

PREVIEW: THE '64 CARS

# POPULAR MECHANICS

AUG. 1963  
35 CENTS

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EIGHT GAMES FOR BOATERS

DETECTING BOOTLEG  
H-BOMB TESTS



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SCOOT-CAR  
12 MPH on Two Wheels





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Champion Spark Plugs! Men who live power and  
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AUGUST 1963

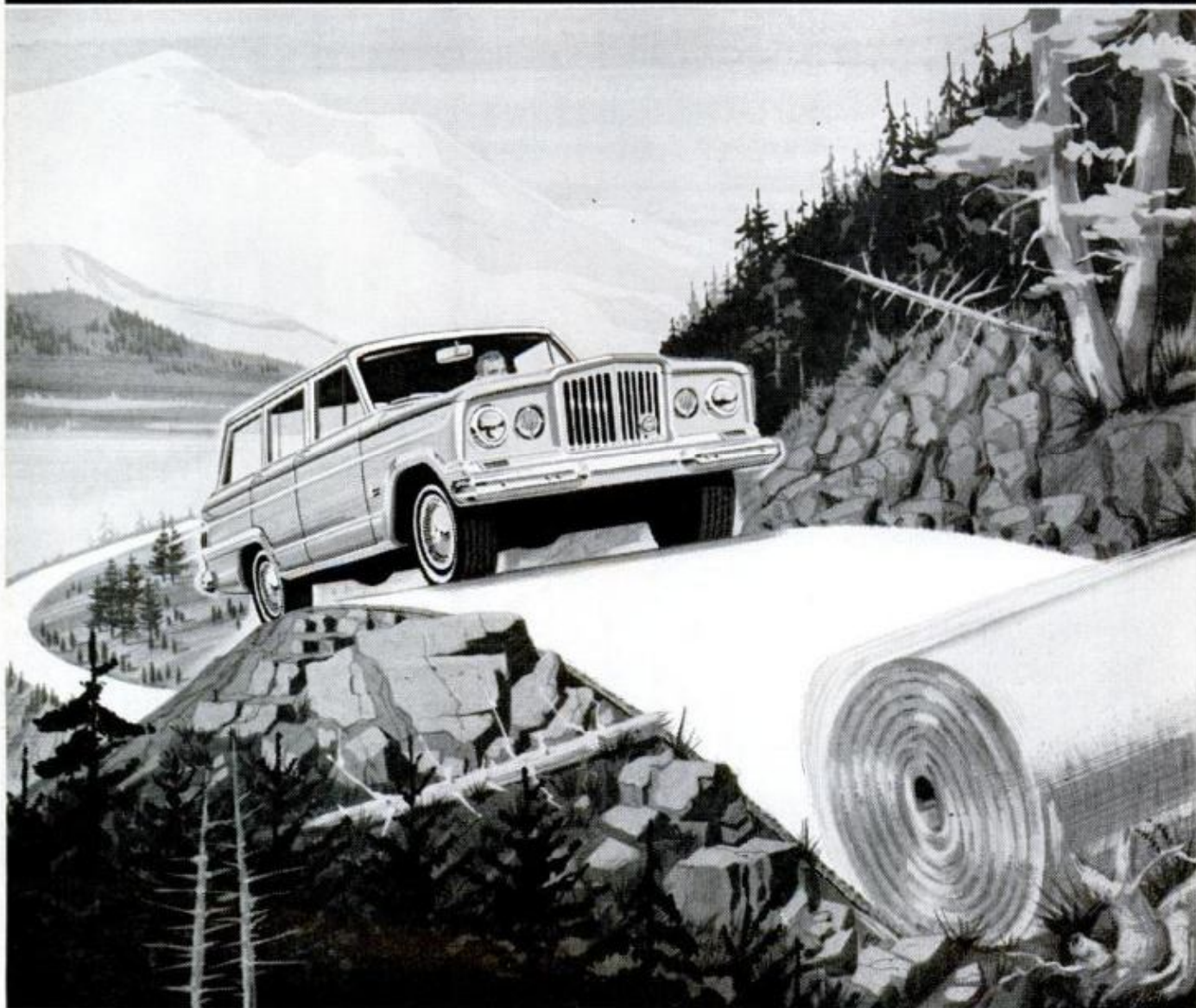


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power front and rear . . . 4-wheel  
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**KAISER Jeep CORPORATION** Toledo 1, Ohio

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AUGUST 1963



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# POPULAR MECHANICS®

AUGUST 1963  
VOL. 120 NO. 2

INTERNATIONAL EDITIONS • AUSTRALIAN • SPANISH • CARIBBEAN • FRENCH • DUTCH

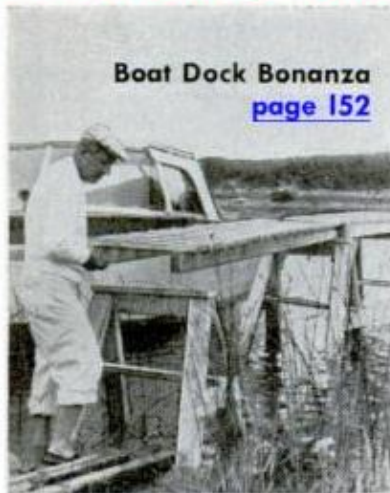
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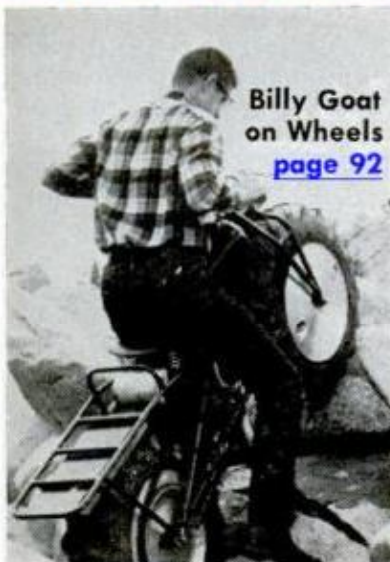
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# BACKSTAGE at PM . . .

We have yet to hear whether Midwestern cornfields have become one big concert hall as a result of our story in the May issue, *Growing Corn to Music*. (In the story, Midwest Editor Clifford Hicks told of George Smith's experiments in Normal, Ill. which indicated that corn yields can be increased as much as 17 percent when music is piped to the fields).

But from the South there comes a new—and quieter—way to make your corn behave differently.

It's with light. Red light, for instance, makes plants grow lean and tall, while blue light makes them grow squat. Violet light makes a plant bend, while yellow-orange spurs photosynthesis, seed germination and flowering.

Under a deep-red light, the corn plants virtually halt flowering and seed germination, while green light seems to have little effect at all on plant growth.

This new light on corn growing comes from the Department of Agriculture field station at Watkinsville, Ga., where 288 lamps in a "growing room" duplicate all degrees of sunlight.

It looks as if musical score and lighting are going to become as important on the farm as they are on Broadway.

As editors, we'll admit that we have a number of special problems (keeping you happy is number one). But seldom do we consciously take stock of how we're doing "dignitywise." So it shook us up a bit when one reader, responding to a readership survey, branded our *Editor's Desk* column of readers' letters as "childish," and suggested that we drop it to "keep up the dignity of the magazine."

We took a dignified look around the office, observed the editors in shirt-sleeves, and pondered the whole thing.

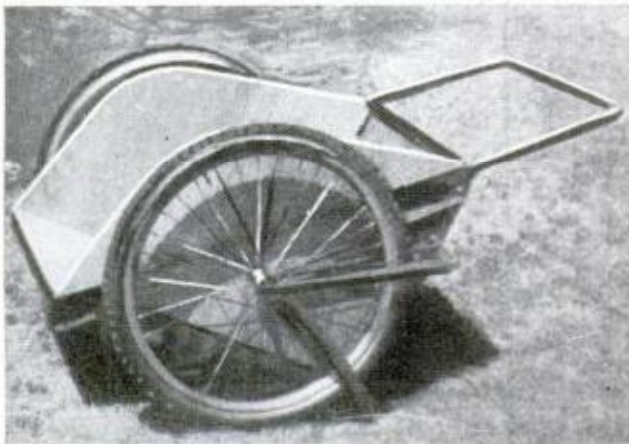
But, dignified or not, we concluded that we'll keep the forum open so that readers can sound off with a "that's great," or "that's awful." Your letters make this business a two-way exchange of ideas. And that, whether dignified or not, can be helpful for both of us!



# Over the Editor's Desk

## Tandem Bike Builders

Thanks for the article on how to build a tandem bike (page 176, April PM). I



made mine from two girl's bicycles at a cost of \$8.

Since we have more grass than snow in Phoenix, I used the extra wheels and parts to make a grass buggy. By raising the handle up and over, the cart dumps easily. (And my boys now want a pony to pull the cart like a chariot.)

Phoenix, Ariz. WILLETT C. MUNSIL

Just a few lines about the fine article on making a tandem bike. I got by on \$5.78 for mine. By luck, my chain fit perfectly, so I eliminated the chain tensioner. Works fine.

I have read and enjoyed your fine magazine for years. Keep up the good work. New Philadelphia, Ohio T. J. LEHMAN

## Fastest Nonrecord

*I Water Ski 106 MPH* (page 126, March PM) is an exciting article, but contains some inaccuracies.

The author refers to the 106-miles-per-hour record set by Harold Peterson as one that still stands in APBA (American Power Boat Association) ledgers. The fact

is that APBA has nothing whatever to do with water skiing.

New York, N.Y. RALPH J. IANUZZI

Author Jack Speirs reports that Mr. Peterson believed his wild slide across water was an APBA record because it was set at a drag-boat race sanctioned by APBA and sponsored by a club that's a member of APBA and timed by a man who's an official APBA timer. But Mr. Ianuzzi, public relations chairman for the APBA, is right—it isn't an APBA record, because they don't keep such records. The important thing is, can anyone top it?

## An Old Saw for Pondering

During lunch hour the other day, we were discussing *Home Workshop Tools You'll See Tomorrow* (page 106, April PM) when someone happened to notice a handyman named Chen sawing a new desk top with a pull saw that cuts on the upstroke. Mr. Chen's saw, which dates back about 1000 years, has rip teeth on one side and crosscut on the other, a convenience the students at Illinois Institute of Technology's Institute of Design might well ponder.

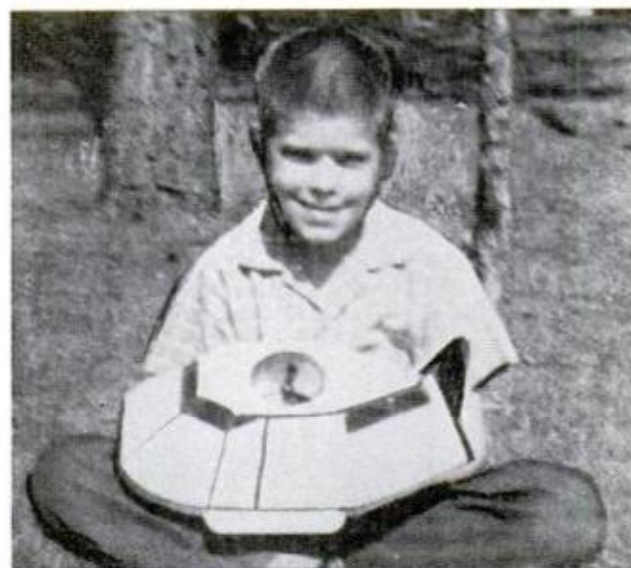
A.P.O., San Francisco, J. G. CARPENTER, LCDR, USN  
R. J. ELLIOTT, LT, USN  
Calif. V. L. THOMPSON, MNC, USN

Okay, Navy, we'll pass along the word on Mr. Chen's saw, and they'll probably ponder it well. We think they did some dandy pondering on that batch of futuristic tools you saw in April.

## Air-Car Fans

Recently our 12-year-old son, Dan, made an air car from your plans (page 160, Jan. 1962 PM). He used balsa wood and cardboard tubes to make the model.

He did some experimenting with it and found that it tended to follow the downhill



(Please turn to page 8)

POPULAR MECHANICS



# Great NEW Idea from CTI

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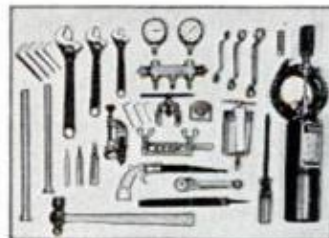


REAR  
VIEW

EXCLUSIVE  
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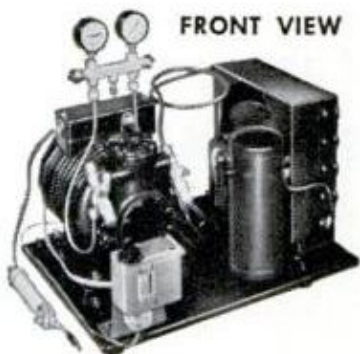
## 25 KITS WITH SHOP PROJECTS

Illustrated above is a view of the new CTI condensing unit, fully assembled. This is a commercial-type, heavy-duty, 1/4 h.p. unit. You build it from 25 kits of parts (and with tools) that CTI sends without extra cost. In addition, CTI includes 25 Shop Projects, which simulate the kind of problems you are likely to encounter in the field. After assembling your condenser, you may then build an air conditioner, freezer, refrigerator or milk cooler.



### Tools Are Included

You receive wrenches, tube flaring tools, hammer, tubing, fittings, gauges and many other items used by the experienced mechanic. Everything is of professional quality. Best of all, CTI trains you to use tools with speed and skill.



FRONT VIEW

## Go in Business



Because air conditioning and refrigeration is expanding so rapidly all over the nation, opportunities to go in business are plentiful. Many CTI graduates have accomplished this high aim. Start in a small way, from your own home, and gradually expand. In time you may wish to add a sales division. Manufacturers offer attractive franchises, including merchandising aids, to ambitious, qualified men.

## You learn by practicing with operating equipment

Thousands once learned this rewarding craft just by completing home study lessons. But CTI goes a step farther—and an important step it is! CTI also sends you 25 kits of tools and parts. You build these parts into an operating unit. It's a practical method because you get experience as you train.

## Earn Cash in Spare Time

Soon after enrolling, many CTI students earn money in spare time. Some handle servicing on a monthly fee basis for food stores, restaurants, taverns and office buildings. Many work part time at local dealers. Quite a number of CTI students have a full-time business going by the time they graduate. CTI kit training gives you the practice and experience you need to step from lesson study to actual field work.

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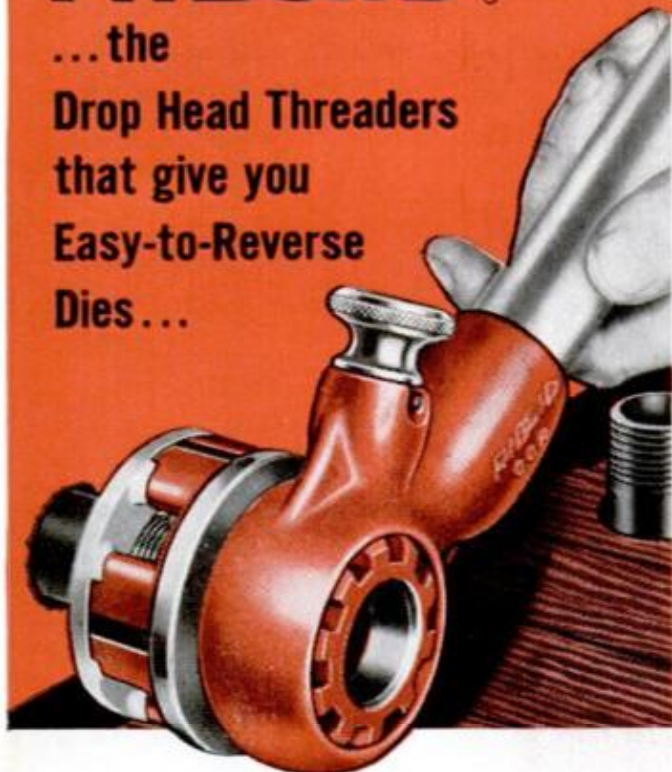
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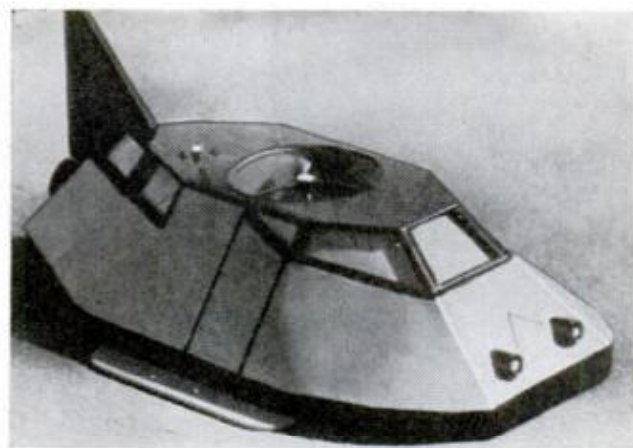
slope on an inclined plane and that weights caused it to move in the direction of the weighted side.

Cartersville, Ga.

MRS. EARL GEER

*Even the big ones we've been in tend to follow a downhill slope and move in the direction of a weight that causes them to tilt. (Some are steered by tilting.) If Dan can get his air car to move up a steep slope, he's got something!*

Here's an air car that I constructed. Among the changes I made is a plastic covering over the car's body and an ex-



tended needle valve coming out of the front of the car.

I have had hours of fun building it and flying it. I hope that you continue to print similar plans of flying models.

New York, N.Y.

NICHOLAS DOUSMANIS

## Roughriders Are Safer?

Just happened to read your June auto reports, and I have a few words on cars.

People have been lulled into a peaceful, deathdealing bliss by the luxury of modern autos. There is no vibration or other annoying indication of movement.

I like to feel the little tremor in the wheel that lets me know what is going on underneath me. I like to have a sufficient lack of cushioning between myself and the frame of the car so that I can tell when something is going wrong, like a flat tire, or loose front-end connections.

I'd suggest comparing accident statistics to see how sports-car drivers stack up alongside luxury-car drivers. Sports-car drivers must learn to drive the car; the car doesn't drive them.

I contend that people have lost the knack of proficiently handling a car, sacrificing this knack for luxury and comfort. Point Mugu, Calif.

TIM O. RUSSELL

*What about it, luxury-car drivers—do you feel you are losing your touch?*

*The Editor*

POPULAR MECHANICS



"YOU'RE NOTHING  
BUT AN  
ECONOMY NUT"



"I CAN'T HELP IT.  
AUTOLITE  
MADE ME THAT WAY"



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9



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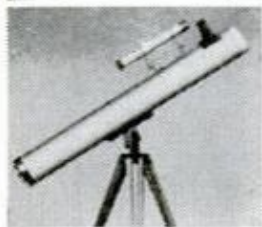
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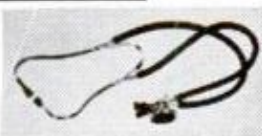
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**The uproar** over the so-called hallucinatory drugs continues. One such drug, LSD-25, which has been undergoing research as a possible tool in psychiatric therapy, is now being widely bootlegged in large cities and on some university campuses, according to a recent article in the *Archives of General Psychiatry*. The use of these illusion-producing drugs has been roundly condemned by medical and psychiatric authorities. They cited the disagreeable and often dangerous side effects, especially among psychologically disturbed persons.

The hallucinatory drugs, such as LSD-25 and mescaline, produce a state of mind described as "all-powerful, godlike." But indiscriminate use, experts say, can result in mental illness and even death. One dose of LSD-25, which stands for lysergic acid diethylamide, could cause a latent psychotic person to disintegrate mentally, says Dr. Roy R. Grinker, chief editor of the *Archives*.

**Could an astronomer** on Mars detect life on earth? Not with our present astronomical equipment, says Carl Z. Sagan of the Harvard University Observatory. Of 80,000 photos of the earth taken from Tiros satellites, only one showed a possible indication of biological life, he said.

Martian astronomers might be able to see light reflections from some large cities and, conceivably, light from atomic explosions, but these would not be conclusive proof that such a being as man lived on the earth, says Prof. Sagan. (Tiros vehicles orbit between 350 and 600 miles up. At its closest approach, Mars is still some 35 million miles from the earth.)

**Chromosome analysis**, a technique for spotting genetic deficiencies in the laboratory, can reveal whether or not a parent is likely to have a mongoloid child. This disorder is the result of abnormalities in the chromosomes, the cell parts that transmit hereditary traits from parent to child.

Normal human cells contain 46 chromosomes. Mongoloid children either have

cells containing one extra chromosome or a greatly enlarged one. By chemical treatment and microscopic examination of a parent's blood cells, scientists can tell whether either parent has enlarged chromosomes. If so, the chances are one in three that a child born to them would be mongoloid. (A few mongoloid children are born to normal parents as a result of a random error in cell division just before the moment of conception.)

**How Korean women divers** are able to stay underwater for several minutes at a time in water that's as cold as 50 degrees is being studied by Korean and American physiologists. So far, the study has shown that the women have coarse, heavily pigmented skin with a thick underlayer of fat. They produce more body heat than the average person, and for longer periods of time. In winter, their basal metabolic rate is 40 percent above normal.

**Flounder a la AEC.** You may someday dine on fresh, unfrozen fish a month or longer after it's caught. The Atomic Energy Commission has developed a radiation bath to keep fish fresh from four to six weeks without refrigeration. The fish, says the AEC, keeps in flavor, and the radiation has no harmful effect on diners. A \$60,000 fish irradiator is being built in Massachusetts to test the bath's commercial possibilities.

**Italy** is getting into the space game with a new twist—satellites within satellites. Italian scientists are preparing such vehicles for launching next year from a Texas Tower in the sea off East Africa to achieve orbit around the equator.

The project is designed to study air drag along the orbital path, a measurement considered extremely difficult but highly important by American scientists. An inner satellite will orbit independently shielded from drag, while the outer element will be subject to the tenuous pull of atoms and molecules in the high-altitude air. Comparisons between the two will be radioed back to earth.

**America's Mt. Everest team** may have brought back data that will prove that much of the tritium contained in rainfall comes from the sun. Climbers collected 40 samples of glacial ice for Nobelist Dr. Willard F. Libby who believes solar flares, as well as cosmic rays, are a source of tritium fallout. Everest's annual frozen rains are followed by dust storms which mark the layers of each year's ice formation. Dr. Libby's theory would be vindicated.

(Please turn to page 12)



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## Science Worldwide

(Continued from page 11)

cated if the glacial layers show a marked increase in tritium content coinciding with years of high sun-spot activity. Dr. Libby will be looking for a tritium concentration of one atom in a billion billion atoms of glacial water.

Heartbeats of whales may explain mysterious thumping noises detected by electronic gear in the Atlantic and Pacific. A Bell Telephone Laboratories official recently reported that scores of pulsing thumps have been recorded in the sea off New England. The sounds move at speeds of a few knots in random fashion, suggesting a biological source. He noted a similarity of timing between the thumps and the pulse rates recorded in an electrocardiogram of a diving finback whale.

Machines haven't made man obsolete, at least not yet. One champion of man's usefulness in the space age, a government scientist, put it this way: "Human limbs have extremely rapid feedback control coupled with infinitely variable power out-put and are guided by sensitive multi-channel sensors." Makes a man proud to be human.

Secrets from the deep may be revealed with a new instrumented submarine buoy developed in Norway. Several such buoys will be anchored at various depths in the North Atlantic between the Faroes and Shetland islands. Designed for pressure at depths of 3200 feet, the cylinder-shaped buoys will store tape-recorded data for at least two months on the force and direction of deep ocean currents, water temperatures and salinity. Recordings must be retrieved for study, but next year an attempt will be made to transmit data direct to shore from the buoys.

Worn-out uranium may help eliminate the smog problem. The AEC reports that depleted uranium could be used as a catalyst in devices attached to automobiles to rid their exhausts of smog-producing elements. Tests show that uranium does the job satisfactorily.

You win, grandma. An old saying had it that you cured a sty on the eye by rubbing a gold ring over it. Now, it seems, the saying is more than an old wives' tale. Researchers at Mayo Clinic tried the treatment on hundreds of staff members and patients suffering from sties. In 92 percent, the swelling disappeared. The clinic researchers came up with a scientific reason:



Chlorine is one of the few substances capable of dissolving gold in microscopic quantities. There's just enough chlorine in salt tear crystals to form traces of gold chloride, basis of many eye medications.



**TV in the hole.** Electronics researchers have designed two television cameras that can be lowered into boreholes to give geologists a worm's-eye view of what's happening underground. The cameras show what rock fractures look like, what minerals are present, why recovery of oil is poor, or how drilling bits are lost.



**Large residues** of DDT and other insecticides have been found in sharks, tuna and other ocean fish, a mystery scientists can't explain. Some fish had concentrations of up to 200 parts per million, well above the government limit of 10 ppm or less for most edible meats.



**Crabgrass**, noxious weeds and hungry insects would most likely make up man's visible world following nuclear war. Trees, flowers, vegetables, shrubs and other plants would probably be wiped out. This cheerful prospect has been described in recent studies made at Brookhaven National Laboratories which indicate that

foliage plants are not nearly so resistant to radiation damage as had been thought. Pine trees are the most sensitive and can be killed by a steady diet of 20 to 30 roentgens of radiation a day. Hardy grasses and weeds, however, can withstand several thousand roentgens a day.



**Don't live on a mountaintop** if you want to be smart, seems to be what experiments at a two-mile-high laboratory have demonstrated. In tests at the University of California's White Mountain Research Station, it's been shown that the brain matures more slowly in young animals taken to great heights. Tests indicated that the brains were delayed in maturing both among mountain-born animals and those taken to high altitudes soon after birth. Scientists say lack of oxygen may delay the growth of nerve fibers in the brain.



**A mechanical "mother's heartbeat"** to lull babies to sleep has been developed by a Japanese company. The battery-operated device throbs audibly, and when placed in the crib will give an infant a sense of security that entices sleep, the firm says.

John P. McNeel  
Science Editor

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# Items from All Outdoors

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In almost every city and town in the U.S. you can find equipment rentals. A good 10 by 10-foot tent will rent for about \$22 for one week. Four sleeping bags and air mattresses will cost about \$34. A two-burner gas stove is about \$4.50, and a gas lantern is about \$3.75. Your total expenditure is about \$64.25, and you'll have a chance to make certain that you really enjoy camping. Many sporting-goods dealers will also apply 90 percent of the rental cost to the purchase price of the equipment if you decide to buy after your trial.

**New Mexico** continues to lead the country in active planning for the future of hunting. We reported some months ago that their Department of Fish and Game was having great success with imported

Barbary Sheep (several hundred hunting permits issued last year), Siberian ibex and francolin hens.

We have now been notified that they will import eight kudu and eight oryx (long-horned antelope) from Africa as a basic breeding stock. There is little doubt that within 10 years New Mexico will be the country's hunting paradise.

**Husbands who object** to the lacquer women now use on their hair will appreciate the report from several lady campers that the stuff attracts droves of insects despite application of insect repellent.

**Unusual game cookery** is a hobby with us, and here's one we tried recently. *Marinated Rattlesnake*: Cut the head from rattler, hang until well drained, then skin. Prepare a sauce with ¼ tsp. of ground pepper, a dash of nutmeg and the juice of four oranges and one lemon. Cut the meat into one-inch chunks and marinate in the sauce for three hours. Remove the meat, drain and wipe dry. Salt and dip chunks in egg, roll in bread crumbs and sauté until brown. It tastes like chicken or tuna.

STUART JAMES  
Outdoors Editor



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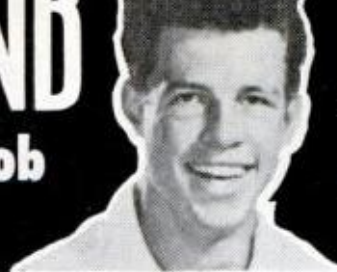
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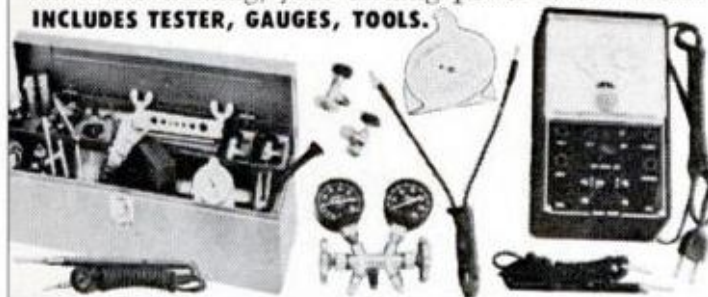


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## Sidelights from the SERVICES

By William R. Kreh

**Hay-fever sufferers** may be in for some relief, thanks to the Navy's Polaris submarines. A 13-pound "spin filter demister" developed to keep air super clean on Polaris subs may be marketed commercially for attachment to room air conditioners. The device uses spinning disks to collect mists, pollens, bacteria and dust particles as small as 20 millionths of an inch in diameter. It has proved to be 99-percent efficient.

**"Bikini"** is the name given a new lightweight reconnaissance drone being tested by the Marine Corps. It was so named, the Corps says, because of "its simplicity and ability to cover strategic areas."

**Quiet, too!** Five goats, known as "vegetation specialists," are keeping the grass trimmed on bunkers containing hundreds of tons of explosives at Otis Air Force Base, Mass. The goats' job is too dangerous for lawn mowers, which might touch off an explosion.

**A sure-fire secret-eater** is now at work in the Pentagon. It's a paper-hungry, pulp-making machine known as Somat and it has replaced the military's old method of burning classified papers. Somat takes the classified documents and turns them into a soggy gray matter that looks like a batch of cereal that's been soaking all night. The machine can devour 500 pounds per hour.

**Black-widow spiders** have lost their place in the Army. Their webs, once widely used for cross-hairs on bomb sights and other optical instruments, are being replaced by extremely fine lines etched into glass with a newly developed process.

**Dropping dynamite** in the ocean is helping the Navy unlock the mystery of the way sound travels in water 4000 feet deep. Temperature and density of the sea at this depth is apparently ideal for long-distance transmission of sound throughout the ocean. To find out more about it, Navy planes are dropping explosives at various points in the Atlantic from Bermuda to Great Britain. Sounds of the explosions are "tracked" by underwater hydrophones located in various spots throughout the Atlantic.

**Army scientists** say they have tracked down several chemicals that would protect troops against nuclear radiation but they cause such severe side effects that they can't be used.

**Dishpan hands** are on their way out of the fleet. The Navy has perfected an automatic scullery that will completely take over the clean-up detail in mess halls. Sailors can dump traysful of left-overs, dirty dishes, soiled silverware, bones, milk cartons and toothpicks into it. Within minutes, the trays, dishes and silverware are washed, sterilized, dried, sorted and stacked, and the waste is ground up and either flushed out the ship's sewerage system or powdered and stored for later disposal. The machine can take care of the mess gear for 900 men in just an hour.

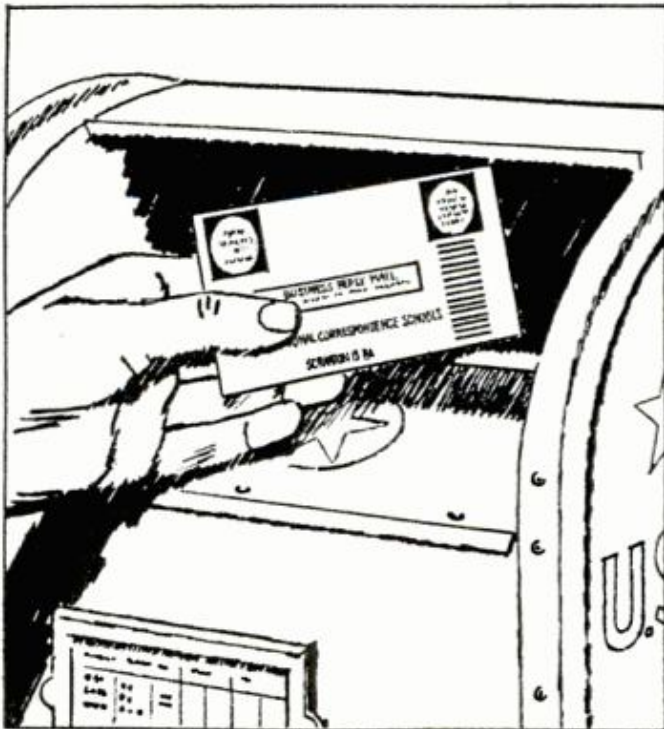
**It's the bark, not the bite** that counts in Air Force sentry dogs, so it's okay if the canines have their teeth extracted. Some of the dogs sent for training have been found to have worn, broken or missing teeth and there was some question whether they should be sentry dogs. But USAF higher-ups ruled that a sentry dog's primary function was to alert its handler and act as a psychological deterrent to intruders and that its ability to attack and hold an intruder was secondary.

**Veteran soldiers** say a Fort Knox, Ky., corporal may have hit on a new wrinkle for standing inspections. He finds that putting his boots in the refrigerator puts a hard shine on them and makes them "stand tall" without wrinkles.

**An Army biologist** has patented a method of putting glass windows in animals. His device, a window made of nonirritating tentallium, can be inserted into laboratory animals to permit observation and photography. The window can be inserted wherever a scientist wants to make an observation, and it can stay in the animal for extended periods without harm.

**Booms to the rescue.** The sonic boom, considered an irritant by many, led to the rescue of an Alaskan bush pilot recently. The pilot, forced down by a snowstorm, used his radio to contact the nearest Air Force station. Using radio fixes taken on the downed plane, an F-102 jet flew five-minute courses supersonically over predetermined routes. The downed pilot, on hearing the resulting boom from each flight, relayed the time of the boom to the Air Force radio dispatcher. By triangulation, it was then possible to pinpoint on a map the exact location of the pilot.





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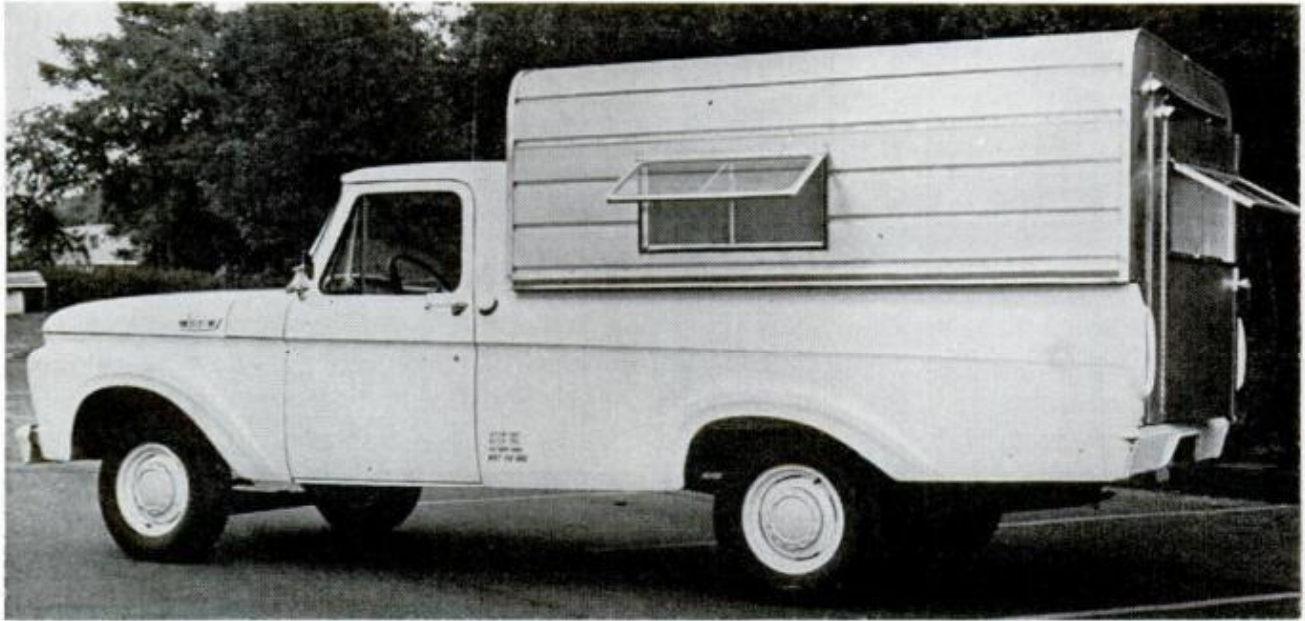


## Spotlight on the

# Versatile Ford Pickup

*For those who master it, this truck offers power, economy and the capacity for varied assignments*

By Ed Nelson



**ALTHOUGH IT'S SPACIOUS**, a camper body doesn't look ungainly on the 8-foot box of Ford's half-ton pickup. *PM* found it behaves well on the road, too

**F**ORD's F-100 half-ton Styleside pickup truck is a working buggy that'll take you almost anywhere you want to go. With optional extra-duty springs like the 1350-pound units on *PM*'s test vehicle, you can bring more along than you're likely to want. The bulk of a camper body is handled easily.

But don't expect a soft-riding passenger car with a box at the rear. The firm suspension emphasizes the F-100's descent from Ford's truck line. Seat belts would improve the comfort and safety over rough surfaces, where it's possible for you to be bounced clear of the seat. A surface rough enough to make the F-100 bottom, however, is hard to imagine. And, happily, there's lots of headroom.

The standard, 223-cubic-inch, 135-horsepower Ford in-line Six handles the pickup's weight (3389 pounds empty) with impressive ease through a medium-duty transmission, 11-inch clutch and 3.73:1 rear axle. Although the three available three-speed manual transmissions all are tagged *Synchro-Silent*, only the standard-duty gear box has synchromesh Low. The heavy-duty clutch is paired with a heavy-duty spring that calls for extra effort by any light-duty drivers.

Automatic transmission is available (priced at \$243.40), but the F-100 still wouldn't be the housewife's dream. A relatively small turning circle makes it maneuverable, but she'll still

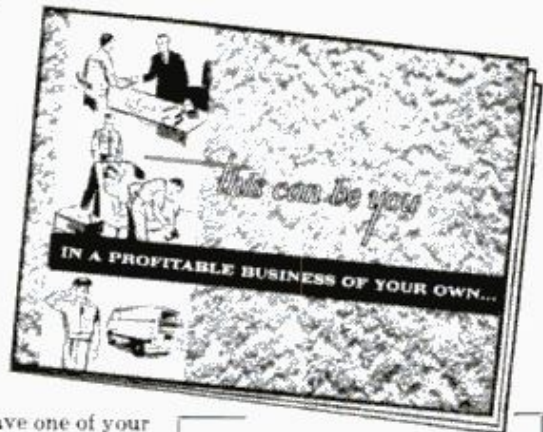
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Shows the way to start in spare time without giving up your job—how to build to a profit of \$250.00 for a 40 hour week in a one man operation—(more if you hire others to do the work)—how we finance nearly three-fourths of total cost and let you pay the balance out of profits. Yes, it's easier to start and it's easier to succeed because of the backing and the "know how" given you by our company. Send your name for this free book which shows you the way to independence in a Franchise business which you own outright.



Grant Mauk

In the past, many men started businesses of their own—and failed. Some entered businesses that were already on the decline. They were as foredoomed to failure as a buggy-whip salesman. Some had no talent for the businesses they entered. Most of them worked for someone else and had no experience in business management.

Today, all that has been changed by reputable Franchising firms. Our Franchise business is one that has been tried, and tested, and proved by the parent company. It is one that has been shown to have an enormous and a growing market. It is a business that has been brought to a high level of success by many other men. The kinks have been eliminated. The methods and plans that lead to success have been clearly charted. When an ambitious man is given the equipment and training he needs, and follows the plans laid out for him by the parent company, success is the logical result.

There are many kinds of Franchise businesses. Many require investments as high as \$50,000. The profits they pay depend on how well the owner follows instructions.

We have a Franchise business that does not require a large investment. In our business you can get started for a few hundred dollars. We finance the rest of the investment for you and let you pay it in monthly payments so small that the profits on just one job a month could cover your payment. The overall investment is small by comparison with many other Franchises—yet the potential is \$250 a week net profit. That's for a one man operation. If you have two or three or more men working for you, the potential increases accordingly.

A small dealer just starting and doing his own service should gross \$180 profit from 20 hours service in a week. If he uses 30% for advertising, etc., he nets a clear \$125. If he services 40 hours, net profit is \$250.

With only two men working for him a 35 hour week brings the owner \$420.00 gross profit. Allowing 20% for advertising, etc., (since he has time to sell) he clears \$335.

What is this business? It's one of the fastest growing businesses in America today. It includes six different services that you perform for the housewife right in her home. No office or shop is needed. No investment in real estate. No problems of finding a good location. In fact, if you have a telephone at home and a car with space in the trunk—you have everything you need except the things we furnish. Your business comes to you on the telephone and in personal calls following up leads generated by National Advertising and by your own local Direct Mail Plan which we furnish. You quote your prices to

the housewife, do the job, or have one of your men do it and collect the money on the spot.

What are these services? The first and most important is the cleaning of carpets, rugs, and upholstered furniture by a revolutionary modern process known as the "Absorption Method." The work is done right in the customer's home. No scrubbing with harsh motor-driven rotary brushes. No soaking with gallons of water. An Aerated Foam loosens the greasy, atmospheric dirt and holds it in suspension until it is removed. A test conducted by an impartial laboratory showed that machine scrubbing in the home removed less than half as much dirt as was removed by the Absorption Method.

Five other services add to your income. With portable power equipment you spray furniture and carpets with a product that retards soiling. You remove stubborn spots like magic. You spray another liquid to make fabrics flame resistant. You mend small damages such as cigarette burns and moth holes, often saving the owner the price of new furnishings. And finally, you deep spray fabrics with a moth killing liquid on which you can give a company guarantee for six full years.

As owner of a business, you have the opportunity to make more money than you could hope to make working for someone else. Also, should you wish to sell, you are building a business with a cash value. When an arm injury made it necessary for Al Svitak to sell after operating his dealership only 17 months, he sold to a prospect supplied by Duraclean at a price 50% above his original investment. G. F. Monroe sold his Texas Dealership after 12 months for ten times his cost. Leo Lubel, after 30 months, sold for \$7,116 over cost. When our Franchise owners want to sell, we help them find buyers.

It's all explained in this free book. Pictures and descriptions show you how the work is done; how to start without giving up your present job; how to build to full time operation through plans worked out for you.

If you are tired of working for others, tired of jumping from one proposition to another; if you have good health, energy, and ambition; if you have a real yearning for independence in a business you own, send for this book. If you have thought that starting your own business would be difficult or expensive, or risky, this book will open your eyes. With our plan it is easier than ever for you to become master of your own destiny in a business you own.

There is no obligation, no charge. No salesmen to high pressure you. Send for this book now. Read it. Then decide if you want to take the next step toward independence.

### OPPORTUNITIES TO FIT YOUR OWN AMBITIONS

The Duraclean Franchise is so flexible that it can be fitted to your own ambitions. As a one man business and based on the rates in our National Price Guide you can make a net profit of \$6.00 an hour—\$240.00 for 40 hours of servicing.

Ward Whitebeek wrote "I have made as much as \$225.00 in one day." L. Lawson says: "In September, working alone, jobs totaled \$1,475." L. Canaday wrote: "\$1,571 in a single month."

If you wish, you can operate as the head of a multi-crew business with others doing the service work.

This increases the profit opportunity as the owner of a business can make as much as \$6.00 an hour gross profit on every hour each employee works. Even after paying him a good hourly wage, the owner can clear \$325.00 a week for himself with only two men on his staff.

Ed Kramsky wrote, "In my second year I now have two assistants, a nice home, and real security for my family." And, E. Davis reported "Gross income increased \$17,660 this year."

So, no matter at what level you have set your sights, here is a Franchise that is worth careful investigation. Send your name now for the Free Book that tells all angles of the business.

### Send name for FREE BOOK

Grant Mauk, President  
3-168 Duraclean Building, Deerfield, Illinois

Dear Mr. Mauk: Please mail a copy of your Free Book telling how I can get a Duraclean Franchise started in spare time without giving up my present income, and how I can build a one man business with a potential of \$250.00 a week net profit. No charge. No obligation. And, no salesman is to call on me. After reading your book I will let you know my decision.

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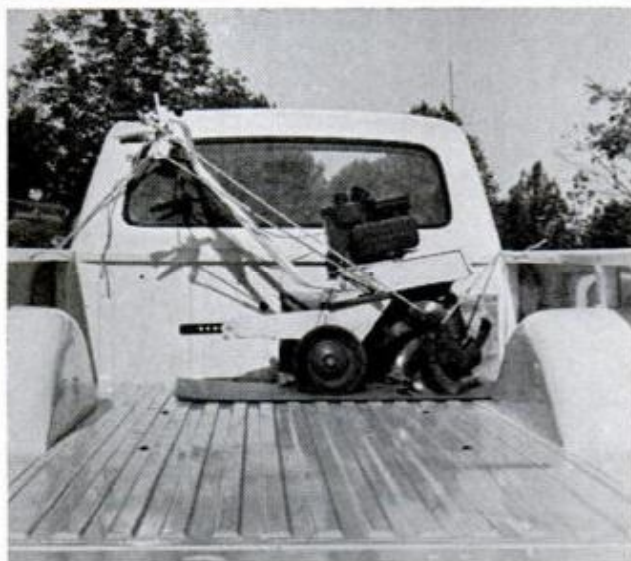
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## Spotlight on the Ford Pickup

(Continued from page 20)



**SWING-UP REAR ASSEMBLY** of the Sportsliner camper (above) gives access for larger loads. But for the greatest capacity, the open box still is preferable

find it stiff work winding the truck into a tight parking hole. And power steering isn't available.

From its prompt, powerful start right up through highway speeds, the noise level is kept well under control. The cab is comfortable, the driving position good. Your throttle foot tires less than in many plushier passenger cars. The throttle is thrifty, too. Our test vehicle was brand new and far from broken in, but we got just a hair under 18 m.p.g. on Regular gas.

PM's long-legged test drivers found the cab comfortable once the seat was moved to full rear. It's also wide—58 inches worth—and the springs are deep, as they'd have to be. There's ample room for three adults in the seat, and the cab floor is high enough to avoid any drive shaft hump.

Getting up into the cab is a two-step climb, of course. But even for some of

(Please turn to page 24)

POPULAR MECHANICS





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rings than any other piston ring brand.

What's the difference between PC "racing" rings and those you can buy? Nothing. They are *identical*, from the specially-selected metals to the solid chrome surface. They are *identical* in design and manufacture, in the long life, fit and dependability that assures new-car power and economy.

Here's another engine tip: to prevent costly oil loss through valve guides, always install Perfect Circle Valve Seals, or have them installed, when you re-ring.



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## Spotlight on the Ford Pickup

(Continued from page 22)

the ladies, this might be less of a problem than swiveling into today's compacts. The F-100's step is enclosed by the door so it'll never be snow- or ice-covered. And the sill extends into the cab area before meeting the second step, giving you a split-level floor effect that is fine for storing empty Coke bottles on a trip.

Vision through a panoramic windshield and wrap-around rear window is excellent. Unless you're carrying a bulky load, there's no chance for a little Isetta to sneak up from a "blind" side.

With the basic truck, there's no rear bumper to protect your neighbor's grille as you back to park, but the body is shaped so you can see the left rear corner through the standard outside mirror.

The floor of the box is 27.2 inches off the ground, nearly as high as the kitchen table and quite a lift for a heavy load. The trunk lip on many a passenger car, however, is close to that height. And the F-100 has 7.2 inches of road clearance to the differential housing. Our test truck had the 8-foot box on a 122-inch wheelbase.

### Camper Wring-Out

With the increasing popularity of lightweight camper bodies on pickups, *PM* wanted to know the effect on roadability. The answer: practically none.

For our test we chose an Aeromotive camper—the Sportsliner from Custom Accessory Sales of Columbus, Ohio. This is only one of many that fit the F-100 series Fords. Inside headroom is fine if you're seated, yet the unit doesn't stick up so high the driver feels extra wind drag. The truck's stability isn't impaired, even in a cross-wind, and road noise is, if anything, muffled by that package of dead air behind you.

Fitting a camper involves several hours' work lining it up, driving good-size self-tapping screws, and fitting the filler panels that adapt the cover for various truck boxes. Two men can lift the Sportsliner camper, and the completed unit is solid. With the truck box already welded to the cab, the final combination is rugged and rattle-free. The camper costs \$302.38 F.O.B., Columbus.

Once the camper has been fitted to the truck, removal and re-installation is simple. For any except very heavy loads, standard transmission and springs are fully adequate for truck or camper. You'll have an economical and versatile vehicle that can handle about any normal family job.

Stripped, the F-100 pickup costs \$2015.24. Options brought our total to \$2388.99. ★★



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**Baby airliners** for light-traffic, short-haul routes may help solve the financial problems of local-service airlines. An 18-passenger plane, capable of 300 m.p.h. for runs of up to 500 miles, has been proposed by a local-airlines association. The plane would be able to land and take off on runways of 3500 feet or less.

**Emergency landing areas** capable of supporting fully loaded jet aircraft can be located from the air by a new method of measuring soil hardness. A rocket projectile, called a penetrometer, is fired from cannons mounted in high-speed jets. The depth of penetration into the ground is governed by soil hardness, and a deceleration switch in the penetrometer measures the impact. Set at a certain level, a bulb in the tail of the penetrometer lights up if the impact is greater than this level.

The Air Force, which is conducting the tests, estimates that there are thousands of flat land surfaces throughout the world

that could support a big jet in an emergency, but the effort of sending land crews in to survey each area is prohibitive.

**Apparent-motion machines** have been found more accurate and much faster for studying aerial-reconnaissance photos than the traditional methods of overlays and side-by-side. Apparent motion involves blinking two photos alternately on the same screen. The photos could be before-and-after shots of the same area to determine military build-ups.

The study, conducted by the Boeing Company, showed that apparent motion was up to 42 times faster than side-by-side. The pictures, taken at different times, are projected alternately on the same screen. Changes seem to flicker on the screen, or swell or shrink.

**When evacuating Indians** by helicopter from a flooded area in Alberta recently, the Royal Canadian Air Force discovered they evacuated 30 percent more than actually lived there. They then discovered some of the Indians were recrossing the river to get another ride.

Kevin V. Brown  
Aviation Editor



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By Jim Whipple



## Look for Some More Fords in Indy's Future. Turbine Car Races 24 Hours on Kerosene

Jim Clark's second place at Indianapolis has shaken up the racing trade more than a little. Driving a radically different sort of car with a modified aluminum passenger car engine that used pushrod valve gear and ate pump gas—he moved at one time to within 5 seconds of winner Parnelli Jones.

Jones' car, which posted the highest average speed ever, 143.137 for the 500 miles, was a classic Offenhauser-powered solid-axle car driven on the ragged edge.

Some observers were of the opinion that had it not been for the oil that Jones' car spilled on the track, or the fact that several drivers made it possible for Parnelli to pass during the yellow flag caution laps (after an accident), Clark might have caught him and won the race. This is one of those fascinating "ifs" that will keep the fans arguing all winter.

Several items are not iffy, however. One is that the days of the four-cylinder, methanol-fueled overhead camshaft Offenhauser engine are numbered. Next May 30th, a whole flock of genuinely Detroit based engines could be on Indy's grid.

Nothing could make this more certain than the story going the rounds recently that a group of sponsors of the Offy-powered roadsters have banded together and are putting pressure on Indy's governing body USAC (United States Auto Club), to prohibit cars weighing less than 1500 pounds from entering the race. This would mean that the Ford-Lotus, Mickey Thompson's cars and other new lightweight designs could not run. The reason: Offy roadster owners have large amounts of money tied up in cars like this year's winner, the Agajanian-Willard Battery Special, and they have a feeling that next year, the lightweight Ford-Lotuses et al. could fill a lot more of the first 10 places than the Second and Seventh that they copped this year. In effect, if the rumor is true, the Status Quo boys are saying, "You can't race your fast cars here, this race is for slow cars!"

A quicker way to kill interest in the Memorial Day spectacle can't be imagined, and we can't see Indy's owner, Tony Hulman, putting a stopper in the path of prog-

ress just as the track regains its former status as the U.S. auto industry's most exciting and colorful proving ground.

We think that there's more than one Ford in Indy's future.

Traditional patterns of engineering are being challenged all over the map this year. Recently a BRM (British Racing Motors) car, powered by a turbine designed and built by the Rover Motor Co. of Solihul, England, placed Seventh overall in the 24-hour race at LeMans, France.

Although not officially scored because of its unique engine, the Rover-BRM finished ahead of everything but the fabulous Italian Ferraris, the cars which have carried development of the piston engine to what may well be its limit.

Rover's turbine performed beautifully, just 10 miles-an-hour slower than the winning Ferrari's 118 m.p.h.

What does it prove? Basically that the turbine can compete in performance and durability with the piston engine and do so on more economical fuels. The Rover raced on kerosene.

Chrysler's newest turbine (p. 26, July '63 PM) has yet to win a race, but the important thing here is that they have discovered that it can be produced quickly and at a price competitive to that of piston engines. A figure of \$350 for the power plant in full production was judged as "a reasonable expectation" by one engineer. Reason for the confidence in such down-to-earth prices is Chrysler's use of non-exotic materials and methods of manufacturing the critical high speed and high temperature parts. For example, turbine wheels, rotating at 46,000 r.p.m. at 1800° F., are made of a low-cost iron alloy by investment casting (wax molds).

Most auto engineers agree that the turbine has several corners to get around before it reaches volume production, while the piston engine is healthier than ever.

Is Our Face Red Department. In the June 1963 Listening Post (page 82) we mentioned only two overhead valve V8s of 10 years ago, Olds and Cadillac.

In addition, Studebaker, Lincoln, Buick, Chrysler, Dodge and DeSoto had overhead valve V8s back in '53.





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- 642

(Solve in 6 seconds) ?

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$$\frac{4}{7} \times \frac{9}{4} = ? \quad (\text{Solve in 4 seconds})$$

1 3/4 % interest per month amounts to what percentage yearly? (Solve in 4 seconds)

$$367 \times 75 = ? \quad (\text{Solve in 3 seconds})$$

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## Tune in on the Inventors

Aircraft powered by the sun and capable of flying 1000 miles per hour at altitudes up to 300,000 feet could result from patent 3,089,670 granted to Elmer G. Johnson of Fairborn, Ohio. Solar power would be trapped in an accordionlike device beneath a rectangular wing. Needing no fuel, the plane could fly indefinitely.

The irate golfer who flubs a birdie no longer has to wrap an expensive niblick around a tree to relieve his feelings. Instead, he can let fly with a simulated "breakable" golf club, patented for just such crises by Ashley Pond III of Taos, N.M. Described in patent 3,087,728.

Rotary lawn mowers can be sharpened in seconds by inserting a new sharpener through a hatch opening and letting the mower's motor do the work. Patent 3,085,387 went to Will M. Harper, Monroe, La.

Photographers can mount their own slides with a motor-driven (or manually operated) binder that does the job in less than 10 seconds. It can also be adapted for binding other types of material. Patent 2,528,754 was granted to Dallas H. Johnson, Avon, Ohio.

For bumbling parkers, patent 3,088,431 describes a device that indicates the position of the front wheels of an auto directly on the dashboard. Inventor Martin Brownshield, Dobbs Ferry, N.Y., designed it to help drivers park in tight quarters.

An automobile that converts into an airplane—using the same power plant—earned patent 3,090,581 for Einar Einarson of Farmingdale, N.Y. For air travel, stabilizers and wings are put in place and road wheels are raised. The craft has removable propellers fore and aft. On the highway, wings and stabilizers are removed and front and rear hoods drop down to give it a conventional auto appearance.

An antisubmarine airborne rocket invented by three China Lake, Calif. men sports a small parachute for slowing the missile down before it hits the water, thus reducing malfunctions. The weapon is said to be smaller and simpler to make than conventional torpedoes. Patent 3,088,403 went to James T. Bartling, Orville J. Saholt and Bernard Smith.



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The term "ginseng" comes from the English translation of the Chinese ideograph for the plant, which means "image of a man." Often, roots are found in a manlike shape, but contrary to legend,

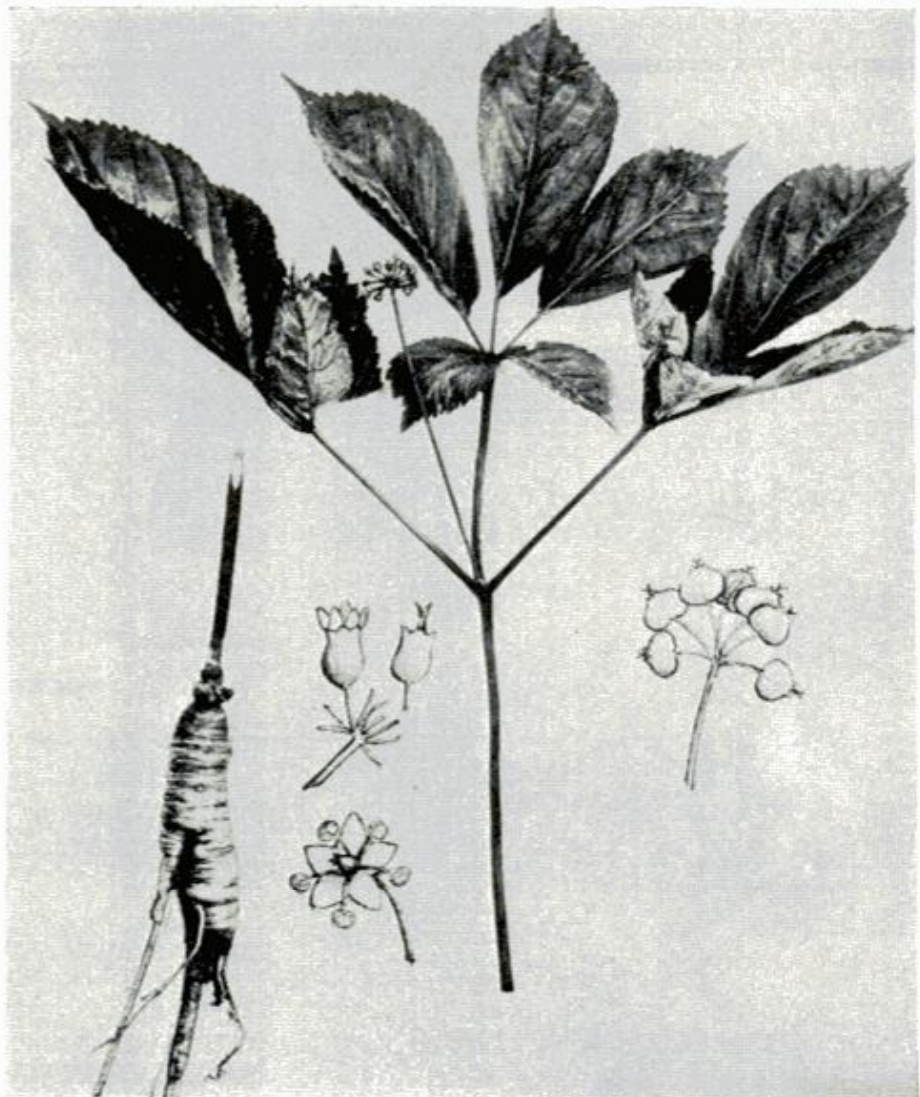
these are no more valuable than other roots.

Fall is the best time of year to dig 'seng, after its thick clump of berries ripen, although many root hunters take it in spring and summer also. It's usually found in wooded and brushy areas, burned-over forests and even along abandoned fence rows. Roots must be carefully cleaned and dried to avoid breakage.

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Prices for wild root run from about \$21 to \$27 a pound, \$6 to \$10 for cultivated root, according to the William J. Boehner Co. of New York, which exports about a third of the \$2,000,000 annual crop.

**GINSENG PLANTS** usually have two to four prongs, sometimes more. Each prong has five dark-green leaves, two of which are smaller than the others. The red berries bring up to \$24 a pound. The Chinese often prepare 'seng by boiling it, or they grind it up for use as a condiment. Since the war, West German firms have taken some ginseng for use in pills, face creams, aspirins, elixirs and vitamins





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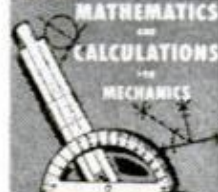
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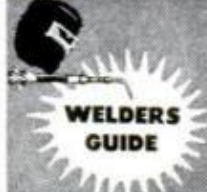
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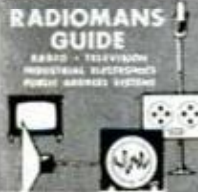
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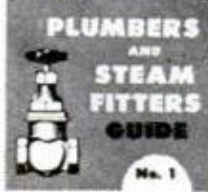
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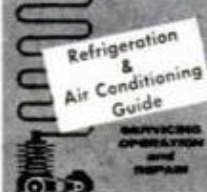
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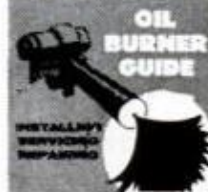
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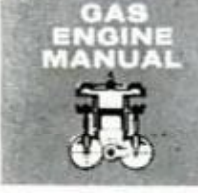
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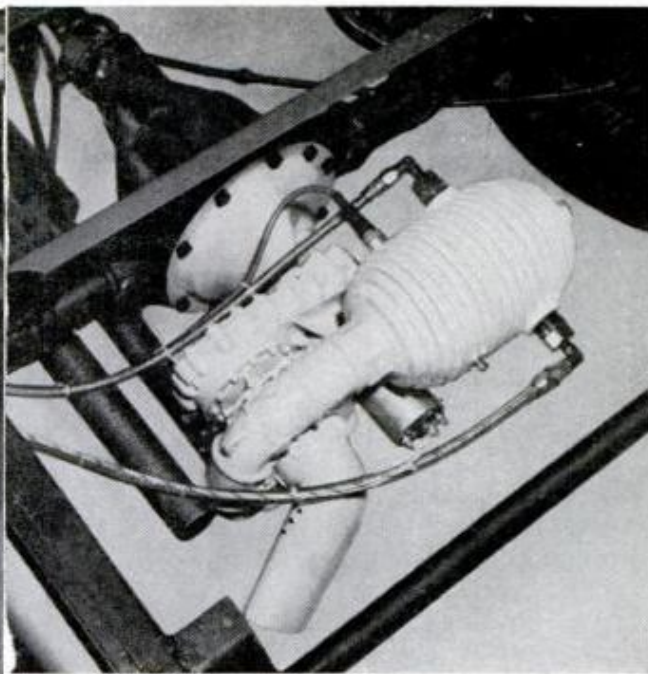
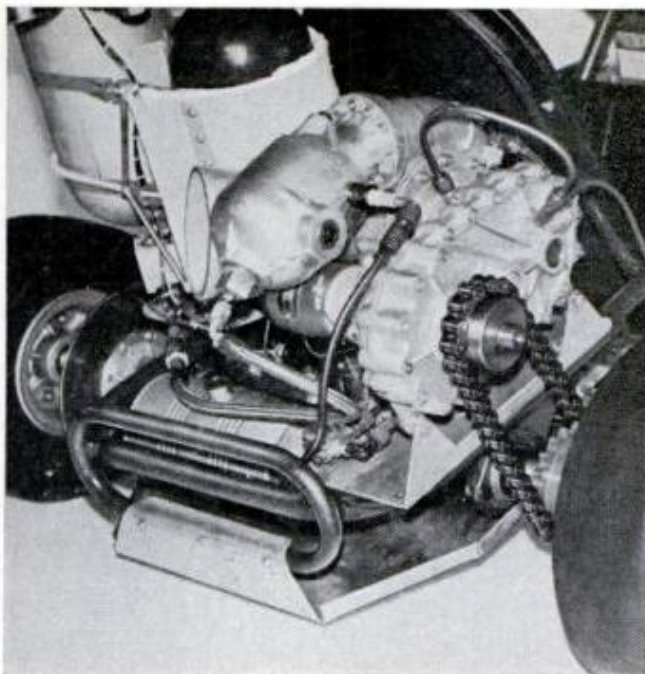
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Half a dozen different turbine engines are now available to add from 45 to 360 horsepower directly to your car's rear axle whenever you call for it.

Installation of the supplemental Microturbo engines is hardly more than a bolt-on operation. Just remove the differential inspection plate and bolt the turbo in its place. Then hook up a tank of turbine fuel, the spark plug wiring, and—for the 1/4-second starting cycle—a five-pound CO<sub>2</sub>

bottle of oxygen. A one-way Borg-Warner sprague clutch passes the turbine's power to its own pinion gear and on to the differential ring gear.

The manufacturer, Turbonique Incorporated of Orlando, Fla., says its Micros can be adapted for almost any fuel. As built, they use Thermolene, a special, nitrate-based mixture now costing about 15 cents a pound. Microturbos also are available in kit form or as a group of castings.

## What Comes Next—Plastic Igloos?

With foam-flotation at bow and stern, a new 17-foot fibreglas kayak tips the scales at only 70 pounds. It's designed to be cartopped to the water, and includes ample under-deck storage space for overnight

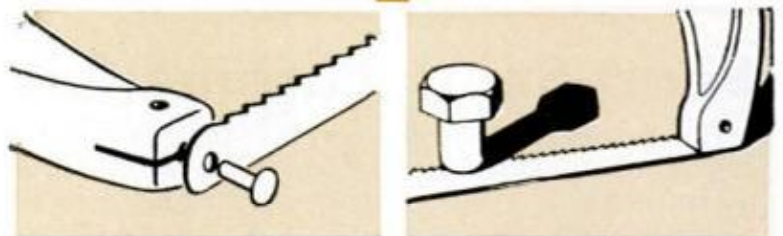
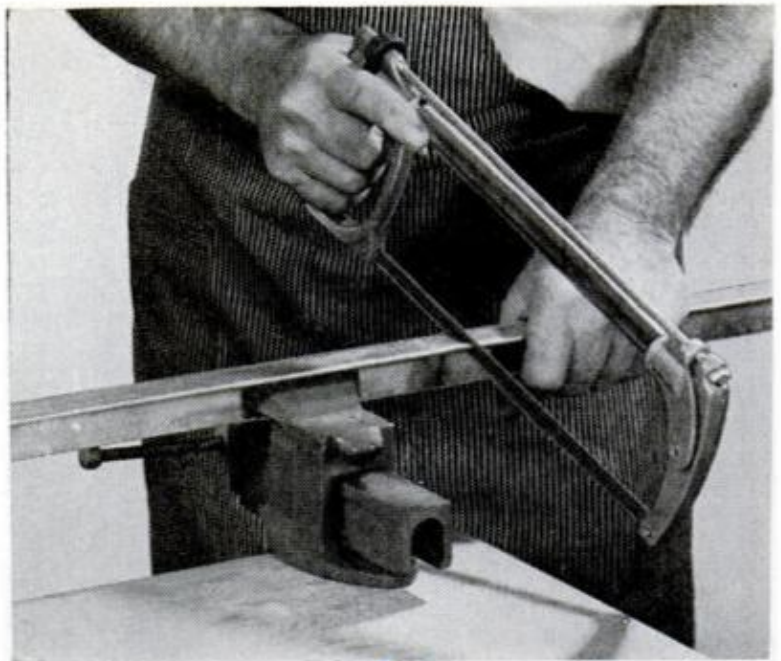
camping gear. Complete with double paddle, adjustable seat and footrest, this updated Eskimo runabout sells for \$279 F.O.B. Graves Yacht Yards, 6 Beacon St., Marblehead, Massachusetts.



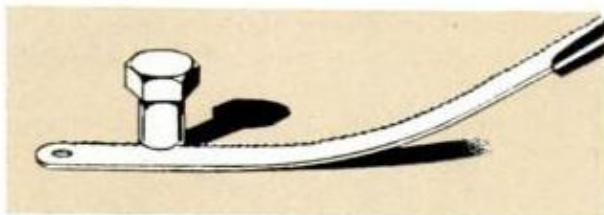


# Hacksaws Are Getting More Versatile

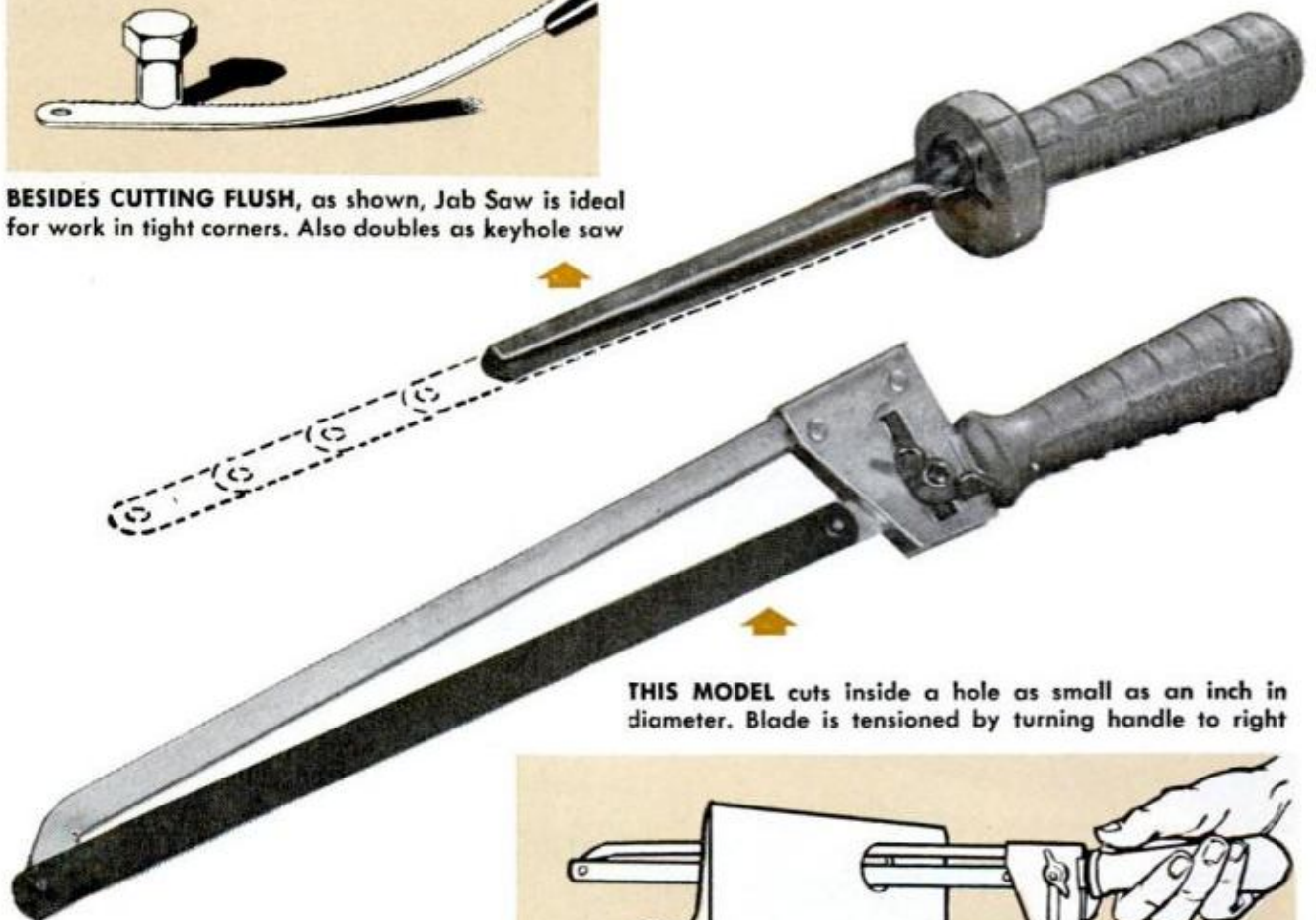
Too often, when a manufacturer claims to have improved a hand tool, he's merely given it a new shape or jazzed up the finish. But three unusual hacksaws by Dreier Bros., Inc., 7301 S. Woodlawn Ave., Chicago 19, Ill., are actually more versatile than conventional models. For example, the Challenger (photo, right) and Jab Saw (center) will both cut flush with the work surface—something you can't do with most hacksaws. In addition, we found the Jab Saw excellent for cutting plaster and gypsum-board, and both it and the Low Boy model (bottom) will get into places that are impossible to reach with a standard saw. Prices: Challenger, \$4; Jab Saw, \$3.50; Low Boy, \$2.75.



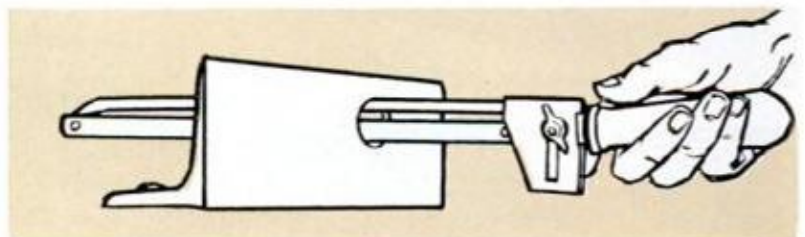
**CHALLENGER BLADE** turns 90 deg. for flush cuts. Model also has adjustable tension wheel, blade storage in frame



**BESIDES CUTTING FLUSH**, as shown, Jab Saw is ideal for work in tight corners. Also doubles as keyhole saw



**THIS MODEL** cuts inside a hole as small as an inch in diameter. Blade is tensioned by turning handle to right







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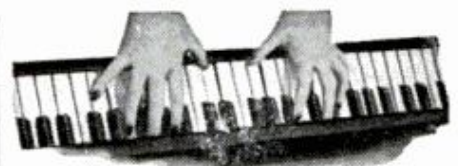
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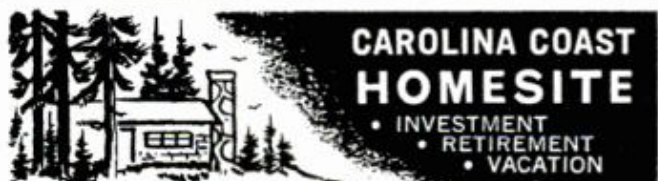
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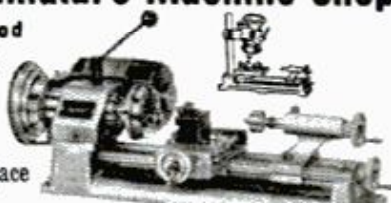
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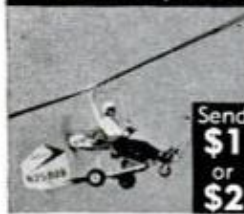
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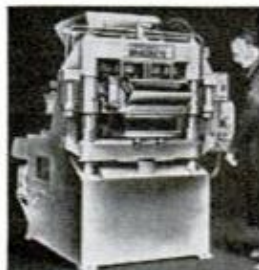
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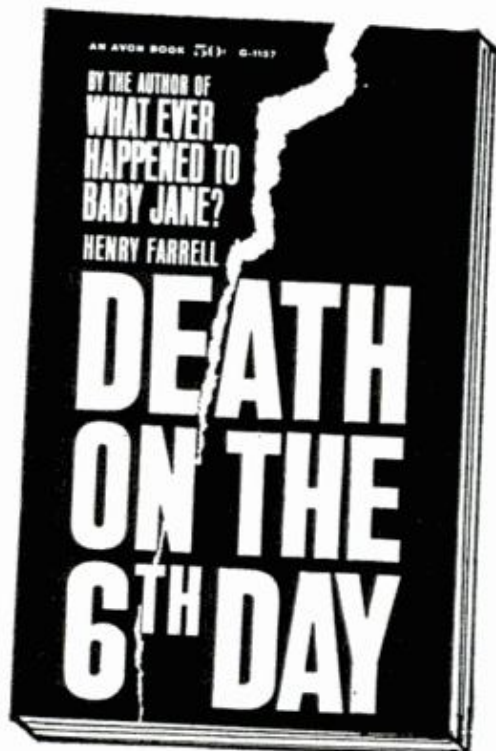
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YOUR Photographs printed on stationery, circulars, postcards, etc. Free samples! Print, 17034 Miles, Cleveland 28, Ohio.

OFFSET-Letterpress printing. Free samples rushed. Chicke Press, Harvey, Illinois.

OVERNITE Offset printing 1000 8 1/2" x 11"—\$6.50. Postage extra. Evergreen, 9420 Trumbull, Chicago 42.

AMAZING Business printing values. Samples. Print Shop, Box 576, Greenville, R. I.

OFFSET Printing, economical, top quality, letterhead, envelopes, forms. All types rubber stamps. Request catalog. Overnight Service, 912 Bob Wallace, Huntsville, Alabama.

1500 ADDRESSED Labels \$1.00. Sturdevant, 6207 Cambridge Ave., Cincinnati 30, Ohio.

PRINTLIKE, Overnite mimeographing. Reasonable. Samples. Scherer, 168 West Harrison, Chicago 5.



## PRINTING OUTFITS AND SUPPLIES

TYPE CASES. Manufacturer. Catalog. King McKay Company, 23179 Telegraph, Southfield, Michigan.

PRINTING Presses, type, supplies. Lists 5¢. Turnbaugh Service, Mechanicsburg, Penna.

MAKE Your own self-molding rubber stamps and printing cuts. Plexirubber. Argyle 1, Wisconsin.

RUBBER Stamp presses, hydraulic operated, electrically heated. Sizes 5"x8", 8"x12", 10"x15". Starting outfits, supplies. Printing presses. Custom Manufacturing, 1464-P East Commercial, Springfield, Missouri.

DO Your own printing. Save money. Simple rules. We supply everything. Print for others; good profit. Raised printing like engraving too. Have home shop. Details free. Kelsey Presses, V-11, Meriden, Connecticut.

RUBBER Stamp outfits, supplies. Kiewit, 2025 Barney Road, Kalamazoo, Mich.

BUY Postpaid rubber stamp materials. Free Press. Duckman, Avoca, Arkansas.

ILLUSTRATED Silk Screen Printing. Instructions with Supply Sources. \$2.00. George Shine, Box 162-A, Springfield 1, Massachusetts.

HARD Type for rubber stamp making, printing. Introductory offer 10 or 12 pt. 20th Century Medium caps or L.C. \$2.50. Free catalog. Barco Type, 232 Evergreen, Bensenville, Ill.

MAKE Rubber stamps. Complete outfit \$99.95. Terms. Duckman, Avoca, Ark.

NO Mimeo, circulars for pennies equipment \$3.98. Luby's, P.O. Box 784, Calexico, Calif.

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MECHANICAL Parts, devices. Small to medium, made, repaired reasonable. Ebbin, 2129 Thomas, San Diego 9, Calif.

MODELS — Small lot manufacturing. Metals, plastics, etc. Milburn, Burlington, Kentucky

## MODELS—SHIPS, TRAINS, PLANES, ETC.

CASTINGS And finished steam-gas engines from simple oscillating to triple expansion. Finest materials and fittings. Catalogue \$1.00. Denison Live Steam Models, PM 1606 Denison, Cleveland 9, Ohio.

SHIP Models. Kits, fittings, plans, books, tools, engines, motors. Big illustrated catalog 50¢. James Bliss & Co., Dept. SM, 342 Atlantic Avenue, Boston 10, Massachusetts.

SHIP Model kits. Clippers, galleons, liners; Operating power boats for radio control; Send 25¢ for catalog. Ideal, 19 West 18 Street, New York 11, N. Y.

SHIP And yacht model fittings; blueprints. Send 50¢ for illustrated catalog listing hundreds of items. A. J. Fisher, Inc., 1002-1 Etowah Ave., Royal Oak, Mich.

ROCKETS: New illustrated catalog 25¢. Single and multistage kits, cones, engines, launchers, trackers, technical information, etc. Fast service. Estes Industries, Penrose 2, Colorado.

SHIP Model kits and fittings: clippers, frigates, etc. Catalog paint-tool list, book list, 35¢. Model Shipways, Box 85, Bogota, N. J.

"WHITE HEAT V" radio-controlled model hydroplane featured June 1962 Popular Mechanics. Full size plans, patterns, accessories and engine available. Literature for stamped addressed envelope. Oc-tura Models, 8144-P No. Milwaukee, Niles 48, Illinois.

MODEL Steam engines, ready to run. Sheridan air rifles. Catalogue 25¢. Gun Shop, Baker, Oregon.

## HOME CRAFTSMEN

WOODWORKERS, Home Craftsmen! Catalog containing lamp parts, veneers, lazy susan bearings, Swiss movements, chair cane, folding metal legs, wooden legs, finishing materials, etc., only 10¢. Barap Specialties, Box 2044-D, Chicago 9.

SWISS Musical movements, experimental special. 3—one tune, 1—two tune, wind-up. \$7.50. Regular \$12.00 will prevail after August. Tunes our choice. Walters, 207-PM, French, Utica 4, New York.

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101 PATTERNS Of smart gifts, novelties, shelves, action windmills plus "Make Money Jig Sawing". \$1.00. Mastercraft, 85M, 7041 Olcott, Chicago 31.

12 JIGSAW Wall patterns. Instructions \$1.00. Miniatures 25¢. Silhouette Workshop, 36 Linnaean Street, Cambridge 37, Mass.

CARPENTER 5 pocket nail aprons, 8 oz. Canvas. Double Strand Sewing, Metal Grommets, Nylon Cord Ties, \$1.50 postpaid. Gregg's Workshop, 5446 N. Moody Ave., Chicago 30, Ill.

2477 PLANS. Patterns, things to make, do. Fun. Profit. World's greatest selection. New catalog 10¢. Craftplans, 18250-A Harwood, Homewood, Ill.

SAVE: Raw picture frame molding, all species, all styles. We will miter corners. Bauerle Cabinet Works, Inc., Hammond, Louisiana.

PLANS For pool table with extra two-face top for table tennis and model railroad. Blueprints B1209 and building instructions \$3.50. Popular Mechanics Service Bureau, 740-M Rush St., Chicago 11, Illinois.

PICTURE Frame moulding, squares and lumber. Kiln dried walnut, cherry, silver maple. Midland Lumber Company, Box 262, Savannah, Mo.

SKIL-CRAFTS New 62-63 catalog. Largest and finest selection of leathercraft, artist, hobbycraft supplies in the world. Free gift with first order. Send 50¢. Refundable with first order. Skil-Crafts, Box 167-P, Joplin, Missouri.

WOOD Screws. Non-corrosive flat head aluminum assortment \$1.00. Flat head stainless assortment \$1.25. Postpaid in plastic box. Joart Specialty Co., Box 3007, Elmira, N.Y.

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SWIMMING Pool. Build yourself. Low cost. Illustrated plan, instructions. Free details. Technical Associates, 8040 N. 8th, Phoenix, Ariz.

FREE Check-list covering more than 500 classifications of projects, plans, instructions, service and repair information detailed in Popular Mechanics famous series of instructional booklets, books, patterns, and blueprints. List covers an extremely wide variety of do-it-yourself data on home remodeling, repair and improvement, hobbies, crafts, boating, games, lawn and garden, and hundreds of others. For your free copy of this helpful list, write: Service Bureau, Popular Mechanics, 575 Lexington Ave., New York 22, New York.

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HEAT Your home from your hot water tank. Thermostat controlled. It's quiet, safe, clean, healthful, economical, and easy to install. Complete installation plan and instructions \$2.00. Heart Heating Co. 3769 Promontory St., San Diego, 9 California.

MAKE Loose screws stay put. New packing holds screws in metal, plastic, wood, etc. Easy to apply. \$1.00 postpaid. Free sample. Striker Enterprises, 1107 Southport, Lisle, Ill.

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## OF INTEREST TO WOMEN

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LEARN Expert cake decorating, candy making. Free details on home instruction method. Candy & Cake, Dept. D-781, Fallbrook, Calif.

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HEAT Homes, cottages. Save dollars. New idea. Free information. Bonanzavilla, Rt. 1, Box 290, Manassas, Va.

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GOVERNMENT Ordnance wrist watches—used, as is. Waltham \$3.95; Elgin \$4.95; Bulova \$5.95. In good running order \$1.00 additional. While they last. Cash must accompany order. Joseph Bros., 5-P South Wabash, Chicago 3, Ill.

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HIGHEST Cash. Gold, jewelry, diamonds, silver, platinum. Mail articles. Free information. Chicago Gold & Precious Metals, 6 E. Monroe, Dept. 5358, Chicago 3.



**CASH** Immediately for old gold, jewelry, gold teeth, watches, diamonds, silverware, spectacles, platinum, mercury. Free information. Rose Industries, 29-A East Madison, Chicago 2.

**CASH** For gold scrap, rings, jewelry, dental gold. Free information, or send items now for cash airmailed immediately. King Ramsey, 1001 West 21st, Odessa 1, Texas.

**WATCHES** Lowest wholesale, free brochure. Davidson's, Box 3247, Phoebus, Va.

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**EXCITING** Adventure locating hidden loot, treasure, relics, etc., with powerful electronic M-scope locator. Lightweight. Guaranteed. Very easy terms. Send for free booklet, interesting customer reports. Fisher Research, Dept. AY, Palo Alto, Calif.

**TREASURE.** Find gold, silver, relics with super, powerful Detectron locators. Free information. Detectron, Dept. PM-8, San Gabriel, California.

"**TREASURE** Hunter's Bibliography", lists all known books, authors, publishers. Every enthusiast needs this reference: \$2.00. Shelby, Box 4266-E, Saticoy, California.

**GUARANTEED** Metal, treasure and water locator only \$3.00. Robbins-2, 57 Scott, San Francisco 17, Calif.

**EXPLORE** Underground, years ahead transistor Metrotech locators detect gold, silver, coins, relics. Information free. Underground Explorations, Dept. A, Box 793, Menlo Park, California.

**SUPERSENSITIVE** Transistor treasure finders. \$19.95 up. Kits available. Free catalog. Reiko, Box 10563, Houston 18, Texas.

**NEW** Coin locator! Free literature. Howe, 811-C Kansas, Atchison, Kansas.

**METAL** Locator kits and assembled models from \$39.90. Terms. Transistorized and underwater models available. Free catalog. Electronic Applications, Dept. M, Box 6095, Alexandria, Virginia.

**TREASURE.** Gold, silver, relics. Find them with new 1963 models. Free information. Raytron Box 715, North Hollywood, California.

## RAZORS

**GENUINE** German blades. Fit any double edged razor. Only \$2.95 per 100 prepaid. The Import Shop, 1502 Cherokee Place, Bartlesville, Oklahoma.

## PERSONAL

**INVESTIGATORS.** Free brochure, latest subminiature electronic listening devices. Ace Electronics, 11500-P NW 7th Ave., Miami 50, Florida.

**INVENTIONS** Wanted. Patented: unpatented. Tremendous manufacturers lists. Global Marketing Service, 2420 77th, Oakland 5, California.

**BIBLE** Questions answered. Stamped envelope. Bylon, 17167 Bentler, Detroit 19, Michigan.

**DEVELOP** Mind power, personality while asleep. Details free. Research Association, Box 24-N, Olympia, Washington.

**BORROW** \$100 to \$1000 by mail. Quick, easy, private. No co-signers. Repay in 24 small monthly payments. For the amount you want write today to Dial Finance Co., 410 Kilpatrick Bldg., Dept. 8-214, Omaha 2, Nebraska.

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**NEED** Money? Borrow \$100-\$1000 by mail. Confidential, repay in 24 months. Free loan application. Budget Finance Co., Dept. MB-173, 317 So. 20th, Omaha 2, Nebraska.

**WILLS!** 60 page booklet explains will-making, plus five blank will forms, complete only \$1.00. Standard, Box 1046, Santa Monica 11, California.

**LOANS** By mail, \$100-\$600. Anywhere. Confidential. Write Union Finance, Dept. PM, 323 E. Camelback, Phoenix, Arizona.

**PROFESSIONAL** Voice training at home. New scientific method. Quick positive results. Feuchtinger Voice Clinic, 6308 N. Lakewood Ave., Chicago 26.

## REMAILING SERVICE

**HOUSTON-NASA** Area. Prompt remails 25¢ single. \$3.00 monthly. Confidential receiving-forwarding. Tremaco, Box 5277-H, Houston 12, Texas.

**PARIS,** France reairmails \$1.00. 2 postcards \$1.00. Services Ltd., P.O. Box 369, St. Prest, France.

"**ECUADORIAN** Registered re-airmails \$1.00. Confidential and reliable. Leon, Box 360, Guayaquil, Ecuador, So. America."

**REMAIL** 30¢. Monthly \$3.00. Labrie, 3364 Station C, Ottawa 3, Canada.

**SECRET** Mail receiving system. Hedgpath, 406-M South Second, Alhambra, California-91802.

**CONFIDENTIAL** Remails 25¢ single, \$3.00 monthly. Box 4327, Tampa 7, Florida.

**WASHINGTON** Remails, 25¢, \$2.00 monthly. Confidential. Redick, Box 1082, Washington 13, D.C.

**MEXICO** Remails 35¢. Questions answered 25¢. D. H., 34 Resaca Blvd., Brownsville, Texas.

**REMAILS** 25¢, \$3.00 monthly. LAMA, 6017 S. 117 Pl. Seattle, 78.

**MEXICO:** Reliable services. Remailing \$3.00 monthly. Ramcke, Correo Chapalita, Guadalajara, Mexico.

**HAWAII** Secret address. Receiving-forwarding 25¢, \$3.00 monthly. Postcards. Coe, Box 984, Kailua, Hawaii.

**MIAMI BEACH** Remails 25¢: 5 for \$1.00. Monthly \$3.00. National, P.O. Box 678-A, Miami Beach 39, Florida.

**CONFIDENTIAL** New York City mail address \$3.00 month. Remails 25¢. Details free. Birnhan, 152 W. 42, New York City 36.

**LOS ANGELES.** Hollywood, San Fernando Valley—25¢ single; \$3.00 monthly. Confidential, 10437P Lanark, Sun Valley 3, California.

## WANTED—MISCELLANEOUS

**U.S. Coins.** Paying 15¢ each for Indian pennies, 1950 nickels, Lincoln cents dated 1931, 1932, 1933. 5¢ each penny dated 1909 through 1915, 1921 through 1924. Complete buying list 50¢. Coins, 3726 7th., Riverside 1, California.

**OLD** Auto catalogs, manuals, MoToR, ATJ magazines, auto mascots, Boyce motometers. Top prices paid. Sheldon Lewis, 154-62 71st Ave., Flushing 67, N.Y.

**QUICKSILVER.** Platinum, silver, gold. Ores analyzed. Wholesale Terminal, Norwood, Mass.

**STAMP** Collections, accumulations. Eagle Stamp Co., 2221 Romine, Pittsburgh 26, Penna.

## FOR SALE—MISCELLANEOUS

**CANNON** Fuse 3/32" diameter, waterproof. Burns under water, 10 ft., \$1.00; 25 ft. \$2.00; ppd. Will Zeller, Hudson, Mich.

**HEARING** Aid batteries wholesale. Free list. Habs, Box 51, York, Penna.

**USED** Industrial work clothes. Shirts 79¢. Pants 98¢. Coveralls \$1.49. Assorted colors, sterilized, laundered. Give size, color. Post paid. P.O. Box 502, Greenville, S. C.

**TEMPLE** Snugglers ends annoyance of slipping eye glasses. 75¢ for 3 sets. Klein Enterprises, 1902 Webster Rd., Orchard Pk., N.Y.

**AUSTRALIAN** Mulgawood souvenirs. Catalog and sample air mailed \$2.00. Phillips, Box 1393-K, G.P.O., Adelaide, South Australia.

## TOBACCO

**CIGARS.** Tobaccos. Save! Free list. Tobacconist, 220 N. Clark, Chicago 1.

## MISCELLANEOUS

**HEARING** Aids only \$28.95. Free trial, terms. Write: Cary-B-Sales, Inverness, Fla. Also small rooted shrubbery.

**ATTRACTIVE** Charcoal sketches made from your favorite photos. 11" x 14" each \$3.95. Satisfaction guaranteed. Free information. Val-art, P.O. Box 1205-SA, Harlingen, Texas.

**NEWSPAPER** Clippings, box tops, labels, wrappers, used books, magazines. Reasonable rates. Write: R. Costello, 639 W. 43rd Place, Chicago 9, Illinois.

**ALL-Purpose** permanent super-powered magnets. 1001 uses. Home, office, workshop, auto. Each magnet 3/4" x 1". Set of 4, 75¢. Lesters, Box 10, Franklin Square, N.Y.

**SEWER** Cleaning machines. Free literature. All Clear, 3040 Matthews Ave., Bronx 67, N. Y.

**N. J. Area** newspaper ad clip service. Jos. Koker, Bx. 121, Closter, N.J.

**FIVE** Original homespun poems. Clean. Not fifth. Send \$1.00. Wamack, 307 East 11th Street, Ashland, Ohio.

**SUPER** Memory overnight! Success guaranteed! Bijou, Box 1727-M, Hollywood 28, California.

**GRAB** Bag, fabulous item monthly, \$12 year. 6 months \$7. Myles, 18670 Ventura, Tarzana, California.

**CONTEMPLATING** California? Send \$1 cash to Orientation, Box 618, Los Altos, California, for helpful pamphlet by former Easterner.

**RECEIVE** Gifts, samples, magazines, catalogs, opportunities, 25¢. "Directory," Adkins, Texas.

**SIGNS:** Indoor or outdoor type. Aluminum, brass, bronze. Send for brochure. R. T. A. Service, Box 522, New York 8, N. Y.

**TROPICAL** Ceylon offering attractive gift parcels consisting beautiful rare curios, antimony, semi-precious stones, silverware, etc. Ten dollars upwards. Remittance only through banks. William Trading Company, Box 698, Colombo, Ceylon.

**LOANS** By mail, \$100-\$600. Anywhere. Confidential. Write Union Finance, Dept. PM, 323 E. Camelback, Phoenix, Arizona.

**FREE** Catalog—Gifts, novelties. Handy House, 214 Main, Hackensack, N. J.

**LONGHORNS.** Genuine Steer Horns. For mounting 4-6 foot spans. Longhorns, Laclede 10, Missouri.

**CESSPOOLS,** Septic tanks restored to newness by miracle crystal pellets. Free literature. Electric Sewer Cleaning Co., Allston 34, Mass.

**FREE** Wholesale catalog! 100,000 products. Tremendous discounts! Taylor Distributors, Newton 2, New Jersey.

**CIGARETTES**—Make 20 plain or filter tip for 9¢. Facts free. Moberly, Box 785, Owensboro, Kentucky.

**SEND** Us wool for blankets. Write Eldorado Woolens, Eldorado, Texas.

**BOOKS** On antiques and their prices. Free circular! P. Warman Publishers, Uniontown, Penna.

"**STAMMER, Stutter, No More.**" (Dr. Young.) Write: Gaucho, Box 9309-S7, Chicago 90.



## Ancient Waterworks

A water system built in ancient times by the Indians has been discovered on an island off the California coast. No date for the system has been determined, but Indians inhabited San Nicolas Island as early as 4000 years ago, radiocarbon dating indicates.

The ingenious water system, which may have supported 2000 people, was fed from a small spring percolating through a sandstone bluff. A series of channels, one 38 feet long, were dug out at the foot of the bluff to collect water seeping over a sandstone shelf. Peck marks indicate that the system was built with stone tools.

## Microbes May Test Drugs

Protozoa, a simple, single-celled organism, may make future drugs safer for man to use. Researchers have found that thalidomide, the drug which causes malformations in unborn babies, inhibits the growth of some protozoa. Thus, they think, these minute, cheaply produced organisms could be used to evaluate a drug's toxicity before trying it on higher species of animals.

No one knows why thalidomide causes malformations in babies, but if it has the same effect on man as it has on protozoa, the drug probably interferes with cellular oxidation at the beginning of life.

## Anemic Spacemen?

Our superbly conditioned astronauts might possibly return from long space voyages as anemic weaklings, NASA experiments suggest. The disability could result from lack of nitrogen in the voyagers' oxygen supply.

Tests conducted with a group of volunteers in simulated space conditions showed that the men developed anemia but otherwise remained healthy. The volunteers were exposed to pure oxygen in an altitude chamber during four two-week periods. The tendency to anemia, according to a Republic Aviation scientist, could represent "potentially serious or disabling" conditions on long space flights.

During the tests, four groups of volunteers put in a 10-hour day performing some 683 physiological and psychological tests; they were monitored around the clock by medical experts in space environment and the life sciences. Health and morale among the four groups remained high despite the development of anemia. Further studies of the effects of a pure oxygen atmosphere are necessary, the Republic scientist reported.

AUGUST 1963



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Mac's No. 13 Radiator Rust Inhibitor has no equal. It positively prevents rust in all automobile cooling systems ... mixes with any type of anti-freeze. And it keeps your cooling system clear for an entire year. Your service station man is ready to pour when you say when.

**MAC'S SUPER GLOSS CO., INC.**  
Los Angeles 42, Calif., Cincinnati 26, Ohio



## "Otter-torium" Shows Otters as Eaters

VISITORS to Florida's Weeki Wachee Springs are treated to a primitive wildlife hunting ritual by naturalist John Hamlet's feeding tank for otters.

Established as a display point for jungle cruise boats, the "otter-torium" is a large glass tank at the edge of an otter refuge. An electrically operated ferris wheel with

16 buckets of live fish is triggered into motion by a radio signal from an approaching boat. The wheel dumps a bucket of fish into a pipe running into the otter tank. Scentsing the fish, the otters dive into the tank just as the cruise boat arrives, and begin their hunt before the eyes of the tourists.



**NATURALIST** (top left) makes adjustment on radio-controlled ferris wheel that dumps fish into glass tank where otters feed (top right). The refuge (below) is on the bank of the Weeki Wachee river in Florida







## New aluminum engine enamel—now in a spray can

Here's another first from "Seymour of Sycamore," America's oldest spray paint manufacturer. Packaged in the familiar aerosol container, which they originated, it's the new engine enamel that has met with such enthusiasm and acceptance by users.

Seymour recommends this highly heat-resistant aluminum engine enamel for all surfaces except the exhaust manifold. Made with Alcoa® Pigments, it's a genuine enamel, according to Seymour, not a lacquer. Users say it dries in 10 minutes, dust free. Now you can dress up the power plant without the usual muss and splatter.

Today, spray aluminum is standard equipment in thousands of home workshops. It's available in several types—including colors. Aluminum paint is durable; a tough film of metal resists wear, cuts the maintenance nuisance. It has great hiding power: one coat covers soiled or stained surfaces (aluminum pigment is opaque).

*Alcoa does not make aluminum paint, but Alcoa Pigments are used in the best brands. Available in either spray cans or conventional containers, brands like Seymour's are at dealers everywhere. Send for our booklet.*

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1705-H Alcoa Building, Pittsburgh 19, Pa.

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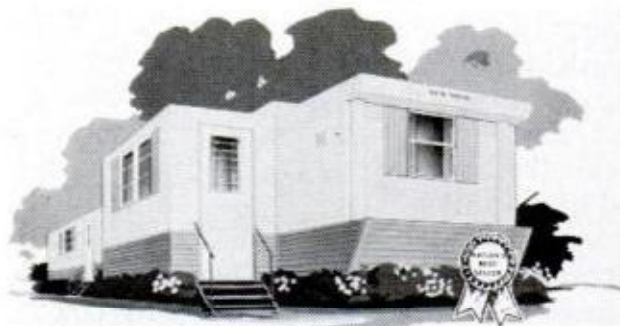
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# Sub Rescues-Four Miles Deep

*Stunned by the Thresher disaster, the Navy is rushing to develop a family of buglike vessels that will snatch men from death under the sea*

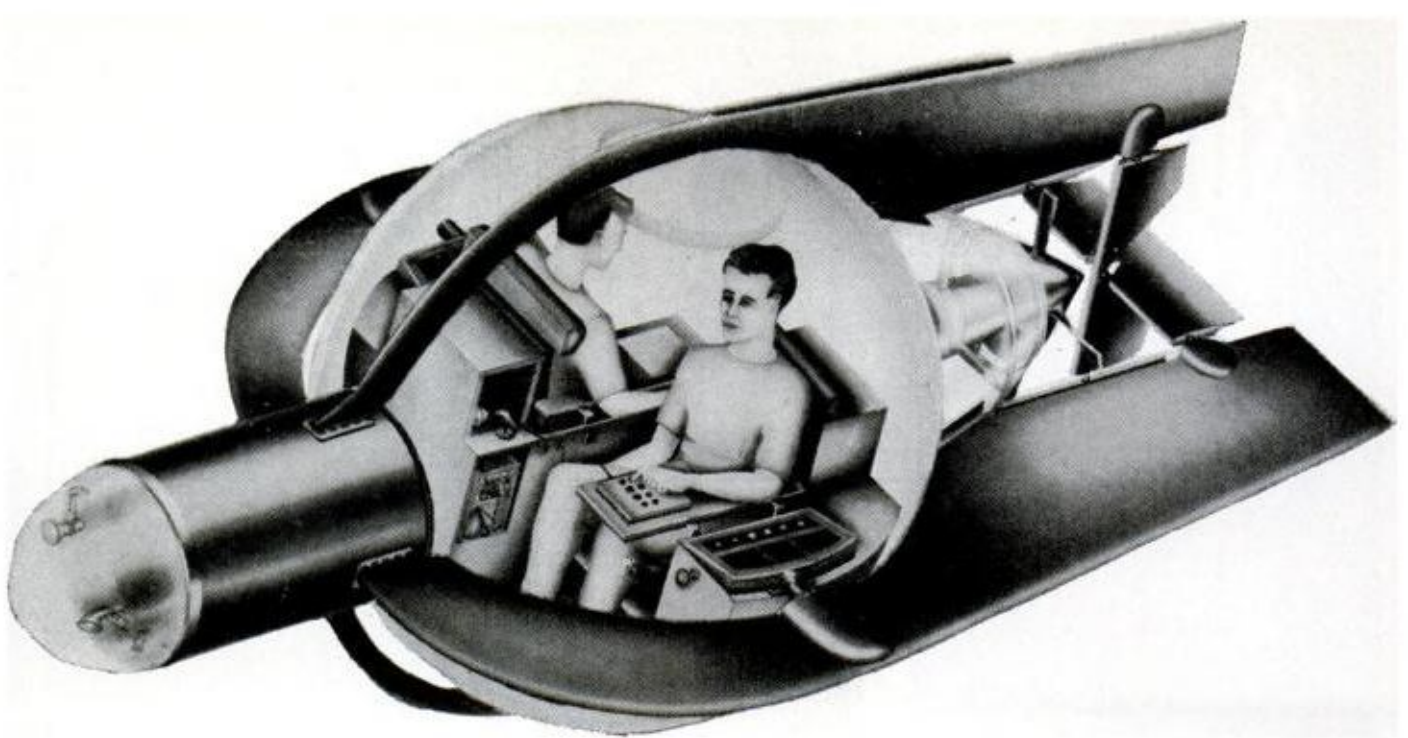


By S. David Pursglove

**O**VER THE NEXT FIVE YEARS, the U.S. Navy will build a fleet of the weirdest looking vessels ever imagined. Experimental models of eerie, crablike metal and plastic monsters are even now far beyond the drawing board stage. They are as unlike conventional surface vessels as space craft are unlike ordinary aircraft.

Their mission will be to probe the abysses of the deepest ocean floors. And they will attempt to answer two of the Navy's toughest problems: How to rescue men from a stricken submarine beyond present rescue range of 1300 feet *and* how to raise a crippled sub from





**PLEXIGLASS SPHERES** for deep-diving research submarines are now undergoing tests by Naval Ordnance. They would give full visibility down to 2000 feet

any depth, especially if it carries Polaris nuclear warheads. Future subs are expected to operate below 20,000 feet.

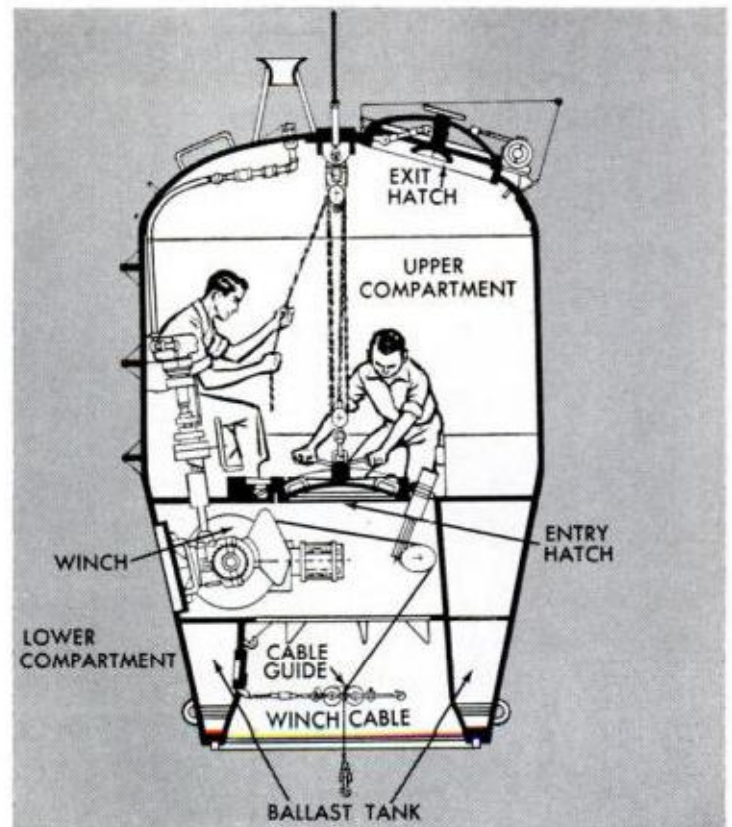
It took the USS *Thresher's* 129 officers, enlisted men and civilians lying dead on the Atlantic floor to jolt the Navy into resuming research on the art of rescuing sub-

marine crews and salvaging sunken hulls.

Two weeks after the *Thresher* disappeared in 8400 feet of water, Navy Secretary Fred Korth ordered Rear Adm. Edward C. Stephan, the Navy's chief oceanographer, to form a committee to look at America's present sub rescue and

**STEINKE HOOD** permits submariners to breathe while popping rapidly to the surface in a "blow and go" escape; it also blocks cold water from their eardrums

**McCANN RESCUE CHAMBER**, which will hold nine men and two operators in its upper compartment, is winched down to a disabled sub's escape hatch



POPULAR MECHANICS







chores as retrieving missiles and nose cones from space craft.

Present diving capabilities of our nuclear subs are still classified information. Nobody knows at what depth the *Thresher* was crushed by underwater pressure. Her sister ship, the new USS *Jack*, will dive deeper than any other submarine in the world, according to the Navy. But it's safe to say that it won't go anywhere near the depths planned for the next generation of submarines. These, says the Navy, will lurk 20,000 feet beneath the surface.

The U.S. has never built any kind of vessel that could reach a crippled sub at 20,000 feet. The European-built bathyscaph *Trieste*, now owned by the U.S., has been to 35,800 feet. But *Trieste* can only descend and look. It cannot rescue men, nor can it salvage a submarine. It has been called a "good deep-sea yo-yo." Once down it can maneuver very little, and it cannot oper-

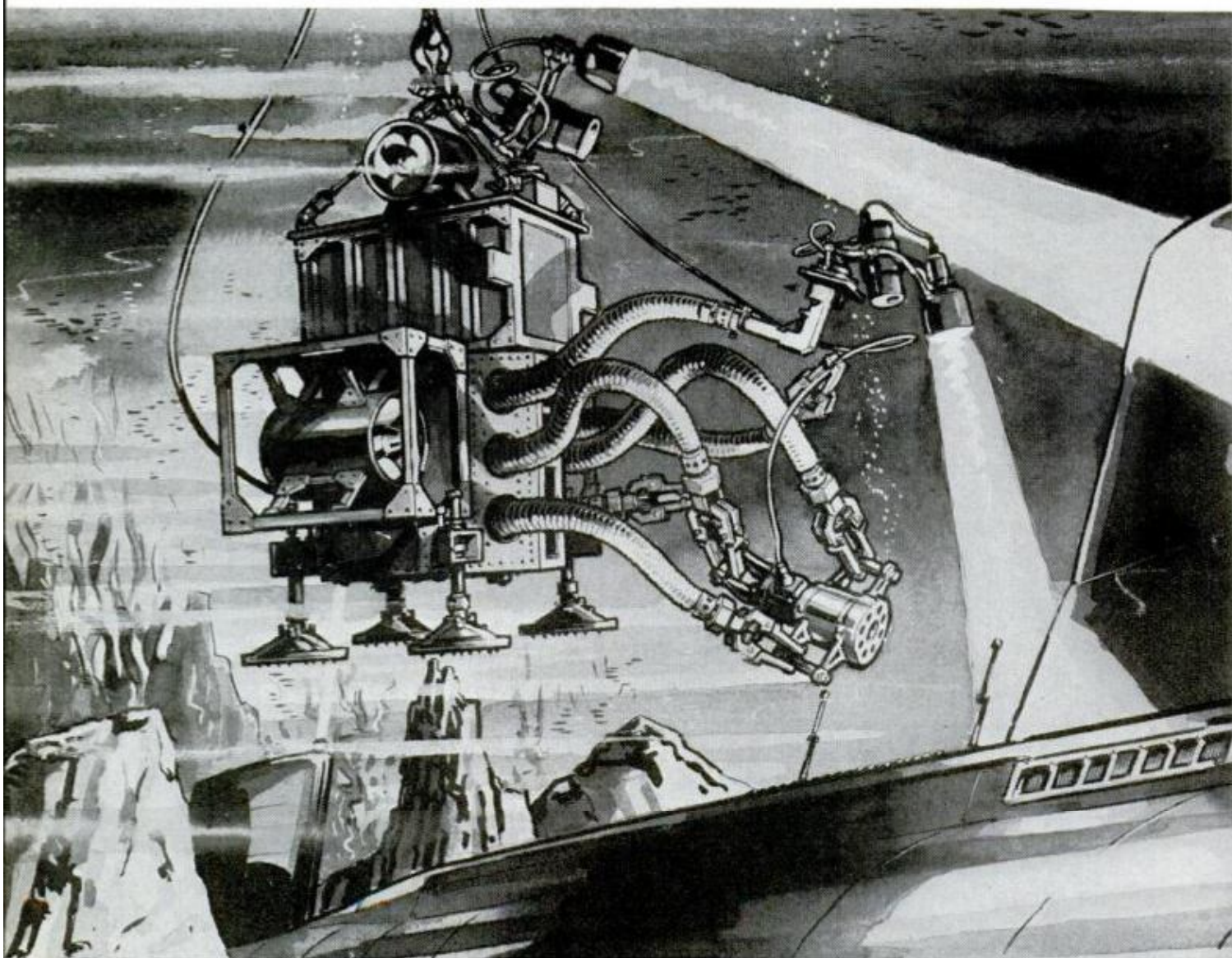
ate effectively in a current of more than one mile per hour.

Mare Island Naval Shipyard is now putting the finishing touches on a new bathyscaph float that will have a two-to-three-mile lateral range on the ocean floor. A two-man sphere will have a four-inch diameter viewing port, and it will also transmit TV pictures to the surface. Two mechanical arms will be able to pick up objects from the ocean floor and deposit them in an outboard basket. For shallow and intermediate depths it will use a lightweight chamber, but for deep-sea areas it will use the six-inch-thick steel sphere cut from the *Trieste*.

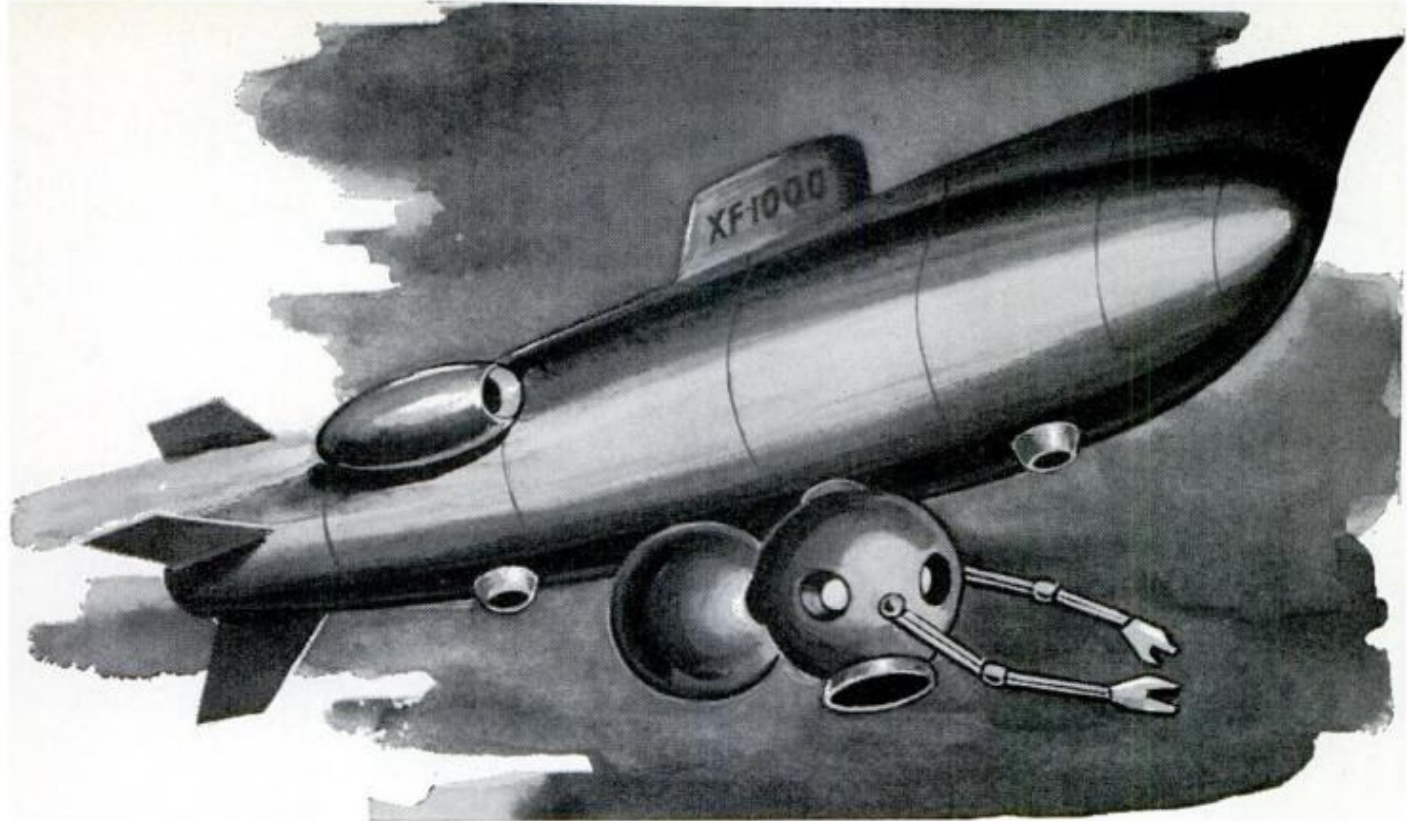
But even this 'scaph will not have a rescue capability. That will have to wait until a deep-diving rescue vehicle now being studied by the Navy comes off the ways. This craft will be a cross between

[\(Please turn to page 202\)](#)

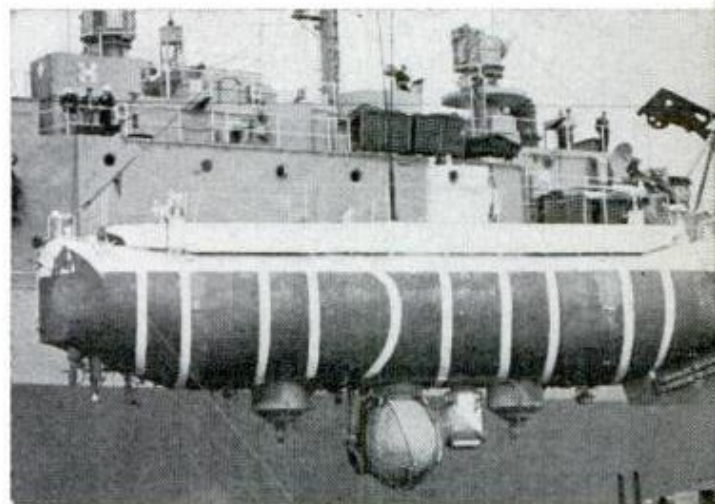
**MOBOT V**, the undersea oil-well robot, could probably be used in sub-rescue work. It is surface-controlled, has motorized arms, is fairly maneuverable







**PROPOSED DEEP-SEA RESCUE** vessel is similar to *Trieste* but more useful. It has mechanical arms for attaching salvage cables, a sphere for personnel

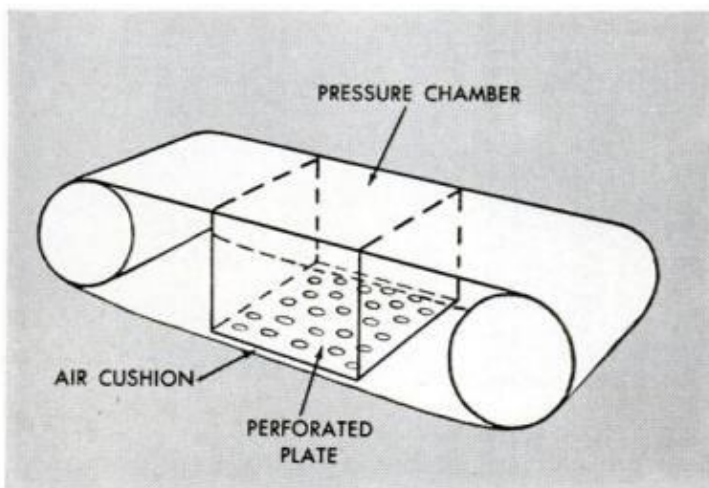
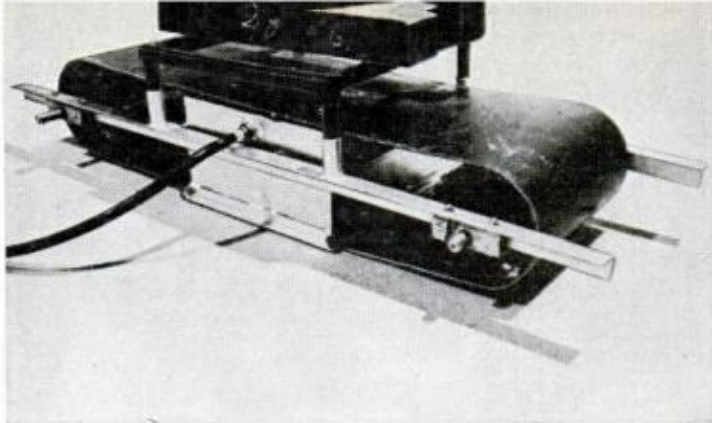


**THE TRIESTE** can only descend and look; it can't rescue men or salvage a sunken submarine. Built in Europe but owned by the U.S. Navy, it has been down to 35,800 feet

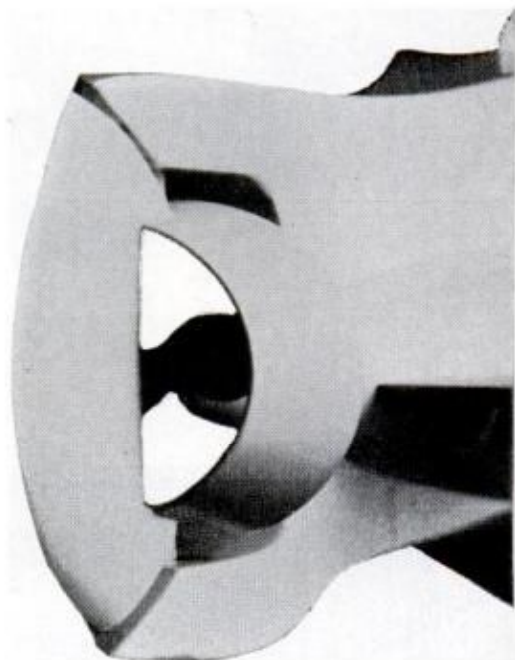
**SUB-RESCUE SHIP**, the *Florikan* (ASR 9), has a McCann Rescue Chamber near the stern and positioning buoys amidships; these are anchored around sunken submarines







**USE OF AN AIR CUSHION** to support a crawler tractor's load makes the tractor cheaper to build and easier to maintain, says the inventor of Air Track. Dr. William Bertelsen, Neponset, Ill., reports that a model (above) supports 500 pounds with an air pressure of 10 p.s.i. Air from the chamber forms a cushion between track and load; a full-size machine would generate its own air and provide its own propulsion.



**ELEVEN-INCH TV** is truly portable. The 12 $\frac{3}{4}$ -pound set operates off house current and uses standard vacuum tubes. It's designed by General Electric to fit into the bookcase. Measuring only 10 $\frac{3}{8}$  by 14 by 9 $\frac{7}{8}$  inches, it has a 60-square-inch screen. Price is \$99.95.

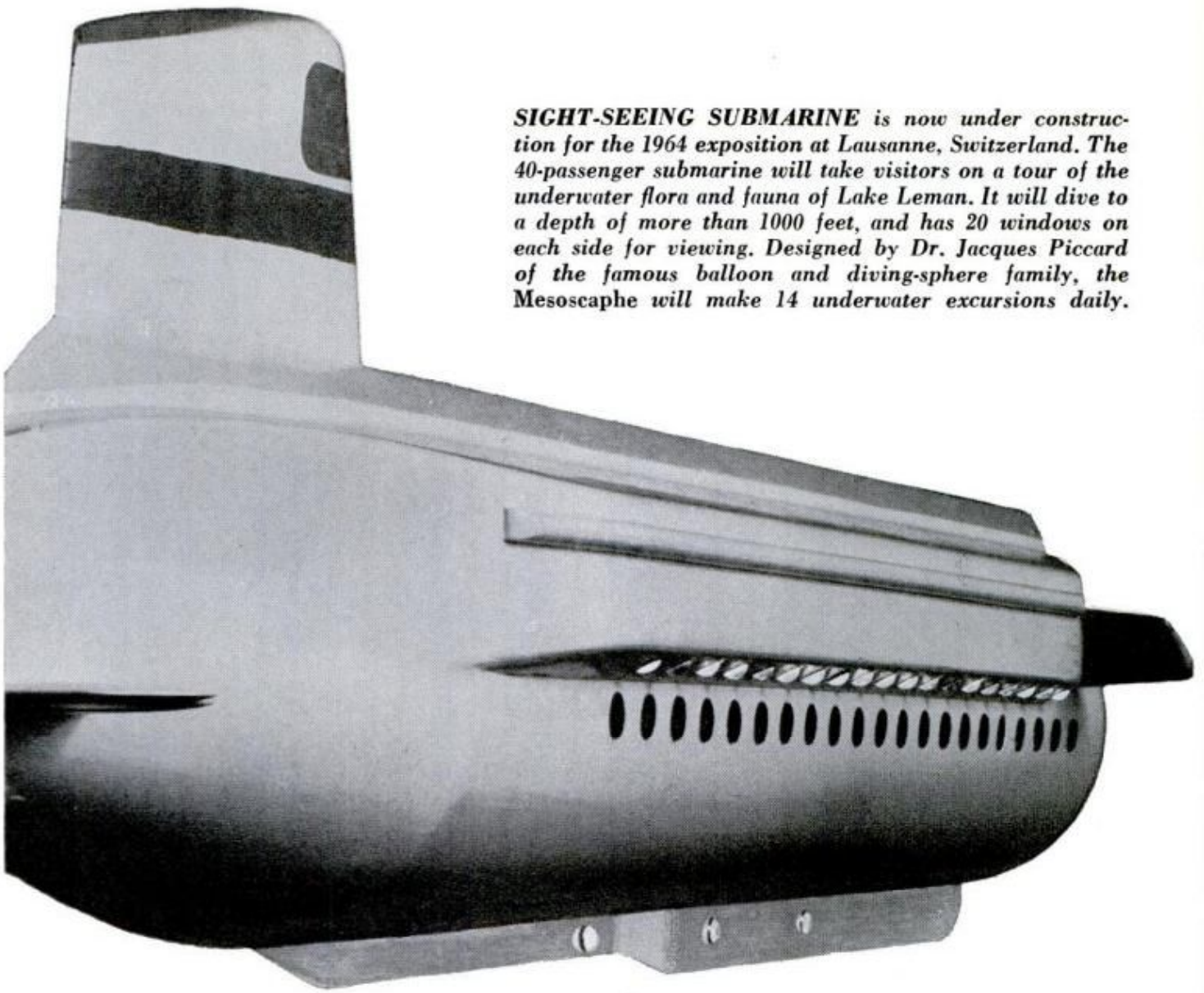


**RAMBLING WRECK.** Now used as a trainer for antisubmarine air crews, the fuselage of a Grumman Tracker is actually the reclaimed portion of a plane that crashed.

Its cockpit and electronic equipment was still in good condition so it was refurbished, installed on a roof near a classroom, and rigged with equipment that projects mock maps and targets on a radar screen so the trainees can fly simulated missions.



**SIGHT-SEEING SUBMARINE** is now under construction for the 1964 exposition at Lausanne, Switzerland. The 40-passenger submarine will take visitors on a tour of the underwater flora and fauna of Lake Lemman. It will dive to a depth of more than 1000 feet, and has 20 windows on each side for viewing. Designed by Dr. Jacques Piccard of the famous balloon and diving-sphere family, the Mesoscapha will make 14 underwater excursions daily.

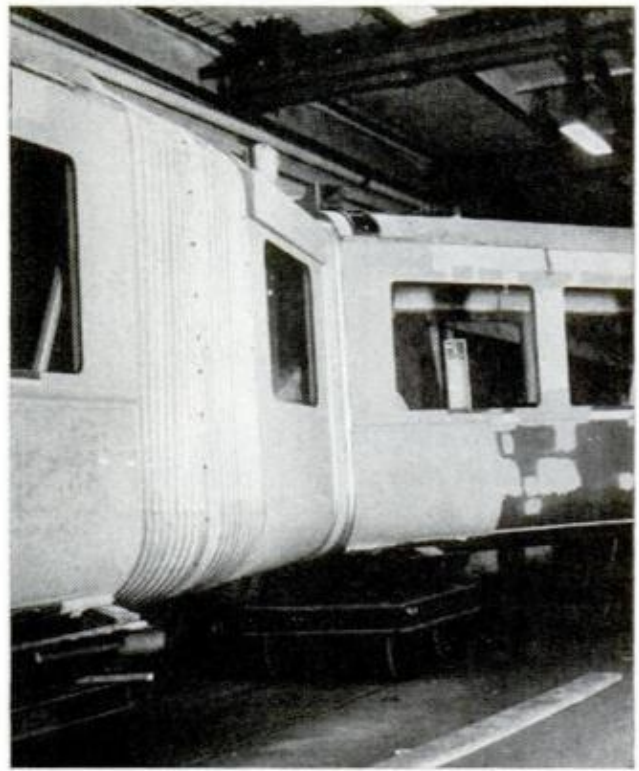


AUGUST 1963



75





### West Germans Add Accordion Pleats to Rail Car

Passenger cars for a suspension rail line between two West German cities are being built in three sections. The center "turntable" section enables the elongated new

car to negotiate sharp turnarounds.

A prototype for the air-conditioned, 195-passenger cars was made from sections of conventional suspended rail cars.

### Small Four-Place Helicopter Has Tandem Rotors

Built to bridge the gap between small two-place helicopters and the larger four-place helicopters, the new Jovair 4 is said to be the only small machine with tandem

twin rotors. It seats four, and each passenger has a door. Its controls can be adjusted to duplicate the feel of the large tandem-rotor controls on the larger helicopters.





*Weary of wild guesses? Here's a factual preview of*

## *What You'll Find In the '64 Cars*



1964 COMET will have same wheelbase but this completely new skin with bladelike front fender tips suggests the familiar Lincoln theme

**S**OMETIMES you can't tell good rumors from bum rumors without an up-to-date score card.

Let's take the good rumors first. Yes, the 1964 cars will have fewer unitized bodies and fewer aluminum engines. Yes, the four cylinder engine is dying off, and more oomph will be put into bigger (but not necessarily the hottest) engines. Yes, many cars will grow in length, and some long-needed improvements in transmissions have been made.

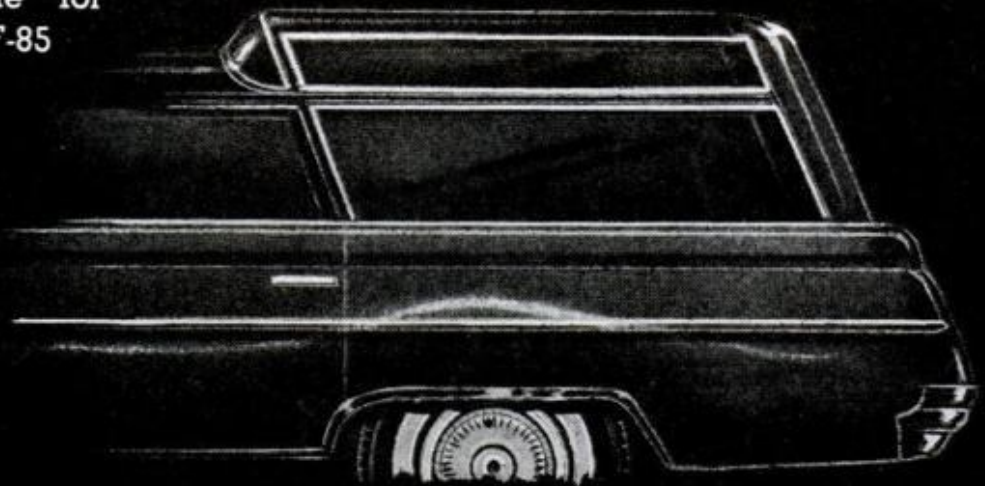
Chevrolet will add a between-size, new 115-inch wheelbase car with a new V8 engine to power it. And that "vista-cruiser" roofline for Buick Special wagons will indeed be a sight for sore eyes.

And the bum rumors, which ones are they? Well, despite what you may have read elsewhere, Chrysler



The new car sketches on these and the following pages show basic changes you can expect to see on many of the 1964 cars. Don't expect the sketch details to be hairline precise. Trim can be altered or a final choice of brightwork between two competing configurations can be made even as this is being written. But the essential changes are here and detailed information about them is given in the accompanying text.

WAGON "Vista-Dome" for Buick Special (Olds F-85 may also have it)



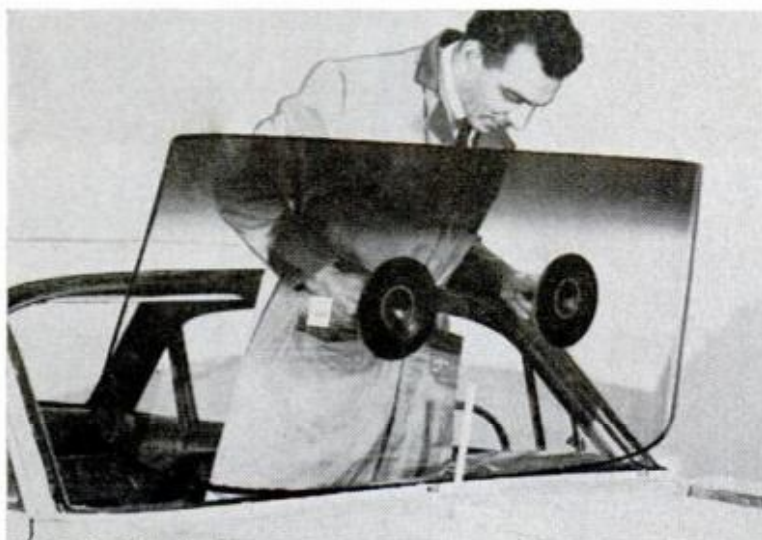
Corporation lines *will not* abandon torsion bars. Chevrolet *will not* drop the Corvair. Buick *will not* have a convertible model of the Riviera. And Ford *will not* bring out the lightweight sports Mustang to compete with Corvette's Sting Ray. At least, not in 1964, Ford people insist.

We do not, by the way, know the name of the new mid-size Chevrolet, and the only guess we'll make concerning it is

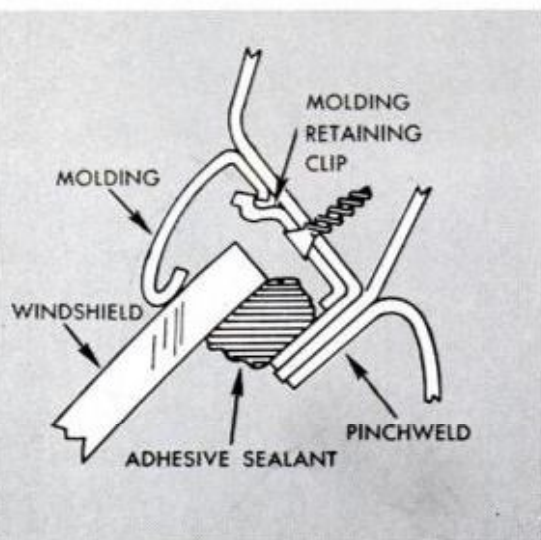
that none of the names you've seen so far are correct. The people at Chevrolet delight in fooling the name guessers.

From reports we've received, we doubt if any of the 1964 styles will really startle you. The bread-and-butter lines of the Big Three will show that same take-no-chances-blend of styling themes borrowed from each other that has been the trend for the last several years.

**GLUING WINDSHIELDS** in place with Thiokol polysulphide, instead of the old rubber gasket-and-glass method, will be commonplace on many 1964 models. It saves about \$8 per car, may reduce number of strain breaks and water leaks

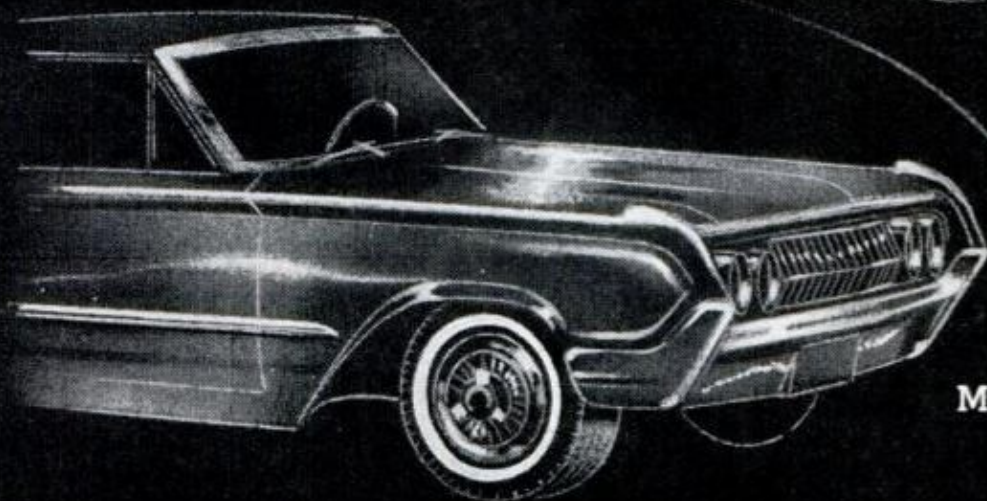


Kent Industries, Inc.





**CHEVROLET** may have contrasting side panel, more headlight framing emphasis

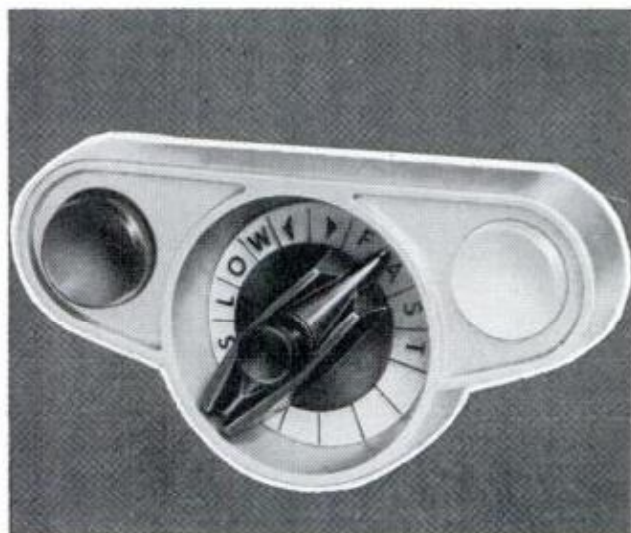


**MERCURY** will sport a prowlike front with fishhook bumpers à la 1963 T-Bird

Here and there, though, there will be some pleasant innovations in styling. The Studebaker Avanti's new grille, for example, will eliminate the old Avanti's armored-car approach. The new Rambler American is reported to be a masterpiece of miniaturizing the Rambler Classic. But more on that later.

Those who've seen the new Thunderbird say that the old banana contours are gone

**EXPECT** a pod-type drive control speedminder such as this to be available as an option on the 1964 Thunderbird and perhaps also on the Ford Galaxie



and in their place are squarer corners and sharper edges reminiscent of the 1958-60 models. And there's a nice rear-end treatment which has bumpers framing rectangular tail lamps looking a lot like Ben Franklin spectacles.

Chrysler's Imperial is also reported to be more pleasurable to behold. Designer Elwood Engle has come up with a fine blend of rectangles crisply reminiscent of the Lincoln, which Engle also designed. The jutting fender extensions are gone, however, along with Imperial's "ill-at-ease" separately mounted headlights. But Engle couldn't resist adding a dummy tire-mount bulge in the rear deck, a little flatter on top but otherwise like the old Lincoln Continental.

And now, suppose we focus down on a car-by-car comparison of the changes in store for '64.

**CHEVROLET.** Because General Motors is reverting in 1964 to the old A,B,C, body shell game of making several cars use the same basic body, the new 115-inch wheel-base Chevrolet will share body, frame and suspension components with the BOP compacts—Buick Special, Olds F-85 and Pontiac Tempest. Of course, there will be





**STUDEBAKER** will use new chambered pipe exhaust system (shown above behind a conventional exhaust). The new pipes eliminate need for large muffler by distributing silencing chamber bumps over length of pipe. Idea is for gas pressure to go through, sound waves to be trapped. Should be less costly and take less space underneath

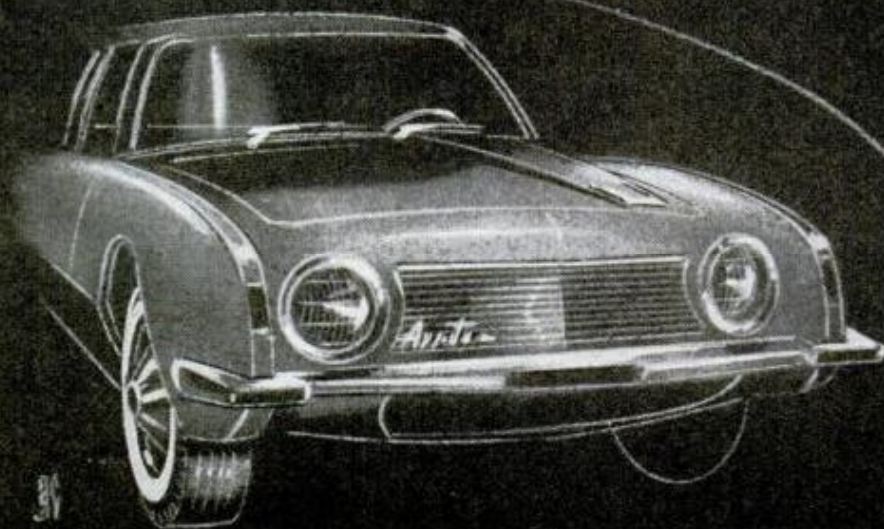
different grilles and front and rear quarter panels for each of the four cars, just as there are among the current BOP compacts which have been sharing their frames and suspensions. The 115-inch wheelbase of the new Chevrolet will fit nicely between the 110-inch wheelbase of the Chevy II and the 119-inch wheelbase of the large Chevrolet.

The new V8 developed for Chevrolet's new car will have about 260 cubic inches of displacement and weigh 84 pounds less than the current small Chevrolet engine known as the "283". The lighter weight makes sense in a smaller car, as proper weight distribution is being jeopardized by too much heavy iron up front in some of the new performance compacts.

**DODGE** will have more squared-off body lines on same 119-inch wheelbase



**STUDEBAKER AVANTI** will acquire a grille





Chevy II will share the new engine, and this not only will spread production costs over a broader base, but give both of them a more potent competitive weapon against the lightweight V8 Ford brought out in mid-1963 for its Fairlane and the peppier Falcon series. Ford's new V8 is currently accounting for 30 percent of Ford Motor Co.'s engine production.

Out of the Chevrolet lineup goes the 90-hp. four-cylinder engine designed for Chevy II, at a time when fuel economy seemed to be an appealing theme in the marketplace. This four-cylinder engine, which currently goes on only one percent of Chevrolet production, will not be completely interred, however. Chevrolet will ship the tooling for it to their new assembly plant in Argentina,

Chevy II styling will change little, with a reorganization of grille and trim doing the job of helping Junior to spot the new model easily. Larger Chevrolets may get the same surface redo with greater trim emphasis around headlights and a contrasting side band on at least one model.

Corvair will show more appearance change than it has shown since it came out in 1960, but the basic body shell will remain the same. A power boost, supposed

to be less costly and more practical than the turbocharger, is rumored for the Corvair Monza.

Corvette Sting Ray's sales volume of around 18,000 in 1963 is high enough to warrant a switch from slow-production fiberglass to steel for the body, but they won't do it for the 1964 model year. Why should they? The body shell was all new this year and is selling handsomely, so only enough trim changes to identify the new model will be made.

Chevrolet will be in the engine business for sure in 1964, because Pontiac Tempest is dropping its "half-eight" four-cylinder engine in favor of a much modified version of Chevrolet's, 140 hp. 230-cu. in. Six. This engine is reported to have a single, overhead camshaft to simplify valve operation and give potentially greater power.

The camshaft has a unique belt drive which uses a synthetic rubber belt built on steel wire cord—a type of belt used for similar non-slip work in industrial power transmission applications.

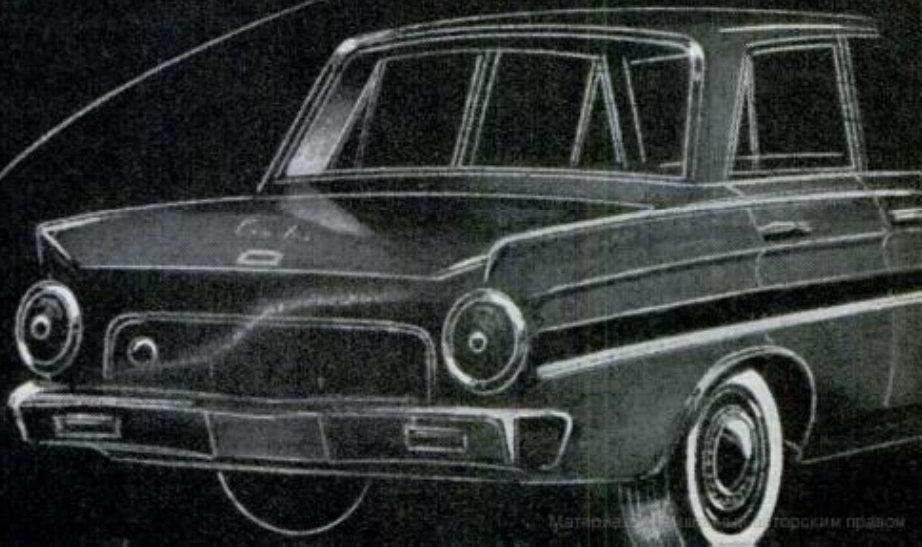
**PONTIAC, OLDSMOBILE, BUICK.** Biggest changes at GM outside of Chevrolet are the Pontiac Tempest, Olds F-85 and Buick Special. All will get new sep-

[\(Please turn to page 198\)](#)



**CHRYSLER'S IMPERIAL**  
will have a strong  
Continental flavor

**FORD'S FALCON**  
will be sculptured  
like Ford Cortina  
for a longer look

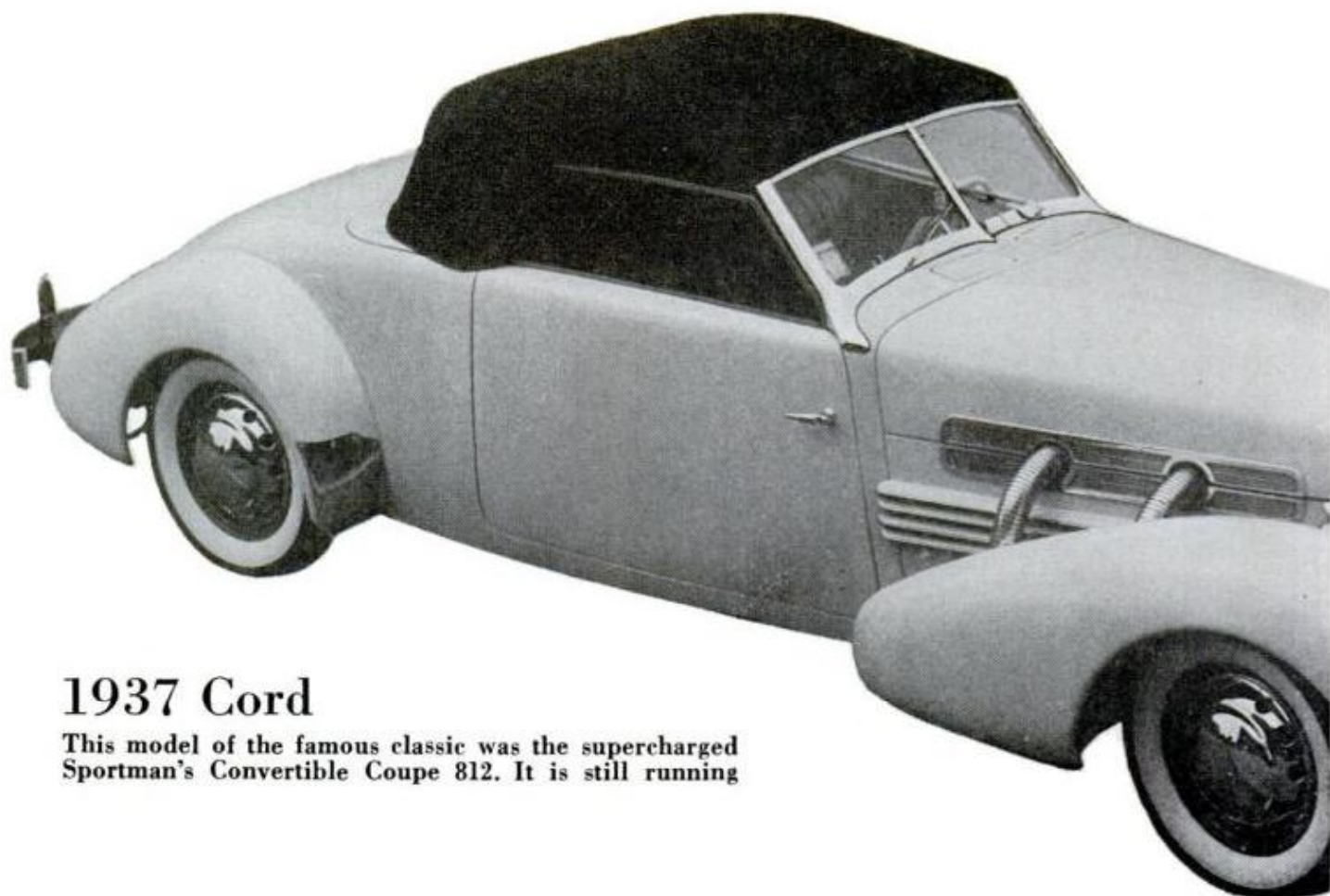
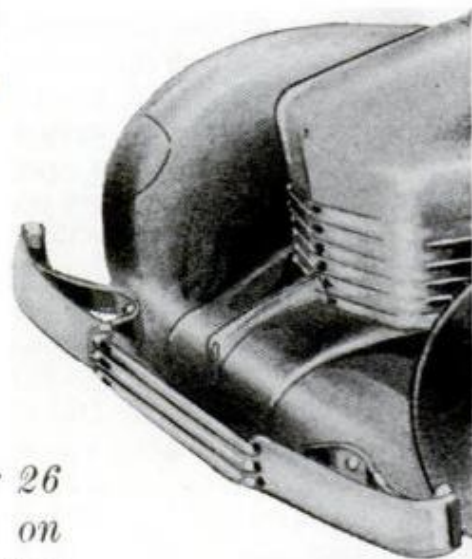




# RETURN OF THE CLASSIC *Cord*

*You haven't been able to buy a new Cord for 26 years. Next year you will. Here are details on how it will compare with its classic forebears*

**By Harris Edward Dark**



## **1937 Cord**

**This model of the famous classic was the supercharged Sportman's Convertible Coupe 812. It is still running**





## 1964 Cord Sportsman

Next year's Cord will have the same classic lines as the original, but it will be on a 25 percent smaller wheelbase

**I**T ISN'T EASY to resurrect a legend, but there are still men who will try it, thanks be.

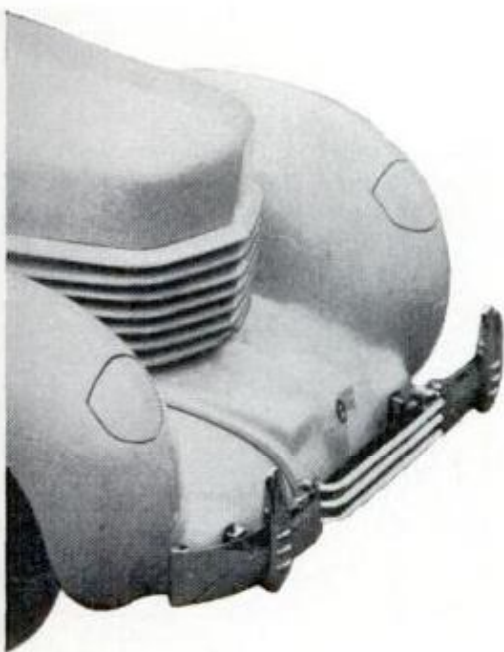
One of them is Glenn Pray, president of the Auburn-Cord-Duesenberg Company of Tulsa, Oklahoma. And the legend he is breathing fresh life into is that of the famous Cord car of the 1930s—the one with the classic lines and such pleasant innovations for its day as front-wheel drive and fold-out headlights.

Over 3000 of these Cords were made in the Thirties and two-thirds of them are still in operation today, lovingly cared for by one of the most dedicated group of owner-fans any old car ever had. Glenn Pray knows this well. At one time, he personally owned 13 old Cords and, long before he purchased the Auburn-Cord-Duesenberg Company, he had decided that the old Cord was the greatest car ever made.

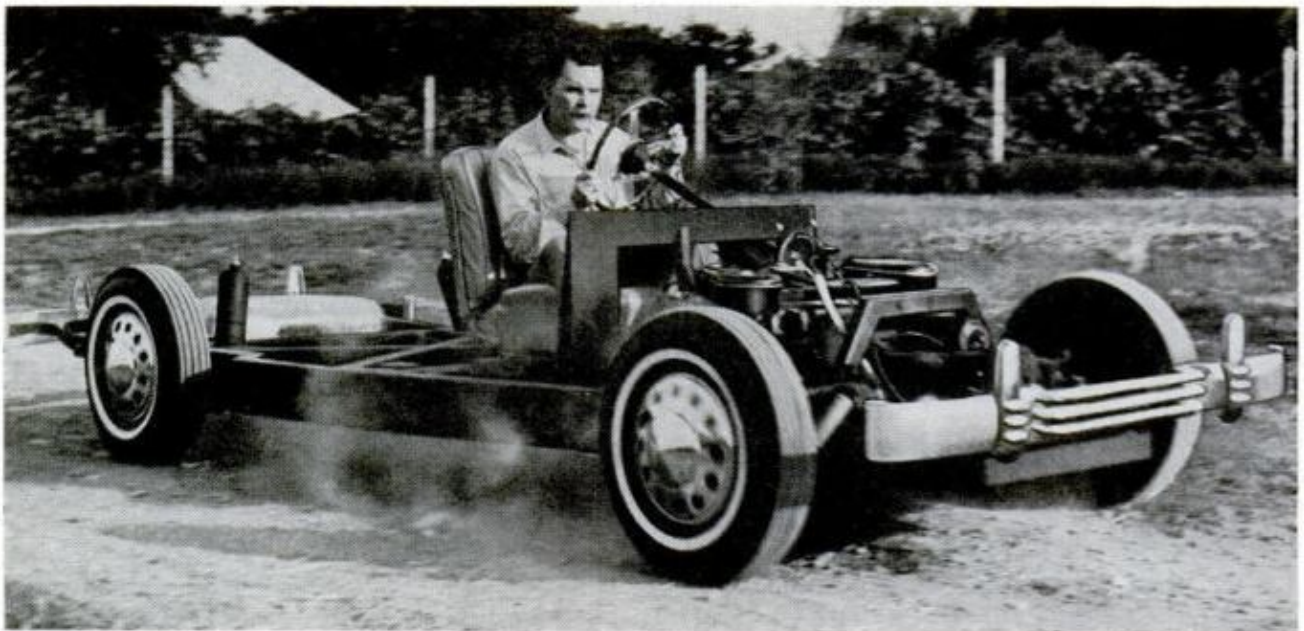
Small wonder, then, that Pray is planning to bring out a 1964 model of the Cord, to be called the Cord Sportsman 8/10.

I was the third person to drive the first stripped prototype of this 1964 car, the first 100 of which are scheduled for delivery to customers by March, 1964.

Keep in mind that the 1964 Cord 8/10 will not be a carbon copy of its forebear, the 1937 Cord 810. True, nearly all the old, great contours are there. You can recognize the rectangular hood and handsome wrap-around louver lines from the prize-winning old-timer designed by Gordon Miller Buehrig, now a senior







**AUTHOR DARK TRYING** out 1964 Cord chassis-engine prototype near Tulsa. Front-wheel drive gave good control over fast cornering runs on this gravel

design engineer with the Body Structures Department of Ford Motor Company's Engineering Research Staff.

You're also likely to do a double-take when you see the retractable headlights. Or the windshield made of two flat pieces set back at a rakish 45-degree angle. It still spells motion, even at a stop sign.

If you have a good memory for profiles, though, you'll notice that the rear quarter panel on the new Cord has been shortened, and the rear axle has been brought forward almost to the plane of the rear glass. The result is a wheelbase on the 1964 Cord which is only 100 inches, or exactly eight-tenths the 125-inch wheelbase of the 1936 Cord 810. Hence the model designation 8/10 for the new Cord, whose width remains almost the same, but whose height, length and body lines are scaled

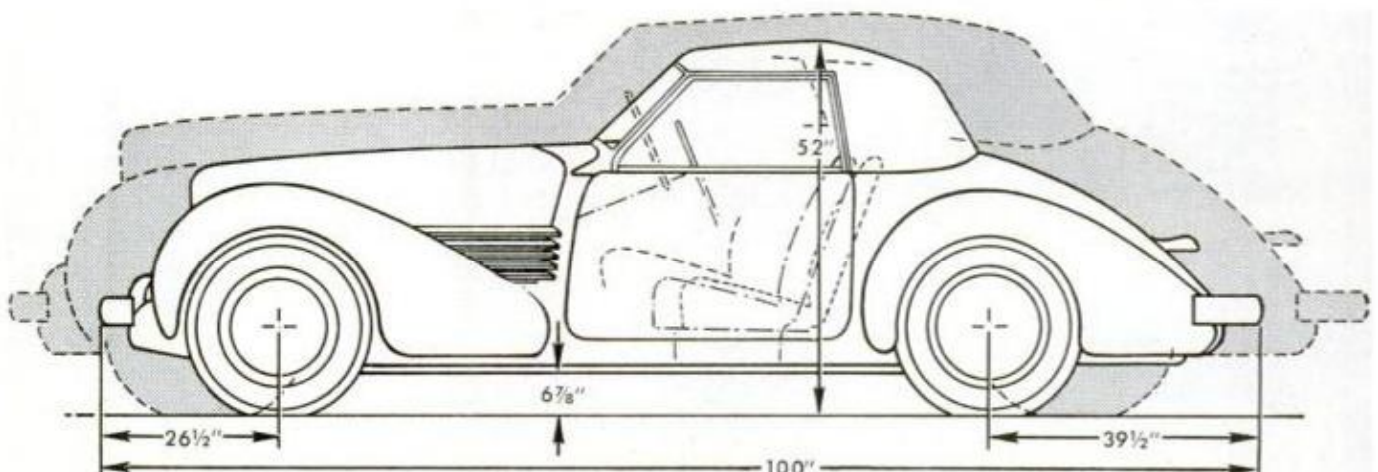
down accordingly to match the smaller wheelbase of the new model.

#### Cornering the New Cord

Front-wheel drive—so prized by old Cord fans—will still be featured on the new Cord, however. And I got the message on what it will mean to new Cord owners from the chassis prototype which I drove. Granted, a prototype drive is not the best way to test a car. For one thing, gravel from country roads can clobber you when you have no fenders. But the ability of this Cord prototype to pull its way around on fast cornering and to work its way out of spins on gravel roads was testimony enough to the value of its front-wheel drive. It should have no trouble matching the reputation of the old Cord 810 as a car

[\(Please turn to page 204\)](#)

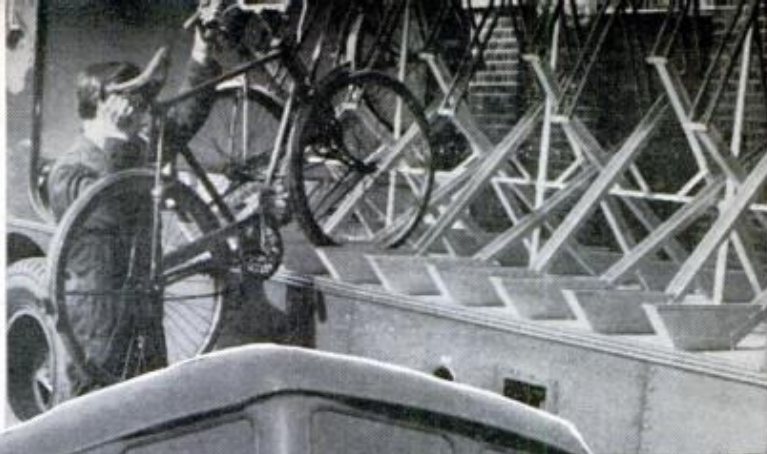
**PLOTTING** the new Cord against the outlines of an old Cord. The new model will be smaller and nimbler, with less overhang and less unsprung weight





## Buses Built for Bicycles

Designed to keep cyclists out of mile-long Dartford Tunnel near London, five double-deck buses will operate a shuttle service through the tunnel. The bus has a bottom section as storage for 30 bikes, and the cyclists will ride in the top of the bus. The service begins late this year.



## Kit for Emergency Living

Operating entirely on LP gas, an "existence kit" contains a thermoelectric generator for lights, radio, television, stove and heater. Assembled by the LP Gas Council, the kit costs about \$1000.



## Adjustable Lawn Sprinkler

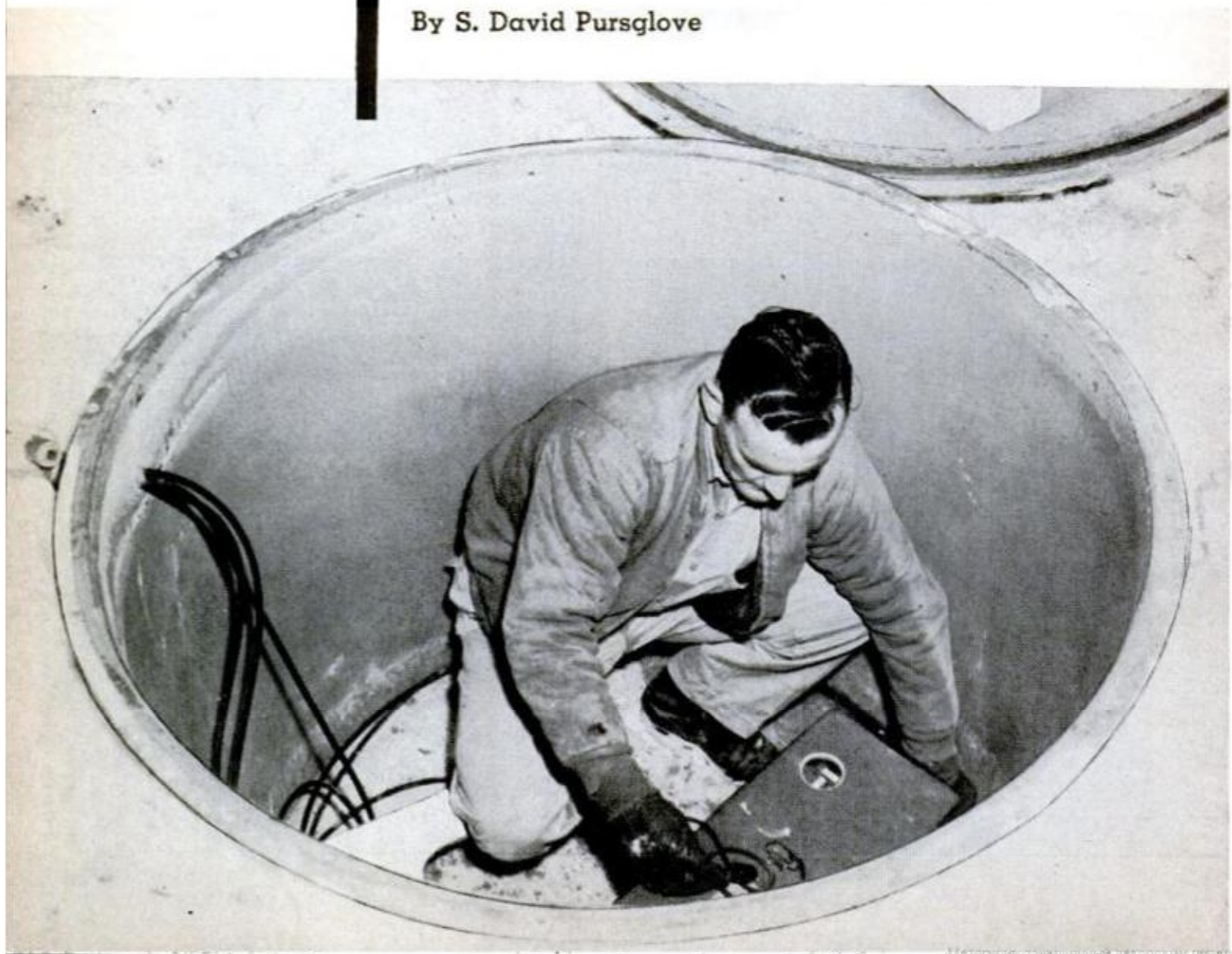
Water pressure on adjustable jet nozzles supplies rotary action for Sky Jet lawn sprinkler. Made by Nelson Mfg. Co., Peoria, Ill., a five-place dial gives it a wide variety in sprinkling patterns.



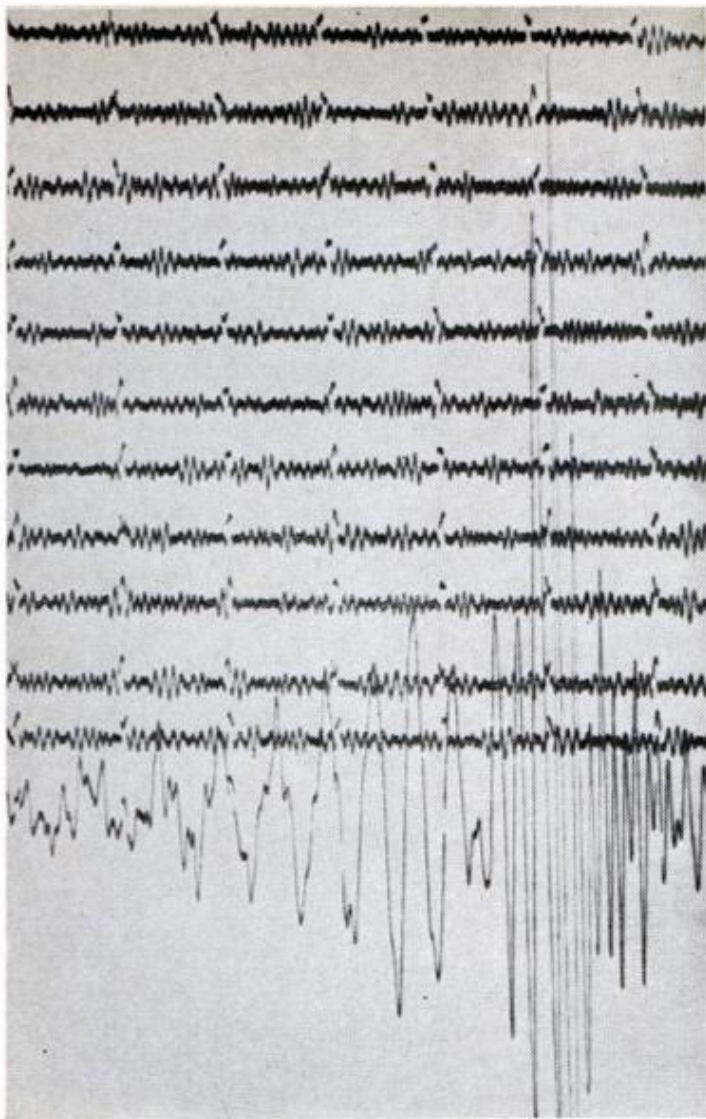
# The Riddle of the BLACK BOXES

*Can nuclear bomb tests ever be effectively policed? Will the so-called "black boxes" the diplomats argue about work and, if so, how well?*

By S. David Pursglove







**BIG BLAST** of the Reds' 57-megaton Arctic test in 1962 showed up on seismogram, above, as giant squiggle so violent that the scribed curve went completely wild at the end of the stylus recording strip

**SEISMOGRAPH CELLS** at manned sites like Cumberland Plateau Observatory, left, monitor nuclear blasts and earthquakes all over the world. Below, vertical level is adjusted in a vault at Uinta



**B**URIED in a shallow hole near the edge of the Fort Sill Military Reservation in Oklahoma is a small metal box about the size and shape of a home freezer chest. Few people have ever seen it because its presence has been a secret. In the box are batteries, fuses and an amplifier. There is also a seismometer that detects the faint tremors that travel thousands of miles through the earth from the scene of an earthquake—or an underground nuclear weapons test.

This small chest is the original "black box." It was built under the \$120,000,000 "Vela-Uniform" research program that took off five years ago when American scientists estimated that it would take as many as 25 manned seismic stations on Russian soil to make certain no nuclear blasts went undetected. Since that time, a number of things have happened. Recently, experts at the U.S. Arms Control and Disarmament Agency indicated that as few as seven unmanned stations inside Russia could enforce a test ban treaty!

The obvious question is: Why do we need only seven now? Have our detection devices improved by a factor of three or more in that short time?

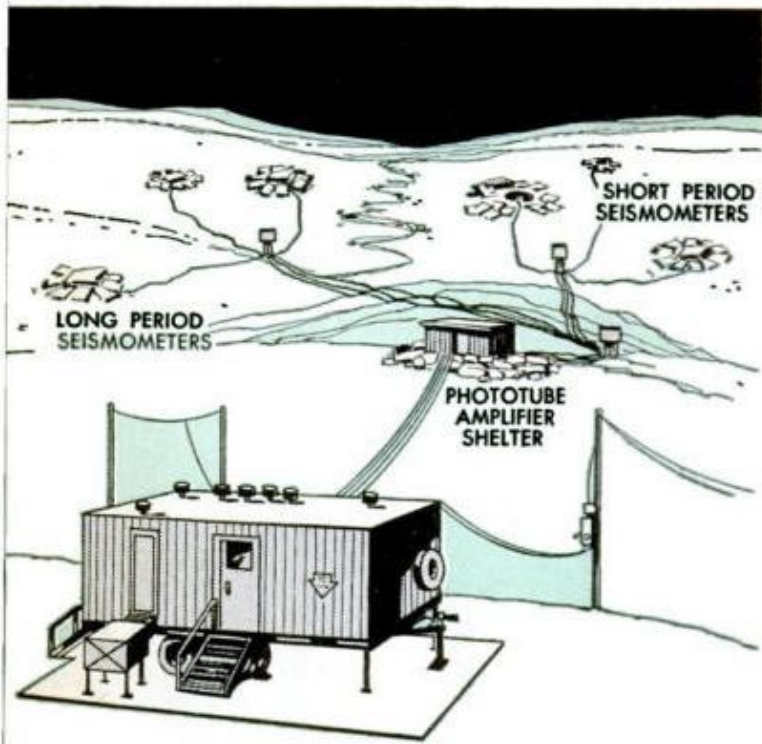
Part of the answer may, indeed, lie in our new "black box"—a term freely used by Russian and American diplomats and newspaper reporters, and thoroughly deplored by Senator John O. Pastore, chairman of the Joint Committee on Atomic Energy, who calls it a "non-existent figment of the public's imagination."

The committee and its technical staff don't mind at all discussing "unmanned nuclear detection stations," "seismic vaults" or "unmanned seismological observatories."

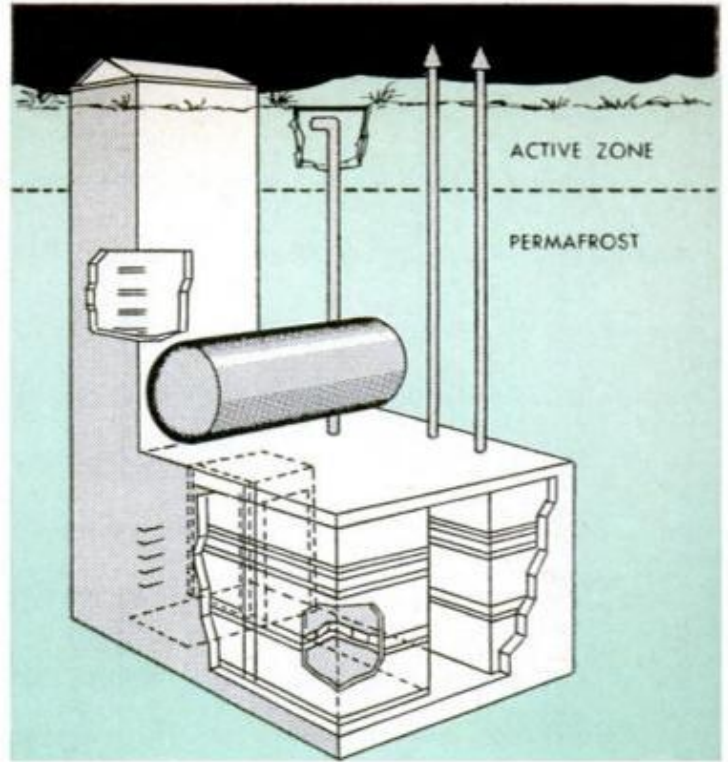
"Just don't call them black boxes," it pleads, contending that the expression gives an erroneous impression that we now have small, portable devices that can detect underground blasts almost anywhere in the world. Not so, says the committee. Any unmanned detecting station, it insists, will be a major device of "bank vault" size, constructed underground and filled with seismometers, timers, recorders, amplifiers and power sources.

Well, then what about that device in Oklahoma? Seismologists in the know call it the "SIE box." Its manufacturer, Southwest Industrial Electronics Division of Dresser Industries in Houston, Texas, won't talk about it, but the Defense De-





**MOBILE** seismic stations are manned, play an important role in detecting sneak tests. Each has three vaults. Van carries timers, amplifiers and recorders



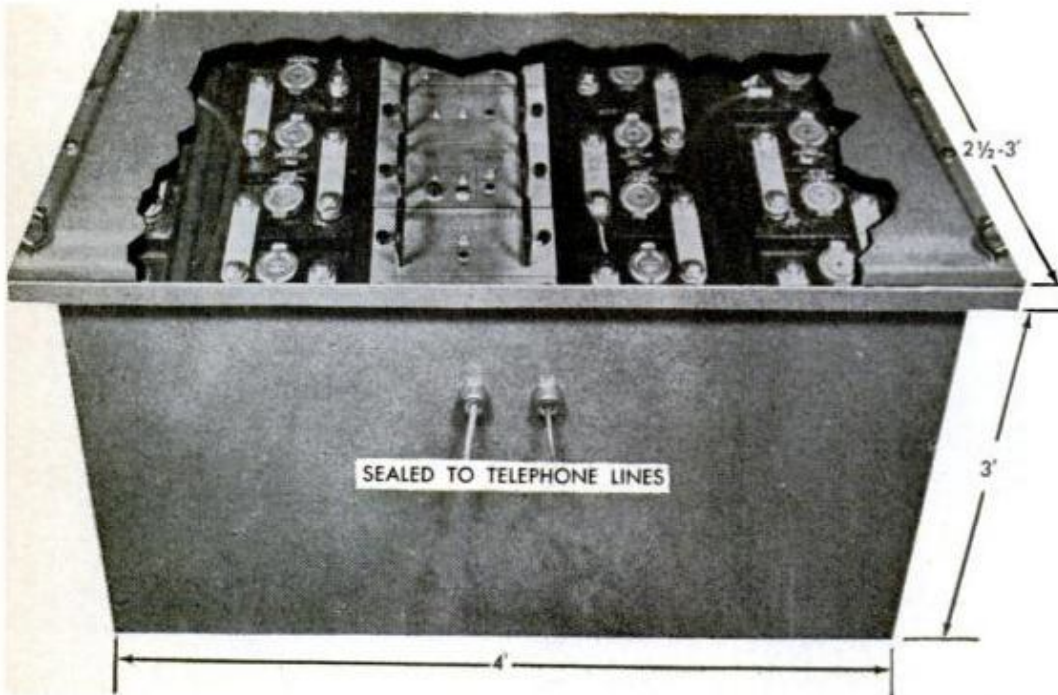
**UNMANNED VAULT** proposed for national detection net inside U.S. would consist of an underground room, eight by ten feet, filled with gear (right)

partment's Advanced Research Projects Agency (ARPA) will. It is a dark gray sheet-steel chest about three feet by three feet by four feet. The lid is sealed with a waterproofing compound to protect the delicate contents.

Those contents are mostly batteries, 400 pounds of them. The remaining 100 pounds include a simple vertical seismometer, an amplifier and a signal demodulator.

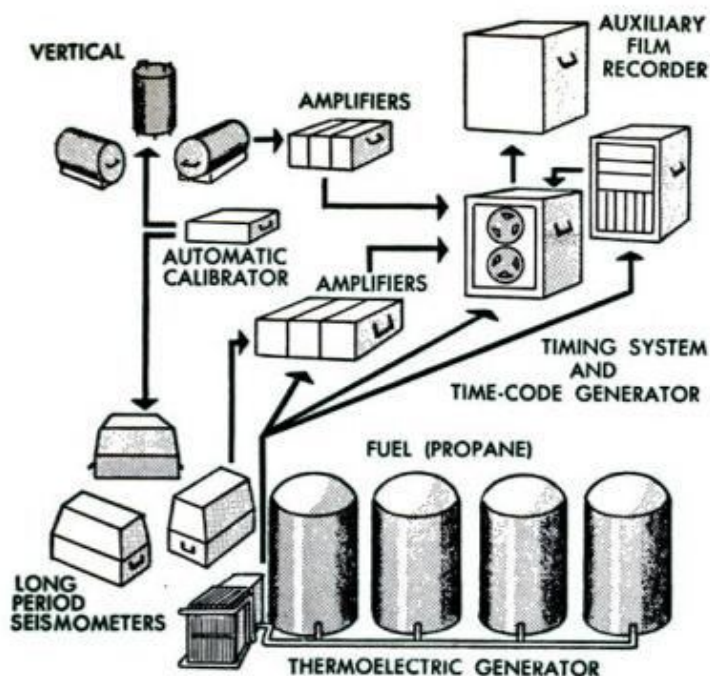
Nothing fancy, the seismometer is the

usual small coil attached to a pendulum suspended by a spring between permanent magnets. As the shock of a distant earthquake (or nuclear explosion) jerks the earth's crust up and down almost imperceptibly, the magnets move with it. But inertia holds the pendulum and coil momentarily fixed. As the magnets move past the coil, a small, slightly changing electrical current feeds into the amplifier. It transmits its signal over ordinary leased



**BLACK BOX** seismic cell buried in Oklahoma is an unmanned unit and possible prototype for use inside Russia if test ban treaty is signed. Unit weighs 500 pounds, contains seismometer, batteries, recorder, controls





**GIANT** unmanned vault at left would contain all the equipment shown here. Though not for use in Red territory, it would serve in the net elsewhere

telephone lines to recorders and other equipment in a small, ranch-style house several miles away. (The house also happens to be the central recording building of ARPA's Wichita Mountains Seismological Observatory.)

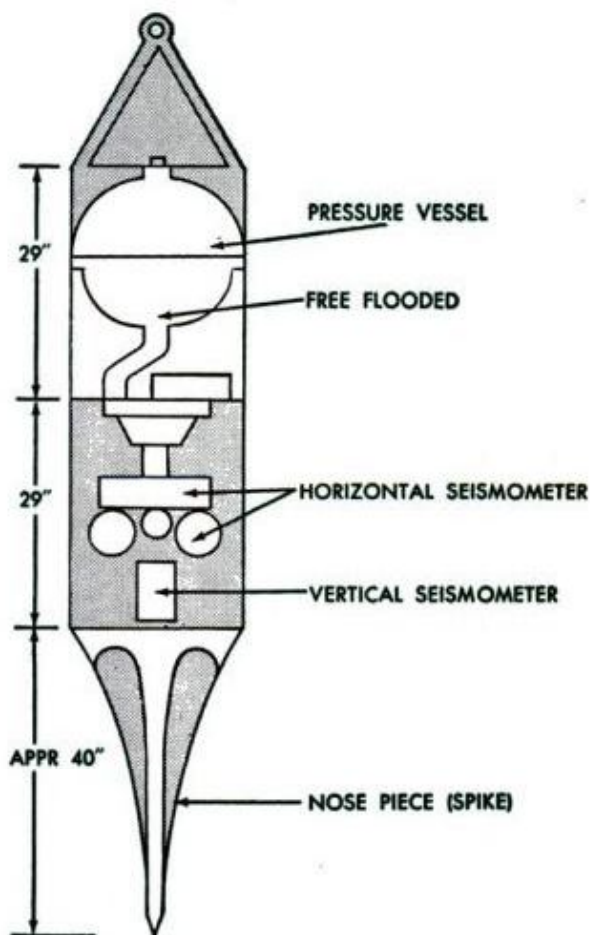
Defense Department scientists cannot tell all they know, but they admit that the black box has spotted most underground "events" that a conventional seismometer should detect, including the first large French nuclear test in the Sahara over 6000 miles away.

The Oklahoma black box was built partly to prove that the components of that kind of a system can operate reliably for at least six months without human attention. It was also meant to prove that an unmanned station is tamperproof. The signal demodulator varies the frequency of the unit's output according to a complex built-in code. Only we (or a control commission) would know the key. A technician routinely monitoring the signals from many boxes would immediately spot any tampering, such as reversing the telephone leads; or slipping a spurious signal onto the line in place of the genuine one.

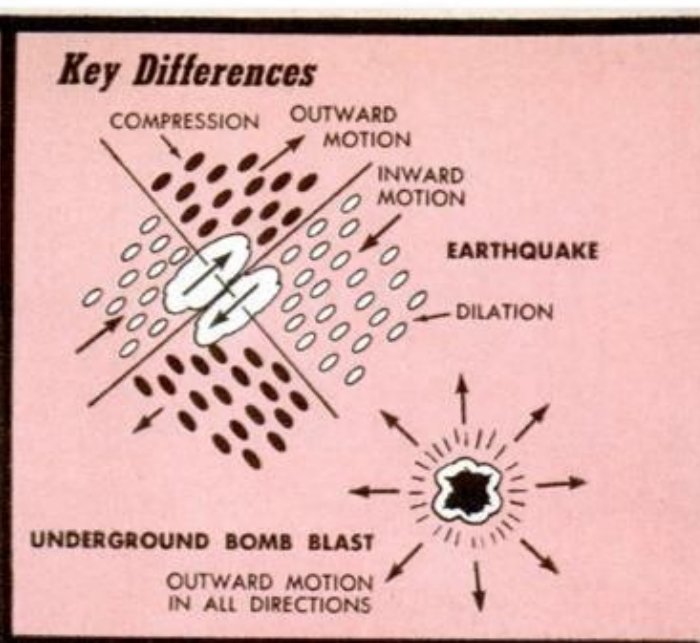
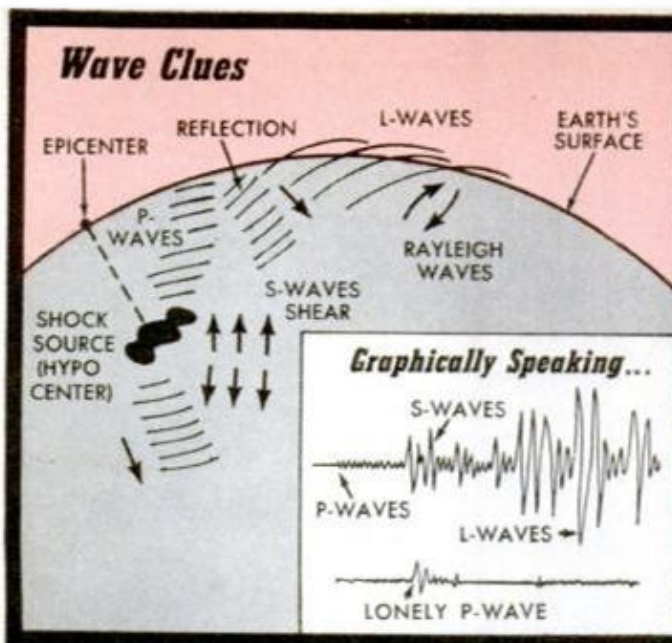
At present, the box is marking time. Its initial job has been done and the engineers have turned the power down to the lowest operating level—too low to spot many



**SUBMARINE BLACK BOX** has most elements of manned station, including (below) power, recorder, timer, detector. It could surround an enemy's shores







**SHOCK WAVES** from natural or nuclear disturbances come in many types, above left. Inset shows how seismic detector records them. Diagram at right shows how earthquake disturbances differ from patterns of nuclear blasts

tests. It's there in case of need, but it doesn't figure prominently in current detection systems.

But the U.S. isn't waiting for the Russians to agree to a black-box detection network inside their borders. We have already built, and are continually adding to, a worldwide system of seismological stations and observatories, ringing the Red homeland and satellite countries. Some are manned by our allies.

Newest item in our bag of detection tricks is an underwater seismic station developed for ARPA by Texas Instruments, Inc. Besides a short period vertical seismometer, it also contains two short period horizontal seismometers, one pointing east and west, one pointing north and south. A transducer detects pressure changes caused by blasts in water. A long metal nose couples the underwater black box firmly with the earth.

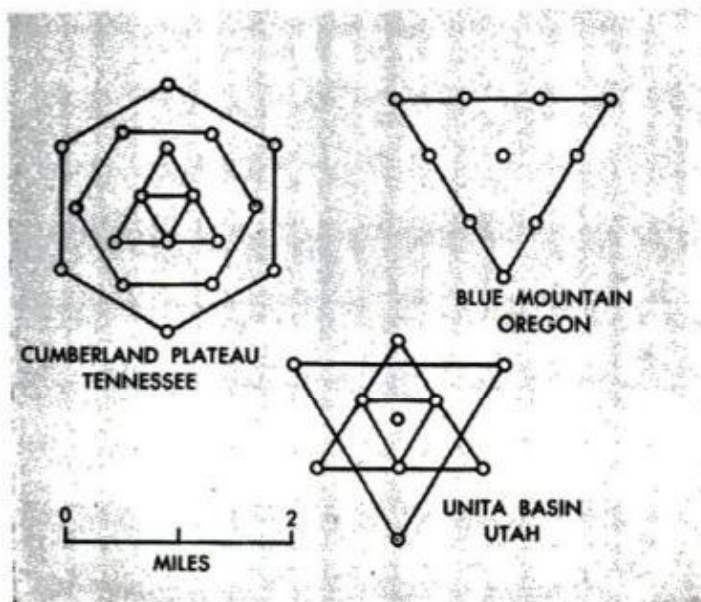
Some underwater stations transmit data acoustically to surface ships. Some transmit through cables. But others are completely self-contained stations in that they contain timers and recorders. They make and store ready-to-use seismograms. When an event needs to be checked, a ship hauls up the underwater station and examines the tape for clues.

Underwater black boxes can be ringed around a potential enemy's coast without his knowledge. There is often less background seismic noise on the ocean floor, and they can be placed close enough to

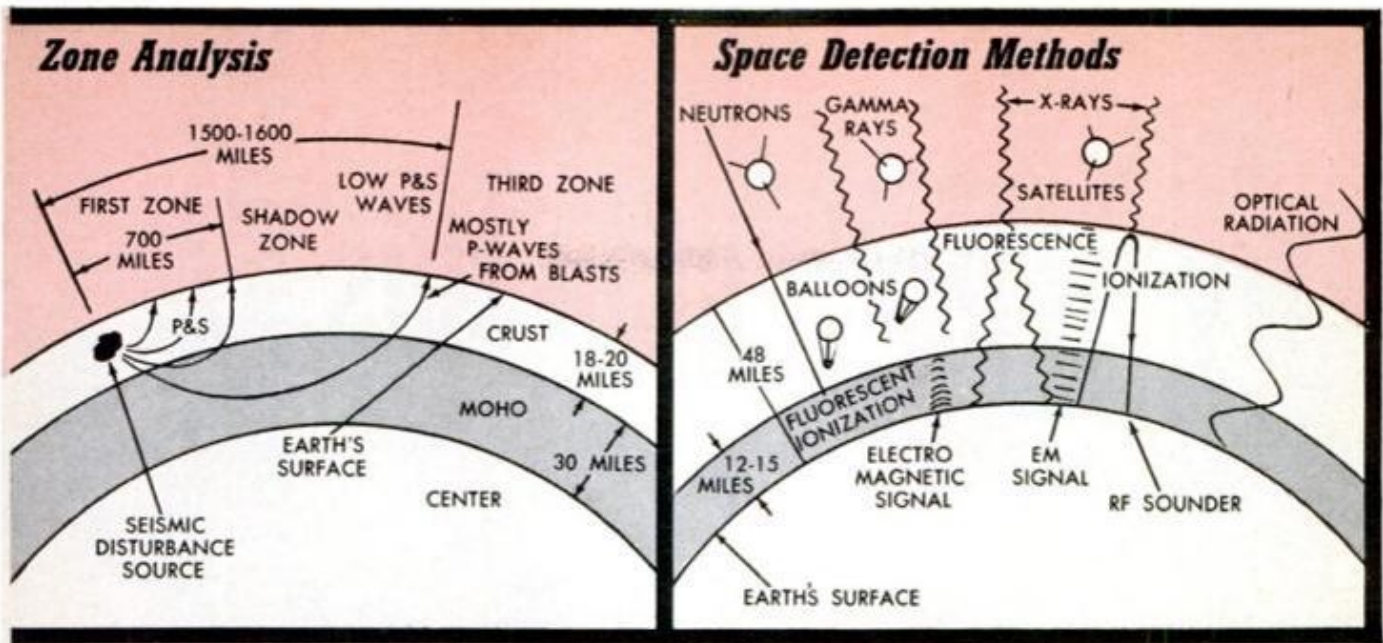
detect the important initial waves, called first motion waves, from a man-made blast. This calls for detectors in every direction within 6000 miles around an event.

Underwater secrecy complicates the cheater's problem of trying to pick a spot for a bootleg test, decide what size bomb he dares detonate, and determine whether he should test in granite, dry sand or a spacious cavern. ARPA's director, Dr. Jack P. Ruina and the Arms Control office's Dr. Franklin A. Long, believe that a high-quality manned station network combined with underwater stations would

**MANNED** stations in U.S. are set up in geometric arrays of multiple seismic units like these to cancel local noise as well as to catch any "spoofing"







**SEISMIC DETECTION** depends on what kind of wave shows up where. Diagram above left shows which waves turn up in various zones outward from epicenter. Sketch at right diagrams the methods of detecting space blasts

be enough to make a nation think twice about violating a possible treaty.

So far, underwater black boxes have worked well. Operating at points near Catalina Island off California, in the Arctic Ocean, near Bermuda, in the Gulf of Mexico and off Hawaii, they have recorded at least five small blasts from our Nevada test site and a number of natural quakes. Have they recorded any Russian tests? Neither ARPA nor the Arms Control people will say publicly, but scientists say it's almost certain that they have.

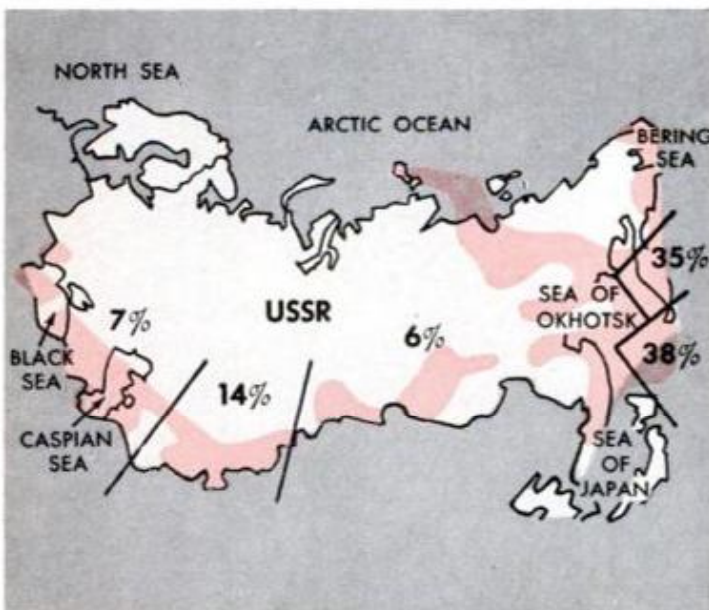
Actually, seismological devices are not

the only safeguards we have against sneak Russian tests. One of the most effective is ARPA's High Altitude Sampling Program (HASP) which sends U-2 aircraft to more than 70,000 feet to strain out microscopic bits of radioactive dust for analysis. An instrument known as the microbarometer measures the acoustic waves monitored from blasts and earthquakes. Besides this aerial check, photoelectric cell devices are detecting the slightest pulse of light from above-ground nuclear shots thousands of miles away. And if we ever sus-

[\(Please turn to page 196\)](#)

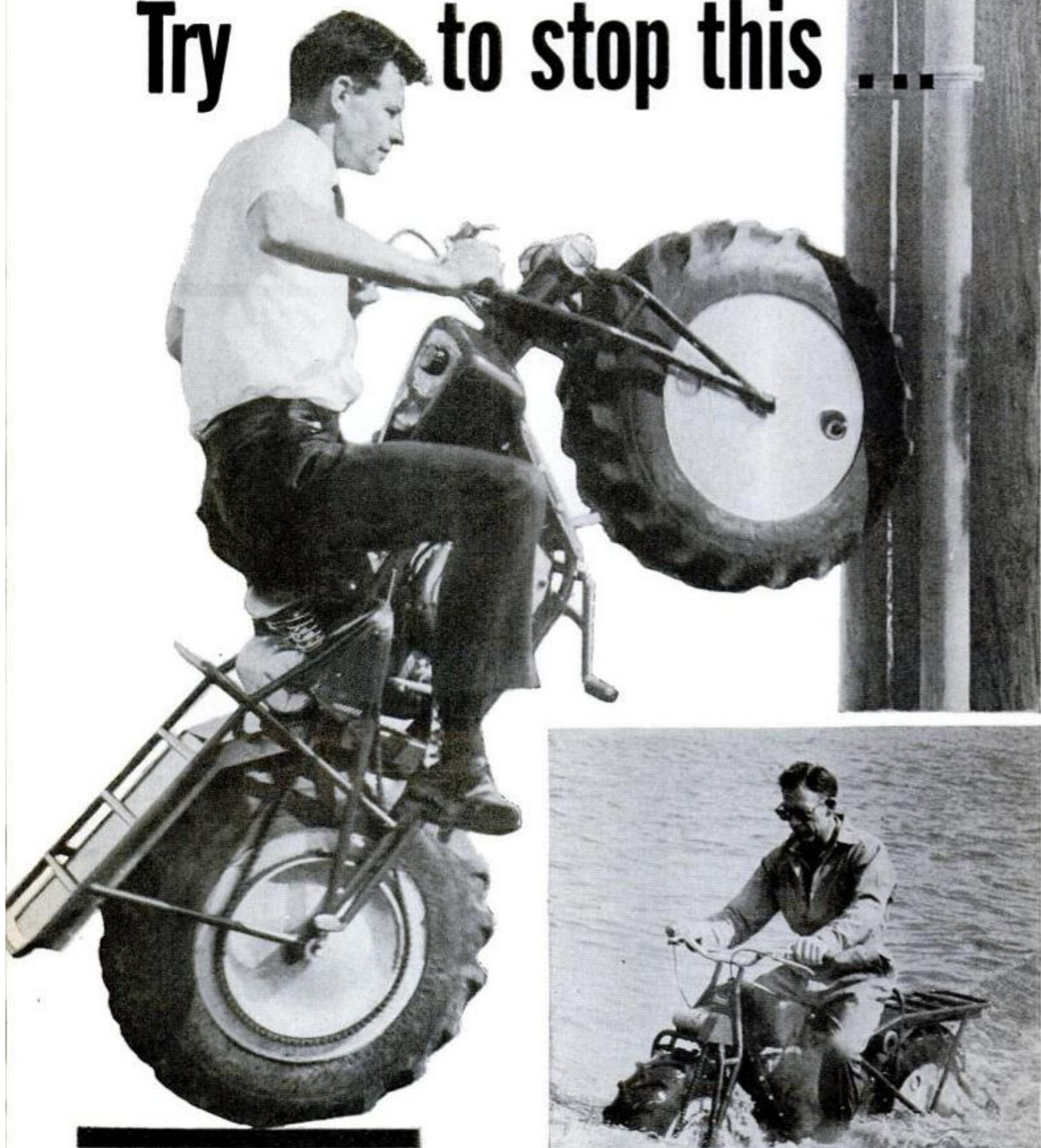
**EARTHQUAKE AREAS** are ideal spots to conduct sneak tests. The map shows seismic areas and earthquake percentages encountered in the area of Russia

**CONTROL CENTER** at Uinta Basin Observatory records on drum graphs vertical and horizontal disturbances from quakes and blasts around world





# Try to stop this ...



**POWERHOUSE ON WHEELS**, the Trailbreaker has front and rear-wheel chain drive, enabling it to climb walls and plow through 15-18 inches of water

92



POPULAR MECHANICS



# MECHANIZED BILLY GOAT

*This lugging fool with two-wheel drive climbs rocks, plows through mud and water, and comes as close to a go-anywhere bike as any we've seen*

By Thomas Stimson

**A**N AMAZING MOTORCYCLE that crawls part-way up phone poles, swims in water and wades through swamps, is the latest thing in rugged off-trail vehicles.

This motorcycle is a climbing fool and can ascend grades in excess of 45 degrees from a standing start, carrying loads of up to 400 pounds.

It creeps down the same grades at low speed under complete control and without locking the wheels. It crawls over enormous boulders and fallen trees instead of

around them. It can tow a fire hose up the stairs of a building, all the way to the top floor. It weighs less than 200 pounds, yet is so buoyant it floats in water.

A rider can plow through water a foot and a half deep all day long and merely get his feet wet. If the water is up to his hips, he can dismount and steady the vehicle in an upright position while it floats, then give it enough throttle to literally pull him along while he walks on the bottom. For still deeper water he can do one of two things: tow the floating

**CLIMBING OVER BOULDERS** is child's play at low speeds. Feet are used for balance, and the footrests swing up to allow clearance of difficult objects

**HEAVY CLEATS** on the large tires afford excellent traction when the Trailbreaker roars through mud that would hopelessly bog down ordinary vehicles







**CYCLE WHEELS** are actually airtight drums, enabling vehicle to be floated in deep water. Fitted with outrigger pontoons, it maneuvers like a boat with driver on the seat

machine behind a boat or canoe or, with the right equipment, extend a couple of outriggers having air bags or foam floats at their ends, then mount his seat and actually ride across the water. The deep-cleated tires are fairly efficient paddle wheels for water propulsion.

This fabulous machine was developed by a company that seemingly shouldn't be in the motorcycle business at all. The "Trailbreaker" is a product of the Nethercutt Industrial Corporation, Sylmar, Calif., a subsidiary of a concern that manufactures cosmetics. Five years and several hundred thousand dollars went into the vehicle's development. It lists at \$695.00.

The reasons why it performs the way it does can be told in a few words: both the

wheels are powered instead of just the rear wheel; it has a fluid drive instead of a clutch; the engine is mounted high in the frame to give 15 inches of ground clearance; and each wheel is an airtight aluminum flotation drum. The big tires also contribute to buoyancy.

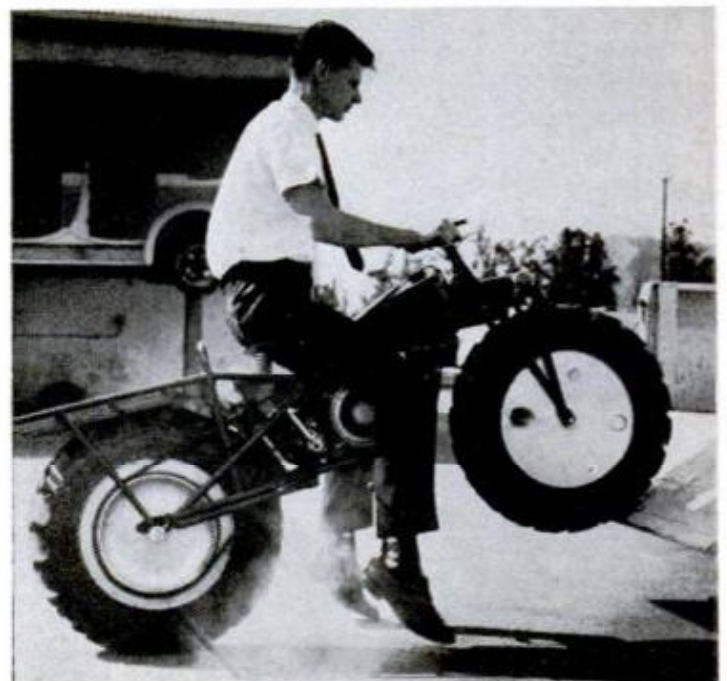
#### High-Altitude Carburetor

The motorcycle is powered with a 10-horsepower one-cylinder, two-cycle West Bend engine equipped with an aircraft-type carburetor that works in any altitude and needs only adjustment for extreme altitude. A spark-arrestor exhaust is used in dry brush where there is fire danger.

The three-speed transmission (81:1, [Please turn to page 187](#))

**DESIGNED FOR WILDERNESS TRAVEL** where roads are nonexistent, cycle resembles two-wheeled tractor. Extra gas can be carried in the two wheel drums.

**CLIMBING THE TAILGATE** of a truck is just one of the Trailbreaker's acrobatic feats. In low gear, it can be driven off the truck in exactly the same manner

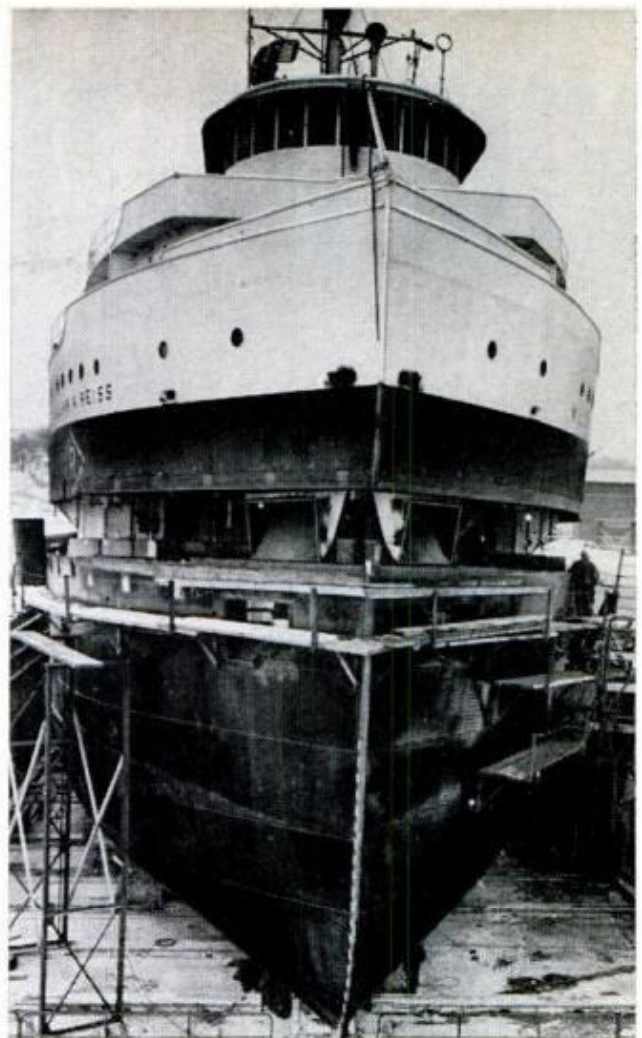






### Blotters Soak Up Swamps

Silt land in Belgium is being reclaimed by driving specially prepared strips of blotting boards—multilayered with space between the layers—deep into the soft ground. The water seeps in and, by gravity alone, flows down the boards to a lower level, thus making the topsoil suitable for such projects as a canal-side dock.



### Lakes Ship Grows a Bit

The Great Lakes steamer *William A. Reiss* was recently sliced neatly in two, horizontally, to add 7½ feet of height and about 4000 tons capacity. A special cutting machine split the ship from stem to stern. Sixty-ton jacks lifted the 1500-ton upper deck, as Manitowoc Shipbuilding Co. spliced in new plates to cover the gap.

### Sidecar for Cyclists

Made to fit on standard bicycles, a sidecar makes a three-wheeler out of a two-wheeler and adds a seat for a passenger or groceries and packages.

There are three models to fit 20, 24 and 26-inch bicycles, and custom-made models for newsboys or sidewalk vendors.

The sidecars are made of sheet metal and are lacquered to match the bicycle. They list at \$59.95. Sold through retail outlets, they are manufactured and distributed by Mohs Seaplane Corp., 2355 University Ave., Madison 5, Wis.

AUGUST 1963





# Pushbutton Eating





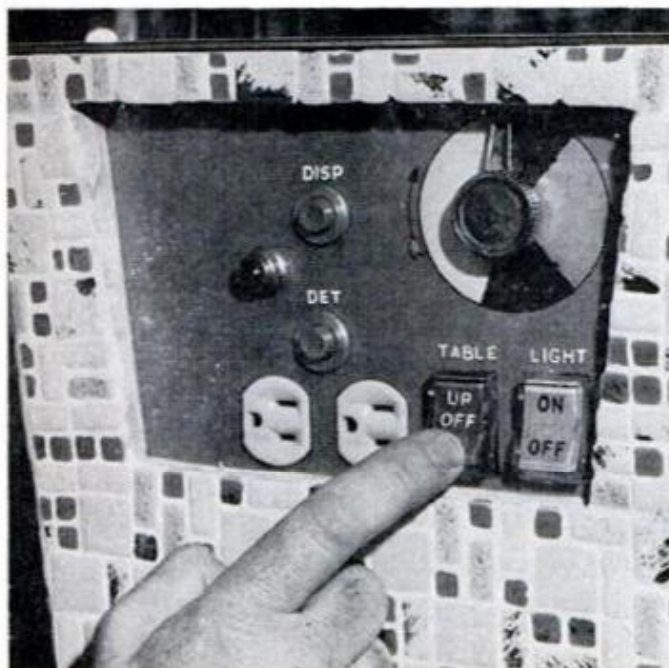
# Center

*Just push a button and this home-made diner sets the table for six. After the meal, it washes and dries the dishes, disposes of the garbage and provides storage for all the tableware*



**DINER COUNTER**, made by engineer John Lenz for his home, is a combination table-dishwasher-disposal unit. Sides come off easily for servicing

**PUSHBUTTON PANEL** gives fingertip control over the lights, dishwashing action and the disposal unit. Circular dial times the four washing cycles



**YOU FLICK A SWITCH** on the end of the "diner" counter and two table leaves fold down with dishes and silverware already in place for a meal.

When mealtime is over, you dial an electric switching mechanism to activate a dishwasher, press a garbage disposal button and—presto!—all the drudgery is removed from kitchen cleanup. Even your dining table is all set for the next meal.

This housewife's dream was designed and built in his spare time by a suburban engineer in Minneapolis. In fabricating the "mechanical waitress" (actually a combination dining counter-dishwasher-disposal unit), John Lenz used standard components wherever possible for reliability, such as switches, pushbutton controls, timers and, of course, the dishwasher and disposal unit. But many elements are of his own design.

Table leaves on each side of the counter provide place-settings for a family of six. Each setting has a plastic plate, salad bowl and dessert dish permanently fastened to an aluminum holder with epoxy glue. A glass and cup are separate pieces which fit in special slots in the metal holder for washing and storage. A metal basket holds silverware. The aluminum holders make a handy unit for carrying a meal into the TV room or outdoors.

At clean-up time, the holders, with cups, glasses and silverware attached, are lined up on the table leaves, with pots and pans in between. Table leaves close up and the holders slide down into slots so they won't tip over when the dishwasher is turned on.

Dishes, pots and pans get a thorough scouring in four separate washing cycles, with food waste being flushed out through the disposal unit in the first five-minute flushing with soapy water. Next, high-velocity pressure hoses spray suds against the dishes during a 15-minute washing cycle. (Garbage can be disposed of at any



time by dumping waste into the top window; press a button and it's gone.)

After rinsing in two separate two-minute hot-water rinses, the dishes are dried with warm air from a screened intake under the table. Rubber gaskets around table leaves prevent leakage.

Despite the four washing cycles, total water consumption amounts to only 12 gallons per washing. Lenz achieved this economy by having water pumped through the spray tube over and over again. A 1000-watt electric heating element in the tube keeps the water at 180 degrees.

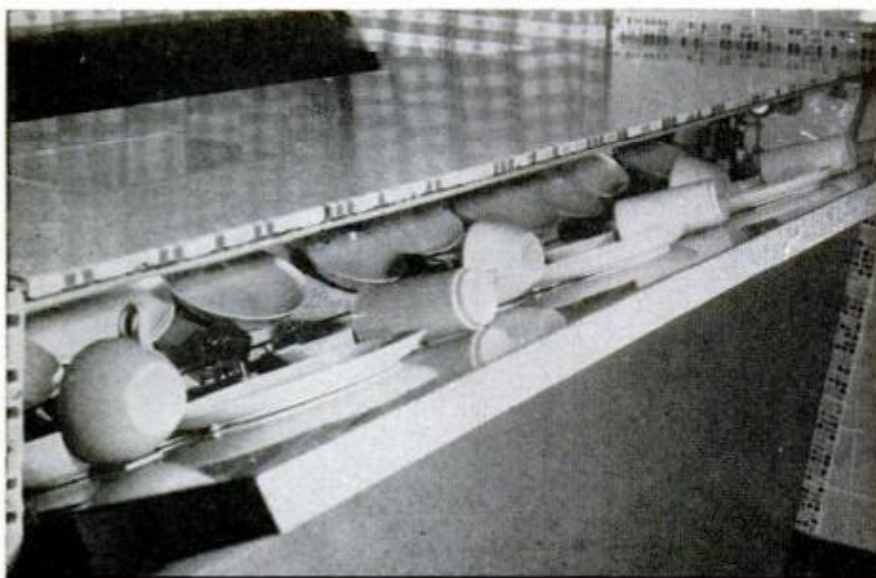
The neatly-designed counter has top and side surfaces of Formica, with the end finished in plates of mosaic tile. The table interior is of fibreglas coated with epoxy paint. A window in the table top

permits a full view of the washing cycle, which is illuminated with interior lights. End and sides come off for servicing.

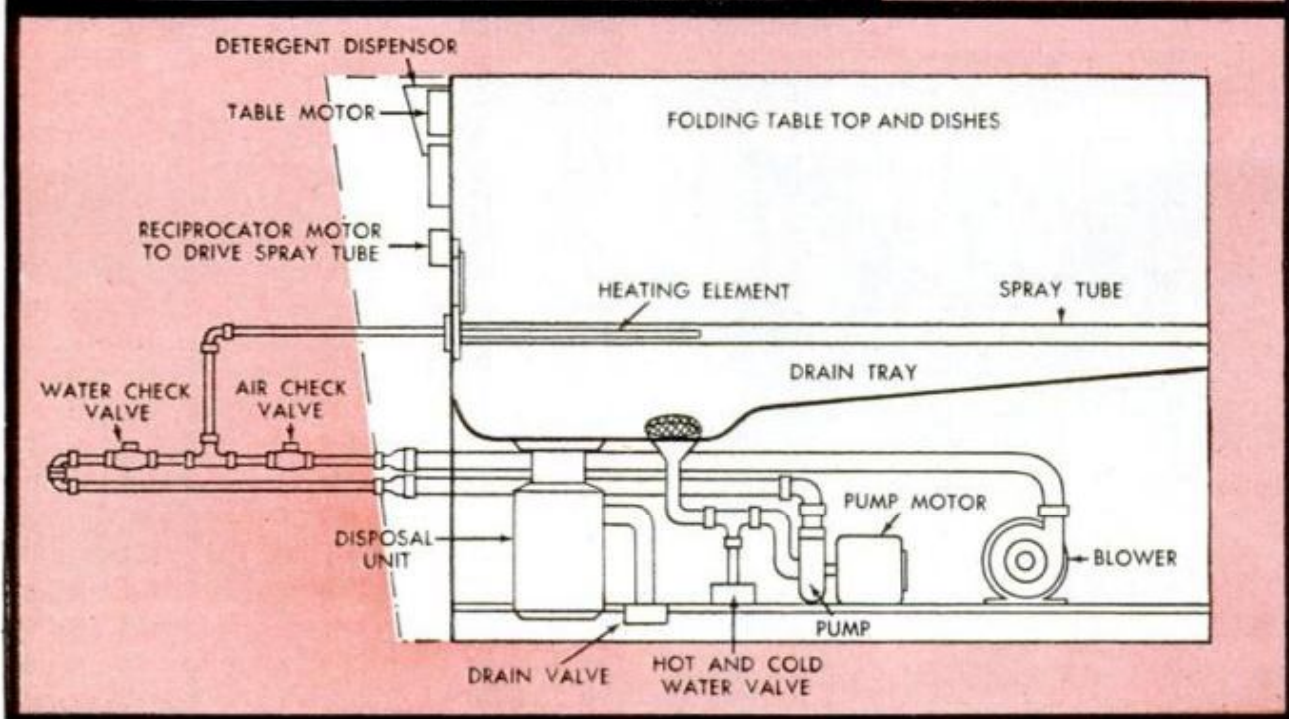
Tiny precision switches, made by Minneapolis-Honeywell, control the automatic table counter and provide built-in protection against mishaps. For instance, the dishwasher cannot be switched on unless the table leaves are closed tight.

Operated by cams on an electric timer, various switches control the 1/3-hp. motor to open and close the table leaves, drive the spray pump, spin the fan, rotate the spray tubes and run the disposal unit.

Other switches keep the water level in the tub constant, open and close the drain, and shut off the electric heating element if it gets too hot. Switches also dispense detergent during the wash cycles. ★★★



**TABLE LEAVES** on both sides of the counter fold down at the touch of a button, with place settings ready for use. Diagram, below, shows dishwashing and disposal equipment inside the counter. Despite four cycles, the unit uses only 12 gallons of water

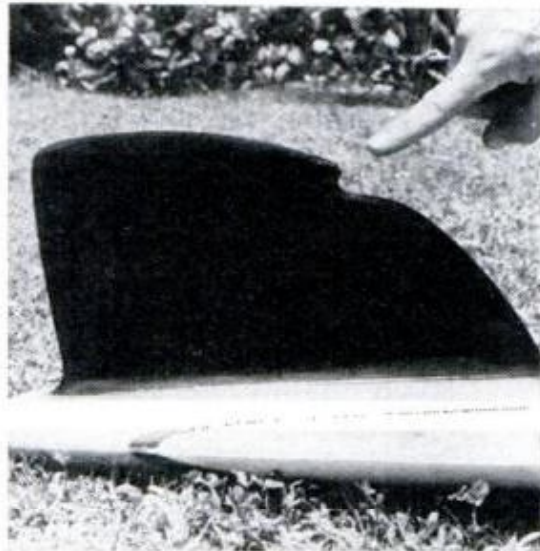




## Surfboard Speedometer

Recessed in the foredeck of a surfboard, a speedometer operates on water pressure against an opening in the board's fin. It gauged the maximum speed on eight-foot waves at Oahu, Hawaii, to be 20 miles per hour.

The device was designed by surfer Bob Shepherd.



## Circular Movie House Puts Audience Inside the Picture

Seated in swivel chairs so they can follow the action, West German movie audiences will soon be sampling movies-in-the-round. A spherical movie house is being built with a 360-degree wraparound screen that will give audiences the illusion they're in the middle of the action.

A spherical reflecting mirror will hang above the audience like a huge lighting

fixture (below, right). Viewers are seated around the perimeter of the globe. The inventor, Adalbert Baltes (below, left), has devised a special camera for shooting 360-degree pictures. These are projected onto the reflecting mirror.

Named the Cinetarium, Baltes' invention is now being built in an amusement center in Hamburg.





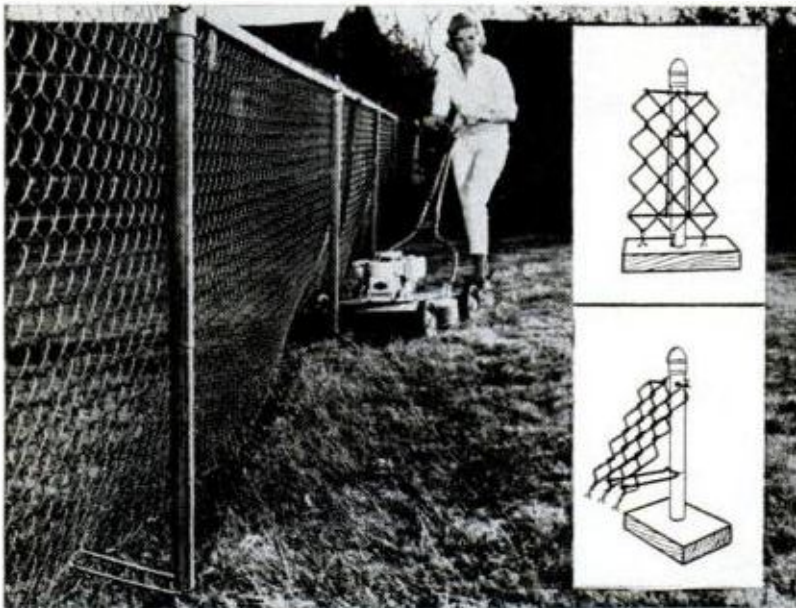


### Table for Those Who Can't Wait to Get to the Office

A collapsible car table, which folds under the dashboard when not in use, can be quickly set up for typing chores or for picnics while you're traveling. The Belgian designed Piccolo-Table fits into almost any make of car, is stain- and scratch-resistant, and provides a rigid

work surface about 12 by 16 inches.

In use, all you do is slide it up, hook on collapsible legs and fit it into the glove compartment. (Individual fittings may vary slightly due to different locations of glove compartments.) In Belgium, the table sells for about \$12.75.

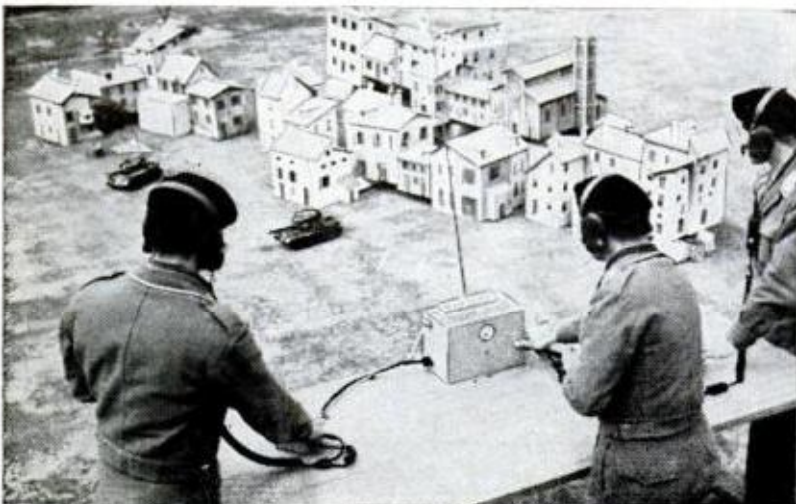


### Trim Borders

You can skip hand trimming along fence borders with a new fitting that lets lawn mowers do the job.

The device, called Trim-Aid, consists of two metal arms attached to a sliding ring. The arms lock the fence against the post (top inset), but hold the bottom of the fence away from the post when the ring is moved downward (bottom inset).

Trim-Aids sell for 69 cents each. They're made by Fence Trim-Aid Manufacturing Co., Tulsa, Okla.



### Miniature War Games

Officer candidates in the Italian Armored Troops School learn tank tactics with radio-controlled miniatures in a Lilliputian-size village.

Cadets, who have an over-all view from the edge of the tiny town, receive orders over headphones. Using remote controls, drivers maneuver the tanks into firing position, while gunners direct the fire of rotating turrets.





# He Makes Accidents Obsolete

*Frank Crandell's hazard hunters explode aerosols, put shoes on machines, listen to rocks talk —so that your life will be safe*

**By Myron Stearns**

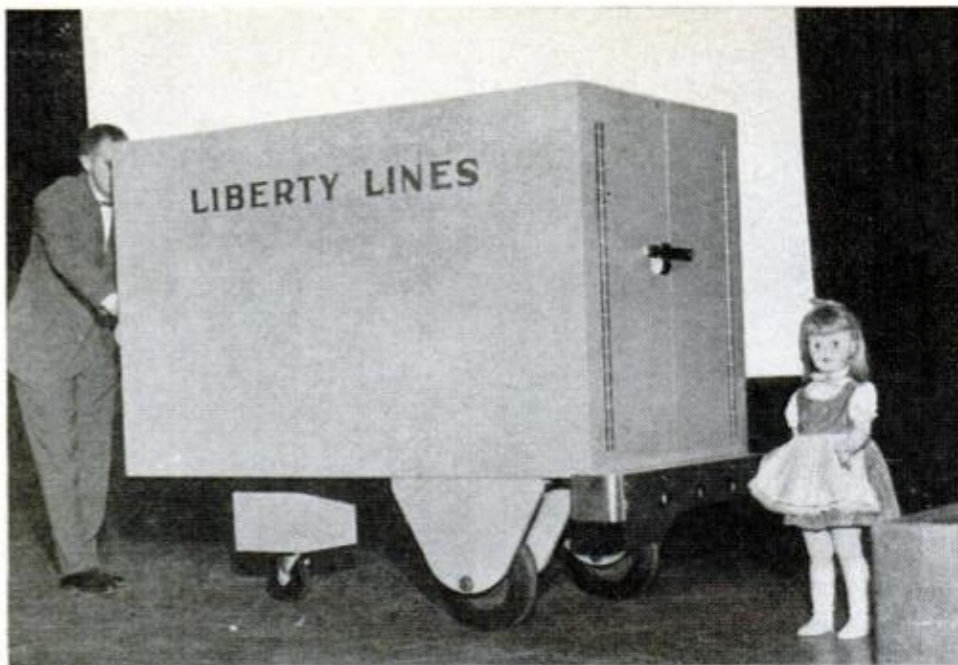
**A** HORRIFIED YOUNGSTER with a squealing sneaker caught between step and sidewall of a descending escalator in a Cincinnati department store weeps with relief as the moving stair comes to a jolting stop. One inch more and his trapped foot would have been mangled in the steel fingers of the comb-plate at the bottom.

A shopper cart, laden with Junior and a week's groceries, slips from the grip of a busy mother as she guides it from a supermarket to her parked car. The runaway heads down an incline toward traffic. As though by magic, it stops before rolling three feet.

Sandhogs at the head of a giant tunnel project suddenly are ordered out of the area by their crew boss. A day later,

**GEOPHONE** that listens to the rocks "talk" is a sort of stethoscope for mining engineers. With it, miners and tunnelers can hear dangerous stress noises and predict cave-ins before they happen





**SONAR EYES** for truck drivers, another hazard hunter "first," detects people or objects behind a backing vehicle with a reflected sonic signal. It warns the driver in the cab with a visual or audible warning read-out

hundreds of tons of rock crash from a collapsing roof to the spot where they'd been working.

Each of these seemingly unrelated and miraculous escapes from tragic disaster has happened—some of them many times. And they are far from miracles. They are accidents that were foiled by shrewd design. The thing they have in common is the inspiration of a hearty, six-foot New Englander named Frank J. Crandell. For it was Crandell and his staff that stopped the escalator, halted the cart and got the rocks to tell that they were about to fall.

For 25 years, Crandell has served as chief engineer of Loss Prevention for one of America's big-risk insurance companies, Liberty Mutual. His secret is a brand new approach to safety. Instead of exhorting people to be careful, he uses design and foresight to eliminate the *cause* of accidents. Working under him, spread across the country, are some 400 safety engineers who call themselves "hazard hunters". Their job is to scout the activities of 70,000 policyholders, sniff out situations that spawn accidents and eliminate them.

Chief Hazard Hunter Crandell works out of a small office in his company's Boston headquarters, or at a sprawling laboratory on an 86 acre tract in nearby Hopkinton. Here, crews of technicians build and experiment with a vast assortment of accident prevention schemes and devices. In a concrete-walled enclosure, rubber-garbed scientists work to eliminate hazards in the handling of radioactive

isotopes. Down the hall, engineers build a finger-guard for a factory machine. Here and there mock-up vehicles bristle with strange devices. In a soundproof chamber, a rickety loom is rebuilt to muffle its noise and, perhaps, eliminate cases of deafness attributed to it by some weavers.

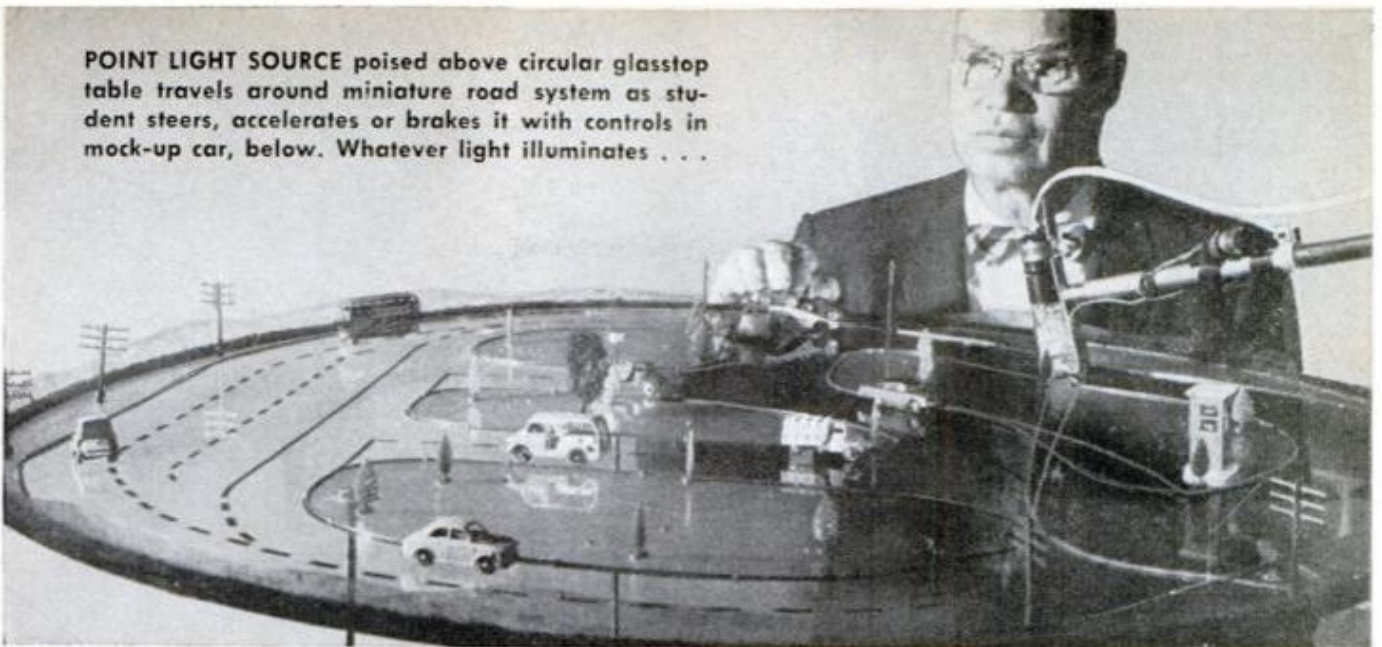
"I want you to listen to this brick," Crandell said to me recently in his office. A moment later I discovered that the brick, lying on his desk, illustrated his whole approach. He fastened it to an amplifier that can multiply sound 300,000 times. He had me put on an earphone. Then, with a small iron clamp such as you find in home workshops, he twisted the screw and squeezed the brick. Into my ears came a sound like frying fat! Crandell told me it was caused by the molecules in the brick adjusting themselves to the new pressure.

Similarly squeezed by the pressure of a mountain above it, he pointed out, different kinds of rock—in a tunnel roof, for instance—give off individual sounds: limestone, like rain on a window pane; shale, like the creaking of timbers; basalt, low-pitched tones like chime doorbells.

To detect this microseismic language of rock under strain, Crandell spent 15 years developing his "geophone"—a sort of stethoscope for mining engineers. Long, sensitive "listening" probes are inserted in drill holes in suspect rock. The highly amplified sounds emitted by rocks under increasing or changing pressure, lets a



POINT LIGHT SOURCE poised above circular glasstop table travels around miniature road system as student steers, accelerates or brakes it with controls in mock-up car, below. Whatever light illuminates . . .

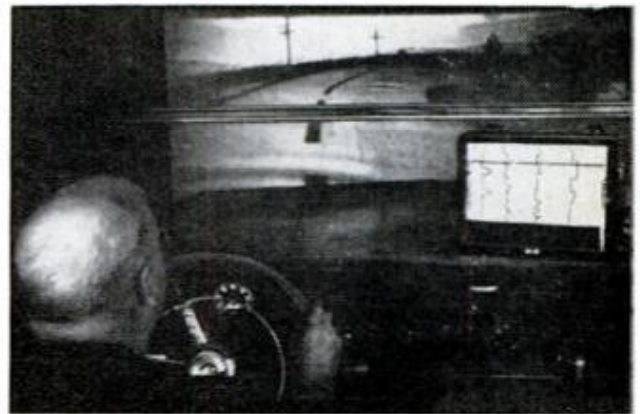


listener detect imminent rock falls or cave-ins *before they occur*. An early detector during construction of a 27-mile section of the Delaware Water Gap supply tunnel for New York City predicted 72 rock falls in advance.

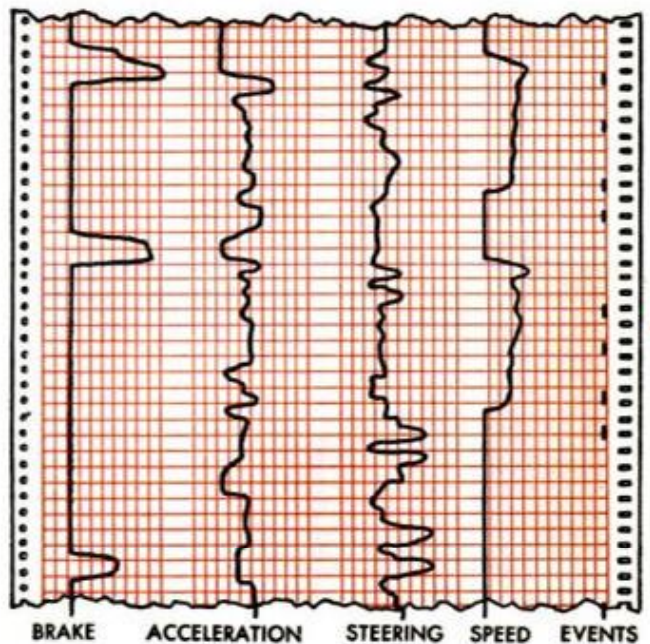
Translating the geophone's odd noises takes an expert, but he doesn't have to be on the scene. At a dam site in Northern Canada, contractors were worried about a high rock wall that looked dangerous. Crandell sent geophones to them, had them make tapes of "rock talk" and then play the results to him over the telephone. There was noise, all right. But it turned out that it came from tension created by steel cables the men had strung to hold the cliff up. Once the cables were cut, the rocks relaxed and stopped "talking". And they stayed put.

Today Crandell's portable geophone is saving lives in Swedish and Australian as well as United States' mines, and in countless miles of tunnel construction. It is also being used in the labyrinthine galleries under the city of Paris, to see whether or not there is danger of city buildings caving in over them.

What prompts anyone to invent such a thing? "Falling rock is the number one killer in mining and tunneling," Crandell reveals. "Before the geophone, crews would whack a mine roof with an iron bar. If it rang, it was good, if it sounded dull, it was bad. What miners called 'popping rocks' was a sure sign of trouble—and usually too late to avoid disaster.

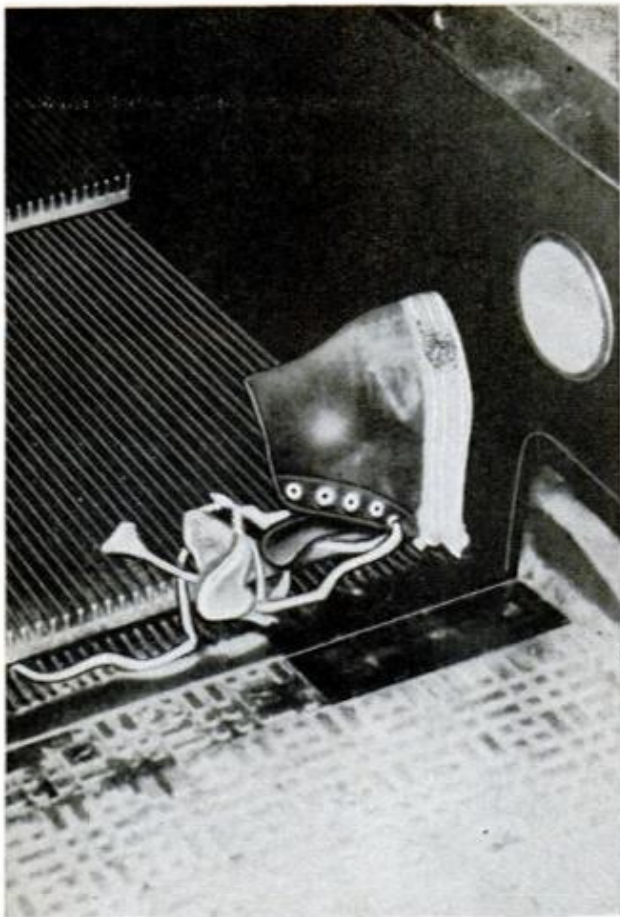


. . . is projected in semi silhouette on screen in front of mock-up's windshield, creating illusion that the make believe car is moving along roadway.



PERFORMANCE chart records steering, braking, acceleration. Sudden moves register as "events" (right), point out flaws when compared with norm

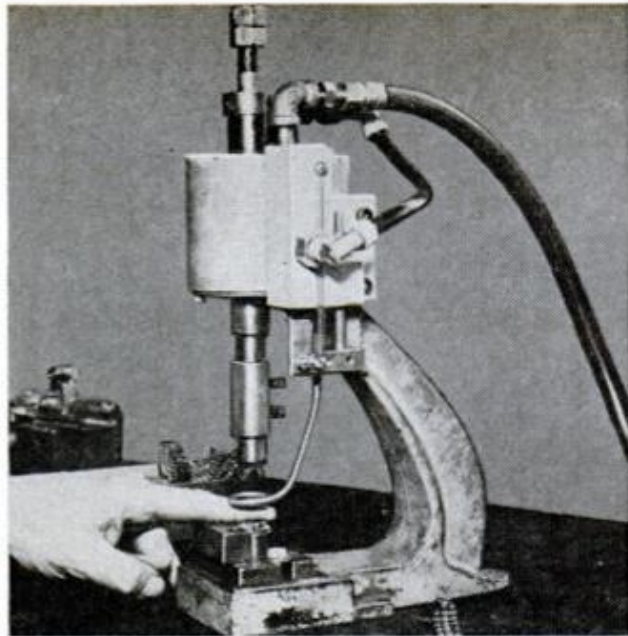




During an early tunnel job on the Pennsylvania turnpike, Crandell and an inspector went into the diggings to recommend supports for what he'd diagnosed as a bad section of roof the day before. "Just as we arrived," he recalls, "tons of rock thudded to the floor, crushing five men. We were so close, stones peppered our hard hats.

"That accident got me thinking," he says. "And you don't turn off your brain on weekends. I was lying in a hammock one Sunday snapping a piece of wood lathe between my fingers. I noticed that long before it broke, the fibers made crackling sounds. I wondered if maybe rock made noises long before it collapsed under tension, and whether a sensitive enough instrument could be devised to hear them."

Crandell is a man who seldom lets a thought pop up without grabbing it and converting it into action. And when it moves, it usually goes someplace. In high school he'd captained the baseball and hockey teams and played everything else in sight—to the point where his highest mark in the entrance exams for Massachusetts Institute of Technology was 17. Undismayed by family headholders, he



**FINGER-SAVER** for watchmakers punch press consists of a simple loop guard devised by hazard hunters. Guard stops the punch from ramming downward when an operator's finger is in the target area

**SAVED FOOT** of youngster whose sneaker caught in escalator graphically illustrates efficiency of automatic cut-off switch designed by hazard hunters. Victim's foot here was removed without a scratch

dove into an extra year of study, tried again, and this time the lowest mark he received was 96.

To this day, almost anything he really tackles goes down. Once he'd made up his mind to lick rockfall disasters, something had to happen. He slogged through underground warrens with a variety of instruments, testing them all, then visited manufacturers to find more.

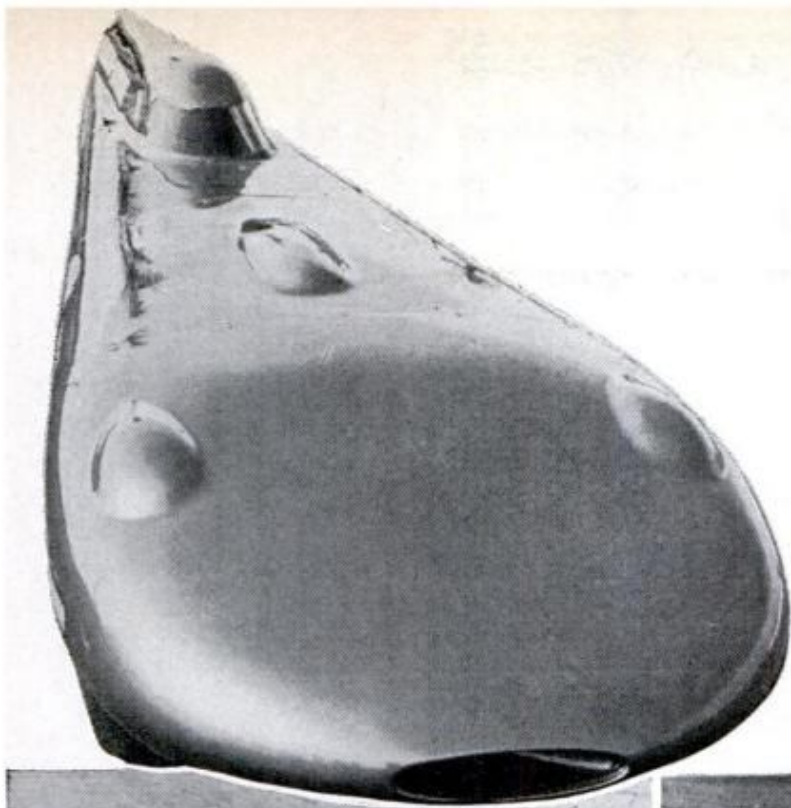
Out of these experiments, the geophone was born, and it has exceeded even the inventor's wildest expectations. Modern versions of it predict earth slides and avalanches on the West Coast. In a language of "clicks" and "tunks" the new instrument, called a seismitron, can detect earth movement smaller than the diameter of a hydrogen atom.

Though much of his work is industrial, many of Crandell's safety projects touch you and me. Some time ago, his hazard hunters turned up the fact that a remarkable number of people were tangling with revolving doors. Since you can't educate millions of people to stop pushing, hazard hunters concentrated on the doors. Thorough investigation proved that accidents almost never happened when the doors

[\(Please turn to page 192\)](#)

POPULAR MECHANICS



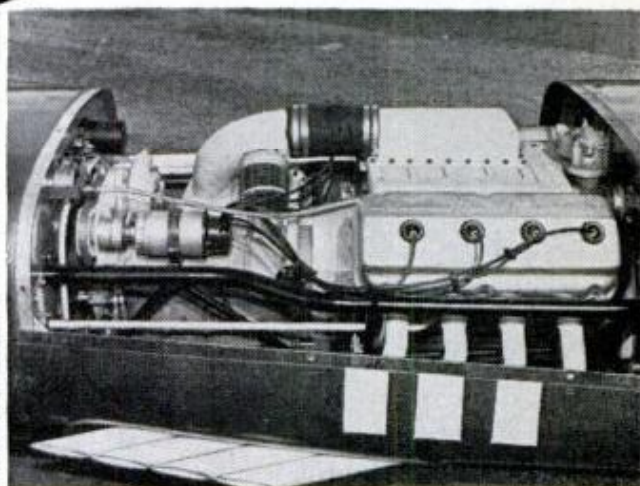
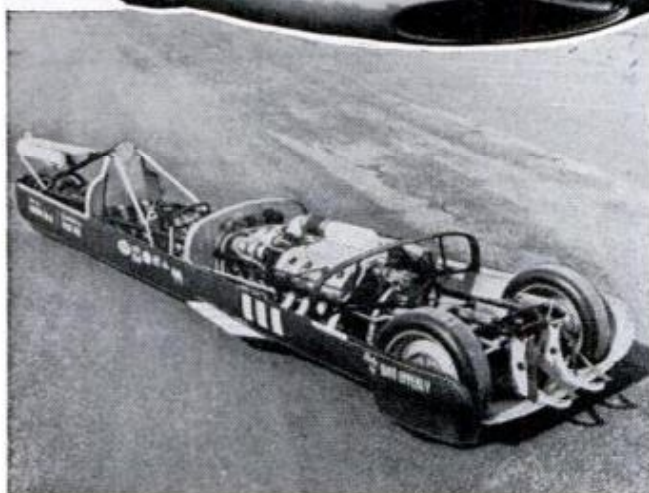


## Speedy Brothers

The Summers Brothers Special, built and owned by two California brothers, is gunning for a speed record on the Bonneville, Utah, salt flats.

The SBS has made a one-way run at 323.87 m.p.h., but was unable to complete its return run in the required time. Bob (the driver) and Bill Summers use a bored-out, super-charged, alcohol-fed 1955 Chrysler engine in their speedster. They say the 744-h.p. rig weighs only 2150 pounds.

The car is a four-wheeler. Hood blisters make room for the GMC 6-71 blower and for springing action by the wheels.



## Missile Patient

"Dental" care for a 103-foot Titan II missile was recently required at Davis-Monthan Air Force Base near Tucson, Ariz.

A tiny drift pin broke off in a hard-to-reach hole in the ablative skirt of the rocket engine. No machine shops could handle such a delicate job, so Dr. Robert Ratcliffe, a dentist, was called in to perform the extraction.

With a portable dental drill, he completed the job—after breaking several drill bits on the hard metal. The skirt, designed to resist heat during firing, is part of the second stage of the ICBM missile being prepared for operational duty at the base.





# Games for Boaters

*Tired of the same old Sunday afternoon cruises? Then try some fun-filled, skill-building water games*

By Patrick K. Snook

**M**ANY BOATING CLUBS are solving the problem of those midsummer what-do-I-do-with-my-boat-now doldrums by borrowing ideas from sports-car clubs.

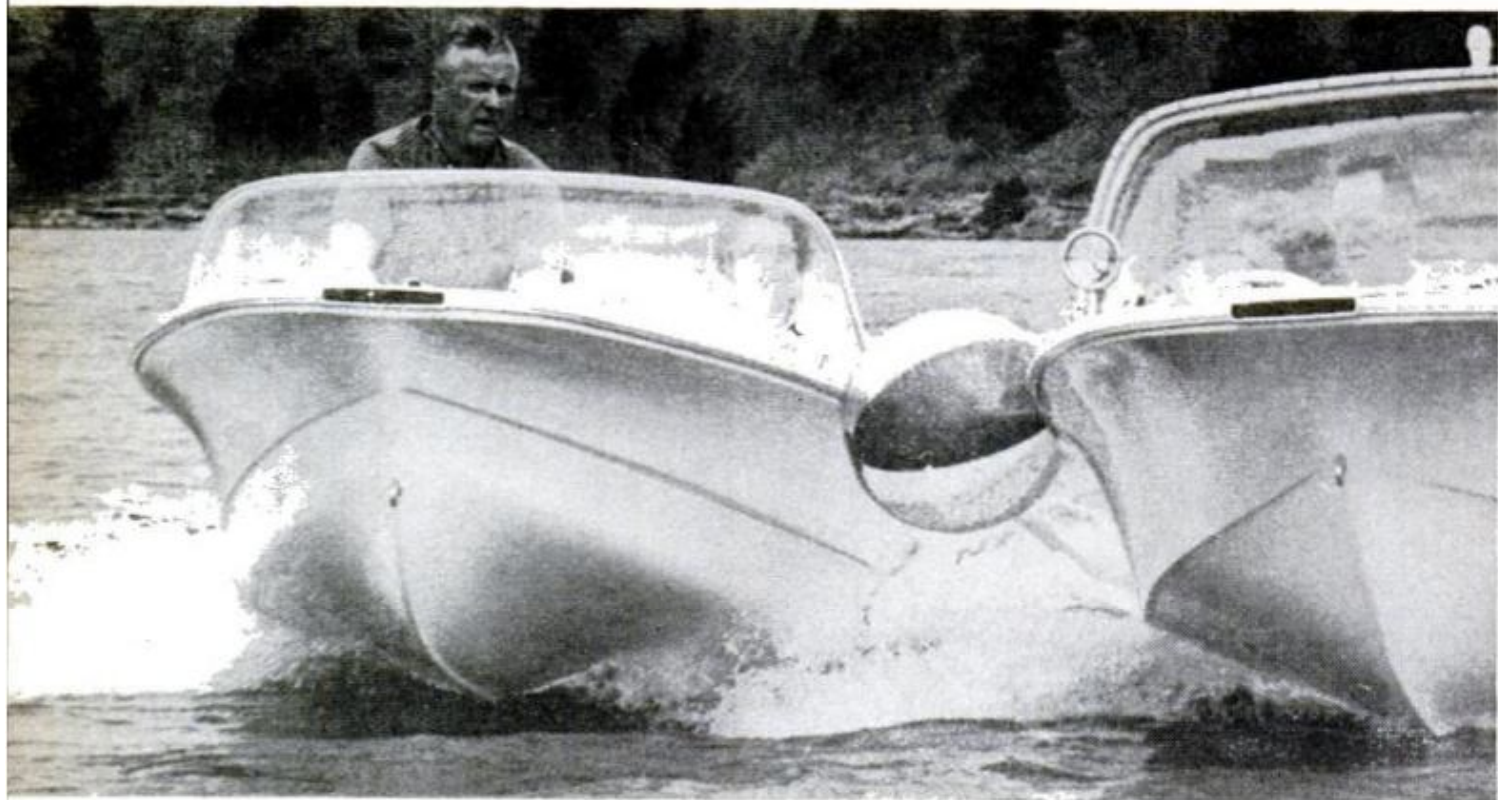
Predicted-log competition, a nautical adaptation of the automobile rally, has picked up thousands of fans over the past couple of years and is already a red-letter date on many club calendars. However, few people have heard of a more recent but equally appealing borrowing, the boaters' "gymkhana."

A sports car gymkhana is run on a twisting road course marked off into sections with flags or pylons. Actually, it's just a series of tests—acceleration, braking, backing, driving through a narrow slot, etc.—and the winner is determined by timing each contestant's run, then subtracting any penalties picked up along the way.

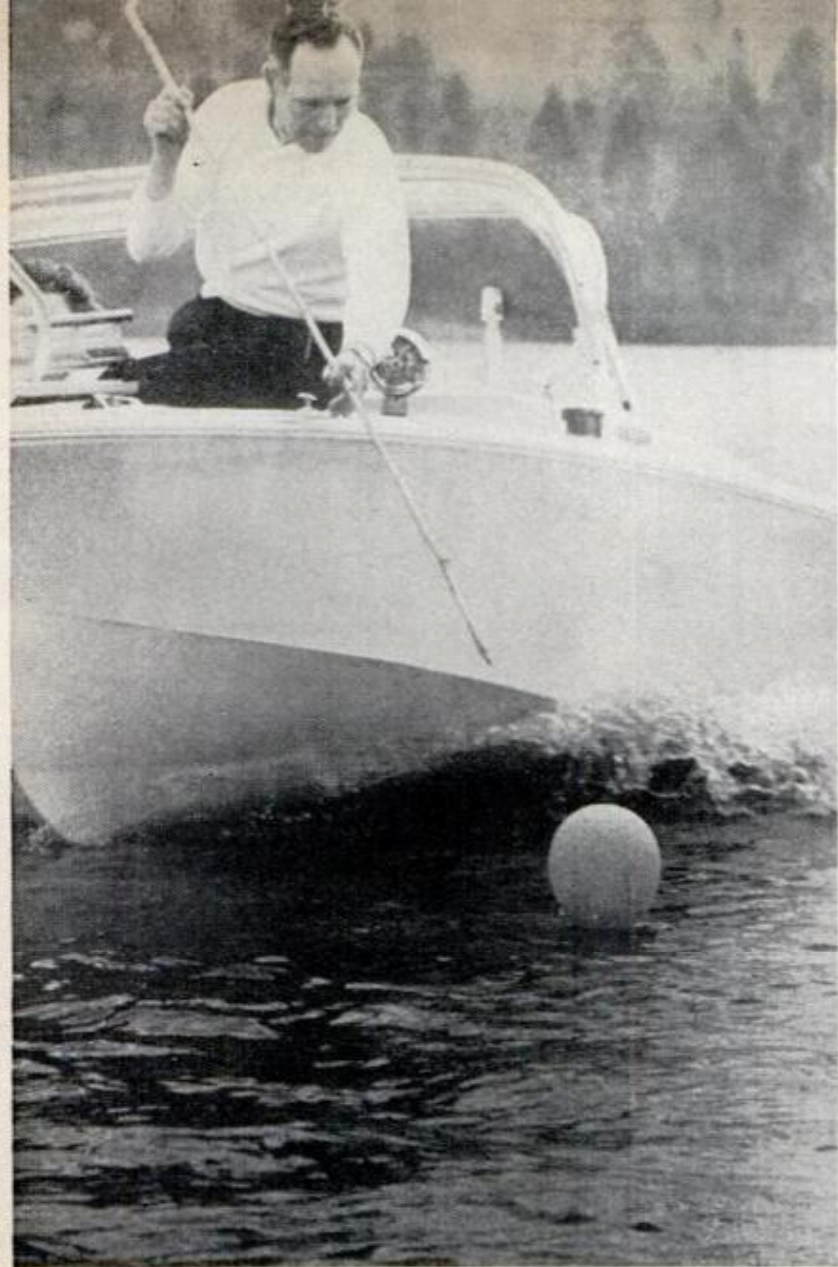
Boaters have taken this general idea, added a few special wrinkles of their own and come up with a number of games which are ideal for livening up your midsummer outings. Turn the page for complete rules and instructions on eight of these games.

**POP-AND-RUN**, right, is a modern version of *Moby Dick* using balloons instead of whales. While many variations are possible, basic idea is to pop all of the balloons

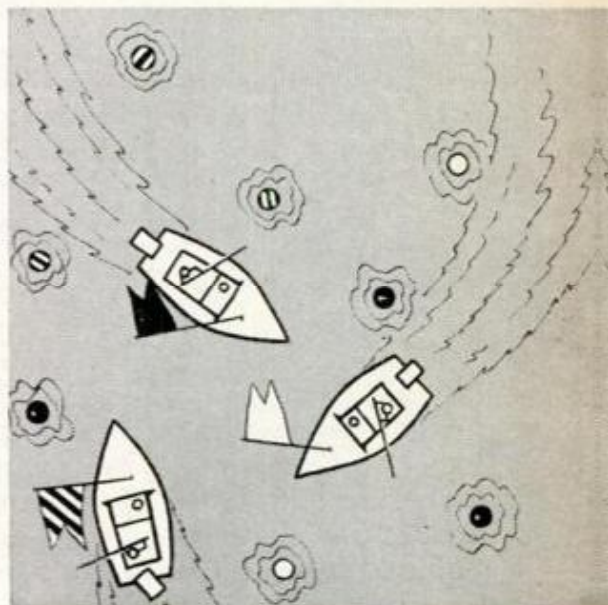
**HIGHBALL HANDICAP**, below, is a real test for a pair of skillful boat drivers. Run too close together and you'll break the beach ball, thus disqualifying your team



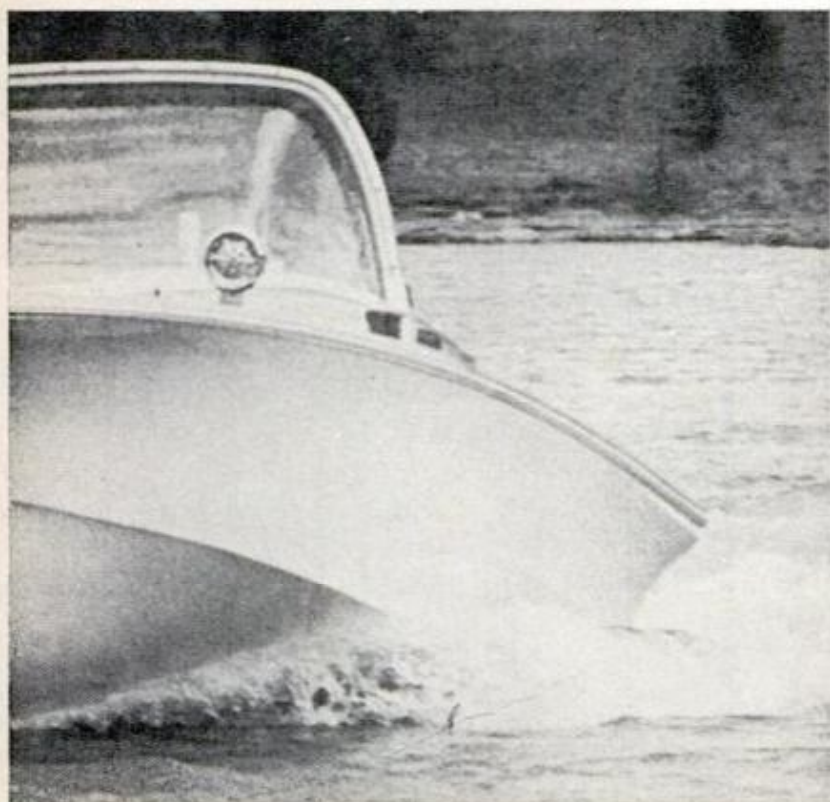




**PLUG CHECK**, an easy dock-side contest, is particularly good for the gals, though everyone who uses an outboard motor should know how to do it

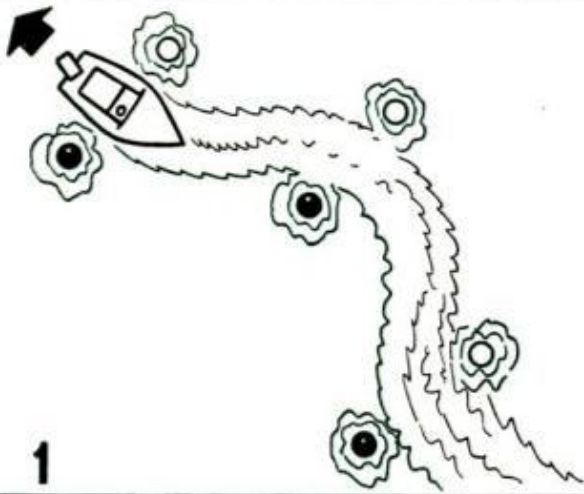


**IN CROWDED WATER**, balloon popping can be dangerous. With this, and every other event, make sure that you have enough open space for safe maneuvering

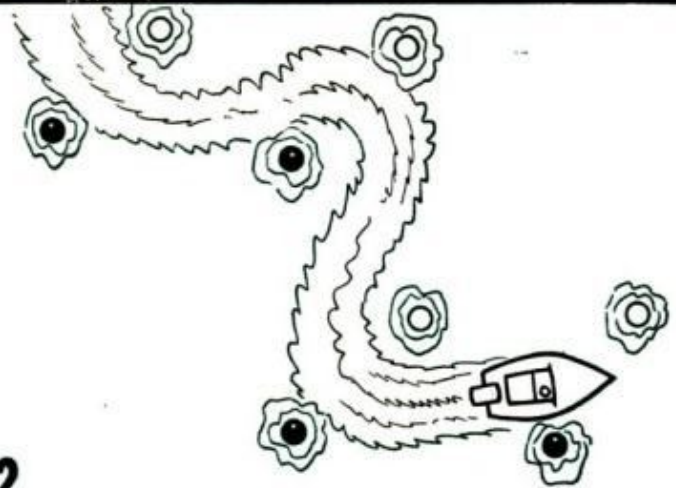


**SHEAR-PIN SWITCH** clocks a contestant's speed at pulling up and locking the engine, removing the shear pin, then putting the engine back in running condition





1



2

**SLALOM.** Use anchored balloons or plastic bleach bottles to mark off a twisting slalom course. These should be located in pairs so that they form "gates" through which the boat must pass. For a fast course, make the gates wide and locate them farther apart; if you want to make things more difficult, use narrow gates spaced only a boat length or two apart.

The actual event is run against time, with the contestant idling up to the first gate and pouring on the power at a signal from the starter. Over-running the markers or leaving the course earns a time penalty, and the fastest time wins.

For a little extra excitement, try a flying start on a tight course and increase the penalty times.

**BACKING SLALOM.** Reverse maneuvering requires a considerable amount of skill, particularly in close quarters, so a slalom variation based on this aspect of boat handling is a real test and has a great deal of spectator appeal.

The competing craft is brought up to the starting gate and shut down. When the starter's flag drops, the contestant must fire up the engine, turn the boat around and back through the course. As in a regular slalom, over-running a marker or leaving the course is a penalty offense.

**TAG-ALONG SLALOM.** Here's one that requires two boats. You can use the same basic slalom course, but the gates should be wider and the turns less severe.

Tie a 10-foot length of very light cord or ribbon between the transom of the lead boat and the bow of the number-two craft. After positioning the boats at the starting gate, both engines must be shut off. Then, at the starter's signal, each driver starts

his engine, and the boats make a follow-the-leader run through the course.

The object, of course, is to make the fastest time without breaking the string between the two boats. This can be quite a challenge, particularly while accelerating. Snapping the ribbon means disqualification for the team.

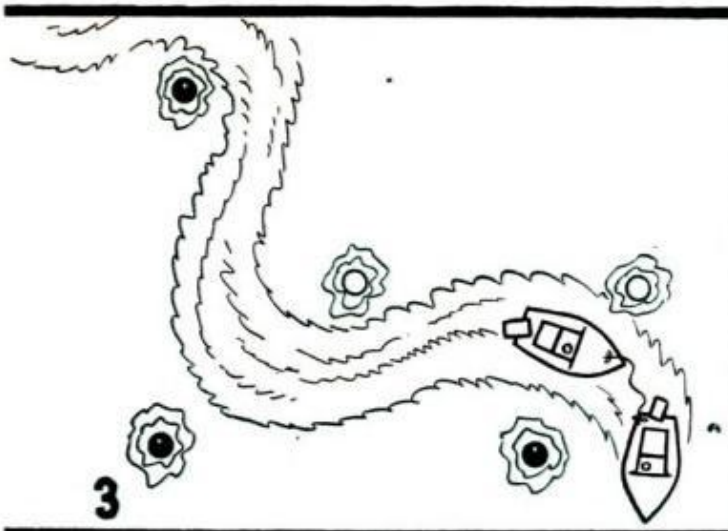
**HIGHBALL HANDICAP.** This is a tough one, and like the "tag-along," requires two boats. The boats take up a position some distance from the starting line and get under way, running side by side. Next, a large plastic beach ball is positioned between the inside gunnels. This is a little tricky, and several false starts are par for the course.

When the team has the ball set, they signal the starter and head through the starting gate. Once on the course, the ball cannot be touched. Fastest time wins,

**FIRST MATES** can be a big help, and many of the clubs are organizing events for husband-and-wife teams







1. **BACKING SLALOM** looks simple, but you'd be surprised at the number of experienced boaters who go off course or over-run markers

2. **STRAIGHT SLALOM** is an ideal game because you can vary speed of course by changing the width of gates and spacing between them

3. **TAG-ALONG SLALOM**, a great test of driving skill, requires a pair of boats to run through the course at approximately the same speed

and dropping or breaking the ball disqualifies the team.

It's a good idea to have an adequate supply of balls on hand if you plan to try this one.

**QUICK PICK-UP.** This event tests skill in close-in maneuvering and the use of a boat hook. A number of bleach bottles are scattered about 100 yards apart, and at the starter's signal, each team (one driver and one hook-handler) retrieves the bottles.

Interesting variations? Number the bottles and pick them up in sequence. Or paint them different colors and start the teams together, each one picking up only one color.

**POP-AND-RUN.** All you need is a good supply of balloons and some lightweight poles sharpened on one end. Either set the balloons adrift or anchor them with stones and lengths of light string. The object is

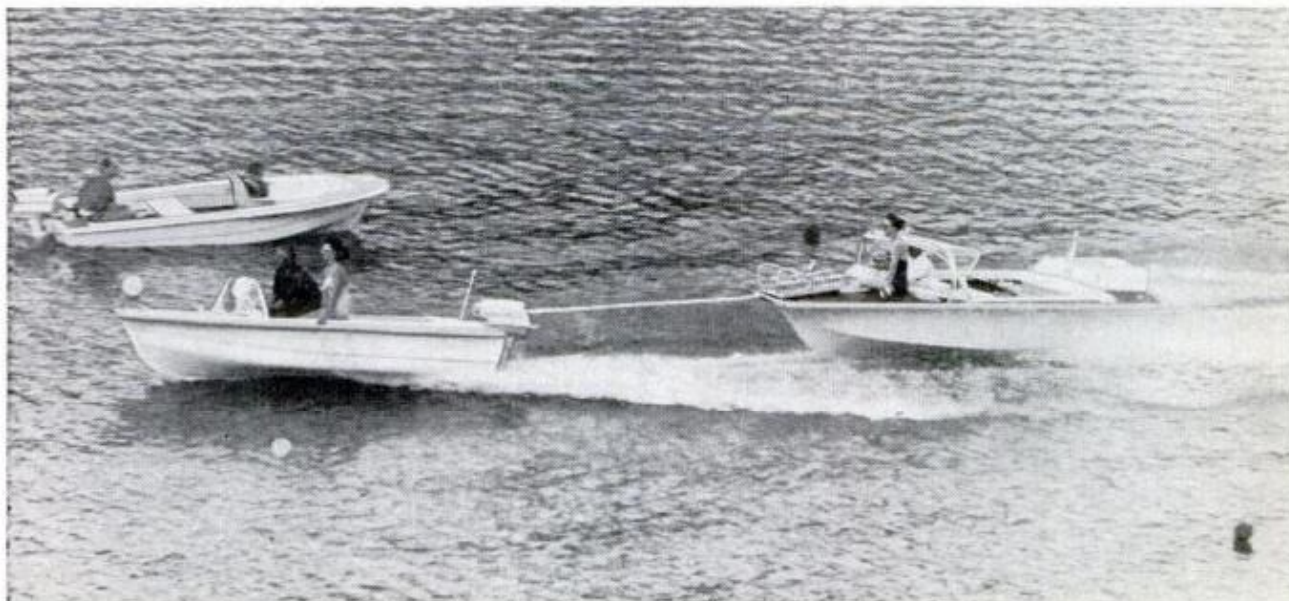
to break all the balloons and get back to the starting line in the fastest time. See "quick pick-up" for possible variations.

**PLUG CHECK.** In this dock-side game, the contestant must remove the shroud, disconnect a spark-plug wire, remove the plug and hold it over his head, then reverse the procedure and wind up by starting the engine. With tyros, better stop at the plug-over-head point to make sure that the plugs don't go back in cross-threaded.

**SHEAR-PIN SWITCH.** Same idea as the event above. However, heaving the engine up requires a little muscle, so this should be a men-only competition (or husband-and-wife teams, with mother doling out the tools and shouting encouragement).

And so it goes. You can probably come up with at least as many game ideas of your own. Have fun! ★★★

**RACING THROUGH** the wide starting gate, two boats enter the twisting course for a tag-along slalom run. If that ribbon snaps, they're out of the race







**STEPPING OVER SLUSHY GUTTERS** with ease, a secretary in London, England, keeps her feet dry with her own invention, a step-over umbrella. A metal ferrule fitted on the end of her umbrella includes a metal bar that folds out (inset) to form the puddle-jumping step, then folds flat again.



**"DISAPPEARING" OVEN** is a counter-height unit that has sides which fold away when not in use and a "door" formed by an air curtain blown from ducts at the edge of the oven. The American Gas Assn. uses the oven in tests designed to add speed to cooking.

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**ELECTRONIC AMPLIFICATION** of sound, taken directly from an instrument's strings by a transducer, does away with the instrument's traditional sound-body and improves its quality, say Les Barcus and John Barry. Above is their electronic guitar beside a conventional guitar.

Their *Violectra*, shown above right with an Italian Mezzadri violin, sells for \$795. The *Violectra* can be played directly into earphones for practice, below right or directly into a recorder.

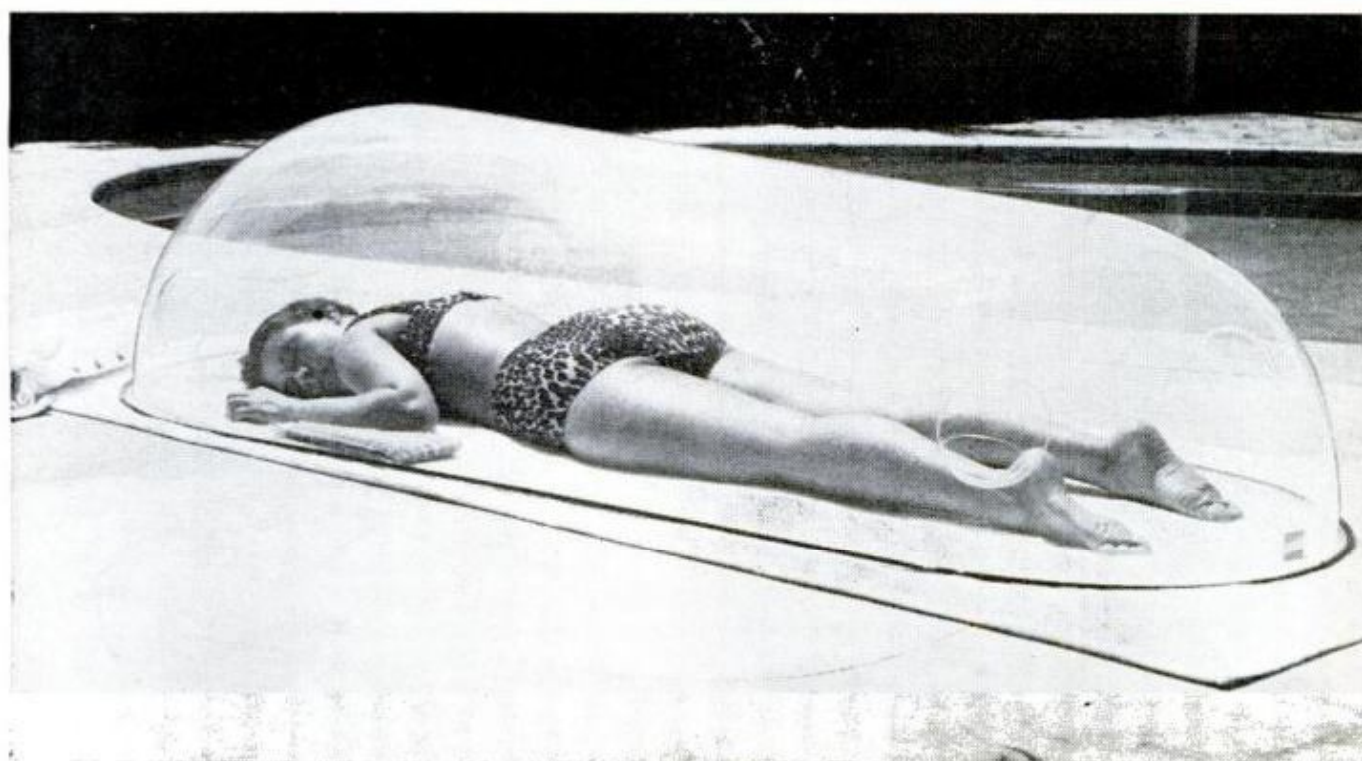
**SUN-BATHING CAPSULE** for use on cool or windy days is made of ultraviolet transmitting plexiglass. The lightweight unit can be carried. The heat of the sun's rays is retained in the capsule, making sunbathing possible in 50-degree temperatures. It's manufactured by Fabor Robison Productions, Inc., 2609 W. Olive St., Burbank, Calif.

POPULAR MECHANICS

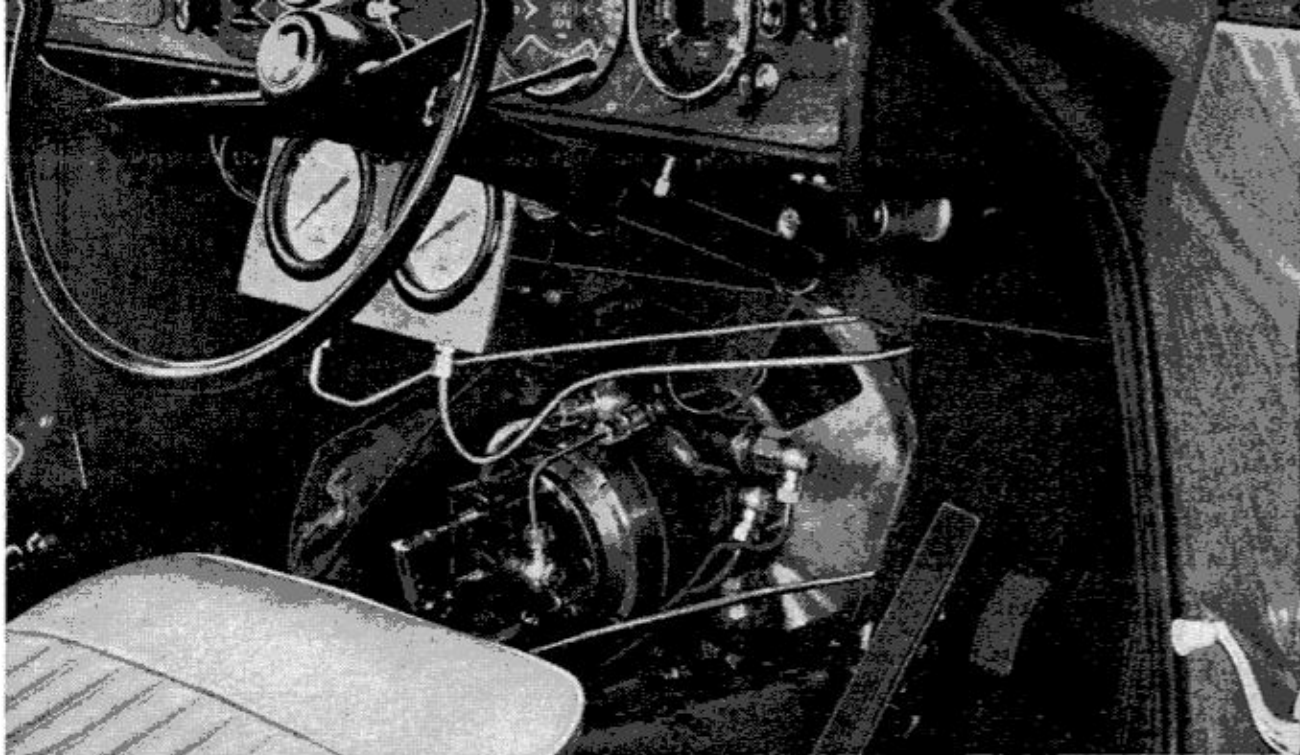




**FOUR CAN SLEEP** in a collapsible extension added to British Motor Corporation's Mini car or van by Wildgoose Worthing Ltd. Despite the extra weight, the car still gets 40 miles per gallon, says the maker. The Wildgoose conversion costs about \$1120—about the price of the Mini car itself.







# Hydrostatic Drive

*Tomorrow's cars may boost drive efficiency, yet discard the gearbox, clutch and even the brakes*

**By Jay Arthur**

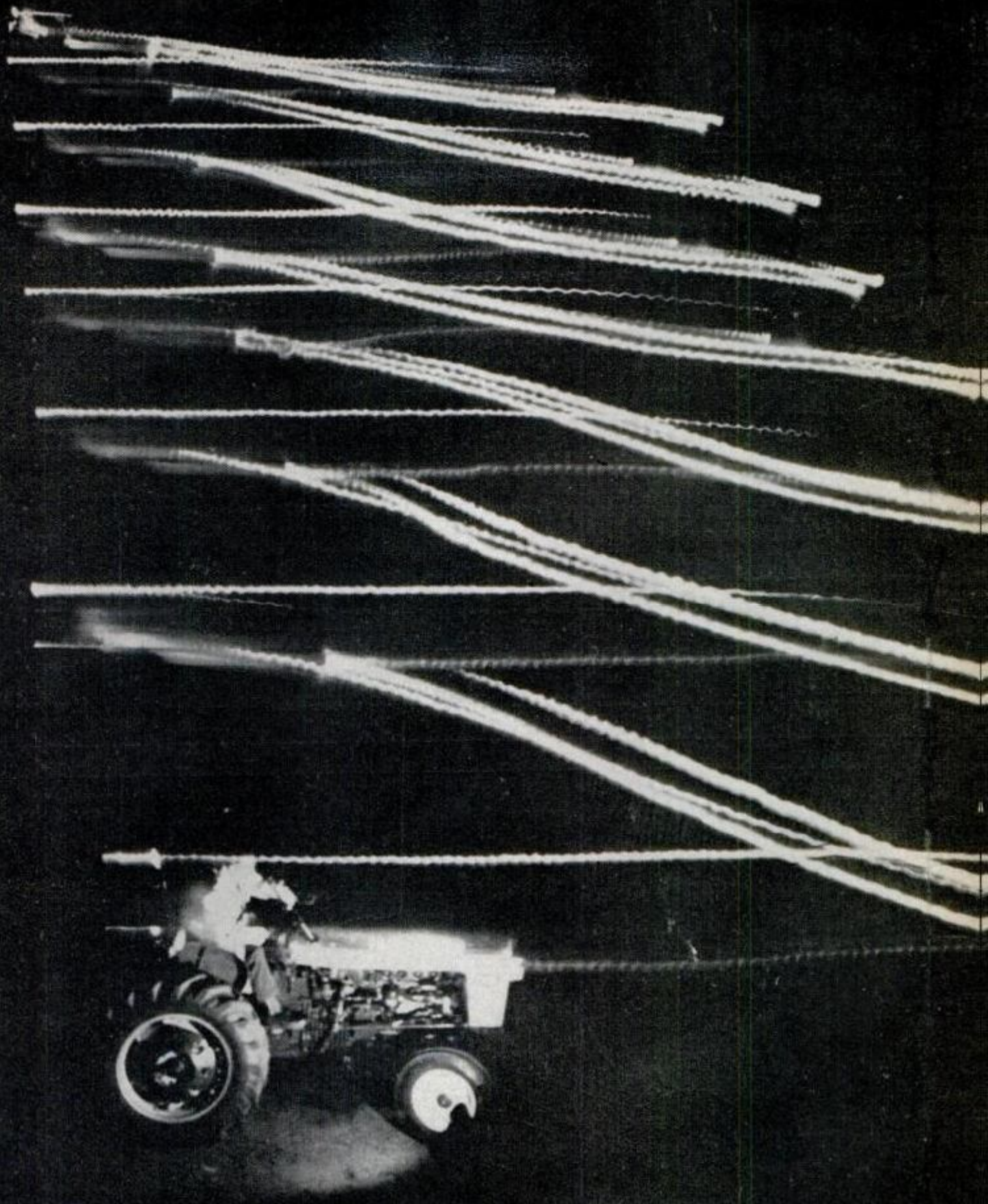
**I**MAGINE A CAR that always operates at peak engine efficiency, getting the most usable power from the least gas whether tooling along an expressway at 70 m.p.h. or inching up a mountainside. Picture it not only stopping on a dime, but giving you change. You'd never need brake linings or drums, transmission grease or repairs. Sound crazy?

The prototype of such a car is operating now in Scotland. It was created at Britain's National Engineering Laboratory. The unorthodox performance comes from its hydrostatic transmission. There is no mechanical gearing or gearbox, no differential, no drive shaft. In fact, this hydrostatic-drive car doesn't even need a rear axle. Its four-cylinder gasoline engine is connected to an oil pump that, in turn, is linked by oil lines to hydraulic motors that drive the wheels.

A swashplate eliminates the usual crankshaft and connecting rods for moving pistons back and forth in their cylinders. This is a round, smooth-surfaced disk pivoted at its center. On a common axis with the disk, the pump (or motor) pistons rotate with their circular cylinder block just as bullets do in a revolver cylinder. As the cylinder block rotates, the pistons' outer ends bear on the plate. Ramp action forces them to stroke in and out and pump oil as they travel. Oil pressure from the drive pump goes to corresponding motor pistons. They pass against the tilted motor swashplate, forcing their cylinder block to turn, thus turning the wheels. Increasing the pump swashplate's angle from vertical makes piston strokes longer, as they ride a steeper ramp.

In contrast, mechanical gears work in step. The ratio you choose is dictated by steps available. With the hydrostatic's





**HYDROSTATIC** tractor's ability is demonstrated in this night photo showing immediate change from forward to reverse using the transmission for the braking system



continuously variable displacement, you get an infinite variety of ratios.

Hydrostatic transmission alone is less efficient than a stepped cogwheel mechanical box alone, but with the latter you can't hold the engine at its best speed. And you need all of the usual drive train with its frictional and inertial losses. For example, to send three-quarters of engine power through the transmission at all ground speeds, a conventional tractor would need an unlikely 29 gear steps. Contrast that with a hydrostatic system that holds the engine at peak-power speed with any load.

You "downshift" the hydrostatic by reducing pump displacement for instant, variable braking with no gears to strip. A zero-angle (i.e. vertical) swashplate locks driven motor pistons with standing oil pressure. Wheels stop cold. By reversing the pump you go into reverse.

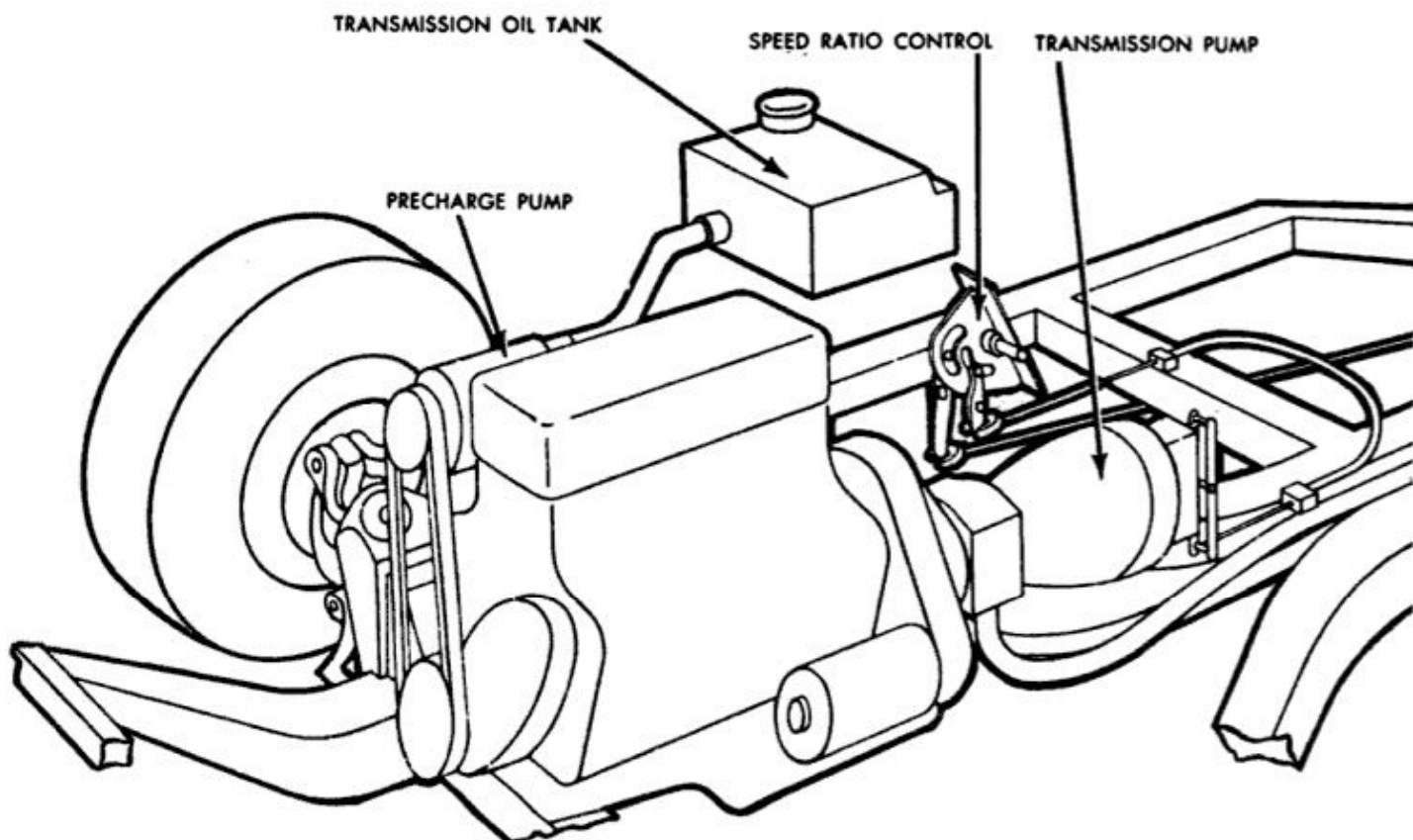
Britain's NEL has demonstrated hydrostatic's fast, positive braking and reversing. They use a Triumph Herald sedan, with transmission and drive replaced by three dual-purpose hydrostatic units and their oil lines. The engine crankshaft drives the pump unit; two hydraulic motors in the trunk drive rear wheels through non-variable reduction gears. For

more economy, the NEL hopes to combine swashplate tilt with the throttle on a single control.

Donald Firth, designer of the NEL system, says that a car built around it can locate the engine anywhere at any angle. You'd eliminate the transmission tunnel, mount hydrostatic motors on the wheels.

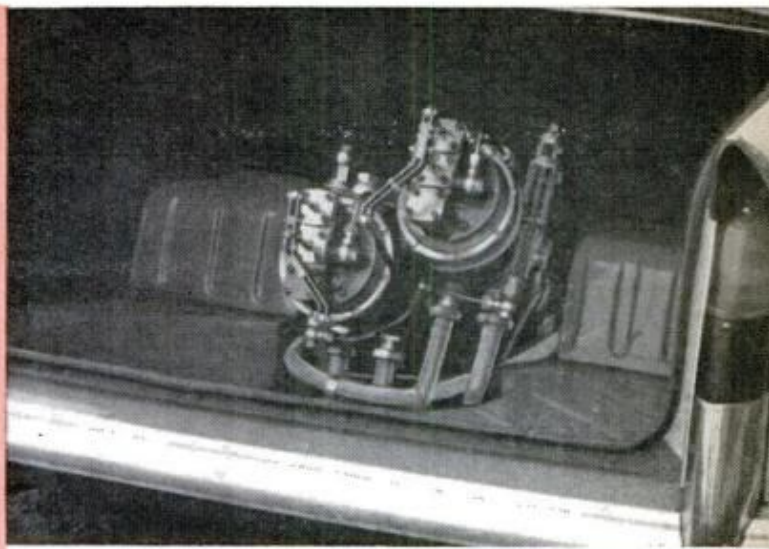
International Harvester's Carl Meile used wheel-mounted radial hydro motors on two experimental tractors. The drive train, from clutch to rear axle and brake drums, was replaced. The motors' pistons operated against the edges of a cam instead of the face of a swashplate. A load governor was designed to match speed ratios to loads. Transmission efficiency was only 79 percent, but I-H men, limited to off-the-shelf components, got tractor efficiency close to standard. With full power available, work was faster. The hydrostatic's advantages showed dramatically on a turbine tractor.

The NEL talks of transmission efficiencies on its Herald of up to 85 percent, and Firth thinks we could get hydrostatic cars "perhaps in as few as three years." Detroit is leery now, but when the British succeed with a commercially practical vehicle, you can be sure U.S. car builders won't be lagging far behind. ★★★



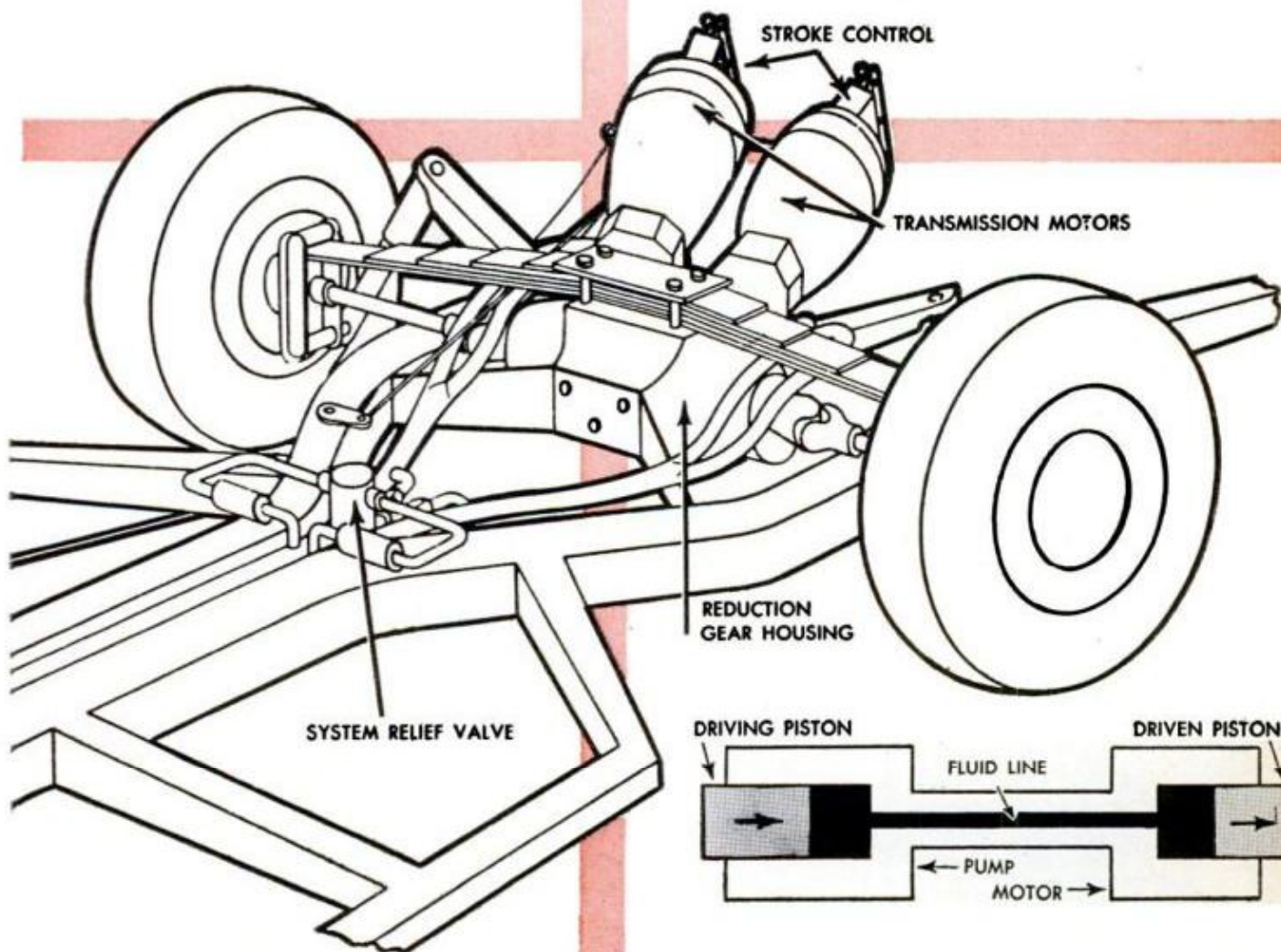
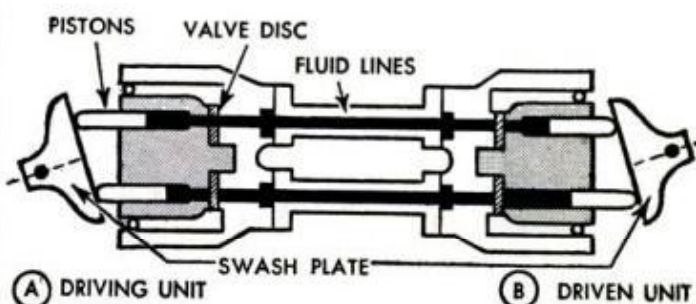


**SMALL HYDROSTATIC** motors are mounted in the trunk of the NEL's test Triumph. They're counterparts of the drive unit, but are considered motors since they're driven by the pump's action



**OPERATION** of one hydrostatic pump-motor combination is shown in this simplified diagram. Depending on the pump swashplate's angle, piston displacement varies to control action at the motors

**LAYOUT** of the test hydrostatic-drive Triumph shows how the drive pump replaces the usual transmission and is linked by oil lines to driven hydrostatic motors in the car's trunk







**MOORING BUOY** that's made of fiberglass and polyurethane foam never needs repainting, won't rust and can't sink, even if punctured. Called "Everfloat," the buoy comes in many colors and sizes, and is a product of the Glasspar Co., 19101 Newport Blvd., Santa Ana, Calif.



**CAP WITH A "POCKET"** is for carrying valuables, cigarettes and credit cards when you're in a bathing suit or other pocketless attire. The cork-billed floating cap has a detachable waterproof pouch that snaps into the crown. It was specifically designed for boaters by Official International Outboarders, Ltd., Box 646, St. Louis, Mo. Price: \$4.95..

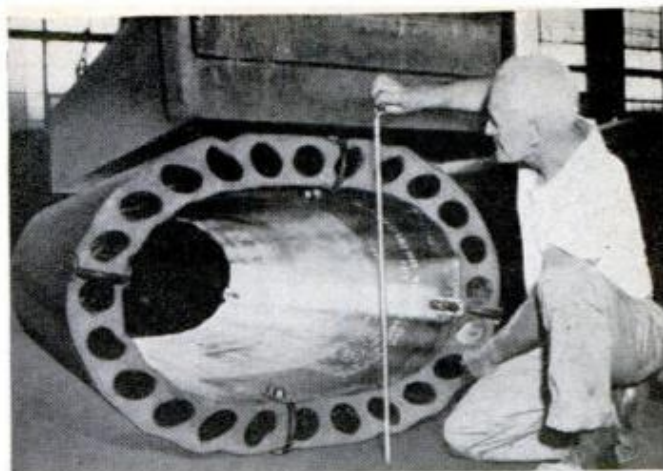






**TRIPLE-DECK DRIVING RANGE** accommodates three stacks of budding golfers in Japan. Built in the heart of Tokyo, on the grounds of an abandoned Buddhist temple, the range has 50 stations on each deck. There is no danger of any of the drives from the upper decks hitting the golfers on the lower decks because of deck overhang.

AUGUST 1963



**SHIP FENDERS** on U.S. Navy tenders will eliminate collision danger to nuclear submarines being refueled at sea. The tenders will wear huge rubber cushions developed by B. F. Goodrich Co. Weighing 2200 pounds, the massive fenders deflect only 12 inches under a 22,000-pound load (photo).



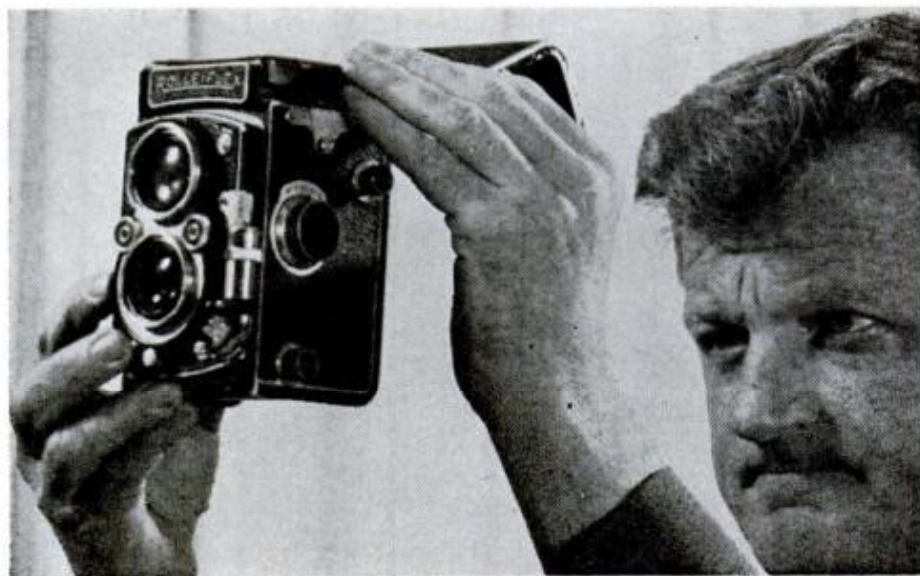
**KNIFE WITH A VIEW** combines a monocular field glass with a five-inch hunting knife. Made of Solingen steel, the Tele-Optic knife has a non-slipping hard rubber handle. Embedded in the handle is a double-lens two-power scope. A flap on the sheath protects the scope when not in use. The hunting knife is priced at \$3.95 from Leon Zakian Co., 58 Engle St., Englewood, N.J.

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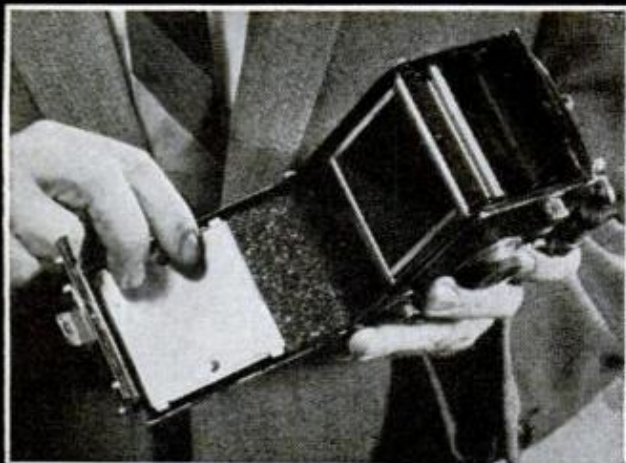
# Buying a Good Used Camera

*Ten basic checks, in the store and at home,  
to spot quality trade-ins on the dealer's shelf*



By C. H.  
Crandall

**BEST CHECK** is looking through back of camera and through lens as you set aperture and shutter at each of their settings to test for consistency



**OPEN BACK** of camera and examine insides. Pressure plate should be firm though not stiff, rollers should spin easily and interior should be reasonably clean. Inside appearance of camera is actually more important than the outside

**ROLL FILM** through camera to test winding mechanism, both with back open and closed. If film comes out with wrinkled edges, it is not winding properly, could cause fogged edges on your negatives or it could even tear the roll



**P**HOTOGRAPHERS are probably the world's most notorious gadgeteers. Every new gimcrack deserves a tryout. This built-in inability to resist new-model cameras, plus the introduction more than a decade ago of good, low-priced models—notably Japanese—has produced the greatest turnover of cameras in history.

Many photo stores, as a result, have genuine bargains on their used-camera shelves. And a used camera is not necessarily an abused camera. However, buying any used precision instrument involves a certain amount of risk, so the wary buyer can minimize the risk by applying a few simple checks, some in the store and some at home during the customary trial period.

Before even going to shop, however, decide what you want the camera for—black-and-white prints, color prints or color slides—and how much you can spend. The first will help establish the size. The 35-mm. camera is certainly the most popular for color slides, and the 35-mm. and 2¼-square cameras are the most common for all-around work. Larger sizes, especially the press and studio types, are for specialized work and should not concern the average snapshotter. Whether you want a rangefinder (with which you focus through a special viewer) or a reflex (with which you focus through either

the actual lens or a duplicate of it) is a matter of personal choice.

1. *Check the appearance.* It has some bearing on previous use, but a shabby-looking camera can still be functionally sound. However, severe dents may mean the camera has been dropped, jarring the mechanisms. Corrosion may extend to working parts. An accumulation of dirt and debris or scratches may mean severe misuse. Burred screw heads indicate an amateur mechanic has been meddling.

2. *Open the back.* The working parts are all inside and your most important checks will be made there. A clean inside is a good sign, no matter how shopworn the outside. Twirl the rollers and test the pressure plate (see photo). Both are important for proper feeding of film.

3. *Look through lens* with shutter on "bulb" to open the lens. Then hold it toward a light and look through it for nicks, scratches, discoloration or disfiguration. (Ignore small air bubbles you'll find on most lenses.) While it's open, move the lens' aperture to each of its f-stops. The iris blades should move in unison and form a symmetrical opening (usually hexagonal) at each stop, and each opening should be half (or double) the size of the one next to it.

4. *Next*, with the aperture wide open, close the shutter and run a similar test.



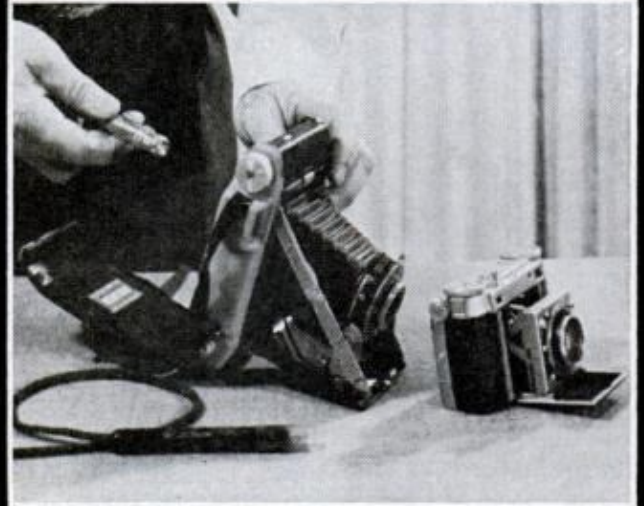
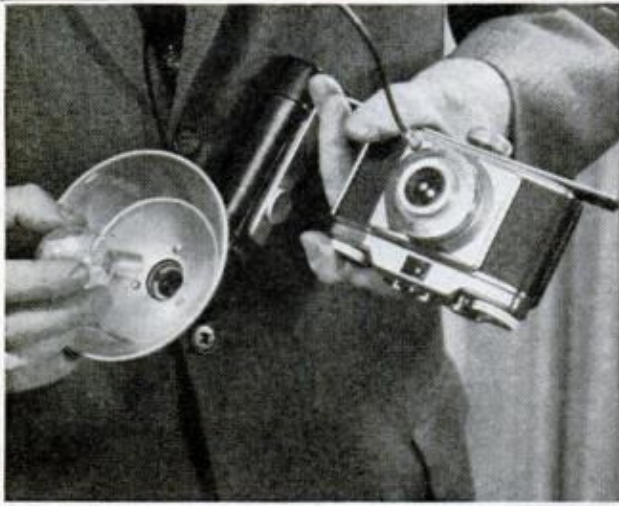
**REMOVE THE LENS** on cameras with interchangeable lenses and examine separately for dents and scratches. Then replace and remove several times to check snugness of fit. Poor fit could cause light leaks or focusing problems

**BUILT-IN METER** can be checked against name-brand meter. Camera meters are usually much smaller and less sensitive than hand-held meters, but the readings obtained should be within ½ stop or so to be of any effective use



**BUILT-IN ATTACHMENTS** can be tested in store. Flash units, bulb or strobe, can be fired at the counter. To check synchronization, look through the lens through back of camera to see if the flash fires while the shutter is open

**CAMERAS WITH BELLOWS** need a special check. Small penlight should be inserted inside bellows to check for light leaks. Even one small pinhole could fog every picture. Also check bellows' adherence to body and lens board



With the camera toward the light, cock and fire the shutter at each of its speeds, up and down the scale. It should look and sound consistently faster (or slower) than each previous setting. **Repeat the test.**

If the blades on either the iris or shutter stick, or in severe cases flop loose, move on to the next camera. The advantage of these through-the-back checks are that you check the lens, the aperture and shutter—the three most important parts of the camera—as well as the cocking and shutter-release mechanisms.

5. *Remove the lens.* If the camera has interchangeable lenses, the aperture and shutter tests outlined above can be done separately. Also, by removing the lens you can examine it for burred threads or for nicks in the mount or scratches on the glass. Shake it and listen for loose elements or bits of glass. When replacing, check snugness of fit.

6. *Run film through the camera.* Bring or buy a roll of outdated film and load it in the camera. With the back still open, run it through once, cocking and firing the shutter and advancing the film one frame at a time. It should ride over the rollers (or sprockets) easily. Rewind it and, with the back closed this time, run it through again. If there is any problem about the film riding up over the grooves

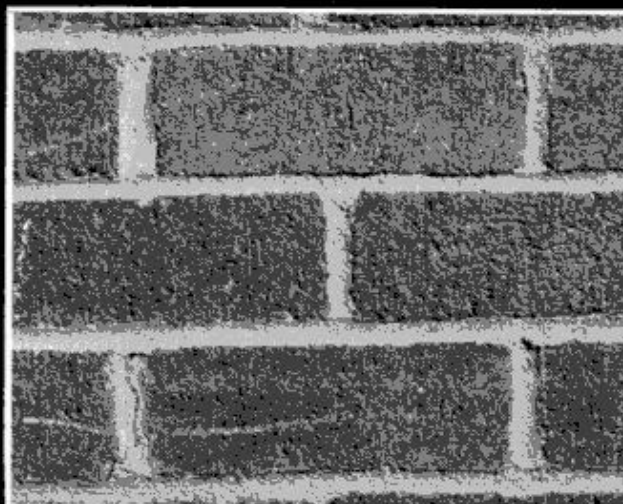
**CAMERA LENS** is perhaps most important—and expensive—item on camera. Working mechanism can be repaired, but a scratched lens is practically useless. The tiny bubbles found in most lenses are harmless





**TAKE SOME PICTURES.** This is the most practical test of all, because it's what the camera is for. Take a few closeup portraits and long-shot scenics, and make prints to check the results for sharpness and shutter accuracy

**BRICK WALLS** or any other flat, detailed surface is excellent for testing the sharpness of lens on a plane, from corner to corner of the frame. These tests should be made with a tripod to eliminate any camera movement



it is meant to run in, or winding sloppily, film may tear.

7. *Check the accessories.* Some cameras have built-in accessories or attachments and, since they are part of the purchase price, they should be tested, too. Flash attachments are quite common, and can be tested readily in the store by borrowing or buying a few bulbs and firing them. If the camera is synchronized for electronic flash, borrow a strobe unit (or bring your own) and test-fire that, too. Built-in exposure meters can easily be tested against another meter.

8. *Check the focus.* This is especially important on rangefinder cameras, where you depend almost completely on the focusing mechanism for sharp focus. Check it for telltale play. On reflex cameras you depend primarily on your eye. On either, however, it's a good idea to double check both the nearest and farthest ranges of the lens. Most normal lenses will focus down to within 3½ feet or so. Do it, and measure off the distance carefully with a tape. Then, with the clerk's permission, step out on the street and focus on something distant, at least 100 feet away. The footage scale on the lens should be on the infinity mark. If both the near and far focus line up accurately with the footage scale, the range in between should be accurate.

9. *Get a trial period.* Most reputable stores will give some form of trial period during which you can take the camera home and actually try it out. The most common is a 10-day trial, which gives you time to test with actual film.

10. *Take pictures.* Use the trial period for some systematic testing especially of the sharpness of the lens and the accuracy of the shutter, plus the intangible of whether you enjoy working with the camera. (Some personal dislikes, not apparent in the store, show up during shooting sessions.) Test the lens by taking closeup portraits as well as pictures of a flat surface with lot of detail, such as brick wall or a newspaper taped to a wall. If possible, use a tripod to eliminate movement, and take pictures at both the widest and smallest apertures. The portraits will tell you how fast the focus falls off from front to rear and the flat-surface pictures will tell you how well it holds up from center to edges. In addition, take scenic long shots to test the lens at infinity.

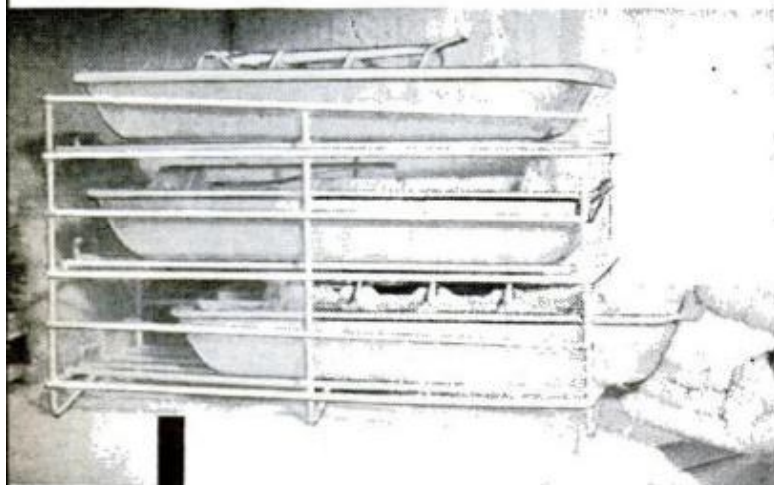
To test shutter consistency, take a series of pictures of the same subject at all shutter speeds, adjusting the aperture each time to keep the same exposure (i.e., 1/25 at f:22, 1/50 at f:16, 1/100 at f:11, etc.). If the shutter is way off on one of the speeds, it will show up in this series. ★★★



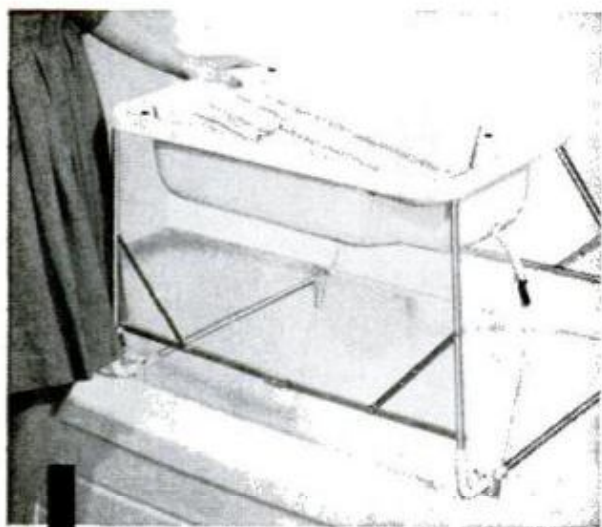
# New for Your Home



**SALT AND PEPPER SHAKER** "buoys" of plastic with napkin-holder base may be hung on boat bulkhead or used on table. Black enamel base model costs \$3.95; mahogany base, \$4.95. By Lister Industries, 141 E. 44th St., N.Y. 17, N.Y.



**ICE-CUBE-TRAY RACK** stacks 3 full-size trays for easy access in freezers over 8 inches high. Chrome-plated rack costs \$3.20; Stewart's, 433-61 St. N., St. Petersburg, Fla.

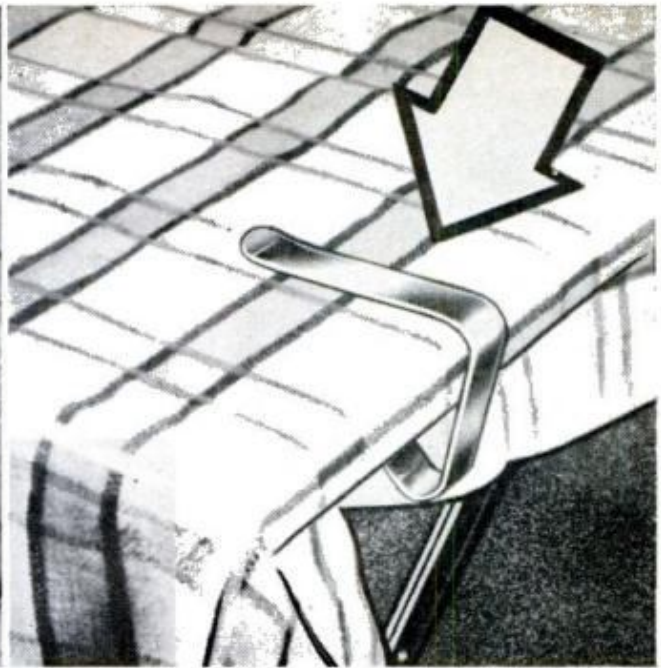
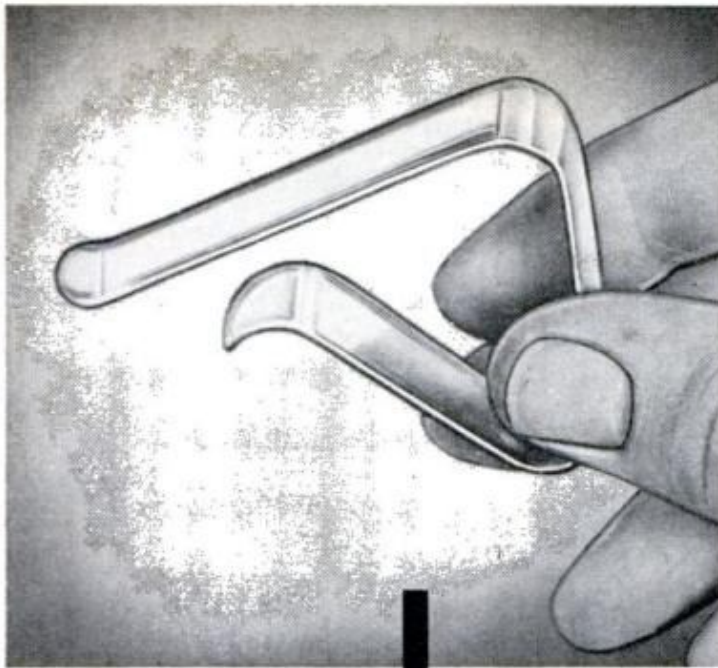


**BABY'S BATHTUB** of polystyrene with steel frame locks safely onto standard bathtub, uses big tub's faucet and drain. Price: \$12.95; Century Prod., 3510 Chatham, Cleveland, Ohio



**UPHOLSTERY FOAM SHAMPOO** and sponge applicator unit cleans color-fast fabric and leather, dries within an hour. 14-ounce aerosol can will clean two chairs or a sofa. Cost is \$1.49 from Bissell, Inc., Grand Rapids, Mich.





**PICNIC CLIP** of spring steel, one-half inch wide, bends into position and instantly holds down cookout gear, foiling the wind. To secure a tablecloth or napkin, the flat leaf goes on top with the angle section underneath. For paper plates, the angle section goes on top. Set of six costs \$1 postpaid from W. Perusse, P.O. Box 81, De Kalb, Ill.

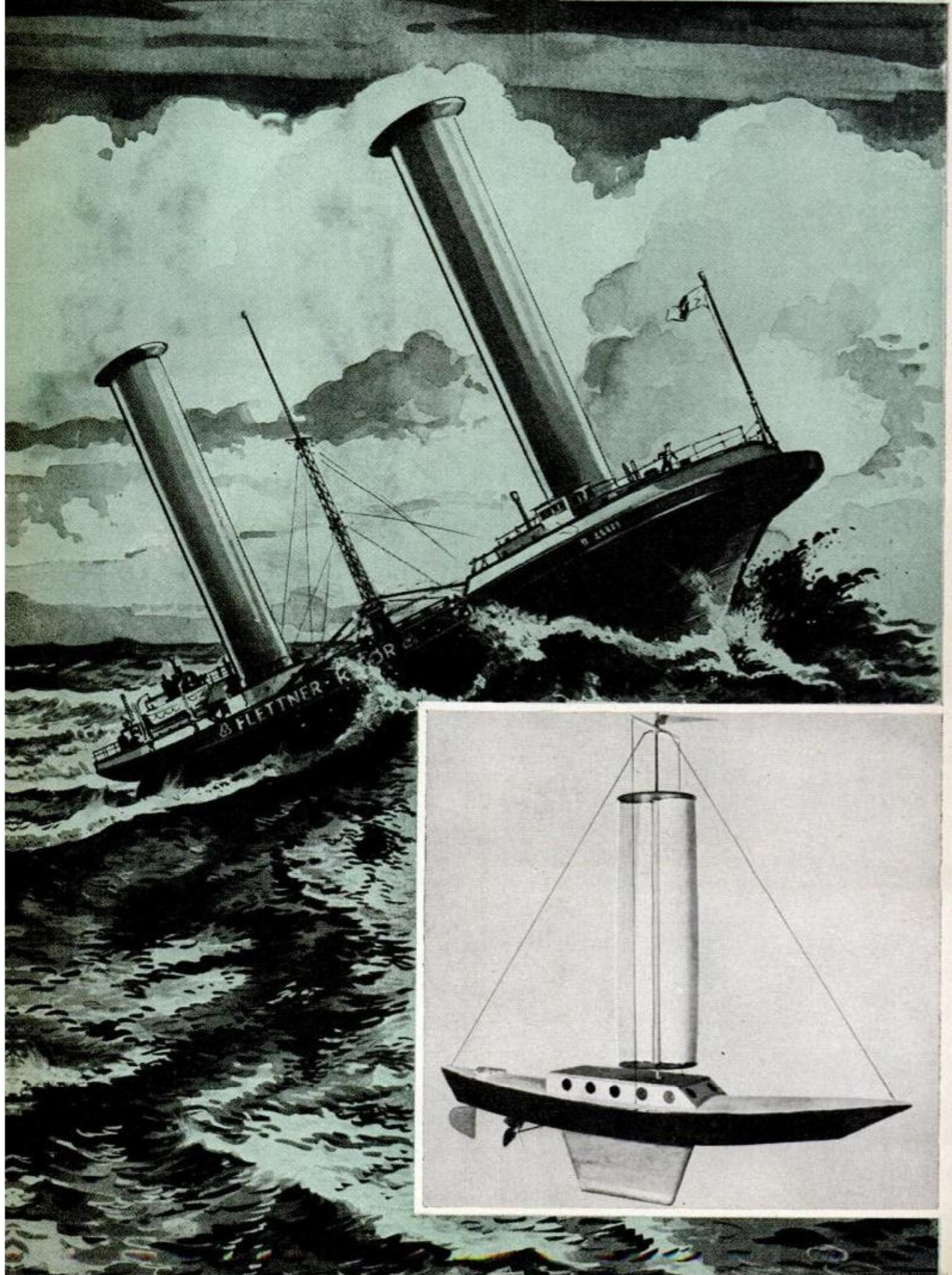
**PLASTIC-BAG SEALER** unit of heater, wheel, lubricant, mat and stand heats to 265 degrees F. and operates by rolling wheel over ends of bags. Complete kit costs \$12.95. Made by the Harwil Co., 1009 Montana Ave., Santa Monica, California



**VIEW THE NEST** through a one-way mirror without being seen by the birds. Plastic wren nest attaches to window glass with special tape, needs no maintenance. Price per nest: \$2.98, from Vu-A-Nest Co., Box 21, Granite City, Ill.









# ROTOR-SAILING SHIP

By Roy L. Clough, Jr.

ANTON FLETTNER'S famous rotor ship *Buckau* was propelled by spinning drums upon which the wind acted to produce thrust. While it required a small motor to spin these rotors, the main source of power was the wind harnessed through the Magnus effect—if a drum is set to spinning in a wind, a thrust vector is produced at 90 deg. from wind impingement.

Unlike the original rotor ship, this little model uses an unpowered modified rotor which also provides rotary shaft power to spin an underwater propeller. It's actually a Magnus windmill that will spin regardless of the wind direction.

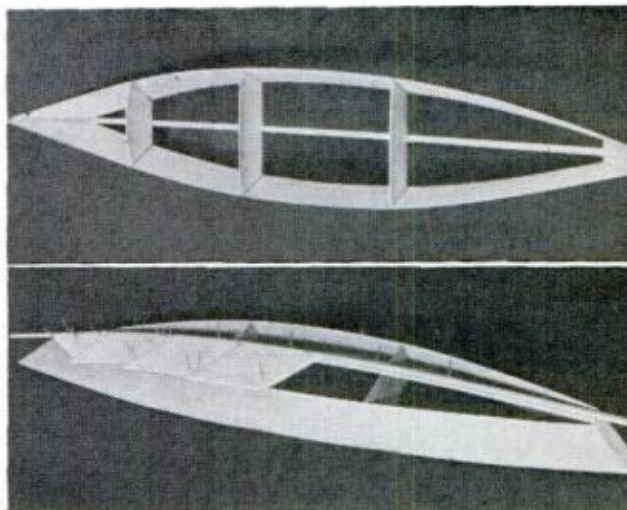
The thrust produced by the rotor is in direct proportion to the speed at which it turns. However, you will note that this rotor has been loaded with a rather large propeller which holds down its speed, since the propeller thrust must be greater than the rotor thrust. The reason for this is actually quite simple.

When the model has the wind on its port beam, the thrust of the clockwise rotor is dead ahead, but when the wind is on the starboard beam, the rotor thrust is toward the rear of the ship. In the first instance, the rotor thrust is added to the propeller thrust, but in the second it is subtracted. Thus, the greater prop thrust makes it possible for the model to tack either way, though it is fastest with the wind from port.

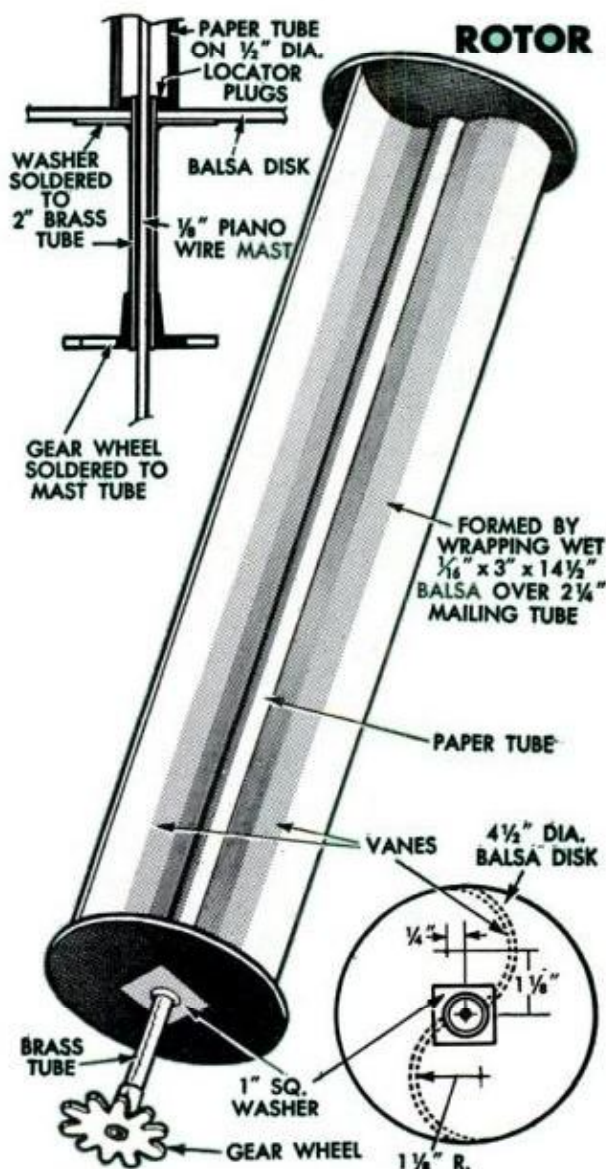
The graceful little hull will go together as easily as a box if you allow the cement to dry well between assembly steps. Solder the "shaft-log" bearing into a bit of tin-can stock and cement it into the hull. The deep keel (pine) should be cemented and nailed to the hull. Drill an undersized lead hole in this and drive in the  $\frac{1}{8}$ -in. wire mast. Ballast can be a length of old shafting, solder, babbitt or type metal. About 24 to 30 oz. will suffice.

To shape the vanes of the rotor, soak the balsa until it's pliable, then bind the two sheets around a  $2\frac{1}{4}$ -in. mailing tube which you have covered with wax paper. When dry, you can make minor dimensional corrections by springing them slightly during assembly. Next, roll up a tube of stiff paper, soak it well in model airplane dope and mount it between the rotor end disks on locating plugs. Finally, glue the curved vanes in place.

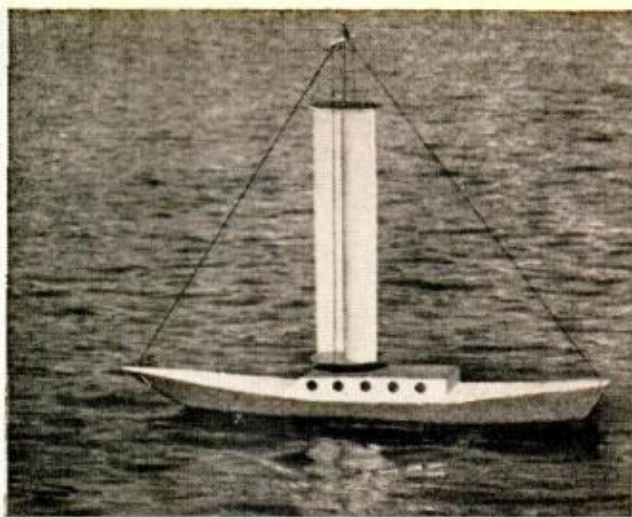
It's particularly important that the gearing and shaft in the power train work



TWO SIDES should be attached at stem and stern block, then sprung apart so that bulkheads may be inserted. Pin guide strip to keel so that different sections of bottom planking may be aligned easily



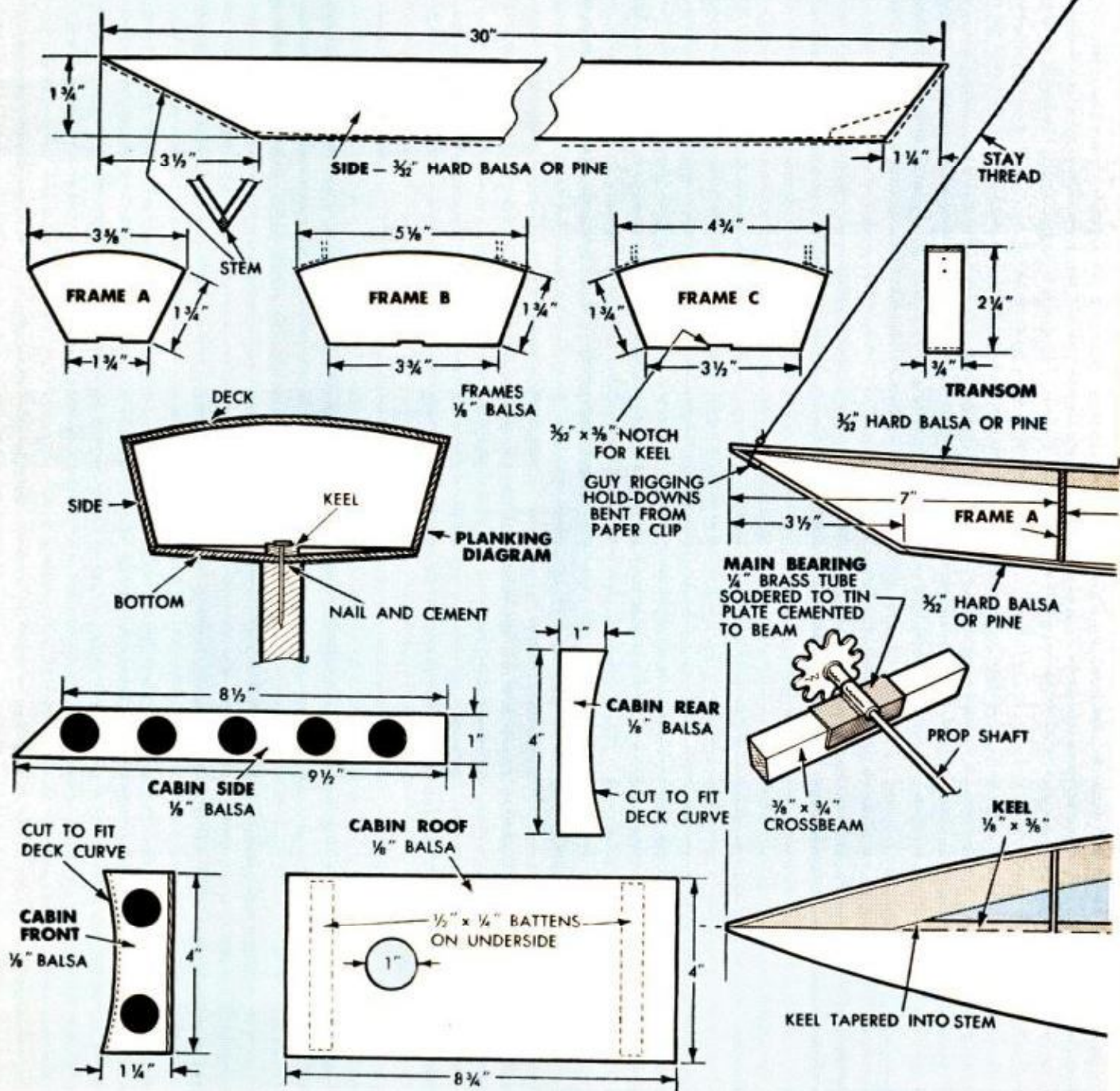




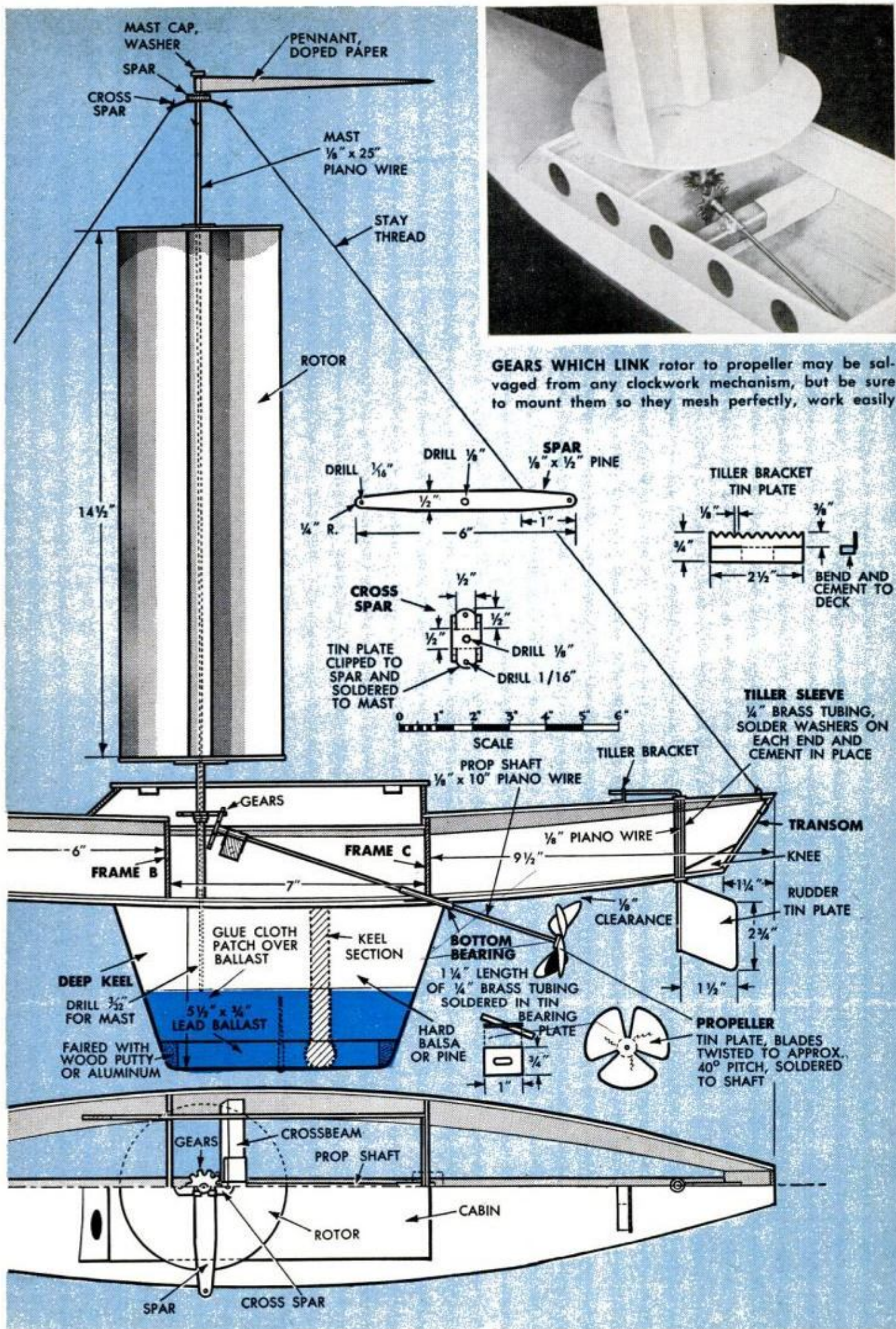
**ROTOR SAILER** makes best speed when wind is on the port beam. At varying angles in front of the wind, speed will vary with thrust vector resultant

freely. Flattened egg-beater gears were used in the model illustrated, but many similar gears would have worked just as well. Be careful to align the cross member which supports the upper part of the propeller shaft. This should mesh perfectly with the gears. You can adjust the location of the rotor gear by slipping washers or bits of tubing over the rotor mast so that this gear engages the prop shaft gear favorably. The shaft log bearing may be very loose and still not leak water, since a couple of drops of lubricating oil will be enough to keep the water from entering.

Make a trial assembly before permanently mounting the parts. The cabin roof should be spot-cemented in several places so that it may be removed easily in case adjustments are necessary. ★★★



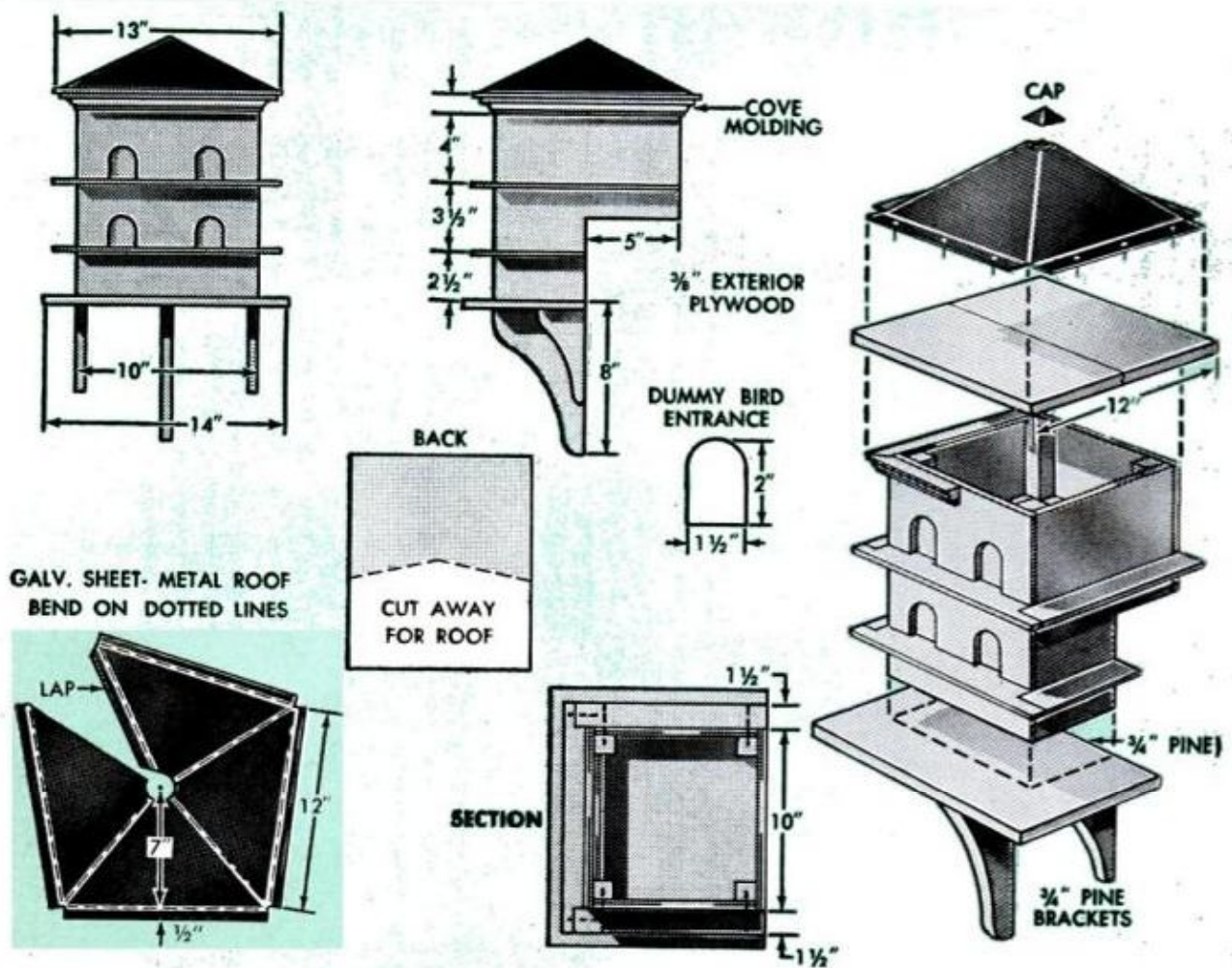
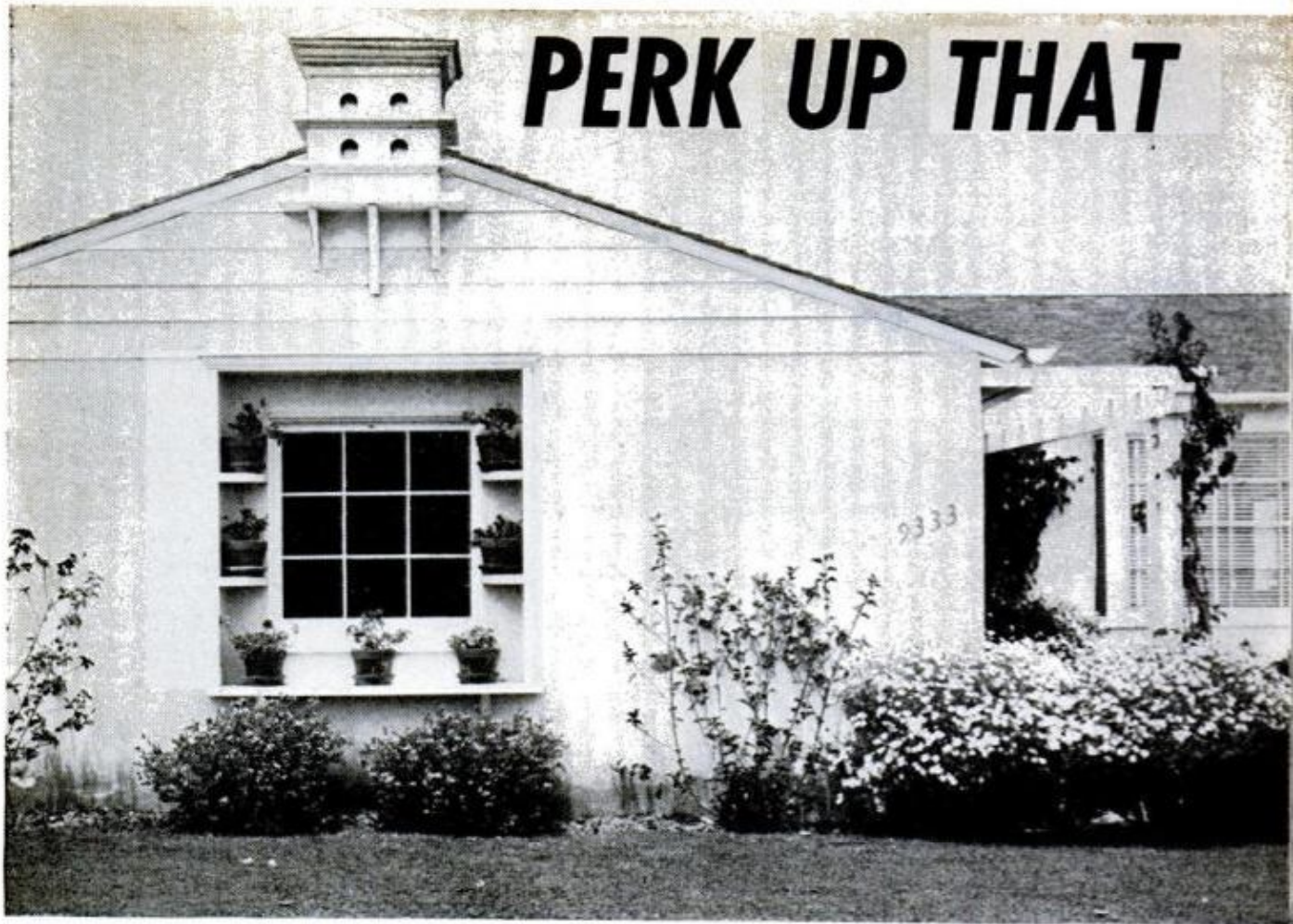




GEARS WHICH LINK rotor to propeller may be salvaged from any clockwork mechanism, but be sure to mount them so they mesh perfectly, work easily



# PERK UP THAT

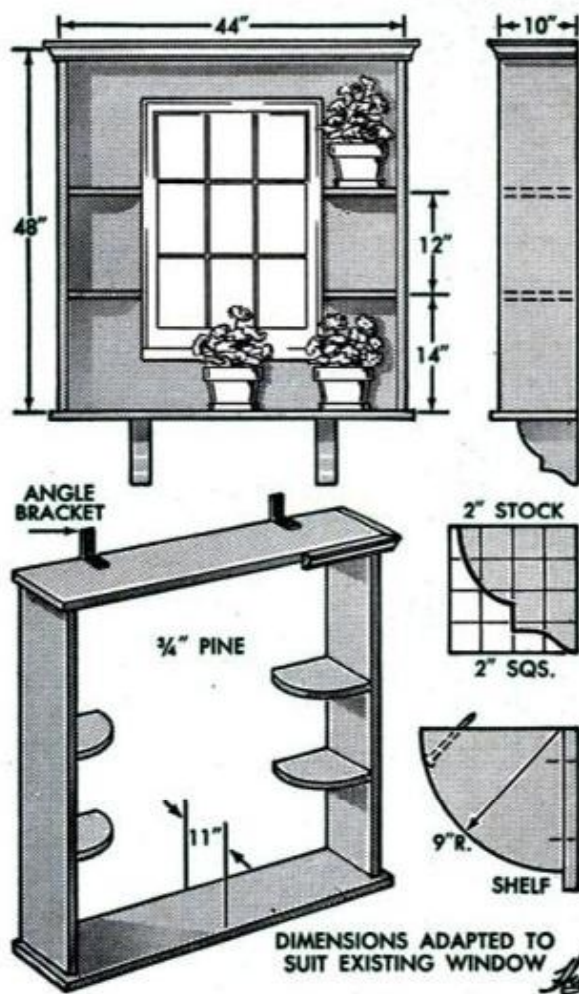




# PLAIN WALL

RELIEVING the plain outward appearance of a home often can be done with a few simple embellishments, and a good example is shown in the photo at the left. Without the birdhouse cupola and the shadow-box window shelf, you can picture how plain looking this wall would be. Yet with the addition of these two face-lifting items the house takes on a distinctive individuality.

The cupola is a dummy affair and made to only look like a birdhouse since the entrances are actually boarded up. The shadow-box window shelf simply frames the existing window and is merely hung over it like a picture frame. In each case, the dimensions given must be adapted to suit individual requirements. The back of the cupola, for example, must be cut to match the pitch of the particular roof. Likewise, the size of the window determines the over-all size of the shadow-box frame. Stock lumber and molding can be used for both items. If you use plywood, be sure it is the exterior type. The roof can be copper or galvanized.—Hi Sibley



## Pint-Size Rake

Cutting down a bamboo rake to 5 or 6 teeth made the handiest tool I ever had for raking out between shrubs. I simply cut away the outer teeth and retwisted the original wire lacing to hold the remaining teeth intact.—P. Casperson

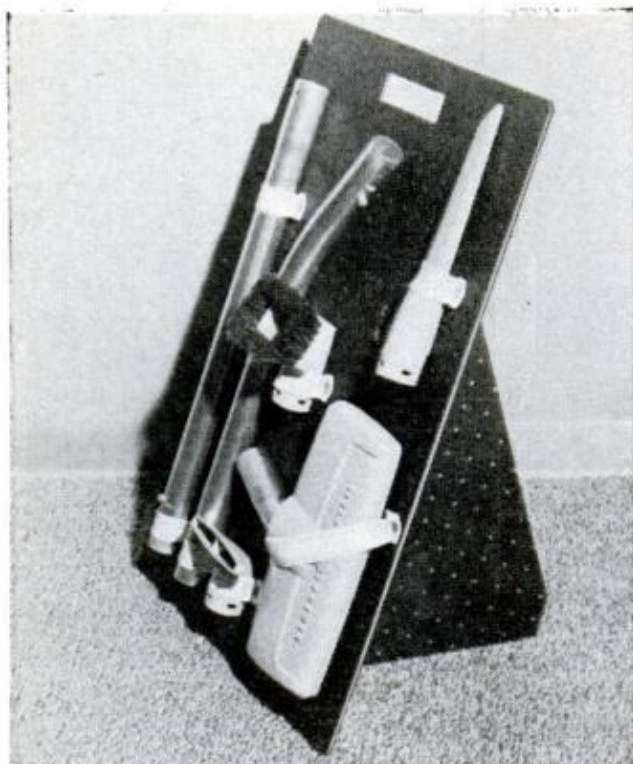
## Less Briquets

The average size barbecue grill is fine for a large cookout, but when grilling a steak or two, the large fire bed is a waste of fuel. Here is where you can make good use of a narrow notched ring formed from a strip of sheet metal to confine the fire.

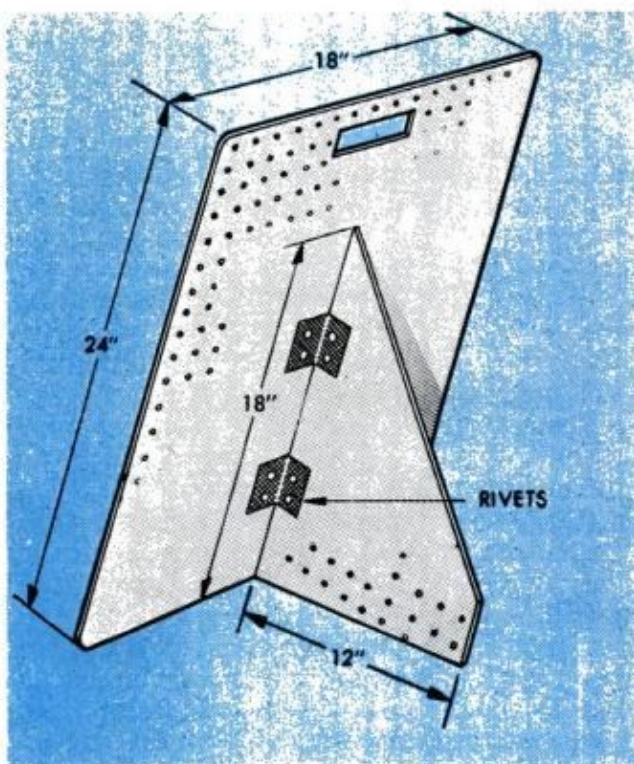




# Easel Caddy Holds Cleaner Attachments

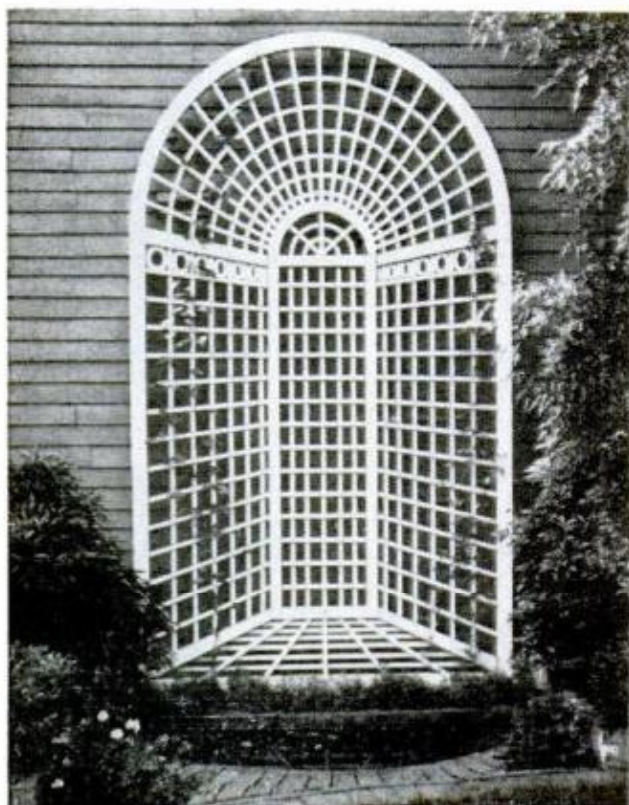


Here's a handy low-cost rack for vacuum-cleaner attachments that can be hung in the broom closet when not in use. On cleaning days, your wife can take the whole rack with her from room to room, standing it up by just folding out the hinged brace in the rear. Thus, every at-

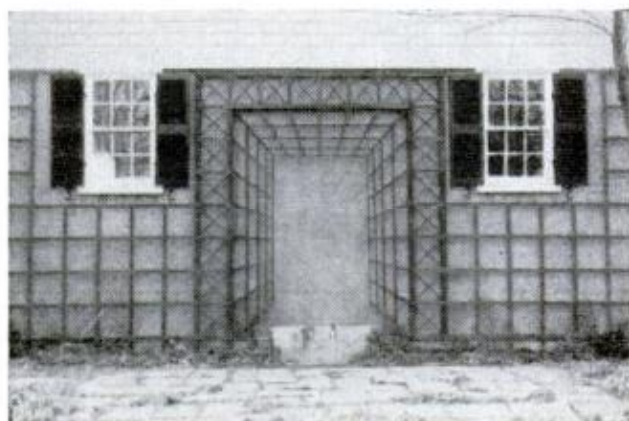


tachment is always handy, ready for instant use. It's an easy one-hour project. Just rivet elastic-webbing slings to the perforated hardboard to hold the attachments, and use rivets to mount the hinges. A slot at the top serves as a built-in handle.—*Barbara B. Paine*

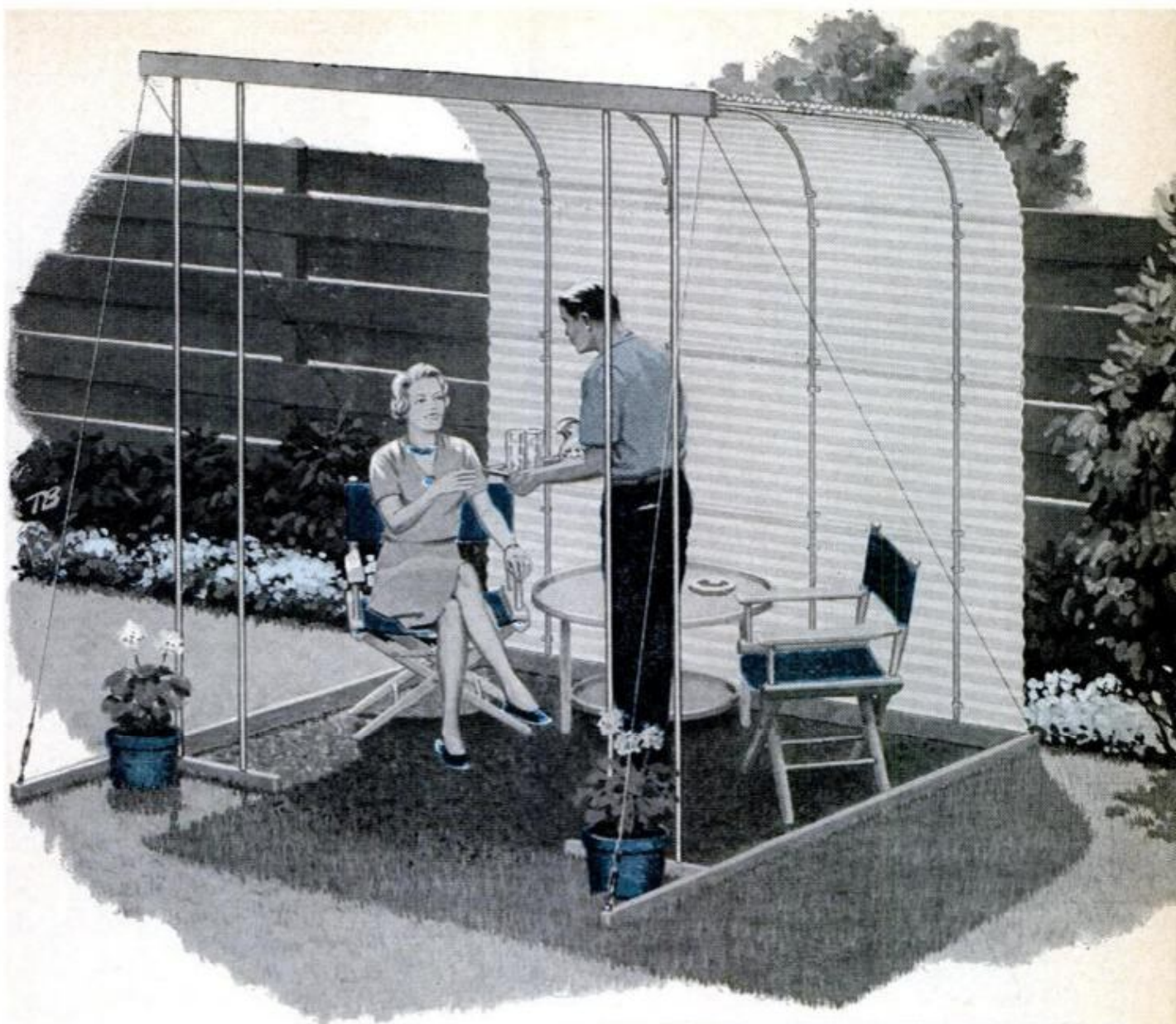
## Flat 3-D Trellises Are Designed to Fool the Eye



You'd think that you could walk right through these 3-d trellises but actually they are flat structures fastened to the side of the house. After making a full-scale paper pattern, 2x2-in. stock is cut and assembled to form the framework. The 1-in. lattice strips of the arch are spaced to create an optical illusion. The other trellis is made with 1½-in. strips tapered and spaced to fool the eye. Lap joints assure rigid construction.



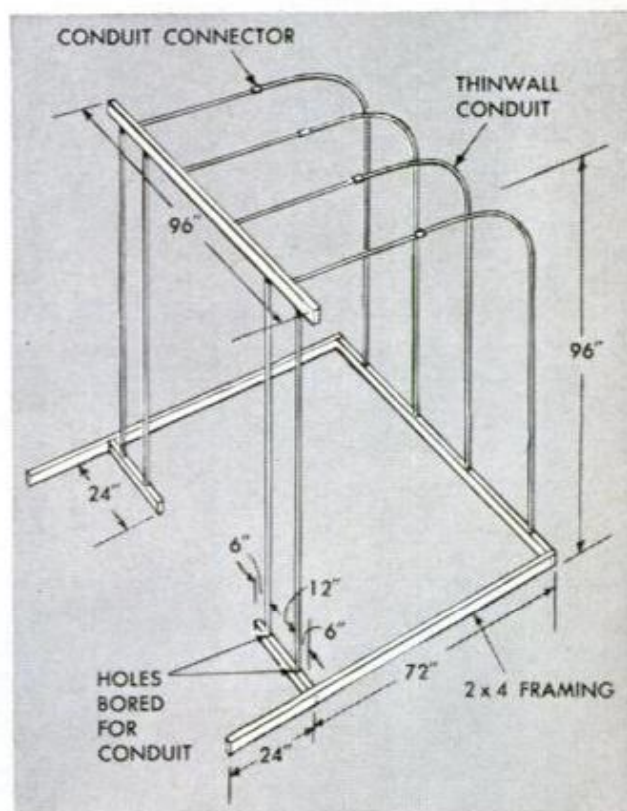




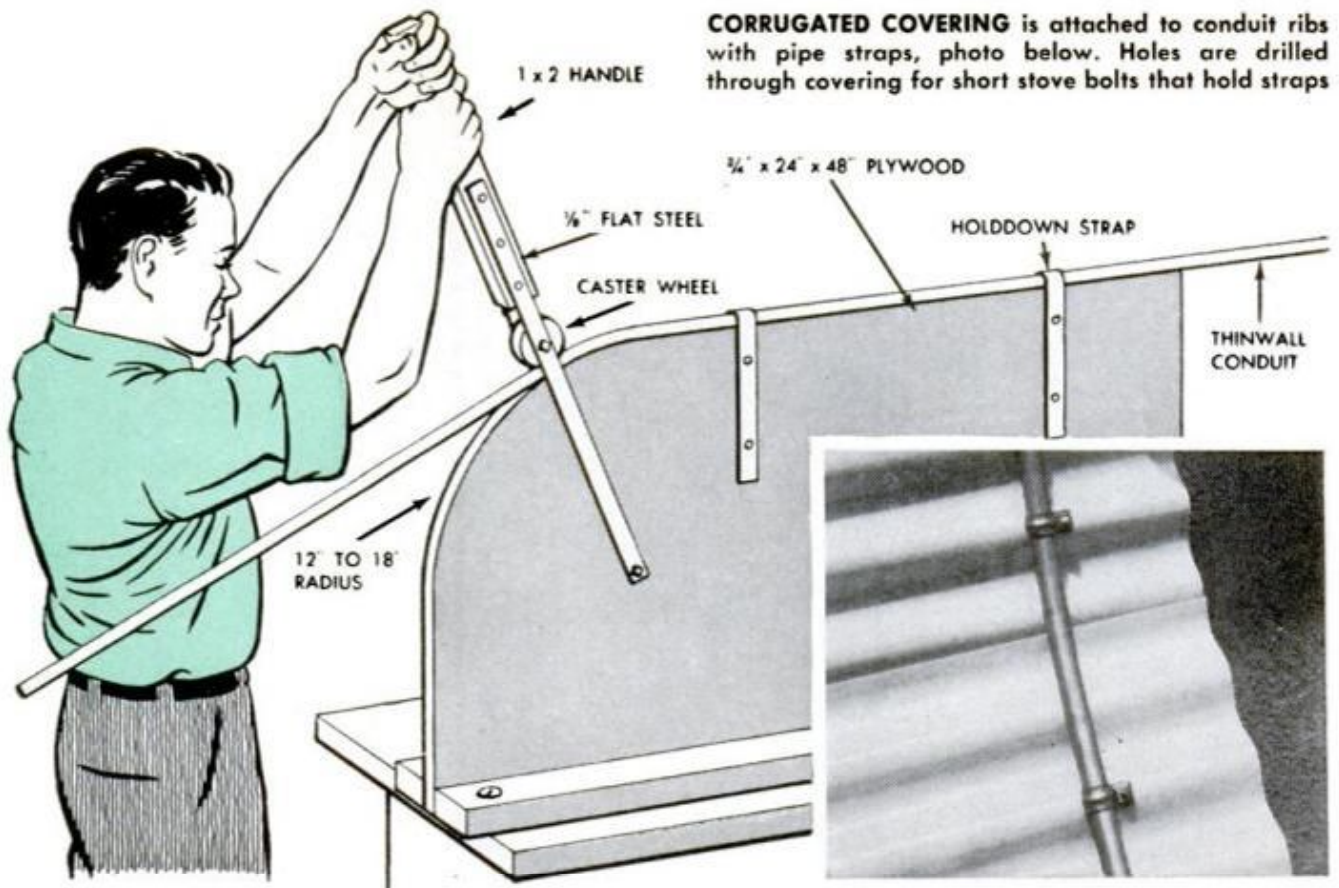
# LAWN CABANA

**W**ANT TO GET AWAY from it all to the peace and quiet of the back yard? This attractive cabana will shelter you from a hot afternoon sun and provide a delightful spot to relax, away from household din.

It's light enough to pick up and move about and park where you want it, and it can be made as festive as you want by covering it with colored fiberglass or aluminum. Best of all, the whole thing comes apart so you can put it away for the winter. The pipe supports merely rest in holes bored in the 2 x 4 framework, and pipe clamps permit the corrugated panels







**CORRUGATED COVERING** is attached to conduit ribs with pipe straps, photo below. Holes are drilled through covering for short stove bolts that hold straps

to be removed. Stakes, turnbuckles and guy wires hold it together and keep it from blowing over in a strong wind.

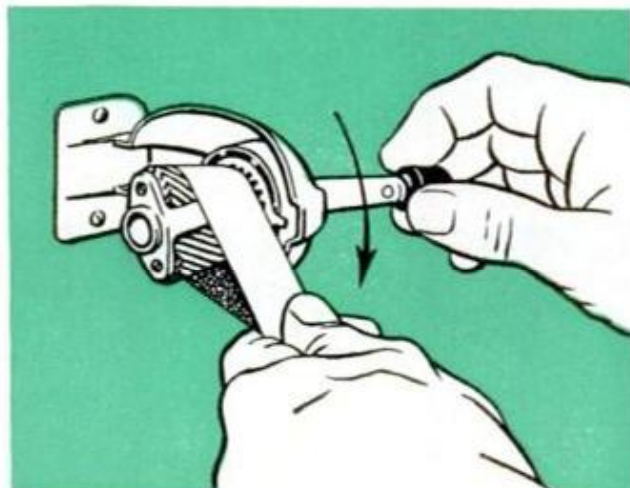
It's a simple thing to make. The pipe supports are formed from standard 10-ft. lengths of 1/2-in. thinwall conduit, and the base is nothing but 2 x 4s set on edge. The four front poles are cut 8 ft. long and the 2-ft. leftovers are coupled to full 10-ft. lengths to form the four bowed ribs.

You can bend the ribs with a borrowed conduit bender, but a jig like the one shown above makes it a simple matter to bend all four ribs exactly alike. The important thing in making the jig is to be sure that the caster-fitted handle is pivoted at the exact center of the radius

point, and that there is snug clearance under the caster for the conduit. In bending each length, a mark is made on the conduit at the point of bend and aligned with a similar mark made on the jig. The 15-deg. springback you will get when the tubing is removed from the jig will give you the desired 75-deg. bend. Regular thinwall connectors are used to join the 2-ft. extensions to the short ends of the curved ribs.

Seven sheets of 26-in.-wide corrugated fiberglass or aluminum are required to cover the cabana. Holes for short 1/4-in. stove bolts are made in the panels at the crest of the first or second corrugations, 3/4 in. to one side.—*Mac L. Olds*

## Loop of Emery Cloth Puts Keen Edge on Pencil Sharpener



If you've noticed that your pencil sharpener doesn't give the clean-cut point it did when new, you can touch up the roller blades without removing them. Simply remove the shaving container and loop a strip of emery cloth over the cutters in the manner shown. Then crank the sharpener in a reverse direction as you move the cloth back and forth across the blades. A few times across is all it takes to whet the cutting edges.—*Michael Ligocki*

**Cane chair seats** can be made taut again by sponging bottom with vinegar solution, 2 tablespoons of vinegar to 1 qt. of water.



## Screw-Cap Brushes

Where you have daily intermittent use for paints, shellacs or oils, you have the twin problems of keeping the materials from drying out and the brushes in workable condition. You can solve both by punching a hole through the screw tops of the jars to take the brush handles. Cut a disk of wood of a diameter near that of the screw top, center drill and cement the two together. Slip the brush handle into the hole and adjust so the brush is immersed in the liquid when the top is in place.—*Jack Eisner*



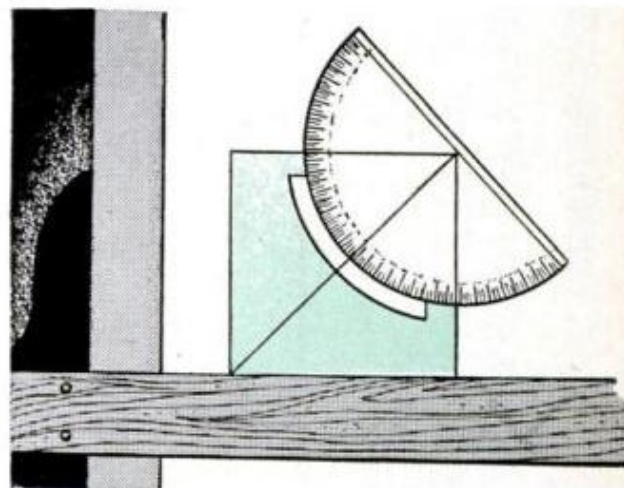
## Holder for Tube Cement

I got tired of replacing the cap each time when using a tube of quick-setting cement just in order to set it down. So I made a holder from a block of wood which would let me stand the tube upright after each use. As you see, I simply cut a groove across the block in which to rest the end of the tube. To make it still handier, I drove a headless nail in the holder so I would have a way of getting the cement to flow should it dry in the end of the tube while left open.



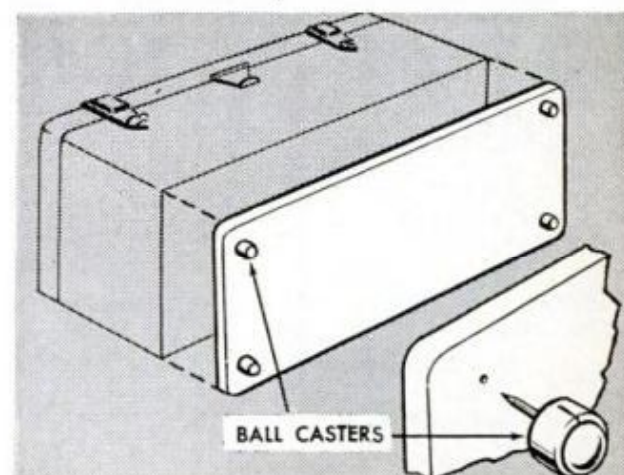
## Triangle of Many Angles

A protractor will serve as a triangle of infinite angles when used in conjunction with this simple guide. Placed against the T-square, the guide supports the protractor at two points, and by using the edge of the guide as a reference point, the protractor can be set for drawing lines at any angle from 0 to 90 degrees by merely rotating it on the guide. To make one you simply cut a piece of thin plastic perfectly square and then jigsaw it after scribing around the protractor to mark the two arcs.



## Toolbox Dolly

You're sitting, or maybe standing, holding parts together with one hand while trying vainly to move that toolbox within easier reach. It won't budge—too heavily loaded with tools. This predicament is easily avoided by making a ball-bearing dolly for the box, using a piece of 1/2-in. plywood and four ball casters. Cut the plywood to the same measurements as the bottom of the toolbox. It can be used as a dolly or fastened to the toolbox with sheet-metal screws.—*Edward J. Kolb*



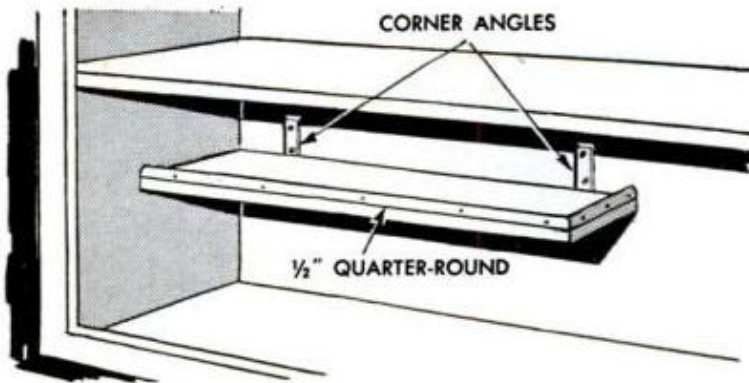




# Solving

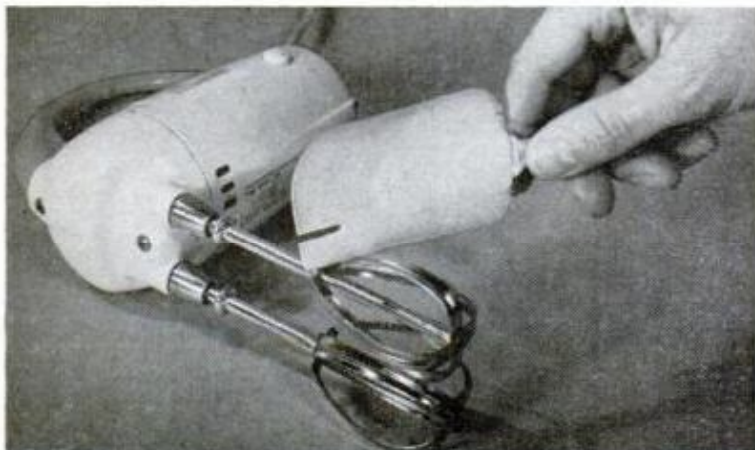
## HOME PROBLEMS

**IF YOUR WIFE** does a lot of sewing and saves the scrap pieces of material to use for patches, suggest that she organize these in a "scrap" book. Simply mount the pieces in a large scrapbook with cellophane mending tape. The book can also hold samples of fabric which she has stored away for later use



**NEED EXTRA SPACE** in a kitchen cabinet? Add a small auxiliary shelf for tumblers, cups, etc., and you'll double the capacity of that part of the cabinet. Hang it with angle irons

**MAKE A TOOL** for cleaning the blades of a kitchen mixer by cutting a shallow slot in a plate scraper. Slip this over a blade and you can clean both surfaces in one easy stroke

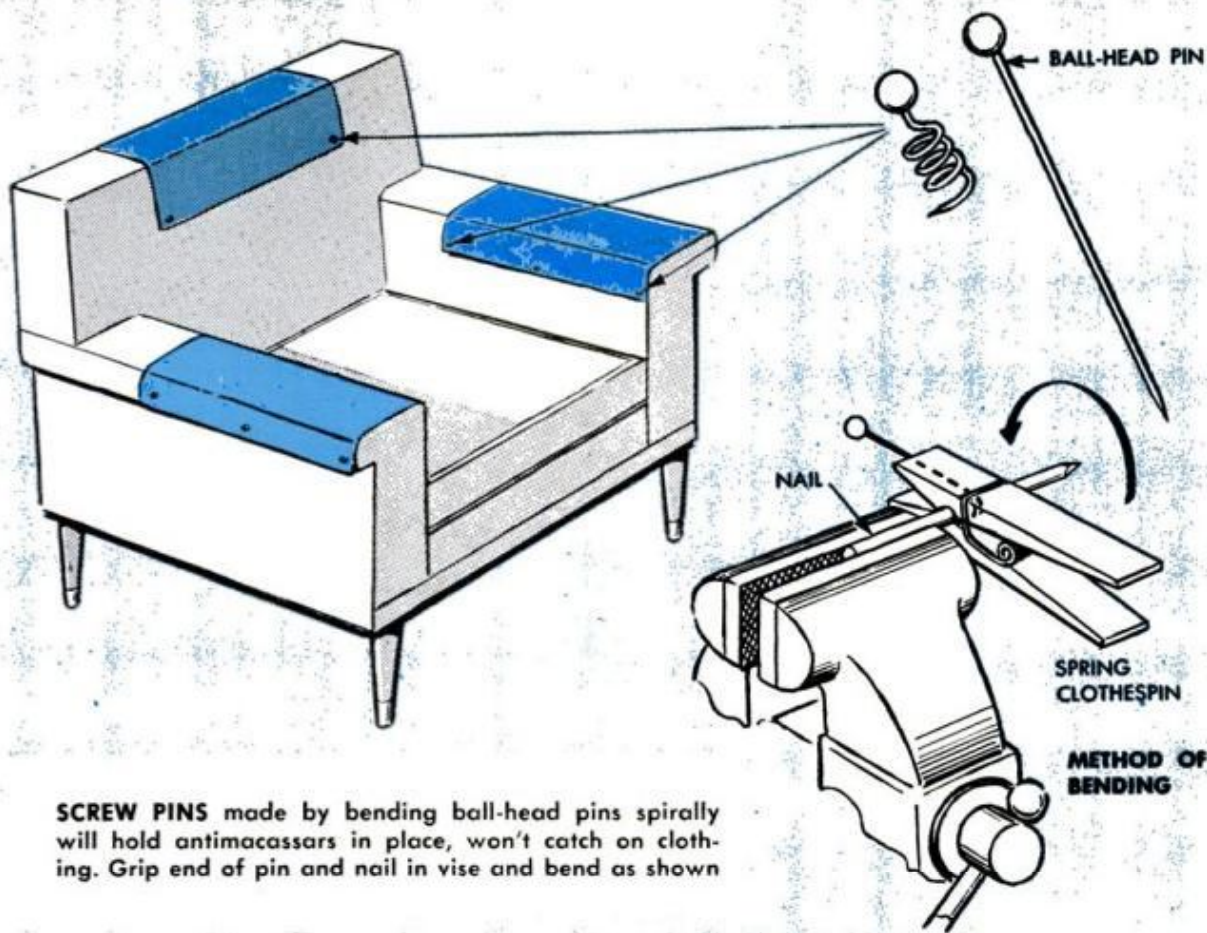


**MOST PEOPLE** use small felt pads on the bottoms of cigarette boxes, lamps and ash trays which might scratch polished surfaces. Plastic rubber works just as well and is much easier to apply. Put a dab at each corner or a bead around the edge

**CEREAL CARTON** makes a dandy sandwich case for picnics, because the foil or wax-paper will protect sandwiches and keep them from drying out. Just fold the lining down and close the flaps. Such a carton also works fine as an emergency lunch box





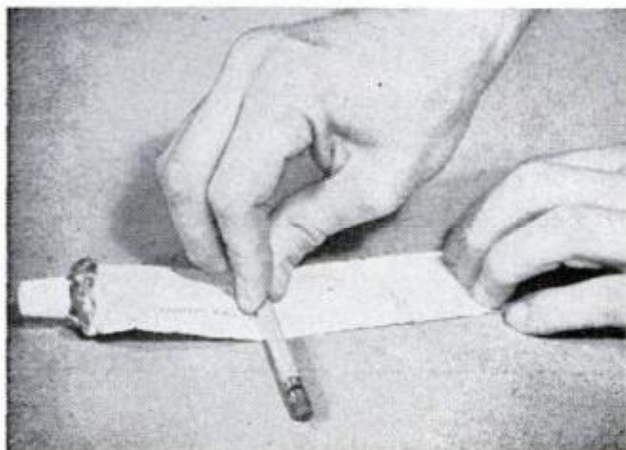


**SCREW PINS** made by bending ball-head pins spirally will hold antimacassars in place, won't catch on clothing. Grip end of pin and nail in vise and bend as shown



**HERE'S ANOTHER TIP** for the seamstress. Spools, even when placed upright, are often accidentally knocked over so that they roll off the table. To avoid this, lay the spool on its side in the handle of your scissors

**SQUEEZING** the last drop of glue or toothpaste from an "empty" tube is easy if you have a pencil handy. Just place the tube on a flat surface and run the pencil from bottom to top, pressing it down firmly



**TO GET A GRIP** on a stubborn jar cap, stretch two rubber sealer rings over it. These will provide a no-slip grip for your hand, enabling you to concentrate your efforts on twisting the reluctant cap





# SHIP AHOY, MATEY!

WITH A CARGO of cookies and a crew of kids, this back-yard sloop is ready to set sail. It's made mostly from exterior plywood with stock lumber being used for the supporting members and other parts.

Begin by nailing the "deck" to the crossbeams. As indicated in the drawing, the mast and crosstree are made of 2x4s. Since the crosstree will see considerable service as a crow's nest, be sure that the 2x4s are bolted solidly to the mast.

Next, fit the topmast to the aft edge of the main mast, nailing it to both the mast and the aft crosstree member. Bevel the top of both masts and center a screw eye on each beveled face to attach halyards.

The mast is anchored by inserting it through a hole in the deck and bolting it to the 2x4 bracing underneath. Additional blocking, nested around the base of the mast as shown, provides extra rigidity.

Erect the bridge by nailing two 2x2 cleats across the main deck, adding side panels and a plywood transom. Bolt the wheelpost in place before nailing down the bridge deck.

Make the ship's wheel by sandwiching 1x1 spokes between plywood disks. Nail the spokes to the 18-in. disk, so that 4 in. of each projects beyond the edge. Rasp these projections round before adding the 8-in. disk. Drill the wheel and the post for a 1/4-in. bolt.

Paint the sloop before outfitting with sails and rigging. Pass the flag cord through the topmast screw eye without knotting; the kids will enjoy running the flag up the mast. Tie the forward bow-sail clothesline to the main-mast screw eye; the back line merely ties into this.

Cut sheeting to the size of the sail outlined by the ropes, pinning the two long edges over them. The hems may be sewn by hand with the sail in place or the lines may be untied and the sail removed for machine sewing.

The dowels, used as rungs in the rope ladders, are marked for drilling and cutting by tying the two ropes temporarily in place and holding each dowel in position for marking.—*F. N. Stephany*



## No More Fish Stories

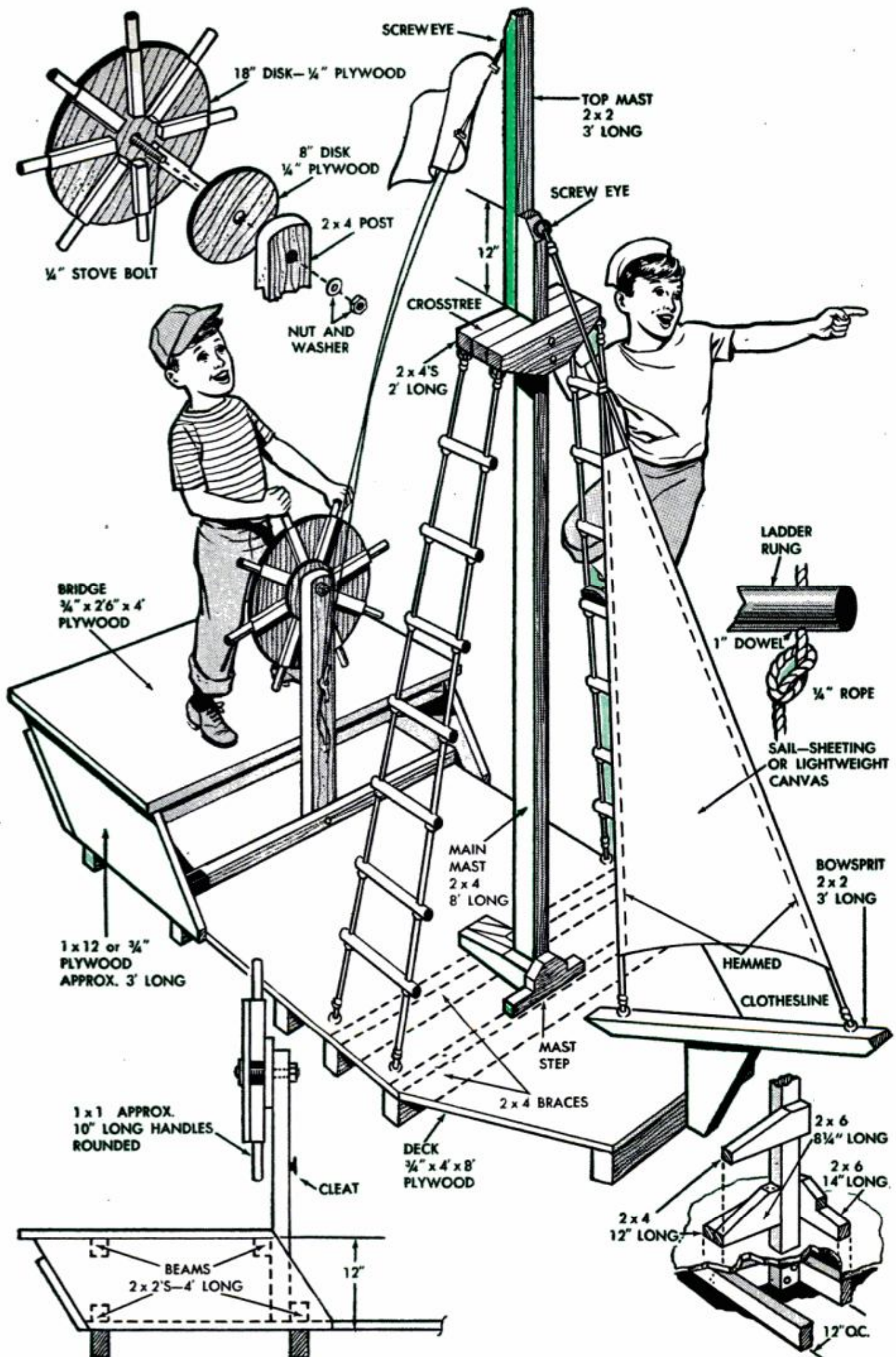
Wet hands and a wiggling fish usually result in a story about the one that got away. You can avoid such disappointments by keeping the fish in the landing net while you disengage the hook. Simply close your hand around the outside of the net to get a firm grip on the fish while you remove the hook.—*John Krill*

## Saw It Square

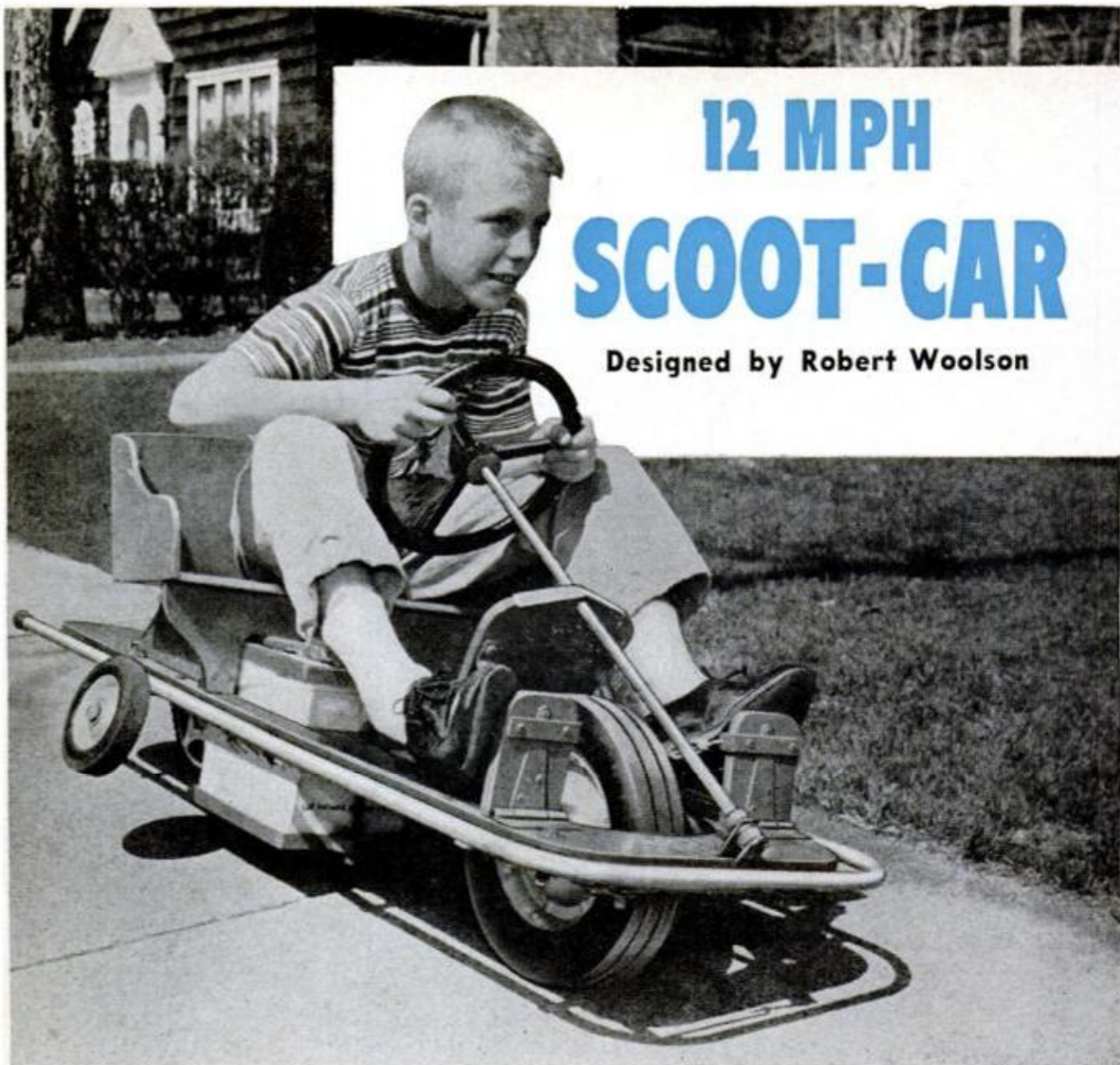
Keeping a handsaw exactly perpendicular to the work is difficult when cutting wide stock. Solve this problem by sawing a 1 x 12 x 18-in. board halfway through. The cut *must* be at right angles to the face and edge. Use the kerf as a saw guide by starting the cut in the usual way. Then hold the board over the saw as shown.—*A. C. Cashion*







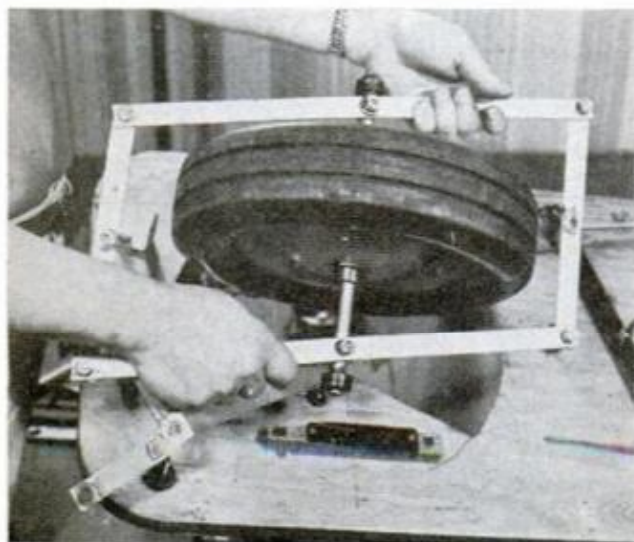




# 12 MPH SCOOT-CAR

Designed by Robert Woolson

**A novel positive steering gear, two forward speeds and a brake that stops on a dime make this sidewalk special a safe vehicle for young hotrodders**



**O**NE full battery charge readies Scoot-Car for hours of fun. Cornering wheels, one on each side of the chassis, give the driver sure stability from a standing start, and a near top speed of 10 to 12 miles per hour puts the car up on two wheels where it steers and controls like a car, but rides like a speedy low-slung scooter.

When cornering, the car leans over on one or the other of the outrider wheels, enabling the driver to keep safe, full control when turning. Power and brake ap-

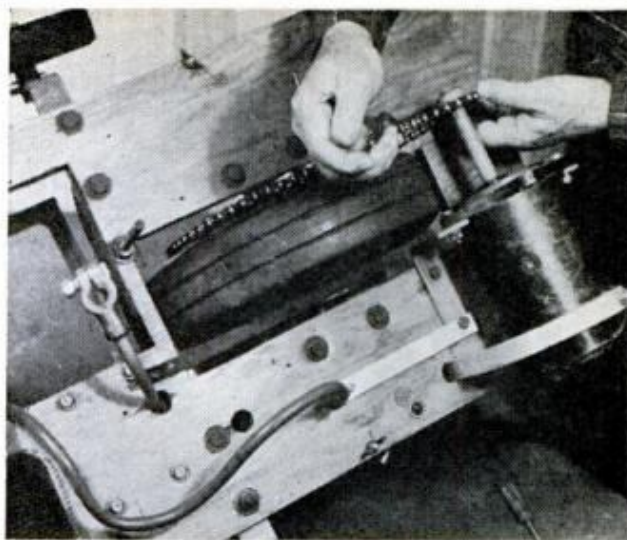
**PARALLEL-ARM** steering gear, assembled, being placed in position. Shorter pivot links are bolted to the deck, using washers and locknuts for free movement



plication are controlled by pedals with strong return springs. Release the power pedal, hit the brake hard and Scoot-Car stops within its length of four feet.

**Caution:** While Scoot-Car is a safe toy mechanically, there are precautions to observe in riding it. When operating it for the first time, the immediate reaction to tipping is to take the feet off the pedals and plant them on the ground. With the car in motion, this can pitch the rider forward. The outrider wheels, of course, make tipping over impossible, and after a few trial spins, the rider will overcome the tendency to brace himself and will keep his feet on the pedals.

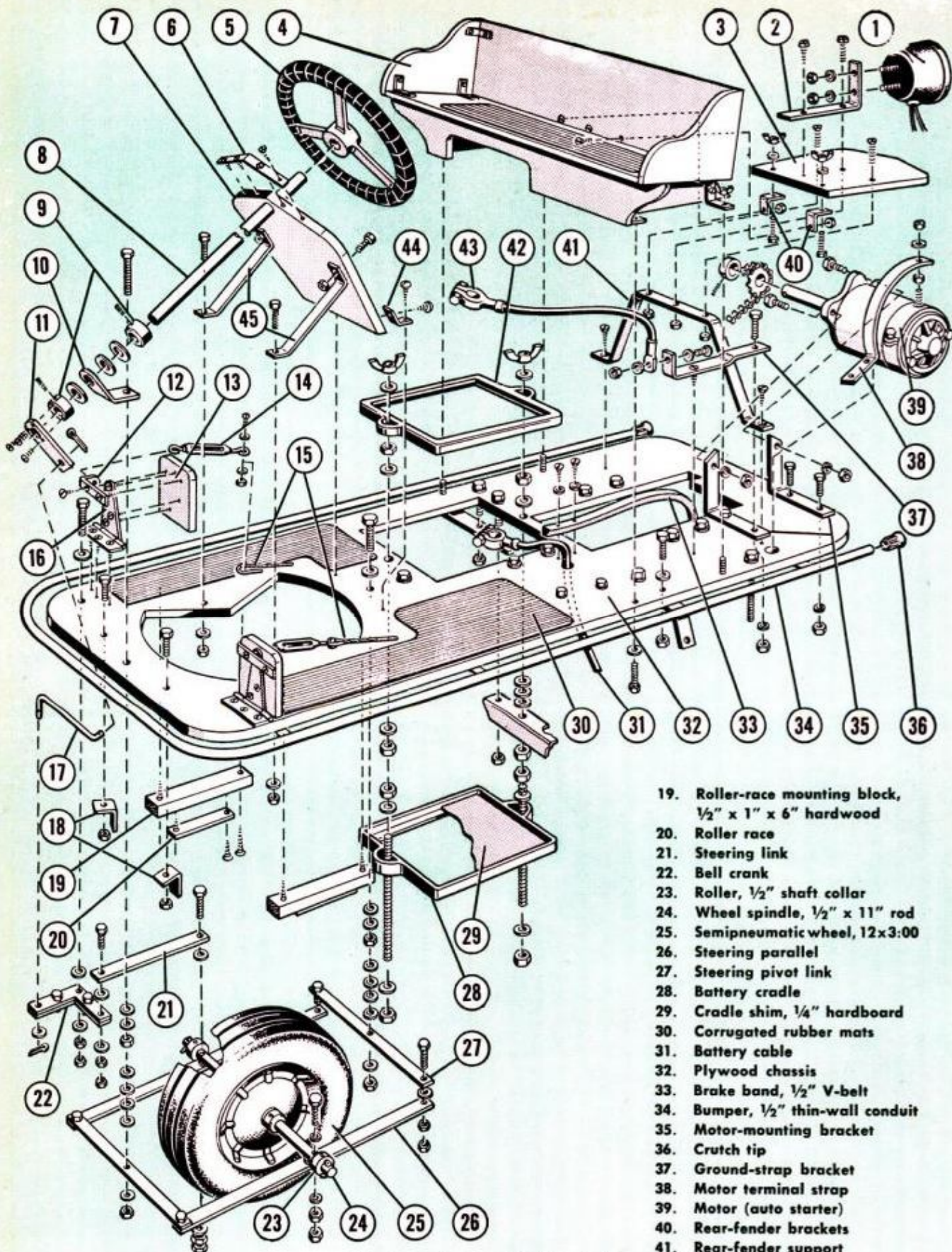
Looking over the details you will see that Scoot-Car is most unusual in design, has a unique parallel-arm steering gear and a positive roller-chain drive from an



**ROLLER-CHAIN** assures positive drive from motor to ground wheel. Slack in chain should not exceed  $\frac{1}{2}$  in. Note position of the ground and power straps







1. Taillight (optional)
2. Taillight bracket
3. Rear fender
4. Seat
5. Steering wheel
6. Front-fender trim (1/8" x 1/2")
7. Front fender
8. Steering post, 1/2" x 25" rod
9. Shaft collar, 1/2" dia.

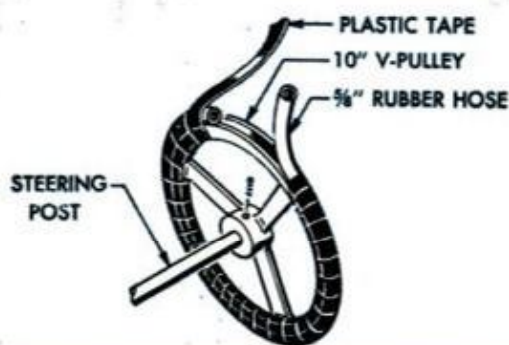
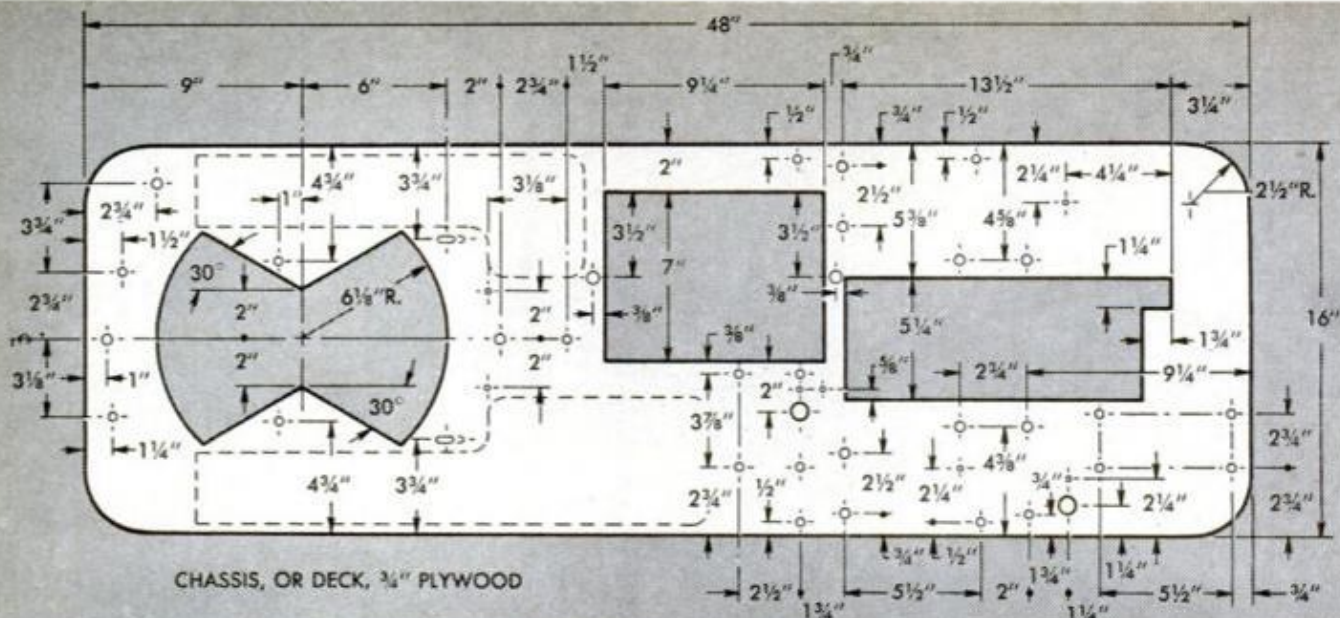
10. Lower bearing, steering post
11. Steering arm
12. Cable bracket
13. Drive pedal
14. Turnbuckle
15. Drive and brake cables
16. T-hinge, 3" leaf
17. Tie rod, 1/4" steel rod
18. Steering limit bracket, 1/8" x 1" flat steel

19. Roller-race mounting block, 1/2" x 1" x 6" hardwood
20. Roller race
21. Steering link
22. Bell crank
23. Roller, 1/2" shaft collar
24. Wheel spindle, 1/2" x 11" rod
25. Semipneumatic wheel, 12x3:00
26. Steering parallel
27. Steering pivot link
28. Battery cradle
29. Cradle shim, 1/4" hardboard
30. Corrugated rubber mats
31. Battery cable
32. Plywood chassis
33. Brake band, 1/2" V-belt
34. Bumper, 1/2" thin-wall conduit
35. Motor-mounting bracket
36. Crutch tip
37. Ground-strap bracket
38. Motor terminal strap
39. Motor (auto starter)
40. Rear-fender brackets
41. Rear-fender support
42. Battery cradle
43. Battery cable
44. Fender bracket
45. Fender brace
46. Semipneumatic wheel, 6 x 1:50
47. Wheel bracket
48. Chassis cross brace
49. Control rod (pedal to switch)
50. Drive and brake cables
51. Return spring





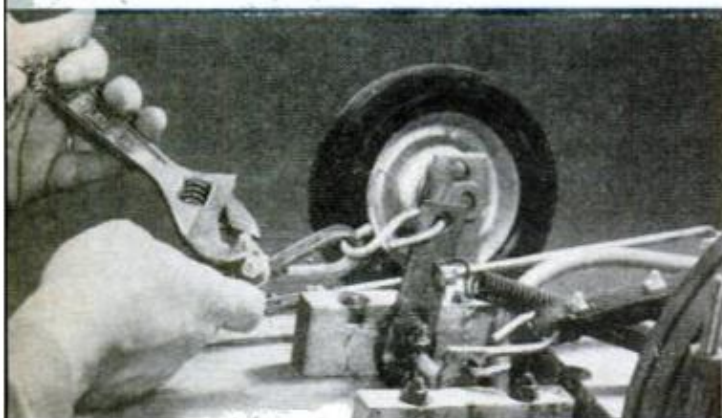




auto-starter motor. Throughout the construction, full use is made of standard, readily available parts and materials wherever possible. For example, the steering wheel is a 10-in.-diameter spoked V-pulley, wrapped with electrician's tape over a length of hose set into the V-rim of the pulley. This makes a neat, attractive wheel of just the right size.

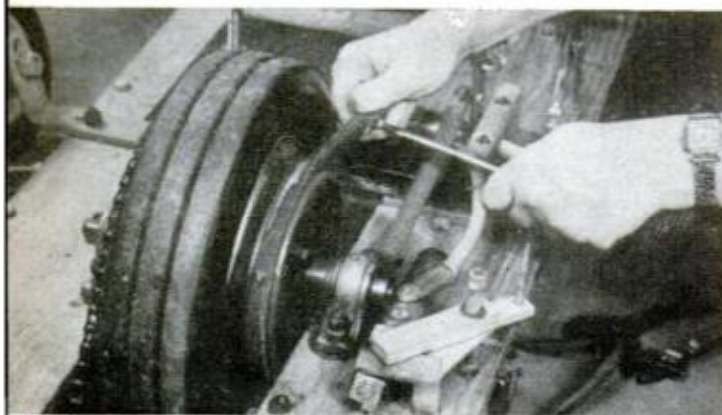
Make the plywood chassis (part No. 32), first cutting the three openings for front and rear wheels and battery cradle as the first step. These openings should be cut just inside the pattern lines and then smoothed out to the lines with a wood rasp. Round corners slightly and sand smooth. Round the corners of the chassis to the radius indicated and sand all edges. Then lay out the hole pattern and centermark the location of holes with an awl. All smaller holes indicated are  $\frac{1}{4}$ -in. in diameter. Those for the battery-cradle studs are  $\frac{3}{8}$  in. in diameter to take  $\frac{3}{8}$ -in. threaded rod. Holes taking the rear-wheel bearing bolts are  $\frac{7}{16}$  in. in diameter and the two largest holes indicated take the battery cable and motor-terminal strap and are each  $\frac{3}{4}$  in. in diameter. The two holes, indicated as elongated, take the brake and power-control cables and are drilled  $\frac{1}{4}$  in. in diameter and at as steep an angle as possible, then enlarged with a round file so that the cables clear without binding. Dotted lines on the chassis indicate the position of the rubber foot mats.

Next comes installation of front and rear wheels. Take the front wheel first and begin by noting closely the relationship of the parts. The parallels and the pivot links are of flat steel (also often referred to as band iron) and are cut to length and drilled as detailed. The front wheel is centered on its spindle with shaft collars, and the outer ends of the spindle are car-

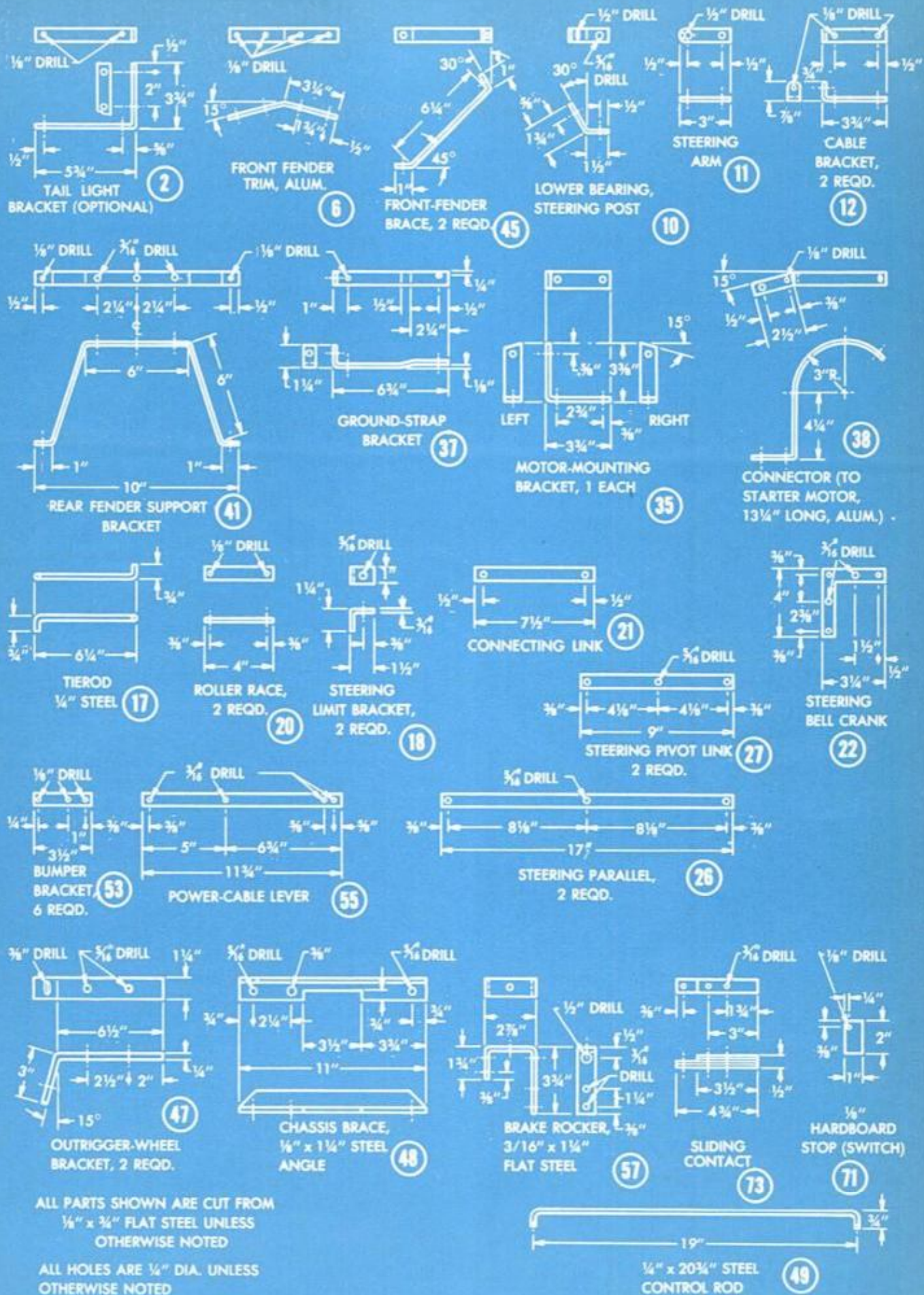


**BRAKE CABLE** is attached to brake rocker with cable eye and clamp. Note end of the brake band

**FREE END** of V-belt brake band is bent back on itself to form a loop taking one eye of an S-hook



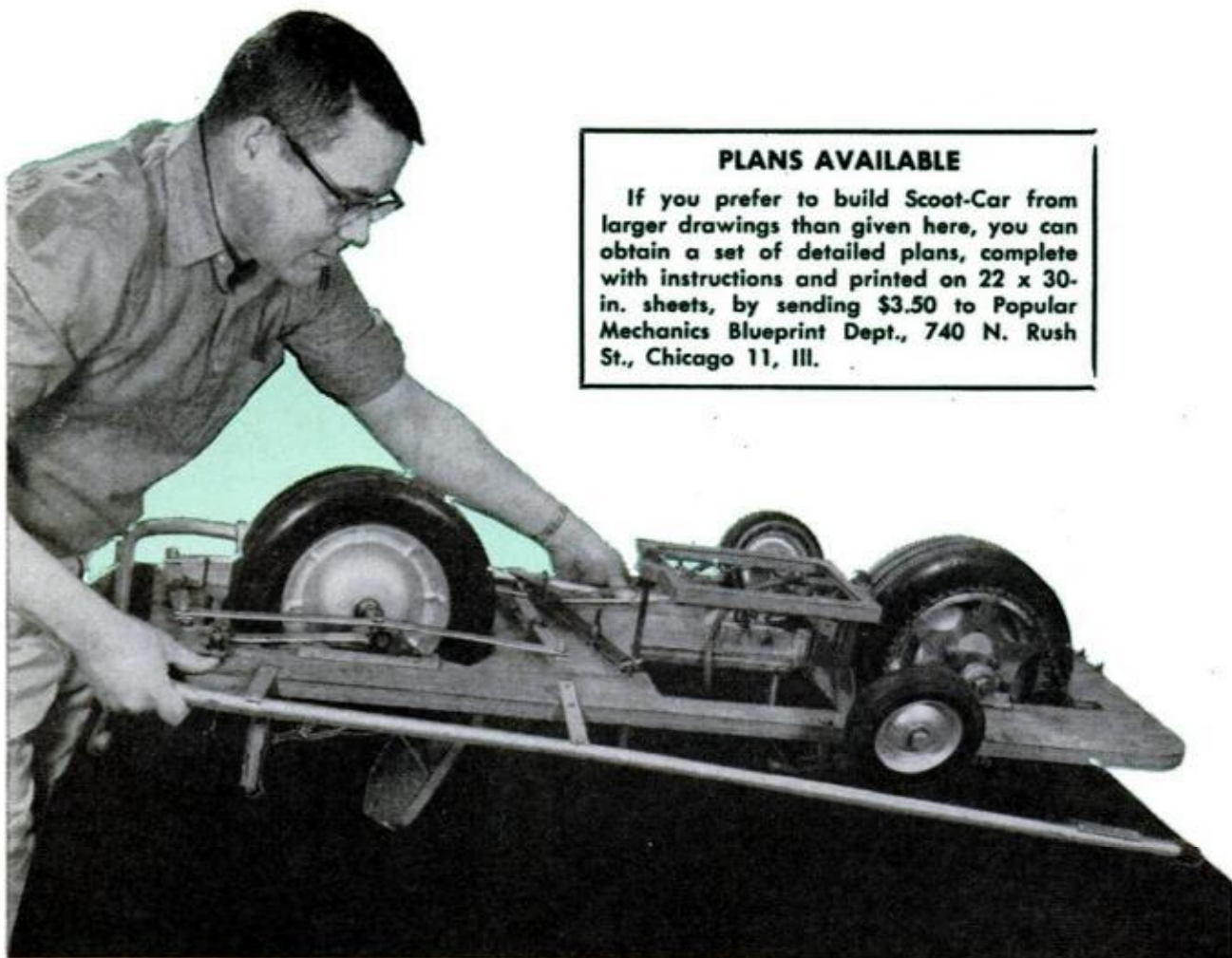




ALL PARTS SHOWN ARE CUT FROM 1/4" x 3/4" FLAT STEEL UNLESS OTHERWISE NOTED

ALL HOLES ARE 1/8" DIA. UNLESS OTHERWISE NOTED





#### PLANS AVAILABLE

If you prefer to build Scoot-Car from larger drawings than given here, you can obtain a set of detailed plans, complete with instructions and printed on 22 x 30-in. sheets, by sending \$3.50 to Popular Mechanics Blueprint Dept., 740 N. Rush St., Chicago 11, Ill.



**LOWER HALF** of battery cradle, or carrier, is held in place by jam nuts. Be sure the nuts are tight

**TURNBUCKLES** provide adjustment on both power and brake cables. Adjustment is made after assembly

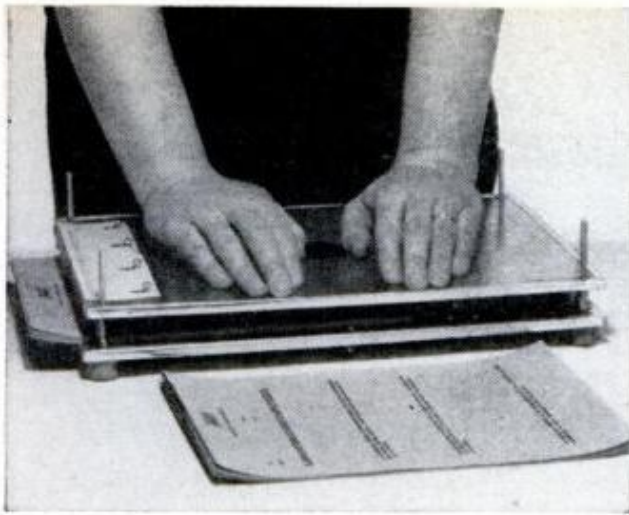


ried on rollers, which are  $\frac{1}{2}$ -in. shaft collars cotter-pinned on the shaft. The spindle is drilled just inside the collars (rollers) to take the  $\frac{1}{4}$ -in. capscrews which hold the parallels to the shaft. One screw is longer to take the steering link. Spacer washers are placed between the joining parts and all screws carry additional washers and locknuts to permit free movement. In the assembly, the rollers on the ends of the wheel spindle ride on races made as shown. Each consists of a mounting block of hardwood and a facing of flat steel, and the two units are attached to the underside of the deck with wood screws. The pivot links are bolted to the underside of the deck and the steering, or connecting, link attaches to the bell crank. The latter is bolted to the underside of the chassis and the free arm takes the lower end of the tie rod when assembled. The upper end of the tie rod is attached to the steering arm on the lower end of the steering post. The steering arm is riveted to a shaft collar which provides a hub and a means of attaching to the steering post.

Now comes the rear wheel which is attached to the deck with two pillow-block bearings and carries the driven sprocket and brake drum. Notice especially the rear-wheel assembly. The brake drum is

[\(Please turn to page 188\)](#)





**SIMPLE MIMEOGRAPH** sells for only \$19.95 (post-paid). Yet, PM editors who tried it got results comparable to those produced by higher-priced models. Uses standard mimeograph stencils, takes paper up to 8½x14 in., which makes it ideal for small offices, clubs, etc. Up to 150 copies are possible on one inking. Absey Prods., 1186 Broadway, N.Y. 1, N.Y.

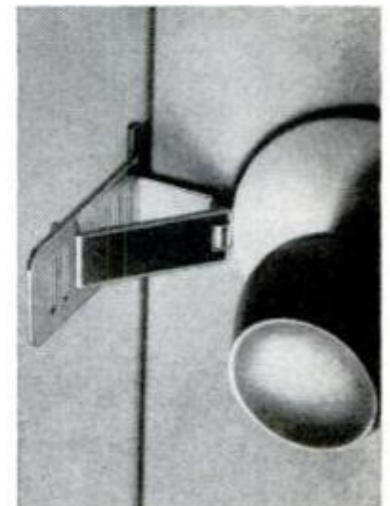
**CALKING COMPOUND** comes in a pressure can that simplifies application. The odorless vinyl-base material is said to give a waterproof seal around bathtub, shower, sink, even windows. Sells for \$1.45 a can, at dealers. Pecora, Inc., 300-400 W. Sedgley Avenue, Philadelphia 40, Pa.



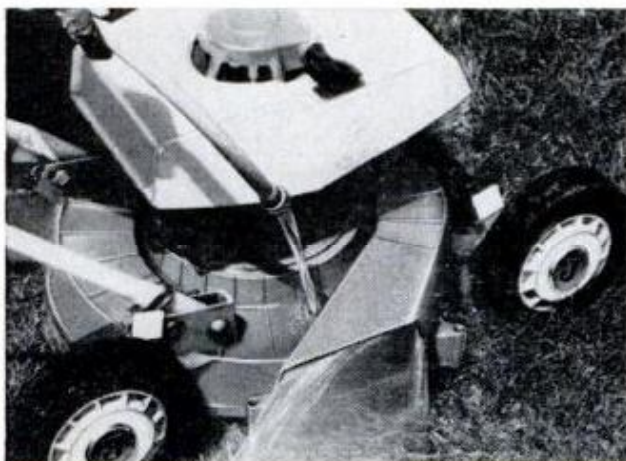
**VARATHANE WHITE** is a liquid plastic coating that gives a hard tile-like finish. Resists chemicals, moisture, weathering. Said to outlast varnish 2-to-1. Ideal for bathrooms, showers. Can be tinted. Costs \$12.95 a gal. Flecto Co., Incorporated, P.O. Box 84, Station A, Berkeley 2, Calif.



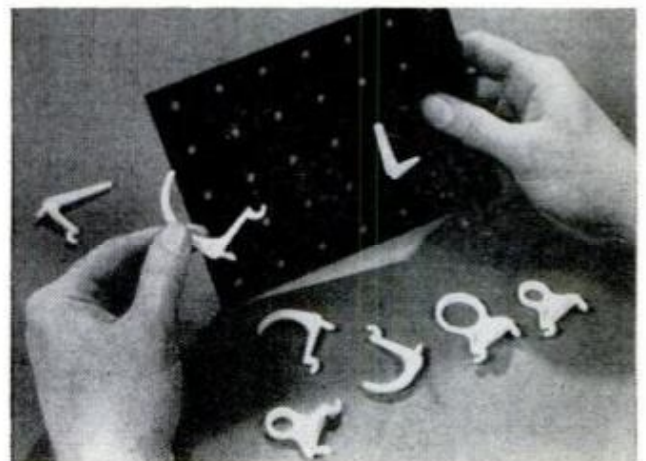
**THIS KEYLESS LOCK** will appeal to travelers and people who live alone. Holds securely shut, from inside, any hinged door that has a latch. Simple to operate. Goes on, comes off in seconds—with no tools. Price: \$1.98 postpaid, with plastic case. Write Cornelia Sales Company, Cornelia, Ga.



**SELF-CLEANING FEATURE** is built into current line of Turbocone power mowers. With motor running, you run water in and the blades clean themselves. Mowers have 3-hp., 4-cycle engines and are said to have improved, smooth-cutting blades. Six models offered. Jacobsen Mfg. Co., 1721 Packard Ave., Racine, Wis.



**NEW PLASTIC PEG-BOARD FIXTURES** are more versatile and have more holding power than any others we've seen. They hold securely, even horizontally or upside-down, which makes it possible to "nest" irregular-shaped objects. Cost 39¢ to \$1.98 a pack, at dealers. Masonite Corp. 29 N. Wacker Drive, Chicago, Ill.







1. PIGGY BANK. Cut coin slot in 1/2-gal. bleach jug, glue on plastic ears and tail, then add plastic-foam legs

## BLEACH-BOTTLE BONANZA

By Willard and Elma Waltner

2. GIANT FUNNEL



3. CANDLESTICK



4. CLOTHESPIN JUG







5. SAILBOAT for the pond or the bathtub



6. PLANTER finished with metallic paint

THE SKY'S THE LIMIT on projects involving plastic bleach jugs and detergent bottles. When empty, these no-rust, easy-to-cut containers have a limitless potential for project use. Most of the items shown here are self-explanatory. The candlestick, Fig. 3, is made by cementing the tops of two detergent bottles together, mouth-to-mouth, then running a dowel through the necks and wrapping it with cord. To make the clothespin jug, Fig. 4, cut an opening in the front and slit the handle to hang on a line. Ballast the boat, Fig. 5, with a little sand, pouring melted paraffin over this to hold it in place.

7. PICNIC SET brightened up with decals



8. SCOURING-PAD CUP



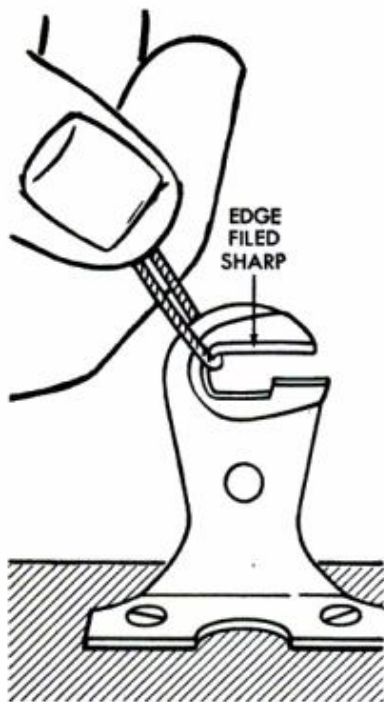
9. SUPER SCOOP



10. TOOL CADDY







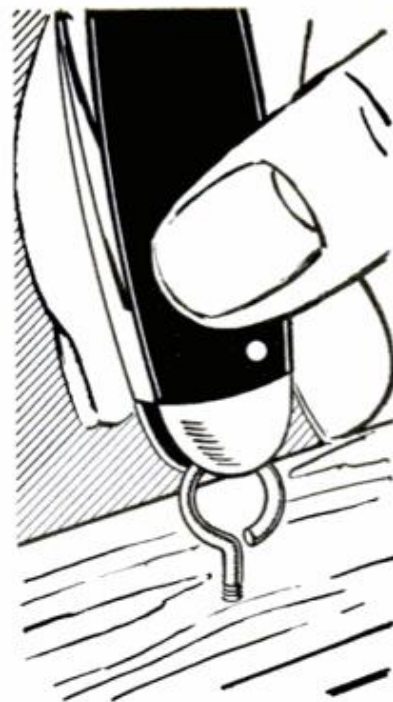
### String Cutter

To convert a window-shade bracket into an efficient string cutter, file the edges of the slot to a knife edge and mount the bracket on a wall or door handy to your work table. To use it, simply loop the string where you want to cut it and pull the loop over the sharp edge. Tell your wife about it; she might like one in the kitchen.



### Brush Clamp

When storing a small artist's brush in a bottle of solvent, you can prevent the bristles from touching the bottom by slipping a clip-type hairpin over the brush handle. The pin lying across the mouth of the bottle will hold the brush suspended at any height and thus avoid the possibility of damaging the bristles on the bottom.



### Hook Driver

Having trouble driving screw eyes or small cup hooks in cramped space? Try using the handle of your pocketknife, as shown above. First, drill a lead hole to avoid putting unnecessary strain on the knife handle. Then, after starting the hook with your fingers, use the slot in the end of your pocketknife to turn it in the rest of the way.

## NEXT MONTH IN SHOP AND CRAFTS

**WHEN THE JOB CALLS FOR FRAMING.** Here's a two-part article that should be required reading if you're planning a remodeling job that involves modifying the basic skeleton of your house. Solid facts on how to cut openings for doors or windows, the right way to enclose a basement stairway, how to "fur" a wall, plus ideas galore on how to solve many other common remodeling problems—you'll find it all in the September *PM*.

**TWO-IN-ONE CAMPER BOAT.** Next month, *PM* brings you complete plans for a 10½-ft. johnboat designed with the camper in mind. Remove five bolts and it comes apart in two pieces—an 8-ft. pram and a 2½-ft. bow locker which can be packed with provisions and camping gear. Just bolt the locker in place and head upstream. When you set up camp, remove it again and you have a sturdy camp chest and an 8-ft. fishing boat.

**TRANSISTORIZED IGNITION.** Everybody's heard about it, but few people know the complete story. How many different types are there? If the idea is so good, why isn't it standard equipment of the '64 cars? What about the kits being advertised today? If you want all the startling facts on this revolutionary ignition system, see the September *PM*.

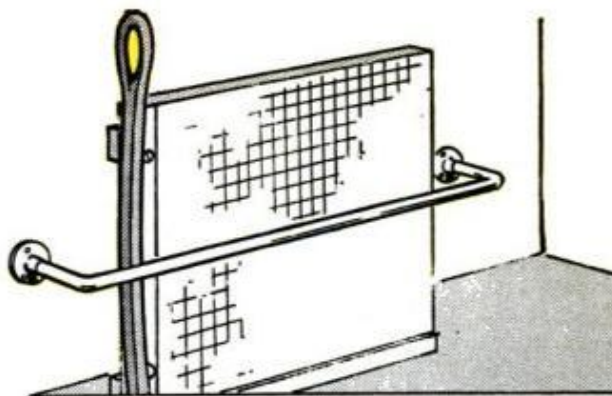
**MOBILE LEAF BURNER.** It won't be long before those autumn leaves start to fall, but you can be ready for them with this handy leaf burner. Basically just a steel drum mounted on a two-wheeled chassis, it has an ingenious hopper system which allows you to empty ashes from the bottom without tipping the drum. You'll find full how-to-build-it plans in Sept.



## FOR CAMERA BUGS

### Towel Bar Stores Trimmer

If you need a way to keep your photo trimmer handy at all times, without taking up valuable space on your darkroom table, fasten an ordinary towel bar to the wall a few inches above the table. The trimmer rests neatly behind the bar, occupying only a few inches of space.—*G. E. Hendrickson*



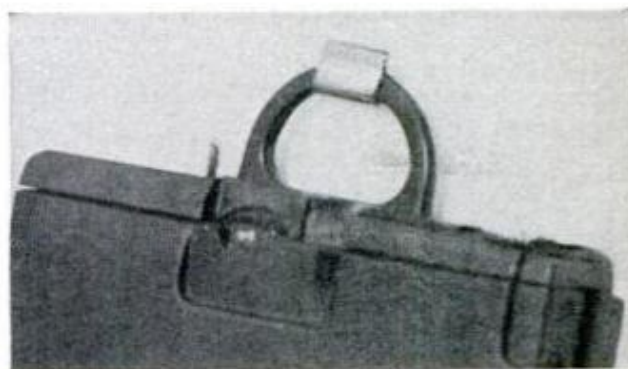
### Is That Developer Still Good?

Too often, amateur photographers forget how many rolls of film have been run through a batch of developer, and don't know the solution is exhausted until they ruin a roll or two. You can avoid this by putting a rubber band around the neck of your developer bottle every time you process a roll. This will tell you, through experiment, when it's time to mix a new batch.—*Wayne Floyd*



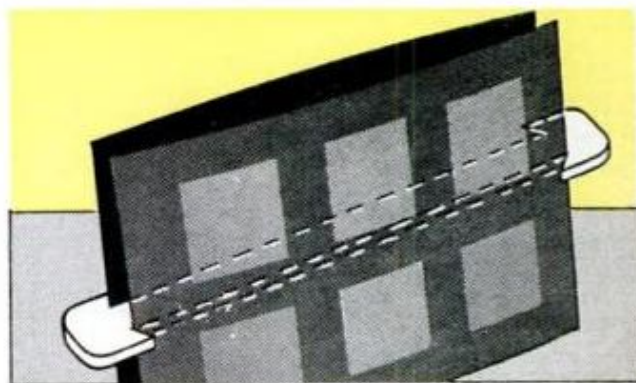
### Tape Identifies Film

By putting a strip of adhesive or masking tape around the slide handle of a film holder or magazine, you can tell which type of film is inside, and there'll be less chance of using the wrong film when working rapidly. Color the tapes with crayon or paint—say, blue for one type of color film, red for another, plain white for black-and-white.



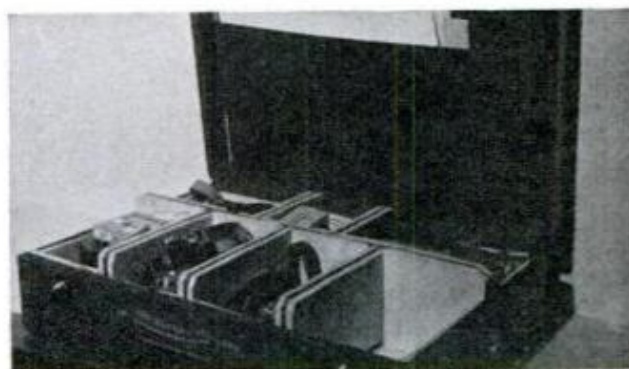
### Self-Standing Ferrotypes Plates

Bowed outward to fit the notches on this strip of plywood, a pair of ferrotypes plates can stand by themselves, saving you a lot of shelf space. Also, the bowed surfaces will cause the prints to pop off as they dry. The strip is  $\frac{3}{4}$  in. wide, and made of  $\frac{1}{4}$ -in. exterior plywood. Distance between the notches must be  $\frac{3}{4}$  in. less than the length of the plates.



### Gadget Bag from Attache Case

An attache case makes a convenient case for your camera and equipment if you divide it into compartments. Make the partitions from sheet plastic,  $\frac{1}{8}$ -in. hardboard or similar material, and pad the inside of each compartment with foam rubber. This type of case is handier than standard gadget bags, as it keeps your equipment separated in compartments.





# New for Shutterbugs

**MODERATELY PRICED** selenium exposure meter rivals some cadmium sulphide models in range and versatility. Reads from F:1.4 to F:22, ASA 3 to 1600, 30 sec. to 1/1000 sec. and 8, 16, 32 and 64 frames per second. Sells for \$15.90; case, booster cell extra. E. Leitz, Inc., 468 Pk. Ave. South, N.Y. 16, N.Y.



**YOU CAN SAVE 30 PERCENT** on the price of Anscochrome color film by buying it on this 8-roll bulk reel. Comes in a light-tight box which feeds the film into cartridges. Retail for \$10.75. Reusable cartridges are priced at 8 for \$1.20. Ansco, Binghamton, N.Y.



**NIKONOS 35-MM CAMERA** operates under water with no special housing. Features include interchangeable Nikkor lenses, special easy-access controls. Shutter speeds are 1 sec. to 1/1000 sec. Costs about \$160 with 35-mm lens. Nikon, Inc., 111 5th Ave., N.Y., N.Y.



**TELEPHOTO BOOSTER** works with Spiratone lenses, as well as some other makes using the T-mount system. Almost doubles the power of the lens without altering its focusing scale. Works only with single-lens reflex cameras. Costs \$15 if bought with a telephoto, \$20 if purchased alone. Spiratone Inc., Dept. PM, 135-06 Northern Boulevard, Flushing 54, N. Y.

**NEW 4X5 PRINTER** is half the size of other models. Its double platens assure fast, accurate print alignment. Costs \$8.95. Yankee Photo Prods., 3349 Union Pacific Avenue, L. A. 23, Calif.



**HIGH-SPEED PRINT WASHER** gives hypo-free prints in 20-25 minutes. It's made of plastic, needs no special plumbing connection, and has no moving parts. Priced at \$49.50 with splash cover and hose. Richard Manufacturing Co., 5914 Noble Ave., Van Nuys, Calif.







### Photog's Safety Harness

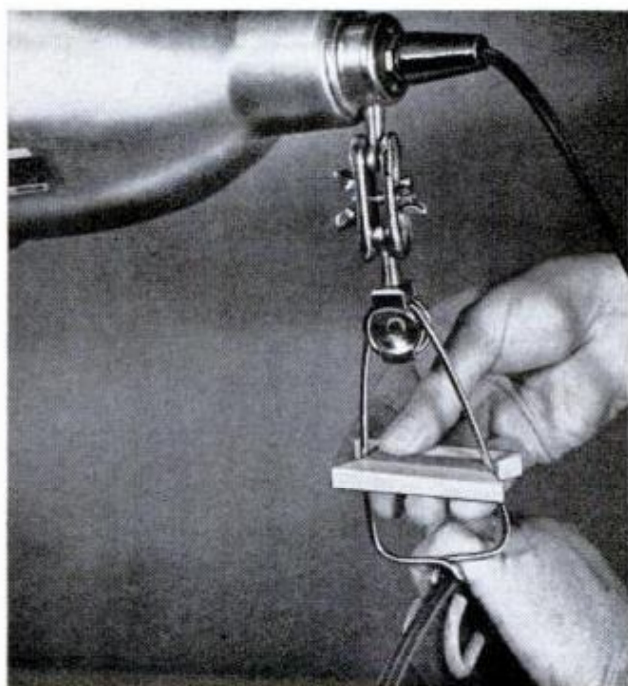
Have you ever tried to aim and focus a camera while balanced precariously on a vehicle moving at high speed? It's not only dangerous, but the pictures taken under such conditions seldom turn out exactly as you would have liked.

When assigned to take some waterskiing pictures, photographers from the Eastman Kodak Co. devised a novel safety harness which makes it possible to get studio quality action shots with a minimum of risk. Basically just a window-washer's belt with an extra pair of ropes, this harness features a four-point mounting which enables the photographer to brace himself while facing in any direction by just leaning his weight back against any two of rope or belt guys. Such a harness would work equally well in an open car or on the back of a truck, and in an emergency, could be made entirely of rope.



### Weakened Spring Clamps

If the spring clamp on your photo lamp has lost its grip, notch the ends of a wood block and slip a flat rubber band around it. Then just force this block up between the springs when mounting.



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### Emergency Lamp Stand

When you need an extra photo-lamp stand in a hurry, dig that Christmas tree stand out of the attic and mount a 1-in. dowel or broom handle in it. You'll find that it works like a charm.—Ken Patterson



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# Buying or Building DOCKS, PIERS and FLOATS

By George Daniels

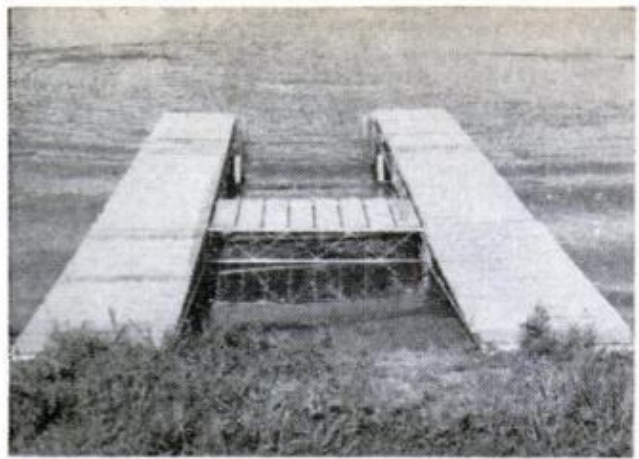
**W**ANT TO DOUBLE the fun value of your lake-front vacation hide-away? A new boat dock or diving float will turn the most ordinary waterfront cottage into a private shore club. Whether you build, assemble from pre-fab units or purchase a ready-to-use structure, the cost will probably be less than you expected and you'll make it up in the increased resale value of your cottage.

If the idea of just dropping a ready-made unit into the water sounds tempting, you can get a 20-ft. floating dock 40 in. wide for about \$150. Add another \$50 and you'll have enough for a similar size all-steel pier with adjustable legs which adapt to any bottom contour. These are just a couple of examples from the almost limitless variety of waterfront equipment that is available commercially. If you know what you want and aren't particularly concerned about cost, you can probably buy it ready-to-use.

However, you'll save money by building your own pier or float. The lumber used in such units (especially piers) should be rotproofed and borer-proofed by pressure treatment with pentachlorophenol or creosote. While you probably won't find this at most lumberyards, it's available on special order. Cost may run anywhere from a third more to double that of untreated lumber, but it's definitely worth every penny.

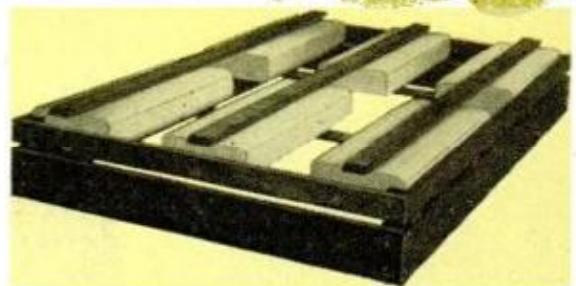
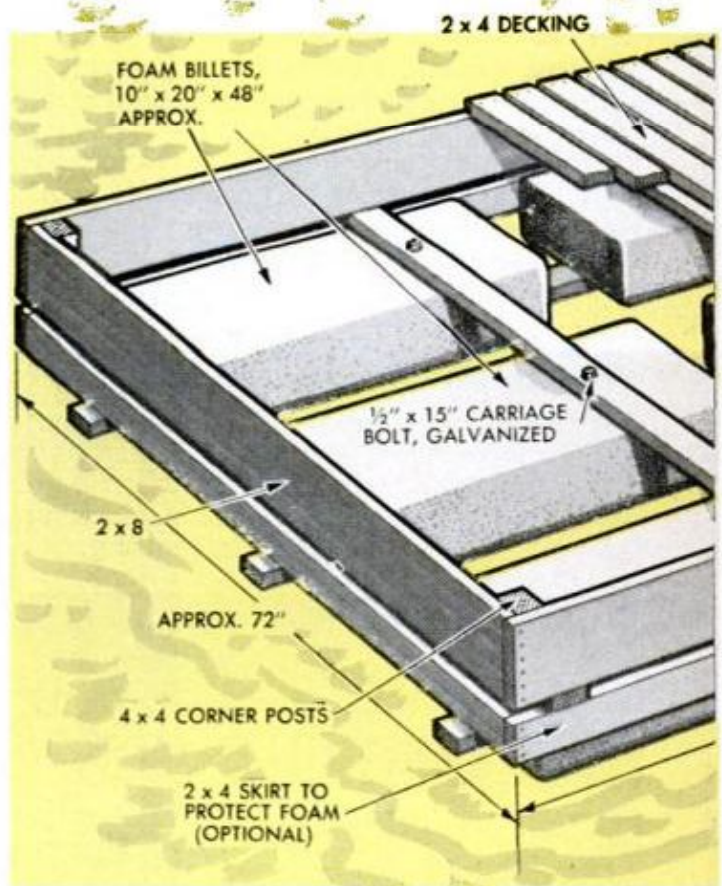
As for flotation, you can buy enough polystyrene foam to support close to half a ton for less than \$30, and it will last indefinitely without paint or maintenance. If your budget is tight, three 55-gal. oil drums will do about the same job for around \$10, if you don't mind seasonal painting and occasional replacement. A good compromise here might be galvanized drums which cost slightly more, but last longer and require less maintenance.

Piers built from scratch can cut costs

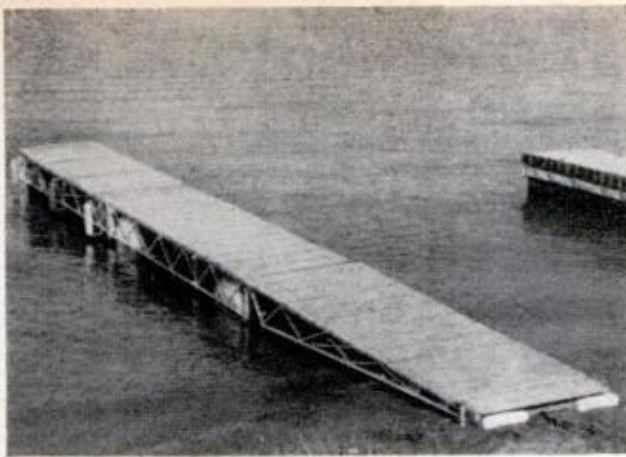


**TWIN DOCKS** connected by a crosswalk form an H-unit with boat slip in center. Note roller-type bumpers on either side of slip which keep boat from rubbing

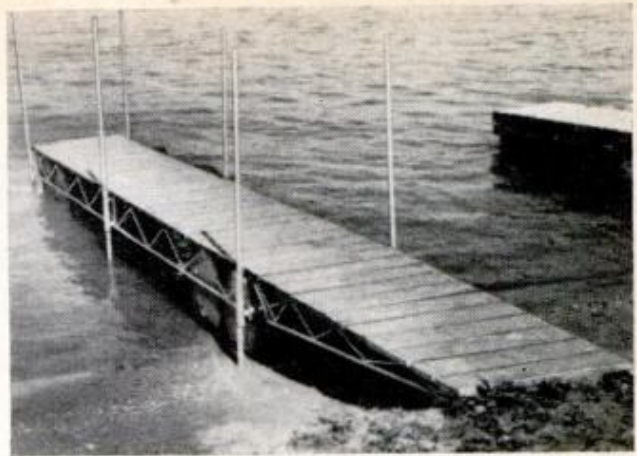
## FOAM FLOAT



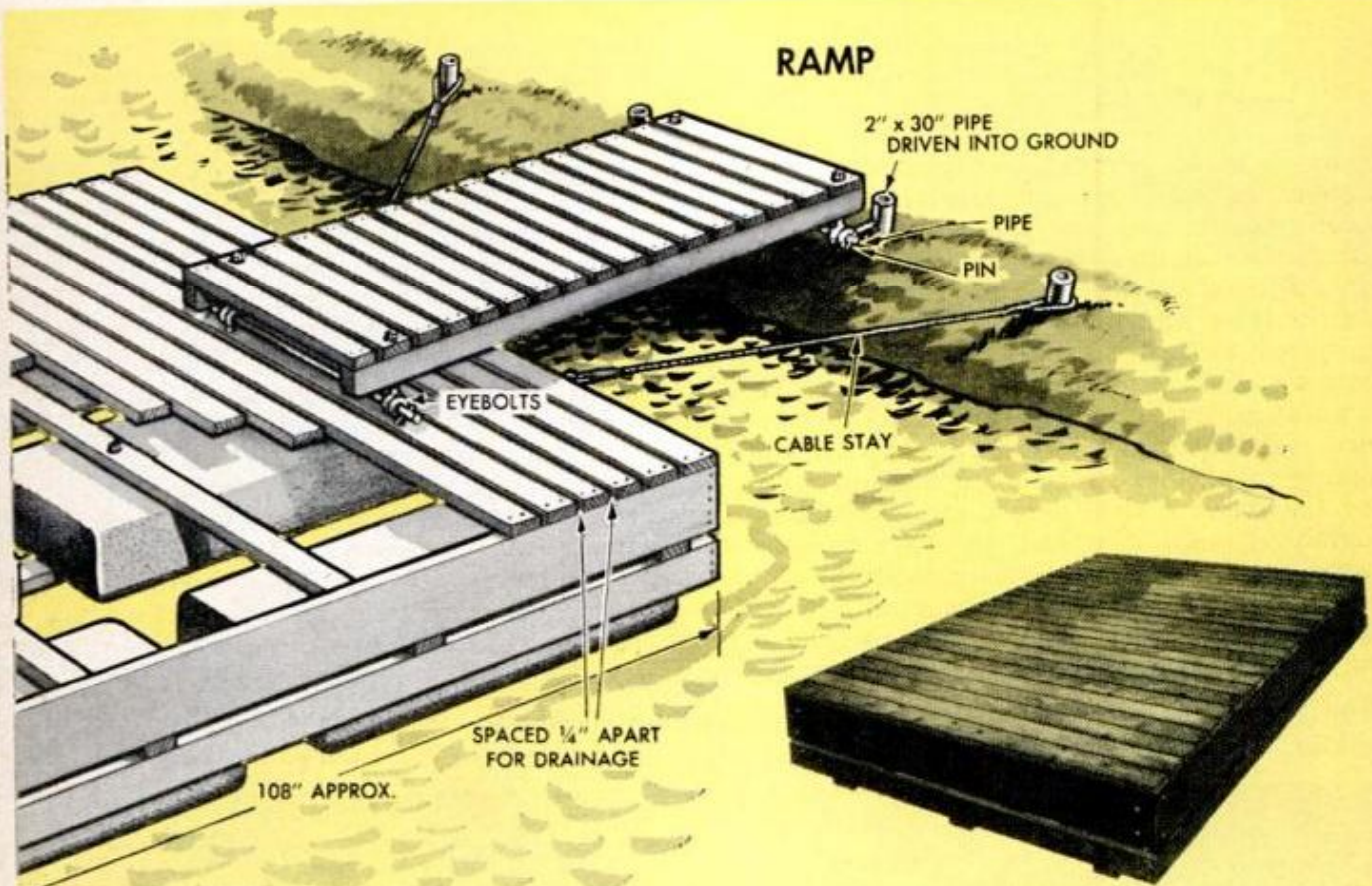




**BUDGET-PRICED** floating dock for sheltered waters uses pre-fab steel trusses with brackets designed to hold oil drums. A 10-ft. section sells for \$63

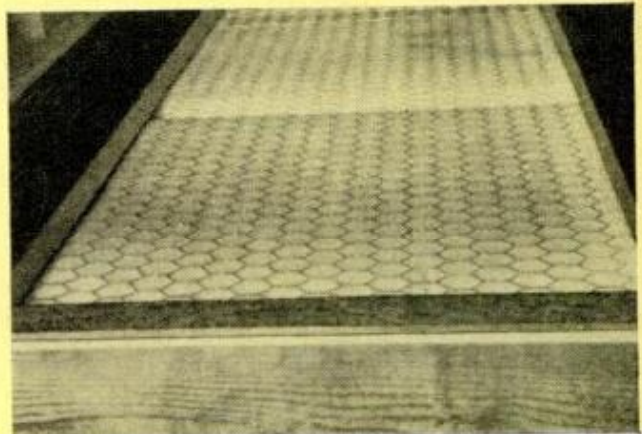


**PIPE PILINGS** hold this floating dock in line. If water level changes, oversized sleeves ride up or down the pipes, allowing the float to rise or fall

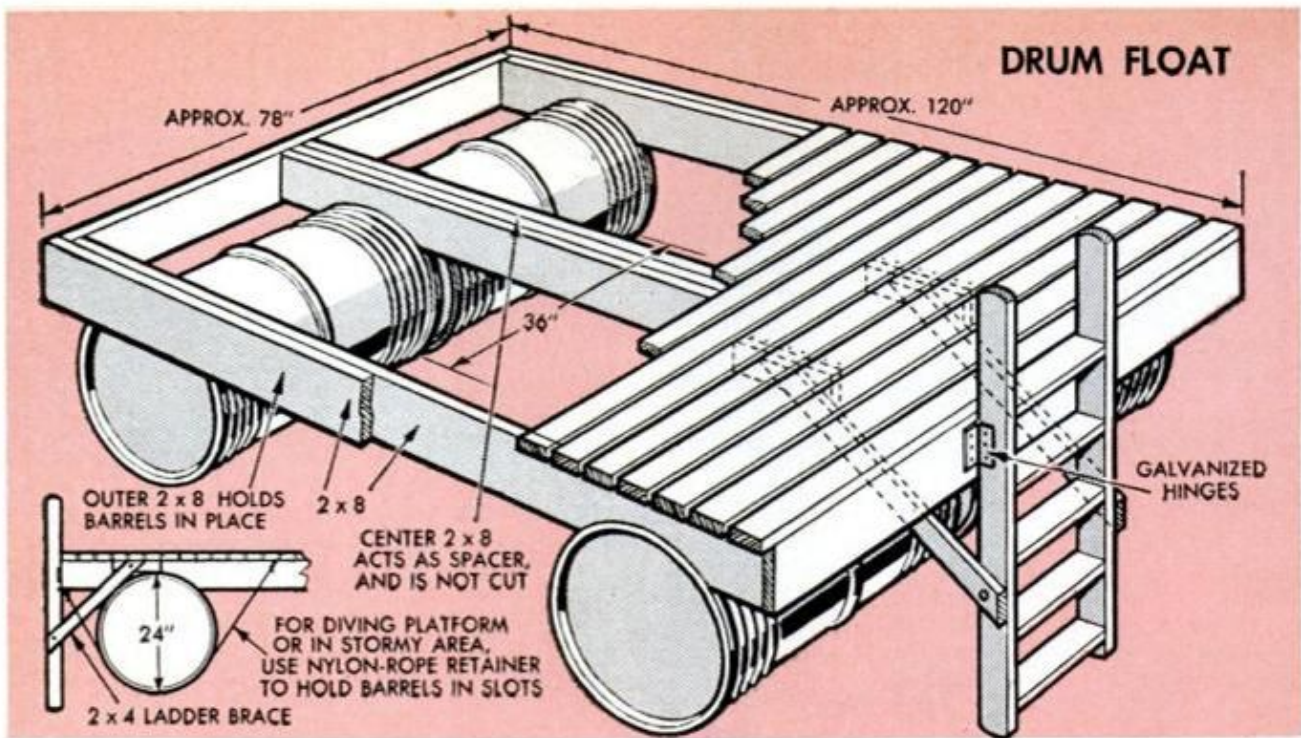


**ONE OFF-BEAT** danger with foam flotation—homeless muskrats will occasionally riddle it with tunnels

**IF YOU LIVE** in muskrat country, protect the upper surface of foam planks with galvanized chicken wire







from 30 to 50 percent, but plan on days instead of minutes for assembly work. Ready-made and pre-fab piers rest on tubular or channel-form metal legs which are adjusted to the bottom contour.

One type has an 8 x 8-in. metal foot designed to rest on the bottom; another terminates in a spiral auger bit that is actually screwed into the bottom by slipping a rod through a hole in the upper end. (You can buy this permanent type for use with home-built piers. With adjustable-height crossbar, prices per pair range from \$12.50 for 4-ft. height to \$20.50 for 12-ft., all with 3-ft. gap between legs.)

**There are a number** of methods of driving homemade pilings. Simple pipe pilings

**TRESTLE DOCK**, the ultimate in simple low-cost construction, is perfectly adequate for sheltered waters

can be sledge-hammered from an anchored boat. Wood pilings should have a square pyramidal point, like that of a soldering iron, for easier penetration; you can either "work" them into the bottom by tilting back and forth while applying pressure, or "bore" them in by drilling a hole near the top of each one for a hardwood dowel so that it can be turned.

In the fall, leg-type piers should be removed from the water. Driven pilings can remain in place, though you may wish to remove the walkways. If the water level varies after ice has formed around the piers, this may tend to loosen them. You can minimize this effect by placing a few large rocks near the piling bases;

**MAKE WALKWAY** by nailing 1 x 5s over 2 x 4s. Stagger 2 x 4 locations so sections can be bolted together





## FIGURING FLOTATION

When planning your float, you can estimate how much weight it will support from two factors: the weight of the lumber and the buoyancy of the flotation units. Douglas fir, the lumber you're most likely to use for framework and decking, weighs about 34 lbs. per cubic foot. Thus, a 2 x 12 will have a running foot weight of around 4¼ lbs.; a 2 x 8 a little less than 3 lbs.; a 2 x 6 just over 2 lbs.; and a 2 x 4 slightly more than 1¼ lbs. Estimate total weight from your lumber bill. As for buoyancy, a cubic foot of polystyrene foam weighs only about 2 lbs., yet it will support about 60 lbs. (though designers usually figure 55 lbs. to allow a safety factor). The popular 10 in. x 22 in. x 9-ft. foam plank can hold over 800 lbs. On the other hand, a pair of 55-gal. oil drums will support about 770 lbs. in addition to their own empty weight of 50 lbs. each so flotation is about equal

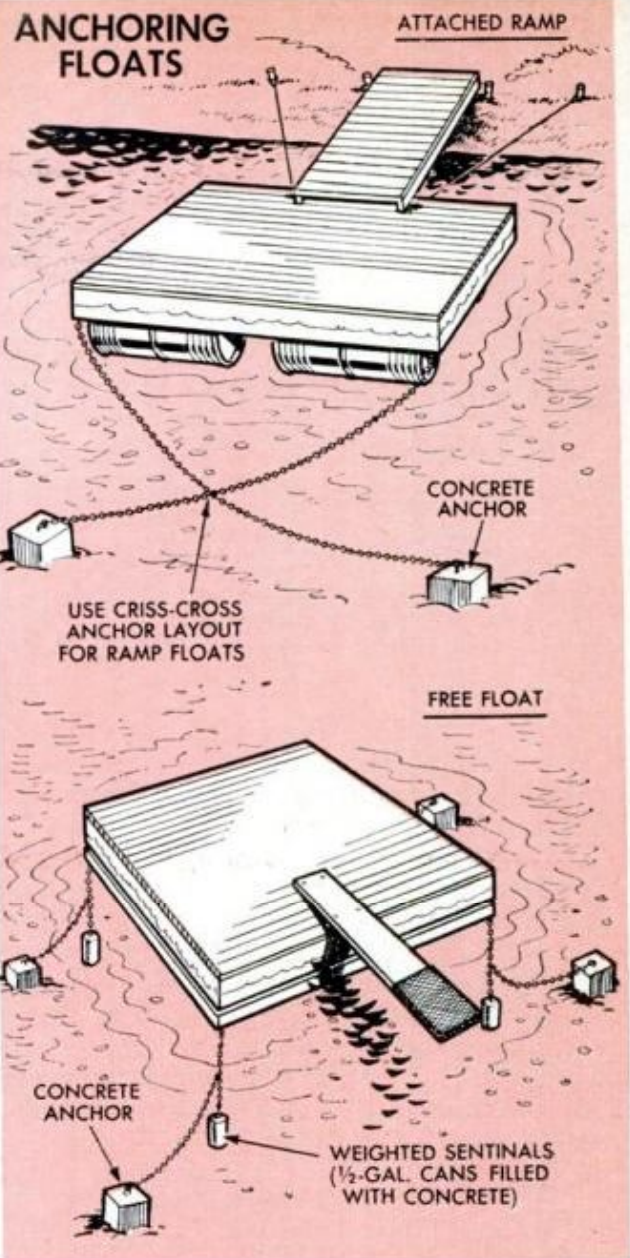
when the water level drops these rocks will break through the ice, loosening its grip on the pilings so that they won't be pulled out of the bottom.

**Floats**, both home-built and ready-made, usually use either foam or drum flotation. An ordinary 55-gal. oil drum weighs about 50 lbs. empty and will support approximately 385 lbs. While prices vary, you can figure on around \$3.50 for a standard drum and about \$5 for a galvanized one. Galvanizing almost doubles the life of the drum so that some last up to eight years. A 10 x 22 in. plank of polystyrene foam 9 ft. long replaces two drums and lasts indefinitely with no maintenance.

**TO ASSEMBLE**, first put trestles in place, then bolt walkway sections to each other and to the trestles



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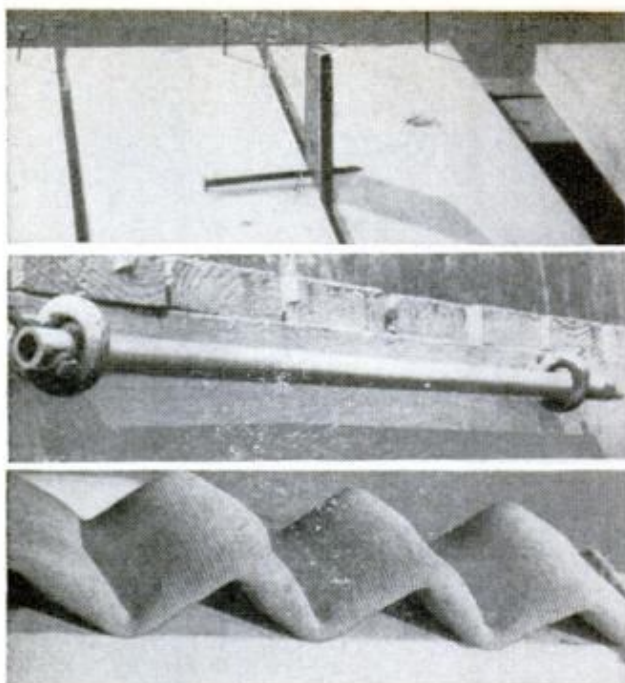


**WEIGHT OF DOCK** is enough to keep it from floating, but keep walkway high above surface to play safe



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**THREE TIPS** on dock building: Spacer board (top) will speed up the job of nailing deck planking, assure even spacing; To cut costs, use large galvanized eyebolts and galvanized pipe (middle) to hinge ramp to float; Worn-out firehose (bottom) makes a perfect dock bumper, so check with your local fire department to see if any will be put on the market soon

It can't rot, and marine borers won't touch it. While this foam costs more than twice as much as comparable drum flotation, its advantages are obvious.

**Polystyrene foam** has only two natural enemies: muskrats and seagulls. The best insurance against muskrats is described on p. 155. As for the gulls, they won't actually eat the foam, but they do get a big kick out of pecking holes in it. However, paint the exposed portions of foam a brilliant orange and gulls won't touch it.

More dangerous to polystyrene foam are its man-made enemies—oil, gas, in-

dustrial chemicals and other solvents floating on the surface of the water. To protect the foam, build a wooden skirt that extends beneath the waterline all the way around your float. This will block out the harmful surface film. In areas of heavy contamination, you'll probably be better off using drums or ready-made metal pontoons. Or you might check on Dow's Tyrilfoam buoyancy billets, which are designed to resist this solvent damage.

**Two home-built floats** shown on the preceding pages illustrate the general construction methods used with both types of flotation. While these small landing or diving floats may not suit your purposes, you can easily vary the dimensions to make narrow docks or large-area fun floats.

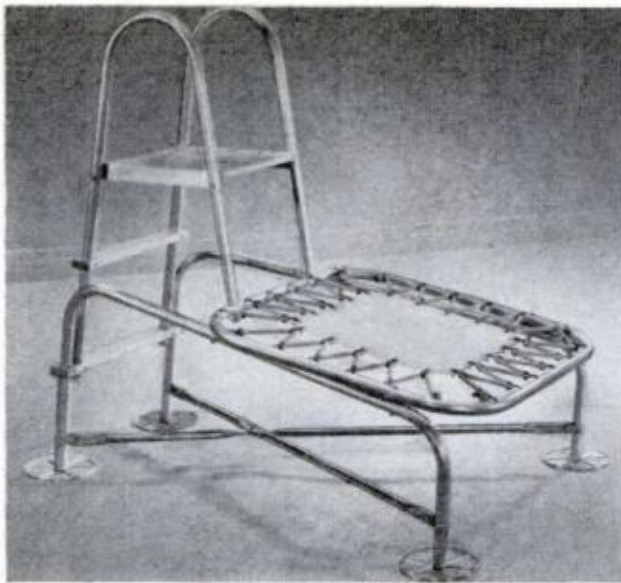
Anchoring a float is basically like anchoring a boat, but there are a couple of special rules to keep in mind. A float linked to a pier ramp should have two anchors at the outer end with the lines crisscrossed to insure lateral stability. A free float requires four anchors with the lines radiating out from the corners instead of crossing. And since the water around a float is a heavy-traffic area,

### SAMPLE PRICES, READY-TO-USE AND PRE-FAB UNITS

ITEM	SOURCE	PRICE
3' x 19" pre-fab steel pier with 8' end platform, decked with fiberglas	Aqua-matic Piers, Inc. Milwaukee, Wis.	\$300
3' x 19" pre-fab steel pier with 8'-8" end platform, nonskid pebbled steel deck, baked marine enamel finish (additional 3' x 8' sections cost about \$57)	Standard Steel Products Mfg. Co. Milwaukee, Wis.	\$200
40" x 8' sectional pier, galvanized steel rod frame, plywood deck	Pasconi Systems, Inc. Cambridge 39, Mass.	\$125
3' x 10' sectional pier, galvanized square tube stringers, auger-tipped legs, wood deck, one pr. 6' legs	Indiana Galvanizing & Mfg. Co. Muncie, Ind.	\$76
32" x 8' sectional all-aluminum pier, bottom pads on legs	Alumidock Div., Metallic Ladder Corp. Randolph, N.Y.	\$98
Aluminum truss ramp, supports 2000 lbs., rubber-tired wheels at float end, lengths from 12 ft.	Alumidock Div., Metallic Ladder Corp. Randolph, N.Y.	From \$250
20" x 20" aluminum pontoons in lengths from 15' to 26'	Kiekhaefer Corp. Special Prod. Div. Fon du Lac, Wis.	From \$160
Prow section for pontoon above, used in building party barge	Kiekhaefer Corp., Special Prod. Div. Fon du Lac, Wis.	\$65
7' to 10' sectional float, steel truss construction, redwood deck, designed for use with 55-gal. oil drums, can also be used with foam. (Sold without flotation.)	Indiana Galvanizing & Mfg. Co. Muncie, Ind.	\$54 to \$76
10" x 20" x 9' polystyrene flotation planks	Gilman Bros. Gilman, Conn.	\$23

**NOTE:** Since space limitations make it impossible to include a complete list of products and manufacturers here, consult your marine dealer for further information.





**BIG BOUNCE** for a small diving float is possible with these two space-saving units. Trampoline, above, sells for \$129.50. Springboard, right, uses torsion spring action of legs, needn't be fastened to dock



lines must be deep enough to be out of the way of boat props and springboard divers, so rig weighted sentinels to them.

To cut costs, you can cast your own 18-in. concrete-block anchors in scrap-wood forms, embedding an eyebolt in the concrete before it sets. Each one of these will weigh more than 300 lbs., so your four-anchor free float will be safely hitched to the bottom with more than half a ton of concrete.

Most commercial docks and floats have non-skid walkways. You can get the same

effect by finishing with a weatherproof coating (Seaprene, or similar) sprinkled with non-skid grit, available from any large paint supply house. The best tool for spreading this grit? A salt shaker.

Accessories for piers and floats range all the way from boarding ladders and springboards to benches where the non-boaters in your family can relax in the sun. If you're thinking big, you might consider a pier-linked float dock which can double as an outboard-powered party barge, a real "boat dock." ★★★

## Make Your Own Mushrooms

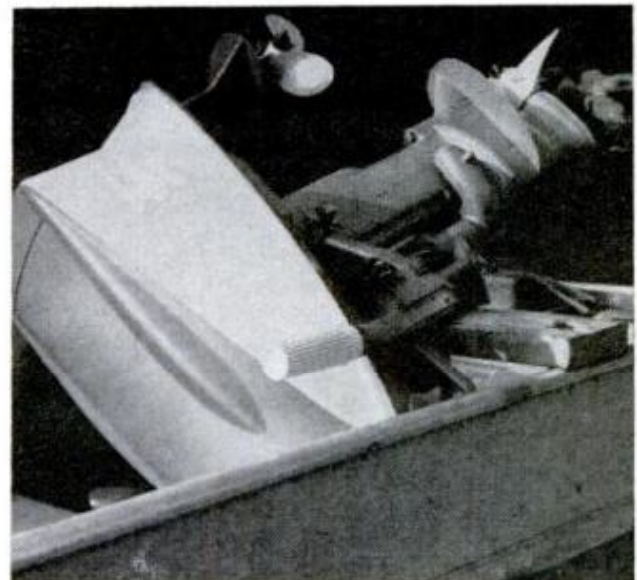
All you need to make the economy mushroom anchor shown below is a discarded water tank and a large eyebolt. Just cut the bottom off the tank and attach the eyebolt to it.—*R. Beach*



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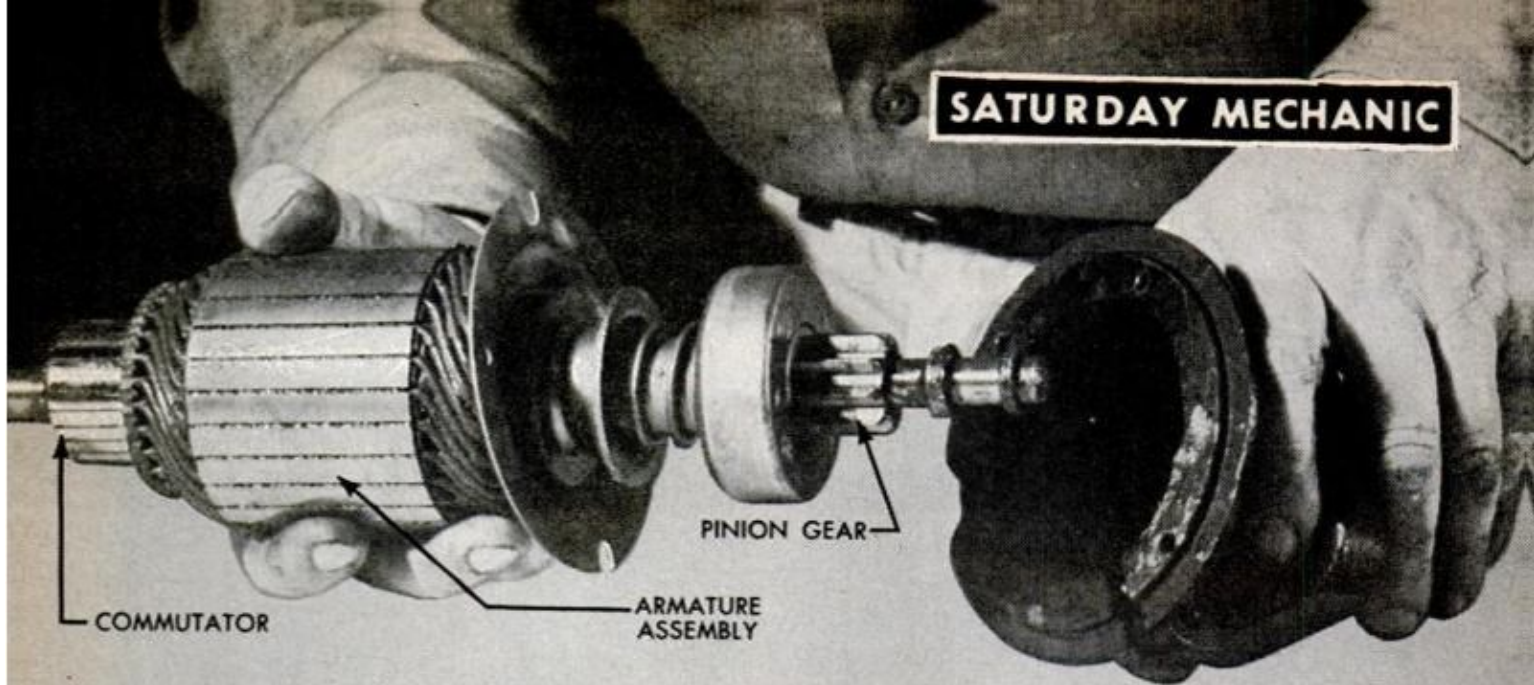
## Trailer Your Motor Amidship

When trailering, your outboard will be a lot safer in the boat than on the transom. To make this possible, clamp or bolt a 2 x 6 athwartships above the trailer axle and clamp motor to this.—*Jackson Hand*



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# THE MOTOR THAT STARTS THE MOTOR

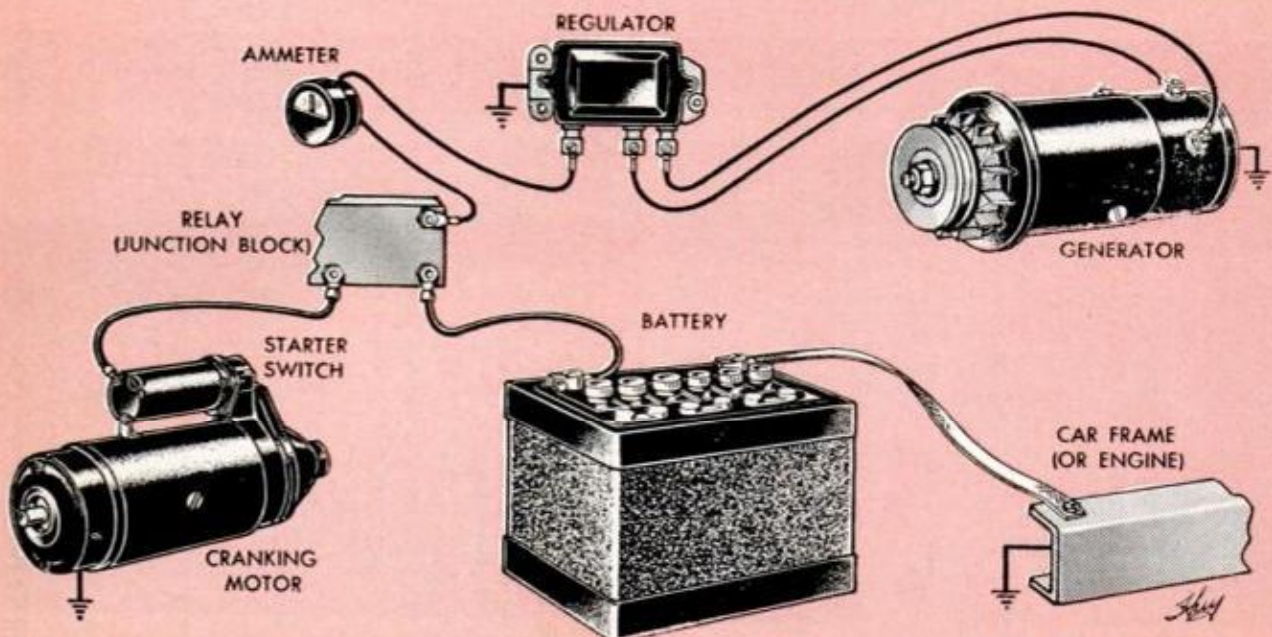
By Morton J. Schultz

**T**O MANY AUTOMOBILE OWNERS, the starter is still a mystery. Few know how it works, still fewer care so long as it *does* work. Consequently, when anything resembling a starter malfunction occurs, most car owners run to a professional mechanic.

Of course, the services of a mechanic may be required since the problem could be inside the starter, but usually you can

save yourself time and money by first checking various conditions yourself. Keep in mind that a starter seldom goes bad internally. Usually, what appears to be a starter malfunction is merely a bad connection, a shorted cable, a faulty switch, or a weak battery—troubles that you can easily handle.

You should also keep in mind that the starter is part of the car's charging system





and all parts of that system—particularly the battery, but also the generator (or alternator) and regulator—must be in good shape for all other parts to work well.

The purpose of this low-voltage, direct-current electric motor we call the starter is to convert electrical energy into mechanical energy. This mechanical energy must be produced at a torque high enough to crank the engine. Thus, for its size, the starter provides a very high horsepower and is capable of operating under a great overload for the short intervals needed to fire the engine.

● Basically, there are only two types of starters used in late-model cars: overrunning clutch-drive starters and Bendix drive starters. Major differences between the two are the types of switches used in the battery-starter circuit and the types of internal control used to disengage the starter from its cranking position once the engine begins to fire. The type of switch used dictates the type of internal control.

### Bendix Drive Starters

Bendix drive starters employ an electromagnetic switch that has only one job: closing the circuit between battery and starter so as to provide the necessary current for the starter to operate.

Overrunning clutch drive starters employ a solenoid switch, or a combination solenoid and relay switch that has two functions. It, too, provides sufficient current for the starter, but it also has the job of pushing the starter pinion gear into mesh with the flywheel. It is this pinion gear that rotates and turns the flywheel. The flywheel then rotates the crankshaft, causing the engine to start. In Bendix drive starters, meshing of pinion and flywheel is achieved by inertial action.

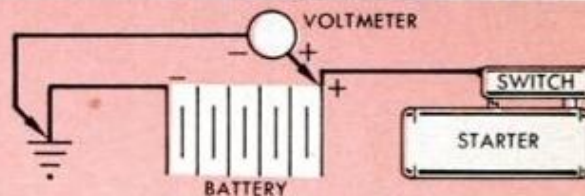
● As indicated above, the switch in an overrunning clutch starter could be just a plain solenoid; a solenoid and relay where the two are separated one from the other, with the relay located on a fender or the firewall; or an integrated solenoid-relay where the relay is built right into the solenoid. However, the integrated solenoid-relay switch has seen only limited use and has not been employed in cars since 1955.

No matter what type of solenoid starter switch is used on your car, the solenoid itself will always be mounted on the starter, as is the magnetic switch of Bendix drive starters.

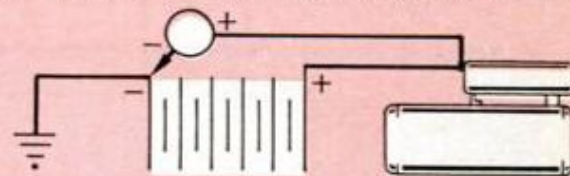
If just a solenoid is used, the cable from the "hot" side of the battery is connected directly to the solenoid. The relay you may have in conjunction with the solenoid is nothing more than a junction box for connecting the cable from the "hot" side of



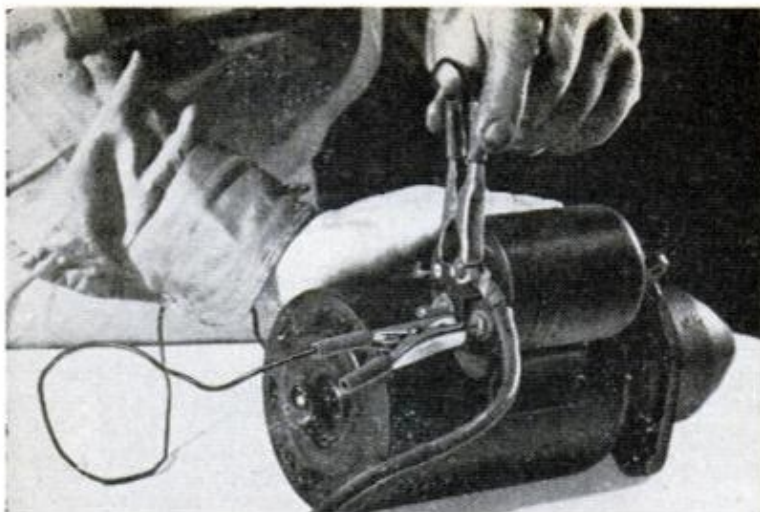
**BATTERY CHECK** using hydrometer is made by drawing a small amount of electrolyte out of each cell



**TO TEST GROUNDED** side of starter circuit, connect one lead of voltmeter to "hot" side, the other lead to ground, as shown in photo and sketch above. To test "hot" side, connect one lead to battery's ground post and the other lead to starter switch (photo and sketch below). All examples are for negative-grounded car







**JUMPER CABLE** between the contact and control terminals of this 12-v. starter makes it possible to determine whether or not the starter switch is defective. If the starter spins when the engine is cranked, the trouble might lie in ignition switch or inside starter

the battery, the cable from the solenoid, and other wires such as the one going to the car's ammeter.

Chrysler-built cars, with the exception of Plymouth, use an overrunning clutch starter with a solenoid and relay switch (Plymouth employs a Bendix drive starter with a magnetic switch); most cars made by General Motors use overrunning clutch starters with a simple solenoid switch (Buick, however, employed a solenoid and relay switch in models after 1951); and Ford-built cars use a Bendix drive starter with a magnetic switch.

● Since an overrunning clutch starter is a bit more difficult to understand, we will explain its operation first. But keep in mind that, with the exception of the operation of the switch and the action of the internal disconnect control, both overrunning clutch and Bendix drive starters operate basically the same, and both are basically the same in appearance.

When you turn on the ignition switch, the battery releases a small amount of electrical energy that flows to the solenoid. This charge forces a shaft to pop from the solenoid and strike a plunger. When activated, the plunger forces the starter pinion gear to engage the flywheel. The movement of the plunger also closes a

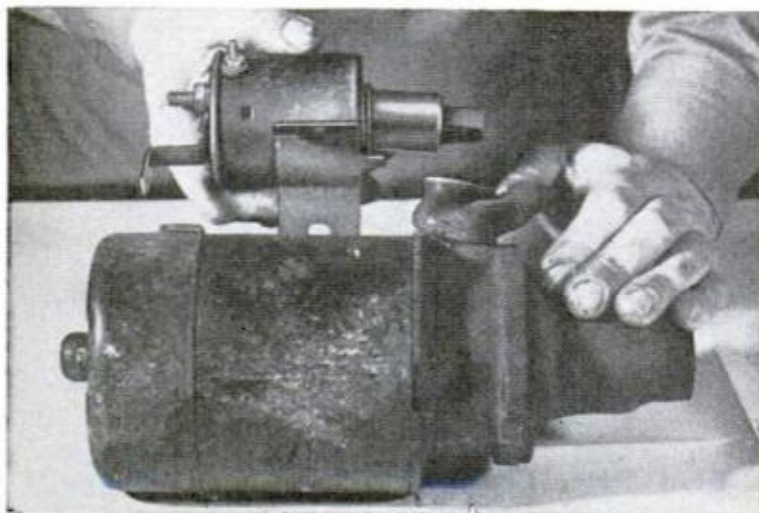
switch inside the solenoid to complete the battery-starter circuit. When this is done, the starter is allowed to receive a large electrical dose from the battery.

To convert this electrical energy into the mechanical energy needed to rotate the flywheel, the starter functions the same as most electric motors. Brushes feed the electrical energy to the commutator at the end of an armature assembly. This electricity sets up a magnetic field, which causes the armature to rotate.

The armature, in turn, is attached to a drive shaft at the end of which is the pinion gear engaged with the flywheel. Constant rotation of the armature causes everything ahead of it—drive shaft, pinion gear, flywheel and crankshaft—to spin.

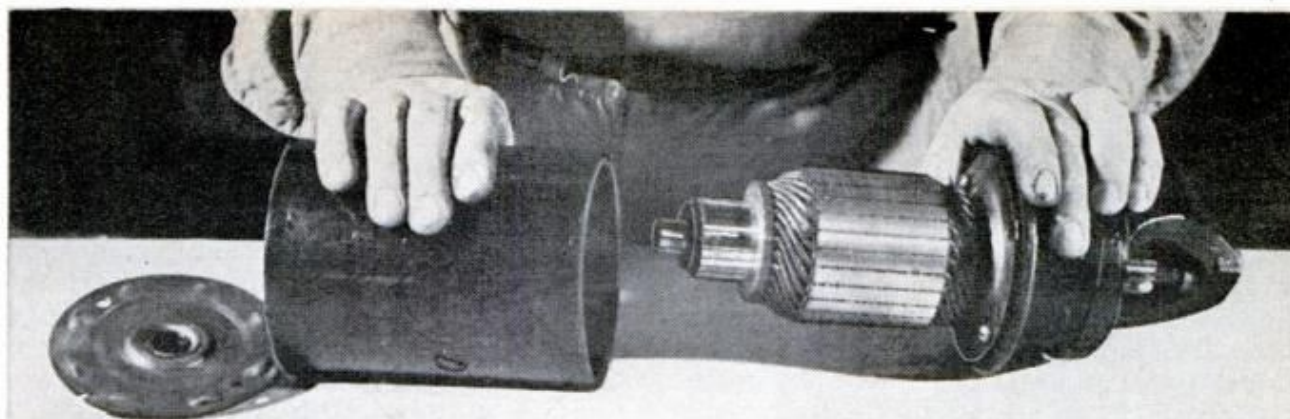
But this rotation *cannot* continue once the engine is running or else the starter could burn up, and the pinion gear and flywheel could chew each other up. So, the solenoid again controls the action.

When the engine begins to run and you release the ignition switch, several things happen. Current to the solenoid is cut off. This causes a strong return spring inside the solenoid to pull the solenoid plunger back, releasing the pinion gear from its mesh with the flywheel. The circuit between the battery and starter is also



**STARTER SWITCH** mounted on starter motor housing may be either solenoid or magnetic type. Failure of the starter to spin, one of the more common starter problems, is caused by a defective switch, so check this switch carefully before dismantling the starter





**TO GET INSIDE** starter, simply remove bolts holding the cover plate and slide the starter out of the case

broken and the starter becomes a dormant part of the car, having no further function to perform until it is needed once again to start the engine.

● Bendix drive starters with their magnetic switches operate essentially the same way, except for the manner in which the pinion engages the flywheel and is forced to disengage when the engine starts.

When the magnetic switch closes, causing current to flow from the battery to the starter, the armature shaft accelerates very rapidly. Instead of turning the pinion, however, this action forces the pinion *forward* along the spiral splines of its sleeve to mesh with the flywheel. In other words, the Bendix drive starter uses the inertia of the pinion and high starting speed of the armature shaft to move the pinion into engagement with the flywheel.

When the pinion becomes fully meshed with the flywheel, its forward motion stops and the pinion is locked to the rotating armature shaft. With all starter parts locked together, the rotation of the armature is actually the force that turns the flywheel and crankshaft.

But when the engine starts, the pinion begins to rotate faster than the armature shaft. As a result, it spins itself back and out of mesh with the flywheel.

● If starter operation is sluggish, chances are in your favor that the trouble is not in the starter, but is instead a weak battery or excessive resistance in the starter circuit—problems you can iron out yourself.

Start at the battery, checking each cell with an accurate, temperature-tested hydrometer. (Incidentally, whenever such a specific gravity test is made, the engine should be at normal operating tempera-

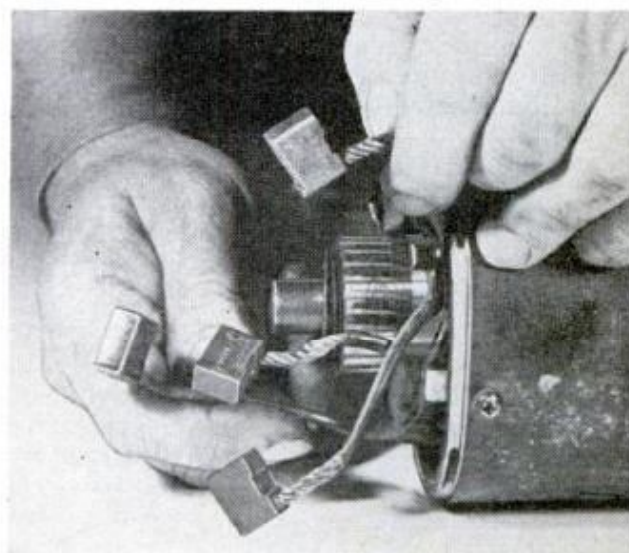
ture.) If hydrometer readings show that a battery is less than fully charged, have it charged and see if this doesn't solve the problem. If not, test the starter circuit with a voltmeter.

A battery that is less than about  $\frac{3}{4}$  charged often denotes trouble in the generator or regulator, especially if you know the battery is in good condition. The generator (or alternator) and regulator should be checked before further starter tests are made.

● Starter circuit tests measure the voltage drop produced by defective circuit condition. Conditions that cause high resistance and poor cranking include faulty terminal connections and defective cables.

To make sure the engine doesn't start during the tests, pull the primary lead wire from the center tower of the distributor or from the coil.

● First, check for voltage drop across the grounded side of the circuit. Hook the proper voltmeter lead to the "hot" battery terminal. If your car is negative grounded, the *positive* lead of the voltmeter is connected to this terminal, which is positive; if positive grounded, the *negative* lead of



**MOST STARTERS** have four brushes which may be held in place by any of several different means, a spring clip or inset pin being the most common. They are easily removed but replacement entails soldering



the voltmeter is hooked to the terminal, which is negative.

Connect the other voltmeter lead to ground on the vehicle frame or engine (the bolt head where the battery ground cable is connected will suffice). Now, crank the engine.

The voltmeter should read at least 9.0 v. for a 12-v. charging system and 4.5 v. for a 6-v. charging system. A reading less than this indicates excessive resistance in the ground circuit, since you know the battery is in good condition—you've just checked it.

Remove the ground cable where it connects to the battery and to ground on the engine or frame. Clean the terminals with a brush saturated with a cleaning solvent, and clean the battery post and the area to which the grounded end of the cable is attached on the frame or engine block.

Replace the cable and rerun the test. If the reading still shows lower than 9.0 v. for a 12-v. system or 4.5 v. for a 6-v. system, the ground cable is damaged internally and should be replaced.

● Now, test the "hot" circuit. Hook the correct lead of the voltmeter to the battery's ground terminal, and connect the other lead to the solenoid or magnetic switch on the starter. Make this connection

where the cable going to the starter is attached to the switch.

Again, crank the engine. If the reading is under the minimums given above, do the cleaning job already described. Rerun the test to see if a proper reading is now obtained. If not, replace the cables.

If no resistance in the circuit is apparent and the battery is in good condition, the solenoid or magnetic switch should be checked next. Testing these switches is also in order if another common problem occurs—failure of the starter to spin.

● To check the switch on a Bendix drive starter, you must first determine the type of magnetic device the starter possesses. There are four kinds: magnetic switches with ignition bypass terminal (these are used in cars with 12-v. charging systems); switches with a single control terminal and an internal ground; switches with a single control terminal and an external ground; and switches with two control terminals.

Switches used on 12-v. starters (with the exception of Studebaker) and switches with a single control terminal and an internal ground are checked the same way. Connect a jumper across the switch from the terminal to which the cable is con-

(Please turn to page 186)

## AUTO CLINIC

**Q** Is there any way to repair an outside rear-view mirror that has become loose and rattles?—A.M., Penna.

**A** Take the mirror from the car and lay it flat, glass side up. Trickle some transparent windshield glass sealer around the edge of the glass, so it runs between the glass and the frame. Let it set for a while to form a secure bond. One type of sealer you can use is manufactured by Minnesota Mining and Manufacturing Company and is called Clear Auto Glass Sealer.

**Q** I recently had to replace several spark-plug cables because the cables had become separated from their terminals. What can cause this?—J.M.P., Va.

**A** The cause is probably the last man who removed the cables from the plugs. You can no longer just pull cables from plugs. The boot encasing today's resistance-type plug adheres to the plug insulator, and any pulling ac-

tion will cause damage. The proper way to separate the cable is to grasp the boot at its base above the spark plug shell. Then, with a rotating motion pull gently to break the adhesion.

**Q** Is there anything to do about an annoying window rattle on my 1962 Rambler without disassembling the door?—W.J.S., N.J.

**A** There is one fix you can try. Get a length of ordinary TV antenna wire. Then, with the window down, push the wire into the channel. This should shim up the channel and make a snug fit between the window and the channel. The antenna wire, since it is plastic coated, makes a good track for the window. If the wire's too wide to enter at any point, shave a small amount of plastic from one side.

As a service to the readers of Popular Mechanics in solving problems relating to their cars or to driving in general, you are invited to submit your questions for answering either through this column or by mail. Address Auto Clinic, Popular Mechanics Magazine, 575 Lexington Avenue, New York 22, New York.



# Keeping Your Car Up To Par

**ONE EASY WAY** to locate a head-gasket leak on V8s having separate top radiator hoses is to remove both of the hoses and take out the thermostats. Next, remove the fan belt so that the water pumps won't operate and fill the block with water to the top of the head. Then start the engine, and while it is idling look for bubbles along the gasket line

**WHEN OVERHAULING** older-type L-head engines, one of the ever-present problems is keeping dust, carbon particles and other debris out of the valve guides. A small twist of clean cloth or tissue paper will do the job, if you can keep it in place. However, a simpler and surer solution is to select a common carriage bolt that will just drop down into the guide

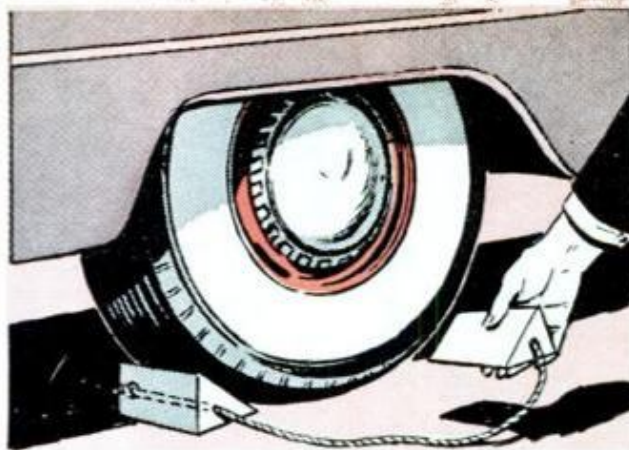
**BEFORE TIMING** an engine having timing marks on the vibration damper, be sure to remove the fan belt. The engine will idle safely without it for a short time, and this allows you to reach down with the timing light to pinpoint marks without risking a painful injury. With the belt connected, your finger might be caught between the pulley and the belt

**ON SOME V8 ENGINES** the front cylinders tend to run cooler than others in the two banks. This can result in fouled plugs, a rough idle and possibly a persistent miss in one or two cylinders. To correct this tendency without the risk of damage to the engine, install plugs of a somewhat higher heat range in cool cylinders. Also, check the thermostat

**TO PREVENT THEFT** of your spare tire from the trunk, pass a length of chain through the center of the wheel and around a brace in the trunk, then padlock the ends together. The same basic idea works especially well in securing the outside-mounted spares found on many small trucks, and may also be used to protect a toolbox, passing chain through handle



AUGUST 1963



**DOUBLE INSURANCE** in the form of two wooden wedges will prevent your car from rolling when it's up on a jack. For easier storage, thread them on a short piece of rope and tie a knot in each end. If you ever have occasion to block both wheels, as on a particularly steep grade, simply untie one of the knots and pull off a wedge to block the other wheel

**WHEN ENGINE COOLANT** is drained for any reason, it's not possible to get all of it back into the cooling system because of the closed thermostat. To avoid loss of time running the engine to open the thermostat, remove a hose at the heater. Then you can pour all the coolant back into the system without unnecessary delay. Be sure to replace the hose

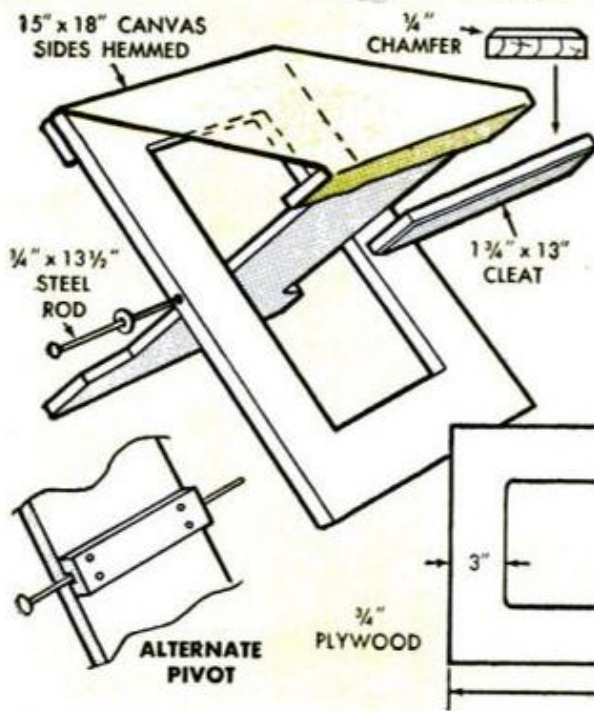
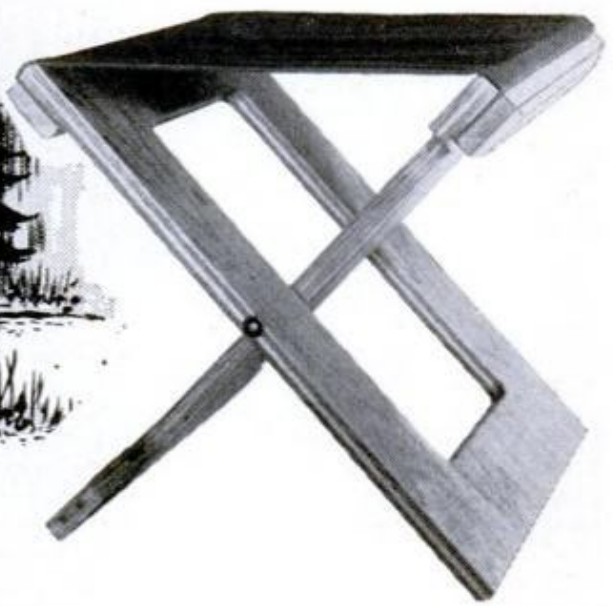
**ODOMETER CABLES** that break off short can be removed by turning a sheet-metal screw into the broken end. Once this is done, you can grip the screw head with pliers and pull the cable out. Old cables coated with hardened lubricant are always difficult to remove, so squirt a little penetrating oil into the open end to loosen it before you begin the job

**AN INCONVENIENCE** when using a conventional tire pump is the lack of a gauge to let you know when the correct pressure has been reached. You can remedy this by installing a small pressure gauge in the pump hose. Just screw the gauge connection into the side arm of a tee and screw hose nipples into the other two arms, then clamp the ends of hose to them

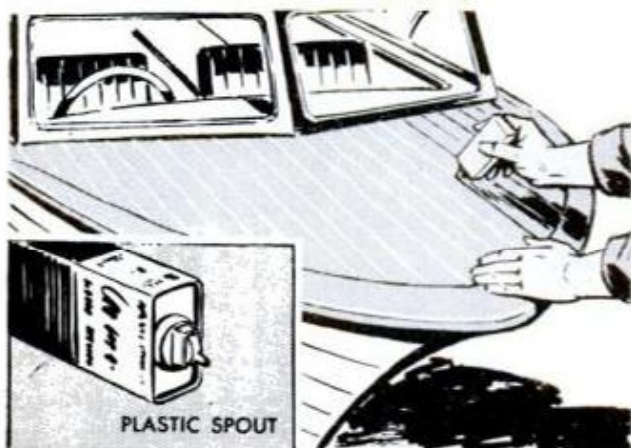
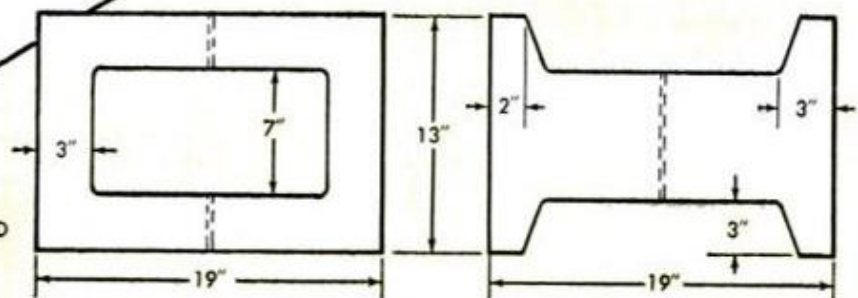




# CAMP STOOL



If, like most outdoorsmen today, you feel a camp is incomplete without all the comforts of home, you'll want to make one of these folding stools for every member of your party. They weigh only a few pounds, and three or four of them take up little room in your car. Make the legs from exterior plywood, the cleats from 1 x 2 and the seat from canvas or duck.—*E. V. Traylor*



## Improved Striping Tool

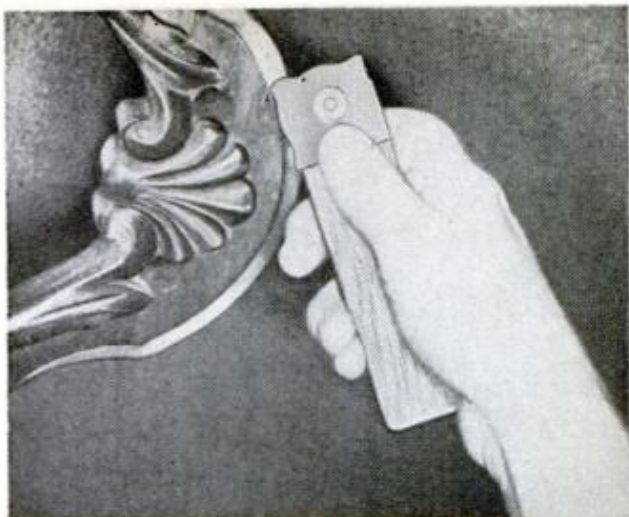
Many a boat owner has ruined a good paint job by doing a poor job of striping the deck planking. But masking for each individual stripe is difficult and time consuming. Solution? Make a striping tool from an empty lighter fluid can—preferably the type with a fold-down plastic spout. Fill with marine enamel, thinned to flow freely through the spout. Then, while squeezing the can gently, move the spout at a uniform rate of speed along the plank joints.—*E. Dahlgren*



# Shopping for Tools



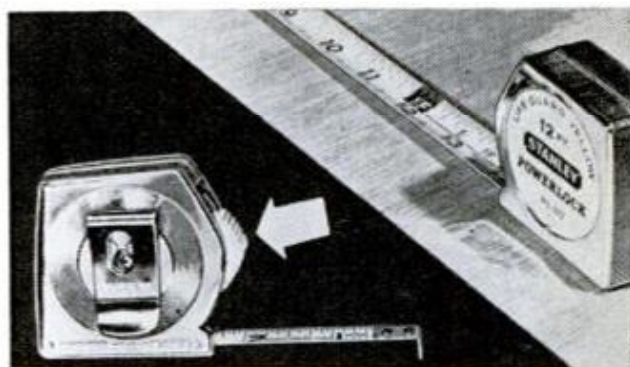
**STANDY** is an adjustable stand that will hold a propane torch at any angle while you hold the work, the brazing rods or the solder. It's safer than the usual run of improvised stands, and comes equipped with a flint gas lighter. Made of heavy-gauge satin-finish aluminum. Priced at \$1.98. Silver King, 1529 Youngs Avenue, Aurora, Illinois



**VERSATILE SCRAPER** is said to be ideal for cleaning carvings and other difficult surfaces before refinishing. Two blades offer a wide variety of concave, convex and straight edges. Pressed wood handle is finished to resist acids and paint removers. Costs \$2.50 postpaid. Extra pair of blades is \$1.25. Dept. PM, Carl F. Maute Co., Box 27, Williamsville 21, N.Y.

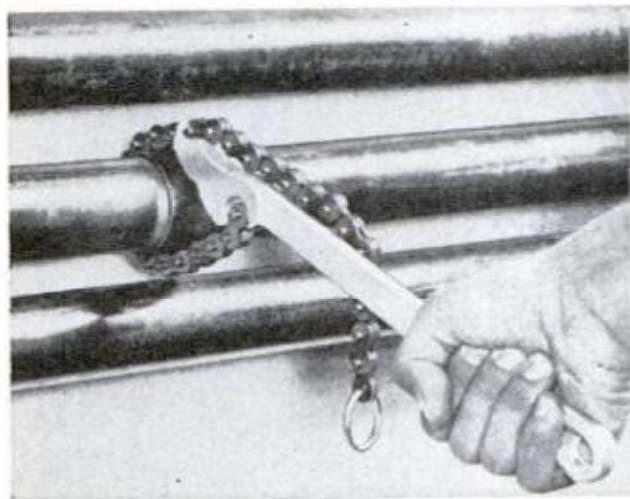


**NEW VINYL-GRIP CHISELS** were specifically designed for geologists and rock hounds. Model ERC-8 is 8 in. long, has a 1¼-in. cutting edge. ERC-12 is 12 in. long, has a ½-in. cutting edge. Prices are \$1.50 and \$1.35, respectively. Estwing Manufacturing Co., Rockford, Ill.

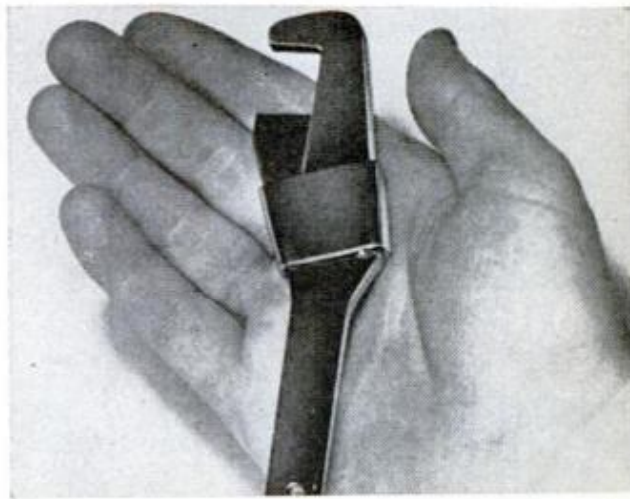


**POWERLOCK PLASTIC-COATED TAPE** locks in extended position, freeing your hands to make notes, etc. It's equipped with a convenient belt hook. Made in ½- and ¾-in. widths, lengths up to 12 ft. Prices start at \$1.59. The Stanley Works, New Britain, Conn.

**UTILITY CHAIN WRENCH** fits ⅝- to 4-in. pipe. Operates in either direction without having to be removed or refastened. Needs only ¾-in. clearance. Chain is 15¼ in. long, and can be lengthened. Handle is 12¾ in. long. At dealers only. Ridge Tool Co., Elyria, Ohio



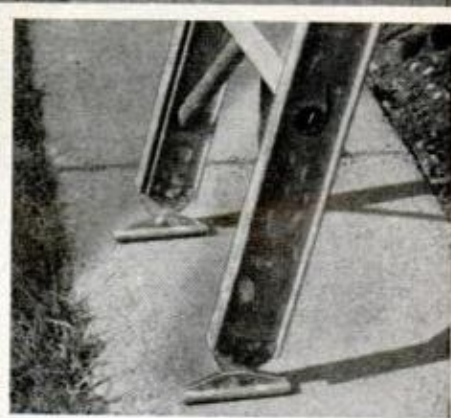
**SLIK WRENCH** has no adjusting screw. You slide it open, put it on the work, slide the movable jaw against the work. Jaw's wedge action maintains a tight fit as you push against it. Price: \$2.98. Empire Mds. Co., 140 Marbledale Road, Tuckahoe, N.Y.





# HOW TO STAY ALIVE ON A LADDER

By Bernard Gladstone



**PLANT IT FIRMLY.** Rubber-faced feet keep metal ladders from slipping. On soft ground, lay plank for footing

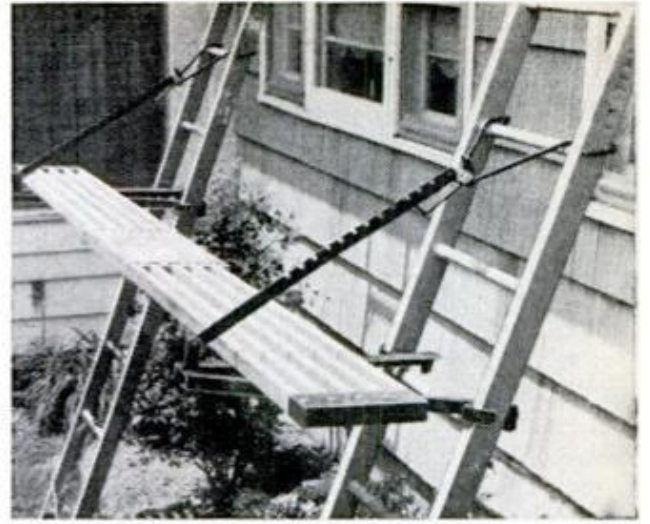


*No home accessory looks so harmless—yet has greater accident potential. But if you're savvy, you're safe*





**FOR ROOF PERCH**, lay ladder flat, hooking brackets over ridge (inset). This simplifies climbing up and down, gives you choice of levels from which to work



**PAIR OF RENTED JACKS** lets you rig scaffold to save a lot of ladder moving. At low heights, as here, take extension ladder apart to avoid renting second one

**WHAT GOES UP** must come down—but not always at the same speed. To make sure *you* will always come down a ladder the way you went up—a step at a time—never forget two rules:

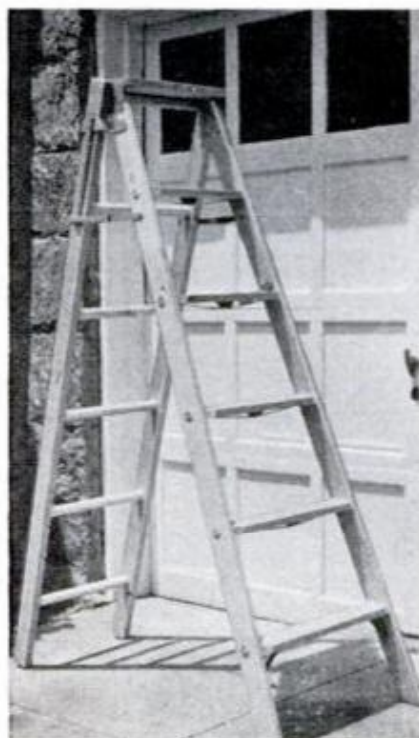
- Don't climb anything but a top-quality ladder which you know is in good repair.
- When using any type of ladder, be sure to follow established common-sense rules on setting it up and working from it.

Before you use a ladder—especially one that's rarely used or one you've borrowed or rented—inspect it carefully. Check rungs or steps to see if any of them show signs of cracking or splitting. It also pays

to test all metal braces under the rungs with a wrench to make certain they're tight. An easy way to test the rungs on a tall ladder is to lay the ladder flat and bounce lightly on each rung with your full weight. Next, stand the ladder in its working position to see if it wobbles or shakes excessively. At the same time, inspect all pivots, locks and other hardware.

If you're buying a new ladder, don't let price alone determine your selection. Even with a small step ladder this can be foolhardy. Remember that more injuries are caused by falls from a three or four-foot height than by falls from a tall extension

**MULTI-PURPOSE LADDER** leads three lives: Left, it's a double-climb stepladder with rungs up back as well as treads up front; runged section extends to convert to small extension ladder (center) or comes off for use as separate straight ladder; adjustable feature lets you offset back (right) for steps or sloping ground





ladder. Since a good ladder will last many years, the few dollars saved is hardly worth the increased risk inherent in a "bargain" of inferior quality. Check the ladder before you buy it. The side rails should be free of knots or other defects.

To preserve a new wood ladder, coat it with a clear penetrating wood sealer or spar varnish before you expose it to the weather. Never use paint—an opaque finish may hide cracks so they'll be difficult to spot later on. It's good precaution to lubricate all hardware at least once a year, and spray exposed metal with a clear plastic or lacquer to prevent rusting. Ladders of magnesium or aluminum need no special maintenance (except for lubrication of pivots), but they should be permanently equipped with rubber-faced safety feet to prevent slipping on hard surfaces. Such metal ladders are lighter and easier to handle than comparable wood ladders, but be very careful when using them near power lines.

Before climbing to any height on a ladder, mount a step or two and bounce lightly up and down to see if there's any sign of shifting or sliding. When positioning a tall extension ladder against the side of a house, one obvious caution is to avoid resting the top end against a windowpane or screen. If you must place the ladder in a spot where a window is located, nail a wide board across the opening first, and rest the ladder against this. If it's not practical to nail the board in place from inside the window, nail it across the upper end of your ladder, instead, before you raise it. To keep the top of an extension ladder from marring a freshly-painted surface, wrap the ends in heavy rags, or

slip a pair of old wool socks or work gloves over them. Be sure to scrape all mud or grease off your shoes before you start up.

When climbing, descending or working from any ladder, always face *toward* it, never away from it. While climbing, hold on with both hands. Try to tuck tools in your pockets or clip them to your belt to leave your hands free. Where quite a load of tools and supplies is needed, climb the ladder first, then haul the load up with a light rope. You can keep most items in a pail hooked onto a rung. While working, hold on with at least one hand. If a two-handed job makes this impractical, hook one leg through a rung.

For certain jobs, a long working platform is more convenient than working from a single ladder. The quickest way to rig up a simple scaffold is to rent a couple of ladder jacks. At relatively low heights such as the setup shown on the previous page, you have the option of mounting such jacks on the *inside* of the ladders, as well, for an underslung platform closer to the wall. Though ladder jacks are made in various styles, the safest type is the kind that hooks onto the ladder rails rather than the rungs. You can also rent an adjustable extension plank of the kind shown, or just use 2x10 or 2x12.

If a ladder must be placed in front of a door, either lock the door shut or tie it open so that no one can come charging through and slam into the ladder while you're on it. If you're working indoors—particularly on polished-tile or hardwood floors—you can keep a ladder from slipping (or marring the floor) by fastening a piece of rubber heel or a split section of hose to the bottom of each leg. ★★★

## HOW TO CARRY A LADDER

**HORIZONTAL TOTE** is safest if you're moving a long ladder any distance. Lift ladder at mid-point for best balance and rest rail on shoulder to minimize strain. For short hauls, as along wall, right, lift vertically to clear ground, steady top with highest practical grip.

Try only on level ground and watch for overhead branches or wires







1. Working alone? No problem, if you butt the foot of the ladder against the wall, then lift other end



2. Raise ladder until end is head-high, grasp top rung as shown and "walk hands" toward the building

## HOW TO RAISE A LONG LADDER...

3. Continue walking ladder—shifting hands from rung to rung as you move forward—until ladder is vertical
4. Ladder can now be moved where it's needed or, if you've raised it at right point, just bring foot out
5. For safest climbing angle, distance from wall to foot should be equal to one-fourth of ladder's height

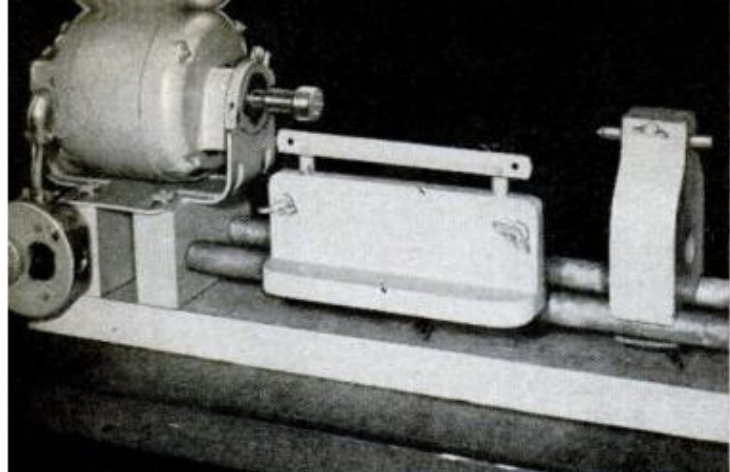


## ... AND HOW TO ADJUST IT AFTER IT'S UP

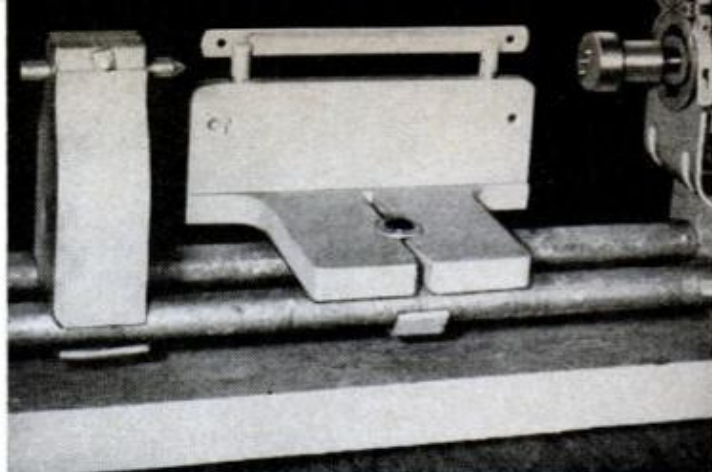
**NEVER REACH TO SIDES** more than comfortable arm's length; stand straight on rungs (left) and don't strain overhead. Raise extension to add needed height (center) by pulling down on rope; spring-loaded bracket hooks over rung (inset). To lower, tug rope till hook is free. Pivoting bar closes hook so it will jog past rungs on way down. To shift ladder sideways (right) tip its top over two or three feet, move foot in line







**HEADSTOCK** of this low-cost lathe is direct-drive, capacitor-starting motor mounted on blocks which are glued and screwed to 2 x 6 base. Note ends of clamp-tightening levers below tailstock and toolrest



**TOOLREST** held firmly to the ways by means of clamp plates can be adjusted to different heights by loosening a pair of wingnuts. Shorter 5-in. toolrest is mounted on single post, is also adjustable

# I Built This Wood Lathe

By E. R. Haan

**I**T TOOK me approximately 12 hours to build this simple wood lathe. Powered by a 1/4-hp. motor, it has a faceplate capacity of about 8 1/2 in. and will take work up to 34 in. between centers. Tailstock and toolrest are clamped securely by means of lever-operated bolts, thus eliminating the need of a wrench.

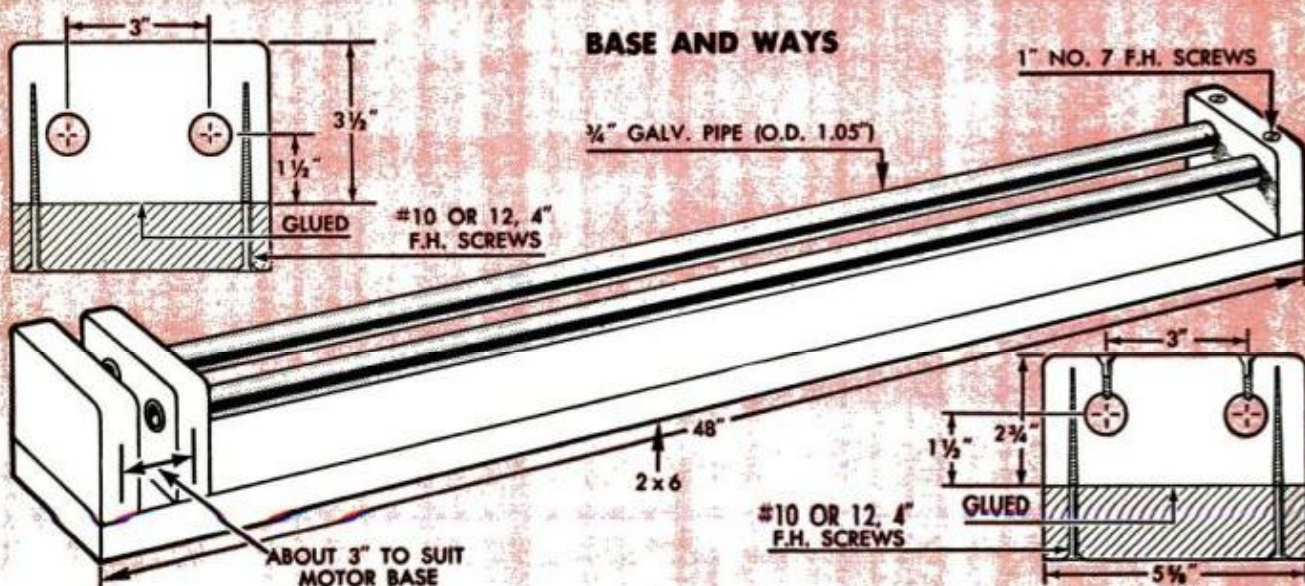
In spite of the low cost and simplicity of this shop-made tool, it's a practical lathe that will handle most common wood-turning jobs and a good one for the beginner. Since materials costs vary, you probably won't duplicate the \$10.67 it cost me. But whether you pay \$10 or \$12, it's a bargain.

A switch on or near the motor will be an extra convenience. On some motors, you can fit a small 110-v. toggle switch to the plate of the connection box to extend inside. This wasn't practical with the

motor that I used, so I mounted a regular switch in an outlet box and attached this to one of the motor-support blocks. I also placed a fuse in the circuit.

One other item that I had to buy was a spur center. The one shown in the photos was purchased from a mail-order house and is designed to fit a 5/8-in. unthreaded arbor. In order to make this fit the 1/2-in. motor shaft, I added a fiber sleeve having a 1/16-in. wall, then drilled two holes to allow setscrews to pass through the sleeve.

● Start construction with the base and ways, shown in the drawing below. After sawing the three blocks to size, bore holes to take the 3/4-in. pipe ways snugly. If at all possible, bore these holes (and all others mentioned here) on a drillpress since this assures greater accuracy than hand boring. After boring the blocks, glue and screw them to the 2 x 6 base.

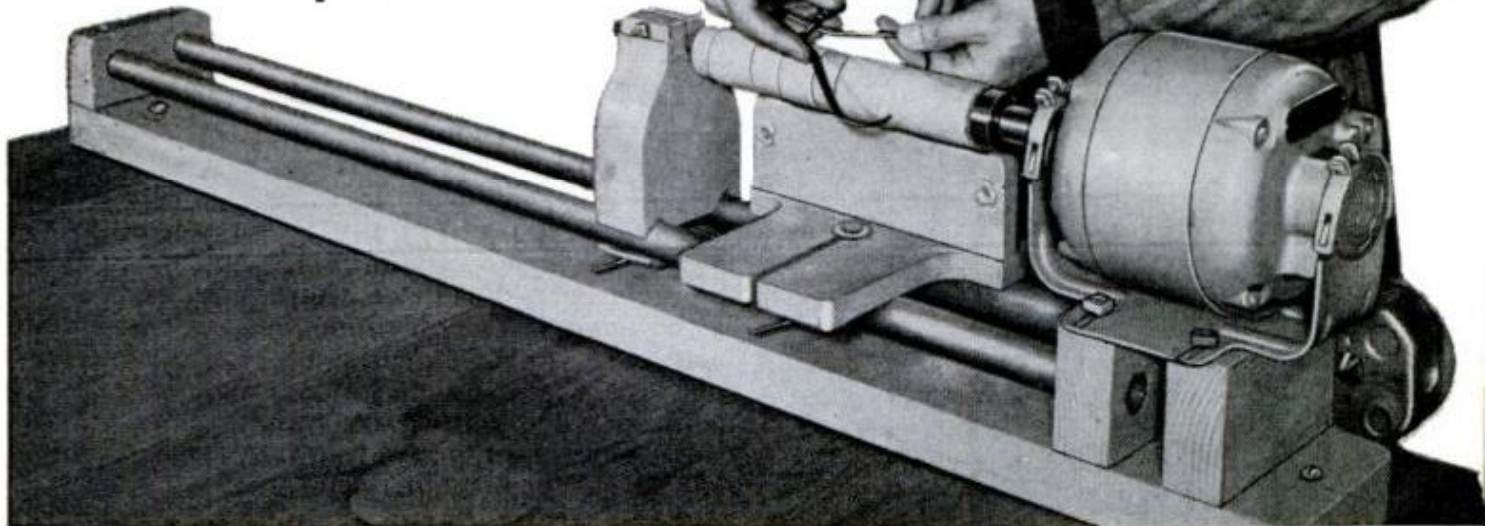




Wood	—	\$ 1.70
Pipe	—	78
Hardware		1.49
Spur Center		1.20
Motor		5.50
		<u>\$10.67</u>



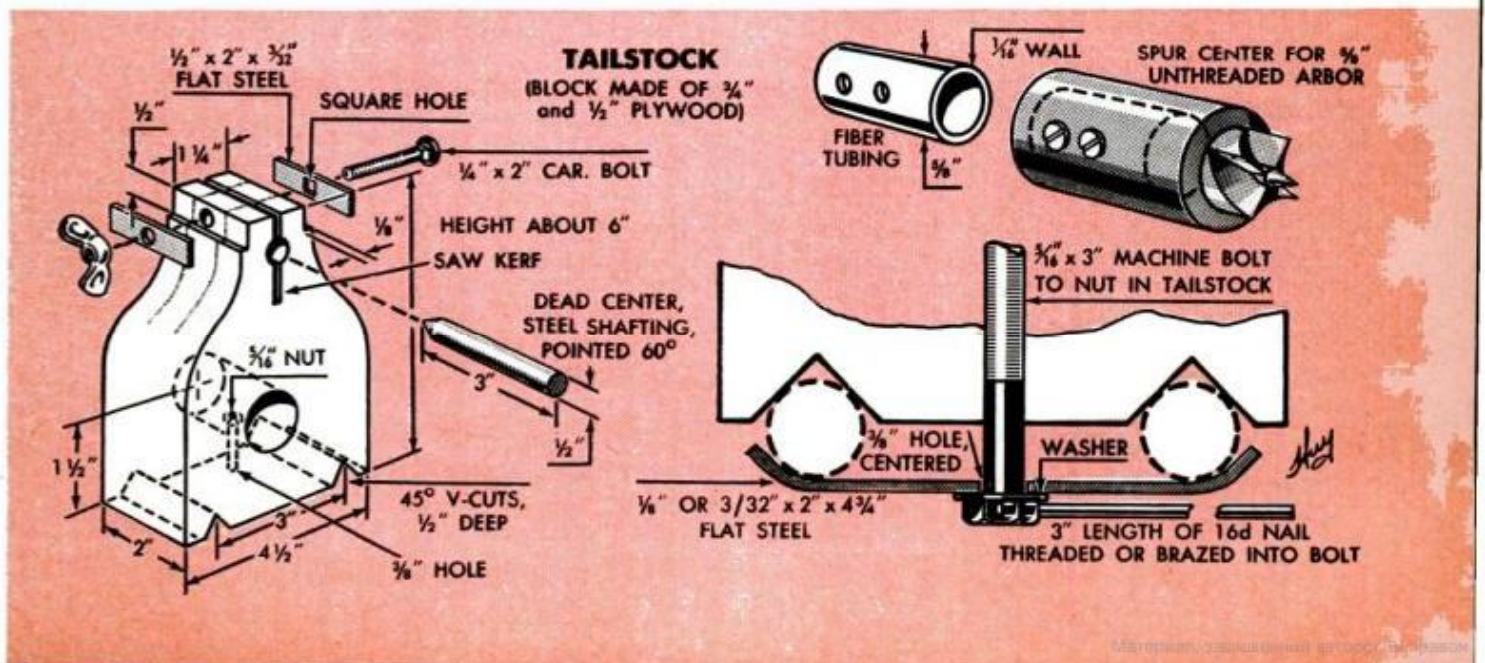
for **\$10.67**



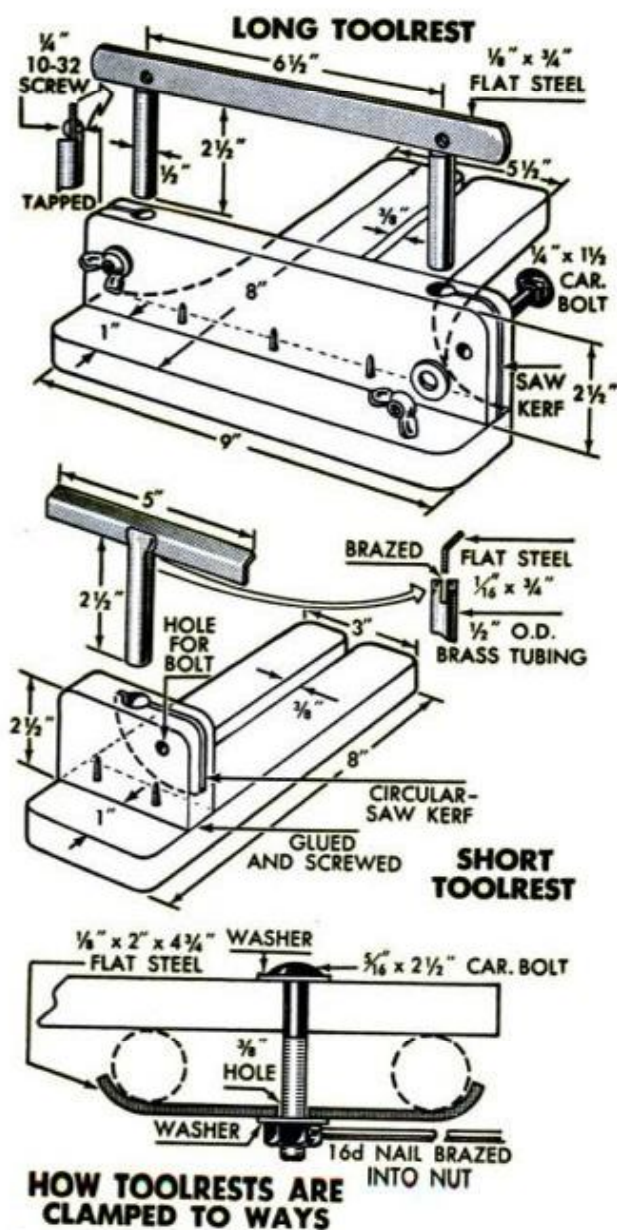
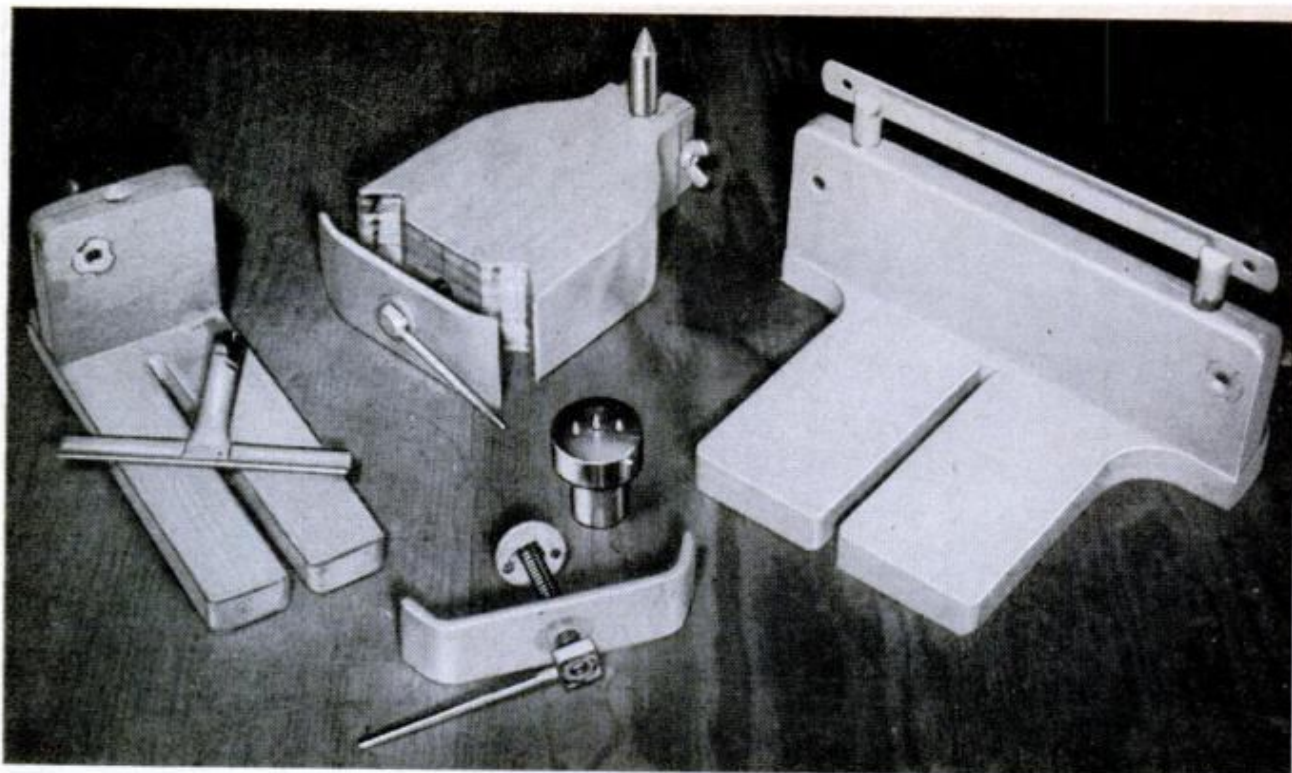
The 4-in. wood screws extend almost all the way through the blocks to prevent them from splitting crosswise along the grain if subjected to stress. Drill pilot and body holes for these screws before driving them home. A little soap on the threads

will make driving them much easier. Drill a small hole in the end of each pipe to take the end of the 1-in. screw which is used to lock the pipe in place.

● The tailstock is of sandwich construction, consisting of three thicknesses of







**TAILSTOCK AND TOOLRESTS** all use the same type of clamp plates to secure them to the ways. Levers are actually 16d. nails attached to bolt heads or nuts, making it easier to tighten or loosen clamps

plywood (two  $\frac{3}{4}$ -in. and one  $\frac{1}{2}$ -in.). After applying glue, clamp these pieces together and allow the glue to dry overnight. In cutting the block to shape, use a circular saw for straight cuts and a band saw for curved cuts, if you have access to these tools. It's especially important that you cut the 45-deg. notches accurately. After drilling the  $\frac{3}{8}$ -in. hole for the clamping bolt, bore a  $1\frac{1}{4}$ -in. crossing hole so that you can insert the nut.

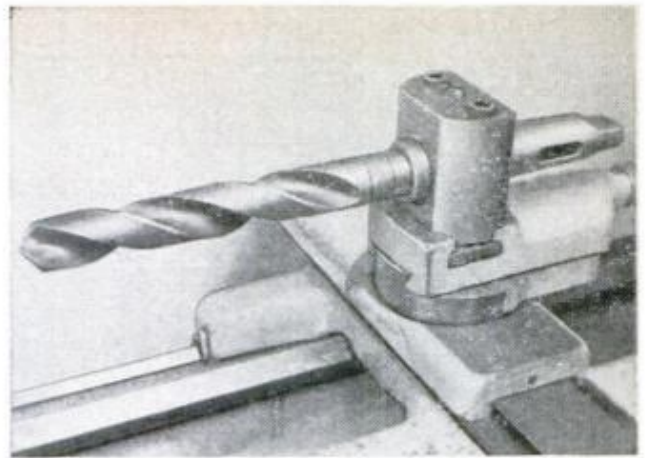
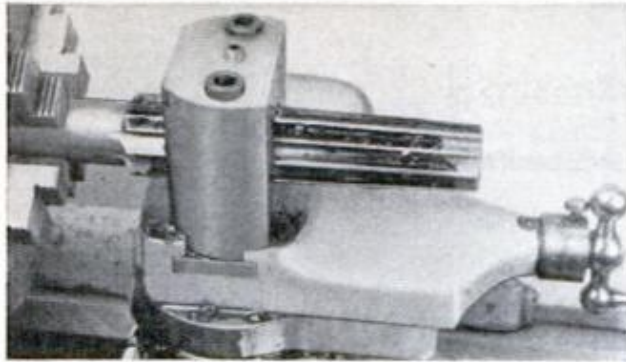
The dead center must be in perfect alignment with the motor shaft. To mark the location of the hole that takes the dead center, set the motor in place temporarily and put the tailstock on the ways against the end of the motor shaft. After drilling this hole, make a saw cut down through the middle of it. Finally, cut notches for the steel plates and install the carriage bolt and wing nut.

Cut the steel clamp plate and bend the ends up to an angle of about 45 deg., then drill a hole in the center for the machine bolt. To make the lever that turns this bolt, drill the head to take a length of 16d. nail. Either thread or braise the nail in the hole.

● The toolrests have the same type of lever-operated clamp as the tailstock, except that a carriage bolt is used instead of a machine bolt. Construction, detailed at the left, is somewhat simpler than that of the two other units, and requires no special explanation. ★★★



## SHOP SHORT CUTS



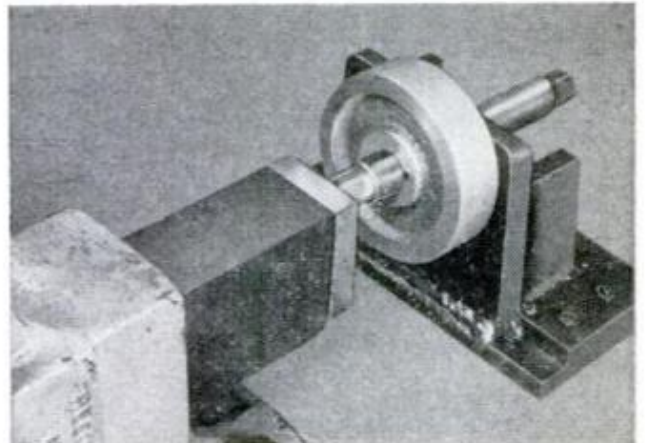
### Toolpost "Chuck" Holds Large Morse-Taper Twist Drills

When other machines in the shop were tied up with rush jobs one machinist came up with a method of mounting a large twist drill on a small lathe for accurate drilling of big holes. Precision twist drills above  $\frac{1}{2}$  in. diameter usually come with taper shanks and must be carried in a Morse-taper sleeve. First machine (rabbet) a steel block to drop into the T-slot on the compound. Then counter-bore the block to seat two socket-head screws,

the latter turning into tapped holes in a clamping plate which slides into the T-slot. Next, clamp the block on the compound and drill and ream for the taper sleeve as in the left-hand photo. Finally, drill and tap the block to take a socket setscrew which locks the taper sleeve. This completes the setup pictured in the right-hand photo, which permits use of the lead screw to feed big drills for precise drilling of chucked workpieces.—H. J. Gerber

### Bench Top Arbor Press

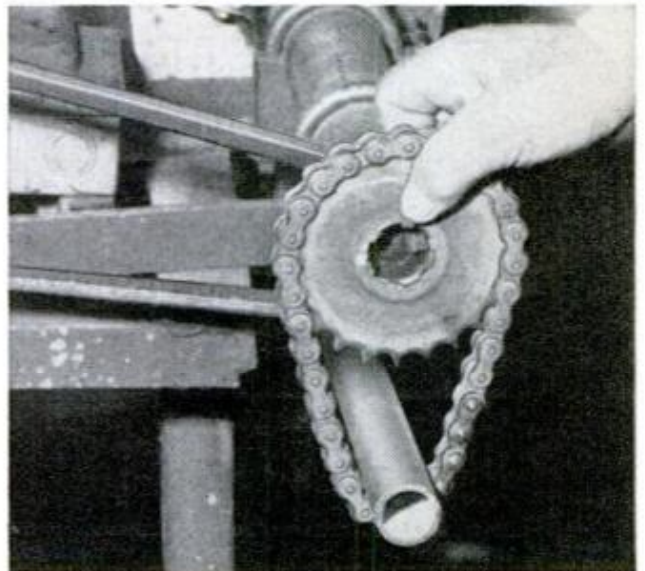
Teamed with the simple weldment pictured, your bench vise can serve as a powerful arbor press for seating pulleys, enlarging sleeves and similar parts in press fits on spindles and shafting. The weldment consists of a steel base, a vertical plate and two brace plates welded to form a platen which is slotted to take the spindle or shaft. A second platen seats against the end of the vise slide. The platen is bolted to the bench top back of the vise and in line with the slide. Photo pictures a typical setup.



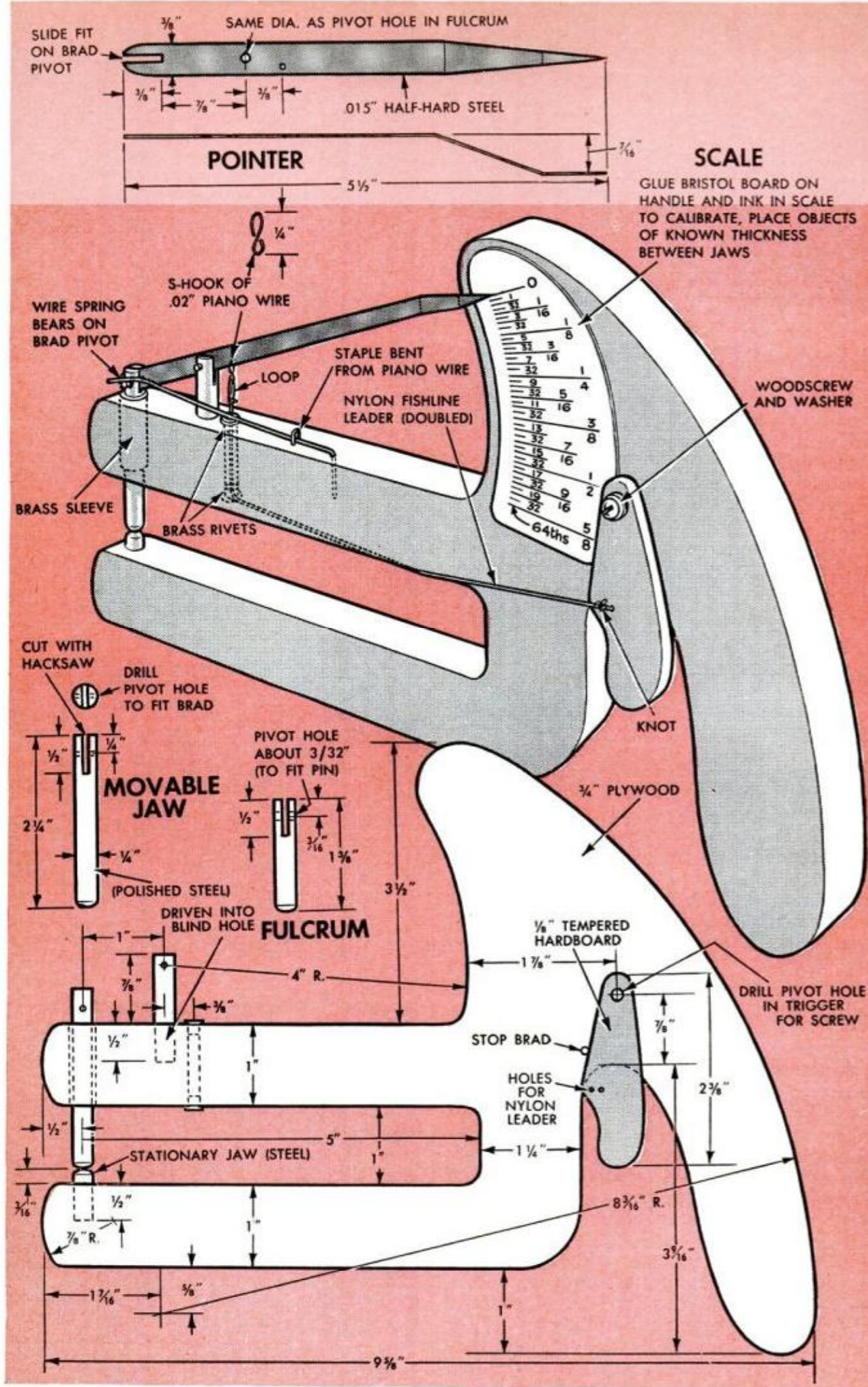
### Pipe Cleaner Works Fast

However odd this contrivance may appear, it will clean the rust off a length of pipe or shafting in minutes, or less! It consists of a heavy sprocket and a loop of heavy roller chain, the sprocket fitted to the spindle of a belt-driven grinder head. All you do is lay the length of pipe in the chain loop, start the grinder and slide the pipe along, turning it uniformly as you go. Move the pipe about half its length, stop the grinder, reverse the pipe and proceed as before. Wear goggles for protection.

**Avoid unnecessary handling** of roller and ball bearings. Even though oiled, perspiration from fingers can cause rusting.



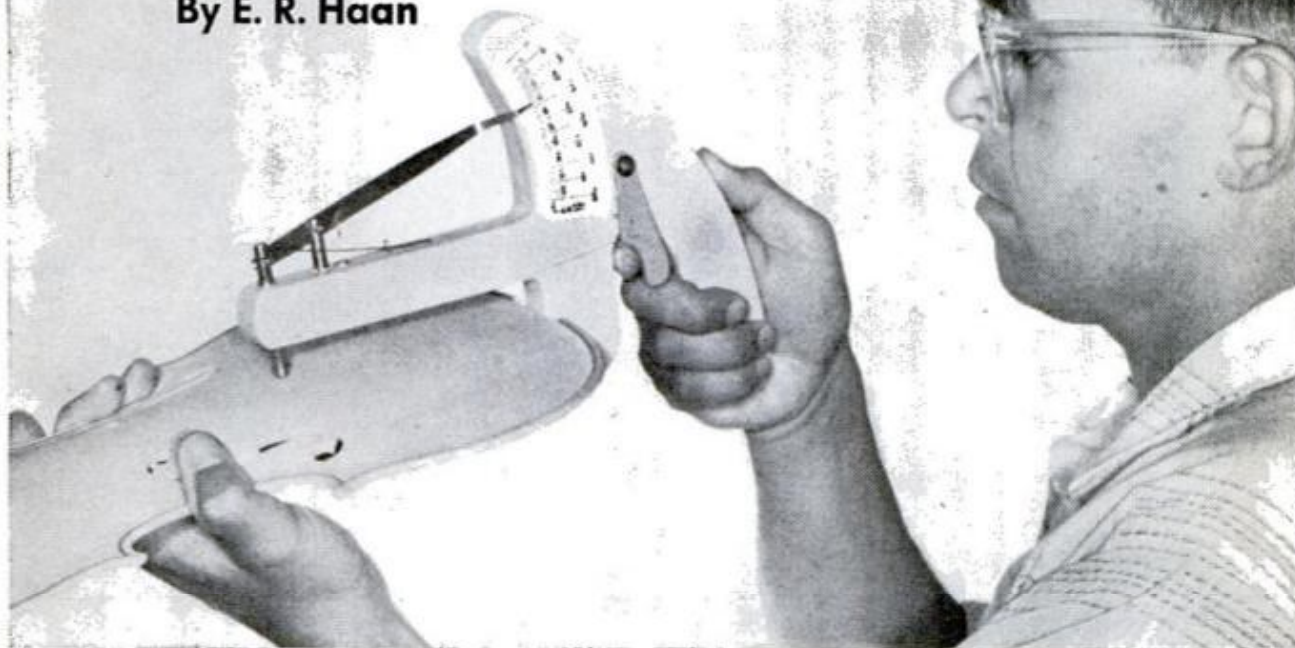






# 4x Magnifying THICKNESS GAUGE

By E. R. Haan



**No eye strain with this pistol-type gauge that lets you take instant readings down to 1/64 in.**

**M**EASUREMENTS are instantly visible on the large, easy-to-read scale of this direct-reading, low-cost thickness gauge. With a jaw capacity of  $\frac{5}{8}$  in. and throat clearance of 5-in., it's particularly valuable for those exacting jobs where the work is thicker near the edges than at the point being measured. In such cases, ordinary machinist's calipers are useless, since to remove the calipers from the work for determining the measurement, the jaws must be opened and in doing so, the original setting is lost.

When making this gauge, it's especially important that the surface of the movable jaw be true throughout, so that it will slip up and down in the sleeve with a minimum of friction. If you dress this jaw down in a drillpress by filing it, use a fine-tooth file and keep it moving up and down as the work rotates. After filing, use emery and crocus cloth to produce a high polish.

Pivot pins must fit exactly in the slot and hole in the pointer and in the holes in the jaw and fulcrum so as to avoid play. Slots in the pointer, movable jaw and fulcrum should be cut with a thin metal-cutting saw. After cutting, smooth the sides of the slots with a thin flat needle file, followed by emery cloth glued

over a piece of tin. The slots must have smooth sides or the action of the gauge will be jerky.

It's best to select the pivot brad and matching twist drill first, then make the slot and pivot hole to fit it exactly. The same applies to the brad and pivot hole in the fulcrum.

An L-shaped spring of .035-in. piano wire will apply just enough downward pressure on the upper jaw to assure positive closing. Force the short end of the spring into the plywood with a pair of pliers, then bend the other end down a trifle so that it will exert pressure in line with the jaw axis.

Calibrate the scale after assembling the thickness gauge. To do this, just slip objects of precise known thickness between the jaws ( $\frac{1}{32}$  in.,  $\frac{1}{16}$  in., etc.) and mark the location of the pointer on the scale. After the main divisions have been marked, you can subdivide these into equal spaces. Divisions at the top of the scale will be slightly smaller than those lower down, since the pointer assumes a more acute angle as it rises.

Mark the scale with India ink and coat it with clear shellac or lacquer, then finish the wood with enamel. ★★★





# Wake Up to Your Song



*Or start breakfast coffee perking with this \$10 music-box alarm clock-timer*

**I**F YOU'RE TIRED of having the same old raucous alarm clock awaken you each morning, then you need this easily made "variety" alarm clock by your bedside.

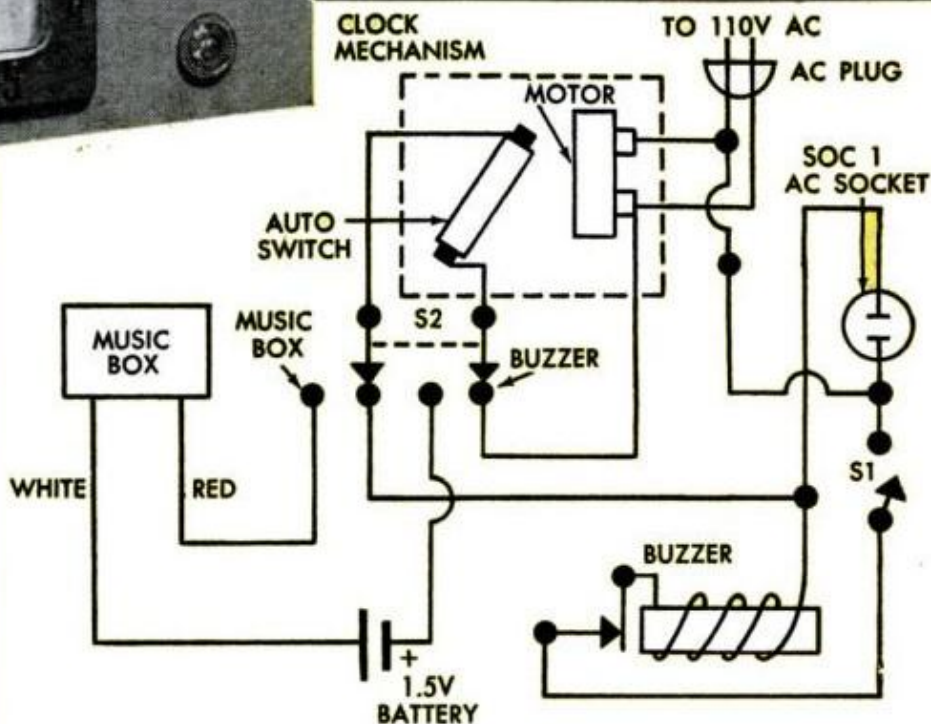
Most of the time it will gently rouse you with a tinkling music-box tune. But whenever you get to bed extra late and feel you'll need something more urgent, just switch to the high-powered buzzer to be sure you won't over-snooze.

Or plug in a bedside radio, or even a percolator to lure you awake the next morning with the aroma of coffee brewing.

If you have to rise at night and don't want to disturb the family, a flashing light will wake you quietly. The heart of this talented timer clock is a Telechron clock mechanism that can be set to operate any electrical device at any preset time. By hooking it up



**GIVE THE MUSIC-BOX** alarm clock a finish that matches your bedroom decor. Socket on top is for appliances to be controlled. Switch on front turns off buzzer



**IN WIRING THE** circuit, make sure the red lead from the music box goes to the positive end of the battery



to an electric music-box movement, you'll have as pleasant a sleep-interrupter as can be found anywhere.

My unit has a homemade hardboard housing,  $6\frac{3}{8} \times 4\frac{1}{2} \times 3\frac{1}{4}$  inches, which is about as small as you can make and get all the parts in conveniently. It is cemented together with white glue, a side at a time. After the glue has set firmly, cut all the necessary holes.

I used epoxy cement to fasten the clock mechanism in place and at the same time to hold the music box and 115-volt outlet, too. If you have a dab or two of epoxy left over, put it on the buzzer mounting screws to prevent them from loosening.

The *s.p.s.t.* switch on the clock is rated at 1650 watts, but this rating is reduced here because the wiring goes through a 690-watt *d.p.d.t.* switch. If you need the full 1650-watt rating, get a *d.p.d.t.* toggle switch that can handle the load safely.

Wiring is straightforward. Follow the simple schematic and make sure the red wire from the music box goes to the positive end of the battery. If it doesn't, the music-box motor will run backwards and may ruin the movement.

For the rest of the wiring (*including that going from the clock coil to the wall plug*) use number 16 wire, though number 18 will do. Remember, besides supplying power to the clock, this wiring must

also carry the load for whatever is plugged into the timer socket for control.

Most anything electrical can be plugged into this alarm clock to suit your own special needs.

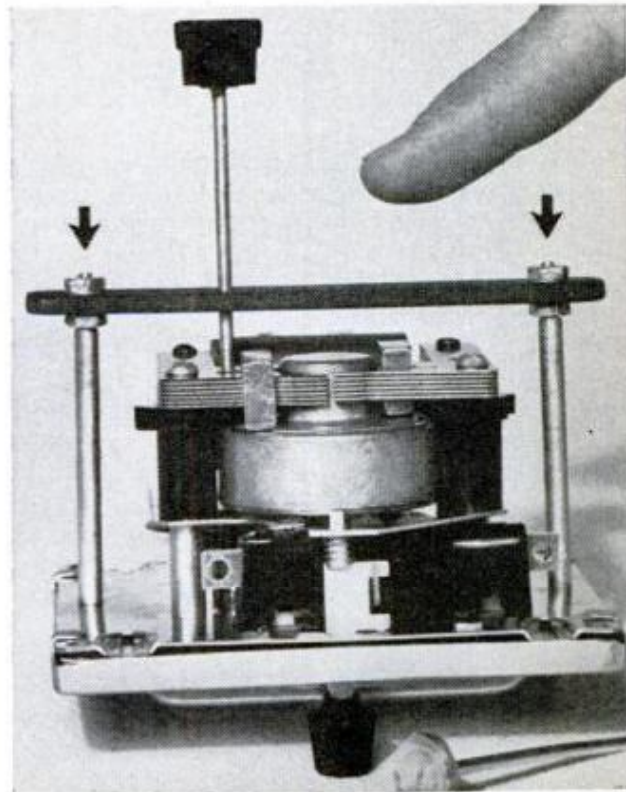
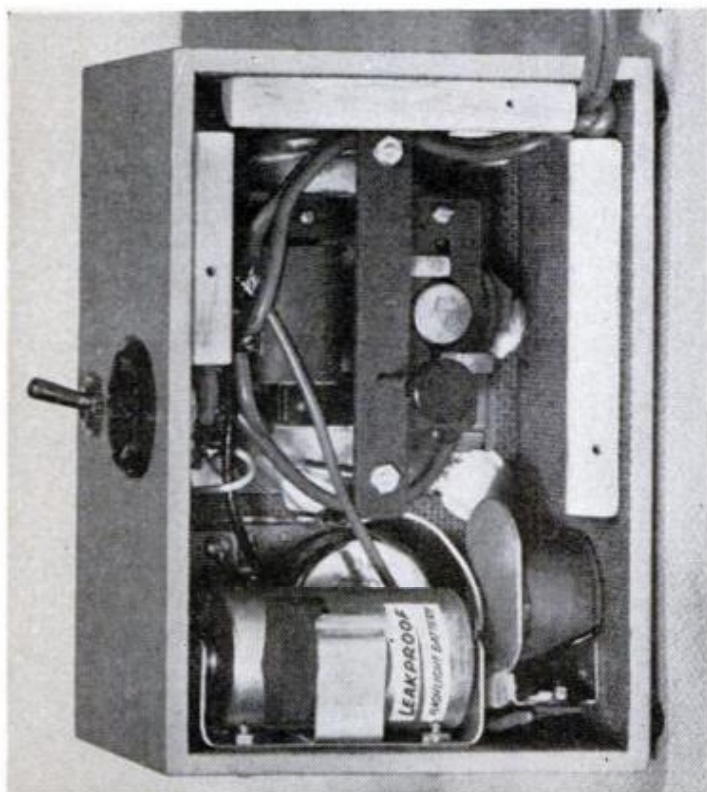
To set up a light alarm, use an ordinary table lamp plugged into the timer outlet. But insert a flasher button from the hardware store between the bulb and the lamp socket. For daytime alarm use, select a red bulb; for night use, choose a white one.—Tommy Thomas

#### PARTS LIST

- \*Telechron timer-switch clock mechanism (MS-793)
- \*Electric music-box movement (MS-763)
- \*115-volt a.c. electric buzzer (EL-86)
- Heavy-duty *d.p.d.t.* toggle switch
- Vent hole plug, 1-inch (pkg of 4)
- Manganese alkaline battery (Mallory type Mn-1300)
- 115-v. female socket (Amphenol type 61-F1)
- Battery holder for 1 D-cell
- S.p.s.t.* toggle switch with wire leads
- Hardboard, paint, white glue, epoxy cement, 115-volt male plug, rubber feet, flasher button, nuts and bolts
- \*These parts are specialty items obtainable from Lafayette Radio, 111-A Jericho Turnpike, Syosset, LI, N.Y. The proper catalog number is given.

**ONCE ALL THE PARTS** are mounted, the case gets somewhat crowded. Before fastening anything down, lay out all the parts inside the case, so you'll be sure of getting everything in and properly located

**CROSSBAR** made from a strip of wood, metal or plastic should be fastened across the rear of the clock mechanism as shown. It will support adjustment shaft to reduce strain and keep it from breaking

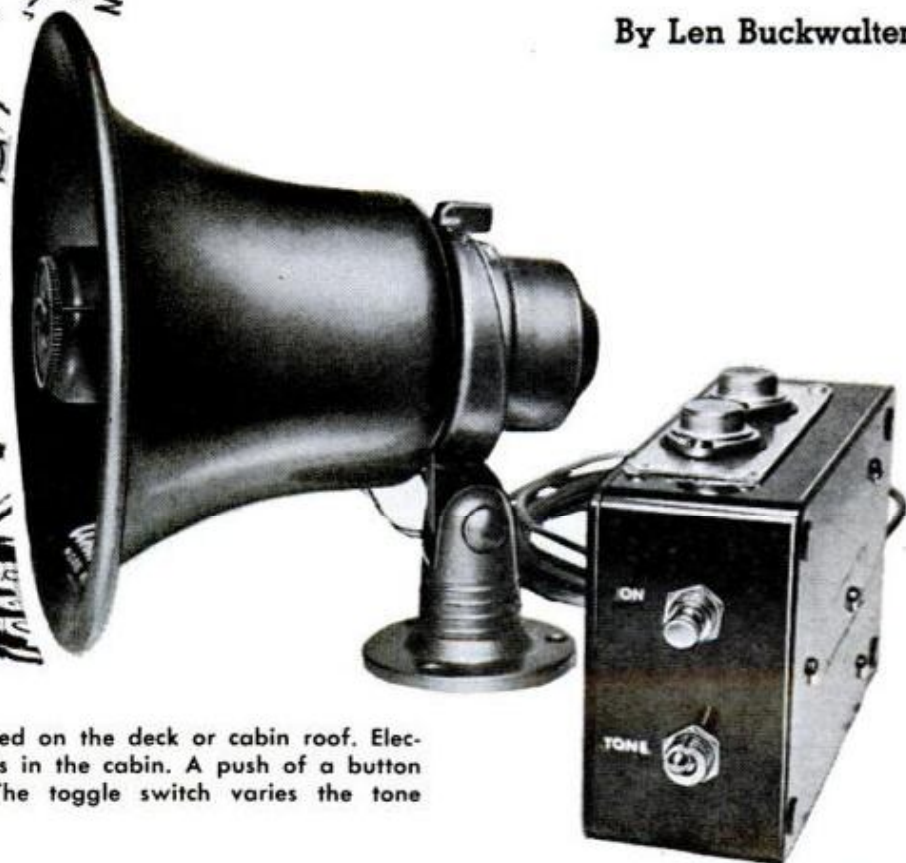




# 2-Mile Boat Horn

*For signaling or emergency warning, make this dual-tone, battery-powered horn for your boat for about \$20*

By Len Buckwalter



**HORN-TYPE SPEAKER** is mounted on the deck or cabin roof. Electronics-packed plastic case goes in the cabin. A push of a button sounds the horn's warning. The toggle switch varies the tone

**F**ORGET ABOUT corroding contacts, heavy solenoids and high battery drain—this transistorized boat horn eliminates such problems.

Relying on electronic action, rather than mechanical, the device is one of the most efficient ways to convert battery power into a loud blast of sound. It works in powered craft with 6- or 12-volt electrical systems or aboard a sailboat with the addition of a small battery pack. You can put it together in two or three evenings at a cost of about \$20 including the speaker.

The electronic horn is built around a 2-transistor circuit. When the button is pressed, the transistors instantly begin a flip-flop action that drives current around the circuit in a series of fast-moving pulses. Fed to the horn speaker, the pulses are turned into a loud steady tone. The horn tone can be easily changed by a flick of the tone switch. Depending on the situation, the horn can sound a mid-range tone for normal use or a piercing, high-pitched tone as an attention-getting alarm.

## PARTS LIST

- R1, R2—220 ohms, 1/2 watt, 10% carbon resistors
- C1, C3—4 MFD, 50 volts, miniature electrolytics
- C2—2 MFD, 15 volts, miniature electrolytics
- J1, J2, J3, J4—binding posts (2 red, 2 black)
- Q1, Q2—2N307 (or Lafayette SP-147)
- S1—spst toggle switch
- S2—spst normally open pushbutton switch
- T1—audio output transformer: primary 48 ohms, ct; secondary 3.2 ohms; 6 watts (Lafayette AR-503 or equivalent)
- Spkr—3.2 or 8-ohm horn-type speaker
- Miscellaneous: Bakelite case 6 1/4 x 3 3/4 x 2 inches with matching front panel; 2 solder lugs; transistor heat sink, 1 1/2 x 4 1/2 x 1/4 inch cut from aluminum scrap; four No. 6 fiber washers, extruded shoulder type; two mica or composition insulators for mounting transistors (Cinch-Jones 2W-1); two 5-lug terminal strips with a center-lug mounting foot



The horn electronics are built into a plastic instrument case. The best place to begin is at the transistor heat sink. The metal case of both transistors must not contact the aluminum heat sink. If they do, the transistors will be shorted together and the horn won't work. Special insulators (specified in the parts list) are sandwiched between the transistors and the heat sink. Be sure there are no rough spots on the heat sink that might puncture the insulator and cause a short circuit. The nuts and screws that hold the transistors down must also be insulated. This is done with fiber-shoulder washers. Wires are soldered directly to the emitter and base terminals of the transistors. The collector connection, which is the metal case of the transistor itself, is made by placing a solder lug under one of the mounting screws.

There is one potential trouble spot in the circuit that should be eliminated before using the horn. These are the mounting screws that hold the 5-lug terminal

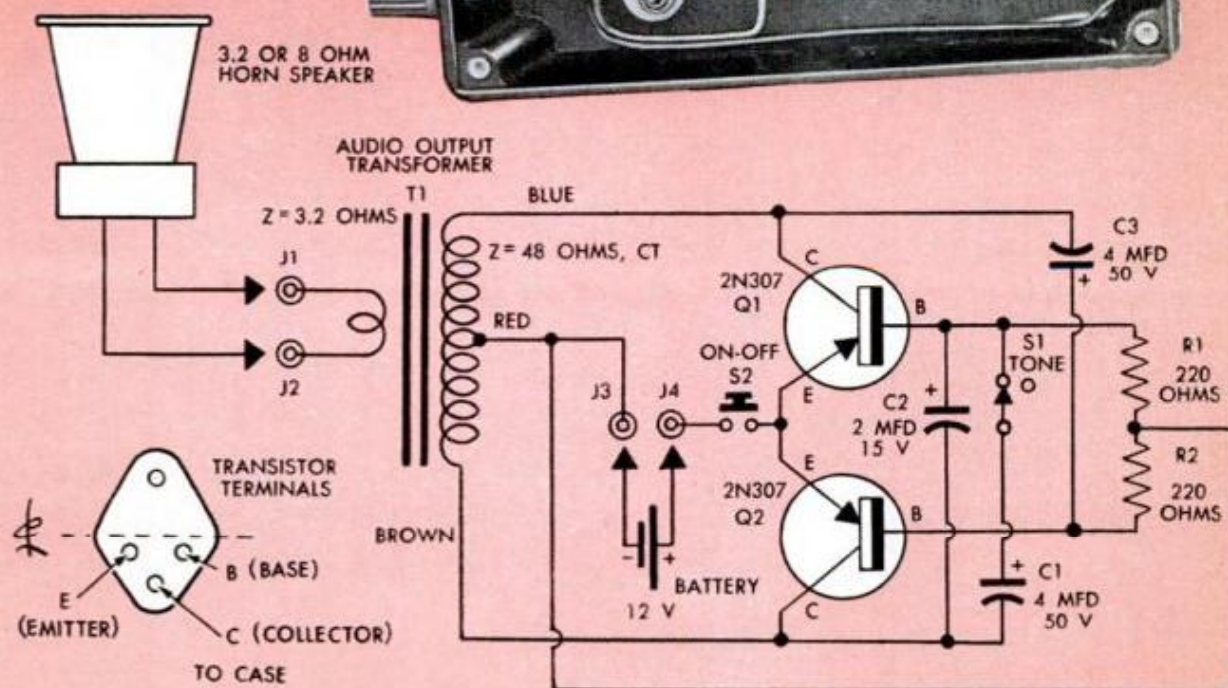
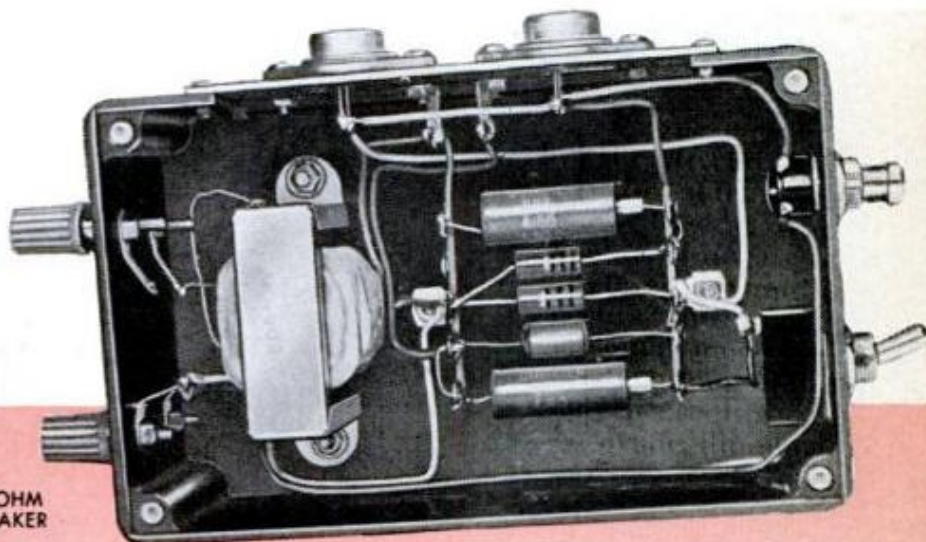
strips to the case. The heads of these screws are exposed. Since they are not "ground," but have live circuit voltage on them, a short could develop if they happen to contact a metal surface. (There is no shock hazard—voltages are far too low.) The remedy is simple: countersink the screw heads or cover them with plastic electrical tape. The transistor cases are also live, but covering them would interfere with proper heat dissipation. Just be sure not to let the cases touch any nearby metal after the unit is mounted. You'll find the difference in performance when using 6-volt or 12-volt power is loudness of sound—lower voltage, shorter range.

Hook up for power through a fuse block and insert a 1-amp. fuse. If there is no block in your boat, install an automobile type line fuse in the positive power lead.

To use the horn on a boat that does not have a power supply, make up a battery pack of two 6-volt batteries in series. Use Burgess F4BP's. They should last through the boating season. ★★★

**CLOSE-UP** view of the case with its cover removed. Both operating switches are at the right, horn and power terminals are all on the left end

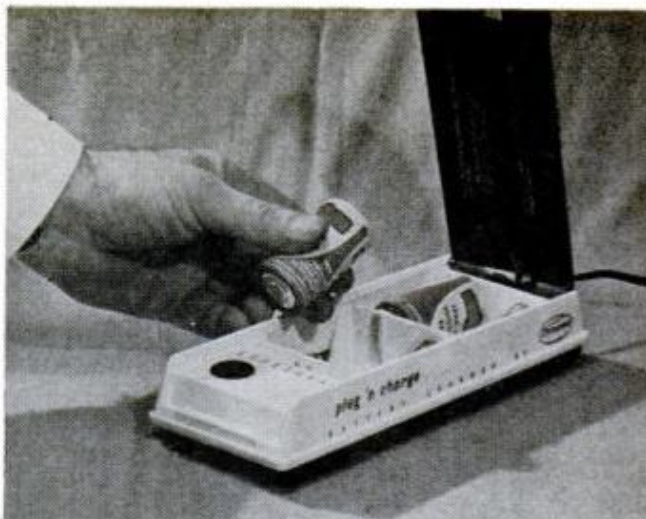
**DOUBLE-CHECK** all wiring before using the horn, and be sure battery polarity is right. If not, you are likely to burn out both power transistors





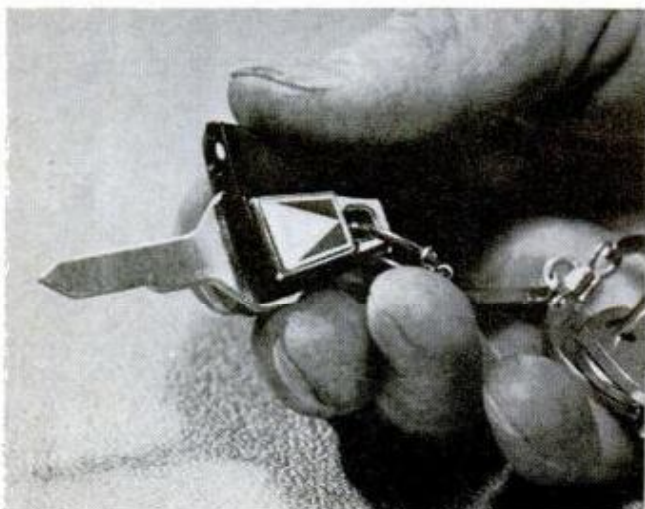
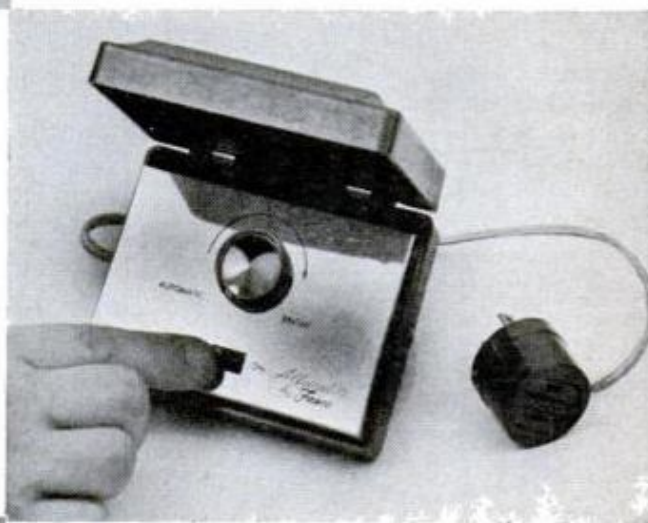
# New in Electronics

**FLASHLIGHT BATTERIES** can last from eight to 50 times longer when you recharge them after each use. Slip them into this plug-in charger overnight. It will rejuvenate almost all 1.5-volt cells—zinc carbon, alkaline or mercury types. Dynamic Instrument Corp., Plainview, New York. \$5.95



**DUAL-PURPOSE RECORD PLAYER** can be used as either an automatic record changer or a single-play turntable. All you do is insert the proper spindle. Adjustable counterweight sets stylus pressure. Garrard Type A, Mark II, \$79.50. Sold by British Industries, Port Washington, New York

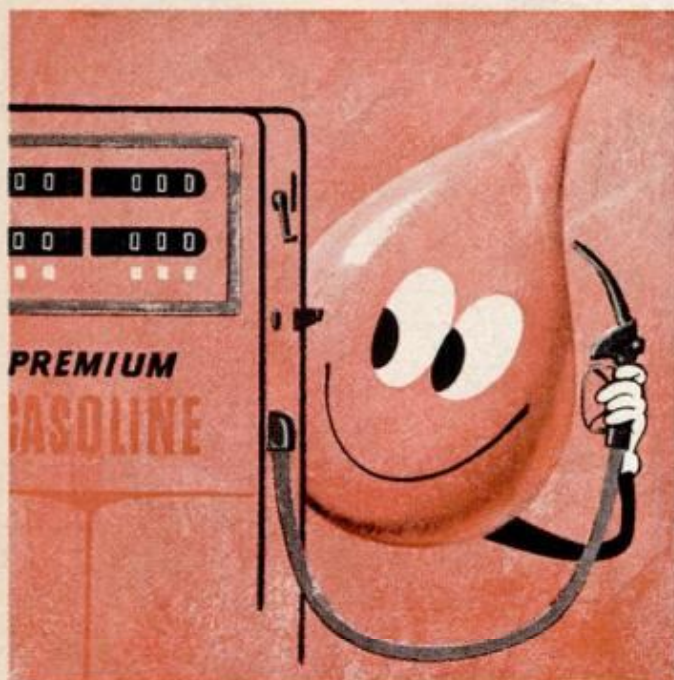
**MULTIPURPOSE LIGHT DIMMER** works in reverse. As it gets dark, lights are turned up automatically. Additional manual control lets you set the light level when you're at home. Alluralite can handle up to 500 watts of incandescent lighting. \$29.95, Fasco Industries, Rochester, New York



**KEYHOLE GROPING** can be reduced with this Key Beam, which uses tiny silver energy cell. Squeeze the key holder and a microminiature lamp lights. It should give up to two years service before a new 34-cent battery is needed. \$2.95, from Flex Electric Inc., Long Island City 1, N. Y.



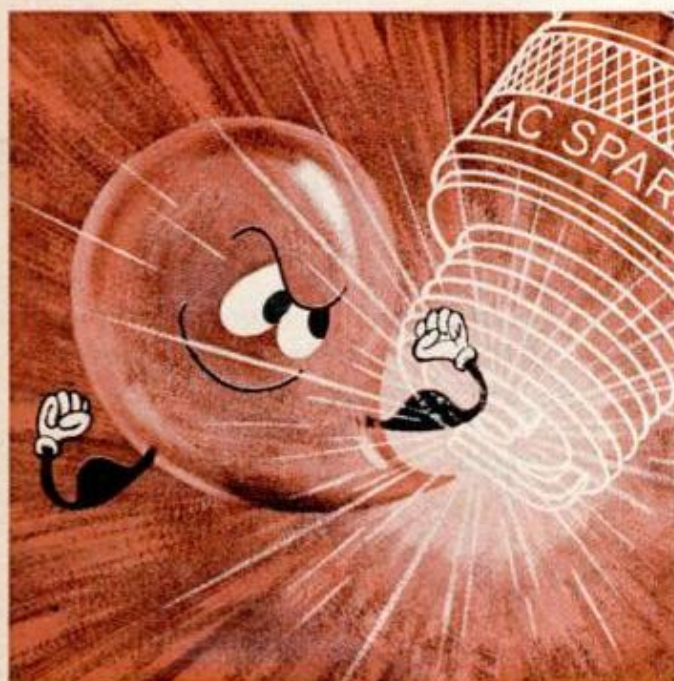
# AC Spark Plugs give you full gasoline power



Today's gasolines are refined to give top mileage, peak power. Ideal mates for AC Fire-Ring Spark Plugs because . . .



ACs unleash maximum gasoline power with a full-bodied spark; give full power longer because they're self-cleaning.



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## FIRE-RING SPARK PLUGS

AC SPARK PLUG THE ELECTRONICS DIVISION OF GENERAL MOTORS





Fast, drop-in loading with new KODAK DUEX 8 Cassette

## *New KODAK Electric 8 Zoom Camera*

# **Gives you the drop on**

***New fast loading, plus battery drive and electric eye keep you always ready to shoot!***

You don't miss any action with this camera. It uses regular 8mm film—in the handy new KODAK DUEX 8 Cassette which just snaps into the camera. At the end of the first 25 feet, flip the cassette over! You're set to go again in seconds! Preload several cassettes and you can shoot roll after roll of action!

**No winding!** Four powerful batteries

drive the film steadily, silently through the camera. Viewfinder signal tells when it's time to replace batteries.

**Zoom smoothly** from wide-angle view to telephoto close-up . . . and see the zoom right in the big viewfinder. Electric eye automatically keeps the  $f/1.6$  lens adjusted to the light. For special effects, you can lock the lens at any setting, or set the meter for more or less exposure than normal, when desired.

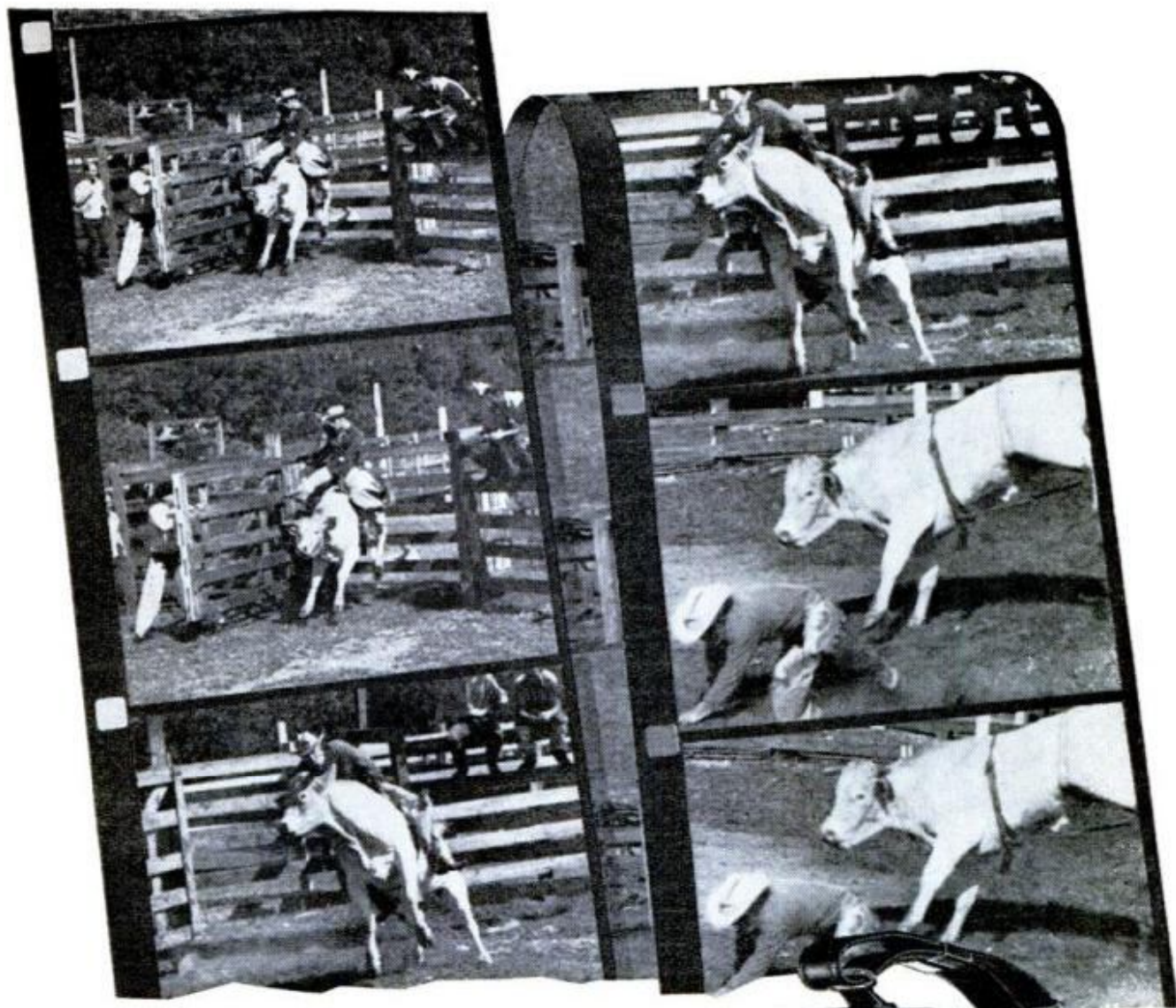
You can shoot at regular 16 frames per second or frame by frame for special titling

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*Price subject to change without notice.*





# CLINIC FOR HOMEOWNERS

**Q** My lawn is getting rather thin with a few bare spots, and although I've applied a fertilizer I think it needs reseed-ing. I'm told this can be done better in fall than in spring. But how? Do I just sow the seed over the existing lawn, working it into the bare spots, or is there some better way?—L. A., Kan.

**A** Yes, you can proceed as you suggest with a reasonable chance of getting a catch of new grass, assuming, of course, that the remainder of the growing season is favorable. If we can judge correctly from your description of the present condition of the lawn, it needs cultivation, that is, a stirring of the top soil to permit water and added plant food to penetrate more readily to lower levels. This can best be done with a lawn spiker, a tool you can usually rent from your hardware dealer. This unit, weighted to penetrate about 1½ to 2 in., does an excellent job of loosening the soil without injuring the grass. Go over the entire lawn with this unit before seeding and applying fertilizer. Then sow seed uniformly, apply fertilizer and follow with a second spiking to work the seed into the soil. Treat spots with a somewhat heavier seeding. Then, unless rain follows immediately, water lightly. Continue watering at intervals unless frequent rains add ample moisture.

**Q** I have an old heirloom upright piano I'd like to refinish. Tone is still good but the case appears to have some light-colored wood with an artificially-grained finish which is now grimy, dark colored and scratched here and there. How should I go about refinishing to make the instrument more presentable?—M. G., N. Dak.

**A** Probably the best procedure is to give the whole case a thorough sanding to remove the "grime" and scratches and then apply an undercoater and two or three coats of colored enamel. Sanding is going to take time as a thorough job will be essential to get a smooth surface over which to apply the finish coats. It is best to first remove the keyboard and then all the panels that are removable and work on the panels separately. There's no need to remove all the original finish. A smooth surface is all that is necessary. Once you get a smooth surface you're ready for the paint job. The first coat should be a white or tinted shellac enamel.

This will serve as a primer or base coat. Although you can apply the base coat and finish coats with a brush, you'll get a better job with a sprayer. Usually you can rent a sprayer from your local paint dealer. Take special pains to get a uniform base coat. Hit all the edges and corners first, then finish the large surfaces with uniform, sweeping strokes, making sure you get full coverage at all points. Allow to dry four to six hours, then follow with the finish coats in the desired color and using the same application technique. Old ivory or bone-white semi-gloss enamel makes an excellent finish for an old piano.

**Q** During the warm weather, damp spots appear on the plaster above my bathtub at the end where the faucet comes through the wall. The spots appear above the faucet. I've searched everywhere for a leak—in the piping and in the roof above the point. I can find no indication that either the roof or the pipes are leaking. My bath is not tiled and if something is not done soon the plaster will be badly damaged. Any suggestions?—W. L., N. J.

**A** You do not say, but we assume you have a shower head. A slow, drop-at-a-time leak in the shower head line is a possibility that might give little evidence, even on a close examination. There is another possibility. If you take warm showers in the summer this seems unlikely, but if you take cold showers then condensation on the pipes may be a cause. There must be an access door or opening, possibly in a closet, directly back of the shower head. If you examine the shower line through this opening at any time the shower is being used, or shortly thereafter, you may find the pipe covered with condensate. This could drip from the horizontal run of the pipe at the point where it passes through the wall, and, of course, could be the cause of the damp spots you see on the room side of the wall. If this is the case, then a wrapping (of material made especially for the purpose) covering the entire length of pipe within the wall is the cure.

As a service to Popular Mechanics readers in solving the hundreds of problems pertaining to a home—inside or out—you are invited to present your problems to The Clinic Editor for his helpful advice. Address your questions to The Clinic Editor, Popular Mechanics Magazine, 575 Lexington Ave., New York 22, N.Y.



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## The Starter Motor

(Continued from page 162)

nected (the control terminal) to the contact terminal. Crank the engine. If the starter spins, the magnetic switch is OK, and the fault lies in the ignition switch or inside the starter.

● To check 12-v. Studebaker starters and magnetic switches with a single contact and an external ground, connect a jumper from the switch-control terminal to ground. On magnetic switches with two control terminals, disconnect the wires from both terminals. Then, connect two jumpers—one from the "hot" side of the battery to one of the switch terminals, and another from the other terminal to ground.

In either case, crank the engine. If the starter turns, the switch is in good condition and the fault lies in the ignition switch or inside the starter. If this test shows the switch to be defective, you can easily remove the switch and replace it.

### Checked by a Jumper

Solenoid switches without relays and those with separate relays are checked by connecting a jumper from the "hot" side of the battery to the control terminal of the solenoid. Crank the engine. If the starter turns, the switch is OK, and the trouble lies with the ignition switch or inside the starter.

The last common trouble is a starter motor that spins, but does not crank the engine. This can happen to any starter, whether it is an overrunning clutch type or a Bendix type. The cause is a defective drive or broken teeth in the flywheel. In any event, this is usually a job for a professional mechanic.

If the source of starter difficulty isn't detected by these circuit and switch tests, the starter must be removed from the car for bench test and repair. This job is usually one for a mechanic.

A thing to keep in mind if you take your car to a mechanic, is what we said before: a starter seldom goes bad internally. Many times, starter troubles can be cleared up by taking the starter apart and cleaning it. Any dirt inside the motor will cause resistance, resulting in less than full output.

If a starter malfunction is caused by bad brushes or poor brush contact, it would pay to have the starter repaired by replacing the brushes. Major damage, such as shorts in the field windings, broken pinion gear teeth, bad bearings or thrown solder from the armature, will mean a big repair bill. In these cases, it may be worthwhile to simply buy a new or rebuilt starter. ★★★



## Mechanized Billy Goat

(Continued from page 94)

45:1 and 25:1) together with the fluid coupling allows any speed selection ranging from zero to 25 m.p.h., and the transmission can be shifted from one range to another at any speed. Throttle and brake are hand-operated. The machine has an overrun mechanism for positive steering that allows the front wheel to travel farther than the rear wheel when making a tight turn. The chain drives are self-lubricating and have 10 times the strength actually needed.

The fuel tank carries an eight-hour supply. If the wheels are not to be used for flotation, they may be used to carry extra fuel or even drinking water. Each wheel drum has four and a half gallons capacity, and the two wheels can carry enough fuel for five days' operation. A small plastic squeeze pump is used for transferring fuel.

### Look, Ma, No Springs

The vehicle has no springs and its low-pressure (5 pounds) 6.70-by-15 tires serve both as suspension and as shock absorbers. The tires are spread to a seven-and-one-half-inch tread and impose no more than two pounds per-square-inch pressure on the ground. This light "footprint" doesn't tear up the surface and allows positive steering even when traversing a hillside of snow or sand.

The Trailbreaker was designed strictly as a remote-area vehicle, for cross-country travel whether or not there are any trails. It can be licensed for road use by installation of an alternator, lamps and other required equipment, available in kit form. Only now on the market, many uses are already being suggested for it. Farmers and irrigators can traverse soft ground with it. Timber cruisers could more than triple their operations, using a paint spray from a pump operated by the engine to mark the trees that are to be cut. Fences, power lines and pipelines can be patrolled without the need of maintaining trails.

It would be ideal for military use. It can operate in areas where the Jeep would be useless, and would make any armed patrol more mobile. It could be used for guerrilla attack, actually bringing back the cavalry on modern motorized lines.

Nethercutt's customers are suggesting new uses for the machine every day. But it may prove most popular as a hill-climbing vehicle for hunters and fishermen. The company's usual customer seems to have only one stipulation when he orders a Trailbreaker—"It must be delivered before the opening of deer season!" ★★

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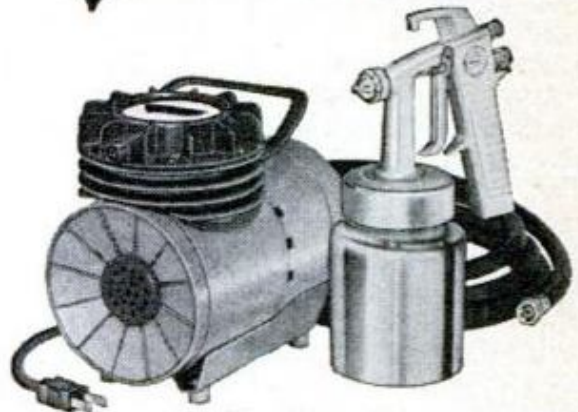
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## 12-M.P.H. Scoot-Car

(Continued from page 144)

a V-pulley which slips onto the wheel spindle to which it is locked with its set-screw and additionally locked by a cap-screw long enough to permit the threaded end to enter a hole drilled in the hub of the rear wheel. On the opposite side of the wheel a smaller V-pulley, with the rim cut away as indicated, serves as a spacer and a hub for the driven sprocket. It is locked to the hub of the rear wheel in the same manner as the brake drum. The brake band is a length of  $\frac{1}{2}$ -in. V-belt, one end of which is attached to the top face of the deck with two wood screws. The other end is doubled back on itself to form a loop around an S-hook, the latter attaching to the short arm of the brake rocker.

The brake rocker is carried on a shaft supported in hardwood bearings bolted to the underside of the deck. The brake-return spring attaches to the long arm of the rocker and to one of the pillow-block bearing bolts. The second S-hook attaches to the long arm of the rocker and to a cable eye which connects to the  $\frac{3}{16}$ -in. wire cable from the brake pedal. Note that turnbuckles are provided on both brake and power cables for adjustment.

### The Control Rod

The power-control cable reaches from the turnbuckle to one end of a pivoted lever. The other end of the lever connects to the control rod, part No. 49. The free end of the control rod is bent at right angles, drilled and cotterpinned to the sliding contact, part No. 73. The lever is returned by a spring, one end of which is hooked to a bracket screwed to the underside of the deck, see parts No. 51 and 52. The resistor, which is the carbon core from a dry cell, is mounted in brackets, parts No. 74 and 75, and is drilled and tapped for three  $\frac{1}{4}$ -in. flat-head screws and two  $\frac{1}{4}$ -in. capscrews, the latter holding it in place between the brackets. Drilling and tapping must be done with care, the tap holes being drilled slightly oversize so that the tap cuts only a 50 to 60-percent thread. One screw of the three shown takes the end of the battery cable, the other two, which are contacts through the resistor, are fitted with squares cut from  $1/16 \times \frac{1}{2}$ -in. flat steel and center-counter-sunk to take the heads of the screws flush. In the off position the spring-loaded sliding contact arm contacts an insulating strip of hardboard, part No. 71, which is attached to the ground strap. This type of switch (in effect a rheostat) prevents heavy current surges and reduces arcing

in the control switch to the minimum.

The motor-mounting brackets are made right and left and are so placed that the regular mounting lugs on the motor can be utilized as fastenings. Note especially how the aluminum ground strap from the motor terminal is bent so that it passes through the large hole in the chassis, the lower end being held in place by the bolt on which the sliding contact pivots. It will be noted that there is an L-shaped retainer attached to one of the brackets supporting the resistor. This has been lowered in the photo for clarity. It has, however, been replaced by a large washer, part No. 76. This retainer prevents the insulator, part No. 71, from swinging out of position.

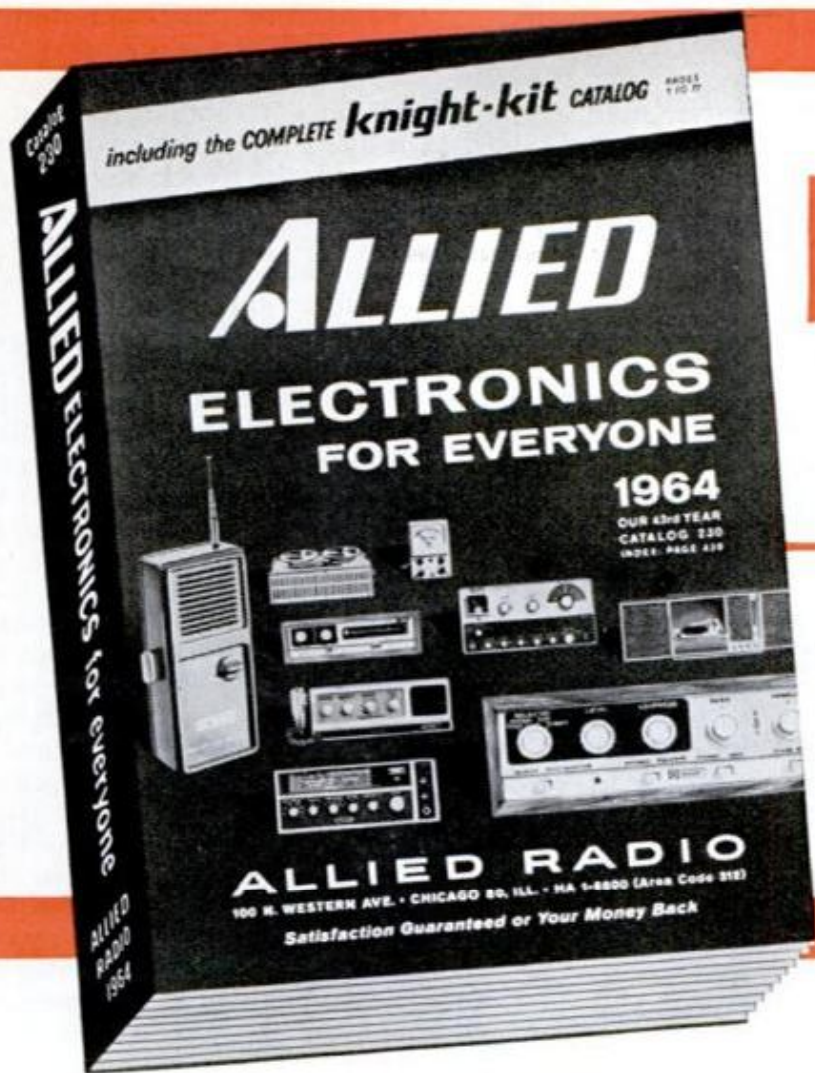
### Seat of Plywood

All parts of the seat except the risers are made from  $\frac{3}{8}$ -in. plywood and all parts are joined with  $1 \times 1 \times \frac{1}{2}$ -in. steel corner angles which are readily available. Care must be taken when locating the front and side risers to see that the holes in the attaching corner angles register with those in the deck to which the seat is attached with bolts and wing nuts. Note also that the inner end of the rear fender is attached to the back of the seat with corner angles, small bolts and wing nuts. The front fender is bracketed and braced to the deck and serves not only as a front-wheel fender, but also as a support for the steering post, or column. The brake and power pedals consist of a 3-in. T-hinge and a pedal, or pad, of plywood, and a bracket which takes one eye of the turnbuckles. The hinge leaves are attached to the deck with wood screws.

The bumper is a length of  $\frac{1}{2}$ -in. thin-wall conduit and is held in place with six flat-steel brackets screwed to the underside of the platform with wood screws and to the thin-wall conduit with self-tapping screws or sheet-metal screws. Rubber crutch tips are slipped on the open rear ends of the bumper. It may be attached either before or after the cornering wheels are in place. These wheels are carried at an angle of 15 degrees on heavy outrigger brackets bolted to the deck. Finally, install the steel-angle brace.

All that remains are installation of the battery cradle, the 6-v. battery and the foot and seat mats which are cut from corrugated-rubber stair treads and cemented to the deck. The taillight can be of the type pictured and detailed and wired into the power circuit, or you can use a battery-powered bike headlight and cover the lens with red cellophane. Also, you'll probably need to do some adjusting of the brake and power-cable turnbuckles to get the controls working right. ★★





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## He Makes Accidents Obsolete

(Continued from page 104)

turned less than 12 times a minute. Once this was established, technicians simply designed a drag brake to keep the door from turning faster than that.

Not all problems are solved so easily. The escalator trick took some doing. That project began when hazard hunters reported that among 300,000 claims that Liberty is called on to settle each year, a number were for injuries on moving stairways. Many, particularly agonizing, were for the torn feet of children.

"That's the kind of accident that gnaws at your insides until you've licked it," Crandell says. "We soon discovered that most victims were little boys from four to six years old, that they nearly always wore sneakers and that it always happened on the way *down*. Experiments soon showed us why. By tucking a toe into the crack between the apron and the edge of a moving step, the sneaker sole is forced back against the next riser and makes a lovely squeal. The fact that the foot is already caught doesn't bother the youngster yet. The foot is comfortable and the friction makes it feel warm. But at the bottom, as the riser slides down to nest, friction wedges the foot further and further down. Ahead are the awful comb-plate teeth, where the treads disappear beneath the floor. Then it's too late. The result is a horribly mangled foot. In a typical case, three toes and part of a boy's foot had to be amputated."

### Foot-Saver Switch

Out at Hopkinton, technicians went to work. First they found that an escalator can be stopped in 11 inches without throwing people off their feet. So, about one foot from the comb-plate, Crandell had them equip each side of the escalator with an automatic pressure-switch that shuts off the power the instant anything—such as the edge of a sneaker or shoe—contacts it. Today, most escalator manufacturers incorporate the switch in their product.

In some instances policyholders themselves come to Liberty with their problems. That's what happened in the case of the shopper carts. Several New England based supermarkets were having trouble with runaway carts bumping into moving cars, creating havoc and, occasionally, panic when a toddler was perched in one. Hopkinton engineers solved the problem with a braking mechanism that would go "on" whenever the cart was unattended. A push or pull on the handlebar released it. No more runaway carts.

Dozens of tricky accident preventers

like that pour from the Hopkinton brain factory every year. To eliminate accidents resulting from delivery men jumping on and off vehicles, Crandell had ignitions wired to prevent the driver from starting his motor until the truck door closed.

To prevent drivers from slipping and falling in winter, he brought heat from the engine to keep the steps warm. Now ice can't form on them.

Multiple reports of ugly accidents in loading docks and construction excavations, when heavy trucks backed up and crushed unwary workmen, succumbed to an easy solution: trucks were equipped with a loud buzzer that sounds off automatically the moment the truck backs.

### Sonar Back-Up Alarm

A more sophisticated version of this howler is a device designed to alert the driver, instead of frightening everyone within earshot to immobility. Actually a tiny sonar set, it operates on the same principle as a bat's homing equipment. Sensing elements on the rear of the van send out ultra-sonic impulses. The signals, reflected by any object closer than 20 feet behind the backing truck, are picked up, amplified, and shot through circuits to trigger a "blip" on an instrument dial in the cab. The device can be set up to sound an alarm at any desired distance within the 20 feet. Developed by Research Director Allen L. Cudworth at the Hopkinton Research Center, it is still undergoing field trials. But it works.

Since the nature of industry makes it susceptible to accidents, much of Crandell's attention is focused on this area.

Safety inspection, Crandell believes, has little value in industry when it becomes routine. For all his objectivity, the chief hazard hunter rumbles with quiet anger when discussing some needless tragedy, and his eyes grow thoughtful as he counts the lives that might have been saved by common sense and a little foresight.

"You have to keep alert for accidents that have never happened before," he says. Though hard-put to keep up with new hazards introduced by bigger bulldozers, taller cranes, more gigantic projects, faster and faster machinery, these are the things that keep Crandell and his hazard hunters in business. The installation of giant, high-speed looms in an old New England mill result in a nifty new safety device. When he first saw the looms, Crandell warned the owners that they were too much for the ancient walls. He knew that high-speed looms had recently collapsed two old German mills—one with a loss of 14 lives. The Yankee mill owners didn't

(Please turn to page 194)



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## He Makes Accidents Obsolete

(Continued from page 192)

believe him. Two weeks after they started rolling, a 152-foot crack showed up in walls thick enough to have held up a medieval castle. Crandell was called back.

To solve that one, engineers made slippery plastic shoes for the machines, allowing them to move back and forth without taking the building with them.

There's plenty of hazard hunting left for the future, as Crandell and his men view it. Out at Hopkinton, dozens of new projects are under way all the time. "We know," says Crandell, "that some people can create accidents where none would exist. But they're not the only victims."

### Aerosol Barrage

"Right now our warehouses are full of aerosol bombs. Pressures are always dangerous and we have a lot to learn about aerosols for this reason. Recently, a youngster took a can of spray to make snow on a Christmas tree. Ironically, the label read 'Merry Christmas'. He put the can in hot water to perk it up, shook it, and lost his jaw and one eye when it exploded."

Today at Hopkinton, aerosols of all kinds are being exploded deliberately to see what happens. Though hazard hunters point out that the industry's record has been excellent, as far as the public is concerned, they admit that the problem is like lightning—no one knows where it will strike. When standard aerosols were thrown on a fire at Hopkinton, some cans were found 300 feet away. Twice, the steel tailgate of a pick-up truck 150 feet from the fire was ruptured by the impact of empty 12-ounce cans. Having found a potential cause for trouble, the safety engineers are on the trail of an answer for it.

In the basement of his laboratory, Crandell has built an "unprogrammed" automobile driving simulator unlike any other known. In it a student can look through the windshield and steer himself down any road he wishes in the panorama projected in front of him. If he steps on the gas, the view through the windshield moves faster. When he hits the brake, the view stops with him. He can steer off the road, crash into other vehicles. As he goes along, a stylus measures his reactions. "We think we can learn a lot," says Crandell, "by measuring and counting the steering reversals a student makes while driving."

Crandell believes that current driver training stops short of the most important instruction. "Everyone is taught to drive under ideal conditions," he says. "No one gets any real experience in how to handle a car in a crisis situation."



Consequently, he's going to build a "skid school" in an unused parking lot beside the lab. "We'll run a line from the hydrant through a supply of liquid soap," he reveals, "and slick down the entire blacktop lot. Then we'll take trainees out in cars and deliberately throw them into skids. We'll teach them how to come out of a skid. It's easy when you know how."

If you think Frank Crandell is fooling, think again. His "Alertomatic" device evolved out of the same sort of wild experimentation. This incredible gadget, designed to keep sleepy night drivers on their toes, is a real Rube Goldberg—but it works. A dashboard light goes on intermittently. The driver turns it off by tapping the horn. If he doesn't tap, the horn blows by itself. If that doesn't wake him, the ignition goes off and on, jogging him. If he's still dozing, it kills the engine.

### Crash-Cushioned Car

Hopkinton is full of experimental cars. Most famous is "Survival Car II," featuring 24 modifications including roll bars, immovable seats, whiplash preventers, harnesses and a fire-extinguisher system. According to the hazard hunters, it would be almost impossible to be seriously injured in a crash in that vehicle.

More than anything else, Crandell would like people to pick up his ideas and use them. He knows they would pay off in lives saved. In one year, Liberty returned \$41,500,000 to policyholders on a total premium business of \$350,000,000. On one 30-mile tunnel job, the contractor's premium was reduced from \$2,410,000 to \$1,723,000, largely through use of the geophone.

Whatever happens, Frank Crandell can look back on one of the most productive and worthwhile lives that man has known. A contracting career of his own—including construction of a Chilean railroad, work in New York subways, a Westchester County development and a parkway bridge—he considers incidental. He says his real work began with hazard hunting.

He won't talk much to strangers about his wife, a busy, practicing physician, or his married daughter and two grandchildren. His private life is a private affair.

Ask him about his future plans and he may tell you about the schoolboy who came to see him in order to find out what a safety engineer does. "I told him some stories about our projects," says Crandell. "Then he asked, 'What do you do in here?'"

"I solve problems," I told him.

"And what do you do when all the problems are solved?" he wanted to know.

"I didn't tell him in so many words," says Frank Crandell, "but I'm not worried about that gaunt possibility." ★★★

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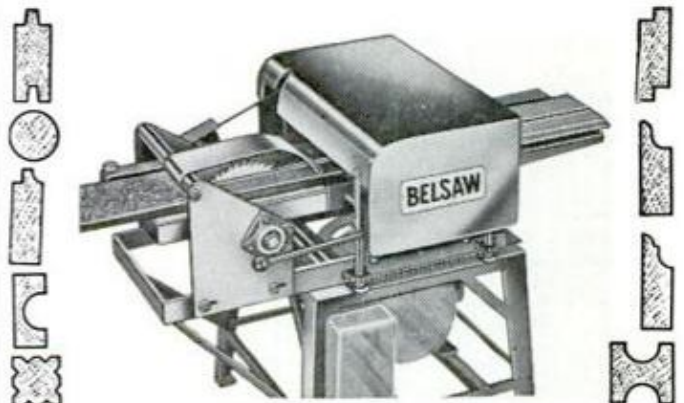


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## The Riddle of the Black Boxes

(Continued from page 91)

pect the Reds of testing nuclear bombs millions of miles out in space, high flying satellites can be lofted to monitor results.

While these watchdogs and the underwater black boxes are filling a large hole in our detection system, the brunt of our nuclear blast intelligence depends on huge manned seismological stations, the first of which was the Wichita Mountains site. Others are on the Cumberland Plateau in Tennessee; Tonto Forest in Arizona, and stations near Baker, Oregon, and Vernal, Utah. The Arizona station will be a test bed for new equipment and ideas.

### Giant Seismic Centers

These observatory complexes feature 10 to 100 seismometers of all types tended by crews of six to 20 men plus mobile data-gathering units. Photomultiplier tubes magnify signals from the seismometers and record them on magnetic tape, while a pencil of light traces them on film. The tape or film is marked continuously by a timer that is never more than one-tenth of a second away from true Greenwich time. The tape is fed into a large room full of permanent storage reels, perhaps after first recording its data in a fast computer. The film is processed in a high-speed darkroom and, in a little more than 10 minutes, displays its picture.

The sensitivity of a single detection station still depends more on clever location of proven equipment than it does on souped-up instruments.

Our underwater stations are one of the fruits of recent research. So are our "deep-hole" units. Project Vela-Uniform scientists found that deep wells are usually very quiet, seismically speaking. Two seismometers in deep wells may do the work of 10 or more surface units. A new triaxial seismometer replaces several units formerly operated simultaneously to spot the direction of a seismic wave. Radar-type scopes display the direction and size of underground events for visual study; computer systems rapidly sum up the recorded signals of a wave as it passes across an array of many seismometers.

More important, ARPA and ACDA scientists now have had enough experience with signals from planned nuclear tests so that they can interpret data with greater confidence than, say, five years ago.

Recent improvements have made our seismometers only a little more sensitive. But scientists have developed better ways of using them. Groups of the units, for instance, used in new geometric patterns, have increased the over-all efficiency of

observatories. Seismometer arrays, usually 10 instruments, now are arranged so that local background noise, such as rail and highway traffic and even wind-caused seismic noises cancel each other out. Signals from distant underground blasts are analyzed by computers. The large "summed" signal from a far blast or quake now stands out more clearly.

Though all this improves our ability to spot distant seismic events, the identification of quake or nuclear test is still a ticklish question.

Most earthquakes push some ground away from the epicenter (the spot on the earth's surface directly above the deep center of the quake, or hypocenter) and cause some ground to fall toward it. Thus, some seismic stations will record first motions away from the source, and others will record first motions toward the source. Shock waves from a man-made explosion, on the other hand, always travel away from the center of the blast.

Stations must be extremely sensitive (have high signal-to-noise ratios) to spot that first motion reliably. But, when monitors learn that an underground event registered both compression and rarefaction waves, they know it was a quake.

### Quakes Vs. Bombs

A better technique is to examine the record traced by the waves that reflect from the earth's surface directly above the event before beginning their cross-country travels. These indicate the depth of the seismic event clearly. Scientists agree that any event 40 or more miles deep is a quake, not a man-made blast.

Some shock waves push the earth at a seismic station up and down, others rock it back and forth. The total movement may be just a few microns (the smallest registered motion was about 20 microns in diameter). Not much movement, but it can be detected and measured.

Four different types of seismic shock waves come from quakes or bomb blasts. In the order they reach a seismometer, they are: P-waves, or "pressure waves", move through the earth away from, and then reflect back toward the shock source—like sound waves traveling through air. S-waves, or "shear waves", move by producing motions back and forth across the wave's traveling direction. They move at a slower pace than P-waves but go farther. L-waves travel horizontally over the earth's surface rather than through dense underlayers, and don't go as far as either P- or S-waves. "Rayleigh waves" move vertically, at right angles to the direction of travel.

When a dozen or more clues in a given



blast fail to identify the event as a quake, then our monitors suspect an underground blast. At this point, in our proposed test ban treaty enforcement plan, the U.S. Arms Control and Disarmament Agency would call for certain information from the Central Intelligence Agency, the Defense Department's Intelligence Agency, the U.S. Geological Survey and the Coast & Geodetic Survey.

### "Spoof-Proofing"

The ACDA will prepare a "travel folder" containing everything the contributing agencies know about the suspicious blast. If it is over or near a city, the event will be ruled out. Earthquakes happen under cities, but people don't test atomic bombs there. If the blast comes from a known weapons test area, or from a remote territory, the agency will call for more intelligence reports.

But most scientists and diplomats discount the possibility of "spoofing" a detection system. The fact of an explosion cannot be hidden. A nation conceivably could try to cover a small blast in one location with a larger blast in another location. If carefully phased, this would hide a small test from a single detecting station but would give it an even bigger seismic kick to wonder about. Small charges planted between test sites and detection stations would confuse the seismic records, but only those of surface waves. Test detection relies much more on deep earth waves.

The experts know that a better way of hiding nuclear tests would be to conduct them in areas where earthquakes are common. Tremors emanating suddenly from a region of low seismic activity, like Kansas, would arouse suspicion. But nuclear blasts in the Kurile Islands and the Kamchatka Peninsula of the USSR's Pacific coast, where over 70 percent of that nation's earthquakes take place, could be distinguished from quakes only by a large complex network of stations.

### Islands Unstable

A few manned stations in Japan would do the trick under good conditions. But seismic conditions in Japan are among the worst in the world. The islands are perched on an unstable, constantly shifting rim of crust material jutting up from the Pacific Ocean floor.

Hence, the proposal to plant underwater black boxes all around the peninsula. These devices, less than 10 feet tall and two feet in diameter, lack only one component of the large manned stations and the unmanned vaults: they have no device for recording the very low fre-

quency waves that take many seconds to pass a station. But even this item is now under development.

The larger "seismic vaults", containing long period seismometers, are what the Arms Control agency would build in the USSR if someday a test-ban treaty is signed. Data from the sealed vaults would supplement information from our own network outside Russia.

The ticklish question of whether seven on-site inspections annually inside the Soviet Union would be enough to prevent cheating remains. Many scientists believe seven (or even less) would do the job. They don't guarantee that every test would be spotted. They think that most of the very small tests would be missed or at least remain in doubt. But on-site inspections, they say, would at least slow the nuclear arms race considerably.

### Our Detection "Specs"

To be on the safe side, the Arms Control group actually would operate at least 15 manned stations, plus the underwater stations necessary to fill in the gaps.

Here is what could be expected from the agency's system:

- Detect one-kiloton blasts detonated in granite. (The Hiroshima bomb was equal to 20 kilotons—20,000 tons of TNT.)
- Detect a two to six-kiloton test in the rocky volcanic soil at the Nevada test site.
- Detect a 10 to 20-kiloton test in loose, sandy, dry alluvium.

This looks like the Russians could get away with tests of small, battlefield-size weapons. However, ARPA points out that these are the figures for reliable detection of every test in the size range and the Reds know that we would detect a few smaller tests. Also, there are only two suitable alluvial areas in the USSR. These could be given special attention.

The figures quoted above are for tamped tests of weapons well coupled with the earth. What about "decoupled" tests of weapons suspended in huge caverns?

According to ARPA, such tests would be costly and time-consuming. Test ban violators would have to dig out a cavern 360 feet in diameter to muffle a 10-kiloton blast; 770 feet for a 100-kiloton explosion. The U.S. took three years to conduct decoupled tests in Mississippi.

That briefly is the black box story. But the Joint Committee on Atomic Energy may be right after all. There may really be no black box. Dr. Charles C. Bates, director of Project Vela-Uniform, stopped the writer in a Capitol corridor one day recently. "About that black box," he began. "You know it's not really black. It's more of a dark gray." ★★★



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## Preview of the '64 Cars

(Continued from page 81)

arate frame bodies which will be several inches longer, but fit the same 115-inch wheelbase the new Chevrolet will have.

### Convertible Mice

The increased size of 115-inch wheelbase was not as much of a factor in the change from unit construction to separate frame and body for these cars, as was the increasing popularity of convertibles. Have you ever heard the mice that live between the windshield and top of a *unitized* convertible?

Buick Special and the Olds F-85 will have a new cast-iron version of their compact V8, and displacement is expected to be upped to about 300 cu. in. from the 215 cu. in. being used on the current engine. Both cars will share the Buick Special's V6 and Tempest will continue its own optional 326-cu. in. V8.

In addition to abandoning its slant Four engine, Pontiac Tempest is expected to drop its controversial transaxle in favor of a forward-mounted transmission and driveline.

### Big Transmission News

New transmissions are, by the way, one of the big 1964 stories, both at GM and Ford. GM is phasing in a new automatic made up of three-speed planetary gearing and controls derived from the present Hydramatic plus a new torque converter. It won't replace all Hydramatics at once, but look for it in the full-size lines as a replacement for the unpopular three-speed Hydramatic in current use. The new (for GM) transmission offers a nice balance between performance and economy, with the torque converter filling in smoothly between the gear ratio steps. Expect to see it first on the Buicks, later on Pontiacs and Oldsmobiles.

The BOP compacts and the new intermediate Chevrolet may adopt a revised version of the transmission now used on the Buick Special.

Oldsmobile is expected to add a new series in '64, one that will fall between the Dynamic 88 and the Super 88. It will use the basic 88 body shell, but have a very hot engine and some fancy identifying trim.

### General Motors' A, B, Cs

Technically, GM will return in 1964 to the old A,B,C body shell system it used in the mid-Fifties. Expensive but out-of-sight stampings such as some of the cowl, floor pan and inner door structures are interchangeable between lower and higher price GM cars, though the outsides will



look quite different, of course. This is GM's big cost-cutting secret. Currently, you can replace your Cadillac windshield at a Chevy dealership for \$50 less. Door handles on an Olds 98 and a Corvair are currently interchangeable. But few people know these things.

For 1964, the B shell will range through all GM lines except Cadillac, the A shell is for intermediate compacts and the new mid-range Chevrolet, and the C shell is for the likes of Cadillacs, Oldsmobile 98s and Buick Electras.

The hiked-up, glass-sided "vista-dome" for the Buick Special (and perhaps other wagons on the BOP compact shell) will add about six inches of height to the wagon, and will probably have a sliding roof section like that on this year's Studebaker Wagonaire.

**FORD, FALCON, COMET, MERCURY, LINCOLN.** The 1964 Falcon no longer looks as if Paul Bunyan sat on the front end by mistake. Body lines stretch closer to bumpers and are straighter, cleaner and crisper, giving an impression of increased length and width, although Falcon's wheelbase will remain 108 inches. Look for an important suspension change here that will improve the ride.

The new Comet (see drawing) changes sheet metal substantially below the window lines, acquiring some of the more mature aura of Mercury and Lincoln in the process. Fairlanes get a new grille and side sheet metal face-lift and a thicker application of chrome trim. Galaxies acquire an even more solid "medium-price" look. Mercury will drop the 116-inch wheelbase Meteor (or perhaps use its name to designate one of the Comet models).

Ford is bringing back a three-speed plus torque converter transmission to fit between the Cruise-O-Matic used by the big Galaxie and Mercury V8s, and the simple two-speed automatic used by Falcon and Comet Sixes. The latter will eventually phase out as production of the new automatic takes over.

Falcon and Fairlane will have the large 289-cu. in. Fairlane V8 available as a power option.

### Race-Tested Improvements

Thunderbird, Lincoln and eventually all larger Fords will switch to the 15-inch wheel and profile tyrex tire which has done well in stock car racing. This will mean 38 percent better work life, 20 percent higher skid resistance and fewer balancing problems at the factory. The low profile design keeps the car's height the same, while the larger wheels permit better circulation of air around brake drums,

(Please turn to page 200)

AUGUST 1963

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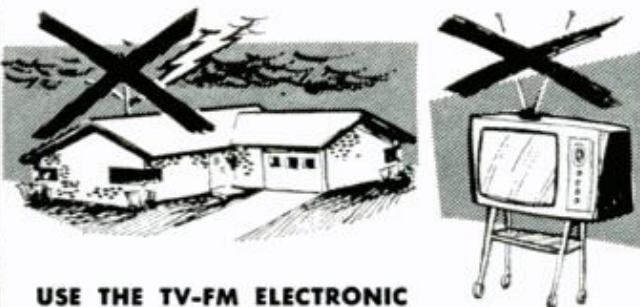
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## Preview of the '64 Cars

(Continued from page 199)

which should reduce brake fade.

Many engine changes at Ford also reflect racing experience. They include wider, thinner webs for connecting rods on high performance engines; these should improve fatigue life substantially. A race-developed counter-balancing mechanism will be applied to all distributor rollers to cut down on the high-speed vibration that can throw off spark timing and intensity.

It was also found that the valves and pistons on Ford race engines actually contacted each other at r.p.m.'s of 6500 or more, so 1964 Ford's engines will have a pad and increased clearance on these parts. Rib locations in the blocks have also been moved closer to the seals to help prevent the deflection that sometimes causes these to blow out, particularly on high mileage engines.

**CHRYSLER.** We've already mentioned the big styling news at Chrysler—the redo of the Imperial. Styling changes on Plymouth, Dodge and regular Chryslers can generally be described as of the "safe" variety that today represents a blend of the main-line models of GM, Ford and Chrysler products.

But rear windows on Chrysler cars will increase somewhat in size for better vision. And there are signs of tampering with that rear T-bird-like greenhouse panel by having some interesting notches and curves cutting into the near sacred parallelogram.

Dodge and Plymouth Divisions sincerely mourn the fact that a past management ordered the disposal of tooling used for the 283-cubic inch V8 first used on the 1953 Dodge. This would be just what they need for power option on the Valiant and Dart. But, lacking this, there may be no V8 for these cars in 1964.

Rumor has it, though, that Chrysler is working with feverish haste to complete a lightweight cast-iron V8 of the 250 to 300-cubic inch range for the bottom engine on Plymouth and Dodge, as well as an option for the Dart and the Valiant.

**RAMBLER.** The dumpy Rambler American has been transformed for 1964 into a cleverly scaled-down Classic, according to those who've seen it. Wheelbase will be at least six inches longer, but all of that won't be reflected in over-all length. This will make the American a full six-passenger, Falcon-sized sedan, as it moves the rear seat up from between the wheel wells to widen it. Look for a long-overdue line of Rambler Classic hardtops.

Rambler has let tooling for an all new 6-cylinder engine, but it won't be ready



until the 1965 model season. Aside from the aircooled Corvair, Rambler will be the only maker to continue offering an aluminum engine block. Chrysler quietly phased out its option on the six-cylinder one this year. Pontiac, of course, dropped its current model, and, for '64, Buick Special and Olds F-85 will replace their troublesome aluminum blocks with all-cast iron.

Aluminum blocks were not so troublesome from a consumer's standpoint as from that of the manufacturer. GM aluminum blocks were permanent-mold castings and there was a tendency to porosity which required too high a percentage of them to be subjected to an expensive sealing operation. Also, the material was erratic in density, a condition that raised hob with such expendable, but expensive tools as drill bits and reamers. But aluminum usage in other parts such as transmission cases, axle housings and radiators will at least make up for the loss of light-weight aluminum engines.

**STUDEBAKER.** There will be a Loewy-restyled Studebaker next year in several forms, all about five inches lower, and they may or may not carry the Lark designation. They will have a novel muffler-less exhaust piping system (see photo) whose width will be no more than three inches at any point. This solves space problems underneath.

The Avanti will not only acquire a grille to relieve the plain line front end, it will sport a dress up job on its interior which will include the application of walnut veneer to the instrument panel.

All Studebakers will move up finally to the 6000-mile oil and grease change interval which neatly fits a twice-a-year cycle for average annual mileage. ★★

### Short, Happy Life

A new sub-atomic particle, the phi meson, was recently discovered by teams of physicists from the University of California, Syracuse University and Brookhaven National Laboratory.

The new particle has an extremely brief life, so brief it's unbelievable to anyone except a physicist. It exists for no more than two ten-thousandths of a billionth of a billionth of a second.

Phi mesons owe their existence to K mesons, and vice versa. When hydrogen atoms were bombarded by K mesons, particles flew off that were found to be phi mesons. And what happens to phi mesons after their incredibly brief lives? They break up into pairs of K mesons. The whole thing sounds faintly cannibalistic, but that's nuclear physics.

AUGUST 1963

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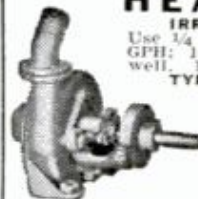


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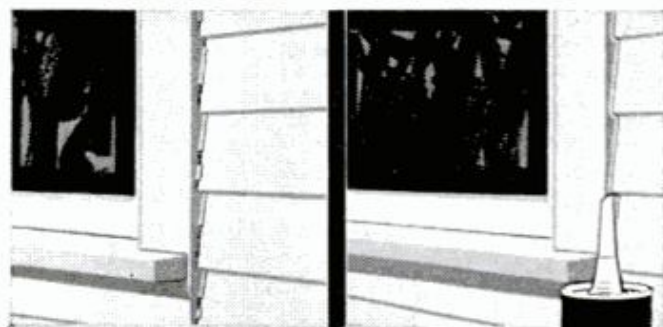
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## Operation Sub Rescue

(Continued from page 72)

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With the present chamber, the skipper of a crippled sub releases the hatch above the sub's escape trunk and a small buoy pops to the surface trailing a thin cable. The rescue ship fastens the escape chamber, carrying two operators, to the cable and winches it down to the sub. Over the escape hatch, the operators manipulate ballast and adjust water in many small tanks until the chamber is sealed in place. Then compressed air blows water from the lower chamber and from the sub's escape trunk. As many as nine men can be hauled to the surface at a time.

### Cables Limit Chambers

Diving chambers are limited to about 1300 feet because of currents and the cable capacity of the vehicle's winch. Another limitation is the length of cable on the messenger buoy. A submarine built to carry two reels of cable (for fore and aft escape trunks) 20,000 feet long, or even 8400 feet long, would have to be "nearly as big as a battleship."

The proposed combination bathyscaph-rescue chamber would be self-propelled and highly maneuverable to enable it to find a sub and mate with its escape hatch.

Ultimately, the Navy hopes to develop new materials capable of withstanding greater underwater pressures. Ultra-strong titanium, for example, would permit construction of larger crew and passenger spheres for rescue operations. The present cost of titanium, \$8 per pound, is prohibitive; submarine steel plate, HY-80, costs only 25 cents per pound. A new steel, which the Navy hopes will cost only a little more than HY-80, is now being developed by the United States Steel Corporation especially for the new deep-diving submarines now on the drawing boards. Called HY-130, it will withstand pressures of 130,000 pounds per square inch. HY-80's strength is 80,000 pounds.

Titanium is notoriously difficult to fabricate and HY-80 is nearly as stubborn. Adm. Ralph K. James, chief of the Bureau of Ships, says of HY-80, "We don't construct submarines, we blacksmith them." The Navy hopes HY-130 will be much easier to work with.

Steel and fibreglas-laminated "sandwiches" similar to safety glass may one day replace conventional steel plate. It will provide extra strength and improved heat and sound insulation.

Navy designers would like to test the use of lithium as the buoyant material in a rescue bathyscaph's float. The *Trieste's* float is filled with aviation gasoline to bring it back to the surface after ballast is dumped. Lithium is the lightest of the solids, only slightly heavier than hydrogen and many times lighter than gasoline.

Deep-diving craft able to operate well below the depths of our present sub fleet (published estimates are 1000 to 1500 feet) are already under construction. These are mostly research craft, ocean explorers rather than rescue and salvage vessels. One is a prototype for future combat subs, the super-secret *Dolphin*, which will operate at about 6000 feet, or 4700 feet deeper than the crew could be rescued.

Another big step away from bathyscaph-type vessels is a small, two-man craft named *Alvin*. Designed by General Mills for the Office of Naval Research, the 20-foot craft will operate at 6000 feet, deep enough to explore all parts of the continental shelf. It will operate at six knots and be fully maneuverable.

### Aluminum Diver

Also under construction is a heavy aluminum deep diver that will cruise at 3.8 knots, 15,000 feet under the waves. The *Aluminaut* is being built for Reynolds Metals Company, but will be leased by the Navy for use by the Woods Hole Oceanographic Institution.

Westinghouse Electric is putting the finishing touches on the *Deepstar* which will maneuver with a three-man crew at 3½ miles per hour at 12,000 feet. It was designed by French undersea explorer Capt. Jacques-Yves Cousteau. It will be powered by two shaftless propellers; varying the speed of either propellers will turn *Deepstar* on a dime.

Before a dive, ballast on *Deepstar* is adjusted so that it is neutrally buoyant. High-speed pumping of a small amount of heavy mercury from a rear tank to a forward tank points the vessel down. Pumping to the rear tank points it up. This lets *Deepstar* climb over hill and dale of the ocean bottom. For a rapid climb to the surface, the pilot releases magnetically attached weights for positive buoyancy.

The most unusual undersea research vehicle in the works is a very small, two-man "utility" submarine designed at Naval Ordnance Test Station in California. This is a five-foot plexiglass sphere with a wall four inches thick. If durability tests confirm the designers' theories, it will provide almost unlimited visibility for its crew at 2000 feet. The plastic chamber would be replaced by a steel sphere for operation down to 10,000 feet.



Although observers say the Navy won't let the absence of deep-sea rescue capability slow its plans for ultra-deep diving subs, nobody will admit a willingness to write off crews of submarines disabled below 1300 feet simply as casualties of the cold war. The Bureau of Ships works as hard as its limited funds permit to make sure that men can be rescued.

Heroic divers proved some years ago that there is a better way for a man to escape from a sub sunk in shallow water (if a McCann chamber is not handy) than to climb slowly up a cable, breathing in the well-known Momsen Lung.

### "Blow and Go"

Careful studies and pure, nerveless guts proved a new "blow and go" method. Crew members enter a submarine's escape trunk and pressurize extremely rapidly, then step through the escape hatch and pop rapidly to the surface, exhaling and expanding air from the lungs steadily as they rise. "Blow and go" is safe down to 450 feet.

A hood developed recently by submariner Harris E. Steinke permits the wearer to breathe if he feels it is necessary, although all submariners can hold their breath longer than it takes to pop up from 450 feet. The hood keeps cold water away from ruptured eardrums.

Techniques for rescuing men have occupied the Navy's attention far more than salvaging sunken subs. Low-key consideration has been given a few salvage ideas such as a collapsible pontoon, similar to a parachute, that could be carried down to a sunken submarine and filled with piped air to raise it. But studies show that even if a sub sank in shallow water, and very few do, it would cost much more than the sub is worth to raise it. Up to now the Navy has been satisfied, if the men can be rescued to leave the sub on the bottom.

However the U.S. State Department is not, and for sound diplomatic reasons. After the nuclear-powered *Thresher* went down, the Soviet Union squeezed a lot of propaganda mileage out of a nuclear reactor lying on the floor of the Atlantic.

The State Department, with the blessing of the White House, has urged the Navy full speed ahead on a deep ocean salvage program. It fears that a similar sinking, say in the crowded Mediterranean, would provoke a world uproar if we could not raise the sub. Especially if, instead of carrying only a power reactor, the sub also carried 16 Polaris nuclear warheads.

Finally, says the State Department, who would be the bad guys and who would be the heroes if the Soviet Union could come along and raise that submarine while we watched helplessly? ★ ★ ★

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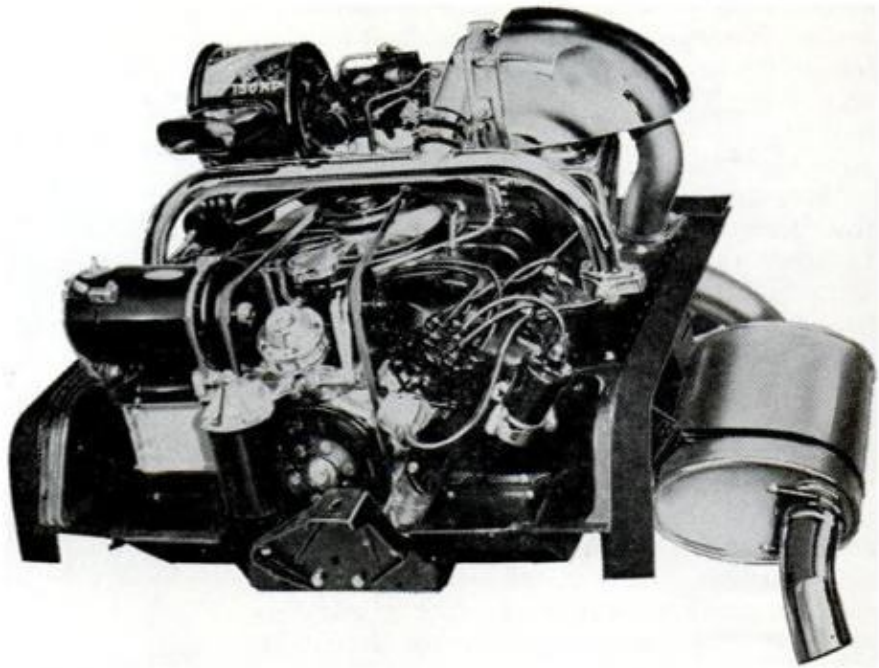
203



# The Return of the Classic Cord

(Continued from page 84)

**ENGINE** for the new Cord will be the same 102-horsepower, 145-cubic inch plant used on the Corvair Monza Spyder. The Corvair turbocharger, which raises horsepower to 150, will be an option on the Cord. So will the Monza 4-speed stick, as an option for Power glide



whose front-wheel drive enabled it to make good time safely on icy roads.

What about the rumor that a front-powered car on a steep incline throws so much weight rearwards that the pulling wheels lose their traction? It was true that the very first Cord—the L29 introduced in 1929—had hill-climbing troubles because its engine was set too far back from the front wheels. The 810 Cord introduced in the Thirties corrected this problem, however. With plenty of weight on its drive wheels, it was a climbing son-of-a-gun. So is the grandson-to-be, the 1964 Cord prototype I drove.

## Ditch Testing

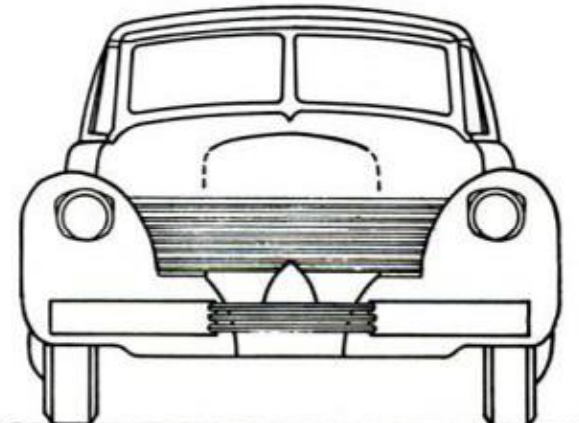
In fact, despite some prototypical ailments, such as a right front torsion bar that needed more tension and rear springs that were a bit too stiff, my test chassis sat well, rode well, climbed in and out of ditches with ease, and certainly seemed to

maintain the correct amount of weight on each wheel. The front driving wheels were not hard to steer, as some might imagine, and there should be no need for conventional power steering on this car.

The prototype was bereft of body, of course, but adding the 280-pound body to the 1440-pound chassis-engine combination will not materially affect the 55 percent front, 45 percent rear weight distribution planned for this car. This is almost exactly the same weight distribution as on a 1937 Cord 812 although total weight of the new Cord will be some 1700 pounds less than the 4000-plus pound weight of the old Cord.

The smaller wheelbase and substantial weight reduction certainly make the new Cord more maneuverable than its classic daddy. Circles can be turned in 36 feet, as opposed to the 42-plus feet required for the 1937 Cord. And zero-to-60 mile-per-hour acceleration runs can be logged in

**1964 CORD** will have same interior dimensions as the old Cord, but be about an inch narrower outside, eight inches lower and about 29 inches shorter





less time. Where it took a 1937 Cord somewhere between 13 and 21 seconds (depending on whether it was supercharged or not) to make it from standstill to 60, my unblown prototype Cord repeatedly made it in a few tenths of a second on either side of 10 seconds.

### Engine for the New Cord

What kind of power plant is responsible for times like these. The old Cord used an L-head V8 Lycoming which was rated at 125 hp. at 3500 r.p.m., or 170 hp. with supercharger. The lighter 1964 Cord will have the same opposed six-cylinder, 145 cu. in. engine used by the Corvair Monza Spyder. It is rated at 102 hp. unblown, or 150 with its optional turbocharger. When coupled with the new Cord's weight reduction, it should work the same improvement on fuel mileage that it does on acceleration.

In case our mention of the Corvair engine startled you, perhaps we should note right now that Glenn Pray is not planning to compete with the miles of market surveys, drawing boards, dies, smokestacks and erupting production lines that represent the giant mass producers of automobiles in this country. His new Cord Sportsman will be a limited production car, incorporating most of the old classic outlines but using, insofar as possible, tested, off-the-shelf conventional parts supplied by other auto manufacturers.

Thus, in addition to the Corvair engine, the new Cord will have a standard Powerglide automatic transmission or, as an option, the same four-speed stick shift used on the Monza Spyder. Cords with Powerglide, such as the prototype we drove, will have the control lever mounted in the center of the instrument panel which, by the way, is where the shift lever on the old L29 Cord was. Cords with stick shift will be controlled by a stick suspended from under the instrument panel.

### Heat Out the Dents

One feature of the new Cord that is definitely not an off-the-shelf item will be its plastic body shell, which will be vacuum-formed for Cord by U.S. Rubber Company out of their Expanded Royalite. This is basically a laminate made up of a low density, expanded ABS plastic resin core sandwiched between two layers of high density, solid ABS plastic resin.

U.S. Rubber Company representatives claim it has, for its weight, greater rigidity and impact resistance than fiberglass or steel. It can be readily patched with epoxy, and any dents made in it can be easily removed by the application of hot air at

(Please turn to page 206)

AUGUST 1963

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## The Return of the Classic Cord

(Continued from page 205)

500°F. It is currently being used for truck engine covers, hood and fender assemblies, and in the first plastic travel trailer body. It is also being tested by Ford Motor Company in an experimental one-piece automobile body weighing only 120 pounds.

The corrosion-proof nature of the Royalite body fits in with the Auburn-Cord-Duesenberg Company's plans for keeping their new Cord as maintenance-free as possible. They have to, for the simple reason that they will have no network of dealerships equipped to provide special service for their new car.

So Cord officials are making sure that your friendly mechanic around the corner can take care of the Cord without any additional training. The stock parts approach—all of them of American manufacture—should help insure this. So should the fact that a complete service manual will come with every car and replacement parts will be deliverable from the Cord plant in Oklahoma by air express. Incidentally, the Auburn-Cord-Duesenberg plant did not spring up recently just for the purpose of making the 1964 Cord. For 26 years it has been conducting a going business supplying replacement parts for all the old classic Cords.

### Two-Section Frame


Other features of the new Cord which will ease servicing problems are a box-type frame with X-members which is made in two sections, so that the front half can be removed in one man-hour for quick servicing of the power plant and front drive unit. With few exceptions, a single size bolt ( $\frac{3}{8}$  National Coarse) is used throughout the chassis. And every line for electrical, gas or brake components will break at the firewall to simplify servicing of any of them.

At present, Cord plans to produce only one basic model, the convertible coupe shown on pages 82 and 83, with an optional hardtop shell. Company officials are setting up for a production rate of 2000 units a year, and the early months of production will be devoted to filling the orders of those who were on the waiting list as of June 1963. Shortly thereafter, however, orders can be taken from new, would-be buyers. Such as you, for example, if you are interested.

And what would you have to pay for this classic-line legend reborn? Somewhere between \$4000 and \$5000, depending on options.


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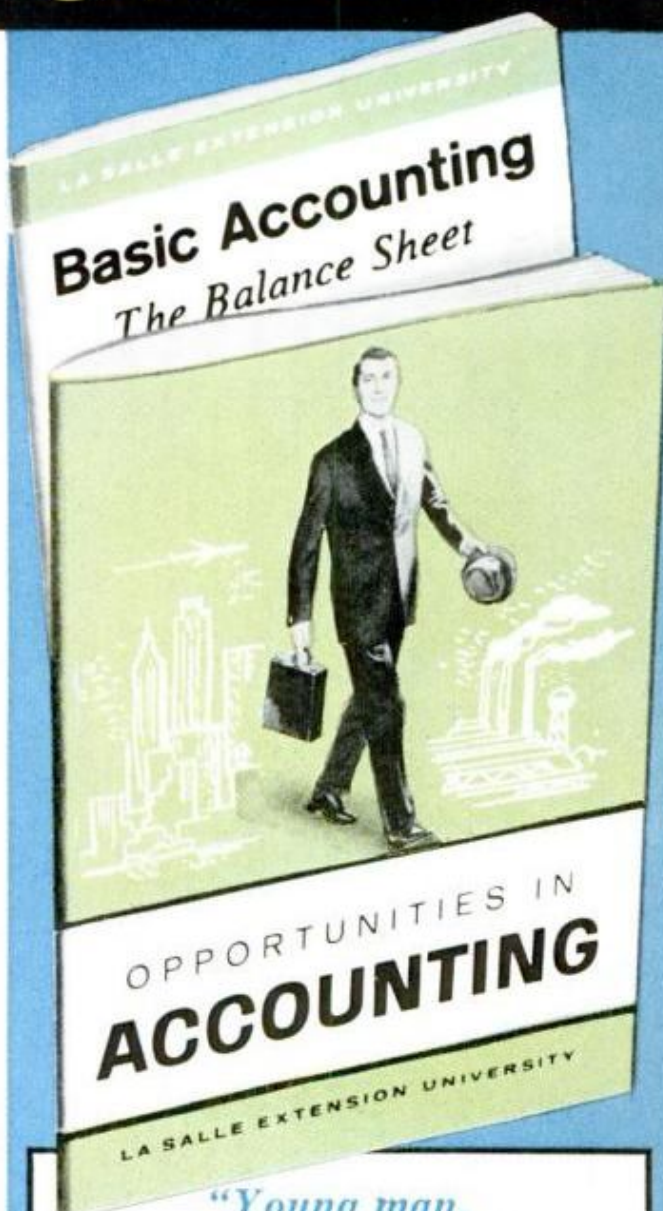
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