

**Exploding the Myths About Oil Changes**

OCT 18 REC'D

# POPULAR MECHANICS

NOV. 1963  
35 CENTS

**Will We Pass Up the Moon for Mars?**

**Calc Your Home for Winter  
Where It Really Pays Off**

PM Editor  
Learns **How to Survive at Sea**



**Driving a World's Record  
407 MPH**

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"can you climb  
a hill?"



"65% grade"

"go off the road?"



"anywhere! and  
with a load too."

"go in snow?"



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"got  
4-wheel drive?"



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NOVEMBER 1963

This One



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# POPULAR MECHANICS®

NOVEMBER 1963  
VOL. 120 NO. 5

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

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**NEXT MONTH—Honest TV Service** and how to get it! December PM tells how to check your serviceman and assure your money's worth when the screen goes black. In the same issue: New Project-a-Plans to decorate your home and lawn for Christmas; buyers guide to snow blowers; a playroom bar for New Year's Eve—and much more

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# Over the Editor's Desk

## The Answer: Yes, a Figloo

I noticed on page 37 of your August issue an article on a fiberglass kayak entitled *What Comes Next—Plastic Igloos?*

The answer is yes. Our subsidiary, the



Laurel Corp., Shippenville, Pa., manufactures fiberglass boats and playground items. Among the latter is a Figloo. It is all fiberglass, and is made in two pieces—the igloo itself, plus the top ventilator plate.

Indiana, Pa. HARRY C. MCCREARY, JR.  
Chmn., McCreary Tire & Rubber Company

*Okay, you're one up on us. But now what comes next—a plastic Eskimo?*

## Good Drivers? Yes and No

Mr. Tim Russell was being polite when he said that people have lost the knack of proficiently handling a car (*Editor's Desk*, page 8, Aug. *PM*). What he really meant, I think, is that over half the people couldn't drive them if they were not automatic and all power.

I always think of a little old lady driving a big luxury car about 70 miles per hour. I wonder if people realize how many Gs their body and the car would pull when these hulks on the road today hit something.

Rio Grande, N.J. JOHN MATHIS

It would seem today that anyone who has enough money to purchase a so-called sports car also automatically feels that he is a sports-car driver. This then seems to give him a self-endowed authority to

completely disregard his fellow man.

I don't need a "little tremor in the wheel," as Mr. Russell puts it, to tell me what's going on underneath me. Further, I don't have to drive a sports car to tell whether I've got a flat tire.

Most misnomered sports-car drivers are a menace to our traffic and highways because it seems that every one of them thinks he's driving in the Monza Grand Prix when he's only going down to the corner drive-in for a Coke.

Western Springs, Ill. DONALD H. SMALE

## Hydro Dynamic Builders

Your *Hydro Dynamic* (page 144, March *PM*) was a snap to build, as your copy stated—and with simple tools, at that. We



increased the weight factor slightly by glassing the whole hull, but otherwise she was built to specifications.

London, Ont. ALLAN C. DONALD

My son and I built the *Hydro Dynamic*. We have had it in the water for over a month now and have really put it through some rough tests. This boat can take it. My son even took it out in the ocean, but



it works best in small chop. We used a 45-horsepower Mercury and obtained 33 miles an hour with three people in the boat. The entire boat cost \$280, and we are more than pleased with it.

St. Augustine Beach, Fla. D. H. WHARFF

## Stiles Aren't the Style

The article *How to Stay Alive on a Ladder* (page 166, August *PM*) was most interesting. However, I was disappointed—

[\(Please turn to page 10\)](#)



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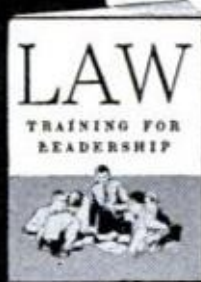
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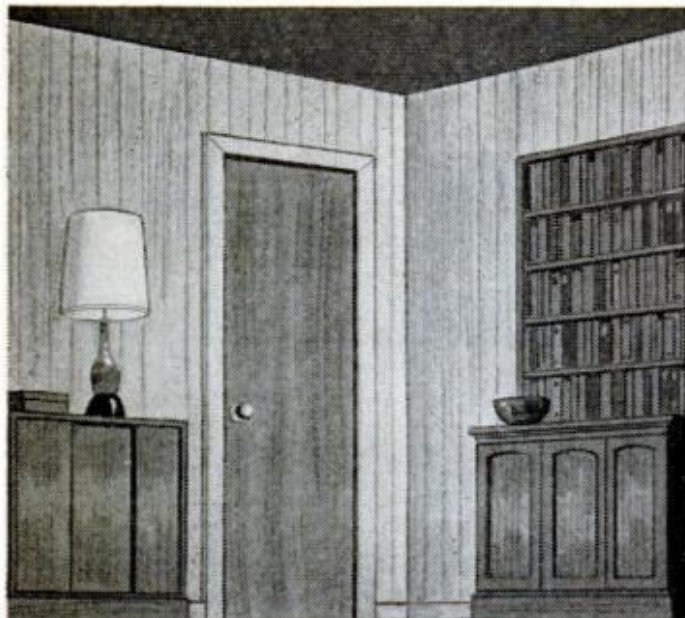
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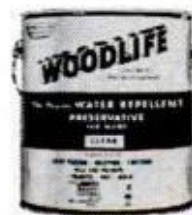
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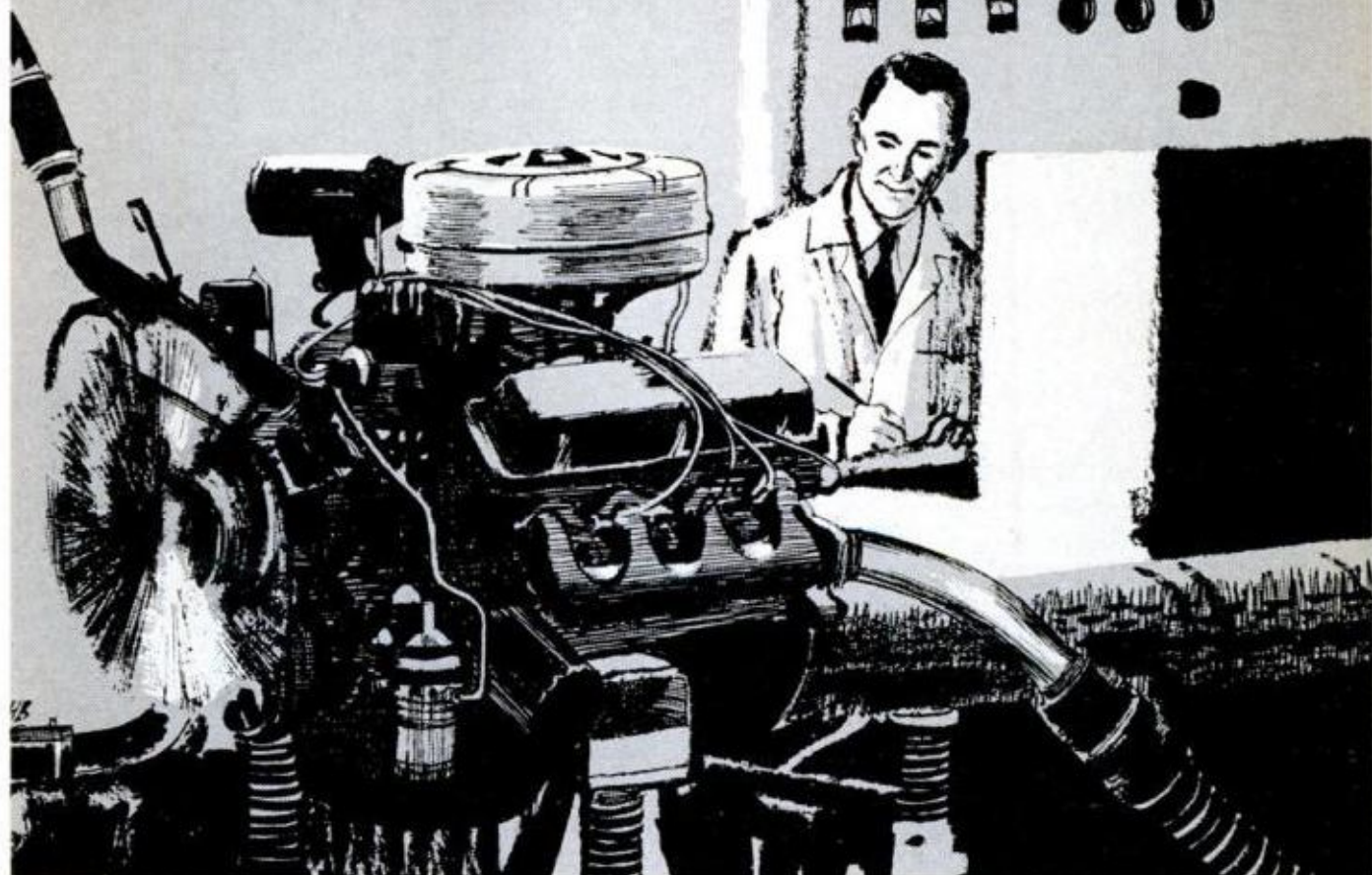
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Cutting engine weight through precision-casting gives more "go" per pound. This is a major reason why this design was chosen for the engines in the Ford-powered Lotus cars—which startled the world at the Indianapolis "500"—and the successful Cobra sports cars.

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may, shocked—to see the lead photograph portraying a man climbing a ladder by holding onto the stiles instead of the rungs. Were he to slip, he could not possibly grip the stiles tightly enough to keep himself from falling, to say nothing of the slivers and torn hands. With one's hands properly hooked over the rungs, they act just like that—hooks.

In spite of this criticism, keep up the good work on safety and accident prevention.

Stillwater, Okla.

V. L. DUTTON

*That's a good point. You may get your hands dirty on the rungs, but it's the safest way to grip the ladder.*

### Neat Knight

Enclosed is a picture of the *Sea Knight* built from the plans in your magazine (May through August, 1957, PM) with some alterations. Top speed at launching



was 25 miles an hour with a 35-horse Johnson motor.

It was our first attempt to build a boat, and it took my father and me three months of spare time.

Mediapolis, Iowa

GENE HANCOCK

*That was a fast building job, and the boat looks great.*

### Automotive Bull's-Eye

Your *Auto Clinic* editor hit the nail right on the head. He told me in a letter that he was pretty sure my 1956 Chevrolet needed timing. I took it to a garage. The mechanic connected up his light and said, "The timing on this engine is way off." It now runs like a different car.

Thank you for a good diagnosis.

Macon, Ga.

CHARLES M. ROBERTS

*Yup, he can diagnose trouble all the way from here to Georgia—and it amazes us, too. Any other readers who are baffled by automotive misbehavior (mechanical, that is) are invited to write him. See page 185 in this issue.*

*The Editor*

POPULAR MECHANICS

# Great NEW Idea from CTI

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Here Is Your  
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## 25 KITS WITH SHOP PROJECTS

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### 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.

## 3 FREE BOOKLETS

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## Sidelights from the SERVICES

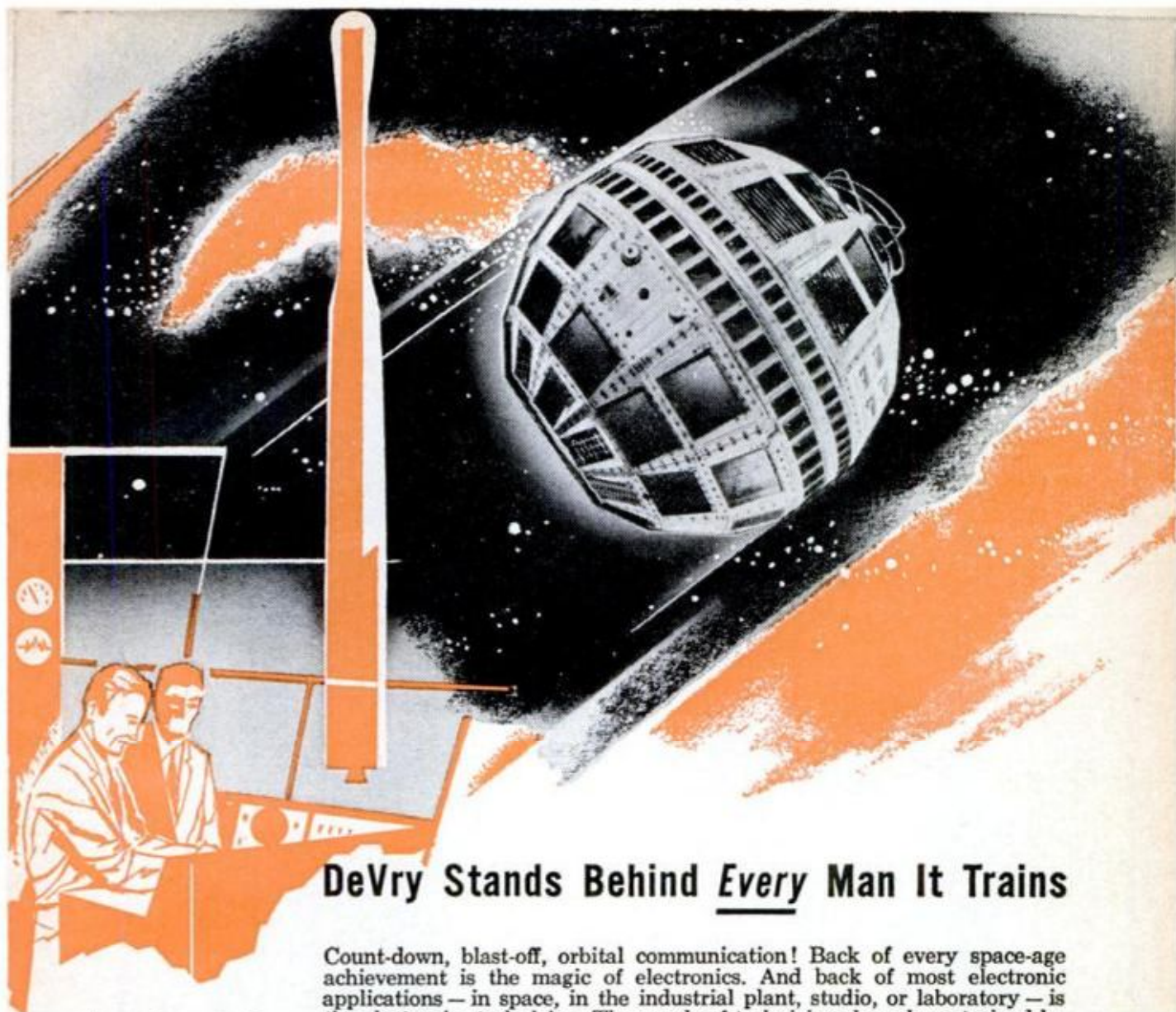
By William R. Kreh

Taking it easy in a foil-covered hammock may sound like pleasant duty, but it's being done in deadly seriousness at the Naval Medical Research Institute in Bethesda, Md., where scientists are running tests to determine when a person sweats and why. In these tests a volunteer lies in a specially constructed hammock called a "calorimeter." The hammock is lined with a light foil, patterned with recording instruments. These instruments measure, at many points on the body, the heat carried off by radiation and convection, as well as the amount of heat carried off the surface of the skin by sweat. In addition to these measurements from the skin, the scientists also measure the temperature of that point of the brain which perceives inner body temperature and sends out impulses which are translated as comfort or discomfort. Through the tests, scientists hope to have a more complete knowledge of what makes a comfortable human environment.

✓ ✓ ✓  
**Paper shuffler.** Private First Class R. Gregory Meese has one of the Army's most unusual jobs. In a laboratory at Fort Belvoir, Va., his job is to find more uses for paper. Right now he's trying to create a paper fabric that can be used for camouflage netting and another fabric that can be used to make paper sandbags. Other projects in the offing are paper strapping, rope, belt webbing and even paper tents.

✓ ✓ ✓  
**Rats that rate.** Some Chicago rats will be getting a lot of personal attention for the next two years. They'll be under the constant care of a nutritionist, a biochemist, a toxicologist, a pathologist and half a dozen technicians. But they won't eat so well. The rodents will get nothing to eat during their entire lifetime except spirodella (duckweed plant) and clorella (algae). Second and third generation offspring will also get the monotonous diet. Under Air Force contract, scientists in a Chicago lab will check on the effects of the diet as part of an effort to provide a life-support system that will maintain a man in a completely sealed environment in space for long periods of time. The rat research is a first step in seeing whether these types of water plants could be used as food on space flights.

POPULAR MECHANICS



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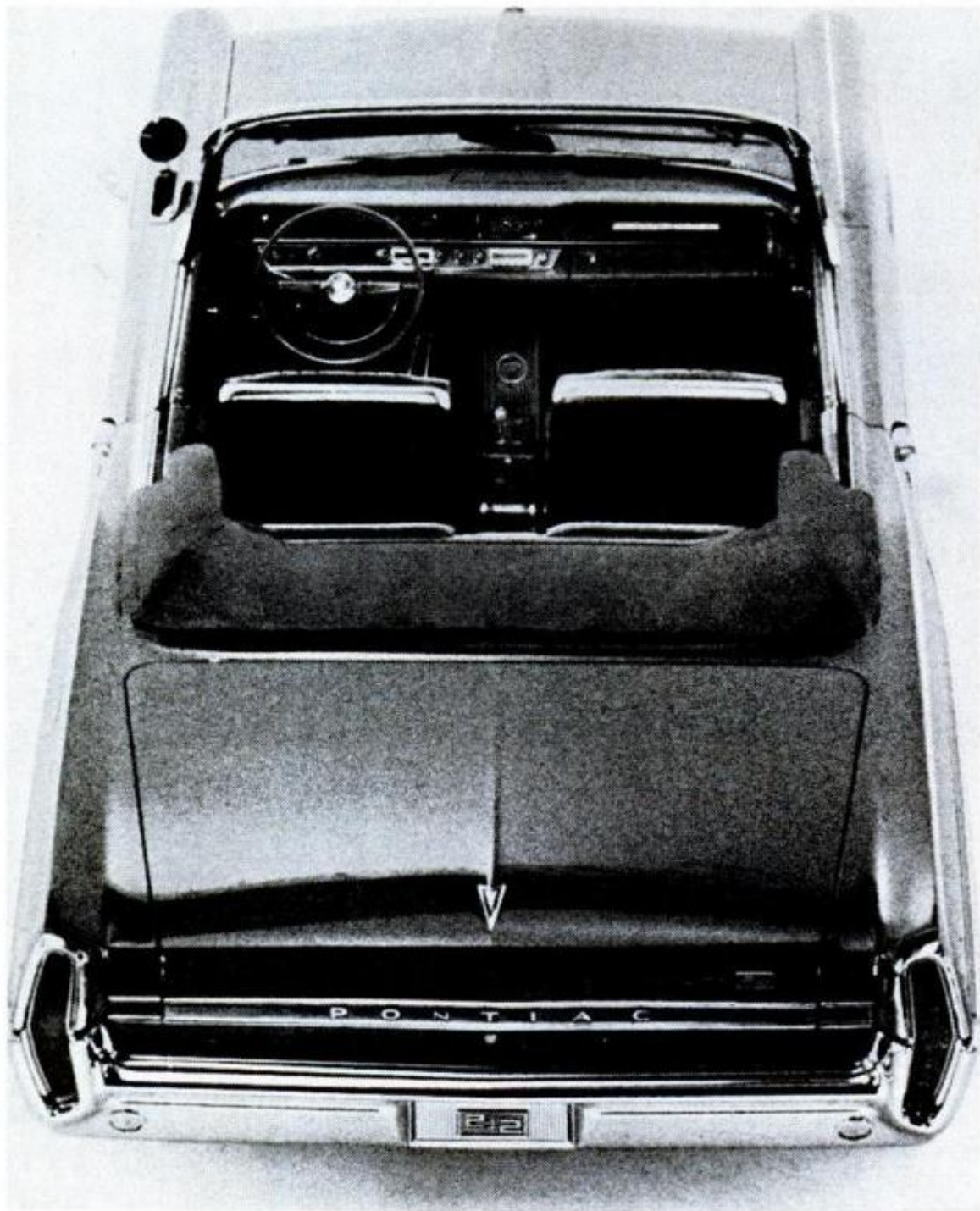
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## *A couple of terrible things just*



Pity the poor men who turn out other brands of cars and then have to look at something like our '64 Catalina 2+2, say we happily. (Not that looks are everything, you understand, but you don't catch us hiding Pontiac's power team under a ho-hum body.)

The 2+2 commences proceedings with a high compression

283-horse 389-incher for the 4-speed box (267 bhp with Hydra-Matic), but there's nothing to stop you from playing footsie with one of our three 421-inchers\*. Take your pick—320, 350 and 370 bhp at your command. Available only with optional at extra-cost 4-speed or Hydra-Matic, with the shift in a central console.

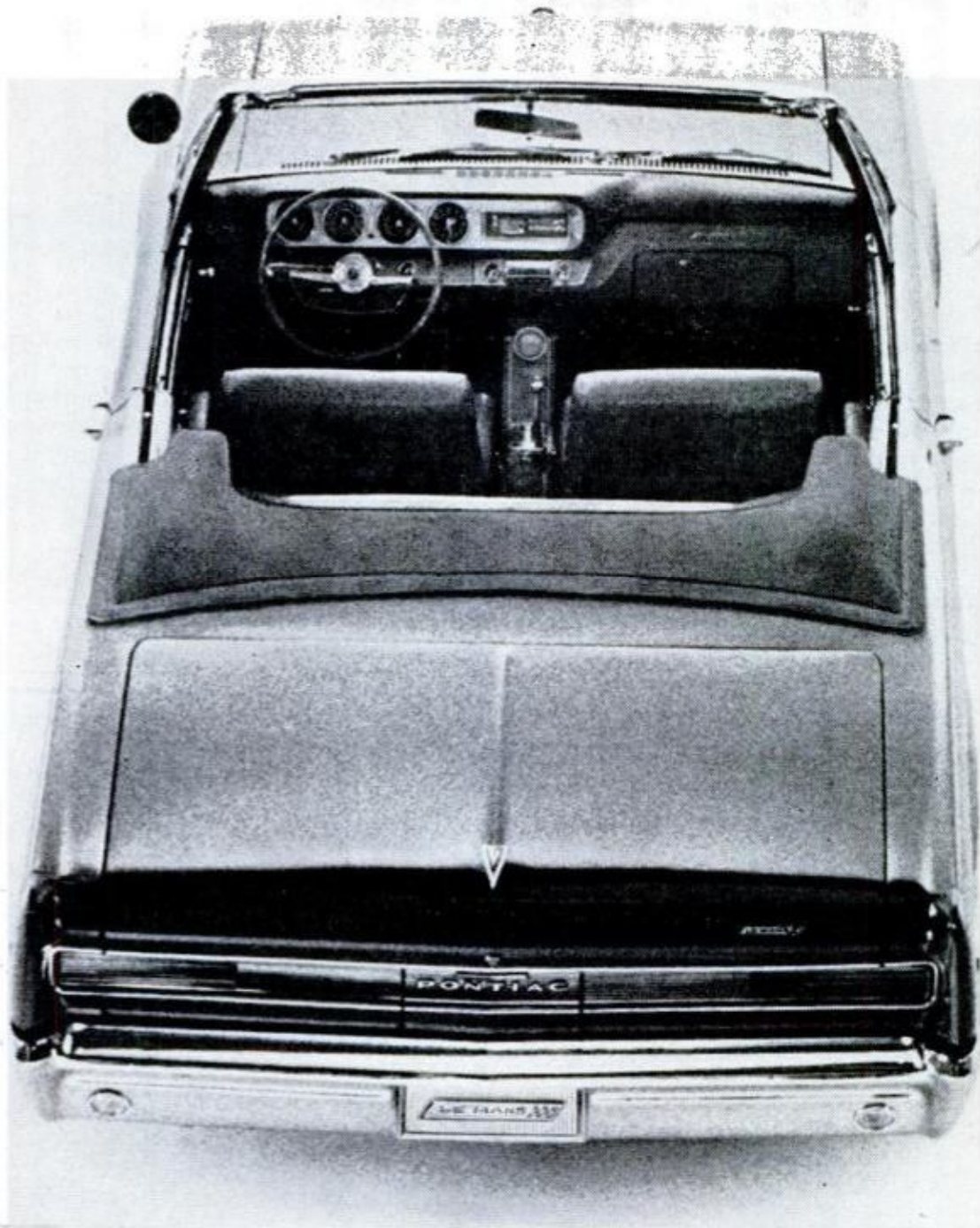
There are two of these cars—

sports coupe and convertible—both with bucket seats and both with their own individual interior styling.

Considering the range of options and accessories we've got, no two 2+2's need be alike. Know just the kind of car you want? Put it on paper for your Pontiac dealer and we'll turn it into metal.



*happened to our competitors.*



Ask us what's new with Le Mans (and every Tempest) for '64 and we'll pour you an earful.

Take engines: the standard plant is now an in-line 6 of 215 inches and 140 horses—and there's a duo of 326-inch V-8s\* at 250 and 280 horses.

Frame?—It's a new swept-hip

perimeter Pontiac type.

Suspension?—Pontiac-type 4-coil, independent front, 4-link rear.

Options?—Tempest is a Pontiac, right? And Pontiac is noted for its options, right? So naturally, there's everything from a 4-speed\* for both 6 and V-8s to a

limited-slip differential\* with a staggering array of no-extra-cost axle ratios.

Anything else? Not much, unless you count bigger brakes . . . longer, 115" wheelbase . . . larger gas tank . . . new steering gear . . . curved side glass . . . and so on. And on. (And on.)

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**Both by the Builder of the Wide-Track Cars**

PONTIAC MOTOR DIVISION • GENERAL MOTORS CORPORATION

NOVEMBER 1963

15



## for good measure

...Stewart-Warner Custom Gauges. They give you the precise information you need to detect and correct engine-system problems before they get serious. No guesswork and no 'warning light confusion.'

Whatever you need in an automotive gauge, rely on Stewart-Warner to supply it. The S-W "2 in 1" Gauge Cluster (above), for example, is a handsome combo unit that features an ammeter and an oil pressure gauge...fits all cars. Other popular Stewart-Warner gauges include: the S-W *Motor-Minder*, a favorite of

mechanics for checking engine performance ...and the S-W *Volt-Guard*, a special gauge for checking battery condition, generator and voltage regulator. Ask your dealer about the *full-line* of reliable Stewart-Warner Custom Gauges...from the most complete line of automotive instruments in America.



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Are you wearing out your motor tens of thousands of miles (or hours) too soon? Are you losing compression, power, gas economy?

Experts know that one mile on contaminated oil causes more wear than a trip across the country! Everyone knows how bad oil produces pitted rings, sticky valves, fuel blow-by, piston slap, lost compression, etc.

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It's not just a costly overhaul: the motor is never as good, and you're without it for days to weeks.

The U. S. Govt., fleet owners, diesel owners, taxi owners, and other motor users get 2 to 3 times the service from their engines compared to other users . . . and these users

take no chances with bad oil. That's why the Simplex Oil Tester Kit is used by governments of U.S., Canada, France, Belgium, etc. . . . and such industrial giants as Bethlehem and U. S. Steel, Goodyear, American Tobacco, DuPont, Int. Harvester, and hundreds of others too numerous to mention.

In a minute or two, the Simplex Oil Tester reveals: whether oil is pure or needs immediate changing; condition of oil filter, acid contaminants, any small leak in head, block, etc., fouled spark plugs, and improperly adjusted thermostat.

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So one test can pay for the Kit a hundredfold! Use it before buying ANY motor, new or used. You'll learn things an expert couldn't tell you without pulling the motor apart.



#### HOW IT WORKS

(1) Put one drop of motor oil on our specially treated Simplex papers. (2) Place 2 drops of oil in vial with special chemicals. Shake well. (3) Compare according to easy instructions with Kit. You'll read instantly the oil's condition, without dials, calculation, etc.

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August 15, 1963

## Boys

After five weeks of basic training, these airmen seem to walk a foot taller in their Air Force blue.

But the Air Force does more than give you pride and confidence. It gives you the chance to work for the future—your country's and your own—the chance to build a career on the Aerospace Team.

You'll learn a vital Aerospace skill, such as guided missile systems...aircraft maintenance...



September 22, 1963

## Men

...photography. Under "Operation Bootstrap," you'll have an opportunity to continue your formal education—even earn a college degree.

And all the while, you'll be helping America to maintain its lead in the Aerospace Age! Remember, the Air Force gives you an aptitude test before you enlist, without obligation. So get a blueprint of your future from your Air Force recruiter.

# U. S. Air Force

# Items from All Outdoors

For the man who has everything, you can now buy a buffalo. If you have a large enough back yard you can buy one alive for \$165. But you can also get one frozen and ready for the oven for \$270. The animals are available when the herds are thinned at the national wildlife refuges, and you can get information by writing: Fish and Wildlife Service, Dept. of the Interior, Washington, D.C. There is one hitch: The government doesn't deliver.

Electricity is now pushing the Spartan camper further into the wilderness. On the western slope of the High Sierras, 50 miles from Fresno, Calif., Southern California Edison Co. has opened a camp that not only has electric outlets at all 100 camp sites, but features electric stoves, hot water showers and electric barbecues.

Two outdoors books have joined our library in the past year, and both are excellent compilations of practical information about their respective fields. *Complete Book of Camping* by Leonard Miracle and Maurice Decker is published by Harper & Bros., and covers everything you might want to know about all kinds of camping. *Every Sportsman's Cookbook* by Maxine Atherton is published by MacMillan Co., and has become

our bible for camp cookery. Following her directions we have actually baked a chocolate cake on an open fire, made salads of wild plants, and eaten woodchuck cooked three different ways.

Two questions often asked about shooting were answered by the experts at Winchester-Western. The word *magnum* comes from the Latin *magnus* meaning "great." A magnum cartridge is one that produces more power and speed than a standard cartridge. The gauge of a shotgun is determined by the number of lead balls the exact size of the barrel that it takes to weigh a pound. The designation .410 in a shotgun is not gauge; it's a caliber.

New for outdoors is a naphtha-fueled heater that is the size of a small coffee pot and gives off 2400 B.T.U.s for 20 hours on one fueling. It would be a welcome companion in a duck blind or ice-fishing shanty. Named the "Sportsman," it is priced at \$24.95 from Therm'x Corp., Inc., 1268 Folsom St., San Francisco, Cal. . . . For anyone who leaves the beaten path and sources of pure water, "Water-for-Living," gives you purified water without the objectionable taste of iodine tablets. This is a pint-size plastic bottle containing a gravel-like chemical that will treat six gallons of water before recharging. You simply fill the flask from any water source, let it sit five minutes, then drink it. It sells for \$6.95 from General Ionics Corp., 101 Terence Dr., Pittsburgh, Pa.

STUART JAMES  
Outdoors Editor

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BEP-82

# CLINIC FOR HOMEOWNERS

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**Q** There's a persistent leak at a joint in a long run of gutter on the north side of my home. It's in a box gutter and I've tried every way I know to stop it, even soldering. There appears to be no rust or other damage as gutters have been regularly painted inside and out. What else can one do?—D.H., Tenn.

**A** You do not list all the measures you have already taken, but have you tried an epoxy-fabric patch? Usually this can be relied on to stop any gutter leak through an opening less than  $\frac{1}{4}$ -in. or so. If the gutter was originally soldered at the leaking joint, then it is likely that the lengths were butt-joined and that the solder has let go due to the stress of expansion or contraction. Such a leak is usually difficult to pin-point and repair. Mix a batch of epoxy cement and coat the joint, extending the coating each way about 3 to 4 in. Then cut a piece of clean cloth (unbleached muslin will do), and lay on the epoxy coating, pressing into close contact. Use a small stick for this purpose; don't touch the mix with your fingers. Follow this step with a second coating of the cement, extending the coating beyond the edges of the cloth. Check the instructions accompanying the epoxy.

**Q** Recently I painted a room, the walls of which had been papered. I had to patch several large cracks and one small opening. Now, after applying two coats of paint the patches still show through, one on the ceiling being especially prominent. What do I do now, with the room newly painted?—M.T., Utah

**A** You'll probably have to repaint the affected areas, corner to corner. Usually there are two reasons for plaster patches showing through paint: (1) The patching material may not be flush with the adjacent surface and (2) the patching material tends to absorb the liquids in the new paint to a greater extent than does the older plaster, causing the paint over the patch to dry more nearly flat than that on the surrounding surface. Probably the best thing to do now is to spot-coat the patches with an undercoater and then repaint the ceiling and patched walls.



Buick Motor Division

## ***Everybody out of the rut...the '64 Buicks are here!***

Our happiest problem for '64 was: how to beat a winner? According to thousands of owners, the 1963 models just about had it made in all departments. But—when your name is *Buick*—you just don't rest on your laurels. You keep pushing to make a great car greater. So . . . the '64 Buicks are new—but *new*. New engines, V-6 or V-8 (you'll like their new gas economy), new, smoother, extra-cost option, Super Turbine Transmissions (and who, but Buick, would build in an altitude compensator?). Youngest looking Fisher Bodies in town! Visit a showroom, sit in any one of the new Buicks, and practice this short easy line: "My Buick." Sounds good, doesn't it?

***...above all, they're BUICKS!***

# Tune in on the Inventors



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Priced the same in Canada

**Golfers** can find out whether their swings are in line with a swing analyzer invented by Thomas F. Williams of Dayton, Ohio. Patent 3,101,949 describes a box-like base with colored markers projecting from both sides. On practice swings, the markers leave color daubs on the club indicating such atrocities as overreaching, slicing, topping and wrist roll.

**Elusive fish** can be netted with an improved fish detector for which four British inventors received patent 3,098,210. It's an underwater ultrasonic echo-sounding system which blocks out strong bottom echoes, permitting the weak signals reflected by fish swimming near the ocean floor to stand out clearly.

**An artificial heart** driven by a motor worn outside the body has been invented by ventriloquist Paul Winchell. Though not yet tested on human patients, it could take over the task of circulating the blood without strain to supporting organs. It received patent 3,097,366.

**Chicken farmers** may soon equip their broods with aprons. Frank J. Lipman of Augusta, Me., received patent 3,101,696 for an apronlike cover that would protect the breasts of growing chickens from injury, thus increasing their market value.

**Heart patients** can now get relief from pulmonary congestion with a new tourniquet which automatically provides alternate pressures to arms and legs at set intervals of time. Designed for use by floor nurses, the device was invented by Dr. William Parry Murphy, Jr., of Miami, Fla. It received patent 3,101,085.

**Tipplers** with a sweet tooth may soon be able to find solace in a new alcoholic beverage which is fermented from (and retains the fragrance of) honey. Patent 3,100,706 went to Stuart L. Adams of Anchorage, Ky., and George V. Niesen of Louisville, Ky.

**Cigarettes** made of ground corncobs provide the puff that refreshes—without nicotine. William C. Schmidt of Indianapolis, Ind., recently received patent 3,100,492 for a new adaptation of this tobacco substitute.





LONG RANGE

# POWER

## GERMAN BINOCULARS



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BECAUSE OF STRIKE

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- 3 Rugged Lightweight Bakelite Body—view for hours without arm fatigue.
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- 7 Deep Lens Insert to prevent scratching.



BASEBALL



VACATIONS



BOXING

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The recent dock worker's strike almost bankrupted one of West Germany's leading binocular manufacturers. He could not ship a single binocular thru New York. He was in dire need of cash. We bought his entire U.S. quota for our American customers. Close to one million of these quality binoculars were sold in U.S., Canada, Europe and South America. Now you can grab yourself a pair for \$4.84—rushed to your door tax paid and postage paid! Far lower priced than a pair of weak Japanese opera glasses!

**Improved 1963 Model from 100 Year Factory**  
West Germany's legendary know-how is reflected in this improved 1963 model. Made in a century-old factory, renowned for its craftsmanship. For instance, each binocular undergoes 57 tests for performance! Objectives interior coated with costly Magnesium Fluoride. Rugged bakelite-aluminum construction for long life, light weight. A GIANT binocular of power! Long range lenses measure 50 millimeters across!

**Enjoy Sensational Views to 50 Miles!**  
Natural wonders magnified and brought closer—to 50 miles or more. We can't mention the famous brand during this sale—but certainly this is one of the world's most famous brands. You'll recognize the famous name instantly when you see them. Yet they're yours at only 4.84—complete!

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Don't confuse with cheap, imported models with plastic lenses. Only genuine ROTHLAR lenses used—made of true optical glass—expertly ground and highly polished! One look and you'll see the big difference—instantly!

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Free repairs or replacement within 1 year of purchase date, against any manufacturing defect. Each binocular undergoes 57 different tests for performance. This guarantee applies to all parts including lenses, focusing mechanism and mountings. No charge for parts or labor.

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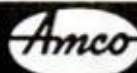
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POWER  
SAW**

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f.o.b. factory. Wt. 25 lbs.

Includes completely assembled cast iron and steel 8" tilt arbor power saw with ground cast iron table . . . less blade. If desired, RIP FENCE for easier work alignment, \$3.50 additional



**REVOLUTIONARY PATENTS DECREASE COSTS, INCREASE EFFICIENCY**  
Full scale power tools of heavy duty 100% cast iron and steel. Streamlined design reduces weight, cuts material and production costs. Special patents provide added efficiency, accuracy, savings. Parts made, assembled, tested and packed right in our own factories, shipped direct . . . save store profits.

**DOES WORK OF \$75 BENCH SAW** as is. Converts easily to equal any \$300 floor model cabinet units! Crosscuts, rips, mitres, cuts compound angles, dadoes, makes coves and mouldings. **FREE CABINET BASE PLANS** Use as portable bench saw as received (inset photo) . . . or transform easily and inexpensively into floor model (as shown) guar. to do work of floor models costing \$300. **FREE plans** . . . sheet of 3/4" plywood and 3-4 hours are all you'll need. Use your AMCO saw for cutting. Plans provide 27" x 24" work surface, 33" height, pullout sawdust bin, tool storage compartment. **UNCONDITIONAL 10 YEAR GUARANTEE**

**BLADE TILTS . . . TABLE STAYS LEVEL**  
• Locks securely at any angle to 50°, raises, lowers 0"-2 1/4" • Patented tilt mechanism, accurate etched scale • Patented motor mount takes std. 1/4 h.p. or larger motor, keeps belt tight, assures perfect alignment at any angle, transmits full power • Takes std. blade, saw insert removes to take dadoe heads, cutters, etc. (not incl.) • Accurate mitre gauge assembly • Ground spindle • Enclosed steel base • "Compo" bearings • Accessories available at factory prices • RIP FENCE, if desired for easier work alignment; Std. size (for bench saw) \$3.50; larger fence (for cabinet base, as ill'd.) \$4.50.

**6" SWING  
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**\$9<sup>85</sup>**

f.o.b. factory

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Complete as shown  
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• Precision ground cast iron tables, adjustable for depth of cut • Rigid cast iron base • New patent-pending design holds clearance between knives and tables at any depth • Rabbet depth 3/8" • Hardened, ground high speed steel knives • Patent-pending fence adjustable to any position, any angle 0°-50° • Patent pending lift-off guard (nothing to loosen!) • Balanced steel cutter head. **UNCONDITIONAL 10-YEAR GUARANTEE.**

**4" BELT  
BENCH SANDER**

**\$19<sup>95</sup>**

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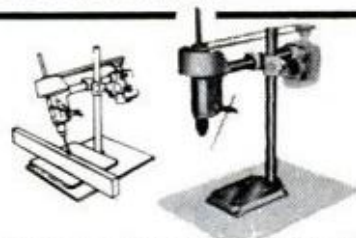
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Batters can muff a hit 26 different ways, according to a Stanford University physicist. Thirteen factors must be taken into account when a slugger steps up to the plate, and since an error can spring from these factors in two ways—too much or too little—the batter has a choice of 26 different excuses as to why he didn't connect. The 13 factors are: Three coordinates of the bat's position (up-down, forward-backward, in-out), three each of tilt, speed and swing angle and one of timing.

Primitive cave drawings uncovered recently near a copper mine in Peru have been tested and found to be more than 9000 years old. They represent the oldest known traces of civilization in that South American country.

Creative people often may be a pain in the neck to the less talented. They thrive on disorder, are indifferent to what other people think and are repelled by conformist attitudes. They're also prone to schizoid, depressive, hysterical and other psychopathic tendencies; but they're better able to cope with such conditions than ordinary souls because they have greater resources within themselves—in short, bigger egos. These conclusions came out of a study of 56 professional and 10 student writers, all creative personalities, at the University of California.

Quick thinking by an officer of the Israeli trawler *Asgad* saved a crew member's eye recently. The craft was 300 miles from home base when a seaman's eye became infected from a steel splinter and vision in the eye was lost. Mordechai Cohen dismantled the *Asgad's* radar and, using its magnet, pulled out the splinter. The eye healed and sight was restored.

Ancient villages of the Hopewell people, the mound builders, were recently uncovered for the first time. Scientists from

(Please turn to page 32)

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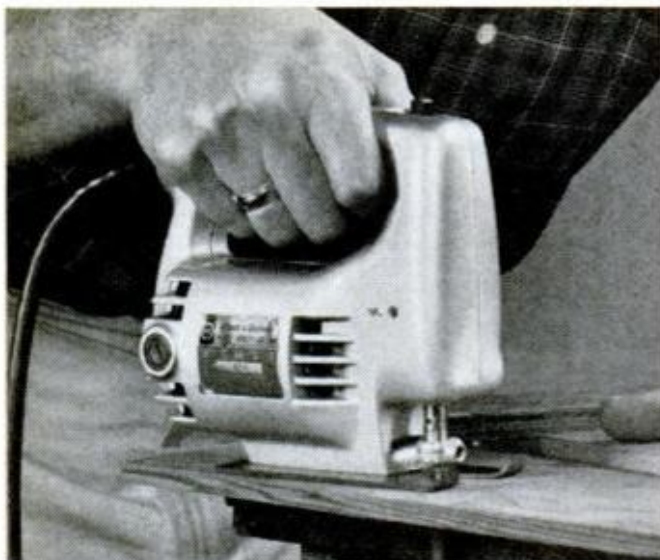
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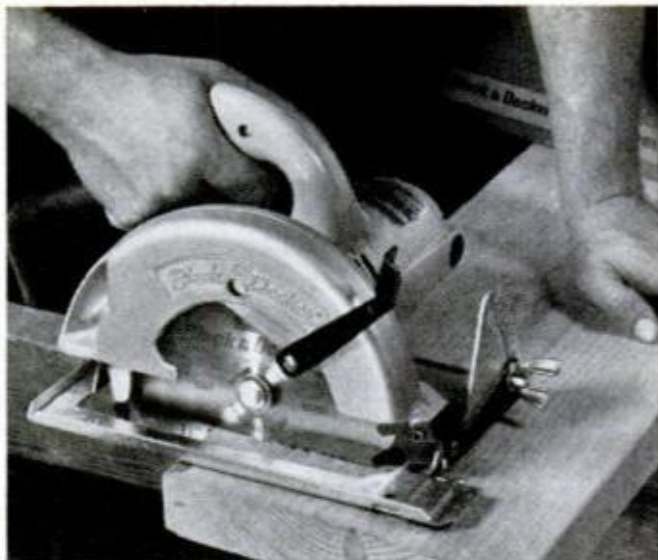
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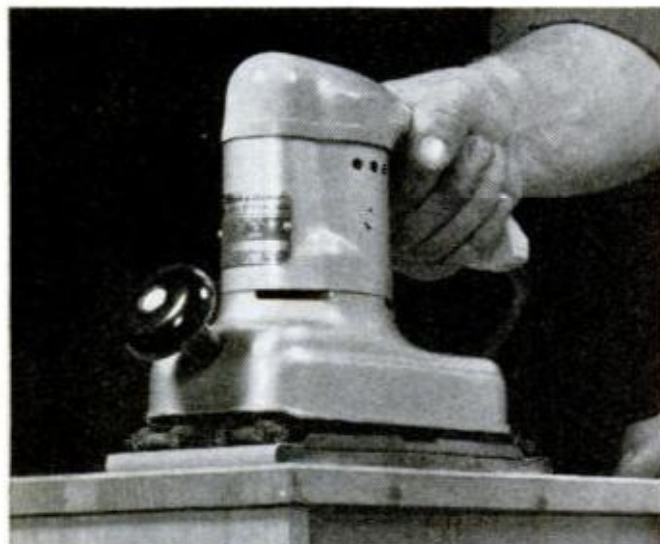




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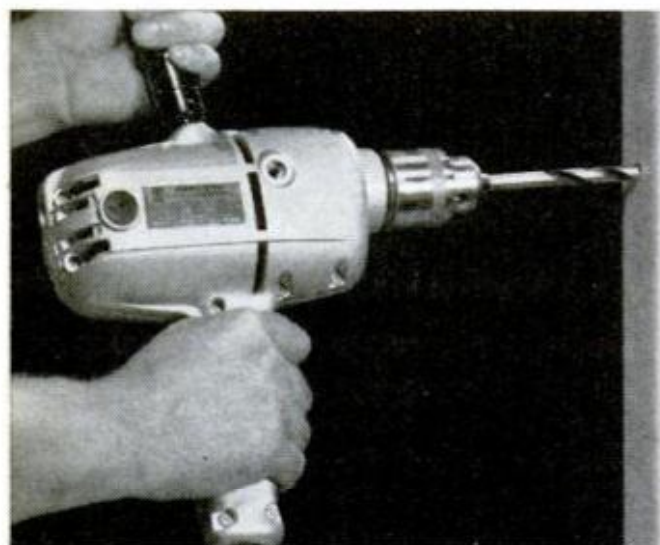


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## Science Worldwide

(Continued from page 28)

Case Institute of Technology found the sites about five miles south of Chillicothe, Ohio. Estimated to be 2000 years old, the sites have yielded evidence of elaborate pottery techniques and advanced farming methods. Indications are that the Hopewells had extensive connections with the Aztecs of Mexico.



**Iodine compounds** may be less objectionable than chlorine for disinfecting swimming pools, Stanford University researchers say. Tests showed that few swimmers complain about eye or inhalation discomfort in iodine-treated pools.



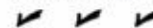
**Contact** may have been made between prehistoric Japan and Ecuador more than 5000 years ago. Papers published by the Smithsonian Institution say that resemblances between artifacts of the Valdivia culture in Ecuador and the Jomon period in Japan are striking. Scientists speculate that typhoons could have driven Japanese ships of 3000 B.C. off course westward to the coast of Ecuador where equatorial currents converge.



**Copping carts** no longer is possible at one chain of supermarkets. To stop people from wheeling the \$35 carts away from the store and not returning them, magnets are planted around entrances and exits to the stores' parking lots. Special casters on the carts lock when they pass over a magnetic field. The carts remain glued to the spot until a special key is passed along the locked wheels by a store employe, opening the magnetic field.



**Sugar maples** along roadways are slowly being poisoned by salt de-icing in winter, according to agricultural researchers in New Hampshire. Salty drainage attacks the trees through the roots, causing premature fall coloration and eventual death. Evergreens, such as pines and hemlock, are damaged by salty slush from passing cars falling on branches and needles.



**The solar eclipse** over Maine last July disclosed a faint new comet near the sun. A Belgian astrophysicist, Dr. Francois V. Dossin, discovered the newcomer with photos taken during the 60 seconds of total eclipse. He used a blue-green lens filter to bring out the light of carbon molecules in the comet.

*John P. McNeel*  
Science Editor



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Capt. Fred Ewing, who created the Air Force's Sea Survival School described in an article beginning on page 112, often hears from some of its graduates who were subsequently forced to use its training. One fighter pilot, who collided with another jet at night over the Atlantic, described his bail-out and subsequent rescue as "a piece of cake."

Ewing, who has since moved to headquarters of the Tactical Air Command, recalls another incident on the streets of downtown Tokyo, Japan. And, for those who haven't been there, traffic in downtown Tokyo is like D-Day. An average of five persons are killed in traffic accidents *every day!* Ewing was stopped for a light when another car, going in the opposite direction, screeched to a halt. The driver jumped out, sidestepped through the maze of speeding cars, ignoring the Nipponese curses, and dashed over to Ewing's car.

"Ewing, you old son of a gun," he said, "you saved my life."

It was another former student, a pilot

of a cargo plane, who was forced down with his crew over the Pacific. All survived, using the techniques taught in the school. PS—He also survived the trip back to his car.

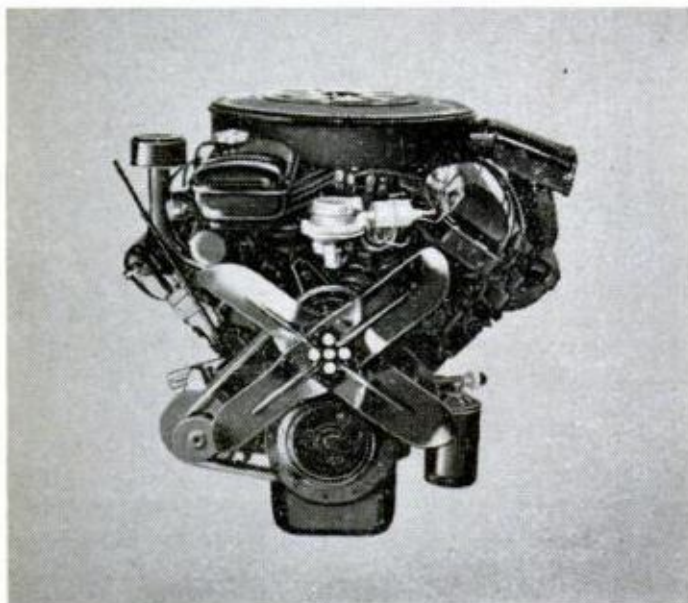
Actual ground speed, a figure devoutly wished for by pilots but never really known without some calculation en route, will now be available instantly and constantly on the instrument panel.

A ground-speed indicator, based on measuring changes in distance and direction to radio beacons, has been developed. It will work in conjunction with current distance-measuring equipment. The DME indicates distance of the plane to or from a station. The GSI will translate this into actual ground-speed readings on another dial.

Midair collisions may be eliminated by a new radar system that automatically provides a pictorial display over a full 360-degree area around an aircraft.

Designed for military formation flying, the system depends on transceivers and display devices installed in two or more "cooperating" aircraft.

*Kevin V. Brown*  
 Aviation Editor



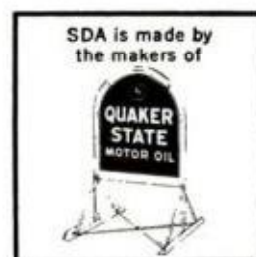
**Get peak performance  
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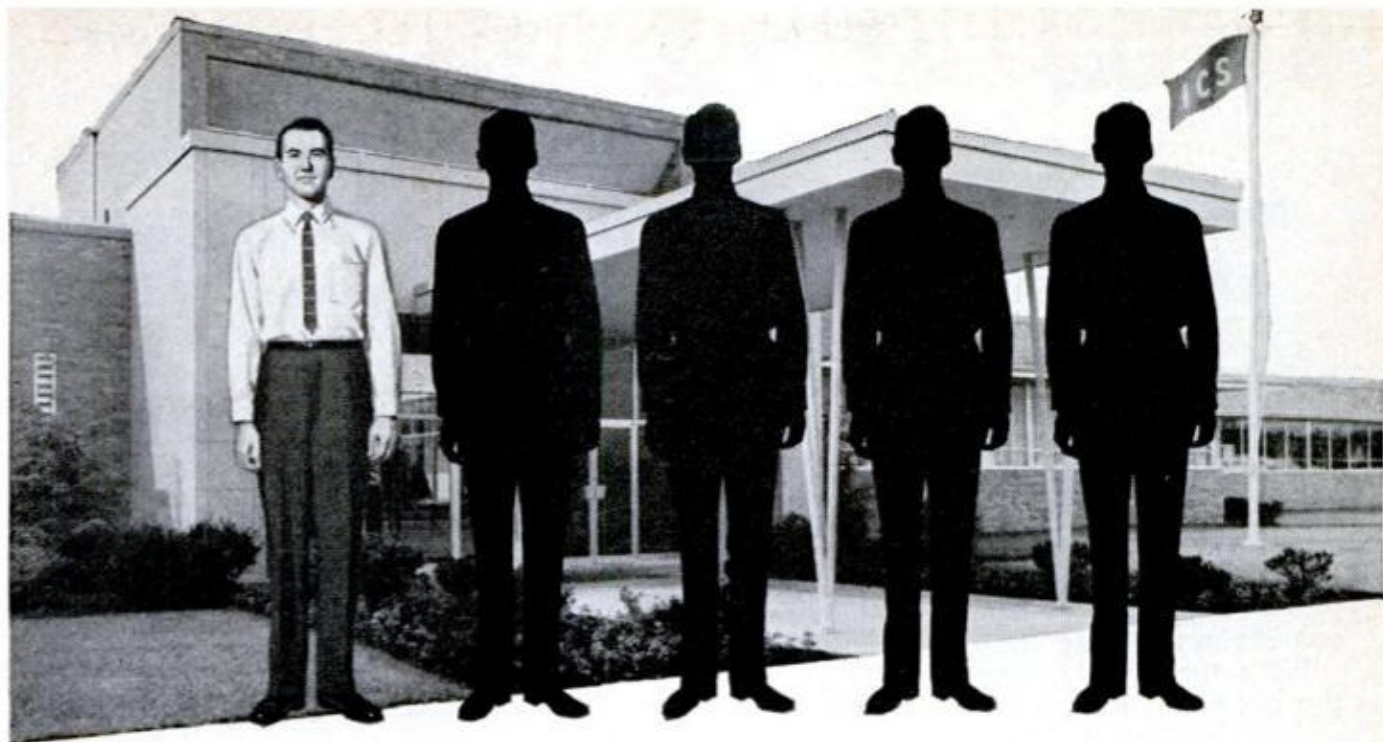
This is tune-up time . . . time to ask your service man for Quaker State SDA. This super detergent additive in your crankcase oil peps up tired engines, restores full power. SDA dissolves away power-robbing varnish and sludge deposits, frees up sticking valves, and prevents rust and corrosion. The result—better engine

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By Jim Whipple



## New Roll-Up Seat Belts For the 1964 Crop of Cars. Expect a Ford-Powered Sweep at Indy Next May

Seat belts are here to stay. After a false start back in '56 and gradual growth over the last three years the public has shown Detroit that it's really interested.

A recent survey showed that **GM** cars have installed seat belts on 19.5 percent of its cars on the assembly line in response to orders; **Ford** 15.6 percent, **Chrysler** 12 percent, **Studebaker** 7 percent and **American Motors** 22 percent.

With the trend going in an up curve the big companies have followed the lead of little **Volvo** and **Studebaker**. **GM**, **Ford Motor Co.**, **American Motors** and **Chrysler** will install front seat belts in all models of their cars starting Jan. 1, 1964.

The cost of the belts will be added to the base price of the car and this will not show on the Federal price sticker.

The major objection to wearing of seat belts has stemmed not from the principle of using them, but from the problems of wearing them. You know the scene: outside belt gets caught under the door, gets wet, muddy while center-of-the-car buckles, slides between cushions.

All these petty annoyances which have let belts lie unused will be things of the past thanks to Roll-a-Belt. This device made by Borg-Warner Corp., Bellwood, Ill. is so simple you wonder why it wasn't thought of before. It uses a little roller containing a spring which is clipped onto the belts. When you release a belt the spring winds the slack around the roller leaving you enough to grasp easily.

A laboratory toy no longer (*PM* Dec. 1961, p. 71) the Wankel rotating combustion engine is to power a production car in 1964. NSU Motorenwerke, AG of Neckarsulm, Germany will commence production of the **NSU Spider**, a convertible sports roadster with a rear mounted single-rotor rotating combustion engine displacing 500 cubic centimeters (31 cubic inches) and rated at 64 horsepower.

Recently unveiled at Germany's national auto show in Frankfurt, the Spider carries its rotating engine in the rear, beneath the luggage compartment, while the

radiator for its water cooling system is mounted ahead of the front luggage compartment. According to NSU the car will be sold in the U.S. sometime in 1964.

The **Indianapolis Revolution** is in full swing. The aftermath of last Memorial Day's showing (*PM* May 1963, p. 69) at the brickyard which saw the radically new (for Indy's squarish oval) **Ford**-engined **Lotus** cars take Second and Ninth places, is a bumper crop of rumors to the effect that designer Colin Chapman's "new era" cars and their sturdy gas-fueled **Ford** V-8 engines will be busting out all over the track next season.

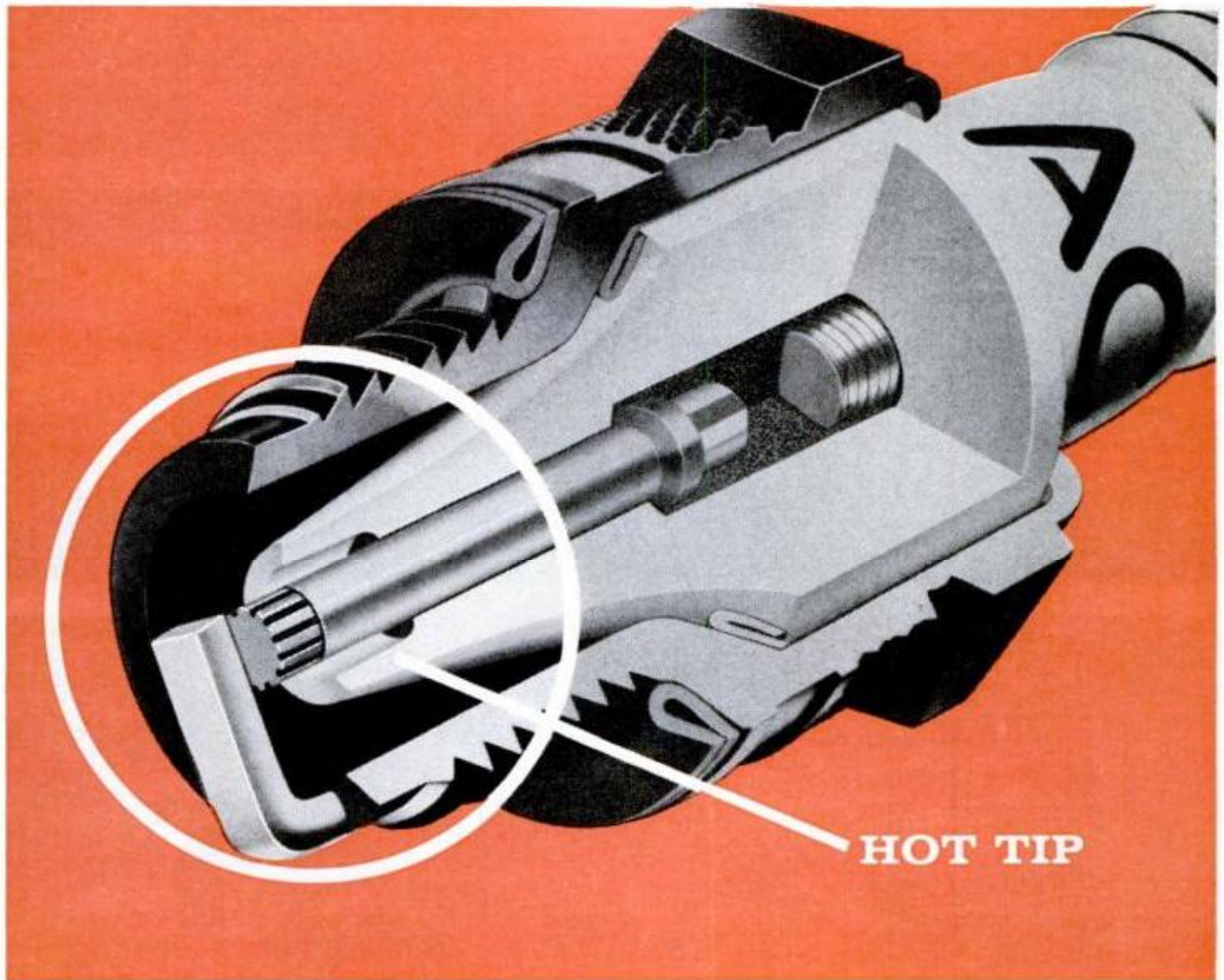
Ford is said to have ordered six cars from Chapman for the '64 race and is reported to be signing up the six hottest drivers to pilot them. Among the six we'd expect to find Jimmie Clark and Dan Gurney of course, with Parnelli Jones, Roger Ward and A. J. Foyt thrown in to make it a Royal Flush in the Ford pits.

Just to complete the landslide, **Ford** is also reported to be making a limited number of its "Indy V8s" available to competitive (i.e. non-Ford Team) entries who would probably be using **Lotus**-type chassis designed by such California pros as A. J. Watson. This is not only a sporting move, but one calculated to improve the breed through encouraging the design of lighter, more controllable cars. At least some of **Ford**'s V8s at Indy next May 30th will have dual valves (four per cylinder) and overhead camshafts. They should be the breathingest engines ever to inhale gasoline vapor.

All this means that the auto museums may soon be bidding on the Offenhauser-powered roadsters that have had such a long and glorious history at the brickyard.

The very latest word is that Ford has "made peace" with Mickey Thompson and will supply him with hot V8s for his "way out Go Karts" that ran **Chevy** V8s in the '63 race. Thus, the "get up and go" boys at **Ford** will make sure that Chevrolet and other GM divisions are non-racing in deed as well as in word.

# AC Spark Plug Tip Design helps you boost power, boost mileage

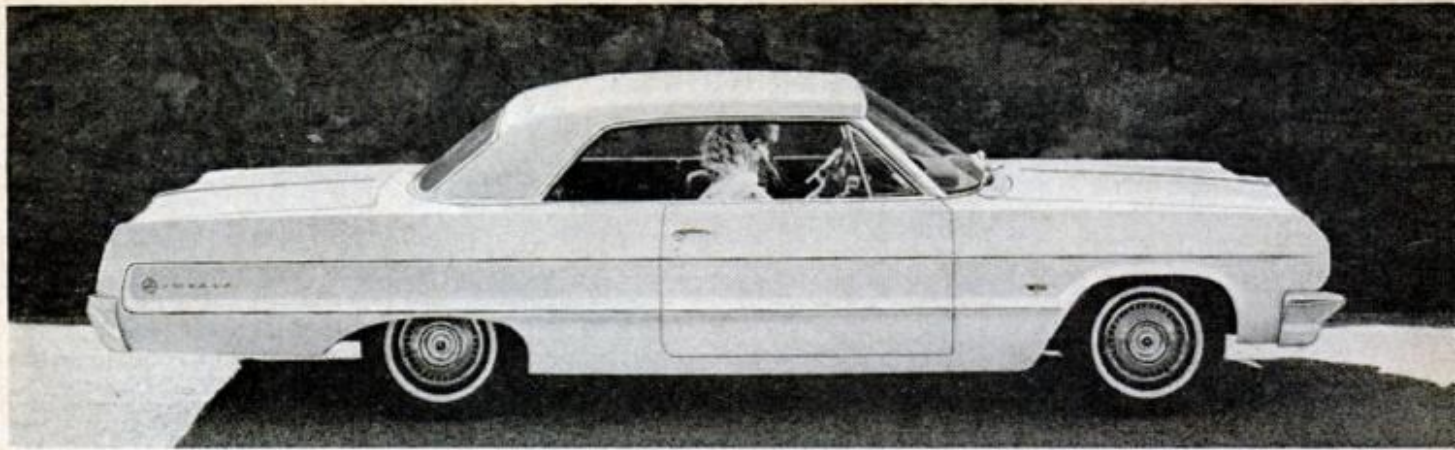


Where other spark plug insulators hug the center electrode all the way to the tip, the AC insulator is recessed, at the end. This deeply recessed insulator tip heats faster, cools faster, to promote AC's exclusive self-cleaning action. The thinner tip leaves more space around the insulator for better scrubbing action by swirling hot combustion gases. Result: less fouling, better sparking that helps you get more power, more mileage. Look for the recessed tip when buying spark plugs for your car. Only AC has this Hot Tip—so insist on AC Fire-Ring Spark Plugs when you buy.



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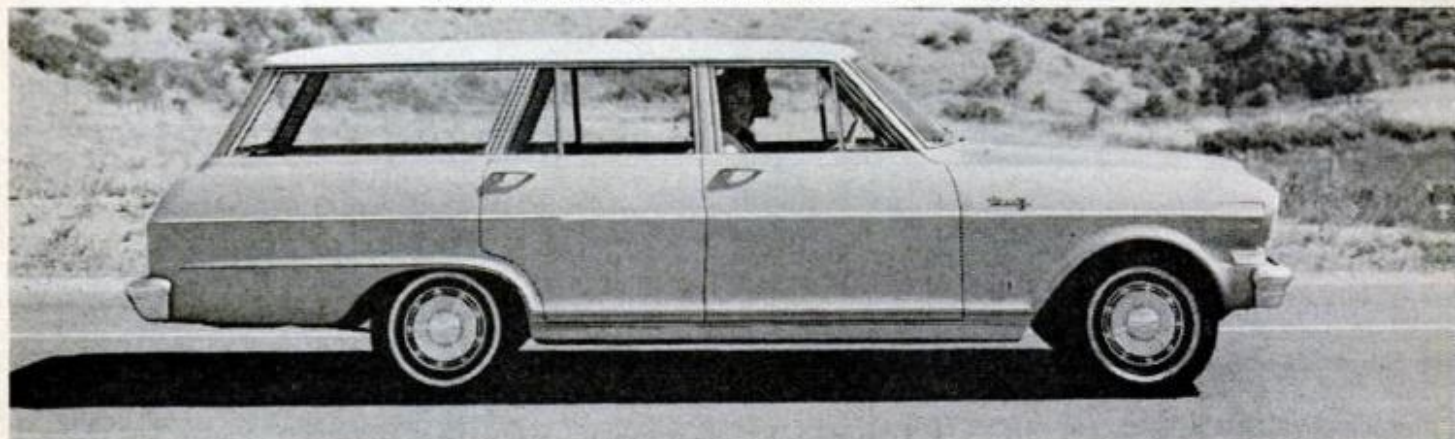
AC SPARK PLUG  THE ELECTRONICS DIVISION OF GENERAL MOTORS



Impala Sport Coupe—one of 15 new models in four series



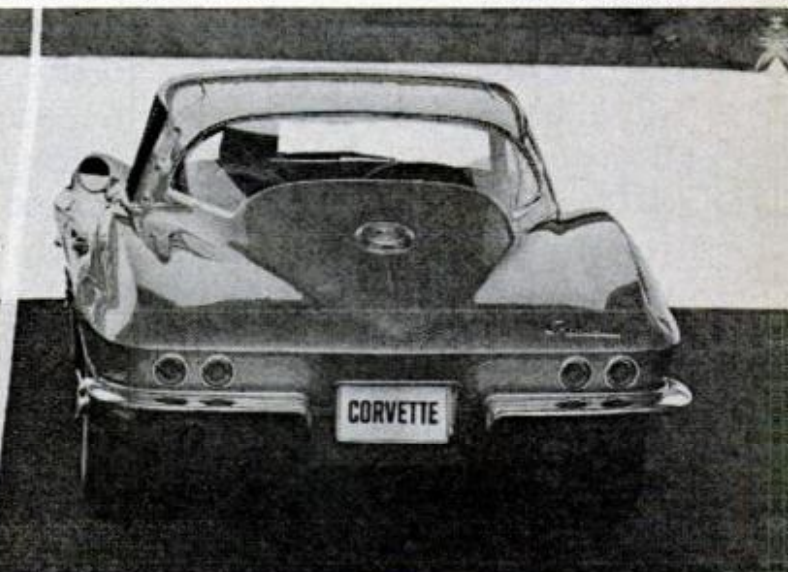
Chevelle Malibu Super Sport Coupe—one of 11 models in three series



More powerful Corvair Monza Convertible

Chevy II Nova 4-Door Six-Passenger Wagon

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# '64 JET-SMOOTH LUXURY CHEVROLET

A CAR THAT'S NEVER BEEN SO LUXURIOUS BEFORE! More luxurious outside with that long clean new look. And much more luxurious inside. The new Impala Super Sport Series, for example, has a new kind of ultra-soft vinyl upholstery and door-to-door deep-twist carpeting that you would be proud to put in your home. And even the lowest priced Biscayne models are now fully carpeted and have arm rests and foam-cushioned seats both front and rear. Then these new Chevrolets have a Jet-smooth luxurious way of going. Quiet. Soft. Transmissions operate smoothly and quietly! That sturdy Body by Fisher and generous coil spring at each wheel cushion you against every kind of road shock. Actually, the whole idea for '64 was to see how much luxury and comfort we could add to the car—but still keep it reasonably priced. And everything worked out just beautifully. Wait until you see it. SEE CHEVROLET'S GREATEST AT YOUR CHEVROLET SHOWROOM.

## NEW CHEVELLE! by CHEVROLET

A KIND OF CAR YOU'VE NEVER SEEN BEFORE! Not a new model or just a new name, but a completely different kind of car from Chevrolet for 1964. Outside, it's a good foot shorter and a few inches narrower than the big cars. Parks in the tightest places. But the passenger space, leg room and trunk capacity are surprisingly generous. Eleven sedans, wagons, coupes and convertibles to choose from. Four engines: a 120-hp Six. A 195-hp V8. An extra-cost 155-hp Six. And an extra-cost 220-hp V8 with four-barrel carburetion. Body is by Fisher—and you know what that means in terms of quality and comfort. Brakes are self-adjusting. Service is seldom. Quality is by Chevrolet clear through. And so is the price, you'll be happy to know. SEE CHEVROLET'S LATEST AT YOUR CHEVROLET SHOWROOM.

## THE '64 CHEVY II by CHEVROLET

NEW CHEVY II V8! An optional-at-extra-cost 195-hp V8, to be exact. Chevy II is now the only car made that gives you a choice of Four, Six or V8 power. Two Sixes, by the way. A 120-hp and a new extra-cost 155-hp. And all the new II's are trimmer outside and nicer inside. Each with Body by Fisher, of course. And rust-fighting rocker panels and long-life muffler. And self-adjusting brakes. And all those other Chevrolet engineering features that keep you from dipping into your savings to keep it going. Come dr-r-r-ive a Chevy II V8 at your Chevrolet dealer's showroom.

## '64 CORVAIR and '64 CORVETTE

NEW CORVAIR POWER! Nearly 19% more horsepower in the standard engine. A full 110 horsepower in the extra-cost engine. And 150 hp in the Monza Spyder. Some nice new interior refinements, too—like softer, more deeply tufted seats in the Monza and sporty map pockets on the front doors. Outside of that, it's still very much the same easy-to-park, easy-to-handle, hard-to-keep-your-hands-off-of Corvair.

NEW CORVETTE RIDE! Smoother and quieter than it's ever been, but no less of a sports car than it's always been. New extra-cost V8 engines up to 375 hp in both sport coupe and convertible. And note the new *one-piece* rear window in the coupe. You'll be surprised at what a beautiful boulevard car the new Corvette is. Yet it's one of the world's few great sports cars, too. . . . Chevrolet Division of General Motors, Detroit, Michigan.

THERE'S 5 IN  
**64**  
CHEVROLET



# Popular Mechanics Shopping Guide

Save your floors through do-it-yourself refinishing. A 16-page booklet, "Here's How to Beautify and Protect Your Wood Floors," gives the basics from complete bare-wood jobs to touch-ups and renewing. Necessary equipment and how to obtain it is discussed; key steps in floor preparation and finish application are illustrated. Of particular value for the novice is a table comparing the properties of commercial finishes. Copies are 10 cents each from the Booklet Department, William Zinsser and Co., 516 West 59th St., New York 19.

Amateur radio, high fidelity and Citizens Band radio make it possible for everyone to venture into the fascinating realm of electronics. "Getting Started in Electronics," a 112-page book written for the beginner, provides clearly diagrammed chapters in basic theory (resistance, capacitance, tube function, etc.) as background for easy-to-build projects, including a walkie-talkie and transistor radio. Fifty cents is the price from Allied Radio, 100 N. Western Ave., Chicago, Ill.

Home fires often start when clothing, upholstery padding or even cloth toys are accidentally ignited. Eliminate this hazard by dipping, spraying or sprinkling your household fabrics in one of four

solutions that can be prepared easily from drugstore supplies. Facts about flame retardants and how to make and apply them are given in the pamphlet, "Making Household Fabrics Flame Resistant," available for five cents from the Superintendent of Documents, U.S. Government Printing Office, Washington 25, D.C.

Gardeners: Ornamental bamboo can add an exotic note to your garden or hedge area. Many species which can adapt to low temperatures, spread slowly and are easy to keep within bounds are available in the U.S. Descriptions of



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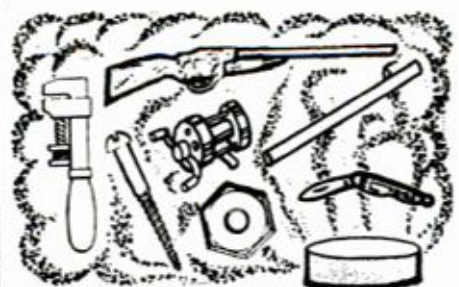
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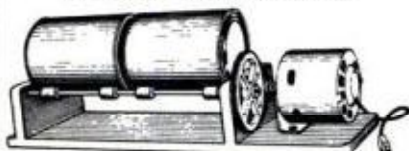
several varieties, including planting, care and propagation, are presented in a pamphlet, "Growing Ornamental Bamboo." In addition, the pamphlet suggests ways to keep spreading bamboo within the original planting area. The U.S. Government Printing Office, Washington 25, D.C., offers copies at five cents each.

**Home laundry** requirements sometimes vary with the size of the housewife! Many big women like small laundries while little women often prefer spacious ones. A circular, "Laundry Areas," gives information on space requirements for home laundries based on studies of work habits and body movements. For your copy of this circular, send 15 cents to the Small Homes Council-Building Research Council, University of Illinois, Mumford House, Urbana, Illinois.

**Ignition problems?** "Let's Take the Guesswork Out of Alternators," a report by Gilchrist and Schmock, developers and manufacturers of automotive-type alternator systems, traces most alternator malfunctions to improper selection of equipment or improper maintenance. To overcome these problems, the authors present a comparison of an alternator system versus an ordinary DC generator and give a method for determining the right-size alternator system for any vehicle. Copies are available at no cost from The Leece-Neville Co., 1374 E. 51st St., Cleveland 3, Ohio

**Garage Door Opener for \$35.** December PM tells how to build it. Door operates with key from a driveway post.

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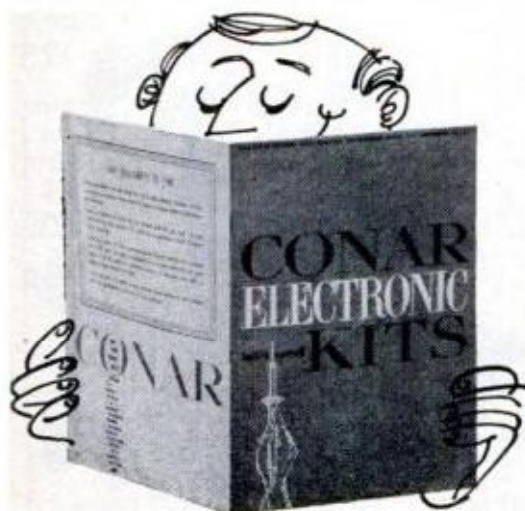
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# Popular Mechanics

Those who want to retire actively may find their island in the sun, whether in city or country, with the help of "Retirement Facilities Register." Published by the Active Retirement Executives Assoc., a series of 8 directories will cover places all over the world with current details on floor plans of units (from mobile homes to converted hotels), menus, medical facilities, workshop and recreation centers, sponsorship and costs. California, with 84 retirement communities, is the territory of the first registry, available at \$3 per copy from the publisher, 6043 Hollywood Blvd., Los Angeles, Calif.

**Crafty-with-watercraft** handymen may learn how to save up to \$1000 in powering a boat. A 16-page illustrated guidebook, "What You Should Know about Converting an Automobile Engine to Boat Use," answers in full such questions as how will it compare with production en-

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**Furniture care** depends upon what "look" you want on a particular end table or chair and then which product you use to provide it, whether it be high shine or low luster. "How to Take Care of Furniture," a pamphlet packed with the newest cleaning methods, ways to save steps and labor, plus hints for hiding scratches, explains what affect modern polishes and cleaners have on specific types of surfaces. Send for your free copy from the Consumer Education Dept., Johnson's Wax, Racine, Wis.

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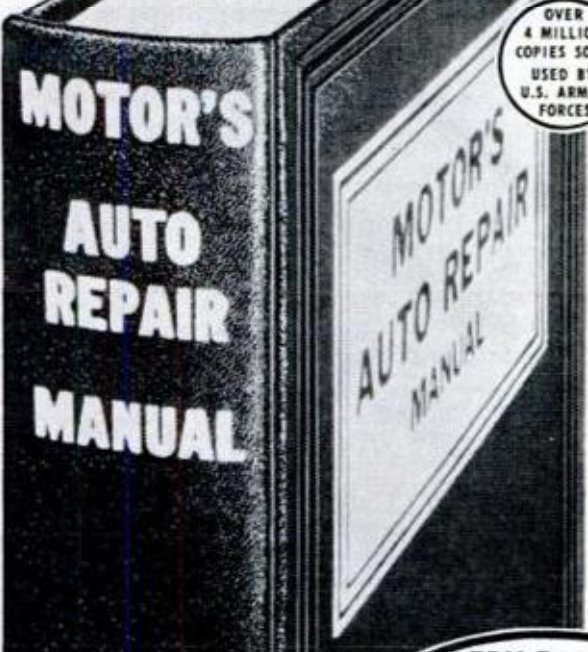
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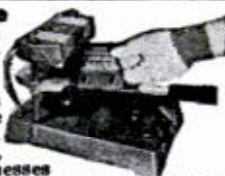
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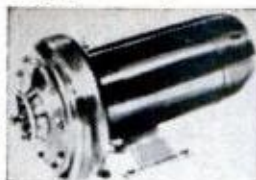
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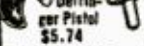
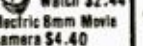

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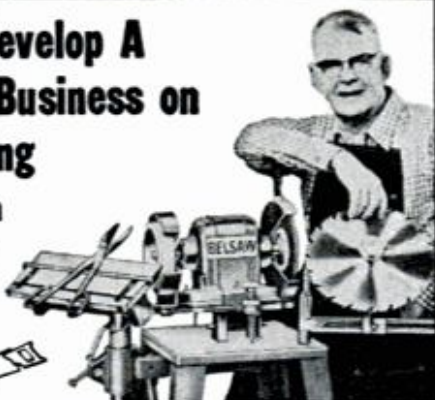
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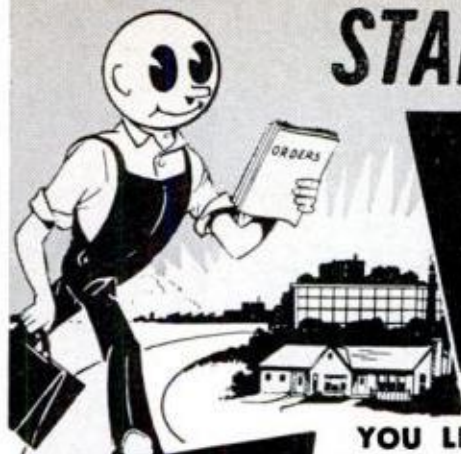
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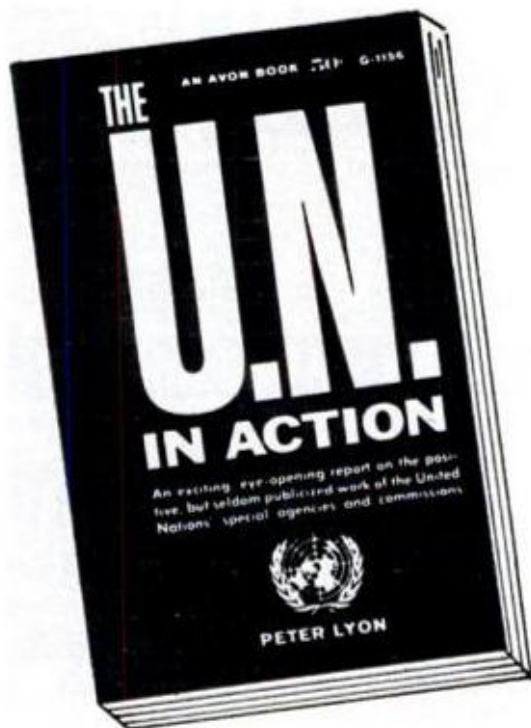
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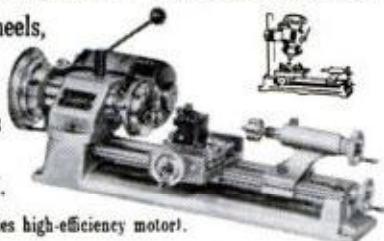


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**BUILD** Your own all-metal wood lathe. Materials cost about \$16.50. For complete plans and specifications, send \$1.50 to: Bishop, Box 358, Chiefland, Florida.

**DO-It-yourself** bath massage! Automatic and fingertip controls. Attaches to your vacuum cleaner. Complete kit and instructions \$16.69. Butch Bath Co., 435 N. Roxbury Drive, Suite 105-F, Beverly Hills, California.

**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.

**EXERCISE** At home on build-it-yourself physical fitness equipment, including bicycle exerciser, rowing machine, belt massager, and abdominal board. Send \$2.50 for blueprints B1208 and instructions. Popular Mechanics Service Bureau, 740-K Rush St., Chicago 11, Illinois.

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**USED** Watches: Waltham, Elgin, Bulova (as is). Each \$4.95. Joseph Bros., 5-PM South Wabash, 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.

**HIGHEST** Cash for gold, teeth, jewelry, rings, diamonds, watches, silver, platinum. Mail articles today. Free gift with information. Chicago Gold & Precious Metals, 6 E. Monroe, Dept. 358, Chicago 3.

**"APOLLO"** or "Mighty Rocket Engine." Tie Tac jewelry. \$2.50 prepaid. Space Hunter Sales, Box 1111, Canoga Park, California.

**WANTED.** Gold, silver, platinum, scrap (any form), coins. Information free. Wilnot's, 1067 Bridge St., Grand Rapids 4, Michigan.

**WATCH** And clock repairing books. Free catalog. North American, Box 77-AM, Fox River Grove, Illinois.

**BEAUTIFUL** Pocket watches \$4.95 postpaid. Brown Company, Box 181, Niles, Ill.

**FREE** Watchmaking course! Details wholesale catalogue 25¢. Bengal's, Culver City, California.

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**CIGARS,** Tobaccos. Save! Free list. Tobaccoist, 3950 W. Lawrence, Chicago 60625.

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**REFRESH** Your home with miniature plastic fruit. Trees—orange, lemon, cherry, peach, or pear. Each potted. 27 fruit 63 leaves. \$1.00. International Distributors, Box 448C, Cozad, Nebraska.

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**UNUSUAL** Gifts from home and abroad. Color catalog free. Import House, 614 East Little Creek Road, Norfolk, Va. 23505.

**FREE** Catalog! Gifts for Mother, baby. Conner, 11428 1/2 Berendo, Los Angeles 44.

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**CONFIDENTIAL** Mail address. Merchandise Bureau, 1103 Mayor Building, Montreal, Quebec.

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LUCKY Seven remail service. 25¢ each. \$3.00 monthly. D. P. Flynn, Box 7, Foster, R.I.

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

CONFIDENTIAL. Remails 25¢ single. \$3.00 monthly. Box 4327, Tampa, Florida. 33607.

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

PALM Beach, Florida prestige, confidential, efficient, reasonable. Box 1086.

CONFIDENTIAL New York City remailing service. G. Martin, 136-04 Northern Blvd., Flushing 54, New York.

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

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

REMAIL Through the Pacific Wonderland. Confidentially 25¢ \$5.00 monthly. Kroker, 2655 Commercial N. E., Salem, Oregon.

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

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

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MOTHER And baby catalog 25¢. Sebastian Attardo, 351 Wadsworth Ave., New York 40, N. Y.

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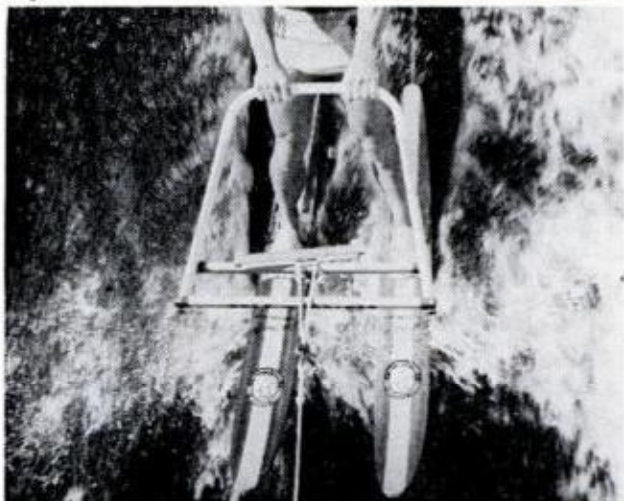
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## How to "Handle" Water Skis



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Holding a downward pressure on the trainer (top photo) until he is standing clear of the water, the skier simply eases the "clamping" pressure, and the Skee-Trainer slips off the tips of his skis to provide a handle to hold (bottom photo).

Made of oak and aluminum, the floatable device weighs 29 ounces. A product of Skee-Trainer, Inc., 40 Catherine St., Norwalk, Conn., it sells for \$11.95 postpaid.

## Moon Hazard

Deadly geysers of atomic particles from surface rocks on the moon might endanger our astronauts after a lunar landing, an Indian scientist believes. The danger would be most acute during solar flares, Dr. M. V. K. Rao of Bombay says, during which the intensity of cosmic-ray bombardment increases up to 5000 percent.

Unprotected by an atmosphere, atomic nuclei in moon rocks take the brunt of solar outbursts, causing them to throw off lethal neutrons. Now on leave at the University of Rochester, Dr. Rao has been measuring radiation from moon-type rocks by bombarding them with atomic particles.

NOVEMBER 1963

81

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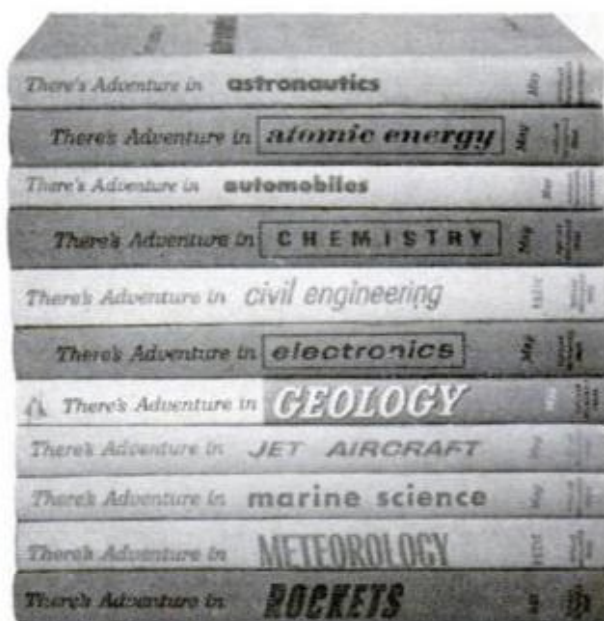
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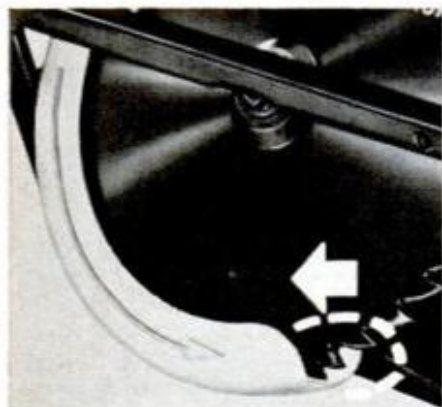
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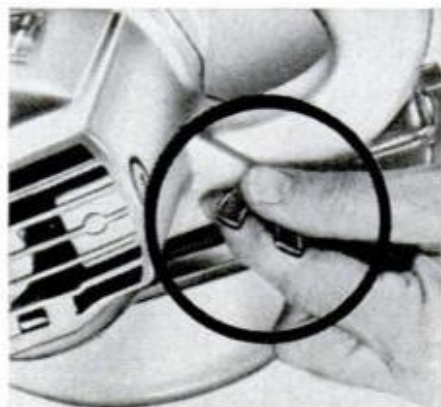
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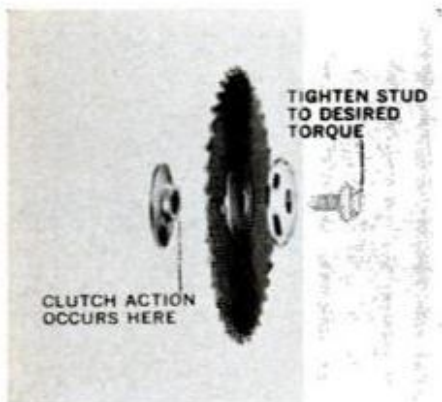
**Bind-free lower guard**—Retracts automatically when saw base is tilted, thus allowing bind-free starts—even on compound miter cuts.



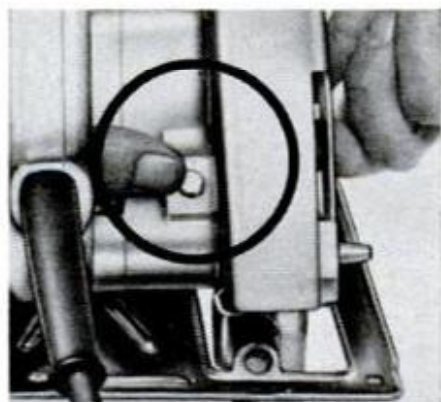
**Easy-to-set depth control**—Conveniently located for easy one hand adjustment. Control locks the saw firmly and quickly at any desired cutting depth.



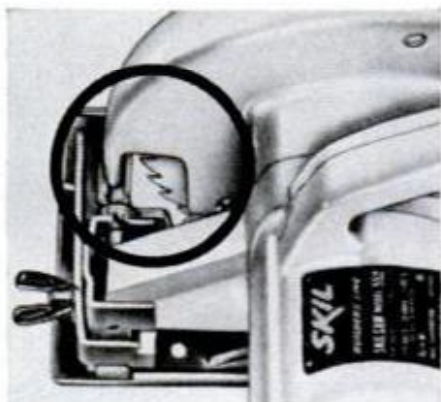
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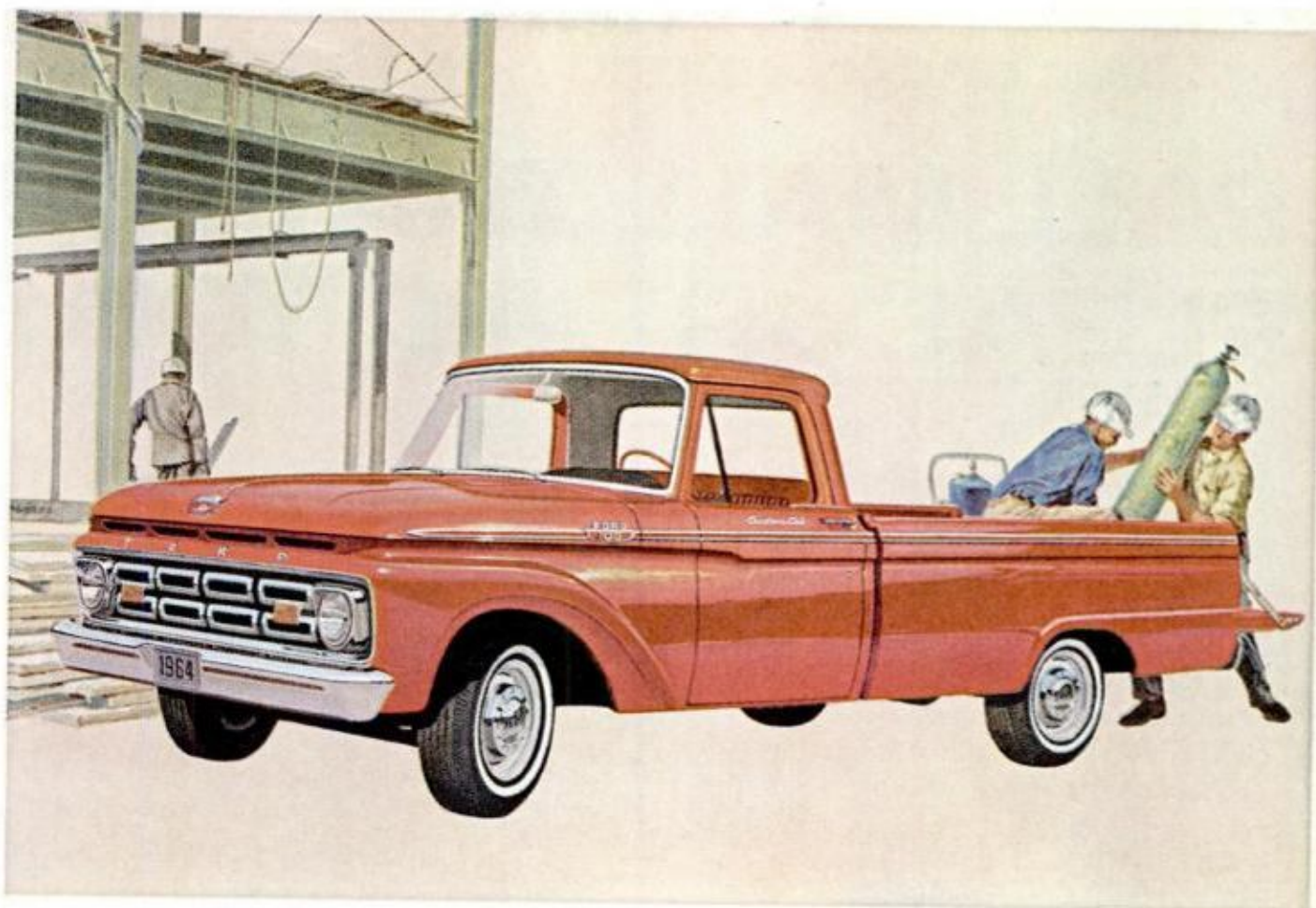
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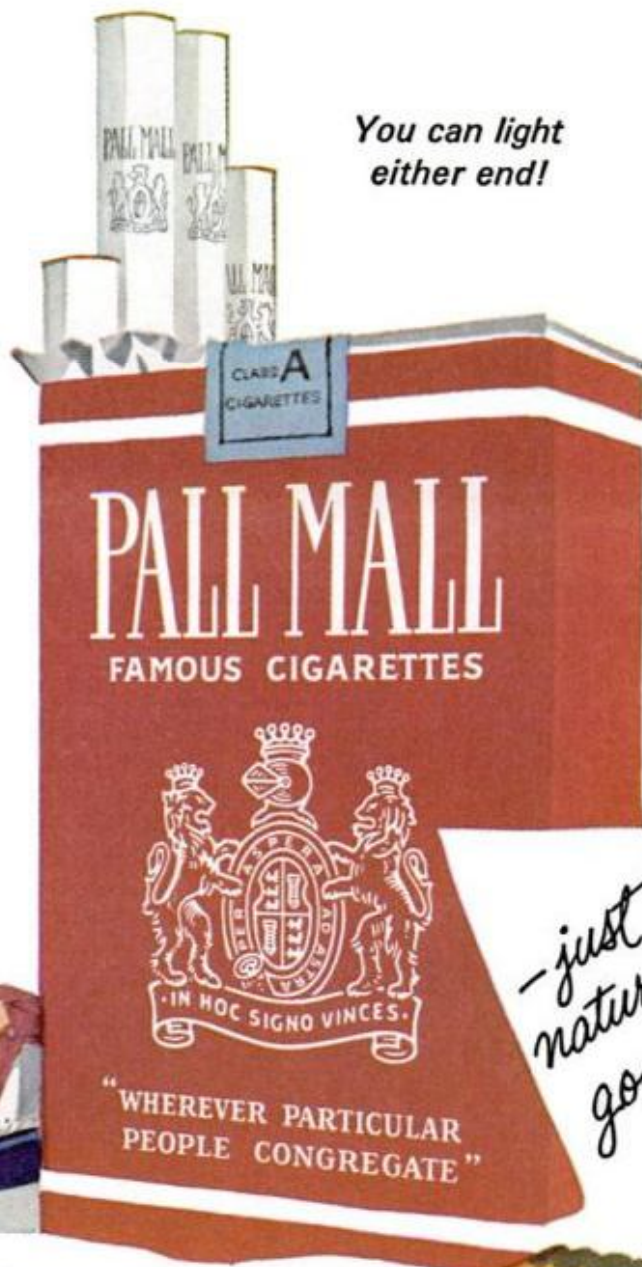
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*- just  
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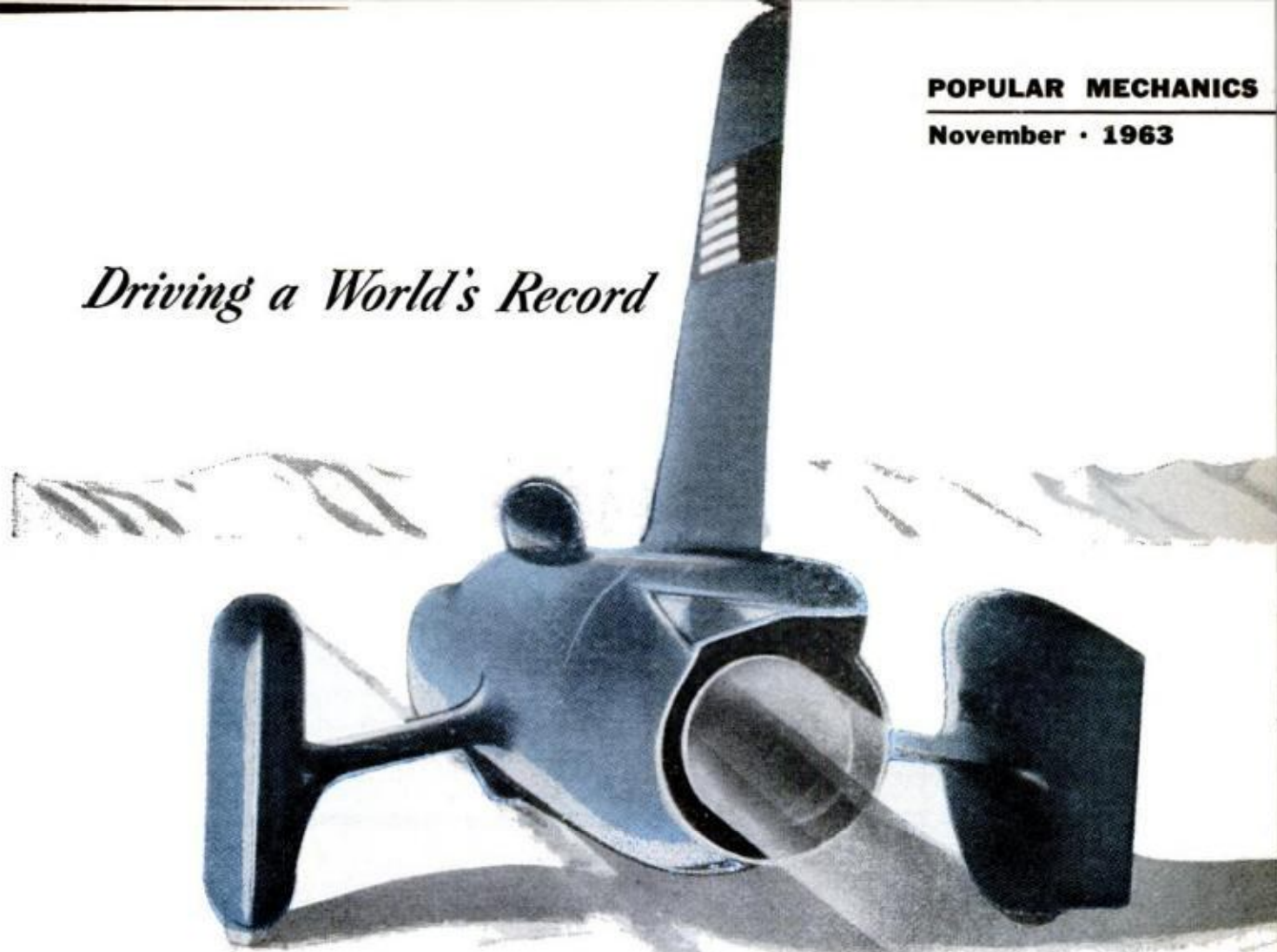
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## *Driving a World's Record*



# *407 Miles Per Hour*



*Our new land speed champion tells how he thundered to a world record on the black stripe that has lured many others to death at Bonneville*

*By Craig Breedlove*

**L**AST YEAR Glenn Leaser was killed when his jet-and-after-burner *Infinity* accelerated so fast it went out of control, here at Bonneville salt flats in Utah.

Three years ago Athol Graham died when his Allison-powered *City of Salt Lake* went into a sickening spin on the salt and pounded itself to junk.

Three years ago, too, Donald Campbell was hurt when his turbine-powered *Bluebird* swerved and flew 600 feet through the air.

Each had been trying to beat John Cobb's one-mile land speed record of 394 miles per hour.

What were my chances of setting a new record?

They seemed excellent.

My *Spirit of America* had handled perfectly in the 22 runs so far, while working up to faster and faster speeds. The car was comfortably stable at 365 miles per hour, the fastest I had gone to date.

The *Spirit* is uniquely different from any of the cars that had tried and failed. Its single front wheel allows a narrow front end and this helps prevent the car from becoming airborne. The tail fin and the two rear wheels that are mounted outboard from the body are designed like the feathers of an arrow to keep the car pointed in the direction of thrust. An air rudder under the nose is geared to turn with the front wheel and provides positive steering at high speed. The car is powered by a pure jet engine that uses a new high-energy turbine fuel developed by Shell.

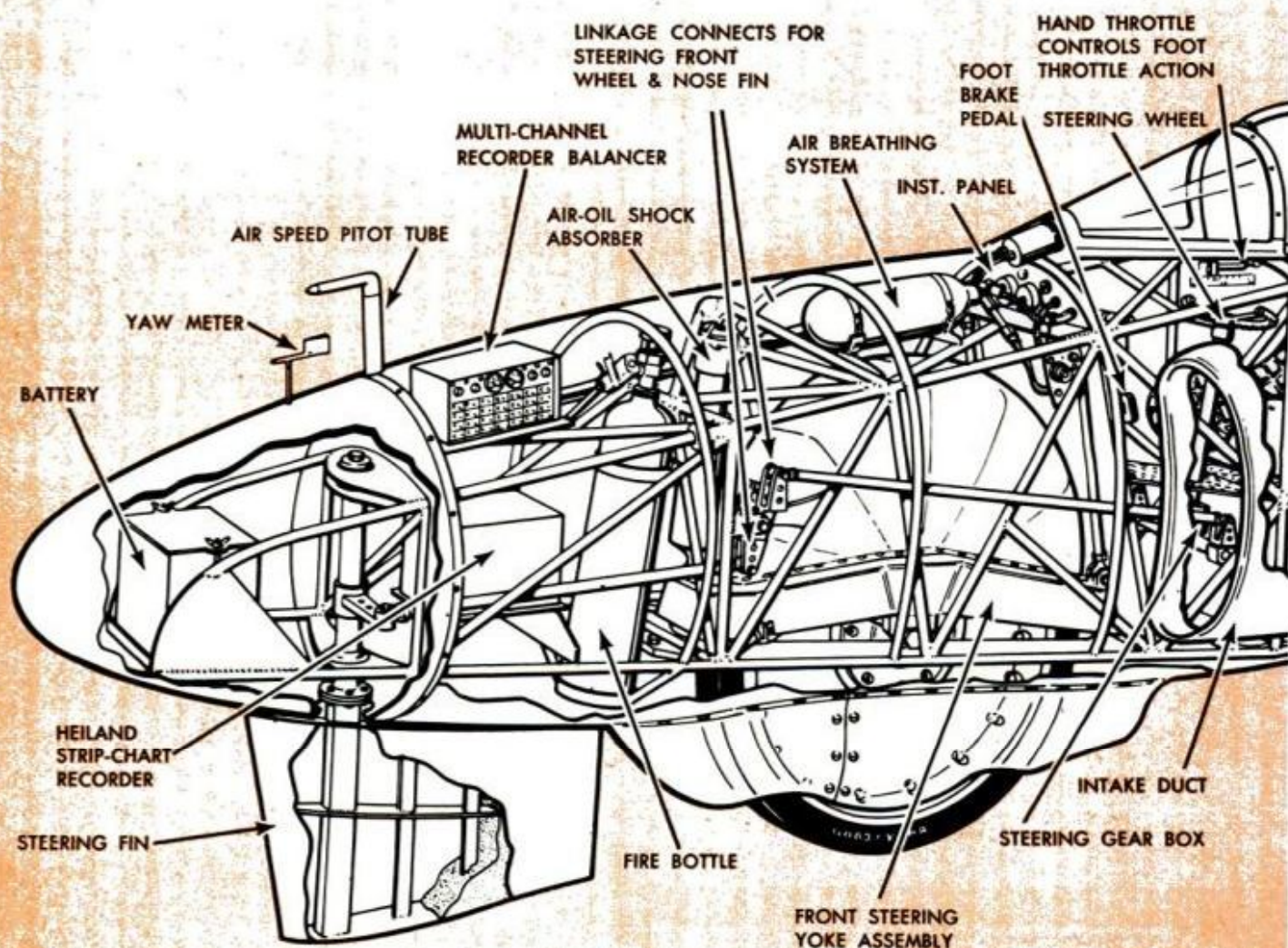
Tires and bearings have always been a worry with unlimited land-speed vehicles, but these problems had been solved for us. *Spirit* was wearing the same set

of Goodyear tires it had used in last year's trials and on all the runs so far this year. The tires are tubeless, have 24 nylon plies, and have an outer skin of rubber hardly thicker than the paper of this page. The wheel bearings were packed with a new grease that, for all practical purposes, has no melting point.

Our only trouble so far had been a minor one. Several times, the door to the drag-chute compartment had buckled under the high wind loads and had released the chute prematurely. But we had stiffened the door and now it should hold.

The big worry was the wind. As little as a three-mile-per-hour side wind could drift me away from the black stripe that marked the centerline of the course.

Nye Frank handed up the clipboard that showed the wind speeds at six different stations along the course, and the figures looked good. Most stations reported dead calm and there was only a slight draft of

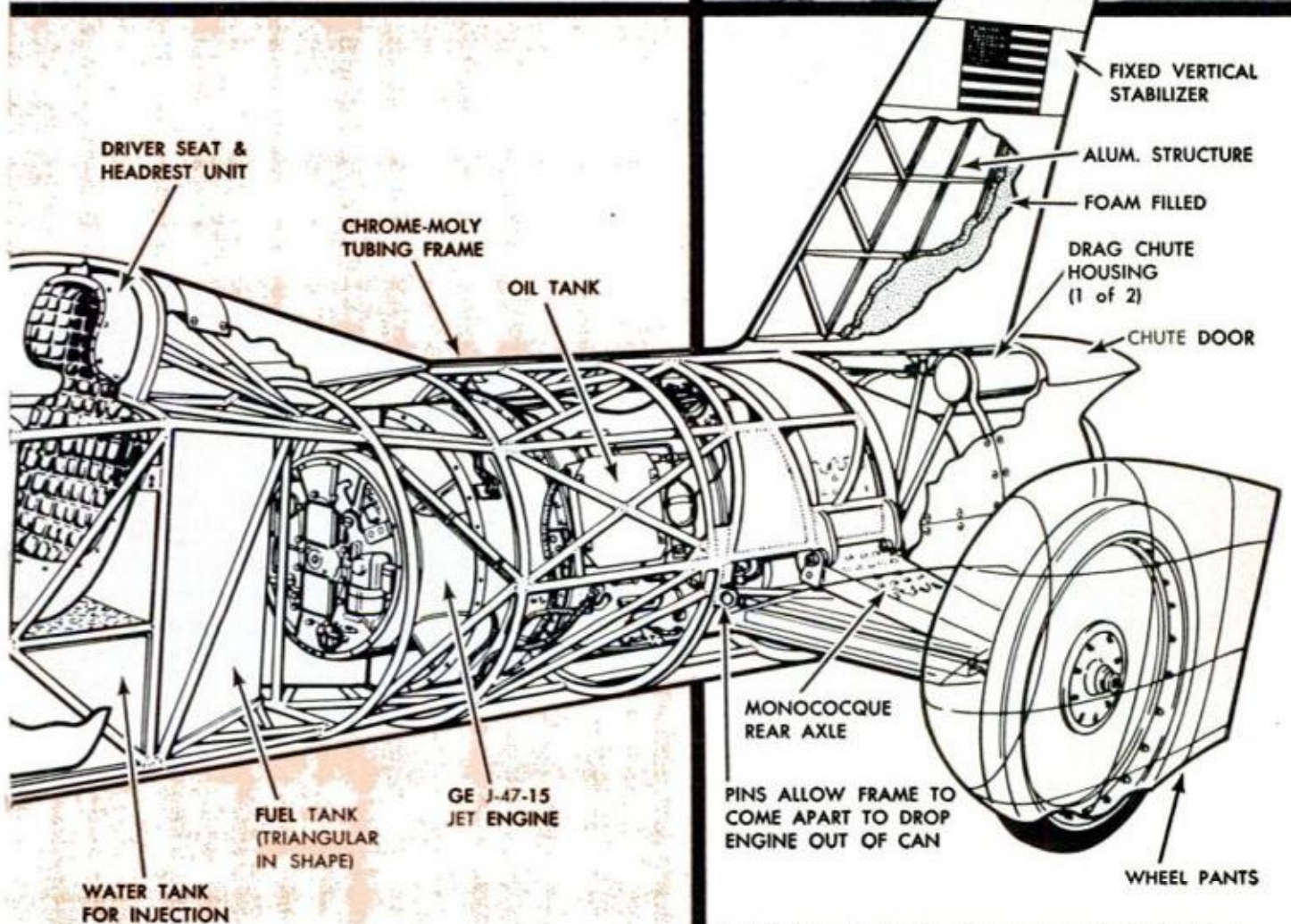


air toward the west at the middle of the course. "Let's go!" I told Nye. He grinned and helped buckle on my helmet and the breathing mask. He attached the canopy and I latched it tight from inside.

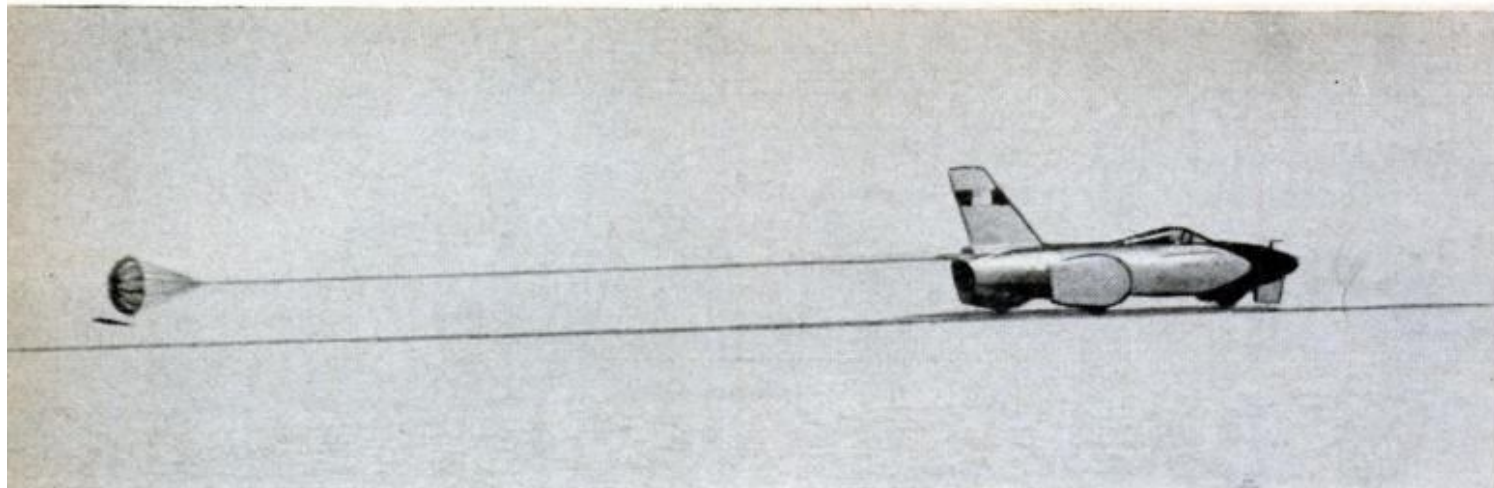
I was making the run at the highest power setting used so far, and I had locked the over-ride hand throttle at 90 percent of the maximum revolutions per minute. This allowed pushing the foot throttle all the way down where I could hold it steady, without exceeding the r.p.m.s we had decided upon.

In August the measured course at Bonneville was 11 miles long, but the first two miles were too rough to use. I was starting at the two-mile mark and, even so, the salt was bumpy enough to bounce the three-ton *Spirit* into the air several times while accelerating toward the

**DRAG CHUTES** are stowed in a rear compartment. Only mishap on record run came when chute door buckled, deploying brake chute and slowing the car



**SPIRIT OF AMERICA** has been compared to a wingless jet plane and, says Breedlove, "that's about what it is." The engine is a GE J-47, similar to the engine in an F-86 fighter. For top speeds, ballast may be used to keep the narrow front end of the speeding car from lifting off the ground



**EIGHT-FOOT** drag chute serves as high-speed brake. It causes the car to swerve from side to side but is not dangerous. Foot brakes are applied when speed drops to about 150 m.p.h. A second chute is available for emergencies

smoother part of the track ahead of me.

Salt dust began swirling around in the cockpit, whipped up and powered by the front wheel. The reason I wore goggles inside the cockpit was to keep the salt out of my eyes.

I noticed a light plane banking toward me right above the salt, then I shot past it. For a second the plane had disturbed me. A camera plane had crossed right in front of me the day before, about 25 feet up, and I got a bad buffeting when I hit its prop wash.

In spite of the cotton I had pushed into my ears inside the crash helmet I could hear the scream of the jet's compressor and some of its exhaust roar. The hard tires crunching on the salt, even the rattle and bang of components inside the car were audible. And the ride, like all the others, was rough as well as noisy.

### Heavy Three-Wheeler

The tires carried 250 pounds pressure and magnified the slightest bumps. The big nose wheel allowed the whole front end to shake from side to side on every bump, and side winds would thrust the nose over to one side. These characteristics of the three-wheeled vehicle had seemed pretty hairy until I'd become accustomed to them. In spite of the way the front end moves around, I'm convinced that the three-wheel design is much more stable at high speed than is any four-wheeler. But it does call for a lot of steering, which kept me busy. By now the markers along the course were flying by.

Anyone trying for a new record for the flying mile almost automatically tries for

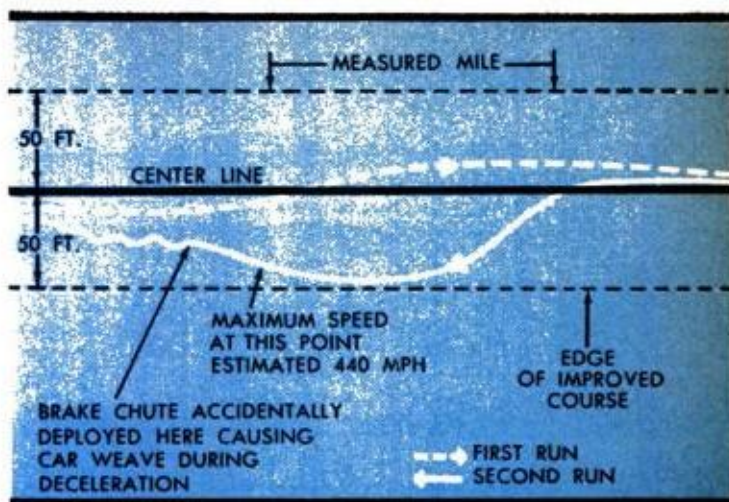
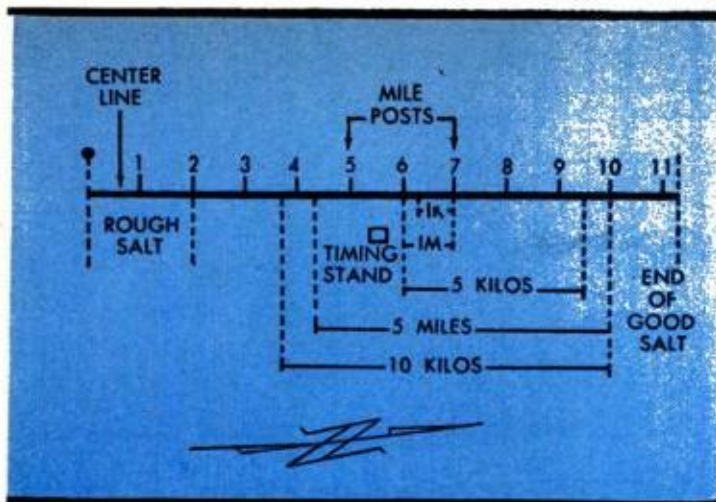
records for other distances as well. The photo-cell timing traps are placed to record the times for the flying-kilometer, mile, five-kilometer, five-mile and 10-kilometer distances. The measurements overlap, of course, with the shortest distances in the center. Ordinarily the 10-mile distance also is light-trapped, but my course was only nine miles long.

I'd started the run several feet to the right of the center stripe and the wind soon drifted me across the line. I stayed there. The car was still accelerating when I went through the light beam that marked the end of the measured mile and the measured kilometer. But by now, only four miles of salt were left and it was time to start shutting down.

I took my foot off, coasted until I was approaching the 10-kilo marker and then pushed the steering wheel knob that flames out the engine and jettisons the drag-chute door. When the door pops off it deploys the eight-foot chute that serves as the high-speed brake. The chute whips around quite a bit and swerves the car from side to side but this is nothing serious. When the speed got down under 150 m.p.h. I began using the foot brakes and rolled to a stop alongside the vehicles at the far end of the course.

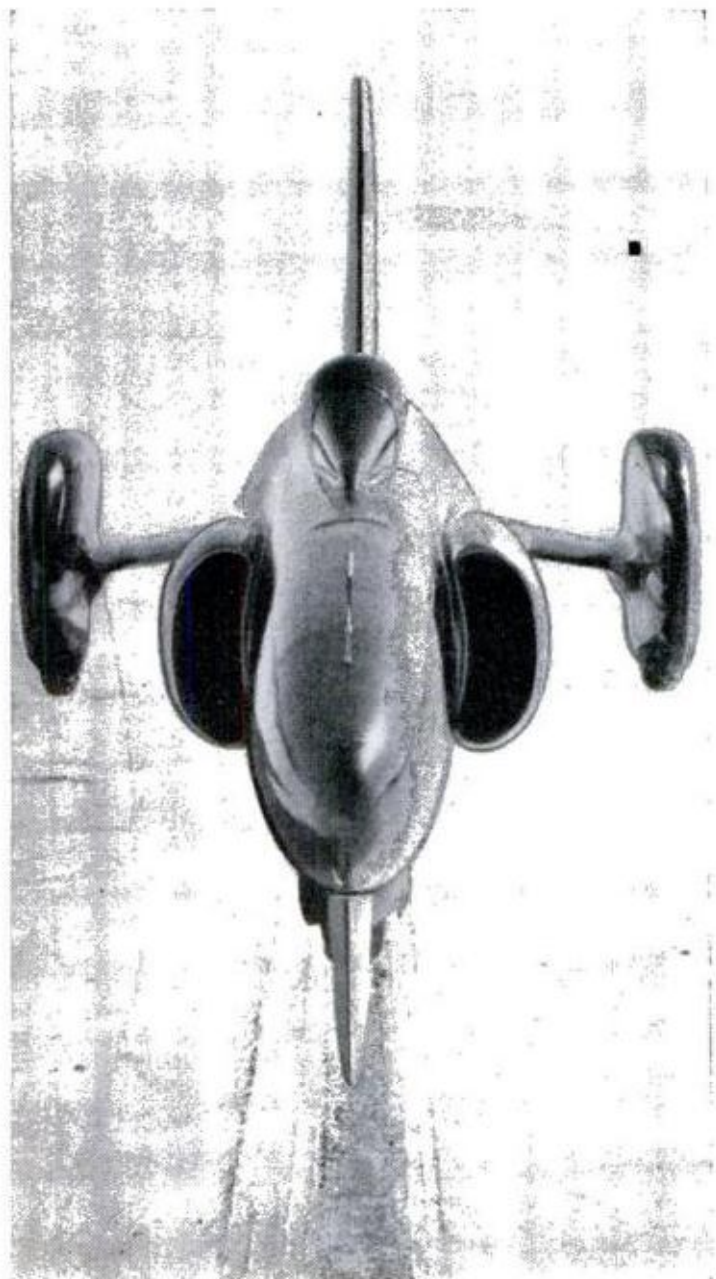
While preparing for the return run (you run in both directions for an official average time) word came from Joe Petrali in the timing stand that I had traveled the measured mile in 9.26 seconds, equal to a speed of 388 miles per hour. This was only six miles per hour under Cobb's two-way average. Petrali also said that *Spirit* had gone through the measured kilometer





**MEASURED COURSE** at Bonneville is 11 miles long but when the author made his run, the first two miles were too rough to use. Even from the two-mile mark, the course was at first rough enough to bounce the three-ton car into the air several times during acceleration. Winds caused slight drift off the center mark

**FRONT VIEW** of racer emphasizes its similarity to a jet fighter. Six-foot tail fin was added after initial trials at Bonneville to give added stability



faster than the record for that distance.

All this changed our plans. The return run had been scheduled at a throttle setting of 92 percent of r.p.m.s. But we seemed so close to a new record that I decided to use additional power. The hand-throttle was re-set at 95 percent of full r.p.m.s, equal (at that temperature and altitude) to 70 percent of the jet's power.

By now the wind was freshening. Gusts were spilling out of a canyon west of the salt flats and creating cross winds of seven and eight miles per hour on the course.

I waited in the cockpit for a while, then the reports showed that the wind had dropped to around five miles per hour. It was time to go; from now on the winds would get stronger.

I started the return run well over to the right of the center line and it's a good thing that I did. By the time I entered the measured mile the wind had drifted the car 40 feet to the left, close to the markers and the rough salt outside the smoothed course. I corrected slowly and kept my foot on the floor, still accelerating.

I'd guess that *Spirit* was traveling at the rate of 440 m.p.h. at the end of the measured mile and I was just taking my foot off the throttle when the car began a slight weaving motion. I knew what the trouble was at once: the chute door had popped open again and released the chute. This could be unfortunate. I felt sure of a new record for the mile but I might miss new records for the other distances. The chute was dragging my speed down rapidly.

There was a long wait at the south end after I came to a stop. Joe Petralli and his



**J-47 ENGINE** mounted on test chassis of the *Spirit of America*. It's rated at 5200 pounds static thrust, which can be increased to 5900 pounds with water injection, and 7600 pounds with an afterburner



**48-INCH TIRES** on the racer can withstand six tons of centrifugal force. They've been tested up to 624 miles per hour with a two-ton load. All 24 of Breedlove's 1963 runs were on the same set of tires

USAC timing crew were inspecting the tape, taking off the elapsed times and averaging them and translating the time into speed. We got the word over the telephone at the same time that Joe was making an announcement to the press at the timing stand:

"Gentlemen, we have a new world land speed record!"

*Spirit of America* had gone through the measured mile in 8.40 seconds on the return run, equal to a speed of 428.37 miles per hour. The average time for both runs was 8.8355 seconds, equal to a two-way average speed of 407.45 miles per hour. This was more than 13 miles faster than the record Cobb made in 1947. And, in spite of the pull of the drag chute, it turned out that I held new records for all the other distances on the course.

During the next few days a lot of people agreed that it was nice that the land speed record had been returned to the United States after 35 years and then they would ask "Who in the world is Craig Breedlove?"

Well, I'm 26 years old, married and live

in Los Angeles. I've been interested in straight-away speed most of my life.

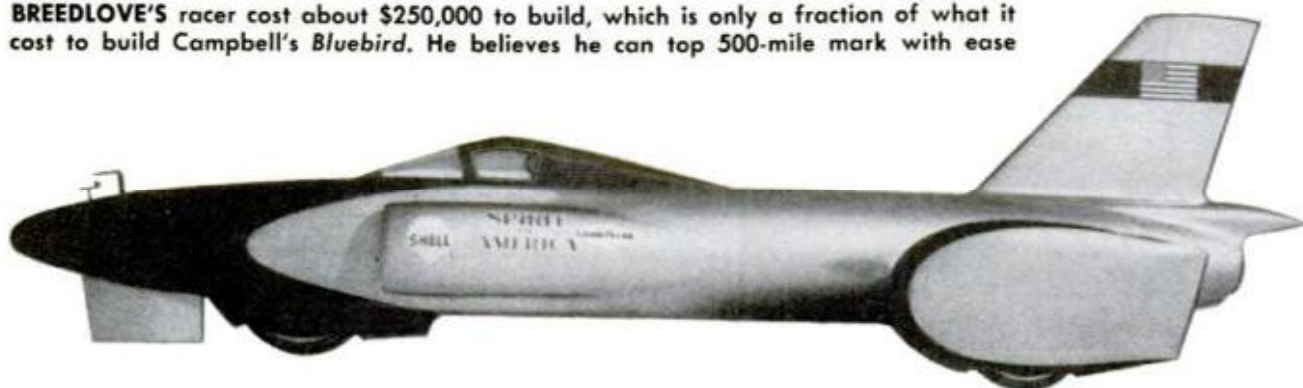
I put my first hot rod together when I was 14 and began running on the drag strips at 16. While in high school I received my first trophy, winning the gas coupe event at the Saugus strip at 103 m.p.h. In all I've taken a couple of dozen first places in dragsters, coupes and lakesters. Three years ago I turned 233 m.p.h. at Bonneville in an "A" lakester but wasn't able to make the return run. I've held various kinds of mechanical and engineering jobs.

Years ago I began to feel that a lot of young Americans are just about as good at designing and building speed cars and at souping up engines as are the racing teams of Europe. I became convinced that we could build a car that would capture the unlimited record for the measured mile. After all, we lacked only money.

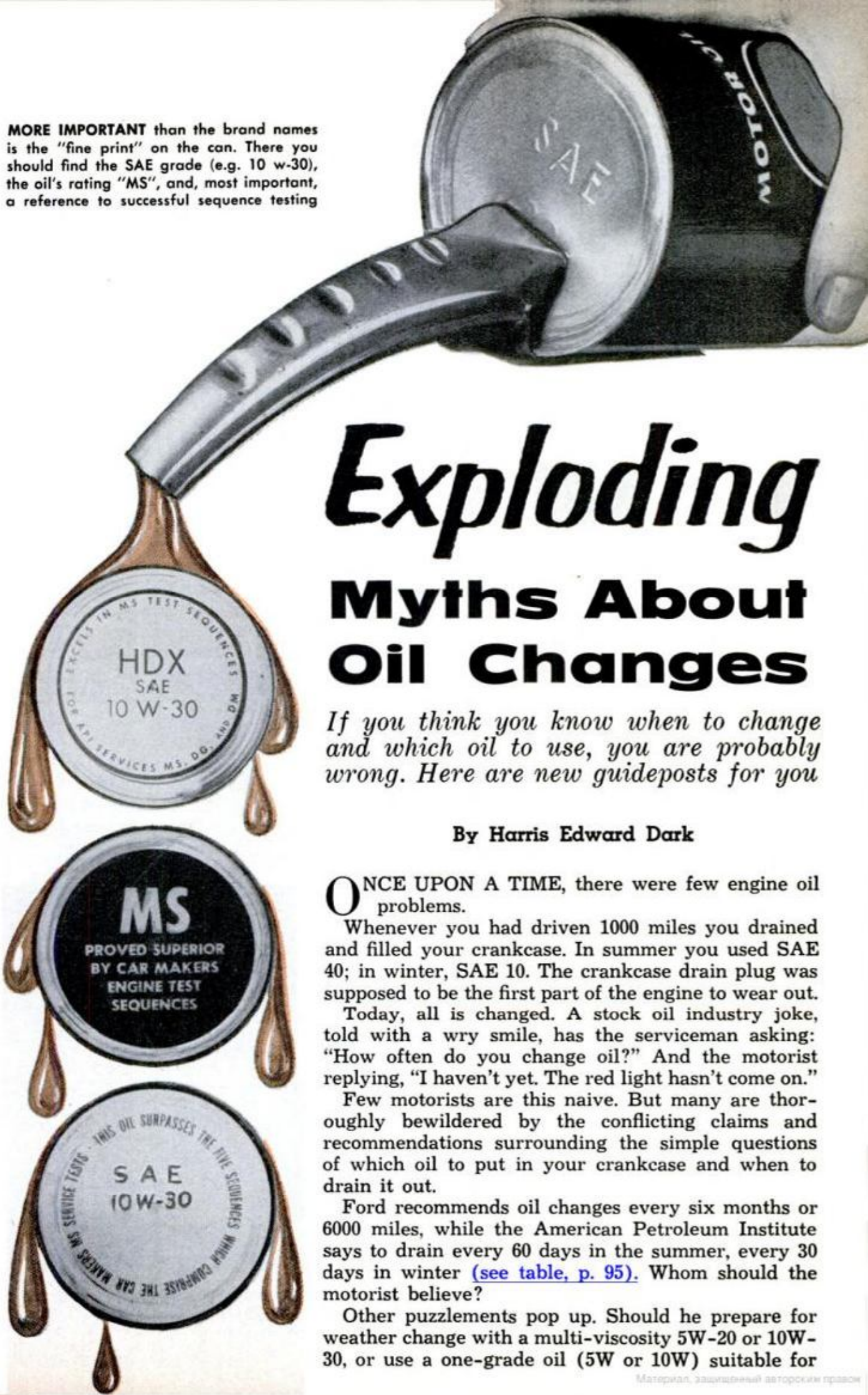
These ideas gradually jelled into the *Spirit of America* project. Deciding on the car's name was easy: the name tells the whole story. First the car was going

[\(Please turn to page 236\)](#)

**BREEDLOVE'S** racer cost about \$250,000 to build, which is only a fraction of what it cost to build Campbell's *Bluebird*. He believes he can top 500-mile mark with ease



**MORE IMPORTANT** than the brand names is the "fine print" on the can. There you should find the SAE grade (e.g. 10 w-30), the oil's rating "MS", and, most important, a reference to successful sequence testing



# Exploding Myths About Oil Changes

*If you think you know when to change and which oil to use, you are probably wrong. Here are new guideposts for you*

By Harris Edward Dark

**O**NCE UPON A TIME, there were few engine oil problems.

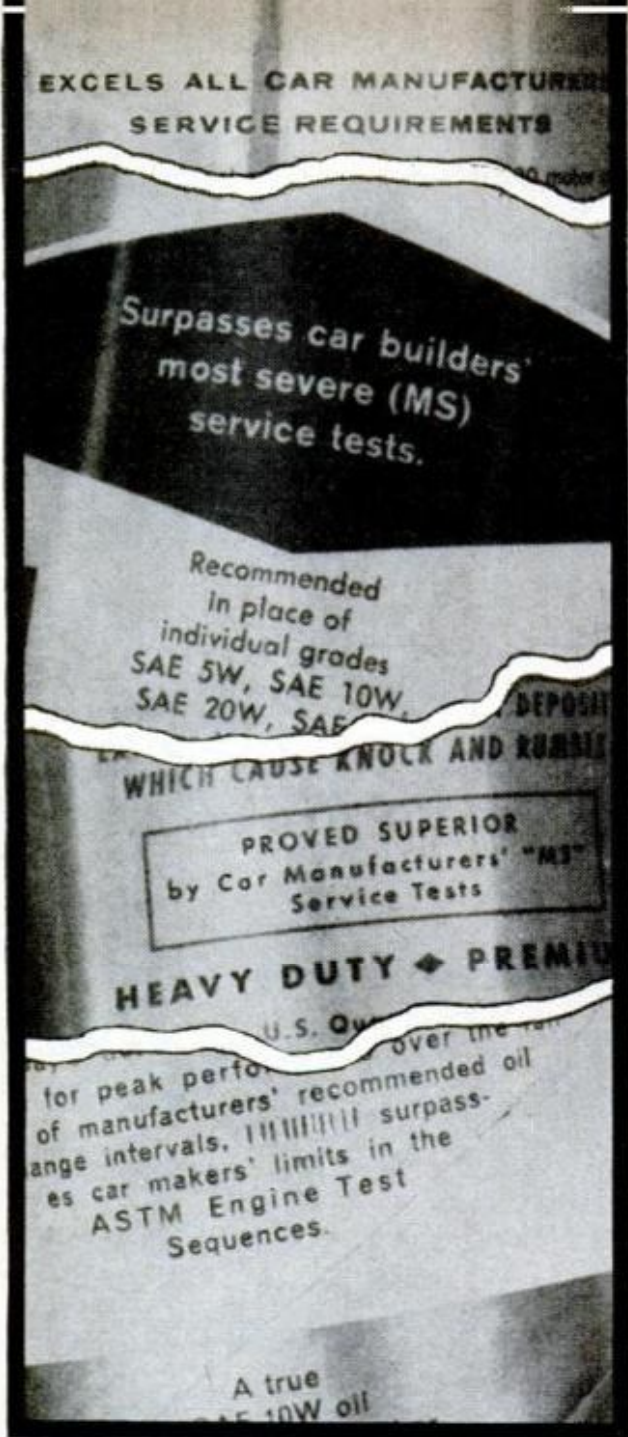
Whenever you had driven 1000 miles you drained and filled your crankcase. In summer you used SAE 40; in winter, SAE 10. The crankcase drain plug was supposed to be the first part of the engine to wear out.

Today, all is changed. A stock oil industry joke, told with a wry smile, has the serviceman asking: "How often do you change oil?" And the motorist replying, "I haven't yet. The red light hasn't come on."

Few motorists are this naive. But many are thoroughly bewildered by the conflicting claims and recommendations surrounding the simple questions of which oil to put in your crankcase and when to drain it out.

Ford recommends oil changes every six months or 6000 miles, while the American Petroleum Institute says to drain every 60 days in the summer, every 30 days in winter ([see table, p. 95](#)). Whom should the motorist believe?

Other puzzlements pop up. Should he prepare for weather change with a multi-viscosity 5W-20 or 10W-30, or use a one-grade oil (5W or 10W) suitable for



**OILS** that are safe for a modern car engine frequently have reference to qualification in auto maker's tests. Oils labeled as above checked out in severe service

the season of the year?

Can he save money on his older car by using an ML (light service) or MM (moderate service) oil instead of the MS specified for all new cars? Aren't ML or MM grades equivalent to those the maker recommended when the old car was new?

Should he buy the "Super" grade, or save 10¢ a quart by sticking to the "Deluxe," "Premium," or "Heavy Duty" grade? Both may come in cans labeled MS (for Motor Severe service), and doesn't this mean that both will give top service?

It doesn't. Tests by auto manufacturers have proved that there are vast differences in the performance of oils labeled MS, and

many such oils have been found wanting. More on this point in a minute.

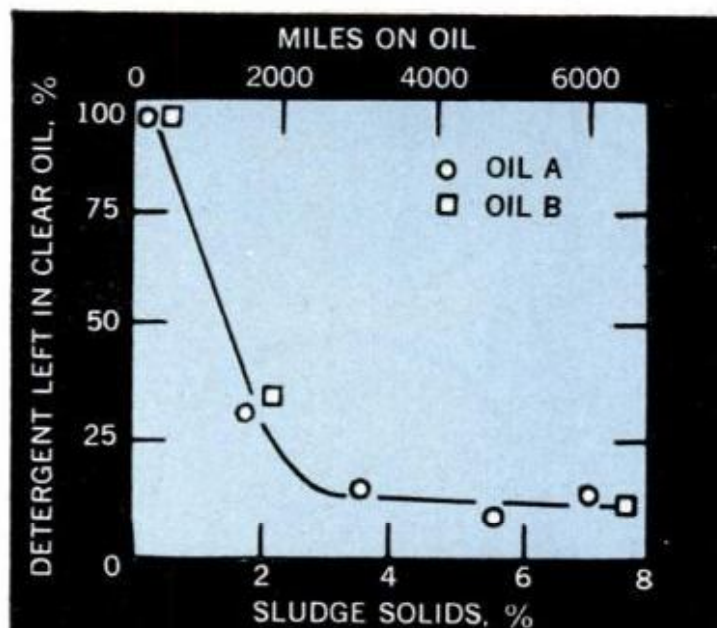
For most car owners, the answers to all these puzzling questions are compounded from massed fragments of current and obsolete information and plain filling station folklore sub-divided into a series of what we might well call "the Oil Change Myths." Suppose we examine these myths one by one and separate the proven facts from the unsupported fables as we go along. The first myth is perhaps the oldest chestnut of them all:

### Oil Never Wears Out

The oil may not but its usefulness certainly does. Even if the base petroleum stock could be separated from the diluents and contaminants, it cannot cope with the high pressures, temperatures and new contaminants in a modern close tolerance engine, once its additives are depleted. It might still be "slippery," but its effectiveness would be "worn out."

Actually, the base stock itself does wear out in one sense. As George A. Round, consultant to the American Petroleum Institute Lubrication Committee, puts it:

"Although oils appear to contain natural inhibitors which retard oxidation, these are not particularly potent at high temperatures and are soon used up. Then we have acid formation, viscosity increase, and sludge and varnish materials separating as deposits. Hence the need for powerful chemical oxidation or bearing corrosion inhibitors. These additives are also



**OIL "WEARS OUT"** as shown in the graph above where dispersant is depleted after 2000 miles. At the same time as dispersants weaken, sludge builds up

called anti-catalysts or catalyst poisoners.

"If we re-refine a *used* straight mineral oil, or one containing the usual additives, the additives disappear and the remaining mineral oil is nowhere near as resistant to oxidation as it was initially without additives. In this respect, it is worn out."

Myth No. 2 is perhaps the most *modern* myth of them all:

**To Be Sure I Am Getting The Best Oil For My Car, The Only Thing I Need To Look For Is An MS Label On The Can**

Because MS is supposed to cover oils designed for severe motor service, the theory here is sound, but it is not enough. Auto manufacturers have discovered that not all oils labeled MS would stand the gaff of high bearing loads and close tolerances found in modern, high compression engines.

As one of their reports put it: "A mid-western town had two dealers handling the same make of vehicle. Over a six-month period the first dealer reported catastrophic cam and lifter failures in 28 new automobiles. This dealer was using an MS engine oil subsequently shown to be deficient in anti-scuff performance. The second dealer was handling acceptable MS competitive oils and had no service failures."

To protect their customers, the automakers working through committee G-IV of the American Society for Testing Materials (ASTM) have developed a sequence

of tests to judge oils in respect to such properties as:

1. Low-temperature, medium-speed scuffing.
2. Low-temperature rusting and deposits.
3. High-temperature oxidation.
4. High-temperature, high-speed tappet scuffing and wear.
5. Sludging and screen clogging by insolubles.

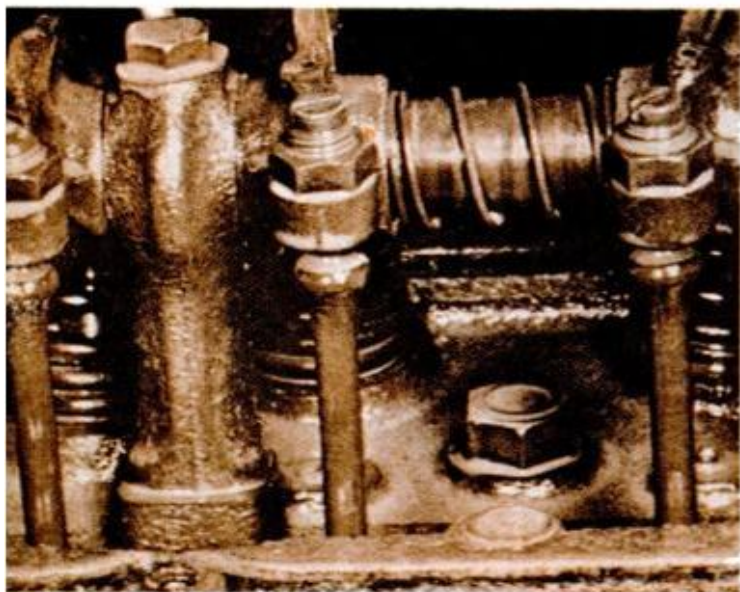
These, then, are the critical sequence tests by which oils are rated by auto manufacturers today. More and more, refiners are willing to tell you when their oil passes these ASTM sequence tests. There's no universal seal indicating quality, nor is there an independent reviewing body to insure that oils *claiming* success in the sequence tests actually passed any test except the refiner's. Samples checked in Detroit, however, indicate that oils that have been labeled "sequence tested" also can pass a similar set of tests run by the automakers themselves.

In shopping for the best quality oil, then, look for specific phrases referring to ASTM G-IV engine sequence tests. Even if the can says simply that the oil passes "engine sequence tests" or "car makers' sequence tests," or only "auto makers' test requirements" you're still pretty sure of being on safe ground. Other encouraging phrases to look for: "auto makers' engine tests," "MS test sequences," "car makers' MS service tests." Photos show you some ways in which sequence tests are indicated on oil can labels.

**1964 CAR CRANKCASE — GRADES/DRAIN INTERVALS**

| Make           | Grades     |        |         | Drain Interval  |
|----------------|------------|--------|---------|---|
| GENERAL MOTORS | Above 32°  | 20,20W | 10W-30  | Every 60 days or 6000 miles<br>Whichever occurs first   |
|                | Above 0°   | 10W    | 5W-20   |   |
|                | Below 0°   | 5W     | 5W-20   |   |
| CHRYSLER       | Above 32°  | 30     | 10W-30  | Every 3 months or 4000 miles<br>Whichever occurs first  |
|                | Above 10°  | 10W    | 10W-30  |   |
|                | Above -10° | 10W    | 10W-30  |   |
|                | Below -10° | 5W     | 5W-20   |   |
| FORD           | Above 90°  | 30     | 10W-30  | Every 6000 miles or 6 months<br>Whichever occurs first  |
|                | Above 20°  | 20,20W | 10W-30  |   |
|                | Above -10° | 10,10W | 10W-30  |   |
|                | Below -10° | 5W     | 5W-20   |   |
| RAMBLER        | Above 32°  | 20,20W | 10W-30  | Favorable operations (over 10 miles<br>per trip) 4000 miles<br>Less than 10 miles per trip<br>Summer 2000 miles<br>Winter 1000 miles<br>Dusty driving conditions 1000 miles |
|                | Above 0°   | 10W    | 10W-30  |   |
|                | Below 0°   | 5W     | 5W-20   |   |
| STUDEBAKER     | Above 80°  | 30     | 20W-40/ | Every 60 days or 6000 miles<br>Whichever occurs first   |
|                | Above 32°  | 20     | 10W-30  |   |
|                | Above 0°   | 10W    | 10W-30/ |   |
|                | Below 0°   |        | 10W-20  |   |
|                |            | 5W-20  | 5W      |   |

**FACTORY RECOMMENDATIONS** for oil change intervals on 1964 models shows an increased interval for GM cars. All recommendations are qualified somewhat in regard to winter and short trip service calling for more changes



**AFTER 192 HOURS** the valve rockers of this engine were in good shape earning a passing grade for the MS labeled motor oil which lasted for the duration



**ANOTHER MS OIL** went through the same test sequence as the engine at left but a look at the sludge generated told engineers the oil was not qualified MS

Here are some other favorite myths:

### High-Additive Oil Tends To Leak

It's hard to guess where this myth came from. Researchers for the big three car builders, Perfect Circle ring manufacturers, and Caterpillar Tractor all agree in substance: "If this were true, we'd know about it. It just isn't so."

### Small Leaks Don't Matter Much

Well now, what do we mean by small? Losing *one drop* of oil in 30 feet of travel will cost three quarts in only a thousand miles. Have the oil checked at every gas fill to be sure a leak hasn't started. It could rob vital engine parts of lubrication or cooling before the idiot light comes on.

### A Dirty Dipstick Means Change Oil

Even the most sales-hungry oil company will admit this is far-fetched. The oil *should* turn black from microscopic particles of potential deposits being held in suspension by those additives you paid for. Most particles are too fine to be filtered so they accumulate and discolor the oil after a few hundred miles. They do less harm in suspension than if they were allowed to precipitate as deposits.

### If I'm Burning Lots Of Oil, I'll Never Need A Change

Engines that burn lots of oil foul themselves and their oil extra fast due to extreme blowby. No oil change means no oil drain. The sludge will keep on piling up, soon blocking the screen and passages unless you're using the best quality oil—

**PISTON VARNISH** on the top piston shown below was result of running sequence test with inadequate MS



not likely if you have a real rolling smudge pot.

If high consumption is your problem and you've ruled out the possibility of leaks, resign yourself to buying lots of oil, dumping the car, or investing in rings and maybe bearings. Incidentally, here's Perfect Circle's suggested break-in for new rings: about a dozen full-throttle accelerations from 15 to 60 m.p.h. with recommended type and grade oil.

### You Can Tell When To Change By Tasting The Oil

This myth has been kicking around since alkalinity became an oil advertisers' catchword, and some people thought you could taste the sourness of too much acid build-up in the oil. But lube researchers we asked said this was news to them. One did

say: "Maybe so—taste is a beginner's textbook test for some acids. Trouble is, some can be poisonous. Anyway, I'd guess what you'd taste would be the combustion acids that are present as soon as you've run the engine with the oil in it."

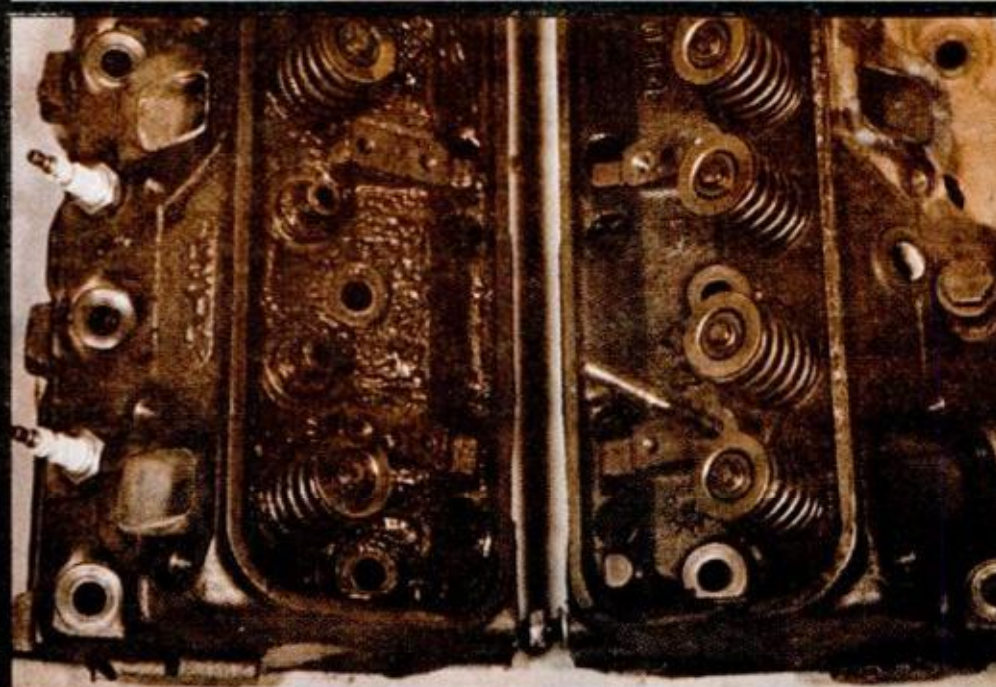
### A Cheap Filter Changed Often Is Better Than An Expensive One Left In Too Long

Any filtration practice is better than leaving a loaded-up filter in the system. When a loaded-up filter refuses to pass oil through the element, the oil goes through a relief valve unfiltered, to avoid starving the bearings.

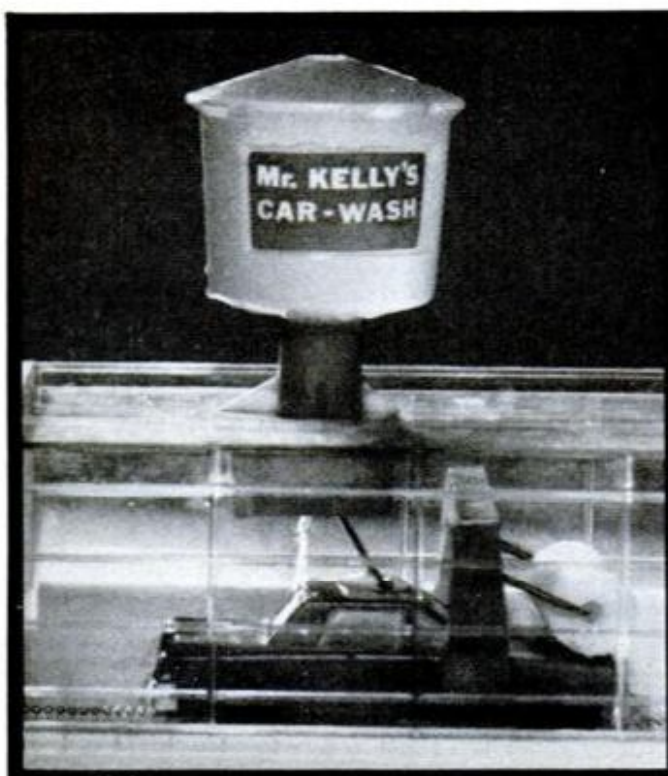
Motor oil researchers in Detroit warn that it's possible for you to buy a new filter with an element so dense that it will hardly pass any oil and poorly made fil-

[\(Please turn to page 224\)](#)

**CRITICAL POINT** in sequence test of MS oil is reached when oil screen clogs, below right. Open screen, far right is from engine using an MS oil that passed. Sludge in top pan (at left) formed after 192 hours of constant operation, clean pan made similar run with different oil. Valve gear of some engines shown below



# PM's **TOP** Ten Toys



**MR. KELLY'S CAR WASH** is a scaled-down miniature of the real thing. Two D cells power a tiny motor that pulls toy cars through the works. In the closeup at left, water pours down over one car as it enters the wash. Car wax, sponges and chamois cloths enhance true-to-life realism. Remco Industries Inc. \$7.95. For 5 to 10 year olds

**METAL SCIENCE BOOK LAB** introduces the young metallurgist to his field. More than 100 experiments with actual samples of 20 different metals and alloys are detailed in the 96-page illustrated manual accompanying the set. The setup for one of them, electroplating, is shown here. For ages 12 and up. \$17.95 from Science Materials Center



# of the Year

*Labs, experts and kids help us pick the best—  
but some other '63 toys flunk their safety exams*

**O**N THESE PAGES are the winners of *PM's* second Toy of the Year Award Program.

They are the cream of the toy crop this year, and may well answer the perennial, "What'll we get the kids for Christmas?"

The toys have been play-tested in school, evaluated by an experienced toy buyer, laboratory tested and judged by experts.

The program turned up some surprising reactions from small fry. Even more significant, laboratory tests revealed that several 1963 toys had poisonous finishes! (They were immediately eliminated.)

Last June, we invited all toy manufacturers to send us their best new candidates; all had to be available for Christmas.

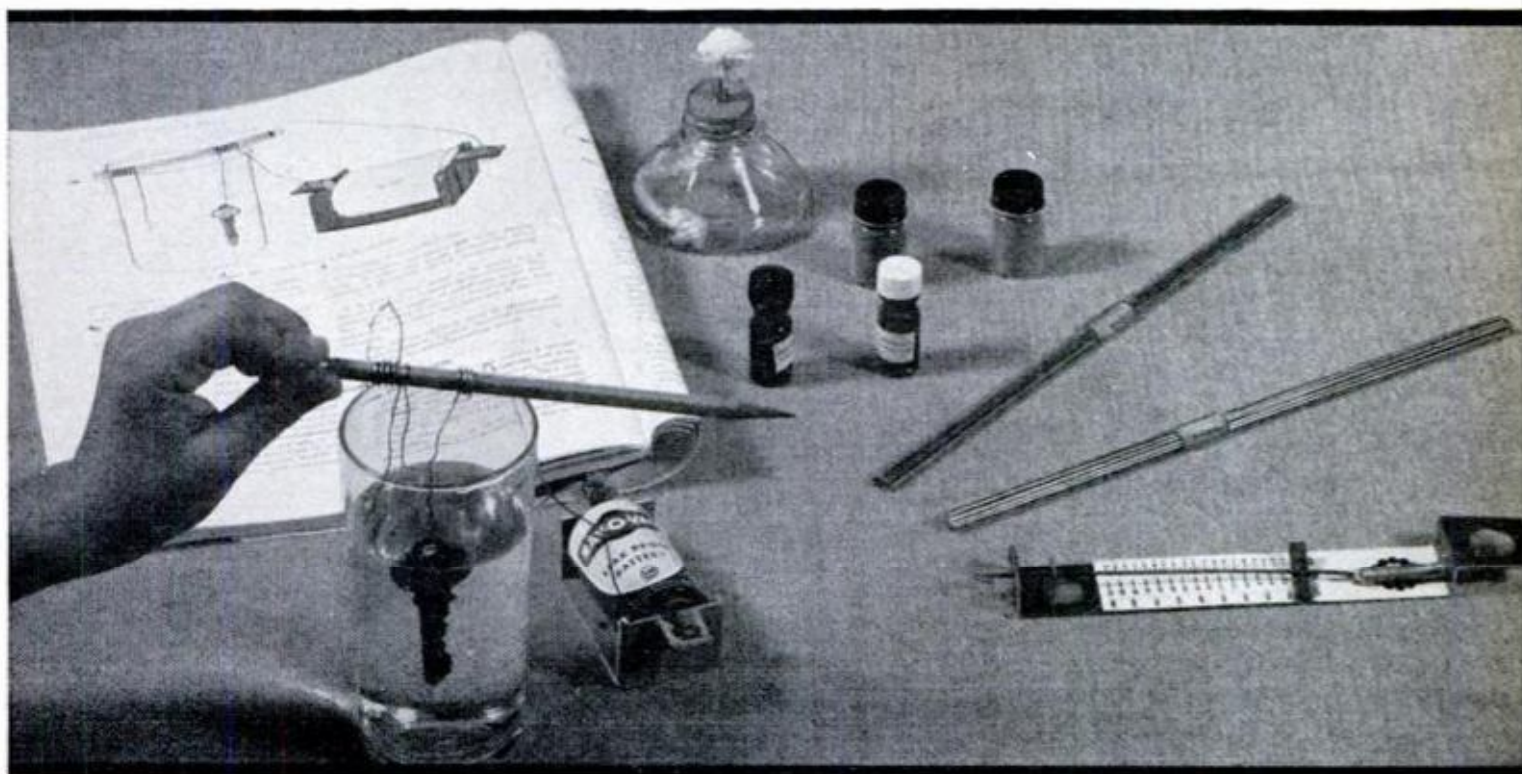
Seventy-seven manufacturers responded with a total of 169 toys, hobby items, laboratory sets and amusement devices.

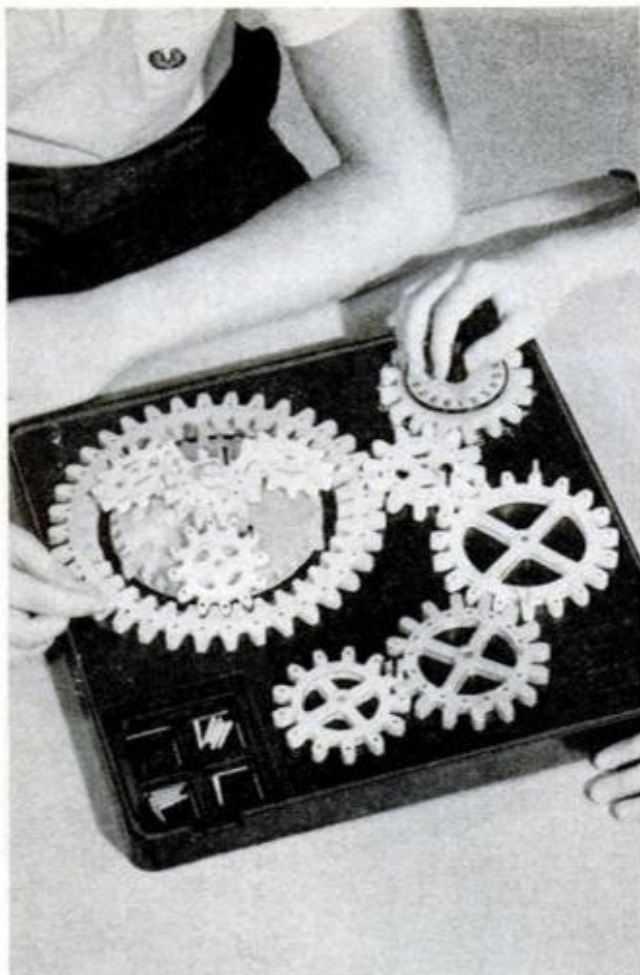
We then were faced with the basic question: What is a *good* toy? We set up the following criteria for judgment:

**Originality**—the toy must be new in

concept, or such a major variation of an older idea that it is, in effect, a new toy; **educational or entertainment merit**—it must entertain and, to some extent, aid the mental, physical, social, or vocational development of the child while continuing to hold his interest; **good design and engineering**—it should be capable of fulfilling the play function for which it was designed; **durability**—it should stand up under normal use and abuse by children of the age bracket for which it was designed; **safety**—it should be completely safe when used as directed by the recommended age group, and should contain no injurious materials or finishes; **value**—it should be a good buy for the money.

We then submitted the toys to one of the best-known testing laboratories in the country. White-coated engineers put each of them through a series of tests. For example, the toys were given vibration tests on an instrument called a Ling Vibration Tester, then were subjected to three dif-





**HIGH GEAR:** Board game with a moving board. To win you've got to get four pegs through the colorful gear train up onto high gear before anyone else. A lesson in gear relationships of simple gears is built into the toy. \$6 from Mattel. For 7 year olds and up

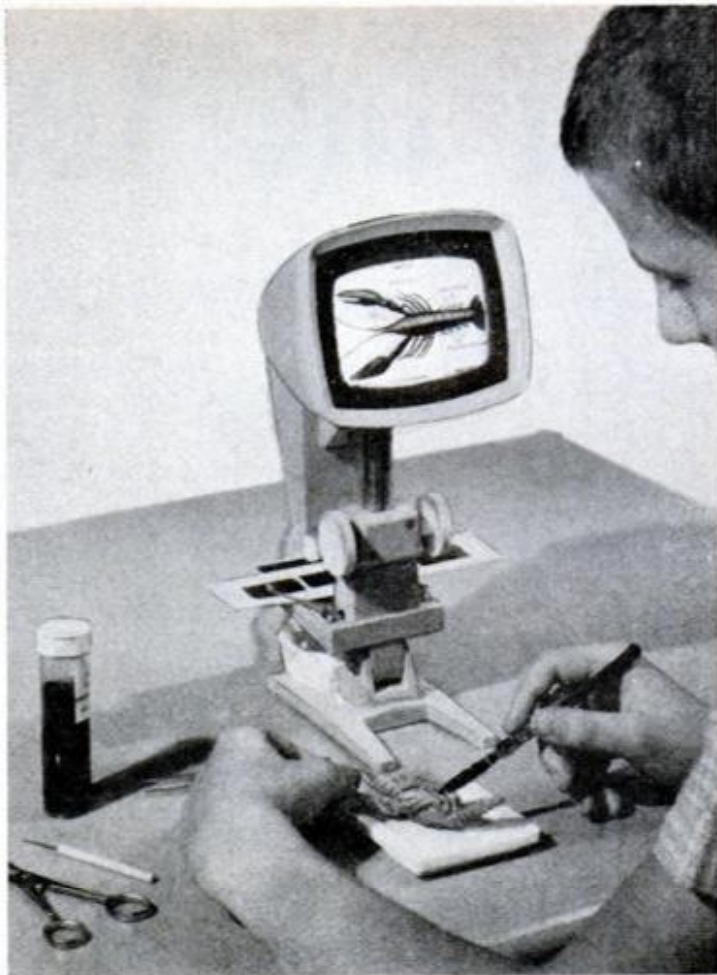
ferent types of impact tests. Plastic parts were pulled out of shape on torture machines, then released to see whether they would return to their original form.

Many toys were given "life tests"—running continuously until they failed. Plastic toys were placed in ovens at 175 degrees F. to simulate the heat of a household radiator. Electrical toys were checked for voltage output, safety and overheating.

Tests of chemical properties showed some surprising results. Paint was analyzed by spectograph. Several of the reports showed that the toys actually could be dangerous. A report on one toy reads:

"Analysis revealed the presence of 'heavy metals' which are toxic in potentially hazardous quantities . . . More than 10 times the permissible amount of lead is present . . . Antimony is present, and none is permissible . . . A substantial amount of chromium was found . . . a toxic metal . . . particularly hazardous in combination with lead and antimony."

Any toy showing a hazard of this type



**MIC OLOGY SET** introduces the 8-and-up set to the wonders of the biologist's laboratory. Projection microscope gives a large-screen image of subject being examined. Here a crayfish is being dissected and compared to color slides. \$24.95 from A. C. Gilbert

was immediately removed from the *PM* competition.

*PM* submitted all toys which had passed the laboratory tests to perhaps the most critical judges of all—the kids themselves. They were play-tested by 135 youngsters, ages 3 to 14, at Miller Elementary School in Evanston, Ill., under the supervision of Loy K. Sanders, acting principal.

We also submitted some toys to a group of 35 playground children, ages 3 to 18.

In both cases, children were asked to rate their favorite toys and give the reasons why; and teachers were asked to comment on the children's reaction. Typical small-fry comments (unedited by us) were:

"It made me think."

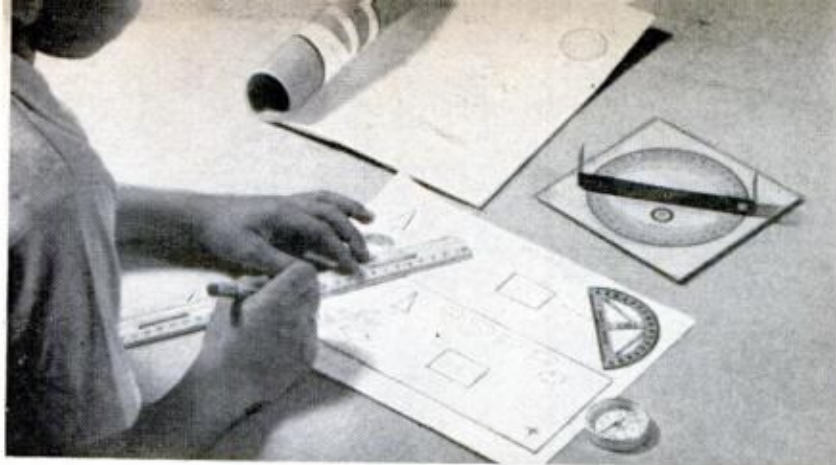
"I do not like this game because it is crummy and gets broke easy."

"I liked this toy because of the talent and patientes it took."

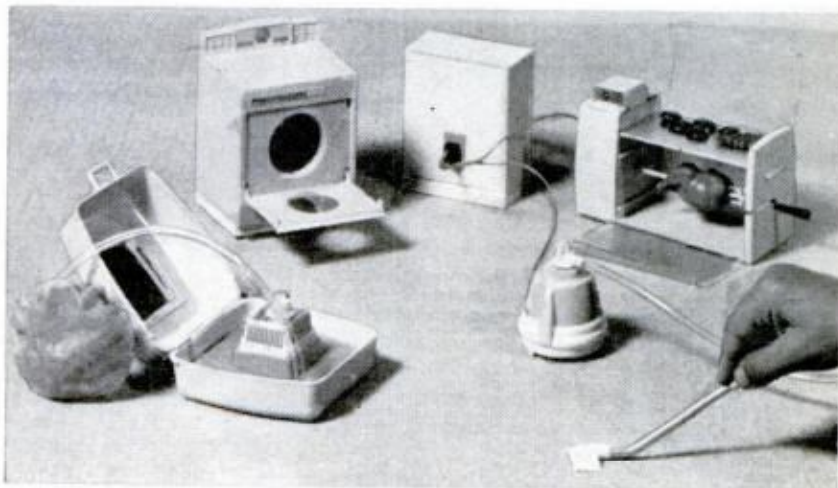
"It's cool—but not way out." (A space-age toy.)

Next, we asked Harold Kamp, toy buyer

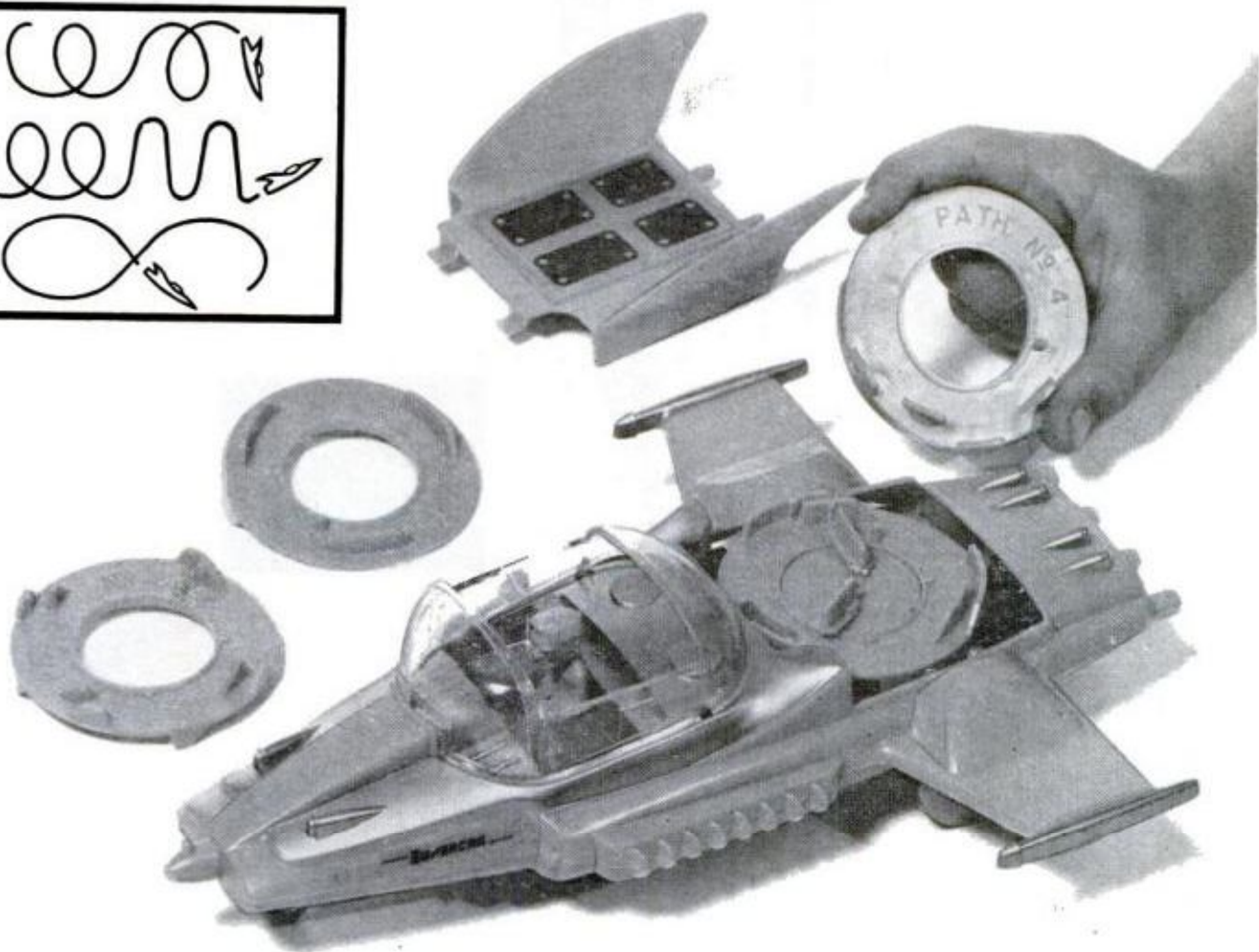
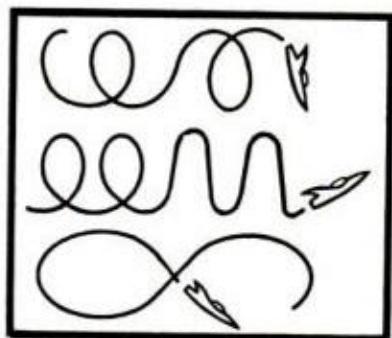
**SCIENCE BOOK LAB of Map Making.** Eight to twelve year olds should have some real fun while mapping out the family grounds. Simple transit and magnetic compass, ruler, protractor, graph paper, string and manual are included. \$3.95; by Science Materials Center



**KIDDYPLIANCES.** Regular household appliances scaled down for 5 to 11-year-old fingers. Basic kit starts the little ones off with a vacuum cleaner and battery holder. Other sets include a washing machine, rotisserie, hair drier, and dishwasher. \$2.98 each. Bachman Bros.

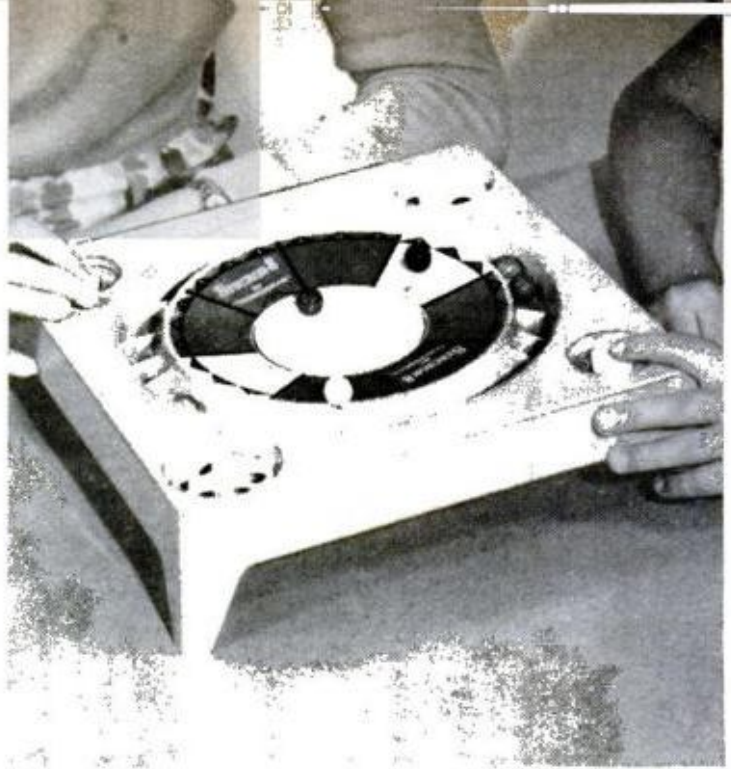


**MIKE MERCURY'S SUPERCAR.** Plane-like auto "flies" along the floor following preset paths. Select desired flight path from eight possibilities, insert the proper cam and Supercar is on its way. One D-cell flashlight battery supplies power. \$6. Remco Industries Inc. 5 to 10 year olds





**ENLARG-A-GRAPH.** Pinhole camera effect enlarges or reduces transparencies and projects them onto the viewing-screen top plate. Slip a piece of tracing paper into place and start tracing. Single knob control. 6 to 13 year olds. \$9. Emenee Industries



**SYNCRON-8.** Skill and action are displayed as you try to spin the marbles into the desired pockets. Whirling disk in the center uses centrifugal force to shoot the marbles out toward the rim. Pushbutton control. For ages 5 and up. \$4.98 from Transogram

for Butler Brothers, to look over each toy to see if it really involved a new concept.

Finally, the official judges went to work. The panel consisted of Dr. Viola Theman, Professor, School of Education, Northwestern University, and also Director of the University's Children's School; Philip Dykstra, Chairman, Home Safety Committee, National Safety Council; and three *PM* editors.

Each toy was brought before the judges. They not only played with it, but they also had on hand a sheaf of background material from all the above sources.

Each judge evaluated the toy without seeing another judge's rating.

Thus we found the top 10 toys of the year. We are convinced that each of them best fulfills our six criteria. We think you—and the kids—will agree.

**TOY MAKER** builds up working trucks, trains, boats, cars from variety of brightly colored "soft" plastic parts. Imagination is the only limitation on possible projects. 2 to 8 year olds. \$3, \$5 and \$6.95 sets. Toy Tinkers



**BOB-TAILED BEETLE** is at home afield. Until you've seen its air-cooled engine perch at the rear, you'll find it hard to believe that all moving parts of the go-anywhere Sportster may be salvaged from a stock VW



**PLENTY OF ACTION** on almost any surface on which a wheel will roll results from lightweight, high (10½-inch) clearance and sturdy VW independent suspension, on Sportster. This one has Corvair engine, but uses VW running gear parts



**WELL, NOT EXACTLY.** Nothing like it ever rolled off the Wolfsburg assembly line, but there's enough Volkswagen hardware in it to stock a garage.

Basically, the Sportster is a sheet-metal body and frame welded into a single unit designed to use any Volkswagen engine plus transmission, front suspension, steering, brakes, rear axles, torsion bars, front seats, shock absorbers and wheels.

Wheelbase of the Sportster is 82½ inches, one foot shorter than the standard VW's. As a result, turning circle is reduced from 36 to 29 feet. Ground clearance is a roomy 10½ inches which makes it an excellent off-the-road vehicle. Overall length is only 119½ inches compared to the 160-inch VW sedan.

Performance is brisk, better than stock VWs, thanks to a weight reduction of 450

pounds over the VW sedan body. Since most of this weight is on the rear wheels, traction is exceptional. To clinch matters, the Sportsters' rear wheels are equipped with 8.00 x 14-inch mud-snow tires instead of VW's 5.60 x 15 tires.

As an aid to handling on rough downgrades, the Sportster has two hand-brake levers acting individually on each rear wheel. The Sportster may be ordered as a completed car for \$1495, as a body ready for addition of VW components for \$895, or you may get complete plans for \$9.

As an option, the Sportster body may be adapted to use the Corvair engine which gives the little runabout a speed of over 100 m.p.h. With the VW engine speed is said to be 85 m.p.h.

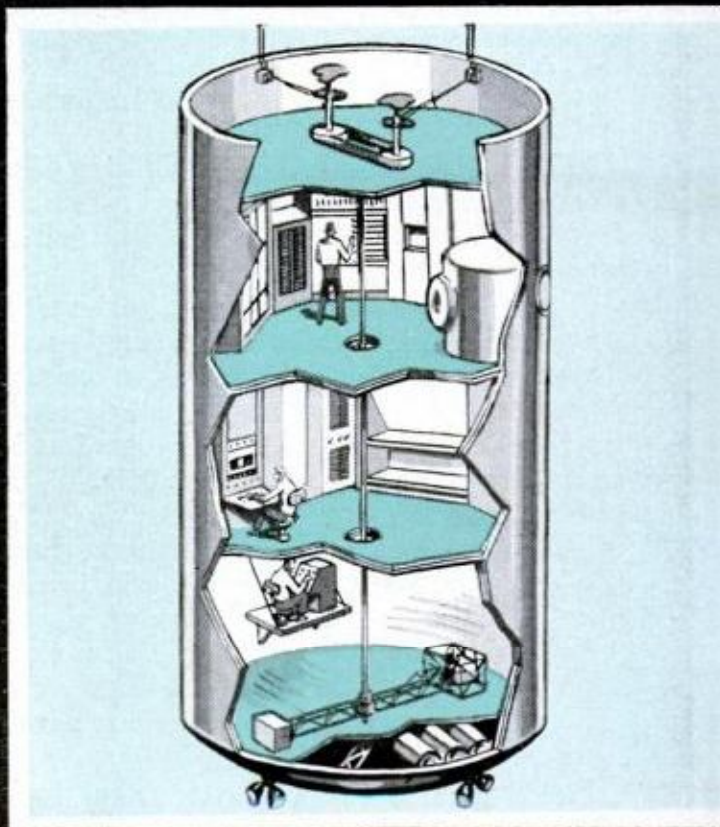
Sportsters are made by EMPI Motor Products of Riverside, Calif.—*V. Lee Oertle*

# Will We Pass Up the



**MARS** excursion module sits atop basic nuclear-powered spacecraft, shown in earth orbit prior to rendezvous with Saturn V boosters carrying propellant tanks. See pages 106-107 for rest of Mars journey sequence

**A SPACE LABORATORY,** probably the Langley "Can," will soon be orbited to conduct the life-support experiments essential for a 19-month Mars journey. Lower compartment has a centrifuge for gravity experiments; prolonged weightlessness may make production of artificial gravity a necessity



# Moon for Mars?

Orbiting laboratories, soon to be sent aloft, could shorten the lead time necessary for our first space journey, whether the destination is the moon or Mars

By S. David Pursglove

**W**HAT WILL AMERICA do next in space?

Is the moon a *must* as a first step, or will we leapfrog that satellite and head for other orbs?

Mars? The red planet is already scheduled for the '70s. But first, we have to find out how to make that 14 to 19-month trip—something that the seven-day moon trip will not tell us. Whether or not Americans ever blast off for the moon, the U. S. has already started its attack on the problem of finding a way to Mars.

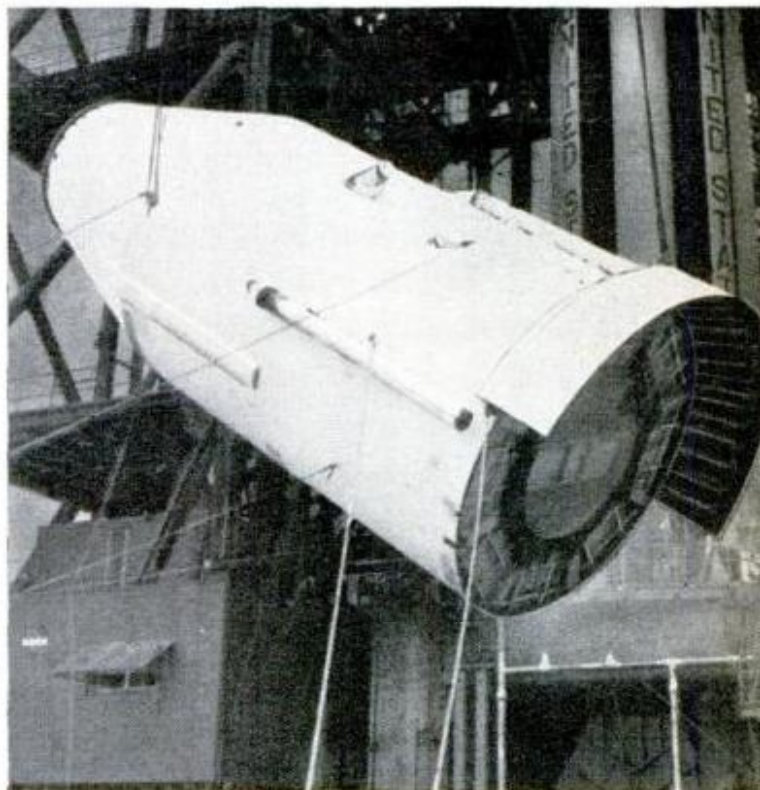
We will seek the solution by orbiting an unglamorous, not very large and not even very expensive metal

can. As soon as it is firmly in orbit, four astronauts will board a "space ferry" and be hurled some 200 miles from earth to a rendezvous with the can. There they will clamber into the cramped metal cylinder that a few irreverent space-agency officials already are calling "that oversize G.I. can."

Hurting at 17,500 m.p.h., more than 200 miles from the earth, the astronauts will experiment and study for at least 100 days, probably for four months and perhaps six months. They will live in the orbiting space station at least 75 times as long as Gordon Cooper was in Faith 7. They

**MODELS** of a two-stage Saturn with Apollo spacecraft are undergoing exhaustive wind-buffeting tests at the Langley Research Center's Transonic Tunnel

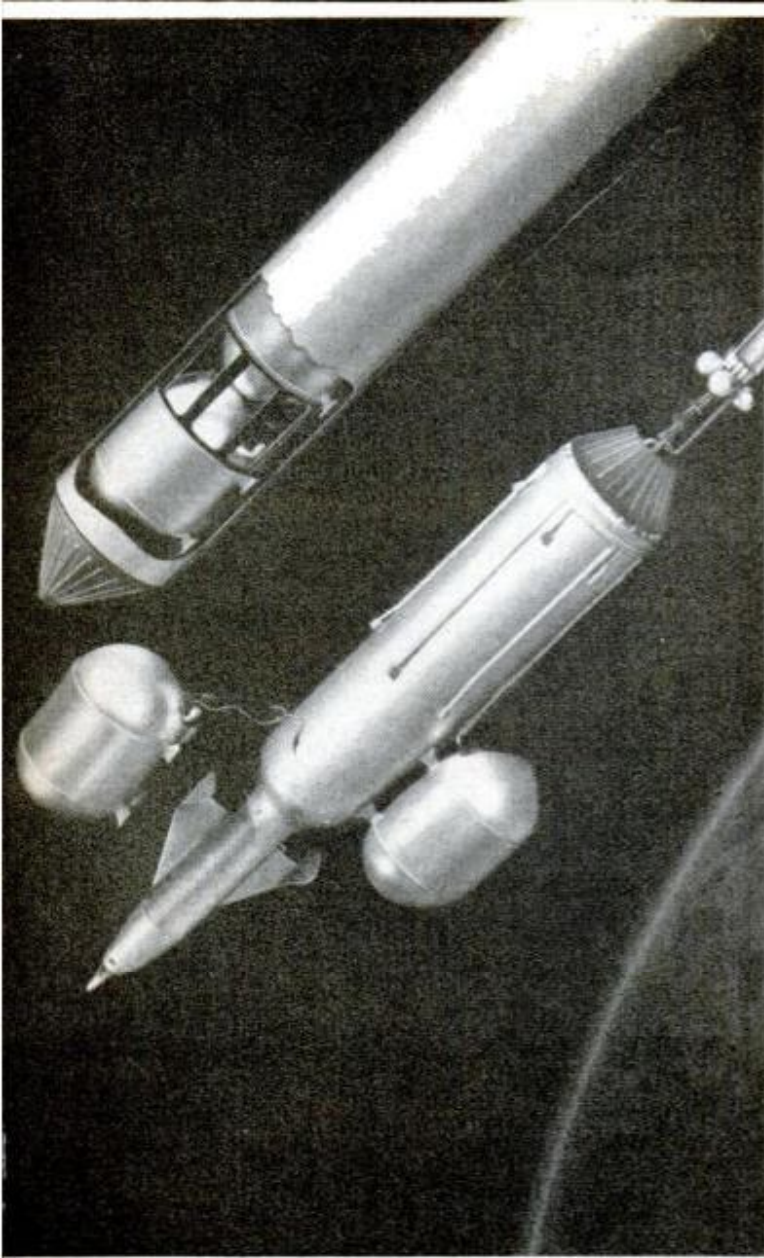
**SECOND STAGE** of the gigantic Saturn IV booster being hoisted up gantry for testing. It will carry the Apollo capsule to the moon, may orbit the space lab



will try to exist without the comforting and perhaps essential effects of gravity, brave radiation hazards and risk puncture of the "can" by meteoroids some 40 times as long as Valery Bykovsky and Valentina Tereshkova orbited during their heavenly duet earlier this year.

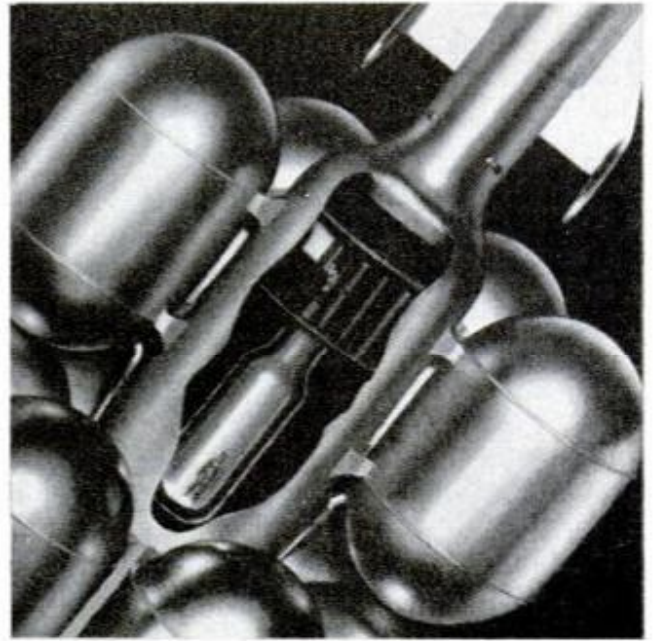
In the orbiting laboratory, the astronauts will be able to study the mysteries and dangers of living in space more than 15 times as long as would be experienced by astronauts in an Apollo moon-trip capsule. This is the important reason for the proposed manned orbiting space station, or laboratory.

What will happen to a man living with-



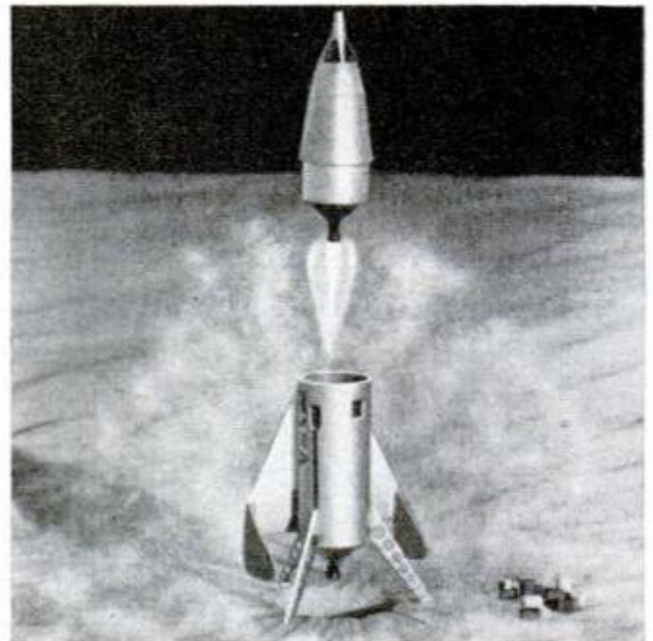
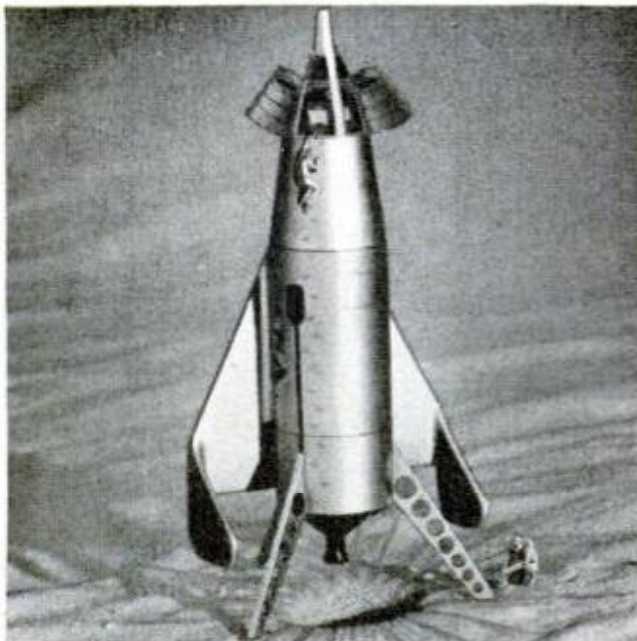
**1. THREE BOOSTERS** will hoist 12 hydrogen tanks which will be attached to Mars craft by the crew

**5. TWO** of spacecraft's four-man crew will ride the landing module to Martian surface for five-day stay



**2. CREW QUARTERS** are back of landing module; "storm cellar" capsule protects from solar flares

**6. FIRST STAGE** of module, which will be left on Mars, will be launching platform for the escape capsule





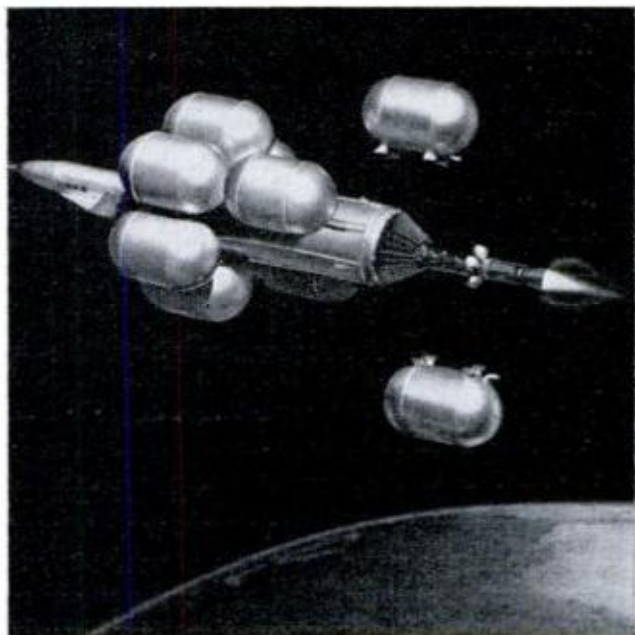
out gravity, and perhaps *with* radiation, on a 400-day—or longer—Mars trip?

Will blood, flowing unevenly under prolonged weightlessness, permanently damage a Mars voyager's brain? Will his blood gradually try to settle in pools and fail to circulate properly? Will calcium separate from his bones in the absence of gravity and slowly shift to body organs where it does not belong? Some researchers think so, based on short-term partial simulation of weightlessness in water tanks, and observation of long-time bed-ridden patients.

If life in the orbiting laboratory bears out these fears, then the spacecraft that

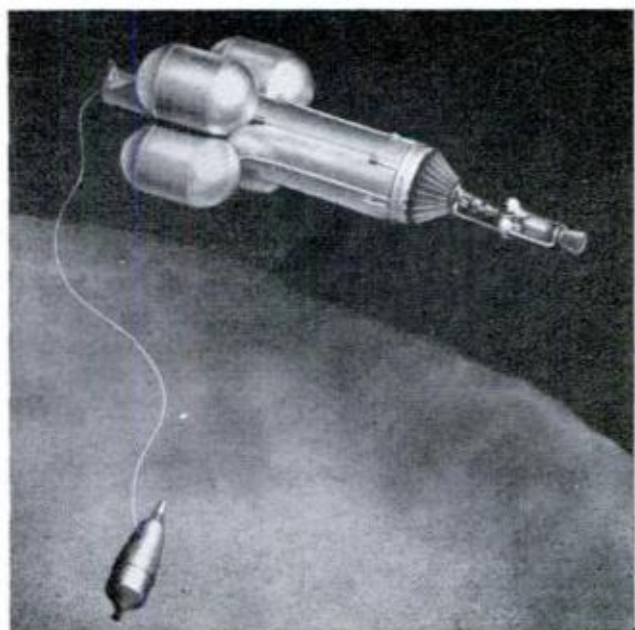
National Aeronautics and Space Administration engineers will design for the Mars adventure will have to have built-in gravity. Many scientists are convinced that a Mars craft will have to have at least *some* artificial gravity. Hopefully little, because the greater the gravity effect that must be created, the greater the expense, engineering problems and the chance that something might go wrong.

Artificial gravity is produced by spinning the chamber where the men live and work. Centrifugal force directs body weight outward and gives a man's feet a substantial platform on the outer wall of a round chamber. It seems "down" to him. It will

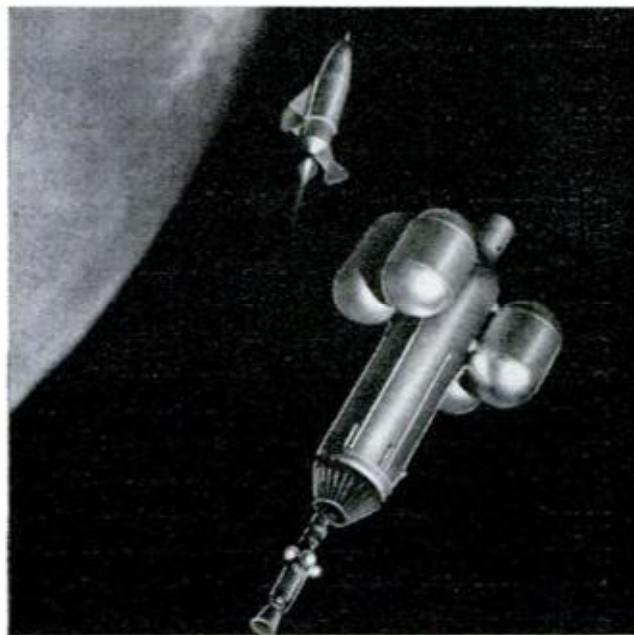


**3. SIX FUEL TANKS** will power earth escape; two empties are retained in case of meteoroid puncture

**7. CAPSULE** will be abandoned in Martian orbit once crew has rejoined mother ship for the return to earth

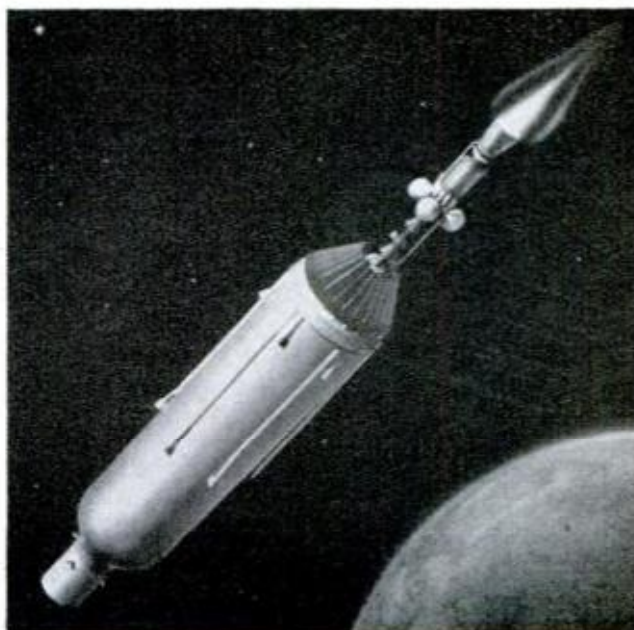


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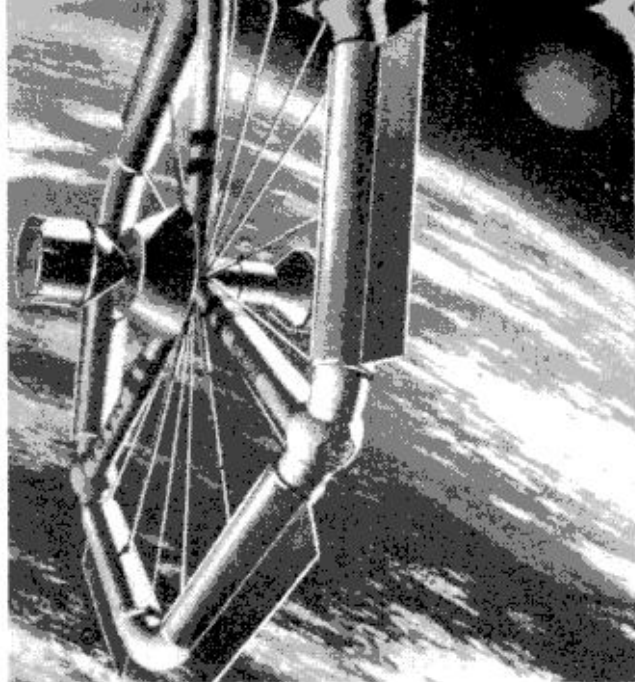


**4. LANDING MODULE** leaves spaceship in Mars orbit. Rockets and drag slow it for landing on planet

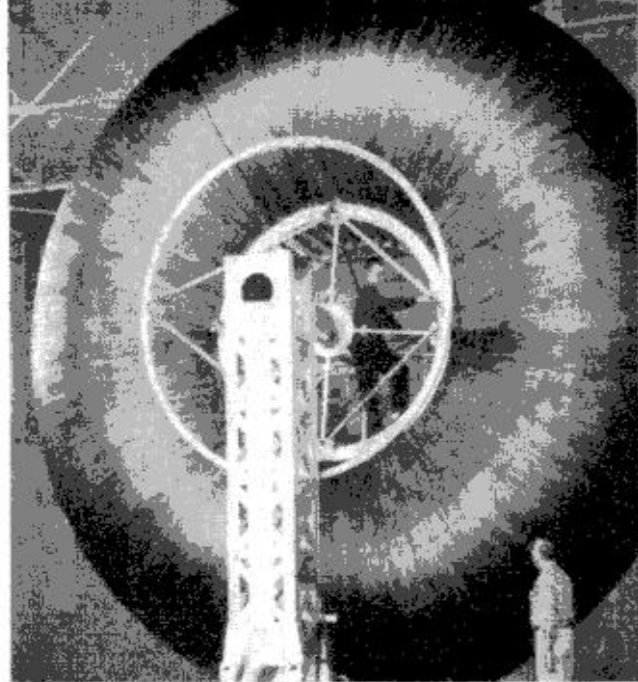
**8. ALL FUEL TANKS** will be jettisoned when rocket re-enters earth orbit; space ferry will land the crew



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**HEXAGONAL SPACE LABS** of the future will rotate to provide artificial gravity for crew. The center is stationary (in effect) for studies of weightlessness



**EARLY DESIGN** for inflatable manned space station, the "innertube," was scrapped when rapid development of big boosters made better stations possible

also seem "down" to his blood, bones and his bladder as well.

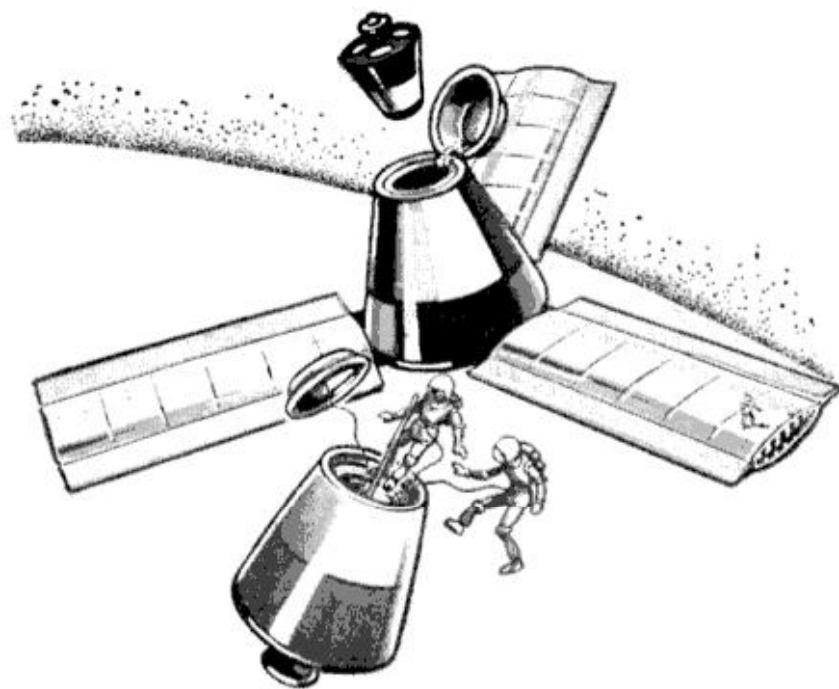
Slow rotation of a small space chamber would produce *some* gravity effect. Fast spinning would result in a much greater effect, but then the crew would suffer dizziness. In large, slowly turning units wobble becomes a real problem. Slight shifts in weight—such as men walking—must be countered with automatically moved weights or heavy mercury piped continuously to where it is needed by computer-controlled pumps.

Design, cost and reliability all suggest using the smallest amount of artificial

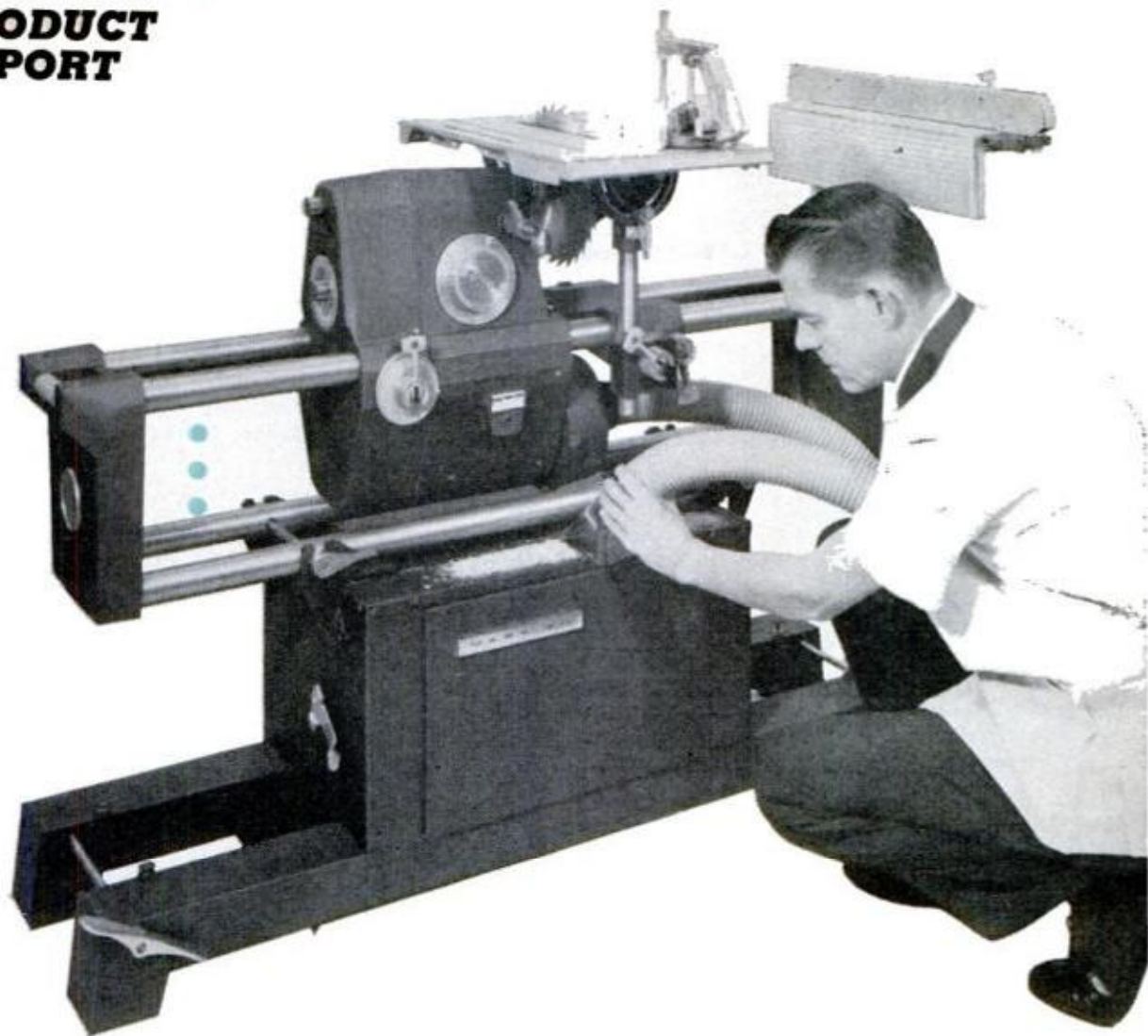
gravity that will do the job. So, one major task for the first space station crew, three or four years from now, will be to find out just how little artificial gravity is needed to keep men healthy and alert on the long flight to Mars.

Does this sound like we are giving up the moon race and putting our prestige bets on a trip to Mars first? Washington has been rife with such rumors. A newer rumor that seems to make the most sense, however, is heard at nearly every turn nowadays. It contends that we can fly around Mars and return, without landing,

[\(Please turn to page 230\)](#)



**Y-SHAPED** second-generation space lab probably will follow the Langley "Can" into orbit by the mid-1970s. Designed by Manned Spacecraft Center in Houston, it will hold a crew of 36, will be hurled into orbit by Saturn V. Enlarged Gemini or modified Apollo capsules will ferry crew and supplies to and from earth. Compartmented arms will rotate about the central chamber to create artificial gravity. The central chamber will be used for experiments in weightlessness



## ***Multipurpose Tool Gets a Built-in Sawdust Vacuum***

*New Mark VII is loaded with improvements to make it more versatile than ever. Now has spindle shaper to add to the five basic tools*

**By R. J. DeCristoforo**

**A**LTHOUGH all the unique and exclusive features of the Shopsmith Mark V have been retained, the new Mark VII, with its quad-tubular frame and charcoal grey color, hardly looks like the same tool.

Having undergone a complete overhaul in design, what was once a 5-in-1 multipurpose tool is now a 7-in-1 machine. Two additional tools have been added to the original five, namely, a vertical spindle shaper and a built-in sawdust vacuum.

The new machine still serves as a saw, drill press, sander, lathe and horizontal boring machine, and still accommodates all the individual accessory tools it did before.

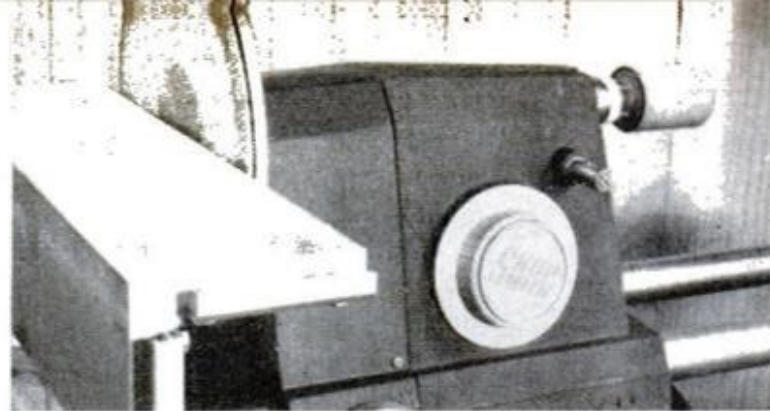
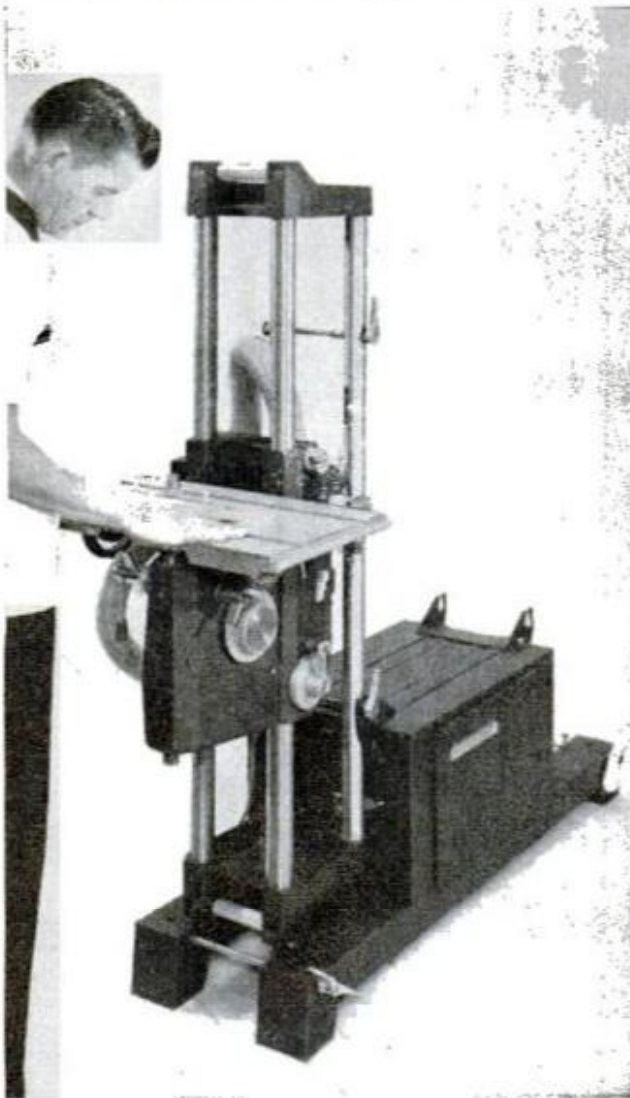
The horsepower of the Mark VII's two-spindle headstock motor has been increased to  $1\frac{1}{8}$ —it was  $\frac{3}{4}$  hp.

The direction of the rotation of the motor can now be reversed—something you couldn't do before—and the motor is controlled by a Safe-See pushbutton key

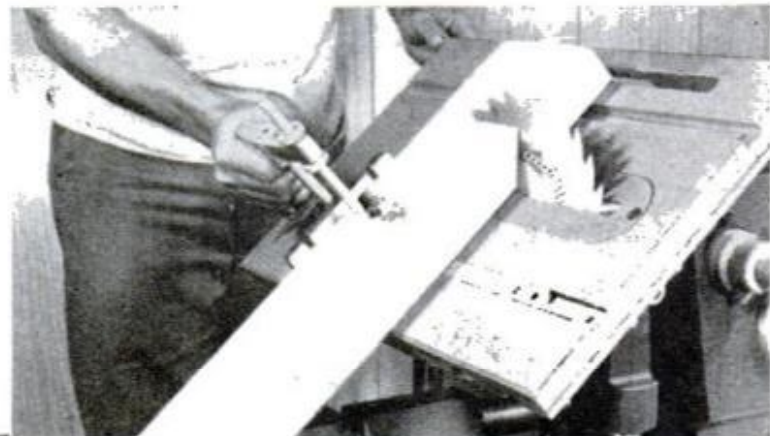


**A. SPEED DIAL** now has click stops for more positive setting. **B. Lever** takes hard work out of moving motor headstock along carriage. **C. Illuminated safety control buttons** make goofs impossible

**MACHINE NOW TILTS** to left to add spindle shaper to original five tools. Reversing action of motor doubles profiles you can get with single three-lip cutter. Drum sander can be used here, too



**SECOND SPINDLE** permits both disk and drum sanders to be mounted at same time. Note that saw-table extension is used here as outboard sanding table

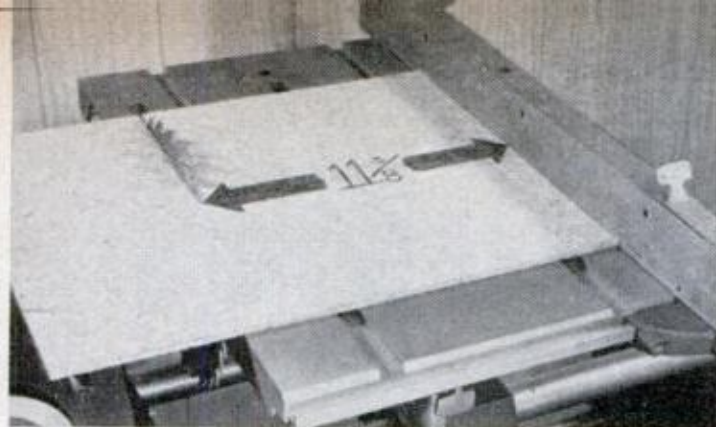


**WHEN TABLE** is tilted 45 deg., the 10-in. blade will cut to a depth of 2½ in. Exclusive pistol-grip hold-down is still standard equipment with basic unit

switch which guards against unauthorized use and tells at a glance that the machine is safe. When not running, an illuminated red button means the machine is unlocked. A yellow button indicates the machine is running in reverse. A green button tells you the machine is running forward. You can't work either green or yellow without punching the center pushbutton, and you can't switch from one to the other without first flicking the key switch and punching the center button. It would take deliberate carelessness to make a mistake.

In addition to being more powerful, the Mark VII has greater sawing and drilling capacity. It's now a 10-in. instead of a 9-in. saw. You can rip and crosscut to a depth of more than 3½ in. at 90 degrees, 2½ in. at 45 degrees. The saw table itself is larger (19¼ x 21 in.) to help handle big pieces easily, and there's enough room in the front of the blade for a 10-in. board.

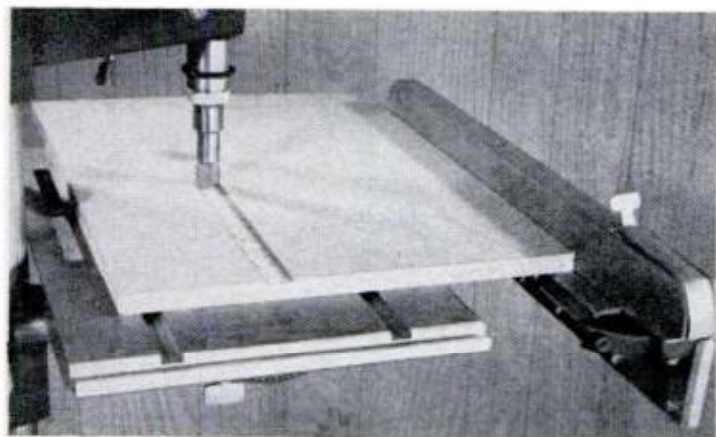
The saw-table extension is now a two-position, three-purpose one. Where before the extension could only be used at the outboard end of the machine for long-board support, the extension can now be



**MAXIMUM RIP CUT** on main table with blade in edge slot is 11 $\frac{3}{8}$  in. While there's little support at left of blade, table extension can be used aft of headstock



**BEFORE THE MARK VII** you could not attach the table extension directly to the saw table. Now you get 24 in. rip cut on main table with blade in edge slot



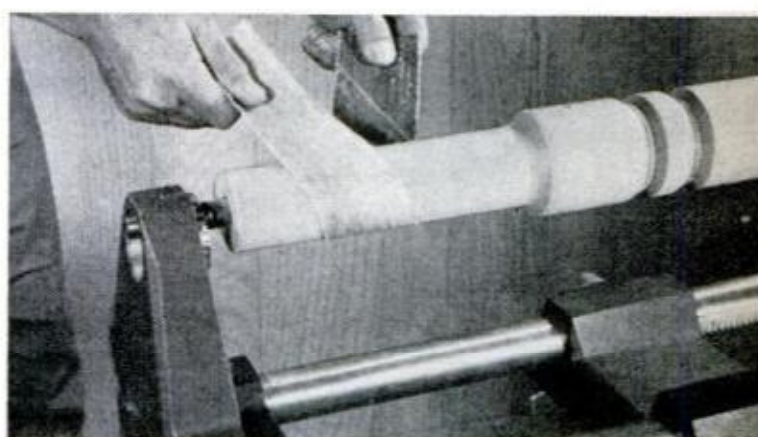
**NOW THAT THE TABLE** extension can be attached directly to the saw table, you have a larger table than before when table is used for drill-press work

attached directly to the table itself. This feature pays off when the saw table is used as a drill-press table. With the extension attached to the saw table, you have a ripping capacity of 24 in. It's 48 in. with the extension in the off-table position.

As a saw, it has the one inherent drawback of all tilting-table saws—you are limited in the length of work you can handle when the table is tilted 45 degrees. This we found is a disadvantage only when mitering long work such as window cornice boards.

Perhaps the Mark VII's most radical design change is its two-way vertical tilt. Heretofore, the machine could only be tilted to the right to change over to a drill press. Now it also can be tilted to the left to convert to a spindle shaper. In the case of the drill press, you can now drill to the center of a 16 $\frac{1}{2}$ -in. circle.

A first with any home-shop woodworking tool is its built-in sawdust vacuum. A flexible hose can not only be positioned to suck up most of the dust and chips as they come from the blade or bit and deposit them in a disposable bag in the base of the



**BONUS FEATURE** of the new reversible motor lets you sand lathe turnings extra smooth. Reverse sanding kills grain "nap" produced by one-direction sanding

machine, but also lets you sweep up when you're through. You may find that the dangling flexible hose gets in your way at times, but it is easily removed and replaced. We found that the sawdust bag on the test model was too small.

The Mark VII now features a double-faced flat/conical sanding disk which permits surface sanding to a uniform thickness, and the reversible spindle permits sanding in either direction to obtain maximum wear from abrasive disks.

Moving the headstock along the tubular ways was always easy enough, but it used to be a real muscle job to raise it up and down in the vertical position. Now it's "racked" to and fro or up and down merely by turning a lever. Vertical positioning of the table is accomplished in a similar manner, while a positioning and engaging stud between headstock and table carriage bind the two together so they may be moved as a unit by the headstock lever.

The new unit retails for \$369.50 complete, ready to plug in. The Mark VII is manufactured by Magna American Corp., Cincinnati 15, Ohio. ★★★

**A PM Editor's Exclusive Report:**

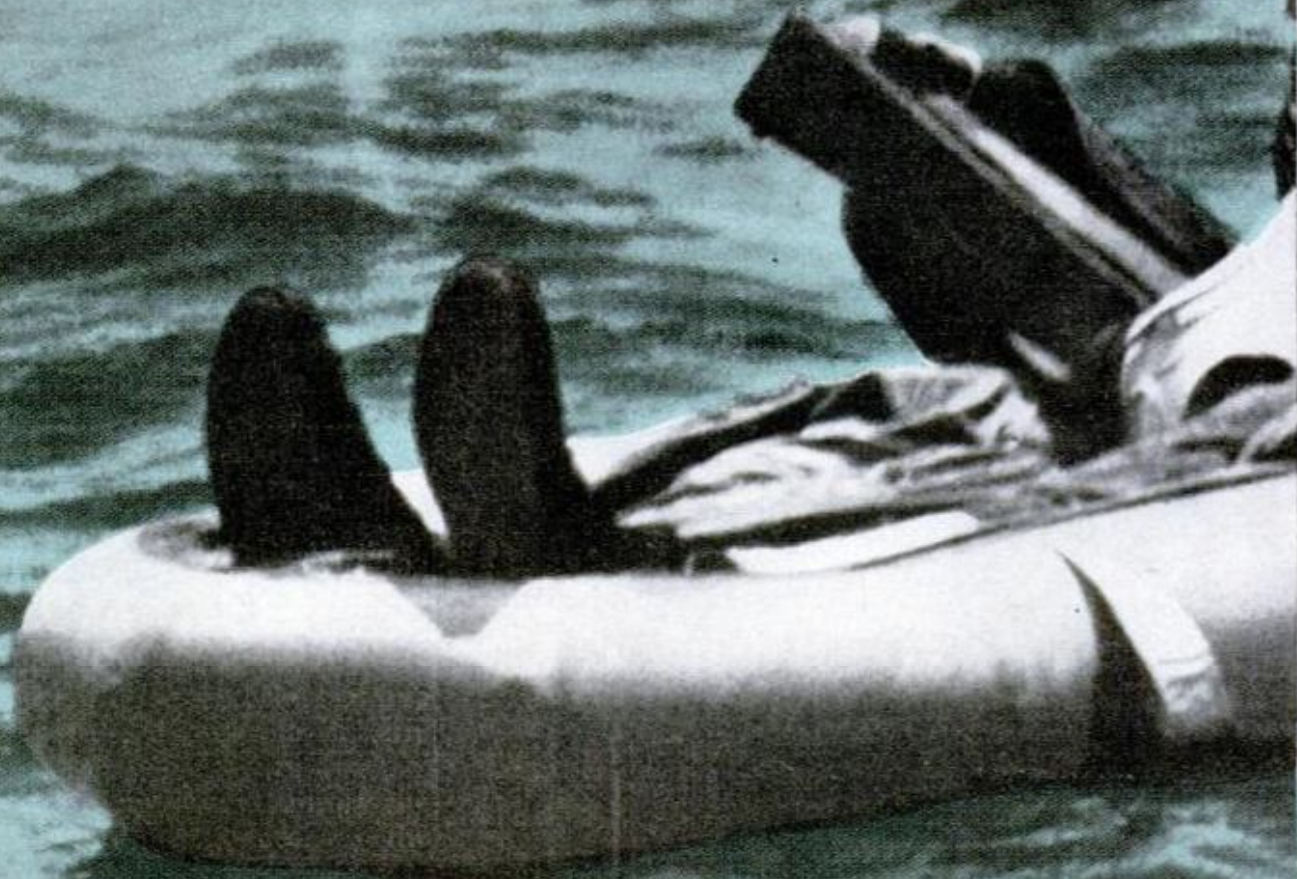
# *How to Survive*

*A unique school of wet knocks uses the sea itself to teach anyone forced down over an ocean that his greatest enemy is, not the elements, but ignorance...*

**I** CLOSED MY EYES and put out my right foot. The tower on the landing craft moved out from under me, and I dropped 15 feet into the sea.

I was supposed to have folded my arms over the preserver, but I didn't, and it hit me in the face as I went under. I bobbed up again coughing sea water and looked around for my raft. It was beyond my reach. I was supposed to pull it toward

**AUTHOR FLOATS** in one-man raft, miles from land, at Air Force's rugged Sea Survival School. He has loosened life preserver and is preparing survival equipment. He spent most of day in raft



# at Sea.....

**By Kevin Brown**

me by the lanyard that connected it to my parachute harness, but the lanyard and the cords to the survival kit and sea anchor were tangled around my legs. I lunged for the raft, but suddenly I was wrenched backward and dragged through the water.

Oh, God, I thought, I forgot to undo the riser.

The landing craft, simulating a chute canopy caught in a current, was pulling

me at the end of a long strap. I remembered to assume a sitting position, with my head bent forward and my legs spread, but the sea water churned past my shoulders and spilled over my face and into my mouth and nostrils. I felt along the chute harness near my shoulder, found the release clasp, pressed the buttons together and down, then pulled back. The riser slipped out, I slowed to a stop and





**SURVIVAL INSTRUCTOR** shows class how to rig the sail on 6-man raft during dockside training. One paddle is used as rudder, other paddle and handles are tied in T-shape and sail fastened to it

**HORSE COLLAR** lifts author from water in approved manner. Entered feet first, it slips up under arm pits and arms are wrapped around it. In this position, collar could lift unconscious man



**PULLEY RIGGING** simulates parachute bailout. Here student pulls on back risers, simulating action that would stop dangerous oscillation during descent

**PARACHUTE DRAGS** survivor through water unless released. Student shows approved position while releasing: sitting up, head bent, legs spread apart





I was bobbing up and down again, spitting brine, but more tangled than ever in the lanyard and cords. I used the breast stroke to swim toward the raft, lunged again and got it. I took a couple of deep breaths, leaning on the raft, tried to clear my nostrils, then turned the raft right side up and twisted it around until the short end was against my chest.

Easy now, I thought, this is tough.

I was to pull the raft to me and under me and flop onto it face down. Instead, my legs floundered under the raft, and I ended up on my back with the raft nearly covering me, lurching around trying to keep my head above water. After a few more tries, I finally made it, breathing heavily, my face in several inches of water at the bottom of the raft. I reached forward along each side for the hand grips, then pulled myself forward again until my head was on the wide end and my legs were in.

Now, to turn over. I reached along my left side, found the release for the seat pack and undid one side. I rolled toward that side and kept rolling until I was lying on my back, looking at the sky, and the pack was on my lap, still connected to the right side. Everything was connected to me or the raft, and the raft and I to each other—and the connections were all tangled around me.

I spent a tedious time unravelling myself, then set out the anchor which would keep the raft drifting with the current, and pulled in the survival kit. From it, I took shark repellent, spread it on the water,

one signal flare, which I tied to my harness for emergency, and the desalter kit. I filled the plastic bag with water, dropped in the chemical cake that would neutralize 90 percent of the salt, and dropped it over the side on a string. The motion of the waves would help dissolve the chemical.

Next, I let some of the air out of the raft, so it would ride easier, and began bailing with my helmet. That done, I untied the cushion from the seat pack, set it under the small of my back and tried to squirm into a comfortable position.

The landing craft had gone, and all I could see in any direction was the sky and the sea. I was alone, 10 miles from any landmark, and I now had the rest of the day to wonder how I got there . . .

It all began about seven years ago when four Air Force transports operating out of Japan crashed at sea within a few months time. Only three of 60 men had survived, although each bailed out successfully and the planes had survival gear.

Capt. Fred Ewing, in charge of survival training there, took his disgust to the commanding general. His chief complaint: The deaths were unnecessary because the crews simply hadn't been taught under actual survival conditions.

"You can't teach sea survival in a swimming pool," he said. "You've got to take a man out to sea, dump him there and force him to survive."

So the Air Force's famed Sea Survival School was born.

Except for the hush-hush school at

**HELICOPTER PICKUP** uses three-pronged "anchor." Student sits on flat prongs and wraps arms around upright axis. Cable reels him up to doorway level

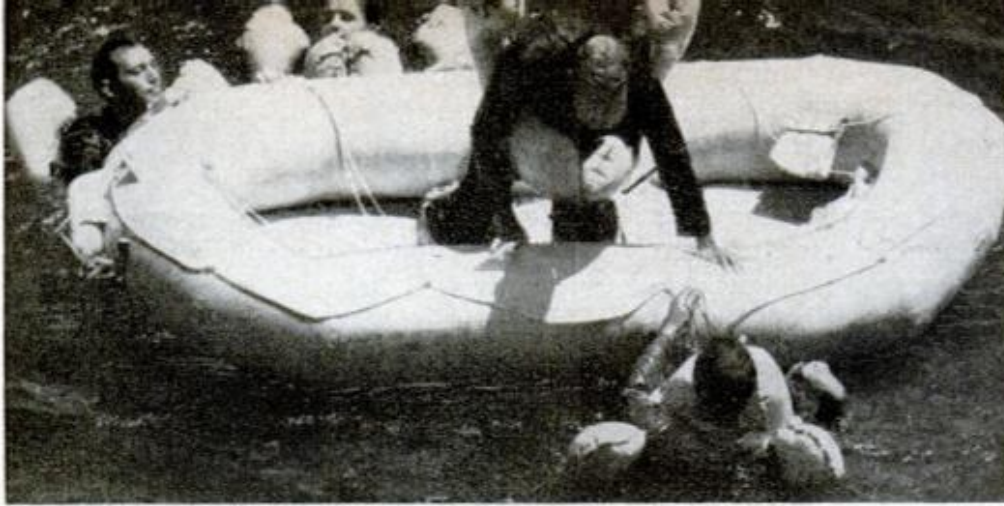


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**DOWN AND DIRTY!** Author steps off tower enroute to spending day in one-man raft. Raft and netlike sea anchor are shown falling with him to his right



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**6-MAN RAFT** team boards raft. Cords around oval-shaped rim help survivors hang on and climb into raft. Paddles and spray shield used for sail are in survival kit in floor of raft. CO<sub>2</sub> bottle, which inflated rim, is shown at left end of the raft



**20-MAN RAFT** crew struggles to get on board. Boarding stations project from opposite sides of raft. Survival kit and canopy are in center of raft. Double rim, inflated simultaneously, can be protected from double blowout by equalizer clamp



Stead Air Force Base, Nev., where they teach crews how to survive enemy brainwashing, the Sea Survival School is probably the roughest of all military schools. Its best teacher is the sea itself. And the school's chief boast is that no one who passed the course, and was later forced down at sea, has failed to make it.

Ewing told me about the school and suggested I contact Capt. Wayne Williams, the school's new commandant. I did, and Williams' reaction was blunt. "The best way to cover the school is to enroll in it."

So, I became the first newsman ever to enter—and survive—the Air Force's Sea Survival School.

It taught me more than survival. I was stung by jellyfish. I picked up bruises with no memory of how they got there. I got sunburned, saltburned and blistered.

I also found new insight on the nature of man under emergency conditions—some of it disillusioning. Much of what I learned can be used by anyone who is forced to survive at sea.

The course lasts a week. It consists of two days of classroom training, one day of dockside training and two rugged days at sea; one of them in the one-man raft and the other divided between the 6-man and the 20-man rafts.

Our class, except for myself, was typical, consisting mostly of pilots and enlisted flight crews. In the classroom, we learned some useful and blunt intelligence:

- The first five minutes and the last five minutes are the most dangerous in any sea-survival situation.

- It's best to go hungry and thirsty the first 24 hours. Food only increases the



**DURING INFLATION** rafts look like this as they unfold. Inflation cord is pulled, then raft is thrown overboard and survivors jump in after it immediately



**SOLAR STILL** distills sea water. Sea water is poured in top and it filters through to bottom as drinking water. Student (right) was relieving his nausea



**SIGNAL MIRROR** is tested by student aboard 20-man raft. Sun's reflection can be aimed through center hole, and messages directed where you want them

body's need for water.

- Most rescues are made the first day. After that prepare for a long stay.

- Water is more precious than food at sea, and the only real sources are rain and desalted sea water. Fish juice, urine, blood or raw sea water hasten dehydration.

- Even two drops of blood can attract sharks. Keep everything in the raft, including vomit and bowel movements.

- In long survivals in one-man rafts, the cramped position can paralyze a man from the waist down.

- In the larger rafts, if anyone dies, strip the body and throw it overboard. He won't need the clothing, you might.

- A man can live up to 12 days without water, but he's dying the last six. The best minimum is a pint a day after the first day.

- The best food is carbohydrates

(candy, sugar, chocolate); the worst is proteins (meat, fish). They require water.

- If you do catch fish, make sure you have water to drink with it, and eat it within two hours or it may poison you.

- If you're rescued, let the rescuers do all the work. They're professionals—usually from the military rescue services (see *The Celebrated Jumping Frogs*, April, 1962, *PM*)—and, in your weakened condition, you can only hinder them.

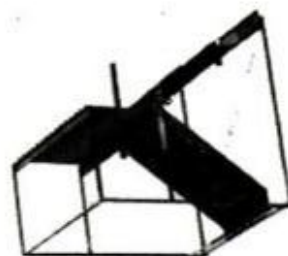
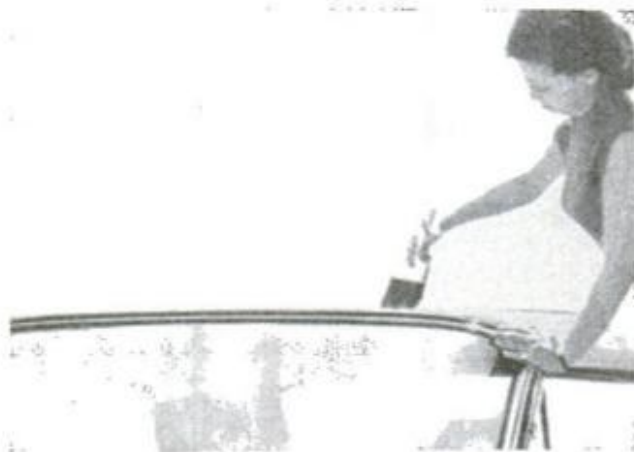
On the dock, they demonstrated the equipment and put us through simulated bailouts and rescues.

Air Force survival kits carry signal flares, a signaling mirror, whistle, matches and a two-way UHF radio. Optional equipment, depending on locality, includes shark chaser, signal dye, desalter kit, food

[\(Please turn to page 206\)](#)

## Winter Cover

Winter protection for a convertible top can be painted on in the fall (top photo) and peeled off in the spring—with the help of an air hose (bottom photo). The protective material is a urethane-base plastic by Urethane Products, Ann Arbor, Mich. The cost is less than \$10.

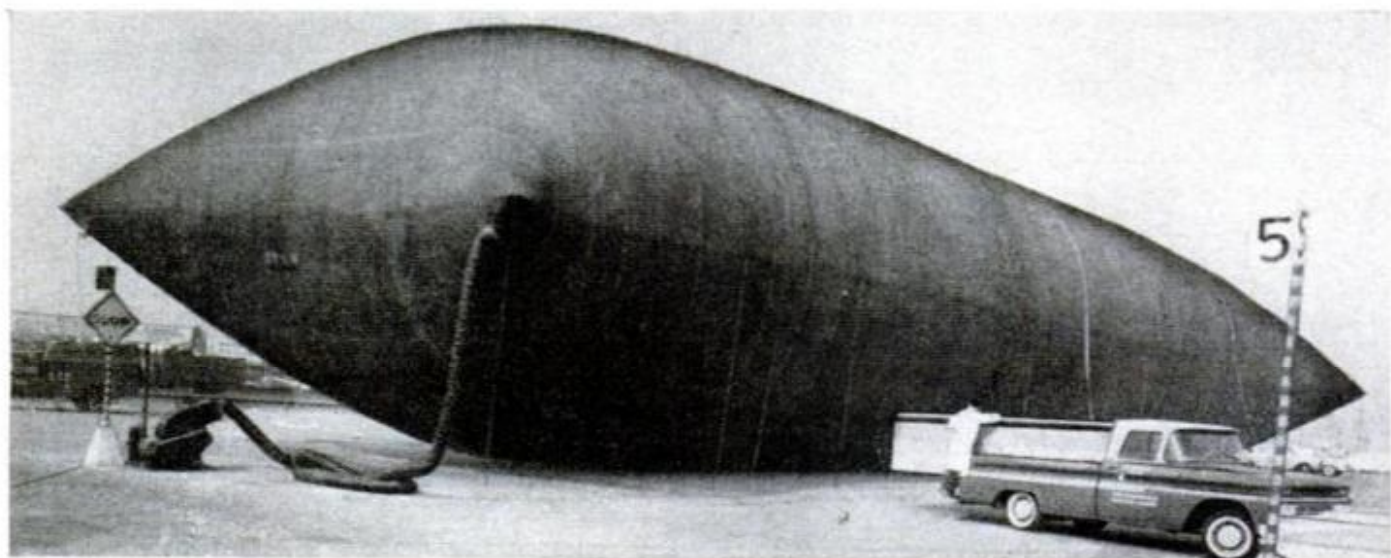


## It'll Fit in the Truck!

It's not a grounded dirigible, but an experimental fuel tank that can be folded up and carried away on a pickup truck. When loaded, it can hold 420,000 gallons. The tank was designed for field storage of bulk fuel by the Army. It's 162 feet long when inflated and 14 feet long collapsed.

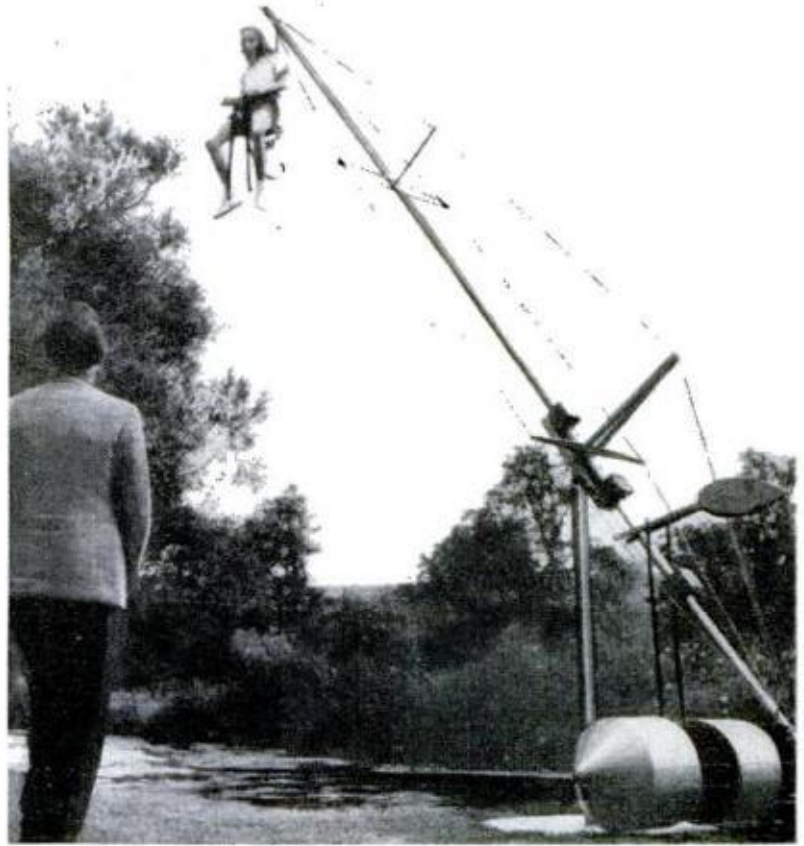
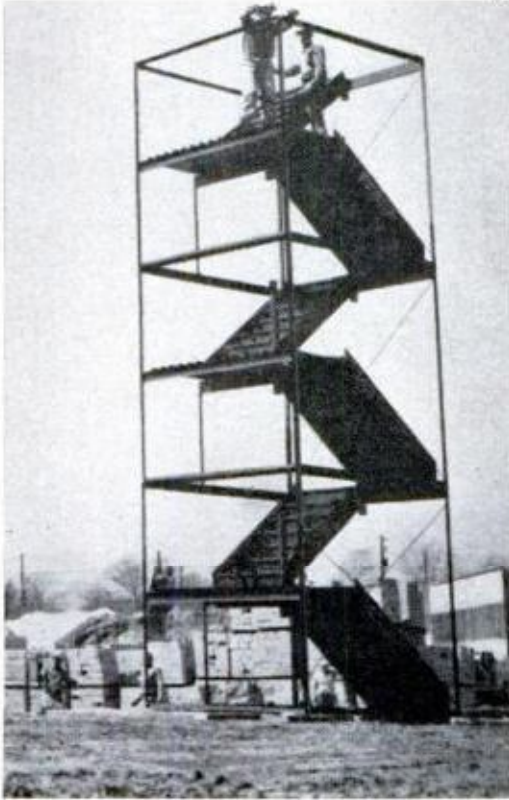
## Quick Way to the Top

Preassembled steel stairways go up like a tower and can be used by workers during construction of a building. They go up five times faster than conventional stairs, says the manufacturer, Pico, Hyattsville, Md. The helicopter appeared in a demonstration of the quickly erected stairs.



## High Ride in the Back Yard

Perched on an insecure-looking saddle, a 10-year-old girl zooms 20 feet into the air on a "pivoted Ferris wheel" in the yard of British artist-inventor John Merton. A counterbalance on the lower end of the arm enables her to shoot skyward. Merton has built several other rides near his home.



## Speedy Sampans

Junks and sampans in South Viet Nam are sporting motors nowadays. The Vietnamese make the outboards using American air-cooled engines, like the Kohler unit shown. The propeller, at the end of a long shaft, is dipped just under the surface to drive the craft.



## Sideways Parker

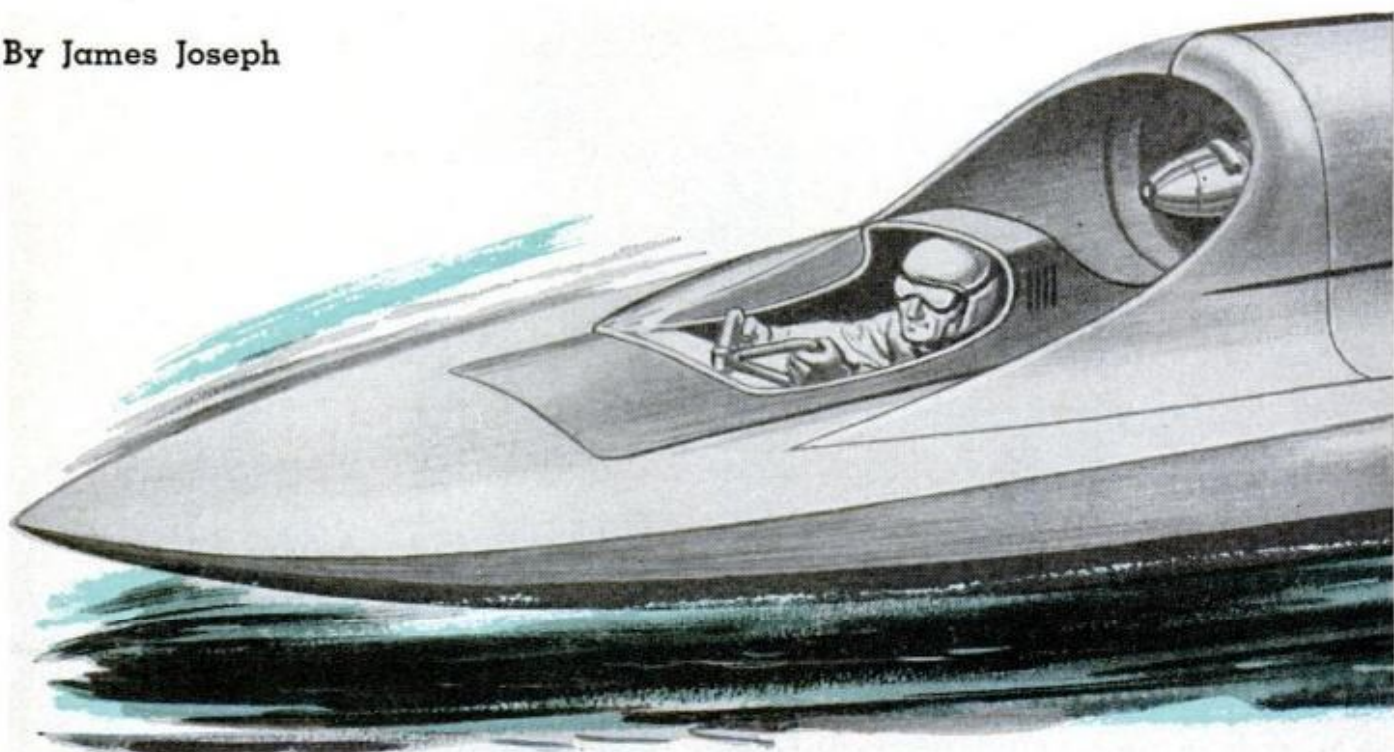
Getting the back wheels of a car into a parking spot is no problem with a new device that hydraulically jacks up the rear of the car and wheels it sideways into place. Usable with most existing cars, it's actuated from the driver's seat. Two San Diego residents are the inventors.



# New Jet-Engined

*Rocketing over the water with 6200 pounds of thrust, Hustler will be a low-flying missile*

By James Joseph



**T**HIS IS THE WAY IT WILL BE: Idling into position on the glass-smooth lake, the needle-nosed turbojet hydroplane gets ready for takeoff. Squeezed into the plexiglass-covered cockpit just ahead of the two-ton, 10,000-horsepower engine, the 28-year-old owner and driver, Lee Taylor, Jr., makes a final check of his safety belt and oxygen mask.

Satisfied that everything is OK, he takes a deep breath, braces himself, and pushes the throttle to takeoff thrust.

Exploding into action, the jet-boat *Hustler*, leaps ahead like a rocket sled. Seconds later Taylor edges the throttle another notch, then gingerly actuates the jet's afterburner, giving it greater power.

Away and running, *Hustler* is a blur on the water. She is literally airborne. Riding on a cushion of air created by a four-foot-wide tunnel under her hull, *Hustler* lifts two inches clear of the water. Rocketing towards the starting point of the timed mile, her Westinghouse J-46 aircraft engine gulping a gallon of fuel per second, *Hustler* is like a low-flying missile.

From start to blazing finish, the first leg of this first run won't take more than 60 seconds—the fuel capacity of *Hustler*.

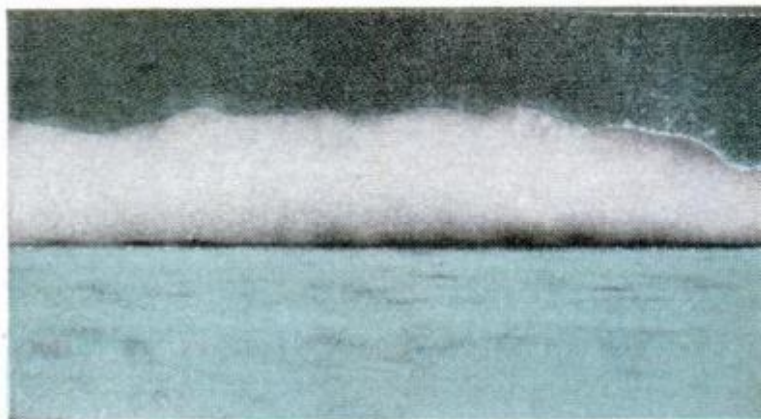
But it is just 10 seconds of this time that really counts.

If Taylor and his jet-propelled lady can cover that measured mile in 10 seconds or less, they'll crash through the over-water speed "barrier," shattering the four-year-old record of 260.35 m.p.h. set in May, 1959, by British speedster Donald Campbell and the jet-powered *Bluebird II*.

"I'll be satisfied this year," says Taylor, "to beat Campbell's mark by a whisker."

Tests have been under way since August, and before the end of 1963 Taylor expects to make his bid to bring the water-speed record to the U.S.

Taylor expects *Hustler* to hit 300 m.p.h.



# Challenger



Actually, his craft's aluminum-clad, wood-and-aluminum-framed hull (steered by thrust deflectors, not conventional rudders) is designed to go 500 m.p.h. Aircraft engineers, however, estimate that given full throttle, the jet could thrust *Hustler* at close to the speed of sound—some 750 m.p.h. at sea level.

*Hustler*, sleek-lined and devoid of outrigger sponsons and the water-rudder common to its jet predecessors (Campbell's *Bluebird* included) will be a record contender in a class by itself. Here are some of the specifications:

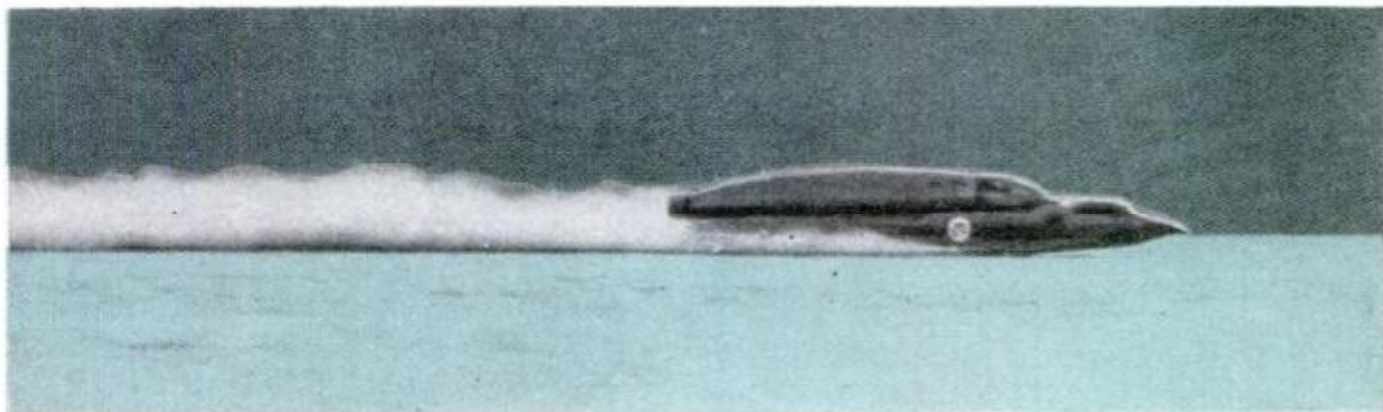
● *Pure-jet engine.* The engine (the same J-46 pure-jet powering the Navy's

carrier-based, though now obsolete, *Cutless* F7U-1 interceptors) will be completely aluminum-cowled, minimizing wind resistance.

The engine will pivot from two titanium trunnion bearings, permitting prerecord-run adjustment of its thrust-angle about 13 degrees from the horizontal.

Controllable plates can either reduce or enlarge the tailpipe's thrust aperture (much like a camera's iris), boosting speed with the smaller aperture. They will

**WORLD WATER-SPEED RECORD** holder, Donald Campbell's *Bluebird II*, made one run close to 300 m.p.h. in setting four-year-old record of 260.35 m.p.h.



overhang the stern two feet, increasing *Hustler's* overall length to about 31 feet. For a record run, though, with afterburner kicked in, the aperture is wide open.

● *Air-thrust steering.* Titanium thrust deflectors, mounted vertical to the turbojet's thrust stream, will supplant in-water rudders—the bugaboo of big-speed jet-boats. Where most hydroplane jets become unsteerable much above 200 m.p.h., *Hustler*, believes Taylor, will respond to its thrust deflectors, possibly throughout its speed run. Nor do deflectors put enormous strain on the transom, as do stern-hung rudders.

● *Ejection seat.* *Hustler* may, following trial runs, be fitted with a standard airplane-type quick-ejection seat. The problem, concedes Taylor, is that hydro pilots can seldom react fast enough to eject themselves in sudden emergencies. Hovering a mere two inches above water, the 250 to 300-m.p.h. boat driver hasn't the built-in safety factor of altitude, as does a plane's pilot.

● *Aluminum-clad hull.* *Hustler*, though wood-aluminum framed (engine stringers, typically, are 1¼-inch oak and ¾-inch 5-ply marine birch strengthened by ½-inch aircraft-spec aluminum) is clad, under-keel, with a super-smooth aluminum skin. Except for cladding and cowl-ing, the jet is fiberglassed.

If Taylor cracks Campbell's record, he'll also bust through a barrier equally as formidable—the “money barrier” which has relegated the unlimiteds to those with unlimited (or close to it) bank rolls.

Taylor is a Sunday boat driver with the guts to build a \$100,000-class boat on a wage-earner's salary. Weekdays, he sharpens cutlery.

He simply decided that he was going to be the fastest man on water. And if

doing it required a \$100,000 hull and jet engine, somehow he'd get them.

Where other aspirants to speed have first sought out well-heeled sponsors, Taylor sought out Rich Hallett, a friend, the builder of Taylor's near-record Chrysler-engined 19-foot hydro (with which Taylor did his Sunday dragging) and one of the world's great racing-boat builders.

Most big-speed designers build a hull, then fit it with an engine. Hallett, always unorthodox, told Taylor to find a turbojet engine and they'd build the hull around it.

Taylor found his big J-46 in a surplus-aircraft warehouse. It had cost Uncle Sam something like \$100,000 back in 1957, but Taylor claims he got it “for peanuts.”

Hallett set to work on the hull in his usual unorthodox manner. Though Hallett mentally assessed the good and bad of the boats he had to beat, he called in a handful of turbojet experts. These included Gilbert Peers, who'd originally been in on the J-46's design, and North American Aviation's Jon Archer, a space engineer who designed the engine's in-boat supports. But Hallett consulted mainly with himself. He didn't huddle with a phalanx of marine engineers. He didn't even prepare plans. He just began putting *Hustler* together, stringer by stringer.

As *Hustler* took shape, a host of big-name sponsors jumped at the opportunity to help with the put-together of what sizes up as a winner. Included are Harvey Aluminum Co., Mobil Oil Co., Casale Engineering (supplying the steering gear), Champion Spark Plug Co., General Tire & Rubber Co. and American Trailer Co. (which custom-built *Hustler's* trailer).

One thing is sure. Lee Taylor comes onto the high-speed stage the most unorthodox contender in the history of the big unlimiteds. ★★★



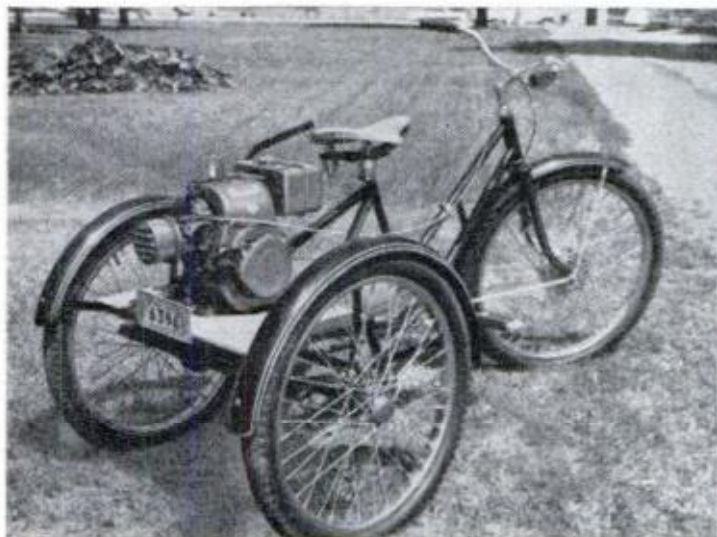
FRAMING for the hull is birch marine plywood and poplar. Battens are spruce, and engine stringers are oak. Aluminum reinforcing is used throughout



## Sharp Appetite

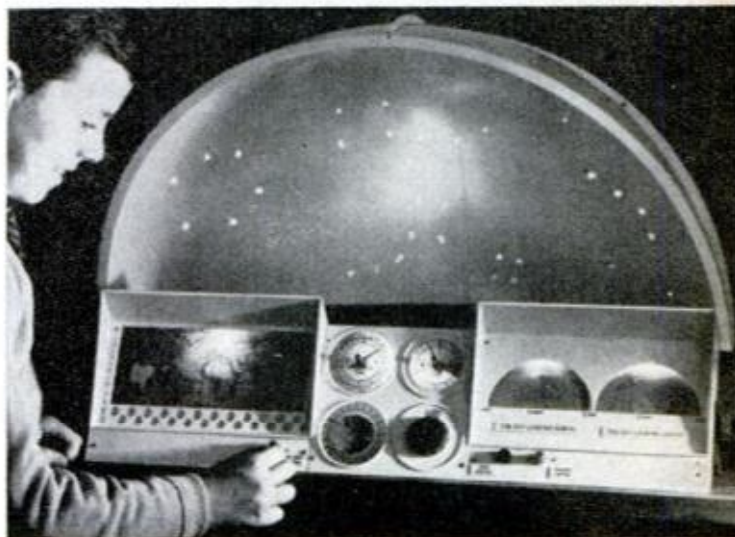
Making certain a newly captured sawfish will eat in captivity takes some skillful hand-feeding—within range of the 32 razor-sharp “teeth” on its snout.

Harold Jacobs, chief diver at Marineland, thrusts a bonito into the sawfish's mouth at mealtime so the creature won't starve while adjusting to captivity.



## Motor Trike for Grownups

Powered by a three-hp. air-cooled engine, a motor trike offers good mileage and enough power for climbing steep hills, says the manufacturer. Throttle, clutch and handbrake are mounted on the handlebars. It's priced at \$199.95 from Go-Byk Industries, Rothsay, Minn.



## Home Planetarium

Young astronomy students can study star systems close at hand with the Cosmorama, which gives the exact sky picture as it would appear from any spot on earth at any given time. Available for \$19.95 from Renwal Science Models, Old Country Rd., Mineola, N.Y.

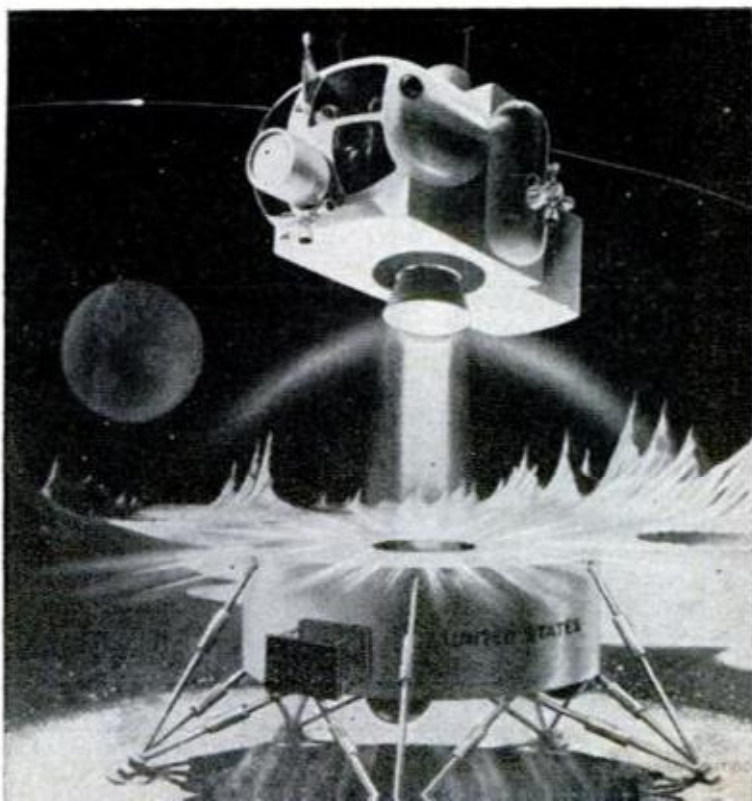
## Moon Takeoff

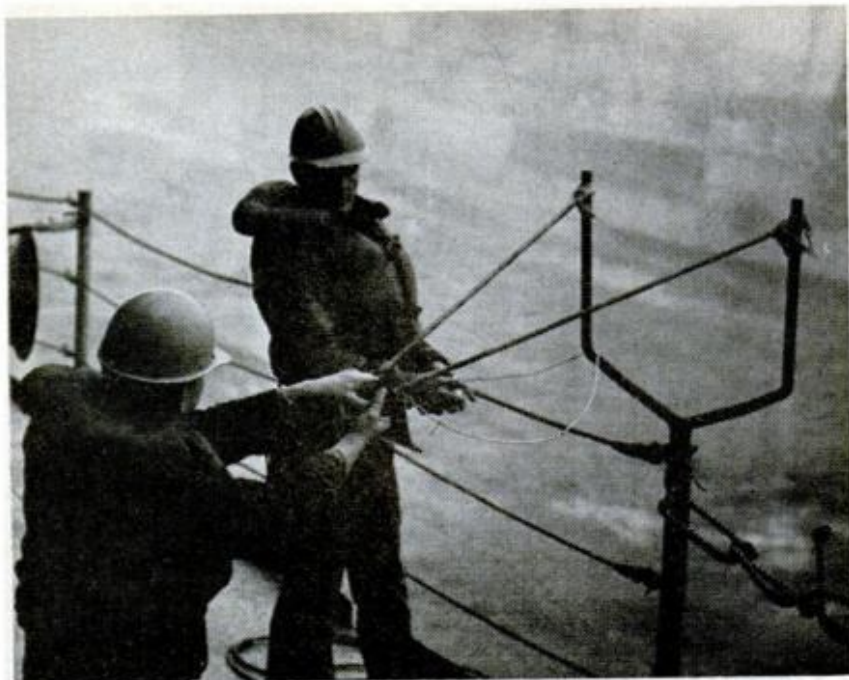
Once the astronauts of Project Apollo have landed on the moon, there's the problem of taking off again. One plan is to use part of the landing craft as a pad for takeoff (drawing).

A two-section “lunar-excursion module” (LEM) carrying two astronauts will separate from the main Apollo vehicle, which is orbiting the moon, and land. A third crewman will stay in orbit.

Later, the two will launch the upper section, rejoin the main module and return to earth.

Bell Aerosystems is developing the ascent rocket engine for the Grumman LEM.





## Sailor's Slingshot

Because a line-throwing gun hurls the weighted line so hard it can injure anyone hit with it, one Navy carrier, the *Shangri-La*, is experimenting with a giant, but old-fashioned, slingshot operated by muscle.

Made of solid steel, it is 17 inches between the prongs. A strong pull can send the weight and the attached line up to 200 feet to another ship.

Lines are sent between ships at sea to haul fuel lines across.

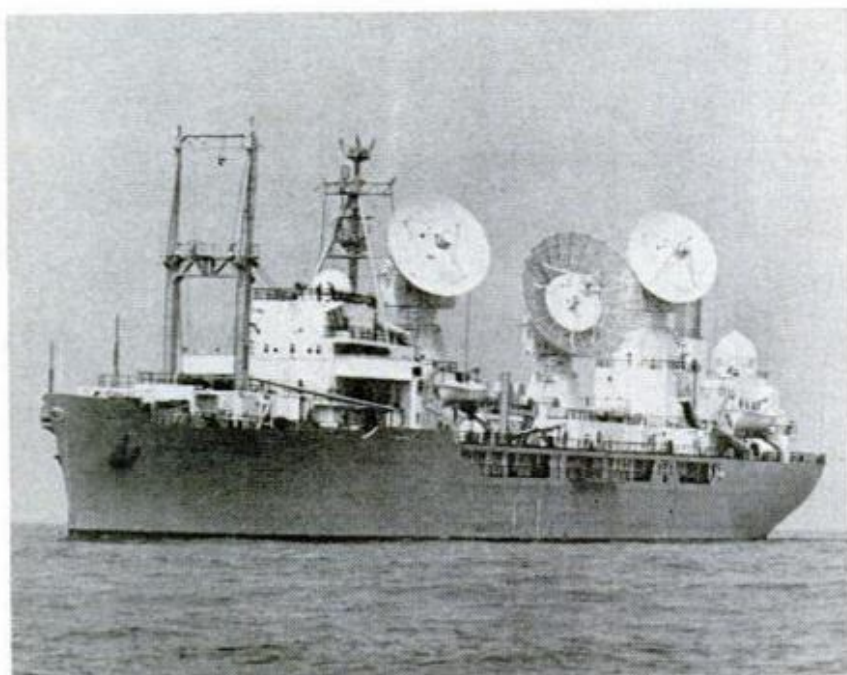


## Stockyard Glitter

It's like building a boat in the basement and then discovering you can't get it out the window.

A German firm manufactured this huge chandelier—it's 29½ feet across—and, until it could be shipped, there was no place large enough to hang it except in a nearby slaughterhouse.

So, for a while at least, the doomed animals had a little glory shed on them from the 532 bulbs in the giant—and elegant—dome light.



## Missile Tracker

A drab World War II troopship has become one of the world's biggest missile-tracking stations, the 14,300-ton *Gen. Hoyt S. Vandenberg*. Due to be stationed in the Indian Ocean, it has huge three- and four-story-high antennas to record missile data and to observe the death plunges of ICBM nose cones.

Sintrak, the tracking radar developed by Sperry Rand and used on the ship, will record up to 100 million bits of data on shoots.

# PM Tests Promising New Anti-Smog Kit

By Thomas E. Stimson

**"THE ONLY CITY** in the world where you can wake up in the morning and hear the birds cough!"

Thus, only partly in jest, does Dr. John T. Middleton of California's Air Pollution Research Center describe Los Angeles, the giant city where three out of every four people are disturbed in some way by air pollution which is produced primarily by automobiles.

Smog has become so bad in the Los Angeles area that leafy vegetables such as spinach and lettuce are no longer grown there commercially—the leaves

become tough and acquire silvery streaks. More and more Los Angelinos are being afflicted with chronic respiratory ills, induced or aggravated by smog. There is a suspicion that smog contributes to heart disease and contains cancer-causing agents.

And the problem is no longer exclusively Los Angeles'. In many American cities such as Hartford, Washington, D.C., Detroit, and Denver, for example, smog has become an eye-irritating nuisance and is growing worse.

The most harmful of smog's pol-

**LOW-HANGING BLANKET** of smog, produced primarily by car exhausts, envelops downtown Los Angeles. Temperature inversion permits cool upper air to trap warmer, smog-filled air in mountain-rimmed bowl of city. Kit PM tested cut smog emissions about in half



| PM TEST CAR RESULTS              |                    |             |
|----------------------------------|--------------------|-------------|
|                                  | WITH KIT INSTALLED | WITHOUT KIT |
| MILES PER GALLON                 | 17.3               | 16.9        |
| 0-60 MPH                         | 11.5 SECS          | 11 SECS     |
| HORSEPOWER AT 3500 RPM           | 125                | *120        |
| HYDROCARBONS (PARTS PER MILLION) | 232 (275 ALLOWED)  | *533        |
| PERCENT CARBON MONOXIDE          | 1.2 (1.5 ALLOWED)  | *2.1        |
| *AFTER DEALER "TUNE-UP"          |                    |             |

COMPARISON of economy, performance and smog output of Dodge engine before and after fitting Chrysler's Cleaner Air Package kit shows the improvement



EXHAUST PIPE containing sampling probes enables pollution control laboratory to make positive recordings of hydrocarbon and carbon monoxide emission

lutants are created when raw hydrocarbons combine with nitrogen oxides in the presence of sunlight. Both these substances are spewed into the atmosphere by automobiles, whose engines produce from two to three times the amount of smog-producing hydrocarbons and nitrogen oxides produced by all other sources of air pollutants.

The waste is enormous, not only for Los Angelinos, but for most other motorists, too. Consider that about seven percent of the gasoline you buy is going to move through your engine unburned and disappear out the tailpipe unused. This means that a tidy part of many motorist's annual fuel dollars are spent in manufacturing smog instead of propelling the car.

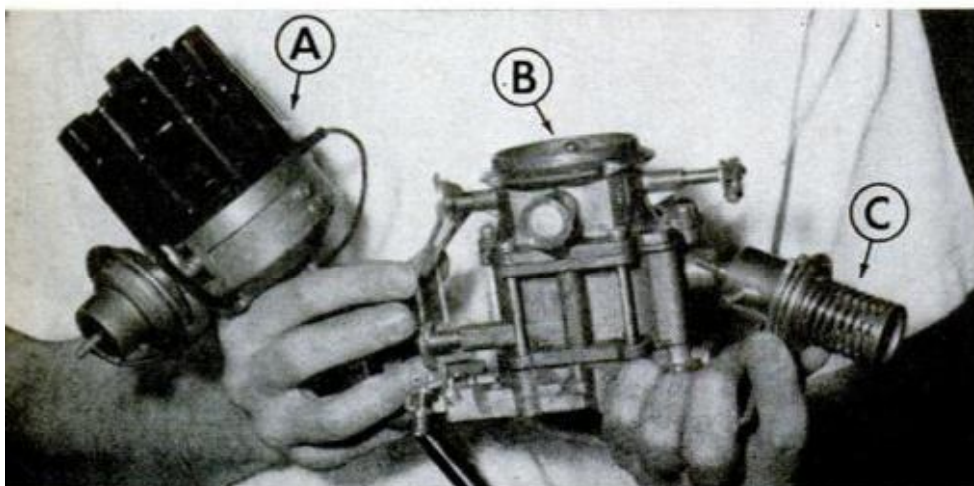
California has passed laws compelling motorists to install anti-smog devices in their exhaust systems as soon as two or more designs are perfected. These devices

—of the afterburner type—will be in addition to the prone-to-clog crankcase emission control valves that are now mandatory on new cars sold in California and standard equipment on a number of American cars this year.

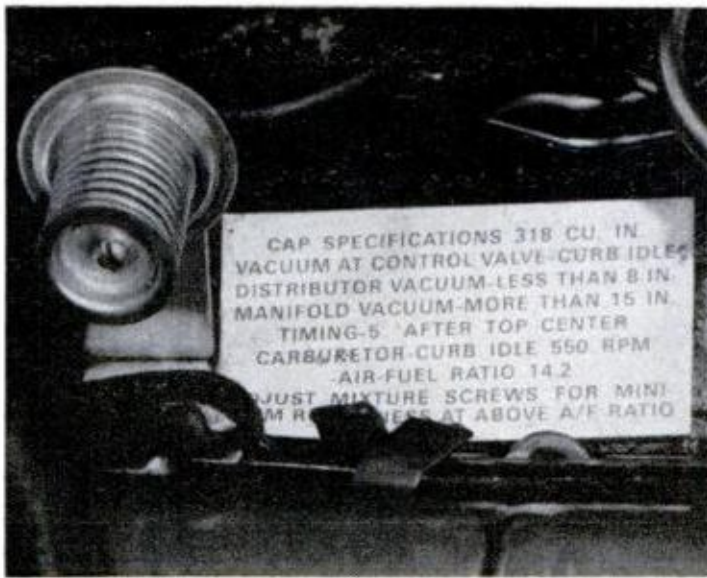
The afterburner type smog preventers are expected to cost at least \$100, which means that California motorists will be faced with the dismal prospect of spending a half a billion dollars for afterburners.

But, happily, there's a new chance that automotive smog can be curtailed in a different way and at little extra cost. *Popular Mechanics* tested a modified automobile whose smog-forming emissions were well under California's stringent requirements. The new system is based on the idea of burning much of this unused gasoline right in the engine.

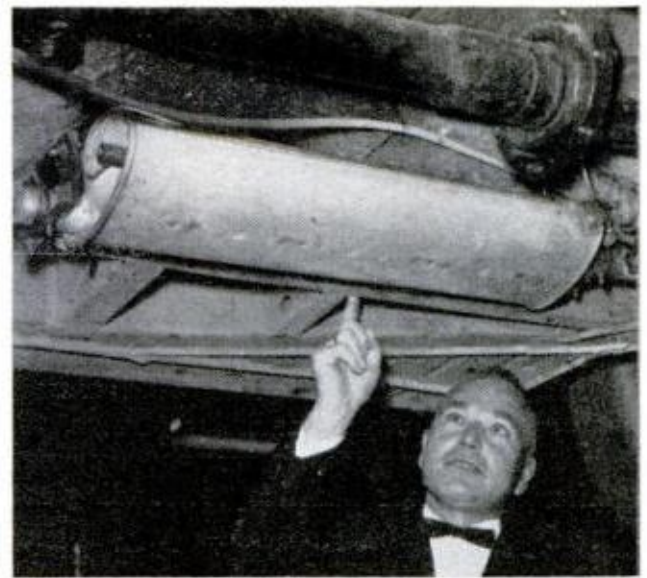
The car *Popular Mechanics* tested was



THREE ELEMENTS at left, make up Chrysler anti-smog kit: "A" is distributor reworked to idle at 5 after top dead center; "B" is carburetor with lean main jets and idle jets with 14.2-1 air-fuel ratio, reduced choke restriction; "C" is the vacuum advance valve that keeps spark advanced during deceleration. Not shown is a heavy duty engine cooling fan



**DETAILED** tune-up instructions on a metal tag are attached to engines of 1000 Chrysler Corporation cars that have been equipped with anti-smog kits



**SMOG AFTERBURNER** assembly replaces conventional muffler under car, but is complicated with valves, wires, etc. Cost to car owners would be over \$100

an ordinary 1963 Dodge Polara that differed from its assembly-line mates in only one respect: it was equipped with Chrysler's *Cleaner Air Package*. This consists of a reworked carburetor, reworked distributor, a special vacuum advance valve, a special tune-up procedure, and the use of a six-bladed engine fan.

PM's test was the first public study of this anti-smog kit. We wanted to know two things about it: does it actually reduce smog and does it affect performance?

With the kit installed, I ran 300 miles of high-speed freeway driving and 100 miles of slow traffic. I put the car on a dynamometer for a power reading, then tried 0 to 60 m.p.h. accelerations against a stopwatch. Finally, I delivered the car to the California Motor Vehicle Pollution Control Board, which had agreed to measure and analyze the car's tailpipe emissions.

Later, the factory restored the car's engine to standard and I re-ran the tests.

With the kit, the car gave somewhat better mileage than without it. I averaged 17.3 m.p.g. with the kit installed; 16.9 m.p.g. after it was removed. These figures are based on true odometer readings.

Acceleration was slightly better without the kit, though it took a stopwatch to tell the difference. The 318-cu.-in. engine Polara with automatic transmission went from 0 to 60 m.p.h. in 11 seconds without the kit; half a second slower with it.

At this point, I deliberately tossed a monkey wrench into my test program. The factory tune-ups, with and without kit had

been precise instrument-controlled operations. I wanted a "typical" tune-up by an average mechanic. A grease monkey at a nearby dealer found the timing okay. Then he "adjusted" the carburetor.

That typical tune-up cost five horsepower and created plenty of smog. On the dynamometer the car had delivered 125 horsepower to the rear wheels at 3500 r.p.m. with the kit. Now, without the kit and with the typical tune-up, the car was producing 120 horsepower.

California's anti-smog requirements for the future are: no more than 275 parts per million of hydrocarbons in the exhaust, no more than 1.5 percent carbon monoxide.

The state engineers found that with the CAP installed, the Dodge emitted 233 p.p.m. of hydrocarbons, 1.2 percent carbon monoxide. Each figure is well under the state requirements. Without the CAP kit (and after the typical tune-up) the engine emitted 533 p.p.m. hydrocarbons, 2.1 percent carbon monoxide. Too much of each.

How about street performance and handling? I could find little difference except that, with the anti-smog kit, the car free-wheeled noticeably when I took my foot from the throttle, taking 4.5 seconds longer to decelerate from 50 to 20 m.p.h. on compression alone. This required more braking in traffic.

I'd heard that the anti-smog kit made for hard starts in cold weather, so I drove to the mountains and let the engine cold-soak all night. There was ice on the ground

[\(Please turn to page 214\)](#)

## Sail Along, Little Dogie

Floating cattle to market on an automated feed lot adds weight to the herd and prevents injury, Cattleman Gerard A. Harrison, Wharton, Tex., has found. He converted a river barge to hold 900 head. The modification was done by Marine Welding & Repair Works, Greenville, Miss.

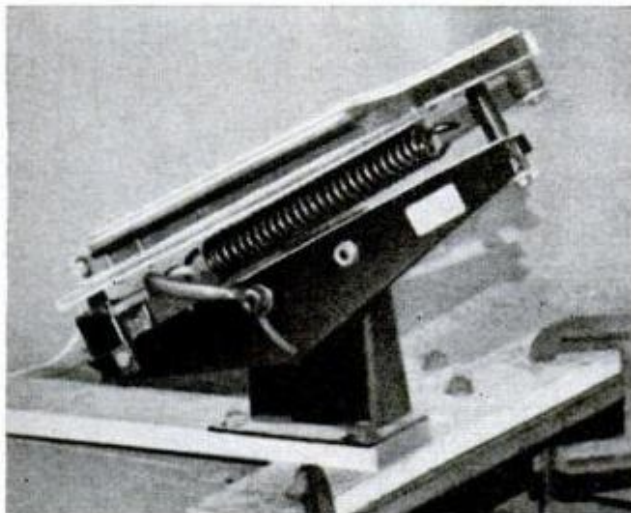
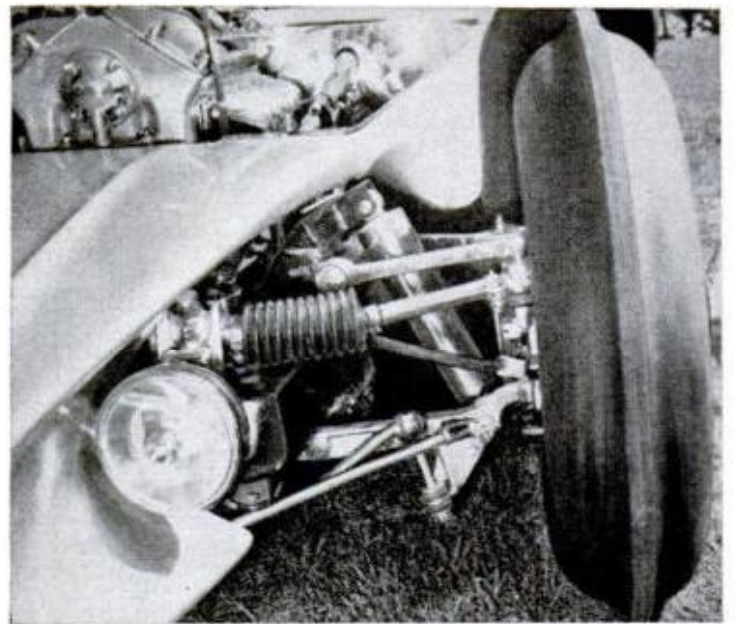
During trips on the Mississippi River, the hold of the barge is filled with feed that is carried to the top deck by an auger, dropped to lower decks by chutes, then moved to the feeding troughs by auger. The top deck is a helicopter landing area.



## It's a Jaguar

Jaguar styling takes a radical turn for the spectacular in a custom-built model, called the "X-Ray," turned out by a Kansas City man. Starting with basic Jaguar ingredients, such as a 1960 engine, frame, suspension and rear end, Ray Farhner fashioned the handmade body from 18-gauge pickled metal. The car, which can exceed 150 m.p.h., has wire wheels; the front wheels carry tractor tires (right).

The cooling system has two radiators, one in the nose, another behind the right front fender. A novel steering wheel, made of steel rodding, provides individual hand grips. Handmade taillights are set inside the concave rear fenders (far right).

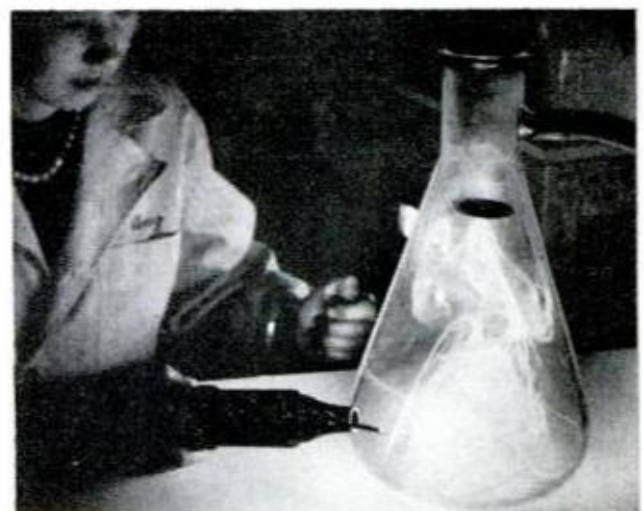
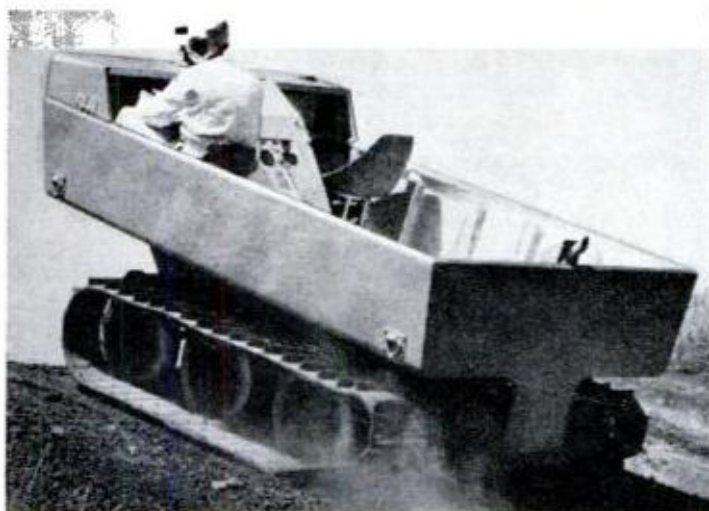
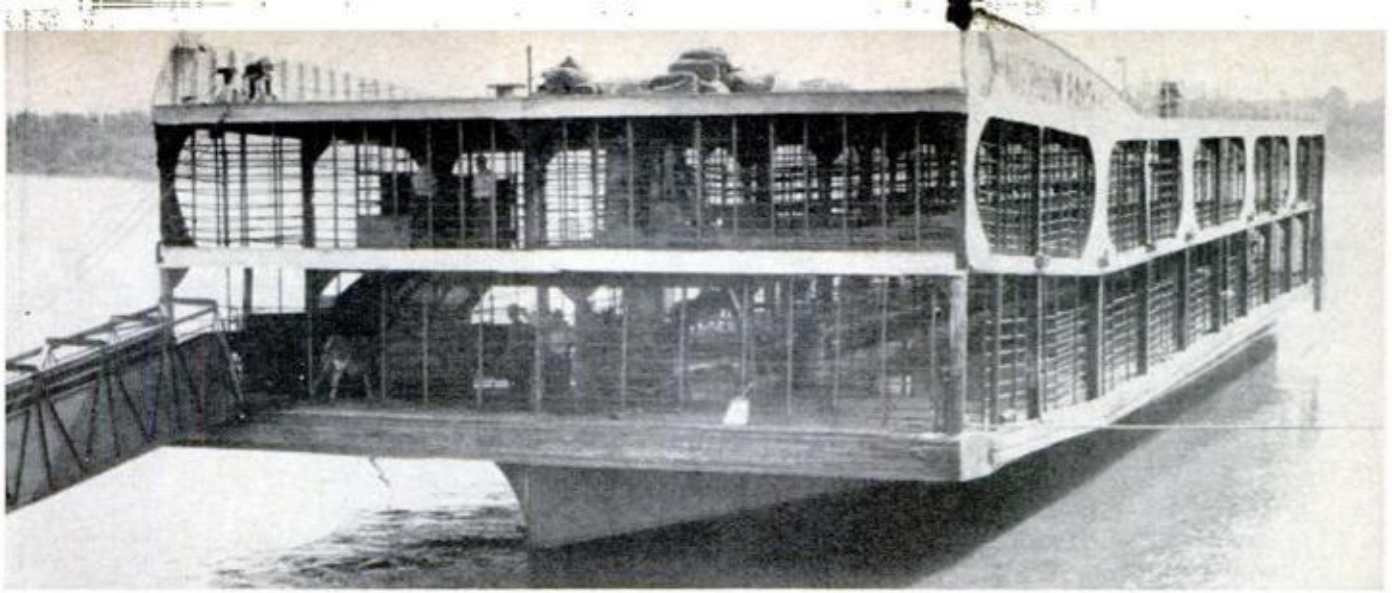


## Here's Another Reason for Not Rocking the Boat

Plugging away at clay targets from a slightly rocking boat is the latest wrinkle in target shooting.

Conventional equipment is used for the sport. A hand trap is suitable, or a portable mechanical trap can be clamped to the gunwale or deck. The arrow (right) indi-

cates the location of the trap (left). The target-breaking range of shotguns is about 40 yards, but the range of the pellets is about 300 yards, so you'll need that much clear shooting space. In addition to leading the target, the shooter must also learn to sense the rhythm of the boat.



### All-Terrain Carrier

A Canadian-designed all-weather tracked carrier for use in snow, swamp and muskeg is being produced by FMC Corp., San Jose, Calif. Traveling on rubber and steel tracks, various models can carry from 1000 pounds to 12 tons of cargo. Speed of the vehicle ranges up to 25 miles per hour.

### Glass That Glows

A new luminescent glass gives such a high contrast ratio that radarscopes using it will be clearly visible in ordinary light. Owens-Illinois silica glass, which is ordinarily colorless, changed to colored glass when exposed to electron beams and supplied enough light for a photo (above).

# How to Buy a Good

*Surplus military rifles can be converted for sport—but look out for broken firing pins, cracked stocks or barrels and amateur “repairs”*

By Edward Matunas

**A** RUSSIAN MAUSER RIFLE that looks potent enough for big game can be purchased in most war-surplus stores for as little as \$12.95.

An Enfield M1V sniper rifle with scope sells for \$49.95; a sleek Italian carbine is priced at \$15, and the U.S. M1 carbine costs only \$65.

Are these used and surplus military rifles really bargains?

They can be. Certain surplus weapons can be converted into excellent sporting rifles. But the buyer must exercise extreme care in his selection of a used weapon. Many used guns have hidden and dangerous faults.

The buyer should first decide exactly what type or caliber of rifle will be suitable to his needs. The U.S. M1 carbine, for instance, is a handsome weapon, but its low hitting power makes it almost use-

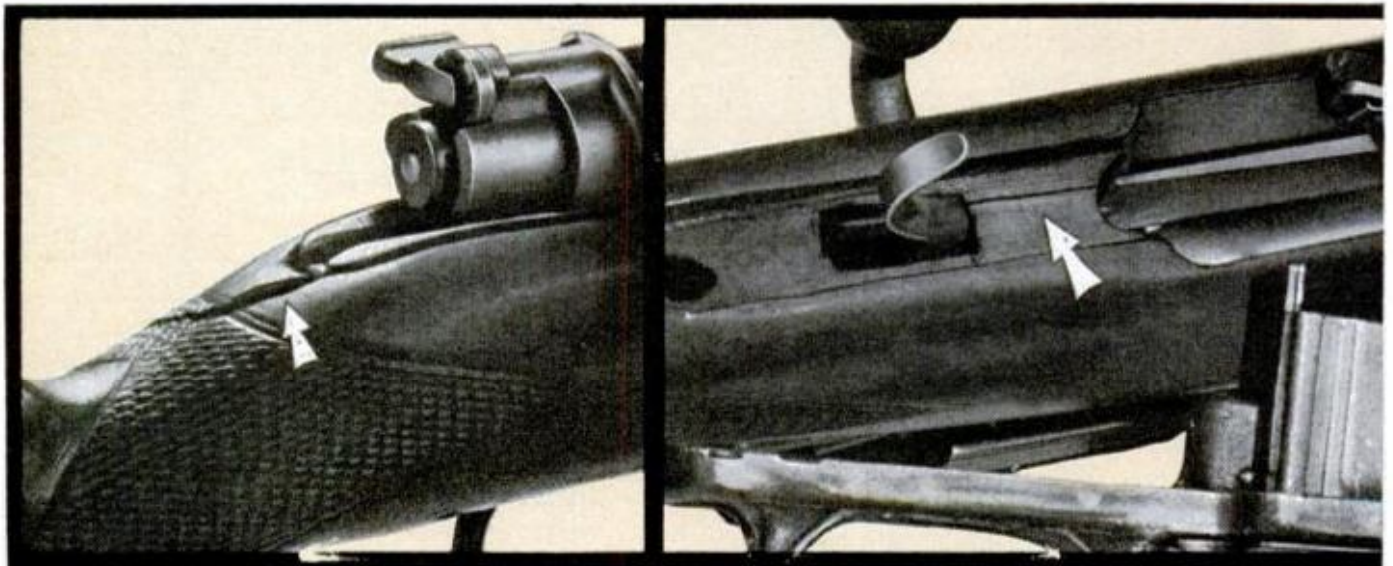
less for shooting a deer except at close range. The gun is suitable for varmint, but a .22-caliber rifle is just as good and less expensive.

Most used rifles can be examined with the same basic system. Begin by appraising the general outside condition of the stock. Wood can be refinished, but there are certain defects that would require costly professional gunsmithing to correct.

The area behind the tang should be examined for cracks or signs of cracks that have been repaired. A small crack in this area will become larger and render the stock useless, and expert checking will be necessary immediately. Another area of the stock to be examined is the wood behind the recoil shoulder. This critical point can be easily inspected for cracks by removing the two trigger-guard screws and sliding the stock away from the trigger

**CRACKS IN THE STOCK** usually show up just behind the tang (arrow). Constant firing will enlarge this crack, and you'll face the expense of a new stock

**REMOVE THE TRIGGER GUARD** and check the stock underneath for cracks. Even a hairline crack may mean the difference between a bargain and a dud

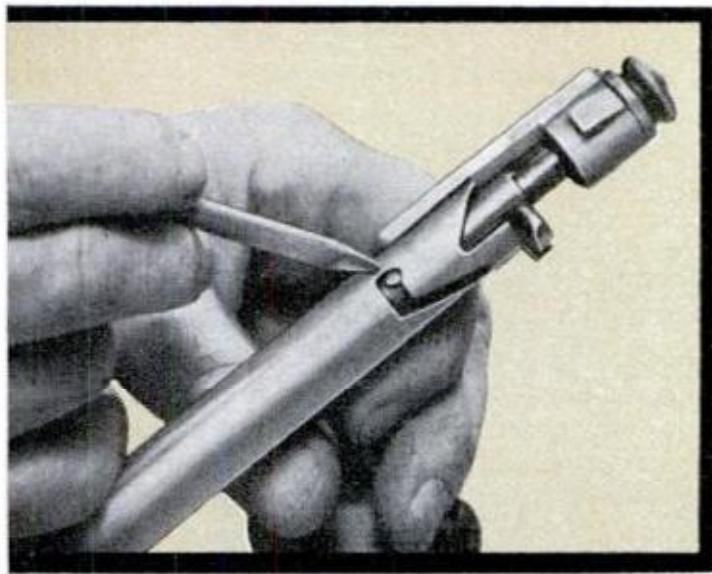




# Used Gun

**GUNSMITH EDWARD MATUNAS** gives a war-surplus rifle the initial once-over before getting down to the careful examination that will tell him whether the gun will be a good sports conversion

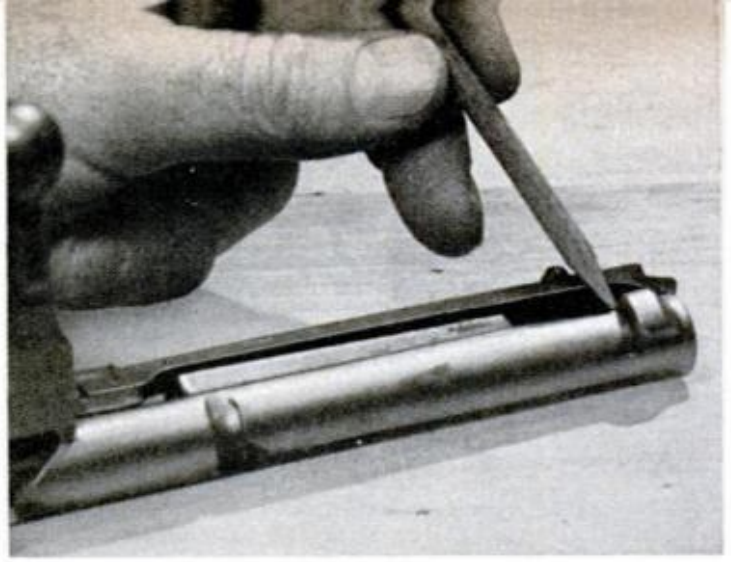
**ITALIAN ARMY RIFLES** have a small pin that holds all the bolt parts together. If this pin is badly worn, it may mean an expensive milling job to replace it



NOVEMBER 1963



**TINY CRACKS IN THE BARREL** of the Krag are not easily detected. Coat barrel with oil and wipe dry. Squeeze barrel in vise; emerging oil will locate cracks



**COMMON FAULT IN MANY KRAG RIFLES** is cracks in the metal. This cannot be repaired. Remove the bolt and check for slight cracks behind the locking lug

guard. The next thing to examine is how the stock fits to the receiver. When the trigger-guard screws are tightened, the receiver should fit snugly in the stock.

#### Examine the Metal

The next obvious point to examine is the condition of the metal's finish. If the bluing or Parkerizing is worn, the gun will rust easily and become pitted. Refinishing the metal costs between \$15 and \$20, and could destroy the "bargain" in a used gun.

Vitally important to the performance of a rifle is the condition of the crown, the slight convex curvature at the muzzle. The crowning should be uniform and smooth in order to expel gases uniformly. An improperly crowned gun will never be accurate on target.

A check on the gun's safety mechanism is simple, but important. First, cock the weapon. Most safeties will not function until the weapon is placed into battery (the cocked position). Place the safety in the full "on" position. Pull the trigger, then move the safety to the "off" position. If all is well, nothing will happen. A faulty safety will allow the gun to fire the moment it is released. In some cases, the safety will not even hold against the initial pulling of the trigger. Safety repair is difficult and expensive.

Most responsible gun dealers will have a trigger-pull gauge as part of their equipment. With this device you can measure the weight, or pull, of the trigger. Avoid a rifle that has a trigger pull under three pounds. Weapons that have had the triggers "lightened" by amateurs can cause considerable trouble. Irresponsible filing

and grinding of the sear, the pawl in a gunlock which holds the hammer at half or full cock, removes the case-hardened metal. The soft, exposed metal then wears rapidly until it deteriorates to the point where just closing the bolt will fire the weapon. This is not only a costly repair, but the condition is extremely dangerous.

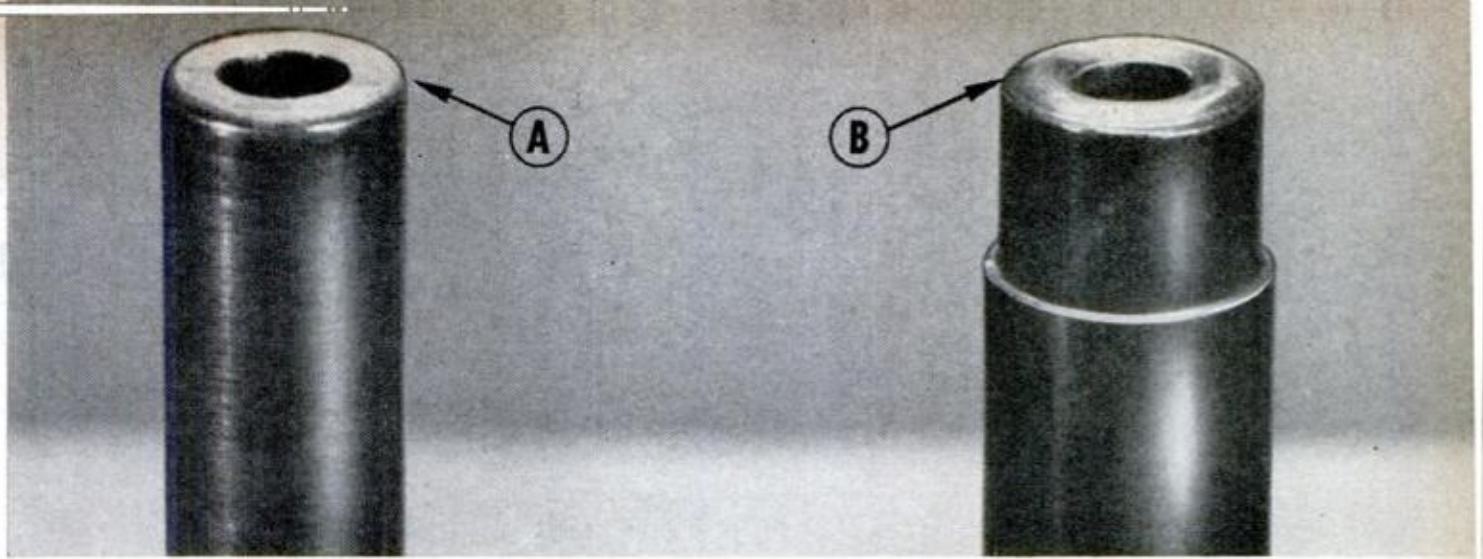
A gun that jams can be a nuisance to a hunter, and it is always a good idea to check the feeding action. A dealer might be reluctant to let a customer run ammunition through a weapon, but evidence of brass filings in the action signifies that the gun does not feed smoothly. This is most often seen as yellowish streaks on the metal of the action, and it means that the gun might be subject to jamming.

Examination of the face of the bolt gives a good indication of how much the gun has actually been fired. When a gun has received an extreme amount of use, the face of the bolt will have acquired a brass coloring and a light pitting.

#### Inspect Bore Visually

Remove the bolt and make your visual inspection of the bore. This can be done by sighting against a light through the rear of the barrel or by sighting down the muzzle and holding a dime in the breech to reflect light into the barrel.

The rifling, the lines swirling through the length of the barrel, should have distinct sharp edges. General darkening or roughness of the bore is a good indication that the barrel has seen better days. Pitting is a sign of neglect and also the death of a barrel. Heavy pitting in the throat of the weapon, the area in the



**BAD CROWNING AT THE MUZZLE (A)** is flat and causes shooting inaccuracy by not allowing uniform expulsion of gases. A good muzzle crown (B) is uniformly rounded. Recrowning a used weapon can cost about \$4.50

mouth of the barrel where the cartridge sits prior to firing, means that the gun will not shoot accurately. Extreme wear in the throat will also cause a loss of fire power, because the gases are allowed to escape. It takes approximately 3000 rounds to "shoot out" the throat.

Always run a cleaning rod through the barrel prior to inspection, and never buy a gun with a heavily greased bore unless the owner will wipe out *all* the grease. Greasing bores is a way to hide shot-out or pitted barrels.

On Mausers and Springfields, the condition of the firing pin can be easily checked in the shop. Cock the weapon and place the safety in the middle position. Withdraw the bolt from the rifle. The cocking piece can then be easily unscrewed to expose the firing pin for inspection. The tip of a good pin is round and smooth. A bad pin will have sharp or broken edges.

Military weapons have their parts numbered. Check the numbers on the receiver and the bolt to make certain that the last three digits are the same. If this number does not match, it means that a bolt from another rifle has been substituted for the original. In this case, be certain to have the dealer check the head space with a gauge. If the head spacing is off, the cartridge case will not be properly supported by the bolt. Firing a weapon in this condition may allow the cartridge to rupture or explode in the chamber.

Japanese rifles in World War II were made from the crudest forms of steel by the fastest methods possible. Except for the few that were obviously machine milled and show signs of good workman-

ship, they should be avoided. A quick check of the receiver will show if it has been made by a casting method.

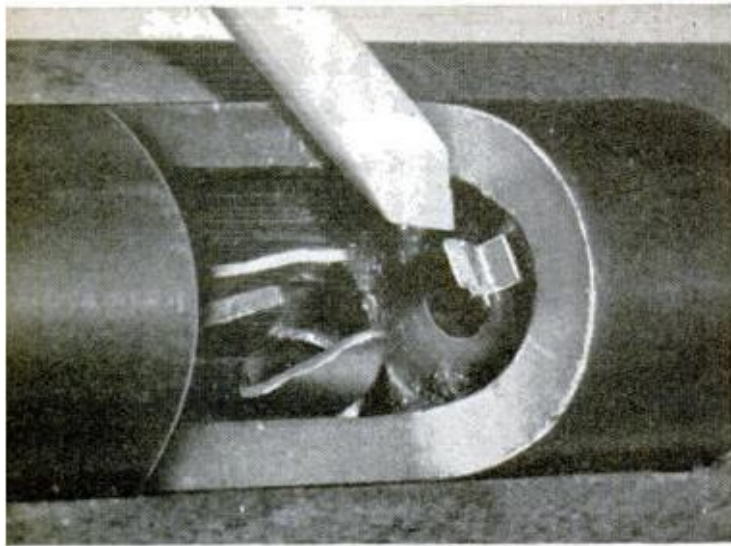
The Italian weapons are the worst of the surplus military weapons. The weakest point on Italian rifles is the small pin that holds the bolt assembly together. To examine this, pull the trigger and hold it back. Open the bolt and remove it from the rifle. The underside of the bolt has a small raceway. In this raceway you will see the pin that holds the bolt parts together. This pin is notorious for wearing, and it will reach a point where the bolt will fly to pieces. If you happen to have the gun at your shoulder when this happens, your forehead will act as a short stop.

#### **Beware of Pipe-Wrench Repairs**

Any weapon that shows evidence of pipe wrench marks on the barrel or receiver should be avoided. This is an indication that someone has tried to remove the barrel with a wrench, a practice that invariably puts cracks in the receiver.

The receivers on Krag rifles often develop small cracks. To check for this you coat the outside of the forward section of the receiver with a light oil. Wipe it dry and place it in a vise. If there are cracks, oil will be pushed to the surface of the receiver when you tighten the vise. Another point to be wary of on a Krag rifle is the back of the locking lug on the bolt. This is easily examined merely by removing the bolt. If you find any cracks around the base of the locking lug, avoid the rifle. This lug has been known to crack and shear off.

The installation of a scope on most mili-



**WEAK SPOT** on most .22-caliber rifles is the bullet clip guide, necessary for smooth loading. A visual check of the chamber will determine its condition

tary weapons creates a problem. In order to clear the scope, the bolt handle will have to be low forged, the safety will have to be lowered, and the receiver will have to be drilled and tapped for the scope blocks. The cost for this runs as high as \$30, possibly more than the price of the weapon. The 1917 U.S. Enfield and the British SMLE Enfield are the only two weapons that do not require bolt or safety alteration to install a scope.

Used lever-action rifles are generally good buys, but even on these sturdy weapons there are a few weak points. On the rifles with exposed hammers, set the hammer in the half-cock position. Squeeze hard on the trigger. If the gun fires, the safety notch on the hammer is gone. Next, pull the hammer back to full cocked position. Apply pressure to the hammer with the palm of the hand until it becomes painful. If the hammer can be pushed off, you will have to replace both hammer and trigger at a cost of \$15. And check the firing pin for a smooth, round point.

When selecting a used .22-caliber rifle, you use the same principles that apply to a high-powered rifle. In addition, examine the back edge of the cartridge chamber for excessive wear. If a rimfire gun has been dry fired to excess, the firing pin may have damaged the chamber. On bolt-action .22s, there is a bullet-guide clip over the top rear portion of the chamber. If this is broken or badly bent, the gun will not feed the shells properly.

A shotgun is the easiest weapon to examine visually. Break the gun, and sight down the inside of the barrel. You will see

immediately if the barrel has any dents or bends. A dent in the barrel will mess up the shot pattern, and it is expensive to remove. Shotgun tubes are easily bent in a fall, and they will never shoot true.

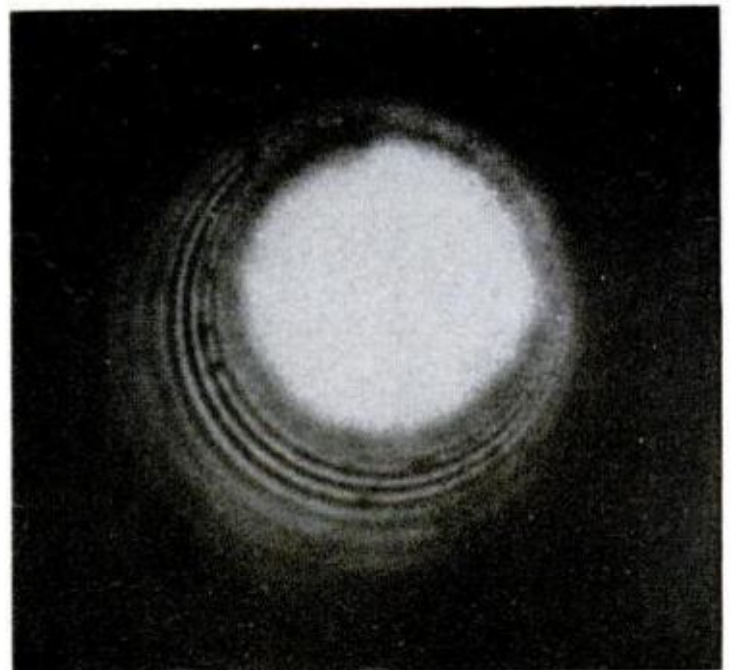
With a double-barreled shotgun, snap off the forend, the wooden piece ahead of the trigger guard, hold the gun by the stock and shake the barrel. The gun should be tight. A gun that rattles has worn locks, and its days of usefulness are numbered. The next step is to remove the barrels and check the firing-pin holes. They should be uniformly round. If they are elongated, the gun will occasionally misfire.

A prime factor in buying a shotgun is the fit of the weapon. When you bring it to your shoulder, it should feel comfortable. To score hits without sights, the gun must feel like an extension of your arm.

On pumps and autoloading shotguns, examine the extractors for wear. A worn extractor can cause a hopelessly jammed weapon. Check shotgun safeties and triggers the same as for rifles.

There are many guns on the market that have already been converted. On a rifle that has had sporting sights installed, be certain that the mounting holes do not go through the barrel into the bore. Pressure can rupture through these holes and cause a barrel to burst.

With these tips in mind you are ready to shop for your used gun. ★★★



**EXAMINING THE RIFLING** of the barrel for signs of pitting is done by simply sighting through the barrel with a bright light reflected from the opposite end

## For Big Snow Jobs

Using compressed air or gas as propellant, the Avalauncher sends a two-pound load of high explosive 400 yards to blast down snow cornices that might cause avalanches in ski areas. It was developed by the U.S. Forest Service.

## Dinner Timer

A new cooking pan made in West Germany is designed to prevent overcooking. Called Pan Clock, it has a timer on the lid which is preset to show at a glance how long your dinner has been simmering.

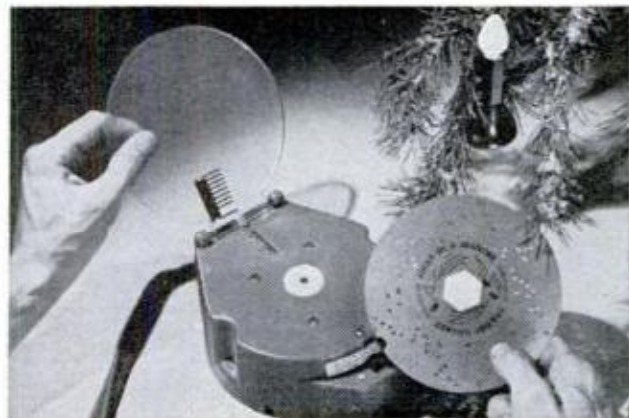


## Weather Mask

For people who suffer discomfort from the cold, a knitted, battery-heated mask warms the air before it enters the respiratory tract. Price of the unit is \$22.50; it's made by Carmen Commodities Corp., 2900 W. Peterson Ave., Chicago, Ill.

## Lights Play Carols

Music rings from bells on the eight Christmas-tree lights in a string of Bell-Lites. The bells are "played" by a disk revolving on a control unit. Made by Delta Electric Co., Marion, Ind.; price \$24.95.



# New for Your Home

**PORTABLE THERMOSTAT** with bimetal element registers slightest temperature change from 30° to 90°F. Hang it up, plug it in; heater becomes automatic. \$10.95; Mears Controls, 13725 S.W. Milliken Way, Beaverton, Ore.



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**ELECTRIC SPRAYER** dispenses household liquids from air fresheners to plant foods with built-in fine-spray a.c. motor. Button switch operates unit; liquids are easily changed. Cost: \$11.95. By Burgess Vibrocrafters, Grayslake, Ill.

**FOLDING FLOOR CHAIR** lets you sit low and in comfort by fireplace, TV or on bleacher benches. Thick foam natural-brown cushions of vinyl fit in solid pine and white birch frame. \$12.95 from Yield House, North Conway, N.H.



POPULAR MECHANICS



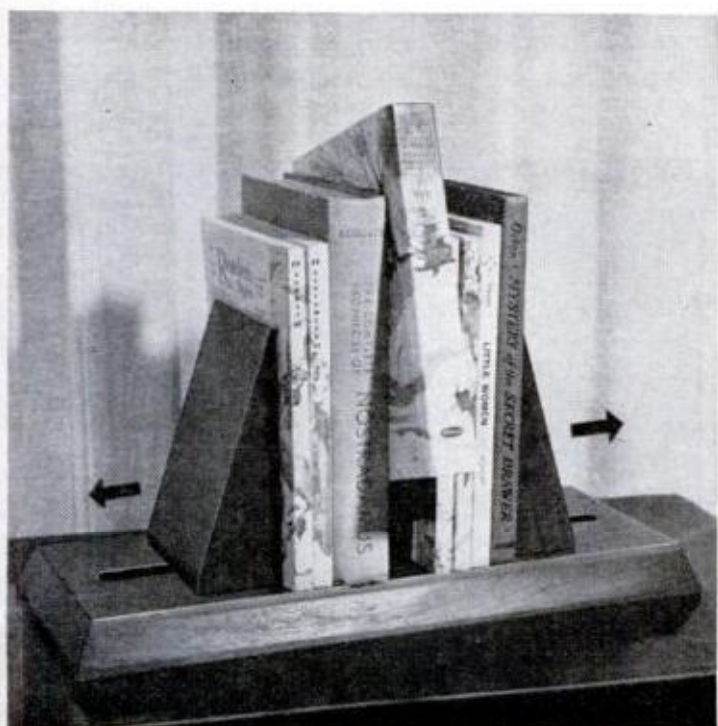
**CANISTER UNIT** of six steel containers with wire stand may be placed on counter, inside cabinet or hung from wall—saving storage space. One-lb. size canisters are \$7.98 a set; two lb., \$9.98 from Lucerna Co., 17 E. 45th St., N.Y., N.Y.



**RUG WASHER** attaches to vacuum cleaner with twist of thumb screw, holds water and shampoo to do 9' by 12' rug. Ten-inch-wide unit weighs six pounds, comes with two brushes (wash and wax) for \$39.95. Made by Electrolux

**AUTOMATIC BOOKENDS** are spring loaded. When book is added, ends draw out automatically and no books or ends fall over. In solid walnut, 15" by 6" by 7" set costs \$9.95. Kunkler's, 4525 Errington Rd., Columbus 27, Ohio

**VERTICAL ROTARY BROILER** takes less counter space than a dinner plate, cooks 8-lb. roast with infrared radiant heat. Unit with motor-powered spit, wire basket and removable aluminum and glass cover, \$34.95. By Sunbeam





### Official Vandalism

Kids would've loved it. They gave a group of men air guns, lined them up as a firing squad and let them bang away at street lamps. The purpose was to test a new unbreakable plastic bowl being made in England. PS.—The bowl didn't break, despite respectable marksmanship.

### Runabout for Triplets

Taking triplets out for an airing is no joke, as a mother in Hertsfordshire, England, discovered. An ingenious husband saved the day. He simply converted a stroller made for two into a three-passenger carriage by making an extension for it and adding an extra seat. Now it rides the triplets nicely.



### Plastic Gas Can

A new plastic container can hold gasoline or other volatile fluids without rusting or corroding. Dent-proof, each is fitted with pouring spout that is also a cap. The one-gallon size lists at \$1.49; the 2½-gallon size, \$2.98. Technical Plastics, 4921 Exposition Blvd., Los Angeles 16, Calif., is the manufacturer.







### Wing Lockers

An extension of the engine nacelles on the twin-engine Cessna *Skynight* makes room for luggage compartments. Lined and sealed from weather, each compartment can hold a maximum of 120 pounds of baggage, increasing total capacity of the airplane to 600 pounds.

### Carrier for the Beetle

Bulky objects such as boats can ride atop a Volkswagen on a clamp-on carrier. The main portion of the carrier is a 36 by 38-inch roof section priced at \$29.95; a rear support (shown), selling for \$8.95, extends the length to 89 inches.

The maker is New Milford Specialties Co., 24 South Main St., New Milford, Conn.



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### Pushbutton Drum

Bass drum and cymbals have been added to the sounds produced by the Wurlitzer organ. An electronic device known as Ssh-Boom, creates the sounds that are operated from the keyboard. Speakers in the organ have been enlarged to give the drum greater fidelity.

### Sturdy Ornaments

Breaking and eating Christmas tree ornaments—a Yule tradition with the younger set—is impossible with nontoxic, shatter-proof ornaments now made of polyvinyl chloride plastic by B. Wilmsen, Inc., Philadelphia, Pa. In many colors and shapes, the Nulite ornaments come as large as bowling balls.



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# MORE House for LESS Money

*An erector-set foundation and full second story in the roof are two of its cost-cutting features*

By Arthur J. Maher

**I**T'S AN ORDINARY looking house, maybe even a little homely, but the sight of it ought to gladden the nation's home buyers. Its purpose: To save money.

That ponderous-looking roof structure, for instance, can save 10 to 15 percent of the cost of a conventionally built roof and second story.

This is one of the findings from the Research House built in Rockville, Md., by the National Association of Home Builders in cooperation with some 40 manufacturers. They wanted to prove that common-sense design and construction—relying heavily on existing materials and techniques—can reduce housing costs now.

The way that roof saves money is shown in sketches on the opposite page.

Generally, a builder using conventional roof framing creates a second story either by running the walls straight up or by including the living space within the roof structure (top sketch).

The latter method lowers cost somewhat by eliminating the exterior walls on the second story. However, it yields a smaller amount of space—usually two bedrooms and a bathroom. Also, it often requires dormers for added headroom or windows.

The Research House (lower sketch) combines the best features of both approaches.

It was framed with very long rafters, which were pre-assembled at the construction site into triangular frames called trusses, then anchored in place. Sheathing and roof covering were applied in one operation, using interlocking plywood strips coated with Hypalon, a rubberlike plastic with high weather resistance.

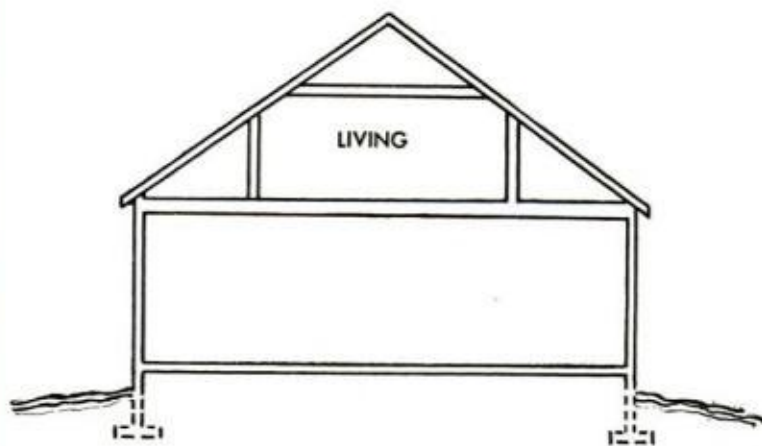
The result is a roof that is one-and-a-half stories high, and wide enough to enclose a 12 by 20-foot master bedroom with adjoining dressing area, two 10 by 14-foot bedrooms, a master bathroom and a combined lavatory/laundry center. Exterior walls were unnecessary, and closets, vani-

**KNOWLEDGE GAINED** in building this Research House will help lower housing costs in this country. Its deceptive ranch-like appearance hides 2128 square feet of living area



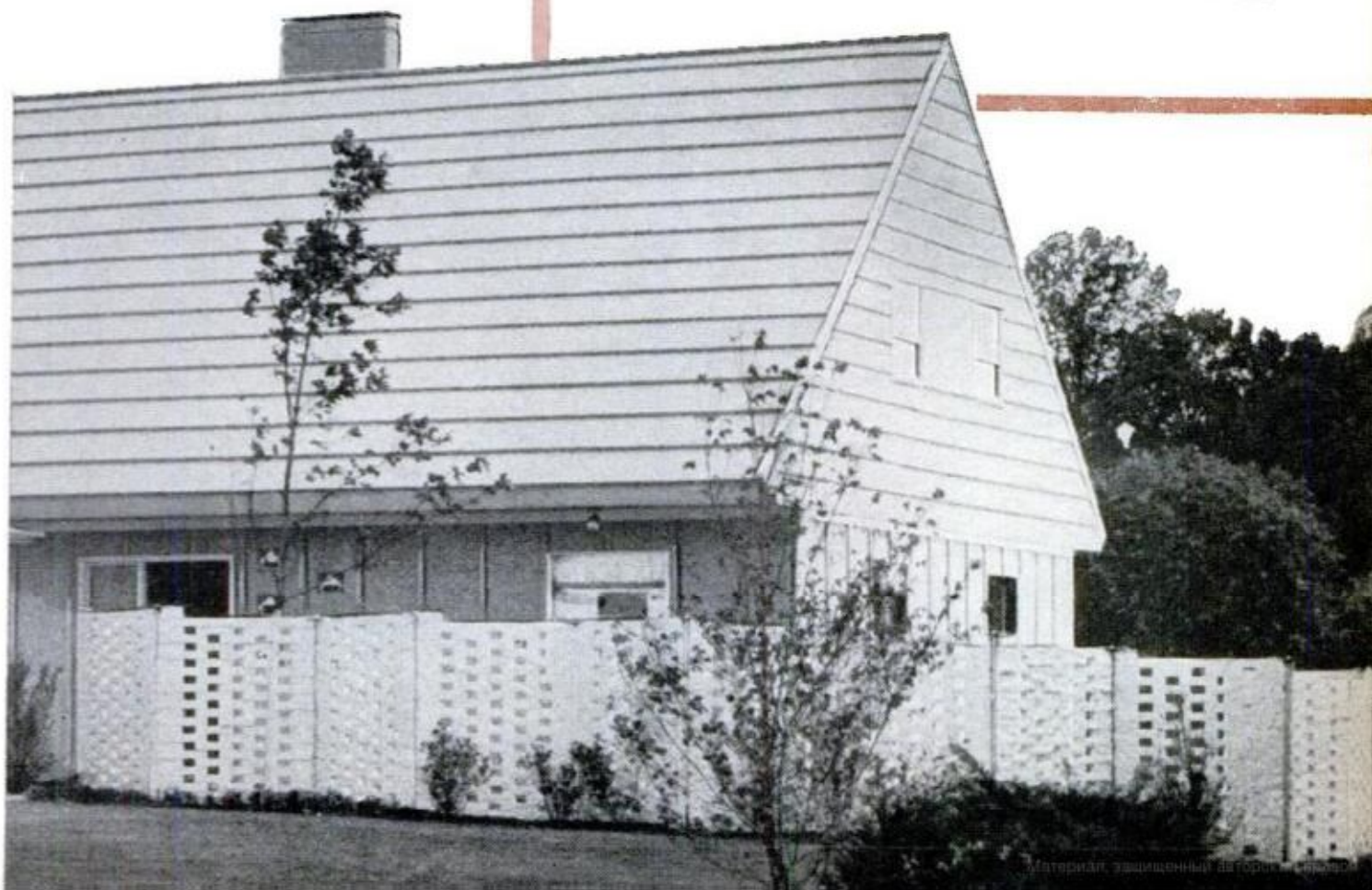
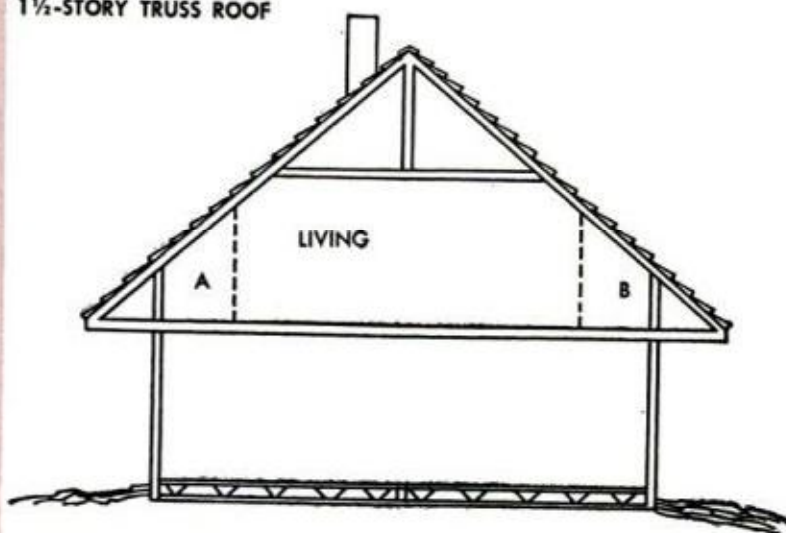
**CAPE COD APPROACH** to putting living space inside the roof structure is more economical than regular two-story construction. However, it doesn't give full second floor, and dormers might be necessary to boost headroom and/or add side windows. Also, some of floor space has to be taken up with closets

### CONVENTIONAL ROOF



**NEW ROOF SYSTEM** uses long rafters to achieve a high, wide peak. This creates room for a full second story. Storage closets are built into areas A and B, which have insufficient headroom for other uses. Side windows and dormers are omitted because house has full air conditioning and mechanical vents

### 1½-STORY TRUSS ROOF



ties and dressers were built into low-head-room areas (A and B, bottom sketch).

Another cost-saving feature of the Research House is its foundation. Made of epoxy-coated steel, it was assembled like a giant erector set. It rests on steel posts which, in turn, are supported by concrete footings. The footings were cast in holes dug by a mechanical borer. The system saves money in the following ways:

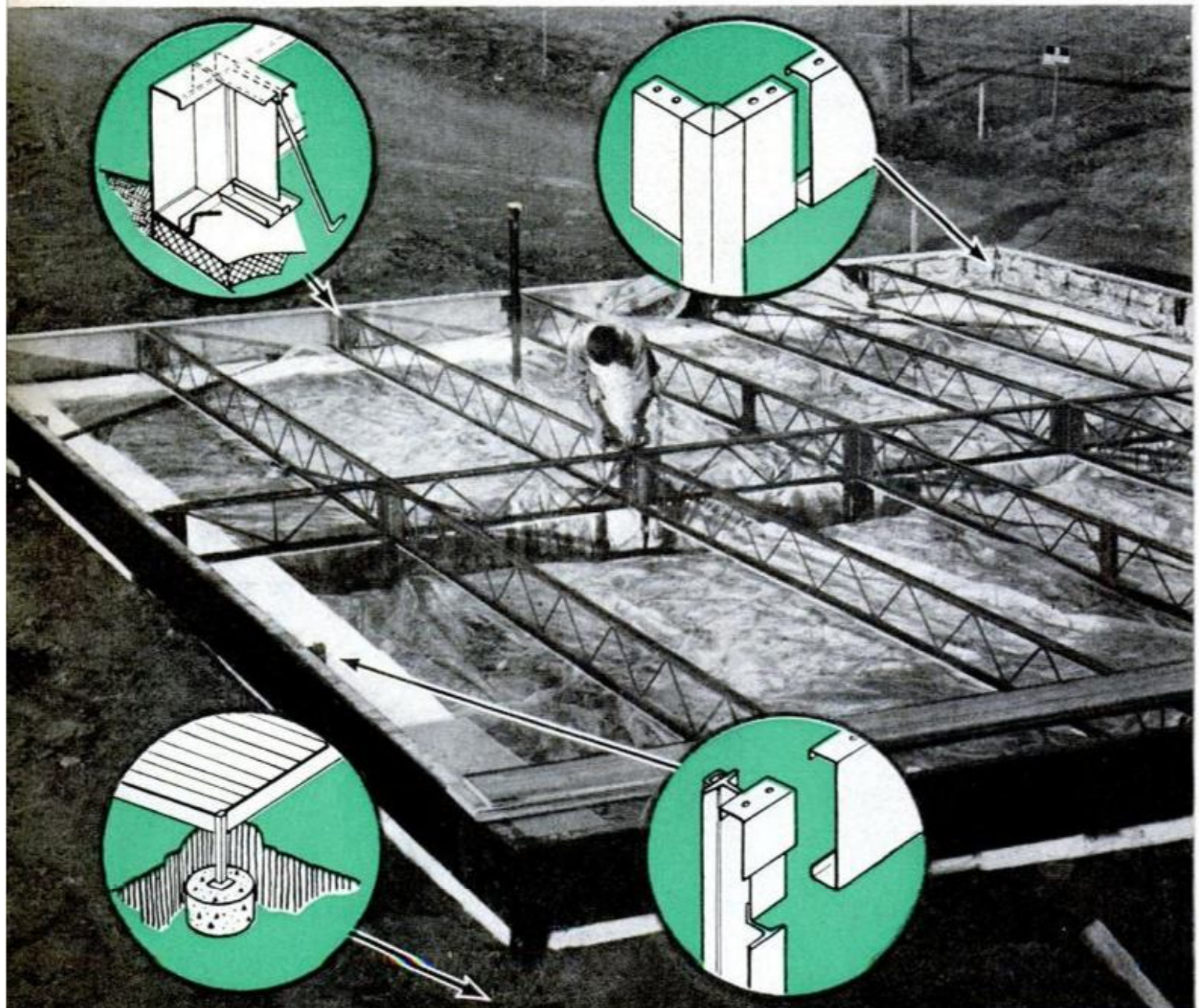
1). It can be placed in half a day, even in bad weather. Conventional foundations can take a week or more. 2). It adapts to low-cost building sites merely by varying lengths of the legs to compensate for un-

even terrain. 3). Since its open-web joists permit free flow of air, the space inside the foundation can be closed off and used to distribute warm air from the furnace, thus eliminating a lot of ductwork.

The floors in the Research House represent still another cost reduction, due primarily to their speed of installation. They consist of subflooring and finish flooring laminated together into planks 12 inches wide and 12, 16 and 28 feet long. These were fastened with epoxy plus very few nails (one nail per plank per joist).

To cut labor costs an estimated five percent and achieve exceptional ease of maintenance, the interior and exterior walls throughout the Research House were covered with prefinished materials. The exterior is of half-inch plywood panels that serve as combined sheathing and siding.

**STEEL FOUNDATION** is assembled with a system of bolting and interlocks. The C-shaped perimeter beam is insulated. Floor planks will be nailed and glued to the open-web joists. A hundred such units will be thoroughly field tested before system is marketed



They were factory coated with a plastic film (Tedlar) that NAHB says has been thoroughly tested for weather resistance. Battens, corner boards, frieze boards, eave soffits and exterior door and window casings were also covered with this film giving an exterior that won't need painting for an estimated 15 years.

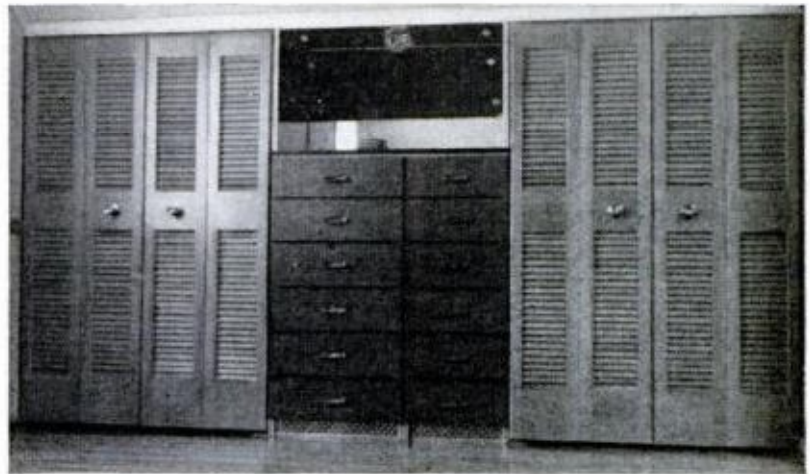
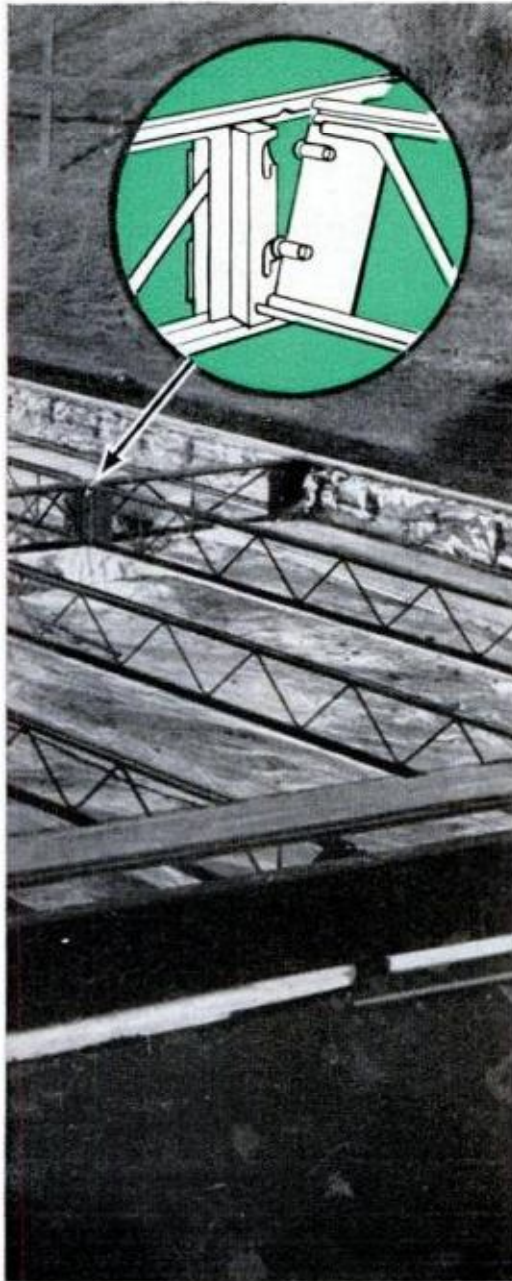
Interior walls are vinyl-surfaced gypsum board, except for the entry and study. Upstairs, the gypsum board was fastened to experimental steel studs with an adhesive. Downstairs, the material was glued and nailed to ordinary 2x4 studs.

The entry and study were paneled with a plastic-finished veneer plywood. The panels were applied with a device called a Wire Pusher (sketch, lower right). When pushed against the panel, it shoots a  $\frac{3}{4}$ -inch length of adhesive-coated wire

through the panel and into the stud, then cuts off the wire at the panel surface. The resulting hole is almost invisible and requires no setting, filling or sanding. Estimated possible saving: \$5 to \$10 a room.

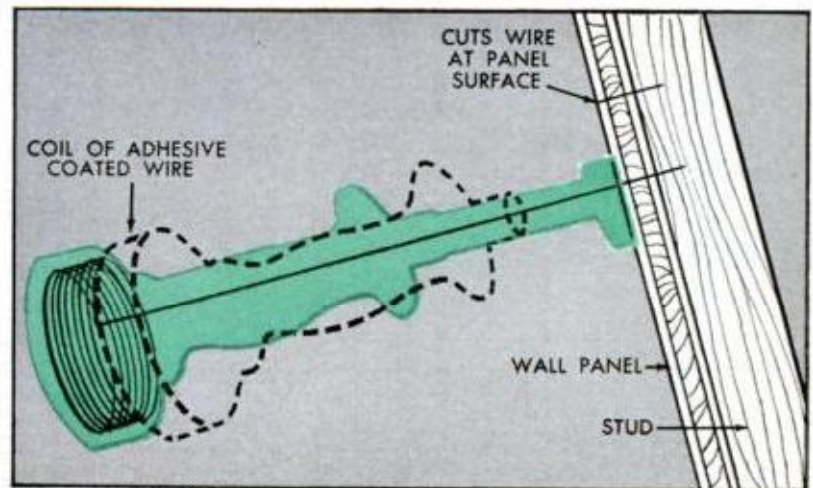
Some parts of the Research House, notably the foundation, must undergo further testing. But one of the best aspects of the building is that its various parts and systems can be employed in combination with standard techniques. Furthermore, such products as the prefinished interior wall panels, the exterior siding, the long sub/finish flooring planks and many others are *already* on the market.

You may never see another house just exactly like this one. But it does prove that there are now ways to build houses easier and at a lower cost. ★★★



**BUILT-IN DRESSERS** on second floor are placed inside low-headroom space, between wardrobe closets. This method makes building a closet simply a matter of installing the doors. Also, it permits the home buyer to pay for the dresser as part of his mortgage

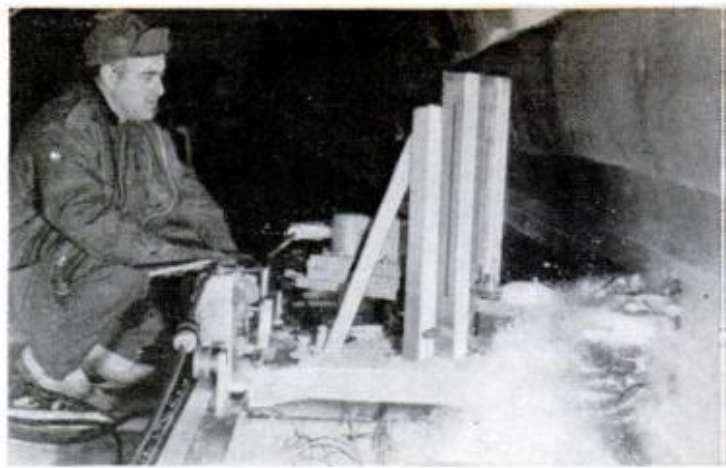
**PUSH THIS TOOL** against a wall panel and it will make its own "nail" of adhesive-coated wire. Resulting hole needn't be concealed, as it is very tiny. Soon to be marketed, this device is a natural for applying wall board, cabinet facing and interior house trim





### Outboard Ice Boating

"Boating" on ice and snow is possible with a 4-horsepower outboard motor that operates a chain-driven wheel which digs into the ice and pushes the boat forward. Made by Polar Motors, 303 Causeway Blvd., La Cross, Wis., the outboard power unit sells for \$241.95.



### Dig This—It's Cool

Snow tunnels under Arctic Army camps are kept free of encroaching ice and snow with a snow trimmer. A self-propelled platform carrying a trimmer head cuts snow loose; blocks are then crushed by another machine and removed by a pneumatic conveyor system.



### Stingers for Starfighters

Three F-104 *Starfighters* have been fitted with rockets in the tails and reaction jet nozzles in their wingtips and nose—to control roll, pitch and yaw—and will be flown 25 miles high to give space pilots training in controlling a vehicle in space.

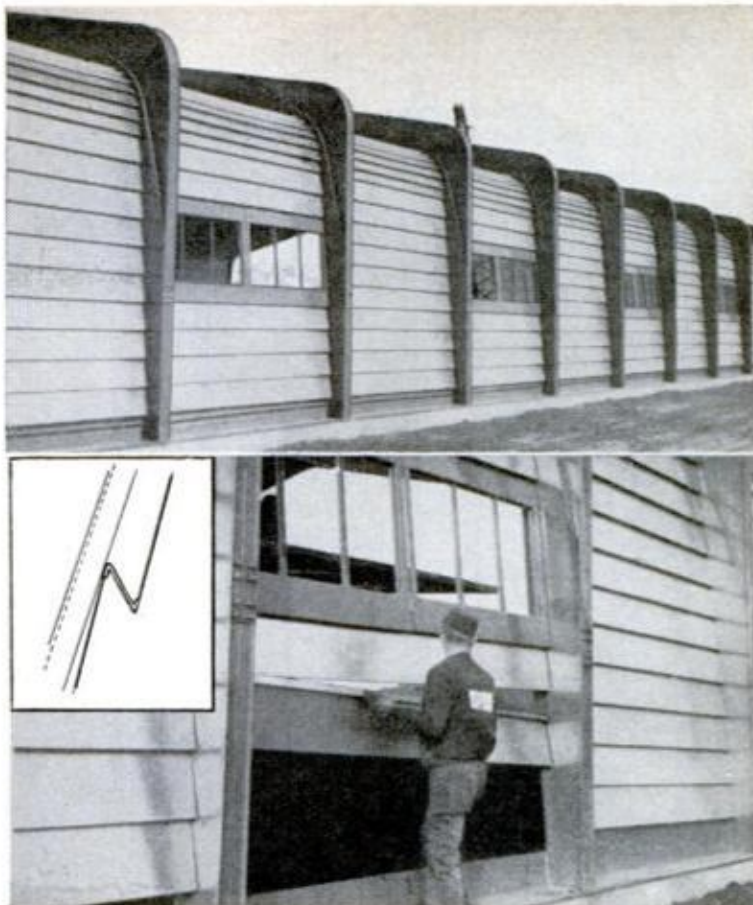
The 6000-pound-thrust AR-2 rocket in the tail will help the supersonic fighter attain altitudes of 120,000 to 130,000 feet.

## Snap-Together Buildings

Building steel warehouses, garages, farm structures and the like is a snap—literally—with a new system recently announced by Lundell Manufacturing Co., Cherokee, Iowa.

Buildings are framed by erecting a row of flanged steel arches on concrete footings. Interlocking Z-shaped panels, which form both roof and side walls, are then snapped into the opposing channels formed by the arch-beam flanges. Standardized window units, designed to interlock with the panels, are also snapped into place, and insulation panels may be clipped inside the walls and roof. End walls are built in a conventional manner.

Result, says the manufacturer, is an economical clear-span building which can be added to merely by erecting more arches.



## You Can Tell the Moose Is a Lady by Her Paint

Montana fish and game surveyors are conducting a game check that looks like fun for everyone but lady moose, who, whether she likes it or not, is being transformed into a "painted lady."

Flying over open land in a helicopter, a pair of state conservationists seek out herds of moose, then fly low over the

stampeding animals and bombard the females with Christmas-tree ornaments filled with yellow highway paint. The ornaments break without harming the animal and paint is shed the next spring. Knowing the number of females around, experts can estimate the number of calves expected, and govern hunting permits accordingly.





Part I

Designed by Robert Woolson

# SIDEWALK

*Classic*

*Christmas 1963 could be one to remember if you have this classy buggy parked under the tree. You'll have time if you start now*





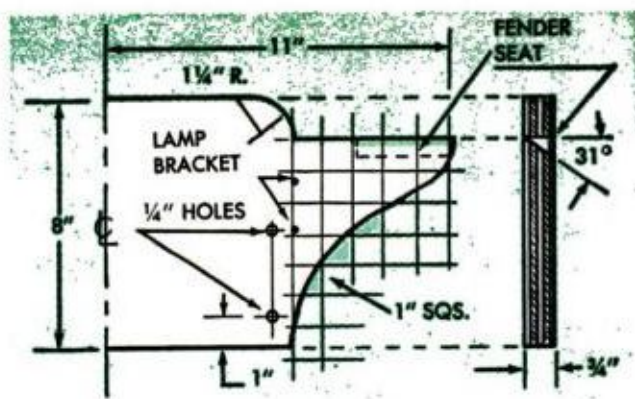
**STEERING COLUMN** is held in position by wooden support (plywood) and metal brace to frame. Metal angle screwed to top of support serves as a bearing

**W**ITH its black fabric top, leather dashboard straps and gas headlamps, this bright-red replica of its prototype—the open roadster—will bring a twinge of nostalgia to grownups and a shriek of delight from the younger set.

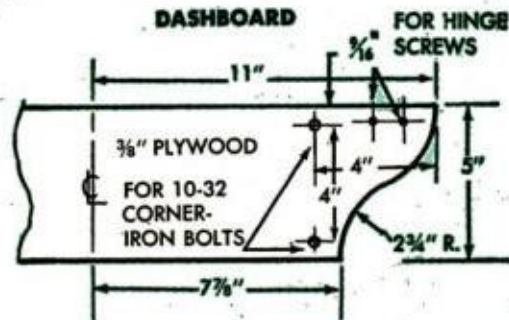
It does a safe, quiet 5 miles per hour, has a 12-volt electrical system and a built-in battery charger. An auto generator serves as a motor and you can buy nearly all the parts at your hardware store.

Before you buy or cut any materials run over the list of keyed parts and check each one out with the pull-apart view so that you'll have a good idea of what goes where on the plywood frame. Dimensions of some parts you have to make, bolt sizes and other information are in the keyed list.

Begin construction with the frame which is cut from a piece of 1/2-in. plywood. Cut the piece slightly oversize, about 1/8 in. all around, to allow for finishing the edges; there must be no splinters. Then lay out the hole pattern and drill all the holes which are located by dimension, except the holes F. Hole diameters are taken directly from the bolt sizes given in the parts list. The seven countersunk holes (indicated by concentric circles) are drilled and countersunk for 1 1/2-in. No. 8 F.H. wood screws. These hold the brake-shaft supports and the front-fender support, parts No. 27 and 31. One hole, D, is not countersunk, as it takes the screw holding the lower end of the steering-column brace, part No. 59,

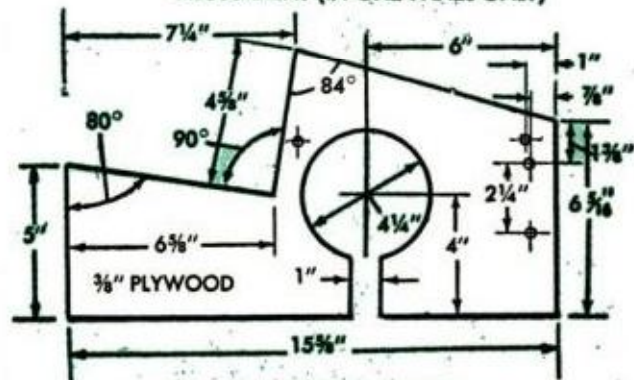


**DASHBOARD**



**FRONT PIECE, BODY**

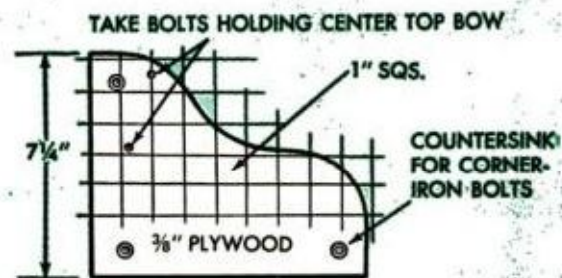
**OPENING FOR DRIVE-BELT ADJUSTMENT (IN ONE PANEL ONLY)**



**SIDE PANEL, BODY, 2 REQD.**



**SEAT BACK**



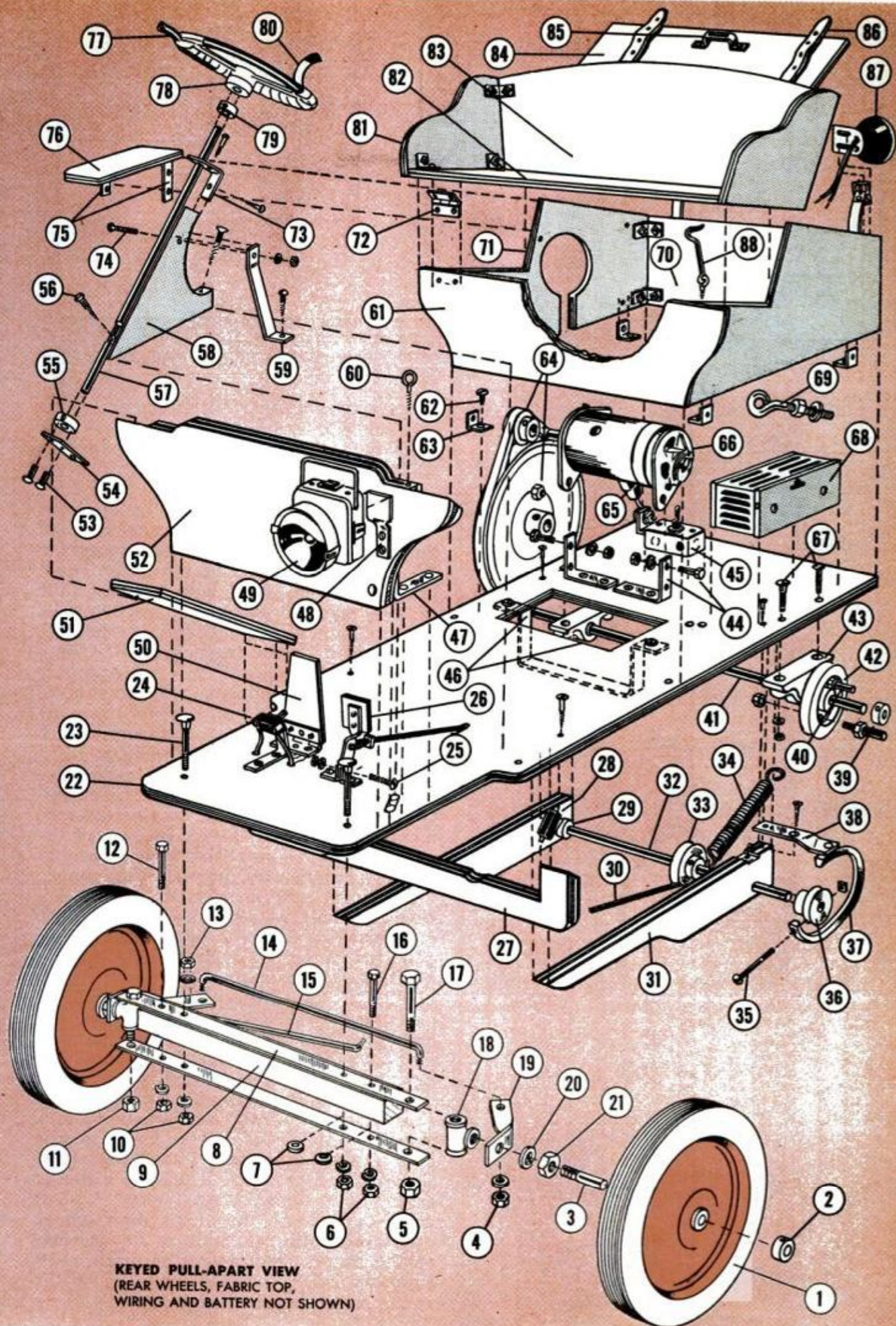
**END PIECE, SEAT, 2 REQD.**

# KEYED LEGENDS

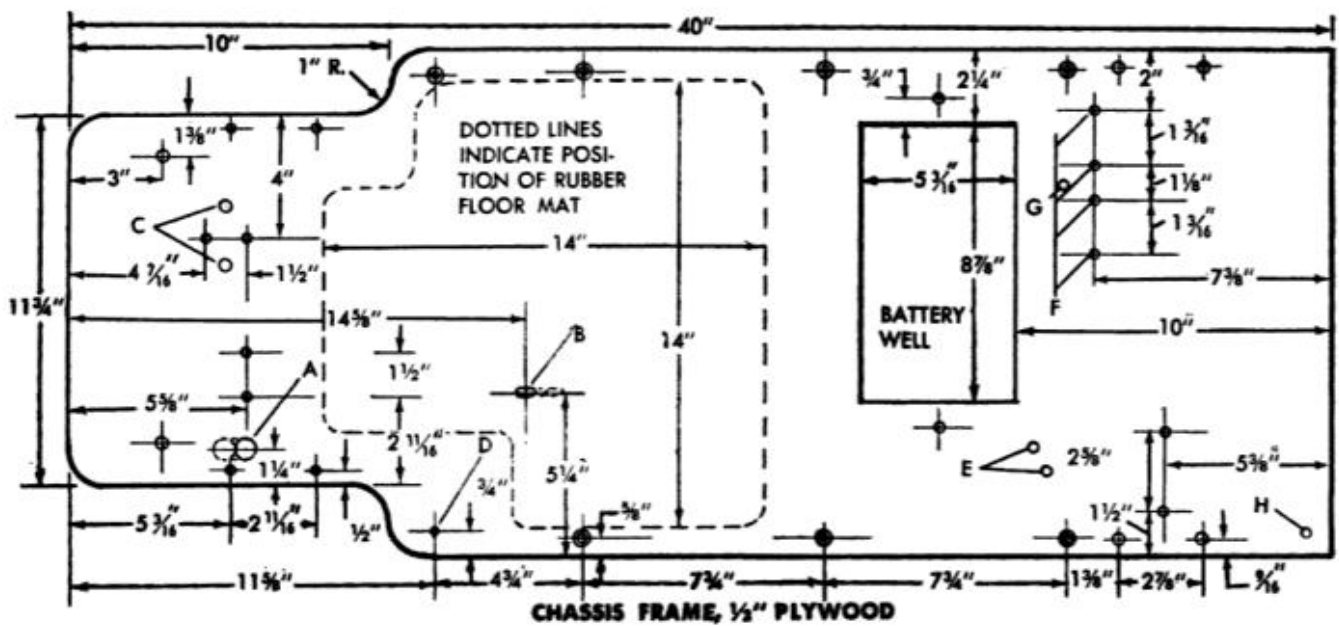
1. WHEEL, SEMI-PNEUMATIC, 12 x 1.75. BALL-BEARING. FOUR REQUIRED (SPARE WHEEL OPTIONAL)
2. SHAFT COLLAR, 1/2 IN.
3. WHEEL SPINDLE, 1/2 x APPROX. 3 IN. STEEL. THD. 1/2-13. TWO REQUIRED
4. HEX NUT, 1/4 IN. WITH WASHER
5. HEX NUT, 1/2 IN., TWO REQUIRED
6. HEX NUTS AND LOCK WASHERS, 1/4 IN.
7. FLAT SPACER WASHERS, ONLY TWO SHOWN; FOUR REQUIRED
8. AXLE STRAPS, TWO REQUIRED
9. AXLE, HARDWOOD
10. SAME AS PART NO. 6
11. SAME AS PART NO. 5
12. HEX-HEAD MACHINE BOLT, 1/4 x 2 1/4 IN.
13. HEX NUT AND WASHER, 1/4 IN., TURNS ONTO END OF STEERING ROD
14. TIEROD
15. STEERING ROD
16. SAME AS PART NO. 12. NOTE THAT BOLTS NO. 12 AND 16 PASS THROUGH AXLE ONLY, NOT THROUGH FRAME
17. KINGBOLT, 1/2 x 2 1/2 IN., TWO REQUIRED
18. PIPE TEE, 1/4-IN. TWO REQUIRED. THREADS REAMED OUT TO TAKE 1/2-IN. KINGBOLT
19. STEERING ARM, TWO REQUIRED, R. AND L., ONE HAS THIRD HOLE FOR STEERING ROD
20. LOCK WASHER, 1/2 IN.
21. HEX NUT, 1/2 IN.
22. CHASSIS FRAME, 1/2-IN. PLYWOOD
23. CARRIAGE BOLT, 1/4 x 3 IN. TWO REQUIRED
24. FOOT SWITCH, DPST, PUSH-BUTTON TYPE, NORMALLY OFF
25. ROUND-HEAD 10-24 SCREW, 3/4 IN. LONG. REQUIRES TWO NUTS, LOCK WASHER BETWEEN NUTS AND TWO SPACER WASHERS
26. BRAKE PEDAL
27. FRONT-FENDER SUPPORT
28. SPOTLIGHT SWITCH, LEVER-ACTUATED, SPDT, BUT USED AS SPST ONLY
29. SHAFT COLLAR, 1/2-IN., ACTUATES SPOTLIGHT SWITCH. A SECOND COLLAR IS REQUIRED ON BRAKE SHAFT TO HOLD IT IN POSITION AFTER ASSEMBLY
30. WIRE BRAKE CABLE 1/8-IN. DIAMETER, OVERALL LENGTH APPROX. 28 1/2"
31. BRAKE-SHAFT SUPPORT, OR BEARING. TWO REQUIRED
32. BRAKE SHAFT, 1/2 x 17-IN. STEEL SHAFTING
33. BRAKE ECCENTRIC, 3-IN.-DIA. V-PULLEY
34. BRAKE RETURN SPRING, 6 1/4 IN. LONG, 1-IN.-DIA. COILS
35. ROUND-HEAD 10-24 SCREW, 2 IN. LONG. LOCKS END OF BRAKE BAND
36. BRAKE-BAND TIGHTENER, 2-IN. V-PULLEY
37. BRAKE BAND, 1/2-IN. V-BELT, OVERALL LENGTH APPROX. 16 1/2"
38. BRAKE-BAND LUG, 1/8 x 1 x 6-IN. STEEL. OUTER END GIVEN ONE-QUARTER TWIST
39. SHAFT COLLAR, 1/2-IN.
40. BRAKE STUD, 5/16-IN. STEEL, TWO REQUIRED. THREAD 5/16-18 AND FIT EACH WITH TWO HEX NUTS
- \*41. REAR AXLE, 1/2 x 23 1/4-IN. LENGTH OF DRILL ROD
42. BRAKE DRUM, 4-IN. V-PULLEY. DRILL 5/16-IN. HOLES THROUGH WEB ON 2 1/2-IN. CENTERS FOR BRAKE STUDS
43. BALL-BEARING PILLOW BLOCK FOR 1/2-IN. SHAFT. TWO REQUIRED
44. MACHINE BOLT, 1/4 x 1 IN. WITH NUT AND LOCK WASHER. TWO REQUIRED. THESE BOLTS JOIN MOTOR MOUNTING LUGS TO 3-IN. CORNER IRONS, ONE LEG OF EACH IRON BEING CUT TO 2 1/4 IN. LENGTH. DRILL HOLES FOR BOLTS CENTERING 1 1/4 IN. ABOVE THE CORNER-IRON BEND
45. DPDT TOGGLE SWITCH. SEE WIRING DIAGRAM
46. BATTERY WELL AND SUPPORT
- \*\*47. CORNER IRON, TWO REQUIRED TO SUPPORT DASHBOARD
48. HEADLAMP BRACKET
49. HEAD LAMP, DRY-CELL POWERED, TWO REQUIRED
50. PEDAL. ACTUATES START-STOP SWITCH
51. FRONT FENDER, TWO REQUIRED. EACH CUT FROM 3/4-IN. PLYWOOD, 4 IN. WIDE, 12 IN. LONG WITH UPPER CORNERS ROUNDED TO 1-IN. RADIUS, LOWER OUTSIDE CORNER TO 2-IN. RADIUS
52. DASHBOARD, 1/4-IN. PLYWOOD
53. SOFT-IRON RIVETS, 1/8 x 3/4 IN. EXACT LENGTH DEPENDS ON WIDTH OF SHAFT COLLAR USED
54. STEERING CRANK
55. SHAFT COLLAR, 1/2 IN. NOTE THAT PARTS NO. 54 AND 55 ARE JOINED WITH RIVETS, PART NO. 53
56. NO. 8 WOOD SCREW 1 1/2 IN. LONG
57. STEERING COLUMN, 1/2 IN. DIA., 18 IN. LONG, STEEL SHAFTING
58. STEERING-COLUMN SUPPORT, 1/4-IN. PLYWOOD
59. STEERING-COLUMN BRACE
60. SCREWEYE, 1/2 IN. TWO REQUIRED. TAKES SWIVEL SNAP ON TOP STRAP
61. FRONT PIECE, BODY
62. SHEET-METAL SCREW, SIZE 1 1/2-8 (OR 10), BINDER HEAD, FIVE REQUIRED
63. CORNER IRON, 1 IN., FIVE REQUIRED TO ATTACH BODY TO FRAME. EIGHT REQUIRED FOR JOINING THE FOUR PARTS OF BODY
64. DRIVING AND DRIVEN V-PULLEYS. DRIVING PULLEY, 2 IN. DIA., 5/8-IN. BORE. DRIVEN PULLEY, 10 IN. DIA., 1/2-BORE. USE 1/2-IN.-V-BELT, 34 IN. LONG
65. TURNBUCKLE, SIZE (CLOSED) 5/4 IN. HOLDS MOTOR IN FIXED POSITION
66. AUTO GENERATOR, 12-VOLT. SERVES AS MOTOR WITHOUT ANY ALTERATION
67. CARRIAGE BOLTS, 1/4 x 1 1/2 IN. FOUR REQUIRED WITH HEX NUTS AND WASHERS
68. CHARGER, 12-VOLT
69. TURNBUCKLE, PART NO. 65, IS FITTED WITH NUTS AND LOCK WASHERS TO PREVENT IT FROM LOOSENING
70. BACK PIECE, BODY, 3/8 x 6 5/16 x 15 3/16-IN. PLYWOOD
71. SIDE PIECE, BODY, TWO REQUIRED. ONLY ONE HAS OPENING FOR BELT ADJUSTMENT
72. BUTT HINGE, 1 1/2-IN., TWO REQUIRED
73. BEARING, TOP END OF STEERING COLUMN
74. SCREW, 10-24, 1 IN. LONG
75. CORNER IRONS, 1-IN. AND 3-IN. SIZES, TWO REQUIRED OF EACH
76. REAR FENDER, 3/8 x 4 x 12-IN. PLYWOOD WITH THREE CORNERS ROUNDED TO 1-IN. RADIUS
77. RUBBER HOSE, 3/8-IN. O.D.
78. STEERING WHEEL, 1/2-IN. BORE, 10 1/4-IN. DIA., CAST-IRON V-PULLEY
79. SHAFT COLLAR, 1/2-IN.
80. ELECTRICIAN'S BLACK PLASTIC TAPE
81. SIDE OF SEAT, TWO REQUIRED
82. SEAT BOTTOM, 3/8-IN. PLYWOOD. MEASURES 8 1/4-IN. WIDE, 21 7/8-IN. ON LONG SIDE, 20 IN. ON SHORT SIDE. PADDED WITH CORRUGATED-RUBBER STAIR TREAD
83. SEAT BACK
84. MOTOR-COMPARTMENT COVER, OR DECK, 3/8 x 8 1/4 x 16-IN. PLYWOOD
85. DECK HANDLE
86. LEATHER STRAP, TWO REQUIRED WITH BUCKLES
87. STOPLIGHT, 12-VOLT
88. HOOK AND EYE, 3 1/2 IN., HOLDS HINGED SEAT IN DOWN POSITION. EYE SCREWS INTO BACK OF SEAT NEAR BOTTOM. HOOK SCREWS INTO FRAME
- \*PURCHASE A 24-IN. LENGTH OF DRILL ROD AND CUT TO REQUIRED LENGTH AFTER MAKING TRIAL ASSEMBLY. LENGTH MAY VARY FROM THAT GIVEN DUE TO POSSIBLE VARIATIONS IN WIDTH THROUGH PILLOW-BLOCK BEARINGS AND WHEEL HUBS
- \*\*INSIDE CORNER IRONS ARE USED THROUGHOUT ASSEMBLY. ALL 1-IN. IRONS JOINING BODY PARTS ARE HELD WITH 10-24 SCREWS AND SQUARE NUTS

## PLANS AVAILABLE

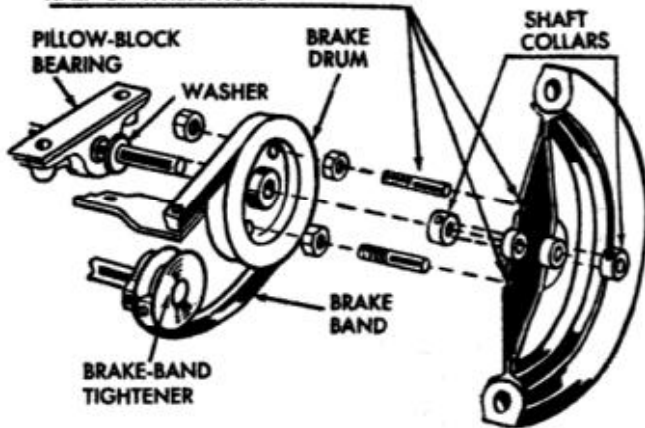
If you prefer to build this classy little car from large drawings, you can obtain a set of detailed plans, complete with instructions and printed on 22 x 30-in. sheets, by sending \$3.50 to Popular Mechanics Blueprint Dept. 740 N. Rush St., Chicago 11, Ill.



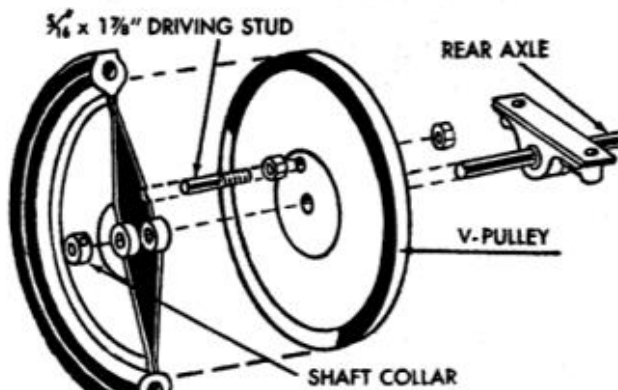
**KEYED PULL-APART VIEW**  
 (REAR WHEELS, FABRIC TOP,  
 WIRING AND BATTERY NOT SHOWN)



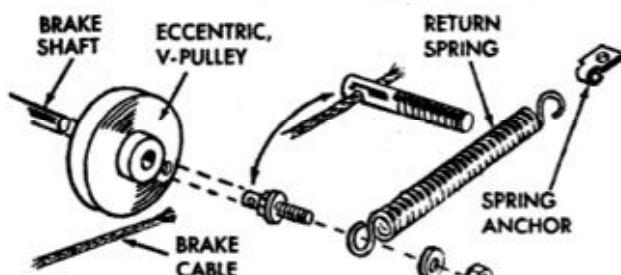
5/16" x 1 7/8" STEEL STUDS ENTER HOLES DRILLED THROUGH INNER HALF OF WHEEL HUBS



**BRAKE ASSEMBLY**



**GROUND-WHEEL DRIVE**



**BRAKE ECCENTRIC ASSEMBLY**

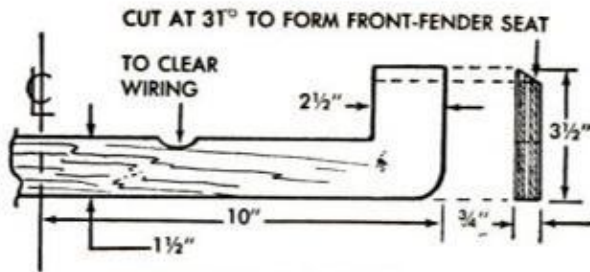
which passes through the frame and turns into the front-fender support.

Holes A and B in the frame must be drilled at an angle, hole A for the steering post and B for the brake cable. Drill hole A slightly undersize and at the approximate angle and then work it to size and the correct angle later on with a round file when you fit the steering post. Also you'll have to do some work with the round file to bring hole B to the correct angle to take the brake cable without binding. Holes C, E, G and H are for the passage of wiring through the frame and only the approximate location is indicated. The four holes F take 10-24 F.H. screws (with nuts) and hold two 3-in. corner irons which serve as motor-mounting brackets. It's a good idea to have your motor on hand so that you can determine the distance between the pairs of holes, as this distance may vary from that given. Be sure of the over-all dimensions of the battery case before you cut the well and make the support.

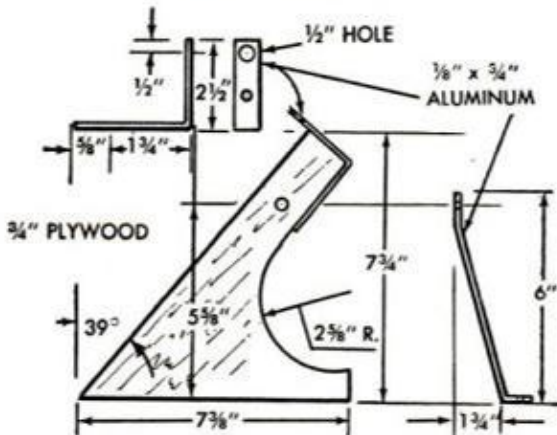
The front axle consists of a length of hardwood and two steel straps. Note in the pull-apart view that there are three pairs of bolts that pass through the axle, the two kingbolts, the pair of carriage bolts holding the frame to the axle, and a pair of machine bolts that hold the three parts of the axle together. The wheel spindles swing on the kingbolts, which pivot 1/4-in. pipe tees. Threads in the body of the latter are reamed out to take the kingbolts in a close fit. A hex nut, lock washer and a steering arm are placed on each spindle before turning the latter into the threaded stem of each tee. You'll see the order of assembly in the pull-apart view. A shaft collar with setscrews holds each wheel.

Assemble the rear axle in its bearings on the frame. Then make the brake-shaft supports and screw them in place on the

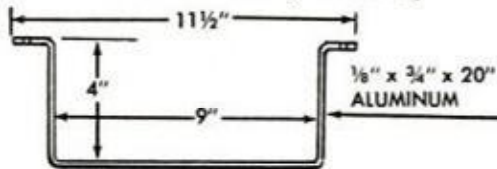
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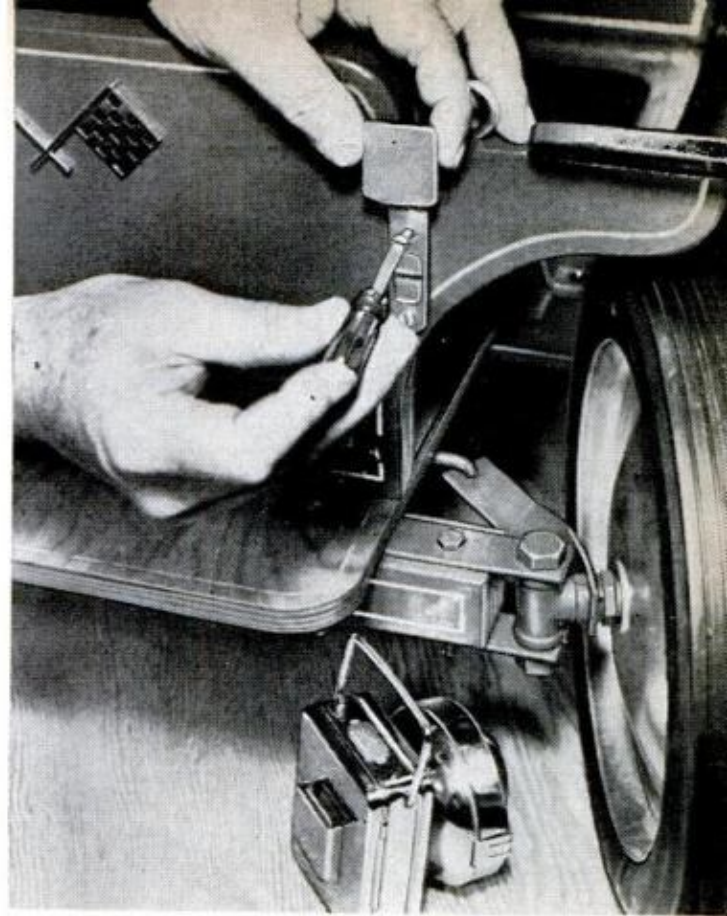
**FRONT FENDER SUPPORT**



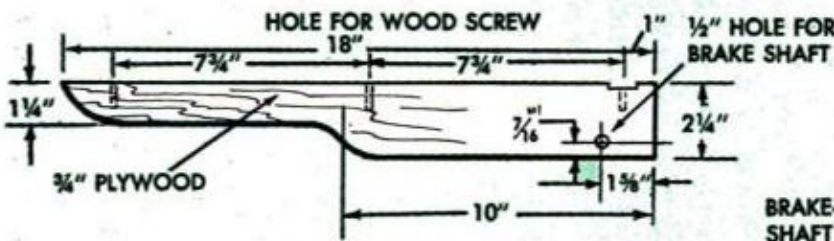
**STEERING-COLUMN SUPPORT (WITH BRACE)**



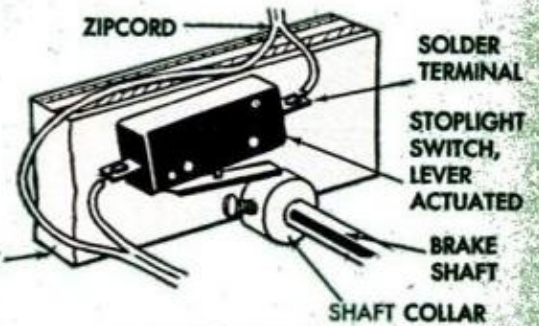
**BATTERY SUPPORT**



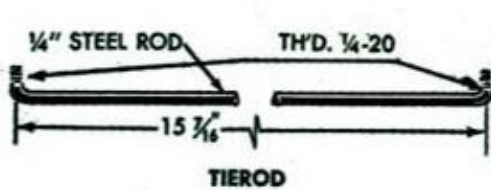
**BATTERY-POWERED HEADLIGHTS** snap onto metal brackets attached to the dashboard. The brackets come with the lamps. Note also the construction of the front axle and the steering-knuckle assembly



**BRAKE-SHAFT SUPPORT, 2 REQD.**



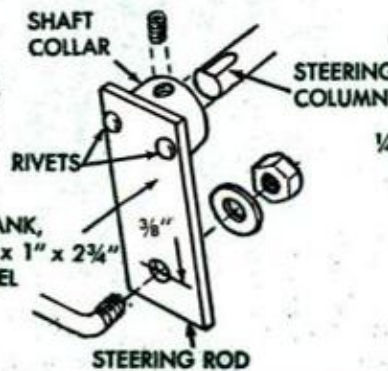
**STOPLIGHT-SWITCH MOUNTING**



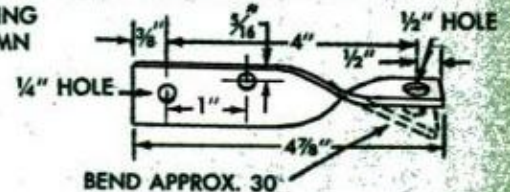
**TIEROD**



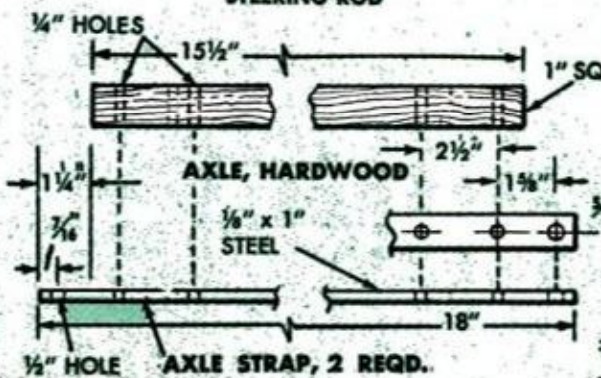
**STEERING ROD**



**STEERING ROD**

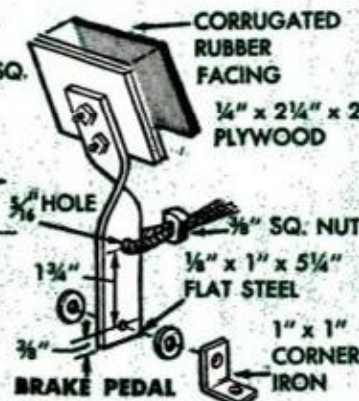


**STEERING ARM, 2 REQD.  
R. AND L., 1/4" STEEL**

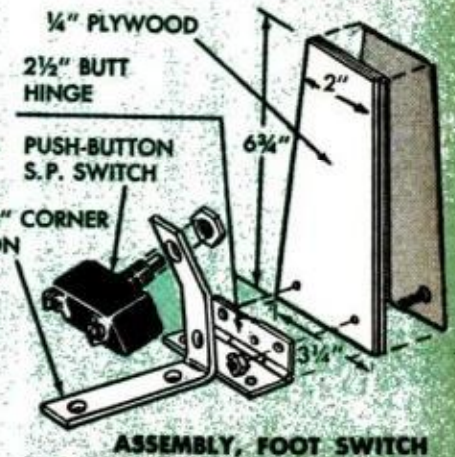


**AXLE, HARDWOOD**

**AXLE STRAP, 2 REQD.**

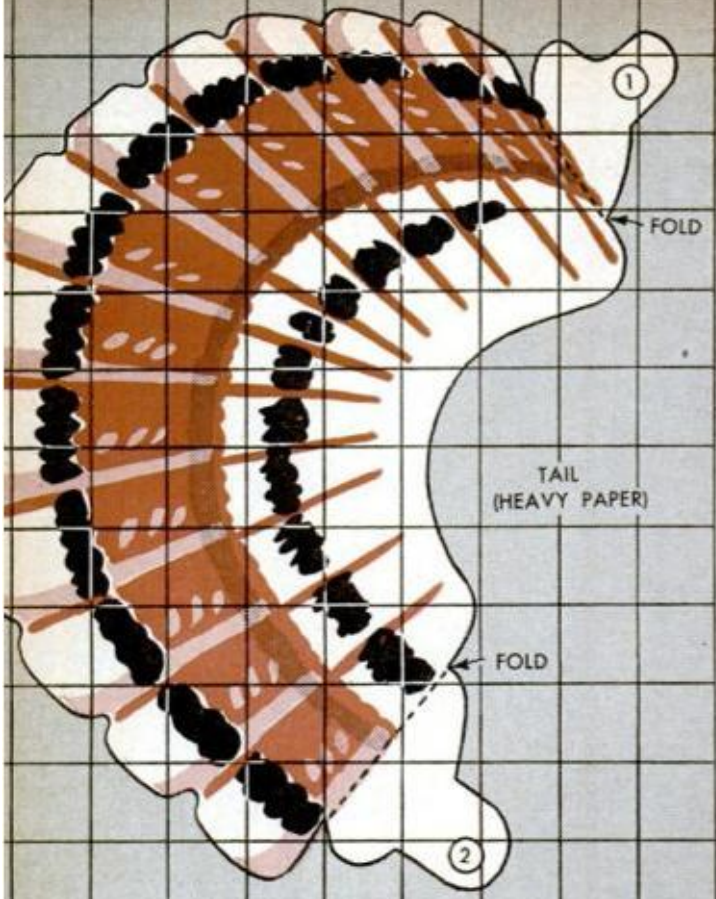


**BRAKE PEDAL**



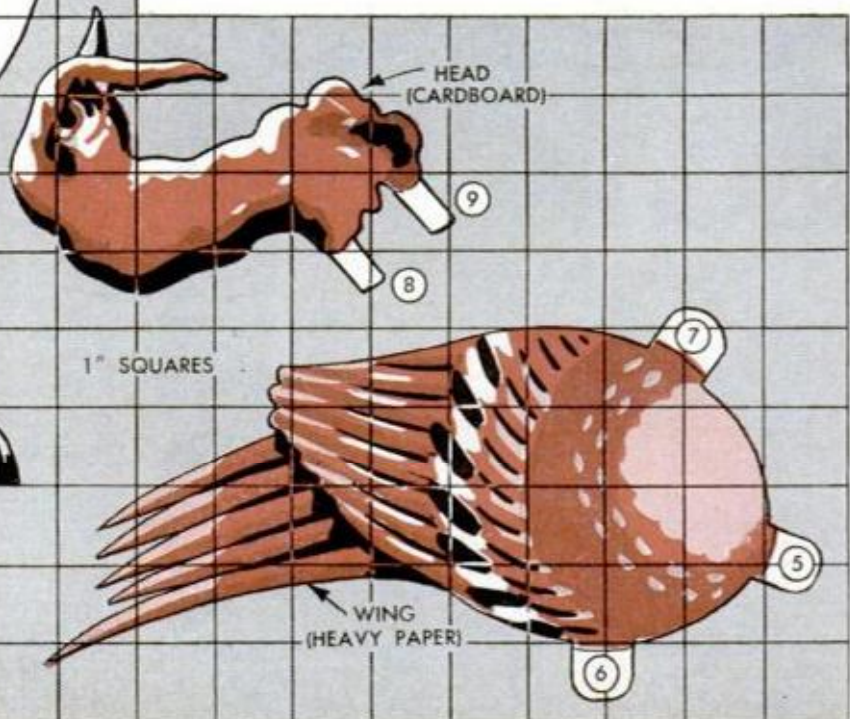
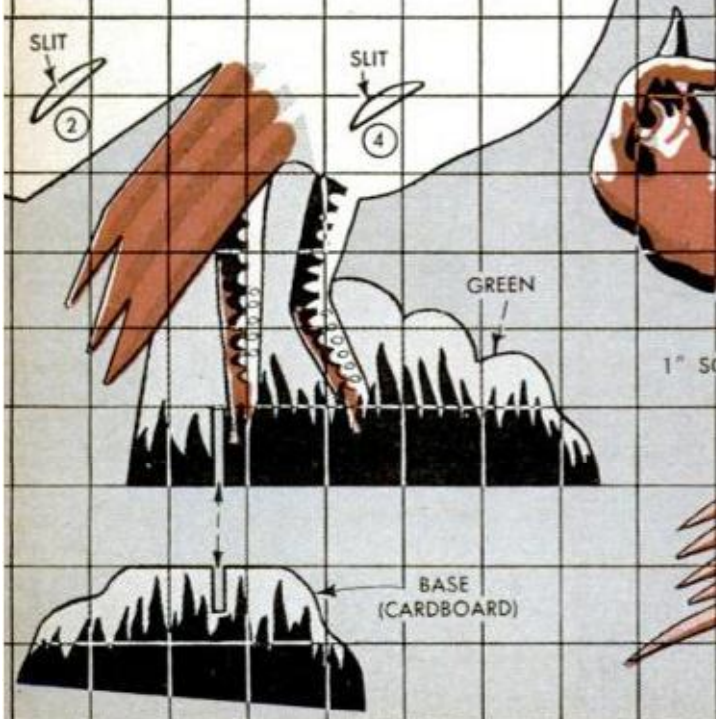
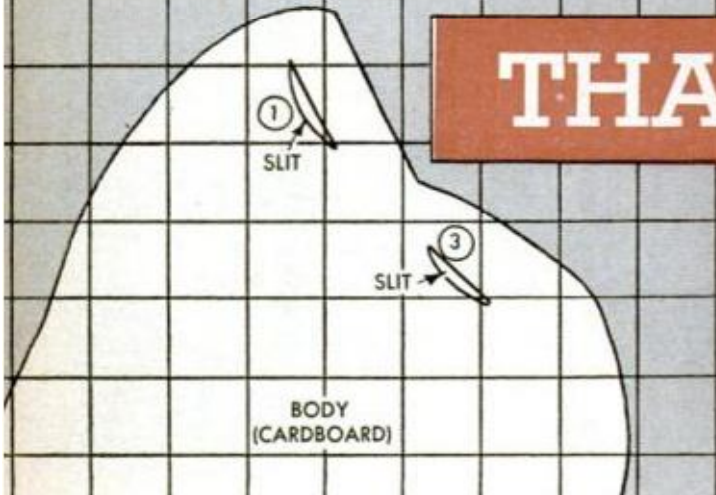
**ASSEMBLY, FOOT SWITCH**

By Jack Eisner



# THANKSGIVING

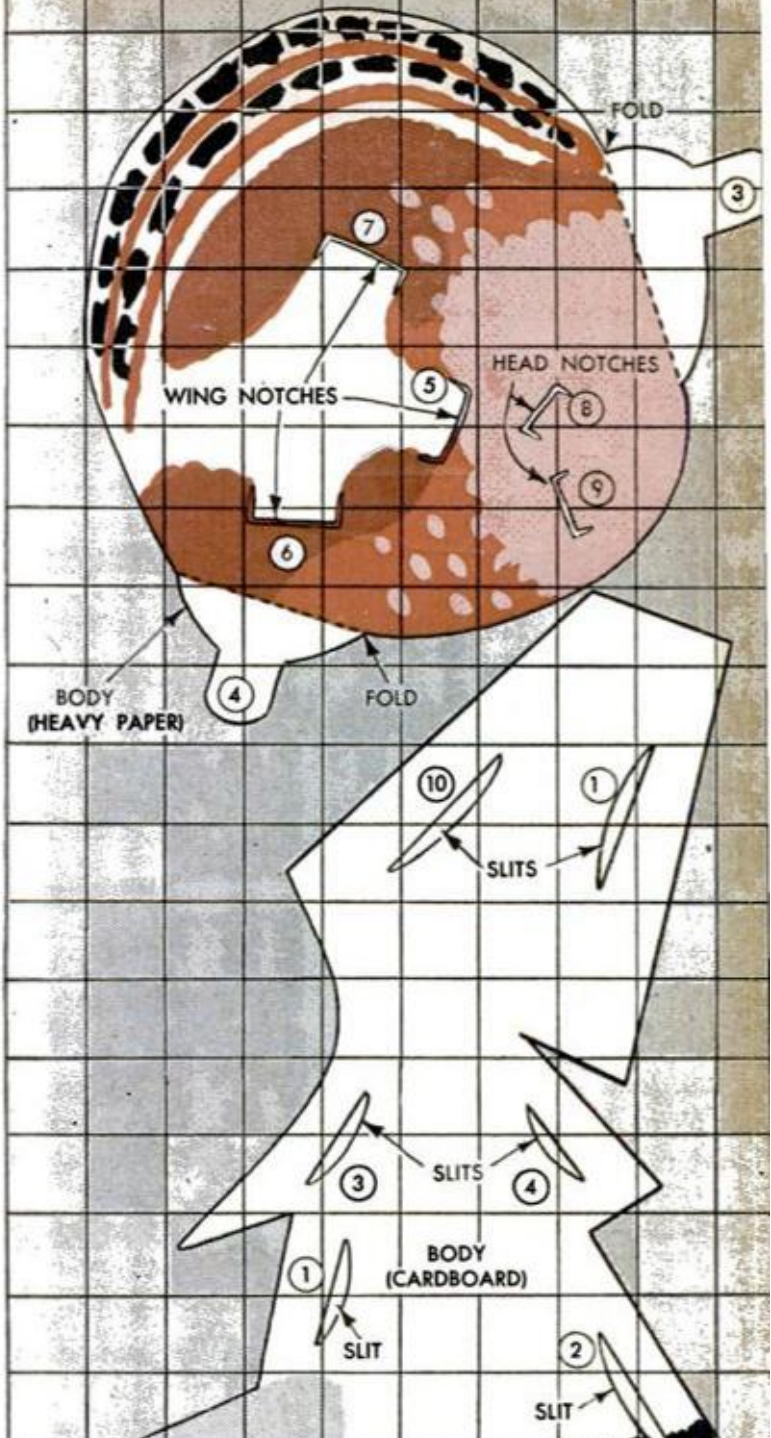
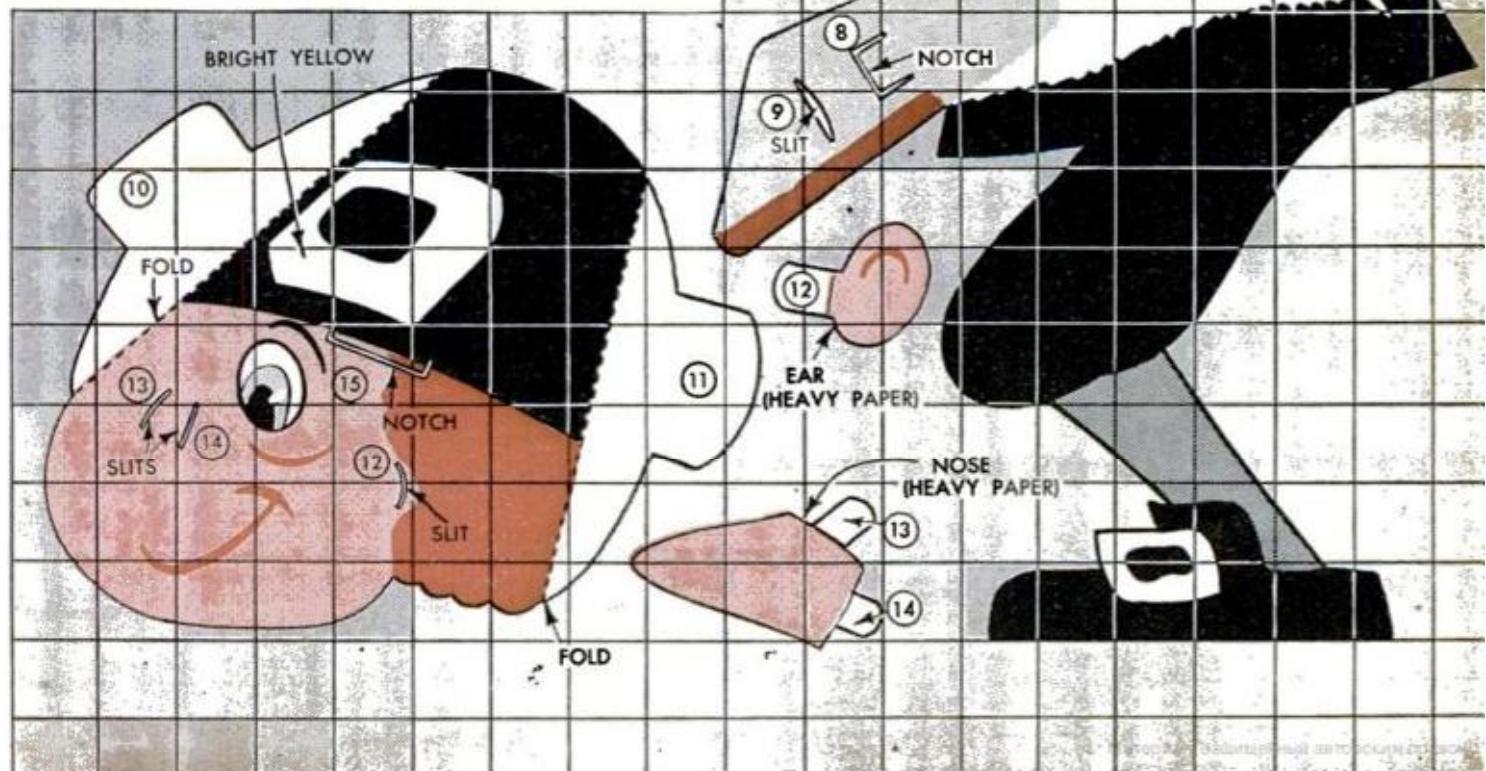
PLACED on your serving table or buffet, these free-standing cutouts will add an appropriate touch to the Thanksgiving-day feast. You can make them most any size you want; for example, by enlarging the magazine patterns on 1-in. squares, you'll have a pilgrim that stands about 24 in. tall. For small table favors you can trace the

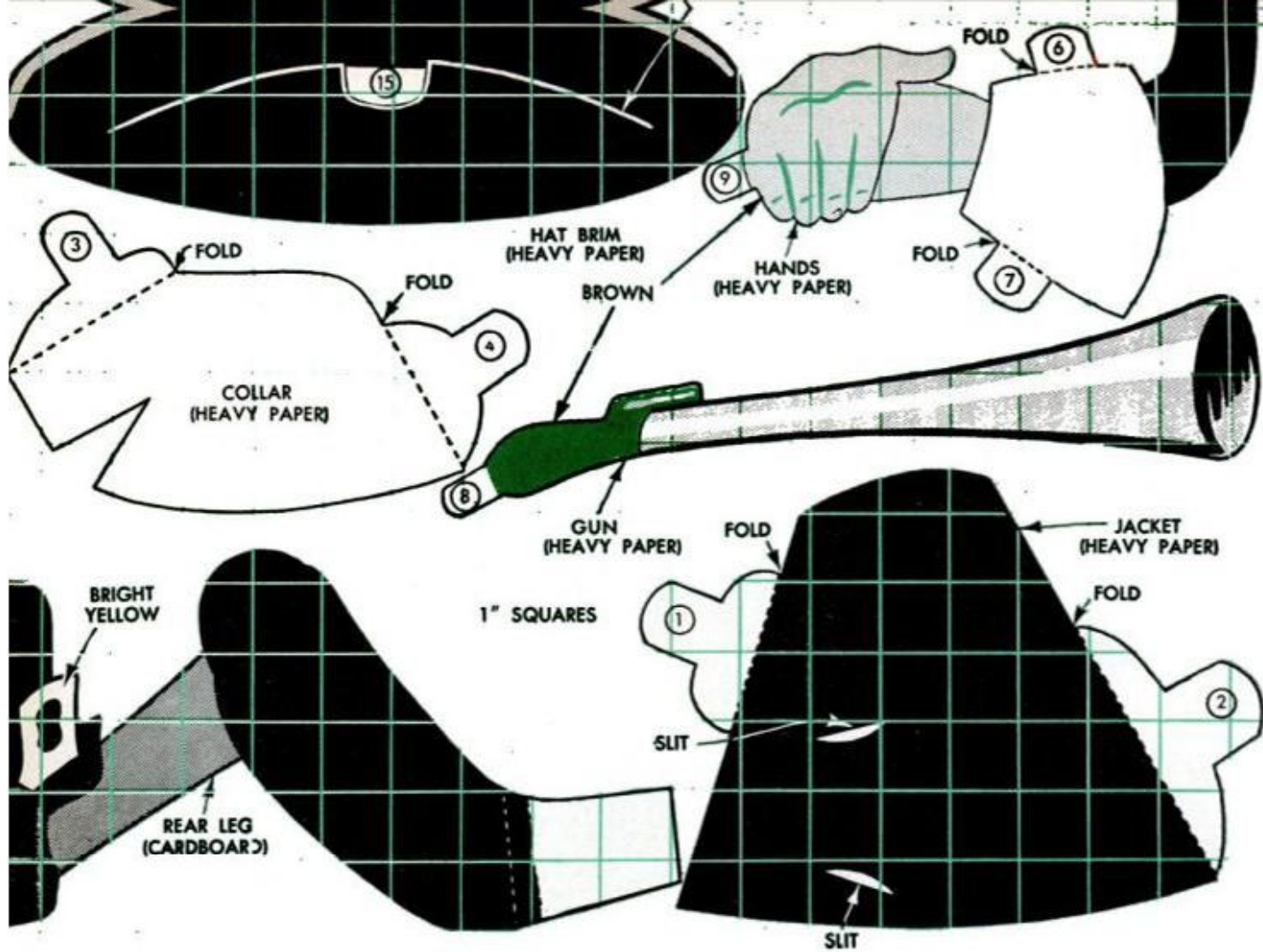




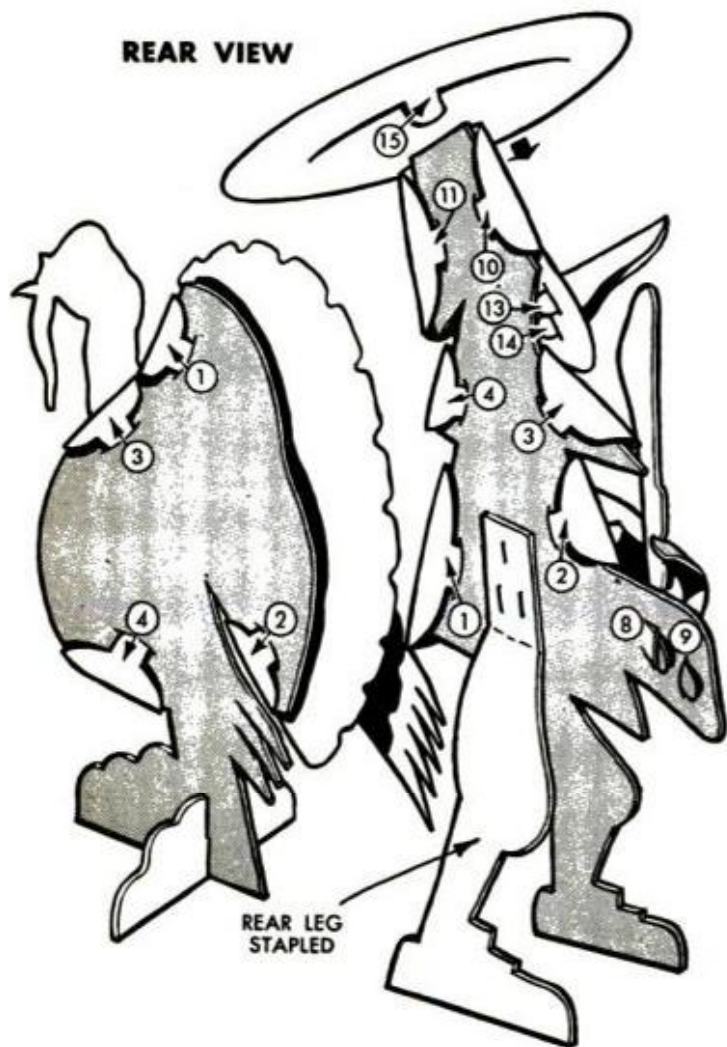
# CUTOUTS

patterns directly from the magazine. The part that requires the most work is coloring in the features and other details after you have the pieces cut out. You can do this with crayons or colored pencils, but you'll find poster paints, watercolors or (for more permanence) tempera paints look far more professional and colorful.





### REAR VIEW



As shown in the drawings, the figures are made of cardboard and heavy paper. The numbers which you see on the tabs and slots indicate the order of assembly, which is accomplished as follows:

### Pilgrim

1. Staple leg to back of body.
2. Attach jacket by folding tabs 1 and 2 around back of body and inserting into slots 1 and 2. Then attach collar in same manner (tabs 3 and 4).
3. To attach arm, insert tabs 6 and 7 into slots on front of jacket, then place tab 9 into slot 9 on gun stock.
4. Insert tab 8 on gun barrel into slot 8 on gun stock.
5. Add hat and face by folding tabs 10 and 11 around headpiece and inserting into slots 10 and 11.
6. Add ears and nose by inserting tabs 12, 13 and 14 into corresponding slots on face.
7. Place hat brim (tab 15) on head.

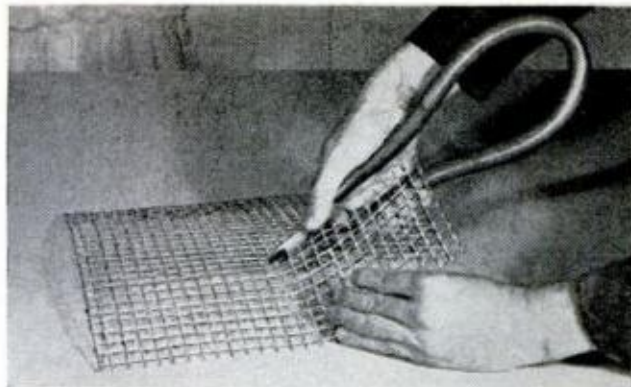
### Turkey

1. Fasten tail (tabs 1 and 2) and body (tabs 3 and 4) in place, using tabs in same manner as above.
2. Add wing and head by inserting tabs 5, 6, 7, 8 and 9 through corresponding slots.
3. Finally place in slotted base. ★★★



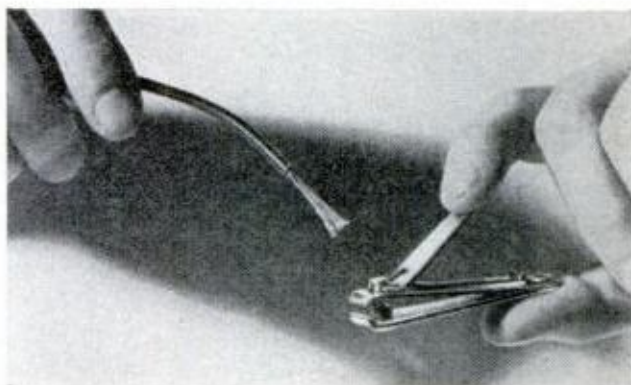
## Self-Opening Pliers

A two-foot length of rubber garden hose can save you a lot of time and effort in such repetitive jobs as cutting hardware cloth. Bend the hose double and insert the handles of your cutting pliers into the ends. The resulting spring action will open the pliers automatically after each cut. The rubber will also cushion the plier handles and keep them from digging into your hands.—*Jack Kenison*



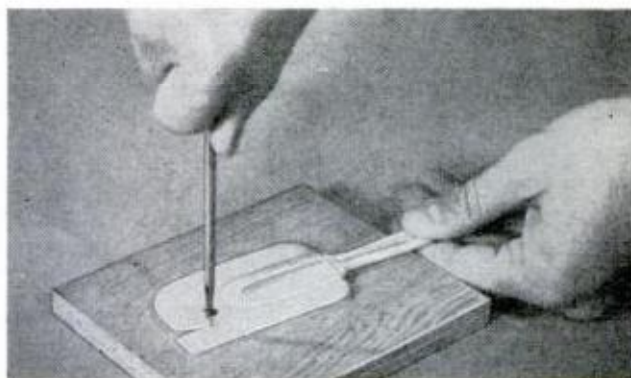
## Improvised Wire Stripper

Next time you have to do a quick electrical repair job and can't find a wire stripper, try an ordinary nail clipper instead. On lamp cord and other light-gauge wires, it is as effective as cutting pliers, and is much safer to use than a pocket knife. An additional benefit is that the clipper's small amount of leverage makes it less likely to cut into the fine strands of wire.



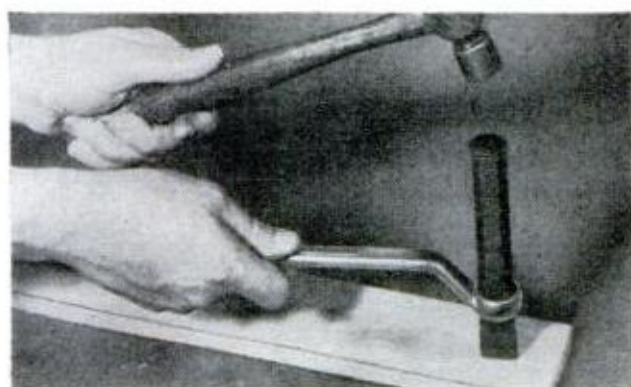
## Spatula Tames Screwdriver

If you've ever lost control of a screwdriver, and had it gouge the surface of a piece of furniture you were making, try this idea: Cut a V-shaped slot in the end of a plastic food spatula so it can be slipped around the screw as shown in the photo. If the screwdriver slips, the spatula will protect the work surface, preventing it from being marred.



## Box Wrench Holds Chisel

A common shop accident is striking your hand when using a hammer and cold chisel. However, this can be avoided quite easily if you keep a box wrench handy. Just slide the wrench over the hexagonal shank of the chisel, letting the latter stand free in the wrench. The wrench will then serve as a handle, permitting you to keep your hand out of the way of misdirected hammer blows.

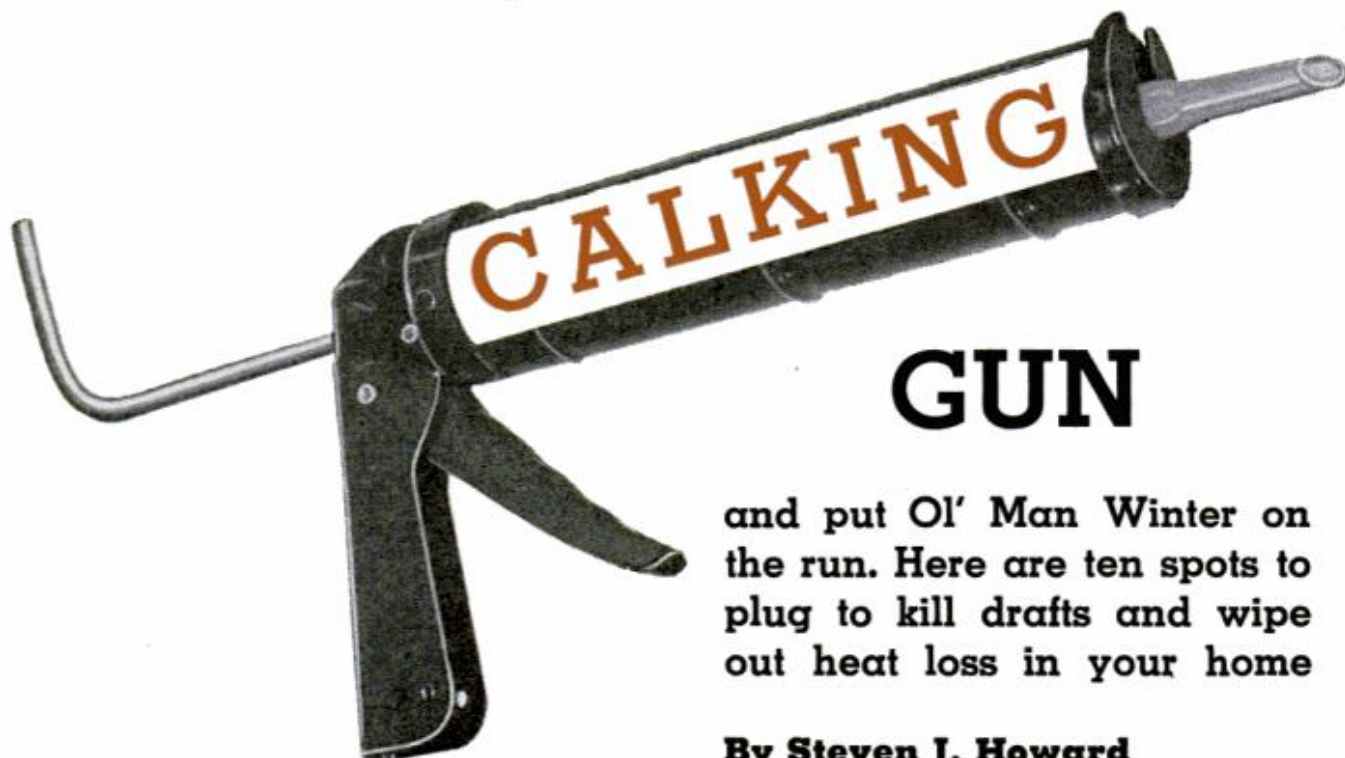


## Faster Handling of Small Parts

When using small nails, bolts, nuts or screws, pour them out onto a piece of sponge rubber or plastic foam instead of the top of your workbench. The soft material will make the screws, etc. easier to pick up, and any that are not used can easily be poured back into their original container. Also, you won't have to worry about brushing sawdust and other stray material from the bench top into the container.—*Ken Patterson*



# JOHNNY, GET YOUR



## GUN

and put Ol' Man Winter on the run. Here are ten spots to plug to kill drafts and wipe out heat loss in your home

By Steven J. Howard

**C**ALKING and draft-proofing your home are not just jobs dreamed up to occupy one of your week ends. They are operations that will make your home more comfortable this winter, while at the same time reducing your fuel bills to a minimum.

Studies made by manufacturers of furnace equipment prove that no home, old or new, can be completely draft-free. But they also show that if last winter's fuel bill was \$400, you may reduce that outlay to as little as \$300 this winter if you take action now. Action may include weather-stripping, if your home doesn't have it, or if it needs renewing. But our concern, here, is with paste sealers only.

Most homeowners view calking as a tedious, messy job. It can be, if you are not aware of all the facts surrounding it. And many homeowners aren't.

In a well-constructed new home, door and window frames are tightly fitted to walls, and joints between frames and walls are closed as tightly as possible with flashing. But this doesn't mean there's no need for calking in a new house. Small cracks still exist—cracks through which air can seep if they're not sealed.

As a home gets older, however, wood shrinks and joints widen. Now, calking becomes as necessary to home maintenance as fixing a leak in the roof. If you are wondering just how much air can pass through a crack, mull over this fact: in areas that need calking, smudges often show up on interior walls adjacent to the crack. These smudges are caused by dust

carried to the wall by air leaking through the crack, leaving a deposit.

In short, there are so many cracks located throughout an uncalked home that they provide excellent "ventilation" of cold air to the inside during the winter, and an excellent passageway through which cooled conditioned air can pass to the outside during the summer. In addition, uncalked areas permit moisture to penetrate the home—moisture that can cause rotting, rusting and spalling inside.

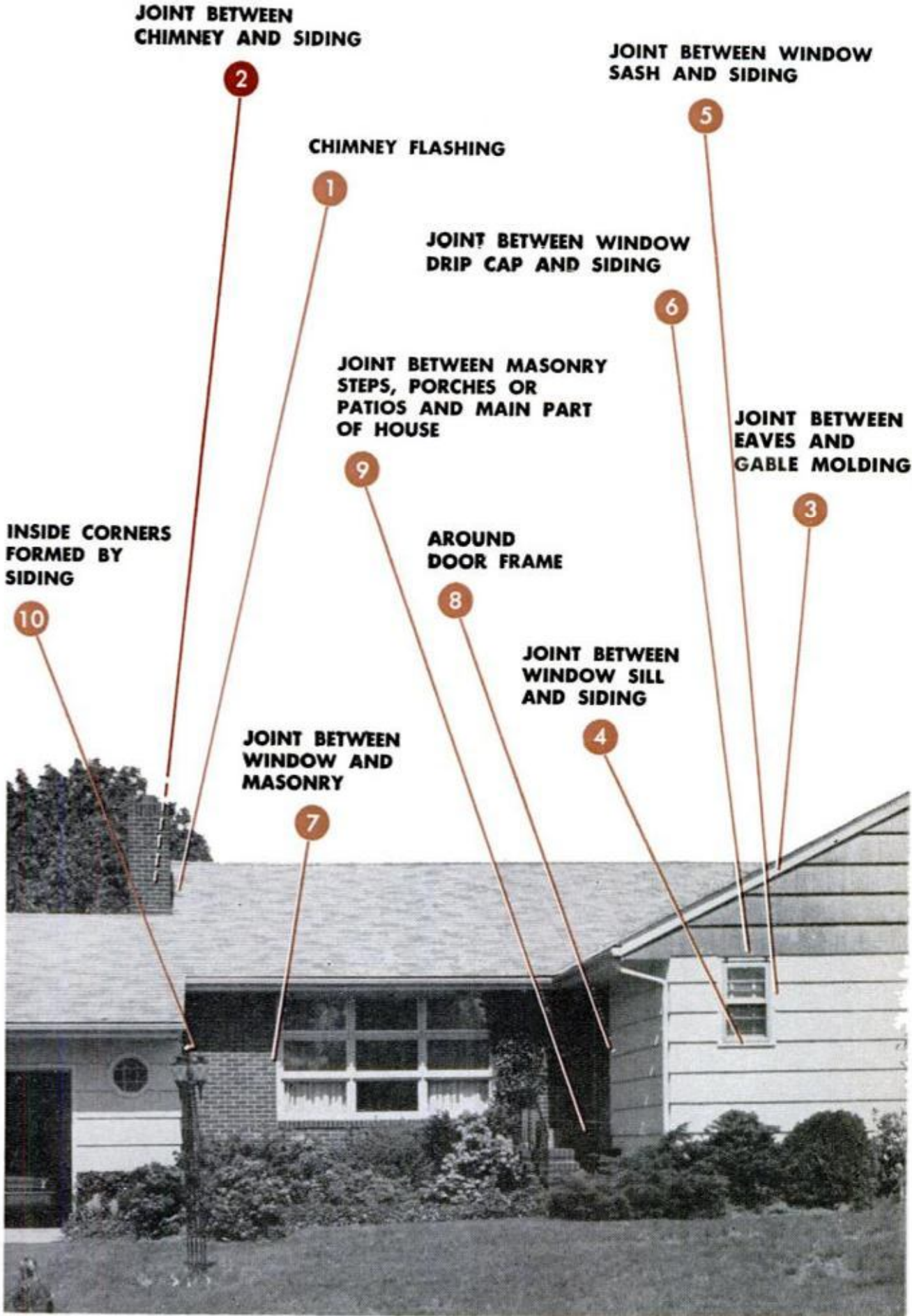
● The job called "calking" is an operation performed only on a home's exterior. Calking compound should never be used inside a home, since it may not harden properly. There are other materials available to fill interior cracks—spackling, putty, patching paste, or one of the new plastic sealers. These will be discussed later in this article.

Regular calking compound is available in only two general types, gun-grade and knife-grade. (However, there are also other "special" types available.)

● The most widely used is gun-grade calking, which is applied with a calking gun. Available in pre-packed nozzle-equipped cartridges or in "loose" form (quart, gallon and five-gallon cans), gun-grade calking is used to seal most cracks around the home. As a rule of thumb, you would use gun-grade calking for those cracks that are no wider than the width of a pencil.

"Bulk" calking is seldom employed today, except by some professional con-

# 10 KEY AREAS IN EVERY HOME THAT REQUIRE CALKING



tractors. Although it is less expensive than the pre-packed cartridge, the sticky compound has to be loaded into a gun by hand, a messy job at best.

With the easy-to-use cartridge, however, you simply insert the container into a gun. A plunger in the gun is forced against the closed end of the tube, starting the flow. When pressure is released, the flow stops. This type of calking is available in white and gray, and can be painted.

● Knife-grade calking is used for sealing wider cracks—as a rule of thumb, cracks wider than the width of a pencil. It is a stiff substance which must be applied with a putty or calking knife, or a wooden paddle, since it is too heavy to flow through a gun. Although stiff when you apply it, knife-grade calking is flexible after it sets and does not disintegrate under the normal contraction, expansion and vibration a home experiences.

The only actual difference between knife-grade and gun-grade calking is an asbestos fiber added to the gun-grade type to make it more flexible and to keep it bound together so it flows in a ribbon from the gun. Both types are made of a combination of natural and synthetic oils to keep them elastic and resilient.

● Gun-grade and knife-grade compounds adhere to most surfaces found in the home—wood, brick, stucco, stone and metal. However, for calking around aluminum surfaces, you should consider using

what is known as aluminum calking compound, not necessarily because it adheres better than regular calking, but because it won't have to be painted.

Aluminum calking contains an aluminum pigment which lets the compound blend with the surface you are sealing, whether it be an aluminum door, window or siding. It is available in both cartridges and containers.

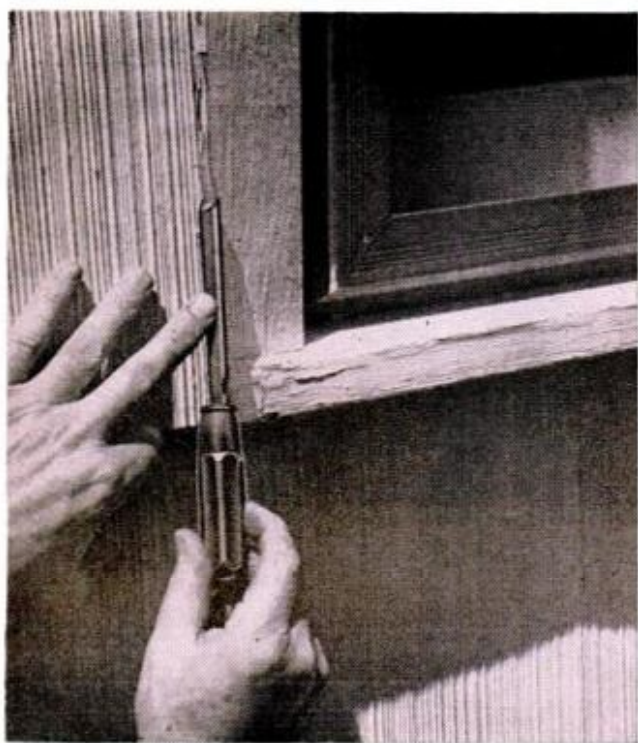
● Another special type of calking is black calking. Designed for sealing cracks around and in roofs, it is basically an asphalt cement. You would use it for sealing around flashings and vent pipes, for holding down roof shingles and for patching minor roof damage, such as small holes. It, too, comes in cartridges or containers.

● Still on the market is cord-type calking, which comes in rolls and is as thick as clothesline. You can use it for filling very wide cracks which knife-grade calking cannot seal. Cord-type calking is pressed into a crack with the fingers.

If you come across a crack which seems to call for cord-type calk, a filler of oakum or steel wool, topped off with knife-grade calk, is sometimes used. While this may result in a superior treatment, it is, of course, more work. Fill the crack to within  $\frac{1}{4}$  in. of the surface with filler and then apply calking.

Working with calk involves three requirements: (1) a careful inspection, (2) proper preparation of the surface, and (3)

**IN PREPARING CRACK** for calking make sure it is clean. Rake out the old dried-out calking and other foreign matter with a screwdriver or wood chisel



**FOLLOW** with a good wire brushing. For added assurance of good adhesion, rub the area with a cloth moistened with turpentine to remove any oil film



knowing how to use the compound.

● Inspection is fairly simple. Make sure no new cracks have formed and that old calking has not dried up. If calking has not been done in several years, you would be safe in recalking, just to be sure.

● In preparing for calking, select a day during a dry spell in your area. The surface must be absolutely free of moisture, since most calking compounds will not adhere to a damp area. (The only exception to this is black calking, and it's a good point to keep in mind, since you can use this compound even when it is raining to seal a damaged and leaking roof area.)

If there is old, dried calking compound in the crack, dig it out with a wood chisel or an old screwdriver. Brush out all particles of dirt and debris with a wire brush, and as added assurance for good adhesion, rub the area with a cloth moistened in turpentine or paint thinner. This will dissolve any grease or foreign matter not picked up by the brush.

A rule you should always follow is never to apply calking to a porous surface, such as bare wood. Although the compound will stick, the wood soon draws all the oil from it and will leave it dry and crumbling. These porous areas should be primed with a primer, thinned linseed oil or a thinned quick-drying varnish. After the primer has dried, it's safe to calk.

● When it comes to actual application of calking with a gun, one school advocates

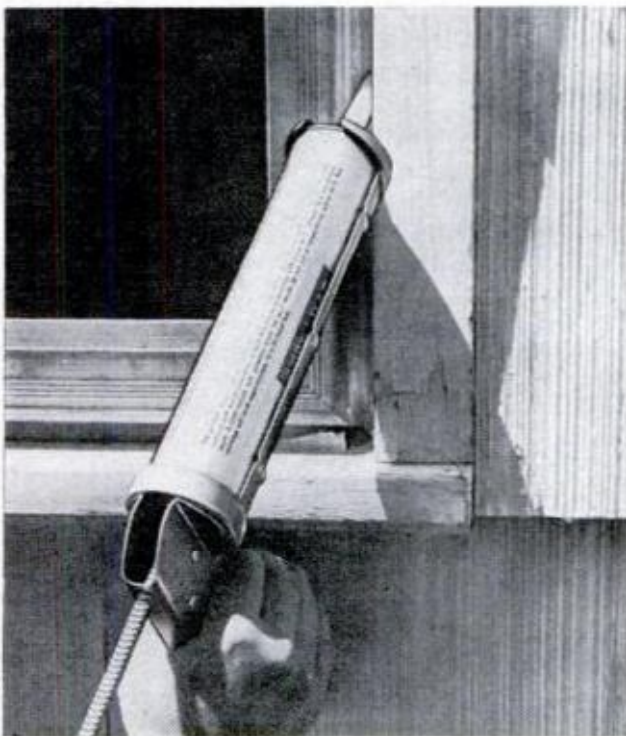


**REPLACE WINDOW PUTTY** which has fallen away with glazing compound to seal out drafts and moisture

**PREFILLED CARTRIDGES** make the loading of a calking gun an easy matter and are discarded when empty



**ALUMINUM CALKING** is best for sealing cracks around aluminum windows. Contains aluminum pigment which blends with the metal and eliminates painting

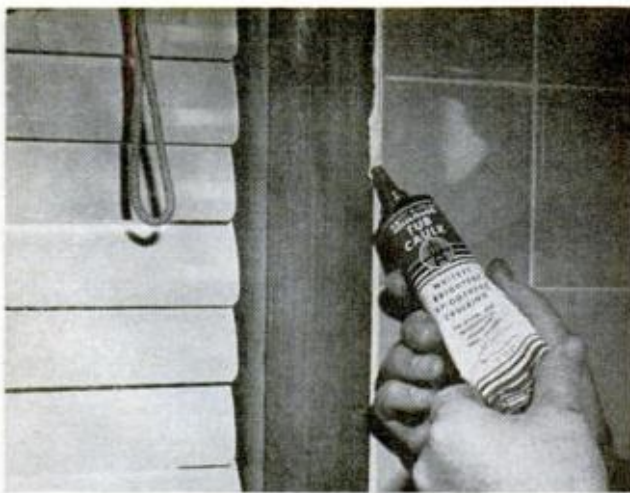


NOVEMBER 1963

**WINDOW APRON** which has pulled away from sill provides natural entrance for drafts. Draw it up tight again by re-nailing to studs with finishing nails



159



**PLASTIC SEALER** which comes in a tube, is a suitable calking for sealing cracks where tile butts a window

pulling the gun, while another states that the gun should be pushed. Handle the gun in whichever way is comfortable for you. It really doesn't matter.

Often, you may run across a hairline crack which seems insignificant. Should you calk it? Absolutely! Water can seep into the house through this crack by capillary action. If the crack is too small for effective calking, compound laid over it will soon pull away. In such cases it must be widened with a chisel to form a deep "V," so that compound has a surface upon which to get a good grip.

Calking compound is relatively inexpensive, so use plenty of it to fill a crack. Too much compound in a crack provides a safety margin. If the compound shrinks, hardens, or crumbles a bit, or if the joint moves, there will be enough compound left in the crack to compensate for the loss until you recalk the area.

### Inspect It Later

A day or two after you have sealed an area, inspect it to insure that the compound has skinned properly. Skinning refers to the way in which calking has sealed, capturing its oils beneath a hardened outer layer. Run your finger along the calked area. It should *not* feel sticky, and your finger should come away clean. If the compound has not skinned properly, remove it and recalk the area with a better grade of material. After the area has skinned, you can paint it, if you wish.

● Cold air can leak in around a room air conditioner unit and its mounting, or through the air-conditioner ductwork. If it is a window unit, the fact that you cannot often hang a storm window contributes to the draft. Apply calking compound all around the outside of the air conditioner and its mounting, pushing the compound well into the crack.

To prevent drafts through the air con-

ditioner itself, purchase a cover to place over the ductwork.

If the air conditioner is a window unit, buy a sheet of clear plastic material that fits all around the outside of the window. Cut out an area in the plastic large enough for the protruding part of the unit to fit through, and tack or staple the plastic to the outside sash.

● After you have calked, you shouldn't sit back and relax. There are still many areas of the home through which cold air can pass—areas that cannot necessarily be calked. Let's look at some of these and see what to do about them, taking it for granted that your home is well weather-stripped and insulated. The areas outlined here are those that do not call for weather-stripping and insulation.

● Check putty around windows for breaks, cracks or dried areas. Cold air seeping through here not only adds to the draftiness of the home, but also causes window sweating as the cold air from the outside hits the warm air on the inside. This moisture could speed up decay of wood sashes.

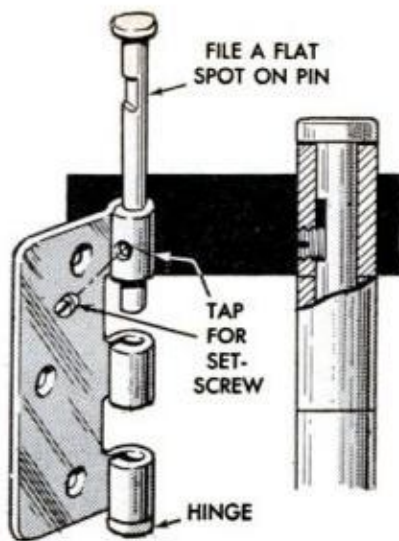
Although still widely used to seal a window in sash, putty is fast being replaced by glazing compound, which offers the advantage of retaining its elasticity indefinitely. Thus, glazing compound is better able to resist sash expansion, contraction and vibration. Before applying putty or glazing compound, make sure the area is well cleaned.

● As a window sill ages it often pulls away, causing a gap that is a fine entrance for drafts. Using 8d finishing nails, secure the apron tightly below the sill. Then fill holes and cracks with a wood filler.

● The tiled area around a bathroom window is often forgotten, perhaps because most homeowners do not know what material to use to stop air entering here. A relatively new development is plastic sealer, which will do an effective job. It was developed originally to seal cracks between a bathtub and a wall, but can be used for any tile repair work.

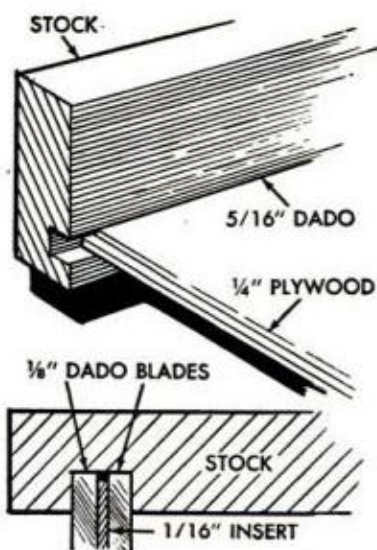
Plastic sealer is sold in tubes and comes in two types: solvent base and water base. Solvent base is recommended where the patch is subjected to a great deal of moisture, such as around bathtubs, sinks and showers. Water base works fine for general jobs. To seal the area around tiled windows, use this water base sealer.

Before applying plastic sealer, clean the area of old grout with a thin-bladed screwdriver and a wire brush. Then hold the nozzle of the tube over the crack and squeeze. After the sealer covers the crack, it can be packed into place with a wooden spatula such as an ice-cream stick. ★ ★ ★



## Foiling Thugs

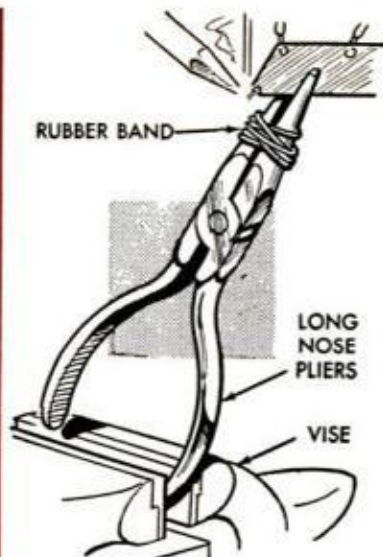
Doors that open outward make life easy for burglars because the butt hinge pins are readily removable from the outside. To lock the pins, open the door wide and drill the hinges as shown. Tap the holes for set-screws so they bear on flat spots on the pins.



## Easy Fit

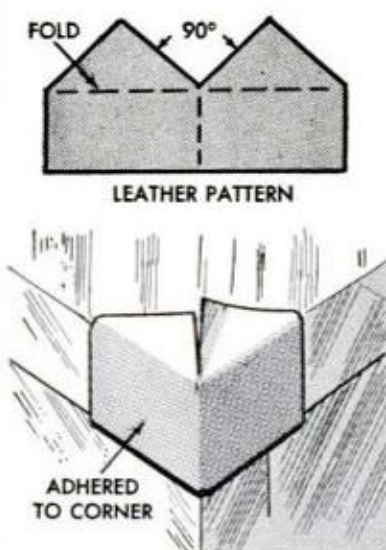
Save time and labor when you are making cabinet drawers by placing a  $\frac{1}{16}$ -in. insert between two  $\frac{1}{8}$ -in. dado blades. The  $\frac{3}{16}$ -in. groove that is cut will make it easy to insert the  $\frac{1}{4}$ -in. plywood drawer bottom and will allow for expansion of the wood.

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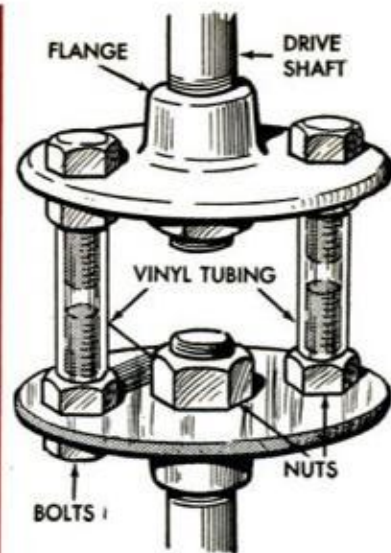
## Soldering Vise

Next time you have a delicate soldering job, try holding the work in the jaws of a pair of long-nose pliers. A rubber band wrapped around the jaws will provide adequate tension. Clamp the plier handle in your bench vise so that the work is convenient.



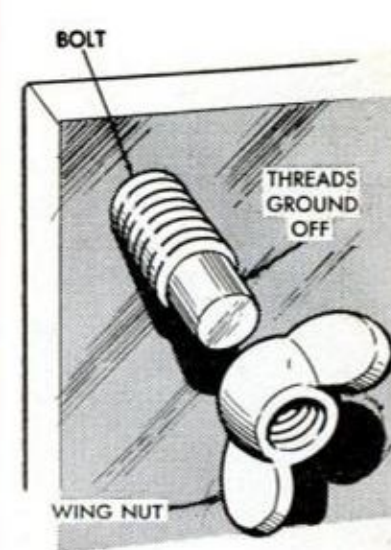
## Corner Guards

These leather guards will keep you from snagging your clothes—or skin—on a corner of your metal toolbox. After making a cardboard pattern, cut the guards from leather scraps or a pair of old gloves. Then use contact cement to fasten guards to the box.



## Flexible Coupling

A flexible coupling for connecting two shafts that are not perfectly aligned may be made from vinyl tubing. Attach a flange and two bolts to the end of each shaft. Then slip vinyl tubing over the bolt ends to couple the drive shaft and the driven shaft.

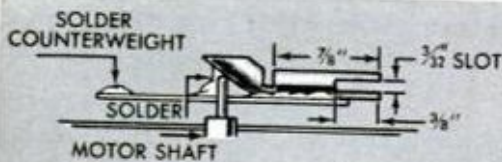
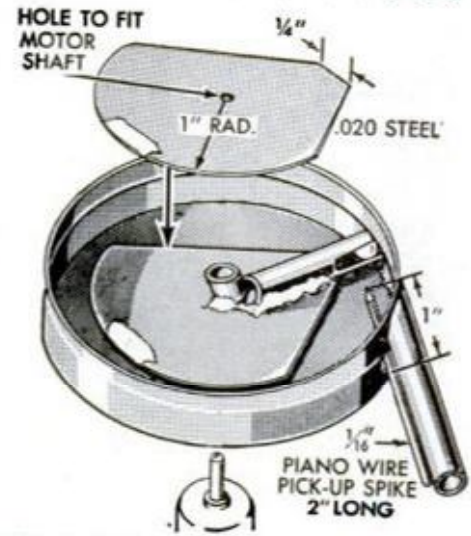
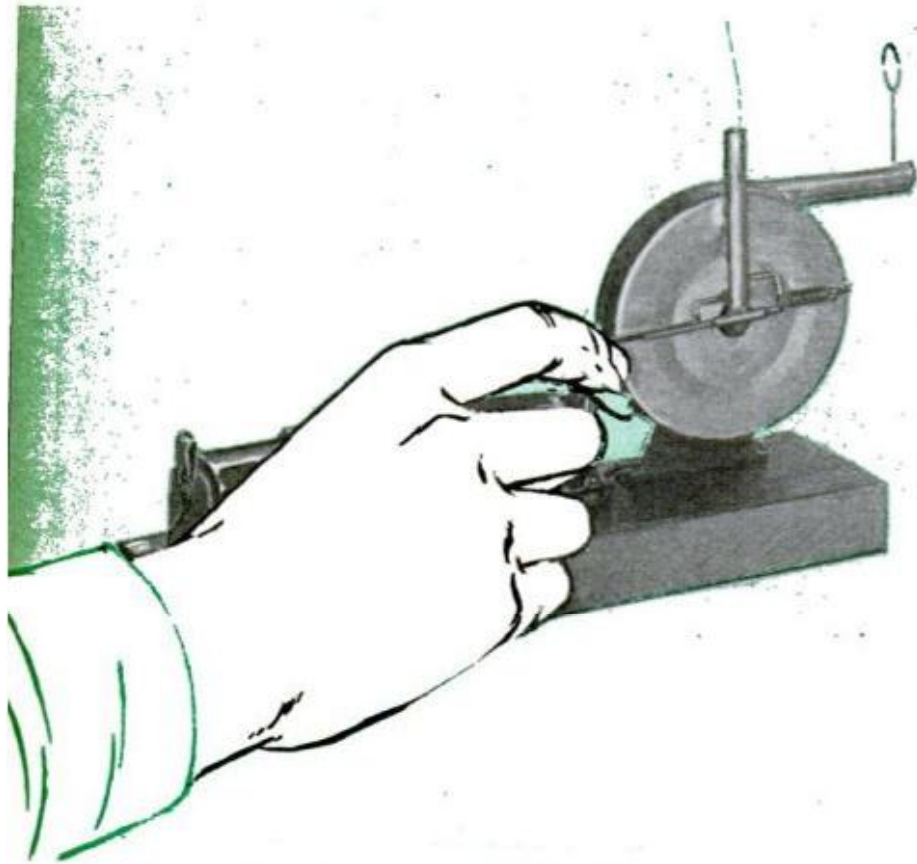


## Timesaver

On workshop equipment which is frequently assembled and disassembled, speed the process by grinding away several threads on the ends of the bolts. The nuts will then slip freely on the bolt end. When the threads are engaged, a fast spin tightens nut.

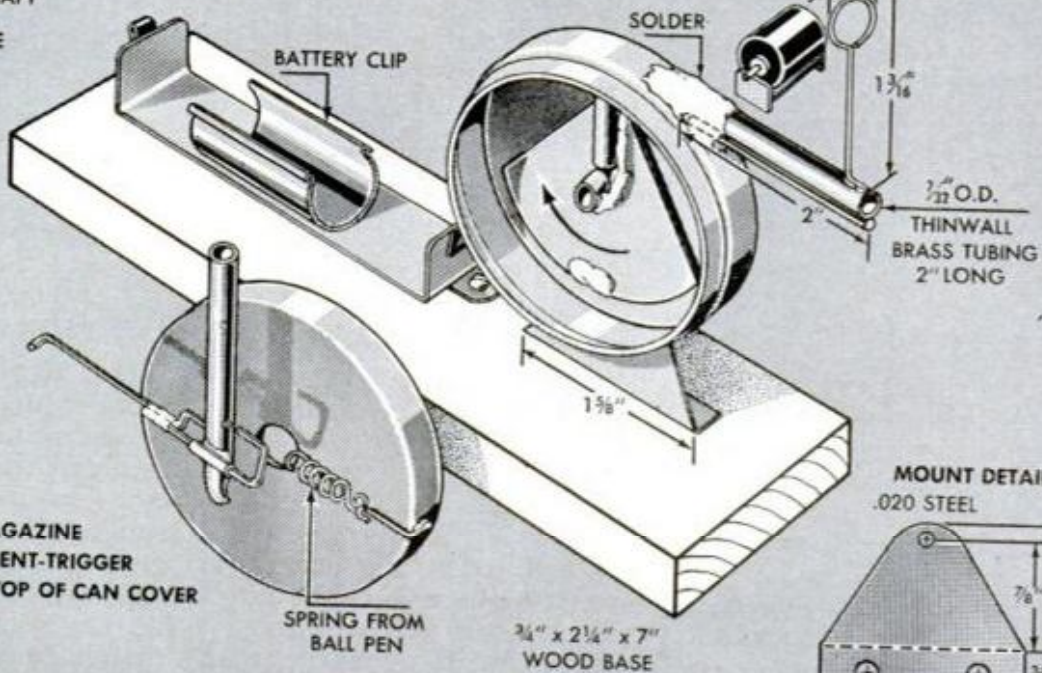
# ELECTRIC CANNON

It spits BB shot with a hum and a click—no flash, no bang. Instead of explosives or compressed gas, there's a spinning motor

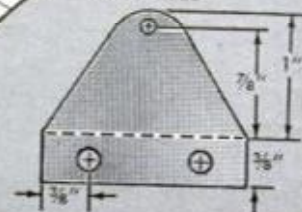


ROTOR TUBE  
DETAIL

PAPER-CLIP SIGHT



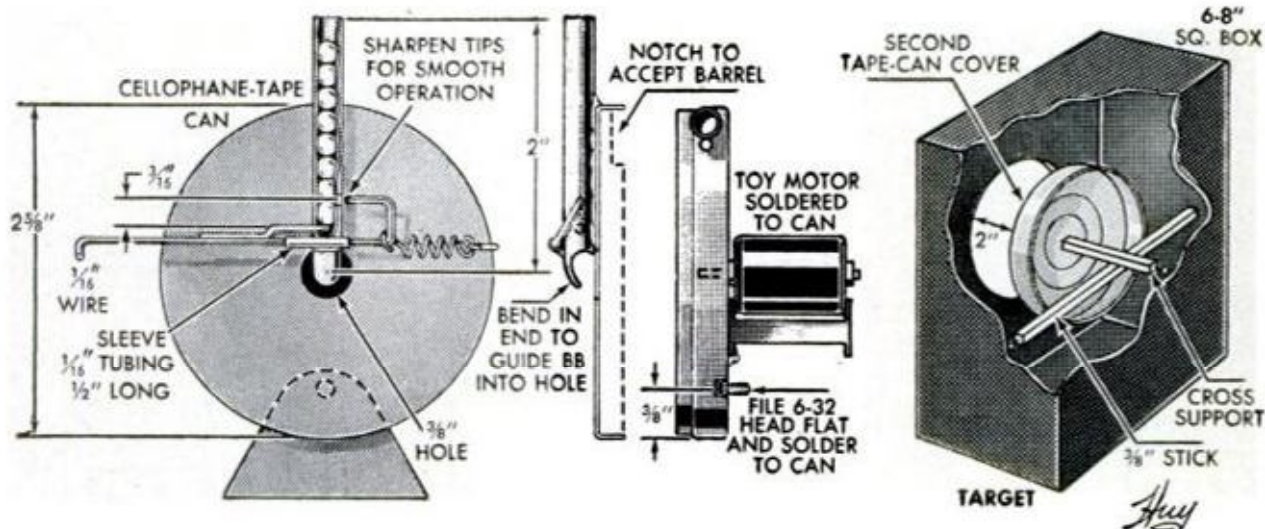
MOUNT DETAIL  
.020 STEEL





# FIRES BBs

By Roy L. Clough, Jr.



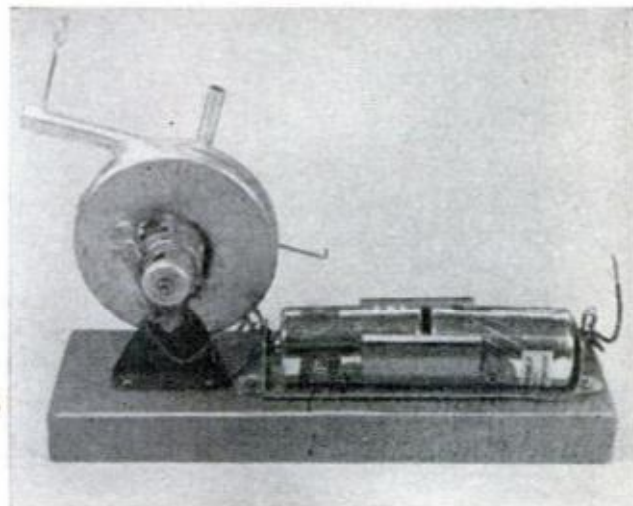
THOUGH this silent shooter throbs with electric power, it's based on just about the oldest ballistic principle on record—the one that helped David clobber Goliath with a sling: pick up a missile, spin it to gather force, then let go. *Wham!*

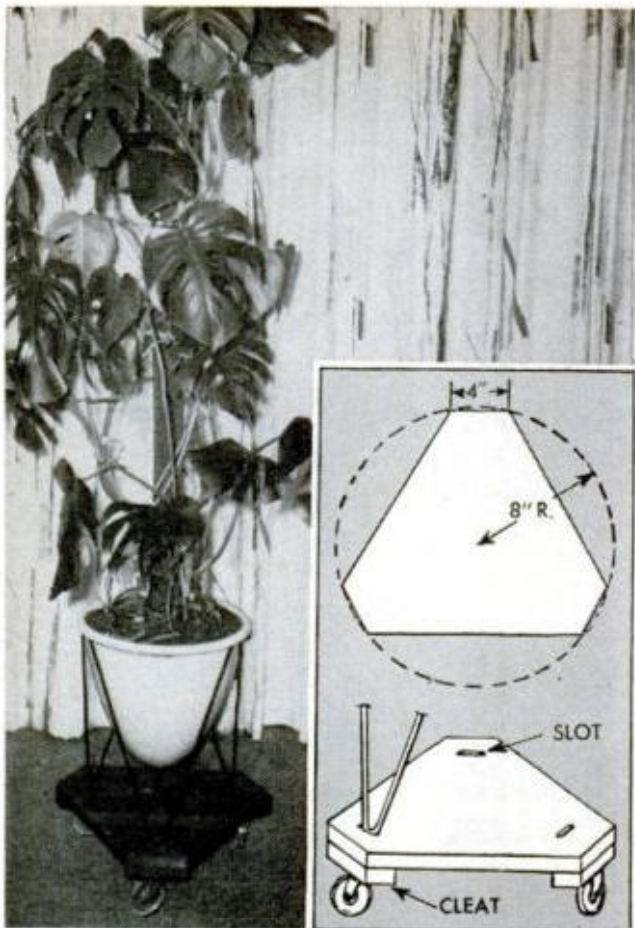
Not that this cannon is any giant-killer. We kept it small to be on the safe side. But it's a great demonstration of centrifugal power, and it'll shoot a BB 25 or 30 feet at a muzzle velocity of around 25 feet per second. This may set you thinking of the potential of a centrifugal gun whirled by a gas turbine at, say, 20,000 r.p.m. With an effective swing radius of about 6 in., you'd get a muzzle velocity of over 5000 f.p.s.—better than a high-powered rifle!

The spin mechanism is simple and cheap to build. The toy motor is mounted by soldering its lugs or bushing (or both) into a hole in the bottom of a cellophane-tape can. The rotor that's spun by the motor shaft consists of a base plate to which is soldered a short tube, bent and slotted to allow free passage of the BB shot. This unit must turn without binding; the pick-up spike must pass freely through the end slot. Bevel the opposite end of the tube

flush with the top of the can cover.

The end of the magazine tube is undercut and bent so the dropping BB enters cleanly into the whirling pick-up tube. A large paper clip provides wire for the trigger. Pulling back on it releases one shot while blocking the others. This lets the rotor recover its speed between shots. The recessed target keeps BBs from rolling all over the house and collects them for quick reloading of the magazine. ★★

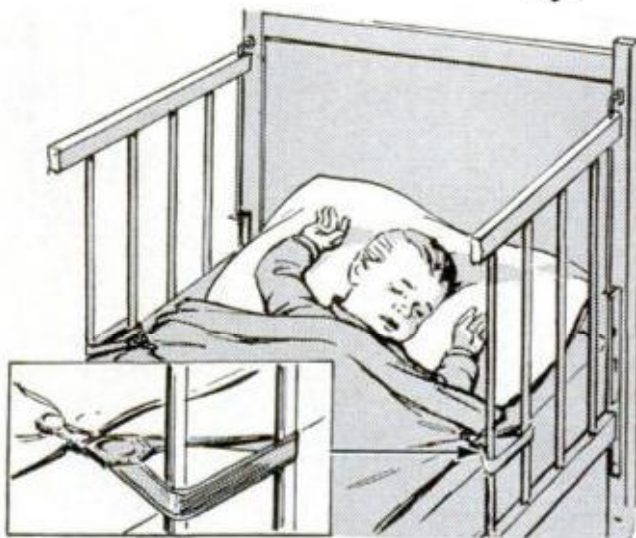




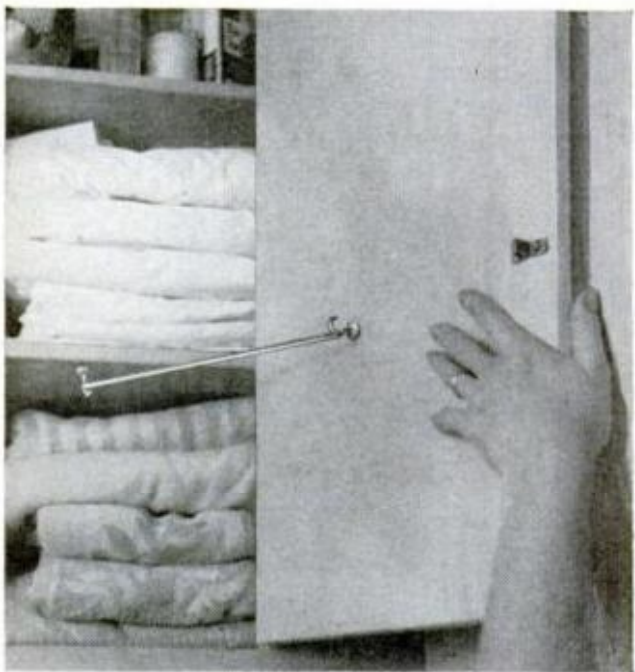
**PLANTS ON WHEELS** can be rolled out of the way when the floor must be vacuumed or polished. If your wife has a large house plant, such as the 60-lb. giant shown above, she'll appreciate a sturdy plant dolly for it. Make the dolly from  $\frac{3}{4}$ -in. plywood, using 3-in.-dia. plastic casters for easy rolling

# Solving HOME PROBLEMS

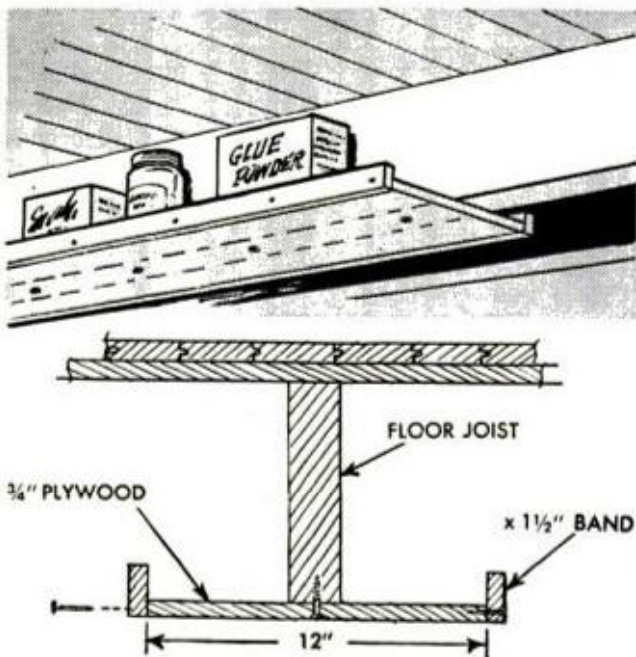
**MEN'S GARTERS** make excellent clips for holding a crib blanket in place. Just loop each garter around a pair of slats and attach it to the blanket. Because the garters are elastic and slide easily up or down the slats, they compensate for movement. This arrangement is much less restrictive and more efficient than pinning the blanket to mattress cover

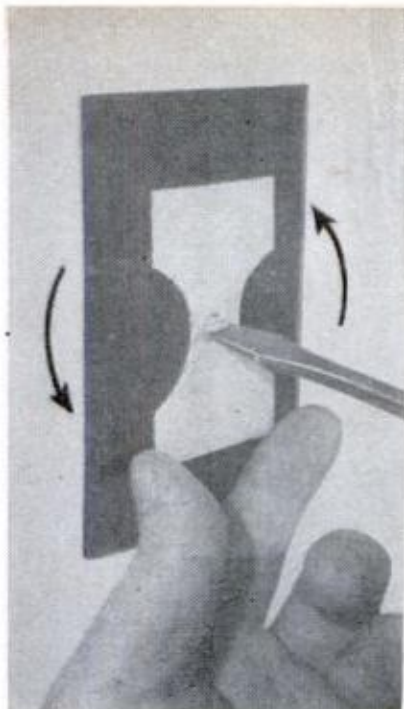


**SNAPPY COMEBACK** for cupboard door: Mount a cup hook on the inside of the door and a matching hook on the bottom surface of one of the shelves, then stretch a heavy rubber band between them so that the door will close automatically when released



**OVERHEAD SHELF** secured to a joist in the basement will provide extra storage space for materials which aren't used frequently. It's an especially good place for storing materials which must be kept dry, such as patching plaster, dry-wall cement and others

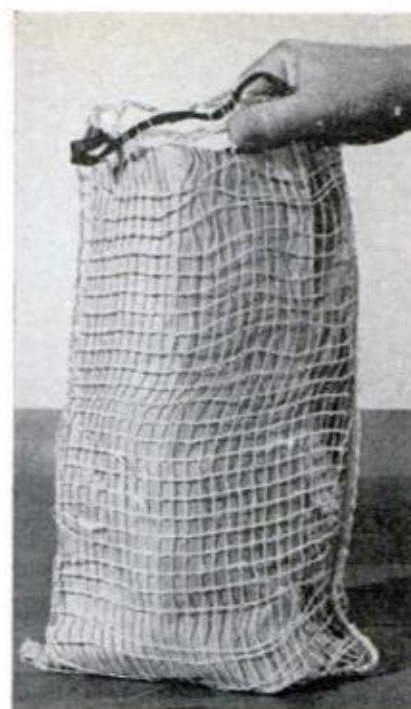




**SAFETY MASK** for electrical outlets prevents children from probing openings with hairpins, etc. Make it from hardboard, as shown. A quarter turn exposes receptacles



**HANGING PINCUSHION** for sewing room can be made by stuffing a cloth-covered wad of cotton inside a plastic tea strainer and gluing a cardboard disk over back



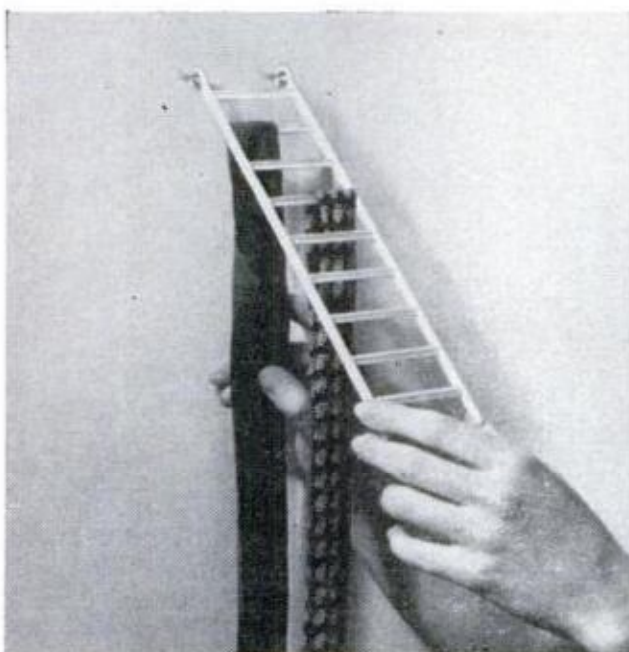
**GARBAGE BAG** won't break when being carried outside if you drop it inside a net bag of the kind in which fruit or potatoes are sold. The net bag is reusable

**BIRTHDAY CAKES** can be decorated without using an elaborate decorating kit. Just pack the colored frosting into a plastic mustard or ketchup dispenser, replace the top and squeeze the dispenser while moving it over the cake to form letters or designs. It's clean, easy and especially good for beginners

**STAINS ON MARBLE** disappear in a jiffy when treated with a thick paste made by mixing two tablespoons soda, a tablespoon salt, a tablespoon powdered pumice and water. Spread this quickly on the marble and let dry, then rub off with a cloth and wash with soap and water. Repeat if necessary

**NOVEL TIE RACK** is actually just a parakeet ladder of the type sold in pet shops or the pet departments of dime stores. Hang it from a pair of screw eyes driven into the wall. To use it, simply swing the ladder out from wall and drop the tie over a rung

**ICE-CUBE TRAYS** won't freeze to the bottom of the freezing compartment if you place a sheet of waxed paper under them. Keep this trick in mind the next time you're refilling the trays. It will save a lot of prying and straining when you want to remove them

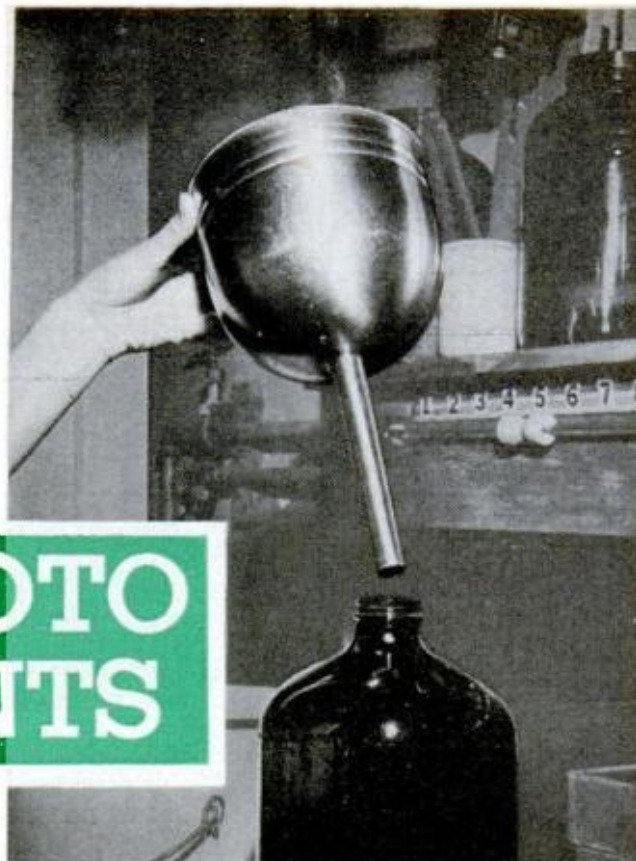
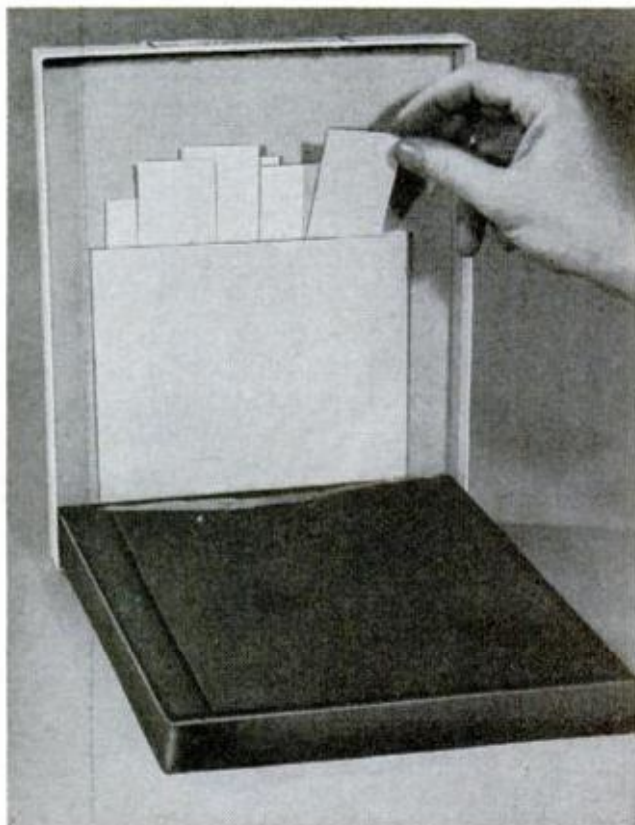




## PHOTO HINTS

**MIX CHEMICALS** in jig time by attaching a toy plastic tennis racket to the shaft of a used 78-r.p.m. turntable motor by means of a hose clamp. (A juke-box motor is shown). Hinge the motor mounting board to the wall so unit can be raised out of the way

**TIRED OF GROPING** around for test strips? If you keep a loose supply inside the enlarging-paper box, chances are that you'll waste time hunting for them under a dim safelight. Eliminate fumbling by keeping strips in an envelope glued to the lid



**KING-SIZE** darkroom funnel originally served as the top of a coffee maker. It is stainless steel, has a capacity of more than a half-gallon and is easier to use than conventional funnels. You can buy a used one for about 50 cents at a restaurant supply house

**THE SOLE PLATE** from a discarded electric iron can be used to make an excellent camera stand. It is especially handy for table top shots and other close-up work. Cut the head off a  $\frac{1}{4}$ -20 bolt; then drill a hole in the plate and set in the bolt with epoxy





## New for Camera Buffs

**TWO UNUSUAL CABLE RELEASES**, from Prontor, are especially useful in low-light photography. The Spotlight model (far left) has a tiny flashlight built into the release button to assist in reading shutter and lens settings. Costs under \$6, with lamp and battery. The Ultra Slow Speed release (left) has its own timing mechanism which lets the photographer shoot at speeds of 2 to 32 sec. without a stopwatch. It sells for about \$20. Both are distributed by Geiss-America, 6424 North Western Avenue, Chicago 45, Illinois

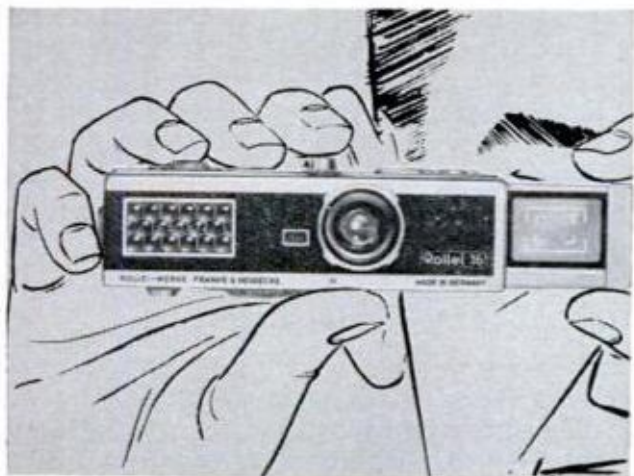


**HC-110 FILM DEVELOPER** is reported to give results similar to Kodak D-76, but in half the time. It processes most black-and-white films in 3 to 6 min. Comes in highly concentrated form, for use as one-shot or reusable solution. Costs \$2.50 for 16-oz. bottle. Eastman Kodak, Rochester 4, N.Y.



**PERUCHROME** is a new color film from West Germany with a 32 ASA. The rolls PM tried gave brilliant, sharp slides with excellent detail in shadow areas. Sold in 35-mm (20-exposures \$3.75, 36-exp. \$5.75), 120 and 127 sizes (both \$3.20). All prices include processing. Perutz, 425 Park Ave., N.Y., N.Y.

**ADJUSTABLE 8-MM SPLICER** gives a choice of two cutting angles—90 and 40 degrees. The 90-deg. cut is the one most often used, but the 40-deg. is useful if your projector tends to jam on splices. Priced at \$2.98, including a supply of splicing tapes. Hudson Photographic Industries, Irvington-on-Hudson, N. Y.



**ROLLEI 16** measures only  $1\frac{1}{2} \times 1\frac{3}{4} \times 4\frac{1}{4}$  in.—not much bigger than a pack of cigarettes. Uses 16-mm. black-and-white or color film. Shutter speeds of  $1/30$  to  $1/500$  sec., f:2.8 lens, built-in exposure meter, parallax compensation. Lists at about \$150. Burrell-Brooks, Inc., 420 Grand Ave., Englewood, N. J.

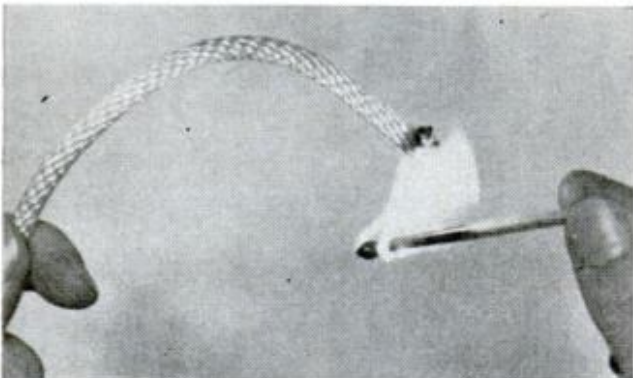


**MINI-DARKROOM KIT** contains everything you'd need to make quality enlargements—a Durst 35-mm. "Newporter" enlarger, 8x10 trays, paper, Polycontrast filters, chemicals, safelight, print tongs, etc. The enlarger will print up to 10x15 in. Price is \$99.95. Durst (USA), 37-15 48 Avenue, L. I. City 1, N. Y.



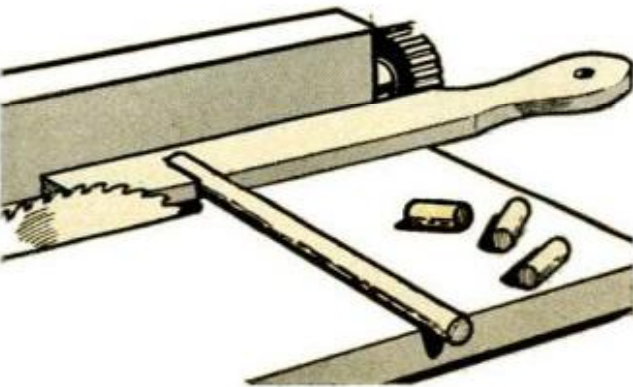
## Clay Serves in a Pinch

Though there is no substitute for periodic professional maintenance on your typewriter, you can prolong the time between tune-ups if you keep the machine clean. Where regular gum type cleaner is not at hand, a lump of clay from a child's modeling set will work fine. Simply press it down on the type faces to pick up the ink and lint, kneading it each time to expose a clean surface.—*R. Lunt*



## Charring Prevents Raveling

The high breaking strength of nylon cord in relation to its light weight and diameter has made it popular for many uses among housewives, farmers and outdoorsman. The greatest problem encountered in using this cord is preventing the ends from raveling. Fortunately, the solution is quick and effective. Braided nylon cord may be kept from raveling by charring the ends with a lighted match.



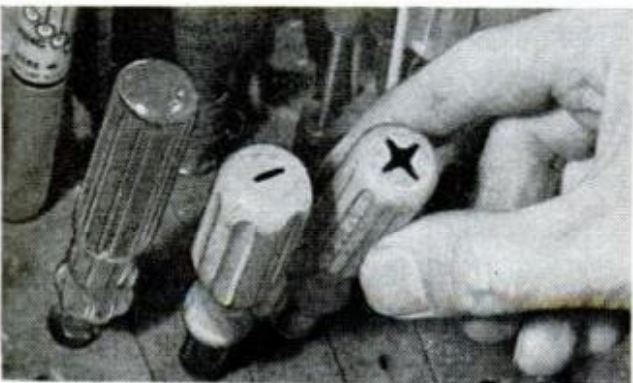
## Dowel Cutting Paddle

You can cut dowels on your table saw with production line speed and accuracy with this notched paddle. Your fingers will be safe too, since there is no need to reach near the blade. The notch is cut to fit the length and diameter of the dowel, then the fence is set to the width of the paddle. The dowel rod is placed in the notch and the paddle is pushed forward for the cut and withdrawn for removal of the piece that has been cut off.



## Eraser Polishes Small Parts

Faced with the job of polishing some small metal parts and with no buffing wheel on hand to do the work, I improvised a polishing wheel from a typewriter eraser. I ran a bolt through the eraser's center hole, tightening the nut securely so that the eraser would not spin loosely on the bolt when I chucked it in the electric drill and turned on the power. The eraser makes polishing a snap.



## No More Guessing

The screwdrivers in my workshop are kept in benchtop racks with only the handles of the tools exposed to view. I used to play a guessing game trying to select the screwdriver I wanted, until I coded the top end of the handle. I used black enamel to mark the handle with either a cross, which indicated the screwdriver had a Phillips tip, or a straight line for those having a regular blade.—*Walter E. Burton*

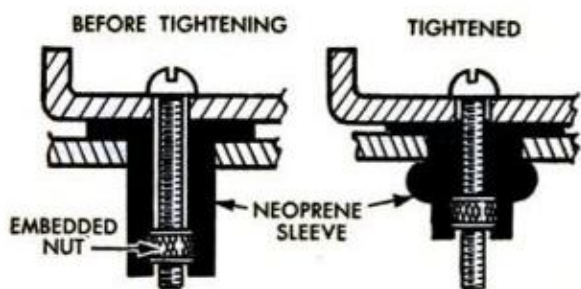


← **PLASTIC ELECTRICAL TAPE** comes in a 20-ft. roll on this convenient pocket dispenser. More suited to amateur use than the usual 66-ft. rolls, and less likely to pick up dirt and grit while stored in a tool box. Retail for about 69¢. Johns-Manville, Dutch Brand Division, 22 East 44 St., New York 16, N.Y.

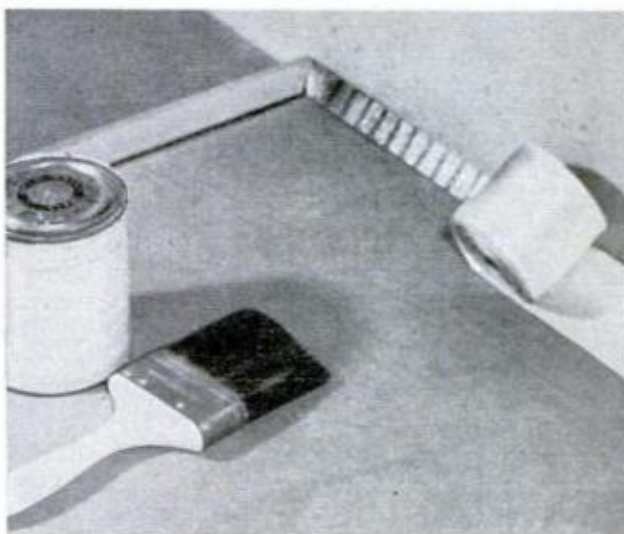
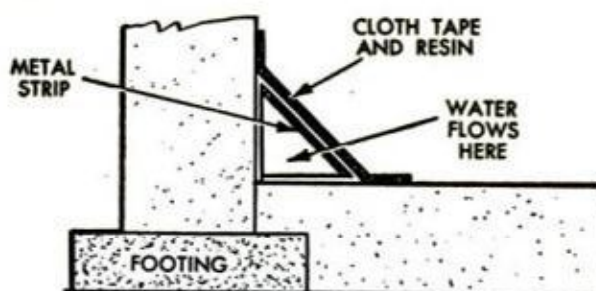
**PEBBLE-LIKE CERAMIC TILES** give a distinctive effect when applied to floors. They come mounted on nylon mesh, to speed laying. Sheets have either squared or interlocking edges. Many color combinations available. About \$1 a sq. ft. Write DBH, Los Angeles Tile Jobbers, 3371 Glendale Blvd., L.A. 39, Calif.



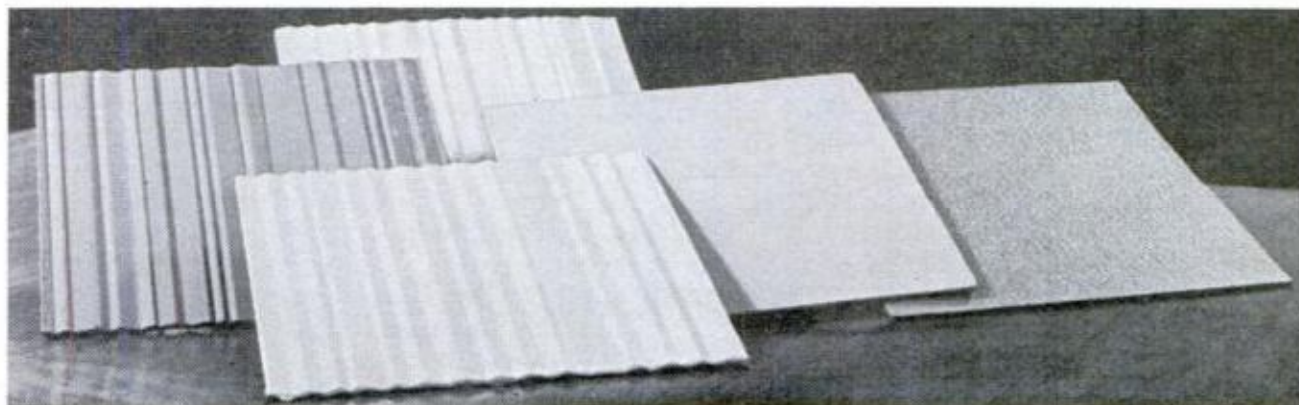
**VERSATILE FASTENER**, tradenamed Well-Nut, can do a wide variety of blind-fastening jobs. It's a machine screw and nut with a neoprene sleeve that expands upon tightening. Dampens vibration, prevents leaks. Ideal for repairing appliances, mounting motors. Rockwell Products, 146 Central Ave., Newark 3, N.J.



**CHAN-DRI KITS** are said to control severe basement seepage. Fibreglas-covered metal channel is installed around basement perimeter to carry unwanted water to a drain. Kits for existing homes cost \$64.40 per 150 ft. of perimeter, for new homes, \$24.65. Chan-Dri, 527 East Shawnee Street, Freeport, Ill.

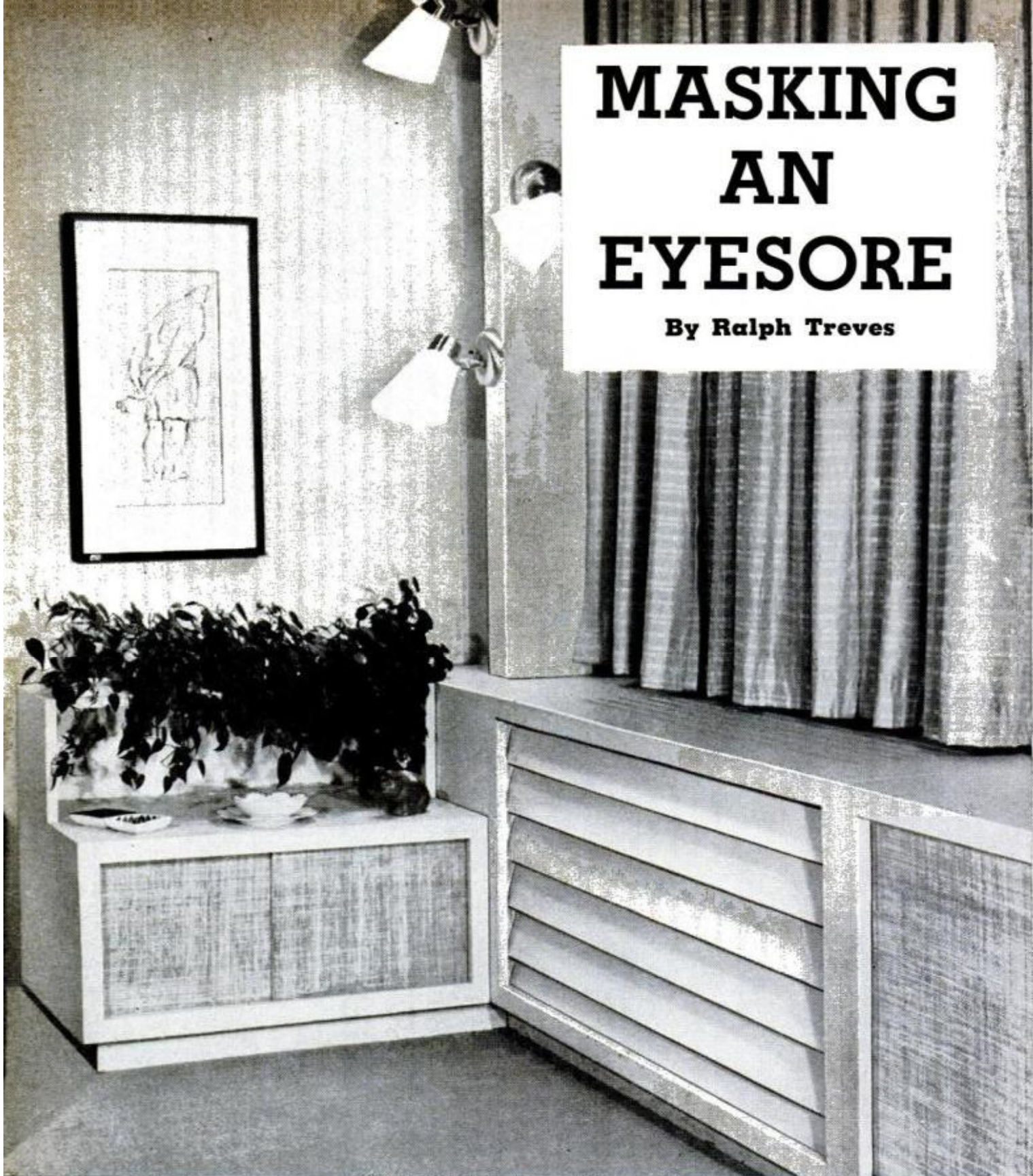


**ASBESTOS-CEMENT PANEL SIDING** is made with a coating of poly-vinyl chloride. Needs no painting. Guaranteed not to peel, blister or craze for at least 10 years. Available in both residential (20 to 25¢ a sq. ft.) and commercial (30-35¢ a sq. ft.) grades. Manufactured by the National Gypsum Co., Buffalo 2, New York



# MASKING AN EYESORE

By Ralph Treves



**N**OTHING DETRACTS from a well-furnished room like a naked radiator squatting under the window—or an ugly pipe climbing up a corner. The room above is cursed with both of these eyesores, but you'd never tell it from the clever way the problem corner has been masked with built-ins.

An attractive counter is built along the wall to windowsill level. It's designed to

match adjacent cabinets for an attractive sectional grouping. The countertop is notched around the steam-riser pipe, and the portion of this pipe that runs on up to the ceiling is hidden by an L-shaped screen made by simply nailing two boards together. In place, it suggests a structural column—but one that doubles very nicely as a pole lamp.

The portion of the counter that covers



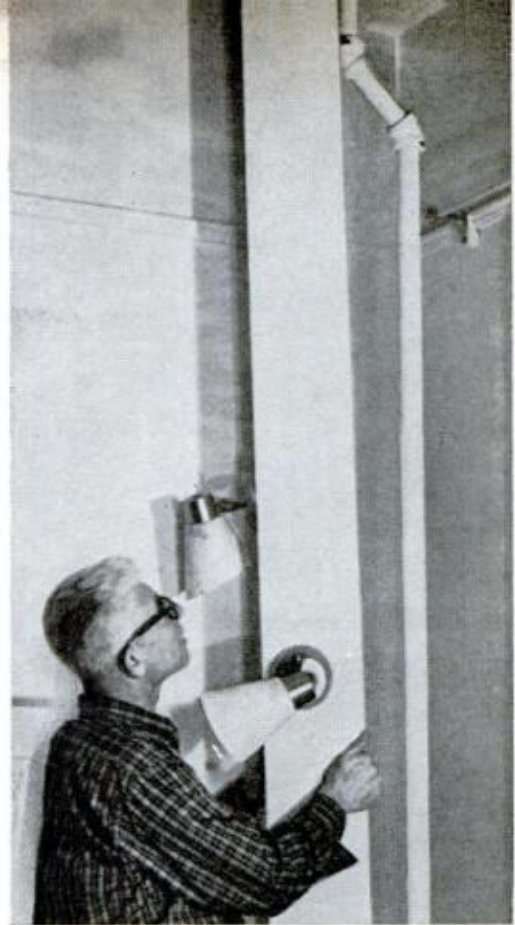
the radiator has attractive louvers to coax the cold air currents off the floor and up along the radiator vanes. The heated air passes into the room through slots cut in the top.

In the arrangement shown here, the corner end of the radiator cabinet is enclosed only partially to permit access to the shut-off valve. This gap is concealed by a shorter cabinet set at right angles to it, which slides away when heat adjustment is necessary. You may wish to make a similar provision at the opposite end if access to an air-release valve is needed.

Construction requires no cabinetmaking skill. As shown below, assembly is by means of simple butt joints. The panels are  $\frac{3}{4}$ -in. plywood, the framing is all 1x2s, except for the louvers and toe plate. The latter is nailed at right angles to a 1x2 stiffener that is installed in two pieces—one nailed between the inner faces of the end panel and partition, the other between the partition and wall.

Assemble the front frame before fastening it to the panel edges. Note that the bottom frame member is supported only at the ends to provide an air passage behind the lowest louver. For this reason, it's best to assemble the frame and apply it as a unit, after the louvers are in place.

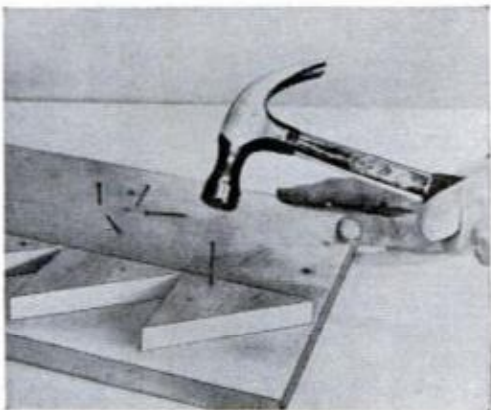
You can simply wire the L-cover around the riser if you turn small screweyes into the rear faces of the boards. The cords from the "pin-up" lamps pass through holes that are concealed when the bases are mounted on the boards. ★ ★ ★



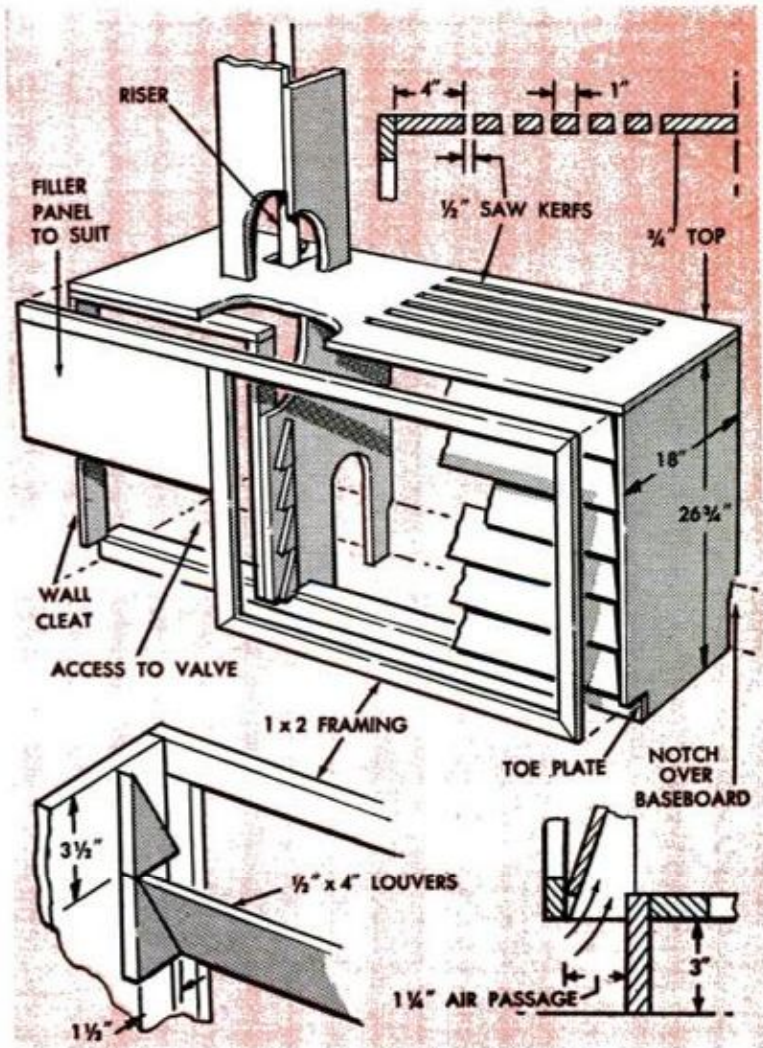
**EXPOSED STEAM RISER** is tucked behind an L-shaped facing that doubles as lamp pole

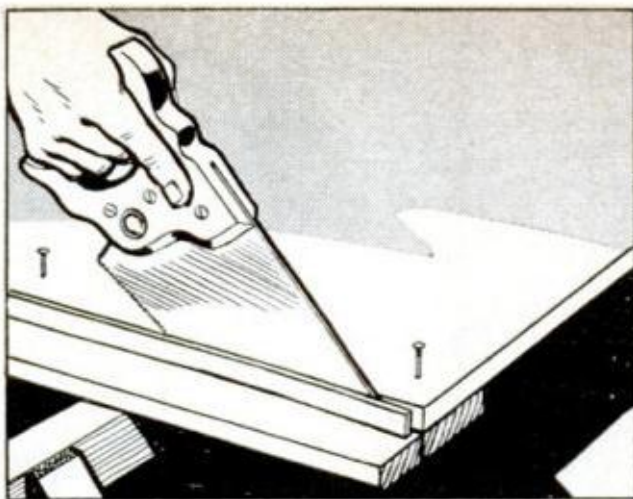


**AIR SLOTS** in top of cover can be cut on table saw with ganged blades—or by running saber saw between  $\frac{1}{2}$ -in. holes, above



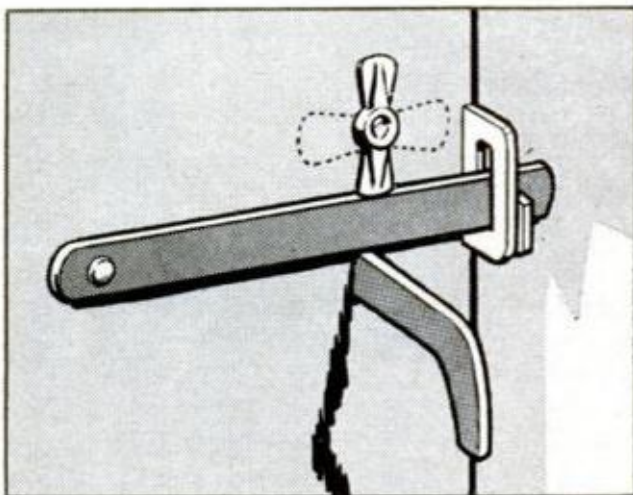
**LOUVER STEPS** are formed by nailing triangular blocks to inner faces of two end panels. Louvers are tacked to front edges





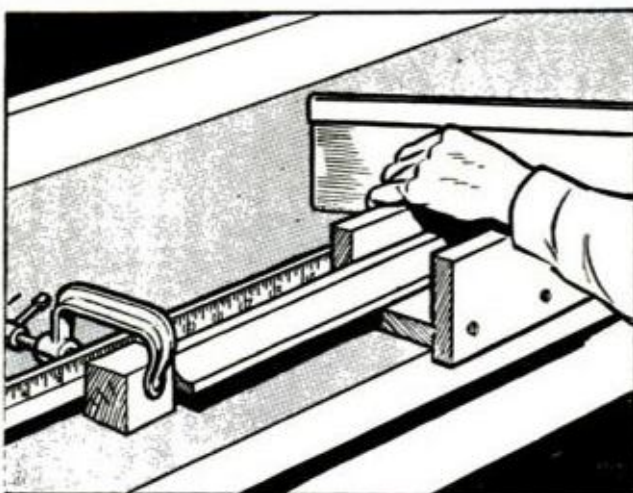
### Scrap Makes Trimming Easy

When trimming off whisker-thin strips from panels or boards it is difficult to keep the saw from running off the edge of the work. You can solve the problem simply by first tacking a length of scrap stock to the underside along the line of cut. Thus by sawing through both pieces of material, the waste piece of stock will hold the saw blade firmly in place along the cutting line, even if the saw cut is being made almost on the very edge of the work. Precise work is easy with this technique.



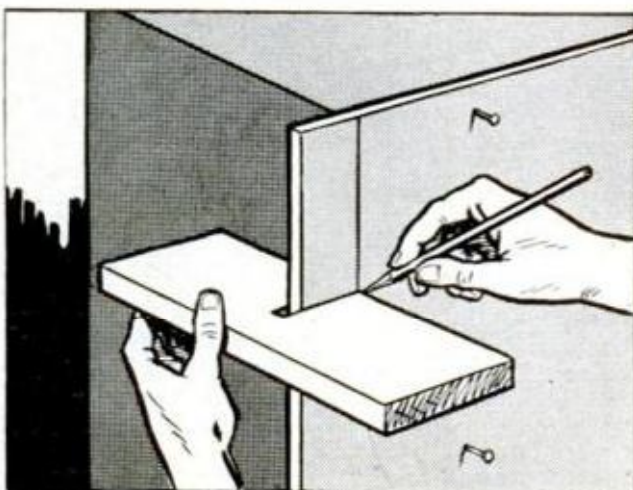
### Turn Button Locks Latch

Doors on garages and storage sheds that have thumb latch hardware can be locked from the inside without incurring the expense of a conventional locking system. All you have to do is screw a turn button above the bar as shown in the drawing. When the button is in a vertical position the bar can not be lifted to unlock the door. The button should be located so that the bar may be lifted clear when the button is in a horizontal position. The screw must be tightened sufficiently so that the button doesn't turn too easily.



### Miter-Box Stop Block

When several pieces of stock must be mitered to the same length with the greatest possible accuracy, a yardstick provides a readymade calibrated stop rod. Nailed to the outside of the miter box so that the end of the yardstick is even with the saw slot in the box, it becomes a simple matter to position and clamp a stop block at the measurement desired. If miter cuts are to be made on both ends of the stock, the yardstick is attached to the opposite end of the miter box.



### Marking Paneling

Where the wall may be irregular and the work cannot be marked from the rear side, a notched block does the trick when it comes to fitting wall paneling at outside corners. The panel is cut about 1 in. over-size and temporarily tacked in place. Then the notched block is placed over the edge of the panel and moved from top to bottom. By keeping the block in contact with the wall and holding a pencil against the block, the irregular wall line will be duplicated exactly on the panel. The notch must be deep enough so the panel does not touch bottom.—*Michael Ligocki*

What's new—and what to do—with

# FANCY HARDBOARD

By Manly Banister

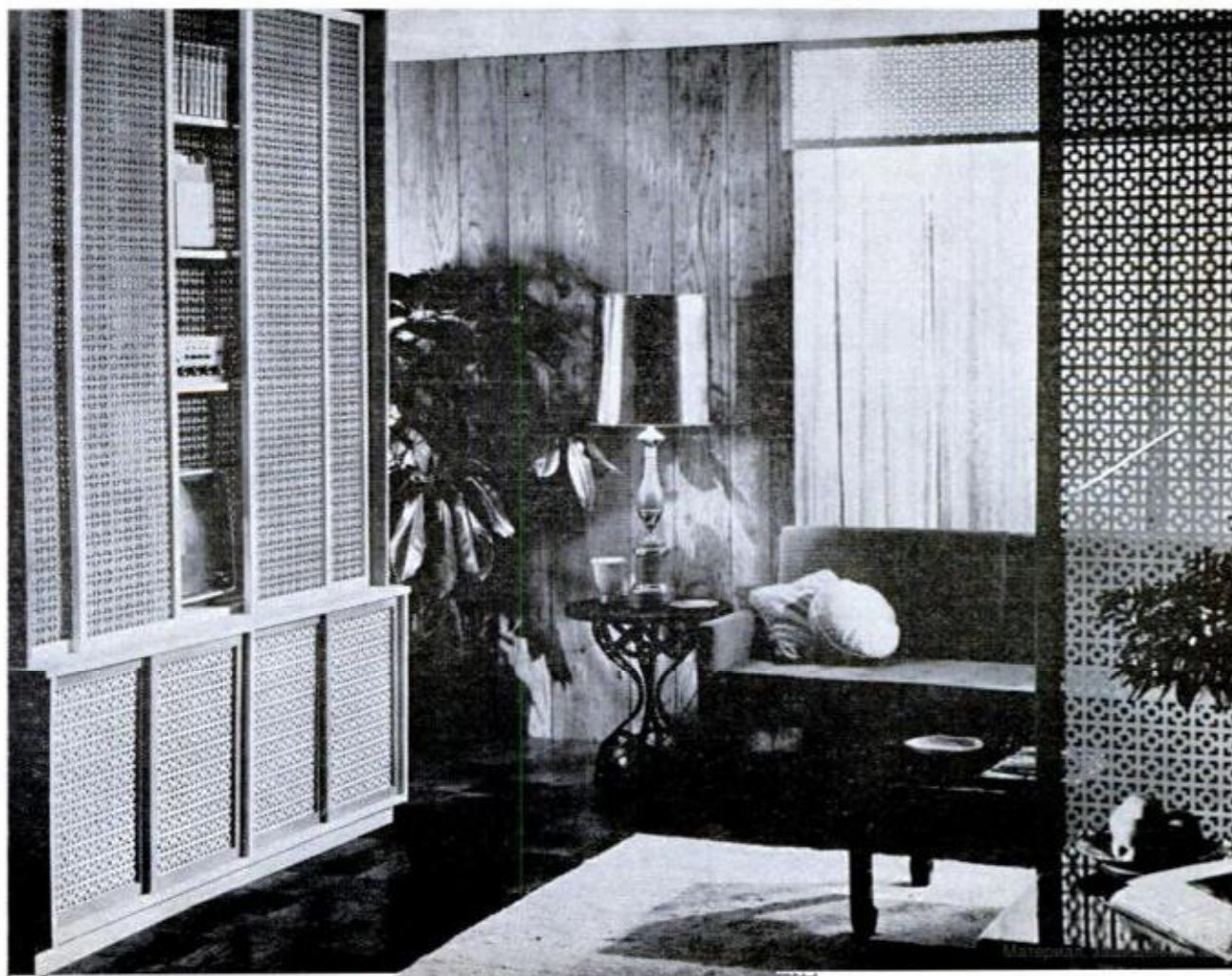
Exciting things have happened to that old reliable brown panel, broadening its use in your shop

**W**HOD' HAVE EVER THOUGHT hardboard would get the glamour treatment? Yet, it's recently moved beyond its plain-Jane construction uses into the unexpected realm of decorative paneling. This all began, some years back, with colorful factory finishes; but if you haven't checked the field lately, you've a surprise in store when you turn the page and see our sampling of the many embossed and pierced designs that are now available.

The dramatic range of uses for these new panels is shown in two photos here and



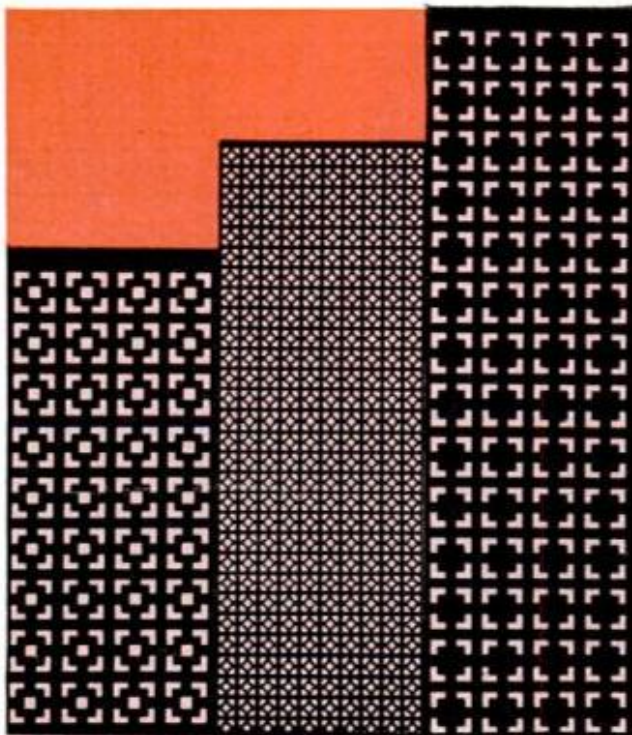
Photo courtesy  
Panelboard Mfg. Co.





**THREE HARDBOARD PROJECTS** detailed on following pages are clustered to show variety of uses for embossed hardboard. Background is Garage Liner, a  $\frac{1}{4}$ -in. hardboard with unperforated "wainscoting"

**FILIGREE PATTERNS** are die-cut from hardboard that is silicon-impregnated for strength. Ideal for a room divider and cabinet doors (previous page)—or for folding screens—the  $\frac{1}{8}$ -in.-thick pierced panels come in three designs: (l-r) Oriental, Venetian and Granada. Panel sizes range from 24x48 in. to 32x96 in. Full line of pre-grooved moldings and hardware available. Called Panelaire, line is made by Paneboard Mfg. Co., Newark, N.J. and sold (ready for painting) through lumber yards and hardware stores



the three projects pictured at the left—each using a different fancy hardboard.

The wide selection should tempt any wood-worker to put the new panels to work. Since hardboard requires some special construction techniques, we've detailed five projects on the next three pages—just to get you started.

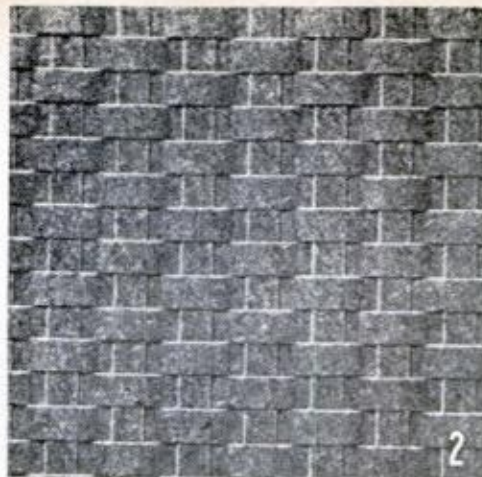
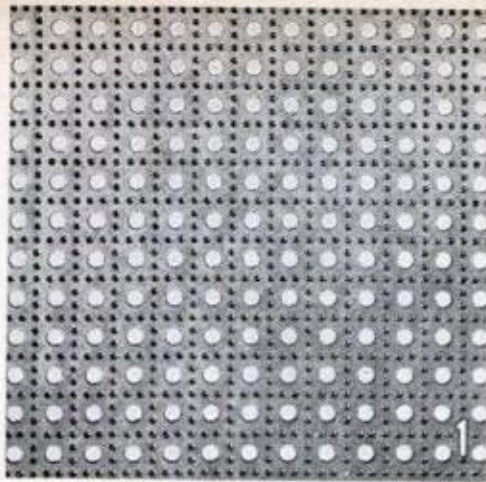
The party bar illustrates three methods of using hardboard. For the serving tops, a prefinished  $\frac{1}{8}$ -in. panel (Sandalite) was laminated to a core of Flakeboard—itsself a hardboard product, though of flake rather than fiber construction. Flakeboard is available in thicknesses from  $\frac{3}{8}$  to  $1\frac{1}{8}$ -in. and weighs less than plywood. Double facing is necessary since gluing hardboard to only the top surface may cause any solid backing panel to cup or draw out of plane. The bottom facing equalizes surface stresses. This doesn't hold true when hardboard is glued to a frame, as in the construction of the center shelves. Here,  $\frac{1}{4}$ -in. panels are glued to only the top face of the 1x2 stiles and rails.

A similar technique is used to apply the vertical Shadobord panels to the skeletal structure of the bar—though this "skin" may be laid on without gluing. Drive  $\frac{3}{4}$ -in. brads along all four sides and into the shelf edges. Where the heads will show, use special colored hardboard nails offered by some manufacturers. These are of hardened steel, an inch long, with annular threads. They don't tend to raise a surface bulge, and are colored to match the board so the heads are nearly invisible.

Another type of framed-panel construction is used for the folding screen. Here, the hardboard sets into grooved stiles and rails—but glue is used only to assemble the frame itself. The panels remain loose within it. If you choose a good-one-side embossed board instead of the double-faced grille we used, some treatment of the screen back is called for. You can paint it as is, or sand it smooth and leave it natural—or face it with colored burlap.

A still simpler assembly is demonstrated by the hamper. The panel edges are merely cemented into aluminum corner posts that have channels to receive them. By notching the posts into the corners of the top and bottom members, you set the back face of the panels firmly against the edges for gluing or nailing.

The wall cabinet is a variation of this assembly method, except that sliding doors replace a stationary front panel. These doors ride in double-channel tracks aligned with the corner posts so that, in their closed position, one door seats in its post channel while the other passes behind the opposite channel. Cut the doors to provide a 1-in. overlap at the center.



### SAMPLE LIST OF FANCY HARDBOARD MAKERS

**EVANS PRODUCTS CO.**, Corvallis, Ore. (Evanite)

**Corru-bord** Corrugated; with holes, **Perfo-bord**,  $\frac{1}{8}$   
**Decabord** Convex ribs for drapery effect,  $\frac{1}{8}$  &  $\frac{1}{4}$   
**Panel 4 (3)** Grooved in 4-in.-plank pattern,  $\frac{1}{4}$

**FOREST FIBER PRODUCTS CO.**, Box 68, Forest Grove, Ore.

**Burlite (6)** Burlap-textured on screen side,  $\frac{1}{8}$  &  $\frac{1}{4}$   
**Sandalite** Metallic color squares embedded in  
 factory-finished surface,  $\frac{1}{8}$  &  $\frac{1}{4}$

**GEORGIA-PACIFIC CORP.**, Equitable Bldg., Portland, Ore.

**Corrugated** Plain or perforated,  $\frac{1}{8}$  &  $\frac{1}{4}$   
**Garage Liner** Perforated but with solid "wainscoting"  
 and random-plank grooved,  $\frac{1}{4}$   
**Ribbed** Similar to Evanite Decabord,  $\frac{1}{8}$  &  $\frac{1}{4}$

**HARDBOARD FABRICATORS CORP.**, 49 Empire St., Newark 12.

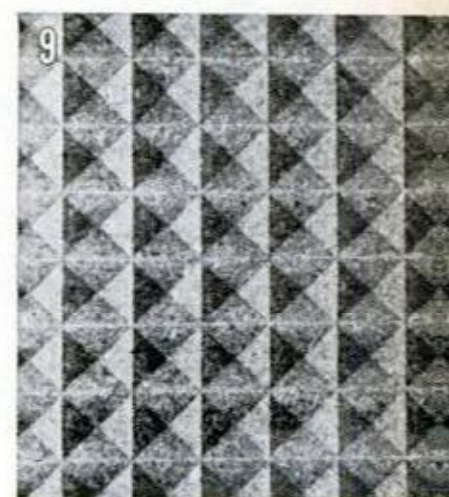
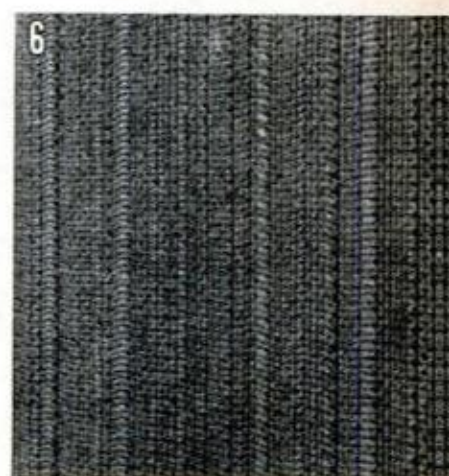
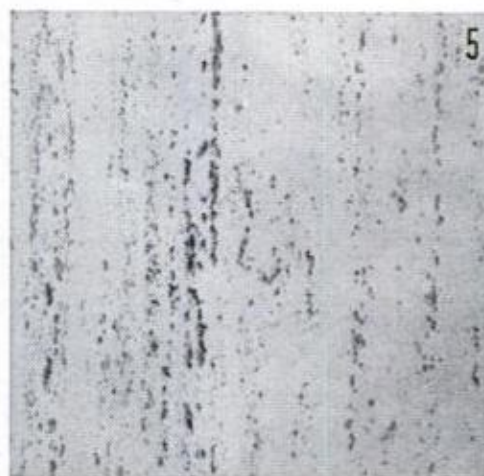
**Caneboard (1)** Linear pattern of two-sized holes,  $\frac{1}{8}$   
**Randomboard** "Swiss-cheese" random-size holes,  $\frac{1}{8}$   
**Checkerboard** Crosshatch check embossing,  $\frac{1}{8}$  &  $\frac{1}{4}$   
**Grecianboard** Tight x-pattern grille (all grilles  $\frac{1}{8}$ "")  
**Romanboard** Similar to Oriental grille, facing page  
**Classicboard** Similar to Venetian grille, facing page  
 Also: **Morocoboard (7)** and **Swirlboard (8)**— $\frac{1}{8}$

**HINES LUMBER CO.**, 200 S. Michigan Ave., Chicago 4, Ill.

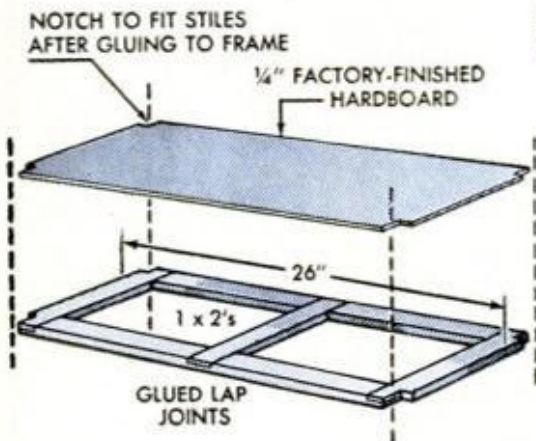
**Louverbord** Solid panel simulates slanted louvers  
**Starpoint** } Intricate pierced grille designs  
**Shadobox** }  
 Also: **Weavbord (2)**, **Wickerbord (4)** and **Shadobord (9)**

**MASONITE CORP.**, 111 W. Washington St., Chicago 2, Ill.

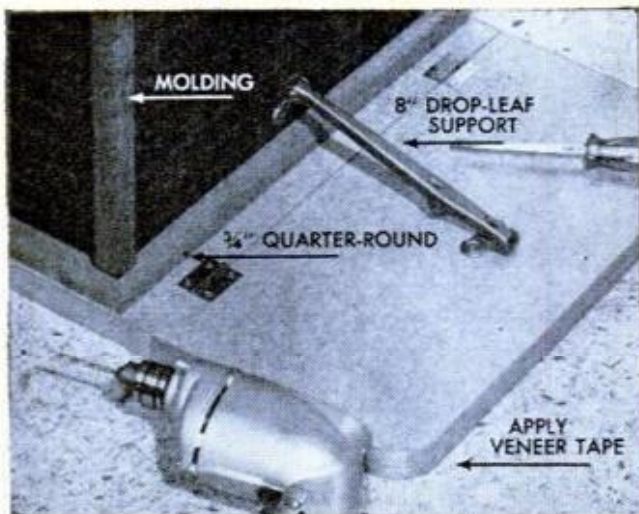
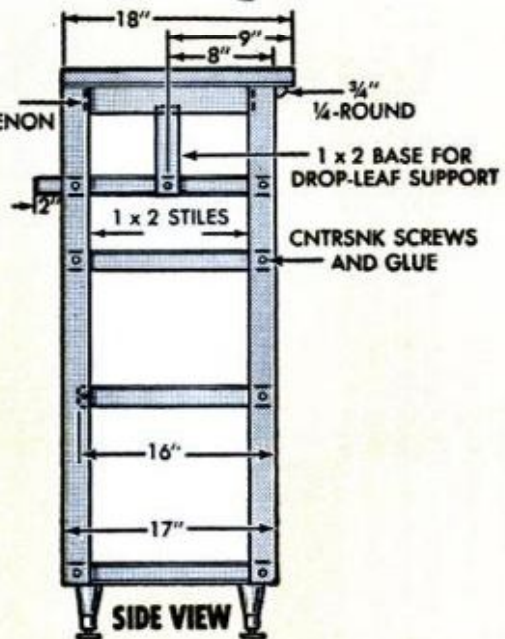
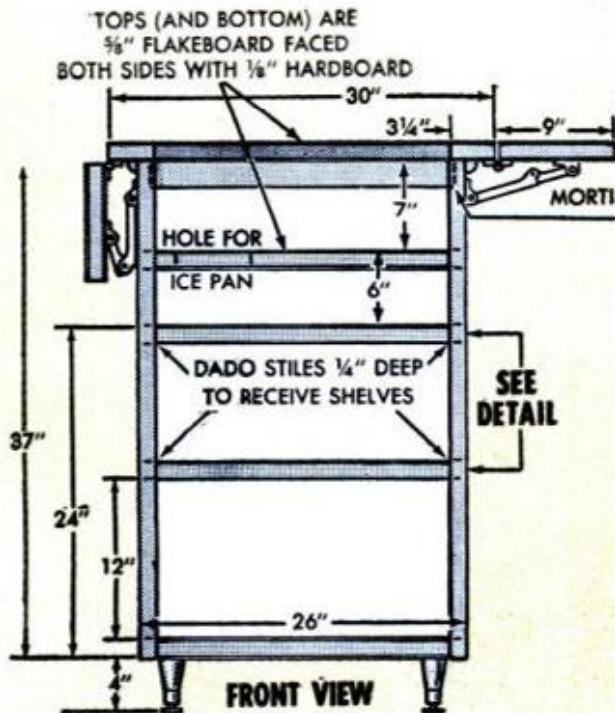
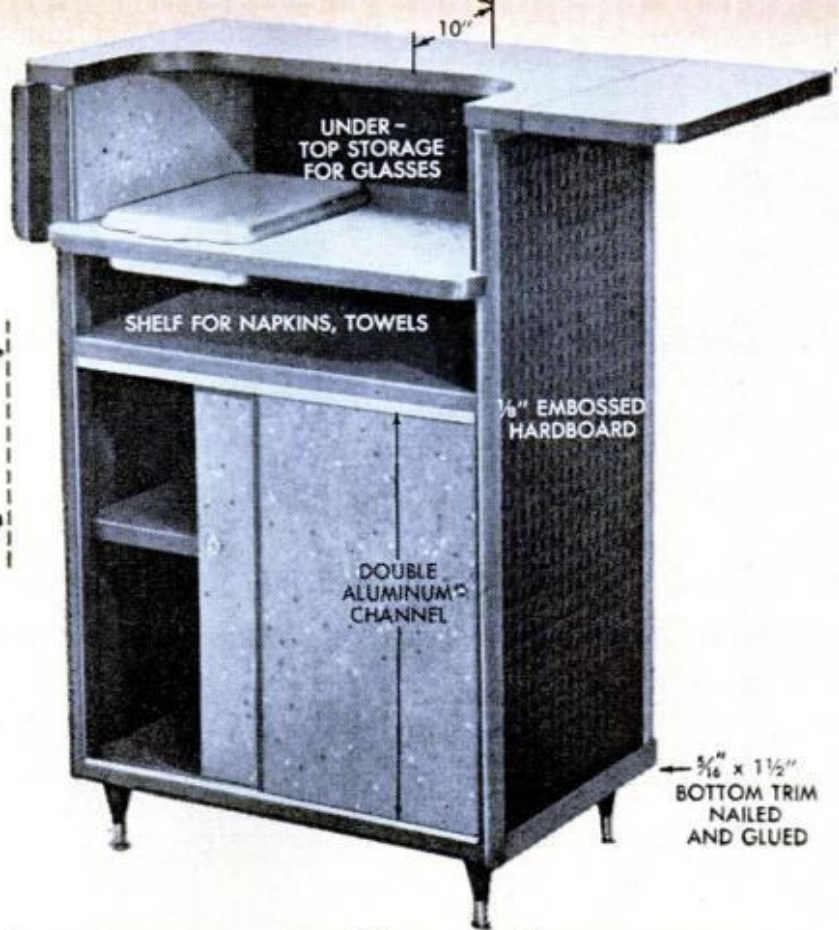
**Marbletone (5)** Two-tone finish simulates travertine,  $\frac{1}{4}$   
**Seadrift** Simulates weather boards,  $\frac{1}{4}$   
**Leatherwood** Similar to Morocoboard (7),  $\frac{1}{4}$   
 All Hines panels are  $\frac{1}{8}$ , Masonite  $\frac{1}{4}$



# REFRESHMENT BAR



**SHELF DETAIL**  
(MAKE ONE 17" WIDE AND ONE 16" WIDE)

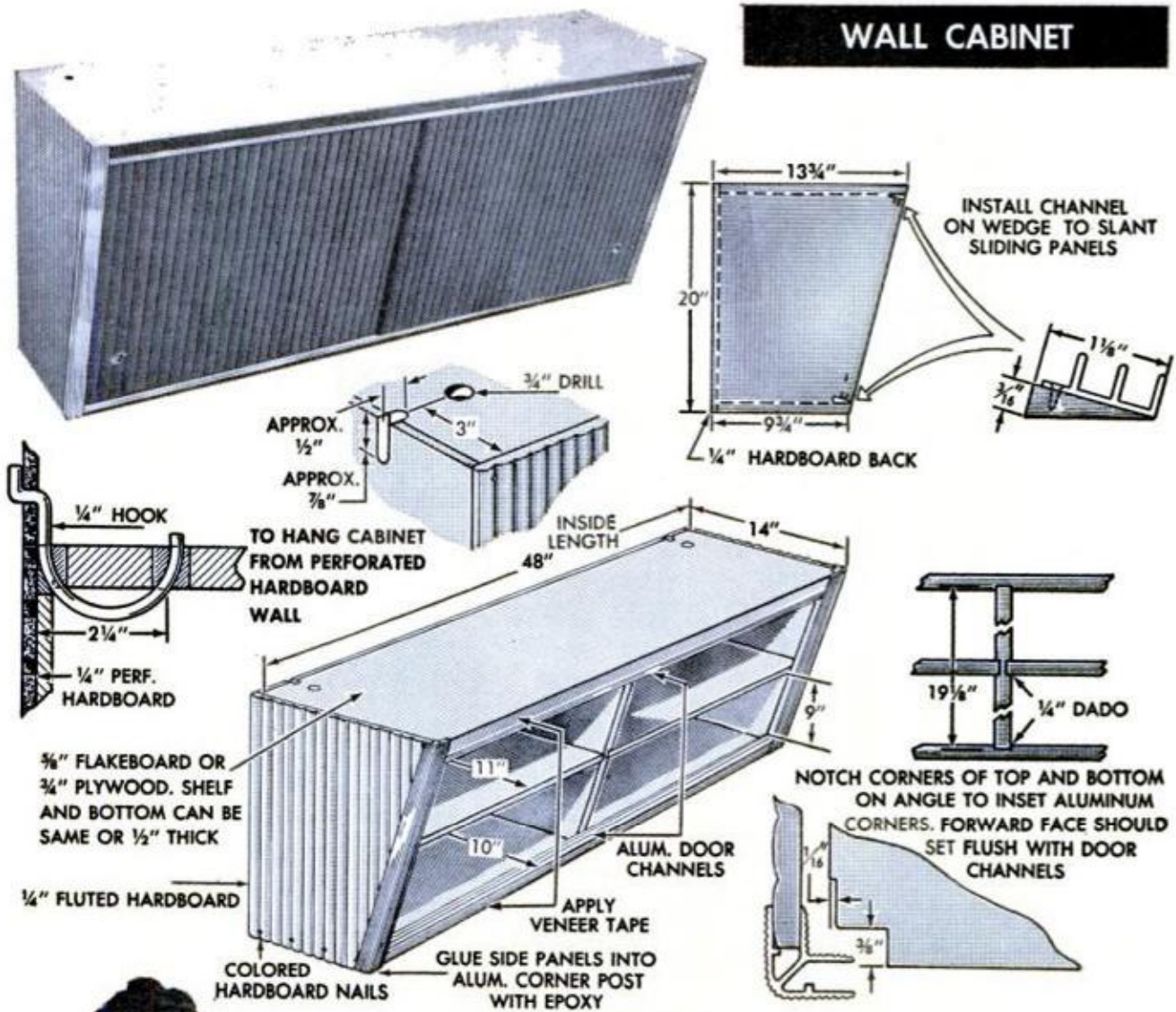


**SANDALITE AND SHADOBORD** were combined on party bar that's easy to move wherever the action is. Shadobord is applied as skin on frame skeleton, edges concealed with wood molding. Prefinished Sandalite is used to face Flakeboard-core top and drop leaves

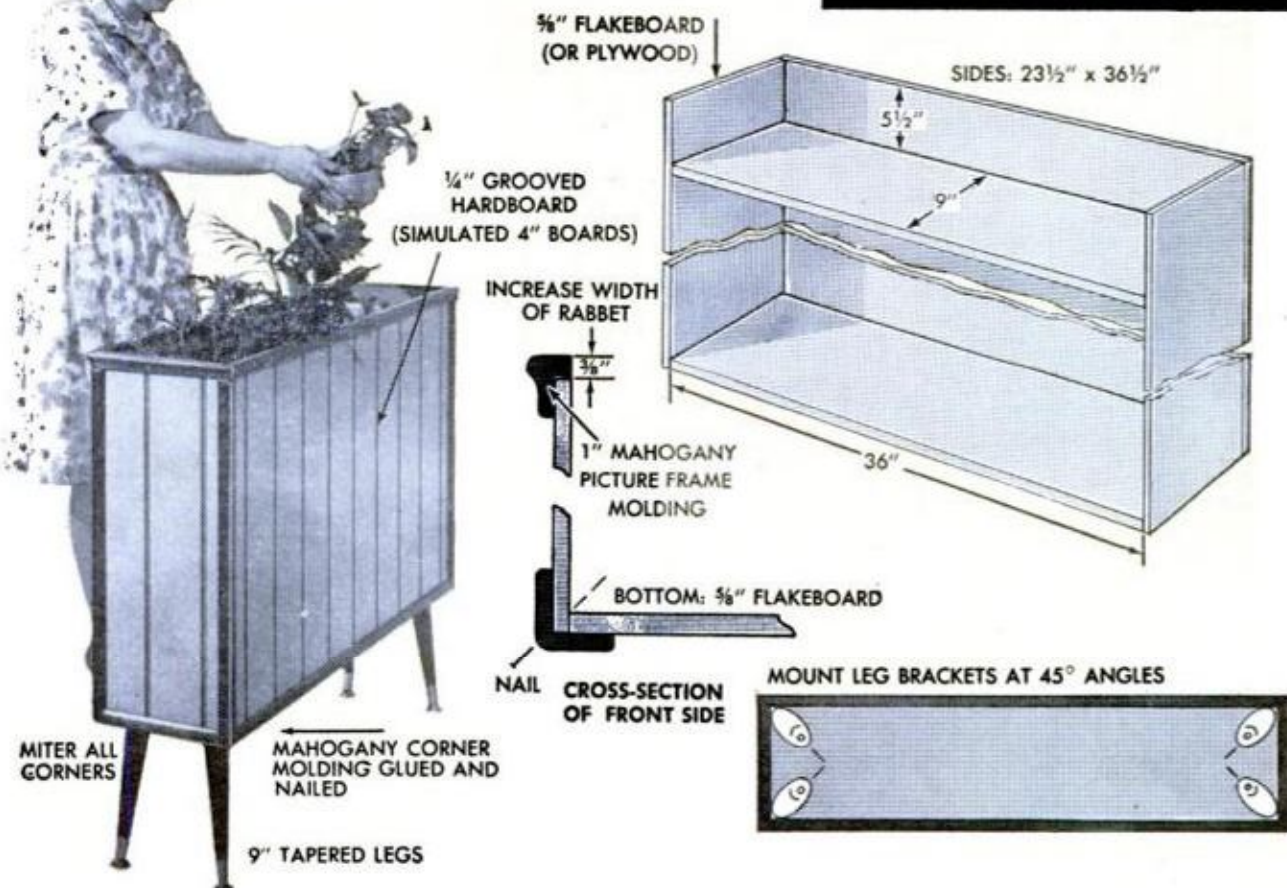
**RIBBED HARDBOARD** was used for the ends and sliding doors of the tapered wall cabinet, upper right. End panels are epoxy-glued into Do-It-Yourself aluminum corner posts. Large-size Peg-Board hooks provide easy way to hang shelf from Garage Liner wall

**GROOVED PANELS** give planter-divider (right) look of planked construction. Actually, it's a simple hollow box with top recessed to take 30-in. plastic or fibreglas planter. Molding hides raw edges of panels, provides good contrast, sturdy appearance

## WALL CABINET

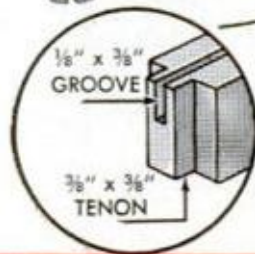
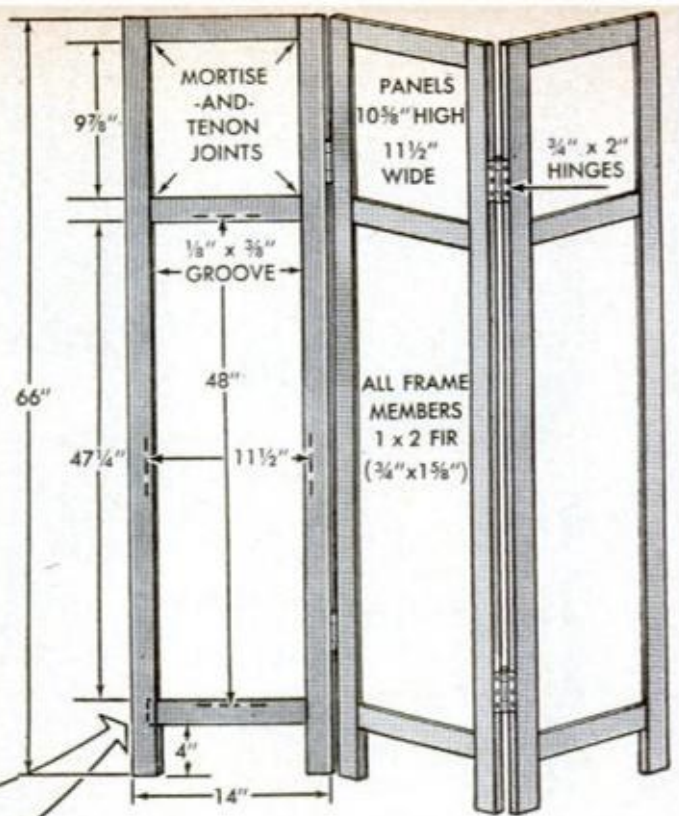


## PLANTER-DIVIDER





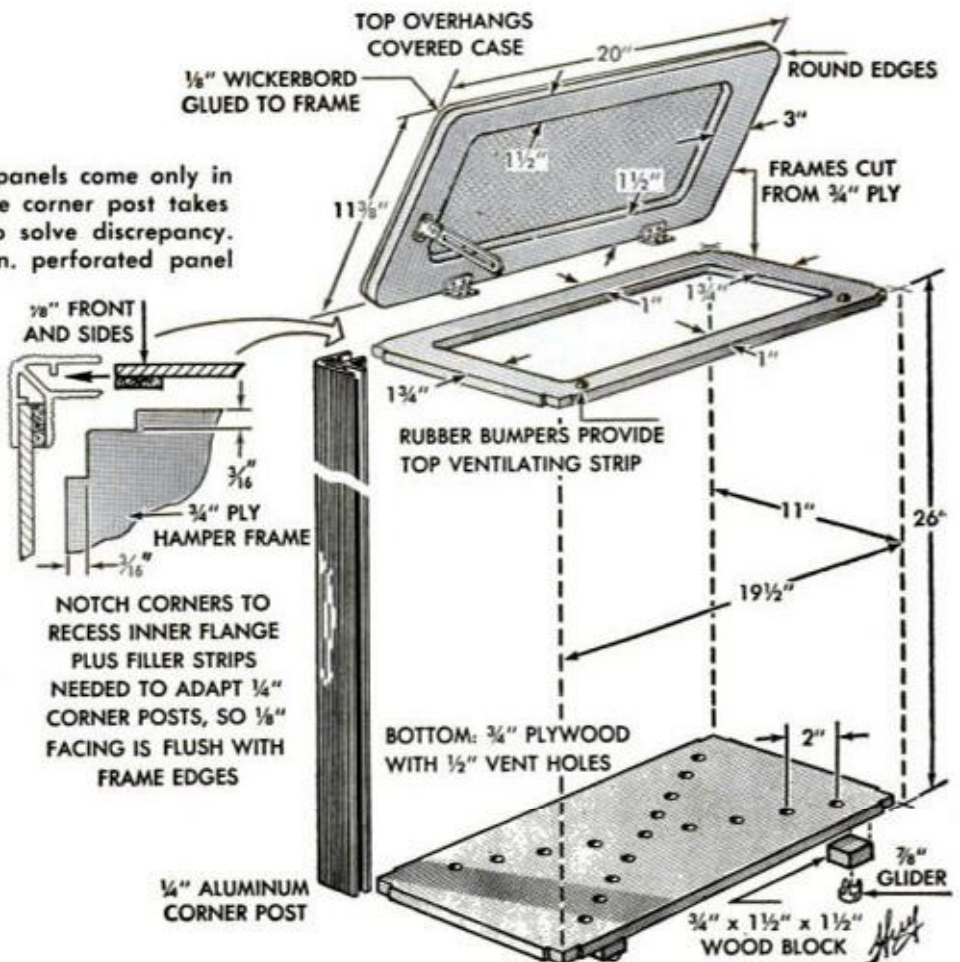
## FOLDING SCREEN



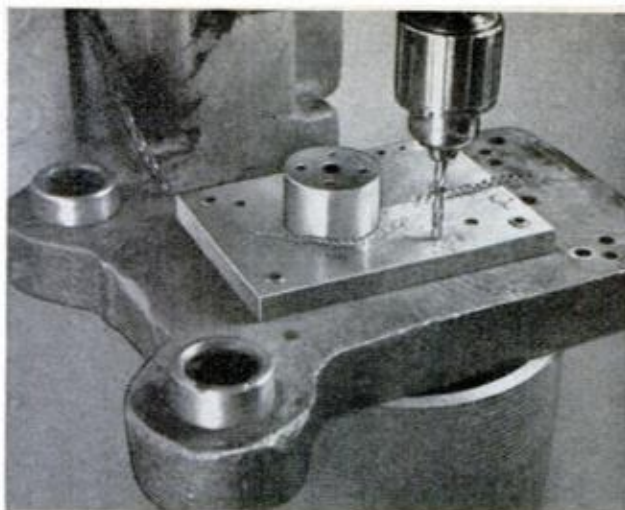
PIERCED OR EMBOSSED hardboards—or combination of two—make ideal screen panels. Starpoint design, above left, provides ventilation, yet masks off area behind. Frame is dimensioned to avoid waste of 2x8-ft. sheet. Groove center rails top and bottom

## CLOTHES HAMPER

WICKERBOARD and some other panels come only in  $\frac{1}{8}$ -in. thickness. Smallest available corner post takes  $\frac{1}{4}$ -in. panels. Sketch tells how to solve discrepancy. If back will be hidden, use  $\frac{1}{4}$ -in. perforated panel





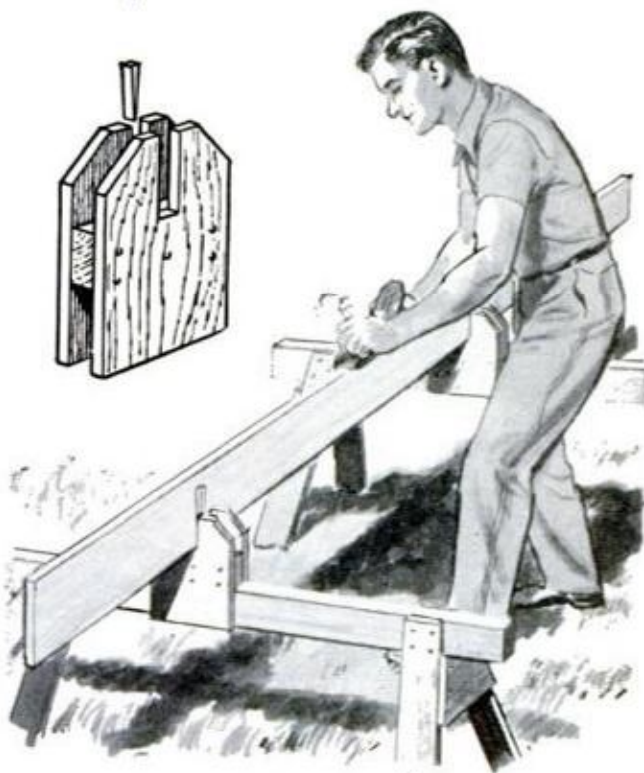


## Pipe Rings Provide Non-tip "Parallels" for Your Drill Press

These non-tipping drill press "parallels" will come to your rescue when you are working with odd-shaped parts. They can be made at little cost from large-diameter pipe. Both ends of the pipe must be faced parallel to each other in a lathe. If your shop equipment includes a surface grinder, you can take the finish cut while the pipe is seated on a magnetic chuck. The photo at the right shows the "parallel" supporting a die shoe that is being drilled for pins.

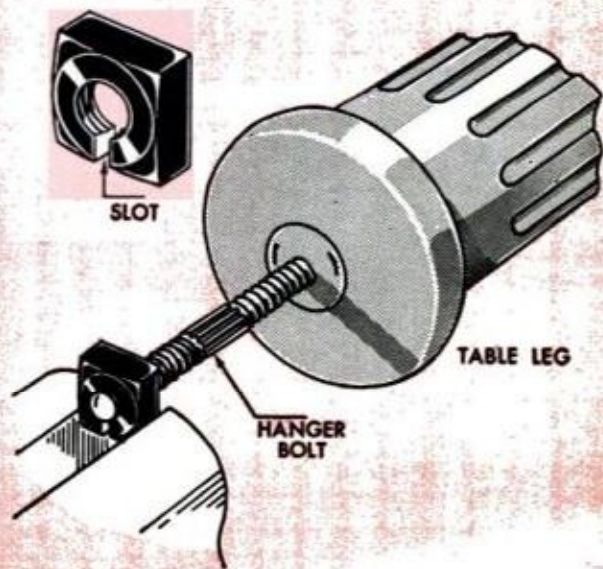
## Sawhorse Planing Clamps

Holding long boards on edge for planing is a problem when you are working outside the shop. However, two of these wedge clamps which straddle the rails of a couple of sawhorses solve the problem perfectly. They're made from scraps of 1-in. stock with spacer blocks that allow them to fit snugly over the horse. Wedges hold the workpiece securely in the notches, which should be made wide enough to accept both 1-in. and 2-in. lumber.



## Split Nut Does the Trick

Having to replace a broken table leg with a newly turned one, I was stumped on how to turn the hanger bolt in the leg since the bolt had to be run in beyond the portion provided for gripping with pliers. Holding the threaded end without damaging the threads was my problem until I hit upon the idea of using a split nut. As shown, I cut through one side of the nut with a hacksaw and then turned it on the end of the hanger bolt. Clamped between the jaws of a vise, the split nut kept the bolt from turning while I twisted the leg onto it.—R. S. Tupper





By Morton J. Schultz

## WHY BOTHER WITH WINTER BATTERY CARE

It's of dubious value if your battery is on its last legs. Here's how to check to see whether it will last another winter

**A** BLEAK WINTER NIGHT, and you've just paid a visit to your mother-in-law. It's late, you're miles from home, but you've finally succeeded in prying your wife loose and she's followed you out to the snow-heaped car. You're anxious to make a fast getaway before her mother thinks up some ruse to coax you both back for another hour's chat. But when you

turn the ignition key, all you get is that heart-sinking sound of an exhausted battery struggling—in vain—to crank the cold engine.

Would diligent winter maintenance have spared you this sad little scene? Not likely. No amount of once-a-year battery care is going to avert the inevitable. It's a waste of time and effort unless your battery is

in a healthy state to begin with. Maintenance might coax a few extra starts from a worn battery, but in the end you're only going to do what you should do to start with—replace it.

Looking at it practically, maintenance of a weak battery may carry you into January or February—right to the heart of winter. In other words, this care will provide just the time you need to experience the inconvenience, discomfort and road expense of a dead battery on a cold day when you're in a rush to get to work—or *away* from your mother-in-law's.

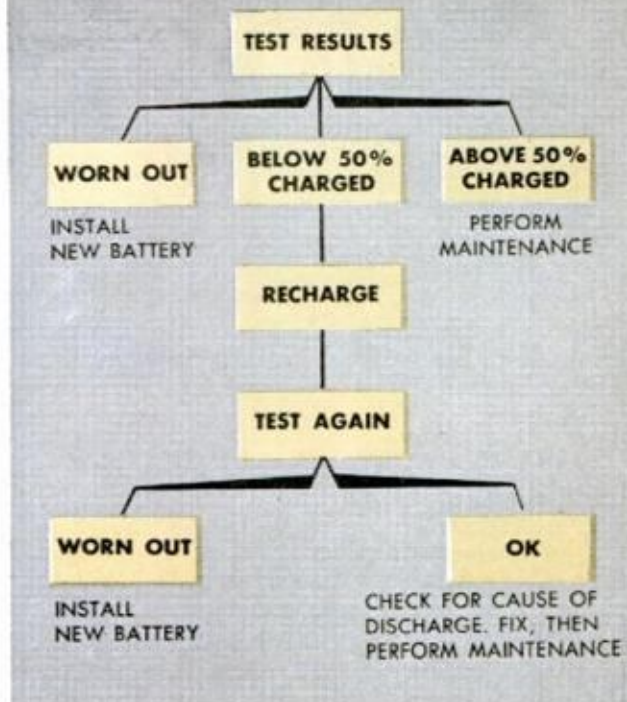
Battery maintenance is a year-round task. Without it, your battery will probably last some 30,000 miles. With it, you can increase this figure to some 40,000 and even 50,000 miles.

How can you tell if your battery will last the winter? You invest about \$2.00 for a battery hydrometer and test the battery's condition (its ability to store and deliver power) and its state of charge (the amount of electrical power in the battery). Once you have the test results, you take the necessary action, as shown in the chart at the right.

A hydrometer records the strength of the electrolyte in the battery's cells by measuring the acid's specific gravity, which is the weight of the electrolyte as compared to the weight of pure water.

As a battery's failure point is approached, there is a widening range in the specific gravities of electrolyte taken from the various cells. In a completely discharged battery, for example, the specific gravity of a cell's electrolyte may be close to that of pure water, which is 1.000. When specific gravity readings vary significantly

## IS YOUR CAR READY FOR WINTER?



**CHART SUMS UP** action you should take to decide if maintenance will get your battery through winter

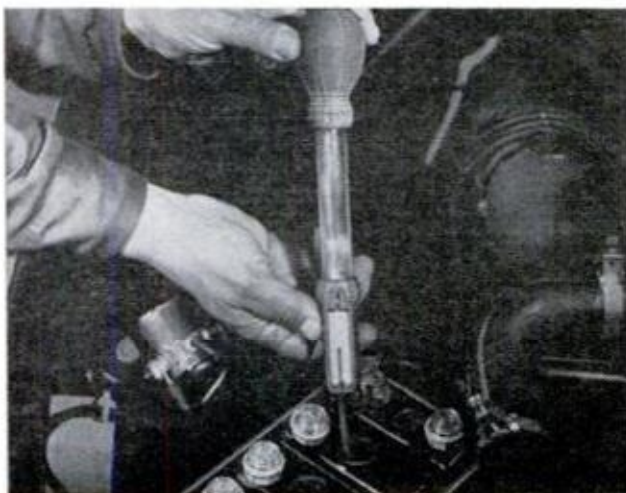
from cell to cell, you can safely say that your battery has outlived its usefulness and should be replaced.

There is a knack to using a hydrometer. Employed the right way, it is an accurate tool—as accurate as a voltmeter (and less expensive), and almost as accurate as a load tester, which mechanics use to determine the serviceability of batteries.

When reading a hydrometer, be sure the float rides free. Record the reading from the scale and return all the electro-

## HOW TO TEST YOUR BATTERY CHARGE YOURSELF

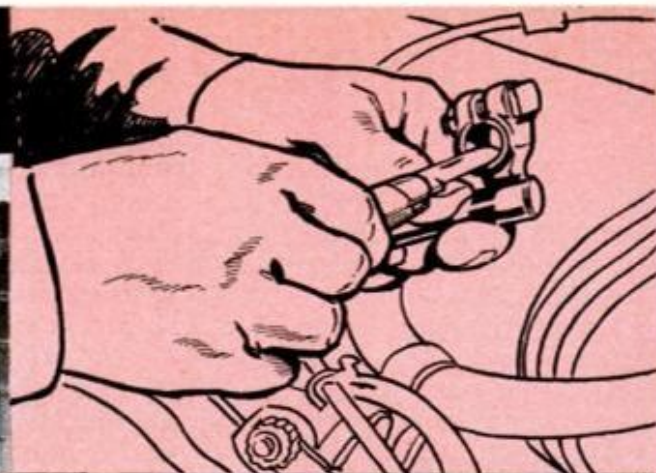
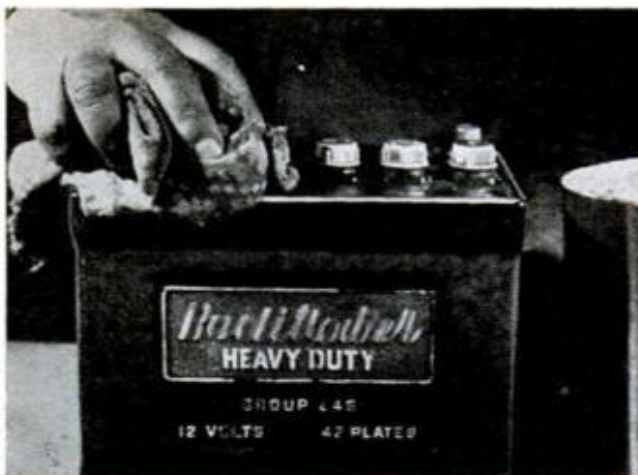
**HYDROMETER IS BEST** inexpensive way to check your battery's condition and state of charge. Squeeze bulb and insert nozzle into cell. Release bulb slowly to draw electrolyte into transparent barrel with float



NOVEMBER 1963

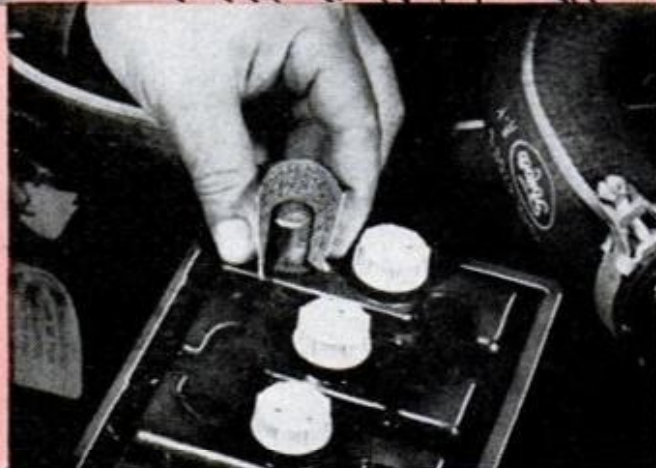
**HOLD AT EYE LEVEL** in vertical position. Jam finger against nozzle to prevent dripping. Electrolyte level should lift float free of bottom without causing it to strike top. Read float's scale at electrolyte level





## CLEANING THE BATTERY

**DISCHARGE** results when battery current follows conducting path across case. To prevent this, dissolve half-pound of baking soda in water and wipe solution over entire battery, including posts (photo above). Take care no soda gets inside cells where it would neutralize the acid. Then, to assure good contact, scrape corrosion and dirt off cable terminals with penknife (sketch above) and brighten posts with emery cloth, as at right



lyte to the cell from which it was drawn. Proceed to the next cell.

Hydrometer readings are affected by the temperature of the electrolyte. Many hydrometers have a built-in thermometer and are capable of recording temperature as well as specific gravity. If yours doesn't, use a separate thermometer to determine the temperature of the electrolyte. Simply insert the thermometer into the cell from which you are drawing electrolyte and record the temperature reading.

For precise specific gravity readings, you should make the following corrections for temperature: *add* .004 to the specific gravity reading for each 10 degrees that battery temperature exceeds 80 degrees F; *subtract* .004 from the specific gravity reading for each 10 degrees that battery temperature is below 80 degrees F.

For example, suppose the hydrometer reads 1.260, but the thermometer records the temperature of the electrolyte as 65 degrees. The true hydrometer reading, then, would be 1.260 minus .006, or 1.254.

Now, what do you do with the readings once you have them? You determine battery condition and state of charge.

To find the condition of your battery, compare the difference between the highest-reading and lowest-reading cells. If this difference is .050 or more, the battery is nearing the end of its life and should be replaced before the coldest weather.

For example, suppose you get readings of 1.230, 1.220 and 1.220 from the three cells of a six-volt battery (for a 12-volt battery, you will have six readings from six cells). The difference between the high-reading and low-reading cells is only .010, indicating that the battery's ability to store and deliver power is okay.

However, if the readings between the cells are 1.250, 1.180 and 1.240, the difference between high-reading and low-reading cells is .070. This indicates that one cell of the battery is extremely weak and that the battery as a whole will soon fail—especially if used in cold weather.

A battery's state of charge—the amount of electrical energy it is storing—is usually expressed as a percentage of full charge. Thus, a battery that is 50 percent charged has about one-half of the electrical power it's capable of storing.

To determine the state of charge of your battery, you should know the full-charge capacity of your brand of battery. To get this information, write the battery's manufacturer or consult a battery reference book at your local battery dealer's shop.

Generally, most American batteries are full-charge rated at from 1.260 to 1.280 specific gravity. European batteries, however, are rated at about 1.240.

To find your battery's state of charge, add up the specific gravity readings of all cells and divide by the number of cells to

get an average. If all cells read 1.260 and the battery is rated at 1.260, your battery's state of charge is 100 percent.

An average of 1.225 indicates the battery's state of charge is 75 percent; an average of 1.190 means a 50 percent charge; 1.155 indicates 25 percent, and 1.110 means the battery is discharged.

If the battery shows a state of charge of less than 50 percent, have it recharged and test it again. Recharging should be done with a low output charger and should take at least 24 hours.

If the recharged battery still doesn't exceed a 50 percent charge, the battery is worn out and should be replaced. If, however, the battery recharges to more than 50 percent, there might be a mechanical cause for its discharging in the first place, and before the coldest months you should track down and correct this cause.

Keep in mind, though, that no battery holds a charge indefinitely—there will be a constant loss of charge although no useful electrical power is being delivered. This standing loss is due to internal chemical action. There is nothing you can do about it, except keep checking specific gravity every month or so, recharging as needed.

Recharging is extremely important to prevent battery sulphation, which is the hardening of the lead sulphate that forms on the positive and negative plates. It occurs more quickly in a battery that is not up to full charge. When a discharged battery is finally charged, the hardened lead sulphate prevents conversion of the plates back to lead and lead peroxide, causing a loss of battery capacity and leading to faster battery wear-out.

Sulphation is also hastened by lack of water inside the cells. For this reason, always maintain the electrolyte level.

A common cause of discharge that you can do something about is external leakage of current. Dirt, foreign matter and spilled

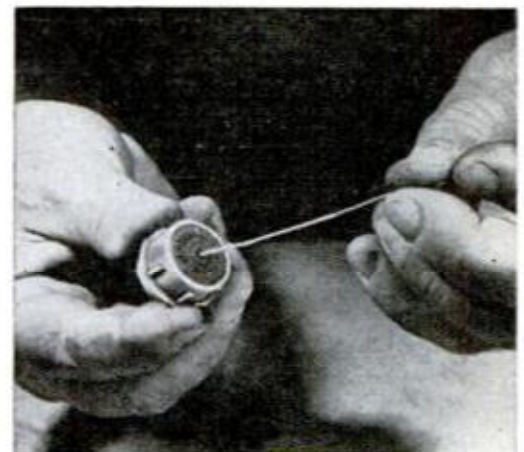
electrolyte on a battery's case provide a conducting path through which the battery can discharge itself, even while standing still. With a 12-volt battery, the percentage of charge lost because of current leakage is four times greater than with six-volt batteries under the same condition.

To guard against current loss, the battery should be cleaned now, before the worst of winter sets in, and about once every three months. Give it a baking soda bath, as shown on page 182. If your battery has much acid on it from spilled electrolyte or from vent-cap fumes, you will notice that the baking soda will foam. When foaming stops, flush the battery with clean water. Repeat the process until a fresh application of baking soda fails to produce foaming, thus indicating that all acid on the battery has been neutralized.

As important as it is to keep the battery case clean, it's just as important to keep battery cables clean, tight and in good condition. These cables must pass current to the starter and the rest of the electrical system. They're connected to the battery by means of terminals which clamp to battery posts, making a solid electrical connection. One cable terminates in the ground of the electrical system, usually the frame or engine block, and the other hooks to a live connection, usually the starter switch.

The battery is unable to deliver power to the electrical system unless cables are capable of carrying the full electrical load. You should, therefore, inspect cables for wear and cracks in the insulation—particularly cables in contact with parts of the car, since these are more subject to chafing. The insulation covering the cables may wear through, creating the possibility of short circuits. A ground cable could also wear, but there is no danger of short circuit, although the cable's current-carrying capacity will be reduced.

**BATTERY VENT CAPS** must be kept free of dirt. If clogged, pressure built up in battery has no way to escape—could bulge the case. Best way to clean caps is with air-pressure hose (left), but if none is available, dig out as much dirt as you can by using wire (right). Cap has holes in both top and underside



## WHEN ELECTROLYTE FREEZES

| STATE OF CHARGE | SPECIFIC GRAVITY | FREEZING POINT—F.* |
|-----------------|------------------|--------------------|
| 100%            | 1.260            | -70°               |
| 75%             | 1.225            | -36°               |
| 50%             | 1.190            | -12°               |
| 25%             | 1.155            | + 3° (PLUS)        |
| DISCHARGED      | 1.110            | +16°               |

Cable terminals that are heavily corroded reduce the effectiveness of the electrical connection between terminals and battery posts. Corrosion could also attack wires beneath the insulation and reduce their current-carrying capacity.

To do away with corrosion on cable terminals, scrape off as much as you can with a knife, wash the terminal with baking soda solution, rinse with clean water and dry with a rag.

As a means of preventing further corrosion—which is the action of acid on metallic parts—apply a protective coating of non-metallic grease to the terminals. Petroleum jelly will serve the purpose. When reconnecting terminals, make sure they are tight.

The battery holddown compartment should receive the same baking soda treatment, since a battery can discharge across its bottom if the compartment is dirty. Also, clean corrosion from battery hold-down bolts. When tightening these, however, do not tighten to the maximum, since a tight holddown bolt can gnaw into the battery case and damage it. Just turn the bolts up snugly.

There are several other reasons why a battery loses its charge. These can be broken down into mechanical and operational causes. If the battery keeps discharging for no apparent reason—and it is clean—look into these possibilities:

### Mechanical

- Faulty or poorly-adjusted regulator
- Short circuit in the wiring (may go unnoticed except for effect on battery)
- Stuck stop-light or truck compartment switch that causes lights to burn constantly at partial or full brilliance
- Hard starting, which drains a battery while the engine cranks
- Worn, stretched fan belt that slips and won't turn generator at proper speed
- Faulty generator.

### Operational

- Insufficient driving to maintain proper battery charge
- Operational errors, such as forgetting to turn off lights, radio or ignition.

The most important consideration you can give your battery during the winter is to keep in mind the temperature at which electrolyte freezes. This depends upon the specific gravity of the electrolyte.

From the chart at the left, you can see that a fully charged battery stands very little chance of freezing, no matter what part of the country you live in. A battery only 50 percent charged, however, has a specific gravity of about 1.190. Electrolyte at such a low specific gravity freezes at about -12 degrees F. This temperature can occur in many northern states.

Sulphuric acid, or electrolyte, acts as a battery antifreeze. The more sulphuric acid in solution in the cells, the safer the battery is from freezing. To obtain this greater concentration of sulphuric acid, the battery should be kept as fully charged as possible.

Keep another important point in mind: in freezing weather, water should *not* be added to battery cells unless you are going to do sufficient driving to enable water to mix with electrolyte already in the cells. Newly added water tends to remain at the tops of cells and will begin freezing at 32 degrees F—the freezing point of water. You should either wait for a thaw to add water, or remove the battery from the car, take it to a warm place, and add water. Then, have the battery charged before putting it back into the car.

What happens when a battery freezes? If you are lucky, the electrolyte will get only semi-hard. You will find some ice forced out the vent holes in the battery caps. Most likely, the car won't start.

Take the battery from the car and place it in warm surroundings for about 12 hours until it thaws out. Fill the cells to level with water and charge the battery before putting it back into the car.

If you aren't lucky, a hard freeze can occur. This will cause the battery case to crack or plates to buckle. Either way, you'll need a new battery.

Another important factor to consider during the winter is the battery's ability to provide power. In cold weather, a starting motor places the heaviest demands on a battery although, if the engine is in good condition and starts properly, this demand is relatively short.

Difficulties of starting in cold weather can be seen in the fact that a fully charged battery at 32 degrees F delivers 65 percent of the cranking power available at 80 degrees F. At 0 degrees F, the cranking power is reduced to a mere 40 percent.

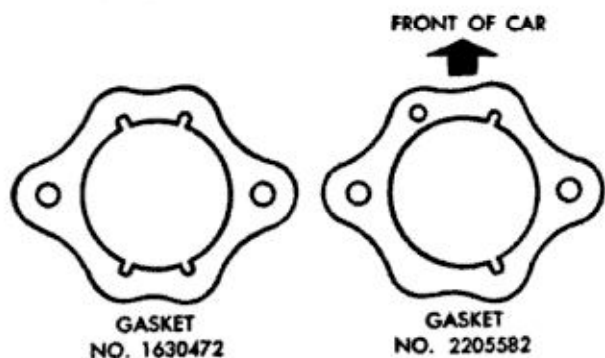
A car's engine at 32 degrees F, requires about 65 percent more starting power than the same engine at 80 degrees F. At 0 de-

[\(Please turn to page 218\)](#)

# AUTO CLINIC

**Q** My 1960 Valiant isn't living up to the ads concerning fuel consumption. Were these ads just a gimmick, or is something wrong?—D.R.H., West Virginia.

**A** We're pretty sure something is wrong. This "something" could also be wasting fuel in other makes—namely '60 and '61 Plymouth six-cylinder cars. Check to see if the correct gasket is installed between the carburetor and intake manifold before making mileage tests and performing tune-ups. On 1960 Plymouth Sixes and Valiants, two gaskets must be used. These carry Plymouth part no. 1630472. Using only one gasket affects fuel economy and prevents proper choke operation. By the way, these gaskets usually come stapled together when you order the part. Remove the staples before installation. All '61 Plymouth six cylinders and '61 Valiants use Plymouth gasket no. 2205582. When this gasket is used, it must be positioned on the manifold as seen in the sketch below.



**Q** I'm buying a new car, and I want to learn enough about auto mechanics to do most of the servicing myself. What books would you recommend?—R.D.R., New York.

**A** First, read from cover-to-cover the owner's manual you will get with the car. Become familiar with the maintenance procedures outlined, since these are the manufacturer's recommendations. Secondly, write to the manufacturer and ask him for a copy of his shop manual—there will probably be a slight charge. This book delves into each individual part of the car and explains what can go wrong and how to repair it. The troubleshooting charts in this book are quite complete. Thirdly, check your library for a good book on automotive mechanics and theory—there are many. This will provide basic information on how an auto functions. (If you want a book of your own, a good, inexpensive one is the Army's Technical Manual

9-8000: "Principles of Automotive Vehicles." Send \$3.25 to Superintendent of Documents, Government Printing Office, Washington 25, D.C.) And, finally, keep reading *PM's Saturday Mechanic!*

**Q** My 1963 Mercury Comet runs swell on an open highway, but the minute it hits a moderately rough road I get all sorts of noise from under the car. Sounds like the exhaust system is banging against the ground. Is this normal?—A.P., N.J.

**A** If your car has an 8-cylinder engine with a 4-speed stick shift, it's normal, but can and should be corrected. The noise is being caused by the engine rear-support leaf spring knocking against the engine rear mount support bracket. It happens in those cars built before March 1, 1963. Take the car back to the dealer for modification. He'll put in a new leaf spring assembly (Part No. C3DZ-6B056-F).

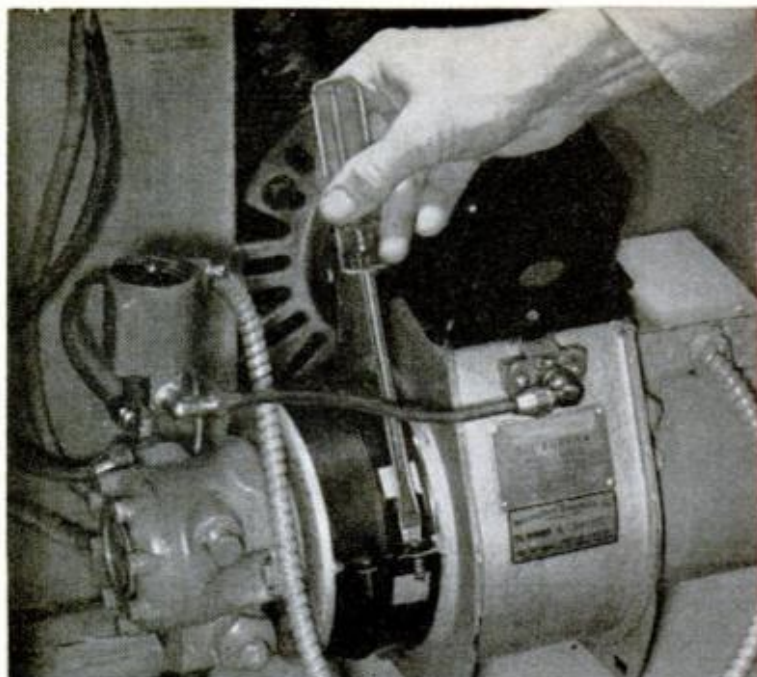
**Q** My Corvair Monza has been a rough idler from the day I bought it. I've checked all the likely causes—carburetor, cylinder pressures, timing, dwell, and so forth—to no avail. Is there something inherent that makes this car idle rough?—C.A.H., Maryland.

**A** There's been no report to indicate an inherent rough idle problem with the Monza. But you've probably overlooked one possible cause: Although hydraulic valves, with which the Monza is equipped, are supposed to stay in proper adjustment, there have been cases where they were originally set too tight. This can cause rough idle. So, have those valves checked and reset to proper specification.

## Service Tips

★ If you find what appears to be rust in your new 1963 Chevrolet radiator, don't worry about it. Chevrolet adds a sealing compound when the car is manufactured. This compound floats about in the cooling system until it eventually becomes lodged and seals those areas where leaks most often occur, such as at hose junction and mating surfaces of castings. Until it settles out, however, this dark brown material looks like rust or oil. Chevrolet says it's harmless and will eventually disappear.

★ Have you heard noise from the power steering pump or noticed a fluid leak on your 1962 or 1963 Mercury or Meteor? Take the car back to your dealer: If the power steering pump is date-coded between D1C and K20C, he'll replace it.



# OIL BURNER TUNE-UP

By E. R. Haan

Spare yourself a costly shutdown this winter by putting your unit in top operating condition now

**O**IL FURNACES seem to have a malicious streak. They usually time their mid-winter breakdowns for the bitterest cold snaps. If you suffered the annoyance and expense of emergency repairs last season, read on for welcome information. And if you *didn't*, don't be too quick to congratulate yourself. That fire-breathin' beast in your basement may be lying in wait for this year's subzero weather. Why risk it? A few hours' time *now* (plus a few dollars) can virtually assure you of trouble-free operation through the winter.

Since almost all home oil burners are of the high-pressure, nozzle-atomizing type that's sketched at the top of the next page, they'll all have similar parts, even though the exact arrangement may vary. To familiarize yourself with your burner's hookup, check it against this diagram. When you can identify all parts, you're ready to start your tune-up.

Choose a reasonably warm day, because the first step is to push down your thermostat to its lowest setting and turn off the cutout switch that controls the electrical supply to the furnace. Better unscrew the fuses, too, just in case someone closes the switch before you've completed the job. While at the switch, inspect the fuses for their capacity rating. Fuses over 15 amps. should not be used.

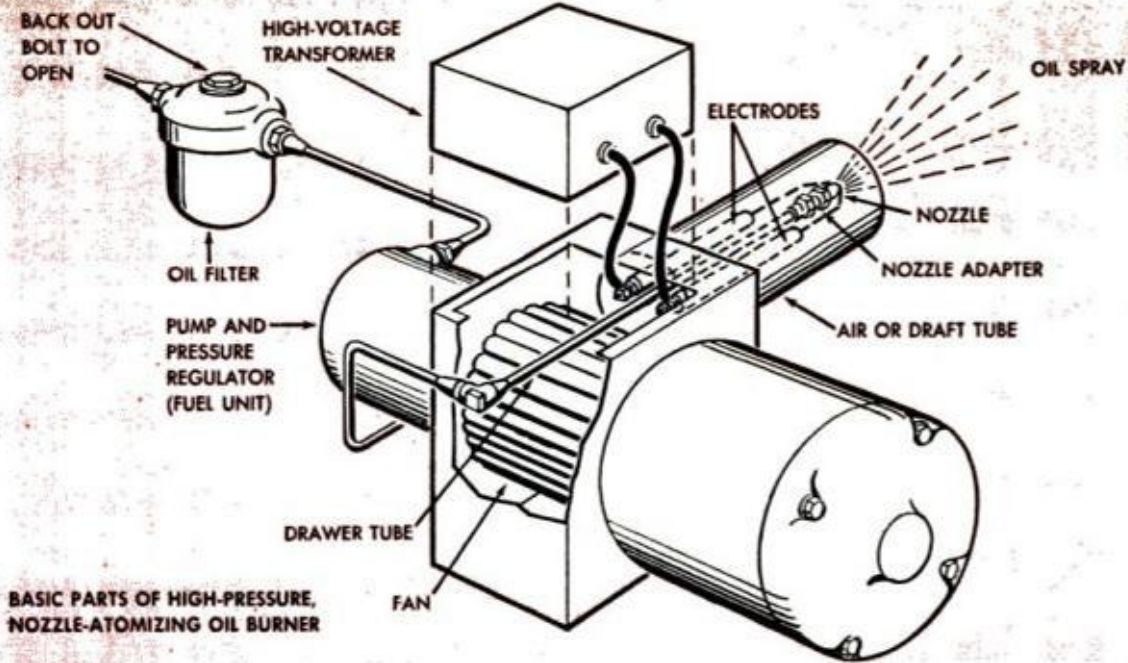
Locate the oil-supply line, look for a shutoff valve and close it. In installations where an oil-storage tank is above the level of the burner there's usually a shutoff valve at the tank end. Some installations have a shutoff valve at the burner end. (In others, where the storage tank is *below* burner level, a shutoff valve often is omitted.) Next, you disconnect the oil line at the burner. This lets you remove

the drawer tube to which the nozzle is attached. Most burners have the ignition electrodes mounted on or at the drawer tube. If the drawer tube and electrodes are attached rigidly to the transformer, you must remove the whole assembly from the burner. On some burners the transformer is hinged so it can be swung over to one side. On others it is located elsewhere on the burner. Usually the drawer tube and electrode assembly can be removed by pulling it backward and upward carefully, as shown, next page. Hold the disconnected end of the tube over a waste rag or small container to take the fuel oil which will run out.

Now, remove the nozzle by using two wrenches, one on the nozzle and the other on the nozzle adaptor—or you can grip the adaptor in a vise and use a wrench on the nozzle. Avoid any damage to the joining ends of nozzle and adaptor as mars or scratches may cause oil leakage. With the average home oil burner it is generally best to replace the nozzle annually, especially if it shows any evidence of having been burned or is heavily coated with carbon. The new nozzle should be of the same size and rating in gallons-per-hour capacity as the old one. You'll find the ratings stamped on the outside. However, if the old one appears quite clean, you can wash it out thoroughly and take a chance on some more service.

For cleaning, carefully turn out the tubular screen and remove the slotted screw and inner part while holding the outside of the nozzle with a wrench. Nozzles have three or four parts depending on the make. Wash them thoroughly, using an old toothbrush, and place the parts on a clean surface to air dry. Don't wipe the



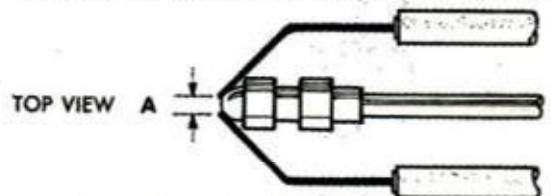


parts with a cloth or paper towel because lint is likely to obstruct the tiny oil passageways. Push a brush hair through the tiny hole in the nozzle cap to make sure it is open, but never use fine wire for this purpose as it may ruin the nozzle. In reassembling the parts be sure to turn the slotted screw down tightly while holding the cap with a wrench.

It is also important to check the adjustment and condition of the electrodes. For proper spark-gap distance and position of the tips, follow the manufacturer's instructions as contained in an installation or maintenance manual. The tips of the electrodes should never be placed in the path of the oil spray. You can make some adjustments by loosening the clamps holding the electrodes. If you have to bend the tips, do this with two pliers as shown below right, to avoid cracking the porcelain jackets around the electrodes.

A common cause of ignition failure is a short circuit between the electrodes through the holding clamps. This is likely to happen when the assembly becomes coated with carbon or the porcelain jack-

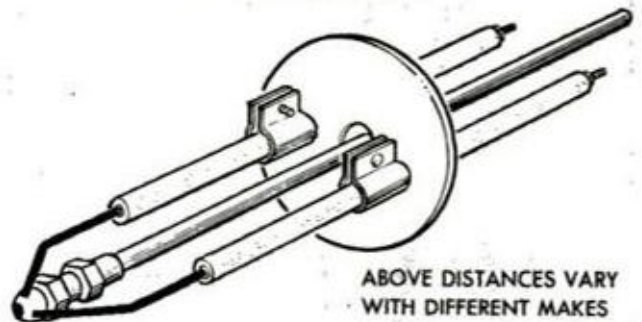
#### POSITION OF ELECTRODE TIPS AND GAP DISTANCE



FROM 1/16" TO 3/16"  
(USUALLY 1/8")

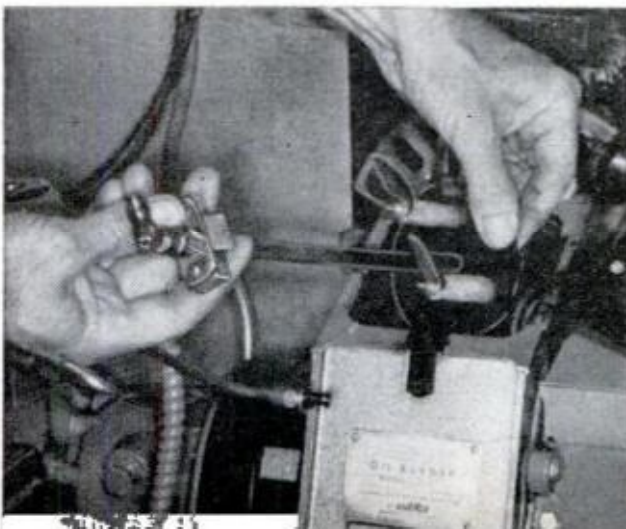


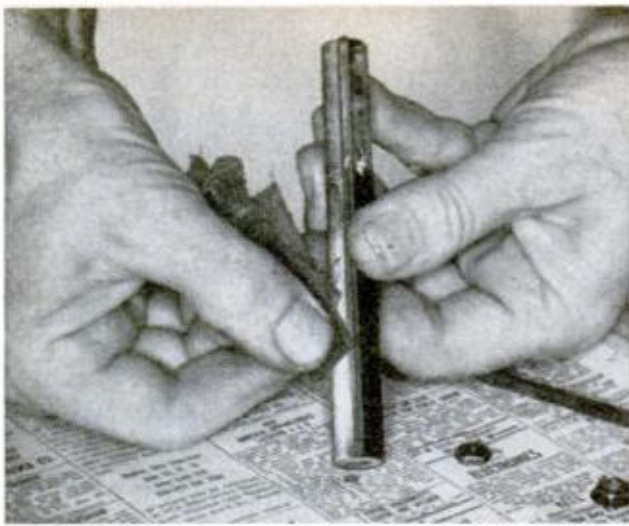
FROM 3/8" TO 9/16"  
TO CENTER OF NOZZLE



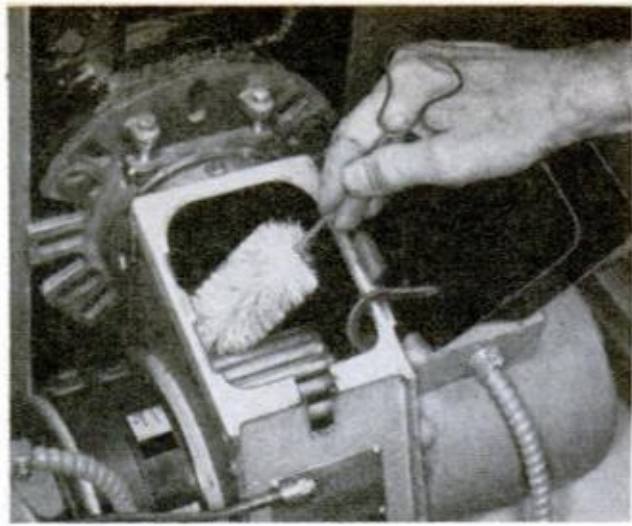
ABOVE DISTANCES VARY  
WITH DIFFERENT MAKES

**BACK OUT** drawer tube assembly (left) for inspection. If electrodes must be bent, use two pliers as at right

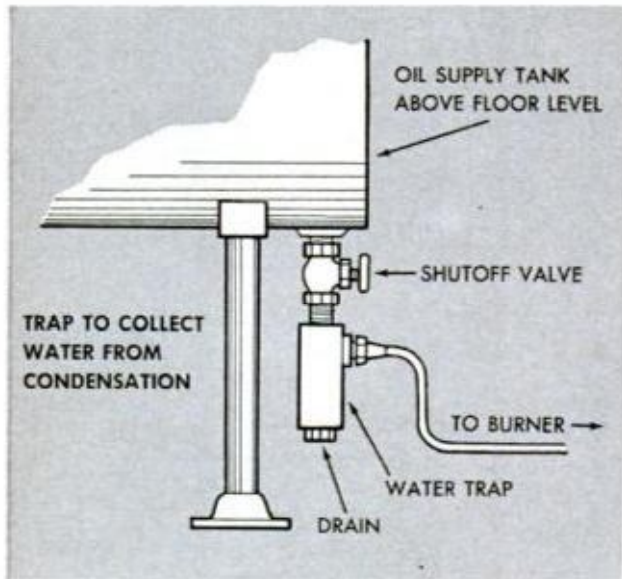




**CARBON COATING** on electrodes may prevent sparking across gap. Remove it by rubbing with emery cloth

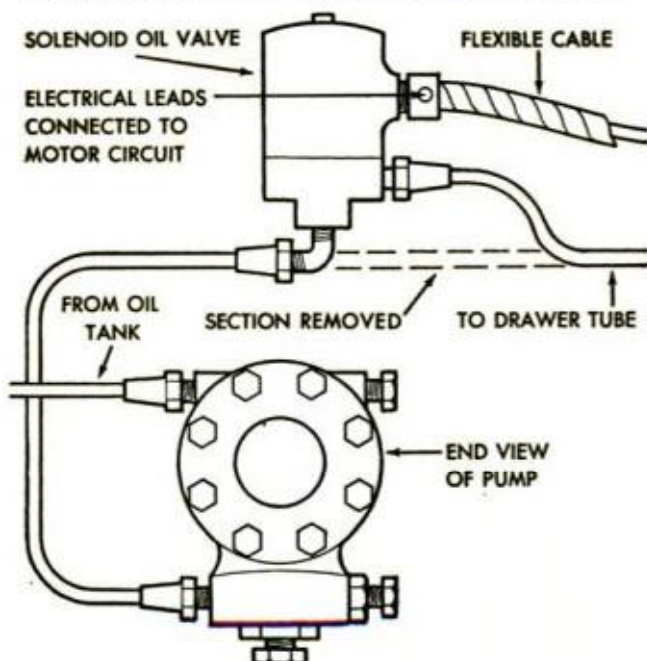


**BRUSH VANES** of burner's air fan to prevent reduction of air supply that's needed for good combustion



**OIL-STORAGE TANK** located above burner level should have water trap to control condensation. Trap must be emptied periodically throughout heating season; just close the shutoff valve and open the drain

**INSTALLATION OF DELAYED-ACTION SOLENOID OIL VALVE**

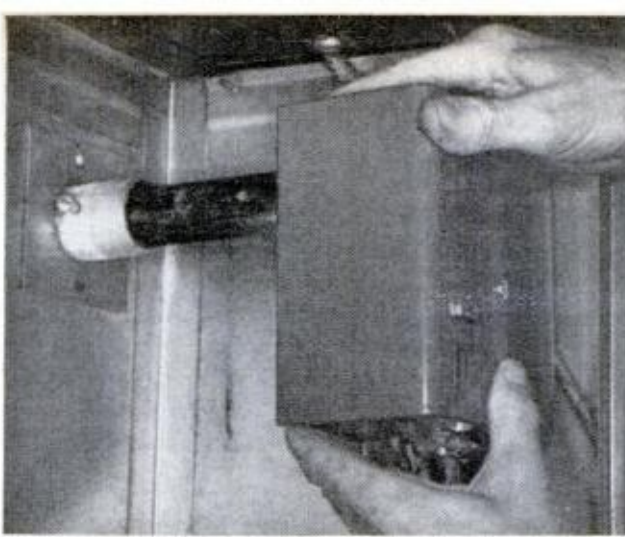


ets are cracked. If the electrodes are carbon-coated, remove them, wash in gasoline and then clean the surface with emery cloth as shown above left. An electrode having a cracked jacket should be replaced with an identical unit.

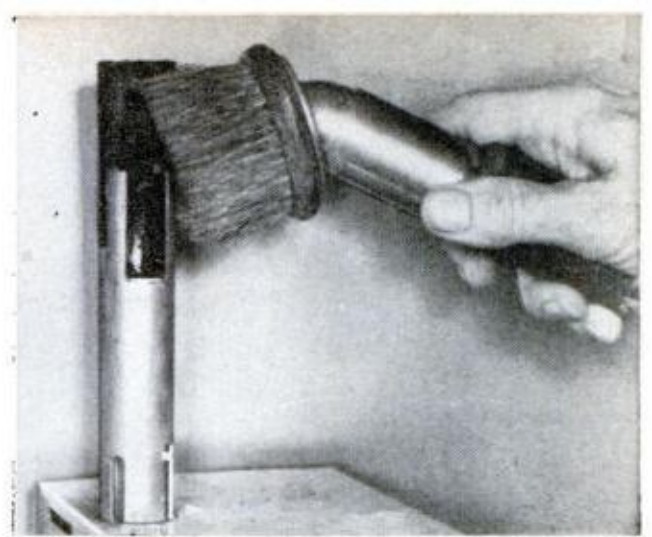
Test for a good spark by connecting the high-voltage leads or terminals of the ignition transformer (if not already connected) so that you can see the spark gap. Disconnect the primary leads of the transformer where they connect to other leads such as those of the motor circuit—usually in a junction box. Then momentarily touch the two bared ends of a plugged-in extension cord to the ends of the primary leads. This should cause sparking at the gap. Take care not to touch the extension-cord leads together or you'll have a short circuit and blow a fuse. If no spark is produced, one or both electrodes may be faulty, the leads to the transformer may be open, or it may be defective.

While the drawer tube and electrodes are removed, clean the vanes of the blower fan. If you've noticed excessive soot on the nozzle, drawer tube and electrodes while cleaning these parts, check if there is any evidence of oil seepage into the draft tube—the tube surrounding the drawer tube. No oil should be present here, as it will volatilize and burn while the burner is operating or immediately afterward.

First, check for indications that the oil comes from the joint between the nozzle and nozzle adaptor; a perfect fit is required here. This check should be made before cleaning the nozzle and drawer tube. You may have to replace the adaptor if the end is marred from changing nozzles. If there's no leakage here, the oil must be coming from the nozzle tip. The best remedy for this is to have a serviceman install a delayed-action solenoid oil valve as in the sketch at left. This pre-



**STACK THERMOSTAT**, attached to back of primary control, pulls out of furnace (or flue) for cleaning



**EXCESS SOOT** on tube acts as insulation, prevents proper function of thermostat. Clean with soft brush

vents seepage of oil from the nozzle when the motor is first turned on and atomizing pressure has not yet been reached. Also, the valve will close before the motor slows down and atomizing pressure dies.

After putting the drawer tube and ignition assembly back in place, and tightly connecting the oil line to the drawer tube, you replace the cartridge of the oil filter. If your installation does not have such a filter, have one installed, unless there is an oil strainer at the fuel unit. To replace the cartridge, set a pan under the filter to catch any oil that may drip out when you loosen the bowl by removing the single nut or bolt, as the case may be, at the top. Discard any oil in the bowl, clean it and insert the new cartridge. When reassembling, be sure that the gasket between bowl and top is clean and not mutilated. A defective gasket should be replaced. The nut at the top must be turned down tightly to prevent oil leakage.

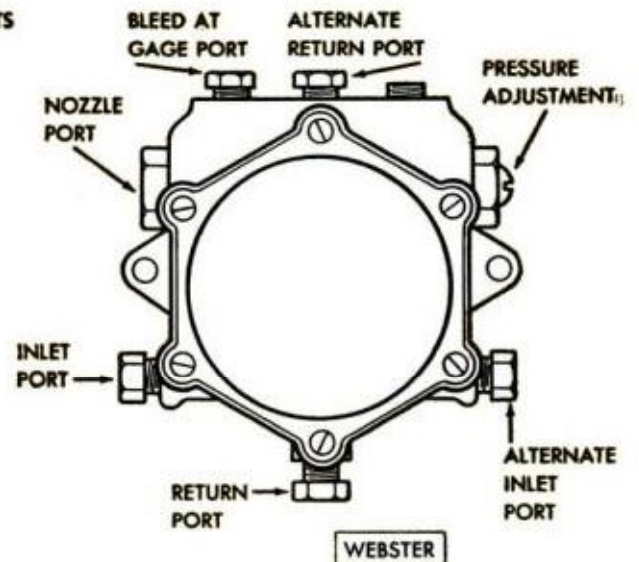
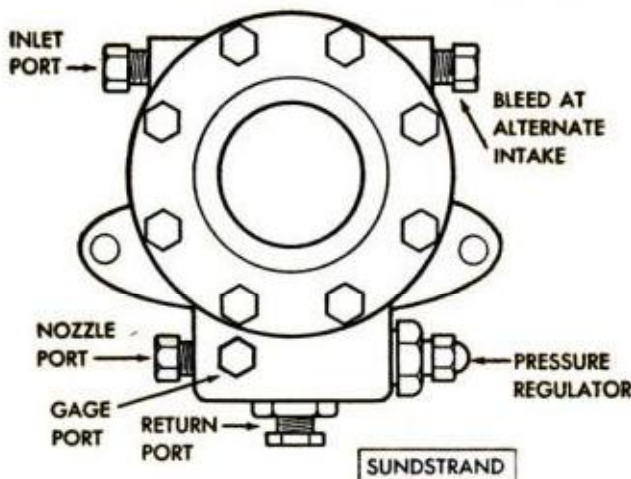
Some burners have a strainer at the intake port of the fuel unit. Its cover or cap often is stamped with the letter S. Remove

the cover and wash the strainer with gasoline. If extremely dirty, take it apart, keeping the parts in their order of assembly, and clean them individually. If the gasket under the cover is defective, replace it. The screws holding the cover must be tightened uniformly to prevent strain on the parts and to obtain a leakproof fit.

Next, locate the stack thermostat which is attached either to the furnace or to the flue. Often it extends from the primary control unit which includes the safety devices that shut down the furnace when anything goes wrong. Loosen the setscrew on the tube extending from the back of the unit to remove it for cleaning.

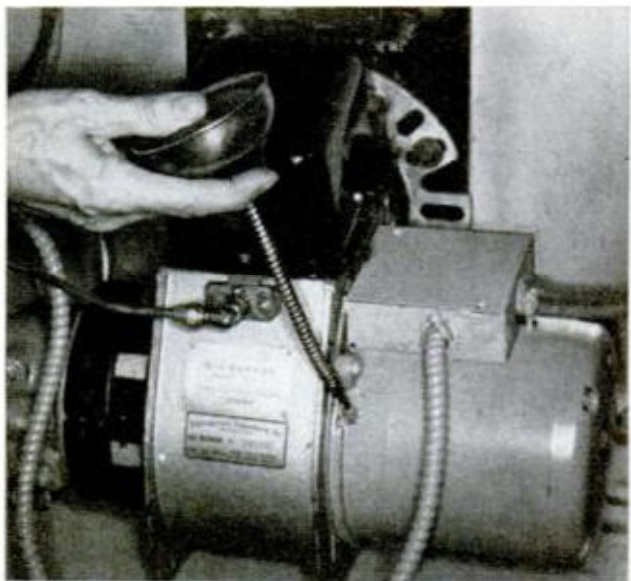
Lubrication, as demonstrated on the next page, should be done now, and twice more during the winter. If a warm-air fan is accessible, the vanes should be cleaned thoroughly as was done at the burner air fan. Also examine the fan belt and tighten it if necessary. This belt, when properly tightened, can be moved easily by finger pressure about an inch out of its straight path between pulleys. With a warm-air

**END VIEWS OF THE TWO TYPES OF FUEL UNITS SHOWING PORTS TO OPEN FOR BLEEDING**



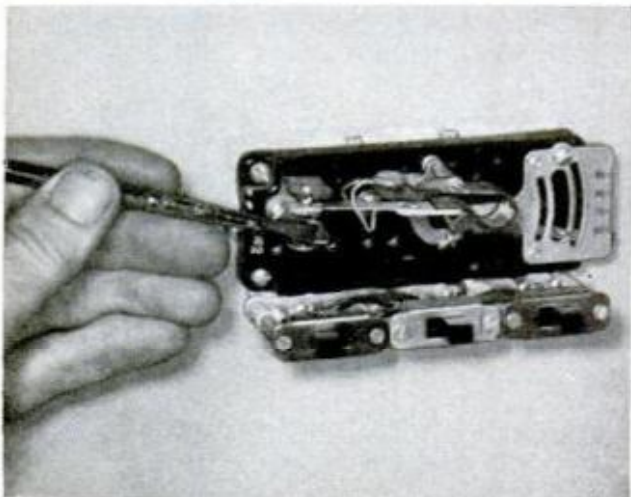


**GARDEN HOSE** can be connected to vacuum hose for access to restricted furnace cleanout openings, as shown above. Same setup is used to clean out housing or flue into which stack thermostat slides



**FOR LUBRICATION**, apply three or four drops of No. 10 non-detergent motor oil to bearings of burner motor (above) and to motors of warm-air fan or water circulator—and also to bearings of fan itself

**ROOM THERMOSTAT** must have clean contacts. Remove its cover, blow out dust and stroke contacts with soft artist's brush as shown below. Never use an abrasive such as emery cloth or sandpaper on contacts



furnace, replace dirty air filters and clean the contacts of the room thermostat. It's also a good idea to remove the thermostat from the wall to see if the hole where the wires pass through allows cold air in the partition to influence the operation of the thermostat. You can correct this trouble by plugging the hole with putty.

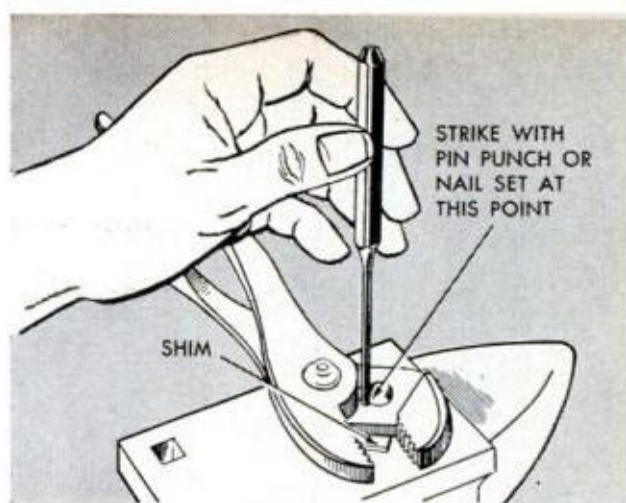
If your tank is not equipped with a water trap you can control condensation by means of an additive put into the oil. This absorbs water and allows it to pass through the burner in minute particles that will not interfere with combustion. Consult your oil dealer about the amount of additive required in proportion to the oil. It is best to put this into a full tank before cold weather sets in. Water that gets into an exposed oil line from an outdoor tank above ground often freezes and stops the oil supply. During extremely cold weather oil may even congeal in the line. Insulation wrapped around the line will help prevent this serious condition.

Once you've finished your tune-up, open the shutoff valve in the oil line, turn in the unscrewed fuses, close the furnace cutout switch, and set up the room thermostat slightly above room temperature which should cause the burner to start. If it does not start, press the reset button on the primary control unit and then check for blown fuses. If the burner motor runs but no flame is established, or if the flame stops while the motor is running, check the oil supply first. If this is adequate there may be an air lock in the oil line. This will cause the flame to stop or cause flame variations. The remedy is to bleed air from the line. To do this you turn off the cutout switch and remove the unused inlet plug from the fuel unit, or the plug used to get a pressure-gauge reading—which ever is at the top of the unit (see sketch, page 189). Then close the cutout switch so the motor starts and oil flows out of the opened port and into a waste rag or container. When oil flows, stop the motor, reinsert the plug and tighten it.

Oil-burner flames should be smokeless, with orange tips. A smoky flame is caused by too much air and will deposit soot. Too little air produces a white flame and carbon monoxide. The amount of air needed for good combustion is regulated by either a lever or a slotted ring which can be loosened with a screwdriver, as in the photo on page 186. When the automatic controls of an oil burner stop its operation, the trouble usually can be traced to a dirty flue thermostat, faulty nozzle, lack of oil, or short-circuited electrodes. Always press the reset button after the automatic controls have stopped the furnace and the trouble has been corrected. ★★★

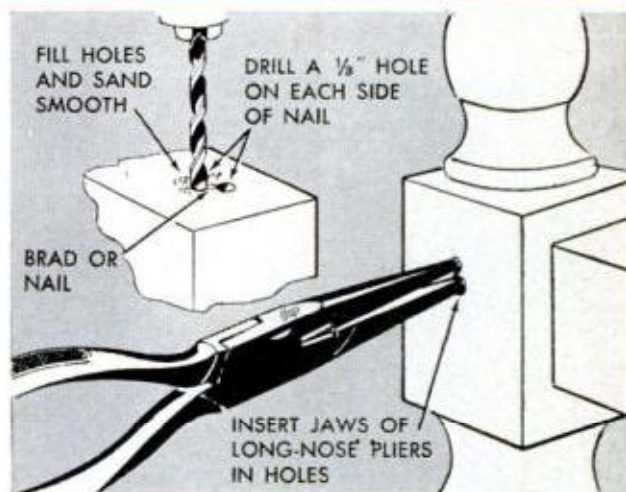
## Slip-Joint Pliers Slipping?

Slip-joint pliers of the type pictured do eventually wear to the point where the jaw slips out of place when you grip something, particularly in the first position. Remedy is simple: lay the pliers on an anvil—any solid surface—shim the jaw to level it and strike with a pin punch or a nailset at the point where the overlapping holes form a projection, as indicated in the detail. One sharp blow on the punch usually will upset the metal sufficiently to prevent the jaw from slipping out of place when you take a grip.



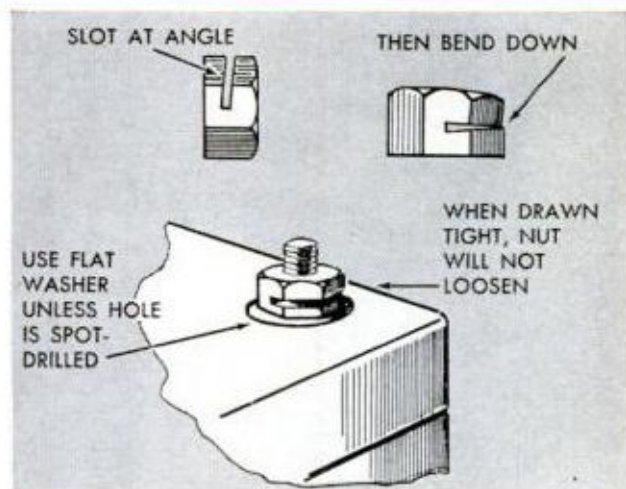
## Go in After That Brad!

On some old pieces, old chairs for example, you'll likely find the tenoned rails cross-pinned with a brad or small nail. Getting this brad or nail out when you have to disassemble and reglue the parts can pose quite a problem. One solution is to drill  $\frac{1}{8}$ -in. holes, one on each side of the brad or nail to a depth of about  $\frac{3}{16}$  in. Then insert the jaws of long-nosed pliers into the holes, grip the head of the brad or nail and ease it out. Fill the holes with a suitable wood filler and sand smooth.



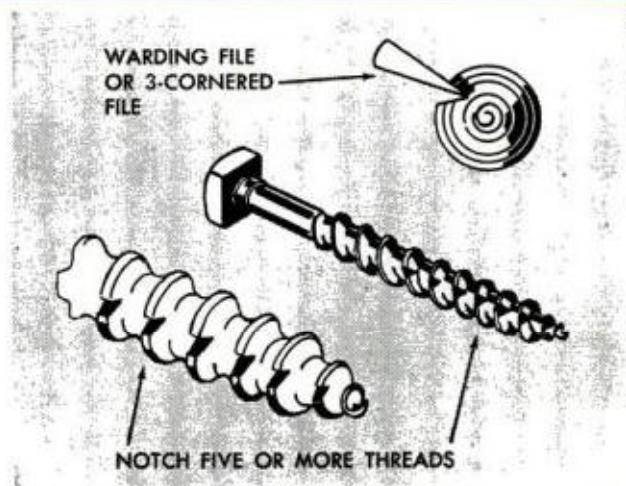
## Shake-Proof Locknut

Need a real shake-proof locknut in a hurry? To save the time of going after one, or hunting for a second nut to run down on the first, just slot the original nut with a hacksaw, bend the slotted half down as indicated and turn onto the threads tightly. It won't let go, even under severe vibration. Be sure you slot it at a slight angle as shown, using a fine hacksaw blade. This trick is suitable for use on hex or square nuts from about  $\frac{5}{16}$  in. up to  $\frac{3}{8}$  in. Use a coping saw on smaller sizes.



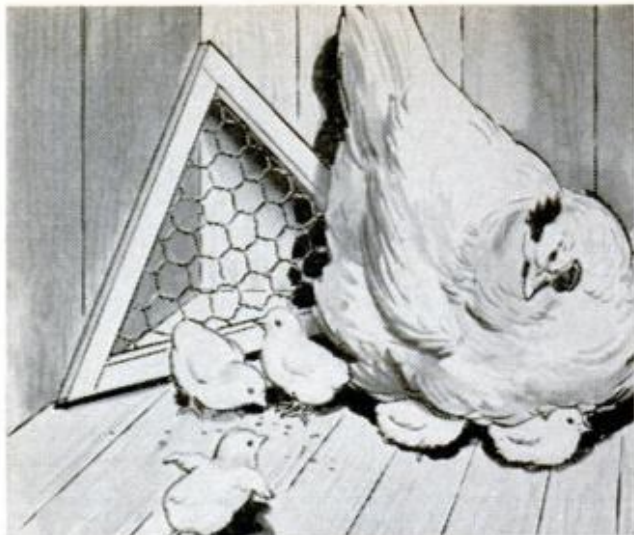
## Self-Tapping Lagscrew

It's nearly impossible to turn lagscrews into some hardwoods unless you drill a hole very nearly the pitch diameter of the threads. Then the screw may not hold. Another way is to make the screw cut its own threads much like a wood tap. Using a warding file or a three-cornered file, notch five or six threads from the point of the screw up, filing the notches at an angle as in the end view. Then when the screw is turned in, the leading edges of the notches will cut threads in the wood, making it a lot easier to turn.



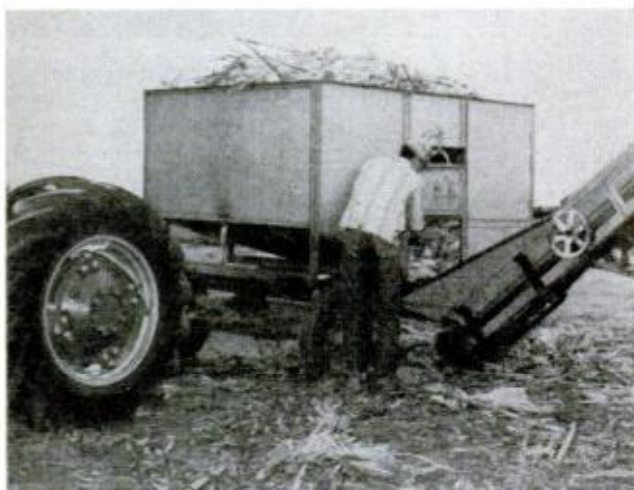
## Frames Protect Chicks

After several baby chicks died of suffocation when they were crowded into the corners of the coop, I built guards to close off the corners. I made these in the form of triangular frames, using 1 x 2s half-lapped at the corners and woven chicken wire. I placed one frame in each corner of the coop and since doing so, have eliminated bird losses due to crowding and suffocation.—*Ann Zawistowski*



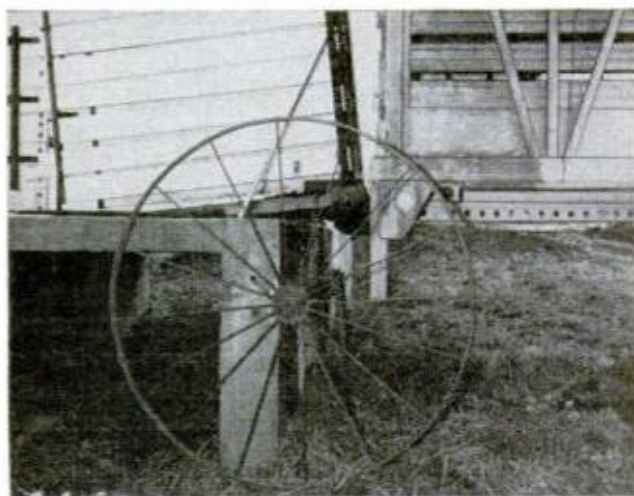
## Hoppers Speed Work

I used to spend considerable time when unloading ear or shelled corn into an elevator. It was necessary to drive the wagon onto a jack, unhook the tractor and then lift the front end of the wagon so that it could be unloaded. Recently, I began using hopper wagons. Now all I have to do is drive alongside the elevator and let the corn roll out. The job has become a fast and easy one since there is no longer any need to unhook the wagon and jack it up before unloading.—*Elmer Moses*



## Adjustable Chute

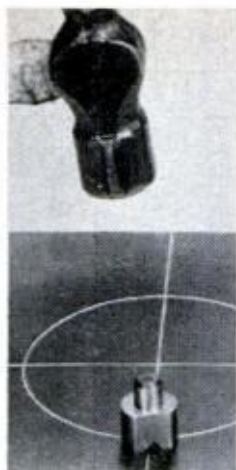
When loading a truck from a chute you will find the job an easy one if the chute floor is at the proper level for the truck bed. A large wheel connected to rack-and-pinion gears makes it possible to adjust the chute to the required height. The adjustment is great enough to handle anything from a farm trailer to a semi-trailer truck. The rods that brace the sides of the chute are adjustable. They can be lifted to allow the sides of the chute to swing out of the way so that the truck doors may be closed before leaving the dock.—*Howard Beatty*



## Rod Saves Corn

When you are working with a corn-picker it is almost impossible to avoid running over some of the corn, especially when you find it necessary to back the machine. This needless waste of crops may be minimized by attaching a  $\frac{3}{8}$ -in. steel rod to the cornpicker. The rod can be either bracketed in place or welded if suitable equipment is available. It is secured to the underside of the cornpicker snout and extended beyond the rear wheel to a brace. The rod acts as a guard that pushes the plants away from the rear wheel when the machine is backed.—*Wilbert Frye*





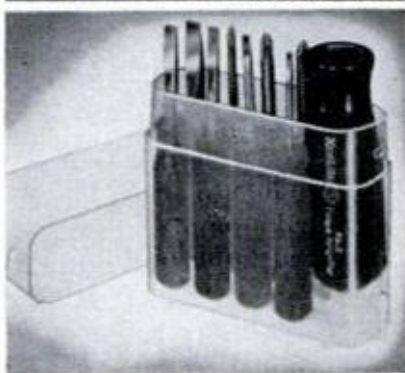
## By Arthur J. Maher

**HAIRLINE ACCURACY** in placing layout marks is said to be easy with this optical center punch. After scribing the work surface, you line up the bushing magnet by means of an eyepiece, then insert the punch and tap. Retails for \$11.10, from Spray-on Products, Inc., 26300 Fargo Ave., Bedford Hts., O.

**MIDGET SCREWDRIVERS** come in a set of 5 slot-tip (3/32 to 1/4 in.) and 3 Phillips (Nos. 0, 1, 2). A special handle is also supplied, to be slipped on when extra torque is required. Sold in pocket plastic case for \$6.25. Excelite, Inc., Orchard Park, New York

**NEW WRENCH** speeds jobs on any tubing line assembled with flare nuts. One end is a standard six-point box for final tightening, the other (below) a ratcheting opening. Sizes are 3/8, 7/16, 1/2 and 9/16 in., priced from \$2.50. Bonney Tools, Alliance, O.

**ONE-HANDY GREASE GUN** is a heavy-duty, refillable unit that could pay for itself in saved car-lube expenses. Handles easily, develops high pressure. Sells for \$10.95 with hose and all-purpose coupling. General Grease Corp., Box 7243 Kansas City, 13A, Mo.

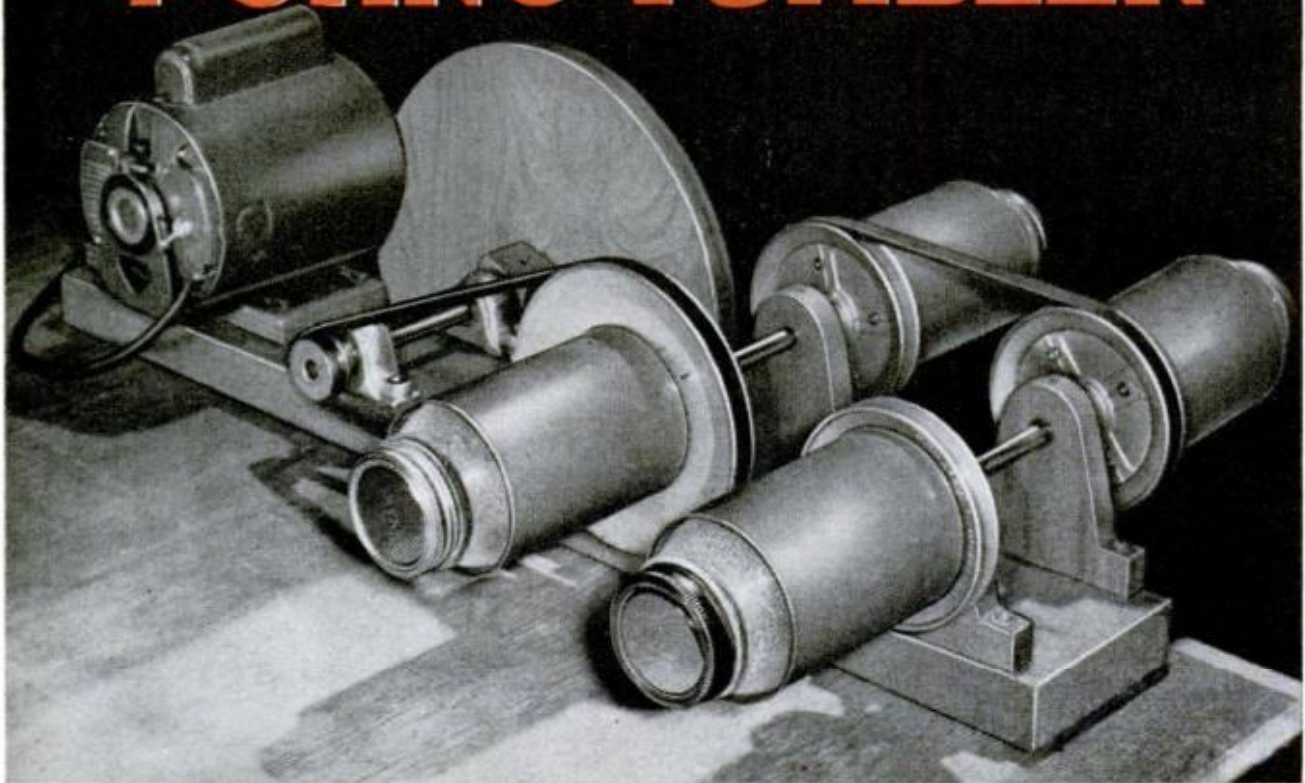


**COOL GRINDER:** Instead of solid grinding wheels, this machine uses small abrasive belts supported by inflated rubber wheels. This reduces heat build-up in the object being ground. Also permits faster stock removal. Prices start at \$59.50 each, from Nu-Matic Grinders, Inc., 875 E. 140 St., Cleveland 10, Ohio

**PORTABLE 5-GAL. MIXER** can be powered by any 1/4-in. electric drill. Manufacturer claims it will mix enough mortar or concrete for small construction and repair jobs as fast as a man can use it. Inside of drum is equipped with fins, to assure thorough mixing. Costs \$10. MIXIE, Box 158, Mooresville, Ind.



# QUART-SIZE 4-GANG TUMBLER



**ROUND AND ROUND** go four quart jars of small metal parts—or gemstones. Abrasive agents (or steel balls) do the polishing and burnishing. Unit is set at edge of table so flywheel can extend below mounting base

**T**HE LAZY WAY to remove burrs, sharp corners, rust and machine marks from small metal parts is to load them in a rotating container with steel balls or a granular abrasive. Since the burnishing is automatic, it spares you tedious hand work. And tumbling is often more uniform and thorough.

The system has long been used for polishing gemstones, since this must be a slow, steady process stretching over days or weeks. With this ganged tumbler, you can work four different materials at once—or charge the four containers with various types of burnishing or polishing abrasives to take care, simultaneously, of several stages in the treatment of a single material. Lazy? Let's just say practical.

Each jar is filled from one-half to two-thirds of its capacity with a "charge". The burnishing or polishing additives vary in volume up to twice that of the work. The jars rotate approximately 34 r.p.m. to give a tumbling speed of about 60 surface feet per minute (s.f.p.m.) for quart fruit jars.

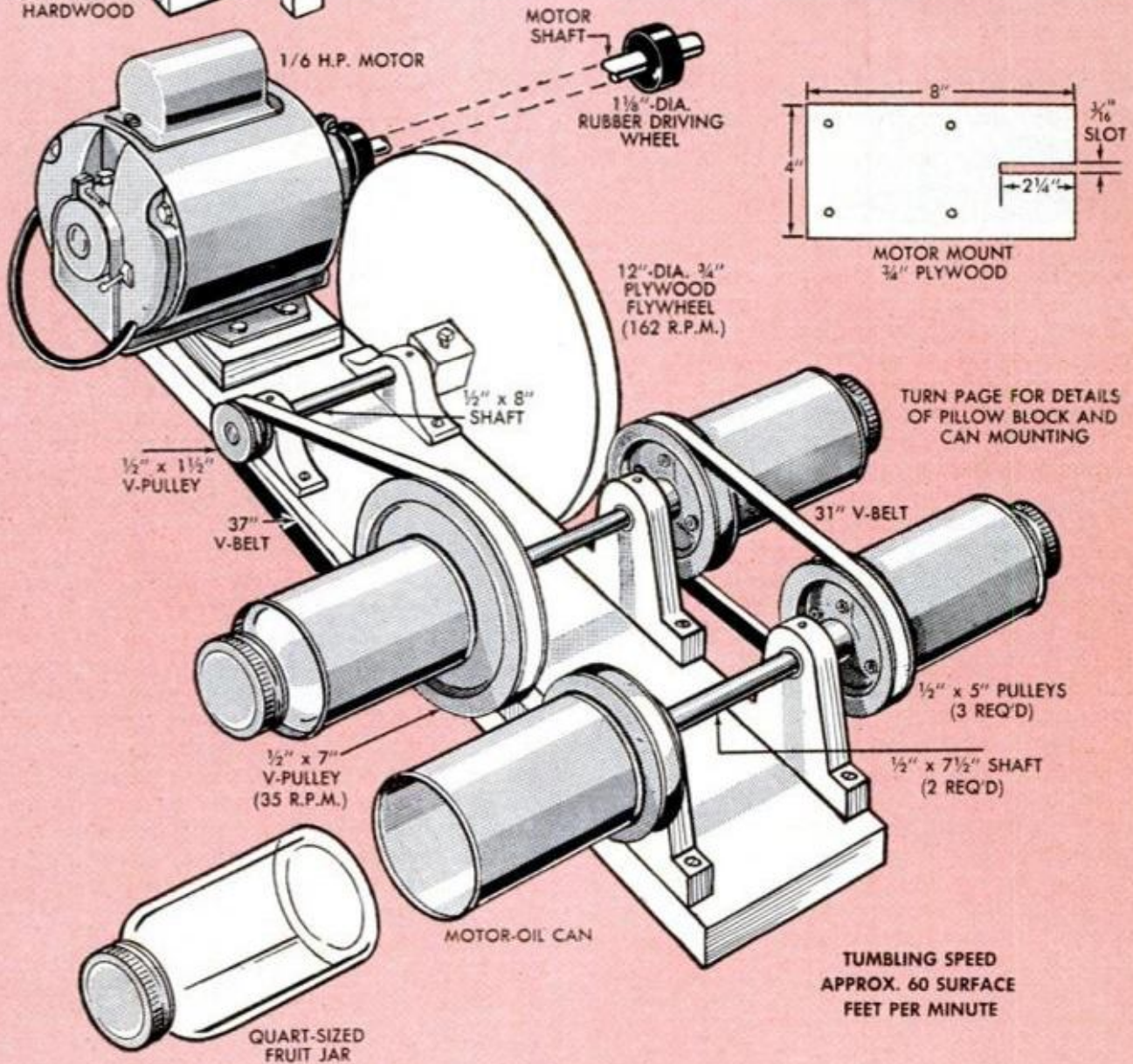
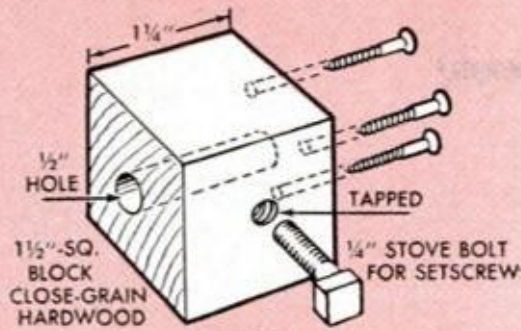
To make the tumbler, start with the base, locating the positions of the three shafts as shown at the bottom of the next

page. Then cut the 12-in. plywood flywheel which is to be driven by friction from a 1 $\frac{1}{8}$ -in. rubber wheel on the motor shaft. Or, you can substitute 14-in. and 1 $\frac{1}{2}$ -in. V-pulleys plus a V-belt. The latter arrangement will result in less vibration and noise than a plywood wheel having slight peripheral irregularities. Next, cut wooden pillow blocks (detail page 196) and fit them with brass bushings, drilled to admit oil. Screw the blocks to the base at the positions indicated and fit with shafts. Or substitute two grinder heads.

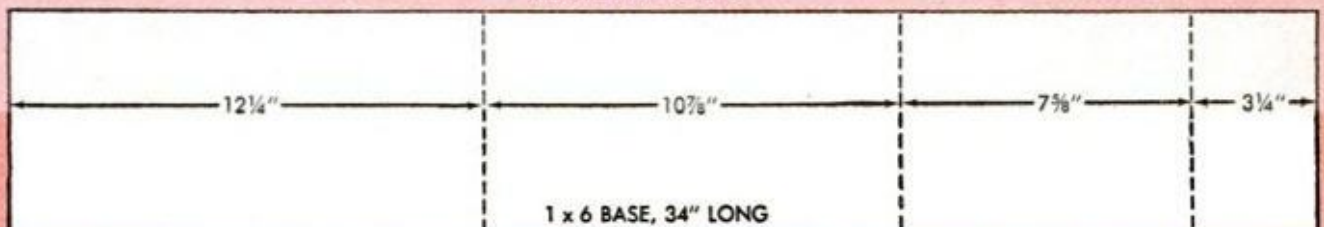
One 7-in. and three 5-in. V-pulleys are used for mounting the cans. The tops are removed with a rotary can opener. Sandwich the bottom of each can between a pair of  $\frac{1}{4}$ -in. hardboard disks turned for a snug fit inside the can. One disk has a stepped edge to fit over the beveled portion adjoining the flat center area of most 5-in. pulleys. You can turn some or all of the disks at the same time by mounting them on a threaded arbor. As fruit jars sometimes vary slightly in diameter you must select jars that fit the cans properly. Both round and flattened jars can be used. The corners on the latter aid in turning

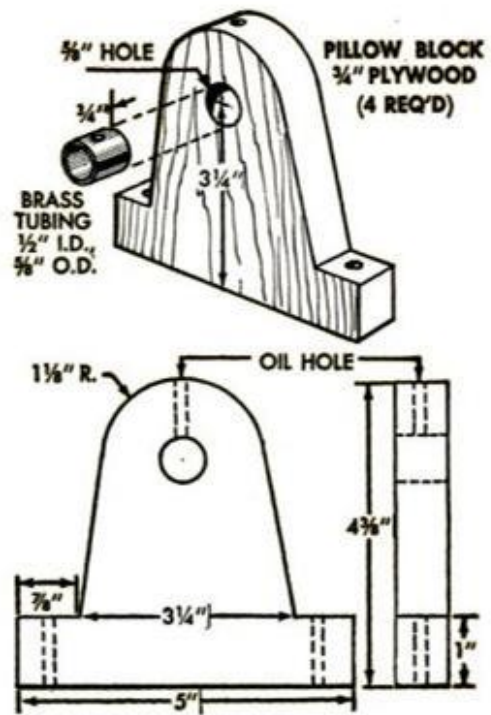
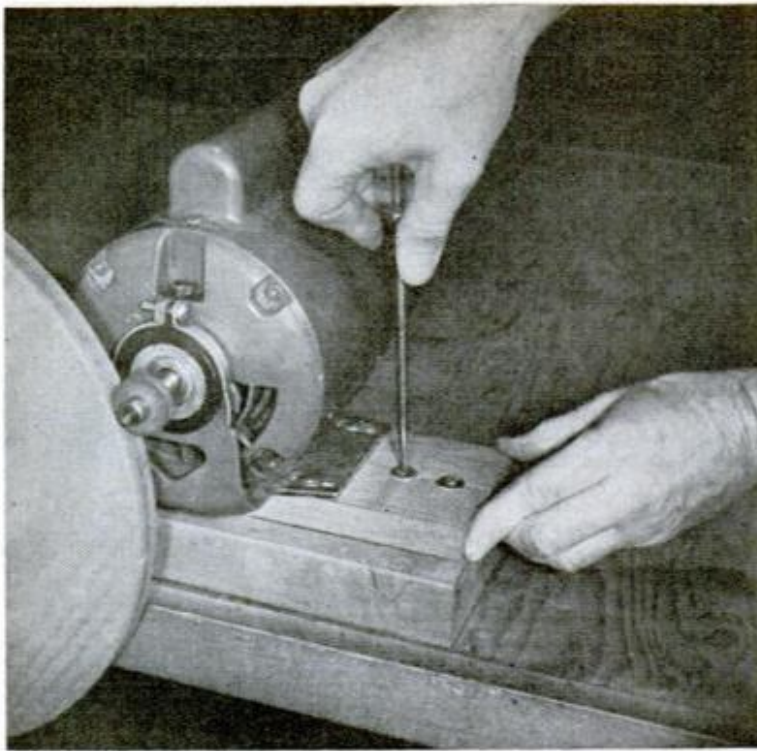


**REMOVABLE JARS** fit snugly in oil-can sockets bolted at centers of the four pulleys. Friction keeps jars revolving as cans turn, yet jars pull out easily for loading and unloading tumbled items



DOTTED LINES SHOW CENTER-TO-CENTER SPACING OF SHAFTS





over the charge as the jar rotates.

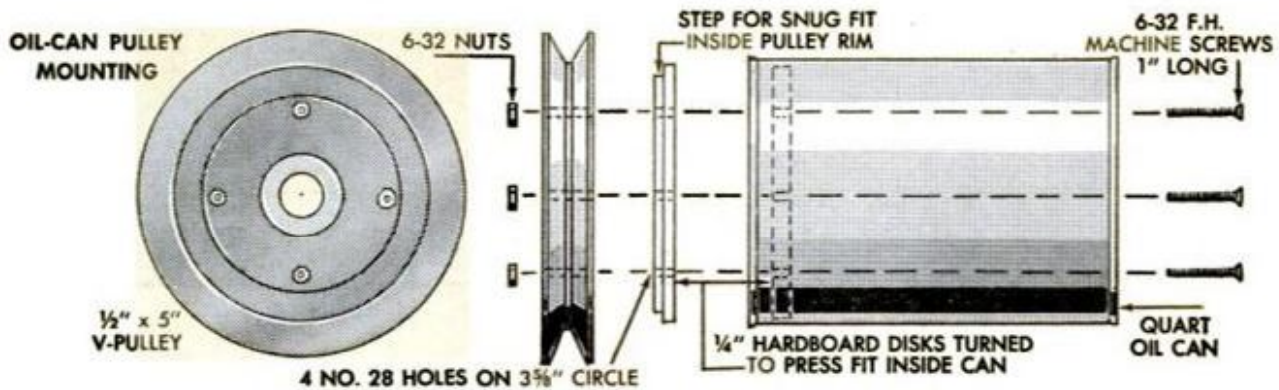
A 1/8-hp. motor was used on the model shown; it was fastened to a 4 x 8-in. piece of 3/4-in. plywood slotted to pass two wood screws which position it (photo above).

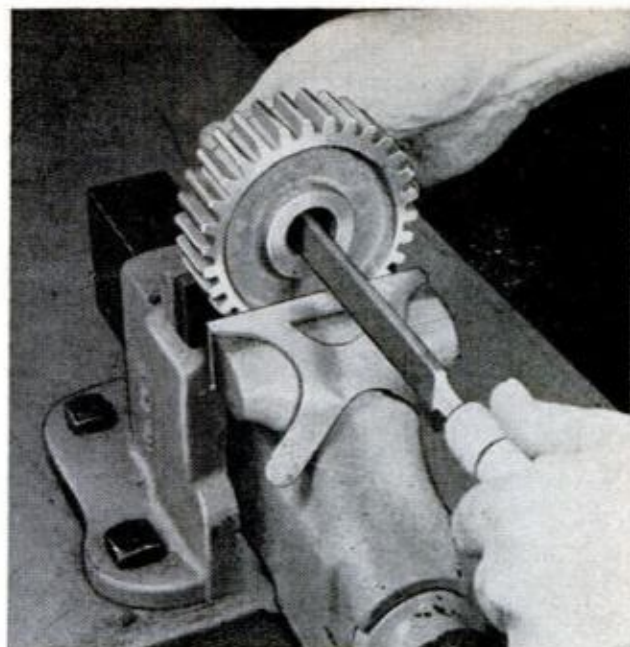
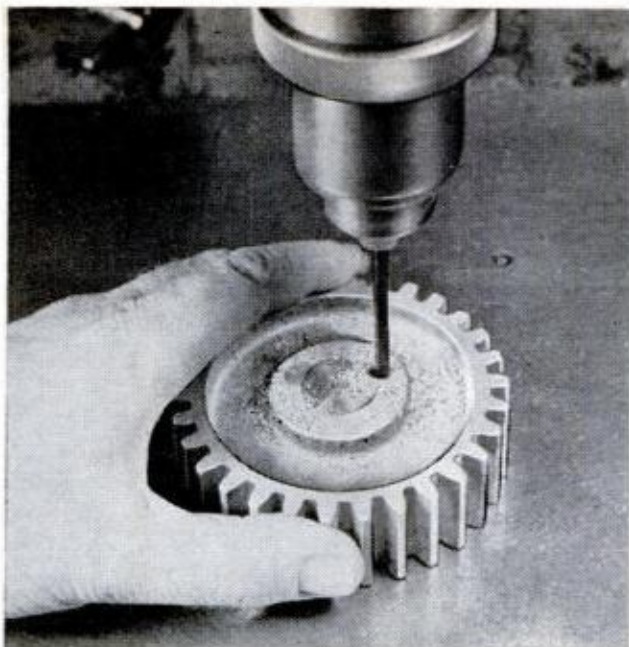
Tumbling speeds vary with the materials being finished. For polishing gemstones of the baroque or cabochon types (with suitable abrasives), a speed of 60 s.f.p.m. is sufficient. The first three or four consecutive polishing operations each require about 50 hours of tumbling at the above speed, and the final fine polishing step requires from 120 to 150 hours. For light burnishing of metal parts with hardened steel balls, which is the conventional technique, a tumbling speed of about 90 s.f.p.m. is used. For more vigorous action the speed may be increased to 250 s.f.p.m. To obtain speeds in excess of the 60 s.f.p.m. on the gang tumbler shown here, you simply put a larger pulley or rubber wheel on the motor shaft.

The abrasives used for polishing gemstones usually are silicon carbide, Nos. 100, FFF, 600 and 1200 grit, and tin oxide

for final polishing. Successive tumblings use progressively finer abrasives. The work must be washed thoroughly after each operation to prevent coarse abrasive grains from getting in with the finer ones. Tumbling is done either wet or dry. Besides the abrasive, the charge may contain chips of wood, pieces of felt, leather, cast iron, steel slugs or steel balls. In the first stage of gemstone tumbling the addition of iron screws (about 20 percent of the charge) has been found to decrease tumbling time from 15 to 20 percent.

In burnishing small metal parts with hardened steel balls, a rolling and hammering action replaces abrasive wear. The balls flatten the minute ridges on the work surfaces. Small balls contact more surface area than larger balls but also have less impact. Therefore you use the largest balls practical for the work. The volume of balls should be about twice that of the work. Soapy water is added until it stands slightly above the level of the charge. Frothing can be prevented by adding a few drops of liquid detergent. ★ ★ ★





## An Easy Way to Make Accurate Keyways

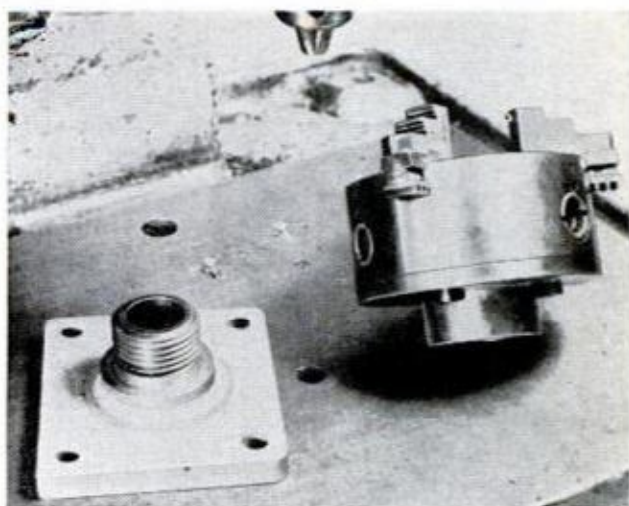
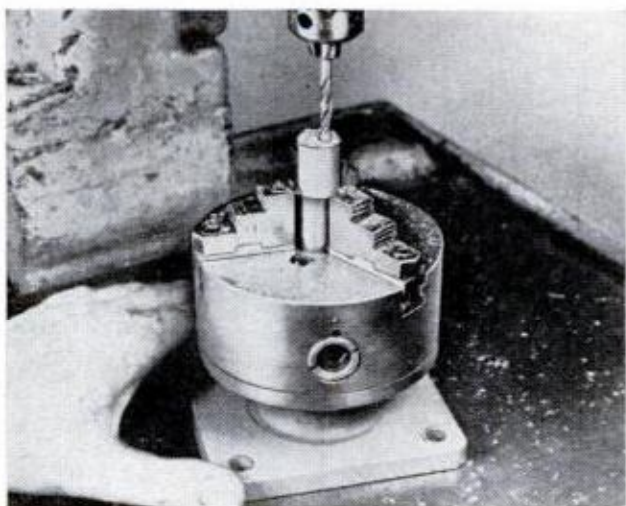
Even for the skilled machinist, filing an internal keyway to an accurate fit and perfect alignment is a very difficult task. The job can be greatly simplified by using the method shown in the photographs above. The first step is to turn a metal plug to fit snugly inside the bore of the gear or pulley in which the keyway is to be made. After driving this plug into the bore, drill through both the plug and the workpiece exactly on the joint line of the

two parts. Then remove the plug and place the gear or pulley in a vise. With some careful filing you will find that it is surprisingly easy to make the semicircular groove square. It is important that the drill diameter be exactly the same as the desired width of the keyway, although any slight misalignment of the groove with the shaft keyway can be corrected easily enough by careful filing until the width of the keyway will accept the key.

## Base Plate Adapts Lathe Chuck for Use as Vise

The small universal chuck that I use on my metal lathe has done double duty ever since I constructed a precision base plate which adapted it for use on my drill press. When I want to support round work end-wise on the drill press, I just thread the chuck on to this base and seat it on the drill press table (left photo, below), just as I would do with a conventional drill-press vise. The base plate was made by welding a bored-out section of steel bar

stock to a piece of flat plate. I set up this unit in the lathe so I could thread the stem to take the chuck. (right photo). Then I faced the bottom surface true with the thread. The hollow stem allows work to project down into it. The chuck itself is not modified in any way and so may at any time be used for its original purpose. One of the many uses for this accessory is holding work so that it can be center-drilled for lathe turning.—*H. J. Gerber*





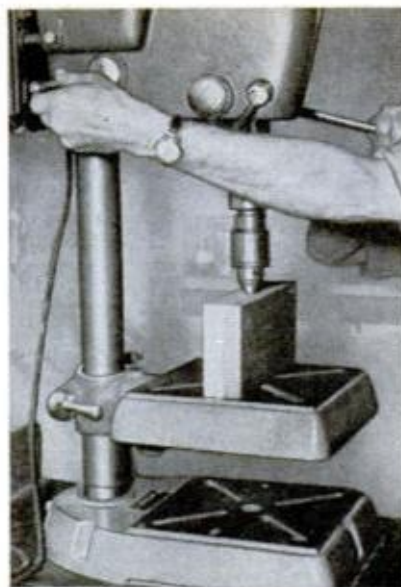
### Drill-Press Oiler

A large drip-type lubricator attached to the quill of my drill press provides an ideal means of applying cutting oil to the drill bit. I salvaged the flexible tube and spout from an old oil can and soldered it into the lower opening of the oiler. I then fastened the unit to the drill press quill. The method of attachment varies according to the individual machine. The oiler valve may be adjusted for any desired rate of flow depending on the type of metal drilled—*H. J. Gerber*



### Low-Cost Bench

A rugged and trim-looking workbench can be built for practically nothing by using the cabinet of a discarded automatic washing machine. The top of the bench is made from three 2 x 10 planks fastened to the cabinet from below with wood screws and projecting along the front for attaching a vise. A 1 x 4 in.-strip fastened along the back edge keeps tools from falling off the rear of the bench. Perforated hardboard screwed to the front provides tool storage.



### Easy Does It

When you find it necessary to gain extra space between the chuck and table of a drill press, here's how you can raise the heavy head and motor without straining yourself. Simply place a block of wood under the chuck and raise the table until the block touches the chuck. Then loosen the lever which locks the head and pull down on the feed handle. This will raise the head to the desired height. When the head has reached the right height, lock it.

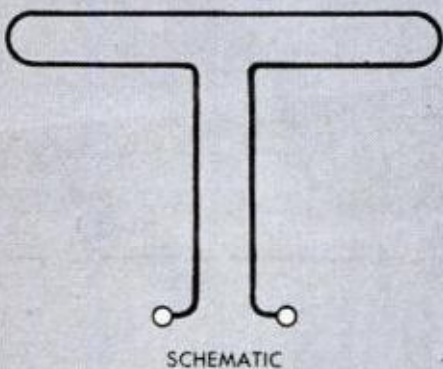
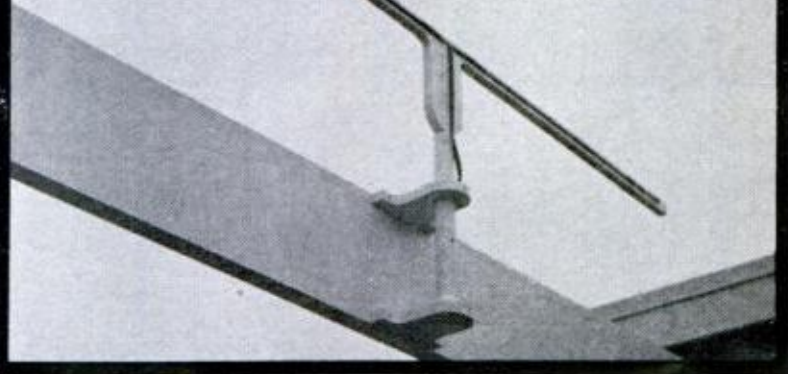
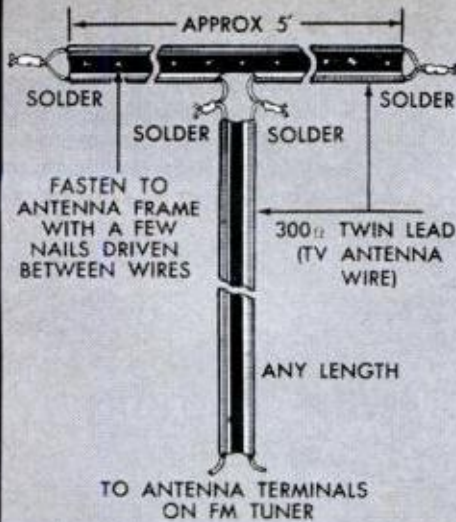
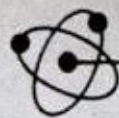
## NEXT MONTH IN SHOP AND CRAFTS

**CHRISTMAS CUTOUTS.** In the December issue, you'll find six all-new Project-a-Plan cutouts to decorate your house and lawn this holiday season. Clever cartoon Santas, cute choir cherubs, and distinctive traditional figures—you can lay out any of these with ease, using either *PM's* 35-mm. paper transparencies or the grid patterns also included.

**FURNACE HUMIDIFIERS.** During winter months, air in the average American home is about twice as dry as that in the Sahara Desert. Many home heating plants aren't equipped with humidifiers, and even when one is present, it is seldom properly maintained. Next month's *PM* tells you which types are best, how they work and how to keep them working.

**YULE CANDLES.** Traditionally, candles have always played a big part in the Christmas festivities. Next month, *PM* shows you how to make two unusual holiday candles that will brighten your mantel or serve as striking centerpiece at the Christmas feast. Each one is a novel design, guaranteed to bring you compliments, so don't miss this article.

**ELECTRIC DOOR OPENER.** Costing almost two thirds less than a comparable commercial unit, this automatic garage-door opener is a real bargain at \$35, motor and all. It's operated from a remote location by a key switch, and has a safety shut-off feature to prevent accidents. You'll find complete plans for this low-cost wonder in next month's issue.



# Simple Antenna Boosts FM Reception

ARE YOU ONE of the many FM listeners who use a TV antenna as an FM antenna? If so, you are not getting the best possible FM reception. TV antennas are not designed for tuning in FM frequencies. Many are specifically designed so they don't react to signals in the FM band to reduce possible interference with TV channels.

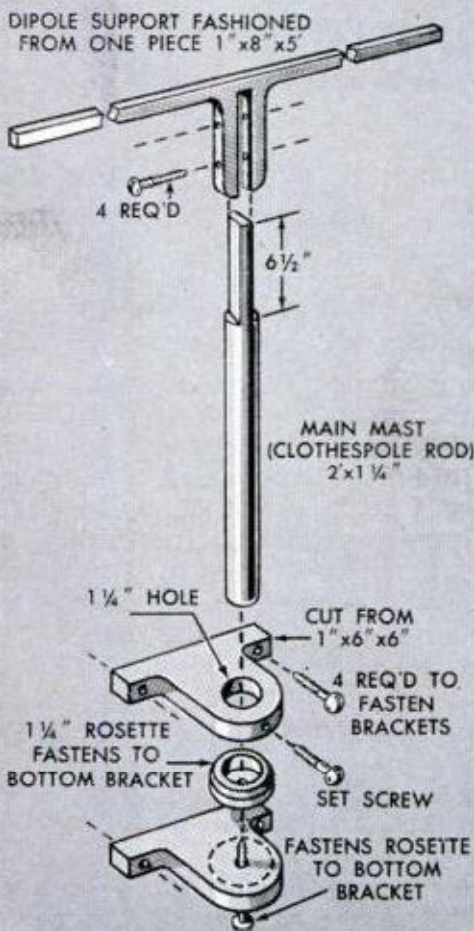
For better FM reception you can assemble a simple folded-dipole antenna which will give surprisingly better results than the TV antenna. Start off by tacking a 5-foot length of TV lead-in wire to a wood support cut from a length of 1x8. Bare the ends of the TV wire. Then twist them together and solder as shown in the drawing at the upper left corner of this page.

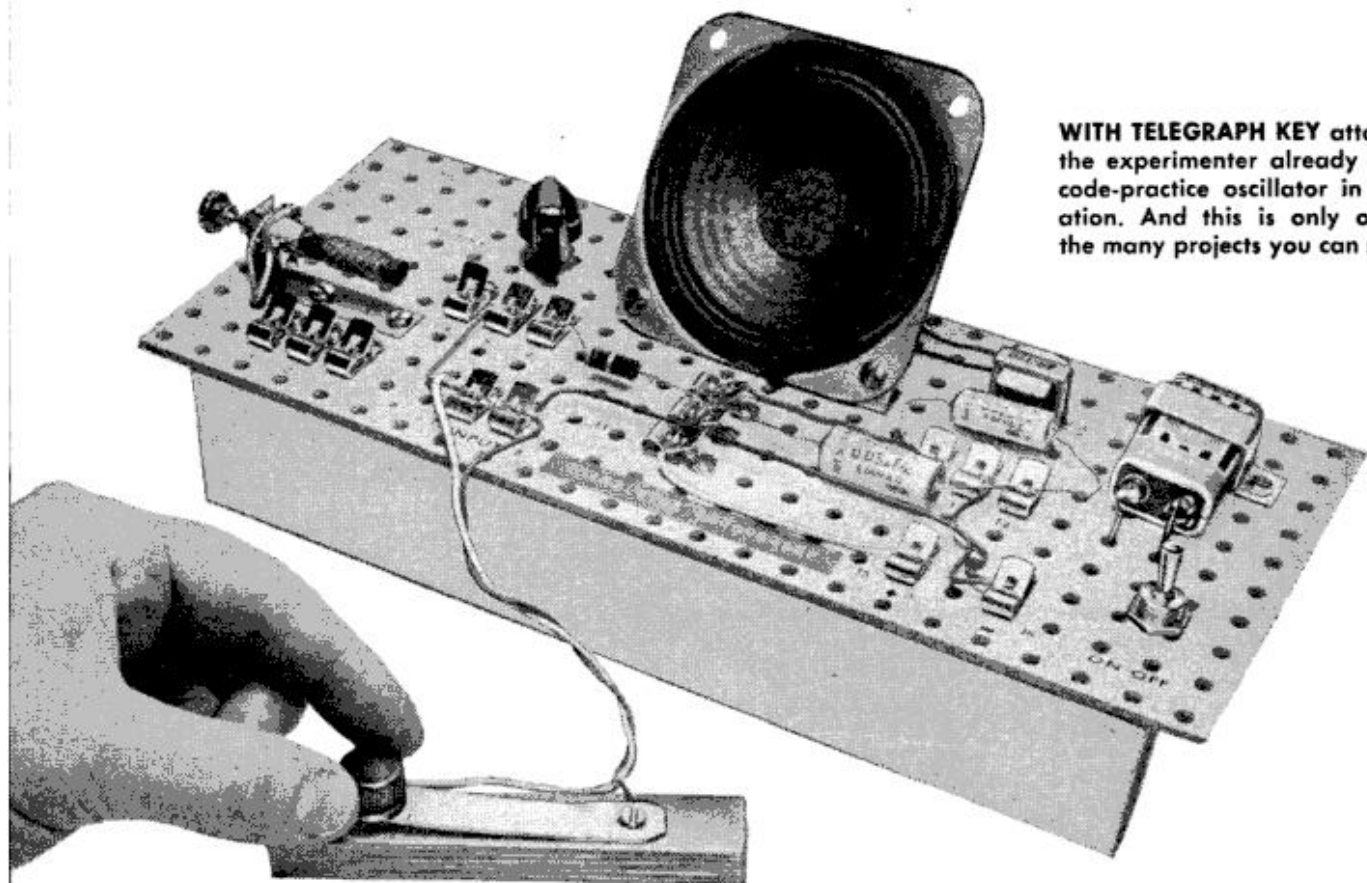
## Form a Loop with Lead-In

Next, cut the lower lead, dead center, and solder the resulting ends to the wire that will connect to your FM receiver. The result is a loop as shown at the middle left. Now fasten the antenna to its wooden mast and attach it to a suitable point atop your building—the higher the better.

Orient the antenna by tuning in a weak station and rotating the antenna until the station comes in loudest and clearest. You'll probably need an assistant at the set to shout out and let you know when you are properly tuned. Once oriented, tighten the set screw on the top bracket to keep the antenna from turning with the wind.

We have this antenna on our San Diego, California, roof and can pick up 29 stations loud and clear.—*John Richards.*





WITH TELEGRAPH KEY attached, the experimenter already has a code-practice oscillator in operation. And this is only one of the many projects you can set up

## Eight Electronic Experiments With a Transistor Breadboard

*Need a burglar alarm, rain detector, metronome? Build them tonight on the kitchen table*

By Len Buckwalter

**A** TRANSISTOR BREADBOARD is a big bargain for anyone who likes to tinker on a tabletop. With about six dollars in parts you can assemble a surprising number of projects quickly and without any soldering.

The board described here builds up circuits ranging from light and water detectors to a musical instrument, code practice oscillator, metronome and an alarm. It can even test transistors, diodes or the cord on the family toaster. The board is shock-free and requires no special electronic skills to build and operate.

A piece of standard perforated hardboard is the basic chassis. Sixteen Fahnestock clips are mounted and numbered (see head photo). After the clips are fastened down, solder lugs are placed un-

der the mounting nuts for the leads of the major components.

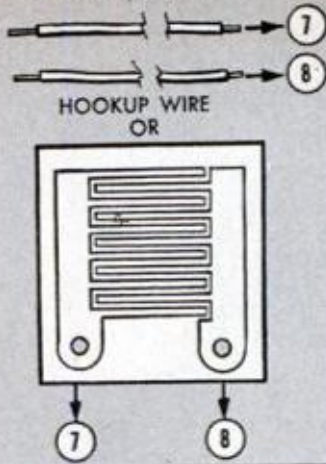
The battery is held down by a metal strip bent into a U-shape which is fastened to the board. Check polarity to be sure it's correct. Correct transistor mounting is also important. Double check the transistor against the basic diagram in the schematic.

Once assembled, check the board by flipping the power switch on and touching a short piece of wire across clips 7 and 8. If you hear a tone from the speaker, everything is wired correctly.

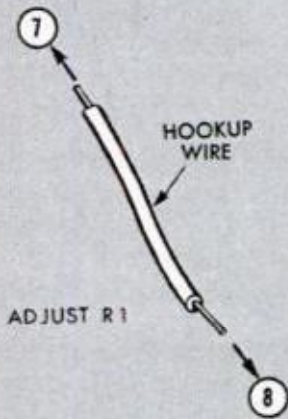
Here are the eight projects, experiments and demonstrations you can perform with the board:

1. *Water Detector.* Take two pieces of hookup wire or a water-sensing element and connect them to input clips 7 and 8.

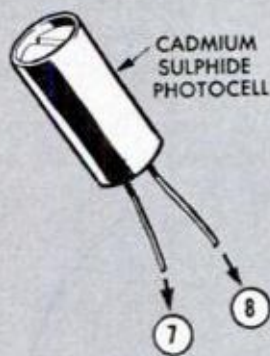
**WATER DETECTOR**



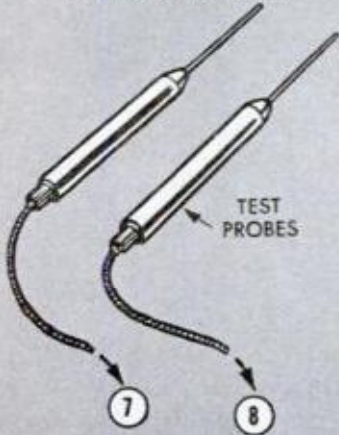
**MUSIC MAKER**



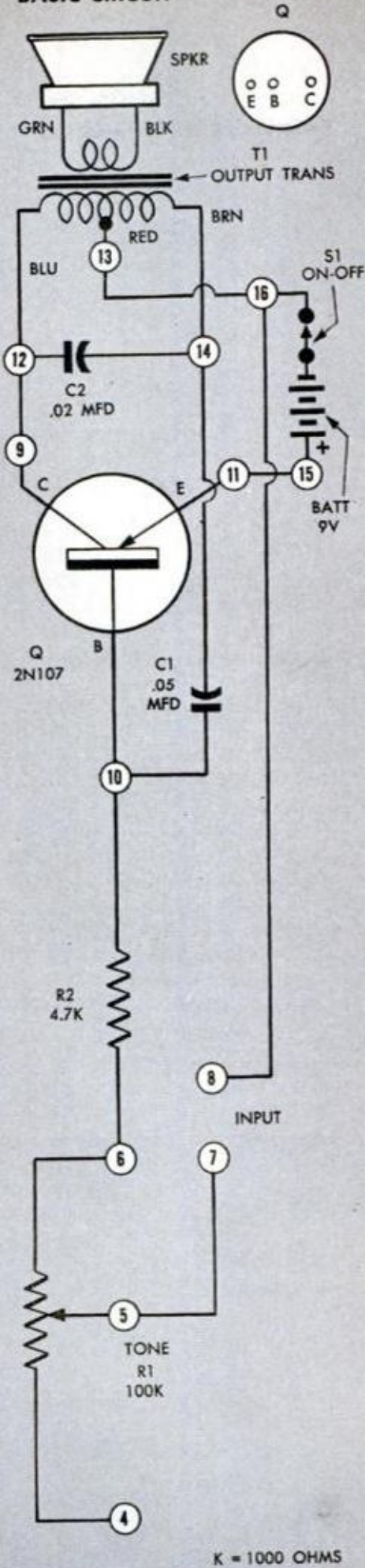
**LIGHT DETECTOR**



**CONTINUITY CHECKER**

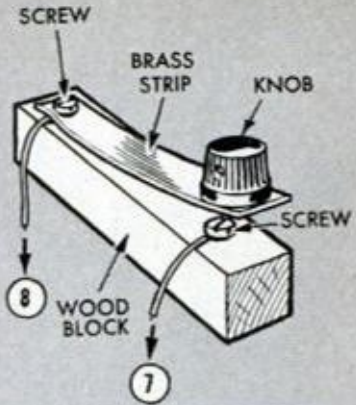


**BASIC CIRCUIT**

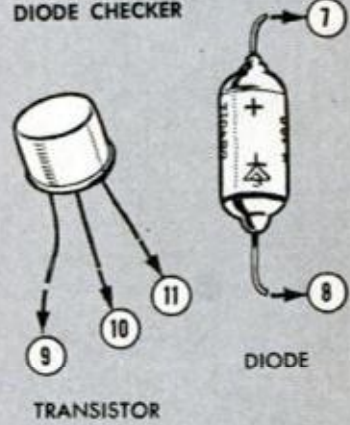


K = 1000 OHMS

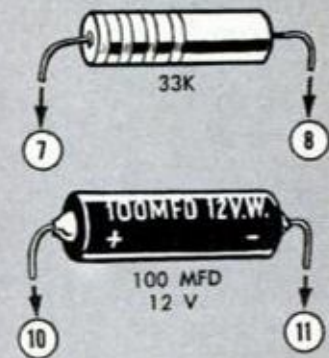
**CODE PRACTICE OSCILLATOR**



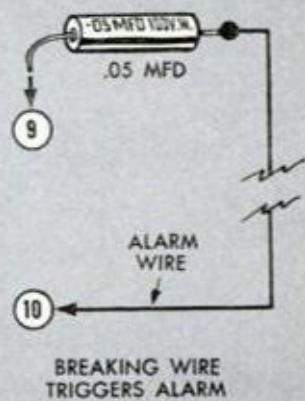
**TRANSISTOR & DIODE CHECKER**

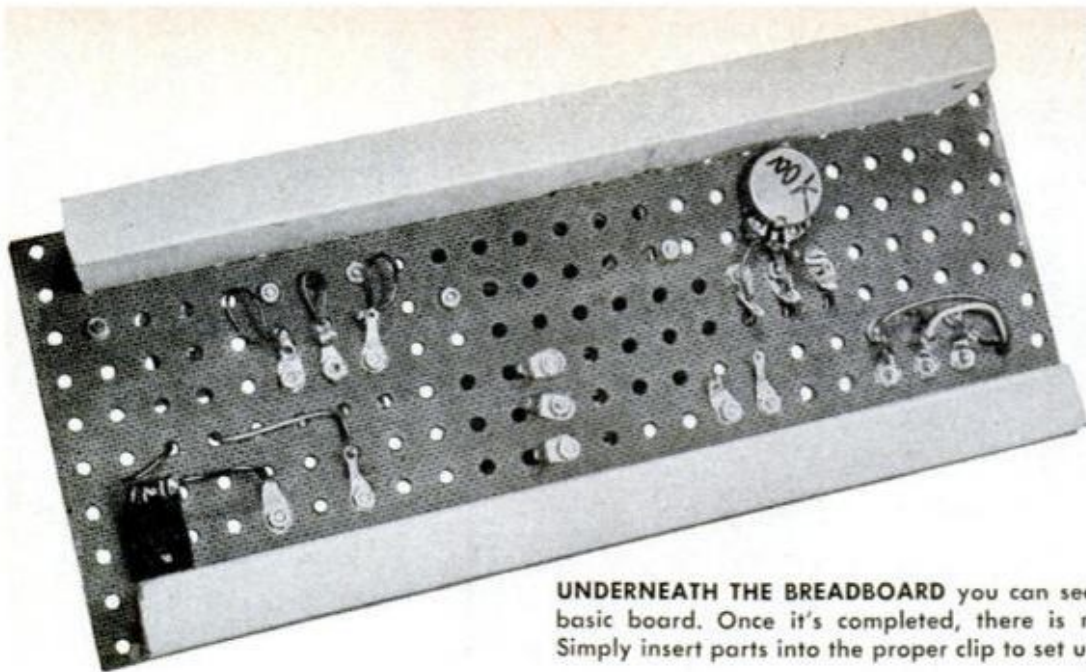


**METRONE**



**ALARM**





**UNDERNEATH THE BREADBOARD** you can see the wiring of the basic board. Once it's completed, there is no more soldering. Simply insert parts into the proper clip to set up your experiments

Turn power switch on. If you use the wires and touch their free ends to a dry object, there'll be no response. But touch something wet and a bleat from the speaker, indicates the presence of moisture.

An interesting variation is pressing the wires to the back of your hand with the smallest possible spacing between them. With your mouth wide open, breathe closely on the wires for about 30 seconds. The buildup of moisture will sound the tone. Next, blow briskly on the wires and note how evaporation kills the tone.

**2. Music Maker.** Try your skill at electronic music with this circuit. Any tune can be played after a bit of rehearsal. When clips 7 and 8 are jumped together, the tone control knob can produce a considerable change in tone from low to very

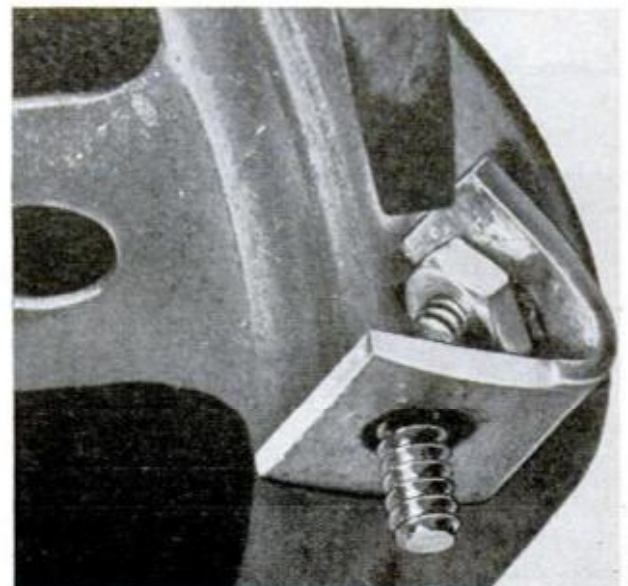
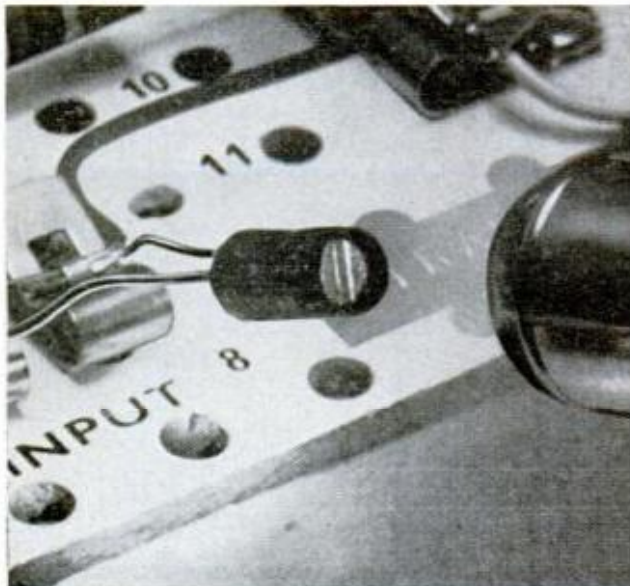
high pitch. This serves as the musical scale. Two playing techniques greatly improve the musical sound. First is vibrato—the knob is rapidly quivered with the hand as each note is played. This eliminates some of the electronic “flatness” of the tone. Also, the jumper wire at the input terminals may be lifted at the end of each note to further enhance the quality of the musical effect.

**3. Light Detector.** A cadmium sulphide photocell across clips 7 and 8 will respond to light changes. With the cell in place, normal room light should cause the tone to sound. But cup a hand over the cell and the tone ceases.

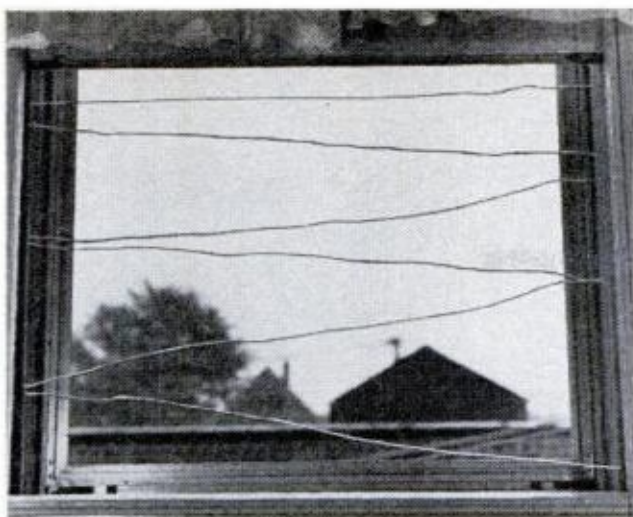
**4. Continuity Checker.** The board can check for broken connections in household appliances. If the a.c. plug is touched

**LIGHT FALLING** on the miniature cadmium sulphide photocell sets loose a tone from the speaker. You can vary the pitch with the tone-control potentiometer

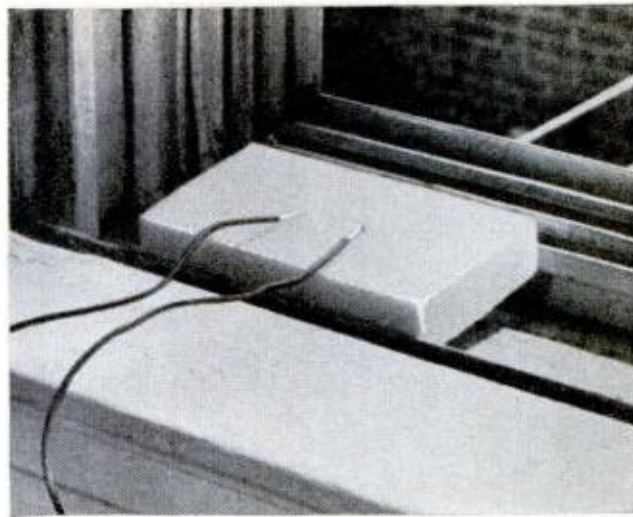
**OVERBEND** a standard 90° bracket to make the mounts for the loudspeaker. Insert screws before making the final bend or you'll have trouble later







**FINE WIRE** strung across an open window in the burglar-alarm element. If the wire is broken, the circuit is activated and the speaker sounds a warning



**INSERT** the two water-detector leads into a dry sponge and place on a window sill. If it starts raining, sponge gets wet, circuit is closed and alarm sounds

to clips 7 and 8, continuity is signaled by the tone. An important step during such tests is to turn on the appliance's power switch to complete its internal circuits.

**5. Code-Practice Oscillator.** A telegraph key wired to clips 7 and 8 converts the board into a helpful aid for learning Morse Code. If the tone becomes tedious, turn the Adjust knob and alter the pitch.

**6. Transistor and Diode Checker.** A good test of a questionable transistor is checking its ability to oscillate. Since the board's basic circuit is that of an oscillator, a good transistor plugged into clips 9, 10 and 11 should produce a tone. (Only one transistor may be inserted at a time.) An important qualification is that the transistor must be a PNP type. To test an NPN transistor, reverse the battery connections.

Testing diodes is done by placing the leads across clips 7 and 8 *both ways*. The tone sounds for one direction only if the diode is good. If it is heard in both positions the diode is shorted. No tone at any time indicates an open diode.

**7. Metronome.** It is possible to slow down the tone frequency until a sharp ticking is heard. Since these pulses of sound repeat at regular intervals, the device can perform as an electronic metronome for setting the beat during music practice. Two additional parts are needed: a 33,000-ohm resistor and a 100-mfd electrolytic capacitor (rated at 12 VDC).

Tie the resistor across clips 7 and 8. Connect the capacitor between clips 10 and 14 (negative lead to 14.) Set the rate of the metronome with the Adjust knob. You can change the over-all speed range by choosing a different resistor. The higher the resistance across 7 and 8, the slower the tick rate.

**8. Alarm.** One capacitor equips the board

for sounding an alarm when a circuit is broken. The practical application is stretching a fragile wire across a door or window. When the wire is broken by an intruder the tone sounds.

Set up the board by mounting a clip in any free hole near clip 9. Place a .05-mfd paper capacitor from the new clip to clip 9. The alarm wire, any length, is run from the new clip to clip 10 on the board. Finally, place a jumper wire across clips 7 and 8. When the power is turned on and the alarm wire remains unbroken, no tone will sound in the loudspeaker. Breaking the wire at any point, however, activates the circuit and triggers the alarm.

These are just eight of the projects possible with the basic transistor breadboard. Others may occur to you through further experimentation. ★★

#### Parts List

- R1—100,000-ohm carbon potentiometer
- R2—4700-ohm resistor, 1/2-watt
- C1—.05 mfd paper capacitor
- C2—.02 mfd paper capacitor
- Q1—2N107 transistor (or any audio PNP general purpose unit)
- S1—Single-pole single-throw toggle switch
- T1—Audio output transformer, transistor type, 400 ohms center-tapped to 11 ohms (Argonne AR-120 or equiv.)
- SPRR—Loudspeaker, 3 1/2" approx., 3.2-ohm voice coil, PM type.
- BATT—Battery, 9-volt (Burgess 2U6 or equiv.)
- Misc.—Parts not shown in schematic, cadmium sulphide photocell, 33,000-ohm resistor 1/2-watt, 100 mfd electrolytic capacitor 12 VDC, .05 mfd paper capacitor; approx. 20 Fahnestock clips (H. H. Smith No. 553 or equiv.); hardboard 12" x 5"; wood strips as shown; 6-32 x 1/4" machine screws and nuts; No. 6 solder lugs.



# Always ready for



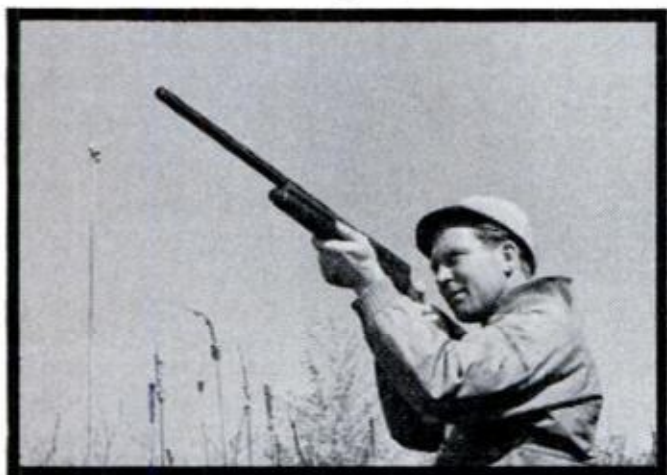
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## Survival at Sea

(Continued from page 117)

kit (sugar, gum, cheese, dried fruit), fishing kit, lengths of cord and repair plugs for the raft. Small survival kits are carried in seat packs along with the one-man raft and are worn by fighter pilots who fly alone. Larger kits are in the larger rafts found on bombers and cargo planes. These larger rafts, incidentally, are similar to those found on ocean-hopping airliners.

The one-man raft also has a spray shield that protects from both sea spray and sun. The six-man raft has paddles and a large spray shield that can be rigged as a sail, using the paddle handles tied in a T-shape as a mast. The 20-man raft has a large round spray shield that is erected, with poles, as a roof complete with drop sides that can completely enclose the raft during storms. The top side is luminescent pink for easy spotting from the air.

### Practice 'Chute Landing

One exercise we went through simulated a bailout. The parachute harness was attached to a pulley rigging which slid into the water. On the way down, we went through the bailout sequence, and learned to manipulate risers to stop pendulumlike oscillation which could spill the canopy. You discover that you must face into the wind. Crossing the risers in front of your face will swing your body around. (If you entered the water with the wind at your back, you'd go in face first.) While still descending, pull the cords to inflate the two underarm life preservers and tie them in front. Then pull the cord to deploy the survival kit and life raft from the seat pack; each will hang by separate lanyards, and the raft will inflate automatically.

Don't release your parachute until you hit the water, then release it immediately. If you wait too long, the parachute will drag you over the surface then could billow out again underwater, drift with the current and drag you under.

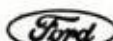

Once in the water, get into your raft immediately, especially in cold water which could freeze you in less than an hour, and get your survival gear organized. Then sit there and sweat out the rescue and prepare for both nausea and boredom. There's little else in a raft at sea.

Rescues, if within a few hundred miles of land or Navy ships, are usually made by helicopter, although sometimes by amphibious aircraft. Helicopter pickups are made by horse collars, rope ladders or a new anchorlike device that has three flat prongs. Hung from a cable, it is dropped in the water and the survivor sits on the

(Please turn to page 208)

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## Survival at Sea

(Continued from page 206)

prongs and wraps his arms around the upright axis. The horse-collar sling is the best, however—even an unconscious man can be lifted up in it. In my opinion, the rope ladder is the worst. Only an octopus could climb it gracefully.

The horse collar is entered feet first, then brought up under the armpits so the cable is in front of the face and the arms can be wrapped around it. One of the Mercury astronauts made everyone in survival work wince when, after his flight, his picture appeared in all the newspapers riding the sling backwards.

The cardinal sins in rescues are discarding your life preserver and reaching for the helicopter while riding the sling. You can fall out, and without a preserver, you've had it.

We finished off the third day being dragged through the water by the landing craft, simulating what a parachute would do to us. I've described my entry "dive" for the one-man raft at the beginning of this article. It can be a dirty business. We had jumped one by one from the tower of the landing craft. The 15-foot drop simulated the impact of an actual parachute entry. The long strap simulated the parachute riser. If we released it in time, fine. If not, it would drag us as it did me. But it dragged another man much worse.

### Rough Ride

He made a routine jump, but the riser snagged, and the dragging began. The man waved his arms frantically, but the instructor spoke calmly through a bullhorn, "Find the clasp, push the buttons in and down, then pull back." He repeated it. The man in the water either couldn't hear him or couldn't do anything about it.

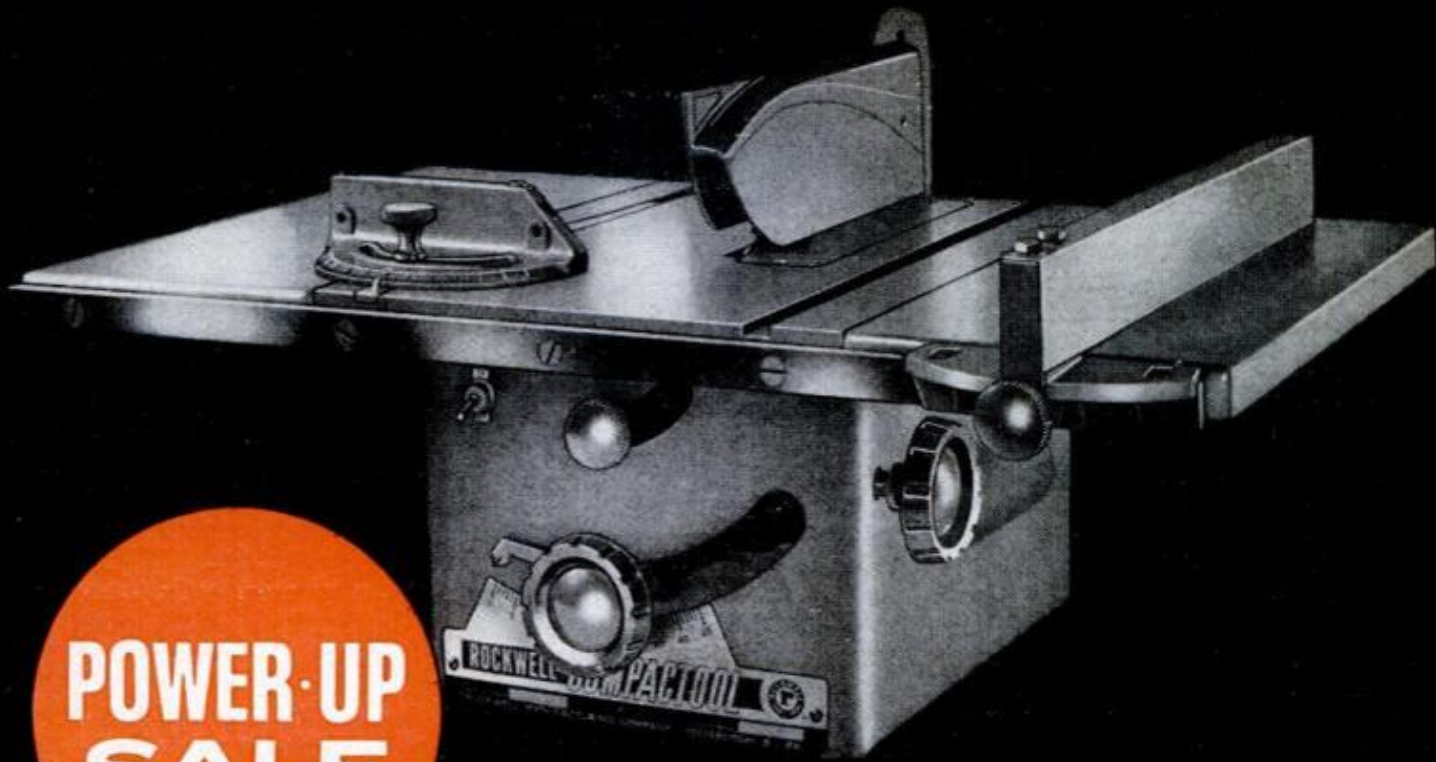
Finally, he lost all composure and forgot the sitting position. He went over on his side, his head went under and his arms and legs began flailing the water. It was agonizing, but the instructor, not a muscle in his face moving, just put the bullhorn to his mouth again, waited until the man's head came up briefly, then repeated the directions. It was like watching Captain Bligh keelhaul a man.

When it became obvious the man was exhausted, the instructor, with a look of disgust, said, "All right, stop the boat."

The crew hauled the man aboard, coughing and retching, then turned their backs on him. The rest of us just stared.

Since I was the only reporter aboard, I asked the instructor why he hadn't pulled the man in sooner. He laid the

(Please turn to page 210)



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## Survival at Sea

(Continued from page 208)

bullhorn along his face until the rim creased his cheek, and looked at me through his dark glasses without blinking. "If this were an actual survival situation, we wouldn't be here to pull him in. The idea is to teach a man how to get himself out of trouble."

The middle part of any sea-survival situation is staying alive aboard the raft. In some ways it's the easiest, but it's also the most unpleasant.

As I described earlier, I more or less made it into the raft, and the rest of my stay was almost sheer boredom. Riding up and down on the waves, I could catch glimpses of a few yellow rafts from time to time, but none were within shouting distance. I dug out the floppy sun hat from the kit, but didn't notice that in my cramped position the flight suit had crept up my legs, exposing my shins. At the end of the day they were burned raw.

Toward midday, I ate four small pieces of candy and squeezed some of the desalted water from the kit (it wasn't bad), but there wasn't much else to do except try to find a more comfortable position. There wasn't any.

If I thought that the one-man raft was unpleasant, however, I was in for a shock the following day, and for strange reasons.

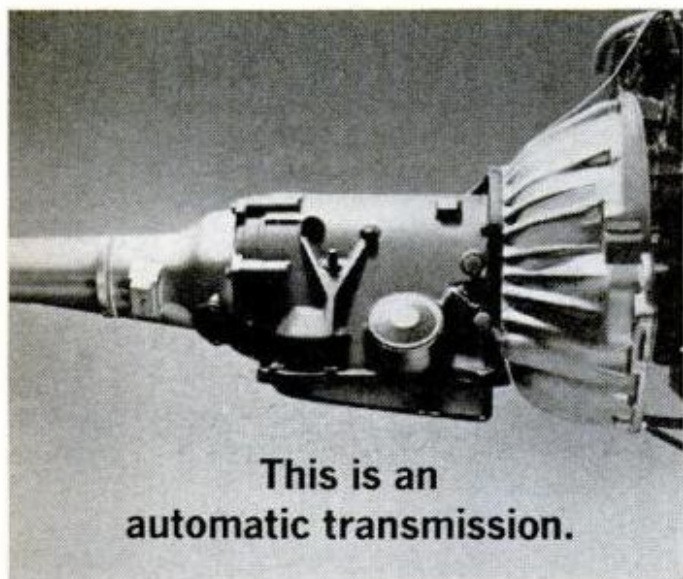
They divided us into teams and sent us over the side the same way we'd go in a ditching situation. Inflation was started on the 20-man raft, then it was thrown overboard while its CO<sub>2</sub> bottle was still filling it up, and we jumped in after it.

When inflated, the 20-man raft is actually two large round rafts back to back. If the wind turns it over—and it did before we got in to weight it down—it's the same on the other side. The survival kit and canopy are in the center and can be reached through waterproofed zippers from either side. Everything else is duplicated, top and bottom.

The first man in has the job of attaching an equalizer clamp to a short tube which connects the two large rings. When clamped, it prevents a puncture in one ring from deflating both rings. With one ring keeping the raft afloat, the other ring can be plugged and reinflated.

One other chore was inflating and setting out the solar still, a large round plastic desalter kit. Sea water poured in the top will filter down through impregnated cloth and produce three pints of fresh

(Please turn to page 212)



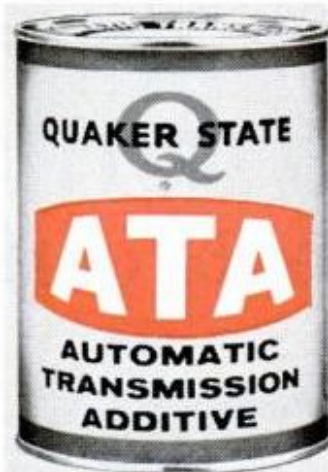
This is an automatic transmission.

It's a \$200 or more "extra" in most new cars.

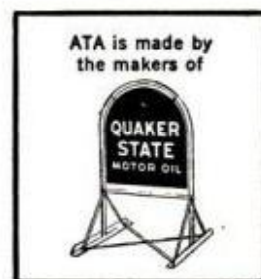
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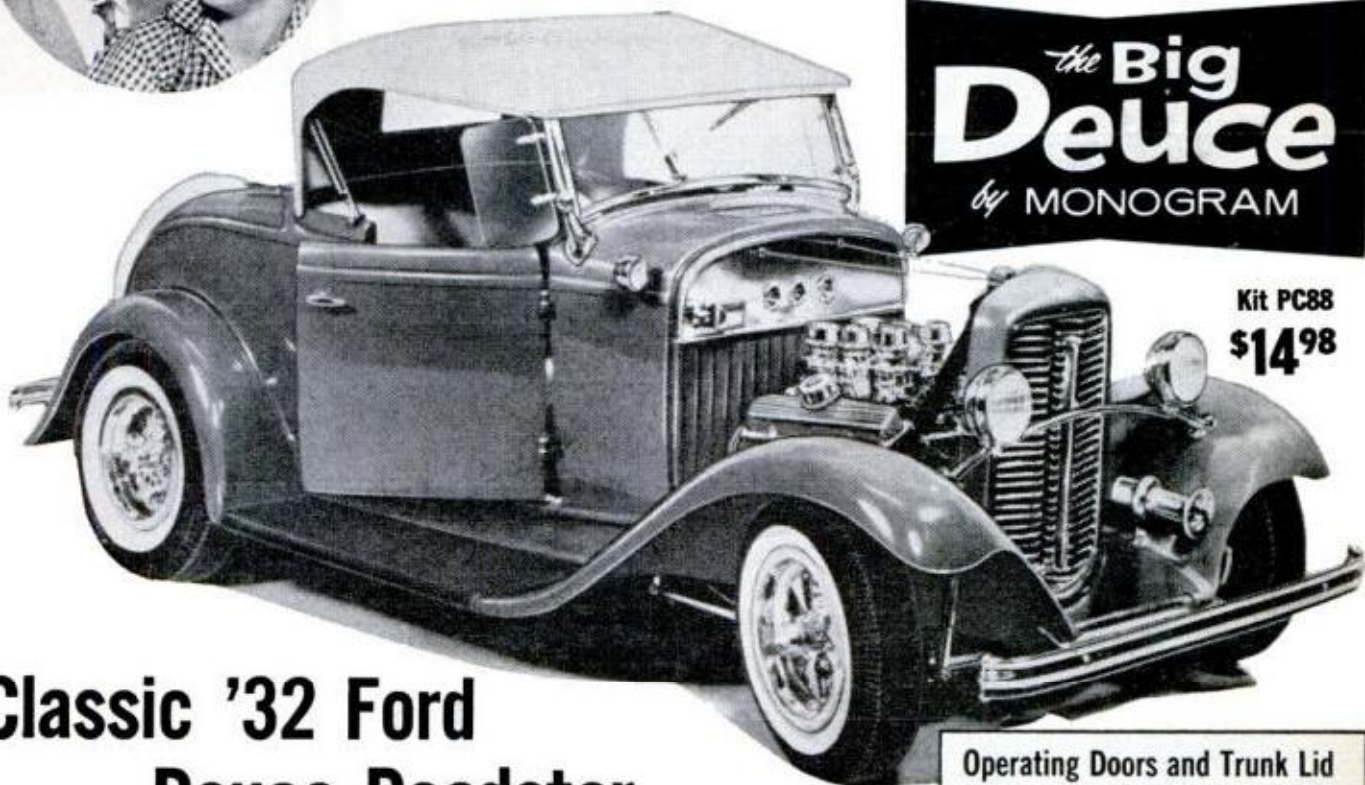




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## Survival at Sea

(Continued from page 210)

water in less than an hour. That done, we had nothing to do but sweat it out, each in his own way.

They had told us that the senior officer should take command of the raft, but no one did. As a civilian, I said nothing.

The sea was extremely rough, lifting up one side of the raft, rolling under it, then lifting up the other side—constantly. No position was comfortable, legs were getting in one another's way, and some of the men began getting sick immediately. Just for the record, it's pure fiction that pilots never get sick—two men sitting opposite me, both jet pilots, were retching almost the entire time. We tried to bail out some of the water and vomit, but the waves were sloshing over the side.

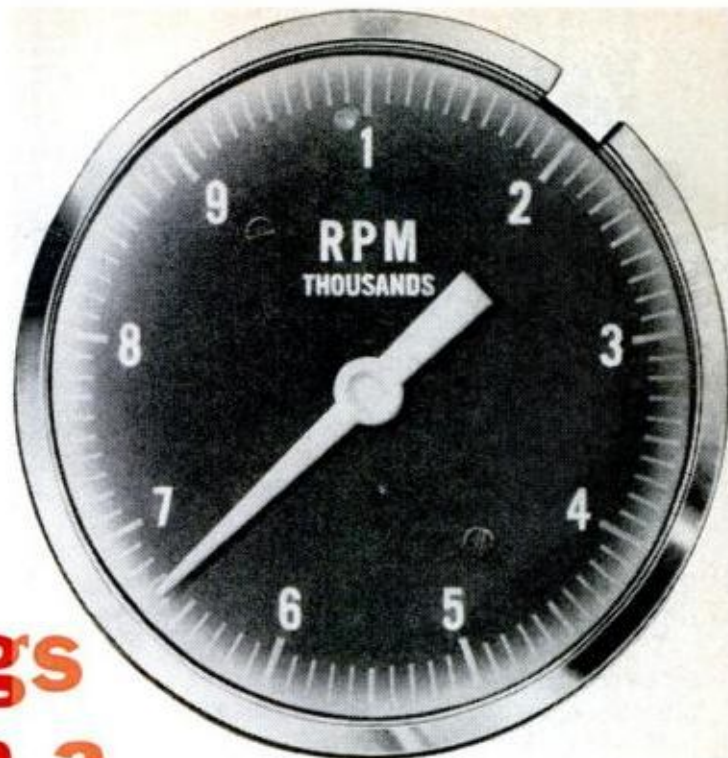
We just gave up. Then some of the men grew quiet. Some grew surly. Some just leaned over the side and ignored the rest. Some never said a word. Some said too much, telling off-color jokes that all fell flat. The worst were the bellyachers, bitching about what someone else was doing, wounding feelings and leaving the whole atmosphere sour. There were no lasting friendships made on that raft, but no one took charge and we were all trapped in this kind of tension.

It took me by surprise, but it was the greatest lesson I learned. Democracy doesn't work in a life raft at sea. Some authority is necessary. If that group, each pulling in his own direction, had been adrift in a real emergency, chaos would have resulted. And these were all military men, used to both danger and discipline. How much worse would it have been with a raft full of panicky civilians!

The exercise in the six-man raft that afternoon wasn't much better. They put four of us in each raft, and it was even more cramped. We were to rig the sail and race to the beach. I was in with a first lieutenant and two enlisted men. The lieutenant should have taken charge, but he hardly said a word. We rigged what was probably the sloppiest sail in the history of the sea. Then each of us started offering suggestions, all contradictory, on how to sail it. It was very unpleasant.

The sea is a devil and it couldn't care less about man's problems on it. He has to figure his own solutions. But I'm grateful for the training, as rough as it was, and am less afraid of the sea now—and have more confidence in the equipment—than I would have been without it.

One thing seems certain. Anyone who survives the sea survival school will survive the sea. ★★★



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Since 1922, cars equipped with Perfect Circle rings have won more than 80% of the races at Indianapolis. Year after year, more major USAC and NASCAR competitions are won by drivers using PC rings than any other piston ring brand.

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**Sealed Power** Stainless Steel oil rings stop oil pumping

## New Anti-Smog Kit

(Continued from page 127)

next morning but the engine fired up just as in warm weather, with no apparent power loss.

All this suggests that Chrysler has found the answer to the smog problem, but this is only partly true. New cars, properly tuned, are fairly clean anyway, and PM tested a new car. Older cars that need a tune-up are the real smoggers. But even these can be cleaned up.

As Charles M. Heinen, Chrysler engineer who originated the CAP, puts it:

"Assume that a car emits contaminants at the rate of about 1000 p.p.m. for hydrocarbons and 3.5 percent carbon monoxide. If there is nothing basically wrong with the engine, a standard tune-up—including lubrication of engine linkages, servicing filters and replacing worn plugs or points—will cut these emissions just about in half. These are all recommended maintenance procedures, anyway.

"Any owner can cut smog production below 400 p.p.m. hydrocarbons and two percent carbon monoxide with a few additional adjustments every 5000 miles. These consist of checking timing, leaning the idle mixture and slightly raising the idle r.p.m."

All these adjustments help, but further modifications are necessary to reach the low emission levels California demands. That's where the anti-smog kit comes in.

An engine with the CAP differs from a standard engine in these ways: Size of carburetor's choke restriction is increased; the main jets give a leaner mixture; idle r.p.m. is increased to 550; carburetor-idle jets are adjusted to an air-fuel ratio of 14.2 to 1 (standard is 13 to 1).

The timing, at idle, is retarded to 5 degrees after top center, but a special vacuum advance control valve advances timing to normal when the throttle is pressed. The distributor is reworked to match.

Overheating in slow traffic, due to the retarded spark at idle, is prevented by a six-bladed cooling fan.

The CAP is receiving its first "blind" test by the public this year. Kits have been installed on 1000 Plymouths, Dodges and Chryslers selected at random from the Los Angeles assembly plant. No guinea pig purchaser knew he was getting a modified engine but each was asked to participate by allowing his car to be tested at intervals.

The Chrysler anti-smog kit is tailored for Chrysler's current production only, not for its older models or for any other makes. But the same principles can be used in designing anti-smog equipment for any make or year. Cost of the kit is expected to run between \$10 and \$15. ★★ ★

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**Falcon** has a new ride  
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 Never been a compact like it.  
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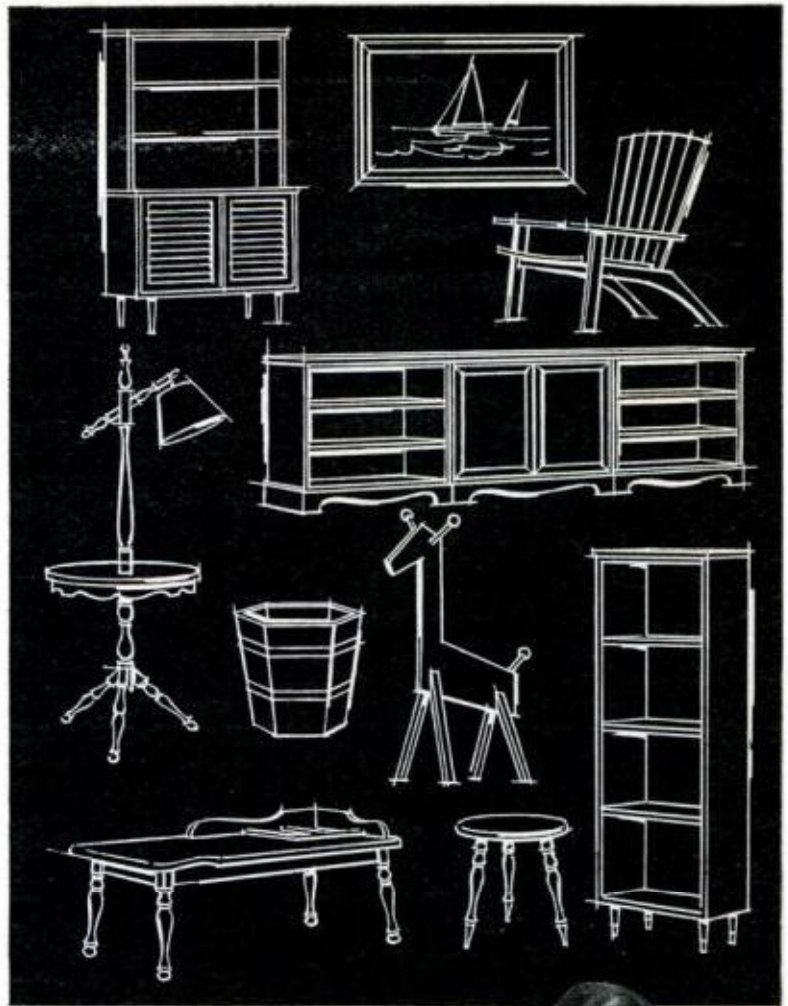
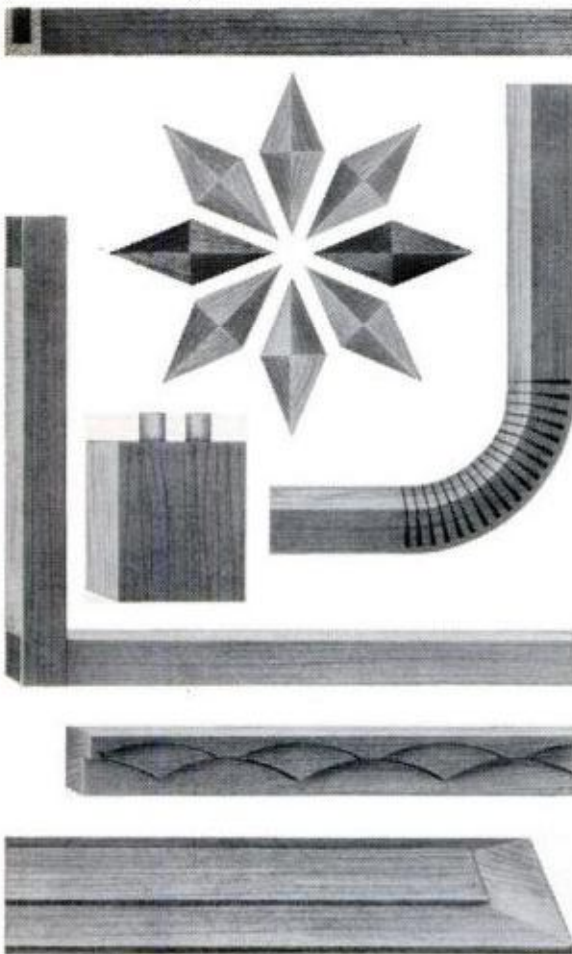


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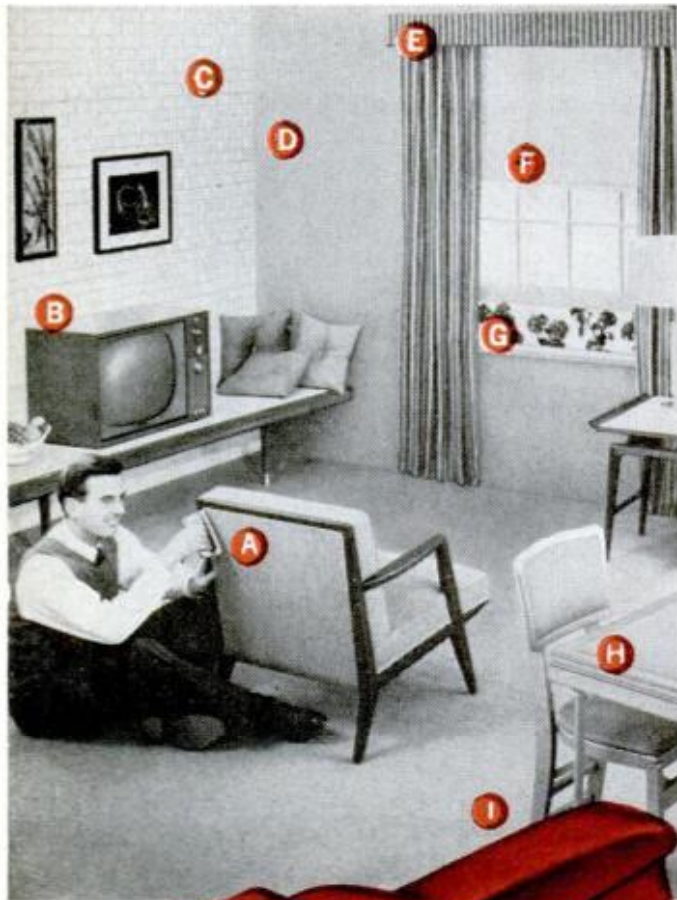


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## Winter Battery Care

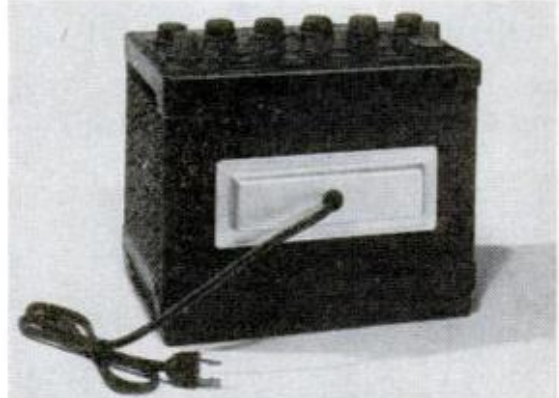
(Continued from page 184)

degrees F, the engine requires about 150 percent more starting power.

In other words, a partly discharged or nearly worn-out battery might start a car satisfactorily in warm weather. In cold, however, it will leave you stranded.

You should be particularly wary if you have a foreign battery in your car and live in a cold section of the country. In temperatures of 20 degrees F. or colder, a foreign battery with its lower specific gravity of about 1.240 may not have sufficient capacity to start the car, although it may be fully charged. In such a case, you can either change to an American battery or have the specific gravity of the battery increased. Your local garage can do this by adding stronger electrolyte.

From these facts, the only conclusion that can be drawn is this: during the winter, you must keep a close watch on your battery's state of charge. Take a hydrometer reading often—during a really bad cold snap, once a day wouldn't be too much. At the slightest indication that specific gravity is falling below the allowable temperature limits for your area, get the battery recharged—pronto! ★ ★ ★



**BATTERY WARMER** helps offset one cause of winter starting troubles. Since your engine needs more *starting* power in below-freezing weather, it's vital to keep the battery at peak efficiency. But low temperatures rob it of up to 60 percent of its *cranking* power. It makes sense, then, to warm the battery and there's a small electric heater designed for the job. It comes with a sticky flange to bond it permanently to the battery side-wall. You keep the cord tucked under the hood; whenever the mercury dips below 32; you plug it in to house current overnight. The heater shown is made by Milesmaster Inc., Exeland, Wis. and costs \$6.95.





(Parnelli Jones wins Pike's Peak Hill Climb in a '63 Mercury.)

## WHAT MAKES PARNELLI RUN?

What put Parnelli Jones up the tortuous Pike's Peak road this year in less time, in a stock car or sports car, than anybody in history? (He whipped a '63 Mercury Marauder around the 12.42 miles of hair-pin turns in only 14 minutes 17.4 seconds—rising 4,708 vertical feet in the process.) What put Tiny Lund in front of the pack at the big Daytona 500-mile race? And Fireball Roberts on top at the hot Daytona Firecracker 400? Dan Gurney at Riverside,

Joe Weatherly at Darlington, Fred Lorenzen at Atlanta? And what pushed Jimmy Clark to the tradition-shattering 2nd place at the Indianapolis 500 in his now famous gasoline-powered Lotus-Ford?

The answer, among other things like ability and nerve, is probably the finest open competition automobiles ever made. And the spark plug used in every case? Autolite. Now, we don't claim the spark plugs won; simply that nowadays most

drivers in major stock car competition start with Autolites—and finish. In fact, through July 4, 8 out of 10 major races (those over 250 miles long) were won by cars fired with Autolite spark plugs.

We put men and money into competition because it helps us make better spark plugs. All you have to do for better spark plugs is ask your dealer to put in Autolites the next time you take your car in for a tune up.

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NOVEMBER 1963

SPARK PLUGS • BATTERIES • SERVICE PARTS  
 **AUTOLITE**  
 THE NAME TO REMEMBER WHEN YOU CARE FOR YOUR CAR

219

# NEW

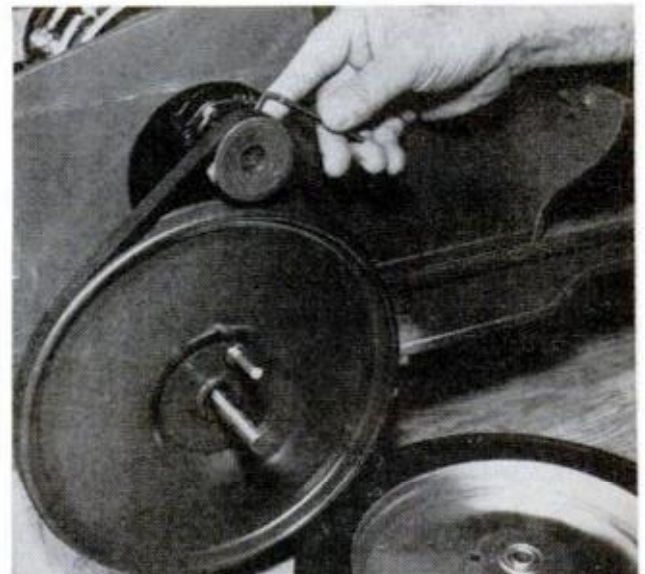
## Sidewalk Classic

(Continued from page 150)

underside of the frame, noting that the one that is grooved for the brake-band lug goes on the right side of the frame, viewed from the front. The complete brake assembly is shown pulled apart on page 80. There are two points to note especially in this assembly. First, the brake-band lug, part No. 38, drops into the groove in the brake-shaft support. The wood screw holding it in the groove passes through the frame from the top side, through the lug and is turned into the brake-shaft support. The inner end of the lug is held by a 10-24 screw (with nut) which passes through a hole in the frame. This hole must be drilled through the frame after the parts are located. Second, the screw holding the forward end of the brake band in the groove in the brake-band tightener, part No. 36, passes through the band and a hole in the tightener and shaft.

Parts of the brake-eccentric assembly are shown on page 80. A  $\frac{5}{16}$  x  $1\frac{3}{8}$ -in. stud is cross-drilled near the unthreaded end to take the end of the brake cable. A nut and washer are run down on the stud and the cross-drilled end inserted in a hole drilled through one side of the pulley (eccentric) rim. The free end of the cable is passed through the hole near the end of the stud and the nut tightened, clamping the end of the cable securely in place. This arrangement provides adjustment of the brake-cable length when the assembly is complete. The return spring is attached to the stud with a second nut and washer and the opposite end of the spring attaches to

**REAR-WHEEL DRIVE** is through V-belt and two pulleys to a stud, the end of which fits into a hole drilled through one web of the wheel. Note stud in pulley



(Please turn to page 222)

POPULAR MECHANICS



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Price

**\$5.50**

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Stronger than steel—  
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Non-slip • Absorbs shocks  
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afford  
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this  
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**This New Feature-Packed 1964 Model Of the Heathkit  
2-Keyboard "Transistor" Organ Costs Just \$349.95 ...  
And You Can Build It!**



What a delightful surprise on Christmas morning! And there's endless hours of fun, relaxation, education and achievement satisfaction ahead for the whole family with Heathkit's 1964 version of the famous Thomas Organ. You'll be saving big money too, by easily building it yourself! No experience necessary! And you're assured long, faithful performance with the full 5-year warranty on tone generators. Can't play a note? Learn quickly and easily with a complete 48-lesson self-teacher course on 4 LP records (GDA-232-2) that's valued at \$50 . . . it's yours for only \$19.95! Like to hear it perform? Send 50c to the address below, and ask for demonstration record GDA-232-5. Plan now to give your family the exciting dimension of live music with the 1964 Heathkit Electronic Organ this Christmas!

**Kit GD-232R, Organ, 160 lbs., no money dn., \$23 mo. . . . . \$349.95**

**GDA-232-1, Matching walnut bench, 16 lbs., no money dn., \$5 mo. . . . . \$24.95**

**Attention Heathkit Organ Owners! Add Variable Repeat Percussion to your Heathkit Organ with the easy-to-install kit.**

**GDA-232-4, 1 lb. . . . . only \$9.95**

**COMPARE THESE  
FEATURES WITH UNITS  
COSTING TWICE  
AS MUCH!**

- **10 True Organ Voices;** Trombone, Reed, Flute, Oboe, Cornet, Violin, Saxophone, Horn, Viola, Diapason
- **New! Variable Repeat Percussion;** produces effects of banjo, marimba, mandolin, balalaika, etc.
- **Variable Bass Pedal Volume Control**
- **Manual Balance Control;** adjusts volume of keyboards in any degree for solo work
- **Variable Vibrato**
- **Standard Expression Pedal;** adjusts volume from soft to full
- **13-Note Heel & Toe Bass Pedals**
- **Two Over-Hanging Keyboards;** each with 37 notes, range C thru C
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- **Compact Size;** 34 1/2" H x 39 1/2" W x 21 1/2" D
- **Transistorized;** for longer life, better tone, trouble-free operation.



**Heath Company, Benton Harbor 17, Michigan 49023**

- Enclosed is \$349.95, plus postage, please send my Heathkit Electronic Organ, model no. GD-232R.
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- Please send my free copy of the new 1964 catalog.

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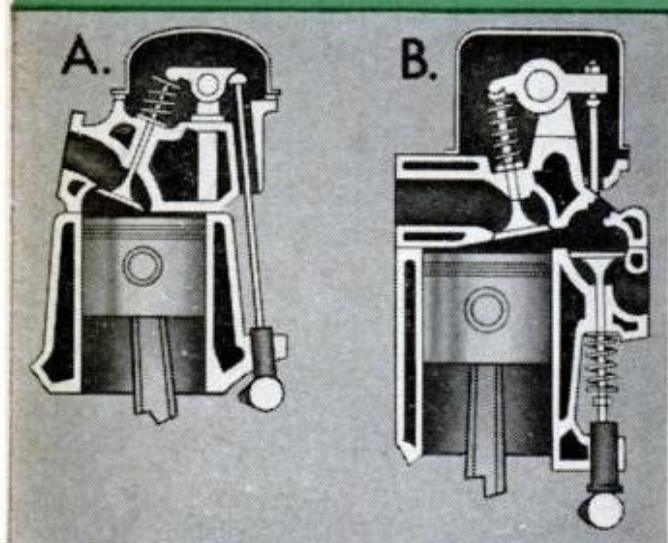
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See all the latest products in Heathkit's exciting line. Over 250 do-it-yourself electronic kits in all . . . by far the world's largest line. There's something for every interest . . . stereo/hi-fi . . . marine . . . amateur radio . . . test and lab . . . television . . . home . . . and hobby. Send for your free copy today, and learn how you can save up to 50%.

# Test your automotive I.Q.



Can you name these engine valve arrangements?



What does this symbol stand for?

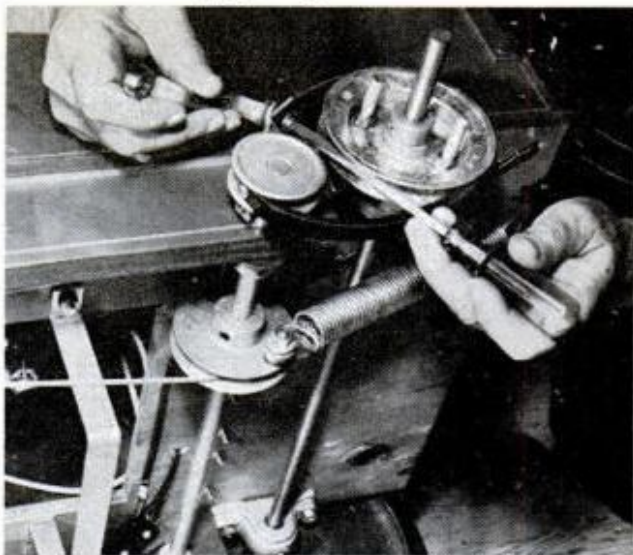
At top, (A) is the popular overhead-valve design; (B) is an F-head setup. The life preserver at bottom is the symbol of Quaker State Motor Oil—because it preserves the life of your engine best. Made from 100% pure Pennsylvania Grade Crude Oil, Quaker State gives every car longer-lasting lubrication, top protection. Always insist on Quaker State—the best engine life preserver.



QUAKER STATE OIL REFINING CORP., OIL CITY, PA.

## Sidewalk Classic

(Continued from page 220)



**BRAKE BAND** is  $\frac{1}{2}$ -in. V-belt anchored to a stationary lug and a tightener and passes around a V-pulley on axle. Note the two studs which engage wheel

an anchor on the bottom of the frame.

Note now the similarity between the ground-wheel drive, and the brake assembly. Both make use of short studs, the unthreaded ends of which enter holes drilled through the inner half of the wheel webs. Two studs are required for the brake but only one for the drive.

The steering gear is of simple construction and consists of the tierod, steering-rod, crank, the column, column support, brace and wheel. The latter is a  $10\frac{1}{4}$ -in.-diameter V-pulley, the V-groove being filled with a  $\frac{5}{8}$ -in.-diameter rubber hose and then wrapped with electrician's plastic tape. This makes a neat, realistic wheel rim. When assembling the steering gear you may need to make some adjustment in the "geometry" by bending the arms so that the front wheels toe correctly.

The body also is of the simplest construction, made entirely of  $\frac{3}{8}$ -in. plywood and joined with 1-in. corner irons, each held in place with two 10-24 screws and square nuts. Parts for the seat are assembled in the same manner, using the same size irons and screws. The one exception in this procedure is the method of joining one leg of each corner iron holding the body to the frame. Here a No. 8 or 10 sheet-metal screw  $\frac{1}{2}$  in. long (part No. 62) is used instead of a 10-24 screw and nut to join the leg of the iron to the frame. Dimensions of the seat bottom, fenders and hinged rear deck, or cover, will be found in the parts list. Rear fenders are joined to the body with corner irons (parts No. 75) and 10-24 screws and nuts. Front fenders are attached to dashboard and fender support with  $1\frac{1}{2}$ -in. No. 8 screws.

(Concluded Next Month)

Fix sticking automatic chokes fast . . .

# GUMOUT AUTOMATIC CHOKE CLEANER

## FREES STICKING CHOKES

Simply squirt on both ends of choke valve shaft, then remove the choke cover and flood vacuum cylinder while the engine runs. It's fast!



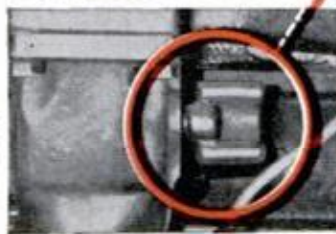
## CLEANS CARBURETOR LINKAGE

Dirty, oily linkage can badly foul up carburetor performance. Now you can clean it in seconds!



## LOOSENS MANIFOLD HEAT CONTROLS

Quickly penetrates and frees heat controls frozen by rust and carbon. Leaves no oily residue to form carbon and cause further sticking.



**\$1.39**  
AT LEADING  
AUTO SUPPLY STORES

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## What's new in utility pliers?



Now you can get famous CRESCENT quality in handy utility pliers. Know what this means? New CRESCENT Utility Pliers are drop-forged of special alloy steel, to insure lasting strength and durability. They're precision-machined and hand-inspected to be sure you get flawless performance. They open to five positive-locking positions with smooth, easy pump action . . . make small jobs around the home or shop a whole lot easier. Next time you buy a pair of utility pliers, make sure it says CRESCENT on the head. Sold by leading hardware stores and tool suppliers everywhere.

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## CHRISTMAS CUT-OUTS!



### Life-Size Full-Color Decorations!

just  
paste on  
plywood  
and  
cut out!

Make your home a holiday showplace with these delightfully different Christmas decorations! Durable paper patterns printed in bright colors are specially made to use on plywood. Simply paste on plywood and cut out with saw. It's easy. Strong, weatherproof Exterior plywood makes figures last for years. Wonderful gifts. Order several today! Supply limited.

**SANTA, SLEIGH AND REINDEER** (above) will delight young and old alike! Wonderful inside or out, on lawn, porch or roof. Jolly 6-ft. Santa, 6-ft.-long Sleigh, 5-ft.-long Reindeer, each only \$1.00.



**JUMBO CHRISTMAS CARDS** — New, different! "Joyous Noel" shows child carolers. "Season's Greetings" shows ornaments. Includes 104 letters so you can personalize card with family name. Each 45x70-in. card, \$1.00.



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Name \_\_\_\_\_

Address \_\_\_\_\_

City \_\_\_\_\_ Zone \_\_\_\_\_ State \_\_\_\_\_

## Oil Change Myths

(Continued from page 97)

ters containing mattress stuffing, kitchen matches, cork liners from bottle caps, etc., have been known to exist. Since filters often are sealed in their cans, you can hardly tell what is used as an element, but beware of bargains. The annual saving will probably be only \$2.50 to \$5—hardly enough money to justify risking engine damage.

### Expensive Filters Work Too Well, Clog Up Too Soon

You have a filter in the system to filter out sludge and other contaminants. It can clog up only when it's doing its job. The biggest charge of the best detergent-dispersant additives will help keep contaminants from clumping together. But those that do cluster should be filtered out, saving the remaining dispersant that much work and prolonging its useful life. Why get a less efficient filter that will pass more contaminants just to avoid clogging?

It's nearly impossible to tell when a filter is clogged, as they're made now, so change them reasonably often; never wait longer than 6000 miles.

### Never Put High-Detergent Oil In An Old Engine

The fear is that a sludge-filled old clunker, if dosed with quality oil it isn't used to, will release volumes of the old gunk, wash it all around the engine, jamming hydraulic valve lifters, and causing general havoc. Once, even the experts were uncertain about this, but major buyers (like the Army) mixed non-detergent and detergent oils in some heavily sludged engines during the change-over without problems. One oil company even went from non-detergent oils to high detergent in all its stations without trouble.

### Never Mix Brands, Weights, Or Types Of Oil

Here's a great sales fable that has even been dignified—wrongly—by publication. The simple fact is that old and new government specifications and service requirements say that each oil shall be compatible with all engine lubricating oils previously qualified. These were the specifications under which the military qualified 700 detergent-type oils, in addition to more than 2000 re-brands of the same oils.

But suppose you have very old, very high-detergent oil in the crankcase and need to add a quart or even two. If you add non-detergent oil like ML or MM, you'll dilute the detergent additives, per-

(Please turn to page 228)

NOW from our Accident Division you get:

# \$1,000 cash a month

even for the rest of your life while hospitalized from any accident.

No, this is not a misprint. If you qualify, you get an iron-clad guarantee which pays you at the rate of \$1,000.00 CASH a month beginning the first day you are in a hospital (other than a sanitarium, rest home or government hospital) from any accident. Even if you're so confined only one day, you still get \$33.33.

There are no gimmicks. Your policy will contain No Exceptions, No Exclusions, No Limitations, no waiting periods, no ifs, ands or buts.

And what's more - - -

This plan is NON-CANCELLABLE and GUARANTEED RENEWABLE for Life.

1. Use your policy as often as you need to—you own it, it can never be taken away as long as you pay your premium on time. Your premium can never be raised; your benefits can never be reduced.
2. You are paid the full amount even though you have other insurance or compensation. You get CASH . . . use it for any purpose: pay bills, buy groceries, pay rent, etc. When you are hospitalized your everyday living expenses still go on. Help meet them with the TAX FREE cash this policy provides.
3. THIS PLAN PAYS CASH WHILE YOU ARE HOSPITALIZED FOR ANY ACCIDENT, ANYWHERE, ANYTIME. You DON'T have to be hurt in any particular kind of accident such as: Auto, Pedestrian, Bus, Traffic, Train, etc. ALL Accidents are covered—at home, at work, at play—24 hours a day.

You get a full month's coverage for 25¢. Send no money. When you receive your policy, read it carefully. Only after you agree it does everything we claim, send in your quarter. This doesn't even cover our cost, but we'll gamble that you will continue at the low price of only \$5.00 a month - - - just as thousands of others have done. Remember for each day you are in the hospital, you get \$33.33.

How can this policy be offered at such a low cost? The answer is simple. You are buying directly from the company through the mail and the savings are passed on to you. No agent or salesman will call or bother you.

Compare this with others. We welcome comparison because this policy pays from the first day, we can't pay any sooner; it pays forever, we can't pay any longer. Remember, the cost is only \$5.00 each month, or, if paid in advance, \$55.00 a year and the benefits are \$1,000.00 a month. Policy issued ages 1 through 80 to residents of the United States who can qualify.

Don't wait until it's too late. Fill out the application and mail it today. There are no strings attached; you are under no obligation.

Sincerely yours,



*C. K. Collins*

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Insurance Center Bldg.  
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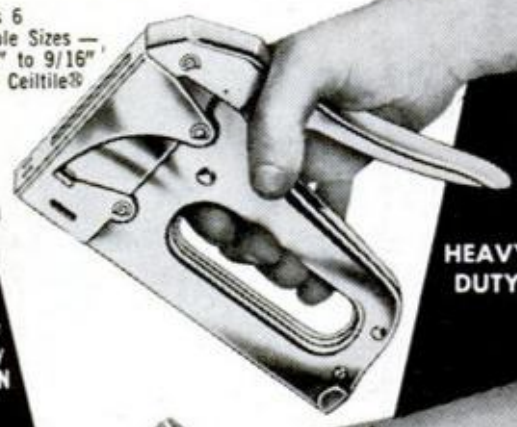
SEND NO MONEY—NO AGENT WILL CALL—Just mail the attached postage paid card. Your policy will be sent immediately. Special payment envelope for sending in 25¢ for your 1st month coverage will accompany the policy. No agent or salesman will call.



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## SHOOT A STAPLE wherever you'd drive a nail!

Uses 6  
Staple Sizes —  
1/4" to 9/16"  
and Ceatite®



HEAVY  
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FEATURED ABOVE!

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retail outlets

**HANDY, POCKET-SIZE  
PLIER**  
perfect for students,  
salesman, housewives,  
clerks, etc. Fits hand  
comfortably for smooth,  
easy stapling



## Oil Change Myths

(Continued from page 224)

haps enough so they can't continue to hold their full load of contaminants in suspension.

### The Only Oil To Use For Really Cold Weather Is 5W

If starting crankability at low temperatures were your only consideration, the thinnest oil you could buy, 5W, would be the one to get. But more important is what happens to your oil after the engine warms up to operating temperature, a figure that varies little from summer to winter:

The 5W-20 multi-grade, with the viscosity-index-improving polymer added, does not become appreciably thinner at 210°F. than regular SAE 20 weight. But regular 5W weight at 210°F. gets extremely thin, so low in viscosity, in fact, that your car manufacturer warns you not to drive faster than 60 m.p.h. with it in your crankcase, and even that speed can be risky if sustained.

If your big problem is getting the car started, and you intend to drive only a few blocks at low speeds, use 5W. If you must drive even occasionally at 50, 60 or 70 for distances of 10 miles or more, use 5W-20 and risk an infrequent hard start in below-zero temperatures.

Incidentally, if you do have trouble starting you think might be attributed to oil problems, try changing brands. One set of lab tests showed a difference of 30 r.p.m. in cranking speed (corresponding to a temperature difference of about 15 degrees) between two brands of oil carrying the same viscosity ratings.

### All-Day 70-mph Turnpike Driving Is The Roughest Test Of Engine Oils

Hardly. Cars with average trips of 10 miles or less are in truly severe service. In the worst shape are big-car engines loafing along in short-trip city service where they rarely use more than 10 per cent of available horsepower. That's why clacking hydraulic valve lifters sing the theme song of the city-driven car. Highway speeds and high-speed operating temperatures help the engine purge itself of soot, crankcase blowby gasses, and harmful chemicals that bring on sludge, varnish and rust.

### Automatic Transmission Fluid Is OK For Your Crankcase

ATF includes little detergent-dispersant because it isn't subject to soot or other combustion byproducts. Its oxidation inhibitors and anti-wear agents also are



different. One car maker once designed a drive that shared crankcase motor oil, but the unit was soon displaced in succeeding models. Besides, for the price of transmission fluid, you can get the best motor oil for your automobile.

**Because There Are Less Additives, Hence More Oil, Per Quart, ML May Be A Better Lubricator Than MS**

This approach can cost you serious engine damage. It's based on the assumption that additives themselves aren't lubricants. Actually, many are. And the others all perform vital functions. If the base oil can't flow through the system, it can't lubricate, so additives, such as those in MS oils, that keep the passages open are vital. All car makers now specify MS.

**You Can Save Money Using ML and MM Oils In Older Cars (1954-57) With Less Demanding Engines**

These oils cost less because they have smaller amounts of additives. To give the engine the same protection with them, you should follow a frequent 1000-mile change cycle. But, for less money you can run sequence-tested MS oils in your engine

because they can afford protection for a longer period.

**If You Use The Best Quality Oil, You Can Forget About When To Change It**

This is a transparent myth, of course. Your decision as to proper oil change interval will probably lie between Ford's carefree "Six-months-or-6000-miles" and API's "every 30 days in winter."

GM's suggested program for its five makes is API's 60 days in summer, 30 days in cold winter weather, plus a 6000-mile limit.

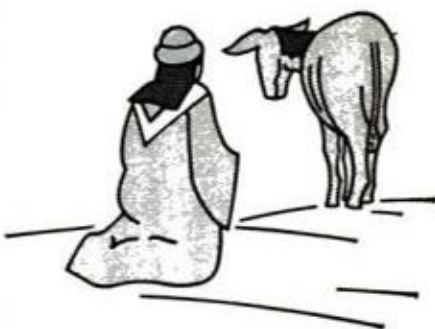
All motor makers qualify their recommended intervals with advice to change more frequently under severe driving conditions such as dusty roads or short trip driving in cold weather.

If you're not going to follow the owner's manual to the letter, we'd advise moving in Ford's direction for summer driving and leaning towards the API's recommendation in winter. Change your filter every 4000 to 6000 miles and check oil level every time you gas up the car at the service station. Play it this way and you'll rarely have troubles which are caused by cranky crankcase contents. ★ ★ ★



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## Pass Up the Moon for Mars?

(Continued from page 108)

sooner than we can land on the moon and come back. The reasoning is that a small manned spacecraft capable of flying past Mars and returning to earth can be launched with boosters that are nearly ready for use. On the other hand, boosters to launch the Apollo capsule for a moon landing and return will not be ready for another couple of years.

Even so, chances are we'll still make that moon voyage first. The Mars boosters may be nearly ready, but life-support systems and shielding are not. NASA scientists say that we will be doing all we can at present to perfect a system to supply oxygen, reclaim water and eliminate waste for up to six months in a space laboratory. We will do that much only with the help of frequent resupply ferries from earth. Several more years at least are needed, they say, to develop a reliable system that will work for up to two years—without resupply ferries.

A second unsolved problem that keeps us from an early fly-past of Mars is shielding. Radiation from solar flares could spell death for astronauts. A seven-day moon journey can be scheduled between solar flares, but a trip of 14 months or more to Mars cannot.

### Spinning Astronauts

Studies on different life-support systems and shielding materials will join the artificial gravity studies that astronauts aboard the orbiting laboratory will perform in preparation for the eventual Mars trip. Both the orbiting "can" and the experiments scheduled for it have been cleverly designed.

Two National Aeronautics and Space Administration research centers are working on space station plans. However, the first station to be blasted into orbit undoubtedly will be based on the "Langley Can"—a design drafted at NASA's Research Center near Hampton, Va. This is a cylinder some 13 feet in diameter and 30 feet long. It features three small compartments for cramped living and working by the four-man crew. A Saturn I-B booster, already developed, will lift the 20,000-pound laboratory into orbit.

One compartment will house a small, man-carrying centrifuge for artificial gravity experiments in the otherwise gravity-free space station. One of the experiments will involve spinning three of the astronauts for a short time each day.

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(Please turn to page 232)

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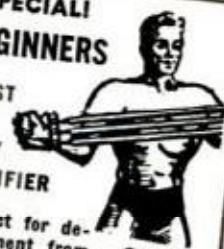
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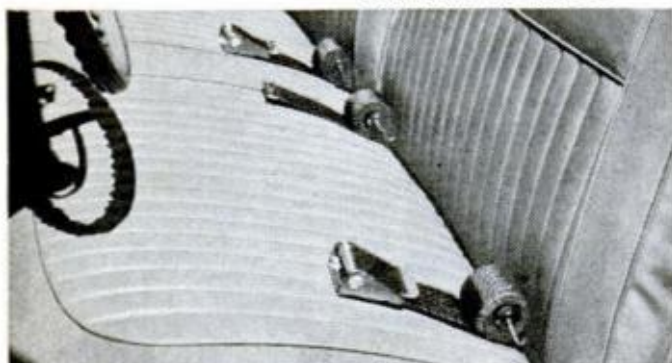
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# Pass Up the Moon for Mars?

(Continued from page 230)

mental alertness, muscle response and other important characteristics will be compared with readings made on the astronaut not undergoing the daily gravity dose. Possibly, NASA researchers hope, an occasional workout on the centrifuge every few days may solve weightlessness problems of the long Mars flight without getting the spacecraft involved in cumbersome artificial-gravity techniques.

The lab as planned will carry about 845 pounds of equipment for scientific experiments. It will provide 96 cubic feet of space and its solar batteries will yield 1330 watts of electricity.

NASA also wants the space lab to produce high resolution celestial photographs that cannot be made from the earth or balloons. The first voyagers will experiment with space suits for wear *outside* the station, for making repairs in empty space. Some of the engineering and scientific equipment will study radiation effects on the station's structure and will measure drag, surface erosion and metal fatigue in the high vacuum of space.

There is a chance that the results of some experiments may pose more questions than they answer. If so, they would be put to "second generation" space stations for answers. Such huge stations would carry, in some cases, up to 36 men and orbit almost indefinitely. They are already under study and development at NASA's Houston center.

## Windmills in Space

The Manned Spacecraft Center there has come up with a "Y"-shaped concept for a station with arms 75 feet long and 15 feet in diameter rotating about a central hub 33 feet in diameter. The motionless hub would be a large laboratory for extensive experiments on weightlessness, while the slowly rotating arms would house living quarters.

NASA officials believe that the first space station can be ready to orbit in two to three years after construction funds are appropriated. When the time comes, the station will be blasted, unmanned, into an orbit 200 or more miles high—above the drag of the atmosphere and below the radiation of the Van Allen belts. A signal from the ground will activate the station's power supplies and the life-support system that recirculates oxygen, discards carbon dioxide and feces, and reclaims drinking water from shaving and bath water and urine. (Early systems will not produce food.) When a telemetered signal

(Please turn to page 234)

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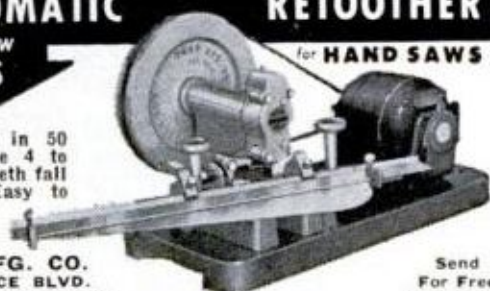
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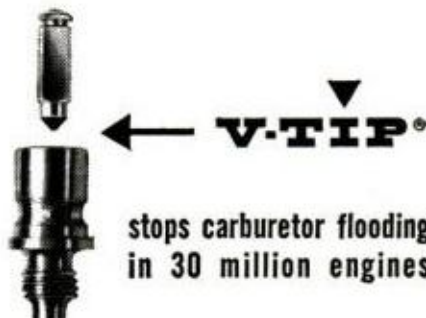


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## Pass Up the Moon for Mars?

(Continued from page 232)

indicates that these systems are working properly, the crew will be sent up.

A Gemini capsule carrying two men will be launched into the same orbit where it will rendezvous with the laboratory and then dock. The two men will enter the station through an airlock, leaving the Gemini capsule fastened alongside as a "lifeboat." Thirty days later, a second Gemini will take two more crew members to the station in the same way. Soon afterward, a Gemini supply craft will head for the station. It will be guided (unmanned) to a port on the side of the station and unloaded. For 90 days, until the next supply craft arrives, it will stay there, collecting waste materials. When the second supply craft arrives, the first will be launched toward the earth where it and its contents will be allowed to burn up on re-entering the atmosphere.

Thirty days after the second ferry arrives to complete the four-man crew, a third ferry carrying two men will dock at a third airlock on the bottom of the station. One man will board the station and one of the original crew members will leave. The pilot will ferry the veteran

crew member back to earth. Thus, every thirty days one NASA scientist-astronaut crew member will be replaced. This system gives physicians on earth a chance to examine the possible cumulative effects of space life in thirty-day increases. At the end of six months, one of the original crewmen will have served the full term in space and will be a living demonstration of the effects of prolonged weightlessness. Should doctors discover alarming symptoms, they could bring the entire crew back to earth in a few hours.

The plan to develop a space laboratory is not new. Serious studies have been under way for several years. In the early days of our space program, NASA engineers even designed gigantic inflatable "innertubes"—lightweight space stations that could be lifted into orbit by the small boosters that we expected to be using. These were phased out, thanks to successful development of powerful Saturn boosters.

Those boosters will get Americans to the moon, but it will take much larger boosters coupled with long-range nuclear rockets to get man onto Mars and then back to earth. However, those moon-shot workhorses likely will put our astronauts on the first rung of the ladder to Mars—before we send a man to the moon. ★ ★ ★

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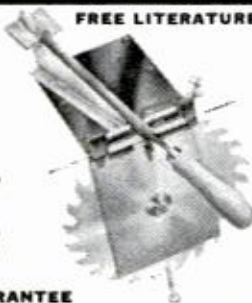
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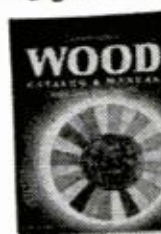
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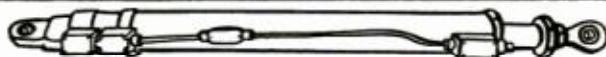
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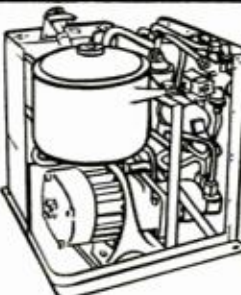
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Handiest tool you'll ever own. Moto-Tool's high speed (27,000 rpm) is ideal for precision grinding, drilling, polishing, carving, engraving, deburring, sharpening. Does fine detail work with pin-point accuracy. Eliminates time consuming hand work, gives the finished job a professional look. Weighs only 13 oz. — handles easily as a pencil. Fastest, most powerful tool of its kind. Widely used by tool and die makers, model builders, gunsmiths, repair men, schools



No. 2 Moto-Tool only.....\$19.95  
No. 2 Moto-Tool Kit..... 29.95  
(Incl. No. 2 Moto-Tool & 23 assorted accessories in steel case)

### NEW HEAVY DUTY NO. 3 MOTO-TOOL

New high torque motor designed for industrial use. Same features as No. 2 plus 50% increase in power. Weighs only 18 oz. Complete with 1/8" and 3/32" collets and finger grip in steel case...\$29.95

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**DREMEL MFG. CO. DEPT. 113-L, RACINE, WIS.**  
QUALITY POWER TOOLS SINCE 1934

# SNOW?

# BLOW.



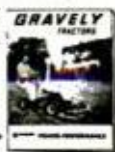
## GO! NOW—GRAVELLY DOUBLES YOUR SNOW POWER!

Blow away snow delay faster, easier than ever with Gravelly! New Swiftamatic 8 transmission (4 all-gear speeds in each direction) bulls through deep snows, zips through light snows. Two-stage, all-gear drive Snowblower clears 26" path, blows snow up to 35' to sides. See your authorized Gravelly dealer today for free demonstration.

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TRACTOR DIVISION  
**Studebaker**  
CORPORATION

5711 GRAVELLY LANE • DUNBAR, W. VA.

**FREE BOOKLET...WRITE NOW!**



## 407 Miles Per Hour

(Continued from page 92)

to be a conventional streamliner with piston power, then I realized that a jet would deliver more power for the same money.

Some friends and I began making design studies. We changed our ideas half a dozen times and finally came up with a basic three-wheel concept that looked good. There isn't room to list all the people who contributed to the idea. Rod Shapel ran more than 100 wind-tunnel tests to determine things like the shape of the nose. If wrongly designed, the nose could acquire lift and raise the front end off the ground at high speed. If we went too far the other way, down pressure would overload the front tire. We thought about running the rear wheels in the open, until the tunnel tests showed that drag was increased 30 percent without the wheel fairings.

Walter Sheehan of Lockheed, who designed the engine air intake ducts for the F-104 supersonic fighter plane, came up with a duct design for *Spirit* that would never let the engine stall out.

### Started in Back Yard

I had been building the car in my back yard, on my own time and money, but soon realized that the project needed a sponsor with money and talent. I told my story to Bill Lawler, marketing manager in my area for Shell Oil Company. Shell had not been active in the racing business in the U.S., but I was enthusiastic and Bill believed me. Together we sold the idea to his management.

We moved the car to a shop in Gardena where Quin Epperly has been building racing cars since 1938. Goodyear Tire & Rubber Company came in as co-sponsor with Shell and designed and built the huge tires. They are 48 inches in outside diameter, and designed to withstand six tons of centrifugal force. They have been tested without failure at 624 miles per hour while bearing a two-ton load.

A year ago we trucked the car to Bonneville and began our trials. I believed we had a winner. Actually, all we had was trouble. The engine wouldn't start. Steering was a problem. (At that time the slow-speed steering was by separate braking of each rear wheel.) The car was unstable at more than 250 m.p.h. It wouldn't stay on the course. Sorrowfully we packed up and returned to rework the car.

The six-foot tall tail fin went on for stability. The fixed front wheel was made slightly steerable (it turns through eight-tenths of a degree, lock to lock). The air rudder turns 10 degrees lock to lock. The

(Please turn to page 238)



**New Hydraulic snow plow lift kit** has D. A. cyl. 1 1/2"x8 1/2" stroke 1 Vickers pump .410 cu. in. rev 1000-1500 PSI 4 way open center Control valve, reservoir, filter, hose & fittings \$80.25 value **\$47.50.**

**New 15 Ton Hydraulic Press Kit** (less Frame) has hand pump 2500 PSI, 1 D.A. Cyl. 4 1/2" bore x 7 1/4" stroke, 2"d. shaft, 4 way valve, relief, hose, reservoir & fittings \$142.50 value **\$79.95.**

**Welding & battery charging kit** has R-1 300 amp gen., 30 ft. cable, helmet, Elec. holder, voltmeter, rheo., sw., volt. reg., gr. clamp, solenoid, relay, gloves, & reactor coil. **\$44.50.**

**NEW HYDRAULIC CYLINDER**

| Bore   | Stroke  | D. Shaft | Long | Double Action | Price   |
|--------|---------|----------|------|---------------|---------|
| 1 1/2" | 4 1/2"  | 1 1/2"   | 10"  | 3 1/2 lbs.    | \$ 3.75 |
| 1 1/2" | 8 1/2"  | 3/4"     | 13"  | 8 lbs.        | \$ 7.50 |
| 1 3/8" | 2 1/2"  | 1"       | 38"  | 11 lbs.       | \$12.95 |
| 2 3/8" | 13"-15" | 1 1/2"   | 30"  | 11 lbs.       | \$14.95 |
| 3 1/2" | 10 1/4" | 1 1/2"   | 19"  | 15 lbs.       | \$12.95 |
| 3 3/4" | 9"      | 1"       | 20"  | 12 lbs.       | \$16.95 |
| 3 3/4" | 16 1/2" | 1 3/4"   | 24"  | 30 lbs.       | \$24.75 |

Under 20 lbs. add 15% for PP. \*good condition

**New OPEN CENTER 4 Way Hydraulic Control Valves.** 1500 PSI 3/8" ports, dual handle, for 1 D.A. cylinder ±10081 **\$12.95.** = 10060 for 1 to 4 D.A. cyl. with adj. relief **\$14.75.** New 3 way hyd. solenoid, valves 12-24VDC 1500 PSI 3/8" ports **\$6.95** per pair.

**HYDRAULIC PUMP BARGAINS 1500 PSI**

| Gear type | Cu. In. | RPM  | GPH | Piston | Price   |
|-----------|---------|------|-----|--------|---------|
| *Pesco    | .375    | 1500 | 120 |        | \$14.75 |
| *Pesco    | .447    | 4500 | 360 |        | \$16.50 |
| *Vickers  | .410    | 3750 | 375 |        | \$17.95 |

Hyd. hand pump 1.5 cu. in. inp. stroke **\$8.95**

**AC-DC WELDER KIT**—With two new Multi-Weld® Motor-Generator units converts to 150 Amp. 110-220V. AC-DC 60-cycle Welder & Fast battery charger, includes switch, reactors, relays, wire, cable, misc., & instructions. Size 6"x13"x12". 75 lbs., **\$48.50.**

**GENERAL SALVAGE CO.** Check or M.O. 2922 E. 27 St., Dept. 113, Kansas City 27, Mo.

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Never before and perhaps never again—this offer of brand new genuine Clinton and Briggs & Stratton engines including 1 yr. factory warranty at less than cost. Perfect power for go-carts, scooters, tractors, mowers, generators, pumps, sprayers, etc. We bailed out 3 big factories who needed cash and the savings are yours while quantities last. Act fast.



Clinton 2 1/2 hp, MdI. 500—Re-coil starter Std. 3/8 shaft w. keyway—ready to go. Reg. price \$49.50 Special (item 1002) **\$29.95**  
2 for ..... **\$59.50**  
6 for ..... **\$176.50**



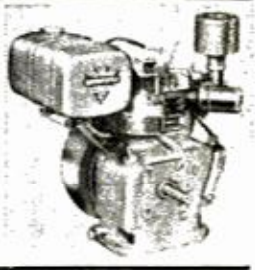
Briggs & Stratton 2 hp, MdI. 60101 Rope start, std. 3/8 shaft w. keyway, Sturdy 4 cycle power. Regular price \$49.80 Special (item 106a) **\$29.75**  
2 for ..... **\$58.90**  
6 for ..... **\$175.50**

**\$67.50**  
**5 3/4 hp.**  
**Briggs & Stratton**



Briggs & Stratton 5 3/4 hp, MdI. 143302, Re-coil start. Std. 1" shaft w. keyway, aut. choke & throttle control—a rugged big engine ready to tackle any job. Regular price ..\$92.60 Special (item 1059) ... **\$67.50**  
2 for **\$130.00** 6 for **\$350.00**

**2 3/4 h.p. Clinton—34.95**  
Model 400, rugged 4 cycle model. Alum. Block, castiron cylinder Rope start—3/8" std. shaft  
Item 1107 ..... **34.95**  
2 For ..... **67.50**



**3 1/2 h.p. Clinton—39.95**  
A big engine with big power, Model 406, 4 cycle, rope start, 3/4" std. shaft.  
Item 406 ..... **39.95**  
2 for ..... **77.50**



**2 1/2 h.p. Lawn Mower Engine \$29.89**  
Clinton Model 403, 4 cycle, 2 1/2 h.p. or 3 h.p. rotary mower. Standard 1/2" dia. shaft with female 3/8" thread. EZ recoil starter. Aluminum block with long life steel cylinder sleeve. It's less than the cost of an overhaul.  
Weight 22 lbs.  
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10" Pipe, wt. 7 lb. .... **\$8.85**  
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10" Fan, wt. 8 lbs. (Item 10E) ..... **\$11.95**  
12" Fan, wt. 10 lbs. (Item 10D) ..... **\$12.95**  
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Use 1/4 HP motor or larger ... 1 HP for up to 5,200 GPH; 1,000 GPH 60' high; or 3,000 GPH from 25' well. 1 1/4" inlet; 1" outlet. Stainless shaft.  
**TYPE X-2** oil-less bronze bearings. **\$10.95**  
Won't rust .....  
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Best for belt drives.....  
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Centrifugal and Gear Pumps in All Sizes  
**LABAWCO PUMPS, Belle Mead 2, N. J.**



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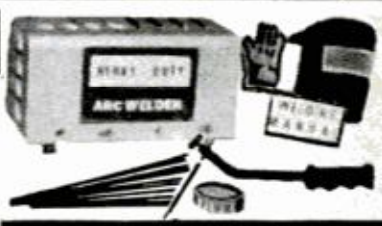
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Order direct from factory; NATIONAL ELECTRIC, DEPT. PM 11, DELRAY, FLORIDA

NOVEMBER 1963

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**1500 PSI Double Action HYDRAULIC CYLINDER**

A Gov't Surplus Hydraulic Bargain! Has 1" bore, 1/2" shaft, 1-7/8" stroke, 8-1/2" eye-to-eye lgth. Ports are 1/4" AN (7/16"-20 thread).  
Cat. No. H-3CSU  
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LOS ANGELES 58, CALIFORNIA

**407 Miles Per Hour**

(Continued from page 236)

two are linked together. At high speed the air rudder does 90 percent of the steering.

These major changes made the big difference, and this year our runs went off right on schedule.

After lunch on the day I made the record a representative of a London newspaper phoned me. "You really haven't broken John Cobb's record, you know," he said. I acknowledged this. Cobb's record, made in a four-wheel car with the powerplant geared to the wheels, still stood even though my jet car had gone faster. Let me explain.

The Federation Internationale de L'Automobile, in Paris, is one of the international bodies that attests to world land-speed records. It is represented in the United States by the United States Auto Club. A year ago USAC established a new class for wheeled jet-propelled land vehicles; FIA hasn't done so yet.

This means that my record is an official world land-speed record as far as USAC is concerned but, at present, FIA has no way of recognizing it. Meanwhile the FIM, the international motorcycle body, has announced recognition of my speed as a world record for three-wheeled vehicles.

**Measure Course With Tape**

USAC takes extreme precautions to make certain that a new record actually is a record. The course is measured and marked by a registered engineer who uses a 100-foot steel tape certified accurate by the U.S. Bureau of Standards. It must be tensioned to the same amount of pull each time it is stretched out on the course. A temperature correction is made to allow for expansion or contraction of the tape itself. As measured, the distances are true to within one inch per mile.

Time is measured by the same kind of digital timer used to clock missile speeds. It prints its record on a tape. The timer is carried twice each year to Boulder, Colo., where its accuracy is checked against an atomic clock.

Each timing consists of a light beam that shines across the track into a photoelectric cell. Every cell is connected by cable to the central timing apparatus. When the car interrupts a light beam a mark is automatically recorded on tape. Four USAC observers (not counting one at each end) are stationed along the course to guard the timing traps and make certain no one tampers with them. The timer prints its results in thousandths of a second and the tape becomes the offi-

(Please turn to page 240)



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Each bit factory stamped HS. Try this set on any thickness steel plate, or even stainless steel. If you are not completely satisfied that these are the finest quality HIGH SPEED Drill Bits, return them on our absolute money-back guarantee. Tested and approved by American Standards Testing Bureau, Inc. You would expect to pay \$30.00 for similar bits. European Common Market makes our low price possible. Packed in handy case; 17-Pc. Set includes 1/16 thru 1/2" bits. Cut-down shank fits 1/4, 3/8, & 1/2" drills. Send \$17.50 plus 50¢ shipping and handling, in check or M.O. to:



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NOVEMBER 1963

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drive screws . . .  
drill concrete,  
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saw every material—  
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polish car without  
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Now a Service Free Light Plant built with a transistorized alternator. Offers 30% greater efficiency—more power for less fuel. Terrific service life—no brushes to arc and burn. No more commutator to wear, no collector ring trouble. And best of all it costs no more to "go modern with Everlite." Thrifty 1200 watt, 115v. AC plant powered by a rugged easy starting 4 cycle engine—leader priced. Model 869-12T. Wt. 65 lbs. as illustrated . . . . . **179.59**  
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DEPT. M3, 7600 STATE RD., PHILADELPHIA 36, PA.

## 407 Miles Per Hour

(Continued from page 238)

cial record of the run.

The *Spirit of America* is 38 feet long, 11 feet 4 inches wide and six feet tall without its six-foot tail fin. Except for the fiberglass sheath of the tail fin, the car has an aluminum skin supported on a full truss frame of chrome-moly tubing. The rear axle is a fabricated-steel unit that arches up over the engine and is designed to absorb some of the wheel shock. The Good-year spot brakes, one on each rear wheel, consist of a steel disk bolted to the wheel. Two pairs of brake pucks hydraulically squeeze against both sides of the disk. The brakes can't drag and are self-adjusting.

### Uses Jet-Fighter Engine

*Spirit's* engine is a GE J-47 similar to that used on the F-86 fighter plane. It is rated at 5200 lbs. static thrust, which can be increased to 5900 lbs. with water injection and to around 7600 lbs. thrust with afterburner. A carbon dioxide fire extinguishing system vents into the engine compartment.

Another safety feature is a sheet steel seat, back and head unit contoured to my body. It is thinly padded inside and beefed up on the outside with extra tubing. In a sense it's a "100-percent crash helmet" to protect head and body in a high-speed crash. I'm strapped in by a five-way harness.

Estimating in round figures, the entire *Spirit* project cost \$250,000. That's a cheap price for the land speed record.

A new record often stimulates competition. By the time you read this, some other driver may have broken my record. If so, I'll be back on the salt as soon as possible. Maybe this fall.

*Spirit's* front end was becoming slightly light at the fastest speeds I ran. The recorder on board the car showed a negative lift in front of 2500 lbs. at speed, versus 2800 lbs. at low speed. This is not critical and I can go quite a lot faster without lifting the front off the ground. But if necessary we'll ballast the front end or we may install horizontal nose fins, locked at a slight negative angle.

Probably I'll use water injection for extra power next time. We are re-working the drag-chute door and its mechanism for positive control.

I don't believe that *Spirit of America* will ever get into serious trouble on the salt; it's too good a machine. And I'm convinced that the car can exceed 500 miles per hour for the measured mile, both ways.

I'll probably find out this summer. ★ ★ ★

# SURPLUS SALE

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EXCESS INVENTORY  
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## AIR COMPRESSOR EQUIPMENT

• Make your own outfit. For painting, tires, shop use, etc. Save to 60%.

- Compressor, \$21.50. Govt. tank, \$11.95. Gauge, \$1.75. Paint Gun, \$10.50. Auto Switch, \$4.45.

**Air Regulator... \$3.95**

## BATTERY HYDRAULIC PUMP

• Item #920. Expensive 12-volt DC 1000 PSI 3 gpm hydraulic pump. Ball bearing precision unit. Use for snow plow lift, farm machinery, wagon hoist, etc. Wt. 25 lbs. Govt. cost \$175.

**SALE \$18.49**



## STORAGE BATTERY WINCHES-HOISTS

• Item #311. 12-v Govt. reversible, ball-bearing 2000-lb. capacity winch. Holds 40' 1/4" cable. For trucks, docks, boats, etc. 55 lbs. Cost over \$250.

**SALE \$49.95**



## 12,000-LB. WAGON-TRUCK HOIST

Limited quantity this price.

• Item #337. Marvellous buy 6-ton hydraulic wagon or truck bed hoist. Easily adapted most wagons, trucks. Consists of complete steel frame for attaching to wagon bed and to frame of chassis. Has large heavy duty 1000 PSI raising cylinder. Detailed illustrated instructions for installation. Wt. 160 lbs. List \$99.50.

**SALE \$59.50**



## 5 KW-AC POWER PLANT

(Only 21 plants, order promptly)

• Item #627. Army 4-cyl. water cooled engine driving AC generator with finest controls, meters, etc. Output 120/240-v, 60-c at 5,000-watts. Rebuilt, excellent. Size 26"x34"x53". Wt. 881 lbs. Govt. cost \$1305.

**SALE \$394**

## SMALL ENGINE BATTERY STARTER

• Item #515. New Fairbanks-Morse push-button starter complete with 12-v storage battery. Works on Briggs, Clinton, etc. Has 12-to-1 gear reduction. Wt. (starter and battery) 25 lbs. List over \$50.

**SALE \$18.95**



## SURVEYORS LEVEL-TRANSIT

Limited quantity, this price.

• Item #832. Made by leading instrument Co. Fine for leveling, contouring, building contractor, surveying, etc. Excellent 8-power scope. Precision calibrated for both vertical and horizontal angles. Complete with tripod, plumb bob, how-to-use data, etc. Wt. 11 lbs. (Tripod not shown.) List \$67.50.

**SALE \$39.95**

• Item #829. Same as above but without transit (vertical angles) feature. Excellent for leveling, setting foundation grades, etc. List \$46.50.

**SALE \$29.95**



# SPECIAL OF THE MONTH!

## PRIVATE PHONE SWITCHBOARD

Sale price good only 60 days

• Item #701. Have your own private phone system. Fine for hotels, factories, stores, etc. 12 private lines. Phones are connected and signalled by simply throwing a key. Lamp lights on incoming calls. Attractive mahogany cabinet, deluxe appearance. Size 23"x25"x12". Wt. 98 lbs. Govt. cost \$459.50.

**SALE \$69.50**

Non-dial phones for this board... \$4.95 each



## LABORATORY AC-DC RECTIFIER

• Item #2253. Expensive Govt. selenium rectifier unit. Changes 115-v AC to DC (25 to 200 volts.) Finest filters, transformers, controls, etc. 19"x12"x3". Wonderful for home experiments, commercial laboratories, etc. Wt. 40 lbs. Govt. cost \$165.

**SALE \$6.91**



## EXAMPLE BARGAINS NEW CATALOG

- \$20 12-Volt Police Siren... \$ 9.65
- \$35 John Deere 30"x2" Bore Hyd. Cyl. 24.91
- \$67 Ball Hrg. 30-to-1 Speed Reducer 37.61
- \$80 Borg 16 gpm 1500 PSI Hyd. Pump 41.90
- \$35 G.E. 110-v Auto. Time Sw. 5.98
- \$205 12-v Golf Car Motor 16.95
- \$29 Standard Phone Co. Dial Phone 7.95
- \$30 Complete Army Field Phone 11.95
- \$75 Govt. Centrifugal 1 1/2" Pump 19.95

All Items This AD  
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FREE Send For  
Big New  
1963 CATALOG

## SURPLUS CENTER

Dept. 805, LINCOLN, NEBR.

# ONE-MAN SAWMILL LOW \$50.00 AS... 50.00 DOWN



Take BELSAW Portable Sawmill right to the trees—turn out valuable lumber for home and farm—sell to local yards—make up to \$50 a day custom sawing for neighbors. BELSAW lasts a lifetime. No crew needed. Power with tractor or auto engine. Beginners get excellent results. Send today for FREE BOOK.

FREE BOOK

**BELSAW MACHINERY CO**  
P.O. 3454 Field Bldg. Kansas City 11, Missouri

Man-size  
**ECONOMY**  
ALL-GEAR-DRIVE  
**TRACTOR**  
at garden-size price

Bigger, more powerful than ordinary garden tractors. For farm, lawn, woodland. Easy to operate. Rugged, built-in quality. 9-12 hp. ALL GEAR DRIVE incl. clutch, 3-spd. trans., diff., 176 to 1 reduc. No belts in drive-train. Wt. 750 lbs. 25 low-cost quick-change tools. Write for FREE CATALOG and dealer name.

ENGINEERING PRODUCTS CO., (1005K-11) Anoka Ave., Waukegan, Wis. 54983



PROTECTS TOOLS, SORTS THEM NEATLY

## HUOT TOOL CHEST

Keeps tools organized. 4 sliding drawers, rugged steel Professional Style cabinet—blue or red—26" x 12 1/4" x 12 1/4". Write for FREE BULLETIN on this and 15 other models.

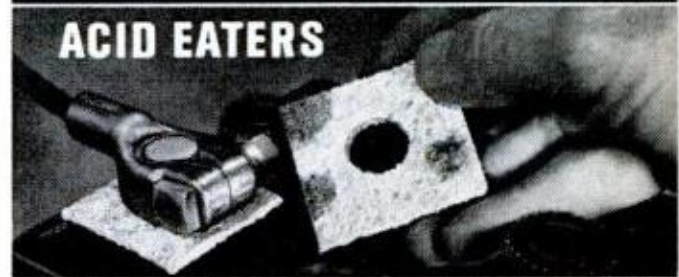


HUOT MFG. CO., 505 N. WHEELER ST., ST. PAUL 4, MINNESOTA

MODEL 107

## STOP BATTERY TERMINAL CORROSION

### ACID EATERS



new fiberglass chemical pads neutralize corrosive acid.

**69¢** per set at auto stores—service stations, or order direct adding 6¢ for postage and handling ■ Install them yourself in minutes. ACID EATERS keep battery posts and clamps dry and clean—no messy insulating oils or grease. Color changes as they work—bright red tells you when to replace for continued maximum protection. Send cash, check or M.O., no C.O.D.

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*(on a somewhat smaller scale)*

England's great champion may have abandoned Grand Prix competition, but he still drives fast. True, his cars now have shorter wheelbases—they're only 2 inches long—and certainly nobody would mistake a table top for LeMans. But the excitement's almost the same, and even Sunday drivers qualify. Try it the next time you're stumped for a party idea. Try it this New Year's Eve. Everything is sure to run smooth-

ly if the set is Model Motoring, with cars powered by super-dependable Thunderjet 500 motors. No den or rec room is complete without a Model Motoring set, and of course, if there's a young man on your gift list, this is what he must have for Christmas. Gentlemen—start your engines!

6 complete sets . . . one to fit every gift budget . . . at all hobby shops, toy, variety and dep't stores.



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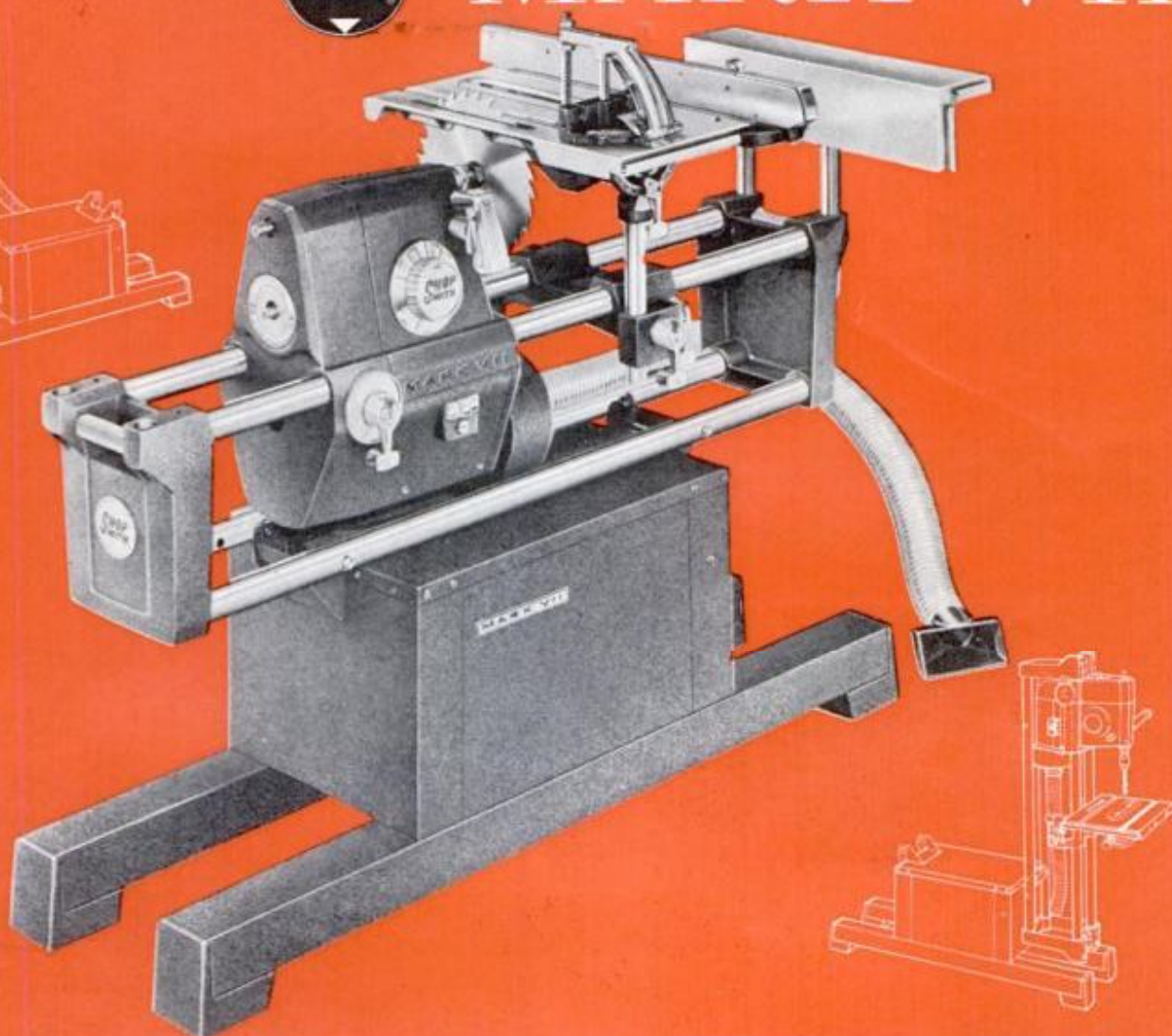
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THE ULTIMATE MULTI-PURPOSE TOOL



MARK VII



### 7 BASIC TOOLS . . .

to complete the job and clean up too!

- BIG VERSATILE 10" TABLE SAW
- DUAL PURPOSE 10" DISC SANDER
- UNEXCELLED CAPACITY 16 1/2" DRILL PRESS
- UNIQUE HORIZONTAL BORING MACHINE
- 34" LATHE . . . BEST IN THE FIELD
- NEW PROFESSIONAL SHAPER
- NEW BUILT-IN SAWDUST VACUUM

A complete shop in a space just 5' x 2'—\$369<sup>50</sup>

Take your first look at the last word in home power tools! Yes! It's a SHOPSMITH. It has all the convenience . . . all the versatility power tool experts have hailed in the SHOPSMITH MARK 5. But the MARK VII is giant steps ahead of all other power tools, providing maximum capacity and versatility in a 5' x 2' space. It features

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| Single purpose 10" SAW—1 hp . . . . .  | \$171.76        |
| Single purpose 9" DISC SANDER—1/2 hp . . . . .   | 123.85          |
| Single purpose LATHE with 12" swing—1/2 hp . . . . .                                   | 171.10          |
| Single purpose floor model 15 1/2" DRILL PRESS—<br>1/2 hp with speed changer . . . . . | 175.94          |
| Single purpose horizontal BORING MACHINE—1/2 hp . . . . .                              | 136.95          |
| Single purpose SPINDLE SHAPER—1/2 hp . . . . .   | 119.48          |
| Single purpose SHOP VACUUM CLEANER . . . . .   | 35.99           |
| <b>TOTAL</b>   | <b>\$935.07</b> |

\*Based on lowest comparable retail prices including motors and stands.

**YOU SAVE** a minimum of **\$565.57**

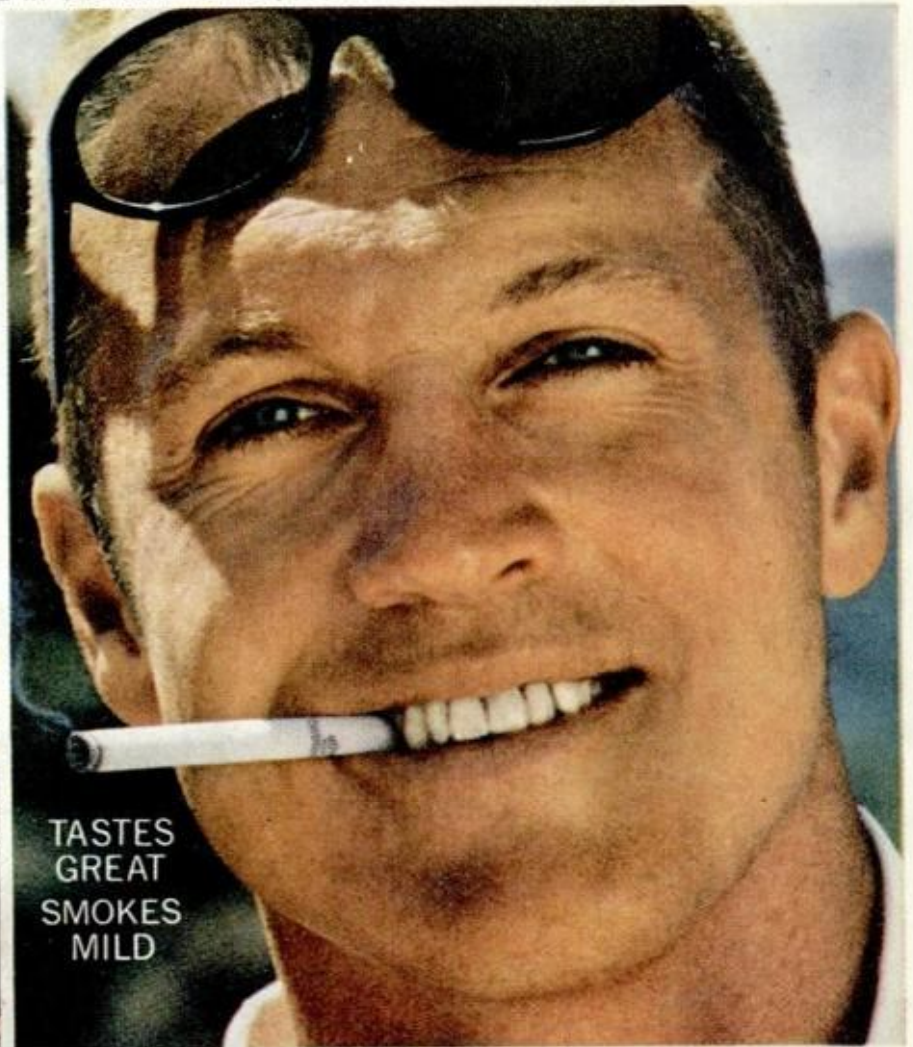
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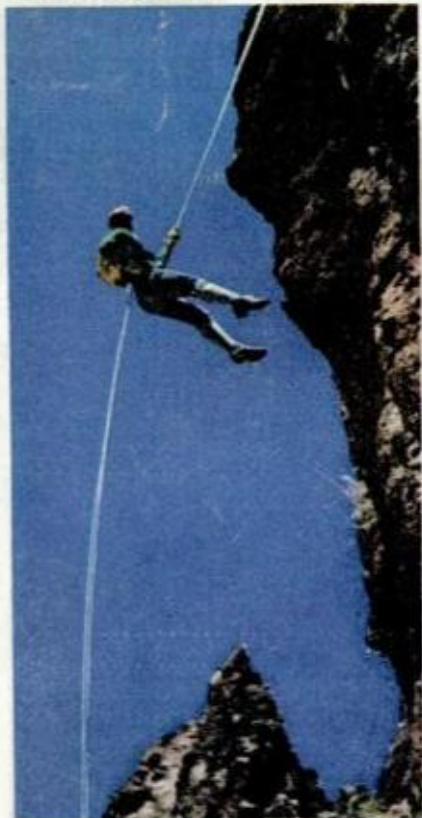
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GREAT  
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