

Popular Mechanics

Today's technology makes it possible for
**DIRIGIBLES TO COME BACK
BIGGER THAN EVER**

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He's just won \$25,000, poured a bucket of champagne over his head.
He's not going to follow all that with a boring cigarette.

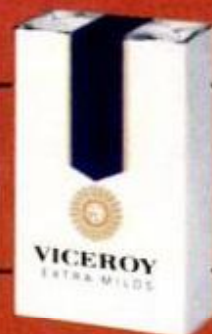


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New Viceroy Extra Milds.
Now get a taste of excitement
in a lowered tar cigarette.



13 mg.
tar.

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

Extra Milds, 13 mg. "tar," 0.8 mg. nicotine;
Kings, 16 mg. "tar," 1.1 mg. nicotine; Longs, 17 mg. "tar,"
1.2 mg. nicotine, av. per cigarette, FTC Report Mar. '74

The Remington 870 "Wingmaster". We designed it to make recoil work with you—not against you.

The 870's smooth pump action helps you make your second shot as good as your first.

An 870 is specially balanced to swing smoothly and point fast on every shot. But what happens if you have a chance for a double? Or the bird you missed is still in range? That's when the 870's pump action really goes to work for you.

The first-rate second shot: Recoil against your shoulder forces a barrel up and back. The 870's pump action actually puts this force to work by helping you 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—without a second wasted.

In other words, your natural reactions to recoil help you keep your shotgun under constant control—and set for that second shot as fast as possible.

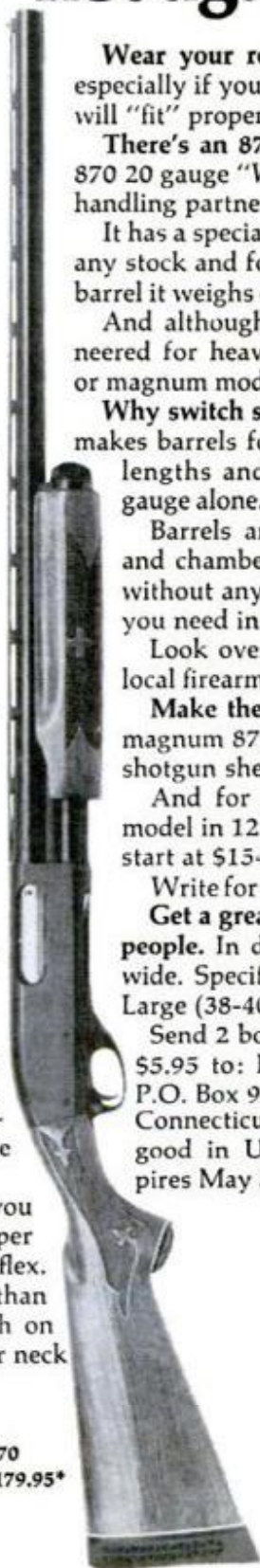
Where the action is. The Model 870 has two separate action bars—one attached to each side of the fore-end—that let you pump it much more smoothly, shot after shot, without twisting or binding the action. That's double insurance it will feed and eject properly under all shooting conditions.

Take a tip from a trapshooter. Visit any trap field, and you'll find the 870 is a favorite with trapshooters everywhere. Remember, a trapshooter may fire five thousand shells or more a year—so he needs a gun that can take it.

Can the 870 take it? We've designed the 870 for extra dependability and ease of handling. The shooters who've made it America's best-selling pump action shotgun seem to think we've done a pretty good job.

Practice makes perfect. New hunter or old, you only get better if you work at it. Practice proper shouldering of your 870 until it becomes a reflex. Always bring the stock to your cheek rather than your cheek to the stock. Keep it high enough on your shoulders so you don't have to strain your neck muscles to get a good sight picture.

Model 870
Vent. Rib—\$179.95*



Wear your regular hunting clothes when you practice—especially if your jacket is thick or bulky. Then your shotgun will "fit" properly when you're out in the field.

There's an 870 that takes a load off your shoulders. The 870 20 gauge "Wingmaster" lightweight shotgun is 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 light 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 built in standard or magnum models.

Why switch shotguns when you switch game? Remington makes barrels for the Model 870 in a wide variety of barrel lengths and chokes—21 different combinations in 12 gauge alone.

Barrels are completely interchangeable within gauge and chamber length. You can switch them in seconds—without any special tools. So you've got all the shotguns you need in one.

Look over the choice of barrels for your 870 at your local firearms dealer.

Make the long shots count with our 12 and 20 gauge magnum 870's. They can shoot all 3" and 2¾" magnum shotgun shells, as well as high- and low-base field loads.

And for southpaws, we've got a standard left-hand model in 12 and 20 gauges. Right-hand Model 870 prices start at \$154.95*.

Write for a free copy of our 1974 catalog for more details.

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This One



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Great guns deserve great ammunition.
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*Prices shown are suggested minimum prices, subject to change without notice.

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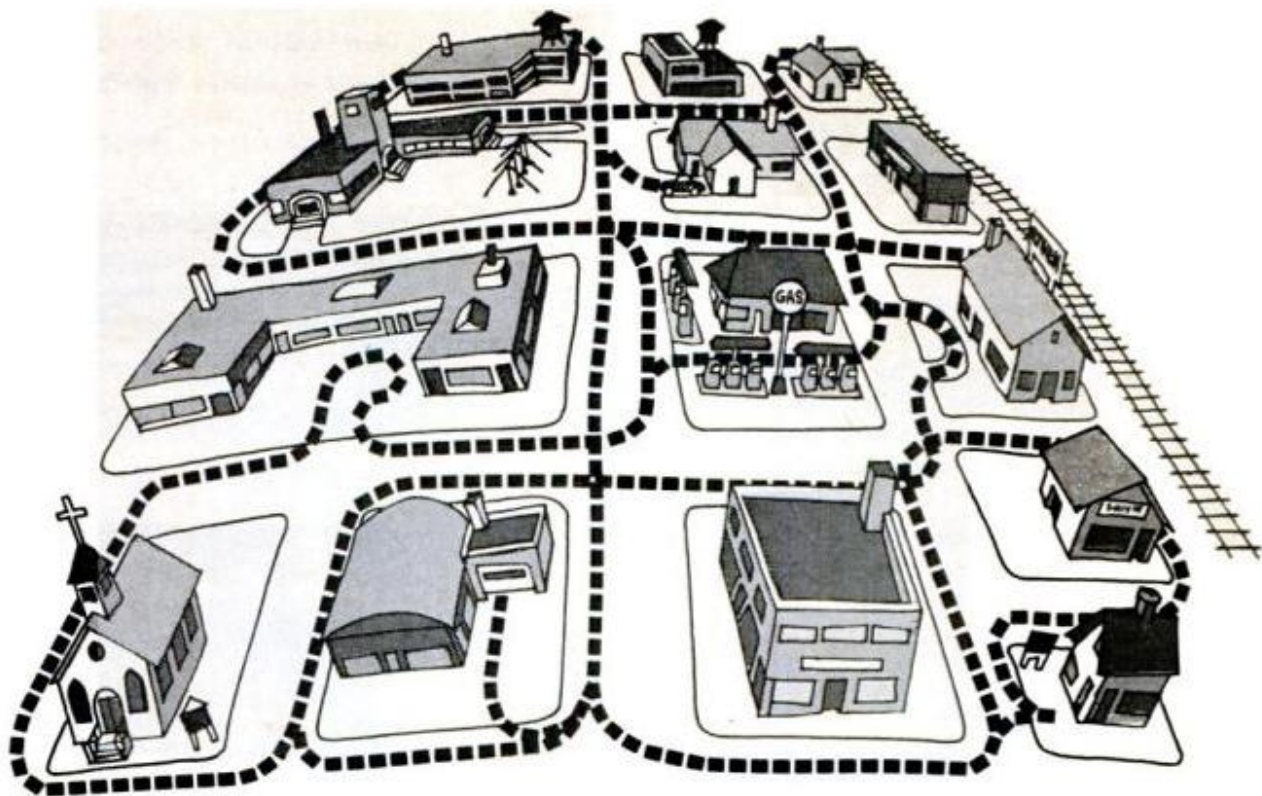
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MEADVILLE, PA. 16335



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So when it comes to oil and oil filter changes...

“Think months, not just miles”

If you, like most of us, are a short trip driver, it means that three out of every four trips you make are for less than 10 miles* It is a fact, as you know, that in today's short trip driving, your engine oil can still get dirty.

That's why your owner's manual recommends that you change oil and oil filter on a time or mileage basis, whichever comes first. That means you should “think months, not just miles.”

So check the date and mileage on your service reminder sticker today. With winter just around the corner, now is a good time to help make certain that your engine is

protected against harmful crankcase contaminants.

And, if you need to change the oil filter, remember that a new AC Oil Filter provides up to 12 feet of dirt-trapping protection. AC helps keep all of those intricate engine parts running smooth and clean.

So ask for an AC Oil Filter at change time to help protect your engine. And remember to “think months, not just miles.”



AC-Delco
Division of General Motors Corporation

*U.S. Department of Transportation

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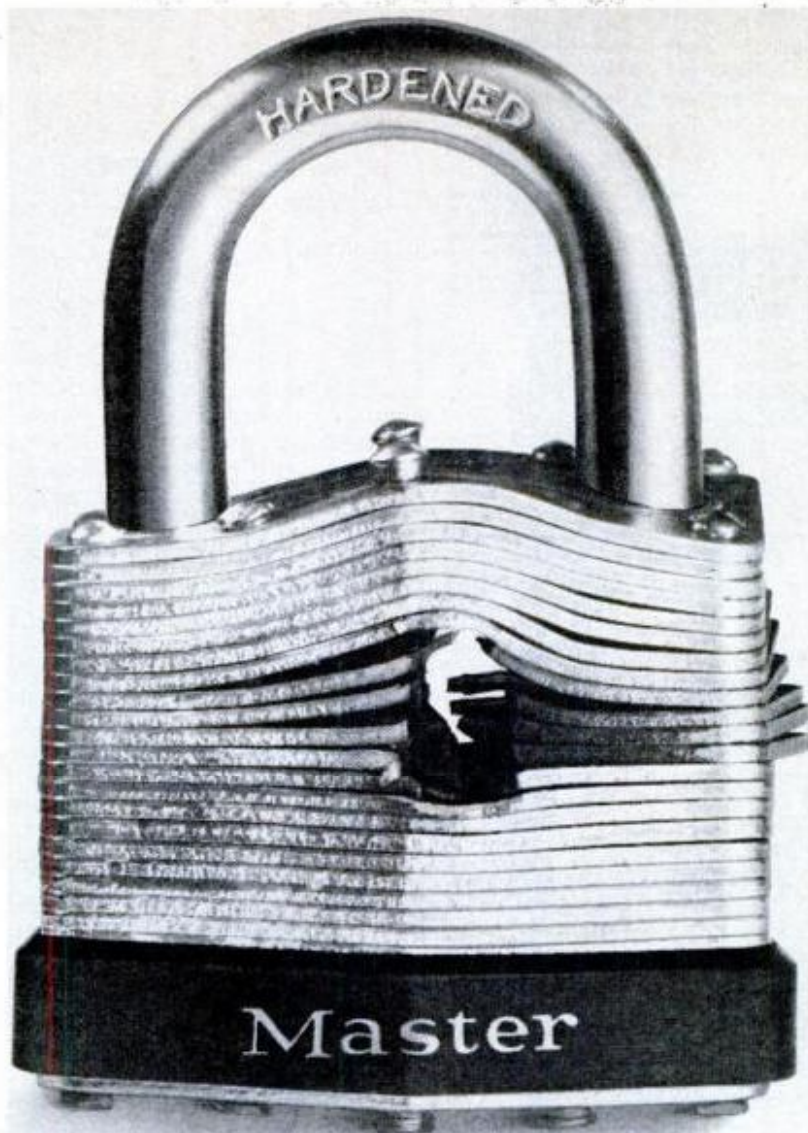


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ON THE COVER: Today's technology makes it possible for dirigibles to come back bigger than ever. *Illustration: Roy Grinnell*

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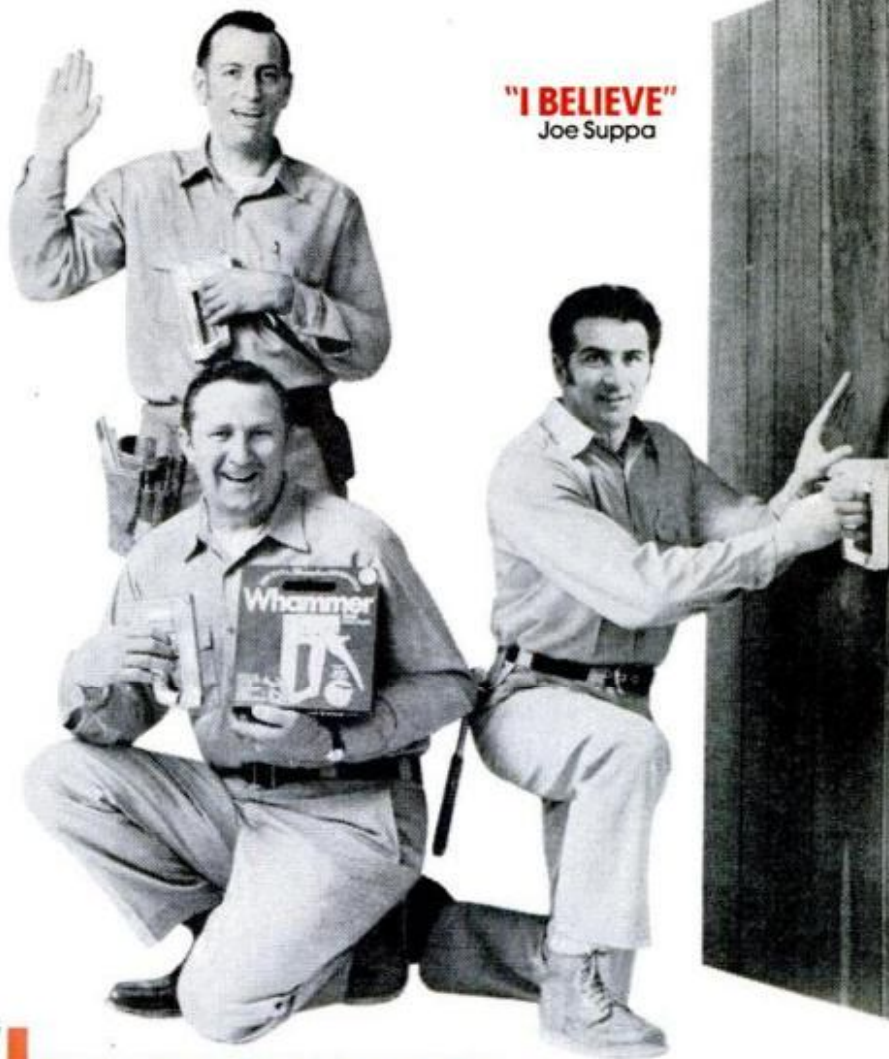
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LETTERS

TO THE EDITOR

Lots of gold in South Dakota

As an ardent gem and mineral collector, I turned to *Pan for Gold This Summer—Here's How and Where* (page 82) as soon as your July issue arrived.

Mr. Behme did not do his homework! Nowhere in the article, even in the fine print, could I find a word about South Dakota. We are the largest producers of gold in the United States. It is possible to earn up to \$200 a week panning in the streams of our Black Hills.

MURDO, S.D.

MAXINE M. WILSON

Mr. Behme speaks of cooking off gold amalgam—called "sponge" by miners—in a retort to drive off the mercury. Mercury

fumes are some of the deadliest known and fast-acting as well. The tendency, for an amateur, is to set his newly purchased retort on a burner of the kitchen range. If this is done, the results are sure to be tragic. A number of deaths resulted from this cause in the early '60s. Retorting should be done in a well-ventilated area, preferably outdoors. As a further precaution, the vent tube of the retort should be submerged in a bucket of water to scrub the fumes and capture the mercury as well. The water will be poisonous and should be disposed of in a safe manner.

Unless regulations have changed since I was mining, retorted amalgam sponge cannot be held by individuals not holding a smelter's license. If obtained by pan, sluice,

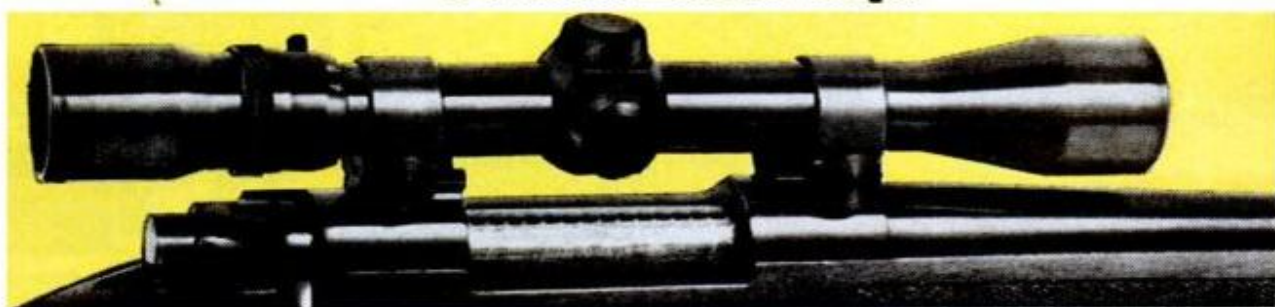
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Four V Models: When the game plan changes, your scope doesn't have to.



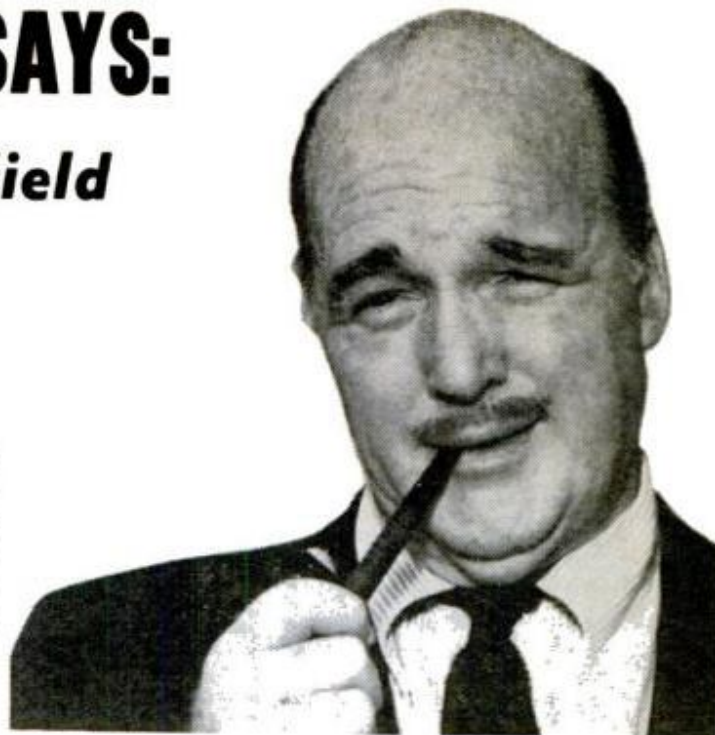
Living in one part of the country doesn't mean you always hunt there. So Weaver offers four dependable variable scopes. Each fog-free. And each all steel where it counts... one-piece tube, turret caps, focusing ring, and eyepiece lock ring. The V4.5, V7, V9, and V12 offer the most-used magnifications in a variety of power ranges. See them at your dealer. Or write for free color catalog showing Wider-Views, K Models, V Models, 22 Scopes, Qwik-Points. W. R. Weaver Co., Dept. 91, El Paso, Texas 79915.

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TOM McCAHILL SAYS:

"The appliance repair field is so uncrowded it's almost lonely!"



Someone once said that if you build a better mousetrap, the world will beat a path to your door. In the home appliance business, a lot of enterprising companies have gotten rich peddling a list of handy electrical gadgets for the home longer than Wilt Chamberlain's arm. The trouble is, the dozen or more appliances in the average American home can go on the fritz, and men with the proper training to do repairs are as scarce as knee-length skirts on teen-agers.

Good Appliance Repairmen are a rare breed these days. Those with a little ambition are booked so solidly you can wait days to get somebody to fix a balky refrigerator or cantankerous toaster. Sometimes, you have to settle for a bum job from a guy who had no business calling himself an Appliance Repairman in the first place.

This brings me to my point. If you want to make money in a field that's begging for trained technicians, there's a fine, low-cost home-study plan available that teaches you how to handle every type of Appliance repair in detail—including refrigeration, air conditioners, and even small gas engines. The course was prepared by the instructors at National Radio Institute. This is the oldest and largest home-study school in the Electronics/Electrical fields with more than fifty years' experience training men like yourself for new careers or spare-time or full-time businesses of their own.

A few years ago, NRI recognized the increasing demand for trained Appliance Repairmen. They set about preparing well-illustrated, easy-to-understand lessons that teach you how to repair home, commercial and farm Appliances. NRI even added a professional Appliance Tester that's included in their low tuition. With the Tester and a few basic tools you probably already have,

you're equipped to service most Electrical Appliances. If you aren't making as much as \$4 to \$6 an hour in spare time fixing Appliances for friends and neighbors within a few months after enrolling, my name isn't McCahill.

The reason I'm no doubting Thomas, is because the staff at NRI is composed of experienced instructors who guide you through the course with more personal attention than you'd get in many classrooms. With the kind of help they give a student and the kind of course they have, you can be the man in demand in this field—even if you've never tried to rewire a plug, or got fed up with school at the 9th grade.

The best advice I can give you is to clip the coupon below and send for the NRI Appliance Training Catalog. It's free, and there's no obligation. NRI doesn't employ salesmen, so nobody will be knocking at your door. All it will cost you is a postage stamp. Take it from Uncle Tom, the Appliance Repair field needs good men. Now.

TOM McCAHILL

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AT HARDWARE AND AUTO STORES

LETTERS

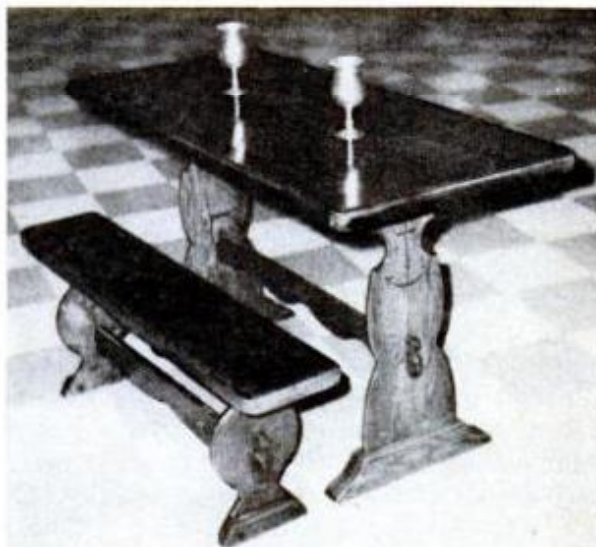
(Continued from page 8)

dredge or simply picking it up with the hands, it can be held in amounts up to 200 ounces troy. If obtained by other means, it must be turned in.

The last caution is that gold is found in very remote and inaccessible places. This is no sport for the out-of-shape or ill-equipped. FAYETTEVILLE, ARK. HUGH DUNCAN

Refectory table

Here's a refectory table made from plans in *A Great Shop That's Neat, Noiseproof and Productive* (page 69, March PM). It's built from 7/8-inch oak of random widths and edged with 1 3/4-inch maple scraps from a bowling-alley floor. The bench was made from leftovers. Total cost: \$23.



Since the table is functional as well as decorative, I moved the legs to 8 1/2 inches from the ends to give more legroom for someone sitting at the end.

If all joints are accurately made, there's no need for dowels to hold the legs in place at top or bottom. The center pieces of wood in the laminated feet should be cut from the same stock as the legs *after final sanding* to ensure a good fit.

ALBANY, N.Y.

A. R. PRATCHETT

Rude awakening 90 years ago

Regarding *Mechanized Bed Rocks You Awake, Not Asleep* (page 129, June PM), may I bring to your attention that a naturalist named John Muir invented a bed sim-

ilar to this. The only difference is that he used a grandfather clock. He made it while attending the University of Wisconsin close to 90 years ago.

WOODLAND HILLS, CALIF.

JEFF VANCE

Civics class

Your *PM Owners Report on Honda Civic* (page 120, June *PM*) was very accurate, and I enjoyed participating in it.

My Honda is accumulating miles at the rate of 2000 a month, and I found a way to recover the six mpg loss due to having the automatic.

I put on a Tiger 500 capacitive discharge ignition system and opened my sparkplug gap to .040. This gave me easier starting with less choke, got my mileage up to your indicated trip mileage of about 32 mpg (local and long distance), and the power increase allows me to accelerate just like a stick shift.

The dangerous pull to the left on acceleration and the pull to the right on deceleration is due to the difference in length of the

driving axles and corresponding torque inequality. This can be completely eliminated by putting two pounds less air pressure in the right front than in the left front tire.

Last of all, a severe flat spot (in acceleration) developed after I had the car for a while. This happened twice and was easily corrected by cleaning out the carb jets. They seem to be very sensitive to small particles of dirt.

SAN DIEGO

ED NILSEN

Keep the spring in your cables

I just finished reading Mort Schultz's article *How to Test and Replace Ignition Cables* (page 134, July *PM*), and it seems to me he has omitted one very important check. After removing the cable from the ignition tower with a twisting and pulling motion, make sure the connection end of the cable is all there and no part of the tongs is missing—especially the spring portion of the tongs.

If this part is missing or deformed, I would suggest a new cable be installed

(Please turn to page 12)

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warmth, durability and a perfect fit are to a man who spends his days in the field. At Herman, we found out what outdoorsmen need. Then we built our line of Survivor boots. The boot you're looking at is our Gun Boot, Model #7194. In redwood brown pebble grain rawhide. Like all Herman Survivors, it's built of the finest leathers. Inside and out. Then it's padded and insulated to -20° with Ensolite® foam. And fitted to the toughest, surest footing you can buy: The Armortred Vibram® sole. It's a great boot for work or sport. Survivors come in a number of styles. All are carefully crafted here in our Down East factory. They're tough. And they're comfortable. Like all our boots. When you're looking for quality in an outdoor boot, hunt up a pair of Hermans.



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FREE CATALOG

LETTERS

(Continued from page 11)

even though the remainder of the cable passes the tests outlined in the article.

Recently I limped home on a 100-mile trip with no garages open. Next day, it cost me \$3.53 for a distributor cap, \$3 for two ignition cables plus \$14 for labor (including tune-up). Before taking the car to the garage, I noticed the two old cables each had one spring missing and a whitish deposit had formed on the connection and the distributor-cap tower. During the last previous tune-up (20,000 miles ago) these springs must have been broken by a mechanic not following good procedures.

PITTSBURGH, PA.

C. H. JANTHEY

Sailboat that turned out perfect

After becoming interested in sailing, I decided to build *The Glen L 10* (page 142, Feb. '71 PM). The project took me four months and about \$400—twice the amount you said in the article.



The boat is made of mahogany with a fiberglass cover and aluminum mast with stainless-steel fittings. This was my first woodworking project and I used only simple hand tools, so I'm quite proud that this sailboat turned out perfect and performs equally well.

MIDDLETOWN, N.J.

SPENCER MORASCH

Complete plans plus instruction booklet for the Glen L 10 are available. Send \$7.50 to Popular Mechanics Boat Plans, Box 1014, Radio City, New York, N.Y. 10019. Specify Glen L Boat Plans No. B 1265.

Self-charging electric car?

Just finished reading the July issue and another article about electric cars—*The Horseless Carriage Returns—Quietly* (page 90).

In all the stories I've read about electric cars, I've seen no mention of a generator and/or alternator. Can't there be one installed to efficiently lengthen the running of a car from the present 30 to 50 hours to a much higher figure—or even indefinitely?

An electric car able to go four or five years—wouldn't that have an effect on oil and power companies!

FREDERICA, DEL.

L.L. HALLOCK

The Auranthetic Corp., maker of the Charger electric cycle (Gas? Who Needs It? Ride a Charger! page 82, April PM) is trying something like that with its two-wheeler and hopes to get some 70 percent regeneration of batteries during periods of deceleration. Electric car builders are also in various stages of developing the technique of regeneration.

Source of flexible shafts

I have started to build a *Backpack Paint-Removing Machine* (page 152, May PM), but now I'm stuck. Where do I get the flexible power cable?

I have tried several different Sears stores with no luck at all. Two of the places never heard of them. I haven't had much luck anywhere else. I enjoy PM, but can you tell me where to find a flexible shaft?

SCARSDALE, N.Y.

WAYNE WILTON

Sears did sell flexible shafts just as the author says. Unfortunately, the firm discontinued selling them about the time our May issue came out. Readers can buy a similar high-quality flexible shaft from the Oswald Manufacturing Co., 65 Channel Dr., Port Washington, N.Y. 11050. A 4-ft. shaft sells for \$34.

My son and I have built one of these units for use in his summer occupation of painting houses. It works very well.

WILMINGTON, DEL.

F.L. BREVOORT JR.

Please keep letters short, and type them if you can. Send them to Letters to the Editor, Popular Mechanics, 224 West 57th St., New York, N.Y. 10019.

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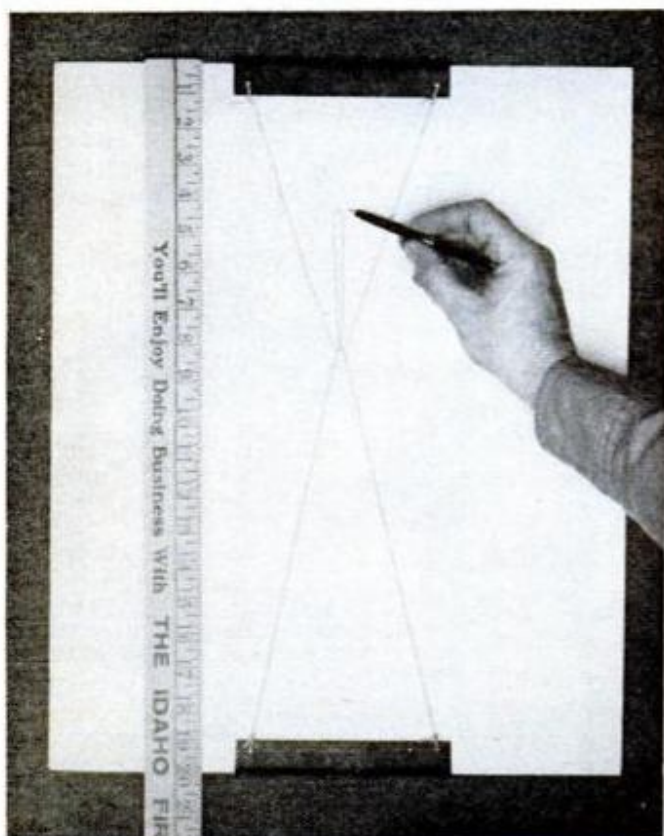
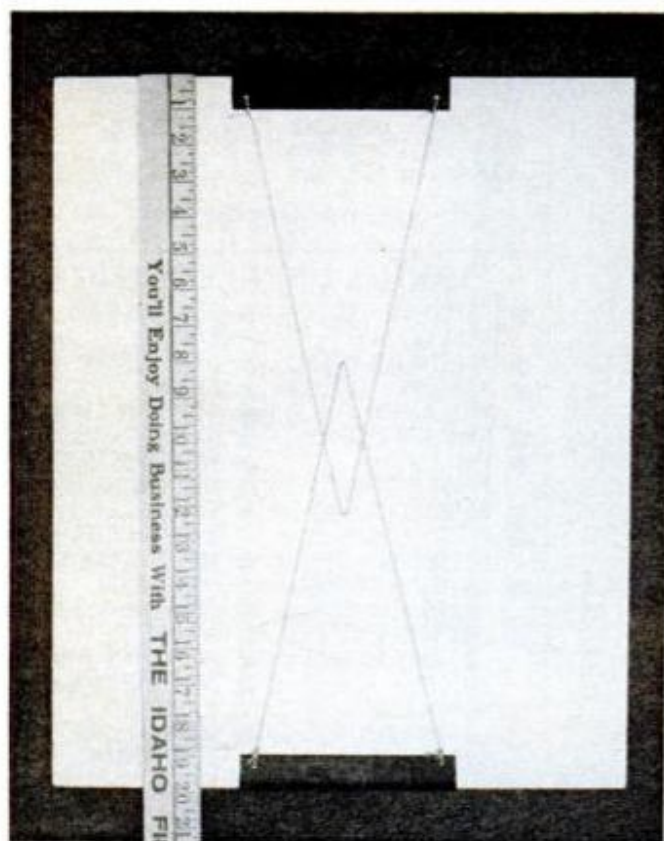
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PHOTO HINTS

FROM READERS



Quick picture frame for mounted prints

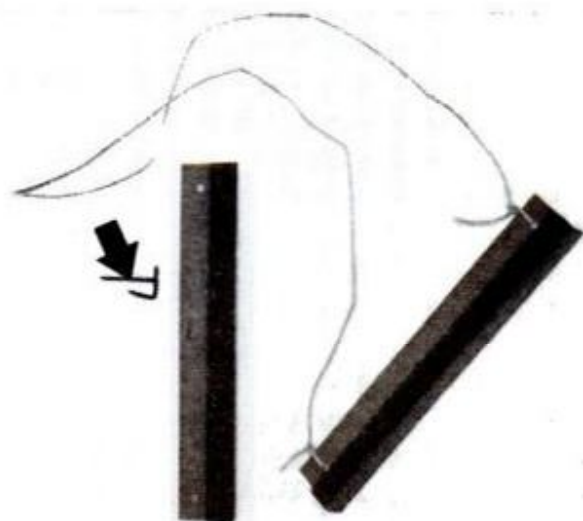
No need to frame your photos and display them under glass. You can show them more effectively, informally and inexpensively by borrowing a tip from the salon exhibitor.

First, dry-mount your photo on mounting board (I use 16x20). Then buy a strip of outside-corner plastic molding as shown (arrow) in the photo below. This usually comes in several decorator colors. An 8-foot piece—enough for about eight pictures—should sell for around \$1. Next, saw the molding into 6-inch strips, and drill or punch out two small holes in the long leg of each, as illustrated.

Cut two pieces of cord, each 6 inches longer than the mounting board, and tie them to the holes as shown below. Center the plastic molding on the top and bottom edges of the board, turn the print face down, and pass the loop of the top cord through the loop from the bottom cord (left). Now pull the cord tight, and hang the print from the tip of the top loop.

If you standardize on one mount size, you can change photos easily.

The outside-corner molding shown will hold the print about $\frac{1}{4}$ inch from the wall. If you prefer the picture to hang closer to the wall, you can use edging, which lacks



the outside corner molding's rear projection. For hanging pictures high on your wall, use an outside corner molding at the top of the picture, and edging at the bottom, to angle the picture downward.

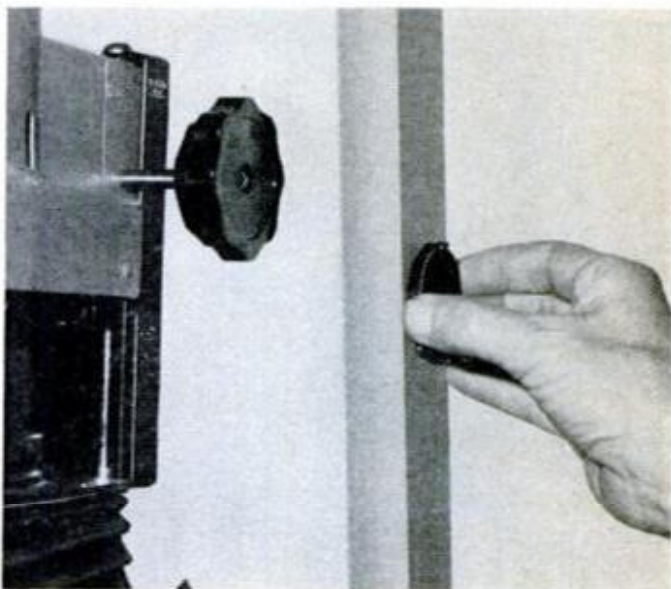
—Phil Stoddart.



Double-stick tape keeps enlarger lens cap handy

Enlarger lens caps tend to get lost when you print. But a piece of double-sided masking tape on the cap's front surface will let you stick it to any clean, convenient spot on your enlarger, the easier to find it again.

—J.D. Maxwell, Vancouver, Wash.



Minolta helps you bag the one that got away.



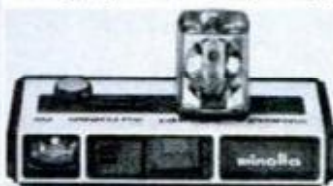
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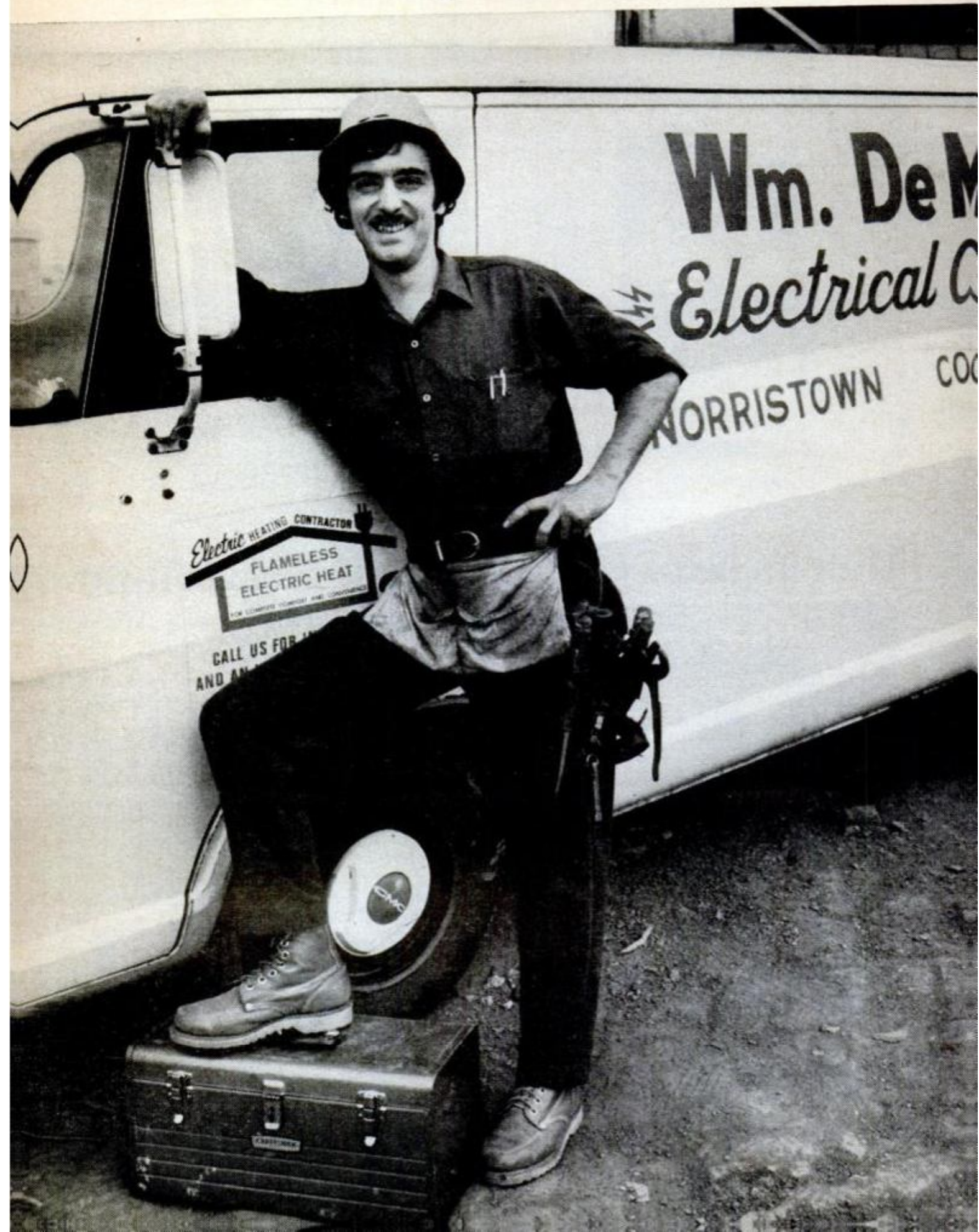
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At 23, Bill De Medio has more freedom, more security and gets more respect than guys twice his age. (Photograph by Frank Cowan.)

CAR CLINIC

BY MORT SCHULTZ

Wanted: smooth acceleration

Take one 1973 Nova with 307-cu.-in. engine and standard transmission, give it a balking condition upon accelerating from a stop just as it gets in the middle of a busy intersection, and you can understand why I think I'm going to suffer a heart attack. The engine doesn't load up and then take off as it would with normal flat-spot acceleration. It has to be coaxed along slowly by feathering the gas and clutch pedals. It happens all the time, and the dealer and all his tune-ups haven't helped one bit. My health depends on a solution. Please.—Richard Bergsrud, Minneapolis

I don't know what your dealer has done, but here are several things he should have done:

1. Tested the distributor vacuum advance unit.
2. Checked the cold override switch. This provides vacuum in all gears until the engine warms up. If the switch or its wire is open, you wouldn't get vacuum during the warm-up period, and this would give you a poor drive-away condition.
3. Checked the carburetor base gasket and replaced it with a new one if it was shown to be impeding the buildup of maximum vacuum.

As you can tell, I think the key to your problem is lack of vacuum. You take it from there.

Locked out

The steering wheel lock of my 1968 Volkswagen no longer works although I have squirted plenty of "free-up" lubricant into it. What kind of repair am I facing?—Oliver V. Lee Jr., Fort Worth, Tex.

Pretty heavy. The steering wheel has to come off and the turn signal switch assembly has to come apart. The steering wheel lock, which is separate in this car from the ignition lock, is then removed and replaced. It is more than an hour's worth of work at a cost of about \$40 if a dealer's shop does

it. You should not tackle the task yourself unless you have the necessary tools, detailed instructions and confidence.

Deep-sea driver

When I drive my 1970 Dodge through deep puddles, my alternator stops charging, but regains composure after a few seconds. My dealer says there is nothing wrong. Is he right?—Lowell W. Daasch, Davenport, Iowa

What's probably happening is that the drive belt gets some water on it and slips. Those puddles must either be pretty deep or you must be going pretty fast for this to happen. Can't you avoid the problem? If not, I would get a new belt of wrapped or laminated construction.

Steering committee

I am having power-steering problems with a 1972 Buick Skylark GS (350-cu.-in. engine), which has 37,000 miles. They started when I tried to get out of a parking space. The wheels would turn a bit and then bind as if they were caught against the curb. Putting the transmission into Neutral and racing the engine would overcome the condition. The system acted well on the road. Soon after, though, the power-steering pump started making laboring noises, fluid turned yellow-gray and steering jammed no matter what I did. My mechanic installed a rebuilt pump, and everything was okay for a few weeks. Now, the trouble is beginning again. What is wrong?—Richard Manalino, Massapequa, N.Y.

I would start with basics. Is the drive belt adjusted exactly to specification and is oil in the power-steering reservoir up to level? Maybe the problem is being caused by a malfunction which is remote from the power-steering system but is putting stress on it. For example, the steering gear and column may be misaligned, or the lower

(Please turn to page 22)

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CAR CLINIC

(Continued from page 20)

coupling flange may be rubbing against the steering-gear adjuster plug.

When these possible causes have been investigated, and it becomes apparent that the trouble is in the power steering, then it can only be in one of three places: the flow-control valve, the pump or the gear itself. The flow-control valve may be sticking, or the pump or gear may be leaking internally.

It would be expensive and unnecessary to rip out the entire system and replace it with new components, which is where you are heading by indiscriminate replacement of parts. The steering system should be tested with a pressure gauge.

Plugging a leak

My year-and-a-half old 1972 Vega air conditioner barely made it through its first summer. By spring, it had lost all of its refrigerant. The service manager of a national automotive center chain told me it was leaking around the front seal of the compressor, and that this was common with GM compressors. He told me I can look forward to yearly recharging since a replacement seal probably won't solve the problem for long. Is he right?—Lawrence R. Perry, Huntsville, Ala.

If a replacement seal is needed and it is installed properly, then I don't agree. But before jumping to conclusions, I think it would be necessary to learn if a leak actually exists by using a good leak detector. Pay attention, too, to the area around the superheat switch. A buildup of metal shavings at the switch cavity O-ring groove may have caused a leak. If chips are not removed when the O-ring is replaced, the O-ring could begin leaking again. Remind your dealer about this.

Mashed dash

The padded dash of my 1969 Ford LTD has started to split along the perforations for

the radio speaker. A split about the width of a pencil mark now extends from that point to the edge where the dash turns down to the instrument panel. Is there any way of patching this crack, since a replacement dash is quite expensive?—James L. Boyd, Yakima, Wash.

It's tough, Jim. You can try to fill the crack with some plastic body-repair compound you can get at an auto supply store. Maybe it will hold. It can be touched up with paint that matches the dash's color as closely as possible. Ford Parts Div. supplies interior paints in aerosol cans. You can order what you need from a dealer under parts code M4J. The next step is to try to find a vinyl trim repair shop, which will remove the dash cover and replace it with a new piece.

I think you should find out why the crack started in the first place. I would look for a condition that has caused excessive stress, such as improperly fastened brackets and screws that hold the dash in place.

SERVICE TIPS

■ **Ford** has advised its dealers they should not use any automatic transmission fluid in Ford-built cars except Type F (ESW-M2633F)—fuel shortage or no fuel shortage. If dealers can't get the fluid from the Ford supply depot, they are to get it locally.

As a Ford owner, you should make sure that nothing but the right fluid is used in your transmission. Any other can lead to transmission failure and, according to the company, will void your warranty.

■ **The 1974 Dodge Colt** has a unique clutch-type fan drive if it's equipped with 2000-cc engine and factory air. The fan drive can be locked in position for maximum cooling, by moving a pawl 90°, or it can be unlocked to reduce engine-fan noise. Dodge suggests that if you drive in real hot areas, and/or fuel vapor lock becomes a problem, that the fan drive should be locked.

■ **Cadillac** has a good tip that applies to other GM cars: a restricted orifice at the modulator line connection of the carburetor can delay vacuum response at the modulator and cause the forward clutch of the transmission to burn. If you begin getting a shudder on drive-away or rough shifting on acceleration, disconnect the vacuum line at the carburetor and open the carburetor orifice with a hand-held .030-inch drill. ★★★

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.

Photographed near Margaree Forks, Nova Scotia.



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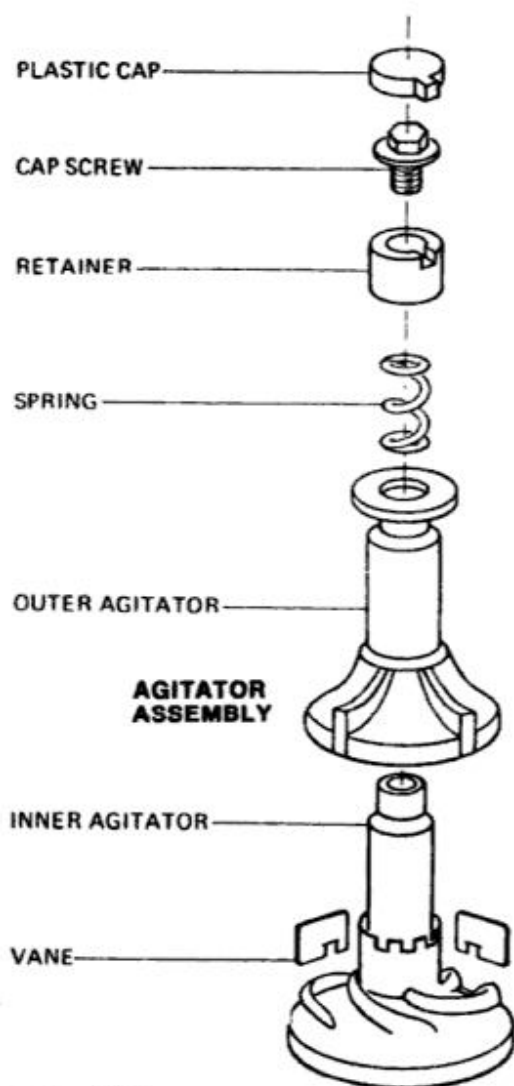
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APPLIANCE CLINIC

BY PAUL MANN



Agitator in distress

My Kenmore clothes washer is having an agitator problem. The agitator takes its time getting started. It labors, jerks and hesitates even when the tub is empty. The belt is tight and the motor is okay. Any suggestions?—V. Miller, Manasquan, N.J.

Check the agitator assembly itself. It has several components, including a cap screw, retainer, spring and vanes, which if worn or loose will make the agitator sluggish. The diagram above shows the components of a typical adjustable-type agitator and will serve as a guide in inspecting parts.

Another possibility is that the belt pulleys (main drive and motor) are loose. This would make belt action sloppy and affect agitator action. These pulleys can usually be retightened.

Beauty of a tip

Please allow me to offer a hint that could save some "home engineer" a fruitless search. It involves mysterious failure of cartridge fuses in main or electric-range circuits when no short or excessive-current situation is evident. I encountered these symptoms: Top burners worked okay. Oven burners worked okay. But when both were turned on, one of the range fuses would open up.

Suspecting an intermittent short, I carefully inspected all wiring in the range, but no dice. The clue that led me to the actual cause was that the blown fuse was too hot to touch. My electric-service distribution box is the type with plug-in "main" and "range" modules, each containing two cartridge fuses held in spring clips. Clips are held in contact with the copper plug-in "knife" blades by a machine screw or rivet. This screw had come loose and there was visible evidence of high temperature: charred bakelite and pitted contacts. The fuse wasn't blowing because of excessive current, but because of excessive heat caused by faulty connections. Heat was being conducted through the fuse clips, melting the solder on the fuse cap.

I made a permanent repair by thoroughly cleaning the clips and copper-buss contact areas and using a brass screw to insure tight connections.—Robert J. West, Traverse City, Mich.

Great! Thanks.

Making ice in the wrong place

My Westinghouse refrigerator's icemaker freezes up. I called a repairman, who charged me \$18. It still freezes. What do I do now?—Paul G. Miraglia, Glendora, N.J.

I assume you mean that water freezes at the spout so it isn't available for making ice cubes. If the repairman didn't install the mullion-heater kit that Westinghouse has distributed to solve this problem, he didn't do right by you. See an authorized

(Please turn to page 26)

Ride the air with push-button shock absorbers.



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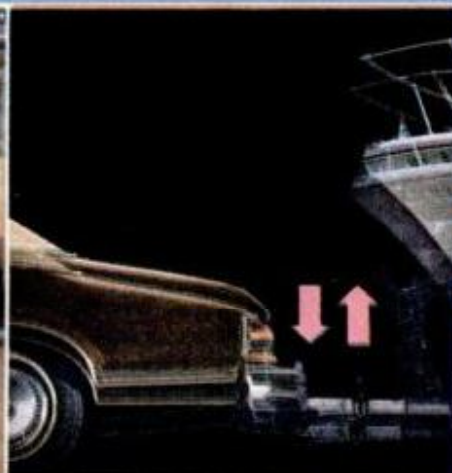
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APPLIANCE CLINIC

(Continued from page 24)

Westinghouse dealer. The kit has complete instructions if you want to try the repair yourself, but this involves taking the icemaker apart and wiring the heater into the icemaker circuit.

Shamed by shaver

I am a trained machinist and should know better, but my Norelco rechargeable electric shaver (Model 45CT) has me stumped. I want to clean and oil it, but can't figure how to get inside without forcing my way in and disfiguring the case. I hope you can help.
—Gordon H. Williams, North Miami, Fla.

Study the top of the case. You will see two screws. Remove them. Now remove the trimmer, held by a small spring wire, the ends of which must be lifted. To do this, make a pick-like tool with a slight hook on the end. Get the hook under the spring at each corner and lift up. The spring will stay in place and the trimmer come off. You will see two more screws. Remove them, and the shaver top will come off.

Breaking news

I accidentally dropped my Corning 10-cup coffeemaker (Model E1210) and broke the handle. Since the unit is almost new, I want to replace the handle, but I can't figure out how to remove the broken one. Tell me.
—Jack K. Y. Hum, Berkeley, Calif.

The handle and bowl are made as a unit. You can't get the handle off. To replace it, you'll have to buy a new bowl (suggested retail price, \$10.95). Sorry.

Forwarding address

I would like to know the address of the Hamilton Beach Co., part of Scovill Manufacturing. I need a part for my mixer.
—Mrs. Ann Dietsche, Kiel, Wis.

Write to Hamilton Beach Div. of Scovill, Box 1158, Spring Rd., Rte. 17 North, Washington, N.C. 27889. ★★★

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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DETROIT LISTENING POST

Small Cadillac due in March

Cadillac is pushing to have its new small car—small by Cadillac standards—ready to preview at the Chicago Auto Show next year. The show opens Feb. 22, so that means pilot production will begin shortly after the first of the year.

If Cadillac adheres to this schedule, the car will go on sale in March.

Olds road-testing K-body car

The scaled-down Caddy is certain to give birth to other new cars from GM. One of the derivatives will be an Oldsmobile. A handmade version of the Olds already exists and is being tested at GM's Milford, Mich., proving grounds. Both cars will be built on GM's all-new K body. It would be logical for GM to pull a Buick off the same body. But that's just a hunch. The Cadillac and Olds are sure things.

Automatic door locks for Chrysler

Chrysler thinks it has worked the kinks out of an innovation Ford came up with a couple years ago and then dropped when it encountered problems. It's a device that automatically locks the car doors once the vehicle attains a certain speed. Ford had trouble with its unit triggering at the wrong time. In carwashes, for example. The car would be hooked up to a tow chain moving at three miles an hour and the locks would snap shut. So Ford discontinued the item. Chrysler thinks it has licked the problem of inadvertent locking. The item won't be offered on Chrysler's '75 cars, but will be an option for '76.

GM likes Mercedes look, too

Ford isn't the only company that admires the Mercedes look—the box shape. Ford admits it used Mercedes as “the reference

car” in designing its new Granada and Monarch. GM also likes the look of the German make but, unlike Ford, isn't about to give a competitor a pat on the back in the open. Despite GM's rule against discussing future cars with outsiders, company executives disclose GM's '77 cars will have square lines on the outside and more people and luggage room on the inside. That's the Mercedes package, no doubt about it.

Unscrambling those mpg numbers

If you had trouble figuring miles-per-gallon claims the auto companies booted around this year, you may be even more confused when the '75 cars come out. For one thing, the Environmental Protection Agency has changed the rules for measuring mileage—with the result that everybody comes out a winner. Going by EPA rules, every '75 car will be able to claim improved mileage over its '74 counterpart. “About the only way to get a true figure on fuel economy,” says Charles M. Heinen, director of vehicle emissions for Chrysler, “will be to add 5 to 6 percent to last year's numbers.”

There will also be some real gains, over and above the hocus-pocus numbers, but not on all cars. The best way to get the straight story is to get your hands on the exact car with the exact equipment you want and drive it for a tank or two. Not many dealers will give you that opportunity. But if you are really concerned about mileage, it would be worthwhile to find a rental car that matches the one you are thinking of buying and spend \$25 to \$50 wheeling it around a few days.

Wankel limping into production

There must be times in the middle of the night when the powers-that-be at GM wish they had never heard of the Wankel engine. The company has put at least \$100 million, probably more, in the engine so far and the

(Please turn to page 32)



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1.1 mg. nicotine, av. per cigarette, FTC Report Mar. '74

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DETROIT LISTENING POST

(Continued from page 30)

end isn't in sight. The best mileage GM has been able to squeeze out of the rotary—under ideal conditions but not “real world” driving—lags behind mileage attained from piston engines of comparable size and power. The latest setback concerns getting the engine in production.

GM has been running a pilot line producing Wankels for several months. One virtue claimed for the Wankel is its simplicity—it uses fewer parts than a piston engine so it should be easier to put together and require less labor. But thus far GM hasn't been able to get the labor content out of engines on the pilot line. They are taking more handwork than Cadillac puts in a \$15,000 car. But this could be because GM wants to make certain it has all the bugs out of the production equipment before putting the engine on an automated line.

The company admits it has suffered a lot of disappointments with the Wankel, but says it still expects to offer a rotary-engine car next year. Funny thing, but American Motors, which has a very small investment in rotary research and development compared with GM's, is more enthusiastic about the engine than any other automaker.

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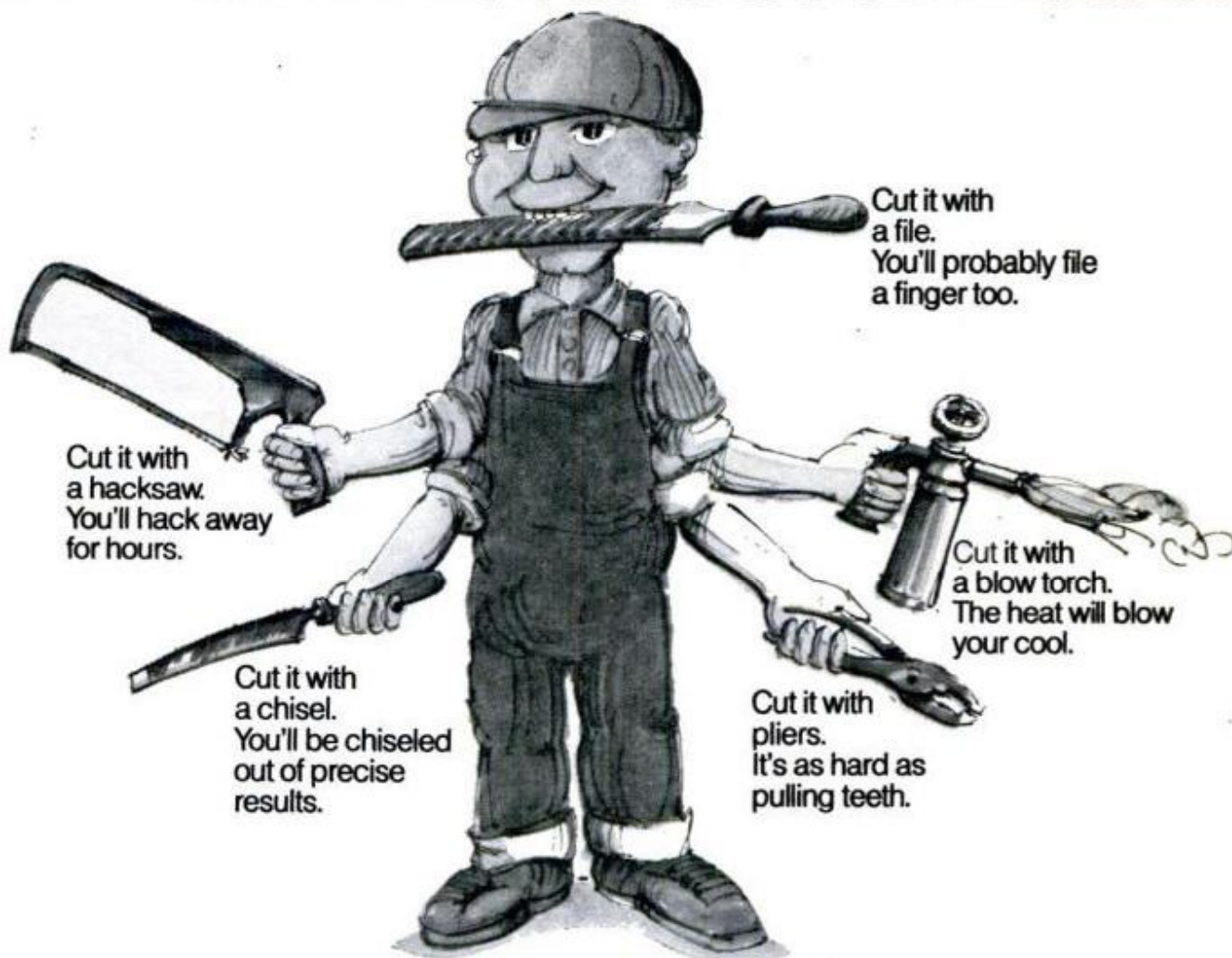
Later introductions for new cars

Car companies are giving serious thought to introducing new models at the start of the calendar year, instead of late summer. This isn't going to happen immediately, but there's a movement afoot. More and more cars, domestic and imports, are coming out in the January-March quarter. The advantage of fall introductions is largely psychological in that the buyer is led to believe he gets a head start by taking delivery of next year's model before the end of the current calendar year. Many production people favor a calendar year, as opposed to a model year, because of the time lost starting from the second or third week of December through the first few days of January.

All car factories close between Christmas and Jan. 1. In addition to the paid holiday, many assembly-line workers stretch the winter vacation by taking off early and coming back late. December downtime could be better used to switch over to new-model tooling, followed by production start-up in January.

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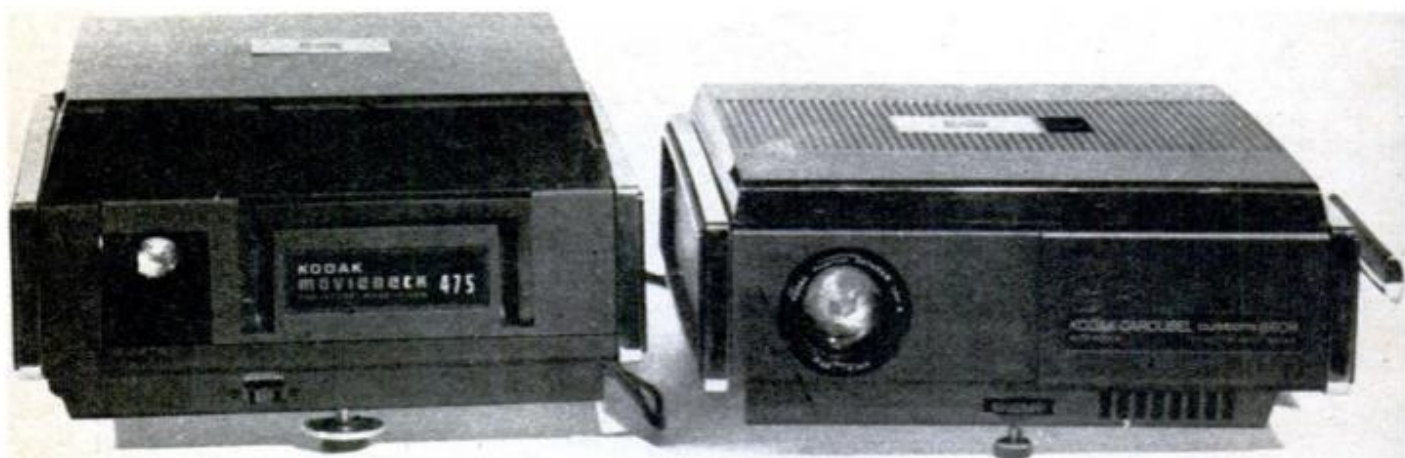
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This 'slide projector' shows movies



by Ivan Berger
PHOTOGRAPHY EDITOR

Remember when movie projectors sat up high, with reels whirring at the ends of spidery extension arms? Latest in the trend toward more compact designs is Kodak's new Moviedeck line—six new Super-8/regular-8 projectors that are almost doubles for Kodak's familiar Carousel slide projectors.

To keep the silhouette low, Kodak mounted the reels horizontally, with the film making two 90° bends as it snakes its way from the feed reel into the projector, through the gate, then onto the hidden take-up reel. If you attach the film end to the feed reel firmly, the projector will rewind automatically at the film's end on all but the \$100 Model 425; otherwise, you pull the end out of an opening in back of the projector and thread it through a channel back to the feed reel. You can also slip quickly into rewind at any point to review scenes, and on the top four models fast-forward lets you skip ahead to later scenes.

Projection speeds range from 18 frames forward, on the 425, to a choice of 3, 6, 18 and 54 frames per second forward and reverse plus still frame, on the top-of-the-line, \$245 Moviedeck 475.

Behind the wood-grained side panels are a film-end trimmer and storage space for a spare quartz-halogen projection bulb, plus instructions. There's also a detachable dust cover and a folding handle. ★★★

Look-alike Kodak Moviedeck and Custom Carousel projectors (above) don't act alike; Moviedeck (left) shows Super-8 and regular 8-mm movies, not slides. Built-in, slide-out screens (below) turn top three Moviedecks into tabletop theaters. Knobs on top deck control speeds (3, 6, 18 and 54 frames/second forward and reverse on the top model) plus stop-motion, fast-forward fast rewind and a white panic-stop button. Threading is same on all models: Film turns 90° from horizontal feed reel, burrows down toward the projector gate and then turns another 90° to wind up on a horizontal, 400-foot take-up reel built into the projector's bottom. Film rewinds automatically through the regular threading path if it's attached to the feed reel.



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And Coleman sleeping bags. They're quilt-stitched throughout to keep insulation from bulging and bunching.

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THE BICYCLE SHOP

BY EUGENE A. SLOANE

\$10,000 for a bicycle?

A kid in my class said someone paid \$10,000 for a bike. Is this true? If not, do you know the highest price anyone ever paid for a bike? Also, I can't find Shimano derailleurs and freewheels in the two bike shops in my area. Do you know where I can get them?
—Gary Hughes, Warminster, Pa.

I saw a bike at the Paris Bicycle Show last year that cost \$1000. It was all hand-made and had all possible parts drilled out for lightness as a racing machine, and had fancy hand enameling and gold striping. Diamond Jim Brady, a famous playboy millionaire of the last century, had a diamond and silver-encrusted bicycle built for his girl friend which I suspect in today's dollars would cost \$10,000. And one or two of Europe's nobility and an Eastern maharajah of years past had bejeweled bicycles that cost somebody a small fortune. Personally I would remove all the fancy jewelry as just so much extra weight.

If you can't find Shimano parts locally, you might try one of the mail-order houses such as Wheel Goods, Inc., 14524 21st St., Minneapolis, Minn. 54441. Its catalog of some 166 pages costs \$2.

Loose crank

I own a bike with Stronglight competition alloy cotterless cranks. I overhauled the bike down to the frame, put everything back together. But on a break-in test ride the left crank came loose. I could unscrew it by hand. I tightened it but it came loose again. What do I do now?—Ted Heliotis, Wanamassa, N.J.

On a cotterless crankset the steel axle is tapered (photo) and so is the inside of the aluminum alloy crank. The crank should be forced onto and held *tightly* in place on the axle taper by the axle locknut. The crank could only come loose if you did not tighten the locknut firmly. And after every 50 to 150 miles (or three times) you should



retighten the axle locknut. Otherwise, as in your case, the softer aluminum-squared, tapered-milled opening can wear rapidly as it is forced against the harder steel shaft, thus ruining the crank arm and costing you about \$16 to buy a replacement left-hand crank. When you tighten the axle locknut, use the correct tool for a firm grip.

Horrible, rasping sound

My new, expensive (\$400 plus) Japanese bike worked fine for a few months but then developed a horrible rasping sound when the chain is on the first, second, third and fifth gears. Sounds like grinding and vibration together. All bearings are okay, the front derailleur is not rubbing. Also the gear cluster wobbles; is this bad?—Scott Miller, Sault Ste. Marie, Mich.

You mentioned the make of the bike and I can tell you this otherwise very fine machine comes with Sun Tour derailleurs. These alloy derailleurs are light and responsive, work fine. But the rear derailleur cage has only one side, instead of a double-sided cage other makes have. Being alloy besides, the cage is quite weak and works well until the bike falls on its side, someone runs into the derailleur or something happens to bend the cage slightly. Sometimes the cage twists as well as bends and either or both conditions cause the chain to rub on the one derailleur cage arm. The bend can be so slight as to be hard to detect visually. But the rubbing sound is just as horrible as you describe. Personally I would replace the entire derailleur, but if you wish to try to straighten yours, you might apply a cres-

(Please turn to page 42)



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quarter. You will be able to see every detail, every flaw, every microscopic scratch that was in the original. That's why Gel Gasket will make gaskets obsolete. You might also notice how clean the 2 quarters you used are. If you have ever cleaned up after gaskets before, you know what a breakthrough this is.

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THE BICYCLE SHOP

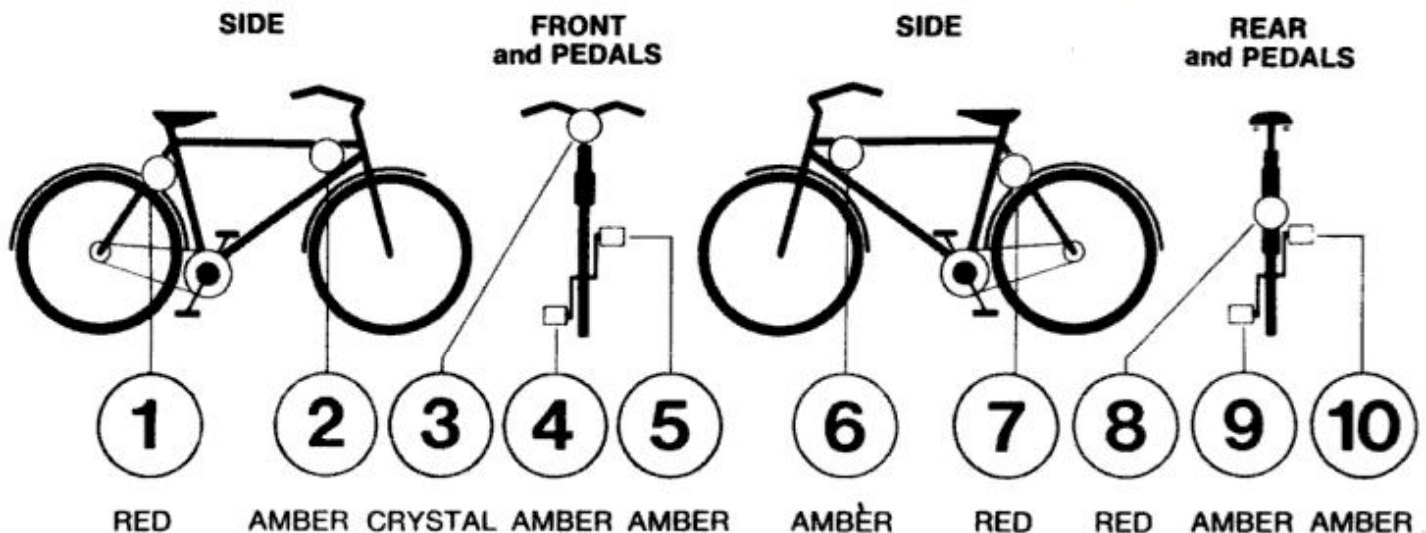
(Continued from page 40)

cent wrench and twist the cage body in the appropriate direction. About the freewheel wobble, I am asked frequently if this is normal because it does look alarming. *Freewheel wobble is perfectly normal.* They all do; it has nothing to do with gear alignment.

Where do the reflectors go?

What is the required equipment such as lights and reflectors for riding after dark in the United States? What type of lights and reflectors do you recommend?—Paul Doyle, Ponca City, Okla.

The Department of Health, Education and Welfare and a number of states have passed or will soon pass legislation requiring Class A reflectors (drawing below) and front and rear lights visible for at least 600 feet. This legislation is still not final, at the federal level. I recommend the Gulco prismatic reflectors. Gulco has a kit of reflectors, red for the rear and for spoke installation, yellow for the side and white for the front. But you still should have lights fore and aft. I like the Wonder Head-Lite, and I see that the company now has a red Tail-Lite. (Or you can take off the Head-Lite glass, spray it with Day-Glo on the inside and have a highly visible rear light.) Fasten it on the seatpost. Put a front light on your head tube. Wonderlights won't give enough light so you can see where you're going, but they will let motorists see and, hopefully, avoid you. Yellow pedal reflectors are also quite visible, and a little light you can strap on your leg which shines white forward and red rear adds moving light.



Why shorten the wheelbase?

A new bike made in the United States has a curved seat tube which shortens the wheel base for better handling on curves. Is this a good idea? Is any other company making such a bike?—Tom Tincher, New York, N.Y.

Because there are literally hundreds of makes of bikes made in this country and imported here as well, I cannot comment on any bike by firm or brand name, as a great many readers wish me to. So I have taken a few liberties with your question which will let me answer it. The U.S.-made bike with the curved seat tube does shorten the wheelbase; it will give fast response on curves because of the shorter wheelbase. However, a shorter wheelbase means a stiffer frame and harder ride. For sport, fun and games this is okay, but for long-distance touring I would suggest a conventional frame design for a softer, bump-absorbing ride.

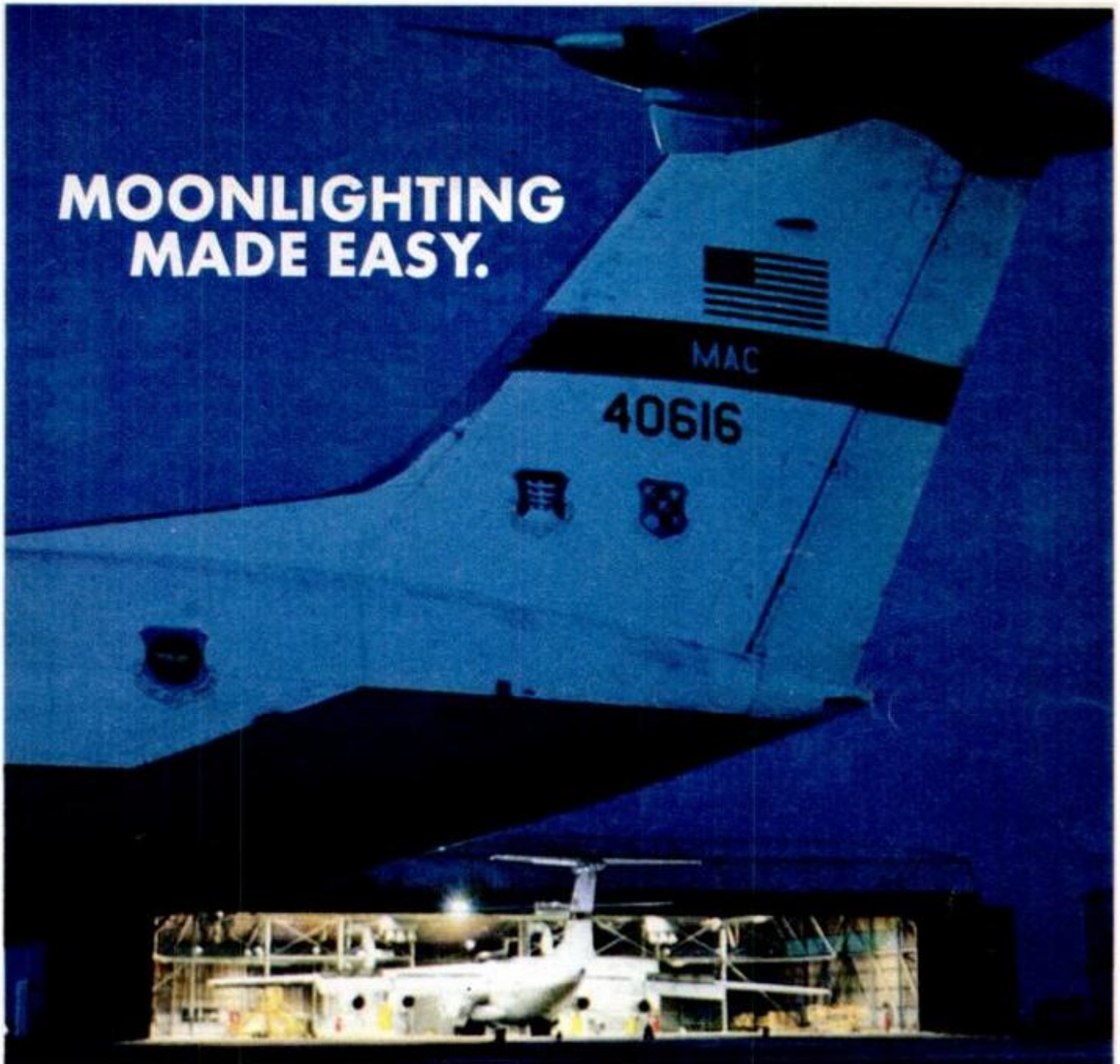
Help get my derailleur on!

I just bought a 10-speed very cheap because it was used and the back brakes were broken. I figured I would save some money by fixing it myself (even though I have had no experience in fixing bikes). Anyway, after days of tragic experiences I finally fixed the back brakes. Days later I heard strange sounds (riding the bike). Looking down at my (rear) derailleur I noticed it had somehow hit against the metal guard and was all bent up.

Then I decided to buy a new one. I tried every which way and I cannot figure out

(Please turn to page 44)

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Ordinarily, moonlighting makes for a long, long day. And when the money is gone, there's often nothing to show for it.

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Think about it. Then fill in and mail the coupon, or pick up the phone and call 800-447-4700,

toll free (in Illinois, 800-322-4400). There'll be somebody on the job to give you the name and address of your nearest Air Force Reserve Unit. Check 'em out, because our kind of moonlighting is not only easier to take, but a lot more interesting.

Air Force Reserve
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3-PM-94

Please send me more information. I understand there is no obligation.

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THE BICYCLE SHOP

(Continued from page 42)

how to put it on. Could you help me?—
Renée Richard, East Hartford, Conn.

Your letter is typical of the kind of urgent queries I receive and my heart goes out to you kids. My first impulse is to pick up the phone to get you out of your jam. I just wish I had the money and the time to do this, but since I do not and must depend on the relatively few letters I can run in these columns I hope those hundreds of you with these urgent problems will forgive me for not having the time to answer you directly.

Now to your problem. Derailleurs are held at the rear of the bike in two ways. Better bikes have a drilled and tapped ear on the rear dropout, into which the derailleur bolt threads directly. Less expensive bikes use a fitting which slides into the dropout, where the axle goes, as shown in the picture. The safety bolt that holds the fitting



in the dropout simply screws together and acts as a clamp so the derailleur won't fall off the bike every time you remove the rear wheel, and so the fitting will not twist in place. Most of the threads in these fittings accept most derailleurs. However, I am afraid that the Simplex may not fit, and you may need a Simplex attaching fitting, not so much for the threading but for the tension arm stop. It also helps, when you are stuck with this or a similar problem, such as how to thread the chain back on through the derailleur, to check a similar bike to see how parts fit on.

As a reminder, I hope my readers will remember that sometimes letters pile up so I may not be able to answer some even in this column, and not for some time. I suggest a good bike book, such as my own *The New Complete Book of Bicycling*—now out as a revised edition with 544 pages for \$12.50, published by Simon & Schuster, Inc., for handling urgent problems. You can find it at a book store. ★★★

New Rubber Stamp Business Pays Beginners ^{UP} _{TO} \$16.50 an hr.

START AT HOME IN SPARE TIME WITH THIS LITTLE TABLE TOP MACHINE . . . WE'LL EVEN HELP FINANCE YOU . . . at less than bank rates!

The multi-million dollar Rubber Stamp Business—once controlled by a few big companies—is now being taken over by small home operators—one in each community throughout the U.S. Men and women who have this inexpensive machine can turn out huge quantities of Rubber Stamps with special wording that buyers once were forced to order from big cities. Material costing only 27c makes a stamp that sells for \$2.75. The machine that does the work is simple and easy to operate and it turns out as many as six Rubber Stamps at a time each with different wording such as names, addresses, notices, stock numbers, prices and other "copy" needed by offices, factories and individuals. Working full capacity, it can earn as much as \$33.00 an hour for the operator! Now you can get into the big-pay business yourself, with your own home as headquarters. You don't need any experience. We supply everything, including complete instructions and eight ways to get business coming in fast. Start making up to \$16.50 an hour from the very beginning. Cash in on the profitable Rubber Stamp business right away.



WE HELP FINANCE YOUR START IN BUSINESS

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● Read the complete and fascinating Rubber Stamp story in the big, over-100-page book. Learn how we even help finance your start. The book contains over 100 illustrations and photographs. And you can read it for a full thirty days without risking a penny!

They tell it Like it is...

● H. D. B. writes: "It all started from an initial \$11.00 deposit on your kit. From your spare-time home business to \$62,000.00 last year I consider excellent progress. And, I am still growing. I've never been successful until you came along . . ."

● . . . and, E. H. T. now has five dealers working for him in order to supply all the stamps that were ordered as a result of an advertisement. He says, "Success is assured when you manufacture a commodity that everybody needs. There is no better way to build a business than manufacturing your own product."

● "If I could not get another Warner Rubber Stamp Shop, you couldn't beg, borrow or steal the one I have now," writes D. R. N. of California. "I am even getting business away from competitors because I do good work and give a guarantee."

Have you neglected looking into an opportunity that gives you additional income while you are employed, and that will go on giving you additional income even after you're collecting Social Security? Now is the time.

SEND THE COUPON TODAY!

NOW! Read the *NEW Warner Success Plan* for 30 days—**ENTIRELY AT MY RISK!**

Find out how YOU can build, step-by-step, to BIG PROFITS —and PERSONAL INDEPENDENCE.

In this amazing Plan you will find exact and detailed instructions for starting a Home Business in spare time—without giving up your present job and without risking the loss of a single paycheck. The Warner Success Plan shows you—with photographs and drawings—just how to make Rubber Stamps just as good as those turned out by the big companies. It shows you how to get orders **without canvassing or house-to-house selling**. It shows you how to expand, how to get others to work for you and how to be **SURE** of at least twice the money you make on your present job for a life of personal independence.

OVER 100 FACT-FILLED PAGES . . .

MORE THAN 100 ILLUSTRATIONS



But don't make any decision now. Read the Plan first—entirely at my risk. Then—after you have made a careful investigation, after you have talked things over with your family—only then do you decide what you want to do.

The thing to do now is to get the full details which I'll send you **FREE**. No salesman will call to urge you to buy anything. Mail the coupon today—or just send a postcard—and I'll see that complete information goes out to you by return mail—**postpaid**.

**RUBBER STAMP DIVISION, Dept. R-2-DK
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Remington "Grit-Edge" blades are available for Hack-saws, Saber Saws, Circular Saws, Bandsaws, and as a Rod Saw. The only thing ordinary about them is their low cost, which is a bargain considering their long life and the jobs they do.

For more information, see your hardware dealer or write: Grit-Edge Products, Dept. 701, Remington Arms Company, Inc., Bridgeport, Connecticut 06602.

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RECOMMENDED CUTTING APPLICATIONS FOR "GRIT-EDGE" BLADES

Material	Rod Saw	Hack-saw	Saber Saw	Circ. Saw
Ceramic Tile	X	X	X	
Slate	X	X	X	
Marble	X	X	X	
Flagstone	X	X		
Brick	X	X		
Glass	X	X		
Fiberglass	X	X	X	X
Tempered Hardboard			X	X
Asbestos Cement	X	X	X	X
Composition Board			X	X
Synthetic Marble	X	X	X	X
Plywood			X	X
Plaster			X	X
Counter Top Material	X	X	X	X
Hardwood Flooring			X	X
Stranded Cable	X	X		
Spring Steel	X	X		
Hardened Chain	X	X		
Stainless Steel	X	X	X*	
Tailpipe Bolts	X	X		
Cast Iron	X	X		

*requires coolant and variable speed machine.

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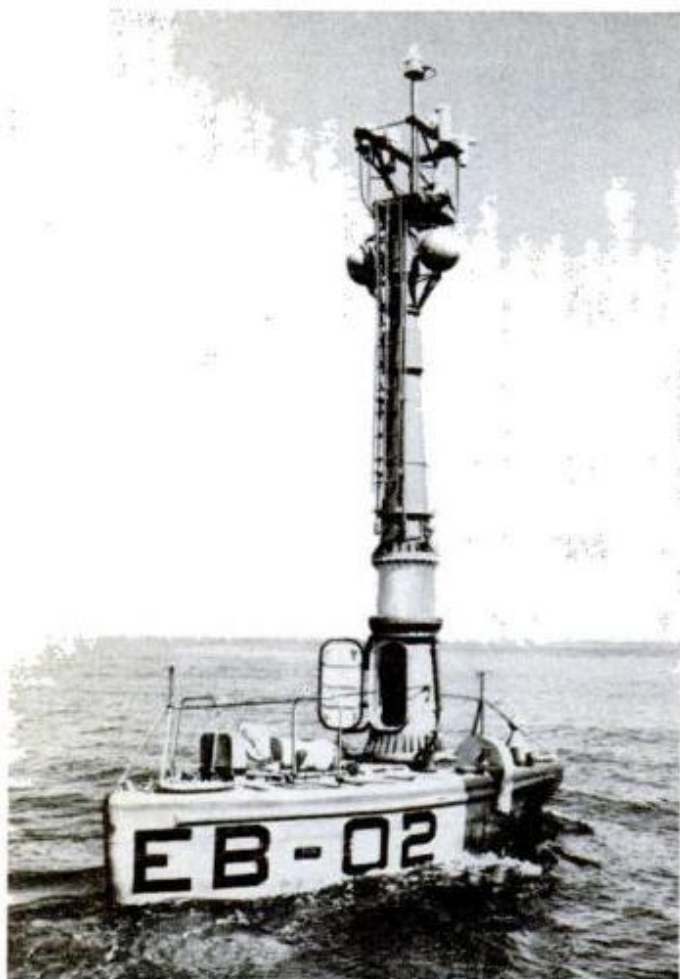


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SCIENCE WORLDWIDE



It keeps eye on Pacific weather

An automatic weather watcher that may enable forecasters to make more accurate and longer-range predictions was recently stationed at its first operating location, a point in the Pacific about 300 miles west of Astoria, Ore. Built for the National Oceanic and Atmospheric Administration by the Lockheed Missiles & Space Co., the 35-ton, boat-shaped buoy is equipped with sensors to record wind speed and direction, water temperature, rainfall, ocean current speed and direction, and wave height. Information is radioed to a shore station for processing. Designed to operate unattended for at least a year, the unit was tested in the Gulf of Mexico (where photo was shot) prior to duty in the Pacific. According to a Lockheed spokesman, the buoy is performing up to expectations.

Listening pays off in powerplant

Potentially dangerous cracks in nuclear powerplants can best be detected by listening, according to a University of Michigan engineer. Prof. J.R. Frederick says the steel vessels containing radioactive substances in powerplants make distinctive sounds that can be picked up by sensitive mikes. Any solid material under pressure gives off acoustic emissions, explains Prof. Frederick, and cracks create sounds different from those ordinarily coming from the material being tested.



Cassette aids in kidney surgery

A pioneering kidney operation was performed by Dr. Robert J. Krane (left) and Dr. Carl A. Olsson (right) with the aid of the surgical cassette and perfusion device they're examining. Removed from the patient—the third man in the photo—the kidney remained in the device for several hours while surgery was performed by the two Boston University Medical Center specialists. It then was replaced in the patient's

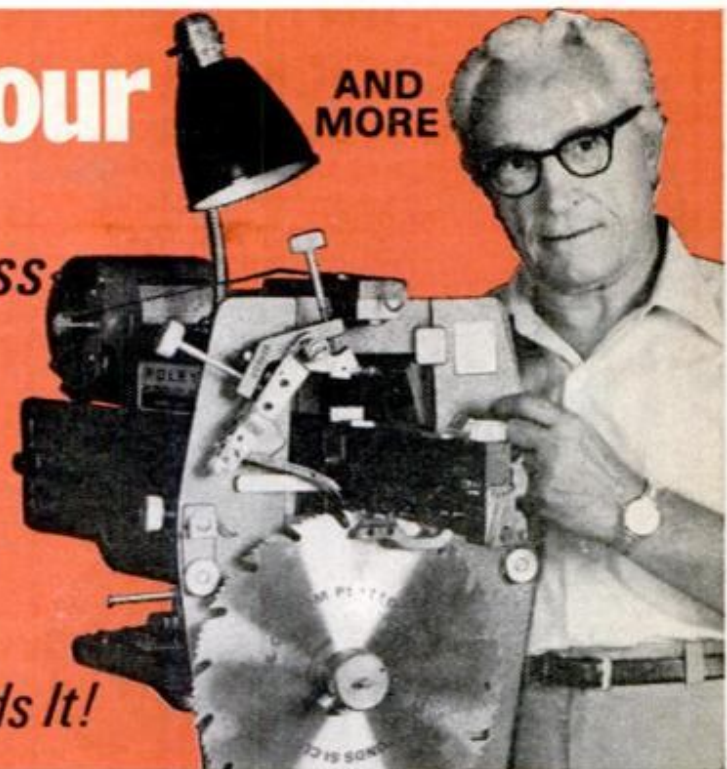
(Please turn to page 52)

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The tremendous growth of the use of Carbide Tipped Saw Blades and other extra hard metal tools is an *extra* bonus for saw sharpening shops using Foley's Carbide Grinding Equipment. It takes just 15 minutes to renovate a carbide blade...15 minutes that pays you \$8—practically all profit, too! Customers are limitless because Carbide tipped saws are being used almost exclusively to cut metals, plastics, laminated woods, hard woods and giant logs.

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There's no need to make a huge investment or carry big inventories when you're in "business for yourself" with Foley Sharpening Equipment. All you need is the equipment and pennies worth of electricity. Foley will finance your equipment to help get you started with minimum investment. When you charge \$8 for sharpening a carbide tipped saw blade, \$7.50 is profit.

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Find out today how you can earn big money in the saw sharpening business. Write today for more information. There is no obligation.



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Please send information on the potential profits in a Sharpening business of my own and how Foley will help finance me.

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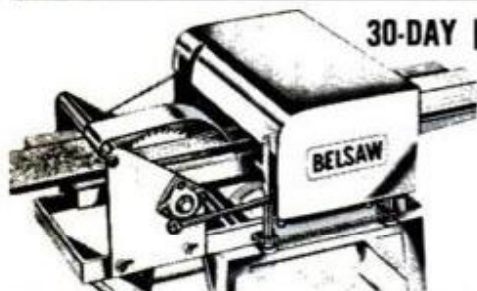
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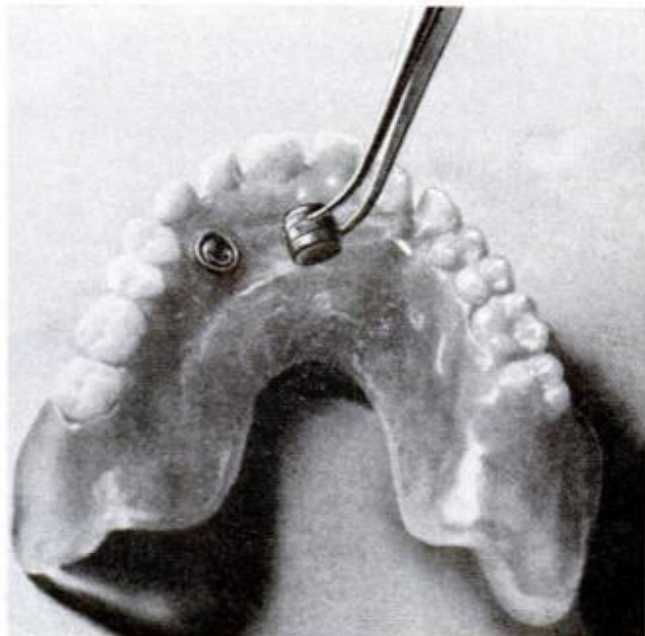
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52 POPULAR MECHANICS

SCIENCE WORLDWIDE

(Continued from page 50)

body. Removal of the organ affords surgeons a better view and makes for improved surgery. The cassette chamber can sustain a kidney for 24 hours.



Valve helps keep denture in place

The problem of the loose-fitting upper plate, common among many denture wearers, is said to be eliminated with the use of a steel microvalve developed by researchers at the Institute of Dental Surgery, London. By permitting the evacuation of saliva and air, the valve creates an increase in negative pressure between the denture and palate. The valve reportedly can be installed in any conventional denture. It is manufactured in Britain and costs about \$20.

Interest in dirigibles on rise

Though some people relegate the airship to the dustbin of nostalgia, there are those who regard it more seriously. This month more than 100 aeronautical experts are expected to take part in a week-long workshop at the Naval Postgraduate School in Monterey, Calif. They will deal with the increasing speculation "on the potential of lighter-than-air craft to meet future transportation needs," according to the workshop's director. To gain an insight into the thinking of some experts in the field, read *Don't Sell the Airship Short*, which appears on page 112 in this issue.

"I lost 4⁵/₈ inches off my waist, 12¹/₂ lbs. of excess weight, shaped and muscled up...in only 14 days."

All I did was one exercise (about 5 to 7 minutes), twice daily, lying on my back in comfort, eating about 20% less...without giving up any of the foods I like...DID IT!



BEFORE
April 24
Weight 276 lbs.
Waist 44⁷/₈ in.

PHOTOS GUARANTEED UNRETOUCHED



AFTER 14 DAYS
May 8
Weight 263¹/₂ lbs.
Waist 40¹/₄ in.

Only two weeks later Mike's waist, arms, and body are built into firm, trim muscle.



BEFORE
April 24
Weight 276 lbs.
Waist 44⁷/₈ in.

PHOTOS GUARANTEED UNRETOUCHED



AFTER 14 DAYS
May 8
Weight 263¹/₂ lbs.
Waist 40¹/₄ in.

Mike Moosman says: "If you have a lot of pounds and inches to lose, this is the way to lose it."

"I Saw and Felt Results in 3 Days!"

Mike writes: "I'm a burly, rugged man... and I never believed that one simple exercise, lying on my back — without giving up the foods I like — could slim me down and shape me up so quickly! The Body Shaper is a great plan for flabby people."

What Is This Ingenious Plan?

The Weider '5' Minute Body Shaper Plan is based on doing one continuous, coordinated rhythmic exercise — twice daily and cutting down 20% of your food intake — without giving up any of the foods you like.

This one, five-minute exercise is designed to slim and firm your flabby waistline and hips (where fat accumulates quickest, giving your body a flabby, weak and distorted look), as well as take off excess body fat **fast** by speeding up your metabolism, burning off stored calories, and releasing excess water. At the same time, it helps to re-shape your chest, hips, firm your arms and legs — improve your total physique!

It's safer than strenuous gym workouts: beats the time consumption and dangers of gym workouts. No disrobing. No sweating. Do it in the privacy of your own home — even while watching TV. The unit weighs about 16 ounces and fits any wallet-size case. You can carry it and use it wherever

Pat. Pending. Copyright Joe Weider 1974

there is floor space — anytime. 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!

What Satisfied Customers Say:

These customers entered our '5' Minute Body Shaper weight-and-measurement-loss contest, and

'5' MINUTE BODY SHAPER
We Care About The Shape You're In — **DON'T YOU?**

WEIDER BUILDS BEAUTIFUL BODIES

IN CANADA: '5' Minute Body Shaper, 2875 Bates Road, Montreal, Quebec.

here are some of the results they achieved within 14 days.

"I lost 18 lbs. and 4¹/₂" off my waist in 14 days," R. Mathews. "I lost 15 lbs. and 4" off my waist in 14 days," M. Harvey. "I lost 15 lbs. and 2¹/₂" off my waist in 14 days," P. Boyd. "I lost 10¹/₂ lbs. and 5" off my waist in 14 days," L. Heathcock. "I lost 11 lbs. and 4¹/₂" off my waist in 14 days," R. Petrich. "I lost 13 lbs. and 2⁷/₈" off my waist in 14 days," R. Vadenry. "I lost 9 lbs. and 3" off my waist in 14 days," J. Minford. "I lost 14 lbs. and 5¹/₂" off my waist in 11 days," M. Reed.

Results vary depending upon how much overweight you are and how much time you give to the Plan. These people have given from 5 to 15 minutes twice daily to our one simple exercise, lying on their backs in comfort, even while watching TV — and just cutting down about 20% on the foods they eat — without giving up the foods they love. Naturally, their impressive results vary. **But, we guarantee that you, too, can expect to lose up to 10 pounds and up to 4 inches in 14 days — or your money back!**

Money Back Guarantee!

Scientific researchers, medical and fitness experts agree — the only way to firm, shape and trim your body is by **working off the inches**. The **Body Shaper** is the simplest way to do it. No gimmicks involved — you will not be ripped off as in the past by so-called "effortless exercisers".

So, we make you this unconditional guarantee: **"Get it off fast!" — and see measurable and firming results in seven days or return the exerciser for your refund!** Proven results are already verified. The guarantee is in writing. Now, can you think of a reason for not ordering your '5' Minute Total Body Shaper?

Satisfaction Guaranteed!!

After receiving your Body Shaper and instruction booklet, use this plan for 7 days. If you do not see your new body shaping up, return the total Body Shaper Plan for your \$9.95 refund.

Weights only 16 ounces.



SEND TODAY COMPLETE KIT ONLY \$9.95

JOSEPH WEIDER Dept. BR / U

5-MINUTE BODY SHAPER PLAN
21100 Erwin St., Woodland Hills, CA 91364

Dear Mr. Weider:

I have a lot of pounds and inches to lose. And, I want to lose it quickly. Please send me the 5-Minute Body Shaper and Plan. If I should fail to see and feel a dramatic improvement in the first seven days, I may return it for my \$9.95 refund.

I am enclosing \$9.95, plus \$1.00 for shipping and handling.

Enclosed is check, money order, cash, for total \$..... (Calif. res. add 6% sales tax).

Please allow 3 to 4 weeks for delivery.

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CITY

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ALL OUTDOORS

Camping

With the excellent equipment available today, a lot of families are camping very successfully without much special training. But knowing what you're doing increases the pleasure, and three recent books are particularly helpful. *The Wilderness Handbook*, by Paul Petzoldt, covers not only the techniques taught in Petzoldt's remarkable National Outdoor Leadership School but also vital matters of health and morale that have been avoided in similar texts. Here's an expert who deals frankly with the stresses that cause a camper to hate his companions and endanger an expedition. Trail practice, conservation, climbing, summer and winter mountaineering are among the many techniques discussed in this volume from W.W. Norton.

Survival With Style is outdoorsman Bradford Angier's extensively illustrated and practical answer for what to do to stay alive comfortably if the worst happens.

And for a comprehensive coverage of all phases of the sport, Erwin and Peggy Bauer have collected 45 how-to and where-to pieces in the new second edition of the *Camper's Digest* from Digest Books.

Fishing

Because a lot of fine fishing waters are now no good, fishermen have had the feeling that creeping "civilization" was endangering the sport and there was little we could do about it. And, until recently, we were right, but

now an organization has come along called the American League of Anglers that has the one goal of picking a fight for our side. It's headquartered in Washington, and hopefully will have branches in 50 state capitals as well. Membership already includes such names as Lee and Joan Wulff, Curt Gowdy, Ted Williams, Ray Scott, Ted Trueblood and a great many others, and for \$10 it can include yours (although any amount will be put to good use). The money is not tax-deductible because the League is a political-action organization, dedicated to putting on the pressure to get things done. A.L.A. is located at 810 18th St., N.W., Washington, D.C. 20006.

Many fishermen suspect the joys of the advanced techniques of the sport, but don't know there are schools just for that purpose. The notable courses run by Lee and Joan Wulff and by Orvis of Manchester are over for the season (keep them in mind for next year), but Berkley's Fly Fishing Holiday schools in Montana and Florida run through mid-October. Information is available from Berkley & Co., Spirit Lake, Iowa.

Shooting

September is championship season with shoot-offs in National Industrial Traps at Middletown, Ohio, on the 8th; International Benchrest and Experimental Championships, Johnstown, N.Y., 14th and 15th; 1974 World Championships, 15th through 29th in Berne and Thun, Switzerland; International



Cruisers can be 13 feet long, as 38 AMF/Alcort Sunfish proved at Second Annual Mixed Doubles Champion-

ship. On a two-day race 51 miles down the Connecticut River, contestants camped out, carried all gear aboard.

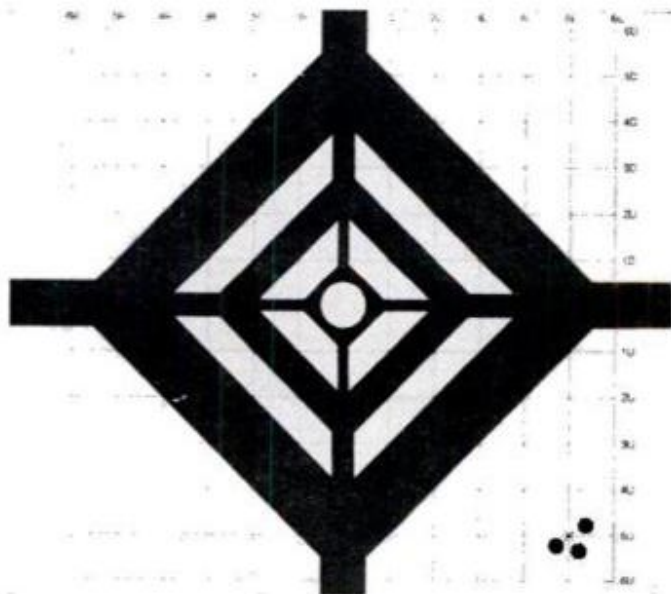
Hunter Championships, 28th and 29th, York, Pa.; and the Police Combat Pistol finals, Sept. 30 to Oct. 3, Jackson, Miss.

Travel

A few years ago Mexican Government officials made up a description of a perfect resort of the future. Then they fed all requirements into a computer and out came a word practically no one had heard of: Cancun. It's a little tropic island off the northern tip of the Yucatan peninsula. No one lived there and all it had was perfect warm



Instant shade is provided with a roll-out awning from Camper's Pride that mounts on motor home or trailer, rolls up securely for storage. It's available from RV and mobile home dealers. Write C/P Products, Box 965, Elkhart, Ind. 46514, for name of nearest dealer; send \$1 for extensive catalog of RV accessories.



Sighting-in is one of the first preparations for fall hunting, and a good idea any time. From Redfield Scope dealers, a 16-inch-square target sheet in vivid orange colors makes an ideal aiming point. Instructions along the bottom tell how to adjust sight to center shot group at range you will usually be firing.

weather, palm trees, great beaches and water so clear you could almost see marlin and sailfish waiting offshore on one side and tarpon and bonefish in the lagoon on the other side.

Cancun is only an hour by air from Miami, less than four from Los Angeles or New York, closer than other Caribbean resort islands. It can be reached by car or RV after driving all the way across Mexico—a bridge at each end of the 14-mile island connects with the mainland—but there is also a car-ferry cruise ship from Miami that now makes the Cancun stop, with car-

(Please turn to page 54B)



Leveling without the need for a hydraulic system (and a \$900 price tag) is the claim for the Easy Way Leveling System, \$144.95. A gauge shows inches of lift necessary; after the legs are set the motor home, pickup camper or van is driven forward or back to even it up. Easy Way Products, Box 131, Audubon, N.J.



Biggest problem of over-and-under shotguns—which barrel to fire when—has a new answer with this latest Ted Williams model from Sears. Each trigger fires either barrel: Pull the front trigger to fire lower and then upper, or rear to fire upper and then lower. A luxury 12-gauger, it's about \$325.

ALL OUTDOORS

(Continued from page 54A)



Waterproof bags, like these SeaQuest Float Bags with buoyant padding, are useful for almost every outdoorsman. Originally designed for skin divers and fishermen, pouches are of Naugahyde with Ensolite flotation, nylon zippers, and should protect small items from bumps, moisture. Camera case is \$6, envelope \$4.50.



Pellet-power of 650 f.p.s. is offered by Crosman's new Model 70. Issued as part of its 50th anniversary celebration, the .177-caliber CO₂ recreational rifle has fixed-blade front sight plus adjustable rear for windage and elevation, bolt action and optional 4X scope. The air-gun with Monte Carlo stock, about \$50.



Action comfort was goal of design for new Athletic Jacket with goose down fill from expedition outfitter Eddie Bauer. Freedom of movement is combined with light weight in men's and women's sizes. Rolled nylon collar hides hood inside. By mail, \$34.95 post-paid from Eddie Bauer, Dept. 38N, Seattle, Wash.

54B POPULAR MECHANICS

go space available for motorcycles and bikes as well.

Two small hotels are already open, and an outdoorsman has a chance to sample great fishing, diving and boating right now before the crowds come.

National Hunting & Fishing Day

Don't forget—take part on Sept. 28. ★ ★ ★



Bugs seem to spot a car, recreational vehicle, truck or cabin boat that has no screens. Though ready-made and custom-made insets are available, an easy out for inside comfort are Magna-Screens, held in place with Magna-Strip, or Non-Magnetic Surface Kits, from Skillcraft Ind., Box 519, Venice, Fla. 33595.



Safety devices deserve to be well made, and this one is. Unlike some tiny so-called "emergency flares" that can't be seen 20 boat lengths on a clear day, Olin's new Winchester Marine Safety Launcher Kit is for real. Based on the famous Very pistol, it fires a 25-mm parachute flare or adapts to 12-gauge meteors. \$53.50.

LOOKING FOR IDEAS ON HUNTING, FISHING, CAMPING, BUILDING, TOOLS, ETC.? CHECK THESE LISTINGS, THEN USE THE COUPON BELOW.

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292. Beautiful Things Can Happen . . .

To all the major areas of your home with this full-color series of six paneling idea brochures. Included are full product data on 17 hardwood paneling lines in a wide array of styles, colors and textures. From Georgia-Pacific Corp. 25¢.

293. RV and Truck Owners—Come Level With Us Firestone's new Ride-Rite comfortaires give you maximum payload, better handling . . . Check it out in color brochure from Industrial Products (Div. of Firestone). Free.

294. "How To Buy A Roof"

Get on top of the situation with this handy booklet. Gives pros and cons of all different types roof materials available. From Johns-Manville. 25¢.

295. Blast Off: Your Guide To Model Rockets

Interested in practicing space age model rocketry? Here's an illustrated how-to-do-it-all brochure, and catalog featuring the complete line of *high flying* Centuri model rockets, engines and launchers. 25¢.

296. Pop Riveting: Professional Results For The Handyman

USM Corporation makes riveting inexpensively available to the do-it-yourselfer with the "Pop" Rivetool. Now you'll be able to accomplish hundreds of fastening jobs that you couldn't tackle before. Photo brochure and diagrams. Free.

297. Nailers and Staplers

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speed and simplify any construction fastener job. From Duo-Fast. Free.

298. Be A Repair Master!

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299. Grinding Away!

Illustrated product brochure has expansive listing of products that will help you perform any sanding or grinding job quickly, easily, and professionally. From Merit Abrasive Products, Inc. Free.

300. Facts About Ultrasonic Soldering

One of the first of its kind on the subject, this 12-page brochure offers a detailed description of how to utilize ultrasonic soldering, what materials can be soldered, and how to achieve perfect results. From Fiber-Sonics, Inc. Free.

301. The "Last Word" . . .

in unique camping equipment and "Baja-proven"® auto-accessories is offered by Dick Cepek, Inc. 100-pages crammed with everything from super-wide flotation tires to genuine GI goodies. Free.

302. Put Your Feet in Them

Catalog describes full line-up of quality outdoor shoes and boots. All of them are fit for work, fun and feet. From Jos. Herman Shoe Co. Free.

303. How To Save Your Car!

32 page illustrated booklet of tips on how to take care of your car's engine for longer life. Includes maintenance schedule for easy record keeping. From Ethyl Corp. 25¢.

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IMPORTS AND MOTORSPORTS



Corvette killer

The Bricklin is a brand-new car from a brand-new automaker. That alone makes it a phenomenon. Getting his dream car off the drawing boards and into a production of 1000 a day wasn't easy for Malcolm Bricklin. The four heavies in Detroit don't

vacuum-formed acrylic which doesn't crumple or radiate damage, and allows deep color impregnation so scratches can simply be rubbed out. There's no chrome anywhere around the exterior of the Bricklin—and that's refreshing. The gull-wing



Bricklin dimensions and weight

Wheelbase: 96.0 in.	Turning circle: 34 ft.
Length: 178.6 in.	Road clearance: 5.5 in.
Width: 67.6 in.	Fuel tank cap.: 21 gal.
Height: 48.3 in.	Weight: 3520 lbs.
Track f/r: 58.2/56.9	

look kindly on someone stealing even the tiniest piece of their pie. No one has dared try—not for a generation.

Bricklin dared and he pulled out a plum. The gull-wing two-seater has design features that make it unlike any other American car (the first cars are just rolling out of Bricklin's plant in New Brunswick, Canada, and already he's looking at plant locations in western and southwestern United States). The frame is of boxed-steel perimeter design with integral roll cage and bumpers that exceed federal specs.

There's no grille up front to duct air to the radiator of the 360-cu.-in., AMC V8 engine; cooling air is deflected up by underbody spoilers. The body itself is of

doors (not seen on a production car since the Mercedes 300SL was discontinued in 1957) are operated by electric hydraulic motors—same as those used for convertible tops. While swinging up or down, they project only 11 inches from the car, making them less vulnerable to passing traffic.

When you slide over the wide sill (because of the bumper-high perimeter frame) into the driver's seat, you're sitting in an excellent bucket seat finished in suede, and

(Please turn to page 54F)





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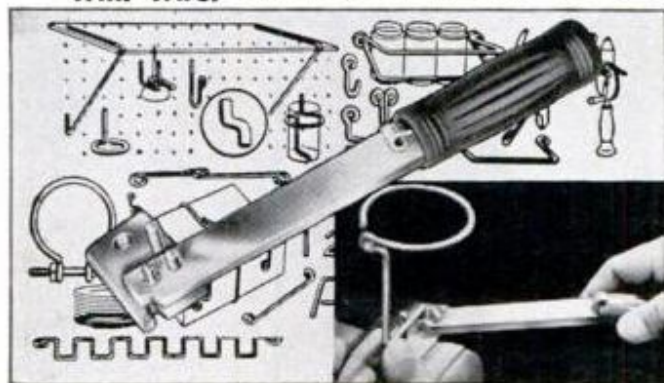


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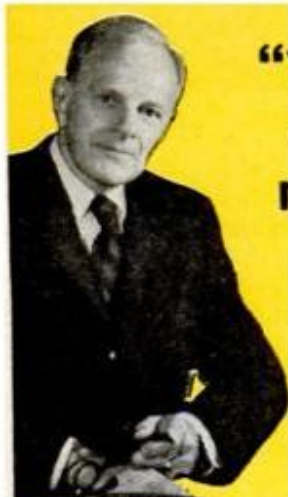
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IMPORTS AND MOTORSPORTS

(Continued from page 54D)

you find as standard: air, AM-FM stereo, tilt-steering wheel, tinted glass, power steering, disc brakes, carpeted interior.

We haven't had the competitively priced, \$6500 Bricklin out on the road yet, but it looks as if Datsun Z cars and Vettes had better get out of the way. Bricklin Vehicle Corp. is at 6900 East Camelback Rd., Scottsdale, Ariz. 85251.

Look, Ma, two hands

A grown man on a Norton with . . . training wheels? Well, these researchers call them outriders and they are, in fact, attached to the big bikes to keep them from falling over. The bike in the foreground has deliberately been placed in a locked front-



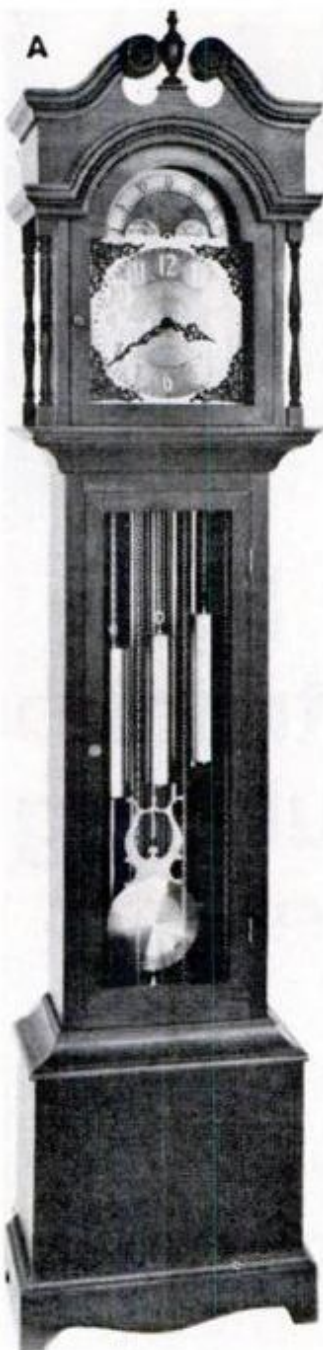
wheel skid and the outriders are the only things keeping the rider from sliding down the skid pad on his you-know-what. The rider behind, coming to a short, straight stop, is on a Norton fitted with a Mullard antilocking front brake—the same type used on some cars with antiskid braking.

On a bike, where steering is accomplished with a single front wheel, a lock-up is particularly devastating—all but impossible to correct. It is hoped the tests and development will lead to a light, compact and economical antiskid braking system fitting most motorcycles without affecting their handling. Mullard Ltd. is at Mullard House, Torrington Place, London WC1.

Speaking of motorcycles, on Sept. 8 Evel Knievel plans to jump Snake River Canyon on his. I don't think I want to look. ★★★

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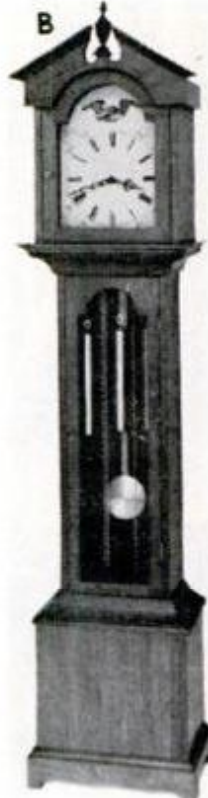
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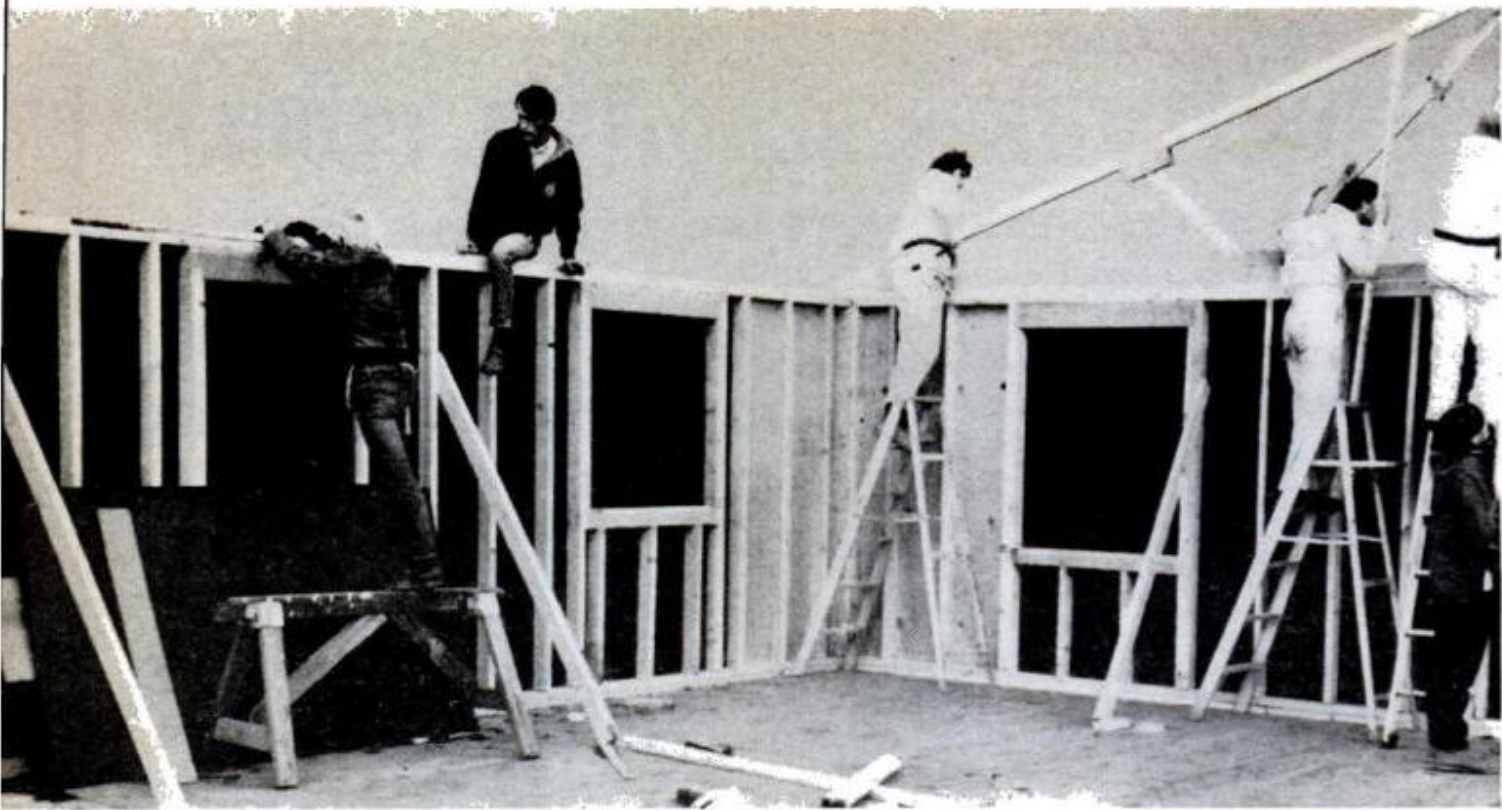
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Construction crew of students in the building-trades class is shown with bus used for transport to site. Instructor W. Earl Watson is at right in front row.

They learn construction by building houses

From framing to landscaping, these Indiana high-school students do it themselves.

by Larry Moores

Any skill is best learned through practice, and this is certainly true of the many skills that go into building construction. There's no better way to teach this knowledge to vocational-school students than to have them build a house.

That's exactly what's done at Mid Central Vocational School in Elwood, Ind., a com-

munity of 12,000 located 45 miles northeast of Indianapolis. Mid Central's building trades program has been in operation since 1965 and has served as a model for similar programs all over the state.

The four-semester course was set up for youngsters interested in learning enough about construction so that they could enter apprenticeships in the various trades after graduation. The dynamic core of the course is its combination of classroom instruction with practical training—each class builds a complete, full-size house. A project of this size allows all students to sample each of the major trades involved in light construction, provides enough work stations to keep

(Please turn to page 54J)

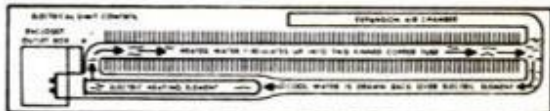
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THEY LEARN BY BUILDING

(Continued from page 54H)

everyone busy and results in a finished product the students can really take pride in. And since the project house is sold when finished, the program recovers most or all of its cost.

The Mid Central program allows students to attend academic classes for half the school day and vocational class for the other half. The building-trades class meets for

three hours a day. After the day's introductory classroom instruction, the students are bused to the building site and spend the rest of the day at work on the house. Work at the site continues through winter months. Classroom instruction is always tied directly to the phase of construction under way on the house. Each student learns the basics of rough and finish carpentry, cabinetmaking, concrete placement and finishing, brick masonry, wiring, plumbing and heating, plastering and drywall, painting and paper hanging.

Although it is intended for students attending high school, some high school graduates have enrolled to get training needed for employment in construction. While officials have no objection to girls in the program, none have yet entered it.

Students in the program have so far built four houses. Each was financed by means of a nonprofit corporation, organized with the help of community members representing trades, contractors, lending institutions and real estate dealers.

Success of the program is manifest when, in an area that offers high wages in factory jobs, 60 to 70 percent of its graduates choose to remain in building trades. ★ ★ ★



Plasterboard ceiling goes up fast with two energetic youngsters wielding their hammers.

Photos: Tom Pantos



Instructor Watson gives a student pointers on installation of the top course of brick veneer used on house exterior.



Three-bedroom ranch house was built by class over period from fall 1972 to spring 1974. Features include double-glazed windows, electric appliances and heat, French doors at rear, fireplace.

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● **Fishing & Marine Gear**—including fish locators, fishing thermometer, digital & flasher-type depth sounders, vapor detector, foghorn/hailer, power inverter—all designed for quality-minded skippers & anglers with a weather-eye for economy.



● **Automotive**—professional auto accessories & tune-up kits, including battery chargers, CD ignition, timing lights, ignition analyzers, tune-up meters, sirens, and more—at build-it-yourself savings.



● **Amateur Radio**—The famous Heathkit amateur gear—transmitters, receivers, transceivers, 2-meter FM gear, novice rigs & accessories—world's largest selection of amateur radio equipment.



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HOMEOWNERS' CLINIC

BY W. CLYDE LAMMEY

Replace old wiring?

I've just purchased an old home which has what my electrician calls "knob-and-tube" electrical wiring. Although he says that the wiring is still in good condition, he strongly recommends that it be replaced. Is he right, or is he just promoting a job?—Roy Wilkins, Columbus, Ohio

Knob-and-tube wiring uses unshielded, rubber-covered wire threaded through porcelain tubes which are placed in holes bored through joists; porcelain knobs are used to secure the wire at outlets and taps. Your electrician is undoubtedly thinking of the hazard of overloading this old type of wiring with modern appliances, some of which have current requirements beyond its normal capacity, particularly on branch circuits. There is also the danger of accidental damage to exposed sections of wiring as they are not housed in conduit. I, too, would strongly recommend that you have new wiring installed in accordance with present-day electrical needs and codes.

Refinish or replace paneling?

One room in my home has prefinished wood paneling in a medium-dark color I don't like. I think it is a dark finish over lighter-colored wood, and the lighter color is what I really want in this room with a northern exposure. Should I try refinishing, or must I replace the paneling?—E. Samuelson, Lexington, Ky.

You don't say but I assume all four walls of the room are paneled. If so, and you desire to lighten the room, have you thought of removing the paneling from three of the walls? This would accomplish at least part of the result desired. I hesitate to suggest you refinish the paneling because of the labor and time involved and the possibility that the completed job might not be to your liking. Unless removal of paneling from three walls satisfies your taste, I'd recommend that you cover the present paneling with new.

Patching plastered wall

Recently I moved to a new address and in one room I discovered a hole in the plastered wall that's roughly 2 in. or so in diameter. It will be concealed by furniture, but it lets in a lot of cold air. How can I patch it?—A. Olsen, Milwaukee

This is the way it's usually done by professionals: Stuff newspaper or, better, insulation into the hole to provide a base for spackling compound. If necessary, hold the stuffing with masking tape.

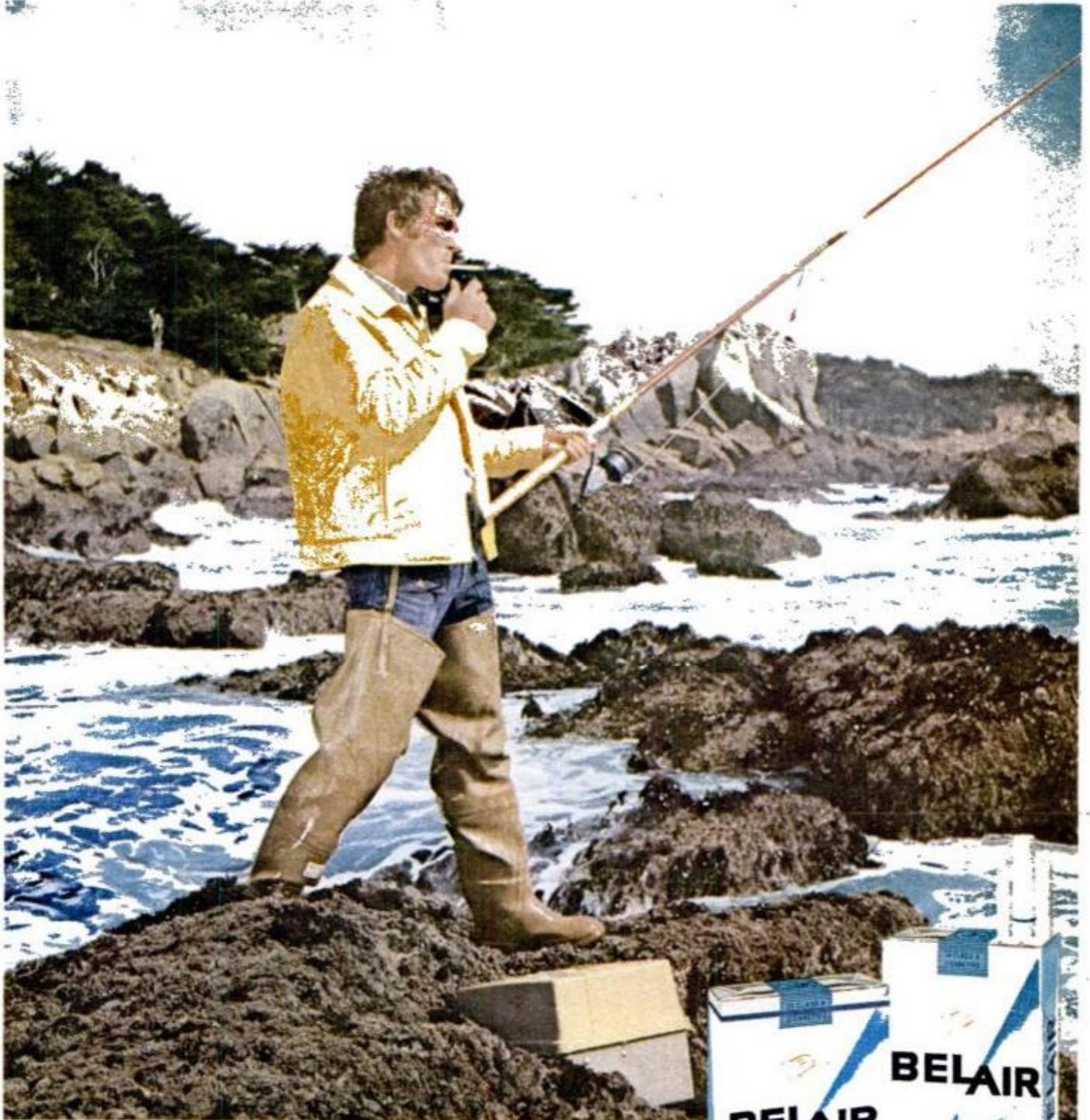
Fill the hole with compound, embed joint tape into it and smooth with a trowel. When dry, the surface will be slightly concave. Apply a second coat of compound, sand it when dry and follow up with a third coat to make a surface that projects slightly from the wall. Sand this coat smooth and flush when dry, coat it with shellac and paint it to match the wall. For more on patching plaster, see *How to Make Cracks Disappear* (page 72, Jan. '73 PM).

Squeaky kitchen floor

My kitchen floor is three-layered: subfloor, 5/8-in. plywood and tiles. It squeaks. I've tried drawing the subfloor and plywood together with screws. It still squeaks here and there when stepped on. What's next?—W. N. Kirk, Pittsburgh

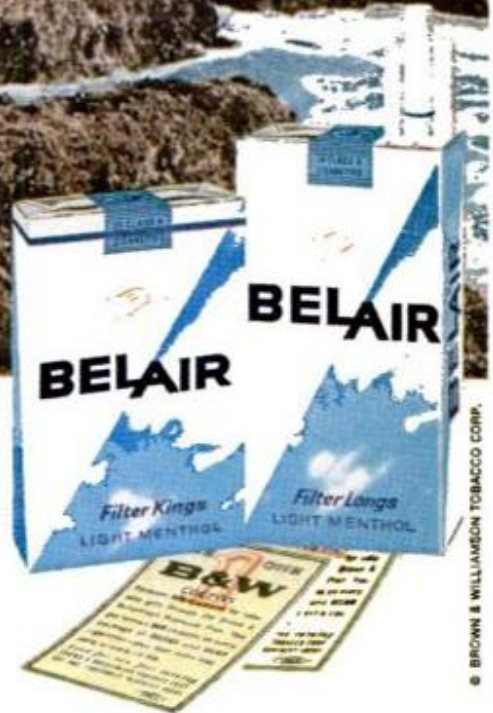
The screws didn't hit the squeaks. The best way to fix them is to have someone walk over the floor while you are in the basement to pinpoint the squeaky spots. Then drive undercourse wood shingles between floor joists and subfloor at these spots, and secure each piece of shingle with two 4d finishing nails. For more remedies, see *How to Silence Squeaky Floors* (page 98, May '73 PM). ★★★

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.




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A kayak that thinks it's a surfboard

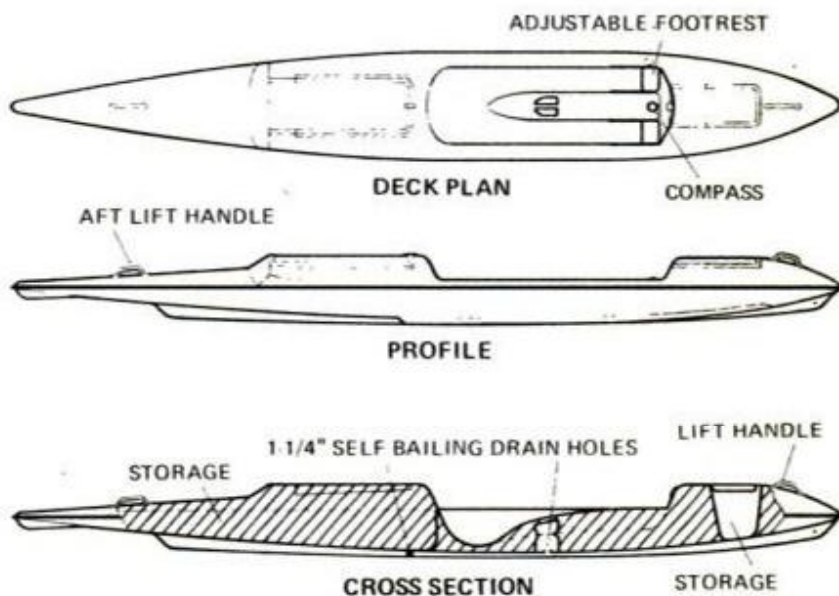
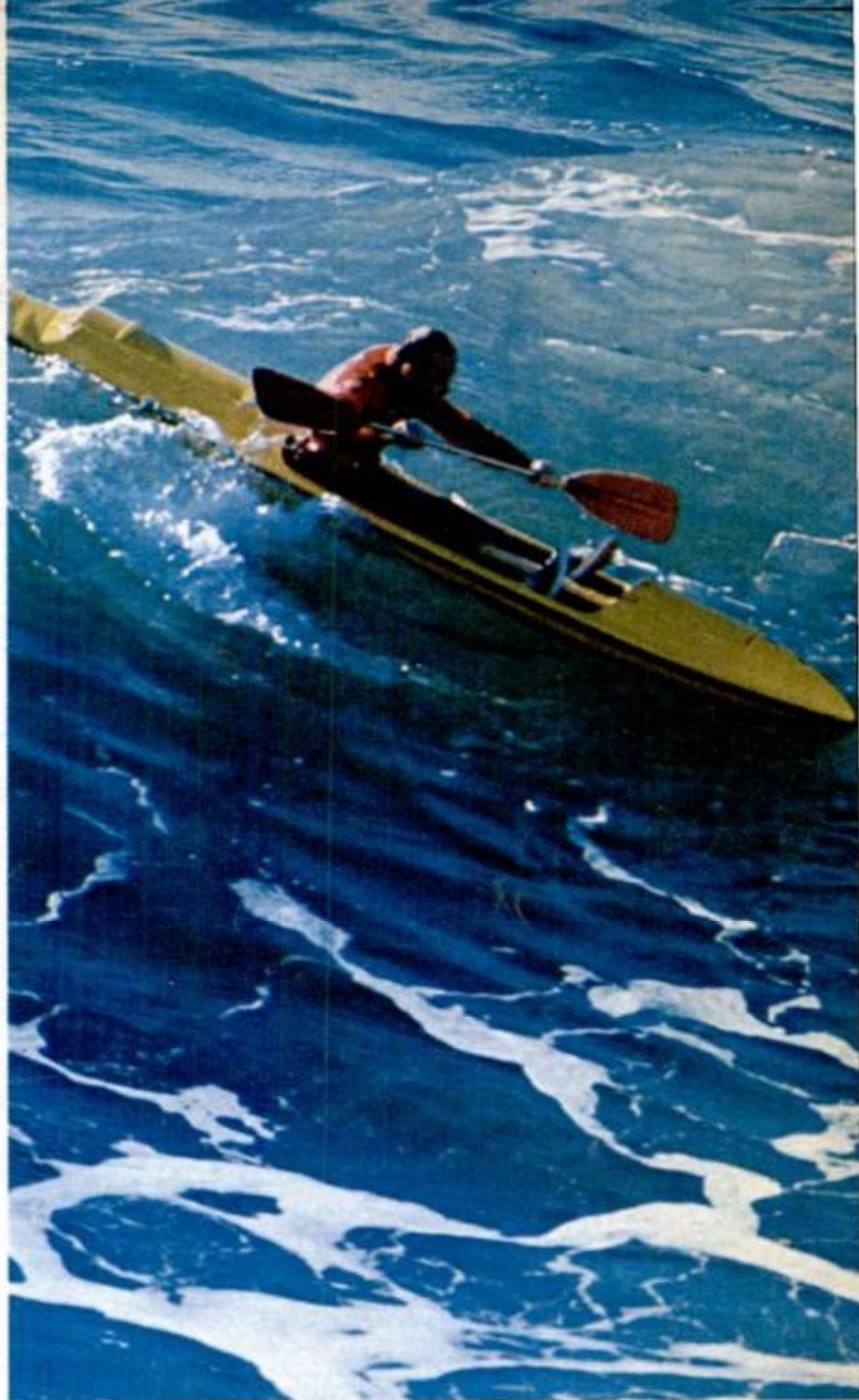
You won't wipe out or Eskimo roll with a Royak, but the action's all there.

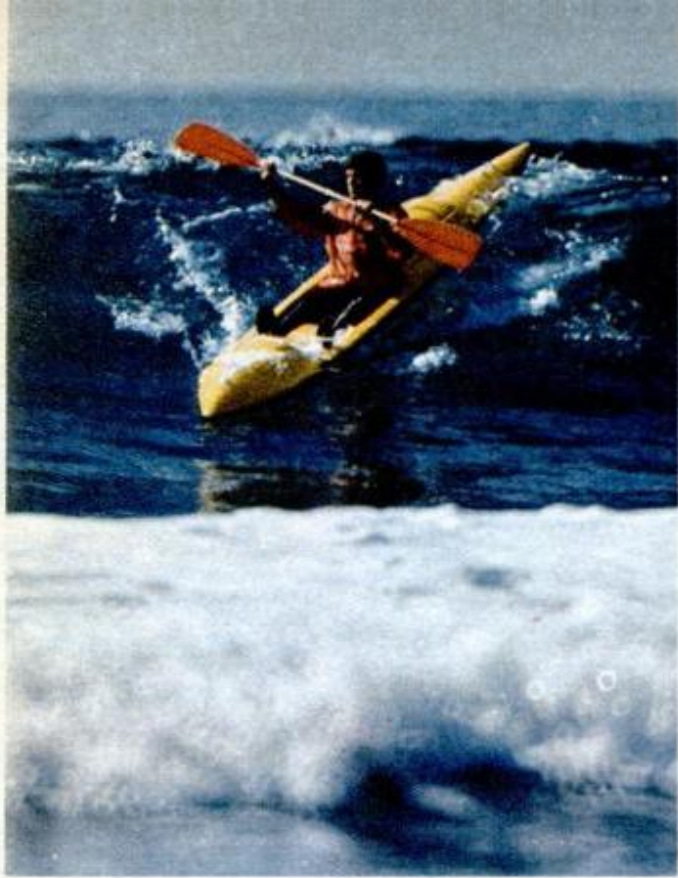
by Philip Hermann

In March 1972, one of the few U.S. patents ever awarded to a paddle-craft went to a float board that looks half kayak and half surfboard—and isn't really either one.

Roy Grabenauer of Sacramento originally designed the Royak for breaking through the heavy surf and strong currents along the Pacific Coast. Skin divers, he felt, needed something better than the cumbersome boards they had been using to paddle out offshore. The result turned out to be not only safe but fun. Now all along both coasts, surfers, campers and white-water enthusiasts have joined this sit-and-paddle water sport. It's \$339, delivered.

The craft is 14 feet 7 inches long, has a 24-inch beam and weighs 65 pounds. It is made of the same rugged heat-formed ABS plastic used in professional football helmets, and the cockpit of the boat is molded to fit the paddler. Adjustable footrests complete the customizing. There is no foredeck cocoon to hold the passenger's legs





Sit-surfing's a new sport

in case of capsizing, and no special skills such as the Eskimo roll with its hip action and weight shifts are necessary. A secret of the Royak's stability is its below-the-waterline seating arrangement; the paddler takes up all the cockpit space and any water which comes in over the gunnels can run out through the self-bailing drains. Polystyrene pellets inside the hull give it good flotation, and the design is stable and hard to tip over. For very rough water, the aft storage compartment can be flooded, giving an even lower ride and increased stability.

River runs and ocean passages have been done successfully with minimum fatigue for the travelers. One group of 23 Royakers, including women, children and six beginners who had never paddled anything before, crossed to islands seven miles off the coast of Baja California. No one tipped in 25-mph rain gusts along the way. Another group followed Lewis and Clark's trail along the Missouri River and covered 180 miles through Montana in a seven-day passage.

Wilderness lake travelers favor the light weight of the little yellow craft when it comes time to portage, and the directional stability and lack of fishtailing when they're using a double-bladed paddle. Scuba divers report it is easy to leave and reboard. Paul Plescia of Royak, Inc., 3510 La Grande Blvd., Sacramento, San Diego, Calif. 95823, reports rental fleets are also growing. ★★

Paddling down waves, up rivers and across lakes, this plastic 14-footer provides fitted-seat cockpit, self-bailer drain, two storage compartments—even a compass for offshore passages. Pellets inside the ABS hull and deck give plentiful flotation; rear compartment can even be flooded for added stability in rough seas. Easy reboarding appeals to divers, directional control without fishtailing to paddlers, lightness to portagers.



**Handsome,
durable and
contemporary
— build it
for \$95**



Color photo: Robert D. Borst

Clean-lined chair is finished with an amazing new plastic laminate that looks—and feels—like cane.

by Rosario Capotosto

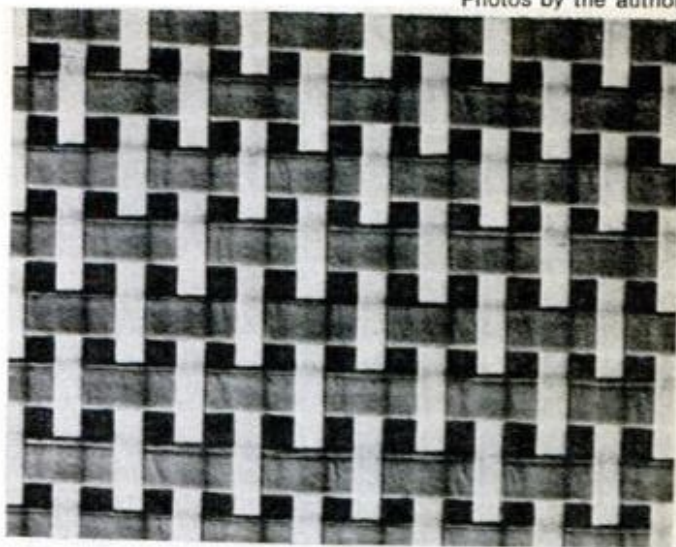
This project is a classic case of putting the cart before the horse. Rather than design a chair and then decide which materials to finish it with, we created it by doing just the opposite. The reason for the switch is the exciting textured laminate—Natural Cane—now offered by Nevamar. When PM's Workshop Editor spotted the material, the decision was made to let readers know about it through an unusual and attractive workshop project—the chair you see on the facing page.

The laminate actually looks like cane and has the feel of cane; its color is also accurate as can be seen in the photo. The over-under weave is realistic down to slight irregularities to complete the illusion of hand-caning (see photo at top right). Except in texture, Natural Cane is the same as conventional plastic laminates. The material is worked with the same tools, and bonded to plywood using contact cement. Nevamar plastic laminates are available at most well-stocked lumberyards. If you have difficulty obtaining it locally, write the maker (see materials information on page 68 for the nearest dealer).

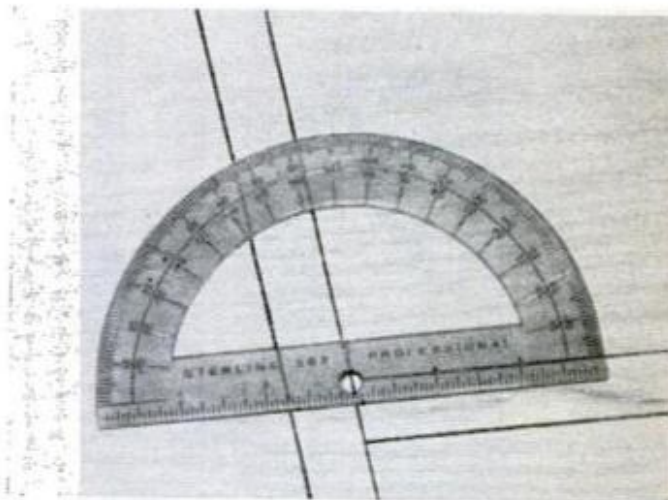
The beauty of the chair is its simplicity of design; you needn't be a master craftsman to build it. And you don't have to be an upholsterer either; the chair is dimensioned around ready-to-use stock cushions sold by Sears. They're available in red, gold, tangerine and olive, as well as the blue shown. If preferred, you can size the chair to suit cushions you already own.

The chair can be cut from a single 4x6-ft. piece of $\frac{3}{4}$ -in. plywood. You'll need two sheets of plastic laminate—one piece 30x96 in., and another 30x48 in. These sizes allow for some waste. If you lay out the parts carefully, however, you can shave the amount needed and buy slightly less laminate. The final big expenditure is for 16 ft. of $1\frac{1}{4}$ x 5-in. walnut. That's nominal size; actual size will be $1\frac{1}{8}$ x $4\frac{5}{8}$ in. As can be seen in the drawing on page 67, the walnut must be ripped to $1\frac{3}{4}$ -in. width, and its thickness

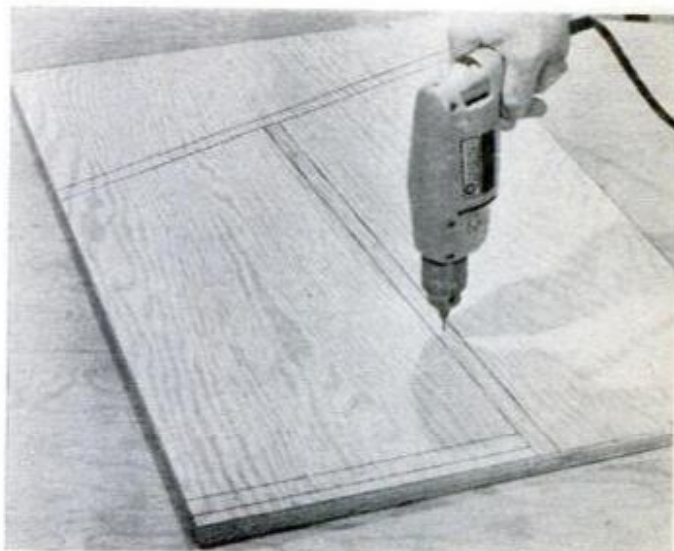
Photos by the author



Actual-size photo of Natural Cane laminate. Slight irregularity of weave makes pattern very realistic.



For seating comfort, angle between seat and back should be about 98° . Check it with a protractor.



Seat and back panel locations are drawn on inside of side panels; pilot holes are then drilled down centers.

Chair is cut from 4x6-ft. piece of plywood

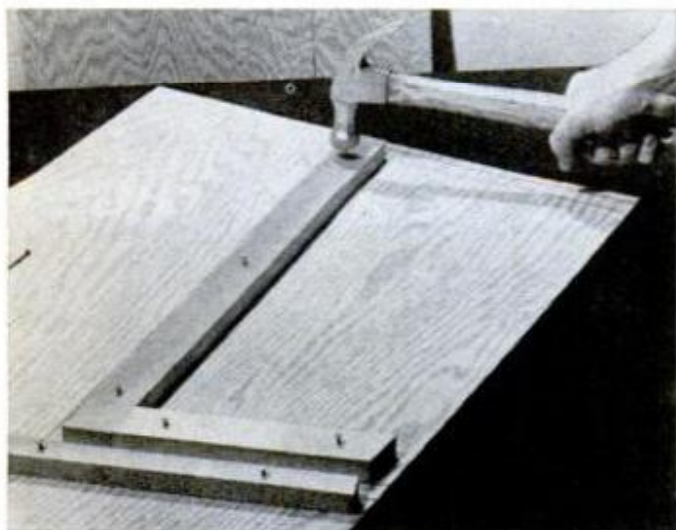
reduced to 1 in. Fillers for grooves and thin strips on the back are cut from the scrap. Before cutting any chair trim to length, you are well advised to prepare the walnut to size. Then, if necessary, lengths can be altered to suit after the chair is assembled.

The chair is comfortable for an average-size person as built, but you may prefer the alternate design shown in the drawing on page 68. In this version, the front panel is pitched back at the bottom at the same angle that the back tilts forward at the bottom. It is easier to rise from a chair built this way because feet can be planted back under the front edge of the cushion instead of in front. If you're undecided about which design you prefer after cutting the plywood

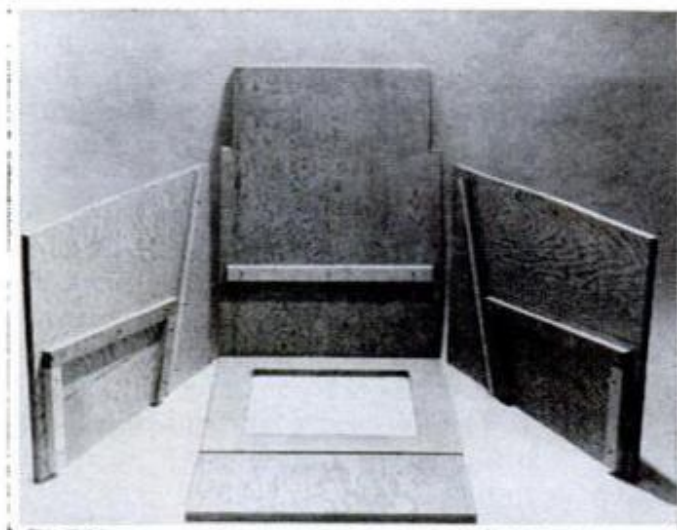
pieces, temporarily tack the chair together and sit in it. Try it both ways before making up your mind.

Building the chair. Start by cutting the plywood members to exact dimensions, but make certain you leave extra on those pieces which will require beveling. Next, using the panels, accurately draw the outlines for the seat, back and front panels on the inside surfaces of the side panels. Drill a row of pilot holes spaced about 5 in. apart along the centerlines of the outlined areas. Cut the required cleats and temporarily install them without glue.

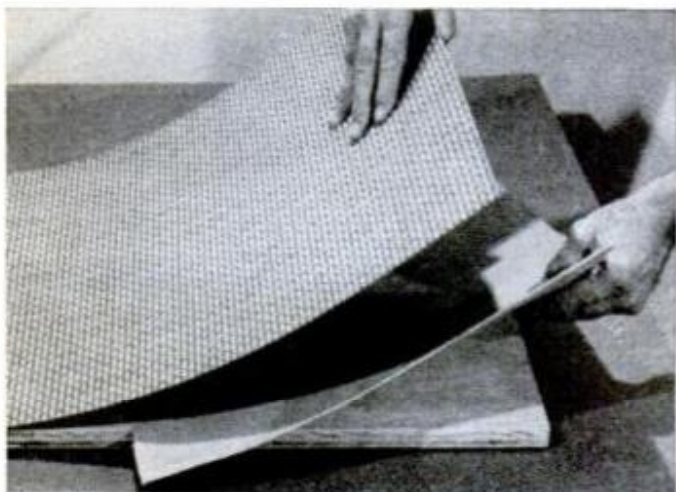
Bevel the rear edge of the seat panel with your saw blade set at 8° , then reset the bevel to about 5° and cut the front edge (so it



Cleats are cut and temporarily tacked on. Permanent assembly is after plastic laminate has been applied.



All components ready for initial, temporary assembly. Only cleat on back panel is permanently in place now.

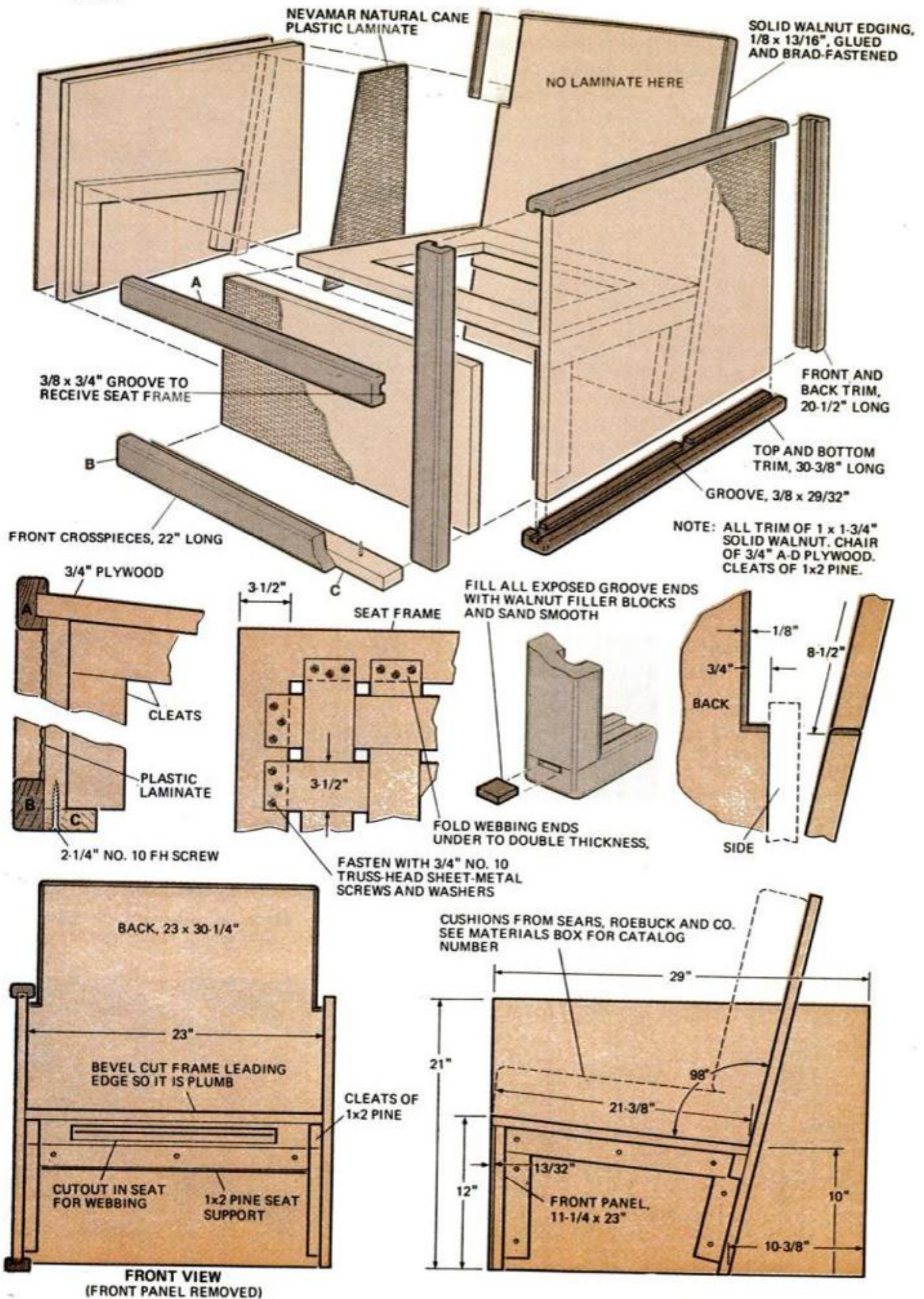


After disassembly, parts are laminated. Brown paper keeps laminate from contact with core until desired.



Router equipped with carbide-tipped straight cutter is used to trim overhang. Edges are then beveled.

CONTEMPORARY CHAIR



will be plumb when installed). On the back panel, the bottom edge only is beveled 8°. Finally, using your sabre saw, cut out the seat opening. Then assemble the chair with partially driven nails so that screw pilot holes can be bored through the holes drilled in the sides.

Applying the laminate is not difficult if you take some precautions. Here are the basic techniques: If cutting on a table saw, use a carbide-tipped blade and cut with the good (decorative) side up. For sabre-saw cutting, use a fine-tooth hacksaw blade and cut with good side down. Cut all pieces to allow $\frac{3}{16}$ in. overhang at all edges.

In a well-ventilated room, apply contact cement to both surfaces quickly and evenly, using a clean paint roller or nylon brush. Allow cement to set according to maker's instructions; when cement does not adhere when touched by brown paper, the pieces are ready for bonding. Keep surfaces separated with brown wrapping paper to prevent misalignment; then, as you carefully slide paper out, press laminate into contact with core. Immediately apply pressure on the laminate with a roller or by sliding around

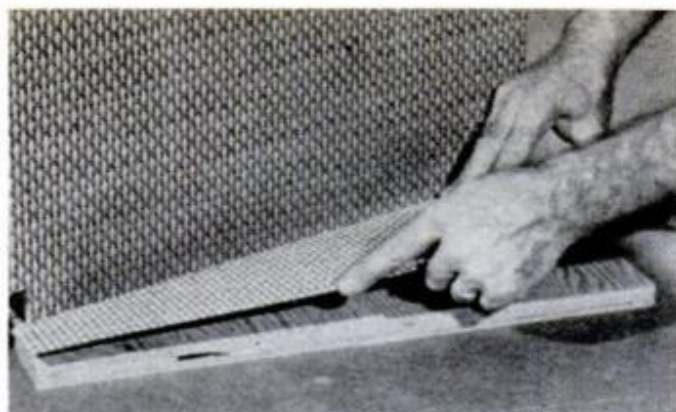
(Please turn to page 157)

Materials information

Cushions: Two-piece Traditional Danish Chair Set. Catalog No. 24 G 19234 LH. Sears, Roebuck and Co., Sears Tower, Chicago, Ill. 60684.

Plastic laminate: Nevamar Natural Cane CE-62. Manufactured by Nevamar Div., Exxon Chemical Co., Dept. PM, Odenton, Md. 21113.

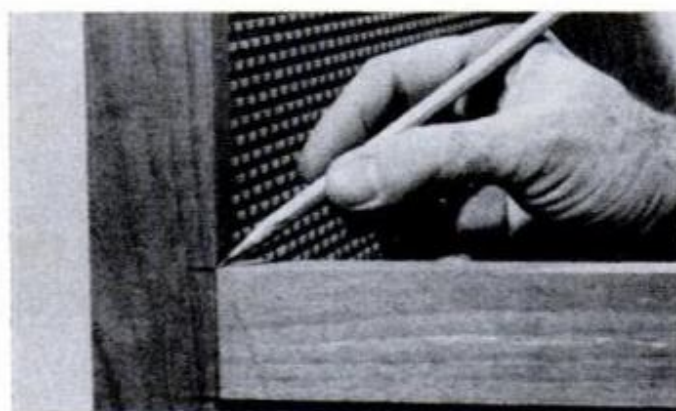
Seat webbing and Wood-Glo finish: Albert Constantine, Dept. PM, 2050 Eastchester Rd., Bronx, N.Y. 10461.



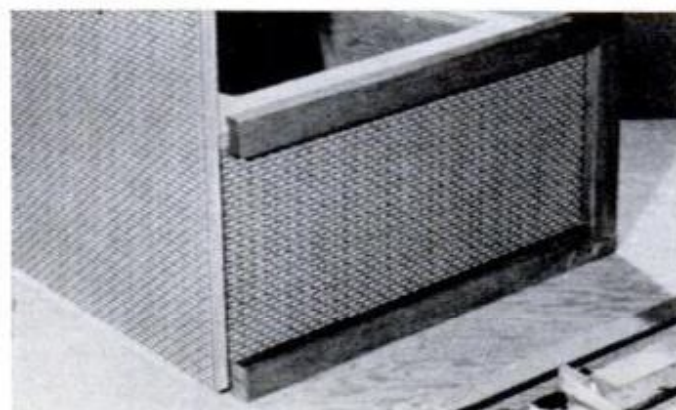
1. Chair is reassembled after you laminate front and back; inner surfaces of sides are then laminated.



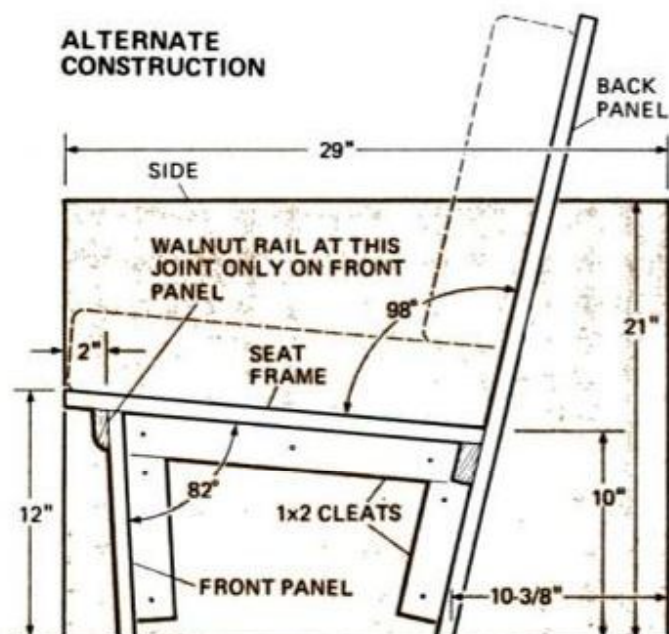
4. Last disassembly is made so that the router can be used to trim overhanging laminate from all parts.



7. After grooving hardwood, assemble the parts on chair, mark at butt joints where radius sanding ends.

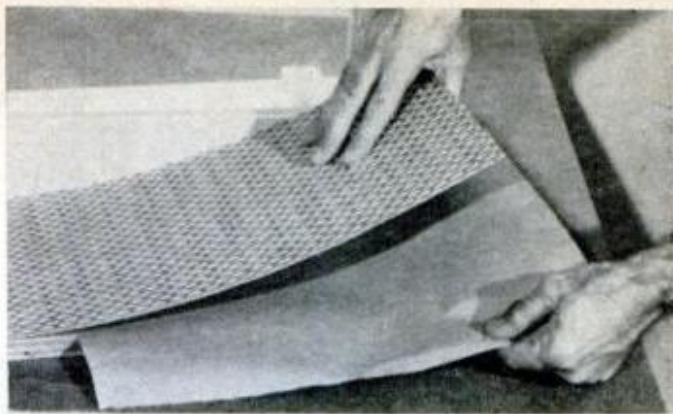


10. Hardwood trim on left corner is removed to show how the trim members are installed on the chair.

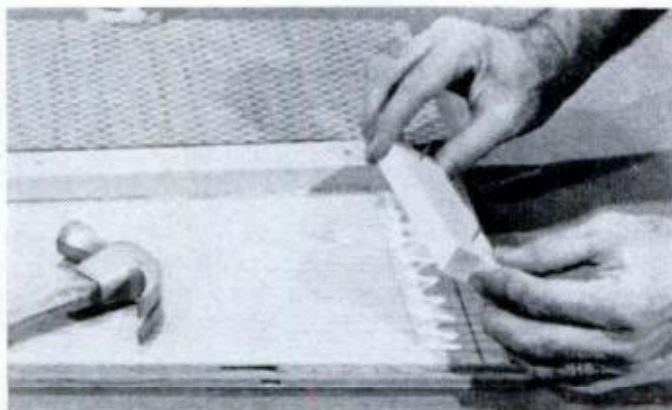




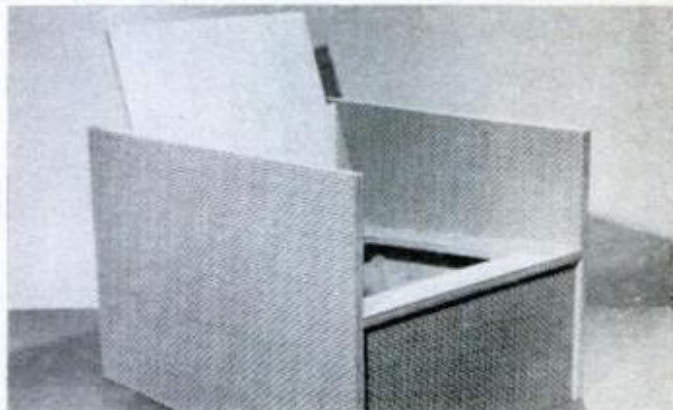
2. Laminate is cut from the back using taped-on pattern as a saw guide. Notice the pattern orientation.



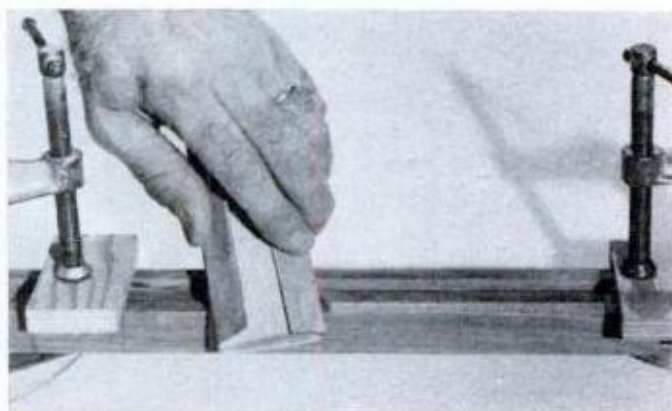
3. Kraft-paper slip sheets are used when applying all laminate to assure alignment on plywood core.



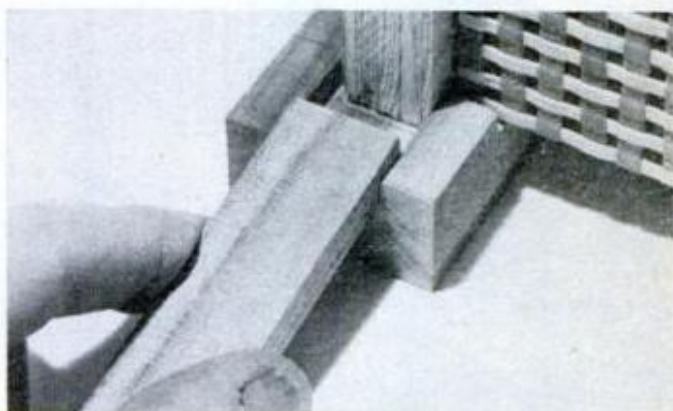
5. Reinforcing cleats can now be permanently attached to inner surfaces of chair with glue and threaded nails.



6. Fully laminated and permanently assembled chair, ready for application of the walnut trim.



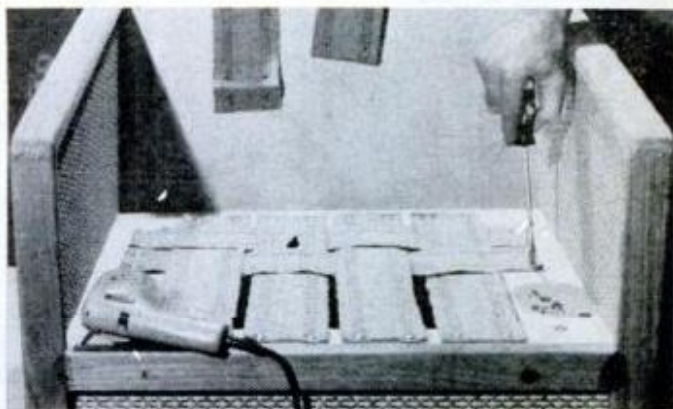
8. To avoid an expensive mishap, scrap blocks are clamped over the trim areas not to be rounded over.



9. Filler strips are used to plug ends of rails, then sanded. This method is easier than blind-grooving.



11. Final sanding of trim is done with trim on chair. Start with 120-grit paper; finish with 220 grit.



12. Chair webbing is installed basket-weave style. Ends are doubled-up; holes are punched for screws.

Ship modeling: New life for an old art

Photos: David Gooley

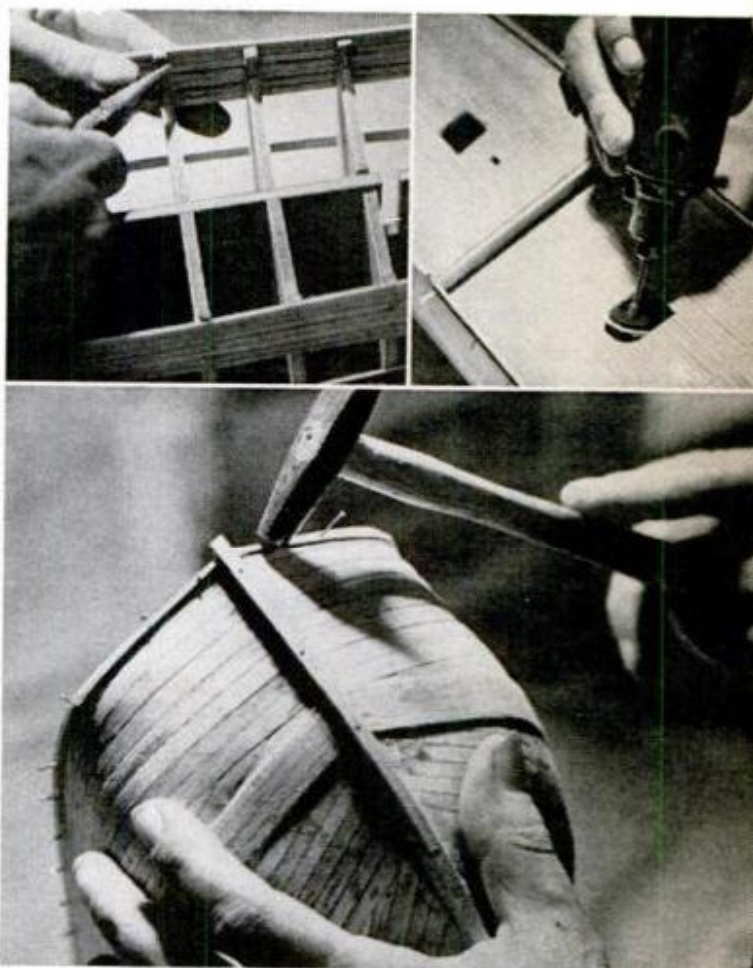


Today's boom in home hobbies is bringing renewed interest in an ancient craft. Here's how a master modeler creates magnificent miniatures—and how you can, too.

by Jake Grubb

Making an authentic replica of a mighty square rigger used to be considered beyond the skills of the average do-it-yourselfer, requiring expert know-how, specialized tools and massive amounts of time and patience. Time and patience are still requisites, but beyond these the task is not necessarily as awesome as it might seem. Authentic construction plans are available from a variety of sources. Books, tools, materials and even many ready-made parts can be obtained at hobby shops. If anything, the use of modern power tools makes the job easier than ever, speeding once laborious, time-consuming hand operations.

Recreating in miniature the majesty of an ancient sailing ship is a rewarding challenge—filled with fun and excitement—that any hobbyist can master, says veteran modelmaker Ed Sims of Laguna Beach, Calif., a man who for 27 years has made his living duplicating legendary vessels in precise scaled-down detail. Getting started is really the hardest part, thinks Sims. The first thing to do is obtain plans for the ship of your choice, often easier than you may imagine. This is done by contacting the proper historical institution. If the ship is American, Sims writes directly to the Smithsonian Institution in Washington, D. C. "Specify the ship you are looking for," he advises, "and the Institution will likely have the original plans or duplicates on file. They will send you copies for a nominal fee—one or two dollars. If they can't supply the plans you want, they will often refer you to a source that can."



Mighty three-masted square rigger, shown in all her ornate glory on facing page, begins to take shape above. First step is planking hull. Thin wood strips, water-soaked to make them pliable, are glued and tacked on with brass pins as temporary fasteners. After glue sets, pins are removed with long-nosed pliers (top left) and holes "pegged." At top right, square holes for masts are formed in deck with tiny disc sander.

Other sources for plans are hobby shops and maritime museums. Most hobby shops stock or can order plans for well-known historical vessels. If the ship you want is of foreign origin or an obscure design, your best bet may be a maritime museum. "There are 82 national maritime museums throughout the world," says Sims. "You start by finding out where the ship you want was originally built, then you write the national maritime museum of that country. They will either have the plans or suggest other sources." Sims recommends the

The thrill and challenge: Working from original plans

museums of Great Britain, Paris, Rotterdam and Barcelona as being most helpful.

Plans will probably be in $\frac{1}{8}$ or $\frac{3}{16}$ -inch scale. Beware of a larger scale or you may find yourself with a model the size of your living room on your hands, Sims warns. However, large-size plans can easily be reduced to any desired scale photographically at a local photostat or blueprint shop.

Tools required for ship modeling are basically simple, says Sims: a pair of needle-nosed pliers, cuticle scissors for fine cutting, an X-Acto knife with No. 1 blade, X-Acto modeler's chisels, tweezers, a $\frac{1}{32}$ -inch-scale ruler, fine sandpaper and a miniature electric hand drill or hand grinder of the Dremel type. Sims uses a hobbyist's jigsaw for cutting out ribs, keels and other parts demanding precise accuracy. He also uses a small bench sander for shaping and

finishing. If necessary, a coping saw can be substituted for the powered jigsaw and hand sanding for the bench sander.

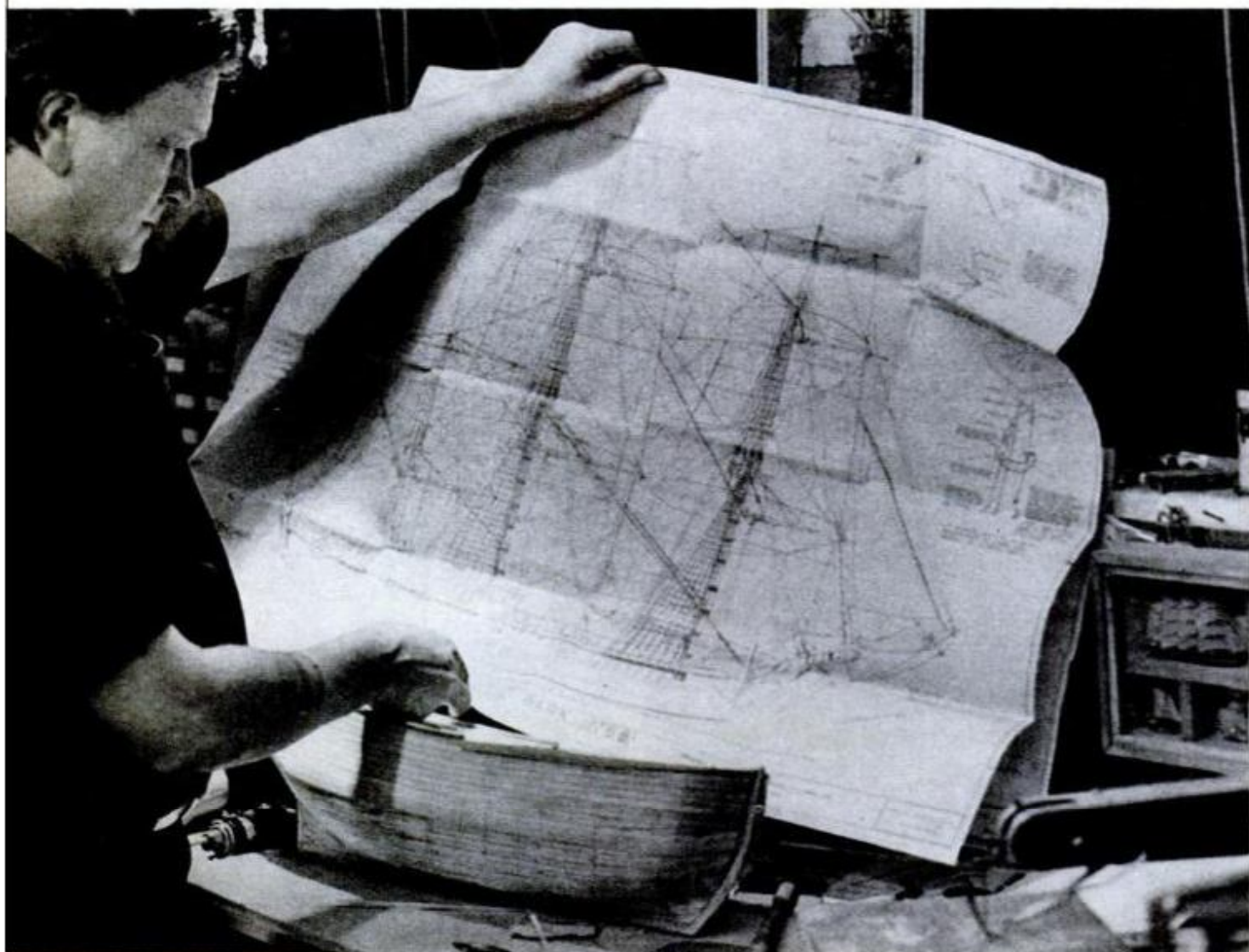
Working from original plans is relatively easy if you take them a step at a time and don't allow yourself to become confused by the mass of intricate detail. Take your time and study each part before attempting to reproduce it. Wherever possible, obtain pictures of the ship you're modeling as these will serve as an additional aid in deciphering the plans. Often pictures will show in three-dimensional form parts that may not be completely clear when shown in flat view on the plans.

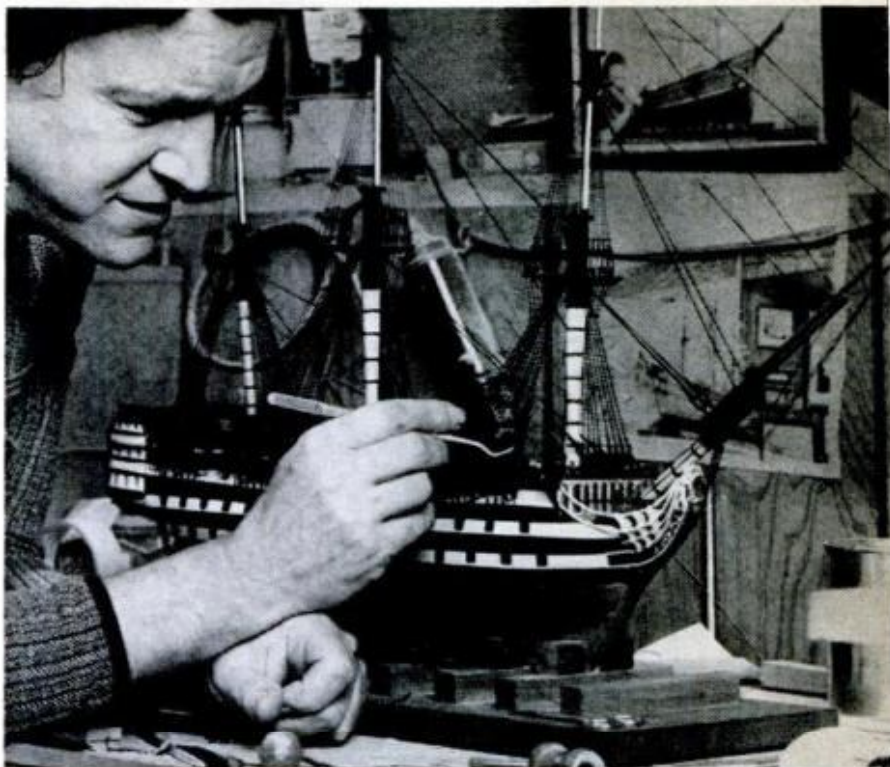
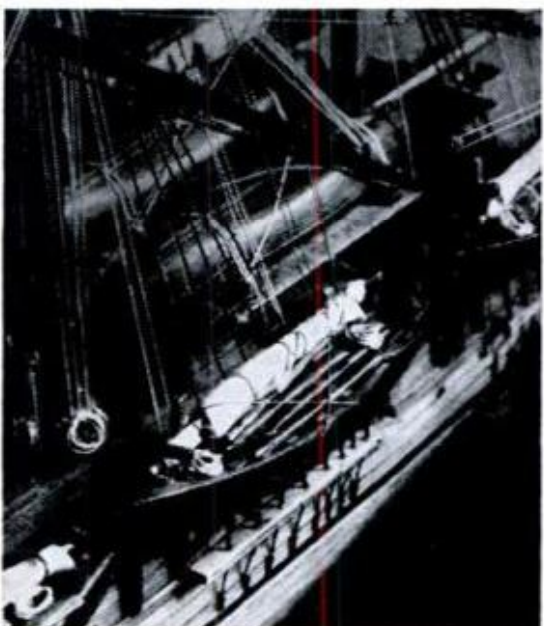
First step in the building process is to make precise tracings of the ribs and keel. These are then cut into templates, laid on $\frac{1}{8}$ -inch-thick plywood and traced again

(Please turn to page 156)

Authentic plans of early sailing ships provide accurate data for superdetailed modeling. Copies of such

originals are available at nominal cost from maritime museums and historical institutions like Smithsonian.





Master modelmaker Ed Sims (above) checks "ratlins" for proper tautness of rigging before putting finishing touches on a 17th century British warship. Photos at left show fantastic detail and workmanship in masts, rigging and deck fittings that are typical of an authentic replica made from original ship's plans. Shown below is Sims's unique method of mounting his models. Instead of being held in conventional cradle, vessel sits on rows of wood blocks simulating heavy timbers, giving it appearance of resting on ways ready for launching. Bolts run through keel hold it in place.



How to make drawers

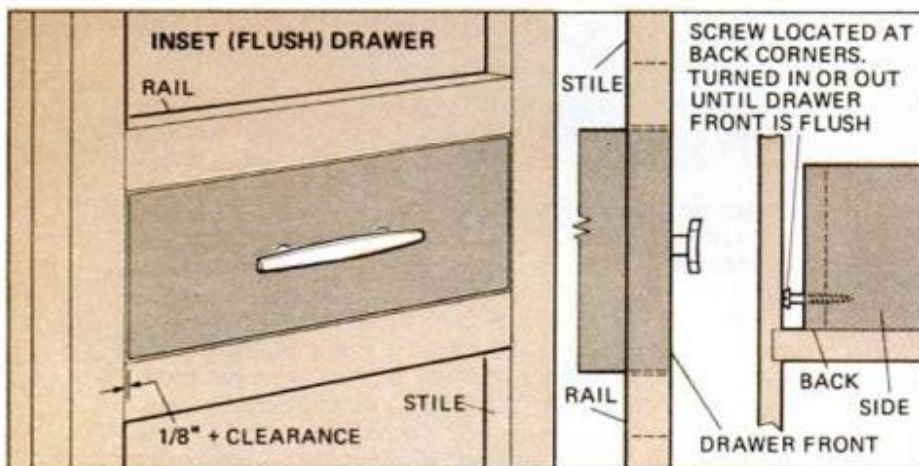
Data: John Gaynor

Though many do-it-yourselfers mistakenly think that making a drawer is beyond their abilities, no great mystery surrounds the task. The two keys to good drawermaking—whether using sophisticated joinery techniques or constructing the simplest drawer—are: 1. accurate measurements, and 2. perfectly square cuts.

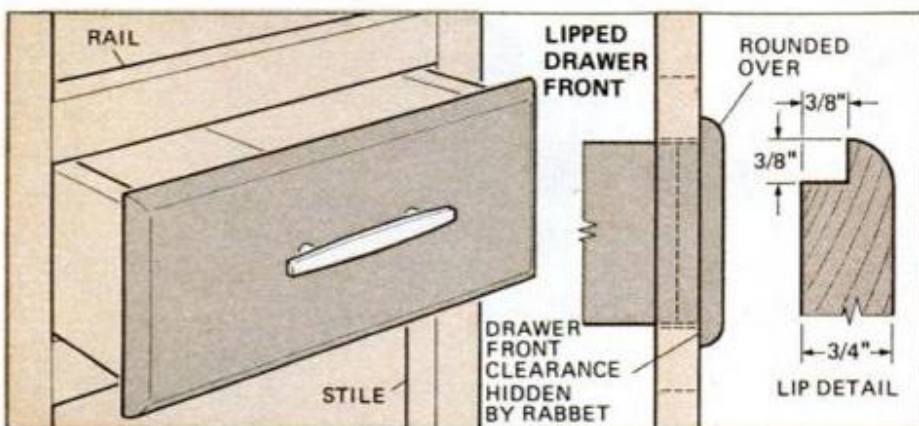
Whether you are building a drawer from a working drawing or taking dimensions

from a cabinet, study the drawing or cabinet carefully to determine the exact height, width and depth. Use the same kind of wood for drawer front as was used on the cabinet; drawer sides and back can be of less expensive nonwarped clear pine. The drawings on these pages give all the basics of good drawer construction. Study them carefully. Additional drawer know-how is spelled out in accompanying captions.

Three most common drawer fronts

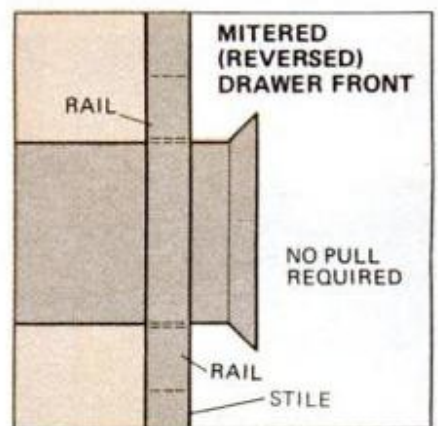


An inset flush drawer should have uniform clearance around the opening on all four sides. The usual clearance is $\frac{1}{8}$ in. When laying out the drawer, carefully determine the length of the sides so that the drawer front will be perfectly flush with the stiles and rails. A pair of screws in the back corners will aid in aligning the drawer front if the drawer is too short.



Rounded or lipped fronts are most commonly used on kitchen cabinets. The advantage of this type front is that the lip conceals the gap between drawer and opening—thus, the $\frac{1}{8}$ -in. clearance mentioned above is not as critical. The lip is created by a $\frac{3}{8}$ -in.-sq. rabbet around the inside edges of the drawer front. This rabbet can be made with a router in one pass, or on a table saw in two passes.

The remaining edge is usually rounded off with either a shaper or a block plane and belt sander. If you prefer a contemporary look, omit the rounding-off step. A lipped drawer front can also be created by fastening $\frac{3}{8}$ -in. quarter-round moldings to all drawer edges.

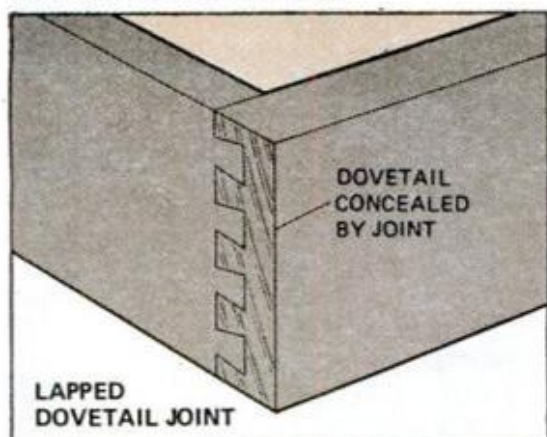


Mitering on the inside edge of a drawer front calls for careful cutting. After setting table-saw blade to desired angle, adjust the rip fence to leave a feather edge as shown.

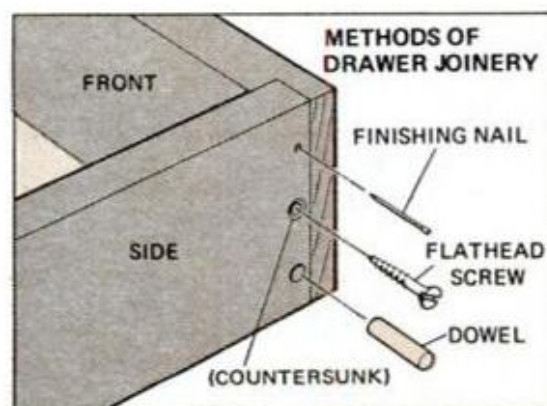
Cut ends of front first (across end grain), then make cuts with grain. For safety, attach wood face to rip fence for close cuts.

Typical drawer joinery

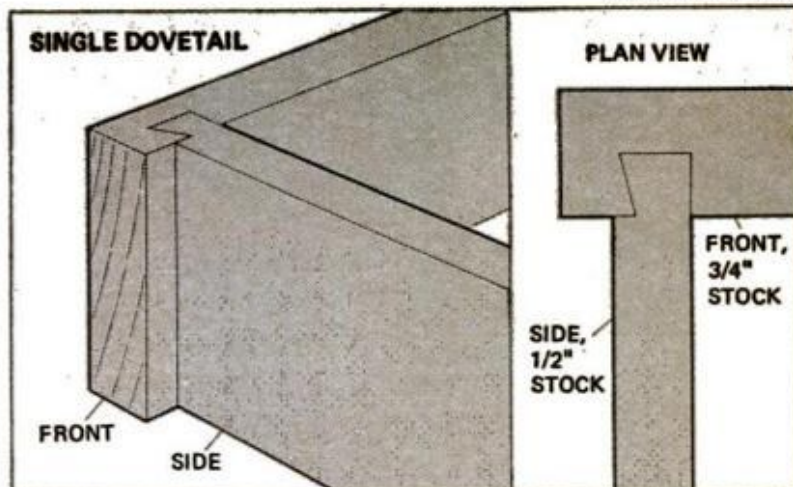
Art: Fred L. Wolff



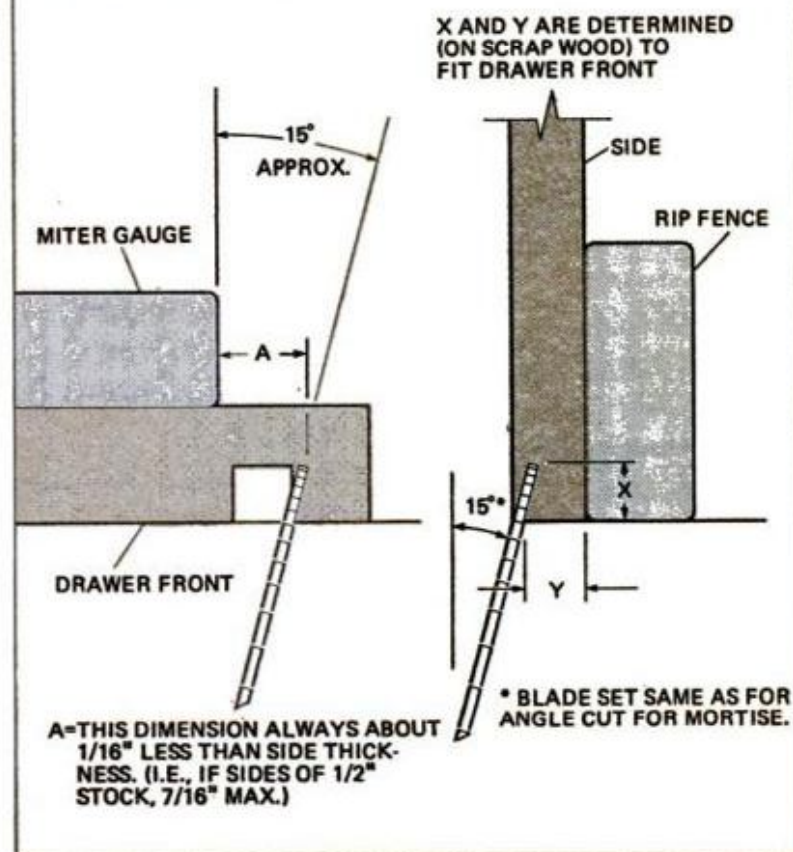
The dovetail joint is the strongest you can use in drawer-making. A well-made dovetail joint will, literally, hold without glue—a fact old world craftsmen prided themselves on. Today the joint is made using a router equipped with dovetail bit, and a dovetail template; instructions for use are packed with the template. Once you are familiar with the template, the joints are rather easy to make; to be safe, first perfect your technique by practicing with scrap wood.



Unless you are faithfully reproducing a period piece with nonglued dovetail joints, the chances are you will assemble your drawers using one of the three fastening methods shown. Regardless of which fastener you use, glue should be liberally applied to mating surfaces of pieces to be joined. For maximum strength, fasteners should be installed parallel to drawer front. Thus, pull on a drawer creates a shear action on a fastener. This gives greater resistance to pull-out than if fasteners are under tension (installed perpendicular to the front).

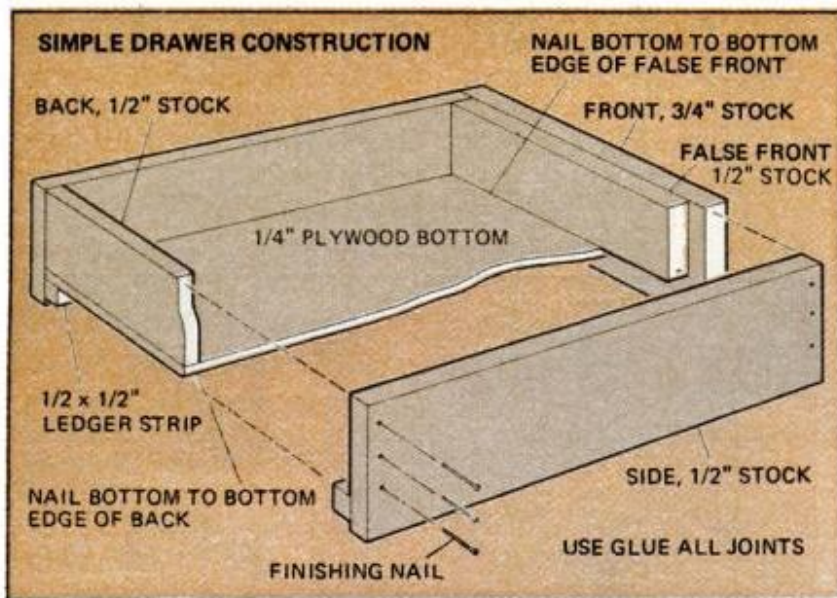


HOW TO MAKE A SINGLE-DOVETAIL JOINT ON THE TABLE SAW



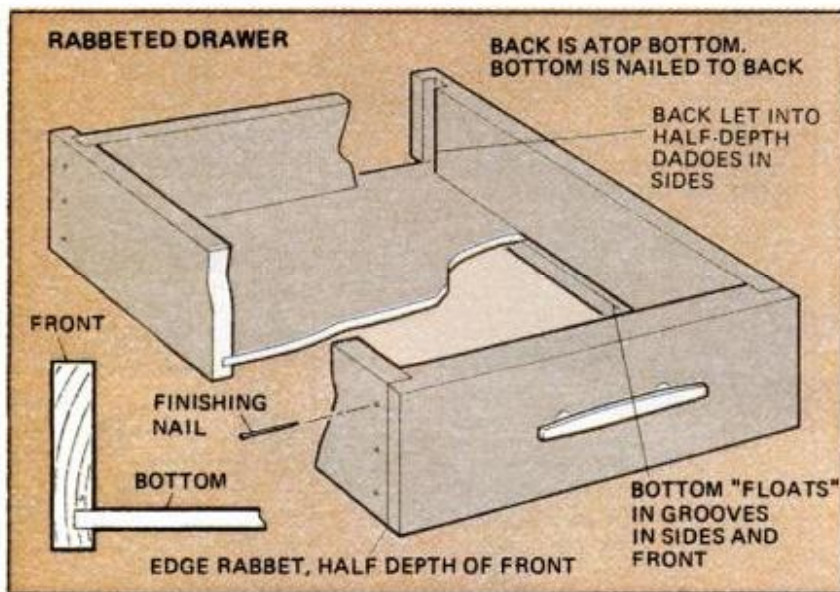
A single-dovetail can be cut on the table saw, but requires much care and laying out prior to cutting. Make test cuts on scrap lumber of exactly the same size and dimension as will be used in drawer construction. Try all test cuts and fits before putting the blade to the project materials.

First cut the dado about one-half the depth of the front. Then set the saw blade to about 15° and make the cut as shown above left. Without disturbing the blade setting, make the mating angle cuts in the drawer sides. The blade can then be set at 0° and the triangular pieces cut out of the sides. Note: X and Y are determined on scrap wood first.



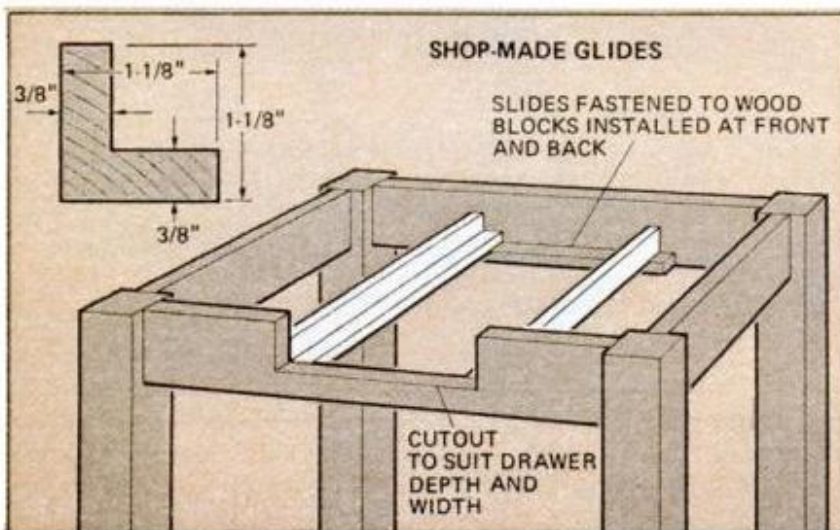
The drawer at left can be entirely constructed using hand tools only. After determining drawer-front dimensions, subtract thickness of sides and bottom. Assemble false front to front with glue and brads. Then cut the sides, back and bottom. Use 1/2 x 1/2-in. strips to make the ledger strips upon which the bottom rests. These are placed so top surface of bottom will be snug against bottom of false front and back.

To assemble the drawer, apply glue, and nail sides to front as shown. With drawer on workbench, apply glue and install the back. Next, flop drawer, position the bottom on drawer frame and secure it with one nail. Before driving a second nail, check the drawer assembly with a square. Holding the drawer square, drive two more nails through bottom into back and false front. To finish assembly, using glue and brads, install the ledger strips beneath bottom on both sides. Recheck with square. Set aside to dry.

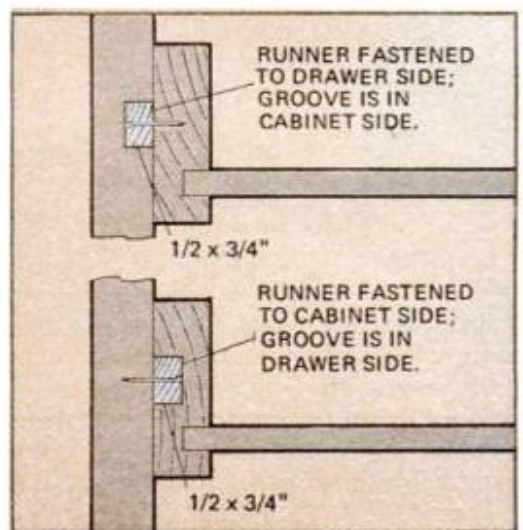


A combination rabbet-and-fastener assembly provides a strong drawer. Here, you simply edge rabbet the drawer front to half the depth of the front and to a width equal to thickness of drawer sides. Test-fit the drawer dry (using brads). When you're satisfied with outside dimensions and squareness, the drawer can be permanently assembled using glue and fasteners.

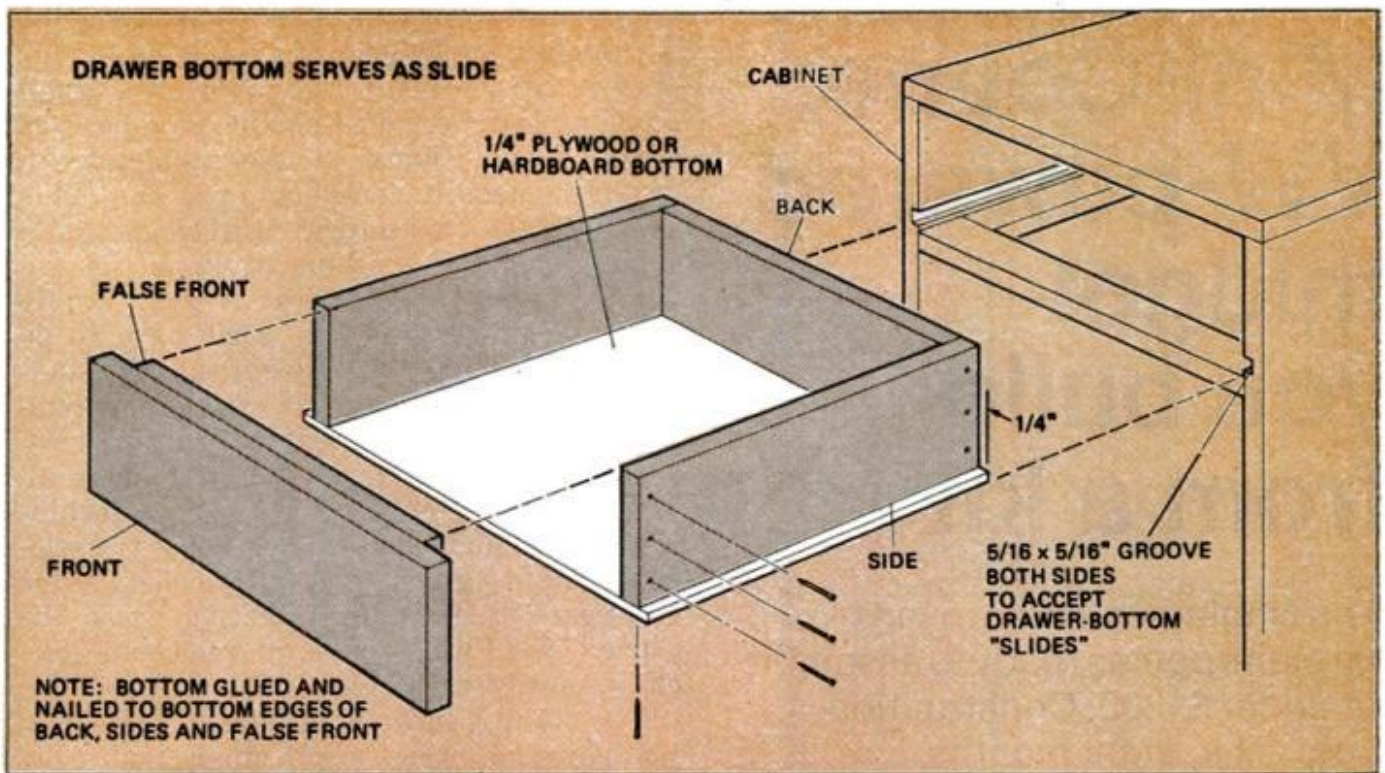
Typical drawer slide and glides



Shop-made wood slices should be cut from 5/4 x 5/4 (1 1/8 x 1 1/8-in.) solid oak or other hardwood. Slides are fastened to blocks at front and back of cabinet. These blocks must be carefully set to assure that the drawer front is parallel to the cabinet front. For ease of operation, spray the slides at regular intervals with silicone.



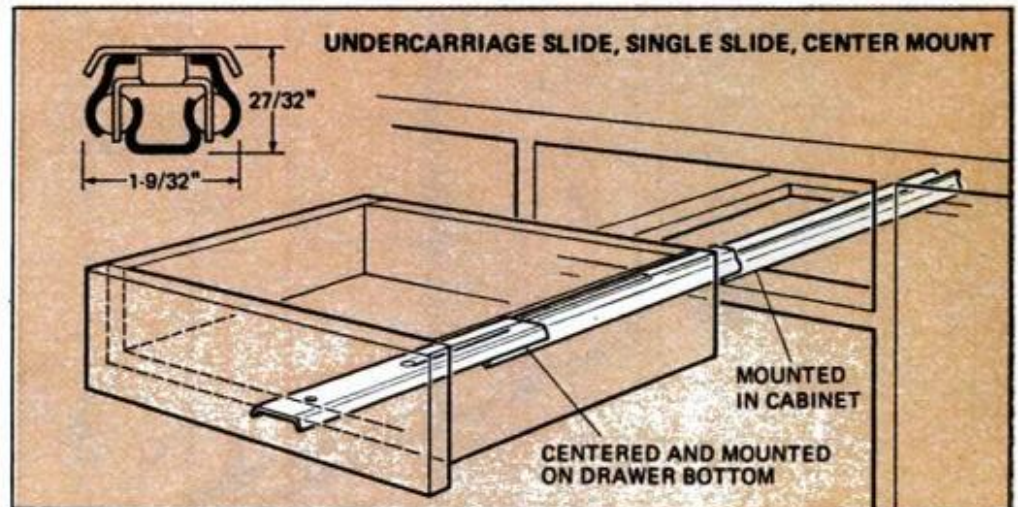
Fast method of making slides is to groove either drawer sides or cabinet and attach hardwood guides to the mating member. To keep the cabinet sides from binding, it is a must that they be unwarped.



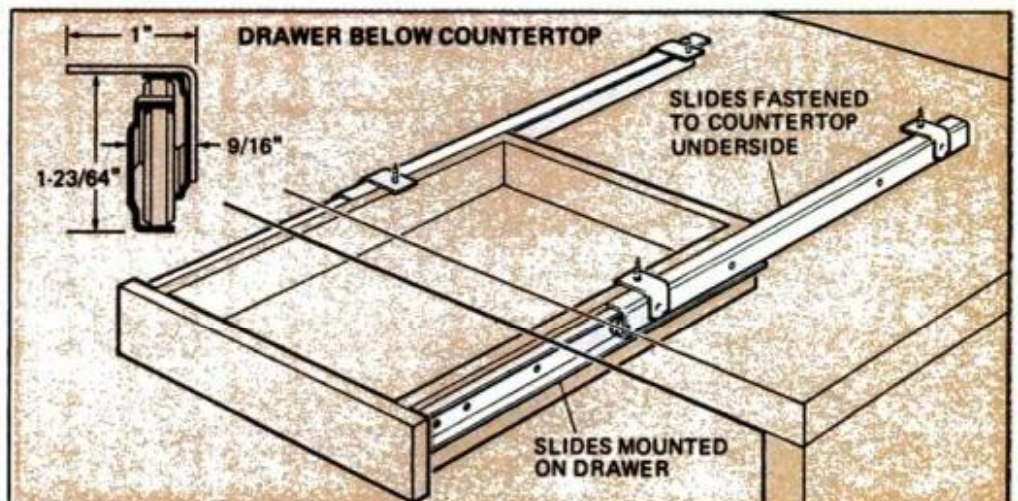
A good stunt—when drawer appearance is not of primary concern—is to build in runners merely by extending the drawer bottom on both sides. This creates slides which ride in corresponding grooves

that are cut in the cabinet sides. In this case, it is best to use 1/4-in. hardboard for the drawer bottom. For troublefree sliding, keep the grooves clean and spray them periodically with silicone.

Commercial slides are available in bottom and side-mount styles (both shown at right). The bottom-mount type is easiest to install; version shown in drawing is screw fastened to drawer bottom (at center) as well as to cabinet rail and cabinet back. Less expensive types feature a single roller fastened to the drawer back.



Side-mount hardware at right can be used to add a drawer beneath a countertop; units operate the same as side-mounts installed in a cabinet. When using factory-made slides, clearance for hardware must be made when building the drawer (drawer must be narrower). Whether using side or bottom-mount slides, always read the maker's instructions before laying out your drawer. ★★



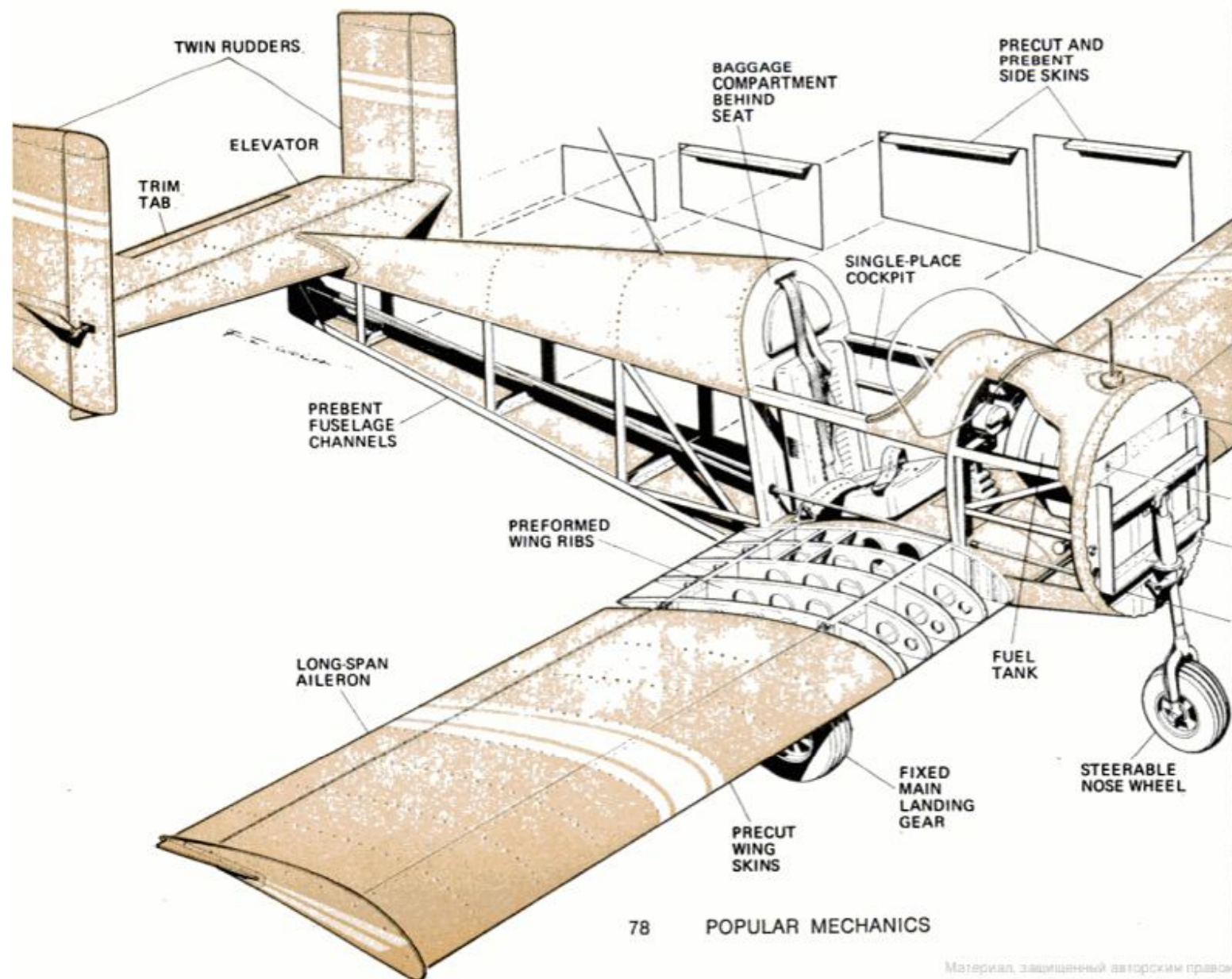
Mini-Coupe: VW-powered midget you build from a kit

This single-seater 'barnyard' fun plane comes ready to assemble for under \$1800. Construction time: six to eight months.

By Sheldon M. Gallager
and Howard Levy

If someone told you you could own your own airplane for the price of a small economy car, you'd probably say he was crazy. Today, thanks to the rapid growth of the homebuilt movement, you can. This sporty little twin-tailed Mini-Coupe is a good example of the kind of plane you can build for less than the cost of your family sedan. What's more, you don't have to do any of the fabricating yourself. The all-metal craft comes as a kit, ready to assemble—you just put it together. Wing ribs, spars, skin panels and other parts are all precut and preformed. There's no machining to do, and even the modern tricycle-type landing gear comes prewelded. After two years of design and testing work, the Chris Tena Mini-Coupe is ready to take off—literally and figuratively.

The Mini-Coupe is a small, low-wing, VW-powered, open-cockpit single-seater designed for safe, easy handling as well as low construction cost. It can operate equally well from paved runways or rough barnyard-type pasture strips, making it a ship





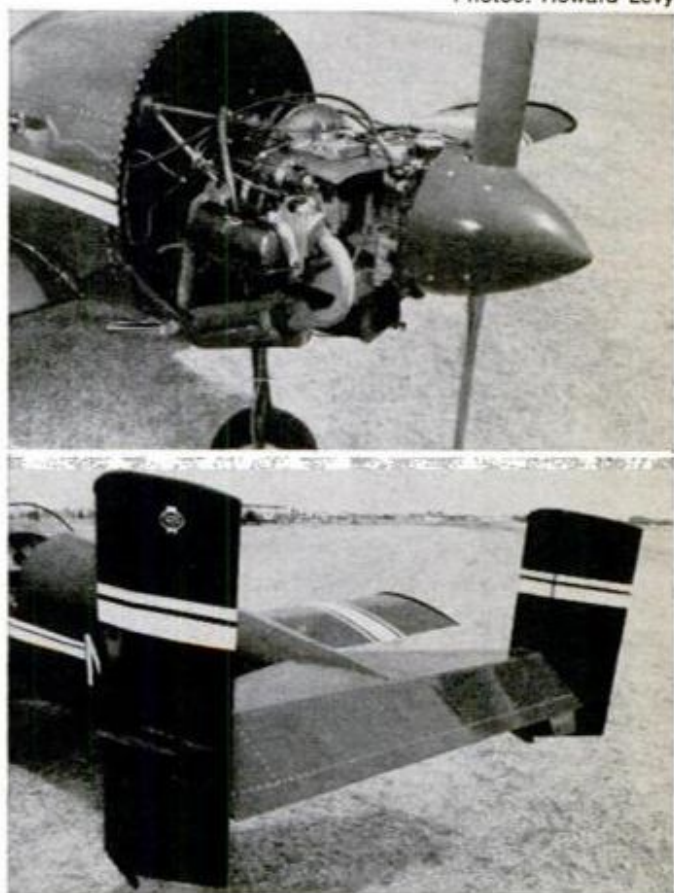
Photos: Howard Levy

Art: Fred L. Wolff

OVERALL LENGTH 16' 4"
WINGSPAN 22' 4"
WING CHORD 42"

WINGS
REMOVABLE
FOR
STORAGE

1600-CC
VW ENGINE



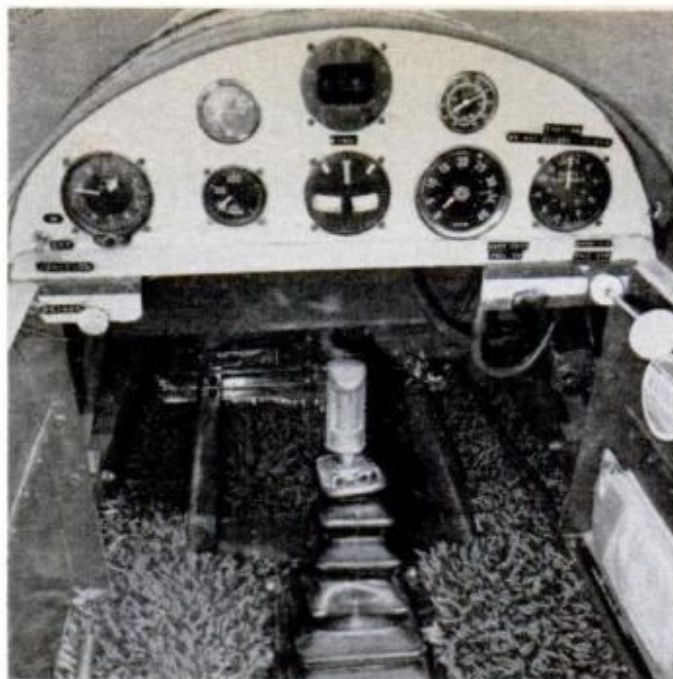
Twin rudders, set wide apart, provide good stability and control in flight, are a novel feature on a small plane of this type. Ailerons, shown in drawing at left, span almost entire length of wings, are also designed for good control with minimum deflection and stick pressure. Wings have constant chord of 42 inches for simple assembly. Middle photo above shows small, compact 60-hp, 1600-cc VW engine with cowling off.

you can fly almost anywhere. Its twin rudders, long-span ailerons and low stall speed give it good stability and control—a docile bird ideal for the beginning pilot.

Two engine sizes are recommended for the Mini-Coupe—the 60-hp 1600-cc VW and the slightly more potent 1700-cc. Maximum speed with the 1600-cc is 105 mph; with the 1700-cc, 120 mph. Cruising speed is 90 mph with the smaller engine, 105 mph with the larger. Rate of climb is 700 and 750 feet per minute, respectively. Other characteristics are the same with either engine. Stall speed is a tame 43 mph with power on, 48 mph with power off. You don't have to worry much about field length—you can get off in 400 feet and land in 500. Upstairs, you can reach a service ceiling of 12,500 feet—not bad for a 60-hp midget. On a 13-gallon tank, the Mini-Coupe has a range of 300 miles, with an economical fuel consumption of 3.5 gallons per hour.

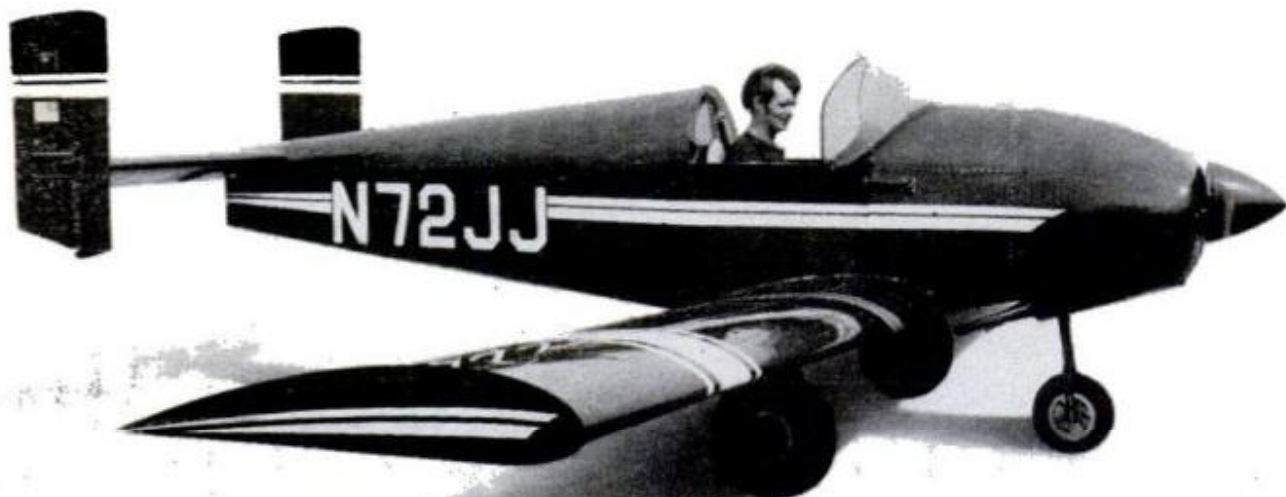
The Mini-Coupe is shorter than many cars—only 16 feet, 4 inches in overall length. Wingspan is 22 feet, 4 inches, and the wings are removable for easy storing of the craft in a small shed or garage. The tri-gear is nonretracting for the sake of simplicity, but the nose wheel is steerable for good ground maneuvering. All control surfaces are operated directly by push-pull rods—no tricky cables or pulleys to rig. Empty weight is 494 pounds with the 1600-cc engine, 500 with the 1700-cc size. Gross weights are 825 and 850 pounds.

Price for the basic Mini-Coupe kit is \$1695, less engine and mounts. This contains all construction materials, including rivets, bolts, locknuts, wheels, tires, zinc-



Trimly booted control stick and carpeted floor help add "plushness" to otherwise simple cockpit. Instrument panel provides airspeed, engine rpm, altimeter, compass, turn-and-bank indicator, plus other gauges.

chromate primer and complete assembly manual. Motor mounts and cowling for either VW engine are an extra \$100, bringing the package to about \$1800. From there, final cost will depend on your particular engine choice and instrumentation. VW engines converted for aircraft use are available for \$700 to \$1400 depending on whether you pick a new, used or rebuilt model. In all, total cost for the Mini-Coupe should not run to more than \$2000 to \$2400. Additional information and ordering instructions can be obtained from Chris Tena Aircraft Corp., 3700 24th Ave., Forest Grove, Ore. 97116. ★ ★ ★



Simple yet sporty, kit-built Mini-Coupe offers flying fun at low cost.

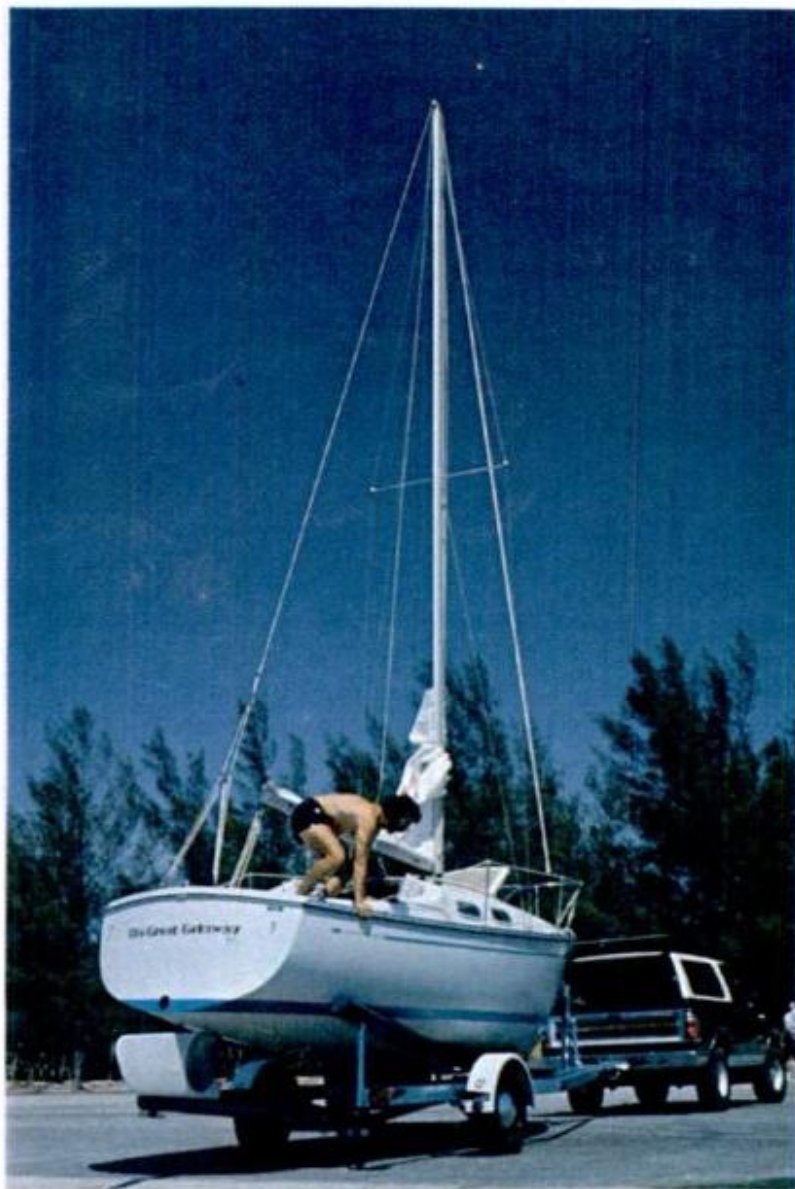
Chrysler builds a cruiser

by Bill McKeown

Photos: Burton McNeely

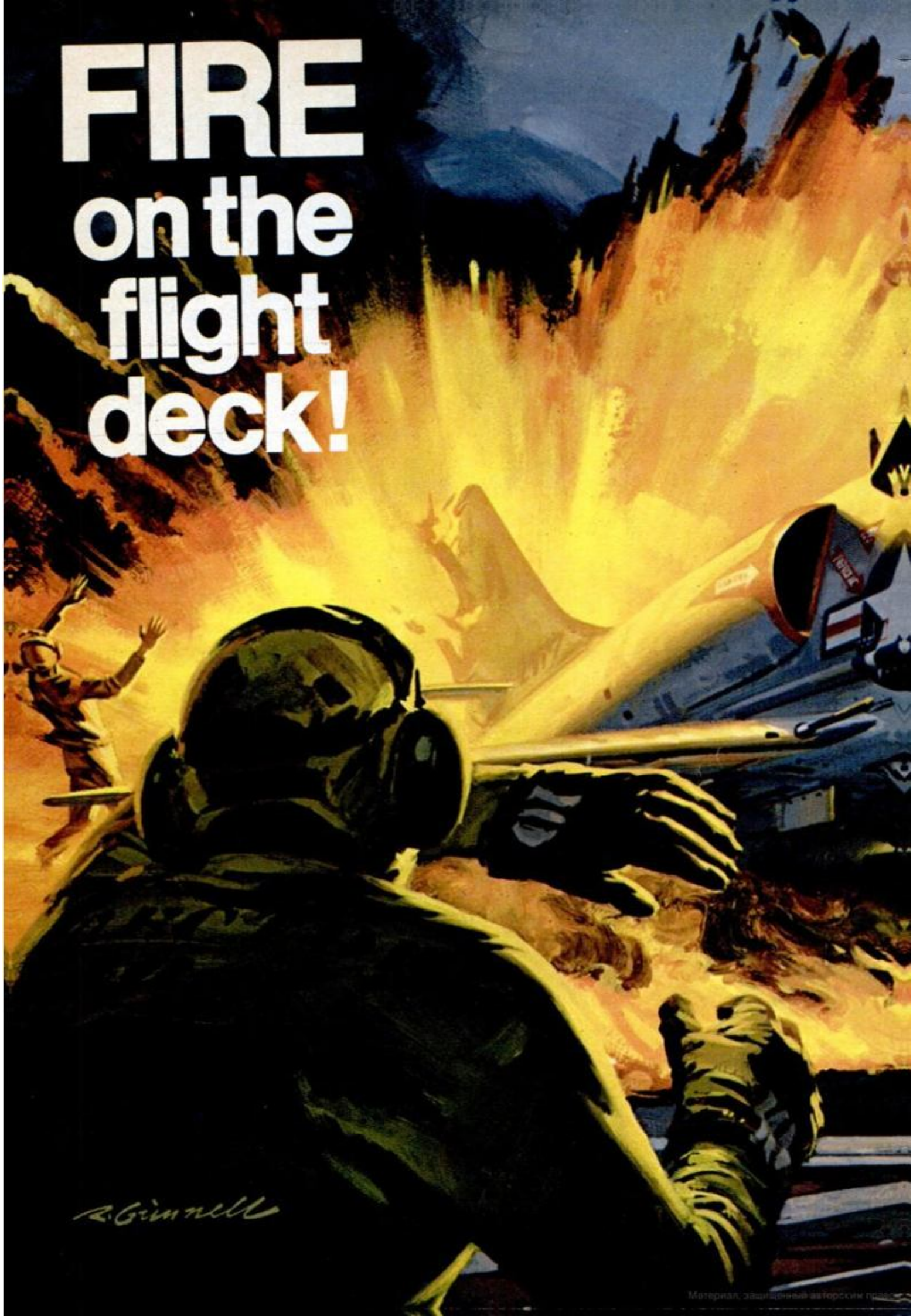
For next spring, Chrysler has a cross between a sports car and a station wagon of a sailboat—and it's a happy compromise. Family-sized answer to the cost of fuel, this trailerable 22-footer sleeps five, brackets on a 10-hp outboard if the wind needs help, boasts lines by Halsey Herreshoff of sailing's famous family—all for \$5000.

Taking her tiller in 15-knot Gulf of Mexico breezes, I found her safe and high-pointing under full canvas, with reef and on spinnaker runs. Her two-foot draft with swing keel and clever hinged rudder up slid us over shoals. Here's a compact performer with no tricky traits that a full family could learn to wind-jam in with pleasure. ★★★



A getaway to anywhere is practical when this new Chrysler 22 swings up both keel and rudder for easy trailering, launching, shoal sailing. To windward, McKeown finds her high-pointing, rates her responsive with only slight weather helm. Spinnaker is among assortment of sails, accessories for handsome high-aspect masthead sloop.

FIRE on the flight deck!




R. Ginnell

1041012

The cry went out, but before it could be heeded, the mighty carrier *Forrestal* exploded into a raging inferno—a living nightmare that was to last for days, claim 137 lives and badly cripple one of the world's greatest warships. In the past few years, similar disasters have struck other carriers, causing a rising death toll. Here's the revealing story of how such tragedies occur and what's being done to stop them.

by Mort Schultz

Illustration: Roy Grinnell



Despite their exhaustion, the pilots and crewmen were in a jovial mood. The day was bright and clear, and the intelligence reports were good: The planes should encounter little flak on their bombing run into North Vietnam. It was near mid-day on Saturday, July 27, 1967. The ship was the mammoth aircraft carrier USS *Forrestal*—a floating skyscraper more than three football fields long with 4 acres of deck space, 10 deck levels, 2000 compartments and a crew of more than 5000. She was steaming through the Gulf of Tonkin at a brisk 27 knots only 60 miles off the enemy coast. In the past four days her A-4 Skyhawks and F-4 Phantoms had made 150 sorties into North Vietnam. Now it was time for another mission. By all indications, it would be routine. There was no hint of the colossal disaster about to strike.

As pilots manned their planes and crewmen loaded bombs into racks beneath the wings, there was an air of relaxed calm—too relaxed. Some men were visiting buddies in areas on the flight deck where they didn't belong. Others were strolling through their work bare-chested and

Hours after the initial blast, men aboard the *Forrestal* still fight fires on wreckage-strewn flight deck (right). Below, smoke and flames stream aft from the stricken carrier as a destroyer rushes to her aid, picking up survivors blown or forced to jump into the sea. The explosion-triggered inferno raged several days, taking a tragic toll: 137 dead, 161 injured, 63 aircraft destroyed or damaged and \$72 million worth of damage to the ship itself. This was the second and worst of three major carrier fires occurring during the 1960s.





in shorts. Those loading bombs were strong-backing the job, giving no thought to the use of nearby hoisting equipment.

"We were pros," was the attitude of one sailor. "What could happen?"

What could—and *did*—happen was the death of 137 officers and men, terrible injuries to 161 others and the near destruction of one of the Navy's most powerful fighting ships—all in a matter of minutes.

Seconds before the first scheduled launch the ship's normal routine was abruptly shattered as a Zuni rocket streaked aft from the wing of a Phantom parked on the foredeck. No one is sure to this day just what triggered the Zuni, but the missile shot down the flight deck and slammed into a Skyhawk waiting to take off on the afterdeck, blasting the bomber and spewing blazing jet fuel onto other aircraft standing nearby.

Within an instant, the afterdeck is a raging inferno as one fuel tank after another explodes in the intense heat. Pilots attempting the leap from their planes fall helplessly into the fiery sea of burning fuel. Crewmen rushing to their aid are engulfed by the flames and disappear. Others caught between the spreading fire and the edges of the deck are forced overboard. Bits of burning bodies are blown in all directions.

But the worst is still to come. Lying on the deck near the flames, hidden by billowing smoke, are two 1000-pound bombs, apparently jolted loose from one of the Skyhawks. In less than two minutes, they will wipe out most of the trained firefighters aboard the *Forrestal*, tear huge craters in the hull and put the ship in deep trouble.

"Fire on the flight deck, fire on the flight deck," blares the ship's loudspeakers. "All hands, man your battle stations." Urgently shouted orders mingle with the rapid-fire clang of the general quarters alarm bell. Frantically, the two main firefighting parties struggle to reach the flames, pulling hoses and carrying extinguishers.

"I watched them from the island," one officer recalls. "They were having trouble. Fire had cut off plugs in the stern. Those amidships had developed pump problems. So the men had to haul hoses from the forward stations."

Precious seconds lost—seconds that gave those two hidden bombs time to get hotter. Finally, the men get their lines hooked up and are ready to start spraying foam on the fire-swept afterdeck. But it's too late. As the firefighters approach the flames, there

are two gigantic explosions a fraction of a second apart that rock the mighty 78,000-ton carrier as if she were a toy boat in a bathtub. Suddenly the men are gone—they simply vanish. In their place are huge, ugly, gaping holes in the deck. Those two unseen 1000-pound bombs, ignited by the mounting heat, had ripped through two-inch-thick steel plate like cardboard, exposing the decks below. Rivers of flaming jet fuel pour down the holes deep into the bowels of the ship, turning her insides into a living nightmare. Scores of men caught in the intricate maze of compartments and companionways below decks are trapped and die, many of them needlessly. Escape routes could have been used, but either the men hadn't been told about them or in their panic had forgotten them.

Topside, the scene is still one of horror and havoc. With most of the experienced firefighters lost, the job of saving the ship now falls on a courageous but inexperienced crew. This leads to terrible mistakes that cost more lives. In the confusion and disorder that prevail, little is done in the next five minutes to keep fire from spreading to other bombs and missiles lying on the flight deck. More explosions shake the *Forrestal*—nine major blasts in all—each ripping a new hole in the deck through which jet fuel pours. Finally—nearly eight minutes after the original Zuni mishap—the order goes out to close the divisional steel doors between the ship's compartments—the first thing that should have been done to keep fire from spreading below decks.

Then comes the most tragic irony of all. Gallant but untrained firefighting crews, hurriedly formed, work side by side, some unwittingly nullifying the effects of the others. One team sprays on protein foam—the proper extinguishing agent for petroleum-fed fires—while another comes along and, knowing nothing better, washes away the foam with water. The foam works only if it's allowed to blanket a fire and smother it; water merely dilutes it and renders it ineffective. More precious time is lost and the fire rages on. There is concern for the after ammunition magazine. If flames reach it, the entire ship could go up. Luckily, the magazine is ordered flooded in time to prevent this danger. Other ships in the task force, heeding the *Forrestal's* distress call, rush to her aid, but can do little to help except to stand by and search for survivors. A few of the men who jumped or were blown

overboard are picked up, but most are never recovered.

Gradually, the mistakes of those first terrible moments become apparent and corrective orders are issued. The ship is kept headed into the wind to confine the fire to the stern, but speed is reduced from 27 knots to 15 to keep the wind from fanning the flames. After 10 exhaustive, agonizing hours of firefighting, the main blazes are at last brought under control, but other fires continue to burn throughout the ship for days.

"I lost track of time," says Chief Petty Officer Gerard G. Johnson, "but I do know I was still putting out fires when the ship pulled into Subic Bay in the Philippines."

The grim tragedy aboard the fire-ravaged *Forrestal* took a fearsome toll: 298 crewmen dead or disabled, 63 of the carrier's 81 air-



Aboard the *Oriskany*, men above anxiously await word of shipmates trapped in bunks by fire. Forty-four died. Below, new "lightwater" foam effectively smothers a jet fire in tests. At top right, carrier *America* tries out automatic flight-deck sprinkler system designed to prevent *Forrestal*-type disasters. At bottom right, twin nozzles can spray foam and Purple K together.



craft destroyed or damaged and \$72 million worth of damage to the ship itself. Her gutted stern charred and twisted, the crippled carrier remained out of action for more than six months. It may be a miracle that she survived at all.

Actually, fires aboard ships of the size and complexity of an aircraft carrier are not uncommon and occur almost daily. While few reach the magnitude of the *Forrestal's*, each holds the potential for a *Forrestal*-type tragedy—a fact that has prompted Navy men to exclaim that “an aircraft carrier is a disaster waiting to happen.”

Only nine months prior to the *Forrestal* fire another major carrier catastrophe occurred aboard the USS *Oriskany* off Vietnam. The trouble began as sailors were unloading illuminating magnesium parachute flares from planes after a scrubbed

bombing mission. The ripcord on one of the flares being carried over a crewman's shoulder snagged on the edge of a watertight door.

The flare, activated by the pulled cord, began smoking. Panicking, the sailor threw the armed projectile into a storage locker filled with some 700 other flares. He slammed the door and turned on the sprinkler system, assuming this would extinguish the fire. Here, as on the *Forrestal*, inexperience was to play a devastating role. The sailor either hadn't been told or didn't remember that water coming into contact with burning magnesium liberates volatile hydrogen. In minutes, smoke and fire poured through the ship's ducts into sleeping quarters on the other side of the locker's bulkhead. Forty-four men perished and \$7 million worth of damage resulted.

A third major carrier mishap occurred aboard the USS *Enterprise* on Jan. 14, 1969, 75 miles south of Pearl Harbor. During maneuvers, hot exhaust from a jet-engine starting unit caused a bomb to explode. The bomb had been stupidly placed only 18 inches away from the unit's exhaust pipe. Result: 28 crewmen dead, 300 injured, 15 planes destroyed and \$68 million in damage to the ship.

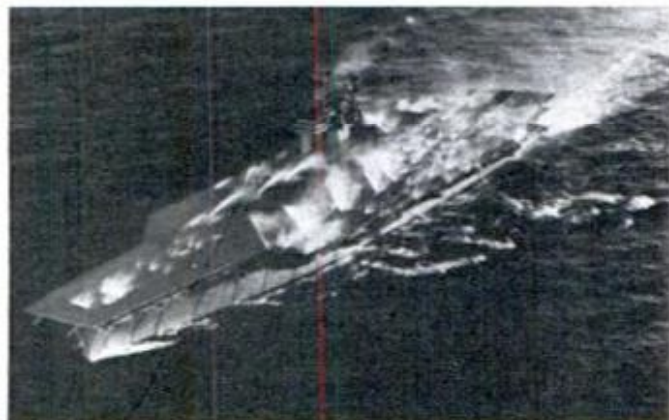
“There are 14 carriers in the fleet and I bet they have several fires a day when at sea,” says Lt. Cmdr. John Donnelly, executive officer of the U.S. Navy Damage Control Training Center in Philadelphia. His command, plus another one like it in San Diego, trains sailors going to sea in the techniques of shipboard damage control, which includes firefighting.

“Fires have to be expected on a carrier,” explains Donnelly. “You can't escape that fact—not with the overwhelming amount of fuel and explosives involved, mixing with carelessness and chance which 5000 people living together in a relatively confined area present.”

But disasters teach lessons. The three major carrier fires of the 1960s shocked the Navy, which realized that unless firefighting training and equipment improved, more accidents of the *Forrestal* type could be expected. And improved they *have* been, with significant results. Since the *Enterprise*, the number of fires hasn't diminished, but the severity of their effects *has*. Within recent years, more than 700 have been reported, and no one knows how many more have gone

(Please turn to page 155)

SEPTEMBER 1974 87



IT'S NEW
NOW



First fully aerobatic sport plane you can buy ready-made

The growing interest in aerobatic sport flying is bringing with it a whole new breed of exciting fun planes designed to do anything an aircraft is capable of. Until recently, most such ships were specially engineered and individually produced. Now this Bellanca Decathlon is said to be the first fully aerobatic, enclosed-cockpit, production-line plane sold ready to fly. Stressed for 6 Gs positive and 5 Gs negative, the trim

dual-control monoplane performs all competition maneuvers, inside and out, plus sustained inverted flight. Features include inverted fuel and oil systems for upside-down flying, a constant-speed prop to prevent dangerous overspeeding, large ailerons for quick control and a stall-warning indicator. Price, with 150-hp Lycoming engine, is about \$17,500. Bellanca Aircraft Corp., Municipal Airport, Alexandria, Minn. 56308.

New power tools: Low prices, bright colors

Would you believe a 7¼-inch circular saw for just \$19.99, a sabre saw for \$12.99, a ⅜-inch electric drill for \$9.99? They're for real—part of a new line of low-cost power tools from Rockwell. In bright yellow housings, the tools also include an orbital finishing sander for \$16.99 and ½-inch drill for \$19.99. All models are double-insulated and are said to incorporate the same quality of construction as Rockwell's higher-priced green line except for features like multispeed or reversible motors. Available at Rockwell dealers.



Handy swing-away bumper mounts for carrying extra gas and spare tire

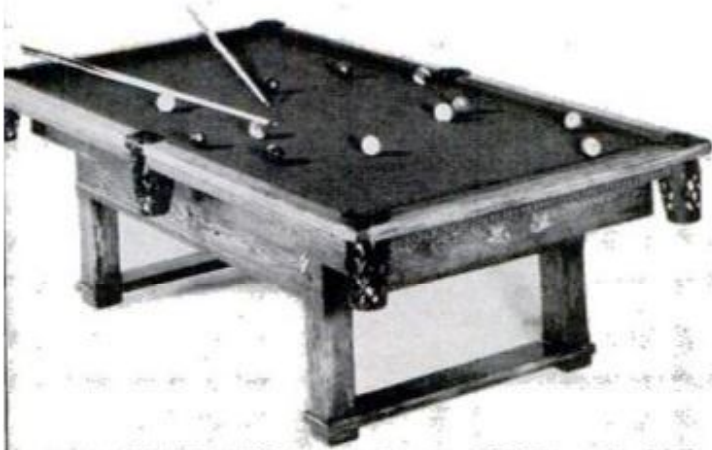
These retractable brackets let you bumper-mount a spare tire or jerry gas can outside a vehicle to save space and hazardous carrying inside. On pickup trucks, they swing out of the way (left,

below) to permit lowering the tailgate. Also for use on Jeeps, vans and motor homes, they're \$36.95 for tire carrier, \$24.95 for can carrier. Valley Tow-Rite, 27 E. Vine St., Lodi, Calif. 95240.



Pool table comes in do-it-yourself kit

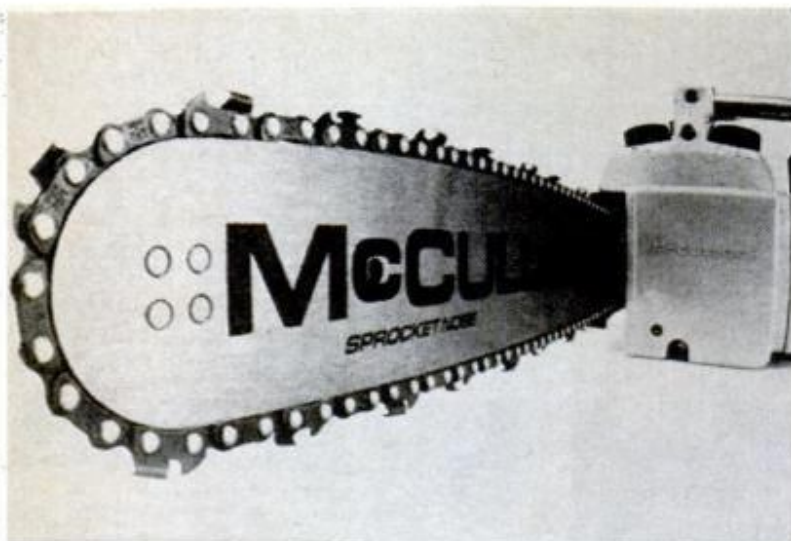
Frame parts of pool table (below) are mahogany, precut to size, and come with black walnut finish or unfinished. Playing surface (44x88 inches) is made of a shale aggregate material. Included are necessary hardware, two cues, brush, set of balls, rack, cover. Prices: \$249.95-\$279.95 (shipping charges collect). Banner Billiards, 4208 Commerce Ave., Fairfield, Ala. 35084.



Seeing in the rain

The ever *avant-garde* French have done it again: A French manufacturer now produces eyeglasses with windshield wipers. Although rather large, the battery-powered wipers and frames weigh only about 2½ ounces. Prescription glasses can be fitted. For other details and prices, write Etablissements Tagada, 65-75 Rue Armand Lepine, 92 Bois Colombes, France.

NOW

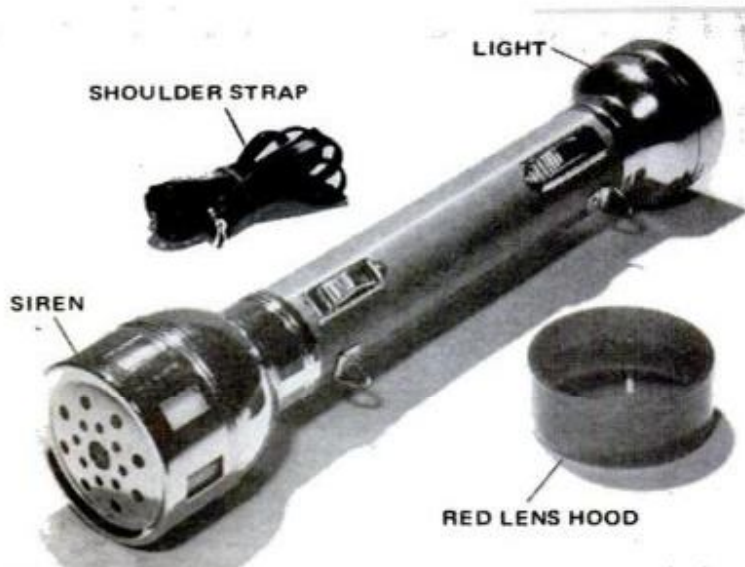
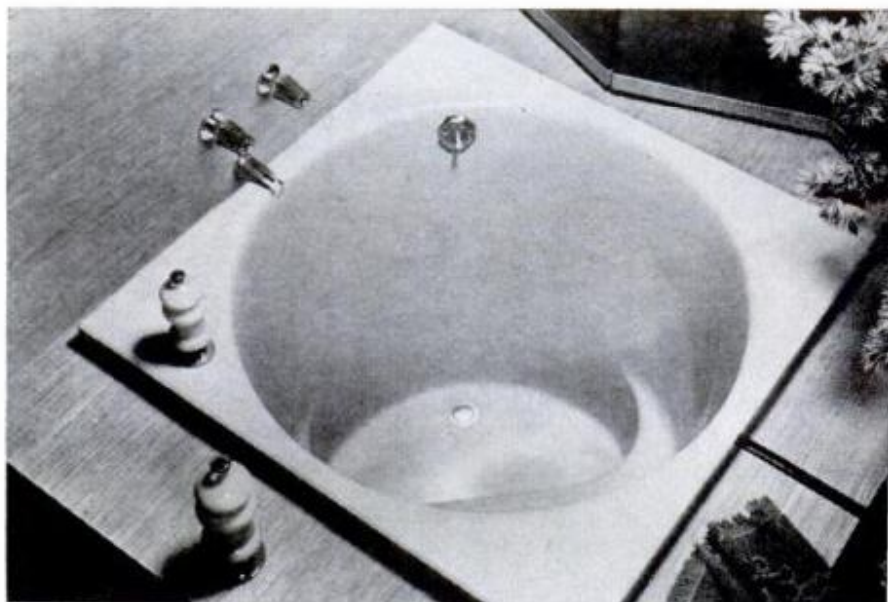


New guide bar for chain saws

McCulloch has introduced a sprocket nose guide bar for its lightweight chain saws. Intended for the nonprofessional woodcutter, the 14-inch Mini Pro bar is standard equipment on two chain saws and can be purchased to update other McCulloch saws now in use. According to McCulloch, the bar provides faster cutting by reducing friction between chain and bar and increases the service life of the chain by allowing it to operate more smoothly at lower temperatures.

'Vertical bathtub' allows bathing while sitting

Design of this unique bathtub was influenced by an ancient Japanese bathing ritual. The 40-inch-square soaking tub is 32 inches deep with low, molded-in seat, allowing for almost total immersion while sitting upright. The Designer Line fixture is constructed of heavy-duty, fiberglass-reinforced polyester, which helps maintain a constant water temperature, and has finished edges on all sides. An overflow adapter kit is included. For price and other details, write American Standard, New Brunswick, N.J.



Let there be light . . . and—if need be—noise

For those who like to be prepared, here's just the item: SOS-Lite has a loud siren audible about 1000 yards away, a flashlight which can be spot-focused up to a 300-yard distance or interchanged with a flasher bulb, a red lens hood and an adjustable leather shoulder band. Metal body is vinyl-coated and water-resistant. Model shown takes three standard D batteries. Price, not including batteries: \$10.75 postpaid from Variety House, Box 50, Sun City, Calif. 92381.

Vise for drill press— quick and versatile

Speed is the name of the game for this vise. Screw-operated jaw of the Cardinal Speed-Vise for drill presses can be quickly moved to secure workpiece and the screw instantly locked into half-nut. Vise jaws have standardized holes for attaching interchangeable jaw plates (left, top of photo), hardened and ground, to hold a variety of shapes and sizes. Sides of vise are machined parallel and square so vise can be turned on either side. Available with 3, 4, 6 or 8-inch-wide jaws. 3-inch model, \$29.40. Cardinal Machine Co., 1819 Dana St., Glendale, Calif. 91201.

Enough to drive a dog to drink

A 116-acre farm in Leesburg, Va., has really gone to the dogs. It's a dog-breeding farm, specializing in beagles. Alfred Caputo, who runs it, has 1850 puppies living in 450 whiskey barrels. The barrels, in which bourbon once aged, are bought from a distillery, aired thoroughly, set on a frame covered with wire mesh and used as inexpensive, ready-made kennels. The pups seem right at home.

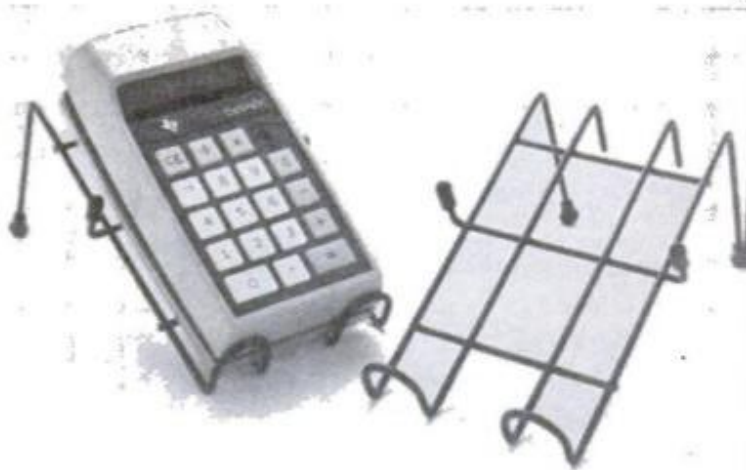


Compactor uses ordinary trash bags

GE's new Model GCG650 trash compactor crushes bulky garbage into a quarter of its original volume. 15-inch-wide by 34-inch-high by 18-inch-deep unit has door-mounted, removable trash bucket with handle. No special trash bag liners are required; the unit accepts inexpensive standard plastic trash bags available in supermarkets. Compactor can be built in or free-standing and needs no plumbing connections; it operates on 117-volt household current. Reversible color door panels permit decorating flexibility.

Rack to hold pocket calculator

Use of a pocket or hand-size calculator can be made more convenient with this simple rack (right). The Bernco Calculator Tilter holds calculator at an angle for easy reading of the keyboard. Rubber feet prevent sliding. Comes in black for \$2.99 postpaid for small calculators; \$3.99 postpaid for calculators wider than 3½ inches (state dimensions of your particular model). From Bernco, 2059 West Artesia Blvd., Torrance, Calif. 90504.



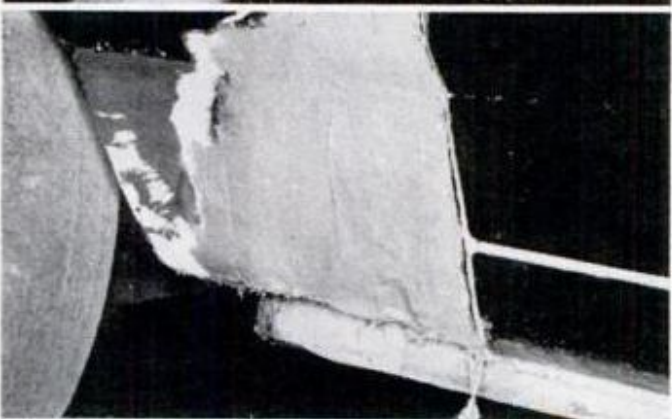
Sprinkler spikes put water where you wish

You can create your own watering system with Sprinkler Spikes and an inexpensive garden hose. Spikes are hammered through hose into ground (above); slotted spike heads control amount of water released. Spray can be directed up or down and spray distance set from a few inches to 25 feet. Package of six spikes, \$1.98. The Simpler Co., Box 868, Saratoga, Calif. 95070.

New phones: Voice, memory, no hands

Voicecaster Freedom Phone (top photo below) has microphone and speaker for hands-free talking and a touch-sensitive dial. It costs \$150 from DTS, Berkshire Park, Bethel, Conn. 06801. Ford Memory Phone (bottom photo) has handset with dial, answers your calls for you when you're out, and takes up to 15 messages each lasting up to 30 seconds. It will be available from local telephone companies, or write Ford, 5001 S.E. Johnson Creek Blvd., Portland, Ore. 97206.





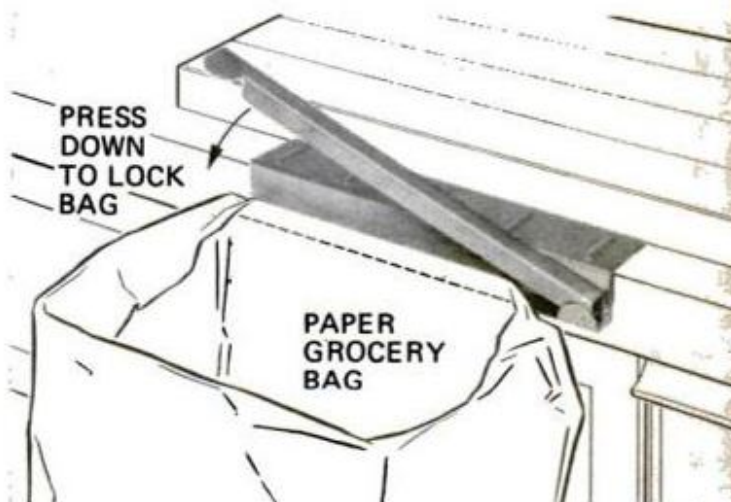
Invisible patches for cars, boats

Repairing rusted-out car bodies and damaged boat hulls is easy with Duraglas, a waterproof patching compound that adheres to metal, fiberglass and most other rigid materials. Unlike conventional brush-on fiberglass patches, Duraglas is a thick, pastelike compound that can be shaped and molded to fill dents, build up low spots and smoothly follow body or hull contours. When used in conjunction with fiberglass cloth, it can patch large areas such as the rusted-out car fender above. For sources of Duraglas, write U.S. Chemical & Plastics, Canton, Ohio 44702.



Compressor inflates tires, beach toys

Puffy Air Compressor operates from any 12-volt lighter receptacle. A 12-foot electric cord with cigaret lighter plug, 3-foot flexible hose, air chuck, inflator nozzle and ball inflator come with the 5 by 5 $\frac{3}{8}$ by 4 $\frac{1}{2}$ -inch, 5 $\frac{1}{2}$ -pound unit. Delivers 60 pounds of pressure. \$29.95 post-paid from Glen-Bel Enterprises, Route 5, Crossville, Tenn. 38555.



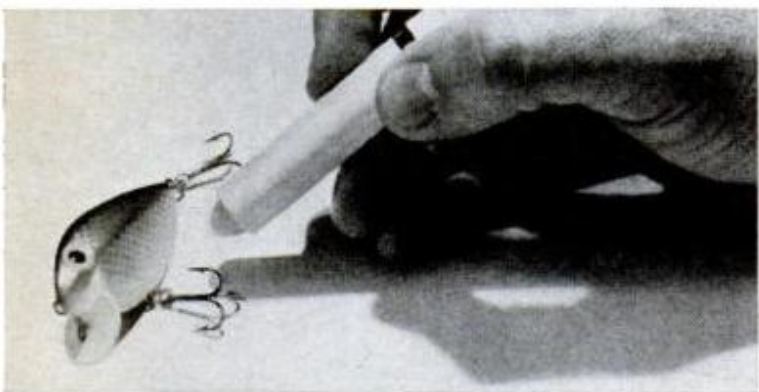
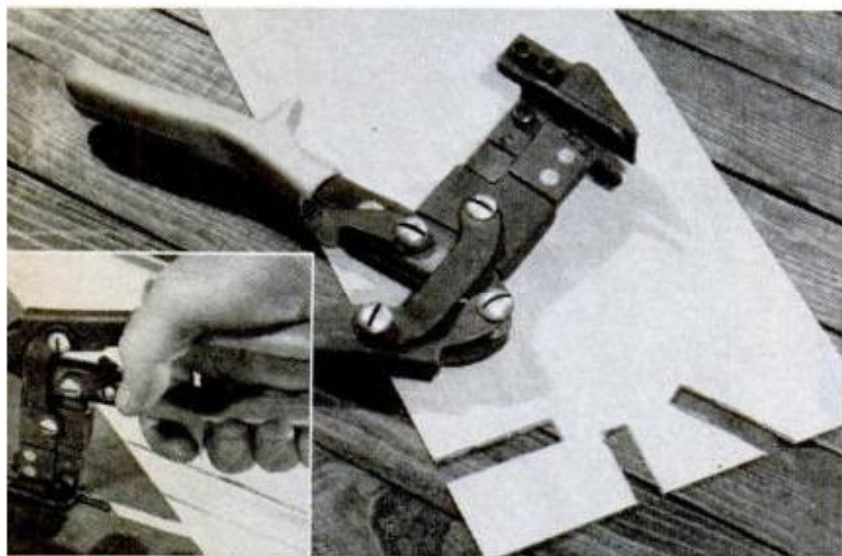
Clamp holds bag for waste removal

In kitchen or workshop, this handy little device can be attached to a countertop for quick and easy removal of waste. Pressure-sensitive material on underside of metal bar secures it to edge of countertop; pivot arm clamps edge of ordinary paper grocery bag in lower channel (above). \$3.50 postpaid. Metal Products Co., 1710 Fifth St., Kenner, La. 70062.

NOW

Tool cuts plastic laminates like scissors

When you're working with plastic laminate, the fast-cutting tool shown below can save a lot of time and work. It makes any type of cut—straight, circular or angled—without chipping the material or binding. Laminate is placed on bottom slotted anvil of tool and handles squeezed (insert). Shears carry lifetime factory service policy and money-back guarantee. Available at most building-supply outlets for about \$13. Karl Klenk, Inc., 20 Gerday Industrial Park, Wilmington, Del. 19804.



Not just another fish story

The Lura Fishstick can perhaps help you put some fishsticks on your table. The powerfully scented paste for luring fish comes in a retractable lipstick-style cartridge. The paste is rubbed onto your lure and is claimed not to wash off in either fresh or saltwater. The 3½-inch-long cartridge sells for \$3.50 each, two for \$5.50 or five for \$10.50 postpaid from Mile High Imports, Box 3173, Dept. PM, Boulder, Colo. 80303.

94 POPULAR MECHANICS



Combination cutting/welding kit

This light-duty cutting and welding outfit can weld steel up to 3/32 inch thick and cut thicknesses up to 3/8 inch. Included in the Redi-Set kit are welding and heating torch, oxygen and acetylene regulators, hose, lighter, goggles, mixer, two welding tips, heating tip and cutting attachment and tip. Suggested retail: \$130. Air Products and Chemicals, Inc., Box 512, Allentown, Pa. 18105.



'Instant' coffeemaker

Coffeemaker with electronic regulator keeps brewing temperature below boiling. Result, manufacturer claims, is better quality flavor in a few seconds. Has shatterproof polypropylene housing. For price and other information, write North American Systems, 20515 Shaker Blvd., Shaker Heights, Ohio 44122.

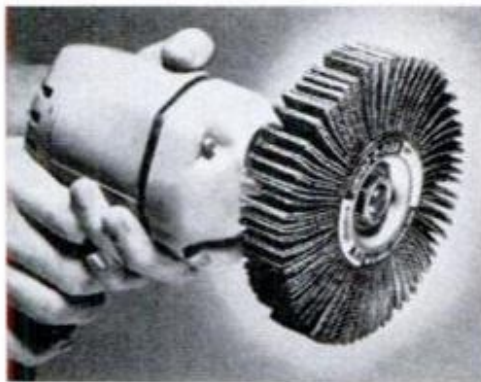
New summer sport: Scooting down ski slopes

A new sport, which takes advantage of normally unused ski slopes during summer, has recently been the rage in Germany. The "Sloper," a small four-wheeled vehicle with rollbar, is hooked to the ski lift (below, left), carried to the top of the slope with "driver" strapped inside, then ridden down the grassy slopes (below, right). Steering is done with the feet, braking with a handlebar. Cheer up—manufacturing has begun for export of the Sloper.



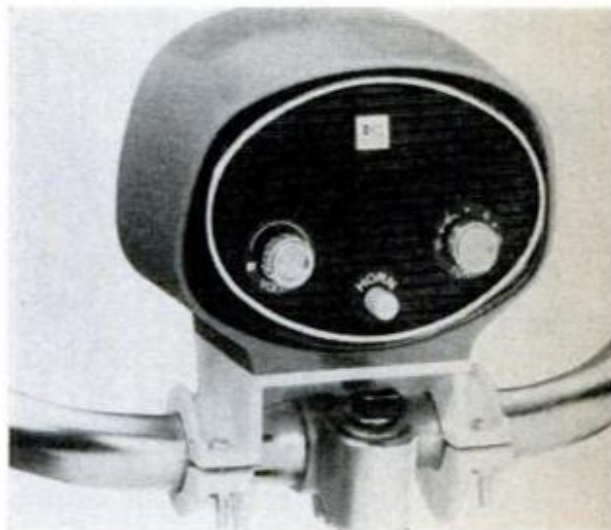
Abrasive wheels chuck in drill

Tiny, flexible wheels, with resilient abrasive cloth flaps for sanding, now have 1/4-inch-diameter shanks to chuck in portable drill (top right) or bench motor. Starter kit (No. CRC) has five wheels (bottom right) from 1 5/8-inch diameter by 1/2 inch wide to 3-inch diameter by 1 inch wide. \$9.95 postpaid from Merit Abrasive Products, Inc., 201 West Manville, Compton, Calif. 90024.



Blades cut plastic sheet

Circular saw blades for cutting acrylic sheets come in 6 or 8-inch diameters for \$14 or \$17.50. Blades fit 5/8-inch arbors, come with bushing for 1/2-inch arbors. Packaged sabre-saw blades are also for cutting acrylic sheet. Cope Plastics, Inc., 4441 Industrial Dr., Godfrey, Ill. 62035.



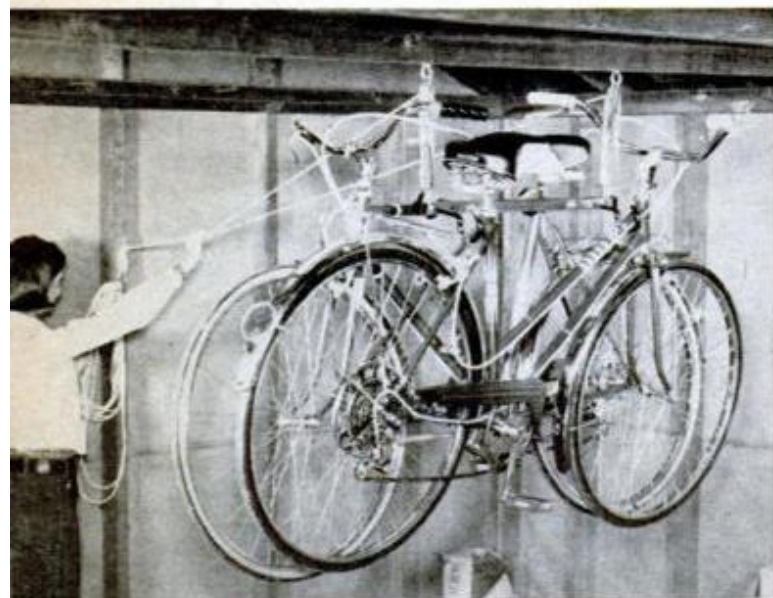
AM radio clamps on bike

No need to miss the morning news while riding your bicycle to work. New Archer Road Patrol AM Bike Radio has universal mounting bracket and quick-release lever to remove radio. Solid-state unit has weatherized black and red oval enclosure. \$14.95. Radio Shack stores.



New color films slide onto dealers' shelves

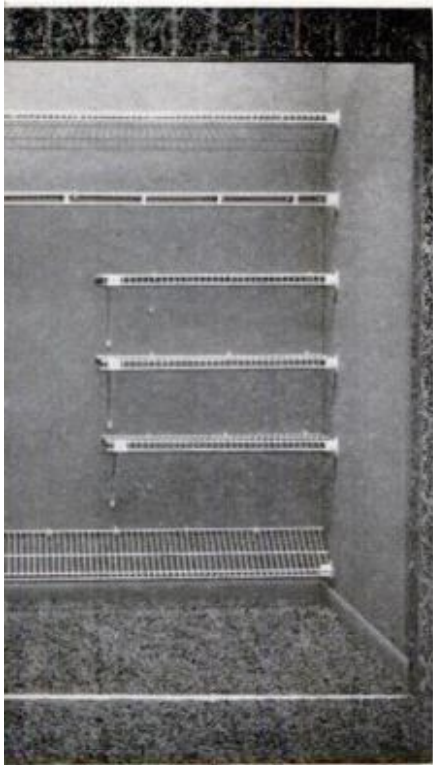
Color slide shooters now have improved versions of some favorite films to play with: the new Agfachrome 64 (which replaces the old ASA 50 Agfachrome) and the new Kodachrome 25 and Kodachrome 64 (which replace old Kodachrome II and Kodachrome-X respectively). All three films have greater latitude, reduced contrast and better color rendition, especially in subtle pastel tones, than their predecessors. And Kodachrome 64 has much finer grain than the old Kodachrome-X did. But overall color rendition of all three is still enough like that of the earlier versions to satisfy fans not looking for drastic changes.



Lift kit stores bikes from ceiling

Sears' Bike Lift Kit allows you to store one or two bikes from the ceiling, freeing valuable garage space (above). A 1 by 26-inch steel lift bar, vinyl-protected bike hooks, four pulleys, 3/16-inch nylon rope with 750-pound strength and all hardware for installation are included. All parts are zinc-plated to prevent rust. Pulleys have a 1 to 4 pull-weight ratio so almost any member of the family can easily lift the bikes (right). \$19.99, Sears, Roebuck and Co.





Easy-to-install shelving

Closet Maid shelving system offers vinyl-coated, steel-rod shelves in an open grille design. Shelves are available in 9, 12, 16 or 20-inch widths, up to 8 feet long. Support brackets, connectors and other hardware allow do-it-yourself installation in any size closet, using only drill, screwdriver and hacksaw. Company will custom-cut shelves, if desired. Shelving supports up to 75 pounds per square foot, can be inverted for use as shoe rack. For prices and other details, write Closet Maid Corp., Box 304, Ocala, Fla. 32670.

Bright bobbies on British streets

What might be the first group of well-lit policemen can be found in Birmingham, England. The police there are testing the use of a battery-powered flashing blue light on top of a bobby's helmet to warn motorists and pedestrians of danger. The light also makes policemen in their dark uniforms more conspicuous at night.



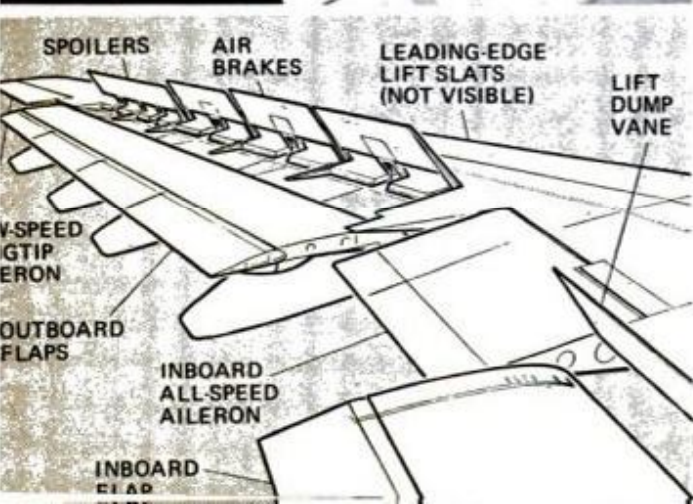
World's heaviest-lifting helicopter

Able to lift more than 35 tons at a time, this Boeing Vertol helicopter will become the mightiest piece of airborne hoisting equipment in the world. The tandem-rotor, three-engine Model 301, a commercial version of the military HLH already under study by the U.S. Army, is designed to speed heavy construction work, such as in the lifting and placing of huge bridge sections and precast concrete walls. First scheduled test flight is set for late 1975.

NOW

Look, man, at those wings!

Europe's new Airbus may not be the biggest jet flying, but it's surely one of the most complicated. Designed for short-field, low-noise operation, the twin-engine, wide-body liner is comparable in size to America's DC-10 and L-1011, but is said to carry larger passenger loads at lower costs. Its wing system, perhaps the most complex ever devised, incorporates twin ailerons for low and high-speed operation, inboard and outboard flaps, leading-edge slats for high takeoff lift, and spoilers, air brakes and lift-dump vanes for low-speed, short landings.



Have you packed the boat yet?

A German company now manufactures a boat that folds up so it will fit into a suitcase (lower photo above). Made of polypropylene, the boat—folded—measures approximately $1\frac{1}{2}$ by $2\frac{1}{4}$ feet and weighs about 25 pounds. Unfolded (upper photo), it measures about $2\frac{1}{2}$ feet wide by 7 feet long. Paddles come in fit-together sections and are fully suitcase-portable also. The two-seater craft can carry up to 400 pounds. For more details and prices, write Nautica-Vertrieb, Waldrebenstrasse 12, 8 Munich 45, Germany.



Mini trailer for mini people—with all the comforts of home

These youngsters of Consett, England, have their own travel trailer—a 4-foot-wide by 5-foot-long scaled-down replica just like their parents' full-size version. The interior (right, above) sports such modern features as foldaway bunks, cup-

boards, sink, electricity and running water. The trailer is pulled by a small battery-powered car that has headlights, brakes, throttle and steering. The kids drive the rig around the yard. Car and trailer were built by their grandfather.

New hang glider: Half wing, half balloon

Famed aircraft designer Jim Bede has done it again. Known for his revolutionary kit-built planes, the BD-5 and BD-5J jet, he's now come up with an ingenious hang glider that's half wing, half balloon. Shaped like an airfoil, it's actually a slim gas bag filled with helium. The gas provides 50 pounds of buoyancy—not enough to make it self-supporting, but enough to give vital added lift. Results are said to be longer glides at lower airspeeds without danger of sudden stalls and falls. Running down a hill is sufficient for takeoff—you don't have to jump off a cliff. It's so simple and safe to handle, says Bede, anyone can fly it. It will be sold by Bede Aircraft, Inc., Newton Municipal Airport, Newton, Kans. 67114.



Economy that's real, but how those disc brakes squeal!

A nationwide survey based on 765,000 owner-driven miles

by Michael Lamm
WEST COAST EDITOR

The name *Audi* dates back to 1910 and is actually a latinization of *Horch*, which means "hark!" in German. We thought you might like to add that to your store of lore of yore, and here's more.

The Horch motor car used to be Germany's Cadillac. August Horch, an engineer with Benz from 1896 to 1899, started the Horch company in 1900. He left it in 1909 to start another firm. He wasn't allowed to use his own name after leaving the first Horch company, so he translated it into Latin.

(Since we're kicking car history around, Ransom E. Olds couldn't use his name, either, after leaving Oldsmobile. When he founded his next company, he used his initials—REO.)

Audis have been around longer than you'd think, and have won a lot of rallies and races. Around 1930, Audi absorbed the engines and machine tools of the old

Photos by the author





Front-wheel drive aids roadability and handling. Owners give the Audi high marks in cornering, traction on ice and snow, resistance to crosswinds. Fwd also bolsters interior space, particularly front and rear legroom, which the Audi boasts aplenty. Clean styling gets satisfied nods, and several owners mentioned good vision through tall windows and over low decks. Fox shares engine, running gear and much sheet metal with the Volkswagen Dasher.



Rickenbacker car that was made in Detroit.

Audi became part of the Auto Union group in 1932 together with DKW, Horch and Wanderer. Ironically, Mercedes-Benz became Auto Union's main shareholder in 1956; then Volkswagen took control in 1964. In 1965, VW resurrected the name Audi, which had lain dormant after World War II. Today, the Audi is part of VW/Porsche/Audi, and the Audi Fox was the first of the new front-engine, front-wheel-drive cars coming from the German automakers. The Dasher is VW's version, and soon to be here are the Scirocco (replacement for the Karmann Ghia) and an even smaller fwd, front-engine mini that will bounce the Beetle out of the U.S. market. Called Golf in Europe, it'll be "Rabbit" here.

Fox owners tell us they find their cars surprisingly roomy and comfortable—much more like a big car than a small one. A retired Long Islander was pleasantly surprised: "I find it as comfortable, and it has as much room as my previous Pontiac Catalina." A Utah student: "Extremely comfortable; front and rear seats hold body firmly; adequate legroom for four large men up to 6-4." On the other hand, a Salt Lake City architect notes, "Front and rear spacious when inside, but older rear

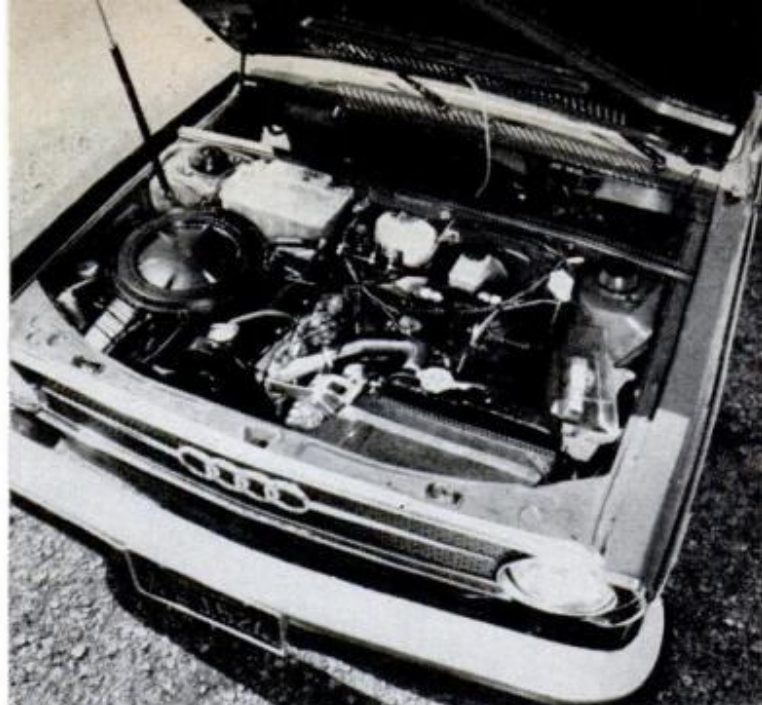
passengers have difficulty getting in and out."

The Audi maximizes interior space by placing its in-line, ohc, water-cooled Four well ahead of the front-axle centerline. The radiator stands to the left alongside the engine, leaving plenty of front legroom. With front-wheel drive, there's no drive-shaft hump, and the rear seat rests well back toward a deep-floored, cavernous, squared-off trunk (whose spare stands upright against the rear-seat partition). It's a marvelous piece of space utilization.

The loudest howl from Fox owners concerns the car's front disc brakes. They squeal. Not only that, but there's not much anyone can do about it. No fewer than 36.7 percent griped about brake noise, and many also mentioned the black brake-pad dust that accumulates on the front wheels. Apparently it's this dust from the brake pads that causes the squeal. We understand Audi's service engineers are doing their best to stop this squeal, and we hope they can retrofit whatever they come up with.

Here are lists of likes and dislikes voiced by a cross section of Audi owners.

A New York lawyer: "Excellent handling and straight-line braking on ice, snow, dry pavement. Excellent mileage on regular gas;



lack of mechanical problems. Brakes could be more powerful. Gas tank should be bigger. Needs speaker cutouts for stereo."

A New York engineer: "Good handling, solid feel on the road, large inside for exterior size. Brakes are only fair, hard to start when hot, front wheels usually covered with dust."

A New Jersey teacher: "It's a helluva lot of fun to drive; smooth-shifting manual transmission, comfortable, fun to be seen in. Handling very responsive. Rear-seat room fine. Great gas economy. Styling like a baby Mercedes. Plenty of trunk and highway acceleration. Of complaints, my wife won't let me drive because she's always in it. And the gas tank ought to be bigger."

A Michigan steno: "It's sturdy and durable, tracks well with fwd, has good gas mileage, comfort, and styling. But automatic transmission shifts roughly, engine surges and it's hard to start."

A California army officer: "Economical, precise, agile, but engine noise is very apparent at higher speeds. It should have a fifth gear for sustained turnpike driving."

Workmanship scored high, with 86.7 percent rating it good to excellent. Many owners compared the Fox to much more expensive cars. "Engine compartment and trunk are also neatly finished," comments a California grocer. And, "as a mechanic, I'm impressed with the quality," notes an Oakland auto technician.

Dealer service, though, took a drubbing in our survey; 70 percent rated it average or worse. It wasn't so much that owners had lots of mechanical problems, but when they did, repairs were slow or incomplete, and



Audi's seats recline, come in either velour or vinyl. Six dashboard vents don't deflect minor grumbles about fixed vent panes. Overhead-cam Four stands well forward, with the radiator at its left for maximum space utilization. Fan is thermostatically controlled. Drivers find their cars need few repairs but that service is below par when things do go wrong. The Audi has a huge trunk, thanks to its square design, low floor and upright spare tire.



parts weren't always available. Owners complained they had to rent cars a week or more (usually from the dealer) while their own were being repaired. Said one: "That's unfair—they socked it to me both ways."

A New York dentist pointed out that while the Fox is set up for computerized engine analysis (like VW, including Dasher models), few Audi dealers have the necessary diagnostic computers. He said he takes his Fox to VW dealers for service.

Economy and handling vied for top honors among owners' specific likes. A North Carolina electrical engineer opines, "The Fox handles very well. It has an ex-

cellent suspension system. It drives beautifully in snow and even on ice." "It handles like a sports car," says a California geophysicist.

Generally, Fox owners are very pleased. Among their praises were the reclining seats, the car's good looks, its low hood and good vision. Roominess kept coming up as the feature that most surprised owners. "Rear riders have enough legroom even with front seats all the way back," is how one matron put it, and a student said, "I'm six-foot-five, and this is the first car in which I've ever had to move the driver's seat forward!" ★★★

Summary of 1974 Audi Fox Owners Reports*

Total miles driven	765,437
Average miles per gallon:	
Local driving	23.1
Long trips	28.1
Body styles:	
Two-door sedan	51.6%
Four-door sedan ..	48.4
Transmissions:	
Four-speed manual	64.5%
Automatic	35.5
Why the Audi Fox?	
Economy	60.4%
Styling	22.6
Size	15.2
Reputation	14.7
Handling	12.4
Performance	12.4
Specific likes:	
Economy	67.1%
Handling	67.1
Comfort	36.6
Styling	26.4
Performance	16.2
Trunk space	16.2
Specific dislikes:	
Squeaky brakes	36.7%

Poor dealer service	11.9
Rattles	11.0
Seat-belt system	6.2
Cold starting	6.2
What changes would you like?	
Less squeaky brakes	10.3%
Vent windows that open	8.6
Fewer rattles	6.9
Better vent system	6.9
Lower initial price	6.3
Number of vehicles owned:	
Fox only	37.0%
Two cars	47.9
Three cars	10.5
Four or more cars	4.6
Other makes of cars owned:	
Chevrolet	22.5%
Volkswagen	15.2
Oldsmobile	12.3
Ford	8.0
Buick	6.5
Comfort opinion:	
Good to excellent	91.3%
Average to poor	9.2
Workmanship opinion:	
Good to excellent	86.9%
Average to poor	13.1

Dealer service opinion:	
Good to excellent	30.1%
Average to poor	70.0
Had any mechanical trouble?	
Yes	60.5%
No	39.5
What type of trouble?	
Brakes	20.0%
Carburetor	13.8
Electrical	10.8
Emissions-control system	10.0
Seat-belt system	7.7
Airconditioning	7.7
Did you repair it yourself?	
No	98.5%
Yes	1.5
Dealer repairs satisfactory?	
Yes	53.7%
No	46.3
Age distribution of owners:	
15-29 years	35.4%
30-49 years	44.7
50-plus	19.8
Would you buy another Fox?	
Yes	83.0%
No	17.0

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

Everybody wants these used cars

PM's Detroit Auto Editor goes to Murray, Ky., and solves the mystery of what they're doing with all that paint!

by Robert Lund



Photos: Elaine Lund



Restored old-timer (left) a '39 Ford, isn't for sale, Howard Brandon (top right) tells PM's Detroit editor, Bob Lund (top left). One of the leading used-car reconditioners in the United States, Brandon lavishes so much attention restoring some cars that he can't part with them. Antique Ford will go into his personal collection of more than 100 cars. A gouge in the dash of this car was plugged and painted so expertly that it couldn't be detected.

The best-looking, smoothest running used cars in the United States come out of a small town tucked away in the southwestern corner of Kentucky, near the Tennessee border. The town is Murray, population 16,158.

For its size, Murray has more used-car dealers and reconditioning shops than any other community in the United States. Its Chamber of Commerce counted 154 shops selling or reconditioning used cars a few months ago. That figure may be out of date now: Eight new shops were getting ready to open at the time I was in Murray.

Murray will turn out something like 40,000 to 50,000 reconditioned cars this year. At retail prices, the cars will bring between \$35 million and \$45 million. That's down from recent years. Until the recession hit the car business this year, the annual "handle" ran between 50,000 and 60,000 cars

with a retail value of \$60 million. But the merchants of Murray aren't worried and they look for business to improve. With new-car prices going up, they see more buyers turning to used cars. They also look for sales to increase now that the gasoline shortage has eased.

It's 623 miles by car from Detroit, where they make them new, to Murray, where they make them over. Why Murray? Why an out-of-the-way, back-in-the-woods town that has a smaller population than Ford or GM employ in a single plant?

The local historians can't pin down the exact year the first fix-and-shine shop opened. It didn't seem important at the time. "As we reconstruct it," says James L. Johnson, executive secretary of the Chamber of Commerce, "a lot of our people went up to Detroit to find work during the depression. They came back home after World War II

and brought their skills with them. That's when the business really got going—after World War II."

Johnson is the right man to run the chamber. He used to be in the dry-cleaning business, where he became an expert on getting the grit and grime out of car fabrics—seats and headlinings. (Johnson is popular around town for other reasons. He was an announcer for Grand Old Opry in nearby Nashville and for many years he traveled the South doing radio play-by-play for baseball games.)

Used-car dealers who buy wholesale have known about Murray for years. But recently the town has started to attract national attention—because a paint company got curious about all the buckets of paint it was shipping to Murray.

Not that the "magicians of Murray," as Jim Johnson calls them, were trying to hide their light under a bushel. It just never occurred to them that their story might interest people outside the used-car business. Until the du Pont company came along.

Du Pont, one of the world's leading makers of automobile paint, sells paint to Detroit by the tank car and also supplies refinishing shops, car dealers and do-it-yourselfers. The company publishes a lively little magazine it sends out to service shops to promote du Pont products. Someone decided it might make a story to find who is the firm's second biggest customer—after Detroit—for automobile paint.

So they counted up the gallons shipped to different markets and discovered the second largest user of du Pont paint is the town of Murray. That didn't come as much of a surprise to the people at du Pont, because the company's salesmen had been writing fat orders in Murray for a long time. But the story in the company magazine was a revelation to others, including Kentucky newspapers that had paid little attention to the goings-on in Murray before du Pont put the town on the map.

Jim Johnson says some follow-up stories since the du Pont article are misleading because they give the impression Murray's reconditioners buy junkers and clunkers and transform them into resalable cars. Murray's shops don't deal in junkers. Except for classic cars, "they seldom buy cars over four years old," Johnson explains.

But you can't take the word of chamber of commerce people as scripture, because they are paid to tell you nice things about their town. So my wife and I drove around



First step in readying a car for reconditioning is to scrub it down with soap and water—inside and outside, upholstery, brightwork, everything. After cleanup man Donnie Boyd finished with this car, he turned the hose on the inside of the door to rinse it, then wheeled it out in the sun to dry. "Best thing to get the crud off," Boyd advises, "is a bottle of Wisk and a pad of steel wool. Then lay into it." What do you do if the sun isn't shining? "No problem. Just aim the house fan at it, turn it up full blast and let it blow."



Thorough cleanup of cars is important to make certain the finish is spotless before painting. Depending on condition of original paint job, car at the left may get up to a dozen coats of paint in reconditioning process. Billy Snyder (left) tackles the front and Donnie Boyd (below) soaps the trunk.

After scrubbing and hand-sanding of a station wagon (right, on facing page), Dean Dix sprays primer preparatory to painting. Mixture of fuel oil and cleaning agent is used for blasting grime from engine (below, facing page). Following mechanical renovation, cleaned and painted car gets waxed. Buffing wheel is used for a few coats; up to 12 more waxings will be hand-rubbed. Cleanup crews in Murray used to be paid a flat \$15 for laundering a car. Experienced hands now draw down \$225 to \$250 a week.

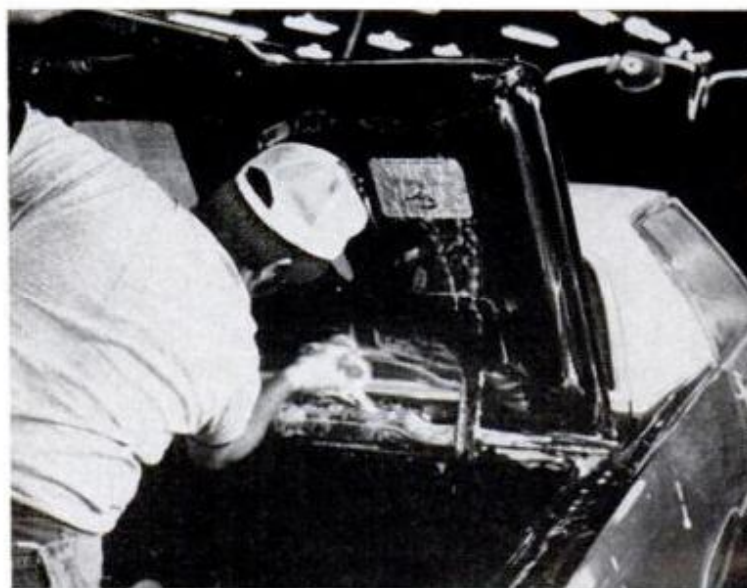
town looking for wrecked and rusting cars. On Main St., Routes 3 and 4, South 12th, where many of the shops are located, and in the suburbs of Almo, Hazel and Kirksey, where the business has fanned but beyond the boundaries of Murray. Jim Johnson was telling the truth. We didn't count more than a half-dozen junkers in a tour covering 20 to 30 miles.

There are some beat-up cars around, but you have to get off the road to spot them. They are used solely to salvage parts for the repairing and reconditioning of other cars. Murray is not a dump for derelict automobiles.

The shops employ anywhere from 2 to 50 people. The biggest had 90 employees until the gas shortage hit last winter. There are a lot of father and son shops, brother and brother businesses and somebody-married-to-somebody's sister combinations.

Despite the thousands of cars around, Murray doesn't offer the individual buyer much more of a choice in used cars than you would find in any small town. Something like 75 to 90 percent of the reconditioned cars are wholesaled to dealers in surrounding states. I checked the ads in the local paper, the *Murray Ledger & Times*, the day I was there and only six used cars were listed for sale.

Murray gets most of its cars from "up North," as they call it—Chicago, Indianapolis, Cincinnati and Detroit. The big shops have resident buyers—full-time employees—in those cities. The large shops operate their own haul-away trucks and when the resident buyer has a full load, a driver delivers the cars to Kentucky. After they have been given the Murray treatment, the haul-aways deliver the cars to dealers who will resell them to the public. Often, the cars



are resold to the same dealers from whom they were purchased.

One shop owner told me an export company operating out of New York offered to buy the shop's entire output for a year. The exporter wanted the cars for South America. The Murray man declined the deal because he didn't want to tie himself to one outlet for his work.

A typical car will get about \$400 worth of repairs and reconditioning to ready it for resale. Most of that money—two-thirds to three-fourths—will go into appearance work, as distinguished from mechanical repairs.

Murray dealers say they work on a tight profit margin—as little as \$10 or \$15 on a car after they have worked it over. A profit of \$100 to \$150 is considered high. And on a few cars they take a trimming.

The used-car business is supposed to be based on mutual mistrust. It's a game in which buyer and seller try to outwit each other. Stick the other guy. While they are shrewd traders in Murray, they say they

Old cars or new?

Should you keep your old car or trade it on a new one? How about trading for a newer used car? How can you tell a good used car from a bum?

The used-car experts in Murray, Ky., say most people trade cars too often. If you give a new car good care, it will last 200,000 to 250,000 miles. If the car has been abused, or if you buy a used car with 150,000 miles on it, by putting \$400 to \$500 in repairs, the car will run another 100,000 miles.

You can do a lot of the work yourself, whether you're buying a used car or cleaning your old car for sale. Here are some tips:

For the cleanup, get a bottle of Wisk (or comparable product), a box of Brillo or triple-0 steel wool and a sponge. Mix some suds and use the Brillo or steel wool on tires, floor mats, pedals, the floor of the car (but not the carpeting) and unpainted metal parts. On painted surfaces and upholstery, use the suds and sponge. Don't be afraid to slosh water on the upholstery inside doors. You can even turn the hose on door fabrics to rinse the suds. It will dry off.

If you're cleaning the car to resell it and there's paint damage or a banged-up fender, don't try to conceal the blemish by touching up the paint or buying a new fender. Once a car has been exposed to the elements, you cannot match the original paint job. The same thing if you buy a new fender. It just won't match. It takes a skilled body man to match paint and metal.

If you try to conceal body damage or scratches, the person interested in buying the car will suspect the worst. "What's he trying to hide? The car must have been in a serious accident." You are better off letting the imperfections show. (You can apply this same information in reverse in buying a used car.)

What do you look for in buying a second-hand automobile?

First off, never, never buy a car that has been used as a taxi or public limousine. You can take a chance on a fleet or lease car, but only if you are a sharp guy on cars.

Don't buy a used car if there is anything wrong with the drive train or engine. If you can't determine this for yourself, pay a mechanic \$25 or \$50 to give you an opinion on it.

If the choice is between a car owned by a guy who drove it to work and a car owned by a little, old lady who only drove to church on Sunday, pass up the little, old lady. Cars are safer mechanically if they are used regularly.

Don't judge a used car by the odometer or the mileage the salesman writes on a piece of paper if you live in a state requiring disclosure of true mileage before a used car can be sold. Salesmen have been known to stop short of the precise truth



play by different rules. The code says, "You don't cheat me. I don't cheat you."

The rule is apparently observed on both sides, because millions of dollars worth of back-and-forth trade between Murray and the dealers it does business with is conducted on the phone. Sellers and buyers do not see the cars before the deal is closed. Both sides are not always fully satisfied, but if there are differences, they are worked out on the next deal.

I listened in on two phone conversations between Murray and dealers selling and buying cars in Chicago. On the first call, the shop in Murray ordered 10 Impalas. There was no mention of money other than a casual "Send me the bill" from the caller in Murray. On the second call, the man in Murray said he had lost \$300 on a previous deal, "so I'm knocking \$300 off the \$4000 I owe you." "Whatever you figure is fair," the voice from Chicago replied.

I wanted to talk to a successful wheeler-

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(Please turn to page 162)

Exposure meters: Aim them right, and they won't steer you wrong

by Ivan Berger
PHOTOGRAPHY EDITOR

Photos: Peter Schneider




Dark face works here, but it's not always the effect you want (see text).



Exposed for dark sweater, this shot washed out the subject's face.



Good overall exposure catches details in both face and dark sweater.



Light meters give different answers when you ask them different questions. A reflected-light meter at the camera position read both the backlit subject and the sky (left half of photo above), recommended an exposure that made the sky 18 percent gray, but silhouetted the face. Close-up reading by the same meter turned the face 18 percent gray (right half), washed out the sky; a spot-meter from camera position would have done the same. A smart photographer would have increased exposure one stop to get more naturally light skin tone.



Meter reading taken from face gives maximum detail, but darkens skin. Usually it pays to open up 1-2 stops.



Metering important details (here, the sweater) brings out detail—but faces are often exceptions (see above).



Incident reading (note meter pointed back toward the camera) usually provides balanced overall results.

Exposure meters—whether hand-held or built into your camera—can be awfully helpful, but they're also awfully dumb. They don't know what you're shooting, or how you want it shown. But with your brain guiding their electronic eyes, they can give you perfect—not just passable—results just about every time.

Even without your help, meters give good results in average picture-taking situations—which, by definition, means they'll give you good exposure most of the time. The brainwork comes in recognizing the non-average situation, and knowing how to deal with it.

Unassisted by your brain, a meter tells you just one thing: the exposure which will produce a negative whose tones all average out to middle gray from whatever subject is in the meter's field of view. If the subject is a middle gray—or a scene with an average mixture of equally important light or dark tones—that's just fine. But if the subject is predominantly dark or light, or much darker or lighter than its background, or if the meter picks up some of the light source that's illuminating the subject, the meter's accurate but unintelligent advice will lead you astray.

Backlight and contrasting backgrounds cause the most problems to amateur photographers. That's one reason you're so often told to face your subjects into the sun, even though it makes them squint and produces deep, harsh shadows. With the sun behind the subject, eyes would be comfortable and open, the face in soft shadow, and the hair glowing, perhaps, from the sun's rays. But a meter at the camera position (or built into the camera) would try to average this small, shadowed face with the vast bright sky behind it. Follow the meter blindly, and you wind up with a deep blue sky (gray, in black-and-white) and a dark, featureless facial blob.

The same holds true when you photograph a black cat on a snowbank or, in reverse, when you shoot a well-lit face against a background of shadows.

Close-up metering is one answer to this problem. Move your meter in so it's reading just your subject, not its background, and that part of the problem's solved. This technique works equally well with hand-held meters, with meters built into nonautomatic cameras, and with those electric-eye automatic cameras whose meters can be locked into a particular reading by pressing the

Close-up or spot metering solves some exposure problems



Close-up metering, whether done with hand-held meter (top) or camera's built-in one (above center), gives reading for main details, avoids errors caused by contrasting backgrounds. Most electric-eye cameras, like this Konica, lock meter readings when you press shutter halfway; once the reading's right, you step back to shooting position and finish the shot. Palm (bottom) can substitute for inaccessible face.

shutter button halfway down (which covers most such cameras we've tried).

But it doesn't work, of course, if there's some reason why you can't get in close to your subject, whether because it's inaccessible or because it would make your subject self-conscious. If you're standing in the same light as your subject (as you usually are, in daylight) you can take a reading from a substitute subject of equal brightness—your hand, for example, if you're shooting a face. If the light is the same but no equally bright objects are handy, you can meter from a lighter or darker object, then adjust your exposure accordingly.

Professionals and some well-heeled amateurs buy spot meters like the Minolta and Honeywell Pentax models shown on page 111. These have meter-coverage angles of only 1° (though they show you a wider area, for easier aiming)—narrow enough to meter just a face at up to about 35 feet.

More compact and less expensive are the semi-spot meters like the Sekonic Zoom, or attachments like the Luna-Pro's which reduce meter coverage from its normal 30° to a somewhat narrower $7\frac{1}{2}^\circ$ or 15° . The meters built into most single-lens reflex cameras are, in effect, semi-spot types, whether they read everything on the ground glass or just a selected area of it—but you can make them more selective by metering through a long telephoto lens.

But the world's not middle gray, which is why we said that close-up or spot metering only solves exposure problems part way. The exposure your meter recommends when reading your subject close-up will register that subject on the film as a middle gray—fine for deeply tanned faces, perhaps, but not for either dark or light ones—let alone for true tonal rendition of white or black objects. This holds true not just for close-up readings, but for all reflected-light readings where the subject is much whiter or darker than average, or where the light and dark areas aren't of equal importance.

To compensate, of course, you just give more or less exposure than the meter indicates, to lighten or darken the results. This is especially true for color slides, where you can't correct tonality as you can when printing from negatives. Fair skin, for instance,

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Aiming meter down (left) means that meter will read subject, not sky glare, especially on overcast days. But make sure meter points at a representative subject tone, not much lighter or darker than the main subject. Meter cell types (below left) are easy to tell apart: Selenium cell (upper meter) has big window, and selenium meters need no batteries. CdS cells (lower meter) have smaller window, need batteries, but read in dimmer light. Of meters shown just below, the four on the right are CdS types, as are all those in the bottom photo; the rest are selenium meters.

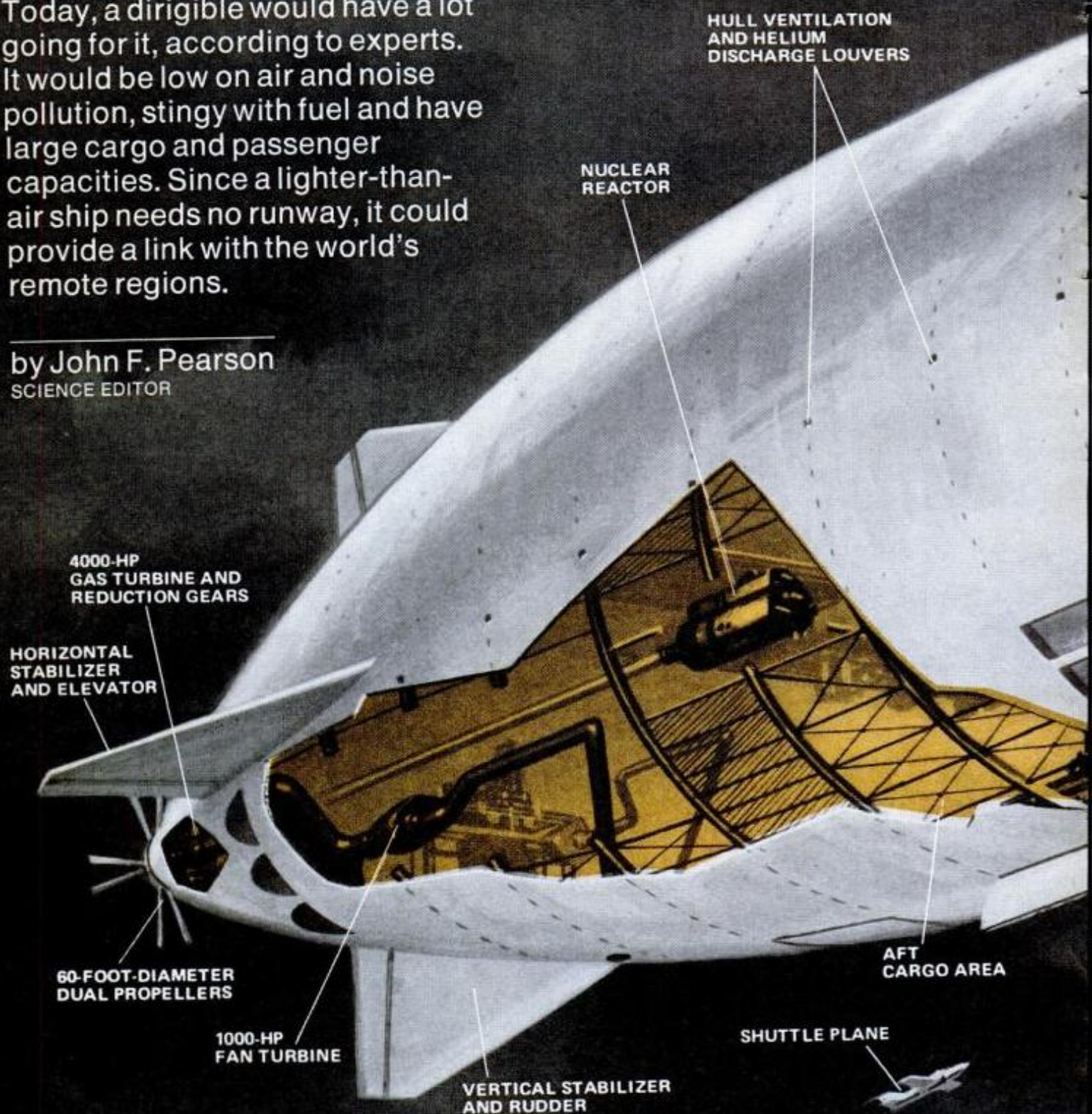


Meters plain (above) and fancy (left) cover wide range of shapes, prices. Plain units include: (1) Gossen Pilot, \$40; (2) Weston Master VI with incident-light dome, \$55; (3) Weston XM-1, \$19; (4) Vivitar 34 clip-on, \$19; (5) Weston XM-2, \$34; (6) Vivitar 30, \$14; (7) Sekonic Auto-Lumi L86, \$17; (8) Vivitar 43, \$27; (9) Gossen Super-Pilot, \$9. Fancy units are: (1) Minolta Auto Spot 1° meter, \$340; (2) Sekonic L-228, 8.2°—28° zoom, \$85; (3) Honeywell Pentax, 1°/21° spot, \$205; (4) Sekonic studio deluxe incident meter, \$65; (5) Gossen Luna-Pro, \$125 and \$35, 7½°/15° spot attachment; (6) Minolta Autometer professional, \$110, and its \$30, 10° spot attachment.

Don't sell the airship short

Today, a dirigible would have a lot going for it, according to experts. It would be low on air and noise pollution, stingy with fuel and have large cargo and passenger capacities. Since a lighter-than-air ship needs no runway, it could provide a link with the world's remote regions.

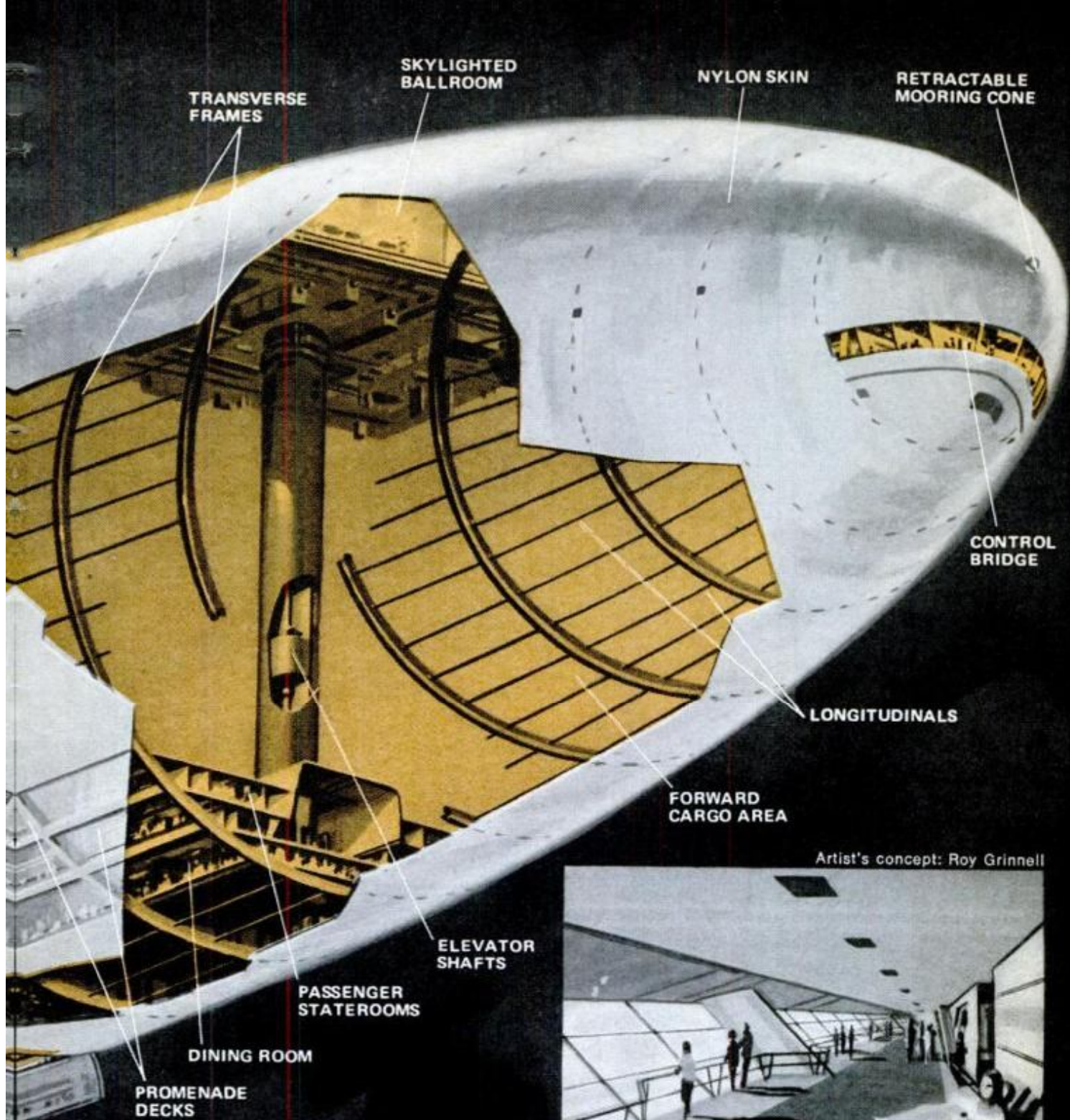
by John F. Pearson
SCIENCE EDITOR



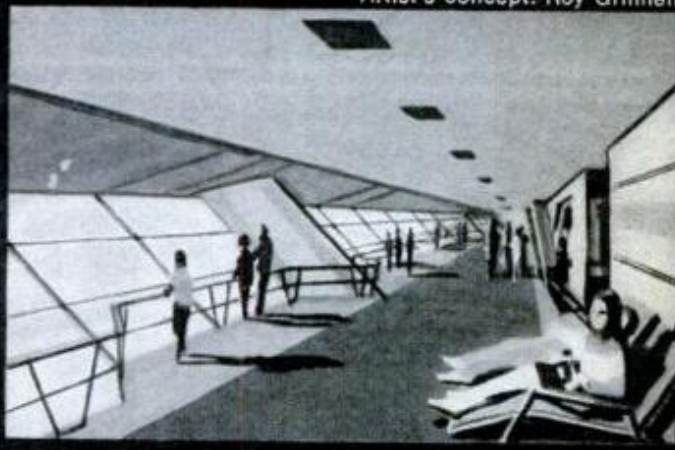
Most Americans who remember the dirigible tend to think of it only as a symbol of a bygone day, as a form of transportation that relatively quickly lost the race against the faster, surer airplane. They recall the enthusiasm and spirit of adventure that marked many pioneering dirigible flights,

and they remember the tragedies, too. The newsreel image of a broken, flaming *Hindenburg* crashing at Lakehurst, N.J., in 1937 is hard to forget.

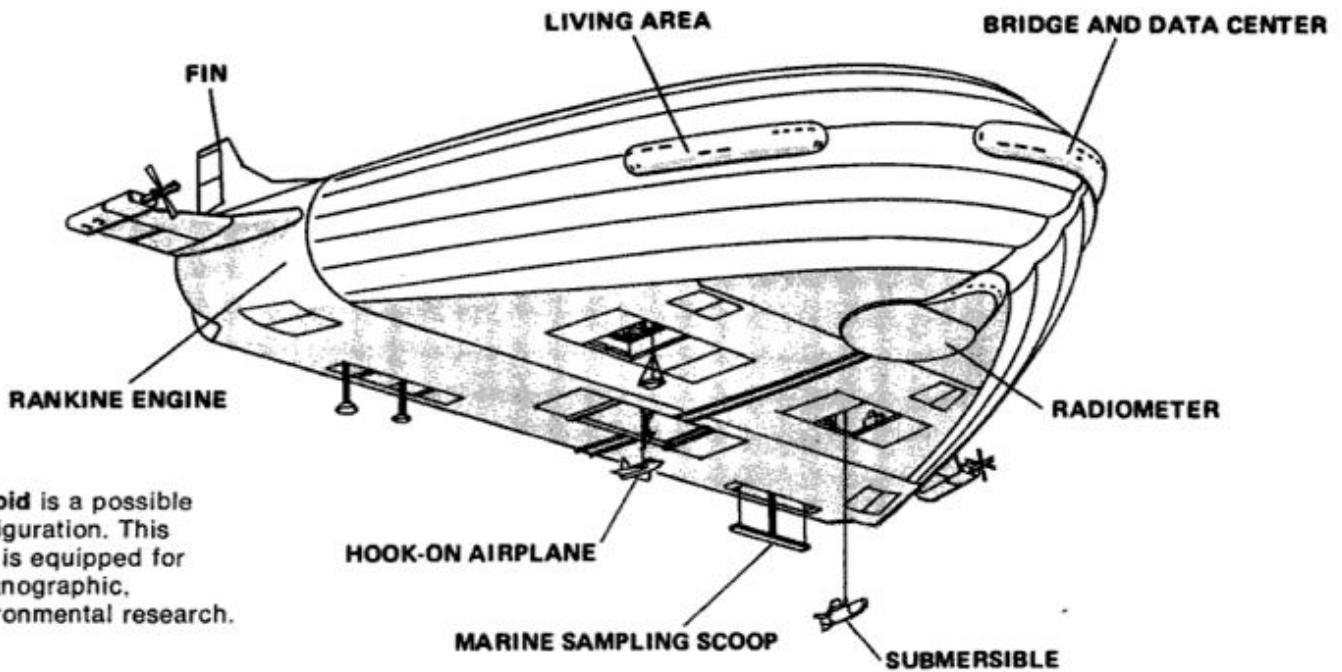
But there are men in this country who don't regard the airship as a gas-bag dinosaur. They view the rigid airship (as opposed



Artist's concept: Roy Grinnell



Nuclear airship, designed by Boston University engineers, would fly at about 100 mph and have a virtually unlimited range. In a passenger-cargo version, the 1000-foot ship would offer 400 passengers the comfort and luxury of an ocean liner—spacious lounges, staterooms, promenade decks. Instead of a five-day ocean voyage, however, a transatlantic trip by airship would take less than 40 hours. An all-cargo nuclear airship would excel at long-distance hauling with a payload capacity of some 300,000 pounds—equivalent to a shipment of 150 VW Beetles.



Deltoid is a possible configuration. This ship is equipped for oceanographic, environmental research.

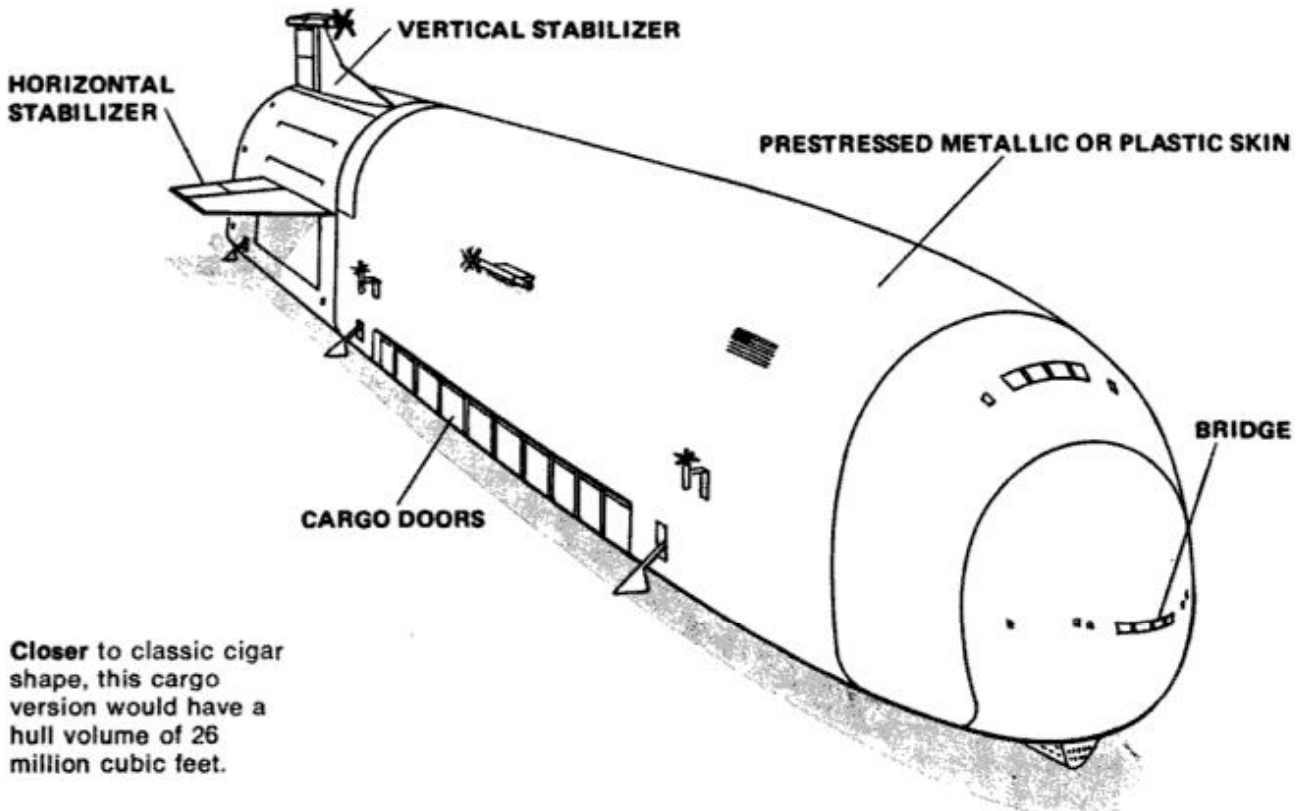
to the nonrigid blimp) as a craft with unrivaled capabilities. They point out that the "flying cigars" were produced by a technology now more than 40 years old. Today's technology, they say, could produce a far safer, more efficient dirigible.

These proponents of the updated airship are no idle dreamers but men of solid technical background. Francis Morse is an associate professor of aerospace engineering at Boston University; George J. O'Hara, a research engineer at the Naval Research Laboratory; Vladimar H. Pavlecka, a corporate technical director who helped design a famous Navy blimp, the ZMC-2; Kurt R.

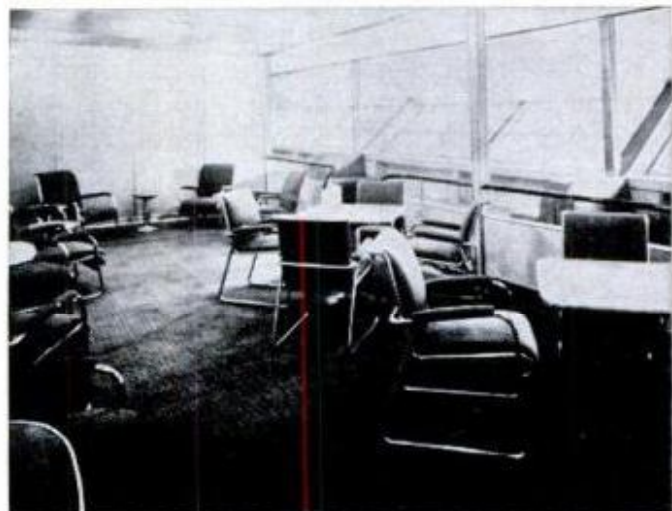
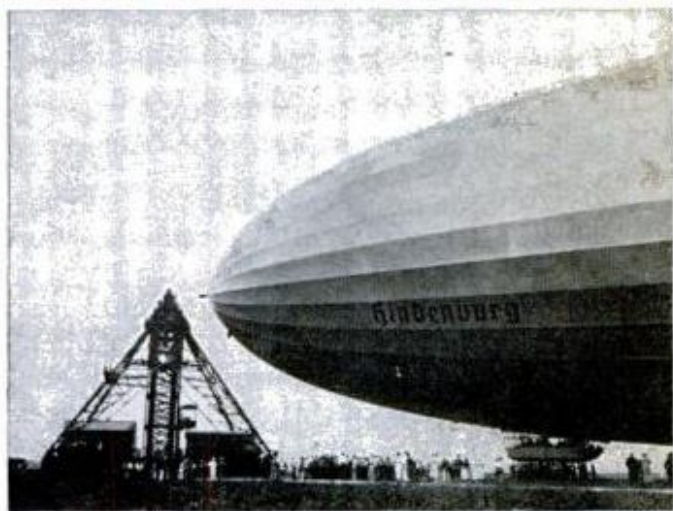
Stehling, a propulsion specialist and technology advisor for Manned Undersea Activities, Office of Coastal Environment, and J. Gordon Vaeth, director of the Office of System Engineering, National Environmental Satellite Service.

In a number of recently published technical articles, they have made a good case for the rigid airship—a name they prefer to dirigible—as a passenger-cargo ship, all-cargo carrier, military or scientific research ship. A modern airship, they contend, would be ideal for nuclear propulsion, which would give it virtually unlimited range.

They describe a ship with an envelope or



Closer to classic cigar shape, this cargo version would have a hull volume of 26 million cubic feet.



Swastika flies over New York. As symbols on fins indicate, the Nazis took great pride in the technically advanced, luxurious *Hindenburg*. In transatlantic crossings, costing \$400 for one-way passage, the ship carried up to 72 passengers. The dining salon accommodated 34 at a sitting. Linen tablecloths, fresh flowers, and fine crystal and china complemented the select German wines and expertly prepared foods that flowed from all-electric kitchen. Lounge (left) looks out on promenade and its angled windows. Above, *Hindenburg* is maneuvered toward mooring mast at Lakehurst.

hull ranging from 12 to 25 million cu. ft. in volume (compared with the *Hindenburg's* 7 million), about 1000 feet long and 300 in diameter. The great size would insure efficiency. These experts point out that the big airships of the 1930s were on the threshold of achieving efficient performance.

The ship would be inflated with helium, a gas that does not react chemically with other substances. Though hydrogen has more lifting power, it burns readily. Ignited hydrogen was the cause of more than one airship disaster in the past.

Some designers don't see the space-age dirigible as having to be in the traditional cigar shape. They envisage airships that resemble an outsized whale or that have a deltoid shape. But Francis Morse and his Boston University colleagues stick with the cigar configuration, claiming for it superior aerodynamic characteristics.

Their passenger-cargo version would carry 400 passengers surrounded by luxury reminiscent of the ocean liner. Passenger quarters would be distributed among three decks in the lower part of the hull. They would have staterooms (some with private baths), dining salon for 200 persons, cocktail lounge, cinema and promenade decks.

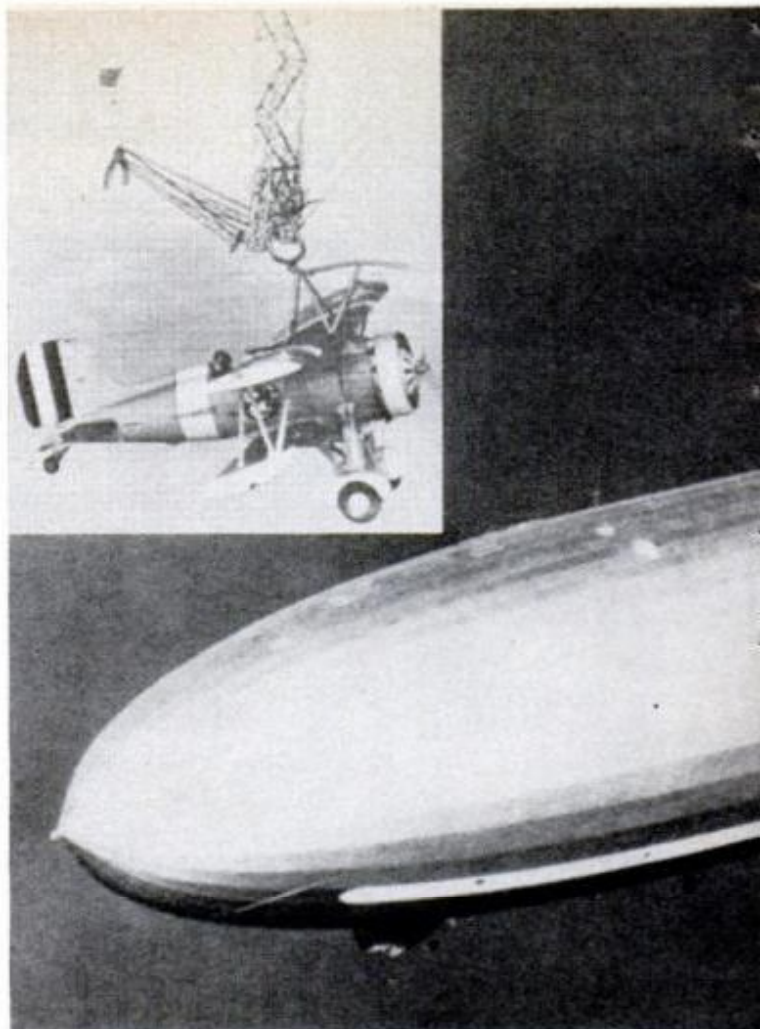
A 15-story elevator would carry passengers to a top-deck ballroom featuring an arched, transparent ceiling for dancing under the stars. Such generous use of space, Morse explains, is made possible by today's lightweight, honeycomb flooring materials.

The BU design would also include a hangar bay and "skyhook" for launching and retrieving an 18-place plane. It would ferry passengers to and from the ship while in flight, eliminating the necessity, at some destinations, of having the dirigible descend to a mooring facility.

Heat created by a nuclear reactor would power three engines aft: a 4000-hp turbine and two 1000-hp turbo fans. They would turn two 60-foot, dual-rotation propellers mounted at the ship's rear tip—a dramatic departure from past designs. The big props would turn slowly and quietly.

The 1000-hp turbo fans would have a second function: Through a series of inlets, they would suck in stagnant air—boundary-layer air—that "clings" to a ship's skin. The breaking up of this layer improves the operation of the big rear fins.

The modern airship, say its proponents, could play a unique roll in transportation. With the decline of the ocean liner, there



is no real alternative to the jet for transoceanic travel. The big liners have all but disappeared from the transatlantic run.

The airship could provide the liner's elegance and comfort but at greater speed. Instead of a five-day crossing by sea, airship travelers would arrive at European destinations in under 40 hours. For those in a real hurry, there would still be the jet.

The airship would add a new dimension to the vacation cruise. Here's how Gordon Vaeth envisions the experience: "At an altitude of 1000 feet the ship would glide quietly over some of the most spectacular sights and scenery the world has to offer, stopping in midair for a closer look through the ship's windows before moving on."

He foresees photographic safaris to the Amazon, history-laden cruises along the perimeter of the Mediterranean, flights over the permanent ice pack to the North Pole. This is more than a flight of fancy on Vaeth's part, for in the 1930s the German dirigible *Graf Zeppelin* compiled an excellent record as a passenger carrier.

In nine years of operation, the airship flew over one million miles, carried 13,000 passengers and spent some 17,000 hours

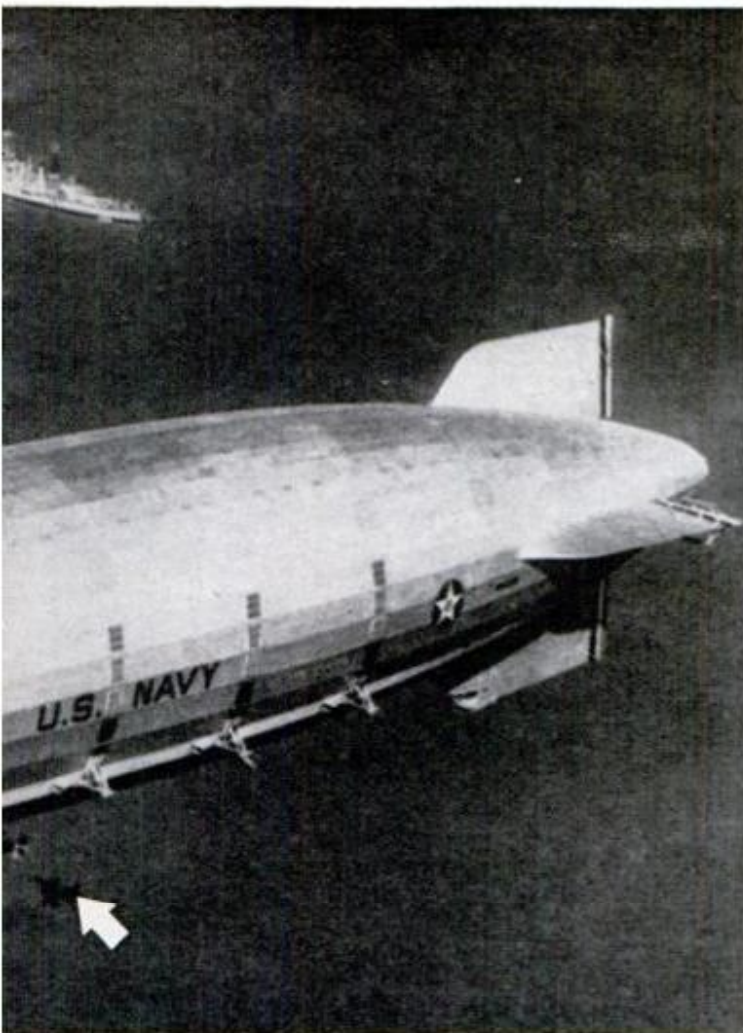
aloft. In 1929, the ship flew around the world, making stops at Friedrichshafen, Germany; Tokyo, Los Angeles and Lakehurst. Two years later the *Graf* made a pioneering flight over the Arctic ice pack. From 1931 to 1937, the airship provided regular passenger service between Europe and South America. She was scrapped in 1938.

The *Graf*, named for the German airship pioneer, Count Ferdinand von Zeppelin, was 775 feet long, 100 in diameter and had a gas volume of 3,995,000 cu. ft. The gas used was hydrogen. The ship was a good example of the Zeppelin design that had evolved during the first two decades of this century. It had a duraluminum skeleton made up of transverse frames and longitudinal girders. Fixed inside the skeleton was a series of individual gas cells to provide lift. The outside was covered with a doped fabric. The diesel engines that turned small props were hung in outboard gondolas.

The *Graf Zeppelin's* success led to the building of the *Hindenburg*, a ship 803 feet long and with a maximum diameter of 135 feet. Its gas capacity, 7,062,100 cu. ft., was almost twice the volume of the *Graf*. Commissioned in March, 1936, the *Hindenburg*

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One of America's most famous dirigibles was the *Macon*, which boasted hull volume of 6.5-million cu. ft. *Macon* had hangar facilities for five small planes (arrow) launched and retrieved by trapeze (inset). 'Tin Bubble,' (left), built in 1929, was of revolutionary design. All-metal skin served as its gas container, too.





Lovely to look at, but gas mileage could be better

A nationwide survey based on 1.2 million owner-driven miles.

by Michael Lamm
WEST COAST EDITOR

Used to be, Cougar and Mustang shared almost everything—bodies, running gear and so on. But for 1974 all's changed. The Mustang shrank to the Mustang II, and the Cougar became, in effect, a luxurious version of the Montego—or, as many owners put it, "a baby Mark IV."

The Cougar's 114-inch wheelbase, its 215.5-inch overall length, all of its major body panels, plus its engines and running gear are the same as those of the Montego coupe.

But the Cougar still has enough distinction and personality to be dubbed "an attractive car at an attractive price," as one owner commented. Styling, in fact, became

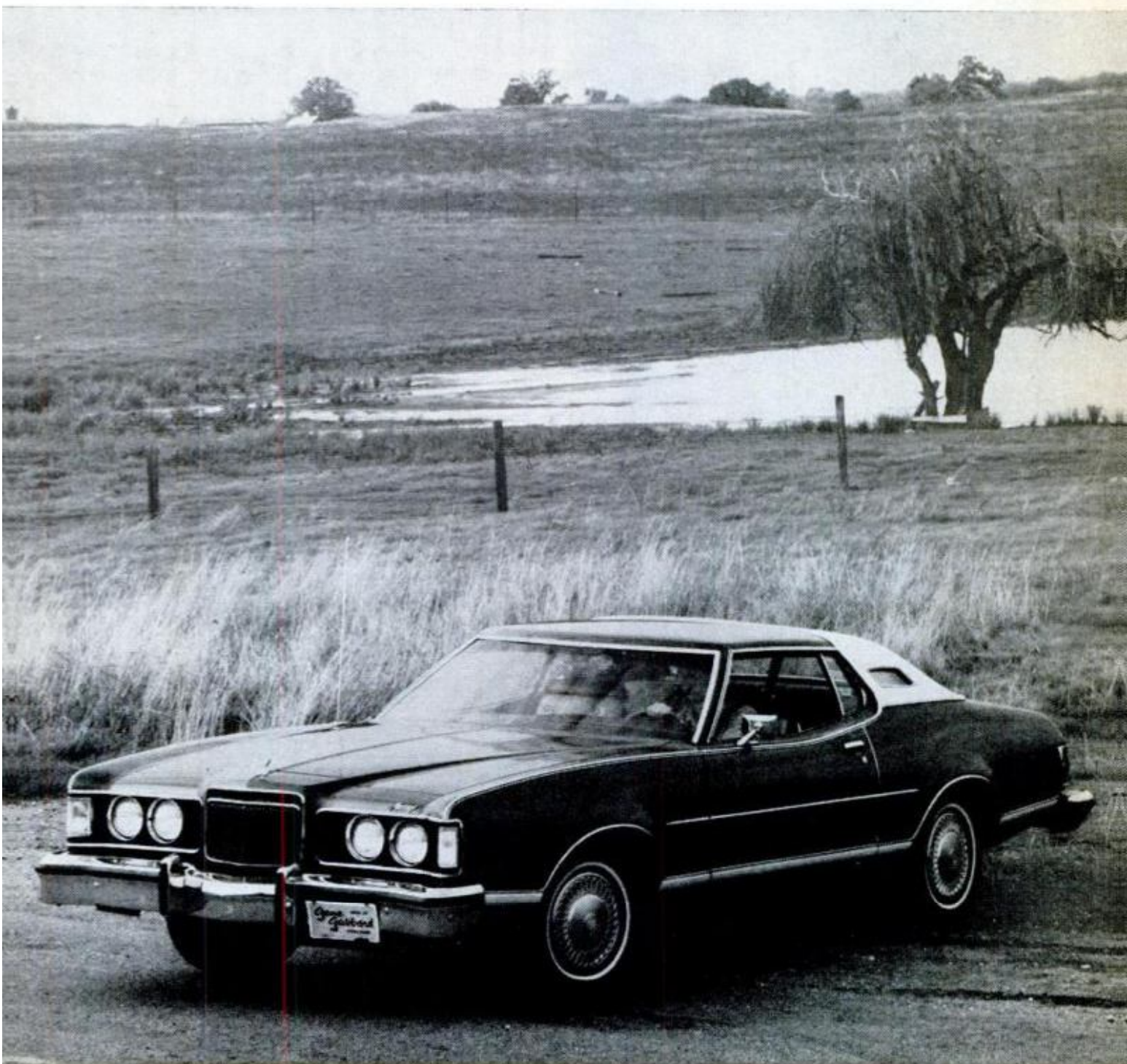
Cougar understeers (above) on very hard cornering but handles well otherwise, and its owners enthused about smooth, silent ride. Fully 20 percent said styling at rear didn't match front, yet Cougar's design did more to sell the car than any other factor. Trunk and rear legroom space is limited. Cougar shares basic body shell with 1974 Montego coupe, and while a few owners bemoaned similarity between these two cars, they were outvoiced by people who called the Cougar a mini-Mark IV. Automatic trans and power equipment are standard in the Cougar.

the principal reason that people bought Cougars.

"A great-looking car inside and out," says a Yonkers mailman. A Jersey butcher: "It looks just like a Continental." A New York bodyman: "A touch of class at \$2000 less than a Thunderbird." "Beautiful outside, luxury inside, instrumented like a sports car, impressive as a Mark IV."—Los Angeles accountant.

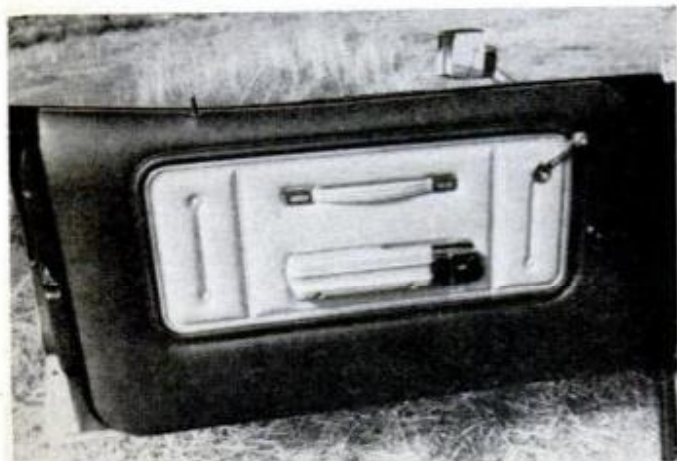
However, all this pulchritude does have its price. Rear legroom is predictably precious. So is trunk space. A few owners complained of the Cougar's resemblance to the Montego—the cars looked too much like twins, they said. A New Jersey customer service rep observed, "Rear of vehicle is short on design. Looks like concentration was spent on front of car and stylists ran out of ideas when they got to the rear, so they just rounded it off." His sentiment was echoed by 20.2 percent of our respondents. And an Illinois airline captain opined, "The body is too big—should be the size of previous Cougars."

Owners leveled their main complaint,





Luxurious interiors brought owner praise, and while rear legroom is in short supply, the fact came as no surprise. Engine compartment (below) is likewise a bit cramped. V8s of three displacements are offered.



though, at gas mileage—an all-around average of 12.7 mpg for the three engines available. We asked whether the recent energy crunch had changed owners' attitudes toward big cars and toward the Cougar. Most (70.2 percent) said no. Here are some random comments:

"No, because I didn't buy the car for its gas mileage; rather for its luxury qualities."—Los Angeles pharmacist.

"No—if I can't get gas, I simply don't drive as far. But I refuse to give up my comfort for the price of gasoline."—New York retiree.

"Yes, I try to cut out unnecessary trips now."—Ohio physician.

"Yes, I feel guilty driving this big a car now. I just got back from a trip through Southern Spain, and the largest car we saw was a 1965 Mustang."—Knoxville salesman.

What about the Cougar's quality and workmanship? "Very good," comments a Michigan supervisor, "all the trim lines up and the body finish is good." "Interior workmanship is the best I've seen on an American sport/luxury car."—Illinois surgeon. And an Oregon dispatcher: "I looked long and hard before settling on this car. Workmanship was one of the deciding factors. The Cougar *by far* surpasses anything in its price class."



Tangle of shoulder harnesses hinders entry and egress for back-seat riders. The entire seat-belt interlock system came in for the usual 1974 gripes, but there's not much that Detroit's automobile manufacturers can do.

On the topic of ride and handling: "Easy to drive and holds the road well."—California office manager. "Luxury ride, quiet, smooth, good performance—a replica of the Lincoln Mark IV."—Georgia librarian. "It sways on curves and understeers, which bothers passengers, particularly those in the front seat."—San Jose nurse.

A major complaint about the Cougar centered on its seat-belt/ignition interlock system. This same complaint has come up in every 1974 owners report, and since the system is mandated by federal law, it's no fault of the automakers. But a related gripe in the opinion of many owners was that the web of belts obscures entry and exit into and from the rear seat.

What changes would owners like to see? "Shorten the console so center rear passenger doesn't have to straddle it." "I wish there were still a convertible." "Bigger trunk." "More color choices." "Better shocks—my first set lasted 12,000 miles." "Position shoulder harnesses so they don't get in the way of people getting in and out of the rear." "Redesign taillights." "Make a space-saver spare standard." "Place vinyl side protective strip higher to ward off nicks." "Make 302 V8 available as in the past."

Respondents often use the space at the bottoms of our questionnaires to write gen-

eral, unsolicited comments. Here's a sampling:

From a Georgia medical student: "I have several friends who own Cadillacs. They all tell me the Cougar's ride is just as good and the interior is better."

"Never have my wife nor I been so enthusiastic about a car."—New Jersey marketer.

"I don't want a compact car, gas crisis or not. The Cougar is the car I want, even if others give better mileage. I want the comfort and safety of a heavy automobile."—Virginia carpet inspector.

"The one fault I find is the 12-month, 12,000-mile warranty. I drive only 5000 miles a year, so you see I am not getting the full advantage of the guarantee. Why punish me for driving less than the average?"—Jersey retiree.

"It disturbs me to read about Japanese engineers improving the efficiency of American cars by 30-40 percent. I certainly hope that the American energy problem is not procrastination for the sake of extending or justifying a research job. What we need is a few more research companies looking for the 'how.'"—Illinois waterman.

And a Michigan baker scrawled across his questionnaire: "I think it's going to be the best car I'll ever own." ★★★

Summary of 1974 Mercury Cougar Owners Reports*

Total miles driven	1,209,654
Average miles per gallon:	
351-c.i.d. V8: Local driving	11.4
Long trips	14.9
400-c.i.d. V8: Local driving	10.8
Long trips	14.4
460-c.i.d. V8: Local driving	11.1
Long trips	13.7
Engine choices:	
351-c.i.d. V8	64.7%
400-c.i.d. V8	28.8
460-c.i.d. V8	6.5
Why the Cougar?	
Styling	78.2%
Size	15.3
Past experience	12.2
Comfort	8.3
Specific likes:	
Styling	64.7%
Ride	50.0
Handling	44.6
Comfort	39.3
Performance	10.7
Specific dislikes:	
Poor gas mileage	20.0%
Seat-belt interlock	10.2
Insufficient power	7.4
Paint finish	6.0

What changes would you like?	
Better rear-end styling	20.2%
Bigger trunk	12.4
Better gas mileage	10.4
Seat-belt system	8.8
More rear legroom	8.3
Has your attitude toward cars changed since the energy crisis?	
No	70.2%
Yes—more mileage-minded	21.1
Yes—use smaller 2nd car more	7.0
Number of vehicles owned:	
Cougar only	42.6%
Two cars	43.0
Three cars	10.2
Four or more cars	4.3
Other cars owned:	
Chevrolet	24.4%
Ford	22.2
Mercury	10.4
Pontiac	8.9
Mustang	7.4
Lincoln	7.4
Comfort opinion:	
Good to excellent	86.3%
Average to poor	10.3
Workmanship opinion:	
Good to excellent	80.5%

Average to poor	19.5
Dealer service opinion:	
Good to excellent	47.4%
Average to poor	52.6
Had any mechanical trouble?	
No	54.7%
Yes	45.3
Type of trouble:	
Transmission	13.3%
Electrical	9.5
Cold starts	8.5
Speedometer cable	6.7
Gearshifting in winter	6.7
Did you repair it yourself?	
No	96.1%
Yes	3.9
Dealer repairs satisfactory?	
Yes	58.1%
No	41.9
Age distribution of owners:	
15-29 years	31.2%
30-49 years	40.7
50-plus	23.1
Would you buy another Cougar?	
Yes	82.2%
No	17.8

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

Wild new speakers—the methods behind their madness

New drivers that replace the conventional cone, new enclosures for cone speakers and added electronics are transforming the old familiar speaker box.

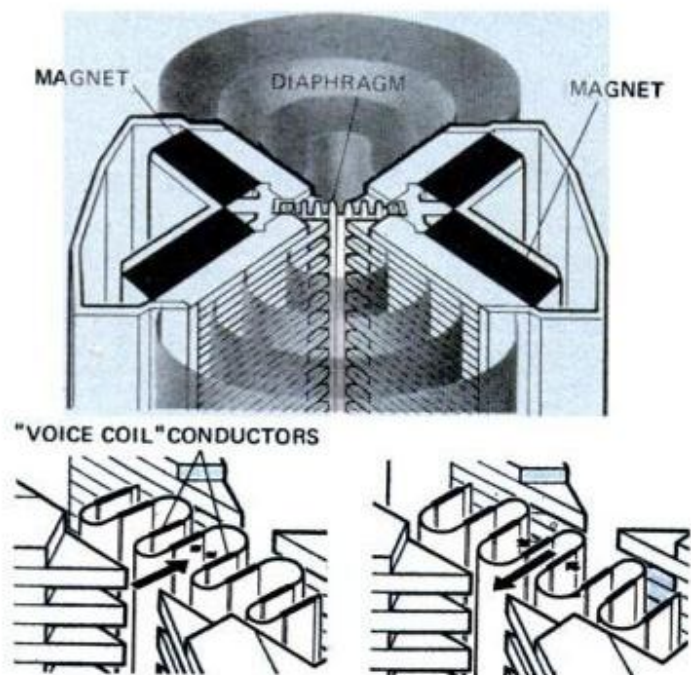
by Len Feldman

New speaker designs are springing up today in as many varieties as flowers in a garden, and as fast and plentiful as weeds. Just which will bloom and which will be weeded out depends less, though, on technical ingenuity than on their sound. Many a technically plausible speaker (staid, conventional ones included) has sounded terrible, while others as ungainly and implausible as bumblebees have proven that they, like the bumblebee, can fly.

But with that warning to listen as well as look, let's survey today's new designs.

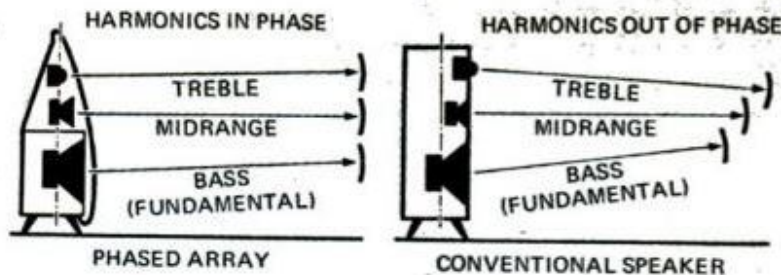
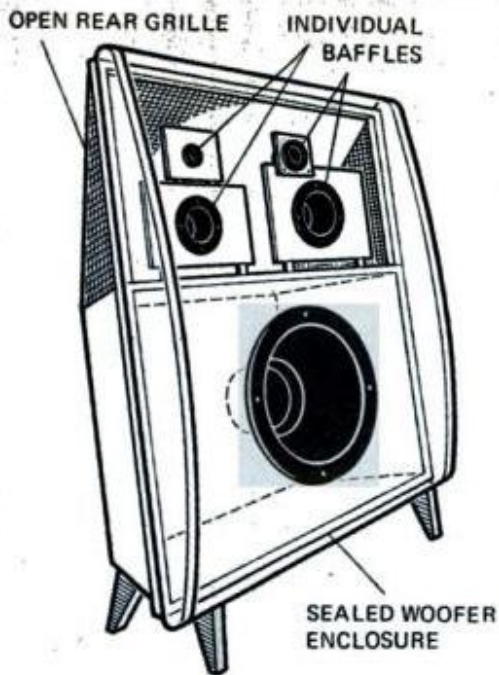
New drivers are the most obvious departure from the usual. Most unconventional is the new ESS Heil (below), which squeezes air out of and into its diaphragm's pleats, rather than pulling and pushing it directly. ESS claims that its light moving mass and the fact that the diaphragm moves only one-fifth as fast as the air it's pushing gives the "air-motion transformer" better response to fast transient signals, plus much higher efficiency.

The Magneplanar, (see page 125) like the Heil, has its "voice coil" printed on its diaphragm in a zigzag pattern, rather than coiled around the usual round form. Its diaphragm isn't pleated like Heil's, but flat, like that of an electrostatic speaker.

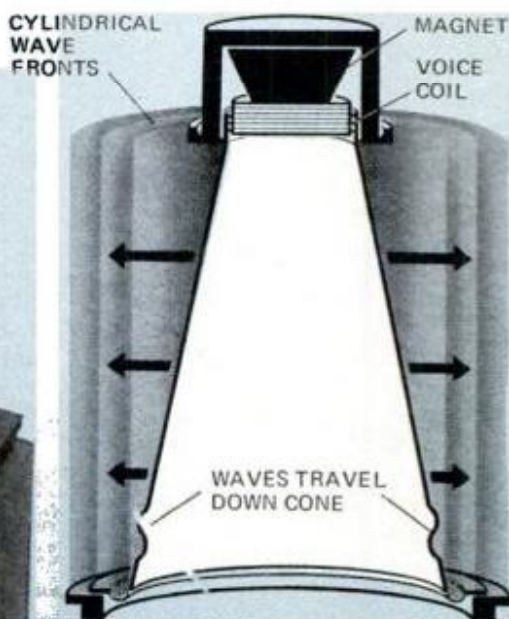


ESS Heil "air-motion transformer" has "voice coil" conductors printed on a pleated diaphragm. Alternate pairs of pleats squeeze together and pull apart as the audio signal passes through the conductors,

inhaling air from one side of the diaphragm while exhaling it from the other. Light diaphragm and limited motion produce good transient response, and horizontal dispersion is nearly 360°.



Dahlquist Phased Array looks like an electrostatic, but actually has conventional drivers, mounted unconventionally. Baffles for each speaker are sized to prevent diffraction (which Dahlquist says makes conventional enclosures radiate spurious signals). Mounting each baffle in different plane compensates for differences in driver depth and response time, assuring no on-axis phase change between the signal's frequencies.



Ohm's "transmission-line" driver looks like a conventional cone driver elongated and turned inside out. Waves travel down cone's sloping sides, radiating sound waves horizontally. Because waves take as long to travel from perimeter of cone's small end out to diameter of its big end as they do to ripple down cone's side, sound radiates in cylindrical 360° waves. Ohm makes this full-range version, while Infinity builds a tweeter version that faces up, with its large end open.

And like an electrostatic's diaphragm, it moves as a single plane, with good transient response due to low mass and short travel.

The conductors are heavier than an electrostatic's thin, overall conductive coating, so the Magneplanar's transient response might not be quite a match for an electrostatic's; but the electrically simpler load imposed by the noninductive conductor layout should be easier for many amplifiers to handle. Like electrostatics, the Magneplanars beam sound fore and aft, so even small differences in the speaker's position in your room may make big differences in what you hear.

The Cerwin-Vega Magnastat tweeter

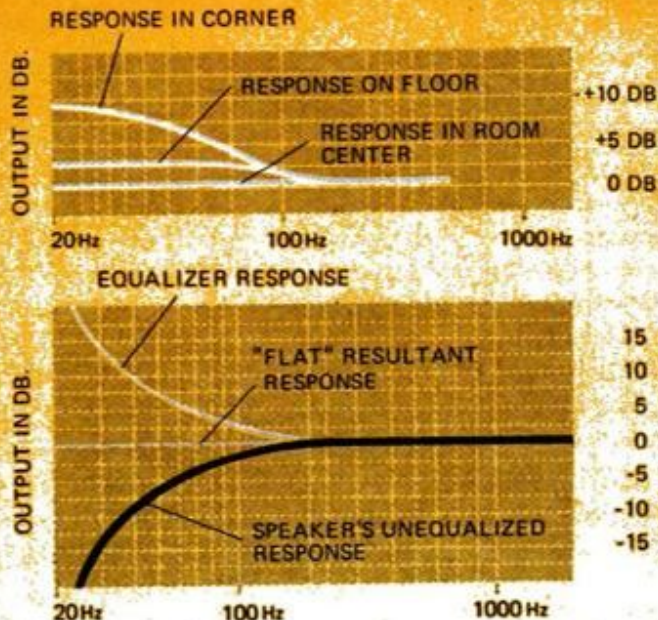
(also on page 125), though it looks a bit like the Heil, may be closer in design to the Magneplanar. So far, few details are available.

Fisher and Polyplanar have two variations on the flat-panel speaker, both light but rigid foam-plastic diaphragms moved by conventional magnets and voice coils. Fisher's version (page 125) has a specially stiffened high-frequency tweeter section driven by a second voice coil, and is available with a choice of patterns or pictures applied to the diaphragm's front surface.

The Ohm speaker (shown above) may be the hardest to understand, at first, largely because it looks so much like the familiar



Electro-Voice "Interface:A" has equalizer (in small box) that adds bass to compensate for speaker's low-end rolloff (lower right curve), also filters out rumble. Other speakers' equalizers also compen-



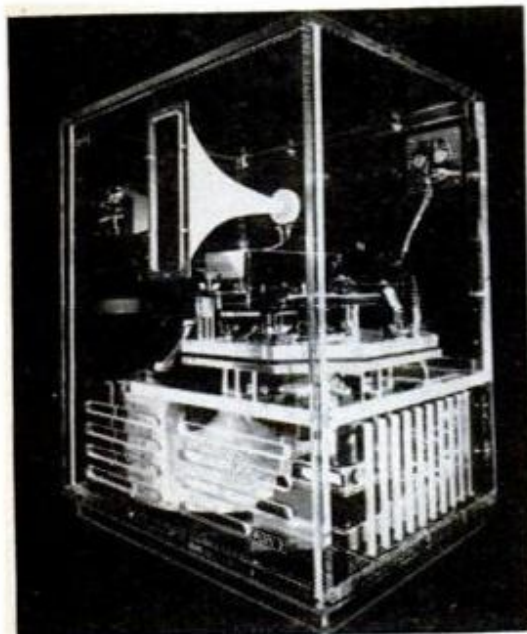
sate for bass response changes due to speaker positioning (upper right curve). Large "drone" woofer has no voice coil, but vibrates with driven woofer to expend response and reduce distortion.



BIC Venturi woofer enclosure has port that superficially resembles bass reflex, but isn't tuned to a specific frequency as reflex ports are, so it can reinforce a broad range of bass frequencies. A built-in circuit also adds accurate loudness compensation at low volume.



Hegeman woofer enclosure is divided into six "pipes," each a different length and resonating at a different frequency. This distributes resonance over a wide band, so bass goes lower and is smoother than usual for such a small (26 x 11 x 8¾-inch) cabinet. Separate but coaxially mounted woofer and tweeter rest in slanted panel at top (this is rear view) for omnidirectionality.

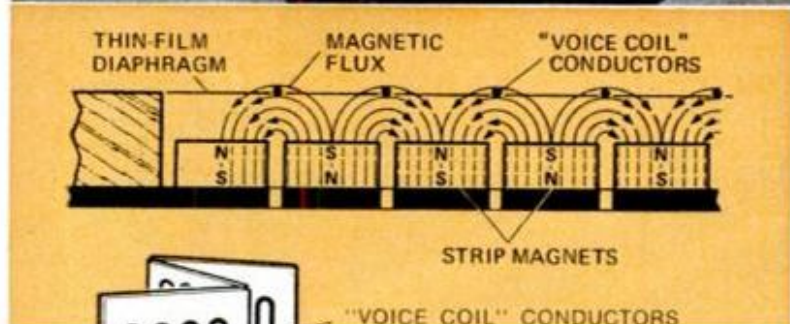


Leslie Plus 2 (shown here in plastic demonstration cabinet) has revolving sound diffuser to "animate" the sound by increasing its dispersion around the room and breaking up bass-absorbing "sounding waves." It's familiar to organists.

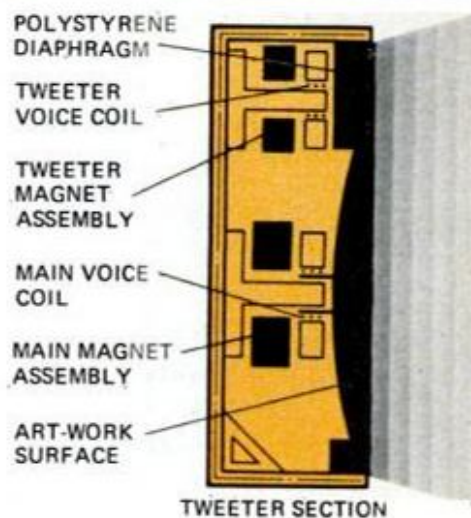
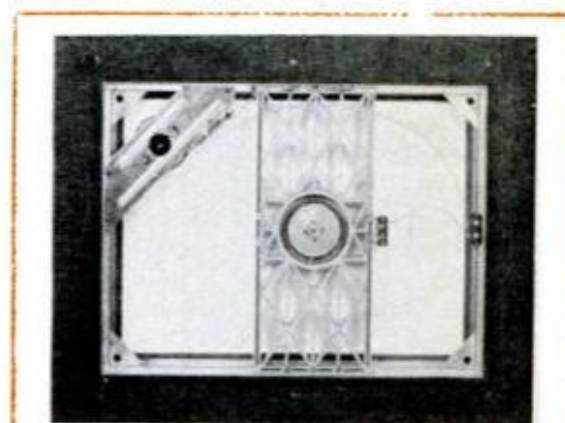


cone speaker. But instead of pumping the air like a piston, its cone agitates the air by flexing its sides gently as sound waves ripple down its slope in rings. Sound waves move faster through the stiff cone than through air, so the ripple can move about two feet down the cone's sloping side in the time it takes the sound wave created by the ripple's beginning to travel the few inches from the cone's narrow neck out to the diameter of its wide throat—where the ripple is by then terminating. Sound therefore radiates 360° in cylindrical waves. At low frequencies, where the wavelength of the ripple would be as long as the cone's sloping side, the cone moves as a unit, radiating sound conven-

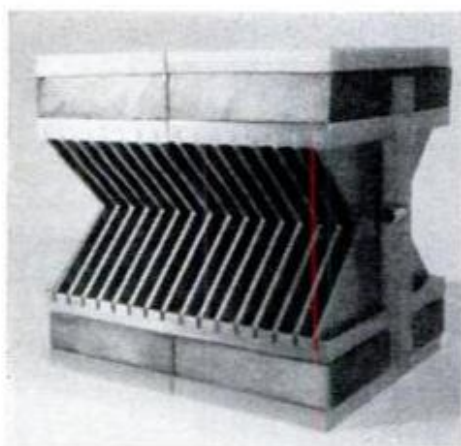
(Please turn to page 161)



Magneplanar speakers look like folding screens, are just one inch thin. "Voice coil" is actually flat zigzag pattern of conductors on flat diaphragm lined up opposite the gaps between strip magnets (see cross-section plan view, above). Version shown is single-ended; "push-pull" version with magnets on both sides of diaphragm for minimum distortion is coming. Sound radiates from both sides of the speaker.



Fisher Sound Panel uses flat plastic diaphragm driven by conventional magnet and voice coil, with second driver for stiffened tweeter section. Thin as a picture frame (2 7/8 inches), it comes with a picture on its front

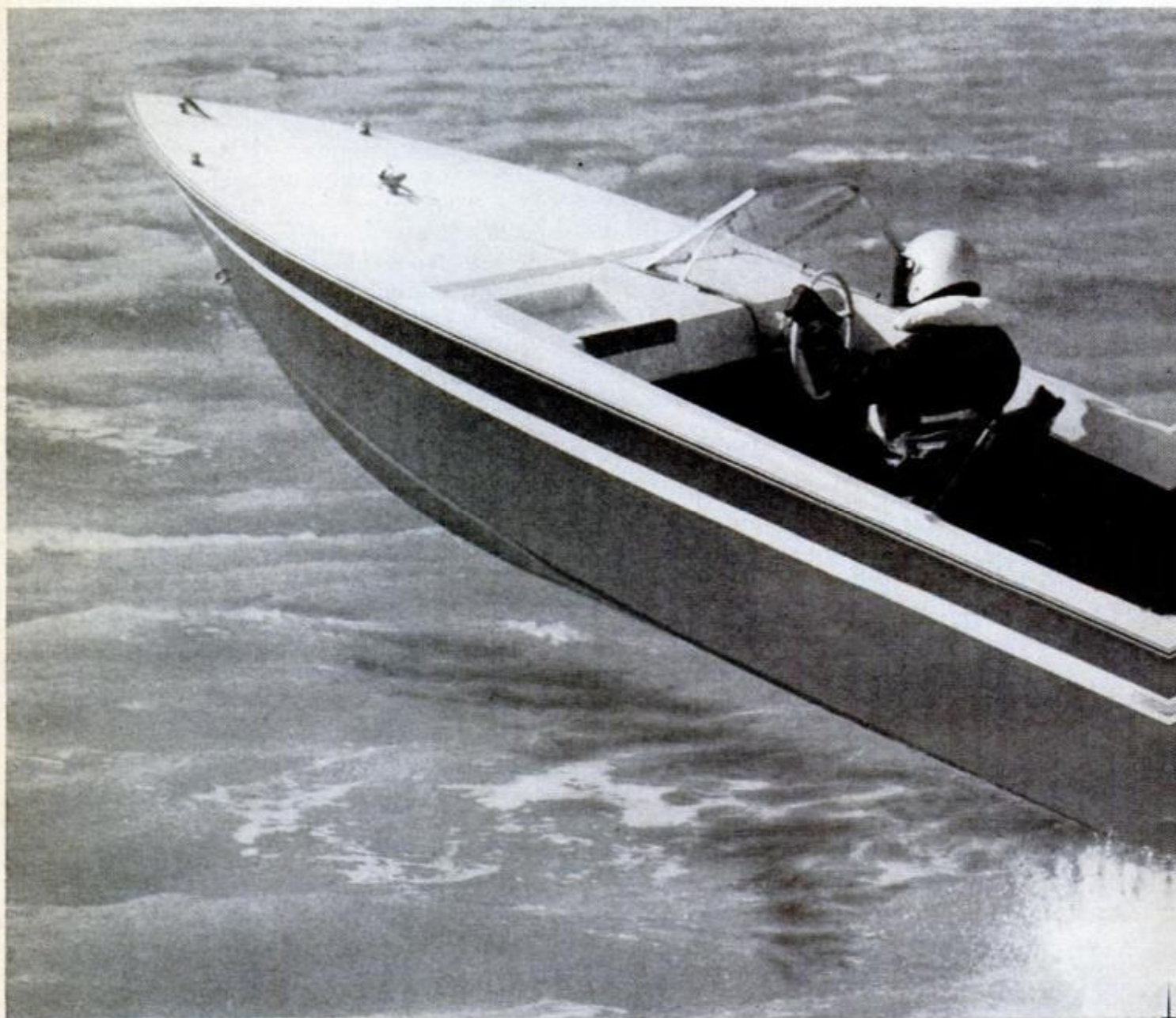


Cerwin-Vega Magnastat is similar in principle to Magneplanar (above), with its voice coil also distributed over a thin diaphragm in a strong magnetic field, but magnet structure is different. Unlike Magneplanar, it's just for middle and high frequencies.



Design Acoustics D-12 is one of several systems angling several conventional drivers in various directions to disperse sound evenly over a broad angle.

Where they bruise 'em to make 'em better



Early morning I drove my car out alone toward the Everglades, according to instructions," the press representative told me. "I turned off behind a line of trees and followed a dirt road until it paralleled a canal. I pulled off, parked in the tall grass and waited. Pretty soon a launch with a driver and a big attack dog idled up the canal and looked me over as they passed. Then they turned, came back, asked me for my name—and finally, picked me up. While that big dog kept an eye on me, the boat driver steered through winding canals and

took me to the company's secret test base.

"But it's my company, too! I'm press relations director for the division. They showed me some exciting new development products, then made me promise I wouldn't write or tell anyone about it."

Right now the hottest boats and motors for 1975 and '76 are running—and have been for over a year—at a set of secret spots you've never seen. More closely guarded than some atomic centers used to be, these are the research bases where high and low performance alike come out of the

Secret marine test centers are field-testing the future right now. Here's an inside look.

by Bill McKeown
BOATING EDITOR

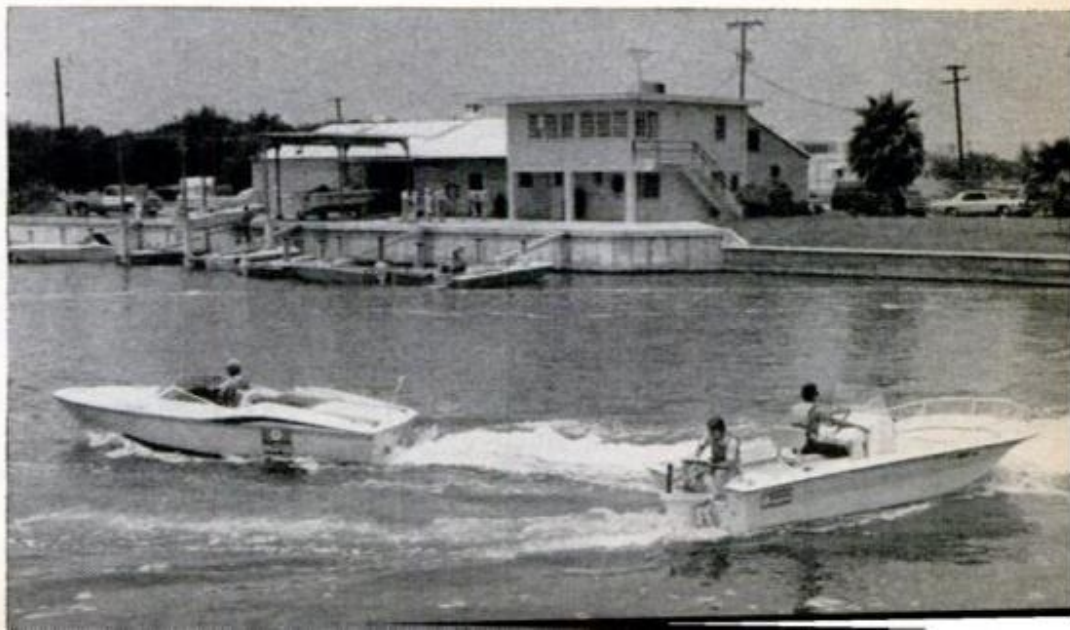
lab and take to the water. In the past, industrial spies with their telephoto lenses have tried boats, planes and skin divers here to check on what's coming up with the competition. Now PM takes you on the first tour behind the hidden high fences, into buildings with no names outside, and off-shore with some of the country's best boatmen.

Though many boat and marine motor companies use waterways near their plants for basic testing, a number of the biggest go to Florida for their full-scale proving grounds. Ten years ago I asked an outboard motor company's head engineer about electrolysis. "That only happens in saltwater, you know," was his brush-off, "so I'm not worried about it." And I'm not surprised he's no longer chief engineer. Florida's destructive tropical waters speed up the electrolytic corrosion that can eat up a metal propeller or lower unit left in saltwater (or polluted fresh water anywhere in the country). Florida's hot weather, in fact, makes hull and motor weaknesses show up fast above and below the waterline. The climate allows non-stop testing all year long (with time out only for "rare" hurricanes).

A typical base will be located inland on a small saltwater channel that leads to open protected bays for speed runs, and a cut out into the Atlantic Ocean or Gulf of Mexico for real shakedown. Ideally, the test center is out in the mangroves, away from the waterfront housing developments that clutter Florida's shorelines. Even some ex-

MerCabo drivers pound through the open seas of the Gulf of Mexico as proving-test track for Mercury marine outboards, stern-drives and inboards. Various hull types are used.

Chrysler's test base on east coast of Florida, uses inland waterway and Atlantic for the performance checks of its outboard, inboard, stern-drive, jet boats, motors, sailcraft.



perienced boatmen find it hard to believe a fast planing hull can throw less wake (and be a safer boat) than a heavy low-sided fishing skiff which chugs along, rolling out a wave that slams boats and docks all along the shore. Retirees who sit all day watching test boats speed by might complain, so companies try to find remote sites where homeowners won't see the boats and competitors can't photograph them.

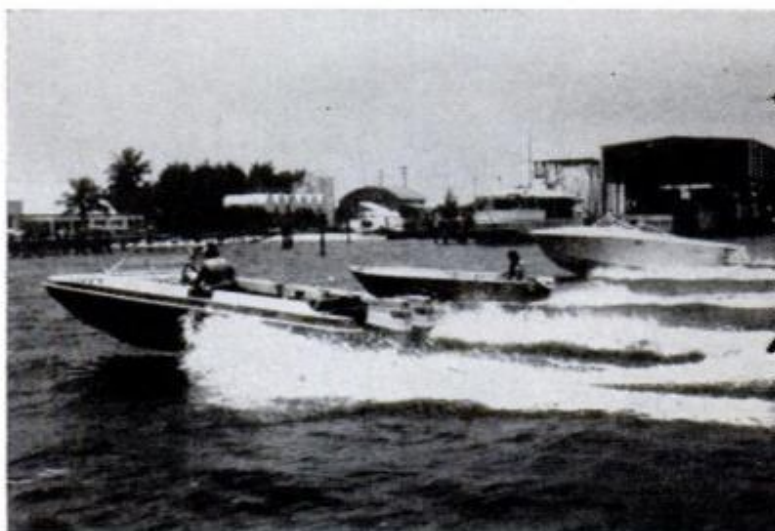
Facilities usually include a boat hoist or ramp, docks to hang samples under water for immersion testing, inside storage with room for maintenance and repair work plus, frequently, a complete machine shop that can fabricate prototype parts. An office stores stacks of records showing just what went right or wrong, and when and where, during every test. Around the property is a high wire fence with sometimes only the initials of the company on a small sign at the gate—just enough for delivery trucks to know where to bring the air-freight loads of products sent down from Illinois or Wisconsin for tests that may tear them up.

Each test center runs checks on its own products and those of the competition as well. There have also been small independent product-test operations, but some have ended up giving a "certificate of excellence" or "approval" to any manufacturer who pays their fee. At the big centers, however, bad ideas are fixed or retired—really good ones go into production.

One of the most impressive operations is MerCabo, the chief test facility for Mercury Outboards and MerCruiser stern drives, in-board engines and accessories. This division of Brunswick Corp. also tests products at its plants in Fond du Lac and Oshkosh, Wis., and at freshwater Lake X in midland Florida. "But there were months when I flew up and down the coastline looking for a perfect spot," MerCabo director Gene Wagner recalls, "before we settled on this location near Fort Myers on the Gulf."

Built from scratch as the latest in boat test centers, it has vertical storage racks and sheds that usually handle 50 boats at a time. Machine shops, elaborate photo studios and lab, and even an on-base motel for visiting engineers makes MerCabo a model operation. In the past, Mercury test drivers and engineers advised some boat builders on ways to strengthen and upgrade their craft—the deep-V hull is one development in which they had a major hand. Wagner's six drivers and engineering staff are now too

busy, but still pass along confidential word to any builder whose hull tries to trip in turns or shows other unfriendly traits. New model runabouts from all over the country arrive at MerCabo for speed and powering checks. Bulletins giving their optimum performance figures, as determined by MerCabo tests, then go out to Merc dealers across North America and abroad.



Evinrude-powered craft speed past Outboard Marine's Atlantic Coast test center. Johnsons and OMC stern drives are also tested at that and Gulf Coast base.

A breakneck ocean marathon driver in his day, Wagner is proud of a no-accident record for MerCabo during its three years of operation, and the friendly relations his drivers have with local boatmen. The fleet of yellow test craft have a reputation as unofficial safety patrol of the area, ready to help any boat in trouble.

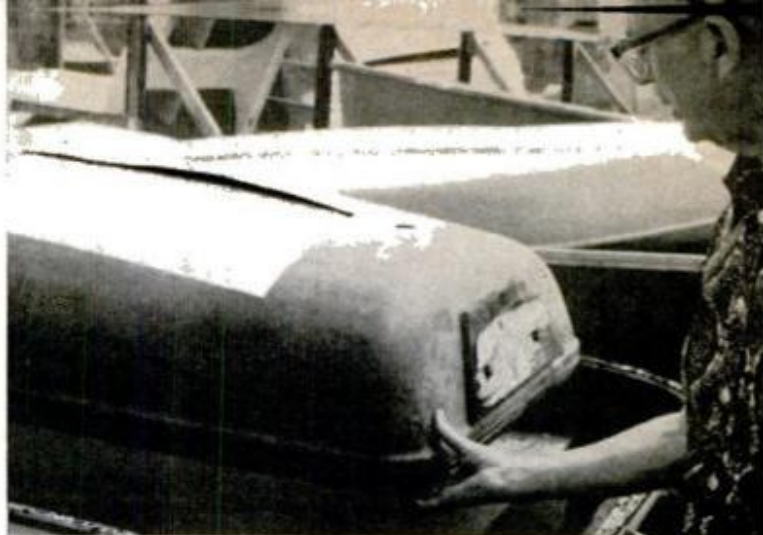
Forty miles south along the Gulf as the seagull flies (and equally hard to find until you're right there), Sears, Roebuck has a little-known base that tests a vast amount of equipment. Fields of racks inside the gate expose over 11,600 samples of paints, building materials, and outdoor lawn, garden, farm and sports products to salty tropic atmosphere. Instruments inside a separate laboratory building record temperature, precipitation, humidity and even the caloric output of the sun on a chart that graphs the effect of every passing cloud.

Field testing here backs up the development work of 200 research and development technicians at Sears' headquarters laboratories in Chicago. Florida test head Warren Tingley has seven engineers, including naval architect Jack Riggelman, in his staff of 21. Both prototypes and production boats and motors are continually tested offshore and

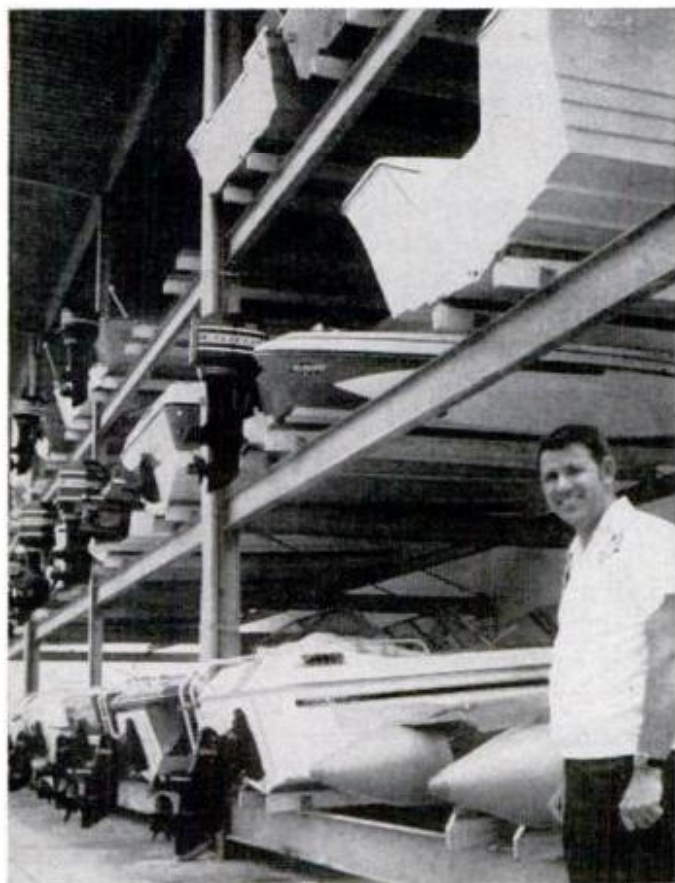
on. The Sears staff recalls a television commercial for a Gamefisher boat model that had already been filmed in color when test engineers decided a different deck color would give it longer life. Boat production stopped while the change-over was made and tested. The commercial was scrapped and filming started all over again.

One not-so-secret Sears tester is Ted Williams. When Williams field-checks outdoor gear, Tingley points out, or watches a production line, the same critical eyesight and perfectionism that made him batting champion get turned on the product.

Outboard Marine Corp., maker of Evinrude and Johnson outboard motors, OMC stern drives, chain saws, lawnmowers and other products, maintains seaside test bases on both sides of Florida. We first reached 100 mph in an outboard with coaching from



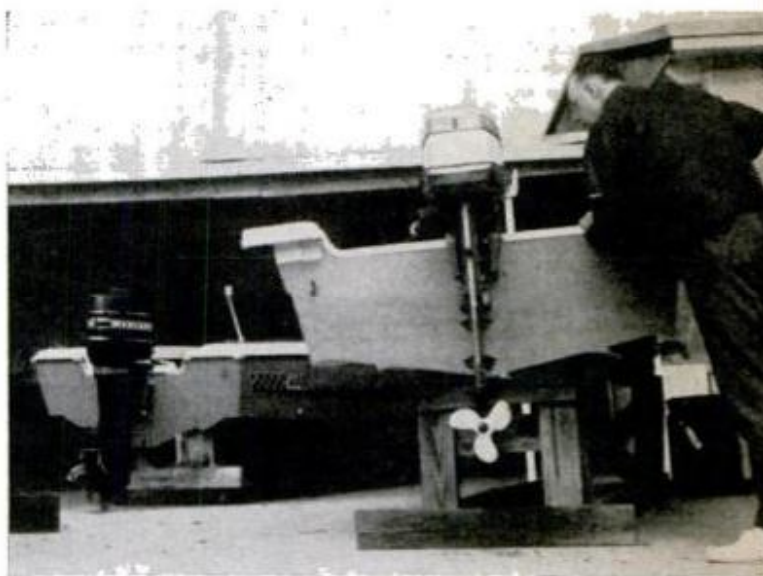
Sears, Roebuck supplements its 200-man test lab in Chicago with extensive Florida field tests supervised by engineer Warren Tingley, shown checking plastics.



Stacks of boats, usually 50 at a time, undergo performance checks at Mercury Marine's MerCabo Gulf test center supervised by former racer Gene Wagner.

high-performance chief Jack Leek off the East Coast base, and once tested early OMC jet drives across the shoals near the test center on the West. Extensive exposure, submersion and performance checks are conducted at both sites.

Chrysler Marine has both power and sailboats in its line, like Sears, plus a wide



MFG runabout models are given 200 to 400 hours of bay and open ocean running test by Marine Tech based on Gulf of Mexico. Performance data goes north to plant.

power range of outboards, inboards, jets and stern drives. All receive initial testing where they're produced, followed by final shakedown endurance check at the Chrysler base near Fort Pierce.

Chris-Craft maintains an on-the-water test center near its Pompano Beach headquarters, and recently MFG Boats of Union City, Pa., arranged with Stu South and Ted Koleta at Marine Tech, near Fort Myers on the Gulf, to provide 200 to 400 hours of running time on every model, with continuous progress reports back to the plant.

But how would you prove out an ocean-going Ferrari? Don Aronow builds his winning Cigarettes in North Miami Beach and then personally checks out each by heading across Biscayne Bay, through Bakers Haulover, and full-bore into the cresting seas of the Gulf Stream. His ultimate test—take it to sea yourself. ★ ★ ★

Your summer dents: How to get them out

If your garage isn't heated, now's the time to use those body fillers that cure best in warm weather.

by Mort Schultz

George Gudat is a professional who doesn't mind revealing trade secrets about his craft, which is auto-body repair.

"Car owners who have a mind to can repair dents and rotted areas themselves," he says.

When you consider that a professional charges as much as \$25 for repairing the minor kind of dent shown in the photo above, this is good news.

I recently spent several hours with George at the auto-body repair facility of Greenbrook American in Greenbrook, N.J., where he is body shop manager. The first thing that impressed me was that tools and materials you need to repair your car's body are readily available.

Consider the tool needed to straighten dents. It's called a slide hammer, and you can buy it at most auto parts or auto body supply stores. Cost is around \$10.

Begin repairing a dent by punching holes in it an inch apart. Use an awl. Screw the slide hammer into a hole. It has a threaded tip. Slam the sliding arm back against the hammer's handle to straighten the dent. One blow should do. Go on to the next hole. (If the dent is shallow—say a maximum of three inches in diameter and one-quarter-inch deep—it isn't really necessary to pull it out if you don't have a slide hammer.)



1. Punch a hole in the dent for special tool if there's no other way you can get behind it to push it out.

Bare-metal the spot. This can be done easily enough with a grinding disc that's attached to an ordinary electric drill. Grind an area which is three to four inches *beyond* the dent.

You are now ready to mix the repair material, which is plastic body filler and hardener. You can purchase the filler in gallon and quart sizes. A gallon costs about \$8; a quart approximately \$3.

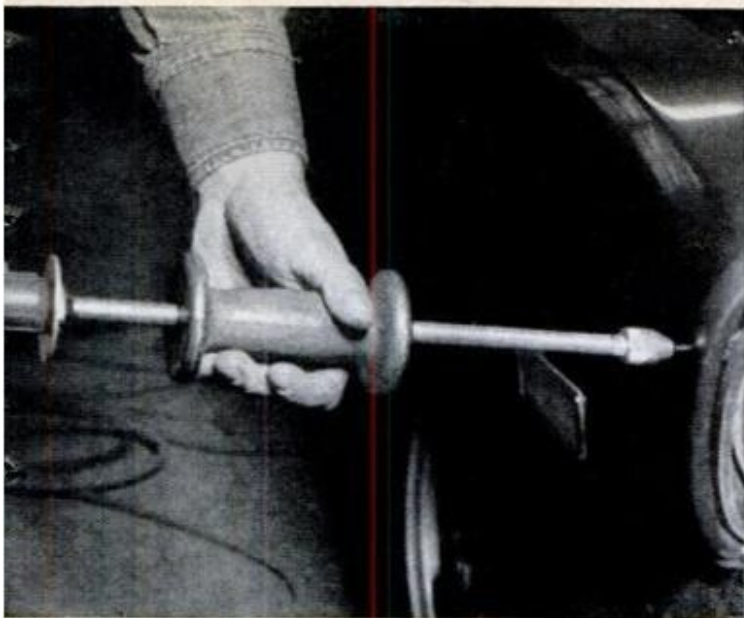
The filler has an indefinite shelf life as long as the lid is kept on tight and it is not mixed with the hardener. The hardener comes in a toothpaste-type tube. Cost is about \$2.

It is essential that the plastic filler and hardener be properly mixed together. Follow instructions on the container. Mixing is made easier by the fact that the filler is white or gray, and the cream hardener is in a color. You are able to see when the two are thoroughly blended.

Don't mix too much. For most dents, a glob of filler no larger than the size of a golf ball and strip of hardener about one-half inch long is sufficient. Mix them together on a clean, flat piece of cardboard or metal.

You have from 5 to 15 minutes working time after the filler and hardener are mixed, depending on the temperature. The hotter the day, the quicker the mix will set.

Avoid making repairs if the car's body is cool (under 60°F.) or damp. The filler will develop pinholes and will not set properly. The ideal working conditions are with the metal dry and temperature at 65°-75° F.



2. The special body-repair tool is known as a slide hammer. It enables you to pull out dent (see text).



3. Grind area around dent down to the bare metal with electric drill; here pro uses compressed air grinder.



4. Always extend repair area several inches around a dent so the final filling and painting can be feathered.



5. Add cream hardener to the plastic filler, and mix them thoroughly. The applicator comes with filler kit.

Use a body-repair-compound plastic applicator to apply body filler. Applicators are available (three to a package, each a different size) for about \$2.

Apply the body filler in light coats until it is built up to a height of an eighth to a quarter inch above the surface. If you have ever spackled gypsum wallboard, use the same technique. Don't lay on globs—mold on one light coat after another.

Keep the filler off paint. It doesn't stick well and could eventually crumble.

Allow the filler to set up, but this doesn't mean that it should be permitted to get solid. You don't want it hard.

The filler is ready for the next repair step when you can put a scratch in it with your

finger nail without having the material come up in a glob. At the ideal working temperature, this takes 15 to 20 minutes.

Using a Surform, "mold" the filler while removing excess. Surform, made by Stanley Tools, is available at hardware stores. It resembles a plane to which the Surform blade is attached. Blades are shaped flat for flat surfaces, half-round for contoured surfaces and rattail for tight curves.

Shave off 80 to 90 percent of the built-up filler, and then let the repair set until it gets very hard. This takes at least 30 minutes.

Now, using a sanding block fitted with a piece of 40-grit sandpaper, sand the area. Follow this with a sanding using 100-grit



6. Plastic filler should be applied one layer at a time, and built up until it is slightly higher than the body.



7. Shaping tool such as a Surform is then used to remove the excess filler before sandpapering the spot.



9. To feather-edge the repair, sand from body paint into the repair area. Don't press down too hard!



10. Apply primer to the repair area. It's a good idea to practice your spraying technique on a tin can first.

sandpaper attached to the sanding block. Sand until the area is relatively smooth.

Avoid sanding the repair material while holding the sandpaper with your hand. You are likely to remove too much material and end up with a shallow spot.

You now need a piece of 220-grit, wet-or-dry sandpaper to feather-edge the paint around the repair area. Keep this paper wet, and sand from the paint edge into the repair area until you have a level surface. You should not feel any difference in the surface when running your hand over it.

If you are working near body trim or lights, mask them and apply a light coat of primer. Primer is available in spray cans

and sells for about \$2. If primer oversprays on to paint, you can wipe it off. You really need not mask off paint around the area until you are ready to spray paint on the repair.

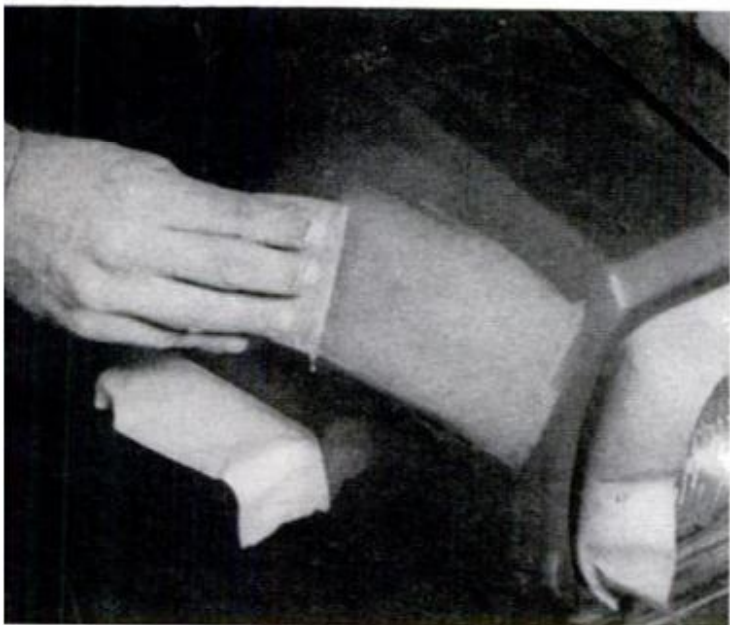
Let the primer dry—about 15 minutes—and apply a light coat of auto-body glazing putty. This material fills sandpaper scratches and other imperfections. Follow application instructions on the container.

Glazing putty comes in tubes for about \$2; in quart cans, about \$3.50 and in gallons, about \$11. It goes on very smoothly.

Allow the work to set and dry for at least an hour. Then, using No. 320 wet-or-dry sandpaper attached to the sanding block,



8. Sand the repaired area until the plastic filler is brought down to the level of the surrounding area.



11. Auto-body glazing compound is a final smoothing step before you apply paint to match color of the car.

lightly sand the entire repair. Follow with a coat of primer. Finally, mask off the area to keep overspray from getting on body paint, and paint the spot. To get the proper color, obtain the paint code from the identification plate attached to the car's firewall or door pillar.

There is usually no problem with ordinary colors, but it may be pretty tough getting an exact match if your car is painted with a metallic paint. Paint used on imported cars is also hard to match. The equipment used at the factory, such as electrostatic paint guns, can't be duplicated by most professional auto-body repairmen, let alone laymen.

If you find it hard to match your paint color with a spray-can product, you can buy a compressed-air supply and paint separately. You can buy paint made by automotive paint manufacturers in quart or gallon size from an auto-body supply house.

The compressed-air kit is an aerosol supply to which is attached a glass or plastic container into which paint is poured. One such kit is called Preval and sells for \$2. (Want some handy tips on how to paint? See *How to Paint With Spray Cans*, page 112, May '74 PM.)

There are three ways to tackle a body rot problem. Two methods won't cost you much, but they are temporary. The third is more costly, but it is permanent. The least expensive and easiest way to do the job is with aluminum tape, which comes in four-inch-wide rolls. Break off pieces of rot and grind the area down to bare metal.

Place the tape over the rot, making sure that it extends at least one inch beyond the damage. Use 100-grit sandpaper to roughen up the tape. Then continue the repair in the way I described above for repairing dents. This method will last about six months. Then, the repaired area will start bubbling out.

A longer-lasting (but temporary) repair can be made with a piece of sheet metal that's the same gauge as the metal of your car (in most cases, 20 or 22-gauge). Be sure the sheet metal extends one inch beyond the rotted area. Grind the damaged spot and attach sheet metal with a Pop-rivet tool that you can buy in hardware stores.

Roughen up the sheet metal with a grinding disc, and proceed with the repair as described above. Pay close attention to applying filler between the metal and car body. Feather the filler into the body so you can't see the contour made by the patch.

Here again you are attaching one piece of metal to another. Eventually condensation and dust will get behind the repair, and it will break down. Figure on getting no more than two years.

The permanent way of fixing body rot is by welding or brazing sheet metal right to the car's body. If you had a body shop do the job from start to finish, the cost might range from \$30 or \$40. But you can reduce it.

Have a professional do only the welding, which will cost around \$10 or \$20. Then, using the procedures outlined above, you finish the job. ★★ ★

Swingline's new Whammer



**A replacement for a hammer?
For certain jobs, the
author says yes.**

by Harry Wicks
WORKSHOP EDITOR

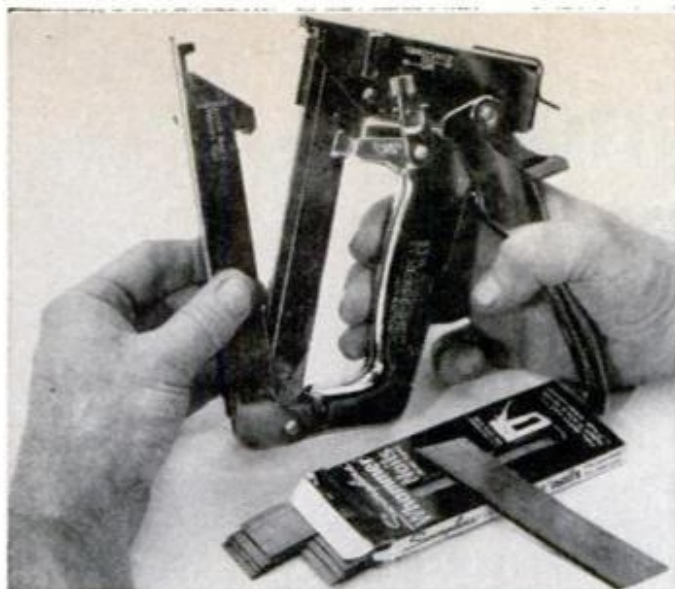
I approached this shop test with a degree of skepticism. Since my 16-oz. claw hammer seems almost to be an extension of my arm on any shop or home-improvement project, I wondered how a "stapler" could possibly replace "old faithful." After a couple of workshop sessions and a day of paneling, I learned the Whammer could, indeed, outperform the hammer on certain tasks.

Basically, the Whammer operates on the lever principle. When the handle is operated, an internal ram is lifted and then driven forward by a ram spring. To use the gun,

you simply position the tool, place the heel of your free hand against the Power Dot on the head, and squeeze off a nail. This two-handed technique gives comfortable position, while holding the gun's shoe flat and firm against the work. After each nail is driven, the handle is then allowed to raise itself and the gun is ready for the next drive.

For openers, I test-drove a dozen or so nails into the hardboard paneling in my workshop. The nails went in easily and were well set (countersunk). This feature I liked because it saves time. Rather than having to rap each nail with nailset and hammer as you go, you just move on to the next nail position. In addition to saving time, the gun avoids the "union marks"—made by a nailset that slipped or an errant hammer—which frequently identify do-it-yourself workmanship.

Loading the tool is easier than an ordi-



Loading is easy. Latch is pulled back (top) to open bottom and strip of 100 nails is slipped into gun (above). Bottom is then closed and gun is ready for use. Nails are sold in packages of 500 and 1000.

nary staple gun because, unlike staples, the Whammer nails are held together by an almost invisible glue. You simply open the gun, slide in a strip of 100 nails, close the gun and fire away.

Though specifically designed for use with wood paneling, the nail gun has, I found, other good uses. It's extra-handy when assembling small bench projects which call for the use of brads. Also it is useful on those projects in which the glue and joints will

(Please turn to page 162)

SPECIFICATIONS—Whammer 2001 Nail Gun

Operation	Used according to instructions, it drives and sets nails with one stroke.
Nails	Brad-type Whammer 2001 nails only. Available in 1-1/32-in. length, 18-gauge galvanized, in four wood-tone colors.
Price	Gun (with 1000 nails), \$19.95; nails per package of 1000, \$1.95.
Manufacturer	Swingline, Div. of Swingline, Inc., 32-00 Skillman Ave, Long Island City, N.Y. 11101.



Casing can be applied using gun. Notice left-hand position to keep gun's shoe flat against the work surface.



Whammer shines on paneling job. Scratches are avoided by lifting gun, instead of sliding on panel face.



Tool is handy at workbench, too. Author used it on such small projects as assembling tissue box above.

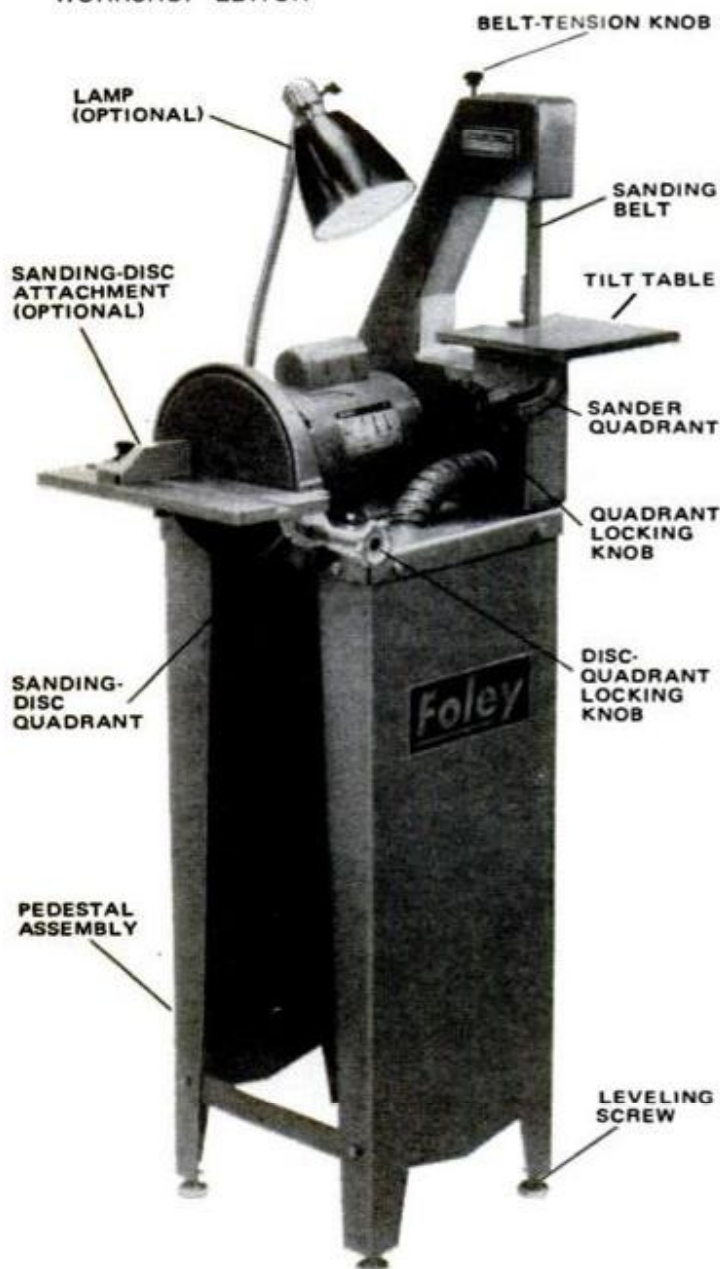


Test comparing countersunk Whammer nail and 4d finishing nail set with nailset. Former is less obvious.

This sander/grinder lets you sharpen almost anything

Foley's newest grinder has pulleys covered for greater safety—direct drive eliminates the drive belts.

by Harry Wicks
WORKSHOP EDITOR



If you don't yet own a sander/grinder, you're in for a treat when you finally do add this versatile piece of equipment to your complement of shop tools. With one you can sand fine work accurately, and sharpen just about every cutting edge you have around your home and shop.

The tool shown is the latest from Foley Manufacturing Co., of Minneapolis. The belt-sander pulleys are enclosed in a sturdy, die-cast aluminum housing for optimum safety, and the tool operates with direct drive from the motor shaft to eliminate possible belt-drive dangers. You can purchase just the sander/grinder and mount it on your workbench, or add such optional extras as floor stand, double-extended shaft motor and disc sander, or light.

Model 311 arrives from the manufacturer practically fully assembled—you simply put together the major components.

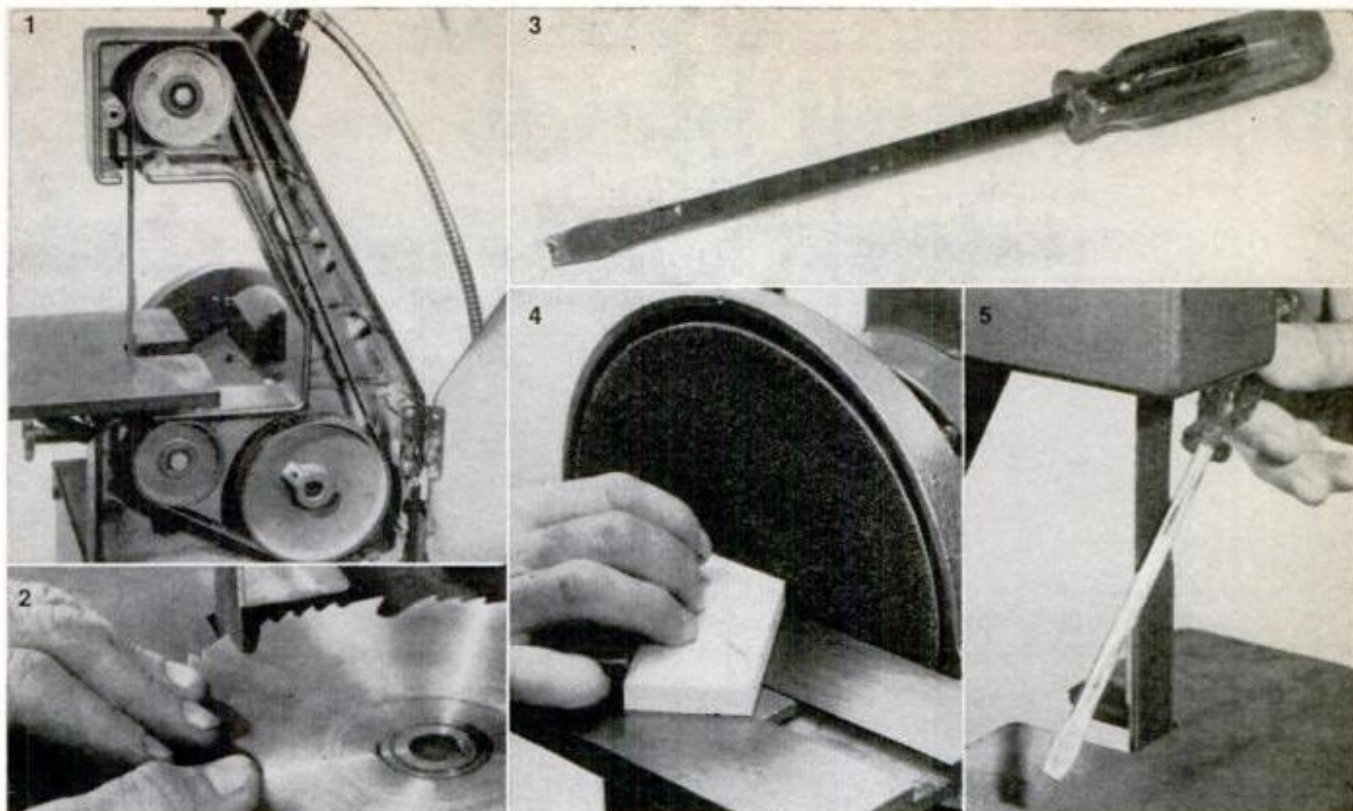
The first task on my test agenda was to do some grinding using the 1x42-in. sanding belt. I quickly restored the edges on a number of items including circular-saw blades, chisels, plane iron and scissors. The tool sharpens efficiently, runs quietly, and the belt tracks without a hitch.

Next, I used the 8-in. sanding-disc attachment to smooth some rough stock. Again, the tool performed beautifully. Then, after squaring the disc table with the disc and adjusting the quadrant pointer to zero,

(Please turn to page 162)

SPECIFICATIONS—Model 311 Sander/Grinder

Motor: ½ hp, 3450 rpm, 115 v.
Worktable height (optional equipment): 40 in.
Overall height: 51 in.
Worktable size: 7x8 in.
Abrasive-belt size 1x42 in.
Pulley bearings: ball
Net weight: 71 lbs. Shipping weight: 76 lbs.
Prices: Basic sander/grinder, \$161.50. Machine with a double extended-shaft: motor and disc sander is \$213.
F.o.b. manufacturer: Foley Manufacturing Co., 3300 Fifth St., Minneapolis, Minn. 55418.



It's a workhorse, says the author. The door is swung open (photo 1) to expose the machine's innards. Belt revolves around a single roller at the top and two at the bottom. Sawdust is drawn into a vacuum through

a small hole below the left roller at the bottom. Typical shop chores: Sharpening circular saw blade (2); using optional sanding disc on miter cut (4). Old beat-up screwdriver (3) is being renewed by belt sander (5).

Mounted on its floor stand, the grinder is particularly comfortable to work at, the author found. Most of the time, he sat on a stool to operate it.



Four projects you'll find fun and handy

One's a game of action that appeals to all age groups; three are conversation-piece accessories for your home.

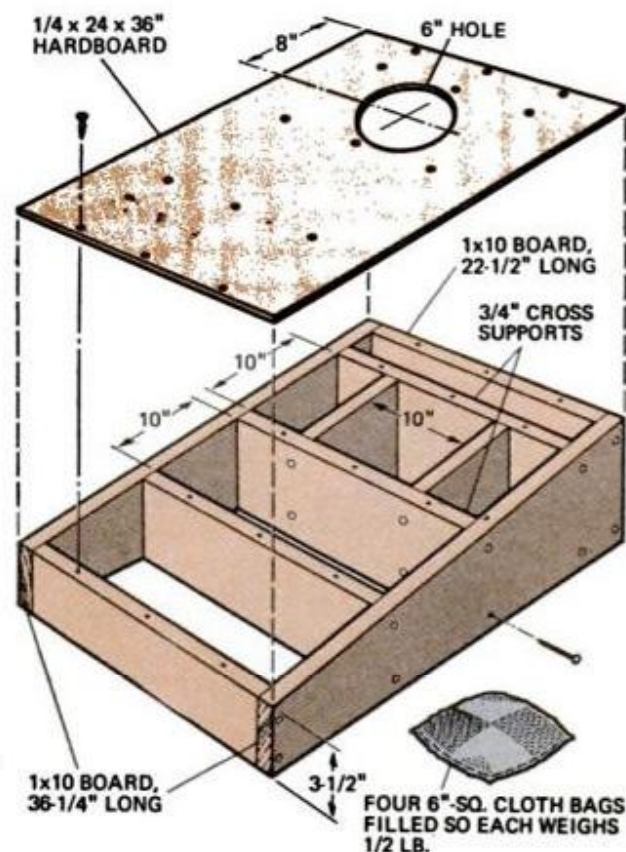
Opponents stand at each side of platform and take turns throwing two bean bags in succession at the bull's-eye. Platforms are spaced about 10 ft. apart for youngsters.

Bean-bag bull's-eye

Played like horseshoes except that you use bean-bags and try to make a "ringer" by tossing a bag in a hole, bull's-eye is a game that can be played rain or shine, indoors and out, by youngsters and oldsters alike.

A hole-in-one scores three points; a bag that lands and stays on top of the platform, one point. If an opponent scores two bull's-eyes in succession, his score of six points wipes out an earlier four-point score of his opponent and gives him a leading score of two. Each player throws two bags in succession, and 21 points wins the game. The platforms are placed about 30 ft. apart for adults, 10 ft. for kids.

A variation in scoring when the game is played by adults involves the use of eight bean-bags, four per player. If all four bags are tossed for bull's-eyes, that player automatically wins the game. The drawing shows how each platform is made, with pine for the base and hard-board for the top.—Carolyn Farrell

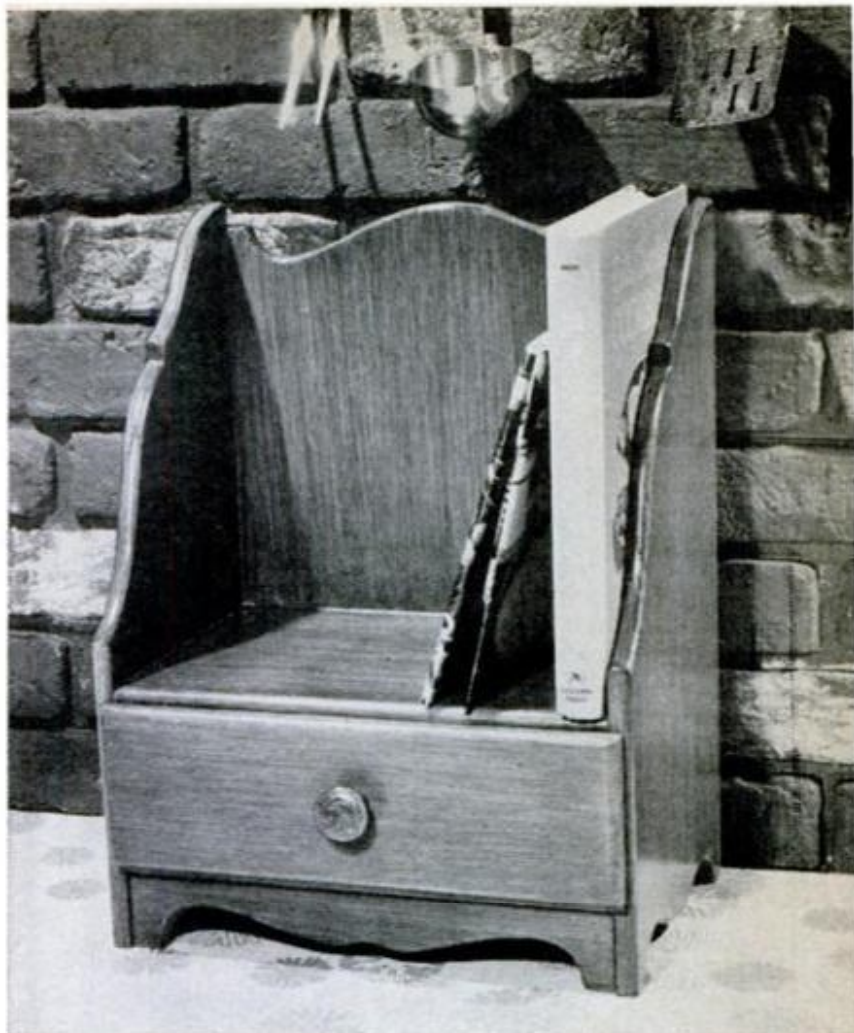


Kitchen cookbook caddy

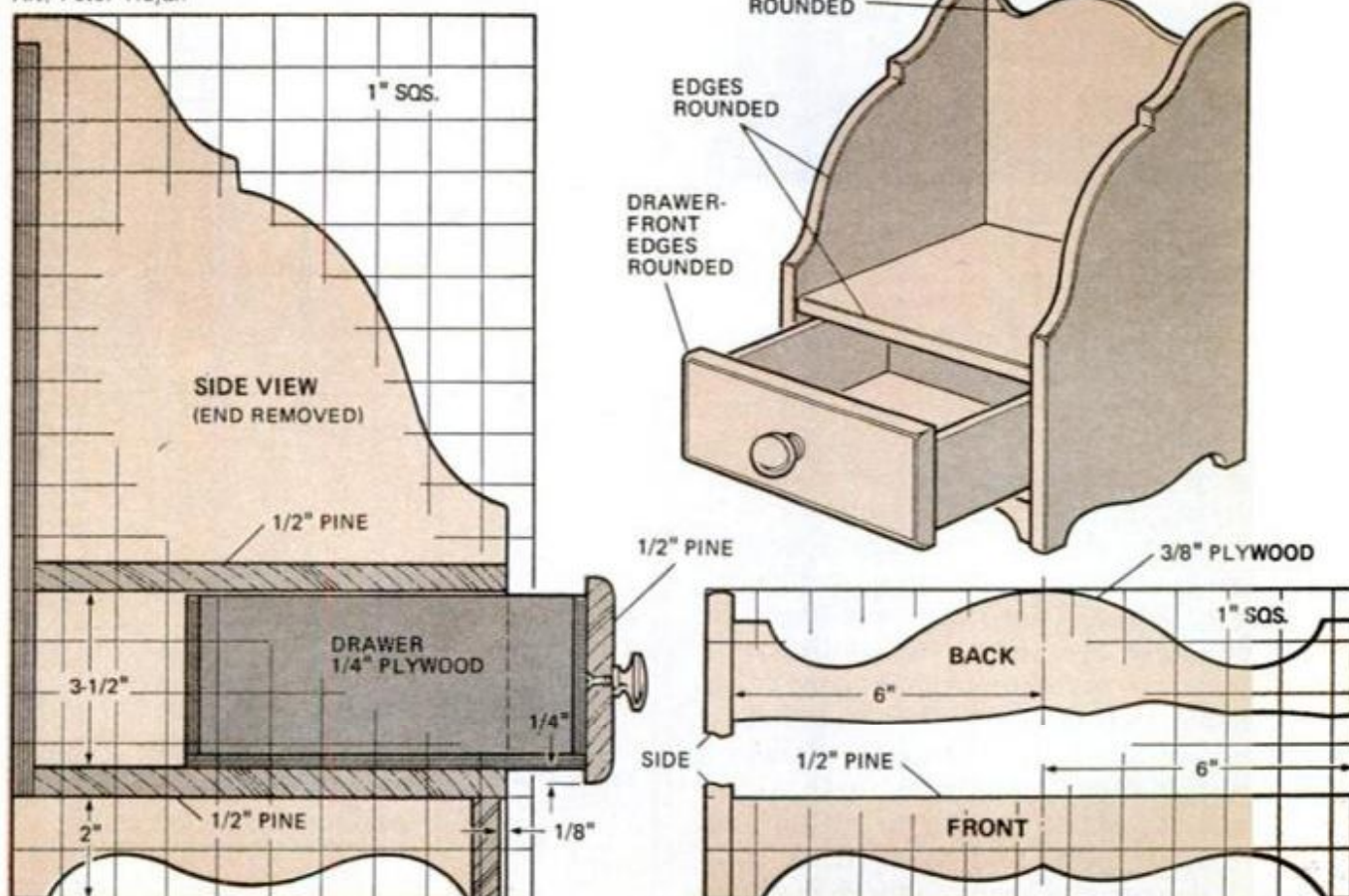
This handsome shelf will add a touch of interest to your kitchen and keep your wife's cookbooks handy at the same time. Its drawer can store recipes galore.

There are no fancy joints to bother with—nothing but butt joints, glued and nailed, are used. The back and the drawer interior are cut from plywood, but 1/2-in. solid pine is used for the rest. Set your rip fence to make the 12-in. cuts and run all at one time to insure a perfect fit for all inside pieces. Saw the curves, then use your router with a 1/4-round bit to round the edges where indicated. Sand all surfaces before assembly.

Assemble the parts with glue and 1 1/2-in. finishing nails in this order: First attach the base apron to the drawer shelf. Then attach the back to both shelves and add the sides. Set the nailheads and fill the holes. Make the plywood drawer as a box with four sides and a bottom, then add the pine false front and the knob. For an interesting finish, try a wood graining or antiquing kit.—*Rosario Capotosto*



Art: Peter Trojan

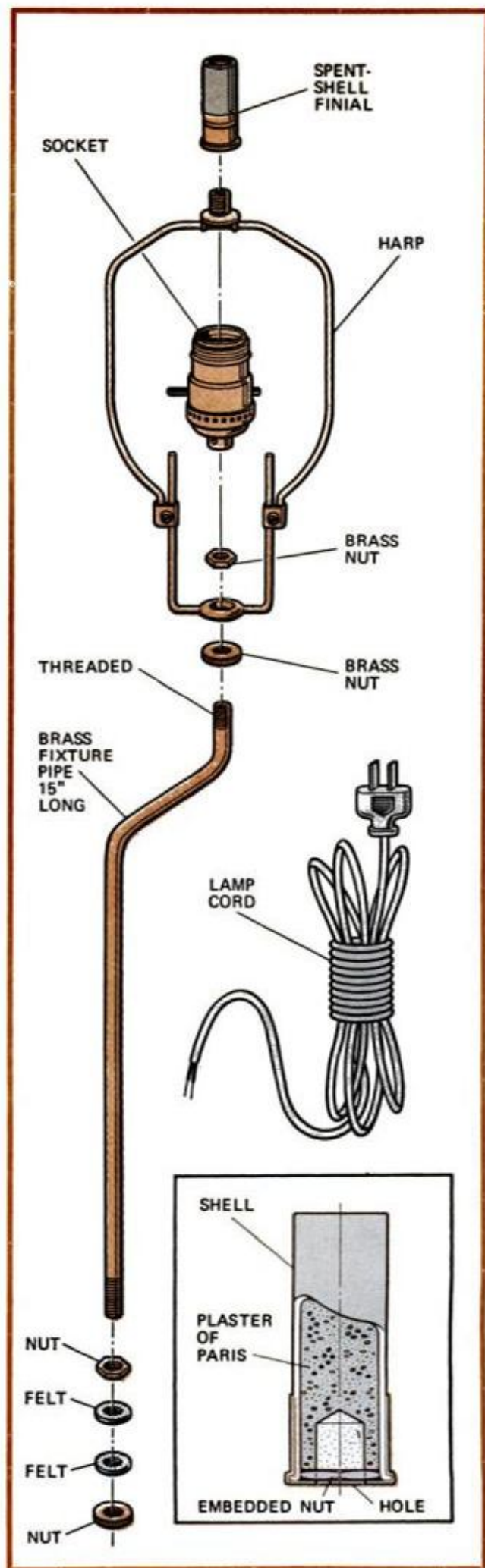


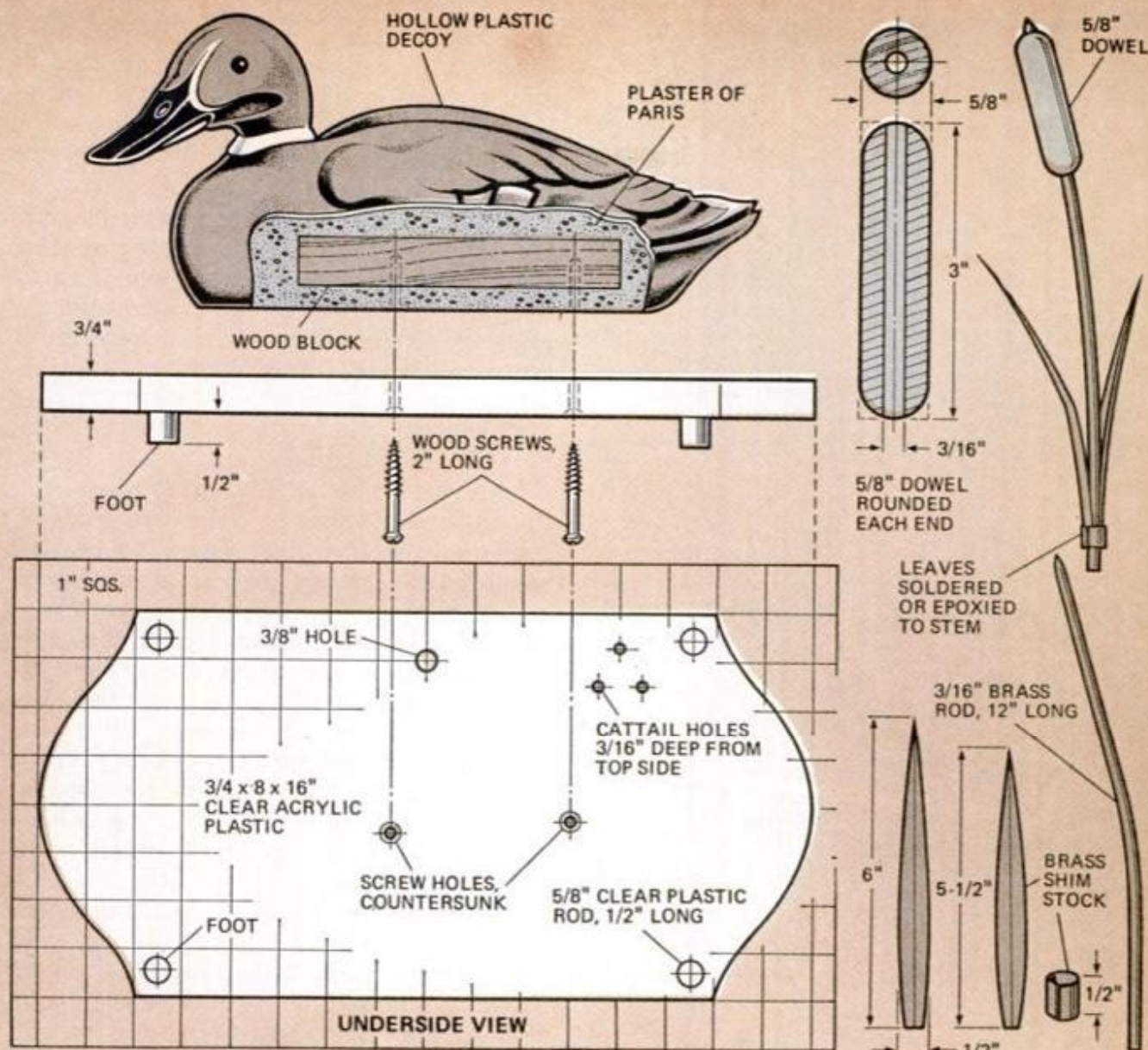


Duck-decoy lamp

A table lamp decorated with a duck decoy drifting on a plastic pond among willowy cattails is a smart accessory for the den of any hunting enthusiast.

The pond is a piece of $\frac{3}{4}$ -in. clear acrylic sheet plastic resting on four clear-plastic buttons. It can be the shape shown (or a design of your own), cut with a bandsaw or jigsaw, sanded and polished. There are two ways to polish sawed edges of plastic: by sanding and then buffing with a muslin wheel charged with white diamond rouge, or by "melting." The latter is done by carefully playing the flame of a propane torch slowly back and forth along the edge until the plastic begins to soften and take on a glassy look. You must work in a well-ventilated room and keep the torch moving.





The decoy shown is one of the newer hollow-plastic ones. The bottom is cut off flat with an ordinary hacksaw blade. Then the decoy is filled with plaster of paris in which a wood block is embedded. The block is used to attach the decoy to the base as shown above.

The cattails consist of three brass rods pointed at one end, and three wood dowels drilled lengthwise for a press fit over the rods and rounded at the ends. Slender leaves cut from thin shim brass are soldered or epoxied to the brass-rod stems. Bands of the same stock are wrapped around the ends to finish them and cover the solder. Cattails are inserted in blind holes drilled in the base from the top.

A spent shotgun shell is used for the shade finial (make certain it's spent). First a hole is drilled in the metal end, then a nut is placed in the bottom of the shell over the hole. A short dowel is inserted in the hole and through the nut, and the empty shell is filled with plaster of paris. When the filler is almost hard, the dowel is removed, forming a cavity for the threaded stud on the harp.

While the shade harp, socket, lamp cord and plug are available at most hardware stores, you may have to go to an electrical store for the 15-in. length of $\frac{1}{8}$ -in. brass fixture pipe. In making offset bends, do not crimp the pipe and make it difficult to pass the lamp cord through.—Paul T. Hennig

Water barometer

Barometric pressure can be measured by a variety of devices. A most ingenious—and simple—one to make is the water barometer. It is surprisingly accurate in predicting stormy weather by the rise of water level in its spout.

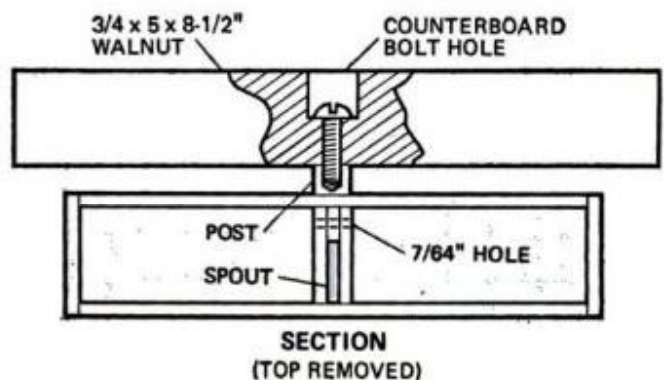
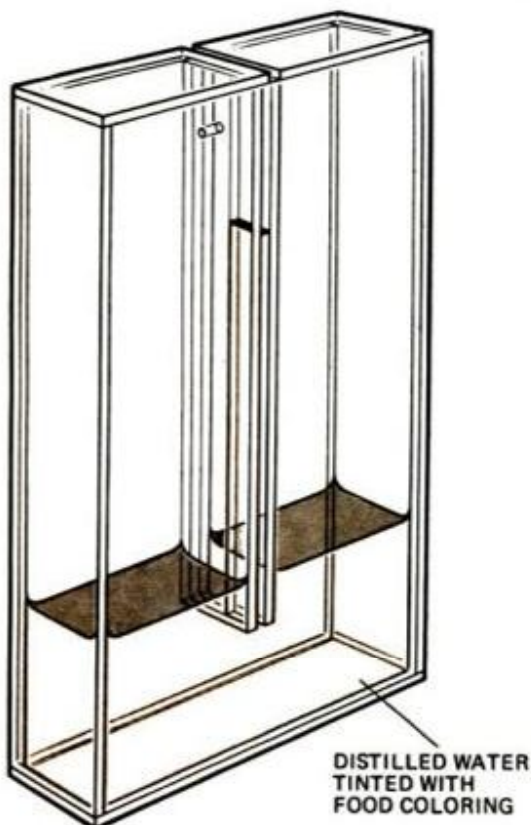
In this barometer, a high water level in the spout corresponds to a low-pressure system and vice versa. Being sensitive to temperature changes and atmospheric pressure, it should be placed where room temperature is fairly constant—not in direct sunlight.

Except for the walnut mounting panel, it is made almost entirely of $\frac{1}{8}$ -in. sheet acrylic plastic. The three pieces for the internal U-shaped spout are cut and cemented together first. Here it's best to use a fourth (scrap) piece as a temporary spacer between the two sides to keep them parallel. Hold the four pieces together with one hand and apply the cement to the back edges of the three with the other. See that the cement does not reach the temporary spacer and prevent it from being removed when cement is dry. A $\frac{7}{64}$ -in. hole must be made in the glued-up assembly to insure equal pressure in both chambers of the barometer.

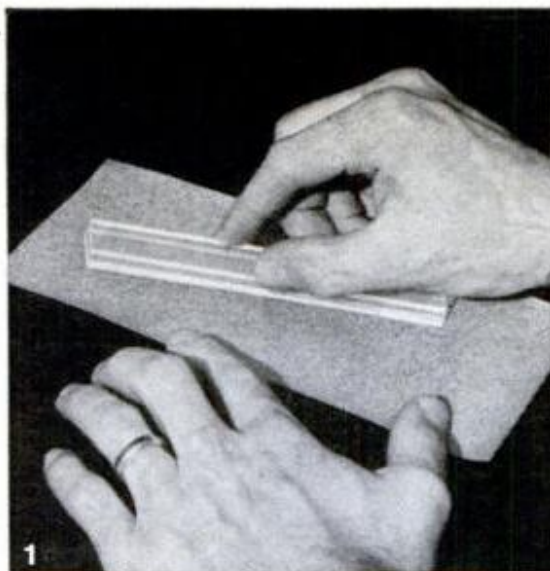
The spout is centered and cemented, first to the $4 \times 7\frac{1}{4}$ -in. back member, then to the front, $\frac{1}{8}$ -in. from the top. Tabs of masking tape will help you hold the spout in position. See that there are no air leaks along cemented edges. If a leak is found, a drop or two of epoxy glue will seal it.

All other pieces, except the mounting post, are 1 in. wide, and to insure uniformity and a perfect fit, it's best to cut the five parts from a single inch-wide strip of plastic. Sanding and buffing, necessary only where edges are exposed, should be done before the parts are ce-

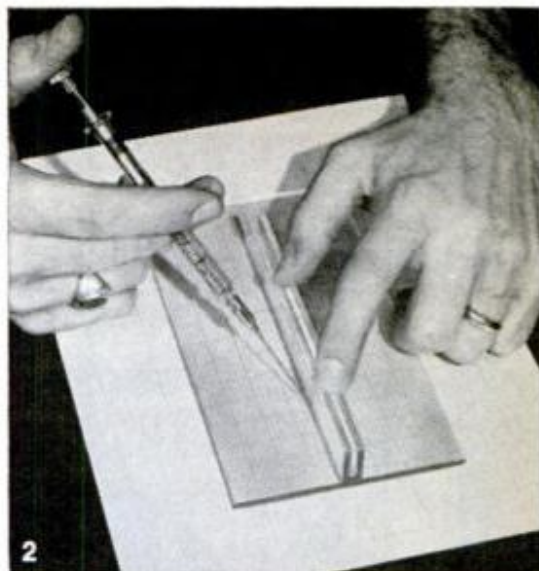
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1. Sanding and polishing of edges is required only when they are exposed. Start with medium paper, work up to very fine grade.



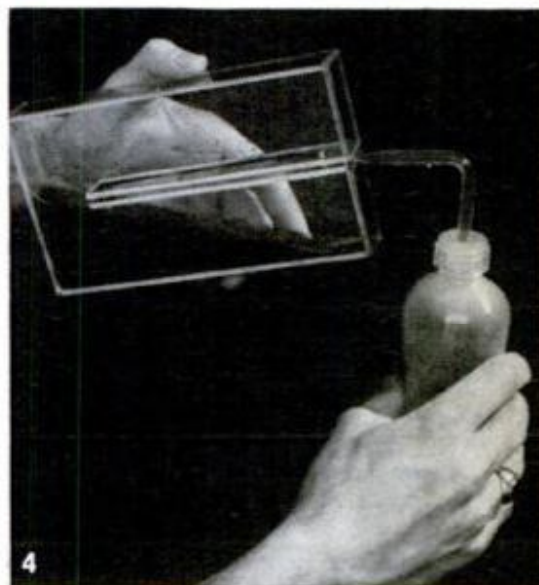
2. Special cement applicator, or syringe, is used to "weld" parts together by capillary action. Avoid getting cement on surfaces.



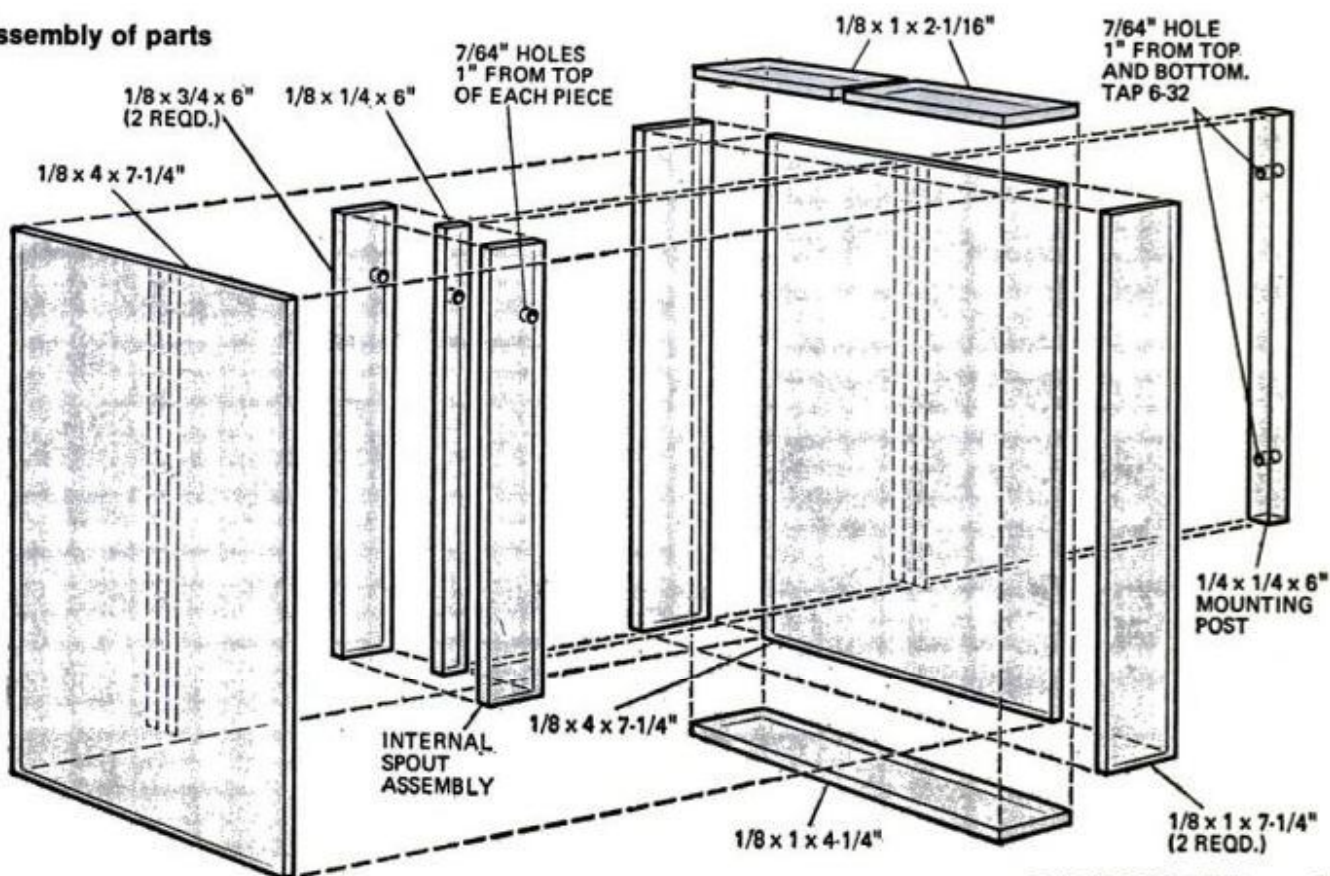
3. Masking tape is used to hold parts in alignment while they are being cemented. It's important that the joints do not leak air.



4. Filling with distilled water tinted with food coloring is best done with a chemist's wash bottle or a clean plastic squeeze bottle.

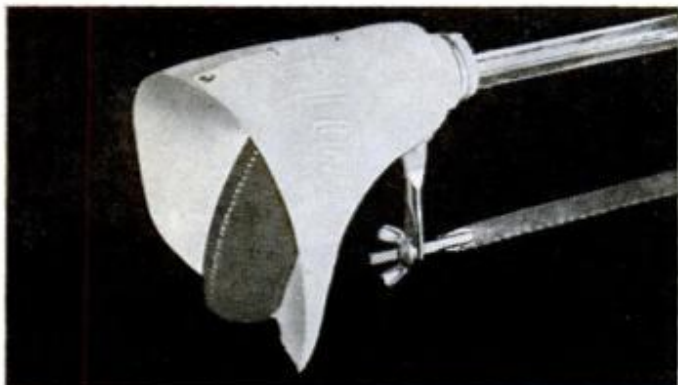


Assembly of parts



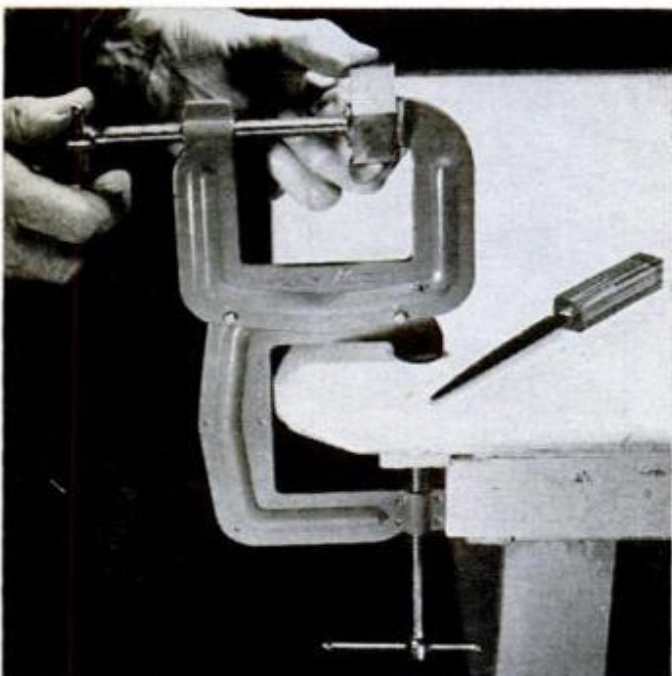
HINTS

FROM READERS



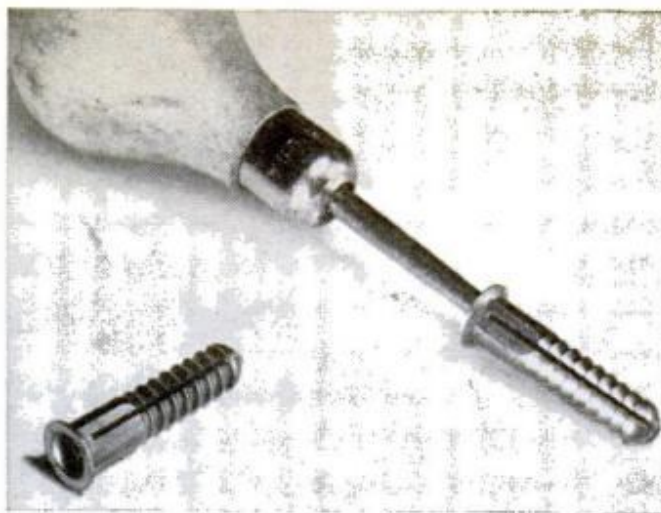
Hacksaw handle guard

The finishing stroke with a hacksaw is often the one that finishes your knuckles, too. Top of large plastic jug, slit and Pop-riveted back together, makes a hand guard.
—Steve Gysendorfer, Potts Camp, Miss.



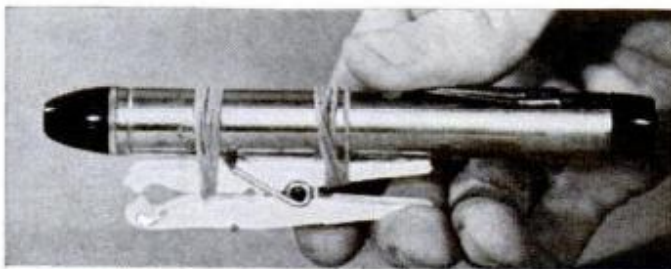
Light vise from clamps

A tabletop vise, particularly handy for holding light work, can be improvised from a pair of C-clamps fastened together as shown with a couple of stovebolts. Clamps can be easily taken apart for normal use.
—Frank Schulbert, East Rockaway, N.Y.



Sheath for awl

A small plastic wall anchor makes a fine protective sheath for the sharp point of a scratch awl.—Robert Curtis, Chicago



Quick trouble light

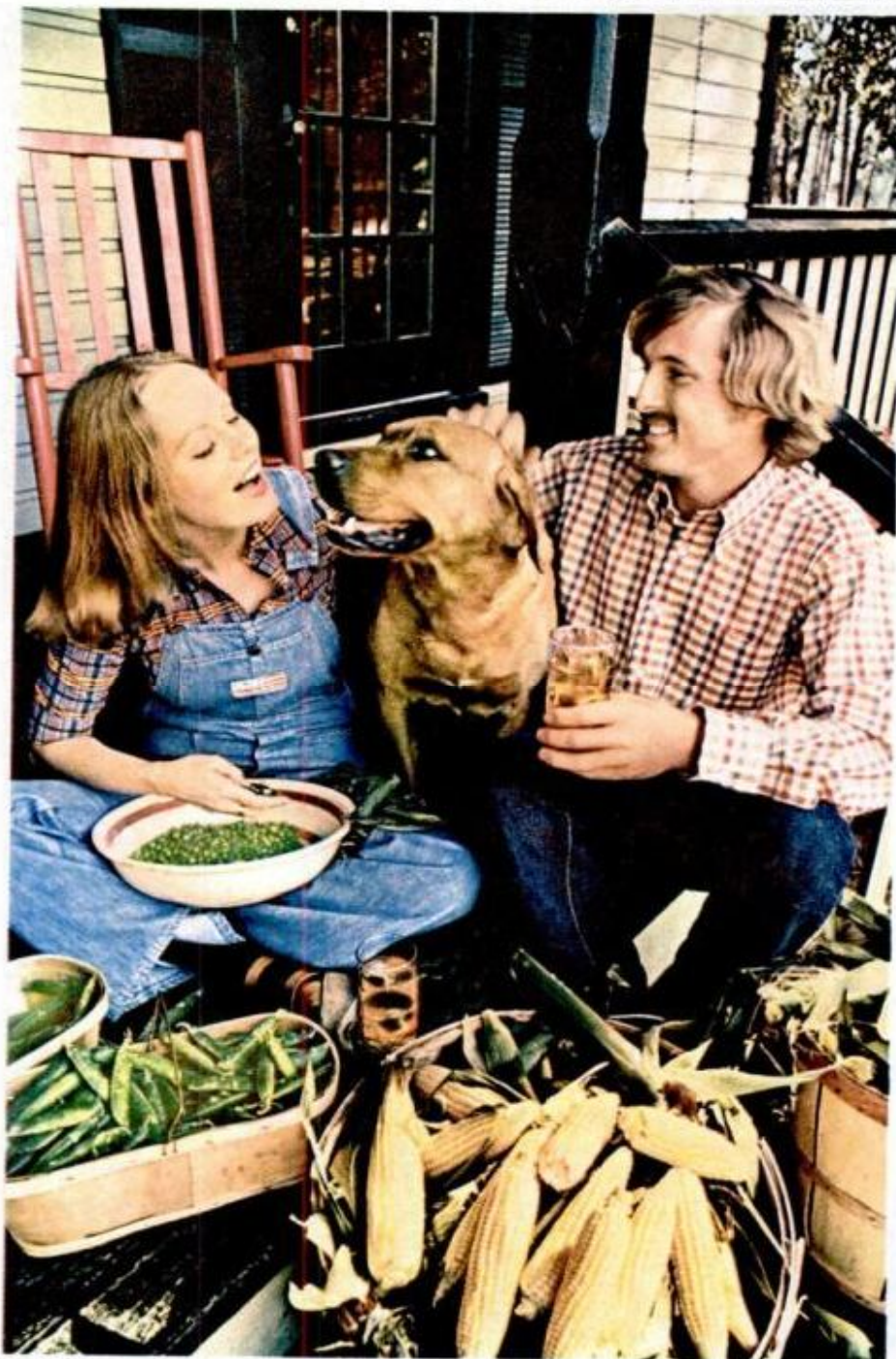
Fasten a spring-type clothespin to a pen light and you will have a trouble light that clips where it is needed.
—Ken Patterson, Regina, Sask.



Small paint-mixing cup

The glass body of a blown fuse is a fine container for mixing small amounts of paint or epoxy.—Robert Weil, Albany, N.Y.

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Clever disguises for storage buildings

Illustrations: Carl Kinscherf

Art: Fred L. Wolff

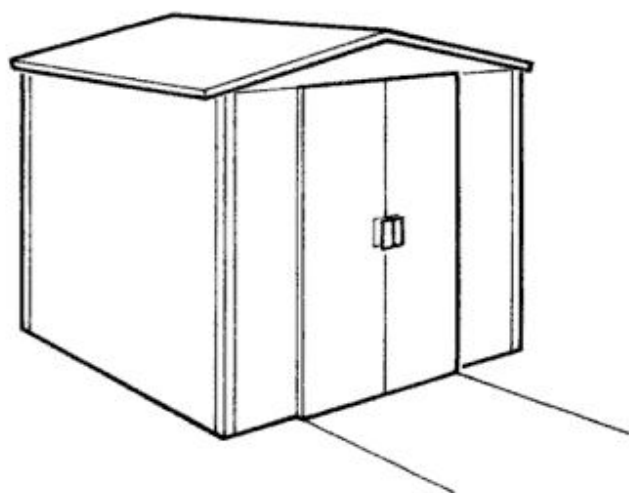
by Wayne C. Leckey
HOME AND SHOP EDITOR

There's good reason why outdoor lawn buildings have become so popular—homeowners have found them necessary to keep the garage from bursting at the seams. With all the yardpower equipment, the snow blower, kids' toys and bikes and a hundred and one other items that have become a part of modern living, the average garage can't house it all and the family car, too. Seeking additional room, homeowners have found lawn storage buildings the answer to the space problem.

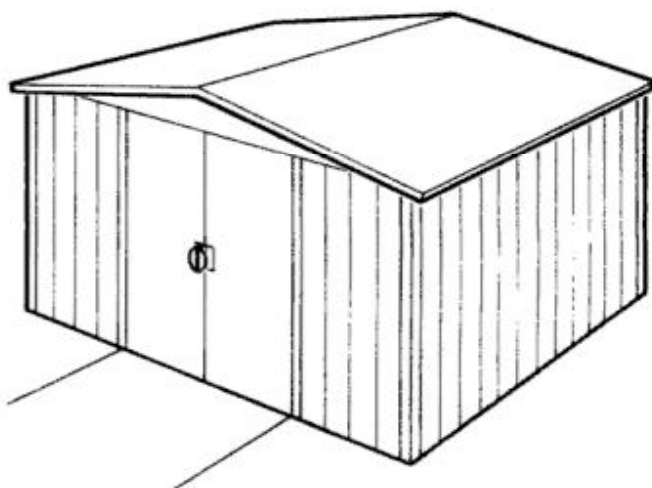
Despite what manufacturers have done to make the buildings attractive and colorful, weathering eventually takes its toll and the sheet-metal structures begin to look a bit rundown and detract from the appearance of the property.

What can be done to make the buildings more attractive additions to a yard, even serve a greater need? We tossed the assignment at Carl Sigman, a designer well known for his home face-lifting ideas, and asked that he take three of the more popular styles which are available and let us see what could be done to relieve their plain look at minimum expense.

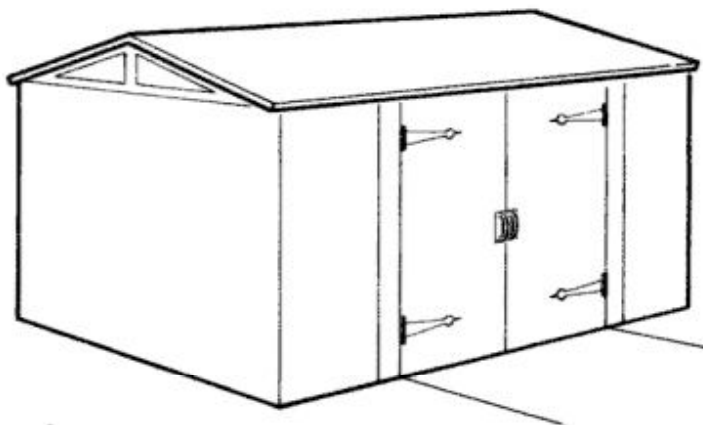
The three designs you see here



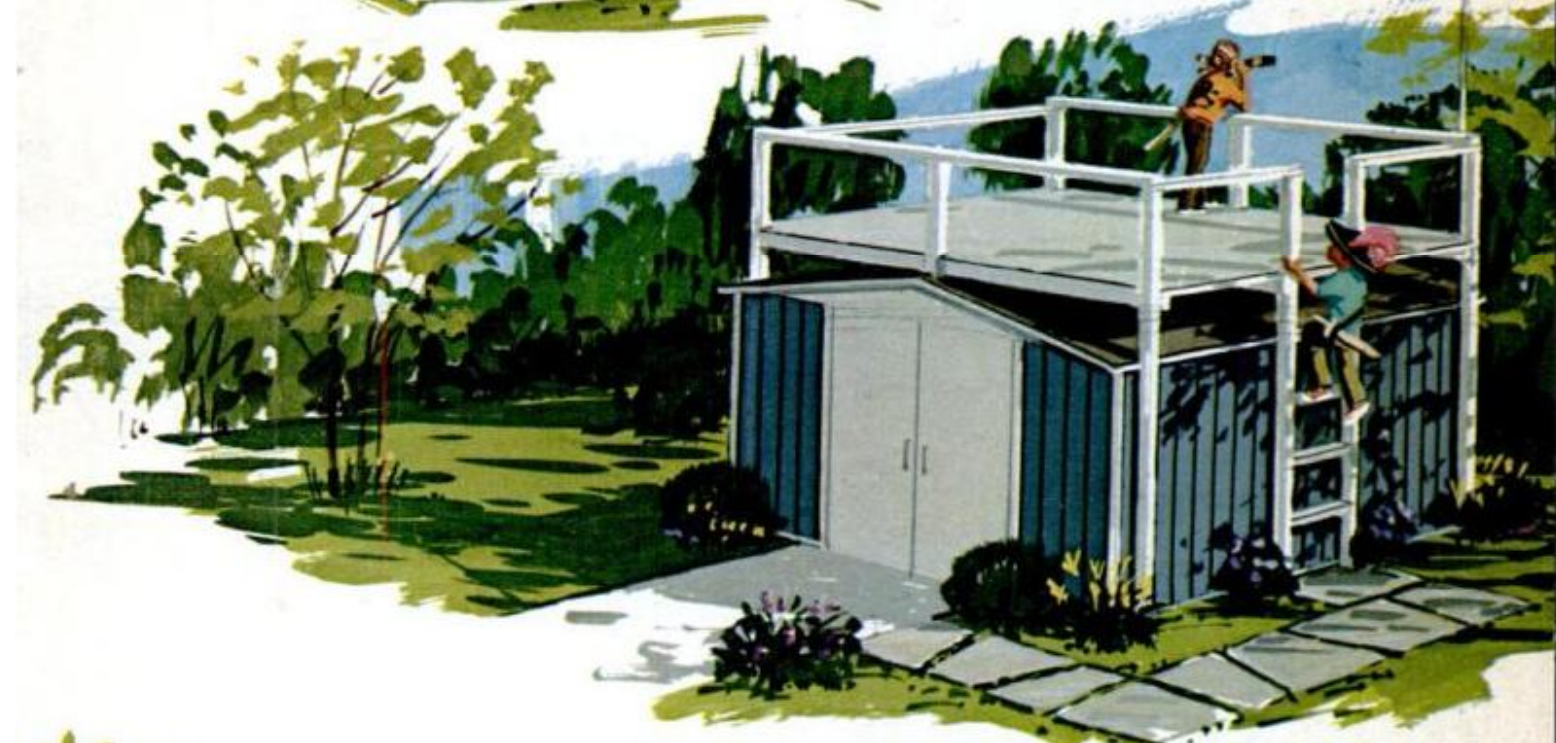
Simplest of storage buildings is the gable-roof "box." Transformation at right shows what benches, trellises, cupola and roof extensions can do to disguise shed look.

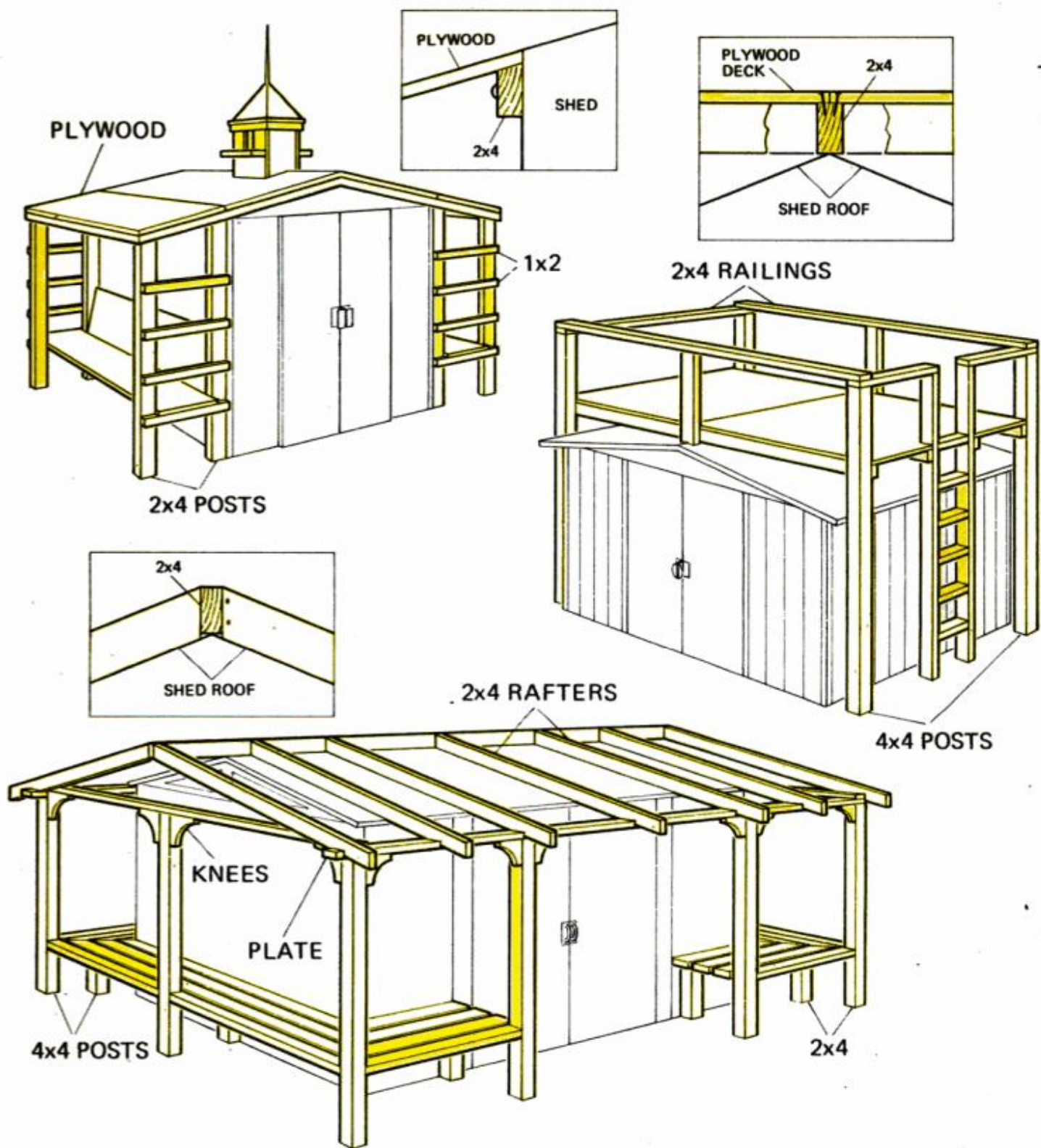


This typical unit is relieved of its plain outbuilding look by clever addition of kids' lookout deck erected over roof. The design incorporates a built-in ladder.



Common side-door building takes on an attractive pergola look with addition of exposed rafters, wraparound benches and climbing vines on supporting posts.





show what can be done to make such structures more attractive. One of the designs adds a pergola look, another provides a "tree house" for the kids. All three are good examples of what a bit of face-lifting will do to give storage buildings more eye appeal and make them more useful. In each case, the face-lifting interferes in no way with the normal use of the structure as a storage building, whether the doors are designed to slide open or swing out.

Each transformation makes use of common lumberyard members—2x4s and 4x4s for the most part, combined with sheets of exterior plywood. All members are treated with a wood preservative, and either stained to provide a rustic weathered look, or painted a matching or contrasting color. In the case of the play platform, most of the load is supported by the four corner posts; the floor actually bears only on the solid ridge of the building itself. ★★★

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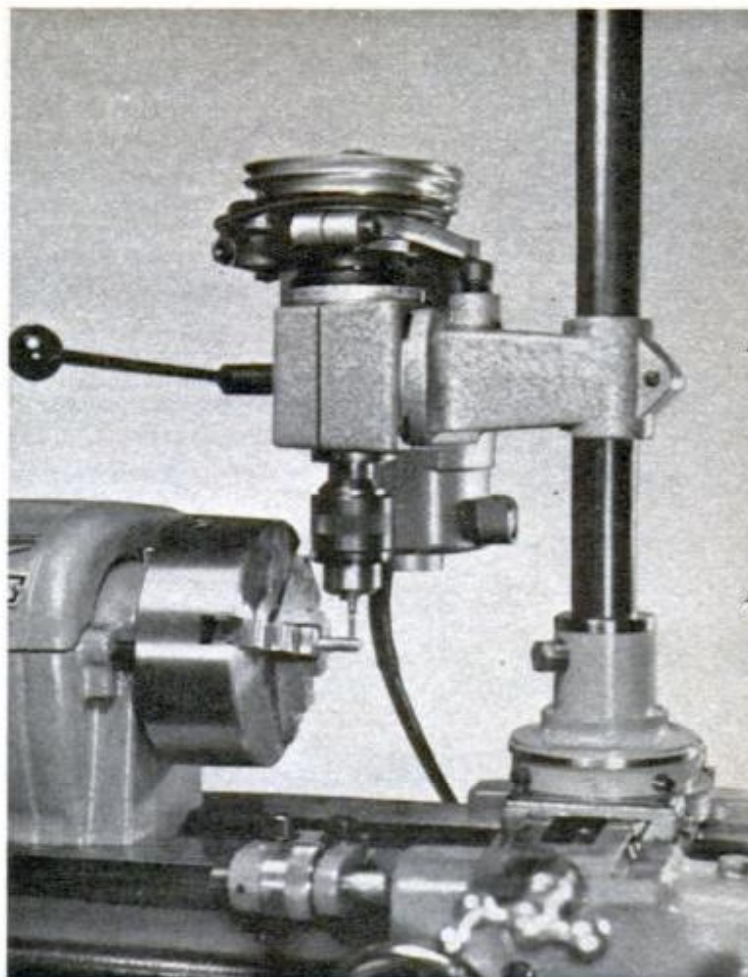
I'm a homeowner. My home has wood siding other.

Adapter mounts Unimat headstock on larger lathe

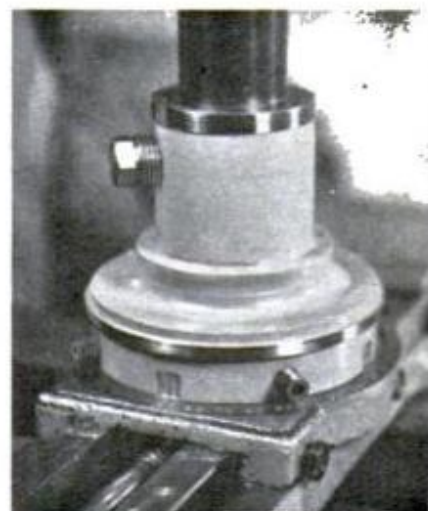
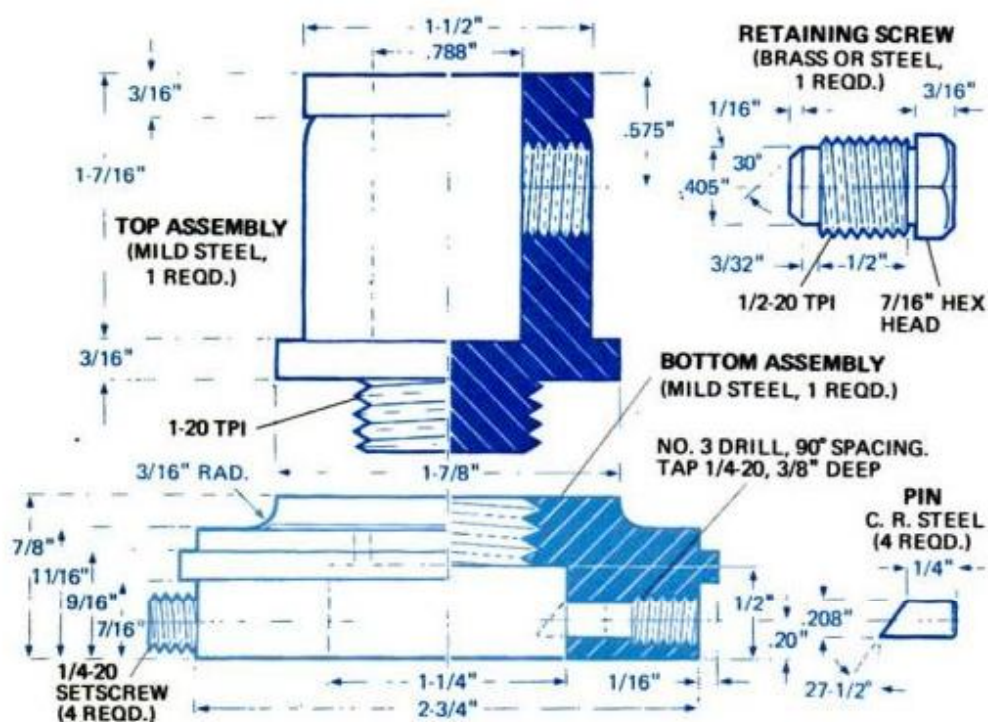
by Richard F. Cutler

The column attachment on a Unimat lathe, which permits the headstock to be mounted in a vertical position, can be used to great advantage on a larger metalworking lathe. With the column attachment and Unimat headstock fastened to the cross-slide of a 6-in. lathe, such as an Atlas or a Craftsman, you can cross-drill shafts, slit long pieces of work, mill, grind and perform other jobs not possible otherwise.

All that's required to support the column rigidly is the two-piece adapter you see here. I made it in two separate threaded sections so that other tools, such as a hand grinder, could be adapted and made interchangeable by simply mounting them to a common threaded base section affixed to the cross slide. The lathe's toolpost and top saddle are removed to accommodate the base. Dimensions are for a 6-in. lathe. ★ ★ ★



Accurate cross-drilling of a shaft is easy with Unimat headstock on column held by adapter, positioned by means of larger lathe's cross-slide feed.



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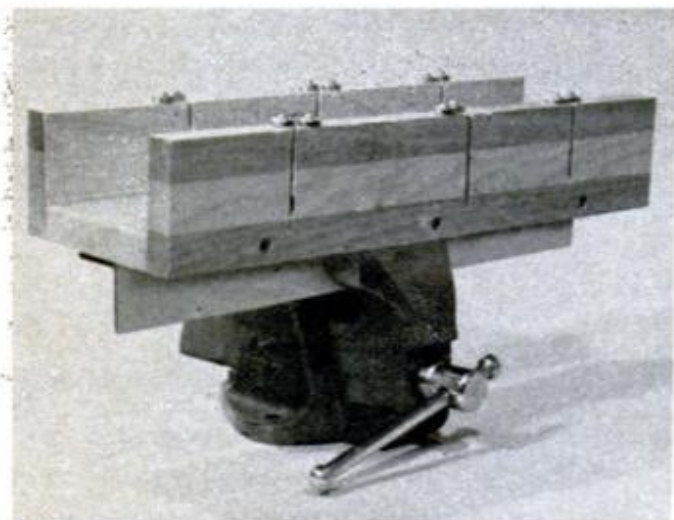
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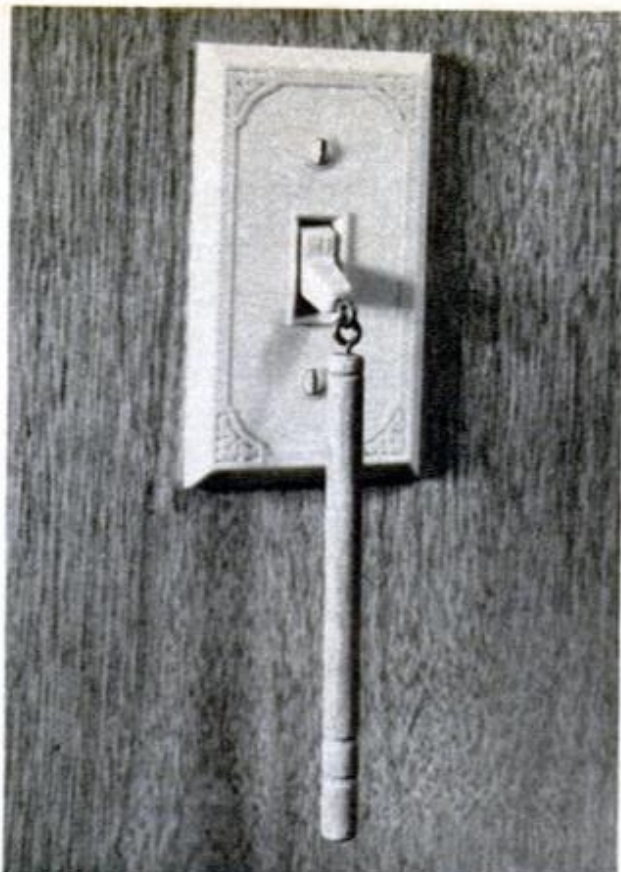
HINTS

FROM READERS



Steadying miterbox

With a length of angle iron screwed to its bottom, a miterbox can be held rock-steady in a bench vise whenever needed, but is not in the way as a permanently bench-mounted one would be.—*Ken Patterson, Regina, Sask.*



Light-switch extension

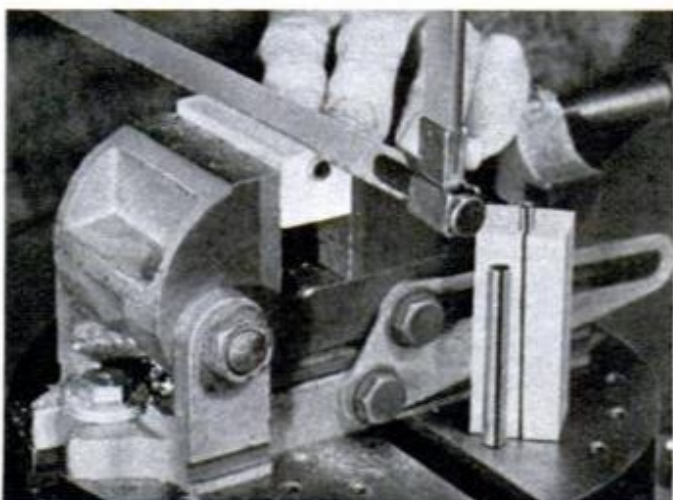
A light switch too high for a youngster to reach can be made accessible with a dowel and linked screw eyes. Drill hole in switch toggle to exact size or the screw eye will crack it.—*Robert Gentry, Waco, Tex.*



Photo cases for tools

Well-made leather and plastic cases for photo gear often outlive the equipment for which they were intended, and are sold at low prices. They are excellent for protective storage of precision tools. Fitting is not necessary because of the variety of sizes and shapes of cases available.

—*Walter E. Burton, Akron, Ohio*



Slitting thin-wall tubing

To hold thin-wall tubing in a vise for slitting, insert it into a hardwood block drilled for a tight friction fit, with the line of cut scribed lengthwise, center-to-center, on the side. Drilling the hole about $\frac{1}{8}$ in. from side of block allows accurate starting of the cut with a fine hacksaw blade.

—*Edwin W. Fuerst, Colrain, Mass.*

FIRE ON THE FLIGHT DECK!

(Continued from page 87)

unreported. But the important point is that not since the tragic events of the 1960s has there been a major ship fire at sea.

What accounts for this dramatically improved record? For one thing, the Navy is seeing to it that more men receive formal training in firefighting at damage control schools. Once trained, these men then return to their ships to teach others so everybody knows what to do in an emergency, not just a specialized few. No nonsense is tolerated—there will be no more stupidities like turning sprinklers on magnesium or washing away foam with water.

In addition to intense training, the adoption of better extinguishing agents and ways of applying them is also helping to keep down casualties and damage. Carriers are now equipped with a new, more highly efficient extinguishing agent called "lightwater," which has replaced protein foam. An aqueous film-forming foam consisting of water and a special detergent, lightwater overspreads Class B fires—those fed by petroleum—and smothers them instantly. It's said to be 300 percent more effective than protein foam against aviation gasoline fires and 150 percent more effective against JP-5 jet fuel.

So that men don't have to approach a fire with hoses, risking the danger of being blown up by unseen bombs hidden in smoke, automatic lightwater sprinkler nozzles are now installed right in a carrier's deck or along the deck edges. Requiring no sailors to man them, they can be remotely operated from the carrier's island to instantly flood any desired portion of the flight deck with lightwater foam.

However, fighting overhead fires, such as from fuel spurting from ruptured overhead lines below the flight deck, still remains a problem. Lightwater can't overcome gravity. If sprayed on an overhead line, it will fall away, allowing the fire to continue burning as long as the pipe keeps ejecting fuel. CO₂ also settles, making it unsuitable for overhead fires as well as posing another problem. CO₂ works by displacing oxygen, which means that anyone in the area who is not equipped with oxygen breathing apparatus (OBA) may become suffocated in the process—and, in fact, this has happened in several cases.

The Navy is now experimenting with a chemical called bromotrifluoromethane, or Freon 1301, as a promising agent in the fight against overhead fuel-line fires. Also known as Halon by its developer, du Pont, it breaks a fire's chain reaction, getting between molecules to stop flames from spreading even though fuel is still spurting from a ruptured line. Instead of displacing oxygen, it mixes with air to stay concentrated on the flames. And, since it doesn't settle, later flare-ups are not likely once a fire has been stopped at its source.

At one time, fires in ships' galleys from deep-fat cookers were a common occurrence—happening almost daily—and just as difficult to fight as overhead fuel-line fires. Now the danger has been reduced by the introduction of aqueous potassium carbonate. The chemical is held in canisters directly over deep-fat-fryer areas and can be released either manually or thermostatically if no one is around. When a deep-fat fire breaks out, the canisters empty and immediate saponification occurs—the burning grease is quickly converted into a harmless soap.

Another new firefighting agent is potassium bicarbonate, known as PKP or "Purple K." Purple K is usually used in conjunction with lightwater foam, the two being sprayed simultaneously from twin nozzles. The PKP knocks flames back, providing a heat shield for firefighters so they can penetrate a burning area to get the lightwater on the fire. TAFES (for Twin-Agent Fire Extinguishing Systems) consist of dual plugs attached to two hoses wound on one reel—one hose for PKP and one for lightwater. There are typically 16 TAFES stations on a carrier. There are also 100 or so separate 30-pound PKP hand extinguishers aboard every vessel.

Another form of dual firefighting equipment is the mobile TAU (for Twin-Agent Unit). This is a motorized tractor used on flight and hangar decks to transport dry chemical and lightwater foam to a fire as quickly as possible. TAUs actually are miniature fire trucks, and every carrier has at least four.

Thus, while there will always be fires aboard big ships, the chances for another *Forrestal*-type tragedy are slimmer today than ever before. Perhaps the lives lost on the *Forrestal*, *Oriskany* and *Enterprise* were not entirely in vain after all. ★★★

SHIP MODELING

(Continued from page 73)

to produce the actual parts. The ribs and keel are cut out with a jigsaw or coping saw and matched against the original plan for accuracy.

Gluing begins when the keel and all ribs are cut. The ribs are slotted and glued along the keel at intervals specified by the plans. The next step is to add planking. The planks are usually $\frac{1}{4}$ by $\frac{1}{16}$ -inch spruce or bass wood, purchased from a hobby shop. These fine strips are attractive in color and grain and, because of their flexibility, are easy to apply to the curving contours of a wooden ship hull. Treating the planks is done in two stages. First the edges are painted black so that when the strips are butted together they're separated by thin black lines that simulate the caulking between teak planks in traditional sailing ships. A quick way to do this is to bunch the strips together in a stack and spray all the edges at one time with black lacquer.

Stage two is to separate planks, let the paint dry, then soak them in a tub of water for two to three days. Soaking makes the wood pliable and easy to work. You begin planking by first laying a strip of wood in a straight line down one side of the hull, positioning it halfway between topside and keel. This gives you a straight starting point for laying up the remaining planks. You glue the plank at each point where it meets a rib, using a water-soluble cement. At the same time, you tack the plank in place with tiny $\frac{1}{2}$ -inch brass pins. These hold the plank until the glue dries. After the first strip has been applied, others are added alternately on each side until the entire half of the hull is covered. At the bow and stern, the ends of the strips are carefully trimmed. Then the opposite side of the hull is planked in the same way. When all planks are applied, the small brass pins are removed with needle-nosed pliers, leaving holes which are then drilled out and filled with tiny doweling "pegs" to simulate the pegged planking used in real sailing ships.

Careful hand sanding with very fine paper smooths and tapers the hull, removing minor flaws in the planking and adding the graceful, sweeping contour lines typical of traditional square riggers. Planking the deck comes next and is done in much the

the same way as the sides of the hull except that the job is simpler and faster because there are no intricate contours involved.

Finishing the hull is done in several steps, depending on the effect and appearance desired. Sims starts with an overall coat of all-purpose sanding sealer, then usually follows this with an oil-base wood stain rubbed on with a soft cloth. In some cases, wood trim is highlighted with paint, depending on historical accuracy or builder preference. Finally, the hull is given a second application of sanding sealer, this time serving as a varnish to produce a softly gleaming satin finish.

With the hull complete, the ship is now ready for a stand. In fashioning his stands, Sims uses an unusual method. Instead of the conventional cradle or flat base, he mounts his hulls between rows of small wood blocks fastened in turn to a plank. The blocks create the effect of a ship perched on ways ready to be launched.

Hull detail begins with deck components such as hatches, winches, cabins, windlasses, capstans and transom. Here is where the use of pictures becomes an important supplement to the plans. While the plans will give the physical dimensions of such deck details, they will not show how they really looked. Many of these are highly distinctive and decorative in design, and only pictures can give you a true feeling of their appearance. The miniature woodwork is all done by hand. Tiny cabin windows are cut out with X-Acto chisels, hatch covers are shaped from thin spruce, lifeboats are carved from solid pine and winches are built up from a number of tiny individual pieces.

The transom, often the most ornate part of the ship, is usually a highly intricate arrangement of windows and scrollwork. Here's where a few special tricks, developed over years of experience, can be a valuable aid to the beginning modeler. Sims has a unique way of making window panes, for example. In each small carved opening for a window, he merely dabs a tiny spot of transparent glue and lets it dry, forming a mottled pane of simulated glass. The result is amazingly realistic. For scrollwork and other textured effects, Sims uses liquid gesso, a surface-preparation material employed by artists for oil paintings. When the fast-drying gesso is applied in repeated coats with a fine brush, it builds up a thick,

irregular base that, when stained, takes on the appearance of intricately carved wood.

The technique can be used on figure heads, scrolls, flowers and other ornamental details. In fact, Sims often simply rough-cuts his designs, then works them over with gesso to achieve the final results—like modeling with clay, but in miniature.

Masts, yardarms, booms and bowsprits are all made from standard wood dowel stock. Sims selects dowel diameters to match the fattest portions shown on the plans, then tapers down the ends by eye. He does rough tapering on a bench sander and finishes up with hand sanding. Square holes for stepping masts are made by first drilling small round holes in the deck, then enlarging these into square openings with a disc sander chucked in a hand grinder.

Rigging is a subject in itself," Sims explains. Before trying it, a beginning ship modeler should study the technique thoroughly from readily available published sources. For this, Sims recommends Harold Calahan's books on rigging for sailing ships, especially his volume entitled *Masts and Rigging*. This can be obtained at most libraries and bookstores.

"You begin with the running rigging—the white lines that control the sails—and work upward," advises Sims. "Once you get past the lower shrouds, the task is 75 percent complete." Sims uses white Irish linen thread in varying weights depending on the ship's size. The ratlins, or ladder-type side rigging, are also of Irish linen thread and are rubbed generously with beeswax to stiffen them. Sims warns against using synthetic nylon or rayon threads because they tend to stretch in time.

Miniature metal fittings such as cannons, pulleys, chains and anchors are available ready-made for nearly every purpose on a ship. These can be obtained at, or ordered through, most hobby shops. While such items *can* be handmade—and a perfectionist would insist that they be—Sims is willing to concede that they offer a handy way to avoid a lot of tedious work and are especially convenient for the beginner. In other words, it's no sin to add a few commercially made details if they'll improve the appearance of your handiwork. The important thing is the end result—and the thrill and satisfaction you'll get from turning out a masterpiece that's your very own from keel to crow's nest. And it's not all that hard, if you really want to do it. ★★ ★

CLEAN-LINED 'CANE' CHAIR

(Continued from page 69)

a clean block of wood, while tapping it with a hammer.

The recommended sequence for applying laminate to this chair is:

1. Apply laminate to front panel and to rear of back panel. Rout edges flush with core (plywood).

2. Temporarily assemble chair parts, including the seat panel. Apply laminate to the inside surfaces of the sides; the outer edges can be left with the overhang at this time.

3. Disassemble the chair and use the router to flush-cut the outer, overhanging edges. Note: Cleats should not be permanently attached until the router is used on the inside pieces of laminate.

4. After routing, install cleats using glue and ringed nails. Assemble chair with glue and screws (use 2-in., No. 8 flathead screws). Then apply laminate to outside surfaces.

With chair assembled, the hardwood trim pieces can be cut and shaped. To avoid waste, use the chair itself to determine the lengths to which the various pieces should be cut.

Cut, groove and position a piece at a time, and temporarily tack each piece on the chair. When all pieces are cut and fitted, make pencil marks where radius sanding should end. (See photo on page 68). Disassemble the trim and round the edges using a block plane or belt sander (don't use a disc sander). When satisfied with the shaping, install trim on the chair using glue and 1 $\frac{3}{4}$ -in. No. 8 screws set in counterbored holes. Plug the counterbores with walnut dowels.

The seat webbing is installed with screws and washers. Fold over the ends about 1 in. to obtain a strong, double thickness. Punch a pair of holes about $\frac{1}{2}$ in. from the end and install webbing using No. 10 truss-head, sheet-metal screws and washers. Webbing used on the chair shown is 10-lb.-weight jute, 3 $\frac{1}{2}$ in. wide. You need 3 $\frac{1}{2}$ yds.

Finally, give all wood parts a last fine sanding with a finishing sander and fine grit paper. Follow this with an application of paste wood filler and two coats of a quality wood finish. Constantine's Wood-Glo was used on the chair shown on page 65; it levels out very well and provides you with a hand-rubbed look without having to do any rubbing. ★★ ★

EVERYBODY WANTS THESE USED CARS

(Continued from page 107)

dealer, so Jim Johnson took me to meet Howard Brandon, of Brandon Brothers Distributors, Inc. (Not to be confused with Brandon Brothers Used Cars, Inc. That's Howard's brother, G.T., who runs an entirely different operation next door.)

Howard Brandon is 44. He is a lean, articulate, outgoing guy who speaks with a soft slur in his voice—but not a southern drawl. Judging by the brick mansion he lives in on top of a hill, a 350-acre farm (complete with private pond) he owns a few minutes down the road from his house and all the outward trappings of affluence, Brandon is well-heeled. But you wouldn't know it by the way he dresses. He wears old clothes. If a job in the shop needs an extra hand, Brandon bounces out of his office and pitches in.

Brandon is in love with cars and machinery. He owned his first car before he was old enough to get a driver's license. "Sometime between my 10th and 11th birthdays I traded a .22 rifle and \$5 for a Model T."

In addition to being a car dealer, Brandon is a collector. Not only cars but anything with a motor in it or on it—farm equipment, planes, steam engines, washing machine motors, a grinding wheel rigged with a motor for sharpening axes—even an old moonshine still. A huge building behind his home and three barnlike structures on the farm property are cluttered with his personal collection—more than 100 automobiles, four planes (three in flying condition) and hundreds of antique motors in various stages of repair.

Brandon got in the car-trading, car-reconditioning business when he was a teenager. When 15, he was sent to Detroit with \$10,000 cash to buy used cars to take back to Murray. "That might seem like a lot of cash for a boy to be carrying around. But I remember one time four guys left here in a car and between the four of them they had \$161,000 cash money."

On his first trading trips to Detroit, Brandon bought cars off the street. He worked with his brother, G.T., who stationed himself at the phone in a gas station that served as a sort of trading post for out-of-town buyers of used cars. Howard acted as buyer.

"I'd see a car I thought we could sell,

maybe in a driveway, and I'd ring the doorbell and ask if they wanted to sell. Lot of times they'd laugh, but lot of times they'd say, 'Sure, I'll sell it to you.'"

Brandon would then go to a phone and call G.T. back at the gas station. G.T. would try to make a deal with one of the buyers. The brothers became so adept at this technique that G.T. often lined up a buyer before Howard hung up the phone.

Howard Brandon now operates his own haul-away and sells between 1500 and 2000 cars a year. Most are sold to other dealers or at auctions open only to dealers. He sells a few cars to retail buyers, but that's a sideline to his wholesale business.

Brandon is one of the best paint-matching men in the country. You have to see his work to believe it. He can take a car door, start with black paint on the left side, white paint on the right and blend the colors together so you can't tell where they merge.

In reconditioning a car, Brandon may use as many as 16 coats of paint. "We had a Mercury that we buffed down to the metal and then put 16 coats on it. But the pitting still showed through the hood, so we removed it and threw it away."

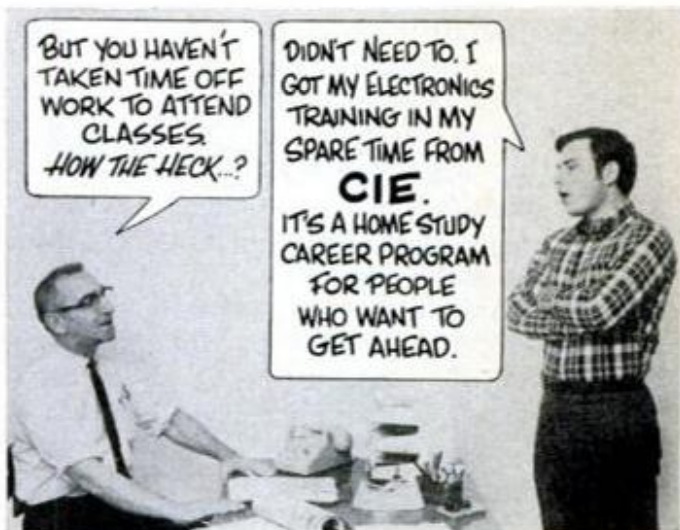
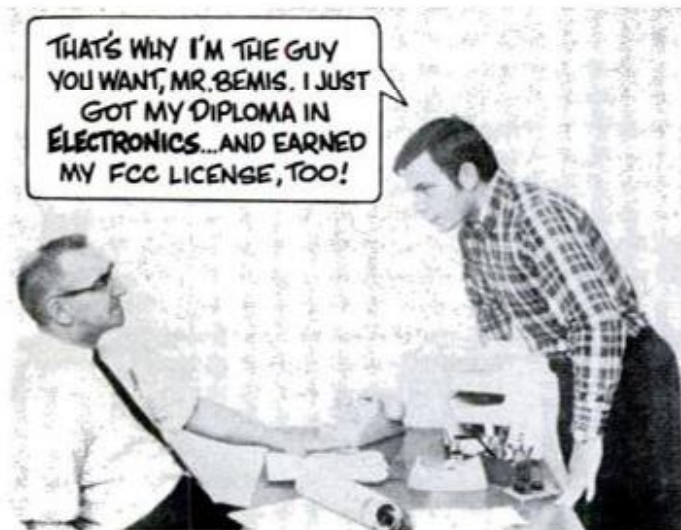
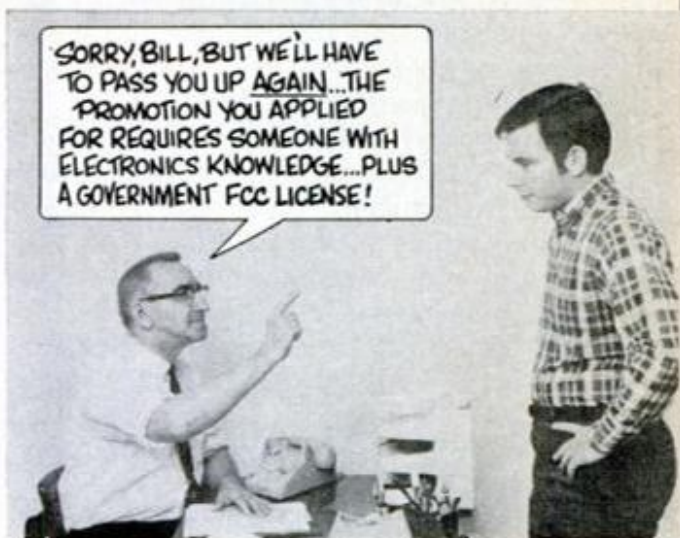
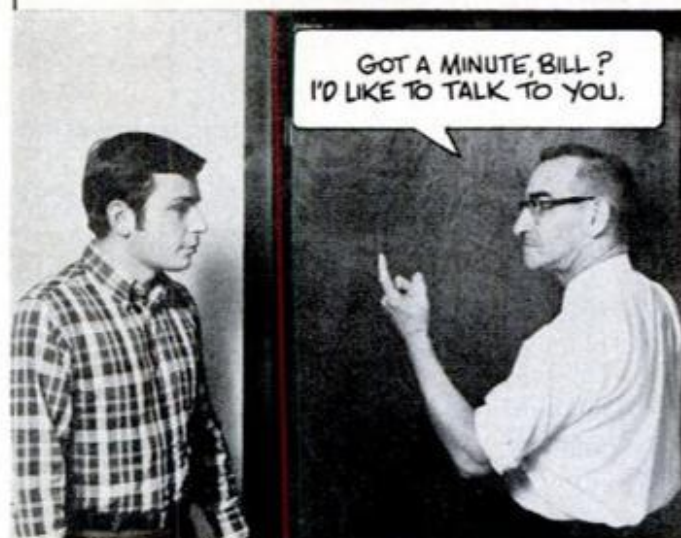
After the paint job, cars are treated with what's known as the Murray finish. Each shop has its own formula for mixing—a dab of this, a dib of that. After mixing, the liquid, with a viscosity of heavy cream, is put in a plastic mustard dispenser with a squeeze top. Every car gets a minimum of four coats of polish. The result is a mirror shine that beats the look of a new car fresh off the production line.

A friend once asked Brandon how he managed to get such a high shine on his cars. Brandon held up the squeeze bottle and pointed to the name on it: Mustard. "I was just kidding, but the fellow went home and put mustard on his car."

The Murray finish is supposed to be a secret. It isn't. The "secret" is in applying coat after coat—as many as 12 layers—of polish and rubbing it in by hand. The first few coats are applied with a buffing wheel. After that, it's all handwork.

Murray still loses a few people to the North, as it did during the depression. But the circumstances are different today. When a Murray youngster packs his tools now, it's not because he can't scratch a living in his home town. He's so good at his trade he can just about write his own ticket at any bump and paint shop in the country. ★★★

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DON'T SELL THE AIRSHIP SHORT

(Continued from page 117)

provided luxury and comfort for 50 passengers, a capacity later increased to 72. Among other facilities, it had a smoking room that was pressurized to keep stray wisps of hydrogen out, and two promenades with angled windows that permitted passengers to view the scene passing below.

The *Hindenburg* was built for transatlantic service. One-way fare between Germany and the United States was \$400.

It was so stable in the air that it is said no passenger ever became airsick. The noise level was very low—only 40 decibels, according to Gordon Vaeth and Kurt Stehling. A saying attributed to enthusiastic airship travelers summed up the experience this way: "You fly in an airplane, but you voyage in a Zeppelin."

Because the United States had the world's only substantial supply of helium—obtained from gas deposits in Kansas and Texas—and because the American government refused to do business with Germany's Nazi leaders, the *Hindenburg* had to use hydrogen, setting the stage for tragedy. On May 6, 1937, during landing maneuvers at Lakehurst, the big ship caught fire and crashed, with a loss of 35 lives.

Though sabotage was rumored, a board of inquiry concluded that the fire was touched off when static electricity ignited hydrogen from a leaking gas cell.

For all practical purposes, the *Hindenburg* disaster marked the end of the airship era. Thus, technical development came to a stop long before the advent of many lightweight metal alloys, structural plastics, tough polymer films (for containing helium), advanced electronic devices, computers, and all the other wonders of modern technology.

Powerplants have been improved since the 1930s. Today's airship designer can think in terms of conventional power in the form of Rankine-cycle engines, gas turbines and Wankel engines—and in terms of atomic power. As opposed to the airplane, a dirigible would be big enough to carry a nuclear reactor.

Today, say proponents, a safe, efficient and versatile airship could easily be built. A small prototype, they estimate, could be constructed for as little as \$25 million—about the cost of a Boeing 747.

A modern airship would excel as a freight carrier. Prof. Morse and his colleagues es-

timate that an airship with a volume of 12.5 million cu. ft. could carry a payload of 300,000 pounds—the equivalent of 150 VWs. Since the airship needs no runways and other elaborate airport facilities, it could pick up cargo in a field close to a factory and take it right to the market area. Remote areas, say in the interior of Africa or South America, would be accessible. Given proper weather conditions, an airship could even load and unload without landing, relying on its ability to hang in the air.

Similarly, the airship could function as a flying hospital, say its proponents, to provide aid in disaster areas. Again, it would not even have to land, but could lower supplies, including heavy gear like power generators and bulldozers, by winch. Disaster victims could be taken aboard the same way.

Another role would be as a flying scientific laboratory, especially for oceanographic, meteorological and environmental work. Since space is no problem, the lab could have a fully equipped data-processing center where experimental results could be made available immediately.

The modern airship could have military uses too, according to Gordon Vaeth and his colleagues. Equipped with sonar devices towed on the ocean surface, it would be especially useful in detecting submarines.

Airships could function as far-ranging units of a flying DEW (Defense Early Warning) line. Each ship could carry RPVs (Remotely Piloted Vehicles) "to increase its radius of observation, action and protection," explains Vaeth. Though slow, the airship would not have to be a sitting duck. It could be armed with batteries of missiles.

Environmentalists could easily live with the airship. Not only are its noise levels low, but its low-powered engines would throw out few air pollutants. And it would not create the need for bigger and better airports, as the jet has.

Though a good case can be made for updating the rigid airship, will it ever come about? Up to now, our government has exhibited little interest.

Prof. Morse sums up the situation this way: "The greatest difficulties are . . . questions of prejudice and persuasion. Disasters such as befell the *Hindenburg* . . . still haunt the public mind. Yet a modern rigid airship should possess inherent safety unparalleled in aeronautical development. It remains to be seen when and by whom the challenge is finally accepted." ★★

WILD NEW SPEAKERS

(Continued from page 125)

tionally—but from what would be the back of a conventional cone.

Piezoelectric tweeters are new, even if piezoelectric devices—which convert bending stresses into electrical impulses and vice versa—have long been used in ceramic microphones, phono pickups and earphones. Different advantages are claimed by different manufacturers: Sound Technology Research claims faster, more precise response, while Polk Audio talks about virtual indestructibility, frequency response to 30 kHz, and no need for a crossover.

New enclosure designs for conventional drivers seem mostly designed for better bass, just as new drivers seem mostly aimed at better treble. One type relies on a driver, though, a passive woofer driven not by electrical contact with the amplifier, but through its acoustical connection with the amplifier-driven (and smaller) active woofer. This "drone cone" has several benefits: it damps that woofer's motions at that speaker's resonant frequency, reducing distortion. It increases effective woofer area at low frequencies, while not adding to the relatively light main woofer's mass, so the woofer can respond with less inertia to fast transients. The drone also increases speaker efficiency by acting like a vent or port in the enclosure, while taking up far less space than an equivalently effective port would. Drones are used in the Electro-Voice Interface:A on page 123 and in various models from Polk, JBL, and Bang and Olufsen.

Another feature the Interface:A shares with other systems is an *equalizer*, an electronic network that reshapes the frequency curve of the signal fed to the speaker, first to compensate for the speaker's own diminished response at very low frequencies, and also to compensate for variations in effective bass and treble response caused by variations in the speaker's placement within the listening room. Equalized systems are also available from Audio Project, Bose, Altec, Equasound, Precision Acoustics and others and in a few compact phonograph or receiver systems.

BIC's Venturi speakers are more obviously variations on the vented enclosure. The difference here is in the snail-curved cross section of its port (see page 124), designed to improve sound at all bass frequencies, not just at the frequency of the main woofer's

resonance. Because your ear loses some bass and treble response at low volume levels, the Venturis also incorporate an "unequalizer" circuit that reduces low-volume midrange till the system sounds flat to your ears again. (Your amplifier's loudness control does this, too, but only very roughly.)

The Venturi also incorporates a midrange horn of a new, compound-curved design that disperses sound over an exceptionally wide area. It covers a very broad frequency range, too (1500-15,000 Hz), to keep crossover networks and their phase distortions out of the crucial midrange—a pronounced trend in today's designs.

Unusual enclosure shapes are another route to increased dispersion. Probably the best-known of these is Bose's pentagonal 901, but there are numerous others with their speakers arrayed in pentagonal, hexagonal, triangular, spherical and vee configurations for increased dispersion, such as the Design Acoustics D-12 (page 125).

Another device for increased dispersion is the rear-facing tweeter whose signals reflect from the wall, as in the E-V Interface:A and various models from Infinity, Stark and Soundcraftsmen.

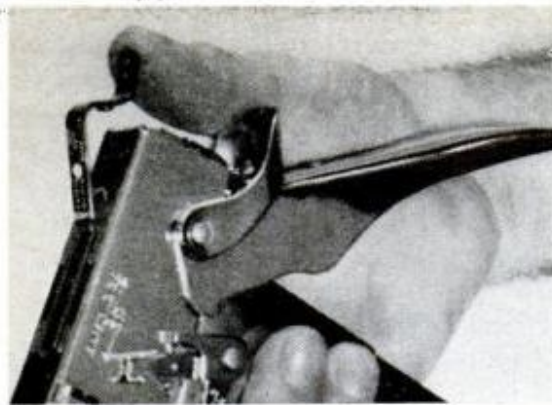
Leslie's approach to better dispersion is a conventional-looking box containing an unconventional device: A rotor which constantly alters the direction in which ball waves are fed into the room. The idea is to break up "standing waves" that cause alternating areas of overrich and over-lean bass within the room, and to give a livelier, more natural sound. The same random-phase effect is achieved electronically for the midrange and treble. In practice, the Leslie seems to work on some music, but makes other music sound a trifle "wobbly."

Servo-controlled speakers are also making news—again. The idea of turning speaker motions into a feedback signal that will reduce speaker distortion isn't new, and servo-controlled systems have been available from LWE and Infinity for some time now. With a new servo system coming from Philips (one of Europe's largest electronic firms), though, the subject will probably get a lot more discussion.

But not all new speaker trends are wild. One of the most sensible we've seen is the trend toward speaker protection through built-in circuit breakers (Magnum Opus, Ultralinear), fuses (Avid) or solid-state protective circuits (Crown). In this high-power-amplifier era, it's a great idea. ★★★

SWINGLINE'S NEW WHAMMER

(Continued from page 135)



Safety guard, which locks ram, is removed to use gun, always replaced to prevent chance of accidental firing.

primarily hold the finished project together (such as the box on page 135 with dovetail-joint corners). Here, several well-set nails were "whammed" to hold the box rigid while the glue dried.

If there is any fault, it is that the gun will jam if a nail strikes a particularly dense object such as a knot or metal fixture. However, the gun is easily cleared by flipping open the bottom plate and aiming the gun downward. Gravity usually takes over and the nail drops out. If the bottom plate resists opening after a jam, you simply pull back on the loading latch, insert the safety guard in front of the latch and turn the guard down on the bottom plate. ★ ★ ★

WATER BAROMETER

(Continued from page 143)

mented. Start with medium-grit abrasive paper, then use fine and, finally, very fine grit before polishing with a cloth buffing wheel charged with jeweler's rouge. Cement the two 1 x 7 $\frac{1}{4}$ -in. side pieces to the front and back members first, inserting them between the two and flush with the edges. Then cement the 1 x 4 $\frac{1}{4}$ -in. bottom piece, using masking tape to hold it, followed by the two top pieces. Top and bottom pieces lap the edges; only the sides fit between.

Now check for leaks by filling the barometer with water; use epoxy to seal any holes. A $\frac{1}{4}$ -in.-sq. plastic post is used to mount the barometer to the walnut panel. Before cementing it to the back of the barometer, drill and tap two holes in it for 6-32 x $\frac{1}{4}$ -in. rh machine screws. The section view, page 142, shows how screws fit in counterbored holes in the back of the mounting panel.

—Gerald Zuhlke

FOLEY'S NEW SANDER/GRINDER

(Continued from page 137)

I made a number of passes with the miter gauge to check accuracy when sanding mitered cuts. The results were excellent—they were on the mark every time.

A good feature is the consideration given to dust collection. A short length of hose from the grinder housing passes down through the table; at the outboard end you simply connect your shop vacuum hose.

All key points considered—safety, performance and tool construction—I rate model 311 a good buy. For the price, though, I think one refinement that might have been included on the optional floor stand is leveling casters instead of leveling screws. I'd rather roll than lift or slide the tool. Perhaps that is nit-picking, but as for sharpening and grinding, it's a dandy. ★ ★ ★

OLD CARS OR NEW?

(Continued from page 107)

and odometers can be rigged or disconnected in a dozen ways.

The thing to look for in buying a used car is appearance. If the car has a clean look about it, chances are it has had good care.

Check the brake and accelerator pedals. Look for wear. If the odometer shows 40,000 or 50,000 miles and the pedals are beat up don't trust the odometer.

Look in the trunk and under the mat, if there's a cover on the floor of the trunk. Check for rust, small gravel and dirt. If you find rust and road dirt, that indicates bad welds in the body and a noisy, leaky car. The auto companies use a reddish or brown glue for trunk mats and the glue looks like rust when you pull the mat up from the metal. There's nothing wrong with the glue. You can tell the difference between the glue and rust by rubbing your finger across the red residue and sniffing it.

New car or used, the magicians of Murray say your car will last longer and you will realize more from it when you trade if you keep it washed and waxed. Wash the car at least once a week. For a long-lasting, hard finish use paste wax every three or four months. And don't stop with one application. Put on three or four coats—by hand.

If you live in an area where rust is a problem, you can do your own undercoating for the price of a quart of 50 or 60-weight cylinder oil. Pour or dribble the oil inside all baffles and cracks. On doors, use about a cup of oil per door. Do the job in warm weather and let the sun get at the door. The oil will drip for about a week.

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—Robert Lund

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EXPOSURE METERS

(Continued from page 111)

requires about one stop more exposure than indicated; white objects about two. In an otherwise sunlit scene, shaded subjects or tones about as dark as tree leaves require about one stop less exposure than the meter indicates; dark or deeply shadowed subjects in a sunlit scene require two stops less.

You can, of course, pick a typical middle tone in your scene as the subject for a spot or close-up reading, and get accurate results that way. Or you can meter the darkest and



Clip-on meters can also be hand-held; \$87 Leicameter (left) couples to M-model Leicas, \$19 Vivitar 24 fits any camera with accessory shoe (but too loosely).

lightest of the important subject areas (those in which you're trying to hold detail), and set your camera for an exposure halfway between the meter's two recommendations.

Low-contrast scenes, such as those made on overcast days or in mist or fog, tend to look overexposed even when they aren't, because the blacks register unnaturally light. Try exposing one stop less than the meter's recommendation. But if you're trying for pastel tones in color shots, try giving one stop *more* exposure than indicated.

Measure incident light, though, and you can avoid the need for most of these compensations. Incident light is the light falling on the subject, not the light reflected from it; incident meters tell you what exposure will give you a middle-gray photo from a middle-gray subject under whatever light's at hand. Lighter and darker subjects will register thus automatically.

A few meters, like the Sekonic Studio and Minolta Auto-Professional on page 111, are basically designed for incident-light use; many reflected-light meters also have translucent white incident adapters that snap onto or slide over their light cells.

Usually, incident meters are held at the subject position and pointed at the camera. That's one reason why incident meters are so rarely used: It's a nuisance to walk back and forth to measure, and impractical to build such meters into cameras, (though some camera meters can be adapted).

Of course, if the illumination at the camera position is the same as the light falling on the subject, you can take a reading right where you are; just be sure the meter still has its back to the subject. This makes incident meters as handy as spot-meters under many outdoor conditions.

Since incident meters basically figure the exposure that an 18 percent-reflectance middle gray object would require, any reflected-light meter can give incident readings if it's aimed at an 18 percent gray card, (available from many photo stores). As long as the card gets the same illumination as the subject (which means, of course, that the meter must not cast its shadow on the card), incident and reflected readings will be the same.

You needn't even use a gray card—any object of known reflectance will do just as well, provided you change your exposure to compensate. If you use your hand, for instance, give your shots one stop more exposure than the meter indicates. If you use a white card (a very handy metering trick in dim light, where a meter may be unable to read clearly), give two stops more.

Creative judgment comes into play when the "correct" exposure you get by aiming the meter properly and interpreting the results isn't the right exposure for the artistic effect you're aiming at. Where incident light meters tell you how to avoid silhouetting your subject in a backlit shot, for instance, you might *want* a silhouette effect, in which case you'd have to underexpose considerably to get what you're after. If you're trying for a light, "high-key" effect, you'll want to give your photo more exposure than the meter recommends; for dark, "low-key" effects, you'll want to give it less exposure.

To bring out the maximum textural detail in one subject area, you might want to lighten or darken it a bit to shift it closer to the middle gray region where most details are visible.

Such creative disobedience to the meter's suggestions are worth learning—but only once you've learned what those suggestions really mean. ★★★



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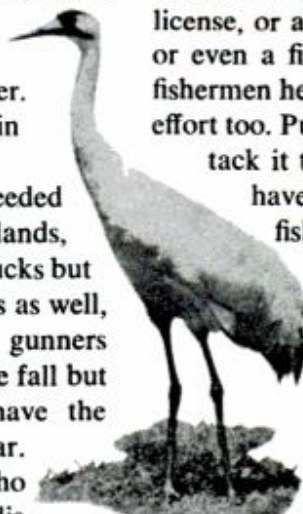
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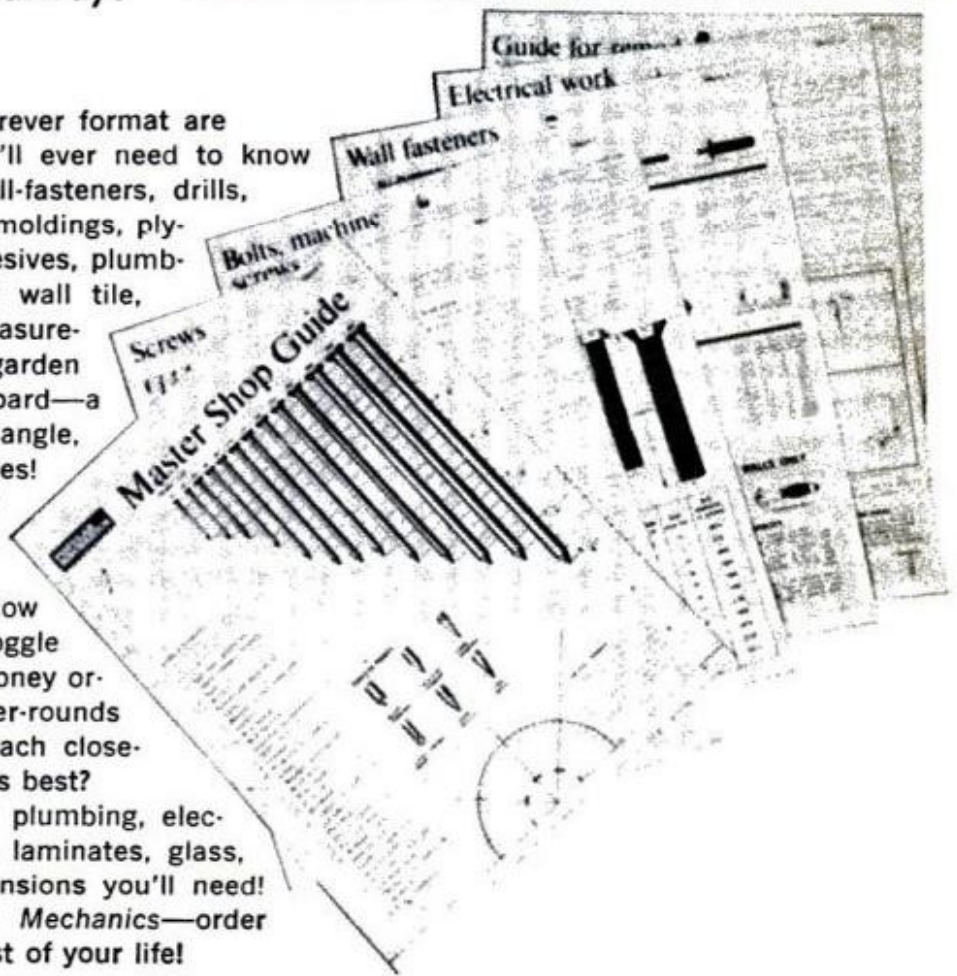


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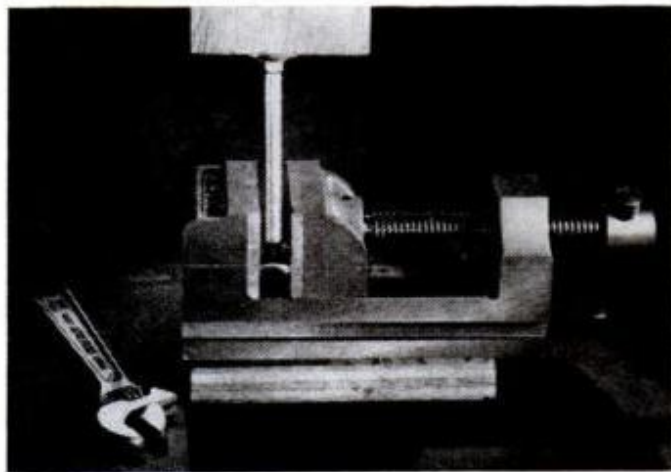
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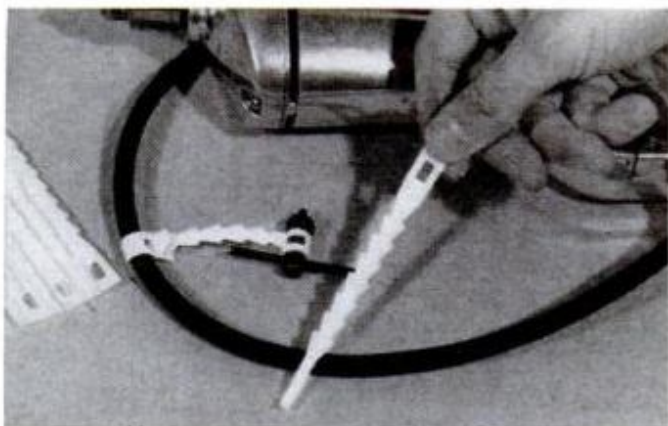
FROM READERS



Emergency jack

When a small jack is needed, a drill-press vise and a carriage bolt and nut will serve the purpose. The bolt should be slightly longer than the distance to be spanned; the nut is held in the vise and the bolt turned with a wrench at the square part of its shank. If the load is to be lifted more than an inch, set the vise on blocks with the bolt protruding through the vise bottom.

—Morris A. Kay, San Mario, Calif.



Chuck-key holder from bag ties

Ties of the notched type, supplied with some plastic trash bags, can also be used to tie a chuck key to the cord of the tool it belongs with. Two of these ties were used to make the chuck-key holder shown.

—Ken Patterson, Regina, Sask.



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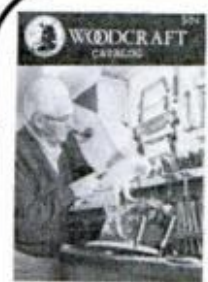
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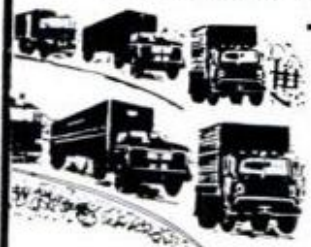
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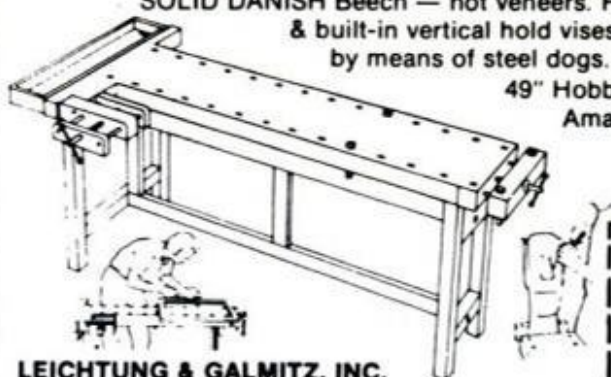


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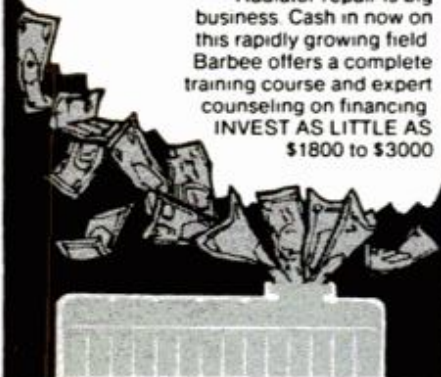
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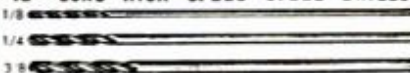
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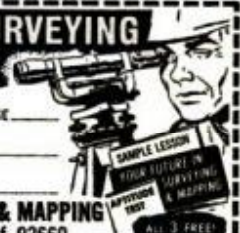


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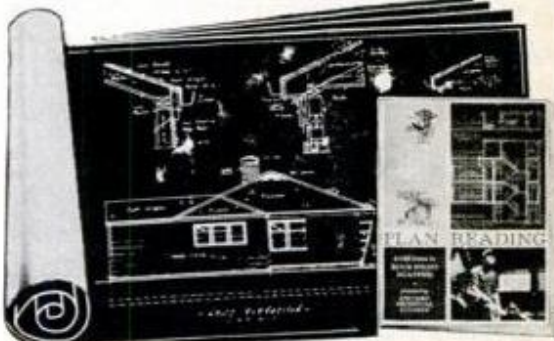
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(Continued on page 183)

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Would your banker make you a dandy offer like this?

Free booklet tells about an important financial safeguard

Suppose a banker made the following offer to a 35-year-old man...

"We will set aside \$25,000 in a special fund for you.

"If you die tomorrow, or *any* time before age 65, we will immediately pay this \$25,000 to your family.

"If you live to 65, we guarantee to pay you \$13,450 in cash. What's more, while we can't guarantee the exact amount, we should *also* be able to pay you an *additional* \$15,586 in dividends, based on our current dividend scale—for a total cash payment to you of \$29,036.

"Or, instead of the \$29,036 in cash—if you prefer, we will pay you \$202.38 a month—in *addition to* what you collect from Social Security—starting at 65 and continuing for every single month for the rest of your life. Even if you live to be 125!

"What do we ask in return for all this? Only that you pay a little over 2% interest a year on the \$25,000."

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Instead of "interest", of course, there's a premium. A premium that varies, naturally, according to your age. But no matter what your age, it's one that, based on the values the policy builds up, works out to be one of the *lowest* in America for participating Whole Life insurance.

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terest-Adjusted Cost Index" of only \$3.65 per thousand. If you can find a similar policy with *lower* cost comparison figures for your age, you'd better grab it!

And, after two years, the policy starts to build cash values, which you can borrow on at guaranteed low interest rates. For emergencies. For college expenses. For business opportunities. For that home of your dreams.

Our 35-year-old man would, for example, accumulate guaranteed policy cash or loan values of \$4,300 after 10 years, and \$8,900 after 20 years—*exclusive* of any refund of premiums in the form of dividends. Policy values, of course, depend on policy size and age at issue.

Financial experts say that most folks urgently need more life insurance—both to protect their family's security now, and to provide more income dollars so that they won't have to go through the agony of pinching every penny after they retire.

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(Continued from page 179)

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(Continued from preceding page)

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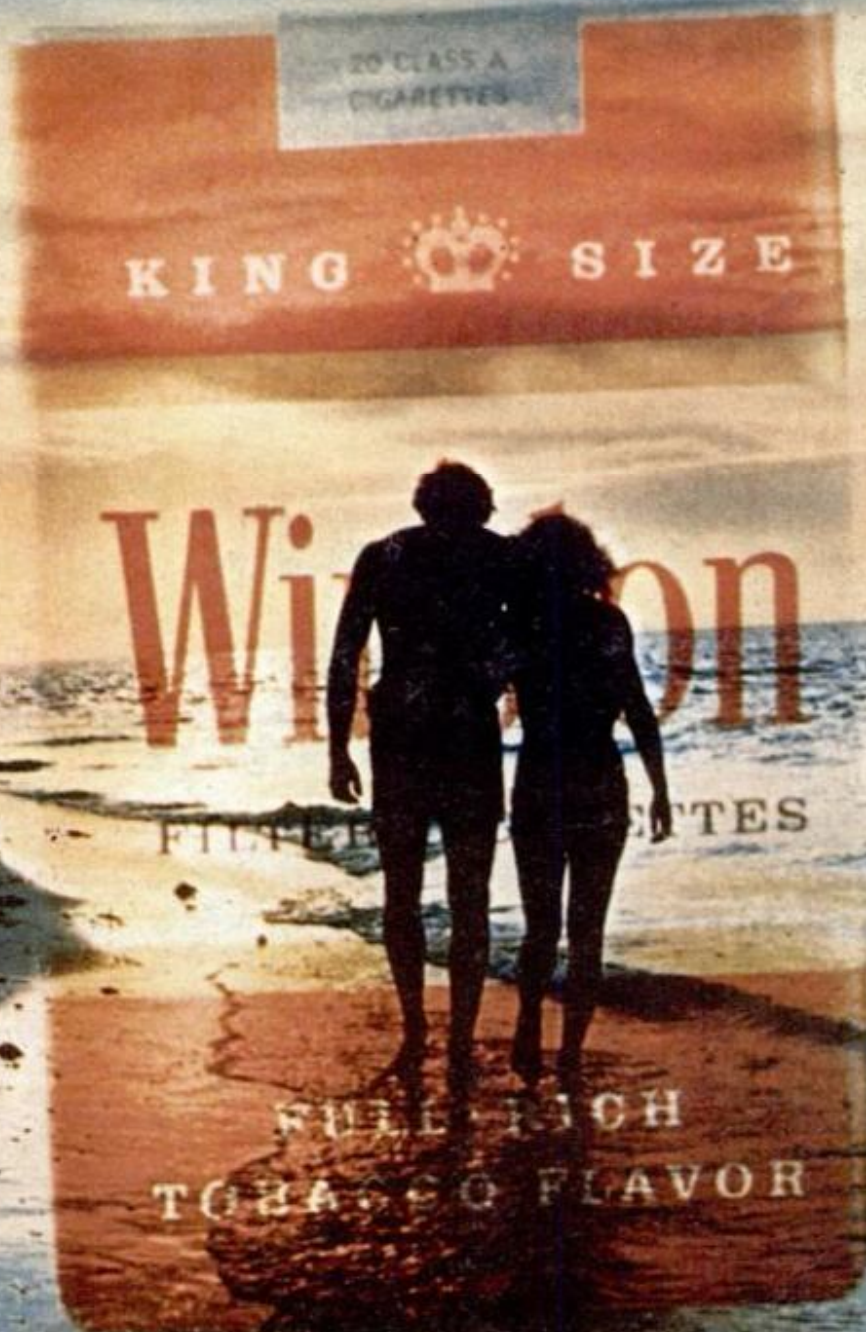
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