

Outdoor decorations that cost almost nothing

Handsome furniture
for under \$100

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POPULAR MECHANICS

DEC. 1971
50 CENTS



**Race your own
radio-controlled car
against top drivers**

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CYCLES:

■ We build and test
three kit bikes
for the trail

Page 80

■ Kawasaki's hot
new 350

Page 88

**Appliances:
Fix 'em
and save**

**A gutsy salvage team gambles all in a
nine-day battle against the sea** Page 92

BEAUTIFULLY GIFT-PACKAGED AT NO EXTRA COST.
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86 PROOF. 65% GRAIN NEUTRAL SPIRITS.



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New "Scotch" Brand High Energy could make ordinary cassettes obsolete.



Today, a new "Scotch" Brand cassette, High Energy, makes ordinary cassettes sound as old-fashioned as 78 rpm records. For good reason. Its new, cobalt-energized tape is a major breakthrough in magnetic sound technology. Not just a little better. A lot. With 3 to 5 decibels improved signal to noise, 50% more output than today's high density cassette tapes.

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"Scotch" High Energy cassettes make only one thing out-dated: the sound you heard from yesterday's cassettes.

Magnetic
Products
Division **3M**
COMPANY

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This One



XUOR-9D6-U2H3

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**I can buy
passenger car tires
for less than truck
tires and get the same
mileage out of them.**

**I can buy truck
tires for less than
car tires and get
more mileage
out of them.**



Do you know which man is right?

To a lot of people, "truck tire" sounds expensive, and because passenger tires will fit their pickups or vans, they reason they can save money with them.

Did you know you can buy a real truck tire—the Firestone Transport—with a 6-ply rating, for about \$8 to \$10 less than a comparable size original equipment passenger car tire? And get longer mileage in truck service with the truck tire?

Why? Because the Transport is designed for truck use, with Shock-Fortified nylon cord body plies and heavier construction to handle the road hazards with a tread made from a

specially compounded Sup-R-Tuf® long mileage rubber, and with reinforced beads and sidewalls.

See your Firestone Dealer or Store. Ask about the truck tire that costs less and lasts longer than a comparable passenger car tire, in truck service, the Firestone Transport. And yes, it also comes in whitewalls. Transport®



Firestone

Transport®

POPULAR MECHANICS

Our picture collection might help you collect more game.

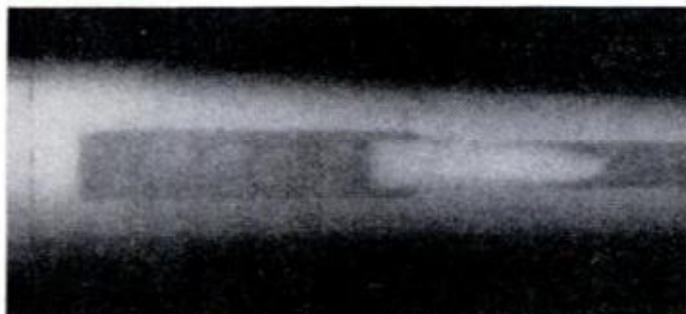
Here's how Remington-Peters engineers are using photography in continuing research programs designed to bring you the finest center-fire ammunition made.

Scientific photography has come a long way from the old box camera. Today, Remington-Peters research facilities are equipped with incredible space-age devices. Among them an ultra-high-speed stop-action camera that can capture an event at less than *one-half-millionth of a second*. Another amazing device is an X-ray system which photographs what happens inside a barrel when a rifle is fired. It can record events at less than *eighteen-billionths of a second*. These two systems were

racy, creates a better understanding of ballistics. This in turn leads Remington engineers to develop those fine differences in our product that produce more reliable, accurate hunting performance.

Research of this type has helped Remington-Peters engineers design their big-game "Core-Lokt" bullets in four shapes—Soft Point, Pointed Soft Point, Hollow Point, Bronze Point Expanding—to meet different hunting requirements. It also helped in the development of the super-accurate "Power-Lokt" Hollow Point varmint bullets. And, of course, this is only one of the many types of research projects that are carried on at Remington-Peters.

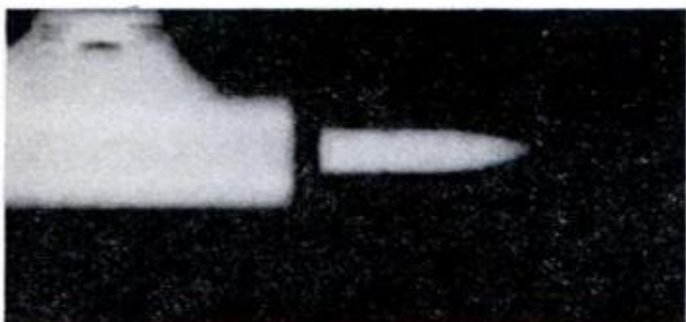
So don't just ask for "A box of cartridges" the next time



Bullet before firing. This first picture is an X ray, showing a Remington 7mm Magnum awaiting ignition inside a Model 700 rifle. If you look closely, you can see the outline of the cartridge.



Traveling down the barrel. The next X ray shows the bullet moving down the barrel at approximately 1900 feet per second. By relating the position of the bullet to a chamber pressure and time, Remington engineers get a better understanding of the dynamics of the firing cycle. This type of research leads to more uniform performance by the combination of primer, propellant and bullet—and hence better accuracy for the hunter.



Leaving the barrel. The last X ray shows a bullet departing the barrel, being pushed by the hot gases. At this critical point, accuracy is greatly influenced. Slight deflections, yawing or other abnormal conditions at the muzzle can be detected with this X-ray technique, which "sees" through the muzzle blast.



At the target. In this amazing high-speed photograph, a bullet is shown entering the hole made by a previously fired bullet. Now, that's accuracy. The rifle was fired from a machine rest.

used to get the pictures that you see on this page.

These pictures are stoppers in more ways than one. The pictures are fascinating to look at, but they also contain important information for our engineers, because they let them see and study what happens when a bullet is fired. They tell the engineer just when and how rapidly the bullet leaves the case, how it accelerates through the rifling and how well balanced it is as it emerges from the muzzle. All this, together with information on pressure, down-range velocity and accu-

you go hunting. Ask for Remington or Peters brand ammunition. You'll find a factory load in just about every common caliber. You might just happen to find that you're dropping more game with fewer shots.

Remington Reports are based on facts documented by the people who design and make our products. To get a free folder to keep them in—and a free catalog—send a postcard to: Remington Arms Company, Inc., Dept. 351, Bridgeport, Conn. 06602.

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Great guns deserve great ammunition. We make both.

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Cover photo by Bob Grant

Race your own radio-controlled car against top drivers and reach scale speeds of up to 300 mph!

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You can be your own minibike mechanic.
In defense of snowmobiles.
Tuning in the world: what, when, where.

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Executive Editor

JOHN A. LINKLETTER
Managing Editor

WAYNE C. LECKEY **SHELDON M. GALLAGER**
Home and Shop Editor Assistant Executive Editor

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After you've sanded, painted and finished the job, admire it with

the good stuff.



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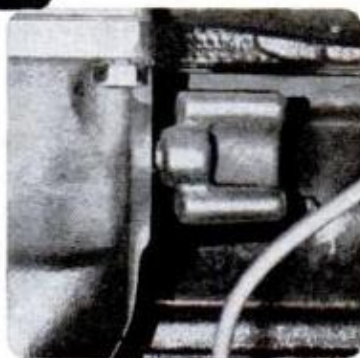
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When cold weather chokes up your car you've got real starting problems... unless you've got a can of GUMOUT AUTOMATIC CHOKE CLEANER handy. It frees sticking chokes fast. Used regularly, it prevents sticking.



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LETTERS TO THE EDITOR

Bottles add flotation?

I cannot understand how you would add flotation to a boat in an upright position merely by putting empty plastic bottles under the floor boards (*Boating Tips*, page 110, Sept. PM).

ARROYO GRANDE, CALIF.

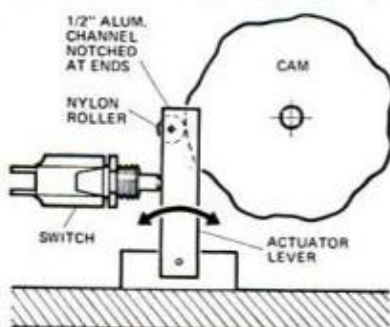
E. R. ROY

They wouldn't add flotation normally; only if the boat were capsized (which the text admittedly did not make clear).

Actuator for House Watcher

I purchased the ready-to-assemble kit for PM's *House Watcher* (page 120, June PM) and put it together according to your article. I found that even with good alignment of the motor shaft and adjustment of the on and off switches, the friction created by the switches rubbing on the cam was too great for the motor.

I devised a method to reduce the friction to a point where the shaft could be turned merely by grasping it with the



fingers. I installed an actuator lever (drawing) and nylon roller for each cam, and it works very satisfactorily. Each nylon roller is 1/2 in. in diameter

by 3/8 in. wide, attached with 3/32 by 5/8-in. roll pins. The actuator lever is 1/2 by 5/8-in. aluminum channel, notched both ends, and attached to a small wood-block base with a 3/32 by 5/8-in. roll pin.

NILES, MICH.

E. E. ULLREY

Side-by-side, 55 years ago

You call attention to a side-by-side bicycle (*No Falling Now*, page 90, July PM) as the brainstorm of Jim Fox of Sarasota, Fla. I suggest that you take a look at the cover of the March 1916 issue of PM, which shows that a Cleveland put the same idea to use 55 years ahead of Mr. Fox.

NASHVILLE, TENN.

JACK E. CUSTER

PM did, indeed, report in 1916 under the headline, Queer Cycle Is Designed to Carry Five Riders, that a Cleveland bi-
(Please turn to page 8)

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01D

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George R. Kelly,
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LETTERS

(Continued from page 6)



cycle dealer constructed "a heptacycle, a seven-wheeled vehicle built to accommodate a quintette of riders. The conveyance consists of the frames of five bicycles joined side by side . . . and the steering posts securely mounted in a steel bar extending along the front. At either end . . . is a wheel supporting the front . . ."

Nature's secrets not so secret

At first glance, *How We're Reading Nature's Secrets From the Sky* (page 68, Sept. PM) seemed to promise a thrilling scientific breakthrough. However, it dawned on me that for some 36 years we in the Soil Conservation Service have been doing practically all the marvelous things mentioned in the article. Our exotic equipment includes aerial photos, a \$2 Army surplus stereoscope, a pair of good eyes and experience.

DUBLIN, TEX.

THOMAS R. BONE

Wants more on bikes

The Minicycle—a Whole New Breed of Bikes (page 140, Oct. PM) is great. Can we get more about bikes? How about building them? And servicing them?

GREENWICH, CONN.

DOUGLAS AUSTIN

Look on page 80 for an article on building bikes, and get the January issue for an article on service.

You mean, steal 'em?

I was shocked to read in the *Boating Tip* entitled *Cartop boat wheels* (page 111, Sept. PM) that you suggest using shop-

(Please turn to page 10)

WE CAN BOWL YOU OVER WITH COLORS

If you don't like blue, we've got red, green, and yellow briar bowls in four popular shapes that never chip nor blister. And like all Falcon bowls they're interchangeable to fit Standard, Oxford, Classic and the new Shillelagh stems, too.

And no matter how you color it, every Falcon pipe gives you a cool, clean smoke. That's because all Falcon pipes have an exclusive, easy to clean, tar free "trap" beneath the bowl that collects tar and moisture.

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Available at better pipe counters everywhere or write: Falcon International, Inc., 4117 North Kilpatrick Ave., Chicago, Illinois 60641

The nice thing about our small economy truck is all the extras you can suddenly afford.



Our small economy half-ton offers you 3 big advantages. A small price. A small gas bill. And small truck maneuverability.

But just because we're smaller and less expensive doesn't mean we're not tough. We hold a full 1,000-pound load just like bigger half-tons do. What's more, our small truck has a big-on-power single OHC engine that can haul a full load at maximum highway speeds. And a special heavy-duty suspension system for smoother riding. Empty or all filled up.

Our low-priced Toyota Half-Ton also comes

with an easy-to-handle 4-speed synchromesh transmission. 6 ply-rated tires. Flo-thru ventilation. A full 6-foot bed. Padded dash. A towhook that bolts to the front of the truck. Tie hooks all round the bed. And a spare tire under the truck that you lower with a hand crank.

In short, when you buy our small Toyota Half-Ton, you get a lot of truck. With enough money left over for some other nice things as well. Things you can't always afford when you buy big.

Toyota Half-Ton.

Camper and special outside mirrors not standard equipment.

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—Francis von Schrader, President

Perfect because with Von Schrader Detergers you provide a service everybody needs: on-location cleaning of carpeting, upholstery and walls. Perfect because every home and building are potential customers—your business keeps growing.

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Perfect because your investment is so small you'll find it hard to believe. And perfect because we help you every step of the way, just as we've helped thousands of other men to financial independence for almost 40 years.

For details (without obligation) send coupon.



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LETTERS

(Continued from page 8)

ping cart wheels. With the coverage your magazine gets, I'd say that there are now about 960 shopping carts without rear wheels because of your article. At about \$40 each, that's about \$38,400 that will be added to the cost of food in the stores from which the carts were taken. Why not just recommend an 8-inch wheel?

HUNTINGTON STATION, N.Y. E.W. KUDER

We've often suggested using parts of junked cars without implying that readers steal the cars. However, the ease of making off with carts gives your argument validity. So from now on it's "8-inch wheels."

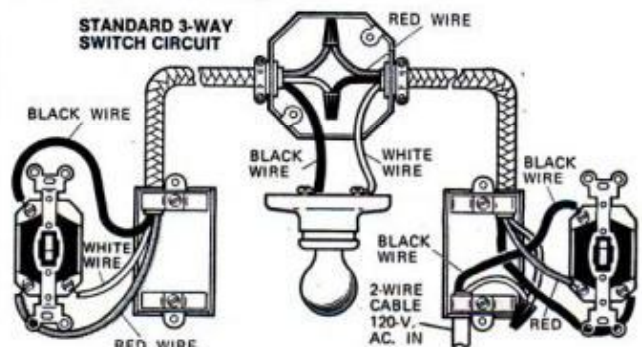
Three-way switch warning

Install a Three-Way Switch Yourself (page 182, Oct. PM) does not conform to safety codes or safety practices! In one "off" position, both wires to the fixture are hot—which could be dangerous to a person replacing a light bulb.

Article 200 of the National Electrical Code states that the white neutral wire is to go to the shell of the lampholder. Technically, none of the three wires to the second three-way switch should be white, but since three-wire cables have a white wire, an exception to this is made in Article 200-7 Exception 2 where an identified conductor may be used where the connections are made so that the unidentified (black or red) conduction is the return conductor from switch to the fixture.

SOUTHOLD, N.Y. DONALD E. TUTHILL
ELECTRICAL CONTRACTOR

We regret the error. While the switches, wired as shown in the October issue, will work, they do present a shock hazard and will not pass inspection. To conform to safe practice, the neutral (white) wire should never be switched in a three-wire hookup; neither should a green wire be used except for grounding equipment. The diagram shown here is a correct—and safe—hookup. ★ ★ ★



POPULAR MECHANICS

Материал, защищенный авторским правом

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.

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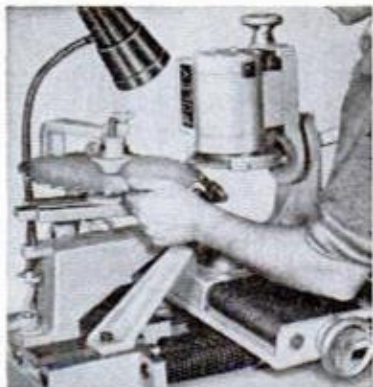
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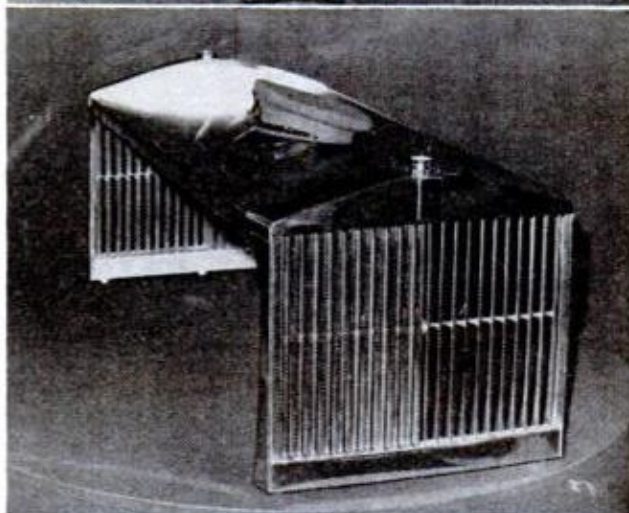
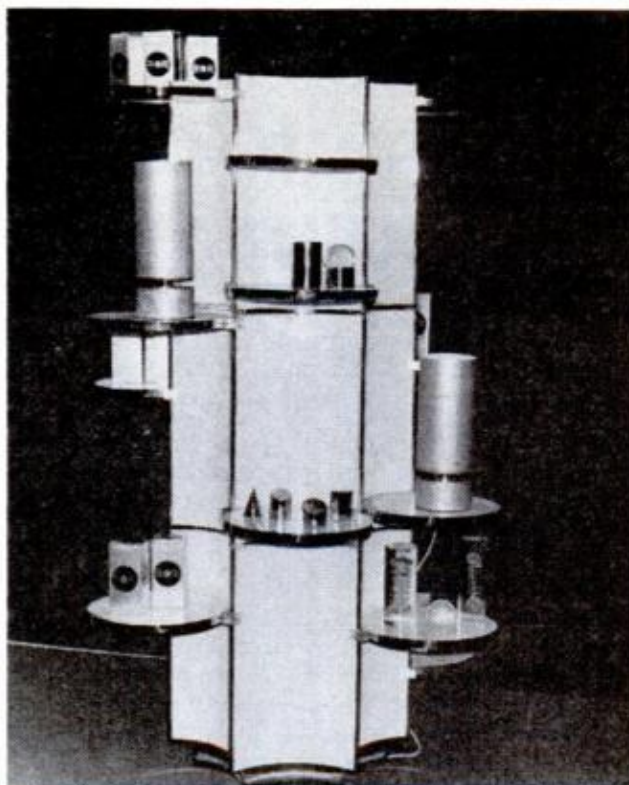


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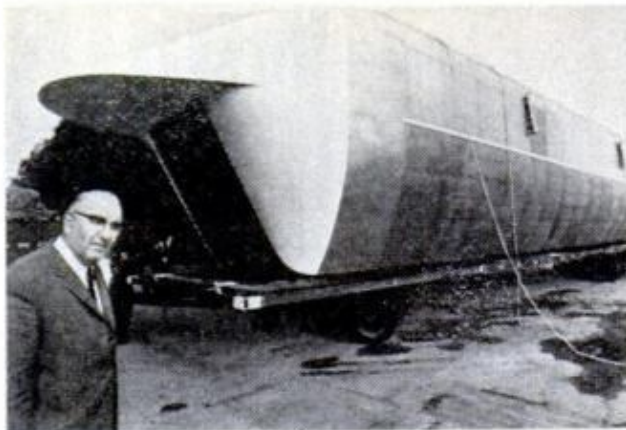
Rocket cutting torch

Using techniques learned in the space program, United Technology Center has developed a lightweight, self-contained cutting torch that can slice through $\frac{1}{4}$ -inch steel a foot per minute. The torch is a hybrid rocket motor with a flame temperature over 5000° F.



Jet-engine firefighter

To increase their mobility and get more power, Soviet Union forest firefighters have mounted a jet engine on a heavy truck. The harnessed engine, according to Russian technicians, can pour out a combined stream of gas and water at 220 pounds per second.



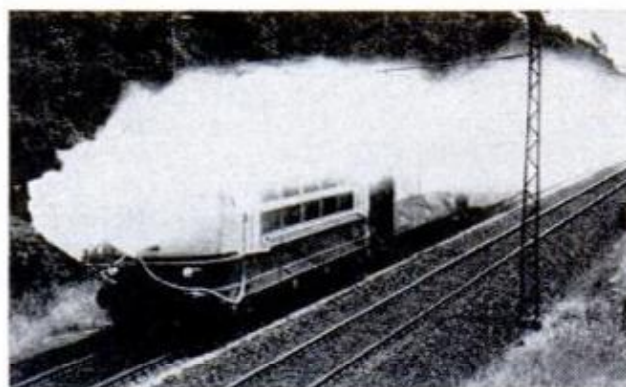
Air-cushion train

Test trials have begun on England's first hovertrain, the RTV 31, designed by Alfred Bunting (above) to reach a top speed of 350 mph. The large vehicle is powered by a new electrical magnetic system; it travels on a cushion of air when moving over rails.



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The Argocat, a go-anywhere vehicle that can cross rivers, climb hills and plough through mud, sand or snow, carries four English firemen and their pump to remote blazes.



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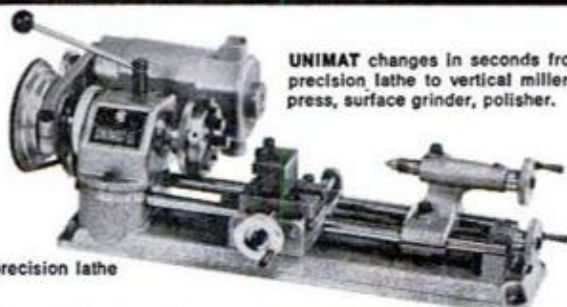
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DETROIT LISTENING POST

BY ROBERT LUND

SMALL CAR IN THE WORKS AT BIG C? Yes—on paper, that is—though Chrysler continues to say no dice to building a minicar for the U.S. market. Nothing's been worked up in clay or metal. The company's hub-cap deep into a program to develop a small, low-price car for the world market. Chrysler's convinced there's a great market for a U.S.-engineered, U.S.-styled car in countries where buyers can't afford Pintos, Vegas and Gremlins. But you probably won't be able to buy one when it's ready, unless you make a trip overseas, because the company isn't going to risk cutting into sales of its standard U.S. products by dangling a dime-store dazzler in front of your eyes.

THREE-BEAM HEADLIGHTS—low, medium and high—projected from a single lamp are under experimentation by all auto manufacturers, but the industry's in no hurry to put them on cars. Safety engineers say the three-in-one could cause confusion, because the driver would have to decide which beam he should use and when to activate it.

What lighting engineers would like to come up with is an inexpensive dimming device that would cut in and out automatically depending on surrounding and oncoming light. GM developed such a device back in the '50s—the Autronic Eye—but it never caught on (except on Cadillac) for two reasons: (1) retail on the item is \$50, and (2) the gear benefits oncoming cars rather than vehicles carrying the eye.

Except for Cadillac owners, nobody wants to shell out for accessories that making driving easier for the other guy.

Speaking of Cadillac, that division's working on an electronic self-starter. It automatically starts the car or restarts it, if it stalls, after the ignition key is inserted in the cylinder. There's no human element involved, such as pumping the gas pedal or holding the key down until the engine catches hold.

SOME AUTO ENGINEERS say it just might be possible to meet 1976 standards on nitrogen oxide emissions if—and that's an elephant-size if—a way can be devised to virtually seal the engine for 50,000 miles. Engineers aren't optimistic that this can be done at a price car buyers can

afford to pay. Ford believes it may be able to produce an almost smog-free engine—the stratified charge job you've been reading about in the papers—but it couldn't be touched after being tuned at the factory.

COWBOY IS THE NAME American Motors is using for the mini pickup it will build on the Hornet shell. But that may be a code designation while the vehicle's in incubation and the finished product could carry a different name. AMC's hoping to have the new entry ready for its '73 line, but that may be pushing it a little.

THE SLIDING SUN ROOF is obviously seen as a hot item at GM and Ford. GM's checking out what would be involved in building its own unit, instead of farming the work out to suppliers. If the sliding roof should become a big seller, GM wants to be in a position to install it in its own plants.

Ford, also gung-ho on the sliding sun top, is rushing to offer it as an option on Pinto within the next couple of months.

IMPACT-RESISTANT BUMPERS which GM decided to voluntarily install on all its full-size '72s make one wonder if this was an element of "getting back at Ford." GM denies it was so motivated, but company sources admit orders to install the bumpers came from GM's top management. GM, Chrysler and American Motors haven't forgotten it was Ford who broke ranks with other automakers by telling the government its bumper standard wasn't tough enough. In coming up with bounce-back bumpers a full year ahead of the legal deadline and ahead of all other automakers, GM served notice on rival car-makers—Ford in particular—that it isn't going to be out-safetied by the competition.

Ford also suggested the government toughen its rule on seat belts. The company believes that the warning buzzer, which alerts the driver to buckle up, should continue buzzing for five minutes, instead of one. Will GM pick up that challenge, too?

A NEW FOUR-DOOR CRICKET is coming to Chrysler from England next fall. This could

(Please turn to page 18)

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DETROIT LISTENING POST

(Continued from page 16)

be the spur Ford needs to bring out a four-door Pinto. The Ford mini currently comes in two flavors, a two-door and a three-door. Addition of a four-door would leave Pinto one car shy of matching the four-car line offered by rival Vega, but give Ford as much coverage in the car department as Vega has—lacking only a minitruck, which Vega has now and Ford is working on.

A HALF-CONVERTIBLE CAR? Not to be confused with GM's safety research job, which has a steel roof, what would you say to a car with a B pillar and steel roof back of the B, but a peel-off fabric top between the B and the windshield, a la Corvette and Porsche's Targa. GM and Ford have sketches of such cars, but have made no preliminary moves to indicate they'll put them in production. If the objection to the convertible is that it's unsafe because there's no roof to absorb the punishment in a rollover, the half-convertible may be the answer; with a B post it's easy to build in a rollbar.

CAR-OWNER REGULATIONS. After writing what amounts to an encyclopedia full of regulations covering the way cars are made, the government may get around to writing and enforcing a few rules that specifically cover car owners. If you pull a trailer, for example, Uncle may specify the size engine that you have to have in your car.

Detroit's argued for two years that it doesn't make sense to legislate the industry on emissions if car owners aren't required to keep antipollution hardware functioning. Take a small car with a small engine hooked up to a trailer, for instance. The car may be a relatively low polluter when it comes off the assembly line, but it doesn't take long to turn it into a belching monster if it happens to be hooked to a trailer that's heavy enough to overtax the capacity of the engine.

The cure, automakers say, is to write a rule requiring that engines be matched to the job they're going to do, if the vehicle in question is to be used for purposes other than that of carrying passengers.

BOB ORBEN, official supplier of end-of-the-column punchlines for *Listening Post*, on the new bumpers: "So Detroit's developed a bumper that'll absorb an impact of five miles an hour. That takes care of nearsighted joggers. Now how about figuring out something for cars?"

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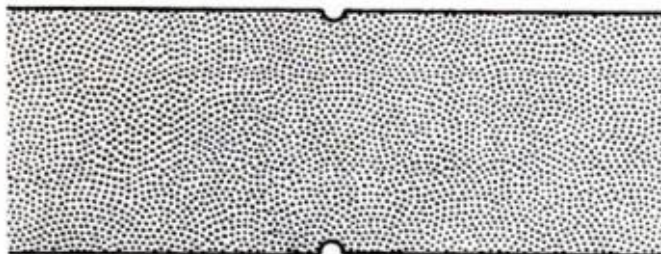
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APPLIANCE CLINIC

By PAUL MANN

Cool hot water

Recently I had a Hotpoint electric water heater repaired because it didn't provide enough hot water. The serviceman told me he installed new heating elements and thermostats. Though the heater is somewhat better, I still don't feel the water is hot enough. Should anything else have been done?—Jack Whitney, Nanuet, N.Y.

An electric water heater is basically a simple heating device (see sketch at right). Its only parts affecting water temperature are the heating elements (usually two—upper and lower) and thermostats. First, make sure the temperature is indeed below what it should be. With thermostats set at "normal," run hot water from a tap and check its temperature with a thermometer. This should be 140°F., plus or minus 10°. If not, then the trouble lies with the elements or thermostats.

If these parts are new, as you say, I'd guess that perhaps the elements aren't right for your tank or that the serviceman inadvertently reversed them. In a two-element heater, for example, the upper element may be rated at 1500 watts and the lower element at 1000 watts. Accidental use of the wrong elements or switching them will keep the water from heating to the proper temperature.

Polarization

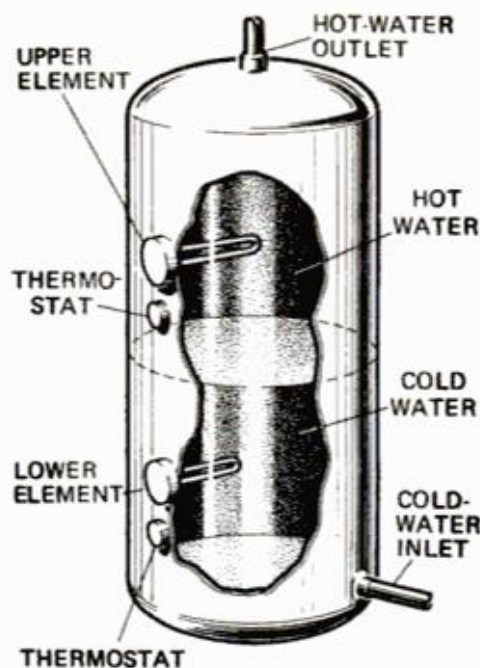
What is a polarized plug?—Fred Langer, Knoxville, Tenn.

It's a plug that can be plugged in only one way. Manufacturers use it on appliances for safety reasons. A two-prong polarized plug will allow a fuse to blow or a circuit breaker to trip if a short develops in the appliance housing. A three-prong polarized plug provides a separate ground for the housing.

Barbecued prongs

What causes the male prongs of an electric table oven to become so badly damaged they must be replaced? I refer to the two prongs onto which the cord plug fits.—Frank St. Andrews, Columbus, Ga.

Prongs will burn and pit badly when



there is poor contact with the cord plug. If you have the usual type of table oven and cord, the plug probably has an on-off switch. Some people have a bad habit of plugging the cord into the prongs with this switch on. This causes heavy arcing that burns metal off the prongs. When enough is burned away, good contact between plug and prongs is lost. Continued heavy arcing ruins the prongs and may require replacement of the cord plug.

Where the money goes

Our Hamilton Beach food mixer has stopped completely. A serviceman told us it's not possible to say exactly how much the repair will be, but he judges that it could cost more than \$10. What kind of a repair can cost this much?—Ralph Farley, Fairfield, Conn.

Several malfunctions can cause a food mixer to stop completely. In any case, this repair shouldn't cost \$10. I judge from this price that the serviceman is anticipating he'll find an open field coil in the motor. I assume the line cord is okay, but have it tested for continuity. A flexible wire lead from a brush to a switch may have broken. You may also have a bad connection or dirty contacts at the selector switch. Check each of these possibilities before the motor is taken apart. Any one is more likely to be causing your trouble than an open motor coil—and a lot less expensive to fix. ★ ★ ★

If you have a question about any appliance, send it to Appliance Clinic, Popular Mechanics, 224 West 57th St., New York, N.Y. 10019. Sorry, but letters cannot be answered individually. However, problems of widest interest will be answered in this column.

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AUTOMOBILE CLINIC

BY MORT SCHULTZ

Putting on the squeeze

So far I've had to replace the exhaust manifolds in my 1969 Valiant two times—three coming up, because the one now in the car has cracked. The manifolds last about 20,000 miles. My mechanic can't explain what's happening. Can you?—Harold Nitz, LaCanada, Calif.

There has been no problem with Valiant manifolds that I know of, so let's guess as to what is happening. My guess is that the man who's installing the part may be overtightening. The correct torque is 10 ft.-lb., which may seem like almost nothing. Perhaps that's why the mechanic is giving the part an extra twist for good measure. If so, he is denying the part the "play" it needs for expansion as it gets hot. Without this "give," the manifold will crack.

Worlds apart

I have a 1967 Volkswagen that has run up 75,000 miles. An authorized VW dealer says it needs a valve job, which I'll buy. But he says he won't guarantee the job without installing new bearings. He estimates the work at \$200 to \$350 (quite a spread). I don't see how a valve job can affect bearings. Does it?—Rex F. Wenger, Fort Worth, Tex.

The mechanic probably meant he can't guarantee that the engine won't use oil after the valve job because the increased load on the bearings resulting from the valve job could cause a loss of oil. The valve job will increase the engine's compression, which will place a heavier load on the bearings that could push oil past the rings. In giving such a wide spread in his estimate (\$200-\$350), he is probably taking into consideration the fact that rings may have to be replaced or just bearings or neither. This can be determined only by opening the crankcase. His estimate doesn't seem unreasonable.

Long question; short answer

In the February 1971 Service Tips section of Automobile Clinic you gave a part number for a new oil dipstick for the 1970 Chevelle and El Camino. My 1970 El Camino with 350-cu.-in. engine has an

improper oil dipstick, according to your article, but the local Chevrolet dealer's parts catalog shows the dipstick that you mentioned (part No. 39255991 as being the dipstick for the Camaro only. The dipstick listed in the catalog for my car is the same one that I now have in the car. I believe your information was correct, because my oil level always appears to be high. However, I'm afraid to act. Should I get the dipstick specified for the Camaro?—W. N. Thurman, Huntsville, Ala.

Yes!

Seeing white

I recently bought a new car. When I took possession, the dashboard was loose, the clock didn't keep time, and wires to radio and courtesy light were loose. I believe the speedometer has been turned back, and the car isn't really new. The dealer tells me that if the speedometer had been tampered with, three white lines would show across the face of the meter. Is this true?—Alfred LaRoch, Millburn, N.J.

That depends on the make of car. Chrysler Corp. models, for example, would show blue lines. In any case, with the newer cars there is no way of mistaking a speedometer that has been tampered with. Your troubles stem from shoddy workmanship at the factory. It's the dealer's responsibility to correct these mistakes.

Airing a problem

The only problem I have with my 1965 Volvo with owner-installed air conditioner is overheating when the weather is warm, even at highway speeds, while the air conditioner is operating. My local Volvo dealer says there's no way of correcting the condition short of removing the air conditioner. Can you suggest something less drastic?—Robert E. Cathey, Garland, Tex.

Since an air conditioner in the Volvo wasn't a factory-installed accessory in this model year, those units that owners installed themselves had condensers which were usually too large for the total engine system. There are a couple of things you

(Please turn to page 24)



Marigolds, daisies, mums.
 A shop full of flowers.
 But for them, it's one
 perfect rose. He chose it.
 For her. To remember.
 Their cigarette? Viceroy.
 They won't settle for less.
 It's a matter of taste.

Viceroy gives you all the taste, all the time.

AUTOMOBILE CLINIC

(Continued from page 22)

can try, however. First, make sure that the condenser is mounted as high as possible. Try to leave at least 1 inch of exposed radiator at the bottom. If you still have the regular 335-mm fan which came with the car, switch to Volvo's 360-mm "tropical fan." Its part No. is 667578. Finally, compromise. If the difference between overheating and not overheating is to run the air conditioner at less than maximum output, do so. Better you should drive in a car that is 10° warmer in the passenger compartment than to stand in that hot Texas sun as you wait for the engine to cool down.

Signed and sealed

I am driving a 1970 Mercury Marquis. At about 15,000 miles, the right rear brake started grabbing. The dealer replaced the grease seal. Okay for 6000 miles when the same thing happened. Again the dealer replaced the grease seal. It has started grabbing again after 4000 miles. What now?—Ralph Carlin, River Falls, Wis.

Replace the grease seal again, but this time have the dealer rectify the cause. To me it sounds like an oversize axle housing may have inadvertently been placed into the car during production, which will cause seal failure.

Looks don't count

The four-barrel Carter carburetor on my 1966 Pontiac 389-cu.-in. engine is only nine months old, but I get a definite jerk when accelerating. Plugs and points are new, and the ignition system has been set up according to specification. The carburetor's accelerator pump plunger looks okay. What have I missed?—M. Sgt. Alec P. Cook, APO New York.

I don't go for this business of something "looking okay," Sarge. The tips of these accelerator pump plungers may look like they stepped out of a Fifth Ave. boutique, but they are usually made of rubber and rubber shrinks. The first thing I would do, then, is replace the accelerator pump plunger, which is the major cause of hesitation on acceleration. Now, once this has been done, if the problem continues I would have the distributor removed from the car and scoped, checking in particular for weak centrifugal

advance weights. Also be suspicious of the vacuum advance unit.

Stop starter trouble

My 1969 Chevrolet Camaro with 350-cu.-in. engine and Turbo Hydra-Matic has gone through three starters. They just seem to chew themselves to pieces. The last starter we installed was a 1970 component with a longer gear travel, but this too went bad. All make a good deal of noise when starting. We've checked the battery and electrical system thoroughly. Also I have noticed that all three starters have two bolts, but the engine has a three-bolt pattern. One mechanic now suggests that we replace the flywheel. What should I do?—John Lore, St. Louis.

Replace the flywheel if flywheel ring gear teeth are cracked or broken, or if the flywheel ring gear shows excessive run-out. Also make sure the flywheel cover isn't cracked or distorted, which will allow dirt and water to enter the starter drive pinion. If the starter makes noise with or without a new flywheel, it will probably be necessary to shim the starter motor between the drive end housing and cylinder case to obtain the required drive pinion depth. Shim at the outboard bolt for deeper engagement and at the inboard bolt for less depth. The starter motor should be attached with two bolts.

Service tips

● Fuel pump problems with 1971 Ford Pintos having 2000-cc engines can be solved by installing a newly designed pump. It can be identified by a yellow paint spot on the pump body and by part No. 70HF-9350-DB that's stamped on the pump body.

● 1971 Chrysler Corp. cars with 318 or 360-cu.-in. engines now have the N13Y specified as the "normal" sparkplug. This is different from what may have been put into the vehicle to begin with. A car with a 318-cu.-in. engine may have been equipped with a N14Y. One with a 360-cu.-in. engine may have been equipped with a N10Y.

● The Virginia Highway Research Council says the best way to clean bug residue, road oil and other matter from a windshield is with a solution of four parts of wood or rubbing alcohol, one part of household liquid detergent and five parts of water. For best results, use paper towels. ★★

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

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 Pulp Making
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 Sec'y, Legal
 Sec'y, Med.
 Secretary, Executive

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 Power Plant Engineering
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 Textile Designing
 Textile Mill Superintendent
 Textile Mill Supervisor

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 Traffic Management

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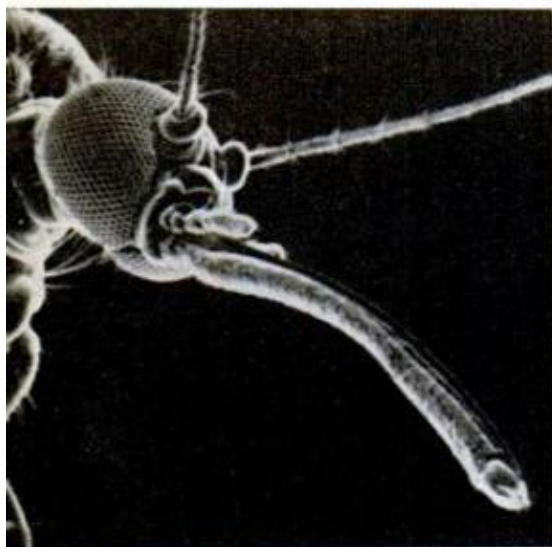
By JOHN PEARSON



Rocking power gets work done

A PUMP THAT USES A SHIP'S ROCKING MOTION for power has been invented by technicians with the U.S. Oceanographic Office and the Coast Guard. Its purpose: to retrieve trace elements in water. Suspended from a cable over a ship's side, the pump's frame oscillates vertically as the ship rocks, causing two banks of bellows to alternately expand and compress. Seawater passes through a filter that traps trace elements, is measured in gallons, then expelled.

HAIR FROM THE HEAD of a 500-year-old Peruvian mummy will help University of Michigan researchers to determine how the human intake of various chemical elements has changed since industrial societies became established. Test results of the mummy's hair will be compared to data derived from the analysis of hair taken from college students, Navy midshipmen and Air Force cadets—lads who come from every section of the country. It's been found that traces of most elements tend to concentrate in the hair. The mercury content of human hair, for example, is some 200 to 300 times the normal amount present in human blood.



Argonne portrait of a skeeter

A SCANNING ELECTRON MICROSCOPE is used by biologists at Argonne National Laboratory in Illinois to study the effects of radiation on small organisms. Their techniques are so effective they can make amazingly sharp photomicrographs of tiny bugs, including mosquitoes that could pass for Martian monsters. The type of microscope used can be likened to a television system, with the microscope column constituting a high-resolution camera tube.

VEGETABLE WASTE, SEWAGE SLUDGE, and cow, chicken and other manure are being converted into crude oil at the Bureau of Mines Energy Research Center in Pittsburgh. The gunk is cooked along with carbon monoxide and pressurized at 1200 pounds per square inch. Result: water and an oil that's not quite as rich as the stuff that comes out of the ground. The method is still experimental.



Air-cushion gear on test model

AN AIR-CUSHION LANDING SYSTEM to enable military transport planes to operate from rough fields, swamps, ice, snow or even water is under development at Bell Aerospace, Buffalo. The landing gear looks like a huge inner tube under the plane's fuselage. An on-board compressor produces pressurized air that escapes through hundreds of vent holes in the "inner tube," forming an air cushion. The aircraft to be used as a test bed for the system will be a de-Havilland "Buffalo" STOL plane. ★ ★ ★

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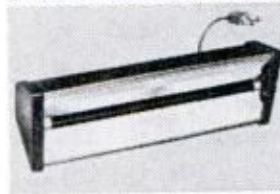
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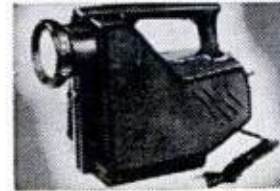
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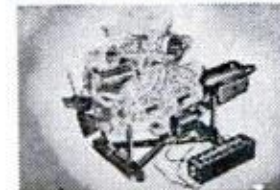
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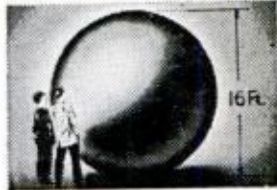
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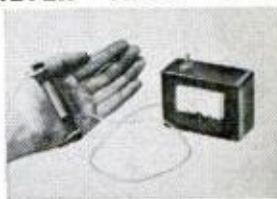
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Drivin' with Dan

How did rules limit the use of wings on Can-Am cars? Can drivers afford added costs for '72 USAC races? Why not a small aircraft engine for Formula 1? Dan Gurney answers these and other automotive questions

Q. *My parents always put regular gas in our car and it knocks like crazy. Could this be hurting the engine?—Richard Mobley, Morrilton, Ark.*

A. Yes. Sometimes it helps to have your dealer check the ignition timing and automatic advance and retard mechanism, so that it can be tailored to suit regular gasoline. In combustion, the knocking is something like an explosion compared to the rapid burning of normal combustion. The explosion bangs the dickens out of bearings, pistons, head gaskets and so on.

Q. *Why did they outlaw the wings on Can-Am cars? They didn't cause any accidents, did they?—Rick Sylvester, Toronto.*

A. They didn't outlaw wings. They only out-



CHIEF MECHANIC WAYNE LEARY (left) receives D-A Mechanical Achievement Award from Jack L. Martin, manager of the Racing Div. of the D-A Lubricant Co. The top wrench on Bobby Unser's Eagle accepted the \$3000 cash award for his outstanding skill, imagination and perseverance preparing a car for the California 500 at the Ontario Motor Speedway, where his name will be inscribed on a permanent trophy. A previous winner of this award from Dan Gurney's All-American Racers team was Bill Fowler—in 1967

lawed wings that were attached directly to the suspension. At first, this seemed to be a step backward in performance, but now it appears they didn't hurt performance. The governing bodies felt that the danger of broken wings required the rules change.

Q. *In drag racing with an automatic transmission, is it best to go from low to drive or leave it in drive all the way? Also, if you have D1 and D2 drive gears, which one should you use?—John Dyke, Exeter, N.H.*

A. This depends on the type and class of car and transmission, plus how they are adjusted. In a passenger car it is usually a bit better to go from low to drive. I suggest that you experiment and make up your own mind.

Q. *I've heard that all the USAC teams complain about costs, yet the 1972 USAC schedule now includes road races as well, which surely means extra costs for another engine besides the turbo-charged ones for oval racing. What's going on? Can you guys afford this?—Ben Carroway, St. Petersburg, Fla.*

A. That is an excellent question. It's true that costs of fielding a competitive racing team have escalated sky high. Until the rules are tailored to reduce the cost to a sane level, all we racers can do is try to raise more money, hang on and keep charging. I don't know how the smaller teams make it.

Q. *Can you explain what carbon monoxide is and what the chances are of encountering it while driving a car?—Joseph Janson, LaCrosse, Wis.*

A. I am not a chemist, just a former racing driver, but I'm told that carbon monoxide is a natural product of combustion in a gasoline engine. It is colorless, odorless and very toxic. A leaky muffler or exhaust pipe, togeth-

(Please turn to page 32)



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DRIVIN' WITH DAN

(Continued from page 30)

er with the right sort of circulation through a vehicle, could introduce harmful amounts into the passenger compartment. Some older station wagons had poor circulation with the rear window down, for example. Luckily, other products of combustion can be detected by smell, so exhaust leaks into the passenger compartment can usually be detected.

Q. Why wouldn't a small aircraft engine make a good engine for a Formula 1 or a Formula A car?—Pete Sherry, Carmel, Calif.

A. Aircraft engines are designed primarily for dependability. They are usually low-rpm engines. They are not designed to put out a lot of horsepower per cubic inch.

Q. Do you think auto racing will end when the internal combustion engine disappears?—Tom Horton, West Unity, Ohio.

A. No, I don't think it will stop. As long as there are human beings on this planet in some kind of machine, I believe there will be some sort of racing.

Q. I bought an AAR Cuda, which is a great performer, but I have carburetion problems with the 3x2 setup—long cranking to clear the cylinders of gas, surge at highway speeds, stumble when the secondaries open, and so on. I had a 406-inch Ford with the same setup that ran fine. Any suggestions?—Al Molinski, Johnstown, Pa.

A. Keep tuning. I don't know of any reason why it shouldn't run well.

Q. I have a 2½-hp go-kart. People tell me if I take the governor off the engine, it will blow. Is this true, or is there a way I can remove the governor and not ruin the engine?—Kenny Buker, Charlotte, N.C.

A. It will not blow just because the governor is removed. Of course, it will be less reliable if you use it harder. Go ahead.

Q. Do you think a Trans-Am race can be interesting without the help of the factories? Would you go to see one?—Terry Reilly, Joplin, Mo.

A. It certainly could if the right people were
(Please turn to page 34)

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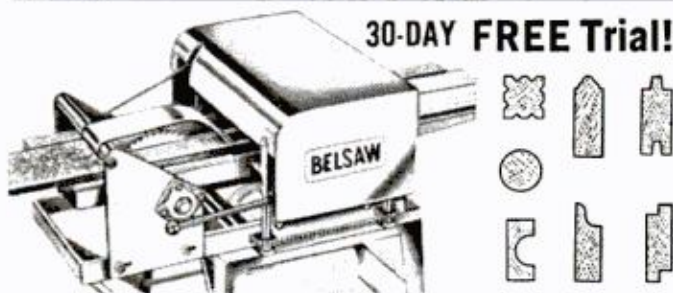
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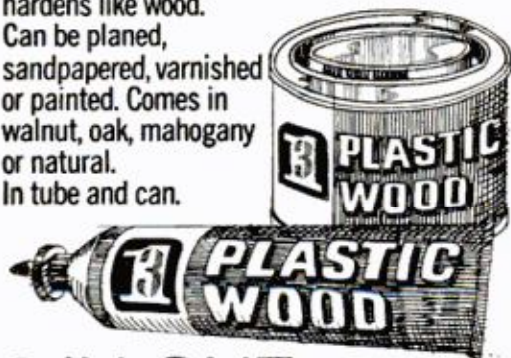
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DRIVIN' WITH DAN

(Continued from page 32)

involved, but as long as we have USAC championship cars, NASCAR stock cars, Formula A cars, Can-Am cars, Formula 1 cars, FIA long-distance sports cars and SCCA amateur racing, as well as sprint cars, midgets and modifieds, plus drag racing, moto-cross and other forms of cycle racing, it's difficult to support Trans-Am racing in terms of racing teams, drivers and spectators. It's too much.

Q. Do you think playing a radio helps or hurts normal home-to-work driving?—Phyllis Howard, Pittsburgh.

A. Driving safely at any speed requires concentration. The higher the speed and the more traffic and road hazards one meets, the more concentration is required. Therefore, I'd say that playing a radio can be helpful under the right circumstances, while under more demanding circumstances, you might be better off to give full attention to driving in order to maintain a minimum level of safety.

Q. Is the Lotus turbine running now in Formula 1 races the same car that tore up everybody at the Indianapolis 500?—Don Smalley, Knoxville, Tenn.

A. No, but there are many similarities, including the Pratt & Whitney turbine engine.

Q. Why does braking a Corvair while cornering increase oversteer? Does it involve swing axles on pre-1965 models?—R. C. Linden, Winona, Minn.

A. Generally I'd say braking while cornering tends to increase oversteer in most cars because it has the effect of taking off weight in the rear of the car and "lifting" a rear wheel off the ground. The pre-1965 Corvair also experienced an unfavorable camber change at the same time which aggravated things. Some of the world's best-handling cars have swing axles. The Corvair was a lot of fun to drive, but you had to pay attention.

Q. How old were you when you started racing?—Mary Jo Robinson, Atlanta.

A. Twenty-four.

★★★

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 22).

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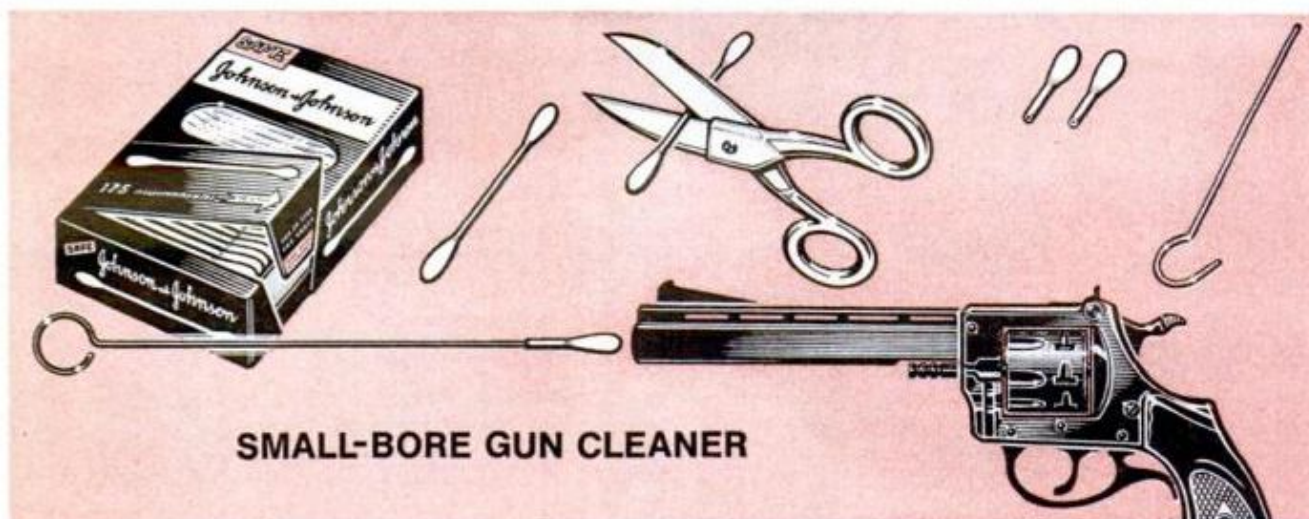
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ALL BY GEORGE REIGER OUTDOORS

HOW EFFECTIVE is Dan Wesson's interchangeable-barrel revolver (*Something Really New in Revolvers*, page 107, Aug. PM)? Some skeptics doubted the dependability of the easily modified revolver, which can be converted from 2½ to 4 to 6-inch barrel lengths in .38 special or .357-magnum calibers. So Dan went to Florida to test it against one of North America's toughest game animals. The result: a boar trophy (right) bagged with a single shot.

BELOW: Jan W. Scheck (age 12), Fort Lauderdale, Fla., makes novel use of safety swabs, the kind with hollow plastic stems. Straighten a coathanger, then fit the hollow end of a severed swab half over the coathanger end to make an inexpensive cleaning rod for .22-cal. guns.



THE FUTURE of private handgun ownership is linked not only to how you use your gun, but the kind you buy. The .25-cal. (left) is popular for plinking and home security. Browning and Colt make fine editions, and Garcia markets still another. Their reliability is excellent and not worth sacrificing for the few bucks you'd save in picking up a "Saturday Night Special." The tendency of bargain handguns to end up in crime helps turn the public against handgun enthusiasts. Some "cheapie" models are so poor, they lose accuracy after firing only a few rounds. Serious owners should avoid them and support legislation putting their suppliers out of business.

(All Outdoors [continues on page 38](#))

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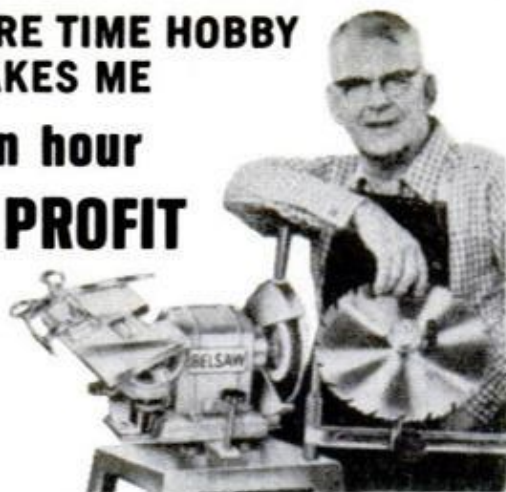


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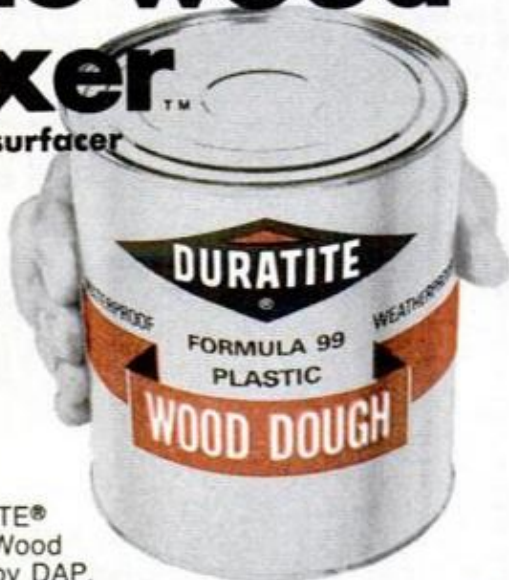
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ALL OUTDOORS

(Continued from page 36)



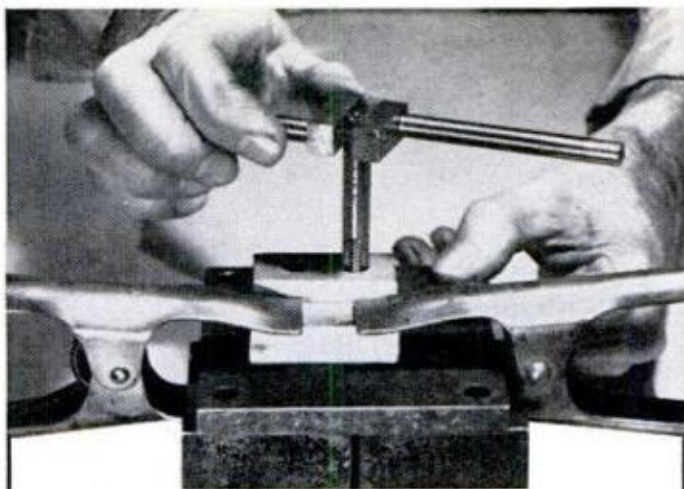
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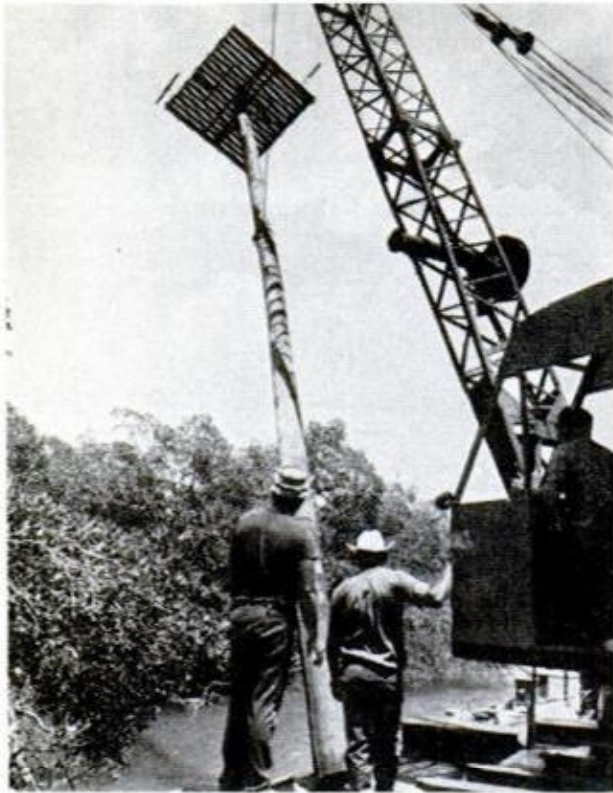
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Laser-beam television

The television set of the future may use a single laser beam to produce a wall-size picture as clear as today's TV. Zenith is experimenting with an electronic tri-color TV projection system now that relies on a single laser light source. The unit contains an advanced acousto-optic modulator and scanning device that "processes" and "directs" the light with sound.



Portable ski track

British cross-country ski enthusiasts don't have to wait for winter; they set up a portable trail. Called Sno-lene Tracking, the portable material, made of polypropylene and polyethylene to simulate snow, comes in 150-foot rolls and can be held in place with wire staples.



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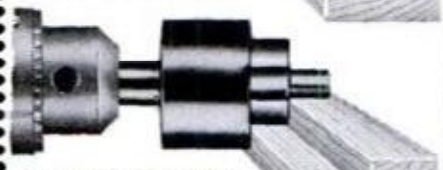
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POLLUTION FIGHTERS'

NEWSLETTER

By SUSAN MAZUR

THE PHOSPHATES CONTROVERSY: To wash with or without them—that is the question. Until September of this year, the consensus was to wash without, since phosphates in wash water were found to speed up algae growth in lakes to the point of choking them. But in September the U.S. Health, Education and Welfare Department called for the return to phosphate detergents since they have been found to be less caustic than phosphate-substitute detergents, even though they are not considered as ultimately good for the natural environment. (Phosphate substitutes were found poisonous if swallowed and irritating to the skin and eyes.)

According to Federal officials, no detergent on the market is completely safe in all respects right now. However, the Gillette Research Institute is working with a \$344,000 Federal grant to find effective phosphate-free heavy-duty detergents.

CATCH A POLLUTER and collect money? Under the Refuse Act of 1899, anyone caught discharging refuse (pollution) into our nation's waters without a permit from the Army Corps of Engineers is subject to criminal prosecution, the penalties ranging from \$500 to \$2500 in fines and perhaps a few months in prison. And "... one-half of said fine," according to the 72-year-old Refuse Act, "is to be paid to the person or persons giving information which shall lead to conviction."

The U.S. Attorney's office is supplying how-to guidelines with instructions for taking samples of the pollutant, having it analyzed and proving the source. The address: James M. Seif, Assistant U.S. Attorney, 633 U.S. Post Office and Courthouse, Seventh Ave. and Grant St., Pittsburgh, Pa. 15219.

A NEW GAME, called *Dirty Water*, from Urban Systems, Inc. (1033 Massachusetts Ave., Cambridge, Mass. 02138) teaches players about water pollution. The object of the game is to "balance" your lake by stocking it with the proper organisms to prevent water pollution. (But, beware of the other player's "dirty water" from upstream!)

Players learn about such organisms as rotifers,

copepods, amoebas, algae, bacteria and various fish. They also become acquainted with methods of abatement and its financing. Other games from Urban Systems are: *Smog*, *Ecology* and *Population*.

A GAME OF TOWN PLANNING, *New Town*, has been created by Barry Lawson as part of his study for his Ph.D. at Cornell University. (He is now teaching "urban gaming" at Wayne State University.) Simplified somewhat so a 12-year-old can play, the game is available from Harwell Associates, Box 95, Convent Station, N.J. 07961. The goal is to build a new community—a pleasant place to live and work—about 25 miles from a major city. But it's environmental considerations versus greed when it comes down to actual construction.



THIS POLLUTION FIGHTER, named Woodsy Owl, was officially introduced in mid-September by the U.S. Forest Service as its national symbol for improving the environment. Woodsy's since been appearing on recycled-paper-posters wearing his Robin Hood hat and green pants and "hooter" alerting people to "Give a Hoot! Don't Pollute."

Decals, bumper stickers, coloring sheets and hooters (soft enough not to add substantially to noise pollution!) are available from the U.S. Forest Service, South Agriculture Building, 12th and Independence Ave., S.W., Washington, D.C. 20250. Also, look for Woodsy's float in the New Year's Day Tournament of Roses Parade in Pasadena, Calif.

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. ★★

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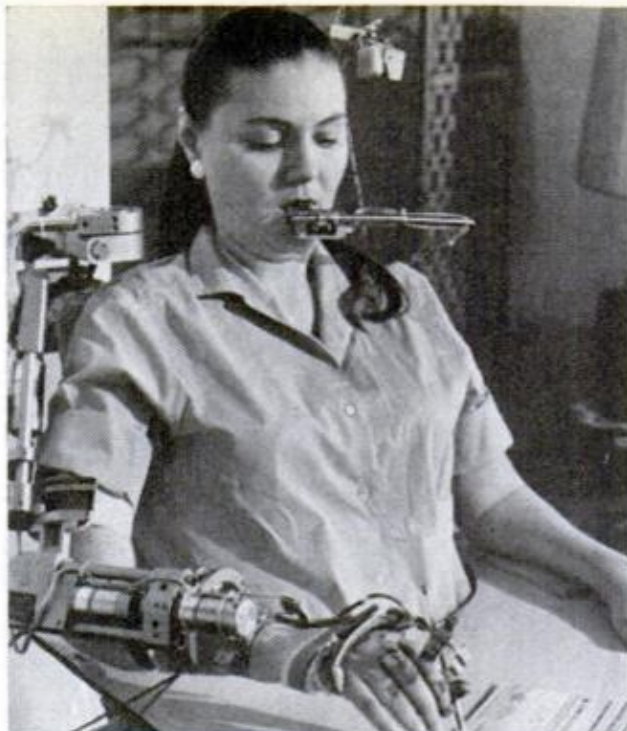
Japan's suspended monorail

The first commercially operated, suspended monorail in Japan runs 4½ miles between Ofuna and Enoshima, near Tokyo. Top speed of the Mitsubishi-built train is 50 mph. Each train consists of two cars, each of which carries 320 persons. Fare is less than 25 cents.



Towering funnel

On the outskirts of Paris, French builders are putting the finishing touches on a graceful, 154-foot-high water tower. The tower will supply water for a new jet airport.



Patient's tongue directs arm

A paralyzed patient operates her arm and directs her wheelchair by pressing her tongue on one of seven toggle switches fixed to a base near her mouth. Research team (bottom) at California's Rancho Los Amigos Hospital inspect their manipulator which can give a patient almost the actions of a healthy arm.

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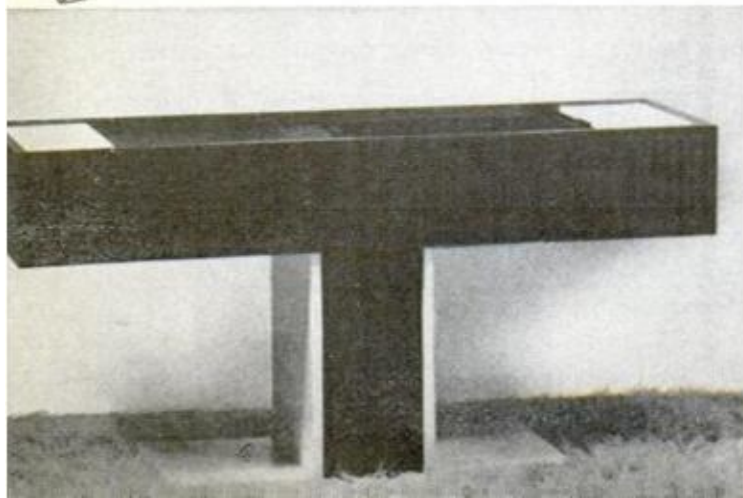
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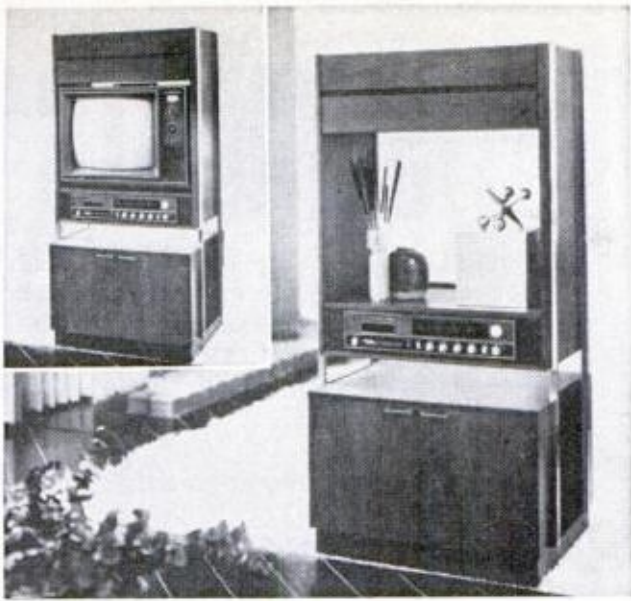
Units that stack together like building blocks or double as room dividers are among the many fresh ideas in home music centers you'll be seeing next year. Here's a preview of some of the most exciting.

By SHELDON M. GALLAGER

CONSOLES AREN'T DEAD YET as indicated by these three swank Magnavox styles. At upper left is a slim column design housing an AM/FM stereo receiver turned on end to save space and an eight-track tape player. Twin back-to-back speakers in the base project sound outward from both sides. Price is \$349. The Tall enclosure at upper right can serve as a free-standing room divider, has space for a TV set and shelves for knickknacks. Hidden in lower section are an AM/FM stereo receiver, record changer, speakers; \$449. At bottom left is a sleek, slab-legged credenza-style console housing an AM/FM stereo receiver, record changer, eight-track tape player and twin speaker systems. It's \$549.



T-SHAPED CREDENZA at left has graceful lines, eliminates massive look of many other consoles. Sliding tambour doors in top open to reveal an AM/FM stereo receiver and record changer. In addition to twin high-frequency wingtip speakers, there's a woofer built into into the pedestal base. Priced at \$349, the unusual design is one of several ultramodern models being introduced in U. S. department stores for the first time by the Canadian firm of Electrohome, Ltd., in Kitchener, Ont.



ROLL-AROUND HI-FI CENTER rides on hidden wheels, can be used as a mobile room divider. Made by Teledyne Packard Bell, it contains an AM/FM stereo receiver, phonograph and eight-track tape player. The open space can hold ornaments or a TV (inset above). Twin speakers store in the base and can be removed for wider stereo separation. Price is \$429.95.



MODULAR UNITS can be stacked in any order. One houses a 21-inch color TV and another an AM/FM stereo receiver and record changer. Matching speaker enclosures are at the top and bottom. When not in use, the open units can be closed from view by sliding down tinted plastic doors. The four RCA modules come in either rosewood or walnut, are priced at \$795.

FITTING SNUGLY TOGETHER like pieces in a Chinese puzzle are GE's clever new convertible components at right. When not in use, the speakers nest compactly under the pedestal-mounted main unit. For full stereo separation, they can be slipped out and spaced farther apart. They're even sturdy enough to double as extra seats for party guests. Main unit houses an 80-watt AM/FM/FM stereo receiver, a four-speed record changer and an eight-track tape player. Each speaker enclosure contains a woofer, tweeter and mid-range horn. Price of system is \$529.95.



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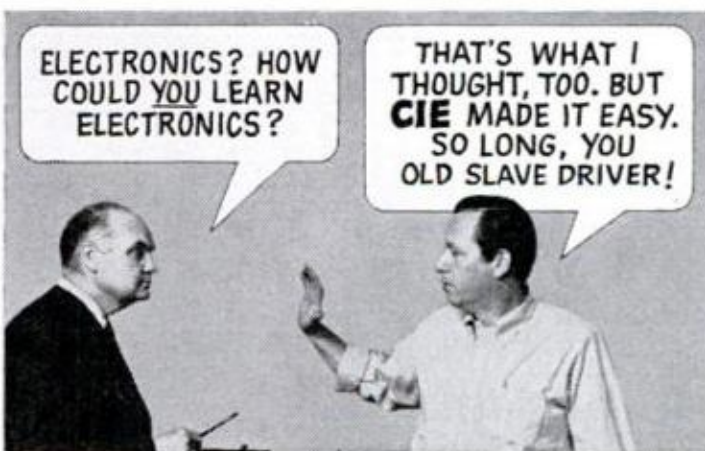
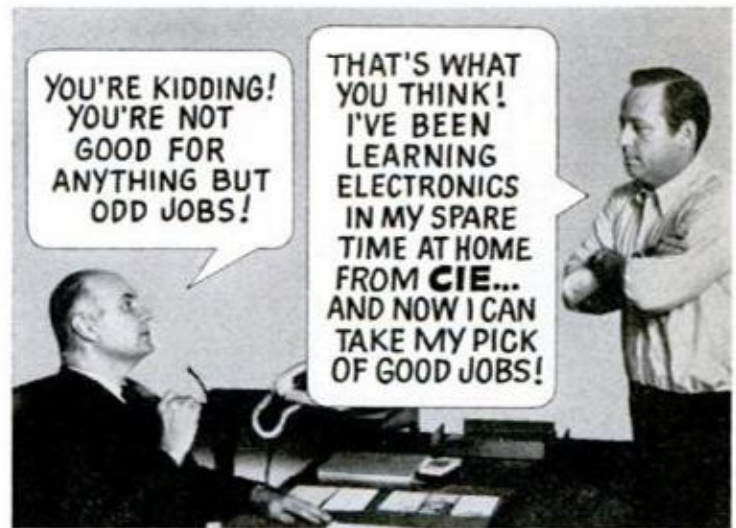
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(Continued from preceding page)

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64E

HOMEOWNERS' CLINIC

BY W. CLYDE LAMMEY

To paint or not

I'm having a house built next spring and two of my friends, one a farmer, say to let the wood siding weather without painting. Their arguments are quite convincing and I'm confused. Can you set me right?—M.K., Ark.

In general, it can be said that paint on exteriors has both a protective and aesthetic value. Weathered siding may be attractive to some but to many such a home is just an eyesore in the community. Even though it may remain structurally sound over the years an unpainted structure usually acquires a neglected, untended look not pleasing to the eye. For this reason alone I would paint the new house. Using paint, you can change the color at repainting time to suit your fancy and also gain the weather-protective values of a paint coating.

Rejuvenating old paintbrushes

I have three old paintbrushes, including a very good one with long bristles, that have hardened due to sheer neglect. Is there any hope now of making them usable again? Can you outline the process?—B.A., Del.

If the bristles are not bent due to their standing on end for a prolonged period, place them in individual cans, pour in sufficient wash-off paint remover to cover the bristles and let them stand for an hour or more. Then remove the brushes, wash off the remover, place them on several thicknesses of newspaper and scrub one way—away from the ferrule—with a wire brush. Put brushes back in the remover for about the same time. Repeat the scrubbing and the immersion in remover; eventually you'll soften all the paint and you can comb out the remainder with a special brush "comb" available from your paint dealer.

The procedure is certainly hard on the bristles but it's the only way I've found reasonably successful.

Unilever faucet leaks

My single-lever sink faucet leaks at a point just below the neck, but only when it's turned on for hot or cold water—

there's no leak when it's turned off. Can you tell me what is wrong and how to fix it?—W.W., Mo.

Your faucet seems to be of the type that has two rubber-ring seals called O-rings (or packing) which fit in grooves cut in the sleeve formed at the end on the neck. These seals become worn in time, but you can get replacements from your plumber, hardware store or the manufacturer. Instructions that came with the faucet will tell you how to disassemble it to replace the seals, or your plumber will do this for a nominal charge.

Concrete over cinders?

Part of my basement has a dirt floor, and I'm planning to pour concrete in this area (about 10x12 feet) to prevent water seepage. Cinders are available for the hauling. Can I lay the concrete over a cinder bed?—T.L., Iowa

You can, but this is not advisable as cinders tend to disintegrate in time. It's best to bed concrete over a tamped gravel fill that is 4 to 6 inches thick. Next, trowel a grouting over the gravel, lay on a plastic sheeting and pour the concrete to a thickness of 3 to 4 inches. For an extra-strength floor, place a wire-mesh reinforcement in the concrete. In making these general suggestions, I'm assuming that your foundation walls go all the way down to concrete footings.

Linseed-oil finish

I've just bought a used sewing machine in a walnut cabinet, so dark the wood is hardly visible. I want to refinish in a lighter color. I'm told to rub on linseed oil in stages to a gloss. Can you advise how to proceed?—C.Y., Va.

If you use linseed oil you may end up with a darker finish than you now have. I'd sand to the bare wood, using a cabinet scraper if necessary to make sure all the old finish has been removed, and then spray-coat with a water-white lacquer over a sanding sealer. This will give you about as near a natural wood color as you can possibly get with ordinary finishing materials. Your paint dealer will rent you a sprayer and supply the necessary finishing materials.

Do you have a home maintenance or repair problem? Send it to Homeowners' Clinic, Popular Mechanics, 224 West 57th St., New York, N.Y. 10019. While letters cannot be answered individually, problems of wide interest will be discussed in this column.

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Today's Army is helping to save lives on the highway.

Doctors agree that many more accident victims could be saved, if they could get skilled treatment in time.

The United States Army is trying to save more of these lives. They're doing it with helicopters and Army trained evacuation teams.

They call the project MAST. Military Assistance to Safety and Traffic. In three experimental areas of the country MAST teams are on 24 hour alert. Trained pilots, skilled medical aid men, communications experts.

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Now you can be a race driver— at any age

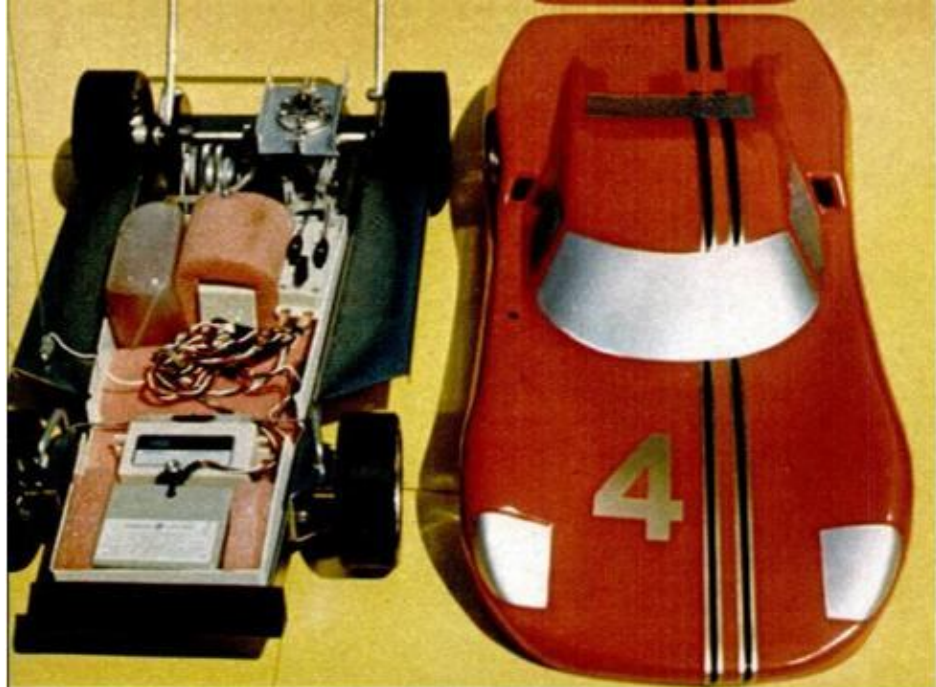
Radio-controlled racing—at scale speeds of 300 mph—calls for all the driving skill and mechanical know-how of the real thing.

By BOB GRANT

THE SPECTATORS JUMPED TO THEIR FEET cheering as the McLaren Mark 8-A screamed through turn eight, flashed down the long straightaway and took the winner's flag at the finish line.

The smell of exotic fuel hung heavy over the track—nitro, alcohol, castor oil. It had been a long, grueling race—the equivalent of a 24-hour endurance run at Le Mans or Sebring. But this race was different. Even though it had all the thrills of a full-scale race—the noise, the crowd, the spinouts and smashups—the entire event took place in a large parking lot.

Everything was scaled down to 1/8th size—the cars, the engines, the track. And the drivers, perched high in the air



HEATHKIT'S SPECTRE R/C car body (\$46.95) includes coil spring suspension and 5.5:1 gear ratio. The engine and radio-control unit must be purchased separately. Model (right) is a Can Am (Group 7) racer

atop stepladders or apple boxes, controlled their cars remotely by radio.

The sport, barely three years old, has captured the fancy of more than 25,000 model owners across the country—all with a yen for big-time road racing, but without the time or the money.

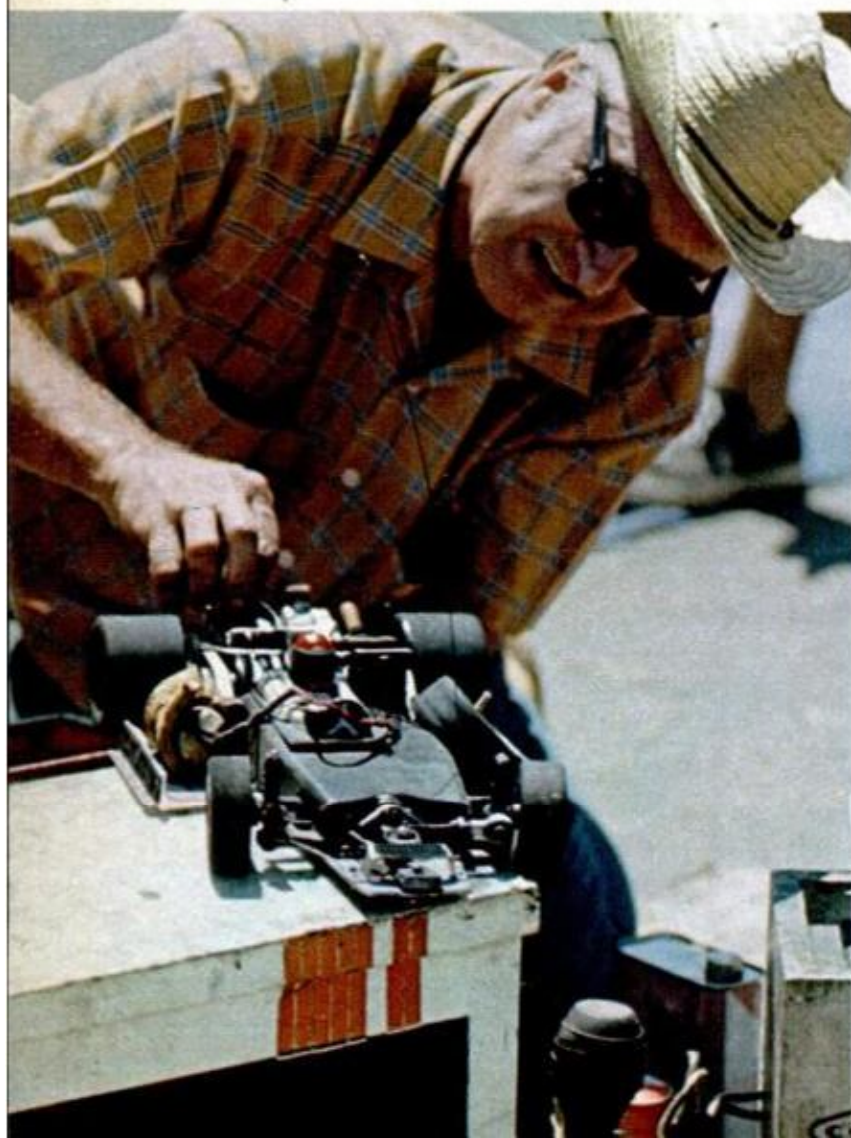
Drivers have a choice of four types of R/C races. Most popular is a road race, similar to the Riverside, Calif., course. Here, the more turns and the tighter the course, the more drivers like it. The Big "O" race on an oval or Indy course calls for a different tire, different sus-

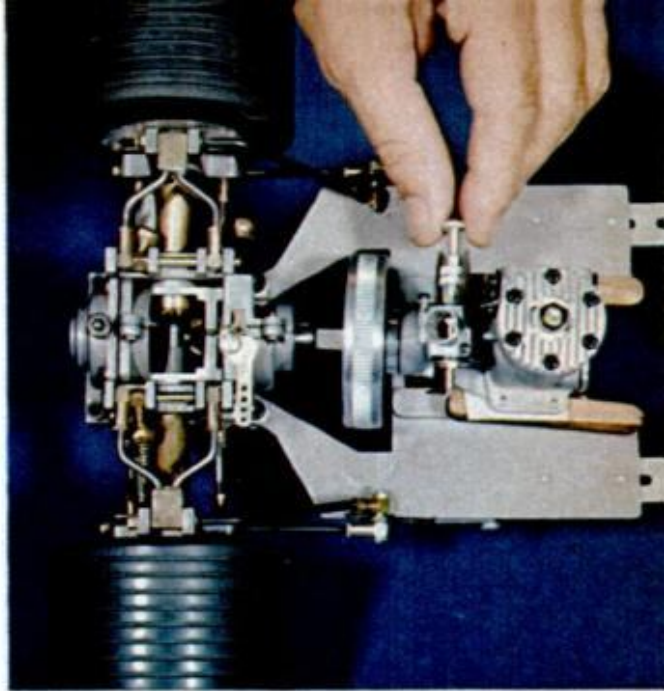
pension setup, and engines and fuel designed for flat-out driving. Another hit is the sports-car slalom—a series of tight turns around five pylons. Last is the drag race done through a 165-foot long "trap"—a timed 1/8th-scale quarter mile.

To match different courses and add lifelike reality, manufacturers are turning out a variety of plastic bodies to represent racing classes such as: Can-Am: McLaren Mk6B, McLaren Mk8A, Porsche 917, Lola T70; NASCAR: Dodge Charger, Dodge Challenger, Ford GT; Sports Car Rally: Datsun 240Z; Indianapolis: STP 500, Matra Ford, Mongoose, Gurney Eagle.

The models are powered by air-cooled, two-stroke model-airplane engines. On a straight-

PIT STOPS are made at least every 15 minutes for gassing up and engine tuning





BEGINNERS can cut their teeth on the Jerobee, built to $\frac{1}{12}$ th scale, then graduate to $\frac{1}{8}$ th-scale models. Carburetor adjustments are frequent when models run on 50 percent nitromethane fuel used in drag racing

away, these cars are able to run up to an average 45 to 50 mph. If you multiply that actual speed by eight, you will see that the cars are moving at a scale-speed of more than 300 mph. On curves they'll speed through at 12 to 20 mph, and on hairpins ease around at 10 to 15 mph.

A few R/C car buffs build their own engine blocks, but most purchase the engines and modify them. Owners invest hours polishing engine parts and smoothing castings. In some cases, porting is done on the two-strokes, and a

milled head added to improve compression.

Racing fuel poured into the miniatures is similar to that burned in full-sized dragsters—a mixture of methanol (alcohol), nitromethane, and castor oil.

The amount of "nitro" will vary with the type of racing and a driver's experience. For the neophyte, about 10 percent nitro is good to learn on. An experienced R/C road racer uses 20 to 30 percent, but if the engine is highly polished and the timing altered it is

(Please turn to page 182)

R/C CAR WEIGHS IN before a race to make sure it totals at least five pounds, the minimum allowed for competition. Race steward (right) checks for the required spare tire, and a "driver" in the model's cockpit



Utah's secret snow country



PART OF OUR GROUP waits for a straggler on Brian Head before setting off on foot for the National Park Service shelter at the peak where our view seemed to reach forever. Snowmobiles made area accessible for many who wouldn't have had breath to climb all the way in the rarified atmosphere above 11,000-foot level



ONE WAY we kept our group together between runs was to pack machines in one large van. But caravan of cars and trailers would serve your club just as well



WE CAME UPON the winter field-test quarters of the AAA Tent Co. and found some new "modular" models in use—as well as an excellent supply of coffee!

The welcome is warm, the snow is powder—and on a clear day in Utah, you can see forever!

By **GEORGE REIGER**, Outdoors Editor

WHAT A VIEW!" "Look at that color!" A group of outdoor and travel writers stood next to their snowmobiles at the edge of southwestern Utah's Markagunt (Paiute Indian for "highland of trees") Plateau and looked into Zion National Park 80 miles away. The air was so clear, some of us imagined we could see into Mexico!

Skiers of the western United States have long known about Utah's incredibly clear skies and fabulous powder snow. But Californians eager to escape crowds on their own home grounds are unwilling to share news of Utah's beauty and open spaces with other skiers—much less snowmobilers. Thus few snowmobile owners outside Utah consider the state when planning family or club expeditions.

At the request of Bob Wilde of Utah's Department of Development Services, I looked over available facilities to make recommendations for improving the southwestern region's "image" in the eyes of prospective snowmobilers. Frankly, I found so much ready and waiting, there was little for me to do but take off and enjoy Utah's hospitality and scenery myself!

With machines borrowed from Bombardier's western distributor, we ran three trails in the Dixie National Forest along the edge of Cedar Breaks National Monument. Every morning the big Ski-Doo van dropped us at our starting point, and we pushed into the outback. Our party explored a little farther each day until by the third outing we were ready for a 25-mile trip (as the snowmobile flies) to a Route 14

GOOD SENSE REQUIRES monitoring all snowmobile crossings on public road. In some states, it's law
DECEMBER 1971



COMMON SNOWMOBILE HAZARD in range land is barbed-wire fencing partly exposed or snow-covered



EMERGENCY RATIONS stashed in touring bag behind seat are a must for long-distance winter travelers





pickup point. It was one long exhilarating downhill run!

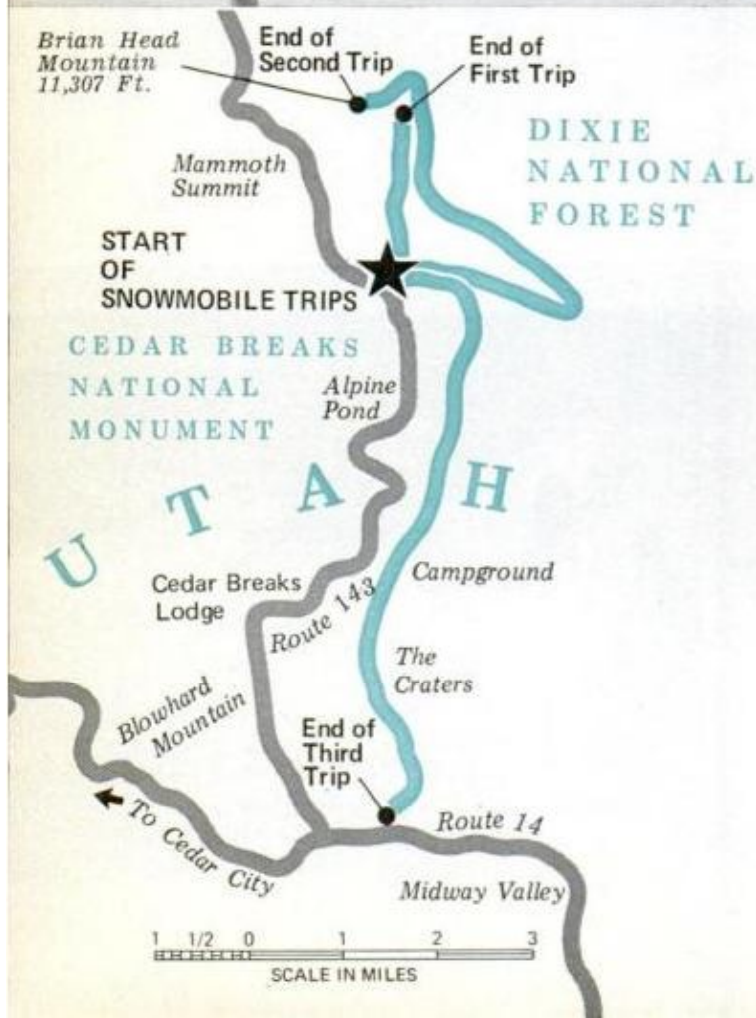
The headquarters for snowmobile activities in this region is Cedar City, located just 23 miles from Cedar Breaks National Monument. There are motels and restaurants in this town of 10,000 open the year around, and the fact you're in a snow-free valley enables you to warm up and dry out after a long day of trail breaking.

Nearby Parowan, just 19 miles north of the monument, also has a few hotels. But if you prefer being close to the action, there are several ski resorts in the heart of the monument that now look on snowmobilers as part of their regular clientele. For example, we stayed in a settlement close to Brian Head Mountain that included a chalet village, a block of condominiums and a Mexican-style restaurant that showed W. C. Fields and Charlie Chaplin movies after dinner.

The many snowmobile trails available vary from short jaunts of a mile or so to three-day excursions. Some are maintained by the Forest Service, and you may be able to persuade an off-duty ranger to go with you. But unless you're staying with someone who knows the area, you'd better seek guide services as well as other information from the Cedar City Chamber of Commerce, 109 North Main, Cedar City, Utah 84720.

Besides exploring rolling pine and aspen forests and discovering breathtaking overlooks, what else can snowmobilers do? Fish! Navajo Lake freezes solid enough to offer safe tracking for licensed anglers, and it produces big trout throughout the winter.

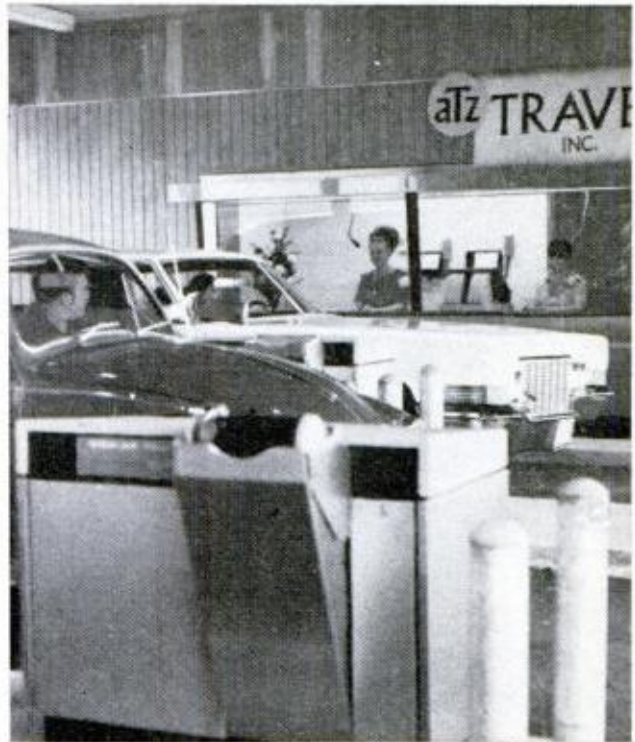
The out-of-stater will find himself and his machine welcome everywhere in Utah. In fact, while other states confuse and frighten off potential snowmobiling visitors with obscure registration laws, Utah says that out-of-staters have 60 days in which to register their machines—giving the tourist ample time for a registration-free holiday in Utah's "secret" snow country. ★★★





Helicopter high jinks

The Blue Eagles, a British Army helicopter display team, spew plumes of multicolored smoke behind as they go through close formation maneuvers. The highly-skilled five-member team performs publicly in Sioux light observation helicopters, flying a daring series of synchronized high and low-speed routines to demonstrate the versatility of the aircraft in combat.



Travel drive-in

There's more to drive-ins than milkshakes and hamburgers. An Anchorage, Alaska, travel agency will make hotel and airline reservations 24-hours-a-day for customers who never leave their cars. Drivers pull into a double window station, give their order through a microphone, and sit back. Within minutes, the ticket is written and exchanged for money through a pneumatic tube system.



Pool in the round

Bored with playing on a conventional oblong pool table, two California fans spent \$200 and one year building this eight-foot-diameter table. The five-pocket circle has normal cushions along the edge, but designers Jim Meyers and Jack Mattson added a flat rail between each pocket. The rail increases the number of reflective angles at least tenfold.

DECEMBER 1971



Underwater sweep

The fastest way to clean a dolphin pool isn't necessarily the most obvious way. Rather than stand on the pool's edge, Joy Carrington takes a nozzle under water with her, brushing the sides and bottom of the English amusement park pool. Dirt is sucked up through an attached hose. By going below, the job is done in half the time.

Learn about winter driving from THE ICE RACERS!



Techniques these cold-weather daredevils use to control their cars on ice can help you become a winter driving pro on the highway By **DICK BAUER**/Photos by John Peterson and Mike Connery

FROZEN LAKES used to be exclusive territory for skaters and ice fishermen. Not any more. Today these tame winter pastimes share lakes with a hardy horde of men who compete in the booming new minisport of auto ice racing.

From Maine to Minnesota, this growing group of cold-weather racing addicts eagerly awaits the same ice and snow that strikes fear in the hearts of millions of motorists.

While drivers by the thousands get involved in slippery highway crashes, the ice racers battle each other side by side through corners and at speeds

approaching 100 mph without benefit of spiked or studded tires.

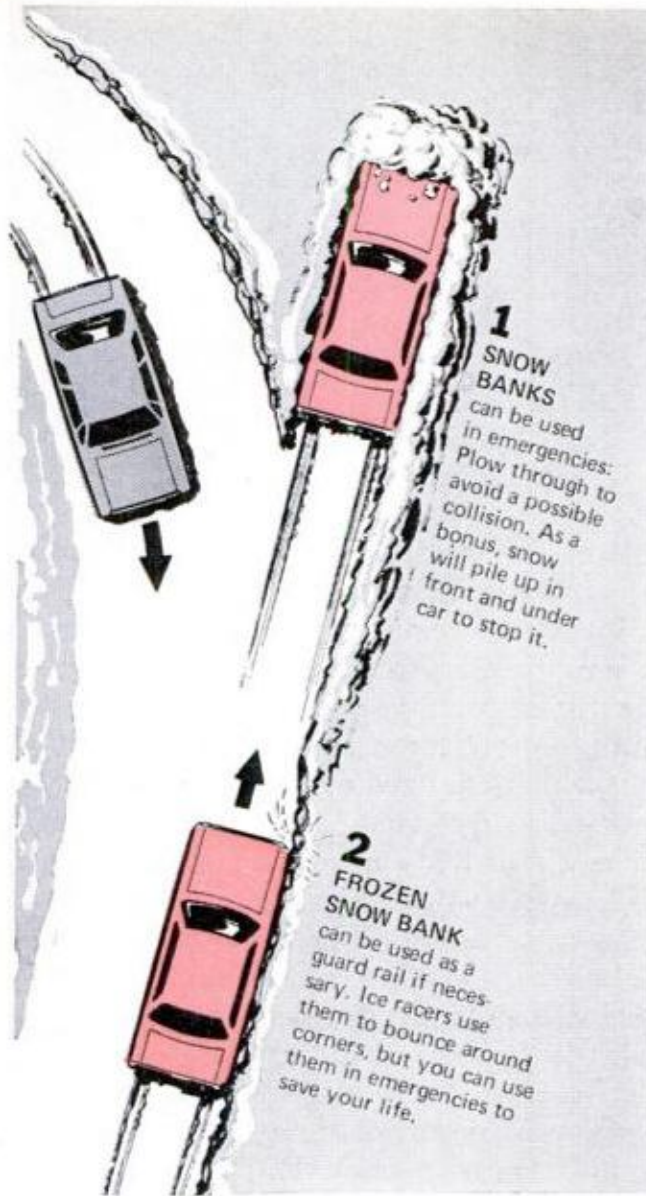
Ice racers aren't superhumans, they don't drive trick cars and they don't use trick tires. Yet as many as 75 of them manage to roar around a twisting course on the ice all together for as long as six hours, accelerating, braking and sliding through corners without losing control. Here's how they do it.

Concentration is the key. In minus 10°F. weather, these men drive with their windows wide open and still finish a race pouring sweat. It's not from the mild exertion of massaging the foot pedals or twitching the steering wheel, but from the exhausting mental effort of keeping superalert every second for four to six hours of driving out of control.

Applying this key to the highway is

POPULAR MECHANICS

Dick Bauer has been ice racing since 1958. Driving a turbocharged Corvair, he won the National Championship ice race in his class in 1970 and was the two-time New England class champion in 1968 and 1969.



ICE RACERS use snowbanks as if they were cushions in billiards; bounce off them to get around corners

the most important step to surviving a winter of driving on ice and snow. Concentration can take many forms which all add up to the difference between a frightened crasher and a confident pro on slick roads.

The first thing a good ice racer does when he rolls out for practice is to find out how much acceleration and braking traction he has. The same rule applies to the highway.

Don't wait until you need your brakes to find out how fast they'll stop. That's too late. Right away, choose the

ICE-RACING STARTS aren't rubber-burning spectacles, but the action in the first turn is really hot!





A SPINOUT can happen to the best racers, who must also learn the techniques of automobile body repair!

first empty stretch of road to try accelerating and braking until you get a firm feeling for the traction limits of your car. Then concentrate on taking advantage of what you learn.

More often than not, instead of frightening you into creeping along with the little old ladies, this exercise will give you the confidence to drive right past them. Later on, if you sense that road conditions may be changing, repeat the exercise. Adjust your driving to the results.

Let's skip the obvious about bald tires, defrosters and windshield wipers to get to brakes. Ice racers spend more time getting them perfect than they do tuning their engines. Brakes that stop just fine on dry pavement can kill you on the ice. A slightly grabbing brake will send an ice racer spinning down the lake like a top. So if your first brake

test of the winter reveals any instability whatsoever, fix it fast.

Tires are critical too. Serious ice racers bring three or four sets, constantly experimenting to find the best combination for the condition of the ice, which changes every weekend. All the fast cars use radials, although there's still little agreement on makes, sizes, tread patterns or compounds. The consensus among top drivers is that radial tires, because of their extra flexible sidewalls, do the best job of keeping the full tread in contact with the ice. The ice racers also have learned to drop tire pressures about three to five pounds below recommended levels assuring full tread contact and maximum side bite.

For years, manufacturers of front-wheel-drive automobiles have been touting the superiority of these cars on



TECHNICAL INSPECTORS (left) check safety equipment and tires. In this sport of skill, spikes or studs in tires are against the rules

FRONT-WHEEL-DRIVE SAAB is prepared for their ice-racing sons by retired New England ice-racing king, Clyde Billings and his wife





ICE ON WINDSHIELD teaches frantically scraping driver a lesson about the need for good defrosters

ice and snow. FWD cars, particularly the Swedish Saab, so totally dominate ice racing that there's rarely a rear-wheel-drive car among the top 10 finishers. In fact, FWD cars have won every race in New England for so long that they have earned themselves their own class. There's another class, called Everything Else, that draws all kinds of rear-wheel-drive cars, but they are hopelessly outclassed.

The traction these FWD cars get on glare ice is incredible, aided by their spectacular ability to ride the snow banks full bore through the corners. If you do a lot of winter driving in rugged snow country, you'd be wise to consider FWD the next time you're in the market for a car (see *Front-wheel Drive to the Fore*, page 126, Nov. '71 PM).



SHOVEL IS STANDARD for all ice-racing competitors; and should be for all drivers on road in snow

Good ice racers use snow banks lining the track like a billiards champ uses cushions. Although you really can't drive down the road bouncing off snow banks all day, you can use some ice-racing tricks to get you out of trouble.

Nearly all drivers have a few routes they drive often. Most common, of course, is the route back and forth to work. When the first snowflakes fall, if not sooner, start concentrating on your routes, fixing roadside obstacles and escape areas in your mind. As you drive your routes, decide what you'd do to avoid out-of-control cars, especially at potential trouble spots like intersections and corners. Remember the areas where you could pretty safely leave the road.

Having done your homework, you'll

(Please turn to page 178)

"WARM" WEATHER RACING means sloppy slush and a visibility problem; on road, anticipate blinding slush



Trail bikes you can

PM editors and their sons assemble and test three rugged new machines and find fun and thrills for the whole family

By **SHELDON M. GALLAGER**/Photos by Robert Borst and John Linkletter

IF THERE'S ANYTHING MORE FUN than riding a trail bike, it's riding a trail bike you've put together yourself. The three kit-built bikes shown here are a sampling of many that offer the excitement of off-the-road trail riding along with the money-saving satisfaction of doing your own assembly work. When you've watched your mount grow from a pile of parts to that final moment when you nervously pull the starter cord for the first time, there's no sweeter or more rewarding sound than the roar of an engine bursting into life.

Trail bikes stand somewhere between true motorcycles and lighter, less powerful minibikes. The wheels are smaller in diameter than those on a motorcycle, but much fatter. The rear drive wheels, in particular, are deeply treaded and broadly beamed—nearly a foot wide on some models—for clawing their way up steep grades and out of sticky muck.

Depending on your needs, you can buy kit bikes in various sizes priced from under \$200 to nearly \$400. The models shown gave PM editors an opportunity to try out several types. All three use Tecumseh engines, but with varying amounts of horsepower. The three are Sportstyl's 3½-hp SS-3, Heathkit's 5-hp Hilltopper and Heald's 7-hp Super Bronc VT-7. The rugged machines incorporate such sophisticated design features as independently controlled dual brakes, motorcycle-type



LEADING IN DOWNHILL RUN is Scott Linkletter on Heald's 7-hp Super Bronc, followed by Peter Borst on Heathkit 5-hp Hilltopper and John Linkletter on the Sportstyl 3½-hp SS-3

**How to
take a
jump the
safe way**



GUNNING ENGINE AHEAD
OF JUMP FORCES
BIKE TO FLY OFF
AT TOO FLAT
AN ANGLE



WRONG



NOSE DROPS FAST AND BIKE LANDS
HARD ON FRONT WHEEL, MAY FLIP



build from kits



OVER THE TOP: Pete Borst, son of PM photographer Bob Borst, takes jump correctly, nose high, on Heath's Hilltopper

COAST UP TO JUMP
AT SLOW SPEED



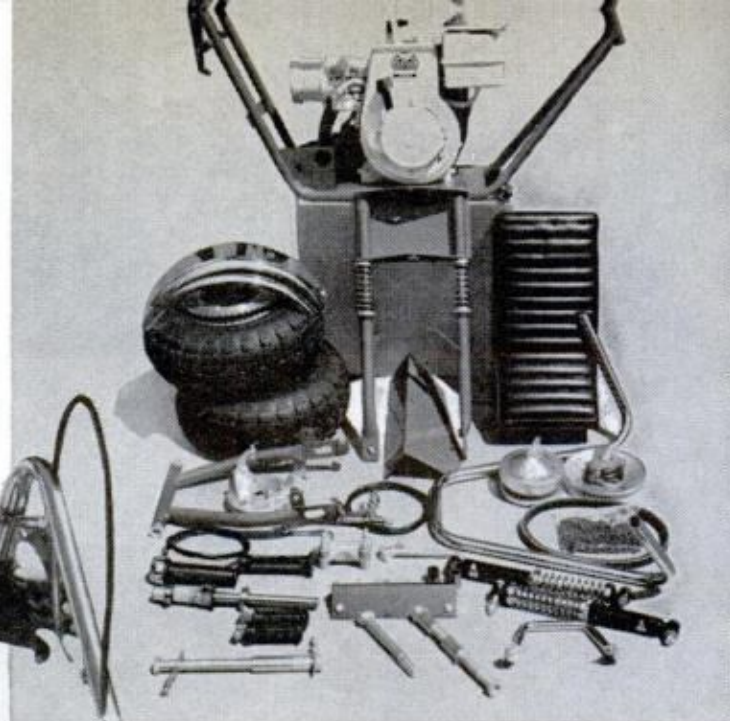
GUN ENGINE
JUST BEFORE
REACHING
CREST OF
JUMP



REAR THRUST FORCES FRONT END
UP AND BIKE LANDS SLIGHTLY
NOSE HIGH ON BACK WHEEL



RIGHT



COMPLETED KIT BIKE gets initial warm-up test by John Linkletter at left. The 3½-hp Sportstyl SS-3 model has an independently sprung rear-axle yoke, costs \$199.95. Kit of parts you get is shown in the photograph above

twist-grip throttles and variable-speed transmissions that automatically downshift on grades to provide added hill-climbing power. The drive arrangement, basically the same for all models, is by belt from the engine to a variable-ratio pulley on a jackshaft and then by chain to a sprocket on the rear wheel.

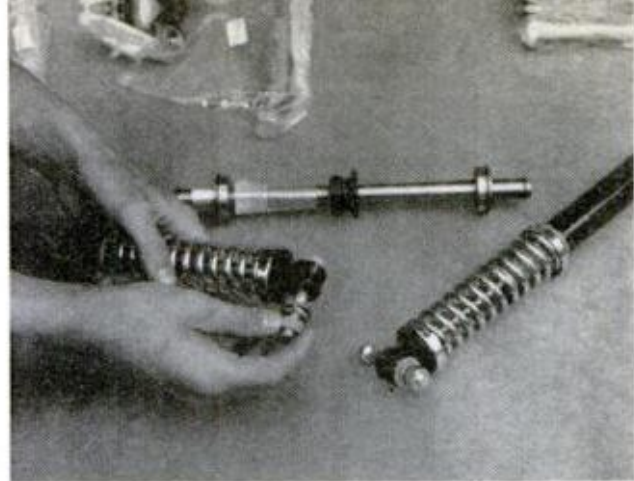
To put the bikes through their paces, we headed for the hills—literally—to Ian Karns' "Minibike Land" in Mahopac, N. Y. This is a professionally designed cycle course full of twisting,

turning wooded trails, steep hill climbs and thrilling jumps where you can become airborne without realizing what's happening until you look down and see the ground receding rapidly away beneath you. Our safari included PM's Managing Editor, John Linkletter; his two sons, Scott and John; PM photographer Robert Borst and his son, Pete, and myself and my own son, Scott. For hours, we raced the bikes up and



PARTS COME INDIVIDUALLY WRAPPED in protective plastic in Sportstyl's SS-3 kit, are tagged with numbers for easy identification in assembly manual

ATTACHING REAR-AXLE YOKE, shock struts and back fender is one of final assembly steps. Fenders are of gleaming chrome. frame members of bright enamel



SHOCK ABSORBER STRUTS, jackshaft and similar items arrive preassembled so you don't have to hunt for small fittings such as nuts, washers and collars

ALIGNING DRIVE SPROCKET with jackshaft is carefully done with a straightedge on Sportstyl bike, as on the other models. Proper chain tension is a must



down over every conceivable type of terrain, including rocky outcrops, tree branches, potholes, loose stones and soft, slippery earth. Later, we transported the safari to a Connecticut shore for some beach riding on sand, slimy pebbles and other assorted obstacles.

Our conclusions: Trail bikes are a rough, tough, remarkably surefooted breed. Not only do they offer an exciting father-son family sport, but they do it with surprising safety. The soft, wide, low-pressure tires provide tremendous traction, even on surfaces you would expect to be slippery and treacherous. Flat out, the machines will do up to 40 or 50 mph. On grades, they'll go up just about anything around.

One lesson we *did* learn the hard way—there's a right and wrong technique for jumping a trail bike (see

sketches on preceding pages). The trick is to take off slightly nose high so you come down hind-wheel-first. The beefy rear springs then take the shock and make for a stable, controllable landing. Hitting the ground front-wheel-first is risky as the wheel can twist sideways, possibly throwing you over.

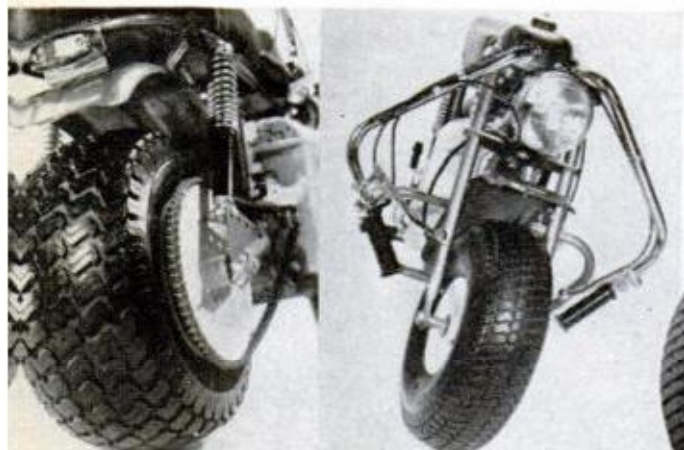
Various accessories are also available. Some kits include a spark-arresting muffler; on others, this is an optional extra. Such mufflers are required by law for woodland riding in most communities and parks to avoid the danger of starting forest fires from engine sparks. Headlight and taillight kits, electric starters and conversion skis for use on snow are also optional. Some trail bike models can be licensed for road use, but state regulations vary. If you'd like to apply, find out the



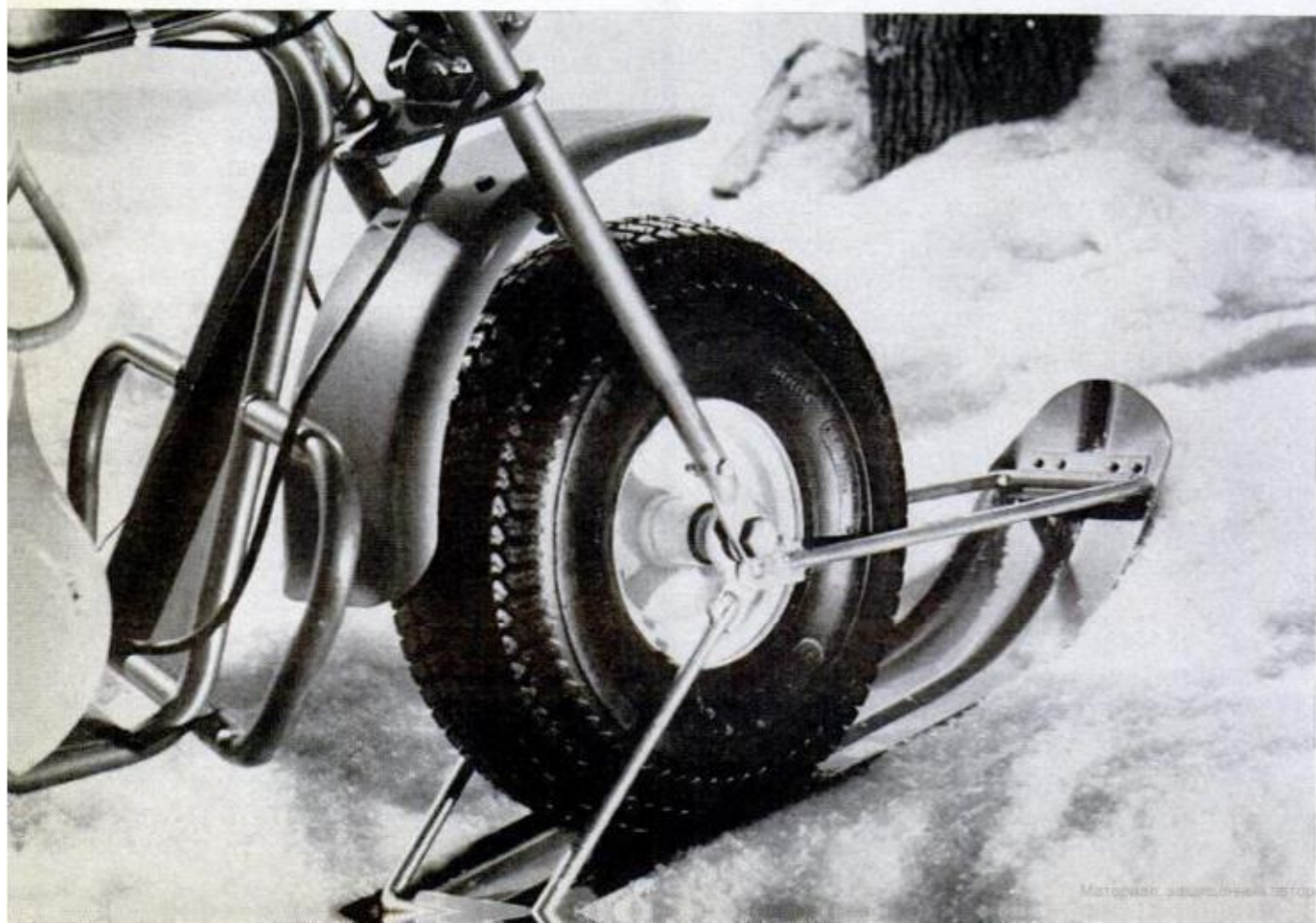
READY FOR ASSEMBLY: parts for Heath bike above

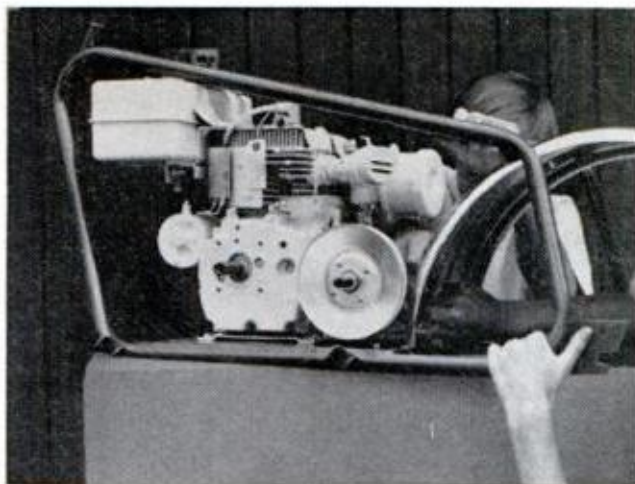


PROVING TWO CAN RIDE as cheaply as one—if not as roomily—are author's son, Scott Gallager, with friend Ellen on Heath Hilltopper. Scott, resting from football knee surgery, had to sit out more strenuous tests



HUGE REAR WHEEL on Heath bike is shown at left, above. At right, the handlebars fold down like a limp-eared hound dog—handy for carrying the bike in a car trunk or wagon. Below, accessory ski clamps to front wheel for use on snow

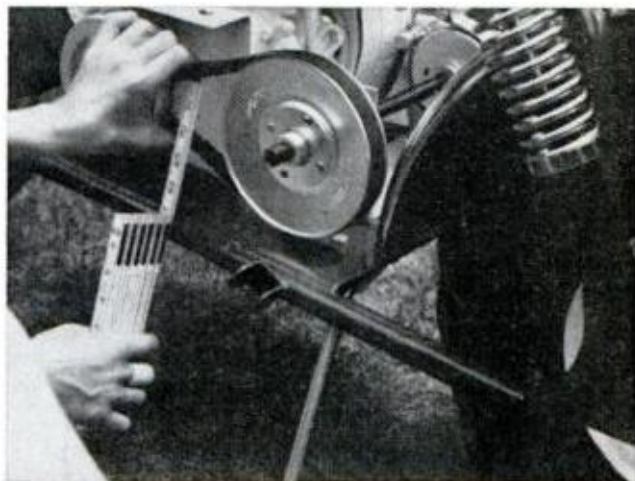




SHIPPING CARTON becomes a handy workstand for making adjustments on partly assembled Heald bike above. At right is kit of parts prior to assembly. Snow ski, lights and special spark-arresting muffler are accessory items. The Super Bronc, with a 7-hp engine, is most powerful of three kit bikes tested



LIKE OTHER BIKES, Heald model has an adjustable jackshaft, here being checked for proper alignment with large drive-chain sprocket on the rear wheel



ADJUSTING BELT TENSION, important last step, is done by squeezing the belt together and measuring across the gap to check for correct amount of slack

proper procedure from your motor vehicle bureau.

Base prices for the kits shown here are \$199.95 for the Sportstyl SS-3 with 3½-hp engine, \$299.95 for the 5-hp Heathkit Hilltopper and \$269.95 for the Heald 7-hp Super Bronc VT-7. Sportstyl's SS-3 is also available with a 5-hp engine for \$229.95. Construction is easy, with assembly time ranging from a few hours to over a weekend, depending on how fast you want to work. All three makers offer additional kit models varying in price and power.

Sportstyl kits are sold by Sportstyl, Inc., Box 628, Lewistown, Pa. 17044; Heald kits by Heald, Inc., Box 1148, Benton Harbor, Mich. 49022; Heath kits by Schlumberger Products Corp., Box 167, St. Joseph, Mich. 49085. ★ ★ ★

FLYING HIGH at right is Scott Linkletter, son of PM Managing Editor John Linkletter, taking jump on rugged Heald Super Bronc bike. Note unusually fat front tire—almost as big as rear—for soft ride



Pick the right fabric and... **YOU CAN STAY COOL IN HOT PANTS**

By JOHN F. PEARSON
Science Editor



TWO LAYERS OF FIRE-RESISTANT FABRIC make a hot assignment easy

WEAR NOMEX COVERALLS and you'll never set the fashion world on fire. But show up in them at a fire and you'll probably be the best-dressed man there. I speak from experience.

I recently donned a set of thermal underwear, coveralls, socks and work gloves—all made from Nomex fabrics—and permitted gasoline to be sprinkled on my duds. A technician touched off the gasoline with a propane torch. Flames quickly crawled up the legs of the coveralls, but it was a good 15 to 20 seconds before I felt any heat. At my signal the technician smothered the fire with an extinguisher, and I exam-

ined the coveralls for burn marks. There were none. Only the gasoline had burned.

There was nothing brave about my "fire act." I knew that Nomex was a proven material. Last year, for example, race driver Sam Sessions cracked up at the Langhorne (Pa.) Speedway and was trapped for several minutes in a burning car. He suffered severe burns on his hands but not on his body, which was protected by a Nomex suit.

"Without that suit," Sam told reporters, "I'd have been a marshmallow."

Nomex was developed by the Du Pont Co. about a decade ago. It belongs

POPULAR MECHANICS



NO HEAT WAS FELT by author in lighting his cigar from glove thumb sprayed with gasoline and ignited

165 VA hospitals to protect patients from fires caused by smoking in bed.

Some years ago the Navy tested different fabrics. Aviation fuel, burning at temperatures over 2000°F., was allowed to engulf a dummy wearing a series of anti-G suits, flight suits and coveralls. The tests indicated that an airman wearing a fire-retardant suit of cotton would have received burns on 67 percent of his body. Conventional nylon would have restricted the burn area to 57 percent. But with Nomex garments, less than 2 percent of the airman's body would have been burned.

Since fire resistance is built-in, launderings don't reduce Nomex's protective qualities. At the same time, Nomex has the "feel" of a conventional fabric and is comfortable to wear.

The best protection is obtained by wearing two layers (underwear and coveralls), rather than a single heavy layer. The outer garment puckers and blisters, increasing the thermal insulation of its surface. Nomex has good insulating qualities, too.

Nomex costs more than conventional fabrics. The pajamas for the VA ran about \$10.50 a pair, compared with \$3 for cotton pajamas. A suit of industrial coveralls is priced just under \$30. ★ ★ ★

to the same family of plastics as nylon, but its chemical structure is more tightly "knit," making it particularly stable. Its fire resistance is an inherent characteristic.

In addition to race-driver suits, the synthetic fabric is used for a variety of protective clothing: military flight suits, firemen's turnout coats, smoke-jumper coveralls, hooded suits for aircraft fire-rescue crews, suits for astronauts and industrial uniforms. Recently, Nomex pajamas were adopted by

CONVENTIONAL FABRICS BURN on chairs while subject in Nomex gear withstands heat in a fire-school test



POWER COMES IN with a bang around 5500 rpm and continues uninterrupted to beyond 9000. If you happen to be in first gear near 5500 and crank in lots of throttle, the S2 will do a spectacular wheelie before you can let off. Even experienced Mach III riders, expecting something much tamer, are caught off guard. Keeping the front wheel on the ground with careful throttle coordination is the key to good quarter-mile times and maximum acceleration out of turns on the road course.

With the 350-S2, a three-cylinder, 350-cc, two-stroke, Kawasaki continues the performance-at-a-price theme initiated by its Mach III 500-cc motorcycle of similar design. Although very much like the Mach III in general layout and appearance, the S2 is a new bike from the frame out. About 50 pounds have been pared off the all-up weight, which helps feel and handling and permits performance not all that far behind its larger predecessor.

Kawasaki recommends that the S2 not be driven at engine speeds under 3000 rpm for fear of plug fouling. But we repeatedly did so (and got away with it) because low-speed handling is so delightful. When dawdling about, it feels even lighter than a 350-cc machine. Power in the 2000-5000 rpm range is adequate, and surging or stumbling becomes a problem only if you try to apply full throttle.

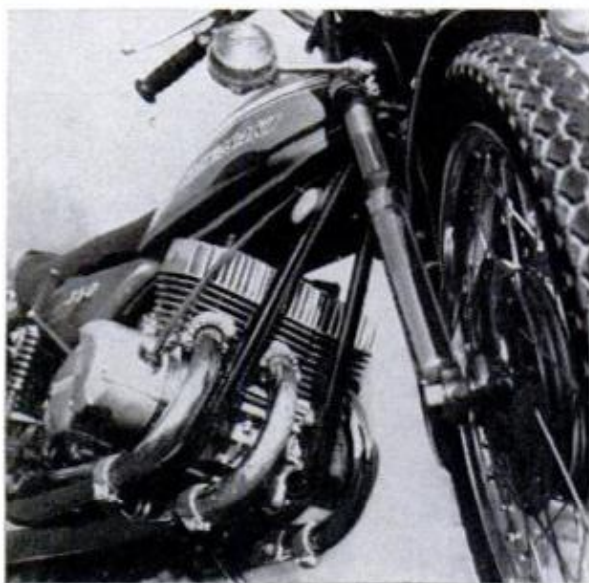
High-speed work on a road course revealed that the S2 has vast potential for this sort of thing, but also uncovered a couple of weaknesses. Because the engine is mounted high in the frame, this bike can be laid way, way over in turns before the foot pegs drag, giving real cornering power. There was some porpoising in the turns, indicating the front fork might need attention (it's fully adjustable). Our test crew unanimously agreed that better brakes would be required for any serious road racing. The brakes are on a par with other 350-cc machines in size and capacity, but *they* lag behind the S2's go power. Despite these drawbacks it was still possible to gobble up heavier, more powerful

Kawasaki's **THREE-**

It's an all-new, middleweight machine with the multicylinder scream of Kawasaki's trailblazing, 500-cc Mach III superbike. The S2 is smaller, lighter and cheaper and comes close to matching Mach III performance!

By JOHN ETHRIDGE

Photos by David Gooley



TRIPLE EXHAUST PIPES alternate with twin down tubes of the frame. Tires on the 340-pound machine are 3.00x18, front, and 3.50x18, rear

hot new 350

with...

CYLINDER

SOCK!



bikes in twisty sections of the circuit.

In touring streets and freeways, the quickness and agility of this model will be appreciated by all who have ever found themselves boxed in a hazardous situation. Steering quickens somewhat at higher speeds, which takes some getting used to, but is handy if you need to change lanes in a hurry. Carrying two up is no problem whatsoever (the rear spring/shocks have an adjustment for this), even if both riders happen to be on the heavy side.

Not so appreciated is a definite tingle felt in the handlebars and foot pegs between 5500 and 7000 rpm. In top gear this corresponds to speeds between

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about 62 and 75 mph—smack in the cruise range on most highways. Dropping engine revs with different gearing in fifth speed would be a highly desirable option for those who intend to use the bike primarily for touring. Economy would improve, too. As it is, highway gas mileage averaged around 28 mpg—not considered good for a 350. Factory figures show a drop from 45 mpg at 50 mph to 26 mpg at 70 mph, so dropping the revs a bit would help.

But Kawasaki three-cylinders didn't become famous for miserly fuel consumption. Performance is the word, at a price you can afford, and the S2 can't be faulted here. Acceleration data re-

89



SWEPT-UP PIPES and tail treatment contribute to the machine's racy profile. Top speed is 110 mph

corded in the table was obtained on a hot, muggy day, which hurts engine performance. The factory-claimed figure of 13.6 seconds for the quarter-mile has been equalled or beaten a number of times by experienced (and lightweight) drag racers on stock S2s under ideal conditions.

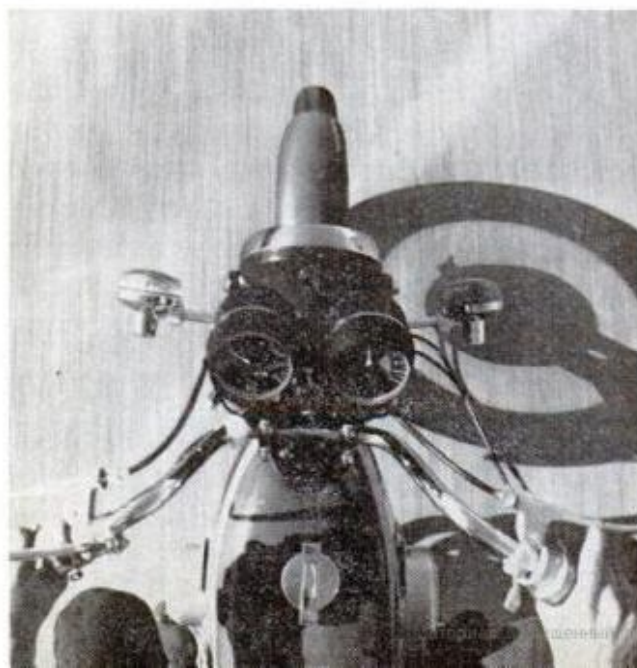
The engine, like other two-strokes, runs strongest starting from cold. Top speed just after starting was 110 mph, which dropped to 100 after a few laps. Taking a tip from an experienced Mach III drag racer, we squirted the cylinder heads with water to cool them before each acceleration run.

Mechanically, the S2 engine differs from that of the Mach III in several ways besides cylinder dimensions. Lubrication is by port injection instead of a semipressure distribution to the lower end. And a conventional ignition system (coil and breaker) is used in place of a CDI (capacitor discharge

ignition) system. CDI, which has the ability to fire fouled plugs under some conditions, is commonly used on high-performance two-strokes. But we experienced no problems at all with the conventional system. It always started easily, and the plugs fired at 10,000 rpm and beyond. Likewise, the lubrication system gave no trouble. Smoke was at a minimum; oil consumption low.

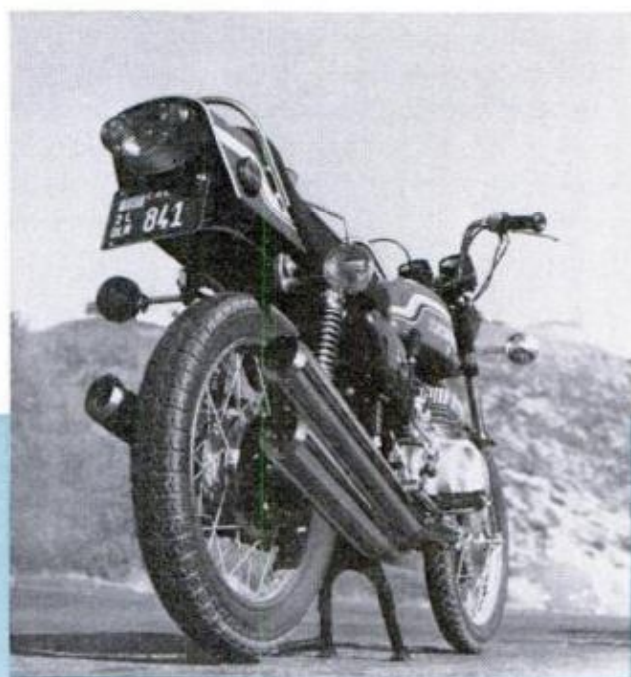
The clutch and gearbox worked flaw-

RIDER'S-EYE VIEW of instruments and controls. Left toe whips five-speed box through the gears



lessly at all times, with neutral easy to find for kick starting. Shorter riders complained about the location of the kick starter causing some discomfort in the folded position, but none of the tall ones mentioned it. The engine/gearbox remained spotlessly clean throughout the test.

All controls are conveniently located and generally light and positive in action. Foot braking and shifting, as they should be, are done without having to remove your feet from the pegs. Placement of the ignition key right in front of the driver between the tachometer and speedometer eliminates the possibility of roasting your fingers on a hot



KAWASAKI 350-S2 SPECIFICATIONS

PERFORMANCE

Quarter-mile acceleration:

Elapsed time, sec.	14.18
Speed, mph	92.97
Top speed, mph	110

ENGINE

Type	3-cyl., 2-stroke, piston valve
Bore and stroke, in. (mm) ...	2.09 x 2.06 (53 x 52.3)
Displacement, cu.-in. (cc)	21.1 (346.2)
Compression ratio	7.3:1
Horsepower @ rpm	45 @ 8000
Torque, ft.-lb. @ rpm	30.7 @ 7000
Ignition system	Battery, triple coils and points

TRANSMISSION

Type	5-speed, constant mesh, return
Pattern	1-N-2-3-4-5
Internal ratios: 1st	2.86
2nd	1.79
3rd	1.35

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engine, a problem with bikes that have it under the gas tank. One pampered member of our test crew thought the S2 should have an electric starter. But the majority opinion was: nice, yes; but necessary, no.

A steering lock, operated with the ignition key but not part of the ignition lock itself, is a commendable anti-theft feature. The toolbox, which has enough room for odds and ends besides tools and is accessible by hinging the seat to one side, doesn't provide for similar locking, a feature it definitely could use.

The overall impression is that the S2 is well designed and well built. The entire test was run without an adjustment of any kind, not even resetting the idle on the three carburetors. One set of sparkplugs was used for everything and never touched after installation. For a bike that's kept in such a high state of tune, this is quite an accomplishment. ★★★

DRAMATIC ANGLE shows the S2 balanced on its center stand. The rear spring/shock is adjustable

4th	1.12
5th	0.96
Reduction ratios: Primary	2.22
Final	3.07
Overall (in top gear)	6.56
Mph per 1000 rpm in top gear	11.2
Clutch	wet, multi-plate

FRAME AND SUSPENSION

Front suspension	telescopic, 2-way
Rear suspension	adjustable, 2-way spring/shock
Frame	double cradle tubular steel

WHEELS AND BRAKES

Tire size, front	3.00-18
Tire size, rear	3.50-18
Brakes, front	drum, double leading shoe
Brakes, rear	drum
Brake size, in., front and rear	7.09 dia.

DIMENSIONS AND WEIGHT

Length, in.	79.1
Width, in.	31.5
Height, in.	43.1
Wheelbase, in.	52.4
Test weight, lbs.	340

CAPACITIES

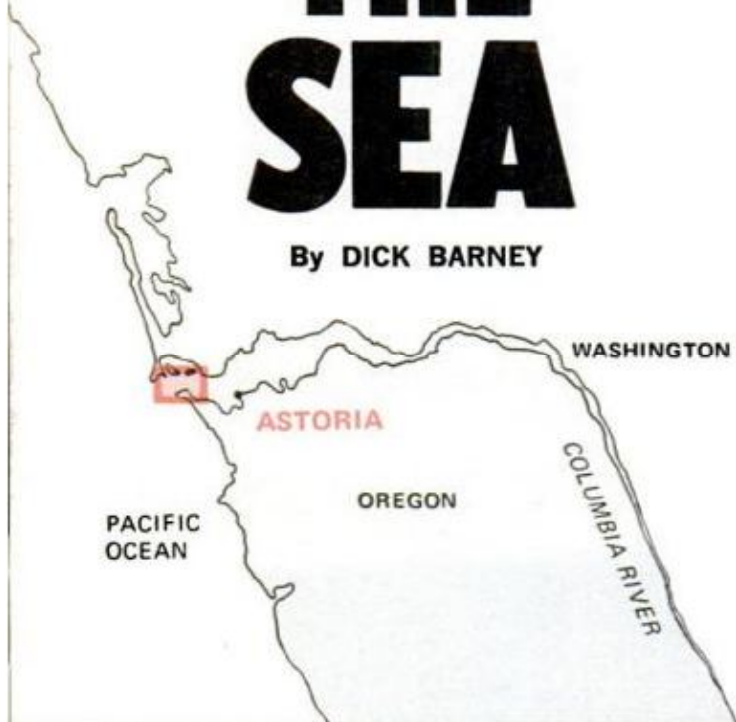
Fuel, gal., including .5 gal. reserve	3.7
Engine oil, qts.	1.7
Gearbox oil, qts.	1.0

PRICE AS TESTED\$895

In the salvage business you don't go out to see

MEN AGAINST THE SEA

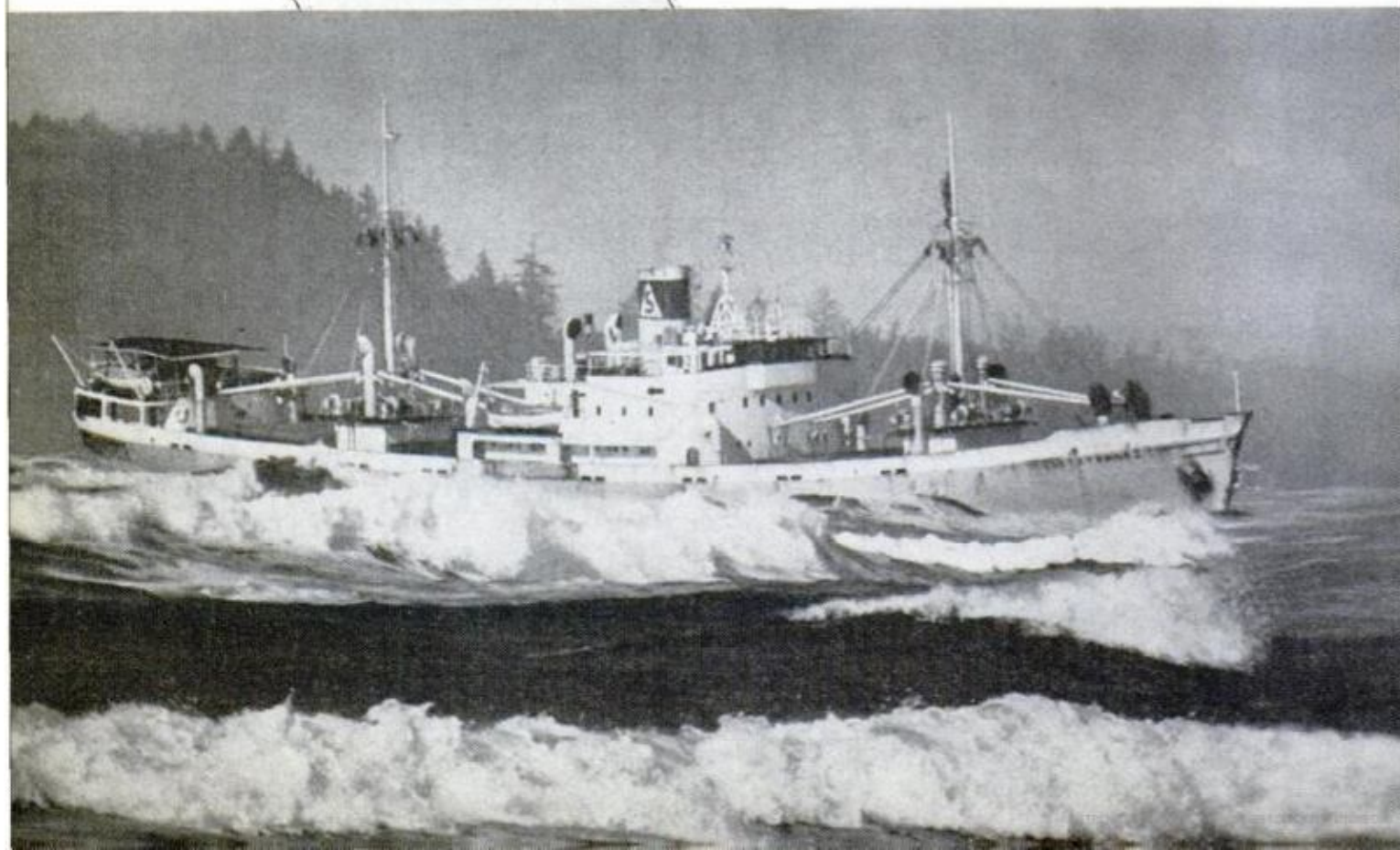
By DICK BARNEY



BREAKERS 20 FEET HIGH sweep in from the Pacific, crashing on sandy shoals that line the mighty Columbia River's mouth. Just the sight of this twisting channel, where seas are whipped to a froth by gusty winds and driven by swift-flowing tidal currents, unsettles even veteran mariners.

When the *Captayannis S.* ran hard aground on Clatsop Spit that Sunday night—Oct. 22, 1967—she became the 24th major victim of this Oregon-coast graveyard for ships. A Coast Guard distress message signaled the start of a nine-day battle to rescue the freighter and its cargo from total destruction. The 2037-ton, Norwegian-built vessel was on its first voyage under Greek ownership, bound for Portland with her hold full of sacked herring-meal protein concentrate.

A Columbia River bar pilot alerted Capt. Reino Mattila aboard the *Salvage Chief*, a 192-foot LSM (Landing Ship Medium) converted for salvage work by Fred Devine Diving and Salvage Co. Mattila relayed the alarm to salvage



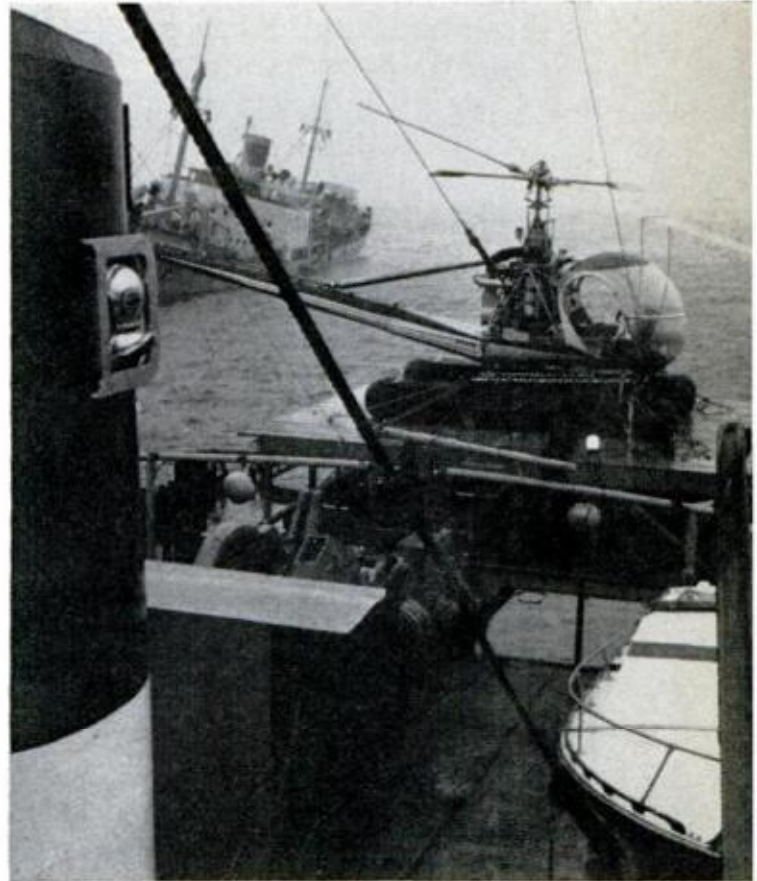
if a job can be done. You go out to *do* it.

foreman J. H. (Mick) Leitz at the firm's Portland headquarters, then churned full ahead to the scene of the stranding. Now abandoned, but with her deck lights still burning, the ship was easy to find. Trapped in a sand pocket, she was being lifted and slammed against the shallow bottom by each passing swell. The *Chief* dropped anchor to await Mick Leitz and daylight.

Ninety miles upstream at Portland, Mick alerted the rest of his salvage team. He called Ken Dye, a professional diver, to be his right-hand man, and leased a 12E Hiller helicopter and pilot.

Next morning Mick and Ken boarded the grounded, unmanned ship by dropping from the copter onto an awning atop the aft deckhouse.

A survey revealed that, although the ship was still tight and dry, the after engine-room bulkhead had buckled, binding the propeller shaft so that she couldn't move under her own power. And to make the situation worse, two



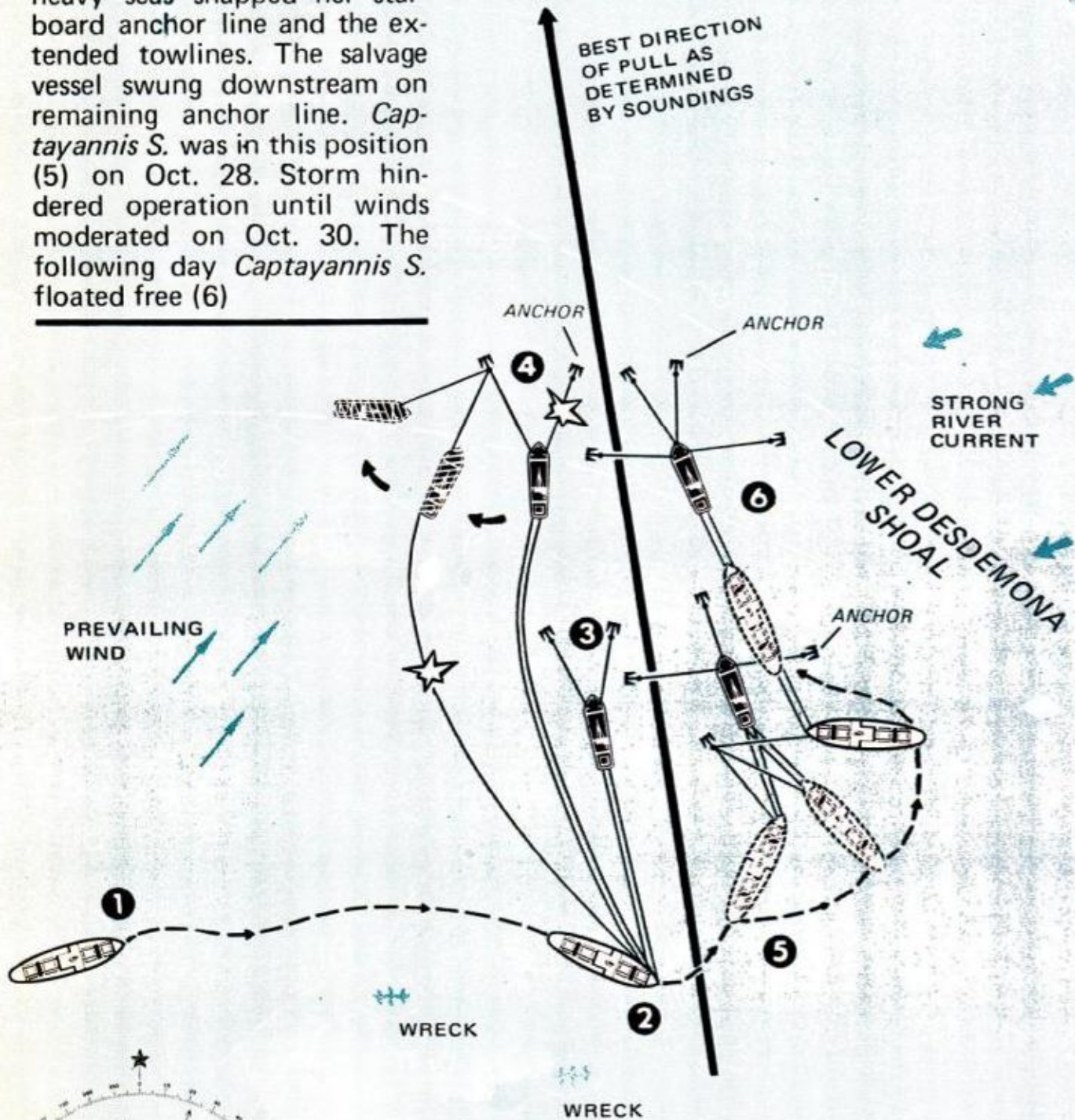
BECAUSE OF HEAVY SEAS, a helicopter was needed to move men, tools and equipment from the salvage vessel to the crippled freighter. The photo below was made soon after 200-ton strain was applied to two steel cables running from the *Chief* to the *Captayannis S.*, obscured by white water over bow



THE GREEK FREIGHTER

ran aground (1) on Oct. 22. By the morning of Oct. 23 it had drifted 1900 yards to point (2) where the *Salvage Chief* (3) attached towlines. *Chief* was repositioned (4) for second tow attempt, but heavy seas snapped her starboard anchor line and the extended towlines. The salvage vessel swung downstream on remaining anchor line. *Captayannis S.* was in this position (5) on Oct. 28. Storm hindered operation until winds moderated on Oct. 30. The following day *Captayannis S.* floated free (6)

SAND ISLAND



PREVAILING WIND

BEST DIRECTION OF PULL AS DETERMINED BY SOUNDINGS

STRONG RIVER CURRENT

LOWER DESDEMONA SHOAL

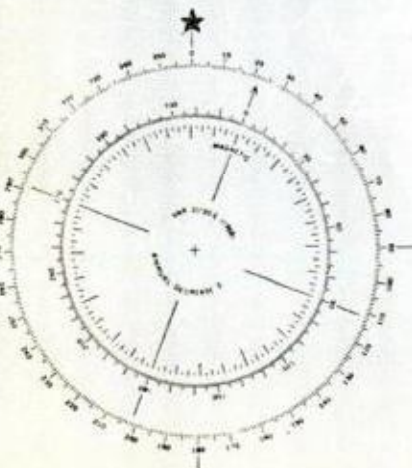
ANCHOR

ANCHOR

ANCHOR

WRECK

WRECK



LEGEND

 SALVAGE CHIEF

 CAPTAYANNIS S.

CLATSOP SPIT

Charts by Tom Minker

of her three electric generators were inoperative.

Mick decided to haul the dead ship off with the *Chief's* powerful engines and winches. First they'd fix the *Chief* in position with two six-ton salvage anchors set well ahead at angles, then run two steel tow-lines to the freighter. It should be a routine refloating job, Mick figured.

Soon the helicopter dropped the end of a nylon line from the *Chief* to the two men on *Captayannis S.* They passed it through a forward chock and took several turns around one drum of the electric anchor windlass. Switching on the windlass, they heaved in the nylon messenger with a 1 $\frac{3}{4}$ -inch steel cable attached to its end. As the heavy



POWERED BY TWIN 1800-hp diesels, the *Salvage Chief*, a 192-foot converted LSM, is all "muscle"

cable sagged into the watery 1000-foot gap between the two vessels, cross-currents swept it sideways into a wide curve. The windlass slowed down, then stopped; apparently it wasn't developing full power.

Mick will tell you that in the salvage business you don't go out there to see if a job can be done; you go out to *do* it. If one thing fails, you try another. You improvise, you jury-rig, you make things work.

They ran the line from the anchor windlass drum to the drum of a cargo winch. By operating windlass and winch in tandem—so that the two shared the load—they soon heaved one end of the towline cable aboard. Making the stiff steel cable fast to the ship's

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mooring bits took time and muscle. Normally it's a job for three or four deckhands, but the two salvage men managed to bend the wire into figure-eights unaided.

As they heaved the second towline toward the stricken ship, a strong ebb tide swung the *Chief* out of the channel, causing her to bump bottom. While the *Chief's* crew winched her back to deep water, sand closed over part of the towline as it lay on the bottom. When Mick and Ken resumed heaving, they couldn't budge the line.

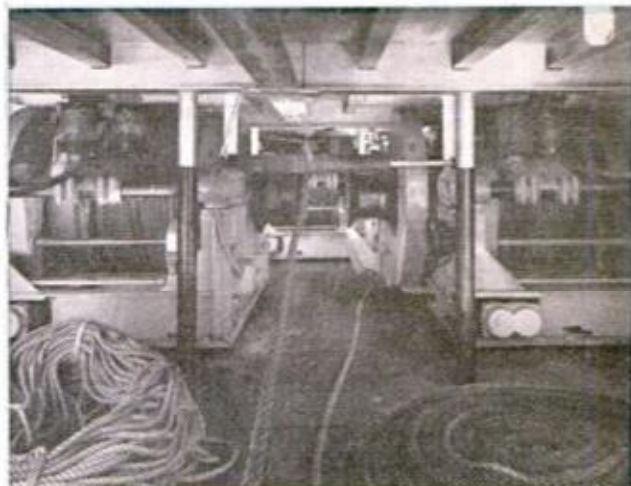
They added winches to their chain of turning drums until they had five pulling at once. To keep the drums turning at the same speed, they sprinted back and forth to the widely separated winch controls—not an easy stunt on a deck slanted at a 14° angle and coated with fuel oil.

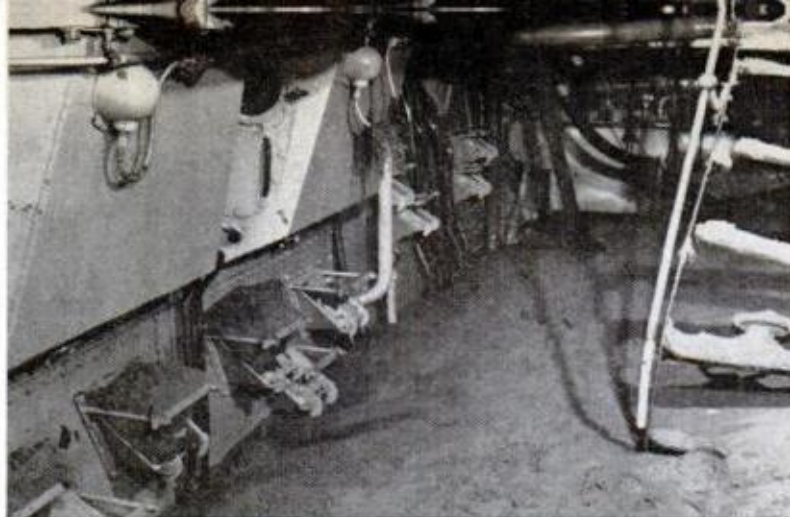
Progress was slow: It was almost midnight when they finally made the second towline fast. They'd been up since dawn and worked hard for 14 hours straight.

Mick and Ken treated themselves to hot showers, then set watches to take soundings every two hours.

Dawn of the second day brought helpers from the *Chief*, followed through the day by pumps, suction hose, and other gear. Then the *Chief* shifted her anchorage farther out to try to drag the *Captayannis S.* across 2000 feet of shoals, through breakers and

SIX WINCHES, each able to exert a 90-ton pull on 2500 feet of cable, are housed below *Chief's* deck





BUDDIES ON MANY A TOUGH JOB, Mick Leitz (left) and Ken Dye at first thought the salvage operation would be routine. But there was nothing routine about twisted ladders and tons of sand in the engine room (above). Photo on the opposite page shows deck area where Mick was caught by a big wave. Though he suffered a three-inch gash over his eye, he was back in the fight the next day

groundswells, into deeper water. With her anchor winches in low gear and her engines turning full ahead, the *Chief* leaned into the towlines with a 200-ton pull.

Success appeared near. The *Captayannis S.* had swung around at high tide, indicating she wasn't hopelessly stranded, and a 14° list to starboard had changed to a 1° list to port.

But another storm was building. Winds from the southwest were hitting 50 mph and higher. The *Chief* lay in the trough of the waves, taking them broadside. At 7:05 p.m., a strong current and heavy seas ganged up to snap the *Chief's* starboard anchor line, then one of the two towlines to the *Captayannis S.* As a result, the *Chief* rolled into a 9° tilt. That a heavy swell could part her remaining anchor line and swing her onto the shoal now became an alarming possibility.

At 9:45 p.m., with the current ebbing at four knots, the *Chief's* list had increased to 15°. Capt. Mattila stationed crewmen with cutting torches so the remaining cables could be quickly parted, and stood ready to give the order. At 10:30 p.m., the second towline let go, and the salvage vessel swung downstream to fetch up on her port anchor.

Aboard the *Captayannis S.* there were no hot showers to end the second day. Her only usable generator had

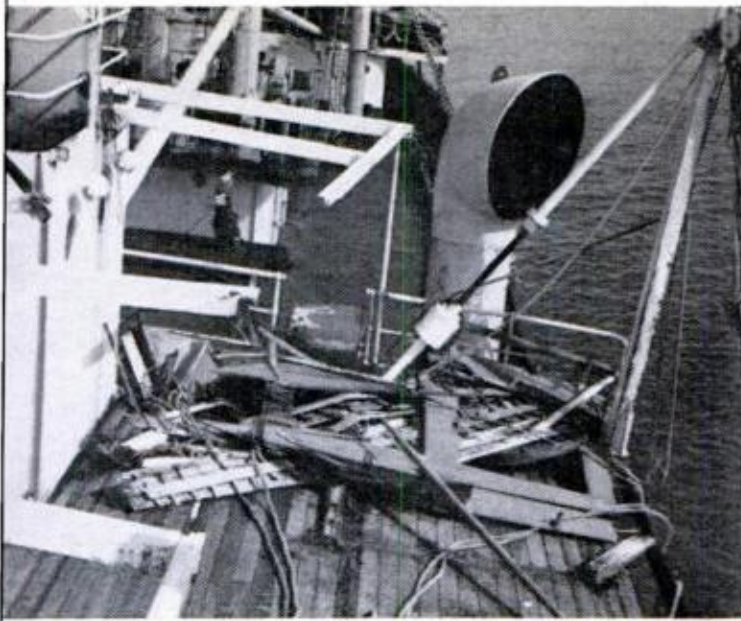
quit, leaving the ship pitch-black and totally without electric power. Mick and Ken now believed she was structurally damaged beyond economical repair.

Working under the usual "no cure—no pay" contract, their incentive to keep trying was the cargo alone; it still lay largely undamaged in the holds. But with seas periodically sweeping over the deck, hatches could not safely be opened, nor could a lighter come alongside to take off the cargo. To save the cargo they'd have to save the ship—the two were inseparable.

The shock each time the ship was slammed against the bottom reached the men wherever they were. But in the engine room—right above the point of impact—the effect was strongest. Ladders buckled, stanchions flexed and metal plates fell from overhead catwalks.

Particularly hard jolts fractured bolts that anchored the big diesel engine. The bolts parted with a *crack* as loud as a rifle shot. But the salvage men had to work in the engine room regardless of the danger.

Dawn of the third day brought moderated winds, though a heavy groundswell continued. A replacement for the *Chief's* lost anchor arrived by tugboat. The helicopter was now making up for time lost while it was grounded by high winds; it lowered cargo nets filled



with pumps and suction hoses, portable light plants and floodlights, oxygen and acetylene tanks, gasoline cans and other gear onto the wreck's deck.

The ship's generator had overheated and stopped the day before because of a sand-clogged heat exchanger. They solved this problem by using a gasoline-powered pump, connected to a hose hanging from the vessel's side into the sea, to run sand-free saltwater through the heat exchanger. Once again they had ship's power, which meant electricity for lights, the anchor windlass and cargo winches.

Before dark of the third day, they had one towline back in place and before noon of the fourth, the second one. The *Chief* would pull only during slack water, they now decided, since the strain on anchors and cables was too great with the current working against both vessels. To hold the wreck steady during tidal current flow, they hooked a line from one of the *Chief's* after winches to the wreck's port anchor and pulled it out as far as the anchor chain would reach. Then they slacked off on the line and let the anchor dig in.

All this was accomplished none too soon. Throughout the fourth day the wind increased. By 8:00 a.m. of the fifth day it was again near hurricane force. The wreck's deck was awash, so that even the heaving in of the anchor

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chain to keep it tight was an adventure.

Breakers battered the deckhouse, testing every porthole. High combers put green water over the bridge. The latch gave way on a steel storm door, exposing the two-inch-thick oak inner door to the seas. It soon was smashed to slivers and the deckhouse passageway flooded. Ken managed to get a line through the steel door's handle and around a bracket inside. With the storm door secured, they set up a portable pump to dry out the deckhouse.

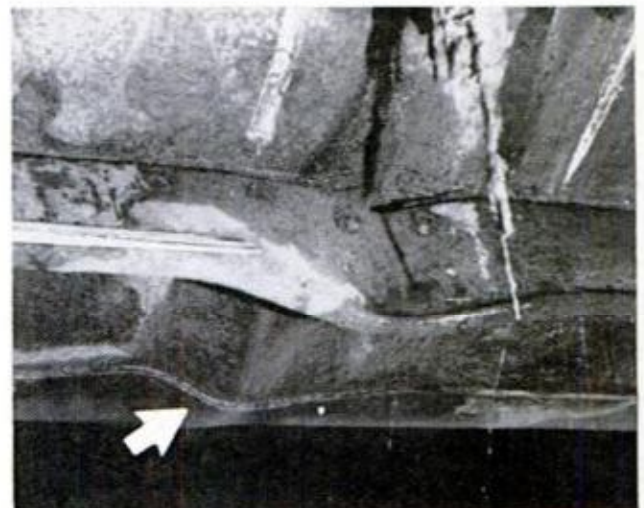
The high seas also fouled the sea-suction hose, causing the generator to again overheat and stop. Mick and Ken went on deck to make repairs. Dog-tired and groggy from lack of sleep, they were not too alert. Mick, struggling with the suction line, his back to the sea, never saw the big wave coming. Ken glimpsed it just in time to fling his arms around a vent pipe and hang on.

When the wave had passed, Ken spotted Mick 40 feet away in a tangle of rope, blood running down his face. Ken radioed the *Chief* and soon Mick was aboard a Coast Guard cutter, on his way to Astoria, Ore., to get a three-inch gash over his right eye sewed up.

Ken gave up on the suction line. He switched back to the ship's pumps to cool the heat exchanger, figuring that sandy water would have to do the job

(Please turn to page 186)

POWER OF THE SEA is attested to by bent steel (arrow) near bottom of the freighter's exterior hull



JUST PATENTED

Hands-off driving:



EXIT OR
ENTRANCE
RAMP

EMERGENCY
PULL-OFF

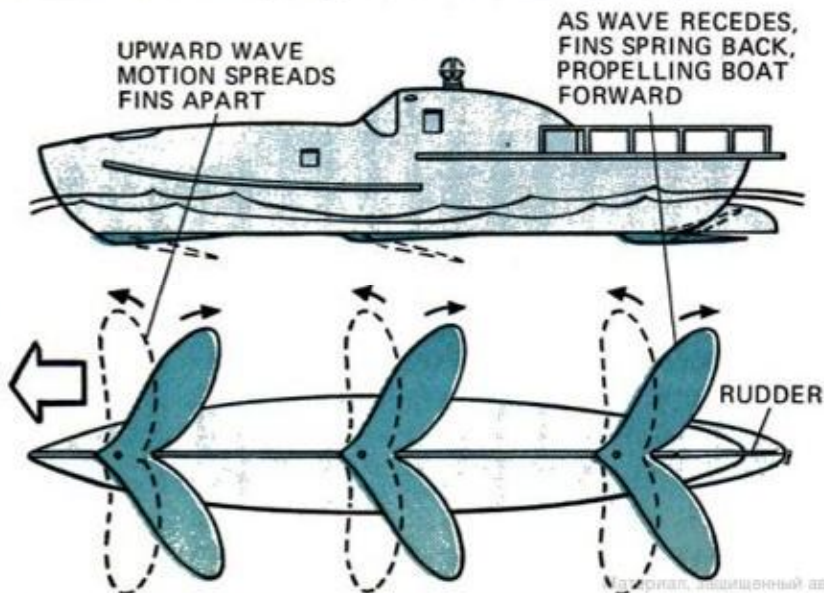
You just sit there with your hands in your lap and this U-shaped elevated highway automatically keeps your car centered without your having to touch the steering wheel. Banked sections let you take curves at full speed. At exit points, the road flattens and you take over manually. There are also occasional pull-offs where you can rest or

make repairs. Designed for safer high-speed driving, the plan eliminates the danger of collisions with cars in adjacent lanes and is expected to cost less than complex electronic guidance systems. Only point not explained by French inventor Pierre Bouthers: What happens when someone breaks down ahead of you in heavy traffic? Ouch!

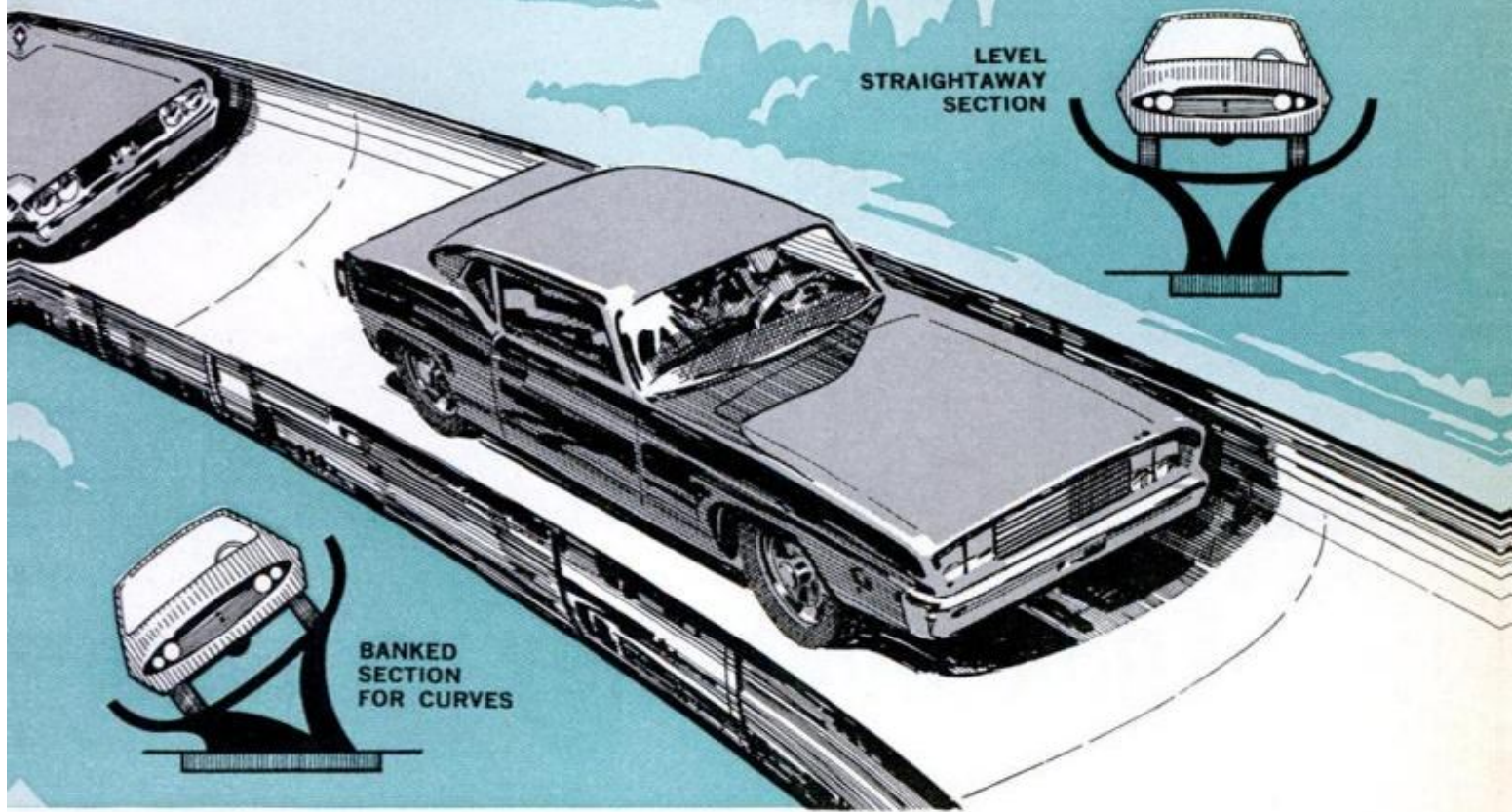


The boat that swims like a fish

All you need is wave power to propel this unusual craft devised by Joseph Gause of Oakville, Ontario. Three pairs of springy, finlike vanes are attached to the underside of the hull. As the upward motion of a wave raises the hull, the fins lag slightly behind, being, in effect, pulled downward by the resistance of the water. As the wave recedes, the fins spring back upward, forcing out water between them and the hull and propelling the boat forward. The bigger the waves, the faster the boat travels. Gause calculates that 2½-foot waves should drive it at six knots—speedy for a boat with no engine.



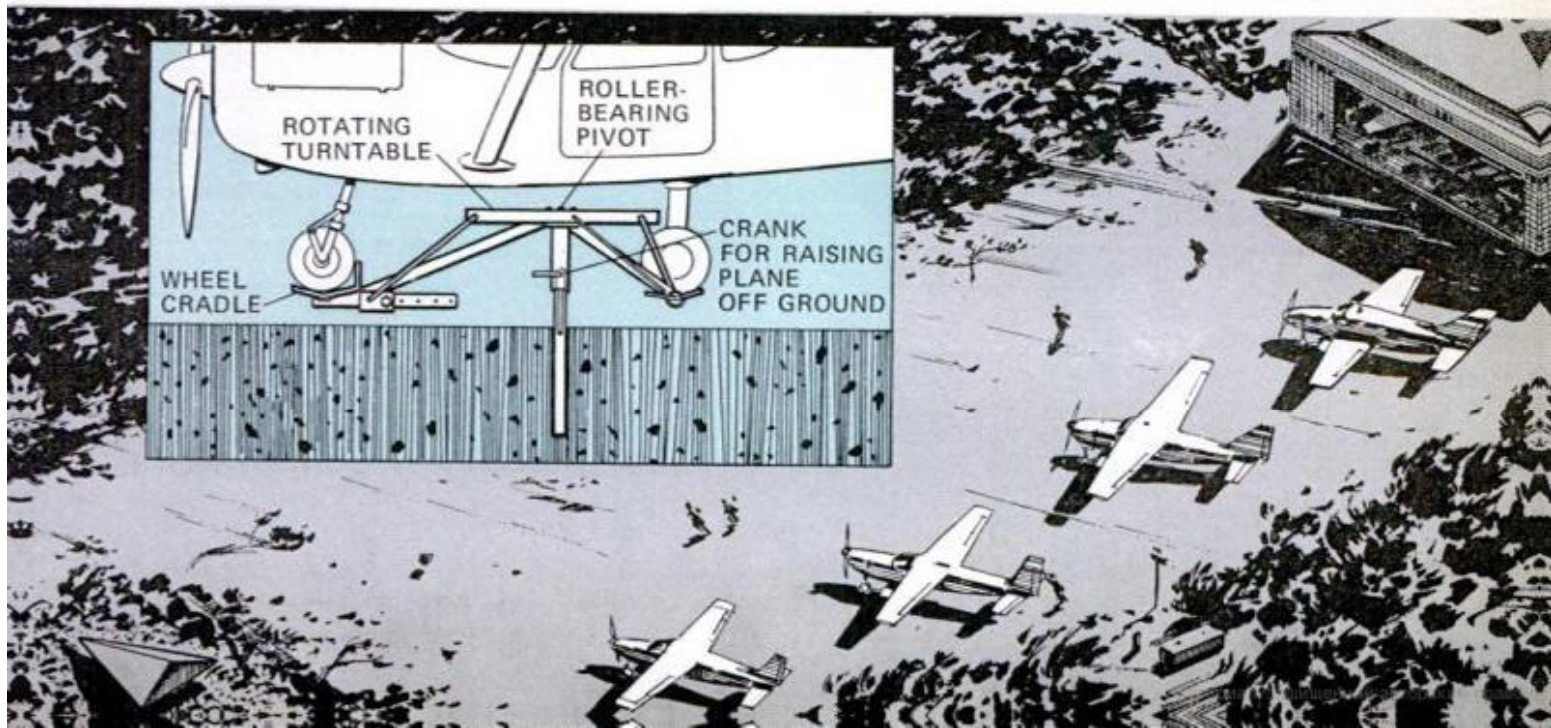
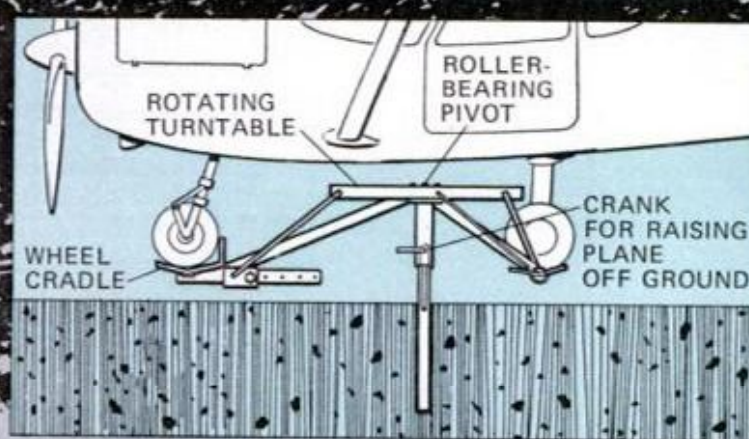
This highway does the steering for you

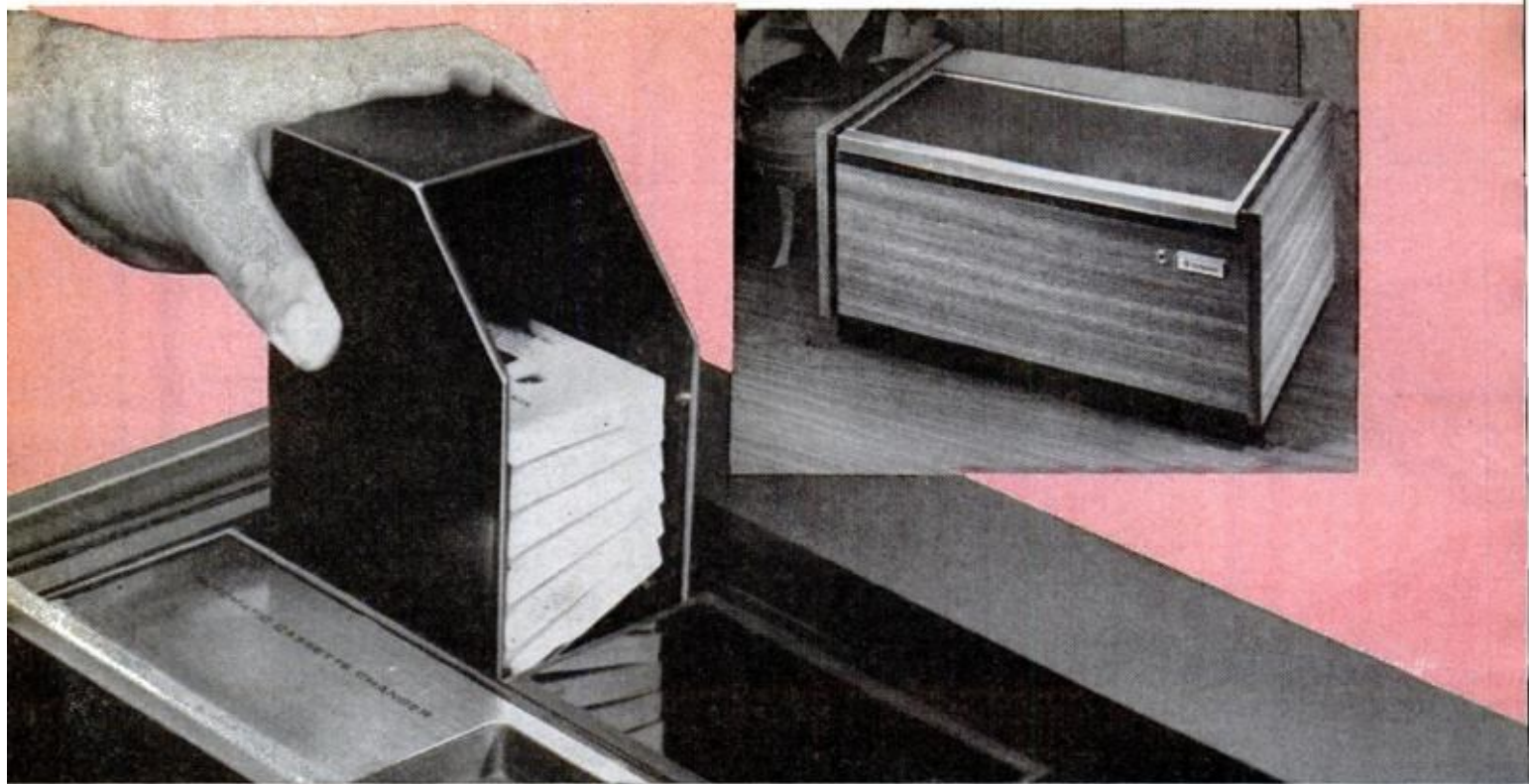


Parking swivels keep grounded planes facing the wind when caught in a storm

High winds often wreck small planes parked on the ground because they buffet them from different directions, eventually breaking their lashings and blowing them over. This can't happen with the rotating turntable below. A plane is locked into wheel

cradles, then raised off the ground by turning a crank. No matter how the winds shift, the plane always swivels so it faces into them—like a weathervane—and is protected from damage. Inventors are Earl Adams, Edmund Eveleth and Everett Larsh, Miami, Fla.

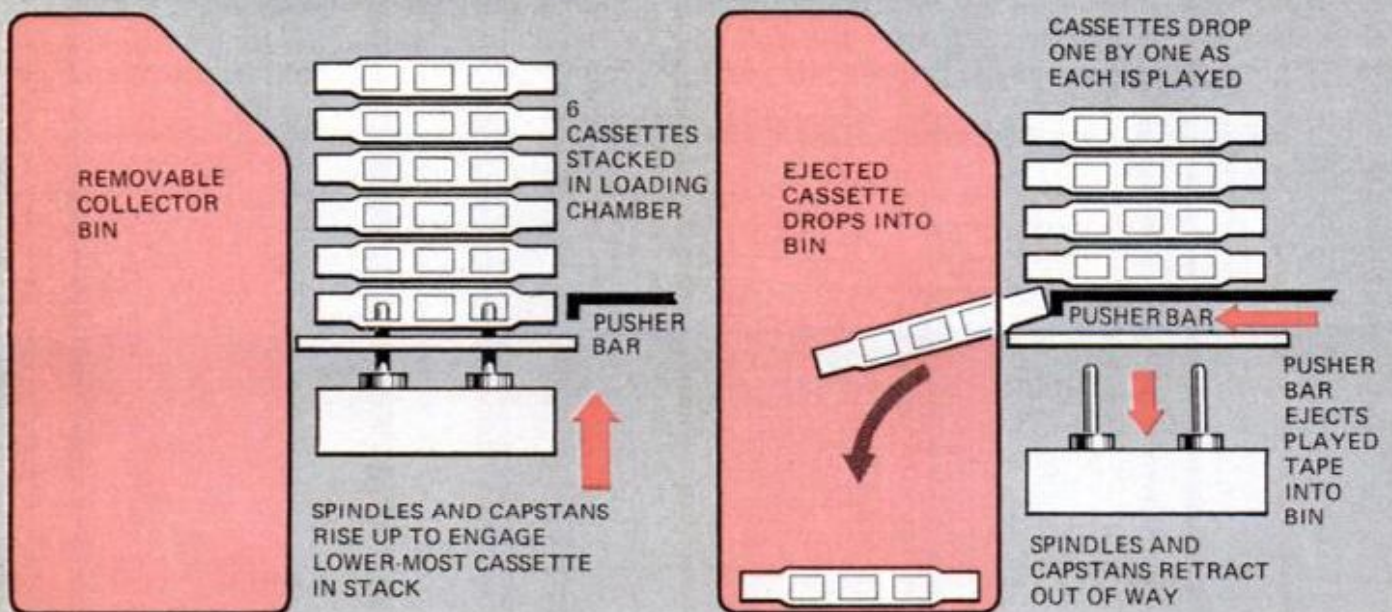




Look what they've done

Cassette players and recorders have blossomed into high-performance home entertainment systems full of smart engineering and fascinating gadgetry

HOW CRAIG'S VERTICAL STACK LOADER WORKS

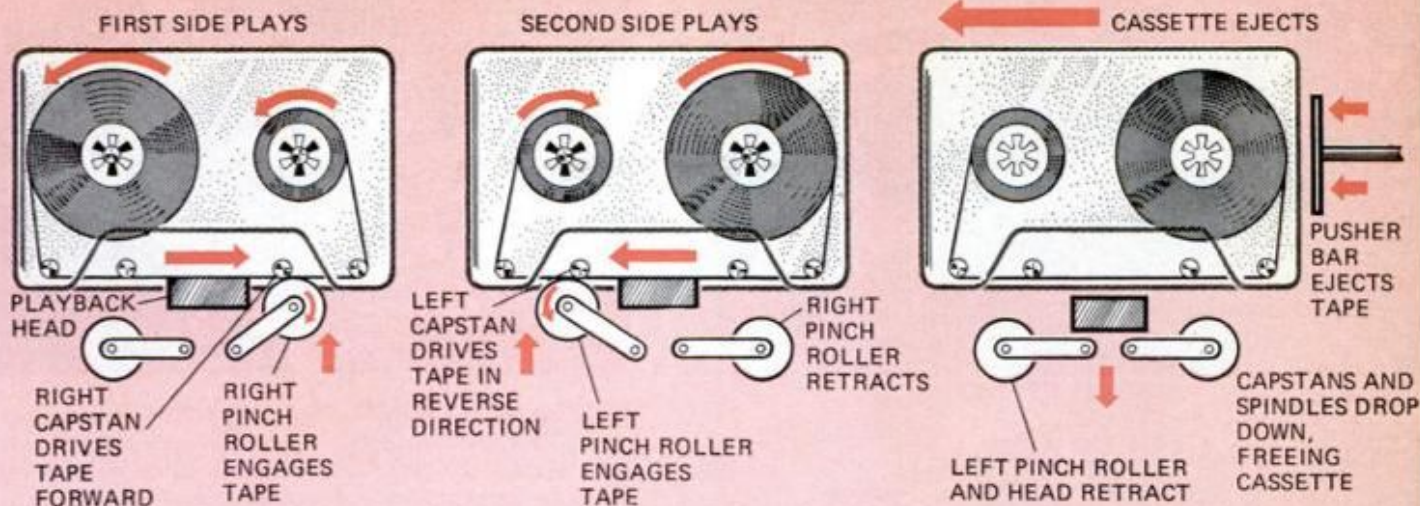


INGENIOUS CHANGER MECHANISM in Craig's Model 2805 deck not only plays a stack of six cas-
100

settes one after the other, but also reverses tape di-
rection automatically to play both sides of each.

POPULAR MECHANICS

HOW A REVERSING MECHANISM WORKS



USING TWO SEPARATE CAPSTANS and pinch rollers is secret of reversing a cassette without turning it over. To play first side, right-hand capstan and pinch roller drive tape forward. To play second side, right pinch roller retracts and left pinch roller engages left capstan to reverse tape travel.

In vertical stack loaders, such as Craig model shown on opposite page, cassette is ejected sideways by pusher bar after playing. In horizontal stack loaders, such as those shown on a following page, each cassette drops down edgewise into playing position, then pops back up, allowing next cassette to fall

with the lowly cassette!

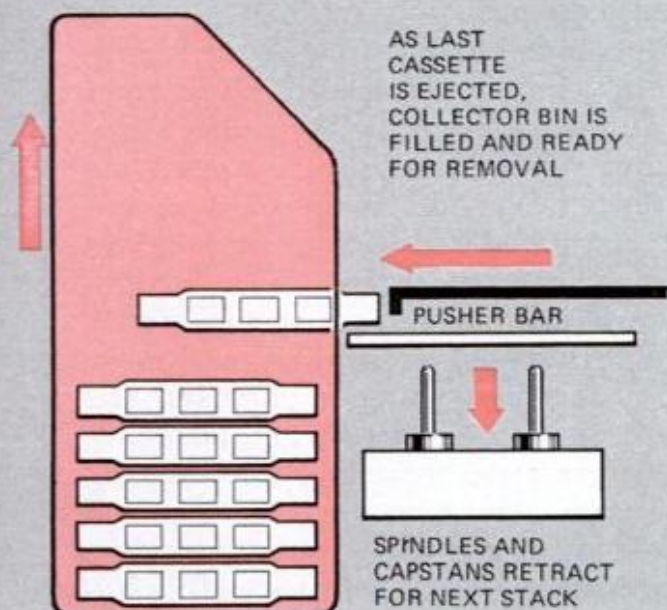
By WALTER G. SALM

THE QUIET REVOLUTION going on in cassettes over the past few years has suddenly exploded into a fascinating new form of hi-fi entertainment. The little portable machines you slung over a shoulder have grown into smartly styled, slickly engineered home units that are fast becoming the heart of high-quality household music centers. The reason: Cassettes now sound as good as disc records,

provide longer playing time, are easier to store and handle, don't become worn and scratched with use and offer other advantages that discs can't touch.

You can put a stack of tapes on an automatic changer, go off and forget them and get 12 hours or more of continuous music without lifting a finger. You can play both sides of a cassette without turning it over—a trick they were saying couldn't be done only a year or so ago. You can stop it in the middle, back it up to replay an earlier selection or skip ahead to an upcoming number. You can also make your own high-quality home recordings live, off the air or from other tapes or records—all things you can't do with a disc.

Cassette equipment has become so sophisticated that prices in the \$300 to \$400 range for advanced models are not



The first stack loading, reversing machine to combine both operations in one, it's priced under \$200

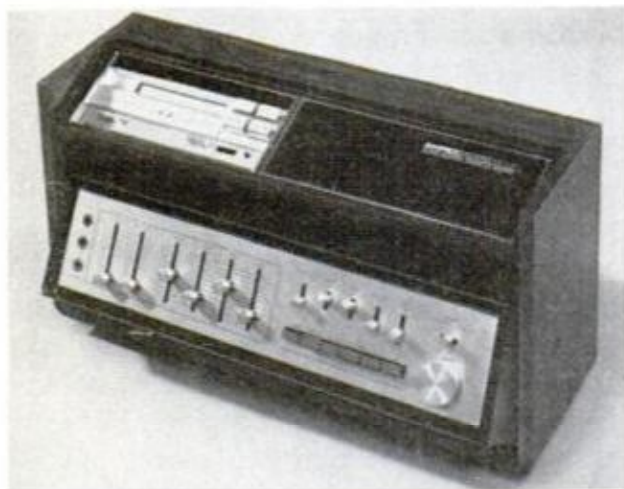
DECEMBER 1971



PACKED WITH PROFESSIONAL FEATURES, new Panasonic RS-275US cassette recording deck at left offers dual VU meters, individual slide-type level controls for both recording and playback on each channel, adjustable bias, memory rewind and automatic shutoff. A socket on back (far left) accepts a plug-in remote control. Price is \$249.95. Above are some of latest high-fidelity recording tapes, including Advent's chromium dioxide Crolyn formulation in foreground, followed by new high-density ferric oxide types such as TDK's Super Dynamic, Maxwell's Ultra Dynamic, 3M's High Energy Scotch, Lafayette's Ultra Dynamic Criterion and Ampex's 632



TWO REVERSING RECORDERS are Bell & Howell 3410 above and Ampex 187R below. B&H's model also incorporates an AM/FM/FM stereo tuner, has slide-type controls and sells with twin speakers for \$259.95



SMART SLOPE-FRONT CONTROL PANEL characterizes Ampex's 187R reversing cassette recorder. Like B&H model above, it includes AM/FM/FM stereo tuner and has slide-type controls. Price: \$450 with speakers

uncommon, although you can buy many fine machines for considerably less. Several almost simultaneous technological breakthroughs are accounting for the cassette's fast rise in popularity as a serious source of hi-fi entertainment. These include remarkably improved tape formulations, electronic noise-suppression systems that eliminate the cassette's biggest bugaboo—annoying background tape hiss—and playback mechanisms that are a marvel of mechanical ingenuity.

The oxide coatings that form the recording surface on tape are made up of tiny magnetic particles called "domains." The domains in conventional ferric (iron) oxide coatings are irregular in size and shape, causing poor recording characteristics. Now several makers are producing special ferric oxide coatings with smaller, more densely packed magnetic particles. The result is a more uniform and more highly sensitive recording surface, capable of greater frequency response and considerably improved sound reproduction. Examples of these special "high-density" tapes, as they're called, are TDK's "Super Dynamic," 3M's "High Energy" Scotch, Bell & Howell's "High

POPULAR MECHANICS

Density," Maxwell's "Ultra Dynamic" and Ampex's "632."

Taking another route, Du Pont has developed a chromium dioxide tape, called Crolyn, whose more uniform magnetic particles are said to boost frequency response by half an octave (a full octave doubles the frequency). This means a machine normally reproducing 10,000 cycles with standard ferric oxide tape is suddenly able to go up to 15,000 cycles with chromium dioxide. Originally designed as a high-quality computer tape, Crolyn has now been licensed to such makers as Advent, Norelco, Sony and Memorex for use in cassettes.

One problem with the new chromium dioxide and high-density ferric oxide tapes is that they require a different recording "bias" from standard tapes. This bias is a high-frequency a.c. signal—usually between 80,000 and 100,000 cycles—that's mixed with the

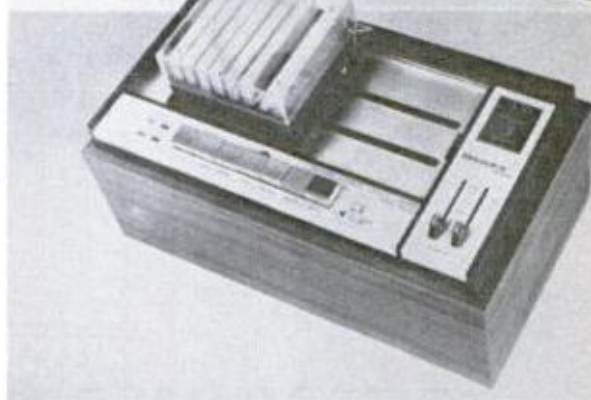
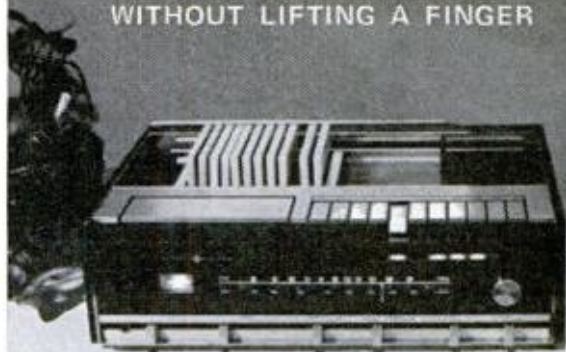


COMING SOON is Panasonic three-head deck, said to offer superior quality because it has separate record, erase and playback heads instead of usual single record-playback head. Price not yet announced

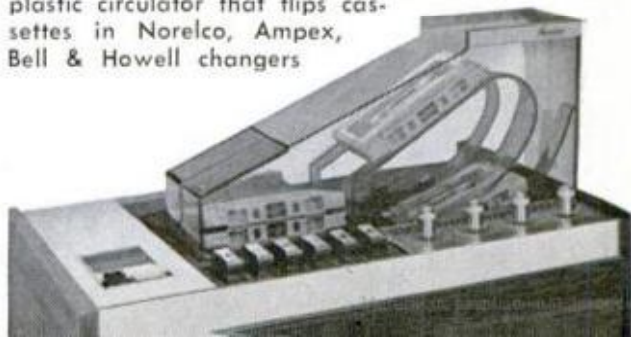


NEW NORELCO RECORDER above incorporates noise-reducing circuitry as well as adjustable bias for standard, high-density and chromium dioxide tapes. Equipped with dual VU meters, the 2100 is \$219.95
DECEMBER 1971

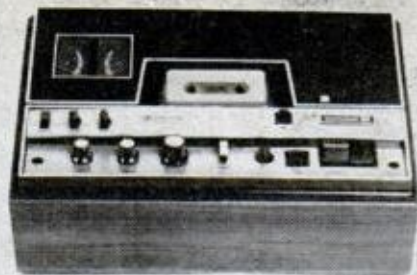
STACK LOADERS—VIRTUALLY
ENDLESS ENTERTAINMENT
WITHOUT LIFTING A FINGER



AUTOMATIC CHANGERS play 10 to 12 cassettes without stopping, providing a whole evening of entertainment. Above are (from top): GE M9000, \$449.95; Ampex 335, \$350; Panasonic rotary model (price not announced); Benjamin RAC-10, \$300. GE and Benjamin models both record as well as play. Below is plastic circulator that flips cassettes in Norelco, Ampex, Bell & Howell changers



6 DOLBYIZED CASSETTE RECORDERS



FAMOUS DOLBY SYSTEM for reducing noise in cassettes is finding its way into an ever-increasing number of home recording decks. Six above are (top row from left): Lafayette RK-D40, \$179.95; 3M/Wol-

lensak 4760, \$299.95; Harman-Kardon CAD5, \$229.95. In lower row from left are: Fisher RC-80, \$199.95; TEAC 350, \$279.50; Advent 200, \$260. Such decks can be played through any good-quality hi-fi system

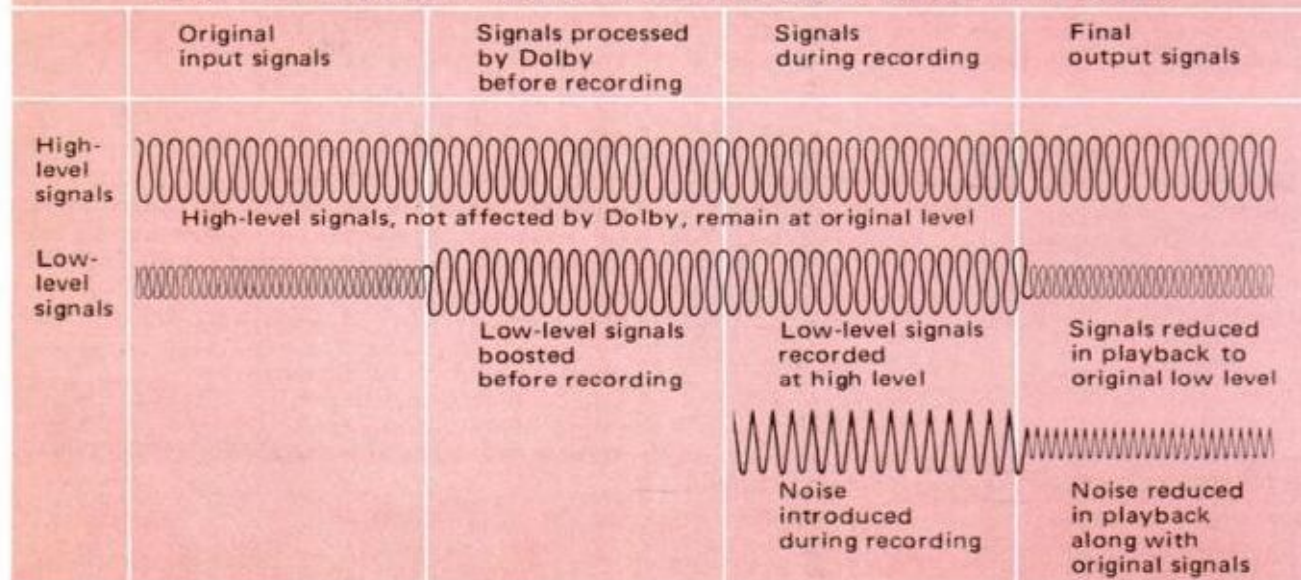
regular audio signal during recording. The added bias has the effect of smoothing out the oxide's basically nonlinear character to produce the desired flat, wide-range frequency response.

For maximum reproduction quality, the amount of bias must be varied to suit the new tapes. Until recently, most recorders had a fixed bias. Now machines are coming on the market with switchable bias to give you a choice.

Some offer two settings, one for regular and one for high-density tapes. Others are adjustable for all three types—regular, high density and Crolyn's chromium dioxide. If you're planning to use Crolyn, this is an important point to check on when you choose a machine, since chromium dioxide requires a much more drastic change in bias than ferric oxide tapes.

Another big splash in the cassette pond has been made by the so-called

HOW THE DOLBY NOISE-SUPPRESSION SYSTEM WORKS



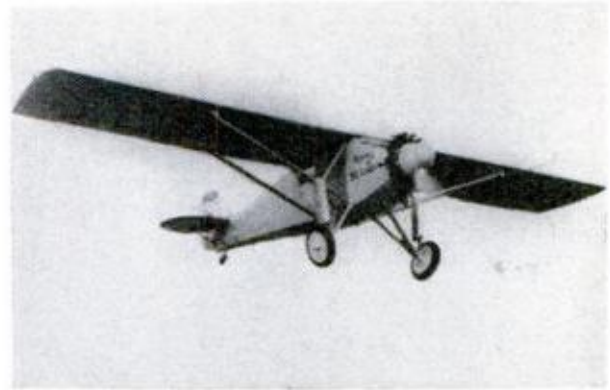


ACCESSORY DOLBY UNITS let you add noise-suppression circuitry to cassette recorders not originally equipped with Dolby system. Two shown above are (top) TEAC AN-180, \$289.50; Advent 101, \$125

"Dolby" noise-reduction system invented by electronic genius Ray Dolby. In this system, quiet, low-level passages of music—where tape hiss is most noticeable—are boosted in volume prior to recording. In playback, they're reduced in volume to their original level. Noise introduced during recording is thus reduced at the same time, becoming much less apparent. Loud passages are not affected by the Dolby system since they effectively mask out tape hiss by their greater volume. The accompanying graph shows how the system works. Not only does it improve the sound of tapes you record yourself, but it also greatly enhances the effect of pre-Dolbyized commercial cassettes that recording studios are now beginning to produce.

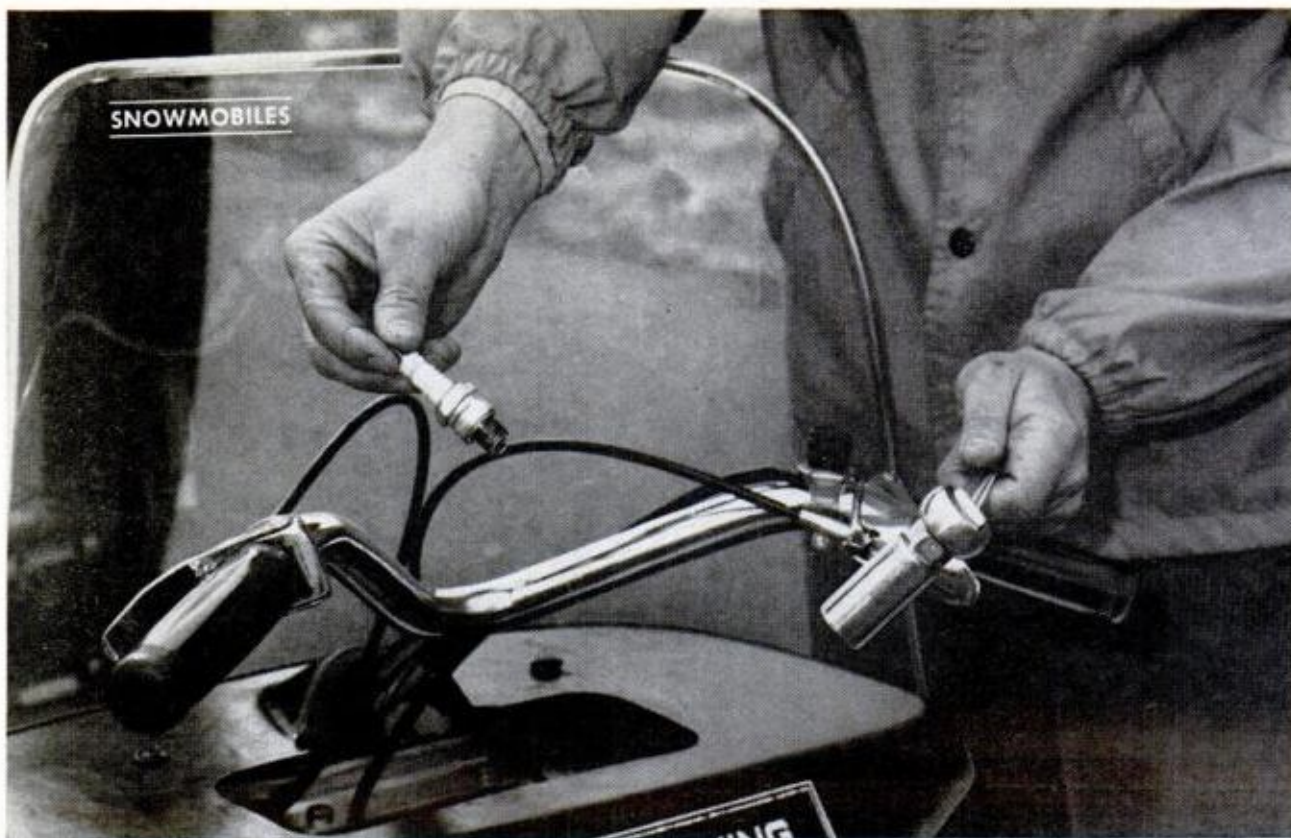
So far, there are at least six cassette recorders offering built-in Dolby circuitry. These are made by Advent, Fisher, Harman-Kardon, TEAC, 3M-Wollensak and Lafayette. Prices range from under \$200 to about \$300. You can also buy add-on Dolby units for use with recorders not Dolby-equipped. These connect between your recorder

(Please turn to page 188)



Nostalgia airborne

Stand-ins for the *Spirit of St. Louis* and Wiley Post's *Winnie Mae* still fly. The two planes (above) were built on the same assembly lines as their famous sisters. They are now owned by Dave Jameson (bottom) Oshkosh, Wis., who purchased, restored and repainted them to resemble the Lindbergh and Post aircraft now in museums.



The right plug for your snowmobile

The sparkplugs that came with your machine may not be the best ones for your use. Here's PM's guide to proper selection

By MORT SCHULTZ

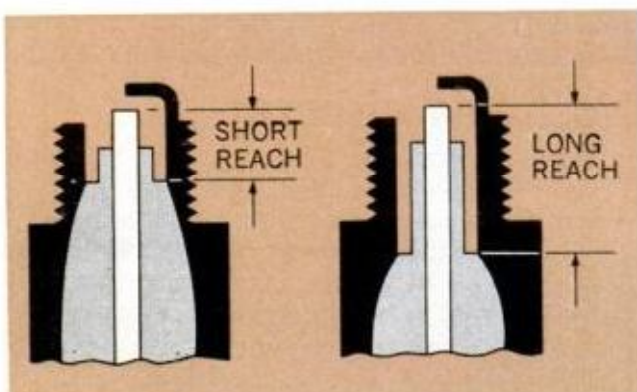
WHEN SELECTING sparkplugs, manufacturers know some owners will operate their snowmobiles at continuous top speeds in deep snow or on steep terrain, causing cylinder-head temperatures to soar. Therefore, most

makers prefer to install "cool" plugs.

The difference between a hot and cold plug has nothing to do with spark intensity. It's simply the difference in temperature at which the plug will operate inside the combustion chamber.

A cold sparkplug has a short reach between the firing end of the center electrode and seat line at the top of the thread. This type plug dissipates heat quickly and is designed for engines that build up high combustion temperatures.

A hot sparkplug has a long reach so that it can transfer heat slowly, allow-



COLD PLUG has short reach which sheds heat to engine head more readily than long-reach (hot) plug

POPULAR MECHANICS

Representative Snowmobile Engines and Their Recommended Sparkplugs

Make	Model	AC	Autolite	Bosch	Champion*	NGK
Bolens	292, 295, R295, 315, 340, R340 399, R399, 440, R440	S41F S40F	AE1X AE901X	W225T1 W260T1	L81 (L6G) L78 (L3G)	B7HZ B8HC
Canadian Curtiss-Wright (CCW)	225, 248, 300, 375, 600 240, 290, 340, 400, 440 450	S83F S41F S82F	B3W AE1X B2W	M225T1 W225T1 M240T1	K9 (K8G) L81 (L6G) K7 (K8G)	A7 B7HZ A8
Chrysler	820	S42F	AE2X	W175T1	L7 or L86 (L6G)	B6H
Evinrude (see OMC)						
Giudetti	TT36, TT36S, GG44, GG44S	S42XL	AG2X	W240T2	N3 (N3G)	B9ES
Hirth	52R, 53R, 81R, 82R, 110R 54R, 55R, 56R, 160R, 190R, 193R 170R, 171R, 191R, 192R, 194R, 200R, 210R, 211R, 220R, 260R 230R	S85F S83F S82F S41F	B6X B3W B2W AE1X	M175T1 M225T1 M240T1 W225T1	K13 (K12G) K9 (K8G) K8 (K5G) L78 (L3G)	A6 A7 A8 B7HZ
JLO	L99 L152, L197, L252 L227, L230, L295, L297, L380 L292, L295/70, L300, L340, L340/70, L372, L395, LR440/2, LR760/2 R295, LR340/2, R340 LR399/2	S44F S85F S83F S82F S42XL S43XL	AE4X B6X B3W B2W AG2X AG3X	W145T1 M175T1 M225T1 M240T1 W240T2 WG190T28	L87Y (L6G) K13 (K12G) K9 (K8G) K8 (K5G) N3 or N60Y (N3G) N3 (N3G)	B4H A6 A7 A8 B9ES B7E
Johnson (see OMC)						
Kawasaki	150A, 150B 150C, 400 295, 340 (free air) 340, 440	S82F S42XL S41XL S43XL	B2W AG2X AG901 AG3X	M240T1 W240T2 W260T2 WG190T28	K7 (K8G) N3 (N3G) N57R or N57 (N2G) N3 (N3G)	A8 B9ES B10ES B7E
Kohler	K295-1, K335-1, K309-1, K399-2, RK399-2, K440-2, RK440-2, K539-2, K618 K340-2 K181	S82F S40F S46	B2W AE901X A7X	M240T1 W260T1 W145T3	K8 (K8G) L78 (L3G) J8 (UJ11G)	A8 B8HC B6
Lloyd	LS-400 (14-mm head) LS-400 (18-mm head)	S42F S83F	AE2X B3W	W175T1 M225T1	L86 (L6G) K9 (K8G)	B6H A7
Mercury (see Hirth, CCW)						
OMC	362 437	S46 S44	A7X A3X	W145T3 W175T3	J8J (UJ11G) J7J (UJ7G)	B6 B77C
Polaris	EC16P Star 175-EC17P, EC29P, Star 294, Star 335-EC34P, EC37P, Star 398-EC40P, EC44P, Star 432 (Charger), Star 432 (TX), Star 488-EC50P, EC744X, EC79P, EC80P EC29PF, EC34PF, EC39PF, EC40PF, EC43PF EC65P	S44XL S43XL S41XL S42XL	AG3X AG3X AG901 AG2X	W175T2 WG190T28 W260T2 W240T2	N5 (N4G) N4 (N4G) N3 (N3G) N3 (N3G)	B6ES B7E B10ES B9ES
Rotax	250, 292TNT, 300, 335, 440TNT, 640, 640TNT 320, 340TNT, 340SS, 669TNT, 775TNT 320SS 370, 371, 399 399TNT	S85F S83F S82F S41F S40F	B6X B3W B2W AE1X AE901X	M175T1 M225T1 M240T1 W225T1 W260T1	K13 (K12G) K9 (K8G) K7 (K5G) L81 (L6G) L81 (L3G)	A6 A7 A8 B7HZ B8HC
Sachs	SA280, SA280A SA290, SA320, SA340 SA290SS (18 mm), SA340SS, SA370, SA400, SA2-740, SA2-740C SA290SS (14 mm), SA340C, SA2-440, SA2-440C SA2-340	S85F S83F S82F S40F S42XL	B6X B3W B2W AE901X AG2X	M175T1 M225T1 M240T1 W260T1 W240T2	K13 (K12G) K9 (K8G) K7 (K5G) L78 (L3G) N3 (N3G)	A6 A7 A8 B8HC B9ES
Solo	206, 209	S41F	AE1X	W225T1	L81 (L6G)	B7HZ
Wankel	KM 914 (1 & 2 rotor)	S41F	AE1X	W225T1	L81 (L6G)	B7HZ
Yamaha	SL150, SL338 (806), SL338B (810), SL350 (802), SL351, SL396 (807), GP396, SW396 (811), SW433 (819) SL292 (812) SS292, SS338 (808), SS396 (809) S300, S350B SS433 (818), SR433	S41F S43XL S42XL S40F S41XL	AE1X AG3X AG2X AE901X AG901	W225T1 WG190T28 W240T2 W260T1 W260T2	L81 (L6G) L78 (L3G) N3 (N3G) L78 (L3G) N60 (N2G)	B7HZ B7E B9ES B8HC B10ES

*Designations in parenthesis refer to Champion's premium Gold Palladium sparkplugs

ing deposits to burn off. It is for engines that run cooler.

Installing a plug poorly suited to your regular use can lead to preignition on the one hand or fouling on the other—power loss and expense in the form of new sparkplugs.

To start your hunt for just the right plug, you have to choose one. This is not as simple as it sounds, because many owner's manuals are vague on his point. Most snowmobile owners assume they have to keep using the same plug that came with their machine.

Let the chart on the preceding page serve as your starting point. If you're lucky, the plug listed for your engine may be the right one. If it isn't, you at least have a plug from which to go.

Once you've installed the plug, pull it after each use and examine the tip. If the plug is too cool for your operation, it will build up black deposits. In that event, switch to a plug of the same make and type that is one heat range hotter.

If the plug begins to show tiny blisters and a whitish cast at the insulator (electrode end), it's overheating and is too hot for operating conditions. Before engine damage is done, replace it with a plug that is one heat range cooler.

The electrode end of a normally operating sparkplug will have a brownish color.

Your dealer has charts to help you get the right one. For example, suppose your machine uses an 18-mm plug and you're partial to Champions.

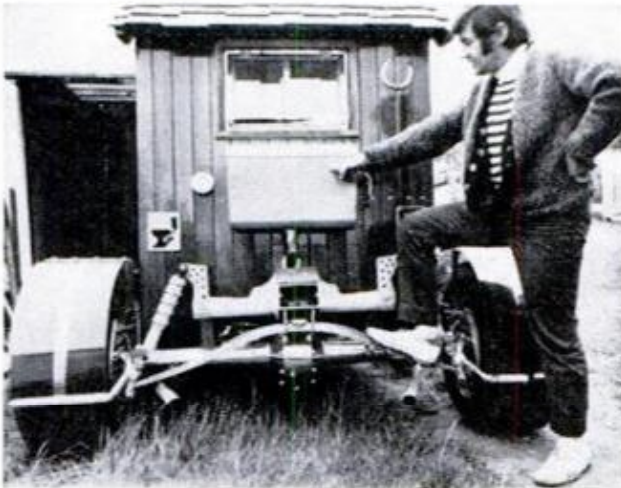
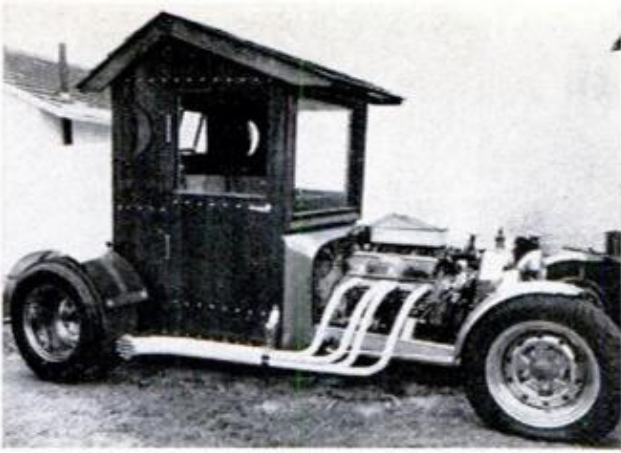
Okay, in this particular category, Champion has designated its plugs as K-13 (at the hot end), K-9, K-8 and K-7 (at the cool end). If a K-9 is too hot for your engine, you should switch to a K-8. Don't jump plugs. Go to the next heat range, hotter or cooler.

There are two other points to keep in mind. Although using the wrong plug in the heat range is the chief cause of fouling, improper fuel mixture and an incorrectly adjusted carburetor can also cause plugs to foul. Check 'em out. ★★ ★



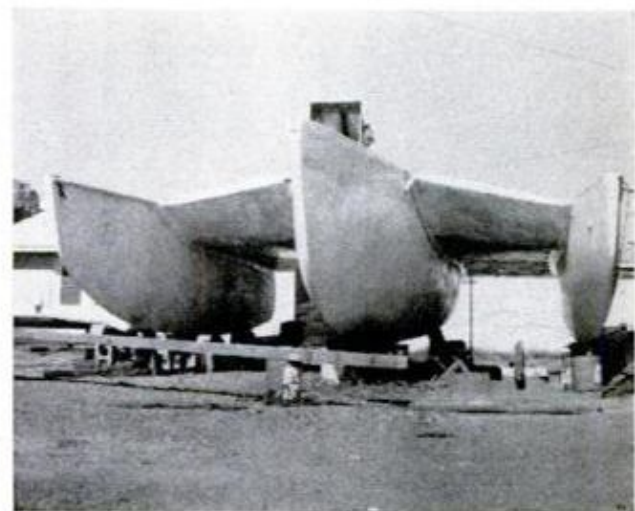
Buffalo roof raising

The 2200-ton roof of Buffalo's Memorial Auditorium was raised 24 feet this year in what has been termed the largest roof-raising project ever attempted. The additional space made room for a new 4800-seat balcony, bringing the arena's seating capacity to 15,200. Forty-eight hydraulic jacks (bottom photo) working in unison were required for the job. Top photos show the roof in its new position.



Whoever thought they'd put wheels on it?

Yes, it looks just like an authentic old-timer—with wheels. The outhouse on wheels built by Reg Thomson, a South African tool and diemaker, is a faithful replica of that old rural standby with a few added touches. The "lavatory" is powered by a 1965 Chevrolet engine brightened with chrome and equipped with triple carburetors (top left). The radiator was cannibalized from a 1913 Model T Ford. The water tank (above, left) at the back contains the battery. The "car" is used only for transportation.



Around-the-world trimaran

Landlocked builders of this trimaran looked ahead when they built their vessel in a Phoenix, Ariz., back yard. The three hulls and cabin are detachable so they can be trailered to California for launching. The 40-foot long, 4½-ton boat, designed to sail around the world, contains 4000 pounds of flotation foam in the hulls. The cabin, including captain's quarters and four bunks for the crew, extends 14 feet across the hulls.

How to customize your hunting-knife handle

By MONTE BURCH/Photos by the Author

A GOOD HUNTING KNIFE should fit your individual use and needs. And making one is not as difficult as you may think. For starters, good blades today are available from a variety of mail-order sources. A good selection, for instance, can be had from Indian Ridge Traders, Box X-50, Ferndale, Mich. 48220.

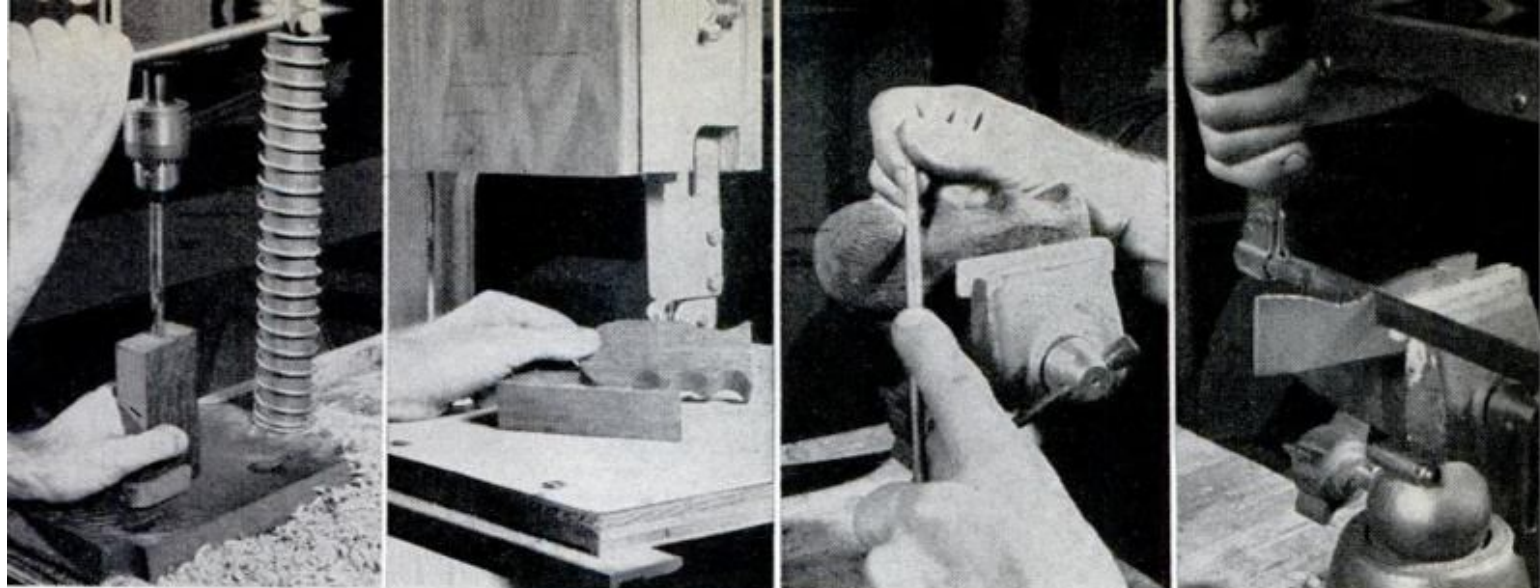
Almost anything can be used as the handle, including antler, bone, ivory or leather rings. However, one of the best materials and probably the easiest to work with is a heavy mineral wood such as amaranth, vermilion, zebra-wood or ebony. These woods will not rot and are heavy enough to balance with the blade. The wood depicted in this article is amaranth—an extremely hard, oily wood that takes checkering or carving and finishes like a piece of fine metal. It is available in the inch thickness required for a good knife handle from Craftsman Wood Service Co., 2727 South Mary St., Chicago, Ill. 60608.

Best bet is to order a knife-blade catalog and select a blade. While you're waiting for it to arrive, trace its design and make sketches of a handle pattern to fit it.

The pattern shown could be adapted to most any knife, but the "three-finger" handle best suits a knife with a forefinger hole in the blade. Grasping the handle at the rear makes the knife front-heavy, ideal for lopping off tree limbs or hacking through bone when preparing meat. By moving your fingers up one notch, you have good control for delicate skinning operations.

Grind about 1¼ inches off the end of the tang. Make a template for the handle pattern out of cardboard, cut a block from the handle wood and glue the template in position. Make sure the block is absolutely square on all sides. Using a clamp to hold it upright and square, place the block in your drill press and bore for the tang. Be sure to measure the exact length of the tang and bore just a bit deeper. Make sure the hole doesn't "lean" to one side. You may have to grind the tang a bit to make it fit properly. When the handle block fits on the tang with just a little persuasion, remove it and cut out the handle as shown





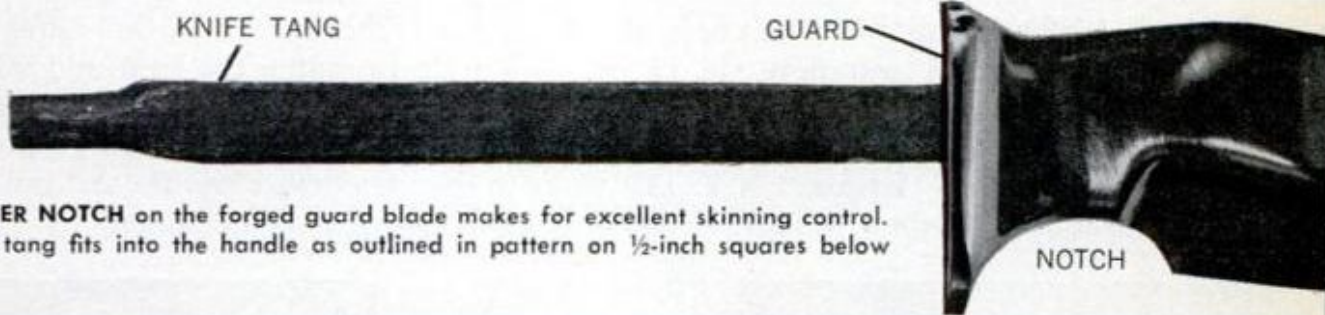
PATTERN FOR HANDLE is traced or glued on squared-hardwood block. Then (from left) block is held in clamp and tang hole bored. Handle shape is cut on bandsaw or coping saw. Next, handle is roughed to shape with rasps and files. Spacer guard is cut from brass stock to separate handle from forged metal guard

in the series of photos directly above.

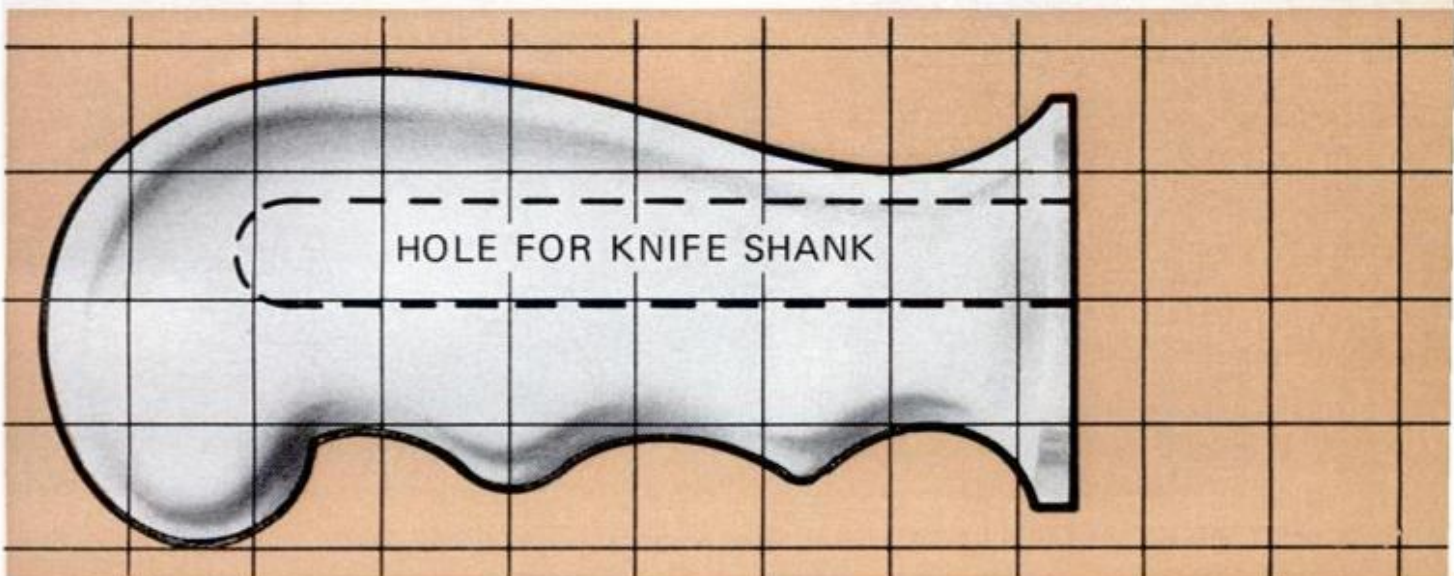
Next make the brass guard. The one shown was purposely kept small so you could get your forefinger into the notch on the blade. It is needed to butt the handle, providing a smooth transition from handle to blade. The guard should be about $\frac{1}{8}$ -inch thick and large enough to extend around the handle at least $\frac{3}{16}$ inch. Using a hacksaw, cut a brass square the size you wish your guard to be and bore it to fit over the tang. You

may have to bore it oversize, as the tang widens at the base of the knife blade.

When you have it bored to fit over the tang and tight against the end of the blade, grind it in an oval determined by the shape of your knife handle. This is a grind-and-fit operation. Grind a bit off, place it on the tang and fit the handle until the oval is centered with blade and tang. Slide the brass guard in place. Mix a batch of epoxy glue and force it into the tang hole in the handle. Then



FOREFINGER NOTCH on the forged guard blade makes for excellent skinning control. The knife tang fits into the handle as outlined in pattern on $\frac{1}{2}$ -inch squares below





FORCE EPOXY GLUE into bored hole. Place brass guard over blade tang and press tang into hole. Let it sit overnight. Next day, put taped blade in vise, sand handle and brass guard with progressively finer paper

place the handle down on the tang and examine it from every angle to insure you have the brass guard positioned right and the handle square with the blade. Tap the end of the handle to seat it and let it set overnight.

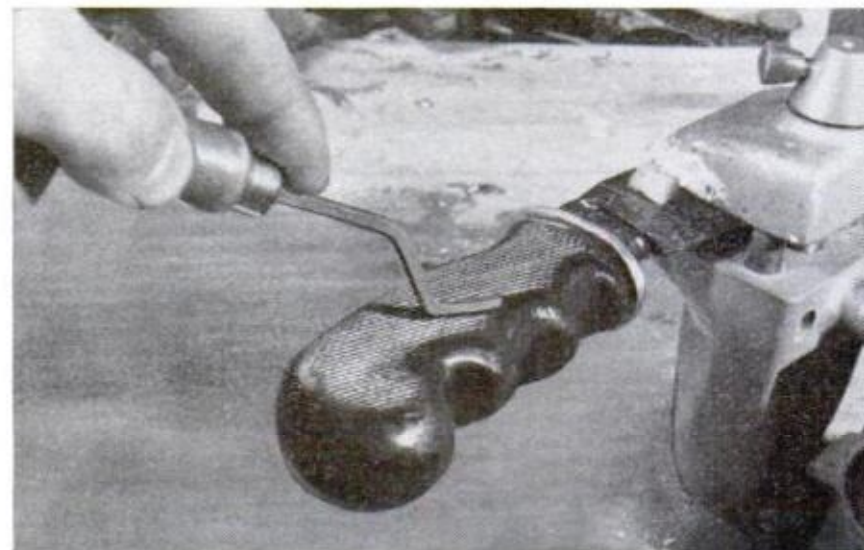
Using finer grits of wet-or-dry sandpaper, finish the handle and guard. If you have a buffing wheel, polish the handle and guard to a satin sheen. Apply a good quality gunstock finish—oil or spray epoxy—and lightly polish with paste wax and a soft cloth.

You may wish to checker your handle so that it will be much easier to hold when wet or in cold weather. Do not use any checkering finer than 18 lines to the inch. It's beautiful, but won't help much on your grip. A complete set of economical checkering tools is available from Frank Mittermeier, Inc., 3577 East Tremont Ave., Bronx, N.Y. 10465. Amaranth and other mineral woods are

especially hard, so hone your checkering tools sharp before you start.

Using a scribe or nail, lay out the checkering design, scratching it lightly into the finish. Using the diamond template, lay out the first line and cut it fairly deep with the single cutter. Switch to the double cutter and score the lines in one direction. When all lines are cut in one direction, find the first line for the other direction with the template and cut it. Proceed as before and when all lines are scored, use the single-line cutter to deepen them and make the diamonds sharp and even.

When the checkering is completed, cut the outline using a fine veiner chisel. Checker the other side of the handle to match the first and with fine sandpaper, knock the sharp burrs off the edges of the diamonds. Apply finish to the checkered handle and polish and burnish it to a fine sheen. ★★★



APPLY QUALITY GUNSTOCK FINISH, spray epoxy or oil type. Then checker the knife handle for better grip, spray checkering with the finish and remove black plastic electrician's tape used to protect the blade



DUCK HUNTING TIPS

By LEFTY KREH

SOME DUCK HUNTERS think early hours and patient waiting in the blind are all that's necessary for a limit of birds. And they probably shoot enough "uneducated" ducks at the season's start to justify their thinking. But to hunt productively as the season moves along takes more than promptness and persistence. Weather

knowledge and decoys kept in perfect condition are also part of gunning savvy. There are little tricks, too. For instance, the decoys above at right are easily spotted as phonies by a circling bird because of their glaring anchor lines. Decoys at left, however, are attached to their weights with clear monofilament. ★★★



USE DUCKS you've already shot. Here author puts out a pair of "resting" birds not far from his blind



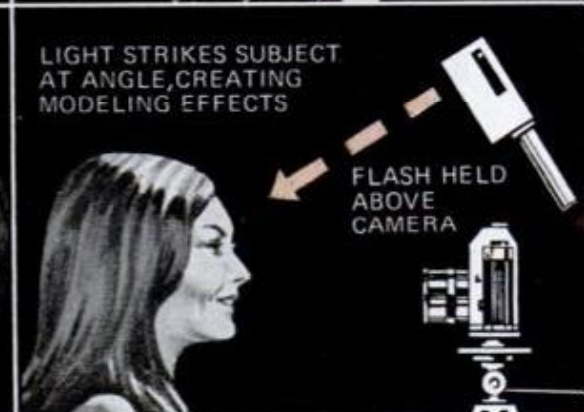
MOVE YOUR CANOE some distance from blind and make sure its bright parts are properly camouflaged



NEVER THROW DECOYS in water in frigid weather. Water splashed on decoys freezes to unnatural glaze
DECEMBER 1971



CAMOUFLAGE YOUR BLIND with local materials. Driftwood and grasses found on spot are best bets



WHAT A DIFFERENCE a few inches can make! Small inset photo above was made with flash on camera, is flat, washed out and displeasing. Larger view shows same setup except that flash was held slightly above camera. Downward lighting brings out facial modeling, heightens contrast, adds depth and tone to picture

Flash pictures: Little tricks that make the big difference

By **SHELDON M. GALLAGER** and **BURT MURPHY**

Photos by Robert D. Borst

EVER WONDER WHY those flash shots come out looking so flat, pasty and lifeless? The trouble is, flash has become so easy to use that its real possibilities are often overlooked. You stick the gun right on the camera in a handy clip and bang away. Sure, it's simple—but it

doesn't always produce the best pictures.

Direct on-camera flash tends to blast your subject with excessive light, especially if you're close. This washes out subtle details, creates glaring hot spots and produces harsh background shadows. There are several simple tricks that can solve



BOUNCE LIGHTING is another way to improve results with a single flash. Note that effect is similar to that of off-camera flash shown on opposite page, with good facial modeling and no flash washout. This technique works well with light-colored reflective ceilings, but can't be used outdoors. Swivel accessory lets you tilt flash upward

these problems. One is merely to get the flash off the camera. It's amazing what a difference just holding the gun a few inches above the camera can make. Instead of harsh direct light, you get a downward cross light that brings out facial modeling, adds depth and dimension to the picture and gives your subject a more "natural" look because it approximates the natural angle of overhead sunlight.

Bounce lighting is another way to soften the effect of flash. By tilting the gun upward, you reflect the light off the ceiling so it strikes your subject at a downward angle, again like the sun, diffusing and becoming less harsh in the process.

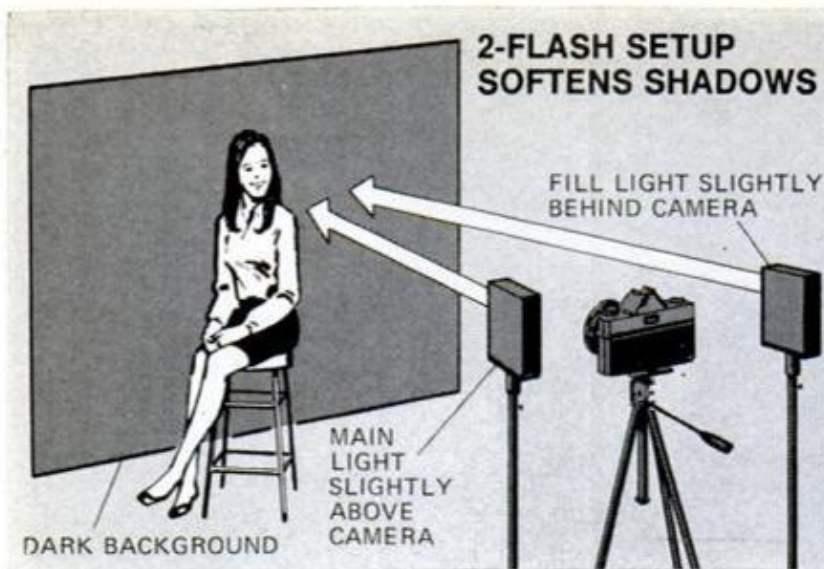
A third trick is to use more than one flash. With additional units, you can fill in dark areas, soften shadows and create special effects not possible with a single flash. This used to be impractical when flash-guns were costly, but today you can buy small pocket-sized mini-strobes for less

than \$15. The three shown at the top of page 117, for example, are little Capro FL-3 units that are sold by Ehrenreich for \$14.95 apiece.

To get the flash off the camera, you'll need some special hardware. The standard shoe clips provided on cameras are not designed for quick flash removal, and the flash sync cord is generally too short anyway.

One answer is a quick-release bracket. These are made in several types to fit a variety of cameras. For convenience in handling, you can leave the flash attached to the camera. When you want to shoot off-camera, you just press a button and the flash holder slips off. For added reach, you can replace your present short sync cord with the coil type that stretches out to five or six feet.

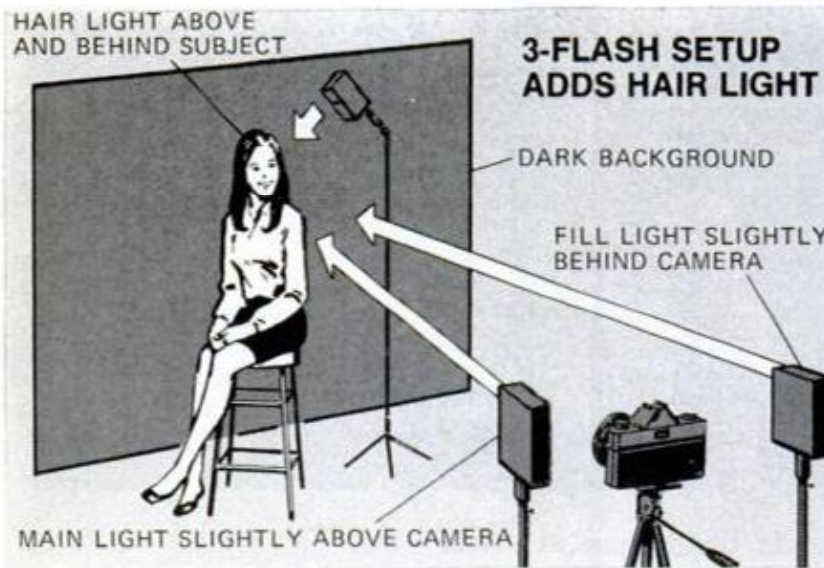
Another way to get the flash off the camera is to mount it on a light stand or similar support. Accessory flash shoe clips are available with a standard 1/4-20



**2-FLASH SETUP
SOFTENS SHADOWS**



ADDING SECOND FLASH provides "fill" light, softening shadows cast by main flash. Main and fill lights should be placed on opposite sides of the camera, with fill farther back to avoid overpowering main flash



**3-FLASH SETUP
ADDS HAIR LIGHT**



THIRD FLASH, above and behind the subject, adds pleasing highlight on hair, helps separate subject from background. Note difference between upper and lower photos. Dark background kills shadows, is dramatic

HELPFUL FLASH ACCESSORIES are shown in photos below and on facing page. Most are inexpensive, ranging in price from about \$2 to \$4 for extension cords, swiveling shoe clips, multiple-flash connectors and



LONG FLASH EXTENSION CORD



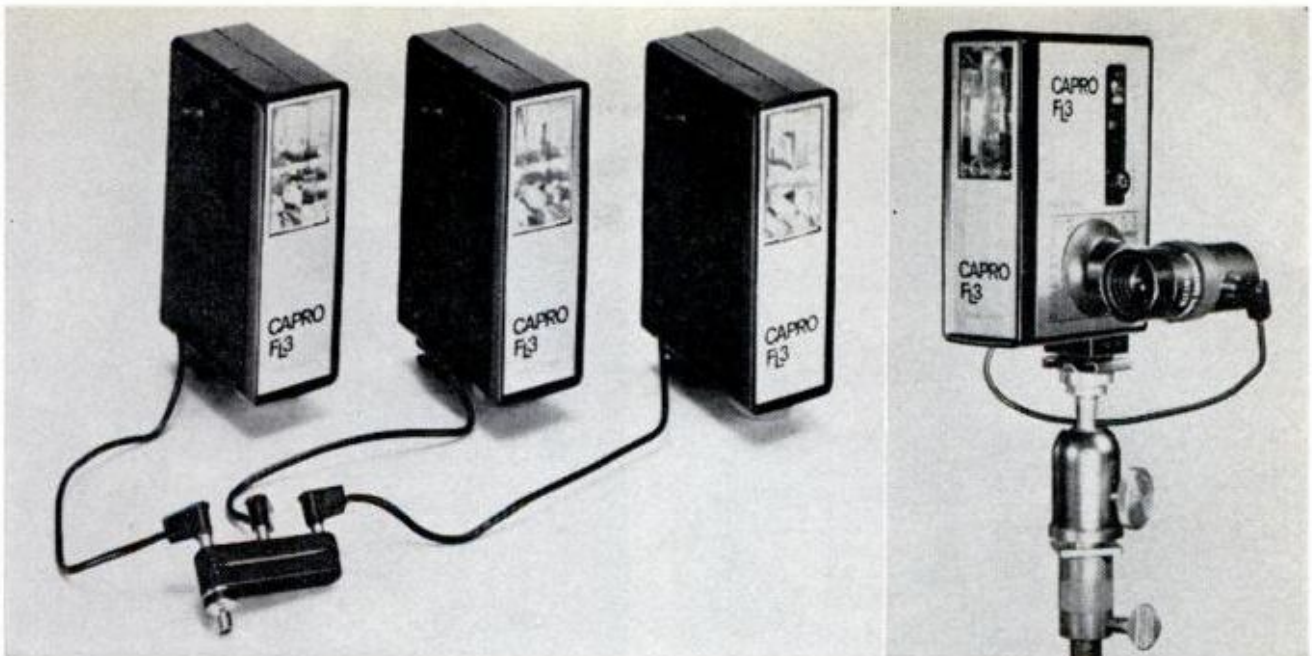
LIGHT-STAND ADAPTER



SWIVELING SHOE ADAPTER



REMOTE FLASH SLAVE TRIPPER



FIRING THREE FLASHGUNS simultaneously is easy with multiple-contact connector at left, above. Connector can be plugged directly into camera's sync socket or attached to extension cord. Photo at right shows slave tripper attached to flashgun. It can fire flash remotely without an extension cord, saving long runs of wire. Mini-strobes shown here are low-cost Capro FL-3 units sold by Ehrenreich for under \$15

threaded tripod socket in the bottom. With one of these, you can attach the flashgun to a tripod, light stand or photographic C-clamp. The advantage of mounting your flash on a separate support is that it frees your hands to operate the camera. It's also helpful when you're shooting close-ups. You can move the camera in tight, but keep the flash farther back in order to avoid overexposing and washing out your subject.

For multiple-flash setups, several types of connectors are available that make it possible to hook as many as three strobes

to a single sync cord. Thus all units fire simultaneously when you trip the shutter. You can use one flash as a main light, set up another as a "fill" to soften the shadow areas and place a third above and behind your subject to serve as a dramatic "hair" light.

For some setups, you'll need one or two long flash extension cords. These come in rolls up to 20 feet in length and usually have a female connector on one end and a male on the other. The male end connects to the female end on your regular sync cord and the other end plugs into

similar adapters. Remote slave trippers for extension flash cost about \$15 to \$30. Coil-type sync cord stretches to about five feet, lets you pull the flashgun off camera, but keeps cord neatly wound when it's not in use



TWO TYPES OF MULTIPLE FLASH CONNECTORS

HOT SHOE ADAPTER

TILTING BOUNCE FLASH ADAPTER

COIL-TYPE FLASH CORD

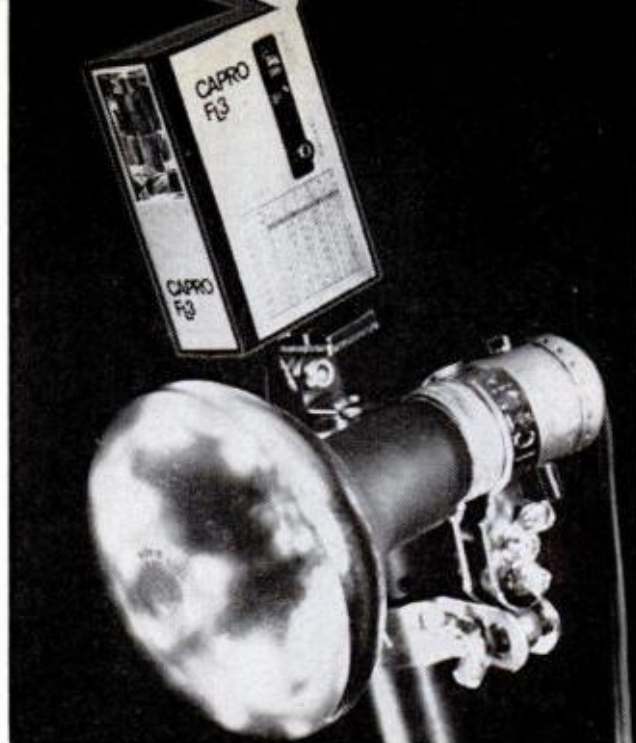


HOT-SHOE ADAPTER fits in standard camera flash clip and enables any gun equipped with a live shoe contact to be put on or taken off quickly without having to connect or disconnect camera's sync cord

the camera sync outlet in the usual way. If you'd rather avoid trailing a long cord around the room, you can also use a slave tripper to fire your extension flash. This is a small, cordless photoelectric cell that attaches to the remote flash and picks up light from the main flash. As the main flash goes off, it trips the extension flash at the same time.

Slave trippers, extension cords, multiple-flash connectors and other flash accessories are readily available at most photo stores. Two of the major suppliers of such equipment are Spiratone, Inc., 135-06 Northern Blvd., Flushing, N.Y. 11354 and Ehrenreich Photo-Optical Industries, Inc., 623 Stewart Ave., Garden City, N.Y. 11533.

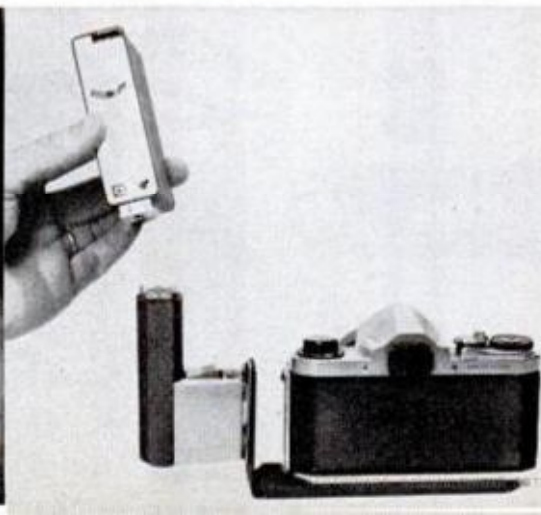
QUICK-RELEASE BRACKETS let you keep flashgun attached to your camera for convenience in carrying, but disconnect easily for off-camera shooting. Bases have $\frac{1}{4}$ -20 threaded sockets in the bottom so they can also be mounted separately from camera on a tripod, light stand, photo clamp or other support. One at left, below, is made by Aimes Hershey, one at right by Honeywell. Prices range from about \$15 to \$20



WANT TO CHECK where your flash is aiming before you fire it? This improvised "modeling" light is made from two photo flood holders linked together and clamped to the post of a quick-release bracket



TWIN-FLASH BAR is useful for shooting groups of people or large-area scenes outdoors at night where maximum light is needed. Not recommended for close-ups, however. Sold by Spiratone, it's \$5.70



3 dancing light displays you can build yourself



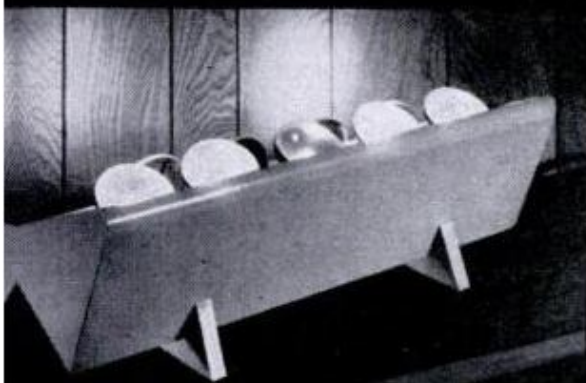
DOUBLE-SIDED DISPLAY above has bulbs facing both upward and downward to bathe an entire wall in constantly changing patterns of flashing colored lights

Colored lights flash on and off for party fun during the holidays or throughout the year. You can control them with simple plug-in Christmas-tree flashers or electronically in time with music from your hi-fi speakers

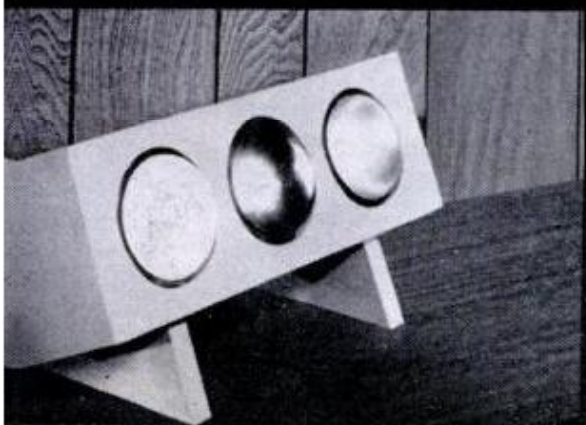
By **SHELDON M. GALLAGER** Photos by Robert D. Borsl

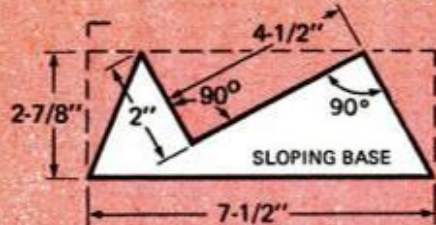
YOU DON'T HAVE TO BE a teenager or rock fan to enjoy the exciting effects of flashing colored lights. The displays shown here can add decorative party lighting to a den or playroom and can also be taken outdoors in summer for dramatic night lighting of porch decks and patios. Unlike conventional "psychedelic" boxes that confine their effects to a small viewing screen, these bulb-type displays can light up a whole wall, creating an eerie, exotic atmosphere for informal entertaining fun.

The flashing lights are based on ordinary 75-watt mushroom-type lamps readily available at hardware stores, electrical shops and discount centers. The bulbs come in a variety of colors, the most common being red, blue, green and yellow. Since they draw little current, you can

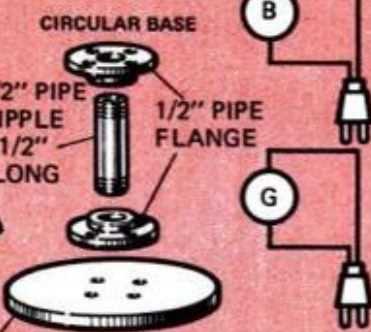
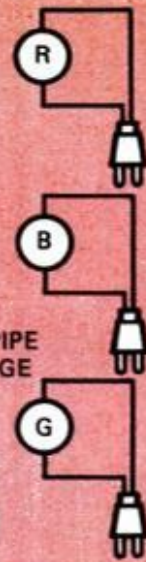
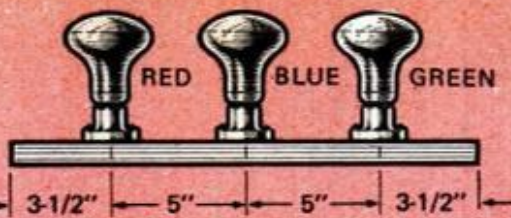
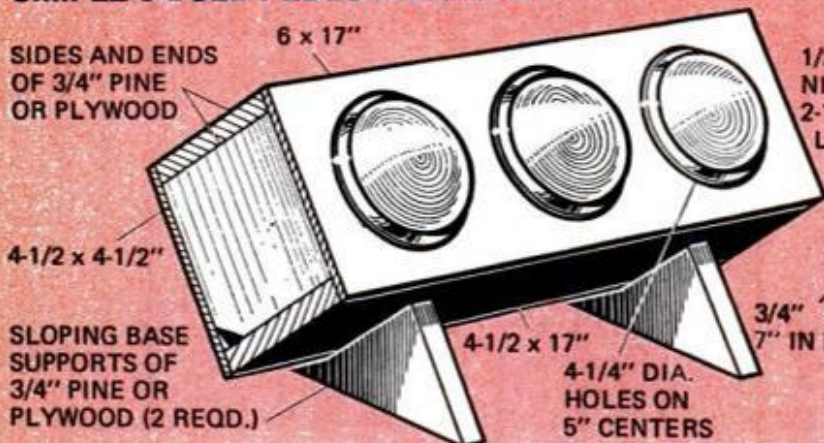


TWO SIMPLER VERSIONS are nine-bulb trough-style display above and three-bulb light box below. Both show three colors, and they can be positioned on a shelf, table or hi-fi console to illuminate a wall





SIMPLE 3-BULB PEDESTAL DISPLAY



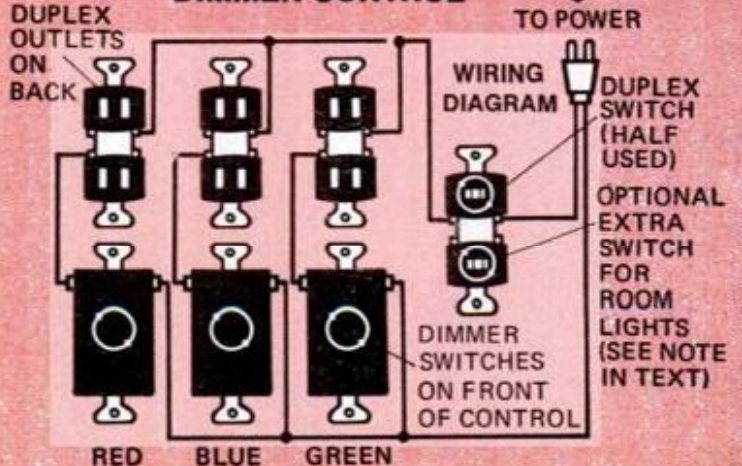
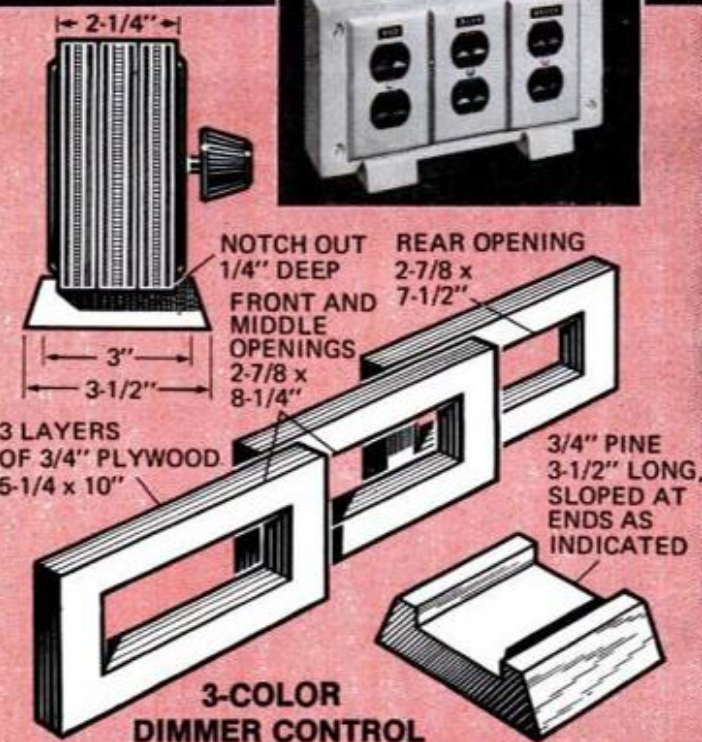
THREE-BULB DISPLAY can be mounted horizontally on sloping base supports or vertically on a simple pipe stand, as shown above. Construction of dimmer control is shown at right, below. Housing is merely a three-layer sandwich of plywood frames with cutouts for controls on front and outlets in back

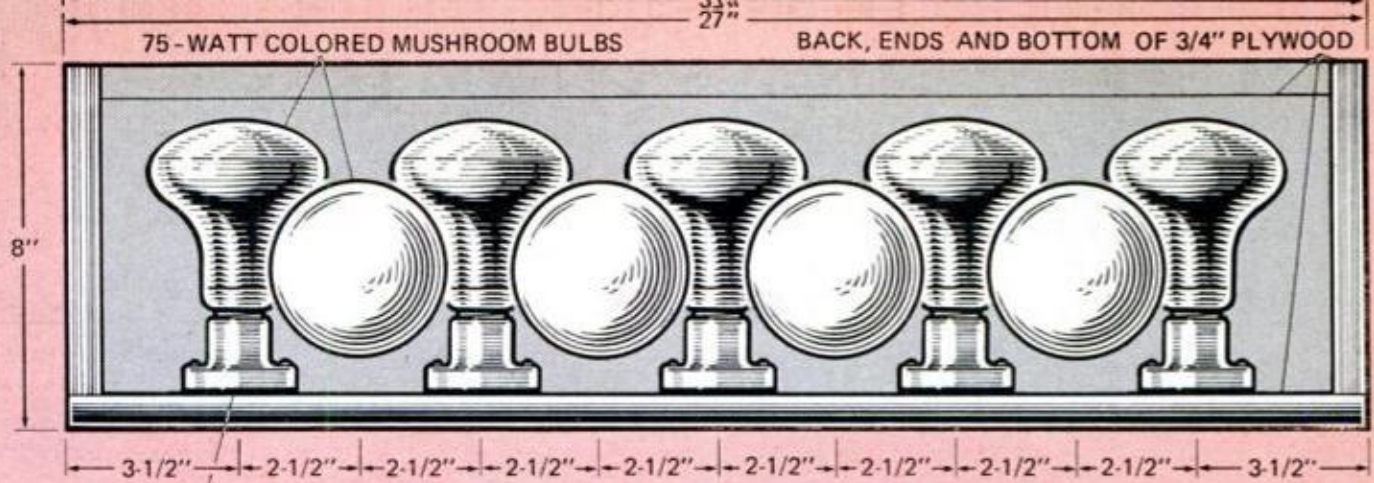
hook a whole string together without overloading your house wiring. However, before attempting to build any of the displays shown here, *be sure to read carefully the safety precautions mentioned later on.*

Three typical displays are suggested to show several design possibilities. There's a simple three-bulb box, a somewhat larger nine-bulb trough-style display, and a still more elaborate 12-bulb strip affair designed to hang on a wall. The larger the display, the more varied the lighting effects and the greater the area covered.

The displays are wired for three different colors of bulbs. Red, blue and green provide the most dramatic effects. If you want a fourth color, you can add yellow, but these bulbs are so much brighter they tend to wash out the other colors.

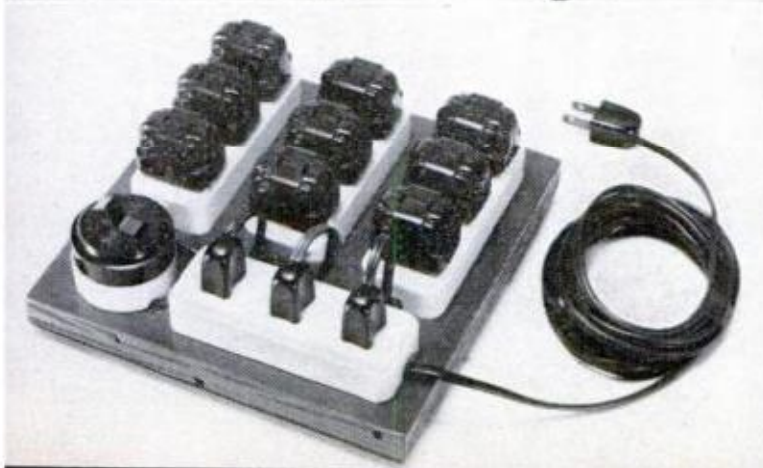
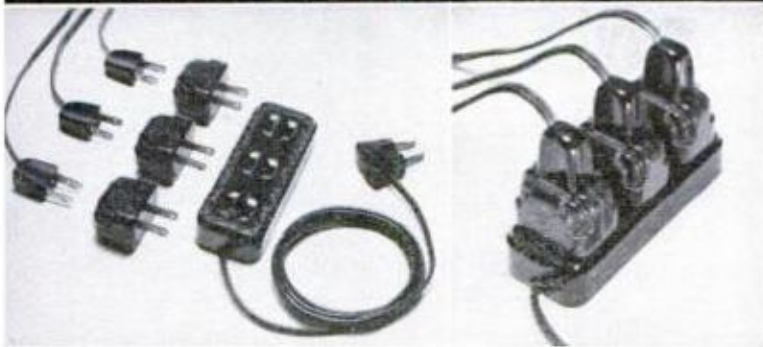
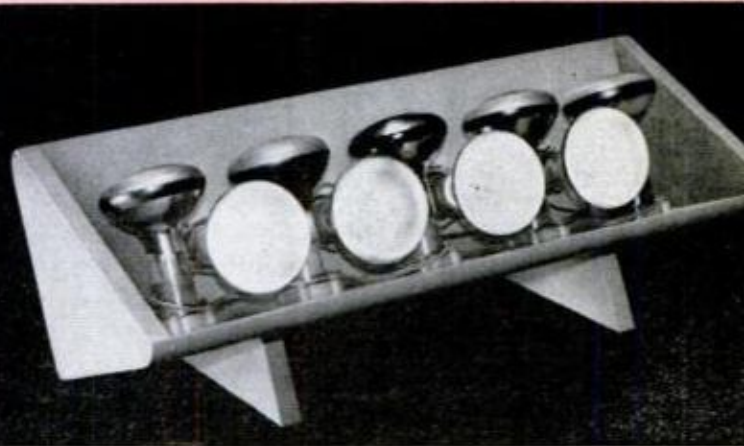
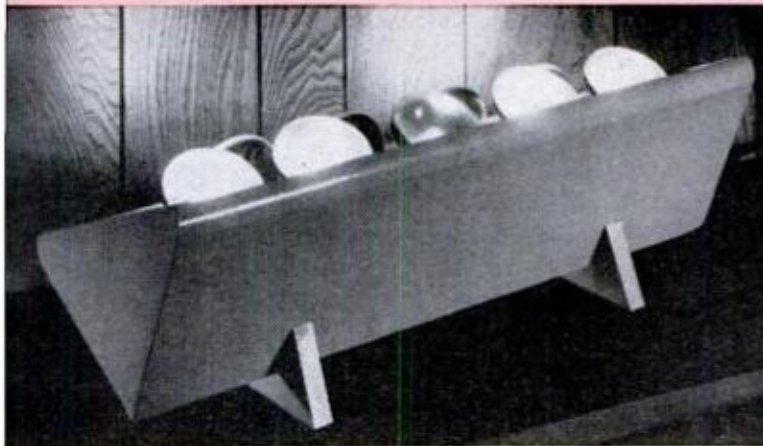
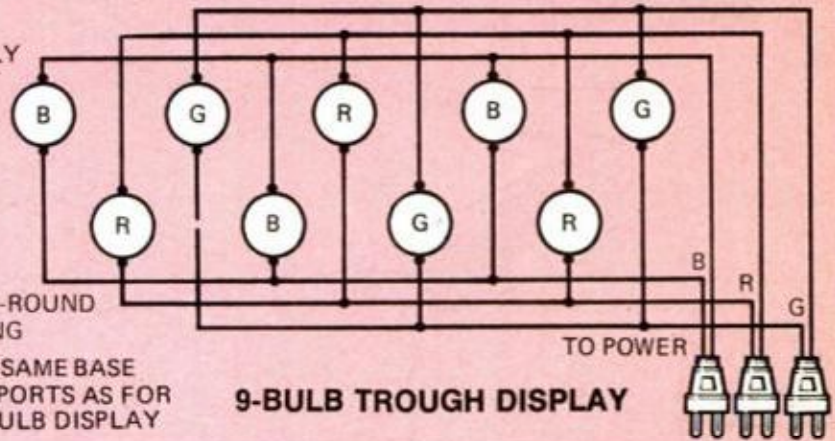
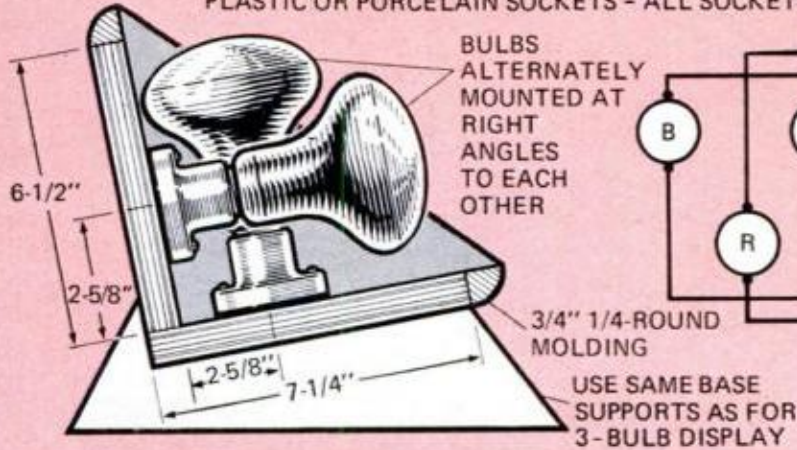
You can control the lights in several ways. The simplest is with the Christmas-tree flashers you plug into a wall outlet to make tree lights flicker. A tiny thermostatic switch inside causes the lights to blink on and off in rapid succession. If you use a separate flasher for each color, the bulbs will flash at random, some coming on as others go off. The result is a fascinating display of everchanging color patterns. The more flashers you use, the





PLASTIC OR PORCELAIN SOCKETS - ALL SOCKETS SPACED 2-1/2" APART

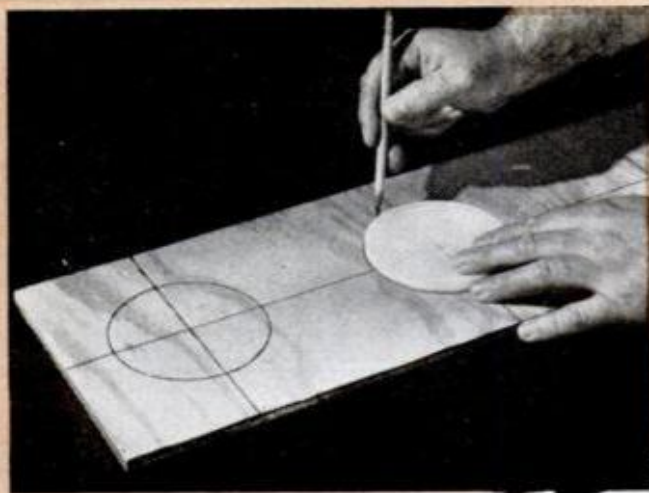
WIRING DIAGRAM



more random and varicolored the patterns appear. The accompanying photos show how to arrange flashers in handy strips using standard three-outlet plastic receptacles on extension cords.

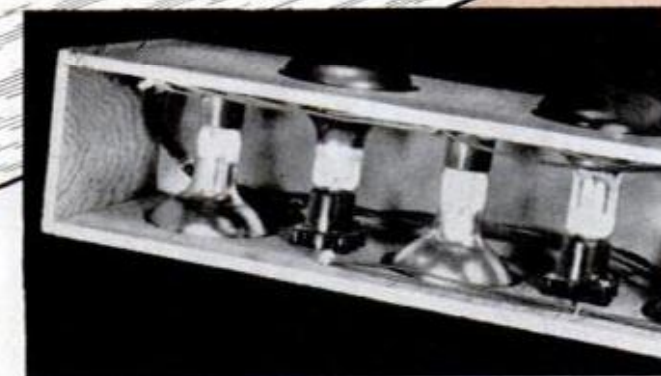
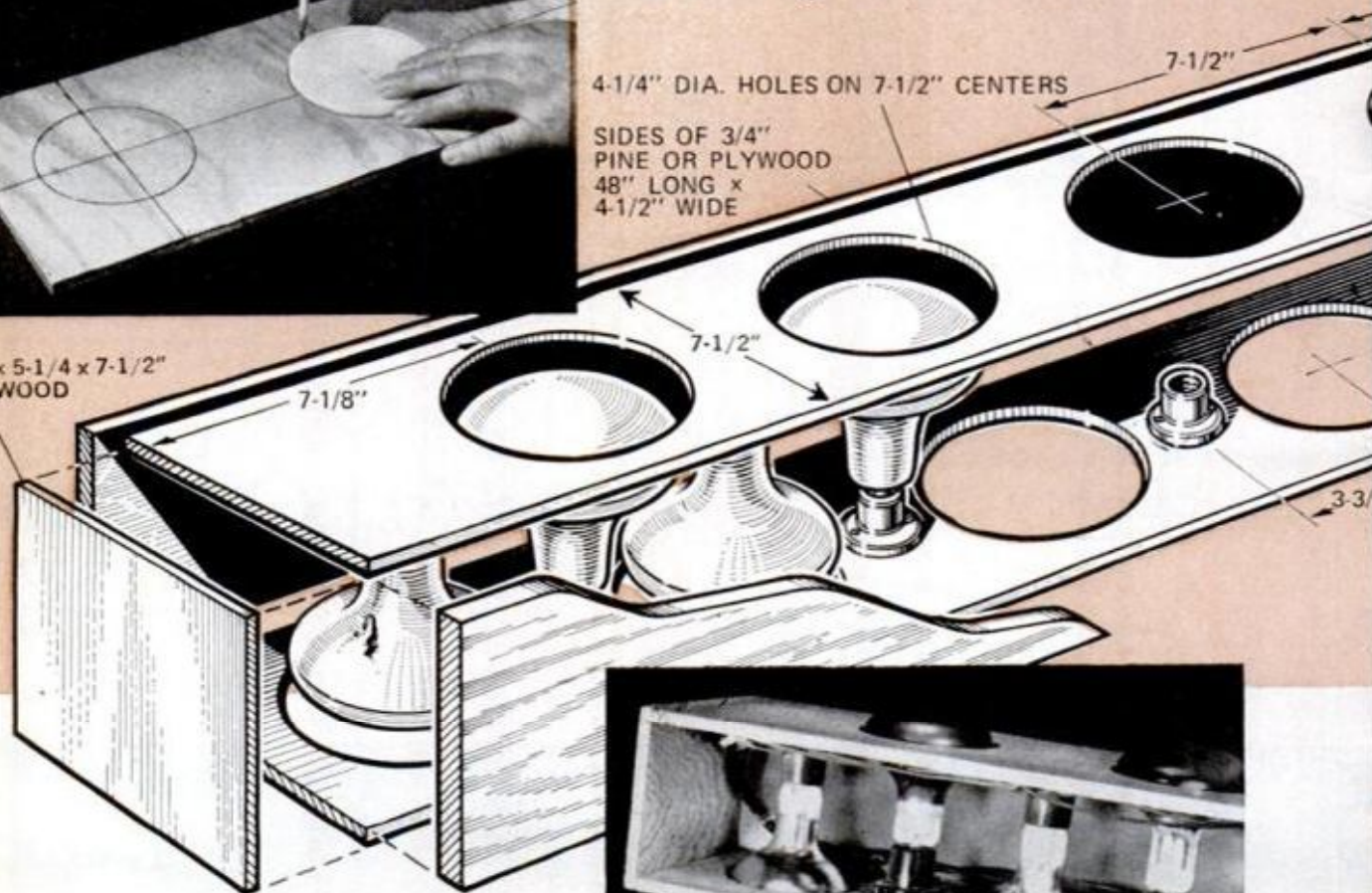
Another way to control the lights is electronically with a "sound-light translator." This device connects to your hi-fi's speaker terminals and electronically pulses the lights in time with the music's beat. The system is based on the use of

TWO WAYS TO USE FLASHERS are shown at left. With one three-outlet strip (upper two photos), you can plug in three flashers, one for each color in the display. A more elaborate version at bottom has provision for nine flashers arranged in three strips of three each. With this setup, you can connect up to nine bulbs so they flash independently of each other, enhancing the flickering effect. It also includes a handy surface-mount on-off switch



BIGGEST DISPLAY is this 4-foot wall unit. Bulbs alternate direction so half shine upward and half down. To mark holes for cutting (left), use plastic lid from 4-inch-diameter coffee or peanut can. Mark center of hole on wood, center lid over mark, trace circle around edge. Cut out holes with a sabre saw

3/8 x 5-1/4 x 7-1/2"
PLYWOOD



different musical frequencies to trigger different colored bulbs. One color will flash on when low notes are played, another with high notes. The effects are somewhat wilder and more truly "psychedelic" than those produced by thermostatic flashers.

Electronic translators are available in a variety of types and capacities. The one shown here is made by Eico Electronic Instrument Co., 283 Malta St., Brooklyn, N.Y. It's a three-channel unit providing inputs for three different colors. It will handle 1200 watts or 400 watts per channel—enough for up to five 75-watt bulbs of each color. It's about \$50 in kit form or \$70 assembled. Four-channel translators, handling four different colors, are available.

If you'd like to experiment with colored lighting, but don't want the flashing effect, there's still another answer. You can wire your bulbs to dimmer controls and vary their intensity by turning a knob. The lights don't flash, but you can turn them up or down in various combinations of colors to create "mood"

lighting for party occasions—much like the stage lighting effects you see in theaters.

The accompanying photos and drawings show how you can make your own dimmer switches—one for each color. The dimmers cost about \$7 apiece and handle 500 to 600 watts—enough for half a dozen bulbs of each color. The three controls are mounted in the front with outlets at the rear for plugging in your lights. A master switch lets you turn all dimmers on or off without disturbing their individual settings. This switch, you'll note, is a duplex type with two toggles but only one is wired. The second is a spare, making it possible to turn off a room light from the same control when you want to switch to colored lights. If you don't want this feature, omit the duplex switch and substitute a single wall-type toggle.

Don't, however, attempt to combine



INGENIOUS "JOY STICK" CONTROL at left automatically balances four separate speakers simultaneously at the flick of its single pivoted handle. Designed by Panasonic for use with its new four-channel sound equipment, the device, in effect, incorporates four individual volume controls in one. Moving the handle forward or back controls the balance between the front and rear speakers. Moving it from side to side changes the balance between the left and right speakers. Price not yet announced.

NEW IN ELECTRONICS



WANT TO CHECK OUT your tape recorder to see if you're getting maximum performance? New low-cost test tapes from Audiotex are now available in all three major formats—cassette, cartridge and open-reel—so you can apply the same tests to virtually any type of recording equipment. The tapes make it possible to check for such factors as head alignment, frequency response, equalization, intermodulation distortion, flutter, stereo balance and channel identification and separation. Prices are \$5.60 for the cassette type, \$6.50 for the open-reel type and \$7.95 for the eight-track cartridge type. The Audiotex tapes can be used for both stereo and monaural tests. They're sold by GC Electronics, Rockford, Ill.



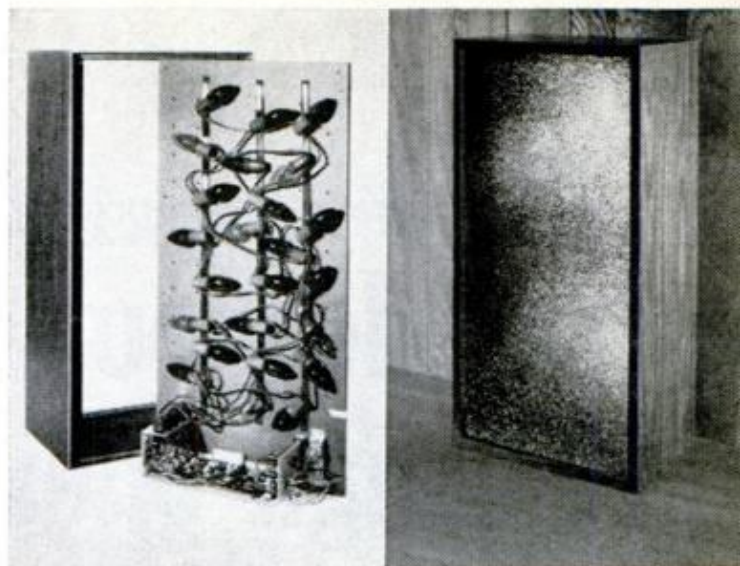
YOU CAN HAVE YOUR CAKE and eat it, too, with this new home adapter for Craig stereo car players. When you want to use your player at home, you simply slide it off its floor mount in the car and slip it into the adapter. The accessory unit, shown at left, above, contains a built-in power supply for converting 117 volts a.c. to 12 volts d.c. so you can operate the player on house current. Adapter comes



with two speakers for stereo listening and has antenna connections for players that also incorporate radio tuners. It can be used with any of the following four Craig floor-mount-type stereo models—3123, 3124, 3125 and 3504. Price for the adapter with speakers is \$59.95. The floor-mount players range from about \$95 to \$155 depending on model. Craig Corp., 921 West Artesia Blvd., Compton, Calif.



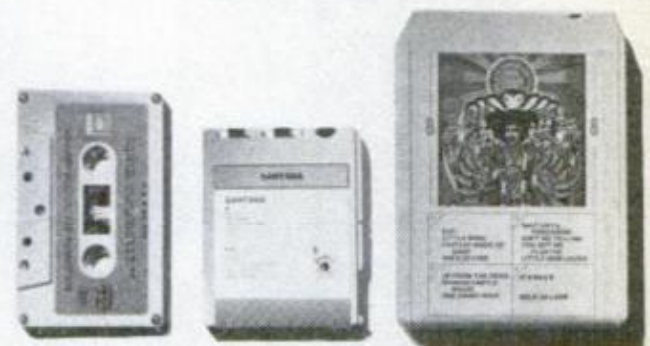
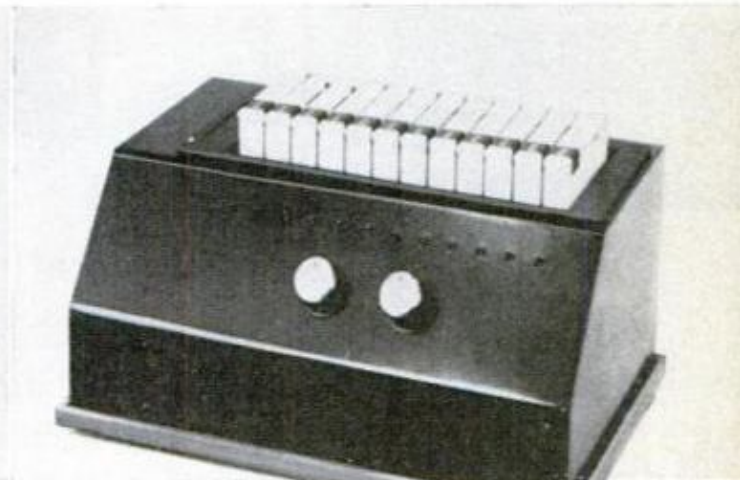
COMBINE A PORTABLE cassette recorder with a special speaker enclosure and you have the clever device shown above. Called the Bass Boom Box, it amplifies the normal sound from the recorder through a separate built-in amplifier and speaker. It also includes a 117-volt power supply for operating on house current at home and even has storage space for extra cassettes at the bottom. For portable use, you just slip the recorder out of the enclosure and take it with you, running it on batteries. Made by Bell & Howell, Model 394BB sells for \$89.95. A similar model incorporating an AM/FM radio with the recorder is \$109.95.



LIGHTS FLASH IN TIME TO MUSIC with this four-channel color organ you can build from a kit. Made by Eico, it electronically controls four different colors of light bulbs according to different musical frequencies. Small bulbs mounted on a back panel (left, above) flicker on and off in rhythmic time to the music's beat, creating dancing patterns of color on a beaded translucent plastic screen. Model 3450 is 30 inches high and sells for \$79.95 in kit form and \$109.95 assembled. Two smaller three and four-channel kits are \$49.95 and \$64.95, respectively. Eico Electronic Instrument Co., 283 Malta St., Brooklyn, N.Y.



NEW "MINI TAPE" is smaller than both cartridges and cassettes, yet is said to offer advantages of each. Like a cartridge, it uses an endless-loop tape, permitting continuous play without requiring a reversing mechanism as cassettes do. At the same time, it's less bulky and makes possible the use of smaller, more compact players. Called the Hipac, it's shown in comparison with a standard cartridge and cassette in photo at lower right. Several prominent Japanese makers—including Pioneer, Toshiba, Sharp, Hitachi and Mitsui—are said to be developing equipment for the mini tapes. Among possibilities: a dual tape player (left, above) and a 12-tape changer (right).



STANDARD CASSETTE

HIPAC CARTRIDGE

STANDARD CARTRIDGE

Troubles after a tune-up? How to... **Troubleshoot the tough ones**



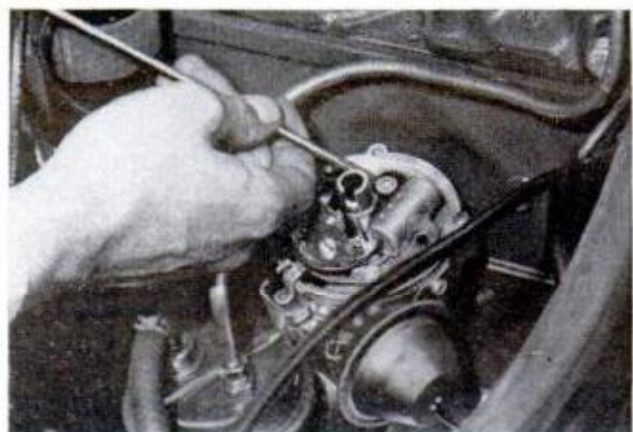
CRANKCASE VAPORS that back up into distributor because of a clogged emission system can burn your points

Have you done a tune-up and replaced parts that have gone bad, just to have everything go out of whack again? If so, then it's time to find and fix the cause of the problem!

By **MORT SCHULTZ**



VENTILATOR HOSE of your emission system can be cleaned on the inside using a rod and piece of cloth



DISTRIBUTOR CAM on many new cars is lubricated by wick held by snap-lock washer; don't overlubricate

POPULAR MECHANICS

WHEN YOUR ENGINE continues to act poorly soon after a tune-up, you've obviously missed something. But what? That's what we wanted to know recently when we asked shop mechanics this question:

"When tune-up procedures fail to correct engine problems, what do you find to be the most common cause?"

We weren't searching for unusual, once-in-a-lifetime failures, but those that occur frequently. Several technicians pointed a finger at distributor breaker points. When points burn, hard starting results. Replacing points without correcting the cause of the burning will just lead to their burning again. Oil and crankcase vapors that work their way into the distributor is one cause of burned points. If the positive crankcase emission system becomes clogged, pressure in the crankcase can build up and force oil and vapors past distributor bushings and onto contact points. Another reason is worn distributor bushings and seals.

As is being done in the lead photo, opposite, disconnect and clean or replace crankcase breathing system components including the ventilator (PCV) valve, ventilator valve hose, and carburetor air cleaner. If your car is an older model with an open PCV system, be sure to clean the oil filter cap in kerosene.

Make sure the ventilator valve is not clogged and that all filter elements are clean. To clear deposits from hoses, push a cloth swab through them with a rod.

Incorrect lubrication of the distributor cam is another reason that distributor points burn. Some distributor cams are lubricated from a wick in the distributor. Follow your car's service manual to the

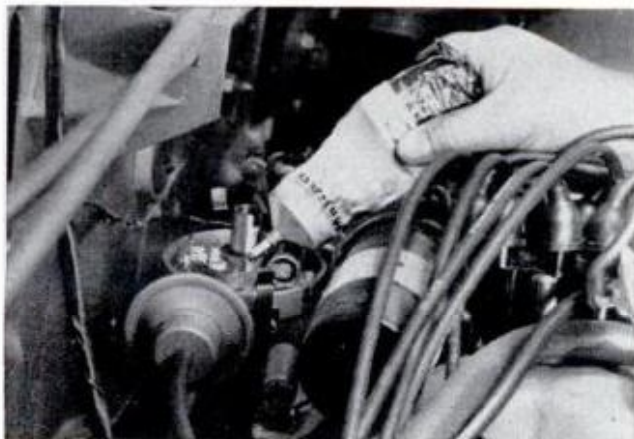
letter when lubricating or replacing the wick. Other cams are lubricated directly. Place a drop of lubricant the size of a pinhead on each cam lobe, but that's all. You can get cam lubricant at an auto supply store.

Handling distributor breaker points without giving a thought to cleanliness is sure to lead to problems. A greasy feeler gauge, for example, will leave a coating on points that may cause them to burn. Clean your tools before touching the points and don't handle the points with your fingers. Perspiration and dirt transferred to the points will cause trouble.

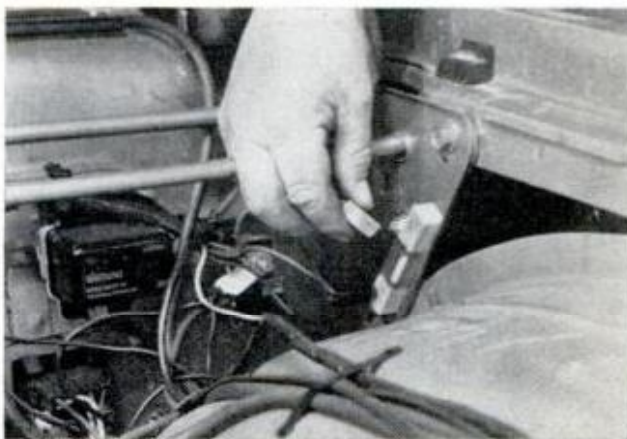
Engine misfiring under acceleration soon after tune-up is another tricky problem. The reason is insufficient voltage to fire sparkplugs after they have worn slightly. Voltage is sufficient to allow perfectly gapped plugs to fire, but once the gap starts to widen firing becomes a hit-and-miss thing. The cause: excessive resistance in the ignition primary circuit. Resistance is purposely built in by use of a resistor wire or a ballast resistor. This keeps distributor breaker points from receiving maximum voltage from a 12-volt electrical system, which would cause the points to burn. Once a resistor changes value, the balance is upset. As the resistance increases, the voltage available to sparkplugs decreases.

If you run into this problem with your car, check your service manual for the value of the ballast resistor or resistor wire and test it with an ohmmeter. If you have no ohmmeter, you may wish to replace the inexpensive resistor on a hunch that it's bad. However, make sure that you get the right one for your car.

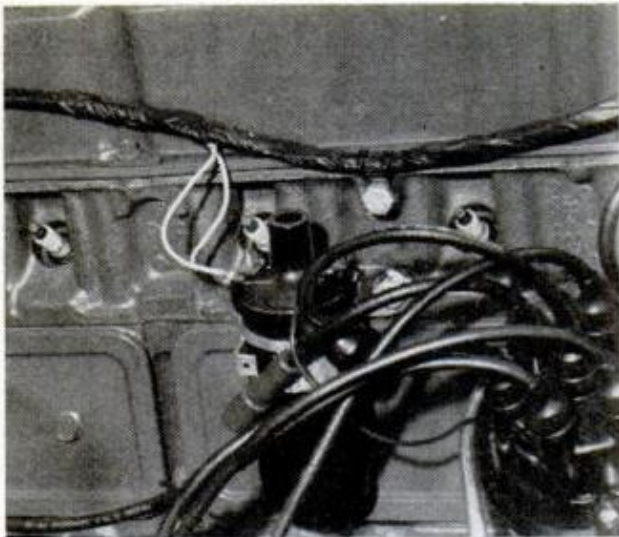
All service technicians we asked agreed



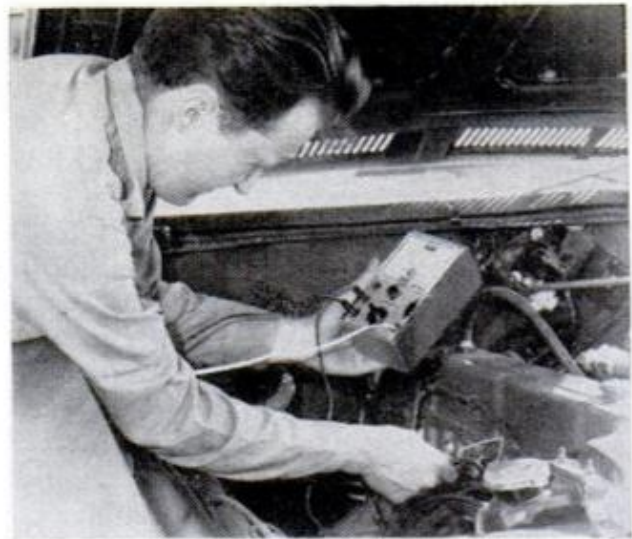
USE A STEADY HAND on distributor cams that must be lubricated directly—and very little lubricant!
DECEMBER 1971



BALLAST RESISTOR puts needed resistance in ignition circuit. Disconnect and check with ohmmeter



RESISTOR WIRE (white leads from harness) is sometimes used in place of a separate ballast resistor



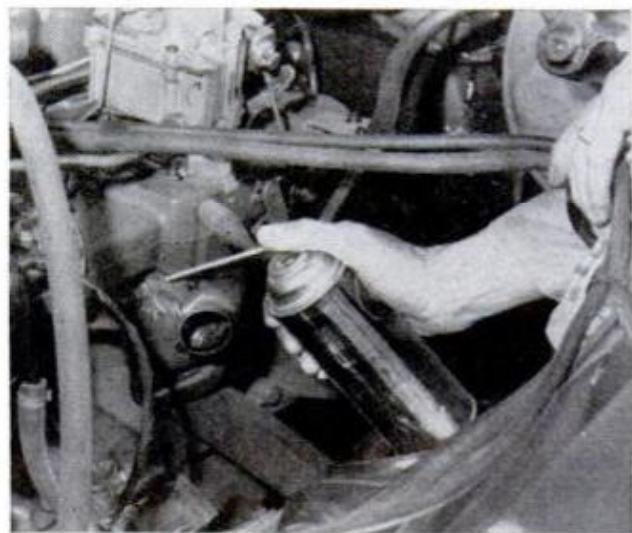
USING OHMMETER to measure resistance of resistor wire means disconnecting cable from junction block

that a major cause of post-tune-up headaches is an exhaust manifold heat-control valve that is not serviced during tune-up. This valve permits the engine to warm up quickly. When it is in the "heat on" position, it closes the exhaust manifold, thus trapping hot gases that hasten warm-up. When the engine is warm, the valve reverts to the "heat off" position, unblocking the exhaust manifold and allowing gases to escape.

If the valve gets stuck in the "heat on" position, sparkplugs will overheat and, when the engine is hot, hard starting may occur. When these problems arise, technicians frequently think "heat valve," because a valve frozen in the "hot on" position is pretty common.

However, when the valve gets stuck in the "heat off" position, it leads to a deceptive situation. For instance, one mechanic told me of a car owner who complained of lack of engine power. The technician pulled the plugs, found them fouled with carbon and did a tune-up. Several days later the owner was back: same problem. This time the technician remembered that an exhaust manifold control valve stuck in the "heat off" position will allow a buildup of carbon on plugs.

You should get into the habit of checking the heat valve often. With the manifold cool, move the counterweight by hand to make sure it is free. But even if it moves freely you have no assurance that the valve plate is doing its job. It may be missing; it could have been burned away. Therefore, start the engine and have some one quickly accelerate while you watch the counterweight. It should flutter.



HEAT CONTROL VALVE on the exhaust manifold must be serviced periodically to prevent engine problems

If everything is okay, lubricate ends of the valve shaft with manifold heat-control valve solvent. Be sure that the manifold is cold. If the valve is stuck and lubrication doesn't free it, tap the counterweight gently as you apply more solvent. It should eventually loosen; if it doesn't, the valve is probably frozen and should be replaced.

Service technicians I spoke to stress the importance of keeping one area of the engine compartment "sloppy" when doing a tune-up. They meant ignition cables.

"A new mechanic we hired did his first tune-up and carefully laid out ignition cables in neat parallel rows," said a new-car service manager. "The owner was back in nothing flat, shouting about his rough-running, backfiring engine."

Many Saturday mechanics have also fallen victim to ignition crossfire. Some even

went so far as to tape ignition cables together to make a neat package.

The problem of ignition crossfire occurs because the high voltage that flows through a sparkplug cable creates a magnetic field around the wire. If an adjacent cable is next in the firing order and is close enough to the magnetic field and parallel to the cable which carries the high voltage, enough of the induced voltage can be absorbed to fire both plugs at the same time.

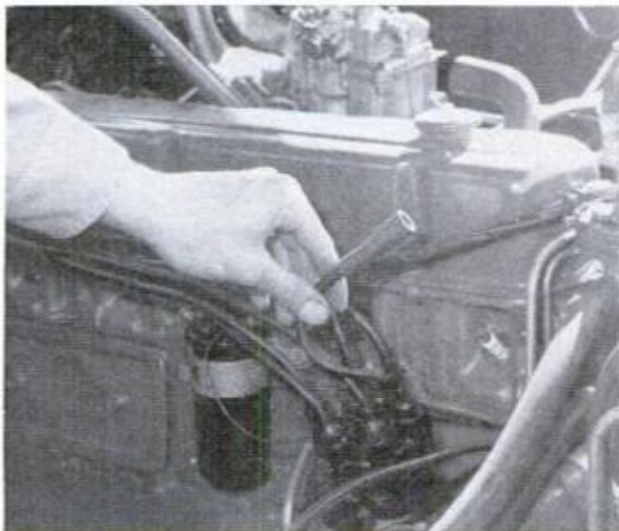
To make sure, this doesn't happen, spread cables as far apart as possible and see that they don't run parallel for any distance. To be really safe, find out the engine's firing order and determine if the cables of sparkplugs that are in consecutive order are next to one another. If so, crisscross them.

Worn-out cables are also a principal reason why a tuned engine will act "untuned."

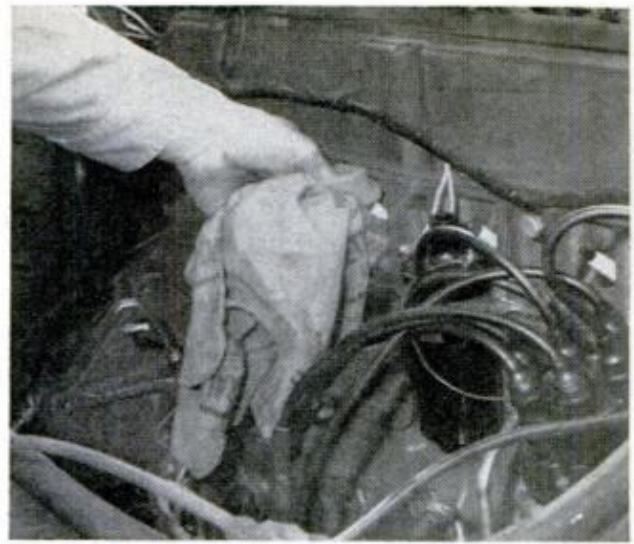
Cracked insulation, caused by exposure to high temperature and grease, allows current to leak. This leads to misfiring. If cables are cracked, replace them. Make sure you get the right type for your ignition. If, for example, your car requires resistance cables, buy only resistance cables.

Examine sparkplug boots closely. As with cables, boots can dry out and crack, allowing loss of current before a plug can fire.

Flashover, as it's called, can also occur if dirt gets on sparkplug insulators. Electricity follows the path of least resistance, which is the dirty path. Get into the habit of wiping off plugs with a clean cloth



SPARKPLUG BOOTS and ignition cables should be inspected with care, especially in event of a misfire



THOROUGHLY CLEAN all ignition parts to eliminate any possible low-resistance paths causing spark loss

when servicing the ignition. This is especially important if you handle plugs with your hands.

One more thing: never pull an ignition cable. You will break strands that are beneath the insulation, which will create an engine-missing condition that will be hard to trace. Grasp and twist the boots—not the wire.

A problem of hard starting when the engine is hot is a condition annoying many motorists. Tune-ups don't help, because the trouble occurs when the temperature in the engine compartment gets too high and builds up pressure in the fuel system that forces gasoline into the intake manifold. When the engine is stopped and restarted, the rich mixture keeps you from obtaining a normal start. The engine is actually flooded.

One way to relieve the situation is to install a fuel-pressure relief bypass that bleeds pressure from one side of the fuel pump to the other, forcing gas back into the gas tank instead of into the carburetor. The bypass has a tiny orifice large enough to relieve pressure, but too small to affect the operation of the fuel system under normal conditions.

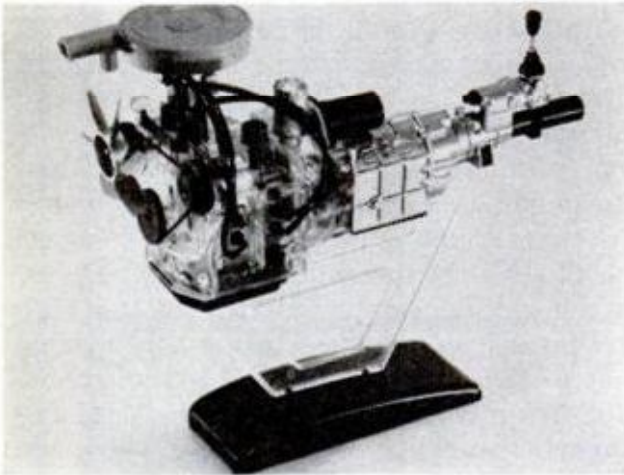
You can purchase a bypass kit from an auto supply store or mail-order house that sells automotive supplies.

Until you get a chance to install this kit, start a warm engine by holding the accelerator pedal smack on the floor as you crank the engine. This keeps the throttle open to allow a maximum amount of air into the manifold to lean out the fuel. As soon as the engine starts, release the throttle. ★★★

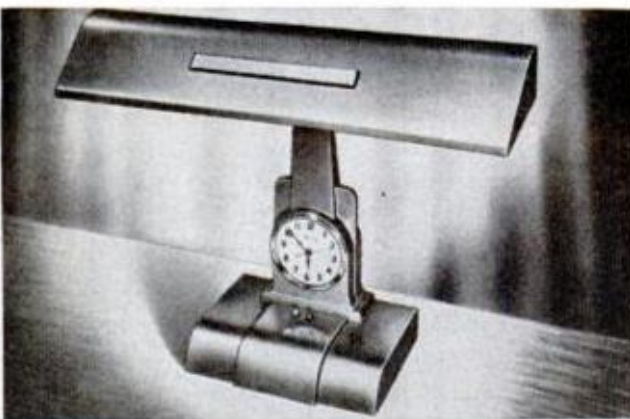
EXCITING



WHEN FAMILY OR FRIENDS meet for an evening's recreation, the Brinktun Fold-N-Roll Table Tennis (No. 401) game is certain to be the center of attraction. It features a 1/2-inch Plyblend Top, wraparound aluminum frame, easy-rolling casters, green lacquer top finish and an easily folded playing surface. Larson Industries, Inc., Recreational Div., Le Center, Minn. 56057.



BUILD A SEE-THROUGH MODEL of the revolutionary pistonless Wankel rotary engine with the Entex Wankel kit. In one-fifth scale, the kit has more than 100 parts featuring flashing plugs, rubber fan belt, stick shift, on-off switch, prepainted or self-color parts, motor and display stand. Runs on two AA batteries (not included), \$5.95 from Entex Industries, Inc., Los Angeles, Calif.



A TIMELY LAMP for the executive's office, the student's desk, or the housewife's work or hobby center is the Litemaster Executor. It features an electric clock which operates independently of the twin 15-watt light tubes. Available in brown, gray, green or tan, it sells for \$29.95 (model No. 60) from Art Specialty Co., 3720 Milwaukee Ave., Chicago, Ill. 60641.

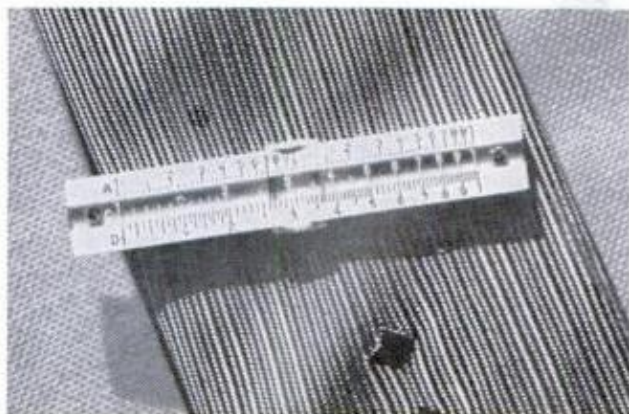


CHILDREN CAN ENJOY solid-state electronic sound right in their own playroom with the Kenner Juke Box. The child just presses the selector which lifts the needle from the record and slides it to the number chosen. Neither needle nor tone arm is ever touched. Features 14 unbreakable records ready to play 30 minutes of music. Retail for about \$15.50 at toy and department stores.

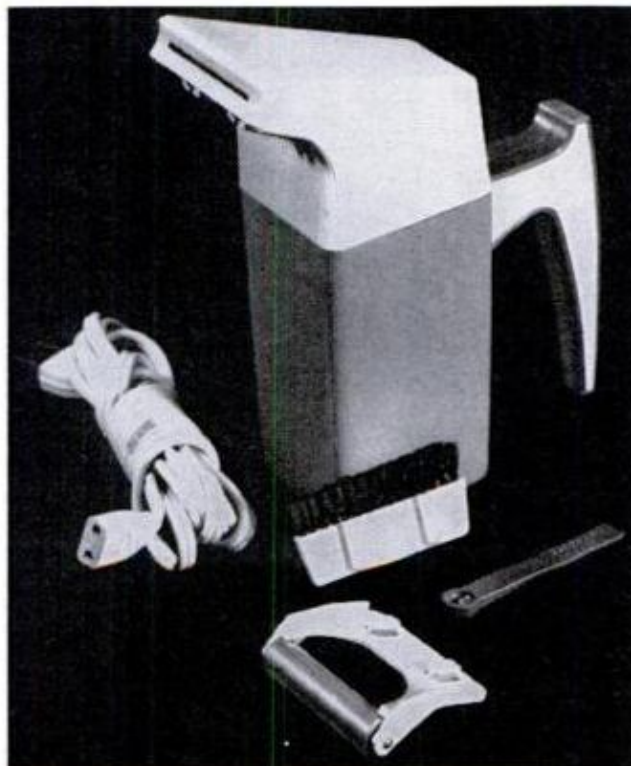
POPULAR MECHANICS

NEW PRODUCTS

BY CATHERINE BILSKI



THIS UNIQUE TIE CLASP not only holds your tie in place but also doubles as a slide rule that really works. Can be used by students, businessmen, engineers, accountants and calculating shoppers. A delightful gift, it comes in green and white or orange and white. Price is \$2 postpaid from Westbury Sales Co., Dept. SR-1001, Box 434, Westbury, N.Y. 11590.



WHETHER YOU'RE HOME OR AWAY, freshen all your clothes with the Stanley Steamer. Just add water, plug it in and in seconds it steams out wrinkles from dresses, suits, sweaters. Made of heat-resistant GE Noryl, it comes with lint brush and presser roller. Priced at \$9.95 postpaid; with case, \$12.95, from Fulker Imports, 520 Southeast Grand Ave., Portland, Ore. 97214.

DECEMBER 1971



GAS-POWERED MINI PLANE called "Fly 'Em" is quiet and small enough to be flown in your back yard; it requires only a 20-foot circle. There's a choice of four World War II planes: the P-40 Warhawk (shown), the Japanese Zero, the P-51 Mustang and the Messerschmidt BF 109. Each is equipped with fuel, battery, fuel-funnel and control lines. Priced at \$9.95 by the Testor Corp., 11500 Tennessee Ave., Los Angeles, Calif. 90064.



YOUNGSTERS WHO DREAM of flying their own jet will find many hours of playtime pleasure aboard the Ride-em-Jet. Designed for toddlers (ages one through three), the toy requires no batteries and has no delicate parts. Made of high-impact plastic, it comes in white with red wheels and American Airlines decals. Retail for under \$15. Kusan, Inc., Nashville, Tenn.

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Cabinet workbench for the man with a small shop



FITTED with a good vise such as the Wilton Flip-Grip shown here, your bench will be ready to take on any appliance repair job or weekend project you'd want to tackle

Ideal for anyone with limited shop space, this handsome little bench has lots of storage built into its 30-inch length

By **WAYNE C. LECKEY**, Home and Shop Editor

Photos by Robert D. Borst

IF YOU HAVE BEEN LOOKING for a workbench that's suitable for a small shop—one that will serve as a tinkerer's bench and let you store your tools in it—this little one should fill the bill perfectly. It features a sturdy top which will withstand a lot of hammering, a sunken tool trough across the back, a roomy drawer with a lift-out nail and screw tray

and a storage compartment that will hold a raft of workshop gear.

While its cabinet base is about 30 in. long, its basic design lets you make it longer if you wish merely by increasing its length and fitting it with two drawers instead of one. There's no reason why you couldn't make it 48 in. long if your shop can stand a larger bench.

If you don't need a workbench, but are in the market for a stand for a radial saw, particularly such as the bench-type shown at the right, the cabinet, with its roomy drawer and storage compartment, makes a dandy place to keep saw accessories within easy reach. Here you forget the benchtop and close in the top with plywood.

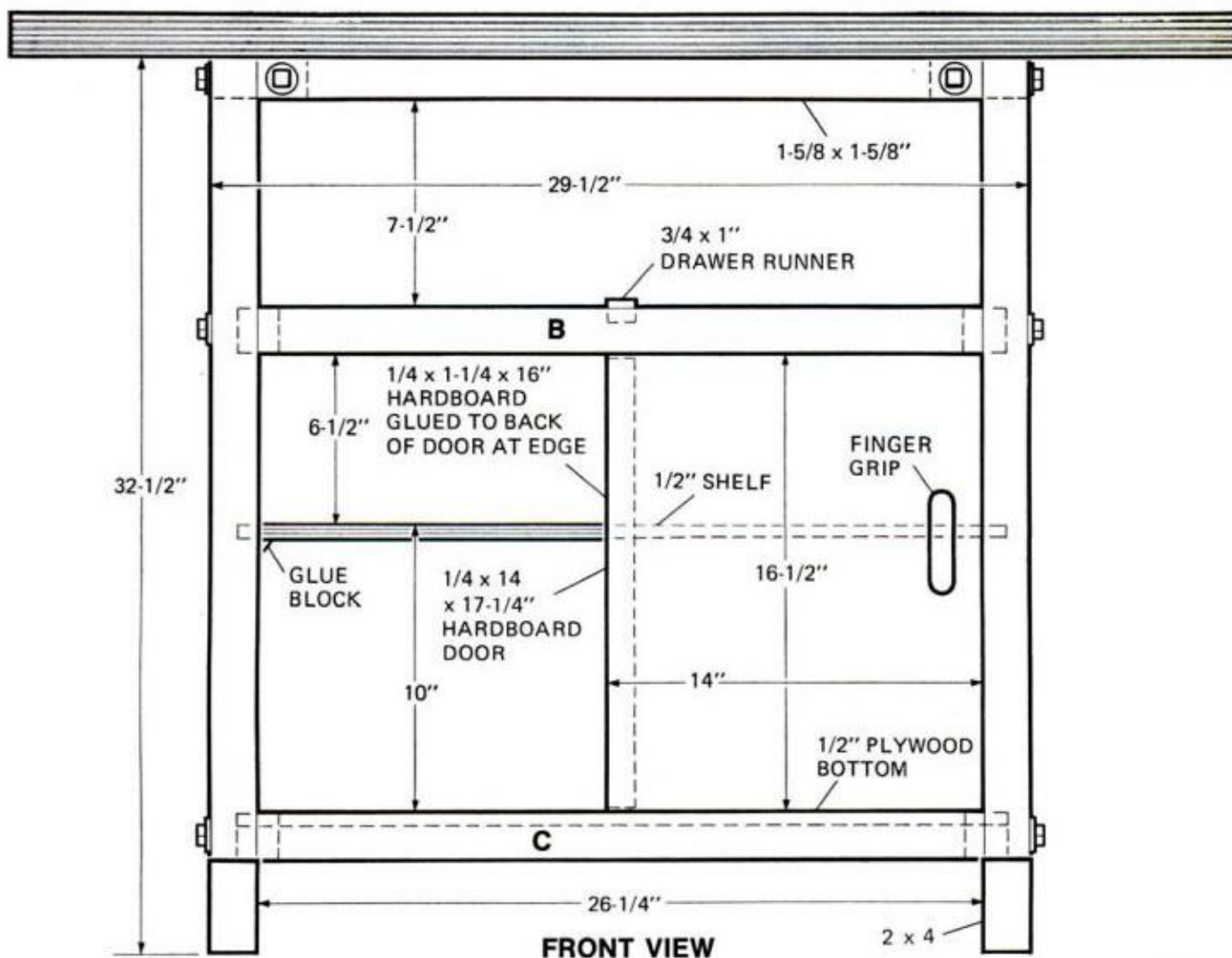
To build the bench from scratch will cost you about \$50—for the tempered hardboard that's used for the doors, end panels and back, plywood for the double-thick top, pine for the drawer, 2x4s for the framing members, lagscrews and paint. You may already have scrap wood you can use to help cut the cost.

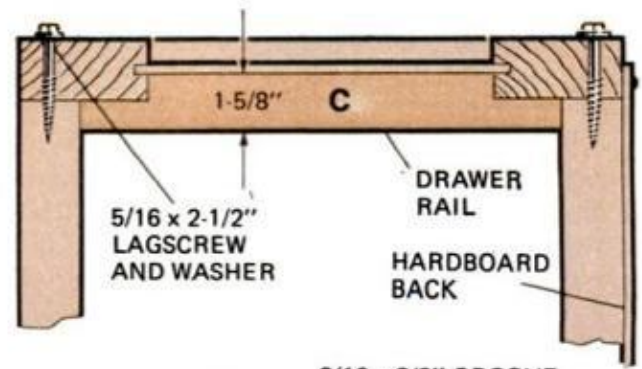
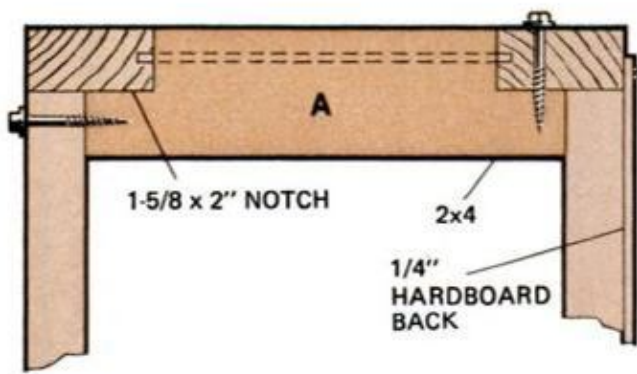
Aside from being made right and left-hand, the two ends are identical. In studying the drawings you'll see that the 2x4 members are grooved to receive 1/4-in. tempered-hardboard panels (actually a strong 3/16 in. in thickness) which are installed as the ends are assembled.

The connecting front and back rails are also alike, with the exception of front

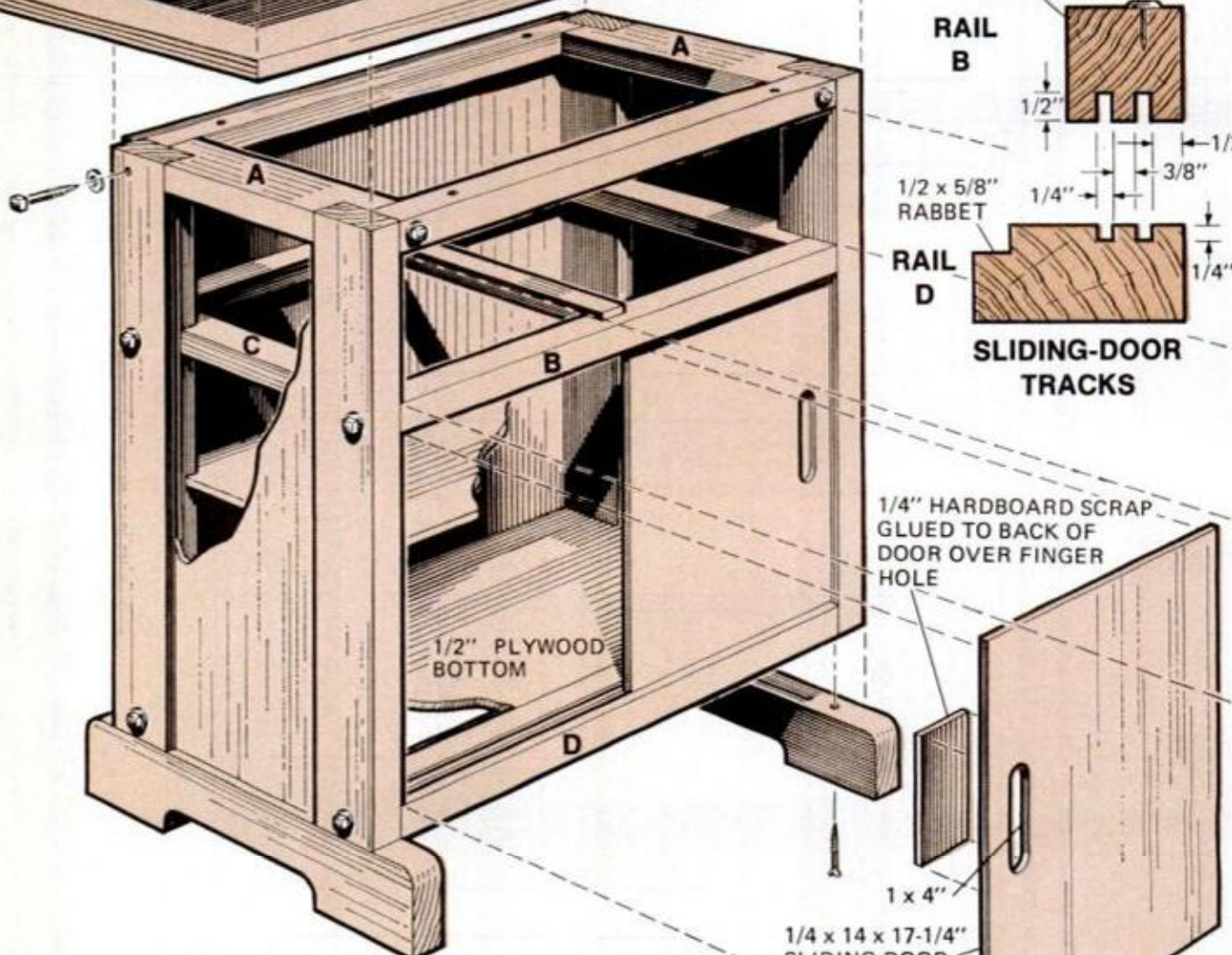
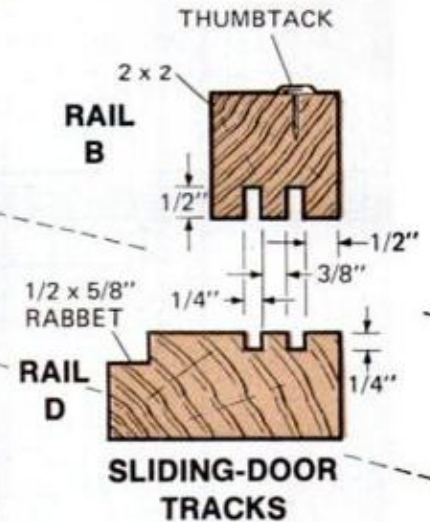
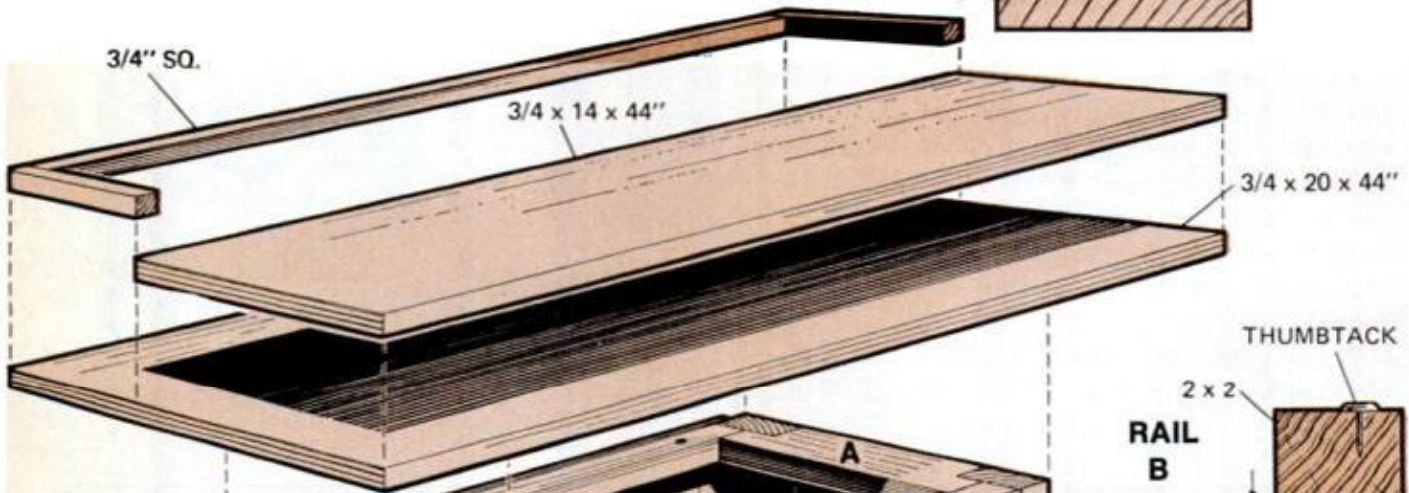


WITHOUT BENCHTOP, cabinet makes dandy stand for many radial saws, gives handy accessory storage





THESE TWO TOP VIEWS show how end rails A and C are notched to fit around the 2 x 4 bench legs. Note that rail C butts against the inside of the end panel

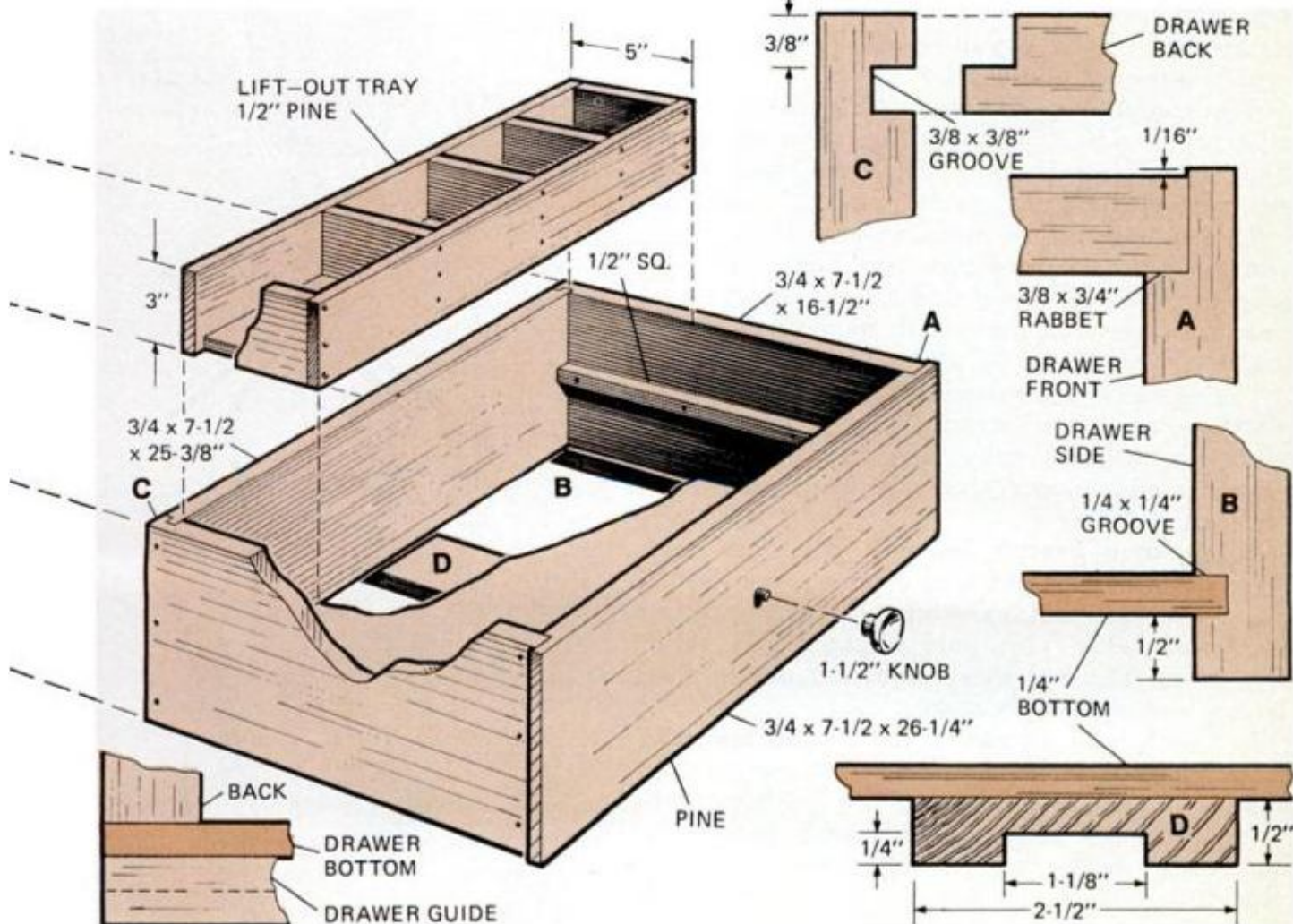
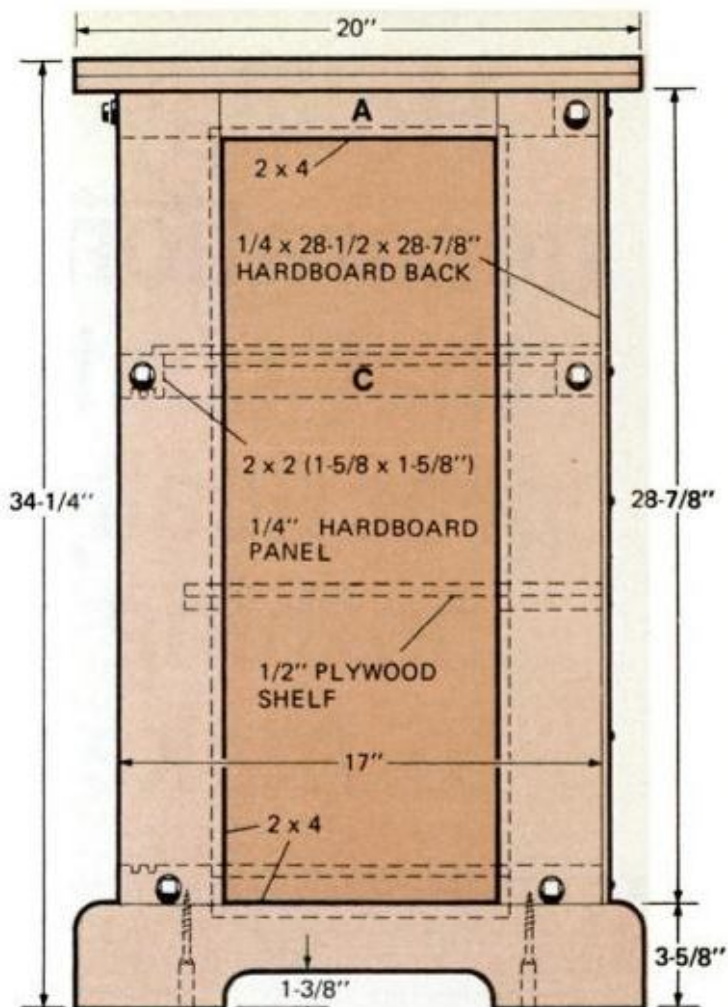


Technical Art by Fred L. Wolff

rails (B) and (D). These are grooved to receive the two tempered-hardboard doors which bypass in grooves. For the most part, the rails are made in pairs, all of the same length. They are joined to the end assemblies with glue and lag-screws. Notice that rails (D), front and back, are rabbeted along the inner edges to receive flush a 1/2-in. plywood bottom. The hardboard back is simply applied and screwed to the surface.

The drawer follows typical drawer construction. It's made of 3/4-in. pine and has cleats nailed to the inside 3 in. down from the top to support a lift-out sliding tray. Hardboard is used for the bottom, and the drawer is guided by a grooved member that's glued to the underside.

The benchtop consists of two thicknesses of 3/4-in. plywood, glued and clamped, then screwed together from the underside. The sunken tool and shavings trough is formed by gluing and nailing 3/4-in.-sq. strips to three sides. The top is attached to the cabinet with screws driven up through the front and back crossrails. ★★★



Holiday decorations that cost practically nothing to make

WHEN IT'S TIME to put your house in the holiday mood, the chore can be as simple as hanging a wreath or buying a bagful of decorations from the nearest department store. Neither approach is very satisfying however. The first choice shows little imagination and the second is tolerable if you have a healthy credit card or a pocketful of cash.

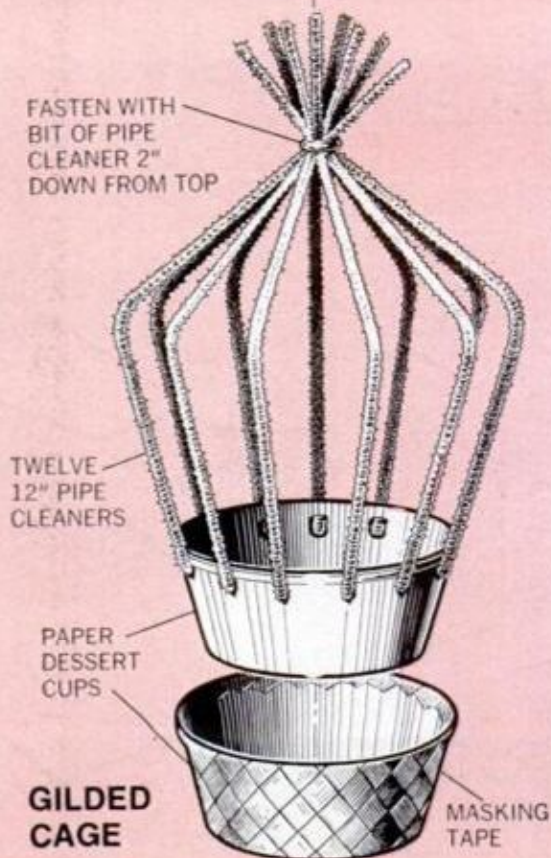
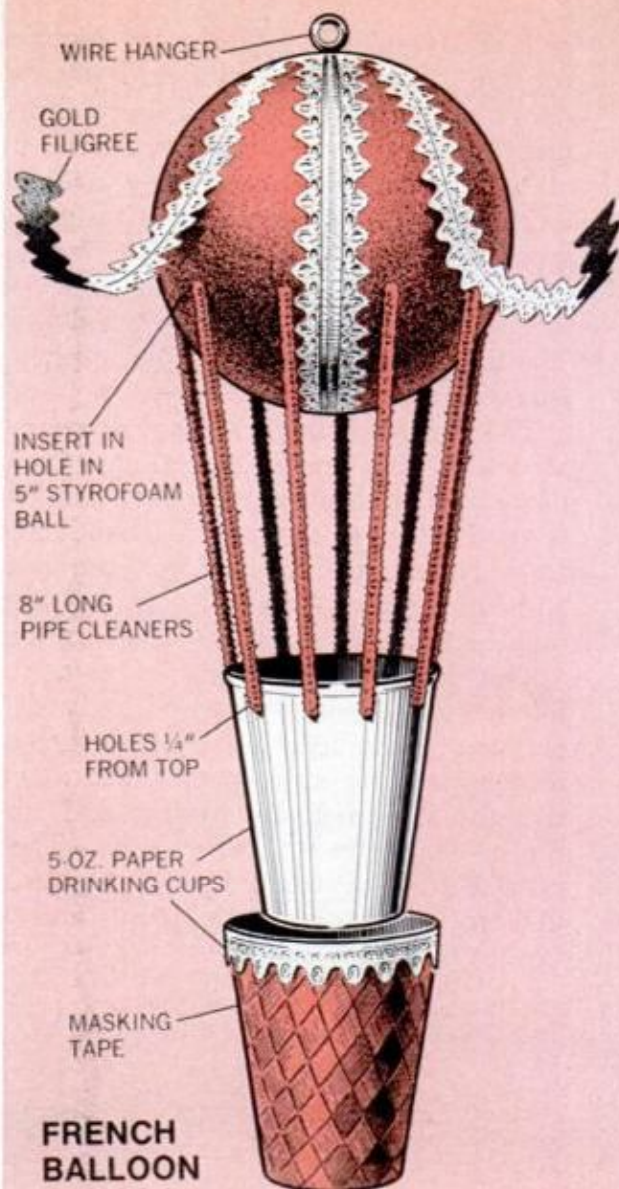
You can create decorations that will look totally professional. To prove the point, we show four on the page at right. Three are homemade, but can you spot the one bought at a store?

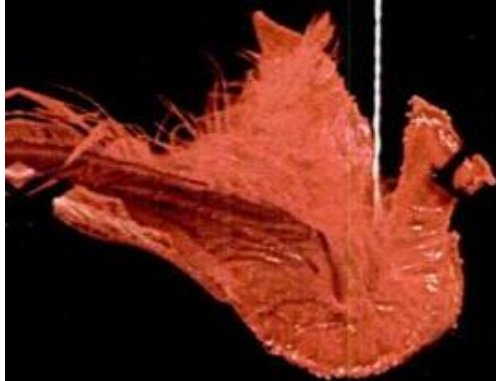
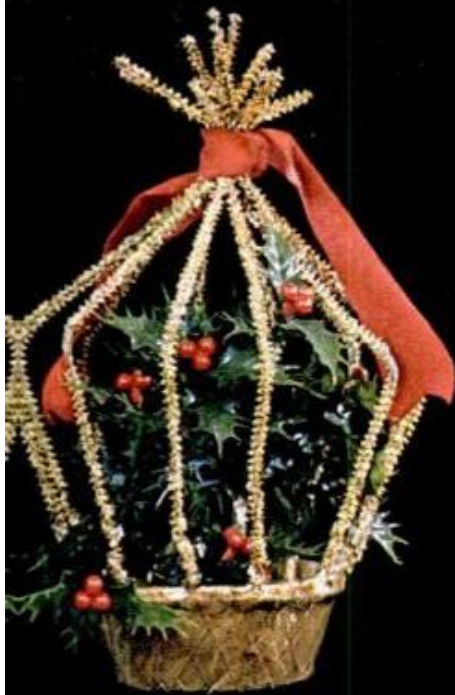
These items can be made, mostly, from items you probably already have on hand. All are easy to make, can be stored for use again next year and are in keeping with modern decorating tastes.

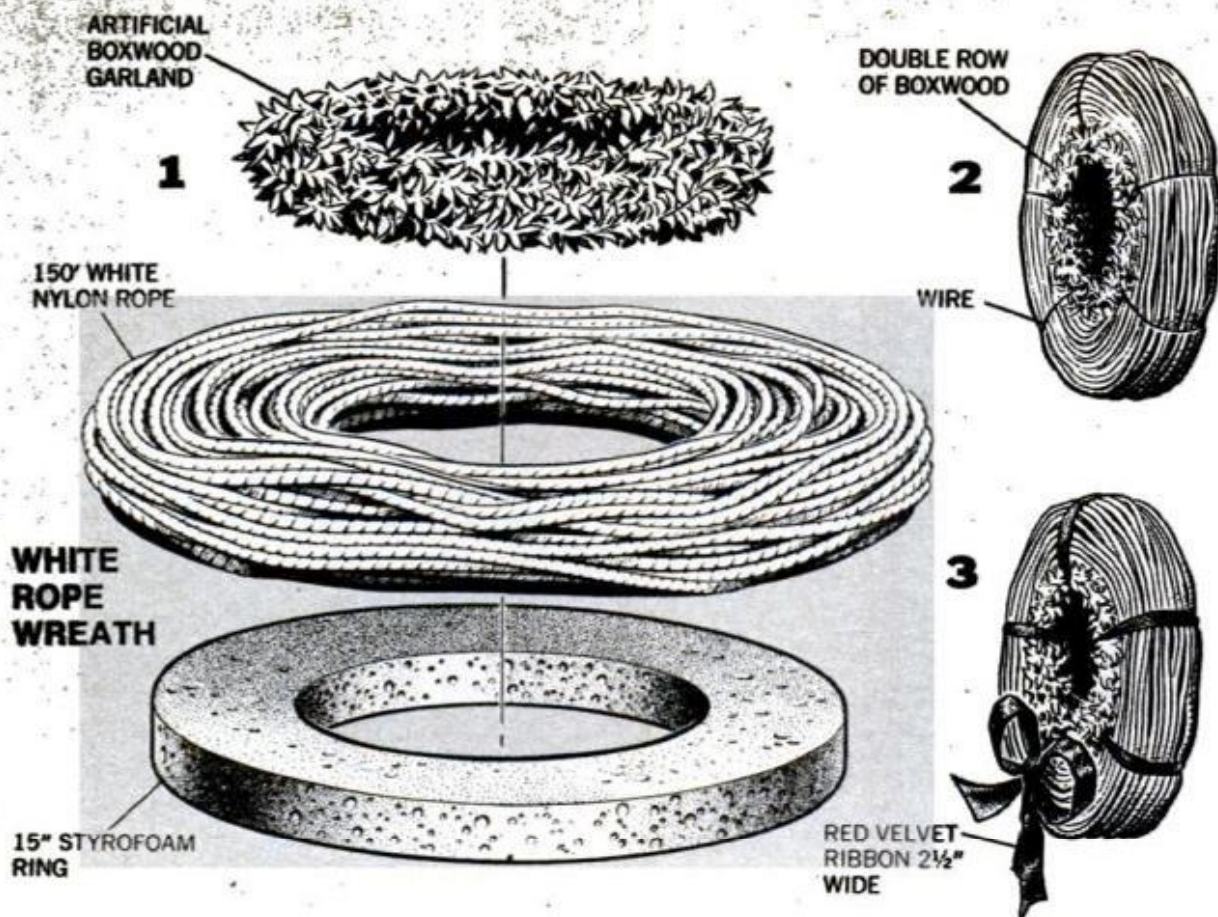
The exterior decoration at far right is simply a nylon-rope "tree" strung on nails in the side of the house and gaily decorated with holly branches and colorful tree ornaments you make yourself.

To make a French balloon, you need two 5-oz. Dixie cups, eight pipe cleaners, one 4-in.-dia. Styrofoam ball, masking tape, glitter, wire and white glue, plus gold filigree, gold paint and gesso. The last three materials are sold at hobby and art supply stores.

For each balloon, makes eight small holes $\frac{1}{4}$ in. down from the lip of a Dixie cup. Insert a pipe cleaner in each hole and bend the inside portion to hold it. Place this cup in a second cup (without holes) and wrap the latter with masking tape in crisscross fashion for a basket-weave effect. Insert and glue other ends of the pipe







HANDSOME WREATH will add to holiday spirit whether hung indoors or out. Instructions are given in text

cleaners in the Styrofoam ball. Wrap the ball alternately with masking tape and decorator strips of gold filigree. Cover all parts with three coats of gesso (allow each coat to dry thoroughly before applying the next). Finally, spray with gold paint and add your choice of glitter. Use a wire loop to hang the balloon.

To make the white rope wreath, you need one 15-in.-dia. Styrofoam wreath base, 150 ft. of 1/4-in. marine (nylon) rope, wire, one artificial boxwood garland 2 1/2-in.-wide, red velvet ribbon, gesso and white spray paint (glossy).

Start by laying the Styrofoam wreath on a flat surface. Next, wind the rope in a circle that roughly conforms to the shape of the wreath. At spaced intervals (see drawing above), wrap wire completely around the rope and wreath and secure tightly. Wind a boxwood garland inside the wreath using a double row of boxwood. Fasten this with wire.

Cover all parts with two coats of gesso. After the second coat has dried, spray with white paint, covering the boxwood completely. To finish, start the ribbon at the back and wind it around the wreath, making knots as you go. Add colorful bows

and streamers knotted at random.

To make the gilded cage, you need 12 12-in. pipe cleaners, 2 Dixie dessert cups, a 3-in. length of pipe cleaner, masking tape, gesso, gold spray paint, gold glitter and wire.

Punch 12 small holes below the cup rims, insert and secure a pipe cleaner in each hole. Again, place this cup in a second holeless cup and wrap the masking tape basket-weave style. About 2 in. from the top, gather the 12 pipe cleaners together and push them down gently to form the cage shape. Cover all parts with three coats of gesso, allow to dry and spray on the gold paint. Add glitter as desired. Attach the ornament to the tree with a wire loop.

And now you know. It was the bird that was purchased. At that, with papier maché, spray paint and a little imagination, you could probably duplicate it. There are still more decorator tricks you might try, such as spray-painting walnuts, evergreen branches, miniature toys and the like. With the variety of spray and glitter paints available today, you are limited only by your imagination. Best of all, the entire family can join in. ★★★

THIS NOVEL YULETIDE FIGURE waits patiently for night to come to spotlight your Christmas door, for his stocking-cap head is actually a standard bullet-type lamp shade. From the back he appears to be just a saucy little elf posing as a yard decoration.

He's called Lite-Sprite by the manufacturer, stands 28 in. tall and comes in a kit which you put together and paint yourself. Vacuum-formed of heavy-duty white plastic, his body comes in two half shells which you place and glue together with a special adhesive and then attach to a wooden base.

The kit includes the cement and full instructions for making and painting the supporting base. To order a kit send \$12.75 to Provost Displays, Inc., 618 West 28th St., New York, N.Y. 10001. The kit does not include the paint or the bullet shade. While the lamp shade can be purchased locally at most any electrical store, you can acquire it with the kit for an additional \$5.75.

As a bonus, the instructions also explain how the two plastic shells can be used as a mold to cast any number of solid plaster figures. Such figures can be used as yard and garden decorations the year round to spotlight shrubbery and other foundation plantings. ★ ★ ★

Santa's helper spotlights your door



A handsome buffet that

Molded reproductions cemented to laminate-covered

By WAYNE C. LECKEY, Home and Shop Editor

PARK IT AGAINST THE WALL and it serves as a credenza for glassware and dishes. Roll it out, swing open the ends and it becomes the "life of the party," either as a portable home bar or an elegant counter for a buffet supper.

The open back and hinged front make the shelves accessible from both sides, and its folding gates support drop leaves to extend its top a full 6 feet. If you wish, a wine rack can be installed in the bottom.

Basically, the entire cabinet is made from inexpensive fir plywood; only the exposed surfaces are covered with decorative laminate, the rest is painted. We used Johns-Manville Melamite and chose a pecan walnut laminate to cover the top, the door fronts and the outside of the gate ends. We painted the interior with Plasti-Kote's Chevrolet orange and the rest a chocolate brown. Finally, we attached Shepherd ball casters to the bottom and cemented eight Spanish molded panels to the gates and doors. The



leads a double life

plywood add a handsome hand-carved look.

Photography by Robert D. Borst.



PERFECT FOR ENTERTAINING, this handsome piece of furniture with its richly carved front, can be rolled out from the wall to serve as an instant bar as you see here, or to provide a handy counter adequate for a buffet dinner

result is the beautiful cabinet you see here. It cost us about \$87 to build, but you couldn't touch it in a store for less than twice that amount.

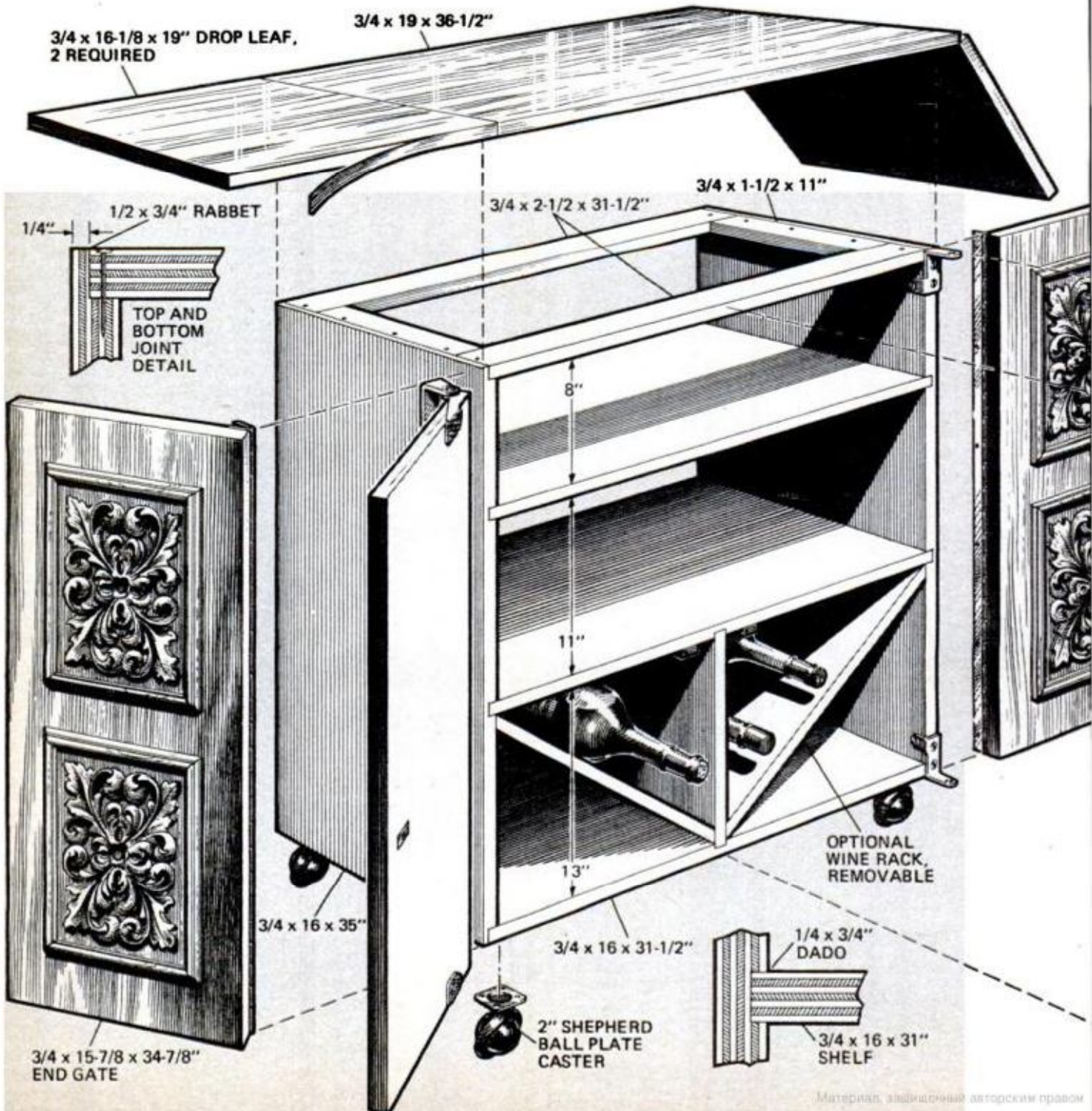
The "carved" panels are molded reproductions of an old-world, hand-carved Spanish door produced by Decorative Components, Inc., of Forest City, N.C. You can buy a set of eight already finished to match the pecan laminate by sending \$22 to United Southern Associates, Box 5521, High Point, N.C. 26262, and asking for panel KR-50070.

Start construction with the basic cabinet, which is nothing more than an open-sided box with shelves. Top and bottom edges of both ends are rabbeted ($\frac{1}{2} \times \frac{3}{4}$ in.),

and dadoes ($\frac{1}{4} \times \frac{3}{4}$ in.) are cut across the inside. If you install the wine rack, dadoes are also cut for it.

Glue the shelves in the dadoes first, then glue and nail the bottom panel and the $2\frac{1}{2}$ -in. top crossrails in the rabbets. Hold the assembly square with a temporary brace until the glue dries. Then, add the $1\frac{1}{2} \times 11$ in. strips in the rabbets. These strips are used to attach the top.

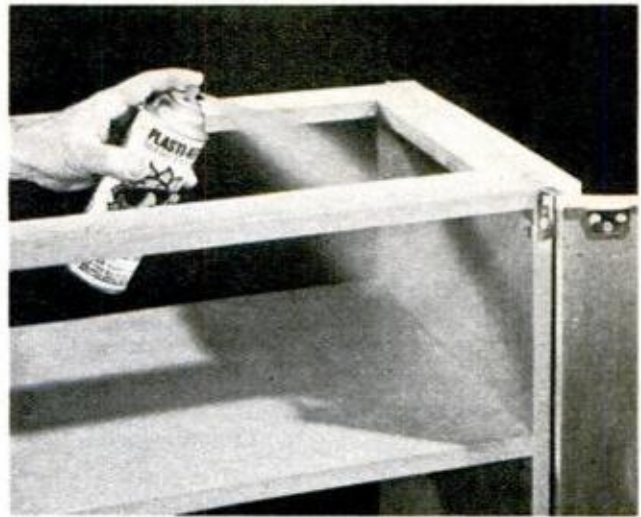
Cut the door and gate panels, plus the top and drop leaves to the sizes given and start covering them with wood-grain decorative laminate. (See *How to Work With Plastic Laminates*, page 154, March '70 PM.) It will take two 3x6-ft. sheets of laminate to cover the edges and the



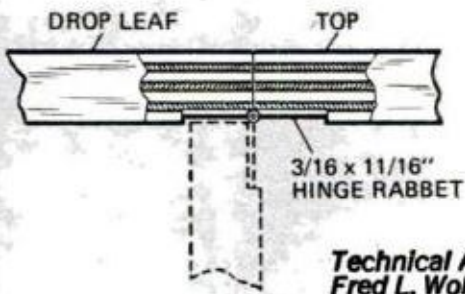
outside faces of the seven panels. Use contact cement to glue the laminate to the plywood. The edges of the panels are covered first. Actually only the exposed edges are covered. Here enough 1-in.-wide strips of laminate are cut and applied and butted at the corners.

Apply contact cement to both the wood and the back of the laminate strips and allow it to set for about 10 minutes, or until the cement is tacky to the touch. Now you are ready to apply the strips, but remember that once the two treated surfaces touch, you can't shift these strips, so it's important that they be positioned exactly where you want them. Straddle

(Please turn to page 187)

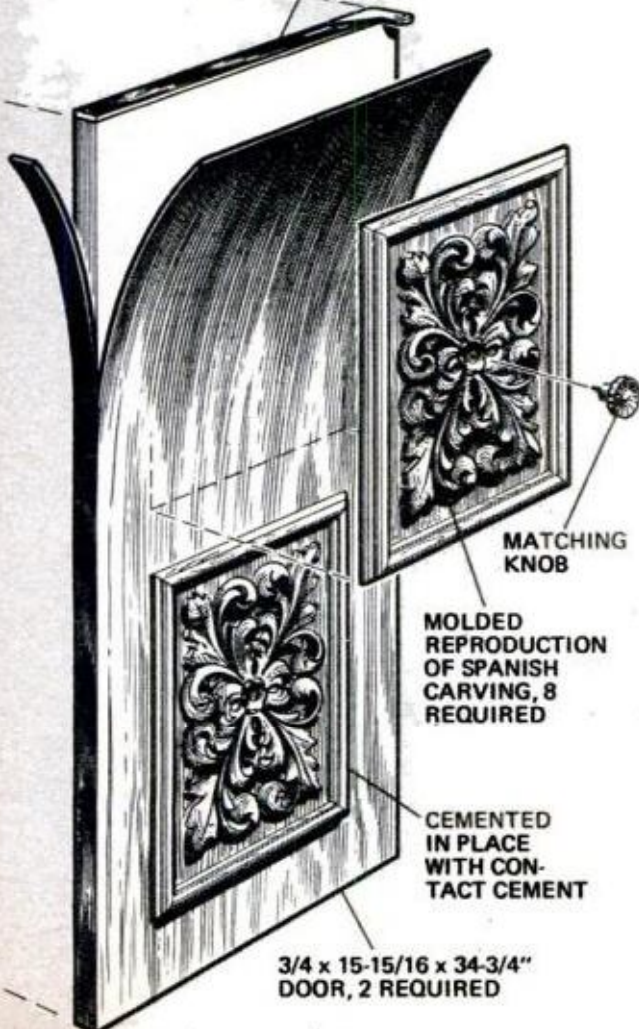


BARE PLYWOOD on inside of cabinet is painted. We did original in "Chinese red" to contrast with walnut



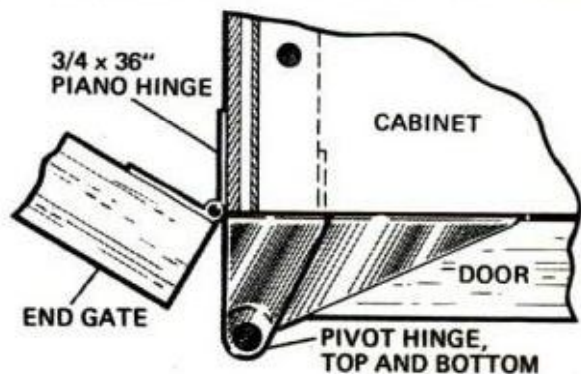
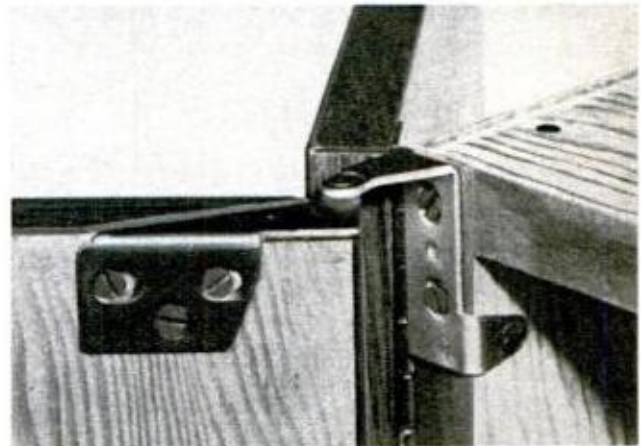
*Technical Art by
Fred L. Wolff*

EDGES BANDED AND
FACE COVERED WITH
DECORATIVE LAMINATE



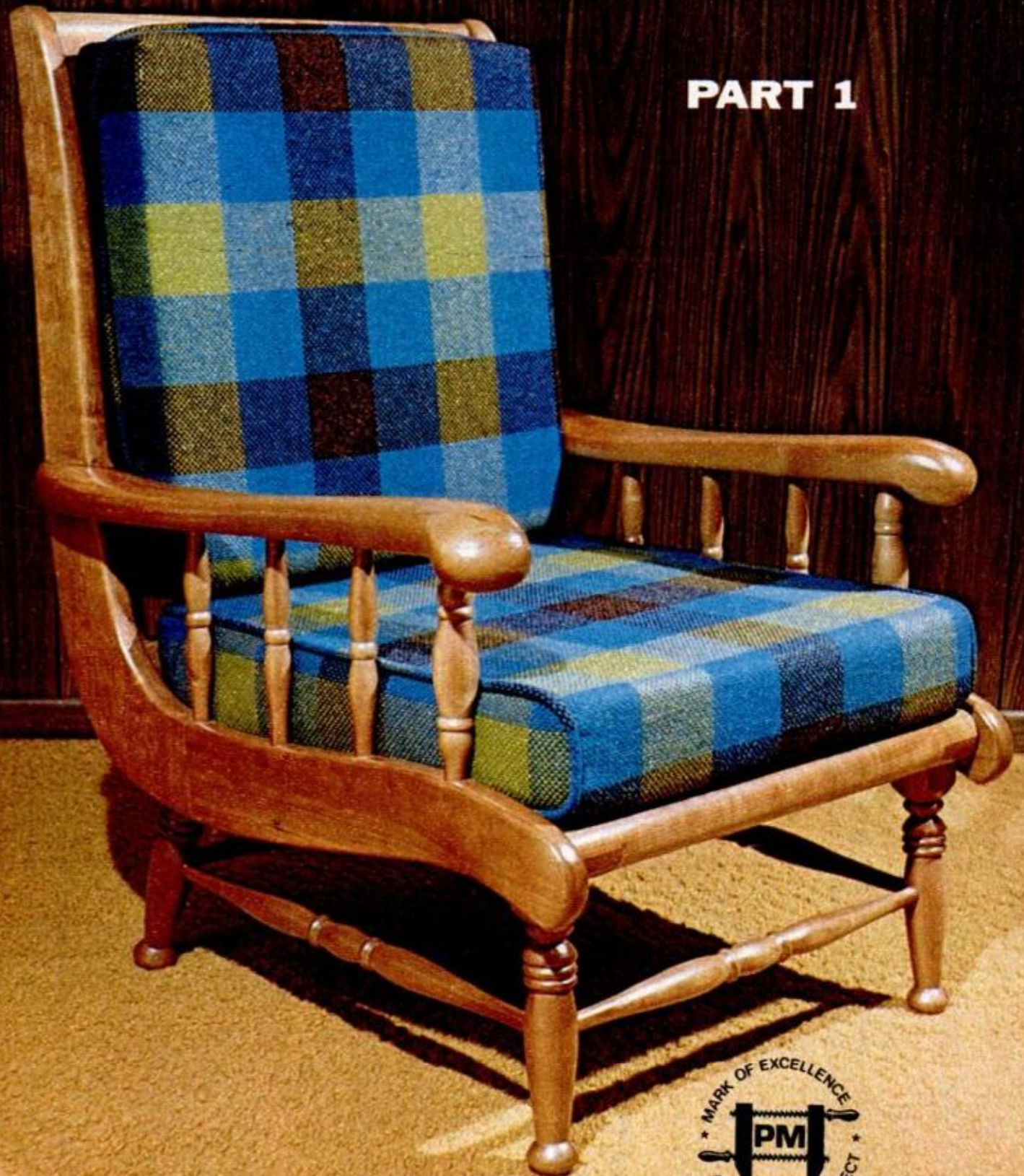
FAITHFULLY REPRODUCED in simulated wood grain, molded "carvings" are hard to tell from real wood

PIANO AND PIN-TYPE HINGES are used to surface-hinge doors and end gates to the plywood cabinet



A colonial chair you can build for \$53

PART 1



Authentically crafted in solid cherry, this family heirloom is offered for PM readers to duplicate. A two-part project

By RO CAPOTOSTO

Photos by the Author

HERE'S A PROJECT to involve you in a number of shop skills, including repeat turnings, spokeshave shaping, lap-jointing and angle drilling. And, since this handsome cherry chair is planned for standard-size, ready-made cushions, you needn't worry about upholstering procedures.

This chair is sturdy, despite its trim lines and somewhat delicate appearance, and its legs, with 1¼-in. tenons, won't loosen in a lifetime. Lumber requirements are minimal: 12 ft. of 5/4 x 8-in. and 8 ft. of 3/4 x 8-in. cherry, plus three lengths of 3/4-in. hardwood dowels.

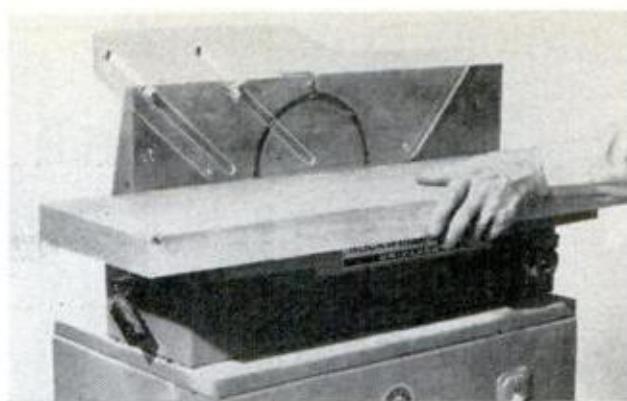
Start with the side panels. Make over-size, rough-cut sections as shown in the diagram. Fit pieces closely to save lumber. It's wise to position sections one atop the other in proper relationship, then lay a full-size paper pattern of the side in place to double check proper angular placement. Remove the pattern and scribe lines to indicate lap-joint limits.

For safety when cutting wide laps, leave a bit uncut at the outside end until all inner portions are cleaned out. This can avoid a nasty accident, such as the work-piece dipping too deeply into the blade.

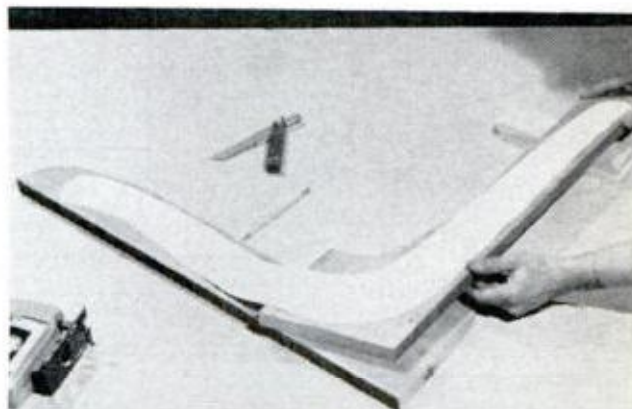
Make right and left sections for each side for symmetry of joint lines. Glue the pieces, using a few nails in the waste areas to prevent sliding during clamping. Then bandsaw sides to size and smooth. When rounding edges, don't shape the juncture of the armrests and the inside back corners.

Due to the bottom curve on side panels, you need a simple jig to bore perpendicular holes accurately for the armrest spindles. Clamp two 2x4 pieces to the work to hold it in the proper plane as indicated in the drawing. Clamp assembly to the drill-press table and bore the holes. Cut armrest pieces and bore spindle holes before contouring the top surface so the pieces will rest flat and true on the table.

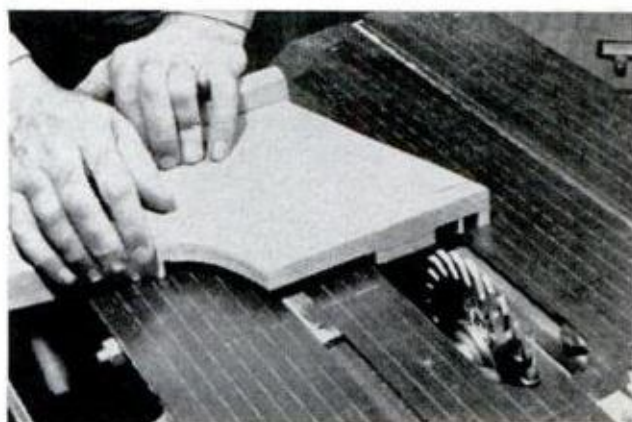
After boring the holes in armrest bot-



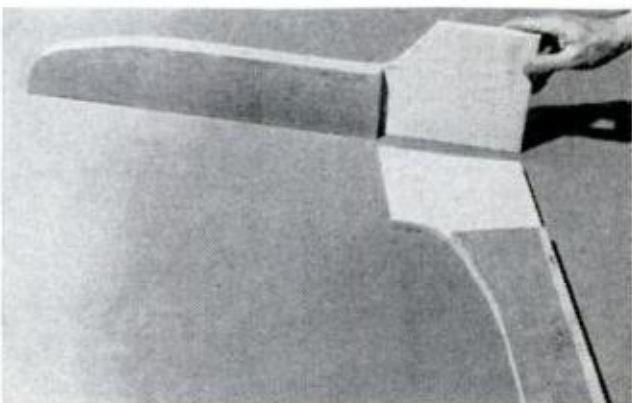
TURNING BLOCKS for the chair legs have squared edges, jointed smooth. Cut them from the 2-in. stock



USE A PATTERN as a guide for positioning the side sections before you mark off the lap-joint limits

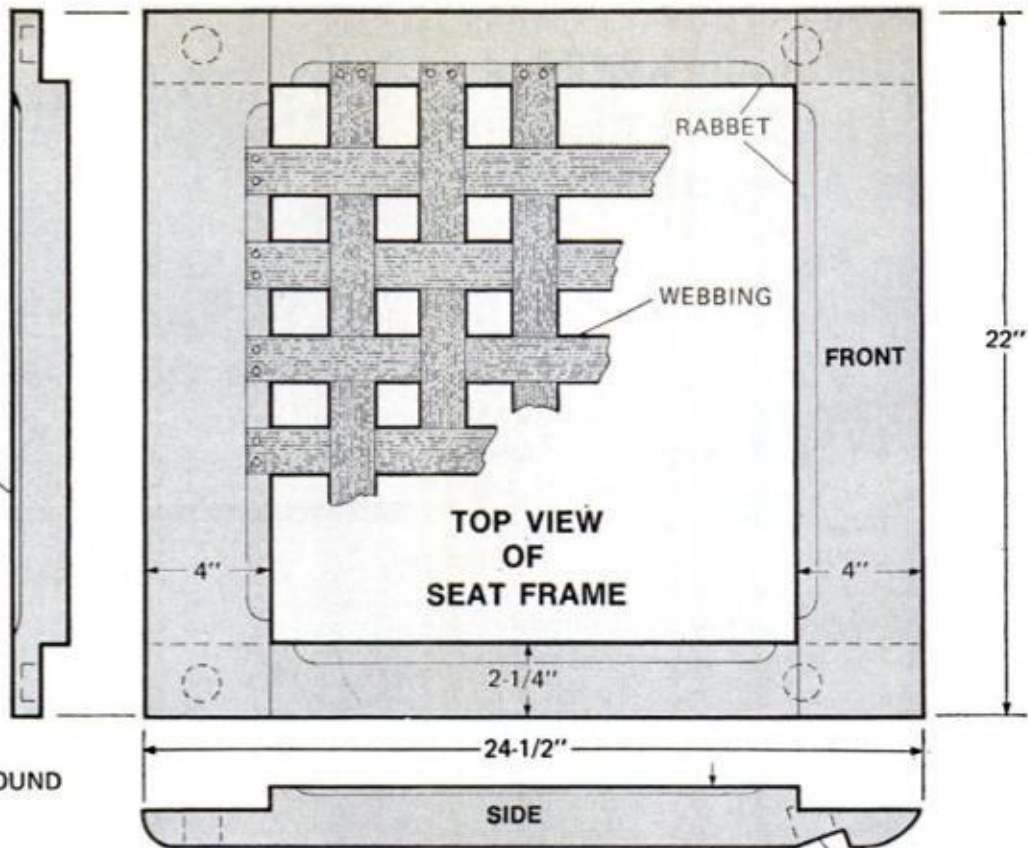


LAP JOINT is cleared with dado blade. Notice end portion is left as a temporary support of the piece

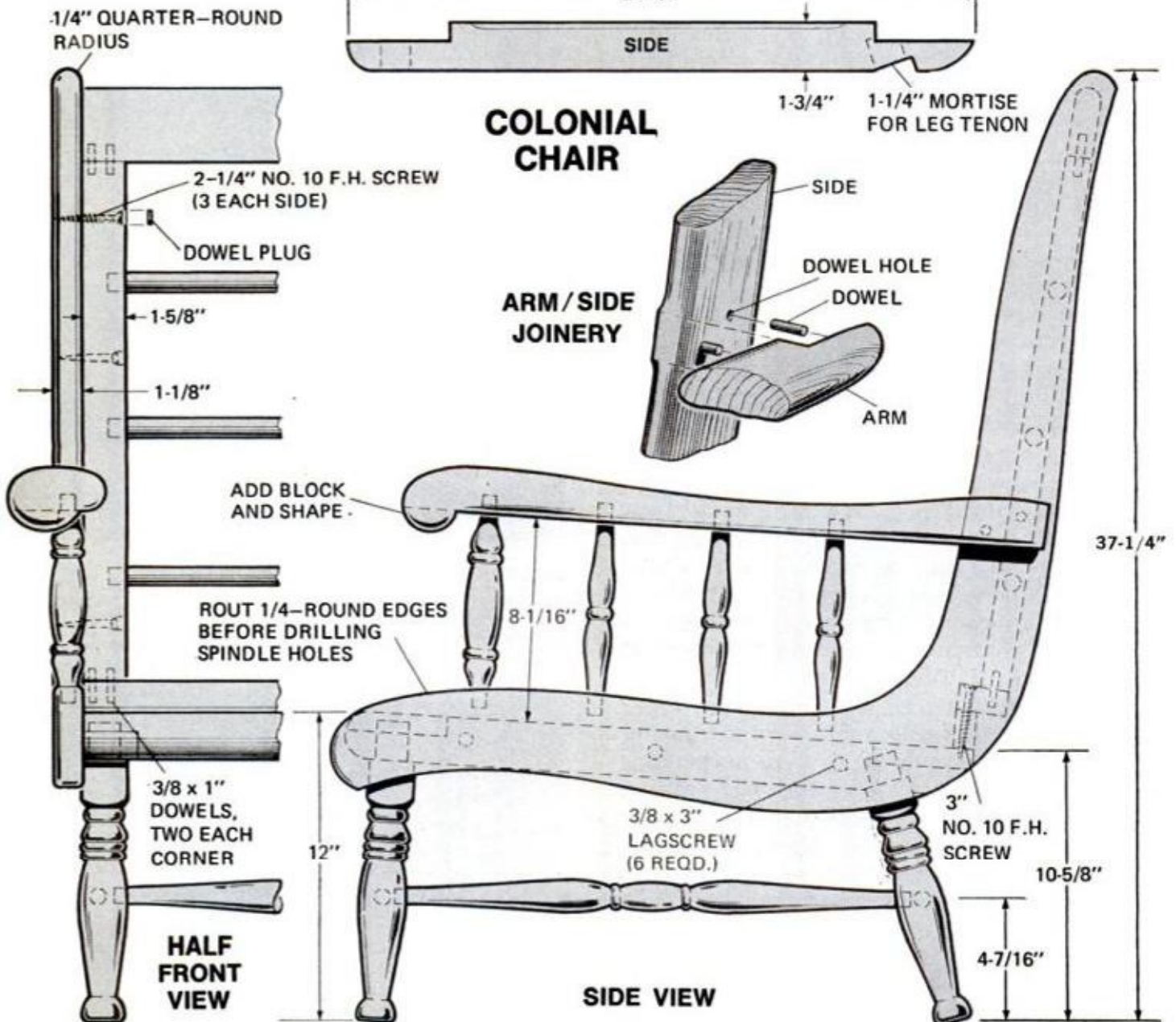


LARGE LAP JOINT like this is extremely strong. Be sure to reverse the position for left and right sides

1/4 x 3/4"
RABBET FOR
CANVAS WEBBING



COLONIAL CHAIR

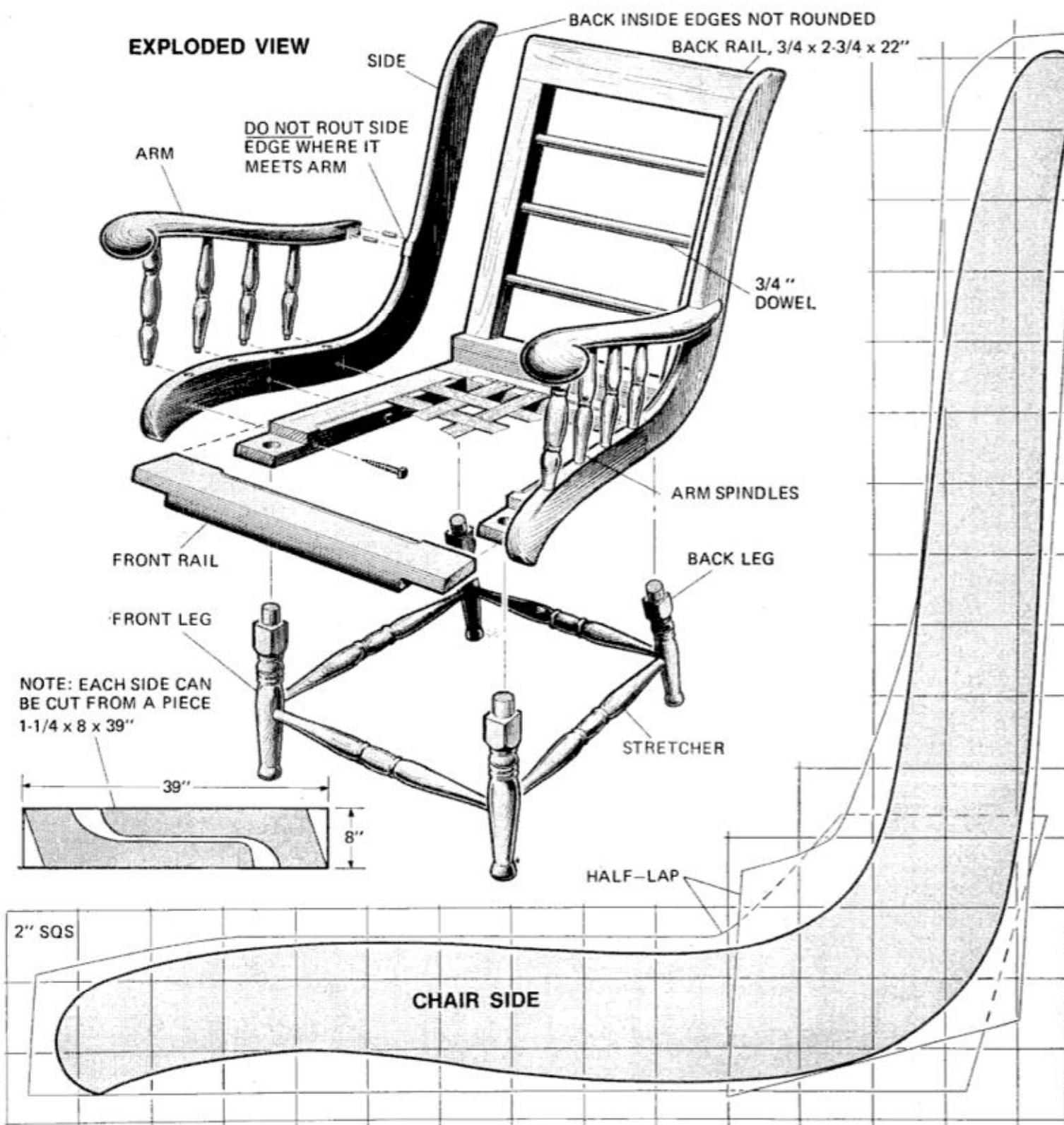


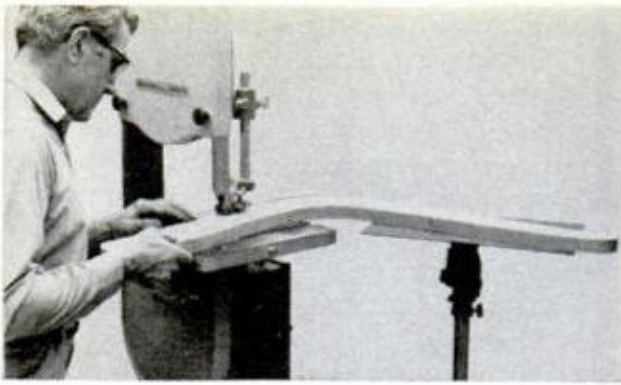
toms, screw on a piece of 2x4 to serve as a temporary clamping block to hold the work in the vise while you shape it with a spokeshave. Before shaping, remove some waste with the bandsaw. Note that the cross section of the armrest takes on varying curves. You can shape the pieces by eye but if you need guidance, cut some cardboard templates from a full-size sketch of the contours.

I erred slightly by not boring the dowel-joint holes between chair sides and

armrests before cutting the slanted side of each armrest. Thus I had to glue on a temporary wedge to get a solid, square purchase with clamps between the two pieces for precise drilling. Anticipate this and bore the dowel holes after you notch out the back of the armrest, but before cutting any curves.

While the chair legs are angled (in one plane, front to rear), the construction and assembly is novel because of its simplicity. Front legs are driven straight into the





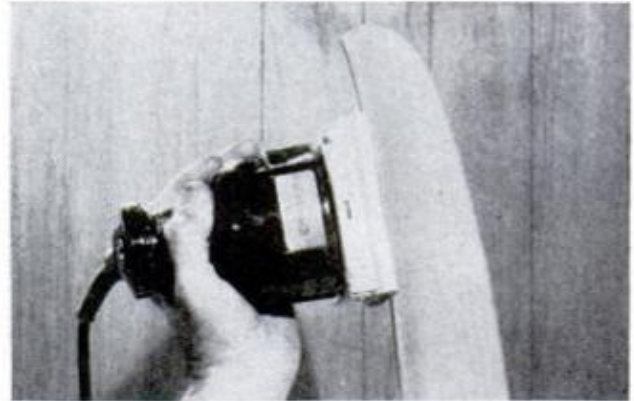
AUXILIARY WORK-SUPPORT PLATFORM is handy aid when bandsawing awkwardly shaped piece like this



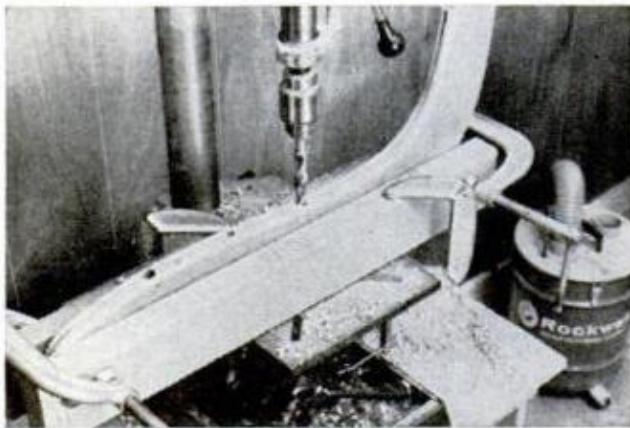
RIPPLES made by bandsaw blade can be smoothed out with spokeshave as shown or plane and sander



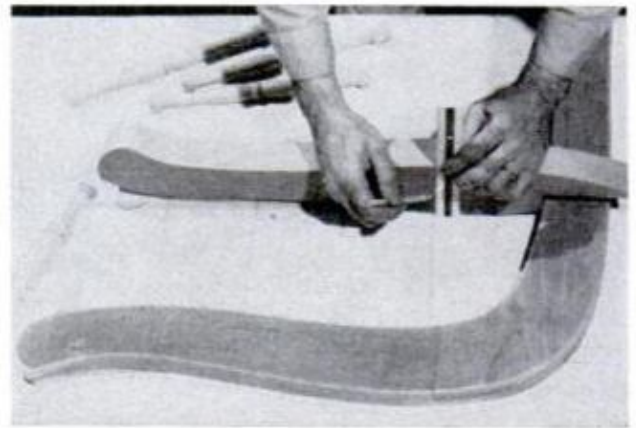
ROUTER with $\frac{1}{4}$ -round bit will cut round edges on side panels. Don't shape where armrest meets panel



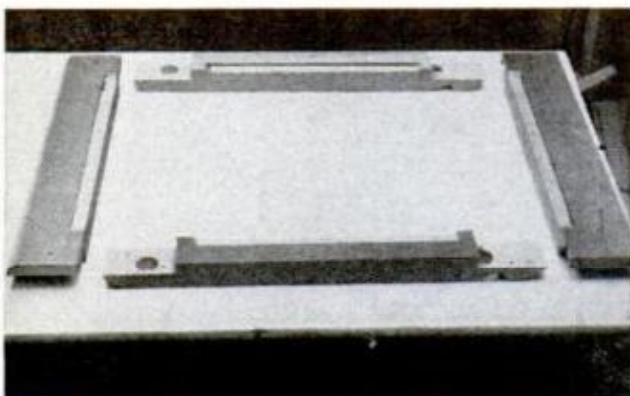
ORBITAL FINISHING SANDER with high o.p.m. lets you do an excellent smoothing job with little effort



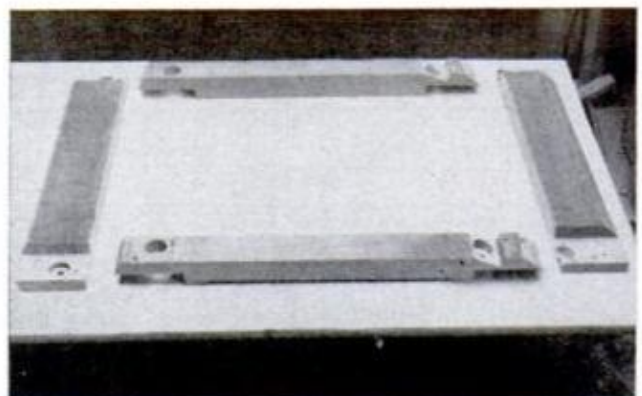
TO DRILL SPINDLE HOLES accurately, sandwich the side between two blocks to hold it true and steady



FULL-SIZE SKETCH offers easiest way to locate the exact position for holes in the armrests and sides

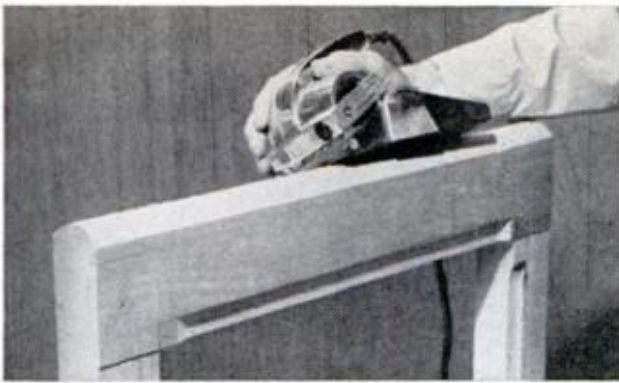


EXPLODED VIEW shows how seat frame is made up. The view of seat shown above is from the top side

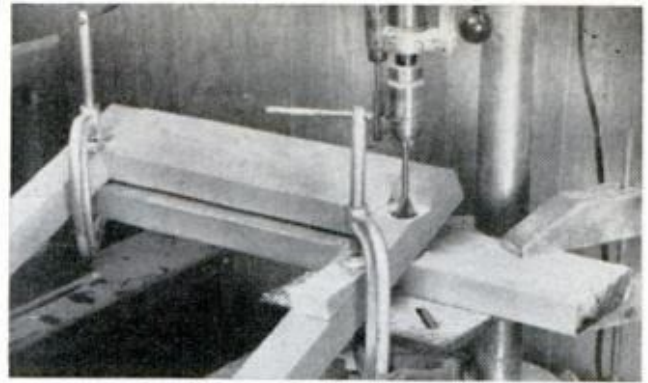


BOTTOM VIEW OF FRAME: Holes are predrilled for illustration, can actually be bored after piece is glued

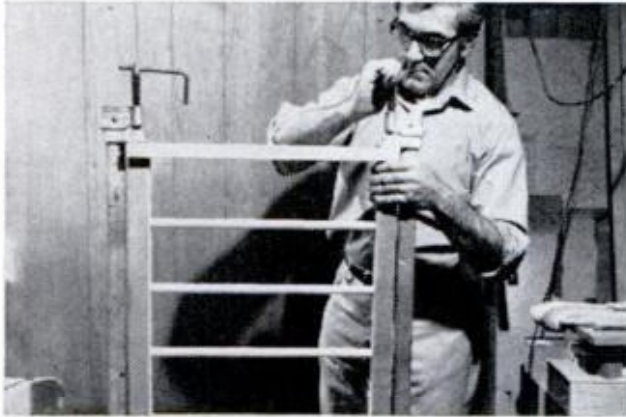
POPULAR MECHANICS



POWER BLOCK PLANE, used to trim assembled seat frame to approximate desired size, saves muscles



SEAT FRAME must be propped up when you bore the angled rear holes. Don't try this without clamps



BACK FRAME is butt-jointed and doweled. Insert the long dowel spindles before assembling the frame



BACK is joined to bottom frame with screws, glue. Using damp cloth, wipe off excess glue before it sets

seat frame, but achieve their angle because the frame slants down toward the back.

The seat and back frames are made up as separate subassemblies and then joined together. Make the necessary cuts on the seat frame parts before assembly, including the angled notches below and wide rabbets for the webbing on the top side. The broad area of the lap joints supports a lot of glue so you need no doweling here. Besides, the leg tenons serve as huge dowels. Back framing members are butted, so paired dowels are called for at corners.

You'll need a simple jig, consisting of a large plank clamped to the drill-press table, to support the seat frame at the proper angle for boring holes for the rear legs. Round the front end of the seat and the top edge of the back frame, thoroughly sand all the exposed surfaces, then screw and glue the back to the seat. The side panels are glued on next. Use flat-head, countersunk screws through the sides of the back frame and $\frac{3}{8}$ x 3-in. lag screws to secure the seat framing.

In Part 2, next month, we'll take on the turnings, simplified upholstery and finishing. ★★★



FOR ACCURACY, holes for screws are drilled on the spot with the members clamped in their final position

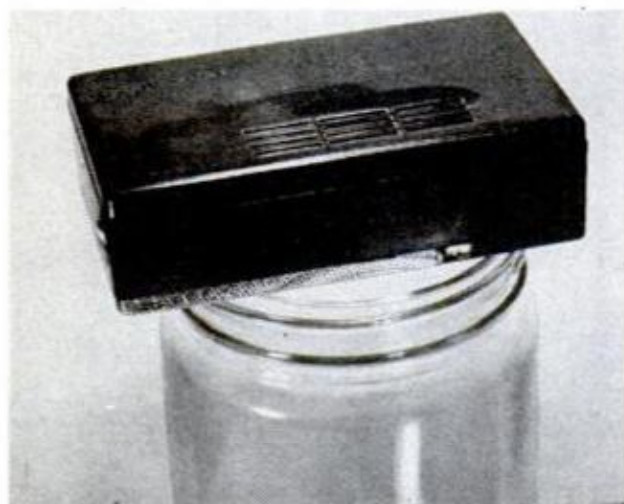
25 tips to save you



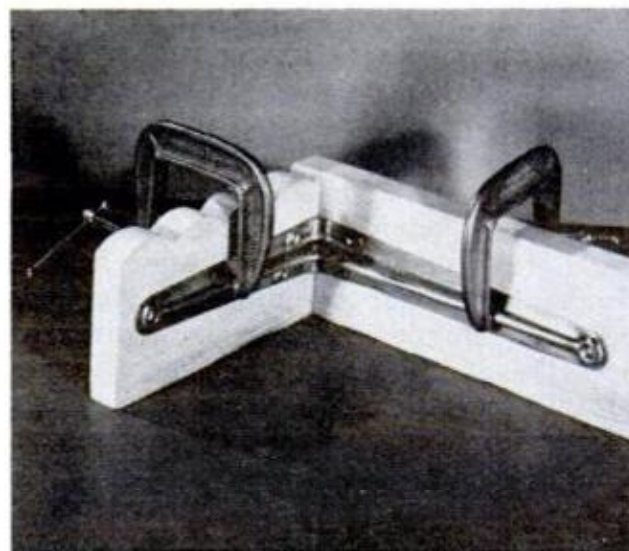
EMERGENCY CANDLEHOLDER can be improvised by inverting a teacup and dripping some melted wax onto the bottom to hold the candle. Since the cup has a handle, the candle can be safely carried about



LACKING A GLAZIER'S POINT-DRIVER, you can make one by holding a putty knife against the glazier's point (triangular nail) and tapping it with a hammer. Works perfectly and prevents broken panes

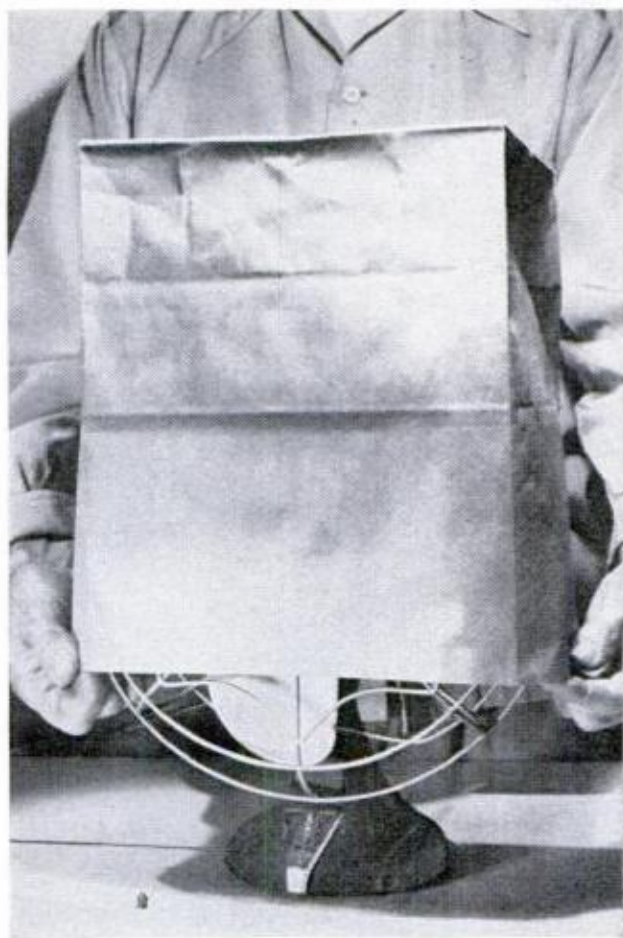


IMPROVE TONE of a pocket-size transistor radio by placing it speaker-side down on top of an open fruit jar. Jar acts as a resonance chamber to bring out bass tones. Note airspace between opening and radio

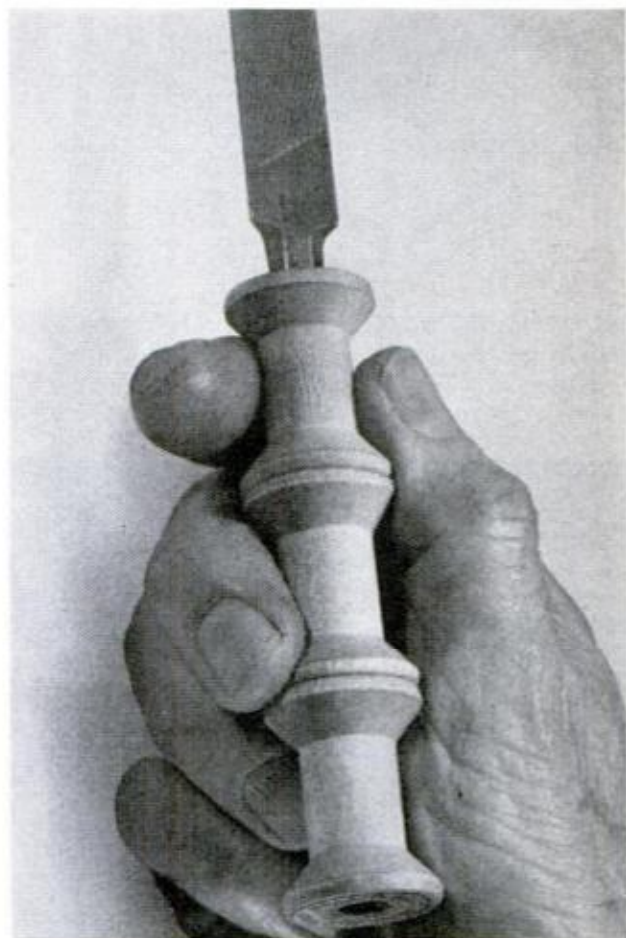


WHEN CLAMPING RIGHT ANGLES, a heavy-duty shelf bracket and two C-clamps will hold the stock at perfect 90° angle while you nail. Stunt works particularly well when making drawers, frames and screens

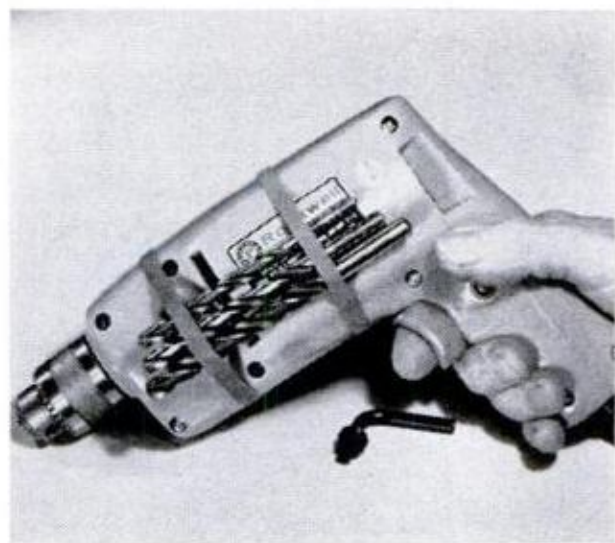
time, money and work



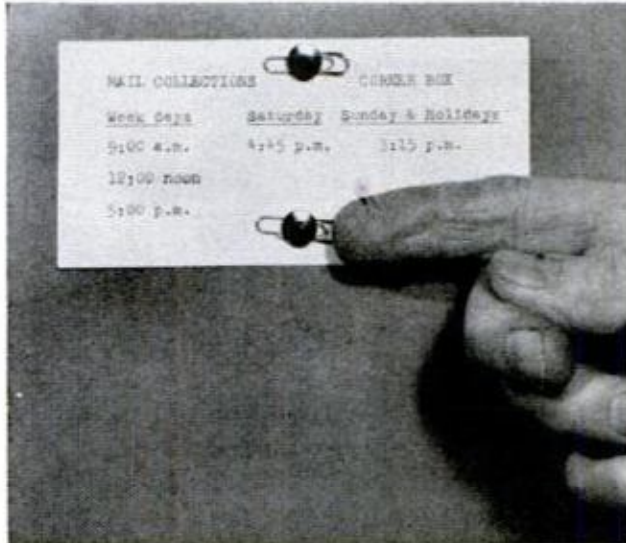
AFTER OILING AN ELECTRIC FAN, slip a large paper bag over the blade guard before turning the fan on. After running the fan a few minutes, turn it off and remove the bag. Trick saves walls from spatter



FILE HANDLE can be improvised by gluing together several thread spools. To attach, simply press the tang of the file into the end spool until you have a force fit. Grip is both comfortable and convenient

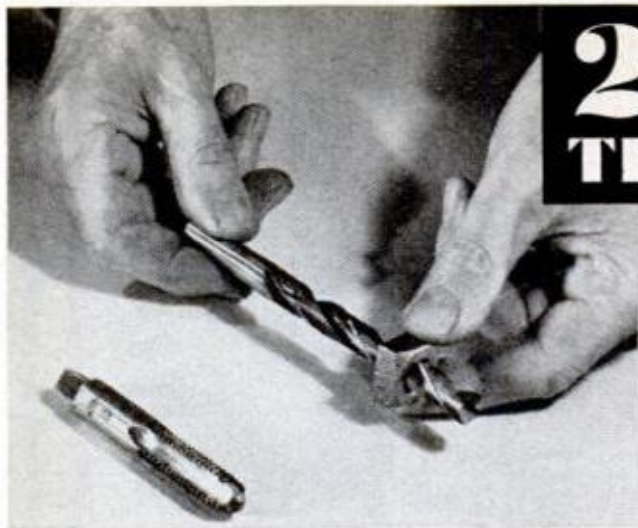


EXTRA DRILL BITS can be kept handy by lashing them to your portable electric drill with a couple of hefty rubber bands. Bits don't interfere with work and can be removed and replaced with little effort

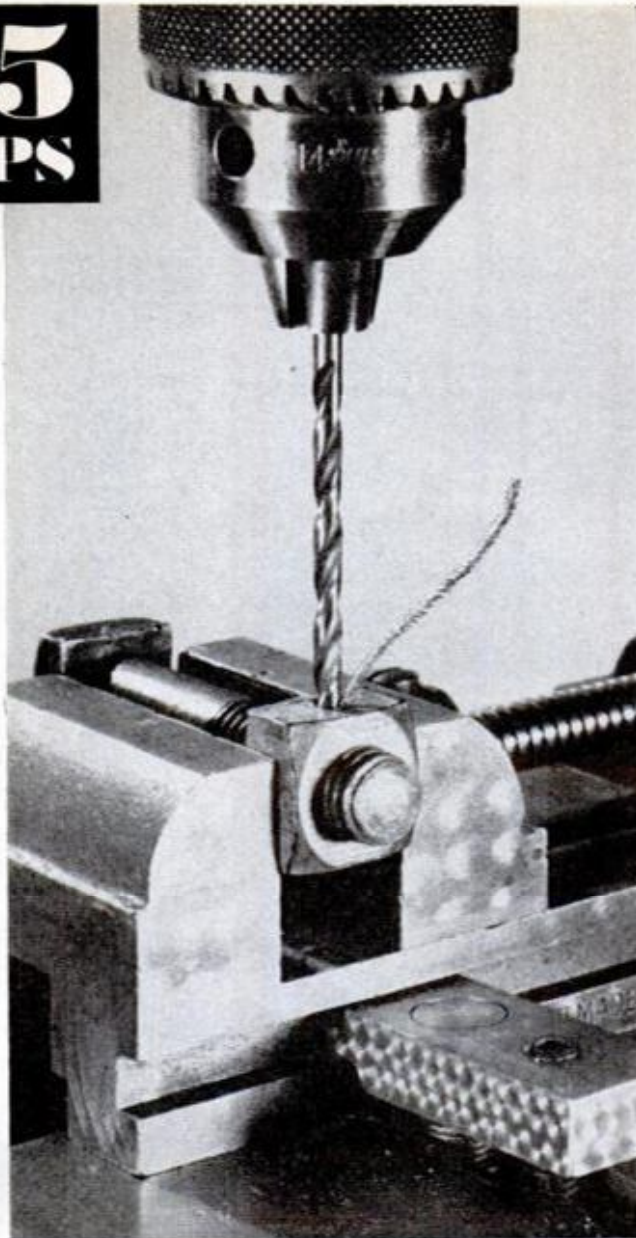


LEVER FOR REMOVING THUMBTACK can be fashioned by placing a small paper clip beneath tack before pushing it home. If clip is placed between bulletin board and material held by tack, it won't be seen

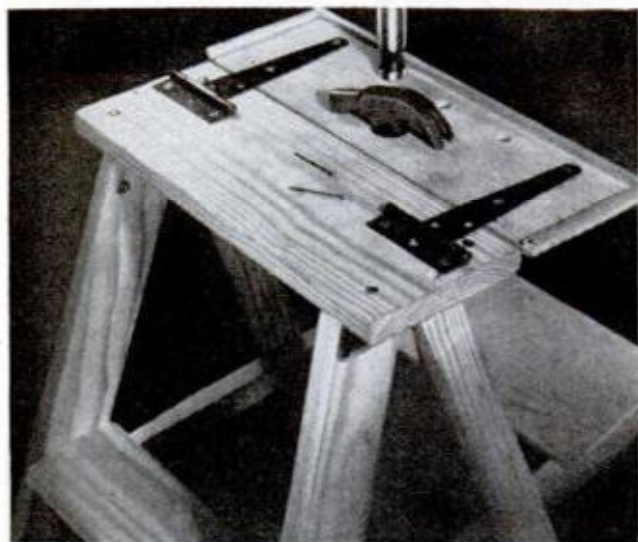
25 TIPS



CHOOSING THE RIGHT BIT to drill a hole for a particular-size tap is simplified if you use the nut from the bolt that is to fit the hole. Simply pick a bit that just passes through the nut without binding



DRILLING THROUGH THREADS of a bolt or rod is just as easy as drilling through square stock if you first drill through a nut that's run up on the threads. Lock nut in vise so drill is at right angle to bolt

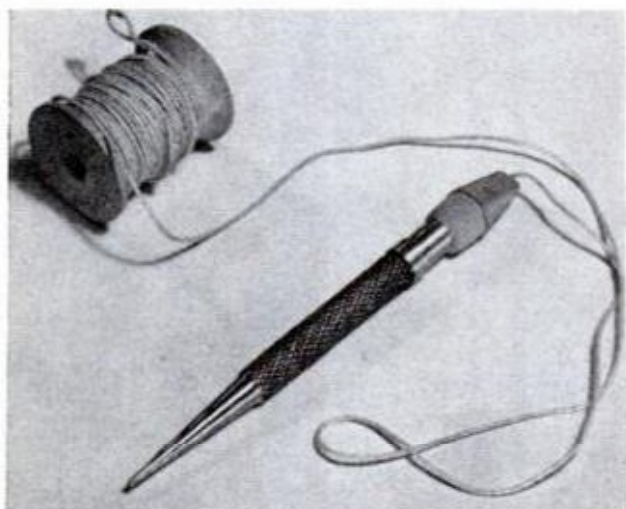


FLIP-TOP SHELF for a stepladder enlarges the top step to provide shelf for tools, paint, brushes and other items needed on job. Make it as shown using bolts or flathead screws to attach hinge to ladder



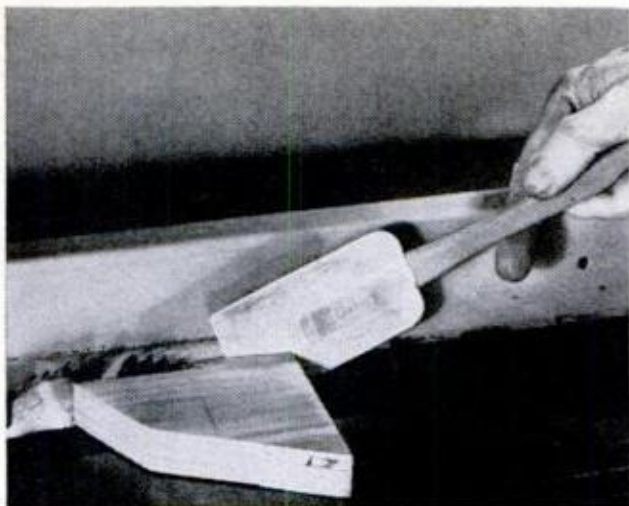
WHEN MIXING RESINS or other plastics, empty cottage cheese container makes convenient tub for weighing materials. After weighing, the chemicals or resins can be mixed in the tub for application

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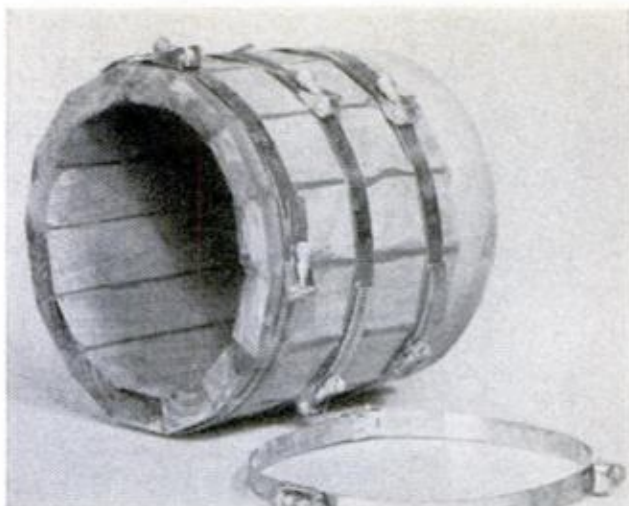


EMERGENCY PLUMB BOB can be made by drilling a hole through the center of a slip-on eraser, then feeding a cord through and knotting one end. Then, push the eraser onto the nailset or a center punch

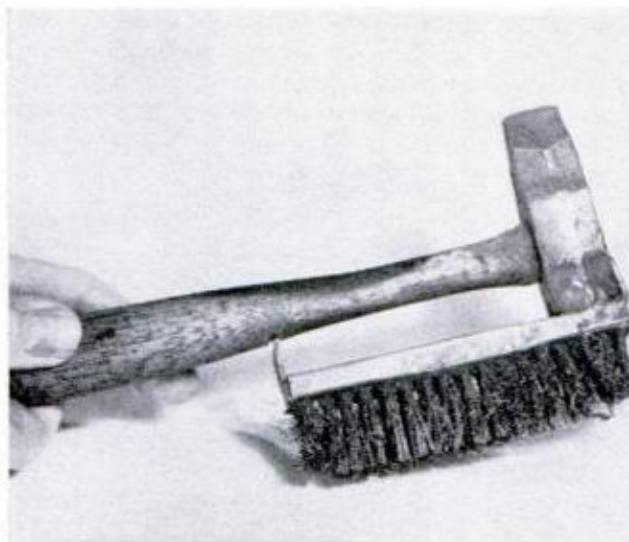
POPULAR MECHANICS



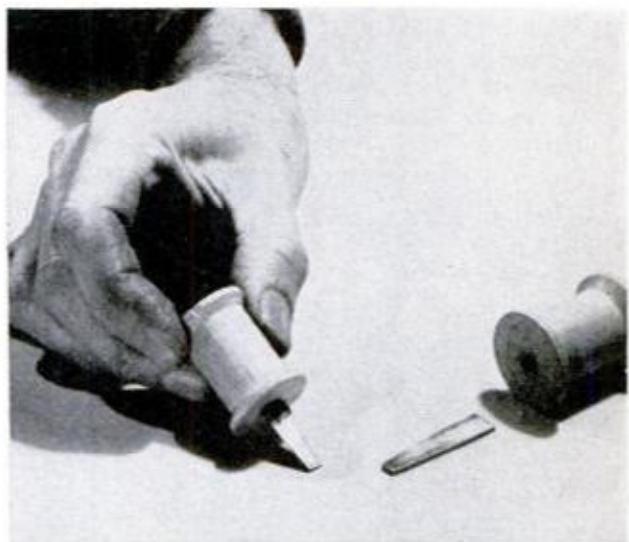
CIRCULAR-SAW PUSHER-STICK can be fashioned by cutting a right-angle notch in a rubber spatula (kitchen item). For clarity, the splitter guard has been removed from the table saw in the photo above



STRONG CLAMPS for joining hopper-type lathe projects can be shop-made using common worm-gear hose clamps. These can be joined to create band clamps of diameter wanted. Get them at auto stores



CHIPPING HAMMER, with wire brush attached for clearing rust particles, can be improvised by welding one end of the wire brush to a single-face, straight-peen hammer. Brush is not fastened to handle

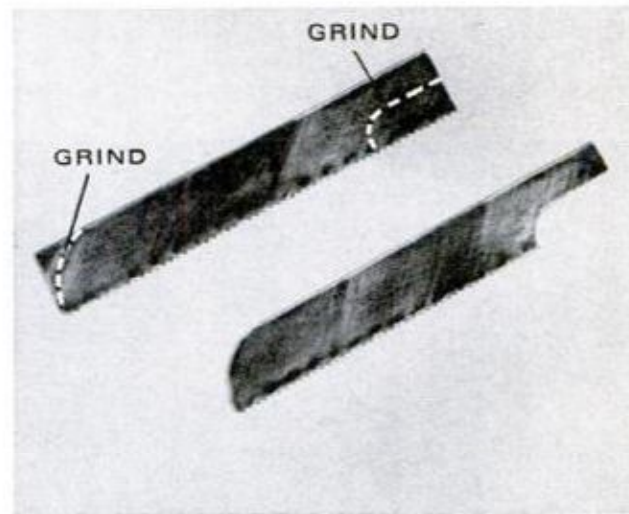


STUBBY SCREWDRIVER to turn screws in cramped quarters consists of a short blade inserted into one end of a thread spool. Blade can be fashioned from any piece of flat (preferably tempered) steel



IF A WHETSTONE is not handy when you want to bring up the edge of a knife, try using the rim of a clay flowerpot. Using this "emergency" stone, you can hone edge of a paring knife to razor sharpness

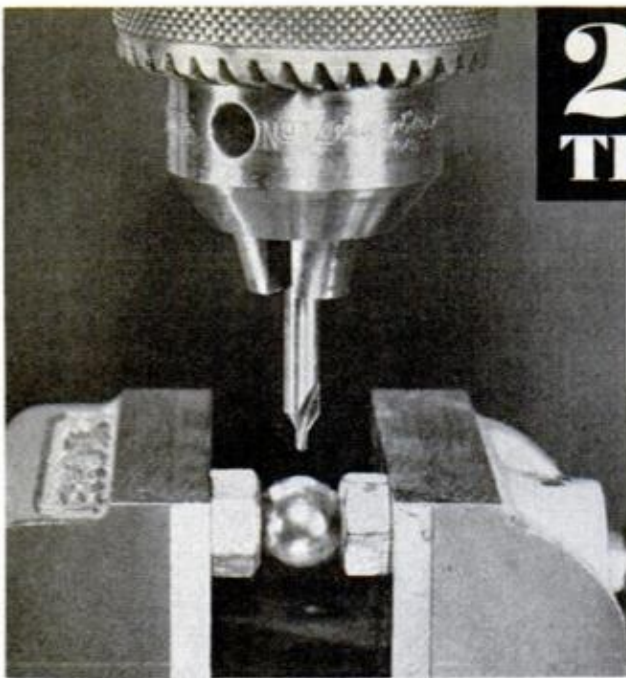
DECEMBER 1971



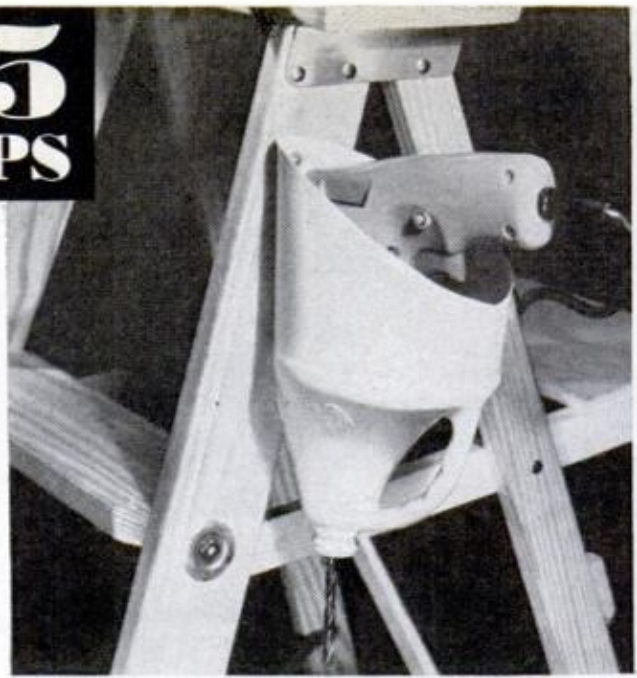
IF YOU BREAK your last sabre saw blade on a Sunday, you can get back to work by grinding a hacksaw blade (as above) to suit your saw. Homemade blade works particularly well on metal and plastics

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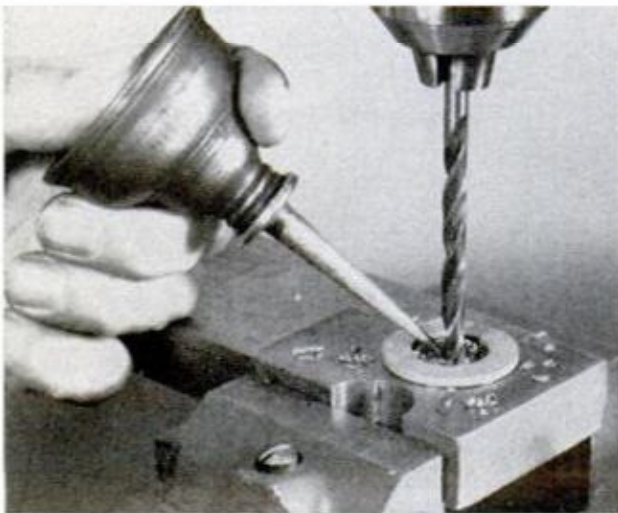
25 TIPS



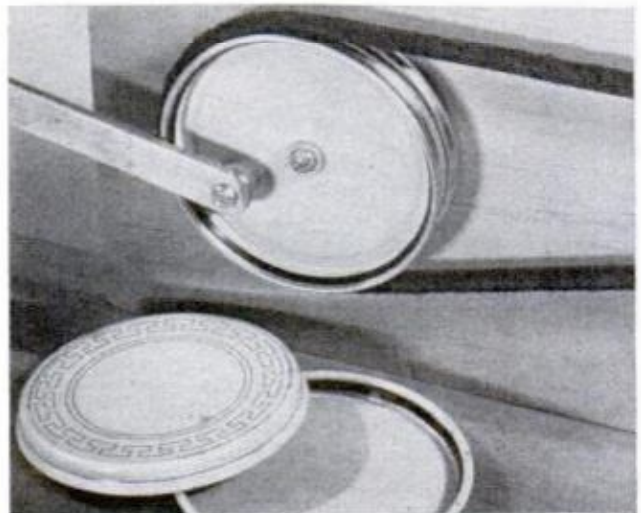
VICE GRIP FOR STEEL BALL to be drilled is best obtained by clamping the ball between two bolt nuts in a drill-press vise. Holes in the nuts should be slightly smaller than the diameter of the ball



YOUR DRILL can offer the fastest draw on the job if you mount a "holster" on the stepladder for it to rest in. On-the-job convenience prevents chance of drill falling off ladder and becoming damaged



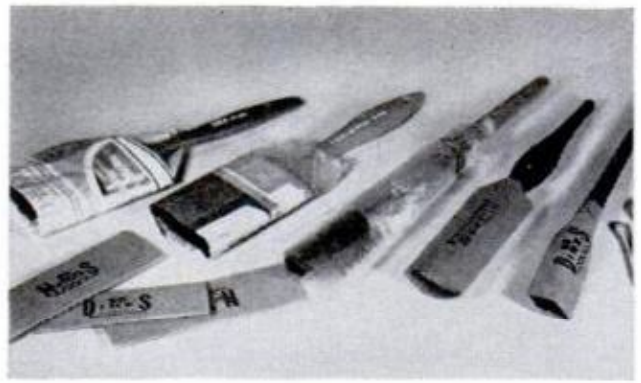
WHEN DRILLING HOLES IN STEEL, a washer placed to surround the spot to be drilled will make a handy reservoir for the cutting lubricant. Trick permits continuous drilling with a minimum of oiling stops



MINIATURE PULLEYS for models, toys or other small projects can be made by sweat-soldering two jar lids together. By using various cap sizes, pulley diameters can be varied to attain desired speeds



SIMPLE PLAYING-CARD HOLDER consists of two plastic coffee-can covers, two buttons and some strong thread. Place covers back-to-back, puncture them to match the buttonholes and sew the "rack" together



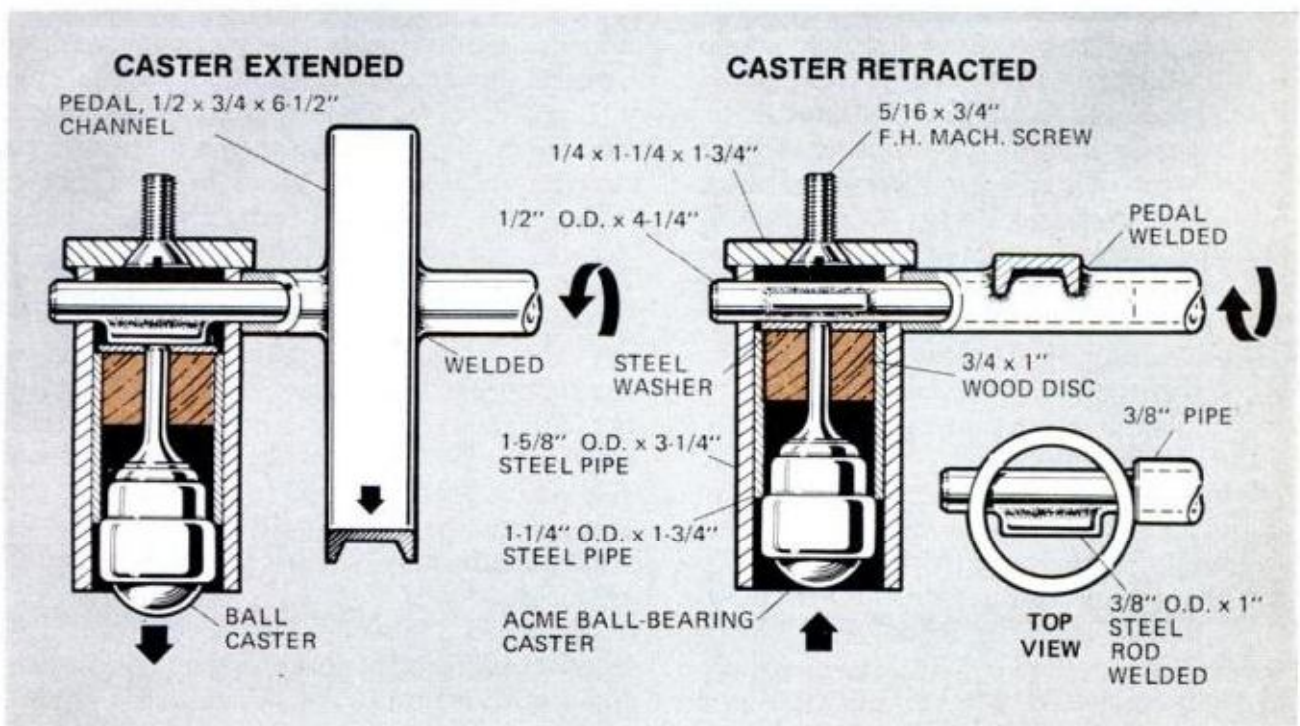
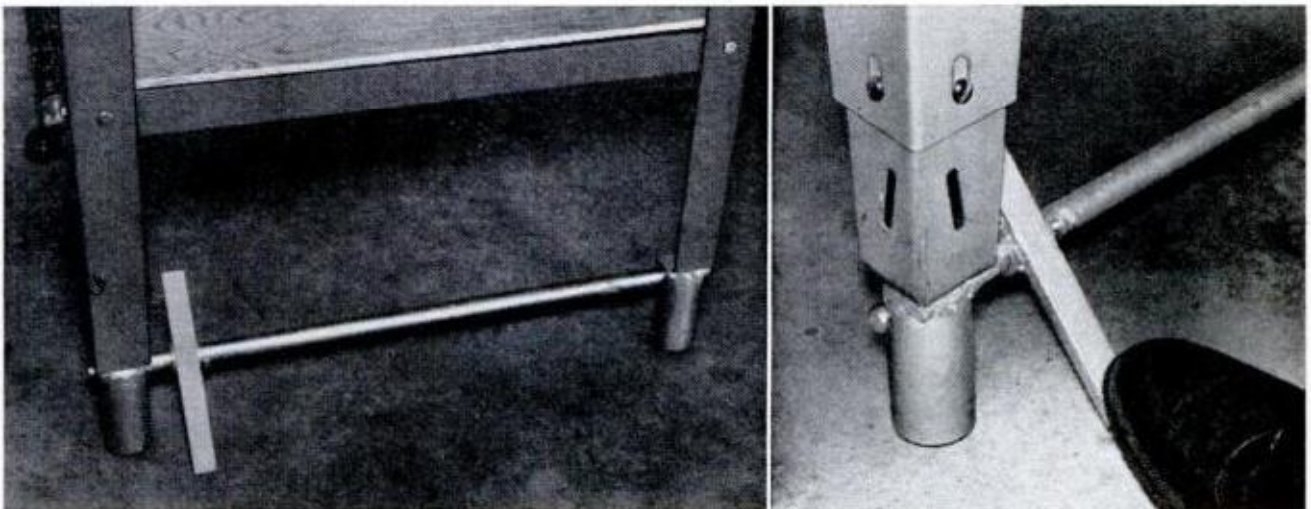
PROPERLY STORED PAINTBRUSHES will last years longer than those that aren't. One neat wrapper is made from plastic cheese and meat containers. For small-size brushes, coin wrappers do a neat job

POPULAR MECHANICS

Retractable casters for your shop machine stands

TIRED OF PUSHING, shoving and groaning every time a piece of shop equipment needs moving across the room? Then picture yourself depressing a foot pedal and rolling the tool effortlessly. By making the retractable-type caster set shown in the drawings below, you can enjoy such shop convenience. When the lever is depressed, the ball casters are forced out of their sockets and locked in a ready-to-roll position. This retractable caster is easy to make—there is no machining called for, yet it's quick-acting and positive. And, as

shown in the photos, one pedal activates the pair of casters. Basically, the idea is simply a fit of 1-in. pipe into 1¼-in. pipe, and the use of a 1-in.-dia. ball caster which seats neatly into the smaller pipe. The trade name of the caster used is Acme; if they're not available locally, you'll find them in the Sears catalog. While one set of casters is adequate for a radial or table saw it's best to have a caster on each leg of the stand to save your back.—William G. Waggoner, Sacramento, Calif.



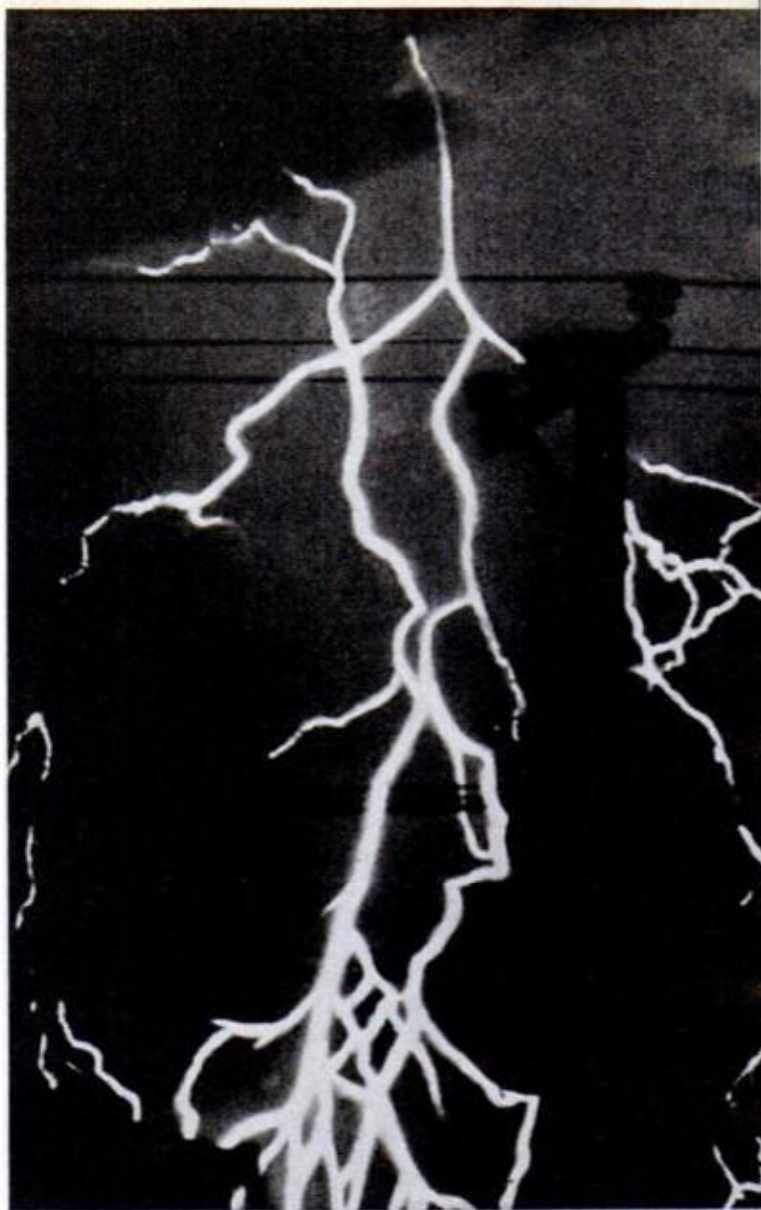
How to have power when there is none

For as little as \$350,
a portable generator can
keep your house safe and
bright when power fails

By RICHARD NUNN

EMERGENCY STANDBY electric power is one of the best insurance policies you can buy for your home today—even though (hopefully) there may never be another blackout like the one that covered the northeast in November, 1965. Power officials—including the members of the Federal Power Commission—are now warning of nationwide brownouts, not only in peak summer months when a lot of electricity is consumed for airconditioning, but most *anytime, anywhere* during the year. (Editor's note: A brownout is a reduction in voltage output by the utility company).

Volumes have been written in an attempt to explain the why of blackouts, brownouts, dimouts, and the flickers. The problem, stated simply, is that electric consumption is more than the electric utilities can produce. Until this situation has been corrected, you can anticipate and expect power shortages and failures, re-



gardless of the area in which you live. Until then, standby power in the form of a home generator is the inexpensive answer to power shortages.

The words "brownout" and "dimout" are incorrect or misleading terms in reference to what really takes place in your home when the "juice" is reduced to a trickle. As electric consumption increases over a given power area, the power company reduces its level or output to compensate for the drain. The reason? To spread available electricity more evenly over the service area. When this happens, there's a noticeable dimming of lights, or a narrow television picture, and, in some cases, the air conditioner, washer, dryer, furnace or refrigerator may blow overload switches or central fuses.

Make no mistake about it, a power reduction is harmful to appliances and some tools with motors. The former, for example, are geared to run at a constant speed.

POPULAR MECHANICS

WHAT SIZE STANDBY POWER UNIT DO YOU NEED?

Will run at one time	5000	4000	3000	2000	1250
	w.	w.	w.	w.	w.
1/2-hp furnace fan	x	x	x	x	x
Refrigerator	x	x	x	x	x
1/2-hp sump pump	x	x	x	x	
Freezer	x	x	x		
Television	x	x			
Automatic washer	x				

When the power or voltage drops, the load on the motor remains the same, and the windings of the motor seek more electricity. The friction of the current on the windings can generate heat which breaks down the motor insulation. The result can be a burned-out motor.

The practical answer to the power problem is an emergency standby power unit. A 2000-w. generator for an average six or seven-room house will supply power for the lights, radio, freezer, small air conditioner or furnace, and sump pump. The cost is under \$300.

If your home has a 230-v. power service, you should buy at least a 3000-w. standby system, which will run the lights, freezer, deepwell water pump, sump pump and one or two average air conditioners. The cost is under \$550.

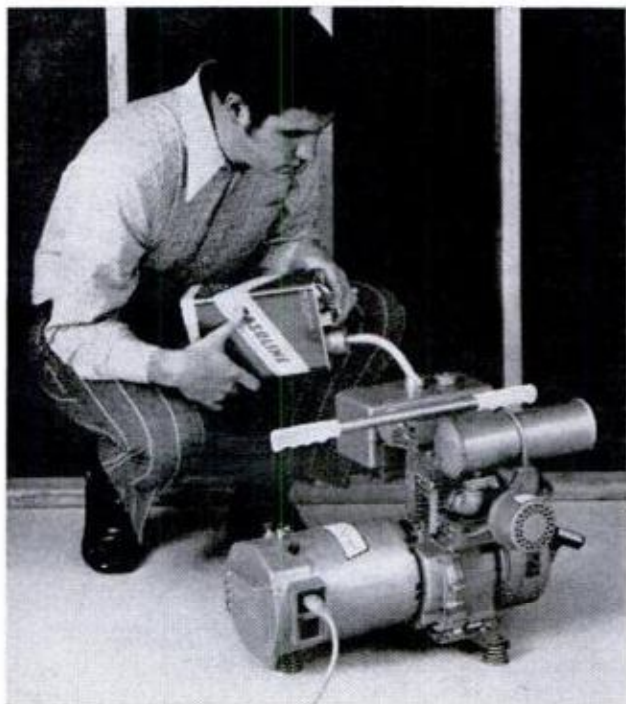
Both of these generators are powered

by gasoline, liquid petroleum or natural gas. Says Paul A. Berberet, who is in charge of buying and product development of portable electric power for Sears, Roebuck and Co. "You should never buy a unit that is too small; power-up properly, since the cost factor is generally a small consideration. And, don't buy standby equipment with the thought of putting the electric utilities out of business. The power they (the utilities) generate is cheaper in the long haul."

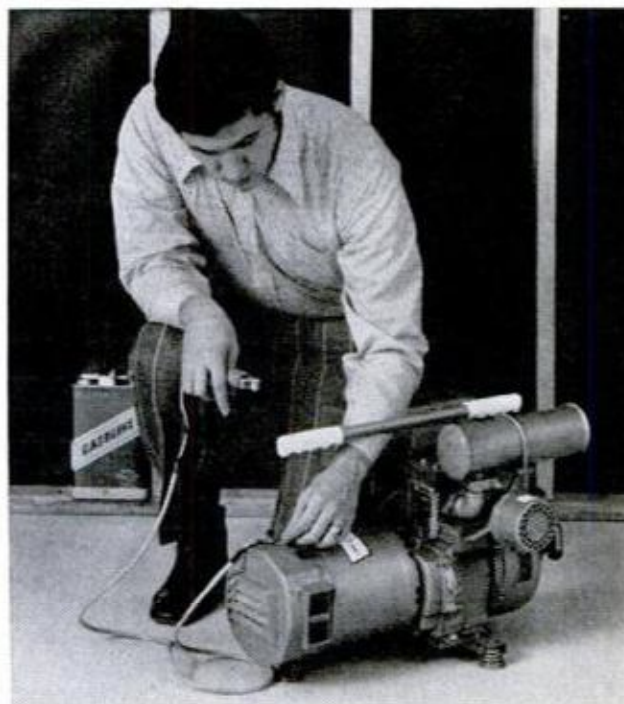
In short, you're buying power insurance. So first you have to determine the type of unit you need and the total wattage you want.

● *Continuous-duty power plants* are designed for daily service with engines that run at 1800 to 2400 rpm. They turn a 3600-rpm alternator. The slower engine speed means that the engine will last about three times longer than other emergency units with "direct" drive. The continuous duty unit is ideal for anyone who needs a prime source of power.

● *Intermittent-use power units* are for partial or full loads of power for interrupted periods of time. Besides their use in the home, some plants are adequate for campers, and sportsmen and the like. Their wattage capacity ranges from 1100 to 5000 and they have features such as oversized mufflers to cut noise, constant voltage regulation, built-in overload pro-



ANY STANDBY GENERATOR should be maintained and at-the-ready for use during peak power periods
DECEMBER 1971



BATTERY CHARGING ATTACHMENT is available for most generators. Pictured is Sears 2000-w. model.

tection and extra motor-starting power.

A *transfer switch* is a *must* when you own generating equipment. With it you transfer high-line power to alternator power during a power failure. It prevents alternator power from escaping back *into the utility* line and raising some poor workman's hair who thinks the line is dead. It costs about \$50.

To determine how much wattage you need, *decide on what you want to keep running when the power goes off*. This may include your entire household—or just a few appliances and the lights.

Drawing from this equipment, list the starting watts for all automatic appliances, such as the refrigerator and freezer. Then list the starting watts for all manually-started appliances you want kept in operation until the utility power is restored. Now list the operating watts of all lights

(printed on the light bulbs), heating devices such as your toaster, and all small appliances with universal motors. Figure the total wattage of this equipment and add some extra wattage for appliances you might add at a later date.

If, during your listing task, you find that some appliances are rated in amperes instead of watts, just multiply the amps. and volts to determine the wattage. For example, a toaster may be labeled at 110 volts and 10.5 amps. Thus, $10.5 \times 110 = 1155$ watts.

The experts believe you can expect power shortages for the next 5 to 10 years, until the utilities can build more generating equipment. Until that time, it makes good sense to have emergency standby power available to meet a problem bound to occur. Such power problems may exist well beyond the next decade. ★★★

Discarded auto tires make perfect concrete forms

When planning the construction of a home I am building in my spare time, I was figuring a low-cost way to make 27 pads (footings) for post-and-beam construction. Since material used for the forms would be lost, I came up with this idea—approved by the local building inspector. I obtained 27 old tires from the

local tire dealer—who was glad to see them go. Then, using a sabre saw, I cut out the bead and side wall from one side of each tire. This side became the form bottom. Tires were placed over footing holes and filled with concrete to provide bearing surface for the posts.

—Arnold R. Castor, Milwaukie, Ore.

NEXT MONTH IN SHOP AND CRAFTS

YOU CAN CREATE A BUILT-IN "LEARNING CENTER." With some careful planning you can have handsome in-the-wall storage and a multimedia study center. Our version gives you a choice of building the unit with or without doors to hide what's behind. Photos galore and complete building plans make this article must reading for all homeowners.

BRIGHT IDEAS FOR DARK BASEMENTS. Yes, you can simply frame and panel a basement to convert it into a usable family room. But, by using a little imagination, you can turn that extra room into an integral part of your home. To spur your creative thinking, we've assembled bold, colorful ideas from three different homes.

ROLL OUT THE BARREL WHEN THE GANG'S ALL THERE. It's a rugged, masculine-looking bar that stores glassware and bar accessories. Designed and built in *PM's* workshop, the bar is actually constructed from an authentic, aged whiskey barrel. Pick up the January *PM* and learn how you can duplicate this original piece of furniture for den or office.

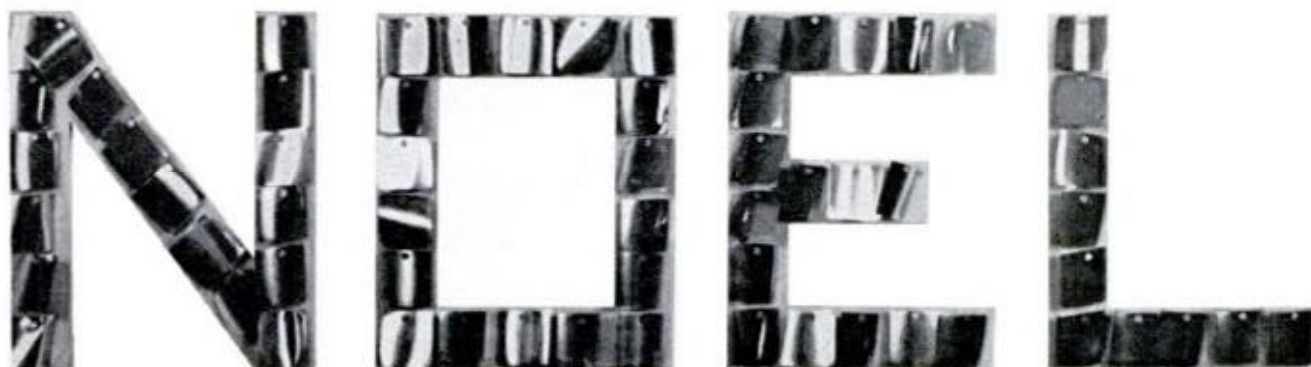
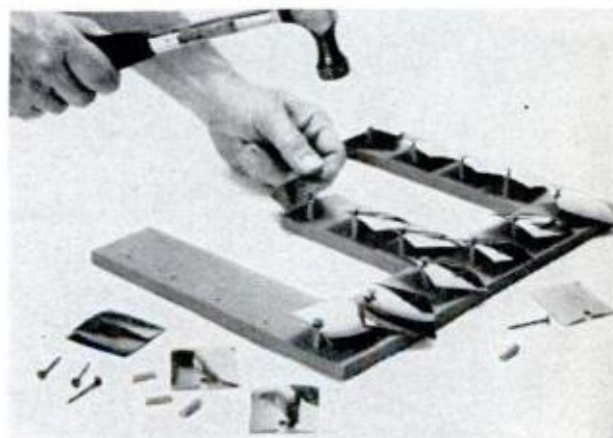
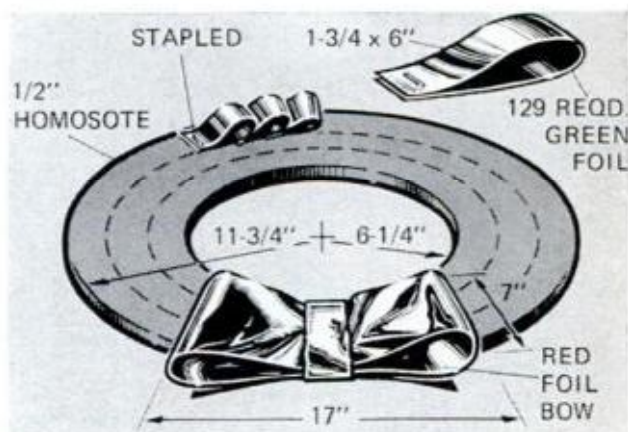
CRAFTSMAN'S SHOP THAT LETS YOU WORK LIKE A PRO. It's the third offering in *PM's* great shops series, and it belongs to reader Mel Crosby of Cape Cod, Mass. Using ideas saved from years of experience—plus a few that he borrowed from the first two shops we presented—Crosby laid out and built a shop that has all the equipment plus a workbench similar to those found in professional cabinet-making shops. In the January issue of *PM* you'll learn how Workshop Editor Harry Wicks reacted when he visited it recently. ★★★

Outdoor decorations from mirror plastic

IF YOU WANT to make outdoor Christmas decorations that really sparkle, use Reflex-A-Flex. Highly reflective when spotlighted, this colorful, mirrorlike plastic appears to contain a myriad of tiny flashing lights when it flutters in a breeze. That's the case when it's used to decorate letters of a Christmas greeting. Below, 14-in. block letters are cut from composition board, painted to match the plastic and covered with 2-in. plastic squares loosely attached to the face with plasterboard nails. Each square has a $\frac{1}{8}$ -in. hole punched at the top so it will dangle loosely on the nail. A $\frac{3}{4}$ -in. section of soda straw slipped over the nail acts as a spacer to hold the plastic away from the face of the letter.

The reflective plastic also makes a handsome door wreath. A ring is cut from composition board, then loops of green plastic are stapled to the board in three concentric rows, starting at the bottom and working up each way until the loops meet at the top. A large red bow of plastic completes it.

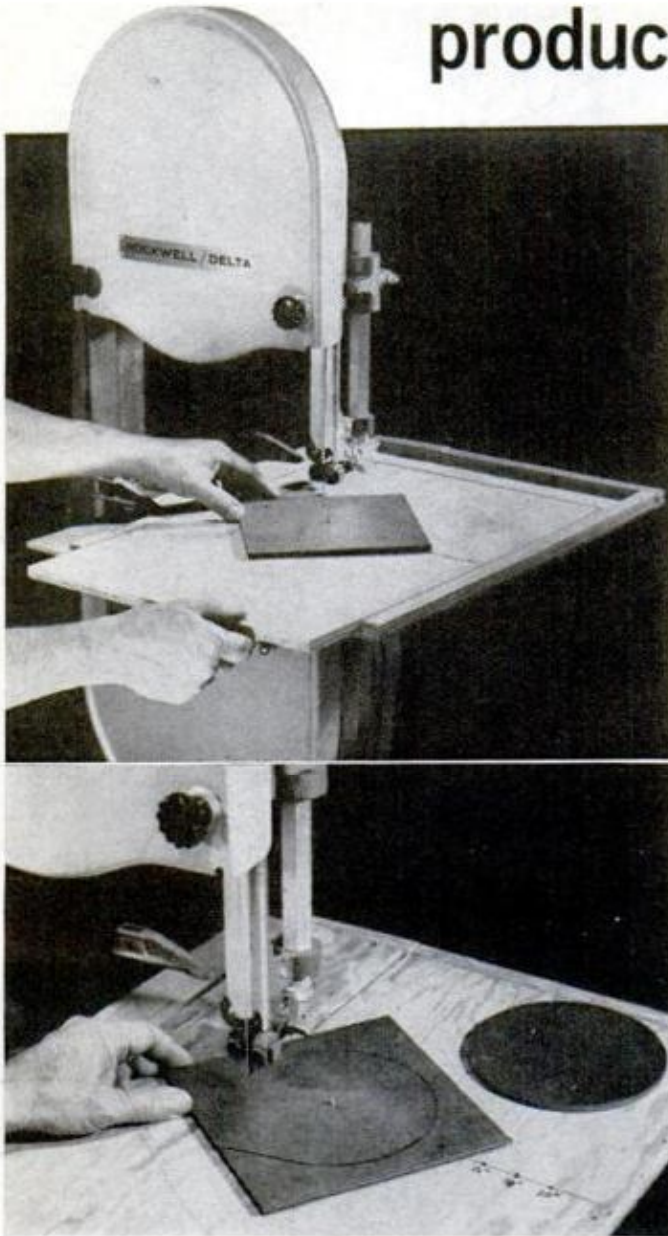
Reflex-A-Flex comes in gold, green, red, blue and silver and in 576-sq.-in. sheets. If you can't find it, you can order it from Provost Displays, Inc., 618 West 28th St., New York, N.Y. 10001, for \$3.50 per sheet postpaid. ★★★



Clamp-on bandsaw jig

WORKSHOP PROJECT

produces perfect circles



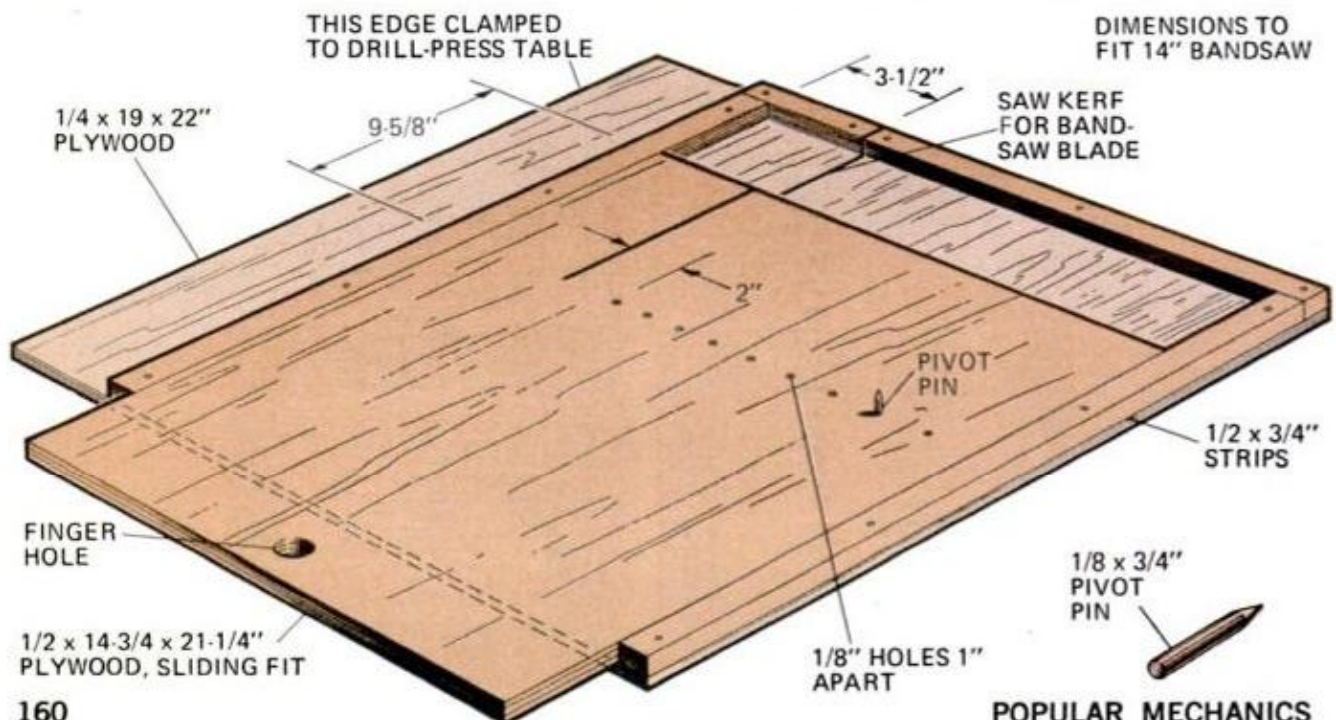
WHETHER you may cut an occasional disc or a thousand, here's a homemade workshop accessory you'll want to have hanging close by your bandsaw. Attached to the table with two C-clamps, the jig will let you cut perfect circles from 4 to 20 in. in diameter in seconds.

Here's how it works: The blank workpiece is first drilled in the center to fit over a $\frac{1}{8}$ -in. adjustable pivot pin in the sliding work surface. Then, with saw running, the blank is fed into the blade by sliding the work surface forward as far as it will go. Now just rotate the work. You can't miss; the pivot pin guides the blank as you turn it.

While the jig is dimensioned to fit a 14-in. machine, it can be made to suit a smaller bandsaw if you narrow the clamping edge and change the location of the blade kerf.

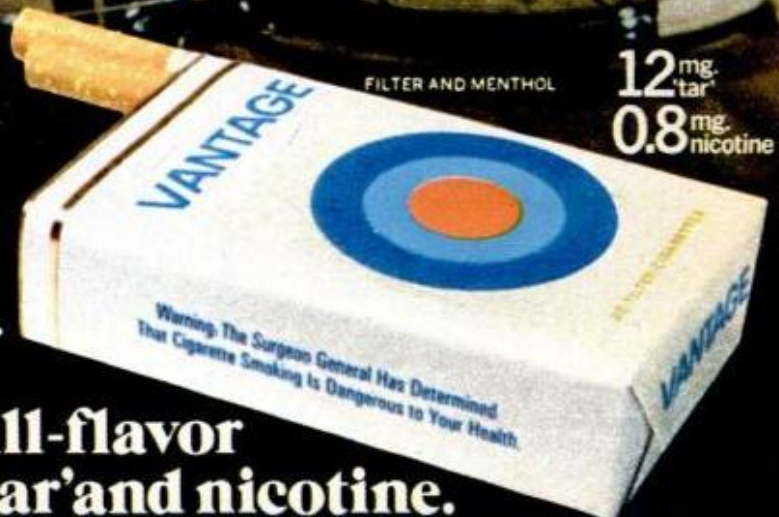
Where it is desirable not to have a hole completely through the disc, you can drill the hole part way from the underside and use a shorter pivot pin. Notice that the blade kerf must cross-align exactly with the pivot-pin holes. —George Gaston, Bloomington, Ind.

WITH BLANK IMPALED ON PIN, you advance it into blade by sliding jig table forward (top, left). Then you simply rotate blank around pivot pin



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Little-known 'tools' you'll want to add to your toolbox

**Check off those you'd like and leave the book open.
If you're lucky 'Mrs. Claus' will spot what you want**

By **HARRY WICKS**, Workshop Editor

Photos by **Robert D. Borst**

IT'S SIMPLE ENOUGH to lay down a couple of rules of thumb for defining a good tool:

- First, it should be extremely functional—thus, used frequently.
- Second, it should be of quality construction to provide years (or a lifetime) of service.

By following these guidelines, instead of an on-the-spot impulse to buy, the wise shopper can rest assured he will get the most value for his hard-earned buck. I shop-tested all the products shown on these pages and each one fulfilled the two rules of thumb for quality as well as function.



POWER TOOLS can be used anywhere if you install Tool Power permanently on any late-model car, truck or tractor. Complete with instructions and a five-year guarantee for \$25 postpaid. Glen-Bel Enterprises, Dept. PM, Route 5, Crossville, Tenn. 38555

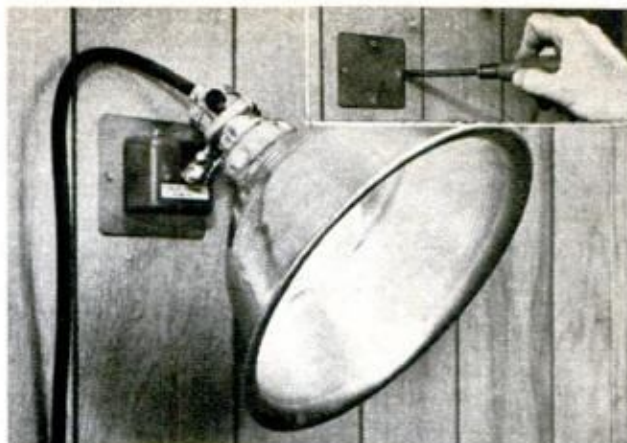


BRANDED TOOLS are sure to be returned by borrowers and an Etch-O-Matic can permanently etch your tools .002 in. deep in 30 seconds. Claimed to be as safe as an electric shaver, it's \$24.95. Provost Displays, Inc., 618 West 28th St., New York, N.Y. 10001

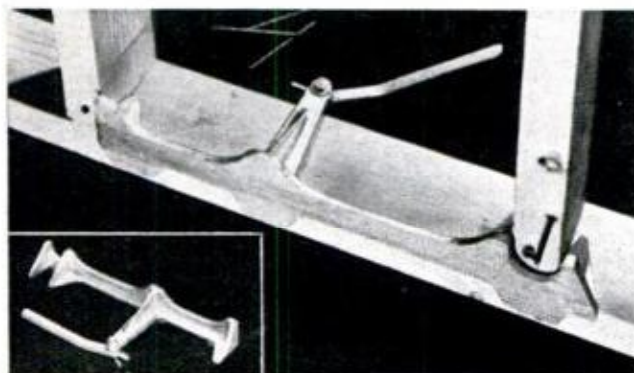
POPULAR MECHANICS



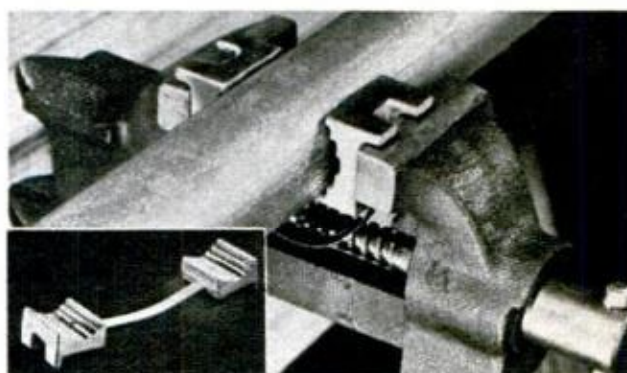
SAW WASHERS called Dial-A-Dado by maker, Arco Tools, Inc., 421 West 203rd St., New York, N.Y. 10034, can be used on any bench or radial saw with $\frac{1}{2}$ or $\frac{3}{8}$ -in. arbor. With set No. 25 you can dial cuts of 40 different widths in graduations of $\frac{1}{64}$ in. With washers and instructions, \$4.50 postpaid



LET THERE BE LIGHT where you want it. Magic-Lite features a heavy-duty, Alnico-V permanent-magnet base that holds light in any position on any ferrous surface on a wall or bench. Priced at \$9.66 with extra keeper plates (inset) at 10 cents each. Modelers Pride, 16721 Stahelin Rd., Detroit, Mich. 48219



POSITION STUDS FASTER with a Stud Spacer that eliminates measuring. Simply secure first vertical, lock spacer, insert next 2x4 and nail in place; then move spacer, repeat for next stud. \$10.25. Die Mesh Corp., Dept. PM, 12 First St., Pelham, N.Y. 10803

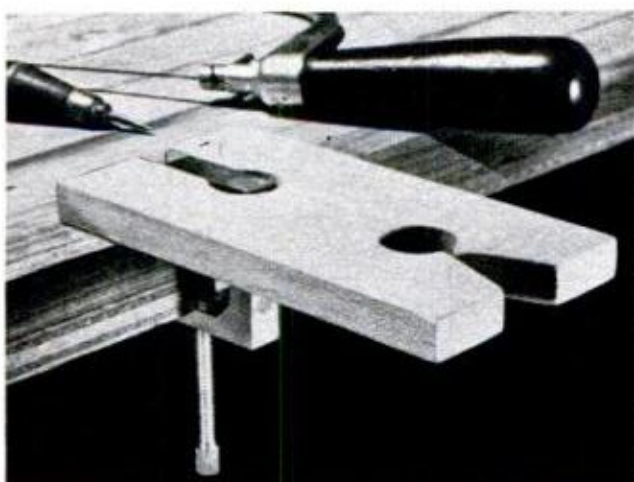


PIPE GRIPPER converts any ordinary vise to a pipe vise instantly. The tool features a pair of cast-steel, serrated jaws which align automatically with a tough spring. Handles $\frac{1}{8}$ to 2-in.-dia. pipe, \$1. Wickliffe Industries, Inc., Box 286, Wickliffe, Ohio

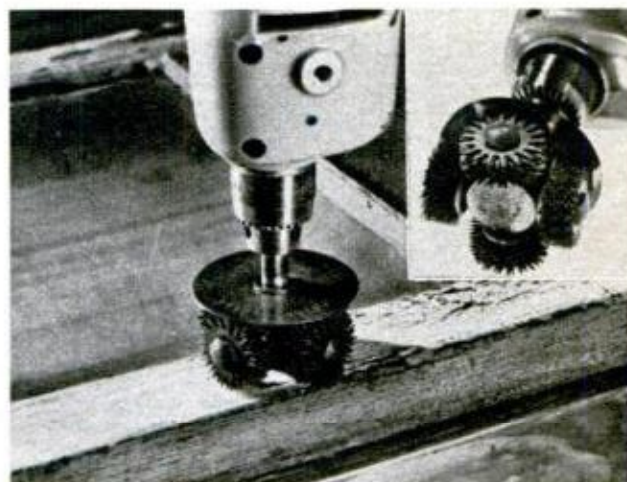
The final question that I asked myself was, "Does this tool merit a permanent spot in my tool collection?" The baker's dozen offered here most certainly do.

And, if you spot one that you'd like to

add to your shop, why not leave the magazine opened to these pages with the tool you want circled. Perhaps you'll find it when you look into your stocking come Christmas morning. ★★★



JIG-WORKING PLATFORM combination labeled Jig-form is designed to facilitate handling and sawing of small, delicate pieces. Priced at \$2, not including an X-Acto clamp which is sold at hobby stores. Broz Engineering Co., Box 207, Scranton, Pa. 18501



PAINT AND GRIME REMOVER can be chucked in a $\frac{1}{4}$ or $\frac{3}{8}$ -in. drill. Model 2-S Roto-Clean Tool is \$8.95; 72-piece replacement cutter set, \$2.95. Kut-Rite Manufacturing Co., Box 521, Royal Oak, Mich. 48073
(More tools on following page)



DOUBLE BUBBLE helps the user to determine plumb and level with simultaneous four-directional reading (inset) from one position. The Multi-Vue level comes in 18, 24, 28 and 48-in. lengths (24-incher sells for \$15.65). Write to the Miracle Instrument Co., Dept. PM, 1569 Third Ave., New York, N.Y. 10028



NEW "PLUMBER'S FRIEND" blasts clogged drains with jet of water instead of using suction. For sinks, tubs and auto gas lines, it comes with instructions for \$5.45 postpaid from Glen-Bel Enterprises, Dept. PM, Route 5, Crossville, Tenn. 38555

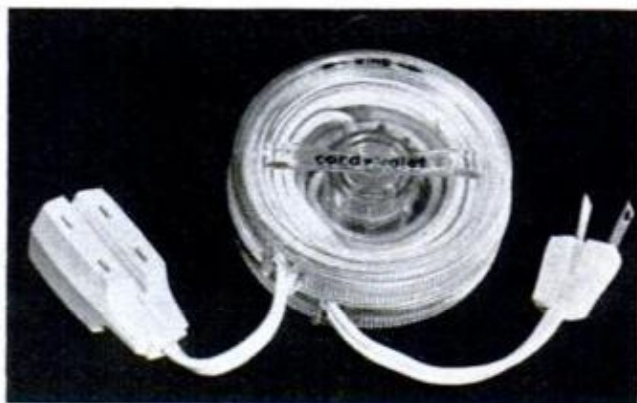
164



GROUND AND POLARITY TESTS of power outlets are quickly made with GM-20 Ground Monitor. Illuminated letters on case and scale on plug (not shown) help user check circuit. \$5.95. Tectronics Manufacturing, Dept. PM, 807 West Third St., Mishawaka, Ind. 46544



INTERCHANGEABLE TOOLS—nine in all—make this Compact Tool Holder a minitoolbox useful in home, car, shop or office. The nickel-plated blades simply twist into the nonbreakable handle: \$2.75 by mail from H. E. Blyer, 52 Clark St., Brooklyn, N.Y. 11201



ELECTRICAL CORD DISPENSER quickly extends 8-ft. cord to desired length; eliminates messy "rats' nests." Available for \$1 from Cord Valet, Dept. PM, 313 Fifth Ave., North Minneapolis, Minn. 55401

POPULAR MECHANICS

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

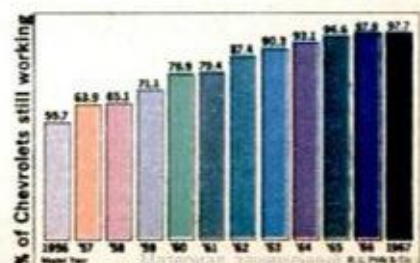


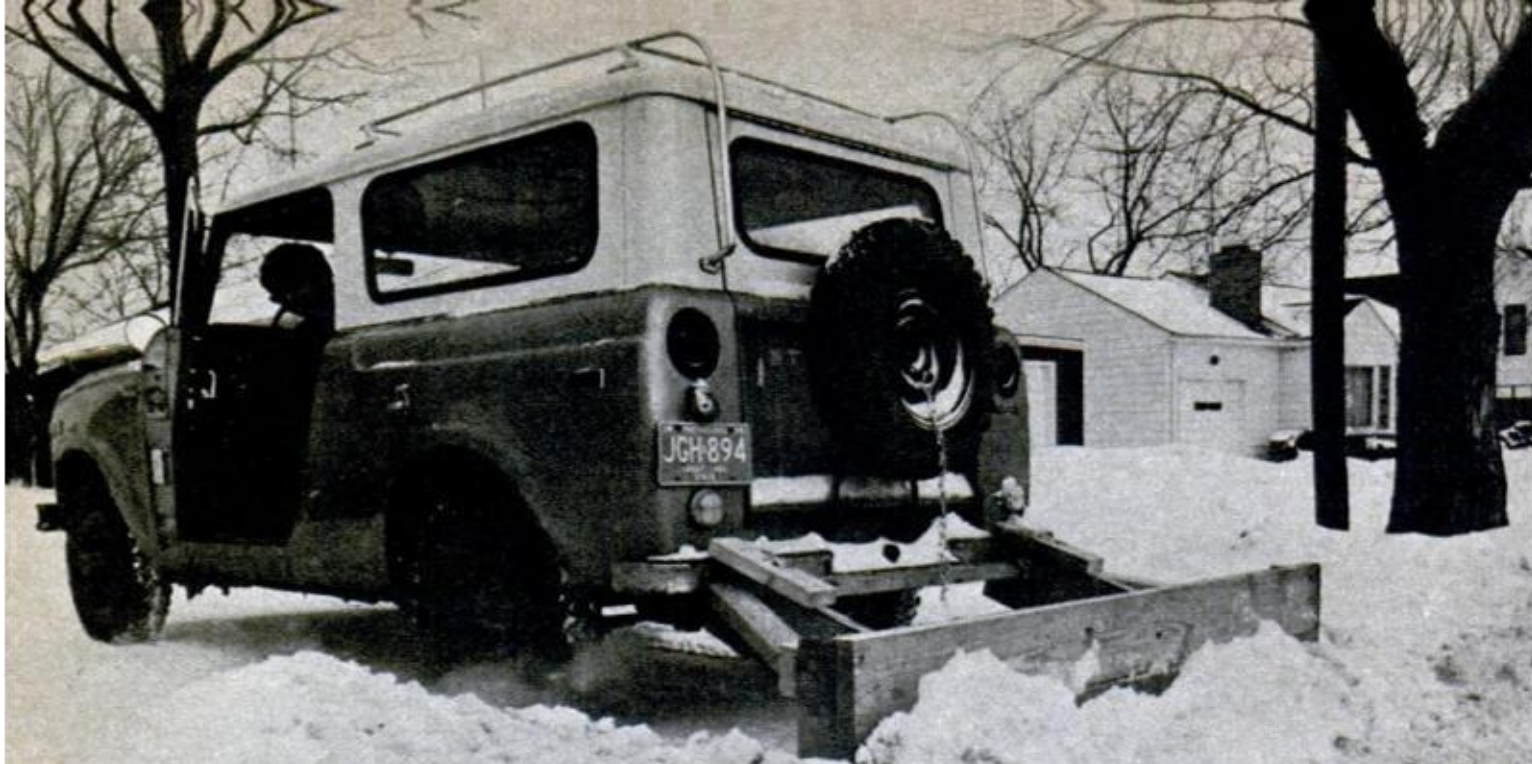
Chevy Fleetside in Zion National Park, Uta

Our Chevy pickup for 1972 might still be your Chevy pickup in 1988. It's that tough!

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service. So say the latest R. L. Polk figures. We make the 1972 pickup even tougher. Because we want it to outlast any truck you've ever owned.





Clear Your Drive the Easy Way

Attached to a car bumper, this homemade snowplow beats shoveling by hand, and it can be made for as little as \$12

By FRANK M. BUTRICK

WITH EACH PASSING YEAR I've noticed that the snow is getting heavier. So last winter, I did something about my long driveway—which seemed almost endless after a heavy snowfall.

I made a snowplow—at a cost of only \$11.93 and four hours' work with hand tools. Since it weighs only 90 lbs., I built it in my basement and then dragged it up the stairs. I don't claim it will do everything that a \$300 unit will—you have to get out to lift the blade after each run. And it will ride on top of hard ice or frozen snow, rather than scrape it. But that's small inconvenience for the \$288 price difference.

Design yours to suit your vehicle. The one shown fits the rear bumper of a Scout (or most any four-wheel-drive vehicle or light truck). Or the plow can be scaled down for use on a family car equipped with studded snow tires or chains.

A primary consideration is providing the means for attaching a chain (or mounting): a sturdy luggage rack, trunk opening, trunk handle, or—on the front end—a loop of heavy wire fastened to the radi-

ator support and arranged to project when the hood is closed. The suspended weight is only 65 lbs., so the selection is more convenience than engineering.

Make a full-sized sketch of the side of the plow, showing your bumper cross section the proper distance from the ground. Lay out the plow face and the angle of the frame and draw the bumper notch, remembering that the plow must have good bearing on your bumper when down, and must not bind when you lift it. Leave heavy stock below the bumper (which transmits part of the thrust to the bumper) and use a separate frame cap to support the raised bumper end of the frame.

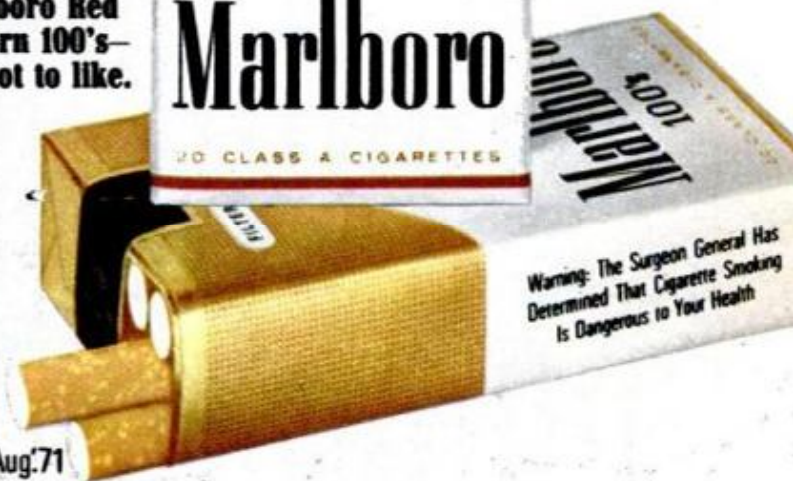
Lay out the frames and saw them. Space the frames to suit your bumper supports, trailer hitch, or any place that will take the thrust. Nail the vertical ribs to the 2x8s of the plow face, letting the ribs project $\frac{5}{8}$ in. below the lower 2x8 to back up the 1x4 shoe. Then nail the frames to the proper ribs, leaving enough space below the frames for the lower stiffener, which

(Please turn to page 190)

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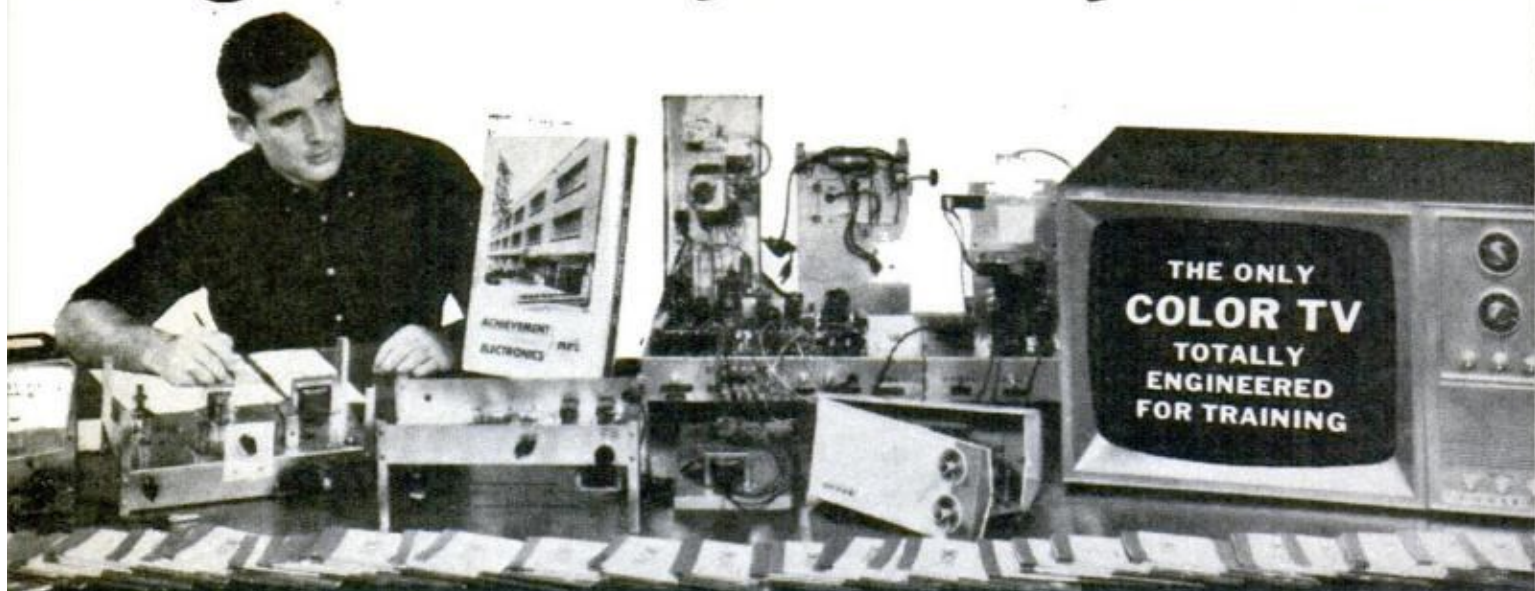


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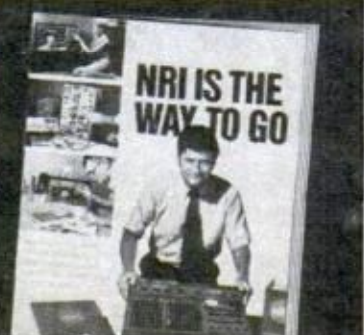
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NRI gives you a choice of a complete Master Automotive Technician course for the career-minded man, or a shorter Automotive Tune-Up and Electrical Systems training program for the home car-repair man.

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Salvaged motor makes a handy shop sander

By R. S. HEDIN

ONE OF THE handiest machines you can have in the shop is a disc sander. For quicker and easier edge finishing, corner rounding and general, small-part sanding, this type of sander can't be beat. The one shown is easy to make and can be finished in a weekend.

The motor can be rated at either $\frac{1}{3}$ or $\frac{1}{2}$ hp as long as it runs at 1725 rpm. It is wired with a single-pole wall switch in a

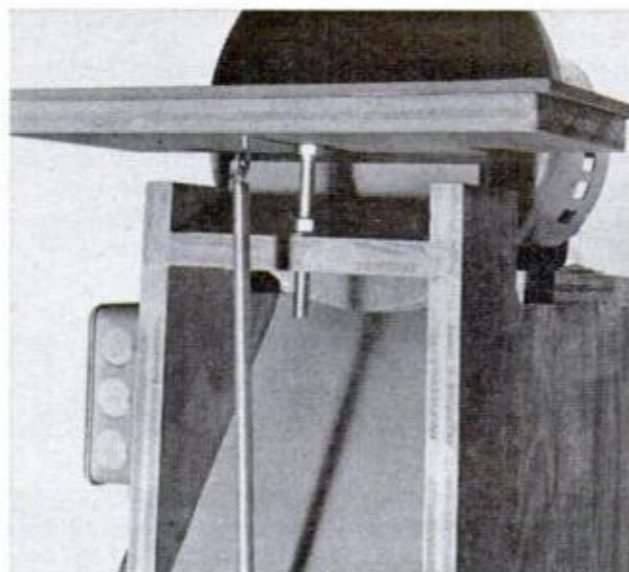
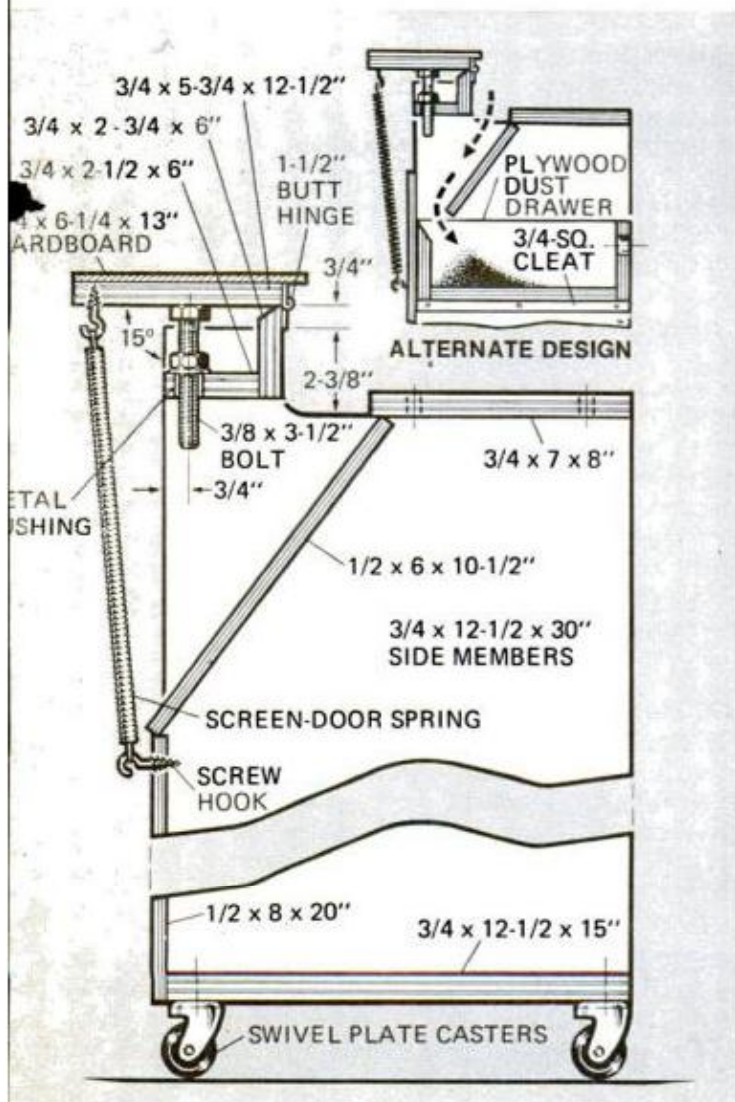


TABLE PIVOTS on hinges, and a screen-door spring holds table against bolt to maintain desired angle

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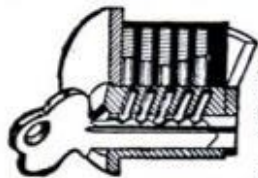
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What Do Many Doctors Use When They Suffer Pain Of Hemorrhoidal Tissues?

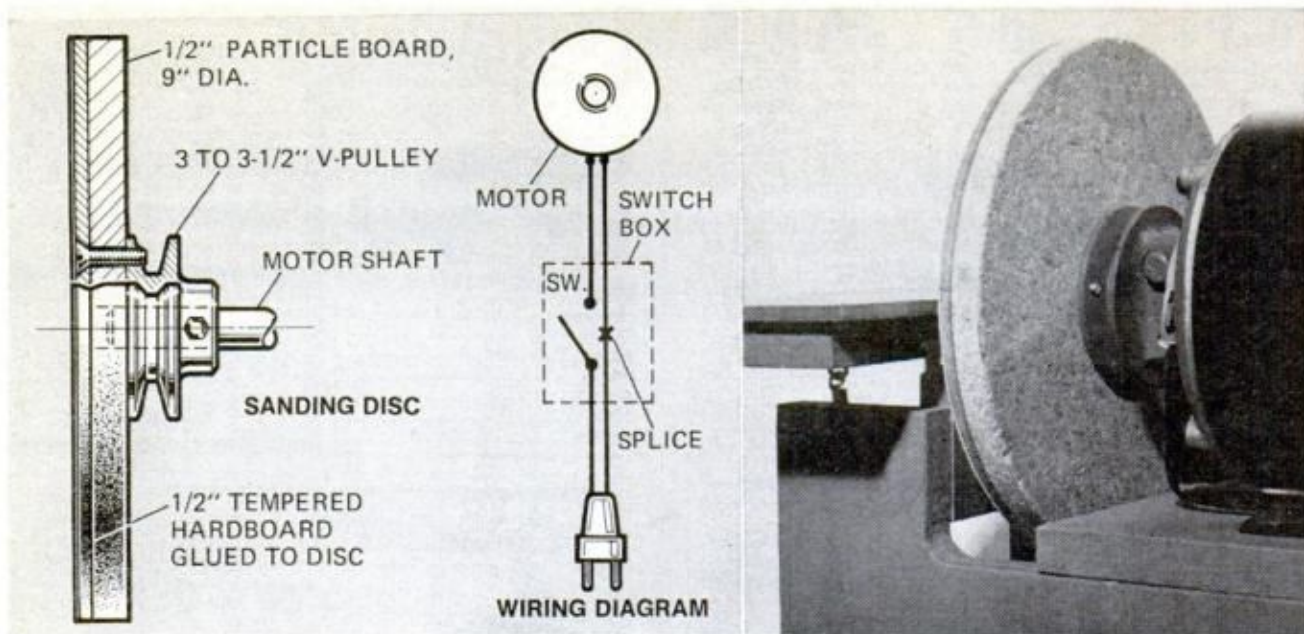
Exclusive Formula Gives Prompt, Temporary Relief In Many Cases from Such Pain. Also Helps Shrink Swelling of Such Tissues Due to Infection.

In a survey, doctors were asked what *they* use to relieve such painful symptoms. Many of the doctors reporting said that they either use Preparation H themselves or in their office practice.

Preparation H gives prompt, tem-

porary relief for hours in many cases from pain, itching in hemorrhoidal tissues. And it actually helps shrink painful swelling of such tissues when infected and inflamed. Just see if doctor-tested Preparation H® doesn't help *you*.

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SANDING DISC is made from hardboard, particleboard and pulley. Switch is simply spliced into line cord

box and motor rotation is counterclockwise facing the disc. The table pivots on hinges and its angle is adjusted using a bolt. The disc is roughed out about $\frac{1}{4}$ in. oversize and, after assembly, turned with a wood chisel to a 9-in. diameter. If the face of the disc wobbles or is not flat, it should also be turned and straightened.

Mount the motor so the disc face is about $\frac{3}{16}$ in. from the edge of the table when the table surface is square with the disc face.

Use 9-in. sanding discs applied with pressure-sensitive cement made for this purpose. The stand can be built with a dust-collecting drawer as shown in the alternate-design detail on page 172. ★★★

Portable table makes you a pro with a portable electric saw

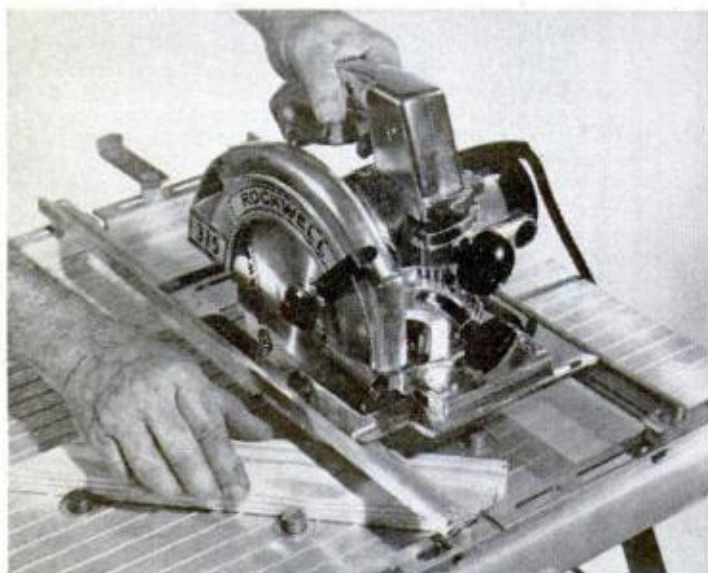


TABLE COMES COMPLETE with folding legs, but can be bought without them (for bench mounting) for \$62.95

Carpenters and do-it-yourselfers alike will find Multi-Mitre well worth its \$75 price tag. It's the handiest thing ever for the carpenter when a house is ready for the final trim, and it makes any amateur an expert when it comes to making 90 and 45° cuts with a portable saw. You just lay the work on the table and zip the full-shoe saw across the two guide rails. A

built-in, 24-in. steel tape speeds accurate measuring, and quarter-turn, pop-up guides permit hairline miters. The table accepts work up to 2 in. thick and 19 in. wide, weighs only 14 lbs. and fits the trunk of a car. The Porta-Table Corp., 1422 Old Deerfield Rd., Highland Park, Ill. 60035, is the maker.—Wayne C. Leckey, *Home and Shop Editor*

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Finally, an end to toilet-tank trickle



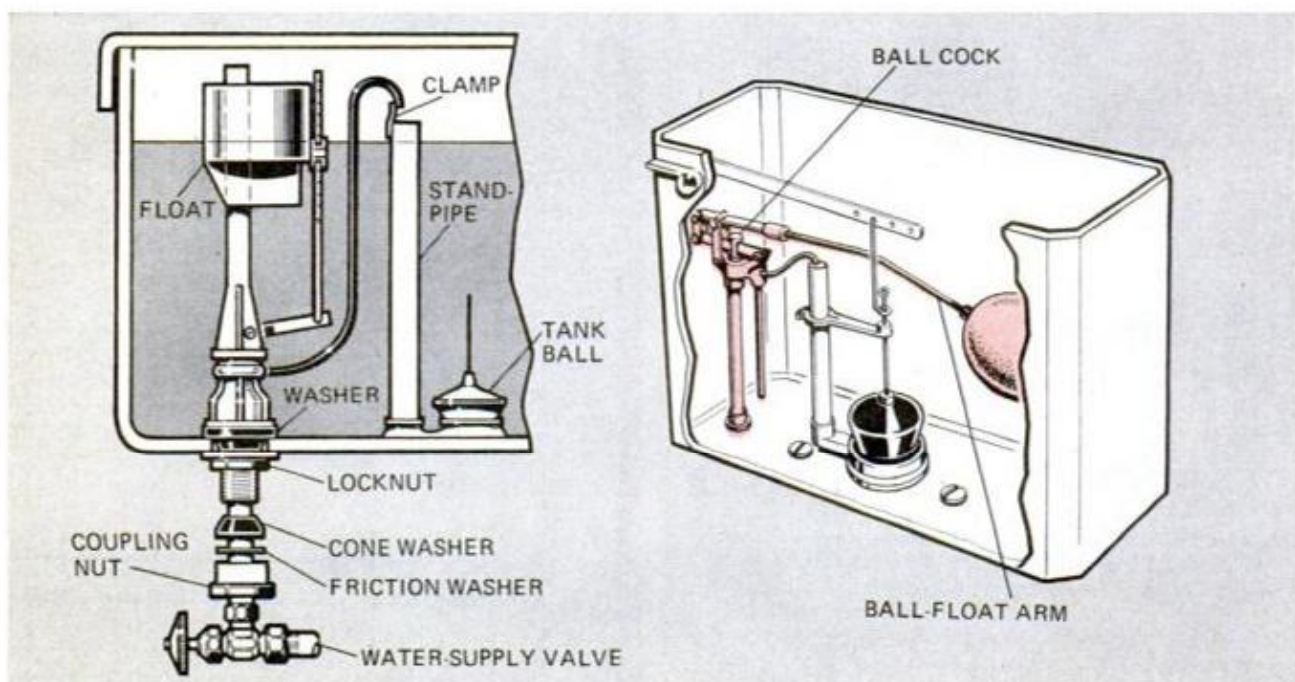
MODEL 200 sells for about \$4.25 at most hardware and plumbing-supply stores. It fits all tanks, comes with full instructions for installing. Made by Fluidmaster, Inc., 1800 Via Burton, Anaheim, Calif. 92806

When the conventional toilet-tank ballcock starts to go bad, you can have a water trickle in the bowl without really knowing it. Often you can't see it or hear it, resulting in the loss of thousands of gallons of water annually.

Usually toilet trickle is caused by a defective or worn-out tank ball, a worn piston seal, a dirty ball seat or a bent trip-lever arm. A new tank ball, a cleaned seat, a new seal and a straightened trip arm may stop the trickle—for a while.

However, there's a new and entirely different ballcock on the market that's designed to put an end to toilet trickle. Called Fluidmaster, it makes use of fluid energy (hydraulic) for shutoff, rather than the limited energy of flotation. Made of plastic and stainless steel, it's corrosion-resistant, it's quiet in action and it has a positive shutoff whether you have high or low water pressure. When the water shuts off, it's like turning off a faucet; water flow stops instantly. There is no gradual shutoff accompanied by irritating whistling and squealing noises as is the case with conventional ballcocks. This new ballcock also signals water waste. When it turns on by itself without the toilet being flushed, you know that water is leaking into the bowl through a leaky tank ball.

It is simple to install. You simply turn the water off at the valve under the tank and back off the coupling nut and locknut holding the old ballcock-and-float assembly (shown in color in the drawing below). The new ballcock takes its place. ★★★



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THE ICE RACERS

(Continued from page 79)

be ready when guard rails, ditches and rocks are buried under the first big snow.

Driving into a snowbank, unless it barely conceals an absolutely immovable object, is a far better gamble than hitting another car. But driving into a snowbank isn't as easy as it sounds. To get there you must have some control of your car. Most drivers, faced with an impending crash, go for the brake pedal, even on glare ice. That inbred reaction instantly converts your car into a guided missile, guided straight ahead into the very object you desperately want to avoid.

Beginning ice racers learn this lesson fast, often the hard way. But experienced drivers, spotting a tangle of race cars ahead, usually avoid their brakes like the plague. Instead, they use the short time they have left to change the direction of their cars with the steering wheel and sometimes even with the accelerator if they spot a patch of traction. They know it's safer to hit a snowbank fast than to hit other cars a few miles an hour slower.

Another tip about snowbanks. Hit them as squarely as possible. On the highway, the idea is to get your car buried into them, not to carom off them the way ice

racers do (unless you're sidling up to a frozen one and using it as a guard rail in an emergency).

Mentally preparing yourself to use snow banks to help you in emergencies is a giant step toward avoiding lethal results of the brain fade of other motorists.

There are some things in this world that you just can't learn from a book. Controlling a car on ice is one of them. Millions of words have been written about how to control a skidding car ("steer in the direction of the skid," and so on), but the fact remains that every day thousands of drivers skid out of control into barriers, rocks, trees and each other. The numbers skyrocket when the roads get slippery.

No one expects a man to slalom down an expert trail the first time he gets on skis. No one expects a man to clear the table the first time he picks up a pool cue. Yet how much training, much less practice, have you had controlling your car in emergency situations? When was the last time you tried a panic stop in the snow from 40 mph? When was the last time you tried recovering from a real skid at even 20 mph?

Learning how your car reacts and *(Please turn to page 179)*

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THE ICE RACERS

(Continued from page 178)

learning how to react yourself will do much more to save your bones or your life than all the safety equipment the auto manufacturers can cram into your car.

Invest a few minutes of your time when the first snow falls. Find a deserted parking lot and practice. Take this article with you. If anyone challenges you, show it to him!

Warm up with a few attempts at maximum acceleration and braking to get the feel of how your car is handling. Then start by driving around in a circle faster and faster until the car spins. Do the same thing again. Just when the car starts to spin, slam on the brakes.

The next time, just as the car starts to spin, declutch or, with an automatic transmission, take your foot off the accelerator. The fourth time, and from then on, start using the steering wheel to help you control the skids.

Before you get dizzy going around in circles, change to driving around an imaginary block. Use the streets to gain stability and speed. Use the 90° corners to continue practicing controlled skids. When the car starts to work for you, go around your imaginary block the other way.

Finally, if there is room, practice skidding through an imaginary slalom course until you get the knack of preventing fishtailing.

A half hour of concentrated practice like this will be worth more to you (and your insurance company) than a whole library full of winter-driving manuals. What you'll get is the *feel* of how soon and how far to turn your wheels in the direction of a skid. You'll learn that declutching, or at least getting off the accelerator, is the best way to restore traction. You'll learn how useless brakes are during a skid.

You'll learn how to control your car better by anticipating its next move with the steering wheel. Best of all, you'll gain confidence in your ability to handle those winter driving emergencies. ★★★

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RACE DRIVER—AT ANY AGE

(Continued from page 71)

possible to run on as much as 50 percent nitro.

In addition to these basic ingredients, many drivers add their own "secret" superfuel components such as exotic oils and detergents. These lubricants can play a key role when you consider the tiny engines are turning over at between 12,000 and 15,000 rpm, with a really "souped up" model able to hit 20,000 rpm.

Two basic types of R/C cars are being run today—those with "in-line" engines, and the "sidewinder" with the motor mounted crossways. Both average 20 inches long with a 12-inch wheelbase. If the track is 60 percent or more "full-bore," like an oval race, sidewinders predominate. For a tight course, in-line models are more popular because they have more sophisticated suspensions and better handling capabilities.

Sidewinders use a formed aluminum chassis. Power is transmitted from the en-

. . . wheels are turning at a whopping 5500 rpm when the car is running full-bore . . .

gine through a gear directly to the right rear wheel. The left rear wheel is driven from the right wheel by the axle. A centrifugal clutch disengages the drive when engine revs fall below 3000 rpm.

R/C models mounted with in-line engines are much more complicated. Both rear wheels are driven wheels. A tiny torque converter gives an infinite selection of gear ratios as well as a neutral, regardless of how high a driver revs the engine. In effect, the in-lines have automatic transmission.

The in-line chassis is cast aluminum for rigidity and for dampening the resonant harmonics. Vibrations can be a major problem in the models just as they are in a full-sized race car by causing the car to "float," cutting steerability and rendering the suspension inefficient.

The suspension system on the in-lines made by Dynamic Models of North Hollywood, Calif., for example, is a complicated design which took a year to perfect. A full four-wheel independent suspension unit, the system is adjustable for any track, even includes radius rods for added stability. There are 20 individual parts in the radius-rod set-up alone, and the completed car has some 320 parts, excluding the radio-control components.

Racers have a choice of the two hand-held radio-control units—the "joystick" originally developed to fly airplane models and adapted for autos, or the new "trigger" system designed expressly for road racing. Both broadcast on a single frequency carrying several channels used to send command instructions to the model.

On the sidewinder, one channel controls the steering, another the accelerator and brake. Response is instantaneous, and steering and accelerating are positive.

Operation of the in-line racer requires one additional channel to control the torque converter.

Competition in R/C car racing is becoming so keen that the sport borders on being a science. No serious racer would compete without an aerodynamic wing or foil on his car to improve performance. It performs two functions: It puts a downward pressure on the rear wheels for better traction and it induces drag, which keeps the car running true on a straight-away.

Wheel balancing is another important consideration. Since the wheels are turning at a whopping 5500 rpm when the car is running full-bore, the rubber tires must be glued to the rims to keep them from expanding under centrifugal force and flying off. Balancing is usually done with a tiny static "bubble balancer," and weights can be glued or taped on, or small holes drilled in the rubber to bring the tires into perfect balance. Often a meticulous hobbyist will even drill a few holes in the engine flywheel to bring it into balance, too.

A variety of tires is usually kept on hand as one track will take one particular style of tire, but a different course will require another type for maximum performance. Wheels are removed as you would on a full-size race car. A stop-nut holds the wheel against the collar of a keyed spline. It takes about 15 seconds to change a tire during a race.

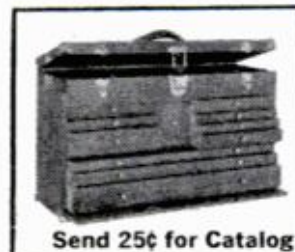
Dirt in any engine ruins performance, and R/C controlled cars are no exception. A tiny sponge air-filter accessory keeps foreign particles out of the delicate engines during a race. Because of tight tolerances, a particle as small as two microns can wipe out an engine, ruining weeks of polishing and modification. If this happens, a new cylinder and piston must be installed, and a driver must start his modifications from scratch.

Another useful accessory is a tiny aluminum heat sink cast in the form of an intake manifold. Since the engines were designed to be cooled by the blast from a model airplane propeller, the sink acts as

(Please turn to page 184)

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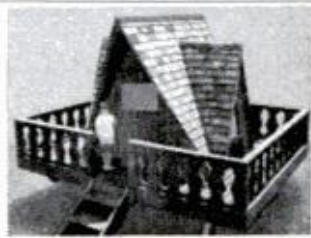
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RACE DRIVER—AT ANY AGE

(Continued from page 182)

a substitute, dissipating motor heat in the car so it won't burn out.

A 12-volt motor clipped to an automobile battery is used to start model car engines. The flywheel of the model is pushed against a rubber wheel on the 12-volt motor, and off she goes.

To be eligible for racing, a car must weigh at least five pounds, and carry a spare tire mounted either externally or internally. Some committees won't admit cars to a race without some sort of human figure in the driver's seat.

Once on the track, racers make a pit stop about every 15 minutes to gas up their four-ounce fuel tanks.

What does it cost to get into R/C car racing? It depends. If you're the type who likes to build from kits, you can get started for about \$200—\$54 for a car kit, \$100 for the radio and servo electronics, plus \$30 for an engine. An additional \$15 is usually spent for miscellaneous hardware.

If kits don't interest you, Dynamic Models, for one, has a ready-to-run car available for \$289.95 complete with radio. For many, however, that's just the beginning. Enthusiasts have been known to spend as much as \$350 to \$500 on their rolling stock in quest of parking-lot victories.

If that's too much for your pocketbook, the small Jerobee is available, but it is only 1/12th scale compared to the more popular 1/8th models.

And just as there are ruling organizations for full-scale racing, there is one for R/C cars—Radio Operated Auto Racing, a nationwide organization based at 3703 Dover St., Fort Wayne, Ind. 46805. A newspaper, *Miniature Auto Racing* (Pacific Publishing Group, Box 1821, Thousand Oaks, Calif. 91360) keeps R/C fans up-to-date. ★★★

3 DANCING LIGHT DISPLAYS

(Continued from page 123)

beyond the holes in the face. This not only provides a neat appearance, but also helps to dissipate heat. The bulbs have a diameter of 3 $\frac{5}{8}$ inches. For good ventilation, the holes should be at least 4 inches in diameter, preferably a bit larger.

One handy trick in making the holes is to use the plastic lid from a 4-inch-diameter coffee or peanut can as a template for drawing the circles. These lids have a clearly marked center point in the

plastic. All you have to do is mark the middle of each hole, lay the lid over it so the center point coincides with the mark, then trace around the edge with a pencil. The circles thus formed will come out a little over 4 inches in diameter—a perfect size for the mushroom bulbs.

In setting up the displays, the object is not to view the bulbs directly, but to arrange them so they shine against a background, such as a wall or ceiling. The three-bulb display and the larger nine-bulb trough are designed to sit on a shelf or table at a slight upward angle so they illuminate the wall behind them. The angled base pieces are identical for both units, providing an upward tilt of about 25°.

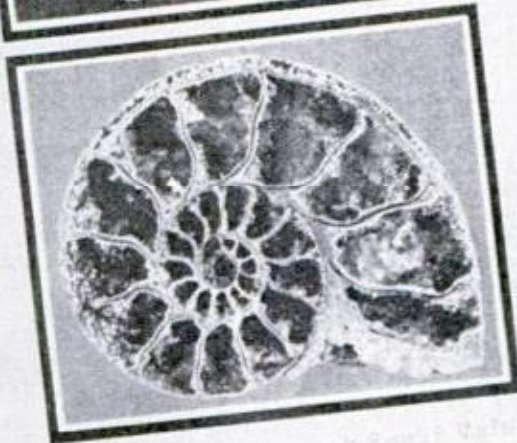
The trough design is unique in that bulbs are arranged alternately at right angles to each other. This way, one row bathes the wall in back, the other lights up the ceiling overhead. Ideally, the display should be slightly above eye level so you aren't looking down into the bulbs and also as a safety precaution to prevent accidental touching of the exposed sockets.

The bulbs are wired in three strings—one for each color—so you have three power cords coming from the display. These can be plugged into three flashers or into the three outlets on a three-channel electronic translator.

The 12-bulb strip display is intended to hang on a wall near the ceiling. It can be supported on shelf brackets of the type used in slotted tracks, or fastened directly to the wall with toggle bolts. Bulbs are arranged alternately so six shine upward against the ceiling, while the other six shine downward, illuminating the wall below. The upper and lower rows of bulbs are wired separately, providing six power cords. If you use flashers you'll thus need six, one for each string. This arrangement heightens the flashing action and also lets you turn on the upper or lower row independently of the other.

Sockets used in the displays are of porcelain or Bakelite. Ordinary lamp cord is adequate to wire them, but since their terminals are exposed, be very careful not to touch them once the connections have been made and power turned on. This is no hazard with the two enclosed displays, but could be a problem with the open-trough type. Thus, keep the displays out of the reach of youngsters and always disconnect them when not in use. Also staple the wiring down flat around the sockets so it can't touch the bulbs. Heat from the bulbs could possibly melt the insulation and cause a short. ★★★

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MEN AGAINST THE SEA

(Continued from page 97)

for awhile. The thing was to keep the ship's bilge pumps working until they could bring more portable pumps aboard from the *Chief*. It had become a grim battle to keep the freighter afloat.

That night the Coast Guard insisted for the first time that all hands leave the wreck.

On the morning of the sixth day, with Mick back in action, the salvage men were dismayed to find the main deck awash on the port side. Even worse, the engine room was flooded. Doggedly they set to work pumping out the engine room, using pumps in tandem. Their morale hit bottom when the water level dropped to expose a deep layer of sand covering the engine-room floor. Sand pumps were flown from the *Chief* and put to work.

With the storm still raging that night, all hands again left the wreck.

The seventh day was a replay of the sixth. Water and sand had to be pumped from the engine room. The wreck's piping was generally damaged or inaccessible, yet three of the four holds had to be pumped out if the cargo was to be saved. The answer for No. 1 hold was a suction fitting through its forward bulkhead, from the forepeak tank. No. 2 was tapped through the engine room's forward bulkhead, and they tapped into a usable line to No. 4.

The winds were moderating, but the groundswell continued heavy, cresting as high as 18 feet. The main engine was now loose and rocking on its bed; only the manifold piping kept it upright as the ship pitched.

While the salvage crew fought to keep the wreck from digging its grave in the sandy bottom, the *Chief* strained to pull her across the shoal. On the eighth day the salvage men could measure the progress toward deep water by watching the freighter's anchor chain. The tighter the chain got, the closer the freighter was to freedom.

The ninth day brought a higher tide and some gain in the battle to keep the wreck afloat. Finally, at 11:20 a.m., Tuesday, Oct. 31, 1967, the *Captayannis S.* floated free!

For the first time ever, Clatsop Spit had been cheated of a big prize.

There were no cheers, no one handing out medals for valor—just the feeling of satisfaction that comes with a job well done. For the first time in nine days, Mick Leitz, Ken Dye, and Capt. Mattila and his crew could look forward to an evening of rest.

★★★

HANDSOME BUFFET

(Continued from page 143)

the 3/4-in. edge with the 1-in. strips and tap them with a hammer and block of wood, then use your router and a laminate trimming bit to trim off the excess flush with the surface on each side. If you don't have a router, you can do the trimming with a flat mill file; the job will just take longer.

When all edges are banded, you now cover the face of the panels essentially the same way, again cutting the 1/16-in.-thick laminate 1/8-in. oversize all around and later trimming it flush. Here, if you use a file, hold it at a 15° angle.

Another trick when positioning the large sheet of laminate is to use two sheets of brown wrapping paper, one at each end of the laminate, to keep the cement-covered surfaces from touching. When you have the laminate just where you want it, pull out one paper and press the laminate down, then pull out the other and repeat.

Since the application of plastic laminate to the doors adds to their overall width, it's wise to double check the overall width of your basic cabinet and cut the plywood doors to suit. In addition to the allowance that must be made for the thickness of the laminate, additional allowance must be made to assure ample clearance for the doors to close when they are hinged. Their width (before laminating) must be determined from the cabinet.

Standard pivot-type hinges are used to hinge the doors, top and bottom, while common piano hinges are used to hinge the end gates. When fitting the pin hinges to the doors, notice that a section of the laminate is cut at an angle and pried off so that the hinge leaf sits flush. Piano hinges are also used to hinge the drop leaves to the cabinet's top. Here the hinges have to sit in 3/16-in.-deep surface rabbets which are cut along the meeting edges. This can be done with a router after the plywood is covered with laminate, or beforehand on your table saw. In either case, the edge banding hides the hinge and rabbets. A rubber tack hammered into the underside of the two drop leaves serves as a stop to limit the swing of the end gates. The latter swing out 60° to support the drop leaves.

The molded carved panels are cemented to the laminate with contact cement. Here a straightedge is used to space the panels evenly, and the cement is applied to the laminate so it's hidden by the panel. Use a small brush to apply a band of cement around the edge of the carving and to the laminate. Let stand for 10 minutes as before, then press in place. ★★★

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CASSETTE PLAYERS

(Continued from page 105)

and amplifier and process signals before and after recording to provide the Dolby effect. TEAC and Advent both offer inexpensive Dolby accessories for \$49.50 and \$125 respectively.

Meanwhile, other makers have developed noise-reduction systems of their own. Panasonic and Norelco both offer cassette recorders with hiss-killing circuitry that works in somewhat the same way as the Dolby method. In general, machines incorporating noise suppression also offer adjustable bias. The two combine to provide the ultimate in recording and playback quality. Other sophisticated features you'll find are twin VU meters for stereo recording, automatic shutoff at the end of the tape and professional-type slide controls that let you make precise settings more easily than turning knobs.

Such advanced machines may not, however, offer other conveniences like automatic reversing and stack loading. They tend to be single-play models, somewhat akin to high-quality single-play turntables. A few do provide automatic reversing, but on only one cassette at a time.

By contrast, automatic changers play a whole stack of cassettes one after the other, but tend to be playback-only models without recording circuitry. These provide hours of uninterrupted music and are designed for those who are more interested in listening convenience than in doing their own recording.

Early stack loaders played only one side of each cassette—you had to flip the stack over to play the other sides. The first changer to provide both stack loading and automatic reversing was pioneered by Craig and is a masterpiece of clever engineering. Priced at under \$200, it plays both sides of six cassettes without turning them over and can also be set to play only one side of each if you wish.

Following suit, other makers have come out with stack-loading changers that also incorporate automatic reversing. These are made by GE, Ampex, Panasonic and Benjamin. GE's and Benjamin's offer recording capability as well. Prices for such units range from about \$300 to \$450.

Most modern cassette players and recorders are "decks" designed for use with an existing hi-fi system. This saves money, avoids duplicating basic equipment and provides flexibility in combining various hi-fi components. Whatever type you pick, the home cassette player or recorder is destined to become one of the most versatile and exciting pieces of hi-fi equipment you can own. ★★ ★

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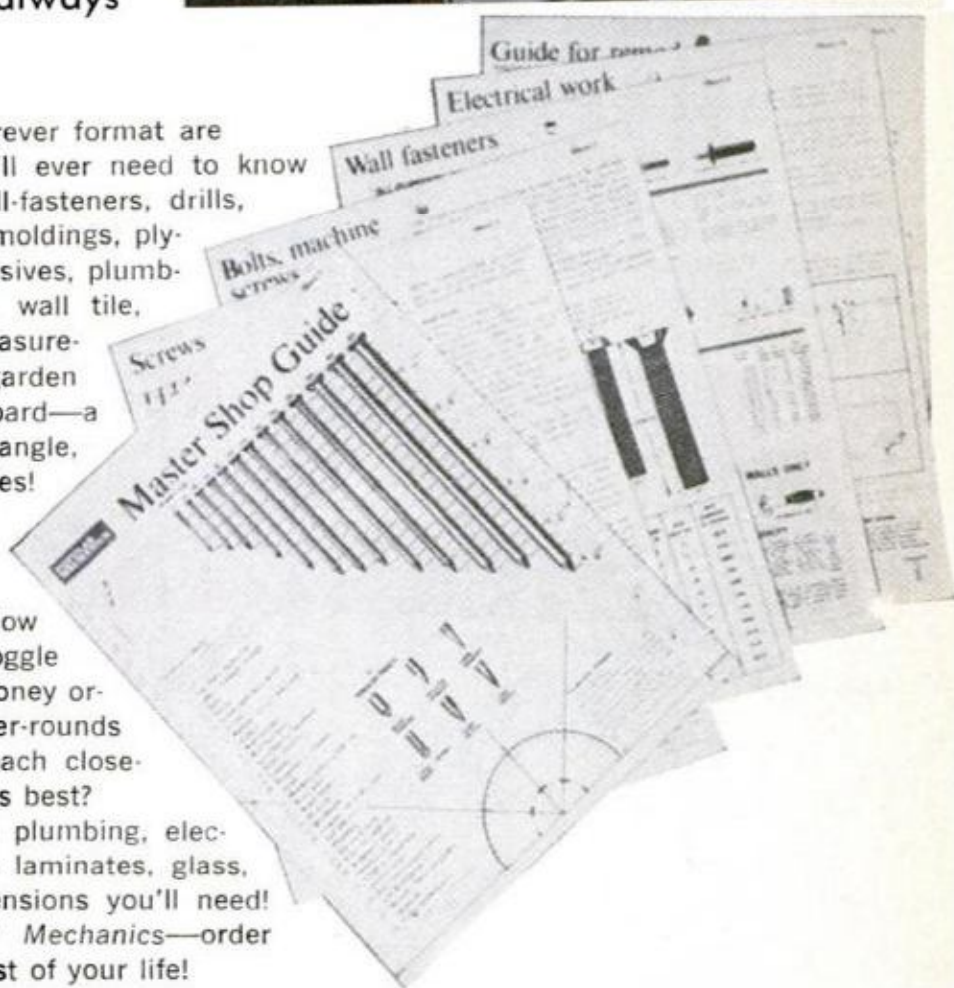
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PLOW is attached to the vehicle by chains wrapped around bumper, then hooked over projecting nailhead

CLEAR DRIVE THE EASY WAY

(Continued from page 166)

is notched to provide good bearing against the ribs to which they are nailed as well as to the frames. A 2x4 is cut to fit between the frames at their bumper end and

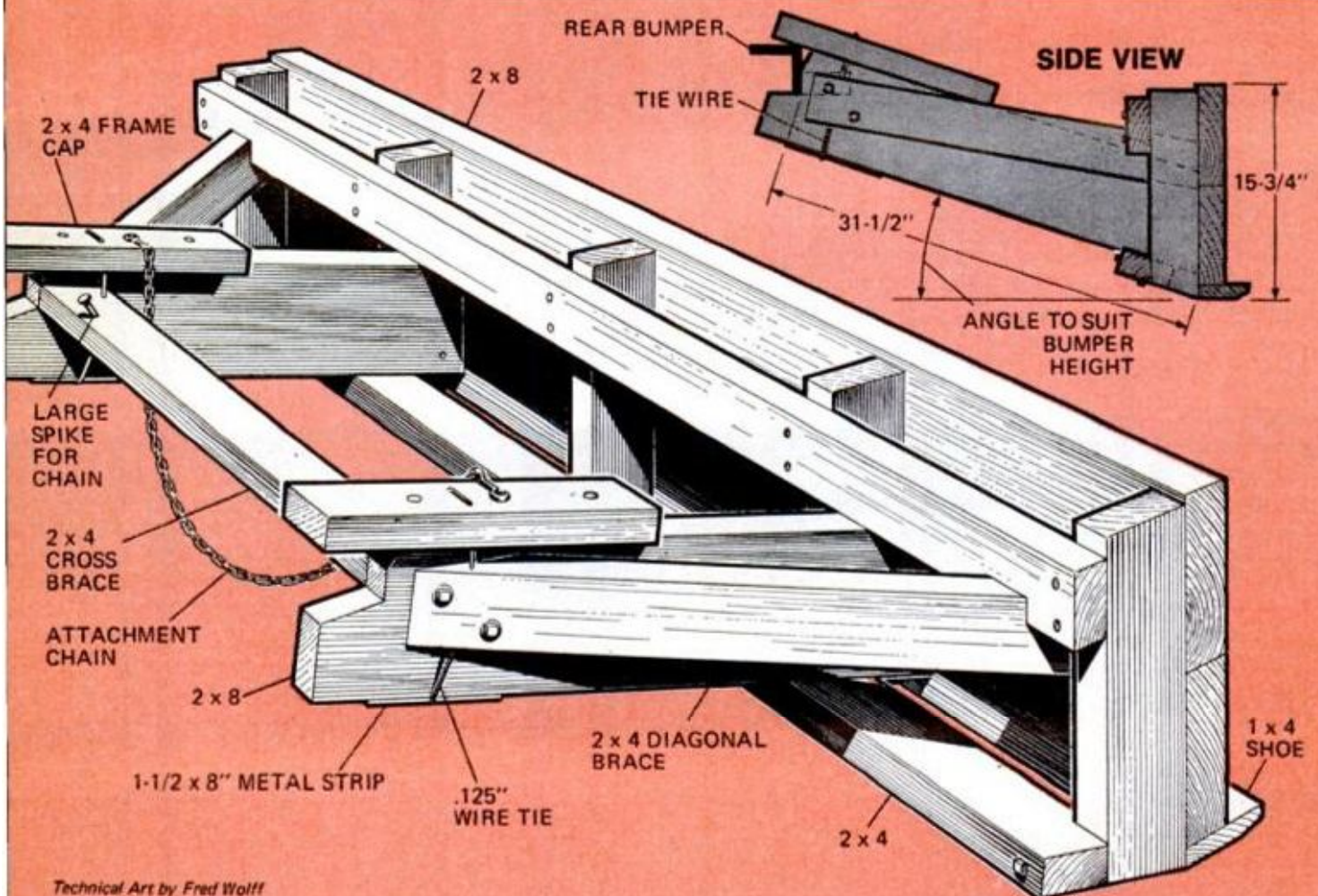
nailed in place, using two small nails to avoid splitting. Cut and fit the diagonal braces and nail them in place. The upper stiffener rests on the frames and is notched to fit the diagonals.

The joint where the frames, crosspiece, and diagonals meet is nailed sparingly (to prevent splitting the lumber). For reinforcing, force a heavy wire through drilled holes, wedge and twist it tight, and nail down the sharp ends.

Consider the shoe as expendable. In my rough driveway I expect it to last, at the most, one or two seasons. Thus, make it from any inexpensive wood. I used a length of 1x4 furring and beveled it to ride over broken concrete. If your drive has a smooth tie-in with the street, you can probably leave the edge square.

A heavy dog chain provides the attachment and lift chains. Decide where the attaching chain can pass around your bumper and provide some lateral control (my rig has about 3 in. of side play with both attaching chains reasonably snug). The lift chain is 3 ft. long and has a heavy ring at one end and a hook at the other.

Using my plow with the Scout, I have moved hundreds of pounds of loose, broken-up ice and plowed through two-ft.-high snowdrifts. ★★★



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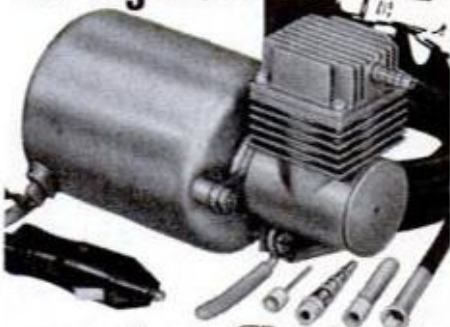
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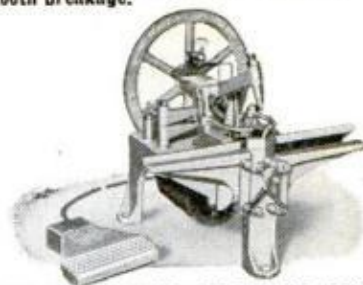
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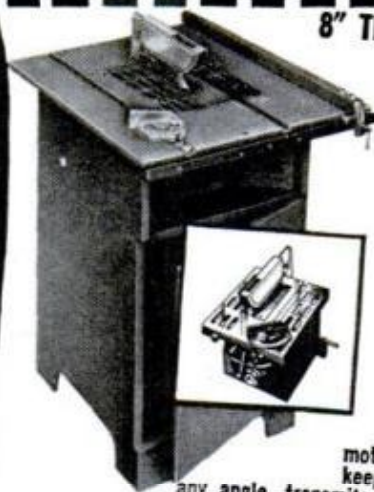
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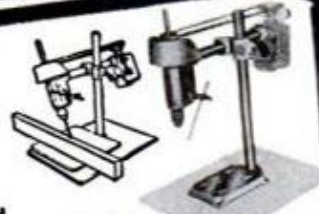
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