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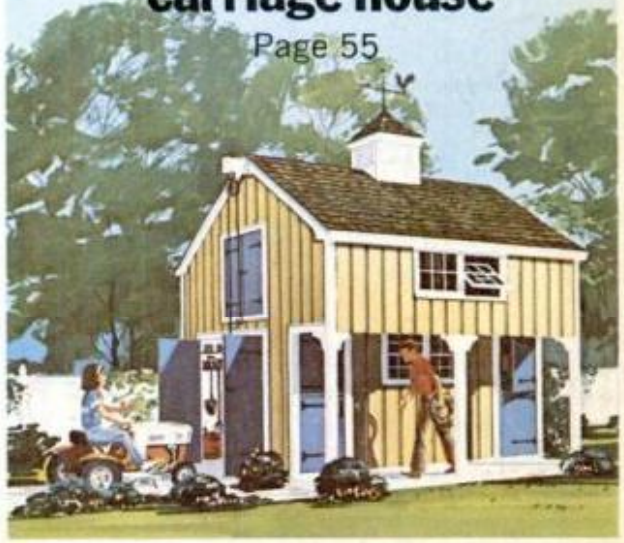

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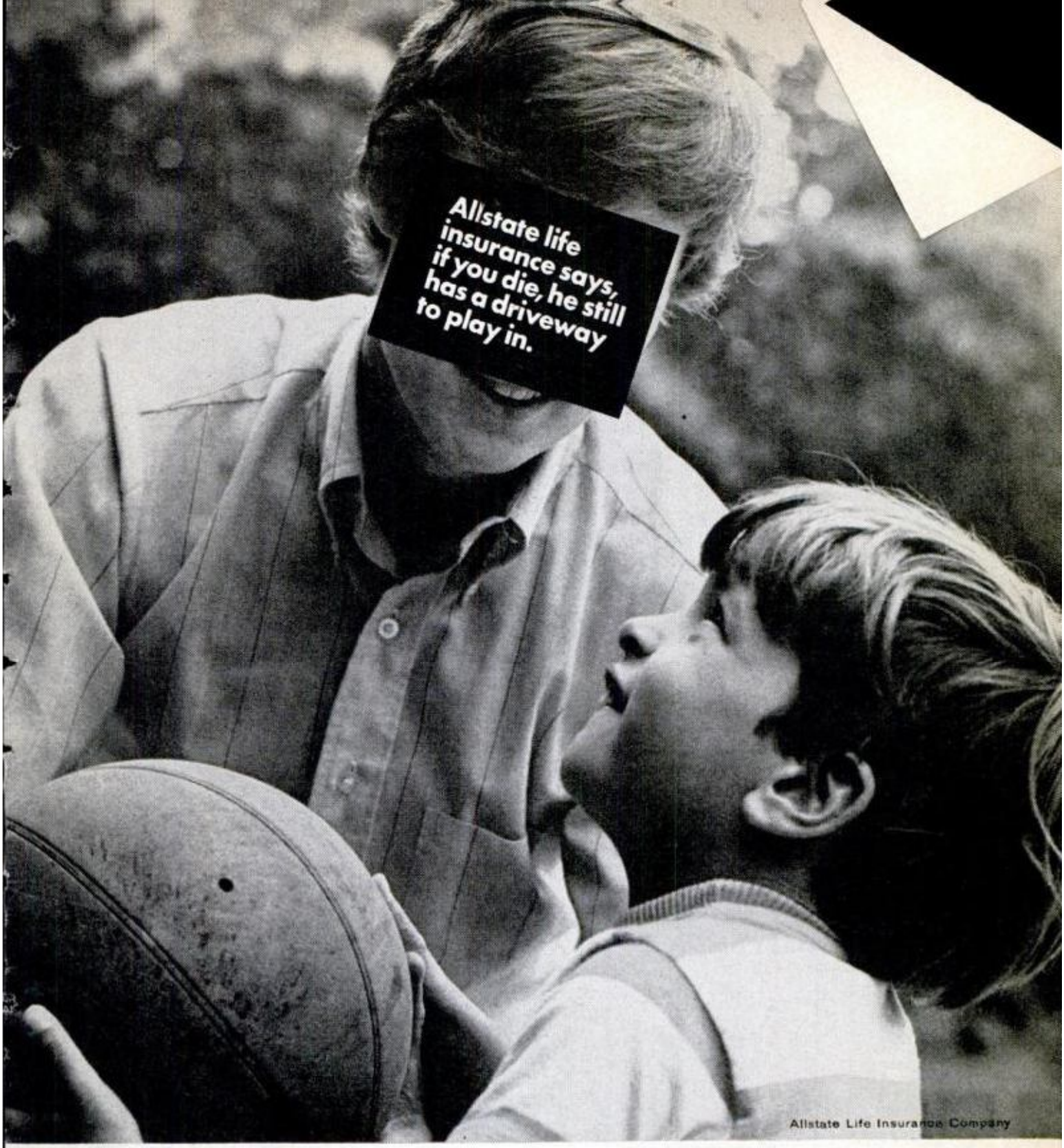

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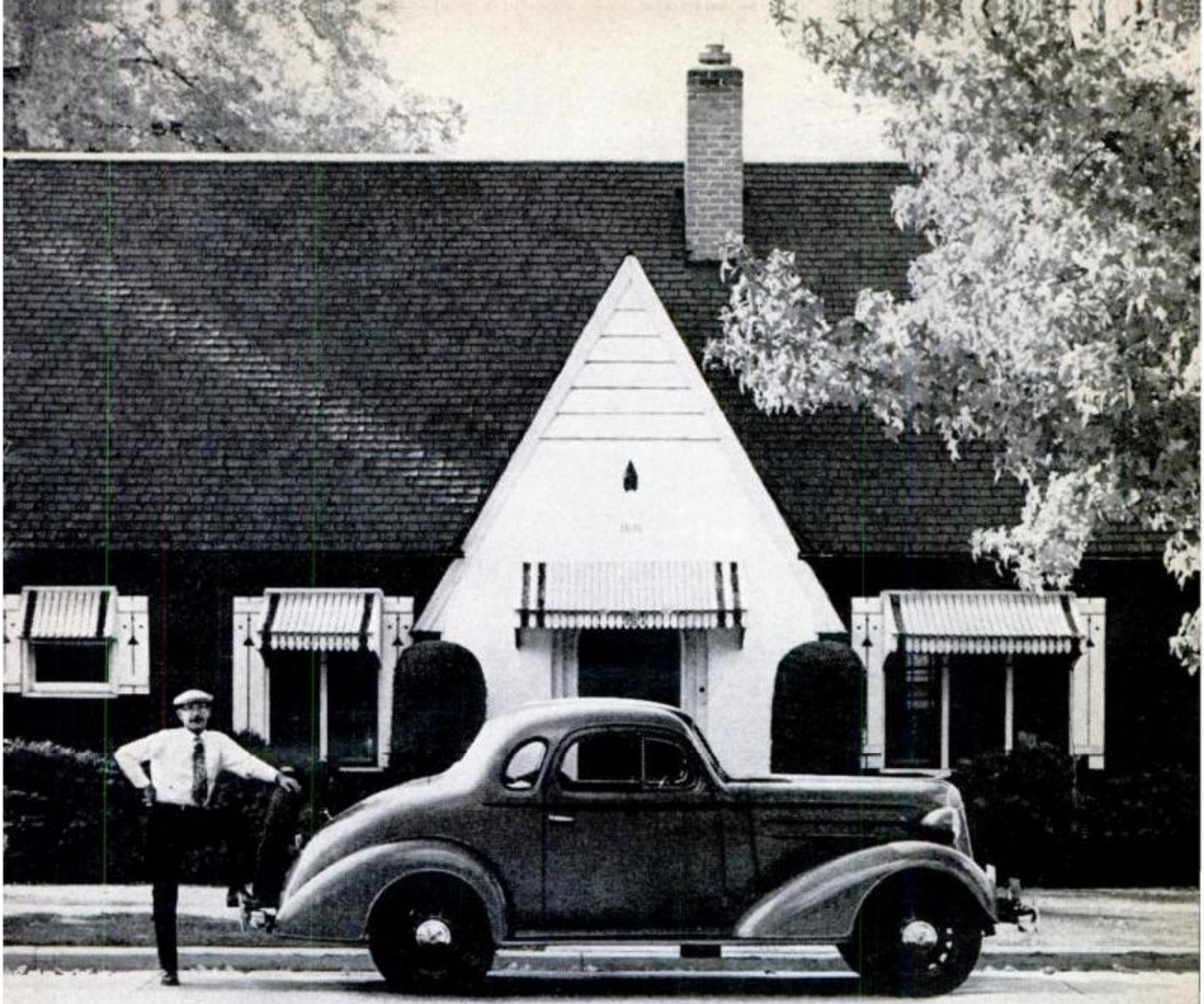

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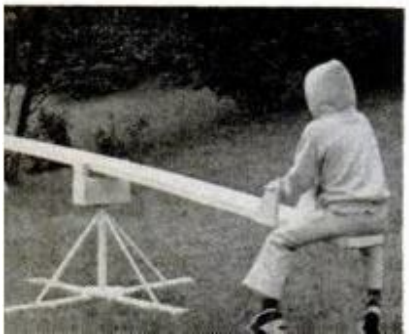

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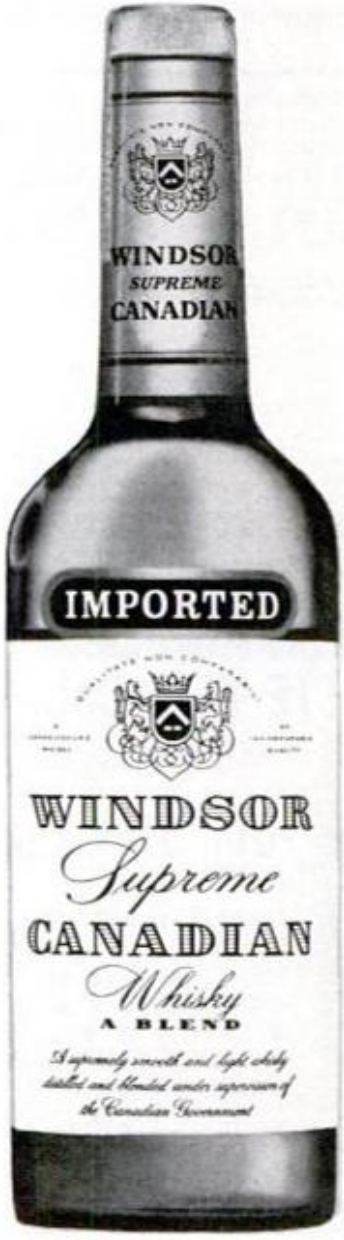

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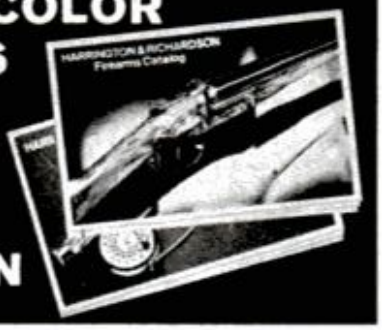

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LETTERS
TO THE EDITOR

No meal for Bill

If auto editor Bill Hartford knew anything at all about cars and their prices, he would eat his words (*Biggest bargain since the Beetle!*, page 108, Jan. *PM*). VW is the best economy car in the world (about 4 million other VW owners will agree). He seemed to like the Fiat better. And he stated that the VW Beetle was over $2000, which, as any fool would know, is not true. Now come on, Bill, don't let those Fiat commercials fool you.

COVINA, CALIF. CHRIS KOTOWSKI

"You're right, Chris," says Bill, "the VW Beetle is an excellent economy car. I know; I bought one new in 1962 and didn't 'outgrow' it until 1968. Wish I had it back.

"As for price, when the Fiat story was written in November, the basic VW Beetle (Type 111) was over $2100! Now, as this is written in January, after all the monetary adjustments, lifting of the federal excise tax and so on, the price is once again under $2000—$1999 to be exact. I hope it's still that price by the time you read this!"

Lusitania went down in 1915

Richard Petrow's article, *When great liners ruled the Atlantic* (page 66, Jan. *PM*) was very interesting. However, if he will check his history book for ships that were sunk during World War I, he'll find that the *Lusitania* was sunk by a German U-boat in the spring of 1915 (not during 1914) off the coast of Ireland.

OCEAN CITY, N.J. HORACE HAZARD

Right—it was May 7, 1915.

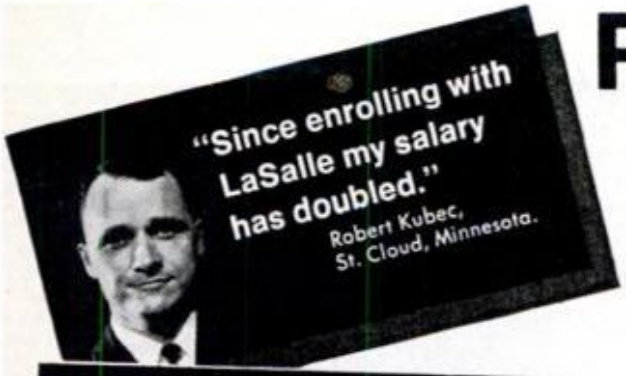
Help for shortwave beginners

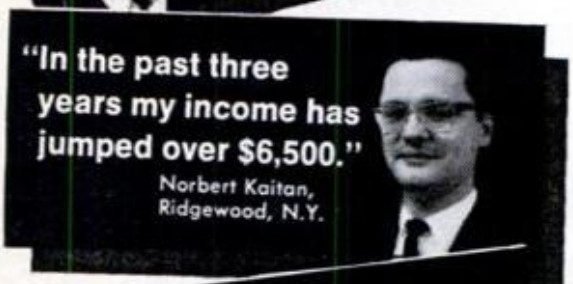
One thing that was left out of *Tune in the world* (page 90, Jan. *PM*) and which is essential to the beginning SWL (shortwave listener) is a list of the many DX clubs that exist. These clubs provide members with a bulletin which is filled with station schedules, loggings from fellow members and other useful data for a beginner. Here's a list of the most popular ones (all will send a sample copy of their bulletin for $1):

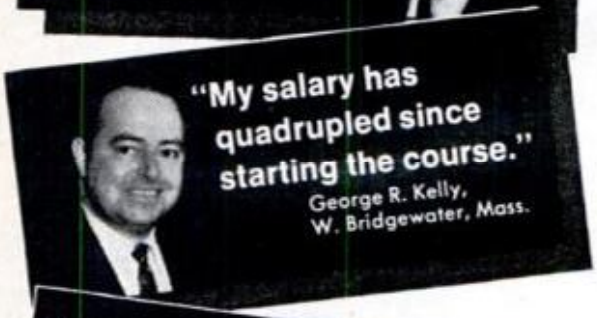
SPEE DX, P.O. Box 321, Santa Ana, Calif. 92702; American SWL Club, 16182 Ballad Lane, Huntington Beach, Calif.

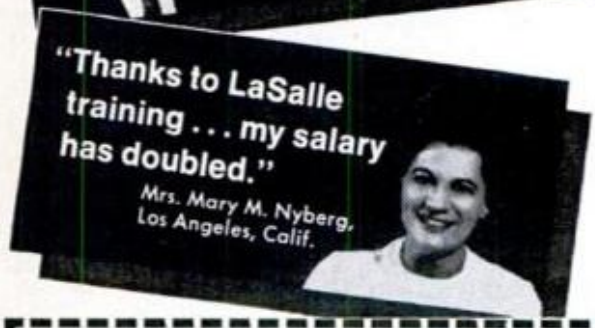
(Please turn to page 8)

WHO ELSE WANTS A BIG RAISE IN PAY?









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BROOKLYN, N.Y. PAUL MAYO

Missed by well-trained editors

In *How to get a well-trained dog* (page 84, Feb. *PM*), does the third paragraph on page 87 say what you want it to say? It looks garbled to me.
STAMFORD, CONN. BEN STURDLEY

It is garbled. The line that's fouled up should read: Upon stopping, he gives the command sit, *and pushes down on his dog's hindquarters.*

Learn from ordeal

I was especially pleased to see *Ordeal on Beartooth Mountain* (page 84, Nov. *PM*) come in time for this year's snowmobile season. A personal-experience article is worth a thousand lectures on snowmobile safety. Let's hope this ordeal will convince snowmobilers to take heed of weather forecasts before venturing far from home.
SAUK RAPIDS, MINN. MARK JARBOE

Twelves not quite 'dominating'

I must take some exception to Roger Huntington's comment that 12-cylinder engines are now dominating Formula 1 and sports-car racing (*Are eight cylinders enough?*, page 84, Jan. *PM*). A look at the 1971 racing season results shows a different story.

Ford's three-liter V8 won 7 of the 11 Formula 1 races and secured 137 points as against 63 points for all the 12-cylinder cars together. As for sports-car racing, the big-inch Chevrolet V8 powers virtually every Can-Am car (402 points vs 105 for the 12-cylinder Porsches) and the V8 Fords dominate USAC open-wheel racing. The only class of racing the Twelves prevail over is the World Championship of Manufacturers. This is due in part to the lack of V8 competition as a consequence of the perpetual changes in the displacement limit. Remember that just a few years ago the big Ford V8 machines walked away with this championship. Perhaps 1972 will be the year of the Twelves.
RED BANK, N.J. CHARLES M. HANSEN

Probably "dominating" is too strong a word for the performance of Twelves in 1971—but watch out for the Penske Porsche 12 and Mark Donohue in the '72 Can-Am competition. (And see next month's PM for a complete preview of 1972 road racing.)

Corrected before the correction

Here's a picture of what I did after reading *Build this old-time yard swing* (page 140, April '71 *PM*). I built the swing according to the plans—which made it 10 feet tall. Then I found your corrections in the June 1971 *Letters* column (in which you said the swing should be 8 feet tall and the swing hangers shortened to 88 inches) after I had already cut my own swing down to 8 feet. The fringe on the top is linoleum. The swing just one of the many things I find of use in *PM*.

VAN BUREN, ARK. E. J. ROTHERMEL SR.

Any other readers who want to build the swing can order Xerox copies of the original article for $1.20 from Popular Mechanics, Dept. JL, 224 West 57th St., New York, N.Y. 10019.

Learn in a parking lot

It's not very often that a widely read magazine such as *PM* will offer such enlightened suggestions as that of practicing spin recovery on snow in a deserted parking lot (*Learn about winter driving from the ice racers!*, page 76, Dec. *PM*). Usually such information is published in the enthusiast magazines.

I agree fully with author Dick Bauer: You have to know how to handle your car to be a safe driver.

It's a shame that most U.S. drivers are ignorant of this. They seem to have the attitude that if you're insane enough to put your car in a "death spin," you'll turn over, or at least cause undue wear and tear on your tires.
LINCOLN, NEBR. GEORGE H. WEST

They have one, too

The Reeseville Fire Department has had an all-terrain vehicle in service for about one year. Like the *Amphibious fire engine*

(Please turn to page 10)

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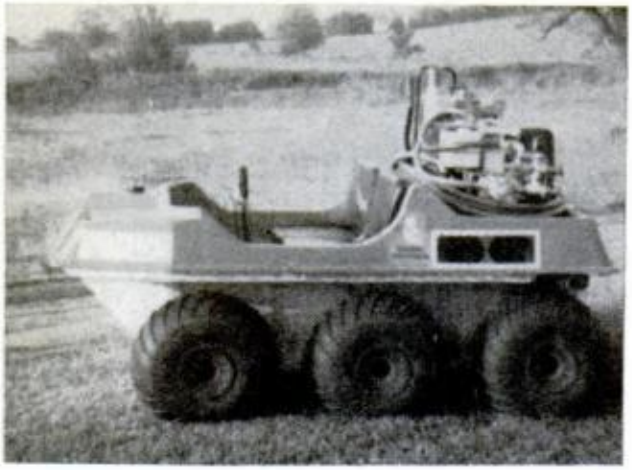


(page 14, Dec. *PM*), it can travel through almost anything to get to remote places to fight grass fires. Top speed is about 28 mph.

Our unit carries two men, 35 gallons of water, a pump, 50 feet of hose and a portable hand radio.

REESEVILLE, WIS. WILLIAM LAU
FIRE CHIEF

December: good or bad?

I have been reading *PM* for the past 30 years. I've enjoyed it, and I hate to see it go to the dogs. Do you realize there was only one general-interest story in your December issue?

What's happened to your articles on American cars—not the Jeeps, etc., but the full-size standards?

LUTZ, FLA. DON SISSEL

In my opinion, the December issue is the most worthwhile and interesting in many, many months. No articles about new cars. Glory be! I don't expect the entire magazine to be devoted to my hobby, woodworking, but I do dislike about one-third of the editorial devoted to automobiles.

LONG BEACH, CALIF. WILLIAM E. PLUM

Great Workshops and weather sticks

Your articles on Great Workshops are terrific. I just finished reading about Mel Crosby's shop in the January issue ((*A craftsman's shop that lets you work like a pro*, page 55).

LAKE FOREST, ILL. JAMES A. HUME

I'm sure there are many readers like myself who would like to have such a shop. But, then, who among us is in the league Mel obviously is?

FORT WORTH, TEX. HENRY BRENT

After reading the January article and being a new reader of *PM*, I'd like to get reprints of previous workshops.

WYOMING, MICH. FRED LEMON

Unfortunately, because of the popularity of the articles, we've run out of tear-sheets and such. Xerox copies of the articles are 20 cents per page plus 20 cents for postage and handling. For $1.20 each, plus the 20-cent postage fee, you can get copies of Is this the world's best workshop *(page 146, June '70 PM) and* A Workshop crammed with ideas you can use *(page 138, June '71 PM) from Popular Mechanics, Dept. JL, 224 West 57th St., New York, N.Y. 10019.*

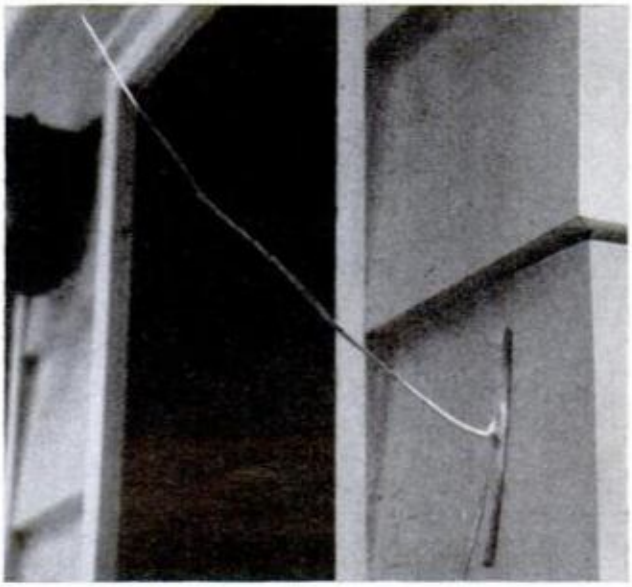
These layouts are absolutely unreal. My wife reads *PM* and when she sees one of your "ideal" working setups, she says, "Why don't you keep your shop like that?" I simply pretend I'm engrossed in a TV program. The only time my shop does get cleaned partially is when my wife sweeps up to keep me from tracking sawdust into the living room.

SACRAMENTO, CALIF. W.G. WAGGONER

In reading about Mel Crosby's workshop, I noticed that he made one of those balsam fir weather-forecasting devices. How does it work?

MANSFIELD, OHIO WALTER C. STEVENS

Here's a photograph of Mel's "weather stick" given to the author. The entire stick



is taken intact from a balsam fir tree and the bark is whittled off. The base of the stick is a small portion of the trunk; the twig is a small branch of the tree about 16 to 18 inches long. One tack holds the weather stick in place. In fair weather, the stick points upward (as shown). When more humidity or precipitation is on the way, the stick points down. ★★★

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YOU GET ALL THIS with new NRI Master Automotive Technician home training. Included is the NRI Achievement Kit we send you the day you enroll . . . ten outstanding kits of automotive testing and repair equipment, plus educator-acclaimed NRI "bite-sized" texts — all yours to keep and use for years to come.

NRI announces a dramatic new way to learn Automotive Repair at home

Top auto experts praise NRI's new training plans

After more than two years of preparation, NRI has made available two new home training programs in Automotive Servicing and Repair, acclaimed by experts as "amazingly complete" and "up with the times." NRI asked two of America's foremost automotive experts to critique its new program. William H. G. France, president of NASCAR and the International Speedway Corp., reported, "The new NRI courses for mechanics are amazingly complete and seem to cover all major aspects of today's sophisticated cars. If you're at all interested in automotive training, I suggest you investigate NRI." Car-tester/writer Tom McCahill was equally enthusiastic. "I've been around cars since bathtub gin, and I've never seen home training for mechanics as great as this."

Professional equipment included at no extra cost

NRI gives you the choice of Master Automotive Technician training or a shorter Automotive Tune-Up and Electrical Systems course for the man seeking greater understanding of basic car repair. The Master course covers every major aspect of auto repair, from changing spark plugs to operating your own garage or car-care center. You not only learn the how and why with NRI's proved-in-use "bite-sized" texts, but you also get professional training equipment you need to actually do the work on your own or other cars as you move along in your home training. Equipment you get — at no extra cost — includes your own ignition-analyzer scope, as well as a dwell-tachometer, timing light, complete set of tools, volt-amp tester and assorted gauges. You get ten kits in the Master Automotive Technician course, eight with the shorter Automotive Tune-Up and Electrical Systems Training program.

The professional tools and equipment you get from NRI are yours to keep and use in the years to come, as you build a top-pay career as a Master Mechanic, or earn $5 to $7 an hour in spare time, or simply save money by repairing your own cars at home.

Train with the leader

The same pioneering home training methods and innovations which have made NRI the leader in other career training fields are now offered to ambitious men who want to turn their interest in cars into a solid, well-paying career. Take a tip from Tom McCahill and Bill France and train at home with the leader. Rush coupon now for free NRI Automotive Catalog. NRI AUTOMOTIVE DIVISION, Washington, D.C. 20016. No salesman will call.

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ALL OUTDOORS

By BILL McKEOWN

WITH 12 MILLION CAMPERS predicted for this year, plus nearly 500,000 new recreational vehicles for a total of four million on the road, it's going to be busy outside this summer. Both good and bad laws will be one result as legislators decide they have to do something about this "problem." Smart outdoorsmen will play watchdog whenever possible to stop unnecessary laws before they get started.

Some communities are already insisting RV owners park their rigs behind the house out of sight. Others object when you use one as a conveniently remote guest house for your mother-in-law. There may be some reason for the rule if your camper looks like you just hollowed it out of a log. But many new regulations are needlessly restrictive.

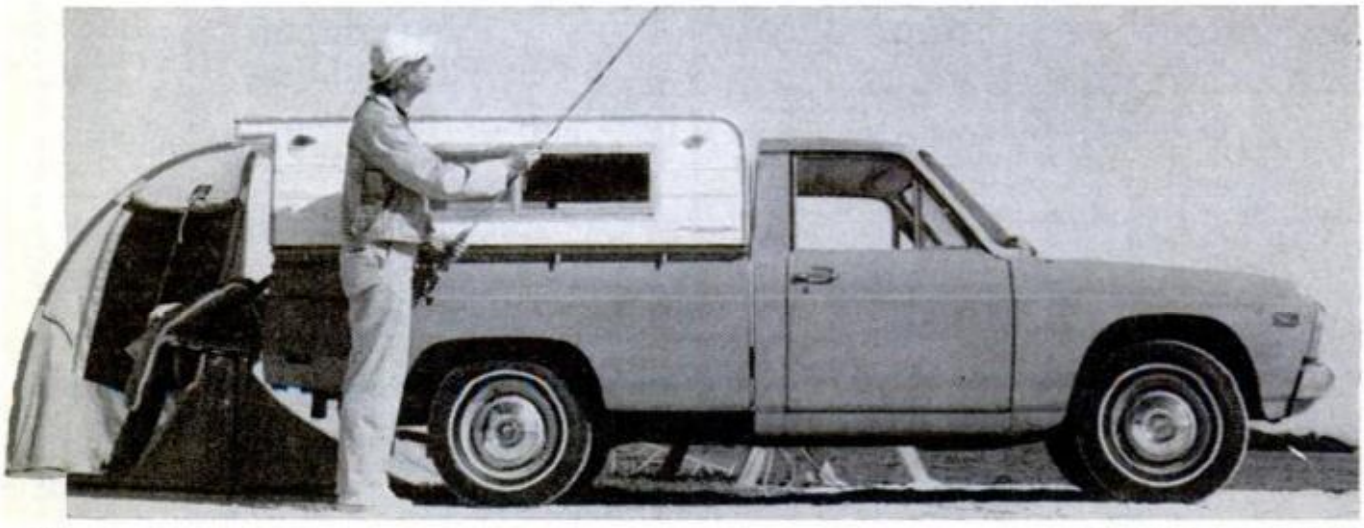
Texas seems to make sense with a requirement that trailer brakes should hold when the rig is stopped on a slope. Modifications appear to be in order for some surge-brake installations. Connecticut intends to require that by 1973 all pickup campers must be weighed at licensed public scales and weight must be within the maximum set by the manufacturer. New laws there will also specify that fire extinguishers, safety glass, outside venting for gas appliances, safety latches for doors and "gas detecting devices" be installed or carried aboard.

UNUSED FARM ACREAGE *may become a new source of recreational land. Colorado, Indiana, Iowa, Louisiana, Michigan, North Dakota, Oklahoma, Oregon, Pennsylvania and South Carolina will have five counties apiece in which the idea will be tried this year, according to the U.S. Department of Agriculture. The pilot program will test the feasibility of providing free public access to sections of private farms for hunting, fishing, hiking or trapping. In the 50 test counties, farmers taking part in the set-aside program, which limits planting of wheat, feed grain and cotton, could receive a payment for the public recreational use of part of their unplanted land if it is suitable. A spokesman for the department's Agricultural Stabilization and Conservation Service tells us state conservation and wildlife management committees will help select test counties at various distances from cities. Land must have some form of growth to prevent surface erosion and it is hoped that crowds from urban centers won't over-use nearby land. But if the test program proves workable, it could open millions of acres of farmland for recreational use.*

YOUNG UTAH HUNTERS, as well as older sportsman, have watched a TV Hunter Safety Program beamed out from Salt Lake City this spring in a weekly early evening television show that could well be copied by other states. Enrollment gift certificates for the course were available to parents buying guns for Christmas

(Please turn to page 14)

FORD'S NEW COURIER, its mini-pickup from Japan, looks like a toy (and also a Toyota or Datsun) but is pleasant for compact camping, we found, and should attract West Coasters after spring introduction there



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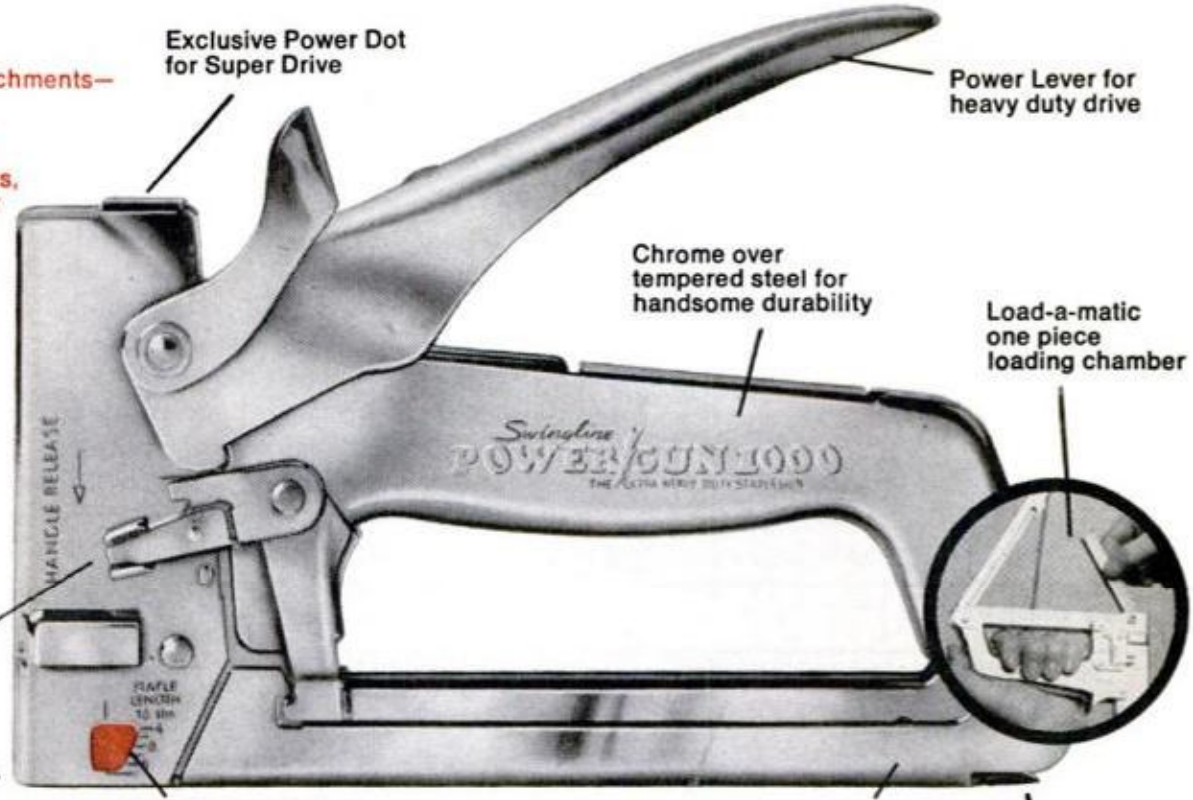
A great new breed of staple gun...



Three new attachments—one to grip and hold wire, one to repair or make screens, one to repair or make shades.

Exclusive Power Dot for Super Drive

Power Lever for heavy duty drive

Chrome over tempered steel for handsome durability

Load-a-matic one piece loading chamber

Safety Lock for pocket or storage

No jam problem—easy to clear

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Swing-open bottom loading

Built in staple extractor

new Power Gun 1000 does more:

If you're a homeowner you've got to own the new Swingline Powergun 1000, the first extra heavy duty staple gun that does it all. You name it. You'll find hundreds of uses, indoors and out.

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ALL OUTDOORS

(Continued from page 12)

from the Division of Wildlife Resources through major sporting goods dealers.

FINDING THE MATCHES on a rainy night while setting up camp has been answered by some admirable new self-lighting accessories. Joining the new line of equipment from Trailblazer by Winchester, the camping and outdoor clothing operation of the Winchester Group of Olin Corp., are a "matchless" stove, lantern and heater. Built-in sparkers that work on the piezoelectric principle of generating electricity through applied pressure are installed in a two-burner propane stove and a 7000 B.T.U. catalytic heater with variable heat control. Single and double mantle lanterns that can also be turned down to reduce glare use sparking flint lighters.

Several makes of catalytic heaters are now available with the small, convenient and moderately expensive LP bottles for fuel. Ease of lighting, I feel, makes up for any added pennies of cost, however. The tower of flame that goes up when you overprime a catalytic with liquid fuel may do no harm, but it means you'd better light those heaters outdoors and it certainly scared the other boats in the harbor when I started one up at night and it looked like we were on fire.

TOWING A CAR LIKE A DINGHY *behind your motor home or pickup camper is getting to be a popular way to add wheels for short errands and trips while the camper holds your campsite space. Chevrolet recommends its manual shift compact Vega, (models with automatic transmissions must be towed only short distances at slow speeds). But with your stick-shift Vega, simply remove your hex-shaped TCS (transmission control spark) switch on the transmission, after disconnecting the wire, and pour in extra transmission oil up to the top. Reinstall hex switch and wiring, say the Chevy engineers, and you're ready to tow at highway speeds.* ★★★

DODGE'S 1972 ADVENTURER is said to be the only new four-wheel-drive vehicle to be offered this year

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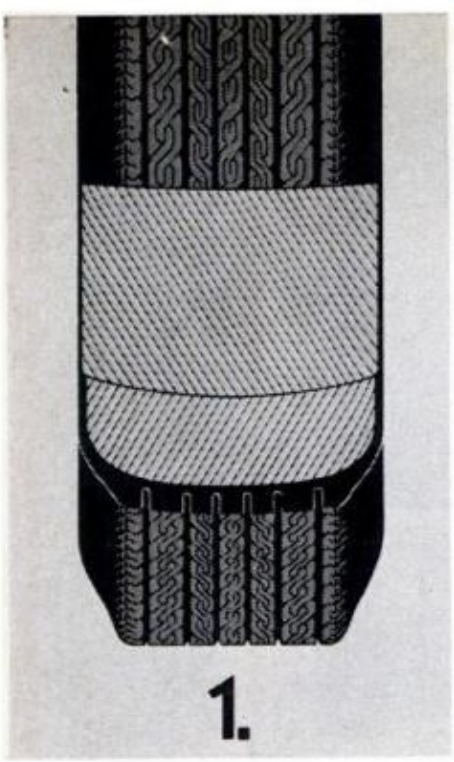

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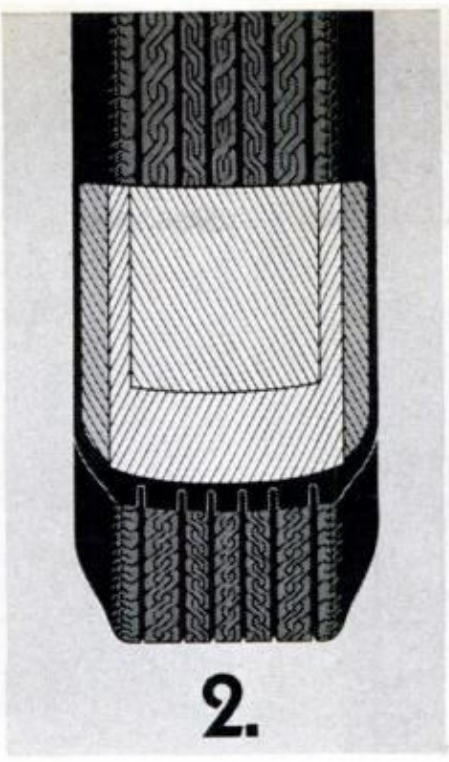

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How to build the people tire.

The problem? Design a tough tire for a new world that has more driving for people to do, more curbs for people to run over, more people who are too busy to check their tires.

1. Give it strong polyester body plies, full tread depth, and a concave molded tread.
2. Put two armor belts of steel under the tread. Steel cords so strong a single cord will pull a car. Cords set so close together you'll need 805 feet for each tire.
3. Or simply see your Firestone Dealer, Store, or service station. You'll find we've already built The People Tire and it's ready for you.

We're not saying it's a tire you *shouldn't* take care of. We're saying that, with a little care, it will really take care of you.

Firestone
500 Steel Belt
the people tire

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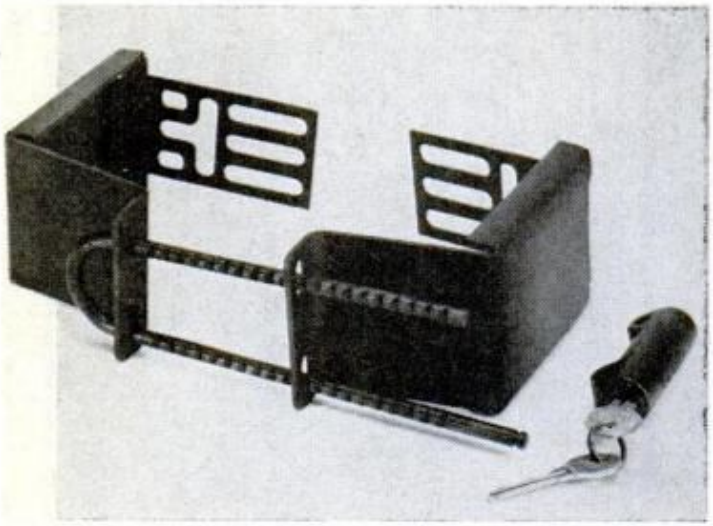
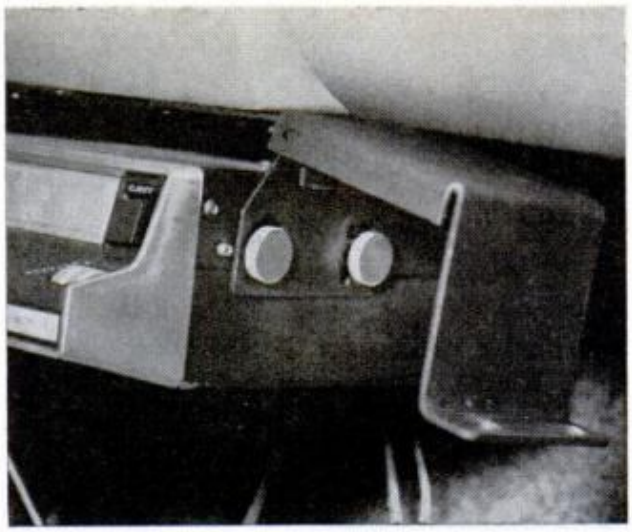
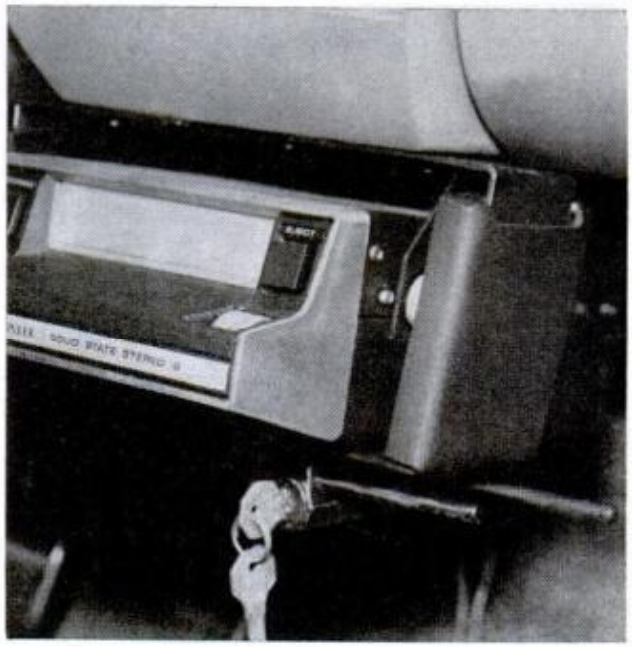
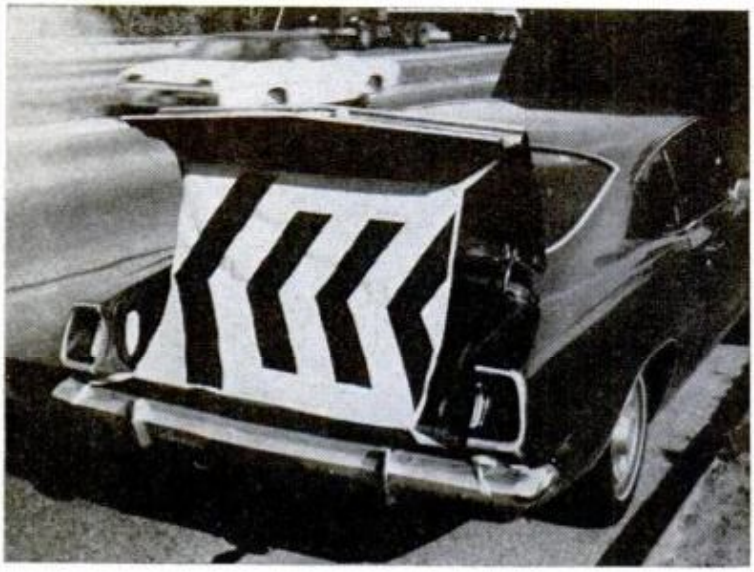
NEW FOR YOUR CAR







YOU CAN THIEFPROOF a dash-mounted stereo tape deck with this ingenious locking bracket—a welcome aid in view of today's high rate of stolen machines. The wraparound bracket completely encloses the player, making it impossible to reach and remove the mounting screws. Shown here in use with a Craig player, it's adjustable to fit any deck up to 9 inches wide by 3¾ inches high. You first remove the machine along with its regular U-shaped hanger, then you reinstall the hanger with the upper ends of the protective bracket sandwiched between it and the underside of the dashboard (upper photo at right). Slotted openings in the bracket's ends usually let you use the same screw holes without having to drill new ones. Sides of the bracket swing down around the player and are fastened securely together underneath with a long shackle and key lock (lower photo at right). This conceals the hanger screws, making them inaccessible. The bracket can also be used with most floor-mount decks simply by installing it upside down. Called Dek-Lok, it's made by Dek-Lok, Inc., 1174 Great Southwest Parkway, Grand Prairie, Tex. 75050. It's available for $9.95 postpaid from Southwestern Sales, Box 35665, Dallas, Tex. 75235.



EASILY SPOTTED by passing motorists, this brightly colored warning sign is designed to protect a disabled car parked along the side of the road. Made of flexible vinyl, the 30x40-inch emergency aid can be quickly stretched between the opened trunk lid and bumper to guard the rear of the car. Elastic loops at the corners hook over the bumper and the corners of the trunk lid to hold it in place. The sign is colored a high-visibility yellow with a black arrow design. It can be rolled or folded for easy storage in a car trunk. Price is $3.79 postpaid from Sta-Put Enterprises, Inc., Box 21, Massapequa Park, N. Y. 11762.

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Our love for the sea has become a science.

We were working to protect clean water long before the word "ecology" became popular. Because without it we're sunk.

Our engineering efforts have resulted in new anti-pollution fuel systems that recirculate unburned fuel; cleaner burning 50:1 fuel/oil mixtures; high intensity Magnapower ignition system and improved spark plugs that assure more complete fuel burning.

We've done a lot about "ear pollution," too. Our new silencing systems have made our 1972 engines the quietest we've ever built.

And we've only just begun.

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Light Fantastics: Chrysler Lo-Profiles

Here's a light touch by Chrysler. Outboards especially designed for the fisherman. They're lightweight, easy to carry. And low, out-of-the-way silhouettes give you full 360° fishing from any seat in the boat. They're powered to your needs, too—in 6, 8, 9.9 and 12.9 hp.

And, if you ask them, they'll do more than fish. For example, the 9.9 and 12.9 Lo-Profiles have enough power to start a small youngster on skis. Or as Autolectrics, they brighten the night with dome lights, generate accessory power, charge the battery and turn on when you turn the key.

All Lo-Profile Chrysler outboards have full gearshifts (easily adapt to remote control); 6-gal. Tote Tanks with fuel gauges; new Chrysler-designed anti-pollution fuel recycling system; self-relieving chokes; no-shearpin props; all-speed Power-Charging; 50:1 fuel/oil mix; up-front controls. And for 1972 they're quicker, quieter and even more economical to run. What's more, they weigh less per hp. than any other outboards in their class.

Family-Style Fun in Chrysler Family-Size Outboards

Chrysler designed these family-size outboards for family fun. So live it up with the Chrysler 55 that weighs less than other lower hp. models. Or raise them up on skis with the sure-fire 45, with Chrysler's exclusive Magnapower C-D ignition. You can challenge the competition with the Chrysler 35—proved year after year to be the winningest in its APBA racing class. Or for just plain "kid's stuff" simplicity there's the Chrysler 20—quietest in its class even at flat-out speeds. They all have Chrysler's anti-pollution fuel recycling system, plus new hustle, muscle and drive for '72.

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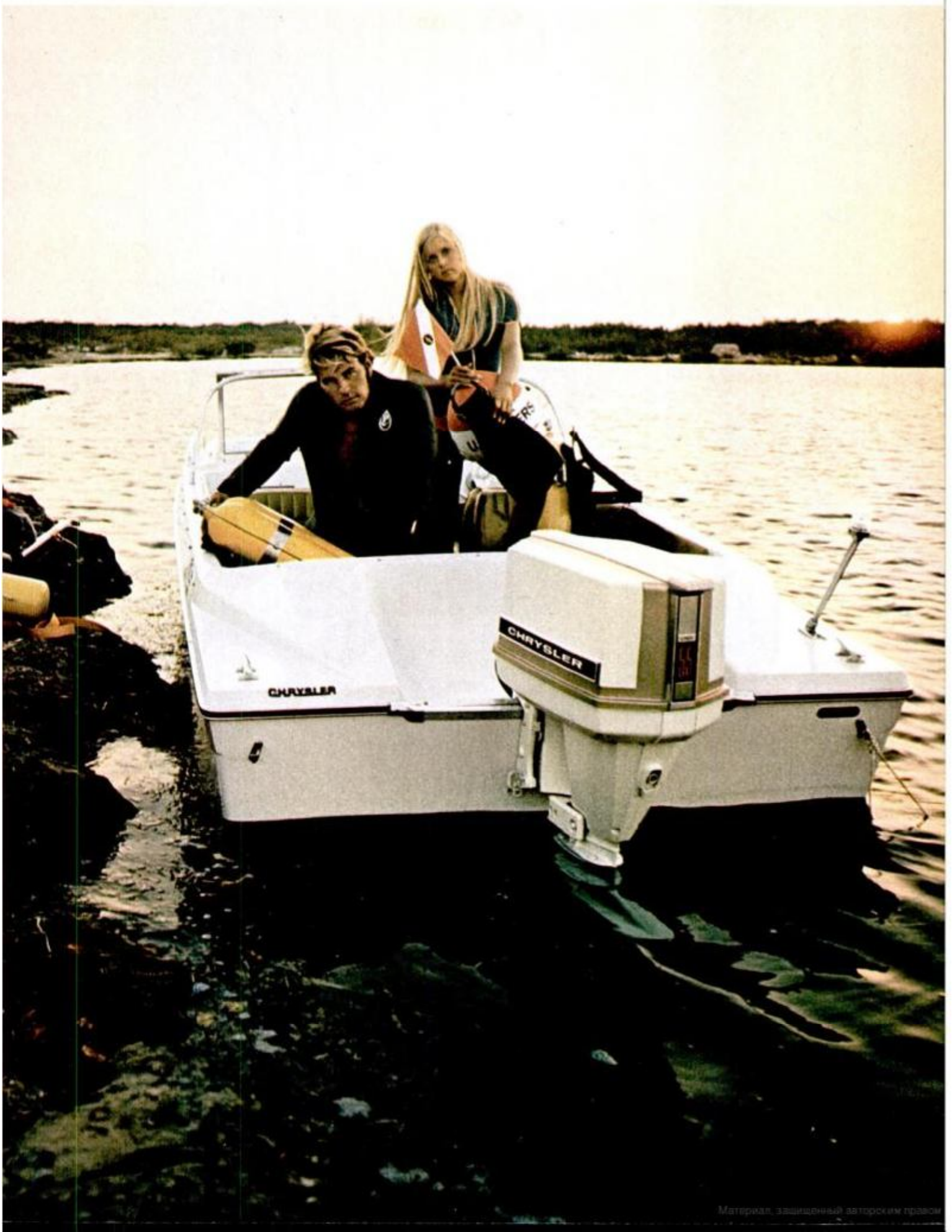

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Chrysler Puts You Out In Front For The Fun Of It!

Chrysler designed these bowriders just for fun. Walk-thru windshields give you complete versatility and convenience fore and aft. Deep, soft upholstered seats provide luxurious comfort for relaxing and fun. Wall-to-wall carpets, full-padded coamings, and padded backs in the bow cockpits make these bowriders "plush" from stem to stern.

COURIER 154

You have five bold choices for '72: three 15′, 16′ and 18′ Cathedrals; two exclusive, premium design Hydro-Vee Couriers—a big 17-footer and an all-new 15-footer that looks more like a sport boat than many sport boats.

But bowriders aren't all that's new from Chrysler. There are two brand-new Hydro-Vee runabouts: sporty 15′ and 16′ Chargers with deluxe cockpits, lockable sea chests, hand-crafted fiberglass construction. Sophisticated, new hull design for soft, dry rides. Plenty of room for people and gear.

CHARGER 154

Chrysler's exclusive Hydro-Vee hull is pure premium quality. An advanced combination of the roomy, soft-riding luxury, safety and stability of a premium deep-V hull, plus the fast-planing, responsive control of a high-performance hydroplane. Every boat is built by hand, with layers of fine glass matting, roving, cloth, resins and deep-hued gel coats.

Check Chrysler's 43-boat fleet; bowriders, runabouts, fishing boats, bass boats, utilities, sailboats, light cruiser and a sport boat; 12 to 24 ft.; fiberglass or aluminum; I/O or outboard. All BIA certified.

CHARGER 186

Ride with the bold, beautiful bowriders by Chrysler. And be a front runner in the fun.

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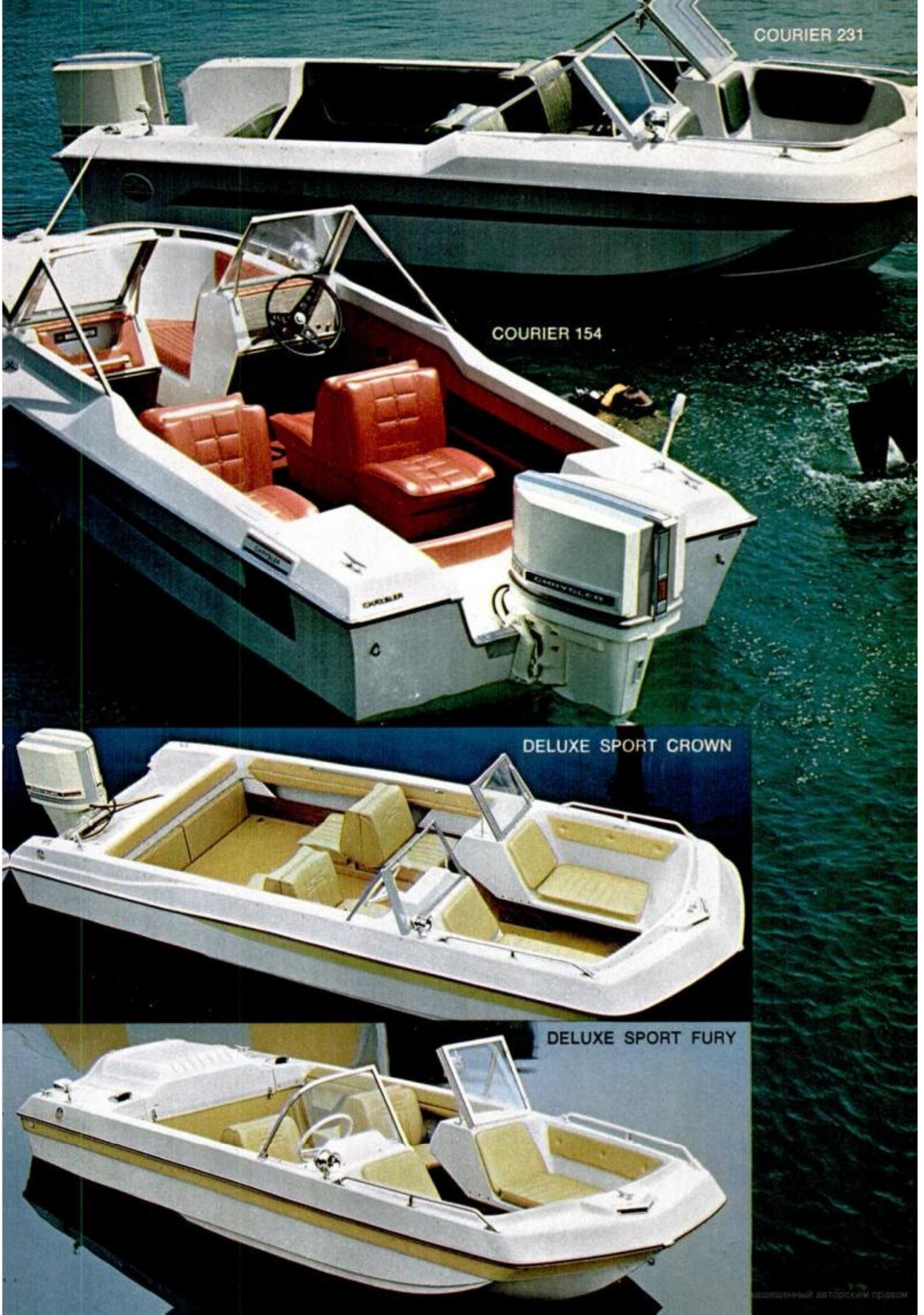
COURIER 231
COURIER 154
DELUXE SPORT CROWN
DELUXE SPORT FURY

The Matchmakers: '72 Chrysler Hi-Performance Action

Famous Chrysler engineering brings you together with high-powered action in 70, 85, 105, 120, 130 and 150 hp. sizes—all certified by BIA. High-energy Magnapower C-D ignition gets you started *fast*—even with a weak battery. You can keep your boat on the water longer with full-bore power all season and little reason for mid-year tune-ups. Chrysler high-performance engines also offer you prolonged no-miss idling; circle-gap plugs that actually clean themselves; new solid-state voltage regulator/rectifiers that significantly increase battery life.

Chrysler engineering also offers new convenience and improved performance with an optional Combination Power Trim / Power Tilt. It's Chrysler's patented electric-hydraulic unit that mounts completely on the motor—not on the boat. It's the industry's only two-stage trim/tilt unit that you can operate at the touch of a single switch. You can make fine adjustment through normal lock bar range, and raise engine full-up for beaching or trailering.

Hi-Performance models feature Chrysler's proved all-speed Power-Charging, the unique head/piston/port design that delivers more certified hp. per lb. New muscle and corrosion-free components inside. A new, Chrysler-designed anti-pollution fuel recycling system. And, with Chrysler's simplified engineering design, you can do more basic service on a Chrysler outboard yourself.

Chrysler's super 70 combines an economy price with superb performance. Chrysler's 85 is North America's most powerful 3-cylinder outboard. The conservatively rated 105 is a proved performer from the word go! The 120 is proof that big power can be beautiful—and versatile—and reliable. And the all-new, ocean-splitting 130 is the maximum outboard you can hang on most popular-size hulls . . . the most hp. that's BIA certified for a production engine!

Top all that off with a Chrysler engineering breakthrough: the new limited-production Racing 150 . . . highest hp. ever certified by BIA ! Take a closer look at the Chrysler Hi-Performance outboards . . . you'll get a whole new outlook on boating.

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Your Chrysler Crew Dealer has fishing maps or a boating guide for you free!

Where to find fish

Detailed maps of twenty of the best fishing spots in the U.S. and Canada have been assembled by Jerry McKinnis, one of the nation's top fishermen. Known by millions of sportsmen through his Chrysler-sponsored TV Show, "The Fishin' Hole", McKinnis tells where to launch, where to find the big ones and what tackle and lures to use. It's a handy guide to local fishing and hunting regulations, and much more useful information for a fisherman and boater.

How to get the most out of boating

A comprehensive guide for the boater. It covers such important points as boat construction, how to select a boat or sailboat; seamanship, how to use tides and currents. It gives navigational aids, tells you how to read charts and the weather. You'll learn how to tie knots. And you'll get a list of nautical terms and the rules of the road. A helpful handbook for every boater with a retail value of 60¢.

Visit your Chrysler Crew Dealer for your free fishing maps or boating guide

There's nothing to buy. Nothing to fill out. Just visit your Chrysler Crew Dealer and ask him for your free copy of the fishing maps or boating guide. They're free as long as they last. While you're there ask to see the exciting new line of '72 Chrysler outboards and boats. (You'll find your nearest dealer listed in the Yellow Pages under "Outboards" or "Boats".)

...And ask him about "Customer Care"

We want you to be satisfied with Chrysler boats and outboards. We engineered them with that in mind. That's why we offer you the industry's only personalized Customer Care program—to prove it. See your Chrysler Crew Dealer today.

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Whatever practical skills you've been wanting to develop, Audel has comprehensive, step-by-step Guides to help you. They show you all the professional tricks of the trades in clearly diagrammed and illustrated "how-to" steps. They can save for you, over and over. Here are four of Audel's many fields . . .

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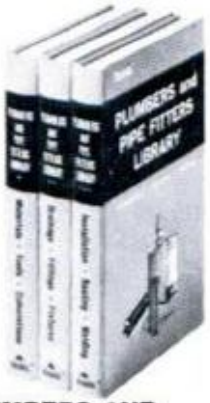

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Three books covering the entire field—1216 profusely illustrated pages on practical fundamentals of basic machine shop operations, setup and operation of spot machines, down-to-earth data on toolmaking procedures, layouts, jigs and fixtures, etc. . . . equally valuable for beginners and experienced men alike. No. 23174—3 Volumes—$16.95

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SOLUTIONS FOR MECHANICAL HEADACHES

AUTOMOBILE CLINIC

BY MORT SCHULTZ

Pipe dream

I own a 1971 Chevy II Nova that doesn't want to take gas. As the tank is being filled, gas spills out of the filler tube on to the ground although the attendant sets his pump to the slowest feed. Even if he tries to fill the tank manually, the gas still backs up. The Chevrolet dealer tells me nothing can be done.—Carl G. Alt, Syracuse, N.Y.

He's dreaming. There's probably a restriction in the filler pipe or vent tube. Perhaps the filler pipe was bent in the wrong spot or at the wrong angle during production. It doesn't matter. The dealer should replace the gas tank under the terms of the warranty. If he doesn't want to cooperate, write customer relations at Chevy.

Beastly excuse

I have a 1970 Mercury Marquis with a 429-2V engine. Why do I hear a main bearing knock whenever I accelerate from a slow speed? The dealer says it's the nature of the beast, and that nothing can be done.—Dr. R. D. Brion, Allen Park, Mich.

"Nature of the beast," my foot. First of all, Doc, it probably isn't a main bearing that you're hearing, but if it were, whoever said you couldn't fix a main bearing? Anyway, the knock is probably a heavy detonation. You should be using premium fuel. If you're not, switch, but if the knock is still there, draw your dealer's attention to article No. 2987CT of service bulletin 146 (8/7/70). It tells him how to modify the distributor to get rid of detonation. This should do it, but if not, then he should replace the head gasket with a thicker one.

Gas pains

My 1969 Volvo 145 automatic wagon is the hardest car to start when hot that I've ever owned. I had the twin Stromberg carburetors drilled, air filter changed twice, points and plugs replaced, and the engine tuned to peak. No help. In fact, as my wife tried to start the car the other day, I got a whiff of raw gas from the tailpipe. Is there a cure?—Wight H. Davis, South Burlington, Vt.

I don't know who's been doing your work, but if it hasn't been a Volvo dealer, then he doesn't know about the service bulletins which have been issued to help solve this problem. If it is a Volvo dealer, he should be ashamed of himself. You may have made a mistake having the carburetors drilled. I hope things haven't been fouled up badly enough to warrant replacement. In any case, there are service bulletins that Volvo dealers have received. One tells them how to set the carburetor floats to overcome hard hot starting. The other tells them how to adjust the hot-start valve, which is attached to the air cleaner assembly and is supposed to draw gas vapors off into the atmosphere instead of allowing them to enter the manifold. If your dealer doesn't clear up the problem to your satisfaction, contact the Volvo distributor in Boston for help.

A real imitation problem

The imitation wood strippings around the imitation wood paneling of my 1970 Ford station wagon look like they are rotting from beneath. I have noticed the same problem on my friend's Mercury wagon. Can you suggest a solution?—Walter Fuller, Moorpark, Calif.

There is no inexpensive solution unless your car is within warranty. The railings are made of fiberglass, and what's happening is that the laminations are coming loose. The only solution is replacement. If the car is still under warranty, you're in good shape. If not, new rails all around will cost you about $200.

A drag

I have a 1970 Chevrolet Caprice that has given me this problem since it was new. When it's warmed up and I stop for gas or to go into a store, it won't restart. The starter drags as if the battery were dead. What's the trouble?—J. A. Digregorio, Las Vegas, Nev.

If the car were older I would say that you may have a carbon condition, but it's not likely with a fairly new vehicle. Instead I think that the problem is with the starter. Maybe there's a short in the wind-

(Please turn to page 24F)

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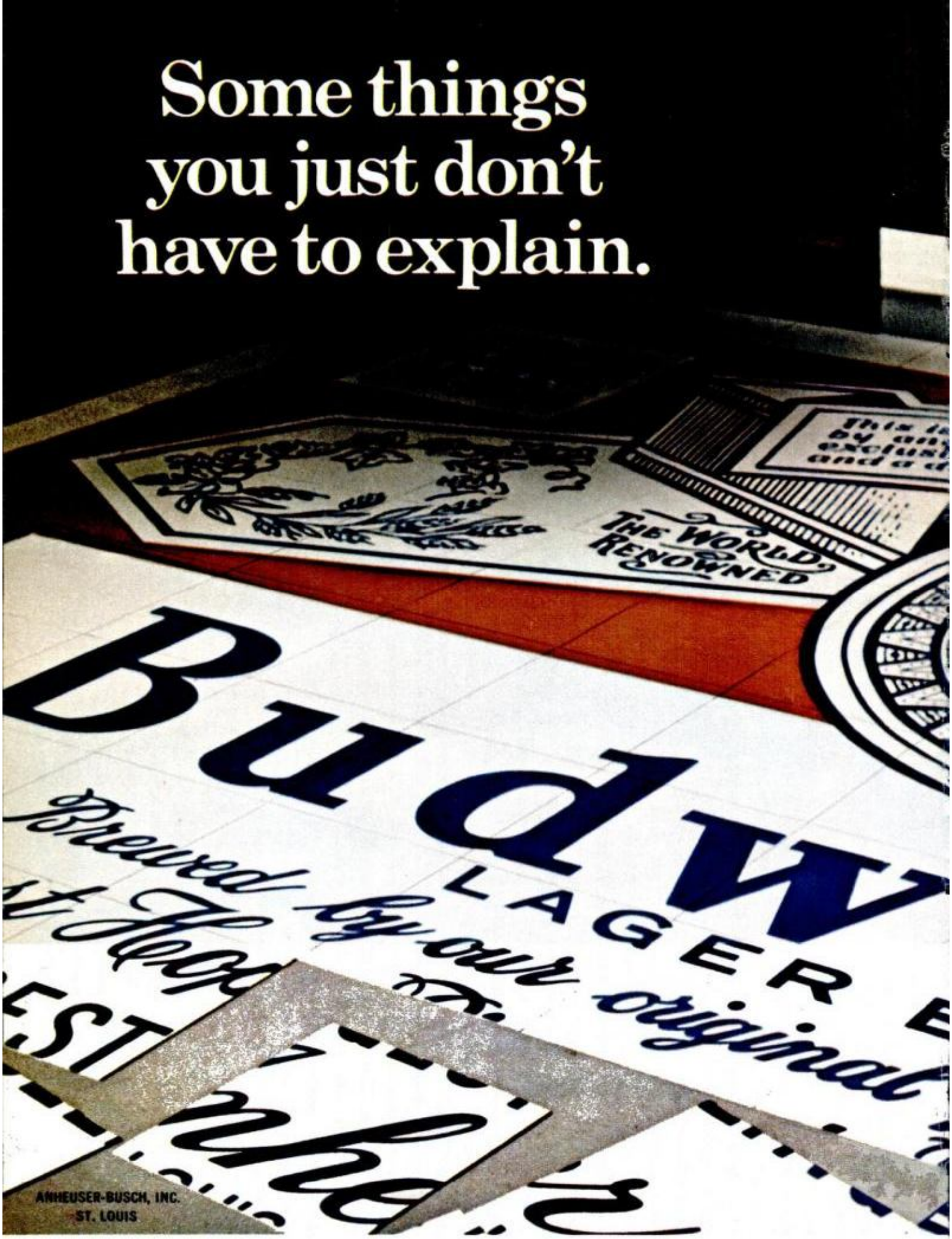

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(Continued from page 24B)

ing, or the armature is worn or burned. Get a starter draw test when the engine is warm. You may need a new starter.

Dark Fury

I've solved a problem that I think other owners of Plymouth Furys (mine is a '69) would want to know about. The tail lamps seem to burn out prematurely. I've found that a small leak exists between the frame and lens through which moisture seeps. This shorts out the bulb. Take the lens off and place a gasket around the frame or a layer of Form-a-Gasket around the lens. Incidentally, a bulb with a brass base seems to last longer than one with an aluminum base.—Michael D. Mellon, Clifton Heights, Pa.

Thanks for the help, Mike.

Chrysler's squealing brakes

We recently purchased a new (1971) Chrysler Town and Country station wagon with power front-disc brakes. When the pedal is depressed, the brakes squeal like mad. My son-in-law bought a new (1971) Plymouth Fury III and has the same problem. What causes this and what is the remedy?—Carlton Darling, Central Bridge, N.Y.

The trouble is probably caused by vibration of the outboard shoe and lining assembly. Chrysler, Plymouth and Dodge issued service bulletins in July telling dealers how to rid 1970 and 1971 models of squealing brakes. Generally, the repair involves applying Cycleweld K-101 cement to the shoe and inside surface of the caliper fingers. See your Chrysler dealer —have your son-in-law see his Plymouth dealer. The Dodge bulletin number is D71-5-4. Chrysler-Plymouth's is 71-5-5.

Noise pollution

I have a 1969 Ford Galaxie 500 with a 302-cu.-in. engine. The problem is an awful clicking noise which the mechanics say is caused by the hydraulic lifters. Is there any way of eliminating it? The mechanics say no.—D.E. Adams, Sharpsburg, Pa.

You can get rid of practically any engine noise . . . even yours. But whether you pay for it or it's done free of charge depends upon your 5-year/50,000 mile warranty. Is it still in effect? No one can say for sure if the clicking noise in your engine is being caused by the lifters. It might be a problem of excessive clearance between the valve stems and valve guides. To get rid of it, the cylinder head has to be repaired or replaced. Or maybe the noise is a result of bad rockers. But even if it is being caused by the hydraulic lifters, it can be lessened by adjusting the valve clearance.

Service Tips

● **Chevrolet** recognizes that problems have been experienced by owners of 1971 models in closing the hoods of their cars. In most cases, the company says, the hood isn't being closed with enough force to compress the rubber hood stops. If alignment is not correct even when you slam the hood shut, then take the car back to the dealer. If the hood edge is too high, he will cut the rubber grommet to reduce the height. If the edge is too low, he will install an adjustable outer bumper.

● **If your 1971 Dodge** with 383-cu.-in. engine and four-barrel Holley carburetor demonstrates lag and stumble during light and medium throttle acceleration from a stop or low speed, here's what to do. Have your dealer tune up the engine according to service bulletin D71-14-5. If that doesn't work, have him install carburetor kit 3683830 as the bulletin tells him to do.

● **Ford** tells owners of 1971 Pintos with 2000-cc engines to check the oil-level indicator. If it isn't seating all the way into the tube, you will be getting false readings. Replace such an indicator with a new one (part No. D1F2-6750-C). You dealer's authority to do this is item No. 3529C of service bulletin 173 (8-28-71).

● **Oldsmobile** has come up with a good tip for car owners who live in large metropolitan areas and are getting "station swapping" on their AM/FM or radio/tape units. In areas where there are large numbers of FM stations close together, one can interfere with another. Olds suggests that you add a 10-inch-long extension to the antenna lead-in. Extensions are available from radio parts supply stores. ★★★

***GOT A PROBLEM WITH YOUR CAR?* Ask Mort about it. Send your question to Auto 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.**

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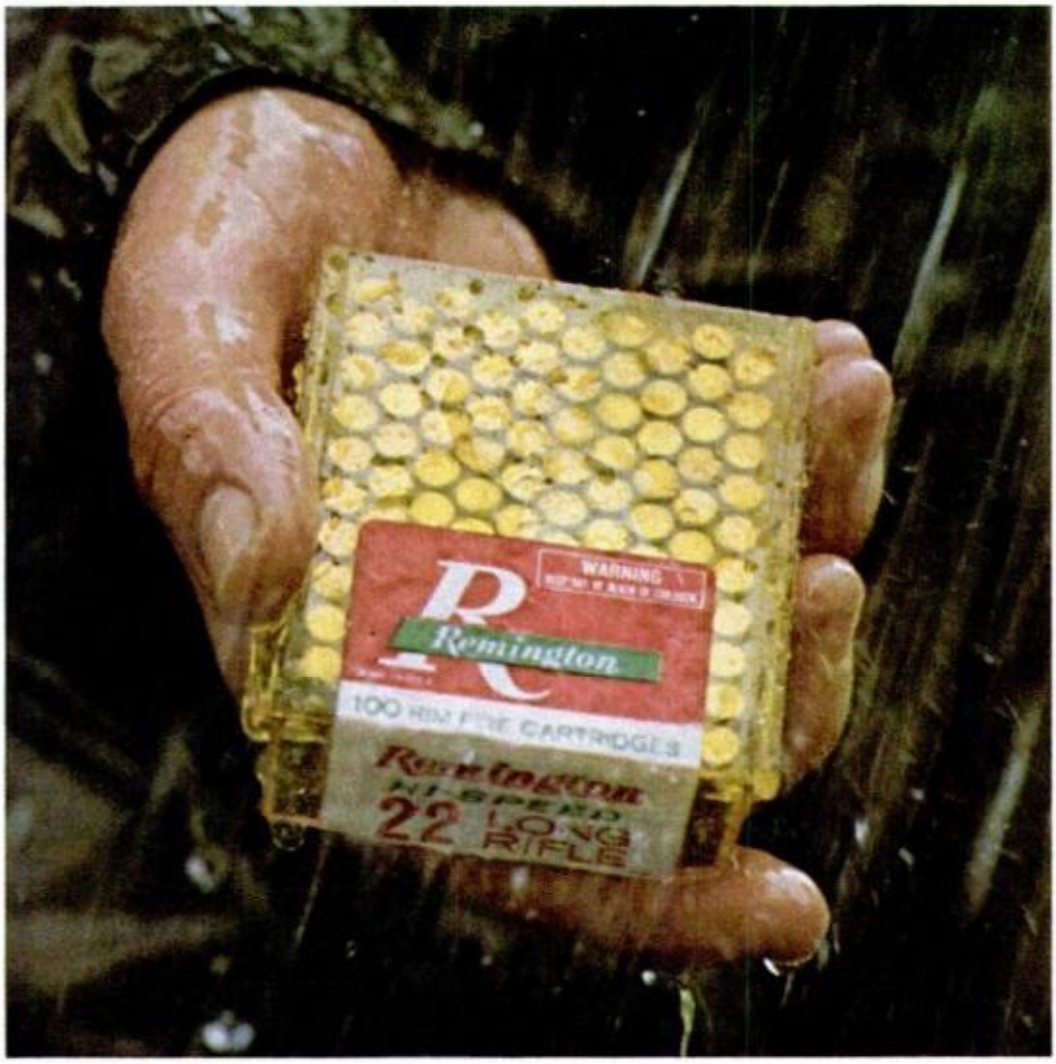

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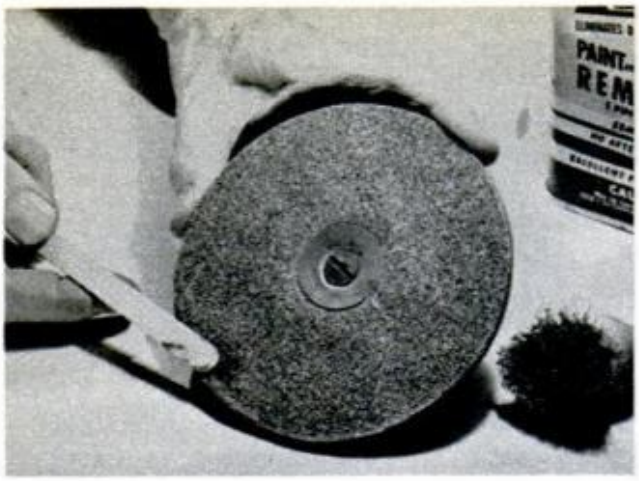
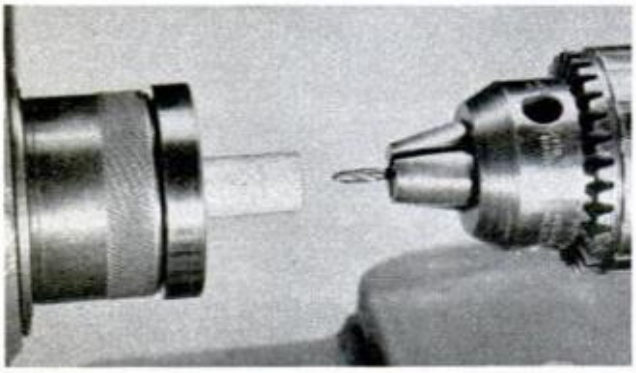


Cleaning clogged sanding disc

When using a disc sander on a painted floor, I found the paper became so paint clogged before it was worn it was no longer effective. By using paint remover and cleaning off softened paint I got more mileage.—*B. W. Ervin, Kent, Ohio*

Router serves as burnisher

By clamping a router upside down, you can use it as a stationary tool to burnish scroll workpieces. Insert a short length of ¼-in. steel rod in the collet, tighten and feed work against the spinning rod.
—*Walter E. Burton, Akron, Ohio*

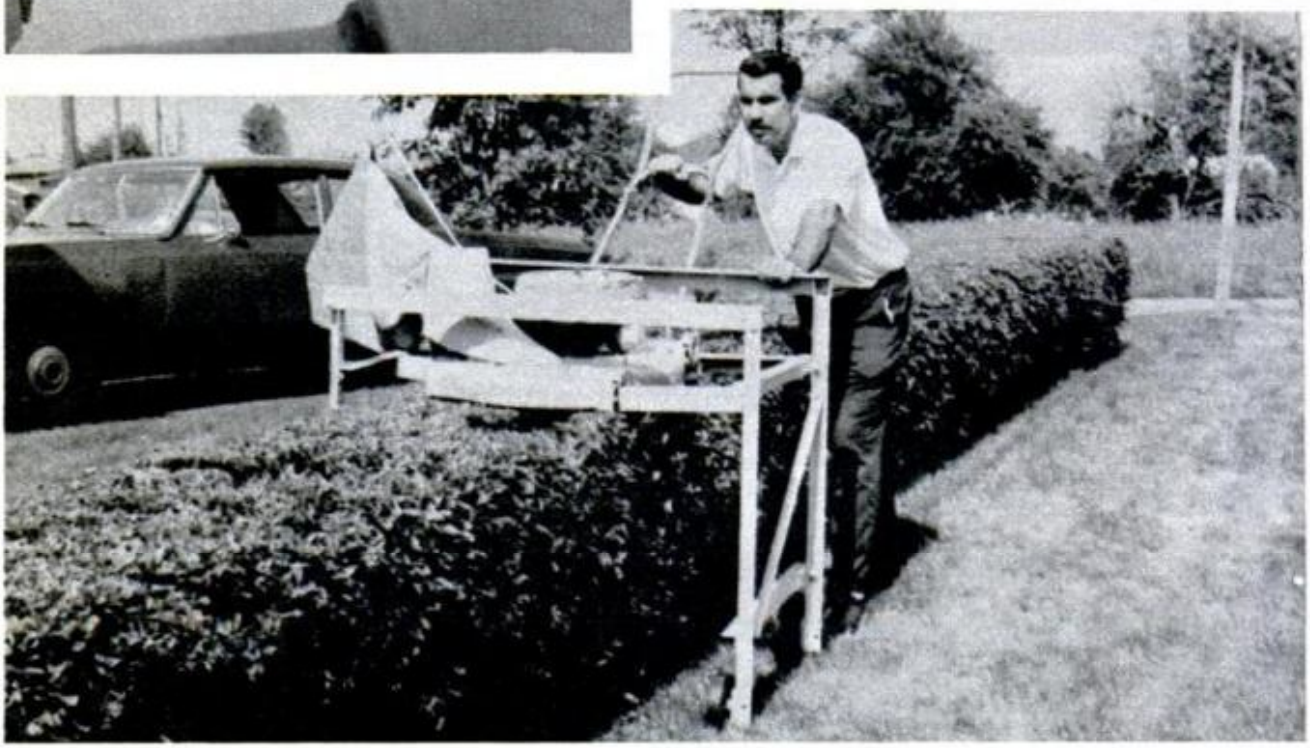


Reducing drill-bit wander

Recently, when end-drilling some hardwood dowels in a lathe, I found the small drill bit tended to wander off center. After inserting the bit deeply into the chuck, I was able to drill the axial holes accurately.—*W. B. May, Oak Park, Ill.*

Power mower now trims hedges

By building the rolling gantry below, I reduced my hedge-trimming time from eight to about two hours. The rig, a welded angle-iron frame, supports my rotary mower. The ground on which the setup rolls must be level to produce a neat cut.
—*Louis P. Bruno, Cheswick, Pa.*



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DETROIT LISTENING POST

BY ROBERT LUND

OLDS LOOKS like a better and better bet to cop first crack at GM's Wankel. (See the lead item in *DLP*, (page 36, Feb. *PM*). A source with contacts on the inside says the latest plan—but not necessarily the final plan—calls for scrapping the small car Olds was scheduled to bring out in '73. Instead, Olds will have a small, Wankel-powered car for '74. The car the Wankel will replace wasn't a new job. It was to be a recycled, spiffied-up version of Chevy's Nova. None of this has been confirmed by Olds or GM, but it comes from a source with a pretty good record for reading GM's cards before they're played. There are long faces at Chevrolet at the prospect of another division getting the rotary first, because Chevy was certain it had the deal locked up.

Olds may have another ace up its sleeve—an aluminum block engine. The division acknowledges it's working on an aluminum block, but isn't saying when it will be ready or in which car it will be used.

***FORD WILL BE NEXT** up with an electronic ignition system. Next after Chrysler, which has it this year as a $35 option on its V8s. Ford will offer the item on its '73 cars—probably at a slightly lower price than Chrysler and probably made by Motorola. Chrysler builds its own.*

Another rumble out of Ford: The company will reportedly use the metric system for the new four-cylinder engine it will build at Lima, Ohio. This is an interesting bit for a couple of reasons. There's been a lot of agitation to get the auto companies to switch to metrics. But Detroit says it isn't interested. When the Auto Manufacturers Assn. polled the industry on the idea two years ago, the consensus was, "Not now, but we might consider it in 10 years."

What happened to cause Ford to move the timetable up eight years? Could be the company's thinking of using the new mini motor in a car designed for the world market, in which case the engine dimensions would have to be given in metrics.

CHRYSLER'S KICKING AROUND the idea of producing parts for its Japanese import, Colt, in the United States. This has led to speculation Big C might build the entire car or its companion import, the Cricket from England, in this country. Negative. Chrysler may yet build a small car in this country but if so, it won't be Colt or Cricket.

IF YOU THINK you're going to get a break on what you pay for car insurance when impact-absorbing bumpers become standard, forget it. You may pay a little less for insurance—assuming the insurance companies reduce rates 20 percent, as they've promised. But the bumpers are probably going to cost more than you'll save on them.

Figure it out for yourself. The auto companies say energy-absorbing bumpers will cost something over $100. Call it an even hundred to keep it simple. Subtract 20 percent—maybe—from whatever you're paying for insurance. Unless your insurance premium runs over $500 a year, you won't save a button on the deal.

However, the insurance companies would stand to make out all right, because they won't have to pay claims on as many nickel and dime collisions. But as far as the car owner is concerned, it's like a restaurant saying the second cup of coffee is free after it's socked you 50 cents for the first cup.

***GOT AN OFFBEAT IDEA** for getting people from here to there? Tell Ford about it. Although Ford figures cars will continue to be the major source of transportation in the United States for the foreseeable future, the company's interested in every and any approach to transporting people. "That's our business, people-moving," says Gene Bordinat, head of Ford's design department, "and we're looking very closely at every method of moving people to wherever they want to go." Ford's serious about this. Along with every kind of car you can imagine, the company's studying moving sidewalks, monorails, robot buses—the whole spectrum.*

GM'S REPORTEDLY DECIDED where the hydraulic power supply will come from if and when cars are built with a central electronic control system. It will come off the automatic transmission.

If you want to interpret this to mean the company's not far—say two to three years—

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from producing a car with a central electronic system, go ahead and read it that way.

THE FRANCHISE FAD has never caught on in the auto business. Sure, there are exceptions—the muffler shops, paint shops and transmission specialists. But for every winner there have been a dozen losers. I know because I've gone to the press conferences and listened to the promoters tell how they were going to clean up. But the great majority of them have gone belly up, instead of mopping up.

Now there's a new outfit in Detroit, Motune, Inc., which thinks it has a format that'll work where earlier ventures failed. It's a do-it-yourself repair shop, and it might interest those of you who enjoy tinkering with cars. The company will supply the space, tools, equipment and parts—you get a discount on parts—for you to repair your own car. Motune, which apparently has money behind it, says it will open two pilot shops in the Detroit area and if the pilots work out, the company will go national. The goal is 100 to 200 locations nationwide over five years.

Another automotive self-service operation has also begun in the Detroit area. U-Tune, Inc., is open in Madison Heights, Mich., with intentions of soon going national. President Duane L. Wasmuth points out that there is one or more trained technicians on hand to provide customers with advice. Equipment even includes an exhaust-emissions analyzer. You can't miss U-Tune's company symbol: It's a big smiling wrench—Happy the Wrench.

The do-it-yourself idea isn't original with Motune or U-Tune. Do-it-yourself shops have been operating in Europe and Canada for several years. But up to now nobody's tried the idea on a national scale in this country.

***THE PRESSURE'S REALLY ON** at Ford for Bordinat and his crew to come up with two new cars as advanced and imaginative as Thunderbird and Mustang were when they first appeared on the scene. Not that Ford's displeased with its current cars. But the company feels the only way it can score points against GM is by following a program of bold innovation. Not with look-at-me-too cars. But with look-at-me-first cars.*

Ford's known to be working on two different two-passenger vehicles, but as currently envisioned, they won't be trend-setters in the way the original T-bird and Mustang inspired a fleet of imitators. ★★★

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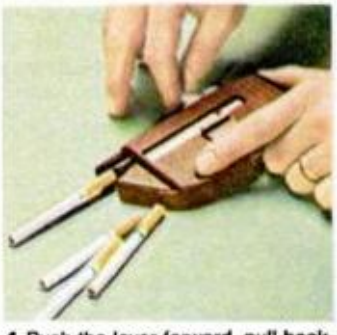

4. Push the lever forward, pull back, push again and there you have a filter cigarette that looks factory-made, tastes factory-fresh...in just seconds. Easy, wasn't it?

Refills contain filters, paper tubes, carry-around packs... and enough vacuum-fresh Laredo tobacco to make five more packs. The cost: under $1.* Less than 20¢ a pack!*

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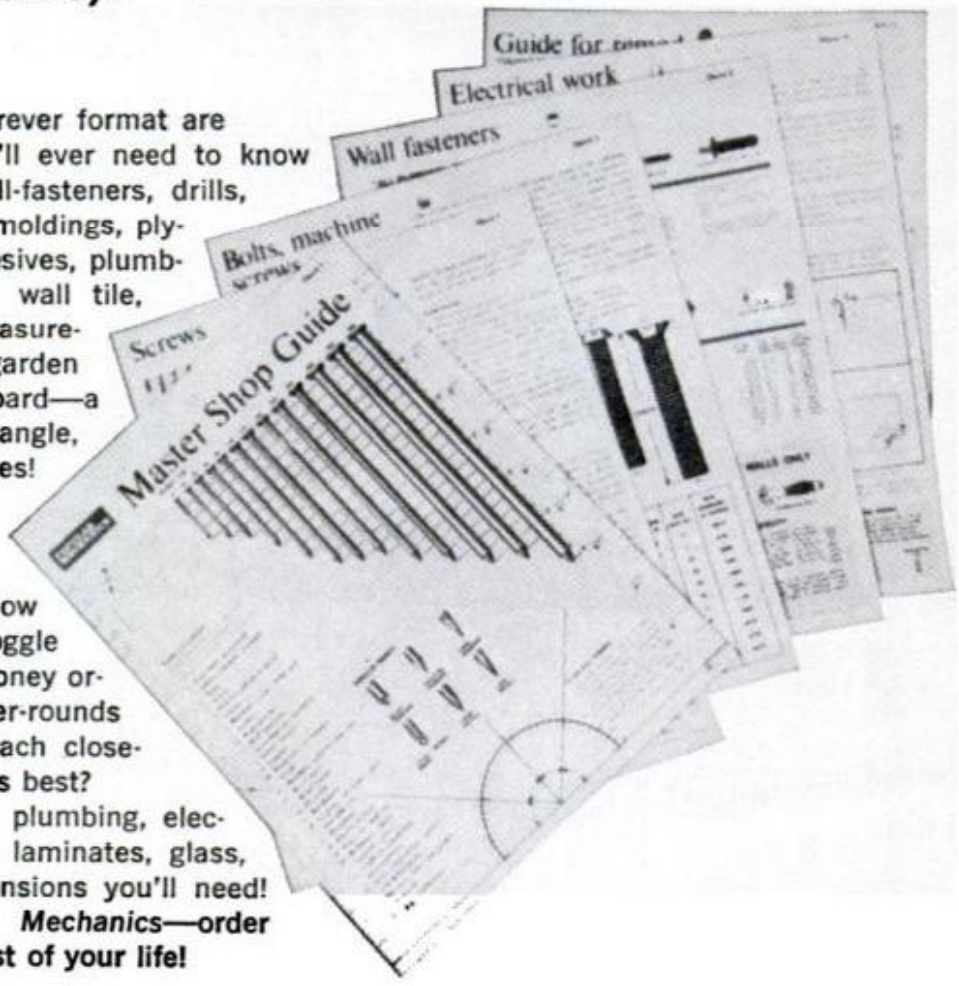

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QUESTIONS ANSWERED

HOMEOWNERS' CLINIC

BY W. CLYDE LAMMEY

Condensate on aluminum storm sash

Why do my aluminum storm windows steam up when the temperature goes below freezing? The steam forms on the inside of the window frames and glass, runs to the sill and freezes. How can I stop this?—John Redmond, Birmingham, Ala.

The storms are at a lower temperature than the air leaking through inner sashes. That air contains moisture, which condenses on the colder metal and glass. Weatherstripping the inner sashes usually eliminates this or minimizes it so it is no longer troublesome. If your furnace is of the unvented, gas-fired type, it is a major source of excess moisture in your room air. It should be vented outside.

Cleaning acoustical-tile ceiling

How can I clean acoustical tile in a basement room? Will it withstand wetting?—Roy Adams, Lexington, Ky.

I've used a wallpaper cleaner—the kind you form into a ball or pallet and rub over the dry surface. It seems to serve very well, but you must work in good light and be careful to remove all streaks by overlapping each stroke of the cleaner. If the ceiling is dusty, cobwebby or otherwise soiled, it's wise to go over it first with a vacuum-cleaner floor brush to loosen dirt and other debris and draw dust from the partial perforations. Then use the cleaner. I've also used an artificial sponge dampened in soapy water and squeezed out nearly dry. After the first sponging, rinse with a nearly dry sponge.

Preventing paint 'skin'

How can I prevent a film from forming over paint after the can has been opened and a part of its contents used?—William Carpenter, Puente, Calif.

Clean paint from the rim of the can thoroughly, using a solvent that mates with the paint. Clean the groove into which the top fits tightly and press the lid firmly down as far as it will go. Then store the can upside down. In cans at least half full this usually prevents formation of film.

Another way is to cut a disc of wax paper to a true fit inside the can and lay this on top of the paint. There's also a liquid—available from your paint dealer—that can be poured in a thin film over the paint. I clean small paint cans in which paint leftovers can be easily stored. I fill these three quarters full, press lids tightly in place and then invert the cans.

Cleaning gold leaf

I have a carved American eagle with wingspread of about 20 in. which appears to be covered with gold leaf. It's quite old and I'd like to clean the gold leaf, removing the grime of years. Can I do this without damaging the leaf?—Axel Lundquist, Minneapolis.

At long range I hesitate to say, but I once cleaned a gilded statuette by applying a mild solution of trisodium phosphate—about a half teaspoonful in a tumblerful of water—with a ball of cotton affixed to a short length of ⅛-in. dowel. I made one applicator for application, another for rinse. With extra care this method proved satisfactory. Press most of the water out of the applicators so that the surfaces won't become overly wetted.

Growing geranium "tree"

At a recent flower show I saw what they called a geranium tree. It was 3 ft. tall and blooming profusely. How is this done?—J. Lannon, Dallas

Geranium trees are quite common in warmer climates. Start with a well-rooted cutting of one of the best flowering varieties. Train it to grow as a single trunk by pinching off all side growth. Stake it early so that the trunk can be supported by plant ties. When it has attained the desired height pinch off the growing tips to induce branching. This procedure takes time and patience, but if you persist your plant will grow into a handsome tree. You can maintain growth with a liquid plant food. ★★★

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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POLLUTION FIGHTERS' NEWSLETTER

By SUSAN MAZUR

TRAPPING EXHAUST PARTICULATES is the job of PPG's new exhaust filter, shown below being installed on a car. This device could consequently permit the continued use of leaded gasoline without worries of lead polluting the air since lead is exhausted in small particles. Action starts with exhaust flowing into an agglomerator in which small particles are stuck together. These resulting larger particles are then spun in the cyclone, a conical mechanism, which deposits them in a reservoir. The particles that get through are removed by a fiberglass filter in a mufflerlike unit. PPG has equipped a test fleet with the system in Corpus Christi and San Antonio, Tex., and has installed experimental systems

on 1972 model cars, now being tested and demonstrated in the Pittsburgh and Chicago areas.

GOOD FISHING FROM OIL RIGS! *A population "bloom" of marine life—some rarely, if ever seen before in Louisiana waters—is appearing as a result of oil-drilling operations, says Burr Tettleton, senior Gulf Coast geologist, Sohio Petroleum Co., Oklahoma City, Okla. He recently told the Interstate Oil Compact Commission that the annual Gulf Coast commercial fishing catch increased from 250 million to 1,622 million pounds between 1940 and 1970—the increase paralleling the growth of offshore oil platforms since 1947 while other U.S. commercial fishing grounds without drilling platforms have recorded declining populations during the same period. Tettleton pointed out these virtues of offshore drilling platforms: 1) they serve as another surface area on which flora and fauna can grow, creating a first step in the food chain; 2) platforms offer protection from predators, currents, wave action and light and 3) they've "revolutionized" Louisiana salt-water sport fishing—rig fishin's the thing now!*

RECYCLING TOO EXPENSIVE? Railroads charge a higher freight rate for transporting recycled materials than for hauling virgin materials, says John Vaccaro, transportation director, the National Assn. of Secondary Materials. It's primarily because the shipper usually cannot guarantee the railroad a certain volume of tonnage on a regular basis whereas the shipper of virgin materials can. And, a group of George Washington Law School students known as Students Challenging Regulatory Agency Procedures—SCRAP—is protesting this freight-rate situation. The students assert that increased rates for recycled materials discourage recycling and violate the national environmental policy. They ask that the railroads be denied their soon-to-be-filed request for increased freight rates and also that they return $1 billion dollars to shippers throughout the country for overcharging these merchants in the past.

POPULATION CONTROL OF INSECTS biologically, rather than chemically, is the way the Zoecon Corp. (Palo Alto, Calif.) is doing it. The firm is making headway, according to Daniel Lazare, vice-president of Zoecon, with a synthetic hormone to eradicate insects by arresting their normal development. Zoecon calls its compounds Entocons; they're synthetic formulations of natural insect juvenile hormones which when introduced after the larval stage of an insect's life cycle are lethal to the organism. But, since insect larvae have a tolerance for this hormone and do destroy vegetation, the search is on still for an even better method of insect control in the earlier, larval stage. **(See also *Birth Control for Bugs*, page 116, Aug. '66 PM.)**

POLLUTION-FREE STEEL MILL *in Berkeley, Calif., disposes of its impurities from molten metal by boiling them away in a vacuum at 4000° F. with an electron beam. The only wastes at Airco Vacuum Metals are a daily bucketful of slag, which gets recycled, and a puff of clean steam. Also, according to the Airco mill, this is the first continuous steelmaking process entirely in a vacuum.*

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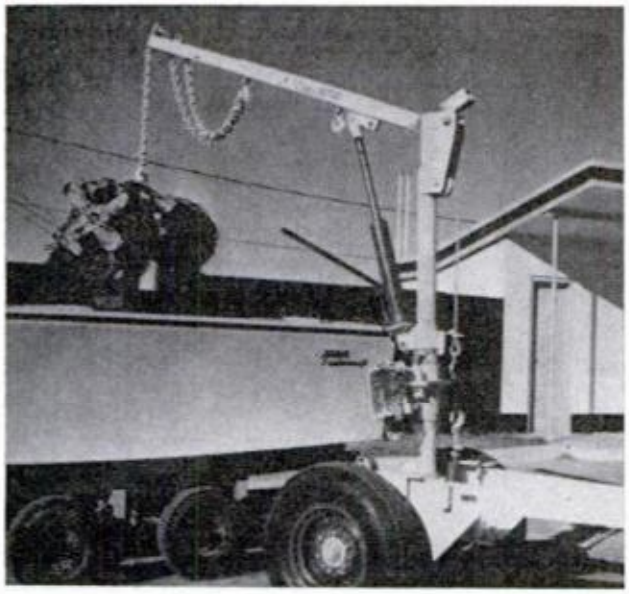
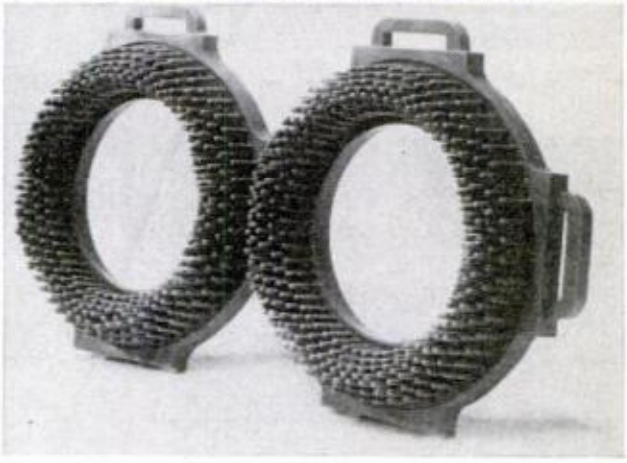


Lifter and hauler

Designed to lift or haul, the Crane-N-Toter has a 72-inch telescoping boom that extends to 80 inches, and can be swiveled on its axis. The unit comes equipped with a transmission jack capable of lifting 2000 pounds, and a high-lift bumper or frame jack with a two to five-ton capacity. To tow, the Crane-N-Toter is hitched to a pickup truck to haul up to 10,000 pounds. Crane-N-Toter, Inc., Des Moines, Iowa, makes it.

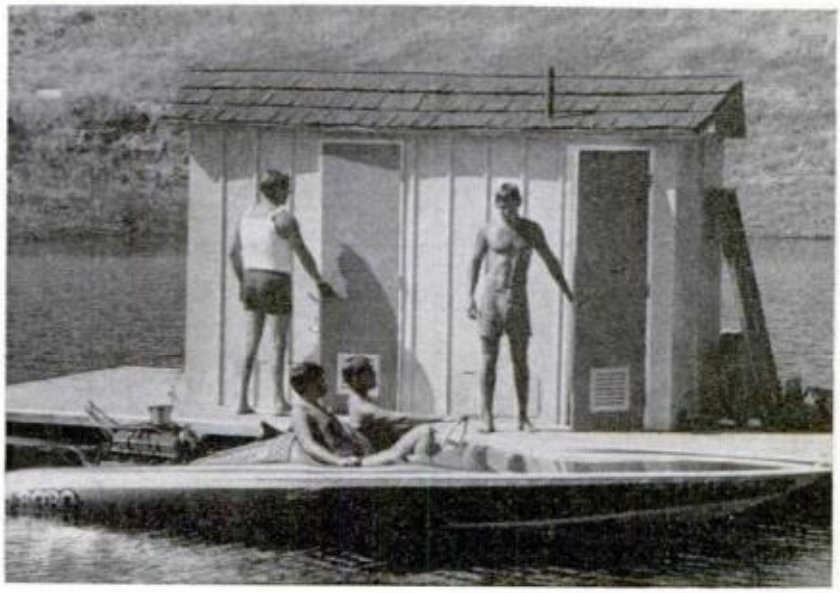


Surface for all seasons

Rather than depend on the whims of weather, a northeastern ski resort has begun installing a 70,000-square-foot slalom run made of polyethylene plastic. Skiers glide on resilient plastic fingers projecting from a circular rim. Called Sno-Mat, the snap-together parts are interchangeable.

A pollution solution

The increasing number of boaters using California waters has led authorities to launch floating, fiberglass-reinforced-plastic rest rooms on some state lakes. The units can be equipped to serve as combination bathroom/shower/dressing rooms. Batteries supply power, and holding tanks for waste are mounted beneath.



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science worldwide

By JOHN PEARSON

Look, Ma—no needle, no thread

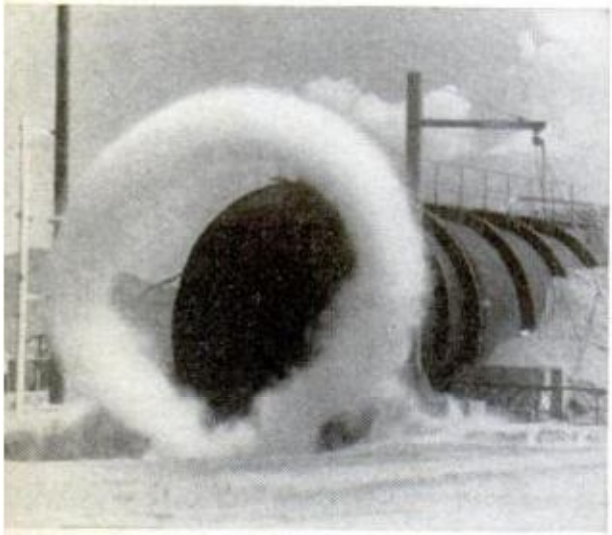
A NEW WRINKLE IN SEWING is a machine that employs ultrasonic vibrations instead of needle and thread to attach one piece of fabric to another. Developed by the Branson Sonic Power Co., Danbury, Conn., the machine can sew most man-made fabrics and some blends of synthetic and natural fibers at a rate of 50 feet per minute. Ultrasonic energy is generated by a solid-state power supply and converted into mechanical vibrations that create localized heat. The heat causes molecular changes, welding the fabric pieces together.

STOP HICCUPS WITH SUGAR. That's the advice of three physicians who report in the *New England Journal of Medicine* that cases of persistent hiccups in 19 of 20 patients were suppressed with doses of sugar —a teaspoonful of the white granulated stuff swallowed "dry." The doctors think the sugar somehow interferes with nerve impulses triggering the hiccup reflex. Before the sugar therapy, several patients had tried other common "cures," including breathing into a paper bag and holding their breath.

The sun's uneven heat pattern

LIKE EARTH, THE SUN MAY HAVE POLAR CAPS. This was revealed by a temperature "portrait" of the sun created by converting electronic measurements into a picture. "Cool" areas, including the two polar regions, show up as dark patches. They have temperatures of about 1.8 million degrees F., as compared with 3.6 million degrees F. of other regions. The portrait is based on measurements by instruments aboard a solar observatory recently placed in Earth orbit by NASA.

A NEW TV SYSTEM MAKES READING POSSIBLE for most partially sighted persons, according to the maker, a Santa Monica, Calif., electronics firm. Comprised of a sophisticated TV camera, a special lighting setup and a viewing table, the system is linked with an ordinary black-and-white TV set. The user places his book or paper under the camera lens, adjusts light intensity and magnification, then runs a scanning control while reading words, composed of letters two inches high, that appear on the TV screen. The system costs about $800.



"Smoke" ring from shock tunnel

CALIBRATION OF A SHOCK TUNNEL—said to be the largest of its kind in the country—has been started at a Sandia Laboratories facility near Albuquerque. Controlled explosions inside the big steel tube—306 feet long and 19 feet in diameter—will subject full-scale test vehicles to shock and high-pressure environments. A side effect of the calibration blasts are king-size vapor rings, formed when humid air in the tunnel is expelled, cooling and forming water vapor. ★★★

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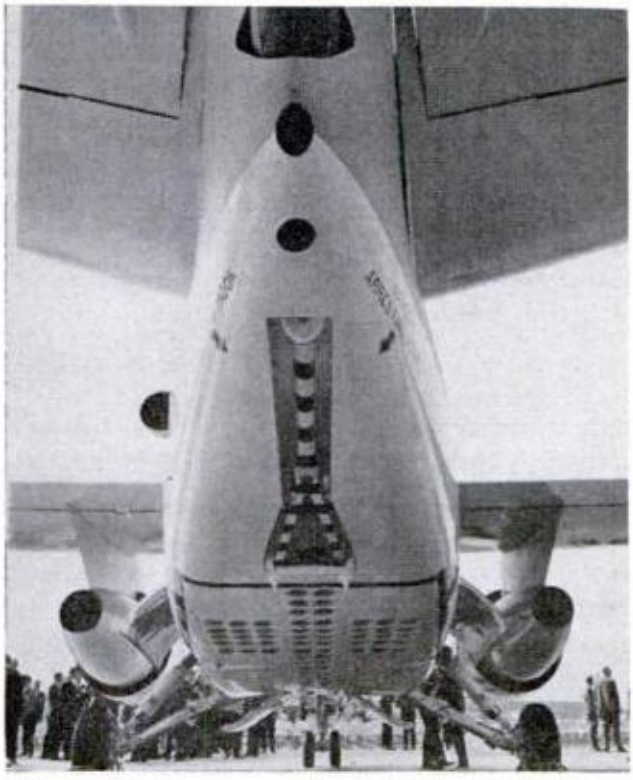
NEWS BRIEFS



Navy's newest sub-hunter

The Navy's latest carrier-based sub-hunter, the S-3A Viking, is shown (top) at its first roll-out. It's the first of eight Navy research and development aircraft being built by Lockheed California Co. The middle photo shows the pilot's seat; the bottom, the craft's tail. The S-3A carries a crew of four, operating advanced antisub-warfare avionics gear. It operates above 35,000 feet, reaches a speed of 400 knots.

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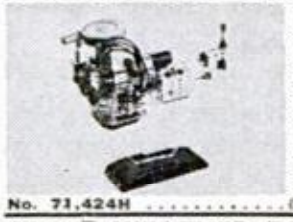
Stock No. 71,475H .....$10.95 Ppd.

AMAZING NEW WANKEL ENGINE KIT!



Thrill to the fun of building your own see-through motorized model of revolutionary pistonless type engine . . . only engine experts think economically modifiable to meet new pollution standards. Replaces piston, cylinder, crank assemblies with rotating discs (sections removed for firing chambers). Smaller than conventional; fewer parts, greater reliability, same speed w/less horsepower. Feat: flashing plugs, rubber fan belt, stick-shift on-off switch. Req. 2—1.5V batt. (not incl.).

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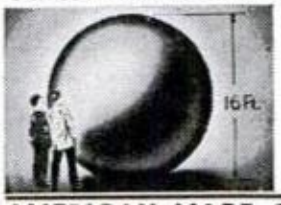

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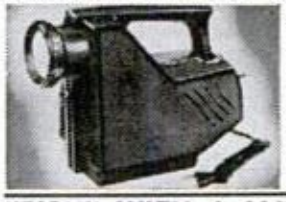

Projects illustrations up to 3" x 3½"—enlarges them to 35" x 30" if screen is 6½ ft. from projector, larger pictures if screen is farther away. No film or negatives needed. Primarily intended for children. Projects charts, diagrams, color or black-and-white in darkened room. 115 v. A.C. . . . 6 ft. cord and plug included. Size 12" x 8" x 4½" wide. Weight 1 lb. 2 ozs. Plastic case.

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Drivin' with Dan

What are the advantages of side-mounted radiators? Will the Wankel engine ever be used in racing cars? Are the Indy cars weighted to turn left only? Dan Gurney answers these and other automotive questions

Q. *In the movie* Grand Prix *I noticed that James Garner steered by crossing his arms. In my driver's education class, we were taught to steer hand over hand. Is this only because one method is suited for racing, and the other for normal driving? What are the pros and cons for each?—G. Louie, Mercer Island, Wash.*

A. I used to cross my arms when racing, and I always held my hand in one certain position on the steering wheel with my right thumb over a spoke at about the 1:30 to 2:00 o'clock position. The big advantage was in always knowing where the front wheels were pointed in relation to my hand position. When steering is slow, this is impractical, so I put hand over hand.

Q. *I've been told I could clean the tappets and rocker arm with kerosene and also run this through the engine for a couple of minutes at idling speed to clean it up. So I did this and am pleased with the results. However, I was also told I'd use more oil. The car is a '57 Chevy with a six-cylinder automatic. Can you tell me how this use of kerosene might affect oil consumption?—John Tyler, Gassville, Ark.*

A. Kerosene is not a good lubricant. I have heard of this process, but it sounds risky.

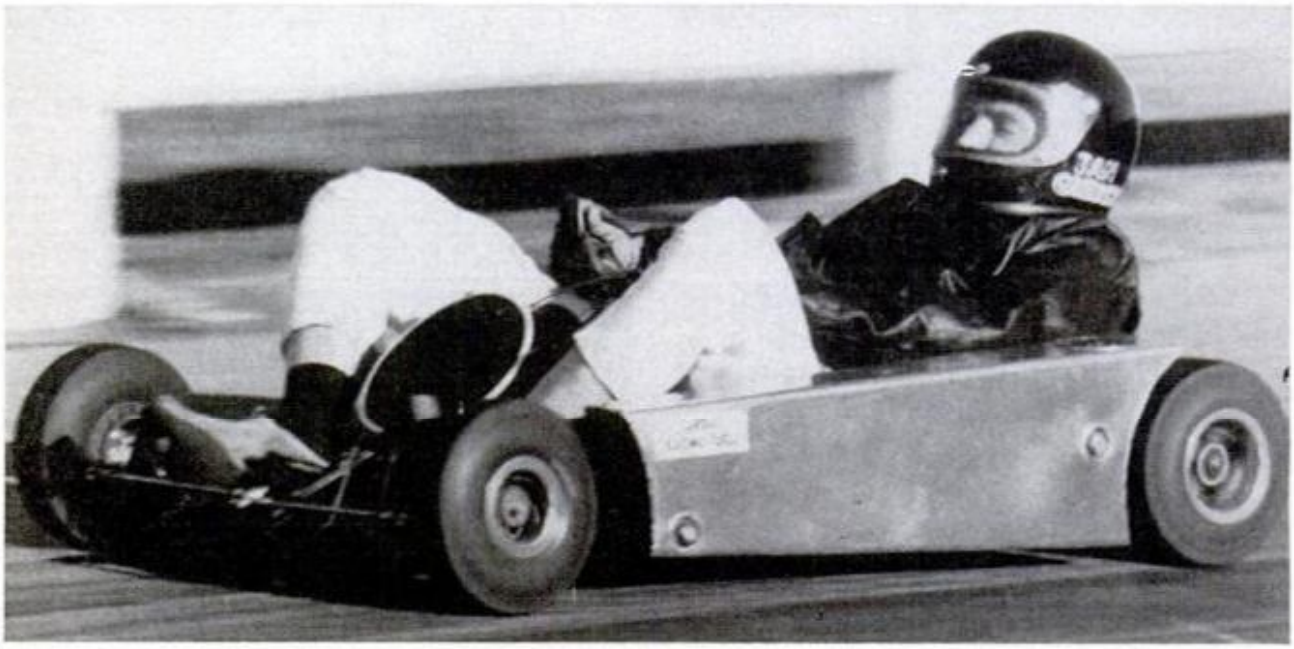
Q. *What are the advantages and disadvantages of side-mounted radiators on Indy and Formula I cars? Do you think the SCCA is a good place for a new racing driver to get started?—Larry Guy, New Cumberland, Pa.*

A. Side-mounters help shorten the polar moment of inertia and also require less water piping. This should mean lower overall weight. They do not lend themselves to the latest full-width blunt aerodynamic noses.

In the beginning, it doesn't really matter

(Please turn to page 36N)

DAN PUTS HIS FOOT IN IT trying his hand at kart racing at the Orange County International Raceway in California. The day of kart racing was a field day for All American Racers and the International Kart Federation. Dan was photographed in this hot, wedge-shaped kart by the federation's magazine, *Karter News.*



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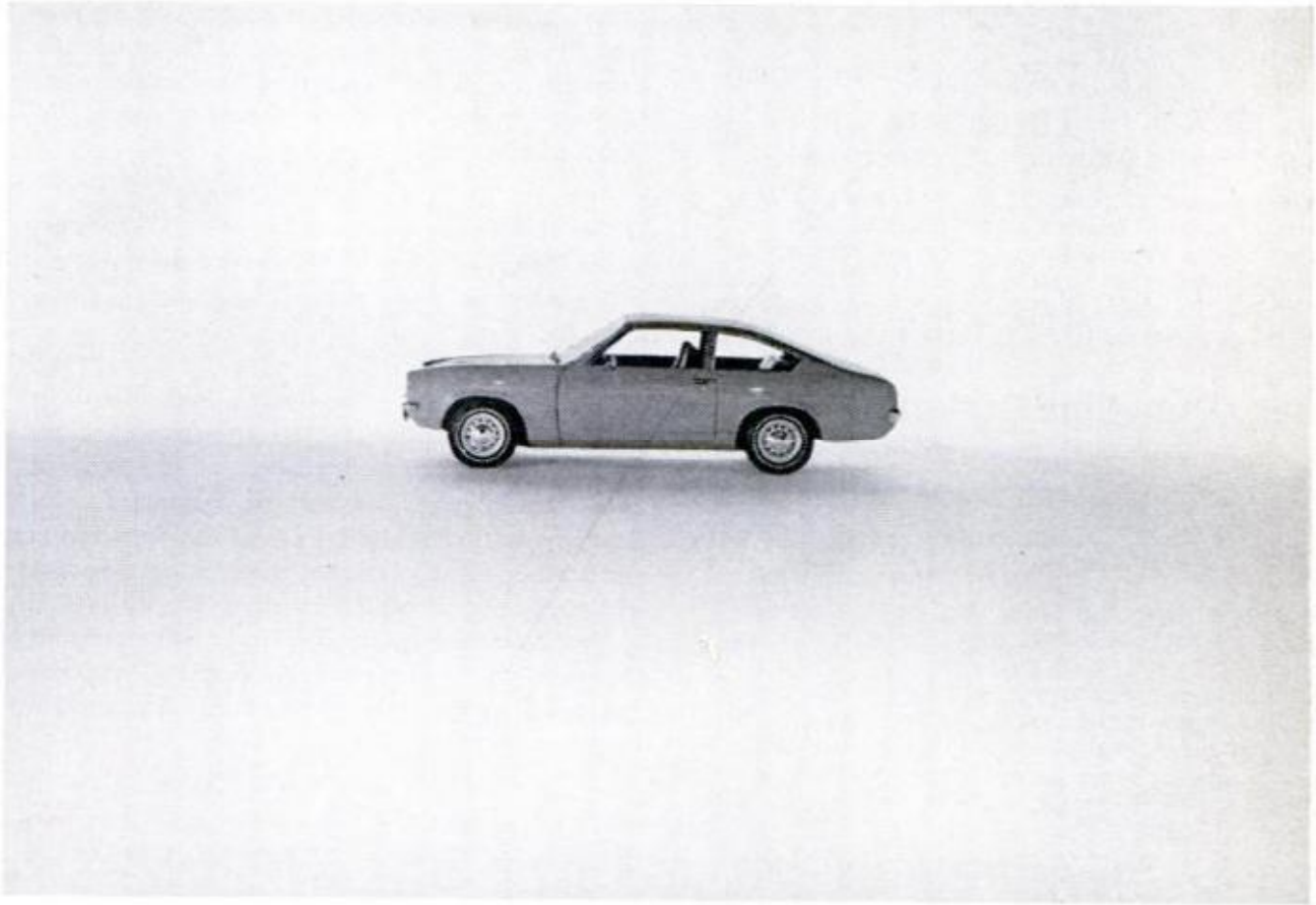
The oil that stands up for the little guy.



Little cars need a little extra help to handle the hills and super highways that were made for the big cars.

Little cars strain harder. So their engines need the oil that gives extra protection: Quaker State. It's refined from only 100% Pure Pennsylvania Grade Crude Oil. Then it's fortified by oil specialists to protect hard working engines from heat and heavy loads.

If you're driving a little car that's straining to keep pace, buy yourself some real peace of mind. Next oil change, be sure to ask for Quaker State by name. It's sold wherever they care about cars.

Quaker State your car to keep it running young.

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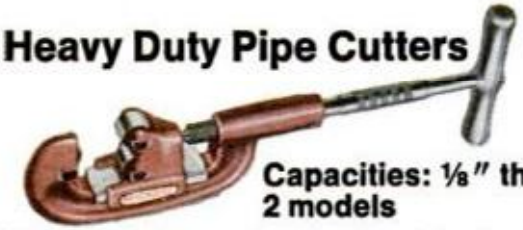
Easiest-to-operate hand threader around! Every threader and set of dies work-tested at our factory. Dies reverse for close-to-wall threading. Interchangeable die heads lock in; release easily. All RIDGID threaders cut perfect threads every time. And be sure to use RIDGID Thread Cutting Oil.

Heavy Duty Pipe Cutters



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Perfectly balanced professional design. Smooth tracking, specially tempered cutter wheel gives straight, burr-less cuts every time — even on rough surfaces. Factory tested for perfect tracking. For close-quarter work, convert to 3-wheel cutter by replacing rollers with cutter wheels.

No. 2-S Spiral Ratchet Pipe Reamer

Capacity: ⅛" through 2"

Self-feeding spiral design and razor sharp cutting edges make reaming fast and smooth. No chatter . . . even on sheet metal conduit box outlets. Reamer Unit, available separately, fits No. 00-R Drop Head Threader ratchet and handle.

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DRIVIN' WITH DAN

(Continued from page 36L)

much where you start racing. I think the SCCA is fine. In the final analysis, you'll find it is up to you, anyway.

Q. *Do you think the Wankel engine will ever be used in Indy or Can-Am racing?—Brad Miller, Brookline, Mass.*

A. My guess is that it will. It seems to have excellent horsepower per pound of engine weight, and I believe that a formula has been prepared for measuring its displacement for Indy racing. Wankels should show up in SCCA sedan racing first.

Q. *Why does everyone prefer Union 76 for fuel on the NASCAR circuit? Will Swede Savage race in the Indy 500 this year?—Philip Johnson, Paradise, Pa.*

A. Union is the only company that blends a real racing gasoline to the specifications requested by the manufacturers at the present time. Union also has sort of a special relationship with NASCAR in that the firm lends support in return for the advertising benefits of being seen at all the tracks.

Yes, Swede has left AAR and is scheduled to drive a Patrick Petroleum Special Indy car designed by Antares Engineering Co., of Detroit.

Q. *Is it true that Indy cars are weighted to turn left only and that they will spin out if turned the other way?—Eric Sewell, Dallas.*

A. This was true in the old days when roadsters had the old skinny tires, but today, the cars are capable of turns in either direction. They are adjusted to turn left a bit better than right, however.

Q. *Why are car manufacturers changing from 14-inch to 15-inch wheels on many new models? If you were to buy a new car (Pontiac, for example) that now has 15-inch wheels, is there any reason why you couldn't put your old snow tires and 14-inch wheels on it, providing the bolt pattern is the same? On a car with radial tires, could you, for example, use an F series in front and an H series in the rear or should all tires be the same for the best handling? Could you mix the 60 and 70 series? I'm wondering about buying snow tires—where radial tires are used, can I use dif-*

(Please turn to page 36P)

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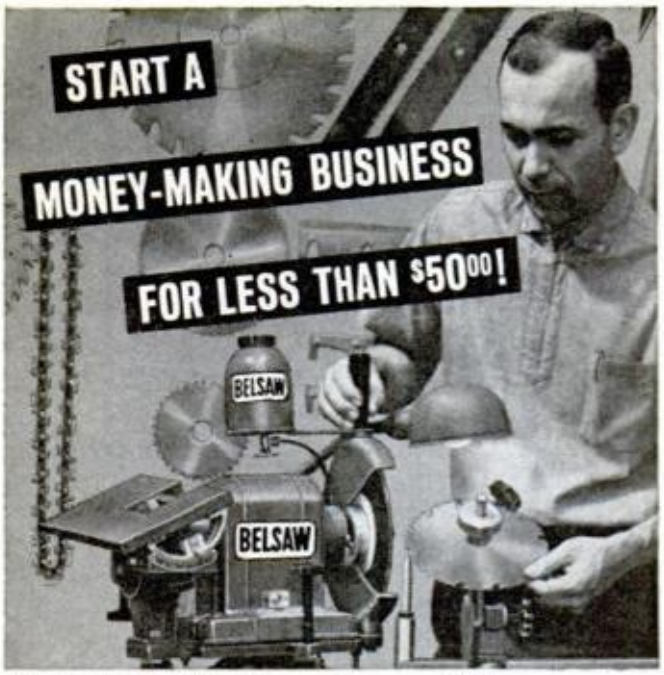

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DRIVIN' WITH DAN

(Continued from page 36N)

ferent brands as long as all are radials? Are studs recommended for radial snow tires?—Kenneth Holland, Quincy, Mass.

A. If the tires clear the brakes and other suspension components throughout the range of bump and droop and turning, you would be okay. However, since the factories usually have good reasons for doing things, it is wise to stick with their recommendations unless you are absolutely sure of what you are doing.

You can use F series and H series. I've found E series polyglas Goodyears to be darned good. You can mix 60 and 70 and you can mix brands. Studs are fine for snow and ice, but more slippery on dry pavement.

Q. *I've noticed that Jackie Stewart has an ELF decal on his Tyrell Ford. What product does ELF handle?—Dennis Sellers, Park Ridge, Ill.*

A. Gasoline, oil and the like. It is a large French petroleum producer, marketer and retailer.

Q. *Did so many cars have trouble in the televised Trenton 200 Indy-car race because the track is so demanding?—Brian Knowlton, Dexter, Me.*

A. The pace these mile-track USAC Indy-car races are run at is such that everything is pretty much stretched to the limit. Tires are right on the edge because the fastest tires often sacrifice long wear. Engines are on the edge temperaturewise, turbochargers and gearboxes are operating at their limits, brakes are not ready for much more, ignitions are vulnerable, drivers are giving everything they have, traffic is very unpredictable. There are many unknowns in each race—and only one winner.

Q. *What about those new sparkplugs that have no gap but spit the sparks out; are they as good as they claim?—Ken Hughes, Richmond, Calif.*

A. I don't know, but I believe they would be much more popular if they were superior to conventional plugs. ★★★

If you have questions on racing, high-performance and everyday driving techniques, send them to "Drivin' with Dan," c/o Popular Mechanics, 224 West 57th St., New York, N.Y. 10019. Questions cannot be answered by individual letters. Questions on maintenance and repair should be addressed to the Auto Clinic (see page 24B).

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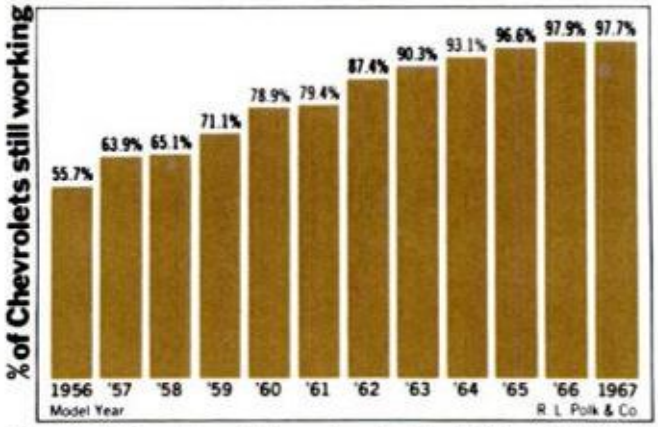
Chevrolet. Building a better way to see the U.S.A.



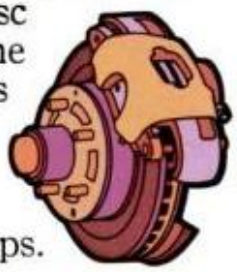
Proof of how long Chevy trucks last. Over 55% of Chevrolet's 1956 model trucks are still in use. No other make has even half, based on latest official industry figures.

A guide to traveling in style and comfort with Chevrolet trucks.

Chevrolet trucks. A
for your

Chevy Pickups.
For shell, slide-in and chassis-mount campers.
That includes everything from basic shelter to fully self-sufficient units that sleep six or more. Your vacation money goes a long way in a Chevy truck because Chevrolets last (see chart on cover). They're designed better, we think. And built better. Pickups and chassis-cabs with an easy ride, good handling, wide-stance stability. And big Chevy chassis for roomy, luxurious motor homes (p. 1).

Front disc brakes standard.
Most braking effort is needed up front, especially with a big camper body aboard. So Chevrolet puts heat-dissipating, fade-resisting disc brakes there. They recover quickly from a drenching, too. Front disc brakes cost extra on some other makes. Chevrolet's are standard. Brake power assist also standard on ¾-, 1-ton and 4-wheel-drive pickups.



Front stabilizer bar available.

High, bulky loads like pickup camper units change a truck's center of gravity. The front stabilizer bar helps give added driving ease and improved handling. Not everyone offers a stabilizer bar. It's available (and recommended) on our ¾- and 1-ton pickup campers and Chevy Van Mini Motor Homes.

Big V8 power available.
Our 350 V8 is available across the line and standard on some Chevy Vans. Our 400 V8 is the biggest available in a pickup. If you can get along with less engine, there's the 307, standard on V8 models except in California. All Chevy engines, even the most powerful, use low-lead, no-lead or regular fuel.

Series 10 Cheyenne Fleetside

Series 20 Cheyenne Fleetside

good, solid foundation vacation home.

Chevy Van. For basic conversions, high tops and Mini Motor Homes.
The simplest conversion adds comforts without basically changing the Chevy Van's configuration. Alternate designs raise the roof before putting cooking, dining and sleeping facilities behind our standard sliding side door. Finally, the Mini Motor Home—a modified Chevy Van with all the comforts.

Massive Girder Beam front suspension.
Hefty control arms and thick coil springs let the front wheels step over bumps independently, without passing road shocks back and forth between themselves. Or up to the passengers. It's the standard suspension on all Chevrolet 2-wheel-drive models.

Two Chevy Van sizes, big and bigger.

All that space inside makes Chevy Van popular with campers, and camper manufacturers. Two wheelbases: 110″ and 125″. There's 141½″, free and clear, from engine to rear doors in the longer model—up to 296 cubic feet of living room. The sliding side door needs only 4½″ clearance to glide open.

Built tough. Built to last.
Chevy pickups give you a truck inside a truck: double-walled cab; double-walled Fleetside box; full inner front fenders. Chevy Van's unitized body is electro-coated to draw rustproofing primer paint into every crevice. Set *your* vacation home on a good foundation. Chevrolet.

Series 20 Chevy Van Conversion

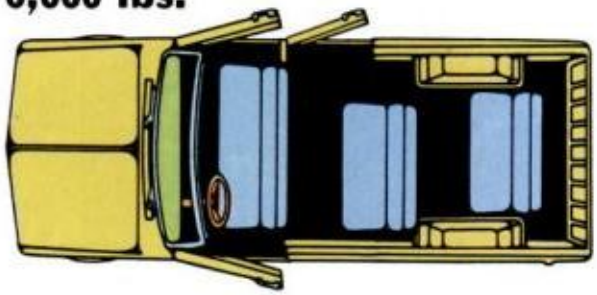
Series 30 Chevy Van Motor Home Conversion

Two different "Vehicle
Chevrolet trucks

Chevy Suburban. "Tow Vehicle of the Year" for 1971.
A national magazine, *Camping and Trailering Guide*, rated Chevy Suburban best for towing over five competitors in 1971. This year's Suburban has all the features that helped earn the title last year. Like Chevy's wide-stance Girder Beam independent front suspension. A ladder-type truck frame. Two-stage coil rear springs.

Power front disc brakes standard.
Hauling a big travel trailer, you'll appreciate the durability and fade-resistance of Suburban's front disc brakes. The system includes a special valve which proportions front and rear braking pressures as needed. Front disc brakes and fin-cooled rear drums are standard on Suburban. So is power assist, front and rear.

Seats up to 9, tows up to 6,000 lbs.



With the available second and third seats, Suburban can take on nine adults altogether with some 40 cu. ft. left over for their luggage. And a Series 20 Suburban, properly equipped, is rated for towing trailers to 6,000 lbs.

Outfit it like a top-line wagon.
Order the Custom Deluxe interior with rich vinyl/cloth upholstery over thick foam cushioning. Add a Comfortilt wheel, power steering, Turbo Hydra-matic, a 400 V8, air conditioning with an auxiliary second cooling unit in the rear. Just remember, under the nice-guy look is one tough truck. A Chevy Suburban.

Series 20 Suburban

f the Year"awards.
get both.

Chevy Blazer. "Utility Vehicle of the Year" for 1972.
Motor Trend, a car enthusiast's magazine, awarded Blazer that honor. But what's a utility vehicle? Well, in Blazer's case, it's a sports runabout. A supermarket shopper. A family trailer puller. A backwoods adventurer. Or whatever. Which is why Blazer's "Utility Vehicle of the Year," 1972.

Wide-stance room, stability.
Built on the same wide track as Chevy's pickup, Blazer has plenty of room inside. For people (five all told, with available seating). And for things like sports equipment and camping gear. Blazer rides wide-track steady, too, on or off the road.

Engines up to a 350 V8 on order.
Blazer offers a husky 250 Six, or you can specify one of the available V8s including our strong 350. You can also order power steering and Turbo Hydra-matic. Power-assisted front disc/finned rear drum brakes are standard.

Twice the drivepower: Chevy 4 x 4s.
Take a Chevy truck, power its front wheels, too, and you have our 4 x 4. The way Chevy engineers four-wheel-drive, you get plenty of ground clearance and a good-looking low silhouette. You get a tight turning circle for off-road maneuvering or slipping into shopping center parking spots. And you get a good ride from tapered-leaf springs front and rear. Chevy's 4 x 4 setup is available on Blazer, Suburban, ½- and ¾-ton pickups and ¾-ton chassis cabs. Because the good places often start where the good roads end.

CST Blazer

How Chevrolet trucks

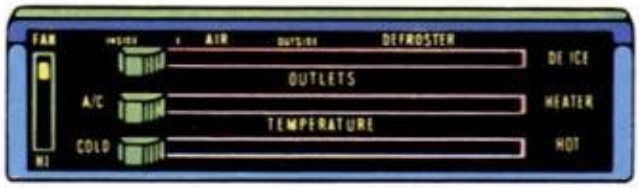
easy

Four-Season Air Conditioning. So weather won't hold you back.
When you're cool, you're more comfortable. When you're comfortable, you're more relaxed. That's the whole idea behind GM Harrison Four-Season Air Conditioning available in Chevy trucks. So you can go when and where you please.

Cool, dry, clean air any time.
Four-Season Air Conditioning supplies a truckful of cool air. Fast. With the humidity wrung out. And most dust and pollen removed. Purely comfortable.

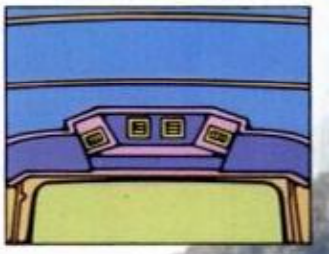
Designed, built for Chevrolets.
So it looks good, works right. You also get *all* the special extra-duty components you need, all installed at the factory.

Controls for Four-Season Air Conditioning available in pickups, chassis-cabs, Suburbans, Blazers.



Air conditioning custom-designed for Chevy Van; rear unit also available.

Rear unit for Suburban available with Four-Season Air Conditioning.



nake roughing it or you.

Comfortilt wheel, power steering ease the driving for everyone.
The smallest wife can handle the biggest camper like a car, when you specify GM Saginaw power steering. If you order a Comfortilt wheel, too, you can change your driving position without leaving your seat.

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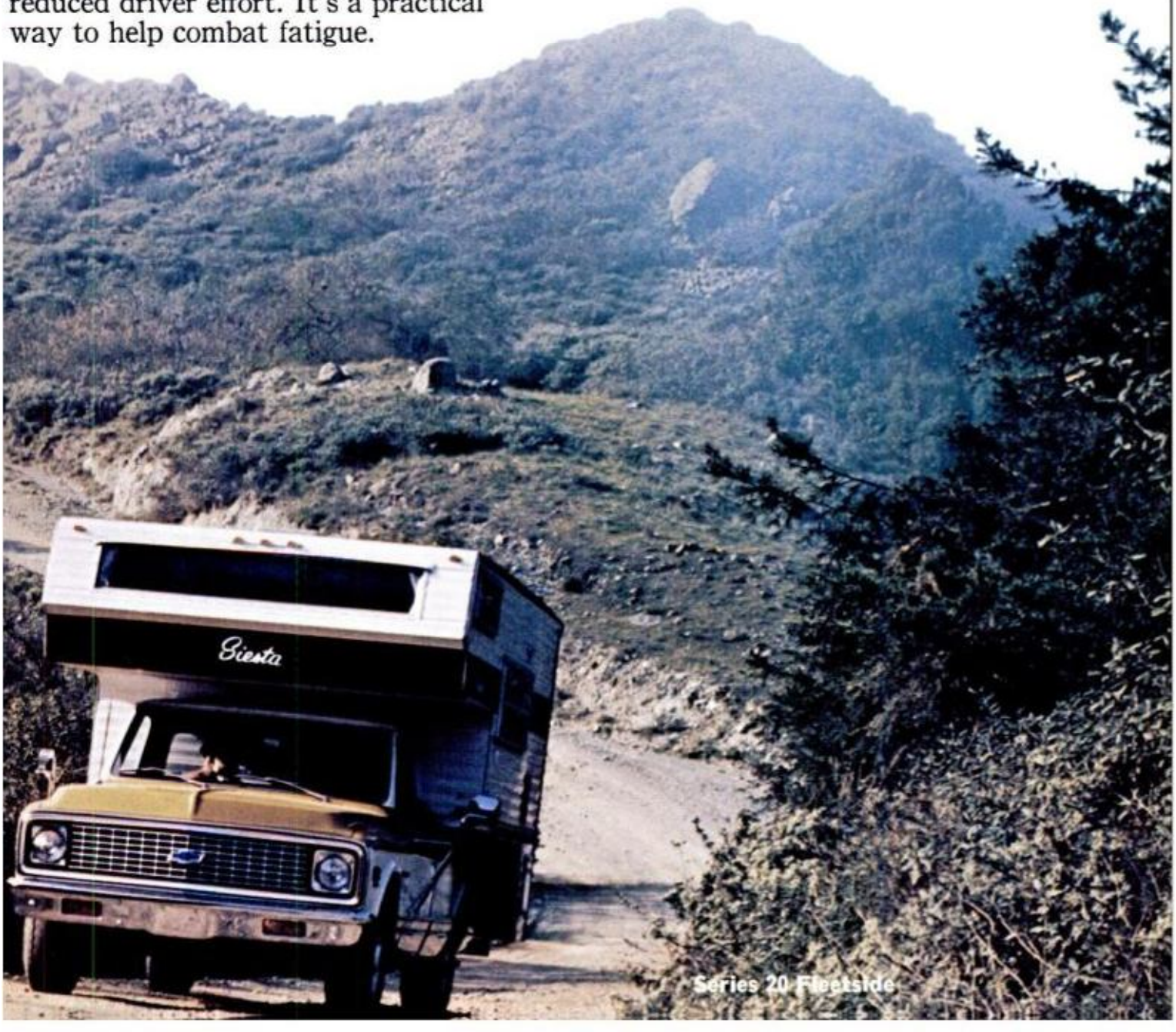
Flick a lever. Swing the wheel up, down, in between. Make yourself comfortable. Swing it all the way up so getting in and out is easier, too. (The tilt wheel is standard on Chevy's Motor Home Chassis.)



With Chevrolet, your truck's a very personal thing.

Blazer, sporting wild new put-ons.
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El Camino. Heads it's a car, tails it's a truck.
At first glance it looks like America's most popular mid-size car. And you can order car stuff like buckets, console, a 454 V8. But out back there's a 6½-foot double-walled cargo box with air-adjustable shocks underneath. Chevy's El Camino: the car that took a body-building course and came out tough.

▼ Chevrolet El Camino

▲ Four-wheel-drive Blazer

Chevy trucks

Take this guide to your Chevrolet dealer for details and specifications on Chevy trucks

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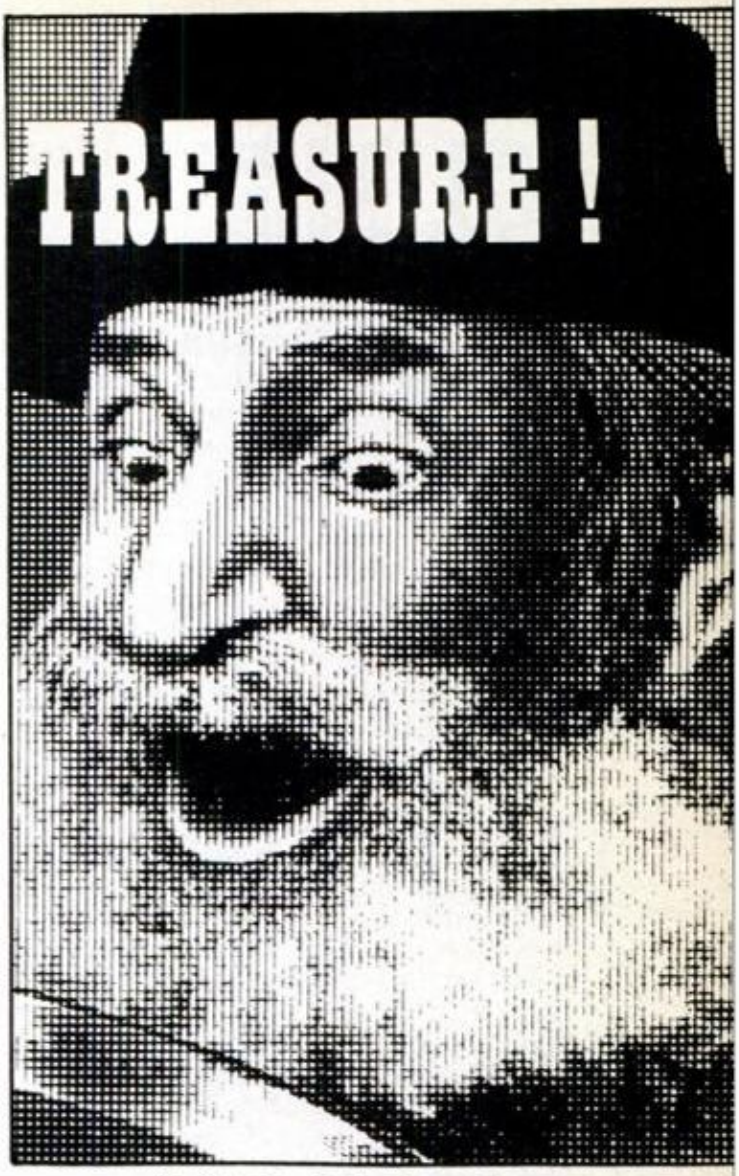

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QUESTIONS ANSWERED

APPLIANCE CLINIC

By PAUL MANN

Wet socks

I have a Norge clothes dryer that doesn't heat up. The drum turns and everything else is okay, but it takes three hours to dry a pair of socks. What's wrong?—Jams Conialer Jr., Alexandria, Va.

Any one of several things. To find the defect, do the following in order:

1. Clean out all lint from the lint trap and vent pipes. Check the area between the rim of the tumbler and the chassis for lint. Lint increases drying time and can cause the motor to burn out.
2. Tighten all connections, especially those going to the heating element.
3. Jump the safety and control cycling thermostats to determine if heat is adequate with the stats out of the circuit. If it is, replace one or both thermostats.
4. Test the heating element for continuity with a multitester. If it shows an open circuit, replace the element.
5. Test selector switch with a multitester or ohmmeter. Replace if defective.

Hot stuff

The top of our gas stove gets very hot to the touch when the oven is on. What can we do?—C. Courtney, Pittsburgh.

The first thing would be to call your gas company and ask for a serviceman. He will check the B.T.U. output of the oven and adjust it if excessive. If the output is proper, you can add more insulation in the space between the top burners and the oven. The stove will have to come apart. Use fiberglass.

Locked out

We have a rather old Westinghouse refrigerator that has a broken door-locking mechanism. A repairman told me that it can't be repaired and that a new mechanism is not available. Can I hook up some sort of magnet arrangement?—J. H. McKinley, Pittsburgh.

No, you can't. By placing magnets in the door you will destroy the refrigerator's gasket setup and its ability to seal. However, I can't buy the repairman's contention that a locking mechanism isn't available. Many refrigerator service shops save parts taken from discarded units. Obtain the model number of your refrigerator. Older Westinghouses have this number beneath the kickplate on the front. Remove the plate. Get on the phone and call every Westinghouse dealer you can find in the classified pages. As a last resort, get in touch with the parts-service department of Westinghouse's refrigeration division at 3 Gateway Place in your city.

Garbage dump

After our new garbage disposer has been used, I notice some waste in the sink. I am sure that the cover is on tight. Where can it be coming from?—Sidney Lane, Portland, Ore.

This could occur if the garbage guard or cover is slightly defective and not containing the waste in the cutting chamber. It may also happen if the waste line isn't able to carry away the volume of garbage and water. The garbage would simply rise in the cutting chamber and flood the garbage guard or cover, leaving residue on the bottom of the sink. If this is the case, you may have a venting problem, inadequate-size piping or a plugged waste line.

Spiked coffee

I make coffee with a Hamilton Beach electric percolator. My husband complains it has the taste of iron. Could it be the water? I use a cleanser to scour the pot after every use.—Mrs. Beatrice Kring, Hempstead, N.Y.

I don't know what iron tastes like, but I doubt if your bad tasting coffee is a result of the water. Your problem probably stems from the scouring cleansers you have been using to clean the unit. Cleansers will scratch the metal and remove the plating. If this has happened, you may have to replace the percolator since replating may not be practical. Before doing anything, though, mix cream of tartar with water and run the percolator through a complete cycle. This mixture helps to remove coffee stains and bad taste. Use this method as often as necessary for cleaning an electric percolator. Remember: scouring powders or steel wool will damage the appliance.

All spun out

Our 10-year-old Frigidaire washer has operated perfectly until recently. Now, it

(Please turn to page 48)

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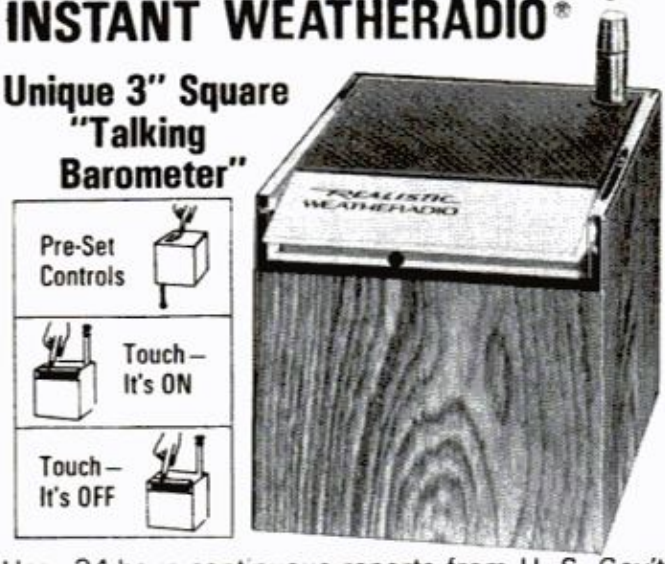

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APPLIANCE CLINIC

(Continued from page 46)

refuses to spin and drain. The wash cycle is okay. What's the trouble?—Walter H. Raines, Canoga Park, Calif.

The problem may be a defect in the wiring between the timer and the motor. Or it may be a malfunction with the timer itself. In either case, the timer is not advancing. If the trouble is not electrical, then it is mechanical. In most cases, the mechanical fault is a broken torque spring.

No go

A Westinghouse oscillating fan I've had for years has suddenly lost its get-up-and-go. Oscillation is catch-as-catch-can. Is there a way to normalize oscillation? —Harvey Helfman, Boston.

After years of use, the link and eccentric arm of the oscillating mechanism may need lubrication. Lack of this will put a drag on it. This is easy to correct. Just loosen the locknut that holds the link, clean the link and eccentric arm, and lubricate these parts with a light coat of white grease that you can buy in a hardware store. Don't use oil—it will drip.

Should the worm-gear assembly and link be badly worn, lubrication won't help. You will then have to replace the part.

Maintenance Tips

● **If cooling is inadequate** though the filter of a room airconditioner is clean and the unit is running properly, the condenser cooling fins may be dust-clogged. This happens especially in areas where outside air is very dusty. This affects cooling by reducing the ability of the condenser to transfer heat. To clean dust from condenser fins, run a vacuum-cleaner tool carefully over the fins.

● **For perfectly clean dishes** and to prevent foul odors, frequently clean food scraps from the trap inside your dishwasher.

● **Protect the polished metal case** of a small appliance such as a toaster by placing it on a soft pad when you work on it. A piece of scrap carpeting will do. This prevents particles of grit and metal found on a workbench from scratching the case. ★★★

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. However, problems of widest interest will be answered in this column.

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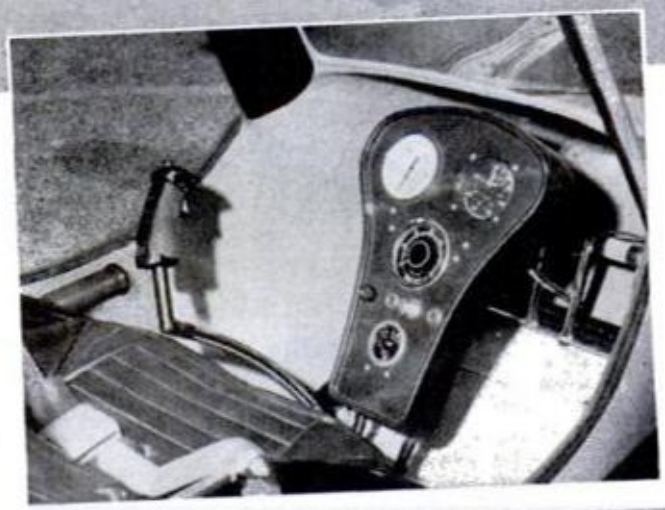
AVIATION

The Scorpion: a real copter from a kit

PERKY SCORPION, with designer B. J. Schramm at the controls, is put through its paces at a recent air show. Below: Cockpit is small but uncluttered and comfortable

Photos by Howard Levy



Powered by a 115-hp engine, this whirlybird cruises at 75 mph and has a 140-mile range. You can build it from 15 separate kits for a total outlay of about $3650

By KARL I. OLNAS

THE SCORPION is a rare bird—a homebuilt that is a true helicopter, not an autogyro. The difference? A copter's rotor is powered while that of an autogyro spins only in reaction to aerodynamic forces. It's a more sophisticated—and more expensive—form of air transportation than its simpler rotary-wing cousin.

The Scorpion comes in kit form—in 15 different kits, to be exact. There's one for every major component—the rotor head, the powerplant, landing gear, and so on.

The advantage to the homebuilder is that he can buy a few kits at a time,

FROM LANDING SKID to rotor, the Scorpion stands six feet high. A two-seat model is also available

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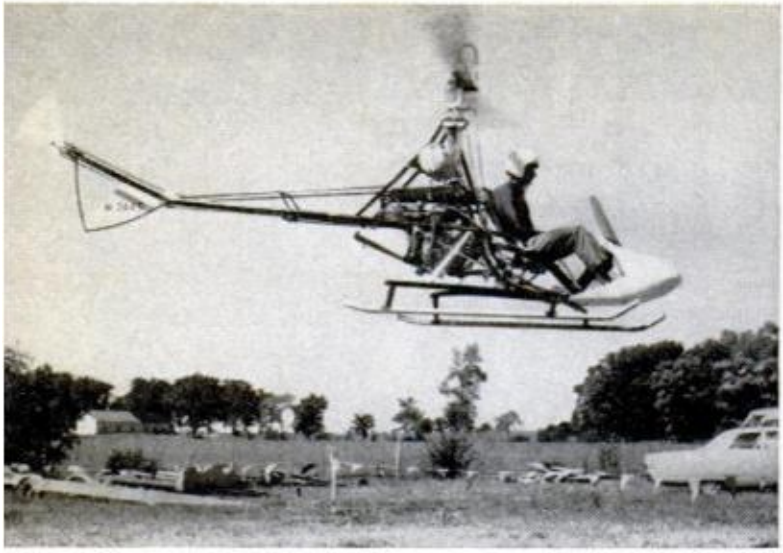


RESEMBLING A BIG FLYING BUG, "stripped" version of Scorpion moves slowly across a California field

FIBERGLASS FUSELAGE, bubble windshield, wheeled landing gear can easily be added to basic craft

building the bird piecemeal and laying out hundreds—instead of thousands—of dollars at a clip. The Scorpion is not cheap. Total price, less engine, comes to about $3650.

The Scorpion is a souped-up version of a copter first flown by B. J. Schramm, its designer, in 1965. Powerplants are outboard marine engines: an 85-hp Johnson, or a 100-hp or 115-hp Evinrude. The four-cylinder Evinrudes have proven popular because of the extra power.

A 115-hp Scorpion has an empty weight of 450 pounds and a gross weight of 750 pounds. It boasts a maximum speed of 85 mph and a cruise speed of 75.

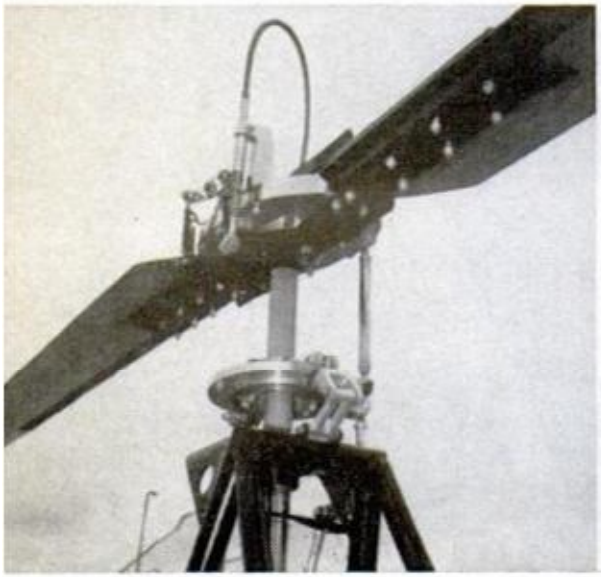
Rate of climb is 1200 feet per minute and the service ceiling is said to be 12,000 feet. Normal fuel capacity of 10 gallons provides for a top range of about 140 miles.

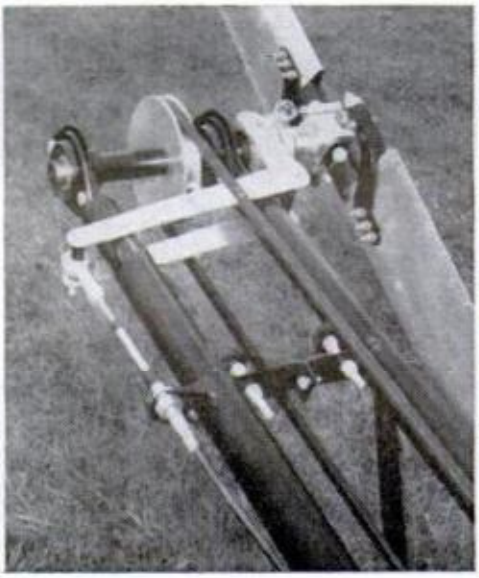
The airframe is a simple tubular steel job with a variety of fiberglass pilot enclosures available. The main rotor is 20 feet in diameter and the tail rotor 3 feet 4 inches. Overall length is 17 feet and the height hits 6 feet.

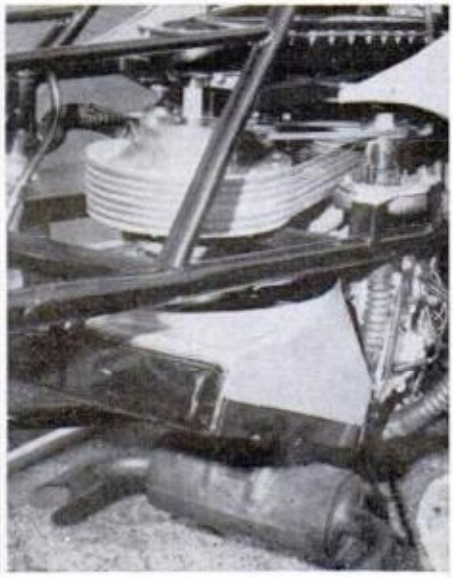
The rotor system incorporates a two-bladed, semirigid main rotor and a Schramm-developed Tractable Control Rotor System. The rotor hub is fabricated of aluminum and the blades are attached to it by retention straps. The two-bladed tail rotor is also aluminum.

Though the Scorpion could never be considered the typical homebuilt craft, it has proved popular among the do-it-yourself set. Last year, a dozen Scorpions showed up at a Midwest airshow. For further information, write the kit maker: Rotorway, Inc., 14805 South Interstate 10, Tempe, Ariz. 85281. ★★★

LOOPED CABLE RUNS THROUGH ROTOR SHAFT (photo at left) to provide pitch control. V-belts (center) transmit power from the engine to the small tail rotor. Favorite powerplant among home-built copter flyers is four-cylinder, 115-hp Evinrude marine engine. It provides more muscle for faster climbs, hotter performance







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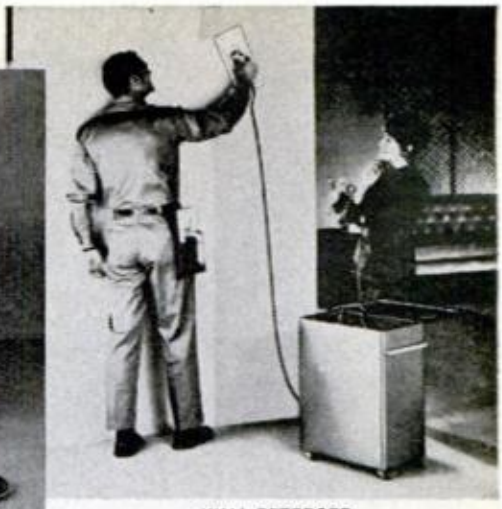

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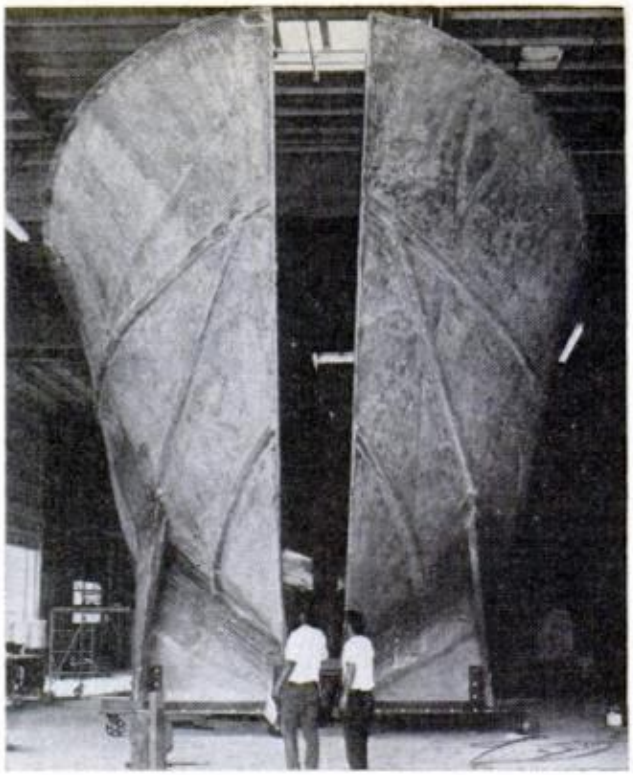
NEWS BRIEFS

Bug does yardwork, too

The Super Bug is an all-terrain vehicle that can be adapted for such chores as mowing and hauling. Plans, drawings and assembly instructions are $3.95; Super Bug, 806 South 80th Ave., Yakima, Wash. 98902.

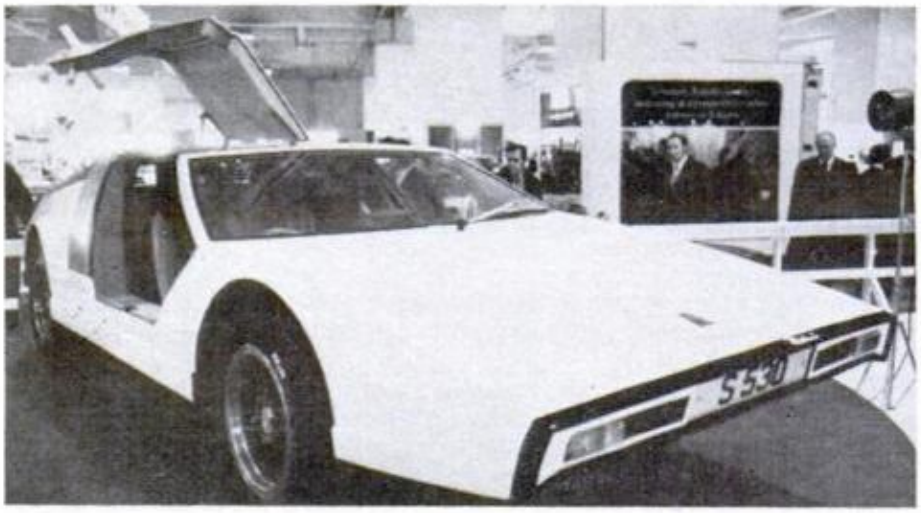


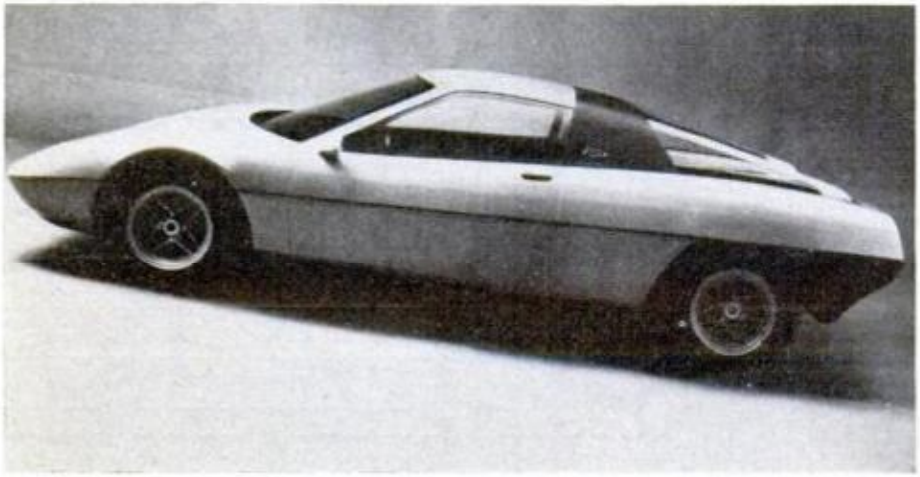
Molds for 75-foot yacht

Workers align two halves of the mold to be used to produce the world's largest Fiberglas-reinforced plastic motor launch, 75 feet in length. Willard Boat Works is making the craft with Owens-Corning Fiberglas.

Aston Martin

Fitted with a 5.3-liter V8 engine, this prototype of an Aston Martin GT car was a highlight of the London auto show. Top speed of the car is said to be 200 mph.





Sports/Tourer

With the prototype GT70 as a base, Ford's new Turin (Italy) Design Studio produced this new mid-engined, two-seat sports/touring car. It was shown at the Turin Motor Show. The wedge shape, nose-down styling and other features make it aerodynamically efficient.

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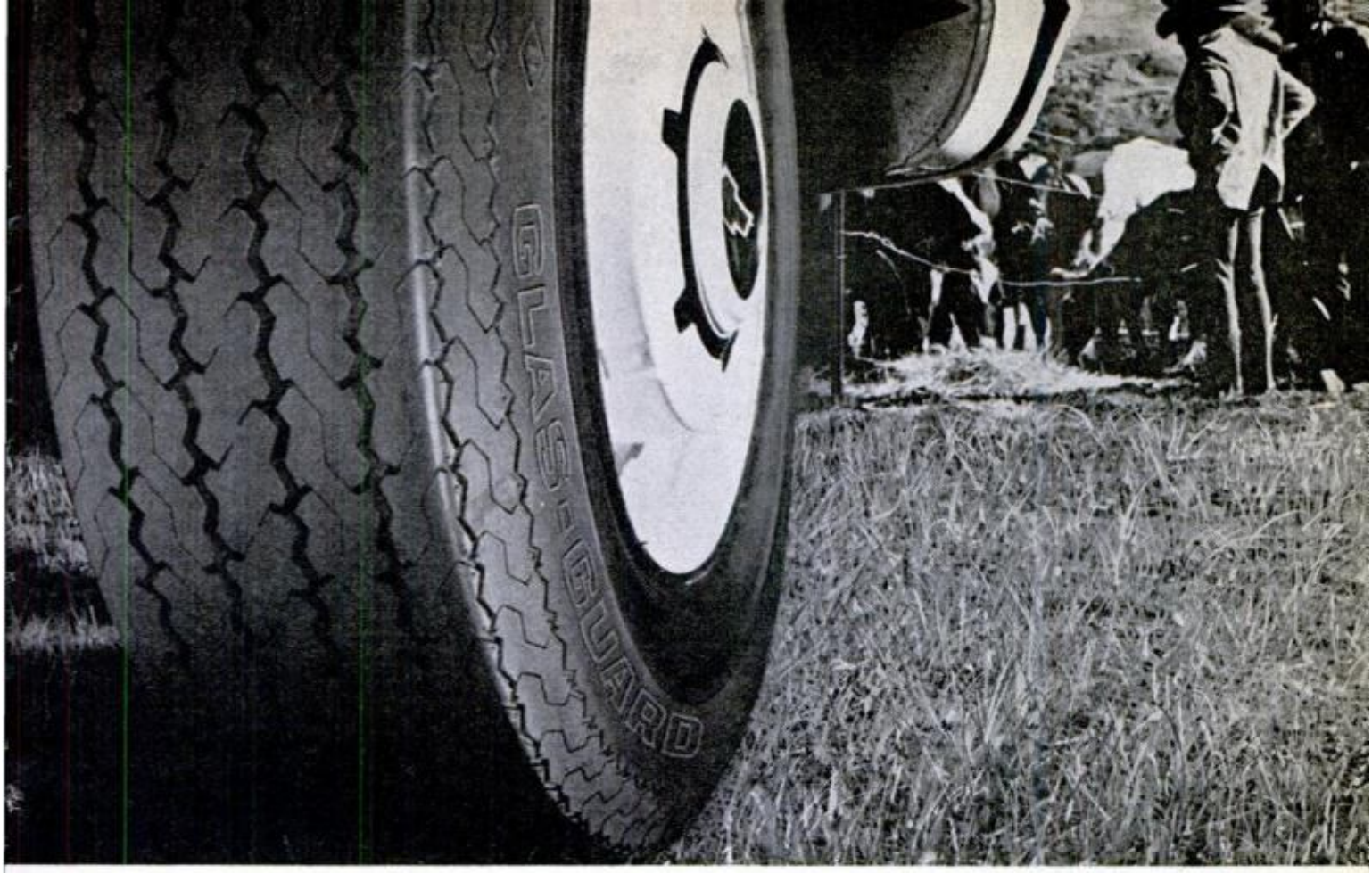

Goodyear GLAS-GUARD, the double fiberglass belted tire specially made for Pickups

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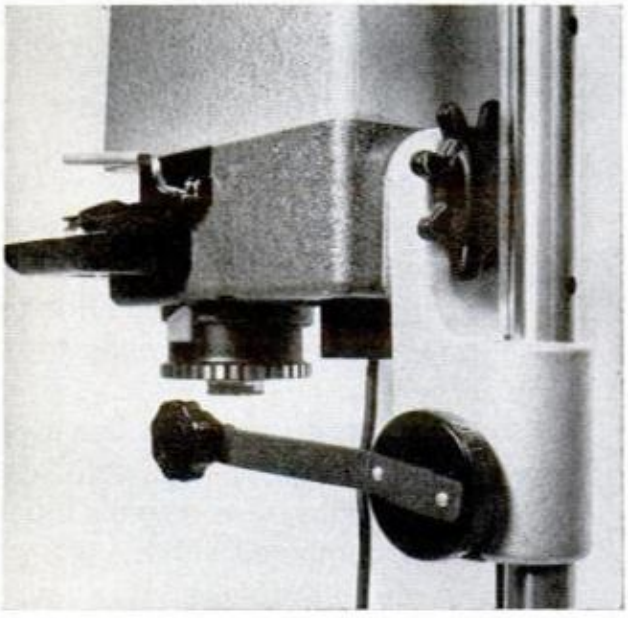
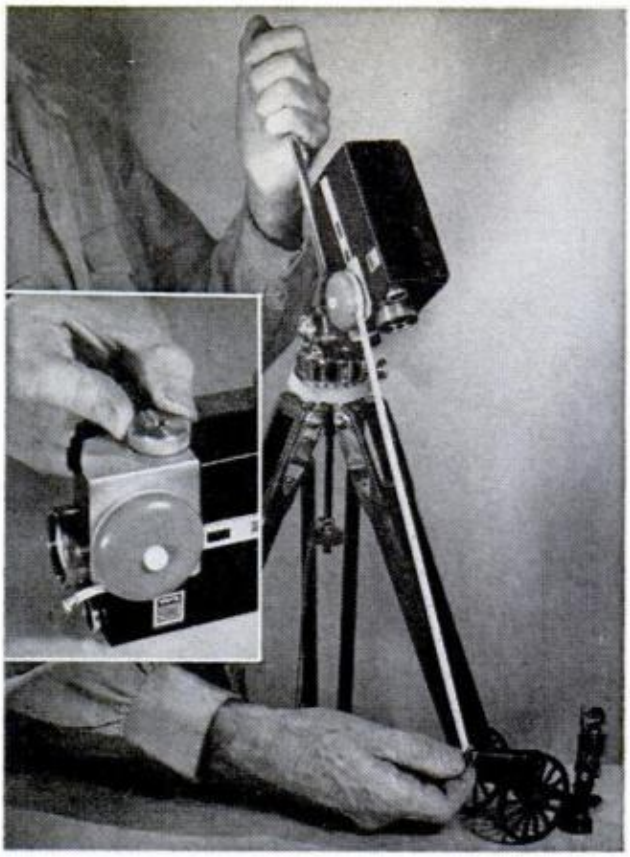
Homemade flashgun mount

The older type of large strobe head designed for a stand can be converted to a portable camera flashgun (above). The strobe is first fitted to a swivel-type tripod accessory, then the swivel is bolted through its threaded tripod socket to a standard L-shaped flash bracket on the camera base. The swivel lets you tilt the strobe to various angles for bounce-lighting effects as well as straight-ahead shooting.—*Rod Moon, Saugus, Calif.*



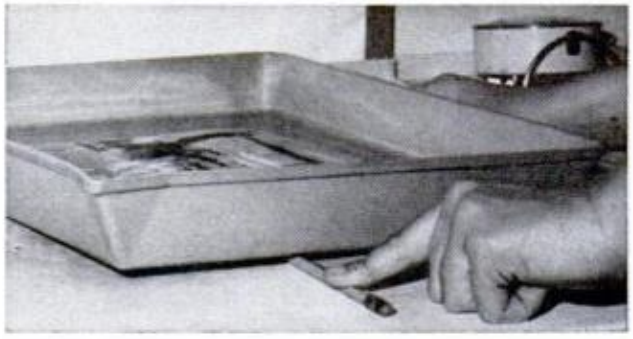
Fast-working enlarger crank

You can speed enlarger adjustments by adding a leverage-multiplying crank arm to the usual column handwheel found on many models. The arm is a short length of thin steel or aluminum bar stock bolted to the handwheel. A radio-type control knob on the outer end makes a fine hand grip.—*Doug Blodgett, St. Charles, Mo.*



Tape checks camera close-ups

Attaching a roll-type tape measure to your camera makes it easy to check distances precisely when you shoot extreme close-ups with a supplementary lens. Bend a bracket from thin aluminum or other sheet metal to fit around your camera and cement the tape to it with epoxy. Position the tape's case so its slotted opening is at or near the lens. The bracket can be quickly attached to the camera with a short ¼-20 bolt threaded into the tripod socket. In use, the tape is simply pulled out until the proper distance mark lines up with the front of the lens. You can buy tapes at variety stores for under $1.—*Walter E. Burton, Akron, Ohio*



Handy rocker for darkroom trays

Rocking a developing tray by hand often sloshes chemical over your bench. Rolling a pencil under the tray will gently swirl the solution without splashing it. —*J. Ray Chenoweth, San Jose, Calif.*

(Photo Hints continues on page 50H)

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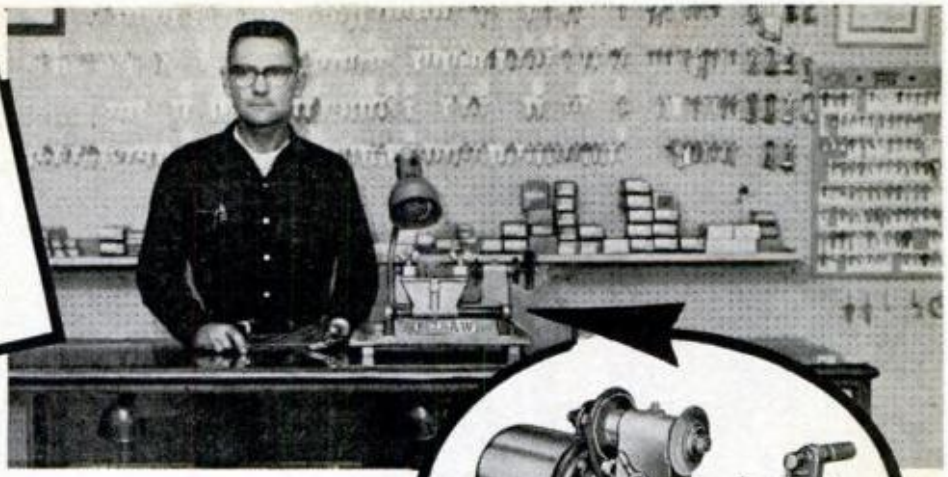

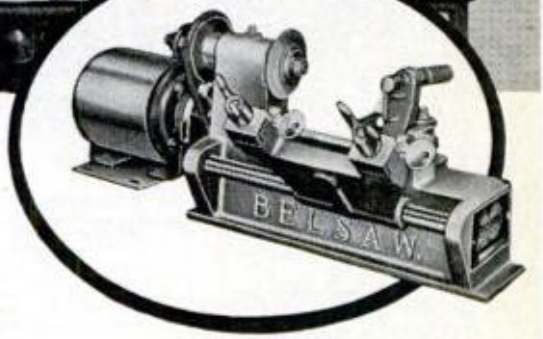

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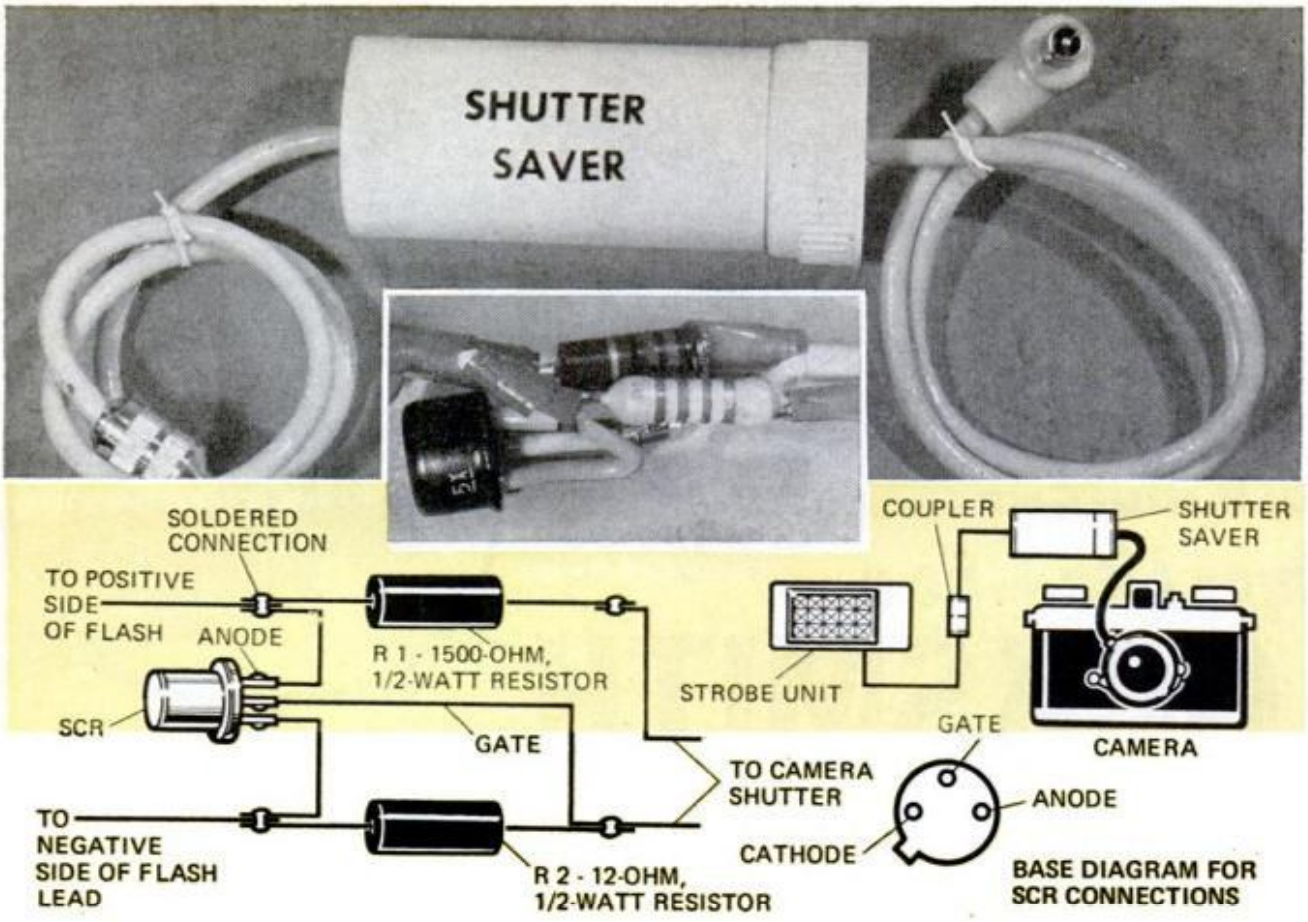


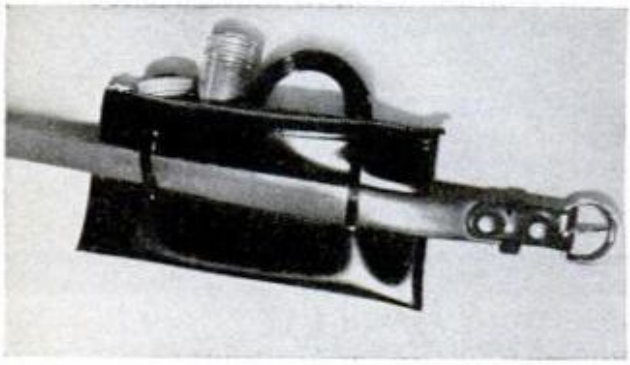
PHOTO HINTS

(Continued from page 50F)

Shutter saver tames flash shots

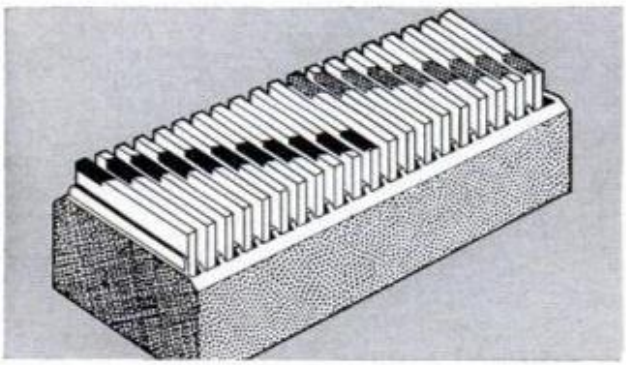
Firing a strobe flash slaps a fat spark across delicate shutter contacts in your camera and may, in time, pit and corrode them. You can protect the contacts with this simple electronic device to tame the spark to a harmless low-voltage pulse, eliminating arcing. It comprises two resistors and a tiny silicon-controlled rectifier (SCR). The SCR, a 2N2325 GE-type C5G, carries the heavy current that actually fires the flash, while the resistors provide the low-voltage pulse to trigger the SCR when shutter contacts close. Parts fit neatly in a small plastic pill bottle. Wire them as shown; solder and tape the connections. Use a separate flash sync cord so the device can be coupled to your strobe or detached as desired.

—A. J. Lowe, Brisbane, Australia.



Belt carrier from a pencil case

A plastic pencil case makes a fine belt holder for small camera items such as extra film, filters, shades, cable releases. Cut two slits near each end to form loops to slip the belt through. The zippered case is easy to open and close with one hand while holding a camera with the other.—*C. Boyd Pfeifer, Baltimore, Md.*



Easy way to file slides in order

Slides can easily be kept in proper sequence with this simple trick. File the slides in correct order, then run a strip of colored adhesive tape diagonally across the tops. Slit tape between the slides and press the ends down around the mounts. Use a different color for each sequence.

—Charles E. Peterson, New York, N.Y.

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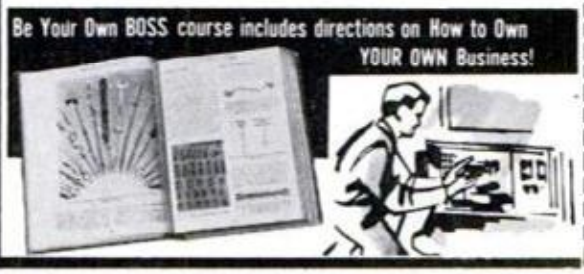

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NEW IN

ELECTRONICS

PLAY-YOUR-OWN TV CASSETTES, much talked about last year, are soon to go on the market, according to announcements by three major manufacturers. Hitachi's player, shown at upper left, is based on CBS's EVR (Electronic Video Recording) system. Already on sale in Japan for about $775, it's due here this spring, but the U.S. price has not yet been determined. Panasonic and Sony both have cassette machines based on conventional videotape. Panasonic's is available in two models shown above—one a player-only version and one a combination player/recorder. Prices are not yet known, but the player-only model is expected to be low enough in cost for home use. Sony's version, shown below, permits both playing and recording and is expected to sell for approximately $800. Blank 60-minute cassette tapes will cost $30. All three systems provide both color and black-and-white pictures and can be used with any color or monochrome TV set, requiring only connections to the antenna terminals.

(For more Electronic News, see page 50L)

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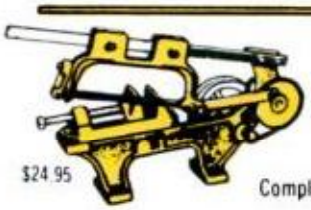

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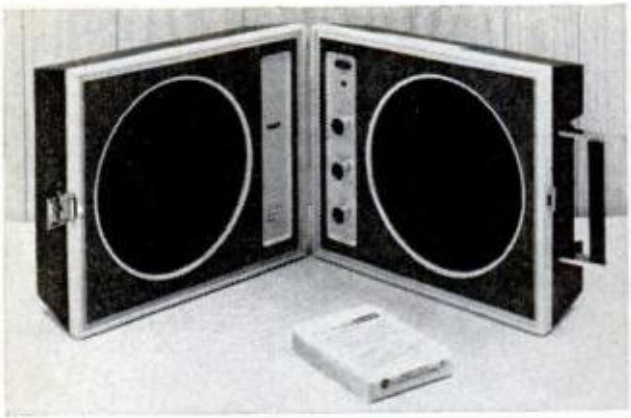
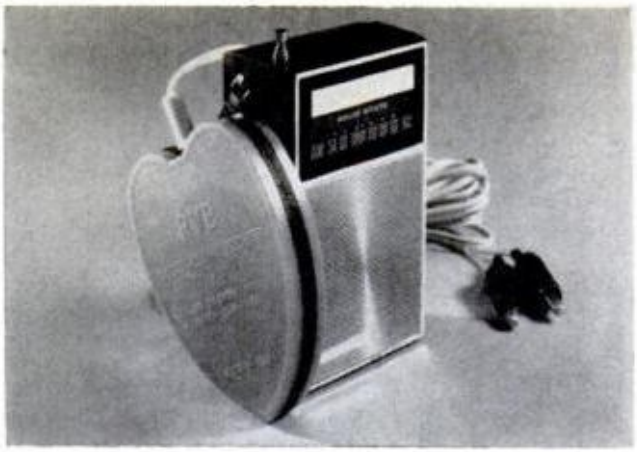
NEW IN ELECTRONICS

(Continued from page 50J)



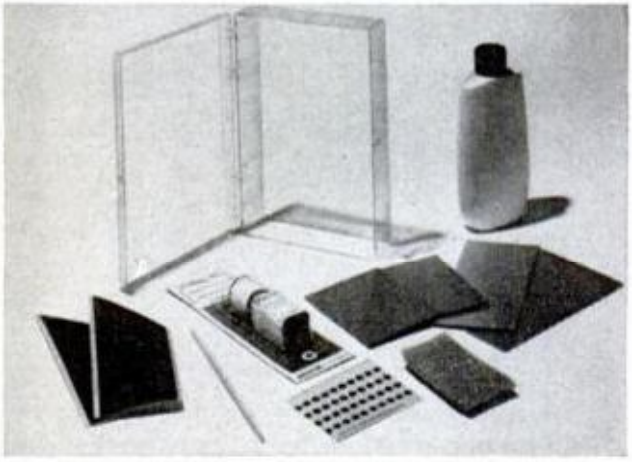
PORTABLE CARTRIDGE PLAYER consists of two hinged sections that can be detached and pulled apart for wider stereo separation. Each half contains a 6-inch speaker, with the cartridge-loading slot and controls in the right-hand one. When not in use, the sections fold together for easy carrying and storing. Made by RCA, Model YZD-589 plays on self-contained batteries, house current or 12-volt d.c. from a car or boat. Price is $89.95.



SIGNAL BOOSTER is said to improve AM radio reception in distant or difficult areas. Working by induction, it requires no connections to the set itself. $7.95, Shotec, Inc., 3393 De La Cruz Blvd., Santa Clara, Calif.

IT LOOKS LIKE A MIRROR or picture frame, but actually it's a hi-fi speaker in disguise. About an inch thick, the thin air-suspension design uses a flat front surface to vibrate, in effect, like a cone. The 17¼ by 20¼-inch Poly-Planar speaker handles 40 watts, comes as framed mirror or painting, is $24.95. Magnitran Co., 311 East Park St., Moonachie, N.J.

YOU CAN MAKE YOUR OWN printed-circuit boards from the kit below. It contains blank copper boards in assorted sizes, layout strips, etching solution and instructions. The plastic box also doubles as a handy etching tank. $3.75, GC Electronics, Rockford, Ill. 61101.



CASSETTE TAPES can be quickly rewound with the Fast-Winder above. The battery-powered aid is designed for use with machines that lack a Fast Forward control, slowing rewinding. $7.95, Executive Devices, 740 South Locan, Fresno, Calif. An a.c. adapter is $5.95.

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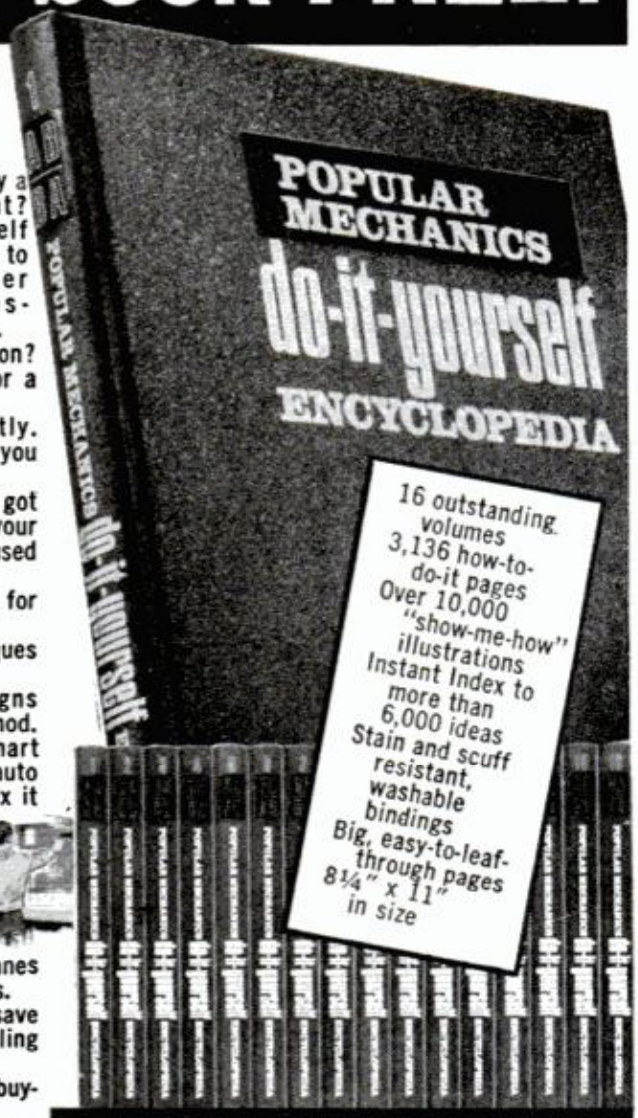

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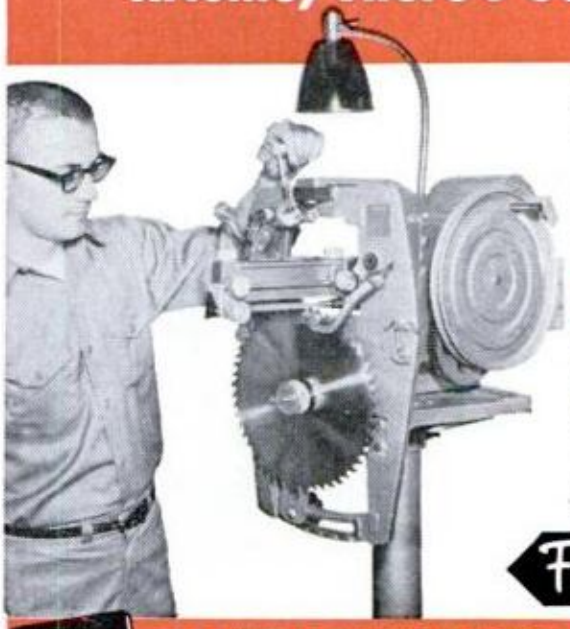

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NEWS BRIEFS

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Water walkers

Walking on water in a demonstration of his Aqua-Hikers for Tokyo TV viewers is Les Banghart, inventor of the foam-plastic floats He describes their action as "similar to walking on snow with skis." The prototype floats were produced by Aqua-Hikers, Inc., Box 605, South Bend, Ind. 46624.

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YOUR MYSTIK TAPE "WHERE, WHAT AND WHY" GUIDE.

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DECORATING	**Mystik® Colored Plastic-Coated Cloth Tape**	18 colors available. Won't stretch. It's washable.
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PAINTING	**Mystik Masking Tape**	Makes sure you get straight lines. Protects windows, baseboards and trim corners.
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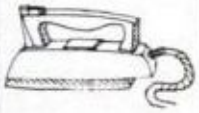
GUTTERS	**Mystik Aluminum Tape**	Patch leaks. Won't rust. Works indoors or out.
RUGS	**Mystik Carpet Tape**	Takes the slipping out of scatter rugs. Holds down carpet tiles because it's double-faced.
 FRAYED CORDS	**Mystik Plastic Electrical Tape UL approved**	Super toughness and stretchiness makes it perfect for repairing frayed wires, appliance cords, insulating and protecting splices.
TENTS	**Mystik Fabric Tape**	It's extra strong and waterproof. Try it on tears in window shades, awnings, tarpaulins.
PLASTIC POOLS & GARDEN HOSES	**Mystik Colored Plastic Tape**	Flexible. Comes in 18 colors. Tear and water resistant. Conforms to irregular surfaces.
HEAVY CARTONS	**Mystik Strapping Tape**	It's reinforced in two directions, can be used for strapping pipes and lumber.

WHERE	WHAT	WHY
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PACKAGES	**Mystik Package Sealing Tape**	High tensile strength. Self-stick, easy application.
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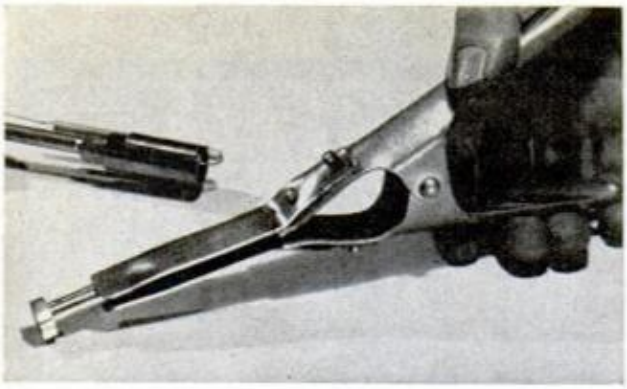
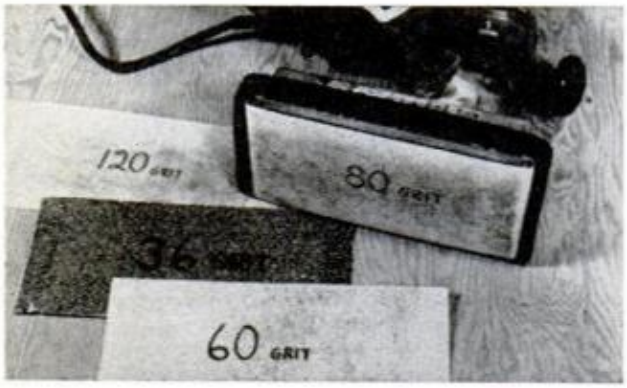


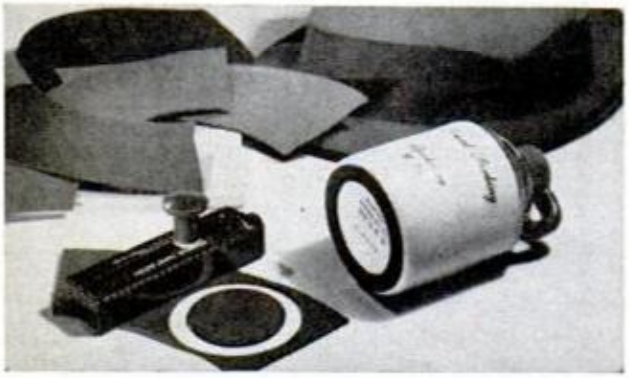
Clamp-extension holds hot tools

To hold small tools for heat-treating, I add removable extensions to a pair of spring clamps. Holder shown comprises two 1/16 x ¾ x 4½-in. steel strips bent to fit the clamp jaws at one end and the workpiece at the other. Drill and tap jaws to receive 6-32 screws to hold "tongs" securely.—*Walter E. Burton, Akron, Ohio*



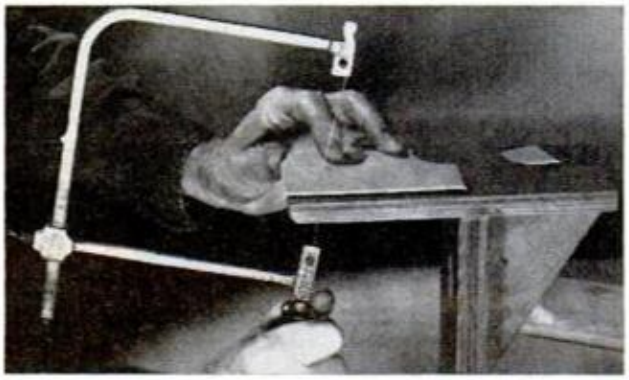
Felt pen shows true grit

If you've ever forgotten which abrasive grade is on your power sander, you know that the paper has to be removed to check the number. But, by marking the face of the paper with a felt-tip pen, you'll always know grit size and other data such as bond type. I've found the markings usually last the life of the paper.—*John R. Pilznienski, Dearborn Heights, Mich.*



Recycle that old felt hat

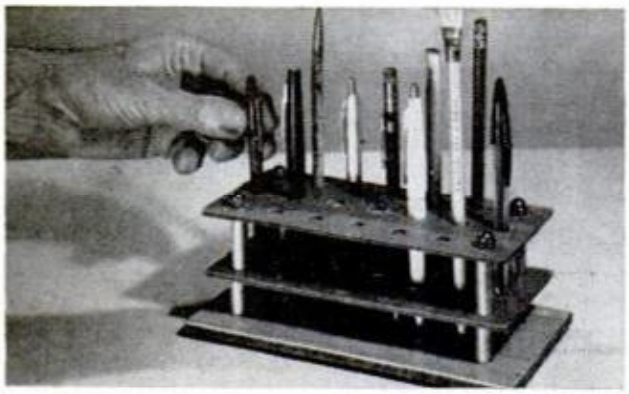
You can put a retired felt hat back to use (partially at least) by cutting it into pads, washers and gaskets for home use. At left, a gasket cutter was used to make a neat ring which was then glued to the bottom of a jug to save furniture from scratches. Make certain that glue used works for both porous and nonporous surfaces.—*B.W. Ervin, Kent, Ohio*



Coped cuts in plastic tile

When making irregular cuts in plastic tile, a jeweler's saw often works better than a larger saw with a coarser blade. At left, starter holes were drilled, then the cut was completed with a 4/0 blade. Jeweler's saws and blades are available from sources such as William Dixon, Inc., Carlstadt, N.J. Saw shown is similar to model No. S-1806.

—*Walter E. Burton, Akron, Ohio*



Shop-made pencil caddy

An easy-to-make desk pen and pencil holder can be quickly fashioned from perforated hardboard. Resembling a twist-drill stand, the base is of finished hardboard. Holes drilled at the four corners receive the four 3/16x3-in. bolts that hold the setup together. If necessary, ream and enlarge holes for specific items to be parked.—*W.B. May, Oak Park, Ill.*

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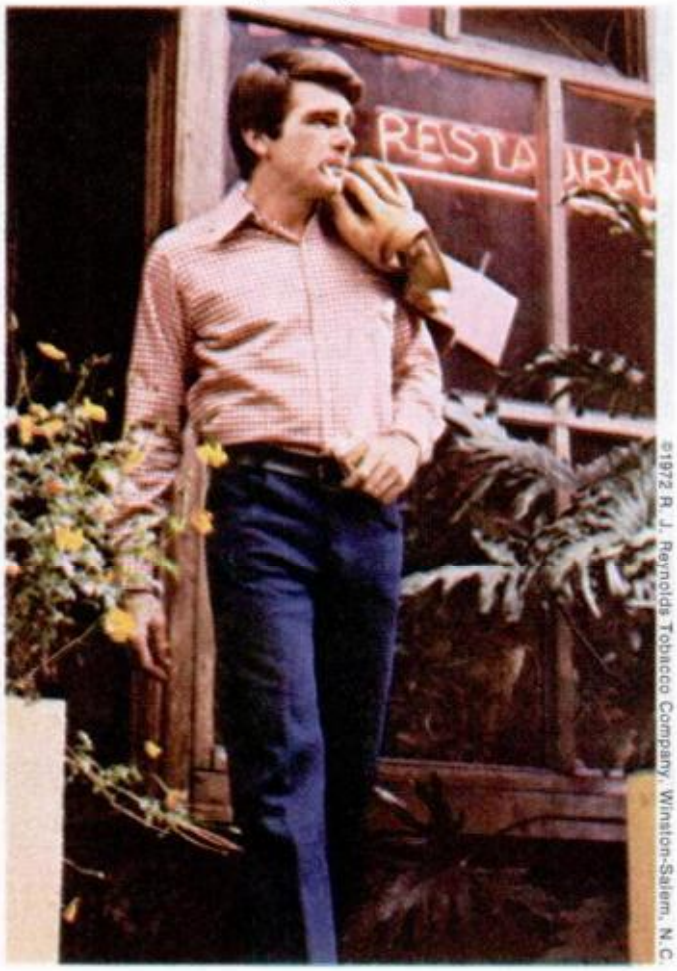

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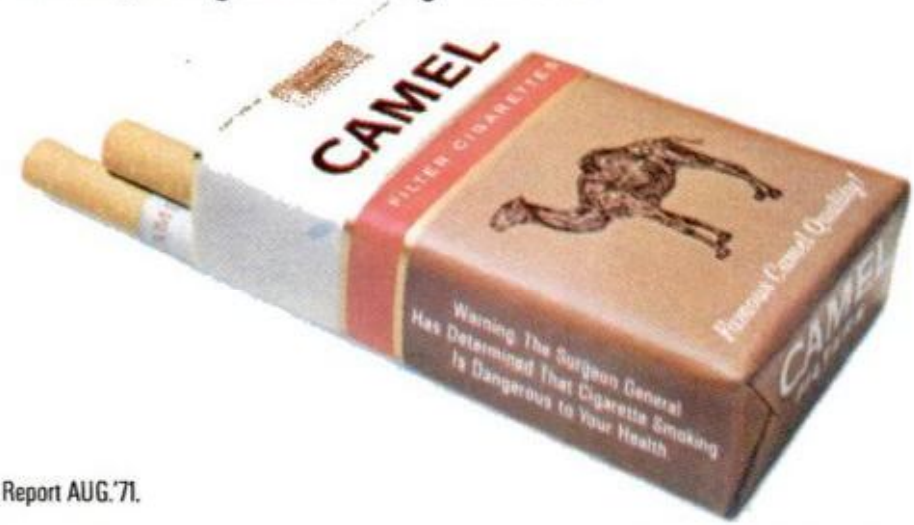
Camel Filters. They're not for everybody.

(But then, they don't try to be.)



20 mg. "tar", 1.3 mg. nicotine av. per cigarette, FTC Report AUG. '71.

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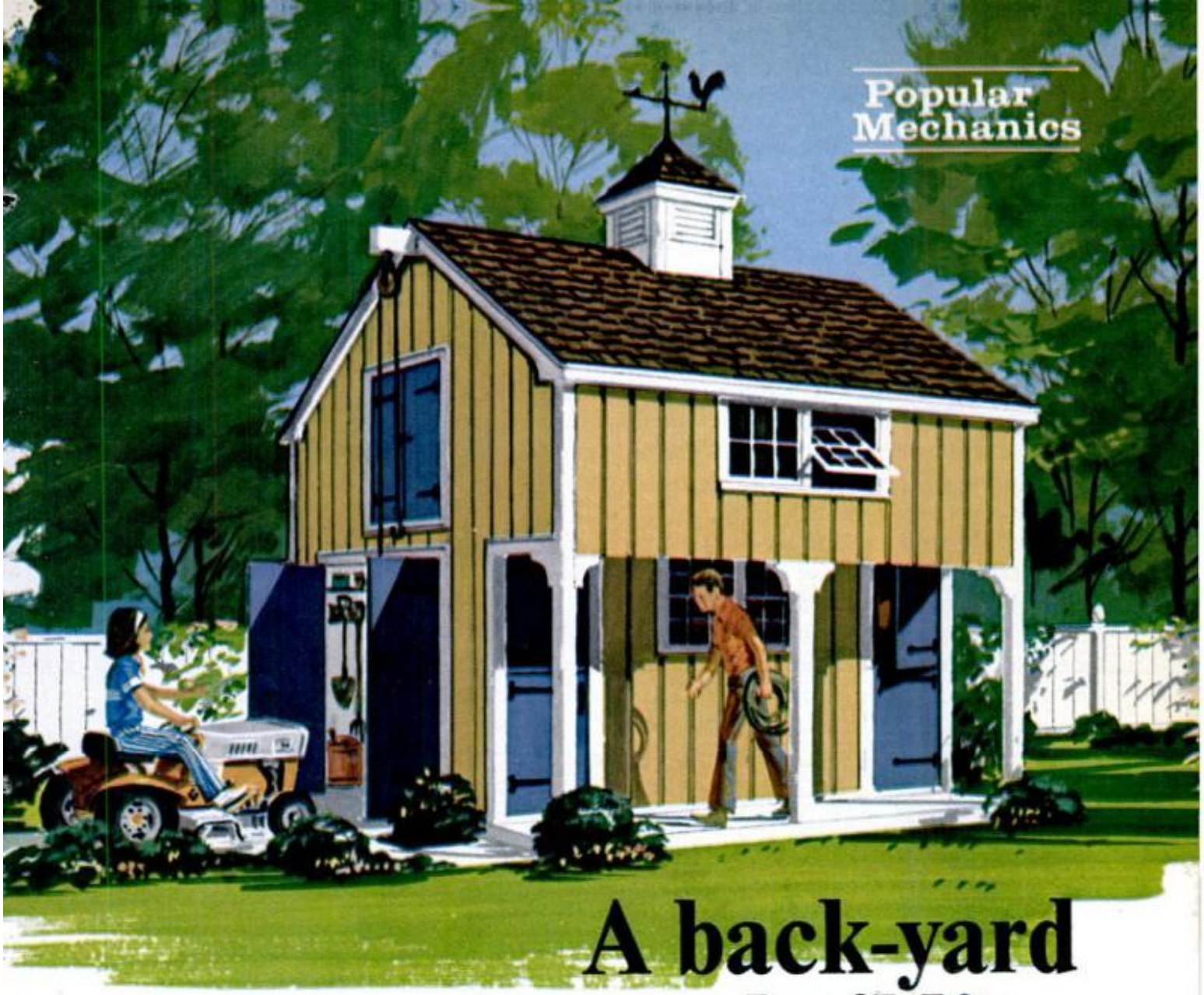

A back-yard storage building that isn't an eyesore

EACH SPRING most homeowners set out with firm resolve to "clean up that mess in the garage for once and for all." But, as most parents will testify, the broom-clean look is usually, unfortunately, a short-lived one. The fact is, the typical garage just isn't built to corral an assortment of bicycles, toys, tools, tractors and the like in addition to the family car.

To relieve that strain on the garage, most decide to build or buy a lawn building. Commercial versions, however, offer little more than storage space when it comes to eye appeal. PM's Carriage House, on the other hand, is an attractive storage building designed to fit a family's many needs.

If you have a swimming pool, you'll find that the space beneath the Carriage House stairs can be put to use as dressing rooms. If you don't have a pool, or never intend to build one, the space is ideally suited for yard-tool storage with the walls lined with perforated hardboard. And even your dog isn't overlooked: He can have his own special niche under the ladderlike stairs.

The patio shown in the artist's rendering at right is optional, but if your

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family enjoys cookouts and family get-togethers, its convenience makes it a worthwhile extra. The seating along both sides also serves as a fence to add to the country look.

The basic house. The floor plan below gives overall dimensions, including the portico. The latter adds architectural charm to the structure, provides shade for midday lazing and shelter when the raindrops keep falling.

The 5-ft.-wide, barn-type doors provide more than ample room for maneuvering a tractor or snowthrower in or out. The doors are not necessary, of course, if the first floor is not to be used for this type of storage.

The first floor can be used as a home office to give Dad a spot to escape to when tackling the monthly bills or some work that he's brought home from the office. There is room enough to accommodate comfortably a file cabinet, desk and a chair or two. And, since the office becomes a man's domain, he will have the advantage of being able to leave his work strewn on the desk and simply lock up for the night. When he returns, the work will be just as he left it.

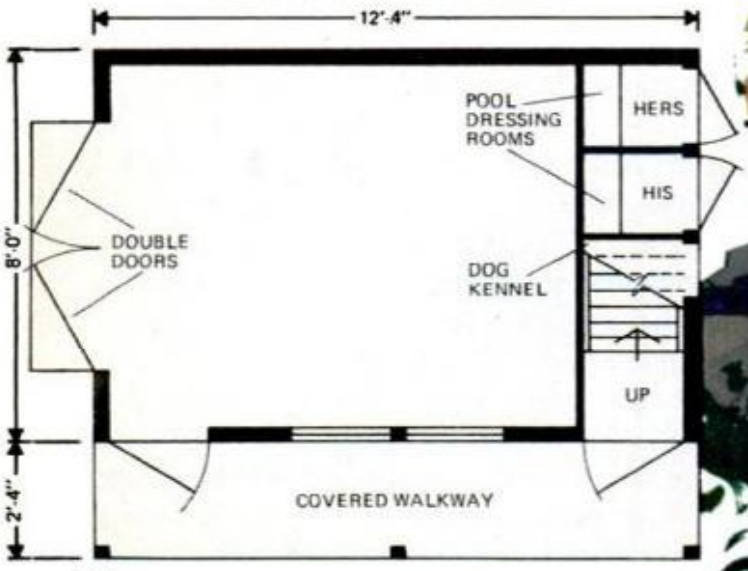
How about a workshop on ground level? There's a lot to be said for any shop that spares you carting materials downstairs, and finished projects back up. And when it comes to using paint and turpentine, those odors won't be in the house—that's a feature that should please all wives.

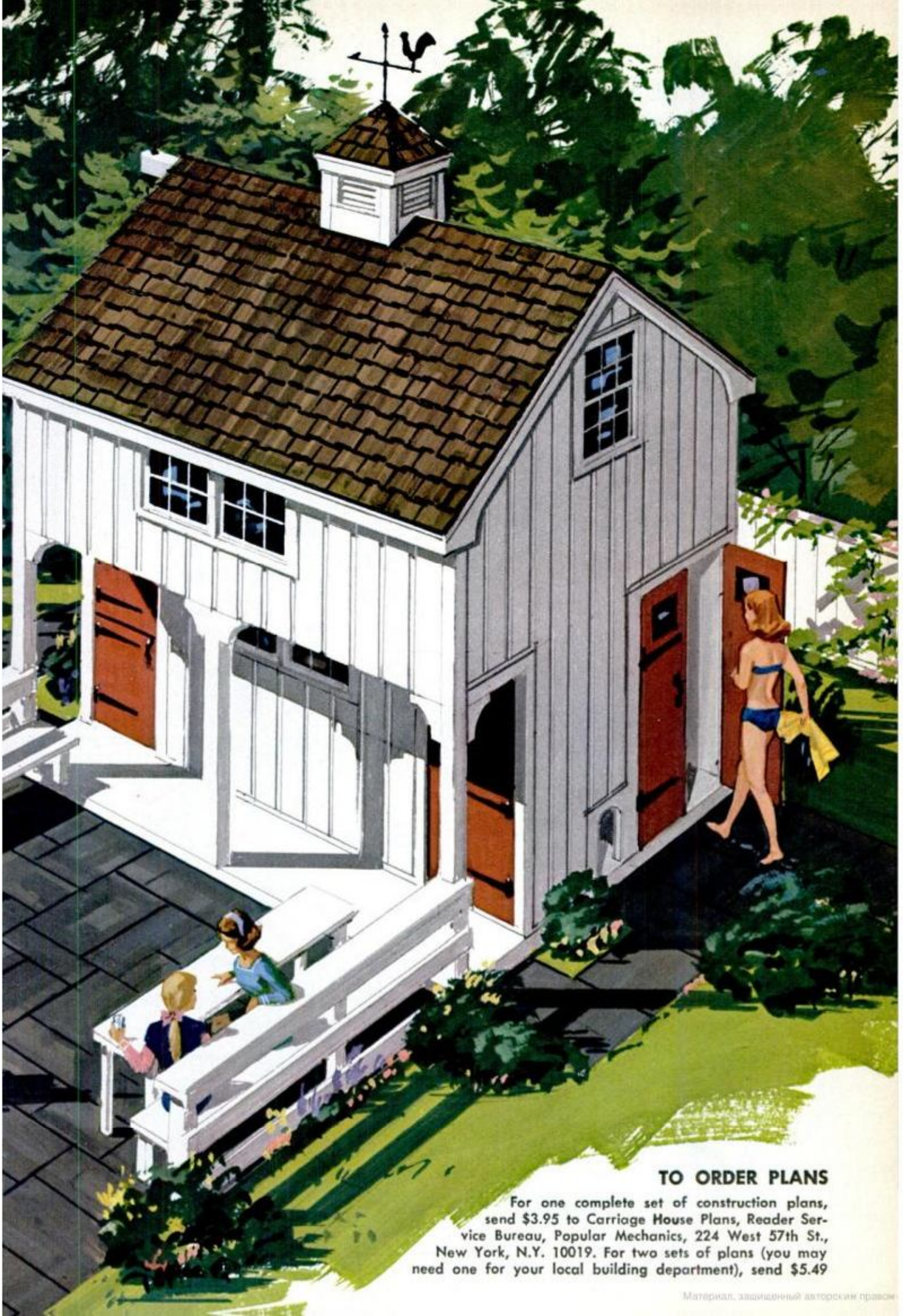
The upstairs. Though small in area, the upper floor provides almost unlimited, additional possibilities. The first and most obvious is to build a bunkhouse for your youngsters. They, as much as their parents, enjoy a place where they can get away from it all. For safety, we've designed ladderlike stairs with handrails for access to the second floor. Though conventional stairs could be built, the limited run to make that 6-ft. 2-in. rise would require an unsafe riser-to-tread ratio. If they're built ladder-fashion, the user

CARRIAGE HOUSE STYLING blends with most homes. Plan below shows space available for whatever use you prefer

Design and illustrations by Sigman-Ward, Inc.

FIRST FLOOR PLAN





TO ORDER PLANS

For one complete set of construction plans, send $3.95 to Carriage House Plans, Reader Service Bureau, Popular Mechanics, 224 West 57th St., New York, N.Y. 10019. For two sets of plans (you may need one for your local building department), send $5.49

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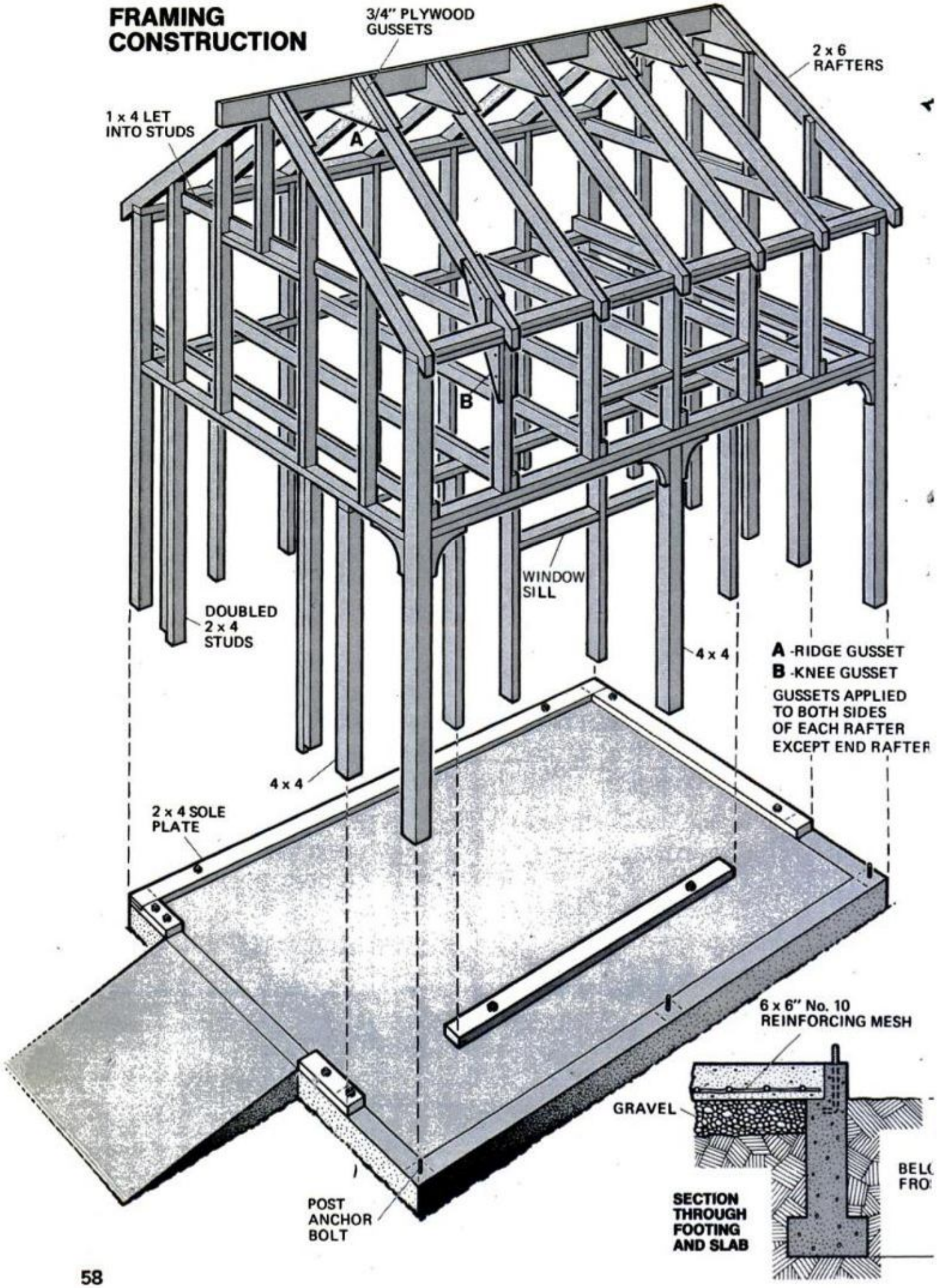
FRAMING CONSTRUCTION



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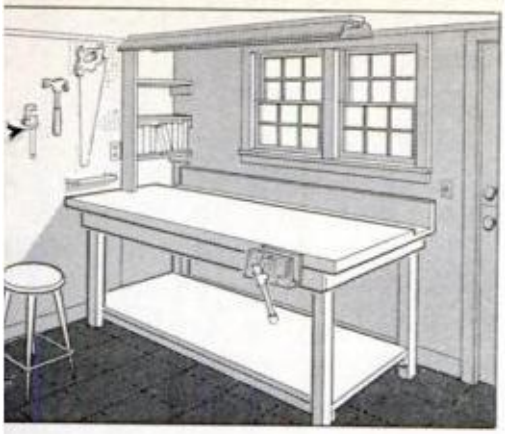
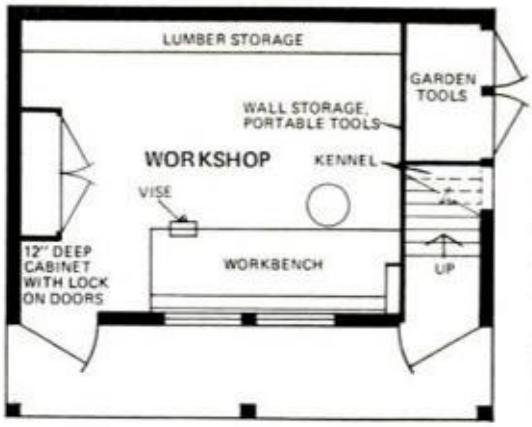
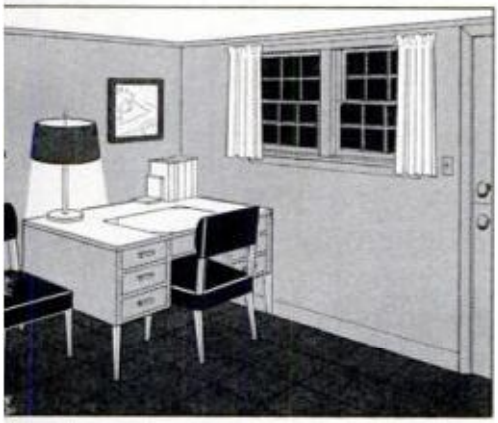
TYPICAL USES FOR YOUR BACK-YARD CARRIAGE HOUSE

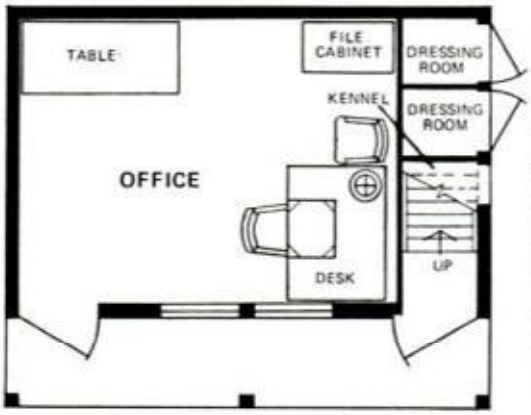




For Dad, a workshop

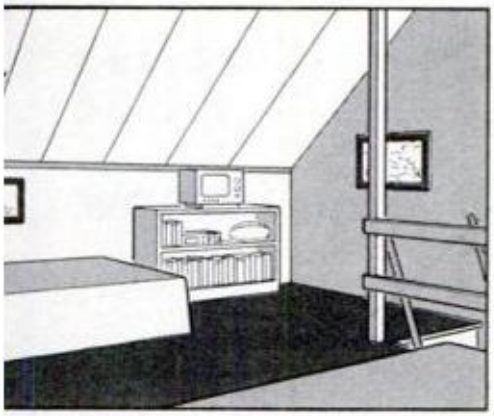
If you have no need of the space for tool or tractor storage, the first floor lets you take your shop out of the basement and into a more convenient location. If the carriage house is intended for nonstorage use such as this, the barn doors shown can be eliminated.

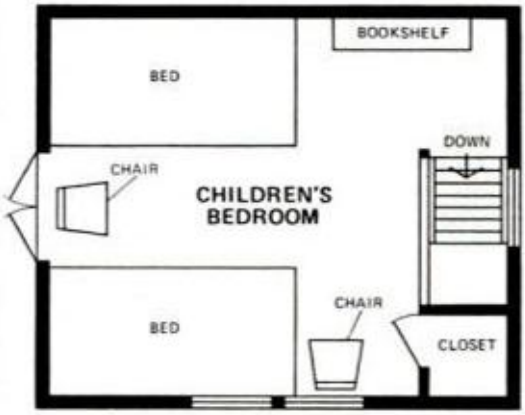




An office to escape to

Whether you work at home full time or not, the quiet, isolated office you gain makes building the little house worthwhile. For this use, the building should be fully insulated and perhaps heated. Consider electric heat—you just turn it off when it's not needed.





Back-yard bunkhouse

Youngsters will get a big kick out of having friends over for a night of roughing it in first-class accommodations. Ladderlike stairs and sloping ceiling up there will cut down on interference from the older generation yet Dad can poke his head upstairs for periodic inspections.

automatically adjusts to the stairs and uses the handrails for safe ascents and descents.

Construction. As can be seen in the exploded drawing on page 58, conventional framing is used throughout with one exception: Since it is desirable to gain use from the second floor, collar beams are not used. But for sufficient strength and rigidity, it is recommended that you use ¾-in. plywood gussets on both sides of all rafters, except the end ones, at the eaves and ridge board (see details A and B in the drawing). Our architect assures us that these will provide adequate structural support. But if you are planning to use the second level for storage only, you can forget the gussets entirely and run collar beams from plate to plate.

Complete building plans are available; for ordering information see page 57. You will need at least two sets of plans, one to work from and a second for your local building department. Since most local ordinances require a permit for outbuildings, you will be well advised to check with the local building department before starting any

(Please turn to page 174)

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STREET TIRES go racing: B. F. Goodrich Lifesaver Radial T/A is first U.S. passenger-car tire certified for competition by Sports Car Club of America

Everything you —but didn't know

By MICHAEL LAMM, West Coast Editor

Shopping for tires means facing an array of tire types, brand and model names, grades, plies, aspect ratios and cord materials. Raised numbers and letters are all over the sidewalls. What do they mean? Which tire is your best buy? What about safety? Here are the answers to questions you'd ask if someone you knew would give you easy-to-understand and straight answers!

Wouldn't a simple rating system make shopping for tires a lot easier? Why has no one—not the tire industry nor the government—come up with a decent rating system for tires?

Confused consumers know all too well the need for a tire rating system, but it's easier to point out the need than to formulate a working system. The federal government has been trying since 1966 to come up with a uniform quality grading system for tires. So far it hasn't gotten very far.

Why not?

Many reasons. First, because some people in the tire industry are against any sort of grading system. A good grading system might show some tires to be inferior. Other tire people feel that the proposed grading standards aren't reasonable. They have a point. For one thing, there's never even been a proposed standard for tread wear. Now what good will a grading system do the average tire buyer if there's no tread-wear standard for his guidance?

Then, too, the industry and the government can't get together on the dozens of variables involved—the methods of testing (what sort of road surface to use, what suspension system, car weight, type of driving, inflation, and so on). Or who should do the testing—the government or the manufacturers? They can't even agree on the rating numbers. As proposed, the government would call the best tires Grade 3 and the worst Grade 1. So the manufacturer of the worst tire could advertise: "Rated No. 1 by the U.S. Government!"

Doesn't the government do some sorts of ratings and testing?

Yes. Right now, standards do exist

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for tire dimensions and labeling. The government also tests tires for high-speed capability, strength, endurance and bead seating. The tests assure basic safety. Tires failing these tests are recalled. But the tests tell you nothing about a tire *before* you buy it. A uniform quality grading system would.

What about ratings by private research outfits and consumer groups?

There have been independent studies and tests by nonprofit consumer groups. The results are available through their publications. Naturally, though, they can't possibly rate all the hundreds of private-label brands and then the thousands of types and sizes of tires. So they've concentrated on major tires from the biggest retailers.

Aren't all American tires made by just a handful of big Akron manufacturers and then sold under different brand names?

Yes, all 14 big tiremakers produce private labels, but about a half dozen produce most of the 125 or so private-label brands. These are sold under personalized names by department stores, filling stations, discount houses and auto dealers. For example, Gulf tires are made by B.F. Goodrich. And Mobil tires by Kelly-Springfield. But some brands, like Sears' Allstate, are made by several different big manufacturers — Armstrong, Kelly-Springfield and Dunlop, for example.

How can I tell who built these private-label brands?

We've prepared a chart on page 64. Each manufacturer now has to use a code lettering system, and this is stamped onto the inside wall. A code starting with V or W tells you the tire was built by Firestone. One starting with D means Dunlop. Up until May 22, 1971, the manufacturer had a three-digit code number, not a letter. For example, 147 used to designate Firestone; 145 used to be

wanted to know about tires

how to ask your tire dealer

CUTTING THROUGH THE CORD CONFUSION

Material	Good points	Bad points	Used for
Rayon	Strong, no flat-spotting; quiet-running	Breaks down when exposed to water (through cut or cracked rubber)	All cord applications; popular in radial bodies and belts
Nylon	Strongest, resists heat	Flat-spotting	All cord applications
Polyester	Strong, no flat-spotting, resists heat	Not suited for sustained high-speed driving	Very popular for body cords
Fiberglass	Light, strong, resists heat, fights tread squirm	Relatively stiff ride	Belts for bias-ply and radial tires
Steel	Excellent impact resistance; will conduct heat away from tire contact patch with road; stiffness contributes to good traction and long tread life	Stiff ride at low speeds	Belts in some radials and in at least one U.S. belted bias-ply tire

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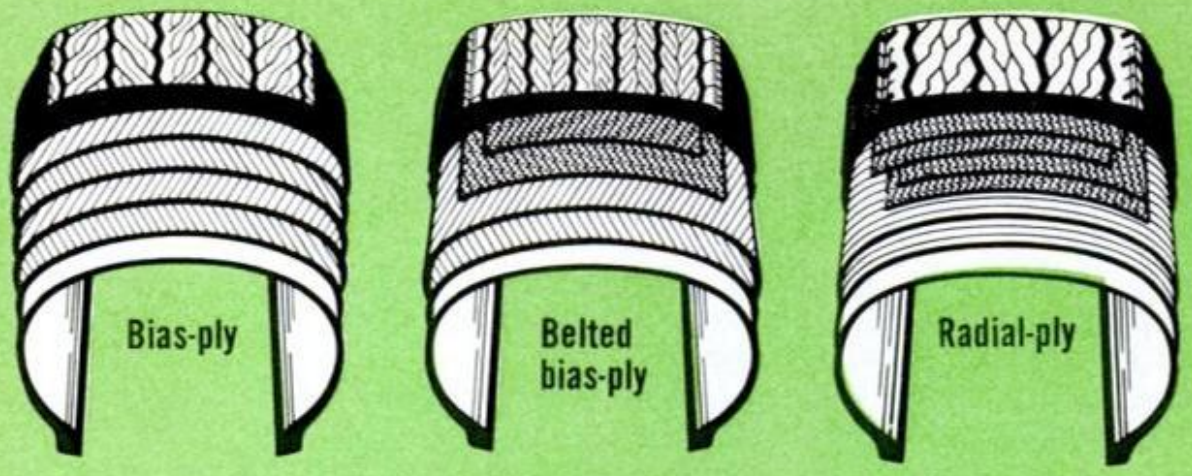

Plies and angles—see *how they run*

Until 1967, U.S. tiremakers built only one type of tire, a type called *bias-ply* or *conventional*. In it, two to six plies (layers of cord) run at angles of 30 to 40° to the bead. Each alternate ply is angled opposite to the one beneath it, resulting in a crisscross pattern. *Advantages:* good sidewall strength, inexpensive to manufacture, smooth ride, adequate handling. *Disadvantages:* tread squirm, hotter running than other types; thus there is shorter tread life and greater potential for failure.

A second tire type is the *radial*, first introduced by Michelin in France in 1948. Sports-car enthusiasts have long known the advantages of radial-ply tires, but radials have just recently become popular in this country. They're now standard equipment on a few U.S. luxury cars. Experts predict that radials will become original factory equipment for more new U.S. cars within the decade.

In radial tires, the main body plies (usually two, but sometimes one or three) run from bead to bead at 90°. This arrangement allows the tire to deform when cornering, while the belts that run around the outside of the main body plies, just under the tread layer, prevent the tire from slipping. These radial belts are made up of fiberglass, rayon, nylon or steel wire, usually either two or four plies to a belt. The cords in the belt plies don't run quite straight around the tire. Instead, they run at a slight angle, ordinarily at 16° and are crisscrossed.

The straight-across body plies give the radial tire excellent sidewall flexibility. And sidewall friction is low when it's running, so it stays cool. Since heat accelerates tread wear, which may cause tread separation and blowouts, the radial can last longer than any other tire type. Too, the belt plies add tremendous strength to the tread, keep it stiff, and with the flexible sidewalls, the total contact patch stays on the road. So you get good traction and braking. If the belt is steel, you also get good impact resistance.

The radials' *advantages:* 40,000 to 50,000 miles of tread life, excellent tractive grip, good impact resistance. *Disadvantages:* weak sidewalls, expensive initially, rough ride at low speeds.

Third and newest type tire is *belted bias-ply*. Armstrong introduced it and Goodyear put it on the map with the Polyglas—their trademark for a polyester carcass with fiberglass belt. Other companies make a similar tire under other trademarks. In belted bias-ply construction, there are two main plies of polyester, nylon or rayon angled about the same as in a conventional tire—30 to 40°. Then, on top of those, are two or four more plies of belt, usually fiberglass, but in at least two cases, steel. The cords in these belts are set at a bit steeper angle than in radials. The circumferential belts are usually angled at 25 to 30°, then crisscrossed.

Belted bias-ply tires theoretically stand between conventionals and radials in most respects—price, handling, longevity and ride. Note that we use the word "theoretically." In practice, belted bias-ply tires have come in for their share of problems—out-of-roundness, ply separation, and some testing organizations have found their handling and tread life to be no better than conventional tires, and their ability to stand the stresses of sustained high-speed driving less than conventional tires. The belted bias-ply tires' *advantages:* less expensive than radials, cooler running than conventionals, longer tread life, good stopping ability. *Disadvantages:* stiffer ride and higher price than conventionals.

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B.F. Goodrich. You might still run across new tires with the old DOT (Department of Transportation) three-digit numbering system.

Who sets the specifications for these private-label brands, like Gulf and Mobil and Sears?

They do—the brand-name customers—Gulf, Mobil, Sears . . .

So, theoretically, the brand-name customer could order a tire built as good or poorly as he wants it, right?

Well, not quite. You still have those government standards that apply to dimensions, high-speed capability, bead seating and so forth. But yes, the customer dictates the specifications. And some have unusual arrangements with the manufacturers. J. C. Penney, for instance, owns its own tire molds for its Foremost lines. It lends these molds to Kelly-Springfield. K-S builds Penney's tires not only to Penney's specs but also with Penney's molds. You know, of course, that Kelly-Springfield is a subsidiary of Goodyear. Goodyear doesn't actually make *any* private-label brands under its own name. Instead, Goodyear owns K-S and also Lee, and these two manufacturing subsidiaries make all of Goodyear's private-label brands. Firestone similarly owns Seiberling and Dayton Rubber, which make most of its private labels, although Firestone makes a few under its own name, too.

Do tire grades that companies use —like "first-line," "second-line, "100-level," "premium"—mean anything?

Not much—there's no consistency between brands. As the FTC has pointed out, there is no "industrywide, government or other accepted system of quality standards or grading of industry products. Within the industry, however, a variety of trade terminology has developed which, when used in conjunction with consumer transactions, has the tendency to suggest that a system of quality

Who makes the private brands for whom?

ARMSTRONG:
Allstate (Sears)*

DAYTON (Firestone):
Cornell*, Davis (Western Auto)*, Douglas*

FIRESTONE:
Amoco*, Atlas*, Getty*, O.K. Tires*, Phillips 66*, Riverside (Montgomery-Ward)*, Shell*, Union 76*

GATES:
Davis (Western Auto)*, Riverside (Montgomery-Ward)*

GENERAL:
Jetzon*

B. F. GOODRICH:
Atlas*, Co-op*, Fed-Mart, Gulf, Hood, Phillips 66*

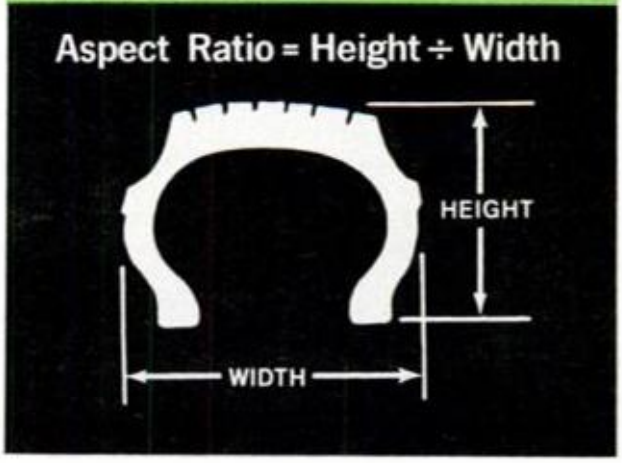
KELLY-SPRINGFIELD (Goodyear):
Atlas*, Cordovan, Foremost (J.C. Penney), Mobil, Nation-Wide, O.K. Tires*, Phillips 66*, Shell*, Union 76*, Vanderbilt, Vogue

LEE (Goodyear):
Jetzon*, Monarch

UNIROYAL
Amoco*, Billups, Co-Op*, Davis (Western Auto)*, Fisk, Getty*, Gillette, Guardian, Peerless, Phillips 66*, Shell*

Note: This list is by no means complete. Each major tire manufacturer makes many more private brands than we've listed. We've mentioned only the best known.

*Some lines manufactured by other companies.



CROSS SECTION OF TIRE shows how aspect ratio is determined. A 78 series tire has aspect ratio of 78 percent which means tire is 78 percent as high as it is wide. Lower aspect ratio means lower, wider tire

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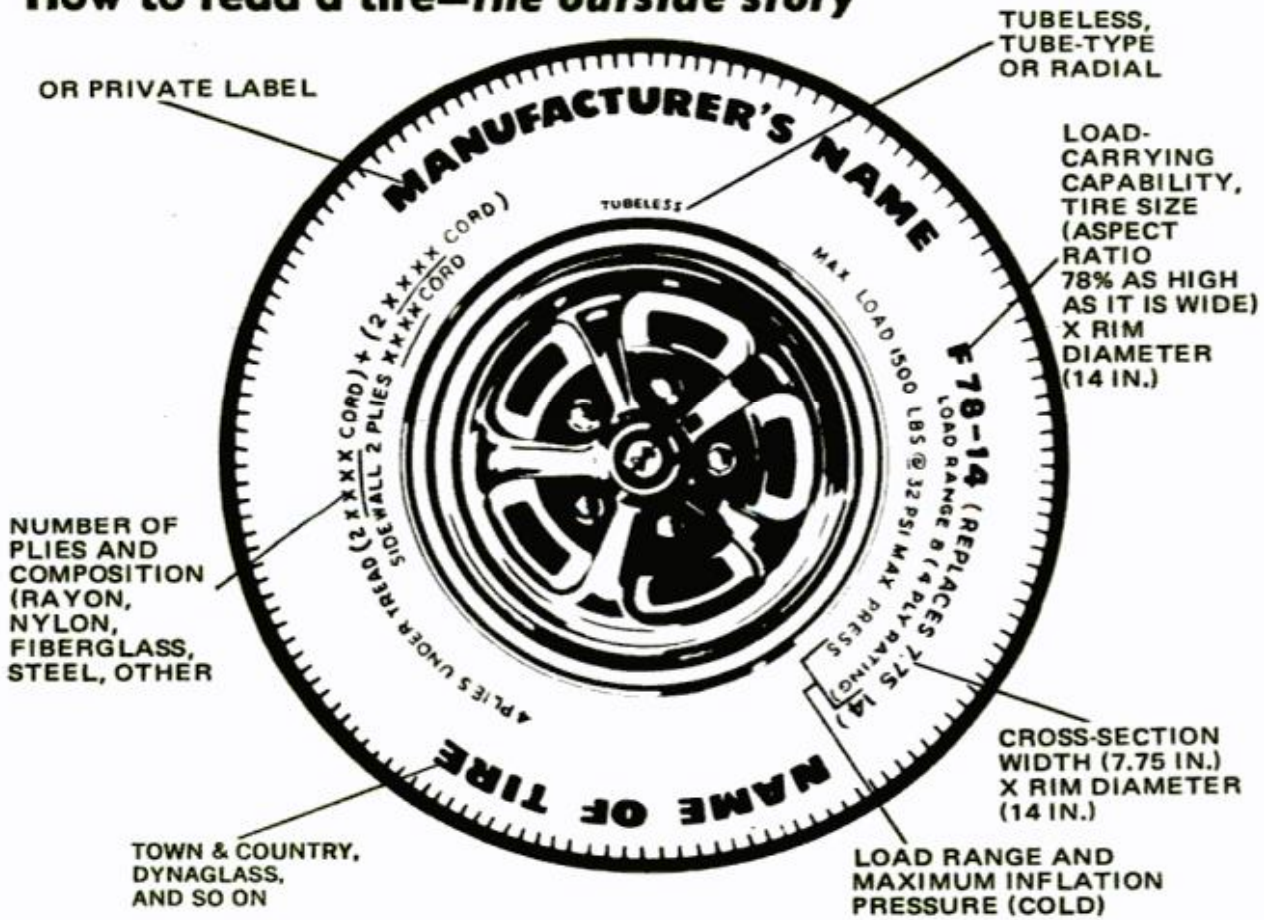
standards or grading does in fact exist. Typical of such terminology are the expressions 'line,' 'level,' and 'premium.' The exact meaning of such terminology may vary from one industry member to another. Therefore, the 'first line' or '100 level' or 'premium' tire of one industry member may be grossly inferior to the 'first line' or '100 level' or 'premium' tire of another member since in the absence of an accepted system of grading or quality standards, each member can determine what 'line,' 'level,' or 'premium' classification to attach to a tire."

Can you judge quality by price? No. An expensive tire isn't neces-

(Please turn to page 170)

How to read a tire—*the outside story*



—*the inside story*

As of May 1971, tires manufactured for sale in the U.S. are required by law to carry a letter code, an example of which is shown at right. This code supersedes the three-numeral DOT code begun in 1968. The new letter code is intended primarily to aid in recalls if specific tires are found to be defective. The code tells: tiremaker's name, manufacturing plant, tire size, type of construction, plus week and year of manufacture. You can use this same code to help identify the manufacturer of private-label tire brands. Look on the inside sidewall of the tire.

DOT

MBVX DBA201

MFG/PLANT SIZE **TYPE** **WEEK/YEAR**

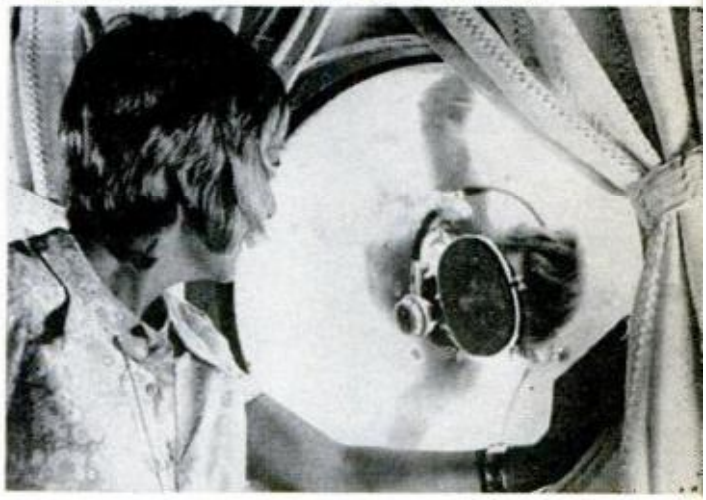
Code reads: Goodyear's Akron plant No. 2; size F78-15; Custom Power Cushion Polyglas, blackwall, and so on; made during 20th week of '71

SOME MANUFACTURERS' CODES

AA-AH .....General	CM-CU .....Continental	MA-PF .....Goodyear
AJ-AP .....Uniroyal	DA-DU .....Dunlop	PH-UN .....Kelly-Springfield
AV .....Seiberling	EH-EP .....Bridgestone	UP-UT .....Cooper
BA-BP .....B.F. Goodrich	FF-HP .....Michelin	VA-WJ .....Firestone
BW-BY .....Gates	HX-HY .....Dayton	WL .....Mansfield
CA-CC .....Mohawk	JA-LF .....Lee	XA-XT .....Pirelli
CE-CH & CV .....Armstrong	LH-LU .....Uniroyal	

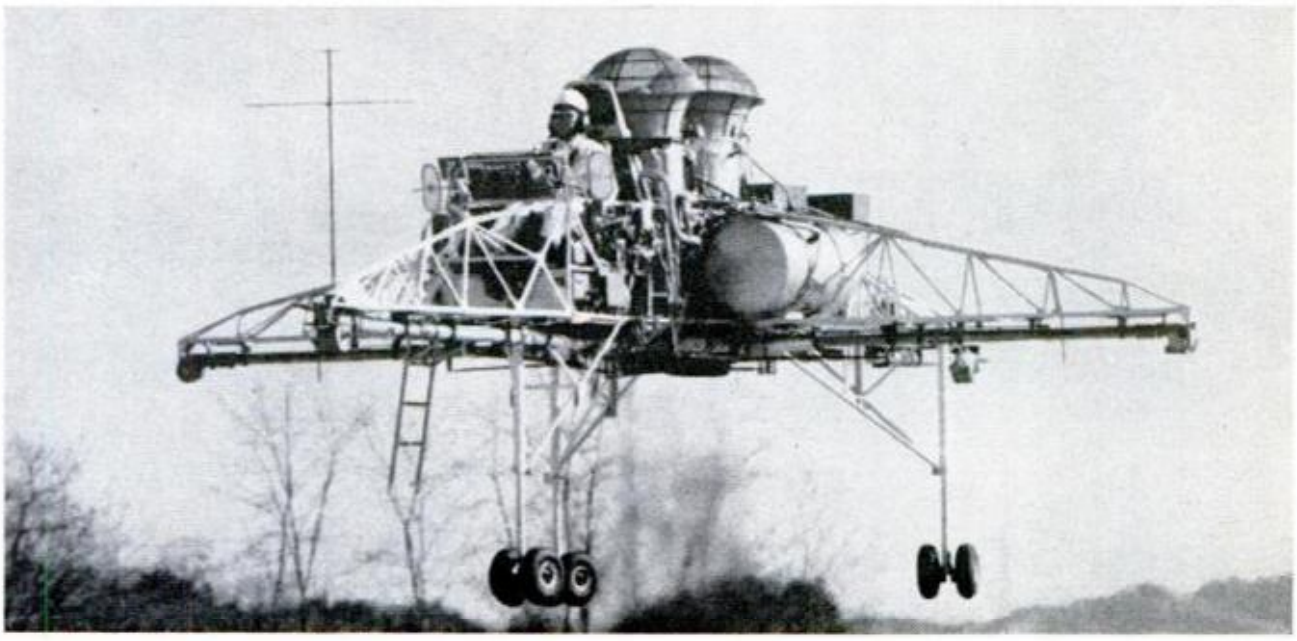
16th century atop the 20th

The Old Wellington public house, a bit of the 16th century in Manchester, England, stands atop part of a 20th century parking garage that's being built under it. The garage roof will be at ground level.



Guests revolve underwater

Guests at the Sonesta Beach Hotel, Bermuda, can enjoy cocktails underwater in a portholed bar that revolves once each 15 minutes to give them a view of marine life.



Japan's flying test bed in free flight

Similar in appearance to equipment used for U.S. astronaut training, Japan's flying test bed hovers here during its first free flight. Operated by National Aerospace Laboratories, the machine was built by Ishikawajima-Harima Heavy Industries.

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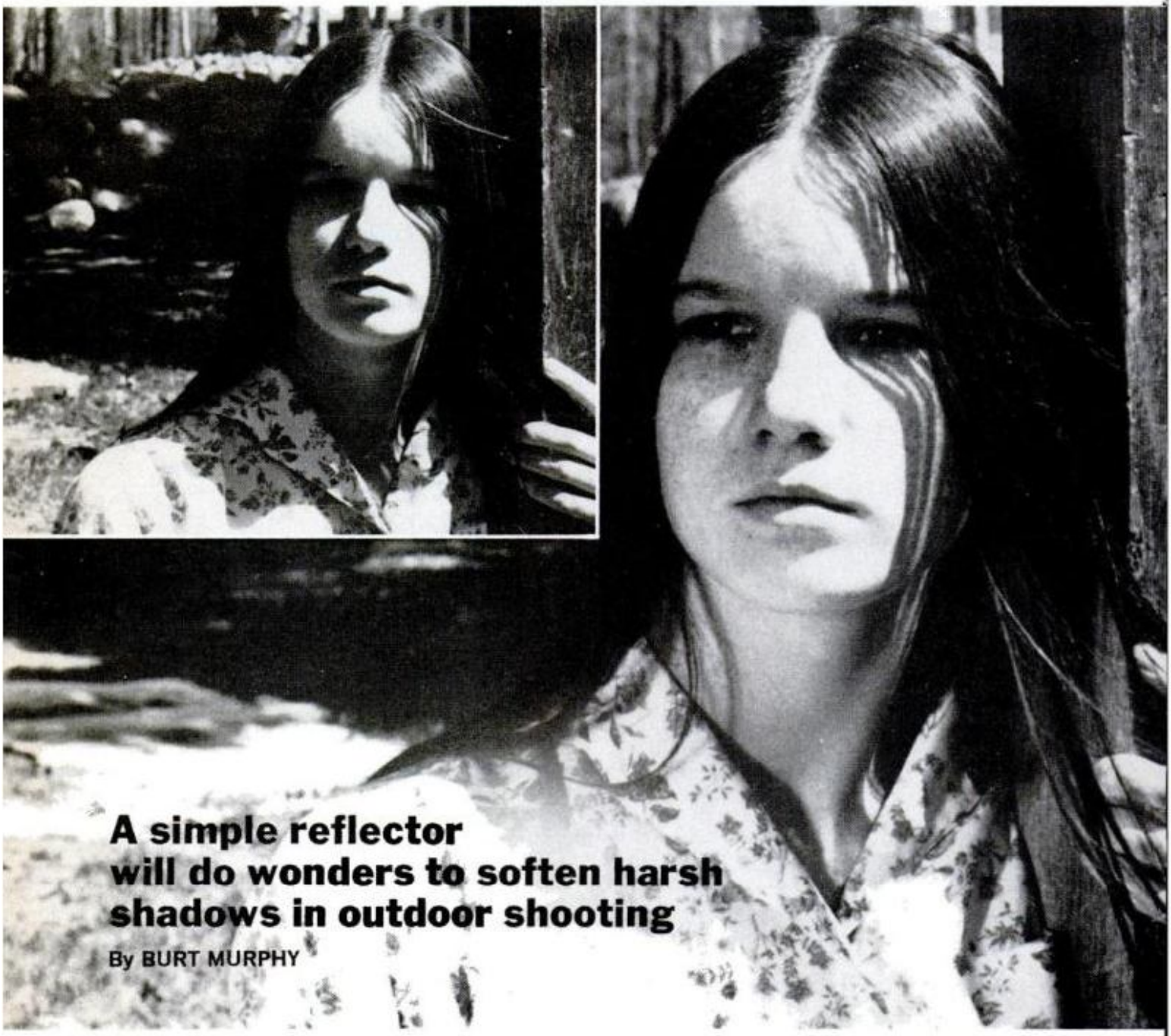
PHOTOGRAPHY

Throw a little light on

AN ORDINARY PIECE of white cardboard can actually serve as a valuable photographic light source—though you might not think of it that way. While widely used by professionals, the reflector technique is often overlooked by the casual snapshooter.

A reflector is especially useful when shooting outdoors under strong overhead sunlight. The downward angle of the sun casts deep, harsh shadows under eyes, nose, lips and chin, often virtually obscuring a subject's face. One answer is a fill-in flash, but a flashgun may not be available or it may produce too much light, washing out delicate modeling and facial details. A simpler solution is a reflector placed below your

WHAT A REFLECTOR CAN DO is shown in two close-ups below. One at left was made with natural overhead sunlight alone, with deep shadows obscuring much of the girl's face. At right, a white cardboard throws just enough light into face to soften shadows without completely washing out modeling effect



A simple reflector will do wonders to soften harsh shadows in outdoor shooting

By BURT MURPHY

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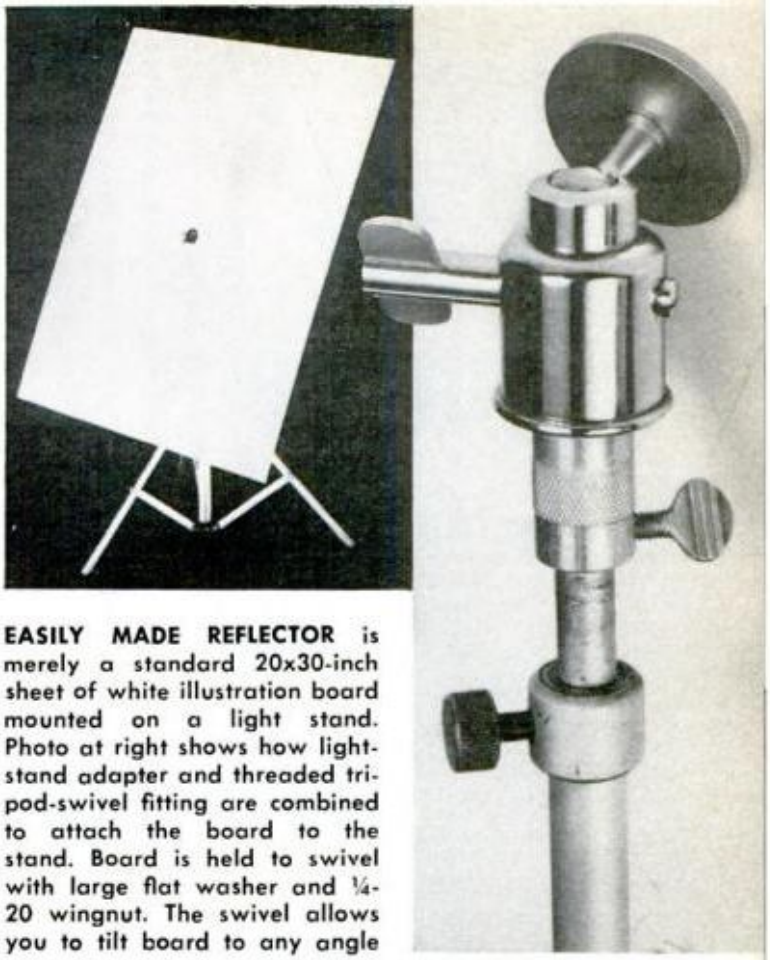
the subject

subject and off to the side opposite the main light. Angled upward, it will throw just enough additional light into your subject's face to soften the shadows without destroying the natural modeling effect. Indoors, a reflector can function as a "fill" light where a direct flood would be too bright.

Reflectors are available commercially or can easily be made yourself. One handy readymade model, Lowel-Light's Vari-Flector, consists of flexible aluminum slats that roll up into a tube for easy carrying. Homemade reflectors can be fashioned from white illustration board, sheet aluminum or an old bedsheet tacked to a wood frame. One version shown here consists of aluminum foil crumpled up, then smoothed out and cemented to white illustration board The crinkled surface disperses light rays for soft, glareless illumination. For brighter lighting, the board can be reversed and the white back side used.

Such reflectors can be propped against any nearby object or mounted on a tripod or light stand. On close-ups, you can simply have your subject hold the reflector out of view of the camera.

A problem to watch out for in color photography is that a reflector may pick up and reflect surrounding colors. If your subject is wearing a bright red dress, some of the color may be reflected back into her face, causing it to go too red. In this case, it may be necessary to move the reflector farther back or angle it so it doesn't pick up the color. ★★★



EASILY MADE REFLECTOR is merely a standard 20x30-inch sheet of white illustration board mounted on a light stand. Photo at right shows how light-stand adapter and threaded tripod-swivel fitting are combined to attach the board to the stand. Board is held to swivel with large flat washer and ¼-20 wingnut. The swivel allows you to tilt board to any angle

TWO TYPES OF REFLECTORS—one you buy, one you make—are shown at right. Upper one is commercial Vari-Flector, a handy portable model that rolls up for easy carrying. Amount of "bow" can be varied to focus or disperse light rays. At bottom is double-sided homemade reflector with crumpled aluminum foil on front, plain white cardboard on back. The two surfaces produce slightly different effects

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AVIATION

Flying the big jets is a numbers game

By LEN MORGAN

"ANNOUNCING THE DEPARTURE of flight . . ." squawks a voice on the airport public address system. For the passengers routinely filing into the airliner, the trip is just beginning. But for the cockpit crew and a platoon of supporting groundmen, this moment marks the end of a complex mathematical exercise started hours before takeoff. Dispatchers, weathermen, loaders, fuelers and airmen have been playing an elaborate numbers game using weights, speeds, distances, winds, temperatures and other variables to get an accurate flight plan that will be safe for the passengers, precise for the pilots and profitable for the airline.

Let's take the glamour girl of air transportation,

The flight plan is a math exercise performed by computer. But the pilot has the final say.

CHECK OF WEATHER MAP is routine precaution. Storms along route may call for change in the flight plan

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FP 074 /22 KDAL/KDEN 727P/293  PL 150 R 000 A 080 H 053 FOD 183
W007 01.29 S0791 0136 0590 M82 0319 TOW 1363 LGW 1227 FL 31
TO....NM...MC..FL.OA.SR..WIND..COMP.TAS.G/S.T/C.ZT.ACTME.B/O.ACBO..M.
ADM.. 083 3400
TOC.. 049 3000 31 .. .. 27 039 M030 445 414 309 19 00.19 050 0050 ...
X001. 098 3000 31 40 01 26 053 M036 484 447 309 13 00.32 018 0068 820
LBL.. 107 3060 31 41 01 26 055 M031 483 451 316 14 00.47 020 0088 820
LAA.. 107 3000 31 44 01 27 037 M027 480 453 311 14 01.01 019 0107 820
BOD.. 039 3080 31 44 01 30 027 M026 479 454 320 05 01.06 007 0114 820
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X003. 060 3200
KDEN. 033 2570 .. .. .. 34 025 M023 332 308 270 23 01.29 022 0136 ...
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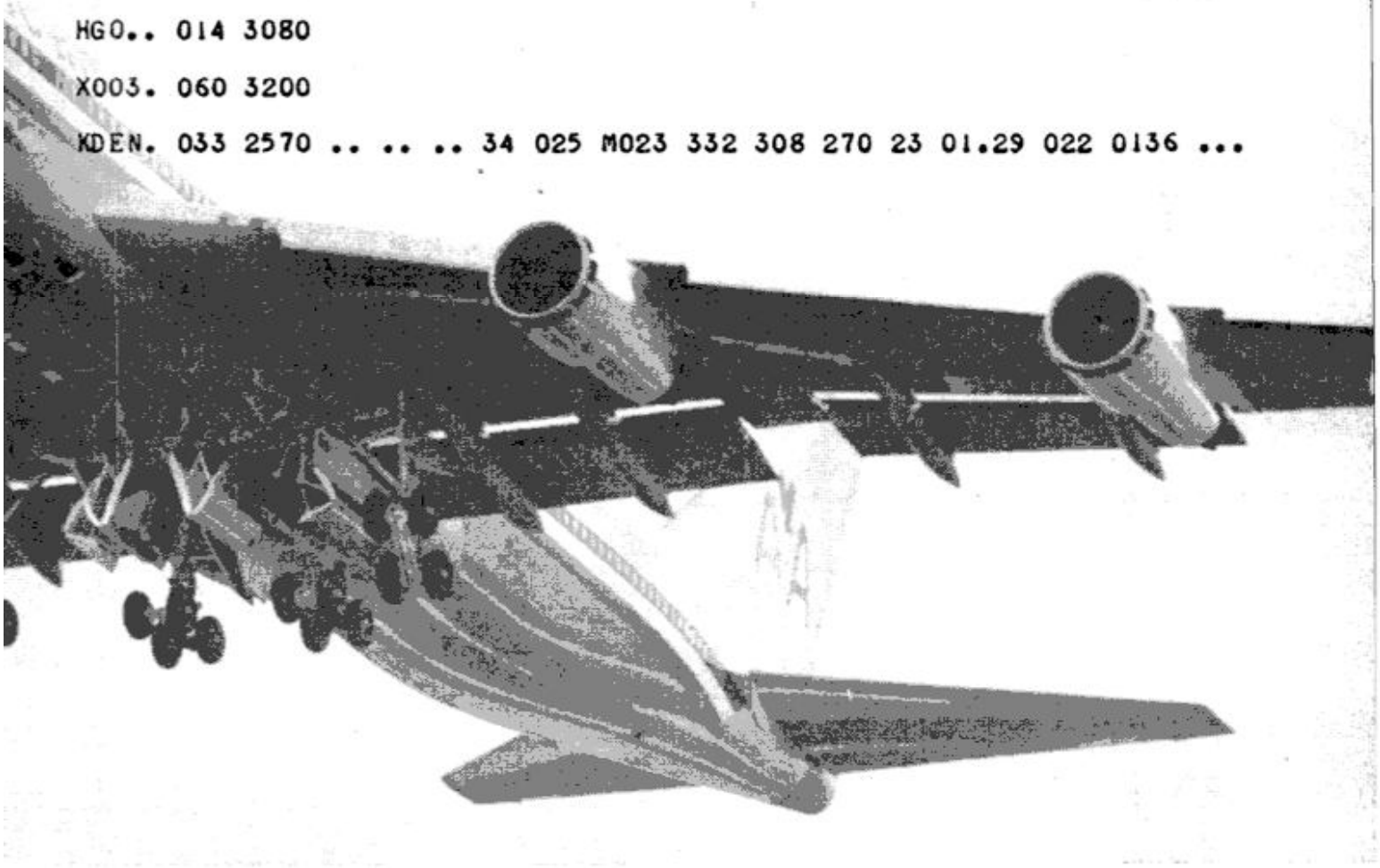

TYPICAL COMPUTER FLIGHT PLAN (above) used recently by commercial pilot on trip from Dallas to Denver. Reading from left across top, abbreviations stand for: Flight plan for flight 74 (**FP 074**) on 22nd of month, Dallas to Denver (**22 KDAL/KDEN**) with 727 pure passenger aircraft No. 293 (**727P/293**). Payload is 15,000 pounds with no reserve fuel (**PL 150 R 000**); alternate fuel, 8000 pounds, holding fuel, 5300 (**A 080 H 053**). Over destination there will be 18,300 pounds of fuel in tanks (**FOD 183**). Route information (**W007**) includes flight time, 1 hour 29 minutes (**01.29**); cost of operating trip, $791 (**SO 791**) with 13,600 pounds of fuel burned (**0136**) during 590-nautical-mile (**0590**) flight. Cruising speed, less than Mach 1 (**.82**). Fuel at takeoff, 31,900 pounds (**0319**); total takeoff weight, 136,300 pounds (**TOW 1363**); landing gross weight, 122,700 pounds (**LGW 1227**); cruising flight level, 31,000 feet (**FL 31**).

Third horizontal line reports conditions at checkpoints along route; checkpoint symbols are in column at left. For example, at Lamar, Colo. (**LAA**), flight 74 is 107 nautical miles (**NM 107**) from last checkpoint, Liberal, Kans. (**LBL**), on magnetic course (**MC**) of 300° (**3000**) at 31,000-foot (**31**) cruising altitude (**FL**). Outside air temperature (**OA**) is 44°; wind sheer (**SR**) factor of **01** indicates air turbulence. **WIND** from 270° is 37 knots (**27 037**); Wind component (**COMP**), minus 27 (**MO 27**); true air speed (**TAS**), 480 knots; ground speed (**G/S**), 453 knots. True course (**T/C**) is 311°; time in this segment (**ZT**), 14 minutes; total time flown (**ACTME**), 1 hour, 1 minute (**01.01**). This portion (**BO**), will use 1900 pounds of fuel (**019**); total used on trip (**ACBO**) is 10,700 pounds (**0107**). Speed: Mach (**M**), .82 (**820**)

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JUST BEFORE TAKEOFF, COPILOT CHECKS with flight engineer behind him for the latest temperature and wind readings, and for the final total-weight figure. Top takeoff weight for a 747 is 713,000 pounds

the Boeing 747. A flight plan for this sky giant is governed by two basic weights: 713,000 pounds, the most it can weigh at takeoff, and 564,000 pounds, the maximum when landing.

These legal outer limits were set during flight tests overseen by the Federal Aviation Administration. Boeing pilots demonstrated that the 747 could become airborne weighing 713,000 pounds and climb over near-airport obstructions even if an engine failed at the takeoff's most critical stage. Other flights showed that landing the plane at more than 564,000 pounds might subject the airframe to undue stress.

But these weights are just the beginning for any pilot flying the 747. Runway length, grade, outside temperature and departure paths leading from the runway gang up to affect maximum takeoff weight, and must be worked into the flight plan.

While 713,000 pounds is legal for takeoff on Kennedy International's 11,352-foot Runway 22R at 92°F., an adjacent 8400-foot strip can accommodate only 645,200 pounds at the same temperature. But if the mercury drops to 62°F., the short runway's weight allowance is increased by 32,000 pounds.

Airport elevation also has a drastic effect on loads because the thinner air at higher levels provides less lift per mile-an-hour of runway speed. Denver's Runway 35, for example, is longer than Kennedy's 22R, but maximum takeoff weight at 92°F. is 96,500 pounds less. Denver is 5331 feet above sea level compared to Kennedy's 12 feet.

Increasing runway length at Denver wouldn't help. Liftoff speeds at greater weights would exceed the 210-mph limit on the aircraft's tires.

Runway conditions are another factor. Planes can take off when there is not more than one-half inch of water or slush, but that amount of slop imposes a stiff penalty. A 650,000-pound plane would have to be slimmed down to 580,000 pounds to be legal under such conditions.

Then there is the wind. On a 92°F. day at Dallas, the "no-wind" limit of 647,600 pounds on Runway 31L may be increased by 1060 pounds per knot of headwind. A tailwind would require decreasing the plane's total weight by 3930 pounds per wind-knot.

But a pilot must remember that a 10-knot tailwind is maximum for the 747. Crosswinds must be resolved by triangulation to find head or tailwind components, with 30 knots of direct crosswind the 747 limit.

What if, after all these calculations, the wind suddenly drops to zero and the temperature rises just as the plane fires up its engines? Fuel and/or payload (usually freight) can be taken off;

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if the discrepancy between legal and actual weight is small, surplus fuel can be burned off on the ground at idle engine power, while the captain attempts to explain the delay to his restless passengers.

However, most 747s take off below their maximum weight because the lighter the plane the less time it usually takes to climb through the lower altitudes where fuel consumption is high. The pilot wants to reach an altitude of 35,000 to 39,000 feet, where jet engines deliver most miles per gallon and where a jetstream may boost groundspeed by 100 knots. It's also the right height to avoid bumpy weather.

Another consideration: The wide variety of fuel prices around the world may make it advisable to carry extra fuel from a low-price area to avoid having to tank up at a high-cost terminal. A penny a gallon difference in kerosene prices is something to think about when it takes 47,210 gallons to fill up a 747.

But in the back of everyone's mind is the absolute necessity to get the craft's weight down to 564,000 pounds before landing. The best laid flight plan may go haywire. A crew sometimes finds itself shoved along by an unexpectedly strong tailwind, which reduces fuel eatup and makes the plane substantially overweight for landing. A flexible captain simply descends to an altitude where fuel is consumed faster.

Landing load, like takeoff weight, is affected by runway length and condition, altitude, temperature, wind and other variables. The rule for computing takeoff and landing weights is to apply all penalties for whatever reasons, and accept the lowest weights that come out.

Most of that is done several hours before departure when probable payload, the reported winds aloft, several possible routes and other data are fed into a computer. It analyzes this information along with data previously stored in its memory such as aircraft performance and reserve fuel requirements, then prints at least three flight plans, one with the least flying time, another the lowest fuel burn, and another the minimum operating cost.

Before looking at them, the dispatcher will study en route weather reports and terminal forecasts. Some considerations: Will deviation around a line squall call for extra fuel? Have any turbulence reports been received? Does the progress of other flights verify the upper wind speeds fed the computer? If terminal weather is marginal, is a hold likely, and where is the nearest clear alternate?

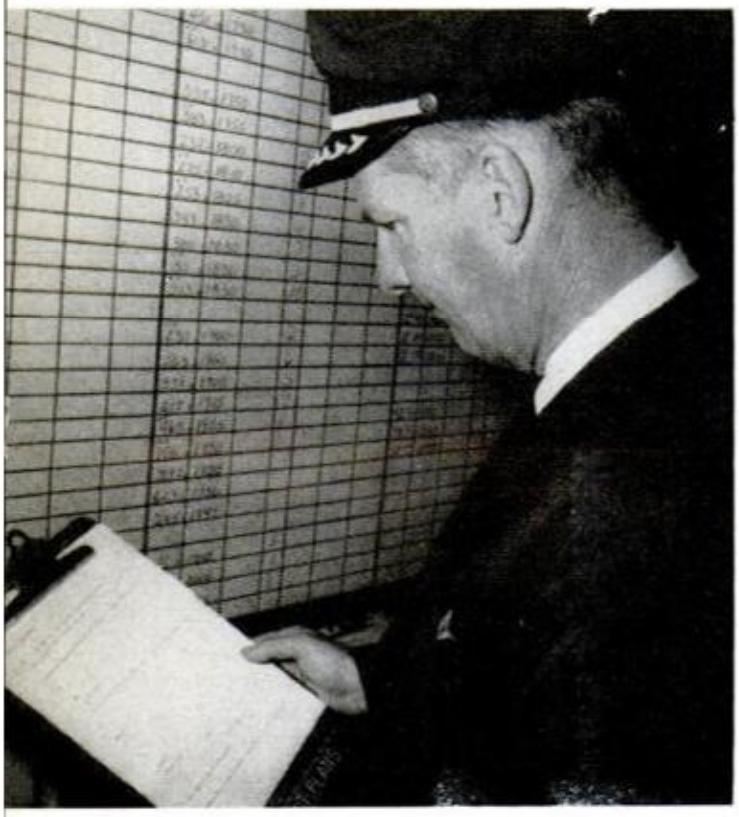
After this appraisal, a tentative flight plan selection is made.

There's no need for dispatcher or pilots to get out pencil and paper and go through lengthy mathematical exercises for this. Instead, they consult quick-reference charts and tables which cover all possible conditions for every

PAN AMERICAN PILOTS confer with company dispatcher before taking off, going over three different flight plans drawn up by computer. Pilots may choose one of three, or turn down all of them and prepare their own. Usually, they take one of the plans and make several adjustments during the flight in response to factors such as unexpectedly strong head or tailwinds, or turbulence

runway on each airport used by the line, plus many airfields that might be used as alternates.

As flight time nears, the dispatcher calls the maintenance department for the ship's exact mechanical status and the possible necessity of downgrading takeoff weight to compensate for any inoperative equipment aboard. Passenger reservation and air freight offices give estimates of the ship's payload. Fuel, route, altitude and the other controllable elements are juggled to match the fixed flying limits of the



AMERICAN AIRLINES PILOT compares his flight plan with the operations board to get a departure gate

747, and an initial flight plan is telephoned to Air Route Traffic Control. Operations personnel are given a probable fuel order.

By this time, the flight crew has appeared. After reviewing weather data, crew members discuss all factors bearing on the trip, and adjust a number here and there until they and the dispatcher are satisfied with the flight plan. By now, the 747 is at the gate.

The flight engineer immediately begins his preflight check inside and outside, paying particular attention to where the fuel is going since there are wrong and right ways to load the seven monstrous tanks in a 747's wings.

Wing strength depends considerably on the weight of fuel in them, so distribution of less-than-full fuel loads is critical. The engineer must double check to insure the amount is correct and in the right tanks.

Meanwhile, operations personnel are carefully loading pallets containing mail, freight and baggage—all of which may approach 80,000 pounds. Light pallets go near the tail, and heavy ones amidships under the wings.

Thirty minutes before flight time, the three-man cockpit crew boards the plane and begins final takeoff preparations. The copilot obtains by radio the latest numbers for wind, temperature and runway conditions, which he passes to the engineer.

Five minutes before departure, a ramp mechanic phones the captain: "You are cleared to start all engines."

When the fourth big JT9D stabilizes at idle power, the last door warning light on the engineer's broad panel goes out. The last passenger ramp is rolled away; brakes are released.

As the big ship waddles across the airport, the engineer is radioed the final passenger count and cargo weight. Using his own library of manuals, he recomputes total aircraft weight, and checks again to make sure it is not above the legal limit.

While the dispatcher is charged with delivering to a crew an aircraft legal for flight, it is the captain's responsibility to insure that his flight is indeed legal for takeoff and will be legal for landing at the destination.

If takeoff weight is maximum, the copilot will ask the control tower for a final wind check as the 747 swings into position for its long takeoff roll.

Soon after takeoff, passengers hear the captain's voice over the PA: "We'll be cruising at 35,000 feet . . . our estimated time of arrival is 3:55 p.m. . . . the temperature when we land will be 30° . . ." It all sounds so easy. ★★★

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Fast mail by trolley

One of Europe's fastest and most reliable postal services is in Amsterdam, where residents simply drop mail into a collection box on a trolley. When a car reaches Grand Central Station, the mail is removed and sorted in the post office at the station.

Fog watchers on Autobahn

Electronic eyes that measure the density of fog have been placed along an 11-mile stretch of Autobahn between Munich and Nurnberg to warn drivers of danger. Depending on fog density, a recommended safe speed is flashed to drivers from each fog meter.

Plug-in gas connector

A German invention makes gas-operated appliances as easy to plug in and out as electric ones. The socket (left) has a built-in safety valve that keeps gas from leaking out if an appliance is not plugged in. Maker is Tuboflex K.G., Hamburg.

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Know your bike and

The bicycle boom has a lot of cyclists stuck on the waiting lists at repair shops. Starting with this issue, PM shows you how to do your own maintenance and repairs in its new regular department, The Bicycle Shop by Eugene A. Sloane

IT ALWAYS PAYS to do it yourself, and sometimes that's the only way to get a job done! Today, with an estimated 75 million bikes on the road, signs on bike stores that read, "Sorry, no more repairs until further notice," are not at all uncommon. And not all bikes are as simple as the ones we knew as kids. Nowadays, kids don't even refer to bikes as "bikes," but call them "10-speeds." There's a whole new vocabulary to be learned. It's not enough to know how to slip the chain back on the sprocket and tighten your coaster brake.

What separates the men from the boys is knowing about "jockey" wheels, rattrap pedals, chainwheels, cottered and cotterless cranks, constrictor and clincher tires, derailleurs, panniers, center and side-pull calipers, dropped handlebars, ankling and—not to forget—the parallelogram-changer principle.

We're smack in the middle of a bike boom. Let's look at the figures, compiled mostly by the Schwinn bicycle people. Back in 1895, the bicycle was in its heyday. That year 28 out of every 1000 Americans bought a bike and two million were sold. In 1971 an estimated 40 out of every 1000 Americans bought a bike and 8.5 million were sold. Interestingly, over 35 percent of the bikes sold today are bought by adults for their own use. And it says a lot for Americans' current interest in bikes to note that nearly as many bicycles were sold last year as automobiles.

Millions of Americans have discovered cycling as an enjoyable hobby and practical means of transportation to work, to store, even for cross-country touring and camping. These cyclists, and you are probably one of them, or soon will be, have contributed to what today amounts to a fantastic renewal of interest in bicycling, surpassing even the 1890s, when bicycling was in flower.

Mute testimony to the bike boom are the stripped shelves and empty stores of the 3500 retail bicycle stores throughout the land. If you're one of the many who can't find a bike right now, though, be of good cheer. The bike boom may have caught bicycle manufacturers in this country and abroad unawares, but they're catching up fast.

With all of the interest in health and exercise lately, Americans have found bicycling to be a vast improvement on jogging, which, to my mind, has to be the dullest possible way to keep fit. Dr. Paul Dudley White, President Eisenhower's famed heart specialist, has also contributed much to the bicycle boom by his ardent interest in cycling as a route to a healthy heart.

I've had questions about the bike boom while appearing on TV and radio, in connection with my book on bicycling, around the country, to which I can only offer my own reason for bicycling. Simply, I was getting flabby, and with umpteen hobbies and a demanding job, had no time for the kind

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know how to fix it!

ABOUT THE AUTHOR: Eugene A. Sloane is one of the growing breed of so-called "bike freaks"—which is to say that Gene is an ardent and experienced cyclist. He is the author of *The Complete Book of Bicycling* ($9.95, Trident Press, 342 pp.). Over 80,000 copies of the book have been sold since it was published in late 1970. At that rate, this veritable "bike encyclopedia" is the hottest selling $10 hardcover in the country

of exercise that would keep me fit. Then one day I discovered that a kid on a rusty old bike kept beating me to my office 12 miles away; he on a bike, me in my car. I bought a bike, and once my aching muscles were in shape I, too, found I could in fact commute 12 miles by bike just as fast as by car and in the process get in a darn good day's exercise. From that time on I have been a confirmed bicycle commuter, in winter as well as in summer, except when the roads are clogged with snow and ice.

I think, too, that Americans like the independence of bicycling, the ability to get away on one's own, without dependence on anything more than two legs and two wheels. In a society increasingly complex, it's refreshing to be able to take such a direct and simple means of getting from here to there, and at the same time be able to enjoy the quiet of the countryside and go slow enough to talk to the corner cop or another cyclist. Doctors, lawyers, policemen, machinists, stockbrokers, are among the myriad occupations of my fellow cyclists. Everybody's doing it!

Whether you're about to buy a bike for yourself, or already have one or several, this new series on the subject of bicycles is designed to help you get all the cycling fun, pleasure and healthful exercise I know is in store for you. With all the bicycles on the road today, ridden increasingly by new riders, we'll cover bicycle safety, for you and for your children, discuss how to buy a bike and fit it to yourself, and present everything you should know about bicycle repair.

Bike mechanics charge $8 to $10 an hour. Whether you have a garage full of bikes, or only your own fine bicycle, you can save quite a lot of money by doing your own bike repair and maintenance. Just turn the page for the first *Bicycle Shop*—this one on the subject of brakes. . . . Happy cycling!

—Eugene A. Sloane

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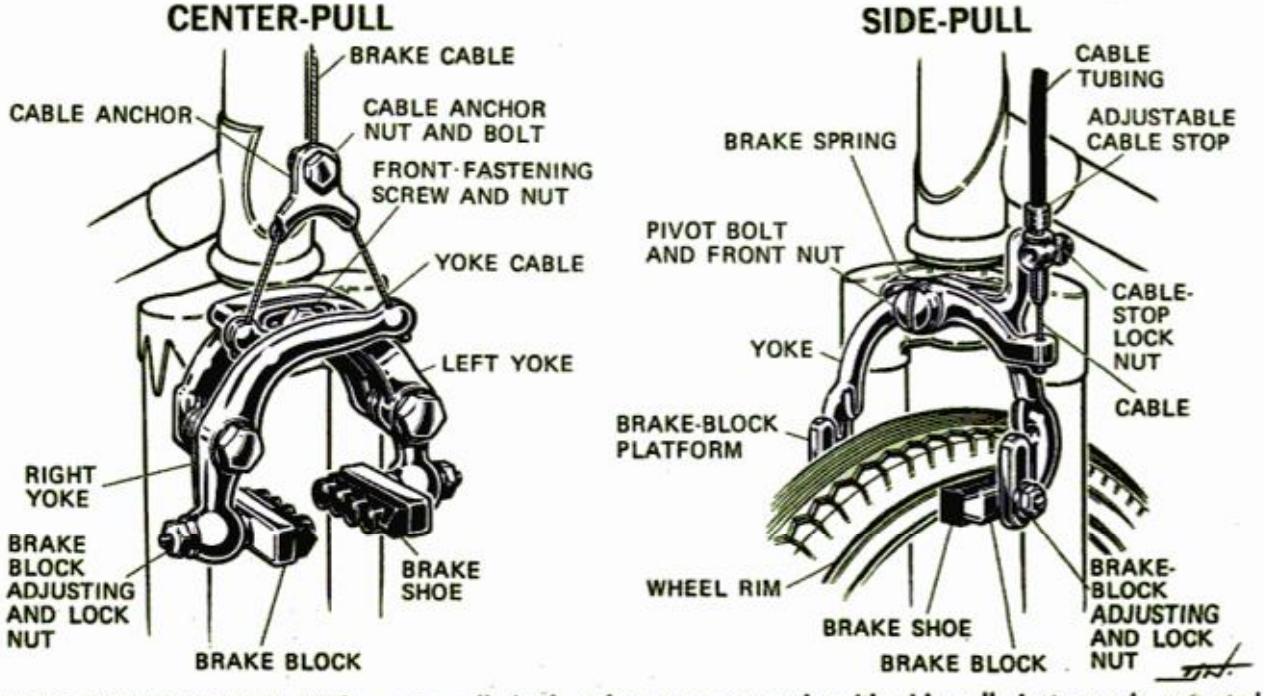
THE BICYCLE SHOP

By EUGENE A. SLOANE

BICYCLE BRAKES aren't really complicated, but they do need correct adjustment for maximum braking efficiency. Basically, there are two types of bicycle brakes in popular use today: the old-fashioned "coaster brakes," which may or may not be combined with a three-speed rear hub, and caliper brakes. Because coaster brakes seldom require maintenance and many bikes now have caliper brakes, let's concentrate on the latter.

There are two types of caliper brakes in general use: side-pull and center-pull. With one recently introduced exception, most experienced cyclists prefer center-pull brakes. Side-pull brakes do not operate as evenly as center-pulls, because only one of the brake yokes operates positively by action of the brake cable, so brake shoes don't always hit the rim evenly. Center-pull brakes, on the other hand, have positive action on both yokes and can be more easily adjusted for better stopping action. The exception is the new Campagnolo side-pull brakes, made in Italy and priced at about $60 a pair. Campagnolo is a well-known manufacturer of bicycle hubs, derailleurs (gear shifters) and other components, and is generally considered to be the top-quality supplier of these parts.

A number of maintenance tips apply to all makes and types of caliper brakes, so let's start with these. First, if after a few weeks you find the brakes on your new bicycle aren't working well, the chances are that your brake cable has stretched beyond the capacity of the brake levers. Or you may find that you have to depress brake levers almost to the handlebars before you can stop. You should be able to stop quickly by depressing brake levers no more than one-half to one inch. If you can't do this, adjust brake shoes so they are no more than an eighth of an inch from the rim when brake levers are not depressed. Before you try to adjust brake shoes, check wheel rim for alignment. It won't do any good to adjust



TYPICAL CALIPER BRAKES. With center-pull, both yokes are actuated; with side-pull, just one is actuated

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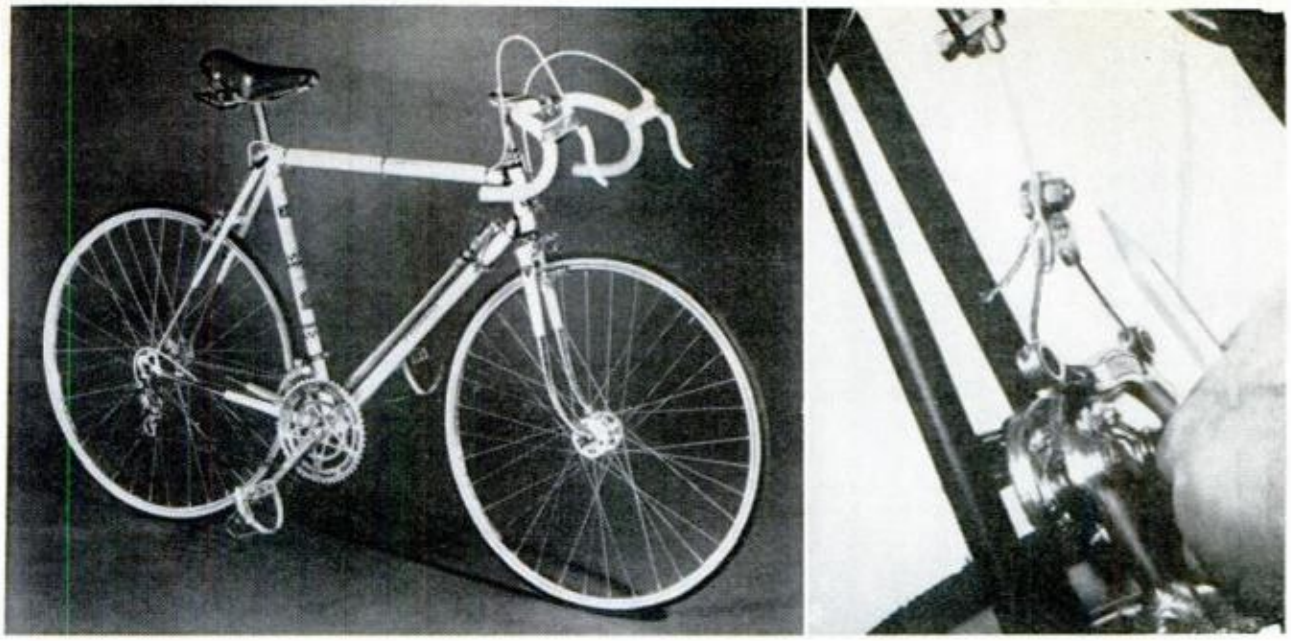

BRAKE CABLES are given ample arcs from brake levers to prevent binding and let handlebars turn freely. Cable clamps hold cables to top tube of bicycle. In rear center-pull brake detail, pencil points to anchor nut

the shoes if the rim is out of line, because brake shoes would have to clear the worst out-of-line condition to prevent rubbing.

If the wheel rim is out of line, adjust by eye by tightening the spoke nipple on the side away or opposite from the desired alignment. That is, if the wheel rim is too far to the left, tighten the spoke nipple of the spoke going to the *right* side of the wheel hub so as to pull the rim over to the right. Turn the spoke nipple counterclockwise (left) to tighten. You may have to loosen spoke nipples on the side opposite the spoke you're tightening. Turn nipples no more than two full turns at a time. Use a spoke wrench (about 75 cents from any bike store); do not use pliers. Remember that rear wheels are "dished" or aligned to the left to permit clearance for the chain to drop on large rear gear. A later article will present more information on wheel alignment and wheel lacing (spoking).

It may seem obvious, but the brake shoe must hit the wheel *rim*, not the tire sidewall. I've seen novices do the opposite, with disastrous results to the tire sidewall. Oil and grease must be kept from brake shoes and wheel rims.

Brake shoes should be replaced when they harden and become glazed. To replace any caliper brake shoe, simply unscrew the brake-block retaining nut, remove block and shoe and replace with new ones. When replacing, be sure that the closed end of the block faces toward the rear of the bicycle. Otherwise, the brake shoe will slide right out of the block when brakes are applied.

Brake cables should be replaced at the first sign of fraying. Cables are stranded wire; if a strand breaks, they are likely to go fast. I also recommend replacing cable tubing at the same time, because it can fray internally and clean tubing always looks neater. When replacing a cable, put a light layer of grease on it where it passes through tubing. Cable and tubing should be long enough so the handlebars can turn freely without binding brakes and cable or turning action. The cable should go into the brakes at front and rear gradually; not at a sharp angle. The cable is clamped to the top tube (metal tube running at top of bicycle from front to rear) in three places. A slight loop in the cable at the rear just under the saddle prevents a sharp angle in the cable and facilitates smooth rear-brake action.

To adjust shoes on side-pull brakes to the recommended ⅛-in. clearance from wheel rims, use the adjustable

(Please turn to page 176)

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Different lending institutions charge different rates of interest. A PM reporter shopping for a $3000 auto loan saved more than $200 in interest cost. Here are his tips on . . .

HOW TO SAVE MONEY ON YOUR NEXT CAR LOAN

By MORT SCHULTZ

WHEN I BOUGHT my new car, I needed $3000 to pay for it. I considered borrowing from an auto manufacturer's customer credit division, a commercial bank, my auto insurance company, or my life insurance firm. I finally chose the life insurance company—and saved $268.08.

YOUR life insurance may have a cash value that you can borrow on at low rates

But that saving didn't come easy. I had to shop around to find the lowest-cost loan, just as I would have compared price tags on any kind of merchandise.

My shopping started when I asked the auto salesman how much his manufacturer's consumer credit division would charge to lend $3000 for 24 months. In my case, a loan would have cost $424.32 on top of the $3000—to be paid back in 24 monthly installments of $142.68 each. An advantage of this type of loan is that you are able to wrap up the entire auto-buying transaction at one time and in just one place—and your dealer will handle all the necessary paperwork.

Deciding to look elsewhere, I began calling on commercial banks. Often overlooked by car buyers is that interest rates may vary from one bank to another. True, all states put a legal ceiling on interest rates. Though banks can't charge more than the legal rate, they can—and do—charge less. That's how they get business.

So don't be afraid to ask. Under the provisions of the 1969 Truth in Lending Act, banks and other credit institutions must state the Annual Percentage Rate. APR is a big help because it gives borrowers a uniform

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DON'T BE AFRAID to shop credit institutions when looking for an auto loan. Interest rates and service charges vary, giving you a margin for savings

price base to work with while shopping.

But if you find interest-rate tables a jigsaw puzzle (as I do), try this tactic: Ask the potential lender how much the total cost of the loan will be, and make sure the cost is put in dollars and cents in the contract. Don't be meek about asking for a breakdown.

In addition to loan principal and interest, your repayments may include service charges. A bank, for example, may offer life insurance to pay off the debt if you die; that way, your survivors aren't saddled with monthly car payments. Life insurance fees are usually part of the monthly pay-back figure and increase the loan's cost.

If I had accepted insurance, the policy would have cost about $1.50 per month, or $36 above the principal and interest during the life of the loan.

But you don't have to buy life insurance when getting a loan. If you do turn it down, make sure the cost is not included in your loan payments.

The next stop was my auto insurance company. The interest rate offered there was attractive—lower in fact than what I would have had to pay at two commercial banks. (See the chart on page 80.)

Equipped with figures from the auto credit company, the auto insurance firm and several commercial banks, I

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COST OF $3000 LOAN FOR 24 MONTHS

Lending Source	Monthly Payment	Total Paid Back	Cost
Life Insurance	$131.51	$3156.24	$156.24
Savings bank account	134.11	3218.64	218.64
Bank No. 1	135.80	3259.20	259.20
Bank No. 2	137.50	3300.00	300.00
Auto insurance	138.45	3322.80	322.80
Bank No. 3	139.01	3336.24	336.24
Bank No. 4	140.34	3368.16	368.16
Credit union	141.21	3389.04	389.04
Auto credit	142.68	3424.32	424.32

turned to the bank where I keep my savings. I was interested in a passbook loan.

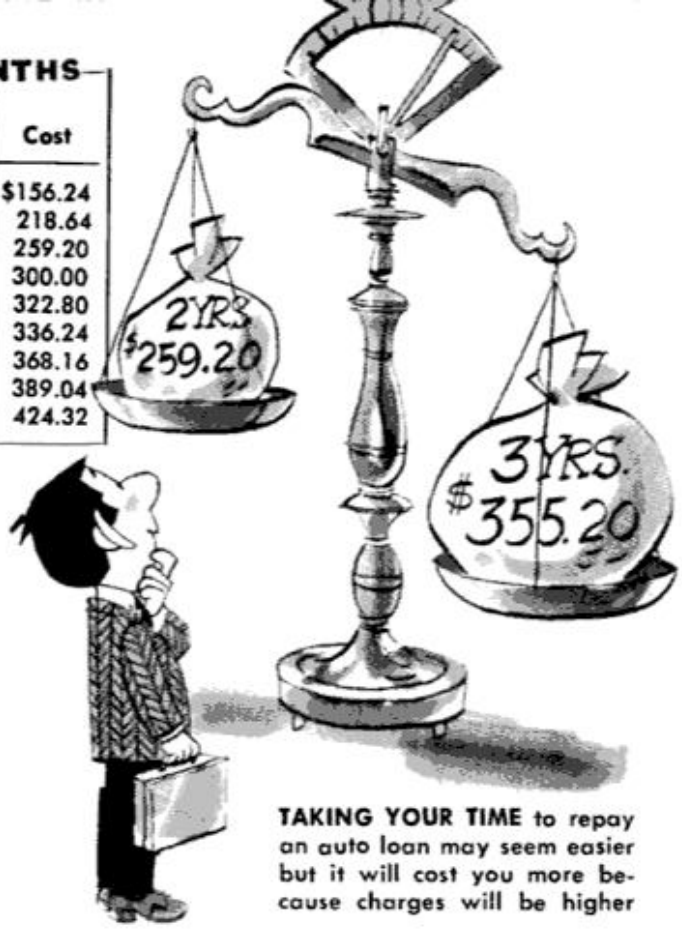
By using your own savings as collateral you can get a loan at comparatively low interest rates. Your savings account continues to earn interest, but the bank freezes the account up to the amount you owe. If you borrow $3000, for example, you must have at least that much in your account. And if you want to make withdrawals, you have to have more in the account than you owe the bank.

If I had borrowed $3000 against my savings account for 24 months, the total cost would have been $218.64, or the second cheapest I could find.

But I was reluctant to tie up my savings. My next stop was at the office of my life insurance agent.

On certain types of life policies—usually referred to as permanent insurance—you can borrow an amount equal to the savings and dividends that have accrued. This is called the loan or cash value and it will come to a lot less than the face value, especially early in the life of the policy. The face value of my policy was $15,000—the amount my family would receive on my death—and the loan value was a bit more than $3000. (Cash or loan values are spelled out in a table contained in the policy.)

The advantage of borrowing on insurance is the low rate of interest, usually between 5 and 6 percent. Normally, it is a simple rate figured on the outstanding balance of the loan. The more you pay back, the smaller the interest payments. Assuming you borrowed $3000 and after a month repaid $500, the second month's interest is computed on $2500.



TAKING YOUR TIME to repay an auto loan may seem easier but it will cost you more because charges will be higher

But be aware that borrowing on life insurance can be self-defeating if you're not careful. It lacks the discipline of paying back a loan since you are not required to make regular payments. In other words, the insurance company is not going to press you as another lending institution would if you skipped a payment.

If you don't pay back the debt and interest (or part of it), the interest that builds up is added to the outstanding balance at the end of each year. Interest for the following year is then figured on this new, larger sum. This dilutes the value of your policy.

If you die before repaying the loan, the outstanding amount will be subtracted from your beneficiary's cash settlement.

But the savings on interest may overcome the disadvantages. As you can see on the accompanying chart, my life insurance company charged me less—$156.24—than the other lending institutions. That was the loan I decided

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Record your own cartridges?

LOW-COST CARTRIDGE RECORDER is this trim **Lafayette** RK-890A at **$129.95. It has twin stereo mike inputs and dual recording meters**

Here's how—and the fun of it

By SHELDON M. GALLAGER

A YEAR AGO wise-sounding hi-fi experts were predicting an early death for the eight-track cartridge as a home-entertainment medium. Today, the eight-tracker is still very much alive and going strong. Two recent developments have given it a powerful shot in the arm. One is the renewed interest the eight-track format has received as a convenient medium for four-channel stereo (see *Smile—You're on Four Channels Now!*, page 130, Nov. '71 *PM*). Another push has come from an increasing number of relatively low-cost home recorders that enable you to make your own cartridge tapes.

Does eight-track recording make sense? If you already own a fairly extensive collection of cartridges, the answer is yes. By making your own tapes from radio programs, records and other tapes, you can supplement your present library in a way that's both enjoyable and money-saving. Whatever happens in the hi-fi field, cartridges are sure to be around for a good long time to come and you might just as well make the most of them.

ALL-IN-ONE RECEIVER has AM/FM/FM stereo radio and eight-track recorder. Toyo unit features "Fast Forward" control, is about $210

Critics point out—correctly—that the eight-track format is not ideally suited to home recording for several reasons. The problem is that a cartridge consists of a continuous loop of tape with eight tracks arranged in four

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AUTOMATIC CUEING SYSTEM on 3M/Wollensak at left assures that you always start at beginning of cartridge to save having to wait for tape to come around by itself. Model 8050 is priced at $149.95

RECORDING DECK at right, by Toyo, offers pushbutton "Stop," "Repeat" and "Fast Forward" controls plus dual recording-level meters. Price is $99.95

LIKE MANY MACHINES of its kind, Telex model at left can be set to shut off automatically at end of each program section or end of all four, depending on how long material being recorded runs. Price is $169.95

FROM SMALL TO LARGE, eight-track recorders come in a variety of sizes and shapes, as indicated by three models at right. Top two, Lafayette's and Craig's, are compact decks designed to play through an existing hi-fi system. Bigger model at bottom is Panasonic's self-contained receiver. Like the Toyo unit on preceding page, it includes AM/FM/FM stereo radio as well as built-in eight-track recorder. Cartridge-loading chamber pops up from top of cabinet under spring-loaded door, as shown in close-up below. When not in use, it swings down out of way, is protected from dirt. Panasonic also makes a recorder-only model without radio for $99.95

PANASONIC RS-820S 8-TRACK SELF-CONTAINED RECORDER WITH AM/FM/FM STEREO RADIO, $299.95

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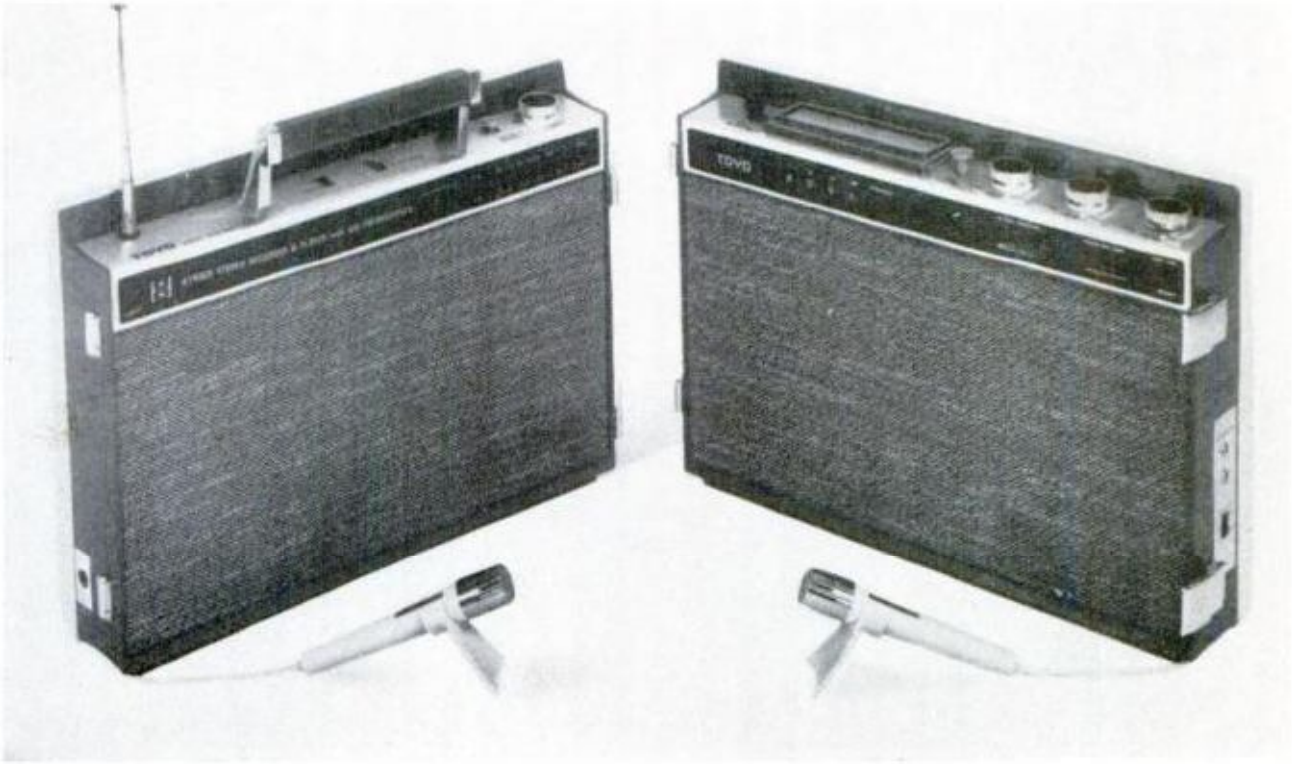
stereo pairs or "program" sections. This makes cartridges much less flexible than cassettes. You can't rewind them, edit them or readily index them. Playing times are relatively short, and there's an audible interruption as one program switches to the next. These limitations *can* be overcome, however. With care, you can make good-quality home recordings and have a lot of fun in the process.

In choosing a machine, you'll find several types available. The most common is the "deck"—a separate component designed to play through an existing hi-fi system. Decks are made by Craig, Panasonic, Lafayette, Realistic

(Please turn to page 180)

TYPICAL RECORDING TAPES are 3M's Scotch-brand 40-minute cartridge at left, above, and Ampex's No. 381 80-minute type at right. Forty-minute cartridges give you approximately 10 minutes' recording time per program channel; 80-minute cartridges, approximately 20 minutes. Both lengths can be used interchangeably in all eight-track recording machines

ONE OF SMALLEST UNITS is Craig's Model 3302 deck at left. About 9 inches wide and 3½ inches high, it has program selector and both manual and automatic "Eject." Price is $154.95. Handy portable model below, by Toyo, has AM/FM stereo radio as well as cartridge recorder. It comes apart in two halves for good stereo separation, is $159.95



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PM PONTIAC VENTURA OWNERS REPORT...

Fine handling,

By MICHAEL LAMM, West Coast Editor

"LARGER THAN A SMALL CAR and smaller than a large one," explained a Cincinnati housewife, telling why she bought Pontiac's Ventura II.

Pontiac introduced its compact in mid 1971. The Ventura II is based on Chevrolet's Nova, major differences being in grille design, trim, interiors and overall length (5.1 inches more for the Ventura II, due mostly to its extended prow).

Except in California, Ventura II and Nova engine choices are the same: Chevrolet's 250-cu.-in. Six and the 307 V8, rated at 110 and 140 bhp net respectively. But for 1972, Ventura IIs built in GM's Van Nuys plant for California consumption may be ordered with Pontiac's (*not* Chevrolet's) 160-bhp, 350-cu.-in. V8. This engine will probably become available throughout the nation soon, perhaps even with power packs.

Then, too, by the time you read this, Oldsmobile will have *its* version of the Nova/Ventura.

What do owners especially like about their Venturas? Handling tops the list of specific likes, with styling a close second. "Neat, tight, economical," adds a Baltimore night watchman. "It handles well, has sufficient power," comments a Georgia civil engineer who also owns a Maverick and whose Ventura II averages 17 mpg. A Wisconsin owner reports, "We like the size of this car for the amount of money it costs; also the way it handles." And a Delaware finance officer: "Sturdy, quiet, quick response, handles well, very good balance between motor and size of the car."

A number of Ventura II owners mentioned that the Six surprised them with its pep. "Really steps out for a Six," was a reaction echoed by many. The 307 V8 also drew that type of comment. Since the 350-cu.-in. V8 had just made its appearance in California, none of our respondents' cars carried it, thus we have no data on it.

Snappy performance unfortunately translates into less gas mileage, as some

DISTINCTIVE GRILLE, headlights in fenders, wider taillights distinguish Ventura II from Chevy Nova

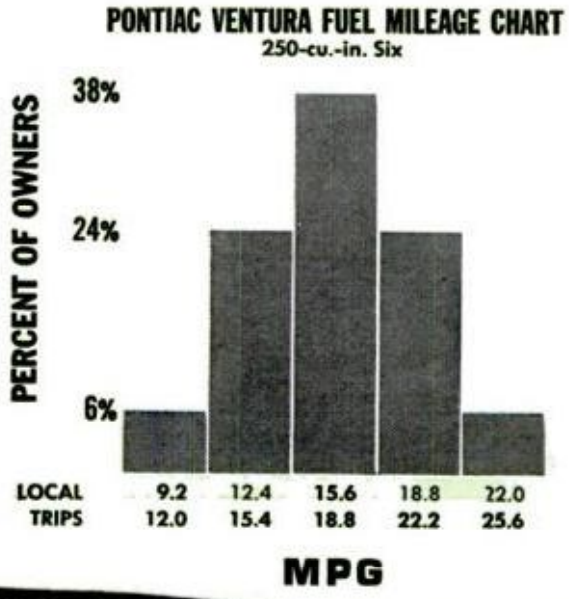
but not stingy enough with gas

Photos by the author

Ventura II owners pointed out. "Mileage not as expected," said a Tampa sales representative whose overall average with the 307 came to 15.1 mpg. In all, 19 percent of our owners specifically mentioned that they'd like better gas mileage. But what the percentage doesn't show is that they weren't objecting violently, just that they'd expected more. As a corollary, some also said they'd like a bigger gas tank (normal capacity is 17.1 gallons).

Another nagging but not especially loud complaint centered on the two-speed automatic transmission. A number of owners hadn't realized when they bought their cars that the small automatic has only two speeds. They said that the way it's set up, it shifts from

A nationwide survey based on 1,200,000 owner-driven miles



low to high at 20 mph, which in traffic means constant up and downshifting, giving erratic engine rpm and thus less gas mileage. (The shift point, of course, can easily be changed.) They complained of sluggish response above 20 mph (in high) unless downshifted. GM's Turbo Hydra-Matic is also available in V8-engined Ventura IIs, and owners with that transmission had no such complaints.

As to comfort, owners of coupes feel there should be more rear legroom, more headroom throughout, and a Minnesota painter said, "It's comfortable, but I think it's more of a four-passenger vehicle than the five-passenger it's advertised to be." Drivers six feet tall or taller complained of not enough front-seat travel, lack of kneeroom, and accidentally turning on the emergency warning flasher with their knees.

How well is the Ventura II put together? An accountant from Colorado answered "How would I know? It's in the shop half the time." Actually, only 7.9 percent found fault with the II's workmanship. "Compares favorably with other cars in the same price range, summed up a Maine forester.

Is the quality of materials up to snuff? "Very poor and flimsy body metal," says a Kentucky student, "dents at the slightest touch." "The body is very

OF STYLE DIFFERENCES that distinguish Ventura, owners like grille (above), greater length (bottom)

Summary of Pontiac Ventura Owners Reports*

Total miles driven 1,239,810

Average miles per gallon
- 250-cu.-in. Six, local driving 15.6
- long trips 18.8
- 307-cu.-in. V8, local driving 14.3
- long trips 17.1

Engines
- 250-cu.-in. Six 56.0%
- 307-cu.-in. V8 ..... 44.0

Body styles:
- 2-door coupe 73.2%
- 4-door sedan 26.8

Why the Ventura II?
- Size 38.1%
- Style 35.1
- Economy 29.4
- Price 22.2
- Past experience 6.7

Specific likes:
- Handling 53.8%
- Styling 32.8
- Economy 23.7
- Ride 21.5
- Comfort 17.2
- Power 15.6
- Size 15.6

Specific dislikes:
- Poor gas mileage 19.0%
- Quality of materials 8.4
- Rattles 8.4
- Poor workmanship 7.9
- Poor rear vision 7.9
- Too light weight 7.4
- Harsh ride 6.8
- Lack of power 4.7

What changes would you like?
- Better materials 8.5%
- More headroom 7.9
- Better gas mileage 6.1
- Better workmanship 5.5
- Change styling 5.5
- More legroom 5.5

Had any mechanical trouble?
- Yes 51.3%
- No 48.7

What kind of trouble?
- Transmission 17.0%
- Carburetor 12.0
- Electrical system 9.0
- Rocker arms 7.0
- Shift linkage 7.0
- Oil leaks 6.0
- Brakes 6.0

Did you repair it yourself?
- No 97.0%
- Yes 3.0

Dealer repairs satisfactory?
- Yes 63.7%
- No 36.3

Is the Ventura II your only car?
- Yes 50.5%
- No 49.5

Other cars owned:
- Pontiac 34.0%
- Ford 20.6
- Chevrolet 16.5
- Buick 10.3
- Dodge 7.2

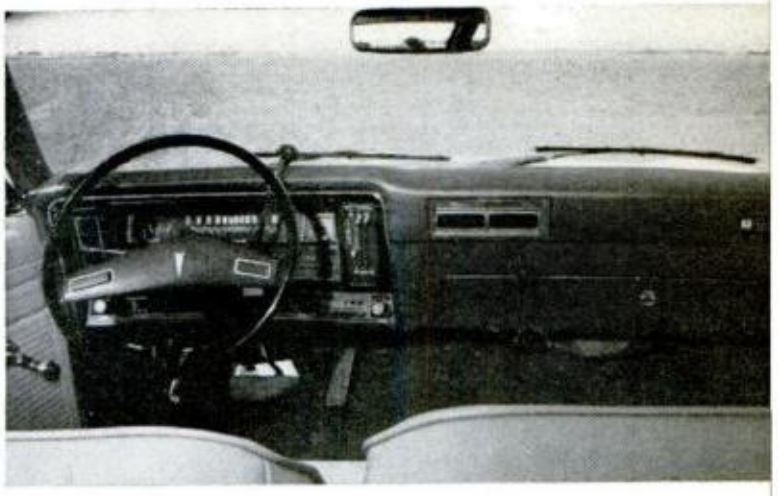
Accessories/power options:
- Radio 54.0%
- Power steering 40.7
- Airconditioning 23.8
- No accessories 15.9
- Protective side molding 10.6
- Whitewall tires 10.1
- Tinted glass 6.9

Age distribution of owners:
- 15-29 years 30.9%
- 30-49 years 36.6
- 50-plus 32.5

Would you buy another Ventura II?
- Yes 61.7%
- No 38.3

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

CALIFORNIA VENTURAS offer Pontiac's 350-c.i.d. V8 as well as Chevrolet's 250-in. Six and 307-in. V8



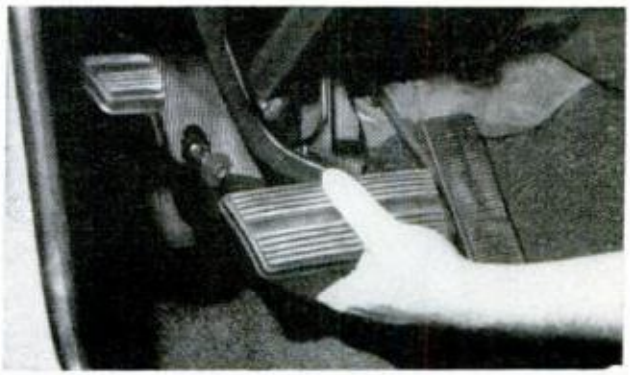
OWNERS SAY VENTURA steers easily without power. Smaller sports steering wheel is offered optionally

solid," disagrees an Illinois laborer, "and the doors close very solid."

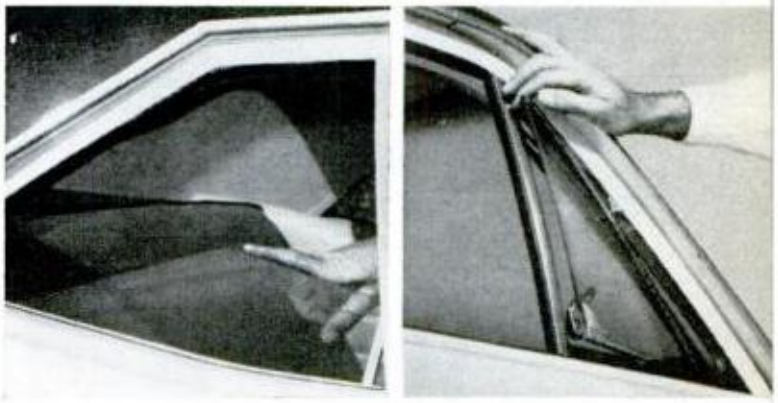
Handling and stability came in for the most praise, 53.8 percent fingering it specifically as the one trait they liked best. "Stability in crosswinds very good." "Holds the road well in highway driving—had owned VW and Opel previously and they're much lighter." "Easy to park."

In the game of I'd-like-to-see-them-change . . . , these suggestions: "Carpeting as standard equipment." "Idiot lights! I wish they would make gauges optional." "Put the hood latch in a spot that's easier to find. Gas stations can't find it and keep bending my front license plate looking for it." "Better view out the rear window for backing up. I can't see the rear fenders from the driver's seat." "More distinctive styling—it looks too much like the Nova." "Multileaf springs instead of one-leaf springs. I had to put overloads on mine." "I'd like American Motors' warranty for my Pontiac."

A Florida student summed up many owners' feelings by asking, "Does the Pontiac name really swing that much weight?" He answered his own question by saying that he thought it did ". . . because it sets the Ventura II apart and takes it out of the realm of the commonplace—or at least I don't see myself at every stoplight." ★★★



OVERALL QUALITY of workmanship is judged good, but mat under brake pedal wouldn't stay put on PM car; similar things annoyed 7.9 percent of owners

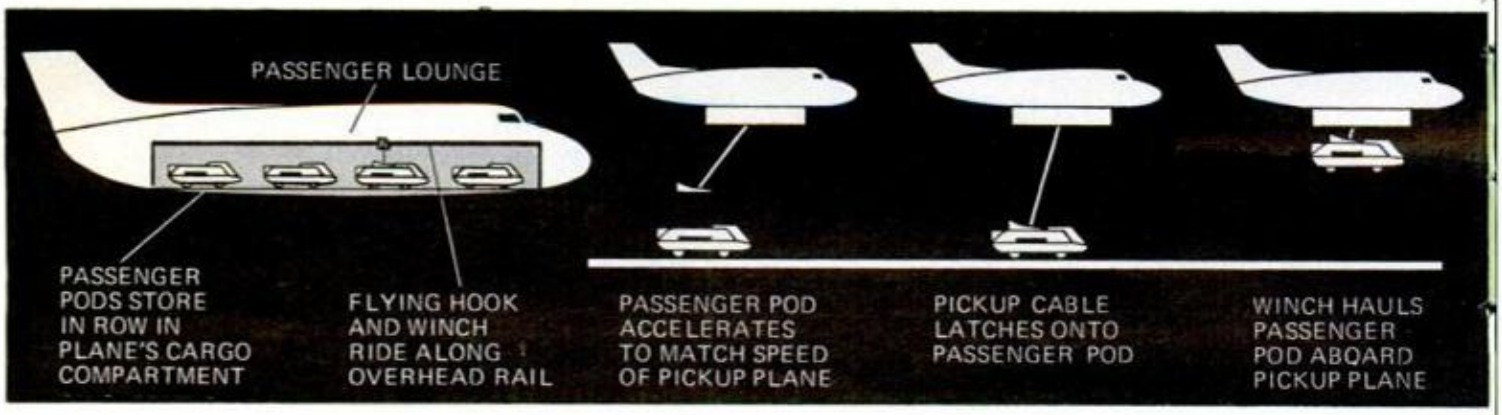


IN COUPE, rear glass rolls down only to here, but Ventura is one of few U.S. cars with quarter panes

TRUNK VOLUME is greater than the Maverick's, Comet's, Hornet's; smaller than Duster's and Dart's

JUST PATENTED

This airliner never lands -it hauls you up instead!



Double toter

You can haul both a boat and a camp trailer with this piggyback rig. The camp trailer locks into supports at the rear of the boat trailer and is raised off the ground by cables so its wheels won't drag. At the same time, the boat trailer's wheels are moved farther back to provide a better balance point for the combined load (upper photo at left). For trailering the boat alone, the wheels are moved forward to their normal position (lower photo). The inventor is Glenn Black, 1007 Wilson St., Bay City, Mich.

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TO BOARD the airliner shown at left, you first get into a small, buslike passenger pod on the ground. The pod accelerates on the runway until it matches the speed of the plane cruising overhead, and a cable is lowered with a hook that locks into a latch in the pod's roof. The pod is then winched up into the plane's hold through large cargo doors, and the liner flies off—without ever touching the ground. Inside the plane, you switch to another pod going to your particular destination. When you arrive, the process is reversed—your pod is lowered to the ground, the cable is detached and the liner is off again for another destination.

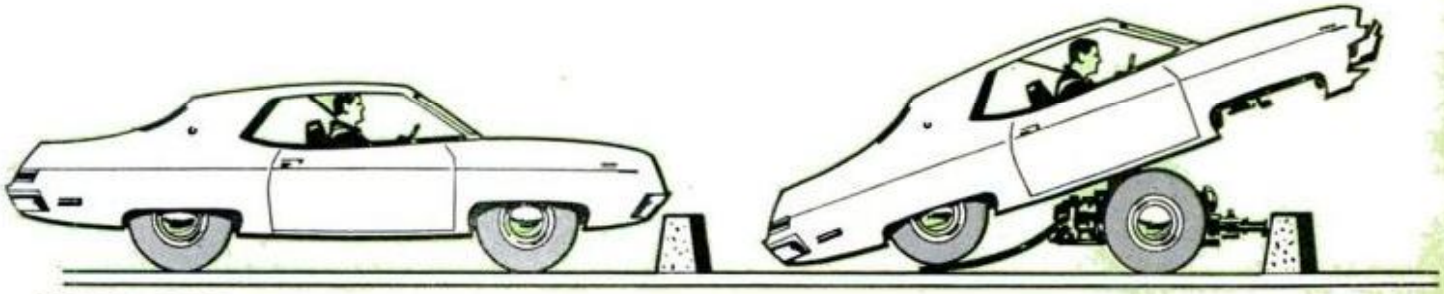
Purpose of the system, devised by Davis L. Bauer, is to make airports smaller, less crowded and cheaper to build. Since the big "mother" planes would never land, runways could be shorter, lighter and would not have to provide parking space for ships between flights. Through periodic crew changes and mid-air refueling, the planes could be kept flying, making only maintenance stops at special service facilities. The pods are wingless, but they have controllable tail surfaces for smooth takeoffs and landings. The cable hook is also fitted with control surfaces so it can be guided remotely to lock quickly onto a pod.

Roll-on stretcher

Accident victims are gently rolled onto this novel stretcher that works like a conveyor belt. The slightly sloped frame has a continuous loop of canvas wound around rollers. Cranking the rollers draws an injured person up and onto the stretcher without having to lift him, thus avoiding movement that might cause worse injuries. The device is currently under study by London police.

Break-apart car cuts crash injuries

Smack an object in this car and you slide safely right over it. The front end, including engine and wheels, is designed to break away in a crash, causing the car body to ride up and over it. Much of the impact energy is dissipated in upward movement and forces the occupants down in their seats instead of throwing them forward. The system is intended to save lives in head-on collisions with other cars or with low obstacles such as walls. It's the brainchild of Barney Shaw, Kingston, N.Y.



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New for the '72 waterways

More power, performance, style and speed—without more cost—are available for the boating season ahead

SLEEK LOOKS TOPSIDE and refined lines below are the trends you'll notice first in this season's latest pleasure craft. More power is available in a greater variety of outboard, inboard and stern-drive packages. Hulls are nearly all fiberglass or aluminum. The recently passed Federal Boating Safety Act already shows its effect in the swing toward better and higher flotation up under decks so a boat won't turn turtle or sink if suddenly swamped.

The streamlined wraparound windshields featured on Chrysler's Conqueror, Glastron/Carlson, Sidewinder and a few others last year are now appearing on many models, from the 22-foot Chris-Craft XK-22 to the Dolphin Caprice 16½-footer on this month's cover.

Interesting power trends are developing as turbines are now offered as standard, though very expensive, options aboard Pacemakers and Chris-Crafts. Ford's 31,500-rpm mill is geared down to give 450 hp at 3000 rpm and a maximum speed of 27 mph for Pacemaker's 48-foot new Sportfisherman. Top speed is also cruising speed since a turbine operates most efficiently wide open. Outboard Marine engines are making news by introducing a water jet for the first time to supplement OMC's stern-drive and inboard powerplants. Mecury's big line-leader, its 140-hp outboard, and Chrysler's 135 or Johnson and Evinrude 125s are big enough to speed along any modest hull, while inboards run up a throaty 500 hp from the MerCruiser racing mills. Wankel engines and diesel outboards for boats still start rumors, but don't appear to be in the production works in the United States this year.

Larson has added an airfoil spoiler on the back of its Shark 1800 runabout as an optional styling extra. Chris-Craft is making

(Text continues on page 182; more photos on following three pages)

TURBINES are hidden compactly in the hold of this Pacemaker Sportfisherman. Only tne side vents, to gulp the air required and exhaust the heat, give away the special new installation

Материал, защищенный авторским правом

CHRIS-CRAFT'S XK-22 may be the sportiest in the 39-model, stylish line with its curved windshield and V-hull

MFG is back in the cruiser club with new Gypsy 21 E-Z Cruiser. Cabin has two bunks and room for more in cockpit

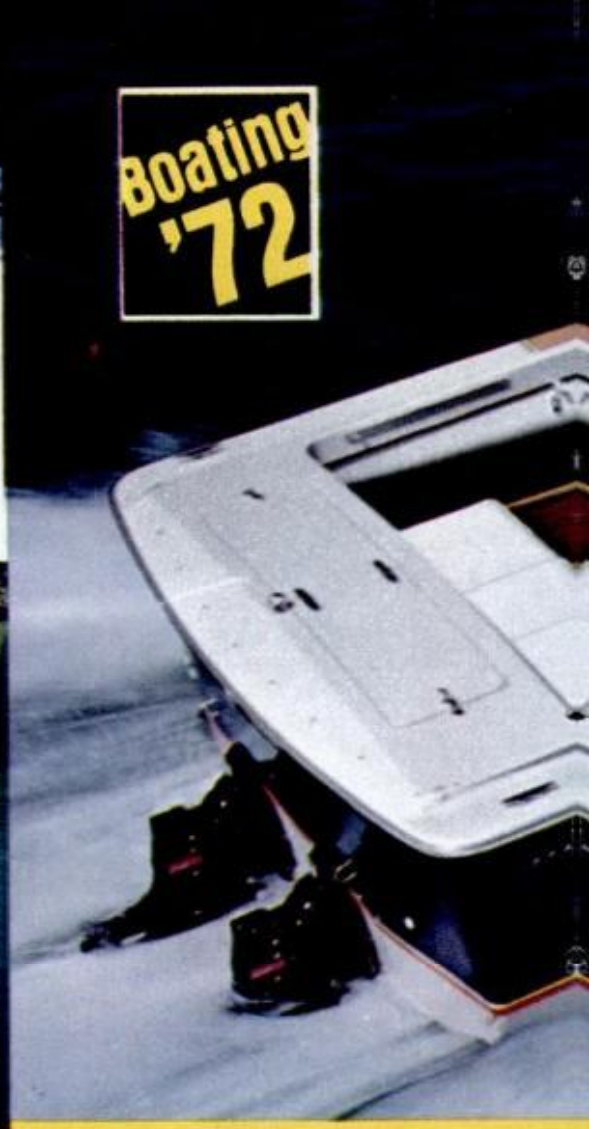
CHRYSLER CHARGER 186 has added distinctive cockpit padding and windshield to well-known hull-foil design

LARSON SHARK 1800 has an optional rear-deck airfoil for stern-drive and outboard models for sport-boat look

QUACHITA 16J Bass Boat is offering improved antitip flotation, foward casting platform, pedestal seating

Boating '72

Boating '72



GLASSPAR V-175 Super Sport is stern-drive or outboard powered. This new runabout has recliner swivel lounge seats forward, fold-down side seats amidships.

KAYOT Bass Boat is designed for fishing comfort and safety with bow and midship grab rails. The model controls easily from central console.

G-W Invader 153 offers beamy open cockpit and center control station. Fishermen in or out of boat should have ample work room.

LUND American Dart is available in 14, 15 and 17-foot models. These V-hull fiberglass craft, like V-14 shown, are rated for 60 hp.

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CRESTLINER Crusader 23: With twin MerCruiser power and deep-V hull of Jim Wynne design, new cruiser can do 50.

GLASTRON/CARLSON style leader, the CV-19 s/s, has water jet or stern-drive power. Also outboards to 155 hp.

MON ARK Bass Boat is another version of the new fisherman favorite. It has comfortable swivel seats, central controls.

SIDEWINDER, A style leader for several years in the racy runabout field, omits windscreen in latest model.

Материал, защищенный авторским правом

For campers, fishermen and

NOT ALL BOATMEN will be out to break speed records or want the wildest look in flashy colors. Some prefer a roomy cockpit, gunwales with minimum fittings to snag fishing lines, or simply some craft that offers a new approach to relaxation. There's a trend toward the quiet skills of sailing, and a number of boats can now be rigged for sailing when the wind favors.

Seaworthiness of some new small boats lets them head for offshore fishing grounds where a big sportsfishing craft used to be required. Now a trailer-boat owner can battle marlin and tuna just as big-craft skippers do.

And for protected waters, the booming bass boats and small dinghies will continue to grow in popularity. Waterways are waiting for all kinds. ★★★

WELLCRAFT's Airslot-24 Hardtop with outriggers installed becomes an offshore gamefisher as well as a family overnighter using forward cabin bunks

BOSTON WHALER Bass Boat uses familiar pedestal seats and mounts a forward electric motor for slow trolling. The 17-footer is rated for up to 100 hp

STINGER from John Allmand Boats, Hialeah, Fla., is a big, open-cockpit, 22-footer fishing utility boat that is now available as an outboard or inboard

Материал, защищенный авторским правом

windjammers

POSEIDON 24-foot Pocket Packet is a trailerable house cruiser from Leeds, Ala., that will convert quickly into a travel trailer when it's hauled out ashore in a campground

WINDSURFING INTERNATIONAL, Pacific Palisades, Calif., makes the 60-pound sailing surfboards with pivoted sail that are said to reach 20 mph yet move in minimum wind

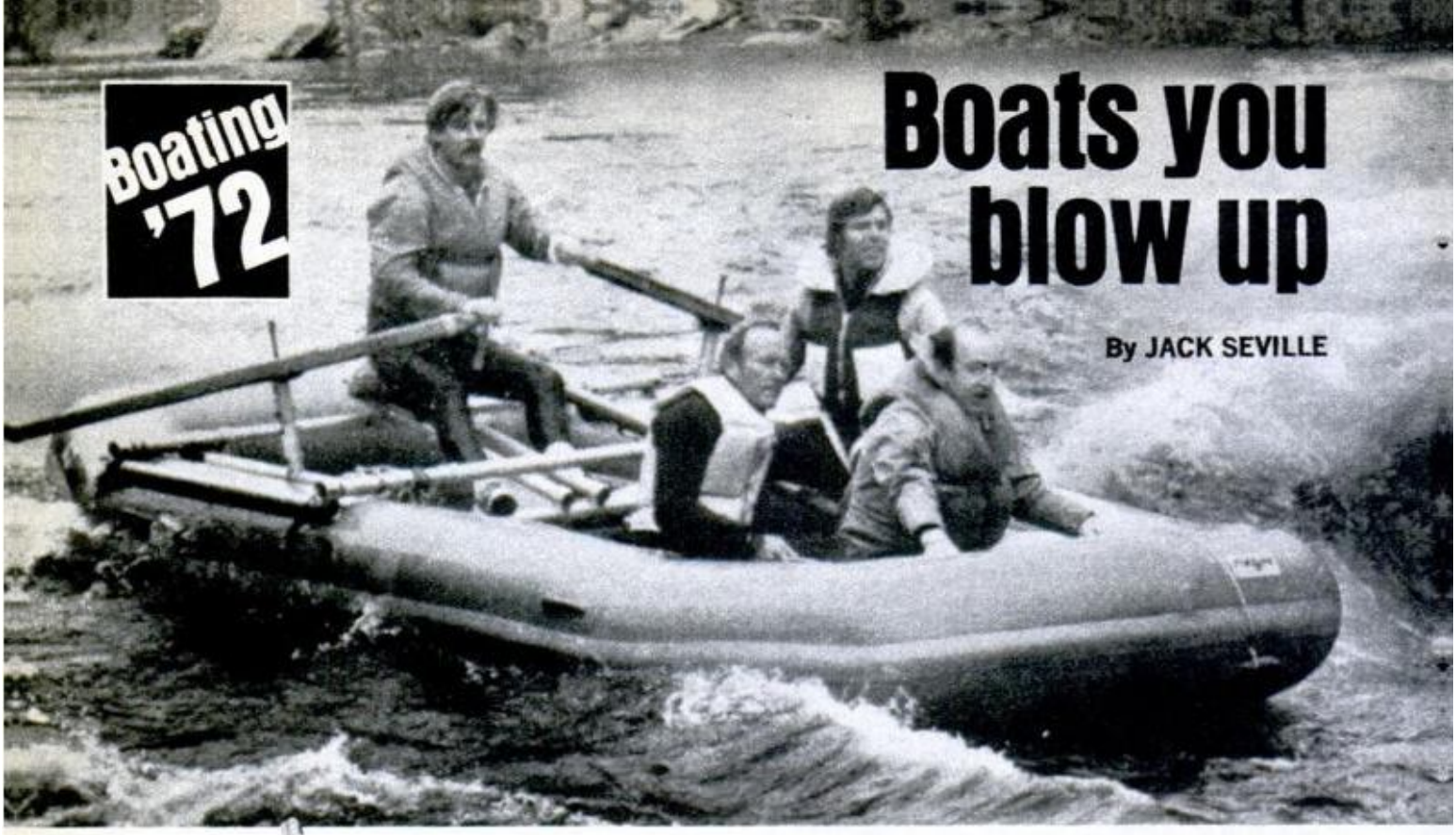
GRUMMAN canoes in nearly all sizes can be rigged to mount leeboards, rudder, mast and sail. Even the square-end Sportcanoe and dinghies can be rowed, paddled or sailed

TABUR MARINE, Montreal, claims that its 10-foot twin-hull dinghy is unsinkable and can normally support up to five passengers. Called Tabur Yak III, it also can be sailed

Boating '72

Boats you blow up

By JACK SEVILLE

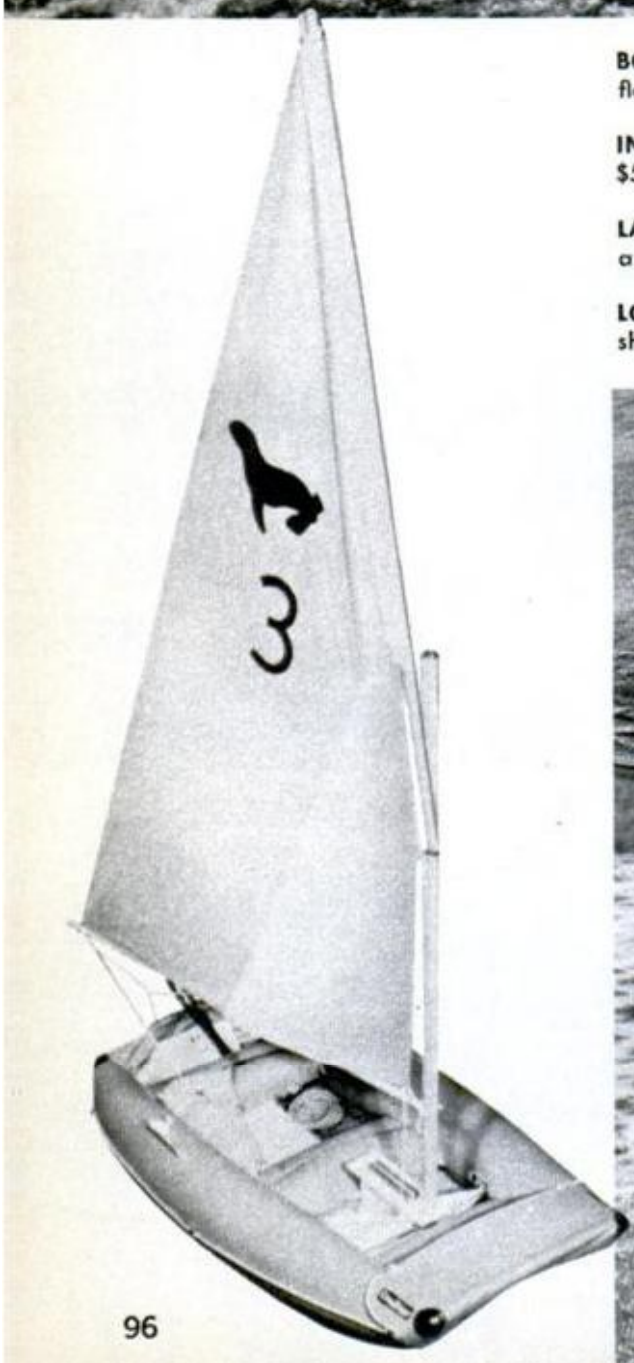


BOUNCING OFF BOULDERS is possible with a rubber river raft's flexible flotation. Avon's white-water models cost up to $1200

INFLATABLE SAILER (below, left) pumps to 8 feet long, 111 pounds; $545, West Products, Newark, N.J. Blowup takes four minutes

LAROS 8 (below), a 10-footer from Pirelli Tire Co. in Italy, is a new import reported to handle up to 18 hp and plane to 22 mph

LOOK INSIDE to help judge quality. Outboard transom support should be well anchored, as in French Bombard runabout (bottom)



INFLATION may be an unpopular word ashore, but on the water it's bursting out all over. Anyone can join. A closet or car trunk is big enough to be your boatyard, and a few minutes of pumping puts you in the yachtsman class.

Today's "rubber boats" are no inexpensive toys. Steer clear, in fact, of the cheap plastic doughnuts you see in variety stores. They can make amusing wading-pool floaters for the kids, but their thin skin, flimsy construction and single air chamber make them too easy to abrade or puncture. Likewise, liferafts shouldn't be considered for pleasure boating. They are adequate for emergency flotation, but are not designed to bounce off docks and rocks, and are difficult to row or steer.

For their purpose, however—that of providing a small light boat that is easy to stow collapsed and simple to cartop or carry aboard a larger craft, one that can handle rapids and rough water safely if necessary—the inflat-

(Please turn to page 178)

SPEEDS to 50 mph are possible with larger models and even 10-footers can be powered for water skiing

BEST CONSTRUCTION is of Hypalon-coated nylon, as used for French Zodiac, rather than cheaper plastic

PRICE is usually an indication of quality. Avon imports from Britain (below) range from $300 to $800

YOUR PROPELLER is a pump. It moves a cone-shaped column of water, producing thrust. The water is cone-shaped because it expands as it moves away from the boat. Its diameter depends upon the diameter of the propeller. Speed of movement is determined by the speed of the propeller and its pitch.

The faster you can move that discharge cone, the faster your boat is going to go. There are, of course, a variety of factors limiting perfect performance. You can have too much pitch, for example, and turn the propeller too fast, losing bite and overspeeding your engine.

Propeller experts delve into a multitude of details when computing probable speed and performance. They twiddle their slide rules and ultimately come up with a set of figures, but the average small-boat skipper can do the same with a lot less work. All you have

More performance?

Pick your prop

By JIM MARTENHOFF

Boating '72

Trial and error are part of the picture, but you can pick up knots with proper diameter and pitch

to know is a simple rule of thumb and how to use it. You can stand on a dock, look at a man's boat, and tell at a glance what speed he probably makes. All you need is gear ratio and pitch.

Pitch is the big secret. This is the distance a propeller would move through the water in one revolution—like a woodscrew moving through wood—if it didn't slip. Propellers always slip, and the slippage is worked out as a percentage.

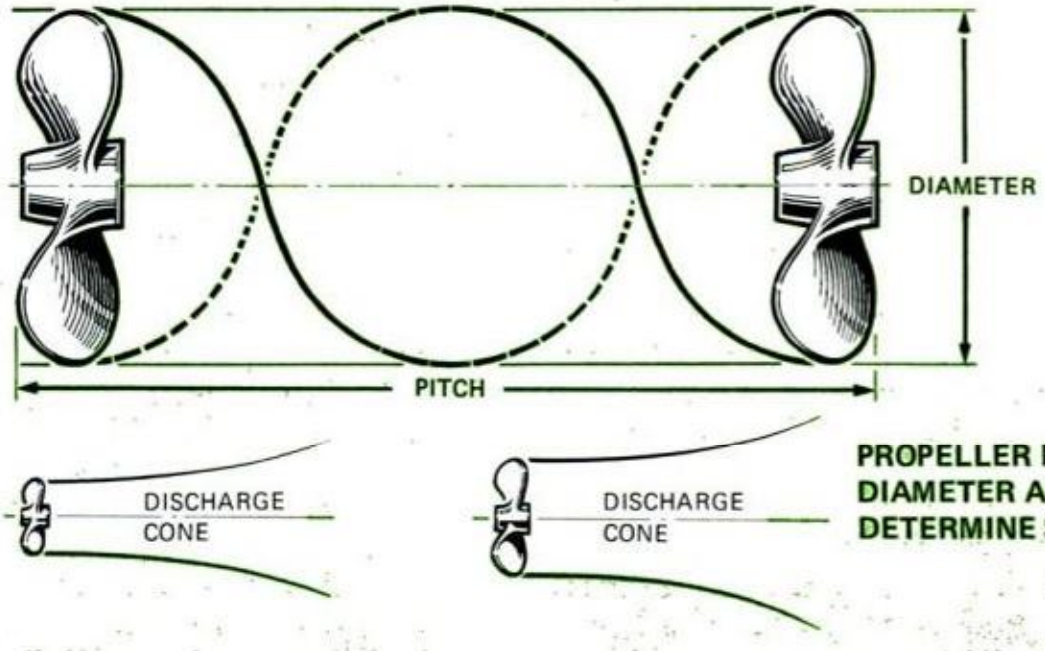
Diameter of a propeller, and its pitch, are usually stamped on the prop hub in that order. A propeller marked 16x18, for example, is one with a diameter of 16 inches and a pitch of 18. They are interrelated. If you increase the diameter of a prop to make a larger discharge cone of water, you may have to reduce the pitch.

Your engine can only do so much work; diameter and pitch must share the mechanical muscle. Engineers think of the relationship as pitch ratio. This is pitch divided by diameter. That 16x18 wheel has a ratio of a bit over 1.1, and if it were an 18x16 the ratio would be under 0.9.

This is useful background, but it has already been done for you on a correctly propped craft. High-performance hulls usually call for a pitch ratio of as much as 1.5, while heavy cruisers might go down to 1.0 or 0.8. Yet you can stump the experts by overloading your boat or distributing weight unevenly to upset its trim. Hence the need for this know-how. If you loaded your fishing boat with a huge, heavy ice chest and other gear so that performance fell off, a little prop judgment might solve your problem.

Forget everything but pitch. Use this

TIME A RUN over a measured course, compare true speed to theoretical and determine prop efficiency



PROPELLER PITCH, DIAMETER AND RPM DETERMINE SPEED

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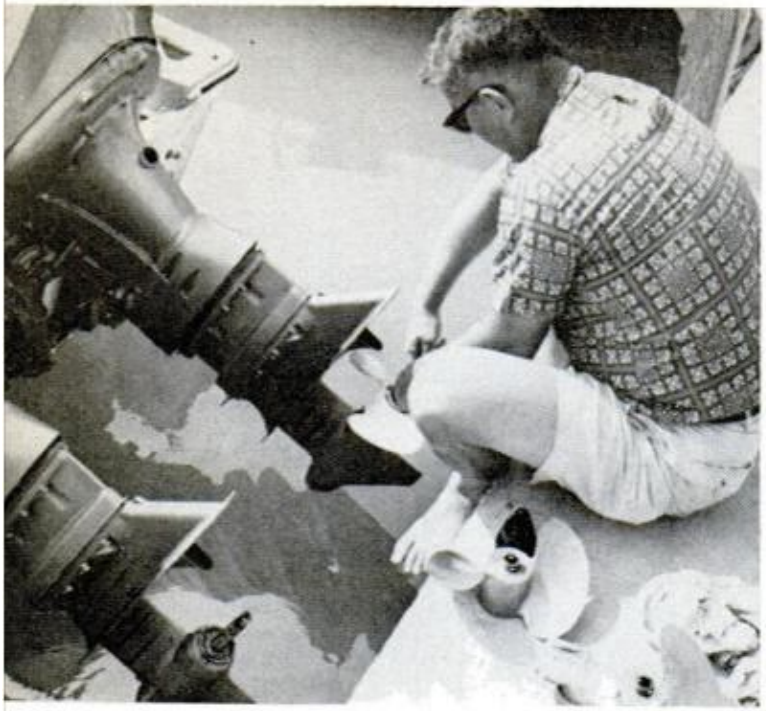
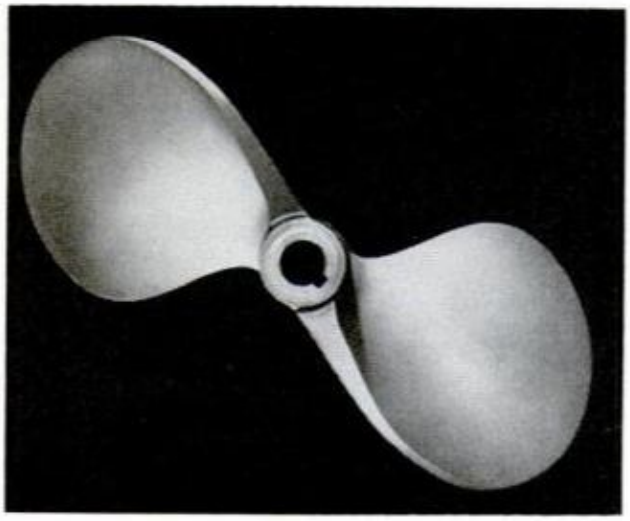


SOME PROP SLIPPAGE can be corrected sometimes by testing various props and timing the performance



RACING PROPS, like this new titanium model from Nicson Engineering, may top 90 percent performance

figure to figure your possible speed. This is the speed you would make if there were no prop slippage. Clock your boat over a measured distance and compare true speed to theoretical. The difference is "apparent slip," as the engineers put it. Slip is not an ideal way to determine efficient performance, but it's handiest if used with understanding.

You figure theoretical speed by multiplying propeller pitch in inches by shaft rpm. Note this is shaft turns, not necessarily what your tach reads. If you have a 2:1 gear reduction between engine and prop, your shaft turns at half the speed of the engine. The 5000 rpm on the tach means only 2500 shaft rpm. Engineers multiply pitch by shaft rpm, then divide by 1056 to find theoretical speed in statute miles per hour, or divide by 1216 to find knots.

This is a lot of work, so here's a trick so simple that you can often figure theoretical speed mentally, knock off expected slippage, and get true speed frequently within a mile or so of the actual figure. It never ceases to surprise friends when you can stand at a dock, listen to pitch, gear ratio and rpm figures, and then announce probable speed.

Here is how it works: Theoretical speed, in statute miles per hour, for each 1000 shaft turns, equals pitch minus one. That 18-inch prop we've been talking about will deliver a theoretical speed of 17 statute miles per hour for each 1000 shaft revolutions. This thumb-rule goes off only with low pitch props of 12 inches or less, or with more than 20 inches, so it fits the average small boat well.

Let's work an example. You have a 21-inch-pitch prop on a big outboard with a 2:1 gear reduction. The tach at top speed shows 5000 so the prop is turning 2500 rpm. With the minus-one rule, the 21-inch prop makes 20 mph per 1000 turns, that's 40 mph at 2000 plus another 10 mph for the last 500. Theoretical top speed is 50 statute mph, and timing shows true speed to be 37.5 mph. The lost 12.5 mph is 25-percent slip, acceptable for an outboard. For a stern drive you might expect about 20, inboards may run 15, and very good installations and race boats can be 10 percent or less. Heavy cruisers and houseboats may go as high as 35 percent, and hull designs will influence slip figures.

High slippage figures may indicate a propeller problem, and trying other props so that peak rpm is correct is one good way to look for increased efficiency. ★★★

Материал, защищенный авторским правом

Group rates for budget boating

Split up the expenses among several friends, and suddenly you're at least part-owner of a dreamboat

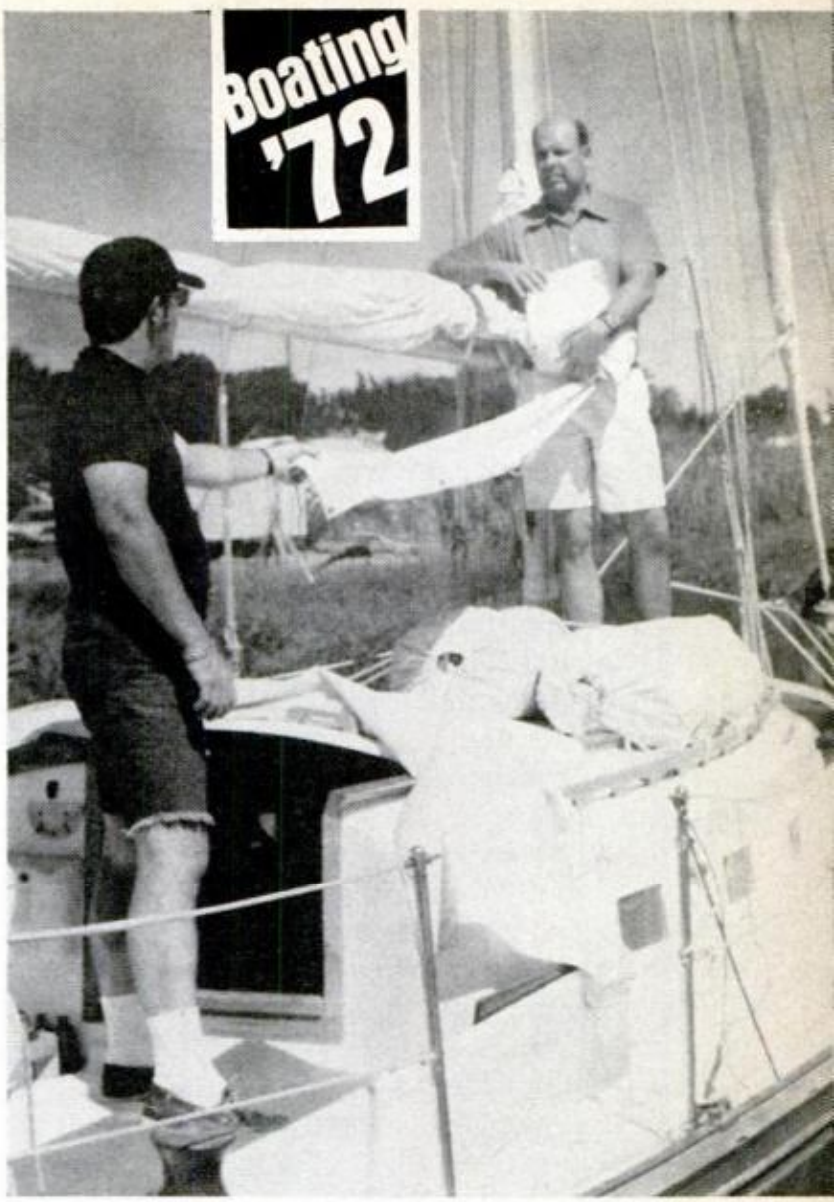
By ANNE STAFFIN

IN NUMBERS there is strength—and also more money. Both of these factors can work to your advantage when you decide to share a boat with someone else.

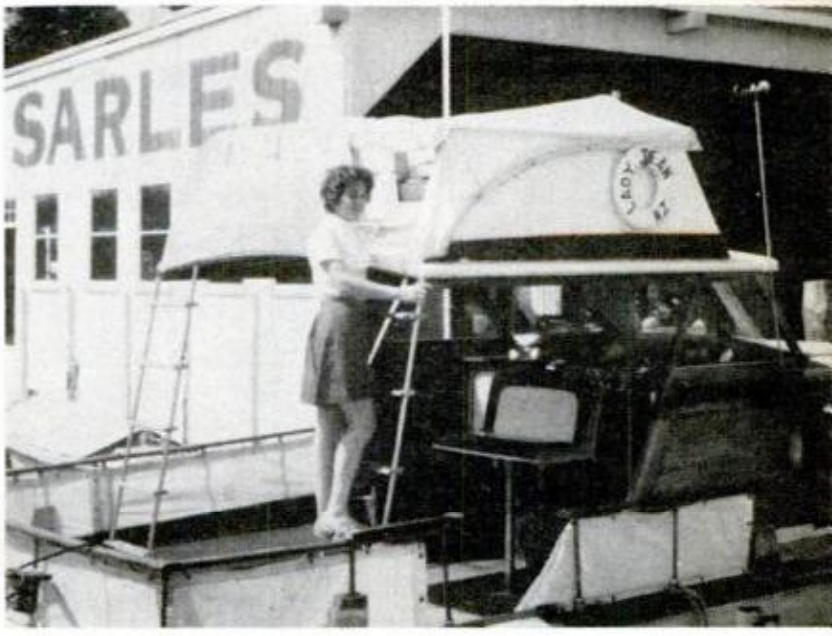
First there is your choice of craft. You probably have an idea of your dreamboat, one with more accommodations and the latest equipment, but your present model is all you can afford. When two families pool their resources, however, expenses such as purchase price, maintenance, fuel and insurance are cut in half. A partnership can afford twice the vessel that one family could have purchased alone.

Labor is a second bonus. A wooden boat today can be a real bargain, but for the do-it-yourself owner there can be hours of scraping, sanding, painting, varnishing, scrubbing and cleaning ahead. Extra hands from other part-owners can shorten the work load and turn a tiresome weekend into a cheerful party.

Joint family boating can stretch your waterway mileage, as well. Family A begins, cruising the boat to a vacation site and spending a relaxing week. On the last day of the vacation, Family B comes up by car and the two families exchange places, with A returning home with



SHARE-THE-COST YACHTING gave John Culver and Frank Wright this 33-footer they partially built themselves



EXTRA BUNK ACCOMMODATIONS are even fitted under flying bridge cover so three families can share boat

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the car and B moving on board for its vacation week plus the cruise back home. By this method, each family spends one week alone on the boat and cuts the fuel cost in half since they travel only one way. The partners can choose a spot more distant from home since they do not have to allow time for the return trip.

John Culver and Frank Wright are next-door neighbors in Westfield, N.J., and from the time they met 10 years ago their dream was a vacation on a sailboat of their own. Six years ago, after extensive investigation, they had a legal partnership agreement drawn up and purchased a 33-foot fiberglass Tavana hull. Both wives remember their husbands disappearing every spare moment all winter under the canvas-covered hulk in the middle of the snowy lawn. While the men did the interior woodworking, using large cardboard templates to check height of bulkheads, drawers and doors before cutting plywood to fit, the women sewed curtains, made bunk cushions and shopped for galley accessories. Mrs Wright estimates that *Karinda*, their six-sleeper sloop, cost them one year of labor and about $10,000 for hull, materials, fittings, sails and insurance for the first year—a figure that they split in half. A boatyard duplicate might run $20,000 to $25,000 today.

Stephen Gifford, a Delran, N.J., personnel director, has an informal partnership arrangement with his son and son-in-law. They're on their fourth boat. "When my older son and daughter got married," he remembers, "our 21-foot Hiliner was too sporty for the women and a bit too small to fit everyone on board at the same time. So we traded it in for a 33-foot fiberglass houseboat, and all of us chipped in the difference in price." High point of the summer for Gifford, his wife, 16-year-old son and the two married couples was an eight-day Chesapeake Bay cruise. "The girls are delighted with the boat's spaciousness," Gifford notes, "and now we can all go out together. There's no maintenance—we just paint the bottom once a year."

When bachelors Cliff Lloyd, 26, Robert Grand, 25, and Kenneth Mulkearns, 25, were fraternity brothers at Newark College of Engineering, they decided someday they would own a four sleeper with big afterdeck and would go into a scuba diving and salvage business together. When they discovered a 32-foot 1959 Chris-Craft in a New Jersey back yard, it had a sound hull, engines that were shot, but it was all they could afford. After 10 weeks of endless work and installation of two rebuilt engines that the boatyard said would never fit, they had her

DISTANCE CRUISING to remote ports is practical when one family takes boat out, another returns it

TOO SMALL TO SHARE? Staffins found compatible families can divide costs for big and small craft

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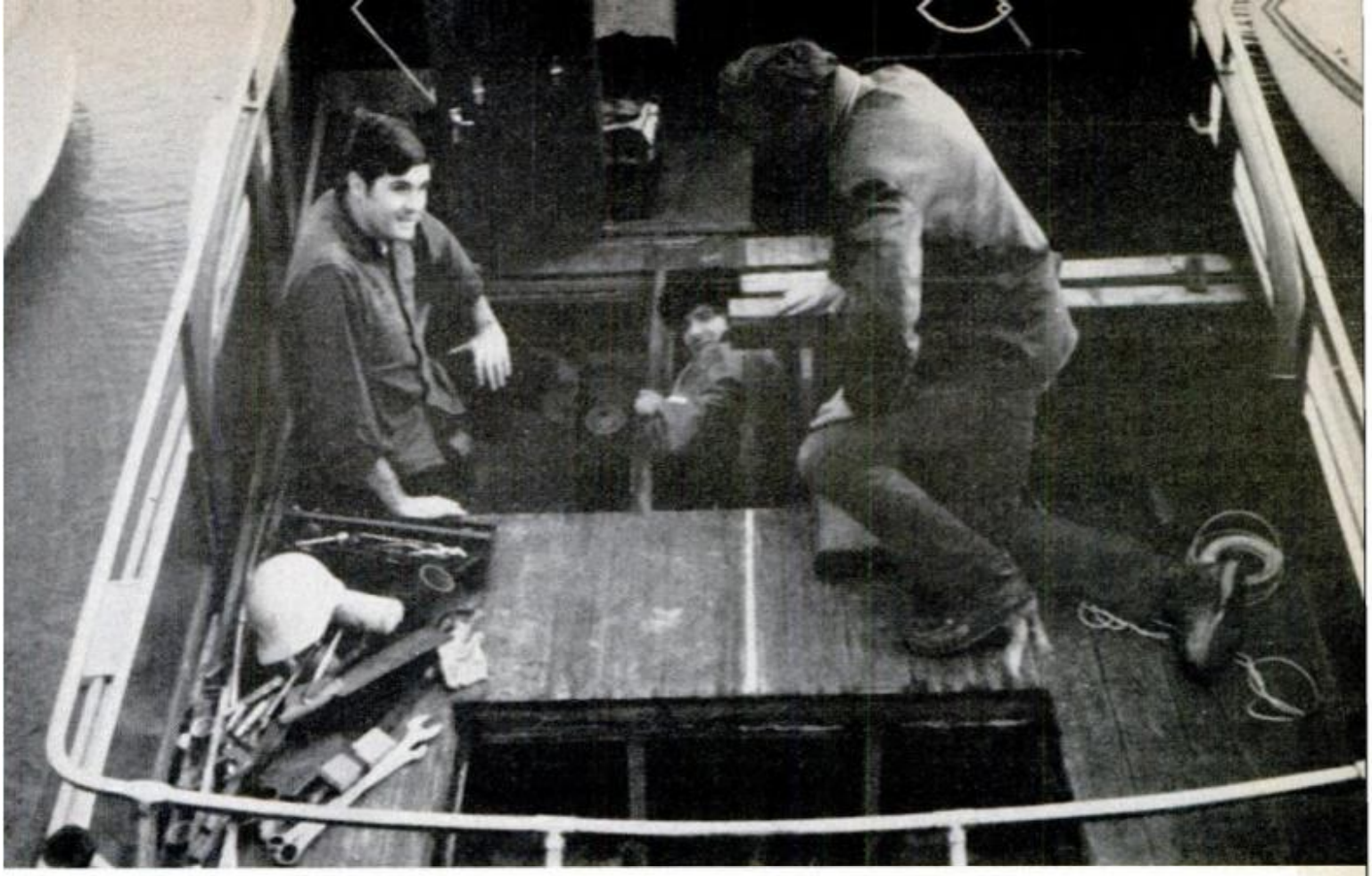

EVEN ENGINE INSTALLATION by amateurs is possible, three college friends discover, when it helps save enough money to make partner-ownership of a sound but aging 32-foot Chris-Craft a financial reality

running like new. Then Ken got his draft notice and the two remaining partners are worried since a compatible replacement can be hard to find.

A legal agreement that spells out percentage of ownership can avoid misunderstandings later on. According to admiralty lawyer Richard Barnett, a partner in the New York firm of Haight, Gardner, Poor & Havens, there are two basic ways to set up joint ownership. The simplest is a joint owner's agreement stating each individual's percentage of interest in the boat. Many fishing boats are owned this way, but in the event of accident or damage there is no limit to liability, except for insurance.

Some people prefer a simple corporation which owns the boat and each family holds a percentage of the stock. The agreement details who will run the corporation, what expenses each family pays, and what happens if someone dies or wishes to sell the boat. Setting up a corporation can cost several hundred dollars but limits a stockholder's liability since the boat is owned by the corporation. Make sure that your vessel has adequate insurance since a group arrangement brings additional helmsmen and navigators.

In our own case, three related families have shared a cruiser successfully for 10 years without a formal legal agreement. One family member is appointed to figure expenses for the year, costs are split three ways and a budget is set which each family pays in periodic installments. Last year's costs included insurance: $397; slip rental for our 35-footer: $550; storage and hauling: $131; fitting out supplies: $182; reserve for major engine and structural repair and replacement: $700; reserve for electronic equipment: $200; miscellaneous repairs and gear replacement: $150; a total of $2310. We figure $1000 a year depreciation, $7 per night for slip rental away from home, and $1 per mile for gas and oil.

Boat partners must be compatible, but the results are a lot of boat for little money. ★★★

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PVC FLAGSTAFFS with upper 5-foot sections of ¾-inch pipe reinforced with ½-inch pipe support flags and banners in windy day

DOCK HANGER LINE (below left) of flexible PVC pipe in a rigid PVC base reduces line-handling confusion when you return to slip

MULTIUSE BRACKET was made by submerging PVC pipe in boiling water until soft, stepping on end and bending up overall fitting

At sea—with PVC

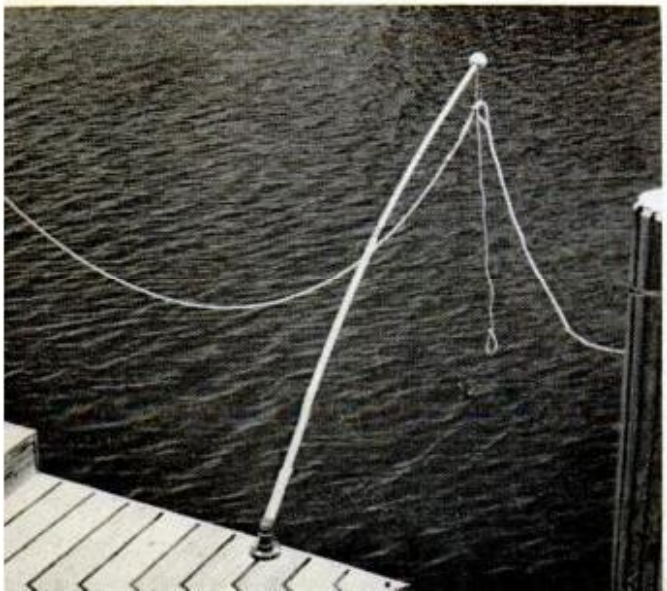
Versatile PVC pipe can take the water and weather exposure that comes with a variety of boating jobs

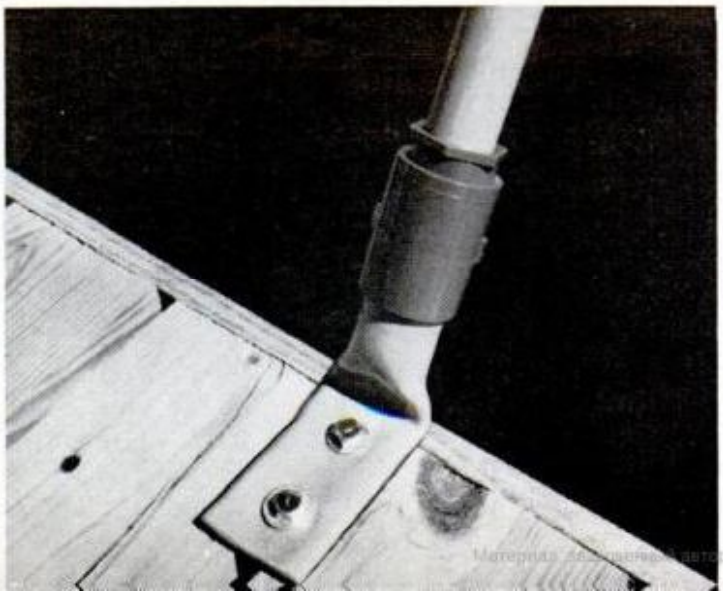
By ROD RADFORD

WITH A NAME like polyvinyl chloride, it's no wonder they call it PVC. And with its no-sanding, no-scraping, no-varnishing qualities for easy maintenance, no wonder it's ideal for use afloat.

I first installed my own lawn-sprinkler system of PVC, saved $300, and discovered the inexpensive material is simple to shape and assemble with heat, a hacksaw and a can of PVC cement. In many other uses, it has proved itself almost impervious to salt, rot, rust and corrosion—so marine applications, as shown here, are a natural.

I used white (to reflect sun heat) and Schedule 40 or 80 pipe. Plumbing and hardware stores stock it in ½ to 16-inch diameters. ★★★





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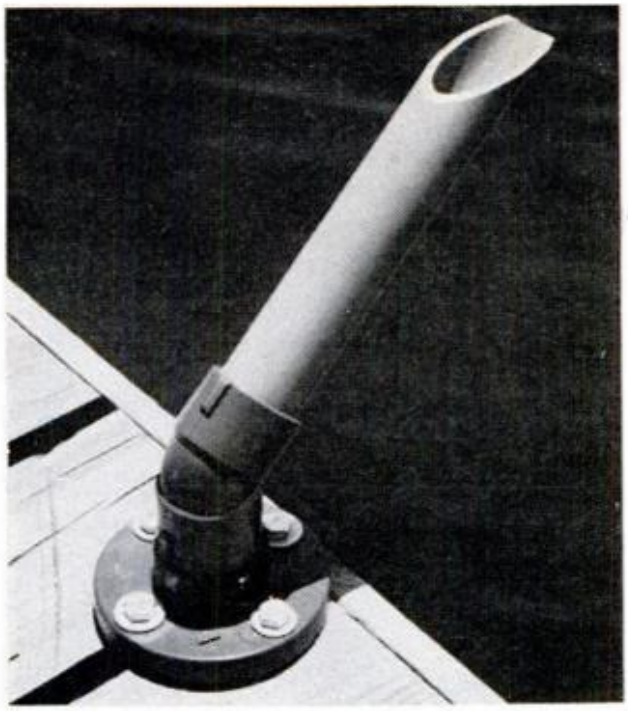


RIGID BASE made with 45° PVC angle fitting and smaller pipe insertion becomes flag or rod holder

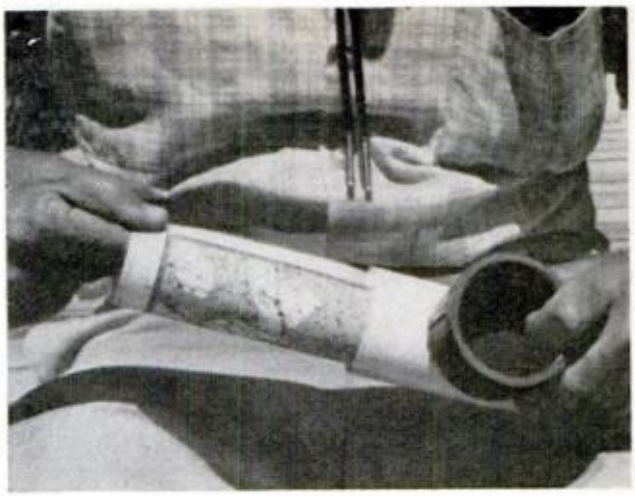
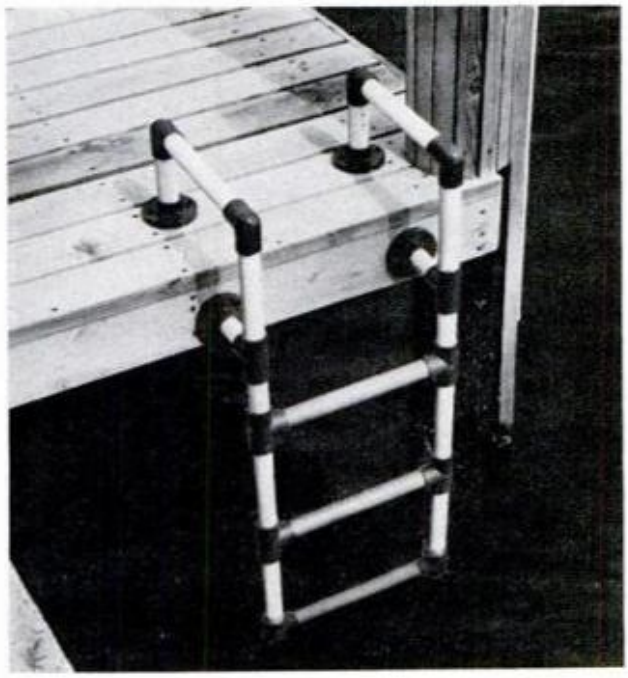
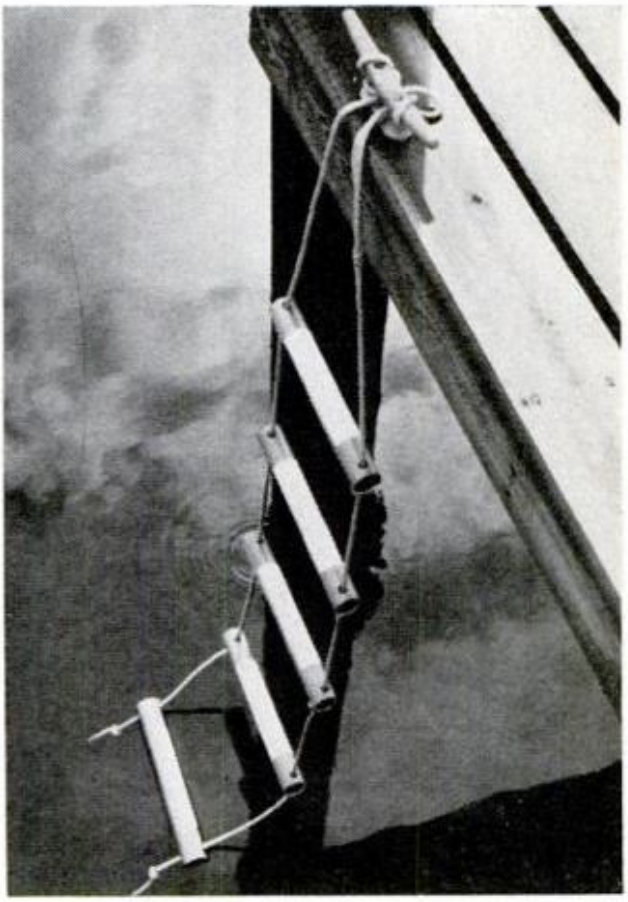


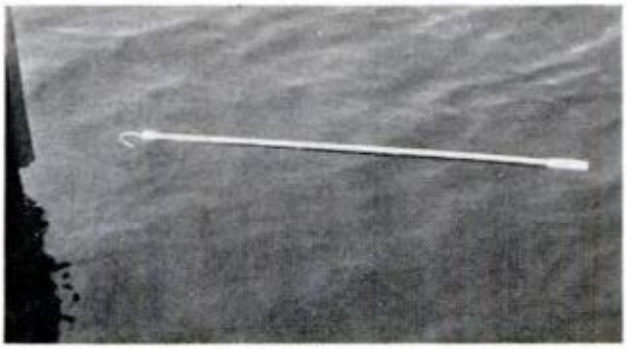
CHART STORAGE TUBE that floats can be made by sealing one end of PVC pipe and capping the other



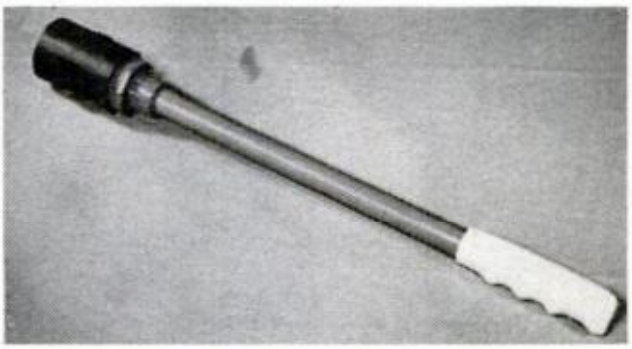
DOCK SAFETY LADDER fashioned from PVC piping and four flanges is impervious to rot and corrosion



PORTABLE LADDER uses 1½-inch PVC pipe joined by polyurethane cord with knots supporting drilled rungs



FLOATING BOATHOOK is made with ¾-inch pipe, a vinyl-covered hardware hook and a rubber hand grip



CLUB FOR UNRULY FISH is made by weighting one end of ½-inch pipe with cement and adding a handle

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Boats '72

The life it

Now the Coast Guard has approved life preservers that are convenient to wear, comfortable, and leave little excuse for drowning

YEAR-ROUND cold-weather safety is provided by Stearns snowmobile suit with flotation, though it's not approved for boating

NEWLY APPROVED for small-craft requirements are Stearns Yachtsman's Blazer, Sailor Vest, Sans-Souci Vest and Windjammer

saves may be your own

By BOB WHITTIER

FEDERAL BOATING LAWS, and state laws patterned after them, require that most boats carry a suitable life preserver for each occupant. Soon the day may come when every craft, whether pushed by power or sail, oars or paddles, must have proper preservers along. Since it's the small boats that often are overloaded and swamp or are tipped over most easily, sufficient life preservers make a lot of sense.

Practically any device bearing the U.S. Coast Guard seal of approval and sold by a reputable retailer is legally acceptable as lifesaving equipment on a pleasure boat. Recently a number of jackets and vests that are easier and more comfortable to wear have been added to the acceptable list by the Marine Department (formerly the Yacht Safety Bureau) of Underwriters' Laboratories and assigned YSB/USCG approval numbers. With such a variety available, how do you choose?

You need to know something about the reasons for various types, their adaptability to water conditions, and accessibility in time of need. The basic advantage of a vest or jacket preserver is that once you put it on, it stays with no effort on your part. You need to hold the buoyant cushion type, so it is less suitable in open waters where help may be some time in coming. A small vest that ties on is best for children.

Buoyant cushions, however, are normally carried on the seats of a small boat, safely above the level of bilgewater. Usually they are nearby when trouble happens, rather than stowed below in a locker. Should you and the cushions end up in the water, however, a breeze may quickly blow them out of reach. Wearing a cushion on your back with arms through the loop straps tends to float you face down with your face in the water. The "approved" method, with one leg and the opposite arm through the loops, places the cushion on your stomach for floating but is awkward. Reports indicate that by 1973 buoyant cushions won't be allowed in place of a wearable device, but on larger vessels throwable cushions and ring buoys may be required in addition to jackets or vests.

Each approved life-preserver jacket or vest is individually inspected by a

PRESERVER PURPOSE determines your pick. For children it should be a fasten-on vest that can be worn continually. Racing models should offer padding protection and float wearer face up with head elevated

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INFLATABLES are easy to wear and stow but are not USCG approved because wearer must activate them

WATER SKI VESTS and belts are now recommended for all skiing and are required for tournaments

SAILING MODELS with wide armholes to allow activity are now receiving some CG acceptance

JACKETS like this Moby Dick model provide warmth, flotation—and good appearance as well

Coast Guard representative assigned to the factory (one reason imported preservers carry no approval). Inflatable types require that the wearer be conscious to operate them, thus carry no approval. Racing jackets can turn an unconscious wearer face up and support his head with a collar. Water-ski belts carry no USCG seal, but recently sailing vests that allow much freedom of arm movement have received Coast Guard approval for pleasure-boat use. Cold-weather jackets with foam flotation are also being accepted in some cases. With the variety of preservers available, there is little excuse for not wearing one or having it handy in time of emergency. ★★★

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Boating '72

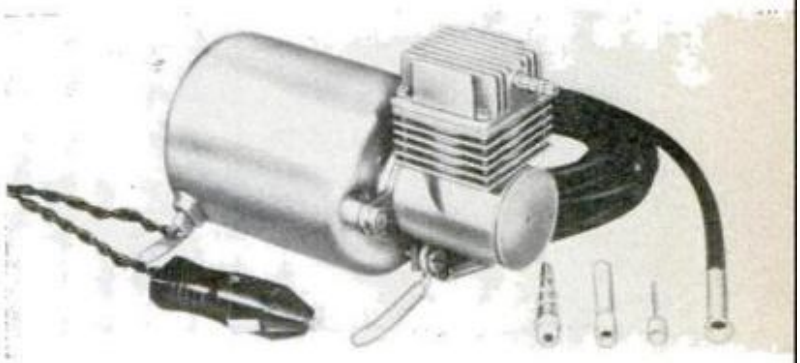
New nautical accessories

PORTABLE RADIOS for pleasure craft are becoming stronger, smaller, lighter. These from RCA feature (at top) six-band receiver that brings in AM, FM, long wave, three short wave bands; fine tuning; beat frequency oscillator; lighted dials. Mark I Strato-World is $150. Lower model has pushbutton for FM, AM, public service, aircraft bands; $80.

ROLL-A-BOAT wheel set from American Recreational Products, Cupertino, Calif., makes dragging the boat down to water unnecessary. Two heavy-gauge aluminum channels bolt to the boat transom. Legs and wheels can then be attached so boat rolls right side up or upside down. In water, wheels can be pivoted up and locked or removed completely. $34.50.

TITAN INVERTER, by General Thermetics, Mount Vernon, N.Y., converts battery power to 60-cycle 110-volt a.c. at 500 watts with surges to 1000. It draws three amps. under no-load conditions; can be cut to 0.1 amp. with optional load presence sensor accessory. The $360 30-lb. unit placed in a well ventilated area will handle refrigerators, freezers. Two units in parallel silently handle 1000 watts.

GRUMMAN BOATS, Marathon, N.Y., has improved a cartop carrier for canoes and small boats. A protective vinyl rub strip prevents gunwale from chafing and a reinforcing bar stops vibration and noise at speed. Sizes to handle one or two boats at once are available. Strong but soft webbing is used as tie-down.



FROM CHRIS-CRAFT ACCESSORIES DIV. comes a 12-volt Speedy Inflator that is claimed to inflate air mattresses, soft tires on a car or trailer, rubber dinghies and the like from car-battery power. The small apparatus plugs into cigaret lighter, is $30. It can also be used to blow out clogged lines.

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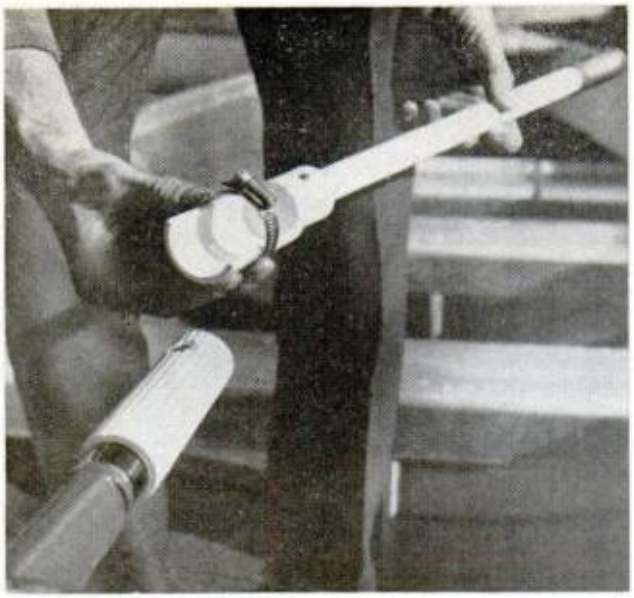
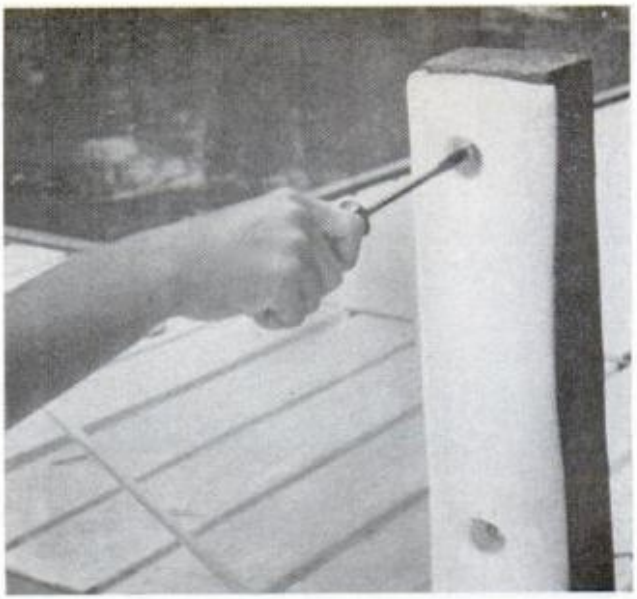
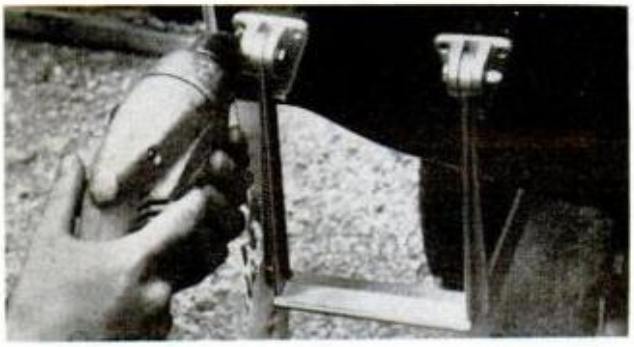


EXTENSION HANDLE from Bremer Mfg., Elkhart Lake, Wis., $6.95, allows helmsman to sit forward from the transom and balance out the boat better or stand momentarily to look for white water ahead. Two-foot extension clamps to grip of outboard tiller to control throttle, direction. A fishing boat, particularly, is more safely controlled from amidships.

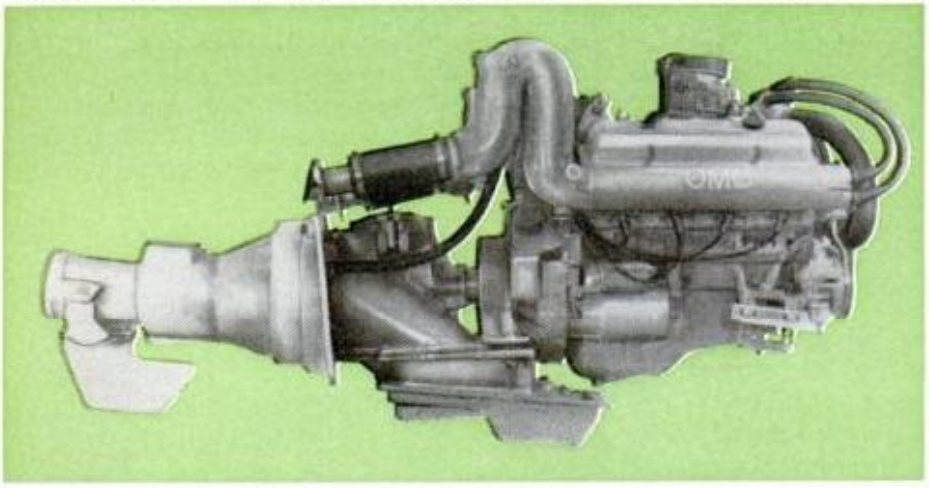


FENDA-FOAM can protect docks, piers, pilings and boats that bump into them. Packaged in nine-foot lengths of half-round, three inches across, at $4.95 complete with washers and $6.95 for four-inch widths, material is said to be mildew and rotproof, unaffected by sun, oil. Maker, N. A. Taylor, Gloversville, N.Y., also produces boat fenders from the Ethafoam.



A MINI BOARDING LADDER, said to be designed for water skiers, is supplied for owner installation by Waukegan Outdoor Products, Gurnee, Ill., $9. Unit could be even more valuable, however, for the man overboard struggling to climb back in again. Tension mounting holds step up against transom when not in use. Made of die-cast aluminum, hinged step is reported to resist corrosion.

SAILRITE KITS, 1650 Verde Vista, Pomona, Calif., give string-and-canvas boatman a chance to sew up his own windblown powerplant. Dacron or nylon cloth, Dacron thread, needles, wax, hardware, and instructions are included in racing sail kits. Portable sewing machine is said to be only other accessory needed; saving of over half cost of ready-made sails is claimed. Catalog available.



OMC WATER JET DRIVE, named the JX-245 by the Outboard Marine Stern Drive Div. is so new that's its first photo at left. Power comes from 308-cu.-in. V8 with "hot" Corvette cam. Large nozzle is said to give good mid-range efficiency; steerable rudder aids low-speed maneuverability. Even boat trim is adjustable by changing trim deflector.

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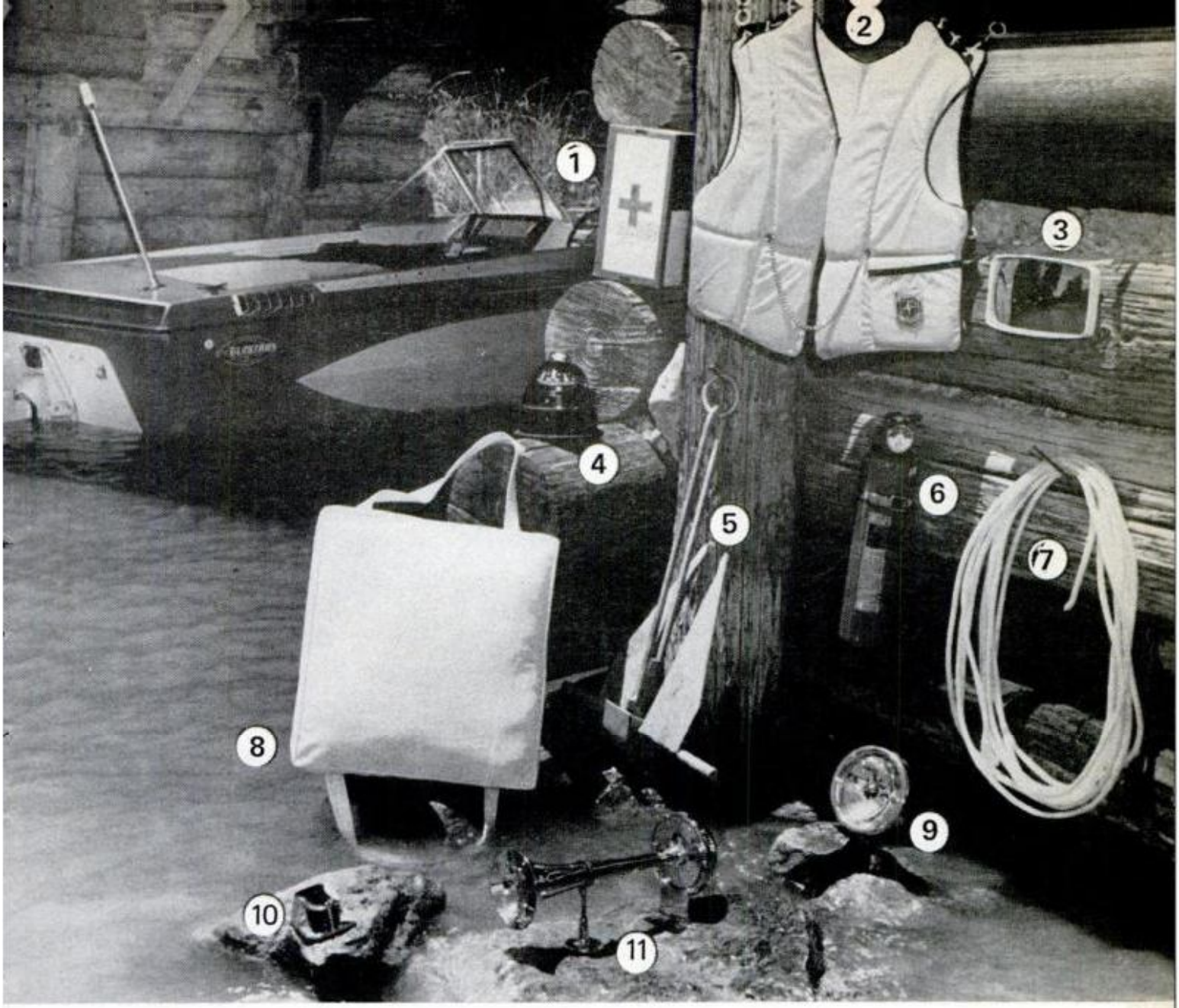

SAFETY AIDS AREN'T NEW, but should be examined, upgraded and renewed, if necessary, every boating season. Some are required by law in many states. Others are common-sense essentials.

1. A first-aid kit for boating use should come preferably in a plastic container that is waterproof and, ideally, will float. Use drugs supplied with caution; antiseasickness pills, for example, can cause drowsiness that might slow helmsman's reflexes.

2. A comfortable life vest of Coast Guard approved type is easier to wear when weather threatens.

3. Some states now require a rear-view mirror for water skiing. Convex type gives a wide view.

4. A compass is not required by law, but can head you home safely at night or in fog.

5. Pick an anchor that holds best in your sandy, grassy, muddy or rocky bottom.

6. Check extinguisher for full pressure.

7. Examine your lines for any chafing.

8. Approved life preserver cushions or vests should be provided for each passenger.

9. Night boating needs a good searchlight.

10. Navigation lights must be of correct type and strength.

11. A horn is required by law on many power craft.

AN UNDERWATER PERISCOPE with a new angle is the Aqua Scope from Aqua Marine Industries, Box 12767, Seattle, Wash. 98111. A $10 underwater viewer with an additional $6 mirror attachment, it can be used from dockside or dinghy to study condition of a boat's bottom or, with mirror tilted back, can scan bottom to spot fish or items lost overboard. A camera attachment is also available.

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Replace mufflers yourself

Start by getting the right parts—at the right prices. When ready to work, be sure you've planned ahead and have all you need. The money you save will be your own!

By BILL HARTFORD, Auto Editor

Photos by the author

PARTS AND LABOR: Any way you add them up, you get a total bill that makes you wonder why you wasted your time—checkbook in hand—waiting for your car to be fixed when you could have done the job yourself.

Even exhaust-system work is worth doing yourself. Labor amounts to your time (only *you* know how much it's worth), and carefully shopping for parts can save you money over their price at a dealer's or service station.

None of the volume-business muffler

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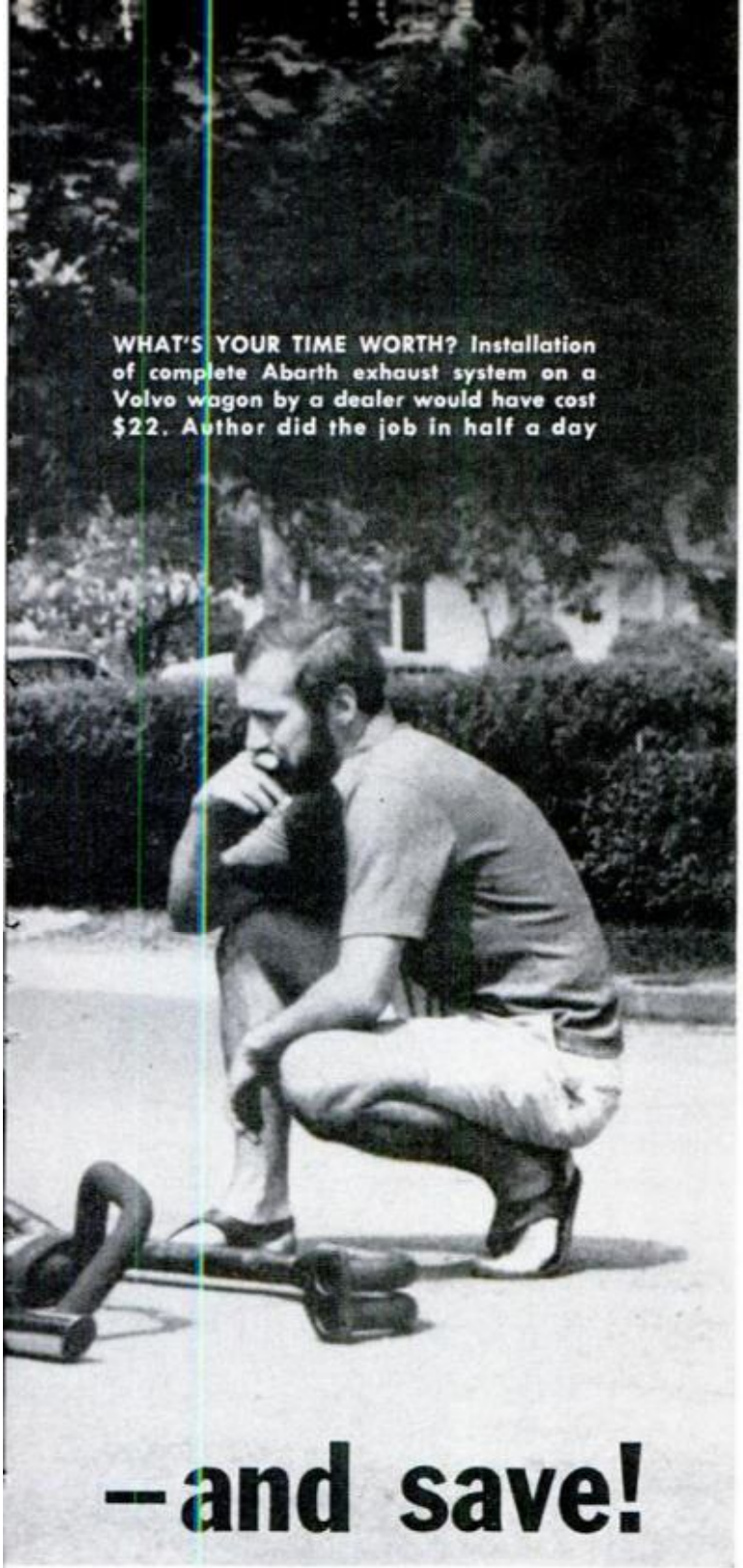

WHAT'S YOUR TIME WORTH? Installation of complete Abarth exhaust system on a Volvo wagon by a dealer would have cost $22. Author did the job in half a day

—and save!

shops we surveyed sell parts over the counter, so it is impossible to determine how their installed-price breaks down into parts and labor charges.

At automotive parts stores, price of over-the-counter parts can be "retail" or "wholesale." If you've built up a rapport with the owner or salesman, or you give the impression that you're picking up parts needed for a job by a local garage, you'll get the lower, wholesale price.

Some "automotive centers" not specializing in exhaust-system work have specific, no-nonsense labor rates for installation of parts you buy from them. A $12 muffler for a standard model car at Sears, for example, has an installation charge of between $4 and $5. If you need a tailpipe, labor comes up to $7. If your time on Saturday is your own and you don't mind getting your hands dirty, it's worth doing yourself. If you anticipate a particularly rough job (by checking under your car beforehand), you can actually borrow the installation tools from Sears for a deposit that's fully refunded when you return them.

Mail-ordering parts usually saves you some money, catalog price being somewhat less than over-the-counter price. Always check shipping charges, however, and watch for over-the-counter sales. Anticipate! You can do that when you do-it-yourself and know your car inside and out. Buy now, install later, if there's a sale on parts due for replacement soon.

How good a muffler you should buy depends on your car-buying and car-maintenance philosophy. If you use-it-and-throw-it-away, then get only a muffler, or any other part, that will last only until the car is the next owner's concern. If you keep your car shipshape and run it for many years, then make certain you buy any one of the many replacement mufflers

REPLACEMENT PARTS for your exhaust system should be chosen carefully. Good mufflers are guaranteed for as long as you own the car. To save work, make sure parts are direct replacement type—no cuts or adjustments necessary. Clamps and hangers should match your car; so always check before purchasing. Abarth components shown here are direct replacements made of heavy 16-gauge steel for long life

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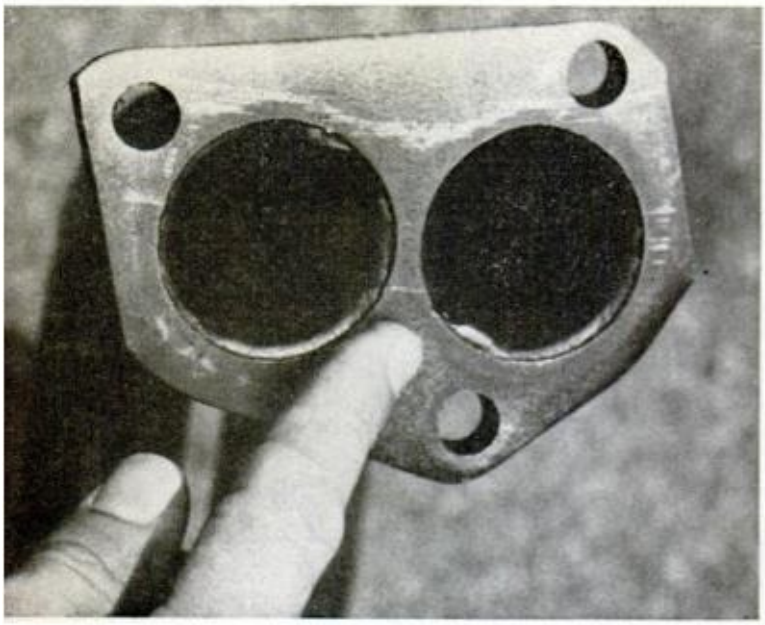

HEADER PIPE slips onto exhaust manifold studs. Don't forget gasket; take care not to mar surface

HACKSAW isn't a substitute for patience, but it can save time and energy in removing rusted parts

MANIFOLD STUD NUTS are only hand-tightened until all of exhaust-system components are in place

on the market guaranteed for as long as you own your car.

When you're getting set to do the job, the secret, again, is planning ahead. How are your clamps? How many new ones do you need? If you're missing a part, especially a critical one, and the job carries over to Sunday when the stores are closed, you're out of luck!

Start removing your old muffler or complete exhaust system when your engine is cold. Exhaust parts get too hot to handle! Remove clamps and pipes that don't need replacing and set them aside. If nothing is salvageable, then a hacksaw will often make quick work of removing your rusted-out and welded-together components.

Header pipes connect to exhaust manifolds by threaded studs in the manifold flange. Often, you'll need an extension for your sockets to reach the nuts. If frozen on, try a penetrating oil on the threads or, if all fails, a torch on the nuts. After the pipe is free, you may not be able to lower it and remove it from under the car because other engine components may be in the way. For example, the oil filter on the Volvo near the header (photo at bottom left) had to be removed! I was able to remove the pipe by cutting it short and twisting it, but could not get new pipe into place without removing the filter. (I was lucky: I had clean oil and a new filter on hand! Be prepared and you can do an oil and filter change while replacing your exhaust system.)

Don't tighten any connections, especially header nuts, until all components are in place. If you're working alone, make sure you have various-size wood blocks, or bricks nearby to support the muffler(s) and pipe(s) while you put clamps in place.

Pipes are usually tapered to indicate how far into the muffler fitting they should be driven. Make sure they are fully seated, before centering and tightening clamps. With mufflers that are shaped other than cylindrically, take care to position them for maximum ground clearance.

After driving for a few days with your new muffler or exhaust system, recheck the clamps and retighten as necessary.

Sure, it's a dirty job, but when you do it yourself, it's a job done right, and done with the tender loving care that only the owner of a car has plenty of. No matter how black and dirty you get, you'll come out in the green. Soap is cheap! ★★★

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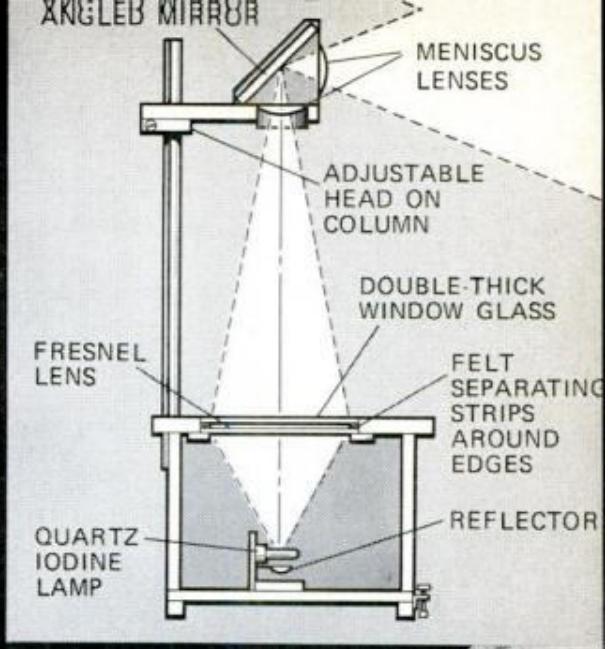
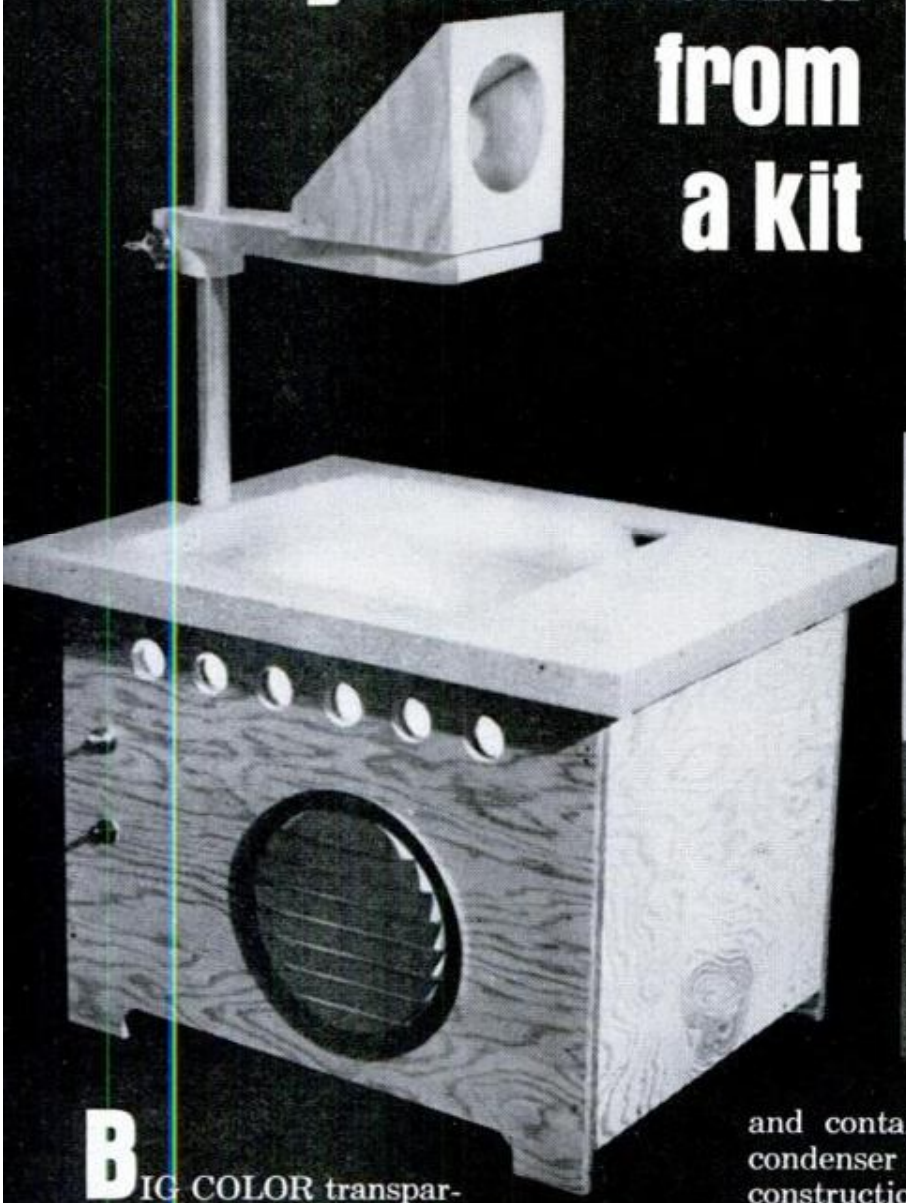
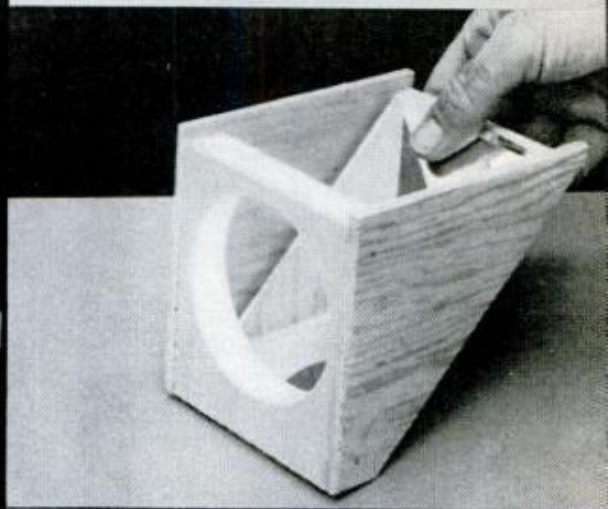
Overhead projector you can build from a kit







BIG COLOR transparencies up to 8x10 inches in size can be magnified into wall-size images on this low-cost homemade overhead projector. You can also project maps, tracings, line drawings, colored designs—anything made on transparent or translucent material to let light shine through. And, you can show outline shapes of opaque objects such as keys, coins and leaf patterns.

The projector, patterned after expensive types used in schools and industry, can be made from scrap lumber and a kit of parts supplied by Edmund Scientific. The basic kit (No. 70,966) sells for $12 and contains an 11-inch-square Fresnel condenser lens, two meniscus lenses and construction plans. The Fresnel lens fits in the top of the housing (lower photo above) and is covered with glass to form the projector stage. The meniscus lenses fit in the angled head that slides up and down the column to vary magnification (upper photo above). In addition, you'll need a 500-watt quartz lamp (No. 40,779; $7.95), lamp socket (No. 40,781; $1.50), lamp reflector (No. 566; $.75), ventilating fan (No. 60,689; $4.95), power switch (No. 75; $.35) and small mirror (No. 60,247; $.65). Parts are postpaid, Edmund Scientific Co., 300 Edscorp Building, Barrington, N.J. 08007. ★★★

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BIG EAR

MOUNTED ON PROW of canoe at right, sound amplifier gives you a highly sensitive listening device as you paddle silently up streams and along lake shores in search of wildlife. Close-up above shows how microphone is held in clamp in center of big parabolic reflector

Материал, защ... правом

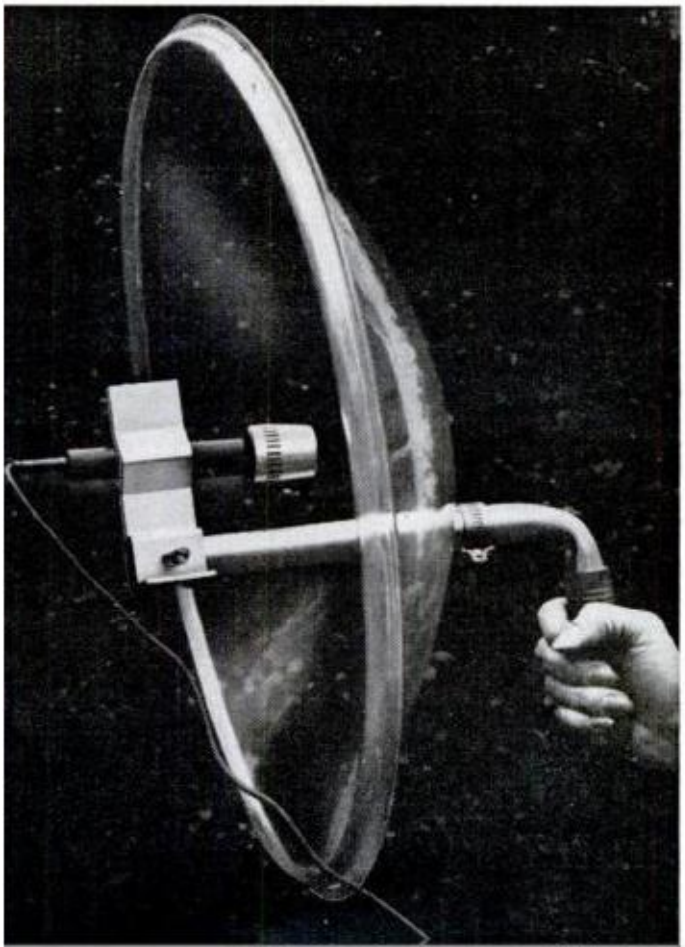
It lets you listen to and record sounds you've never heard before

By MARK SOSIN

THE AVERAGE MICROPHONE picks up sounds from only a few feet away. But wrap a parabolic reflector around it, and suddenly you have a highly sensitive listening device for recording distant sounds, such as from unseen birds and animals far away. Developed by professional wildlife photographer Dan Gibson, the reflector focuses sound waves to a central point, magnifying them as much as 12 times. It will hold any standard microphone in an adjustable clamp and is made of clear plastic with a pistol-grip handle so you can aim it easily and see through it to where you're pointing. Human voices and wildlife sounds can be picked up at distances of 75 feet or more.

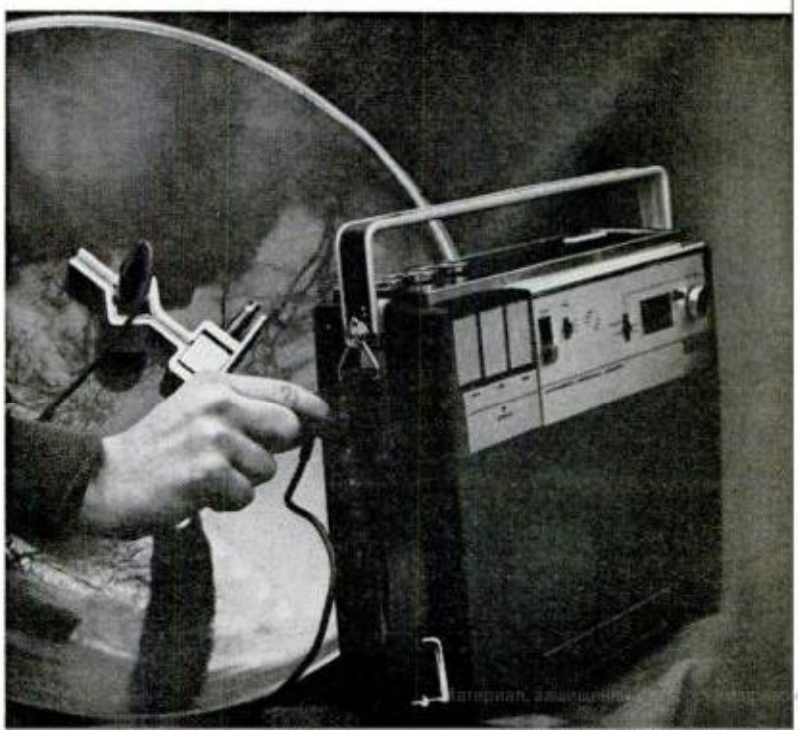
The centrally mounted mike can be plugged into any small portable reel-to-reel or cassette-type recorder for capturing wildlife sounds directly on tape. For bird watchers and nature photographers, the device can also be used to attract wildlife. In this case, you first record distant bird or animal sounds on a short stretch of tape, then you play the tape back through the speaker with the volume turned up high. The bird or animal, thinking a rival has invaded his territory, comes closer to investigate—and that's 'when you snap his picture.

For moviemakers, the method can be used to create a taped sound track to add realism to nature films. If your recorder has a monitoring jack for earphones, you can listen to the tape as it is recorded. This enables you to use the reflector as a sensitive direction finder for zeroing in on faint and elusive sounds. Attached to the bow of a boat or canoe (see facing page), it makes an excellent radarlike detector to help you search out hidden wildlife. You can also mount it on a camera tripod and rotate it slowly until you pick up sounds. Called the Sound Parabola, it's $49.50 from A-V Explorations Co., 505 Delaware Ave., Buffalo, N.Y. 14202. ★★★



PISTOL-GRIP HANDLE makes parabolic reflector easy to hold and aim, as shown at left. Clamp at center is adjustable to take any type of small hand mike.

BELOW: Photo shows how mike cable plugs into input jack on portable cassette recorder. Price of the plastic reflector without microphone is **$49.50**



How and where to look for leaks

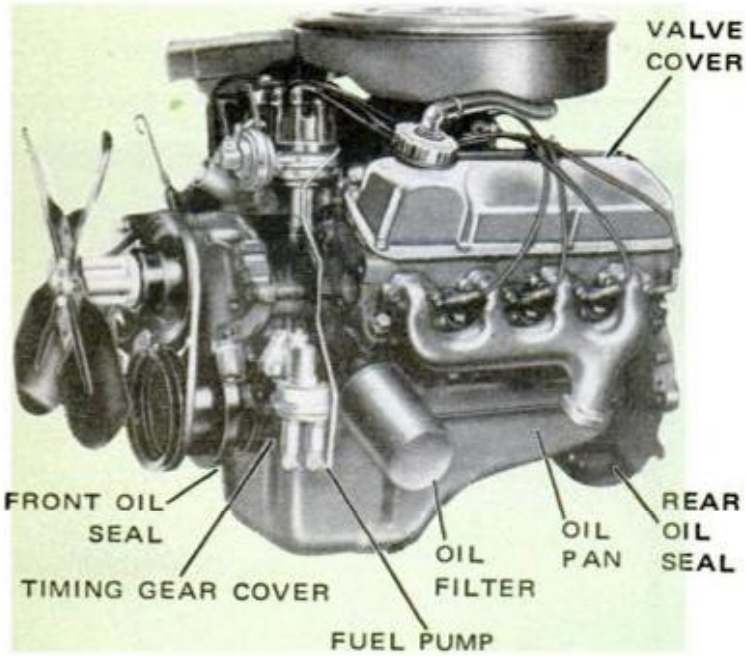
To check for airconditioner leaks you may need a pro to use a torch-type leak detector; other systems in your car you can test yourself. A periodic inspection of systems carrying oil, coolant and fuel is necessary. Don't forget the brake, transmission and other fluids.

By MORT SCHULTZ

SAVING MONEY is just one benefit of giving your car's circulatory system a periodic inspection. Another is the security of driving a troublefree, safe vehicle. A car's circulatory system consists of hoses, tubes, pumps and other parts that hold and transport vital fluids within the airconditioning, brakes, cooling system, engine, fuel system, power steering, shock absorbers, differential and transmission. Engine oil and coolant, in particular, should be checked every time you fill the gas tank. Other systems need a more thorough examination. You can do it in an hour. I do it once every two months. Here's how:

Airconditioning. Allow the airconditioner compressor to run at maximum output for about five minutes. Then, with the unit still running, look into the sight glass, normally found on top of the receiver-drier unit. The receiver-drier is a horizontally or vertically

WHERE TO LOOK FOR ENGINE OIL LEAKS



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mounted cylinder usually attached to the condenser.

On some units, the sight glass is out into the high-pressure line that extends from the receiver-drier to the evaporator. If you see slow-moving bubbles or foam beneath the sight glass, it may mean that the airconditioner has lost some charge, perhaps because of a leak. The sight glass should be clear. However, there is an "if." If the air temperature is 70° F. or lower, bubbles may appear in the sight glass. This may be perfectly normal.

For this reason, either recheck the sight glass when the air temperature goes above 70° F. or block the flow of air to the condenser now with some sort of cover, such as cardboard or a blanket. If bubbles disappear, you can be satisfied that the circulatory system is in good shape.

An airconditioner can leak refrigerant from the compressor, condenser, evaporator or any connection. Before having a system recharged, the leak should be found and fixed. This is done by scanning the system with a torch or electronic leak detector. A change in the color of the flame of a torch-type detector or a change in the sound emitted by an electronic leak detector reveals the leak.

Brakes. The first evidence of a brake fluid leak that many drivers get is when the brake pedal hits the floor. Don't let it go this far. If the pedal starts to get low, check fluid level in the master cylinder. It should be about ½ inch from the top.

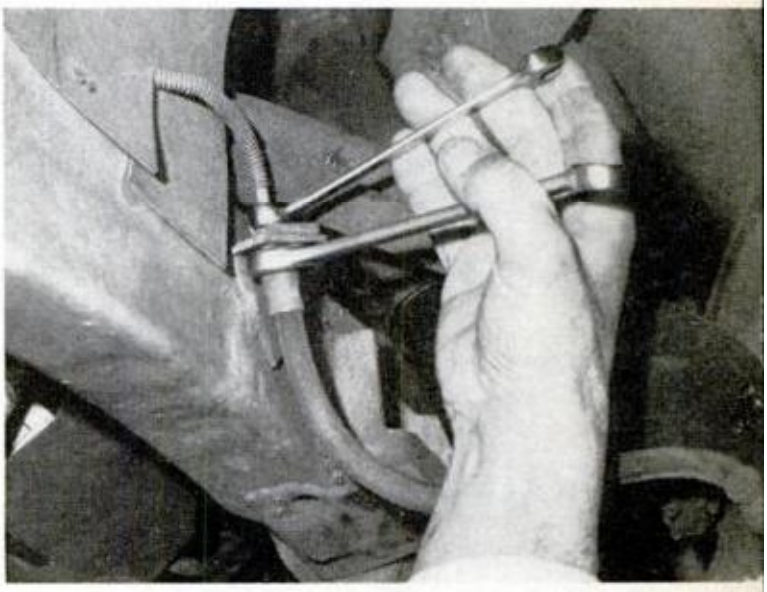
If your car is equipped with front disc brakes and rear drum brakes, the front reservoir of the master cylinder usually serves the discs; the rear reservoir, the drums. If the fluid level in the front reservoir is low, it could mean the disc brake pads are worn, as well as reveal the existence of a leak.

A brake system can leak from lines, hoses, connections, wheel cylinders or master cylinder. Inspect for leaks by examining connections, hoses and lines from the master cylinder back to each wheel while someone pumps the brake pedal.

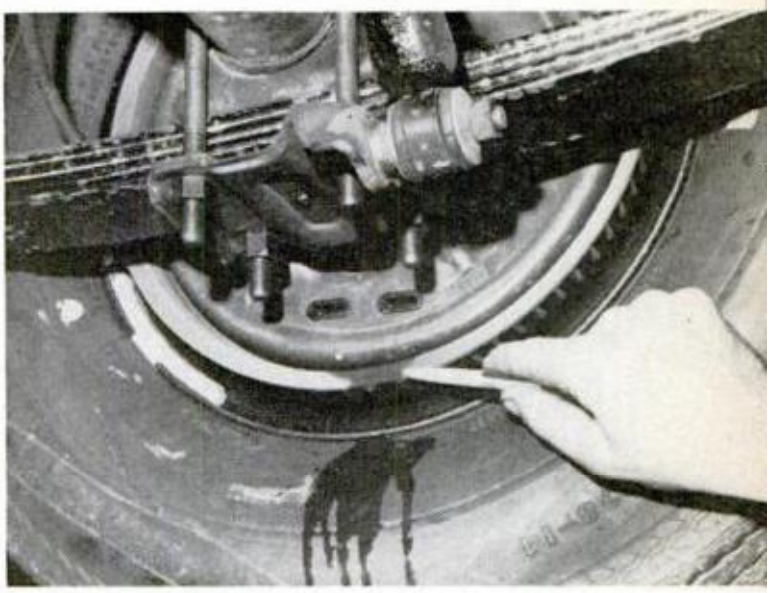
If the leak is from a connection, tightening the nut will often stop it. If a line or hose is leaking, replace it.

If you spot brake fluid on the sidewall of a tire, the wheel cylinder is probably leaking. Pull the wheel and check. Brake linings that are saturated with fluid should be replaced. Another indication of a wheel-

MASTER CYLINDER of hydraulic brake system should be checked. Low fluid level is first clue to a leak



BRAKE-LINE CONNECTIONS should be checked for tightness: You might stop a leak before it starts



WHEEL CYLINDERS of hydraulic brake system will often dump fluid on inside of tires when they fail

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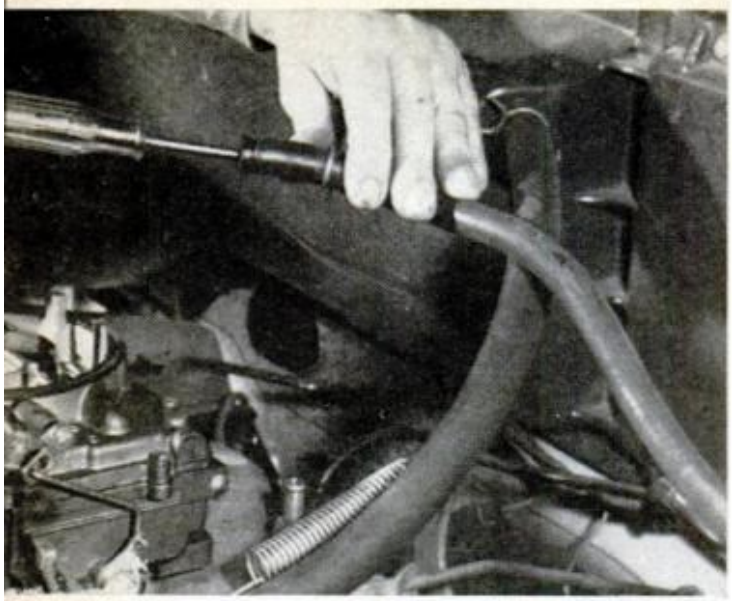
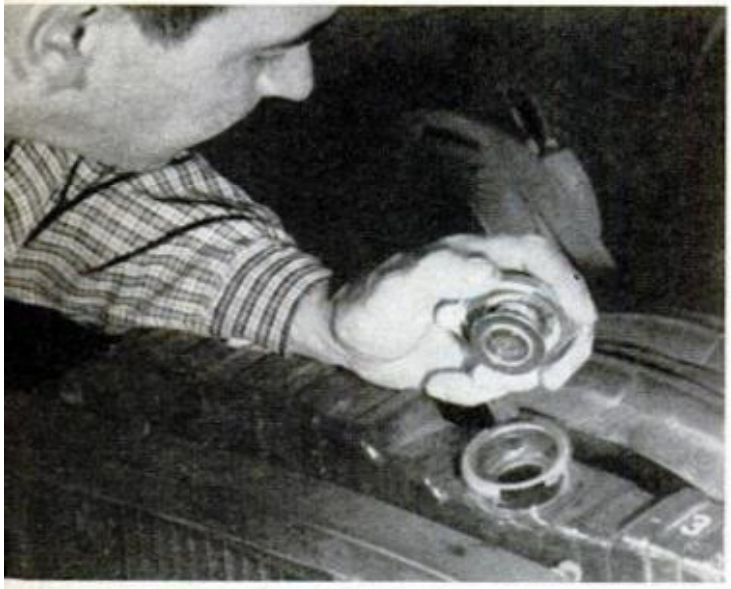
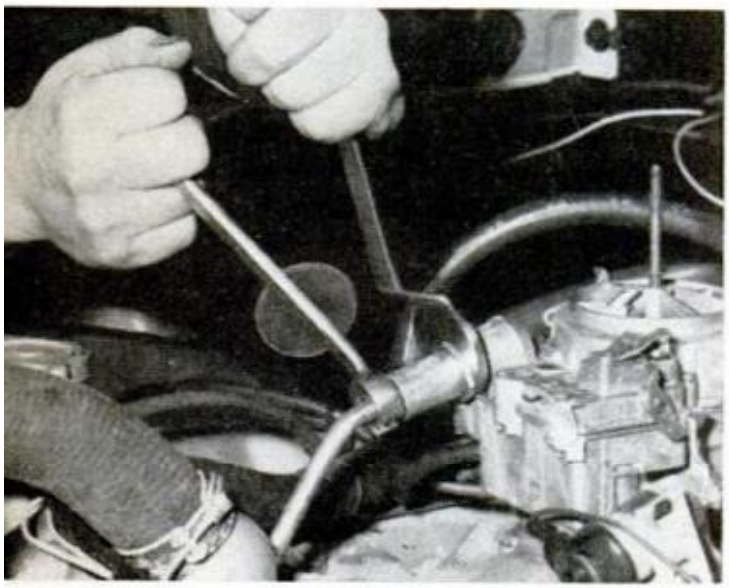


BRAKE-FLUID LEAK from master cylinder may go into power-steering unit. Check vacuum line for fluid



APPARENT COOLANT LEAKS may just be result of overfilling the radiator. Check that level is to spec



FUEL-SYSTEM LEAKS most often occur at carburetor fuel-line, fuel-pump fittings. Check for tightness

cylinder leak is a wheel that grabs when the brake pedal is applied.

If you haven't uncovered the leak, don't give up. It is probably internal, past the seals of the master cylinder. Fluid may be leaking from the cylinder into the power-assist unit, indicated by fluid in the unit's vacuum line. The master cylinder should be overhauled or replaced.

Cooling system. Aside from the fuel system, the cooling system accommodates the most fluid in a car—anywhere from 13 to 18 quarts. To determine if the cooling system is leaking, check the coolant level by removing the radiator pressure cap. Make sure the engine is cold.

The top of the coolant should be 1 to 3 inches below the top of the filler neck. The exact amount depends on the car, so check your owner's manual and never overfill the radiator. Unless the car has an overflow tank, coolant will be lost out the overflow when the engine heats up and the coolant expands.

If the radiator is losing coolant, check all connections for leakage while the engine's cold. Small leaks in particular can escape detection when the engine is hot, because coolant will evaporate rapidly.

The best way to check a cooling system is with a radiator pressure tester. Leaks can usually be seen.

If you don't have a tester, start the engine (cold) and examine top and bottom hoses, hose connections, thermostat housing, radiator top and bottom tanks, radiator core, radiator drain plug, engine core plugs, heater hoses and heater core.

If you don't spot the actual leak, shut off the engine and examine everything once more. A grayish white or rust-colored substance is a sign of a leak.

A defective radiator pressure cap could account for coolant loss. Test cap with a pressure tester. If you don't have one, ask your gas station attendant to do it.

One more leakage possibility is an internal crack in the block. Heat up the engine, pull out the oil dipstick and let some oil drop on the hot exhaust manifold. If it sizzles, it signifies that coolant is getting into the oil.

Engine. An engine may be using oil because of an internal problem, such as worn piston rings or valve guides. However, you should not overlook the possibility that oil may be leaking.

In fact, an external examination is the

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first thing to perform if the oil dipstick indicates a loss of oil. While you're driving, if your engine drips just three drops of oil every 100 feet, it will lose three quarts in 1000 miles!

The illustration on page 118 shows those areas of an engine through which oil is most likely to be lost. Often the cause may be a bad gasket that requires replacement, but if the trouble is a bad oil seal, a major engine repair is normally called for.

Fuel system. When full, fuel systems handle anywhere from 17 to 26 gallons of volatile gasoline and are extremely troublefree. However, connections can loosen. That's why you should check and tighten fuel-line and fuel-pump fittings.

In addition, give carburetor mounting bolts and cover screws a twist. Now if you seem to be using too much gasoline, see *How to Save 1½ Gallons of Gas Every Tankful,* (page 146, June '71 *PM*).

Power steering. Warm up the engine and shut it off. Remove the reservoir filler cap and check the oil level. If the level is low, add power-steering fluid and check the system for leaks.

Start the engine and turn the steering wheel, stop to stop, several times. Don't hold it at a stop for any length of time.

Look for leaks at hose connections, power-steering gear and power-steering pump as the wheel is turned. If fluid comes from a hose connection, try to stop it by tightening the connection. If the return or pressure hose is leaking, replace the hose.

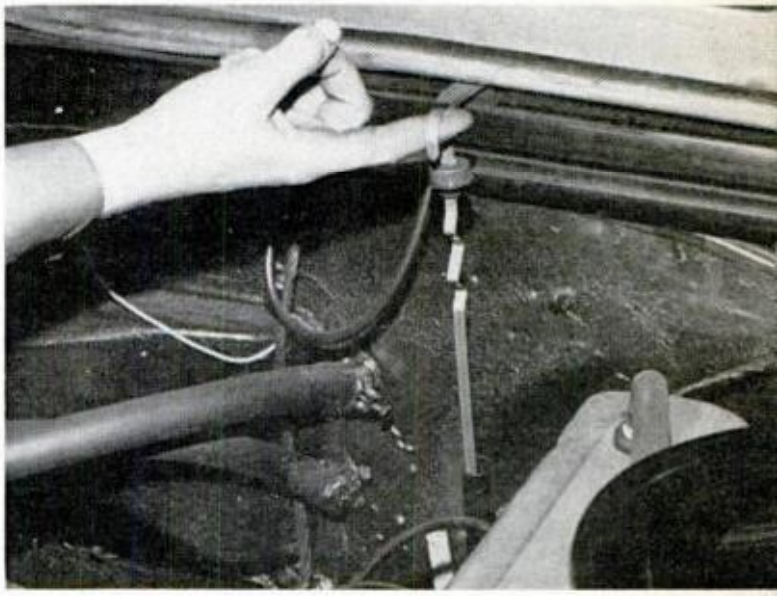
If the leak is from the gear or pump, the unit will have to be removed for repair or replacement.

Shock absorbers. Inspect shock absorbers at the seal covers for shock-absorber fluid, a thin liquid that has a brown tint. A slight trace of fluid around the seal cover is acceptable. However, if the leak is heavy, replace the shock absorber.

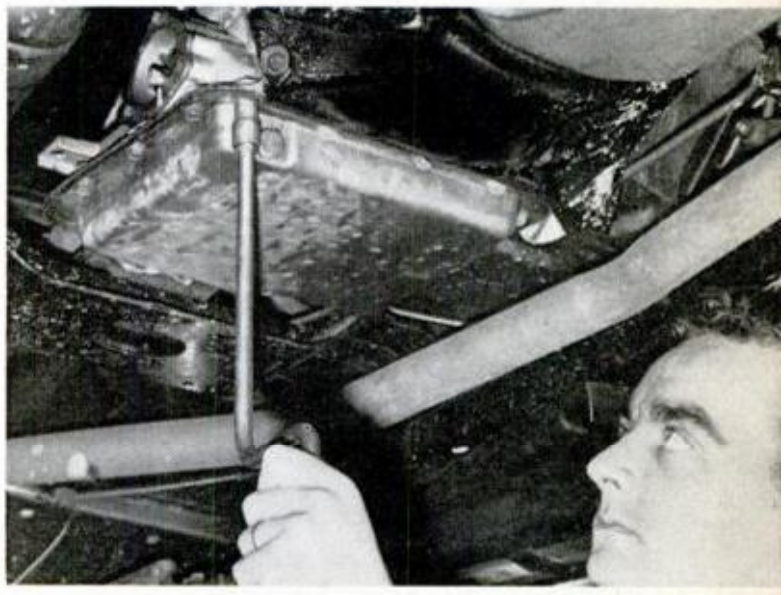
Differential. Remove the filler plug and check with your finger. Level should be high enough to feel the fluid. If not, add lubricant and tighten the differential cover bolts. This will stop any loss of fluid unless the cover gasket is bad.

Transmission. Check the automatic transmission fluid level as spelled out in the owner's manual. In most cases, you bring the transmission up to operating temperature, leave the engine running with the transmission selector lever in "park" and check the dipstick. ★★★

SHOCK ABSORBERS should be checked for leaks at seal that retains hydraulic fluid. Extend the shock



TRANSMISSION FLUID should be checked periodically to maintain level recommended by manufacturer



TRANSMISSION PAN can be source of fluid leak. Inspect and tighten all the pan bolts as required

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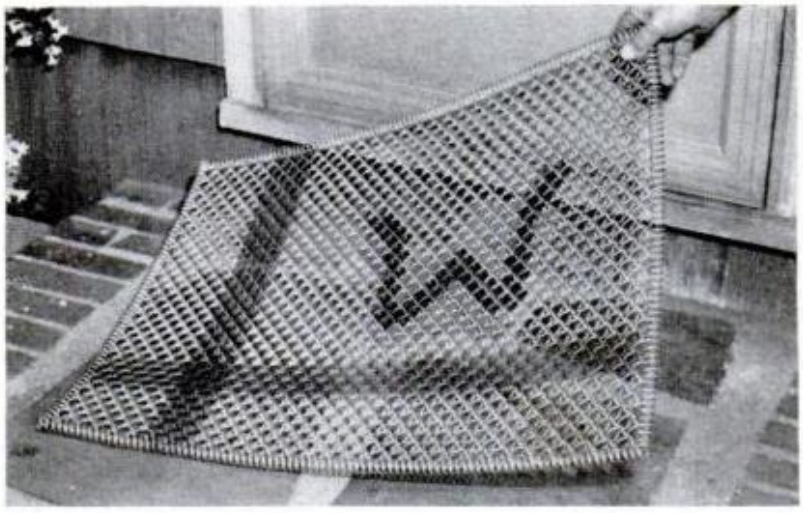
EXCITING

NEW PRODUCTS

BY CATHERINE BILSKI

SPEEDY HOSE CONNECTOR lets you attach a 50-ft. garden hose to nearly any sink faucet to douse minor paper and wood fires in your home or apartment. It interferes in no way with regular use of the faucet. Hose stores under sink for quick accessibility. Not intended to replace home fire extinguisher, the connector is priced at $3.05 by Liquid Systems, Inc., Box 145, Congers, N.Y. 10920. Specify name of faucet maker when ordering.



A PERSONAL, DECORATIVE TOUCH is added to your front entry by the Numat Door Mat. Made of metal, it never needs cleaning; mud, sand and snow scrape off easily. Price is $4.50 plus $1.50 for postage and handling; monograming kit, 25 cents (makes any initial or number). Made by Numat Distributors, Inc., Dept. P-91, 764 Main St., New Rochelle, N.Y. 10805.

PLAY BASKETBALL in your own back yard with the Gerber Basketball Outfit. It comes with two-piece post of 4-in.-sq. tubing and treated hardboard backboard that's painted with an orange "shooting eye" for greater accuracy. The lower section is embedded 40 in. in the ground; upper section bolts to it. $69.95 f.o.b. Gerber & Schlatter Mfg., Inc., Route 2, Box 92. Paulding, Ohio 45879.

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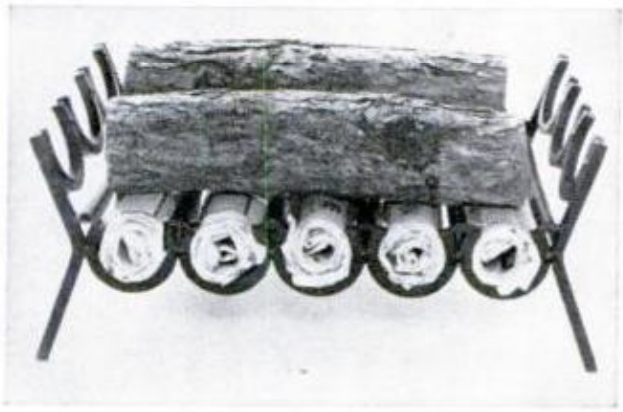
MIX OR MATCH your favorite mugs or colorful glassware on this space-saving display tree. Sturdy steel frame holds eight cups and is cushioned to protect your delicate glassware or china. Ideal on counter or shelf, it's portable, too. Available in three colors: avocado, yellow and wrought-iron black. $2.29 from Grayline Housewares, Inc., 1616 Berkley, Elgin, Ill. 60120.

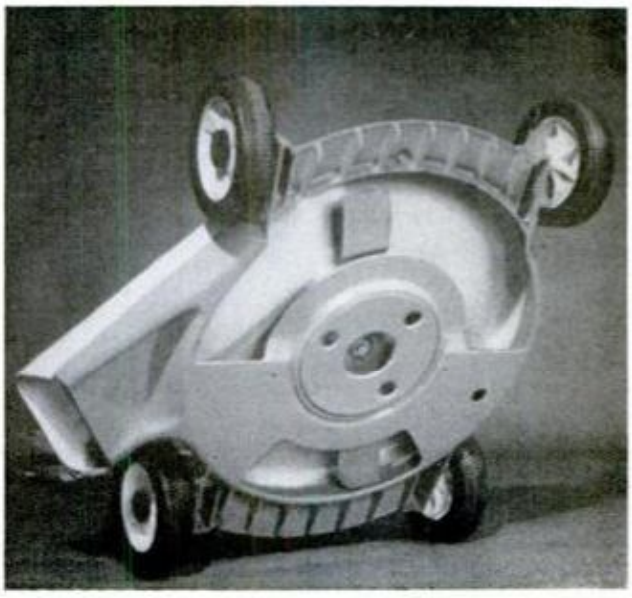
MAKE YOUR FAVORITE fountain treats at home with the Sodamaster. It gives you a quart of fresh, sparkling soda water when you want it; no more lugging bottles home from the store, or running out of soda water during parties, or special trips to the market. Just fill it with tap water and insert carbonating charger. Sodamaster and two carbonating charges sell for $19.99 plus $1 for postage and handling. Corn Enterprises, 1317 Third Ave., Los Angeles, Calif. 90019.



ELEGANCE AND STYLE mark the design of the Kindelabra II fireplace grate. Newspaper rolls can either be used as kindling for wood log fires or for a complete paper fire. Makes firebuilding foolproof, offers easy method of newspaper disposal, and eliminates messy storage and handling of kindling. Priced at $29.95 postpaid from Kindelabra, Box 253, Dept. F, Wellesley, Mass. 02181.

PRACTICE PITCHING MOUND of tough fiberglass lets young pitchers warm up and train under real game conditions. Lightweight and portable, True Pitch measures 6 ft. in diameter, weighs 57 lbs. It provides a mound of regulation height, eliminates cost of maintaining dirt mound. Ideal for indoor practice; can be rolled anywhere. $149.50 from True Pitch, Box 11, Altoona, Iowa 50009.

SAFETY is the whole idea behind the Ward No. 101 lawnmower. More than 50 percent of the bottom is enclosed to reduce the risk of throwing objects, and foot guards make it next to impossible to walk into the whirling blade. The mower weighs 53 lbs., has pull starting, adjustable folding handle and a new muffler that reduces engine noise. Available through Montgomery Ward stores; $109.



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What you BEFORE TERMITES PUT

HOW TO TELL ANTS FROM TERMITES. Since you can't escape from them—termites are active in every state but Alaska—it's money in your pocket in repair savings if you can recognize them early. The sketch at left shows difference between the insects

By HARRY WICKS, Workshop Editor

Photos by Robert D. Borst

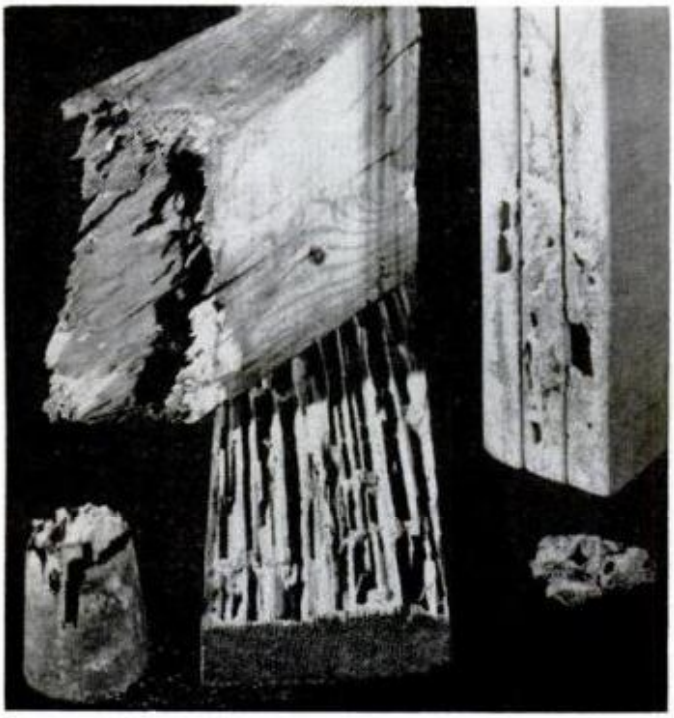
BOB VERNON DISCOVERED that his first-floor joists were infested with termites when he was having his basement remodeled. Until then, he didn't realize that the floors in the kitchen and the second-story bath were sagging because of termites. By the time his "education" about his uninvited guests was completed, he had to lay out over $300 in termite-control fees and roughly another $250 to have carpenters repair those eaten joists and beams.

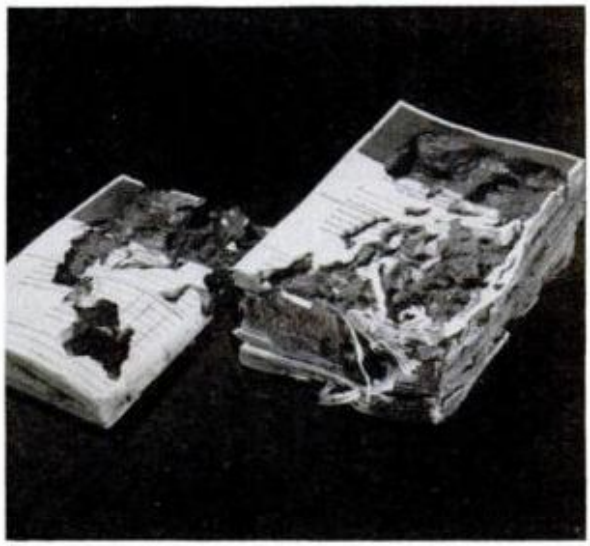
Mrs. James Floyd was first aware of the insects when she spotted some silver wings in a cellar window well. Before she was through protecting her home a complete professional treatment cost her more than $500.

Though these names are fictitious, both termite cases are true and were observed first-hand by me on Long Island, N.Y. The list could go on and on. One estimate of total annual damage by this voracious pest is $500 million. What's more important: If your home is attacked, *treatment and repair* can cost you anywhere from $500 on up.

Dr. David L. Watson, entomologist for Velsicol Chemical Corp. in Chicago said, "Each year 20 million American homes

Typical termite damage





ORDER PADS (above) were stored in a basement. The termites enjoy paper as much as wood meal

EATEN WOOD (left) removed from several homes. Cone (lower right corner) is a termite structure

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should know... THE BITE ON YOU

are damaged—some of them severely—by colonies of termites." And he adds, "Approximately only two million of these are treated."

Three main factors contribute to this costly oversight by homeowners:

- *Homeowner lack of ability to detect the early presence of termites.*
- *Fear of selecting a fast-buck operator when calling in a pro.* A reliable pest-control specialist will inspect your home at no cost to you. (For resale inspections, there is usually a $15 to $25 fee.)
- *The "embarrassment" of having termites in your home.* Because the presence of a PCO (Pest Control Operator truck) in the driveway is considered a stigma by many homeowners, they wait too long to call in an expert. Actually, the real embarrassment is to have bugs and do nothing about it.

Subterranean termites, which do over

Conditions that invite termites in for a feast

WINDOW WELLS, if not kept clean, provide ideal entry for termites through the wood window frames

PLANK ALONGSIDE FOUNDATION WALL with crack is another open invitation for the hungry attackers

PILES OF TRASH AGAINST HOUSE give the insects more than adequate protection from birds of prey

EXTERIOR CELLAR ENTRANCE with wood sole plate in earth will almost guarantee attack by termites

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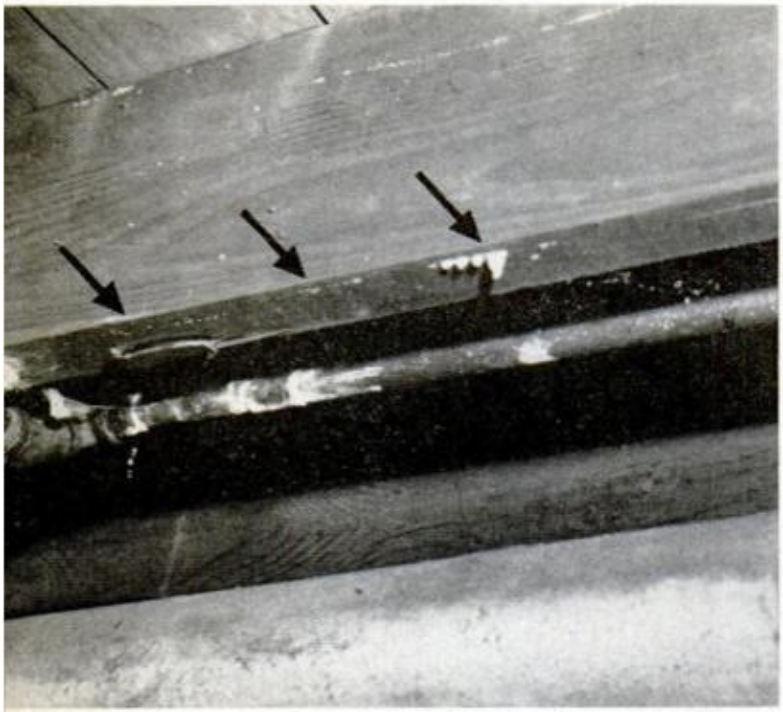
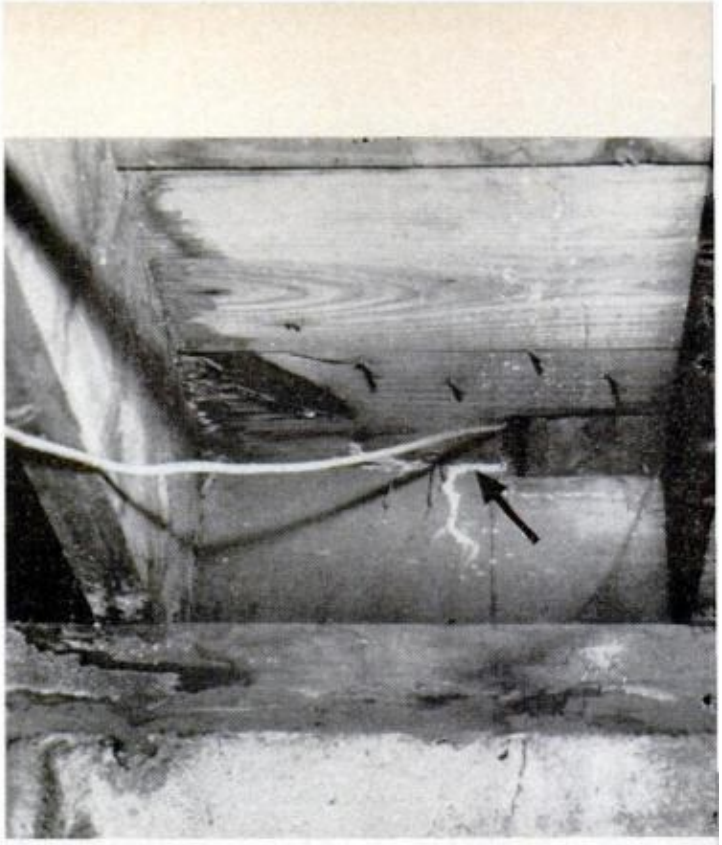
Sure signs of termites



TERMITES OFTEN TRAVEL along surface of joists by building mud tubes to create livable environment



MUD TUBES ALONG SILL show that termites are headed for better feeding grounds on the first floor

ANYWHERE WOOD meets grade, termites may be found. Here, wood actually appears to be rotted

90 percent of insect damage to buildings, avoid air because they become dehydrated. Thus, they build mud tubes and structures (see cone, page 124) to maintain humidity suiting their environment.

This is why they are usually never seen—except at "swarming time" in early spring or fall, usually on a warm day after a rainfall. Swarming normally occurs once a year in northern states and twice a year in the South. The swarmers drift on the wind for up to a mile, until the queen and her cohorts find a site for establishing a colony. Once the swarmers drop their wings, they start to burrow in the earth for moisture. Termites do not live in a house; they nest below it in the soil. Unlike carpenter ants, they do not leave a sawdust trail; they digest all cellulose in their woodwork, fabric and paper meal.

What a homeowner can do. First, keep the foundation free of any debris which can protect the pests from the air and preying birds. Second, it's wise to check periodically any wood members near the earth, such as the basement entry and wooden frame window in the photos, or garage-door framing. For some unknown reason, in new construction it is fairly common practice to jamb out and trim a garage-door opening before pouring the slab and driveway. Termites then have a direct route to the home because the jambs pass through the slab and rest on the earth.

An annual spraying or pouring of chemicals around the foundation wall will also deter attack. You can use chlordane as a 1-percent solution, dieldrin as a 0.5-percent solution, aldrin, 0.5-percent, and benzene hexachloride (BHC), 0.8-percent. Bottles and valves for mixing

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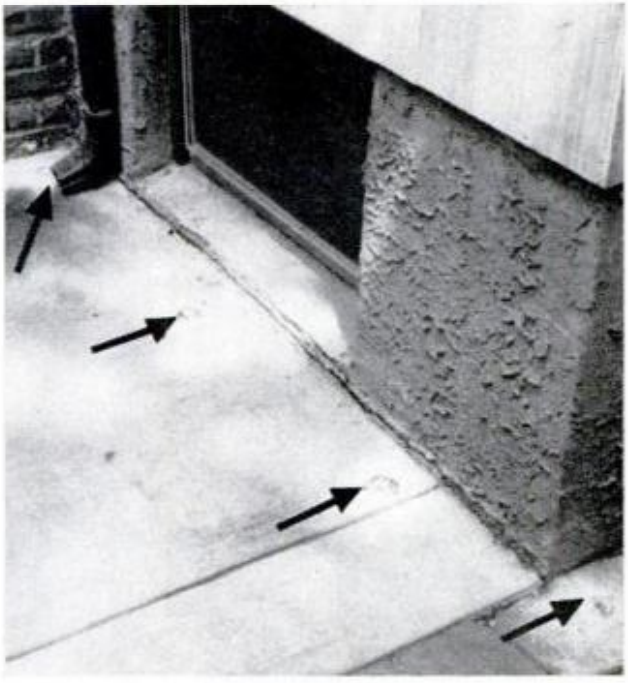
Exterior treatment

PROS GIVE STEPS EXTRA-HEAVY DOSE of chemical, since they are especially prone to termite attacks

PCO EXPERT feeds chemical behind brick for treatment of the void between veneer and the sheathing



HOLES ARE DRILLED EVERY 2 FT. or so around the home. Photo above shows several in the concrete

AFTER DRILLING, chemical is pressure-fed into each hole. Those in concrete slab are then patched

the solutions are available at nurseries. These are simply attached to the garden hose and the proper amount of chemical poured into the bottle. When the hose is turned on, the correct mixture is sprayed. *Caution*: Check your state laws to make sure the chemicals you plan to use are permitted. Read the labels carefully and follow manufacturers' instructions.

Other than this preventive maintenance, your best bet is a professional PCO. After several days with Steve Schwimmer of Fumex Sanitation Inc. of New Hyde Park, N.Y., I learned that the legitimate specialist has the homeowners' interest at heart. Great care is taken to do the job as quickly as possible—without sacrificing thoroughness—and to return the home in as near its original shape as possible. How well they do this,

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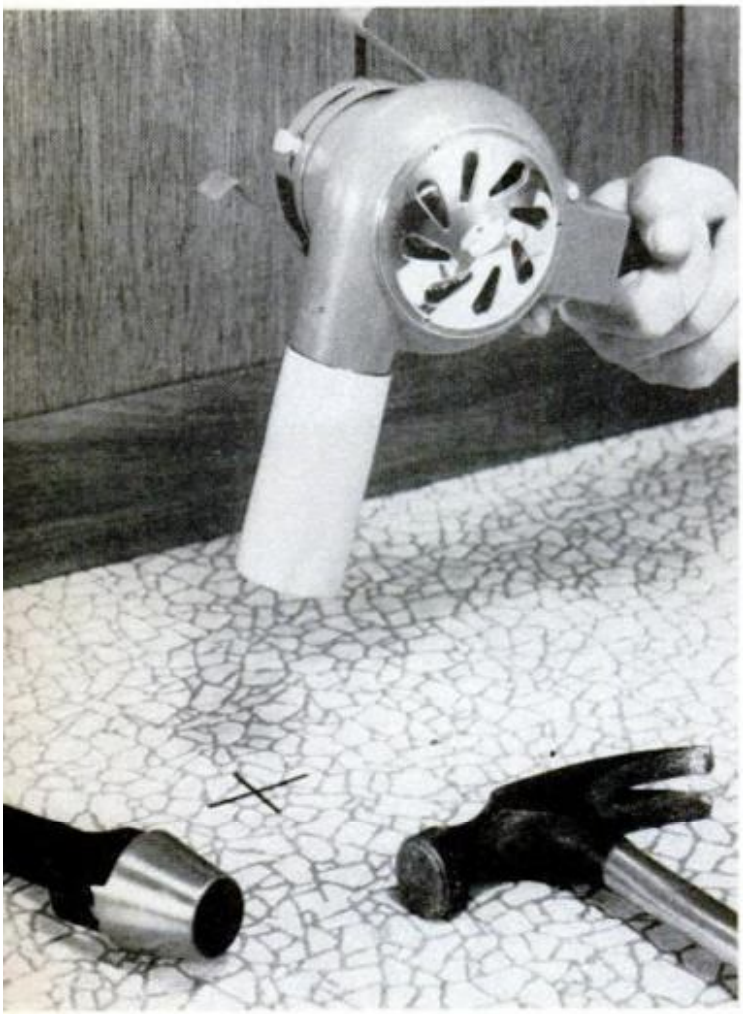
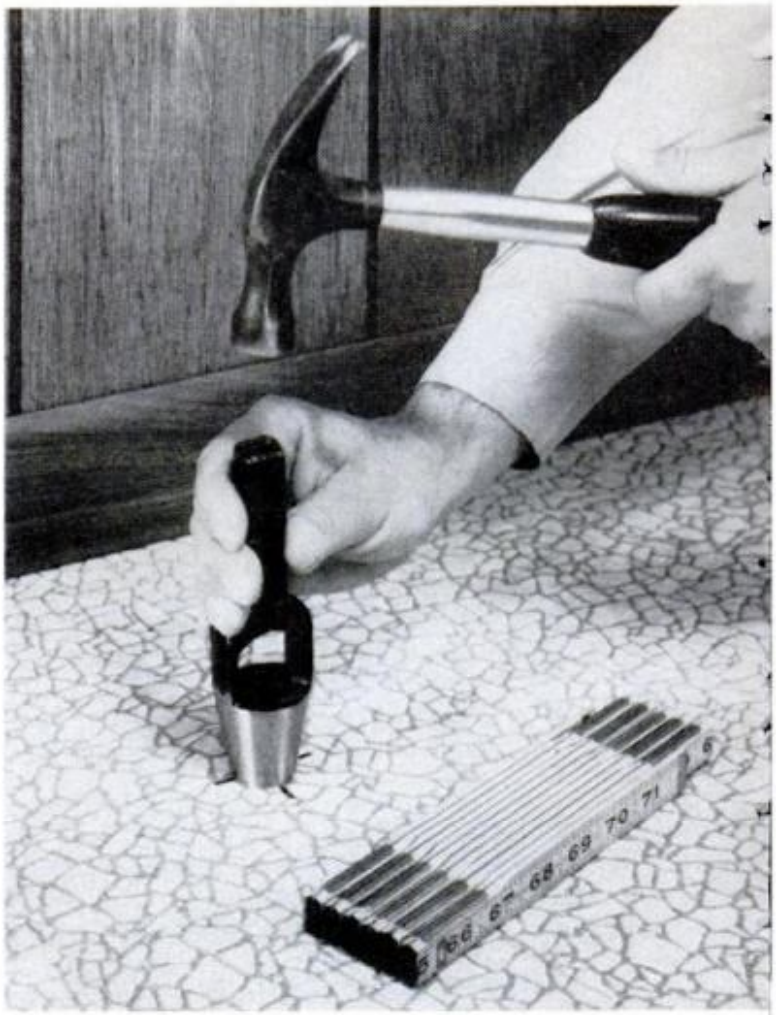
Interior treatment of slab floor

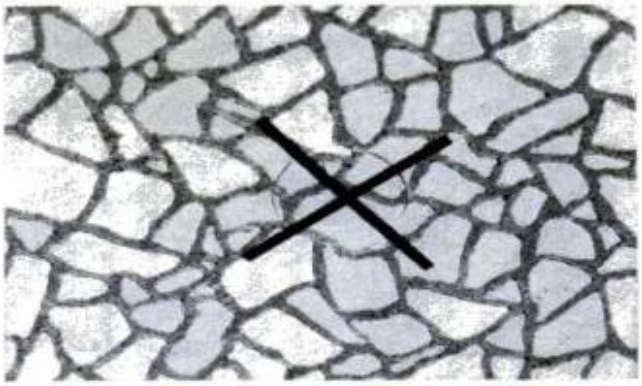


1. **FLOOR TILES** are heated with a flameless heat gun to soften spot to be drilled for chemical treatment



2. **PUNCH,** rapped with hammer, makes clean cut. Tape in shape of an X is for clarity in spotting plug

5. **TILE CUTOUT** is replaced after the concrete slab is patched. Care is taken to align the tile design



6. **X MARKS THE SPOT** where the treatment occurred. Without it, the cutout in the tile is virtually invisible

indoors and out, is shown in the photos.

What the professional can do, that an average homeowner cannot, is a *complete* job. Inside or out, he can get to the termites through the use of sophisticated equipment. He'll treat all soil *around and under* your home with a modern scientific chemical. (The outfit I traveled with used Gold Crest chemicals.) This treatment will create a termite barrier

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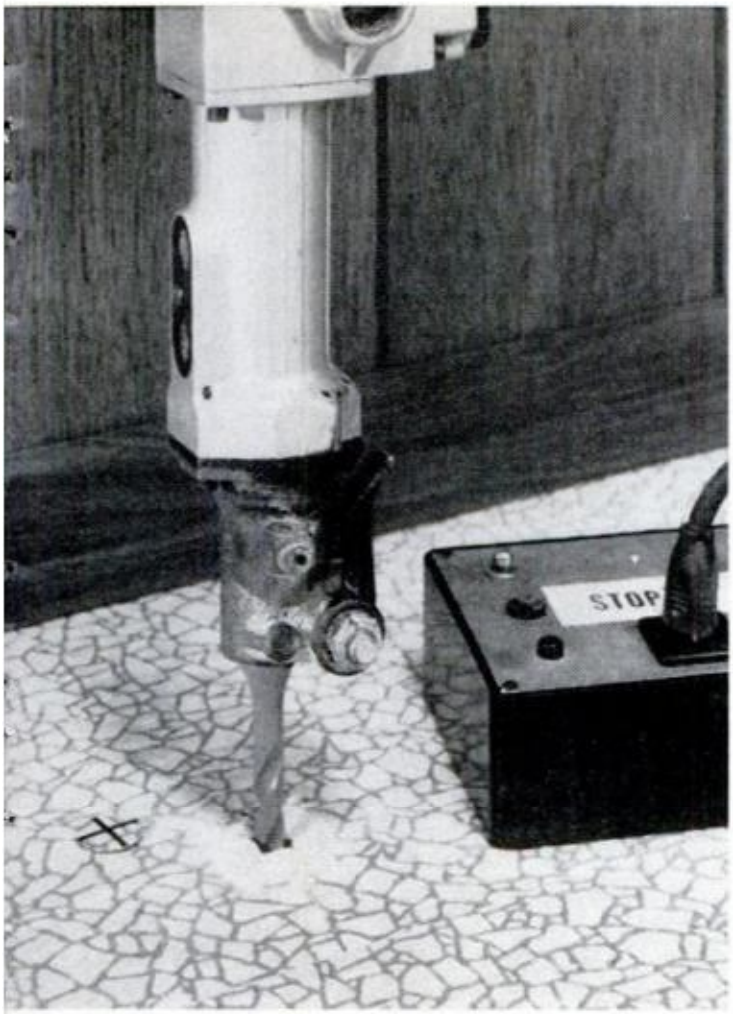

3. CONCRETE SLAB is drilled; electronic stop device in foreground turns off drill if near a conduit

4. CHEMICAL is forced into holes; an expandable rubber flange around shank prevents any splashback

7. WITH X REMOVED, treated area will go unnoticed. Same result by a homeowner is virtually impossible

that will last a minimum of five years.

The foundation is treated down to its footing (see photos showing exterior work). Steps and concrete slabs that butt the home are protected by boring holes and then pressure-feeding the chemicals through them to saturate the earth below. The pest-control operator will repair the "damage" that occurs during the job —for example, the holes in slabs—and clean up afterwards so it's virtually impossible to detect signs of treatment. Most operators, however, are not carpenters. Thus, repair of termite-eaten joists, sills, flooring and the like will require a carpenter's service after a treatment.

Tips on avoiding termite infestations:

- Keep wood away from the foundation.
- Seal foundation and basement floor cracks to eliminate passageways.
- Make an inspection at least once a year. And if you have the least doubt, call in a specialist; a periodic inspection might save you $1000 or more. ★★★

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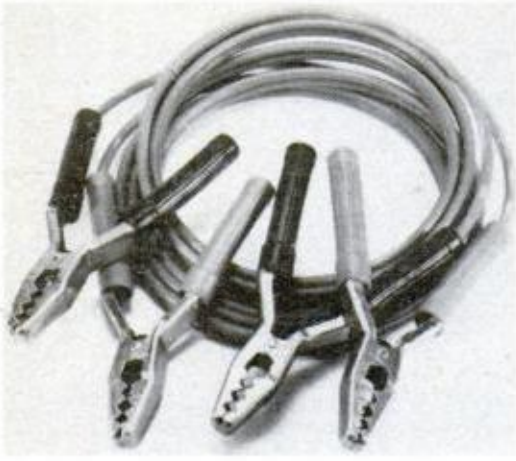
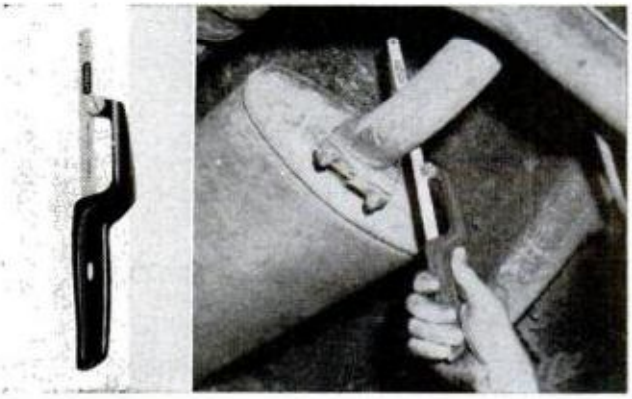
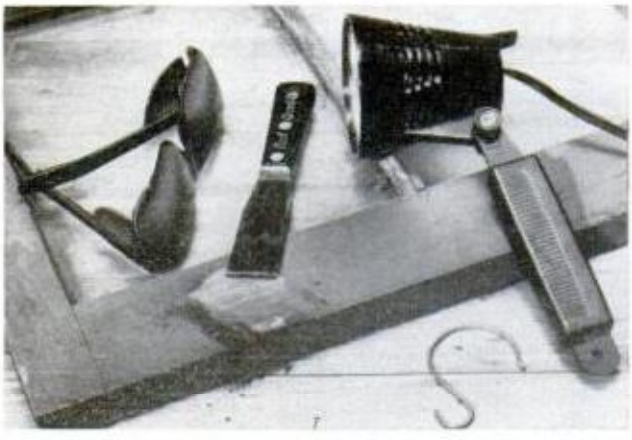
New tools you should know about



BATTERY BOOSTER CABLE is self-storing, recoils like a telephone cord, comes in seven models. No. 6-12 (shown) features 6-ga., 12-ft. wire and 200-amp. clamp handles; $14.30. Coilhose Pneumatics, 415 Hope Ave., Roselle, N.J. 07203.

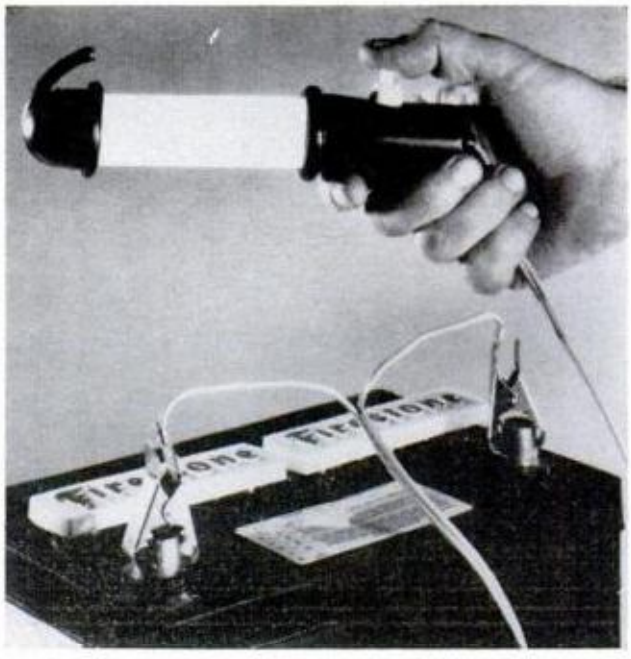


MINI-HACKSAW offered by Stanley Hardware, New Britain, Conn., is sold through hardware stores for $1.98. Tool combines tough plastic frame and standard hacksaw blade to perform functions that bigger saws can't do.



TORCH LAMP can melt paint, solder or act as photographic lamp. Kit X-1991.9 (not including putty knife) sells for $26.60 postpaid. Brookstone Co., Dept. C-PM, 7 Brookstone Building, Peterborough, N.H. 03458.

PLASTIC RIVETS known as Radfast come in a $1.75 starter kit with 18-in. lengths of three different diameters. Under heat, plastic can be expanded to predetermined size and shape. Radiation Technology, Inc., Dept. PM, Rockaway, N.J. 07866.



PORTABLE HAND LIGHT operates from any 12-v. battery source using a standard 15-w. auto bulb. Comes with pushbutton switch and a 15-ft. cable with spring clips for connecting to terminals. $3.98 postpaid from Autodeco, Inc., 46 Joyce Rd., Framingham, Mass.

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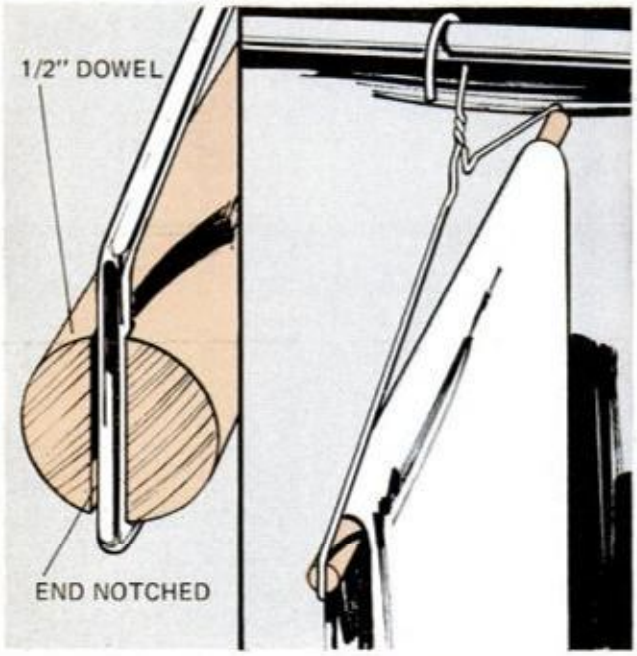
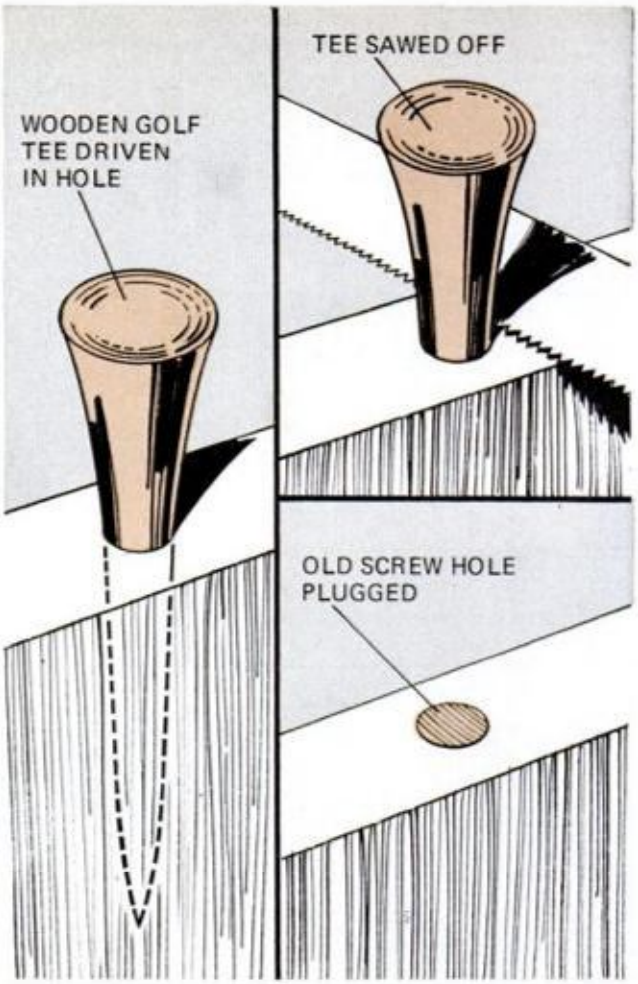
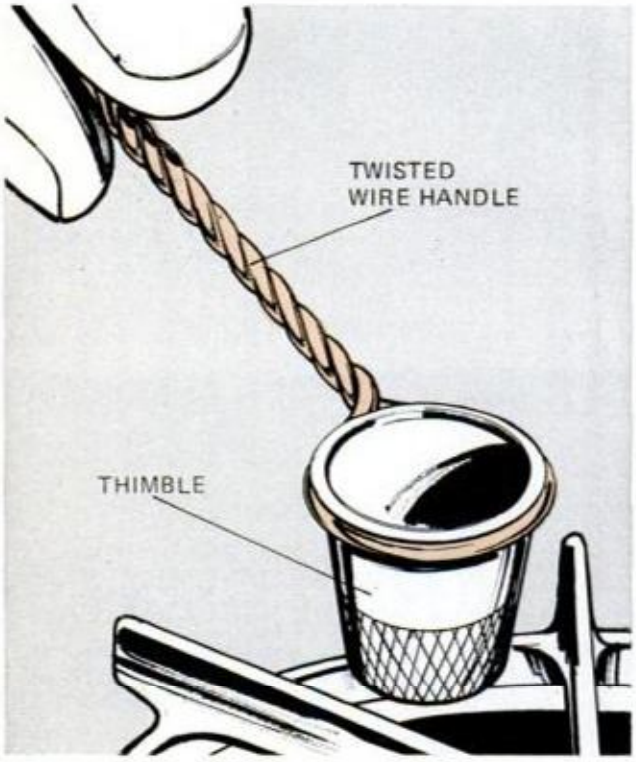
BETTER WAYS TO DO IT!



UNBENDABLE TROUSER HANGER can be fashioned from the fragile, wire-type hanger you get back from the dry cleaner. Simply cut a length of dowel, then notch the ends for force-fit.—*Charles W. Ball, Ontario*



ENLARGED SCREWHOLES can be quickly repaired by plugging them with a wooden golf tee. Drive tee until snug, then trim off the protruding part using hacksaw blade without its frame.—*Andrew Vena, Philadelphia*



A TINY LADLE often simplifies matters when you wish to cast lead parts for your models. You can make one using a seamstress's thimble and a piece of twisted wire as shown above.—*W. H. McClay, Pasadena, Calif.*

ALTHOUGH FINE FOR LONG LOGS, ordinary sawbucks won't hold short lengths that don't span the legs. Use a notched board between the top rails to solve the problem.—*Henry M. Springer, Hopewell Junction, N.Y.*

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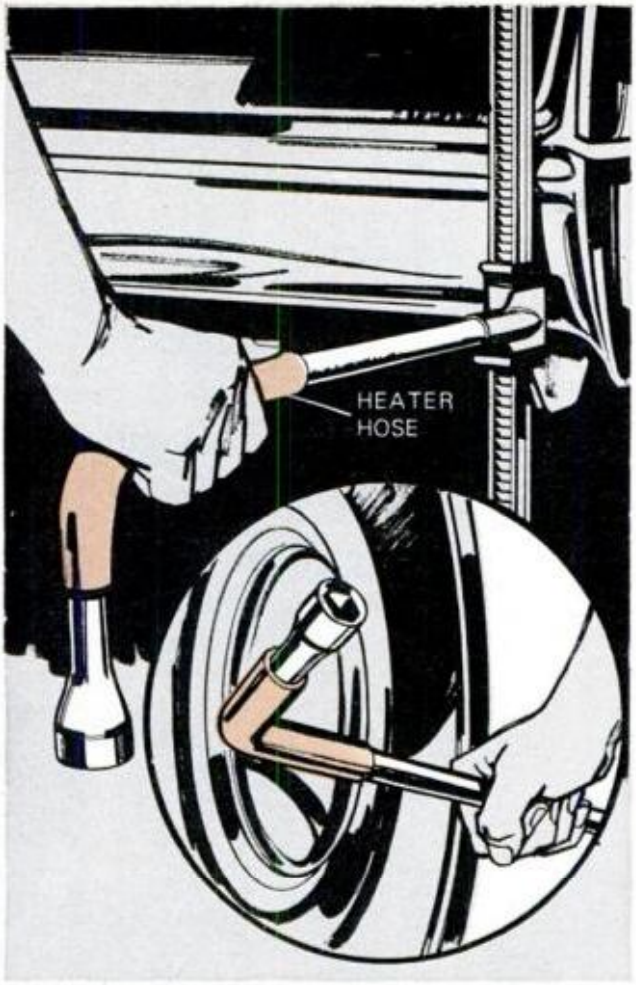
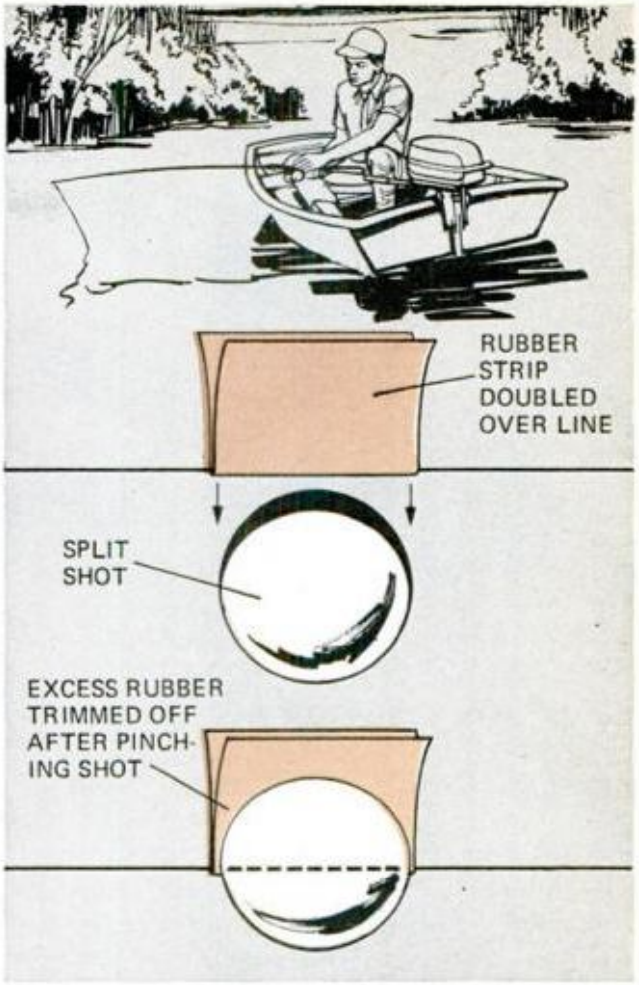
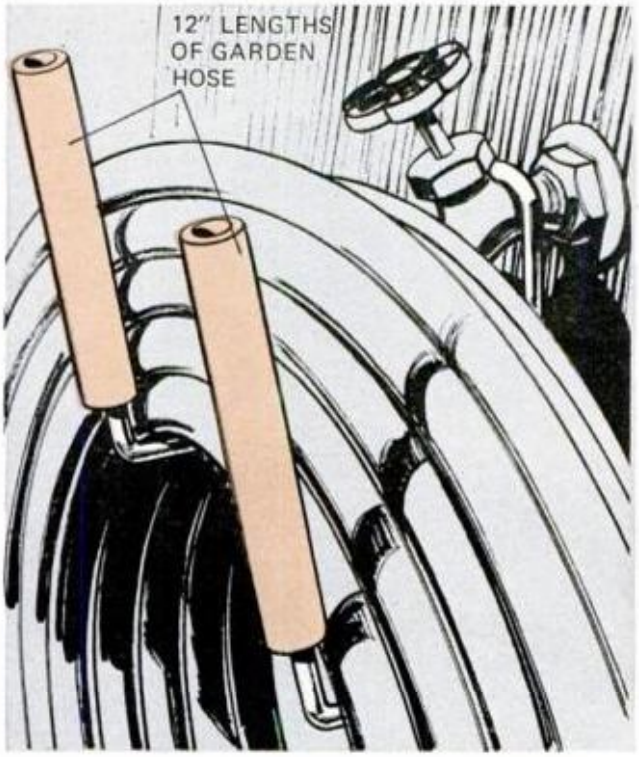


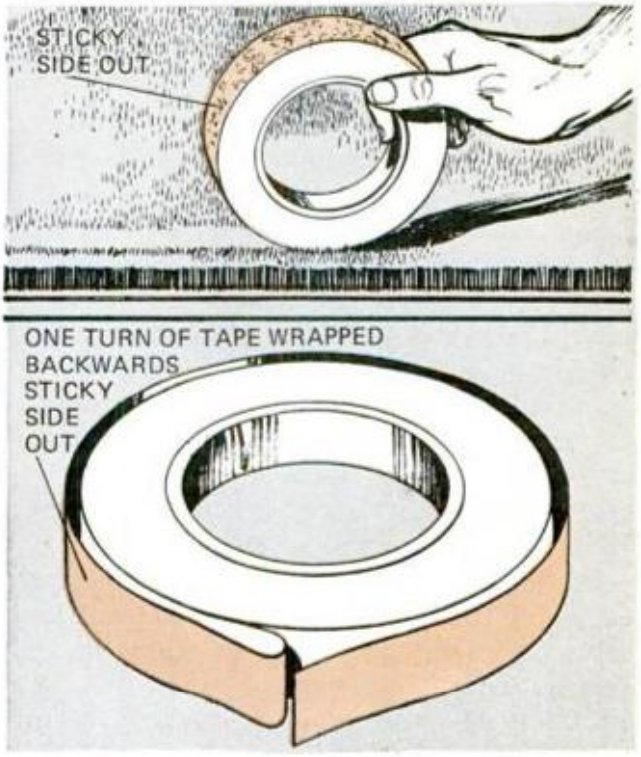
IF YOU SLIP a 7-in. length of heater hose over your jack handle you'll have a comfortable grip—even during winter. Bonus: Use it as a mallet for tapping a hubcap in place.—*Frank J. Bradley, Paterson, N. J.*



SPLIT SHOT won't slip on a line if the slit is first filled with toy-balloon rubber before the shot is pinched. Cut off excess rubber and keep spare strips of rubber on hand.—John Krill, North Lima, Ohio



GARDEN-HOSE CADDY CAPACITY can be increased by slipping a 12-in. length of old hose over each leg. The trick will let you store another 50 ft. or so of garden hose easily.—*Robert G. Lanzit, Cincinnati*



LINT PICKUP doesn't require special store-bought gadgets. By taking one complete turn on a roll of *any* tape and reversing it, the roll itself becomes the lint-picker handle.—*Andrew Vena, Philadelphia*

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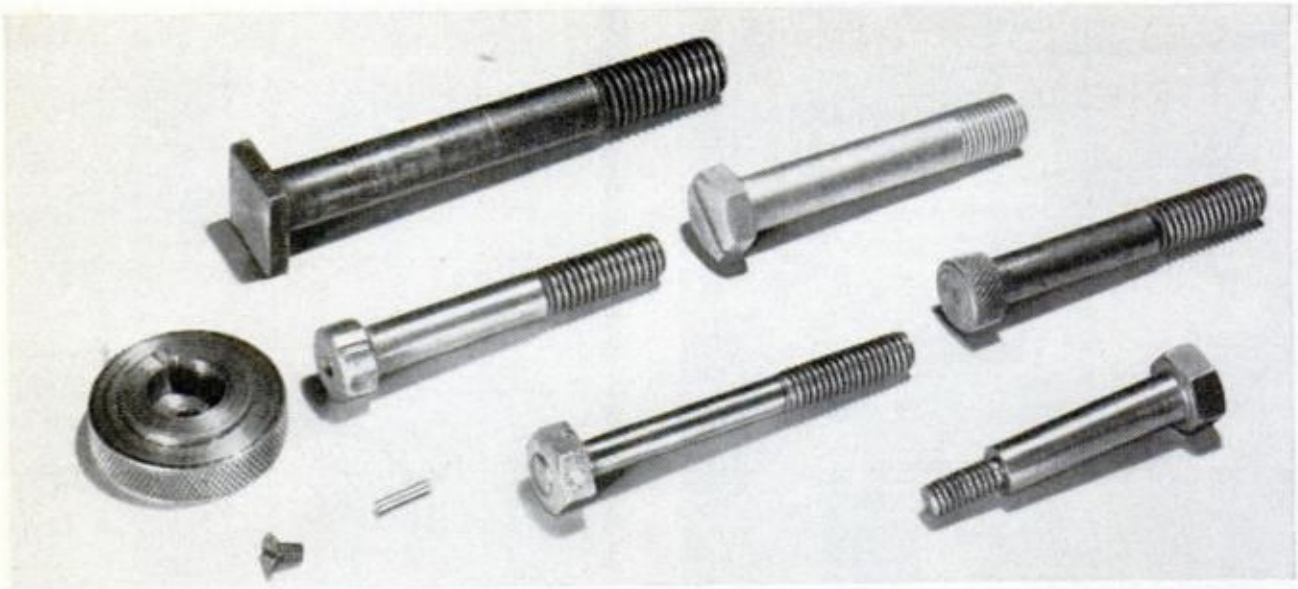
How a lathe can solve bolt problems



By WALTER E. BURTON

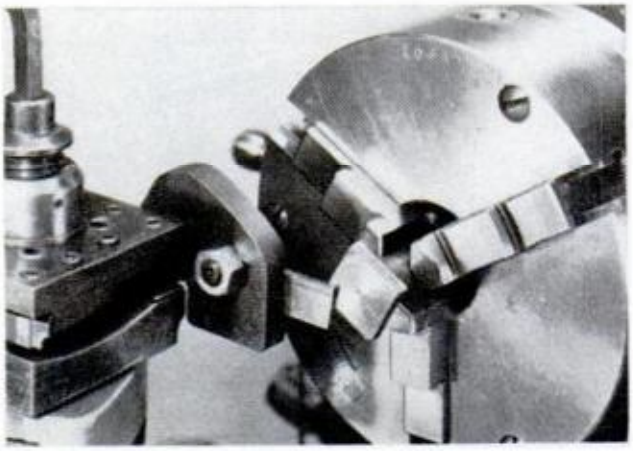
A GOOD FEATURE about a metal-working lathe is that it can be used as an emergency tool for turning out needed parts, such as particular types of bolts or screws. And in many cases a needed part can be modified from a similar, available part.

For example, it is not difficult to lathe-make a complete bolt, starting with a hexagonal or round steel bar. For a sizable bolt, the bar is typically mounted between centers. The body is turned to diameter with a portion of the bar left to form a hexhead or to be milled to hexagonal shape. Then the bolt is threaded. For small bolts, it may be convenient to hold the bar stock in a chuck and do the threading with a die.

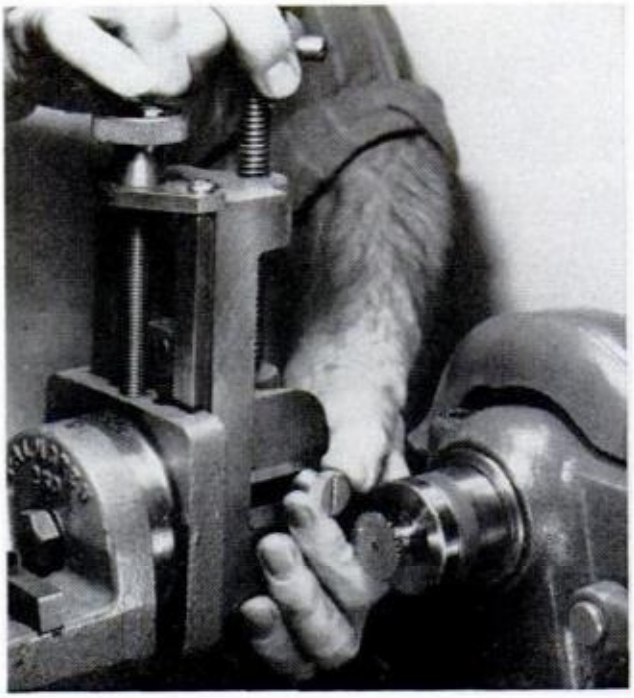
In modifying existing bolts for special uses the lathe can be mighty useful. The photos show several such modifications. Others may suggest themselves, or, rather, be suggested by particular needs when an experimental machine is being built, or some other work is being done in which either special bolts or "normal" ones not in stock at the moment are needed.

Standard bolt heads often are too high to enter the T-slot in a machine-tool table or to be used in some other limited space. Here, the excess metal can be trimmed off with a rough-turning bit or a cutoff tool.

Sometimes it's desirable that a bolt with a square or hexhead can also be turned with a screwdriver. You can add



FINISHING CUT is being made on thinned-down square head of bolt for use in T-slot of tool table



SETUP FOR MILLING SLOT in a hexhead bolt: Milling attachment holds bolt, collet holds the cutter

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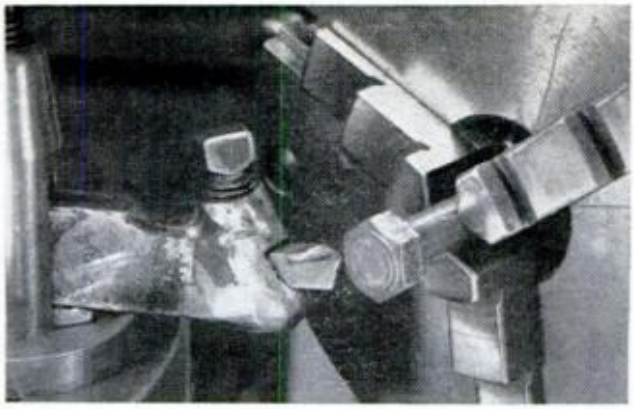
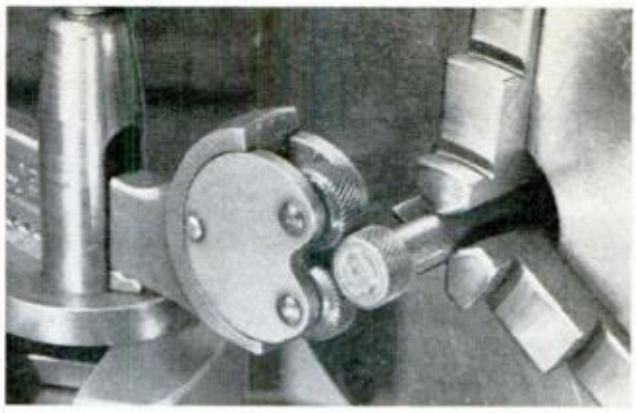


HEXHEAD BOLT is easily converted to roundhead one. Here, bolt is held in a three-jaw universal chuck



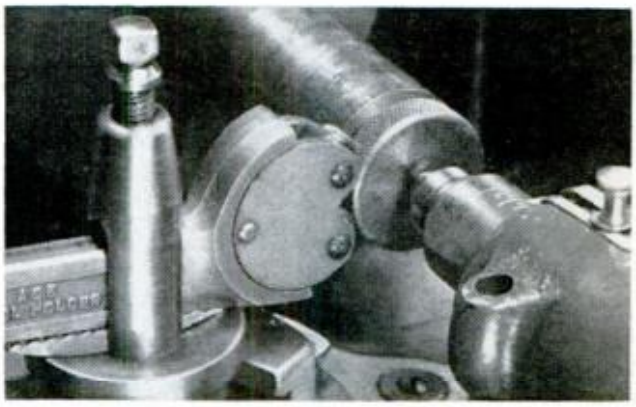
ROUNDED HEAD of the former hexhead bolt is knurled for easy finger-turning in its new application

a neat slot by clamping the bolt in a lathe milling attachment and mounting a suitable cutter (such as a slotting saw) in a headstock chuck or collet.

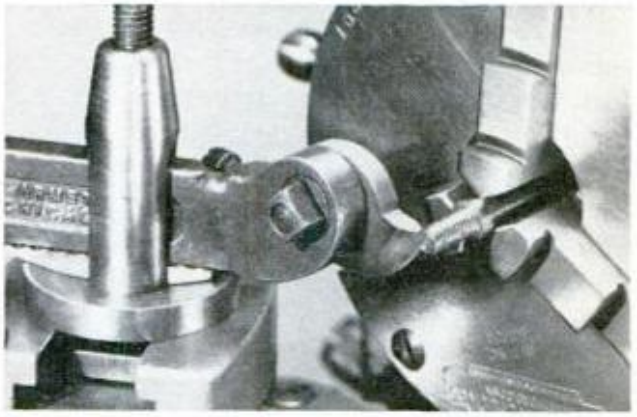
In other uses, it may be desirable to have a bolt with a round and knurled head so it can be turned readily with your fingers—a thumbscrew, in effect. Knurled, hollow-head capscrews are standard items, but not always at hand. For a small knurled head, the regular head of a bolt can easily be turned down and knurled.

To fill a hurried need for a shoulder bolt, a standard type can simply be mounted in a reasonably true-running chuck or between centers, and the threaded end turned to the desired diameter and rethreaded. The shoulder screw shown in the photos has a $\frac{3}{8}$-in. body (or shoulder) dia., and a $\frac{1}{4}$-20 thread. It was made from a $\frac{3}{8}$-in. hexhead bolt.

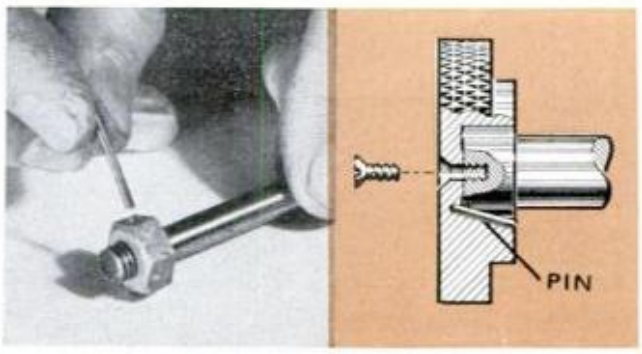
Making a special bolt on a lathe or modifying a standard one for some particular purpose may not be as romantic as machining the barrel for a model of a famous cannon, but this helpful ability of the metal shop's most versatile tool can save time and money. ★★★



WHEN GREATER FINGER or hand power is required, head can be fitted with larger diameter knurled cap



SHOULDER BOLT being made: Threaded end has been turned to smaller diameter and is being rethreaded



CARRIAGE BOLT (photo, left) is converted into hexhead type by threading head-end on lathe and installing a nut. Hardened steel crosspin keeps nut from turning. Sketch shows way to fasten large knurled head on bolt which originally had hexagonal head

SOFT ALUMINUM SLEEVE is used to protect the bolt threads in chuck while bolt head is center-drilled

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Things to make

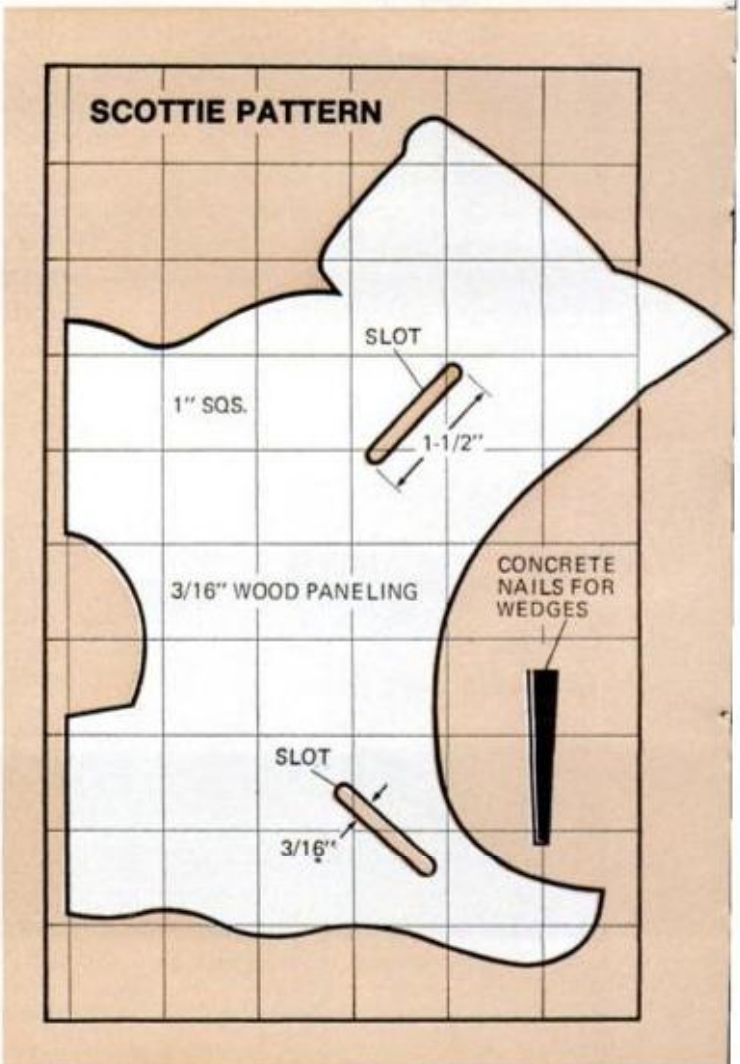
SCOTTIE BOOKRACK, constructed of prefinished plywood scraps, is held together by cut nails used as pegs through holes in protruding tenons.

Scottie bookrack

HERE'S AN EASY WAY to make your shop hours profitable in terms of dollars and cents. The bookrack shown above is designed so that it can be produced singly or by the dozen to give as gifts or sell. And, because it consists entirely of prefinished plywood, chances are you will be able to make them for practically nothing from plywood scraps left over from a home remodeling job.

Start by gang-cutting the dogs to shape on the bandsaw. Cut as many at one time as your bandsaw can handle. Then, after making the routing jig for your drill press as shown at far right, use a straight (router) bit in your drill press to rout the front trough slots, one dog at a time. To rout the rear slots, remove the jig pins and relocate the guide strips. When you are satisfied with the location, rout all the rear slots.

Trough boards can be cut and drilled to receive the cut (concrete) nail "pegs." Sand all parts to insure splinterfree edges and apply a matching stain to the unfinished sides of the plywood. To finish, apply two coats of paste wax and buff to a sheen.—*F. Harry Louden*



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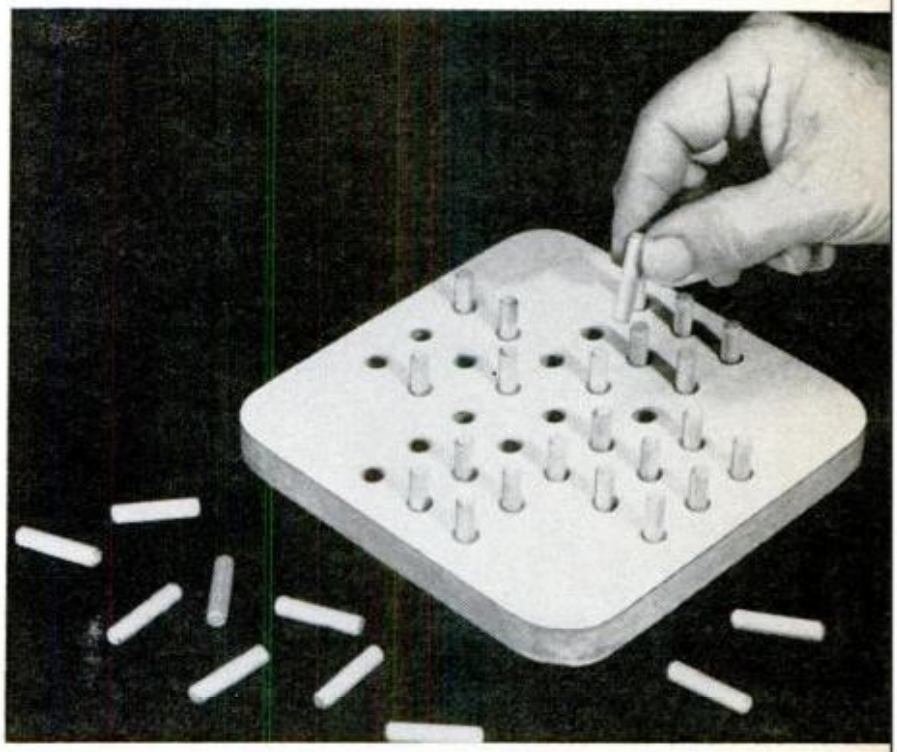
for fun and function

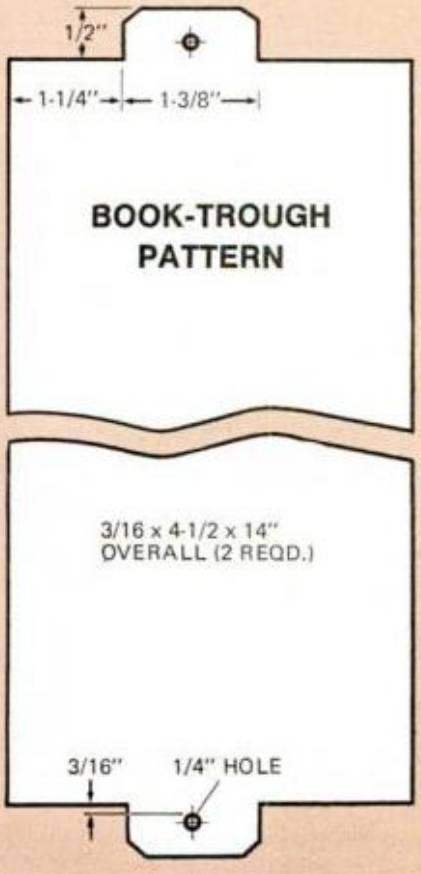
Jump-a-peg puzzle

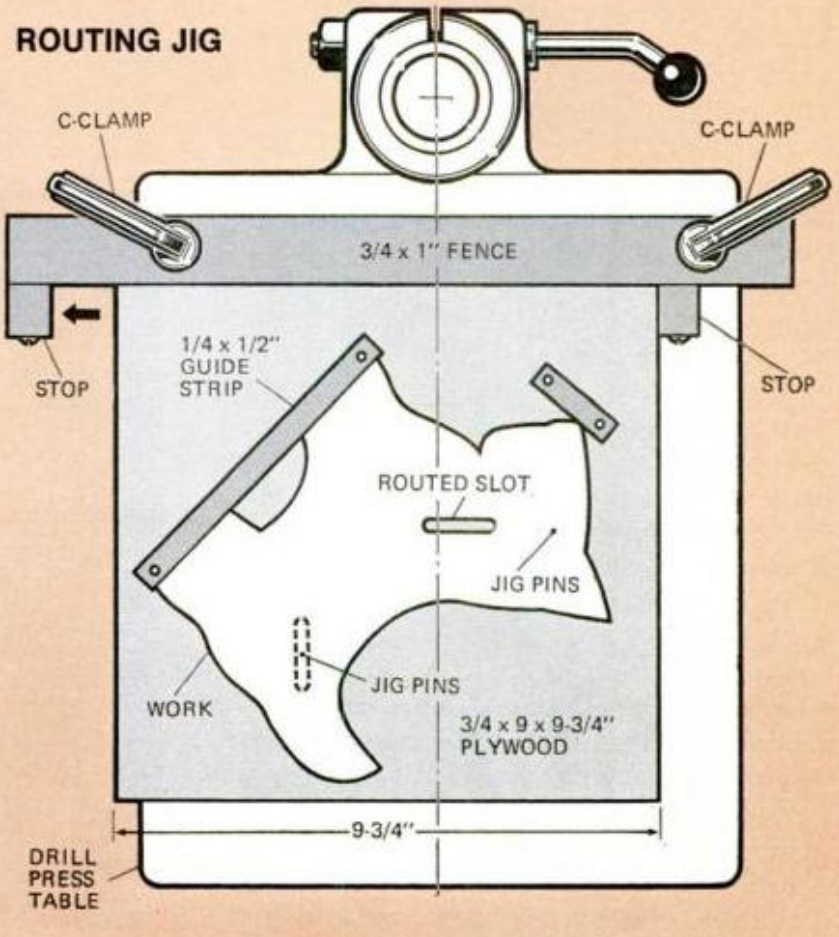
THE PUZZLE at right is made by drilling 33 $^{9}/_{32}$-inch holes, ½ in. deep and 1 in. apart, in a 6½-in.-sq. scrap of ¾-in. plywood. The 32 pegs required are cut from ¼-in. dowel.

To work the puzzle, place the 32 pegs in the holes, leaving the center hole empty. Then by making jumps (horizontally or vertically and *over* one other peg at a time) you try to wind up with one peg in the center hole. As each peg is jumped, it's removed from the board. It all sounds easy until you try it. If you reach the point of tearing your hair, take a peek at the solution on page 145.

—F. Harry Louden







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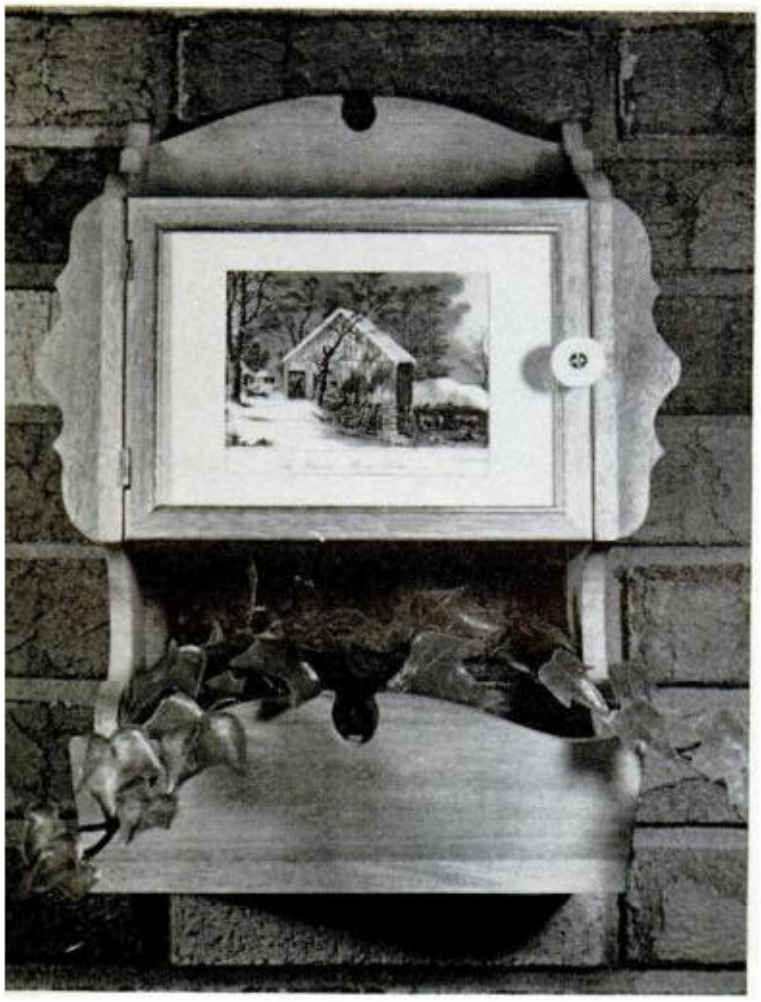

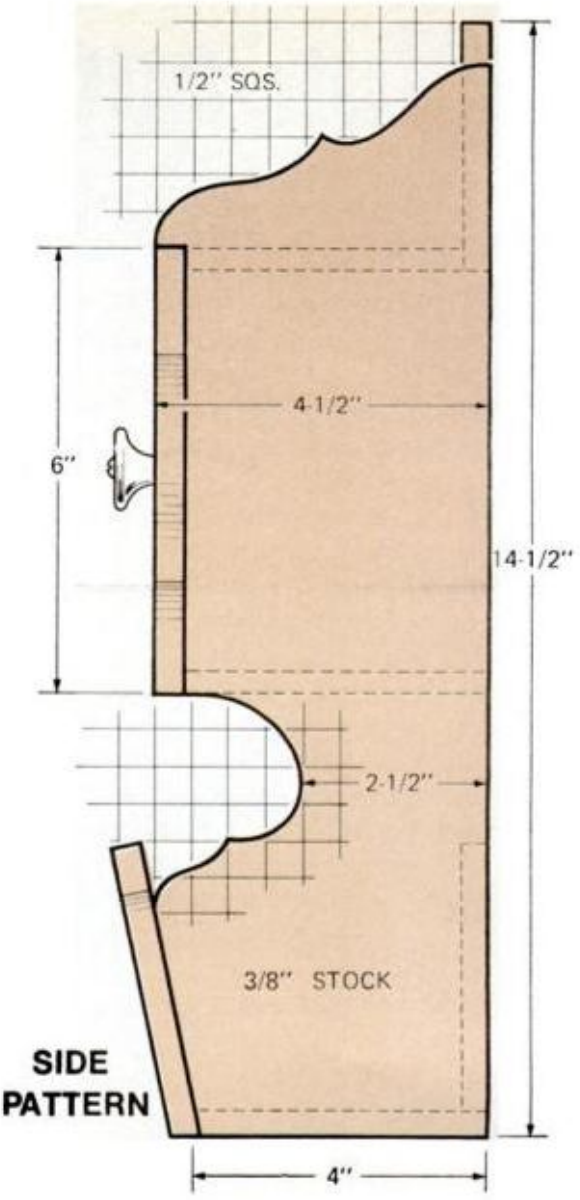

Early American minishelf

THIS SMALL WALL CABINET blends well with any decor because the picture-frame door is used to display favorite greeting-card scenes, which can be changed periodically to reflect the season. Behind the door, there is room for storing small personal and household items such as pens, pencils and pads. The tray below can be utilized as a planter for artificial or live greenery. If the latter is used, the tray must be fitted with a waterproof liner.

The 6x8-in. picture frame used was bought at a variety store, remaining measurements were determined by its size. For a larger or smaller frame simply adjust dimensions to suit. The cabinet looks best if made of a hardwood such as cherry or walnut. If you use pine, try to select boards with small, tight knots. The cutouts are sanded, glued and assembled as shown on the facing page. You can leave the piece natural and finish with a semigloss varnish or antique using the stain of your choice. To hang, turn two eyescrews into the underside of the top shelf and drive two screws through them.—*Don Shiner, Nescopeck, Pa.*

CABINET WIDTH is determined by the picture frame. Check the width carefully, then use clamps and glue

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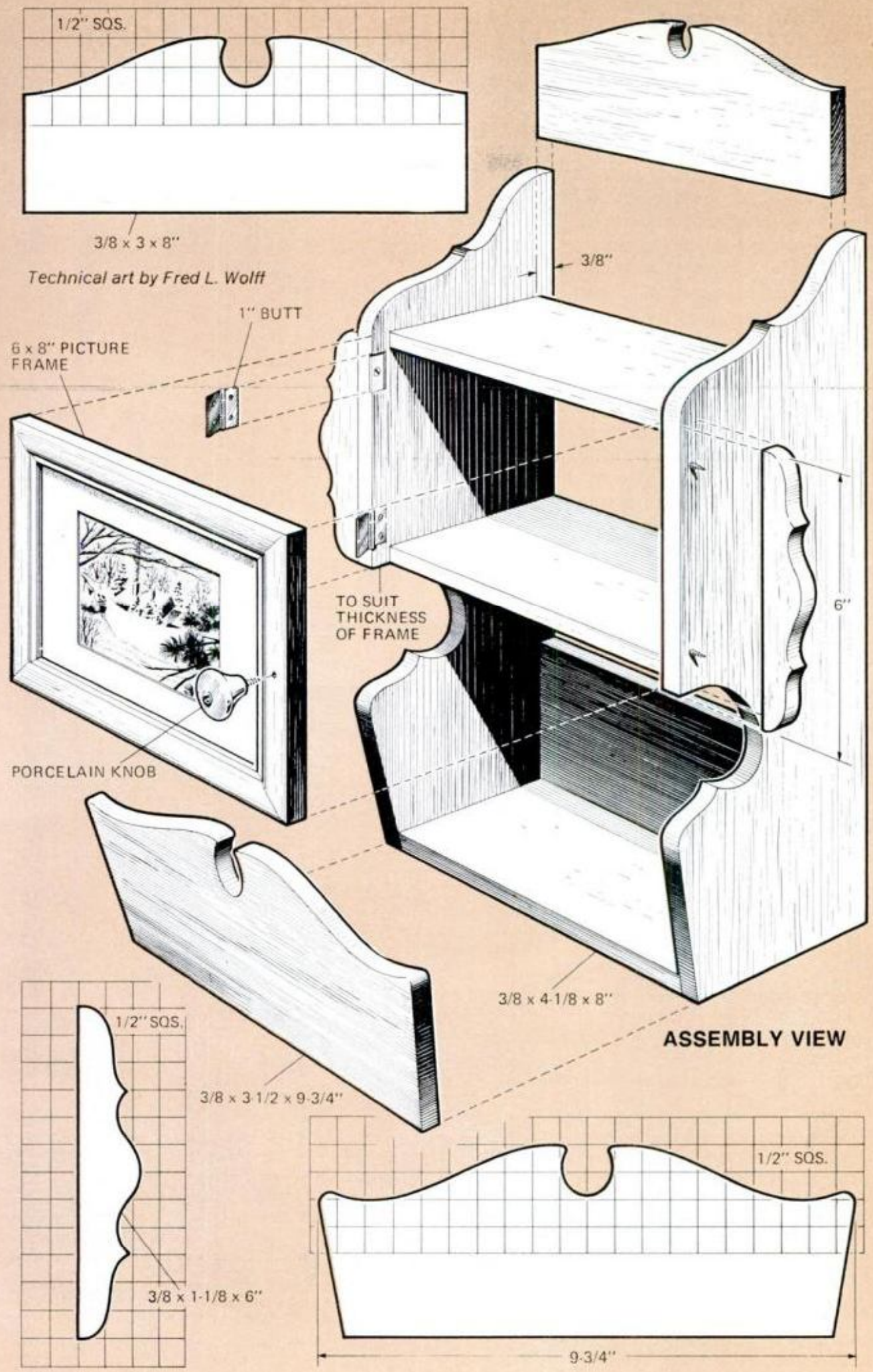

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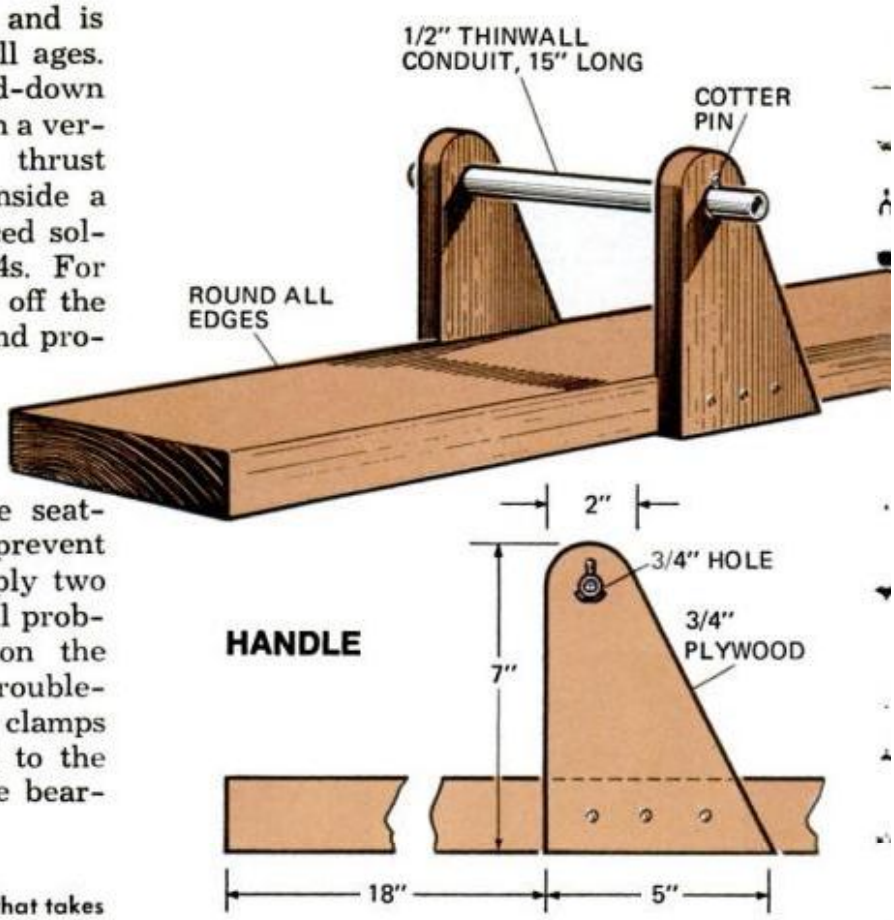
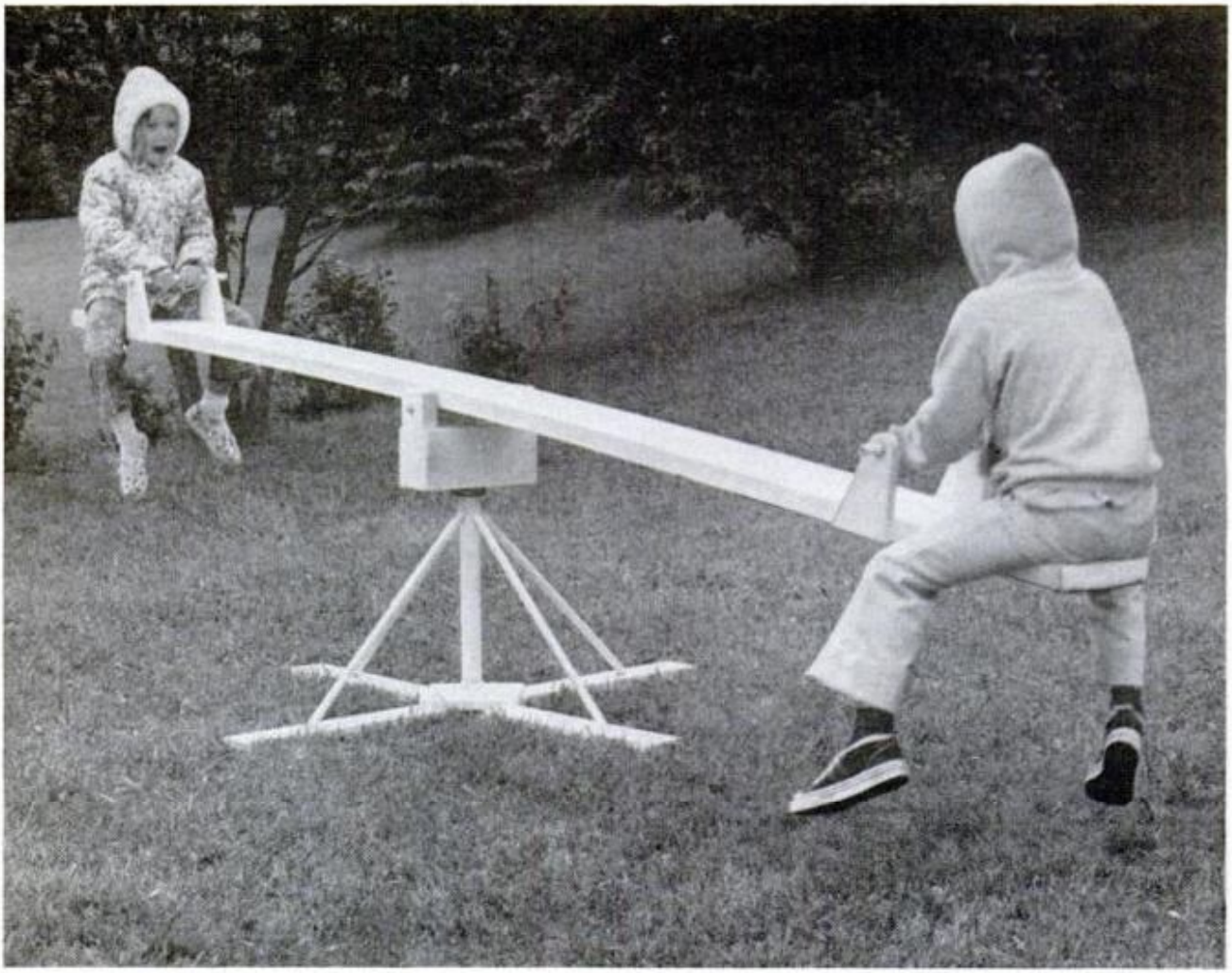
Rotating seesaw

THIS SEESAW has a new twist and is sure to be irresistible to kids of all ages. In addition to the usual up-and-down movement, the seat board rotates on a vertical shaft that's fitted with a thrust bearing. The shaft in turn fits inside a pipe post that's anchored and braced solidly to a nontipping base of 2x4s. For safety, you would be wise to rope off the area in which the seesaw rotates and provide only one entrance to eliminate any possibility of a child who's among the spectators getting bowled over and injured.

Use a sound 2x8 plank for the seatboard and round all edges to prevent splinters. To finish the seesaw, apply two coats of exterior house paint. You'll probably want to use a lubricant on the moving parts to assure a quiet, trouble-free action. Notice that conduit clamps are used to attach the seat board to the steel rod that pivots in pipe-nipple bearings.—*R. S. Hedin, Minneapolis*



YOUNGSTERS get lots of exercise on seesaw that takes them around and around as well as up and down



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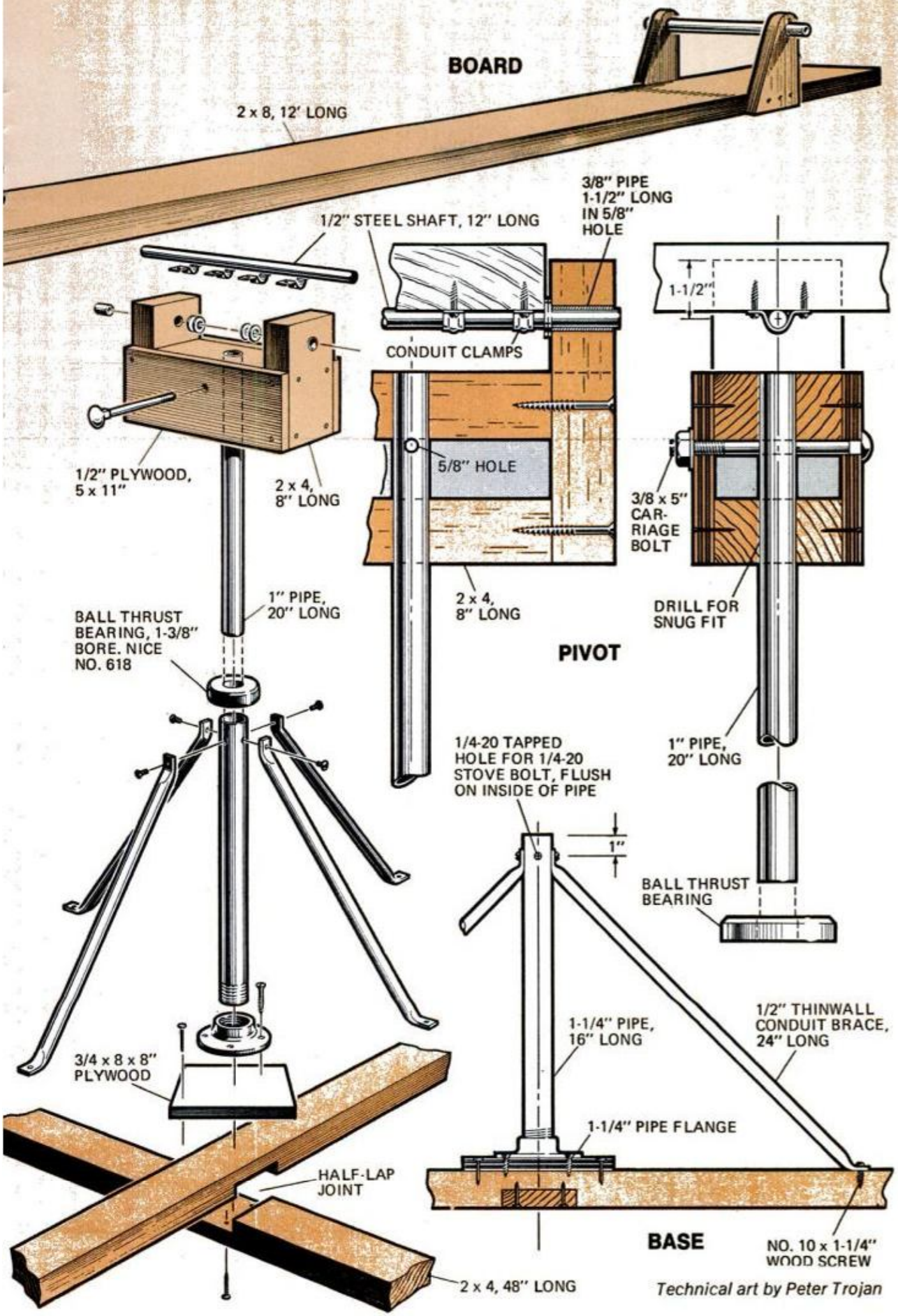

Technical art by Peter Trojan

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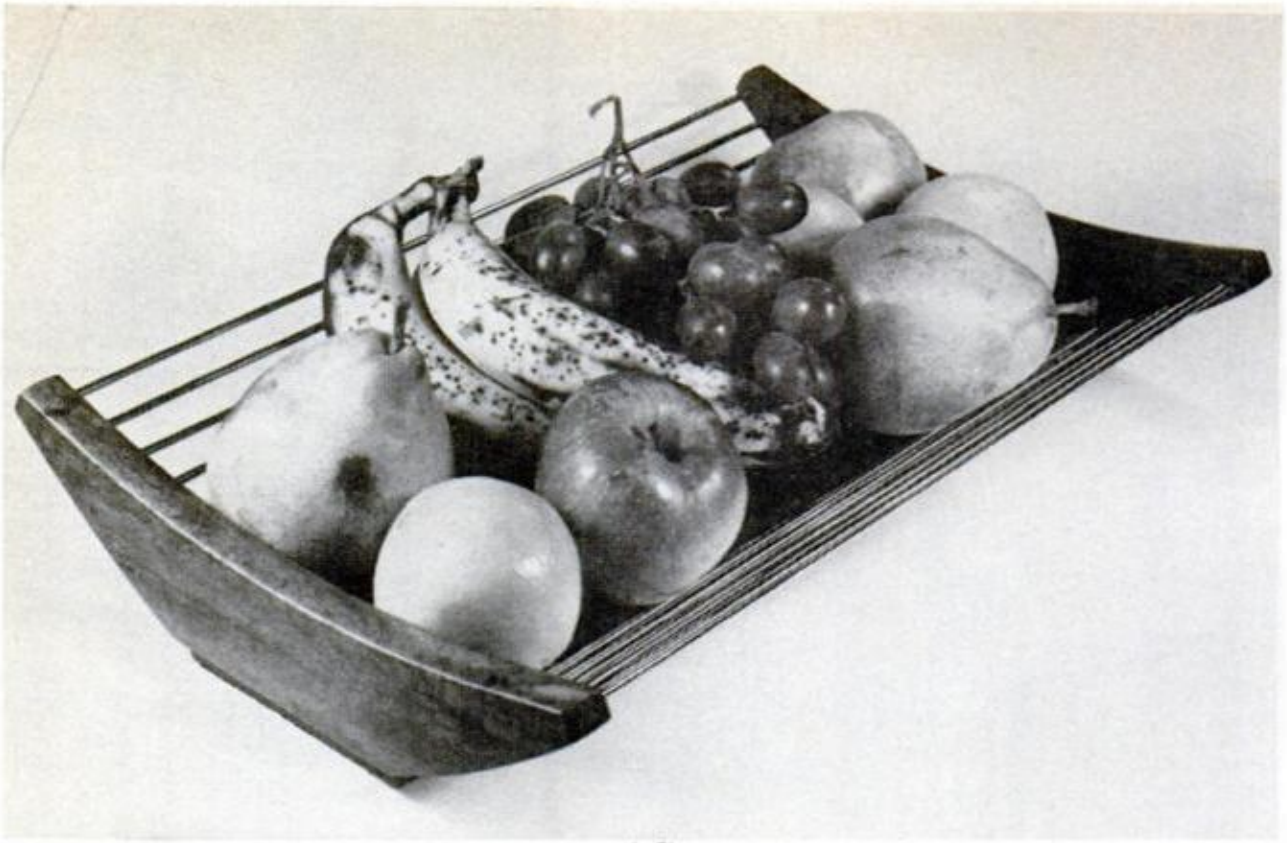
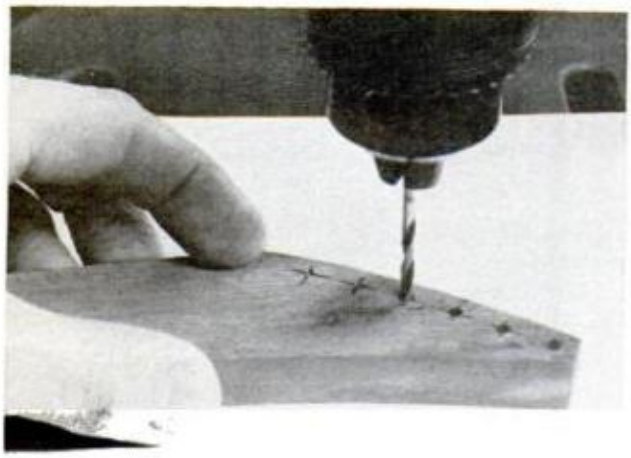
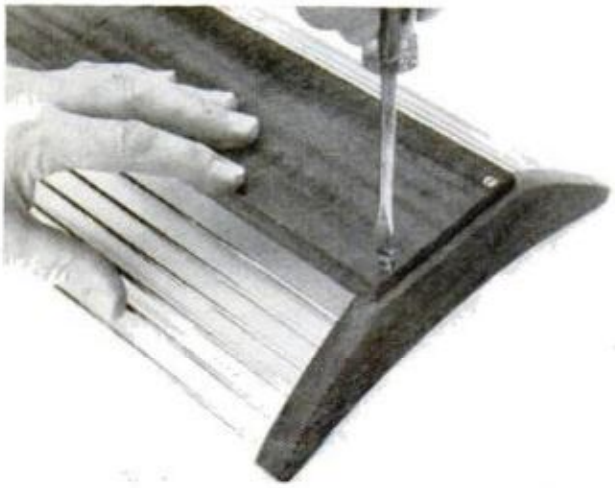




HOLES for steel rods are laid out and bored with precision on the drill press to a depth of 7/16 in.



BOTTOM is edge-rabbeted, as are sides, and then joined with glue and four 1¼-in. No. 8 f.h. screws

Contemporary fruit trug

SIMPLICITY of design and construction makes this a particularly appealing project to tackle on a Saturday afternoon. With only cutoff-size pieces of wood required, expense is no obstacle if you wish to use high-grade hardwood. Figured rosewood was used on the trug (a trough or tray) shown. Walnut, mahogany, teak or the like would also suit the design. Stainless steel is ideal for the rods; in all likelihood, you will find a source listed in your local classified directory. If you must substitute brass, make certain that you polish and lacquer the rods before installing them.

Mark and cut the first end using a coping saw or bandsaw, then smooth the edges with a spokeshave or sander. Use this as a template for the other end. Mark rod-hole positions as shown, indent them with a center punch to prevent bit-drift, and drill the blind holes. Use a stop on your drill bit; or set the depth stop on your drill press for ½ in. Next, cut the 12 rods to length and slightly chamfer the ends with a smooth cut file. Note that the ends of the base are rabbeted.

Assemble the unit with glue and screws, and finish with three coats of shellac. Rub with 00 steel wool between coats.

—*Kenneth Wells, Portsmouth, Hants, U.K.*

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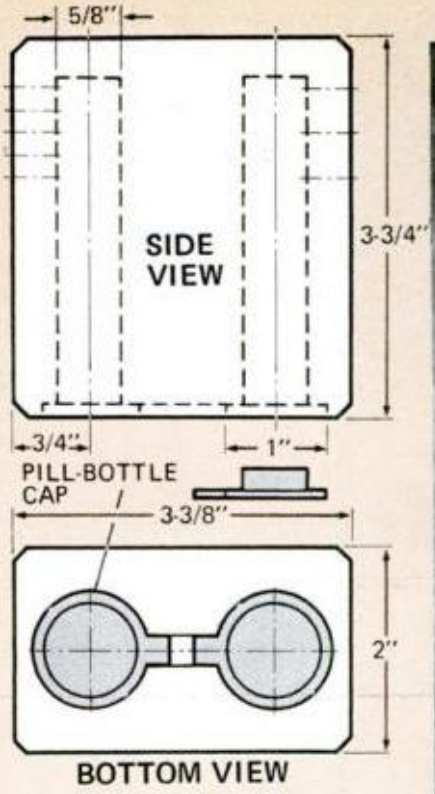
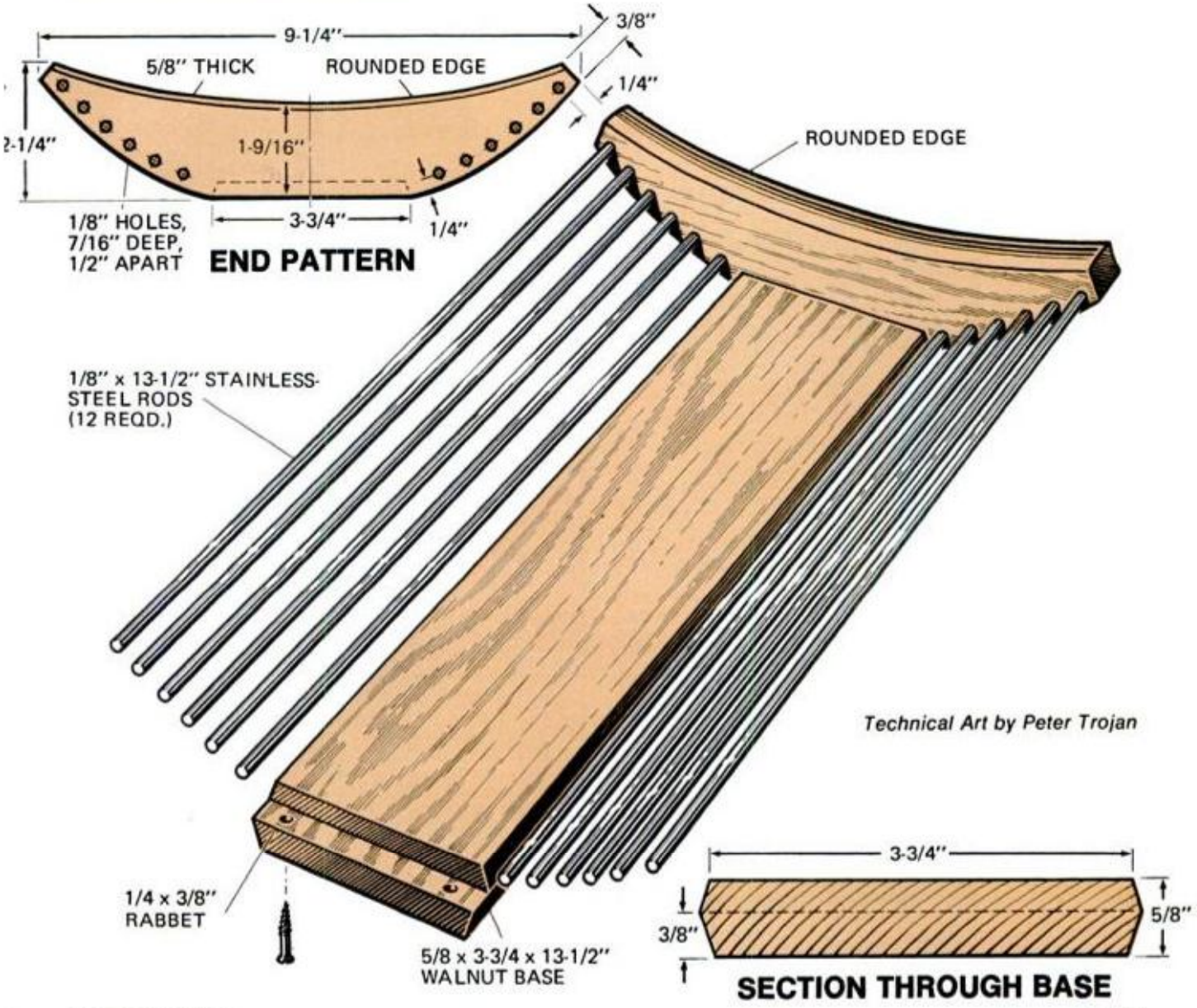
Salt-pepper shaker

HERE'S a novel way to corral salt and pepper in one tip-proof container. The only materials you need are a 2 x 3⅜ x 3¾-in. (actual dimensions) piece of wood and two pill-bottle caps. Drill the shallow counterbored holes for the caps first, then drill the two ⅝-in. holes almost through the wood block. Next, cut the groove for the cap-tabs with a chisel. Finally, drill the holes for the salt and pepper.

For fast indentification, stamp P and S on the top with a counterpunch.—*Jim Hamm, Yakima, Wash.*





Technical Art by Peter Trojan

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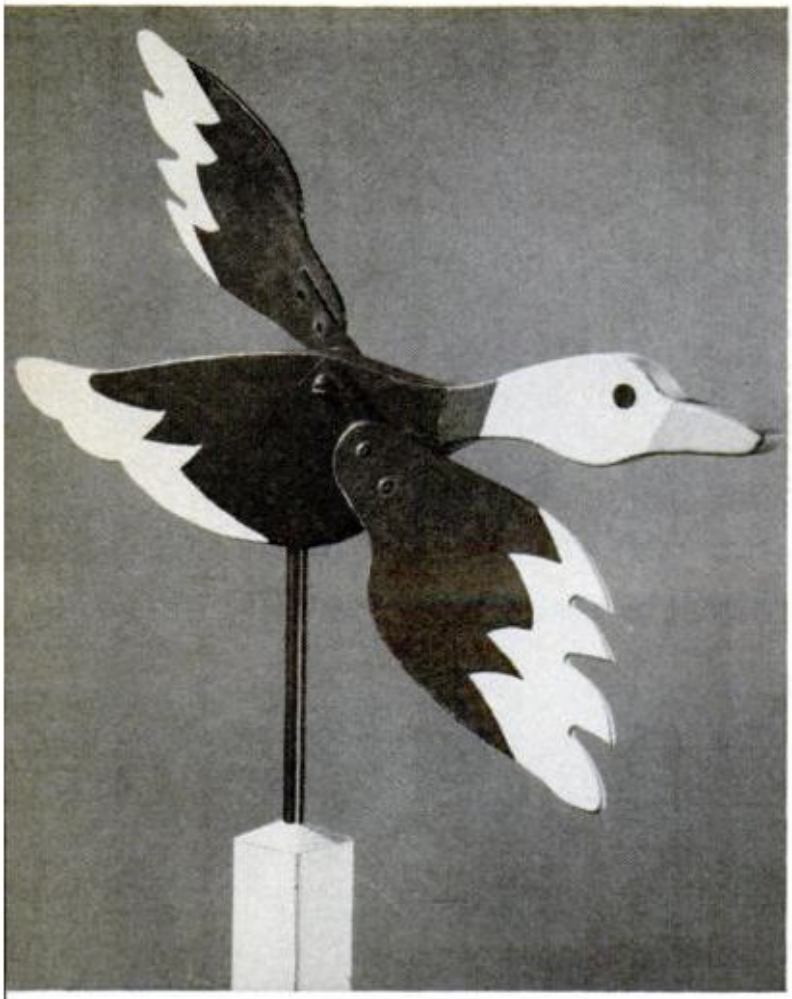

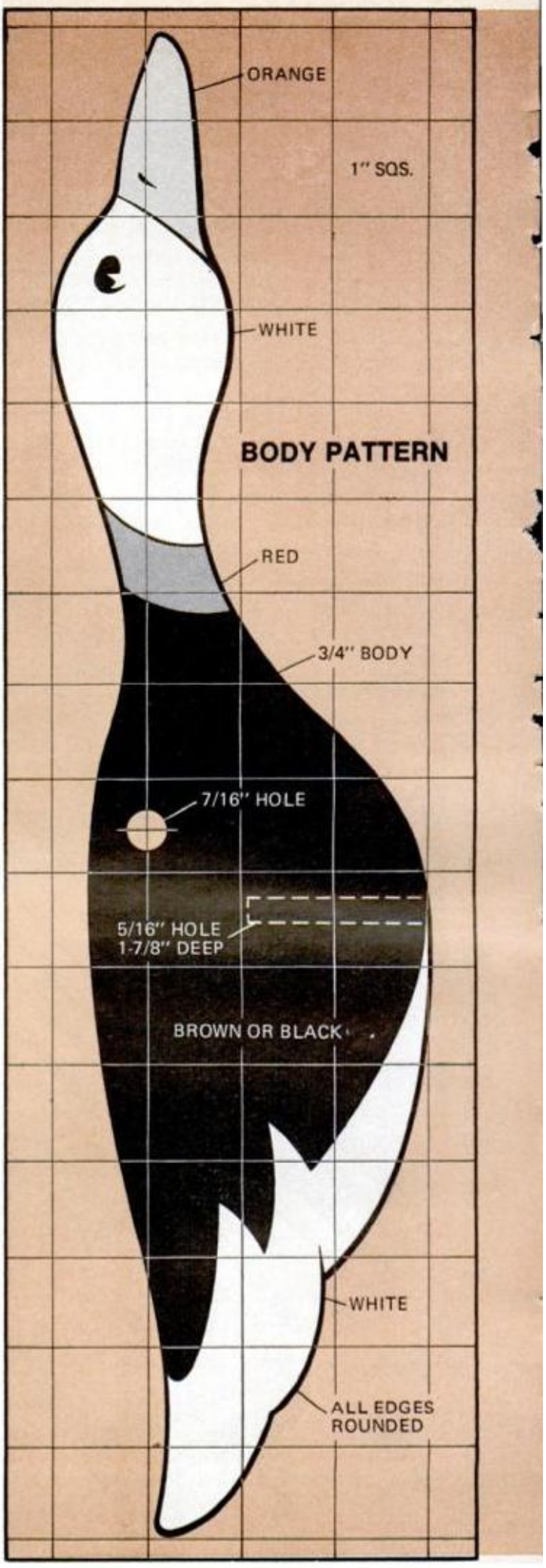

'Flying' duck weathervane

JUST A GLANCE at this weathervane lets you know wind direction immediately. Like its living counterpart when taking off, this wooden flying duck is always headed into the wind.

The body is of ¾-in. pine, and the flapping wings are cut from tempered ⅛-in. hardboard. To make the wings spin in the wind, you will need two 1/16 x ¾ x 3-in. pieces of flat metal. These parts must be bent to provide an offset. To bend, secure the strap metal in a vise and, using an adjustable wrench, twist it to the approximate angle given. The offset is assured by placing nuts on the stovebolt between each wing and the duck body. After all parts are made, assemble the duck for a test fit. A fan should provide enough breeze to let you know whether the wings operate freely. Then disassemble, prime all parts and, using the color scheme shown, finish the bird and reassemble. To mount, drill a hole in the body and insert a ¼-in. rod. The other end of the rod stands in a hole drilled atop a planted post. Remember that the hole in the body must be large enough to permit the bird to pivot freely.

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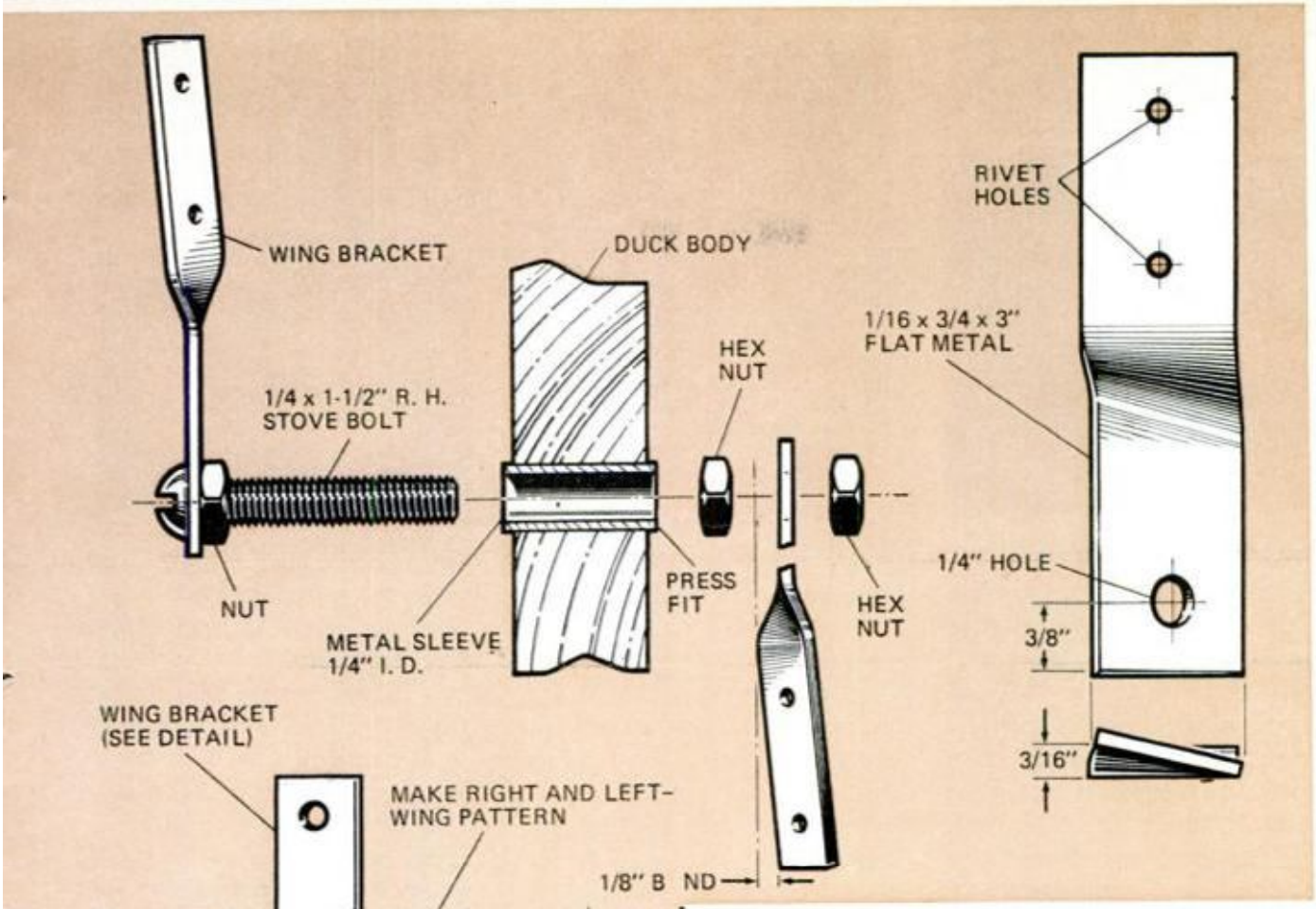
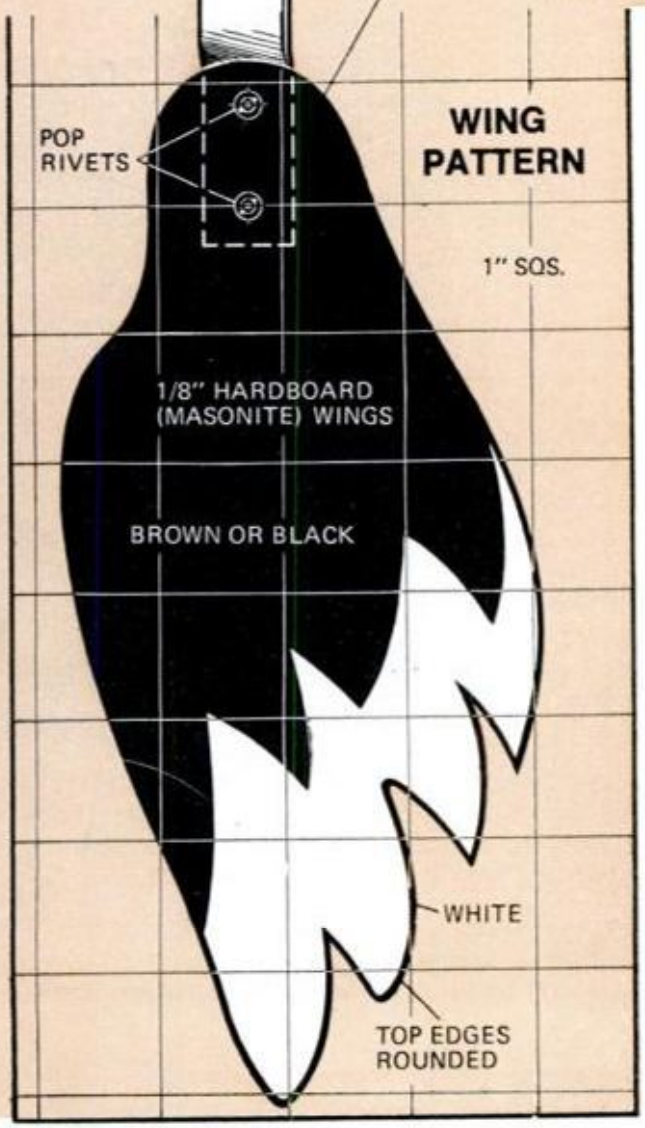
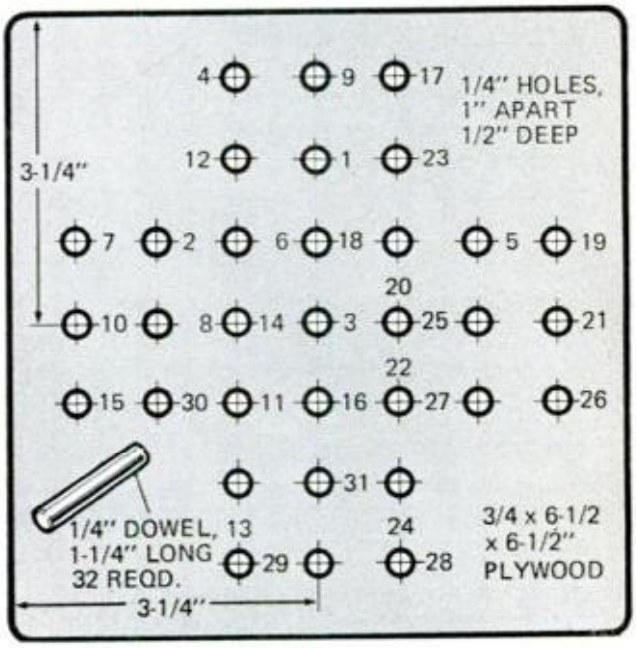




SOLUTION TO THE JUMP-A-PEG PUZZLE APPEARING ON PAGE 137

To remove all pegs and leave just one in the center hole, follow the numbered sequence shown below. Remember: Another peg must be jumped—and removed from the board—to make any move legal. For example, the first move is peg No. 1, which jumps the hole marked with moves 6 and 18 and lands in the center hole. After you remove the jumped peg, the second move is into the hole created by the first jump. In the third jump, the first peg jumps back into the hole it started from. Note that several holes—18-29, 24-28 and four others—are used twice to complete the puzzle. Also several holes are unmarked.



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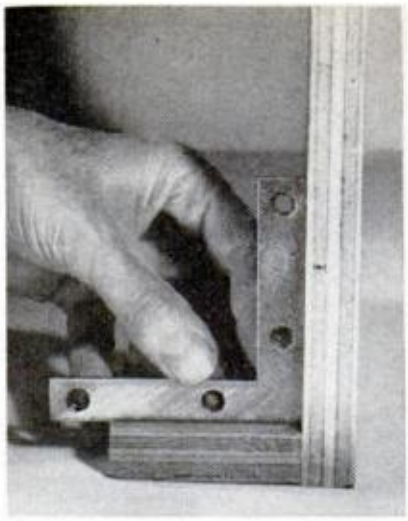
HINTS
FROM READERS

Cabinet 'feet'

Plastic caps from toothpaste tubes can frequently serve as feet for small cabinets. To use them, cut small washers from Styrofoam, push the right-size screw through and cement foam in the cap with epoxy. If cement saturates the washer, use more epoxy to fill the cavity neatly and hold the screw.—*Walter E. Burton, Akron, Ohio*



Mini try square

When working in tight quarters on a cabinet, you can use a flat corner mending plate as a tiny try square. In most cases the metal plates are fairly square but you should check it with a regular try square to be sure. The L-shaped plates come 2x2, 3x3 and 4x4 in. and sold by hardware stores.—*B. W. Erwin, Kent, Ohio*

Emergency washer

When you need a faucet washer in a hurry but the only one you have is too large, screw it to the faucet spindle and chuck it in your drill press. While spindle is turning, rest a file on a wood block and hold it against the washer. In seconds you'll have the right size.—*Robert Brightman, Great Neck, N.Y.*

Foolproof method for punching holes in spring steel

To make holes safely in spring steel (like a clock spring) use a bar of solder as an anvil. Place steel on the solder-anvil and strike a sharp blow on a straight-shank punch held at the hole site. After practicing on scrap, you'll be able to cut clean holes. You'll find the straight shank tool doesn't split the steel.—*Harvey Miller, Danboro, Pa.*

NEXT MONTH IN SHOP AND CRAFTS

BETTER WAYS TO GET A BETTER HOME. Your best bet for a larger or better home can be found in the home you have. To help you solve those nitty-gritty home modernization problems, PM's editors have rounded up 40 pages of ideas for upgrading the house you already own. You'll see how you can: Expand *down* as well as up . . . Update a living room whether it's 5 or 50 years old . . . Give an old home an exterior facelift . . . Add an outside basement entrance . . . Create more storage space . . . and more. The special section also includes imaginative ideas for basement family rooms and instructions for installing an automatic roof ventilator for greater summer comfort. It's a roundup of practical, do-it-yourself ideas for better living—economically—you can't afford to miss.

PATIO PLANTERS FROM A BARREL. We've located a source that sells used barrels for less than $20. And in one Saturday work session, you can make a pair of patio tub planters that will be the talk of the neighborhood. A commercial version costs about $25, but after reading April PM you can have two for less than the price of one.

KNOW YOUR WOOD JOINTS. The difference between shoddy workmanship and a craftsman-like project can be quickly determined by the joints the builder uses. This article includes all the joinery techniques you should know about and will earn a permanent spot in your reference library.

PLUS: A fire-engine bed, new building products, great storage ideas, and more.

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17 mg. "tar," 1.2 mg. nicotine av. per cigarette, FTC Report Aug. 71.

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From PM's workshop:

CUSTOM-BUILT CABINET is covered with plastic laminate to minimize cleanup time. Drawers are partitioned to suit the author's radial and table-saw accessories

a radial-saw accessory cabinet

Designed and built in our own shop, this cabinet lets you make use of that wasted space beneath your radial saw—regardless of what brand it is

By HARRY WICKS, Workshop Editor

Photos by Robert D. Borst
Shop consultant: John E. Gaynor

THIS ACCESSORY CABINET for a radial saw was designed by *PM* to provide a convenient, attractive and easy-to-keep-clean storage unit to hold the equipment you need for a radial saw. Our cabinet fits beneath Sears' 12-in. radial saw (shop-tested and reported in *Sears' Best Radial,* page 120, Aug. '71 *PM*). But its overall size can be easily altered to fit the space under any make of radial saw.

To make cleanup a simple chore, we covered all exposed parts of the cabinet with Johns-Manville Melamite (plastic laminate). For appearance and eye-relief, we used avocado and white. Admittedly, the laminate is a luxury, but the thought of never having to repaint a dirt-smeared cabinet more than justified the cash outlay. (In fact, a deluxe workbench we're building for an upcoming issue will also be plastic-laminated.) However, if you prefer, the cabinet can simply be painted with an enamel.

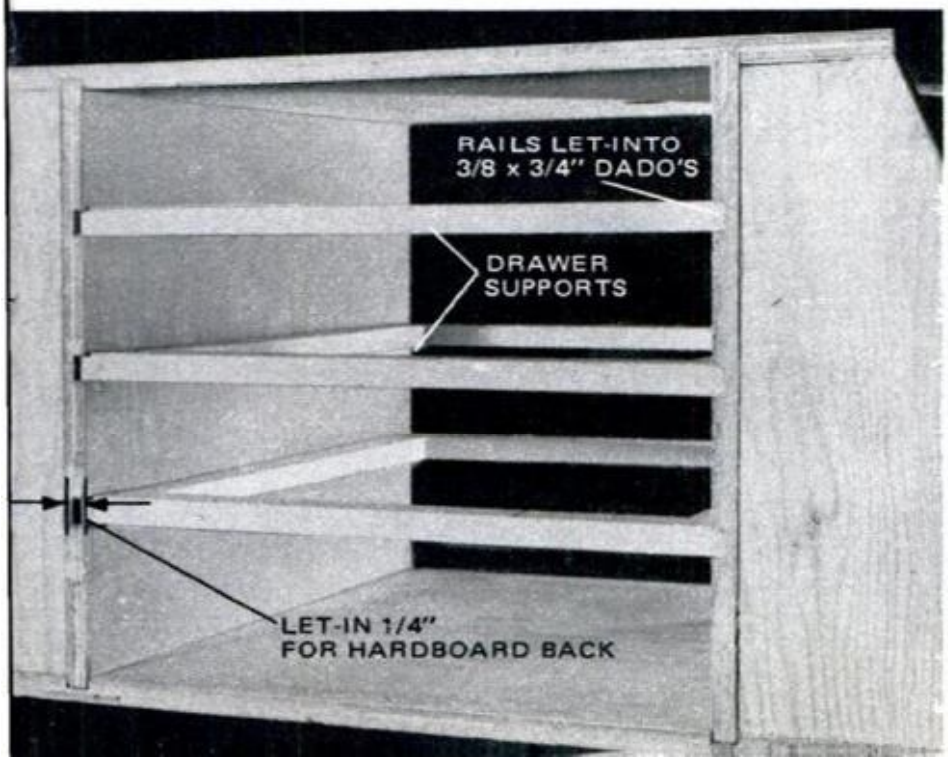
How it's built. Constructed of ¾-in. A-D plywood, the box is actually symmetrical—with one exception: the top, bottom and sides are edge-rabbeted to receive the ¼-in. hardboard back. Similarly, drawer slides at the back are set in for the back. All edges are flush.

When laying out your cabinet, take all dimensions directly from your radial saw. Then, if any *do* vary from those shown in the drawing, simply mark the changes right on the drawing and custom-build your cabinet to suit your saw. Also, the dimensions shown do not allow for the laminate, so make certain that *you do* if you plan to cover your cabinet as we did.

Also, when laying out your cabinet—and before doing any cutting, rabbeting, or dadoing—double check exact location of the four drawers at front. If you've altered the cabinet dimensions, drawer depths must be adjusted accordingly.

The drawers. The amount of drawer space that the cabinet provides surprised me when we finished the project. In fact,

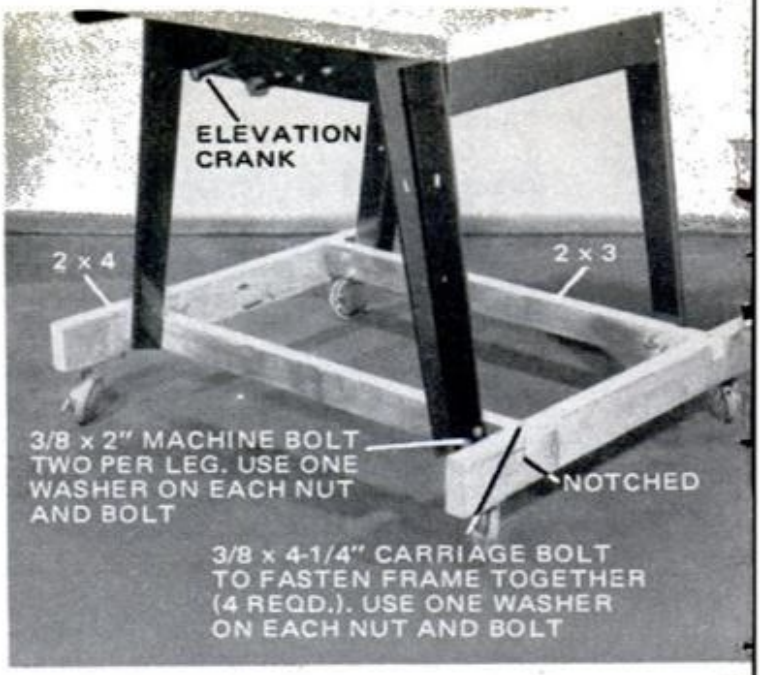
BASIC CONSTRUCTION is symmetrical. Unit can be sectioned into identical quarters with one exception: Back edges of sides are edge-rabbeted and drawer slides are let in ¼ in. to receive the hardboard back. Right end, like the left end, is fitted with perforated hardboard, holds safety goggles and the like



there was more storage space than I needed for my radial-saw accessories. So, I used the bottom drawer for table-saw items. And, for the first time in 20 years, all those items are in one convenient spot.

For future flexibility, I decided simply to butt-join all divider/partitions. I used ½-in. pine, gluing and nailing them in place after positioning the various accessories in each drawer. Should my requirements ever change, it will be easy to knock out the old dividers and install new ones where I want them. Location of accessories in the drawers is a matter of personal taste and working habits. I laid them all on the workbench and then, based upon frequency of use, placed them in the drawers.

The cabinet ends. Since there was space at both ends I installed a pair of shallow drawers. They are extremely handy for



ACCESSORY CABINET sits on base (above) shown and described in *Sears' Best Radial* (page 120, Aug. '71 PM)

RADIAL-SAW CABINET

NOTE: CABINET CONSTRUCTED OF 3/4" A-D PLYWOOD, DRAWERS OF 1/2" CLEAR PINE, FALSE DRAWER FRONTS OF 3/4" PLYWOOD

CABINET DESIGNED TO FIT SEARS 12" RADIAL ARM SAW

TOP, 3/4 x 23-5/8 x 28-11/16"

DRAWER GUIDES, 3/4 x 1-1/2" (ACTUAL) PINE - LET INTO 3/8 x 3/4" DADOS

3/8 x 3/4" DADO

19-3/8"

1/4 x 17-3/4 x 19-3/4" HARDBOARD BACK, LET INTO 1/4 x 3/8" RABBETS

23-3/8"

CABINET FACED WITH AVOCADO MELAMITE

1/4" PERFORATED BOARD PLACED IN DADO, NOT FASTENED

CUP HOOK (2 REQD.) TO SUIT TAPER JIG

DRAWER BOTTOMS, 1/4" HARDBOARD

20-7/8"

19-3/16"

1/4 x 1/4 DADO, 1/4" FROM BOTTOM EDGE

SIDE, LET INTO 3/8 x 3/4" DADO

TO SUIT OPENING*

BOTTOM, 3/4 x 23-5/8 x 39-1/2"

3"

4D FINISH NAILS

FALSE DRAWER FRONT, 1" WIDER AND LONGER THAN DRAWER FRONT, FACED WITH WHITE MELAMITE

ALL PARTITIONS BUTT-JOINED

CENTERED ON DRAWER

AMEROCK KNOB NO. T-551

3"

PARTITIONS TO SUIT; USE 1/2" CLEAR PINE

*DRAWER(S) DEPTH(S) SHOULD BE BUILT TO SUIT OWNER'S ACCESSORIES

A better idea for safety: Buckle up.

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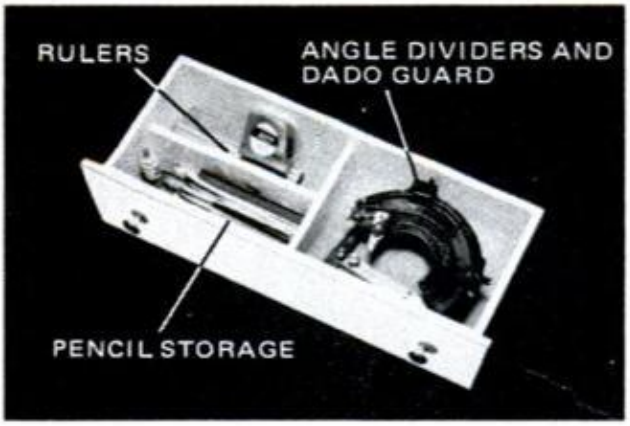
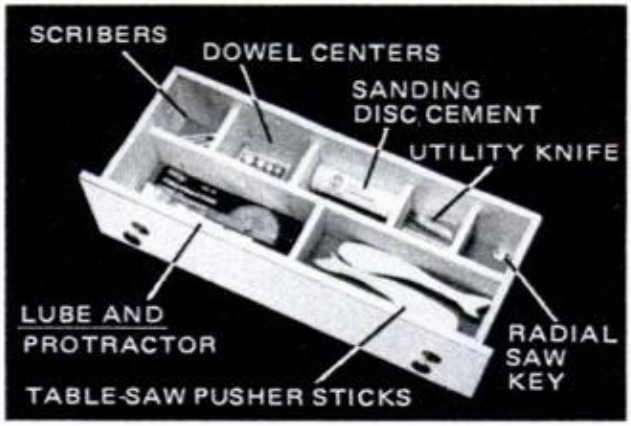
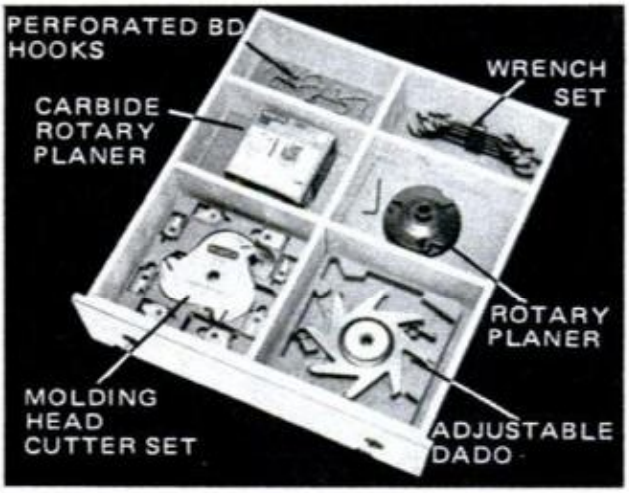
Typical drawer construction



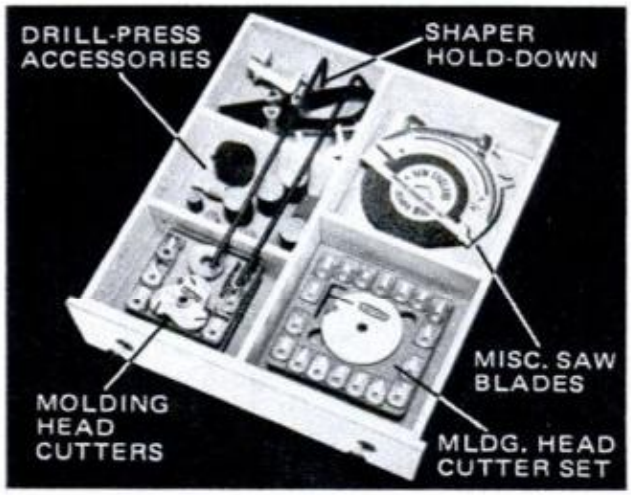
END DRAWER IS SHALLOW, ideal for frequently used items such as a tape measure and your pencils



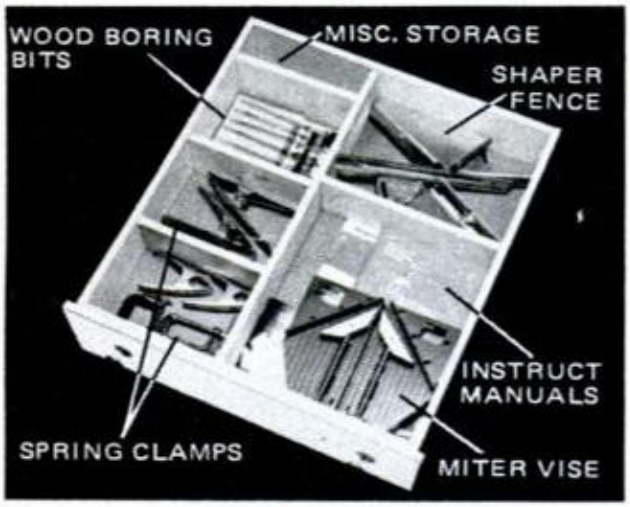
DRAWER AT OTHER END also holds miscellaneous items, including pusher-sticks for use on the table saw



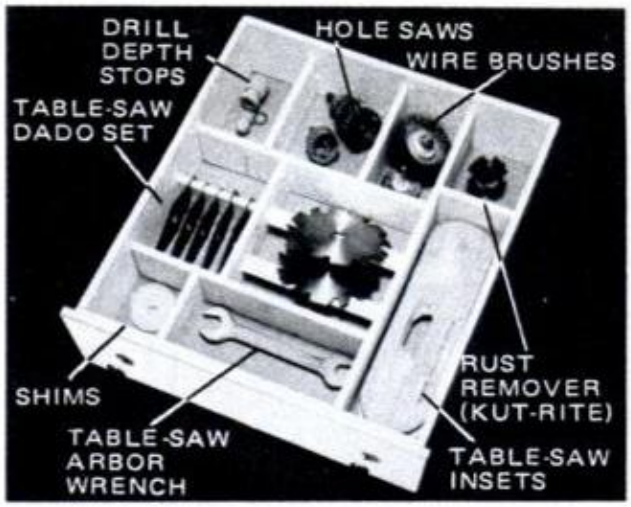
TOP FRONT DRAWER holds accessories used most often, plus small items such as hooks and wrench set



SECOND DRAWER contains items used with less frequency, also masonry and metal-cutting blades



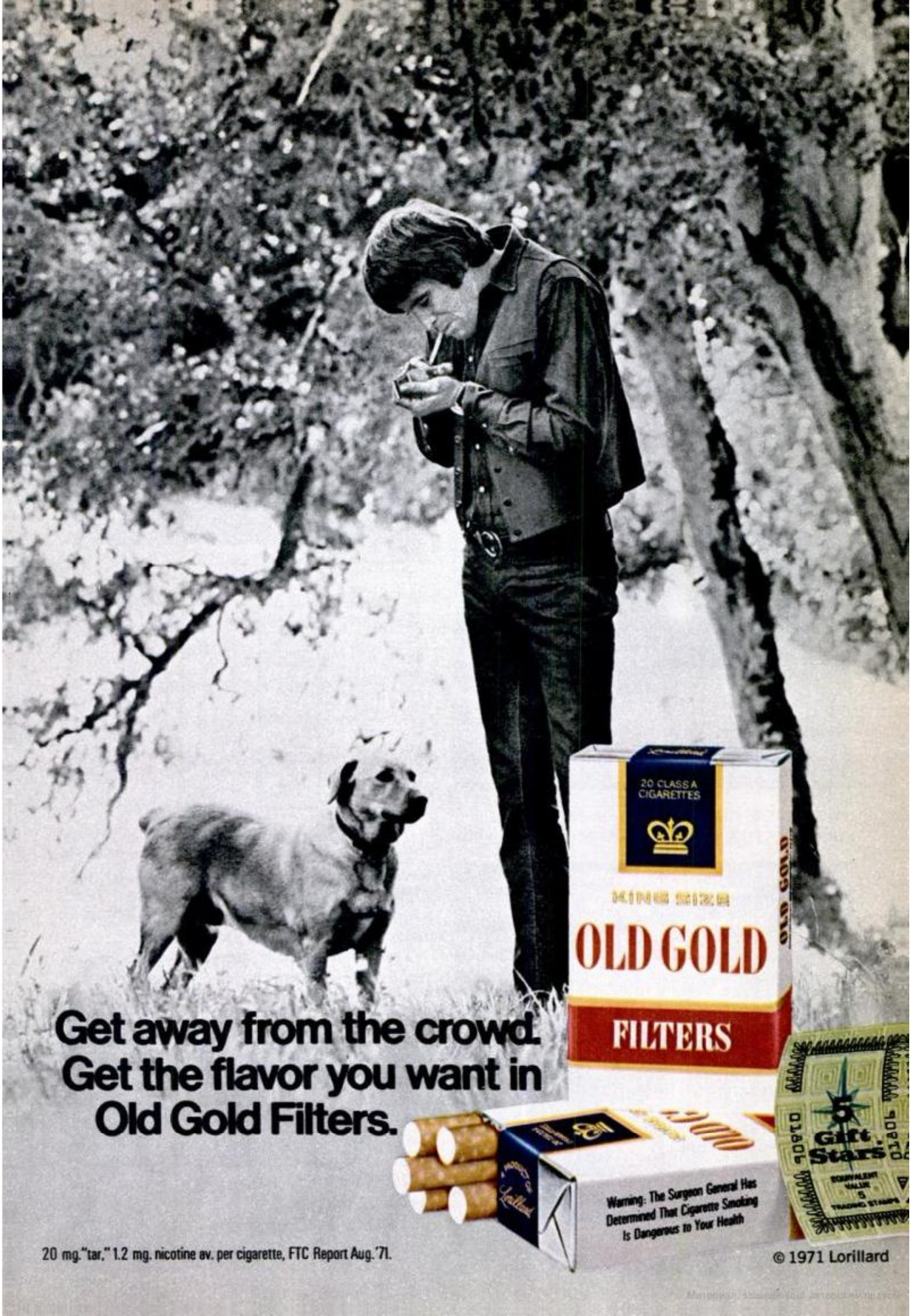
THIRD DRAWER contains the accessories needed when the radial is converted for use as a drill press



BOTTOM DRAWER keeps all of the table-saw items neatly collared in one spot—a first for author's shop

small items such as pencils, tape measures, dividers and the like—which seem to have a way of getting lost in the shuffle when left on the workbench. The perforated board was left brown (as it comes) and given two coats of McCloskey Heirloom varnish. My feeling here was that if I painted them, dirt and smudge marks would inevitably appear and I would be constantly repainting.

The radial-saw blades are hung on a removable ½-in. dowel (see the sketch

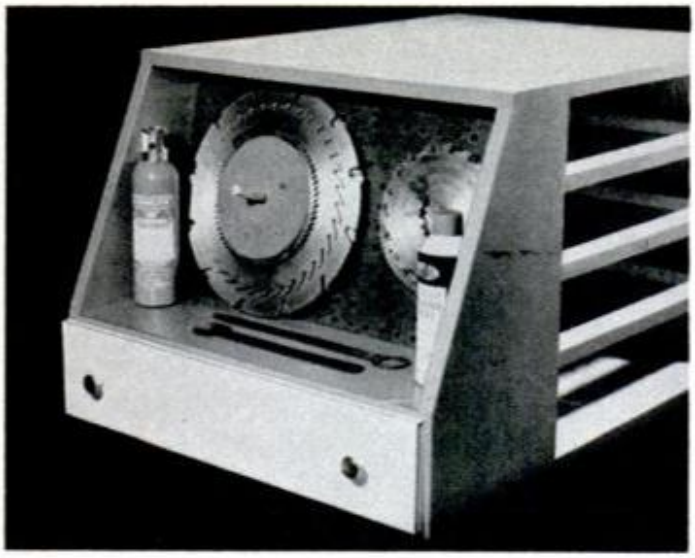


Get away from the crowd. Get the flavor you want in Old Gold Filters.

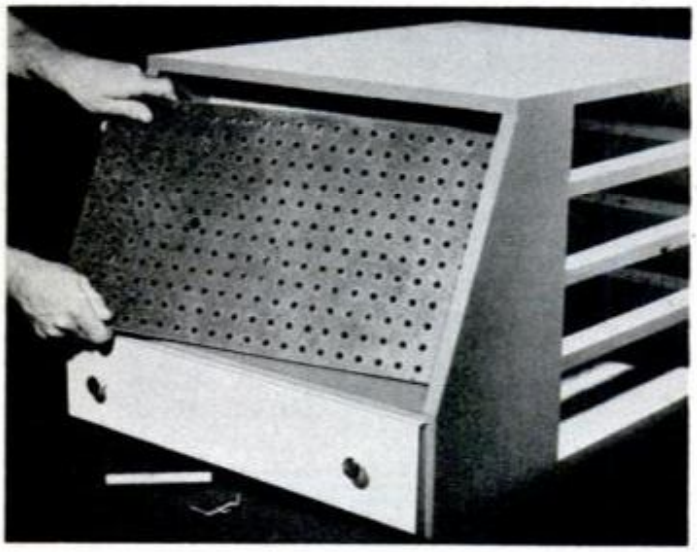
20 mg. "tar," 1.2 mg. nicotine av. per cigarette, FTC Report Aug. '71.

© 1971 Lorillard

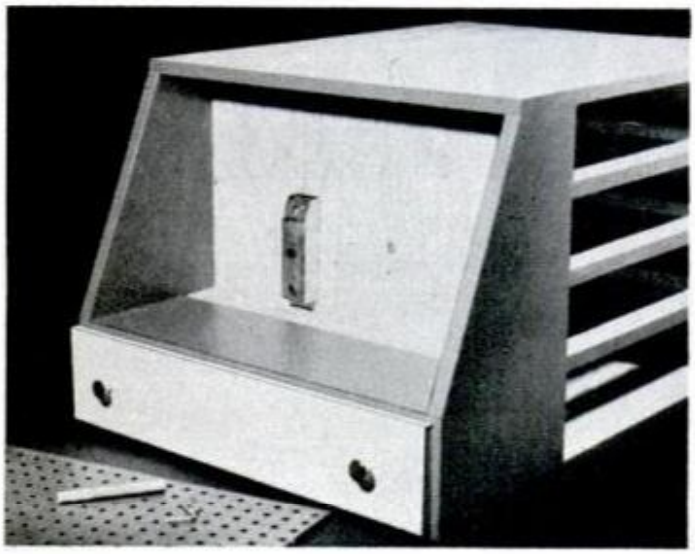
Perforated ends are removable



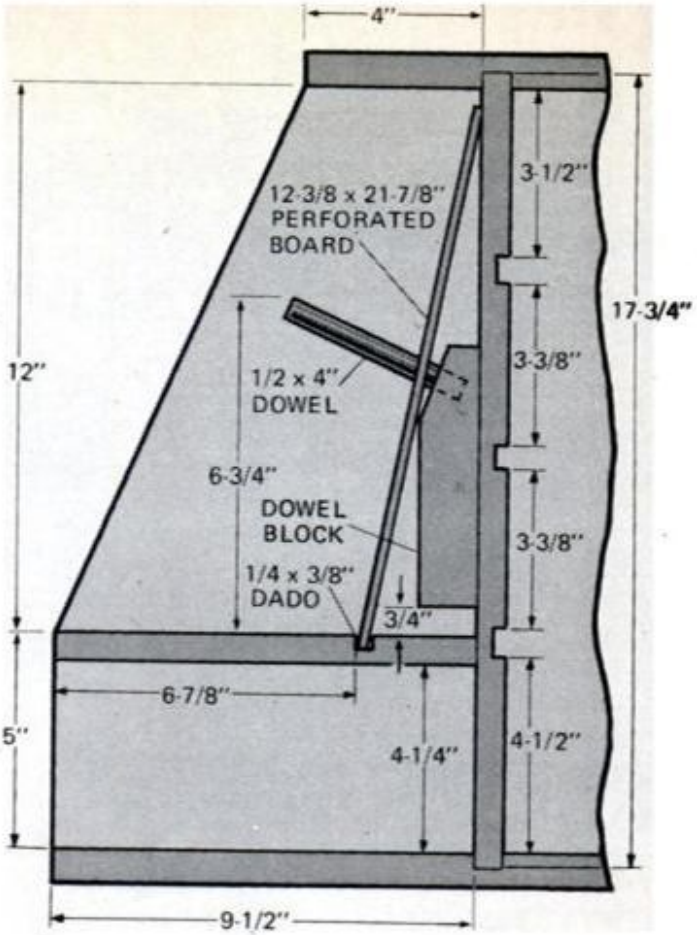
SAW BLADES are hung on ½-in. removable dowel on left end of cabinet. Hardboard spacers protect them

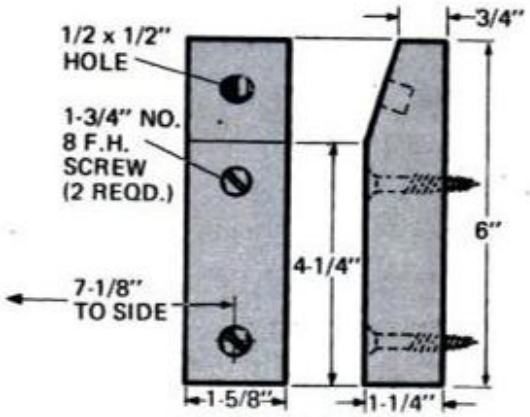


PERFORATED BOARD is not permanently fastened in place, but rests in a dado, as in the sketch at right



BLOCK for holding dowel must be carefully located. Size of saw blades determines its permanent position





DOWEL BLOCK

above). It's good shop practice to use spacers between the blades to keep them from dulling one another. (I used 6-in.-dia. circles cut from hardboard.)

The reason both perforated ends are removable is simply one of cleanliness. From time to time, the boards can be lifted out and the dust removed with a vacuum cleaner. To keep sawdust out of the drawers, the back is fitted with ¼-in. hardboard.

Even if the number of radial-saw accessories you currently own is limited, the cabinet shown will be a welcome addition to your shop. While in process of building your accessory collection, you can use that valuable drawer space for almost any kind of storage. ★★★

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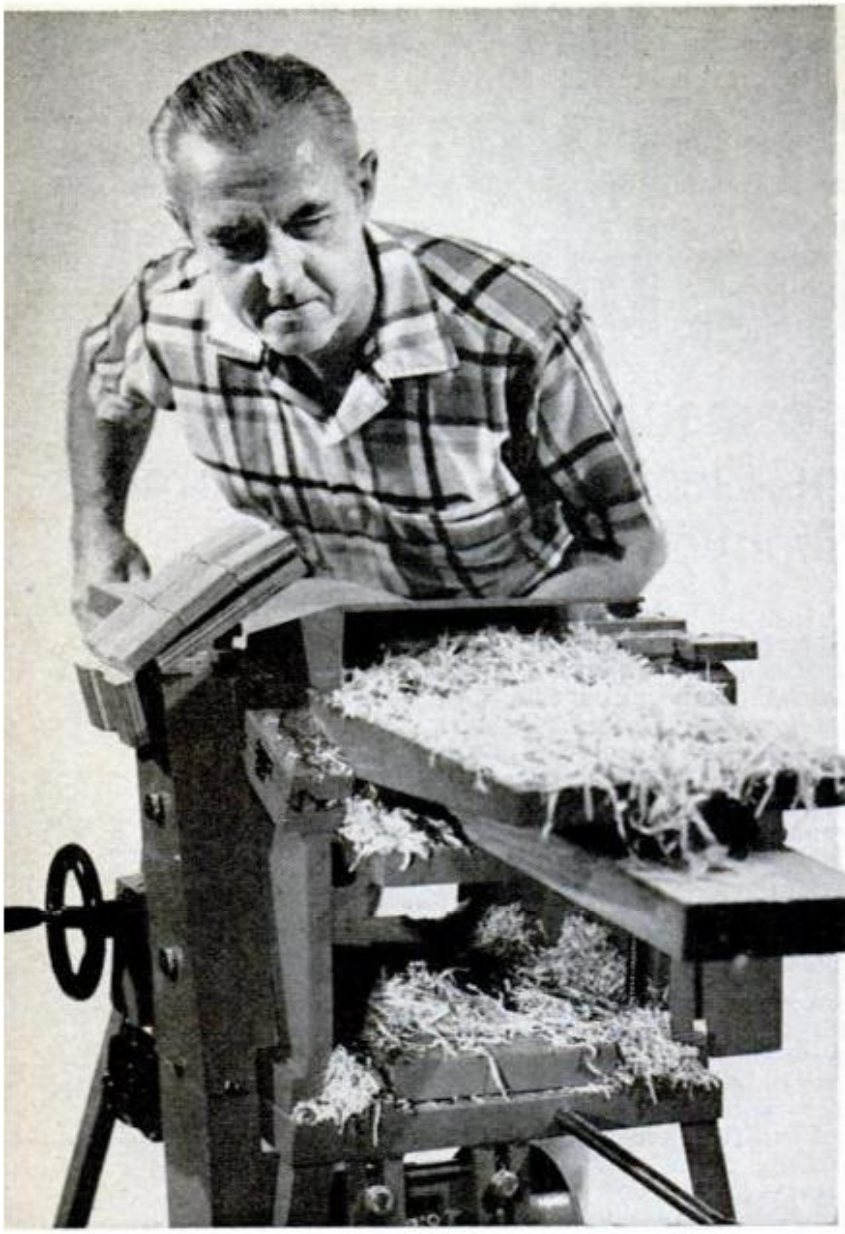


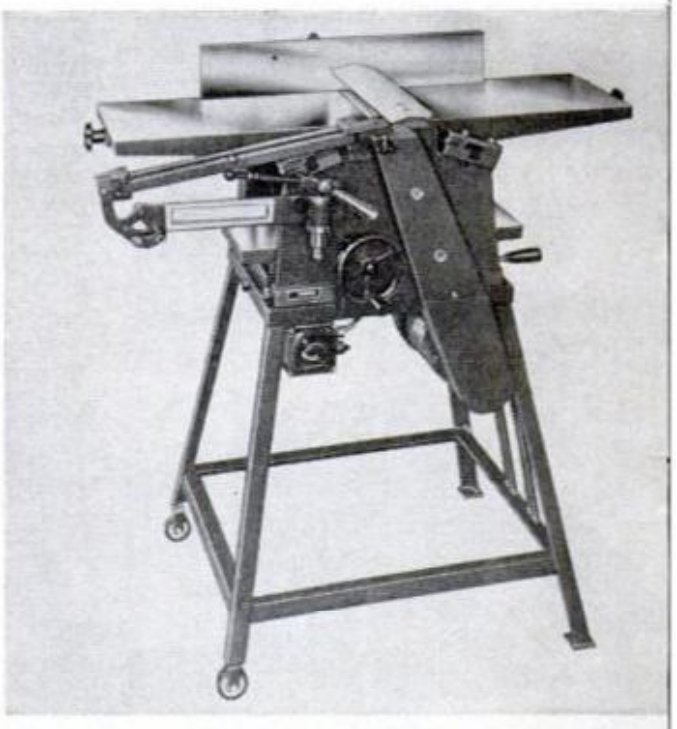
PM tests the Flottjet

a new combination jointer and thickness planer from Germany

First of its kind for the home workshop, the tool's 6400-rpm cutter does a glass-smooth planing job

By WAYNE C. LECKEY
Home and Shop Editor

THREE-FOOT TABLE supports a long workpiece for jointing. Adjustable fence is movable across the width of the cutter



SPECIAL HOLD-DOWN GUARD available helps you use jointer to plane face of wide lumber

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THE GERMANS have put together a unique workshop machine, called Flottjet, which serves both as a jointer and a thickness (surface) planer—something no U.S. manufacturer has ever done.

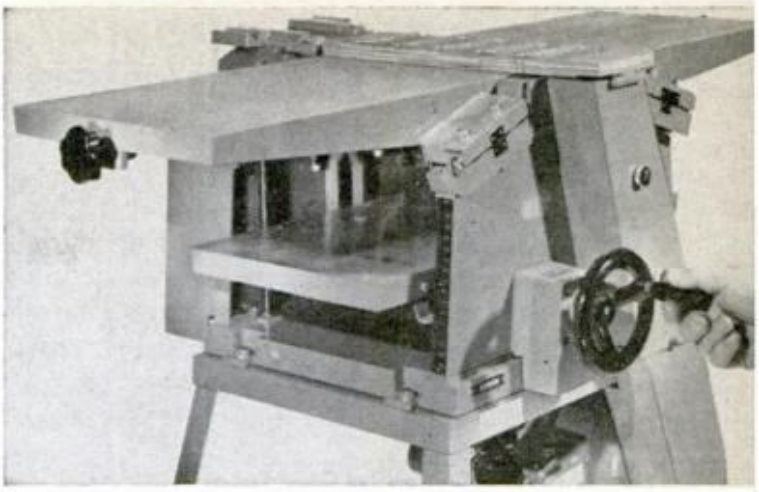
As a thickness planer it does a superb job. I was impressed by the businesslike, solid-sounding hum when I turned it on; more so by the extra-smooth, ripple-free cut it makes. Hewing chips at some 12,800 cuts per minute, its high-speed cutterhead produces an almost glass-smooth surface —automatically. Once the board is fed under the antikickback fingers, the machine takes over and walks the piece through while you wait at the other end. Its self-feeding mechanism will plane a board at 20 ft. per minute, and accept lumber up to 10 in. wide and 6 in. thick.

As a jointer I found it to have one minor disadvantage. Because of its design, the machine hasn't the conventional chip chute. Shavings soon pile up on the planer table below the cutter and you have to stop now and then to rake them out.

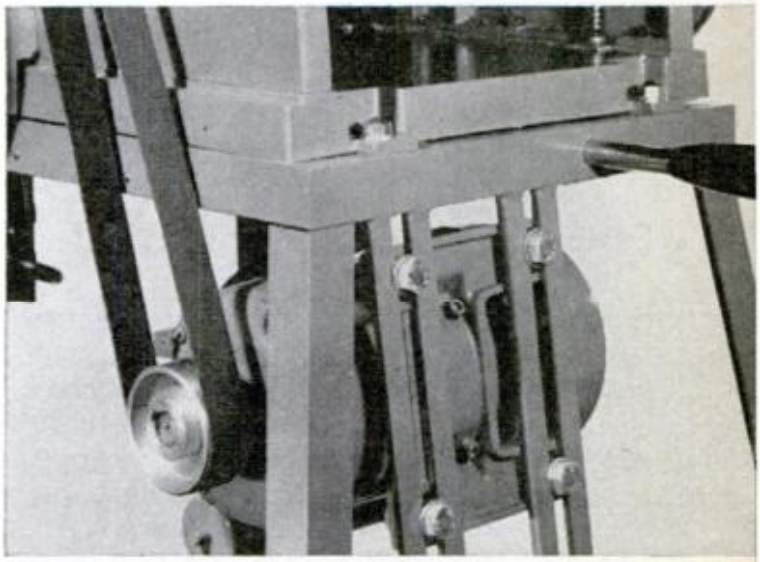
Acro Associates, Box 56, Whippany, N.J., sells the tool for $490 f.o.b. ★★★

SPECIFICATIONS

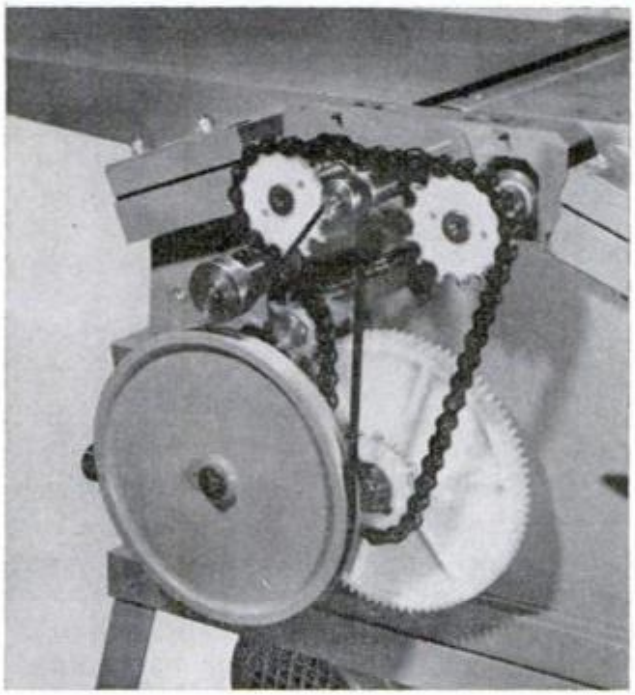
Planer capacity	6x10 in.
Jointer capacity	10-in. width
Cutterhead	two blades, 6400 rpm
Power feed	20 ft. per minute
Jointer table	36 in.
Planer table	20 in.
Maximum cut	3/16 in. per pass
Motor	1½ hp, 220 v.



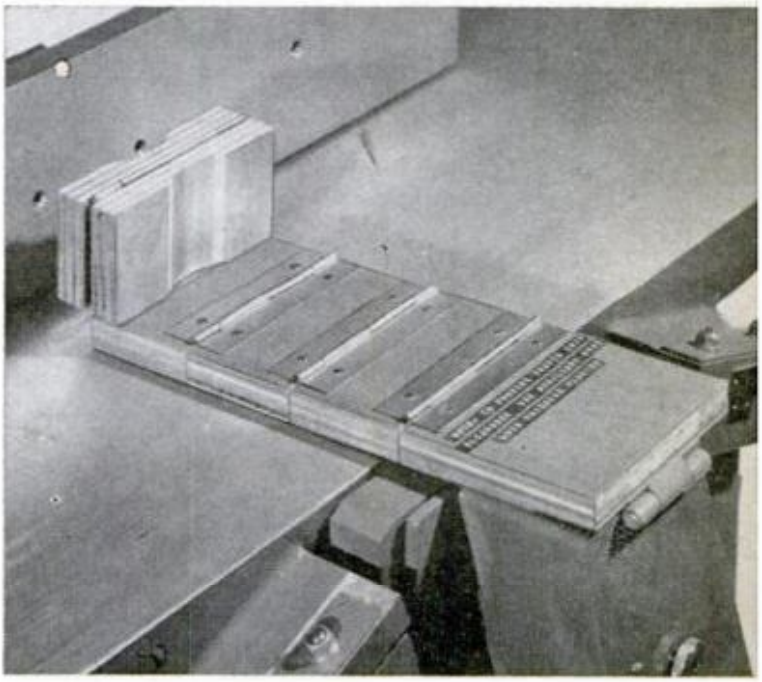
CONVENIENT HAND CRANK raises and lowers 20-in.-long planer table. Maximum cut per pass is 3/16 in.



POWERFUL 1½-HP MOTOR uses 220 v., has flat-belt drive. Pull-out handle lets you wheel machine



CHAIN-DRIVEN GEARS of tough plastic need no attention, make automatic feed mechanism extra quiet



HINGED WOODEN SECTIONS serve as guard to keep cutters fully covered when you're jointing or planing

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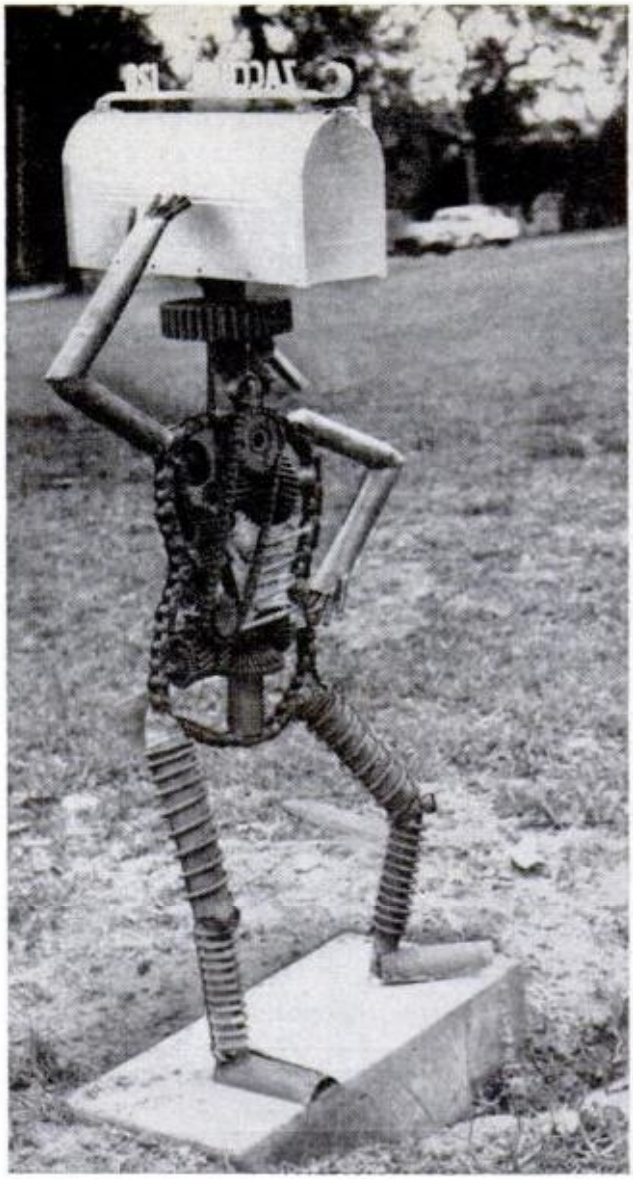
HINTS FROM READERS

'Geared' to carry the mail

The novel mailbox stanchion at right, resembling Atlas holding the world, holds my rural mailbox. It's made from odds and ends of farm equipment such as gears, springs, nuts and bolts welded to form an interesting piece of yard sculpture.

—T. Zacchini, Fruitville, Fla.



Glasslike edges on Plexiglas

After reading *How to Work With Plexiglas* (page 176, June '70 *PM*), I experimented with finishing the edges. I found you can get a beautiful polished-edge finish by using a propane torch. With torch moving, heat until edge becomes glassy and blends with the surface.

—Harry L. Collins, Sutter Creek, Calif.

Eskimo trick to clean rug spills

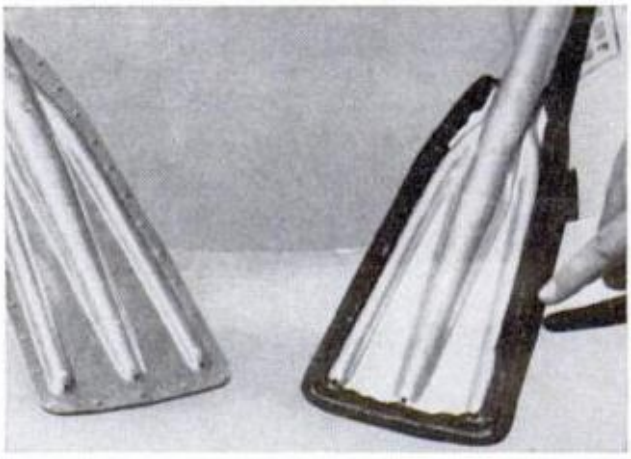
When a bowl of vegetable soup was dropped on our living-room rug recently, I recalled reading that Eskimos rub cornmeal into pelts to clean fur. So I rubbed cornmeal vigorously into the wet spot. After it dried, I vacuumed the mess away and had a clean rug. So far, this trick has worked on all rug types.

—S. Anne Larkin, Marion, Ohio

Rustic patio furniture

Here's an outdoor table and chair set you can make without spending any money. Next time you or a neighbor cut down a tree, save a couple of sections 12 to 15 in. long for seats. Be sure both ends are square. Then ask an electrical distributor for an empty reel to serve as a table.

—Craig Wilson, Barberton, Ohio



Oar 'bumper' protects rubber boat

Exposed metal edges on the oars that came with my rubber boat quickly scuffed edges of the inflated gunwale during rowing. Photo above shows original oar (left) and how I solved the problem by slitting a rubber windshield-wiper hose lengthwise and cementing it to the oar edges.

—John Krill, North Lima, Ohio

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APRIL Preview OF POPULAR MECHANICS

SUPERFAST SPY PLANE NOBODY TALKS ABOUT

But we do. We tell you who owns it (us), who it spies on (them) and how it does it.

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- Expand down as well as up
- Extend over an attached garage
- Update dated living room
- Facelift and get a new exterior
- Remodel a tired bath
- Add a great basement family room

'72 ROAD-RACING PREVIEW

Will Mark Donohue, in his sophisticated Penske Porsche, run the McLarens off the road (like a gentleman, of course)?

CAN YOU CATCH A FALLING STAR?

Not very likely. But it's worth $1000 if you do. At least, that's what one Connecticut family got for the meteorite that came crashing through their roof. Don't count on being so lucky; the odds are astronomical.

OWNERS SOUND OFF ON THEIR FRONT-WHEEL DRIVES

What owners say about Detroit's only front-wheel drives—Eldorado and Toronado—will be good to know when you're eyeing fwd imports.

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WPM2C1

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Safety-glaze your storm door with plastic 'glass'

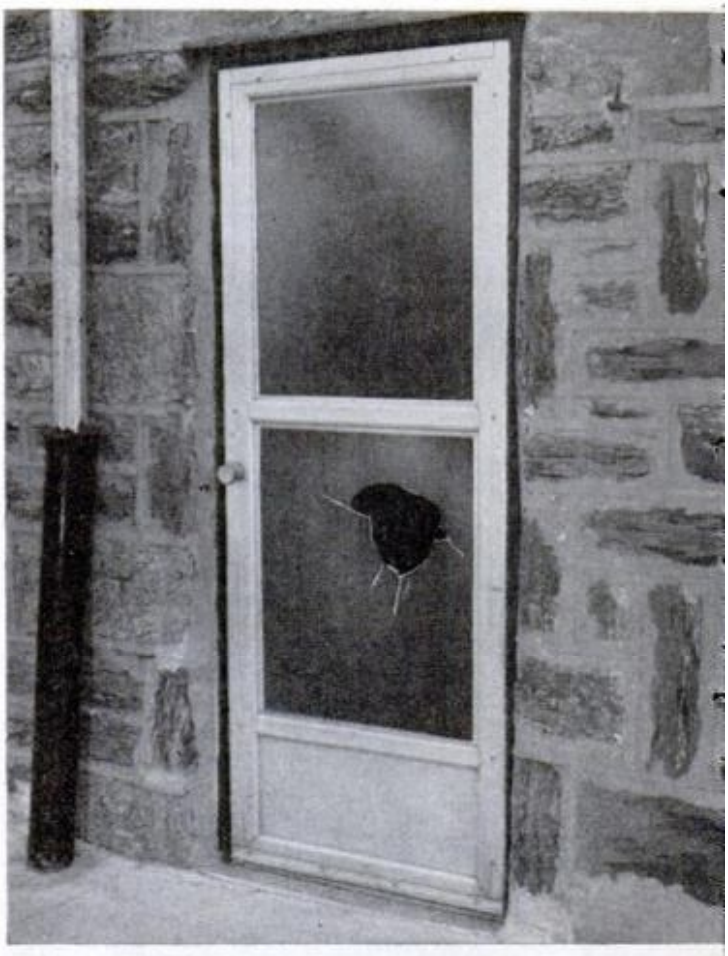
By HARRY WICKS, Workshop Editor

"HE PUSHED HIS HAND through a storm door sash and was badly hurt." That sad story, with variations, covers an all-too-common home accident which you can prevent in your own home for less than $20.

In the next month or so, you'll be replacing those "storms" with screens, so why not give some thought now to safety glazing? By substituting one of several safety glazing materials now available, you can get rid of your existing, unsafe storm-door sash for good.

Seriousness of the problem has been recognized by the National Safety Council and the U.S. Public Health Service, who conducted a survey that revealed: 1) Three out of four storm-door accidents occur when someone is going out of the home: and 2) One-third of all accidental

(Please turn to page 164)



REGLAZED STORM DOOR eliminates chance of severe cuts because acrylic plastic does not shatter. Most door accidents occur when someone leaves the house

TO REPLACE BROKEN WINDOW with break-resistant material, you first remove and discard the whole sash

PLASTIC CAN BE CUT by scoring (above) and snapping, or with a circular saw and fine-tooth blade

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Now! MOTALOY gives your car's rings and valves a replating job while you drive!

SEE HOW ONLY $6 WORTH OF MOTALOY RECONDITIONS YOUR ENGINE—

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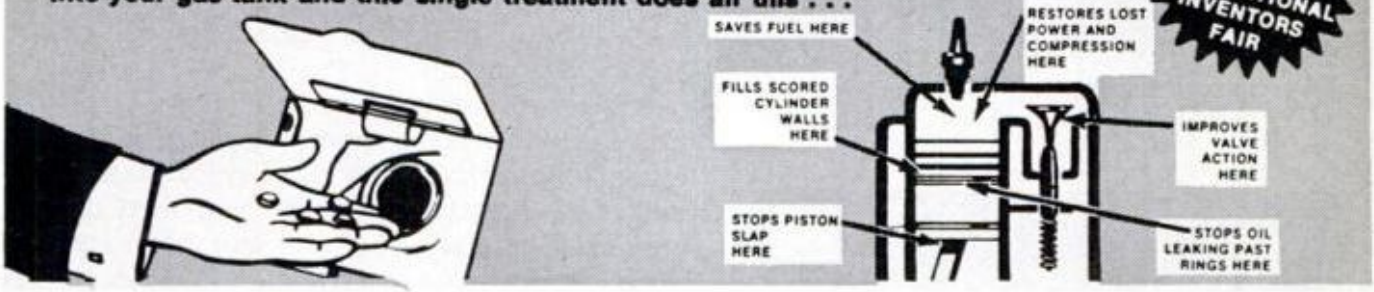

TESTS BY TRINITY TESTING LABS PROVE MOTALOY RESULTS!

Radioactive Isotope Tracer Tests Confirm Motaloy's Plating-Action!

. . The activation of the Motaloy and the subsequent tracing operations of the activated Motaloy was conducted by an independent research laboratory especially licensed by the Atomic Energy Commission to supervise the industrial application of radioactive isotopes.

Approximate Amounts of Activated Motaloy Deposited on the Surfaces (after approx. 60 hours of operation)

Piston Rings	Light
Piston	Light
Cylinder Walls	Light
Intake Valve Face	Very Heavy
Exhaust Valve Face	Heavy
Intake Valve Seat	Heavy
Exhaust Valve Seat	Medium

The above tracing of the radioactive Motaloy is positive proof of the actual transfer of the Motaloy particles from the gasoline tank on to the surfaces of the above surveyed parts of the engine.

JUST DROP 4 Motaloy tabs into your gas tank . . . and you've started your engine rebuilding job! Each tab is a scientifically compounded alloy of 9 metals and elements. As you drive, tiny Motaloy particles are released into the fuel. These Motaloy molecules are carried through the fuel line into the combustion chamber . . . where the intense heat of ignition activates them to soften, then remove carbon deposits. Then, Motaloy starts metal-plating pitted and worn surfaces of cylinder walls, piston rings, valve seats, and stems.

A SINGLE MOTALOY TREATMENT DOES ALL THIS FOR YOUR ENGINE!

The more you drive, the more protection Motaloy deposits in the form of a fine, anti-friction metal plating that rebuilds, smooths, and protects vital surfaces! As Motaloy continues to plate and re-plate, engine compression is increased without a ring and valve job! Gas mileage improves, your engine eats less oil! And over fifteen years of use by over a million motorists — some of them with cars that have locked over 100,000 miles after a single Motaloy treatment — prove that Motaloy can keep your engine running younger and peppier . . . for years longer!

PROTECTS NEW ENGINES . . . REJUVENATES OLD ONES!

Getting a new car? Start it off with a Motaloy treatment — 6 dollars of protection that can mean invaluable extra engine life for your car. Motaloy can actually help maintain full factory compression for the life of your car . . . so you'll get better performance for years longer . . . and a better trade-in or resale price whenever you decide to sell! And Motaloy's track record on cars that have rolled up 50,000 . . 70,000 . even 90,000 miles shows fantastic results in improved compression, lower gas and oil consumption, better pickup, smoother running — just as if the engine were years younger! Give your car's engine a new . . and longer . . . lease on life with amazing Motaloy! Remember — *a single Motaloy treatment lasts for the-life of your car!* And Motaloy cannot harm even the finest engine in any way!

TRY MOTALOY AT *OUR* RISK!

A complete Motaloy package (4 tabs) is only $6.00. Try Motaloy in your car for 30 days, to give its plating action a fair chance. If at the end of that time your car's engine isn't running smoother . . . if you aren't using less oil . . if your gas mileage hasn't started to improve (as it will continue to do until you've reached full factory compression) . . . if you don't agree that Motaloy has given your engine a new lease on life — just return the empty Motaloy package, and we'll send you back every penny of your purchase price! If you *do* find Motaloy does all the wonderful things we say it will, tell your friends about it. They'll thank you for spreading the good word!

*Gold Medal, Naples, Bronze Medal, Brussels, 1964.

Complete Motaloy Package (4 Tabs) Only $6.00

2 car families: 2 packages for $11.50

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L.A.M., Sioux City, Iowa

"About 5 years ago I put Motaloy tablets in my Cadillac. I drove this car 125,000 miles and it never used any oil between changes — 1,500-2,000 miles!"
V.V.G., Cincinnati, Ohio

"My Chevrolet had 49,000 miles on it. It had noisy valves and other troubles. Motaloy corrected all this. It is running better than new."
L.F.M., Walterboro, S.C.

"After using Motaloy in my Chevrolet my compression increased an average of 31½ pounds per cylinder, which to me is conclusive proof that Motaloy will do everything that is claimed for it."
W.P.C., Elkview, West Va.

"My Dodge used one quart of oil every 225 miles. After using Motaloy I drove 1,245 miles and did not have to add any oil."
G.W., Cincinnati, Ohio

"Since adding Motaloy I have driven more than 1,500 miles, and I must say that I am amazed about the wonderful results. My gas consumption improved 40%, and my oil consumption is practically nil."
W.G.K., Fort Atkinson, Wash.

"Motaloy raised the compression in my Chevrolet from 65 to 100 pounds, plus giving me five more miles per gallon."
W.A.C., Granite City, Ill.

"My tractor was in poor condition and ready for a complete overhaul job. Now after 5 months of use with Motaloy added the tractor has more compression and oil consumption has decreased by half."
E.H., New Plymouth, Idaho

"As instructor of the Automotive Shop I have been running a series of tests on your product "Motaloy" and I wish to take this opportunity to report to you our findings. I put Motaloy in some 35 vehicles and have obtained marvelous results. In a majority of cases (all except 2 cars with burned valves beyond repair and/or broken oil and compression rings) the compression was brought up to factory specifications, oil consumption greatly reduced and gas mileage increased."
B.L.H., Instructor Automobile Shop, San Antonio, Texas

"We have sold Motaloy for nearly 8 years and have yet to have a dissatisfied customer. A good number of those who purchase buy again when they change cars. Many refer their friends to us when they see the results Motaloy gets in their own cars . . . a good job in increasing the efficiency and operation of their engine."
E.W., Service Owner, Texas

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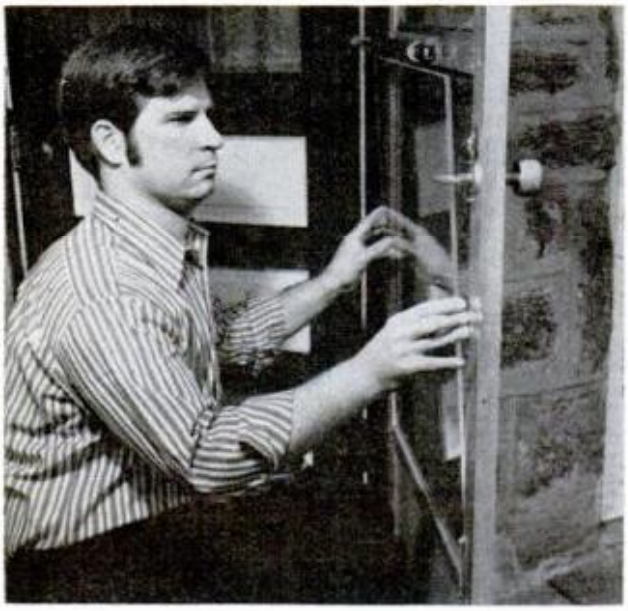
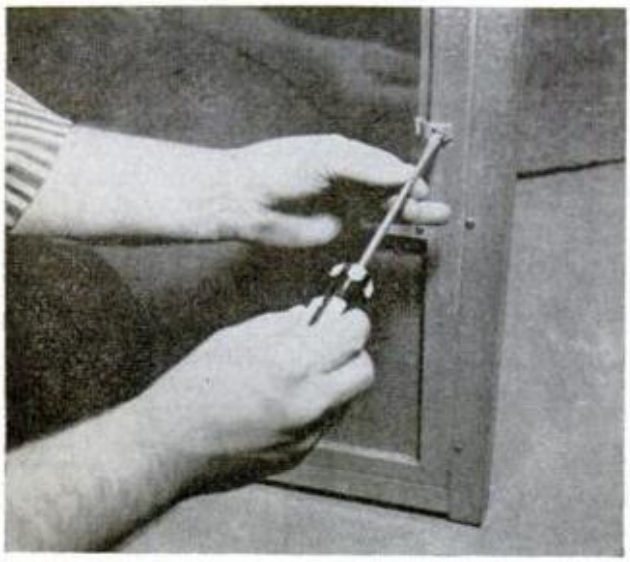
SAND THE CUT EDGES with a medium-grit paper. Smooth edges assure maximum break-resistance



PROTECTIVE MASKING PAPER is removed and sheet is installed, unframed, in the storm-door opening



TO FINISH, tighten sash-holding clips around opening just as you would for a conventional frame

SAFETY GLAZING

(Continued from page 162)

glass-door injuries are sustained by children 5 to 14 years old.

As a result, the National Safety Council, American National Standards Institute and Consumer Safety Glazing Committee have been working to establish a standard for safety glazing in residential and commercial buildings and, with details varying slightly, more than 20 states have added laws covering safety-glazing methods to their building codes. It is expected that such codes throughout the nation will be revised within a few years to recognize safety glazing.

Approved safety-glazing materials include acrylic plastic sheet, tempered glass, extruded sheets of polyvinyl chloride and extruded acrylic sheet. I happened to choose Plexiglas, but you can also use other clear acrylic sheet such as Lucite. In 1/10-in. thickness, it will fit the molding of most storm-door frames.

An easier way to glaze the door that lets you eliminate the frame is shown in the photos—1/8 or 1/4-in. material is recommended. Purchase a sheet sized as close as possible to the storm-door window opening, after allowing a 1/8-in. clearance on each side and the top when the sheet is installed to permit thermal expansion. If the sheet requires trimming, scribe and break it with the special cutting tool designed for sheet acrylic. You can also cut it with a power saw and fine-tooth blade.

Set the fitted plastic into the storm door opening and replace the retaining clips. For a firmer hold, shim the clips with small wood or rubber wedges.

To wash the plastic, apply a mild soap and lukewarm water solution with a clean, soft cloth. Rinse well and dry by blotting with a damp cloth or chamois. Periodic rubbing with a high-quality, hard auto paste wax—*not cleaner-wax combination*—will fill minor scratches and restore luster. Apply the wax sparingly and buff it with a flannel cloth.

Other areas where you might consider safety glazing are tub-shower doors and garage doors (the latter especially if you have a basketball backboard over them.) For a booklet containing other Plexiglas project ideas, send your name and address to the Rohm & Haas Co., Dept. PM, Box 9730, Philadelphia, Pa. 19140. Include 25 cents for postage and handling. ★★★

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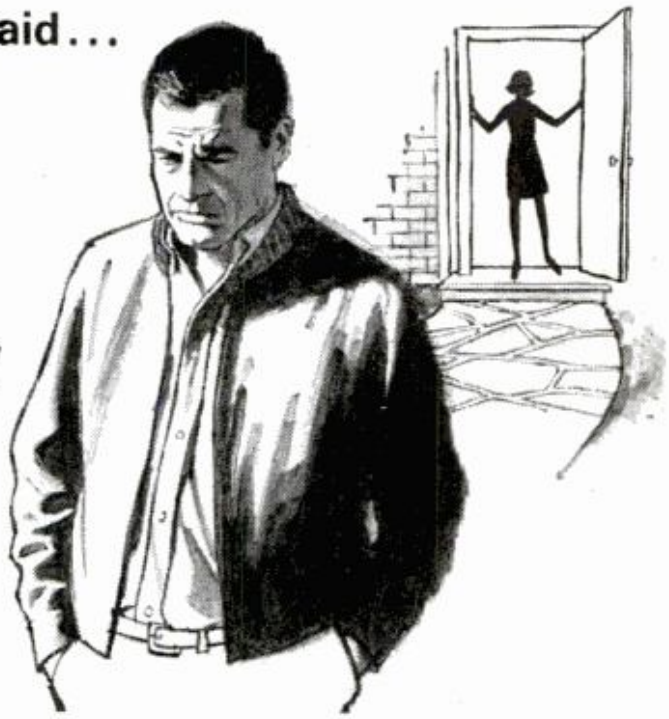
THIS CAN BE YOUR "BIG BREAK"

if you're a man who's ever said...

"I'm sick and tired of my Job!"



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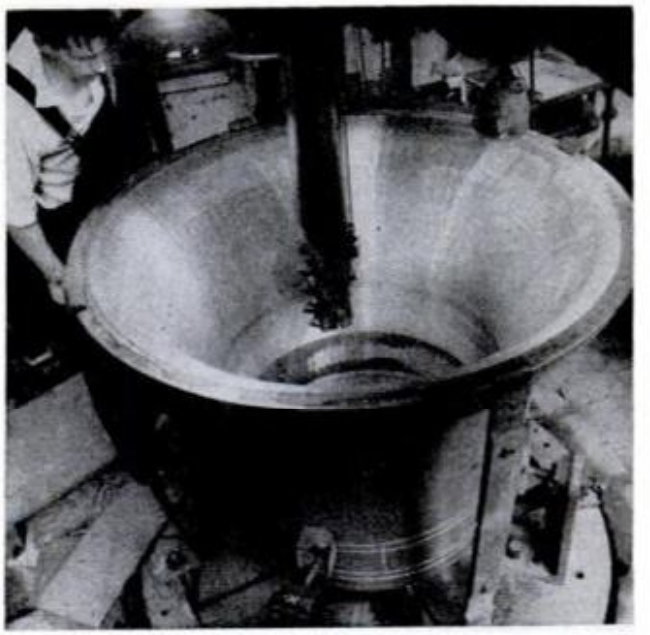
NEWS BRIEFS

Kitchen in a bowl

The handiwork of a French designer. this spherical kitchen can be covered completely by lowering the top. The bowl contains a range, sink and two wood cutting boards.

British bicycar

Local scrapyards supplied auto mechanic Stuart Turton with an 1100-cc Vauxhall engine, Triumph Herald rear axle, plus other parts to build this 800-pound trike.



New tune at Westminster

Six of Westminster Abbey's old bells have been melted down with the metal going into a set of 10 new bells being cast at Whitechapel Bell Foundry (top), a shop that has been in business in London for more than 400 years. The bells are tuned on special lathes that turn the bell (middle), rather than by chipping away the inside by hand as was done formerly. When the bells are hung in the Abbey they will be 30 feet lower than the former ones to reduce tower sway. The new level is also expected to improve bell tone.

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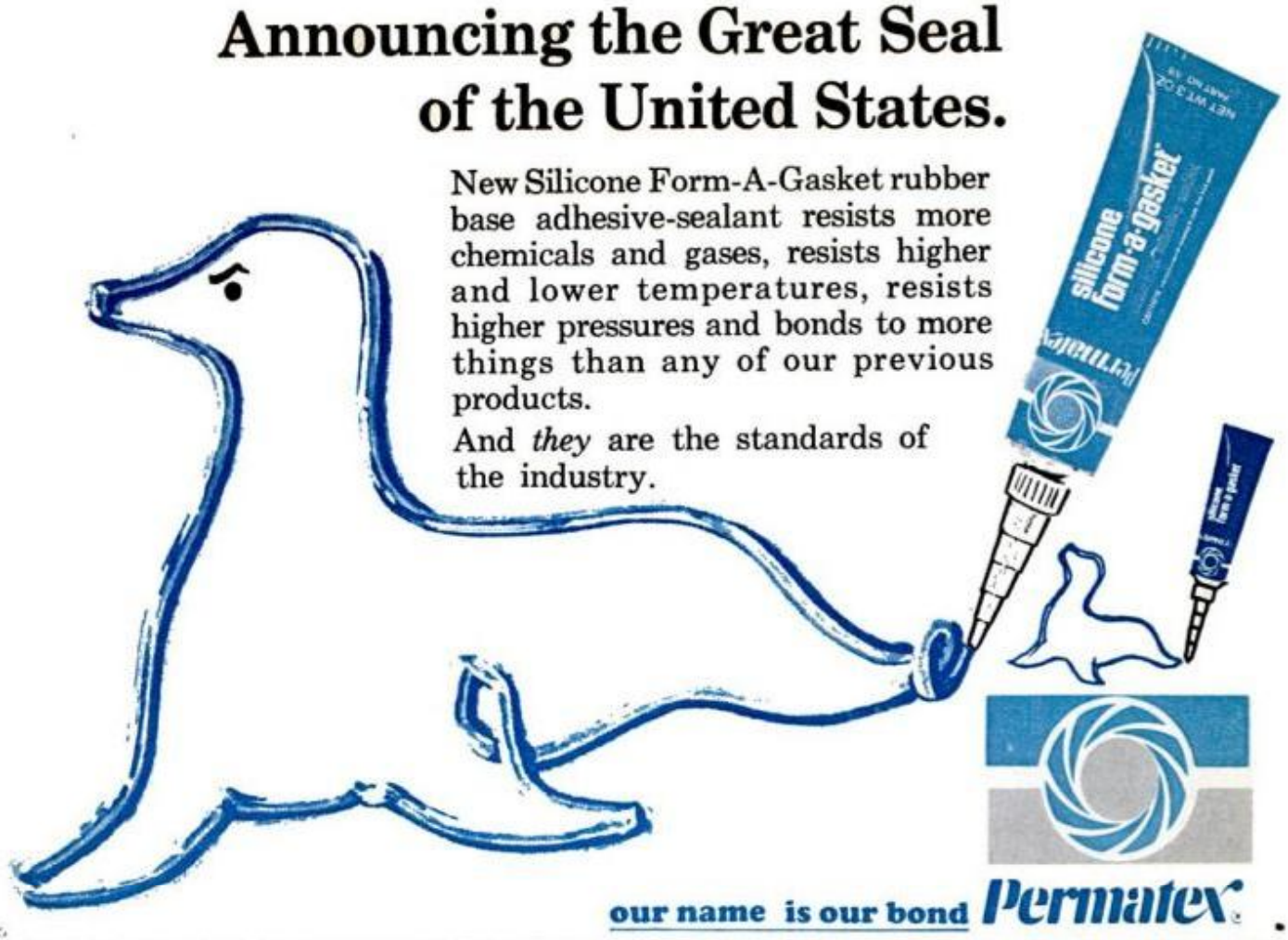

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ALL ABOUT TIRES

(Continued from page 64)

sarily a better tire. But you can usually figure that a cheaper tire will rate below average in one or more of the categories in which a tire is rated: tread life, stopping ability, rupture resistance and cornering ability. Many people buy tires on the basis of price alone, but that's a mistake. Price is only one factor.

What are some of the other factors?

This is the nitty-gritty of tire buying. You have to ask *yourself*—how many miles do I drive every year? How long am I going to keep my car? Because if you're planning to keep it only 12,000 miles, there's not much point in buying tires good for 40,000-mile tread life. And what *kind* of driving do you do? Do you usually drive 65 mph on freeways or 45 mph over potholed gravel roads or 30 mph on city streets? Do you carry heavy loads? What sorts of weather will you run into? Rain, snow, mud, ice? Some manufacturers publish informative guides to their particular tire lines based on the type of driving you do.

Has anyone ever figured out the cost of different types of tires on a mileage basis?

Yes. Recently Pat Ross, who's executive vice-president of B.F. Goodrich Tire Div., put the following figures on the different tire types: He said that to drive 1000 miles on a set of conventional bias-ply tires costs $1.65 to $1.80. Belted bias-ply tires run you about $1.30 per 1000 miles. And radials cost about $1.20 per 1000 miles.

I don't understand the new tire sizes. Why are some new tires called F78-14? Or G60-15? What was wrong with the old 6.00x16 system?

The thing that was wrong was that it didn't tell you enough about the tire. 6.00x16 simply said that you had approximately a 6-inch cross section and a 16-inch rim diameter. In F78-14, the F tells load-carrying capacity, which is about the same as for the old 7.75x14. The letter A indicates load capacity roughly equal to the old 6.00x16, and the letters go up to L, which has about the same load-carrying capacity as the old 9.25. Now the 78 stands for aspect ratio.

What's aspect ratio?

Aspect ratio means the ratio of a tire's height to its width. In other words, an F78 has an aspect ratio of 78—it's 78 percent as high as it is wide. The lower the number, the wider the tire. An F60-14 is 60 percent as tall as it is wide. And the 14 in F78-14 is still the rim diameter.

What about tire designations with an R in them?

The R stands for radial. An ER78-14 is a radial. Various codes also have different ways to say the same thing. For instance, 7.75R-14 is the old numbering system in inches, with no load capacity letter. 185R-14 is tread width in millimeters. Then with imported radials you also end up with some strange codes like FR70-HR14. Here the H indicates continuous speed capability. The H means this tire is good for up to 130 mph sustained. S means speeds up to 112 mph, and V means up to 165 mph. These last letters are used only for radial tires.

And what about load-rating symbols? What does Load Range B mean, or Load Range D?

Load Range B equals a four-ply rating; C equals six plies and D equals eight. This doesn't mean the tire actually has to have that number of plies. It's an equivalence. And, of course, a tire's load-carrying capacity depends partly on its inflation. The higher you pump it up, the more it can carry (within limits). But the maximum load capacity is stamped onto the outer sidewall of all new tires. For example, a tire might say, "Max. load 1500 lb. . . 32 p.s.i. max. press." That means that if you have four such tires and you pump them all up to 32 p.s.i., you can safely drive your car with a gross weight (car plus load) of 6000 pounds.

Does number of plies affect tire strength?

The fewer plies you have, the less internal friction and the less heat you generate. Most conventional tires today have four plies and a four-ply rating. Most belted bias-ply tires, like Goodyear's Polyglas, have two polyester body plies for the sidewalls plus either two or four fiberglass belt plies. Radials use from one to three body plies (rayon, usually), and two to four belt plies of fiberglass or steel. The low number of sidewall plies makes for cooler running, yet the belts give plenty of strength and freedom from tread squirm. Soft sidewalls keep the tread from lifting up in sharp turns, so you keep more rubber on the ground. And the belts contribute to puncture resistance and long life. That's why radials last so long and why belted bias-ply tires can, too.

I've heard that radials are the best tires

(Please turn to page 172)

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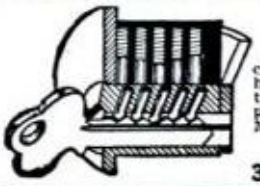

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ALL ABOUT TIRES

(Continued from page 170)

that a person can buy. Is this really true?

Again, we're back to that question, "Best for what?" Yes, on a cost-per-mile basis over the long haul, a good radial is hard to beat. If you get 40 to 50,000 miles from a set, you pay less per mile even though you pay more initially. A good set of four radials will set you back $190 to $250.

Do belted bias-ply tires ride "rough"?

A bit rougher than conventional tires. You feel some flat-spotting with fiberglass belts, just as you do with nylon. The reason the industry went to belted bias-ply in such a big way a few years back is that they offer some of the advantages of the radial—longer tread life, better traction—and yet they can be manufactured on the same equipment as old-style conventionals. To produce radials, a tiremaker must invest in a whole new range of very expensive equipment.

Will radials take over the way belted-bias tires have?

No one knows for sure. Predictions from Akron vary quite a bit. Goodyear predicted recently that only 5 to 10 percent of new Detroit cars will wear radials by 1975. B.F. Goodrich, on the other hand, predicted the 1975 percentage at nearer 40. Quite a bit depends on the automakers—whether they want radials, because radials do cost more and will up the price of a new car. No doubt, though, more cars will be wearing radials soon. As more are made, the price will drop.

I understand that belted bias-ply tires stand about midway between conventional bias-ply and radials in quality and price.

In price, they're about 10 percent above conventionals and 10 percent below radials. A good belted bias-ply tire will give you better roadholding and longer tread life than a conventional—in some cases almost as good as a radial. The trick, is to find a *good* belted-bias tire, and that's not always easy. Belted bias-ply buyers have had problems with out-of-roundness, flat-spotting, ply and tread separation and belt breakage.

Why do belts break? Is this very common?

These are usually fiberglass belts in belted-bias tires. Belt breakage used to be quite common. In 1969, retreaders reported a reject rate for glass-belted casings of 75 percent. That means only one out of every four fiberglass-belted casings was fit for retreading. This compares with a 33-percent reject rate for conventional casings. But the glass-belted casing reject rate is dropping, and for 1971 it was only 38.5 percent. Now the reason fiberglass belts break is usually because the tire hits a sharp object, like a rock or curb. Often you'll never have reason to notice the break, and often, too, the tire's conventional plies are plenty strong enough to make it safe. But there's always that chance of hitting the broken spot again, which can cause a blowout.

How can I tell if I'm getting a good belted bias-ply tire?

You can't, nor can you tell about any other type of tire. Some radials don't corner as well as some conventional bias plies. Just because it says radial or belted-bias doesn't make it good. Without a comprehensive quality grading system, you pretty much have to put your faith in your dealer and the manufacturer. You get no guarantee of a tire's quality, not even when you buy the most expensive premium steel-belted radial.

Then what about warranties? Don't they mean something?

Some do, some don't. You always get one, but they're all different. Most warranties replace tires that fail because of poor workmanship or materials. Some fix all punctures for free. Others prorate replacement on the basis of the amount of tread that's left. But that can be tricky, because some warranties let the dealer charge you an inflated price for the replacement tire, so the allowance he gives you on the remaining trade means nothing. Other warranties guarantee tread life for a specific number of months . . . 18, 24, 36, or 40. If the tire shows its tread-wear indicators before that time, the dealer gives you a certain preset, percentage in trade on a new tire. This is called a warranty but it's more like a guaranteed trade-in.

Be sure to read your warranty carefully. And deal with a brand name that you can get anywhere, so if you have to replace a tire, you won't have to go back to the dealer who sold it to you. If you're on a trip or if you've moved, that can be a hassle.

How can I tell if a tire sale is legit?

Shop around—see what other stores are charging for the same tire. Or wait for a sale—pick out a tire and then wait for it to be on sale. It's always a mistake to wait until that very day your old set quits. Start shopping before you need those replacements. ★★★

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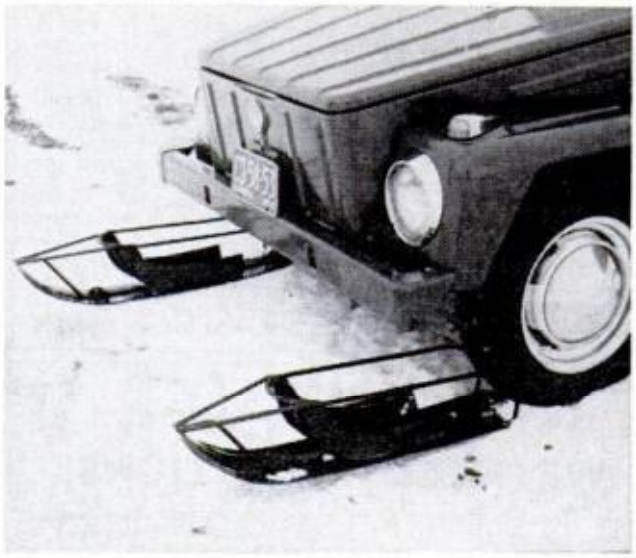

Kuebelwagen with skis

A Canadian who owns a Kuebelwagen—a German Army vehicle—has added a number of nonmilitary improvements to his car, including a pair of skis for the front wheels so he can use it in snow. The car, now powered by a 1500-cc Volkswagen engine, is basically the same design as the scout car used by the Germans in World War II.

BACK-YARD STORAGE BUILDING

(Continued from page 59)

construction. Codes vary from one area to the next, but they do spell out the distance that a structure can be built from property lines. Thus, forgetting to check could result in the unpleasant task of having to relocate the structure.

The exterior. Aesthetically, the best bet for finishing the Carriage House on the outside is to match both siding and roof shingles to the master house. But if shakes or one of the prefinished, newer materials will blend with the style of your home, you might consider using one of these. Then you will be able to enjoy your Carriage House season after season without additional maintenance. ★★★

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THE BICYCLE SHOP

(Continued from page 77)

cablestop. To bring the brake shoe closer to the rim, squeeze the brake yokes together with one hand and turn adjustment nut counterclockwise. If you cannot bring the brake shoe close enough to the rim this way, you will have to screw the adjustment bolt down as far as it will go (clockwise), then loosen the cable anchor nut and bolt, squeeze brake yokes together, pull the excess cable through the bolt with pliers and retighten the cable anchor nut and bolt. The type of side-pull caliper brake shown on page 76 has no cable anchor because the cable has a lead stop at both ends. Most caliper brakes have a cable anchor, though. When buying a replacement cable and tubing, I suggest you take your old cable and tubing to the bike store to make sure you get the right type and length. I also suggest you purchase an inexpensive set of metric socketwrenches—from 6 to 12 mm—a good investment if you intend to do your own bicycle repair and maintenance.

Center-pull caliper brakes can be adjusted by following instructions above for side-pull brakes. All you need know is that some parts are located in a different place. Cable slack can be taken up by loosening the cable anchor bolt and nut on front or rear brakes.

Troubleshooting tips for brakes

- **Brakes hard to apply.**

a. Loosen brake pivot bolt at front slightly (side-pull brakes only).

b. Check to see if brake yokes rub. If so, pry apart with long screwdriver.

c. Check cables for sharp angles where they go into yokes. Readjust cable angle, if necessary.

d. Put drop or two of light oil on brake pivot bolts and brake lever bolts.

- **Brakes do not hit rim evenly.**

a. If you have adjusted brake blocks as noted in this article and still can't get brakes to hit rims evenly, loosen brake pivot bolt at *rear* of headset (front brake) and *rear* of chain stay (rear brake), readjust yokes so rim is centered between blocks and retighten pivot bolt.

- **Brakes shudder when applied.**

a. Brake pivot bolt front or rear nuts are too loose, should be tightened.

b. Pivot bolts are bent, should be replaced.

- **Brakes squeal when applied.**

a. Brake shoes need replacing.

b. Check rim for foreign substance such as rim cement.

c. Check brake shoes for foreign substance embedded in shoes. ★★★

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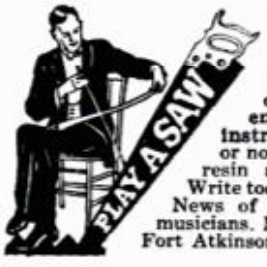

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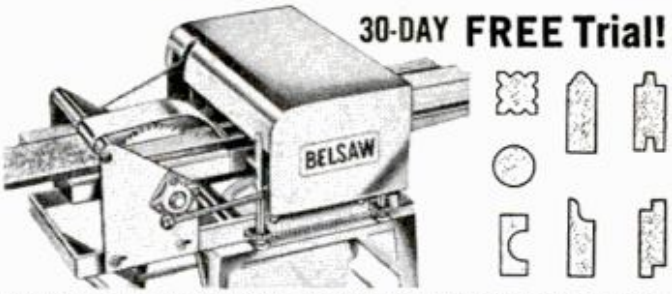

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BOATS YOU BLOW UP

(Continued from page 97)

ables are ideal, as the European creators of these and other compacts have known for years.

The price you'll have to pay depends, of course, on size, construction and, even more important, on material. The materials used in the less expensive models will be polyvinyl chloride (PVC). More expensive, longer life models will be made of bonded laminates of nylon coated and impregnated with neoprene or Hypalon (two types of synthetic rubber). In between these are various vinyl combinations and rubberized canvas.

The most maneuverable are the canoes and kayaks. Fishermen can backpack them into small ponds and meandering streams while, in experienced hands, they offer safe sport in white-water rapids. Several manufacturers sell them for under $100. Larger sizes gain some stiffness and additional safety with inflatable floors and seats. Two-man canoes are available with leeboards and sail for prices of about $185 to $300.

Least expensive are the small rafts shaped like elongated doughnuts. Both Sears and Spiegels list several sizes in rubberized canvas from $50 up. Gladding has also recently introduced models of this type. Among the most versatile inflatables are rafts of this same shape in larger sizes and prices from $100 to $400. Avon offers a special 15-foot river boat for white-water trips, priced at $1195, as part of its extensive line.

Because rafts are beamy, they are stable, but you sacrifice ease of rowing. This is best accomplished with quick short strokes. In the event of a man overboard, climbing back in can be tricky. They tend to drift away with any breeze and are propelled by a swimmer's efforts to kick and slide back aboard. To mount an outboard motor, the models with pointed bow and wooden transom give best performance, and water skiing speeds are possible with big engines. Sail kits are also offered for some models.

Sources of inflatables and information include Avon Boats from Inland Marine, Wilkes-Barre, Pa.; Imtra, Medford, Mass.; Seagull Marine Sales, Venice, Calif.; and Bonair Boats, Merriam, Kans.; Lidair and Nylux from Leisure Imports, St. James, N.Y.; Laros by Pirelli, Precise Imports, Suffern, N.Y.; Recreonics, Avenel, N.J.; West Products, Newark, N.J.; Universal Sportime, Yonkers, N.Y.; Zodiac of North America, Annapolis, Md. Remember—the more expensive models resist sun, abrasion, water and gasoline for long life. ★★★

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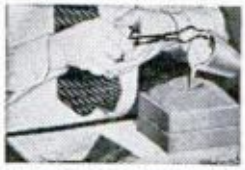

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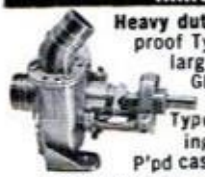

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RECORD YOUR OWN CARTRIDGES?

(Continued from page 83)

(Allied Radio Shack), BSR McDonald, Roberts, Sony/Superscope, 3M Wollensak, Telex and Toyo. Prices range from $99.95 to about $200.

For those who want a self-contained machine, Panasonic and Toyo offer a combination receiver-recorder that includes an AM/FM/FM stereo radio. Toyo's is about $210; Panasonic's, about $300. If you want to record while you're traveling, there's even an under-dash model for cars that both records eight-track tapes and includes a radio. Made by Boman Astrosonix, it can be removed on a special slide-out mount for use at home, too. Another take-it-with-you model is a battery-powered portable, by Toyo, that also has a built-in radio.

Blank tapes typically come in 40 and 80-minute lengths. Since each is divided into four program sections, a 40-minute cartridge gives you about 10 minutes' recording time per program and an 80-minute cartridge about 20 minutes. There are also some shorter tapes that provide approximately eight minutes per program. Prices run from about $2.50 to $5 depending on tape length and quality.

If you want to record while traveling, there's even an under-dash model for cars . . .

Because eight-track tapes are continuous loops, it's important to start recording at the beginning or you have no way of knowing where you're at or how much recording time you have left. The "beginning" is the point where the two ends of the loop are spliced together with a strip of metallic sensing foil. The foil is what triggers the shift from one program to the next. To find this spot, you simply run the tape through until the foil trips the switch mechanism, then you know you're at the beginning. Some recorders offer a "Fast Forward" control to speed up this process—a handy feature to look for.

Once at the beginning, you select the program you want to use—number 1, 2, 3 or 4—then start recording. Here's where it gets a bit tricky. Wherever possible, you want your recorded material to end before the trip mechanism switches to the next program. The switching produces a noisy click and a brief interruption that can be annoying when they occur in the middle of a musical passage. When recording from records and tapes, it's best to time the selections first to see how long they run. In popular music, you can usually get three to four pieces on a 10-minute stretch of tape. Plan your selections so they don't overrun the end of a program.

Long classical pieces will probably occupy several programs so that interruptions are unavoidable—you just have to put up with them. One way to minimize interruptions is to buy the longer 80-minute tapes.

As a safety feature, most recorders can be set to shut off automatically either at the end of each program or at the end of all four. This eliminates the chance that you may accidentally rerecord over a previously recorded section of tape, erasing the earlier material. This feature can goof you up, though, unless you're careful. If you set the recorder to shut off at the end of one program and the material you're recording runs longer than that, the machine will stop in the middle of a selection.

However, in the event you're not sure how long your recording will run, set the machine to shut off at the end of the fourth program. Then you can stop it manually at any point in between as needed.

On some machines, the cartridge is ejected automatically when the recording mechanism shuts off; on others, the mechanism stops, but the cartridge remains engaged. In the latter case, you have to remove the cartridge manually, wait a second or so, then reinsert it in order to restart the machine. With the eject feature, the cartridge is disengaged, but remains in the loading slot. All you have to do is push it back in to restart the recorder. As with most types of recorders, eight-track models have a separate "Record" button—usually bright red for easy identification—that must be pushed to start the recording process. This makes it unlikely that you will accidentally record over something you want to save.

While eight-track tapes can't be cut and edited after a recording, you *can* do a certain amount of editing during recording. When taping programs off the air, for instance, you can stop the machine at the end of a musical passage to cut out idle chitchat, news announcements, commercials and so forth, then restart it again at the beginning of the next selection. You can also mix two different inputs to create special effects. You can, for example, plug a phonograph into one channel and a mike or musical instrument into the other channel. This enables you to sing or play along with records, recording both simultaneously. ★★★

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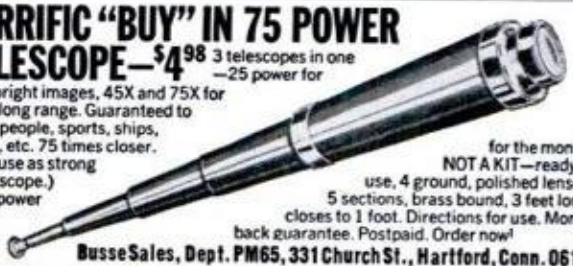

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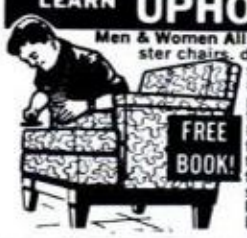

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NEW FOR '72 WATERWAYS

(Continued from page 90)

an underwater innovation, out of sight under the hull of its deep-V Sea Lancer. Called "Shal-O Draft," the prop and shaft spin in a semitunnel somewhat like the protective propeller arrangement brought from fishing boats to pleasure craft by Penn Yan Boats.

Most new hulls, however, stick with the recently popular deep-V designs for offshore "seakindliness" and with cathedral multikeel variations for more protected waterways. The "V" can roll a bit at anchor but cuts through larger seas with minimum pounding. Tri-hulls that have a major keel along the centerline and sponson-type smaller keels out at each side provide a lot of beamy cockpit space aboard, lift to skip along the surface with the hull on plane and settle in to stabilize the craft at dockside or at anchor so that passengers or fishermen moving around do little to rock the boat.

The powerplants available this spring make many of the new hulls possible. Up to 500 hp can be tuned out of high-performance racing MerCruiser and Holman & Moody engines. Chrysler has a new Super Bee III stern drive of 340 cu. in., and the big new outboards also allow placement of motor weight all the way aft for good planing performance. Many inboard boats are trying for the same trim with V-drives. Glastron, Chris-Craft and others offer water jet power and Outboard Marine has just announced it will market a water jet in addition to its stern drives and inboard engines.

Volvo Penta, the marine division of the Swedish car company, was the first to introduce a successful modern inboard/outdrive a few years ago. Now it is announcing a diesel that uses hydrostatic transmission. Particularly suitable for sail boats with limited bilge space, the engine can be mounted wherever convenient and only needs to be connected to the propeller by a flexible hydraulic line. Import of a Wankel rotary combustion outboard motor of about 10 hp from Germany has also been announced.

Offshore racing has had a strong influence in the development of famous names like Bertram, Thunderbird Formula, Donzi and Magnum, and this year the leader so far is Cigarette Racing Team, Inc., of N.E. 188th St., North Miami Beach, Fla. Three open models of 19, 24 and 28 feet overall are available for pleasure boatmen who prefer speeds over 50 mph. Racing versions of these Don Aronow speedsters completely dominated ocean competition last year.

Among smaller craft, that bass-boat boom that *PM* first predicted is now in full swing. The days when a fishing boat meant a leaky skiff are gone. Pedestal swivel seats, central steering console with perhaps a vertical stick control rather than a steering wheel for the helmsman in smaller craft, gunwales with no cleats to snag fishing lines and sometimes a gas outboard aft plus a foot-steered electric on the bow are signs of the well-equipped boat. Fiberglass and aluminum are by far the favorites for hull material. While Trojan and a few others offer options of wood in larger cruisers, the great majority of 1972 pleasure craft will be of metal or fiberglass-reinforced plastic. Innovations like stern platforms and transom doors that swing down into boarding steps, such as those Glastron offers, are developments that deserve more popularity.

Craft with open cockpits for utility and fishing use, like the larger new Boston Whalers, Aquasports, Makos and others, now provide safety for fishing and passages well offshore in moderate weather. Convertible tops and side curtains are becoming standard accessories that allow camping aboard. Models in 20-foot ranges frequently offer small cabins, as with Wellcraft's new Airslot 24, or even a mini-tuna tower as seen on the 24 Aquasport. Above this size, the flying bridge is increasingly popular this year. Aboard cruising sailboats of this same size and up, central cockpits are appearing that divide cabins both forward and aft.

New boats for the waterways of '72 will have more speed and range. Properly handled, that should provide more safety and years of useful life afloat. ★★★

SAVE ON YOUR NEXT CAR LOAN

(Continued from page 80)

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Two final money-saving tips:

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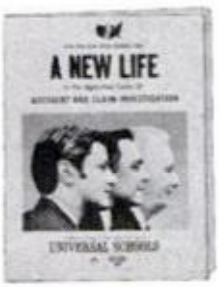

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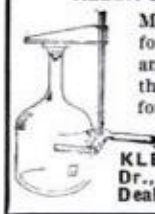

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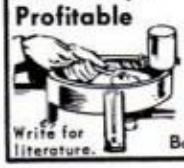

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(Continued from preceding page)

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(Continued from preceding page)

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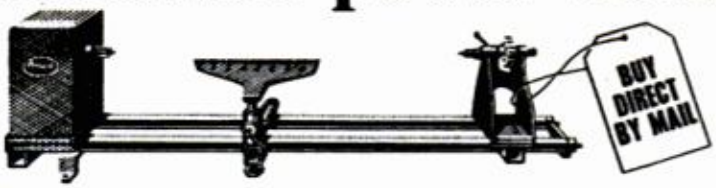

They do the same job as tools costing up to 5 times as much.

We skipped the chrome to save you money . . . but we did not skip anything on performance. Actually, we skipped more than just chrome, we cut out every costly frill that wasn't absolutely needed.

The lathe shown above isn't exactly flashy. We admit it. But in a recent article, Popular Science used it to demonstrate wood lathe technique and said: "You won't go wrong with this economical introduction to wood turning." It is typical of our tools which in spite of low prices, are full scale and offer full performance and precision.

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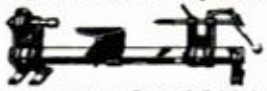

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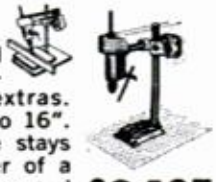

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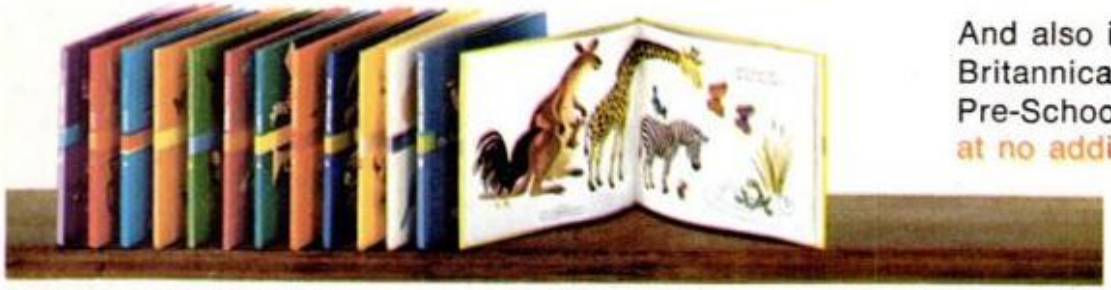

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But even Mercury couldn't have Thunderbolt without our special spark plugs. It takes a "cold" plug to handle a spark this hot. We came up with Perma-Gap spark plugs. A super-tough tungsten alloy center electrode resists spark erosion, provides amazingly long plug life. You may never need to change spark plugs again.

Thunderbolt. When we put something this good in our 140 hp—world's most powerful production outboard—why not pass it all the way down the line?

We did. Your Mercury dealer has the fastest start in boating for you. In all ten great Mercs. See him soon.

Complete range of power: 4, 7½, 9.8, 20, 40, 50, 65, 80, 115, 140 HP. For nearest Mercury Dealer, see the Yellow Pages under "Outboard Motors." Mercury Marine/ Division of Brunswick Corporation, Fond du Lac, Wisconsin/Canada/Australia/Belgium

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