

Need Extra Money? How to Make It Page 82

POPULAR MECHANICS

SEPT. 1971
50 CENTS

Like No Other Boat:
20 Pounds — \$60

Page 102



A
Convict
Reveals
**HOW YOU
MAKE IT EASY
FOR BURGLARS**

Mediterranean Coffee Table
You Can Build for \$35

FIRST OF THE '72 CARS

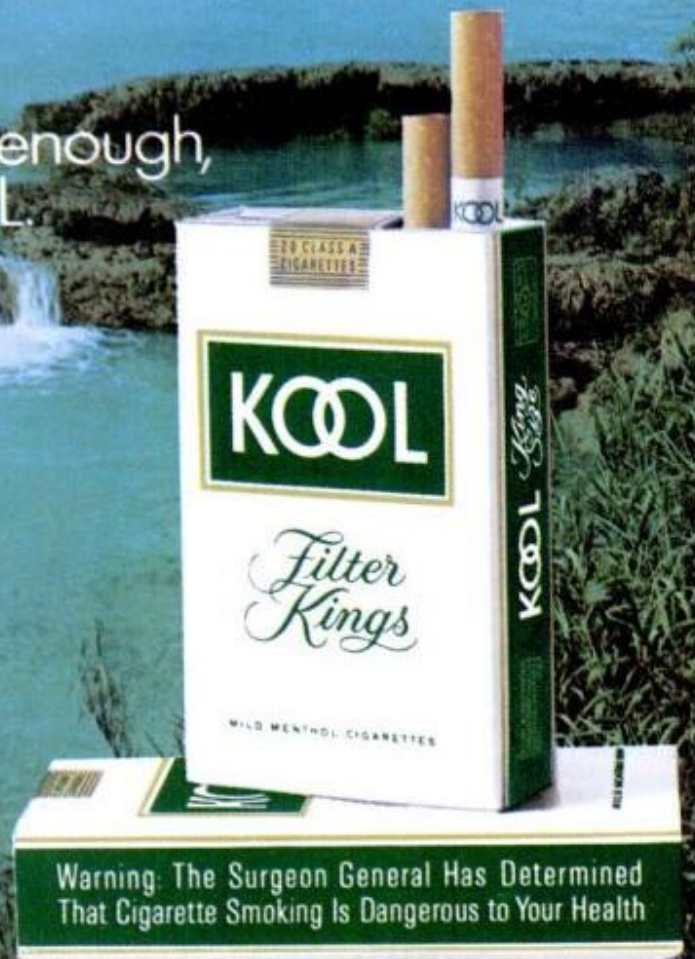
Page 98

Toaster Won't Work? Washer, Dryer,
Dishwasher Troubles? Write to Our
APPLIANCE CLINIC Page 146

The Awful Truth
About Helicopters:
UNSAFE AT ANY HEIGHT



If your menthol isn't smooth enough,
come all the way up to KOOL.



18 mg. "tar," 1.4 mg. nicotine
av. per cigarette, FTC Report Nov. 70.

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The shaver that beat the blades.



Early this year we introduced the new Norelco Tripleheader III. It's the closest, fastest Norelco ever—actually capable of shaving as close or closer than a blade. After using it two weeks, 112 men compared it with the leading chromium and platinum blades. The blades couldn't beat us for closeness. On comfort and lack of irritation, we beat the blades.

The secret is new super Microgroove™ floating heads. Designed in a revolutionary way, the heads gently press down the skin around each whisker and literally lift it *up* to the rotary blades. So the whisker can actually be shaved off *below* skin level!

The unique Norelco shave. Close but still comfortable. That's how we beat the blades.

Norelco®
We beat the blades.

This One




9WRG-TST-EPOZ

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SEPTEMBER 1971

1

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How to pick a shotgun shell that gives you a sporting chance.

Remington hunters can help you pick the right shot size... and Remington engineers make sure it travels straight and true.

Some people have an idea that shot size "isn't all that critical". But a hunter who tries to make do with whatever loads he happens to have on hand can be making a big mistake. Experienced hunters consider the kind of country they'll be hunting in, the kind of game they're after, when they're going after it... then they decide what shot size is best for that situation. Here are some of their ideas:

Ducks. For close shooting over decoys they use No. 7½. For middle range, the extra weight of No. 5 or 6 helps. And, for long range or fast passes, No. 4 seems to work best.

Geese. Wallop is needed here... the kind delivered by big loads with large shot such as BB and No. 2. Many hunters prefer No. 4 for denser patterns at shorter ranges.

Quail. For taking bobwhites early in the season when their feathers are light, No. 9 shot is adequate. But as the season wears on, feathers get thicker and heavier, so most hunters switch to a No. 7½ or 8 shot.

Pheasants. For cornfield shooting where long shots are usual, better use No. 5. On a normal rise over dogs and for all-around use, No. 6 is the favorite.

(Our 1971 catalog goes into more detail about shot sizes for other species. It's yours, free for the writing.) Making sure of your shot size is one thing. Making sure the shot gets to where it's supposed to go is something else. That's why it pays to know a little about the complete shell before you chamber it.

The key to successful shotgunning is "pattern"... how the shot is grouped when it reaches the target. The pattern should be dense enough to eliminate gaping holes for game to fly through. (Barrel choke is important in patterning, too, and will be covered in a future Remington Report.) The patented Remington and Peters "Power Piston" one-piece wad starts you off with a greater chance of getting your game.



Since the "Power Piston" (photo on left) helps cushion the shot when it's fired and keeps it from flattening itself against the barrel, more shot stays round. (The picture above right is shot fired from a competitive shell.) And since round shot shoots straighter, you end up with about 10% more shot in your pattern than with old-style wads.



(Incidentally, we make our own shot in our own shot towers, and it's made hard to prevent deformations. And we make sure it's round before it goes into the shell. Hard shot is more apt to stay round when it leaves the shell.)

There are good reasons why we put our "Power Piston" in a plastic shell. Properly made, a plastic shell stands up to bad weather... resists swelling, splitting or scuffing. And Remington and Peters shells are designed to chamber perfectly. They also have a special lubricant coating to help prevent chamber corrosion.

Our patented "Kleanbore" primer is a hunter's dream, because it won't rust or corrode shotgun barrels. These primers provide instantaneous ignition with up to

30% less firing-pin energy. And we take the time to match the primer to the load.

Remington makes two types of shotgun shells: powerful "Express" loads for long range, and "Shur Shot" field loads. Peters makes "High Velocity" long-range loads and "Victor" field loads.

Our Model 1100 automatic and 870 pump field shotguns are tested and matched with Remington and Peters ammunition. The result of that testing is that you tuck a real team under your arm when you go into the field. Since shotgun shells are usually the least expensive item on any hunting trip, why take chances with the wrong shell, when Remington or Peters shells can put the odds in your favor?



Remington Reports is a continuing series based on information straight from the Remington experts who design and engineer all Remington products. If you'd like to clip them out to make your own hunting and shooting manual, we'll send you a free folder to keep them in. To get the folder and the catalog, write: Remington Arms Company, Inc., Dept. 234, Bridgeport, Conn. 06602.

Remington® DU PONT® PETERS®
Great guns deserve great ammunition. We make both.

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Cover Photo by Jerry Imber Taken at Cypress Gardens, Fla.

Like No Other Boat: 20 Pounds, \$60—Unsinkable Water Wagon is the Bass Boat's Latest Competition

NEXT MONTH IN POPULAR MECHANICS

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- 40 Tips That Save You Time, Work and Money. Roundup of great shortcuts.
- Minicycles Offer a New, All-Family Sport. Slick two-wheelers are great for everyone.
- Dan Gurney Tries Snowmobiling . . . and finds it's almost as much fun as auto racing.

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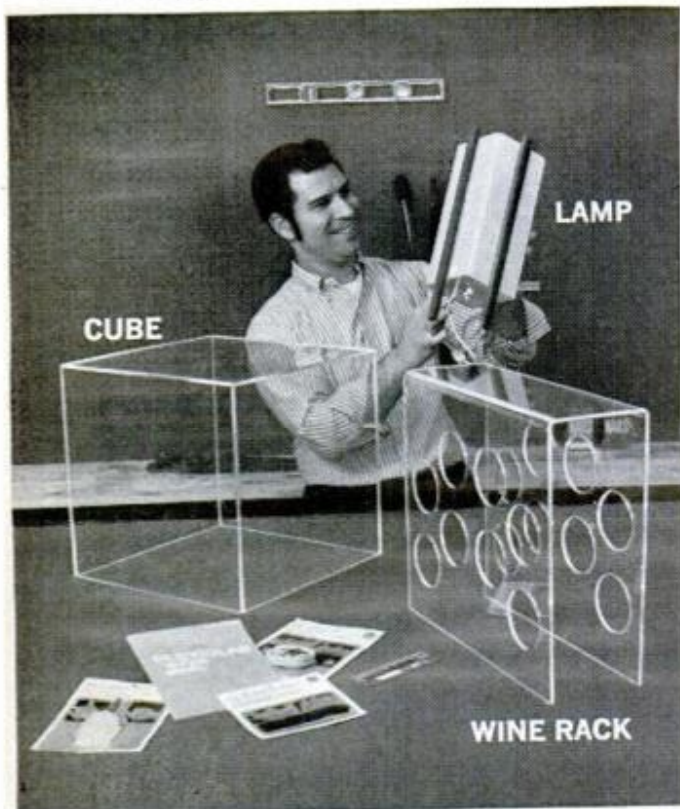
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LETTERS TO THE EDITOR

Stay in your own back yard?

I hope your author tells his friends to do all of their canoeing in their own back yards if he teaches them to handle a canoe as they're doing in *Back-Yard Float Trip* (page 92, July PM). In none of the pictures could I see anyone in the position he should be in for safe canoeing in water over three feet deep.

To be safe, get down on your knees and lean back against the thwart. If your knees are tender, kneel on a pillow. This keeps the center of gravity below the waterline and makes the canoe one of the safest craft afloat. If you sit on the thwarts or seat, the center of gravity is several inches above the waterline, which means that it takes only a slight movement sideways to cause a spill.

And never go out with only one paddle apiece. If one is lost overboard, an extra can be a lifesaver.

DRESDEN, ME.

FRED L. STOUT

Our author does say "... take at least one extra paddle on all trips; two are better." We agree that canoeists should kneel when approaching white water or in a storm, but even if the skipper runs a taut canoe, we've seen the best of 'em relax on seats when the going gets easy and the water's smooth.

Bad trip for prowler

After reading *Build PM's \$30 'House Watcher'* (page 120, June PM), I've come to the conclusion that it is infallible. If the lights don't scare the prowler off, the jungle of extension cords will surely trip him to death.

CARMICHAEL, CALIF.

THOMAS BLACK

Joy in the back forty

You did an admirable job telling *How to Enjoy More Summer Fun at Home* (page 123, Aug. PM). As my wife keeps telling me, it's all here in my own back yard. But how can you enjoy crabgrass?

RIVERSIDE, CONN.

JOHN AUSTIN

Lightly salted, with oil and vinegar.

Punch a mako on the nose

Included in *A Killer Shark May Save Your Life* (page 70, June PM) is a section on "How Not to Become Shark Food." The

(Please turn to page 8)

POPULAR MECHANICS

Материал, защищенный авторским правом

"Look who's smiling now!"

Sometimes a man sets his ambitions high enough to make skeptics smile. But how often he gets the last laugh! "At the time I started studying with LaSalle, I was working as a factory clerk. Before completing the course I was transferred to cost accounting and my salary was increased by \$1800. Now, having completed the course, I'm in charge of the department and headed for the five figure bracket. LaSalle's course helped me pull myself out of a boring and ill-paid job into a position of almost unlimited opportunity."

The words in quotes come directly from one of the pleased reports that are sent to us by LaSalle graduates. LaSalle files contain many letters from men and women who have increased their earnings with the help of LaSalle training. You, too, can prepare for the career opportunity of your choice through LaSalle home study—without interfering with your present work—and by devoting only a little of your spare time.

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Mr. _____ Age.....
Mrs. _____
Miss _____ (Circle title and please print)

Address..... Apt.No.....

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

LETTERS

(Continued from page 6)

last statement is: "... many sharks have been driven away by a sharp blow on the nose, even from a fist." This in itself is dangerous. The skin on a shark's nose is rough and scaly; a blow by a fist may drive the shark away, but chances are it will cut your fist, producing blood, which in turn will cause a feeding frenzy that endangers everything in the area.

LA SALLE, QUE. ANDREW MCGILLIVRAY

Our resident shark fighter says that the best haymaker a man can muster underwater isn't likely to break the skin on his hand because 1) the grain of a shark's skin lies in the direction of the blow and offers a relatively smooth striking surface and 2) the force of a submerged man's swing is quite limited. Any shark that flees after a blow on the nose is responding to fear, not pain; he's suddenly startled by becoming the attackee, not the attacker he thought he was. "But finally," says our expert, "if any shark has a mind to take you, you can play the Warsaw Concerto on his nose with both fists and you'll only be whistling Dixie—or, more appropriately, Nearer My God to Thee."

Young fleet owner

Our son has played with his *Mini-Truck Fleet* (page 174, Dec. PM) for three



months and he really enjoys the toys. Thanks for this project plan.

FINDLAY, OHIO

JOHN WASILKO

Wiper control? No—after '69

I would like to build your *Speed Control for Windshield Wipers* (page 138, Jan. '70 PM), but a friend of mine says he installed one on his 1970 Chevelle station wagon and has been unable to get it to work properly. I have a similar wagon,

(Please turn to page 10)

TOOLS CAN'T FIX EVERYTHING.



That's why Mystik[®] created a line of tapes that should be in every tool box.

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Pick up a set wherever you see Mystik's Tool Box Tapes display. That way, if your tools can't fix it, you can always count on your tapes.



Send self-addressed stamped envelope for free booklet on "How to do it better with tape" to Mystik, Borden Chemical, Division of Borden Inc, 50 West Broad Street, Columbus, Ohio 43215.

TOM McCAHILL SAYS:

“You can pocket \$5 to \$7 an hour if you're good enough to fix these things.”

The coming of the automobile built a multimillion dollar service industry in a few, short gas-eating years. The same thing has happened in the electrical appliance field. Manpower is desperately needed now to repair appliances.

But there is one big difference. Anybody with a few simple tools can get started in appliance repair. No expensive equipment is needed.

What is needed is the right kind of training. You can't strike it rich in today's job market with nothing more than muscle. Nor can you hang onto an old-time job skill while an electronic monster with buttons replaces men around you. It's like driving a buckboard down the Jersey Turnpike. The fuzz would locate you fast and send you out to pasture.

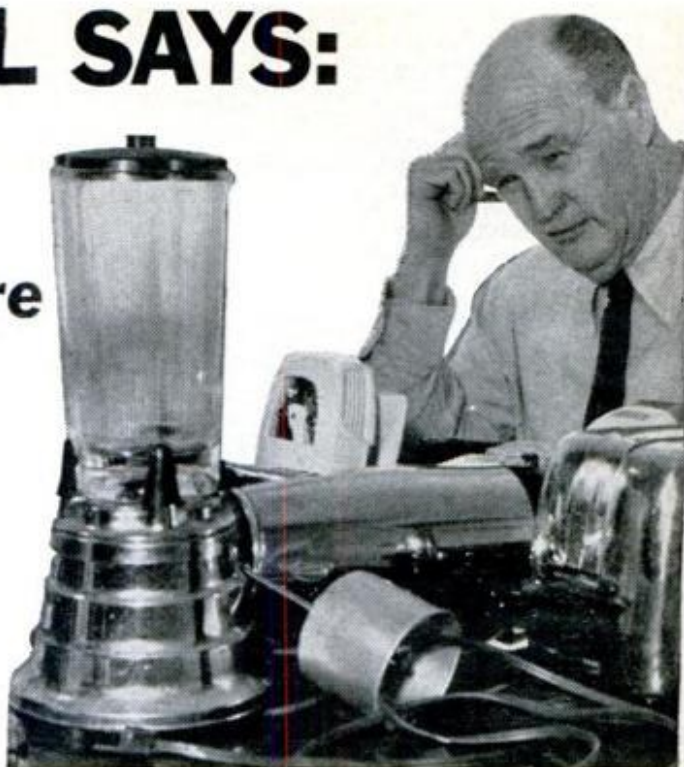
If you want an up-to-date job skill with good opportunity—why not take a look at the Electrical Appliance Repair field?

This field is loaded with opportunity because every house in our high speed land is loaded with appliances. There are about four times as many appliances as we have men, women, children and babies in the good old U.S.A. There are over a billion of these electrical gadgets being used, abused and broken. If you know how to do fast repair jobs on them, how much you can earn can well depend on how much you want to earn.

The opportunities in this field are all the better because you can prepare for them fast. There's one short, sweet course you can take right in your own home and it covers everything. I'm referring to a home-training course offered by the Appliance Division of National Radio Institute—one of the biggest and oldest home study schools of its kind.

NRI gives you the whole works. Their training covers basic electricity and how to use test instruments. They cover the electrical and mechanical operation of every type of appliance from toasters and coffee-makers to dishwashers; from vacuum cleaners and automatic laundry equipment to air conditioners and refrigerators. They even show you how to fix farm and commercial appliances and small one-lung engines.

The training is designed to be interesting, practical and fast. You can make \$5 to \$7 an hour extra fixing



appliances in spare time starting soon after you enroll. They give you all you need to know to do fast, profitable repair service. They even include equipment without charging you extra. And the full cost of the training is surprisingly low.

If you are driving a buckboard in today's job market, at least find out what the Appliance field can do for you. NRI sends you a fancy, illustrated book about their training so you can judge for yourself. There's no obligation and they don't send a salesman to pressure you. All I say is get the facts and see for yourself. Send the coupon today while you are thinking about it.

Tom McCahill

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Address _____

City _____ State _____ Zip Code _____

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LETTERS

(Continued from page 8)

but a 1971 model, and am wondering if it will work on mine.

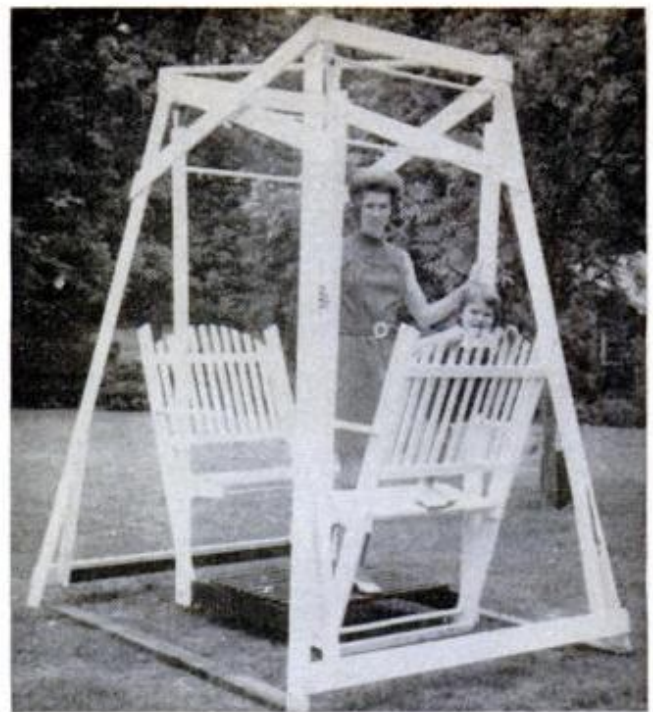
CHICAGO

GRISWALD GREEN

The control works well on older model cars, but, unfortunately, at the time the article was being written, Detroit was in the process of making substantial changes in wiper circuitry. As a result, the control cannot be made to function properly on late-model cars, especially those with two-speed wiper controls. The designers of the project have made several attempts to come up with modifications to permit it to be adapted to newer cars, but there are so many variations from model to model that this has been impractical.

Good diagnosis, doctor

My son Robert's industrial arts class at Hernando (Miss.) City High School built the *Old-Time Yard Swing* (page 140, April PM) for his mother. It looked funny to me, so I cut its height about 18 inches—just two weeks before your June issue came out with the corrected height of 8 feet. My daughter and granddaughter give



the "new" swing a more reasonable appearance.

BATESVILLE, MISS.

DR. M. P. MEACHAM

Shock-replacement warning

In *New Shocks . . . and You Save \$22*

(Please turn to page 12)



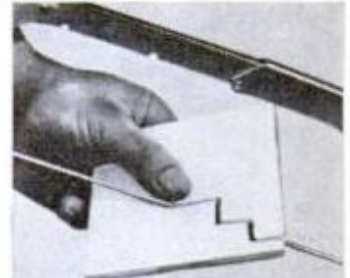
Hacksaw Blade. New! Virtually unbreakable. Makes thin, straight cuts. No need to protect the edge when you carry it in your toolbox.



Circular Saw Blades. New! No need to change blades when you change materials. Come in 6½", 7", 8" and 10" diameters, to fit most saws.



Saber Saw Blades. Universal ¼" shank saws, coarse grit for fast cuts, fine grit for smoother cuts. Make plunge cuts in tile, cut small circles. Also available in 4" and 6", ½" shank.



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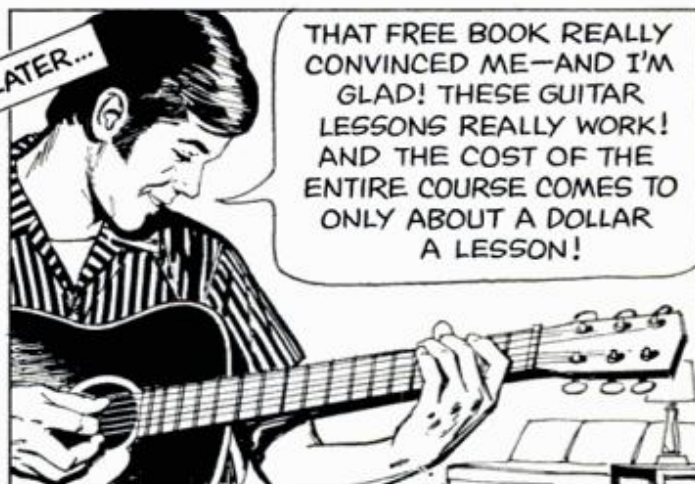
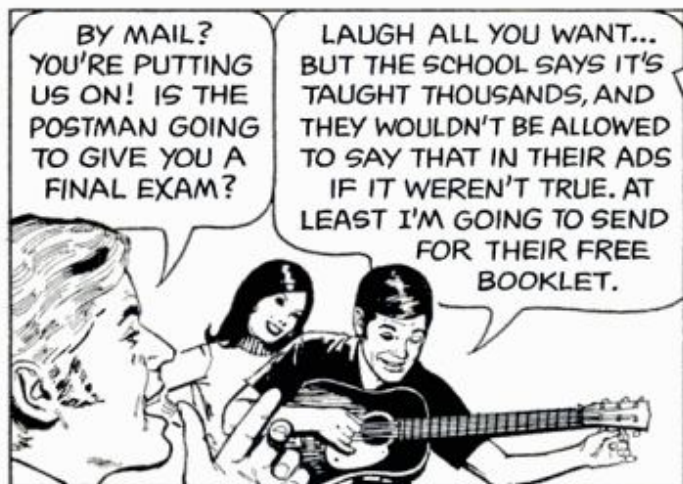
They can cut glass, cement-asbestos, tile, fiber glass and the hardest metals; make smoother cuts in veneers and laminates; help you do jobs you couldn't try before.

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LETTERS

(Continued from page 10)

(page 120, July *PM*) it would have been wise to mention that, when you are removing shock absorbers, the lower control arm and rear axle should be supported to avoid a serious accident due to sudden coil-spring tension release.

NORWALK, CONN. \ DAVID E. SEYBOLD

Van conversion a la *PM*

Using the ideas in *From Van to Camper*—\$340 (page 148, Feb. *PM*), I bought and converted a Ford Econoline van.



The top was built of 1/4-inch exterior plywood and 2x2 and 2x4 framing. The adjacent roof abutment took some kerfing of the bottom 2x2 for proper fitting. I sealed the entire top with fiberglass resin, epoxy-base paint and marine enamel.

The dimensions are almost the same as in your article with a 40° slope in front, 12° on the sides and 15° in the rear.

SAN FRANCISCO

F. J. KIELIAN

Amazing progress

I was interested in the item, *Tow Truck in Your Trunk?* in *On-the-Go Camping* (page 28, July *PM*). It describes an \$89.95 kit that permits one to pull his vehicle out of the mud.

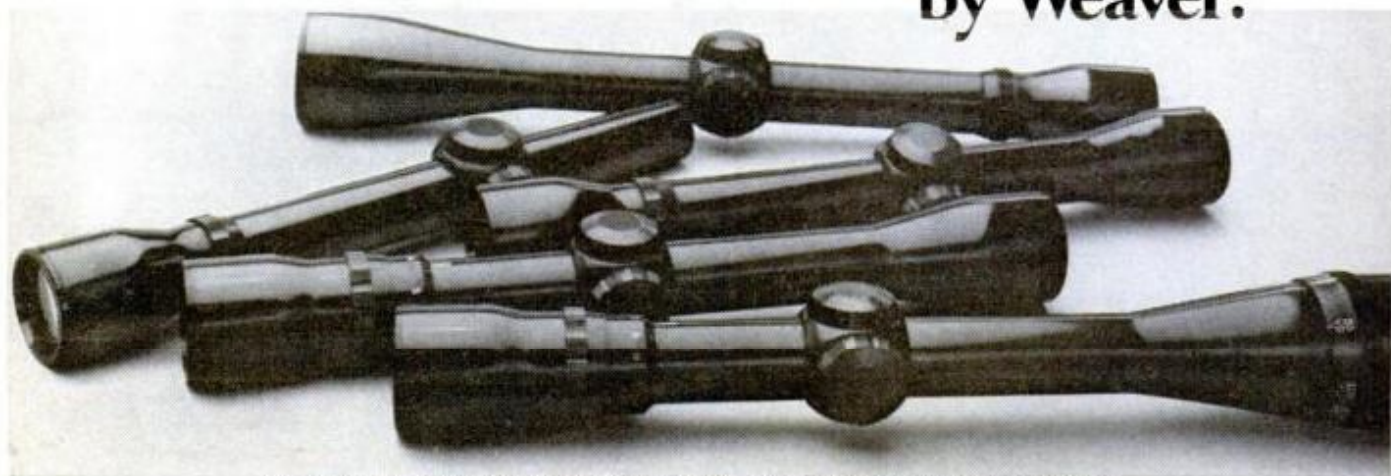
Forty years ago, when I learned to drive, cars had hubs on the wheel that protruded—and spokes that were real. I always carried rope under the rear seat, and when stuck we could use a tree or another car as an anchor and just tie the rope to the spokes and wind it up on the wheel hubs. We got that “accessory” as part of the basic price of the car plus the cost of 100 feet of rope. I am amazed at the progress we have made in 40 years.

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"What started as a hobby, now pays me \$10 an hour"
 Yes, many MUI graduates make better than \$10 an hour turning old wornout furniture into bright new decorator pieces! **Stack it up against what you're doing now!** Are you making \$150 a week? \$200? \$250? Do you put in long hours of dull work, with small raises? Is that the way you want to spend the rest of your life? Just imagine, you can make \$150, \$200, \$250 upholstery just **one chair or sofa** these days! And if you're the kind of person who likes to work and earn, you can sometimes finish a job like this in a day. That's pay, ... and it beats what most college graduates make!

AS YOU LEARN, YOU JUST SLIP INTO THE IMMENSE FLOW OF UPHOLSTERY WORK! Think of all there is! . . . Sofas, lounging chairs finished in beautiful fabrics, which MUI tells you how to get at the right price — even leather and all the new vinyls. And then you have built-ins and breakfast nooks, boats, trailers and all the millions of automobiles in America. Yes, you learn all this and more! When we finish teaching you, (in your own home in your spare time) and when you get our California state approved diploma, you **know** this business . . . as a **real professional!** You will then have one of the most fantastic moneymaking skills in America built into your head and hands! No one can ever take this skill away from you . . . and no one can ever fire you, because you're the boss of a business that you can take with you . . . You can make big money from then on . . . any time, anyplace you want to put out your shingle!

When you read the papers you see there's a strike here, a lockout there. Detroit lays off 150,000 men. A plant is shut down and moved out of state. A new automated machine eliminates 5,000 jobs. They talk about dislocated workers and try to do something about it. What pays the bills if you get caught up in one of these situations? When you know upholstery, life gets very simple and lots of fun. It's simple because where there are people, there are upholstery jobs and lots of them. It's fun because life is fun when the bills are paid and there's money in the bank, even enough to buy those things you've always wanted for yourself.

MUI IS APPROVED BY THE CALIFORNIA SUPER-INTENDENT OF PUBLIC INSTRUCTION AND IS AUTHORIZED TO ISSUE A DIPLOMA IN UPHOLSTERY.

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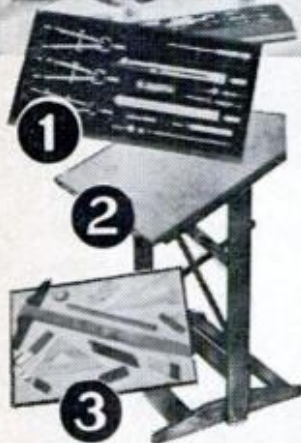
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POLLUTION FIGHTERS'

NEWSLETTER

ENVIRONMENTAL JOBS MAY DOUBLE during this decade. With the rising interest in restoration of the environment, says Herbert Bienstock, New York regional director of the U.S. Department of Labor's Bureau of Labor Statistics, the number of people now employed in environmental activities—665,900—could double to 1.2 million by 1980. He notes the areas of oceanography, geology, meteorology, architecture and wildlife conservation as fields that are growing rapidly. He expects, too, that 50 percent more people—150,000—will be engaged in water-quality improvement by 1975.

MOBILE COLLECTION CENTERS may soon be coming to you, if you're unable to bring your refuse aluminum to a recycling station. Reynolds Metals Co. now operates 11 traveling reclamation units throughout the United States—five trucks in which aluminum is magnetically sorted from other metals and stored in bins, and six trailers in which aluminum is shredded. These units pay 10 cents a pound for aluminum (material is weighed on an electronic scale in tenths of a pound)—in cash for up to \$10 worth or by check for a higher amount. For information on places and dates of collection scheduled for the reclamation units write: Reynolds Metals Co., 6601 West Broad St., Richmond, Va. 23218.

TREES FOR BEANS. If you're a pork and beans fan, have 45 cents to spare and are moderately selfless, you can easily help restore our nation's wasted lands. The Hunt-Wesson Co., of Fullerton, Calif., producer of Big John's Bean 'n Fixin's, initiated a "trees-for-beans" program in November, 1970, which has thus far resulted in the planting of 55,000 evergreen trees in the fire-ravaged national forests of the Pacific Northwest. Hunt-Wesson's promise to the consumer—that one evergreen tree will be planted at Hunt-Wesson's expense for every label taken from a can of its product and sent in to the company—is validated by a certificate, which is signed by the chief of the U.S. Forest Service and the president of Hunt-Wesson. The signed certificate is sent to each participant in the program to acknowledge the planting of his tree.

AN ECOLOGY RESEARCH CENTER is under construction at Oak Ridge. The U.S. Atomic Energy Commission expects the \$440,000 facility to be completed by the spring of 1972 at its National Laboratory at Oak Ridge, Tenn. Primary goal of the project is to determine the effects of thermal discharge on aquatic life in lakes and streams surrounding electric powerplants discharging heated water. The usual effect has been adverse: Heated water accelerates the growth of undesirable plants and bacteria.

RECYCLING FILM.—*Recycling . . . just what does it mean? According to the National Assn. of Secondary Material Industries, Inc. in its film, Recycling Resources (available to all nonprofit groups for \$9), recycling is ". . . the utilization of waste as valuable new resources . . ." For details write the association at 330 Madison Ave., New York, N.Y. 10017.*

A NEW BOOK, *Opportunities in Environmental Careers* (Universal Publishing and Distributing Corp., \$5.75), offers many suggestions as to ways you can help ease our ecological crisis through an environmental career. The author, Odom Fanning, describes opportunities in such fields as environmental management, ecology, earth science, resources and recreation, and environmental design and environmental protection. He includes source lists for additional information.

EIGHT PORTABLE INSTRUMENTS for measuring environmental conditions underwater have been designed by Beckman Instruments, Cedar Grove, N.J. The instruments, intended especially for schools are:

1. Turbidimeter—measures water transparency as changes (winds, tides) occur.
2. Electronic secci disc—investigates water transparency to determine depth plants can grow.
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DO YOU KNOW about some action being taken to fight pollution that we don't know about? In your community? On the job? Tell us about it. Write Environment Editor, *Popular Mechanics*, 224 West 57th St., New York, N.Y. 10019. ★ ★ ★



Transport 500 Wide Oval, Traction All Season
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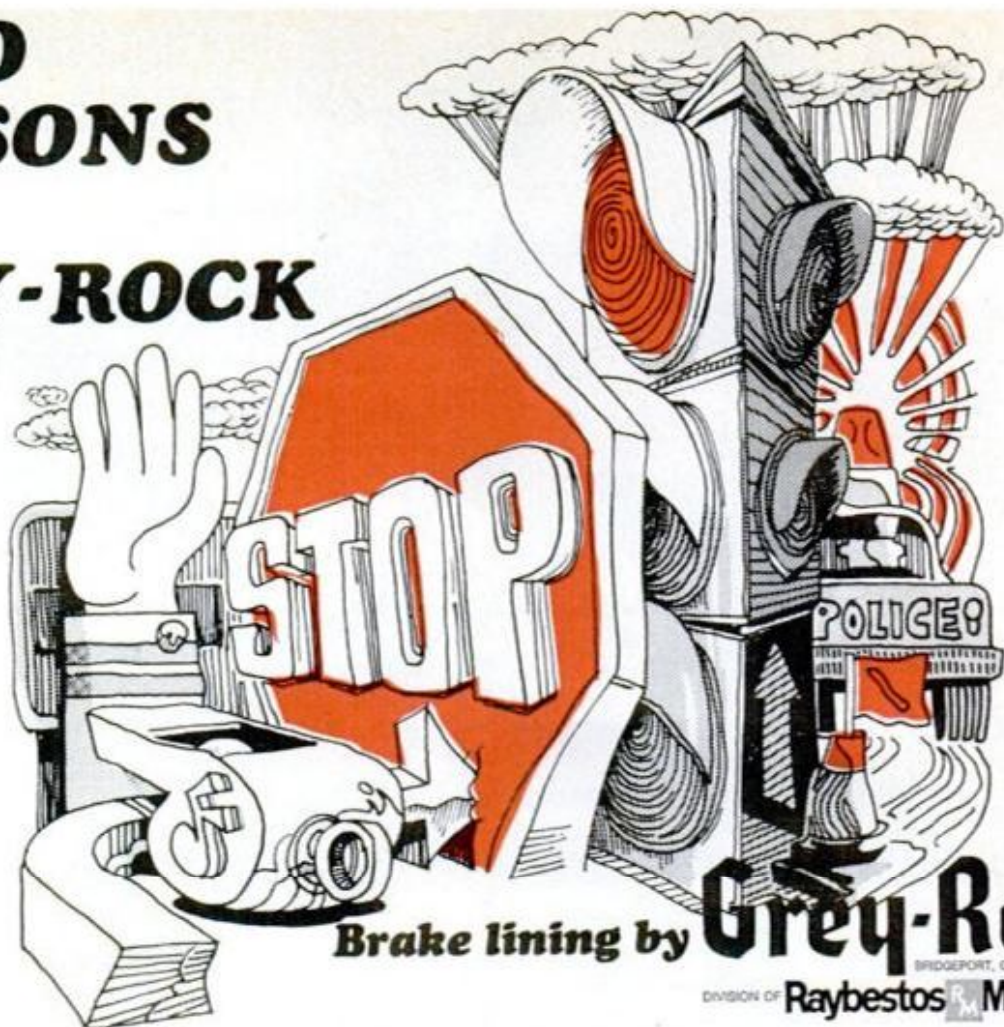
The Transport 500 Wide Oval puts more rubber on the road for more stability and a whisper-smooth ride. And up to 50% more mileage than the Firestone tire it replaces.

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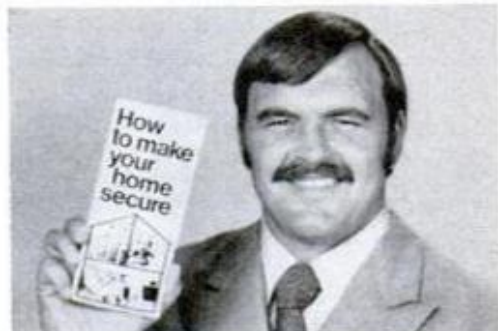
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By JOHN PEARSON



Egg launching in Canaries



Gem diamond gets the eye



The draftsman is a machine

A SCIENTIFIC EXPERIMENT OF SORTS recently washed up on the shores of Trinidad. It was a 10-foot-long, 800-pound plastic "egg" that had been set adrift nine months before from the Canary Islands, off Africa's northwest coast. Swiss researchers, including the egg's sculptor, wanted to find out if wind and current would cause the art object to drift along the same route to America followed by Columbus in 1492. When the Trinidad coast guard found the egg, it was shattered. Missing were an automatic movie camera and a time-recording mechanism.

BABIES WHO SUCK THEIR THUMBS are only doing what comes naturally. That's the opinion of a Northwestern University physician, who says the habit is a way of getting rid of excess energy. He points out that similar baby habits—such as swinging a foot or lip biting—often carry on into adulthood.

THE "ROCK" SEEMINGLY BEING OGLED by the praying mantis is one of a collection of man-made diamonds recently presented to the Smithsonian Institution by General Electric. Last year GE synthesized gem diamonds—a trick scientists had been trying to pull off since around 1800—by subjecting graphite to extreme pressures and temperatures in a special vessel. The gem shown weighed one carat before cutting.

A TINY SUPERBATTERY that's activated by air and reportedly lasts six times longer than conventional types has been invented by a British company. Called the Metair Primary Cell, it's a spin-off from fuel cells developed for the U.S. space program. It weighs a quarter ounce and is rated at 250 milliamperes and 1.5 volts. Unlike standard mercury-zinc cells, the Metair gives constant voltage throughout its life—a boon to users of hearing aids and other small electronic devices. To activate the cell, a plastic covering is removed, letting air enter through minute holes. The maker says the battery has fuel-cell cathodes and zinc anodes, but how air "turns on the juice" is a well-kept secret. You may be able to buy a Metair battery later this year.

BAD NEWS FOR DRAFTSMEN is a computer-plotter system developed by New York architect Lawrence Lerner. Specifications fed to a computer are turned into pulses that move a plotter head (at right in photo). The head moves on a cushion of air, is propelled by electromagnetic forces, and draws with wet ink or pencil. The system now is turning out interior drawings for the new Sears, Roebuck Chicago headquarters—tallest building in the world. ★★★

POPULAR MECHANICS

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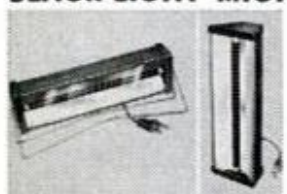
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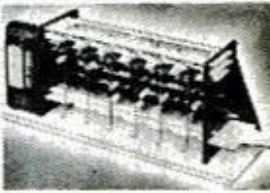
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Solve problems, teach logic, play games with miniature version of giant electronic brains! Adds, subtracts, multiplies, shifts, complements, carries, memorizes. Colored plastic parts easily assembled. 12" x 3 1/2" x 4 3/4". Incl. step-by-step assembly diagrams. 32-p. instruction book covering operation computer language (binary system) programming, problems & 15 experiments.

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ASTRONOMICAL TELESCOPE KITS

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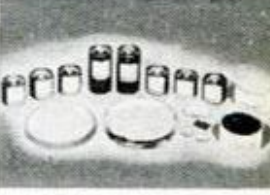
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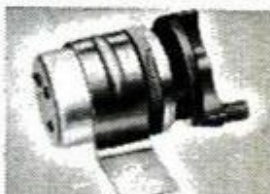
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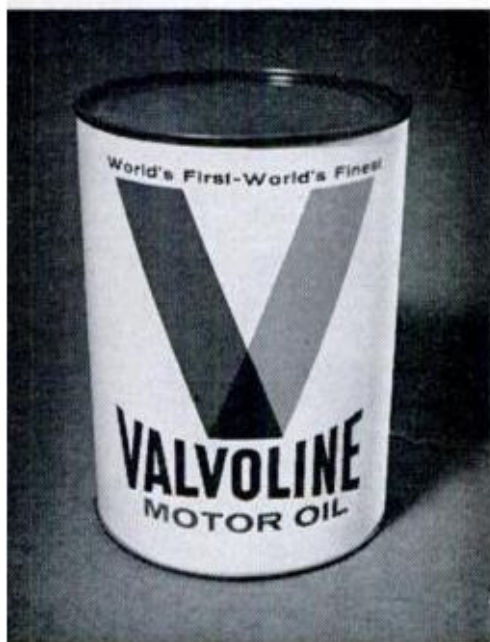
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DETROIT

LISTENING POST

BY ROBERT LUND

LOOK AT THE '72 CARS with a sharp eye; you may be able to see the beginning of a movement away from the long-hood short-deck shape in styling. Just barely and not on all of 'em. Detroit's trying to make cars more crashworthy and the theory is that a more even distribution of weight and metal fore and aft would provide a better cushioning effect in an accident. The long hood gives more protection, more area to absorb energy, in a head-on crash. But you pay for it if you get tagged from the rear, because there's not much metal to soak up the blow. Cars are due to take on a new shape even without this incentive, because the stretched hood, stub deck has been just about played out.

A NEW SPORTY PERFORMANCE CAR is in the works at Ford—actually two cars: one for the Ford label and a derivative for the Mercury emblem. They'll be somewhat tighter than the present Mustang in the length, a little bigger in width. Starting price is expected to be around \$3000. They'll be ready for fall of '73 or '74.

UP AND OUT. Car roofs and windshields are going in these directions over the next couple years: Roofs will have to go up because seats are going to become more erect. This calls for raising the roof two, maybe three, inches. At the same time, windshields will be pushed out (in the direction of the hood) three to five inches to increase the safety zone if you're propelled forward in an accident.

ULTRASMALL CARS FOR 1975 will not reach the point of no return if GM and Ford can help it, so long as there's a chance the government might require reworking them. Only way to make certain the shavetails will pass inspection is by turning the plans or prototypes over to Uncle. But that means the vehicles become a matter of public record and the cat's out of the bag. The companies are trying to work out a deal to have details of the cars withheld until they are closer to production. This has been done before.

Why all the secrecy? It's the old argument that if you reveal your hand too soon, people might not buy what you're selling today

because they'll wait to see what the new one looks like.

MONEY SPENT TO IMPROVE CARS cannot be judged by what shows on the surface. Even the few all-new machines for '72 don't look much different from the '71s. But the auto companies are putting millions where it doesn't show—on safety items, beefing up the hardware, making cars more durable and easier to service. Ford, for one, says it spent substantially more for hidden improvements on its '72s than it shelled out in other years for changes that were largely frosting on the cake.

OPTIONS MAY BE CUT BACK. It looks as if the auto industry is quietly backing away from the idea of letting the customer design his own car by adding or subtracting dozens of options—though nobody's admitting it. More and more car producers are adopting a 5-95 approach to what goes on an automobile or is left off. This means if an item doesn't go into five percent of production—after a fair trial—it's discontinued.

The opposite side of that coin is the option that makes it big. If it goes into 95 percent of production, it's made standard. Either way, the customer loses the right to decide what he wants in certain accessories.

INSURANCE RATE CHALLENGE. Auto company archivists are saving up those full-page ads and statements by insurance company executives promising reduced rates on cars if Detroit will design automobiles the way the insurance industry thinks they should be designed.

"They'd better be prepared to make good," a Ford source says, "because we're going to remind them of their promises when we've made the changes they've been bugging us about." Car builders acknowledge they could build them better and they're working on it. But they're burned over the insurance companies socking it to them in ads.

EGG-CRATE GRILLES ON THE WAY OUT? Not on '72s, but beginning with the '73s. Aside from the fact they're fragile and easily damaged, designers don't like the looks of the cross-hatch-

(Please turn to page 30)

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THE FOLLOWING ITEMS, OPTIONS ON SOME OTHER MODELS, ARE STANDARD EQUIPMENT ON THIS 1971 MODEL SPC DELUXE 4 DR. HARDTOP		
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DETROIT LISTENING POST

(Continued from page 28)

ing effect with the bigger bumpers coming in '73 and '74. The new look will consist of heavier bars running vertically or horizontally, but not crisscrossed.

COMPLEXITY OF CAR REGULATIONS is reaching a point where it may be necessary to establish a new department of government to keep track of them from the time a vehicle comes off the line until it's junked. The auto companies already record the names and addresses of original owners. But there's no follow-up when a car passes on to subsequent owners. Both government and the industry would like a complete history of all cars, covering not only changes in ownership but service, accidents, who drives 'em, where, for what purpose and how many miles a year, deletions or additions made after the car leaves the factory—a "Dear Diary" from the cradle to the scrapyard.

It sounds like the biggest roll of red tape of all time. But one thing it would do would be to make it virtually impossible to dispose of a stolen car. Thieves could still heist them, but they'd have a tough time fencing the hot wheels for resale.

CAN ROBOTS REPAIR CARS? GM and Ford are looking at the idea, although there's nothing imminent. Automakers have been discussing the idea with manufacturers of automation equipment. The latter believe it may be possible to rig robots with existing diagnostic equipment and program the machines to perform certain routine service jobs. You'd still need a mechanic-operator to hook the repair unit to the car and feed in information on make and model and the step-by-step for the machine to follow.

CARS FOR ROADS AND RAILS are being studied by American Motors in conjunction with Chalmers Manufacturing Co., an AM subsidiary. The study will evaluate safety, emergency provisions and operation-skill requirements of autos which AM hopes can be guided along automatically on freeways at controlled speeds.

BOB ORBEN, who runs a joke factory writing funny lines for television comedians and disc jockeys, says he's been reading *Listening Post* for years. "I like the whole magazine," Orben adds. "It's one of the few publications you can read where if you see something stripped, it's gears!"

★★★



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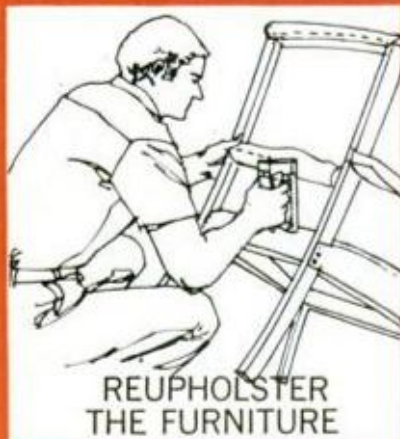
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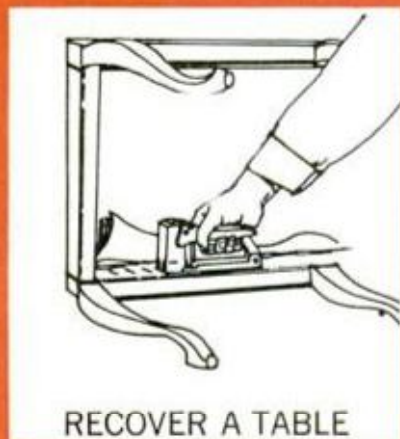
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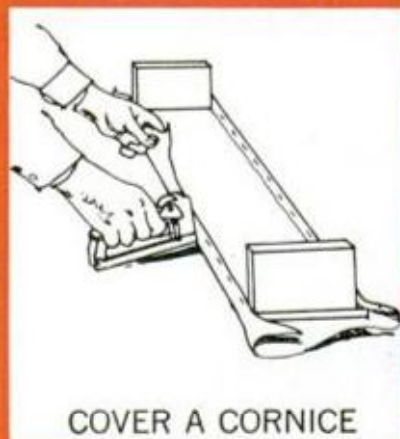
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Drivin' with Dan

Should radiator grilles be covered in cold weather? Will changing design trends help stock-car racing? Can drivers hear the fans cheer during a race? Dan Gurney answers these and other automotive questions.

Q. Do you worry about the same things before a race, now that you are a team manager, as you did when you were a driver? Would you mind saying what they are—and were?—Sally Kessiah, Jacksonville, Fla.

A. Yes, but certainly from a different viewpoint. It just has to be different when you are seated in the cockpit. I am now concerned with the many things which have to do with reliability, improving our pit operations, pit-signaling, race tactics, fuel mileage, and so forth. Usually a driver does most of his wor-



DAN USED RADIO during the inaugural running of the Pocono 500 to keep in touch with Bobby Unser in the No. 2 Olsonite Eagle. As shown on the scoring tower, Bobby was running in second place behind eventual-winner Mark Donohue in Car 66 when this photo was taken. After leading the race for many laps and always in hot pursuit of Mark from second place, the Gurney car developed turbocharger problems, so a very disappointed All American Racers team and Bobby Unser had to settle for ninth place

rying in practice and qualifying. Once the race begins the driver doesn't have time to concentrate on anything but his driving.

Q. We have a 1970 Buick. My husband puts cardboard in front of the grille during cold weather "to keep the engine warm." I say the grille is made for a purpose and should not be covered as it will ruin the engine. Who is right?—Mrs. Herbert Christoph, Chicago.

A. You are both right. It is easier for the engine to reach normal operating temperature in very cold weather if you block off some of the air passing through the radiator. You run the risk of overheating if the day isn't cold enough and you are running it hard. You should keep an eye on the temperature gauge. Modern cars are equipped with thermostats which can cope with most temperatures without the cardboard.

Q. What are understeer and oversteer, and are there any advantages to either?—Jeffrey K. Lee, Honolulu, Hawaii.

A. Neutral steer is halfway between and it is best. Understeer means that the car doesn't actually turn as much as the front wheels turn. Oversteer is when the car turns more than the front wheels turn. Oversteer is the beginning of the spin. A very slight understeer seems to be the thing that drivers like most.

Q. If the designers are right, the shape of passenger cars in 10 years will be more like spaceships. Do you think this will be good for stock-car racing or hurt it?—Gilles Genereux, Ottawa, Ont., Canada.

A. I doubt if it will do much for the racing one way or the other as long as each driver has about an even chance going in. On the

(Please turn to page 36)

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DRIVIN' WITH DAN

(Continued from page 34)

other hand, the new shapes will probably make normal road cars safer and easier to drive and maneuver.

Q. Do you think the Ford Motor Co. will ever return to racing? If so, in what way?—John Parish, Searcy, Ark.

A. I can only guess, though I doubt that it would ever return to building racing cars. But powerplants might be another story. It can make components available at relatively low cost and still not be participating in racing. I believe that people will always race; it seems to be a basic thing with human beings. And I'm sure that the auto companies enjoy having their products or derivatives of their products getting the checkered flag. The question is how much effort they want to put forth.

Q. Can race drivers hear when the fans are cheering in any kind of racing?—Troy Smithfield, Biloxi, Miss.

A. Very rarely, but often they can certainly see them standing up, waving and carrying on, and they love it.

Q. What makes a car a sports car? I keep reading that Corvette is America's only true sports car.—Norm Meunier, Wakefield, Mass.

A. Beauty is in the eyes of the beholder, I think they say. Frankly, if you want to feel that your car is a sports car, I think it can qualify. Originally, the sports car was only a two-seater with a fold-down top, but the definition has gradually changed over the years and there is no absolute authority that I know of.

Q. My pal says that more interesting and better developments come out of Can-Am and I say that more are coming from Formula 1. What do you say? (We both agree that USAC is next to last and NASCAR last in this area.)—Kenneth Hobbs, Claremont, N.J.

A. I'd say you are partially right regarding Formula 1 and Can-Am, but the USAC picture is also very competitive in the new-idea area these days. It would be a big mistake to say that your analysis will hold true in the

(Please turn to page 38)

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DRIVIN' WITH DAN

(Continued from page 36)

future even though it is considered to be true historically.

Q. Will driving a car with a 14-inch wheel on one side and a 15-inch wheel on the other cause any problems?—John Phipps, Rossville, Ga.

A. It depends a lot on the total diameter of the tires. If they are the same, this shouldn't cause trouble. If not, this will give the differential more work—it creates an imbalance similar to that of different-length legs on a table.

Q. Who did the best driving job, and what team did the best preparation job in the Indy 500 this year?—Billy Felts, Norfolk, Va.

A. Al Unser and the George Bignotti team, without a doubt.

Q. When you won the 1967 Belgian Grand Prix, how much money did you win as the driver?—Harry Harness, Pittsburgh.

A. Approximately \$5000.

Q. I'd like to know if the full face helmets are very hot to wear; also the address of the company which makes them.—Andrew Harlam, Ellsworth, Me.

A. No, they are not very hot to wear, because the bottom is still open. They do create a "fogging" problem with the window while you are sitting still, but if you are careful and use a bit of antifog solution, there is no problem. Here's the address of one very good company: Bell-Toptex, 2850 East 29th St., Long Beach, Calif.

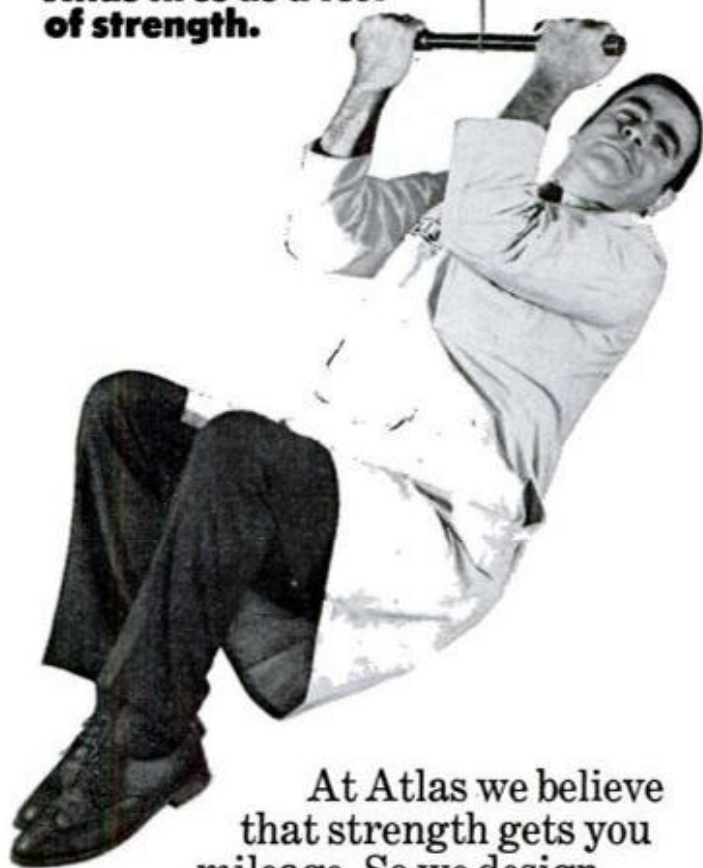
Q. Why don't you drive the pace car at Indianapolis?—Kenny Kurtz, St. Paul, Minn.

A. I am sure that the Indy pace car will be driven by an experienced driver from now on; 1971 was a tragedy for all involved. I'll drive the pace car in 1972 if I am asked. ★ ★ ★

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 52).

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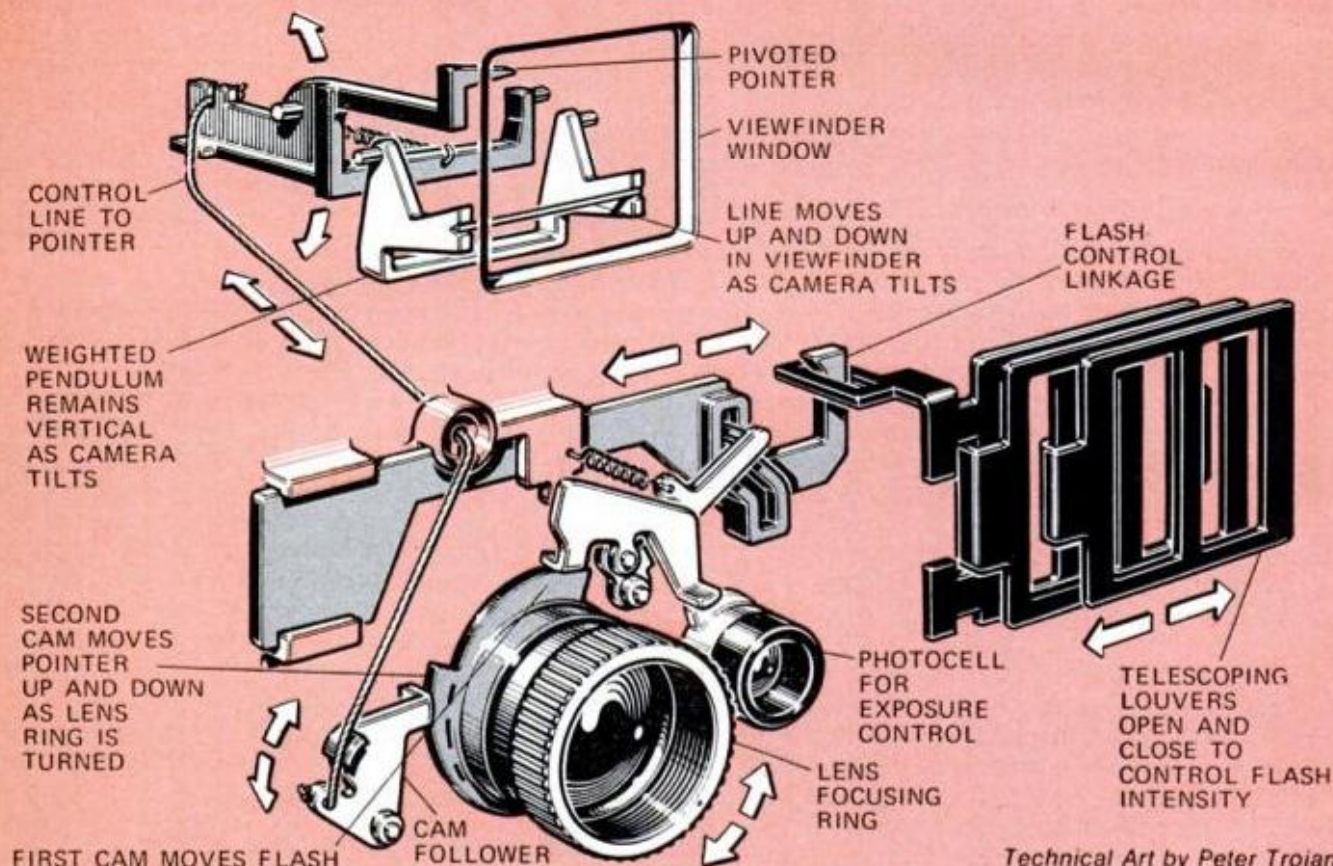
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Technical Art by Peter Trojan

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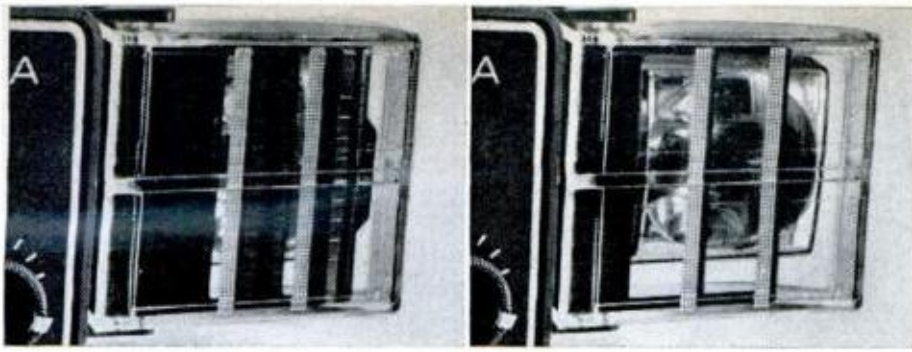
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3 RAISE CAMERA LEVEL AND SHOOT



HOW FOCUSING SYSTEM WORKS in new Polaroid is shown in drawings above. Aiming line in viewfinder at subject's feet establishes subject distance through triangulation. Turning lens ring until pointer coincides with line then focuses lens to same distance. Twin ramp-shaped cams attached to lens-focusing ring simultaneously move pointer in viewfinder and adjust telescoping flash-control louvers as lens is turned



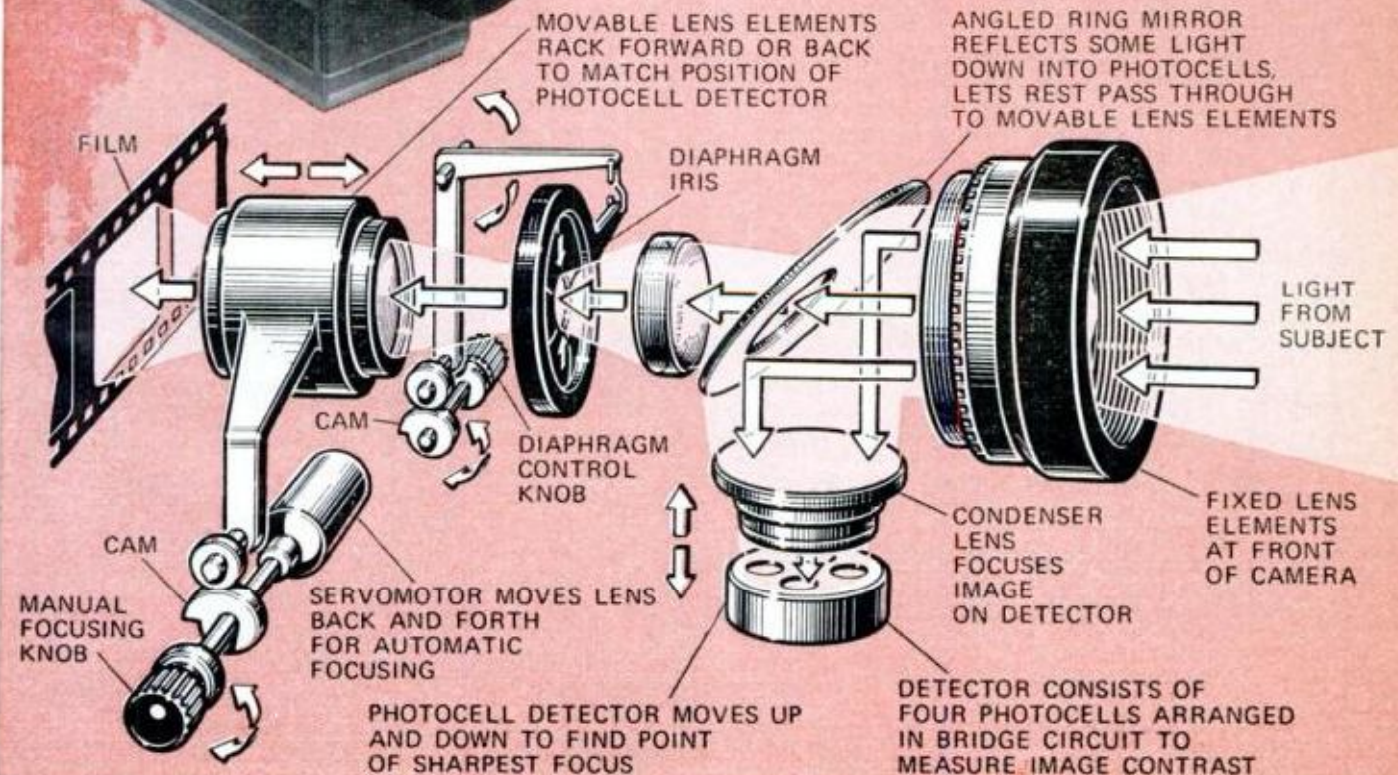
TINY LOUVERS in front of flash cube work like a venetian blind. Linked to lens, they close down on near shots to reduce flash intensity (far left) and open up on distant shots to increase intensity (near left)

and the angle indicates how far away the subject is. A black bar in the viewfinder window is attached to a tiny pendulum that remains vertical as the camera tilts. The position of the bar thus registers the amount of tilt relative to the vertical pendulum. You then turn the lens until a pointer lines up with the bar and camera is focused at the corresponding distance.

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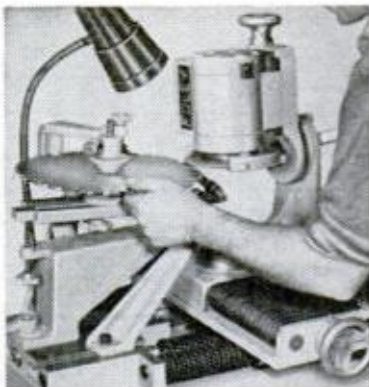
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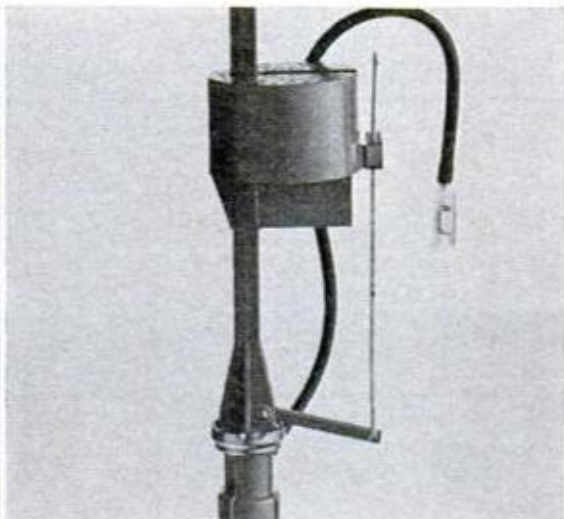
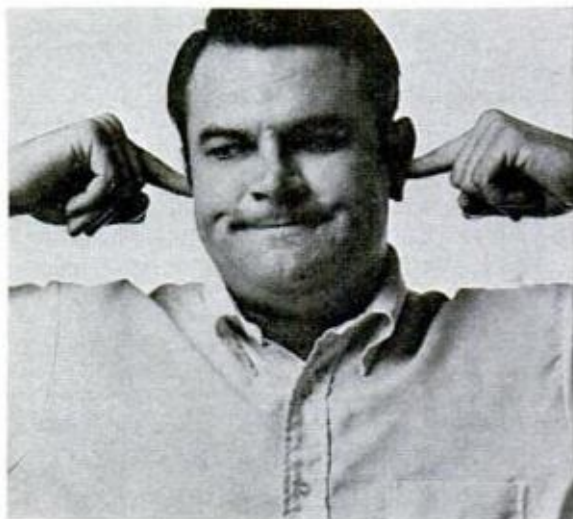
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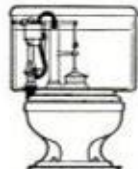


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Whether you're a Hall of Fame mechanic like Jake King, head wrench for Sox and Martin, or Mr. Fix-it at home, you want hand tools that help you get the job done right, quicker and easier.



S-K TOOLS USED BY HALL OF FAME MECHANICS (L to R): Jake King, NHRA/AHRA; Ernie Derr, IMCA; Harry Hyde, NASCAR; George Bignotti, USAC; Doug Barbour, SCCA; Iggy Katona, ARCA.

Victory begins with men who love to work with their hands. Sox and Martin proved it again in the Pomona Pro-Stock.

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Professionals like Hall of Fame mechanic Jake King—and thousands of home handymen, too—prefer S-K tools. Join the club. Save big during this sensational sale.

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PUBLICATIONS **WORTH WRITING FOR** BY CATHERINE BILSKI

MECHANICALLY SPEAKING, the router is one of the simplest and most versatile power tools around. To help you get the most of yours, Stanley Tools offers a booklet entitled *Operation of the Modern Router* which describes and illustrates every aspect of the router and its operation. It provides specific instructions for safe use of the router, including changing bits, setting the depth of cut, feeding the router into the work, and more. For your copy send 50 cents to Marketing Services Dept., Stanley Power Tools, Box 2217, New Bern, N.C. 28560.

TO ASSIST YOU in planning your new or remodeled kitchen, Mutschler Kitchens has prepared a helpful portfolio. Each section of the portfolio is index-tabbed and removable dividers provide space for your own notations or additional material you may insert from time to time. There's

even a booklet with recipes on Amish Cookery. It's something you'll want to keep as a permanent guide and reference file. Just send \$3 to Mutschler Kitchens, Dept. PM, Nappanee, Ind. 46550.

WHAT TO DO, and what not to do, about mildew on exterior siding is the subject of a pamphlet entitled *Some Plain Talk About Mildew*. It tells what mildew is, how to test for it, how it damages paint finishes and how to fight it. For your copy see your local Pittsburgh Paints dealer or write to PPG Industries, One Gateway Center, 10 North, Pittsburgh, Pa. 15222.

CHOOSING A HOME—new or old, condominium or apartment—is a major step in anyone's life. A new brochure, *How to Spot a Better Home*, can help you select one. It tells what to look for in heating, insulation, windows and doors, weatherstripping. It gives valuable tips on checking outlets and appliances, noise levels, how to evaluate a neighborhood and how to add up the costs before you buy. Write for this free booklet from Ponderosa Pine Woodwork, Dept. P, 39 South LaSalle St., Chicago, Ill. 60603.

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**MONEY-SAVING
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GET 'EM WHILE THEY LAST!**



**21-PC. SOCKET SET
WITH FAMOUS S-K RATCHET**

USER SAVES \$18.99

*If purchased separately,
retail price would be \$38.97*

\$19.98*

No. 4521-9. All-purpose 3/8" drive set includes popular S-K ratchet, 9 standard sockets, 8 deep sockets, Universal joint socket, 2 accessories. In steel case.



**50-PC. COMBINATION SET
PLUS HIP-ROOF TOOLBOX**

USER SAVES \$15.09

*If purchased separately,
retail price would be \$48.07*

\$32.98*

No. 7150. 1/4" and 1/2" drive set includes S-K ratchet, 17 standard sockets, magnetic screwdriver, 4 bits, 18-pc. hex key set, chisel, 5 combination wrenches, spinner handle, spark plug socket, locking plier.



**12-PC. ALLOY
COMBINATION
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USER SAVES \$15.07

*If purchased separately,
retail price would be \$34.51*

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No. 7112. Twelve C series wrenches in sizes from 1/4" to 1 1/8". Plus 10" tongue 'n groove plier with cushion grip handles. Vinyl pouch.

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SALE**



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S-K tools—finest quality money can buy!

Backed by the best warranty in the business! None better anywhere!

Keep this ad as a reminder of the season's finest tool buys.

Then visit your hardware store soon.

elry and dozens of other decorative objects from cast-off articles, odds and ends, remnants and scraps. The 376-page book, *Scrap Crafts*, tells how. Each project is clearly explained in detail, beginning with a list of tools and materials needed, and the step-by-step instructions explain craft procedures. Price is \$2.50 from Dover Publications, Inc., 180 Varick St., New York, N.Y. 10014.

PLANS AND INSTRUCTIONS are available for a "Roll-Away Closet" for the kids' sports gear, plus a full size "Storage Bed" for junior with deep drawers that slide away beneath it for all the toys he'll ever collect. Send 20 cents for these cutaway plans plus a list of other do-it-yourself projects from Money-Saver Projects Associates, Box 303, Chappaqua, N.Y. 10514.

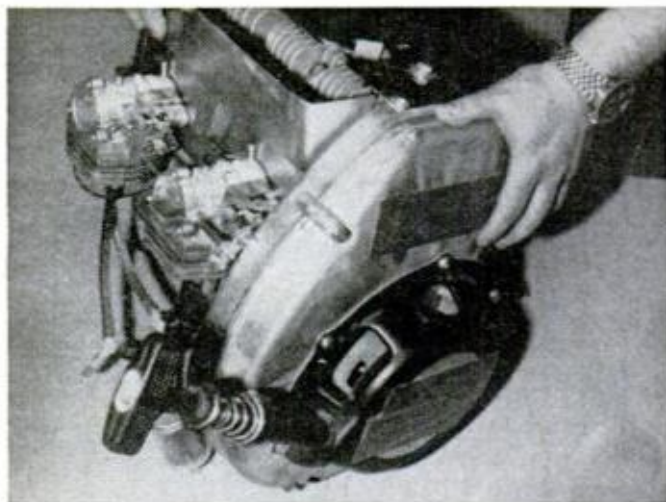
SOCIAL SECURITY has just released two new pamphlets which have been completely revised to include the 1971 amendments. They are *Your Social Security* (SSI-35), which explains the four Social Security programs—Retirement, Survivors, Disability and Medicare Benefits—and a pamphlet entitled *Social Security Benefits . . . How You Earn Them and*

How to Estimate the Amount. (SSI-47). They're yours for the asking: call, write or visit your local Social Security office.

THREE NEW, FACT-FILLED EDITIONS with essential background for all business managers as well as professional security managers and installers have been announced by Mountain West Alarm Supply Co. Titles are *Design for Security*, *Silent Sentinels* and *Practical Ways to Prevent Burglary and Illegal Entry*. These books discuss security planning, management, locks, alarms and electronics. A folder with detailed summaries of these books and how to buy them may be obtained by writing to Mountain West Alarm Supply Co., 4215 North 16th St., Phoenix, Ariz. 85018.

SUNGLASSES are a popular fashion accessory but are too often bought on impulse without regard for quality, eye protection or eye health. All the facts on how to get the most for your money and how to make a wise selection of glasses that are not only fashion-right but vision-right are described in the 15-page booklet, *Sunglasses and Your Eyes*. It's free by writing Bausch & Lomb, Dept. 3219, Rochester, N.Y. 14602. ★★★

NEWS BRIEFS



New Bede plane to do 215 mph with 32-hp engine

The tiny, single-seat, V-tailed BD-5 "Micro" is expected to travel 215 mph powered by a 32-hp Japanese engine (left). Wingspan of the craft is 13½ feet. Three prototypes are being built by Bede Aircraft of Cleveland (see *Cabin Plane for \$3500*, page 112, May '69 PM).



All in vane

A weather vane on a prison in Hannover depicts the arrest of the prisoner who made the vane in the prison workshop. He constructed it as a reminder of his term in jail.

Nickel goes a long way

Nickel ore travels slightly more than eight miles in 55 minutes on this long conveyor belt installed in French Caledonia by Yokohama Rubber Co. Six 350-hp motors drive the belt, which can carry 800 tons per hour. Weight of the conveyor with a full load is 1500 tons.



Mobile Olympic scoreboard

A mobile, lighted scoreboard has been developed by Toshiba Electric Co. for the Sapporo Winter Olympic Games. Visible for over 300 feet, the board rises about 25 feet.



Get away from the crowd.
Get all the flavor you want in
Old Gold Filters.



19 mg. "tar," 1.2 mg. nicotine av. per cigarette, FTC Report Nov. '70.

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SOLUTIONS FOR MECHANICAL HEADACHES

AUTOMOBILE CLINIC

BY MORT SCHULTZ

Saving gas

My 1970 Chevrolet with 350-cu.-in. engine pours gasoline out the vent line when the car's parked on a downgrade. Is there a fix?—John C. Moyers, Oak Ridge, Tenn.

Make sure the neoprene connecting hose between the tank and external tube is neither sagging nor kinked. Also check to see that the vertical loop in the luggage compartment is extended vertically from the compartment floor and securely fastened. If this fails to solve the problem, have the internal tank vent system checked by a Chevrolet dealer.

Curing a shimmy

My 1970 Ford LTD has had a severe vibration since it was new. It begins at about 60 mph and is particularly noticeable in the back of the front seat, although it's felt in the steering wheel, too. The dealer has aligned the front end, balanced the wheels, put on new tires and inspected the driveshaft and universal joints. What should I do now?

—R. E. Volkert, Dubuque, Iowa.

Bless the dealer—he sounds like a grand fellow—and ask him for just a little more help. For example, ask him if he measured the driveshaft's linearity. Did he check the rear-axle companion flange runout? Has he made certain there is no misalignment between engine and driveline? Hint that Ford publishes a noise, vibration and harshness manual he should consult—it presents all conceivable reasons for problems of this sort.

Coming of age

I would greatly appreciate answers to three annoying problems with my 1970 Volkswagen, just a year old: (1) brake squeal—the dealer says it's here to stay because it's caused by hard linings; (2) preignition; (3) much difficulty shifting into first gear.

—Ralph Stein, Queens Village, N. Y.

Happy birthday, little old VW. Here's how to stay in good health for the next year. First, learn to live with the brake squeal. The dealer is right. It's caused by hard brake linings and the only way to get rid of it is to switch to another,

less durable lining. Second, preignition in 1968 and later models is most often caused by hit-and-miss tune-up adjustments, especially ignition timing. That engine must be set up exactly to specification because of the exhaust-emission equipment it has. Finally, have your shift linkage adjusted while the engine's cold. Often, stiff shifting in a new car will loosen up after some road runs; it apparently hasn't in your case.

In fine condition, but . . .

I have a 1967 Pontiac LeMans V8 with automatic transmission which has run only 12,000 miles. It is in A-1 superb condition. An annoying leak, evidenced by a stained garage floor, has been diagnosed by my dealer as a leaky rear engine oil seal. He says the repair would require removal of the engine, but that the trouble is not critical and need not be repaired. The car is still under warranty, but I don't know what to do. It's in such fantastic shape I'm afraid it won't be returned to me that way. What would you do?

—Bruce Lippe, Roselle Park, N. J.

The dealer is correct when he says the engine must come out for this repair. However, I disagree that the work doesn't have to be done. The seal has apparently hardened. The leak will never get better—only worse. I would fix it before the warranty expires.

Powerless windows

I have a 1971 Cadillac Coupe de Ville. My power windows do not work with the ignition key turned to Accessory. I've seen power windows of other Cadillacs work with the key in this position. My dealer tells me that after a certain serial number, Cadillac windows work with the key on Ignition only. I'd appreciate your comments.—Dr. P. R. Peters, Sayville, N. Y.

The dealer is right. The change was made for safety reasons and became effective with vehicles produced on Feb. 1, 1971. Some people leave children in the car with the key turned to Accessory so the kids can listen to the radio while they're shopping or some such thing. Power windows make a great toy. This

(Please turn to page 54)



With a new John Deere Chain Saw, Stanley might have found Livingston before lunch.

But even if you aren't blazing trails through trackless jungles, your John Deere chain saw will zip you through dozens of other woodcutting chores. Compare its weight vs. engine size with other chain saws, and you'll go for its outstanding power-per-pound value. Needle-bearing engines give you full power in any position. Sturdy, narrow guide bars minimize pinching in the cut. Your John Deere dealer has "chained lightning" in four models, with cutting bars up to 19 inches long. Buy one now and next Saturday do a whole week's worth of felling, cutting, trimming and pruning. Before lunch.

Chained 
Lightning

Specifications slightly different in Canada.

For folder, write John Deere, Dept. CS, Moline, Ill. 61265

AUTOMOBILE CLINIC

(Continued from page 52)

leads to two dangers: first, a kid can get hurt catching his finger in a window, and second, he can run down the battery.

Right-rear sag

I have a 1966 Chrysler Newport that is sagging in the right rear. What should I do about it?

—Leonard Staudinger, Woonsocket, R. I.

A sag to one side at the rear can normally be corrected by adjusting torsion bars to bring both sides of the front suspension to specified height, which for your car is $1\frac{1}{8}$ in. $\pm\frac{1}{8}$ in. By adjusting the front the right and left-rear corners will usually return to equal height. Have the job done by a Chrysler Corp. dealer. If the entire rear end is too low, both the left and right-rear springs should be replaced.

Date of birth

When scouting around for a car, how can I tell, without taking a salesman's word for it, in what year a car was manufactured?

—Donald M. McCabe, Sierra Vista, Ariz.

It depends on the car, of course, and I don't have room to go into all of them here. However, here are a couple of examples: Ford has the production date stamped on a tag that's attached to the door. With Chevrolet, you have to examine the serial number. It will have 12 digits, 6 on each side of a letter. The number immediately preceding the letter is the model year. If you're really serious about this, ask the dealer to show you a service manual. The first section of most service manuals explains how to identify models.

Forced retirement

My 1958 eight-cylinder Plymouth was bought new and has run 117,000 miles. I've taken good care of it and use it everywhere, including freeways. Recently I read an article about diagnostic centers that said: "Some items, such as fatigue of heavily stressed metal parts on older cars, which may lead to a catastrophic failure of a vital part, are not

likely to be disclosed." This sentence scared the pants off me. My mechanic tells me that my brakes, front end and steering are okay as far as he can tell. But in view of the mileage and age, I'm wondering if I shouldn't junk the car. I would like your opinion.

—Herbert DeLisser, Baltimore.

Metal fatigue is not the issue. Metal fails more frequently in the newer cars than in cars as old as yours because of flaws. Surely you don't have to worry about that. If you asked whether you had to be concerned about worn parts, I would have to say yes. But worn parts, such as bushings, spindles, ball joints and brake linings, can be searched for, found and replaced. I wouldn't junk a car because of a worn idler arm, for instance. My opinion? Keep the car.

Service Tips

● **If your 1971 Thunderbird** has a whining noise coming from the power-steering pump at 1000-2000 rpm, have your dealer check the upper pressure plate to be sure that it's the right one. If it doesn't have an indentation mark on its face, replace it with a pressure plate that bears the part No. D1AZ-3D590-A. Tell your dealer to see service bulletin 161.

● **Owners of 1971 Oldsmobiles:** If you want more light from the instrument panel, make sure the correct bulb has been installed. For 88s and 98s that bulb is No. 1893. For the Toronado, it's 1819.

● **For Corvair owners** who have been bothered by odors and fumes, Chevy has issued a diagnostic and repair guide that tells dealers how to track down and correct the trouble. It's Chevrolet Service News No. 3 (3/71).

● **Dodge** spells it out in no uncertain terms, so be forewarned: "The coolant installed in all Dodge car and truck-engine cooling systems at the factory consists of a solution of water and a high-quality ethylene glycol antifreeze," the company says. "The antifreeze used contains an additive for corrosion protection and an antifoaming agent for coolant stability. Additional additives for this protection and increased cooling are not recommended. Such additives may not be compatible with the coolant and may be detrimental." ★★★

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.



Goodyear GLAS-GUARD ... big on the road

The new fiberglass belted tire for Campers

It's big on the road.

The fiberglass belts fight tread-wearing squirm to give you long mileage.

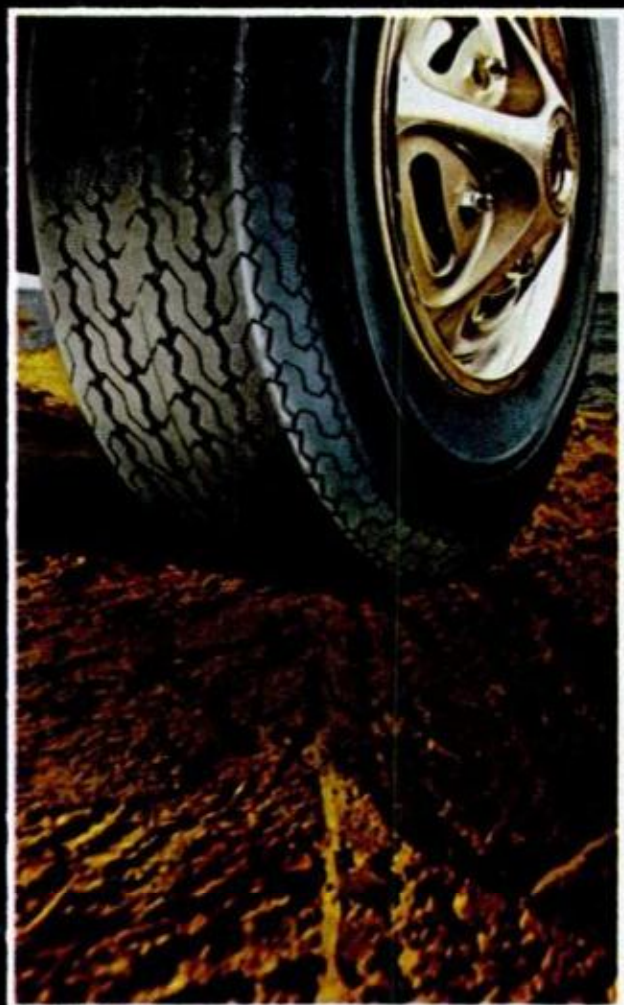
The belts also hold the tread firm to give you command on wet roads, braking and cornering.

And GLAS-GUARD is also big off the road. Where rocks, ruts, potholes—and breath-taking views—lie waiting. GLAS-GUARD's tough nylon body, combined with the fiberglass belts, wards off the blows.

Ask your Goodyear Dealer or Goodyear Service Store for the GLAS-GUARD tire. It could save your vacation.



New GLAS-GUARD tire: 2 fiberglass belts and 4 nylon cord body plies for extra protection.



GOODYEAR

GLAS-GUARD - TM The Goodyear Tire & Rubber Company, Akron, Ohio

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HOMEOWNERS' CLINIC

BY W. CLYDE LAMMEY

Sticky tile floor

I laid tiles on my kitchen floor, over underlayment, and now the adhesive is coming up through the joints, resulting in a rather messy, sticky job. What's wrong and how do I remedy it?—G.W., La.

Either you applied too much cement or you slid the tiles into position rather than starting them at the edge of adjacent tiles and pressing them firmly into place. Go back to the dealer and get a cleaner that's compatible with the tile. Usually a light rubbing with a cloth dipped in the cleaner will lift the excess cement. Wipe up the excess as you go, then wax the floor.

Locating bail pulls on chest

I have a chest with deep drawers and I want to replace the handles, or pulls, with ones that have a scrolled back plate. My catalog refers to these as "Chippendale Brasses." What's the rule for locating them?—L.A., N.C.

If, by "rule" you mean locating the holes for the posts, the common practice is to place the pulls at the halfway point; that is, you measure the height of each drawer front and bore the holes along the centerline, at points where each pull will be located equidistant from the edge of the drawer front. Of course, the backing plates of the replacements pulls should conceal the holes bored for the original ones.

Scratch banisher

How can I conceal several unsightly scratches on top of my lamp table? Is there some way to do this without refinishing the entire top?—T.A., Hawaii.

There is a wax-like product in stick form, available in various colors, which you simply rub into minor scratches. You can also use stick shellac, which also comes in colors to match most finishes. Stick shellac is melted into the scratch and must be sanded flush after hardening. The former product, commonly known as "Putty Stik," requires no sanding.

Drying plastic food bags

Isn't there some way to dry the interior

of plastic food bags quickly? I wash 'em, turn 'em inside out and back again but still there's the problem of getting them really dry, inside and out. Can you enlighten me?—W.D. Mass.

I suppose there are a baker's dozen ways of drying food bags but the method that seems most effective to me is to stuff 'em with paper toweling after washing. This "balloons" them, allows air to circulate and the paper toweling quickly absorbs any beads of moisture remaining. You can dry the toweling and reuse it.

Removing pencil marks

My Junior marked several boards of hardwood I'd recently bought for a do-it-yourself project. I tried sanding lightly but this only spreads the marks. I think a soft-lead pencil was used but I'm not sure whether it was a lead pencil, china pencil or black crayon. What to do?—L.O., Wash.

If the marks were made by a lead or china pencil or even a crayon, then sanding won't do. If you think they are lead-pencil marks, try an ordinary eraser first. If that doesn't work, rub marks lightly with a cloth dipped in alcohol (substitute fine steel wool for cloth if the wood is open-grained, such as oak). Wipe up any excess alcohol immediately. If you suspect that the marks were made by crayon or china pencil, try using turpentine.

Kitchen-cabinet door bumpers

I have steel cabinets in my kitchen and the rubber door bumpers have deteriorated. Several are missing. Are replacements available, or is there a substitute?—E.R., Kans.

The cabinet manufacturer can probably supply new bumpers, but you can make them yourself. From a small piece of 1/8-in. sheet cork cut pieces about 1/2 or 3/4-in. square. Remove the old bumpers and cement these replacements in their places.

Bed molding

Will you explain "bed molding"? I've seen this term but don't know what it means.—V.R., Ariz.

This can be defined as any strip molding used to enclose a corner such as that where the wall joins the ceiling, the purpose being that of ornamentation. Cove molding is perhaps most commonly used in this location; it may be combined with other shapes cut on the same strip. ★★ ★

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BACK-COUNTRY CAMPER

By V. LEE OERTLE



ON HIGHWAY, Hi-Country Camper rides level without adverse effects on ordinary handling of Bronco

THIS LIGHTWEIGHT CAMPER is the first truly compact coach ever marketed exclusively for short-wheelbase, station-wagon-type trail cars. While our field test was made with Ford's Bronco, these mini vans can also be adapted to Scouts, Wagoneers, Rovers, and so on.

Inside, the coach is equipped for cooking, cooling and sleeping. Outside, a set of loading jacks makes it possible for the owner to haul his camper to road's end, then unload it and use his vehicle to explore or hunt the outback beyond. And while the interior space is a mite cramped, toting this new piggyback camper surely makes an outing a lot more comfortable than trying to sleep in a confining 4x4 interior. The rig is infinitely more practical than trying to tow a trailer up rough mountain roads.

On the road, the Bronco runs as though she doesn't have a 600-pound monkey on her back. Weight is effectively spread over the carrier vehicle, and overall height is kept low so the coach will be little problem in forested regions and less wind resistance will be noted on the open road.

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Loading method: two corner supports and two jacks.

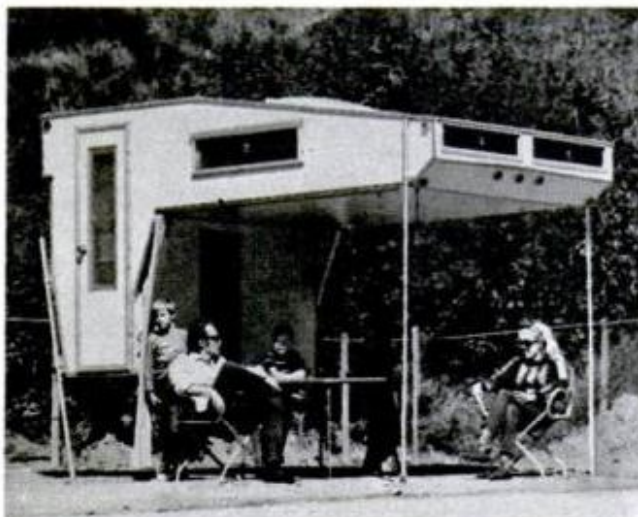
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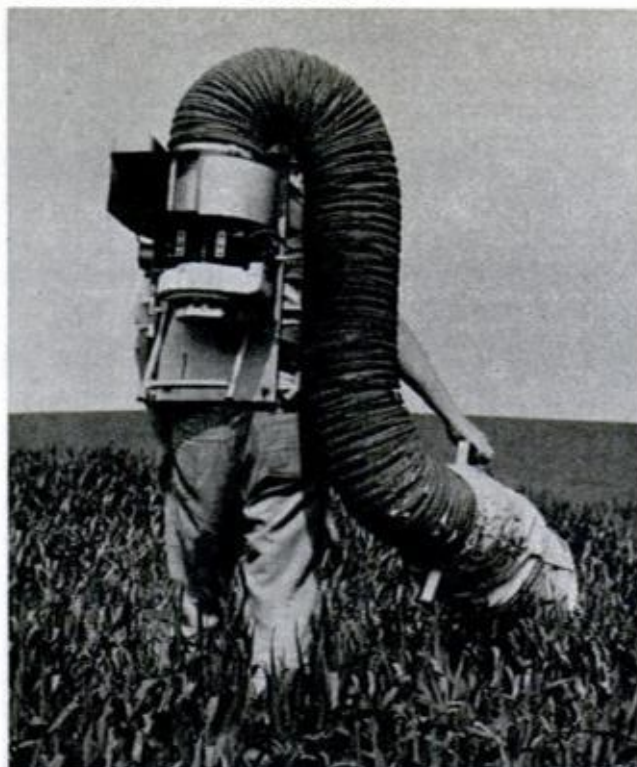


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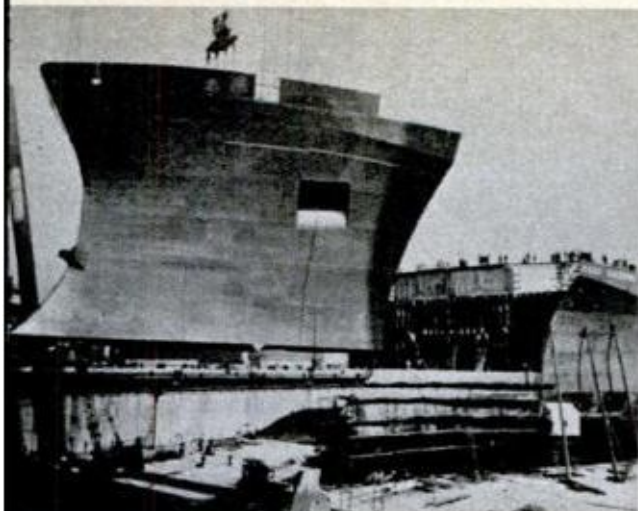
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Field vacuum cleaner

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Big Belfast bow

It takes the world's largest crane to lift 730-ton bow sections of giant tankers being built in Belfast. Nine tankers are on order. This bow section measures 52 feet high, 67 feet long and 35 feet at the after end.



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The addition of a hydraulic/electric snowplow makes the Attex all-terrain vehicle both a work and play machine in winter. Plow is \$195; ATV Manufacturing Co., Glenshaw, Pa.



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SEPTEMBER 1971

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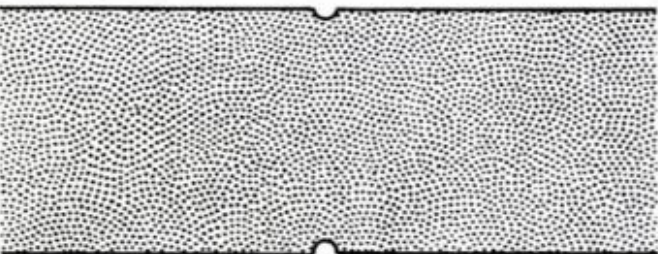
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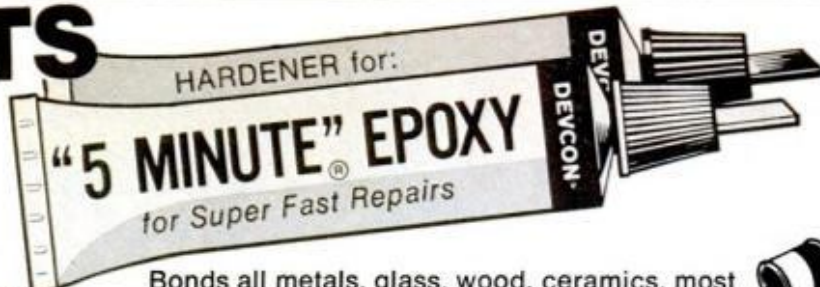
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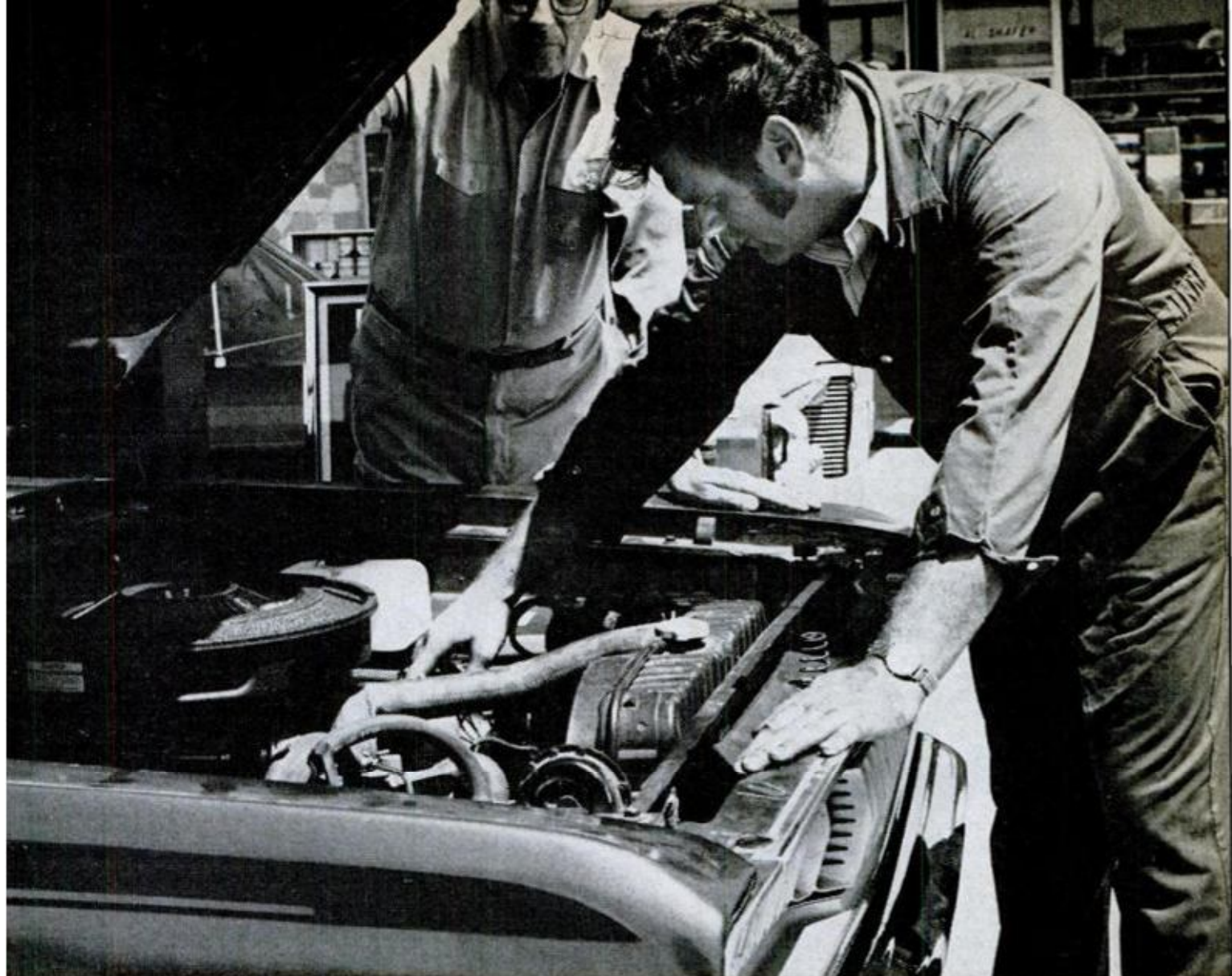
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HINTS FROM READERS



Handle for knurled nut

Knurled nuts, such as those finger-tightened on photo tripods, can be a nuisance when they refuse to lock under finger force. To cure this, flatten a piece of aluminum tubing and drill a hole to receive a self-tapping screw supplying the tightening force.
—W. B. May, Oak Park, Ill.



Spool as depth stop

A wooden spool can be used as a drill-press stop for bits that will fit its centerhole. Adjust bit in the chuck so it projects below the spool a distance equal to depth of hole required. When jaws almost reach spool top, lift it and blow out the chips.—Walter E. Burton, Akron, Ohio.



Homemade cap remover

It's almost a certainty that at some point you've come across a twist-off cap that won't. You can make this handy cap remover from a piece of threaded rod and two short lengths of dowel. Surprisingly, the "gripper" provides plenty of spring to get a firm hold.
—B. W. Ervin, Kent, Ohio.

Heat made this clock work after thorough cleaning and oiling failed

Recently, after taking out the works of an antique clock and thoroughly cleaning and oiling the innards, I found it still didn't run. I was about to throw up my hands in disgust when I tried holding a 100-w. bulb a few inches from the works. Surprisingly, after a few minutes the clock started to run and has been working ever since. I figure the bulb heat thinned the oil enough so it could run to the friction points where needed. In any event, the repair was successful.—Albert E. Rohmer, Washington, D.C.

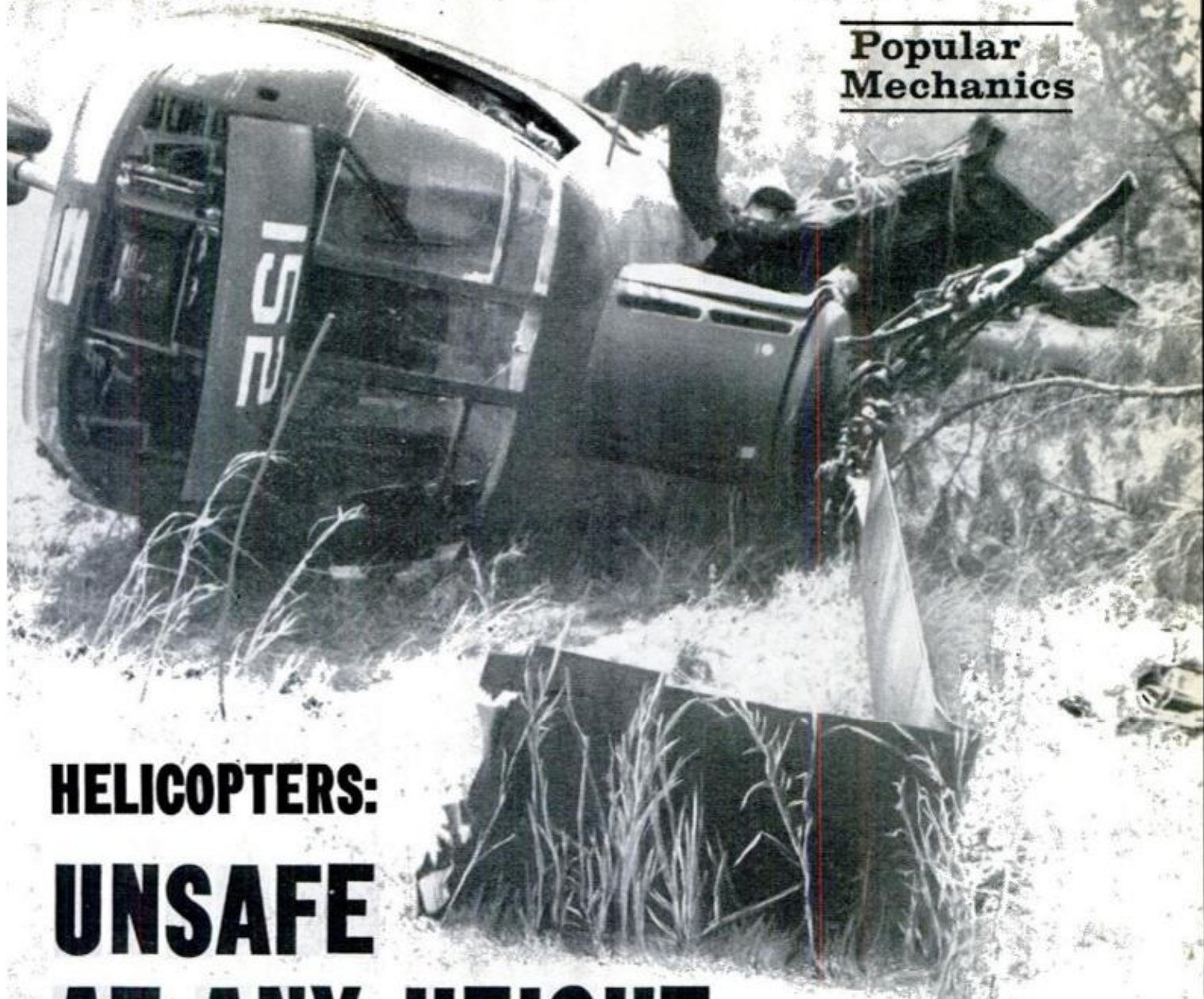
NEXT MONTH IN SHOP AND CRAFTS

40 GREAT TIPS TO SAVE YOU TIME AND MONEY. A perennial favorite that PM readers look forward to, this year's roundup of practical home and shop ideas is our best yet. Included are good, sensible tips and solutions for everyday nitty-gritty problems utilizing materials and items you probably already have on hand.

HOW TO INSTALL A WASTE DISPOSER. Do you wish you could be your own plumber and install that sink waste disposer your wife has wanted? You can and you can pocket the plumber's fat paycheck in the bargain. We show you how—step by step—a plumber does it. If you don't have the wrenches on hand, you can rent them and still wind up with a handsome saving.

BEHIND THOSE HANDSOME WALLS—STORAGE GALORE. Starting with a carriage house in the Boston area, designer Karlis Grinbergs fashioned a "hardwareless" house that's high on good looks and low on upkeep and maintenance. Take a tour of this fascinating house and learn how you can update your home with his ingenious design concepts.

A LOW-COST "SHAPER" FOR YOUR SHOP. It's actually a set of rotary rasps you can use in your portable drill mounted in a bench stand. We tested them in PM's workshop, found them an inexpensive way for the average workshopper to get more use from what he already owns.



HELICOPTERS: UNSAFE AT ANY HEIGHT

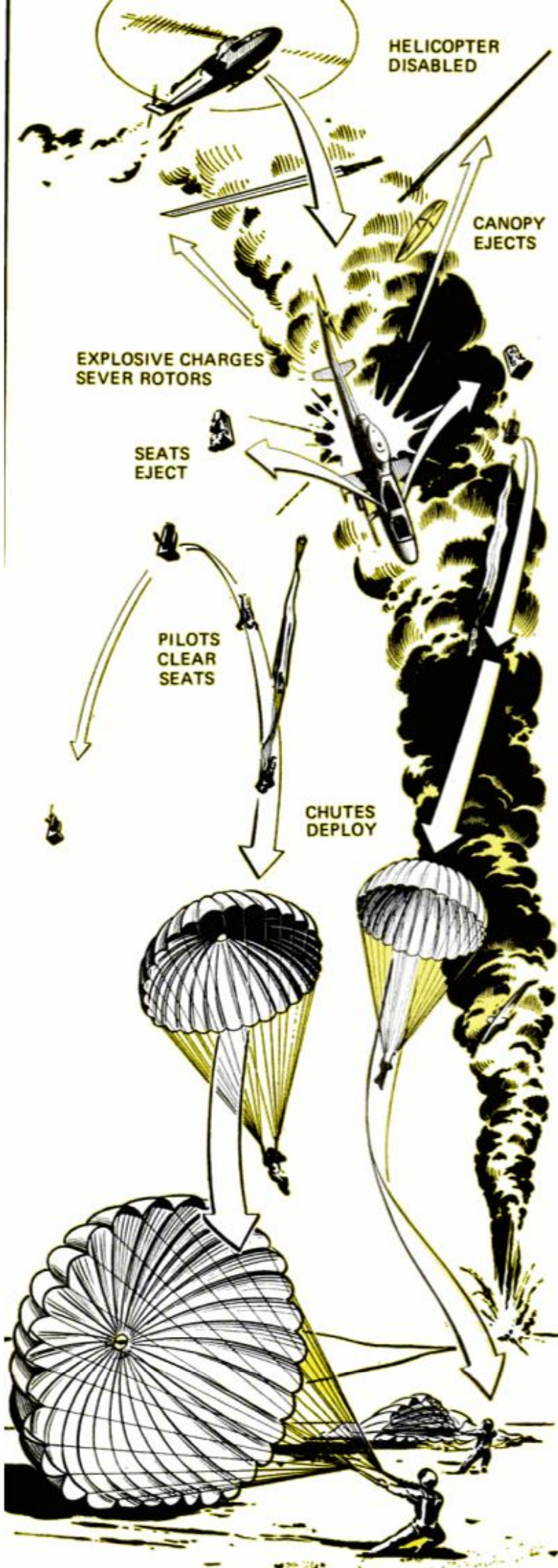
By JOHN ENNIS

Over a two-year period, some 2300 military copters crashed—about a quarter of them in noncombat accidents. The cost: more than \$500 million—and over 1200 lives.

EARLY THIS YEAR, Maj. Milton Roberts was killed when his Army helicopter crashed near Broome Island, Md. The following day astronaut Eugene Cernan, backup commander of Apollo 14, narrowly escaped death when his chopper plunged into the Indian River near Cape Kennedy and burst into flame. Twenty-four hours later, a Coast Guard helicopter quit flying and fell 1000 feet into the frigid waters of Hampton Roads off Norfolk, Va. Lt. Cmdrs. James Webb and Bill Murphy nearly drowned in that mishap.

Although the accidents occurred many miles apart, they had one thing in common. All three copters were piloted by veteran flyers who were unable to escape from their falling aircraft.

"There is no way to safely eject from a disabled helicopter," Army WO Robert Miller told me in an interview. "I've logged almost 300 combat missions and if you



want to see how unsafe these machines can be, take a look at the Pentagon's own records."

During a two-year period—the Defense Dept.'s fiscal years of 1969 and 1970—there were 1989 Army helicopter crashes, resulting in the loss of 969 lives and a cost to the taxpayer of \$303,859,000. The Army says 419 of these accidents happened in a noncombat environment.

The Marine Corps lost 227 helicopters during the same period and half the accidents occurred away from the battlefield. Of the 244 officers and men who died, 109 were killed during training exercises or while in transit from one base to another. The value of the 227 helicopters was \$138,295,570.

The total number of Navy helicopter crashes for the two fiscal years was 121, but the service refuses to say how many men were killed or to give a breakdown of combat and noncombat losses. It also declines to reveal how much money the accidents cost the taxpayer.

"The reason for not making this public," says a Navy public information officer, "is that it could be harmful to the morale of our men." The information might also be harmful to the morale of the victims' bereaved families. The tragic thing is that none of the flyers had a chance to escape death.

"You're looking at a record that could be greatly improved had helicopter safety kept abreast of rotor-wing technology," said WO Miller, who plans to quit flying this year.

In a midair emergency, a pilot's best chance to escape serious injury or death is to put his helicopter into autorotation. This maneuver uses the upward flow of air to turn the rotor blades of a falling aircraft. To make it work, a pilot must have control of his helicopter, be at a fairly high alti-

ESCAPE FROM HUEY COBRA, a small two-seater, is a variation of basic HEPS—Helicopter Personnel Escape and Survival—system. Pulling a D-ring would set off a rotor-severing device and eject both pilots. Fast-deploying parachutes are crucial to success of the system, which was developed in a Navy program

tude, have favorable weather conditions and be able to see where he is going.

Chances of executing a successful autorotation are poor. "There are more than a dozen things that can prevent it, such as a lost rotor blade, fire or electrical failure," Miller says.

A pilot unable to autorotate must bail out or stay with his helicopter while it crashes. Because these craft usually fly at low altitudes, there is practically no chance of executing a successful parachute jump. Three of the five Navy pilots who have attempted to bail out recently have died. This is one of the reasons few rotor-wing flyers wear parachutes. By contrast, the pilot of a supersonic jet has a 90 percent possibility of ejecting safely.

Lt. W. H. Baker, a combat helicopter pilot assigned to the Engineering and Advanced Systems Dept. at the Naval Weapons Laboratory, Dahlgren, Va., believes the disparity in percentages is "grimly paradoxical" when you consider it is the helicopter pilot who usually rescues the jet flier.

Baker and those who preceded him at the Naval Weapons Laboratory have been working for over a decade to provide helicopter airmen with a reliable escape system. The project began in 1961, when the Navy realized that if it was to continue flying helicopters, the alarming fatality rate had to be reduced.

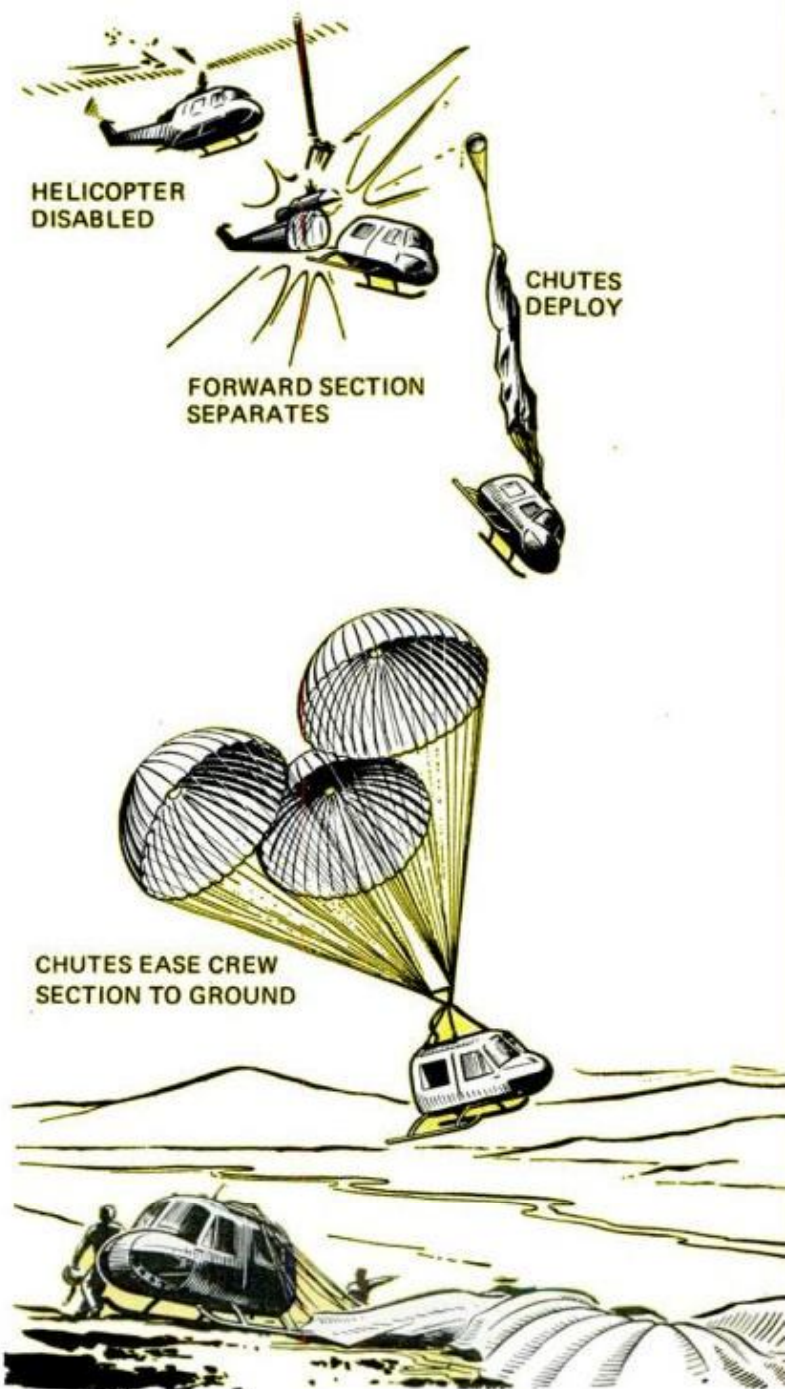
The engineers discarded one plan after another before adopting the obvious: Make the helicopter a part of the escape system by designing the fuselage so that it can be parachuted to earth. Such a system would allow the men to remain inside the aircraft, where they'd have a better chance of surviving a parachute drop.

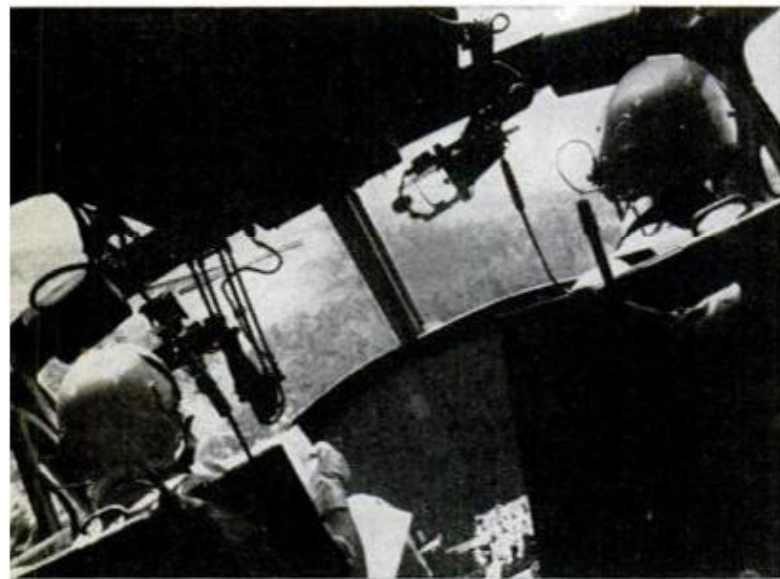
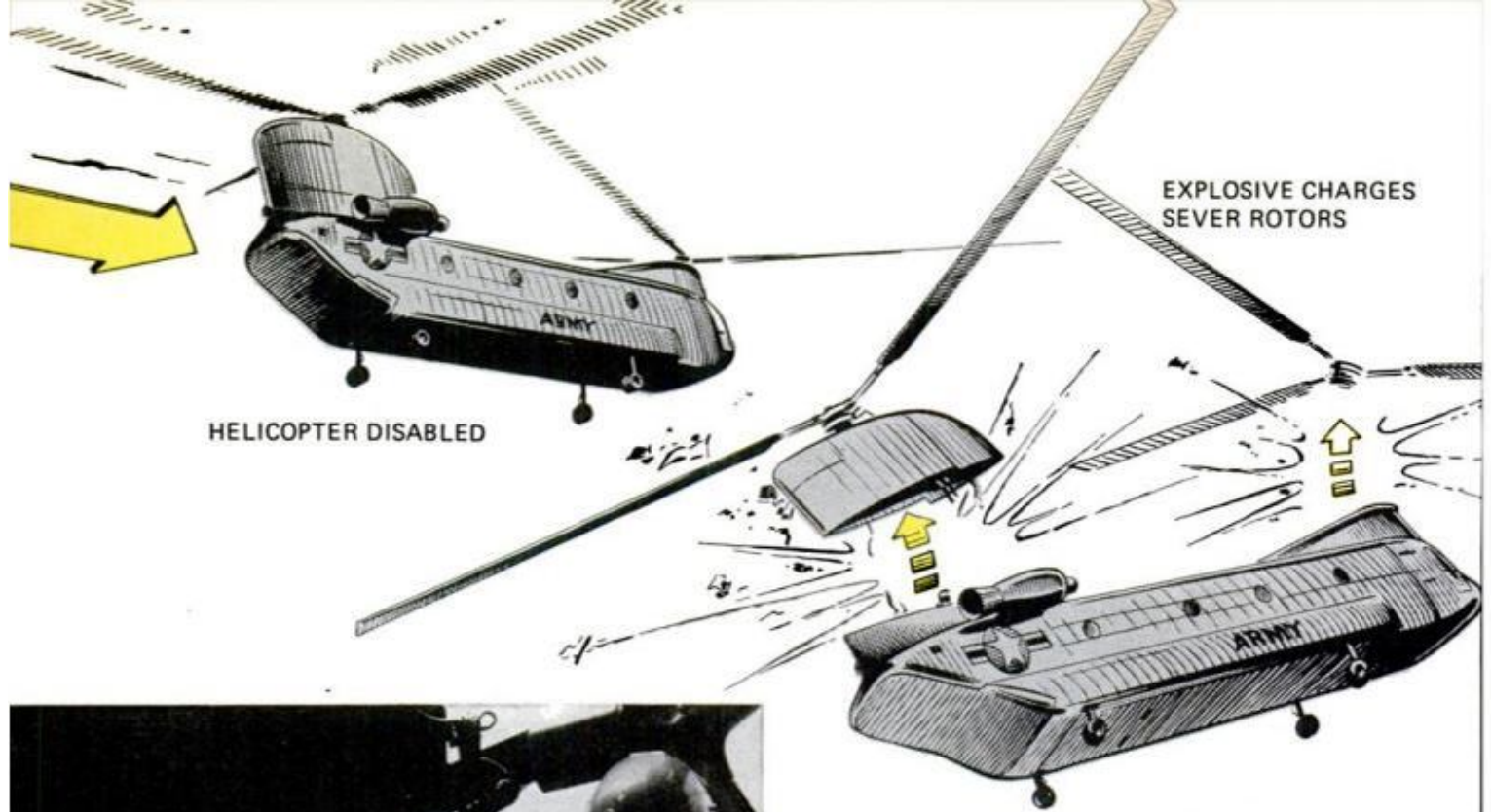
When the idea was first proposed, senior officials shook their heads and

MEDIUM-SIZED UH-1E helicopter would be rigged so that pulling a D-ring would actuate a system for severing both the rotors and cockpit "capsule." Fast-opening chutes would fill with air within two seconds, permitting the capsule and the crew to come down safely from altitudes as low as 50 feet



JET PILOT is rescued by a copter in Vietnam. If hit, the chopper pilot has less chance to survive





ANGLED FOR ATTACK, copter flies over the Mekong Delta. Training for each pilot costs about \$40,000

THIS COAST GUARD rescue helicopter fell 1000 feet into water off Norfolk, Va. The crew survived



said it wouldn't work. The engineers argued that the concept was feasible and proved it several years later when they successfully parachuted three remote-controlled HUP-25 helicopters to safety.

The Navy calls this escape system HEPS, which is a slightly juggled acronym for Helicopter Personnel Escape and Survival. It has been five years since the Navy proved the system would work and during that time thousands of men have died in helicopter accidents. Although the Navy still lacks funds to get the HEPS program off the drawing board, it has successfully designed variations of the system for different types of helicopters.

No one can say how much it will cost to install HEPS in helicopters because no one knows when the system might become operational. Few military pilots are even aware of its existence because the Navy has done little to publicize it.

"Perhaps one of the reasons we haven't said too much," explained a Navy information officer, "is that explosives are used and they could be dangerous."

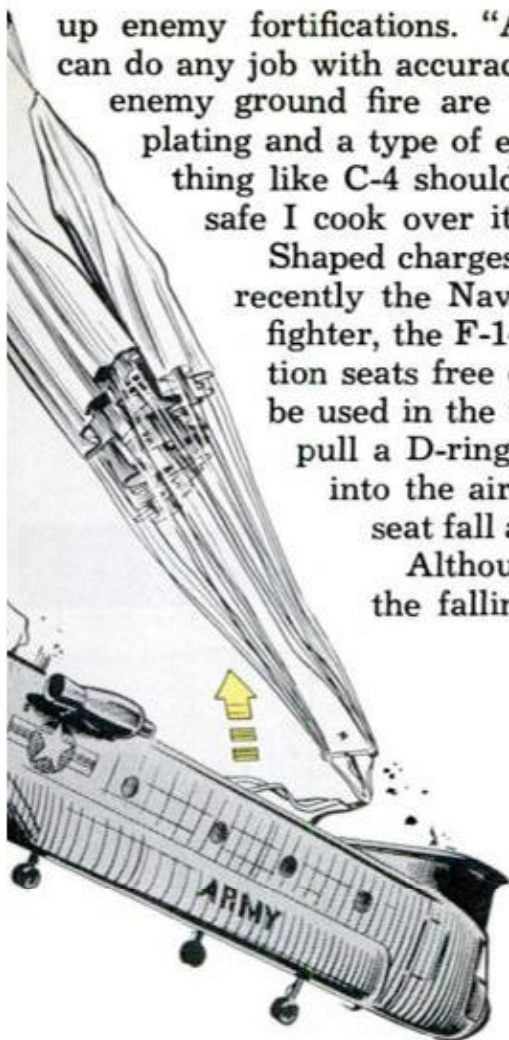
"That's pure rot," replies Lt. Ron Mason, a Navy demolition expert who spent two tours in Vietnam blowing

up enemy fortifications. "A shaped charge of explosives, properly placed, can do any job with accuracy. And the chances of a premature explosion from enemy ground fire are very small. Of course, you'd have to use armor plating and a type of explosive that would not explode on impact. Something like C-4 should do the trick. That's a plastic explosive that is so safe I cook over it."

Shaped charges have been used successfully in space capsules and recently the Navy decided to incorporate them into its newest jet fighter, the F-14. Because shaped charges can be used to fire ejection seats free of a disabled aircraft, engineers believe they could be used in the tandem-seat Huey Cobra too. Here the pilot would pull a D-ring to activate rotor-severing knives and fire himself into the air, where his parachute could open and the ejection seat fall away.

Although there is little danger of premature explosions, the falling debris from a helicopter might endanger other

(Please turn to page 180)



CHUTES DEPLOY AUTOMATICALLY

HEPS SYSTEM, proven in tests but not yet operational, was developed in answer to the need for a method of saving the crews of disabled helicopters. The choppers frequently fly at such low altitudes that escape by standard parachute methods isn't feasible. Sequence shows how big CH-46 copter could be saved by using system

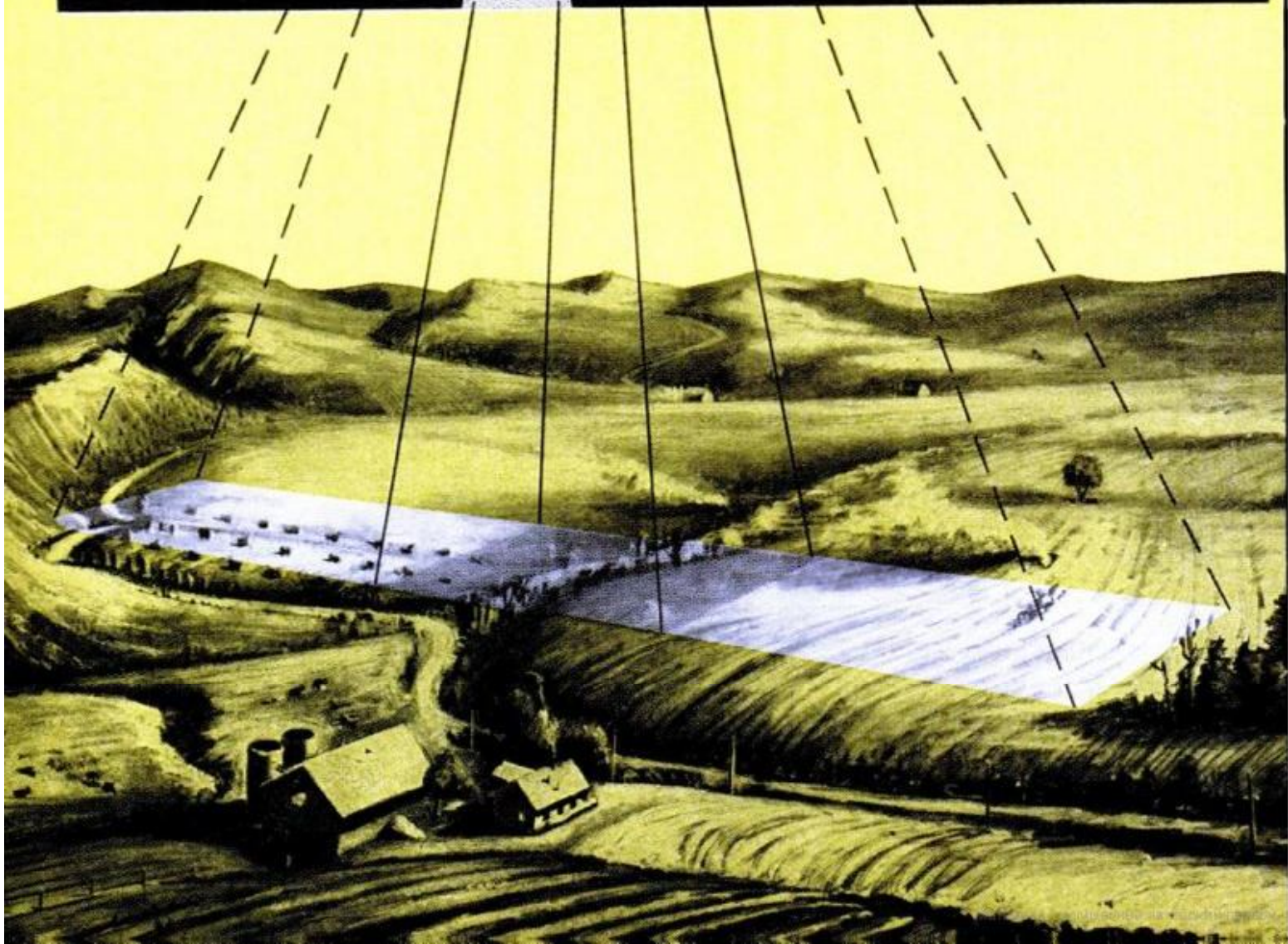
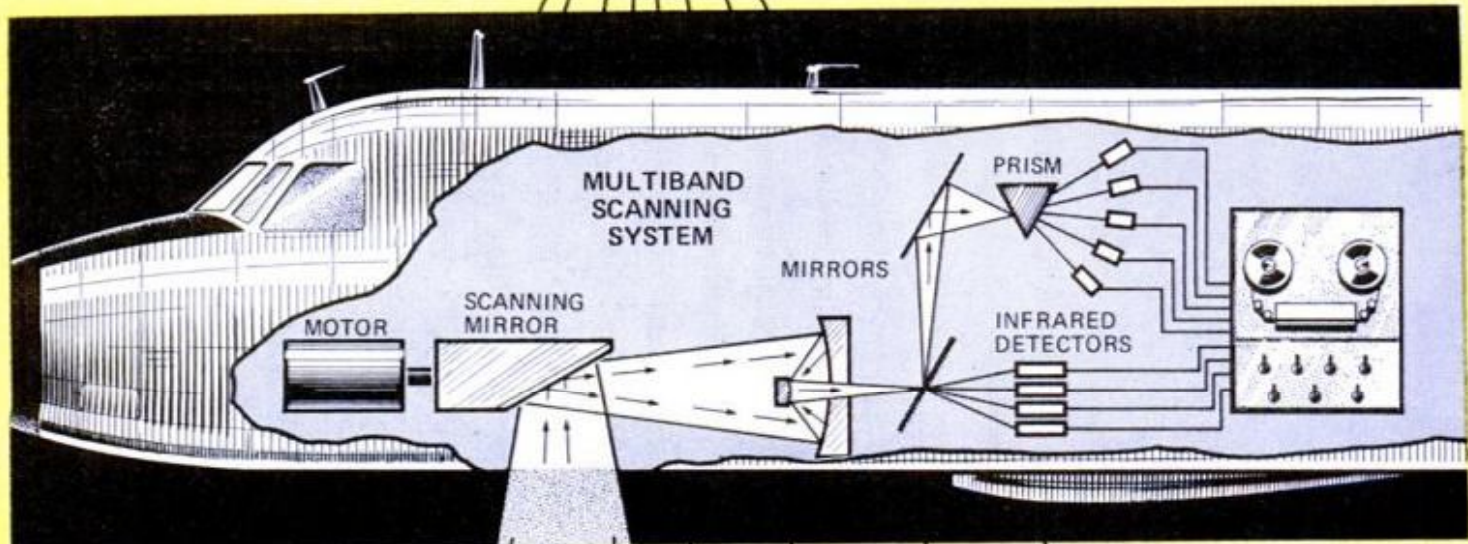


CHUTES EASE DESCENT

Illustrations by
Fred L. Wolff



How We're READING NATURE'S



From far above the Earth, specially equipped planes and satellites can identify blighted crops, pinpoint oil and mineral deposits, locate best highway routes, spot areas of pollution. It's done by a method called multispectral analysis

By JAMES R. BERRY

A COMPUTER begins to chatter at the Laboratory for Applications of Remote Sensing (LARS) near Lafayette, Ind. A minute later the printout emerges—a 15-inch-wide, 6-foot-long sheet of paper covered with symbols. It gives vital data about a proposed highway route, like firmness of the soil and drainage capability. The information will save millions in construction costs.

● At Purdue University's Dept. of Agriculture, LARS spews out more paper covered with letters: "C" stands for corn, "S" for soybeans, "A" for alfalfa, and so on. A complete survey of the vegetation on several square miles of Indiana farmland has been completed in seconds. The process is so

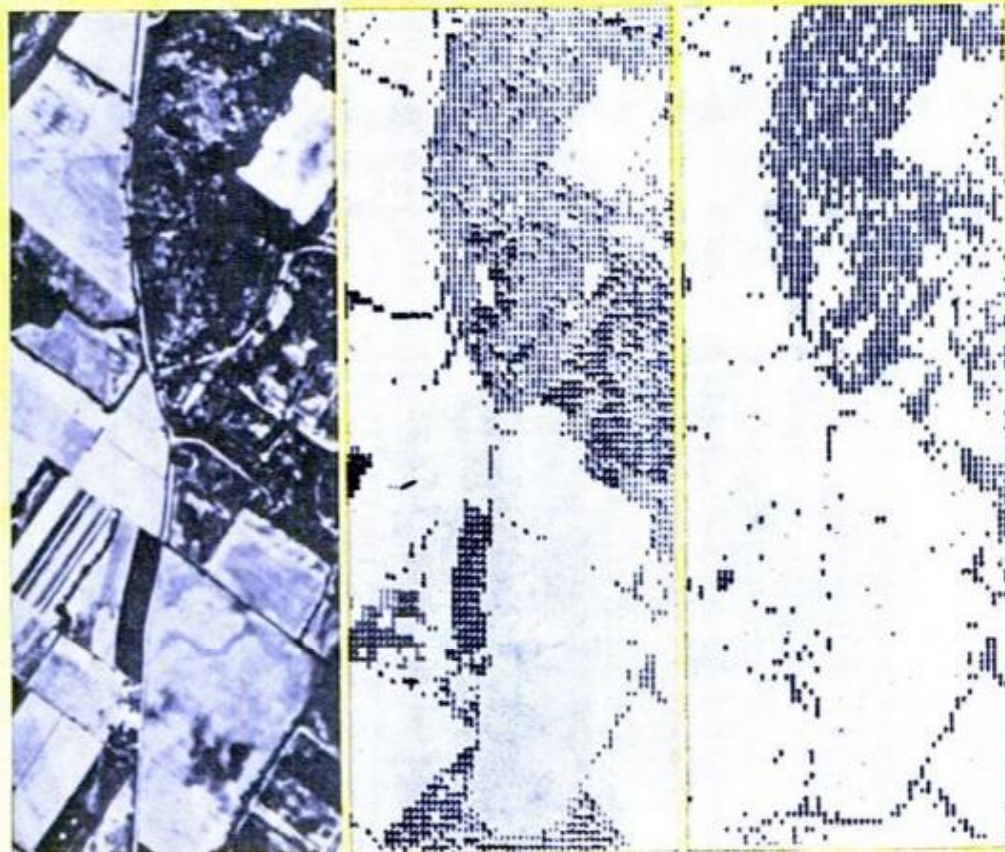
sensitive it can detect different plant varieties or measure corn blight in four degrees—from mild to severe.

● At NASA headquarters in Houston, other researchers use a similar system, first carried aboard Apollo 9, to survey thousands of miles for major geographical features: cultivated and irrigated areas, timber, water.

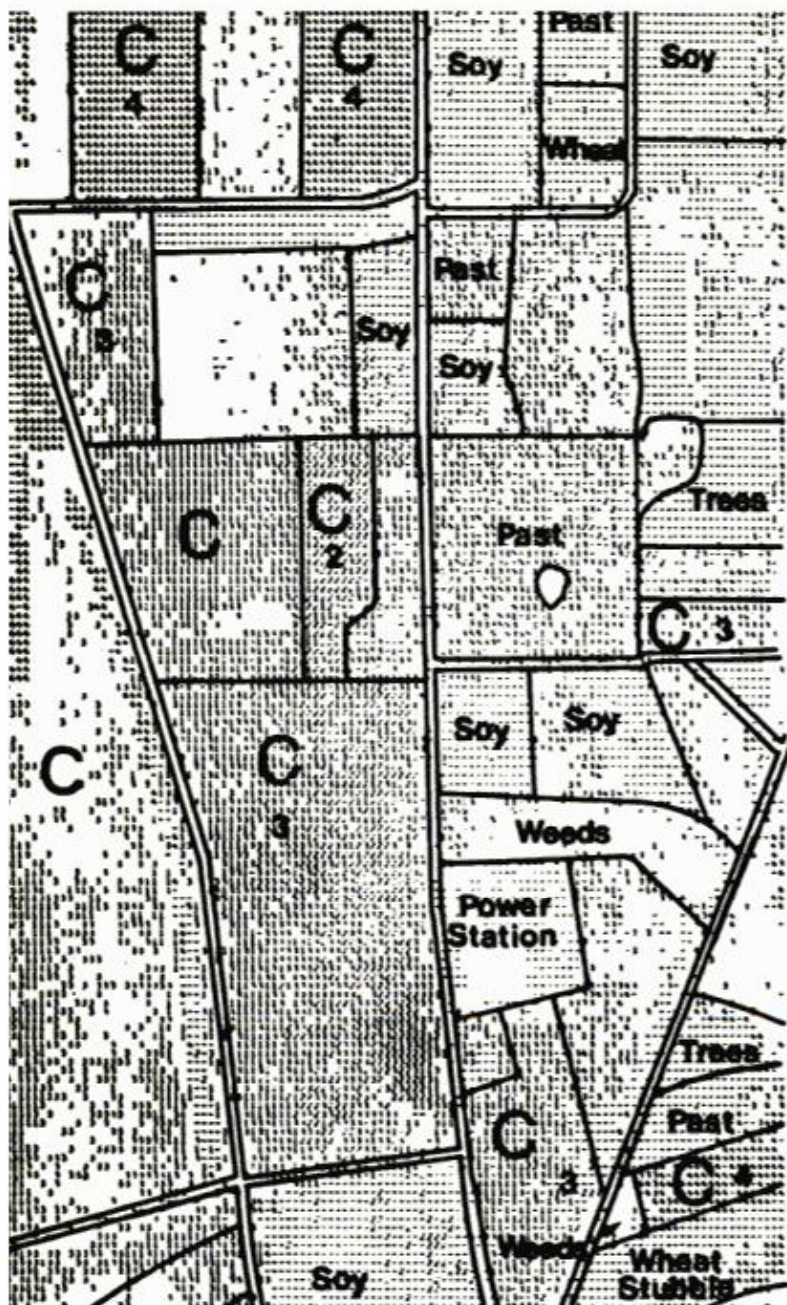
These three events are the results of an amazing new process known as multispectral analysis (MSA)—the analysis of light reflected from the Earth to a specially equipped airplane or satellite.

What will MSA mean to you? Briefly, it promises to improve your standard of living by increasing food production,

COMPUTER PRINTOUTS FROM PHOTO

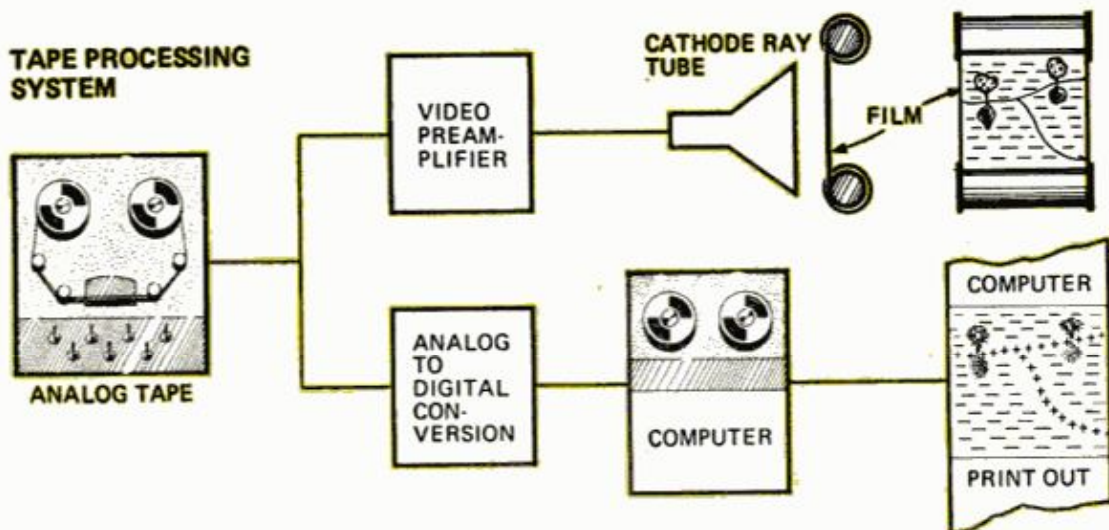


TAPES MADE by multiband scanner can be fed into a computer to produce maps of selected features—crops, bare soil, water, trees. Fields of application include everything from agriculture to the detection of pollution



IT TAKES SECONDS to produce a survey showing four varieties of corn, soybeans, wheat, other features

AIRBORNE SCANNER RECORDS analog tapes which are changed to pictures or digital data for computer



guarding against environmental pollution, locating water, minerals and other resources, and aiding in such tasks as urban planning and identifying good construction sites.

The light we see is only a small slice of the electromagnetic spectrum, ranging from gamma rays to radio waves. Its visible portion can be split into scores of smaller color bands such as blue, green, yellow, red. Although an aerial photo made from film sensitive to almost any single color band will spot a cornfield or a forest, shots made simultaneously on several sheets of film, each sensitive to a different band, will reveal types of soils, crops, trees—a wealth of detail.

The amounts and shades of color reflected by various plants and ground features depend on their chemical and physical composition, and once this reflected spectrum has been identified, MSA photos can map them from the air. Oats, for example, reflect little blue-green, so a photo made from film sensitive to blue-green light is dark. Oats show well in yellow-green, fade in orange-red. Wheat is just the opposite.

When it comes to fine details, MSA can distinguish between dozens of varieties of oats, corn, soybeans and other crops—this because of small differences in chemical makeup. Healthy trees reflect well in the red band. Disease reduces chlorophyll and cuts

reflectivity by 50 percent or more. Using MSA, forestry experts can gauge the extent of an infection almost as soon as it hits—and may even be able to determine the particular disease.

One of the big questions in MSA work has been how many and which color bands should be used to identify a given ground feature. "We study photographs of the same area taken in 15 bands or so, spot something interesting, and then find out what's there by actual inspection," says Robert Miles, highway engineering professor at Purdue. "After that, we whittle down the number of bands needed."

Getting multispectral photos was once a complex undertaking. To take shots in 15 bands, a plane had to carry 15 cameras, each with its own film pack, lens and filter. Now, equipment developed at the University of Michigan simplifies the job.

Called a *multiband scanner*, the equipment focuses light through a single lens and onto a special prism. The prism separates the light beam into as many as 18 bands of light, each of which is directed into a photoelectric tube. As a plane flies over an area, the intensity of each band constantly fluctuates, depending on the ground objects below. The photoelectric tube converts these fluctuations into an electronic signal that is recorded on tape.

Later, the tape is used to recreate these changes in light intensity on a cathode-ray tube like one in a TV set. Taking a motion picture of the tube yields a photo strip that might have been made by a conventional camera.

Recently a plane used this equipment to scan a strip of Indiana 70 miles long and one mile wide in 15 different bands. I looked at one of the 15 strip photos and asked Marc Tanguay of Purdue's Engineering School why the patches of cultivated fields, clumps of buildings and highways didn't appear in color.

"We could have used color film, but that's expensive and we aren't interested in pretty color," Tanguay answered. "We really want to know only how

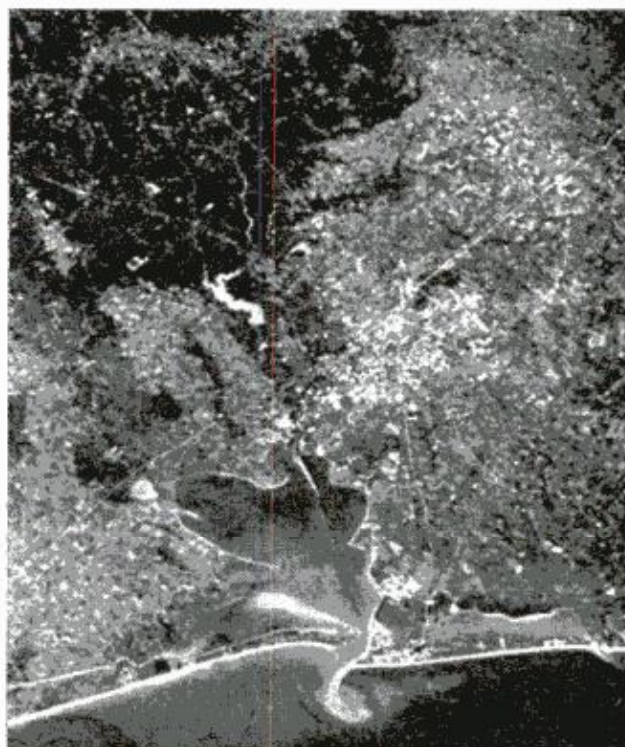
much light a given object reflects in each band." The work at Purdue and other laboratories has been successful in reducing the number of bands needed and making MSA easier, faster and cheaper. Three to six bands are enough to identify most surface features of interest, and Skylab, due to be orbited in a few years, will carry scanners and cameras covering those bands.

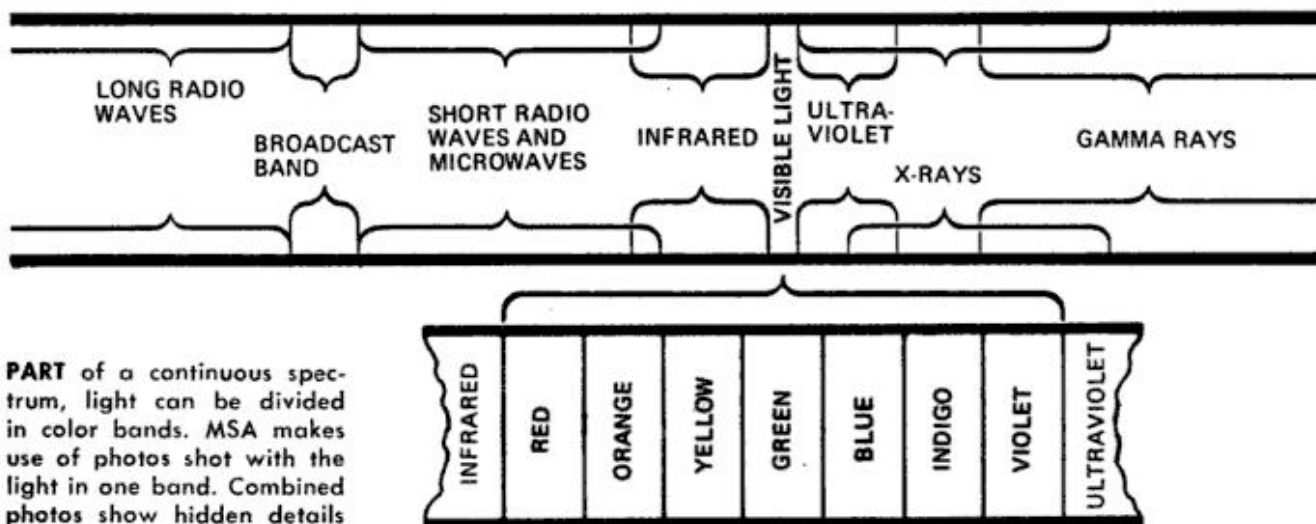
While visual inspection has been used to compare photographs of objects in several bands, the job is enormous. Today, the computer has almost completely taken over the job of analyzing MSA data. At the Laboratory for Applications of Remote Sensing affiliated with Purdue, computers digest up to 18 MSA bands, then print out maps of land features such as crops, lakes, rivers, and bare fields.

"The same tapes that are used to make photographs can be fed directly into computers," explains Robert D. MacDonald, technical director of LARS. "Our programmers can command an analysis of the 18 bands singly or in combination."

A dozen computer printouts, each about six feet long, hang on a wall. The first is a mosaic of symbols rep-

SILT IN WATER, urban areas, forests and other details are revealed in this MSA photo of Houston





PART of a continuous spectrum, light can be divided in color bands. MSA makes use of photos shot with the light in one band. Combined photos show hidden details

representing soil, water, trees and other features. "That map was made by combining all 18 bands," said MacDonald. "That's easy to do."

In a second printout, a stream of S's meander down the paper. "This map combines those bands that identify water," MacDonald said. "That line of S's is the Wabash River. Those other groups are probably ponds."

MSA has already been used to search for corn blight and other incipient crop disease, and to make agricultural surveys of economically important crops. Engineers are using it to map certain types of soil and thus plan depth of bed and thickness of highways and airport landing strips. They can also map the extent of water drainage over watersheds for the most efficient placement of dams.

The technology developed to make MSA practical is leading to other interesting inventions. In a process developed by Philco-Ford, for example, unsuspected details hidden in ordinary photographs can be brought to light. In the process, electronic and optical equipment divides black and white photos into 18 or more shades of gray, each slightly darker than the next. A different color is assigned to each shade and a transparency made in that color. Finally, all the transparencies are overlaid to make a composite.

"The process amplifies small tonal differences the eye can't see," explains Don Ross, the man who did the most to perfect the process. Working with a

color photo of the Houston, Tex., area taken by the Gemini 12 astronauts, Ross was able to change it from a picture that showed very little detail to one that revealed a wealth of information. In the final version, for example, a pine forest near Houston appears in two distinct colors—representing two species of pine tree.

A two-inch-square photo of the Persian Gulf that underwent this MSA enhancement technique, taken from 150 miles above the Earth, revealed details of the ocean floor 180 feet below the water's surface. "We learned from this that enhancement can help map ocean floors, record shifting sand dunes, update hydrographic charts," Ross said.

If MSA can detect so much detail from conventional photos or from the limited surveys made thus far by airplanes and earth satellites, what will happen when regular research—NASA's Skylab Earth Resources program—begins?

As Allen Watkins, chief of the Earth Orbital Missions Office at the Manned Spacecraft Center, recently stated, regular use of MSA will greatly extend man's ability to plan, predict, and manage resources here on earth. Available oil and minerals will be located, ocean resources pinpointed. The best routes of travel over land or water will be identified, water pollution detected, and yields of crops predicted months before harvest. In the future we will all benefit from daily inventories of the larder we call Earth. ★ ★ ★

The Shredder-Grinder:

A little machine that makes quick compost of garden waste.

THE COMPOST GRINDER has been around for about 50 years. But, aside from nurserymen and avid gardeners, few ever heard of it or knew what it could do. Designed to prepare organic materials—leaves, grass clippings, flower stalks, twigs—for the compost pile or for use as mulch, the grinder has lately become a hot item at hardware stores as well as garden shops.

Bans on burning garden trash have led many homeowners to seek some way of reducing leaves and prunings to compact piles so they can be bagged easily for pickup by trash col-

WEAR SAFETY GLASSES when shredding—stone chips may fly up. Sears Shredder-Grinder (above) has three rotary blades and 6-hp gas engine, costs about \$190





FINE MULCH you can spread immediately over flower beds and around shrubs comes from leaves shredded by machine. If preferred you can bag the condensed material (right) for prompt disposal or for later use

lectors. Grinder owners soon discover the value of a compost pile: that the rich humus it yields is excellent top dressing for lawns.

There is a wide choice of grinders and a wide range of prices. The machines will handle twigs and fairly heavy plant stalks, but most will stall on thick brush and tree branches over an inch in diameter. Some are shredders only, others are combination



UNIFORM MULCH is produced by the Kemp Suburbanite Shredder through its rotation of 42 steel teeth at 3400 rpm by a 3-hp Briggs & Stratton gasoline engine or 1-hp electric motor. Price is about \$250

LIGHT BRUSH is also handled by W-W's Model 66-G. Twenty-four curved hammers, rotating at 2500 rpm, flail garden waste. Powered by a 7-hp, electric-start gasoline engine or a 1-hp motor, it costs about \$260



TIPS ON MAKING GOOD COMPOST

Mix compost materials while you shred them and add a layer at a time to the pile, advises W-W Grinder Corp. Wet each layer thoroughly as you build to a maximum depth of three feet. In a few days, when the pile begins to heat, make air holes in it to let the bacteria breathe. A water hose turned on full force or a pipe driven through will work; don't step on the pile and compact it further, though. Prevent excessive heat by watering and turning the pile every week or so. Better yet, run the mixture through a shredder-grinder.

Here are some of the materials you can put in a compost heap: leaves, grass clippings, flower and vegetable stalks, vines, hedge clippings, weeds, fruit and vegetable parings, citrus skins, sawdust, hair trimmings, sewage sludge, coffee grounds, chicken feathers, and manure. If you use much manure, mix it one part manure to three parts plant waste. To check acid soil, add lime.

Balance the materials you compost or you'll have an evil-smelling garbage dump. Never spray compost with a fungicide, nor add leaves sprayed with an insecticide—it kills the bacteria. Also avoid soapy water, grease cutters, and strong chemicals.

shredder-grinders; a few heavy-duty types will even break up and mix soil with the dead vegetation, but many will not. Hopper openings, engines, transmissions, and ease of moving the machine around vary considerably. It's the kind of device a wise buyer would shop around for and want to see demonstrated before making his choice.

For homeowners with big yards, just reducing billowy piles of leaves to a few bags full may be reason enough to own a shredder-grinder. In sandy and rocky country, where topsoil is scarce, a sturdy machine can become a small soil-making factory.

You alternate batches of vegetation with shovelfuls of dirt, letting the machine break them up and mix them together. Then, from time to time, you run the mixture through again to aerate it and thereby speed up decay. The result is a steady source of enriched soil, produced in a fraction of the time nature takes unaided.

As the box on the left explains, all kinds of organic matter are grist for the compost heap. Recycling these "waste" materials can be done quickly and the results are richly rewarding.

—James M. Liston

EIGHT TILLER TINES sweep across grate bars at 800 times a minute in Roto-Hoe Cut 'N Shred Shredder, which takes light stuff in top and brush in a side chute. Unit driven by 3½-hp engine costs about \$160

V-SHAPED BLADES shred at 3400 rpm in the Gilson 54253 Mulcher. Powered by a 3-hp gasoline engine, it costs about \$150. A larger model—equipped with 12 blades and a 5-hp engine—retails for about \$200



Two Bargains

PM OWNERS REPORT
PLYMOUTH CRICKET

A Nationwide Survey Based on
600,000 Owner-Driven Miles

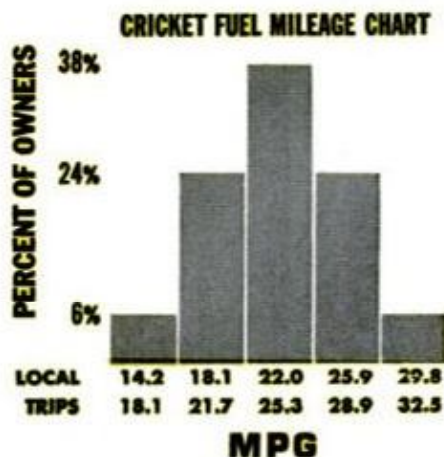


CRICKET comes only as four-door: Colt has three styles. Both use unitized bodies

CHRYSLER CORP. missed launching its U.S.-built small car last year and decided to bring in two new captive imports instead. It's not an unusual practice—Buick does it with the Opel; Lincoln-Mercury with the Capri. Chrysler itself had been bringing in the French Simca and the British Sunbeam Arrow until recently.

But obviously Chrysler felt it needed something new to fill the small-car breach, and chose to bring in two complete unknowns. These two cars—the Colt, marketed by Dodge dealers and made in Japan by Mitsubishi; and the Cricket, sold through Plymouth dealers, manufactured in England by Rootes—are very similar in most important aspects.

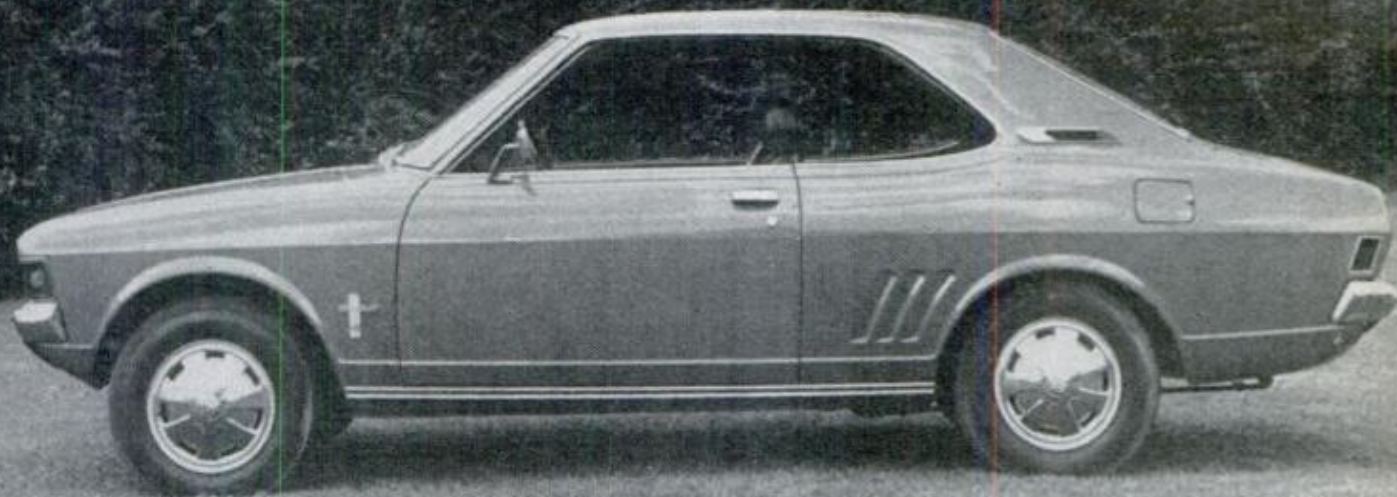
Biggest on-paper differences are these: The Cricket's four-cylinder engine uses pushrods; the Colt's has an overhead cam and hemispherical combustion chambers. The Colt puts out 83 bhp to the Cricket's standard 70, but an optional carb gives the Cricket an identical 83. The Cricket's wheelbase is a bit longer (98.0 inches vs. 95.3), but total lengths are nearly the same (162 inches to the Colt's 160). The Cricket weighs roughly 100 pounds more. Both cars have front disc brakes, McPherson strut front suspension and unit bodies. Rear



..But Brickbats, Too

A Nationwide Survey Based on
750,000 Owner-Driven Miles

PM OWNERS REPORT
DODGE COLT



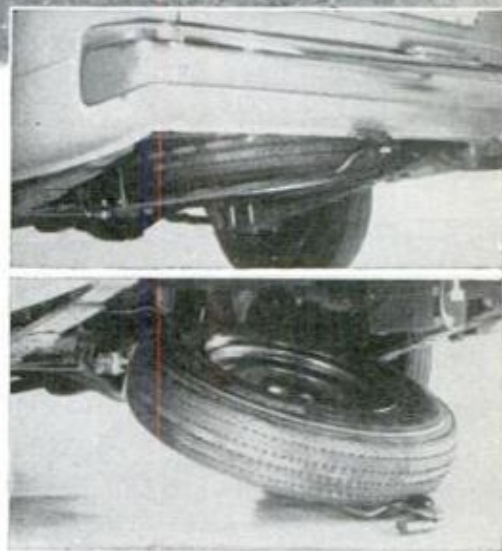
springing is by leaves for the Colt, by coils for the Cricket.

The Colt comes in three body styles—sedan, hardtop and wagon—while the Cricket's available only as a four-door. Yet the Cricket sedan has a much larger trunk (14 cu. ft. to the Colt's 9) and just as much interior space. P.o.e. base prices are \$1915 for the Cricket and \$1995 for the Colt four-door.

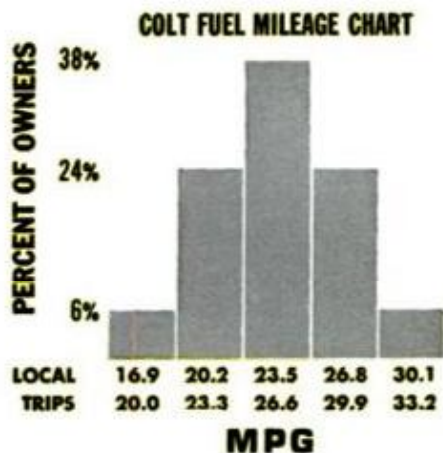
So are they a toss-up? We'd driven and reported on both cars when they first came out (*Test Driving Colt and Cricket*, page 32, Jan. PM). The real test, though, comes in living with a car, so we asked owners for opinions.

The first person answering our "Why did you buy the Colt?" question said, "I've always liked Dodge products," so we already begin to see Chrysler Corp's marketing strategy. The Colt, of course, is no more Dodge than Plymouth, and Chrysler makes no secret of these cars' origins. We got a similar answer on an early return from a Cricket owner: "I bought my car for its size, because it's a Plymouth product, and it's economical." These words came from a Cedarhurst, N.Y., teacher.

The Colt gets slightly better gas mileage than the Cricket, but only about 1 mpg. Cricket owners listed economy as their main



COLT'S spare doesn't encroach on trunk, yet Cricket has five more cu. ft. of space



	16.9	20.2	23.5	26.8	30.1
LOCAL TRIPS	20.0	23.3	26.6	29.9	33.2

MPG



OWNERS like Colt wagon but want roll-down rear window; can't drive with open liftgate, long cargo



CRICKET'S standard equipment includes disc brakes, radial tires. Optional carb gives 13 more horses



COLT OWNERS praised their cars' workmanship more than styling while Cricket owners put it vice versa

DRIVERS like Cricket's contoured buckets, full set of gauges, yet complain of leaks and wind noise



reason for buying, while Colt owners put size first. Then, Cricket owners complained more about poor gas mileage, apparently because Colt drivers were averaging more mpg than they expected while Cricket people were averaging fewer.

What especially do you like about your car? **Colt owners:** "I have had many people remark about how much bigger and more comfortable the back seat is than many Camaros and Mustangs they have ridden in."—California student. "Accelerates smartly; takes all but very steep grades at good driving speeds."—Arizona lime kiln operator. "Adjustable seats and steering wheel, easy to park and maneuver."—California legal secretary. And the following from a machinist who ought to be an ad copywriter: "My Dodge Colt with the hemispherical combustion engine and overhead cam gives me efficiency and performance as well as economy. It has comfort and dependability at half the cost."

Cricket owners had these *specific likes*: "Good speed, really moves out, excellent maneuverability, excellent vision, nice trunk size, economical."—New York camp director. "Holds the road very well."—Georgia letter carrier. "Terrific girl car," said a 22-year-old Pennsylvania secretary meaning (we hope) that it's a good car for young girls to drive. "The standard radial tires seem very stable, even on ice."—Wisconsin technical rep. "All the refinements found in higher-priced cars."—District of Columbia clerk. "Good styling."—Illinois insurance

COLT INTERIOR was found comfortable, two-door coupe most popular with four-door wagon close behind



Summary of 1971 Dodge Colt and Plymouth Cricket Owners Reports*

	Colt	Cricket		Colt	Cricket		Colt	Cricket
Total miles driven	758,187	620,255	Rattles	13.5	—	Did you repair it yourself?		
Average miles per gallon			Poor gas mileage	7.6	12.9	No	100.0%	96.1%
Local driving	23.5	22.0	Windshield leaks	—	11.8	Yes	00.0	3.9
Long trips	26.6	25.3	Poor materials	—	11.8	Dealer repairs satisfactory?		
Body styles			Poor workmanship	—	9.6	Yes	70.7%	58.7%
Two-door coupe	41.2%	—	Too light	7.0	—	No	29.3	41.3
Four-door sedan	26.7	100.0%	Wind noise	6.4	—	Is this your only car?		
Four-door wagon	32.1	—	What changes would you like?			Yes	50.3%	34.2%
Why did you buy?			Improve brakes	12.9%	—	No	49.7	65.8
Economy	59.8%	66.3%	Better workmanship	4.3	13.9%	Other cars owned:		
Size	28.2	19.1	Better materials	4.3	11.9	Dodge	24.7%	10.6%
Style	19.5	19.1	More power	—	8.6	Chevrolet	16.9	12.2
Price	9.8	14.0	Better styling	5.5	8.6	Plymouth	9.0	28.5
Handling	6.3	8.4	More legroom	8.0	—	Pontiac	7.9	11.4
Specific likes:			Better seat shape	—	8.6	Rambler	10.1	—
Economy	60.8%	53.6%	Better service	—	6.0	Ford	9.0	—
Handling	51.7	48.6	Add vent windows	4.9	—	Buick	—	8.9
Comfort	31.8	32.4	Had any mechanical troubles?			Chrysler	—	7.3
Power	30.1	—	No	76.5%	58.4%	Age distribution of owners:		
Style	28.4	24.6	Yes	23.5	41.6	15-29 years	38.1%	46.4%
Performance	11.9	—	What kind of trouble?			30-49 years	39.2	37.4
Trunk space	—	20.1	Electrical	19.1%	9.0%	50-plus	22.7	16.3
Ride	11.4	—	Carburetor	16.7	15.4	Would you buy another?		
Specific dislikes:			Transmission	—	23.1	Yes	78.1%	57.3%
Squeaky brakes	14.6%	—	Brakes	16.7	—	No	21.9	42.7
Poor dealer service	—	15.2%	Speedometer cable	16.7	—			
			Oil leaks	—	9.0			

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

man. "Good workmanship and lots of standard equipment."—New Jersey secretary. "Good gas mileage and lower insurance rates."—Memphis student. "Childproof rear door locks."—Connecticut postal worker.

Now let's ask what features owners don't like. *Specific complaints, Colt:* "Sways a little in strong crosswinds at freeway speeds." "Noisy brakes." "With the automatic trans, I just don't get that extra mileage I'd hoped for." "Could be a little quieter." "I keep bumping my head on the roof when I hit bumps in the road." "Rear axle has a clunking sound, and the brakes fade badly on hard stops." "I worry about having even a minor accident—the gauge of the Colt's sheet metal

is so thin that the entire roof can be pushed in with one finger. Even the bumpers are flexible."

Specific dislikes, Cricket: "My Cricket is a good car, but Chrysler Corp. should realize that its dealers are killing their cars simply by passing the buck. Instead of giving honest service, I had to buy a set of metric wrenches so I can work on the car myself. The salesmen and mechanics don't know or care about this car; it took 3½ weeks to deliver a new windshield from Detroit to Toledo—61 miles." "Am not getting the mileage I was told I'd get." "For a new car, we've had entirely too many troubles—leaks, rear end almost fell out and the transmission wouldn't

(Please turn to page 184)

COLT'S variable-ratio steering gives more mechanical advantage the harder you crimp steering wheel

CRICKET'S coil-spring rear suspension, standard radial tires help it stick in high-speed cornering

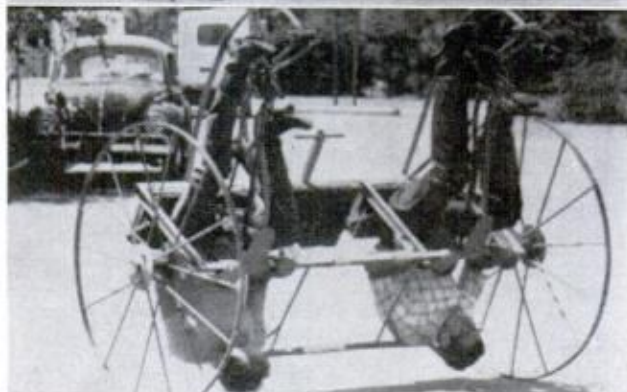


NEWS BRIEFS



Propeller tows skier

Tired of plodding cross-country, Eero Aikio, a Finnish aircraft technician, built a prop-driven ski tow. Powered by an air-cooled, chain-saw engine, the rig rides on two skis. Aikio holds onto long, wooden handles and steers by pulling harder on one than the other.



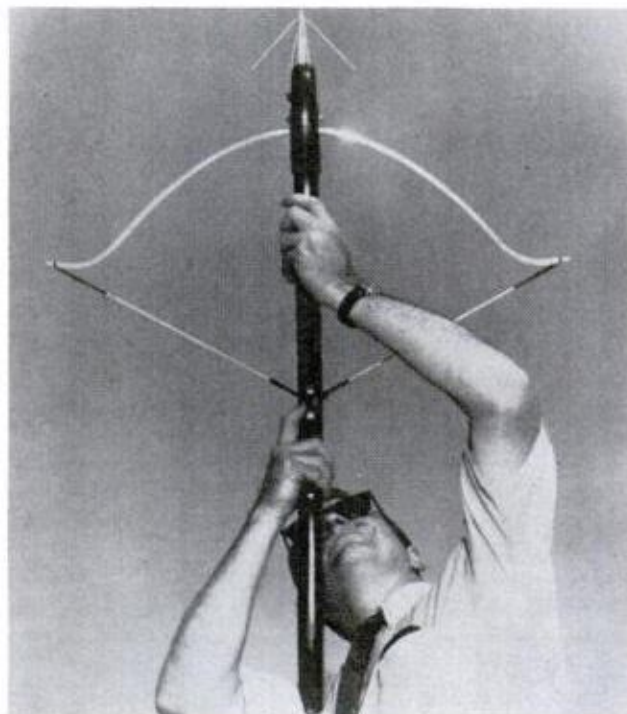
Novelty bike flip-flops

You can stand on your head and pedal this crazy bicycle, but keep your seat belt fastened. Pete Leidich and Jerry Hook, engineering students at the University of California, Davis campus, built the side-by-side tandem vehicle to compete in a homemade fun bike contest.



Bugatti 37 'Moon Raker'

Leather helmet and goggles come with this replica. A British firm—Dri-Sleeve Car Co.—is building 50 a year for sports-car types who like their shift lever and hand brake on the outside. The two-seater has no top, but has a modern 1600-cc engine and suspension.



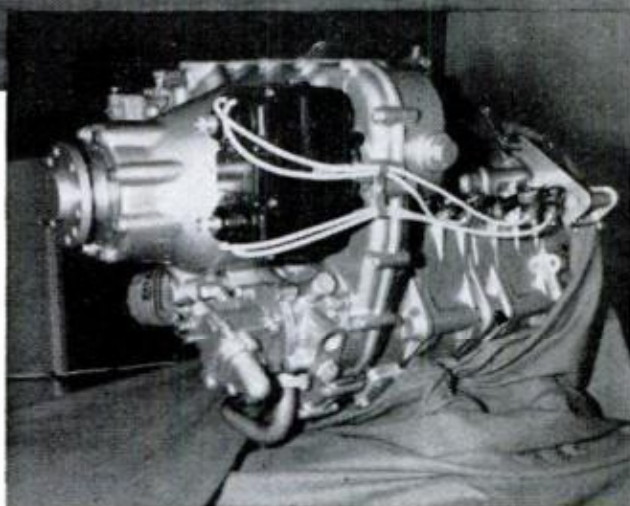
Old weapon, new use

Engineers at Motorola found an ideal missile to test their new radar target-scoring device. It's a special arrow shot from a crossbow. When the arrow zips through invisible electronic rings around the target, the device records how close the arrow came and its angle.



Quietest lightplane

Powered by a Wankel rotating-combustion-chamber engine (right), this four-place Cessna Cardinal is being flight-tested by Cessna Aircraft Co. as part of a Navy-sponsored "quiet airplane" program. The Navy wants a light tactical aircraft that won't advertise its presence over enemy territory. Besides the Wankel engine—by Curtiss-Wright Corp., U.S. licensee—the plane has a three-bladed, wide-chord prop and an elaborate muffling system that ejects the exhaust above the aircraft.



Californian's 'car' is king of the road

Other motorists give Abraham Shiepe Jr. of Malibu a wide berth when he's driving his "car," a 7½-ton armored personnel carrier. Shiepe bought the 1943 M-20 from MGM Studios for \$2000, spent \$4000 converting it to a family sedan, then had it inspected (right) and licensed. Classed as a "tank," the vehicle has two, four, and six-wheel drive, gets 5.6 mpg.

It's Your Business

Need extra income or want to be your own boss? You might think about one of the service specialties—from rug cleaning to printing circulars—described in this article. For many men, a part-time line has grown to a full-time business operation

By MORT SCHULTZ

IN THESE DAYS of rising costs of everything from groceries to a college education, more men than ever before are seeing the need to “moonlight”—on a second job or in a part-time sideline. Factory workers, firemen, policemen, postal workers, teachers and ministers who are just managing to keep their heads above water; men who today find themselves out of a job because of layoffs; men who wonder how they're going to make ends meet on social security when they're retired—all would be a lot happier if they could find a little additional income that would make things easier.

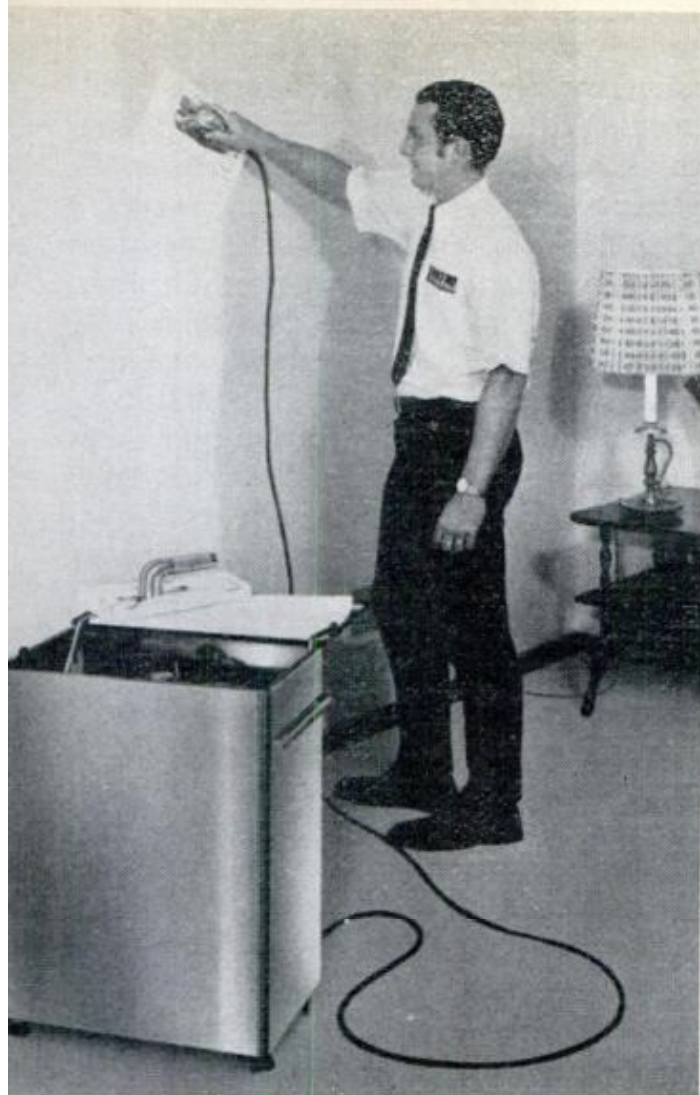
In recent years the pot of gold at the end of the rainbow for anyone seeking it in a small business operation appeared to be in some kind of franchise. There's nothing wrong with a good



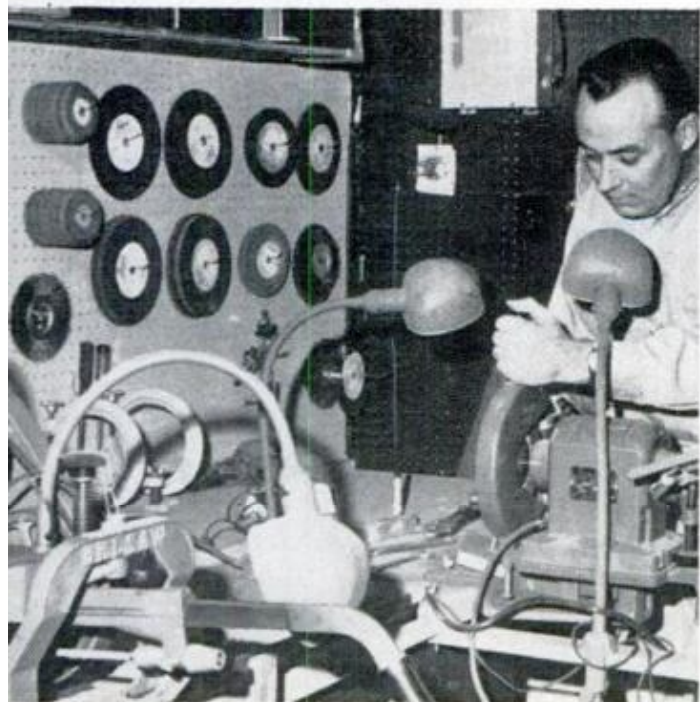
WALL-TO-WALL CARPETING, which must be cleaned in the home, has created a steady demand for rug-cleaning specialists. The Von Schrader machine, said to be unique in the field, costs \$725

franchise—if you can bankroll it. But, like everything else, the price of getting into the best game in town has gone up. If you have \$8000, \$10,000, or more, you can buy a chance to prove how good a businessman you always knew you were.

For men who can't afford a franchise—or risk leaving their present job—what's left? Year after year many companies have advertised in *Popular Mechanics* ways of making spare-time income from a business headquartered at home and requiring only a modest



MACHINE FOR CLEANING WALLS (above) was developed by Von Schrader company in response to requests from successful rug-cleaning operators. With it an operator can do seven average-size motel rooms in a day. Belsaw Sharp-All (below) is used to sharpen circular saws and other bladed tools used in the home, garden and shop. It takes about five minutes to sharpen a small circular saw for a fee of \$1.50



initial investment. How well do such businesses work out for those who operate them only part time? Do they, in fact, blossom into full-time businesses?

The Von Schrader Manufacturing Co. of Racine, Wis., has been using *Popular Mechanics* for almost 40 years to tell readers how they can build a profitable rug-cleaning business with the company's patented rug detergent. Von Schrader also manufactures an upholstery detergent and a wall detergent as well as its own specially formulated detergents. The company has sold thousands of machines and it might be expected that by now this field would be overcrowded. But the trend to wall-to-wall carpeting (which must be cleaned in the home) and the increased use of carpeting in motels, business offices and schools has generated even greater demand for this service.

In 1935 Francis Von Schrader started his company by buying the inventory of a rug-washer manufacturer. This consisted of 50 machines and enough repair parts to build 300 machines.

Von Schrader knows what it's like to start small and he still operates with the personal touch of a small-town businessman. He calls those who use his equipment "Von Schrader associates" and it's not unusual for any of them to receive a personal letter from the president. Because of this paternal interest, he receives a steady flow of correspondence from "little fellows getting started" who like to share with him their latest success story.

"The greatest enjoyment I get out of life," says Von Schrader, "is having some small part in helping a man better himself. One of the best examples of this is a man in Michigan with a family of 13 children. He and his wife put every one of them through college with the money they made using our equipment. Cases like that give me and all of us in the company the feeling that we are helping. Ours is a small business; we're not trying to take a lot of money out of it."

The Von Schrader rug cleaning ma-



A VARIETY OF JOBS, including stationery, circulars and labels, can be turned out on Kelsey press

chine is unique in the industry. The proper amount of detergent is released from the tank by a solenoid valve to a mixing chamber. Air exhausted by the electric motor that drives the brush is channeled into the mixing chamber to create a dry foam. The foam is released in front of a slowly revolving brush. Behind the brush a squeegee roller raises the detergent from the bottom to the top of the rug pile where it is immediately taken off by a vacuum intake.

The machine's unique feature is that it allows foam to be in contact with the pile only a matter of seconds so that the loosened dirt doesn't soak back into the rug and, thus, the rug will be left virtually dry.

The machine weighs 54 pounds and sells for \$725. This price includes such supplies as spot removers, small brushes and sufficient detergent to do work that will earn about \$400. An equal amount of special concentrated detergent on a re-order costs \$14. With this much material an associate can do 4000 square feet of rug and gross \$400, at an average charge of 10 cents a square foot.

Von Schrader suggests that a man start with one rug detergent and acquire

additional equipment only after the demand for his services dictates the need for it. Still, some operators grow fast, as this letter from an associate indicates:

"After two years as a part-time cleaner, I had to give up my job as a salesman. I started with two pieces of equipment and an old station wagon. In less than four years I added two wall detergers, two rug detergers, an upholstery machine, a fleet of four panel trucks, a new station wagon, five full-time and five part-time employees. I grossed over \$50,000 last year and I will double that next year."

What can a beginner expect? "Nine days after receiving the detergent and after I had given a 60-square-foot demonstration, I was awarded the contract for cleaning 9380 square feet of carpet, although two competitors underbid me by a considerable amount. I grossed \$938 on that job."

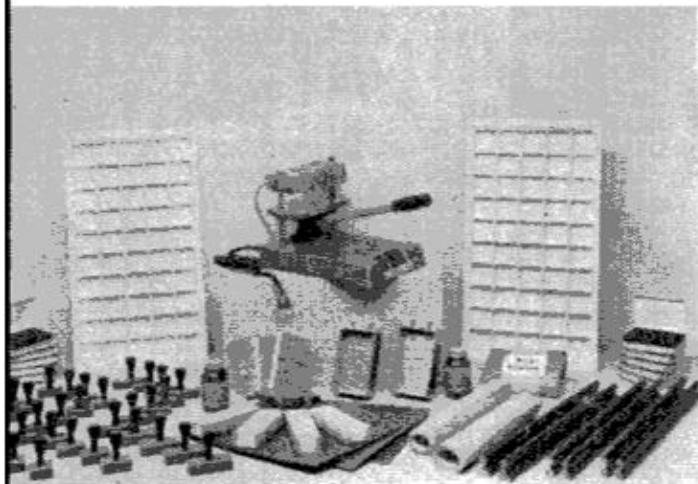
The Kelsey Co. of Meriden, Conn. is another old-line organization offering attractive income possibilities. Kelsey sells handprinting presses and supplies. Kits start at \$74.95 and run to \$525.50. The size of the press—there are four sizes from 3 by 5 inches to 9 by 13 inches—dictates the price. An instruction manual is included.

Kelsey presses allow you to print a multitude of jobs, including stationery, circulars, labels, photograph and movie titles, church literature, tags and greeting cards. Orders can be obtained in a number of ways, including newspaper advertising and by advising local business firms of your service.

C. E. Mosher, president of Kelsey, says that many of his customers are individuals who are seeking a source of extra income.

"Some have parlayed their small Kelsey equipment into full-time profitable businesses," he claims.

One such customer is Arthur C. West of Chula Vista, Calif., who "took a fling," he says, by buying a Kelsey outfit in 1956 for \$359.22. His shop now contains approximately \$18,000 worth



MAKING RUBBER STAMPS with an outfit like this enables some part-timers to earn \$5 to \$7 an hour

of printing equipment and all of it is paid for.

"Last year," West states, "we made a net profit of \$10,000 with my wife working in the print shop full time and myself part time in conjunction with another job."

Many mail-order companies keep their customers informed of new methods to employ in using equipment and increasing business. Kelsey, for example, sends out a newsletter periodically, while the Belsaw Machinery Co. of Kansas City, Mo., provides its customers with a mini-magazine of 32 pages four times a year.

Belsaw sells equipment that sharpens tools and utensils. Its Sharp-All, as the machine is called, sells for \$279 and comes with an operator's manual. Other firms in the same business that advertise in *Popular Mechanics* are Foley Manufacturing Co. of Minneapolis, Minn., and Treyco Products, Inc. of North Tonawanda, N.Y.

The equipment can be used to sharpen circular saws from 4 to 48 inches in diameter and other bladed tools used in the home, garden and shop, including knives, mower blades, shears, planer blades, chisels and clippers.

Edward Dobbins, sales manager of Belsaw, claims that Sharp-All will sharpen a small circular saw in about five minutes.

"Most men charge \$1.50 for this, which means that if you set up a small

sharpening business you can make as much as \$6 an hour," Dobbins says.

"Many of our customers," he continues, "are retired or semiretired individuals who want to supplement social security."

Getting people to sharpen their tools may seem difficult. It isn't.

In addition to the more obvious ways—making house-to-house calls and calling on carpentry and cabinet shops, and other businesses that use tools requiring periodic sharpening—some of Belsaw's customers have thought up some really imaginative approaches.

One man in Houston, for instance, who takes long walks in nice weather, makes it a point to stop off when he sees a neighbor pruning plants.

"Don't bend 'em . . . snip 'em," he advises. This opens the door to a discussion of his tool-sharpening business.

In starting his small business, a Belsaw customer in San Francisco had his wife whip up sandwiches in which he inserted a typewritten note that read, "I have a Belsaw tool and saw sharpening business, and I'm looking for bread and butter accounts."

He dropped the sandwiches off at carpentry shops, lumber yards and sim-

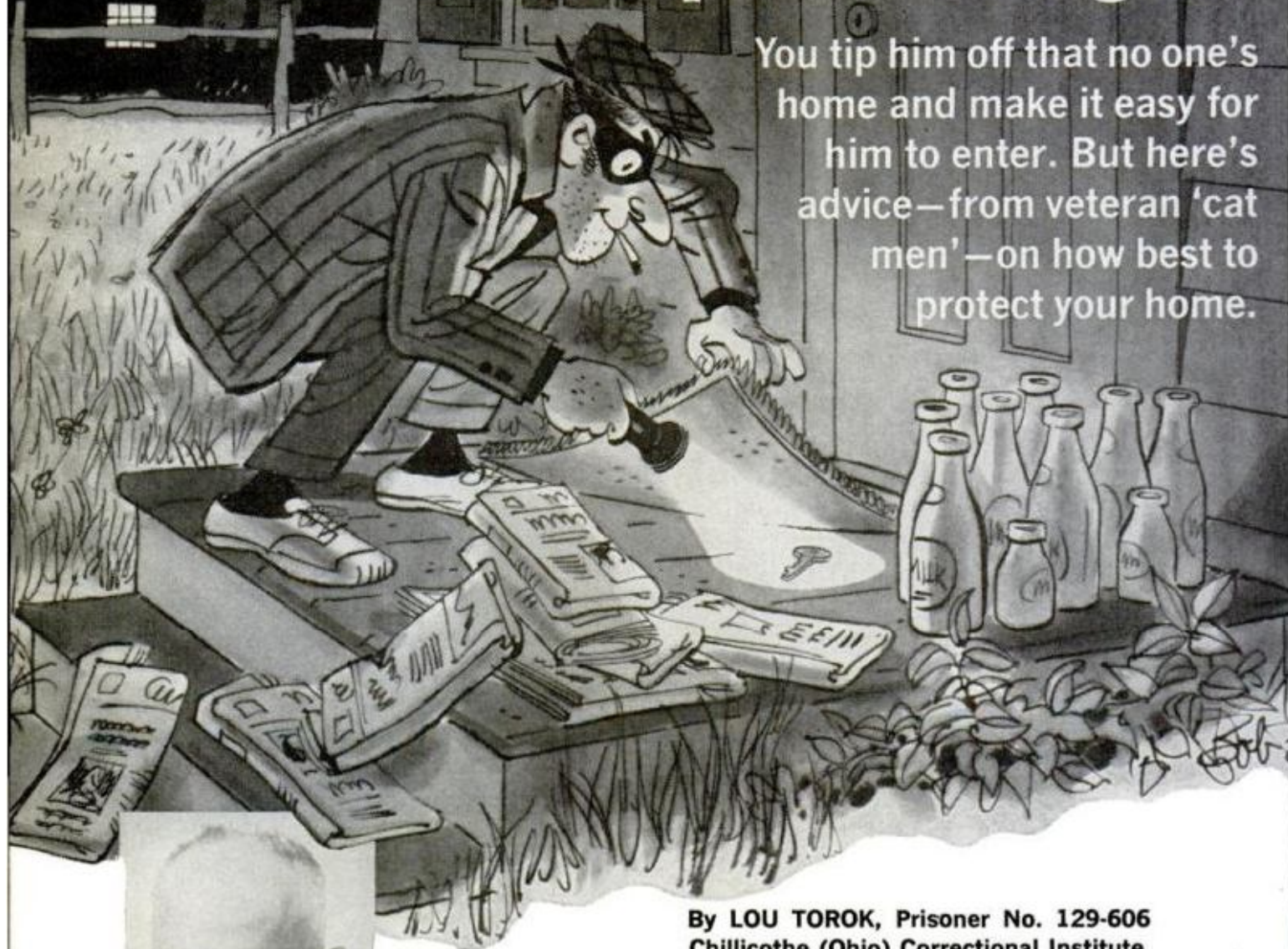
(Please turn to page 186)



LITTLE MECHANICAL KNOW-HOW is said to be needed when using this machine to make engraved signs

How You Help the Burglar

You tip him off that no one's home and make it easy for him to enter. But here's advice—from veteran 'cat men'—on how best to protect your home.



By **LOU TOROK**, Prisoner No. 129-606
Chillicothe (Ohio) Correctional Institute



WRITER Lou Torok listens when "cat men" talk

BURGLARY IN THE UNITED STATES is big business. In 1969, the latest year for which the FBI publishes statistics, burglars made off with some \$620 million in stolen goods, more than half of it from residences. If none of your possessions was among the loot, consider yourself lucky, especially if you live in a big city.

Burglaries fall into two categories: jobs by professionals and jobs by amateurs. The pro is an expert—a "cat man," in prison slang—who earns a good living through careful planning and cunning thievery. There really is little you can do to keep him from gaining entrance to your home or place of business once he's convinced that you have things worth taking—a hoard of cash, valuable jewels, expensive furs. If you're a middle-income businessman or wage earner living in a relatively modest neighborhood, it isn't likely the pro will pick on you. He goes after big scores.

He chooses his jobs with care and cases them thoroughly. He can open most any lock in a matter of seconds. Ingenuity is his middle name. One veteran I talked to recently—among the many burglars I've met in prisons in California, Maine and Ohio—laughingly told me that he once lined up a number of jobs by attending a civic meeting devoted to burglary prevention. As well-dressed

matrons asked a police lieutenant and a locksmith how best to protect valuables, the old thief made mental notes.

"The locks and other protective devices discussed at that meeting were ridiculous," he told me. "They could work only against the amateur."

That's the point of this article: You may not be able to protect yourself against the pro, but you can stop or discourage the amateur.

In most cases he is an opportunist who decides on the spur of the moment to prowl your house or apartment. He's after loose cash, piggy banks, watches, cameras, hi-fi gear, portable TV sets, tape recorders, guns, clothing—anything he can turn into a quick buck. He may be supporting a drug habit.

Don't help the housebreaker by leaving invitations for him. Don't let mail and newspapers pile up at your front door while you're off on vacation. Have deliveries stopped while you're away. Always arrange to have your lawn mowed or your drive cleared of snow in winter. The same boy who does your lawn can see to it that your garbage cans are where they belong, not lying where the garbage men dropped them the morning after you drove off to the seashore. Have milk deliveries stopped.

Remember to close the garage door, for an empty garage is another form of invitation. Be sure to lock the garage, especially if it connects with the house. A burglar can close the garage door behind him for absolute privacy as he jimmyes the connecting door.

At the same time, try not to create an "all locked up" look. Don't pull all of the shades down or close all of the venetians. Leave some of the shades at mid-position or some of the venetians open. Avoid uniformity.

Noise is another ploy. If you're going off for the weekend or just for an evening out, leave a radio playing so that it can be heard by anyone standing near the front or rear door. If you plan to be away for a week or two, hook the radio to an electric timer that will turn it on at, say, 9:00 a. m. and off at mid-

night. Incidentally, daytime burglaries, which have increased 286 percent since 1960, are more common than nighttime forays.

Lights also create uncertainty for the housebreaker. But don't save pennies by simply leaving one light on in one room. That's too obvious. Light many lights in several rooms. Again, timers can be used (*Clock Timers: Easy Way to Automate Your Home*, page 112). You could even install an electric control box that can be programmed to flip radios and lights on and off throughout your house (*Build*

Try not to create an 'all locked up' look. Don't pull all of the shades down . . .

PM's \$30 "House Watcher," page 120, June '71 *PM*).

There are other precautions you can take, according to cat men I've known, to increase your protection:

- *Locks.* Install double dead-bolt locks on *all* outside doors. Spring-type jobs are inadequate. By inserting a stiff piece of plastic or venetian blind, the prowler simply pushes back the bolt. And, for Pete's sake, don't hide a key under a doormat or flowerpot. Housebreakers look for such hiding places.
- *Windows.* Many kids get started in crime because of the temptation of an unlocked window. Be sure to lock the upstairs ones, too. Burglars can climb ladders. For the best protection, install hard-to-break laminated panes.
- *Dogs.* A frightened, barking house pet is your best form of protection.
- *Neighbors.* A trusted neighbor is invaluable. He can see to it that mail does not accumulate or your lawn become scraggly. Most important, he may spot a stranger eyeing your place.
- *Police.* Make sure to notify them before you leave on vacation.

Finally, always remember that the three best friends of the burglar are loneliness, quiet and darkness. ★★★



Leitz 6x24 Trinovid \$225



Bausch & Lomb 9x35
Porro Prism Type
\$289

Zeiss 8x50 Central Focusing \$399



How to Choose

Whether you use them for boating, car rallies or girl-watching, there's a lot to know if you want the latest features at the best price



Miida 7x28
Straight Through
\$125

BINOCULAR APPLICATIONS

USE	6x30	7x35	7x50	8x30	9x35	10x50	16x50
General	E	G		E			N
Indoor Sports	E			G		N	N
Outdoor Sports		E	G	E			N
Boating		E		E	G		G
Hunting		E		G	E	N	N
Nature Study	G	E			E		G
Travel	E			G		N	N
Plane Spotting	N				G	E	E
Night Use		G	E				N

E—Excellent G—Good N—Not recommended

Note: When shopping for a binocular, you may see intermediate sizes such as 6x20, 6x24, 8x32, 8x40. Use the recommendations nearest to the glass you are examining.



Swift 7x50
American Style
\$349



Bushnell 7x50
Insta-Focus
\$109.50

and Use Binoculars

By ROBERT BRIGHTMAN

Technical Art by Fred L. Wolff

WHAT IS a binocular? Are field glasses and opera glasses binoculars? No. A binocular always uses a set of prisms in its optical system. Without prisms, binoculars would be about three times as long and their fields of view would be very narrow—like looking through a 10-in.-long pipe. Field glasses are limited in power (magnification), seldom more than five times (5X); opera glasses are usually 2X to 3X.

How far can you see with binoculars? The same as with the naked eye! All binoculars do is bring the object closer. You can see the moon with the naked eye, and it is 240,000 miles away. But with 10X glasses the moon will seem to appear 24,000 miles away—or 10 times closer.

The first time you shop for a binocular, the salesman will invariably ask what power glass you want. If you're indecisive, he may recommend an 8X glass—generally, a good all-around choice for most outdoor work.

If you examine an eight-power glass closely, you will see numbers near the eyepiece end reading 8x30, 8x40 or 8x50. The first number refers to the power; the second to diameter in millimeters of the objective lenses (large lenses opposite the eyepieces.) The larger the objective lens—in the same power—the brighter the image. Thus, if you want a glass for stargazing, select one with a large objective lens: 40 or 50-mm. But, as the objective gets bigger, so does the binocular—heavier, too.

Another term you may come across is "relative brightness," a method of comparing image brightness of glasses with different powers and objectives—sort of a common denominator. To obtain it, divide the objective lens diameter (40-mm, for example) by the power (10X, let's say), this gives 4. Square this number (4x4) and you get 16—the relative brightness of a 10x40 binocular. The lower the magnification—with the same objective—

the higher the relative brightness. Also, the larger the objective—with the same power—the higher the relative brightness.

Another important buying criterion is the field of view. Obviously, the wider the field of view, the easier it is to keep a moving object or animal in view. If a wide field of view is important (for game spotting or horse racing) select a glass with a low or medium power: 6X or 7X is best.

The field of view can be measured by the angle formed by two lines drawn from the observing position to the two opposite edges of the visible field seen through the glass. It is commonly indicated by the number of yards (or feet) visible between the lines 1000 yards from the binocular. For example, a glass with a field of view of 128 yards at 1000 yards has a 7.3° angle of view.

However, an extra-wide field of view may not be an advantage, if gained at the expense of clarity. A true wide-angle binocular should show a sharp field of view in the center of the field. If you have to refocus to get sharp edges, try another glass.

Chromatic aberration, an annoying fault found in some cheap binoculars, shows up as a color fringe when you look at a post or tree against a bright sky. It tends to make a halo around

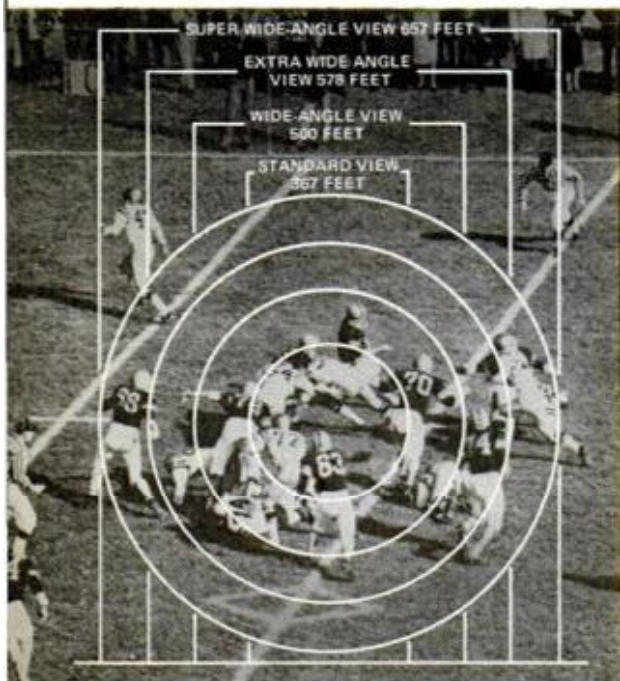
MAINTENANCE TIPS

- Don't drop your binocular; you won't if you always use it with the strap around your neck.
- Keep lenses free of dust and fingerprints. Use lens tissue or camel's hair brush for cleaning.
- Your name and address should appear somewhere on carrying case.
- Salt spray should be wiped off immediately with a damp cloth.
- Store binocular in clean, dry place.
- If your binocular ever needs repair, write to manufacturer for instructions as to where it should be sent.

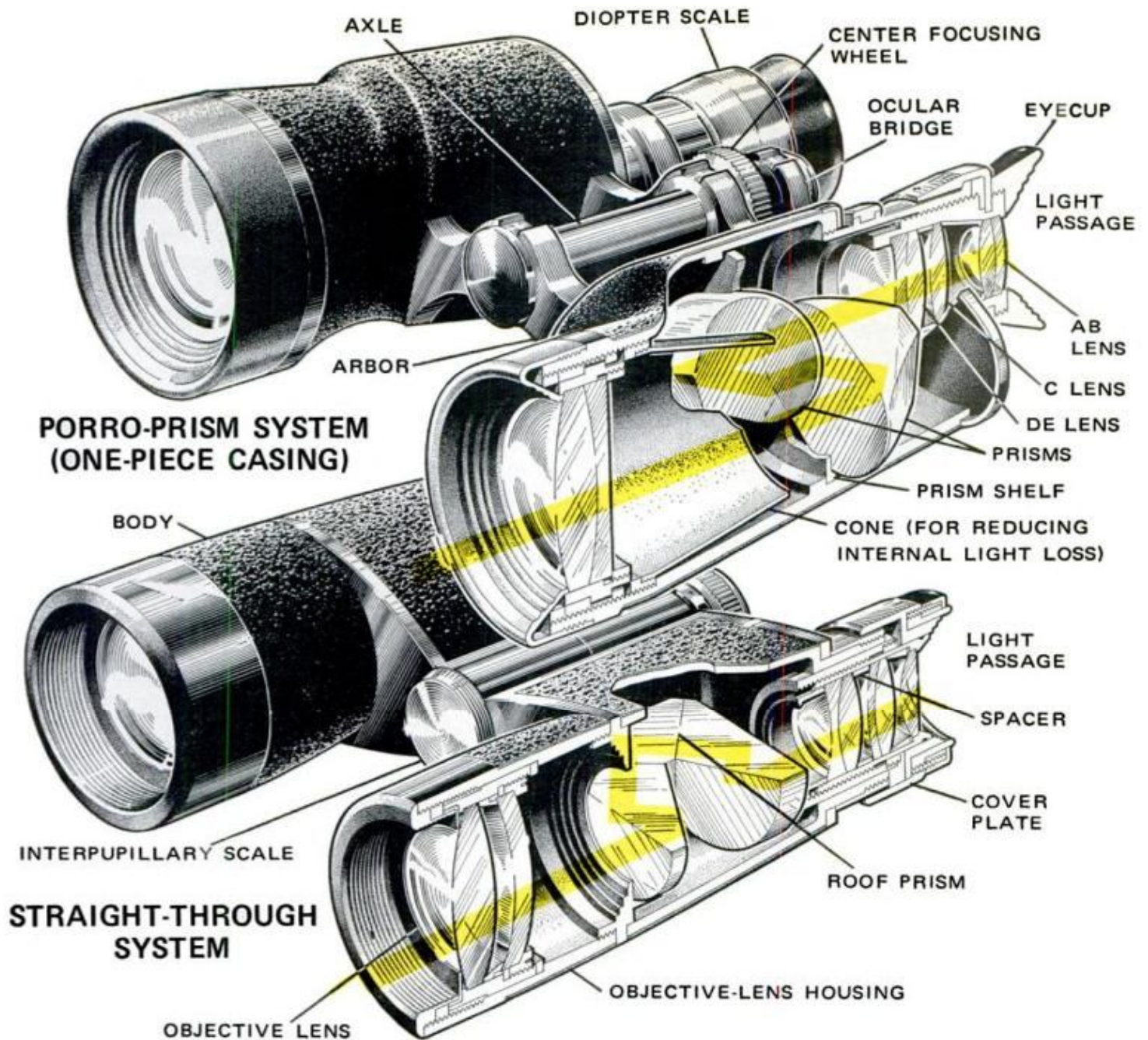
the image, thus affecting the definition.

How about antireflection coatings? Very important. All binoculars now have them in *some* form, but a good one should have *all* reflecting optical surfaces coated to prevent internal glare. A cheap glass will have such a coating only on visible glass surfaces—outside the eyepieces and objective lenses.

How can you tell if internal optical parts have been coated? Quite easily. Hold the binocular at arm's length at your waist so that an overhead lamp is reflected from the objective lens. Shift the glass slightly until you can see a



PARTIAL VISION is the result (above, left) when you try to use binoculars without removing your eyeglasses. Image at right provides full vision. Wide-angle binoculars (comparable sizes shown at left) offers advantages over a standard binocular when used for watching football, hockey, horse racing and similar sports where the action ranges over wide field and is fast moving. Wide-angle glasses are also recommended for plane spotting, hunting



SIX POINTS TO CHECK BEFORE BUYING

- Shake the binocular; nothing should rattle inside.
- After adjusting and focusing, you should see a single image, no overlaps.
- Lenses and prisms should be coated.
- Focusing should be smooth and easy. Be wary of glasses that bind or have a loose point when focusing.
- Image should be crisp and clear, no color fringes should appear.
- Check for distortion. A straight line (edge of building or flagpole) should remain reasonably straight when moved towards edge of binocular field.

series of reflections of the lamp in the lens—one for each optical surface of the prisms and lenses. If the reflections you see have a decided purple or blue cast, then you can be reasonably sure that all of the internal surfaces are coated.

What about independent or central focusing (IF or CF)? Each eyepiece of an IF system must be adjusted separately. However, this system permits the manufacturer to make a more nearly dustproof and waterproof binocular. The CF system allows you to change the focus for both eyes at once as you follow rapidly moving action such as a horse race or hockey

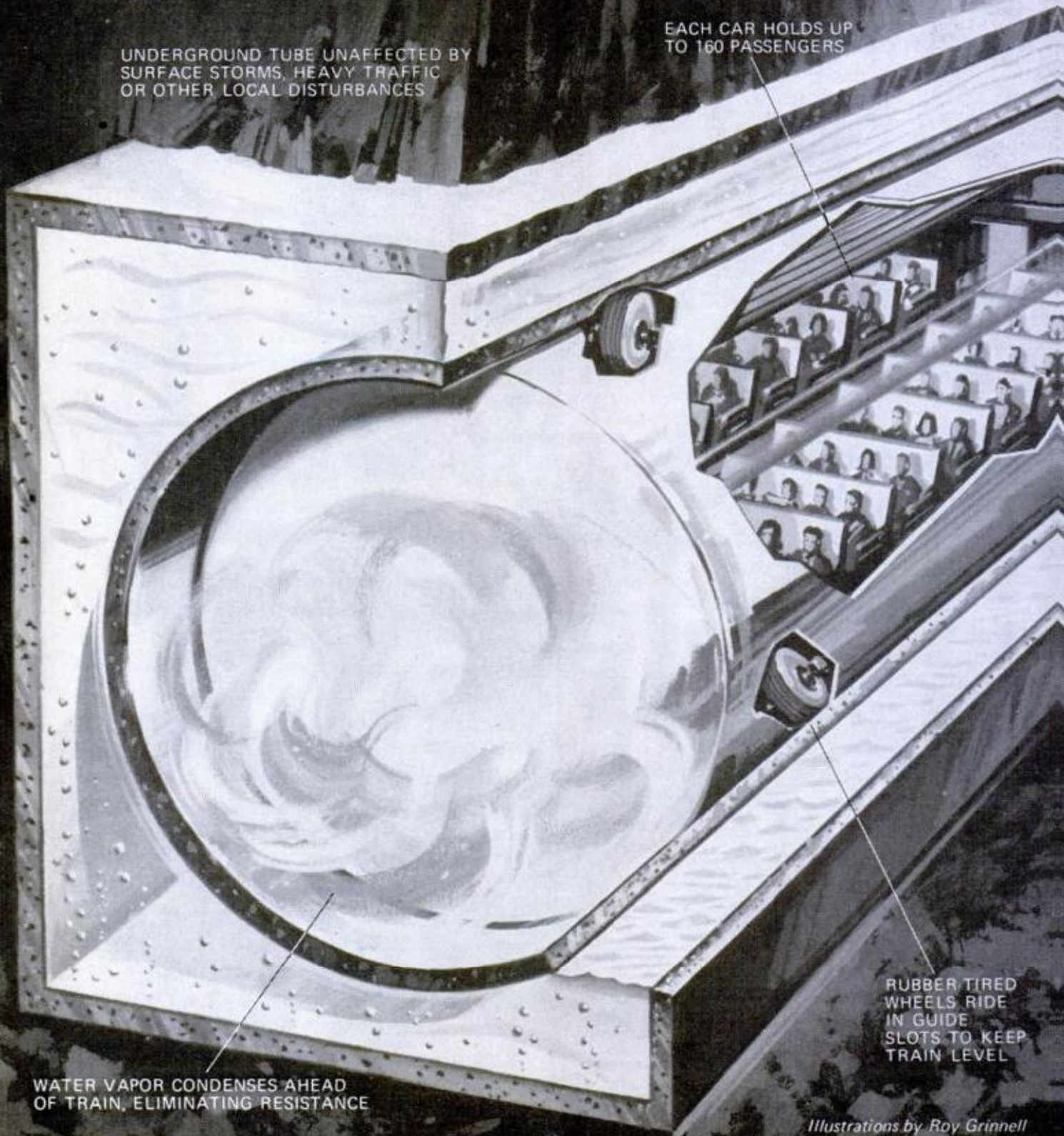
(Please turn to page 188)

Train of the Future: 400 MPH on

HIGH-SPEED TRAINS encounter one big problem: The faster they go, the more air pressure builds up in front and the more power is required to overcome the resistance. Eventually, the resistance mounts up to a point where it acts, in effect, as a wall. In the new system shown here, bulletlike cars are driven by steam through an underground tube—like a piston in a cylinder. The tube is filled with water vapor that replaces the air without the need for costly vacuum pumps. As the cars accelerate, pressure causes the vapor to condense on the walls of the tube, leaving virtually a clear vacuum ahead. Speeds up to 400 mph or more are possible on a single blast of steam, and the train can coast for several hundred miles without slowing appreciably. At each stop, a new blast of steam sends the train on its way again. The ingenious plan, designed for long-distance, high-speed travel, is under study by Susquehanna Corp. of Alexandria, Va.

UNDERGROUND TUBE UNAFFECTED BY SURFACE STORMS, HEAVY TRAFFIC OR OTHER LOCAL DISTURBANCES

EACH CAR HOLDS UP TO 160 PASSENGERS



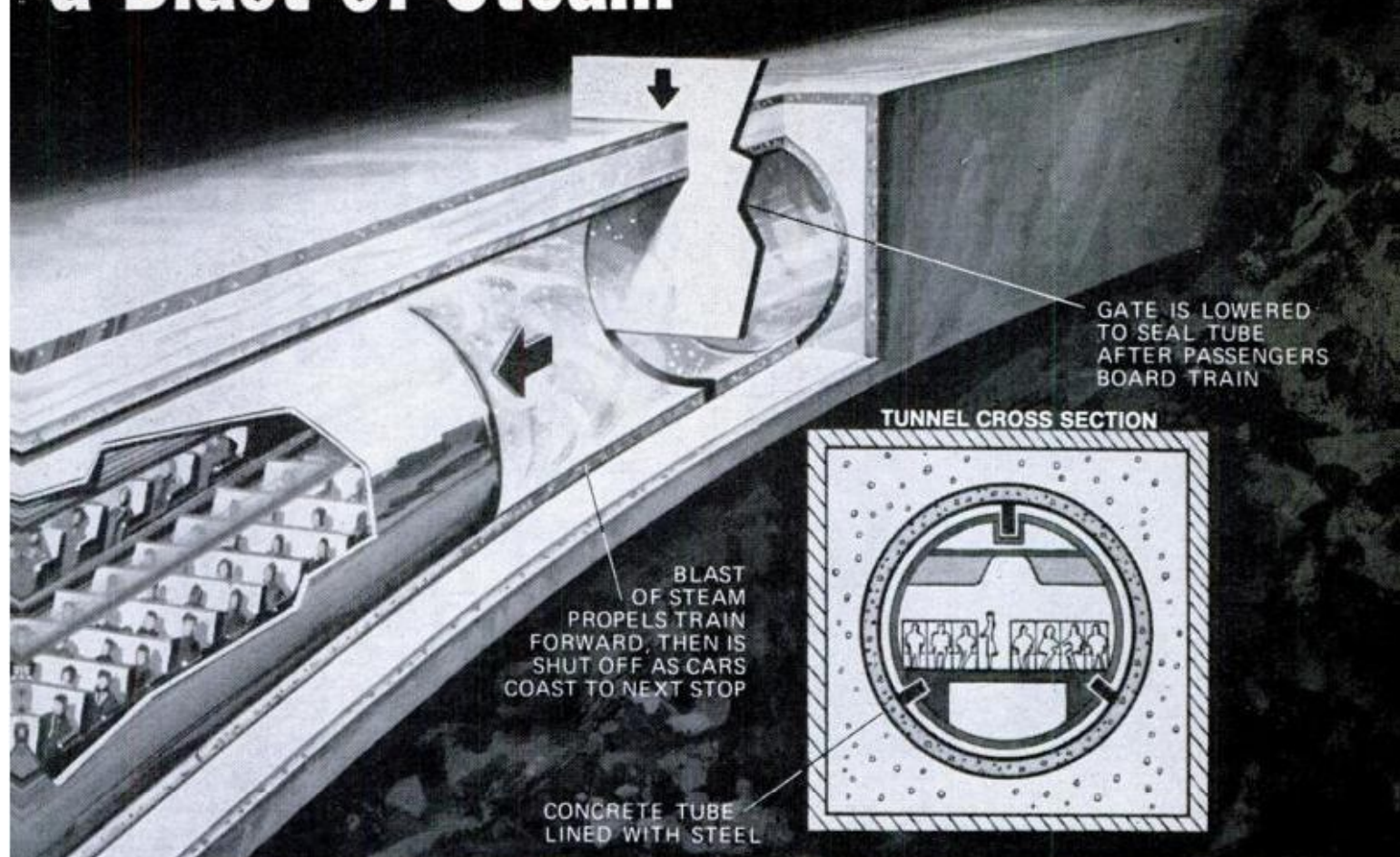
WATER VAPOR CONDENSES AHEAD OF TRAIN, ELIMINATING RESISTANCE

RUBBER TIRIED WHEELS RIDE IN GUIDE SLOTS TO KEEP TRAIN LEVEL

Illustrations by Roy Grinnell

a Blast of Steam

JUST PATENTED



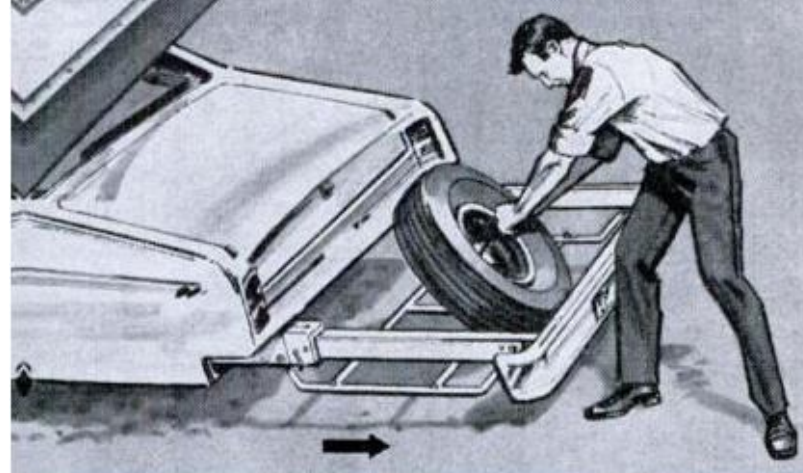
GATE IS LOWERED TO SEAL TUBE AFTER PASSENGERS BOARD TRAIN

BLAST OF STEAM PROPELS TRAIN FORWARD. THEN IS SHUT OFF AS CARS COAST TO NEXT STOP

TUNNEL CROSS SECTION

CONCRETE TUBE LINED WITH STEEL

Quick-Change Slide-Out Spare



Your spare tire is usually buried at the bottom of a trunkful of luggage when you suddenly need it on a trip—but not this one. You simply slide out the rear bumper and with it comes the spare held neatly in a telescoping rack. Your jack, a lug wrench and other tools can also be stored in the rack for easier access. The inventor is William T. Woods of Bertrand, Mo.

Handy Indoor Garbage Disposer

You don't have to go outdoors to get rid of the garbage with this convenient through-the-wall disposal system. You just open a door, toss in your bags of waste, and they slide down a chute directly into a pail placed outside. For emptying the pail, the hinged chute swings up, lifting the lid with it. Invented by George O. Mullens of Gardena, Calif., the chute arrangement will also prevent animals from getting at the garbage.



CHUTE SWINGS UP FOR ACCESS TO PAIL

IN CLOSED POSITION, CHUTE SEALS CAN AND PREVENTS ANIMALS FROM OVERTURNING IT

RINGBOUND STORAGE WALL FROM A KIT

Freestanding yet rigid, these modular components can be expanded or changed

By HARRY WICKS, Workshop Editor

AS YOUR FAMILY GROWS and your home seems to shrink correspondingly, you hunt more storage space. Eventually, no place is left to install a closet. That's about the point the Karlis Grinbergs family reached when Mr. Grinbergs decided to do something.

Unlike the average homeowner, Karlis is an architect who resolved the problem by creating the attractive shelving system you see here. The finished product brought so much praise from his neighbors and relatives that

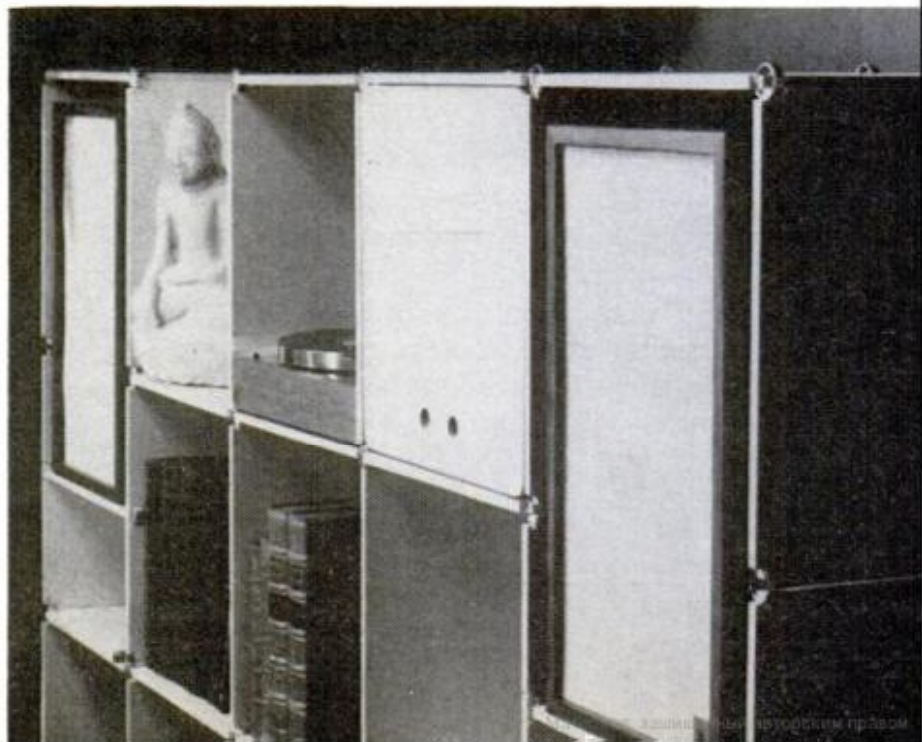
he decided to put it on the market.

His conception goes beyond what is ordinarily called modular construction (basically, boxlike units stacked or fastened together). His system breaks down into square and rectangular panels. And because his personal taste ruled out ordinary hinges, he invented an ingenious "ring" method detailed on page 96. Besides the obvious plus of being practically invisible, this method offers a flexibility no other system—that I know of—matches. Should

Color Photos by Tony Linck, Robert Lofgren
Data: Estelle Guralnick

STORAGE WALL UNITS shown on these pages are just three of the variations that an ingenious hinge design permits. The panels can be assembled in see-through fashion (above) and used as dividers or, if desired, fitted with doors in order to conceal the contents within the storage units (right, also facing page). The panels are available in two different sets—16 or 32 panels per set. The secret of the construction is a unique hinging system designed by Karlis Grinbergs (see drawing on page 96). To order a pamphlet that describes what is available and lists the prices, write Karlis Structures, Inc., Dept. PM, Box 161, Millis, Mass. 02054

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you tire of one setup or your needs change, the unit can be taken apart and reassembled to serve a new function. You need only simple hand tools.

Once you decide what arrangement you want, you start assembly with the vertical members face down on the floor. Several rings are then pushed into the corners of the squares to form the basic structure (using the side of a screwdriver and a hammer to tap them in). When a joint has been completed this far, you connect the top corners with another ring. For rigidity, Karlis says that when the basic structure is assembled, a back panel must be added to each horizontal row. Finally, the structure is set upright and rings on the other side tapped home.

Panels. There are three standard panel sizes (in inches): 13x13, 13x26 and 17x17. Panels are made of imported $\frac{3}{8}$ and $\frac{1}{2}$ -in. 7-ply birch plywood. While they come unfinished, you can order them in a variety of finishes, including lacquer, oil, stain, clear, white and yellow. For more information and prices, see the caption at the bottom of page 94. ★ ★ ★

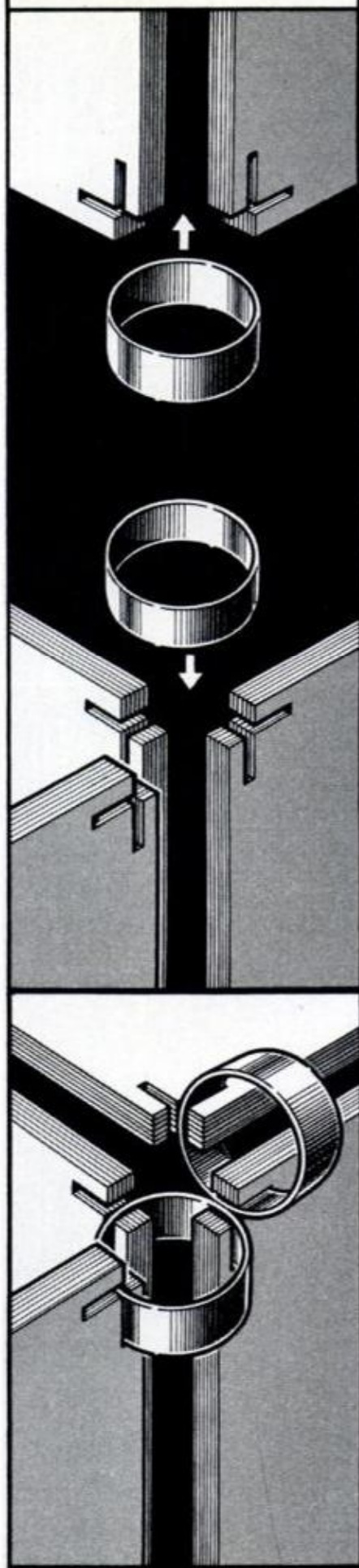
COLLAR-TYPE "HINGES" give Karlistructures shelving system its versatility. The panels come notched and kerfed as shown in the drawing (upper right) and are ready to assemble with nickel-plated steel rings. The novel shelving concept is protected by a U.S. patent

BOXLIKE ASSEMBLY (shown below) uses panels for doors, makes an ideal closet for hiding toys in a child's room or in a family room

KARLISTRUCTURES

HINGE DETAIL

U. S. PATENT NO. 3554382





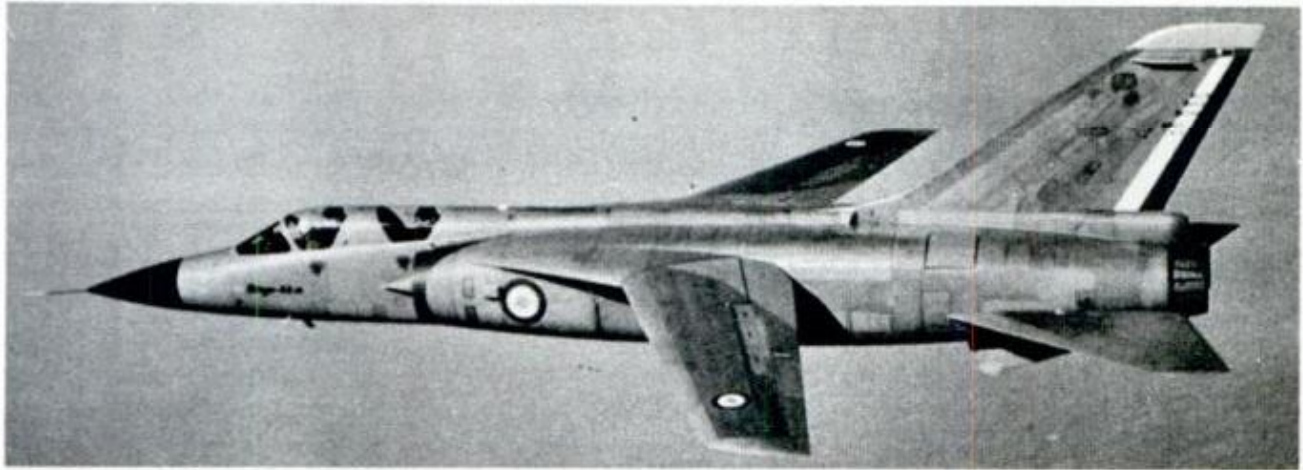
Prototype of mini

An Italian engineer, irked because he had parking problems with a full-size car, designed this prototype of a mini that'll be powered by a four-cycle, 246-cc engine.



Trees grow in school

Nature lovers in Ruhme, Germany, objected to removal of two old oaks for a new school, so the architect planned the building around the trees. Wide holes let trees grow.



French fighter-bomber can hit Mach 2.5

New, twin-engine Mirage G-8 jet, shown in its first flight, can travel at more than twice the speed of sound. Its movable wings sweep back for high-speed flight.



A car you build for \$700

Milles Mandry & Co. in England sells the chassis kit for \$400. You provide a used Mini frame and engine plus your labor.



No towel, thanks

Lord Snowdon designed this steel bathroom. Multidirectional jets spray you in one cubicle; warm air dries you in the other.



FORD PINTO model at the right is the three-door Runabout which features greater glass area in the lift-up rear door. Stage 5 Pinto (above) is a do-it-yourself job with parts like performance headers, twin carbs and other plumbing that's Ford-approved



**The Ford,
Lincoln-Mercury
Lineup for '72**

From Pinto to

Photos by Bruce Moss



DE TOMASO PANTERA, a low, sleek, two-seater, mid-engine sports car, is distributed by Lincoln-Mercury. Built by deTomaso Automobili in Italy, the Pantera (Italian for Panther) is powered by Ford's 351-cu.-in., four-barrel V8. The powerful domestic engine combined with styling and coachwork executed by Ghia Studios in Italy, result in an exotic sports car that's easily serviced



All New for '72!



MONTEGO has all new lines on top of new frame and suspension, and wider stance front and rear



T-BIRD is a two-door hardtop only. Rear-seat passengers get benefit of stretched dimensions



TORINO gets bold front-end treatment in Gran Torino series, shares new frame with Montego



MARK IV abounds in luxury and ostentation, is up 3.2 inches in wheelbase, 4.0 inches in length

Pantera

By **BILL HARTFORD**, Auto Editor



JUST LOOK AT THAT SPREAD OF GLASS! The 1972 Pinto Runabout with its dramatically bigger backlight will send the enthusiasts among owners of last year's Runabouts clamoring . . . "They said they wouldn't change the car for years! Ford has out-Volkswagened Volkswagen! Now I'll have to buy a '72 back hatch to update my 'old' Runabout . . ." Indeed, a simple eight-inch extension of glass down the deck lid has transformed the rear-end appearance of the car.

This most obvious change for '72 is among a host of less visible revisions that have been made since the Pinto's introduction last year as part of Ford's "running changes" approach to improving the car, but not altering the basic



COMET GT continues as the sporty alternative to the two-door and four-door family sedan compacts



FORD has minor trim and ornamentation changes, and new options such as electrically operated sunroof



MUSTANG continues three body styles with biggest engine available now the 351-cu.-in. 4-bbl., HO V8



CONTINENTAL is marked by minor trim changes and the addition of power-operated front vent windows



MERCURY has wide model offering, including three wagons and more options including Sure-Track brakes



sheet metal. Changes the past year have ranged from adding a knob on the ashtray to improving rear springs and shocks, and fitting front disc brakes on Pintos with the 2000-cc Four.

Refinements that clearly identify the '72 editions of this American "peoples' car" ("... \$64 down and \$64 a month!" goes the commercial) include carpeting standard, side-impact beams and new colors, not to mention a repositioned headlight dimmer foot switch that is now within reach even of drivers who aren't six-foot-four! (See *Pinto vs. Vega*, page 76, March '71 PM.)

The Pinto's price of admission continues to include the Do-It-Yourself Manual which, however excellent and instructive, is still not the complete, detailed "shop manual" that I would like to see included with all consumer products more complicated than a toaster. The manual emphasizes the Pinto's inherent simplicity and serviceability. And Ford, with its new 1700-man Customer Service Div., which, by the way, is as large as its sales division (!), indicates a genuine concern that service customers get a fair shake.

Capri, Lincoln-Mercury Div.'s mini-Mustang, continues wowing small-car buyers. Selling at a rate of 50,000 a year, the two-door coupe has quickly become *the* stylish import for enthusiasts who also want convenient service from a domestic dealer. This year the 2000-cc Four became an option—owners with the standard 1600-cc Four desired more oomph (See *Owners Report*, page 82, April '71 PM).

Maverick and Comet compacts have

MAVERICK has side-impact protection, radial-tire option, 2.79:1 rear axle with 250 Six for economy

POPULAR MECHANICS



COUGAR continues convertibles in the base and XR-7 series and offers three versions of the 351 engine

a special appeal and versatility used to advantage in Ford's marketing: In their basic configuration, they're perfect, sensible, family sedans, but with the addition of wider tires, some stripes and optional "glamour" colors have the sizzle that appeals to swingers. Compare the *stripped* Maverick and *striped* Comet GT pictured on page 100 to see

what just a little imagination can do.

Both car lines offer the 302 V8 as their big displacement engine, and, on the economy end, Maverick's got the 170 Six, Comet the 200 Six.

Side-impact protection is now included in the doors of both cars and a seat-belt reminder buzzer (on all model lines by December, on T-bird now) will blast you until you buckle up. (There's got to be *some* way to get everybody to wear belts—in Australia it's the law!)

Both offer even more options for '72: accent groups, convenience groups, trim options, radial tires, floor shifts, heavy-duty suspensions, and a whole smear of new colors and combinations.

Torino and Montego are where the

(Please turn to page 190)

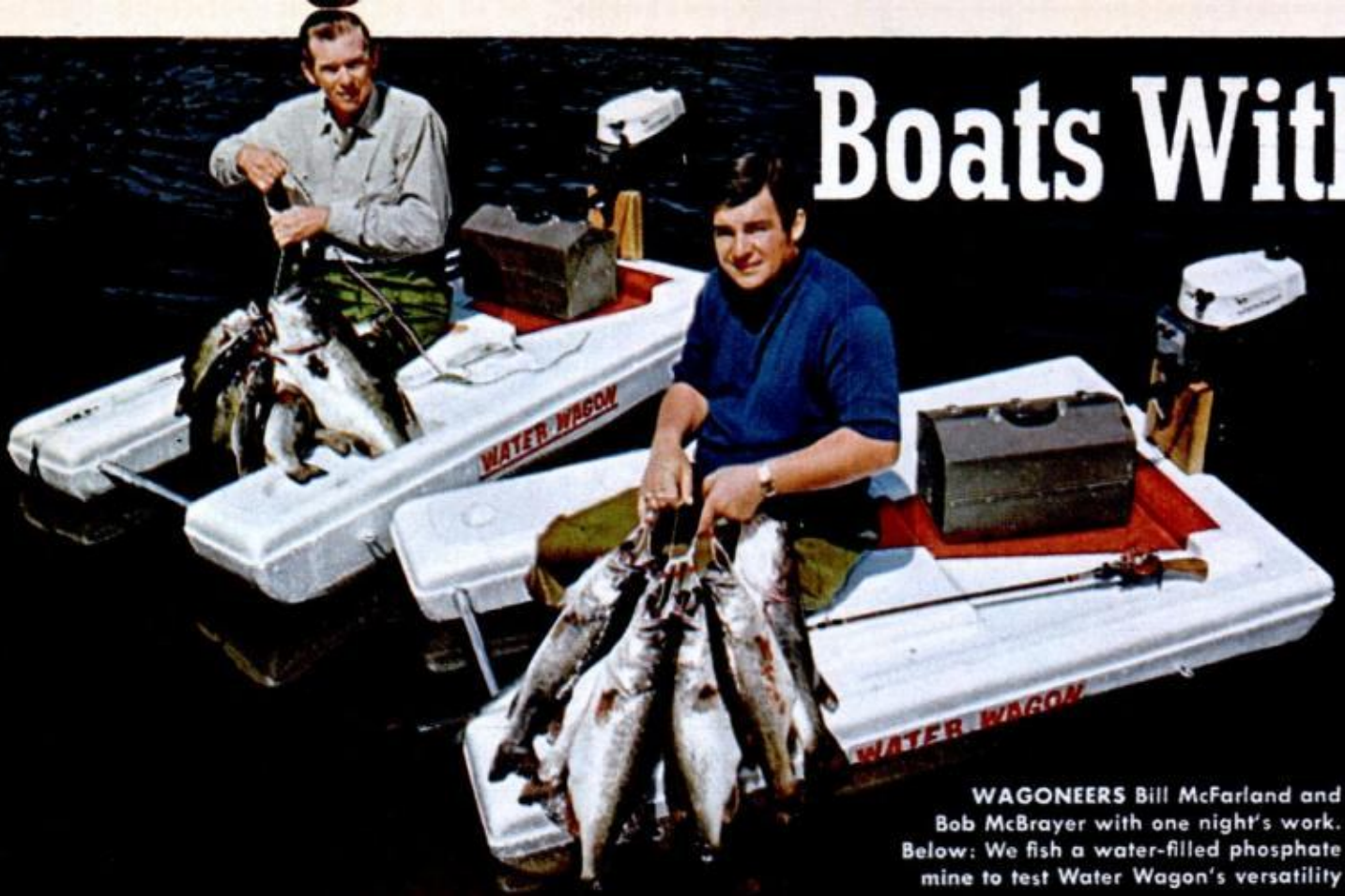
1972 FORD AND LINCOLN-MERCURY SPECIFICATIONS

Car	Body Style	Wheel-base (in.)	Overall Length (in.)	Overall Width (in.)	Track (f/r in.)	Engines in Model(s) Series* (Displacement, cu. in.—V8 except as noted—carburetion)
Pinto	2-dr. sedan, 3-dr. sedan	94.0	163.0	69.4	55.0/55.0	97.6 (1600cc)-4-1bbl., 122 (2000cc)-4-2bbl.
Capri	2-dr. sports coupe	100.8	167.8	64.8	53.0/52.0	97.6 (1600cc)-4-1bbl., 122 (2000cc)-4-2bbl.
Maverick	2-dr. sedan, 4-dr. sedan	103.0 109.9 ¹	179.4 186.3 ¹	70.6 70.7 ¹	56.5/56.5	170-6-1bbl., 200-6-1bbl., 250-6-1bbl., 302-2bbl.
Comet	2-dr. sedan, 4-dr. sedan	103.0 109.9 ¹	181.7 188.6 ¹	70.6 70.7 ¹	56.5/56.5	200-6-1bbl., 250-6-1bbl., 302-2bbl.
Mustang	2-dr. hdtp., SportsRoof, convertible	109.0	189.5	74.1	61.5/61.0	250-6-1bbl., 302-2bbl., 351-2&4bbl.
Cougar	2-dr. hdtp., convert.	112.0	196.7	75.1	61.5/61.0	351-2&4bbl.
Thunderbird	2-dr. hdtp.	120.4	216.0	79.3	63.0/63.1	400-2bbl., 429-4bbl.
Torino	2-dr. hdtp., 2-dr. Sports-Roof, 4-dr. hdtp., wagon	114.0 118.0 ^{1,3}	203.7 ² 207.7 ¹ 211.5 ³	79.3 80.0 ³	62.8/62.9 63.9/64.0 ³	250-6-1bbl., 302-2bbl., 351-2&4bbl., 400-2bbl. 429-4bbl.
Montego	2-dr. hdtp., fastback, 4-dr. hdtp., wagon	114.0 118.0 ^{1,3}	208.1 212.1 ¹ 215.4 ³	78.6 79.6 ³	62.8/62.9 63.9/64.0 ³	250-6-1bbl., 302-2bbl., 351-2&4bbl., 400-2bbl. 429-4bbl.
Continental Mark IV	luxury coupe	120.4	220.1	79.2	63.0/63.1	460-4bbl.
Ford	2-dr. hdtp., convert., 4-dr. hdtp., pillared hdtp., sdn., wagon	121.0	218.4 221.4 ³	79.2 79.8 ³	63.3/64.3	240-6-1bbl. ⁴ , 302-2bbl., 351-2bbl., 400-2bbl., 429-4bbl.
Mercury	2-dr. hdtp., 4-dr. hdtp., pillared hdtp., wagon	124.0 121.0 ³	224.7 220.5 ³	79.3 79.4 ³	63.3/64.3	351-2bbl., 400-2bbl., 429-4bbl.
Lincoln Continental	4-dr. sedan, coupe	127.0	225.0	79.6	64.3/64.3	460-4bbl.
Pantera	2-dr. mid-engine sports car	98.4	167.0	67.0	57.0/58.0	351-4bbl.

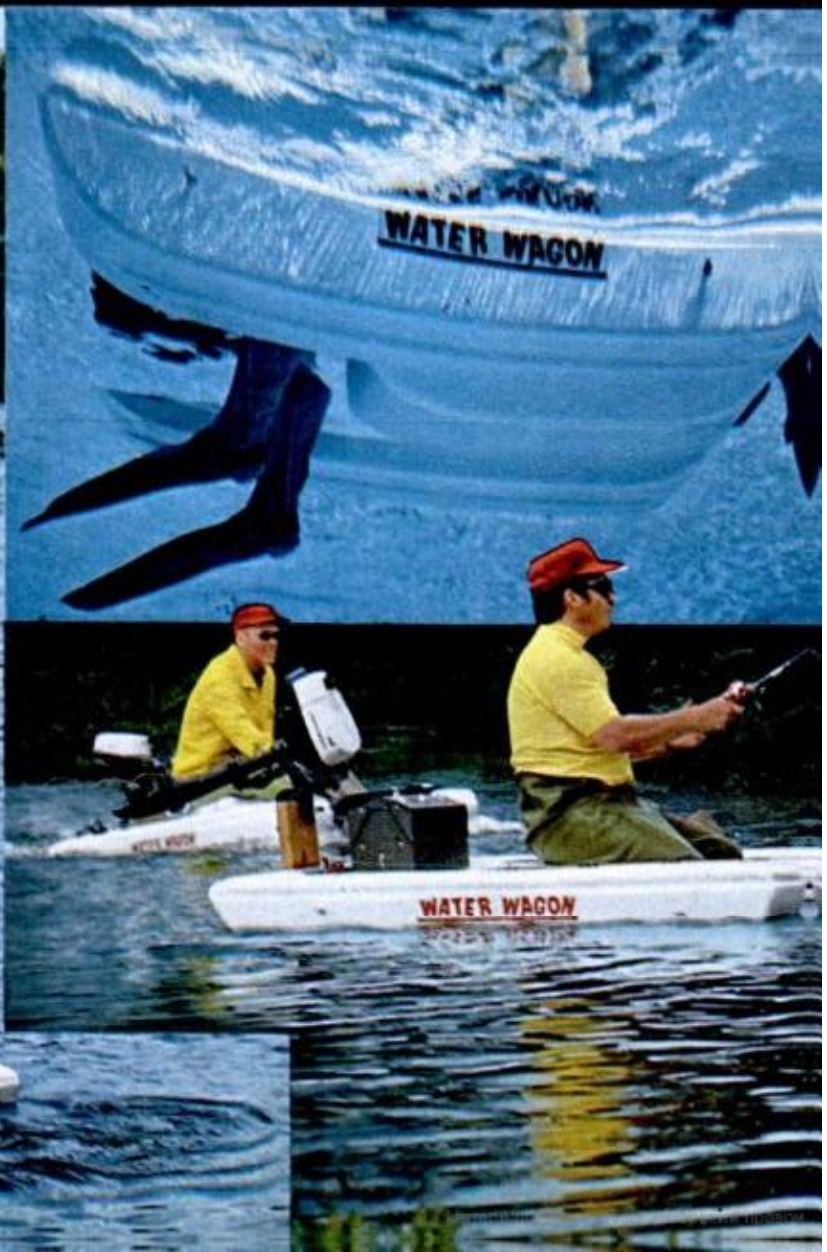
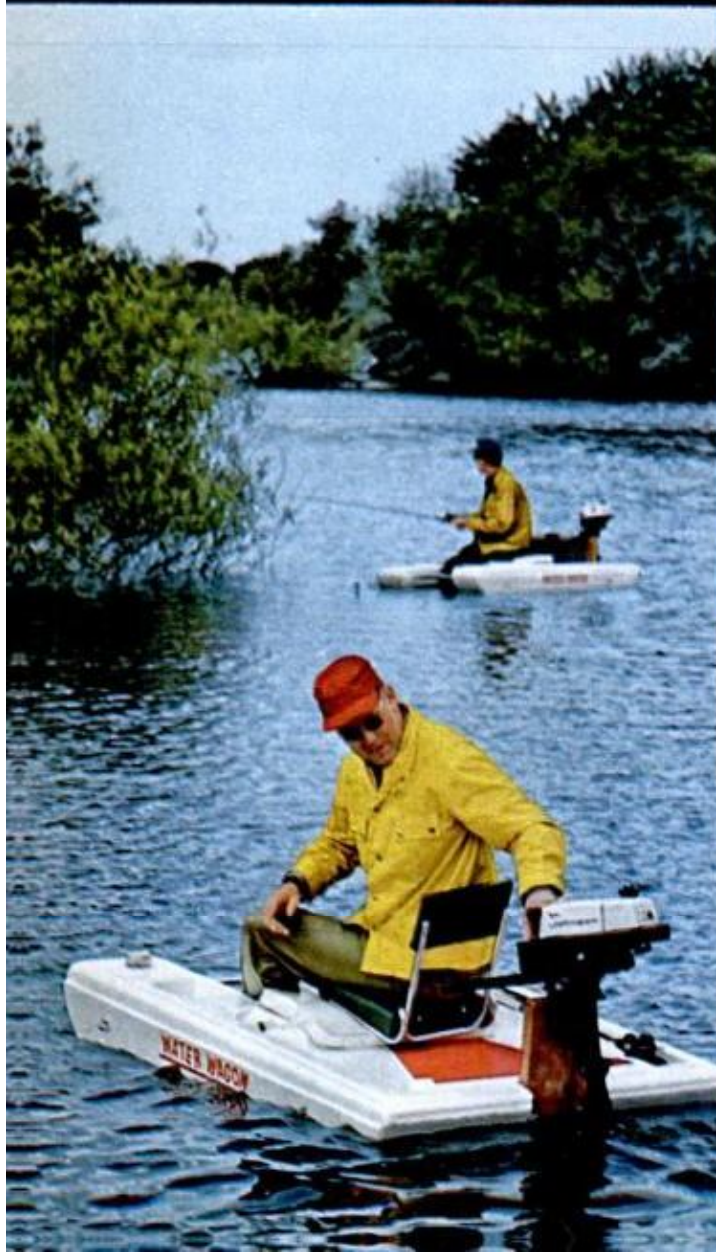
1. 4-dr. models; 2. Lengths for base Torino series, all Gran Torino models several inches longer; 3. 4-dr. wagon; 4. not available in California.

*Not all engines available in all models

Boats With



WAGONEERS Bill McFarland and Bob McBrayer with one night's work. Below: We fish a water-filled phosphate mine to test Water Wagon's versatility



a Purpose... Under \$100

No toy, the lightweight Water Wagon is the bass boat's latest competition. And there are dinghies, kayaks, mini-sailers . . .

By GEORGE W. REIGER, Boating Editor

Photos by Jerry Imber at Cypress Gardens, Fla.

IT MAY LOOK SILLY, but a Water Wagon is all business. A day's fishing in central Florida proved not only that the reclaimed phosphate pits we fished could produce big bass, but that the Water Wagon was our best means of getting at 'em.

The concept was born in float fishing by inner tube (see *Inner-Tube Float*

Fishing, page 74, Aug. PM) when two Texas anglers decided that, while they liked wading for their fish, they also wanted something in which to move quickly from spot to spot. Inner tubes provide a fun way to fish, but they're no way to get upstream after a long day's angling.

So the Texans experimented with

AUTHOR (below) lifts 20-pound Wagon. Bottom: Three were carried atop station wagon for the fishing trip



shapes and materials. First they tried Styrofoam. But this was abandoned when they realized how rapidly it dissolves in contact with gasoline. Though a Water Wagon will hopefully see few oil slicks, Bob McBrayer and Bill McFarland still wanted something to stand occasional spills or leaks of outboard fuels. After all, they hoped to produce

the equivalent of a motorized inner tube!

They finally settled on solid expanded polystyrene. It can float in a sea of gasoline without ill effects and it is highly impact and puncture-resistant—during our day's test, I took the liberty of running my Water Wagon repeatedly against surface-level brush and stakes to see what damage I'd do. After 15 minutes of this idiocy I went back to fishing with one small dent and unimpaired buoyancy.

The Water Wagon is unsinkable and, if flipped, virtually an oversized life preserver. The contraption can support 700 pounds, but it weighs just 20, and you'll be able to transport three of them atop a station wagon and one inside. It has two compartments for a portable fathometer, live bait, or ice and cold drinks. Two smaller circular compartments hold beer. There's ample room behind for a tacklebox, and side trays keep rods from rolling overboard.

With easily-installed motor mounts, our boats carried 2-hp Johnson outboards, lightweight and integral-fuel engines that were perfect companions for our Wagons.

When fishing, you sit on a life preserver or stadium chair and your legs,

(Please turn to page 180)



LIGHTWEIGHT SAILER (hull weighs but 30 pounds) in \$100 category is Sea Snark from Fort Lee, N.J.

HUNDRED-DOLLAR DINGHY (below, left) that converts to mini-sailer is Sportyak from Dayton Products

FIVE-FOOT-FIVE DINGHY that holds 550 pounds is Chub (below); \$89.95 from Spocraft, Hicksville, N.Y.



Microwave Cooker You Can Build From a Kit

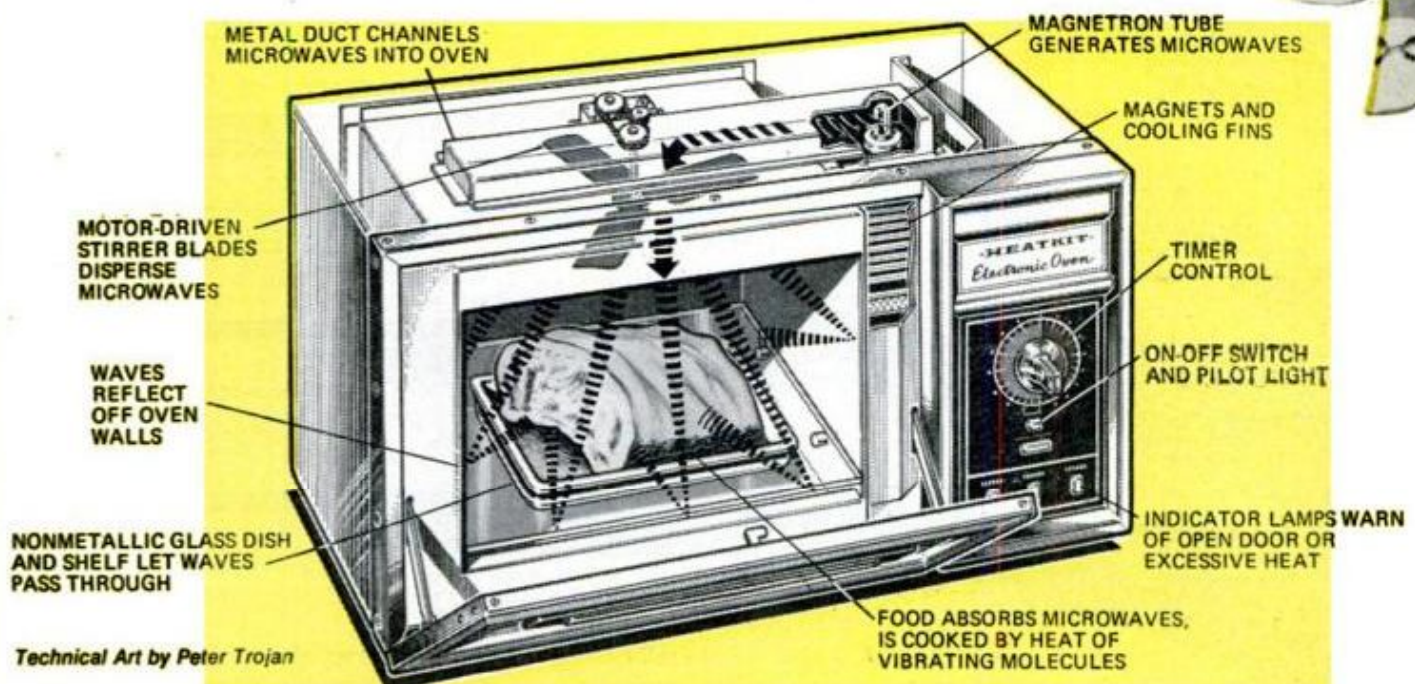
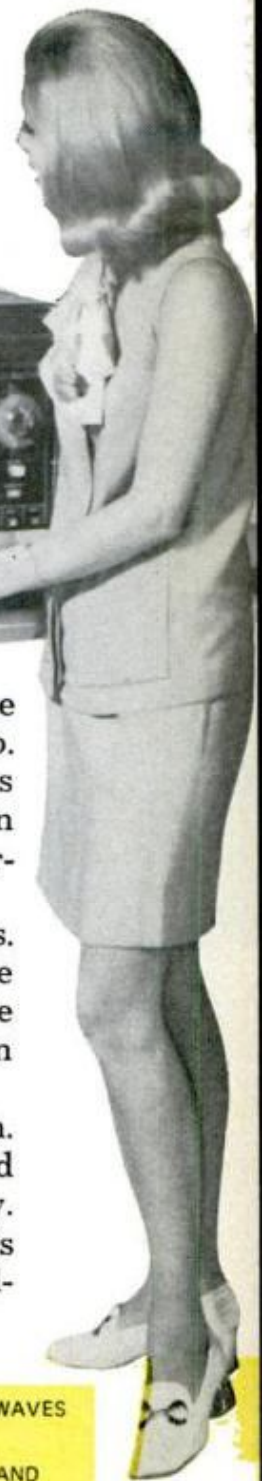
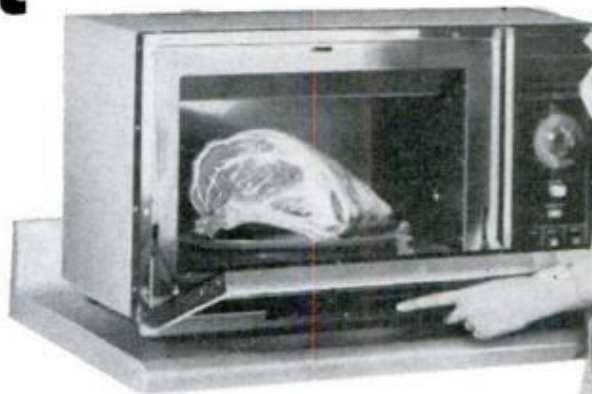
IF YOU'VE EVER SAT DOWN to a dinner of cold snacks because your wife forgot to take the roast out of the freezer in time, you'll be intrigued by this new type of almost-instant electronic cooker. Made by Heath, this first microwave oven to be available in kit form also accomplishes some remarkable cooking feats. It will do a

three-hour roast in 45 minutes, heat a frozen TV dinner in six, bake potatoes in four and turn out a sizzling hamburger in one or two.

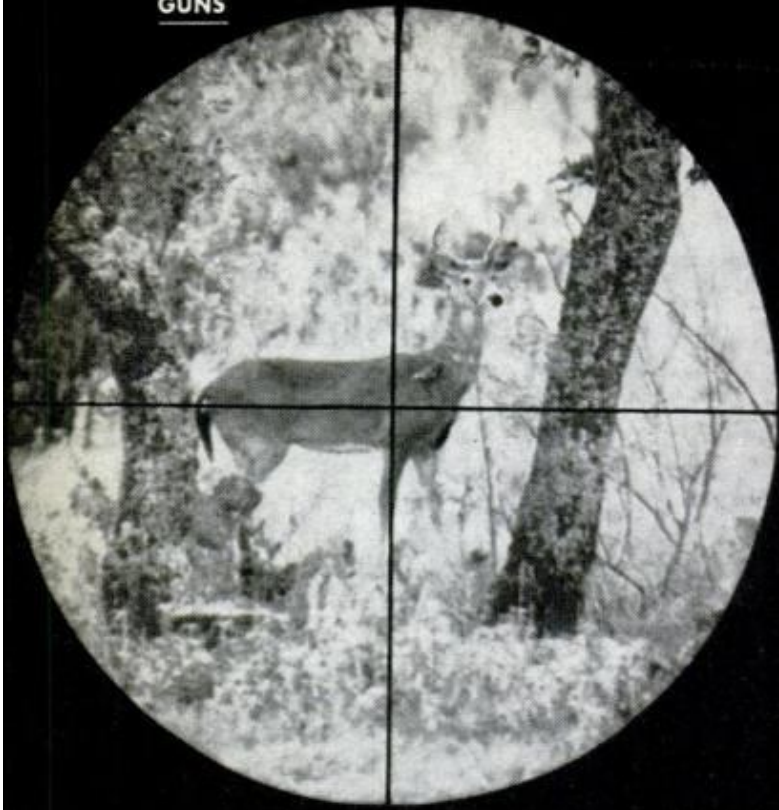
While microwave ovens are not cheap, the kit price of \$399.95 represents a substantial saving over \$600 to \$700 ready-made models. Construction is 90 percent mechanical assembly with relatively little wiring and soldering. The kit can be built easily in a few evenings.

Electronic ovens work by bombarding food with high-frequency waves. These vibrate the molecules so violently that friction generates intense heat, cooking the food quickly, inside and out, all at the same time. The waves, bounce off the oven walls to strike food from all sides. Motor-driven "stirrer" blades, like a fan, disperse the waves for even distribution.

Elaborate safety precautions prevent accidental exposure to radiation. An interlock keeps the oven from operating while the door is open, and a second interlock prevents the door from being opened unintentionally. Ridges around the door lip are precisely spaced to match the radiation's wavelength to act as a leakproof wavetrapp. The model GD-29 kit is available from Heath Co., Benton Harbor, Mich.—*Walter G. Salm*



Technical Art by Peter Trojan



Lever-action single shot



Bolt-action magazine



Lever-action magazine



Pump-action magazine



Semi-automatic magazine

POPULAR GAME for the all-around rifle includes (top, left to right) medium quarry, deer; varmints, prairie dogs and crows; and big game, the moose

POPULAR MECHANICS

Is There Really an All-Around Rifle?

By GEORGE C. NONTE



PM asked a gunning expert for his opinion. This is his controversial answer



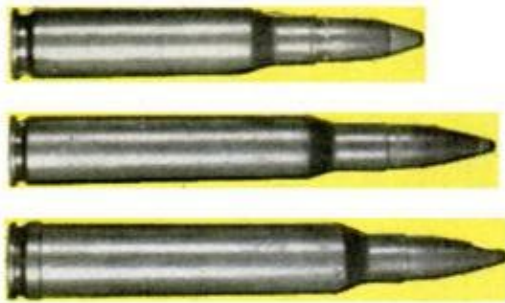
WHETHER an “all-around” rifle really exists depends on just how broadly you interpret that term. Certainly no single gun/cartridge combination is equally suitable for varminting after prairie dogs and for stopping Cape buffalo—and all critters in between. But then how many people hunt that broad a range of game or would *want* to do it with a single rifle?

The man for whom a single all-purpose rifle is a real need is the fellow who manages to get out a few weekends each year for varmints, does a reasonable amount of shooting at targets several times during the summer, and makes a big-game trip every few years. His varmint shooting may range from prairie dogs or crows (depending on where he lives) to coyotes or foxes. His target shooting will be done at less than 300 yards, and the biggest game he’s ever likely to hunt is elk or moose.

The “hot” .22 calibers such as the .220 Swift and .22-250 are of no consideration simply because their tiny, light bullets don’t hold together and penetrate medium game well. They’re perfect for varmints, but not much else. Next, the fast-stepping 6-mm/.243 cartridges such as the .243 Winchester, 6-mm Remington and .240 Weatherby, do a far better job on deer than the .22s and are just as accurate and effective on varmints. If you contemplate hunting nothing larger than mule deer, any of the 6-mm cartridges is ideal. They are accurate enough for any paper-punching you might want to do, yet perform superbly on deer and small (black) bear. What more could you ask?

Well, we do want something that will kill elk and moose—and the 6-mm won’t quite make it.

Next in line are the 6.5-mm and 7-mm short Magnums, such as the .264 Win-



THE 30S WE CONSIDERED (top to bottom) were the .308 Winchester, .30-06 and .300 Winchester Magnum. From shell-case size alone, '06 splits power difference between other two. Medium-sized mule deer (right) is the largest game the average hunter sees in a lifetime



chester and 7-mm Remington Magnum. In factory loads, the 6.5-mm doesn't have as good a reputation on heavy game as the 7-mm; its bullets aren't as heavy or as strongly constructed. In good-quality rifles, both are accurate for most varmint shooting, but won't do quite as well as the smaller calibers already mentioned. My choice is the 7-mm Magnum. It will make clean one-shot kills on elk and moose if the shooter does his part. The heavy-bullet (175-grain) load will penetrate deeply from almost any angle to reach an animal's vitals.

But while we might say the 7mm Magnum qualifies as our all-around rifle cartridge, it's not ideal. Let's probe further.

In the ever-popular .30 calibers only the .308 Winchester Magnum has adequate power for our upper game limits. Yet it doesn't have a flat enough trajectory for long varmint and target shots, and is a bit low on energy for big bear—but it will do nicely on elk and moose. The .300 is far, far better, but its recoil and muzzle blast—like the 7-mm Magnum—are so great that the *average* shooter may not be able to handle it unless he spends a lot of time practicing. For anyone not truly expert in handling the big-bore rifles, I consider the power of the .300 Magnum more of a handicap than an advantage.

That leaves us the venerable .30-06, which has probably killed more game

on this continent than anything else, possibly excepting the .30-30—which we won't even consider as an all-around candidate because of its low power and looping trajectory.

What has the .30-06 got? In heavy bullet loads (180 and 220-grain) it has shocking power long proven sufficient for even the biggest of North American bear. These same heavy loads perform admirably on elk and moose, while the lighter (150-grain) bullets are perfect for deer and small bear. With bullets from 110 to 150 grains, the .30-06 is superbly accurate, having a flat-enough trajectory to take all but the very smallest varmints out to 300 yards or so with surprising regularity.

It does this without the ear-splitting blast and shoulder-bruising recoil of the 7-mm and .300 Magnums and does not require barrels as long as the Magnums to operate efficiently. Furthermore, a much wider range of factory-loaded ammunition is available (especially in remote areas) for it than for any other calibers we've mentioned. At least six different bullet weights are offered. Likewise, a great variety of rifle makes, models and types is chambered for it.

If I had to settle on one caliber for the rest of my hunting life, I'd settle for the .30-06.

Now let's talk in terms of type and general configuration. We want the

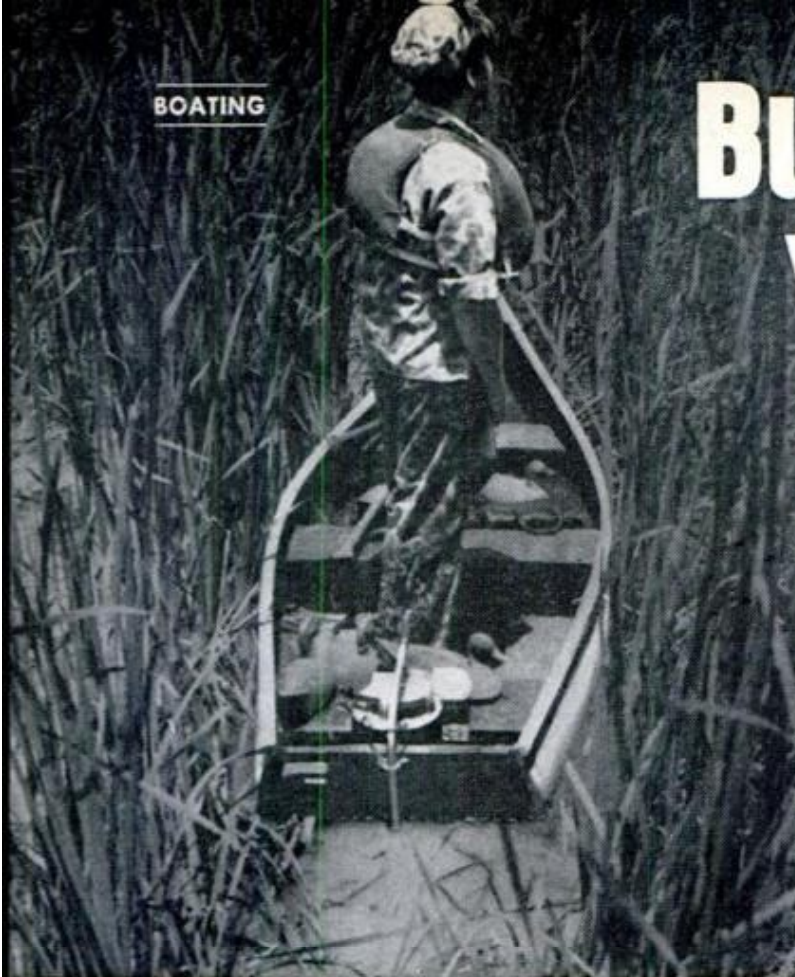
(Please turn to page 192)

Buy a Jet for Your Jon

Here's a new mini-jet system for jonboats, canoes and dinghies

By IVAN E. PRALL

Technical art by Peter Trojan



DO-IT-YOURSELF inboard or outboard power for your canoe or jonboat? That's what a young engineer from Sycamore, Ill., has come up with. Neither the inboard nor outboard system uses a propeller, for Dick Ott's kits, starting at \$29.95, are water jets.

I'm a boater inordinately plagued by sheared pins and busted props. And the safety aspect of propless power appealed to me. So, equipped with a few basic tools, a discarded power-mower engine and curiosity, I set out to build and test an Otterbine jet.

I experimented with a 5-hp inboard design and found the major job working with inboard jet power in a 12-foot canoe is centering the unit. Your jet must be dead center on the keel line or the craft will tend to steer to one side. I had to use a lot of silicone sealant to fill in my first mistakes!

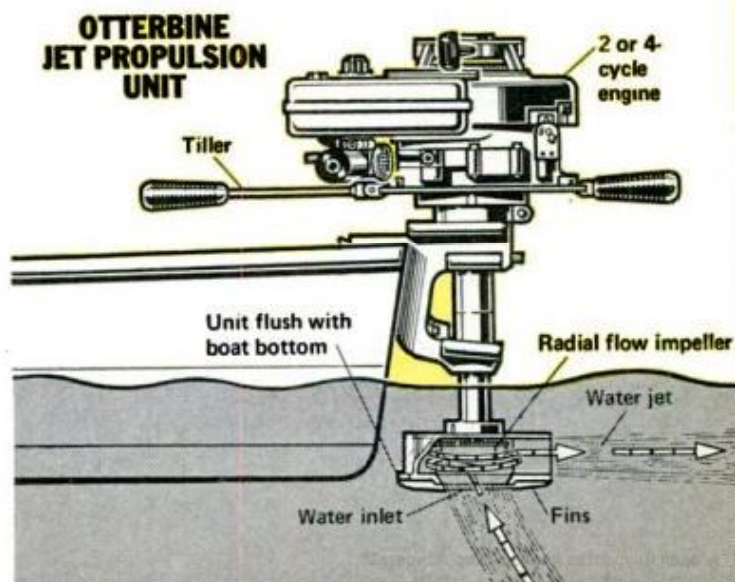
Once complete, the system behaved flawlessly. One weekend after heavy rains I used it on the Illinois River with a swift current and plenty of debris: we scooted over the white-capped river without a failure. My next project: an outboard jet with more hp. ★★★

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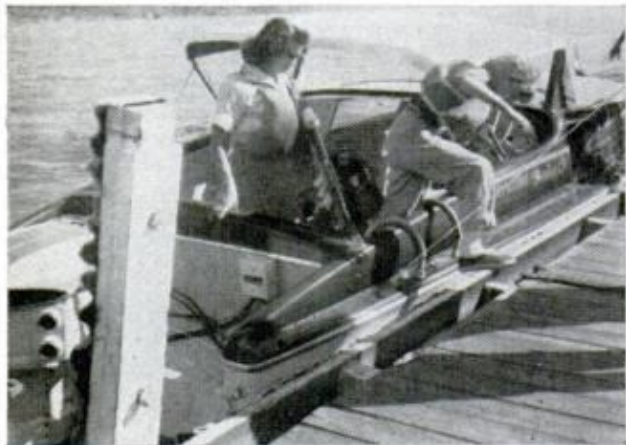
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OUTBOARD (B) AND INBOARD (C) MODELS of Otterbine jet adapt to two or four-cycle engines. Author finds four-cycle system cleaner and prefers units such as the 8-hp Briggs & Stratton (A)



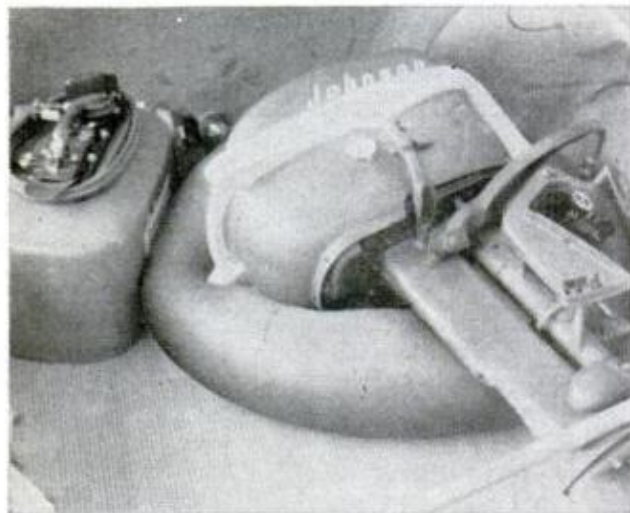
BOATING TIPS



Multipurpose boarding ladders

While normally used by swimmers and skiers for climbing back into a boat, boarding ladders can also be mounted inside the cockpit of a high-gunwaled cruiser to make it easier for women and children to climb in and out from boat to dock.

—Lee H. Schrimpf, Tulsa, Okla.



Inner-tube motor cushion

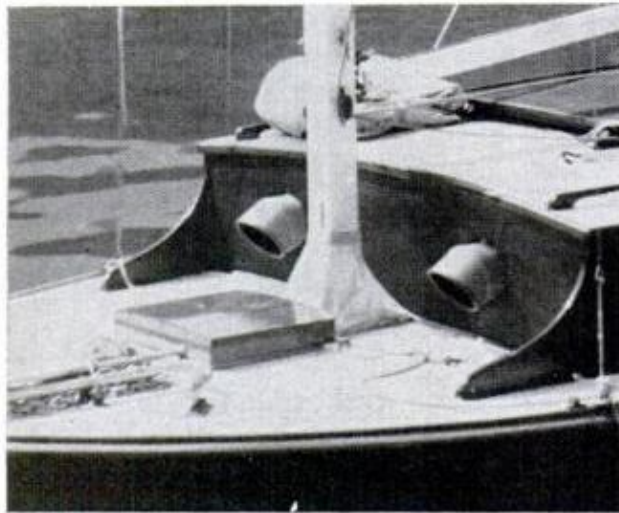
Patch up an old inner tube for use as an outboard-motor cushion in back of your car for rides to and from your launch site or stowed forward in your boat when the outboard is used as an auxiliary. This will save the engine a lot of unnecessary bumps and bruises. Inflate tube just enough to support motor's weight. Check it periodically to make sure you're not losing air.

—Lee H. Schrimpf, Tulsa, Okla.



Bleach bottles add flotation

Placing empty plastic bottles (with caps on tight) under the floorboards in the bilge of your wooden boat adds much positive flotation with little extra weight and at little or no cost. Arrange your different-sized jugs to fill up all the odd spaces.—Gene Cabot, Louisville, Ky.



Stovepipe ventilator

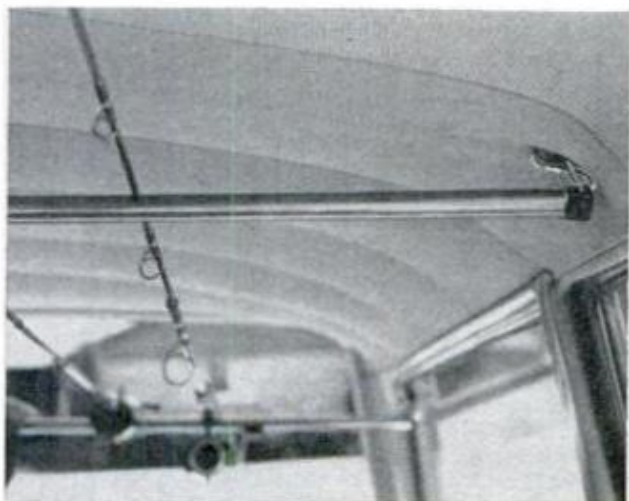
If you have a day-sailer with portlight ventilation holes, painted galvanized stovepipe will keep out the rain and spray while permitting air to circulate. Two-thirds of a 90°-angle pipe coupled to a short piece of straight pipe provides a drip point below the lower edge of the portlight but doesn't obstruct visibility from inside the cabin. Cost? About \$1.75 apiece.

—Rod Radford, Delray Beach, Fla.



Cartop boat wheels

While there are several commercially-made cartop-boat-wheel attachments that make rolling your boat from car to water's edge easier, make your own by attaching shopping-cart wheels on a bolster strapped to the boat. Bolster snaps on and off gunwales.—*Lee H. Schrimpf, Tulsa, Okla.*



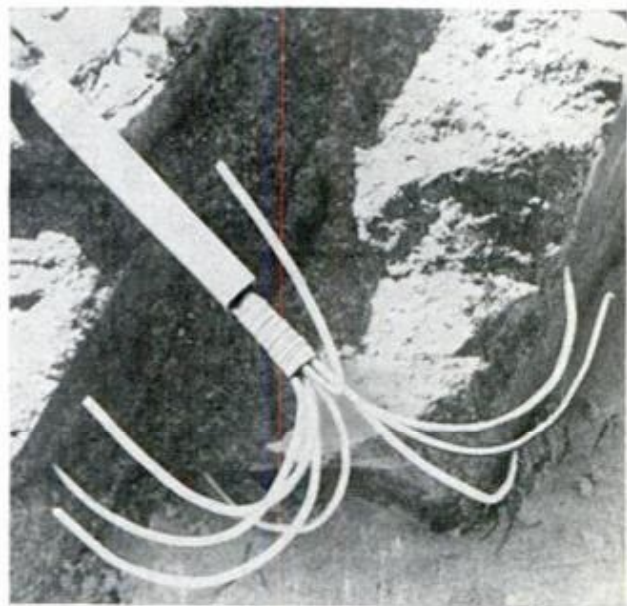
Instant fishing rod racks

Two clothesrod hangers (one in the roof of your station wagon and another fastened to the rear side windows with suction cups) will effectively support fishing tackle and other boating gear. The assembled fishing rods are secured to the clothes racks with heavy rubber bands looped around the rod handles, passed under the racks and then looped over the handles again.—*Lee H. Schrimpf, Tulsa, Okla.*

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Homemade anchor for reef fishing

No matter how rough or rocky the bottom, this home-made grapnel is nearly snagproof. Eight flexible arms hold rock and coral under all but most compelling wind or tidal conditions, but loosen or open up when boat is powered in different directions above it. Made of soft iron, rods are taped to a square section of aluminum tubing and the tubing then filled with mortar, melted lead or "Por-Rod" cement.—*Rod Radford, Delray Beach, Fla.*



Eliminating boating glare

If sun glare from sky and off the water annoys you while boating, try using the stick-on glare shields found in auto supply stores. Since they attach to the inside of your windshield, rain does them no harm, and even salt spray will take time getting this stuff to peel. If you really want to economize, cut green plastic sheeting to desired dimensions and glue that in place.

—*Lee H. Schrimpf, Tulsa, Okla.*

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Easy Way to Automate Your



PARAGON
24-HOUR TIMER
7 AMPS, ABOUT \$9



INTERMATIC
24-HOUR
WALL-BOX TIMER
15 AMPS, ABOUT \$10



PARAGON
AIR CONDITIONER
CONTROL
ABOUT \$12



RHODES 60-MINUTE (LEFT)
AND 12-HOUR WALL-BOX
TIMERS. EACH ABOUT \$6

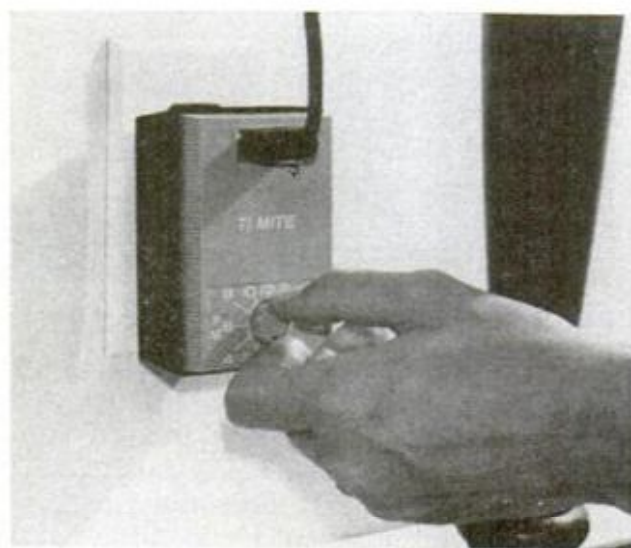
By WALTER G. SALM

ONE OF THE HANDIEST and cheapest electrical devices you can buy for your home is an automatic timer. Yet, until recently, these versatile controls have been little known and little used. What they can do, in effect, is automate your home. They can turn lights and appliances on and off for you when you're not around to do it yourself. And, unlike people, they don't forget or fall asleep.

With today's rapidly rising burglary rate, an automatic timer can become an important home protection aid. You can program it to turn a light or radio on

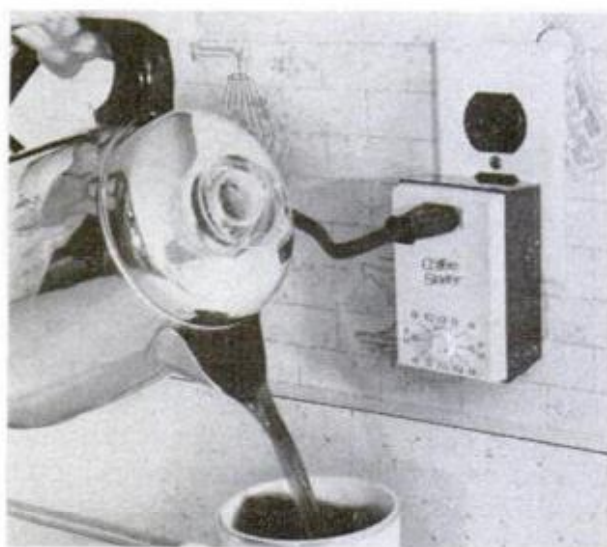
and off at preset times when you're away to give the appearance that the house is occupied. You can leave a light burning late at night and have it go off toward morning without getting up to turn it off.

Timers can also add fun and convenience to daily living. You can come home to a cool house because a timer will have turned on your air conditioner a half hour or so before your arrival. Your front door light will have gone on so you can see to get in if you come home after dark. You can go to bed listening to music without worrying about who's going to shut it off



PLUG-IN TIMERS fit directly into a wall outlet with no dangling cords. The light or appliance to be controlled is simply plugged into receptacle on front and a knob turned to desired switch-on time.

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Model shown at left has five-hour "on" period, primarily to keep a lamp burning in the evening when you're away. Model above has a pot of hot coffee waiting when you awake. Both are made by Paragon

POPULAR MECHANICS

TIMERS: Home

Lights flash on to discourage burglars, your hi-fi shuts off when you go to sleep and there's a pot of hot coffee waiting when you wake up—it's all done with inexpensive devices that can make your home life more fun. Here's how



INTERMATIC
24-HOUR TIMER
7 AMPS, ABOUT \$10



PARAGON
COFFEE
STARTER
10 AMPS
ABOUT \$6



CALECTRO
60-MINUTE TIMER
6 AMPS, ABOUT \$6



LAFAYETTE
24-HOUR TIMER
15 AMPS, ABOUT \$8



RHODES
60-MINUTE
BOX OR PANEL-
MOUNT TIMER
ABOUT \$7

—it will go off automatically after you've fallen asleep. Your TV will turn off after the *Late Show* without your having to get out of bed to switch it off. In the morning, you can have a pot of steaming hot coffee ready and waiting when you awake. Connected to a radio, a timer can also serve as an alarm clock awakening you to soft music or an early newscast.

Timers are essentially electrical switches with a built-in clock mechanism to determine when the switch will open and close. There are many different models, but generally they break down into two basic types—single-action timers that turn

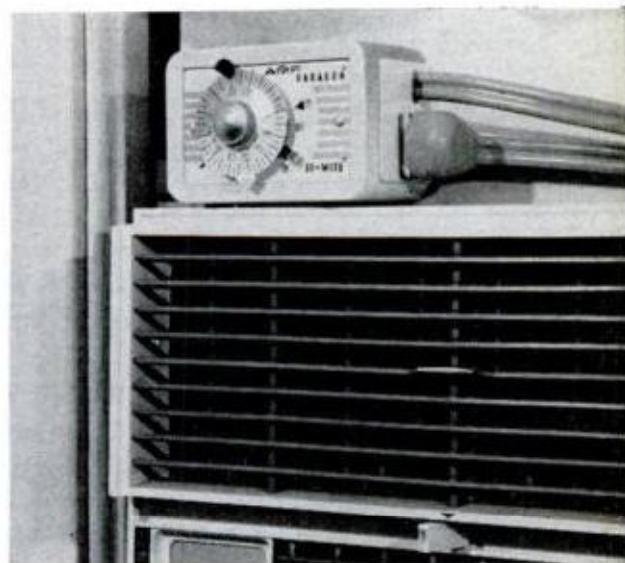
a light or appliance off after a preset delay and double-action timers that turn both on and off at preselected times. The latter are more versatile, but there are important uses for both types.

Among the largest makers of timers are Paragon, a division of AMF, Intermatic and Rhodes. Timers are also available in a variety of types from mail-order houses like Lafayette Radio, Allied Radio Shack, Sears, Roebuck and Montgomery Ward. Prices range from as little as \$5 or \$6 up to \$10 or \$12.

One of the most useful all-around models is the 24-hour clock timer. It contains,

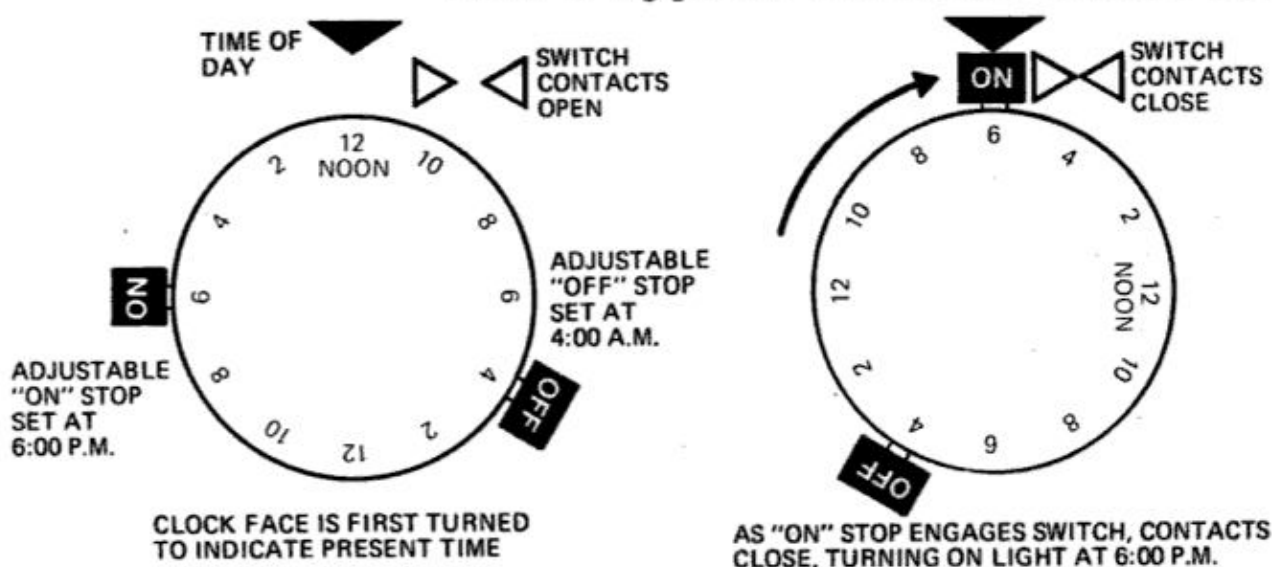


CLOCK TIMERS with 24-hour movements turn lights or appliances on and off at any preset times and the same cycle will repeat each day. These by Paragon illustrate two different types. The general-purpose
SEPTEMBER 1971



model shown at left is rated at seven amps, handles lights, radios, TV sets, small appliances. Timer above, especially designed to control heavy-duty appliances like airconditioners, is rated at 12 amps

How a Typical 24-Hour Clock Timer



INSTEAD OF HAVING HANDS THAT TURN, the entire clock face rotates on a typical 24-hour electric timer. Adjustable stops are moved around the rim

in effect, a 24-hour electric clock movement and can be set to turn on at any time of the day or night and shut off any time later. You plug it into a wall outlet and, in turn, plug the light or appliance you want controlled into a receptacle on the back. Adjustable stops around the face of the clock are simply moved to the desired on and off settings. Unlike ordinary 12-hour alarm clocks and clock radios, the timer will automatically repeat the established on-off cycle every 24 hours without having to be reset. This is especially useful for controlling house lights when you're away for extended periods since the lights will continue to go on and off at preset intervals every day for as long as you're gone.

The usual procedure is to set the timer so the lights come on when it gets dark and go off at your customary bedtime hour to give the house a lived-in look. With several timers, you can actually program a sequence of different lights going on and off at different times for an even more realistic effect.

Intermatic makes a 24-hour timer in two versions—one a self-contained table model and the other designed for mounting in a standard electrical outlet box. The latter is handy for use over a kitchen counter or in similar locations where you have a wall outlet located high enough for easy access. Paragon also has a 24-hour table model with an interesting added feature—a so-called "random off" control. Instead of

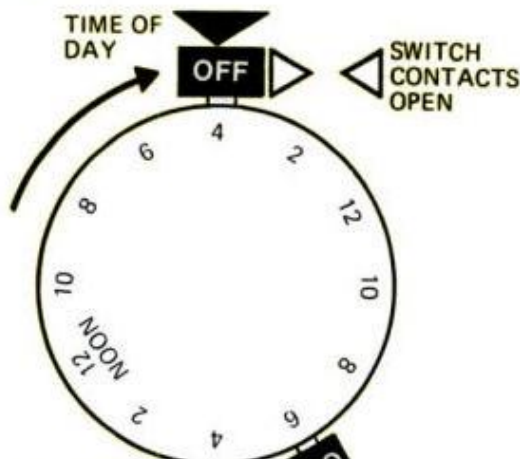
to desired "on" and "off" points. When the "on" stop swings around to an arrow indicating present time of day, it trips a switch and the light or appli-

turning off at exactly the same time each day, it shuts off half an hour earlier or later than the preset time, giving a random appearance to the pattern to fool would-be burglars watching the house.

Some simpler timers have a fixed "on" interval. You set them to come on at a desired time, then they go off five hours later. The five-hour period gives you roughly the span of time normally covered from dusk to bedtime. Paragon has two models of this type, one intended for use as a coffee starter in the morning. In this case, an adjustable "off" setting is not necessary since all you want is to have the coffee hot when you awake. Fixed-interval timers are less expensive than the 24-hour clock type and come in convenient plug-in models that slip right into a wall outlet with no cord to fuss with.

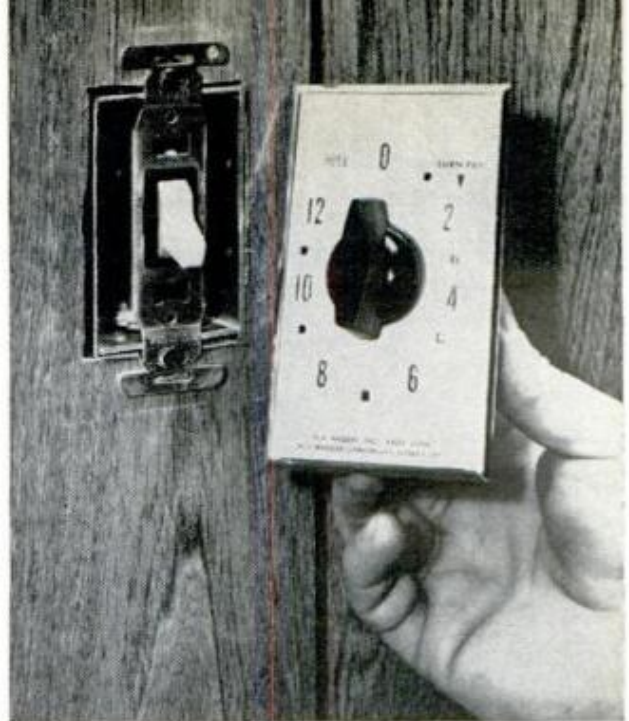
Another breed of timer is the wall plate type designed to replace a standard wall switch. Installation is simple. You just disconnect the existing toggle switch, attach the same two wires to the back of the timer and fasten the timer's plate to the wall box. Rhodes makes several models of this type in a choice of different time ranges. The most popular are the 60-minute and 12-hour versions. These are basically single-action, delay-type switches. You turn the knob to the desired amount of delay—up to one hour in the 60-minute type and up to 12 hours in the 12-hour model—and the light or appliance goes off at the preset time.

Works



AS "OFF" STOP ENGAGES SWITCH 10 HOURS LATER, CONTACTS OPEN AND LIGHT GOES OFF AT 4:00 A.M.

Technical Art by Stanley Cohen



DELAY-TYPE TIMER fits in a wall box, replacing the regular toggle switch. Knob sets amount of delay, here up to 12 hours. Rhodes makes several models

once turns on, in this case at 6:00 p.m. When the "off" stop reaches the arrow, the switch opens and the light or appliance goes off, here at 4:00 a.m.

The 12-hour timer is useful when you want long time-delay intervals, such as for keeping outdoor lights burning for several hours after you've gone to bed. If you have a yard light or post lamp controlled from an inside wall switch, you simply substitute the timer for the switch and dial the amount of time you want the outside lights to stay on.

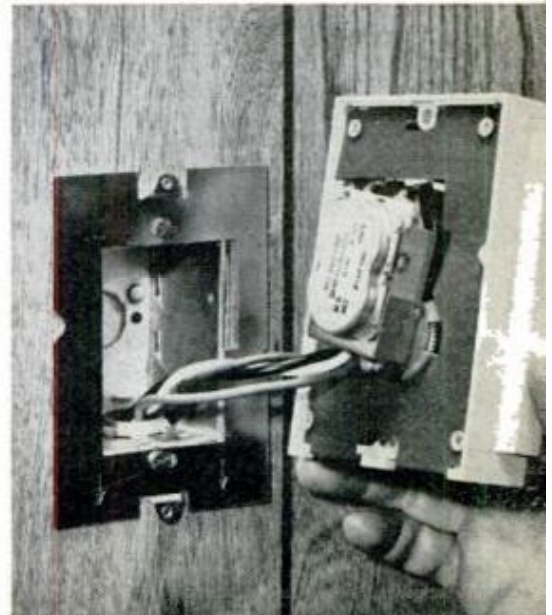
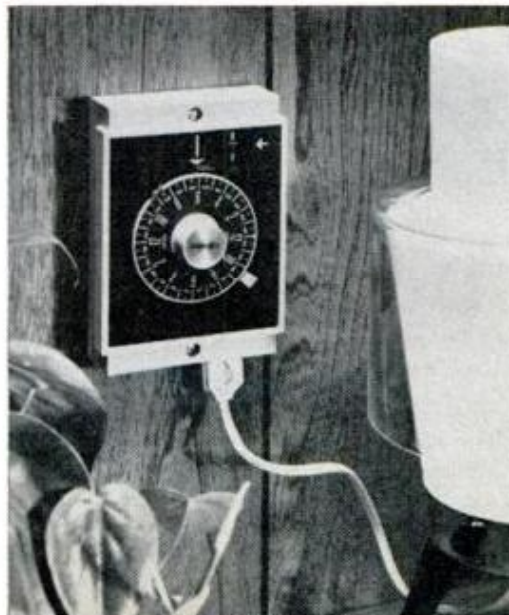
The 60-minute timer is handy for shorter delay intervals and is especially useful for turning off a bedside lamp, radio or TV set after you've fallen asleep. If you have a wall outlet controlled by a switch, you can substitute the timer for the switch and plug the light, radio or TV set into the outlet. Just before retiring, you turn the timer knob to give the desired delay, say 30 or 45 minutes, and at the end of this period off will go whatever you have plugged into the outlet.

If you don't have a switch-controlled wall outlet, there's another answer. It's a simple plug-in "sleep switch" made by Calectro. It has a long cord so the control can be kept by your bed and the other end plugged into a wall outlet across the room. The end that plugs into the wall has a receptacle for a lamp, radio, TV or other appliance. The control can be used as either a remote on-off switch or an automatic timer for delayed shutoff depending on how you turn the knob.

Most timers have a manual control or position that enables you to operate them as a straight on-off switch when you don't want automatic operation. Some use light-sensitive photocells instead of clock movements to turn house lights on when it gets dark at night and off when it gets light in the morning. These are simple and require

(Please turn to page 192)

WALL-MOUNT TIMER, by Intermatic, has same 24-hour clock movement as company's table-model version except that it's designed for installation in an electrical wall box. You attach a wide metal plate to the box first, then fasten timer to the plate, as shown at right. Receptacles in the bottom edge provide one outlet that's controlled by the timer's settings and one permanently hot outlet for general use



Handy Light Control For Your Darkroom

One goes on as the other goes off in this clever switching system that puts operation of your work light, safelight and enlarger at your fingertips.

By M. S. SCHROEDER

ONE OF THE BIG NUISANCES of darkroom work is fumbling around for switches when you're trying to work fast and can't see what you're doing. Your enlarger, safelight and room light must all be turned on and off in quick and proper sequence for efficient operation—a forgetful flip of the wrong switch can ruin the job.

The handy control box shown here can end the fuss and doubt by putting all necessary switches right at your fingertips in one central location. What's more, each switch is wired in such a way that it controls two functions simultaneously—thrown one way, it puts one light on and turns another one off; thrown the other way, the reverse occurs. This not only sim-

CONTROL BOX doesn't have to be fancy. Made from scrap wood, it uses standard household outlets and switches mounted with regular wall plates. Switch positions can be labeled for quick identification

plifies your operation, but it also serves as a safety precaution—it's impossible to turn two lights on accidentally at the same time and spoil your work.

The control consists of four toggle switches and two duplex outlets—standard household fixtures available at any hardware or electrical store. You can arrange the parts any way you want, but the layout shown here works well and makes it easy to remember which switch controls what. An on-off toggle acts as a main power switch and is side-mounted since it's used only occasionally.

One duplex outlet is mounted in the upper edge of the box. The regular white overhead room light or work light plugs into one half, and the safelight plugs into the other half. The second duplex outlet mounts in the lower edge of the box and powers the enlarger.

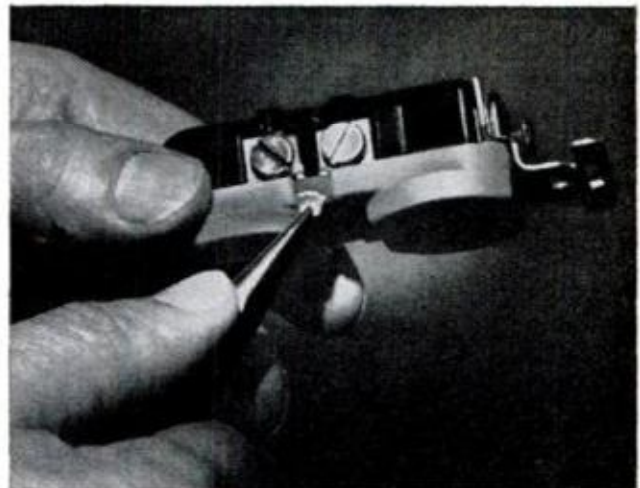
The main controls are mounted on the face of the box because they're used constantly. These three toggles are of a special type known as three-way switches—the kind you buy when you want to control one light from two different locations. Essentially, they function as single-pole, double-throw switches. In this case, they're wired so each controls two lights—one in each toggle position. When one light is on, the other is off and vice versa.

The vertically mounted three-way toggle switch determines which of the two horizontally mounted switches is activated. In the up position, you have a choice of either safelight or room light by flipping the upper horizontal toggle back and forth. In the down position, the lower horizontal switch takes over and gives you a choice of either safelight or enlarger. Note that the safelight is wired through both horizontal switches so it can be controlled from either one. This lets you select either safelight and room light or safelight and enlarger, depending on which combination suits your needs at the moment. If you want to switch back and forth between room light and enlarger, leave both horizontal toggles in the left-hand position and simply flip the vertical toggle up and down. In the up position, the room light will be on and the enlarger off. In the down position, the room light will go off and the enlarger will come on.

In use, here's how the arrangement typically works: You flip the vertical tog-

gle up and the upper horizontal toggle to the left to give you room light for inserting a negative into the enlarger. Then you throw the vertical toggle down to turn off the room light. With the lower horizontal switch, you now flip to the left to turn the enlarger on for focusing, then to the right to switch on the safelight for putting paper in the easel, then back to the left to turn the enlarger on for the exposure, then to the right again to switch the enlarger off and the safelight on for removing the paper and processing. Finally, when processing is completed, you throw the vertical toggle back up and the room light comes on.

It's impossible to turn on either the room light or safelight accidentally while the enlarger is on. This is an important feature since exposure readings, if you're



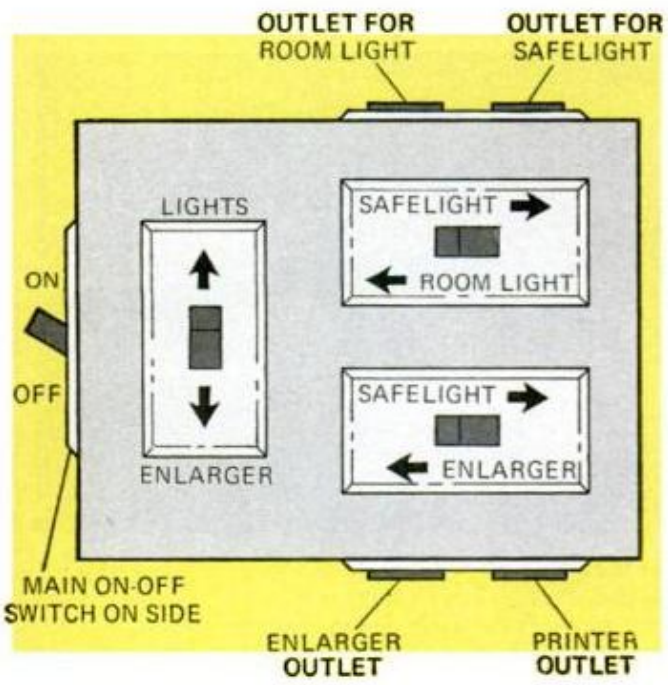
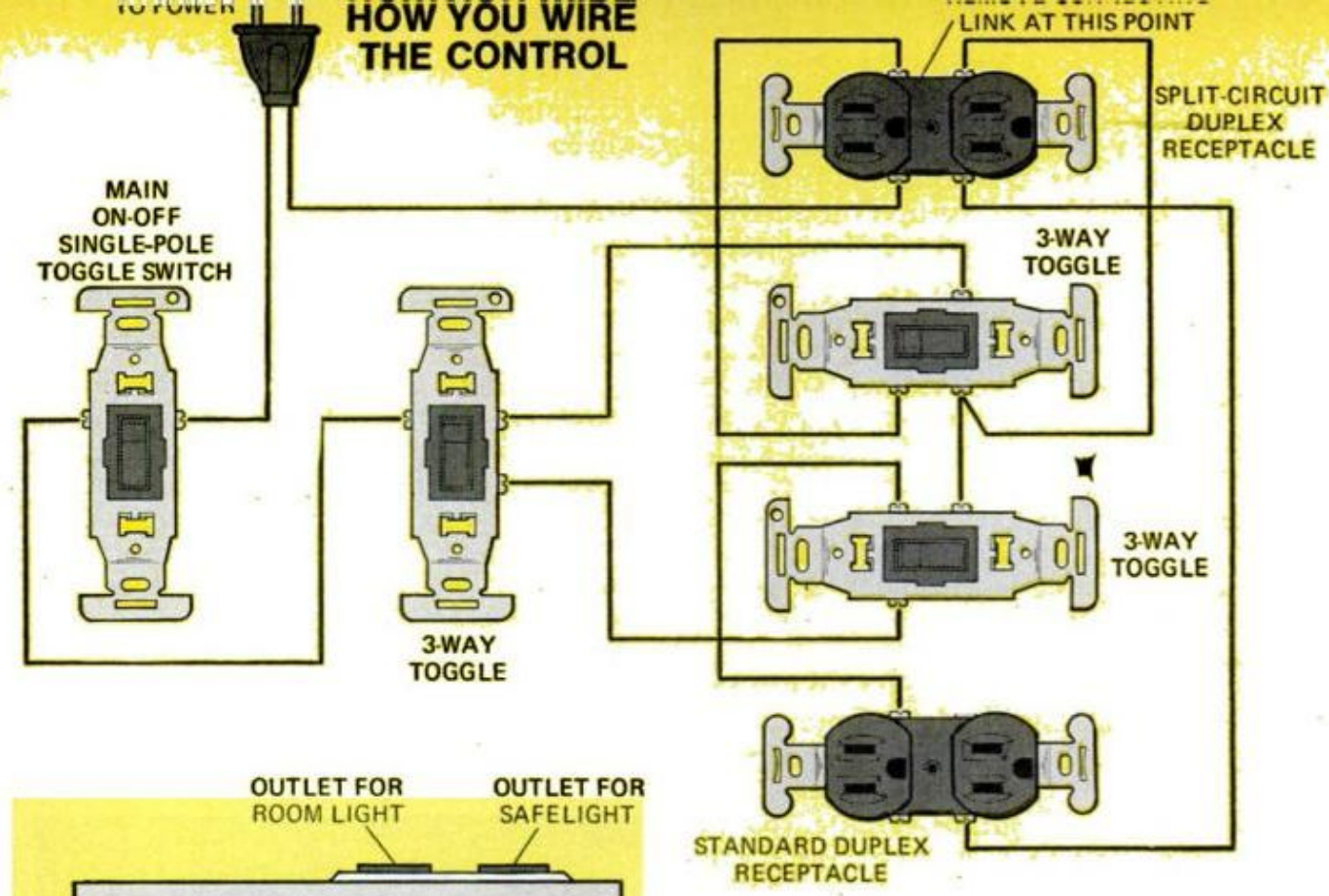
REMOVING LINK between terminals on one side of upper duplex outlet splits the circuit so the outlet can power two lights independently of one another

using a meter, ideally should be made with the safelight off. Also, some sensitive printing papers are affected by prolonged exposure to a safelight.

If you already have a room light controlled by a wall switch, it's best to set up a separate white work light that can be turned on and off independently. Plug this light into the room light outlet. If you're using an automatic timer, plug this into one enlarger outlet and connect the enlarger to the timer. The other outlet can be used to power an exposure meter, non-automatic timer or contact printer.

For the control to work properly, there is one important modification that must be made to the upper duplex receptacle. Remove the metal connecting link that joins the two terminals on one side, as

HOW YOU WIRE THE CONTROL



WIRING DIAGRAM above shows simple hookup that enables you to control your work light, safelight and enlarger in various combinations. Note that the three main switches mounted on the face of the control are three-way types used for controlling house lights from different locations. One on left is deliberately mounted vertically so position of its toggle will indicate which of the other two switches is in operation. The duplex outlet in the lower edge of the box powers the enlarger and a printer or timer. Similar outlet in upper edge powers room light and safelight. This must be modified as indicated by removing connecting link between one set of terminals so receptacle will function as two separate outlets. Diagram at left shows switch positions and what each one controls

shown in the wiring diagram. The link is designed to be removable and can easily be broken away with long-nose pliers. This way, the two outlets function separately so that only one is "hot" at a time, depending on which way the upper horizontal toggle is thrown.

The control box can be made from any material that's handy. The one shown here is about 8 inches wide by 12 inches long by 4 inches deep. The sides are strips of 1x4 pine with front and back panels of 1/4-inch plywood or hardboard. Since the control is not part of permanent house wiring, it's not necessary to mount the switches and outlets in metal wall

boxes unless you wish to. For simplicity, the fixtures can be attached directly to the front panel in suitable cutout openings. Just be sure there's plenty of clearance between them with no chance for wires to touch at any point. Use at least 16-gauge lamp wire for making connections. Run the power cord out a hole in the side of the box and plug it into a wall outlet. At the end of each darkroom session, remember to flip off the switch on the side and this will kill power to the whole control. Switch positions can be identified with a bold marking pen or stick-on labels of the type made with a labelmaker. ★★★

NEW IN PHOTOGRAPHY

THE LONG SNOOT on this new Polaroid camera has a special purpose. It serves as a fixed bellows or extension tube, enabling you to shoot big head-and-shoulder color portraits with perfect results virtually guaranteed every time. In fact, that's all the camera is designed to do—take close-ups

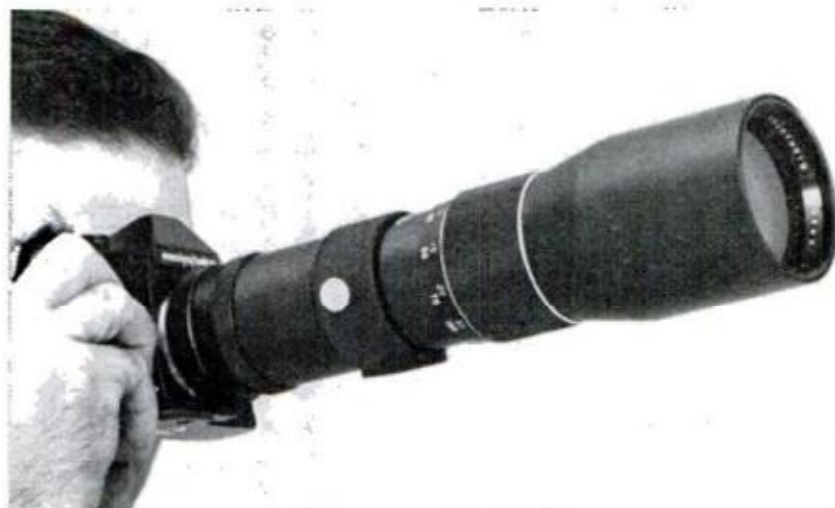
— but it does it with amazing ease and sureness. Your exposure is fixed at 1/60th of a second and f/25. You always use a flashcube regardless of lighting conditions so results are consistent. A flash shield diffuses the light for safe close-range shooting. Even focusing is fixed. You adjust your position until a double-image rangefinder indicates you're on target—about 38 inches from subject. Then you trip shutter and 60 seconds later out comes a 3x4-inch color portrait. Price? About \$20. Name? Appropriately enough, Big Shot. What else?



ONE OF THE NEWEST of the small-looking, big-format cameras is the trim Fujica below. Only slightly larger than a 35-mm camera, it shoots 2 1/4 x 3 1/4 pictures, delivering snapshot-size prints without enlargement. You get eight exposures on 120 film or 16 on 220. The f/3.5 lens has speeds to 1/500th second and can be removed in mid-roll without spoiling the film even though the shutter is within the lens itself. Price with standard 100-mm lens: \$375. Telephoto and wide-angle lenses are available.



LONG TELEPHOTO LENSES are usually hefty in price and weight, but this new high-powered 400-mm Vivitar is relatively light on both counts. Designed for single-lens reflex cameras, it's priced at \$169.50, weighs 2 1/2 pounds and is said to handle easily even on hand-held shots without a tripod. The f/6.3 lens, called the Auto T-4, is 11 1/2 inches long, covers angle of 6°, can be focused as close as 24 feet. Provides meter coupling and automatic diaphragm stop-down on most SLR models; also has own tripod socket in barrel. Adapters to fit Mamiya, Pentax, Nikon, Canon, Minolta, Miranda, Exakta, Leicaflex and Topcon cameras are \$10 to \$15. Ponder & Best, Inc., 11201 West Pico Blvd., Los Angeles, Calif.



Caulk Your Way to a Better Paint Job

By G. G. SHURR and
C. R. MARTENS



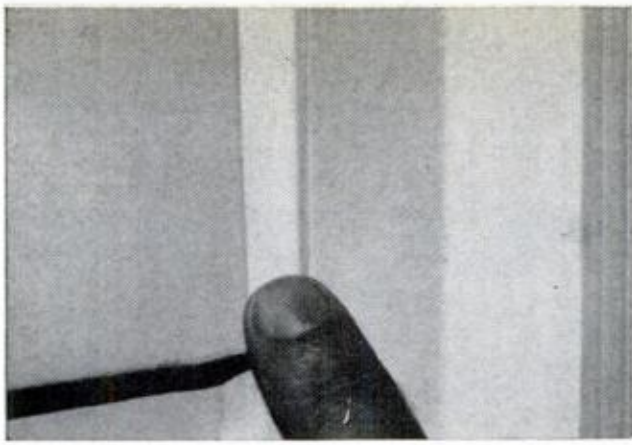
TYPICAL PAINT PROBLEMS caused by caulking-compound failure are shown in the two inset photos. Quality caulking, when properly applied, eliminates failure near joints, prevents paint pulling away from substrate

ALTHOUGH MOST HOMEOWNERS expect long-term durability from a house paint, few are aware that the performance of even the highest quality paint can be ruined by an inferior caulk. Many homeowners use or specify paints costing \$10 or more per gallon to insure long-lasting results, yet, they will lose all the costly quality benefits by using a 59-cent tube of caulking compound.

The importance of caulk to paint durability, especially on wood surfaces, is evident when you consider the type of paint failure that usually makes repainting

necessary. House repainting within a short period of time is seldom required because paint failures on large siding areas are usually minimal. Cracked and peeling paint is found more often around windows, doors, trim and siding ends. These conditions are the result of caulk failure—not paint failure.

The main causes of paint failures in these spots involve exposure of end grain. This generally occurs at points where siding butts against window or door trim, at corner boards or where two lengths of siding butt each other. Similarly, end



ACRYLIC-CAULKED JOINT between end of siding and trim is in good condition after two years' exposure



POOR CAULKING leaves end grain exposed. Moisture then creeps in between casing and masonry wall

grain is exposed in door and window-trim joints and on fascia boards at the corners of the house. Unless these joints are properly caulked, water can and will enter and be literally sucked into the wood by capillary action—in much the same manner that a tree carries moisture from the ground to its limbs and leaves. And, once moisture is in the wood it swells; then, as the wood dries, it contracts. As shown in the photographs, this alternate swelling and contracting action eventually causes the paint film to crack and peel.

To eliminate, or at least minimize, the chance of a breakdown, all wood joints should be tightly caulked in cases where end grain is exposed, or where water can collect, as on window sills. Of course, joints between dissimilar materials, such as brick and wood, should also be caulked.

But even carefully applied caulking compound will not prevent paint failures if the caulk fails before the paint. Though 10-year paints have been available for some time, low-cost, long-life caulks have not. Industrial sealants, such as polyurethane or silicone types, are expensive and are not usually considered (and, most likely, not available) for most residential applications.

Oil-based caulks can be expected to last only one or two years. Butyl caulks are better, and their life expectancy is three to four years. After that, both types become brittle, with a tendency to crack and peel away from the joint, permitting moisture to enter.

Relatively new acrylic latex caulks provide better results. Tests have shown them to stay flexible longer than oil and butyl caulks. Although they have only been on the market for four years, tests

conducted by the Sherwin-Williams Co. indicate that acrylic latex caulk has a useful life of at least five—and very possibly 10—years. Additional tests by the Rohm and Haas Co. concluded that acrylic latex caulks remain in excellent condition after nearly five years' outdoor exposure. From both of these test programs, it appears likely that acrylic latex caulk should have useful life approaching the 10-year mark.

Acrylic latex caulks cost a little more—about 25 percent more than butyl and almost twice as much as oil caulk—but the cost is insignificant when compared to the cost of a good-quality paint job. And acrylic latex caulk has other advantages: It flows easily and has little odor, it can be applied while the surface is still damp, it isn't gummy or sticky and can be worked with thumb or finger. It is also more mildew resistant, accepts paint well and can be coated within one-half hour after application. And soap and water can be used for clean-up.

For the best paint job when using an acrylic latex caulk follow these rules: 1. Choose a caulk made by a reputable manufacturer. 2. Apply it to a primed surface, not bare wood. 3. Do not use water-based acrylic caulks at temperatures below 40° F. (and store cartridges at temperatures above freezing). 4. On repaint jobs, thoroughly clean chalky surfaces and scrape off old caulks to promote superior adhesion. ★★★

The authors, G. G. Shurr and C. R. Martens are, respectively, director of paint research and technical advisor for the Sherwin-Williams Paint Co. They have spent thousands of hours studying paint and the causes of its failure.

Do All of Your Own Routine Service and Maintenance!

From oil change to ignition timing, you can save a bundle and avoid the service-station or dealer-service hassle

By MORT SCHULTZ



FUEL FILTER, in line to the carburetor, is easily removed for replacement

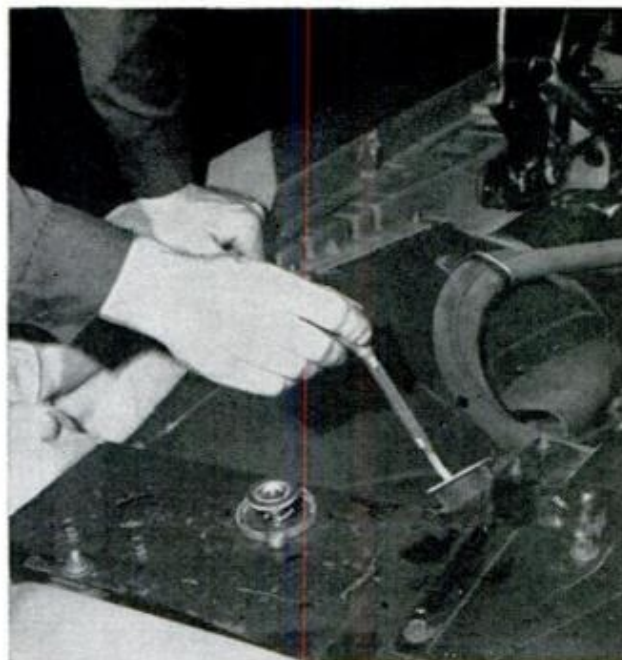


OIL FILTER may get too tight to loosen by hand; if so, you'll need a strap wrench to get it started

HOW MUCH MONEY can you really save by doing your own routine service and maintenance? I priced 10 services specified in the owners manual for your car. Each is easy enough for most car owners to do themselves. They're listed in Table A (see facing page) which indicates in specific dollar amounts the cost of professional services (parts plus labor) for each job. These prices were obtained from a new-car dealer's service department and a gasoline station in the New York metropolitan area. Prices, however will differ in various parts of the country, also vary according to make and model of car. We used a late-model eight-cylinder



INEXPENSIVE HYDROMETER is used to check specific gravity of electrolyte which reveals state of charge

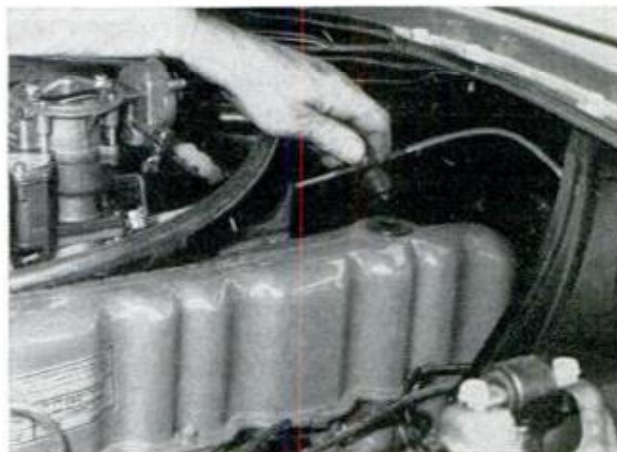


RADIATOR COOLANT can be checked using new type hydrometer: Number of floating balls gives reading

Chevrolet with automatic transmission and two-barrel carburetor.

Costs of do-it-yourself equipment and supplies (see Tables B and C on the next page) were obtained from several sources, including a regular automotive parts supply, Sears Roebuck and the J.C. Whitney Co., one of several large auto direct-mail companies. Each price comes from one of these sources (specified), to make the total as representative as possible.

The important point to remember is that prices of equipment and supplies vary. It pays to shop around. You will notice as you check the cost of professional service versus do-it-yourself service that you can



EMISSION-CONTROL VALVE is easily removed from seat, replaced or cleaned; remember to replace hose

TABLE A—THE COST OF PROFESSIONAL SERVICE

Service Provided	Dealer	Gasoline Station
1. Change engine oil and oil filter	\$8.55	\$8.25
2. Lubricate chassis	2.70	2.50
3. Replace carburetor air cleaner, in-line fuel filter	8.70	6.50
4. Remove and service sparkplugs	4.80	4.00
(Remove and replace sparkplugs)	(\$10)	(\$10)
5. Set distributor points and time ignition	3.40	2.00
6. Service cooling system	13.45	8.50
7. Service emission-control system	4.29	2.00
8. Check fluids (strength of battery electrolyte, level of power-steering and brake fluids)	No charge	No charge
9. Rotate tires	3.20	2.00
10. Service automatic transmission	24.50	17.10
TOTAL COST (Without new sparkplugs)	\$73.59	\$52.85
(With new sparkplugs)	78.79	58.85



AIR CLEANER is removed from its housing on top of carburetor. New air cleaner is installed in seconds



SPARKPLUG SOCKET, if not supplied with car, will have to be bought, usually for less than 50 cents

save as much as \$54 by doing the work yourself—if you have the equipment.

Costs of equipment and supplies are given in separate tables to impress on

TABLE B—COST OF EQUIPMENT

Item	Supplier	Cost
Grease gun and extension	Sears Roebuck	\$4.99
Sparkplug wrench	J.C. Whitney	0.32
Sparkplug cleaning tools	J.C. Whitney	1.49
Sparkplug gauge	J.C. Whitney	0.47
Distributor-point gauge	Auto parts store	2.79
Timing light	J.C. Whitney	5.98
Cooling-system hydrometer	Auto parts store	1.29
Battery hydrometer	J.C. Whitney	1.29
TOTAL COST		\$18.62

TABLE C—COST OF SUPPLIES

Item	Supplier	Cost
Engine oil	Sears Roebuck	\$4.00
Engine oil filter	Sears Roebuck	2.75
Chassis lubricant	Auto parts store	0.79
Air Cleaner	J.C. Whitney	2.29
In-line fuel filter	J.C. Whitney	2.98
Sparkplugs (if needed)	Auto parts store	(6.40)
Coolant	Sears Roebuck	3.38
Emission-control valve	Auto parts store	1.29
Auto. transmission fluid, filter and pan gasket	Auto parts store	7.65
TOTAL COST (Without new sparkplugs)		\$25.13
(With new sparkplugs)		\$31.53

you the fact that equipment cost is a one-time expenditure. By doing work yourself and cutting down the number of trips you make to a mechanic in a year, you'll soon save enough money to pay for equipment. If funds are short you don't have to buy everything at once. Spread it out.

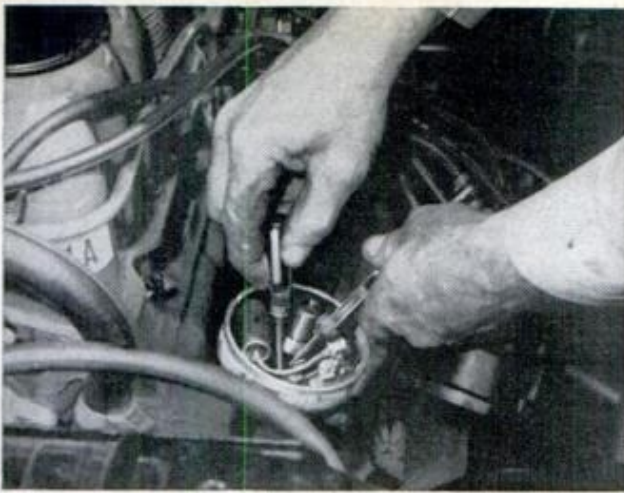
While there isn't sufficient space here to detail how to do each job listed, most of these services have been covered in past *Saturday Mechanic* articles and will be covered again in the future.

Meanwhile, if you need guidance, try to get a service manual for your car by writing the manufacturer's director of technical publications. Manuals cost about \$5. You may be able to get information free of charge at your public library if it has an auto reference manual such as the *Motor's Auto Repair Manual*. The owners manual for your car (if you have lost it) you can get another from the manufacturer) will tell you how often the maker suggests that each service be done.

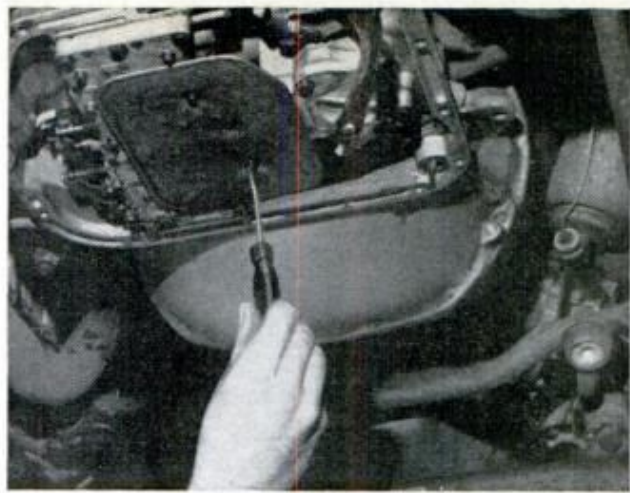
Some hints to make your work easier:

- Warm up the engine before you drain oil. Empty half-gallon or gallon plastic bottles make handy receptacles. For ecology's sake, don't pour old oil down the drain. Recap the bottle tightly, mark it "Used Oil" in big letters and put it out for garbage pickup.
- An oil filter in use will often become so tight you won't be able to free it by hand. Use a strap wrench if you have it. If not, you can save part of its cost by buying a 12-inch pipe hanger from a hardware store and wrapping it around the filter; placing a screwdriver through the hanger's holes will give leverage.

Before installing a new oil filter, coat



POINTS FEELER GAUGE is a small investment that will save you money. Keep it oiled to prevent rust



DROP TRANSMISSION PAN to change filter, fluid. Remember to install new gasket that comes with kit

its gasket with a film of oil. Tighten the filter by hand *only*.

- There are three main types of hand grease guns: one that you hand-fill with grease, one that accepts grease cartridges and operates like a caulking gun and a third for use either way. Most people prefer the cartridge type because it is less messy. However, grease bought in bulk costs about 30 percent less.

Get an extension for your grease gun; greasing out-of-the-way fittings, such as on upper ball joints, will be easier.

- The in-line fuel filter of most cars is held by two small clamps. Slip them off the hose, remove the filter and replace it with a new one.

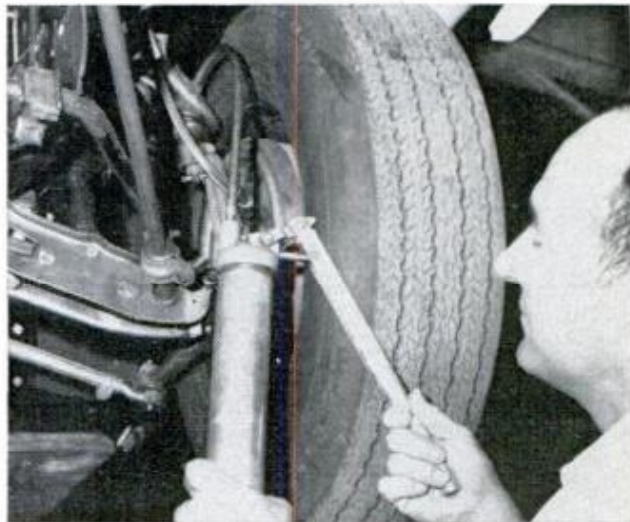
- Sparkplugs of engines in good condition and operated sensibly can be removed, cleaned and regapped until the recommended gap is no longer obtainable. Replace a plug that shows damage or can't be gapped to specifications.

- Distributor points need not be replaced until they show excessive wear or damage, such as pitting or dishing. When you put in new points, also replace the condenser. To gap points, insert the specified feeler gauge between points and turn the adjustment screw until you feel some resistance on the gauge as you pull it from between the points.

As long as you have a timing light, use it more often than the carmaker recommends in his maintenance schedule. Performance of your car depends on maintenance of proper timing.

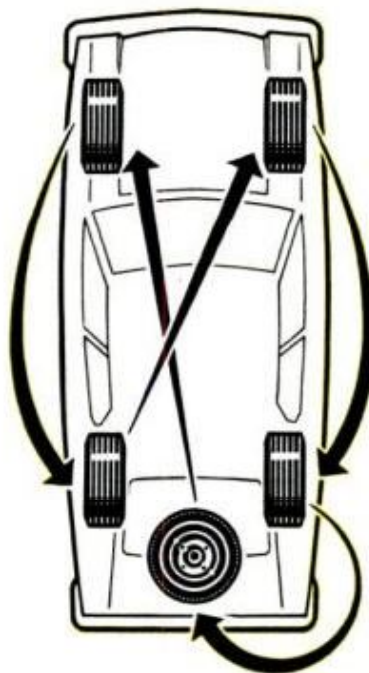
- Cooling-system service involves draining old coolant (be sure engine is warm), squeezing hoses to see that they aren't

(Please turn to page 187)



CHASSIS LUBRICATION can be done with inexpensive grease gun; the cartridge-fill type is the easiest

TIRE ROTATION USING SPARE TIRE



EXCITING
NEW PRODUCTS

BY CATHERINE BILSKI

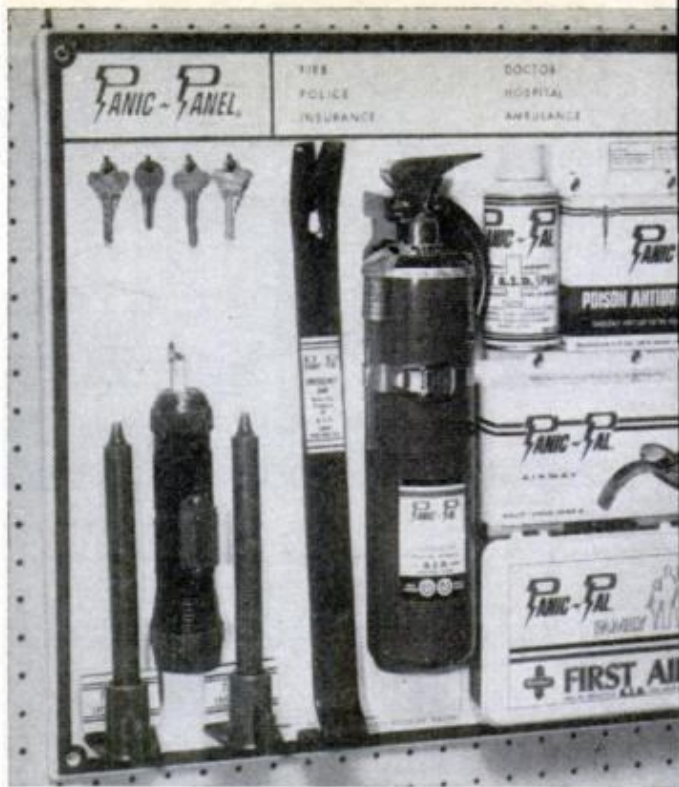


RESTORE COLOR AND LUSTER to black vinyl cartops with Black Top Wax. It's impregnated with deep, rich pigment that not only colors but waxes, seals and weatherproofs the vinyl. A high-speed foam-rubber applicator on the can top applies the wax quickly and evenly. Wax also works wonders on faded tires, retails for \$2.45. Turtle Wax Manufacturing Co., 1800 North Clybourn, Chicago, Ill. 60614.



PROTECT YOURSELF AND FAMILY against the danger of fire with the Compact Fire Alarm. Ultra-Alert Sensor activates buzzer when room temperatures reach 135°F. in plenty of time for effective action. Plugs into any 110-120-v. household outlet. Ideal for trips. Priced at \$6.95 from Woolley's of St. Petersburg, 5202 Joe's Creek Drive North, St. Petersburg, Fla. 33709.

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WHEN EMERGENCIES ARISE, be prepared with the Panic Panel Emergency Center. It contains dry-powder fire extinguisher, first-aid kit, poison antidote kit, airway resuscitator, aerosol spray for burns, emergency pry bar, magnet-mounted flashlight, candles, safety matches and mounting hardware. Sells for \$29.95 postpaid from M. C. Distributors, 4104 College Ave., Indianapolis, Ind. 46203.



BUSINESSMEN, OUTDOORSMEN and just about anyone who needs a quick cleanup shave, will find this cordless, battery-powered Mini Shaver a great timesaver. Compact and portable, it's designed for use anywhere a regular razor would be impractical or impossible. Suggested retail price is \$6.95. It's made by RCA Parts and Accessories, 2000 Clements Bridge Rd., Deptford, N. J. 08096.

POPULAR MECHANICS

CAMEL FILTERS/POPULAR MECHANICS GUIDE TO COMPETITION CARS - 1971



FORMULA A



FORMULA 1



CHAMPIONSHIP



TRANS-AM



FUEL GAS ELIMINATOR



CAN-AM



FUNNY CAR



STOCK CAR



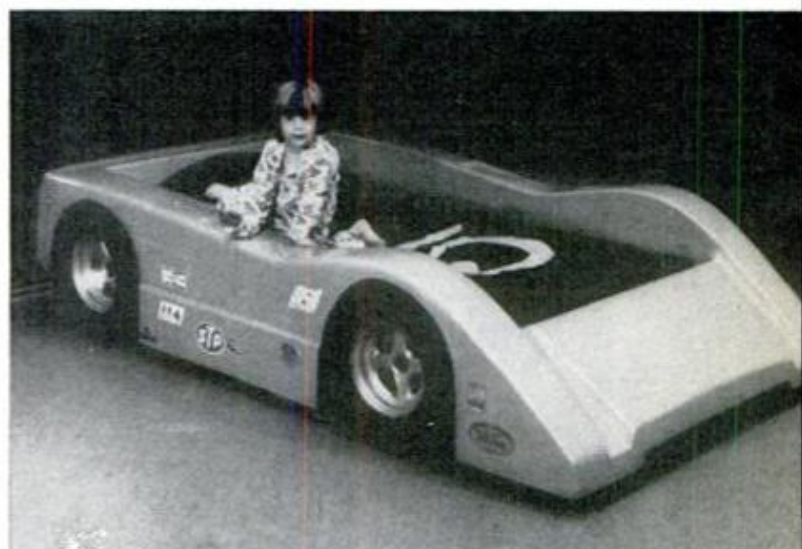
COMPETITION ELIMINATOR



FRAME AND HANG POSTERS, prints, pictures, charts, drawings, whatever, in just a few minutes with this kit. Called Frame-All, each kit contains four plastic frame strips, four corners, a cutting tool, cutting guide, picture and wall hangers and complete instructions. *PM's Racing Guide* (shown) was framed in less than 15 minutes; the frame was cut to suit using a tablesaw. The kit retails for \$1.95 and is made by the Allen Field Co., Inc., 10 East 22nd St., New York, N.Y. 10010.



NOW IT'S POSSIBLE to retain and enhance the natural beauty of wood while adding decorator colors. Americolor Wood Finishes produce a glowing satin finish that brings out every delicate shading of wood grain. Made for all unfinished interior wood surfaces, the product offers a choice of green, red, white and blue. \$3.80 qt. Minwax Co., Inc., 72 Oak St., Clifton, N.J. 07014.



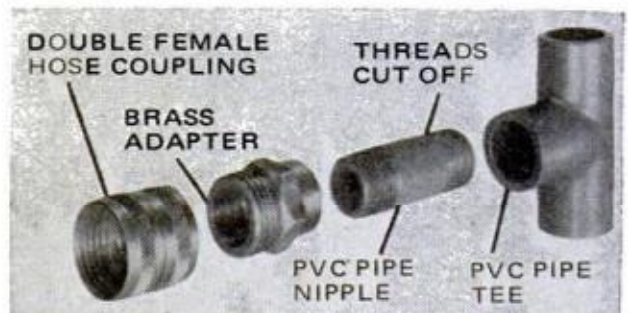
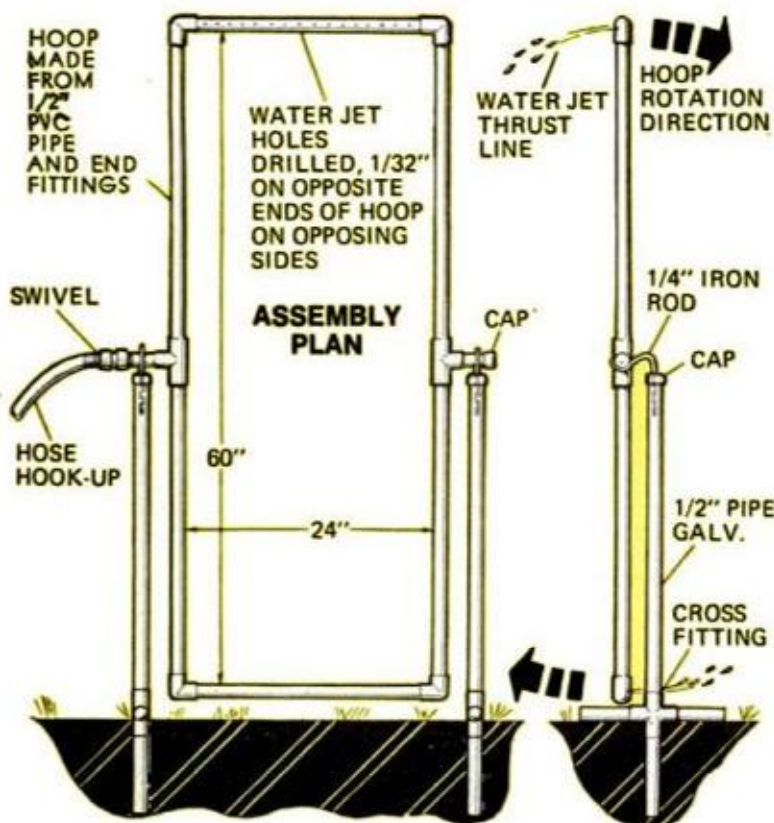
THE LATEST IN SPORTS CARS is one in the form of a bed. Produced in high-gloss fiberglass, the Can Am Sleeper comes with replica racing wheels and tires, race-sponsor stickers and a standard twin box spring and mattress. Measures 98½ in. long, 59 in. wide and 23½ in. high, and sells for \$349. B. F. Meyers & Co., 18340 Mount Baldy Circle, Fountain Valley, Calif. 92708.

Build This Water Hoop For the Fun of It



THIS ROLLICKING WATER HOOP enables you to water the lawn at the same time the kids are having a ball jumping "rope" and getting drenched as the hoop turns. Strong jets of water escaping from pinholes drilled in opposite ends of the hoop cause the hoop to turn Ferris-wheel fashion when it's connected to a hose.

The toy was invented by Frank Reed and Marty Trent of Palos Verdes Peninsula, Calif., and you can make one like it from 1/2-in. PVC pipe and standard plumbing fittings. The hoop turns on two supporting posts anchored in the ground, and a double female hose coupling prevents the garden hose from twisting into a pretzel as the hoop turns. PVC pipe tees, plus short pipe nipples, provide axles at the center point of the hoop. The hoop is assembled with regular PVC cement. ★★★



HOSE HOOKUP is assembled from two standard brass fittings. Adapter is threaded to take PVC nipple

POPULAR MECHANICS

**3-Way
Hi-Fi Cabinet**

A Lot of Looks for Little Money

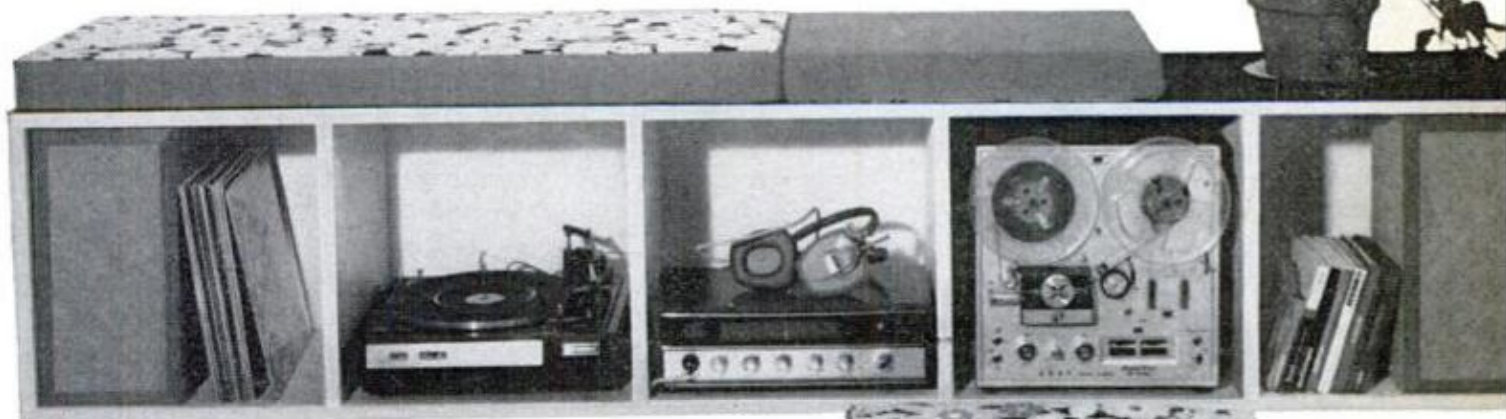


By JACKSON HAND

A sheet and a half of plywood is all you need for this versatile, compartmented enclosure that will stand upright, sit on a base or squat on the floor

A HI-FI CABINET doesn't have to be fancy to be functional. This one organizes a variety of home-entertainment equipment in a versatile, smart-looking, easy-to-build music center that can be used in several ways. It can be arranged horizontally on a base, credenza style. Without the base, it can squat on the floor with cushions on top to double as a bench in a den or playroom. Where floor space is tight, it can be stood on end, stacking your hi-fi components vertically for maximum use of minimum area. Besides hi-fi gear, it can also store a projector and other hobby equipment.

The enclosure is a simple box with five open compartments. The

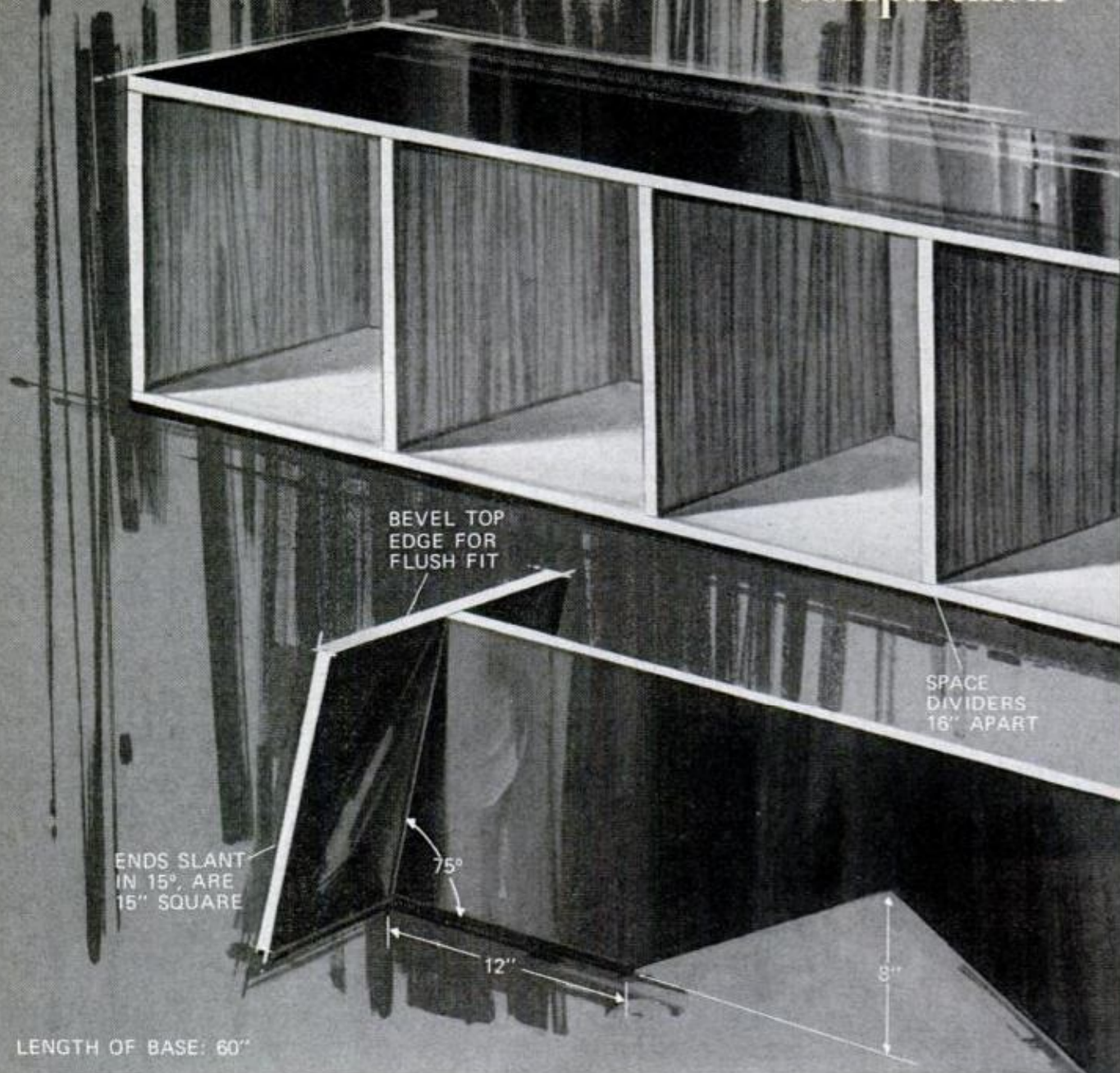


ROOMY ENCLOSURE has cubicles for hi-fi gear, tape and record storage and twin stereo speakers. This on-the-floor version also doubles as a bench. Vertical arrangement is shown on a following page

SEPTEMBER 1971

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5-Compartment



LENGTH OF BASE: 60"

cubicles are each 16 inches square and are thus symmetrical, offering the same-size openings no matter whether they're vertical or horizontal. The 16-inch width accommodates just about any type of hi-fi equipment commonly sold and also makes it easy to cut standard 4x8 plywood with a minimum of waste.

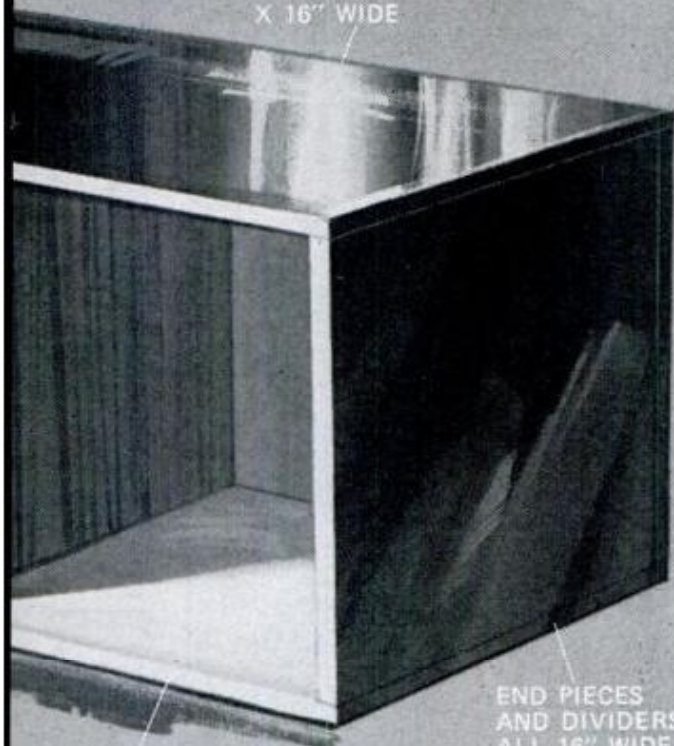
All parts are ordinary good-one-side $\frac{3}{4}$ -inch fir plywood. The inner face can have knotholes so long as they're patched and not open. There's no fussy carpentry—it isn't necessary if you use a painted finish. All joints are simple butts held together with glue and finishing nails. Nailheads, corner cracks and the plywood edge grain are filled flush and smooth with vinyl patching paste so they become invisible when painted.

As shown here, the enclosure is finished with flat black enamel on the outside and white on the inside, giving it a slick, modern look. You can, of course, use veneered plywood if you wish. In this case, miter the corner joints for a neater appearance and cover the exposed edges with a matching wood tape to conceal the plywood grain.

The top, bottom and back are all 16-inch-wide slabs $84\frac{1}{2}$ inches long. Slice two of these from one 4x8 sheet of plywood and cut the third from a second sheet. This will give you three full 16-inch widths without loss of wood produced by the saw kerf. From the remainder of the first sheet, cut a strip $15\frac{1}{4}$ inches wide. This is for the end pieces and compartment dividers. The $15\frac{1}{4}$ -inch width allows for

Hi-Fi Cabinet

BACK AND
SIDES 84-1/2" LONG
X 16" WIDE



ALL
OPENINGS
16" SQUARE

END PIECES
AND DIVIDERS
ALL 16" WIDE
X 15-1/4" DEEP

ALL PARTS
3/4" PLYWOOD

Optional Base Unit



the 3/4-inch thickness of the back panel, making a total cabinet depth of 16 inches. Cut the strip into six equal 16-inch lengths.

In this case, the saw kerf is unavoidable and each of the pieces will come out just a trifle less than 16 inches.

In assembling the enclosure, there's one trick that will simplify the painting job later. Tack the back panel temporarily in place with a few small brads so it will help to form a rigid structure, but don't add glue at this point. After the glue has dried in the other joints, remove the back panel and paint it separately on the inner face. At the same time, also paint the inside of

the enclosure. With the back off, it will be easier to reach into the cubicles. Give the wood several coats in order to build up a rich, smooth finish. Finally, glue the back permanently in place and paint the outside of the enclosure.

If you decide on adding the base, its height can be adjusted to suit other furniture or to fit a particular location, such as under a window. Raising the enclosure makes the hi-fi components easier to reach and operate.

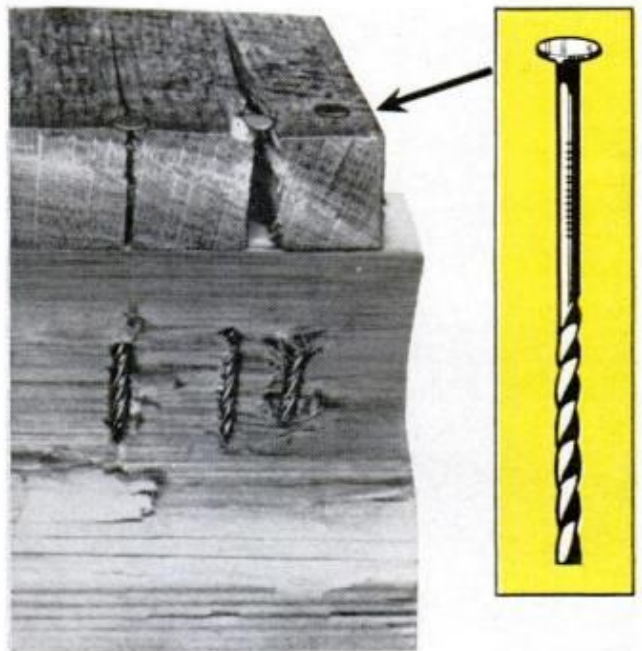
The on-the-floor version is a bit rough on us over-40 fellows, but is great for teen-age parties in a playroom and adds extra seating capacity. Colorful plastic cushions can usually be purchased in stock 16-inch-square sizes at department and discount stores. ★★★

NEW PRODUCTS FOR

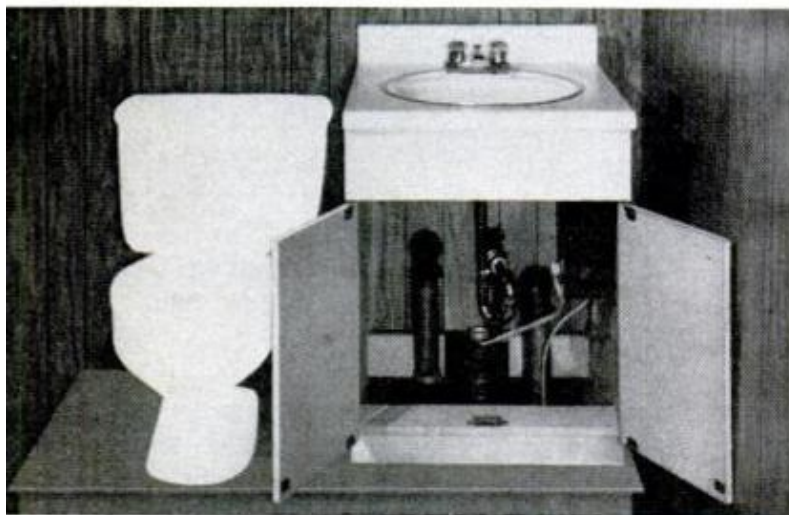
By HARRY WICKS, Workshop Editor



NEW ADHESIVE "forgives" improper placing because you can shift or remove parts for a minute after they are joined, yet it still sets up to give a strong permanent bond. Glue will attach the decorative wood-like Repli-Carve (above) to door fronts without brads or clamps. For more information on both products, write Emco Specialties Inc., Dept. PM, 220 New York Ave., Des Moines, Iowa 50304.



BLUNT-POINT SCREW-SHANK NAIL eliminates splitting hard or very dry wood when lighter-shank nails or staples cannot be used. Maker claims this nail sacrifices no strength: blunt end pushes wood fibers out of the way and spiral shank provides "hold." In 2 and 2 $\frac{3}{8}$ -in. lengths, nails are strip-coated to fit Duo-Fast CN-137 Nailer. Duo-Fast Fastener Corp., Franklin Park, Ill. 60131.

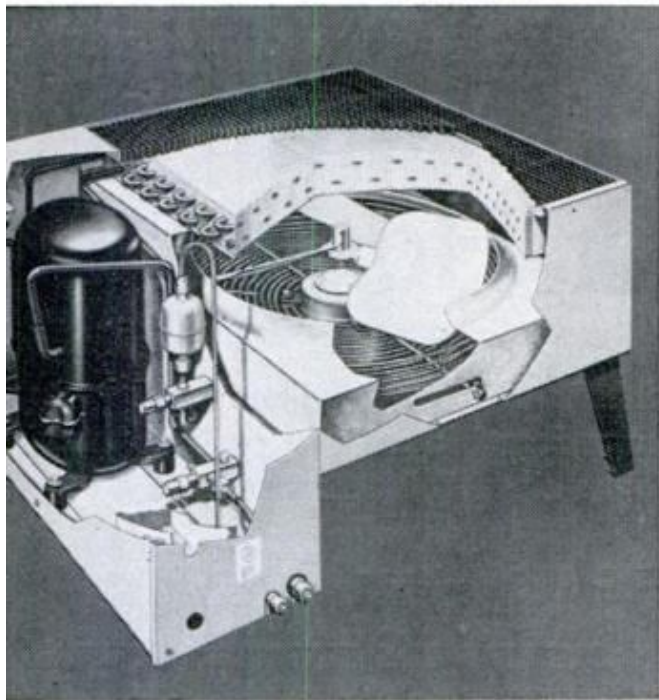


ADD-A-BATH offers economical way to add a bath to your basement without breaking up concrete floor; toilet and vanity mount on 5 $\frac{1}{2}$ x24x54-in. steel sump. Waste collects in airtight sump; as it reaches actuation height, factory-installed sewage ejector starts automatically, evacuates waste to existing plumbing. \$650. Beacon Add-A-Bath, Inc., 7719 West Belmont Ave., Chicago, Ill. 60635.



WATERPROOF COATING for exterior and interior masonry surfaces can be applied with roller, spray gun or brush. Maker claims sealer, called Dur-A-Poxy, has no objectionable odor, low toxicity and is fireproof. The epoxy resin can also be used on wood surfaces affected by subsurface moisture. Priced at \$28 per gal.; Dur-A-Flex, Inc., Dept. PM, 100 Meadow St., Hartford, Conn. 06114.

IMPROVING YOUR HOME



AIRCONDITIONER CONDENSING UNIT only 18 in. high features upward discharge for extremely quiet operation, easy installation and service flexibility. Compressor and controls, isolated in separate acoustical compartment, are protected from weather. HS8 comes in two to five-ton sizes. For dealer, write Lennox Industries, Inc., Dept. PM, 200 South 12th Ave., Marshalltown, Iowa 50158.

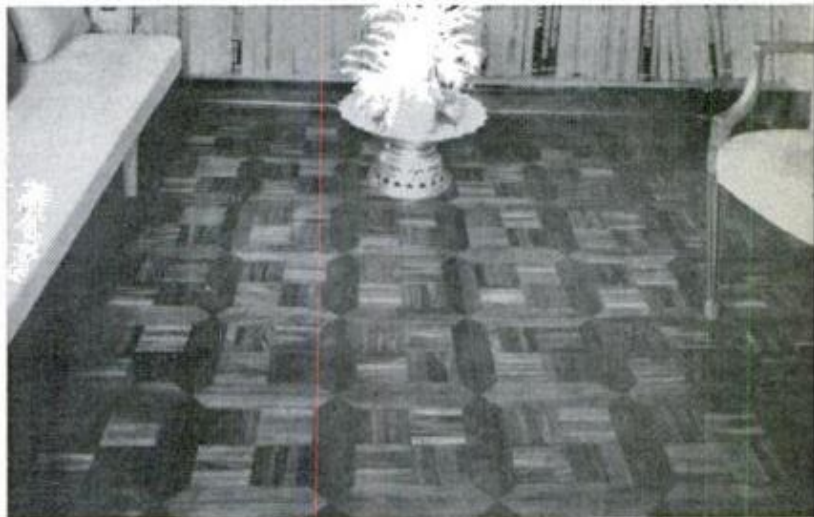


PANELING INSULATION $\frac{5}{8}$ in. thick, for basement remodeling jobs, fits between 1x2 and 2x2 furring members spaced 16 in. on centers on masonry walls. Sold in rolls, Conwed Insulation is wrapped in asphalt-bonded kraft liners, has stapling flanges for quick installation. Cost: about 10 cents per sq. ft. Conwed Corp., Dept. PM, 332 Minnesota St., St. Paul, Minn.



SOLID-STATE DIMMER for incandescent lighting boasts special suppressor guaranteed to cut interference in radios, intercoms or TV. On-off switch on Dimmit has rotary control for full illumination, mounts easily in standard single-gang wall box. U. L. listed, dimmer comes in single and three-way models. Nutone Div. of Scovill, Dept. PM, Madison and Red Bank Rds., Cincinnati, Ohio.

SEPTEMBER 1971



EXOTIC WOOD, meticulously laid in a small motif, gives Thomas Jefferson Finger Pattern Flooring a traditional old American elegance. Thailand wood floor patterns, about \$2 per sq. ft., are applied with Tectona mastic over any clean, flat surface, then sanded and finished with sealer and wax. For information, write Bangkok Industries, Inc., Dept. PM, 1900-10 South 20th St., Philadelphia, Pa. 19145.

133

Modernize With Bifolds And Beautify Your Home

Sliding closet doors are dated and inefficient. Now folding-door kits let you replace them with good-looking bifolds in less than a day

By WAYNE C. LECKEY, Home and Shop Editor

WHEN FITTED WITH SLIDING DOORS, a closet is never more than half open. The doors always block half the opening, so that you have to keep sliding the doors back and forth to get at what you want.

It's easy to get rid of these dated, unattractive and inefficient doors by replacing them with modern bifolds. Such doors make the whole closet immediately accessible, they glide open effortlessly and they're good looking. In addition, they simply lift out whenever you want.

You can find bifold doors in almost any lumberyard or building supply store. They are offered in a choice of many decorator styles; in plastic, wood and metal; finished and unfinished, and in sizes to fit any standard-width closet or door opening.

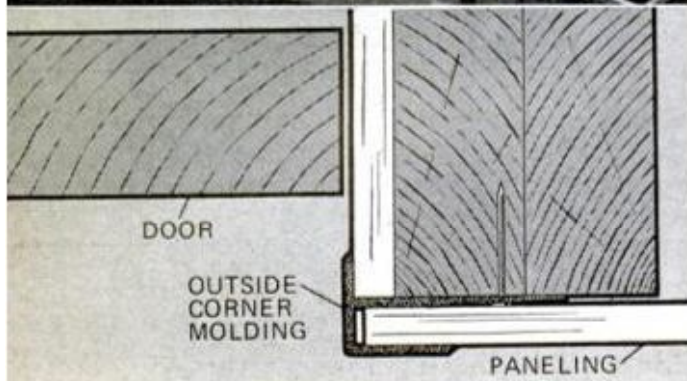
Some are just plain louvered panels, others have fancy carved inserts to add to their good looks. Still others are molded in one piece, completely finished, ready to hang.

Bifold doors come in kits complete with mounting hardware, including the overhead track, jamb brackets, top pivot stud, guide wheel, snugger, aligners, brass pulls, screws and a wrench, plus full instructions. In most all cases the door panels come factory-hinged (in a few you'll have to add the hinges), with pivoting studs already in place

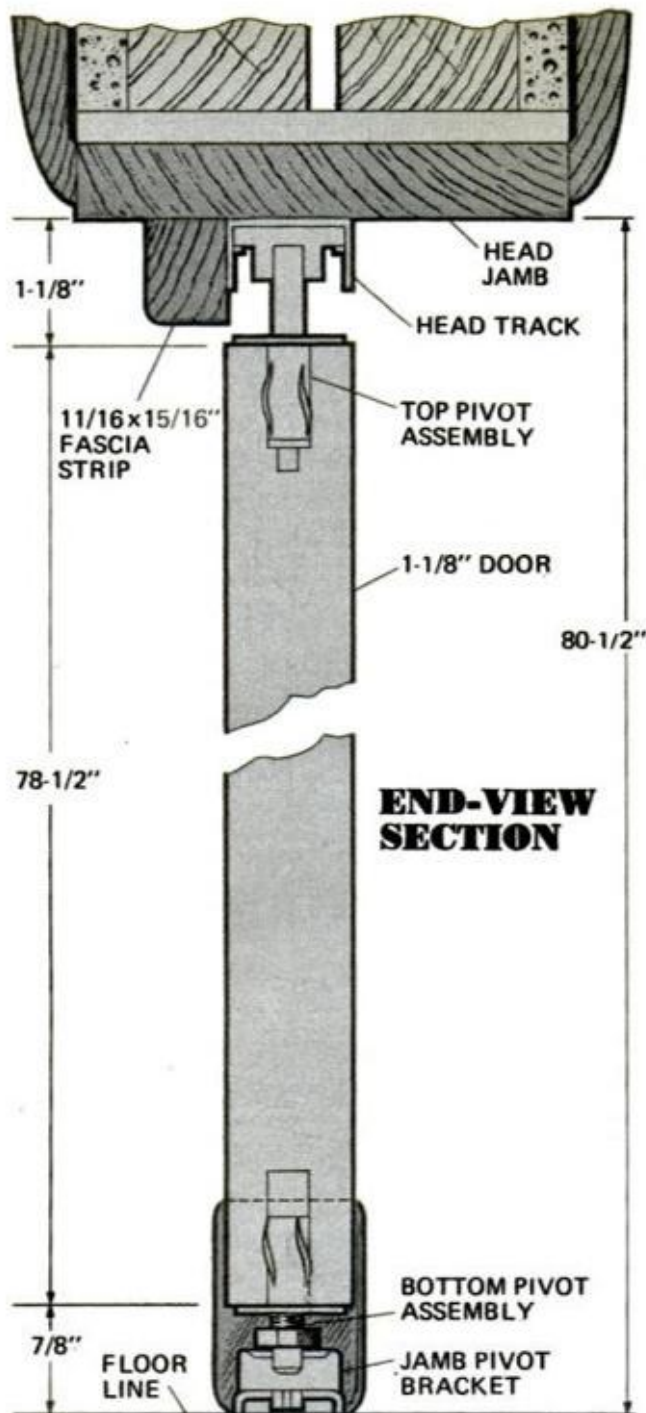
MOLDED NYLON BIFOLD DOORS made by DuPont (top, left) come factory-finished, ready to hang. Four-panel set sells for \$80

CONVENTIONAL WOOD BIFOLDS (near left) are smart-looking, even when used in opening trimmed with metal molding (drawing)

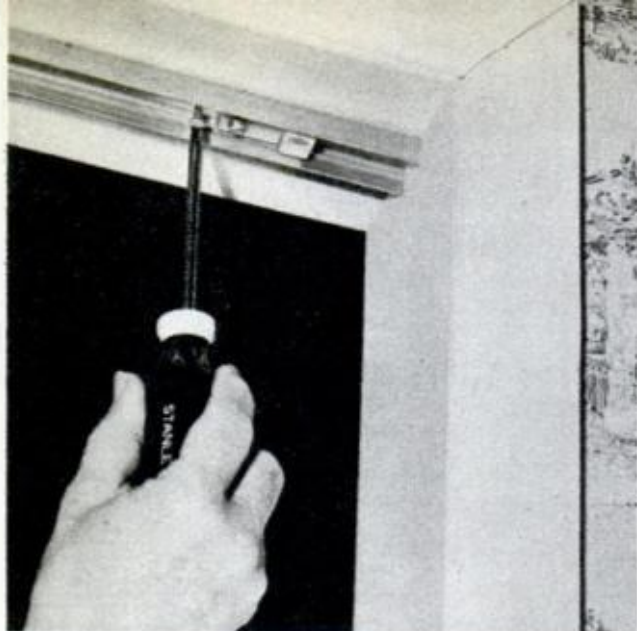
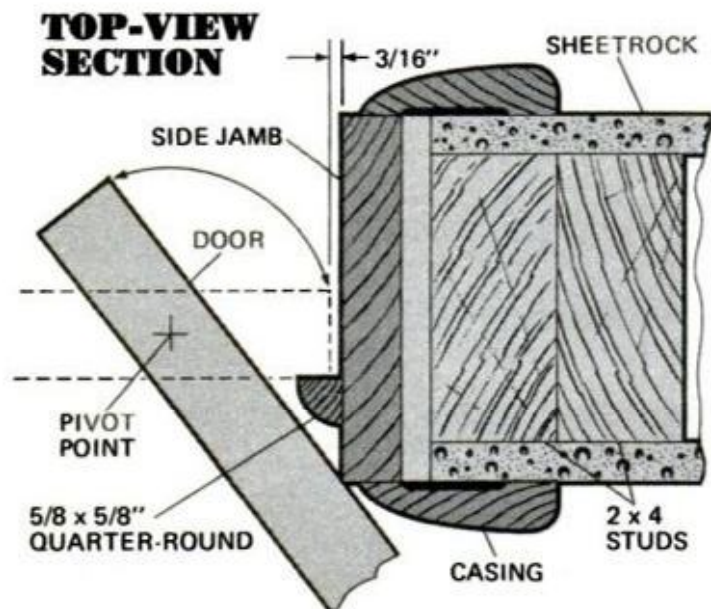
WHOLE CLOSET IS INSTANTLY OPENED (right) with bifolds from Sears—a real convenience compared to dated sliding doors







Technical Art by Fred Wolff

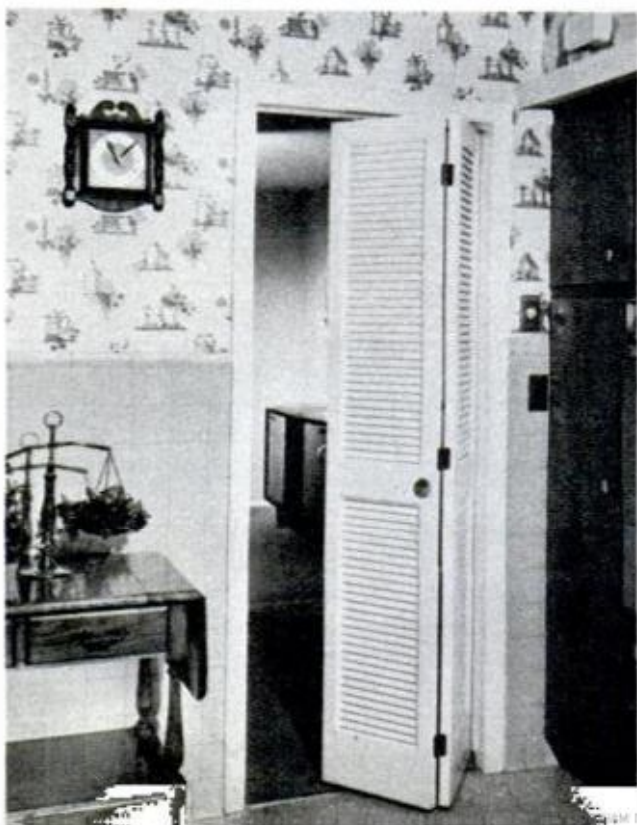


FIRST STEP: Install the overhead track by screwing it to the door-opening header 1½ in. in from edge

in the top and bottom edges of the panels.

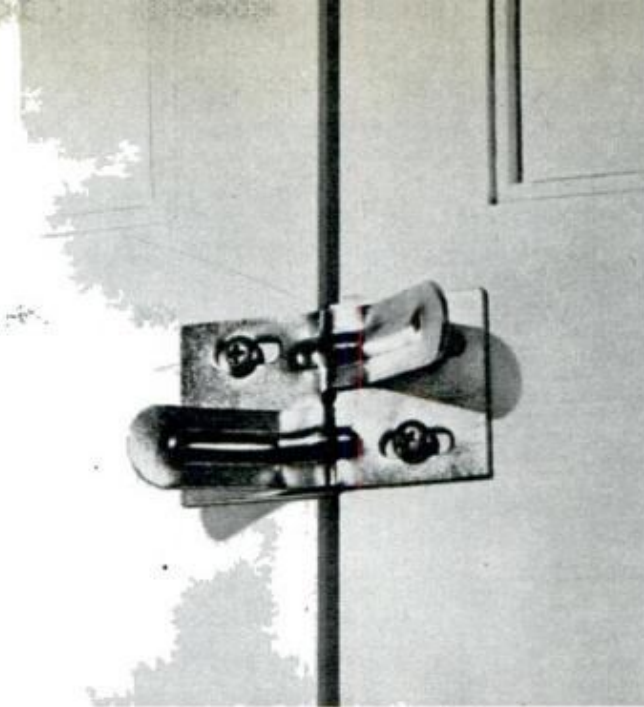
You can buy these doors in two-panel units to fit nominal closet openings of 24, 30 and 36 in., and in four-panel units to fit 48, 60 and 72-in. openings. All doors (whatever the make) come 80 in. tall to fit the standard opening height of 81¾ in. Where the closet opening is of an odd width, you are faced with the work of remodeling it to accommodate stock doors. In cases where the opening might be as little as ¼ in. too narrow, you can get by without remodeling the opening by trimming ¼ in. from the aluminum track and countersinking the jamb brackets ⅛ in.

PRIVACY, PLUS AIR, is obtainable with bifolds when desired. Here a two-panel unit is in 30-in. doorway





SECOND STEP: Attach the two jamb brackets at the floor and on a plumb line with the overhead track



THIRD STEP: After lifting doors into the overhead tracks and brackets, add aligners to the rear sides

Plastic vs wood. There are good things to be said about both kinds of doors. DuPont turns out attractive bifold doors which consist of molded nylon facings attached to tubular steel frames. They're heavier than wood bifolds and they cost more but, because the facings are molded in one piece, you don't have to worry about joints opening up, shrinking or swelling. They come factory-painted, which saves time and paint, and they can be washed with soap and water. While the doors are built to last a lifetime, the louvers in the molded facings are simulated and, for this reason, will not let air circu-

late through a closet. Also, such doors are suitable only for closets (as opposed to doorways) since the molded facings are attached only to one side of the steel frames.

With conventional, louvered wood doors, air circulation in a closet is no problem because even if the lower sections of the doors have solid panels, the upper sections have spaced slats. Wood doors also allow trimming if they're a bit too wide for the opening to be used. But you do have to paint them, which can be a time-consuming job. A spray gun makes good sense when it comes to this. ★★★

THESE SMART-LOOKING BIFOLDS, called Valencia, have bottom panels decorated with expanded polyurethane carvings combined with open slats at top. From Sears, four-panel unit for 48-in.-wide opening costs \$56.95





**Would You Believe... This
Was Once a Garage?**





REMODELED EXTERIOR (facing page) shows windows chosen to fill old garage-door opening. Handsome interior can be duplicated by careful craftsman

STONE FIREPLACE and raised hearth are the focal center of the room. Decorative panel inserts flanking fireplace have dimmer-controlled lights behind

For more room, why not convert your attached garage? It's already roofed and, with the construction techniques used by the Robert M. Skares, you can have a cathedral ceiling

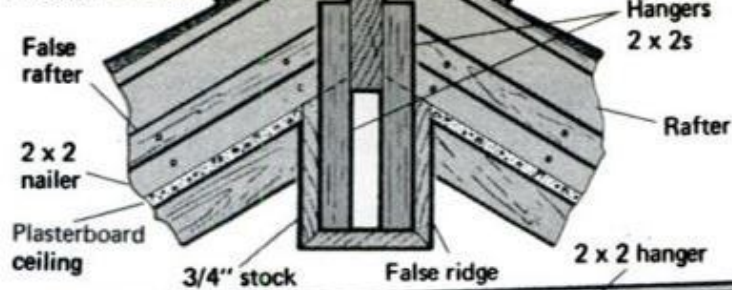
By **HARRY WICKS**, Workshop Editor

*Photography by Les Turnau
Data by Annette Sukov*

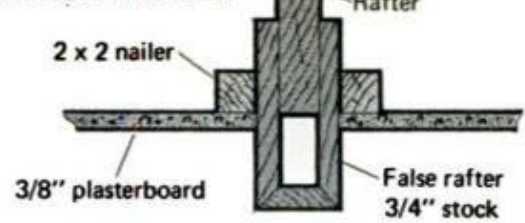
SEEKING a spacious family entertainment center close to the kitchen, Mr. and Mrs. Robert M. Skare of Golden Valley, Minn., chose to utilize the already attached garage for that "addition." The decision not only eliminated architectural design problems, but, in fact, improved exterior appearance because the garage doors—which faced the street—were replaced with windows that are compatible with those in the existing house. And what the owners saved on structural costs they used for a detailed, and very elegant, interior-finish treatment.

Creation of a cathedral ceiling meant that the joists (called collar beams in a garage) would have to go. Without them, the roof would very likely sag under load, so they called in contractor William Schneck & Sons to solve the problem. A 6x12-in. beam was snaked in beneath the ridgeboard. This transferred the roof load to the ground via spiked-together 2x10-in. headers over studs. The existing rafters were then tied

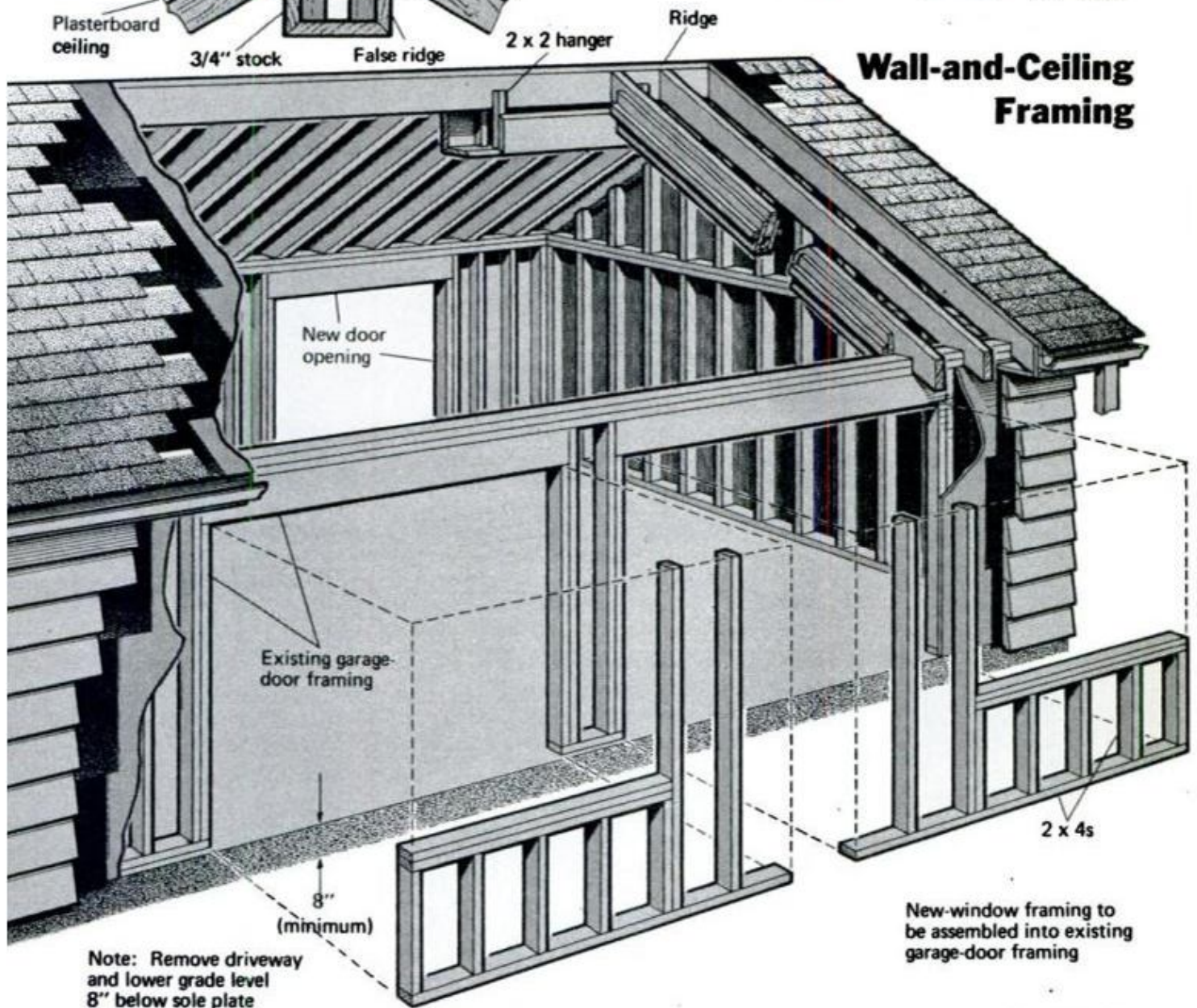
SECTION OF FALSE BEAM



FALSE RAFTER

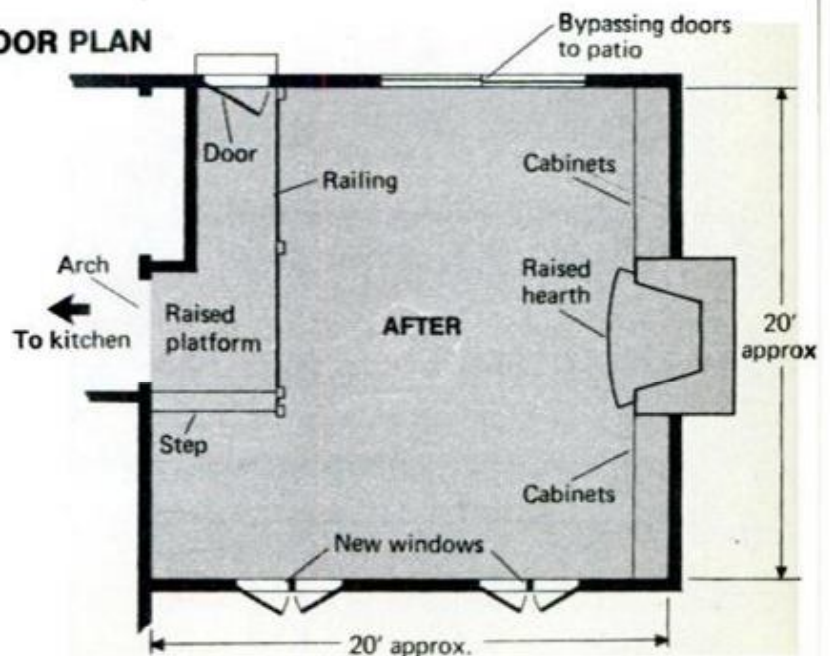
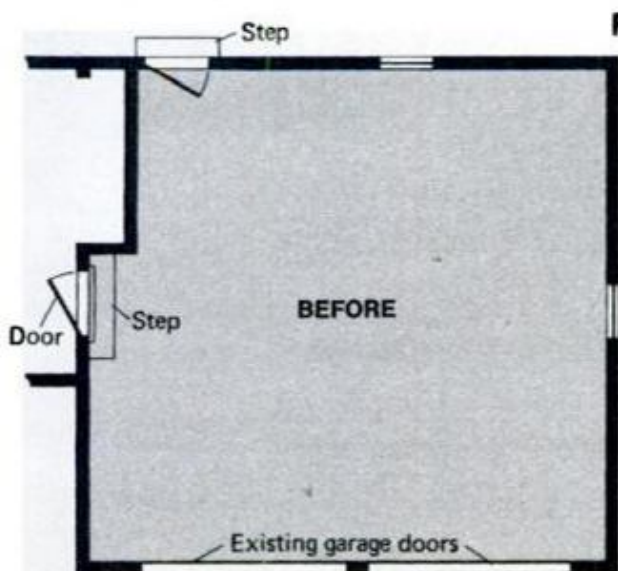


Wall-and-Ceiling Framing



Note: Remove driveway and lower grade level 8" below sole plate

FLOOR PLAN



Technical Art by Fred Wolff

Tiling Is Now Easier

Adhesive-backed tile puts an end to a messy, sticky job; lets you install a colorful new floor in a matter of hours

Color Photo by Robert D. Borst

By WAYNE C. LECKEY, Home and Shop Editor



Than Ever

REMEMBER what a job it was to lay floor tile; how careful you had to be to spread just the right amount of adhesive or it would continue to ooze through the joints; how you got the icky stuff all over your hands? That's all changed now with floor tile that comes with adhesive already applied. You simply peel off the backing paper and press the tile in place.

To see for ourselves we tiled the kitchen floor you see at left with Armstrong's Place'n Press Excellon (a vinyl asbestos tile) and I must say it beats the old way all hollow. It bonds instantly (no waiting for cement to dry) and *really* sticks. For this reason, we found you need to position it just where you want it the first time. You'll find this special pressure-sensitive adhesive will bond firmly to any smooth surface above or below grade. It can be applied right over existing floors.

We selected a pattern called San Roque. You get nine 12x12-in. tiles to a package that costs about \$16. To cover a floor measuring 4x6 ft. you need 3 packages; 9x12 ft., 12 packages; 12x15 ft., 20 packages. To cut it you use regular household shears. For the best installation, floors must be smooth and completely free of wax, grease and dirt. Dusty concrete subfloors should be vacuumed. Firm enamel paint and firmly bonded, smooth-surface (not embossed) linoleum or resilient-tile floors need not be removed.

Tile should be kept warm—70°F.—for at least 24 hours before installation, during the job and for a week after to help establish a firm bond to the subfloor.

First, pry up molding at the base of the walls so tile can slide underneath during installation. Find the center for each end wall. Connect these points by striking a chalk line down the middle of the floor to establish a "center chalk line".

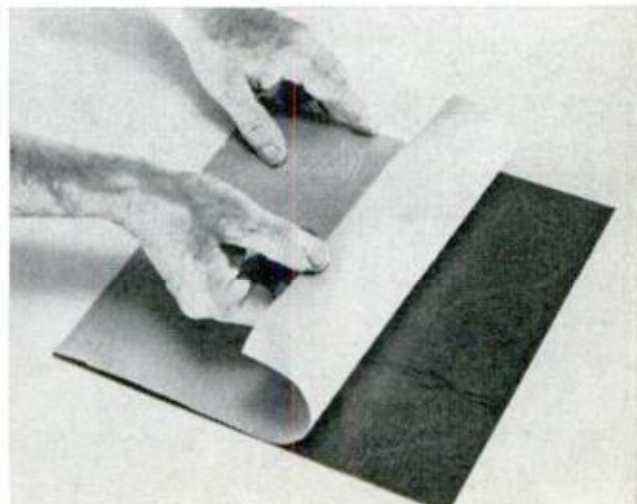
Next, locate the center of this line. Using an actual tile (paper backing intact) draw a perpendicular line. On this, strike a chalk line connecting the two sidewalls. The floor is now divided into quarters.

Place a row of tiles along the perpendicular chalk line from the center of the room to the sidewall (do not remove the backing). Measure the distance between the sidewall and the last full tile. If it is

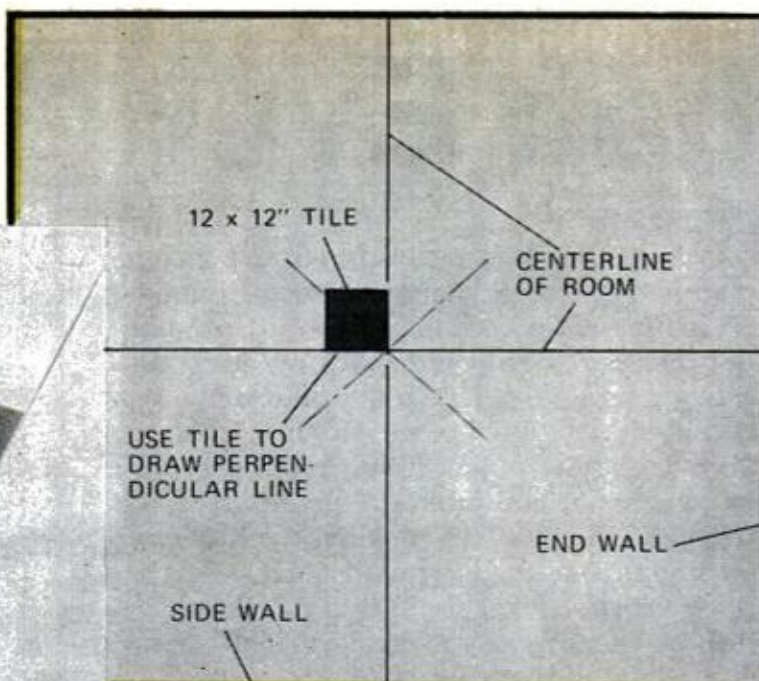


NOW IT'S AN EASY WHITE-GLOVE JOB—even your wife can tile a floor. Tiles 12 in. square cover fast

TILE HAS A SLICK PAPER BACKING, which you can peel off easily to expose a sticky bonding surface



TO MARK A 90° LINE across centerline of room, an actual tile is used. As shown in the diagram at right, the tile is placed at the midpoint of the centerline, then a pencil line is drawn along edge of the tile and the mark is extended to the side walls



less than half the width of a tile, strike a new chalk line beside the old center chalk line half the width of a tile and toward or away from the wall. This will give even borders. Repeat this step for the end wall.

Start placing tiles at the center point where the chalk lines intersect, removing the backing paper from each tile as you install it. Make sure that edge tiles are even with the chalk line and each tile is butted tightly against adjoining tiles. Do not slide, but press them firmly into place.

Cover the first quarter of the floor, except the border area.

To cut and fit tiles next to walls, place a loose tile (A in diagram, page 145) ex-

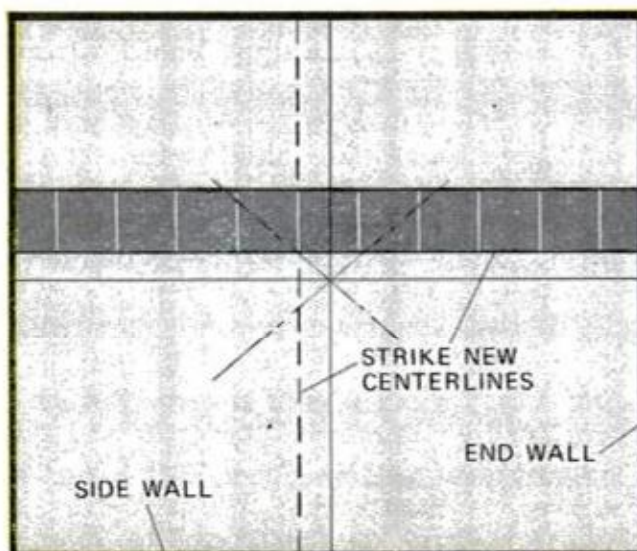
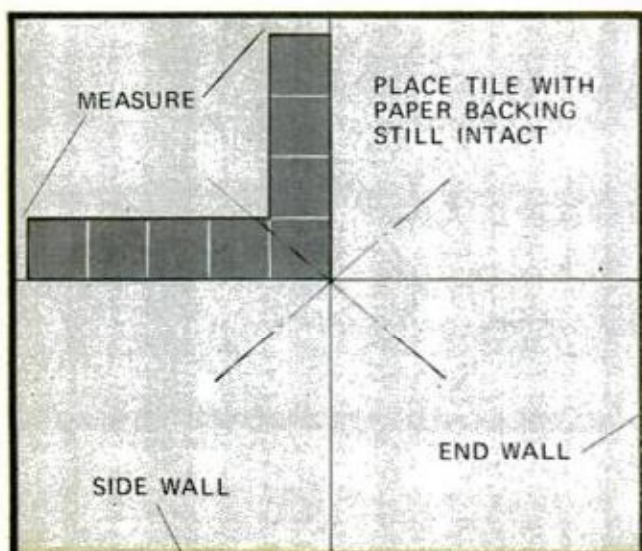
actly on top of the last full tile in any row. On top of this, place a third tile (B) and slide it until it butts against the wall. Using the edge of the top tile as a guide, mark the tile under it with a pencil; then cut along this line with household shears.

To fit around pipes or other irregularities, make a close-fitting paper pattern, trace this on the tile and cut along the marks with the shears.

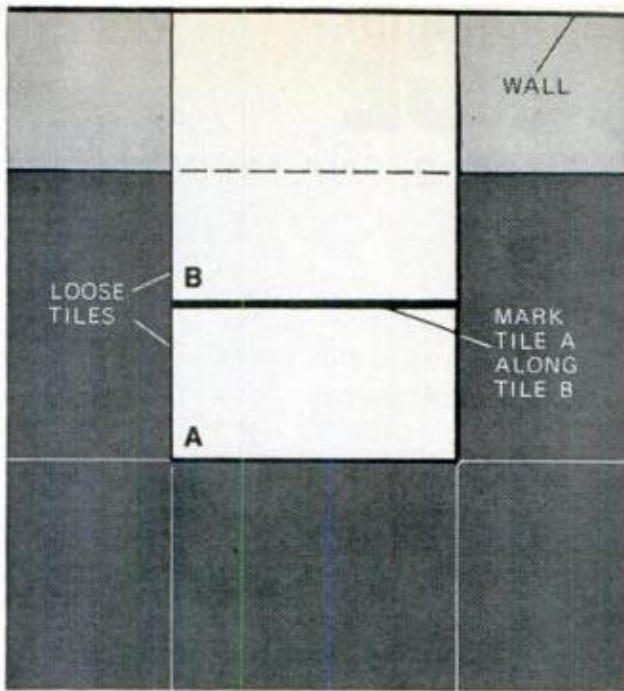
Follow these procedures when tiling the other three-quarters of the floor.

Caution: The backing paper is extremely slippery. Remember to place it in a wastebasket immediately on removal so there's no chance of slipping on it. ★★

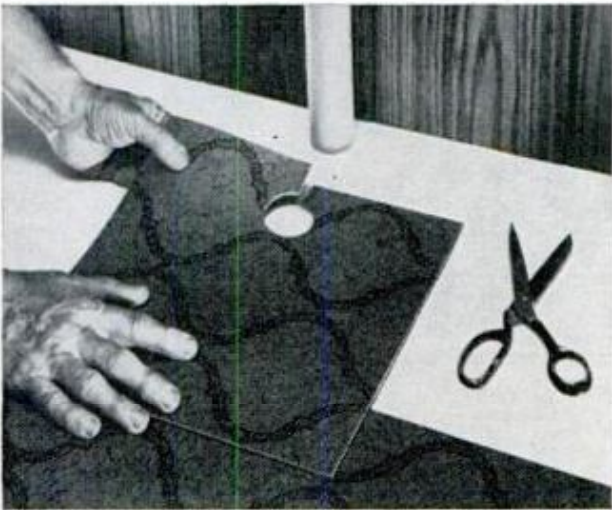
TO AVOID NARROW BORDER PIECES (less than half a tile wide), check by placing a row of tiles along the 90° line as shown below. If less, strike a new line half the width of a tile away from the old line—toward or away from side wall. Check end wall in same way. This will give even border on all sides of room



HINTS FROM READERS



TO SCRIBE-FIT BORDER TILE to wall, place tile A on top of last full tile in row (above). Then place tile B over A, butting it against wall. Make a pencil mark along edge of B (below) to mark A for cutting



TO FIT TILE AROUND PIPES, or other odd-shaped obstructions, make a paper template. When satisfied with fit, trace it onto tile and cut out with shears

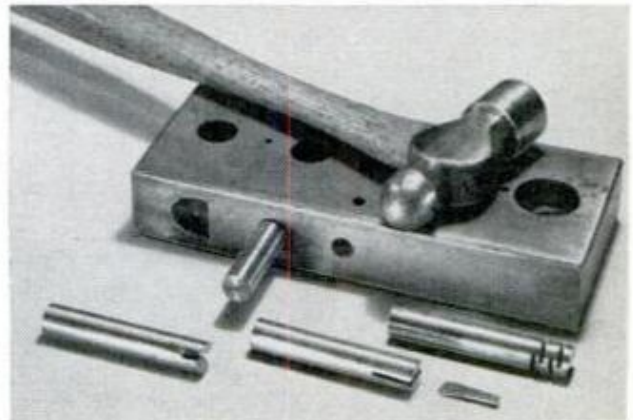
SEPTEMBER 1971



Nonskid typewriter pad

If your portable typewriter moves a bit every time you throw the carriage, don't despair. A remnant of rubber-base carpet padding will solve the problem perfectly. In use, the typewriter will sink into the pad and the rubber backing will "lock" it in place on any slick surface.

—Arthur L. Rouleau, Fullerton, Calif.



Tightening loose pins or studs

An oversize hole doesn't necessarily prevent a metal pin (stud) from doing its job. The trick is to make the pin expand in diameter at the bottom when struck with a hammer. There are three ways you can anchor loose pins in bottomed holes. One is simply to make a V-notch in the end of the pin which will cause the end to flare. Another is to make a saw cut in the end of the pin and use a wedge to spread it. The third way is to make saw cuts in the side of the pin, two from one side and two from the other. Thus, when the segments are compressed by hammering, this increases the diameter of the pin at the bottom.—Walter E. Burton, Akron, Ohio

APPLIANCE

QUESTIONS ANSWERED **CLINIC** By PAUL MANN

There she blows

Water in our electric percolator never comes up the tube in sufficient quantity to make coffee although it gets hot. What is wrong?—Don Rizzo, New York.

Check the perk tube and the well for an accumulation of foreign matter that may be blocking the flow of water. Make sure the base of the tube sits firmly in the base of the percolator. And be aware that the aluminum washer that fits around the flared end of the bottom of the perk tube must be free. Bubbling water causes this washer to vibrate, which, in turn, helps pump water up the tube. Shake the tube. You should hear the washer. If not, soak the perk tube about an hour in electric coffee-pot cleaner, which you can buy in a hardware store. Most times this will free the washer—test by perking a pot of coffee. If it doesn't, you'll have to replace the perk tube.

Cylinder won't turn

The motor of our Philco electric clothes dryer runs, but the cylinder won't turn.

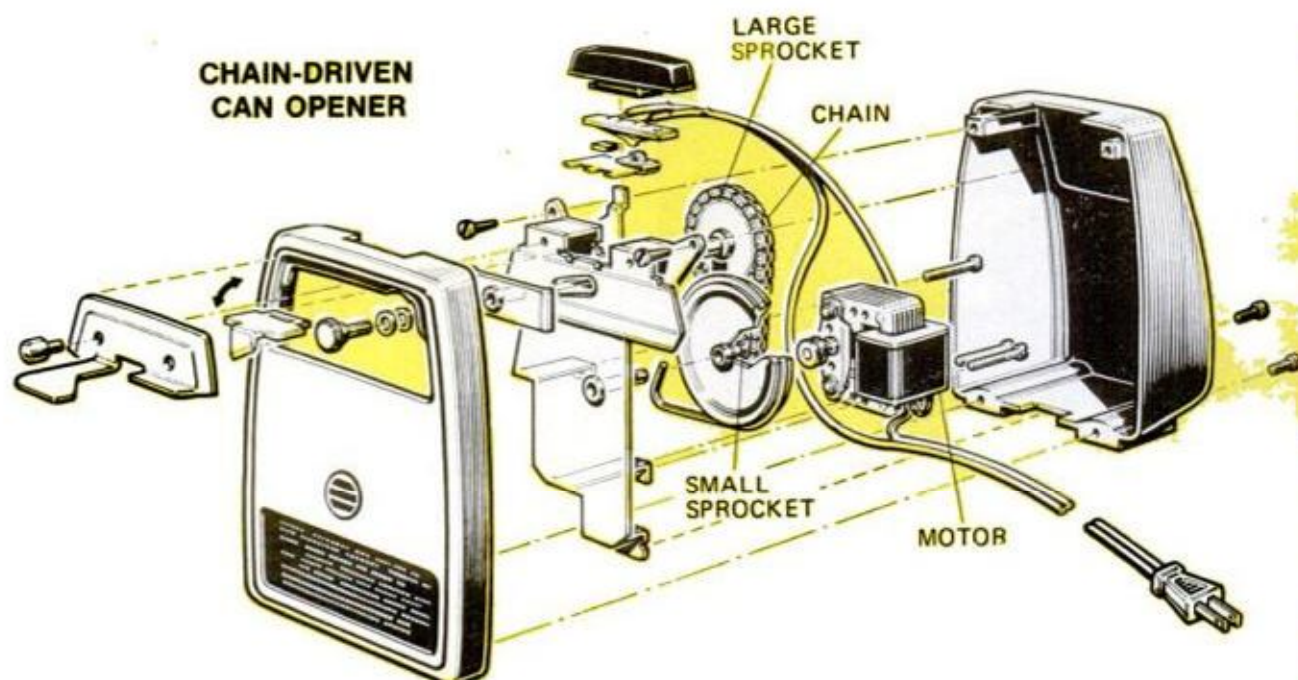
What can cause this problem?—Les Sommers, Los Angeles.

Remove the back of the unit and look for a broken or loose belt. If it's broken, take it to a hardware or automotive supply store and get a new one of the same size. The dealer should measure the old belt with a belt gauge to determine the exact size you need. You may also have a loose electric motor or idler pulley. Tighten bolts while putting tension on the part by pulling it back against the belt. Finally, the cylinder pulley shaft may be frozen. Clean the shaft and/or replace the bearings.

Stalled can opener

Our electric can opener hums, but doesn't run. It's made by John Oster Manufacturing Co. of Milwaukee, Wis. What's wrong?—John Brenner, Detroit.

Some electric can openers have a gear system with one or two pinions to drive gears. Others use a chain and pulley to drive the sprocket that turns the cutter. (see exploded views below). Open the case



and check gears for broken teeth. Replace defective parts. If your unit has a drive chain, look for a broken link. If you replace the chain, leave some play in it. One that's too tight will wear quickly and fail prematurely.

Getting parts

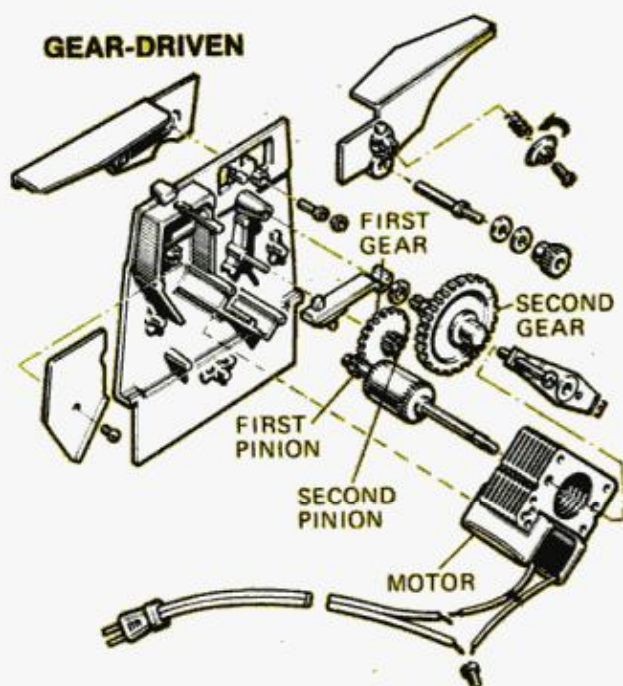
Where can I get a new spit motor switch for a Black Angus rotisserie?—Richard Sobel, Tarrytown, N.Y.

New appliance parts usually can be obtained from a dealer who sells the particular make of appliance or from a distributor. Distributors are generally listed (by manufacturer affiliation) in the yellow pages of a phone book. If not, write the parts division of the particular company; in your case Black Angus, Inc., Winsted, Conn. 06098. When ordering, check your service information so you can provide the correct make, model and number of the unit.

Burned waffles

Recently our Sunbeam waffle iron started burning waffles. What causes this?—Jerry Morris, New Brunswick, N.J.

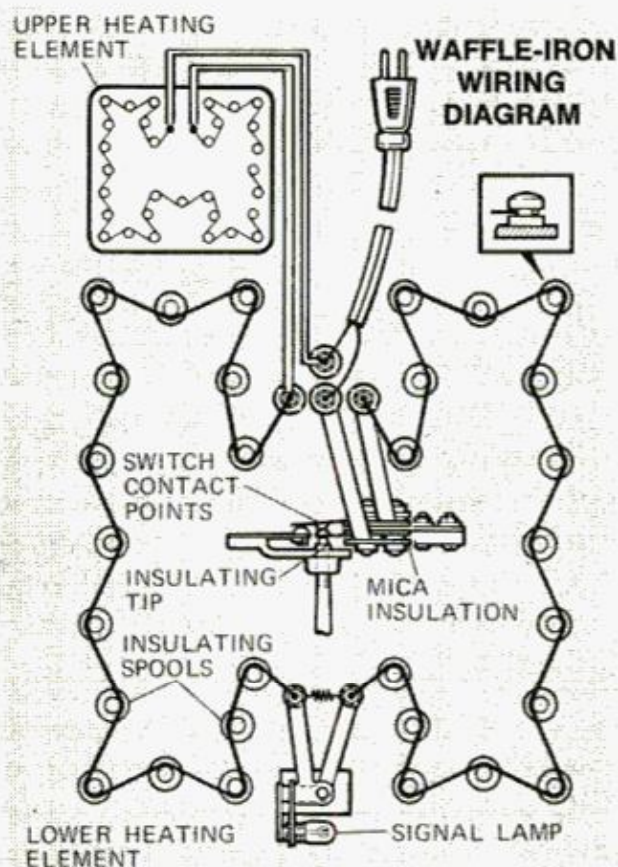
The thermostat contacts have probably welded themselves closed. If so, heating elements stay on all the time, because the circuit never opens. Pull out the line-cord plug and remove the bottom cover of your unit. You'll see a set of thermo-



With this issue, *Popular Mechanics* begins a monthly service column with the purpose of saving you money. It will deal with household appliances, especially with their care and repair. All appliances, large and small, will be discussed, including washing machines, clothes dryers, dishwashers, airconditioners, toasters, garbage disposers, vacuum cleaners, electric coffeemakers, electric can openers, refrigerators, broilers, electric knives, blenders. . . .

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 published in this column.

stat switch-contact points. With the tip of a small screwdriver, carefully pry between the points. If they are welded, there will be resistance and the points will break apart with a "snap." Once they are welded closed, replace them; the same thing will happen again if damaged points remain in use. To replace them, replace the entire thermostat. Be sure the new one exactly duplicates the old so that mountings will fit. ★ ★ ★



A Spanish-Style Chest With a Marproof Top

The accent is Mediterranean, from the sculptured cabinet to the mosaic-top. It's easy to build and blends with any decor.

By ROBERT WORTHAM



THIS handsome Spanish chest is as easy to build as it is good to look at. The dark-stained wood and mosaic-tile top will add richness to any room in your home, regardless of decor.

To determine the dimensions of your chest, first select your tile. Then, alter top dimensions to fit the tile chosen so that you'll avoid extra tile cutting.

On the chest shown, I used an imported mosaic tile which came in 1-ft. squares on paper backing. It cost \$1.25 per square. After laying squares on the plywood top, add $\frac{1}{2}$ in. (in width *and* length) to the plywood. This will give you a $\frac{1}{4}$ -in. grout line around the perimeter. Ceramic tiles were available where I shopped in $4\frac{1}{4}$, 6 and 12-in. (actually $12\frac{1}{2}$ in.) sizes, with thickness ranging from $\frac{1}{4}$ to $\frac{3}{4}$ in. All sizes can be set with easy-to-use tile mastic.

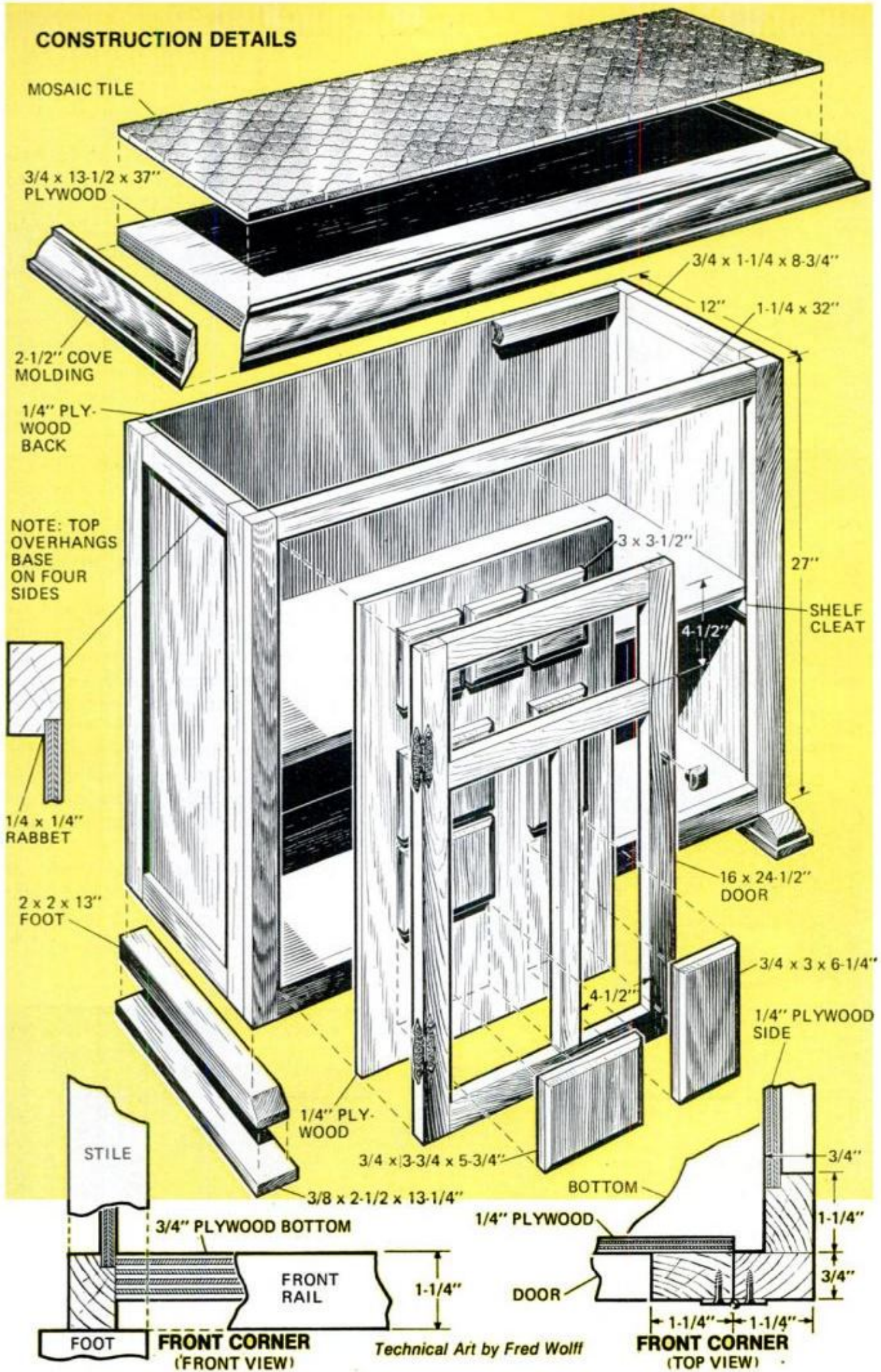
The 12x27-in. end panels were made with $1\frac{1}{4}$ -in. framing (stiles and rails) ripped from $\frac{3}{4}$ -in. stock and rabbeted. Then $\frac{1}{4}$ -in. plywood was glued in the rabbets. Though the drawing shows the plywood let into edge-rabbets, the plywood could be simply glued and tacked to the inside of the framing (as with the doors).

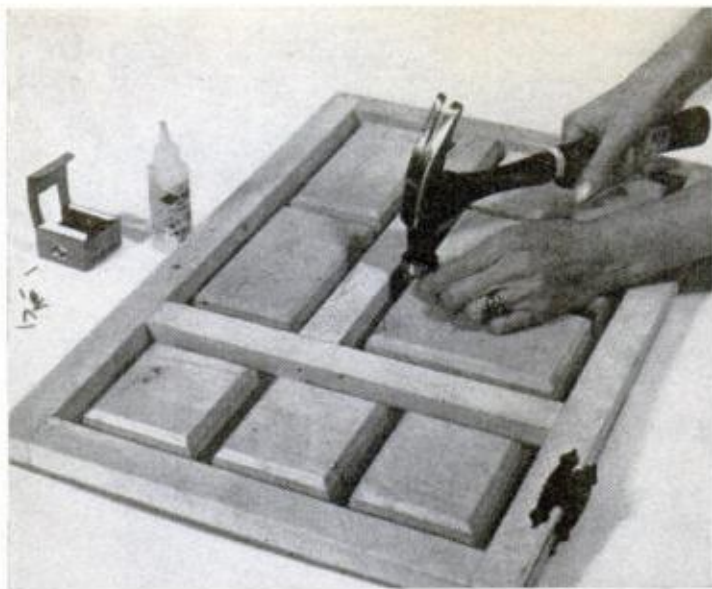
The latter were framed with $\frac{3}{4} \times 1\frac{1}{4}$ -in.-stock and the $\frac{1}{4}$ -in. plywood backup panel was glued and nailed to the frames with short brads.

Panel blocks were cut from $\frac{3}{4}$ -in. stock and fastened to the plywood backing with small brads and white glue. For a sculptured look, bevel the blocks along the top edges with the table saw set at 45° . When you lay out the blocks, leave at least $\frac{5}{8}$ in. around each block.

The feet were ripped $1\frac{1}{2}$ in. wide from 2x4 stock and then

CONSTRUCTION DETAILS





DOOR STILES AND RAILS (top) are made of $\frac{3}{4}$ -in. stock. Blocks are beveled 45° on the top edges and then glued to the $\frac{1}{4}$ -in. plywood backing with a $\frac{5}{8}$ -in. spacing on four sides

PLYWOOD-TOP SIZE is determined by the tile you use. In case above, 1-ft. square mosaic tile was applied, using mastic. Half tiles are used around the perimeter to complete surface

TILE GROUT is raked diagonally between tiles with straightedge (right). After wait of about 30 minutes, the excess grout should be washed off the surface of tile with a sponge and water



beveled 45° at the front. These, in turn, were glued to the lower feet and the leg setup was then fastened to the cabinet below with flat-head screws.

Edge (cove) molding is fastened to the plywood top so that it sits above the plywood the thickness of the tile and mastic. With the molding placed before the tile, the former can then serve as a leveling guide when you lay the tile. Apply the mastic with a notched trowel and let it set about 15 minutes (*Ed. note: Check instructions on the label. Your brand of mastic may be different from the kind the author used*).

As you position each tile, or square, tap it lightly with a hammer and clean wood block to assure a tight bond. Allow this to dry overnight before you apply any grouting.

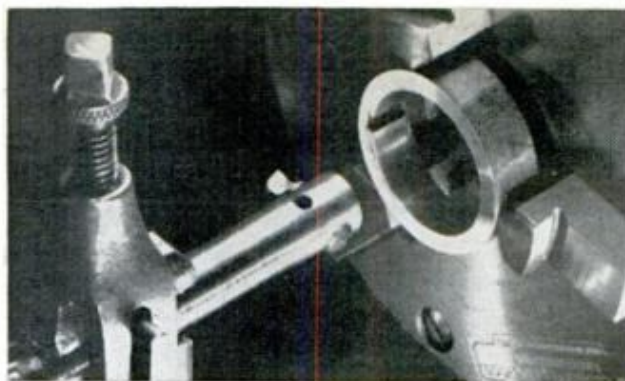
Next day, mix dry grout and water to the consistency of mayonnaise. Apply grout between tiles with a straightedge to rake it into the spaces. Depending upon temperature and the amount of water you use, the grout should dry in about 30 minutes. After it has set up, wash off the excess grout with a moistened sponge, using a circular motion for best results.

After letting tile and grout dry for a day, I stained the wood a dark walnut and finished it with satin varnish. ★★★

HINTS FROM READERS

Boring bar as keyway cutter

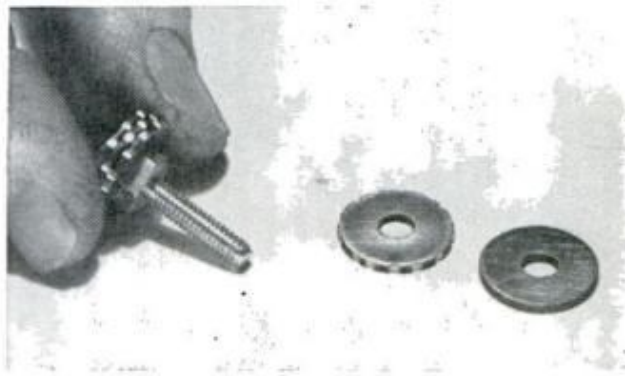
Cutting keyways inside holes is not one of my favorite jobs, but I found I can accomplish it without tedious filing. One method is to use a cut-down tool bit (the desired width of keyway) with a boring bar in the lathe. With spindle locked, if possible, use the carriage to get the plunging action and cross slide for depth of cut.—George Durham Jr., Vero Beach, Fla.



'Knurled' head from washers

A substitute for a knurled bolthead can be improvised from three or four washers. First file several notches in each washer rim, then clamp the washers against the head of an ordinary bolt, using a nut. If a flathead bolt is used, the outside washer hole can be countersunk so that head will be flush (or nearly so).

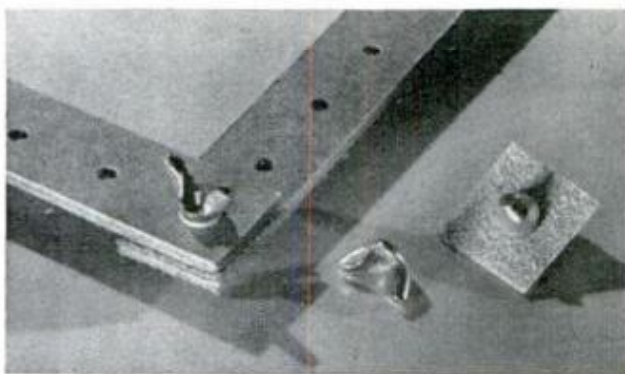
—Walter E. Burton, Akron, Ohio



Sandpaper inserts stiffen joint

A bolted lap joint in hardboard, wood, particleboard or plywood can be reinforced by inserting a two-faced piece of sandpaper between the joint-halves. The reinforcement is actually two squares, or discs, of sandpaper glued back-to-back. With this trick you'll find the joint will be stiff using just one bolt.

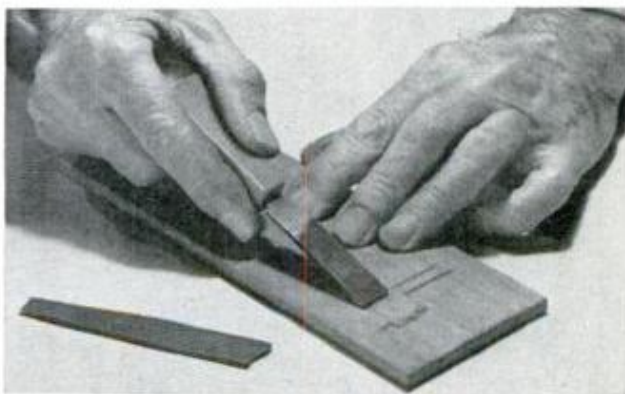
—B. W. Ervin, Kent, Ohio



Push-scraper from a file

Next time you break a file, don't throw it out. By grinding the end of the handled portion flat and square, and grinding off adjacent teeth until smooth, you can create a sharp pusher-type scraper. Held almost parallel to the work as shown, it produces fine shavings. At right it is removing pencil marks from plywood.

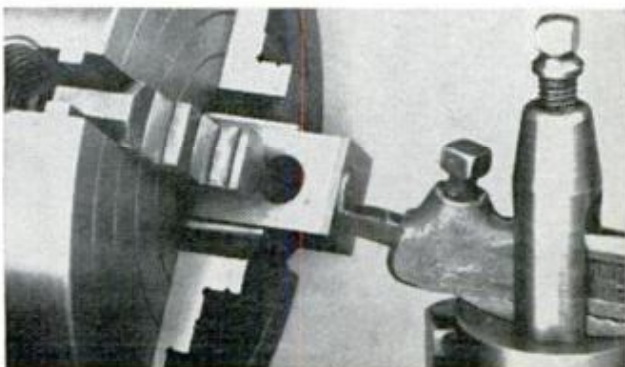
—W. B. May, Oak Park, Ill.

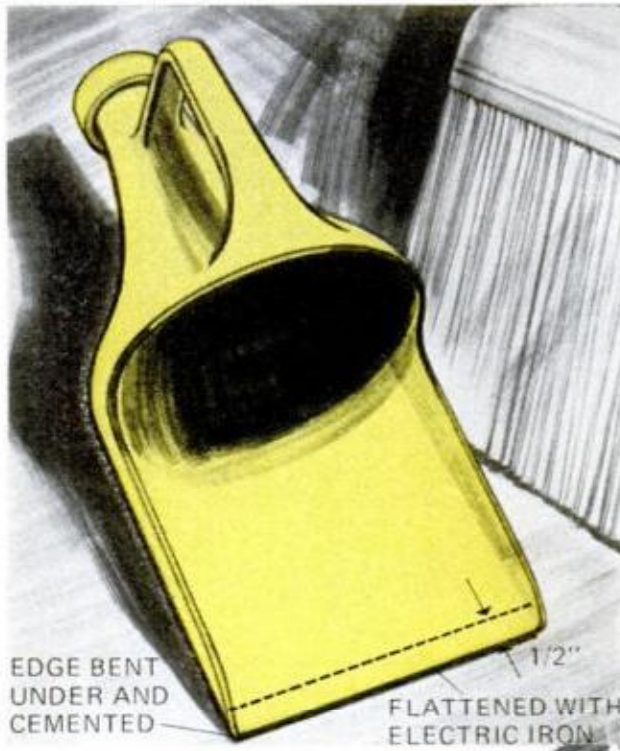


Color gauges metal removal

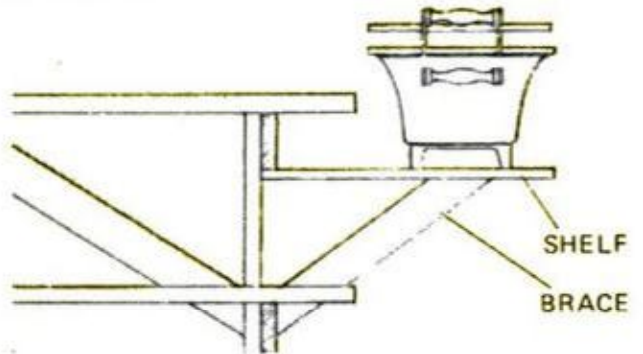
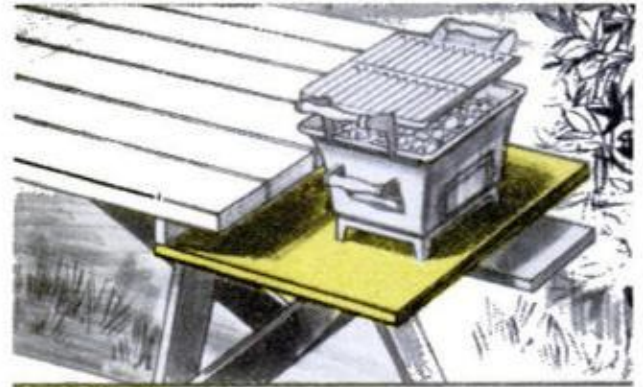
The amount of metal to be machined from a block using lathe face cuts can be gauged by applying colored lacquer to the portion to be removed. When the operator can no longer see any color, he knows that the job is done. The trick saves a lot of time because you don't have to stop the lathe for measurements.

—Walter E. Burton, Akron, Ohio

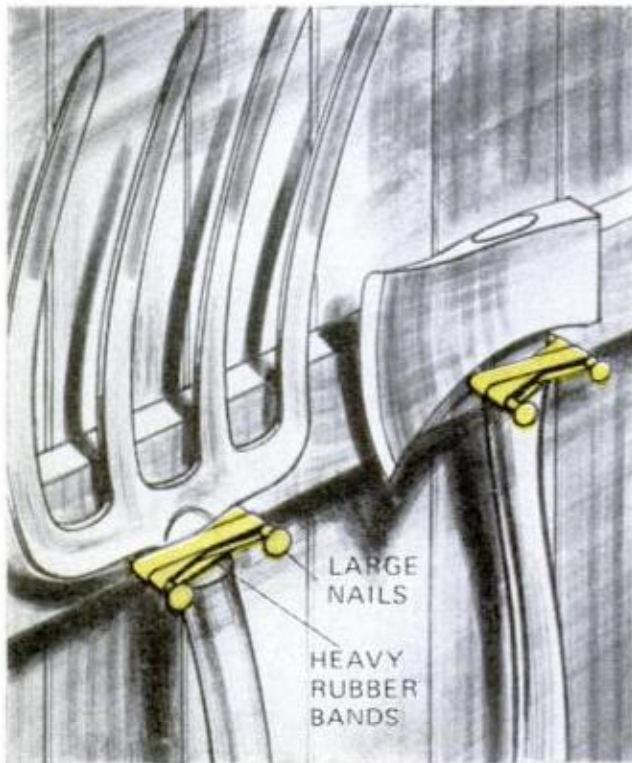




DUSTPAN from an empty Clorox jug is still another way to utilize those handy plastic containers. After cutting to shape, flatten the bottom with an electric iron set for "nylon."—*M. A. Elliot, Hilo, Hawaii*



HIBACHI COOKING is even more fun when the small brazier is right at the table. Fasten platform to 2x4 supporting tabletop and attach a diagonal brace for rigidity.—*Russell E. Walker, Trenton, Ont., Canada*



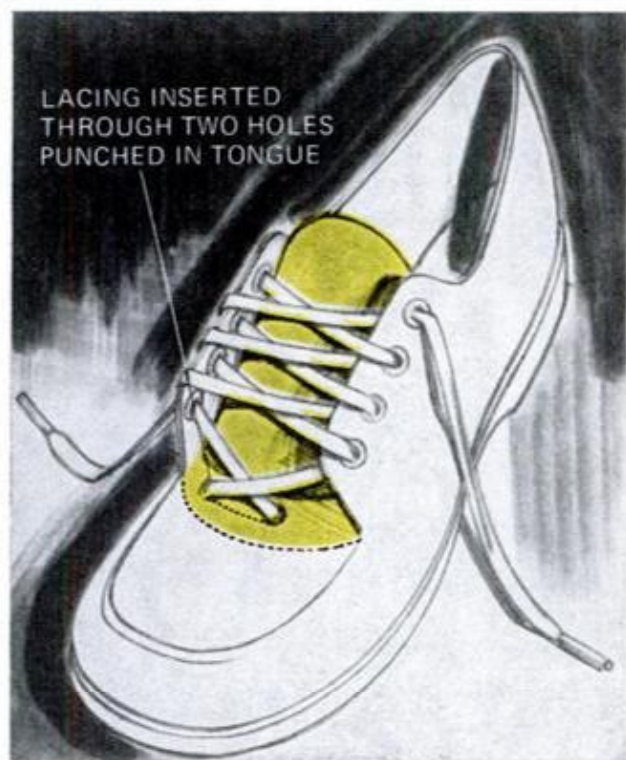
SHARP-EDGED TOOLS can be secured against an accidental dislodgement that might lead to personal injury. Simply cut strips from an inner tube to hold them in place as shown above.—*Albert Pippi, Baltimore*



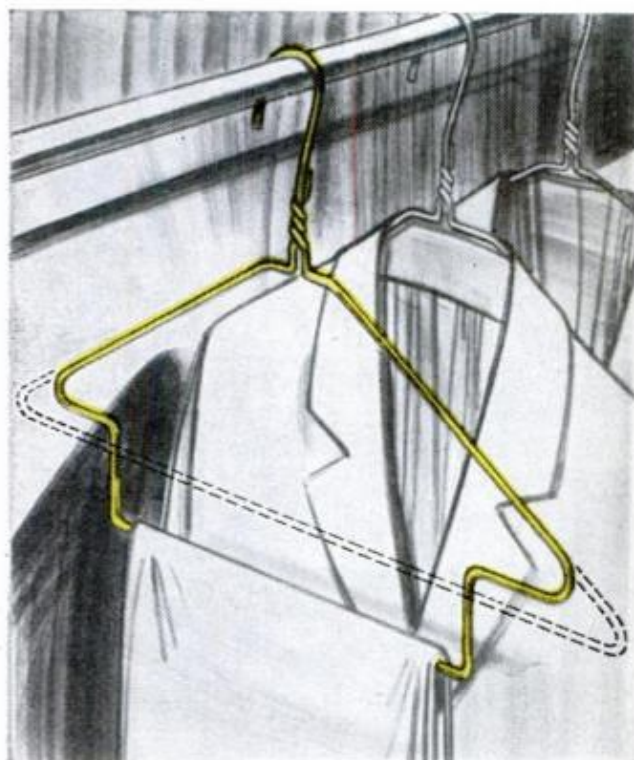
GALLON PLASTIC BOTTLES can be used to protect small trees from rodent damage. Just cut a hole in the center of the bottom, make a slit down the side and put in place.—*Ralph O. Fritts, Amsterdam, Mo.*

HOME PROBLEMS

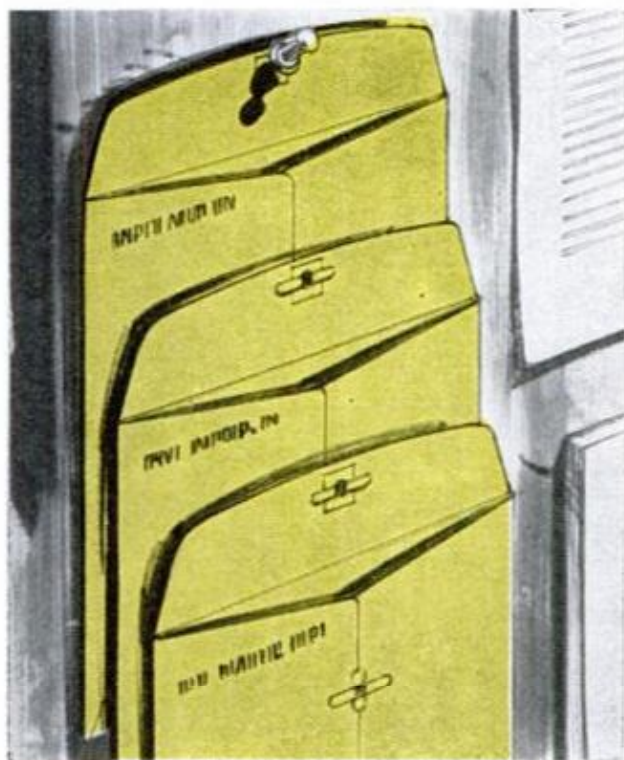
Illustrations by Adolph Brotman, Worman Associates



LOOSE SHOE TONGUE can be put in its place by punching two holes in its lower end and two mating holes in the shoe. Then, use the shoelace to hold tongue.—Dennis G. Richardson, Sr., Perkinsville, Vt.

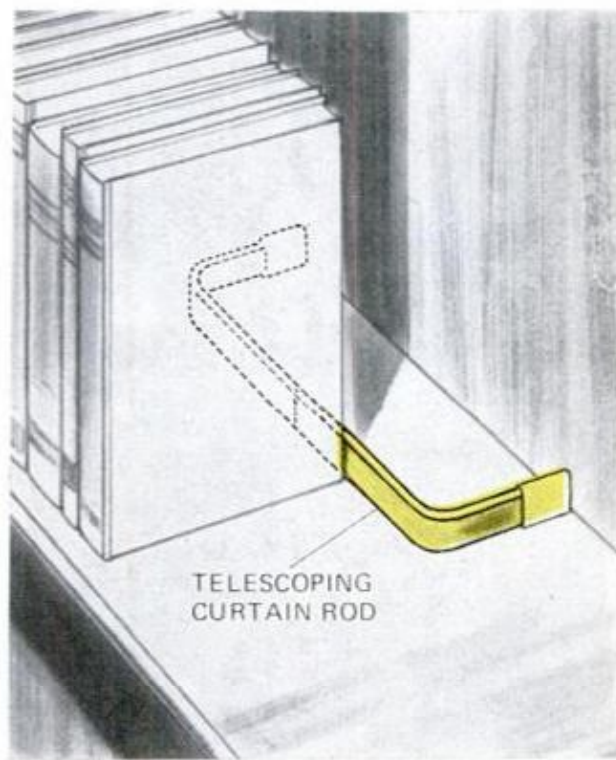


WIRE COATHANGERS can be customized for hanging slacks or junior-size clothing if you bend them down as shown. First, measure the clothing article to be hung, then bend wire to suit.—Frank Shore, New York



NEAT HANGING FILE for your shop can be fashioned using inexpensive large envelopes held together by their metal clasps. Thus, any envelope can be easily removed when you want it.—William Swallow, Brooklyn

SEPTEMBER 1971

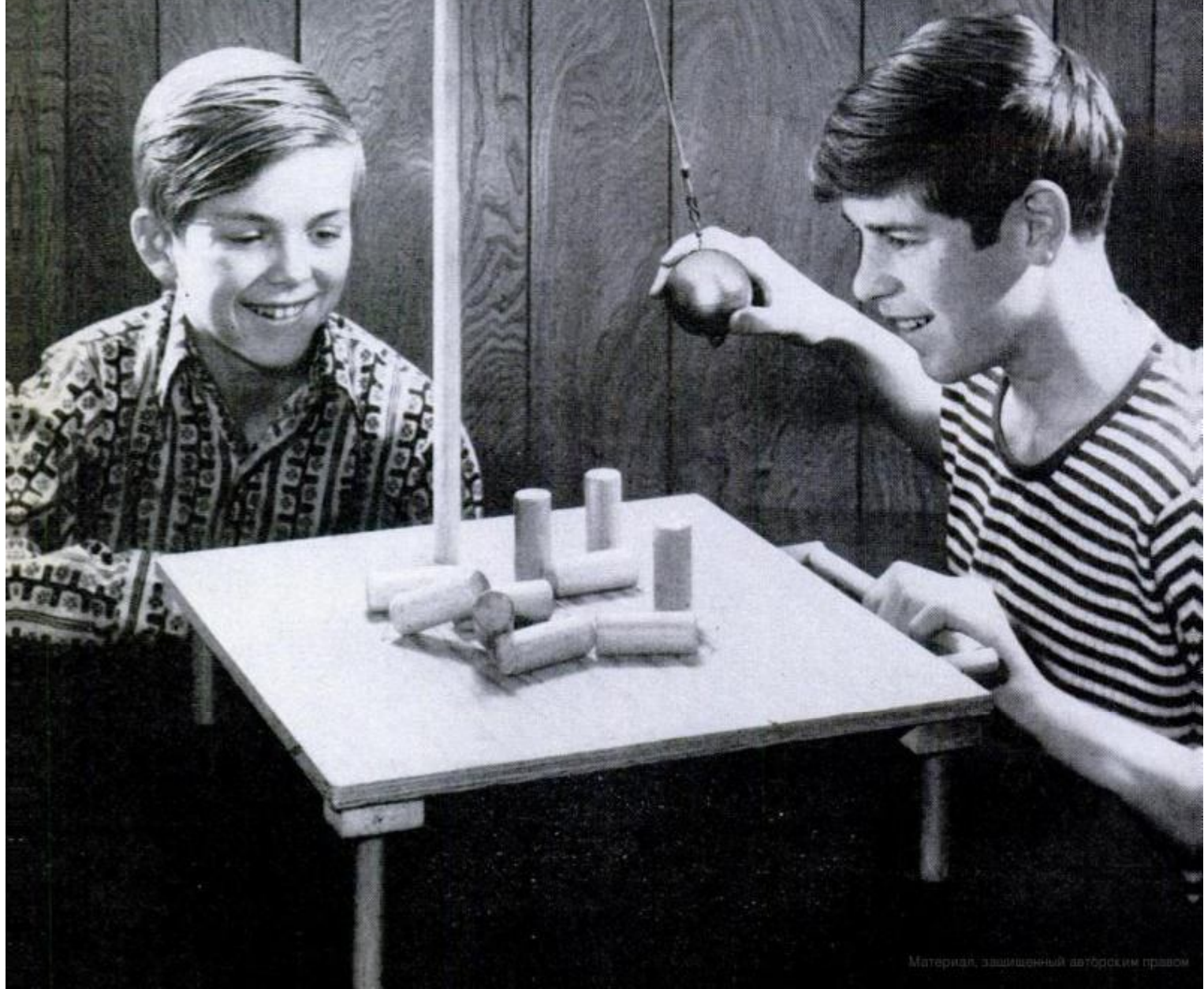


SMALL BOOKS will stay in line with others on deep shelf if you lay a curtain rod behind them. To protect the back of the bookcase, or wall, wrap rod ends with masking tape.—William Swallow, Brooklyn

153

Skittle Bowl Has Automatic Pin Setter

This exciting game becomes twice the fun since you can reset the pins by a lever.



IF YOU'RE FAMILIAR with the game of Skittle Bowl you know what a nuisance it is to set each pin individually every time you make a strike or spare. Milton Pullen of Taylor, Mich., has worked out a time-saving way to set all ten pins at one time by pushing a lever. A bar pulls each pin upright when the hinged, spring-loaded lever is depressed.

Construction. Use $\frac{3}{4}$ -in. plywood or particleboard for the 16x20-in. "alley" (part B) and add glued-on blocks for legs, pole and spring guides. Blocks for the latter are actually collars cut from 1-in. dowel.

Now center part A ($\frac{1}{4}$ -in. plywood) on the bottom of part B and fasten it temporarily with small brads. Drill through both parts to provide the $\frac{7}{64}$ -in. fish-line holes. Corner holes go through part A only and are used to mark the top. Remove part A and drill the $\frac{7}{16}$ -in. corner holes, then drill the $1\frac{1}{32}$ -in. corner holes in the top to be $2\frac{3}{64}$ in. deep. This gives a drive fit for the $\frac{3}{8}$ -in. dowels.

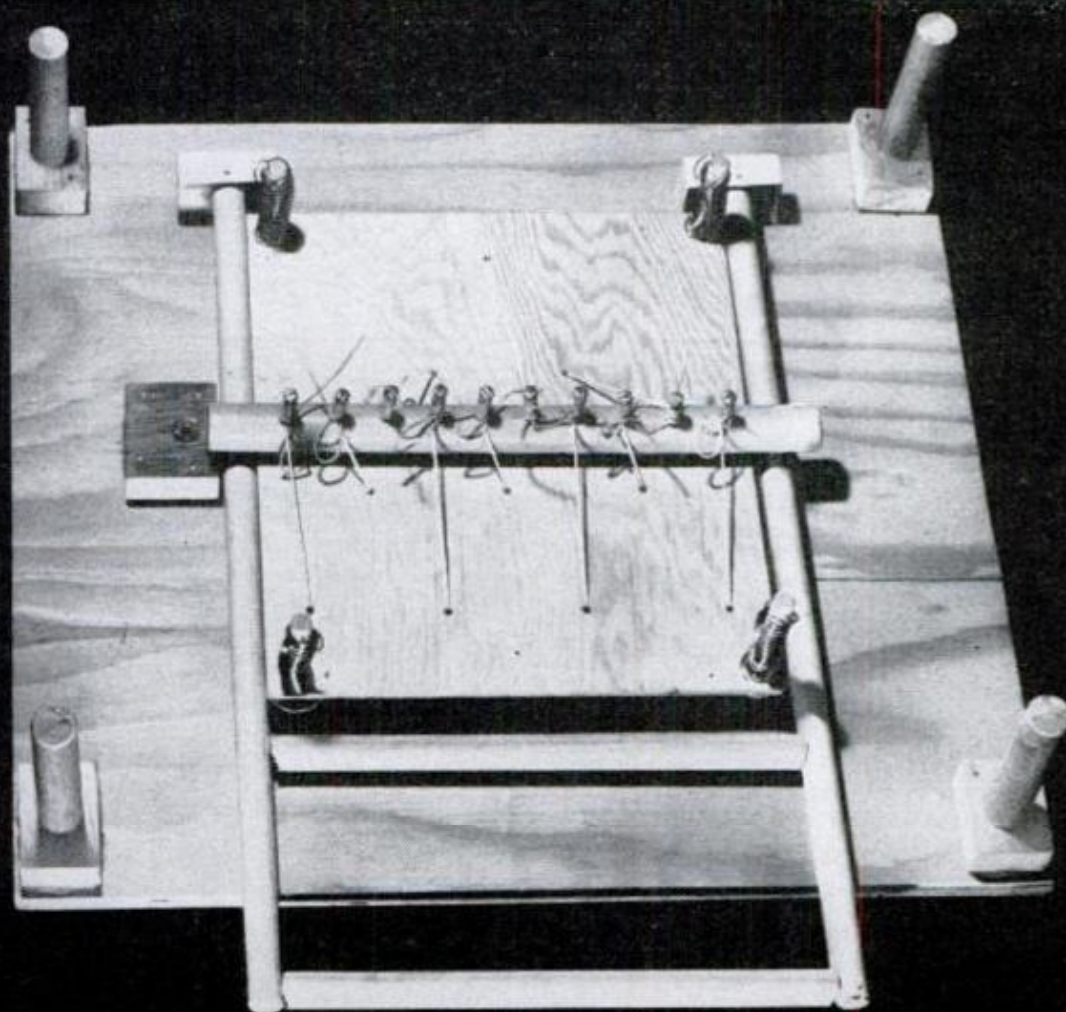
You'll need $\frac{5}{8}$ -in.-thick spacers between parts A and B. These can be made from 1-in. dowel with a $\frac{3}{8}$ -in. hole bored through the center. Now the $\frac{3}{8}$ -in. pins can be glued in; make sure they sit squarely. Let these parts dry while you make the pinsetter.

With part A in place on the underside of the top, lay the $\frac{1}{2}$ -in. dowels of the lever alongside and get the exact length of the cross rods. Cut them slightly oversize to allow for filing the ends to fit the sides. Drill small holes for brads, apply glue and pin. *Note:* Don't glue on the hinge blocks until final assembly.

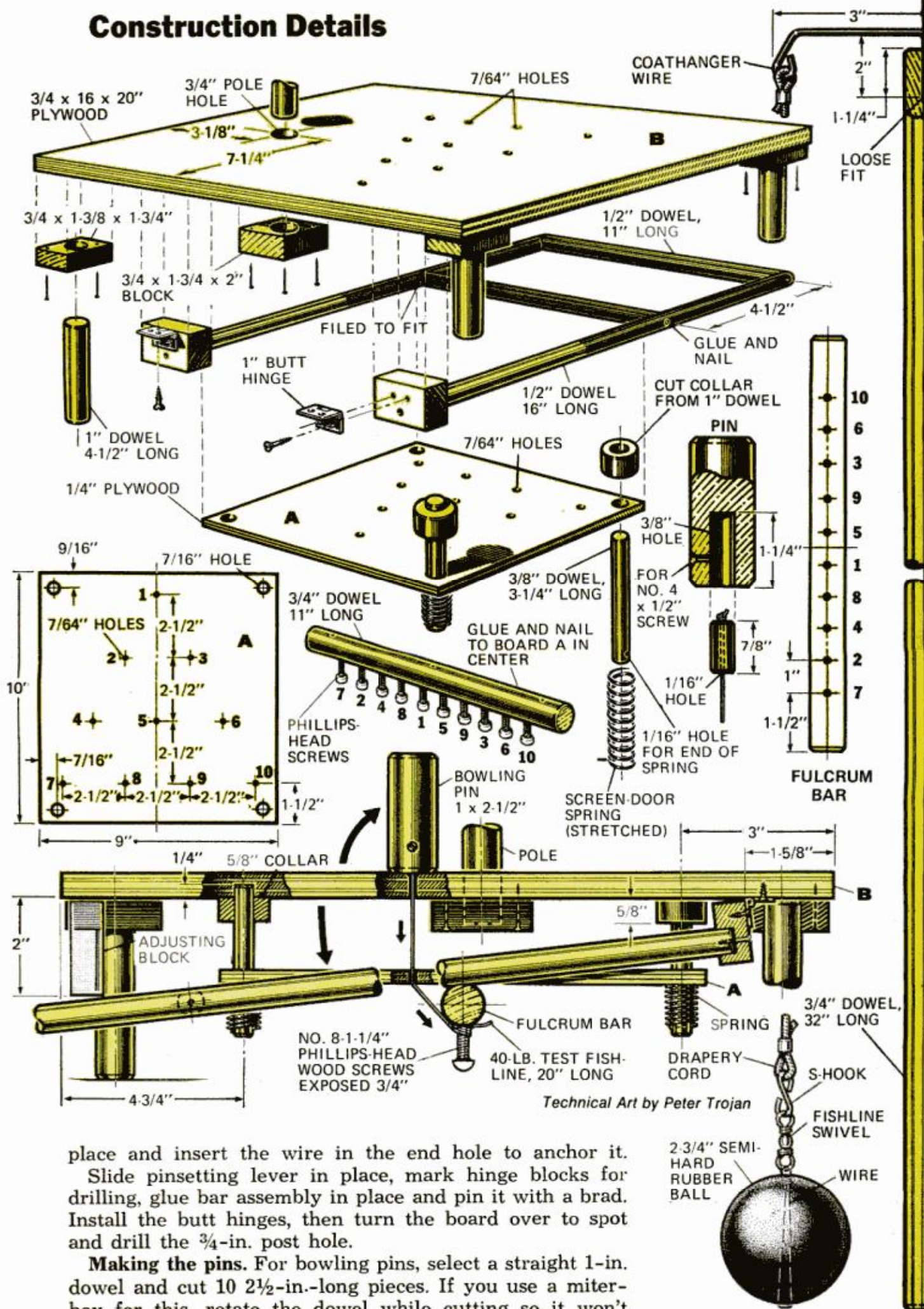
Next, cut and drill the 10 screw holes in the fulcrum bar, a $\frac{3}{4}$ -in. dowel about 11 in. long, which is glued to the bottom of part A. Study the photograph below. Turn $1\frac{1}{4}$ -in. screws in the 10 holes, leaving at least $\frac{3}{4}$ in. of each exposed. Stretch a screen-door spring and cut off four 4-in. pieces. The springs should fit loosely over the $\frac{3}{8}$ -in. guide pins. Mount part A in place on the guides, slip the springs in

UNDERSIDE VIEW shows pin-setting lever and fulcrum bar to which the pins are tied with fishline. Springs retract the lever when pins are set to provide slack in the lines. Latter are wound around the 10 screws

PHOTOS BY ROBERT D. BORST

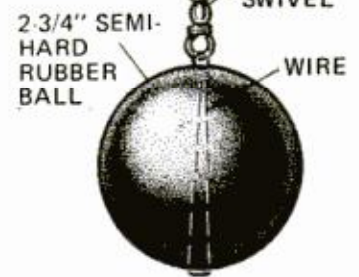


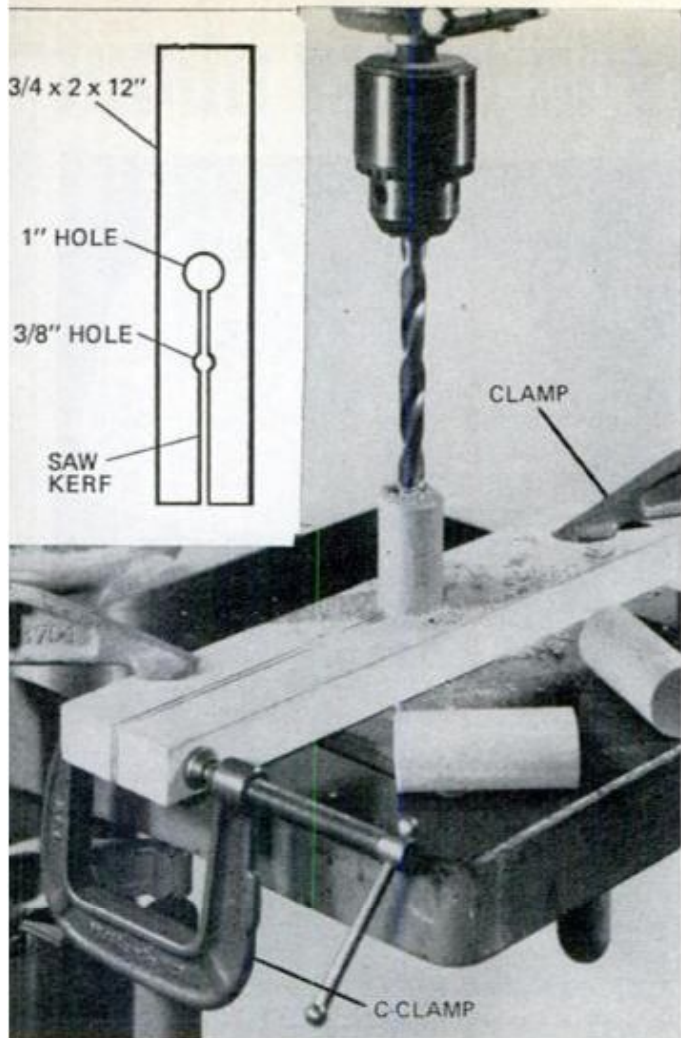
Construction Details



place and insert the wire in the end hole to anchor it. Slide pinsetting lever in place, mark hinge blocks for drilling, glue bar assembly in place and pin it with a brad. Install the butt hinges, then turn the board over to spot and drill the 3/4-in. post hole.

Making the pins. For bowling pins, select a straight 1-in. dowel and cut 10 2 1/2-in.-long pieces. If you use a miter-box for this, rotate the dowel while cutting so it won't



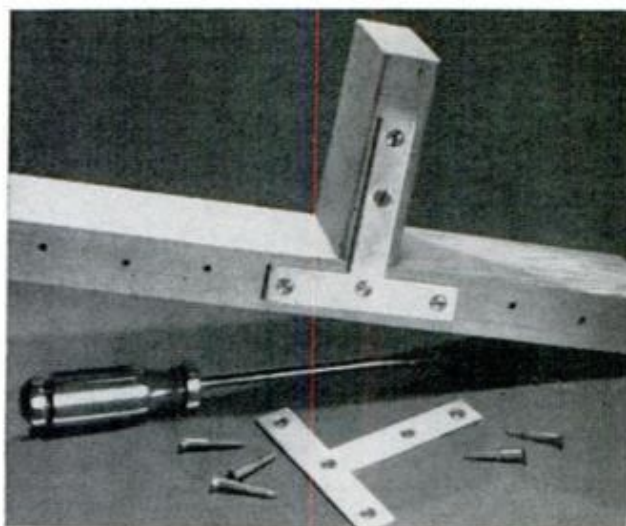


DRILLING JIG for bowling pins self-centers both $\frac{3}{8}$ and 1-in. dowels under the chuck for accurate drilling

splinter. To drill the pins, make a jig from $\frac{3}{4}$ -in. scrap wood, in which bore 1 and $\frac{3}{8}$ -in. holes as shown above. Split these holes down the middle with a saw kerf and the jig is ready to hold pins for accurate boring on a drill press.

Make a string-threading needle from spring wire so the point passes through the holes in parts A and B. This is used to fish the lines through both boards. Here the 2-in. adjusting block is first placed between part B and the lever. With bowling pin in "set" position, the fish-line is then pulled taut, wound around the screw and tied with a slip knot. Do this for each pin. When all strings are tied, remove the adjusting block, then drill the end of the ball pole for the coathanger wire. The fit should be free-swinging, but not sloppy. You could insert a $\frac{1}{2}$ -in. piece of wire in the bottom of the hole for a bearing.

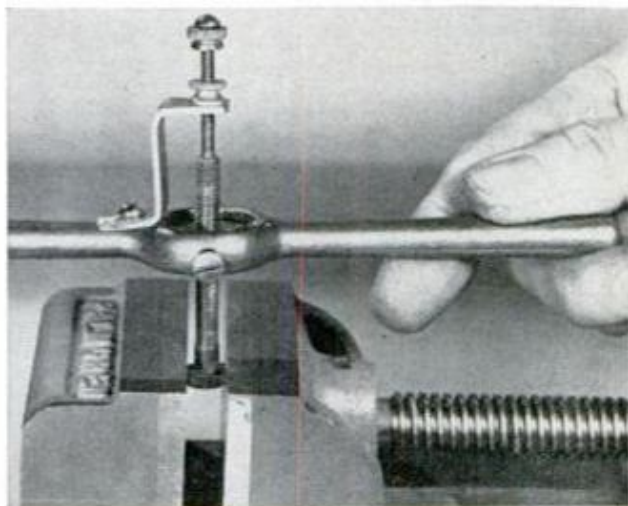
Compared to bowling, the game is played backwards with the number one pin away from you. You swing the ball around the pole and try to score on the backswing. Scoring is the same as in bowling. ★★



Stronger stilts for the kids

Although stilts are one of the easiest toys you can make for your youngsters, the problem of securely joining the "steps" to the legs usually stops most folks from making a pair. If you fasten the parts together using T-brackets and screws both sides of step, the stilts will be surprisingly strong. It's easy to raise the steps as a youngster grows or becomes more daring.

—Donald Jacobson, Minneapolis



Die-stock threading stop

Next time you hand-thread a number of pieces to the same length, this stunt will help you do it accurately in less time. Simply drill two holes in a metal strip, tap one and bend the tip as shown (so the threaded top hole centers with die when fastened) and screw it to the die stock. A full-threaded screw adjusts to desired length, locks in place with a knurled nut.

—Peter Legon, Malden, Mass.

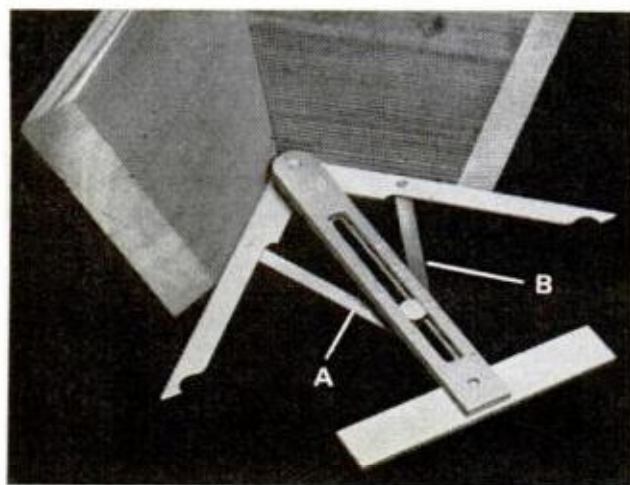
New tools you should know about



SELF-PRIMING PUMP can be used with any $\frac{1}{4}$ -in. electric drill, is claimed to pump 200 gal. per hour. Model CMP has ports for $\frac{1}{2}$ -in. I.D. hose, \$6.95. Flotec Inc., 24510 Carmenita Rd., Norwalk, Calif. 90650.



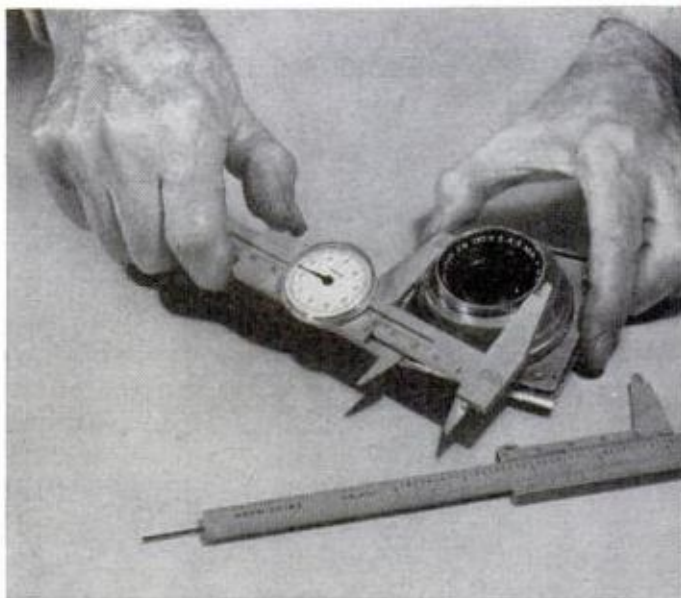
TAPE RULE from Lufkin, Box 728, Apex, N.C. 27502, features easy-to-read black markings on yellow background. Scales are printed on back of tape for speedy reference. Inset photo shows table of contents.



ANGLE-DIVIDERS make it easy to divide and bisect angles. Model 835 has two scales, A: 30, 45 and 60°; B: for 4, 5, 6, 8 and 10-sided objects. At hardware stores, \$8.10. General Hardware Mfg. Co., New York, N.Y. 10013.



PLASTIC HARD HAT, required on government construction jobs, is sound investment when there's any danger of being struck by falling objects. Priced at \$4.75, it's available by mail from Beno J. Gundlach Co., Box 544, Belleville, Ill. 62222.



DIAL CALIPERS newly introduced are made of plastic to keep cost down. Models available give measurements in .001 in., .1 mm and (combined) .01 and $\frac{1}{64}$ in., \$9.95 each; vernier calipers, in .001 in., $\frac{1}{128}$ in. or .1 mm, \$3.95 each. Schlesinger's for Tools, Ltd., 1020 East 54th St., Brooklyn, N.Y. 11234.

It's only natural.



Only NATURAL MENTHOL...
not the artificial kind. That's what gives Salem a taste
that's never harsh or hot. That's why Salem tastes as fresh
as Springtime. It happens every Salem.

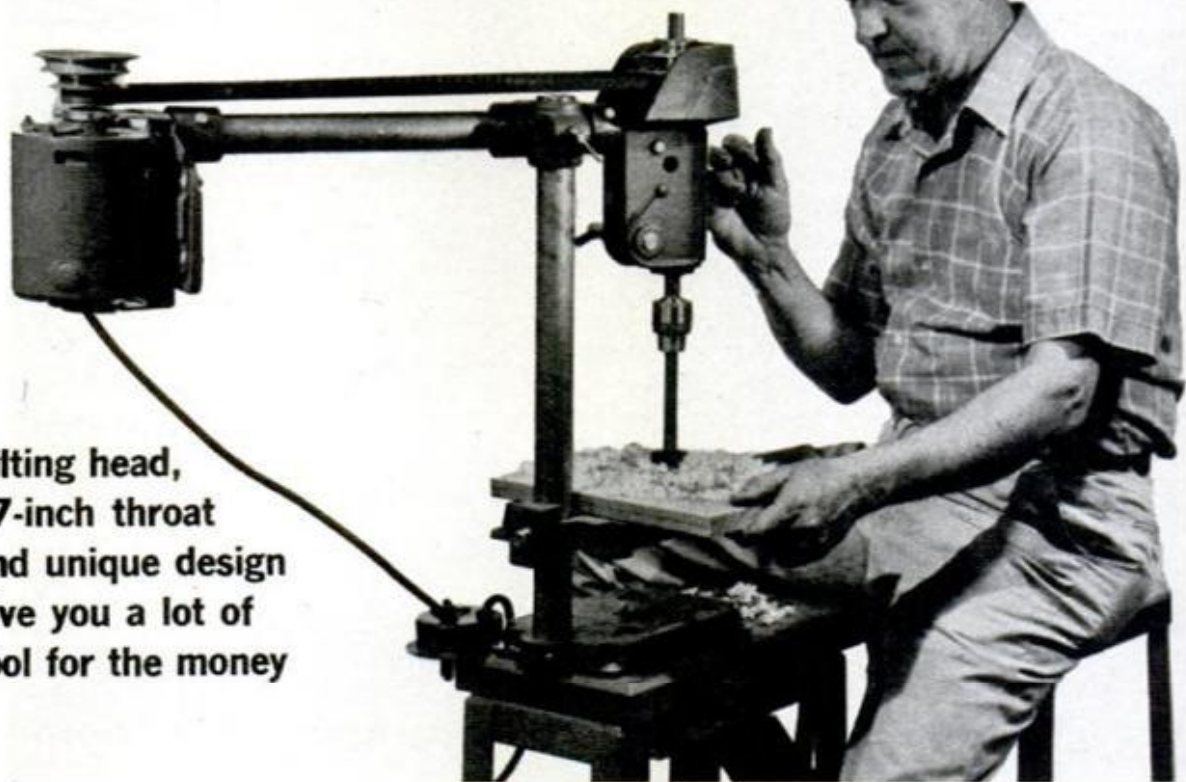


© 1971 R. J. REYNOLDS TOBACCO COMPANY, WINSTON-SALEM, N. C.
19 mg. "tar", 1.3 mg. nicotine av. per cigarette, FTC Report NOV. '70.

PM Shop-Tests AMT's Radial Drill Press

By WAYNE C. LECKEY, Home and Shop Editor

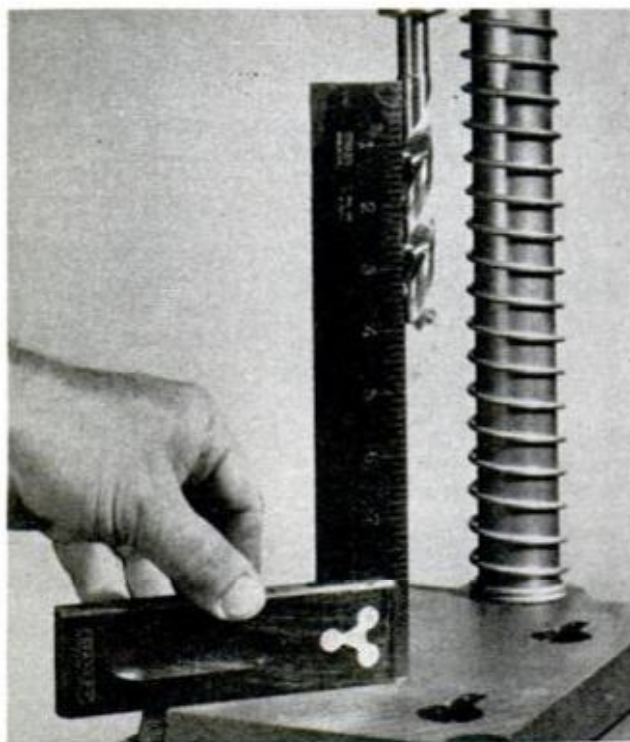
Tilting head, 17-inch throat and unique design give you a lot of tool for the money



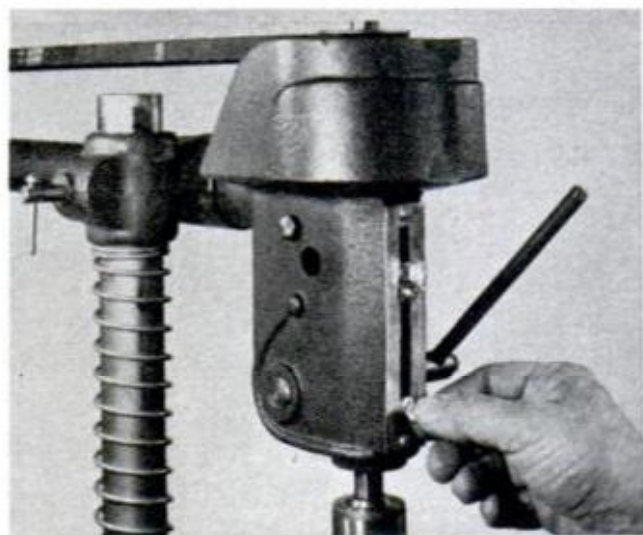
I'VE JUST PUT AMT's radial drill press through the wringer, and I must say that for \$62.70 it's a lot of drill press. It has a head that tilts 360° and it will reach to the center of a 34-in. circle. And if you happen to have a ¼ or ½-hp motor which

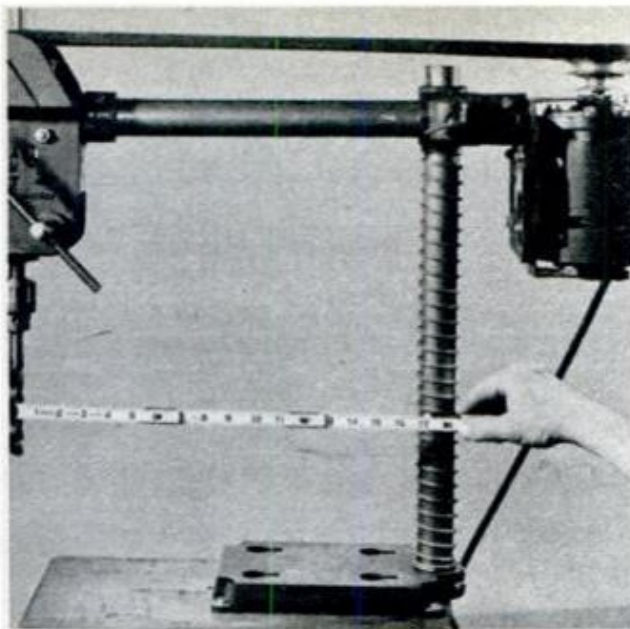
you may have salvaged from an old washing machine, you can purchase the basic machine for \$34.95 f.o.b. to make it an even greater buy. A V-belt and a three-step pulley will cost you \$3.90 more.

When you get this drill press, you'll see



TRY SQUARE IS USED (left) to return head to vertical position after tilting or sliding it in or out. Another way is to make index marks in horizontal tube and two-way slide clamp and align the two marks. Below: Thumbscrews in slot of a drill head provide simple depth-stops to preset travel of spindle





MAXIMUM THROAT CAPACITY is a whopping 17 in. when drill head is fully extended. Motor counterbalances outboard head, requires table bolted to base

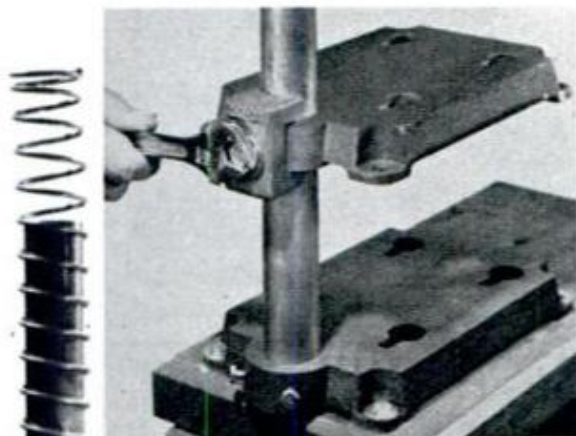
DUPLICATE BASE CASTING offers option of sliding table at \$3.95 extra. Here coil spring is not needed. Clamping bracket tightens the table to the column



ON-TABLE DRILLING requires two-way slide clamp to be swung 30° to right to center drill chuck. In this offbalance position, machine requires sturdy bench

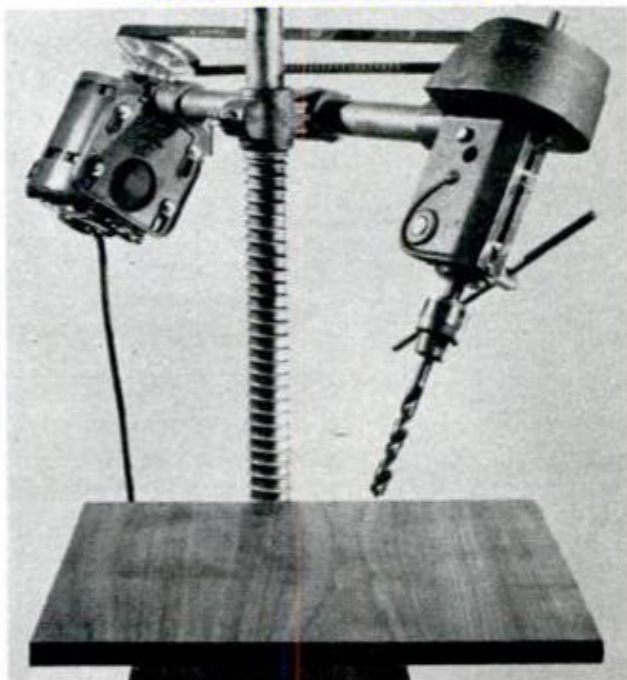
that it differs in design even from other conventional radial drills. For one thing, the basic machine does not have a sliding table; you use its fixed cast-iron base for on-table drilling. This means that up-and-down adjustment is made by raising and lowering the head and motor, rather than a table. To make this less of a burden, a coil spring which slips over the column is provided to help support the weight of the

(Please turn to page 189)



COIL-SPRING SUPPORT slipped over column helps bear weight of the drill head and motor during raising and lowering, also prevents an accidental fall when the lock handle is loosened

Photos by Robert D. Borst



DRILL HEAD TILTS 360° when locking handle in slide clamp is loosened. Plywood table bolted solidly to the base casting provides a king-size drilling surface



Think enormous.

Small cars are making it. The M60-A1 is 27 feet long, 12 feet wide and weighs 52.5 tons, loaded.

Flashy colors are in. The M60-A1 gives you a choice of one. An odd, brownish green.

Gas economy is a must. At 3 gallons to the mile, it's not one of our best selling features.

But talk about power. The M60-A1 offers a 750-horse, 12-cylinder air-cooled engine and cross-drive transmission as standard equipment.

And maneuverability. The M60-A1 turns on a dime. Large, but a dime.

And ease of parking. Who's going to fight you for a spot?

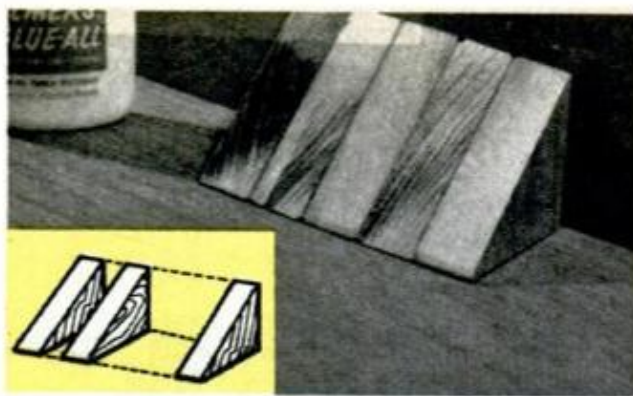
The M60-A1. It isn't small. It isn't flashy. It isn't even economical.

It's just enormous.

If you have the bug to move to something bigger, see your nearest Army representative. He'll tell you about the opportunities to make it big. In Armor.

Today's Army wants to join you.

Army Opportunities	Date _____
Dept. 200, Hampton, Va. 23369	2PM 9-71
Please tell me more about the big world of Armor.	
Name _____	Date of birth _____
Address _____	
City _____	County _____
State _____	Zip _____ Phone _____
Education _____	

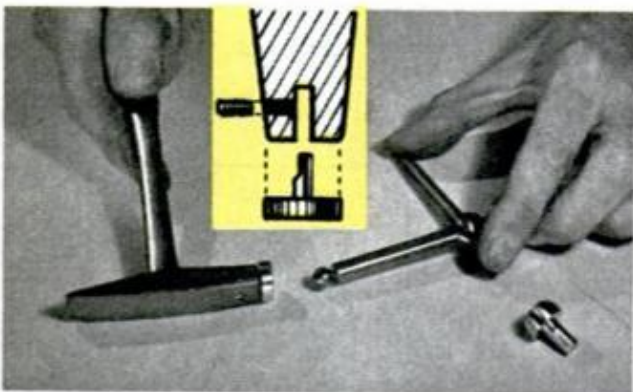


HINTS FROM READERS

Cross-grain glue block

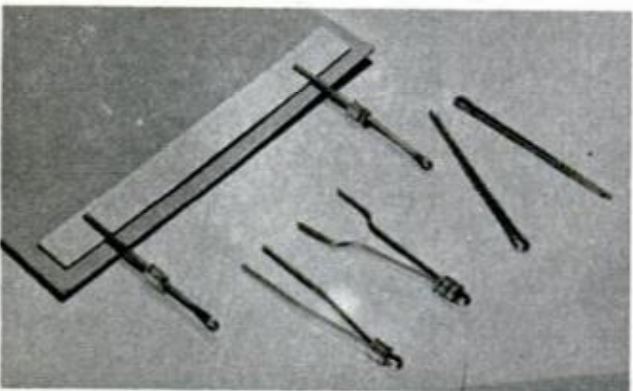
Several triangular pieces of scrap wood, glued together with grain direction alternating, will create a strong glue block for reinforcing joints. The crossed grain discourages splitting, and the strength of both glue surfaces is identical. Simply gang the pieces into a single block as you glue them into place.

—Walter E. Burton, Akron, Ohio



'Softening' hammerhead

A small hammer, such as an upholster's tack-hammer, can be adapted so it won't mar finely polished parts by fitting it with a soft brass tip. Easily made on the lathe, tip is a brass disc having a $\frac{1}{4} \times \frac{1}{2}$ -in. shank that fits a $\frac{1}{4}$ -in. hole drilled in the hammerhead. If head is hardened, anneal before drilling for the shank and a set-screw.—W.B. May, Oak Park, Ill.



Clamps from cotter pins

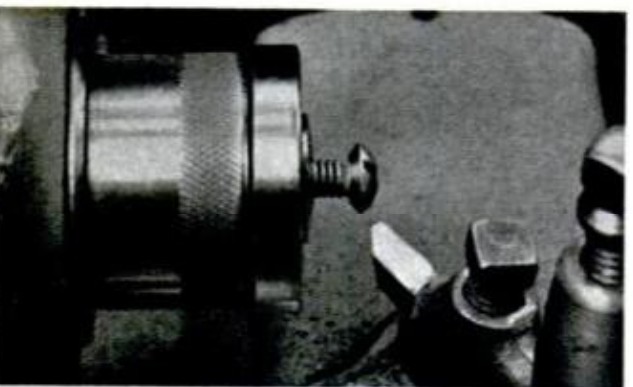
Tiny clamps for applying pressure in model and hobby work can be fashioned from long cotter pins. Prongs are bent so that, for about half their length, they diverge from the eye. Tips then are shaped to suit the workpiece. A few turns of wire wrapped around the pin near the eye force prongs together when the wire is pushed forward.—H.J. Mann, Chicago



Bonus use for shrinkable tubing

Plastic tubing, which shrinks to half its original size when heated with a match or soldering iron, can be put to a number of practical uses other than covering wire. If slipped over the shank of a punch or screwdriver and heated, it makes a dandy nonslip, insulated grip. It's also good for padding perforated-board hooks.

—W. Erwin, Houston



Making countersunk screwheads

When you need a screw or bolt with a countersunk head, it's easy to rework the head of a regular roundhead screw. Simply chuck the screw in the lathe and set the compound rest at a 40° angle with the axis. Then, feed the bit so bevel is cut on bottom of screwhead. Actually, you'll end up with a screw similar to an oval-head type.—B.E. Retlaw, Elvira, Utah



The Room Shrinker.

In the first place, one coat looks like two. That shrinks a room to half its size before you start.

In the second place, this paint flows on quicker than your ordinary paint and levels smoother. That cuts it down some more.

In the third place, drying time is one or two hours. And if you're covering a real problem color, and you

have to paint a second coat, you can do that in four hours.

Then in the fourth place, your rollers, brushes and equipment (and your goofs, if any) clean up with soap and water.

You don't even have to write down "Dutch Boy Nalplex Latex Flat Wall Finish."

Just ask the man for the room shrinker.

N
INDUSTRIES
111 Broadway,
New York, N.Y. 10006

An Abrasive Cutoff Machine You Can Make for \$15

By BOB ECKERT

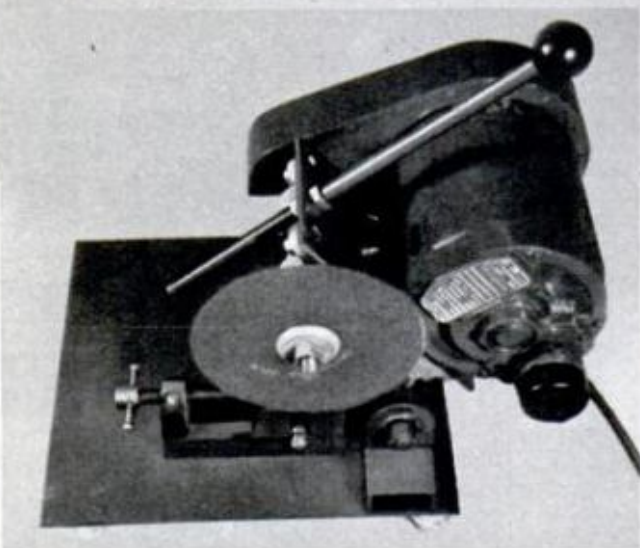
CUTOFF WHEEL was built mostly with parts author had around shop. For photo clarity, the wheel guard was removed here; you should add one for safety

CUTTING THROUGH 1-in. steel rod by hand is one of the most time-consuming, arm-wearying chores you can tackle in the shop. Since I frequently work with metals, I decided to build the handy little machine shown here to ease the task. I get a remarkably fast and accurate cut and a surface-grinder finish on the metal.

Spare parts lying around in my shop were used to build my machine. The only tools needed are a screwdriver, wrench, hacksaw, drill press (or portable electric drill) and a 1/2-20 NF (national fine) die.

Basically, the machine consists of a base, riser channel, angle brackets, rocker-base pivot assembly, combination depth-of-cut adjustment and handle and the belt guard cover.

Start construction with the machine base and the rocker base. Lay out all



holes as shown in the drawing on page 168 and double check the pillow-block dimensions (distance between mounting holes for these may vary from those in the drawing; just allow for any difference before you drill the holes). The 1/8-in. holes are for a tension spring needed to prevent the abrasive cutting wheel from being forced into the workpiece by gravity.

When drilling the rocker base, make
(Please turn to page 168)

...alling the new girl is working up your nerve, working out your line,
...en she says yes and everything's cool and you can relax and...

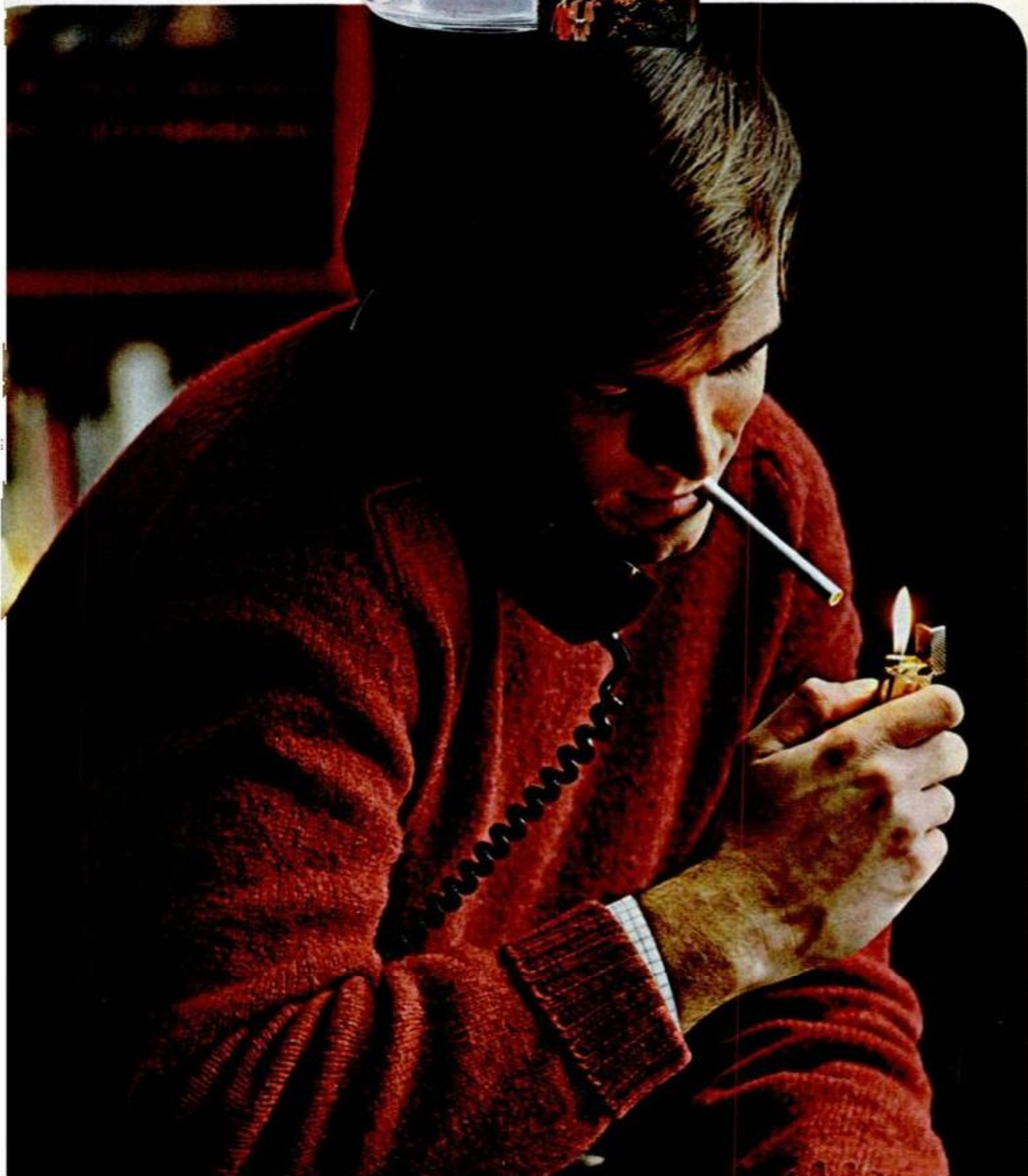
This...is the L&M moment.

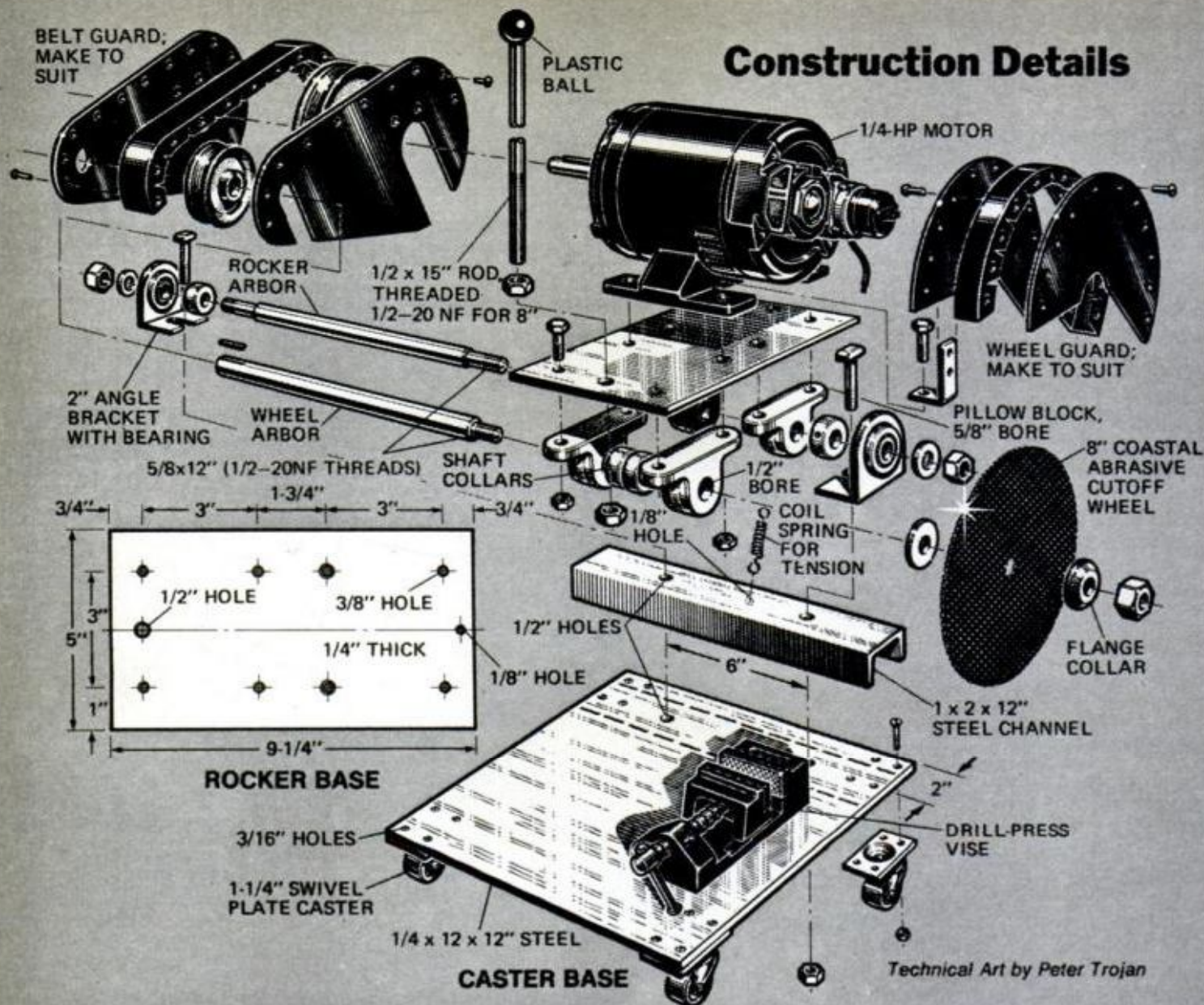


The pressure's off.
Break out an L&M. Light up
and enjoy the rich, full flavor
that makes L&M right for you.
Right for now.

RICH, RICH L&M

19 mg. "tar", 1.3 mg. nicotine
av. per cigarette by FTC method. (Jan. '71).





ABRASIVE CUTOFF MACHINE

(Continued from page 166)

certain the countersink is deep enough for the two $\frac{3}{8}$ -16 NC (national coarse) fh slotted machine bolts to lie flush within the plate surface. Make an error here and there's a good chance the motor's base might twist and break its weld from the motor when you're tightening it in place.

The combination depth-of-cut adjustment and handle regulates how far you can lower the cutting wheel, also keeps the wheel from cutting into the base. It also serves as the machine's handle.

The belt guard cover, used for safety as well as looks, can be made of sheet metal; use Pop rivets to hold it together.

After making all parts except the belt guard cover, start assembly with the rocker base, regarding the end with the $\frac{1}{2}$ -in. drilled hole as the front. After the unit is assembled—mostly a matter of patience

and trial-and-error fitting—install the power cord and mount the switch.

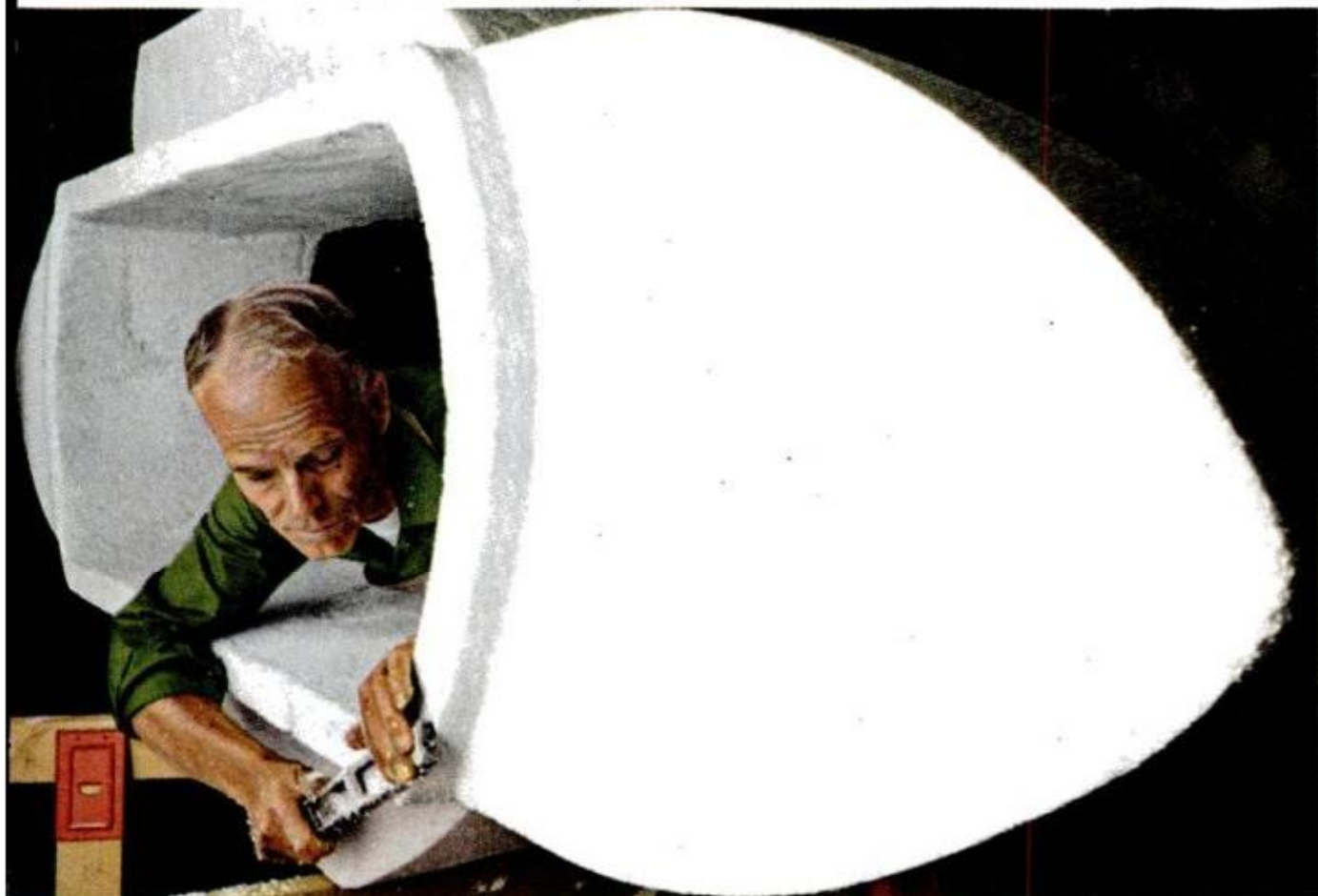
All shafts and pillow blocks can be obtained from local hardware stores. They come as a set for use as mandrels for buffing and the like. A set—shaft, two pillow blocks, nuts and washers—sells for about \$7. One shaft (for the rocker) from these sets should have a $\frac{5}{8}$ -in.-dia. bearing surface with both ends turned down to $\frac{1}{2}$ -in. diameter with $\frac{1}{2}$ -20 NF thread.

Attach any special wheel, such as the Coastal Abrasive Zippidi-Do shown, with large washers on both sides and secure it with a $\frac{1}{2}$ -20 NF hex head machine nut.

Adjust belt tension by sliding the motor back and forth. Don't make the belt too tight; pressed at the center, it should deflect about $\frac{1}{2}$ in.

The machine throws a lot of sparks, so always put on safety goggles before you use it. A common drill-press vise is used to hold the work. ★★★

Old Crow's good taste begins with men who love to work with their hands.



It may be that Kentucky men are natural craftsmen. Take Glenn Crosswhite, assistant to our Master Distiller. When he isn't judging the taste of our Bourbon you'll likely find him turning out handicraft at home, like this unsinkable foam kayak.

Craftsmen made Old Crow famous. Back in 1835, our people figured out the formula that made Bourbon taste good, bottle after bottle, and later they handmade the first sour mash Bourbon. We still use our hands in making Old Crow.

Lots of folks are rediscovering the pure joy of working with their hands. If you'd like to try your hand at this kayak boat, write for the same plans Glenn Crosswhite used: Old Crow, Box 675, Frankfort, Ky. 40601.



Trace kayak outline on foam block. Cut out rough shape.



Shape and smooth. Work carefully or rasp will cut too deep.



Seal with water-based paint before launching. For plans, see address at left.

Old Crow
Made by good Kentucky hands



KENTUCKY STRAIGHT BOURBON WHISKEY. 86 PROOF. DISTILLED AND BOTTLED BY THE FAMOUS OLD CROW DISTILLERY CO., FRANKFORT, KY.

PUSH-PULL SAFETY ON TOP OF STOCK BEHIND BREECH.



IT'S YOUR MONEY...

but shooters who want and expect maximum performance from an AIR RIFLE will find the

Great New BENJAMIN

combines entirely new standards of ACCURACY AND SAFETY with SMASHING PEAK POWER AND RELIABILITY to make it the logical choice of those hankering for a BB or Pellet Gun you can trust.

In designing this beauty, we chose to retain Benjamin's durable, time-tested action, universally praised by marksmen for its functional excellence. It also embodies bronze barrels, machined brass and steel parts to enhance shooting merit; a real walnut stock.

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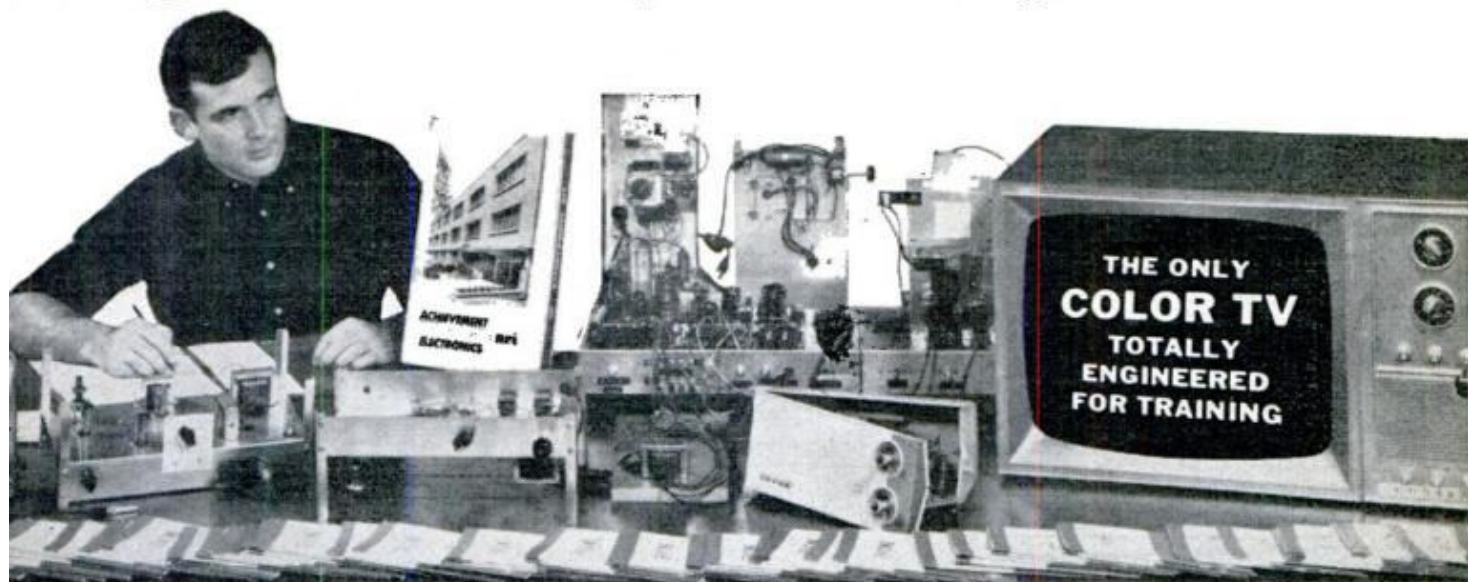
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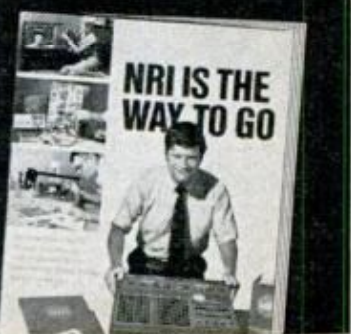
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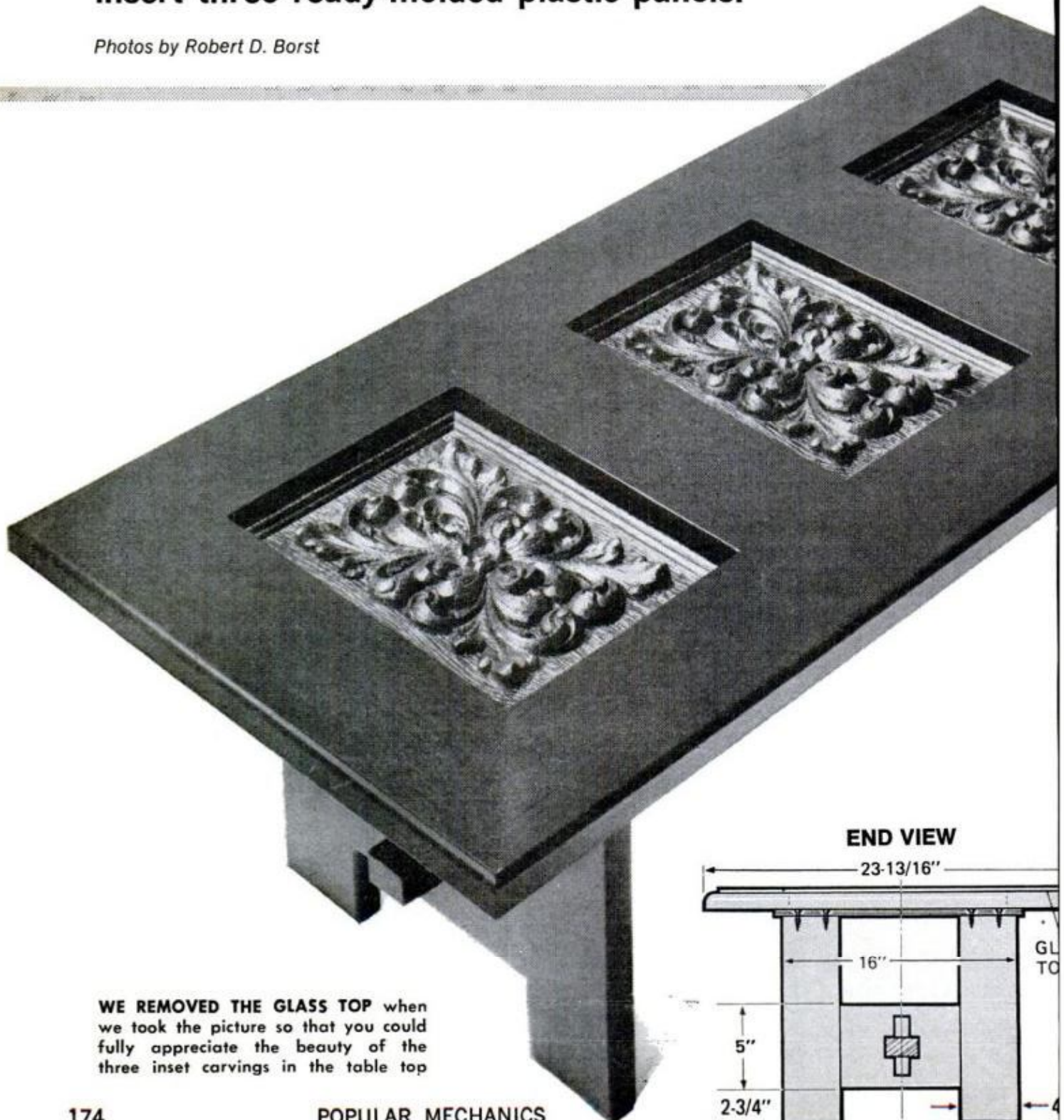


Anyone Can Build This Coffee Table For \$35

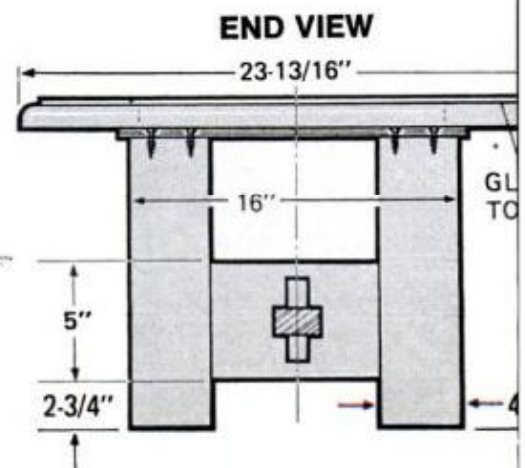
By WAYNE C. LECKEY
Home and Shop Editor

You can 'carve' its handsome top in the time it takes to insert three ready-molded plastic panels.

Photos by Robert D. Borst



WE REMOVED THE GLASS TOP when we took the picture so that you could fully appreciate the beauty of the three inset carvings in the table top



YOU NEEDN'T BE AN EXPERT woodcarver to build this elegant-looking coffee table. The three sunken panels under its glass-covered top are inserts that sell for \$1.75 each.

We built the table you see here from 5/4 pine, sprayed it black and placed plate glass on the top for a total of \$34.94. You couldn't buy it in a store for less than \$100.

The three "carved" inserts used in the top are molded reproductions of an old-world, hand-carved Spanish door—one of many similar overlays produced by Decorative Components, Inc., of Forest City, N.C. You can buy them finished or unfinished. Since we planned to paint the table

black, we ordered unfinished panels. A set of three costs \$5.25 postpaid, ordered from United Southern Associates, Box 5521, High Point, N.C. 26262. Ask for part KD-50070.

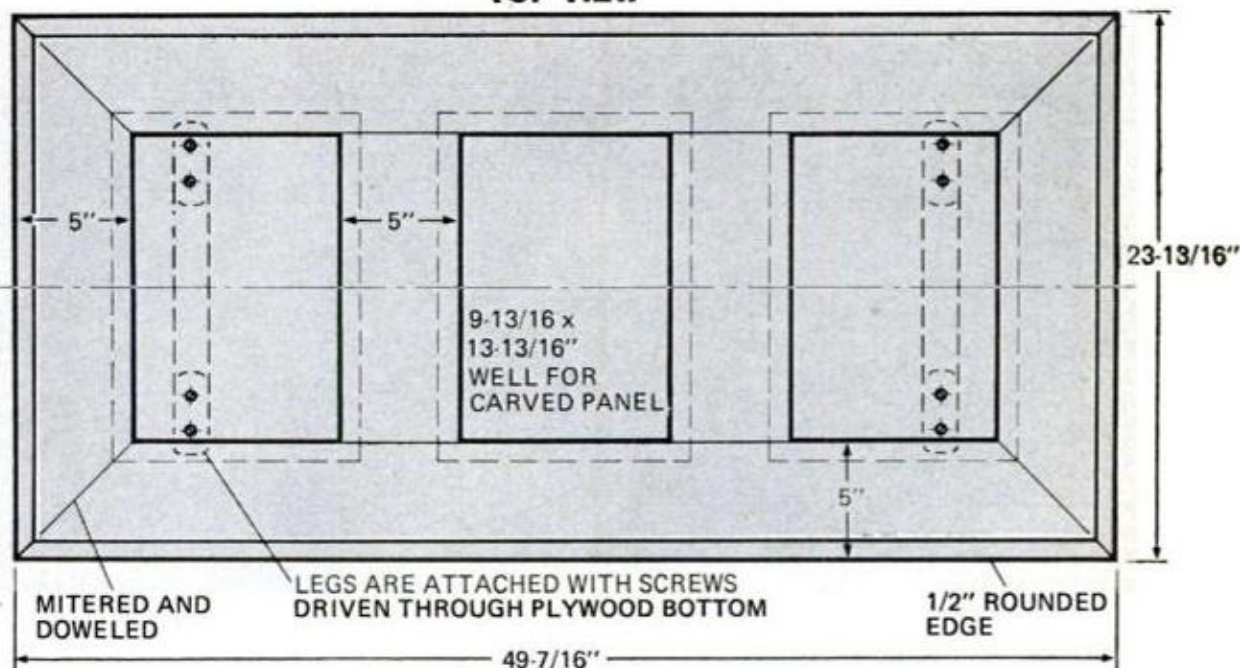
The Spanish panels also come in beautiful wood-grain finishes so faithfully reproduced it's difficult to tell them from real wood. As inserts and overlays, they can be used dozens of ways to decorate the fronts of cabinet doors, plain flush doors, furniture and the like. If you want completely finished panels in a certain wood graining they are \$2.25 each. Check with the maker first.

Five-quarter pine is actually 1 1/8 in. thick and any lumberyard has it. A length

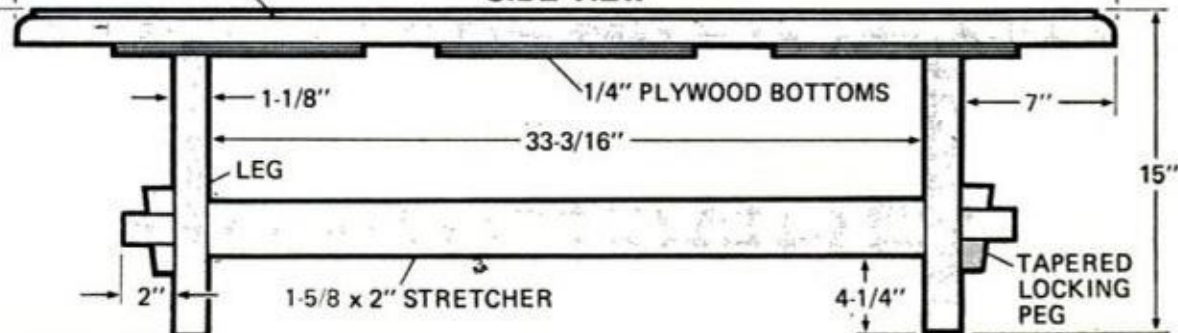
MATERIALS LIST

Amt.	Size and Description (Use)
4 pcs.	1 1/8 x 4 x 13 3/8" pine (legs)
2 pcs.	1 1/8 x 5 x 8" pine (leg cross members)
2 pcs.	1 1/8 x 5 x 49-7/16" pine (top side members)
2 pcs.	1 1/8 x 5 x 23-13/16" pine (top end members)
2 pcs.	1 1/8 x 5 x 13-13/16" pine (top cross members)
1 pc.	1 5/8 x 2 x 39-1/16" pine (stretcher)
3 pcs.	1/4 x 11-13/16 x 15-13/16" plywood (well bottoms)
1 pc.	1/4 x 23 x 48 3/4" plate glass (top)
3	Spanish carved panels No. KD-50070 (inserts—see text)

TOP VIEW



SIDE VIEW





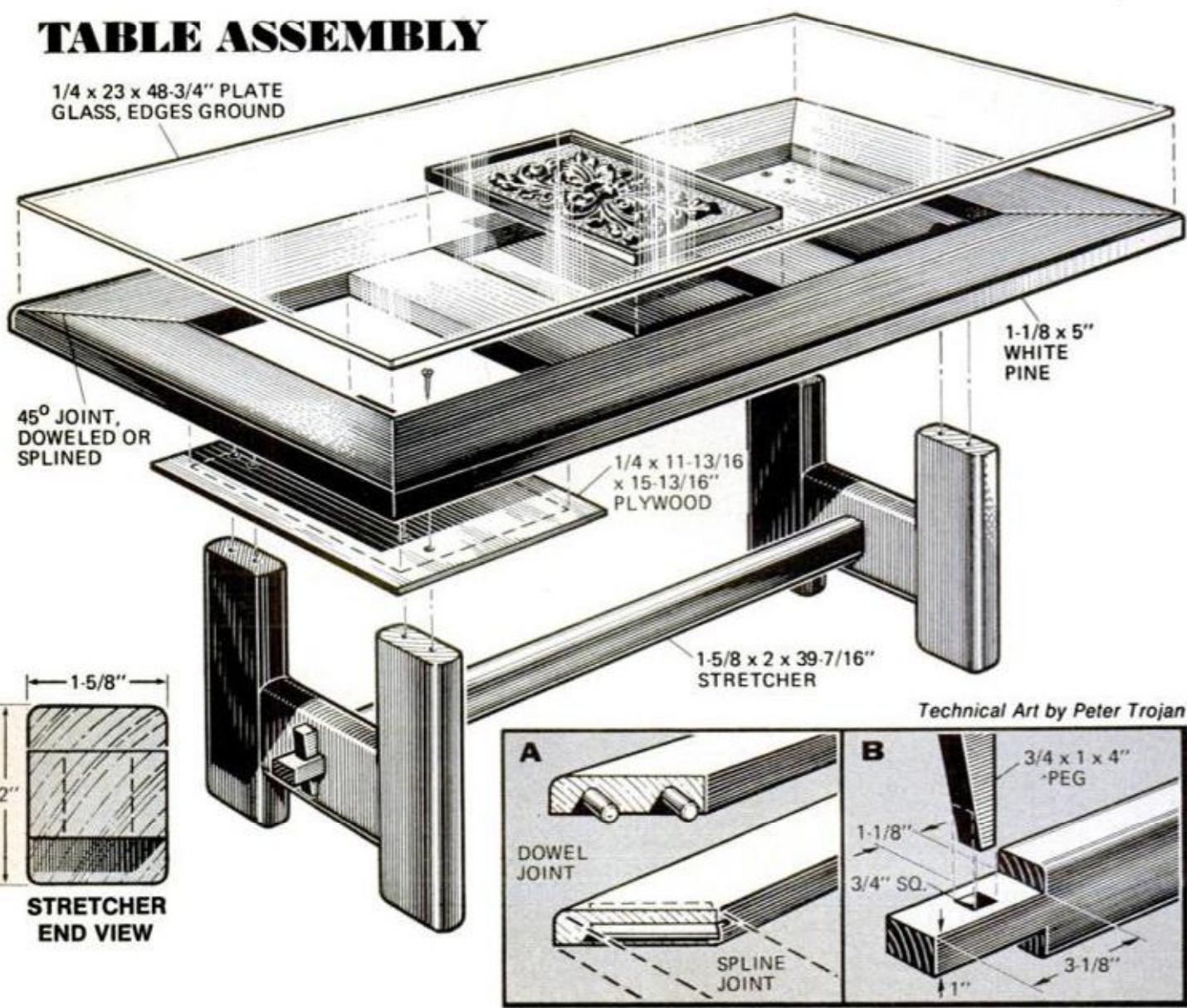
"CARVED" PANEL

of 2x3 is used for the leg stretcher; 1/4-in. plywood panels to cover the bottoms of the insert wells.

The cross member of the H-shaped legs is doweled and a square hole made in the center for the shouldered stretcher. To do this, bore a 1-in. hole and shape it with a square file until the slot measures 1 5/8 x 1 in.

The two cross members of the top that form wells for the inserts are doweled to the side members, as are the mitered corners. The plywood overlaps each well on the bottom. The top is attached to the leg assembly with screws driven down through the plywood and into the tops of the legs. Round all edges as indicated and sand all exposed surfaces smoothly before painting. You can add small felt discs to the top for the glass to rest on. We spent \$16 for the plate glass. Its edges should be ground. ★★★

TABLE ASSEMBLY



Keep Those Copies of Popular Mechanics!

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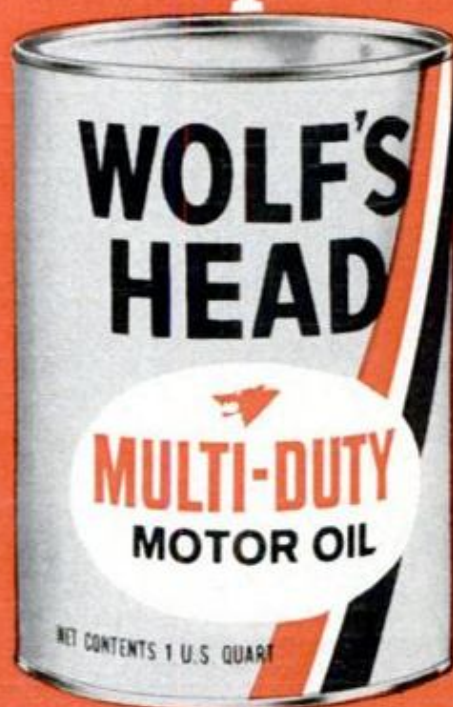
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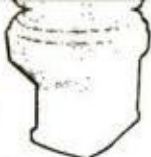
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UNSAFE AT ANY HEIGHT

(Continued from page 67)

aircraft flying in close formation. Unless a solution to this problem can be found, pulling a D-string could set off an expensive chain reaction.

The armor-plate that Mason claims is necessary could reduce a helicopter's performance. As any pilot knows, each aircraft is designed for a certain maximum weight. Increase the weight and the chances of crashing also increase.

Navy engineers claim HEPS would not exceed 5 percent of the total weight of a helicopter, but some pilots think that figure is unrealistic. "I have heard the same claims made for other systems," says Lt. Cmdr. Bill Burton, "but when they rolled off the assembly line they were much heavier."

Burton, a Navy safety officer who flew helicopters for 10 years, believes the Navy will have to trade weight for safety if HEPS is adopted.

The most obvious benefit to be reaped from HEPS is a saving of people, and they can be expensive to replace. The Navy, for example, spends \$40,000 to train a helicopter pilot and \$5000 to send each crewman through school. One helicopter usually carries a pilot, co-pilot, crew chief and door gunner. Total training expenditure: \$90,000.

Not long ago a noncombat helicopter accident in the Mekong Delta killed eight men. An Army spokesman in Saigon said it would cost \$200,000 to train replacements and \$140,000 to replace equipment.

Military readiness also suffers when helicopters are lost. During the summer of 1967 I spent several hungry nights with men of the Ninth Infantry Div. who were on a search-and-destroy mission in the Mekong Delta. When the five-day operation ended, we learned that a shortage of helicopters had prevented all the men from being resupplied. It is not an unusual occurrence.

Helicopter accidents also have a serious effect on troop morale. Standing on the beach in southern Spain one morning, I watched as wave after wave of Marine helicopters flew shoreward from ships of the U.S. Sixth Fleet and inserted members of the Second Marine Div. behind "enemy" lines. The name of the game was Operation Steel Pike.

According to the scenario, the helicopters were to fly toward land at 1000 feet, discharge their troops and return to the ships at 500 feet. Suddenly there was a flaming roar as two of the aircraft collided at low altitude near the landing zone. Thirteen men died during the next 10

seconds. Most of the younger marines I talked with that day said they didn't "feel like playing war any more."

Because of its small size, the Marine Corps is dependent upon the Navy for many of its safety programs. The two services deploy together to avoid duplication of effort and expense.

The Army, with its large budget, is not dependent upon other services and has made some important advances in helicopter safety. Lt. Col. E. B. Covington, an Army information officer at the Pentagon, says crash-resistant fuel systems are now being installed in many Huey helicopters.

Fourteen helicopters with crash-resistant fuel systems recently were victims of accidents or enemy ground fire. "We determined that seven of these would have leaked fuel and subsequently burned if they had had conventional fuel systems," Covington says.

The Army has also installed proximity warning devices in its training helicopters to lessen the probability of midair collisions. No decision has been made on whether to place the instrument in all rotor-wing aircraft.

Navy engineers would like to marry HEPS with the Army's new safety equipment and the union could save many lives. The Navy recently conducted a comprehensive study of 231 helicopter accidents. Their findings revealed that if an escape system had been installed in the aircraft, half of the 571 men who died would be alive.

"With the way things are today," says Lt. Cmdr. Burton, "the only way to improve our safety record is to quit flying—and that we can't do." ★★★

BOATS WITH A PURPOSE

(Continued from page 104)

with or without stocking foot waders, dangle in the water. Swim fins provide propulsion. While a mite awkward at first, I soon adapted to this do-it-yourself propulsion, and by the end of the day was practically unconscious of my movements—a condition greatly enhanced by the regular bass pickups and runs I got on my blue plastic worm bait.

But the best feature is price: just \$59.95. There're not many boats around these days for a hundred dollars or less. And it's nice to know you're doing your bit to fight economic inflation while sailing a Sea Snark, rowing a Spoacraft, or chugging from one bass hotspot to another in your Water Wagon.

For more information on Water Wagon, write Box 9276, Amarillo, Tex. 79105. ★★★

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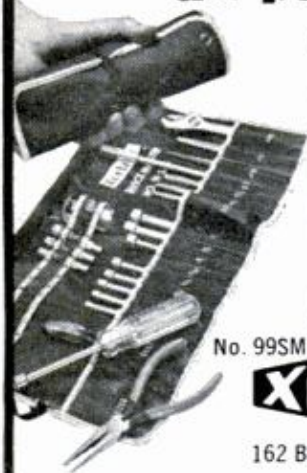
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OWNERS REPORT: COLT-CRICKET

(Continued from page 79)

shift." "Interior seems cheap." "Noisy at expressway speeds."

What about ride and handling? **Colt:** "Best riding small car I've ever been in, both front and rear."—California distributor. "Drove it on a vacation from Riverside to Dallas, averaging about 75 mph; handling was superb, even with a lot of luggage on top."—California salesman. "Handles like a much bigger car."

About Cricket's ride and handling: "Very good handling and excellent riding comfort."—Michigan mechanic. "Suspension is fantastic; rides very well in windy weather."—New York student. "Comfortable to drive, easy to park."—New Jersey patrolman. "Tremendous handling with rack-and-pinion steering."—Connecticut sales rep. "Good for short distances, but for long trips it needs a longer wheelbase and larger tires."—Ohio technician.

What changes would owners like? **Colt:** "About two more inches of headroom." "More luggage space." "Hood should stay open without a prop rod." "More room in the rear seat." "Eliminate all that road noise." "I'd fix the car myself if I didn't have to go out and buy a whole set of metric tools." (Not one Colt owner reported doing his own repairs, and only 3.9 percent of Cricket owners did.)

Suggested changes, Cricket: "Horn should be on the steering wheel, not on the directional lever." "Change the name." "Better interior lighting." "Better workmanship." "Horn is inconvenient; gas pedal is uncomfortable." "Should get better gas mileage." "Parts ought to be easier to get—you have to wait too long." "If they'd make it so it doesn't fall apart, I'd have a great car."

What about quality? **Colt:** "Much better than others in the same price range." "Some parts seem cheap—lots of plastic; loose chrome." "Very good except for carpeting." "Workmanship outclasses U.S. cars." "Solid car." "Trim fit could be better." "I think real effort went into the design and manufacture of this car." "Okay for the price."

What about quality? **Cricket:** "Windshield leaks, chrome quickly peeled off handles, otherwise fine." "Excellent." "The car needs to be manufactured once again." "Fair, but certainly better than my Olds." "Car is attractive but obviously cheap inside and out." "Good—I'm well satisfied." "The Cricket is tightly built, and the engine/trans/rear axle are well in tune with its size and capabilities. I think it will turn out to be durable." ★★★

THIS WAS ONCE A GARAGE?

(Continued from page 140)

high). Because of these dimensions, extra footings were installed to support the structure. For textural contrast with the paneled walls, the hearth was constructed of smooth-cut stone while the fireplace face was skinned with a lightweight volcanic stone. Built-ins which flank the fireplace are a matter of personal taste. If your budget is limited, they can always be added later.

Walls. Framing, as shown in the drawing, is the conventional stud-wall. In the garage-door opening, holes were bored in the slab, and after some concrete was slushed in, anchor bolts for holding the sole plate were dropped in place.

From this point on, all construction was standard with the exception of the recessed paneled walls. Like the ceiling, the walls were insulated with full-thick batts and covered with 1/2-in. plasterboard. To insure against drafts, joints were taped and spackled as were all countersunk nail-heads.

Next, if you're duplicating the room, apply 1/4-in. prefinished paneling over the drywall using mastic and nails. Then carefully measure the four walls for height and length to determine exact placement of the 1x6 vertical and horizontal framing members. Once these are up, it is simply a matter of mitering and placing the base-cap molding which surrounds each recessed panel. Bear in mind when selecting the paneling that you will have to match and stain those 1x6 members and moldings. How much of a job this will be depends in part on the type of paneling you choose.

The look of old-world craftsmanship that this room boasts is actually achieved mostly through the use of stock moldings. (Even the dentil is available at lumberyards.)

Lighting. At the angle between roof and wall, a decorative alcove was installed to conceal fluorescent fixtures, controlled by a switch within the room.

Cost for a garage conversion will vary considerably, depending on how much work you will do yourself, and to what extent you will contract work.

The average PM reader can probably handle most of the job himself—including the fireplace, which can be a relatively simple chore if you install one of the many factory-built versions that are self-insulating and require no footings. Even without a fireplace you will wind up with a finished project you'll be proud of, and a room that works wonders for your family's everyday living. ★ ★ ★

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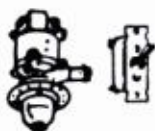
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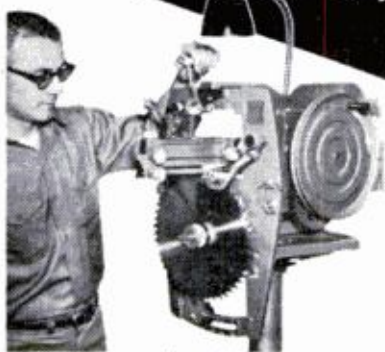
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IT'S YOUR BUSINESS

(Continued from page 85)

ilar businesses, and left them with the foremen. When he returned the next day, he was greeted with several orders.

For those who don't particularly care for the tool-sharpening business, Belsaw offers an opportunity to start a locksmithing business. The company provides a series of 30 learn-at-home lessons and the machinery that is needed for \$205. According to Dobbins, many men make from \$5 to \$10 per hour on a part-time basis.

Most small businesses can be set up without undergoing an extensive learning process, but the auto radiator service business is not one of them. Only those

SMALL-BUSINESS OPPORTUNITIES

For more information about the opportunities mentioned in this article, write the companies listed below:

Von Schrader Manufacturing Co., 16th St. and Junction Ave., Racine, Wis. 53403.

The Kelsey Co., Meriden, Conn. 06450.

Belsaw Machinery Co., 315 Westport Rd., Kansas City, Mo. 64111.

Foley Manufacturing Co., 3300 Fifth St., N.E., Minneapolis, Minn. 55418.

Treyco Products, Inc., 332-A Niagara St., North Tonawanda, N.Y. 14120.

Inland Manufacturing Co., 1108 Jackson St., Omaha, Neb. 68102.

Hydraulic Jack Repair Manual Co., Inc., Box 3, Staten Island, N.Y. 10314.

Scott Machine Development Corp., 215 Prospect Ave., Walton, N.Y. 13856.

Warner Electric Co., 1512 Jarvis Ave., Chicago, Ill. 60626.

Concrete Machinery Co., 839 Lenoir Rd., Hickory, N.C. 28601.

who are mechanically inclined should consider it.

One of the most famous small-business training schools in the country is that of the Inland Manufacturing Co. in Omaha, Neb., which runs a two-week radiator repair course. The school is for customers who purchase Inland's radiator servicing equipment, which costs anywhere from \$700 to \$14,000. The company offers a pay-as-you-earn plan.

Obviously, this is not a business that can be set up in the basement of your home. However, many men have used their garages. The benefits of the business are commensurate with the effort and money which are needed to get started. There's a need and profits are good.

According to *Service Station Management*, an automotive trade journal, approximately 85 percent of the auto radiators in use today are plugged badly enough to need cleaning and service. Inland says that men who enter the business

can earn \$14 to \$16 an hour servicing auto radiators and \$18 to \$25 an hour servicing truck and tractor radiators.

How have men fared who have gone into the business? Harold Schaley of Stronghurst, Ill., works at his radiator business as a sideline. "Last year I had a gross income of \$4000," he says.

Clifford L. Stotler of Plattsburgh, N.Y., entered the business on a full-time basis, buying \$5900 worth of equipment from Inland. After being in operation only 10 months, his income exceeded \$15,000.

Another business that requires some training, but not as much as a radiator repair operation, is hydraulic jack repair. Did you ever stop to realize how many jacks there are in use at gasoline stations, auto repair shops, trucking firms, bus companies, body shops, factories and farms? How many men in your area are in this business? Not many, you can be sure. Look them up in the yellow pages of your telephone book.

You can start a jack-repair business in your basement or garage. It doesn't take much room. But a word of caution: If you're not mechanically inclined or you don't like to work with tools, forget it.

This is a learn-at-home business. The company, Hydraulic Jack Repair Manual of Staten Island, N.Y., sends you the training literature, which costs \$35. When you're ready to go into business, the company sells you the parts you need to do complete repairs.

For those who don't like mechanical work, there are several other small businesses to investigate. One is making custom-engraved signs for such organizations as schools, hospitals, business firms, hotels, motels and banks.

"One of our customers recently advised us that he grossed \$400 on a weekend at a horse show by making identification plates for horse stalls," L. J. Wischerath, marketing manager of Scott Machine Development Corp., told me.

This company, which is based in Walton, N.Y., makes sign engravers. The smallest machine costs \$213; larger ones, \$335 and \$425. It will take you less than an hour to learn how to use one.

John P. Rathmell of Elizabethtown, Pa., chief medical technician in a hospital, started to engrave signs for after-hours recreation. He earns up to \$15 an hour in his spare time.

"Any place that I observe a paper sign I try to sell a permanently engraved plastic sign," he says.

Another interesting business possibility that can produce extra income is the production of rubber stamps by use of a machine which is made by the Warner Elec-

tric Co. of Chicago. It costs \$606, which includes materials. Warner offers a finance plan at a small interest rate.

Accompanying the machine are instructions for making stamps, and ideas on how and where to sell the product.

Buy E. Allred of Columbus, Ga., bought equipment from Warner in 1959. Since then, he has made more than 31,000 stamps, which has allowed him to buy a new home and car, travel, and assure his kids of an education.

Another company that advertises in *Popular Mechanics* is Concrete Machinery Co. of Hickory, N.C., which sells aluminum molds for making ornamental concrete items, such as bird baths, flowerpots, statues, animals, seats and tables. The company offers over 350 different molds, and its instruction book on working with concrete is considered one of the best.

V. S. Flowers, president of the firm, says, "We get many letters telling how our molds have furnished enough extra income to pay for vacations, second cars, college educations and so forth. It can be a part-time or full-time business, and on as big or small a scale as you wish. You set the pace." ★★★

DO YOUR OWN ROUTINE SERVICE

(Continued from page 125)

mushy (rotting), checking that clamps are tight, testing the radiator for leakage and testing the thermostat. A properly-cared-for system won't usually need a reverse flush. Use only good-quality coolant—it contains an antirust inhibitor.

Test coolant at least once a year with a hydrometer—the type shown on page 123 costs but \$1.29 and contains small balls which indicate the strength of the coolant by the number of balls that float.

● To service the emission-control system, disassemble all parts—including hoses, caps, canisters—and clean them. Most makers suggest that you replace the PCV valve every 24 months or 24,000 miles, whichever comes first.

● In addition to frequent checks of electrolyte with a battery hydrometer, wash the battery at least once a year with a baking soda solution and rinse with clean water. Tape tops of the caps to keep soda out of the battery.

● When rotating tires, include the spare. Follow the diagram on page 125.

● Warm up the engine before you drain the transmission, then drop the pan, replace filter, scrape off the old pan gasket, put on a new one, reinstall pan and fill transmission with new fluid. ★★★

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HOW TO CHOOSE BINOCULARS

(Continued from page 91)

game where the action ranges from one end of a field to another.

To focus an IF glass, close one eye and move the eyepiece back and forth in front of the opened eye until the image is as sharp as possible. Do the same for the other eye. Adjust for interpupillary distance by moving the two sides of the binocular until they match the distance between the eyes. To focus a CF glass, close the right eye (or cover the right objective lens) and move the center wheel back and forth until you get a sharp image with your left eye. Next, close the left eye and rotate the right eyepiece until the image for the right eye is as sharp as possible. The glass should now be accurately focused.

These adjustments will compensate for eyeglasses. However, if you persist in wearing them when using a binocular, you can get one with either flat or reversible eyecups for use with or without your eyeglasses.

What about binocular design? There are three basic styles: German and American Porro prismatic and straight through. German style—the original—is characterized by two parallel tubes, side by side, connected by cover plates at top and bottom. In an effort to increase rigidity and provide a firm optical alignment that wouldn't get out of whack under hard usage, Bausch & Lomb pioneered a one-piece barrel—the so-called American style.

This type of construction is also featured by Zeiss, Leitz and most Japanese makers. From an optical standpoint, American and German styles are identical. Both use Porro prisms to reflect light back and forth and to erect the image.

The straight-through binocular, made under the trade names of Trinovid (Leitz), Dialyt (Zeiss) and Miida (Japanese), uses three prisms in each half instead of two as found in a Porro prismatic binocular. It also has five reflecting surfaces instead of four. While this extra surface represents a four to six-percent loss in light transmission, it permits a lighter, more compact binocular. Where weight is a factor, such as on a hunting trip, the straight-through glass has much to recommend it.

How about price? Samples for Bausch & Lomb range from \$259 for a 6x30 glass to \$349 for a 7x50 suitable for marine work. Zeiss glasses range from \$115 for an 8x20 mini-binocular to \$489 for a giant 15x60 suitable for stargazing. Leitz binoculars (all of them are straight-through

types) start at \$225 for a 6x24 to \$310 for an 8x40.

The Japanese, to the dismay of old-line optical companies, sell at considerably lower prices. For example, you can buy a Tasco 8x30 for around \$19 and pay \$135 for a Miida 8x32 straight-through type. And Vixen recently introduced a 20x80 wide-angle binocular for \$250. The Japanese also use a quality-control system for export binoculars. The JL inspection mark, which is engraved on the binocular body, stands for Japanese Light Machinery Industry. ★★

AMT'S RADIAL DRILL PRESS

(Continued from page 161)

head-and-motor assembly when the locking handle is loosened. (A separate cast-iron table is available at \$3.95 extra and when this is used, the coil spring is removed.)

Auxiliary table helps

For light offtable drilling it's possible to use the workbench to which the drill press is bolted, but it is recommended that you add an auxiliary table to the base casting so you will have a suitable-size work support when the horizontal arm is extended beyond the base casting. I found that two 3/4-in. thicknesses of plywood glued together and bolted to the base casting will provide you with a good solid auxiliary table.

Because there is no stop to automatically return the tilting head to a 90° angle with the table, you must either use a try square or scribe index marks in both the horizontal arm and the face of the two-way slide clamp and align the marks.

If you want to call it a fault, the one thing I did notice was a slight shimmy in the machine when drilling with the head fully extended. This, however, is something which is inherent in the offbalance design of all radial drill presses, but since most drilling is done with the drill head and motor positioned at a balanced point, only on such occasions when maximum throat capacity is used do you experience vibration. But for my money, to have a 17-in. throat available, the slight shimmy is a worthwhile "fault."

For safety in shipment the head and base assemblies come unassembled, but you get full instructions for putting the machine together and operating it. For more information on this unique drill press and other low-cost workshop machines write the manufacturer, American Machine & Tool Co., Dept. PM, Royersford, Pa. 19468. ★★

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'72 FORD, LINCOLN-MERCURY

(Continued from page 101)

fanfare is this year. The Ford and L-M intermediates are new from the ground up. The two-wheelbase approach has been adopted for both lines: 114 inches for two-door models, 118 for four-doors.

Overall lengths for Torinos vary depending on body style and series; the "high series" Gran Torinos are longer, and have a bolder, more distinctive front end as well. There are nine models in the line, down from 14 last year. Montego is also available in nine models, including for the first time a fastback model, the GT.

Both cars share new perimeter-frame and separate-body construction. This body-on-frame design incorporates energy-absorbing S-shape front rails. Front disc brakes are now standard, and the new front suspension carries the coil spring between the upper and lower arms. The rear suspension is also new, using upper and lower links, coil springs and angle-mounted shocks to lower roll center and provide good directional stability. Side impact protection has been added, also a new sound and insulation package.

Ford and Mercury are little changed for the new model year. On Monterey, automatic transmission and power steering become standard equipment. Additional options such as Sure-Track Brakes, which prevent rear-wheel lockup, can now be ordered on any Mercury.

Ford's front end looks different for '72, if you look closely, that is. The model lineup stays at 19. Inside, a 12-inch-wide mirror improves rear visibility and handsome high-back buckets are standard on LTD Broughams. A new pin-and-slot bumper-jack system is an improvement (it's also on T-birds, Torinos and Rancheros). Electrically operated sun roof and rear deck release are new options.

Thunderbird loses its nose for 1972. The center grille and hood still "thrust forward," says Ford, "but in a softer, wider and more rounded manner." T-bird's new body (two-door hardtop only) is on a new frame with four-link suspension in the rear. Increased dimensions particularly benefit rear-passenger space.

Many new interior and exterior design features characterize the car, but most notable are the technical changes under the skin: improved steering column, new front discs, radials standard, side impact protection, and noncorroding plastic fender aprons are some. Ford's new 400-cu.-in. V8 with two-barrel carb is T-bird's standard engine with the 429 an option.

Mustang, after the significant changes of the '71 model year, is practically un-

changed this year. Power team revision is most significant: The 250 Six starts the lineup and the 351, four-barrel, HO V8 tops it off. All engines use regular fuel. The 351 premium fuel engine and the 429 are no longer available. For '72 the 351 HO is a Hot Option available in all three Mustang models. Convertible interiors have been upgraded with better trim, fabric and steering wheel standard.

Cougar, also changed extensively for '71, is little different this year. It still comes in five models—a two-door hardtop in the Cougar, XR-7 and GT series and a convertible in the Cougar and XR-7. The 429 engine has been dropped, but still offered are three versions of the 351-cu.-in. V8: the standard 351 with two-barrel carb, the 351 CJ with four-barrel carb designed for high revving and deep breathing, and the so-called "quiet exhaust," detuned version of the CJ. The latter is available with automatic transmission only and a lower numerical axle ratio is standard.

Mark IV is the latest Continental in a series that began in 1939 with the Mark I. The Mark II appeared in 1955 and the III in 1968. The 1972 Mark IV is a motor car four inches longer and a half-inch lower than the III. Wheelbase is up a bit over three inches. Interiors are roomier and more luxurious with new standard features like six-way power seats and other convenience, safety and appearance hardware.

The Mark IV has many features standard that are optional on a less expensive automobile, but, still, over a dozen extra-cost options—such as electric sun roof, intermittent windshield wipers, headlamp dimmer and reclining passenger seat—are available. Under the hood is the 460 V8 and the Sure-Track Brake System continues standard.

Lincoln Continental gets its vent wings back for '72 (on the four-door model). The front vent windows, or mini vents as L-M calls them, are power operated. Many power features are standard on the car: windows, steering, brakes, seats and other convenience and comfort items.

Pantera is, because of its high degree of refinement in automobile design, its consequent \$9000 price and its two-seater impracticality, of limited interest to most potential new-car buyers. It is, of course, of great interest to the enthusiasts who appreciate the performance potential of the 351 V8's amidships location, the rack-and-pinion steering, fully independent suspension, steel-belted radials and four-wheel power disc brakes. Also standard in the steel monocoque body are power windows. Only options are AM/FM stereo, air and magnesium wheels. ★★★

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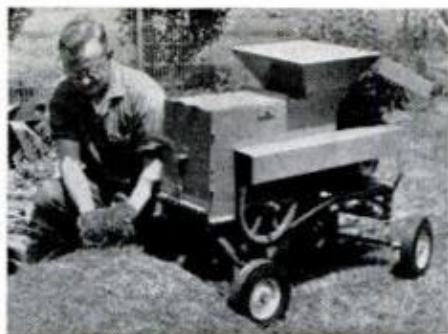
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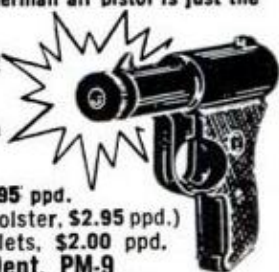
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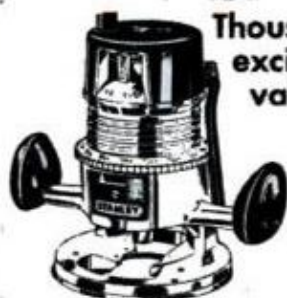


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ALL-AROUND RIFLE?

(Continued from page 108)

maximum combination of accuracy, reliability, durability and convenient operation.

There are .30-06 semi-automatics, pumps, bolt actions and single-shots. No .30-06 lever-action models are currently available. All models are acceptably accurate and reliable, but we want to choose the best of the batch. The bolt action ranks first in accuracy, durability and reliability; the single shot second; and the others about equal thereafter. In convenience and speed of operation, however, the standings are reversed. The auto comes first, followed by the pump, lever, bolt, and single-shot. But speed of operation is always after accuracy in importance, and the difference between the various types is small when one considers that time must be allowed between shots to secure a new aim. Fast repeat shots are usually just so much noise and wasted lead.

Bolt action possesses other advantages: It's easily disassembled for cleaning; has camming power to chamber damaged, dirty, or bent cartridges; and, in the event of a malfunctioning cartridge, is better able to clear the chamber and get it back into operation. These things are mighty important when you are many horseback or foot-slogging miles from a gunsmith.

But what *kind* of bolt action? We want a rifle with a sufficiently heavy barrel to produce good accuracy, and one long enough to give the claimed ballistic performance of the cartridge. These factors rule out the ultralightweight, stubby-barreled carbines that have somehow become so popular. Not only are these guns less accurate, they kick like the dickens, and muzzle blast is very bad. We recommend a medium-weight 22 or 24-inch barrel which brings rifle weight up to at least 7 or 7½ pounds. Another half-pound makes the rifle even steadier for those quick shots taken when you're puffing after a quick dash to shooting position.

If you are a staunch devotee of iron sights, the stock must have a comb low enough to allow free and easy use of these sights. Many of today's rifles are made with the assumption that the buyer will install a scope. Therefore, the stock comb is really too high for the sights that come with the gun. If you have to make an effort to crowd your eye into line with the sights, sooner or later you're going to miss a shot—and it will probably be at the best trophy you've seen all season! But, if you install a scope, select the comb height that will place your eye in line with the scope's centerline.

Make and model is a matter of personal

preference and budget. Good .30-06 rifles begin at \$121.95 for Savage's model 110E and \$124.95 for Mossberg's new model 810. Prices, thereafter, range up through Browning, H&R, Ithaca, Remington and Winchester models from \$140 to \$180 to premier and custom designs for \$300 to \$350. Some makers offer \$5000 models, but I feel no field weapon should ever cost more than 1/10th that amount. For \$100 to \$300 you can get a safe, accurate and dependable rifle that will serve all your hunting needs and still do well for your sons when they start to hunt. ★★★

CLOCK TIMERS

(Continued from page 115)

no setting, but they also possess some disadvantages. They stay on all night—longer than you may want your lights to burn—and they go on and off at the same time each day—a tipoff to anyone watching that you probably aren't at home.

To avoid this problem, a few models incorporate both a photocell and a clock movement. The photocell turns on your lights at dusk, and the timer can be set to turn them off at a selected hour later in the evening. One nice thing about this setup is that your lights go on at dusk, regardless of seasonal changes in the time of day. However, Paragon, which used to incorporate a photocell in its timers, has now eliminated it, believing that adjustable "on" settings plus its random-off feature offer more flexibility and realism.

In buying a timer, regardless of type, it's important to know its power-handling capacity. Some lighter-duty models, rated at six or seven amps, are fine for lights, radios and TV sets, but may not handle heavy-drain appliances such as airconditioners. Paragon, for instance, makes a timer specifically designed for airconditioner use and rated at a hefty 12 amps. A few other timers go as high as 15 amps—enough capacity for a full circuit load.

Most timers are rated in amperes, although a few use wattage as a measurement. Appliances can be rated in either amperes or watts, depending on the maker and type of equipment. If you want to compare the two, you can convert amperes to watts by multiplying the number of amps by 117—standard house voltage. To convert watts to amps, divide by 117. Intermatic timers are made by International Register Co., 4720 West Montrose, Chicago, Ill.; Paragon timers by Paragon Electric Co., Inc., Two Rivers, Wis.; Rhodes timers by M. H. Rhodes, Inc., Hartford, Conn.; and Calectro timers by GC Electronics, Rockford, Ill. ★★★

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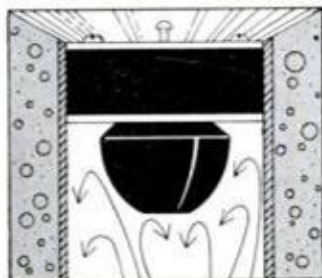
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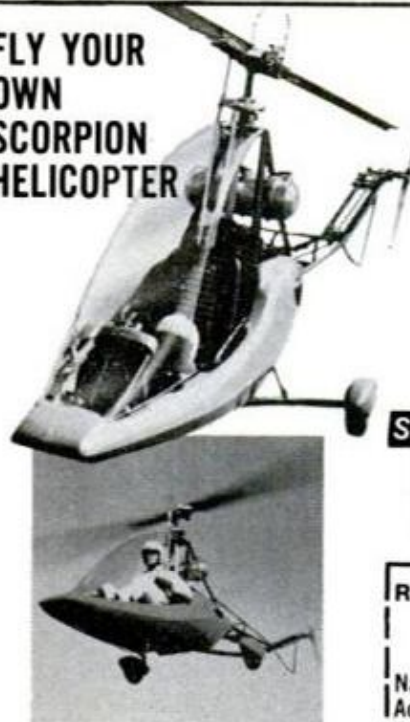
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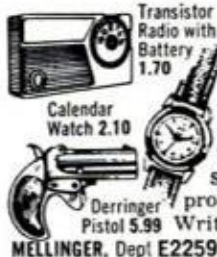
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(Continued on page 202)

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(Continued from page 198)

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(Continued on next page)

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(Continued from preceding page)

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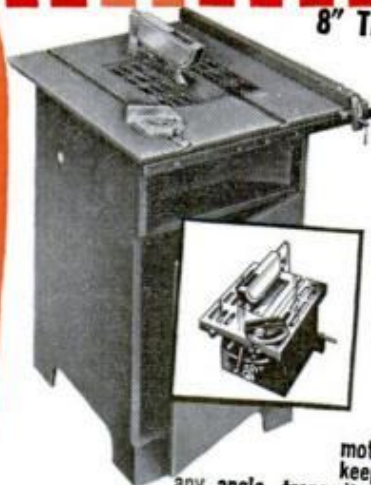
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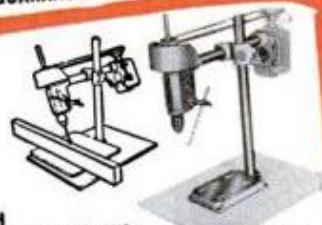
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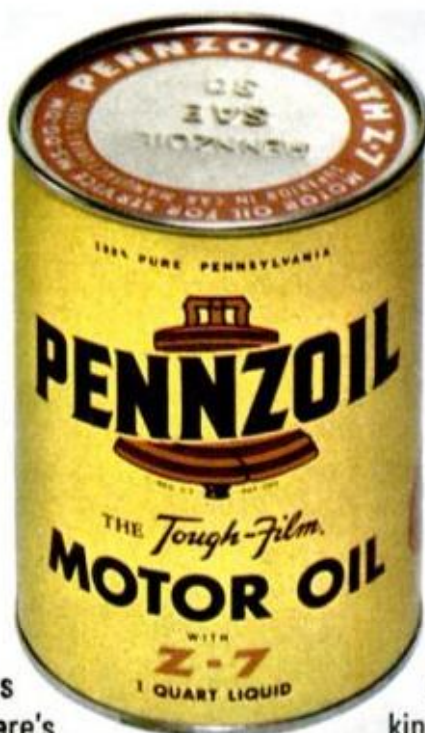
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