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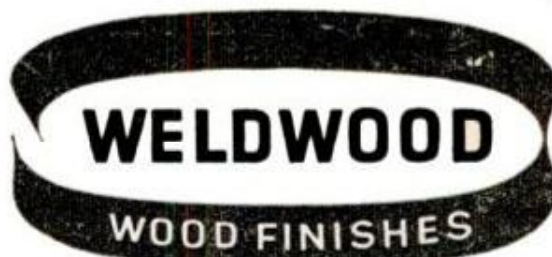
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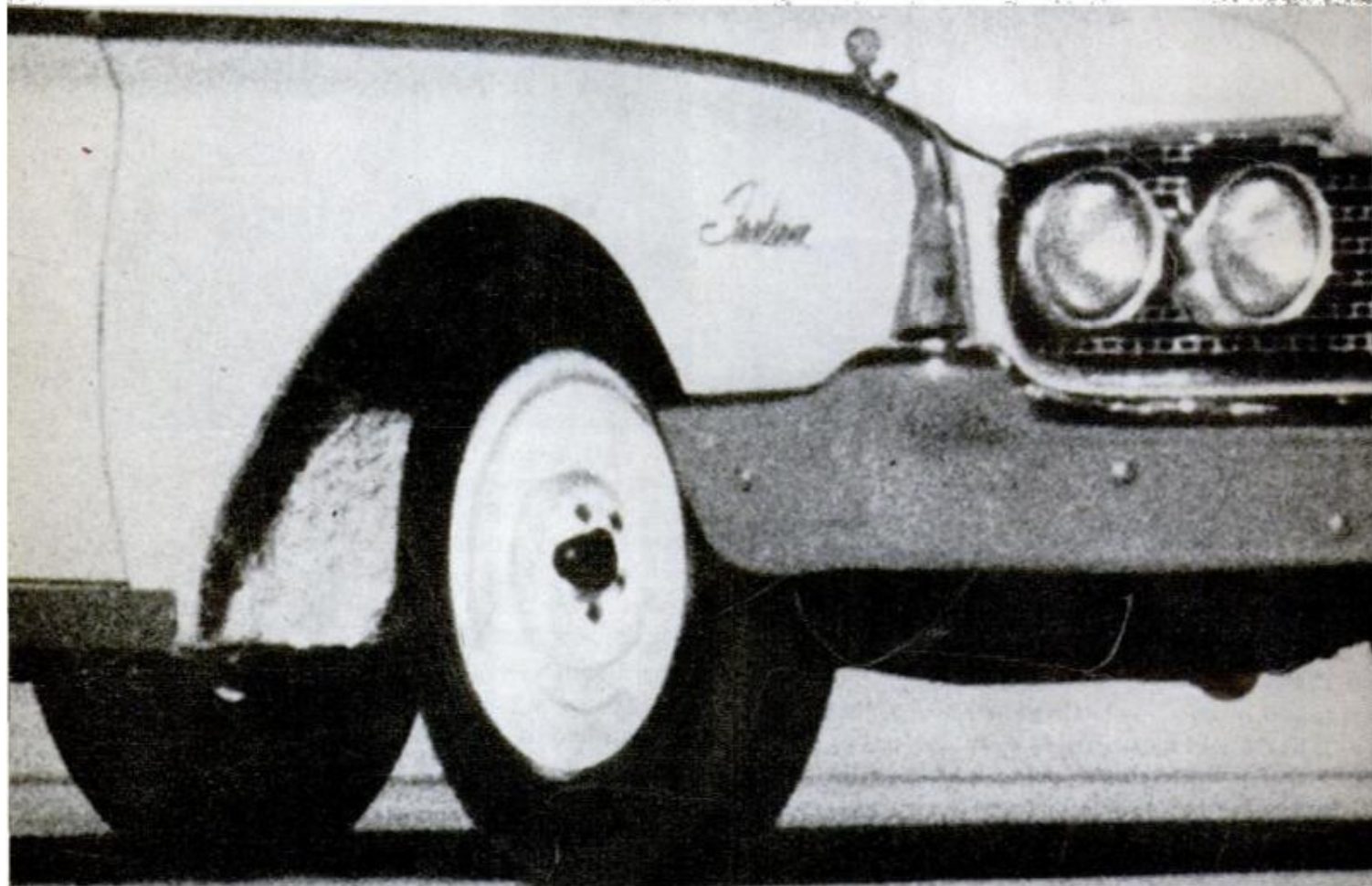
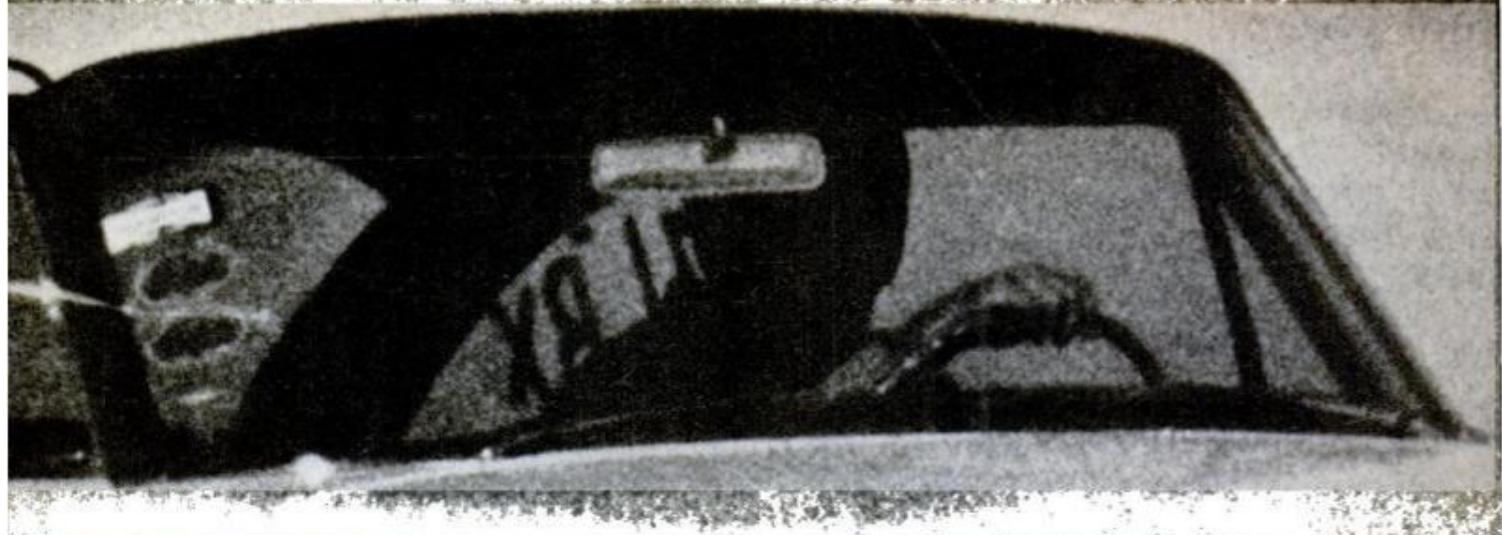


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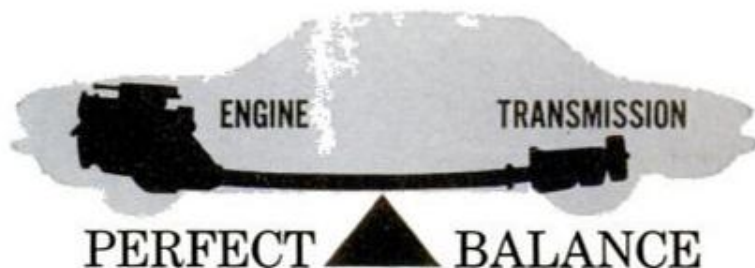
Turn to detailed index on page 6. Sources of additional information on items in this issue are shown on the Where-to-Find-It List, available without charge by writing the Bureau of Information, Popular Mechanics, 200 E. Ontario St., Chicago 11, Ill.

Next Month...

HERE COMES the annual automotive issue—almost 50 pages on cars, cars, cars. You'll see a "Gallery of Classics"—America's all-time great autos—in full color. Also, photos and complete specifications on the 29 most popular imports, and an engineer's analysis of all the latest developments in transmissions, chassis and engines . . . Plus a long line-up of other fascinating features

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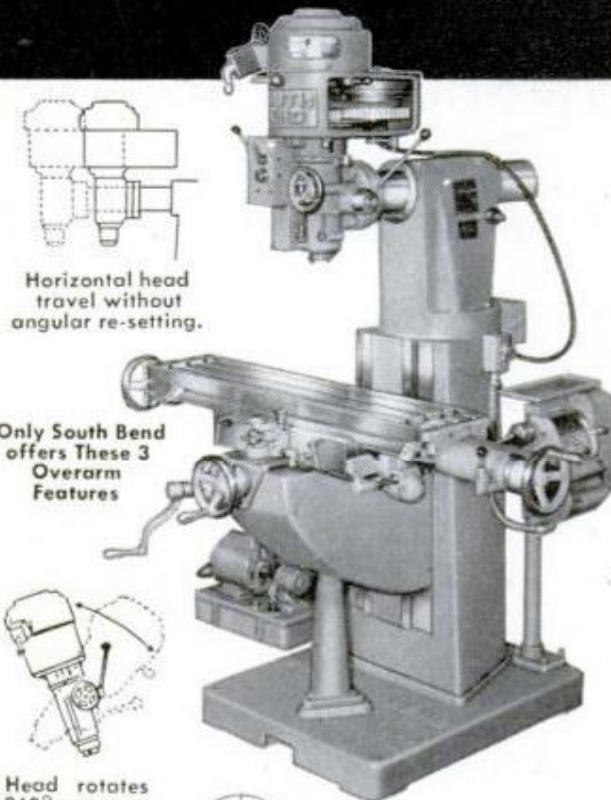
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Are You "STANDING STILL" on your job?

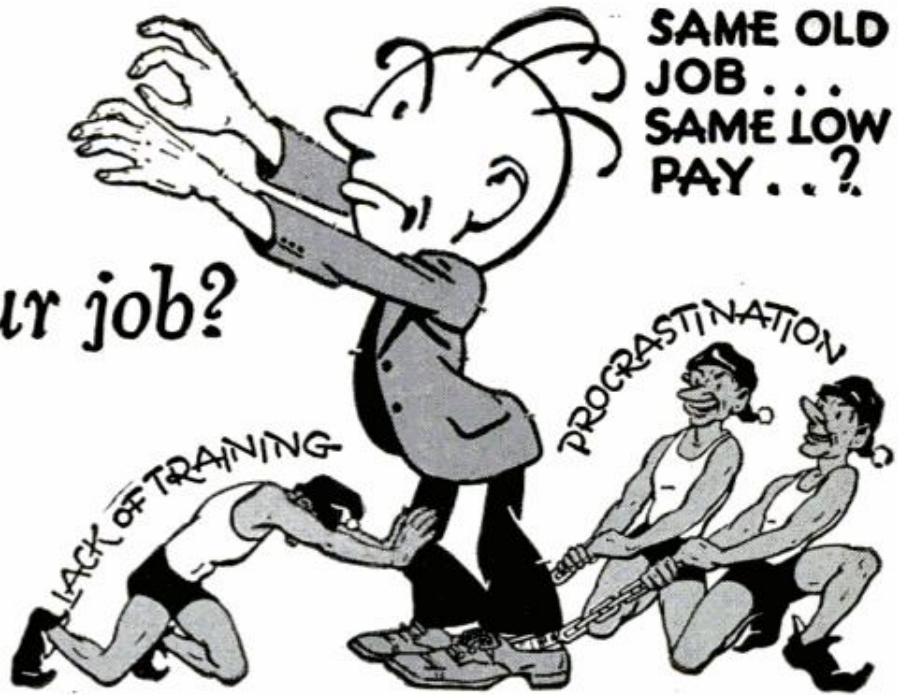
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NOTICE—It is the intention of this magazine to provide its readers with information regarding the latest developments in the mechanical arts. Except where otherwise indicated, this magazine has no information as to any unexpired patents in respect of the developments reported herein. In the event that commercial use is to be made of any of the developments reported herein, it is suggested that legal counsel be consulted to avoid liability for patent infringement. It is not the purpose of this magazine to encourage patent infringement but, as indicated, it is the intention of this magazine to report on the latest developments in the mechanical arts.

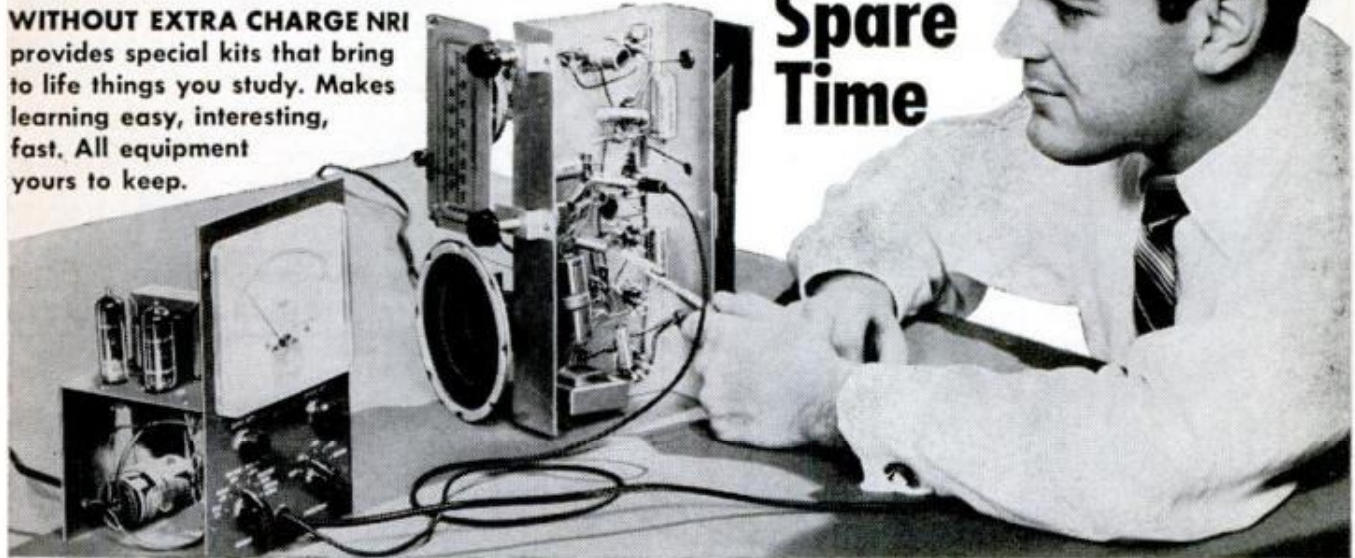
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Over the Editor's Desk



To the Editor:



I thought you might like to know of the success I had with an outdoor animated (Christmas) display which I made from your November 1958 issue. Your article said "It's the animated display that gets the real attention and enthusiastic comment." —and so it did! Thanks.

Paul B. Lacy III
(aged 13)
Covington, Va.

☆☆☆

To the Editor:

I noted with interest a picture on page 167 of your June issue regarding one power mower pulling another to speed up lawn cutting.

The enclosed picture will give you an idea of the hookup I have been using. I mounted the throttle of my towed mower on the side of the motor so I could more easily remove the handles and put them back on when I use the smaller mower for trimming around shrubs.

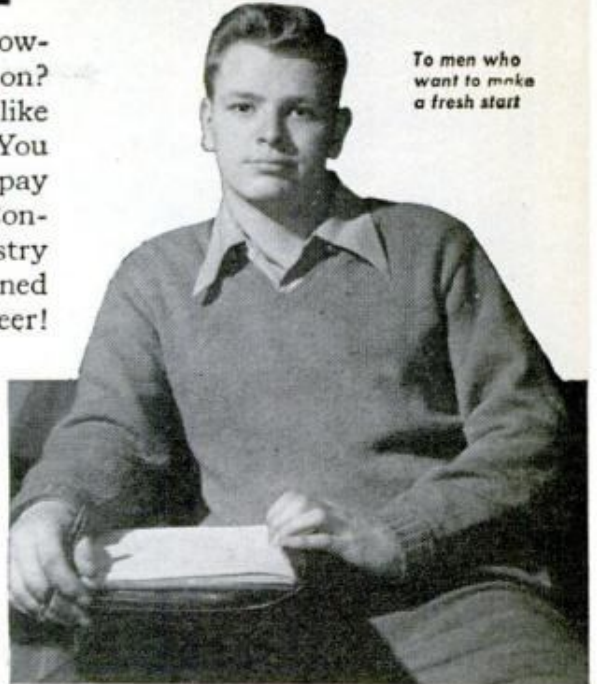
The front and rear towing bars and their

(Continued to page 12)

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Get experience as you train

A famous "mechanics" magazine made a survey of home study school graduates. The editors found that 90% got pay raises, 42% earned promotions, and 17% started businesses of their own. CTI home study offers other advantages. You keep your present job as you train. You live with your family. You set your own pace, select study hours most convenient for you. You also get truly personalized instruction. Best of all, CTI sends practical training kits—to help you get experience as you learn!

Earn money as you learn

The typical CTI student is eager to put his skill to profitable work on a part-time basis. Though most students prefer to tie up with local dealers and repair establishments, a surprising number are independents. The extra cash helps meet training cost. Often there's enough to bank, or invest in more equipment.

Start a business—Be the boss

Armed with knowledge, seasoned with skill acquired through practice on kits, and equipped with tools and gauges, many graduates start out on their own. Some expand into retail stores. Others contract to service taverns, restaurants, food stores and commercial buildings. The more ambitious become air conditioning contractors.

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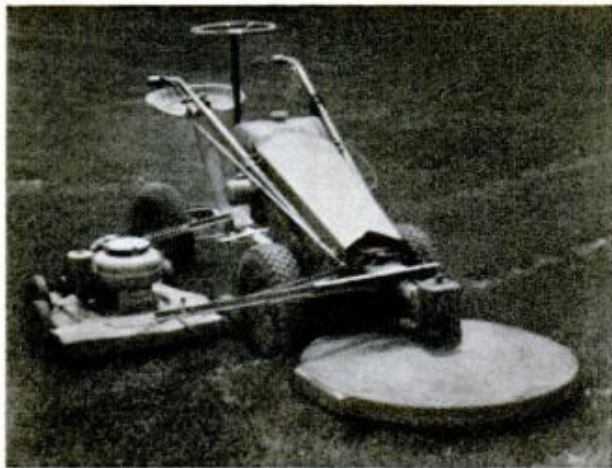
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braces are firmly attached to the towing mower. The chains pulling the other mower are a bridle arrangement in front and a single chain at the rear. The chains should be adjusted so they are tight when the mower is standing still on a level surface. The rear of the mower being pulled should be directly under the rear tow bar. This is what keeps it in its proper position on turns and while in reverse. The longer towing chains in front allow the mower to ride up and down over bumps.

These two mowers have a total cutting width of 51 inches.

E. J. E. Mitchell
Ottawa, Ontario

To the Editor:

Enclosed are some shots of the better part of four years of my life.

Once a '31 Ford roadster, I've passed her off as everything from Maserati to '31 Thunderbird. Inside is a modified flathead Merc. coupled to a 26-tooth Lincoln with overdrive leading out to a two-speed rear end. No lack for gears.

You might say she's more sports car than rod, having all the luxuries, radio, heater, defroster, bucket seats, a ride that amazes all passengers and, my pride and joy, no rattles! Done with a big cross member and interlocking door latches.

Also standard equipment are coil overloads in front, a rumble-seat type trunk,

(Continued to page 14)



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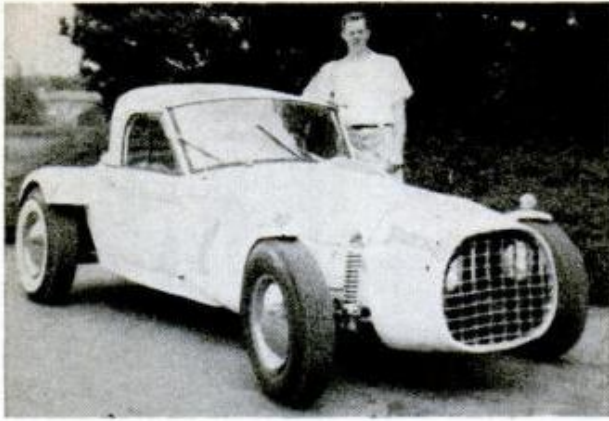
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Jim Curtice
Corvallis, Oregon

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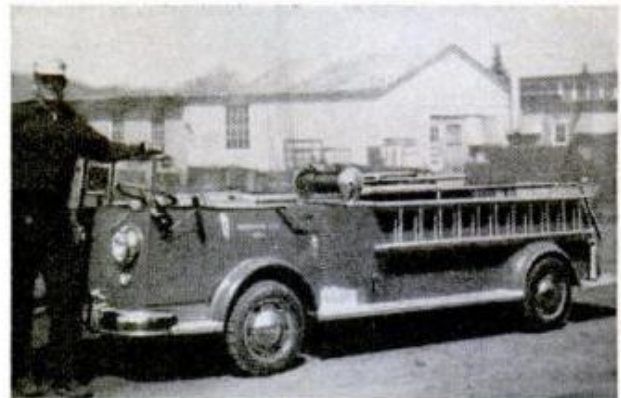
ONE OF THE feature articles in our October issue was "Mr. Rescue and His Bloodhounds," the story of Russ Cone of Los Gatos, Calif. We regret that Mr. Cone did not live to read the story of which he was the hero. He was struck by an automobile in September and died just about the day our October issue appeared on the newsstands.

☆☆☆

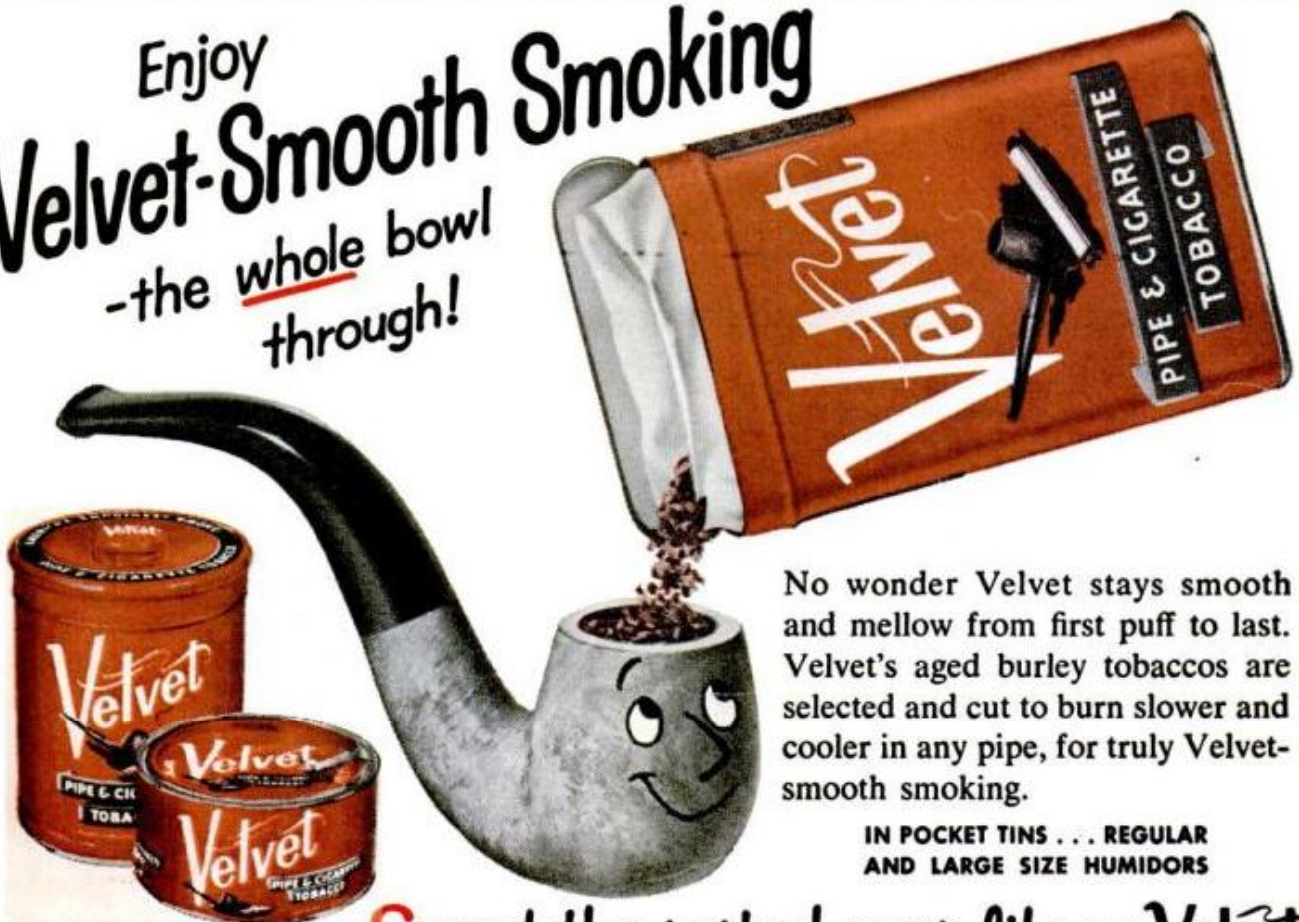
To the Editor:

Here is a miniature American LaFrance fire truck I built. Seeing it running around town, people wondered why the borough bought such a small truck so they put it in the newspaper to set people straight.

Roland C. Bower
Berwick, Pa.



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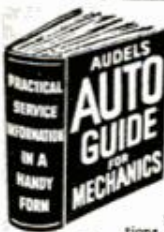
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Rollers By Baker, Inc., Brandon, Vt.

2. PATCHING MATERIAL is fast setting, is especially formulated to handle unusual and difficult leakage problems in masonry walls. It will stop the flow of water leaking through cracks or breaks in a masonry wall even though applied when the water is seeping in. Anchors bolts and hooks to masonry

The Reardon Co., St. Louis 14, Mo.

3. WAXLESS FLOOR COATING is self-polishing, produces a bright, long-lasting luster on linoleum, asphalt tile, rubber and vinyl tile and similar resilient floor coverings. Applies easily with a cloth or applicator. No rubbing. Dries in minutes without any streaks. Goes on white, but dries clear

Price & Stevens Chemical Corp.,
710 Ohio St., Buffalo 3, N. Y.

4. MATCHING SWITCH PLATES for wood-paneled walls are available in the popular paneling woods and are made from solid stock with the grain running vertically. Plates are smooth-sanded, ready for finishing. Made for single or multiple switch, outlet, jack box. Combinations also are available

Superior Panel Plate Co.,
606 Mead Ave., Sheboygan, Wis.

5. REPAIR KIT for Venetian blinds contains 12 plastic slot supports, or ladders, which are installed without sewing and without dismantling blinds. Simply lift fallen slot, insert plastic ladder, push fasteners through tapes into the ends of the ladder. Takes less than a minute to replace a single ladder

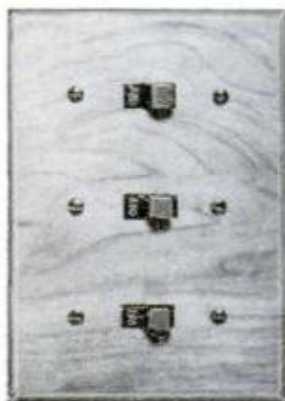
Slat-Fix Co., 72 Spruce St., Hicksville, L.I., N.Y.



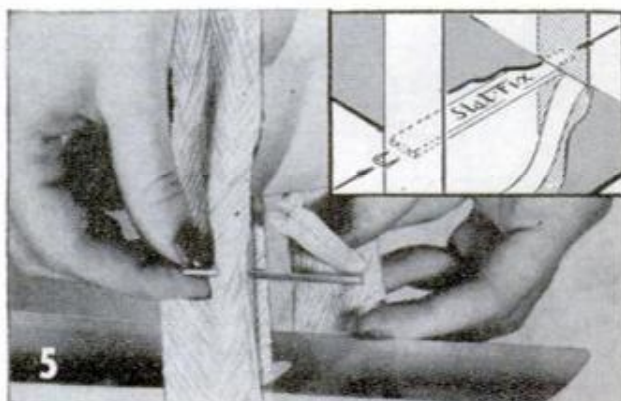
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By James Biery

MULTIPLE SCLEROSIS, the crippling disease resulting from degeneration of the sheathlike covering that surrounds nerve fibers in the brain and spinal cord, may be linked to cosmic rays. Dr. John S. Barlow, Harvard University neurologist, says a statistical study of the occurrence of the disease shows it varies with latitudes in the same way as does the occurrence of cosmic rays. The disease thus is more common in northern parts of Europe and North America than in southern areas. It is rare in the Orient, South America, Africa, the Tropics. Other scientists have suggested that the mystery of distribution of multiple sclerosis might depend on the amount of radiation from the sun, or trace elements in the soil. If positive links are found between cosmic radiation and incidence of the disease, says Dr. Barlow, protection may be effected by chemical agents known to lessen biological effects of radiation.

Minute quantities of radioactive tracers are used to measure blood loss in patients undergoing extensive heart operations at University of Michigan Medical Center. A small amount of the patient's blood is "tagged" with radiation, then replaced. A sample taken before the operation shows by the amount of dilution of the radioactive blood just what the patient's normal supply of blood is. A second sample, taken after the operation, indicates whether the supply is back to normal. Such a test is an aid to surgery, says Dr. Edward A. Carr, Jr., one of the innovators of the technique, because a patient's recovery after surgery is greatly aided if his total blood volume can be controlled accurately by the surgeon. Previous to use of the tracer technique, methods of determination could be off as much as three pints.

What do vitamins do? Experiments at the Long Island, N. Y., Jewish Hospital have revealed that one vitamin, A, maintains the sense of taste. Laboratory animals deprived of the vitamin were unable to distinguish between regular tap water and ultrasour quinine water. Chief sources of vitamin A are milk, egg yolk, yellow fruits and the yellow and dark-green vegetables. ★★

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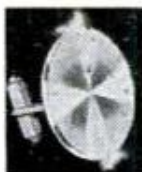
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Shiny tops and bottoms of tin cans decorate a large spruce at Christmastime in the yard of Lauren Cahill in Denver, Colo. The ends of the cans are punched near the rims, strung on heavy cord and draped on the tree. At night the tree is lighted by two foreground floodlights. Sunlight brings out striking reflection patterns during the day. To space the lids on the cord and prevent them from sliding together, the end of the cord is passed through the hole in the lid, looped over the rim and then passed through the hole a second time. After stringing, the ends of the cord are tied to the branches near the top.—K. E. Althoff

Scientists Won't Give Up: Insist Man Can Fly Like a Bird

Long before the Wright brothers proved they could fly in machines, men were trying to fly like birds—using flapping wings. Now two scientists at the University of Chile are renewing the argument, claiming that, simply by using the mechanical, biological, electrodynamic and aerodynamic similarities of birds and insects, man can strap on a pair of wings and take off. A 154-pound man, for instance, would need wings about 10 feet long with a flight surface of 60 square feet. To maintain a speed of 45 to 50 miles per hour, he should flap his wings 35 times a minute or about once every two seconds. They estimate this would require about as much energy as walking up a flight of stairs at 30 steps a minute. Depending on conditions, he could keep it up from 5 to 30 minutes. Much of their theory is based on the availability of new materials, both metals and plastics.

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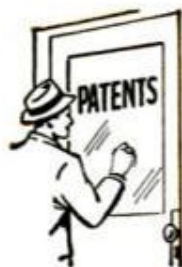
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INVENTORS**

By John Linkletter

NO 3-D GLASSES or wide screens are needed to produce the three-dimensional images of a new two-screen motion-picture system. Separate filmings are made of foreground action and background settings. For viewing, the foreground is projected onto a wire mesh screen; the background is rear-projected onto a screen behind the mesh. Between the screens, a neutral density filter keeps the background image from striking the front screen or the foreground image from getting to the rear screen. Alvin M. Marks, Whitestone, N. Y., Mortimer M. Marks, Beechhurst, N. Y., and Satiris Fasoulis, Clifton, N. J., received patent No. 2,952,182 for the system.

An afterburner apparatus for purifying auto exhaust won patent No. 2,953,898 for George W. Cornelius of Portuguese Bend, Calif. He assigned the patent to Holley Carburetor Company.

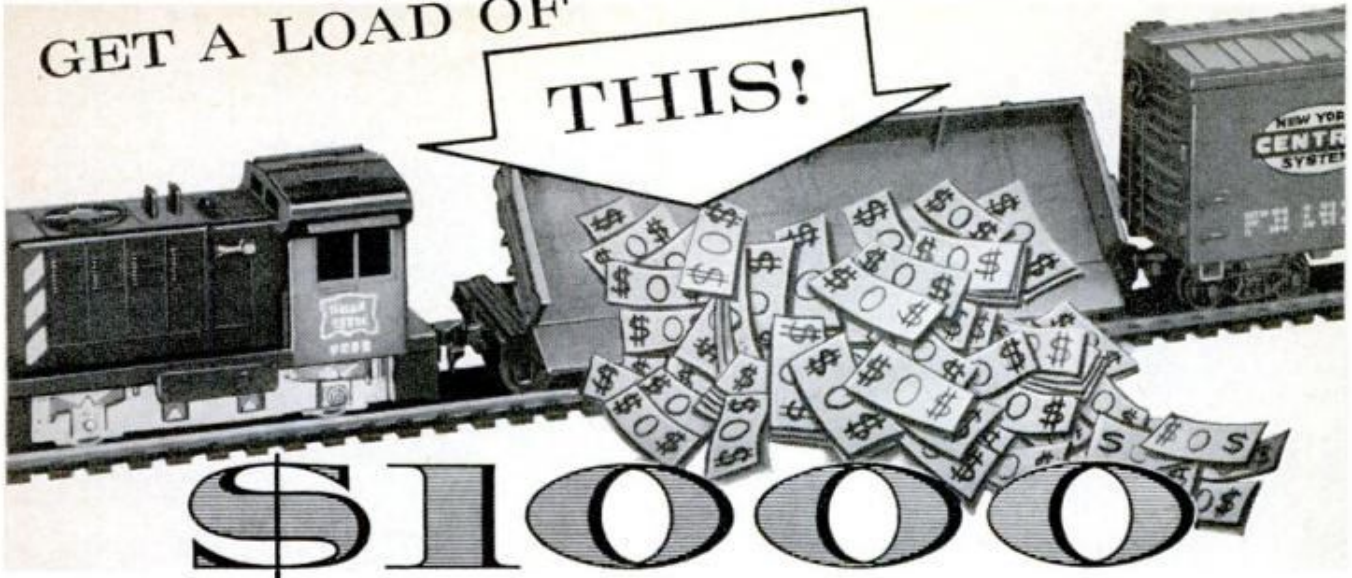
Frost can't get at fruit trees covered by a polyethylene bag invented by George J. Nelson of Milwaukee, Wis. The inventor found that the bag's .003-inch thickness allows sunlight to enter to mature fruit. Vents let air circulate. The device was awarded patent No. 2,953,870.

A paint pail invented by Garth Showers of Tannersville, N. Y., has a place for everything needed in painting. Bins and trays on the sides hold brushes and other tools, and a disposable paper liner keeps the pail clean. Because of its shape, the bucket lies flat against the side rails of a ladder.



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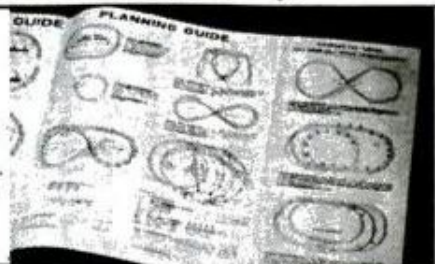
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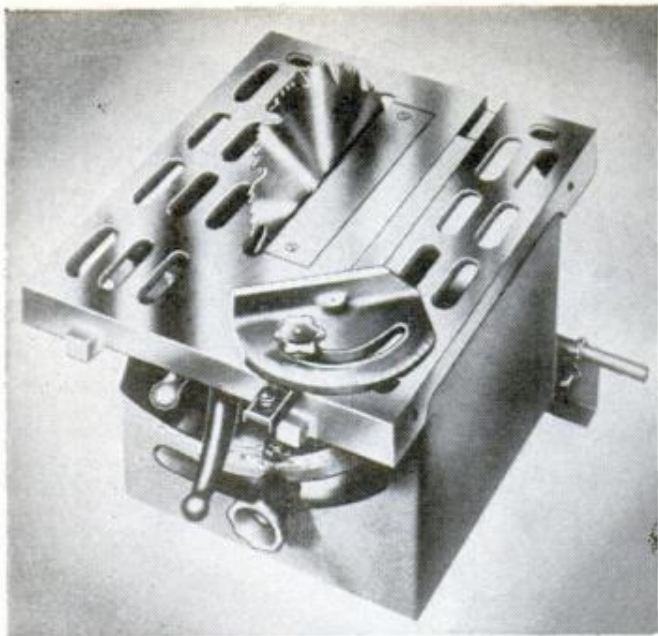
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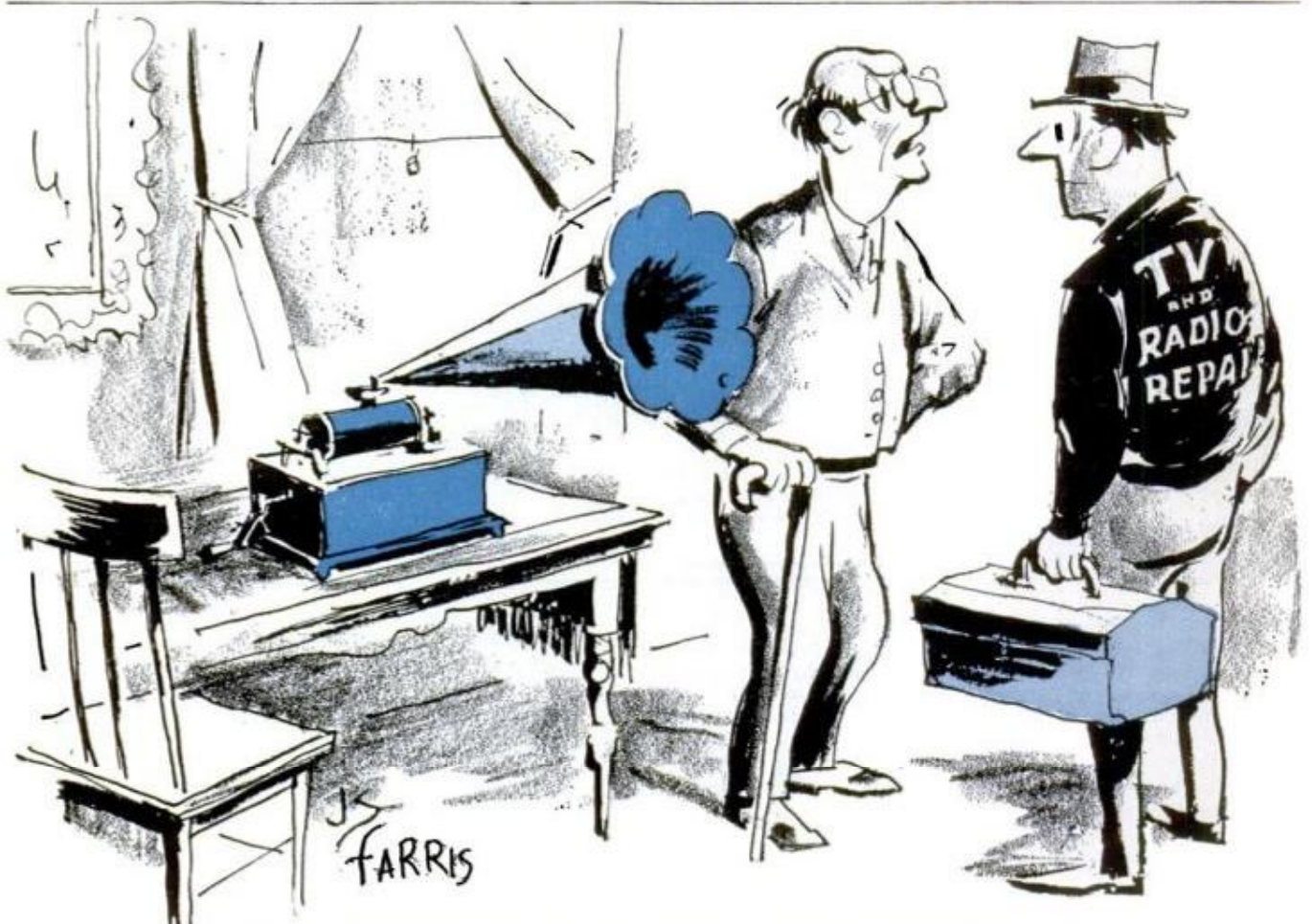
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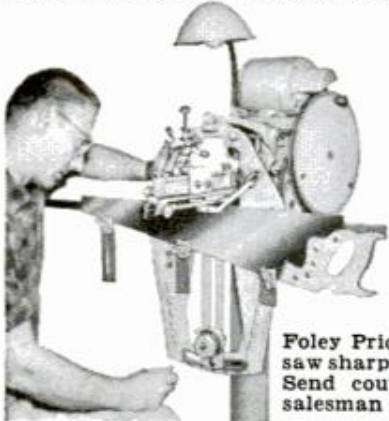
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ITEMS FROM ALL OUTDOORS

By Dick Kirkpatrick

TOURISTS HEADED SOUTHWARD this winter have a chance to visit and use a unique public park, the Key Largo Coral Reef Preserve, a 75-square-mile beauty spot that is completely under water. Strange? Not if you've ever dived into the kaleidoscopic wonder that is a tropical coral reef. To preserve the coral, underwater vegetation, and myriad tropical fish that swim among them, the Florida and federal governments have worked together to stop the depredations of commercial collectors of fish, coral and shells, and the free-diving spear fishermen.

The preserve extends offshore for about four miles to the drop-off of the continental shelf, and parallels Key Largo from Carysfort Reef to Molasses Reef, including The Elbow, Key Largo Dry Rocks, and French Reef—21 miles of prime fishing, diving, and sightseeing water, and it's all yours. Plans are under way to run glass-bottomed excursion boats over the area from Key Largo.

If you're stuck for something unusual in the line of a Christmas gift for an outdoor type, there's something really new on the market. Sports-In-Sound, Inc., of 211 West 58th St., New York 19, N. Y., has produced two 12-inch, 33 $\frac{1}{3}$ r.p.m. records, one on field-dog training and another on shotgun shooting. They give your man the equivalent of an evening with the expert in both fields. One, titled "Training Your Dog to Hunt, Point, Retrieve," is by Henry P. Davis, veteran sporting dogs editor and the only man who has been asked to judge every major bird dog field trial in this country and Canada. The other, "Wing, Trap, and Skeet Shooting," is by Jimmy Robinson, another distinguished outdoor editor known internationally as "Mr. Trap and Skeet." First of a series of platters on sports topics, they are available both at record outlets and sporting goods stores.

Best new product across the outdoor desk this month: The new Weaver "V8," 2 $\frac{1}{2}$ to 8-power variable telescopic sight, first variable scope with an unobstructed scope tube, no turret, no power-change ring, and no joints in the scope tube. It fits the standard Weaver-Detachable Top Mount, available for over 150 rifles.

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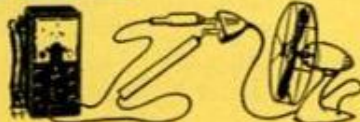
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Control circuits of most furnaces use 24 volts obtained from step-down transformer. Here's how to check room thermostat to see if wires to it are live.



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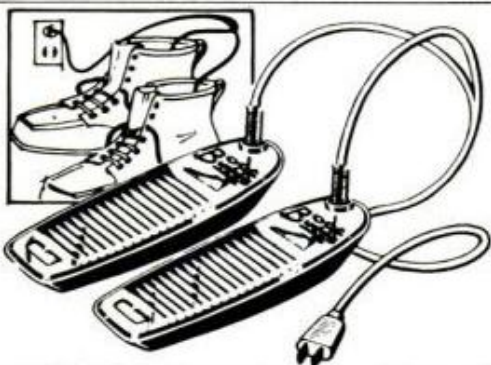


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WHAT'S UP IN THE AIR



By Kevin V. Brown

AT SUPERSONIC SPEEDS, parachutes produce a pumping action that bounces their cargo dangerously. Instead of parachutes, astronauts may be glided back through the atmosphere to Earth in a flexible "paraglider." Wind-tunnel tests show that a glider made of nonporous material such as aluminum alloy would slow re-entry much better than a conventional parachute. It has a flexible wing with rigid leading edges. The wing folds up and remains completely folded until needed. The capsule, with the astronaut inside, would be suspended from the glider.

A Pan American World Airways plane set some sort of new record recently. It carried 15,000 passengers from Tokyo to California, all on one flight. The passengers—all females—were canaries destined for cages in living rooms throughout the United States.

A Ph.D. degree in Outer Space?

Cranfield College of Aeronautics at Bedfordshire, England, has opened what may be the first postgraduate course for space scientists. Aim of the year-long class is "to stimulate an interest in the subject and to provide training suitable for future workers in the field." Fee: £75 (\$210).

And while we're in outer space, have you ever wondered what might happen to the astronaut if he comes back to Earth and it's raining? This problem is the subject of a study to find an effective method of removing rain from the windshield of re-entry vehicles. Results indicate that several of the methods tested could provide satisfactory visibility under inclement re-entry conditions but, as the boys in Detroit will testify, no method devised yet is perfect, whether for automobiles or space ships.

Astronauts may look like human flies in their spaceships if they wear shoes recently constructed for them. The shoes, operating on a low-voltage power supply, have electromagnetic soles and a microswitch which interrupts the magnetic circuit each time either heel is raised. The wearer can walk on the walls, floor or ceiling at will, as easily as walking to the corner drug-store. ★ ★ ★

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Keeping up with the ATOM

By James Biery

ONE OF THE DANGEROUS products of atomic fission is going harmlessly to work for the weatherman. Strontium-90, which, under certain conditions, can cause cancer, will power electronic sentries to flash weather information from remote mountain posts. As the radioactive strontium disintegrates into stable zirconium it releases atomic particles and heat; the heat will run the electric generator. The sentries will use a compound of strontium that is insoluble, and thus cannot be absorbed by living organisms, and, because the fuel is long-lived, they should run for at least two years without servicing. First job for the sentries: to pass along information on temperature, wind speed, barometric pressure.

Since radioactive strontium is part of the fallout debris from nuclear tests, the U.S. Food and Drug Administration is investigating its content in food and is exploring ways to lower human exposure to the danger. Dr. Edwin Laug, chief of the physiochemistry branch, says fruits carry a lower level of strontium-90 than do vegetables. He attributes this to their relatively smooth skins from which particles of fallout tend to fall; also, most fruits grow on stems, branches or vines and thus are removed from direct contact with contaminated soil. Best way to reduce fallout in the diet, he suggests, is to peel skins of tubers, remove outer leaves of vegetables or shell the legume variety and thoroughly wash all fruits and vegetables before preparation.

Radioactive clouds from nuclear tests may be having some effect on feathers of some birds, say scientists at St. Bartholomew's Hospital and Medical College, London, England. Ornithologists have spotted birds with out-of-season color in England and Africa. The birds, which had come from northern Europe and Russia, were discovered during the past year. One, tested at the British Atomic Energy Authority's Harwell center, was found to be radioactive. The St. Bartholomew group has since found they can artificially change the color of a bird's feathers by submitting it to radiation.

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Spotlight on the

HILLMAN HUSKY

By Jim Whipple

ONE OF THE most likable and practical of all imported cars is the British-made Hillman Husky station wagon. The single model, a two-door, lists at \$1679 delivered at East Coast ports. For Midwest delivery you must pay \$35 additional freight. This price includes all basic necessities excepting the heating and ventilating system which costs \$55 extra.

The Husky has a remarkable amount of useful space in a body that's only 12 feet 8 inches long, and just 5 feet wide. It will hold four adult passengers; two in the individual, bucket-type front seats and two on the folding rear seat.

For family use, the rear seat will hold three average-sized six-to-ten-year-old children. Behind the rear seat there is still room for luggage in a space 33 inches high, 52 inches wide and 29 inches long between the seat back and the one-piece, side-hinged rear door.

When filled completely to the roof, this works out to 18 cubic feet of extremely usable space. Even without loading above the top of the rear seat back, this area will hold two large double suitcases plus two week-end cases. To load more than this while carrying the full passenger complement you must pile luggage up so that it obstructs vision through rear window.

As a total cargo carrier the Husky delivers 40 cubic feet of space when you swing the rear-seat cushion forward and lower the rear-seat back to make a steel-shod luggage deck 50 inches in length.

Access for loading and unloading through the rear door is good. Dimensions of the door are: width 37 inches, height 30 inches. This opening compares favorably with that of the largest U.S.-built station wagons.

Actual load space of 40 cubic feet is just

(Continued to page 34)



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Sidelights from the PENTAGON

By William R. Kreh

SMALL-BOAT OWNERS may benefit from Coast Guard experiments with a talking radio-beacon at Cape May, N. J. It's a microwave transmitter that simultaneously broadcasts a rotating light beam and a voice message from a revolving tape. Tape and beam are so synchronized that when the beam points south, the tape announces "Cape May 00." By the time the beam has swung three degrees, the tape has revolved to the point where the message is "Cape May 03," and so on. The announcements, like the light, go all the way around, changing messages at three-degree intervals. It's estimated that a book-sized microwave receiver would cost a boater about \$50. The experimental transmitter is good for 12 miles, but advanced models could broadcast up to 20 miles.

"One-minute car wash" techniques have been adapted by the Marines to cleanse their amphibious vehicles of salt water after each ocean-going maneuver. The briny liquid could corrode the machines if not rinsed off promptly, and cleaning by hand-hosing was too time-consuming. A specially designed rack gives the vehicles a high-pressure shower as they're driven through.

An Air Force B-47 has been hung by the Navy, but it's not as ignominious as it sounds. The huge jet bomber is suspended between two tall towers at the Naval Ordnance Test Station at China Lake, Calif. The purpose is to test missile fuses at various positions on and around the plane to check their firing ability at each spot.

Throwing bottles into the sea with messages is as old as fiction, but the Navy is going the story-tellers one better. It's burying bottles in an underwater gulch near Port Hueneme, Calif. The idea is to check underwater sand slides. The bottles will wash free and float to the surface whenever one occurs.

S/Sgt. T. P. Conway studied actual case histories of emergency ditching or abandoning of aircraft and decided that survival equipment often was too difficult or impossible to recover from the plane. His solution was to assemble a compact kit that each crew member could carry on his person. Using discarded tobacco tins, he is able to stuff into each one: 100 feet of nylon line, eight feet of snare wire, two packs of first-aid gauze, two packs of matches, three fishing hooks, two fishing flies, a bottle of water purification tablets, two fatigue tablets, four bouillon cubes, three sewing needles, two candles, a bottle of iodine and a razor blade. He water-proofs the tins by sealing them with tape.

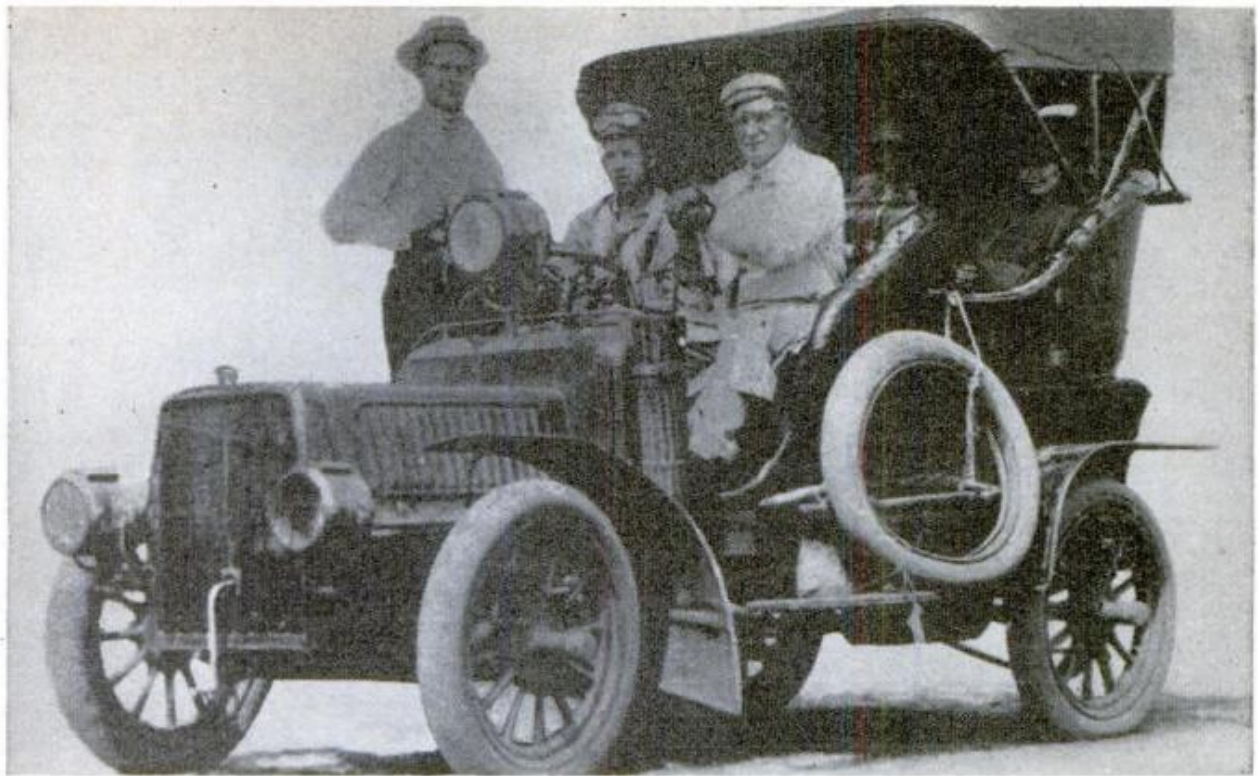
Sky-writing jets may soon run out of ink. Air Force engineers have developed a way to eliminate vapor trails left by high-flying aircraft. It reduces the size of water particles left by the burning jet fuel by mixing tiny dustlike particles in the engine exhaust.

And here's more good news for Junior! His breakfast cereal not only makes him an All-American but it's also useful in the jet age. Recently 375 servings of a dry cereal were spread on a runway to see how much of it a jet would pick up in its engine intakes when running at full power. The cereal represented normal debris that a jet would expect to encounter on runways. Later more damaging articles will be used to see just how much a jet engine can absorb.

How long can a missile be stored? An Army Redstone was successfully fired recently after resting on the launch pad more than two years.

Homing pigeons carrying tiny radio transmitters may reveal navigational secrets useful to military aircraft. The Office of Naval Research is attaching transmitters weighing less than two ounces to the birds with a light harness. The transmitters emit signals over a range of 20 miles. The signals, picked up by receivers on the ground, track the individual birds to their destinations. Over a period of weeks, deviations in routes and speed may reveal how the pigeons are able to detect, identify and navigate toward a given target.

The Navy has discovered a powder that takes the heat out of fires and puts out gasoline and oil fires twice as fast as ordinary extinguishers. It's called "Purple K Powder" and it consists of very finely powdered potassium bicarbonate. In tests it extinguished an oil fire in 11 seconds. The last smoke drifted away in 16 seconds. ★ ★ ★



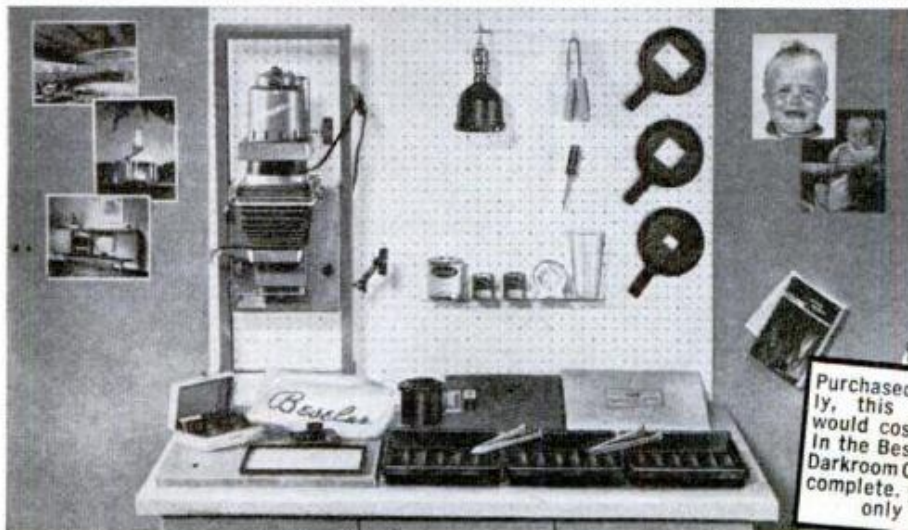
DO YOU KNOW THIS OLD-TIMER?

Influence of European design on American cars is nothing new, as witness this turn-of-the-century dreadnaught with right-hand drive and landau top. It was

probably a sensation in its day, having wooden wheels and what were then the latest in tires—pneumatics (without treads). If you can't name it, see page 250.

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about half that of the full-sized American wagons such as Ford and Chevrolet. However the Husky's 86-inch wheelbase is almost three feet shorter and its over-all length is five-and-a-half feet less than that of the big jobs.

In spite of its squarish silhouette and ultra-compact dimensions, the Husky wagon is an attractive vehicle with clean lines and pleasing contours. The designers who styled the Husky have done a skillful job in creating the illusion of greater length.

Seating in the Husky is quite comfortable with the driver's bucket-type seat adjustable over a four-inch range. There's adequate leg and foot room for the six-foot-plus driver who is quite comfortable except for the fact that the accelerator pedal thrusts way out from the fire wall and forces his right leg into a cramped position.

This isn't as objectionable to a driver of average stature, but in all cases the throttle pedal doesn't provide rest for the right foot which must be held tensely pivoted on the heel in a position that's awkward and tiring. However, it shouldn't be too difficult to install a conventional, treadle-type throttle.

Seats are built up of foam rubber and covered with pleated vinyl that looks much like leather and, speaking from experience, has been found to wear very well.

One of the really enjoyable features of the new Husky, (the current model has been available since late last summer), is the excellent all-around vision. The windshield is very wide and deep and in addition has relatively thin corner pillars. The hood is smooth and slopes forward quite sharply to the front permitting a view of the road very close to the front of the car.

(Continued to page 36)

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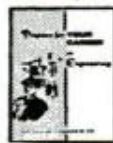
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Rear compartment side windows are long yet have no pillar. There are sliding glass panels for rear compartment ventilation.

Another delightful feature of the new Husky is its short-stick gearshift control, acting on a four-speed synchromesh transmission. Synchronization is on second, third and top ratios which are the ones used in 95 percent of all driving. The action of the gearshift can give the Husky a considerable sports car flavor if the driver is practiced and well coordinated.

The Husky's engine is a lately improved version of the sturdy, smooth-running four that's powered all Rootes Motors products for the last several years. This engine with its pushrod-operated overhead valves has a bore and stroke of 3.0 x 3.0 inches, displaces 85 cubic inches and is rated at 51 horsepower. Compression ratio is a conservative 8 to 1 which will allow you to use the lowest-priced gasolines.

The Husky's engine provides what can best be described as "briskly satisfactory" performance. It will accelerate to 60 miles per hour in 18.2 seconds, which is pretty commendable when you consider that the Ford Falcon compact with an engine of 144 cubic inches will make 60 m.p.h. in 15 or 16 seconds. The Husky has no trouble in keeping up with fast-moving expressway traffic.

Fuel economy for 764 miles of combined city, high-speed turnpike and country road driving averaged out to 25.2 miles per gallon. This might seem strange for a car as compact as the Hillman Husky until its weight of 2080 pounds is considered.

This weight is the result of extremely solid construction which makes the Husky virtually immune to squeaks, rattles, or vibration. The name Husky is well chosen, as the little wagon gives every indication of being able to stay on the road indefinitely as far as durability of body structure is concerned.

The Husky's ride is typical of British small cars, taut and well controlled with remarkably little rolling or pitching on smooth-surfaced yet uneven roads. On rough surfaces the Husky's ride is firm and inclined to some jiggling.

Handling is uniformly good as the Husky has new, low-friction recirculating-ball steering gear that makes traffic and winding country roads almost a pleasure to cope with.

Considering its really compact size and small engine, the Husky is an exceedingly useful and capable little car. It's ideally suited for household stop-and-go hauling, yet there should be no hesitation in taking it on long trips as long as there aren't many passengers in the rear seat. ★ ★ ★

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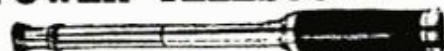
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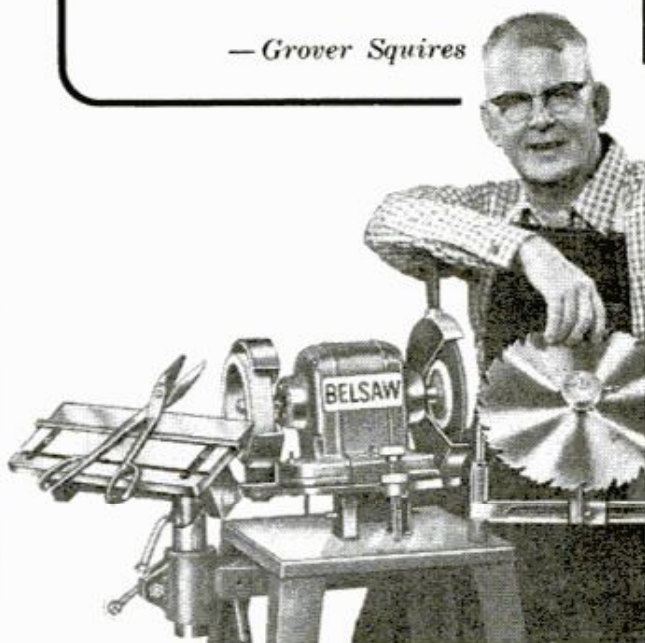
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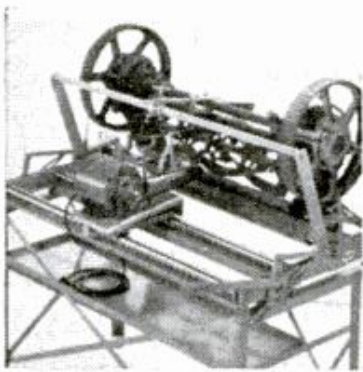
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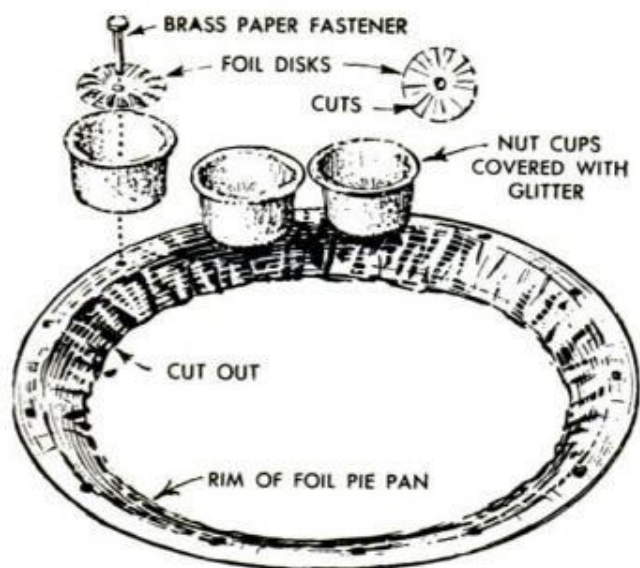
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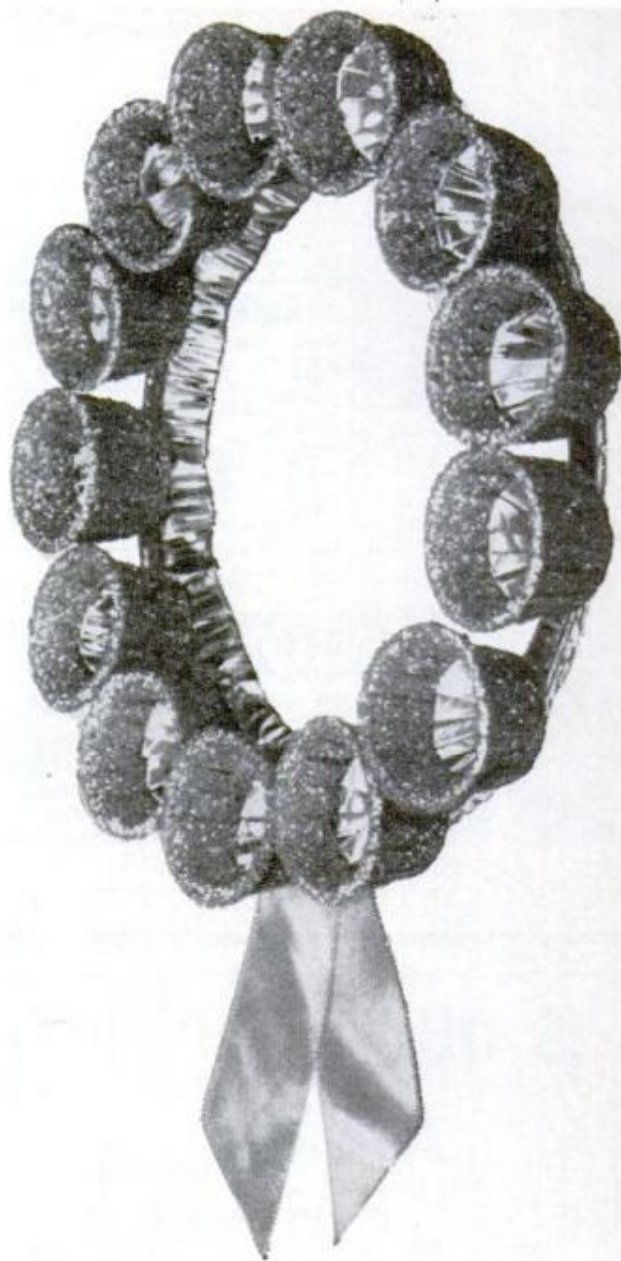
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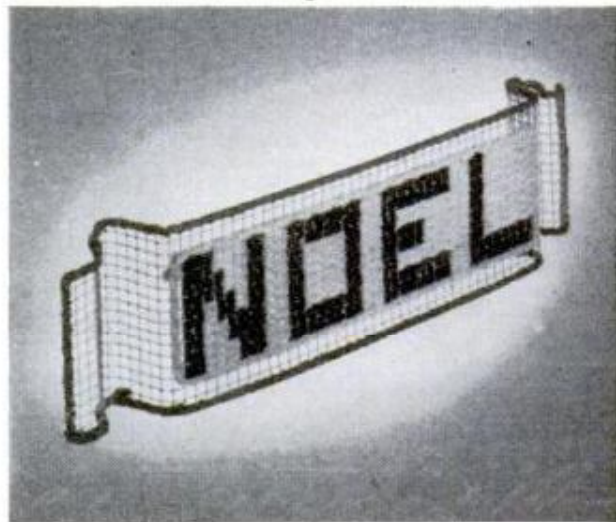
An aluminum-foil pie plate with the center section cut out makes the frame for this attractive Christmas wreath. Nut cups are spaced around the plate rim, and these are covered with red glitter on the inside and green glitter on the outside. The nut cups are attached to the rim of the pie pan by means of brass paper fasteners. To make the glitter adhere to the nut cups, a clear adhesive is spread over the cups with a small brush. Then the glitter is sprinkled on the surface while the adhesive is wet. Allow one color to dry before applying the next one. A circular piece of foil, cut as shown in the illustration, fits into the center of each cup and is held in place by the brass paper fastener. Disks may be cut from either silver or gold foil, depending on the color desired. The wreath is finished by taping a red-ribbon bow to foil-pan rim.

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NEW Small stamping tool. Stamp dog tags, identification bracelets and social security plates. Everything furnished. Maurer Metal Specialties, Box 934, Springfield, Ill.

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17 PROVEN Ways to make money typing at home! Detailed information \$1 (refundable). Rycos Service, 210-G Fifth Ave., New York 10.

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\$2,000,000.00 FUTURE. 6% royalty paid from three inventions sales for \$200.00; 3%, \$100.00. Send check, references. Inventions, Investments, 210 5th Ave., Suite B-106, New York 10, New York.

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BUILD Plastic signs. Complete revised instructions \$3.00. No experience necessary. Big demand. McMaster Sign Co., 730 State St., Bellingham, Wash.

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MAILORDER. Latest fantastically profitable proposition. Harper, Box 1224-P, Clarksburg, W. Va.

OPERATE Profitable mailorder business! Gilbert Risdien, 1461 Hubbard, Detroit 9, Mich.

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IN 1952 I was unemployed, broke. Today own \$18,000 home, drive Cadillac, have bank account. Anyone can do this. Write Norris Cole, 217 West 49th, Bradenton, Florida.

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FOREIGN Import Directory \$1.00. Lists 400 exporters. Tech Publications, Box 821, Logan, W. Va.

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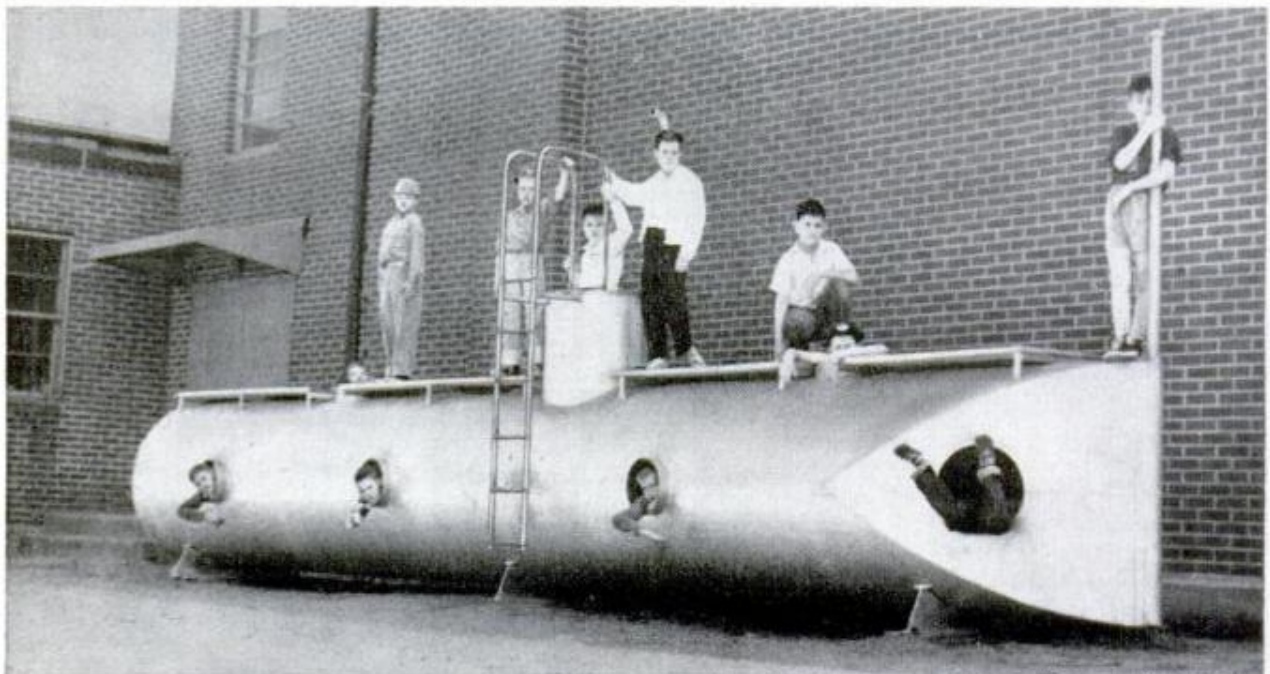
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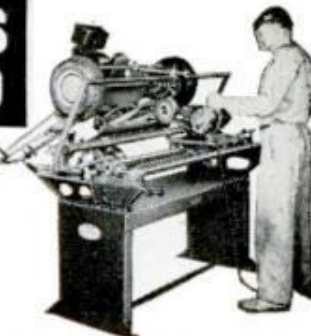
Sell 20,000 fishworms per week @ \$4 per 1000 from a bed 3 feet wide and 8 feet long. We teach you how to raise and where to sell fishworms and crickets. Write for free literature.
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Millions have done it so can YOU!



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Send for these 5 AMAZING PICTURE COURSES

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See America's finest values in Hi-Fi, Stereo, Ham Radio, Kits and Parts! Over 100,000 electronic marvels for today's enjoyment, exciting gifts, all-year pleasure. Low as \$2 down, pay balance after Christmas.

Mail this ad to **RADIO SHACK, Dept. 60M3**
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YES! Without obligation mail free catalogs for full year.

See values like this!



Transistor Pocket Radio only \$8.88

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City _____ Zone _____ State _____

KEY OCCUPATIONS—

Law, Accounting, Commercial Art

by B. Richard

The occupations described here will serve as an example of the many professional and administrative job opportunities that can lead to substantial earnings and a secure future for those who are willing to undertake the training and education so necessary in this field.

About half of all those with "white collar" jobs in 1958 were employed in the business professions. These 14 million workers have in common long periods of study, education and training — preparation that has enabled these workers to take their place in the professions, the fastest growing of all major occupational groups.

The trend in this field is toward requiring more education and training than was previously the case. In most states, lawyers, for example, are required to obtain a law degree from a state-approved law school before they are permitted to take their bar examinations. While formal education may not be quite as important in the other occupations described below, training and knowledge are an essential prerequisite for success, and earnings generally increase correspondingly with knowledge and practical experience.

LAW—

One of the advantages to being a qualified lawyer is the opportunity for self employment. Of the 226,000 lawyers in this country practicing in 1958, 80 percent were in private practice. Two-thirds of these private practitioners were in practice by themselves.

After they become established, these private practitioners can accept or reject work as they choose and determine their own workload. Because of this, experienced lawyers can continue to practice well past the usual retirement age if they desire.

Lawyers also have the advantage of being able to attain extremely high earnings. In 1954, for example, lawyers in practice 25 to 29 years had average earnings of over \$11,000 a year, and established lawyers in

large law firms had average annual incomes of over \$36,000.

Before these earnings can be achieved, however, lawyers must ordinarily undertake many years of education and practical training. Before a lawyer can practice in any state, he must either pass the bar examination for that state or, in some states, he is permitted to practice after graduation from certain in-state law schools.

Some states permit graduates of correspondence law schools to take bar examinations, and in other states two or three years of college work and completion of an American Bar Association or state-approved law school is a requirement before an applicant is permitted to take the bar examination.

In many cases, law school graduates find correspondence courses an excellent refresher in their preparation for their bar examinations.

After passing the bar examination for their particular state, lawyers can go into independent practice or they can act as an assistant to an experienced lawyer to acquire additional experience before striking out on their own. Ordinarily, beginning lawyers are not particularly well paid, but their earnings quickly rise as their experience increases.

ACCOUNTING—

Truly a key profession in industry, accounting is one of the major stepping stones to management. It is the second largest field of professional employment for men, and in 1958, 400,000 accountants and auditors were at work in this country.

Because accounting is a highly specialized professional occupation, education and experience play an important part in the advancement of the beginning accountant.

Many fine correspondence courses are available to those desiring a background in this field, and these courses have helped a great many experienced accountants pass

Continued to Page 64

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6
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their examinations to become certified public accountants (CPA's).

Business schools and colleges offering courses in accounting also provide excellent preparation for those desiring to get started in this field.

Today it is possible for beginning accountants to start at salaries up to \$450 per month, provided they have a good educational background. With experience, accountants can progress to supervisory positions and salaries increase with responsibility. Accountants in industry have the opportunity to progress to highly responsible positions such as company treasurer, and there are more corporation presidents who started their business careers as accountants than through any other profession except for law.

The long run employment outlook for accountants is good because it is expected that business management will make greater use of accounting information in years to come. Complex tax systems, the growth of publicly held business corporations which are required to submit financial reports to stockholders, and the greater use of accounting services by alert small businesses will tend to make the accountant increasingly valuable in future years.

COMMERCIAL ART—

Each time you read a magazine or look at a television commercial, you see the work of the commercial artist. Commercial artists have a wide range of duties including the preparation of advertising layouts, cartooning, lettering and designing.

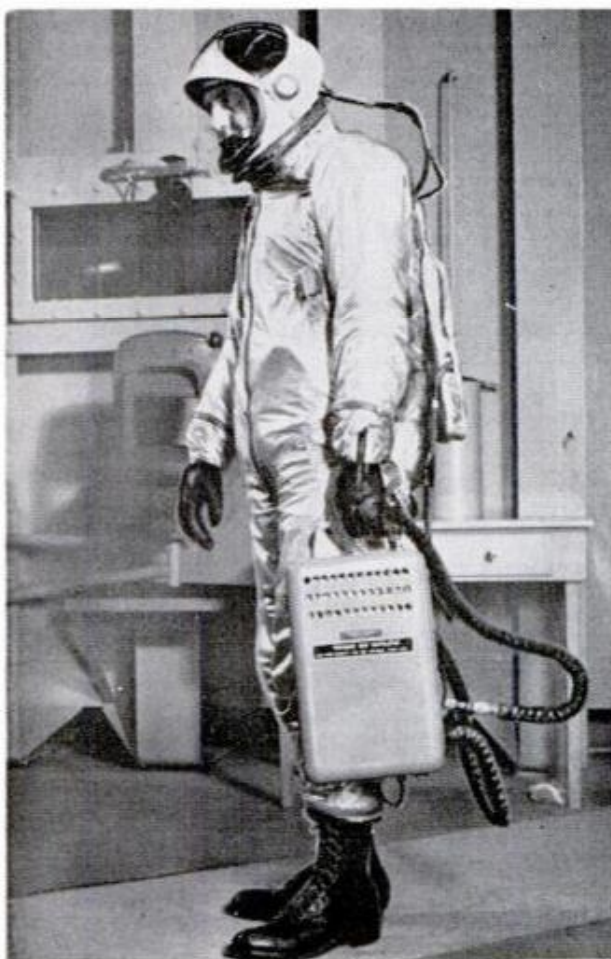
In 1955 Art Direction Magazine surveyed 2,500 art directors and top commercial artists, and the survey showed that 20 percent earned \$15,000 or more annually. Here is strong evidence of the earning power of experienced artists in the commercial field.

Because business establishments are expected to increase their expenditures for all kinds of visual advertising, the employment outlook for commercial artists is good. However, the trend in the past several years shows that those artists with highly specialized skills and advanced training will be in greater demand than those with only a general background.

Artistic ability is of course the most important prerequisite for success in this field, but training and practical experience are also extremely important. Many successful artists have been trained in specialized art schools or institutes. Courses of study ordinarily take two or three years and cover such fundamentals as perspective, design, composition, etc. Specific skills such as advertising layout, typography and lettering are also covered.

Beginning commercial artists ordinarily are restricted to more routine artwork. As experience is gained, they progress to more skilled and specialized jobs and can enter into a management job in which they have charge of an entire art department. Many experienced commercial artists have found it profitable to work on their own on a free-lance basis.

For more information on other career opportunities, write for your free copy of **SKILLS for AMERICA**. Write Popular Mechanics, Department SFA, 200 E. Ontario St., Chicago 11, Ill.



Air Force Flight Test Center, Edwards AFB, Calif.

Portable "Heat Beater" Ventilates Pressure Suit

Pilots for the X-15 space plane wear a special pressure suit that is completely airtight. In flight it is connected to the plane's cooling system, but on the ground it becomes a "sweat box" in the desertlike atmosphere around Edwards Air Force Base, Calif. A portable air conditioner has been designed to relieve the problem. Intended primarily for the X-15 program, the portable device can be used with any type of airtight suit that restricts air circulation and causes physical fatigue.

DECEMBER 1960



REMOVE that GAG from Your VOICE

Don't you often dream of being able to command immediate attention when you speak? Wouldn't it be wonderful to have a voice that RINGS WITH AUTHORITY AND ASSURANCE . . . instead of feeling that your voice is bottled up inside you? Science has demonstrated that VOICE is one of the real secrets of PERSONALITY.

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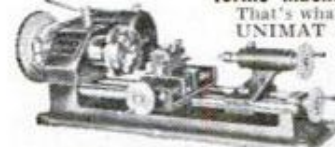
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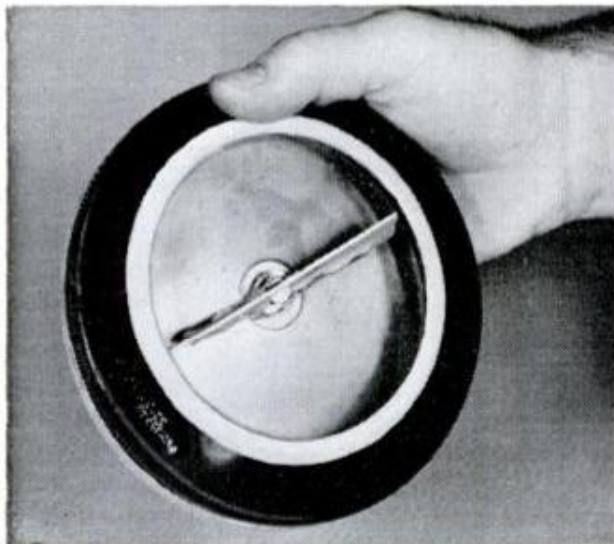
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67



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When its retractable railroad wheels are down, an eight-passenger station wagon clicks along the remote right-of-way of the Ontario Northland Railway and serves as ambulance and rail-inspection car. Dashboard buttons operate whistles, lights and other railroad equipment. It converts for road use in a few minutes.

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HOW'S YOUR WEATHER IQ?

By Samuel Cabot, Jr.

HERE ARE 20 QUESTIONS about the weather, winds, tides, and other climatic vagaries. Try them and see how you fare; the correct answers are listed on the next page. A score of 10 correct is fair; 12 right, good; 15 correct, you're an expert; 18 right, you're an authority.

- The instrument used to measure the speed of the wind is called an:
 - Ammeter.
 - Anemometer.
 - Anemone.
 - Anomaly.
- If you were to stand on the Tropic of Capricorn at high noon on December 22, 1960, where would you see the sun?
 - Due south, halfway to the zenith.
 - You couldn't see it—it would be below the horizon.
 - Due north, halfway to the zenith.
 - Directly overhead.
- What is meant by the **Roaring Forties**?
 - The zone between 40 degrees and 50 degrees north or south latitude, noted for strong winds.
 - The period, 1944-1949, marked by numerous hurricanes along the Atlantic seaboard of the U.S.
 - Gales on the Grand Banks, which frequently exceed 40 miles per hour.
 - The district in New York City where the Weather Bureau is located.
- At what temperature do Centigrade and Fahrenheit thermometers read the same?
 - 10 degrees below zero.
 - 40 degrees below zero.
 - 120 degrees below zero.
 - No temperature.
- The prevailing wind of India that reverses its direction every six months is called the:
 - Mongoose.
 - Simoon.
 - Monsoon.
 - Macaroon.
- A fine novel that tells the life story of a storm named Maria is:
 - "Low Pressure Area," by James Gould Cozzens.
 - "Batten Down the Hatches," by C. S. Forester.
 - "One Cloud Too Many," by Rumer Godden.
 - "Storm," by George Stewart.
- The **Beaufort Scale** is:
 - A loathsome skin disease common in the Carolina coastal regions, caused by excessive humidity.
 - A system of classifying winds by numbers according to their strength.
 - A device for weighing snow to ascertain its moisture content.
 - A logarithmic thermometer scale.
- Two square flags with black squares in their centers mean:
 - Cold wave.
 - Double-header tomorrow.
 - Hurricane warning.
 - Snowfall of over two inches.
- Some early barometers measured air pressure by water, instead of mercury. How tall a tube of water did they need?
 - 4½ feet.
 - 16 feet.
 - 33 feet.
 - 60 feet.
- When Gabriel Fahrenheit devised his thermometer, he chose for his **zero point**:
 - The freezing point of alcohol.
 - The lowest temperature ever recorded in his home town of Danzig.
 - The lowest temperature available with a mixture of ice and common salt.
 - The freezing point of mercury.
- Those big puffy fair-weather clouds are called:
 - Cirrus.
 - Cerberus.
 - Stratus.
 - Cumulus.
- Chinook** means:
 - The warm spring wind of the Rocky Mountains.
 - A large hailstone.
 - An Apache weather prophet.
 - A typhoon of the China Seas.
- In Arctic circles, explorers often see the aurora borealis. What do they call the phenomenon in the **South Polar regions**?
 - Aurora antarctica.
 - Southern lights.
 - Aurora australis.
 - The same name—aurora borealis.
- Degree day** means what?
 - The anniversary of the founding of the Royal Weather Observatory at Greenwich, England, celebrated as a holiday by weathermen everywhere.

- b. A day on which the temperature falls to one degree below zero, or lower.
 c. Graduation day at the School of Applied Meteorology.
 d. A term used (generally in the plural) to indicate the number of degrees by which the mean temperature of a given day falls below 65 degrees.
15. On a weather map, a line connecting points of equal temperature is called:
 a. An isotherm.
 b. An isobar.
 c. A thermodyne.
 d. A warm front (or cold front).
16. Low tides occurring at the first and last quarters of the moon are called:
 a. Shrove tides. c. Neap tides.
 b. Lammas tides. d. Whitsun tides.
17. When folks in Nova Scotia speak of the bore, they mean:
 a. The chief of the Halifax Weather Bureau.
 b. A cold north wind (the word being a local corruption of **Borealis**).
 c. The high tidal wave of the Bay of Fundy.
 d. The month of April, described by a local poet as "the time of melting slush and oozing mud."

18. What are the doldrums?
 a. Headaches caused by sticky weather.
 b. A zone characterized by weather similar to that of the horse latitudes.
 c. Tropical weather stations.
 d. A type of patent rain gauge.

19. From an airplane, you may often see on a cloud bank the shadow of the plane encircled by a little rainbow. What is this phenomenon called?

- a. Brocken specter. c. Cloud corona.
 b. Solar halo. d. Strato-nimbus.

20. Which of the following is not a wind:

- a. Sirocco. c. Norther.
 b. Harmattan. d. Mistrial.

HERE ARE THE ANSWERS to the weather quiz, **How's Your Weather IQ?**, on facing page.

- | | | |
|-------|-------|-------|
| 1. b | 2. d | 3. a |
| 4. b | 5. c | 6. d |
| 7. b | 8. c | 9. c |
| 10. c | 11. d | 12. a |
| 13. c | 14. d | 15. a |
| 16. c | 17. c | 18. b |
| 19. a | | |

20. d (Mistral is the cold wind of the Rhone Valley; mistrial is a judicial mistake.)

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WEN PRODUCTS, INC., 5810 Northwest Hwy., Chicago 31, Ill.

Christmas

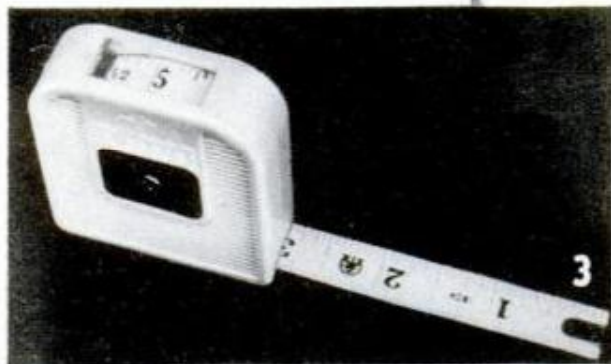
SHOPPING FOR TOOLS



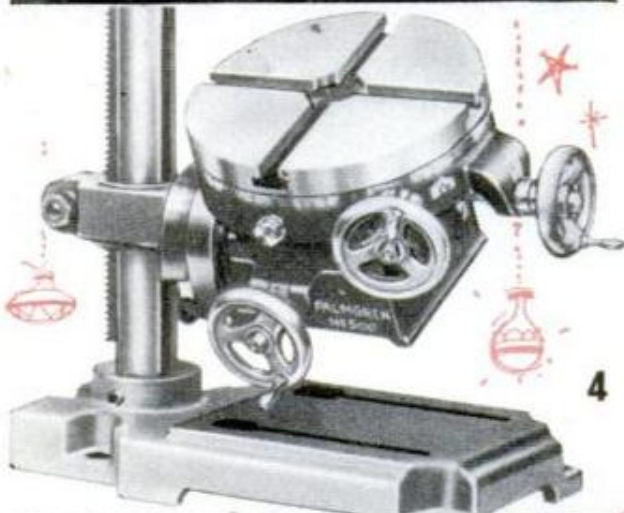
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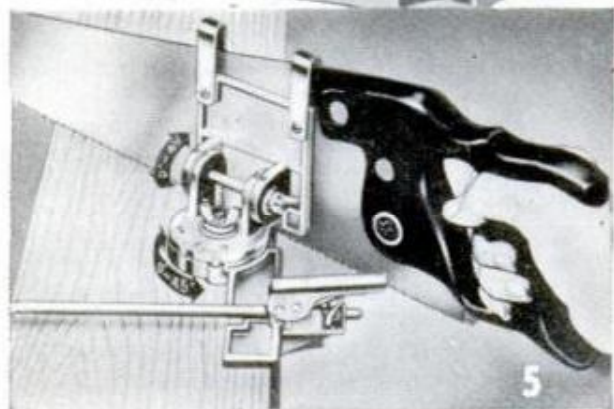
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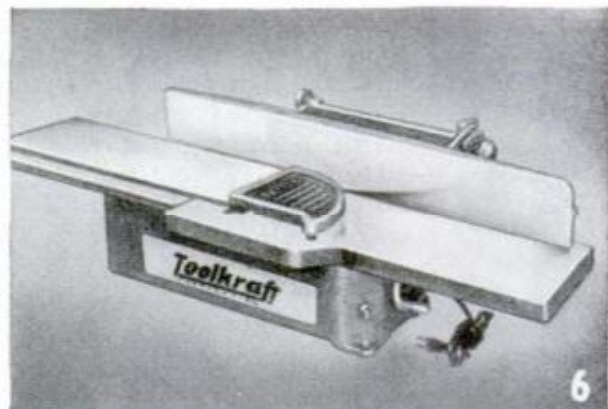
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4



5



6

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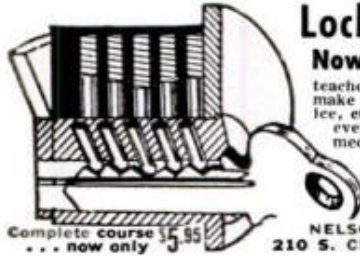
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(Continued to page 74)

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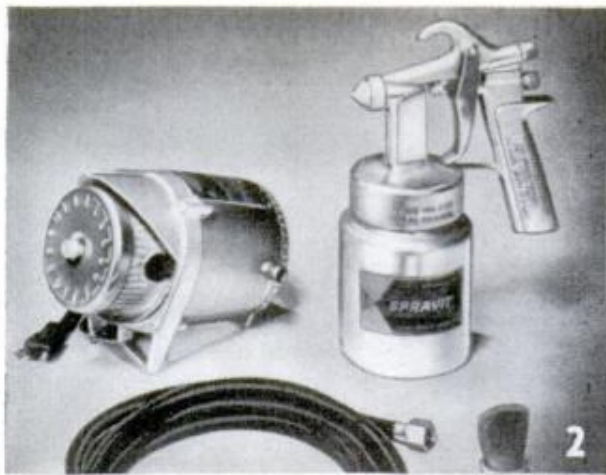
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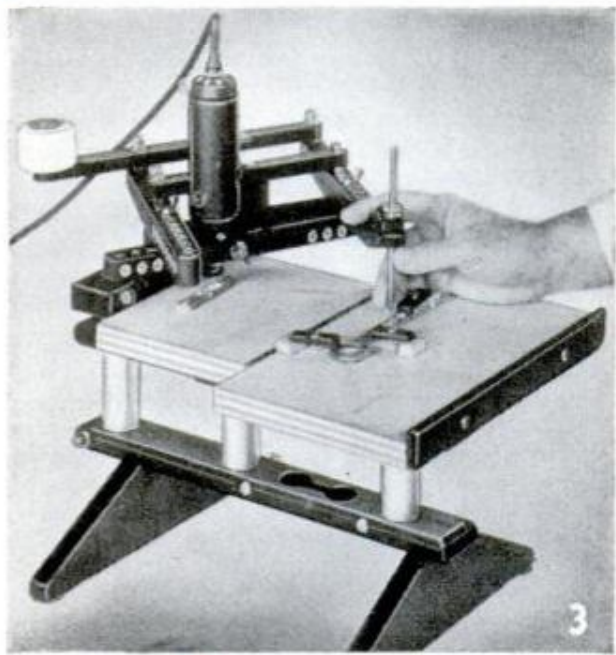
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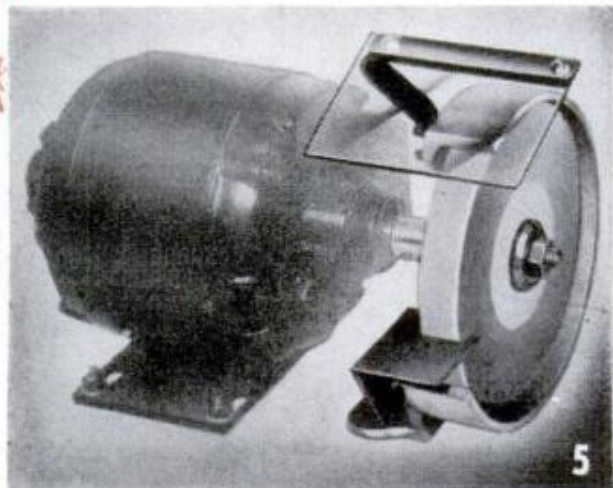
4. TOOL HOLDER offers both convenience and protection to those who use such striking tools as chisels, star drills and certain types of punches. Has a shock-absorbing plastic handle with a nonslip hand grip. Available in both one-man and two-man models

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(Continued to page 76)



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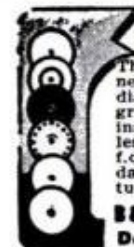


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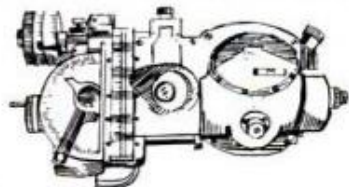
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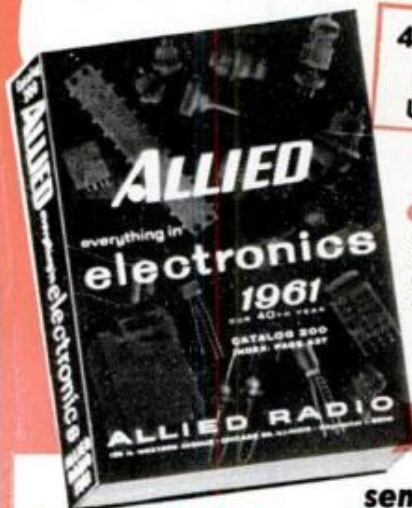
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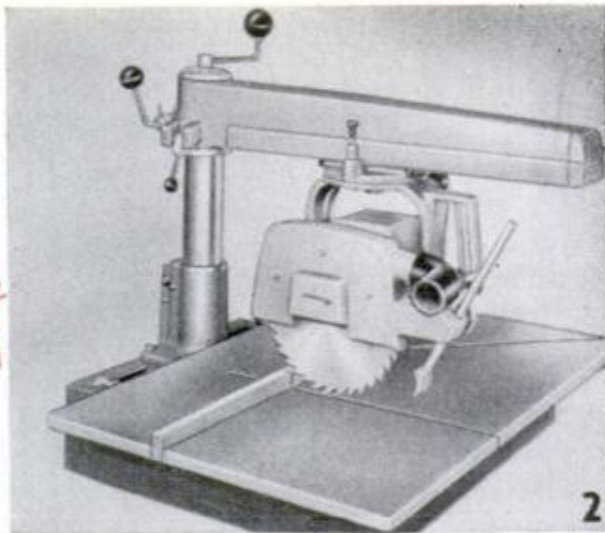
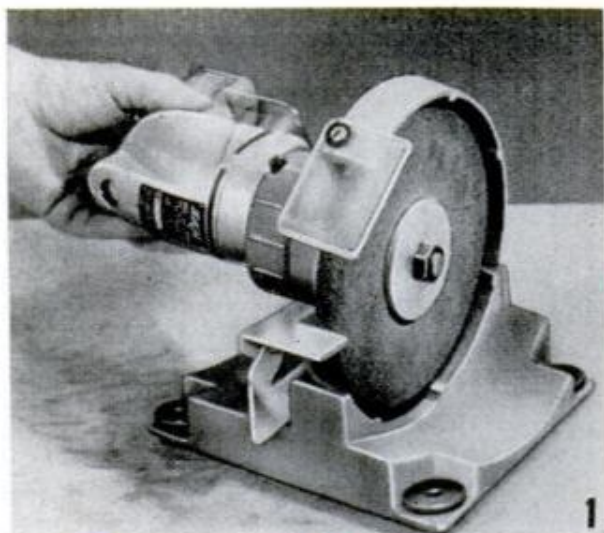
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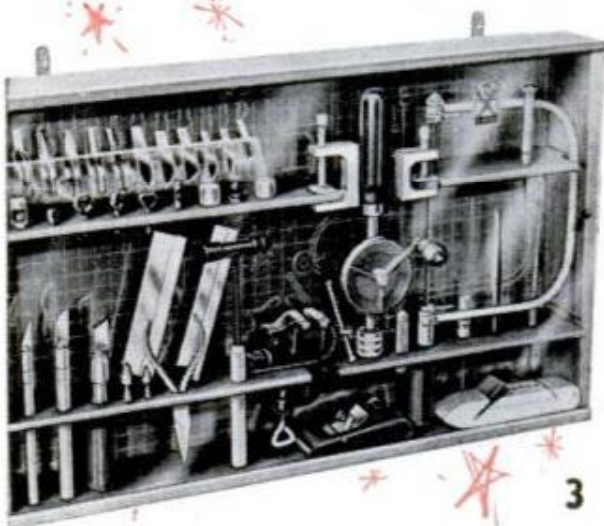
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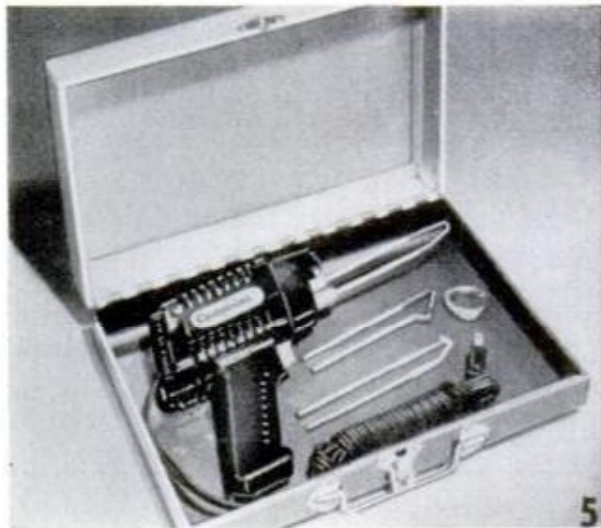
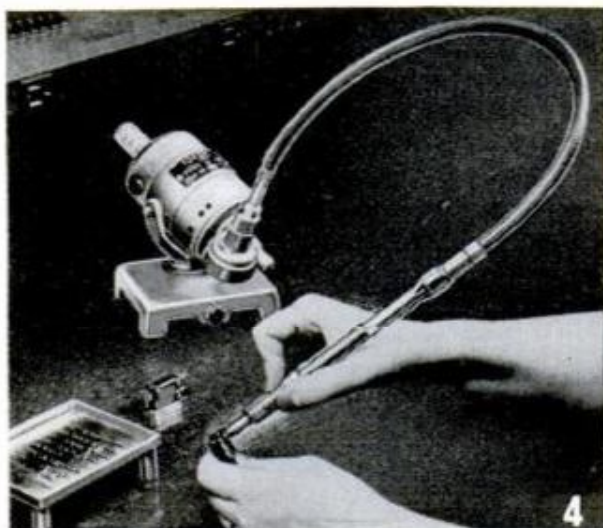
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(Continued to page 78)



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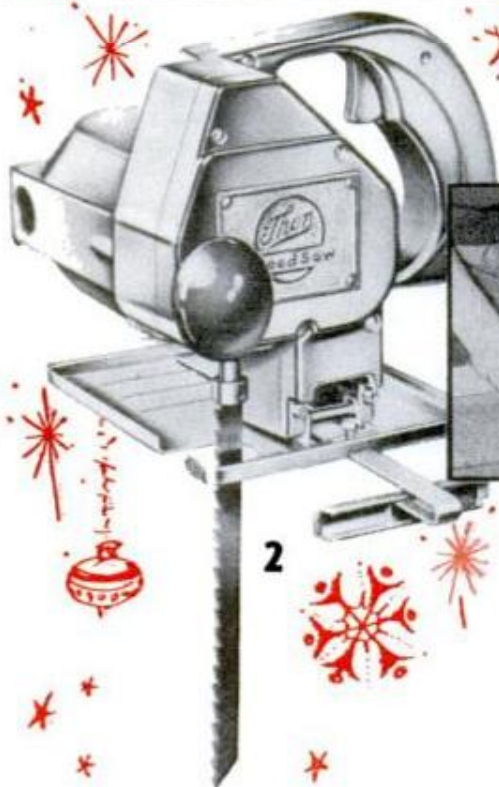
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Address _____

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Enclosed: Check Money Order Sorry, no C.O.D.'s.

Christmas SHOPPING FOR TOOLS



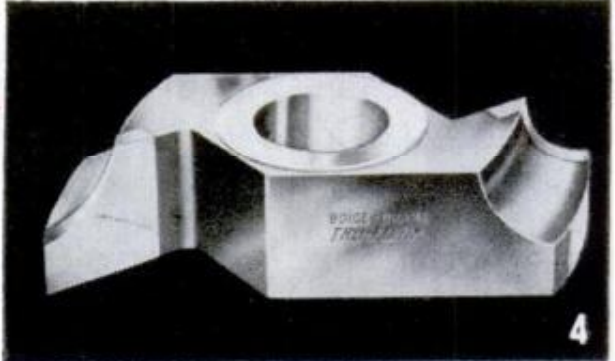
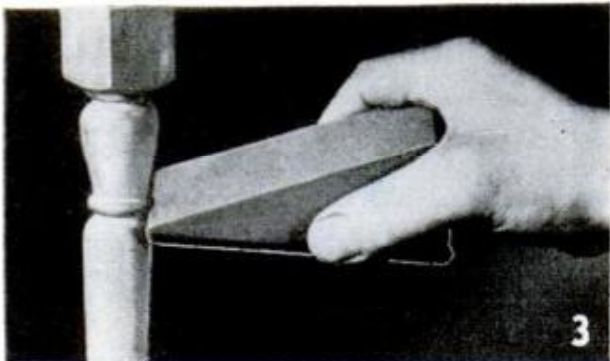
1. FIVE TOOLS driven by one motor make this the combination for home craftsman, hobbyist, builder and carpenter. Motor is a power head, or driver, for sander and scroll-router pictured above, also a power plane and a shaper using a wide range of cutters. Motor operates at speed of about 23,000 r.p.m.
Porter-Cable Machine Co., Marcellus St., Syracuse 1, N. Y.



2. PORTABLE JIGSAW cuts 6-in.-thick stock, handles precision scroll work with fine-toothed blades. Cuts wood or metals with suitable blades. Comes with combination ripping guide and circle cutter, also a protractor permitting angle cuts to 45 degrees. Universal 4.5-amp. motor turns up 2400 strokes per minute. All rotating parts turn on ball and needle bearings
Thor Power Tool Co., Speedway Div., 1421 Barnsdale Rd., La Grange Park, Ill.

3. POCKET-SIZE SANDING BLOCK features three work faces and is wedge-shaped to get into corners, between beads, into flutes, also deep vees. Standard 9 x 11-in. sheet of sandpaper can be cut into four equal refills. Each strip is stretched and then wedged into place by means of a special wedge-shaped end piece
Midwest Abrasive Co., Owosso, Mich.

4. SHAPER CUTTERS with involute relief feature carbide cutting edges which deliver up to 10 times the productive life of ordinary cutters when working plywood and resin-bonded chipboards. Cutters are available in a variety of shapes for cabinet work, also sash, millwork; 1/2, 5/8 and 3/4-in. bores
Boice-Crane Co., 943 Central Ave., Toledo 6, Ohio





“bargain”

batteries

BAH!

from now on it's a Delco DC-12 for me!

You can try to get by with a “bargain” battery—but a couple of dollars more for a Delco DC-12 Dry Charge can save you time, money and trouble!

What does it cost you to be two hours late for work? Most of us can't afford it, and it's especially annoying when caused by a bad battery. A dependable Delco Dry Charge Battery starts you off on time day after day, in all kinds of weather . . . yet it costs little more than so-called “bargain” batteries.

WHY YOU CAN BE SURE DELCO DC IS 100% FRESH

Delco Dry Charge Batteries stay bone dry until sold . . . can't lose any “zing” on the shelf. Delco DC comes to full, 100% fresh power only when you actually see the dealer add the activator fluid that makes it ready for work . . . thus you can be sure you're getting all the power you pay for!

YOUR DELCO BATTERY DEALER IS A LOCAL BUSINESSMAN

He appreciates your business, and automotive service is his specialty, not a sideline. He knows your car and your driving habits, and can specify the Delco DC battery that suits you best. He is conveniently located a few minutes from home, wants your continuing

DELCO DC-12 . . . Best to START with . . . Best to STAY with

Another reliable General Motors product, distributed nationally through



SEE TWO NEW TV SHOWS FOR DELCO—“Stagecoach West” and “The Islanders” on ABC-TV.

gasoline, oil and service business . . . and wants to be sure that you're satisfied and will come back regularly.

WHY JUST TRY TO GET BY . . . BE SURE WITH DELCO DC-12!

If time or money means little to you, you can afford a “bargain” battery. But if you're in the same boat with most folks, you need the 100% fresh, dependable power that makes Delco America's No. 1 Battery . . . “Designer's Choice” for most new cars, and “Driver's Choice” for replacement, too . . . proved so in surveys year after year. When it's time to replace, ask your dealer for Delco DC-12.





Nomad 6-Passenger 4-Door Station Wagon: hard-working utility with a glamorous flair.

*Here!
A new measure of
your money's worth...*

NEW 1961 CHEVROLET!

Here's clean-as-a-whistle style that'll never cramp yours. No needless bulk or ornamentation on this '61 Chevy. And inside you'll find a full measure of roominess and comfort. Getting in and out is a breeze, thanks to doors that are up to 6 inches wider. And sitting in this new Chevy is pure solid comfort because those new seats are the closest thing you could want to easy-chair height and accommodation. There's also a new kind of deep-well trunk (you can stack baggage 15% higher) for hauling odd-ball objects you used to have to leave home. These are improvements you can see, feel and sit upon—improvements that make Chevy America's Number One new-car investment.



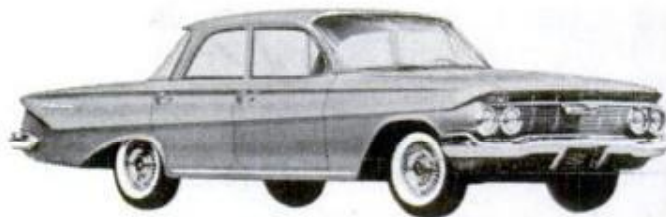
Bel Air 4-Door Sedan: with contemporary-contoured rear deck and canopied roof line.

Now... big car comfort at small car prices

NEW '61 CHEVY BISCAYNE 6

the lowest priced full-sized Chevrolet!

Here's the Chevrolet that gives you everything that makes a big car worthwhile, at a price you'd expect to pay for shaved-down cars that give you a lot less. These new Biscaynes combine all of Chevy's 1961 improvements with the traditional Chevy pluses of solid Body by Fisher, tried and true V8 or six-cylinder dependability, and smooth, sure Full Coil ride. Try a '61 Chevy Biscayne, your budget will love you for it!



Biscayne 4-Door Sedan.

Modelmakers in a Tizzy

By Carson Kerr

A WEEK AFTER the U. S. Air Force announced its Starfighter jet had set a new altitude record, last December, miniature construction kits of the plane were sold out in stores from coast to coast. Model manufacturers tried hard to step up Starfighter production, but most of them already were behind schedule with many of their other kits. The Christmas season has thrown them into a tizzy for the past 12 years, and keeping up with demand was doubly difficult last year because the women have joined the mil-

Assembling models such as this one of the Explorer I satellite is now the nation's chief hobby





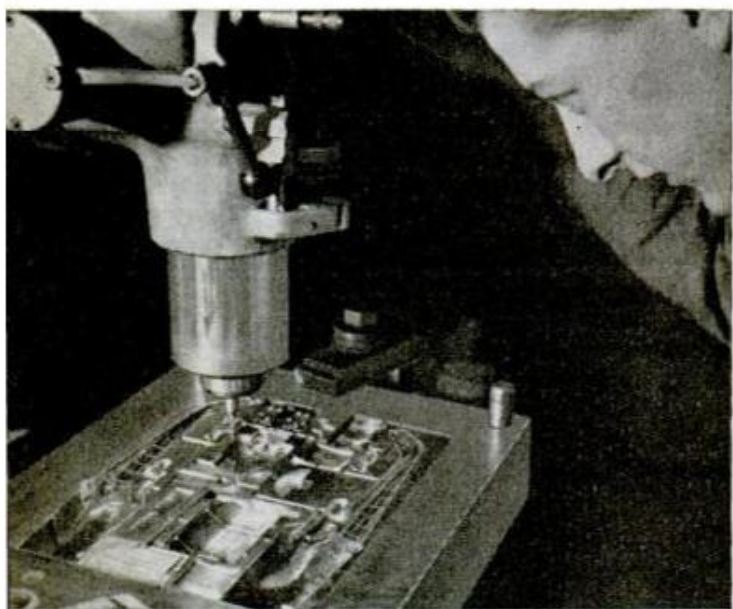
Revell, Inc. photo

1. First step in model production is to make scaled-down plans based on the original's large blueprints



Monogram Models, Inc. photo

2. Skilled craftsmen then create a master model by hand sometimes as much as a year before production



5. Final fitting for mold that will make hundreds-of-thousands of helicopters is a painstaking task



6. Human figures are formed in reduced size by a sculptor using live models, then are further reduced

lions of American males who have taken up modelmaking, an activity that has replaced stamp collecting as the nation's number-one hobby.

Model kits, which sold to the comparatively quiet tune of \$6,000,000 in 1947, reached an annual sale of \$35,000,000 in 10 years, then soared to more than twice that amount in 1959. The 1960 figures will probably top \$100,000,000.

Miniature models have become big business mainly because they no longer are looked upon merely as toys. Apart from recreational value, they're important to education, scientific research, therapy, movie and television production, the manufacture of boats, trains, autos and planes, the settling of court cases, and even as aids

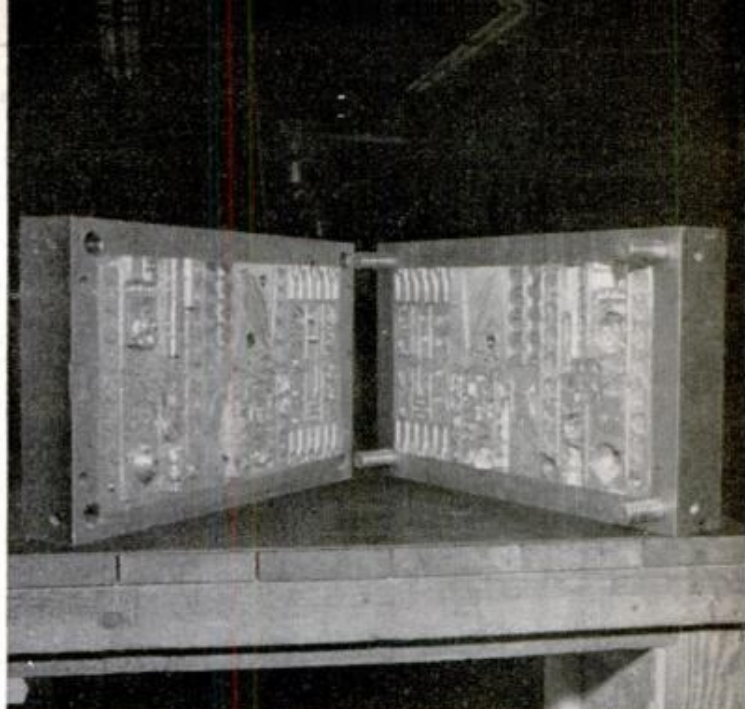
to the foreign policy of the United States.

"The surface of our market hasn't even been scratched," says Lewis Glaser, president of Revell, Inc., the company that has captured about half the world market with annual production in excess of 30 million units. Revell turns out everything from space equipment and atomic power plants to replicas of Walt Disney's *Perri* squirrel. This year the company introduced detailed dollhouse kits, designed by leading architects, expected to attract mothers and daughters as strongly as its new, operating, aircraft engines attract fathers and sons.

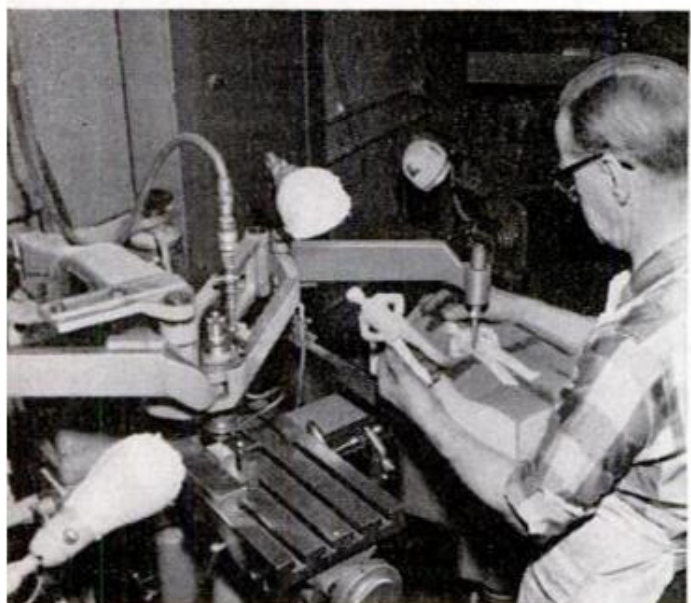
Lionel Corp. (with a past reaching back to 1900, when Joshua Lionel Cowen started making miniature electric motors) is keeping pace with the future by offering mili-



3. Pilot models are then broken down to provide patterns for molds of the many parts which go into kits



4. Precision molds can be complicated affairs. This one is for half the parts needed to make an engine



7. Using a pantograph machine, a technician etches a mold in steel from a cast of sailor he is holding



8. Original sculpture, left, and scaled-down reproduction, right. Lifelike accuracy helps sell kits

tary railroad units—radar and missile cars, exploding target cars, helicopter cars with spring-wound launching platforms.

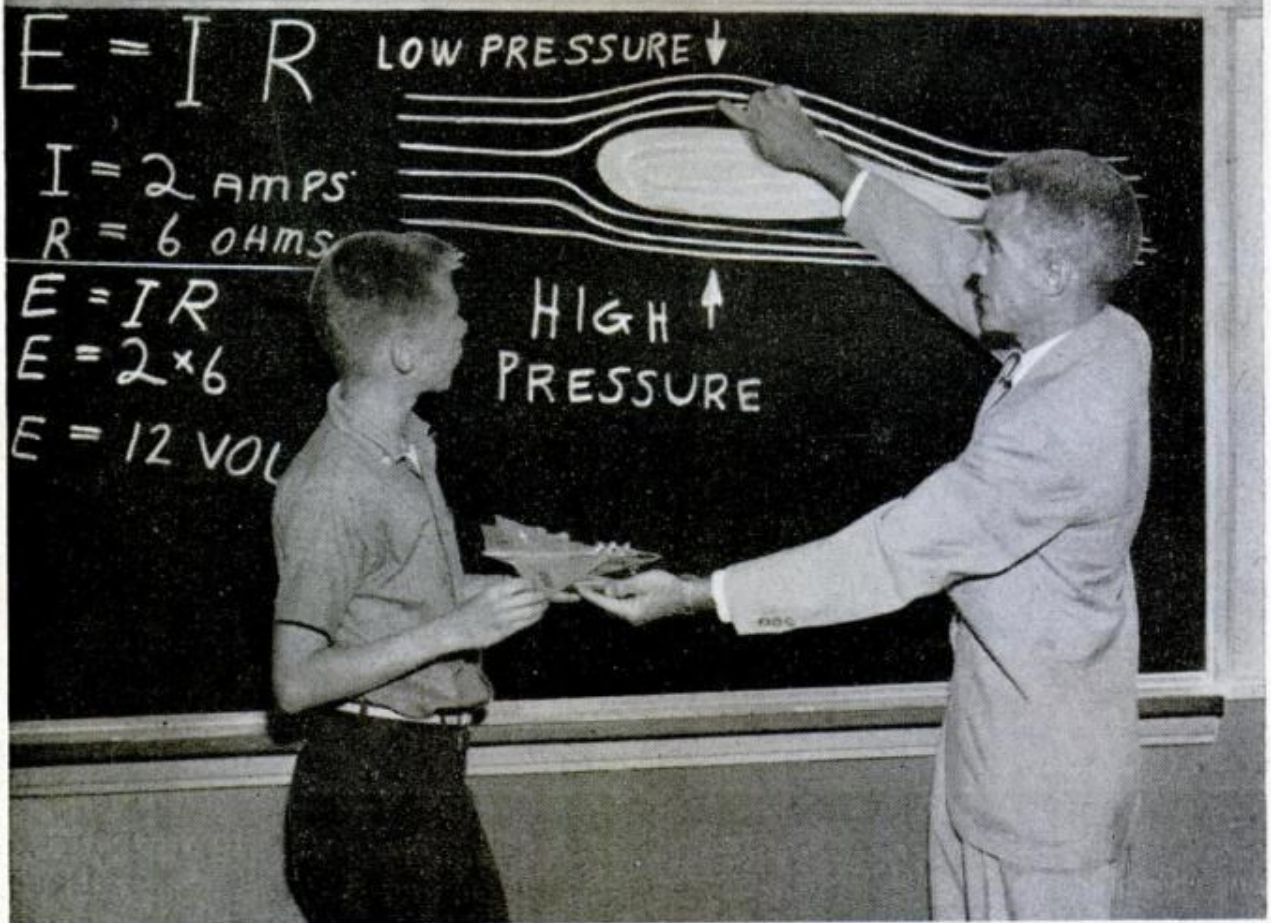
An air-power kit—18 U.S. Air Force planes mounted on wires (scale: 1 inch equals 50 feet)—is a best-seller for Monogram Models, Inc. This company also offers orbital rockets, space taxis and other futuristic models.

"Authenticity is what has made models more than kid stuff," points out Monogram's president, Jack Besser. "Because reasonable facsimiles no longer are acceptable, we carry our efforts to attain realistic detail to a necessary extreme. Authentic human figures have probably added as much interest to modeling as anything else. Our pilots and drivers are fashioned by a

sculptor using live models then successively reduced in size. Though some are only half-an-inch high, we want perfection right down to the dimple in the chin."

The Ideal Toy Co., founded in 1902, although a relative newcomer to the put-together field, has broadened the scope of modelmaking with such innovations as replicas of prehistoric people and animals. Products manager George Belinski reports, "Educators were delighted. They felt that here, at last, was an interesting way of presenting paleontological information."

One of the largest selections of model kits—150 in 17 categories—is offered by Aurora Plastics Corp., specialists in "Winged History" and "Famous Fighters." One of their most popular missile kits is a work-



Classroom use of models, like model building, is increasing. Teacher August Macaluse, at Los Angeles Junior High School, shows student Steve Whipple a principle of aerodynamics after Steve built model plane

ing model of Mark III, complete with fuel for 30 launchings. Aurora also has had success with human-figure kits.

Famous for model train accessories, Bachmann Bros., Inc., pioneered in a new direction two years ago by introducing a series of interlocking, paint-by-number bird kits approved by Audubon societies.

Renwal Corp. has clicked with *The Visible Man*, a carefully sculptured human body with a clear lucite outer form showing the circulatory system and revealing organs that can be snapped into position and removed.

Aristo-Craft has come up with lifelike flower kits that are used for both education and decoration.

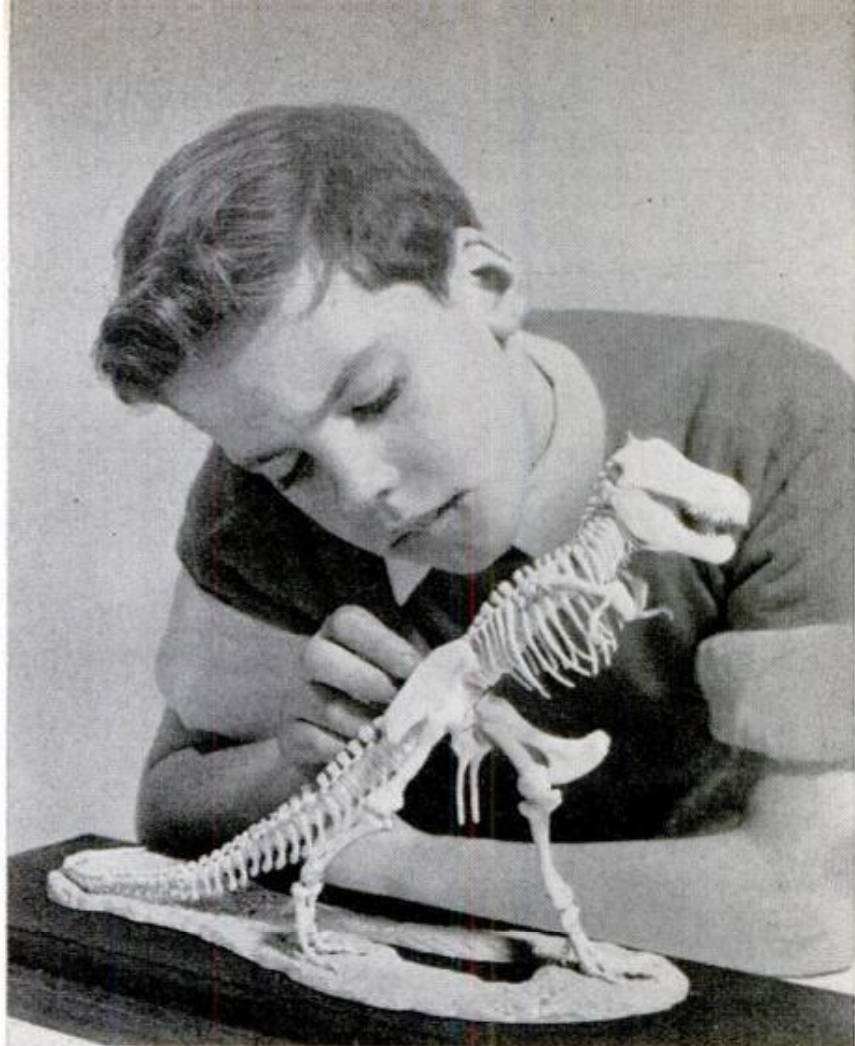
The Lindbergh line manufactures model planes connected to remote-control sticks that allow budding pilots to make the models assume different flight positions.

Comet Model Hobbycraft, a pioneer model plane maker, and probably the largest manufacturer of plastic, U-control motorized models and balsa flying planes, has contributed to aviation-age education by offering a series of planes, ranging from a simple glider to the newest space craft, that builders can advance to as their skills develop. With some kits, Comet includes an authoritative book, *What Makes An Airplane Fly*.

Authenticity has been a key factor in Revell's success since 1950, when it hit the big time with a faithful reproduction of Jack Benny's Maxwell. Stressing accuracy calls for a lot of research and sometimes also results in some surprising developments. For example models of Russian military equipment are in demand, for they are hard to come by. Preparing a Yak fighter plane kit, Revell designers obtained information on everything but the landing gear. After weeks of studying Russian aviation history, they finally devised the type of gear they figured would have been used. Their studied guesswork later proved to be correct. For a model of Columbus' *Santa Maria*, a researcher combed the Spanish Admiralty archives in Madrid, Spain, and got copies of the original plans. Working on the Starfighter, Revell researchers did such a good job that production of the model had to be held up until clearance from the Air Force could be obtained.

The Wright brothers spent less than \$1000 on their flying machine but it cost Monogram \$25,000 to perfect it in miniature. Wilbur and Orville hadn't worked from blueprints so Monogram designers journeyed to the Smithsonian Institution, in Washington, D. C., to study and photograph the original from all angles.

Scaled-down. This is a replica of the *Tyrannosaurus Rex* dinosaur of 75 million years ago. The 46-piece plastic model was in development for two years



Scaled-up. This bumblebee made from a model kit is eight times real size. It was designed after museum specimens and is assembled from 44 plastic pieces
Ideal Toy Corp. photo





Bachmann Bros. photo

Replica model kits such as one called "Birds of the World" are popular with girls as well as with boys

Assisted by museum curators and other experts, Ideal took *Tyrannosaurus Rex*, a dinosaur that was two stories high and 50 feet long in real life, and scaled the skeleton down to 9 inches in height and 16½ inches in length. The job took two years but the success of the kit made the effort well worthwhile.

Intricate model kits, such as Revell's Westinghouse atomic plant and *Cutty Sark* clipper ship, can take well over a year to perfect and costs can run to \$200,000. Two or three months are spent in preparing true-scale plans. The pilot model is then prepared and is inspected by designers and operators of the original thing whenever possible. Every detail possible to be reproduced in miniature is then made of clay, plaster, wood or metal. Months of mold-making follow.

Strict attention to detail has made models important to the aviation industry, and many modifications have resulted from tests of models, saving a great deal of expense in plane production. When Revell was tooled up to mass produce DC-8 kits, Douglas decided to lengthen the fuselage by two feet. Not one modeler in a thousand would have known the difference, but the molds were changed to keep the model accurate. Small wonder that foreign

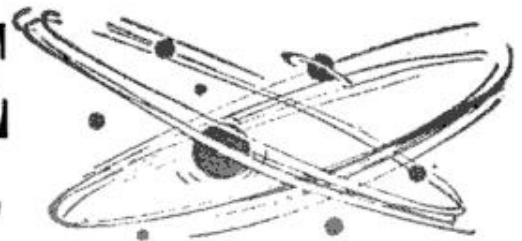
pilots being indoctrinated in DC-8 operation tour the Revell plant in Venice, Calif., and pick up kits as part of their course.

Electronic engineers are using miniature planes to test guidance systems, and the time may come when there will be kits for the construction of planes that can be guided electronically. Producing them might be a gamble, but anyone who is afraid of risk won't last long in the model business. Revell, for example, once planned a missile model, only to have the Defense Department scrap the parent project. The company could only follow suit, with a loss of \$75,000.

American models are distributed throughout the world by the U.S. Information Service, and the larger manufacturers also send thousands of kits to underdeveloped countries. Thanks to kits, school children in Ghana, for example, are familiar with the design and operation of modern planes and automobiles although most of them have never seen the real thing. Models of the atomic reactor plant were displayed at the Tunis International Fair last year, and were officially recognized for helping confirm the United States' policy of applying technical atomic knowledge to peaceful purposes. This kit has been ap-

(Continued to page 256)

AN EYE ON SPACE



By Dr. Dan Q. Posin

PROFESSOR OF PHYSICS, DE PAUL UNIVERSITY
SCIENTIFIC CONSULTANT AND ADVISOR, COLUMBIA BROADCASTING SYSTEM

WHEN WE LAND ON MARS, we'll dash, panting, to gaze upon the canal regions. But we'll also have some more pressing problems.

The Martian atmosphere is very thin, like ours at about 50,000 feet, and we probably won't be able to breathe without one of those portable breathing units. Furthermore, we may find only about one percent as much oxygen in the Martian atmosphere as we have on Earth, and this oxygen content is not concentrated enough to pump into our breathing units effectively.

We may have to obtain our oxygen by quarrying it. By heating portions of the ground, we may be able to release oxygen which is bonded chemically into Martian soil. Of course, before going, we will want to be pretty sure that the Martian soil will have this trapped oxygen, and for this reason various soils thought to be like those of Mars are being studied now and oxygen is being extracted from them. One type of soil studied is a red sandstone from southern Texas. This soil contains much iron oxide. The second is a lava type like that of the Painted Desert in Arizona. Both of these soils, upon heating, have yielded oxygen, though not enough. Techniques must be improved to make them yield more.

Other studies looking toward Earth-peoples' survival on Mars have led to experiments on growth of bacteria in an atmosphere considered to be Mars-like. Also, to test the effect of breathing and living in a thin atmosphere, colonies of Earth-mice have been subjected to existence in tanks which are progressively evacuated of air.

A group of mice have been quite blasé about it all at the thin air pressure corresponding to 15,000 feet of altitude, and they may get by at 50,000 feet. Peruvian Indians, in the Andes, seem to enjoy life on the 15,000-foot mountain tops, and some of them don't like to go down into the valley, because so much air there gets into their lungs.

The question still remains as to how man would fare in a very thin atmosphere. On Earth we know that many animals native to the high mountains prefer to come down to lower heights to sleep. But this may be for better seclusion and shelter, and to repose in regions warmer than that on the mountain heights at night.

But more about bacteria and vegetation. Research is under way to find out what kinds could exist on Mars. To make studies one must, of course, try to duplicate Martian conditions.

Take temperature, for example. An average summer day on Mars can range from about 77 degrees F. in daytime to about 20 degrees *below zero* at night. On Mars, the atmosphere consists mostly of nitrogen, perhaps 98.5 percent. Most of the remaining small portion consisting of argon, carbon dioxide and oxygen.

In the experiments being carried out at Armour Research Foundation of the Illinois Institute of Technology, a Martian atmosphere is produced in test tubes. Into them are placed certain species of Earth bacteria and several types of vegetation. The question, of course, is can the bacteria survive in the Martian atmosphere and, if so, do they retain their initial vigor?

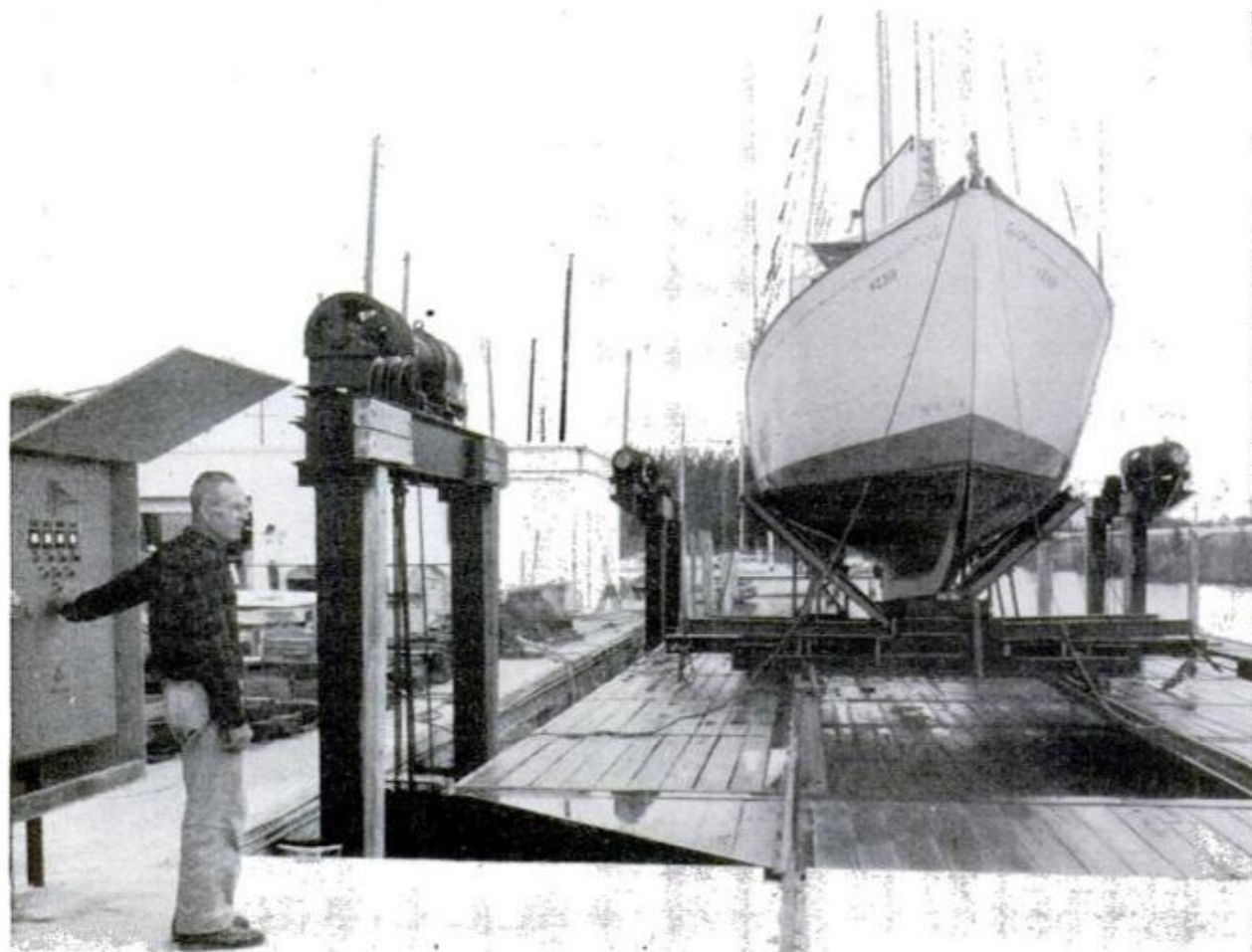
The vegetation used in a set of studies consists of mosses and lichens, and it will be fascinating to learn which kinds of elementary life can survive in a Martian atmosphere with what is believed to be Martian vegetation. ★ ★ ★

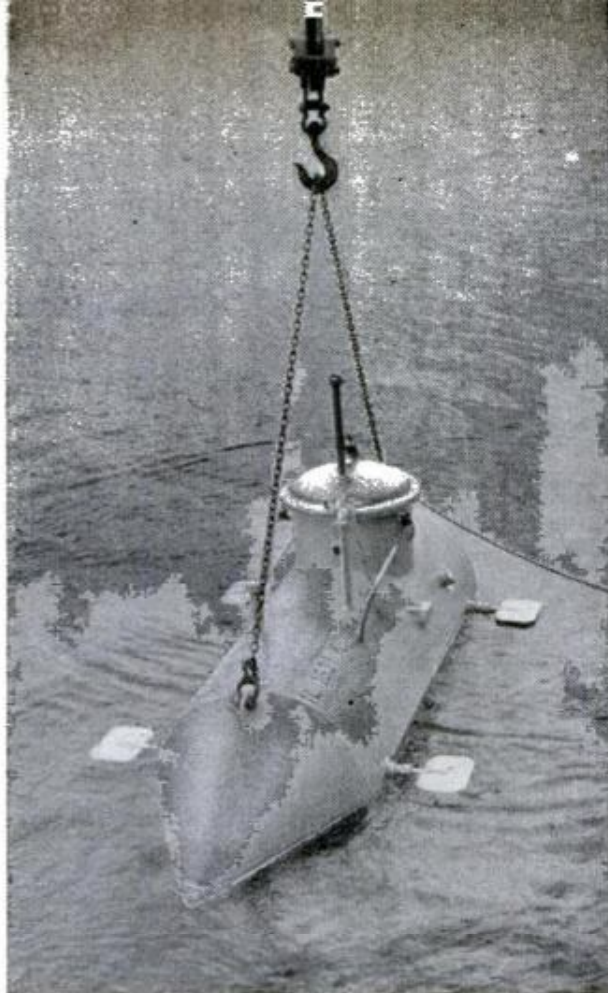


Elevator Hoists Boats on Cradle

Miami marine engineer Raymond Pearlson demonstrates his new "Synchrolift," which provides a fast, easy, inexpensive way to launch and load boats up to 100 tons.

The elevator, with a cradle already in position on its rails, is lowered into the water. The boat pulls in over the cradle and is lifted out and pushed into the yard.





PM photo

Sub Made From Water Tank

Powered on the surface by a five-horsepower engine and underwater by a two-horsepower electric motor, a homemade 13-foot submarine now prowls Lake Michigan. Isadore Portnoff and Jerry Krason of Chicago made the hull from a used 500-gallon water tank. The craft weighs 3000 pounds.



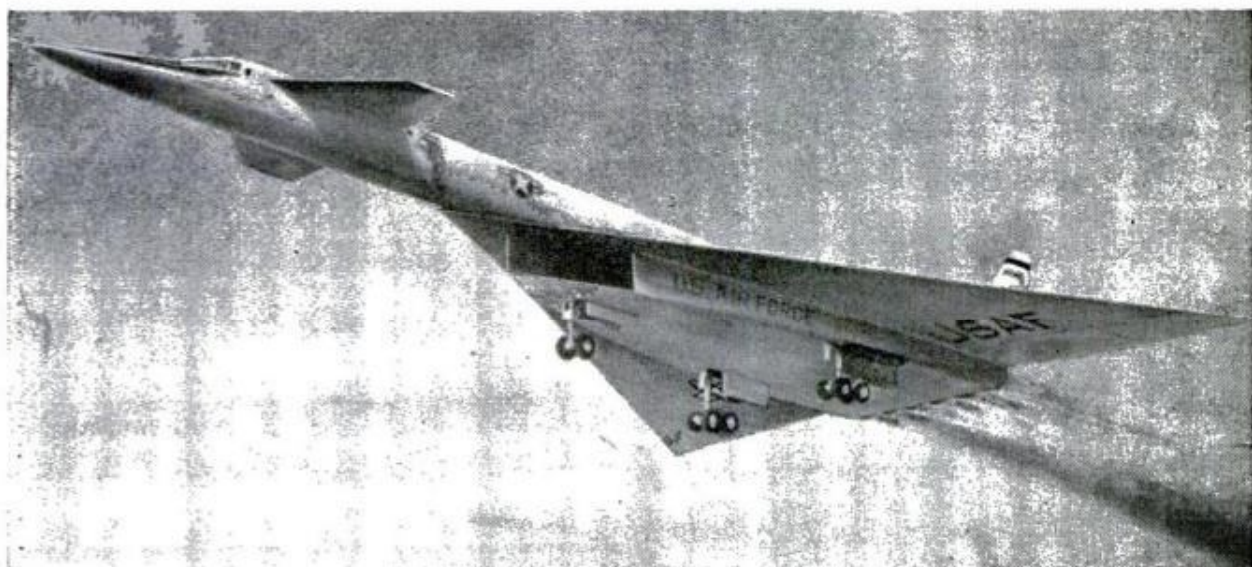
Hot Dog!

How to heat hot dogs without bursting their skins? A West German engineer devised a table-top cooker that brings the red hots to eating warmth by bathing them in steam. Water is placed in a pan at the bottom of the heater and as many as 80 hot dogs can be placed in the glass container.

Air Force B-70 Will Fly Three Times Speed of Sound

Six jet engines will power the B-70, the Air Force's newest bomber being built by North American Aviation, to speeds in excess of Mach 3, three times the speed of sound. Shown in an artist's sketch, the

needle-nosed craft permits its crew to sit well forward in "shirt sleeve" comfort without the need of bulky pressure suits. The huge ship will be able to use runways currently accommodating B-52s.





By Jim Whipple



New compacts draw buyers for "big brother" cars. Auto industry puts on the greatest show ever.

Which way will the ball bounce? The new **Buick**, **Olds**, **Pontiac** compacts are in the showrooms. **GM** has placed its big bets and now the wheel of fortune spins. Whether compacts or "full-sized" cars gain in sales, and if so which ones, is still pretty much an open question.

One thing is sure however, **B.O.P.** dealers have profited from the experience of **Chevy** dealers last year. These were the gentlemen whose showroom floors were stocked with accessory-loaded **Corvair 700's** with Federal price stickers showing radios, heaters, automatic transmissions and all the other "goodies" that **Chevy** could bolt on them.

When they saw these prices the conservative buyers of compacts—secretly hoping to find a new car at used-car prices—recoiled and threw up their hands in dismay.

Today's **B.O.P.** dealers aren't making the same mistake. Each showroom has its **F-85**, its **Tempest**, or **Special** in a stick-shift "standard" model with just a heater at a rock bottom sticker price. For **Olds** and **Buick** this comes to just under \$2500 before state and local taxes. **Pontiac's Tempest** is ticketed at a bit over \$2200 with heater.

Some early reports on the sale of new compacts indicate that they are acting as traffic builders, bringing people into the showrooms to look them over. In many cases these lookers wind up buying the "big" car instead of the compact after a real selling job by the dealer.

This, of course, is what happened in **Chevy** showrooms during the 1960-model year. They came to look at the **Corvair** and stayed to buy **Chevy Biscayne Sixes** by the trainload.

If something like this happens to **Buick**, **Oldsmobile** or **Pontiac** dealers, not too many tears will be shed, because there's more money to be made selling the full-sized cars, even at closely figured prices.

An executive of one of the **B.O.P.** divisions remarked happily after reading his first 10 days' sales report: "The big job is going great, it looks as if compact sales will be 'plus' business." In other words if

sales of the newly redesigned big **Buick**, **Olds** or **Pontiac** are good enough, the parent division will have a profitable year even if the compacts do not "take off" like **Falcon** did last year.

A compact to watch in the year ahead is **Valiant**, and possibly its higher-priced **Dodge** counterpart the **Lancer**, as well. **Valiant** sales have been coming up fast in the last few months after a very slow start. The reason given by happy **Chrysler Corporation** people is that the public has discovered that **Valiant** gives them handling, ride and roadability of a high order and plus performance of the 101-horsepower engine at prices very close to the bottom.

A look in at the Forty-Third National Automobile Show in Detroit's great new **Cobo Hall** revealed more cars and more people than had ever been together in one room before. (It's easy to do this, just get a room that measures 725 by 405 feet.)

Surveying the glittering panorama, six-and-one-half acres of shining chrome and glowing color, one couldn't help marveling at the wide choice offered the American car buyer.

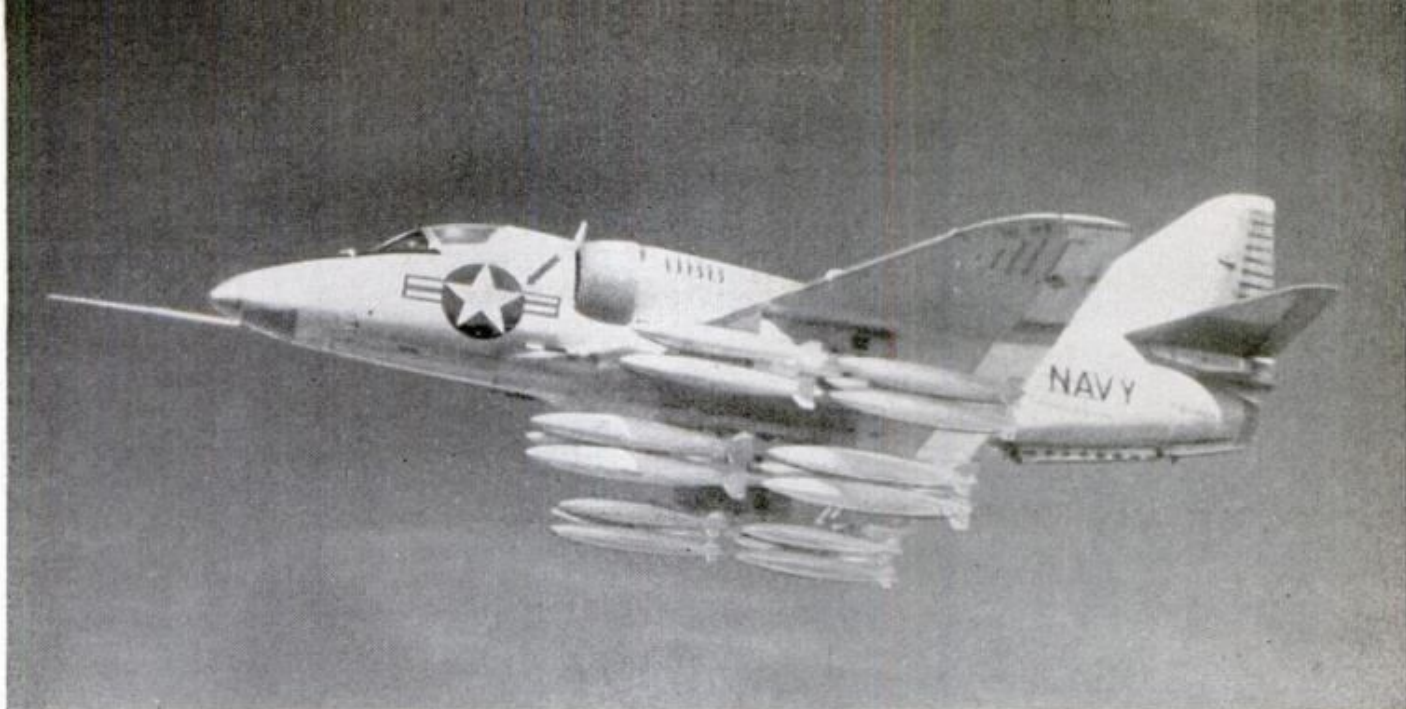
The industry is to be congratulated for the scope and magnificence of its show in general and for the "Auto Wonderland" in particular. This last, an exhibit of semi-technical nature, was set up by parts manufacturer groups such as the rubber, brake, spring and electrical component industries.

It was a veritable science museum of the modern auto industry. For those who live within reach of Detroit, the show should be a "must see" next fall.

Ford and **Chevy's** new short-wheelbase light trucks, the **Corvair 95** and **Ford Econoline**, have already attracted a considerable amount of attention.

According to early reports this is not idle window shopping but solid interest backed up by rising order volume.

These useful vehicles are the result of market research (valid for a change) which revealed that most farm and delivery truck users don't carry heavy enough loads to justify the overload capacity and pulling power of today's standard half-ton trucks.



Six times as many bombs can now be carried by the Navy's A4D Skyhawk with the use of a new multiple bomb rack adapter. The bomb-cluster rack system has successfully completed a rigorous testing program which included level, dive, loft and skip bombing. More than 150 bombs were dropped in tests conducted at the Patuxent Naval Air Test Center in Maryland and from the decks of the Navy's attack carrier *Independence*

Barnum's first tour of the Midwest was made famous by the reaction of a prairie farmer seeing his first giraffe—"There ain't no such animal!" And the same farmer, seeing this new British Shortland straddle carrier, would probably have repeated himself. The big machine, designed to lift and carry huge loads of timber, pipe, girders and long bulk loads, is inspected by a giraffe at a circus in Belfast, Northern Ireland





Buried under ten feet of earth and concrete, the tunnel housing the atom gun curves like a half-mile track

The World's Greatest

By Richard F. Dempewolf

IN A CIRCULAR underground tunnel that is half-a-mile long and big enough to accommodate a subway train, groups of technicians move along a curving line of magnets strung down one side like a king-size necklace. Occasionally they stop to inspect one of the racks of electronic tubes set at intervals between the giant chunks of steel.

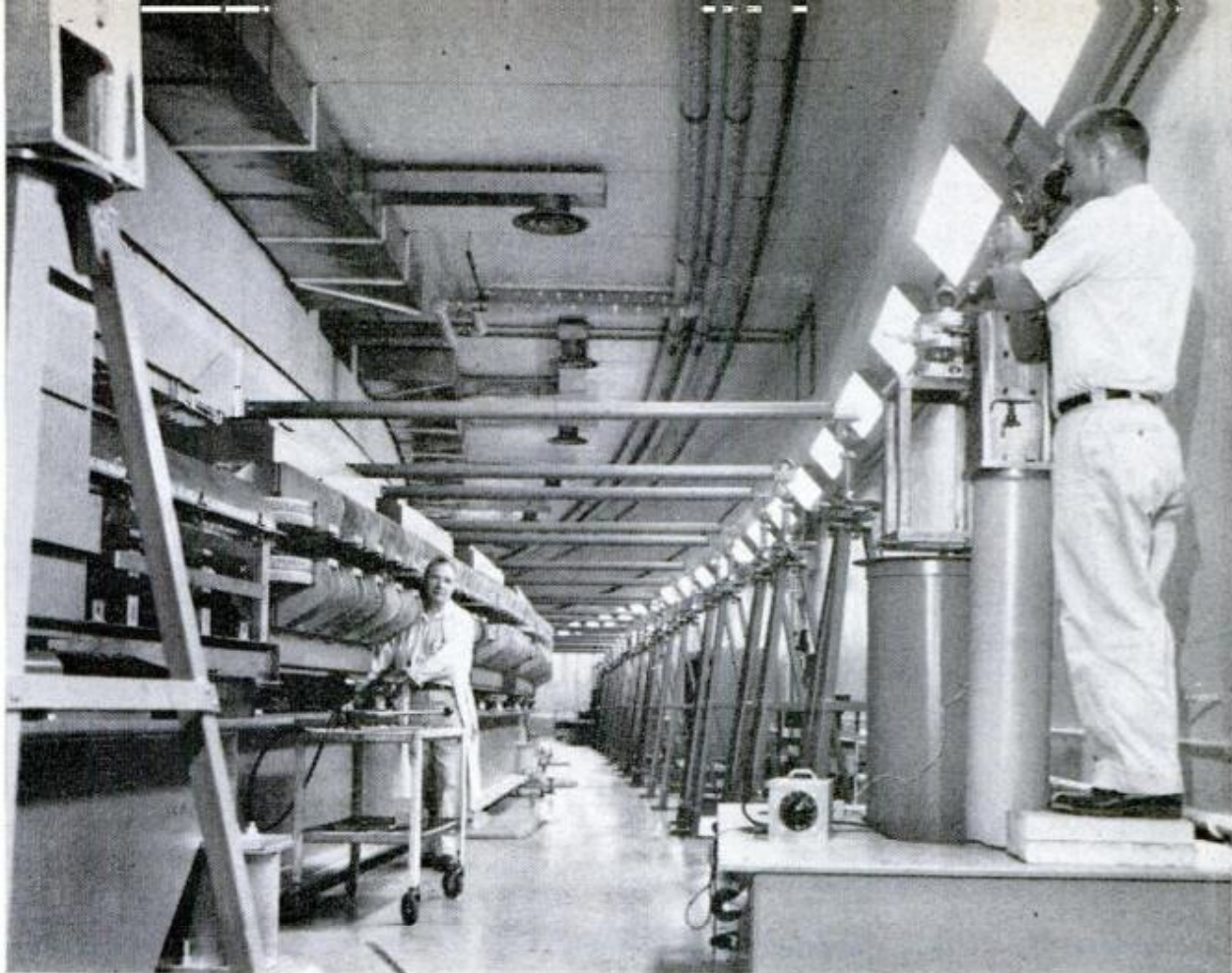
A hundred feet off the tunnel, in a balcony room housing a high-speed computer and a dial-studded control console, operators peer through windows overlooking an eerie array of equipment. On their right are twin towers of stacked capacitors encased in doughnut-shaped aluminum housings. From this monster, cables reach out through glittering clusters of glass tubes to their instrument console. In front, a 110-foot-long tube, some three feet in diameter, stretches away below them toward the big tunnel like the barrel of a mighty gun—which it is.

At a signal from the safety crew that the tunnel is clear of people, a man at the console throws the switch on a high-voltage generator. Red lights flash in critical areas, raucous buzzers bleat through

the cavernous spaces of this nine-acre honeycomb. Big gates shut and are locked behind retreating technicians and safety crew. The operator throws another switch, activating the "gun."

There is no *bang!* Just the muffled roar of the big generators. But down the length of that 110-foot barrel surges a speeding charge of nuclear bullets. In less than a microsecond they are swept into the huge circular tunnel. Through high vacuum they are speeded up by a series of high voltage "kicks" during each revolution, and are nudged into their circular orbit by staggering magnetic forces. In *one second* on that race course, the "bullets" have spun around the half-mile circuit some 300,000 times—160,000 miles—and are traveling within one-tenth-of-one-percent of the speed of light.

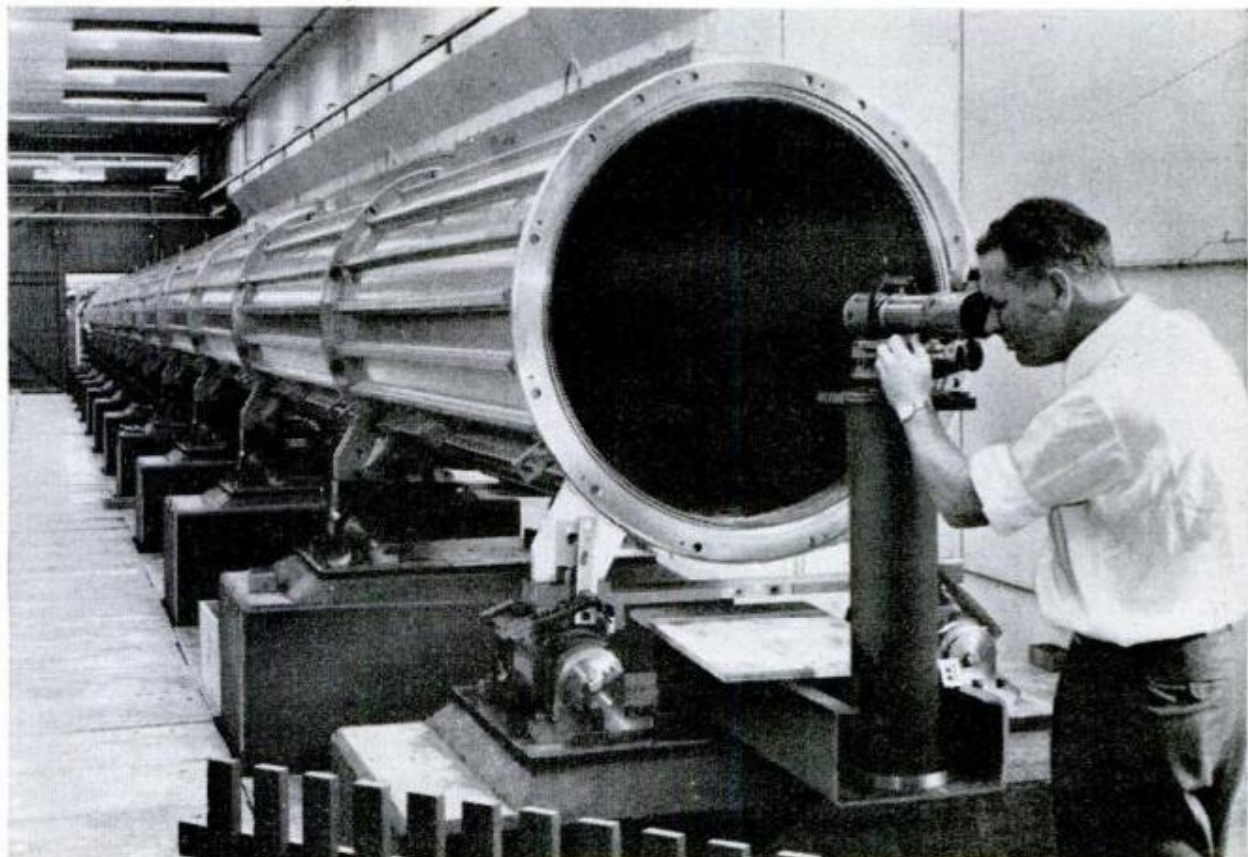
Then, without a sound, a tiny target, or "flag," is thrust into the path of the speeding particles. In one destructive instant, a cataclysm of radiation floods the area as atomic debris flies off in all directions to be counted, photographed in flight and painstakingly analyzed by a battery of scientists.

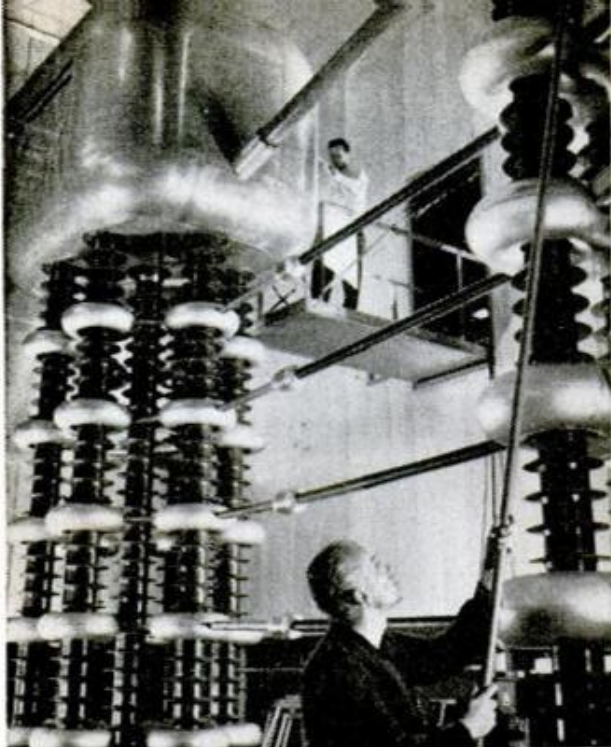


Technicians use surveying instruments to line up magnets, left, that hold proton "bullets" on true course

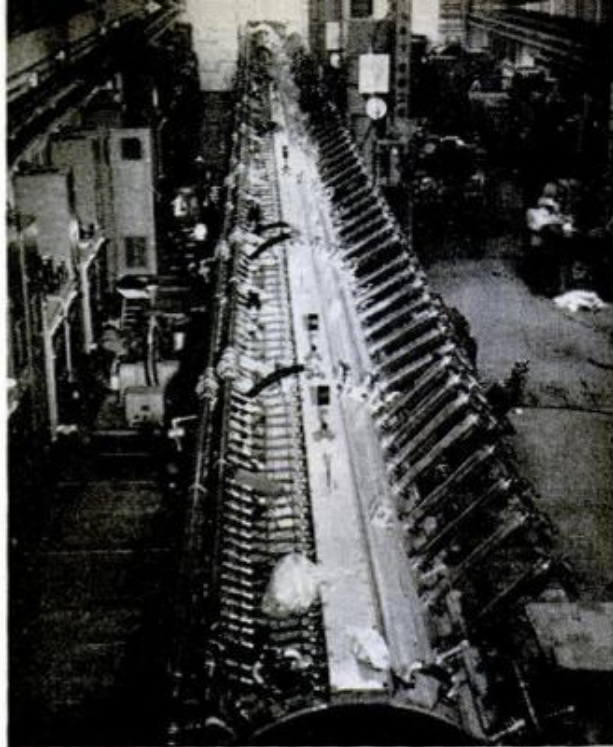
Atom Gun Blasts Off

Protons speed down this 110-foot-long linear-accelerator, then are pulled onto the raceway by the magnets





Cockroft-Walton generator gives the proton beam its first kick of acceleration — 750,000 electron-volts



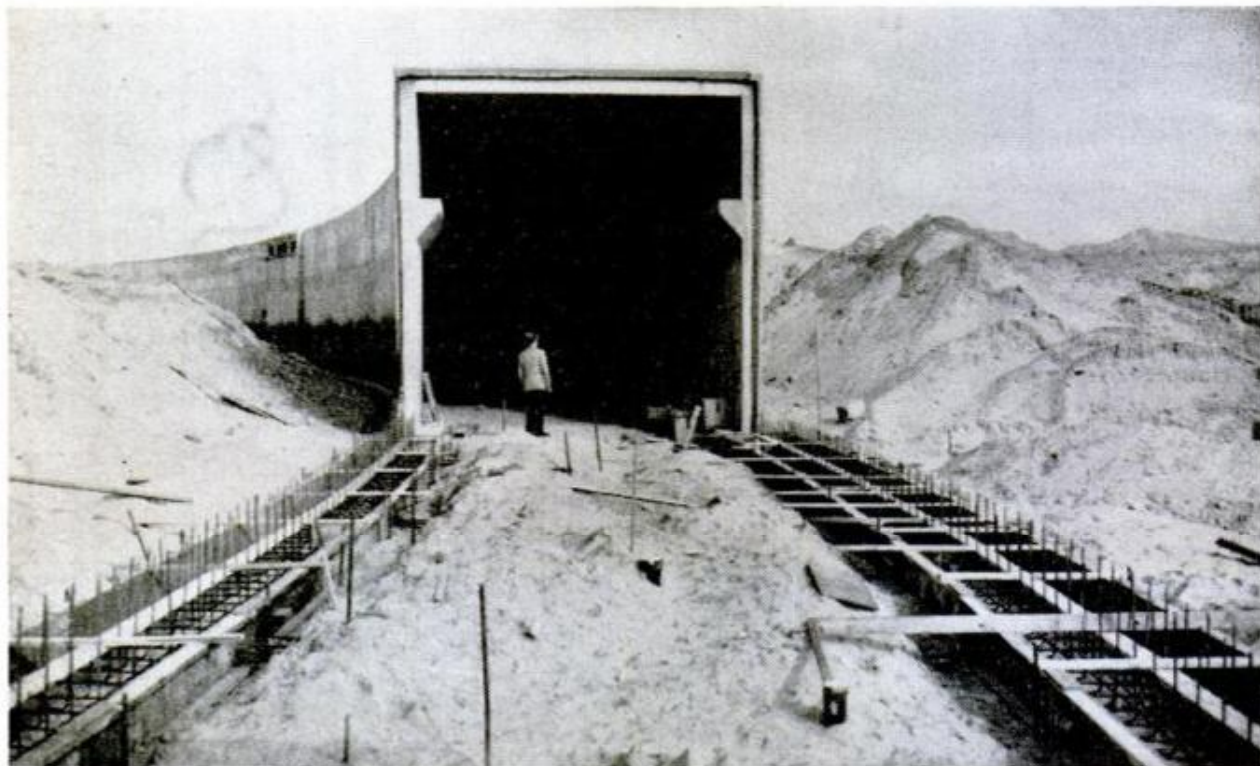
R. A. Abbott photo

This is the second stage of the linear accelerator that boosts beam by some 50 million electron-volts

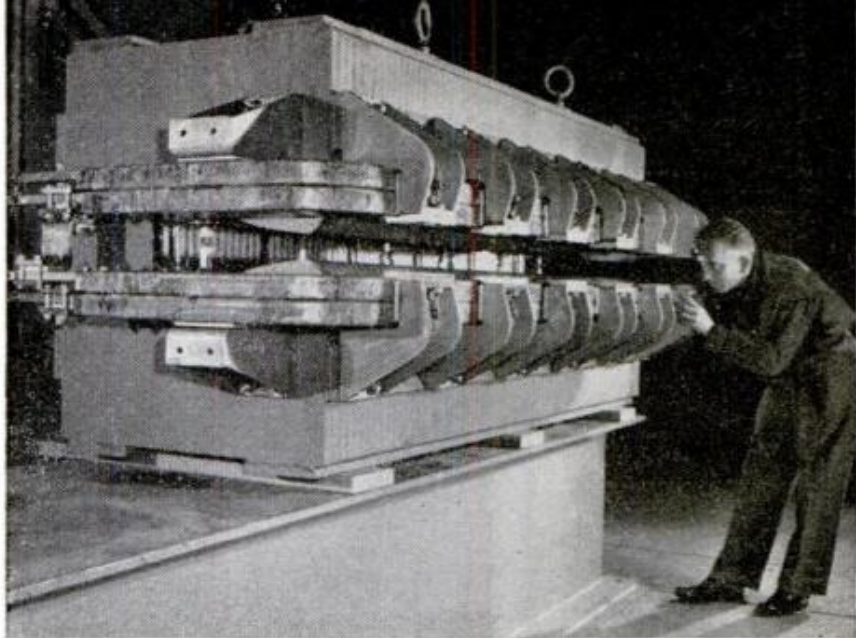
This is the world's newest, most powerful "atom gun"—the 30-billion-electron-volt Alternating Gradient Synchrotron at Brookhaven National Laboratory, Long Island, N.Y. Construction of the sprawling 4400-ton string of magnets and windings began in 1956. This fall—four years and some \$31,000,000 later—the gigantic machine, known around Brookhaven as "The AGS," began firing strange projectiles at billions of invisible targets. Both bullet and target are among the smallest bits of matter in the universe.

To get an idea *how* small, try the target—an atom's nucleus—for size. In terms of a meter (about three feet three inches), the width of such a target would be about 10^{14} times smaller. That's the figure "one" followed by 14 zeros. The bullets are protons, infinitesimally small nuclei of hydrogen atoms produced in the ion beam, or "flux," created by the AGS' huge Cockroft Walton generator. The Synchrotron fires a stream of these protons at a target material containing billions upon billions of the particular atoms under study.

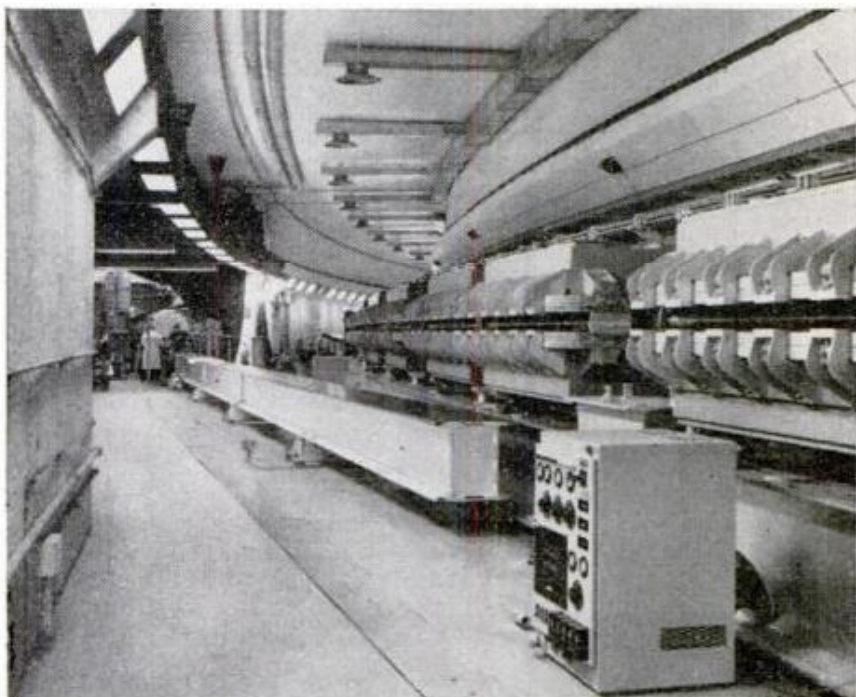
Construction view of tunnel housing the "gun," or Alternating Gradient Synchrotron. It's heavily shielded



Each of the 240 strong-focusing magnets is made of 2800 laminations of steel plate. With coils each weighs about 16 tons and bends proton beam 1.5 degrees

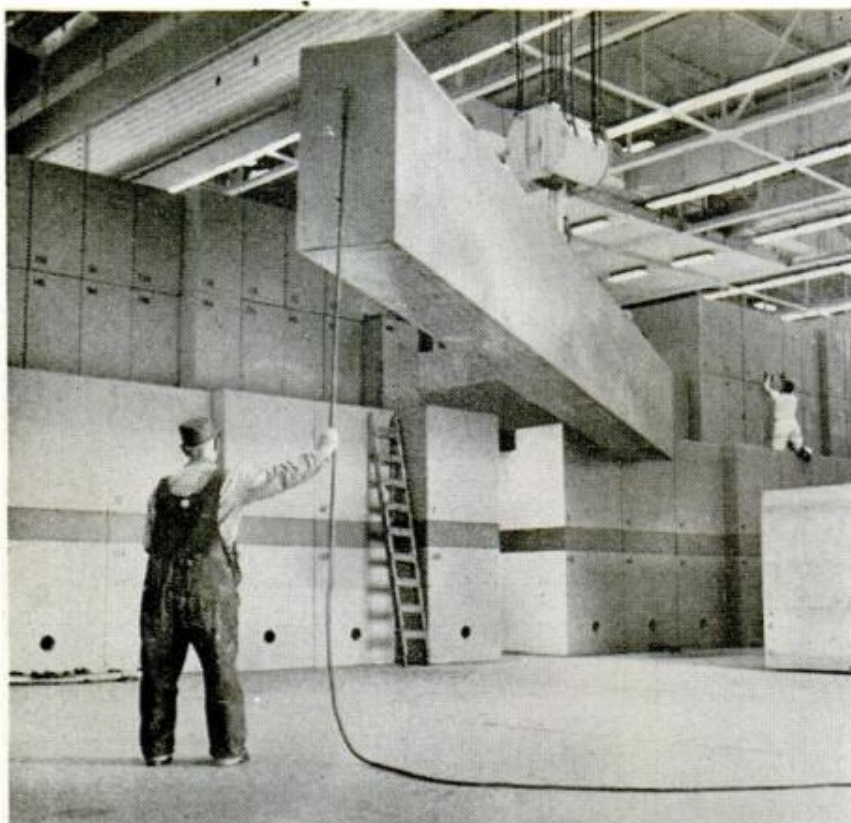


Linear accelerator (it rests on steel beam in center) injects protons into the orbit of the Synchrotron's circular ring of magnets on pedestals at right



Control console of the Synchrotron is a collection of dials, switches and cathode tubes. Proton beam originates in a dome on the other side of the window





Shielding blocks in the target building are moved into place with 40-ton crane. Some of the concrete blocks weigh 34 tons; 1446 such blocks are required

The "hits" scored by the scatter-gun technique will enable scientists to recreate rare cosmic events that occur naturally only in the far reaches of space. From Brookhaven's yawning tunnel may come new clues to the greatest secrets of the universe.

What is the ultimate particle of matter? Of what is it made? How is it created? What are the cosmic forces that bind all the nuclear particles of an atom into a package so incredibly small that it takes multibillions of them to make a barely visible speck of anything? What is the key to the endless storehouse of fabulous energy that is released in the total annihilation of matter? Does it lie in the weird phenomenon of "antimatter" which, scientists have begun to suspect, was formed in equal quantities with other matter when all things were created? The instant a proton and an antiproton meet, they destroy each other, releasing energy 1000 times greater than that resulting from the fusion reaction of atoms in a hydrogen bomb. A few of these strange particles have been produced for brief instants in powerful atom-smashing predecessors to the new Synchrotron, leading atomic physicists to believe that there exists some tremendous cosmic force holding protons and antiprotons apart in the structure of matter as we know it. What is this force, and how does it work?

Particle accelerators such as the AGS function as sort of "atom microscopes." They make it possible for scientists to construct a picture of what is inside an atom's

nucleus. But the more energy that can be imparted to the proton (or electron) "bullets," the more "events" will occur when they strike a nuclear target. This means that more of the pieces that make up the structure of an atom's nucleus can be "seen" as they fly off following each atomic collision.

The first cyclotron, built in 1930, kicked particles up to about 80,000 electron-volts of energy, and gave physicists their first real look at a few basic bits of the nuclei they shattered. During the 1950's, the three-billion-electron-volt (BEV, for short) Cosmotron at Brookhaven, and the six-BEV Bevatron at the University of California, were able to produce particle beams billions of times more intense than nature's cosmic rays. From these big "guns" came the first discovery of a host of weird new particles—among them, antiparticles.

The "bullets" (the proton beam) for Brookhaven's new "gun" begin as hot hydrogen gas in the Synchrotron's Cockroft-Walton ion generator, which performs somewhat the same function as the booster stage of a rocket. Protons are knocked off hydrogen atoms with a high voltage "kick," and sent on their way with an initial energy start of 750,000 electron-volts. They shoot from the Cockroft-Walton into the "second stage"—the 110-foot-long barrel of a linear accelerator. Here the beam is squirted through 124 "drift tubes," strung down the center of the "gun" barrel in a series of lengthening groups that "bunch"

(Continued to page 248)



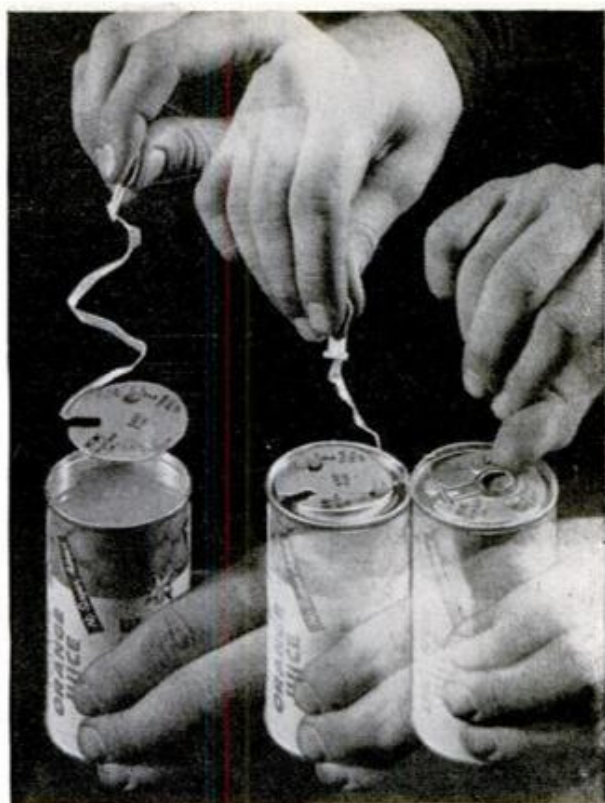
Fingerprints the Easy Way

No muss, no fuss—no ink or paper, either—both Texas lawman Bill Decker as he fingerprints himself with the new optical fingerprinter developed by Electronics Division of Chance Vought Aircraft. The unit uses an optical technique which picks up the print directly from his finger and projects it on a screen for immediate observation or recording. An enlargement of the screen's picture forms a background. The device is officially called Precision Recording (Optical) of Fingerprints—PROOF for short.

Windbreak Unfolds from Sled

Warming up with a cup of hot coffee during an ice-fishing session, John Buckingham of Lake Geneva, Wis., shows his unique ice-fisherman's windbreak. Built around the familiar sled that most ice fishermen use as a combination carryall and seat, the light metal framework unfolds and spreads "wings" of heavy clear plastic film. The angler sits in relative comfort on the folding seat, out of the wind but still able to see what's going on around him.

☐ The ladies have forced Boeing to redesign the floors of the 707 jet air liner. Their spiked heels were riddling dimples in the honeycomb-aluminum sandwich floor. Now Boeing is making its floors of corrugated aluminum sheets spot-welded to upper surface skins.



Tear-Off Top for Can

Next time that TV pitchman tells you to "tear off the top and mail it in with your entry" he may be talking about the top of a can. A quick-opening aluminum top is undergoing tests for frozen-juice containers. It has an aluminum tab which, when pulled, tears out a thin, scored strip of aluminum around the circumference of the top. The top comes free at the end of the strip, leaving a smooth, safe opening. Though designed for frozen juice, the makers are confident the tear-top has unlimited application.



SKIN DIVING FOR GOLD

By Bob Hyatt

FIVE THOUSAND gold-hungry prospectors are nothing new to the well-worn hills of California's Mother Lode country, for thousands of Forty-niners grubbed in its hills and panned its creek banks during the gold rush years in the mid-19th century. But now, a hundred years later, a new breed is prospecting those same streams—on the bottom.

Wearing underwater breathing apparatus, they probe the eddies and cracks and pockets along the rocky bottoms, picking up nuggets (two youths took 86 ounces of pure gold—at \$30 an ounce—from under a bridge on the Yuba River). They also are taking out promising muck and gravel with lightweight suction dredges, then run it over a miner's "riffle box," where the heavy bits of gold settle into pockets while the water carries the lighter sand, gravel and dirt back into the stream. There have been some real bonanzas; one man took out \$100,000 in two and a half months, and hundreds of divers pay for their time and equipment at the rate of \$100 a day. Statistics and details are scarce, though. You can't stake a claim on a river bed, so the successful divers learn to keep quiet.

You can go into business for as little as \$25 with mask, snorkel, and a little hand "sucker" to pick up gravel; and really setting up with a dredge, compressor, wet suits (it's cold down there) and breathing gear for something like \$1000.

But the lure is strong—you could take that thousand bucks out of a rich pocket in a few minutes if you're good, or lucky—or both.



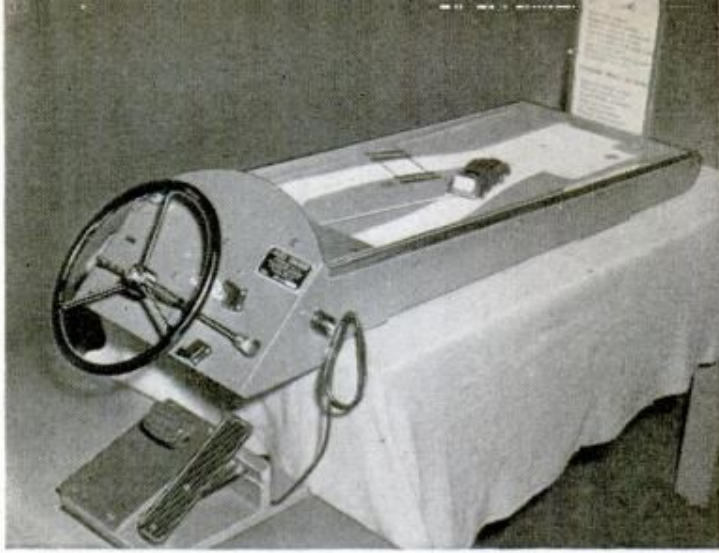
Boy-girl diving team works over a rocky river bottom with prying tools and a bag for specimens. Below, Dick Anderson, veteran Los Angeles skindiver, holds his portable dredge. In his left hand is a small "riffle box." California dealers can't keep up with the demand for small-scale dredging gear





Most divers work in teams of at least two, one working the bottom while the other tends the compressor and riffle box. Here, borrowing the old-timers' panning technique, Dick Anderson pans out the take while he takes a breather and thaws out. There's about three ounces of flake and nugget gold in that pan; that's at least 90 dollars' worth. Below, it's not all at dramatic depths. A diver with only his face in the water chips at an underwater crack in a riffle. Air hose leads to compressor, saves carrying and refilling tanks





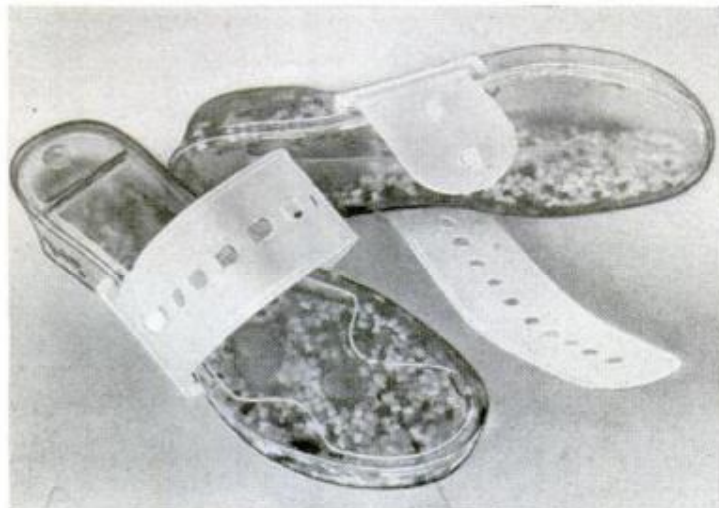
Driving School on a Tabletop

Beginning drivers can practice highway and city driving complete with turns, stops, traffic and even parallel parking on a new automobile trainer. The machine transmits the manipulations of wheel, brake, accelerator and gearshift lever to a model car which runs on a roadway printed on an endless belt. The controls operate a variable-speed motor and reversing switch.



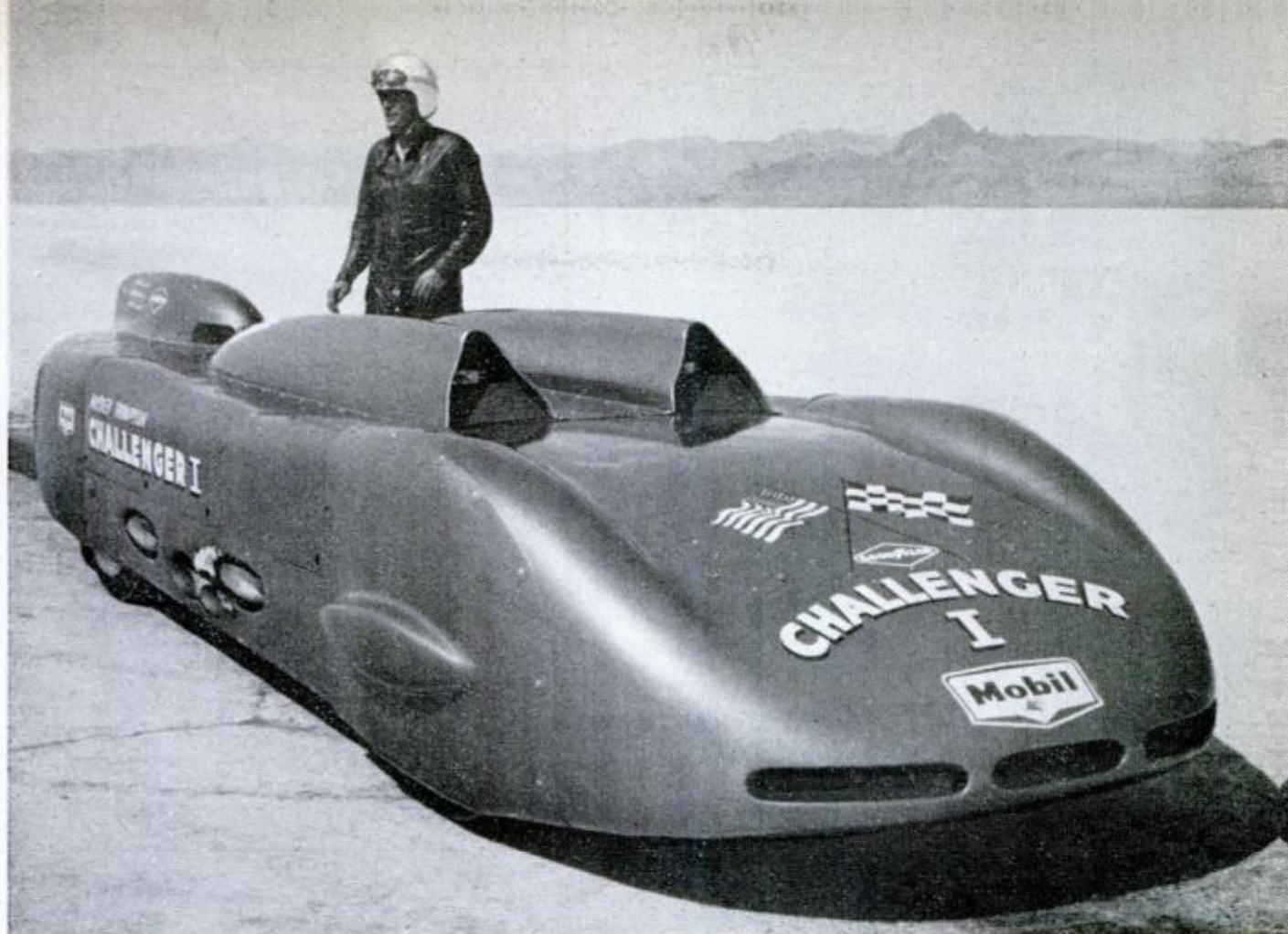
Suspension Bridge For Conveyor Belt

Spanning the Snake River near Pasco, Wash., a 930-foot-long suspension bridge supports a conveyor belt that carries construction material from one side of the river to the other. The belt transports aggregate for the concrete construction of the Ice Harbor Dam being built by the U.S. Army Corps of Engineers to provide 540,000 kilowatts of power and to extend navigation 35 miles up the Snake. If the rock and sand had to be trucked from one side to the other, the shipping distance would be 15 miles. The belt delivers 660 tons an hour from sorting bins on the south shore to the batch plant on the north shore. This aggregate will be used for making up a large portion of the more than one-million cubic yards of concrete that are required to fill in the \$135,000,000 dam and lock. The suspension bridge is supported by steel towers which are 100 feet tall.



Aquarium Sandals

Plastic sandals with built-in aquariums may be turning up at beaches next season. A plastics fabricator has announced production of a hollow sandal made of transparent acetate plastic and filled with a clear liquid, brightly-colored plastic pebbles, and plastic fish. As the wearer moves or walks, the contents move and the "fish" dart among the "pebbles." Sure to draw attention on or off the beach, the sandals are available in sizes to fit girls from ages 3 to 12.



Mickey Thompson and his *Challenger I*, which sped 406.6 miles per hour one way, but broke down on return

By Thomas E. Stimson, Jr.

AS OF NOW, hot rodder Mickey Thompson of California has driven a car faster than any man in history. This fall he was clocked at Bonneville at 406.6 miles per hour, three and a half miles per hour faster than the unlimited one-way speed made by John Cobb of England 13 years ago.

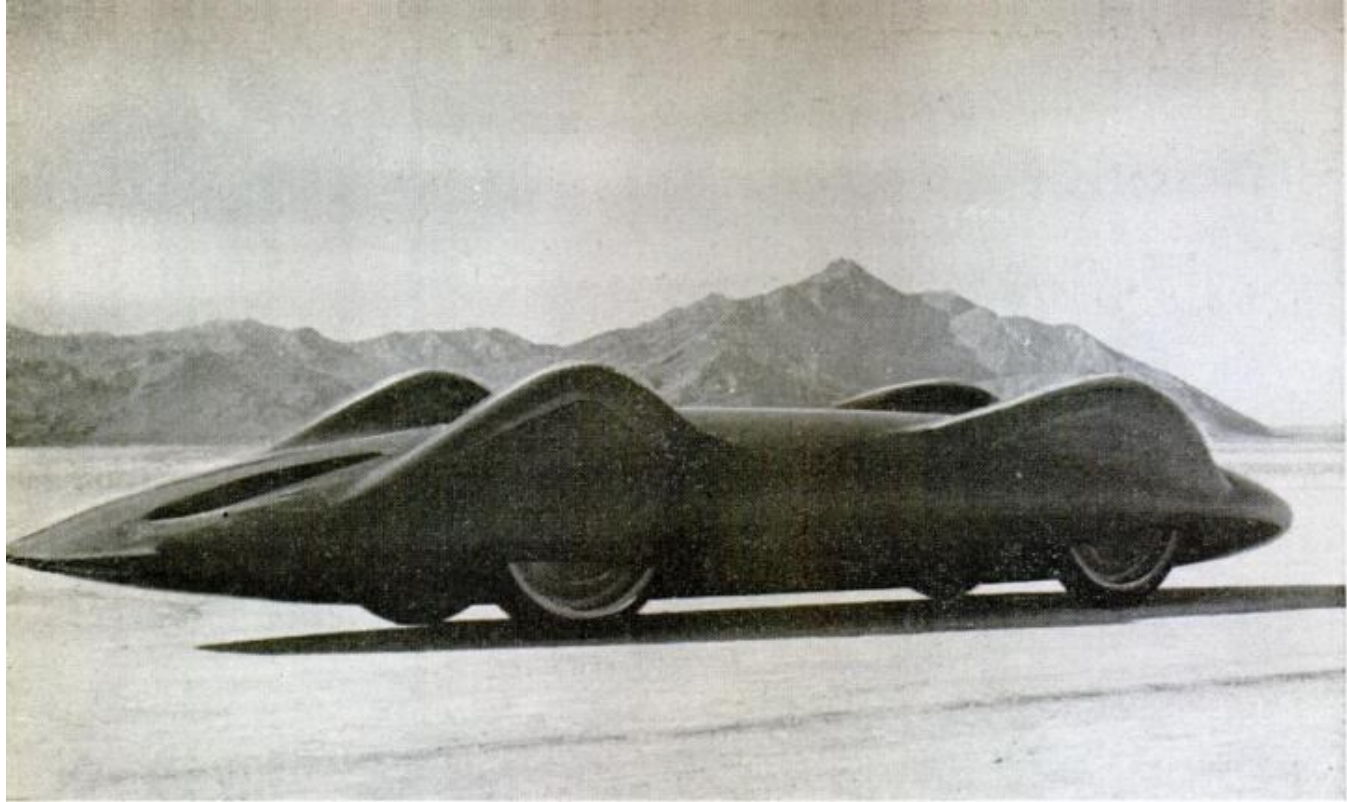
Thompson snapped a drive shaft while shifting into second at 210 miles per hour on his return run and failed to beat Cobb's international two-way land speed record of 394.1 miles per hour.

Bonneville's Magnificent Trials — and Errors

Bluebird on trailer in foreground is followed by English "task force" across salt flats to measured course

PM photos by the author





The sleek *Bluebird*, product of more than a million man-hours of work by employees of some 90 British firms, made trial runs on the salt flats before its ill-fated assault on the international land-speed record

In all, five different drivers tried to beat Cobb's old record this past season. One contender, Athol Graham of Salt Lake City, was killed when his Allison V-12-engined car got away from him at around 300 miles per hour and rolled across the salt.

Art Arfons, Akron dragster, burned out the clutch of his Allison-powered vehicle and retired. Dr. Nathan Ostich of Los Angeles was out of the running when his pure jet automobile developed suspension trouble at about 300 miles per hour.

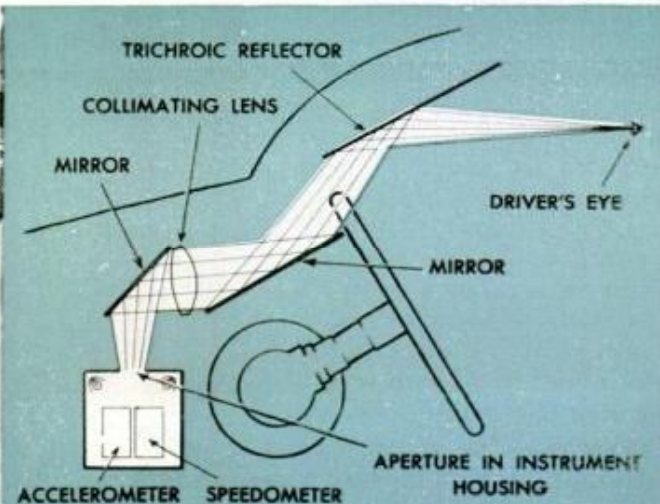
The most ambitious attempt of all was made by Donald Campbell of England whose *Bluebird* automobile represented virtually a national engineering effort by British industry. Ninety different companies participated in building the car and more than a million man-hours of work went into its design and construction.

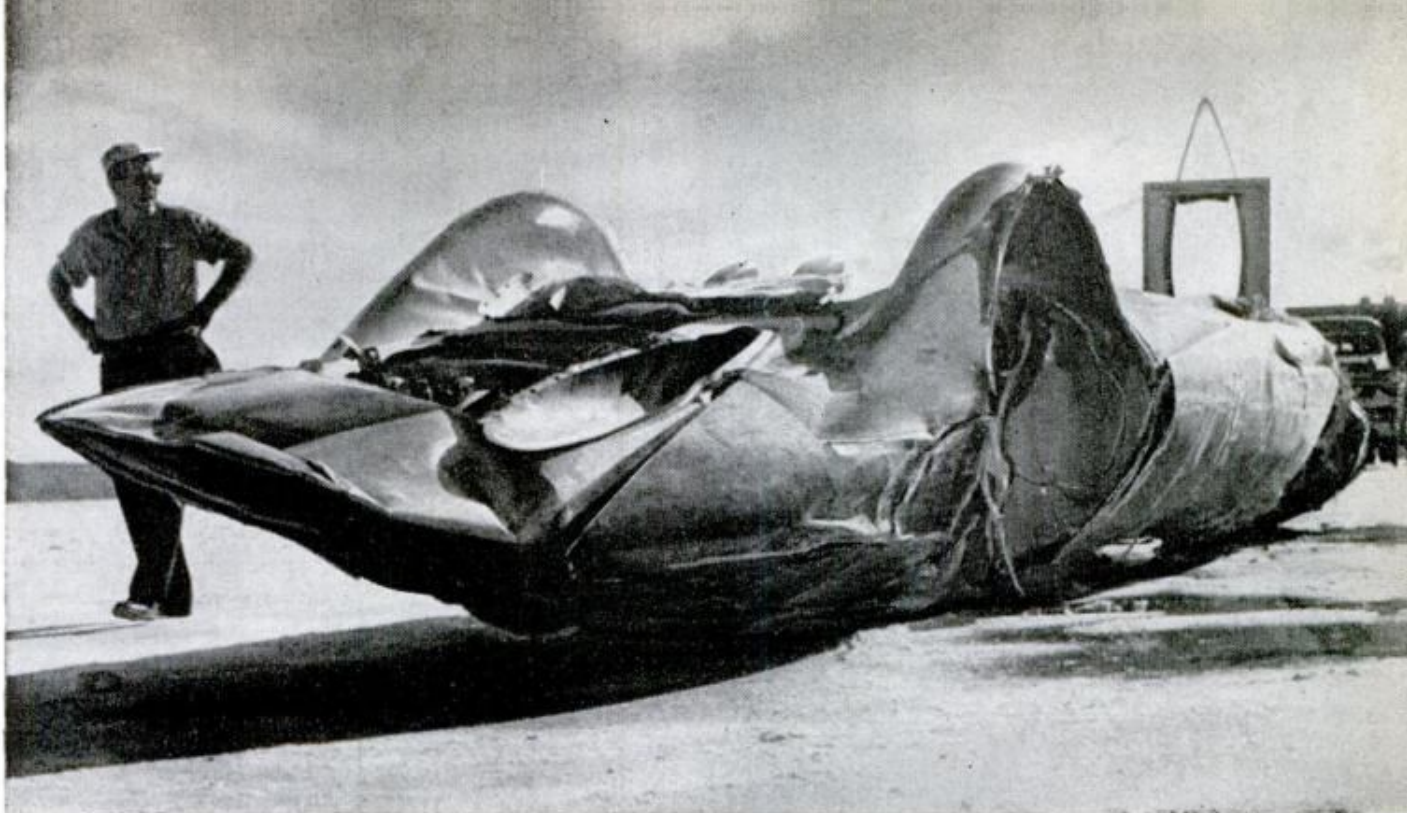
Campbell's land speed record attempt cost an estimated \$4½ million.

Bluebird was powered by a 4250 horsepower *Proteus* free-turbine jet engine that was modified to deliver its power to all four wheels. The car was expected to be safe and stable at up to 500 miles per hour and might even go faster if a suitable straightaway could be found for it. The car was the most sophisticated and advanced land vehicle ever built.

The experts still don't know exactly what happened to it. In a preliminary run and while accelerating rapidly, the car yawed away from the track. It appeared to lie almost on its side for a moment, then it became airborne. In a series of long bounces and slides it traveled three quarters of a mile before losing its right wheels and coming to rest. The engine was still

Optical system projects readings of *Bluebird's* speedometer and accelerometer as images that appear to be on track surface 100 yards ahead of car. Driver sees figures without moving eyes or changing their focus





UPI photo

A slight swerve from the course at 325 miles per hour put the *Bluebird* into a skid and a series of bounces that ended current hopes for a new land record. Driver Donald Campbell escaped with minor injuries

running, at idle. Campbell was shaken and bruised and the car was too badly damaged for another attempt this year.

Comparing Mickey Thompson and his *Challenger I* to Campbell and *Bluebird* is like comparing David to Goliath. Thompson's four-wheel-drive car is powered by four reworked and supercharged Pontiac automobile engines and is mostly a "made-by-Mickey" product. Yet Thompson is no novice; he has been running at Bonneville for years and holds many of the all-out speed records. As far back as 1953 he turned 194 miles per hour in a modified coupe.

Last year in *Challenger I* he broke all of John Cobb's old records except for the flying kilometer and the flying mile. He set a U.S. one mile record of 363.6 miles per hour.

His car is 19 feet 7 inches long and weighs approximately 6000 pounds. It is completely unsprung, with all its weight resting solidly on its axles. The four engines burn straight alcohol, develop in excess of 3000 horsepower, and are cooled by ice water circulated from individual tanks. In addition to disk brakes the car uses a drag chute for deceleration.

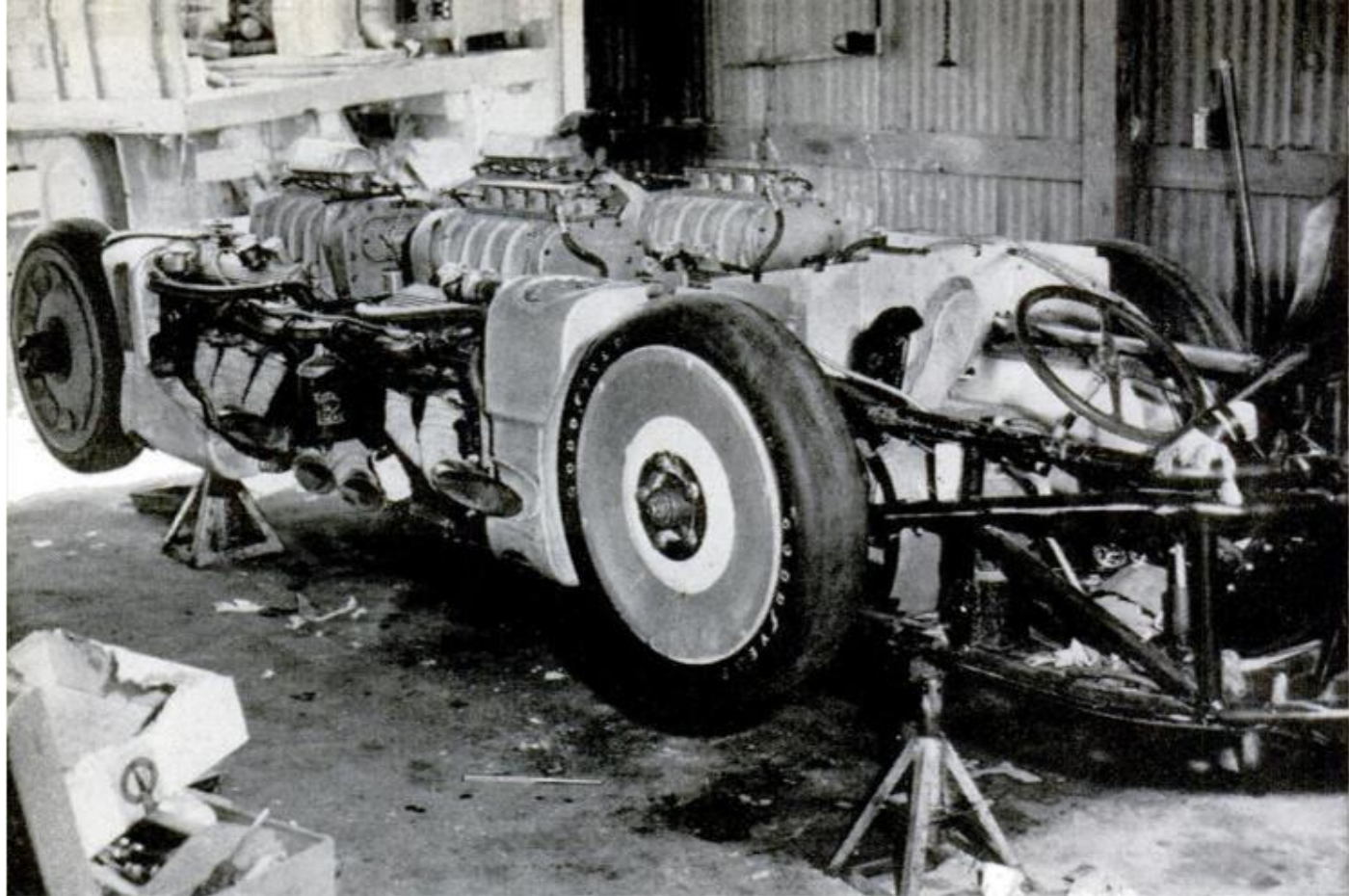
The driver breathes oxygen and wears shoulder harness. He sits in a semireclining position with his knees higher than his hips in an armored cockpit behind the engines. He has two foot pedals, the right one for acceleration, the left for braking. The brake pedal has a cap at its tip into which the toe of the driver's shoe fits.

Tires have always been a major problem in attempts at new speed records. Cobb's

Campbell, son of the famed Sir Malcolm, dons oxygen mask before seating himself in the *Bluebird*'s cockpit

PM photo by the author





FM photo by the author

Mickey Thompson's car in a garage at Wendover shows its four supercharged Pontiac powerplants. The slick, tubeless Goodyear tires, built for Thompson, have been machine tested at 500 miles per hour under load

tires, the best that could be built in 1947, were in shreds at the end of each run.

Thompson used specially designed tubeless Goodyear slicks, 30 inches in diameter, that were tested under load in excess of 500 miles per hour on Goodyear's multi-stage dynamometer. The tires have a carcass of low angle nylon cord and an outer coating of pure rubber only .020 of an inch thick. They are mounted on 21-inch magnesium wheels, are inflated to 100 pounds per square inch. Normally a "land speed record attempt" tire is changed at the end of each run; Thompson's proved to be so good that in trials he used the same set of tires for more than 100 miles.

Thompson's top speed came at the end of almost a month of test runs during which time the car was modified several times. At first the front wheels were spinning excessively because aerodynamic lift lightened the front of the car. Thompson added 700 pounds to the front end, later installed an air spoiler in the form of an aluminum rib across the front of the body to decrease the lift.

England has held the record for the flying mile for decades and means to keep it if possible. Campbell's father, Sir Malcolm, held the record several times in the past. Campbell himself holds the world speed record on water, having traveled at the rate of 260.35 miles per hour in his *Bluebird* jet hydroplane.

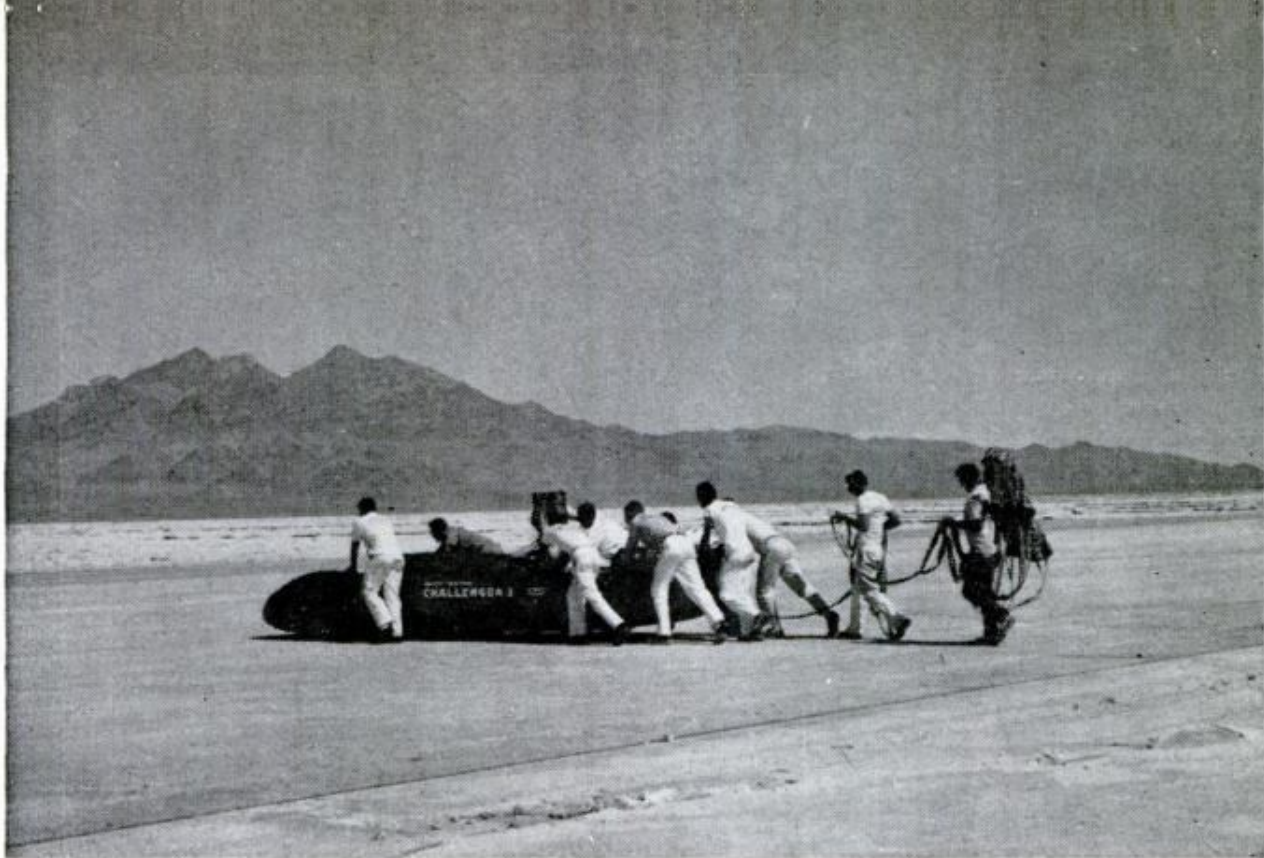
Campbell left as little to chance as pos-

sible when he decided to go after the land speed record. Norris Brothers, Ltd., the big engineering firm that designed the *Bluebird* boat, was put in charge. Five years went into the designing, testing and construction of the car.

The driver breathes oxygen through a mask. His helmet contains a two-way FM radio that connects with the pits. So that he won't have to take his eyes from the course in front of him, the figures that show his speed and rate of acceleration are reflected onto the windshield. Important pressures and temperatures in the vehicle are transmitted by radio to a telemeter truck. Technicians can advise the driver by voice if they see that the oil in a gearbox, say, is reaching a dangerous temperature.

The car is 30 feet long, 8 feet wide and 4 feet 9 inches tall. It weighs four tons and clears the ground by four inches. Its main frame is made up of sheets of aluminum honeycomb sandwiched between aluminum plates. A fully independent wheel suspension system is used.

For the speed record attempt, Dunlop developed a new low-profile tire 52 inches in diameter, of a special low-stretch rayon and coated with a scant one-fiftieth of an inch of rubber. The inner tubes are inflated to 130 pounds per square inch with nitrogen gas and the tires are so stiff that there is no standing wave and virtually no centrifugal distortion at 500 miles per hour, the speed at which they have been tested.



Crew of technicians with Mickey Thompson's *Challenger I*, a car that has traveled faster than any other automobile in history

Thompson in cockpit of his car with shoulder harness, crash helmet and oxygen mask. Helmet fits tightly inside steel shell that is part of the car's body



PM photos by the author

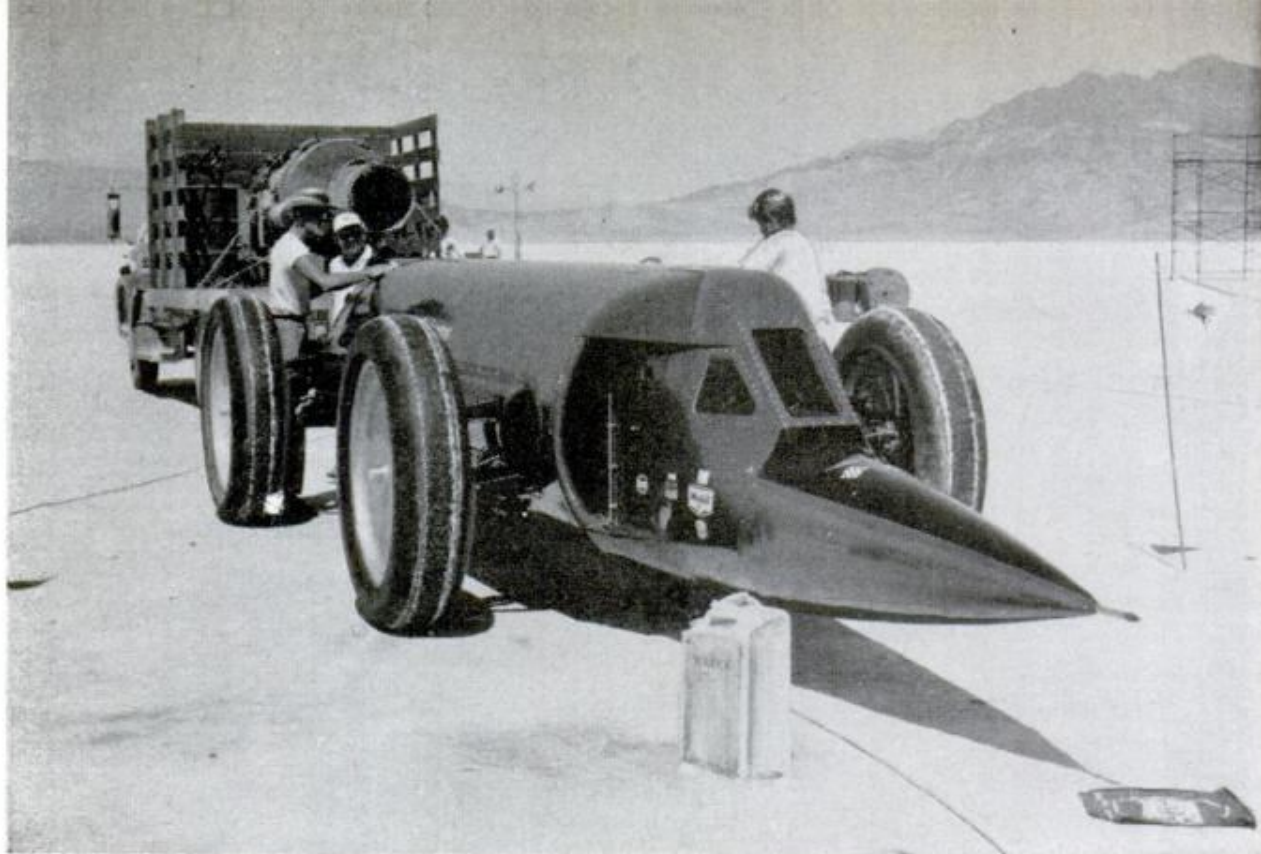
"Unlike the limited record breaking cars of the past, *Bluebird* has no large tail fin to help stabilize it," says K. N. Norris, one of the designers. "A tail fin would need to be so large that it could sway the car violently in side gusts.

"Instead, the big wheels provide considerable stability. Each wheel and tire assembly weighs 400 lb. and at 400 miles per hour is rotating at around 2600 revolutions per minute. This produces a strong gyroscopic effect. The car tends to travel straight ahead.

"In theory the body is aerodynamically

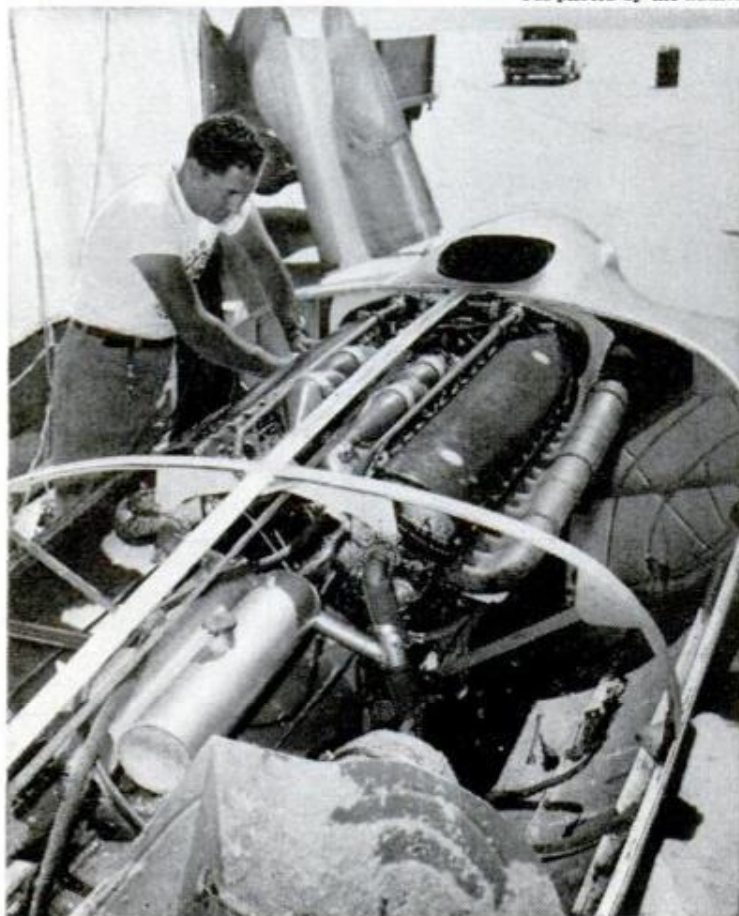
neutral," Norris continues. "Our desire was to carry the car's static weight on its wheels at all speeds. Four of the telemetry circuits in the car are used to measure the angles of the wheel suspension legs, to tell us whether the car is resting too lightly or too heavily on its wheels at any particular speed."

One of the oddities of a fast car is that its front wheels rotate faster than its rear wheels during deceleration. The center of gravity moves forward when the car is being braked, putting more weight on the front tires and depressing them. In effect



Pure jet racing machine driven by Dr. Nathan Ostich of Los Angeles developed wheel shimmy at 300 miles per hour and did not run for the record. Dr. Ostich plans to change suspension

Art Arfons of Akron, another contender for speed record, had clutch trouble. Here he works over his car's Allison V-12 engine
PM photos by the author



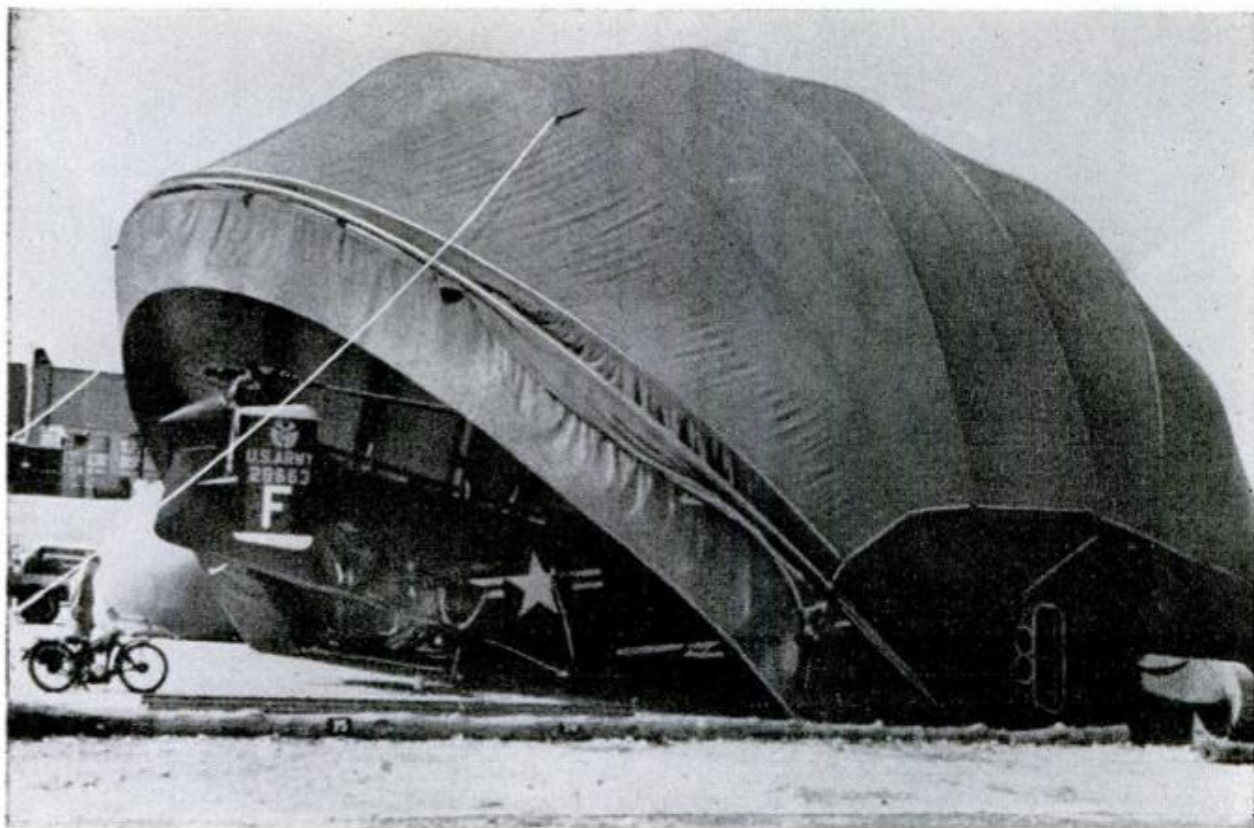
they become smaller and so must rotate faster.

In a four-wheel-drive car with all wheels driven by a single engine this creates a serious problem called "shaft windup." The front wheels try to turn their shafts and gears faster than the engine will allow. To avoid heavy stresses and the chance of a snapped shaft, a free-wheeling device is incorporated ahead of the engine.

From its planned top speed, *Bluebird* was to be decelerated below 400 miles per hour by aerodynamic speed flaps that open into the wind from each side of the rear of the vehicle, then by multiple disk brakes on each wheel shaft. These are mounted inboard on the gear boxes to reduce the amount of unsprung weight. Their friction elements consist of asbestos, powdered metal and additives molded to shape. Under full load the brakes heat up to 2200 degrees, turning red and then yellow with heat. One of the service vehicles carries high-speed fans to cool them at the end of each run.

To bring *Bluebird* to the U.S., an expedition was made up virtually on a task force basis. Tons of spare parts were shipped from England. Eighty tires were packed in separate containers and a dozen extra wheels were turned out. A special trailer was built for moving the

(Continued to page 242)



Portable Hangar for Helicopters

Easily moved by truck, an Army hangar may be folded up and transported to advanced areas for housing helicopters. It opens up accordion-fashion, supported by steel ribs, and can be held partly opened to

allow ground crews to work on craft in daylight. When fully closed for complete protection, it is supported by a small blower. The hangar stands 36 feet high and weighs 7400 pounds.

High Chair Collapses Into Bed

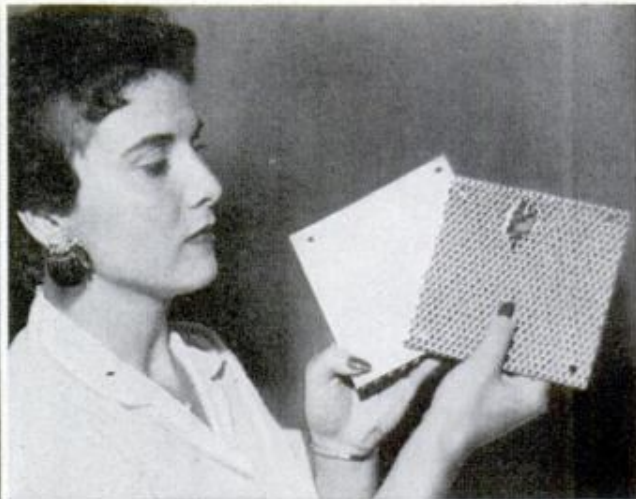
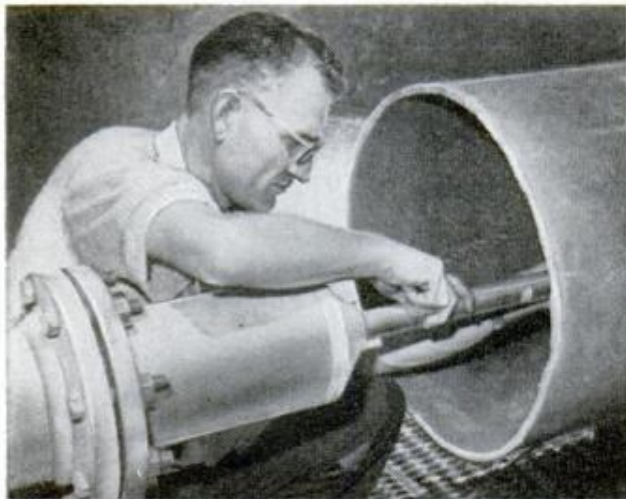
Since lunchtime for children is quickly followed by naptime, a French inventor devised a chair for feeding that quickly converts into a bed for sleeping. The chair's

table and footrest fold to form the foot of the bed; the backrest folds back to form the head. The canopy for the day-bed slips into a pocket behind the chair.



French chair that folds into a bed for children stores flat

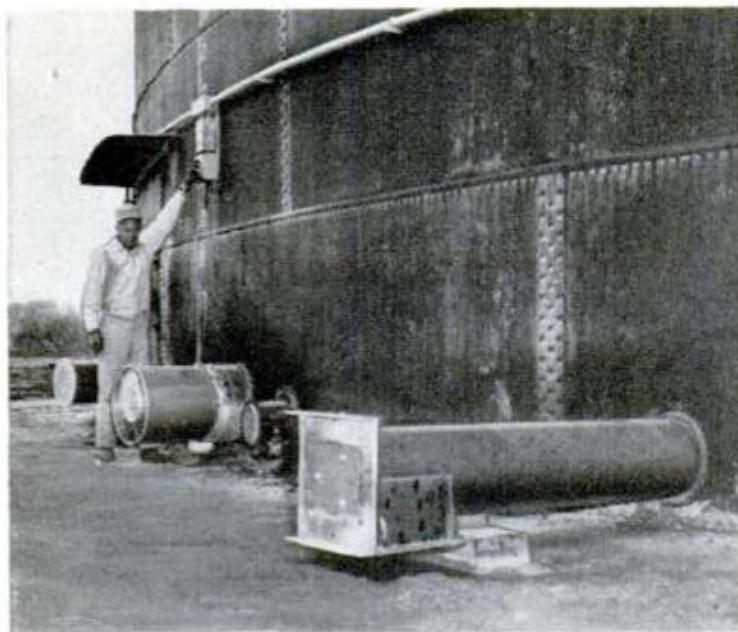




Fastest Gun in Texas for Artificial Meteorites

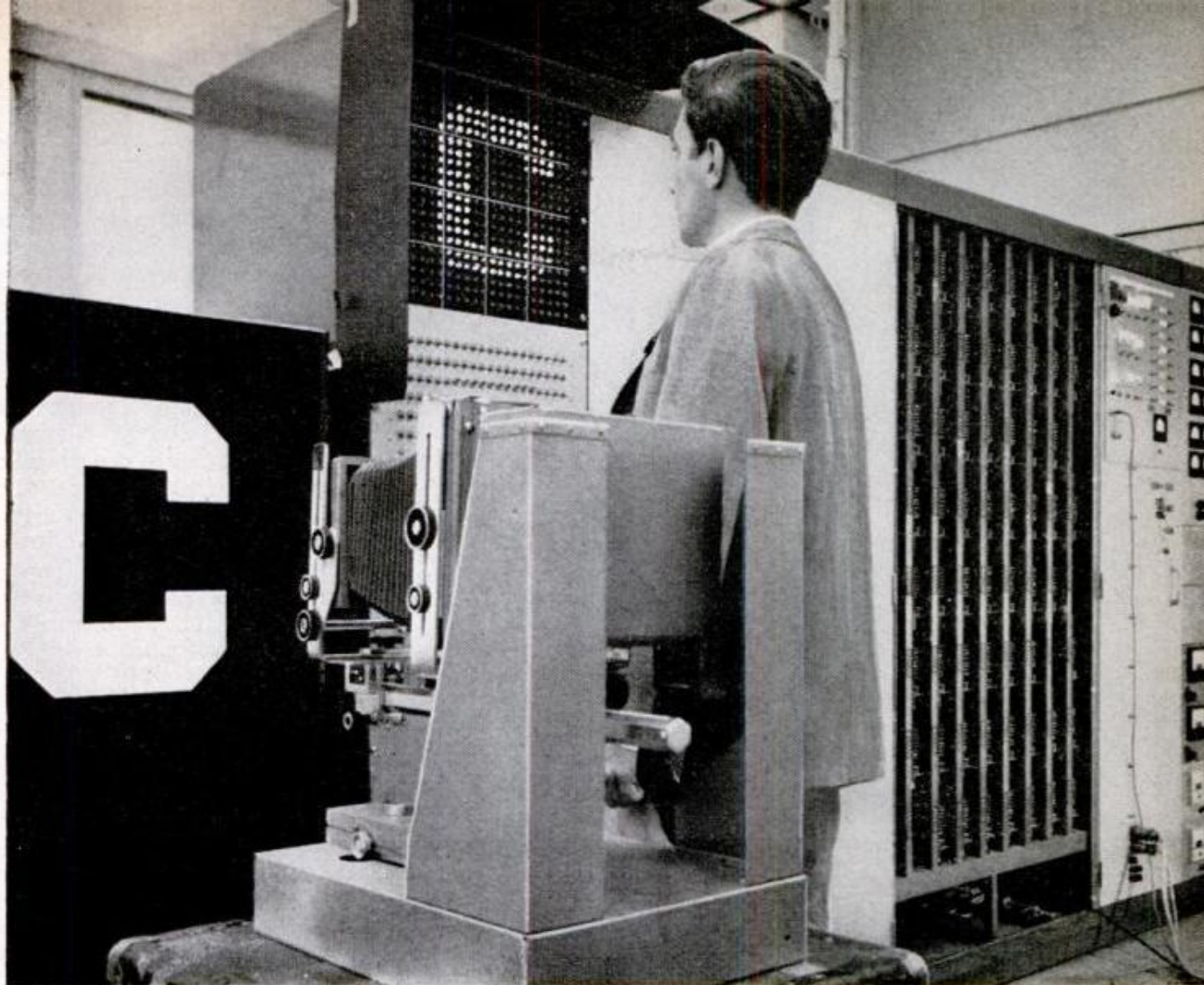
Colt's frontier handguns, firing their bullets at around 550 miles an hour, were peashooters compared to a "gun" developed by Chance Vought Aircraft engineers in Dallas. Designed to fire tiny artificial meteorites through a vacuum tank and into samples of structural materials for space craft, the gun uses a shaped charge of RDX

explosive to accelerate $\frac{1}{140}$ -ounce pellets of aluminum to velocities of 16,000 miles an hour. Above, left, H. T. Armstrong fits a 1.2 by 3.5-inch charge into the firing tube. Electronic timing grids measure the speed of the pellet. At right, a damaged aluminum "honeycomb" sample after being struck by a tiny "meteoroid" at near-orbital velocity.



Converted Fuel Tank Stores Texas Grain

Take a quarter-million bushels of grain in need of storage and an unused railroad oil-storage tank, add an ingenious storage engineer, and you get one of the biggest, and perhaps the strangest, grain bins in the business. The Johnson Grain Company, of Dallas, Tex., took over the oil tank at Silsbee, Tex., a 30-foot-high, 144-foot-diameter steel tank. They cleaned it up, added loading and unloading equipment, a ventilating system, and a temperature-control system. The converted tank holds 128 carloads of grain, usually milo-maize, and keeps it in excellent shape awaiting shipment. At left, top, a worker checks for "hot spots" on an electronic thermometer that gives 144 temperature readings from thermocouples spaced every five feet through the interior. Below, another worker checks a vent fan, one of eight five-horsepower electric fans that suck air in through roof vents, circulate it through the grain, and discharge it through four ducts at the base. The large pipe in the foreground of the top photo houses a power auger that can completely unload the tank in about three days.



Perceptron identifies C. This type of "reader" will eliminate slower human reader from first step of translating

The Magic Box That Reads Russian

It translates faster than you can read

By Volta Torrey

FIFTY YEARS AGO *Popular Mechanics* pictured a box on the side of a telephone to convert one language into another. More has been done to make such an automatic interpreter possible in the last 10 years than was done in the first 40. Still more will be done in the next 10 years.

Printed words now can be translated faster than a tobacco auctioneer can talk. Next year the U. S. Air Force expects to have an "automatic language translation complex" capable of turning a 300-page Russian book into English words and phrases in an hour.

A machine already is translating the Russian newspaper *Pravda* into English.

Russian-English dictionary looks like phonograph record. Words are in band of tiny streaks near rim





Congressmen consider its output readable, but Dr. Gilbert W. King, director of the International Business Machines Group which developed this machine calls what comes out of it "pidgin English." (It recently translated "Little Red Riding Hood" as "Red Cap.") IBM engineers now consider this machine obsolete, and are building a new transistorized model.

Good machines only do what they are told to do. To produce better translations now, machines must be told how to do more than look up the meaning of words and phrases. They must be instructed in analyzing sentences in one language and synthesizing new sentences in another, which calls for a more complete knowledge of languages.

This is being acquired. Dr. Anthony G. Oettinger of Harvard, for example, recently developed a new technique known as "predictive analysis" which is being used experimentally to unravel some of the complex syntax in Russian sentences.

English, too, has to be understood better, Machine that now converts *Pravda* into English is fed by typist. It translates faster than she can type

Russian newspaper *Pravda* is translated into English. Sample of results is shown here. Experts still consider translations unsatisfactory and are concentrating on improvements in sentence structure

Товарищи депутаты!

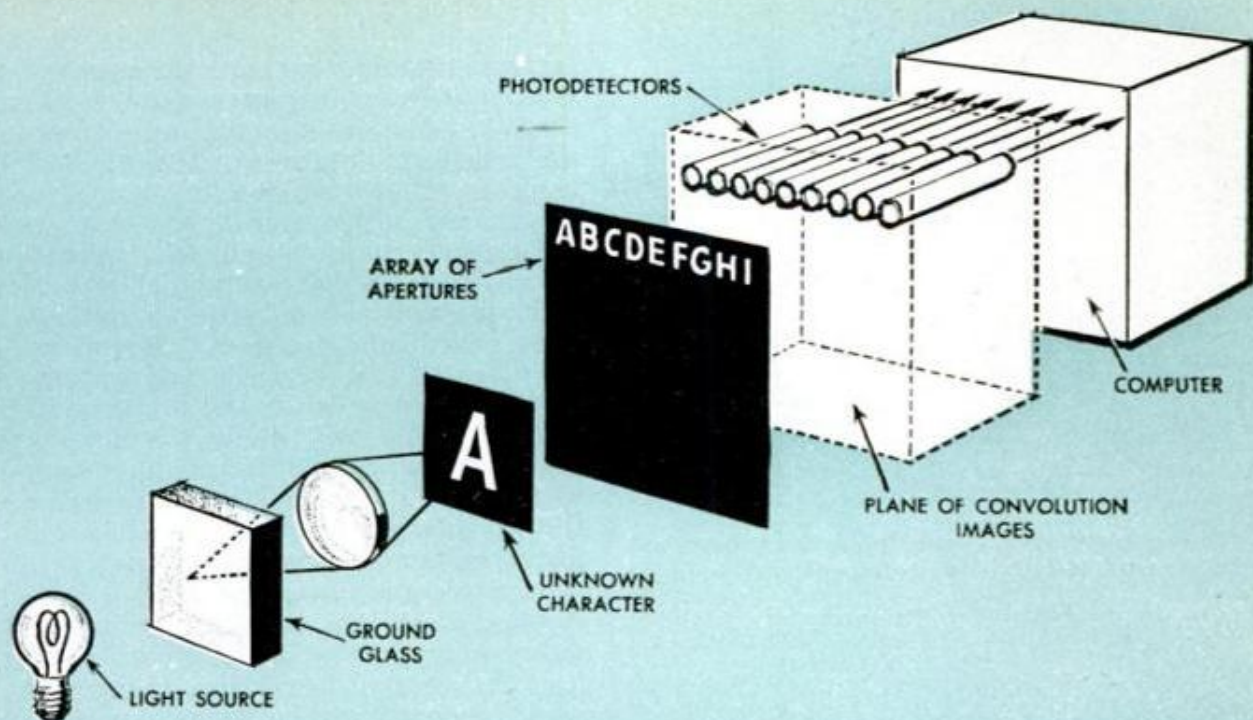
Все выступавшие на сессии выразили полное согласие с положениями, выдвинутыми в докладах, и единодушно поддержали предложения Советского правительства об отмене налогов с рабочих и служащих и других мероприятиях, направленных на повышение благосостояния советского народа, и о завершении в 1960 году перевода всех рабочих и служащих на сокращенный рабочий день. В своих выступлениях депутаты единодушно одобряли внутреннюю и внешнюю политику Советского правительства.

Comrade deputy !

All appearing on session expressed full consent with/from positions, advanced in reports, and unanimous supported offer Soviet government about cancellation taxes with/from worker and employee and other measures, directed on increase welfare Soviet people, and about completion in 1960 year translation all worker and employee on abbreviated worker day. In own appearances deputy unanimous approved inside and foreign policy Soviet government.

Comrade Deputies !

All those who spoke at the session expressed complete agreement with the positions advanced in the reports, and unanimously supported the proposals of the Soviet government for abolition of taxes collected from industrial, office and professional workers and for other measures directed at improving the welfare of the Soviet people, and for the completion in 1960 of the transition of all industrial, office and professional workers to a shorter working day. In their speeches the deputies unanimously approved the internal and foreign policy of the Soviet government.



Optical-electronic "reader," now being built, will compare characters to those in its memory, and photodetector will notify computer which letter it has encountered. It will recognize 1000 characters per second

and Dr. Victor H. Yngve of the Massachusetts Institute of Technology recently explained previously puzzling features of our language.

A code for electronic translation of languages was worked out in 1947 at Princeton, and Prof. L. E. Dostert and his associates at Georgetown University demonstrated in 1954 that a machine could turn Russian into English. In that "Kitty Hawk experiment," the machine had a vocabulary of 250 words. The one translating *Pravda* now can use hundreds of thousands of words (Shakespeare used only about 24,000), and Gen. Donald P. Graul of the Rome Air Development Center expects a machine to have a vocabulary of 1,500,000 words next year.

Dr. King's new whirling dictionary makes this possible. It is a 10-inch glass disk that looks like a phonograph record, but is spun at 1400 revolutions per minute rather than 33. Russian and English words are printed in hundreds of tiny tracks in a band less than half an inch wide near its rim. The words in this "photoscopic disk memory" are not printed the way they are in books for people, but are spelled out in a binary code similar to a telegrapher's code. Only two symbols are used in this code: (1) A white space followed by a dark dot, and (2) A dark dot followed by a white space. Each letter of each language's alphabet is represented by a different sequence of these precisely spaced dots. It

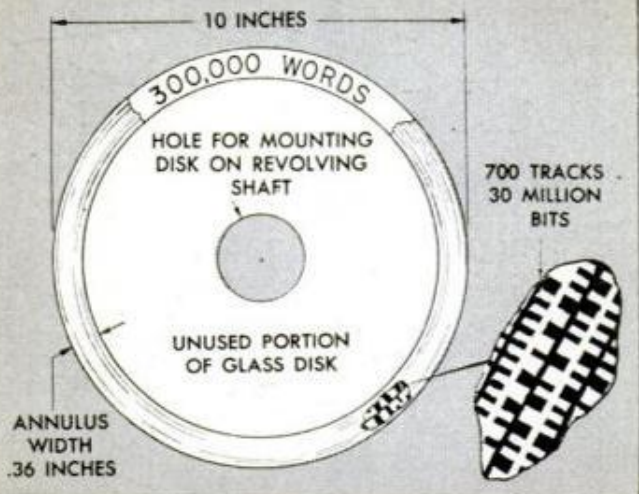
In 1910, *Popular Mechanics* suggested that an attachment on telephone would translate foreign languages

AN INTERPRETING TELEPHONE

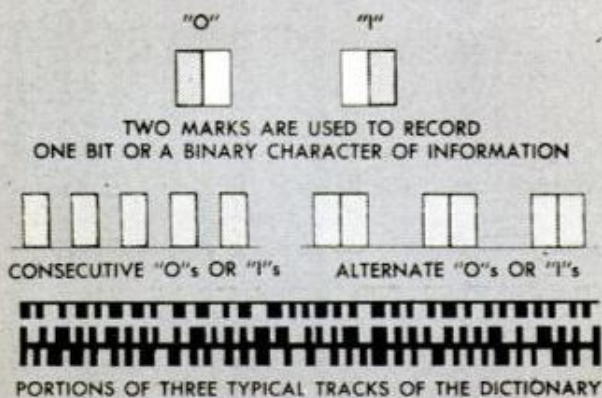
The reader must not be led to think by the above head that any such wonderful device has yet been invented, or that there is anything but a very distant likelihood of such a device in the future. Yet, every great invention has appeared impossible to the many and difficult to most before its arrival and very simple afterwards.



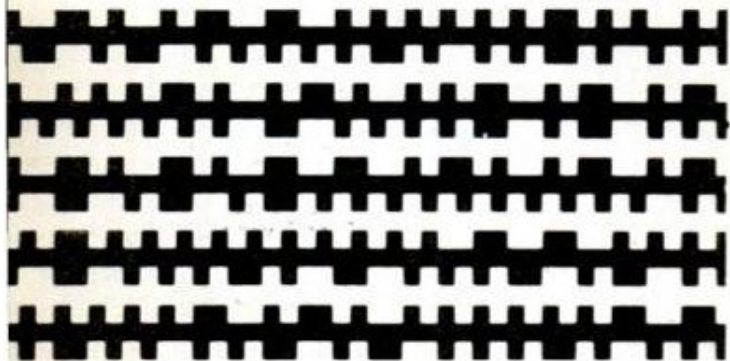
The interpreting telephone, however, is nothing more or less than the prophecy of a Michigan inventor, who believes the time will come when a person at one end of the line can speak one language and that any language can be heard at the other end. That is, any language the telephone is provided with. The drawing shows the Michigan man's idea of how it is to be accomplished. Attached to the side of an ordinary telephone receiver is a box in which the different languages are stored. If the man answering the phone is Chinese, he will move the indicator opposite the Chinese language, and then some mysterious mechanism yet to be designed will receive the English words coming over the wire and convert them into Chinese.



Although packed with words, whirling dictionary can be revised and a new edition brought out overnight



Binary code's two symbols, zeros and ones, combine to form letters. Below: Disk track enlarged 300 times



Memory of new reader (page 111) will be type fonts



takes a lot of dots to represent even a short word this way, but each symbol is only 0.00033 inches wide, and there is room on the disk for so many words that the IBM engineers consider this dictionary's capacity virtually unlimited.

To print so finely, the disk's makers had to devise new photographic processing techniques, in which only a little fluid is used, and this fluid is finely filtered.

To read such fine printing, a beam of light darts from one track full of symbols to another, the way you flip the pages when you use an ordinary dictionary, until it finds the right one. The machine then reads the words there with the light beam. English words and phrases are alongside Russian words and phrases.

After English words or combinations of words that can be substituted for those used in Russian have been found in this way, they are typed out by an electric typewriter attached to the machine.

The machine's speed is staggering. It can look up a Russian word's meaning in $\frac{1}{300}$ of a second, and turn out an English version of an 1800-word Russian article in 60 seconds.

Getting the literature into the machine, in fact, now takes longer than translating the words and phrases. Typists feed the IBM translator by punched tapes. A girl can punch out only about 40 words a minute. So this will soon be automatized.

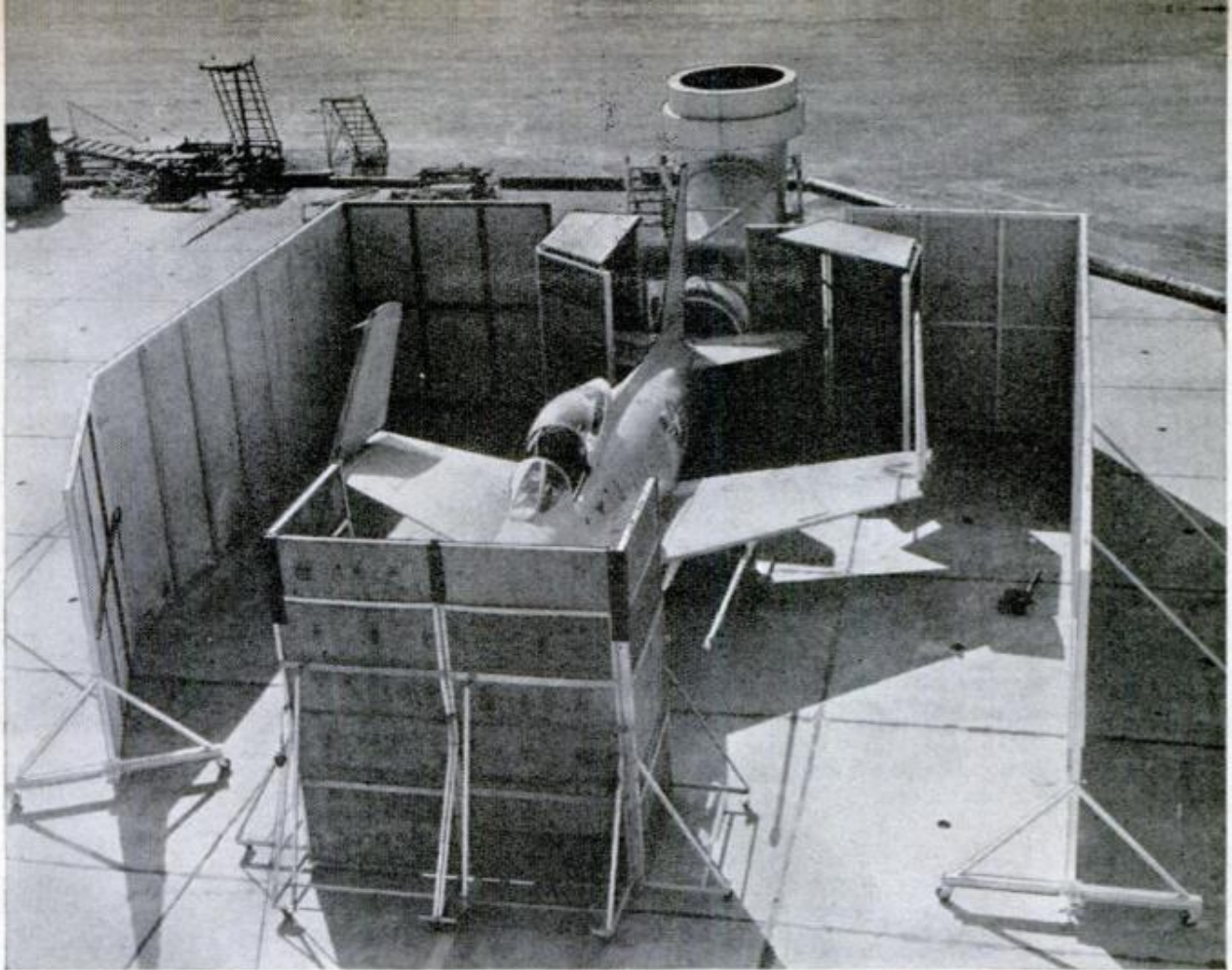
Years of study have gone into efforts to design reading machines. In some systems, the characters are scanned for unique features. Such systems are difficult to adapt to a wide variety of type faces. This difficulty is believed to have been overcome now.

For the translating complex planned by the Air Force, Baird-Atomic, Inc., of Cambridge, Mass., is working on a reading machine that will be able to "remember" how letters, numerals, and punctuation look in different fonts of type. Its memory will consist of an array of English, Cyrillic and Greek letters from various fonts, stored in photographic masks or optical apertures. The machine will compare each letter it finds in the text that it is asked to read with those in its memory.

The makers of this optical-electronic device expect it to feed punched tapes to the translator 60 times as fast as girls could prepare them. But it will not work directly from printed pages the way the girls do. It will require filmed copies of the Russian publications to be translated. The machine has been designed to recognize 1000 Russian characters per second on these films.

Experts still differ about the wisdom of

(Continued to page 254)



Mammoth Elbow Suppresses Jet Noise

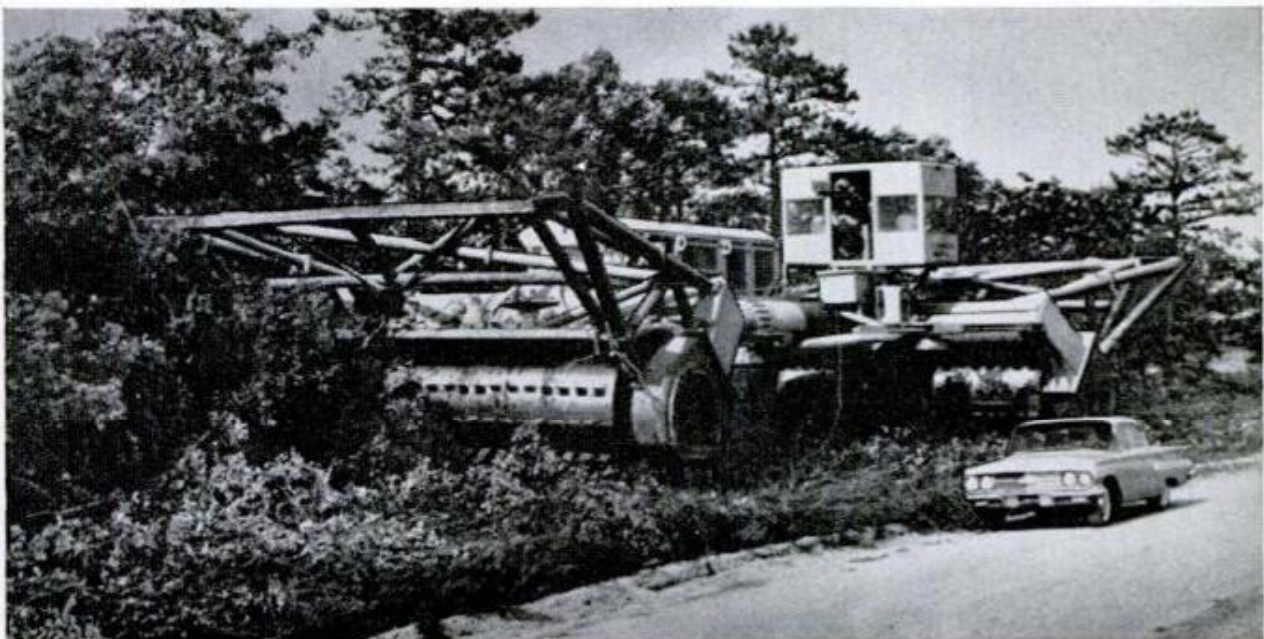
Plumbers could be credited with an assist in developing a noise suppressor for jet engines. The Naval Air Station at Alameda, Calif., is experimenting with a portable

metal screen around a huge elbow. When a jet is to be ground-tested, the screen is moved around the plane and most of the exhaust is absorbed by the elbow.

Huge Machine Rolls Right Over Trees

Crashing through stands of timber on cleated steel drums, a new 130-ton tree-crushing machine chews up wooded areas at a rate even the mythical woodcutter Paul Bunyan would admire. Whereas his famed

Blue Ox merely flayed about, knocking trees down, the machine fells the trees, then compacts the debris into a mat to prevent erosion. The machine levels three acres of woods an hour.

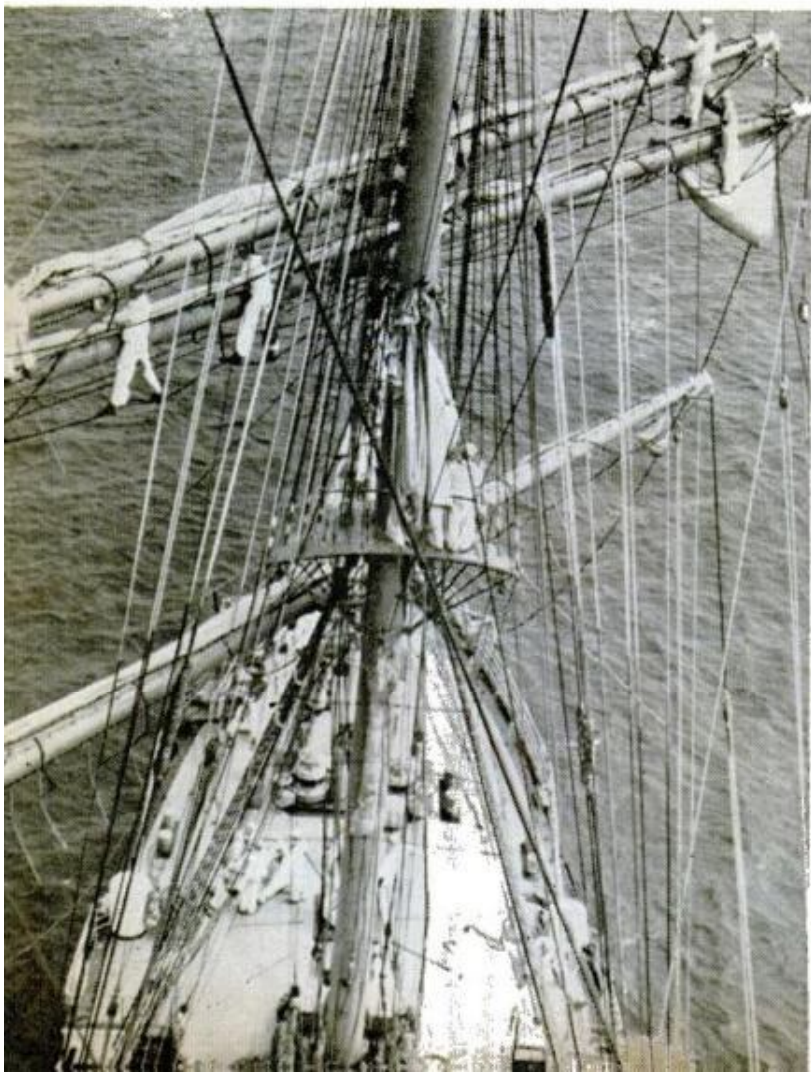




Sail Ho! The training ship *Kaiwo Maru*, proceeding gracefully at left, is one of two run by Japan to prepare men for its merchant marine. At right, its sails whipping in the breeze, is Norway's *Christian Rodich*

Windjammers Still Sail

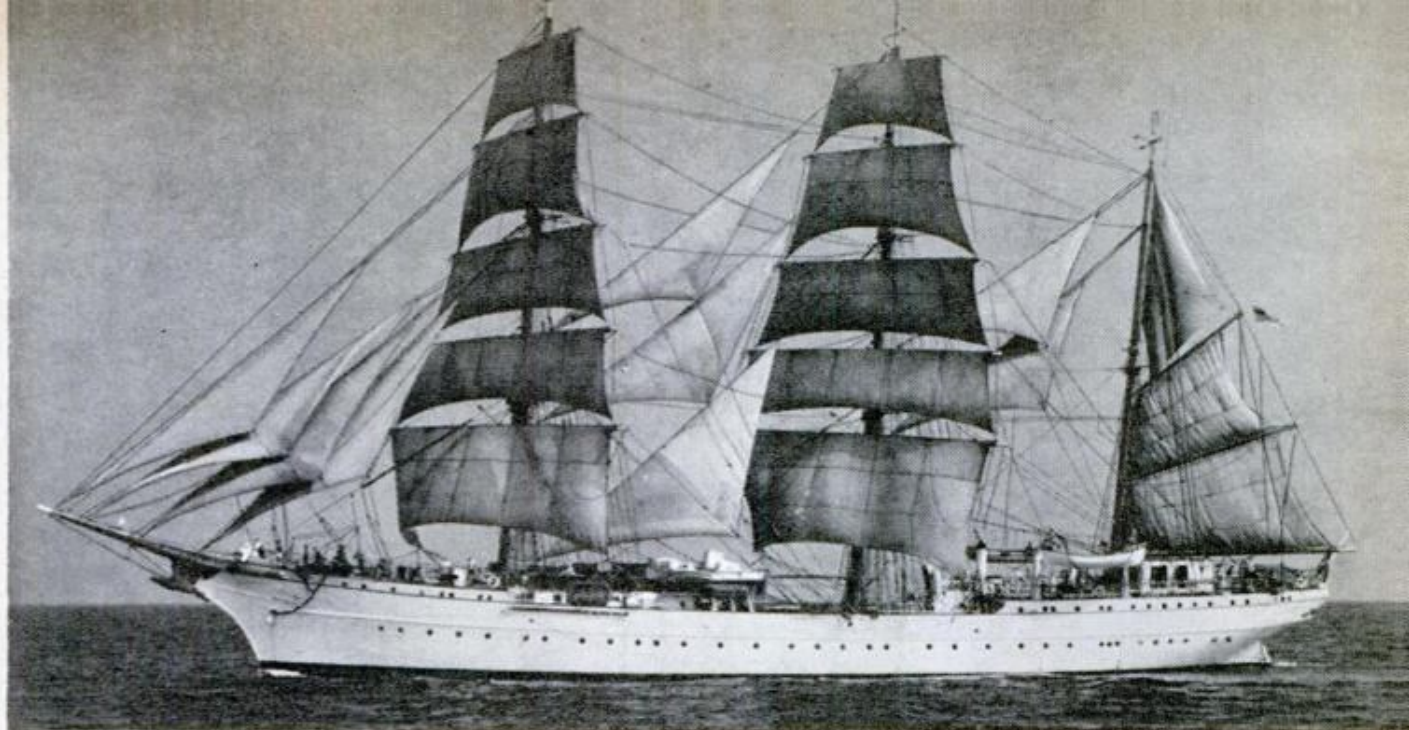
Aloft, men of the U.S. Coast Guard try their hands at furling the sails on the training ship *Eagle*. Such schooling imparts to them self-confidence, teaches basic seamanship



SOMEWHERE on the great oceans a white sweep of sail dips and rises with the rolling swell, and the chant of men hauling on canvas carries in the air. Sailors, as they have for centuries, continue to go down to the sea in sailing ships—a fact that may seem surprising in an age of diesel and atomic power.

But as a result of some 17 nations employing windjammers to school their naval and merchant marine cadets, the number of sailing men and sailing ships has, if anything, tended to increase since World War II. Other countries, agreeing that nothing imparts the feel of the sea so much as sailing under canvas, are embarking on similar programs. Chile, for example, uses a schooner launched in 1952, and West Germany recently took delivery of a 1600-ton bark to replace its training ship *Pamir*, which was lost in a hurricane. Other countries with schools under sail include: Indonesia, Japan, Russia, Italy, Portugal, Sweden, Rumania, Yugoslavia, Denmark, Spain, Finland, Brazil, Belgium, Norway and the United States. Every few years some training vessels are entered in a sailing race from England to Portugal.

On these pages: ships that run before the wind.

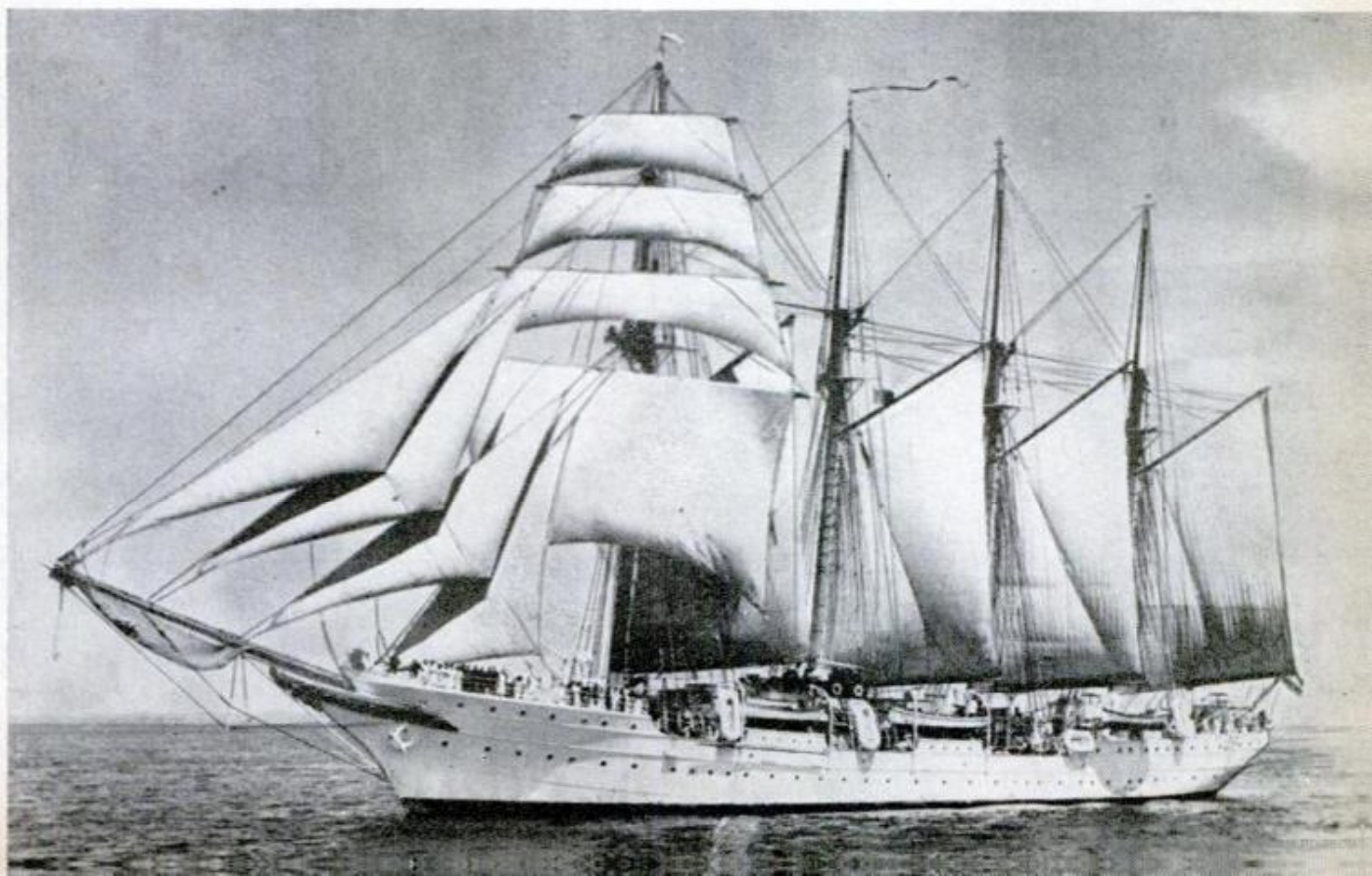


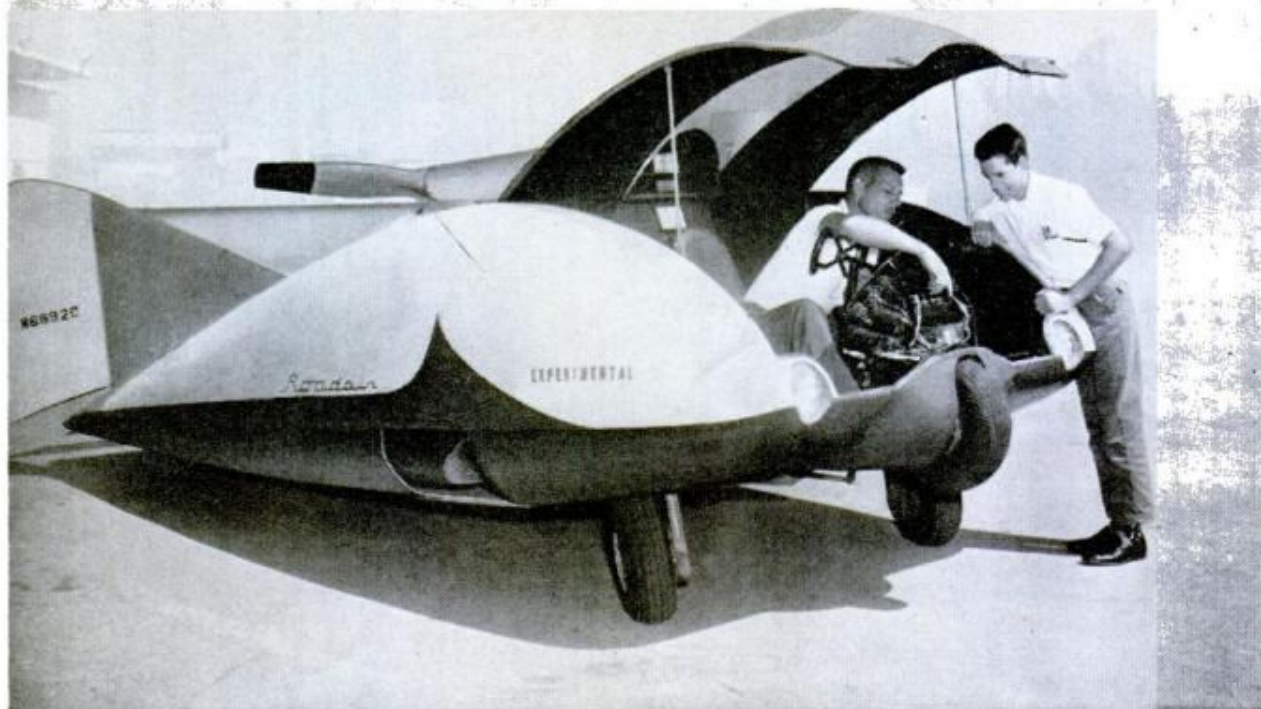
Under two flags. The *Eagle*, formerly a German naval training craft, was acquired by the United States as a war payment

Brazil trains its future naval officers on board the *Almirante Saldanha*, four-masted vessel with plenty of sails to furl

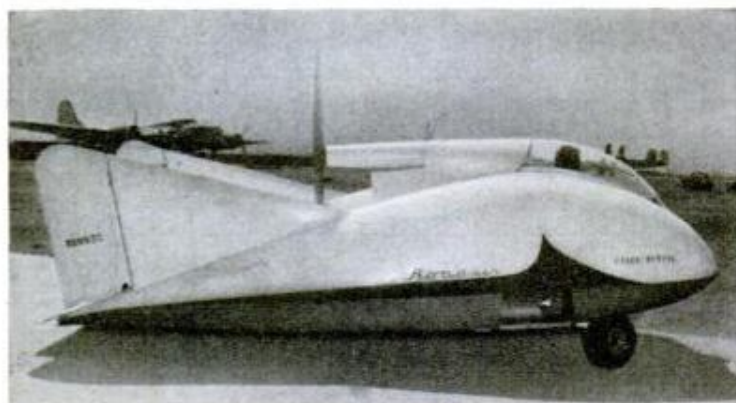


Spanish naval cadets learn the ropes of seamanship sailing the *Juan Sebastian De Elcano*, a striking topsail schooner





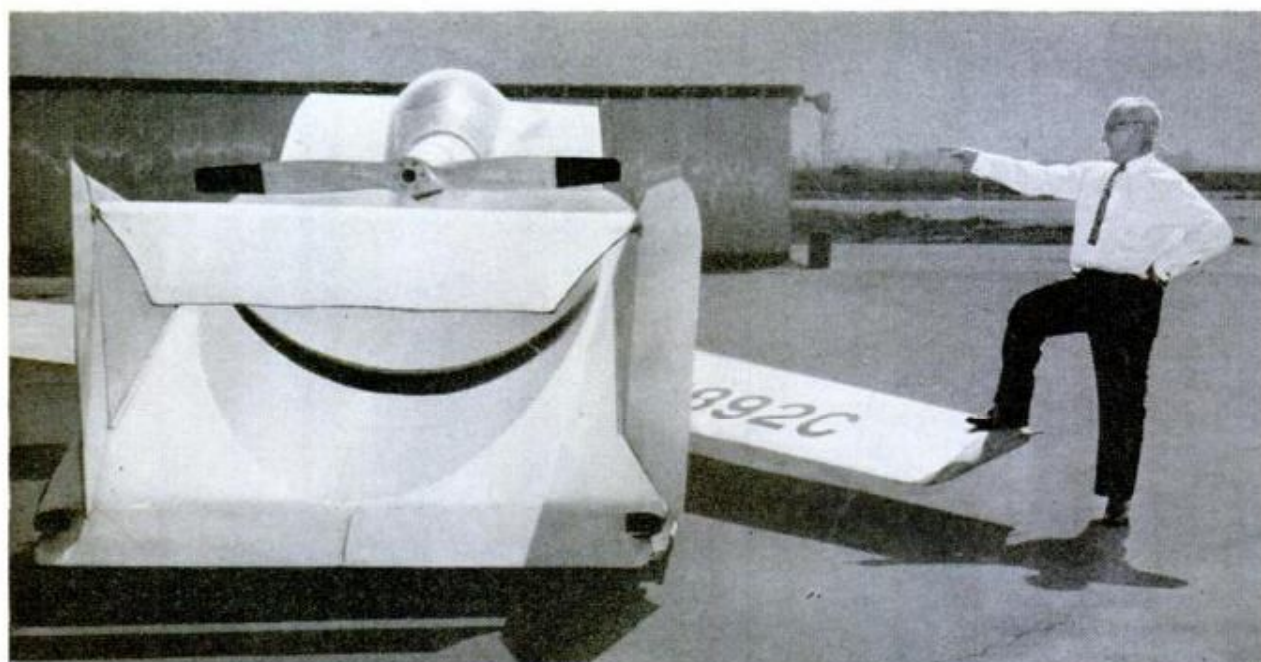
Roadair operates as auto or plane from same controls. Same action moves rudders and wheels. Wings fold up inside body



Estimated cruising speeds are 90 miles per hour in air and up to 75 on ground. FAA experimental license has been issued

Flying Automobile

Another flying car has completed its initial flight tests successfully. Called the Roadair, the car has a body 15 feet long and 7 feet 10 inches wide. As an auto, it rides on a tricycle gear, the single rear wheel driven by a small gasoline motor. As an airplane, the wings fold out from the body to a 25-foot wingspread. A 75-horsepower airplane engine drives the single pusher propeller. Twin rudders and elevator are located in the rear. Expected retail price: Approximately \$10,000.



Captain Edward V. Rickenbacker has won equal distinction in the automotive and aviation fields. Prior to World War I, he engaged in experimental work on automobiles, and in racing. During the War, he became a celebrated combat aviator and shot down 22 enemy planes. Afterward he manufactured automobiles, ran the Indianapolis Speedway and entered the field of commercial aviation. He is now Chairman of the Board of Eastern Air Lines, Inc.



My Most Exciting Moment

By Captain Edward V. Rickenbacker

DURING WORLD WAR II, while enroute across the Pacific on a special mission undertaken for the Secretary of War, our plane ran out of gas and crash-landed in the Pacific Ocean.

For more than three weeks, my companions and myself, without food or water, unprotected from the blazing sun and burning salt water, had tossed about on the surface of the ocean. One of our little company of eight had already died. After 24 days together, our three rafts had separated.

It was late afternoon of the 23rd day, when we sighted two planes. We were wild with rapture at the prospect of being rescued at last! I waved as hard as I could with my old hat. But the planes, flying only a few yards off the water, passed within a couple of miles and then disappeared into the setting sun.

Then we heard that wonderful sound of throbbing motors again, this time much closer. The two planes were coming back! One of the planes went off while the other dived right over the raft. We yelled like maniacs. The plane was so low that I could see the pilot's expression. He was smiling and waving.

The plane straightened out and made a cautious landing on the darkened sea. After taxiing within a few yards, the pilot shut off the engine. I paddled up and caught hold of the pontoon. The radioman climbed down to help me. The pilot joined him, and I remember thinking how clean and handsome they were, how proud I was to have them as countrymen!

The pilot, the late Lt. W. F. Eadie, of Evanston, Ill., and the radioman, L. H. Boutte, of Abbeville, La., helped to lift Hans Adamson, whose back was injured, into the high cockpit. The plane had room for only one passenger so I took it for granted that John Bartek and I would be left behind. But our Navy pilot said calmly, "Why, Captain Eddie, you fellows are going too." I looked at the cockpit. "Where?" He smiled and said, "On the wing".

On the way, they gave us the good news that our other companions had been located the previous afternoon. When we finally reached the Navy PT boat, I remember thinking that planting my feet upon the deck of an American boat was the next-best thing to being home.

All that we could say was "This is heaven," and "Thank God," and "God Bless the Navy."

A large, stylized handwritten signature in black ink that reads "Edward V. Rickenbacker". The signature is written in a cursive style with a long, sweeping tail.



WHAT'S NEW FOR

Sun Enterprises, Inc., 3121 Washington Ave. North, Minneapolis 11, Minn.

KNIFE SHARPENER powered by water from the kitchen sink hones up blades with an aluminum-oxide abrasive wheel. The sharpener attaches to the tap and the force of the water turns a nylon turbine which also spins the sharpening wheel. Both are attached to a single stainless-steel shaft and are housed in a plastic case

SPRAY-SCRUBBER, taking power from water coursing through the garden hose, makes it possible to scrub, clean and rinse in one operation. Made of lightweight aluminum tubing, the shaft has a fingertip water-flow control. The 16-inch-long brush has polystyrene bristles set in hardwood and conceals the jet-spray head. For use on smooth or rough surfaces

Titan Sales Corp., Buffalo, N.Y.



GRAPEFRUIT KNIFE has three blades: one is curved, blunt-pointed and serrated so it can be inserted at the edge and worked all the way around the half of the fruit to loosen the peeling; the two other blades, set closely together, are placed to straddle the membrane between segments and thus help to separate the grapefruit from the inedible membrane

Cherry Development Co., P.O. Box 313, Downers Grove, Ill.





Monroe, Hattenbach, 347 Fifth Ave.,
New York City 16

ELECTRIC SHAVER is powered by a battery that stores enough electricity to give 15 shaves on a 20-hour charge, when plugged into a 110-120-volt outlet. The switch, a transparent ring surrounding the shaving head, also lights up the shaving area



Sears Roebuck and Co., 925 S. Homan Ave., Chicago 7, Ill.

TRIPLE-DECK bunk bed made of maple-finished hardwood in Colonial style stands 79½ inches high, features a sliding, straight-hanging ladder and a removable guard-rail. Designed for a growing family, it may be broken down into three twin-size beds when more room becomes available

BOTTLE THERMOMETER slips on and off baby bottles and is held in place for a reading by an elastic cord. It records the temperature when heat is transmitted through a pliable copper band, which conforms to contour of the bottle, and into a sensitive bimetal element

Zinn Originals, 321-A Greenwich St.,
New York 13, N.Y.



OUTDOOR TORCHES for lighting up a patio, lawn or beach party come in sealed, tamperproof cans. The torchhead, in the can, burns from four to six hours, all the while repelling insects. A kit contains six torchheads, six wicks, two five-foot stands and head-holders

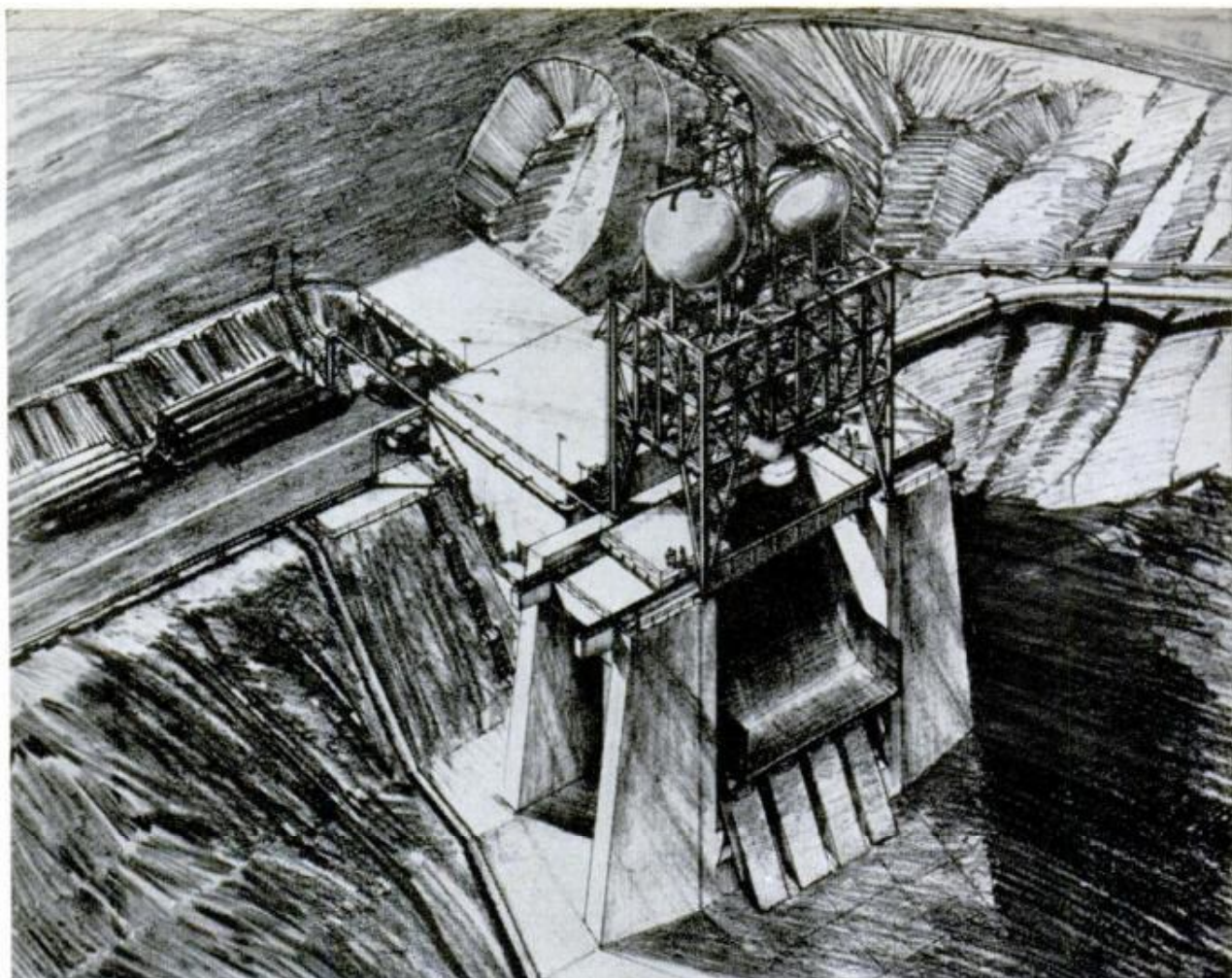
Harrison Oil Specialties, Inc.,
Milwaukee, Wis.



PLASTIC BAGS now come in rolls; to use, a bag is unrolled to a heat-sealed separation and the bag is torn along a perforation below this seal. The perforated end becomes the mouth of the bag removed. Handled much like wax paper, a roll holds 25 plastic bags

Jordan Associates, 230 Park Avenue,
New York 17, N.Y.





Test Stand for the Powerful F-1 Space Engine Rises in Desert

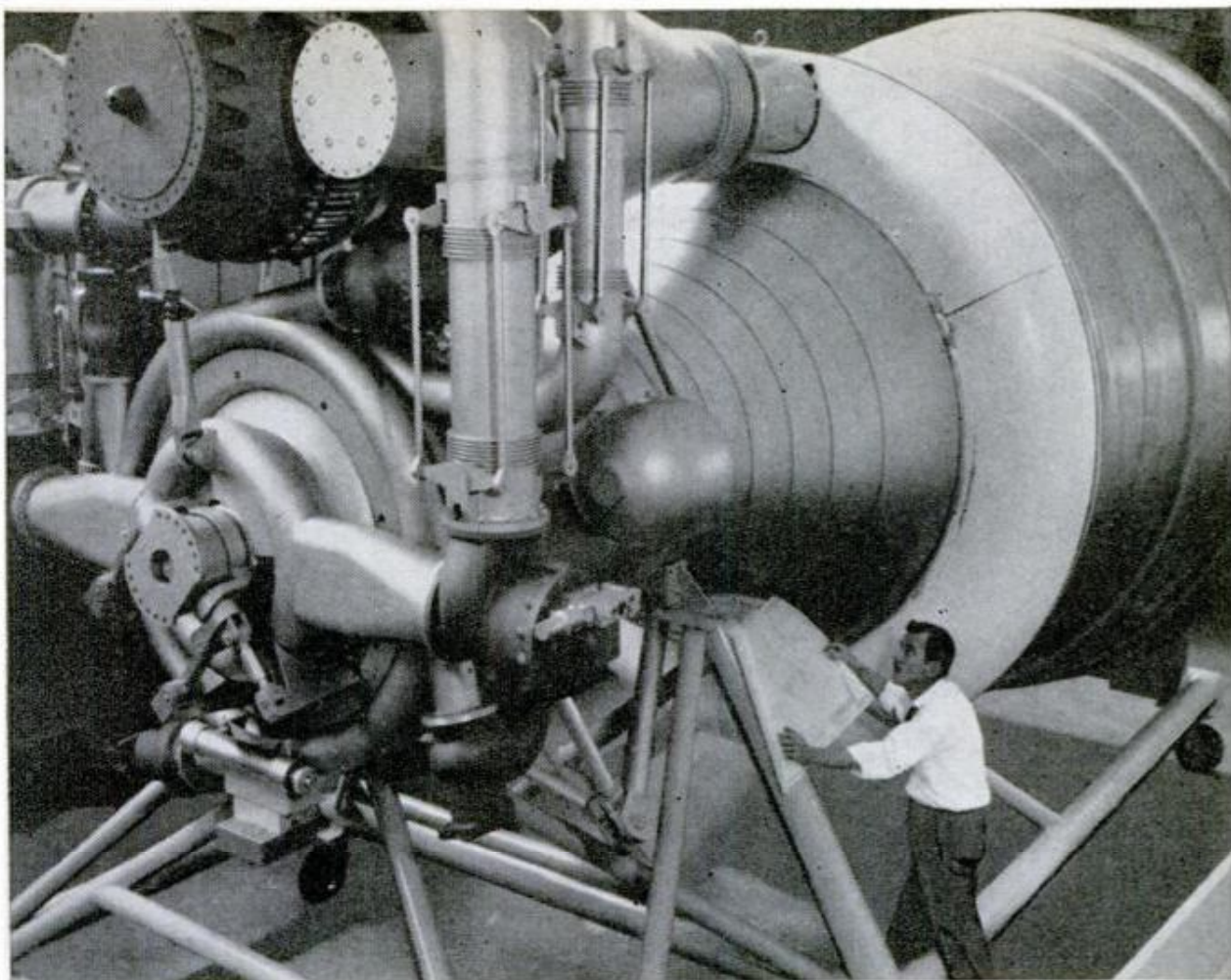
Rising from the desert at Edwards Air Force Base, Calif., are three huge test stands designed to keep the F-1 space engine tethered while under development. The single-chamber engine is being built

for the National Aeronautics and Space Administration for use, in clusters, to put into orbit a 150,000 pound space laboratory. It develops 1.5-million pounds of thrust, or three times as much thrust as any space

Mapping Lightning Flashes Helps Predict Weather



Lightning spotter stations, positioned in Kansas, Oklahoma, Arkansas, Illinois, Iowa, and South Dakota, are being tested by the Army Signal Corps as an aid to weather prediction and tornado spotting. The detector stations are equipped with special radio receivers which pick up static generated by lightning flashes and relay the information to a central station in Kansas City. The operator can detect heavy lightning in a limited area, which can mean thunderstorms, and can track the storm's position with accuracy.



F-1 rocket will look much like this full-scale mockup when it is ready for flight in about four years

engine available today. As a result, the largest test stand, 1-B, is being set into 12,000 yards of concrete. Rising to a height of 230 feet from this base will be a reinforced girder framework to hold the engine

in place while engineers check its performance. To control the exhaust blast, the flames will be directed downward, then outward as they hit a 260-ton water-cooled flame deflector.

Turbocharged Diesel Engine for Pleasure Boats



Safety and economy features of diesel power can be built into inboard pleasure boats with a new series of marine diesels by Caterpillar Tractor Co. of Peoria, Ill. The series features their turbocharging feature, which uses waste power in exhaust gases to boost air intake to each cylinder, raising efficiency and producing a clean exhaust. Available in 130, 180, and 270 horsepower models, the engines burn No. 2 furnace oil in an efficient four-cycle system that can idle indefinitely without carboning or exhaust smoke.



Bread dough leavened with a chemical agent rather than yeast needs no lengthy rising time. One new type of dry mix, when stirred with water and popped into the oven, can produce fresh, crisp loaves in 40 minutes

By Thomas E. Stimson, Jr.

NEARLY HALF of your grocery bill is going for foods that weren't on the market 10 years ago.

Food retailers say that there are about 6000 items on the shelves these days as against the 1500 foods that were available in the late 1940s.

At the corner grocery today you can pick up such new foods as a complete steak or Chinese or Mexican dinner, with all the trimmings, perfectly cooked and then quick-frozen for preservation. You can buy instant tea, dehydrated onions, instant rice and pretrimmed and packaged fresh vegetables. With convenience foods like these a housewife can prepare an elaborate dinner in an hour. Not much more than 10 years ago the same meal took three or four hours to prepare.

A revolution has been going on in the

food industry and yet food scientists are saying that we haven't seen anything yet, that the big revolution in foods is still ahead of us.

They are talking about dehydrofrozen foods and "dry liquids." In the laboratory they are testing new aerosol foods that you spray from a can. Soon they may have canned peas that look and taste like fresh peas.

They have a new table cream that contains vegetable oil in place of butterfat and so can be used by people with heart trouble. They are exploding lima beans and other seeds with high-pressure carbon-dioxide gas to create a whole new family of puffed and popped snacks. They have new ways of tenderizing meats.

Of course, there are very few brand-new foods. Most of the developments that are being studied are concerned with better



Beans cascading from the bottle above have been treated to require no soaking; they can be baked and served in 45 minutes. Below: \$7.50 worth of dehydrated and frozen foods—from soups to chicken dinners

Well, how about cream of olive soup, exploded lima beans and cream that never saw a dairy?

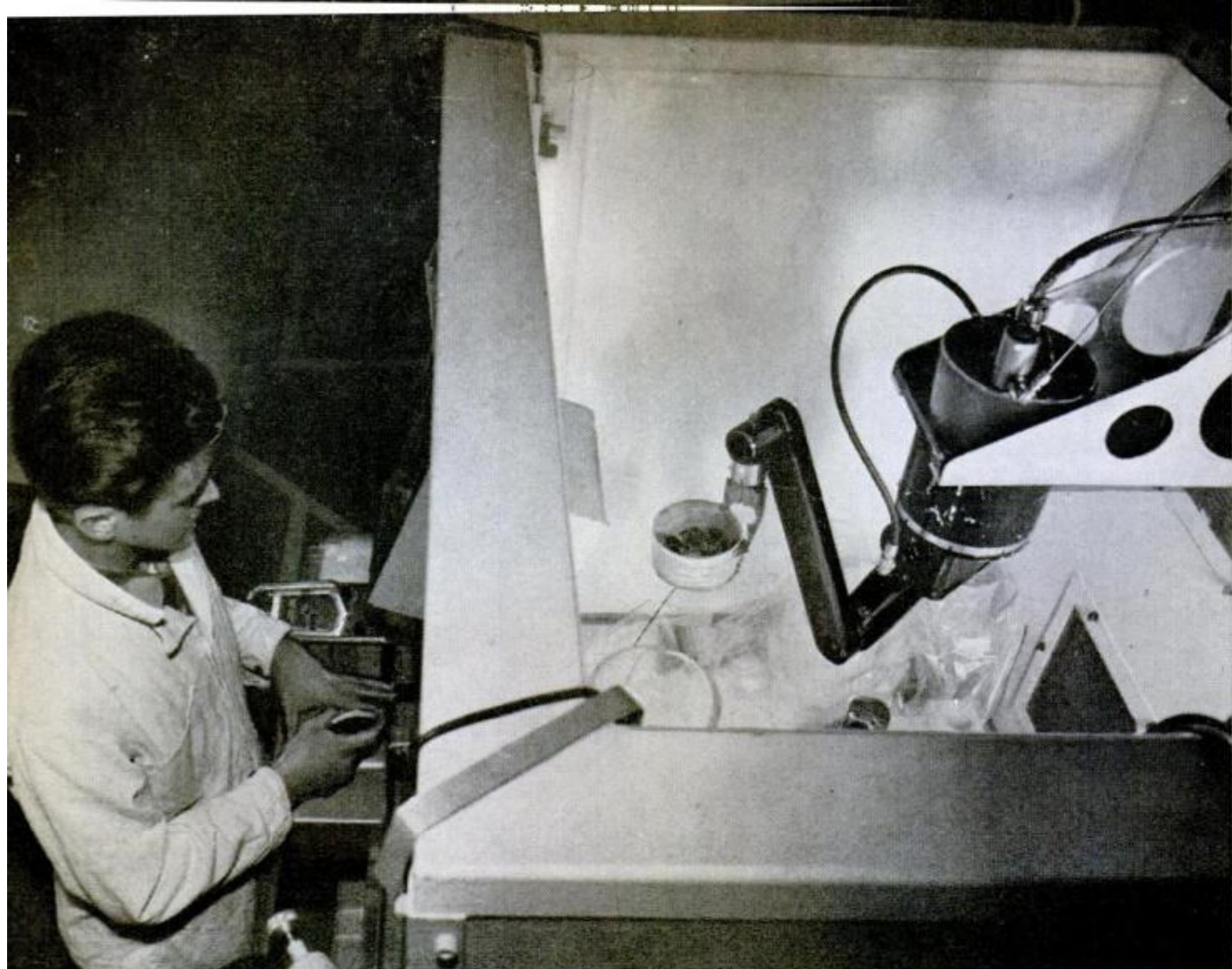
ways of preserving foods, or adding or restoring flavors, or compounding tailor-made foods for people with special food requirements.

For foods that are really new (to most of us), how about a can of fried baby bees? Or a can of candied ants, or fried grasshoppers? You'll find these "delicacies" on the gourmet shelves of some supermarkets. For \$3.50 you can buy a large can of boiled muskrat, if you feel you must, and on the same shelves are cans of roast caterpillar and rattlesnake steaks.

Less exotic, and more palatable to most of us, are some quick-cooking beans that have been developed at Stanford Research Institute in California. Ordinary dry beans need six hours of soaking and three hours of cooking; the new beans bake to perfection in 45 minutes with no soaking at all.

Dr. John P. Nielsen, senior food scientist at SRI, originated the fast-cooking beans after studying the bean's chemistry. He devised a soaking solution that supplements a deficiency in the bean itself. After being





Irradiation of foods is tried at Stanford Research Institute in effort to find better preserving methods

soaked, the beans are dried again and are packaged for the consumer. The process has passed from the laboratory to the pilot plant stage and the beans should be on the market in about a year.

The treated beans are said to have a slightly better flavor and to be somewhat more digestible. Nutrition studies are continuing in the hope that beans can be made to yield an even greater percentage of their food value.

Dr. Nielsen also has been doing studies in which unsaturated vegetable oils are substituted for butterfat in table cream. The vegetable oils help maintain a low blood cholesterol, hence the cream should be popular with people who have circulatory or heart disturbances. The difference in taste is hard to detect and the new cream fools almost everyone when used in tea or coffee or on cereals and fruit. It, too, will be on the market soon.

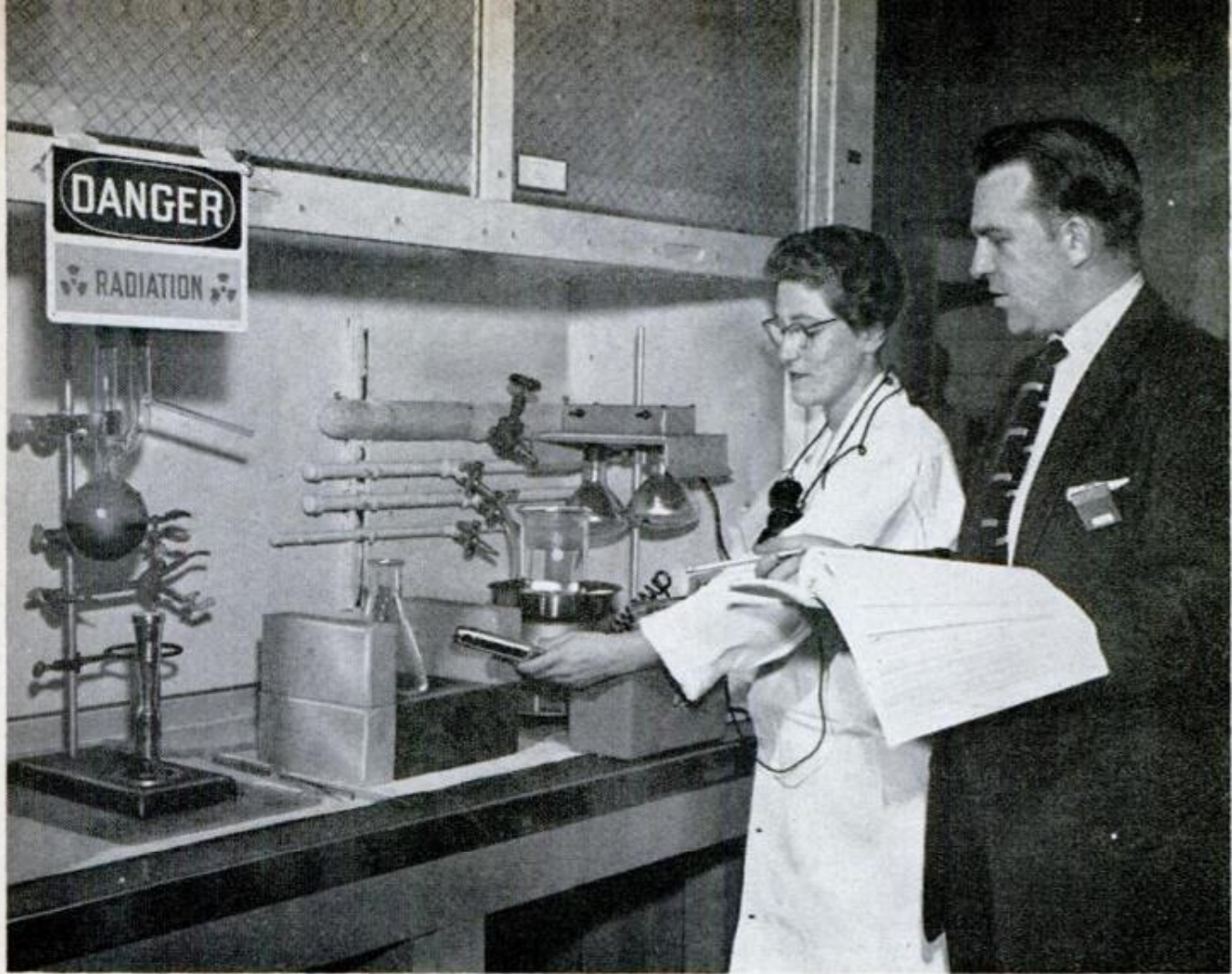
One of the exciting things that is on this side of the food horizon is "micro-encapsulation." This is a technique by which a liquid is changed into a dry dust and yet is instantly available as a liquid. Each tiny liquid globule is coated with a thin dry film of gelatin or some other soluble and digestible substance.

The coating idea was developed by National Cash Register Company to encapsulate a dye that would become a substitute for carbon paper; scientists now see a big future in it in the field of dehydrated foods.

They are thinking about encapsulating butterfat and adding it to powdered dry nonfat milk. The dry mixture would change instantly into cream or whole milk when water is added. The butterfat would never turn rancid in storage because the coating around each globule effectively prevents oxidation. Later in this article you'll read about another new way of preserving fresh milk; in the long run the method that provides the highest quality at the lowest price will be most widely adopted.

Most natural foods contain up to 90 percent of water. The same food when dehydrated takes up only a fraction of its original space and can be stored for long periods of time. It is restored to its original size and shape by adding water which is allowed to soak in. Powdered eggs, instant coffee, instant mashed potatoes and various soup mixes are among the dehydrated products that enjoy a wide sale.

But relatively few of the dried foods have all the flavor and palatability of the fresh products. Today it seems possible to ex-



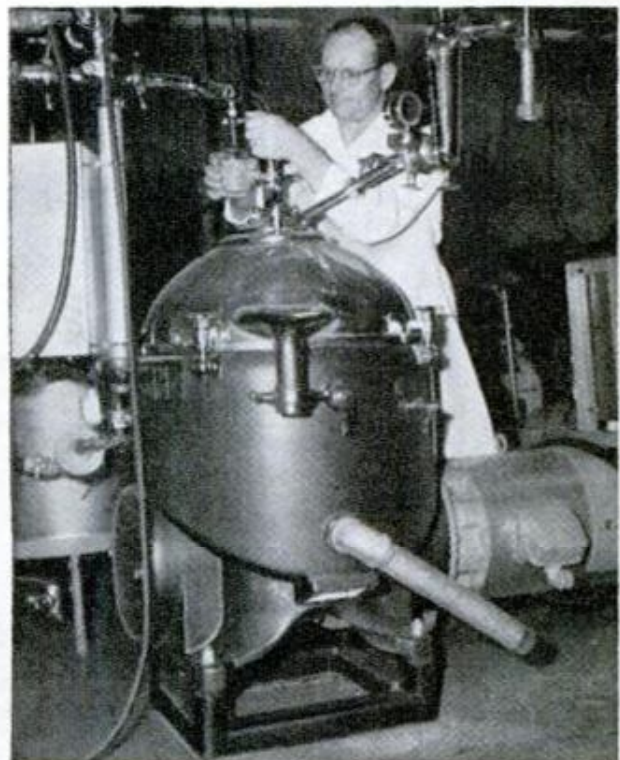
Radioactive isotopes are added to pesticides and detergents used to protect and wash vegetables so a technician equipped with a counter can tell how effective are the new cleaning processes. One uses sound waves

Controls for dryer in Department of Agriculture lab are intricate, but the experimental machine provides valuable information for researchers. It presses dried foods into a dense, thick sheet for packaging



DECEMBER 1960

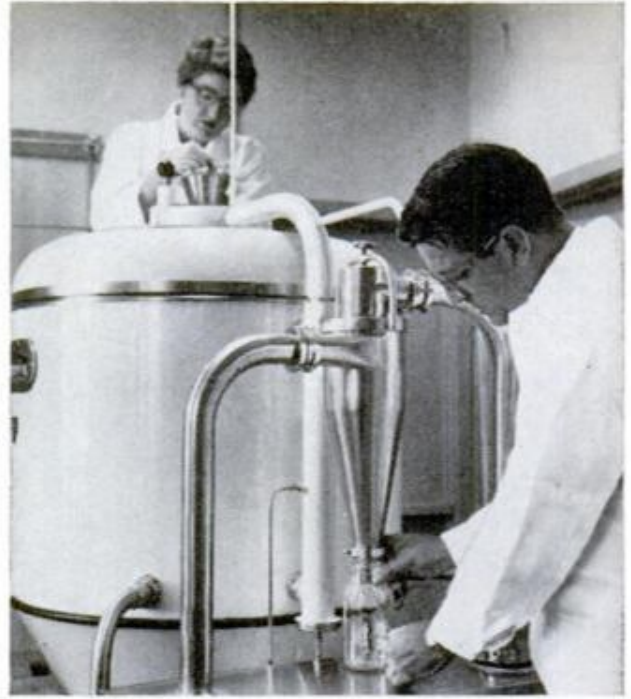
Centrifugal separator used at the University of California extracts juice from the pulp of such foods as tomatoes. It is used in experiments seeking to find ways to better preserve various pastes, sauces



125



Taste tester, isolated in booth at Stanford, blindly reaches for food on which he will pass judgment



Spray dryer at the Institute converts liquid to dry powder, is used in studies of new food preparations

tract the natural oils from a vegetable, encapsulate them, and add them to the dehydrated product. It may be practical to preserve the food's vitamins the same way. Too, the enzymes that bring out the characteristic flavors are often lost in dehydration. Micro-encapsulation of enzymes may be the best way of regenerating the fresh flavor when water is added to a dehydrated food.

It may be possible, for instance, to encapsulate the aroma-and-flavor-producing ingredients of fresh coffee and add these to the dehydrated "instant" product. For many people this would be a tremendous thing all by itself!

Food scientists have begun to learn a great deal about how to take odors and

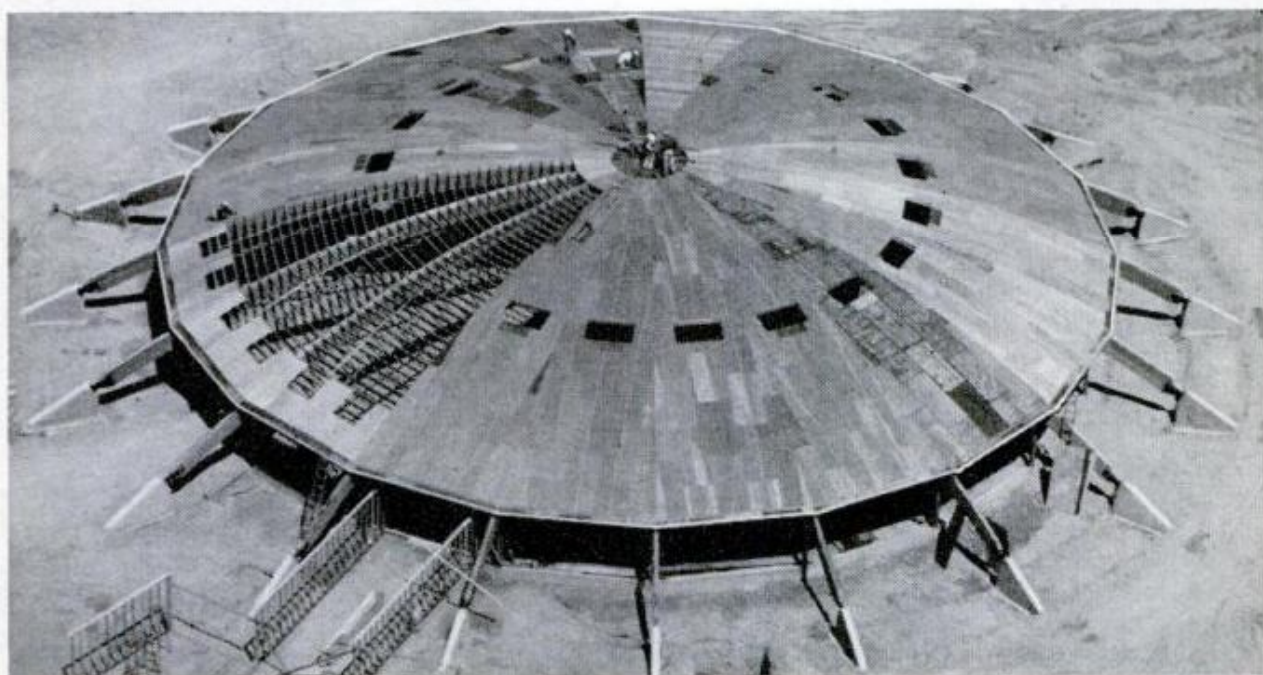
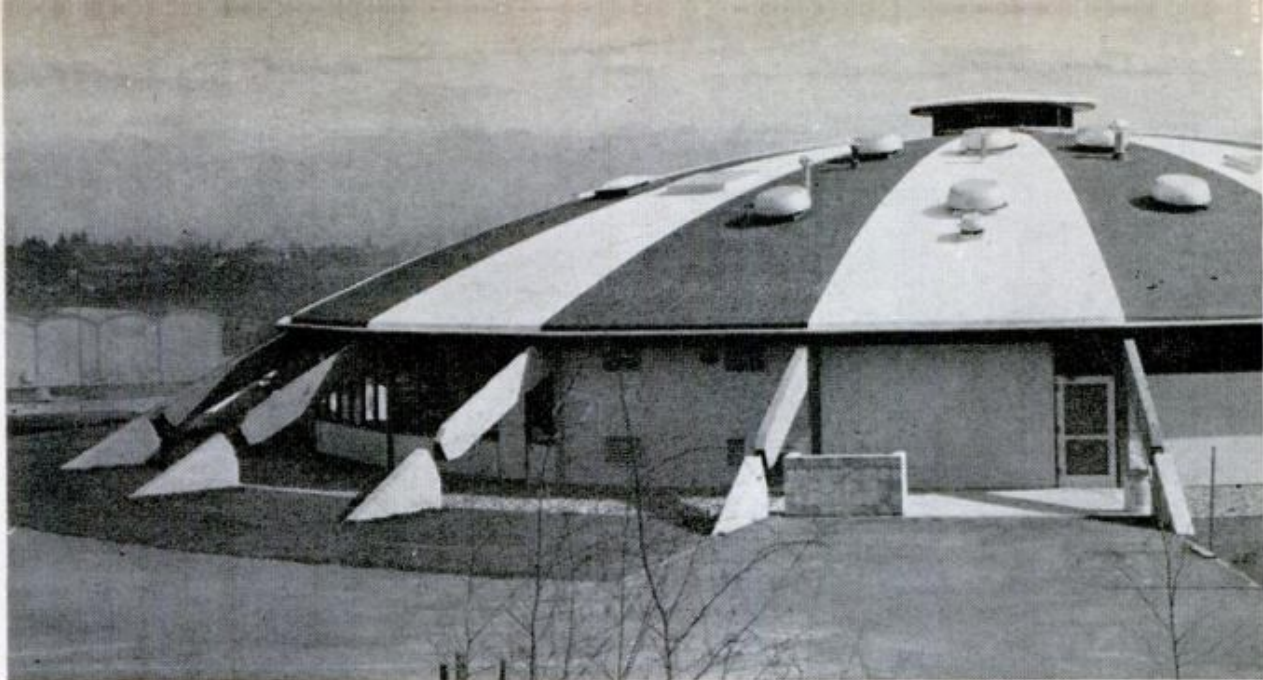
flavors apart and to analyze the chemical compounds of which they are composed. The scientists hope to be able to stabilize these essences and return them to the foods, to be retained over long periods of time.

At the Western Regional Laboratory of the U.S. Department of Agriculture, for instance, a technique called gas chromatography is used to determine the things that give fresh bread its appealing flavor and aroma. Surprisingly, it has been found that acids, alcohols and acetones are mostly responsible, although the entire aroma-flavor package contains more than 60 different compounds. The goal of the USDA research is to find a way of preserving these volatile

(Continued to page 238)

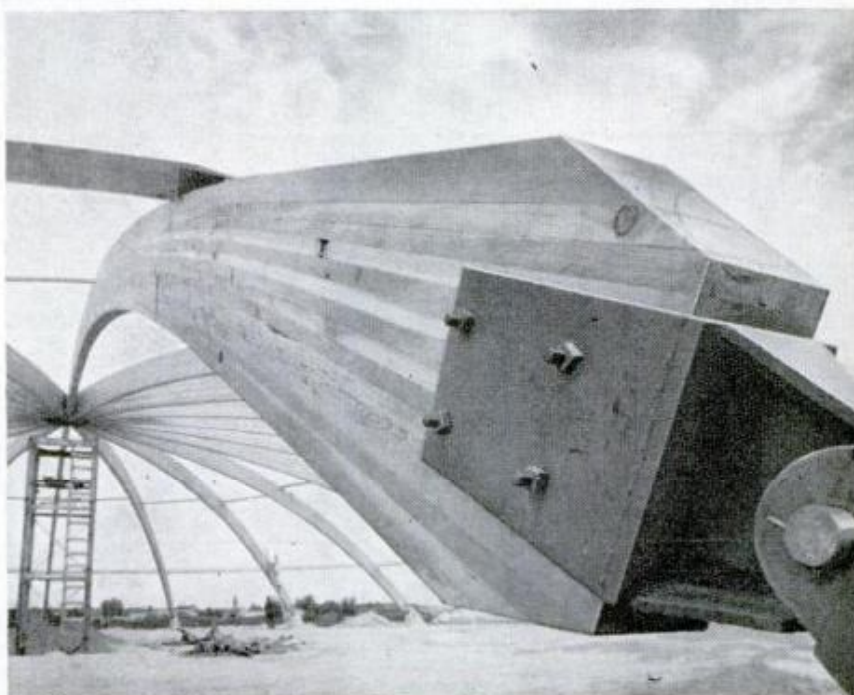


Drum dryer is used by a Department of Agriculture researcher in studies that seek to develop an improved, dehydrated mashed potato—another "instant" food



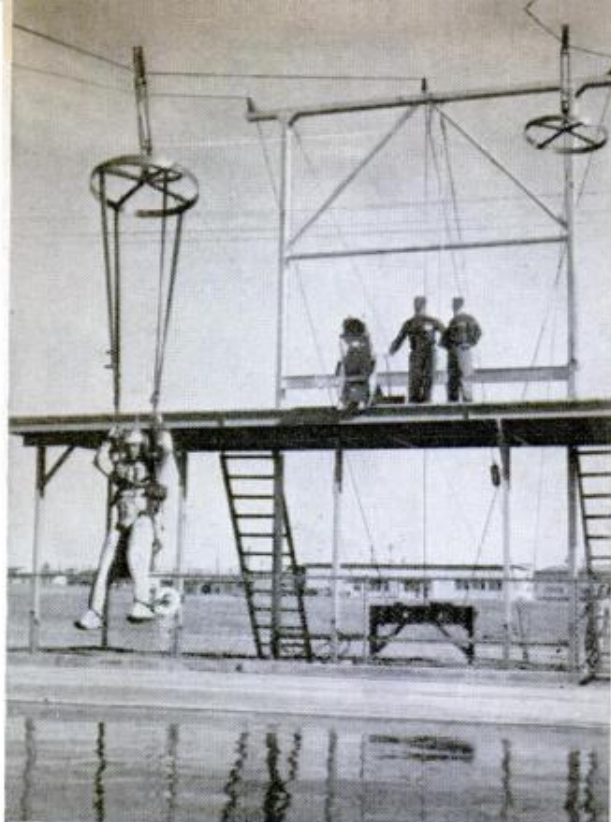
"Flying Saucer" Cafeteria

Although it looks like a flying saucer come to rest on curving, retractable legs, the cafeteria of a new school in Tacoma, Wash., is anchored firmly on laminated beams set in concrete—a technique of great functional value. The 20 beams soar to the center of the building and are tied together. No columns are needed to support the roof, which is made from plywood sheets curved over the beams. The roof spans 144 feet.



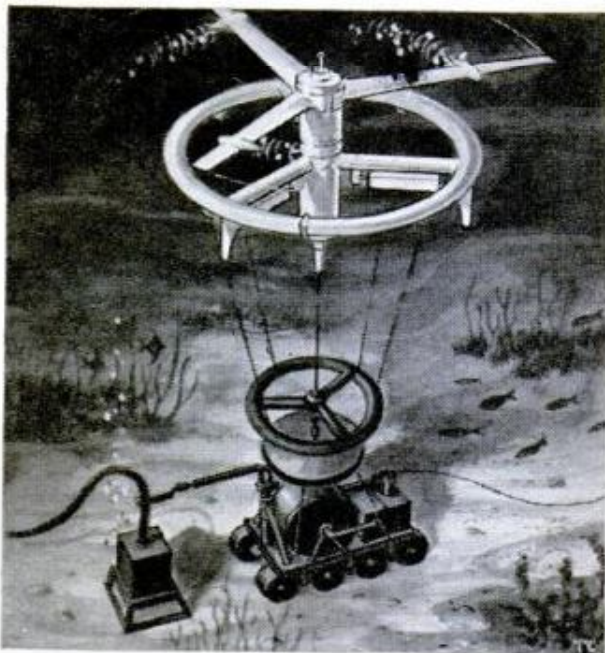
Pilots Practice Getting Dunked

Three hours of a six-hour course in water survival are spent in the water. The Air Force's liquid life-saving program is augmented by a pulley-wire arrangement that simulates a parachute drop and climaxes by dropping the trainee in the pool. The airman first releases a one-man dinghy from his seat pack. It drops into the water where it automatically inflates. Still suspended, he inflates his underarm life preserver and, when his feet touch the water, he releases his parachute harness and drops all the way in. He then swims to the life raft and climbs aboard. Advanced classes practice jumping in groups and swimming, with full regalia, to a four-man raft. The initial jump from the tower simulates the "shock" effect of a parachute opening. The remainder of the test gives the trainees safe experience in ditching at sea, efficiently, quickly and safely.



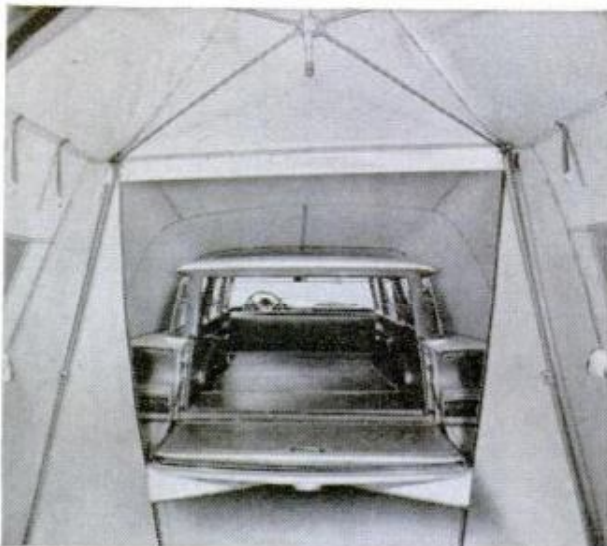
Underwater Television

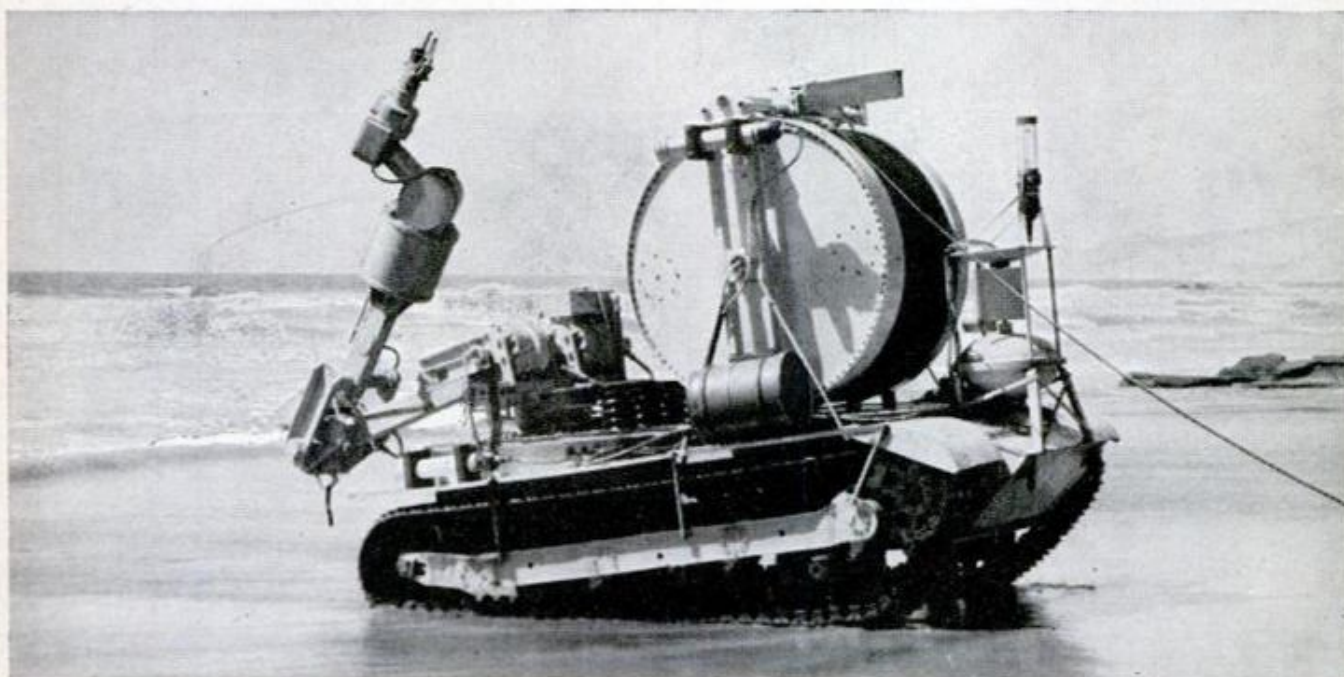
It looks like a tank or a helicopter, depending on which angle you view it from, but it's actually an underwater machine developed for the Navy for exploring the sea at depths up to 20,000 feet below the surface and five miles from the coast. The RUM (for remote underwater manipulator) has a jointed mechanical arm which can pick up and bring back samples from the ocean's floor or assemble and install instruments for long-range investigations. It has four television cameras on a closed circuit which, via a long coaxial cable reeled out to shore, sends back pictures of the vehicle and its surroundings. The tank tracks allow it to travel on the bottom of the ocean; the helicopter device allows it to swim over rough spots.



Tent Fits on Station Wagon

Combining the advantages of station wagon camping with the open floor space and head room of an umbrella tent, a new tent opens through the rear panel into the open tailgate of any station wagon. The opening is covered by an awning with side curtains which extends over the rear windows of the wagon body. With the wagon removed, the awning can stay in place to form a "back porch," and a four-foot square of mosquito netting zips over the opening to form another window. In bad weather, the same awning zips down to cover the opening. The tent is nine feet, four inches square and sleeps three easily. Two more can sleep in the wagon bed; the side curtains assure privacy and keep out the light.







Wins Pistol Crown the Hard Way

When Donald J. Weldon, Navy fire control technician, broke his right hand two months before the finals of the Navy pistol-match championship, he began practicing left-handed. With his right hand still in a brace, he went on to win.



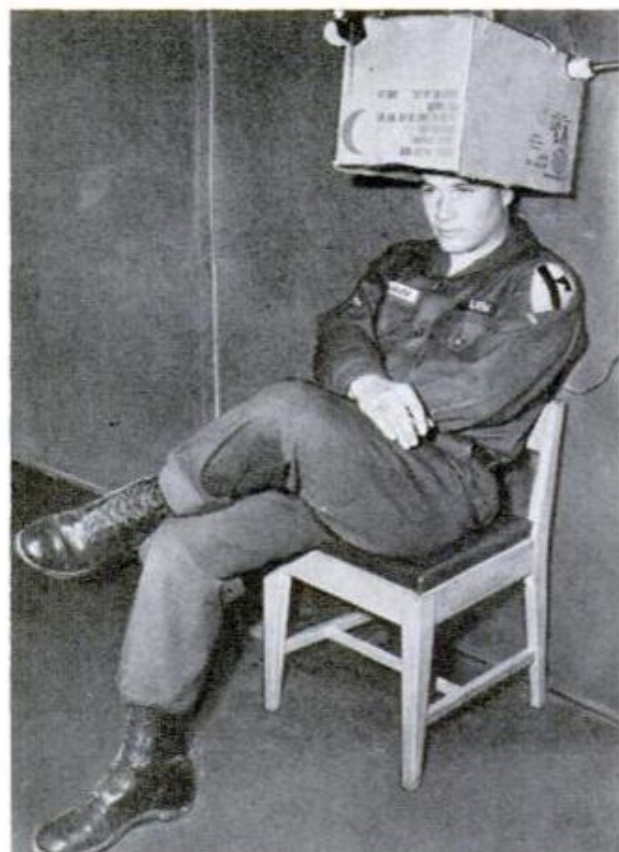
Man Baits Dog

Looks like a man making a sandwich the hard way, but it's really SPCA Officer Odin White, baiting a dog trap at the Hayward, Calif., airport. Traps were used to reduce packs of dogs which created a nuisance chasing rabbits around the runways.



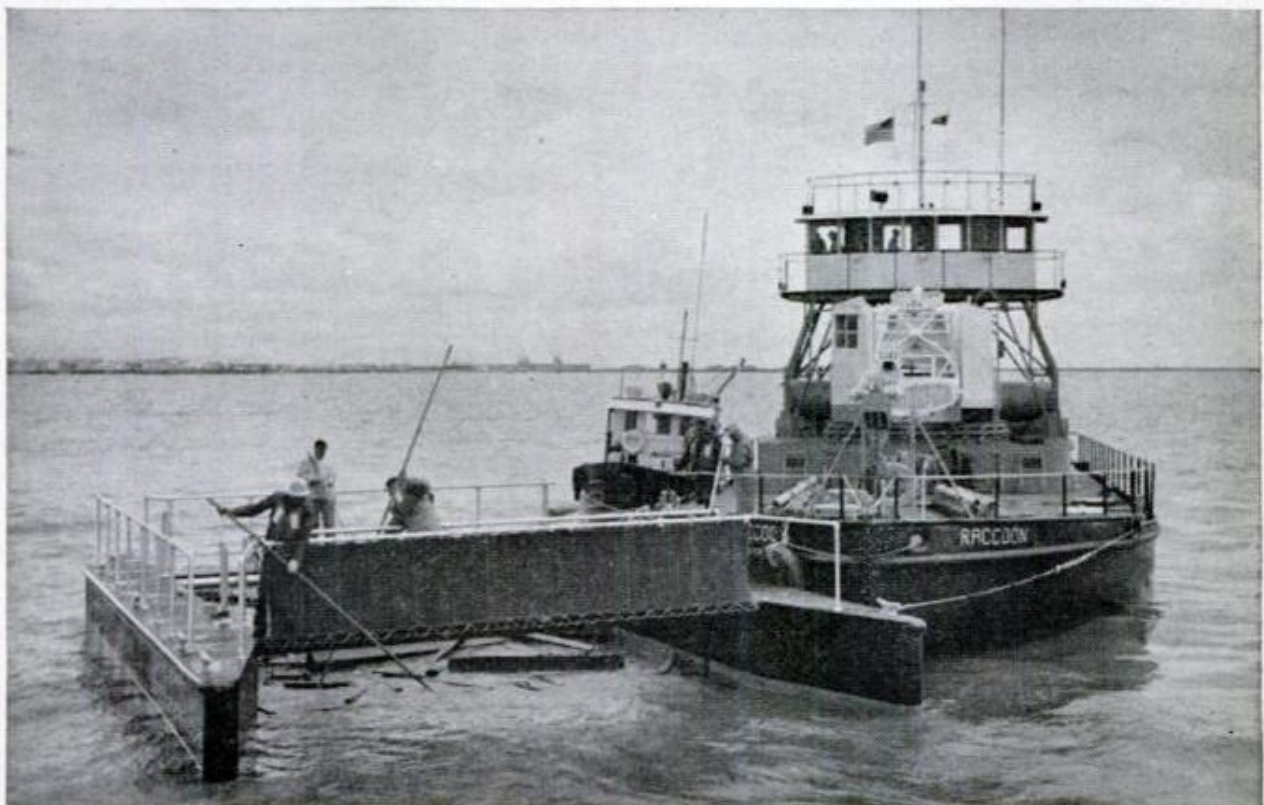
Organ Plays Through Radio

Any radio or electronic amplifying system serves as an audio output for a German "Minichord" organ, demonstrated at the 1960 International Spring Fair in Frankfurt. The keyboard is portable, has a range of four octaves and can be used with any normal speaker system.



Soldier Improvises Beauty Shop

When it was known in Korea that Pfc. A. L. Frederick had been a civilian hair stylist, he was besieged by Army nurses and USO girls. He improvised a dryer from a C-ration box and four light bulbs. Dowel pins became wave rods, and home-permanent kits became his wave solution.



Army Catamaran Clears San Francisco Bay of Debris

Mushrooming construction and redevelopment programs, deteriorating piers and shore structures, thoughtless vandals who deliberately throw trash and garbage into the water, coupled with a smog-abatement program that outlaws any open burning have all created a major navigation problem in the San Francisco Bay area. Float-

ing debris has become a menace to ships and amphibious aircraft. Army engineers met the problem with a catamaran-type vessel that drags a one-ton net between its hulls about three feet underwater. When the net accumulates about 10 tons of debris, it is lifted to the tug and hauled away to be burned in a special incinerator.



Teaching a new colt to lead, Joe Armstrong holds the lead line while Ray Sewell controls a loop around the hindquarters to help. Reluctant now, the youngster will soon get the idea and learn to follow the lead wherever it goes. This first, important step lays the foundation for all the training to come

Train Your Own Horse

By Bob Moulder

THE SADDLE HORSE, long acclaimed by horsemen and trainers as smarter and easier to train than its rider, is growing in popularity, taking its rightful place beside the thoroughbred and harness horse. Why? Certainly not the decline of motorized transportation. Horseback riding and a love of good horseflesh has been a part of the American tradition—and that of our English forebears—for centuries. And for perhaps a hundred years, the horse was more important to the development of our country than motorized transportation is in these times.

But today, with more and more families moving out of the city into the wide open exurbs, families can again own and use riding horses—and they can double their pleasure by training their own.

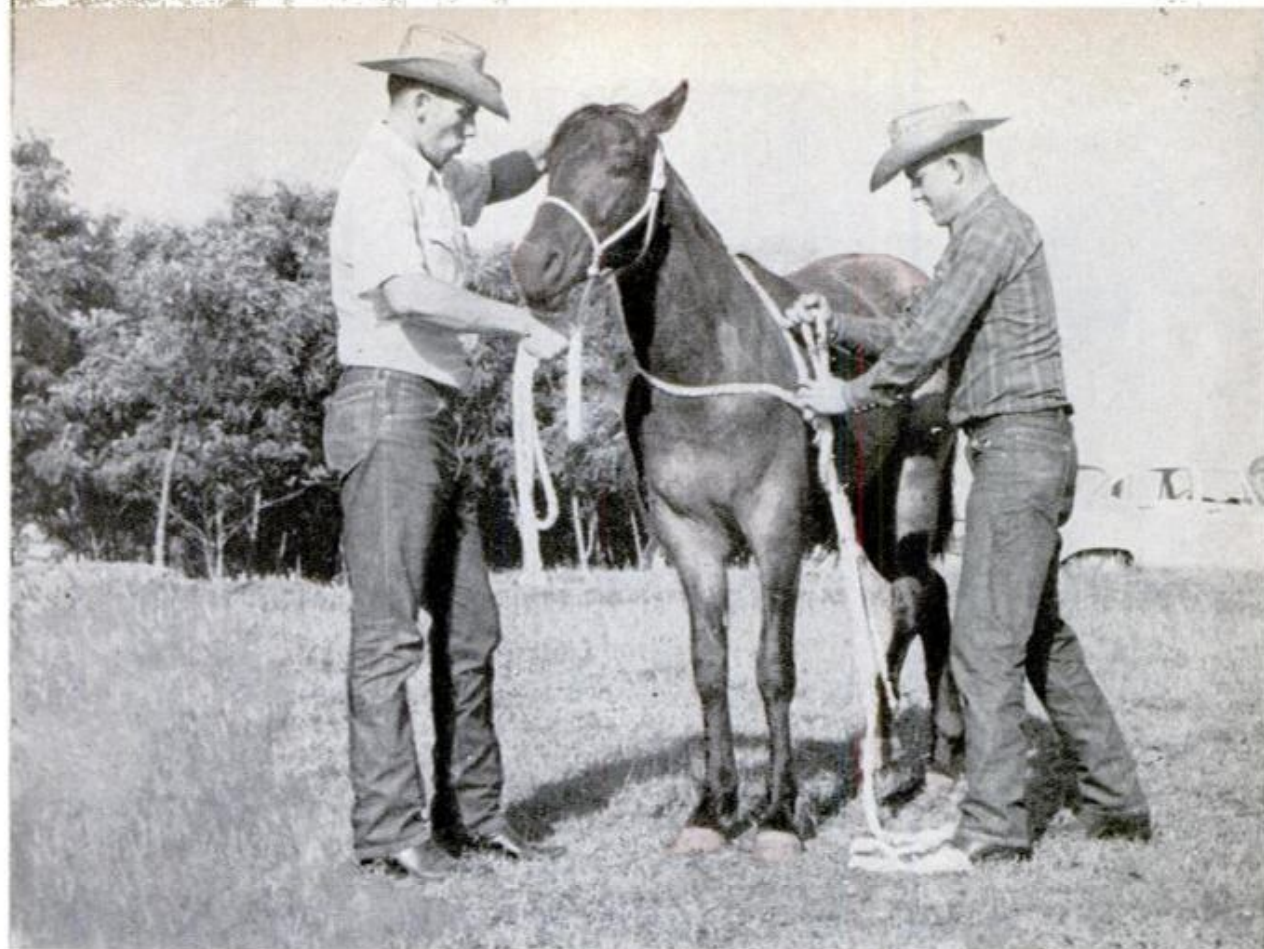
The saddle horse is not a pet reserved for royalty. It is a working man and sportsman's horse. Owning and riding a good horse is fun. But that is only half the fun. The other half is breaking and training the animal from a colt. When this is done, there is a bond between horse and rider that is as

strong as that between a man and his dog.

You don't know how to train a horse? Relax—there is no magic feat to training your animal. Neither do you have to be a champion cowboy to do the job. All it takes is a liking for horses, patience, and some knowledge of a few fundamentals that have varied only a little in centuries of horse breaking and training.

Professor Carl Williams, of Mississippi State University at Starkville, Mississippi, whose job it is to teach Quarter Horse conformation and training at the university's School of Agriculture, gives seven basic rules for training a saddle horse which will change your colt from a frisky rebel to a gentle servant and companion.

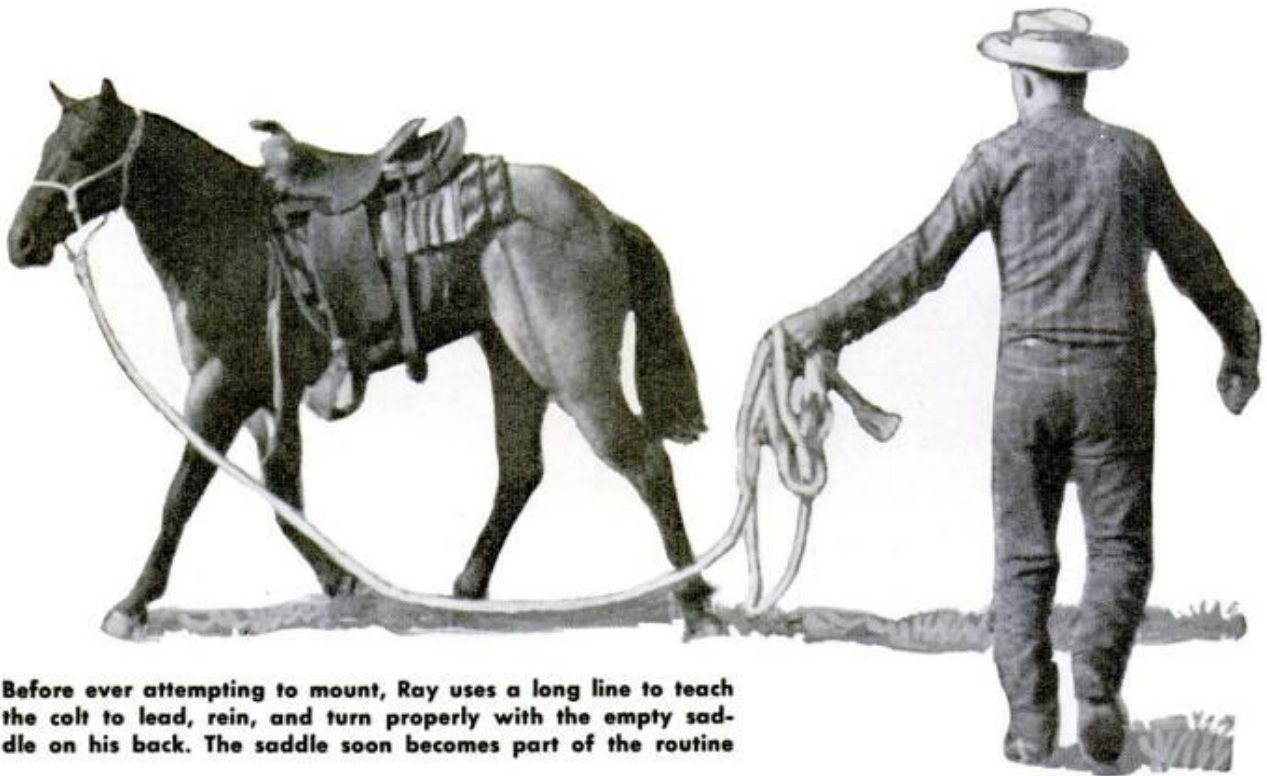
Halter breaking your colt: Breaking the colt to lead is the first step in training any kind of horse. This can be done at any age, but it is easiest when the colt is still nursing. When this is the case, the mother can be used to walk beside the colt as a calming influence. In almost all cases, this is done when the colt is about six to eight months old. The halter-trained colt is much easier



Step two—18 months old, gentled and thoroughly broken to the lead line, the colt is ready for his introduction to the saddle and rider. Joe holds the halter and the colt's ear while Ray runs a rope around his neck and back to a hind leg to discourage jumping during the early stages of the breaking process



Rubbing the blanket and saddle gently across the colt's back for a while assures him that there's nothing to fear, and he soon forgets his resentment. Then it's time to fasten the girth, but loosely



Before ever attempting to mount, Ray uses a long line to teach the colt to lead, rein, and turn properly with the empty saddle on his back. The saddle soon becomes part of the routine

to handle during training. While still a young foal, the colt can be handled quite easily. A little work each day for several days will usually result in a colt that will lead readily.

The best way to begin teaching a colt to lead is by pulling gently on the rope from one side of the colt. When he steps around, give him some slack in the lead rope. Repeat the procedure until he readily turns toward you when you pull on the rope. Then, try getting him to step forward by pulling straight ahead. Always give him some slack when he steps forward. This shows the colt what you want him to do. He'll catch on in a few minutes.

If the colt is reluctant to lead forward, a loop around his hips or rear quarter will

encourage him to move. A loop around his chest, with the rope between his front legs, is sometimes used on older horses. A tug on this rope will usually make the horse move forward.

Older colts that have never been handled are often tied to a fence for a few hours to start the halter breaking process. This teaches the colt respect for the rope and halter and will teach him not to pull back on the rope. The colt then can be taught to follow by using one of the methods mentioned earlier.

Breaking the colt to ride: Breaking usually begins when the colt is around eighteen months old. The animal that is handled easily and made friends with early, is usually much easier to handle. Most horses are

Time to change from the halter to a hackamore, which does the same job but spares the colt's mouth from the occasional but necessary yanks during training



"Back" and "whoa"—important lessons —come next, and are much easier to teach before trying to mount as well as handy during the sometimes-precarious attempts at training from the saddle



First time up. Holding the left rein shorter than the right, so the colt will turn if he starts to move too soon, Joe mounts and dismounts several times to get him accustomed to the new weight



broken to ride gradually today instead of being caught for the first time, saddled and ridden immediately. That "old West" method is hard on both the horse and the trainer.

Training horses has been compared to the basic rules of raising children, being firm, patient, and beginning early. By working gradually, the horse can be gentled and can have time to become accustomed to the blanket and saddle. The blanket and saddle should be patiently rubbed across the horse's back until he loses his fear of the unnatural trappings. As soon as he learns that they are not to be feared, he will not resent them. Only older horses that haven't been worked should need to be restrained to saddle. One way of doing this is by tying one back hoof. If you have someone helping, he can hold the horse by the ear until the foot is tied. This isn't necessary with gentle horses.

Saddle and walk: Give the horse a little time to get accustomed to the saddle on his back, then tighten the girth slightly. He can then be exercised in a walk and trot in a circle on the end of a long line. This will acquaint the horse with the saddle when making various movements. You should also teach him what the command "Whoa" means at this time. Give him the command and then give a short jerk on the line, and he will soon learn what you mean.

The hackamore: Young horses are usually ridden at first with a hackamore. This prevents injury to the mouth while teaching the horse to rein. The hackamore should be adjusted to fit the particular horse; some animals respond better when it is at a different place on the nose.

Back and rein: The next step is to teach the horse to back and to rein. This doesn't come as natural to the horse as moving forward, but it is advisable to teach the horse this movement at an early age. You can also teach him the basic principles of reining before ever mounting the saddle. This can be done by tying the stirrups together under his stomach and running the reins through the stirrups and driving him from behind. You can teach him to turn with his

(Continued to page 236)



Once he accepts the rider on his back, the colt is ridden in irregular figure eights for about an hour a day. It is important not to ride too long or to work the colt too hard

Tall—and at home—in the saddle, Joe and the newly-trained saddle horse enjoy a graduation ride. Time, patience, and gentle, careful handling have paid off in a steady, stable mount



Inflatable Sailing Catamaran

Starting from a package small enough to carry on a car-top rack, a new sailing catamaran inflates and assembles into a 9½-foot sailer that will support three adults. Made of a special waterproofed nylon fabric, the hulls are each divided into four separate compartments. The fabric resists tearing and rotting. The catamaran is manufactured in North Ireland.

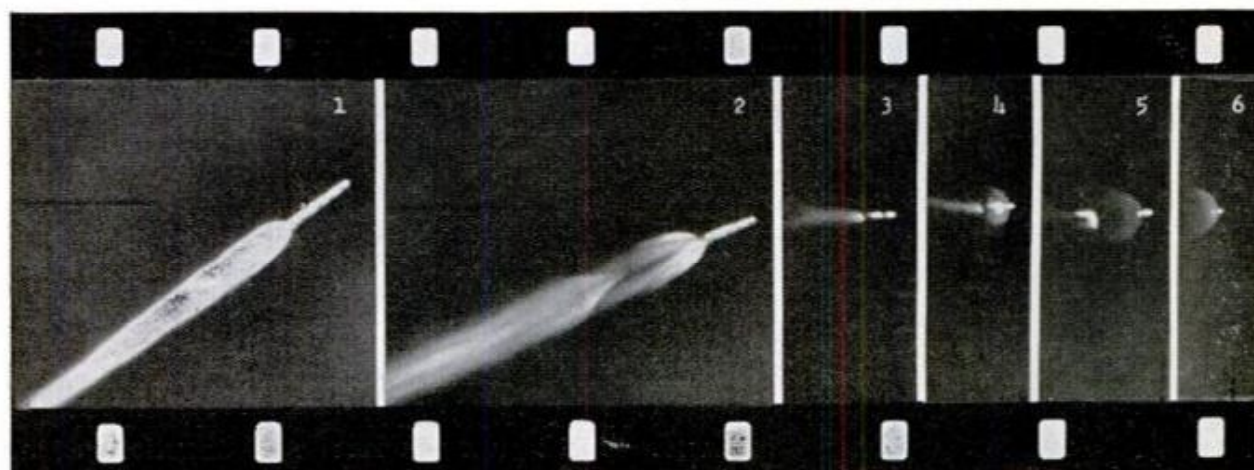
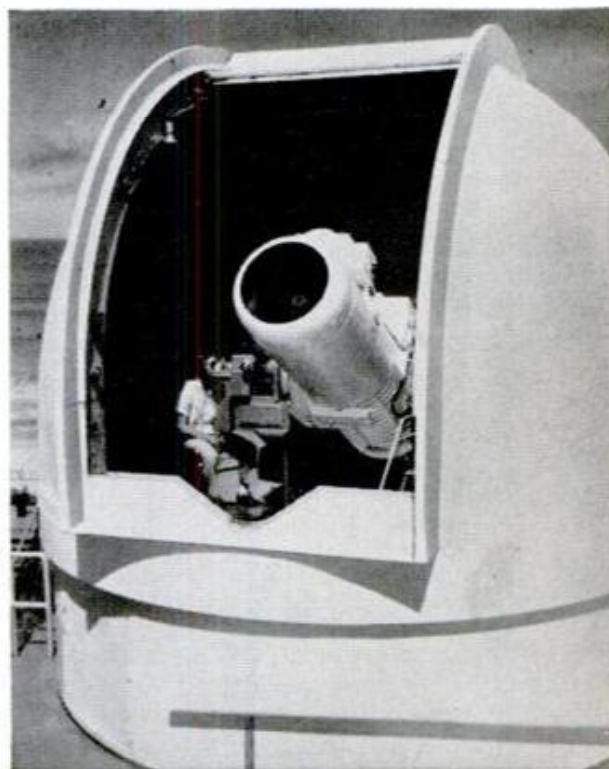
Recent tests by the Army at Fort Devens, Mass., showed that the most consistently visible color for clothing was a fluorescent "blaze orange" — much better than the usual red or yellow.

Studies by a University of Wisconsin scientist disclose a maximum heart rate of 1320 per minute and maximum respiratory rate of 1080 per minute for the masked shrew, a mouselike mammal.



Giant Missile-Tracking Camera

ROTI (recording optical tracking instrument) is basically a 24-inch telescope with a 500-inch focal-length lens system mounted on a 70-millimeter camera. Two of these units are used to track missiles fired from Cape Canaveral and record their performance for later evaluation. In the sequence below, 1) a Titan missile blasts off and is photographed about 25 miles above the Cape; 2) the first stage is shown burning out; 3) the first and second stages separate; 4) the second stage ignites; 5) it begins to leave the first stage behind; and 6) it is photographed more than 50 miles from the camera, still climbing and traveling spaceward at nearly 5000 miles per hour. The second stage will continue into outer space where its ballistic trajectory will start downward and the re-entry vehicle will re-enter the atmosphere and into the down-range splash net. The initial part of the trip sets the pattern, however, and the new cameras record how well it performs then.



The Metric System - PRO

By **Chauncey D. Leake**

Professor of Pharmacology, The Ohio State University
President of the American Association for the Advancement of Science

THERE ARE 10 good reasons why we should voluntarily and gradually get our weights and measures on the metric system:

(1) It is much more simple and easy to use in computation than the clumsy ancient disorderly English system;

(2) It is an interrelated and coordinated system for linear, volume, mass, energy and electro-magnetic standards;

(3) It is universally used all over the world in scientific studies, and indeed greatly facilitates such studies;

(4) It is in common ordinary daily use all over the world, except in English-speaking countries, which are thus at a disadvantage in communicating on measurement at an international level;

(5) It is commonly used in trade and commercial transactions, except in English-speaking countries, which thus are at a disadvantage in selling abroad;

(6) Its uniformity in standards tends to reduce cheating or deception in trading, or in buying and selling;

(7) Its direct capacity for indefinite extension into the sub-atomic or super-cosmic worlds makes it essential for our modern development of nuclear energy and space exploration;

(8) It easily relates us as humans to our environment, since the meter is about an arm's length, or a long step;

(9) It can quickly and easily be learned in childhood;

(10) It can readily be applied to machine tooling and manufacturing with resulting simplicity of procedure, interchangeability of parts, and uniformity of product.

There are other more subtle psychological reasons for adopting the metric system. Thus it provides a simple and easily understood basis for reaching *agreements* on standards, and thus assuring a method of obtaining world-wide uniformity in measuring, whether for scientific or for commercial reasons. Again, if the agreed-upon physical standards, now in Paris, were ever to be lost, they could be exactly reproduced. Further, the commonly used English-named weights and measures in the United States are legally defined (and thus reproducible) only in terms of the agreed-upon international metric standards. Why not, then, use these metric standards themselves in our every-day business, whether household, scientific, industrial or commercial?

The English lost their physical standards in a fire in the House of Commons in the middle of the 19th Century, and could only reproduce them from historical records. Meanwhile we had defined our standards on the metric standards, even though we continued to use the English terminology. The result is that slight but now significant differences exist between the English standards and ours. This causes much, and will cause more, confusion in technical matters. It would be better for us all to go directly to metric usage.

There are two major objections to our going on metric usage: (1) a commercial factor which traders are reluctant to admit; namely, that variations in standards of measurement permit shrewd traders to learn where to buy long measure (as with long tons, or imperial gallons) and sell short measure, and (2) costs of converting machine tools and manufactured products to metric standards.

The first objection is specious and suggests a resistance to honest trading which is unworthy of our professed ethical ideals. The second objection is superficial, since the change can be made gradually and eventually would result in real economic gain. The American drug industry is gradually converting to metric use in all phases of manufacturing and merchandising, with resulting economy and efficiency in its rapid expansion, especially in world markets.

However, there are subtle psychological objections to the metric system. It is "felt" to be foreign, strange, different, and being of French origin, slightly immoral. These "feelings" are unworthy of intelligent people, but they exist. This sort of quasi-religious, highly emotional, irrational, and semi-superstitious antagonism to the metric system reached its culmination in the successful efforts of an Ohio fanatical astrologer and numerologist, Charles Latima, when his organized opposition prevented legal adoption of the metric system in the United States in 1876.

Recently there was an important international conference on systems of units held under the auspices of the American Association for the Advancement of Science. Except for some questions on the basis of costs, there was unanimous agreement that the full legal adoption of the

(Continued to page 222)

By Ralph M. Drews

Chief Metallurgist, Fabricating Divisions, Republic Steel Corporation

"SHOULD American industry convert to the metric system" is a very old question. At least 40 years ago this question was a subject of lively debate in our schools and newspapers. The popular argument in favor of conversion at that time was supposed simplicity and international usage as well as the fact that our monetary system was a decimal measurement. Proponents of the change made it sound like a simple matter—nothing more difficult than changing from standard to daylight time.

Surely, there is much more to it than that. We must first consider the knowledge of the people with no scientific education, their training and their gradual acclimation to using the metric system. I feel quite sure that, if a poll were taken of the American public, very few persons would have any idea of the relationship of the metric system to itself or to our American system. Yet, most of these people have come in contact with the metric system at some time in their school days. The use of *milli*, *centi*, *deci*, *deka*, *hecto*, *kilo*, *meters*, *grams* and *liters* is no simple language or measurement system to them. It is quite confusing.

Within the steel industry it may not be too difficult to recalibrate our scales and change the headings on our report sheets, but much more sober thinking must be given to the billions of dollars in drawings in our engineering files and of the astronomical number of dollars in operating equipment. To keep this equipment operating requires constant maintenance and replacement of worn parts made to the drawings in our files. All of this has been engineered to the American measurement system. To change now to the metric system would require redimensioning of our entire file of drawings with cumbersome metric decimals, having a large number of figures in order to make new parts fit accurately.

In addition to the making of coke, iron and steel, the steel industry in this country is involved in making numerous so-called finished iron and steel products. These vary somewhat from plant to plant, but may be castings, pipe, tubing, couplings, wire, nails, fencing, bolts, nuts, rivets, roofing, containers, shafting, cold-drawn bars, structural shapes, reinforcing mesh and so on. In this finishing or fabricating field, the steel industry has another astronomical investment in machines, engineered to and mak-

ing products to the U. S. measurement system.

How this change is to be brought about and what benefit it will be to the American producer and consumer becomes quite confusing—at least to me.

If the conversion from inch to centimeter is made by using the metric equivalent of the inch measurement, then we have done nothing more than change existing dimensional figures to probably something more complicated. For instance, the 1-inch measurement is equivalent to 25.4 millimeters—an American standard in use for 25 years—or to 2.54 centimeters; $\frac{1}{2}$ inch (0.500 inch) to 1.275 centimeters; $\frac{1}{4}$ inch (0.250 inch) to 0.635 centimeters or 6.35 millimeters; $\frac{1}{8}$ inch to 0.79375 millimeters; $\frac{1}{16}$ inch to 0.396875 millimeters, and our popular $\frac{1}{1000}$ (0.001 inch) tolerance figure becomes 0.000254 millimeters. After all this conversion is accomplished, we should merely have adopted a much more difficult way of expressing the inch measurement.

Products made to metric system dimensions of simple numbers are in no way interchangeable with products made to the inch system. For example, a 2-centimeter bolt cannot be used in place of a $\frac{1}{4}$ -inch bolt, and standard metric-dimensioned pipe will not interchange with American.

If the conversion is to be made by adopting the existing metric-country standards, which I believe is what most proponents would like for new design, by continuing to manufacture to the inch system for existing requirements we might never get out of the mess. This would mean redesigning all our product standards. It would mean retooling for the entire American industry—not only the steel industry—while at the same time maintaining present tooling and setups for existing equipment and products. It would mean dual stocking of parts from now on. It could even mean producing equipment operating with sections made to both measurements. Of course, to start with, our people would first have to be briefed on the metric system. Obviously, this could produce considerable costly confusion. And what have we gained?

If there is any thought that we can simply "pull the shade down on the inch measurement" and change over abruptly to the metric system, it most likely will be a

(Continued to page 228)



Ice Skating Rink Built Into Downtown Apartment

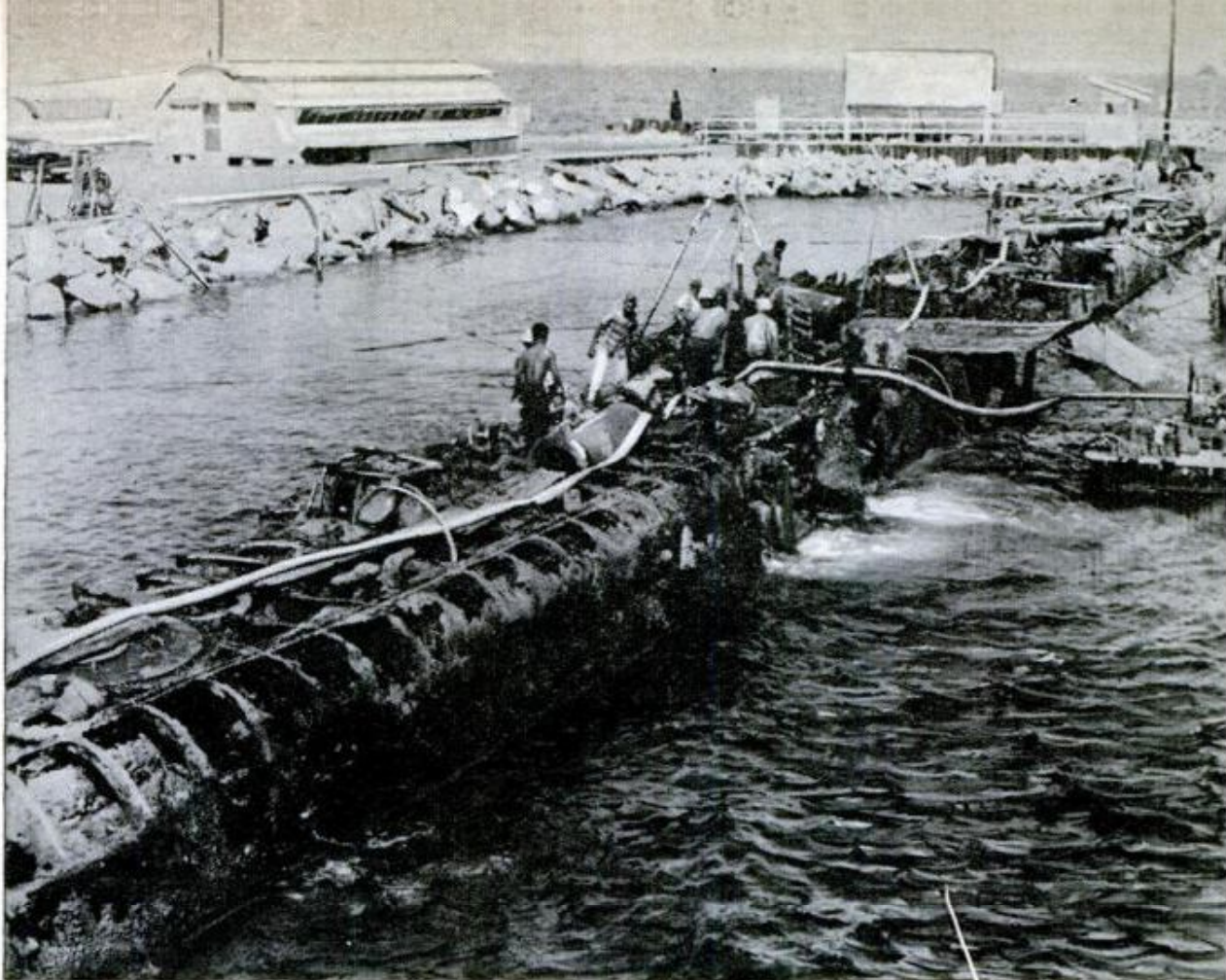
Midtown Manhattan seems an unusual spot for a private ice skating rink, but at 213 West 58th Street there's a 20 by 32-foot skating area built into the rear of a fashionable apartment building. The owner, Alan Murray, a shoe manufacturer and ice-skating instructor, had the rink built into the site of an unused stable behind the building

so his friends and students could take a turn on the ice without inconvenience or temperature worries. An ice-making machine capable of freezing 10 tons of ice a day keeps the ice in shape, and Mr. Murray's apartment and offices are around and above the rink. Above, the host and his daughter watch the skaters from the apartment.

Suitcase Folds Up Like High Silk Hat

It was made in England, of course, the country most identified with the folding top hat. When folded, it rather resembles an over-size underarm case. When unfolded, it becomes a normal-size suitcase. Made of light-weight canvas, it has two stiffened sides that are swung inward when collapsing the suitcase. When open, the two sides are held in place by clips. The collapsible case, because of the canvas, is relatively light in weight, some sizes weighing less than five pounds. It is available in four sizes, ranging up to 26 by 15 by 7 inches, and priced up to about \$21. When folded, it can be slipped into a canvas envelope for storage, just like a plastic raincoat. The envelope can be carried in the case.



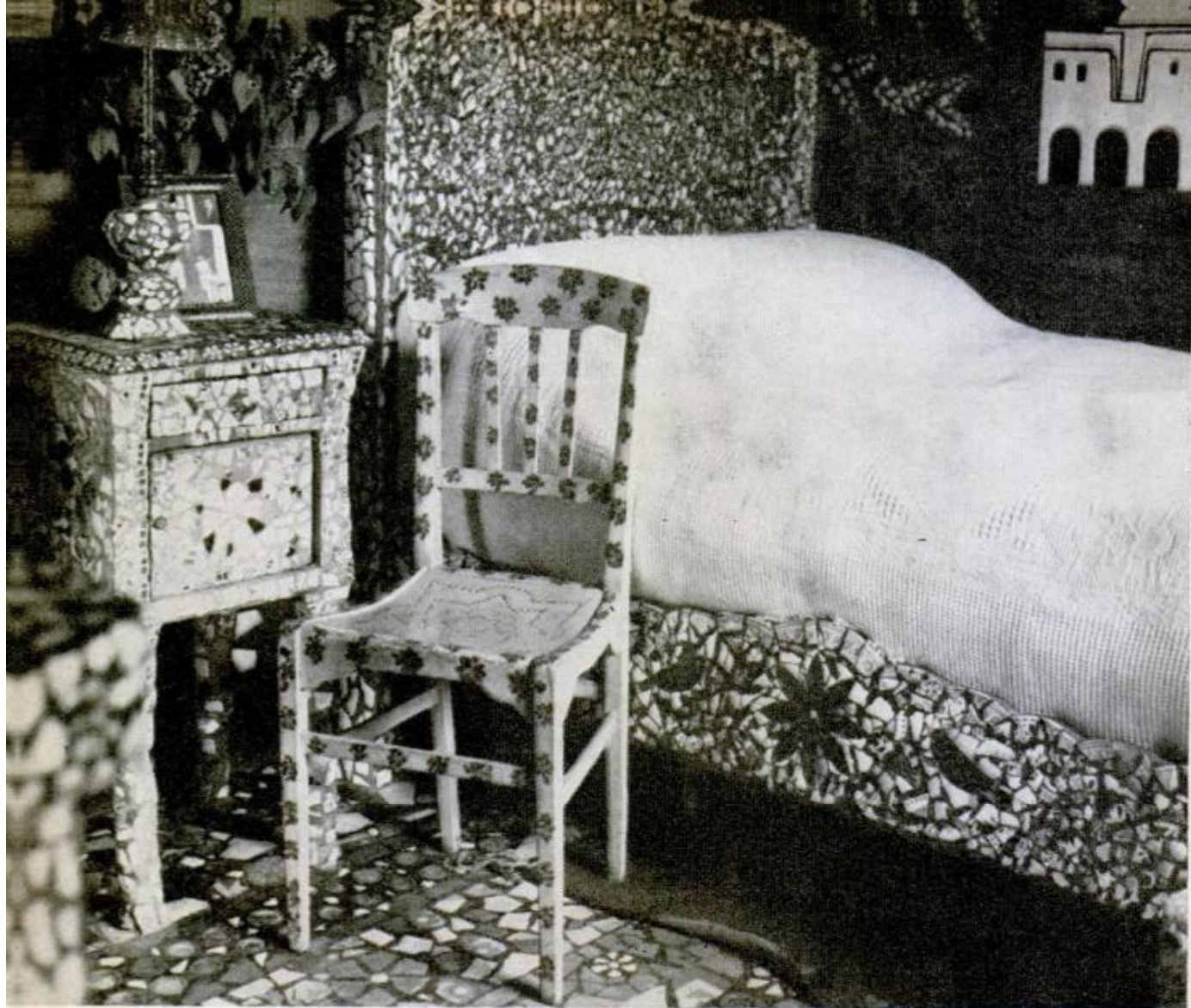


Sub Comes Up After 20-Year Dive

Sunk by Japanese bombs near Cavite in the Philippines during the early days of World War II, the USS *Sea Lion* was raised later by the Japanese, then sunk a second time by American bombers during the recapture of Luzon. After two months' work a Philippine salvage firm raised the twice-sunk submarine by sealing the many holes

in her hull with concrete and pumping water from flooded compartments until the hull was buoyant enough to be raised out of the bottom mud. The operation uncovered one strange mystery: In a crew locker, a U. S. nameplate and medal were found, inscribed "Fred Wroble," though he was never known to be aboard the *Sea Lion*.





Bedstead, lamp base, nightstand, floor—these surfaces are covered with mosaics made by Raymond Isidore

MOSAIC HOUSE

His beret tilted in the way sported by artists, Isidore touches on paint to a butterfly design he made from bits of broken glass and pottery. With his wife, right, he sits in their mosaic-embellished courtyard





Thirty years of careful work have resulted in Isidore's home becoming a showcase for his mosaic designs

FRENCH STREET CLEANER Raymond Isidore for 30 years has been salvaging bits of glass, china and crockery from the mounds of dust he gathers each day and using them to decorate his house, the wall around it and the patiolike yard. The result is that his home has become a sparkling showplace for mosaic design and a rival, as a tourist attraction, to the famed cathedral in his town of Chartres.

Isidore is himself fond of churches and many of his designs have been fashioned to resemble such well-known cathedrals as the one in Chartres, Notre Dame, Sacre-Coeur and others. Flower designs predominate on the wall around his courtyard and on the floor of the courtyard which itself

holds a display of flowers and plants in mosaic-encrusted flowerpots.

Mrs. Isidore cooks on a stove that has been surfaced with bits of broken crockery, and most of the rest of the household furnishings are similarly covered with the carefully fashioned designs. The exceptions are chairs. These are painted with designs because the cement, in which the mosaic pieces are fitted, would make the chairs too heavy to move about.

The only major part of the house that has not been overlaid with mosaic design is the roof. But Isidore, who has cemented in four million bits of glass and crockery through the years, from time to time studies, reflectively, its artistic possibilities.



Frogmen Televisе Fish From Undersea Craft

Two Coast Guard frogmen who studied fish and fishing practices at Gloucester, Mass., toured around underwater seated in a submarine-like craft made from a Navy bomber fuel tank. It is designed to be filled with water and sink, using a plastic foam material to achieve partial buoyancy. It is equipped with fins and rudder which are operated by one frogman while the other sits facing the stern with an underwater

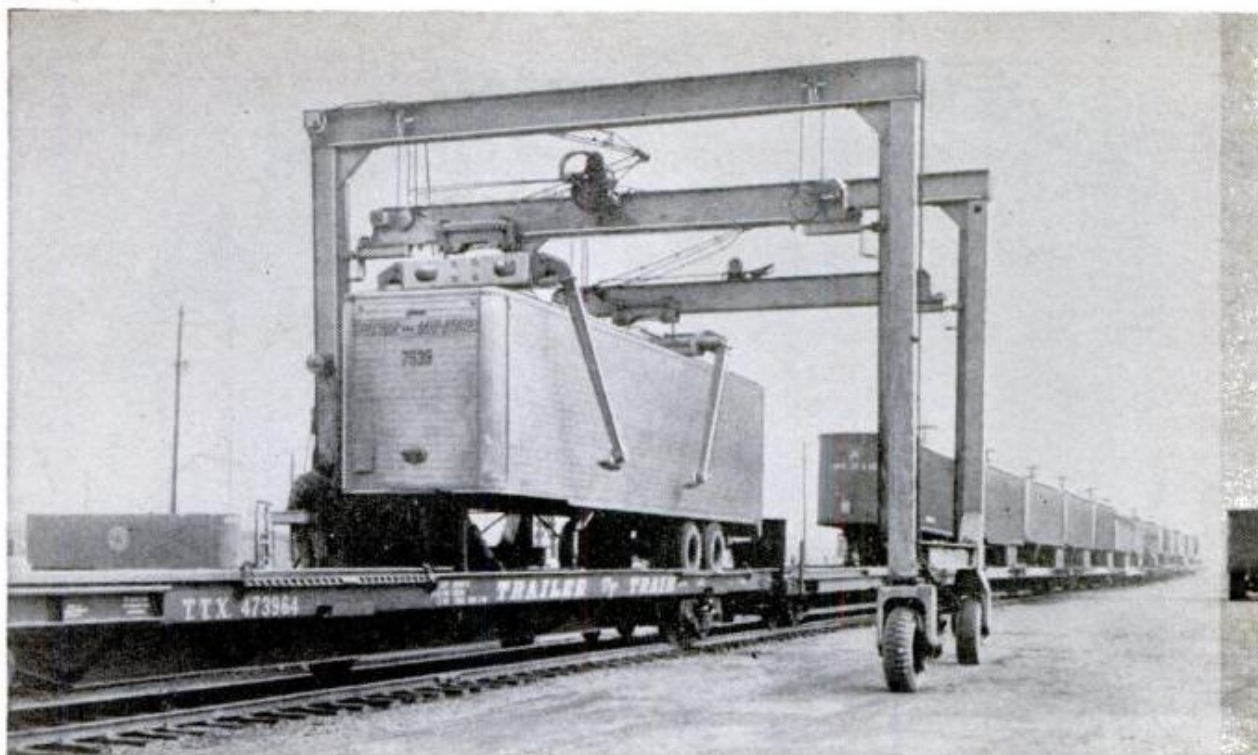
television camera. The craft is towed by a surface ship which has a television screen for displaying the pictures. In an attempt to learn more about the catching of fish, the towing craft on occasion also tows a net, just in front of the frogmen. One thing they learned was that contrary to general belief, fish sometimes go into the net tail first, apparently not aware that they have been overtaken.

Fingerprints Cast in Plastic for Improved Identification



Instant fingerprints — foolproof, permanent plastic casts of either a whole finger or of a dusted print—are possible with a new method developed by the Army Quartermaster Corps. With the method, liquid plastic is sprayed on a latent print, or a finger is dipped into the plastic, which is peeled off and turned inside out to become a model of the original finger. The resultant print is clearer, more accurate, and easier to handle than the usual rolled-ink prints.





Self-Propelled Lifter Unloads Piggybacks

Big brother of the familiar "straddle carriers," a new vertical lifter is unloading 18 big piggyback trailers an hour in the South Kearney, N. J. rail yards by simply lifting them off their flatbed rail cars.

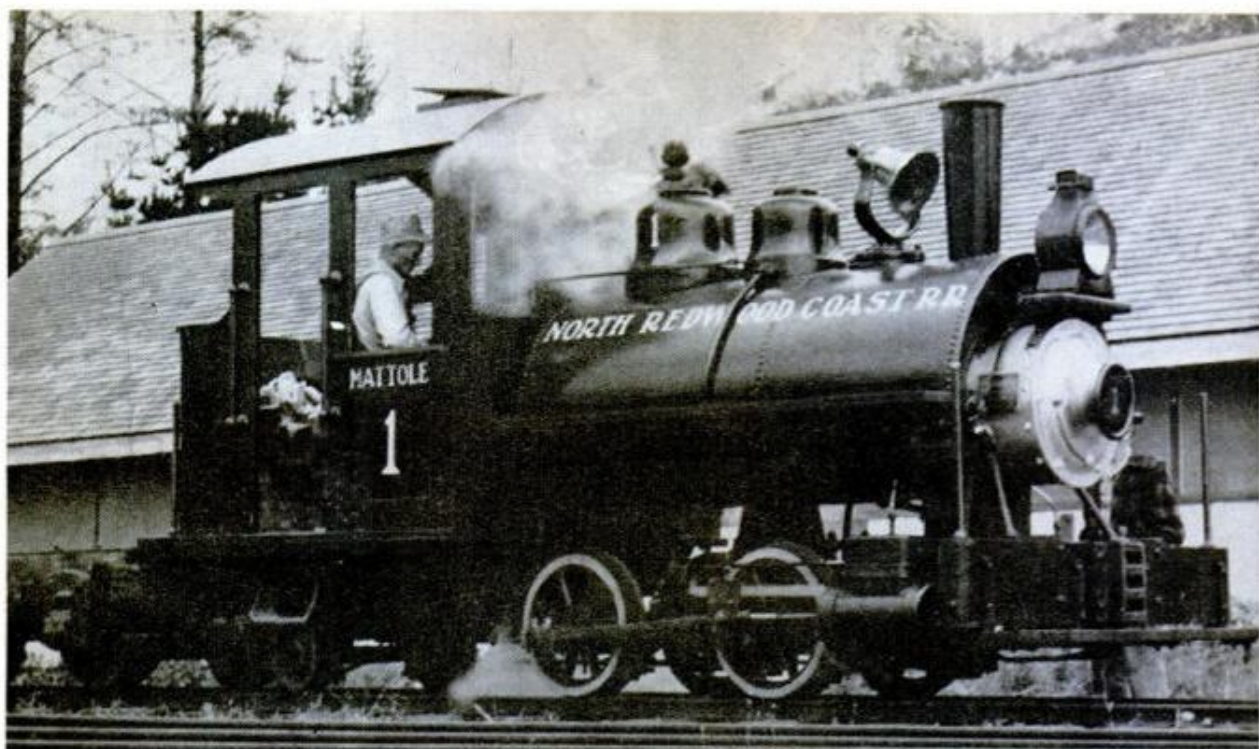
Straddling the entire train, the big lifter picks up a trailer with its four arms, rolls it across the top beams on trollies, and eases it onto the ground. The one-man operation works with any trailer or container.

Chair Folds Out to Become Gentleman's Gentleman

Danish furniture designers, as most furniture buyers might know, have a talent for the unusual. One of their latest creations is a cherry and teakwood chair that, when not in use, folds out into a valet piece. The

back becomes a coat hanger, the seat is used for draping trousers and the small compartment beneath the seat stores pocket articles. It's designed for either private lounge or executive suite.





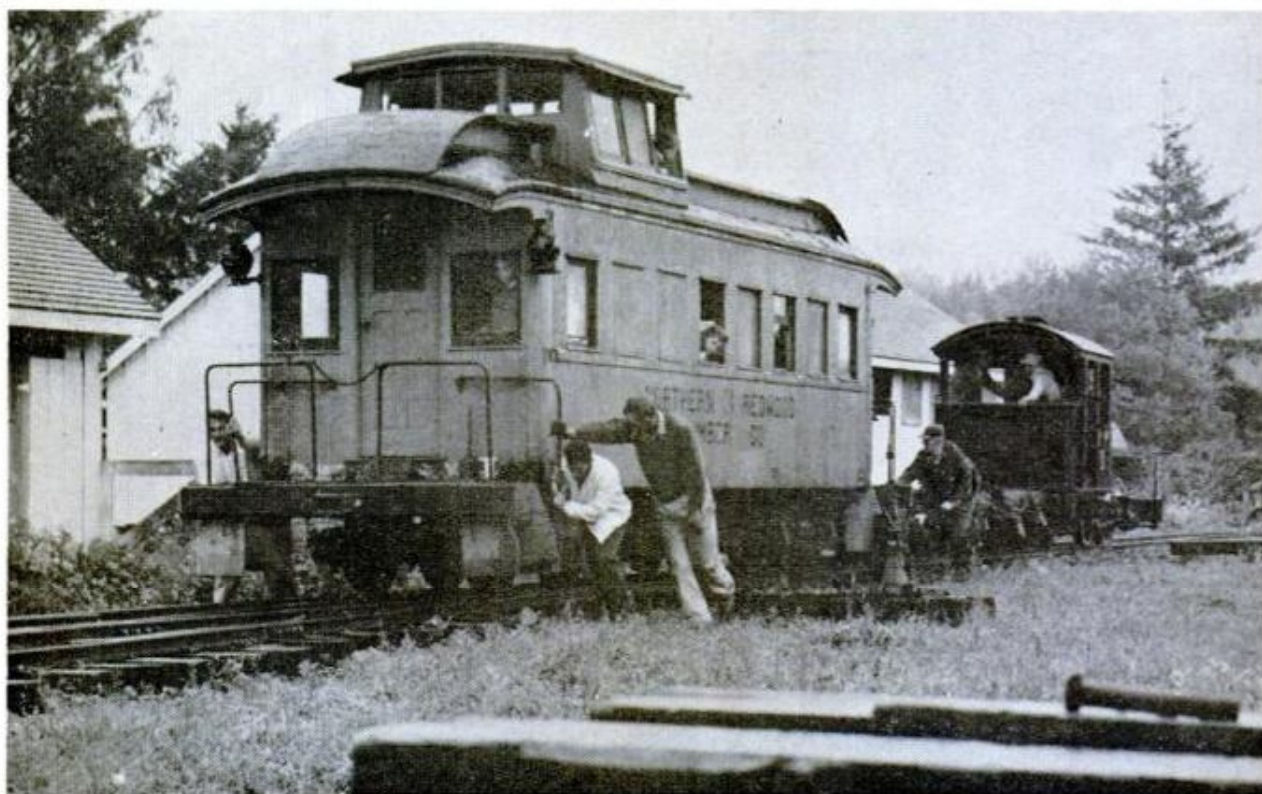
Abandoned and half-buried for 46 years, old Mattole No. 1 rides again—for about 300 feet to nowhere

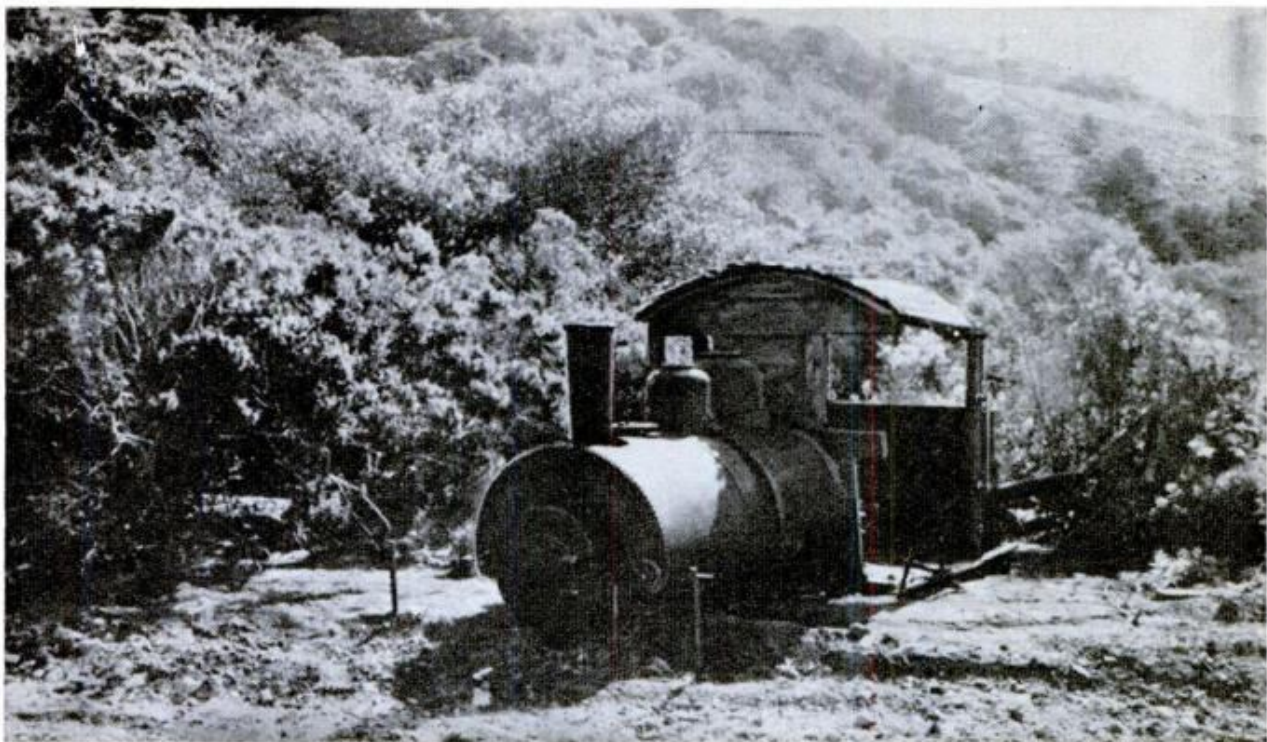
The Engine That Was Born Again

By Cliff Essex

Photos by Henry Sorensen and Gus Haggmark

Coach was donated by neighbor to give revived engine something to pull. Cupola converted coach to caboose





Engine looked like this when found, still riding on buried tracks. Nearly 10 years of work lay ahead

AROUND THE TURN of the century the rough forested hills of northern California's lumber country were laced with hard-working narrow gauge railroads. In time much of this equipment was abandoned and today is highly prized by collectors. Unfortunately it is sometimes impossible to remove this material because of the terrain, or because, in the wet

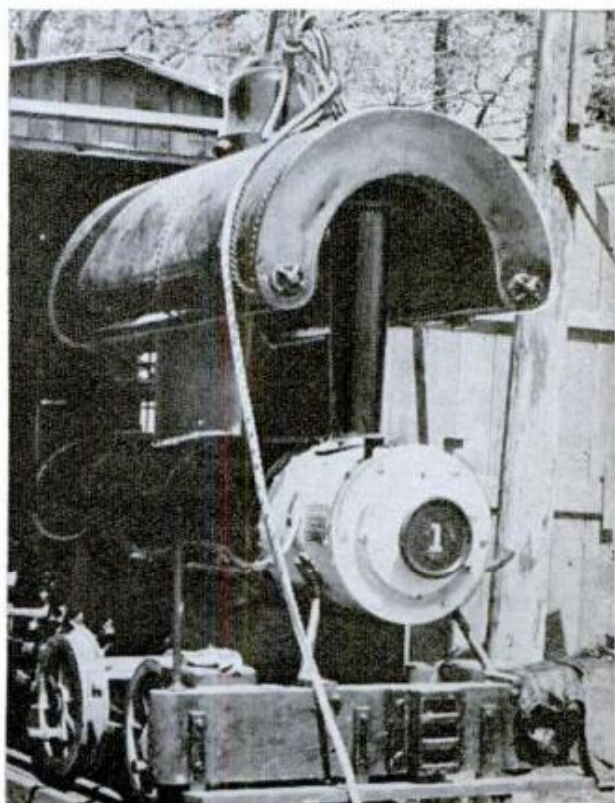
climate that encourages shaded ferns to grow five feet tall, wood and iron have rusted and rotted beyond use.

Henry Sorensen felt lucky when he found a locomotive near the ocean, away from the forest. But problems were apparent. The engine was buried up to her boiler in the dirt and gravel of a dry stream and would have to be dug out by

Sorensen (l.) and Haggmark (r.) chat with friend

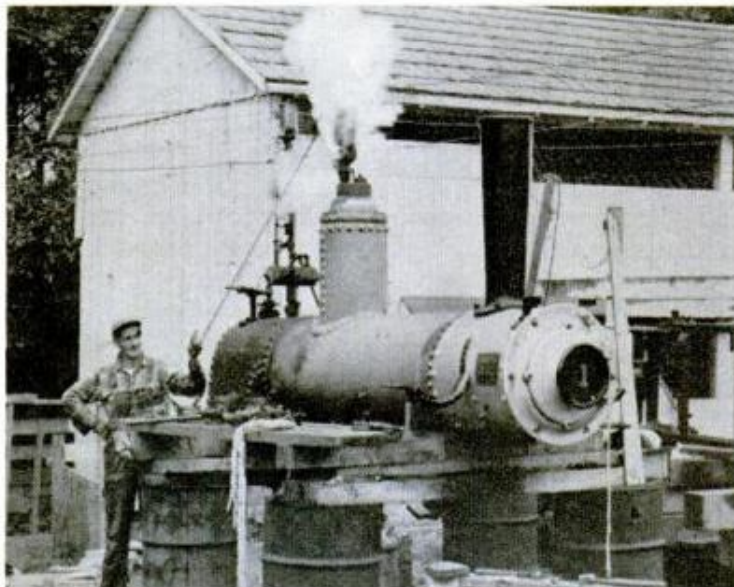


Saddle tank, all repaired, is lowered onto boiler





Entire cab had to be rebuilt by hand, since most of it had eroded away. Sorensen (right) took special night class in woodworking to learn how. Most of the engine's instruments and fittings had to be replaced



Sorensen estimates it cost him \$2000 to restore the engine. He saved on labor, however, which was mostly donated by friends



hand. Then it would have to be taken across the Mattole river somehow, and certainly an access road would have to be built. All this would have to be done while he was building a new home and running his poultry and dairy ranch 75 miles away to the north.

The relic was actually found by Henry's close friend, Gus Haggmark, who works for Pacific Gas and Electric and shares Henry's enthusiasm for old trains. Gus heard about it from a friend who had stumbled on it while quail hunting.

Investigation showed—and this alarmed Gus and Henry—that title to the old engine was owned by a man in Los Gatos, 300 miles away. He had acquired it in 1940 but lacked the opportunity to work on it, so Henry, for one dollar, became the proud owner on Dec. 29, 1949.

The locomotive had once been used for hauling tanbark from its terminal near the city of Petrolia, to a wharf out in the ocean, terminating at Seal Rock. About three miles long, the route curved around a hill following the Mattole River to its mouth, then along the rocky shore of the Pacific where waves came right up over the rail bed, to the wharf. Freight from the cars was "high-lined" to boats

(Continued to page 226)



Delicate Touch

Atomic scientists at a Hanford, Wash., research plant decorate Christmas trees in an unusual manner. They put the trees in cells where radioactive material is handled. They then place ornaments on them by remote control, using manipulators, getting practice for handling "hot" material.



Luminous Chair

Reading lamps are obsolete in homes furnished with a model from a new line of translucent plastic chairs. The chair itself is luminous and provides sufficient light for reading. A lounge model, it lights up from fluorescent tubing concealed under its foam-rubber cushion.

Russia Claims World's Largest Helicopter

With a gross weight of 84,000 pounds and a capacity of 80 passengers, the Russians have placed their MI-6 helicopter in nomination as the world's largest. Two 4635-horsepower gas-turbine engines drive the five-bladed main rotor and the smaller

four-bladed tail rotor, giving the craft a top speed of more than 165 miles an hour. The fuselage, which is almost as large as a modern airliner, can also carry vehicles which are driven aboard through clam-shell doors at the rear.



**SHOP NOTES
AND CRAFTS**



BRANCH OUT WITH SOMETHING DIFFERENT IN LEAF WALL DECOR

By Louis Pamper

THIS autumn branch of leaves "growing" on the wall of your living room or foyer will leave your friends agog. So real looking, they'll want to take a closer look, only to find that it is fashioned entirely from sheet brass and tubing. A conversation piece to say the least, it makes a striking and most unusual wall decoration.

Begin by making master tracing patterns of the four leaves given. A total of 100 leaves are needed in all, close to 25 of each size. Scribe the patterns on 24-ga. (.020) soft-tempered yellow brass and cut them out with snips. Flatten the curled leaves after cutting and deburr the rough edges with a fine file. Each leaf is embossed to simulate veining. This is done with a metal bar ground to a dull knife edge. Place the leaf on a hardwood block and then strike the embossing tool sharply with a hammer



BRANCHES AND LEAF STEMS are bent to various angles and shapes, giving an artistic, natural appearance



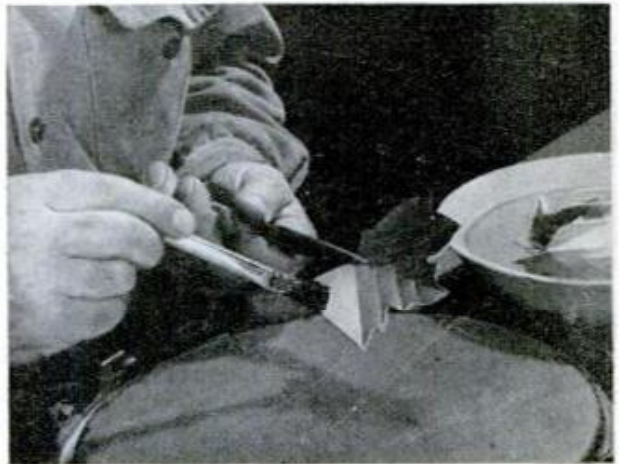
EACH LEAF PATTERN is first scribed on 24-ga. sheet brass and the outline carefully cut with duckbill snips



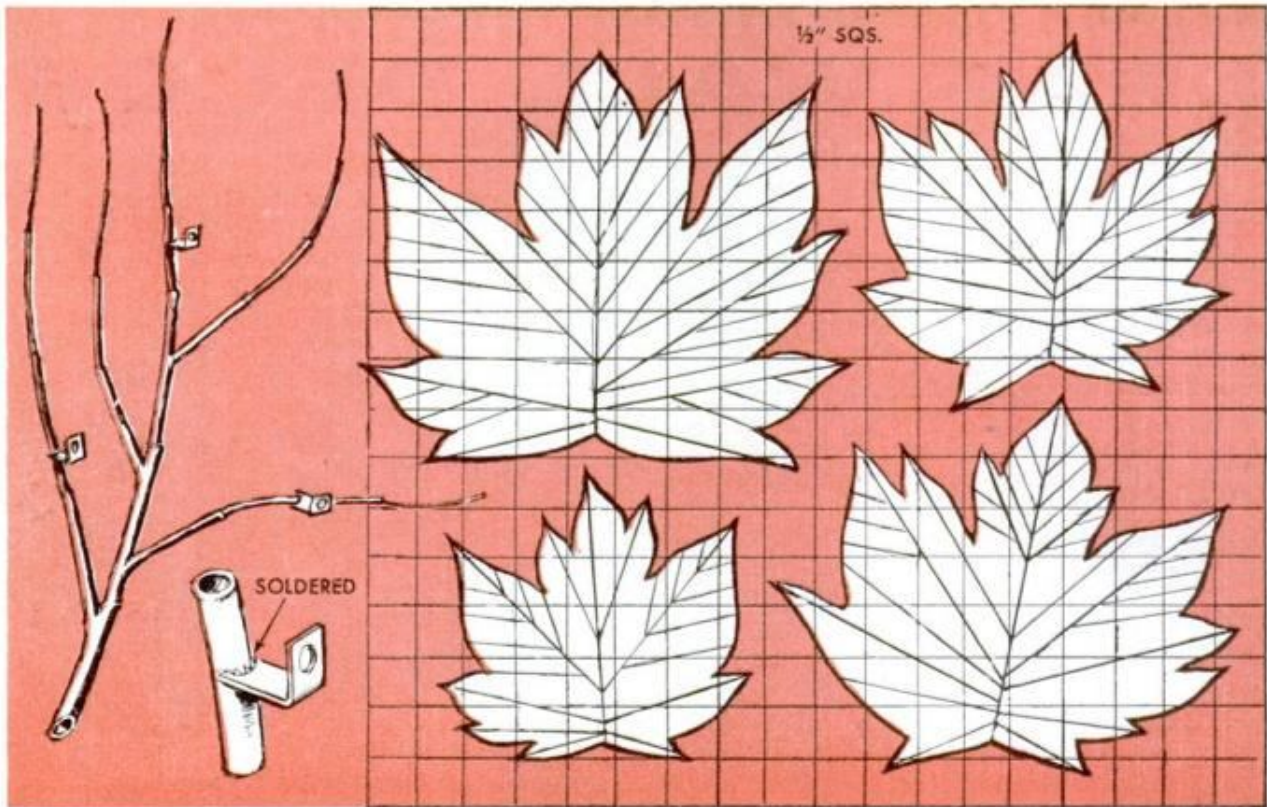
LEAVES ARE FLATTENED on a solid surface by tapping curled edges with hammer. Then edges are filed smooth



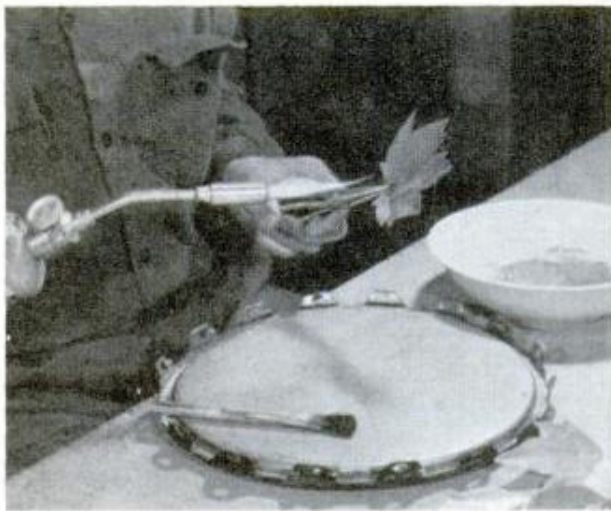
EMBOSSING OF LEAVES is done by striking knife-edge metal sharply while leaf is on hardwood block



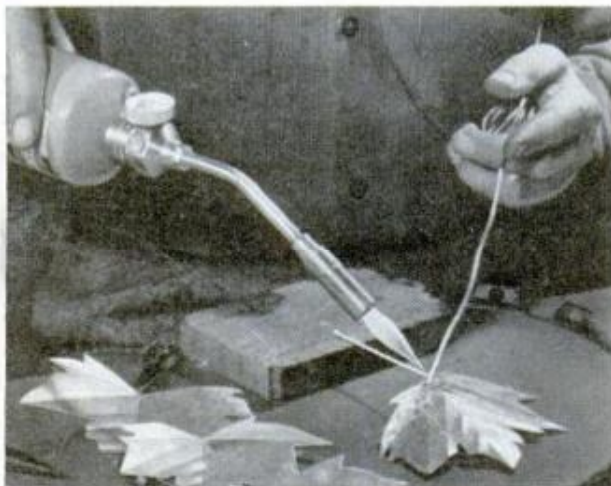
LEAVES ARE COATED with acid flux prior to coloring by dipping in acid few seconds or applying with brush



COLOR IS ADDED by playing flame of torch (below) to leaf and then quenching immediately in cold water



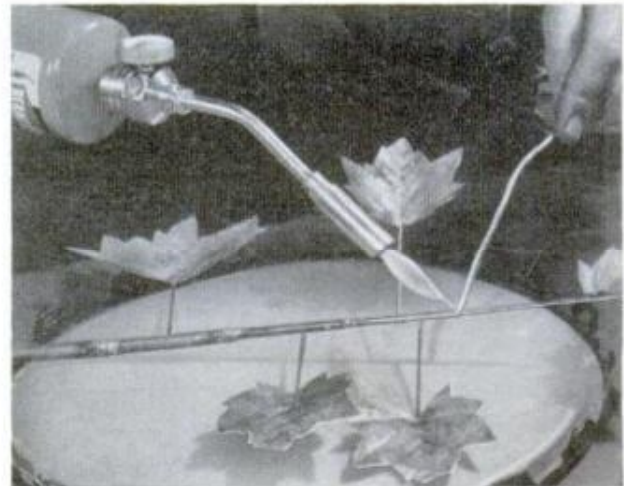
EACH LEAF IS FITTED with a stem soldered to the back. Welding rod cut in 3-in. lengths is used for stems



to indent, or upset, the metal. After embossing, the leaves are given an autumn hue by coating them with soldering flux (muriatic acid) and then playing the flame of a torch over them. Several leaves may be dipped in the acid at a time or the acid may be brushed on. Hold each leaf with pliers and heat with the torch until a greenish-blue vapor rises. Then immediately quench the leaf in cold water. With practice you'll learn the right moment to remove the flame. If you don't have a torch, you can heat the leaves over the burner of a gas stove. Acid remaining on the leaves requires neutralizing by immersing in a baking-soda solution, one cup soda to one gallon of hot water. Let the leaves "soak" for one hour, then rinse in hot water.

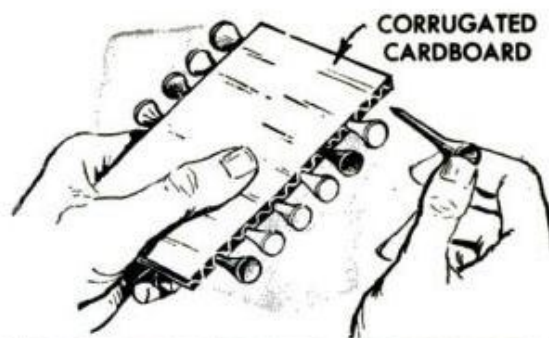
(Continued to page 230)

TAPERING BRANCHES are formed from telescoping sections of seamless brass tubing which are soldered



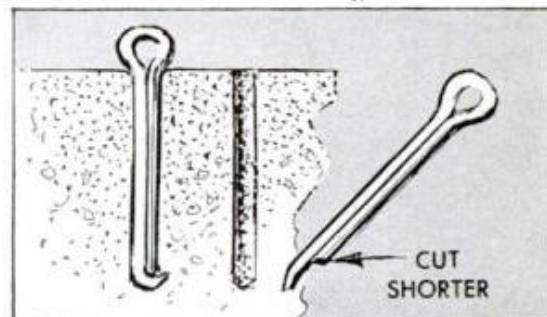
Rack Those Extra Golf Tees

Like a lot of other small items that must be carried about before being put to use, golf tees are easy to lose and hard to find when needed. To keep them in order and always at hand, rack a dozen or so in a piece of corrugated cardboard, the kind that's faced on both sides of the corrugation with heavy brown paper. Then stick the whole thing in your pocket or in your golf bag for safekeeping.



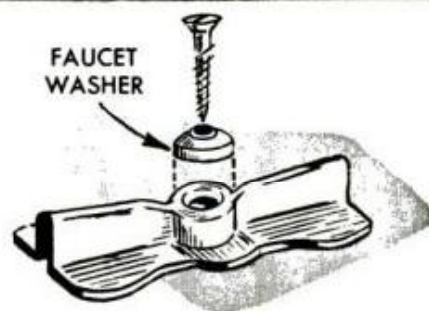
Cotter Pin Masonry Anchor

One of the simplest ways to anchor an eye in a concrete basement wall for supporting a clothesline or hanging a shelf is to use a large cotter pin. The eye is readymade and the pin can be altered so that it will anchor itself solidly. Just drill a hole, cut one leg of the pin shorter than the other, bend the long leg slightly and drive it in.



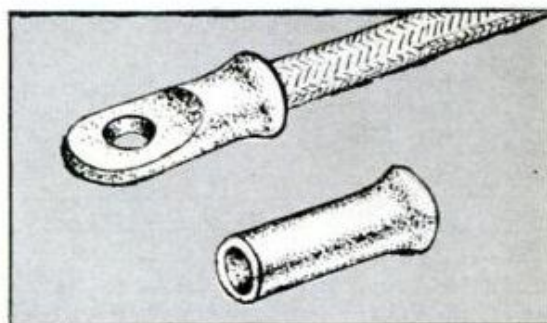
Faucet Washer Locks Turn Button

Turn buttons that hold storm sash and screens have a tendency to turn the screw as they are rotated to release the sash or screen. Because of this the buttons are likely to be quite loose after being released a few times. If you turn the screw down on a rubber faucet washer, you won't have this trouble.



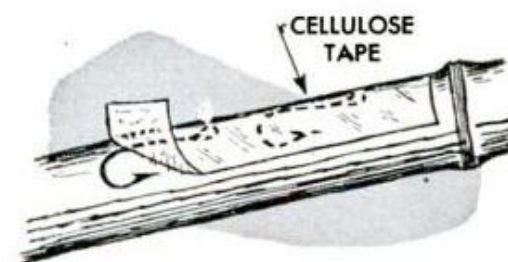
Replacement Terminals

Replacement terminals for electrical connections in the wiring system of your car can be made quickly from copper tubing. Terminals suitable for generator and starter cables, for example, can be made from 5/8-in. lengths of tubing. Simply flare one end of the tube, fit over the bared wire and solder. Then flatten and drill the end as detailed.



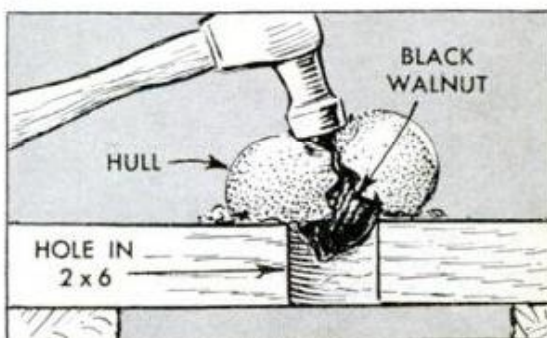
You May Need Extra Fishhooks

Fishermen who work narrow, sluggish creeks for catfish or bullheads don't always bother carrying a complete fishing kit. But should a hook snag irretrievably, an extra hook will be needed to save the fishing day. One way to carry the extras safely is to stick them to the pole with a strip of cellulose tape.



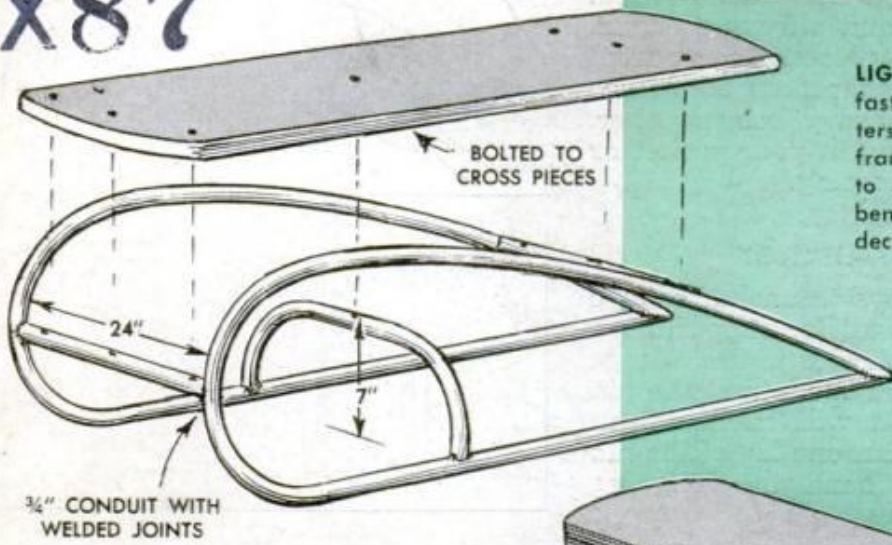
Easy Way to Hull Walnuts

Long before mechanical hullers were heard of grandpa used this method of "shucking" walnuts. And for the fellow with only a bushel or two of walnuts to hull it's still one of the fastest and cleanest hand methods. Just drill a hole through a 2 x 6 near one end, place the nut over it and tap with a hammer or mallet. The nut will go through the hole but the hull will be stripped off cleanly.

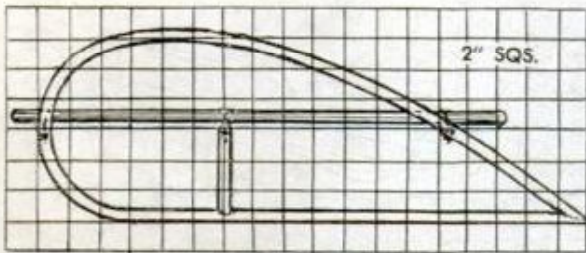


FUN ON RUNNERS

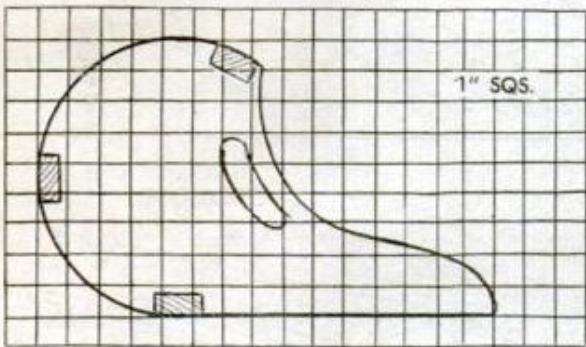
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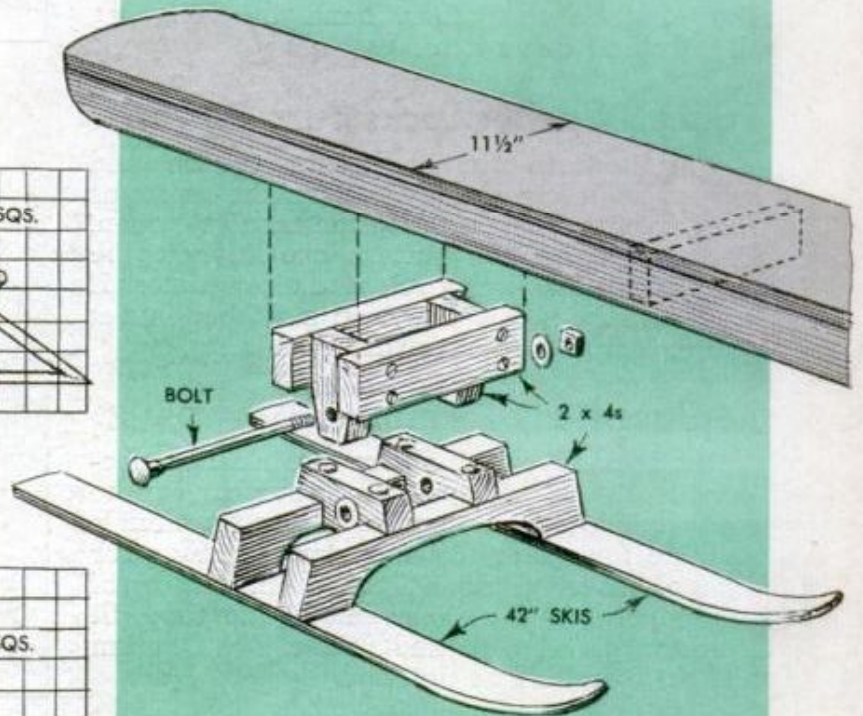
LIGHTWEIGHT COASTER is the fastest thing on runners for sitters or belly floppers. Make the frame of rigid metal conduit bent to shape with an electrician's bending tool. Attach the plywood deck with 1/4-in. carriage bolts



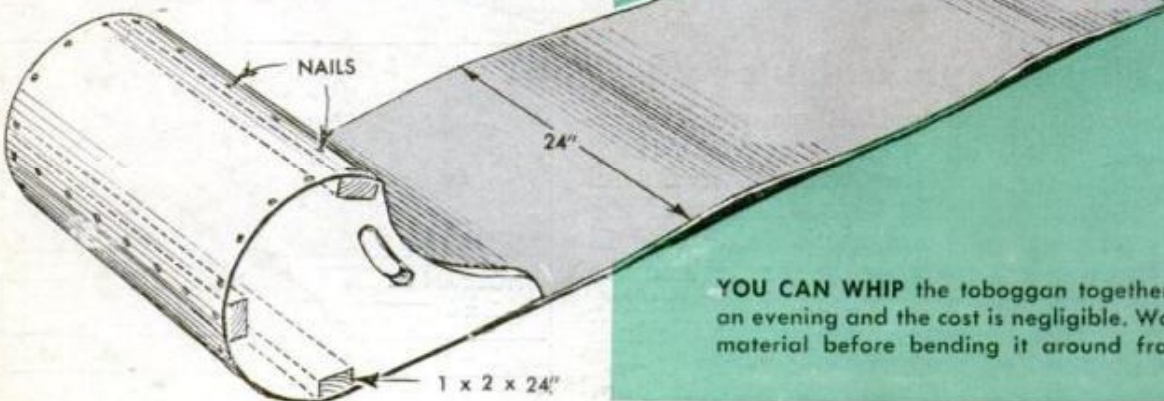
LIGHTWEIGHT COASTER



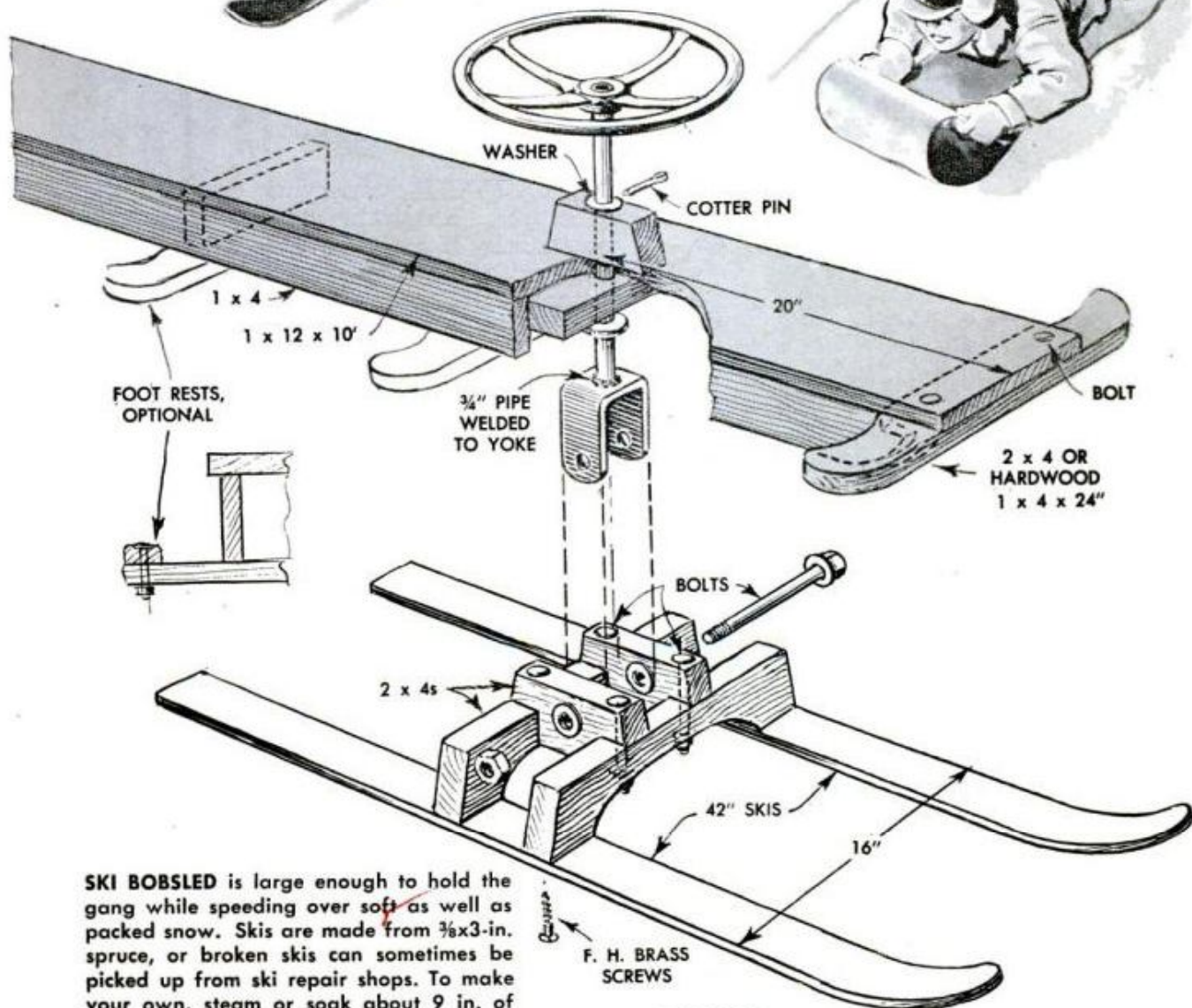
JIFFY TOBOGGAN



LINOLEUM UNDULATES WITH SLOPE

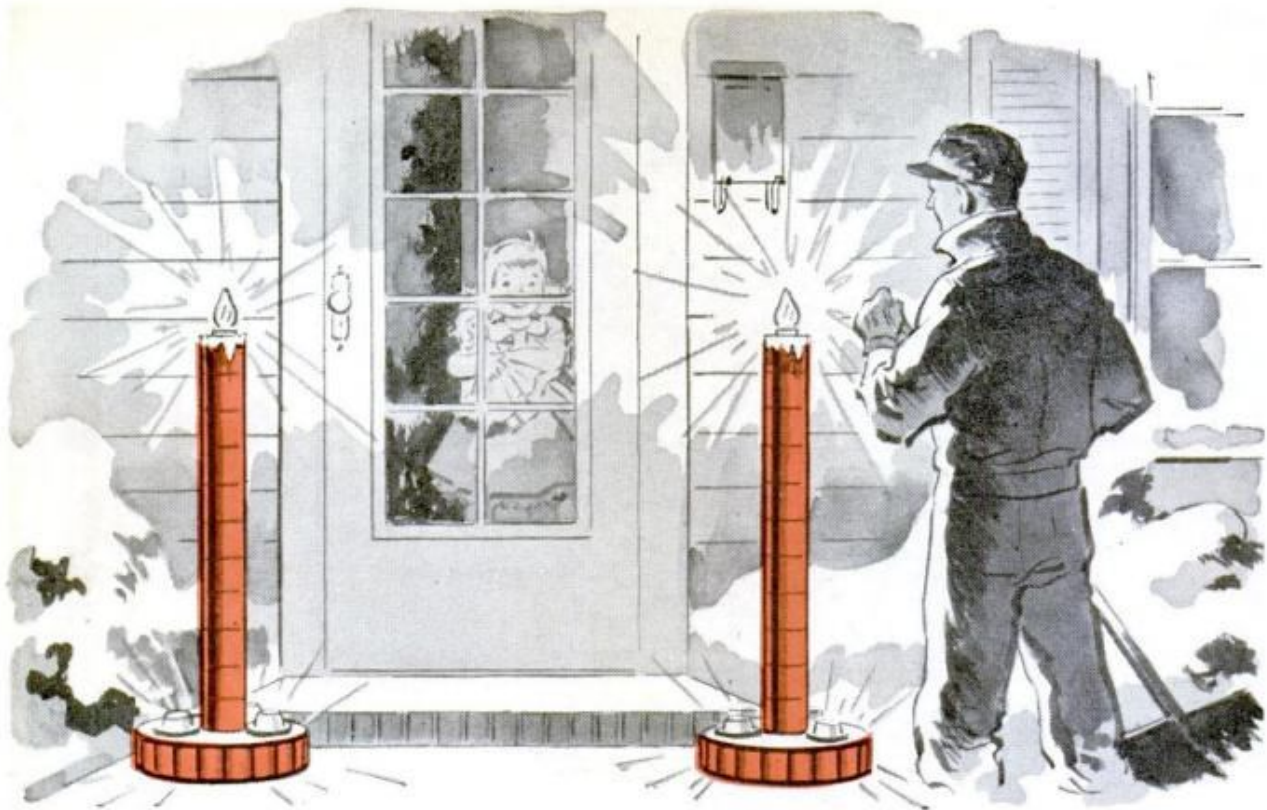


YOU CAN WHIP the toboggan together in an evening and the cost is negligible. Warm material before bending it around frame



SKI BOBSLED is large enough to hold the gang while speeding over soft as well as packed snow. Skis are made from $\frac{3}{8}$ x 3-in. spruce, or broken skis can sometimes be picked up from ski repair shops. To make your own, steam or soak about 9 in. of the ends and bend them over curved forms

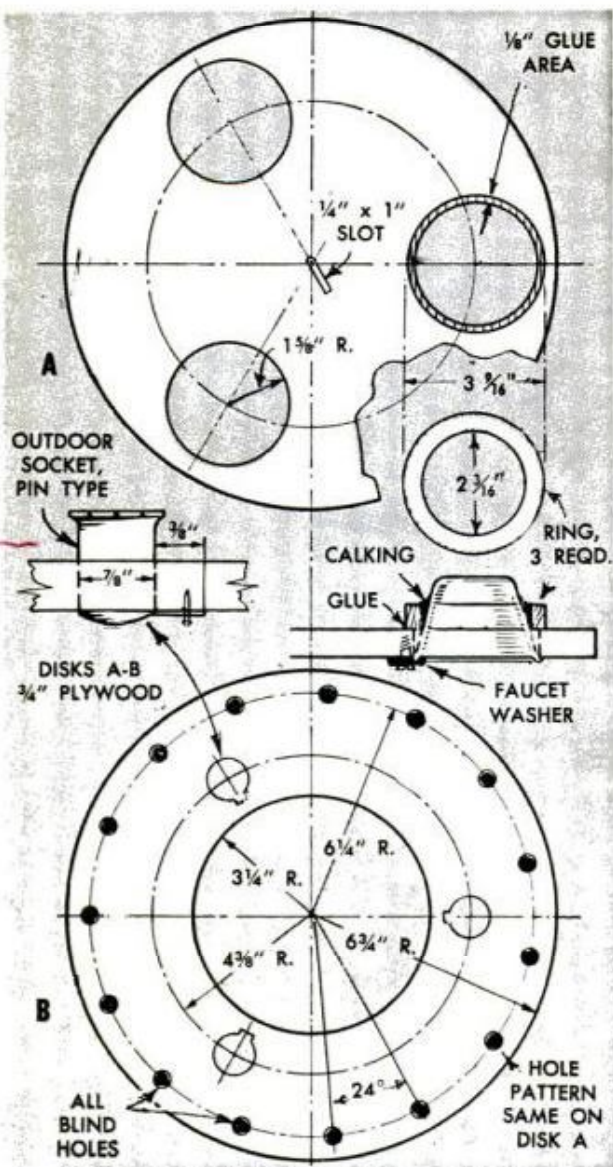
SKI BOB

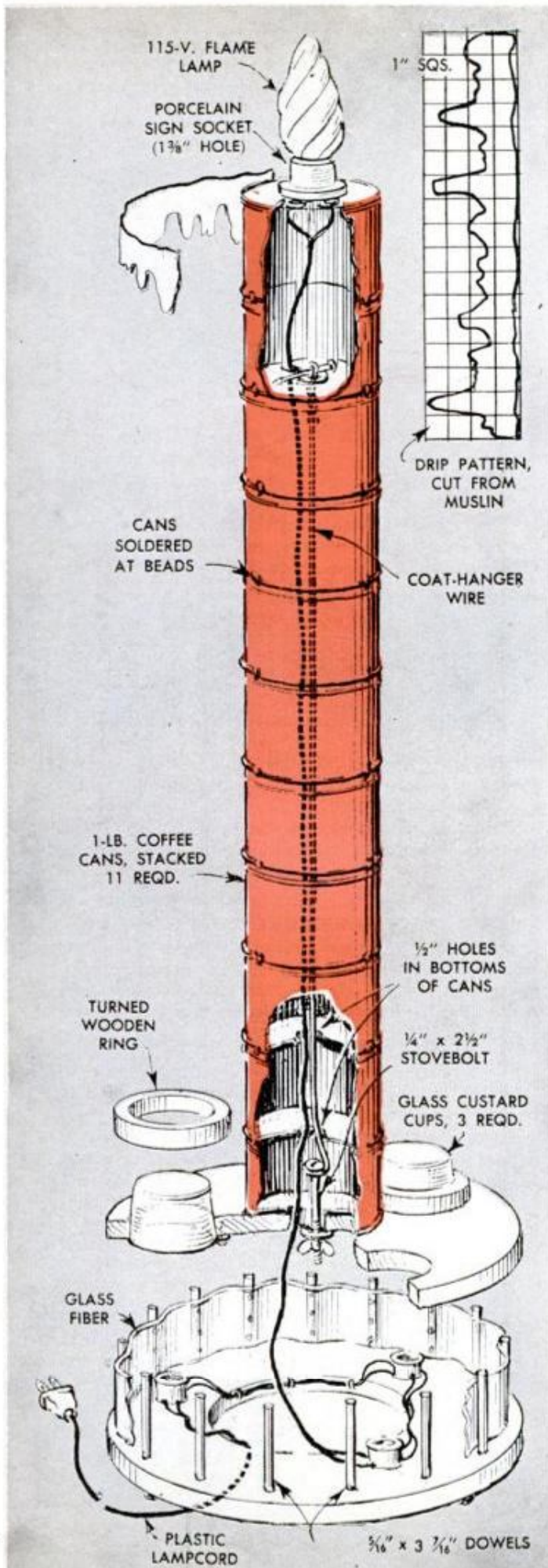


CANDLES LIGHT YOUR DOORSTEP

HOW BETTER can you express the warmth and hospitality of the holiday season than by lighting your doorstep for all to see with these towering candles? A look at the details on the opposite page and you'll see that each candle is made by stacking and soldering eleven 1-lb. coffee cans and then mounting on a base made by assembling two disks of plywood with a 2 1/4-in. wide strip of colored glass fiber between. See the details A and B at the left for construction of the base and sizes of parts. Note also from the detail on the opposite page that the top can is inverted and its top is soldered to the top of the one below it after the base and column, or body, of the candle are assembled. Each of the 11 cans has a 1/2-in. hole centered through the bottom to permit insertion of the anchor wire and lamp cord. The anchor wire holds the base in place as will be seen from the detail. Glass custard cups serve as globes for the three bulbs in the base. Each globe is held in place over the holes bored in the base disk, detail A, by a wooden ring and screws driven up from the bottom of the disk and through faucet washers. When the assembly is complete solder the top coffee can in place, fit the socket and flame lamp and complete the wiring. Add the drip pattern which is glued in place. Then paint the column and base red.—A.L. Mills

use C 9 1/2 Xmas-type bulbs

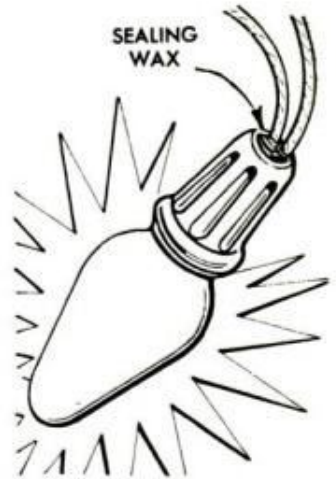




DECEMBER 1960

Socket Repair

To increase the life of Christmas-tree light sockets and prevent entrance of moisture which might short the wiring, fill the open end of each socket with wax. Center the lead wires in the opening so that the wax will flow and level around them.



Sanding Block

Sandpaper cemented to a length of cove molding makes the perfect sander for chair legs, clothes poles or any rounded surface. Glue a block to the back of the molding to serve as a convenient hand grip.



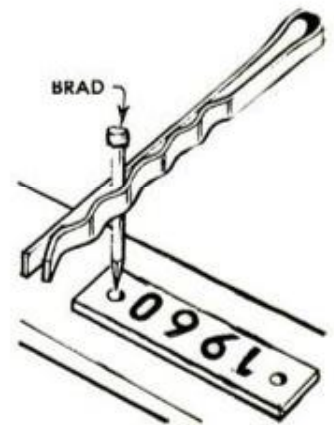
Brush Storage

After using a sign painter's or artist's brush, dip it in petroleum jelly to prevent it from hardening in storage. Before using again simply rinse the brush in a solvent to remove the jelly coating. Turpentine is a suitable solvent.



Brad Holder

When driving brads save your fingers by using a bobby pin as a holder. It will hold the brad in the desired position until it is started and there's no danger of injury. A light pull releases the pin and the brad is then driven home.



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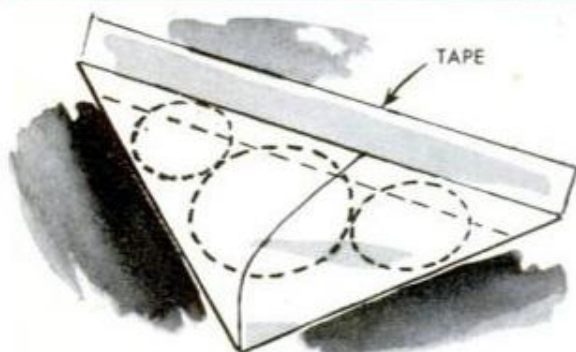


A STRIP OF SANDPAPER glued to a bottle of medicine can serve as a warning to anyone in the home other than the person for whom the medication has been prescribed. Use coarse sandpaper so that the bottle is easily located by feel alone, should this ever be necessary. Also, it's a good idea to destroy all prescription medicines after they have served their purpose



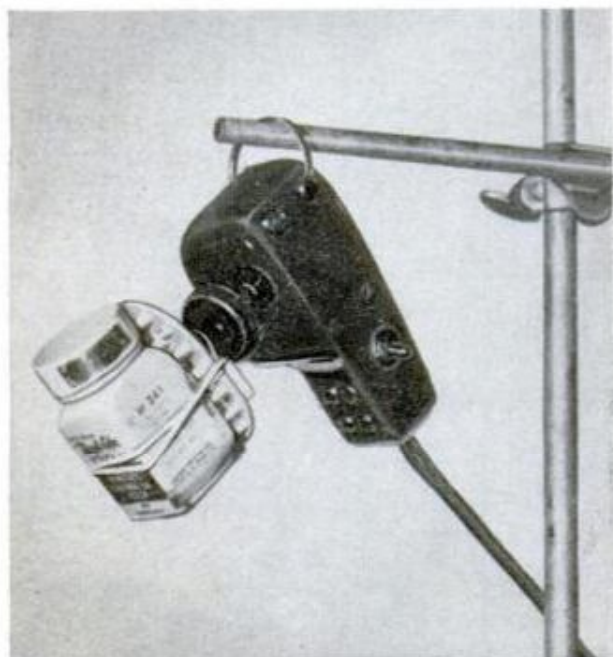
MOTORISTS, HERE'S A TIP for those cold winter days when fogged-up windshields and windows make driving difficult and hazardous. Spray the glass surfaces with a regular spray-type window cleaner to which has been added just enough soap flakes to make the solution cloudy. When wiped from the glass, an invisible film will remain to keep the glass clear

SOLVING HOME PROBLEMS



WHEN MAILING COINS, don't place them loosely in the envelope, but try handling them this way: Cut the corner from an old envelope, place the coins inside, tape the open end shut and slip this little container right into the regular mailing envelope

PIGMENT WHICH HAS BECOME CAKED in the bottom of a small container can be brought back to uniform suspension by attaching the container to an ordinary household 60-cycle vibrator, as shown below left. The vibrator's frequency is just perfect for the job



OPENING PAINT CANS, below, is a snap with this handy little device which can be made in a few minutes. Simply drive a large-headed nail into one end of a stick or dowel, slip the nail head under the lid, pry backward and the lid will pop right off



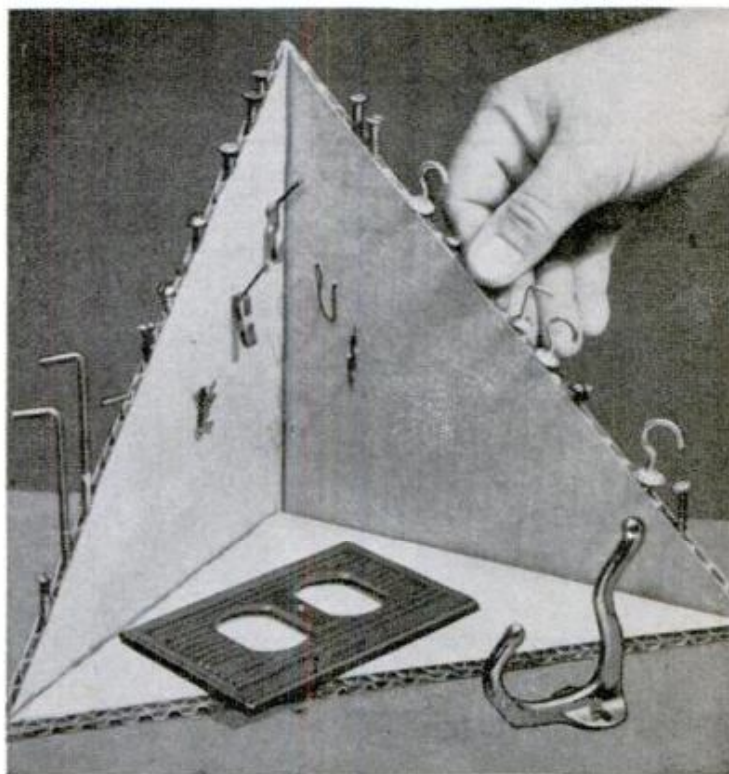
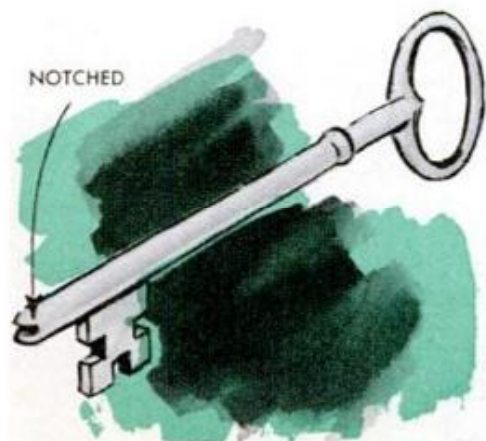
NEWLY WASHED SHEETS, bedclothes and other items are likely to develop a stale, musty odor if left stored in a drawer for any appreciable length of time. One simple, effective and inexpensive way to prevent this is to place a bar of sweet-smelling soap in each drawer



CLEANING A READY-MADE BOW TIE need not be a chore. Simply fill a jar $\frac{1}{2}$ full of home-type cleaning fluid, immerse the tie in this and close the lid tightly. Thirty to sixty seconds of vigorous shaking of the jar will clean the tie thoroughly

REDECORATING YOUR HOME can throw things pretty much into confusion unless you provide beforehand a place for those hooks, screws and other items that are so easily lost. Best way to keep track of them is to cut the bottom corner from a cardboard box and then insert the items into the openings in the corrugations

THERE COMES A TIME in the life of every family when junior locks himself in the bathroom. Foreseeing the possibility of this happening, saw a slot in the end of the key so it can be turned by inserting a small screwdriver through the keyhole



MAKE IT A Merry Christmas

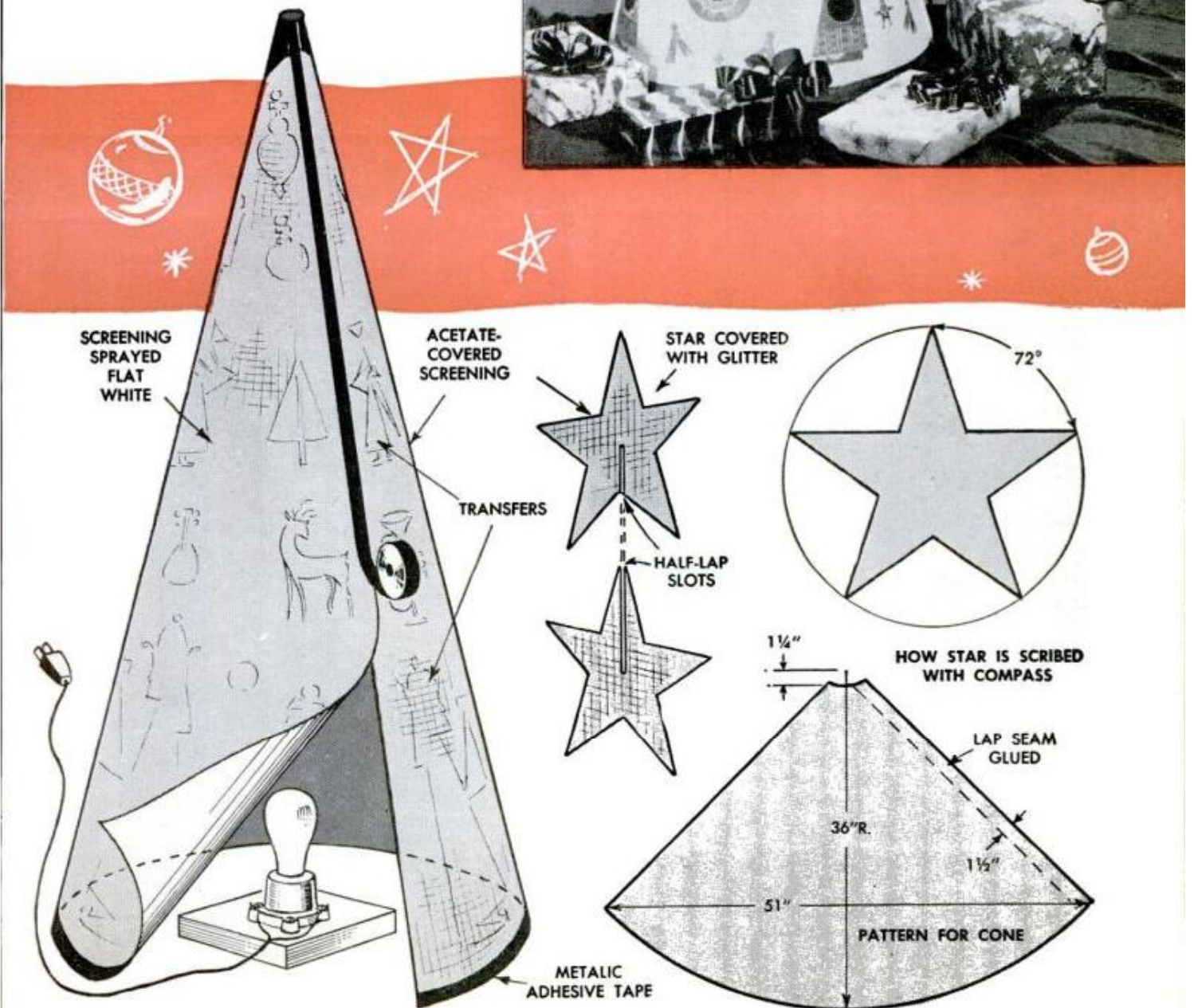


EVERYONE has their special way of making Christmas merry. But the guy or gal who likes to make things has a way all their own of *making it* so. Making someone happy with a gift gives the greatest satisfaction when the gift is the handiwork of the giver. Whether dad is making something for the youngsters or Johnny is making a gift for mom, or the family is decorating the house for the holidays, there's a special kind of merry Christmas that comes only to those who enjoy working with their hands.

The following 16 pages are packed with many clever things to make for Christmas, either as gifts or decorations. All have been carefully selected for their simplicity and uniqueness. Some can be made in an evening, others will take longer. But if you get started now, you'll have ample time to *make it* a MERRY CHRISTMAS.

Glowing Christmas Tree

Strikingly different, this modern version of a Christmas tree is a cone of acetate-coated wire screening, sprayed white and decorated with gold, red and green Rhinglas transfers. When placed over a 100-watt bulb, the translucent tree glows from within and sends a shaft of light out through the top to illuminate a glittering star perched atop. Acetate-coated screening, such as Cel-O-Glas, is the kind used to winterize breezeways, doors, windows, etc., and can be purchased from both Sears and Wards as well as local hardware stores. You can get the transfers at art and paint stores. Cut the coated wire from a paper pattern, using snips or old scissors. Then, before rolling into the conical shape, spray it flat white on the outside and apply the transfers as you would decals. Finally, form it into a cone, cement the seam and cover both seam and edges with gold metallic adhesive tape. The star is made of coated wire, too, covered with glue and sprinkled with gold glitter





IONS ★ MAKE YOUR OWN DEC

Fanciful and Beautiful

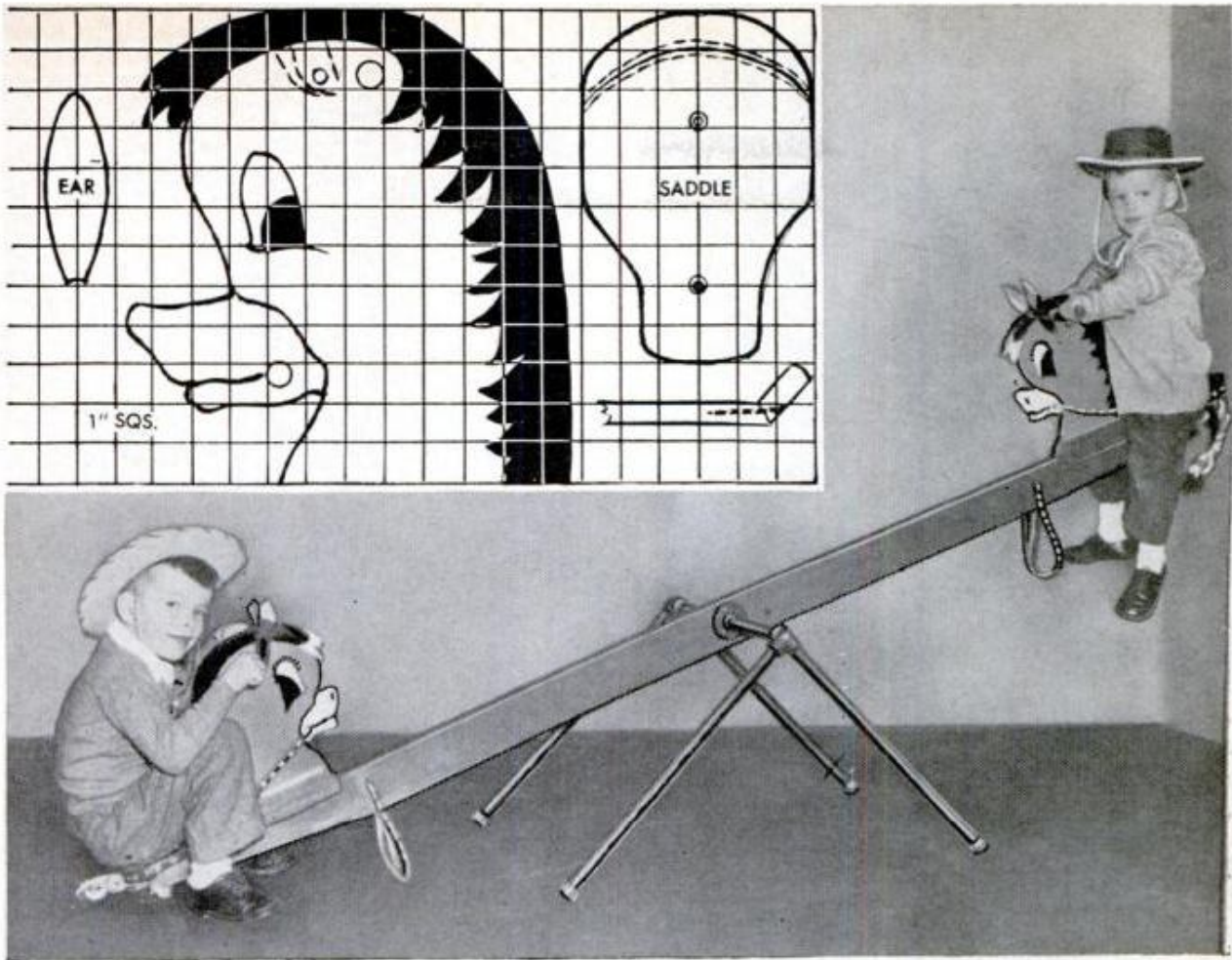
No two of these weird but really beautiful candle centerpieces will be alike since there is no control in forming them. Looking like fairy-tale formations of colored icicles, these unusual Christmas candles are formed by dipping a container of melted paraffin in water quickly and lifting out. Here is how one is made: A dipping rack is first made of wood to fit a pail or other large container; the bathtub will do. Then any glass or foil container, a small pie pan or ashtray are perfect, is placed on the rack and a white or colored candle is supported upright in the container by tying the wick with a string to the handle of the dipping rack. Melted paraffin, to which a little stearin is added, is poured in the container and a few pine cones or small ornaments are placed in the warm wax. The setup is plunged into cold water, in and out quickly. The submerged wax seeks the water level and crystallizes instantly into the most unusual formations. The deeper the water, the taller the formation. The wax, of course, will embed the cones as well as tiny ornaments in a solid mass. Further ornamentation can be added by tying ribbon bows or angel figures to the candles to suit your fancy

★ MAKE A GIFT FOR CHRISTMAS ★ MAKE A



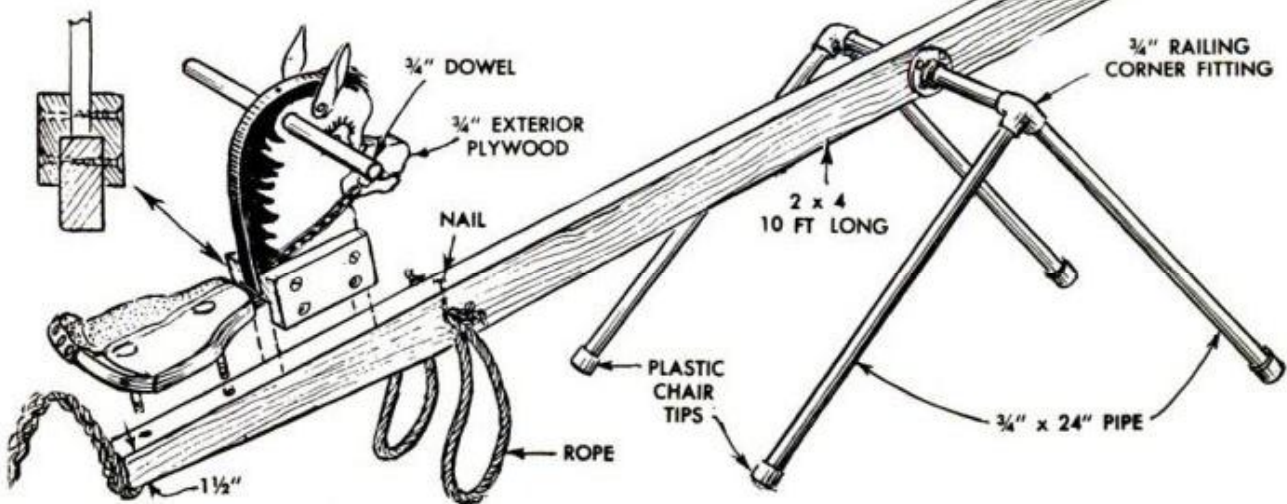
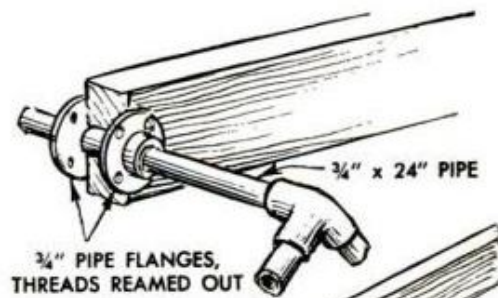
★ MAKE YOUR OWN DECOR





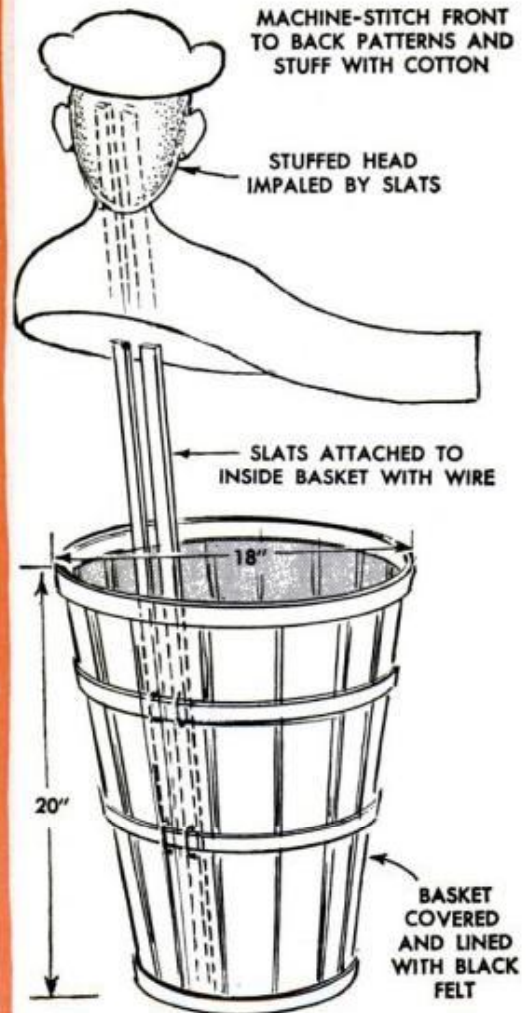
Bronco Buster Packs Rough Ride

Taming the wild ones becomes kid's play on this ride-'em-cowboy seesaw. The beam is a 10-ft. 2 x 4 set on edge and supported by a pipe stand assembled from standard fittings. Two pipe flanges, reamed out to remove the threads and screwed to opposite side of a hole bored through the 2 x 4, provide bearings through which the pivot pipe passes. Horse heads are of plywood for strength, a broomstick or dowel form handholds. Saddles are fashioned from pine and padded. Stirrups and horse tails are hemp rope. Painted bright colors, young riders will whoop it up Christmas morn





★ MAKE YOUR OWN DECORATION ★

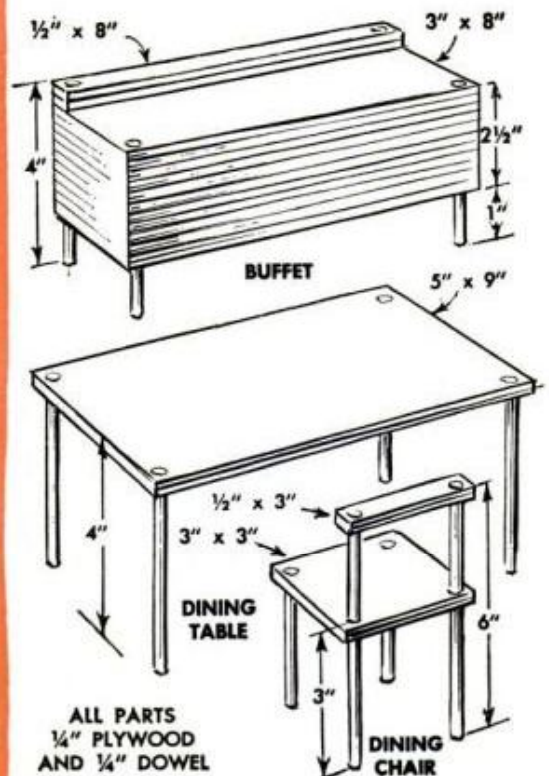


★ MAKE A GIFT FOR CHRISTMAS ★ MAKE A

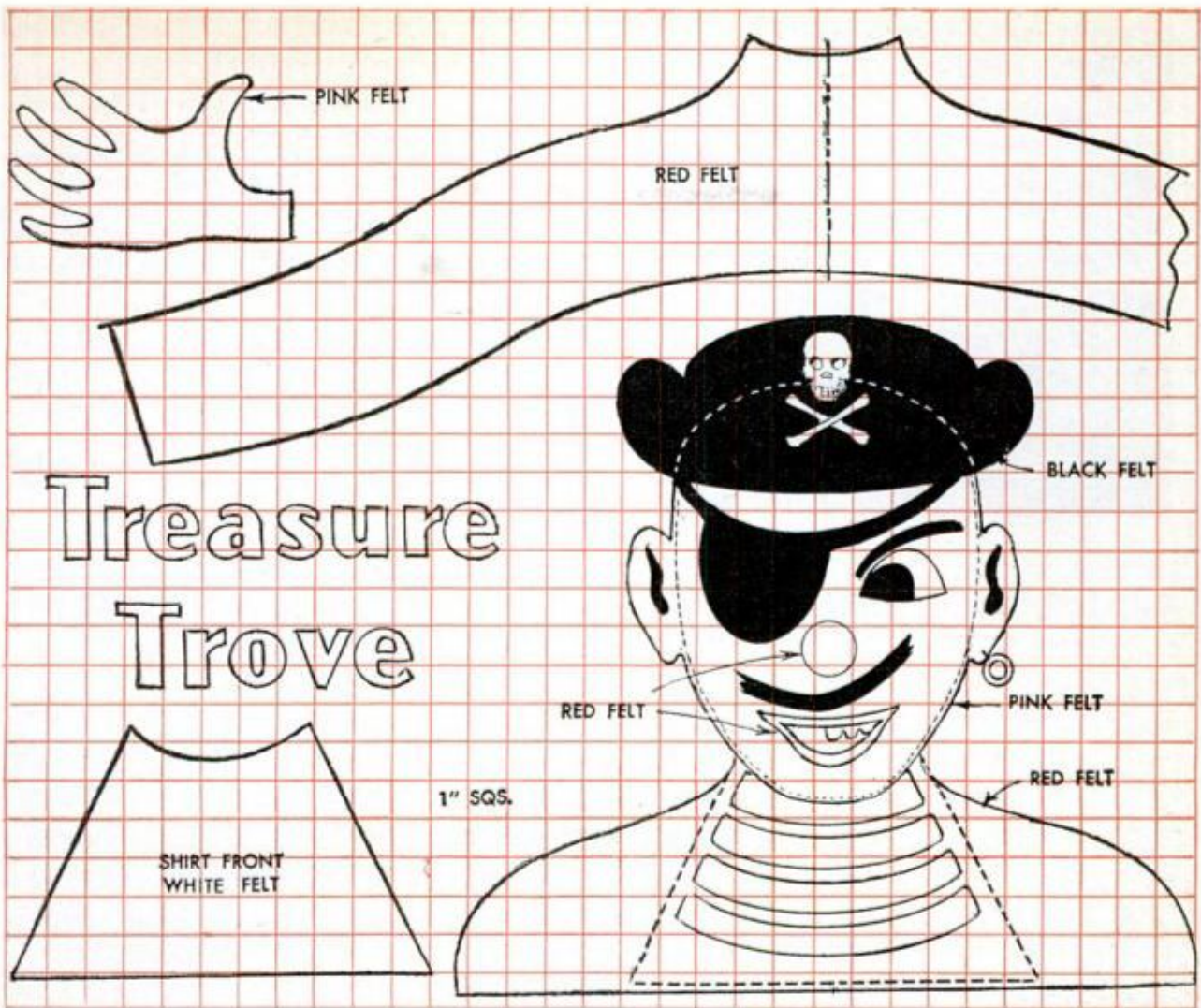
Pirate's Treasure Trove

Fill it with gifts on Christmas morning, then let it round up toys the rest of the year. This cute idea takes care of the toy clutter in a child's room. Start out with a fruit basket about 20 in. tall and wire two wooden slats 20 in. long to the inside to support the pirate's head. Next sew a double sleeve of black felt so it will pull over both inside and outside of the basket and glue it to the bottom edges. Cover the bottom likewise. The pirate is sewed together as a separate unit, doubling up on the various patterns and stitching them together at the edges but leaving the bottom of the head open so it can be stuffed with cotton. The features are glued in place, after which the stuffed head is forced down over the supporting sticks. The red-felt arms are wrapped around the basket to meet pink hands which are stuck in place with glue. Skull and cross bones are glued to the hat, and the words "Treasure Trove" are cut from white felt and glued to the front. The striped shirt front is made by backing up the openings with white felt. This is done only in the front half of the shirt pattern. Complete the dashing pirate by sewing a plastic curtain ring to one ear and a "diamond" to the ring finger of the left hand

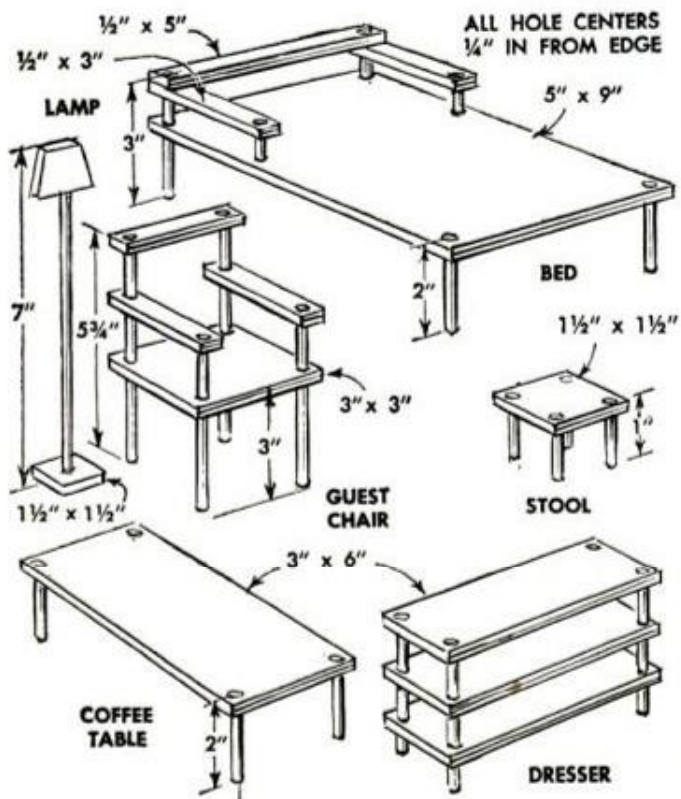
★ MAKE YOUR OWN DECORATION ★



POPULAR MECHANICS

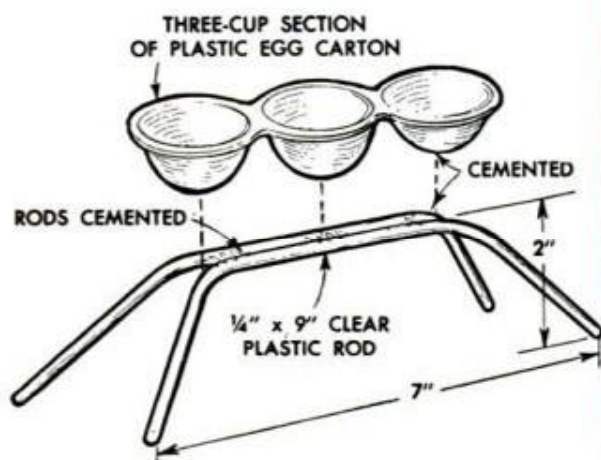


GIFT FOR CHRISTMAS MAKE A GIFT FOR



Quickie Doll Furniture

Scraps of plywood, a few short dowels and an evening are all it takes to make this simple set of doll furniture. Holes for the dowels are made slightly undersize so the parts fit snugly. Alignment of holes is assured by drilling two or more parts at one time. Sandwiched parts form the buffet



Mini-Candelabra

Plastic egg tray provides cups for candles of this miniature candelabra which are cut from tray with coping saw and cemented to plastic stand. Two extra cups provide mold for casting ball candles. Pouring hole is made in one, string wick inserted and both cups are taped together for pouring each candle

Royal Card Holder

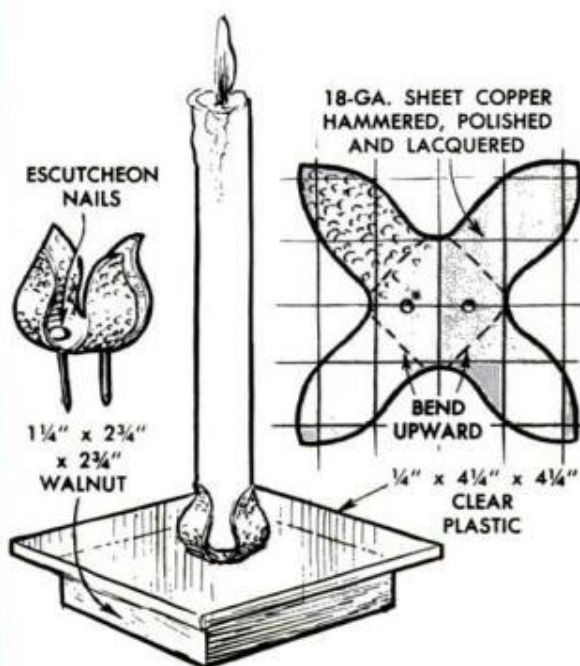
King-size crown fashioned from cardboard paint-bucket liner makes holiday holder for greeting cards. Liner is cut down, painted gold and decorated with red and green sequins



Novel Candlesticks



Firly one at left is bright foil pie plate slitted around edge and curled inward. One below consists of fancy wood block topped with square of clear plastic and fitted with metal candle socket of hammered copper



★ MAKE YOUR OWN DEC ★

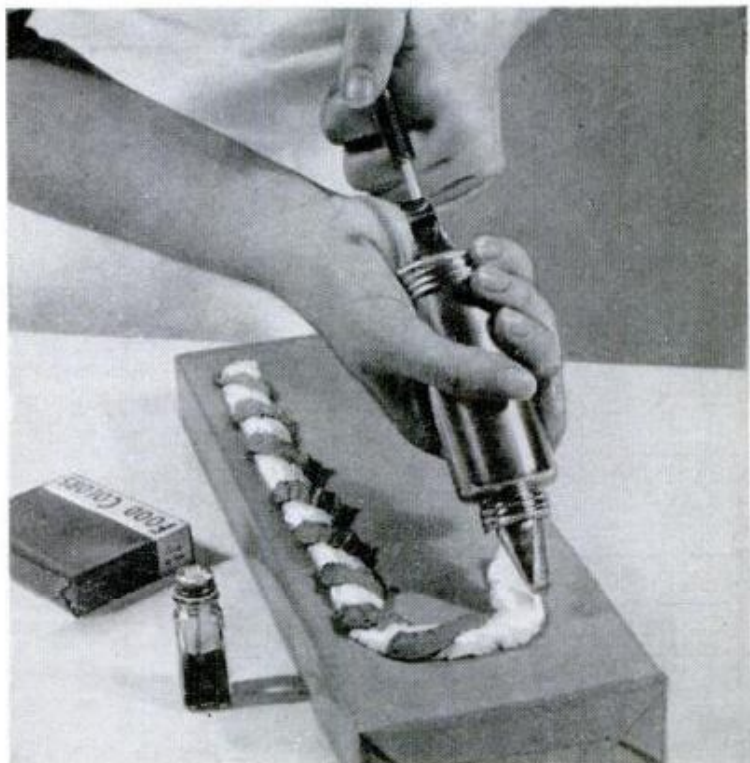
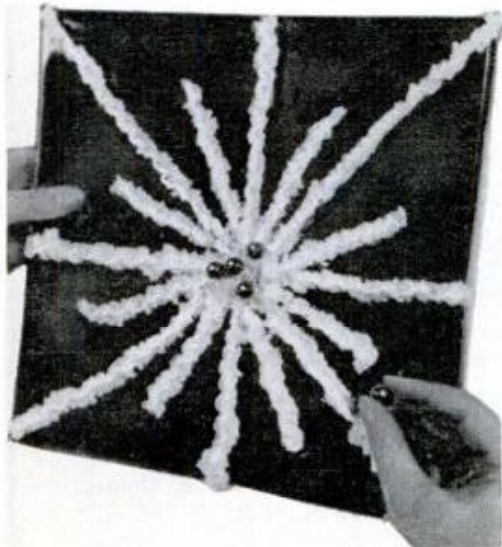
★ MAKE YOUR OWN DEC ★



Gift-Package "Icing"

Ever think of decorating your gift boxes like a cake? You can do it cleverly with a mixture of snow-like suds whipped up from a handful of soap flakes. Use your cake mixer and add soap and water until mixture stands in snowy drifts. Snowflakes can be formed by putting the

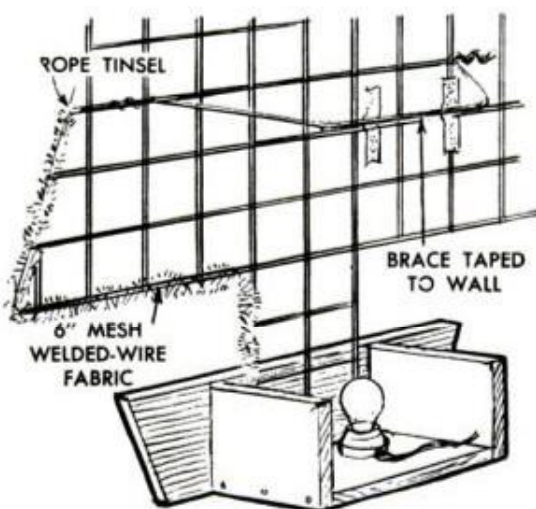
mixture in a cookie press. A pastry tube or plastic squeeze bottle is used to write greetings and form ribbons, using a somewhat thinner soap mixture. If left to dry for a day or two, the snow suds will dry and harden into a permanent decoration that won't brush or rub off





Greeting-Card Tree

Cut tree-shape from a scrap of welded-wire fabric, which normally is used to reinforce concrete, and then trimmed with strands of rope tinsel, this dazzling Christmas tree displays the greeting cards you receive. Floodlighted from below, the tree is set in a wooden "planter" and taped to stand 6 in. out from the wall. The wire mesh is painted white, ball ornaments are hung here and there and small tabs of cellophane tape are used to hold the cards in place



★ MAKE A GIFT FOR CHRISTMAS ★ MAKE A

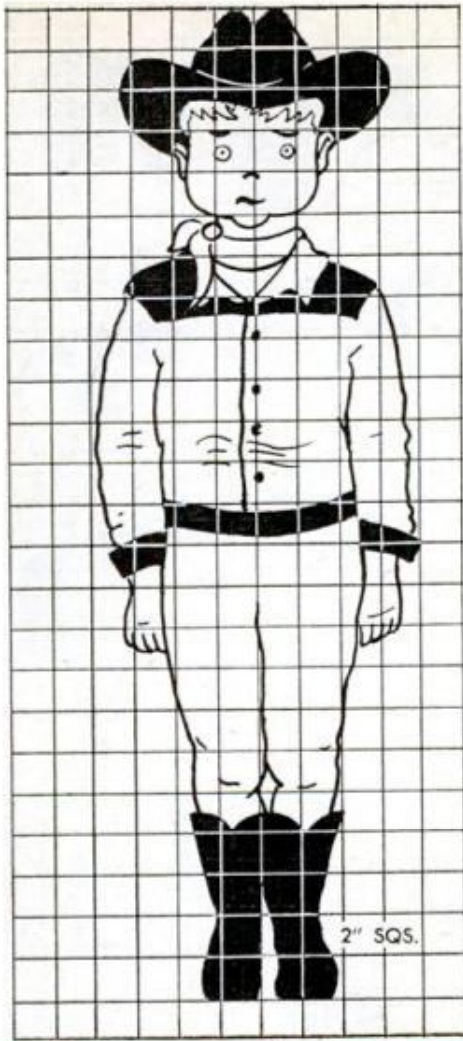


Lawn Santa Cutout

Your home takes on a holiday mood to passersby when a jolly Santa is stationed outside. Made any size you wish, you can cut him out in a hurry with a portable electric jigsaw. To enlarge the pattern, rule off on wrapping paper the same number of squares as given, drawing them 4 or 4½ in. square. Then with the squares of both patterns numbered for quick reference, the small pattern is enlarged by drawing in the portion of the outline that appears in the corresponding square. Be sure to use exterior plywood and give the cutout a coat of shellac after you cut it out. Paint Santa's suit bright red, boots black, fur and whiskers white. Prop Santa up from behind and put a spotlight on him at night

READY-DRAWN PATTERN AVAILABLE

If you don't feel equal to enlarging the Santa pattern yourself, you can buy a 42-in. pattern ready for tracing. Send 50 cents in-coin to Blueprint Dept., Popular Mechanics Magazine, 200 E. Ontario Street, Chicago 11, and ask for pattern No. 121



MAKE YOUR OWN DECORATIONS



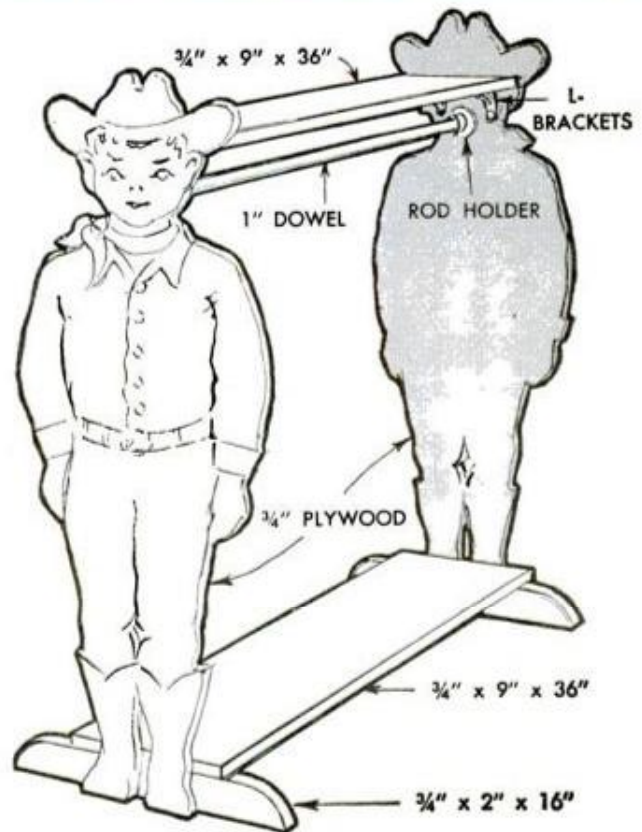
GIFT FOR CHRISTMAS MAKE A GIFT FOR

Wrap Wrangler

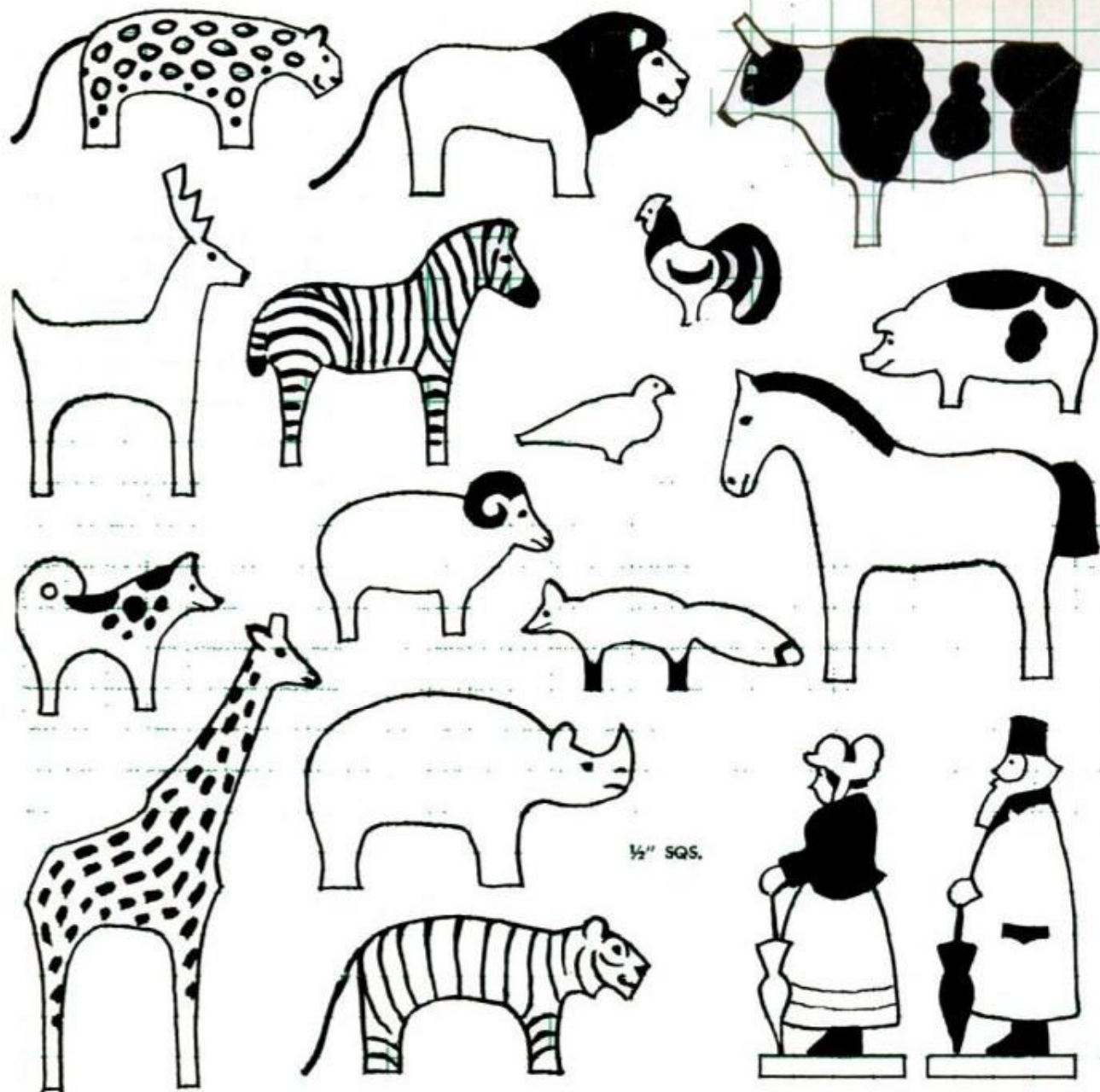
Young cowpokes who can barely reach the stirrups as well as a coat hook will find this western wardrobe rack just the thing to corral stray play clothes. Two cowboy cutouts standing 48 in. tall support a shoe and boot rack at the bottom and a hat shelf and clothes rod at the top. The drawing details the parts. Both cutouts can be jigsawed from a 3 x 4-ft. sheet of plywood, tracing a full-size pattern on $\frac{3}{4}$ -in. material. The magazine pattern is enlarged by ruling off 2-in. squares on wrapping paper. Both cowboys are painted alike: yellow for the hair and shirt, light blue for eyes and pants, white for neckerchief, red for hat and mouth, light tan for face, hands and neck and dark brown for the rest. The backs of the cutouts are painted bright red as is the rest of the parts of the rack. Regular clothes-rod sockets are used to support the pole between the cutouts

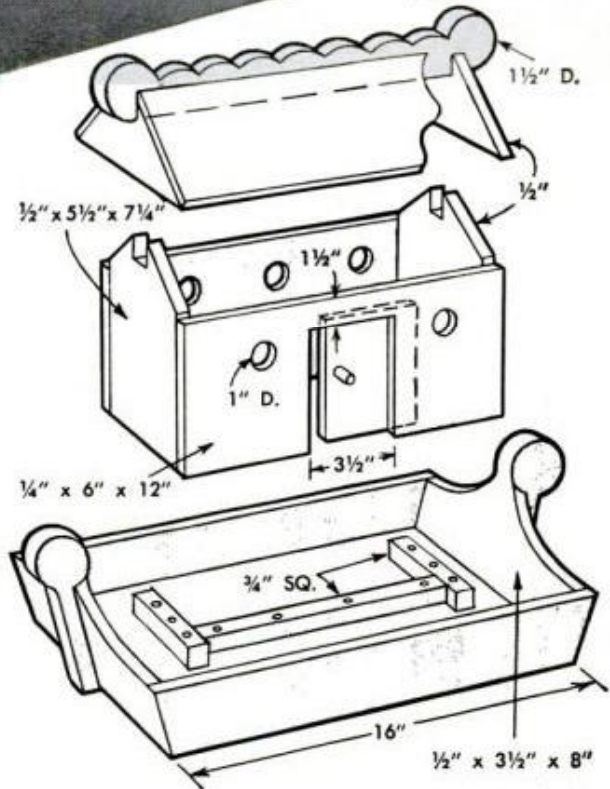
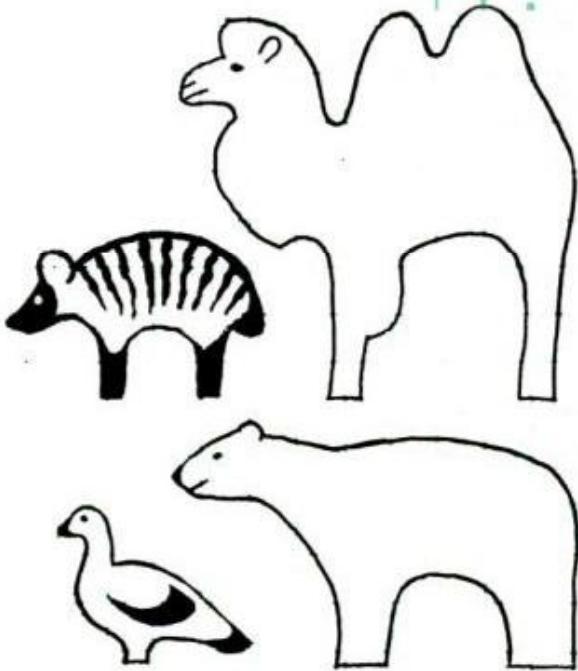
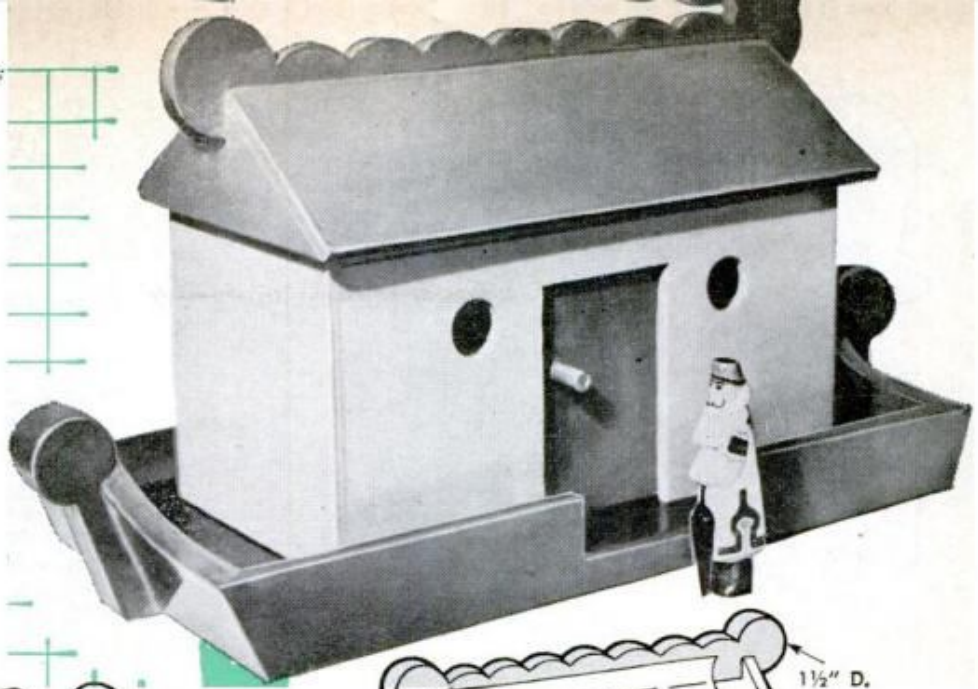
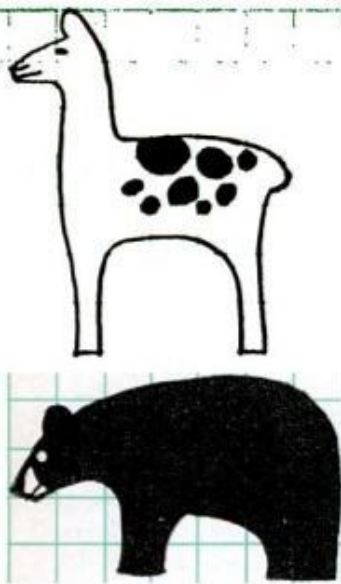
DECEMBER 1960

MAKE YOUR OWN DECORATIONS



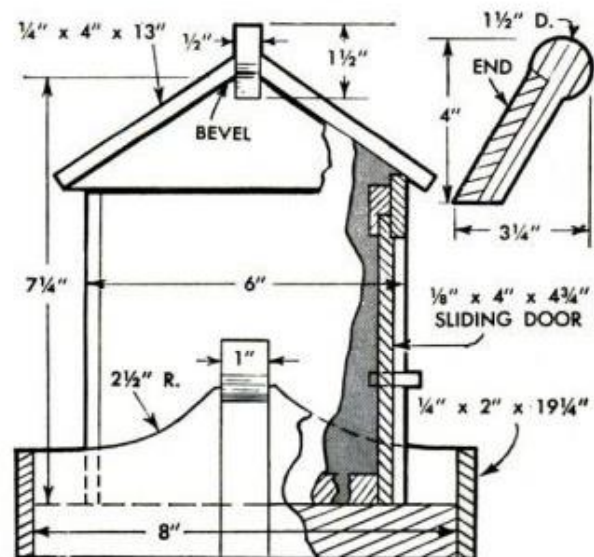
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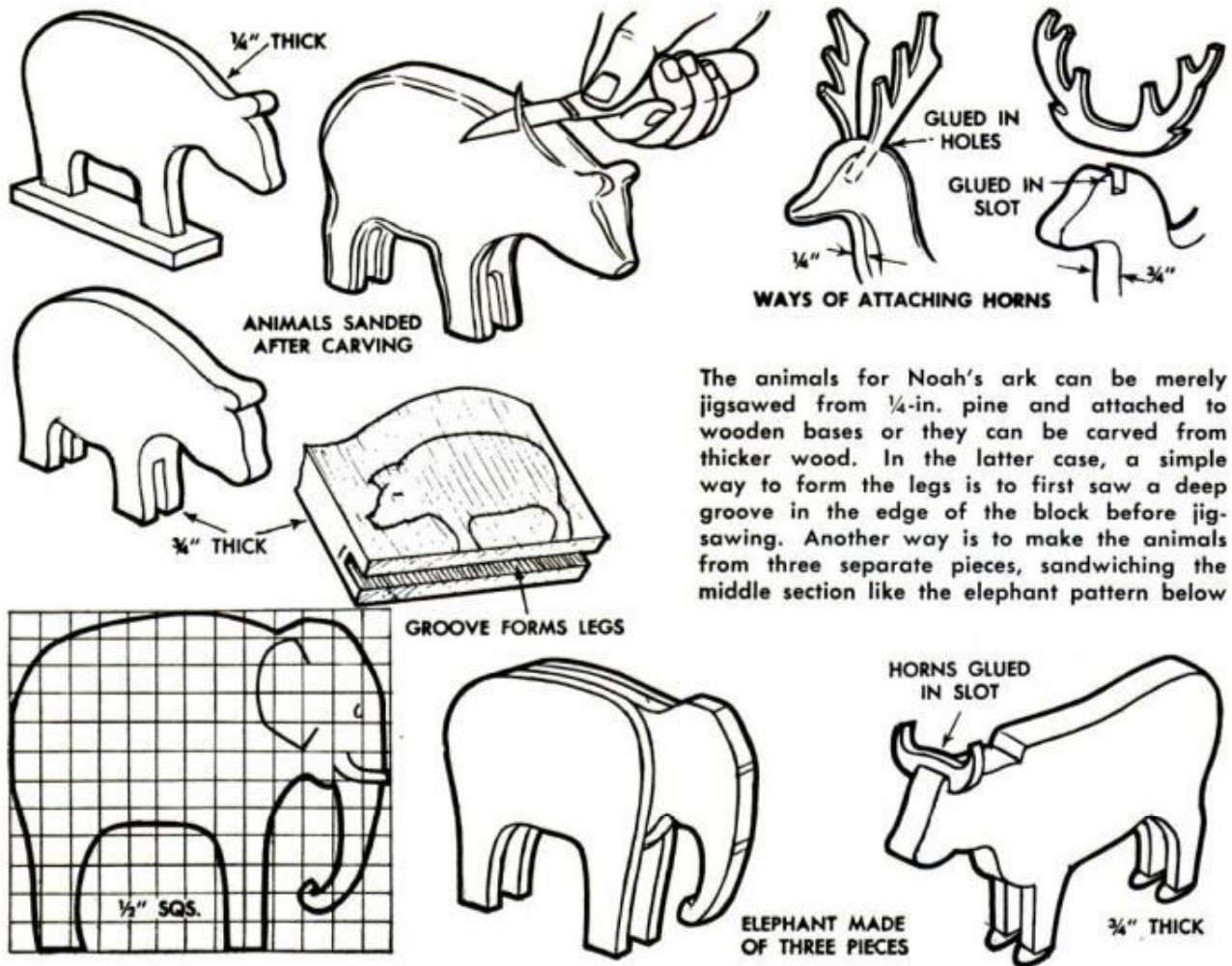




Noah's Ark

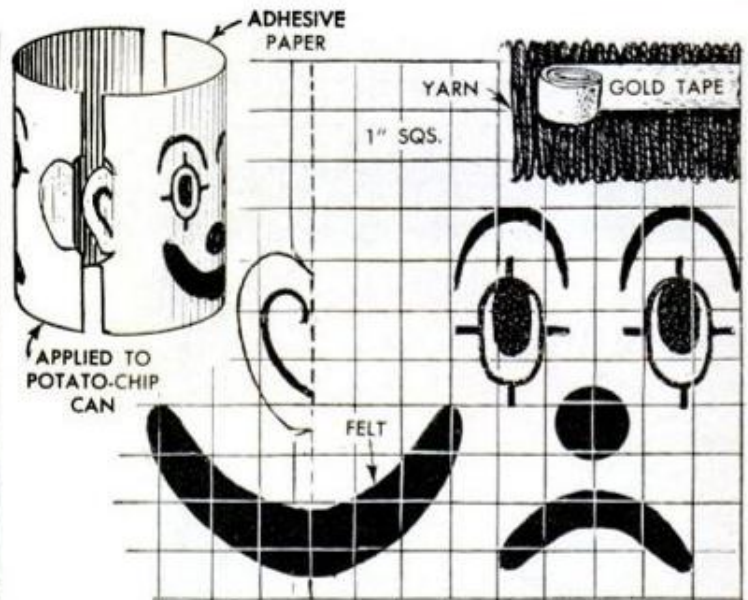
Dad couldn't make a more fun-packed toy for little tykes than this old favorite—Noah's ark. Most of it can be made from scrap plywood and pine. The cabin has a sliding door and the roof lifts off for chucking in the many animals. The pull-apart drawing shows how the ark is made in three sections, the cabin being glued to the hull. Cleats attached to the floor of the hull and across the top of the door opening on the inside provide a track for the sliding door. The lift-off roof rests in notches, and a piece of dowel is used as a door handle. Patterns for the animals are given on $\frac{1}{2}$ -in. squares, two animals are carved from each pattern





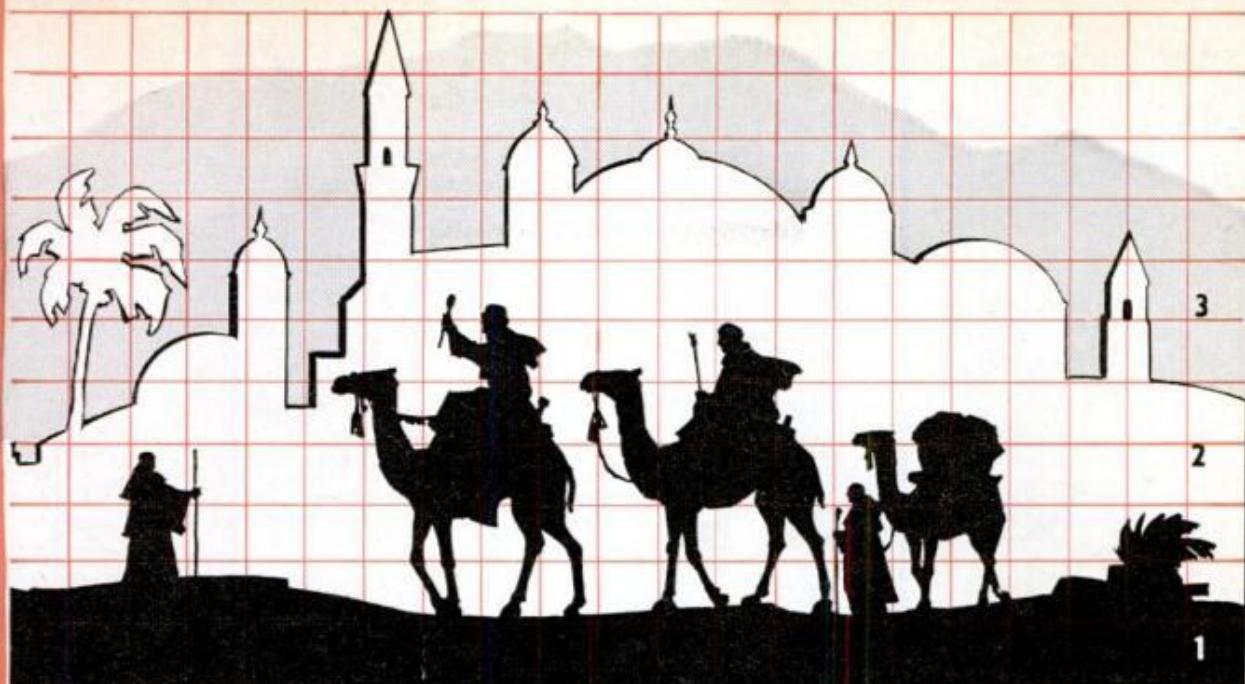
The animals for Noah's ark can be merely jigsawed from 1/4-in. pine and attached to wooden bases or they can be carved from thicker wood. In the latter case, a simple way to form the legs is to first saw a deep groove in the edge of the block before jigsawing. Another way is to make the animals from three separate pieces, sandwiching the middle section like the elephant pattern below

★ MAKE A GIFT FOR CHRISTMAS ★ MAKE A



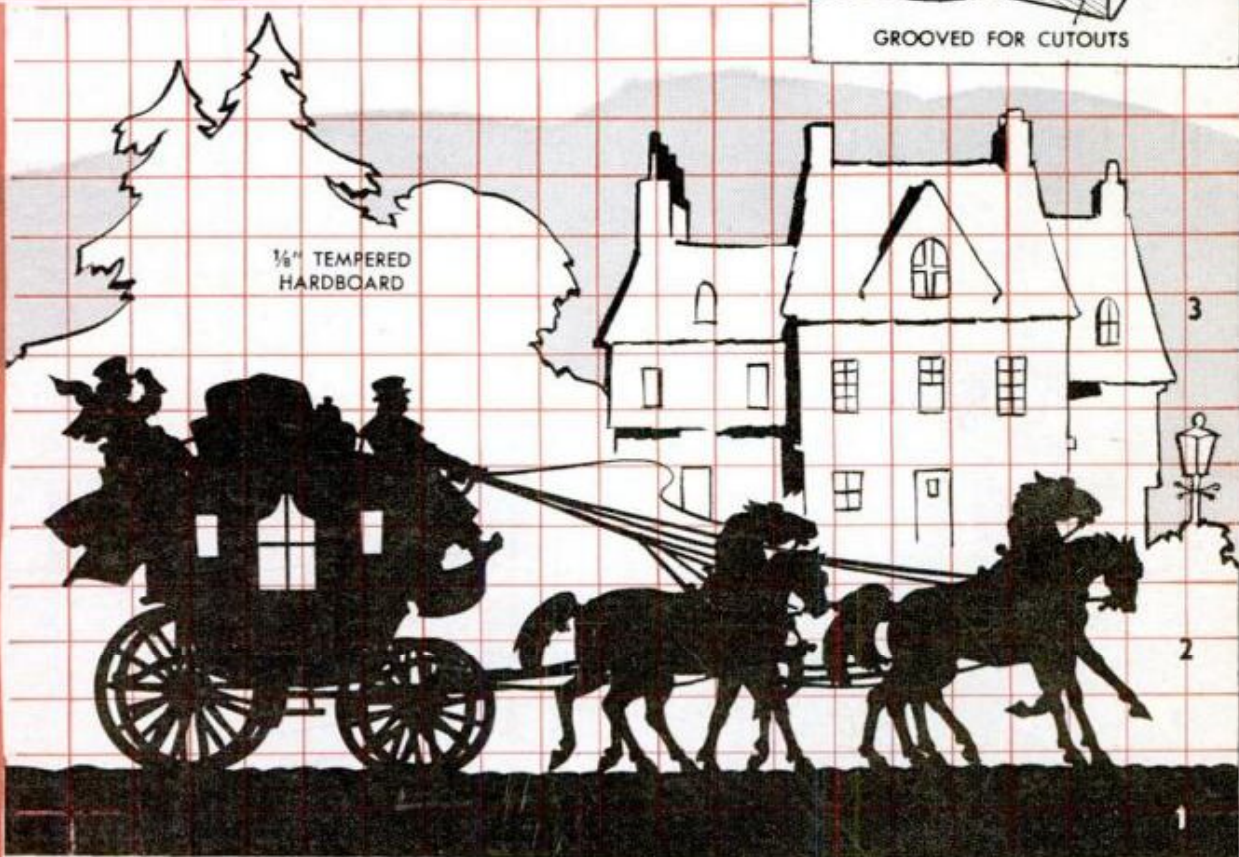
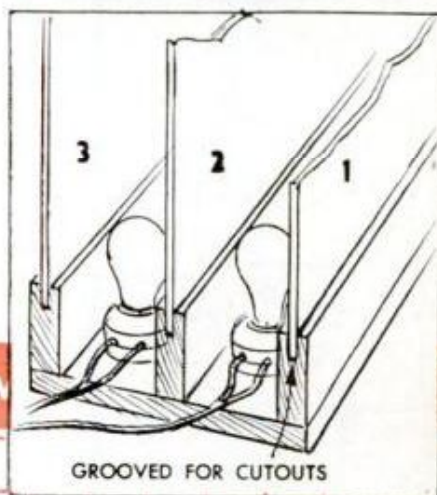
Clown Waste Basket

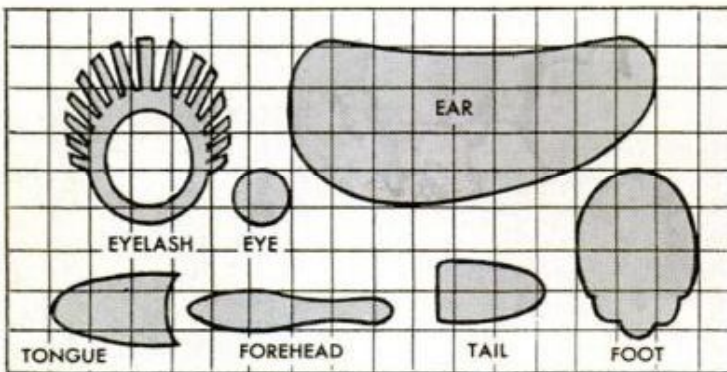
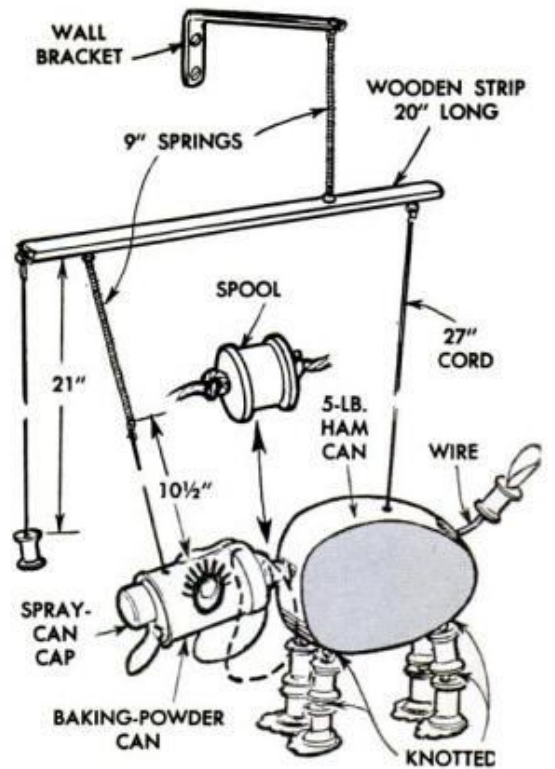
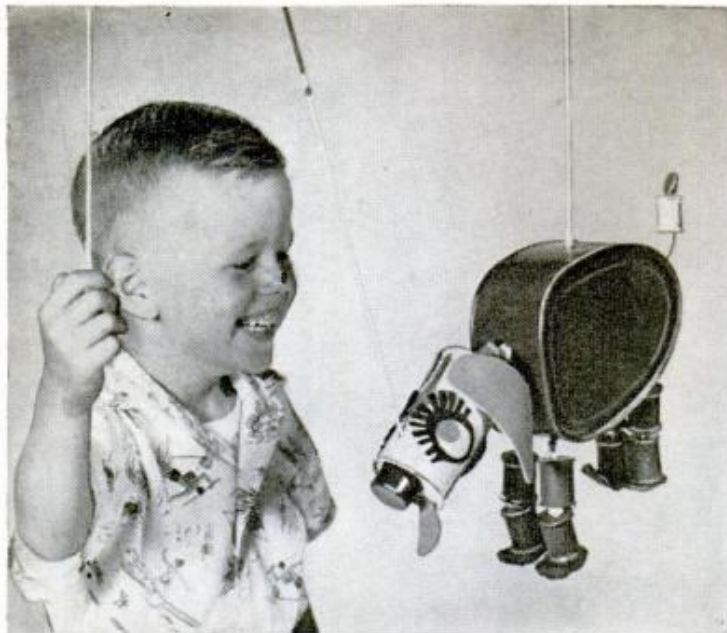
Happy on one side, sad on the other, this novel waste-basket is a potato-chip can covered with two pieces of self-adhering white paper cut to form ears when stuck together. Red yarn hair is added at the top, features are cut from black, blue and red felt, glued to front and back



Christmas Window Silhouettes

Stood parallel in a grooved wooden base, three jigsawed cutouts make an eye-catching silhouetted Christmas display for a window when lighted from below. Cut from hardboard to which the enlarged patterns are pasted for sawing, the front cutout is painted black, the middle one light blue and the rear one dark blue. White bulbs placed in the channels provided create a third dimension in making the cutouts stand out in stark relief against the background





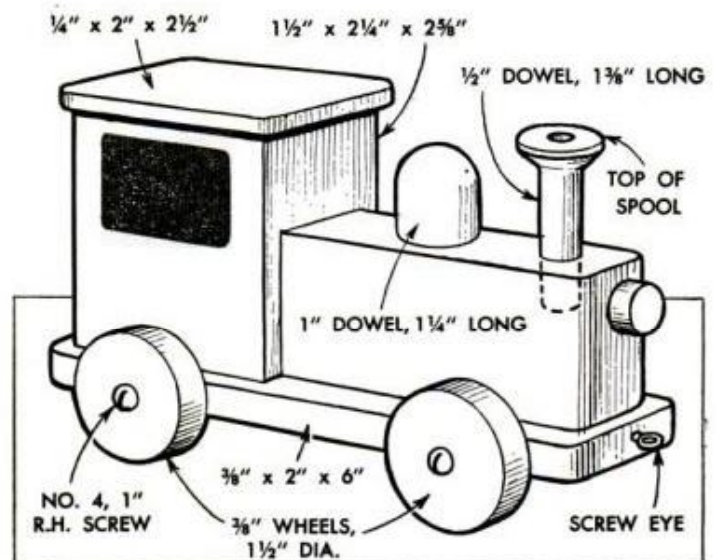
Gangling Pooch

A tug on the cord causes this tin-can hound to flop and gangle about like the lazy dog he is. Hung in reach of the crib in a nursery it provides a novel infant's toy that is made from odds and ends



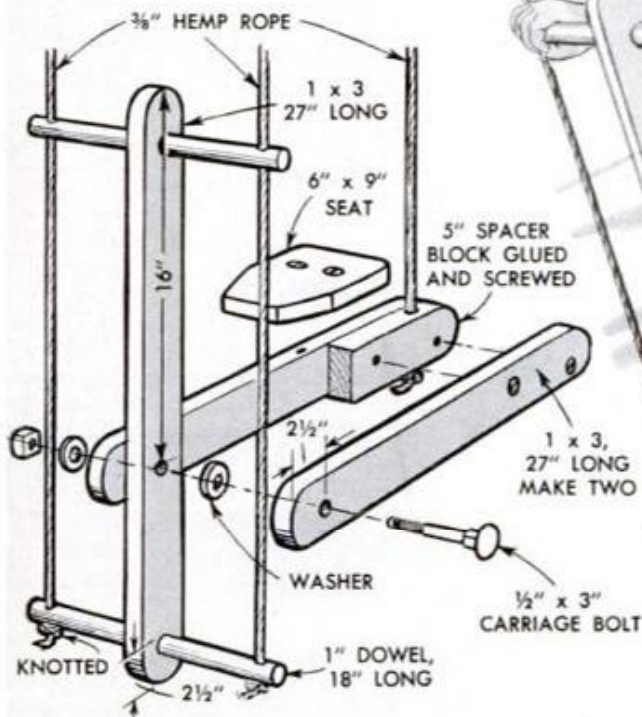
Christmas Favorites

Sambo is not apt to brush you off since he makes it his job to keep your toothbrush handy. It takes a head start to make him as his body requires many plastic toothpaste-tube caps which are threaded on wire. Choo-choo pull toy is a toddler's favorite and is easily made from scraps in the wood box



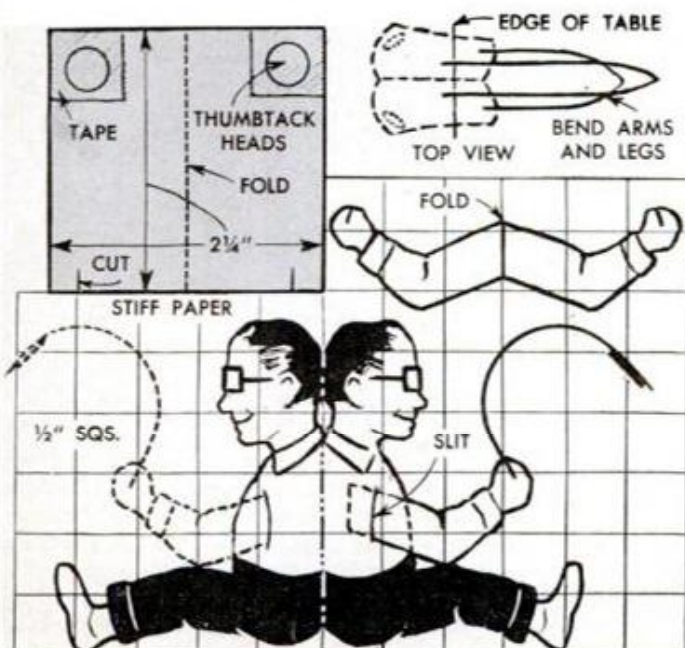
Rainy-Day Swing

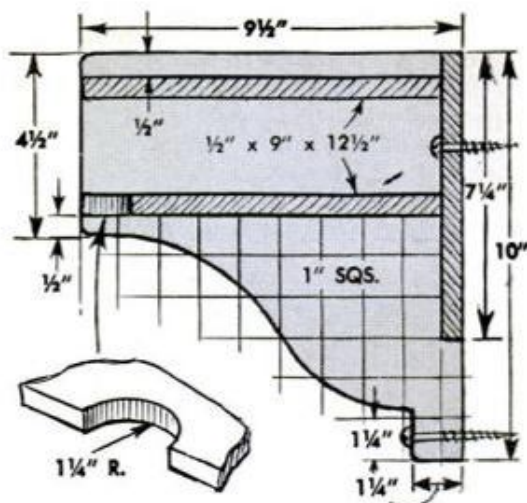
Designed to hang from three clothesline hooks screwed to the basement joists, this indoor swing will while away many hours for cooped-up youngsters. It's made from 1 x 3 lumber, 1-in. dowels and hung with strong hemp rope



Balancing Herkimer

An amusing toy, "Herk" seemingly defies the law of gravity when he hangs precariously by his heels. Counterbalanced newspaper is the secret

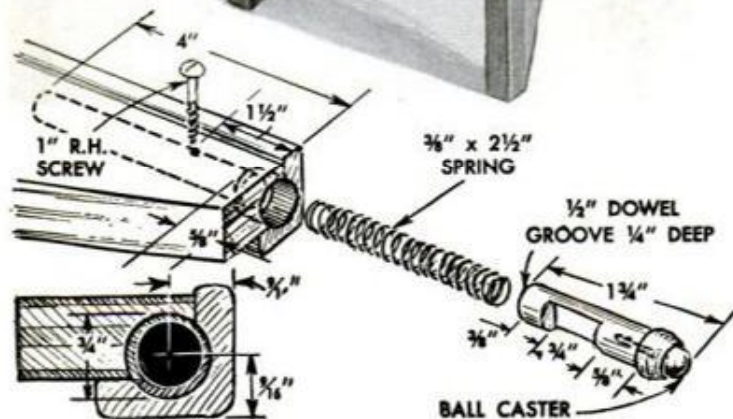
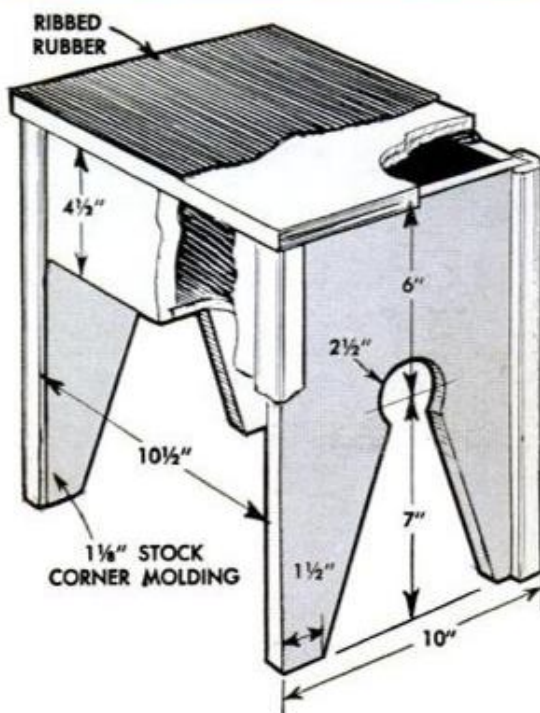
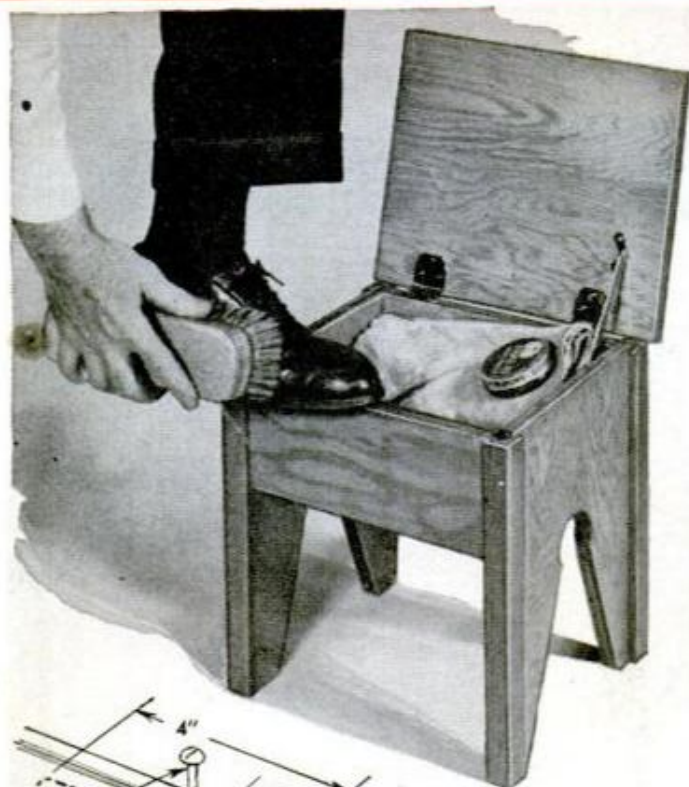




Hold the Phone

Handiest thing ever can be a "pin-up" telephone shelf. Large enough to accommodate a cradle phone with room to jot a note, there's a second shelf to hold a directory. Screws fasten it to the wall

★ MAKE A GIFT FOR CHRISTMAS ★ MAKE A



It Rolls With a Kick

This kitchen step-stool rolls across the floor but not when you stand on it. Pop-out casters in legs retract under weight. Handy for reaching cupboards, also for chucking shoe-shine kit. An easy project to make, it uses strips of ready-made corner molding to trim the legs and hide the joints. Rubber surfaced lid affords safe footing



Display Your Salon Photos On a Folding Screen

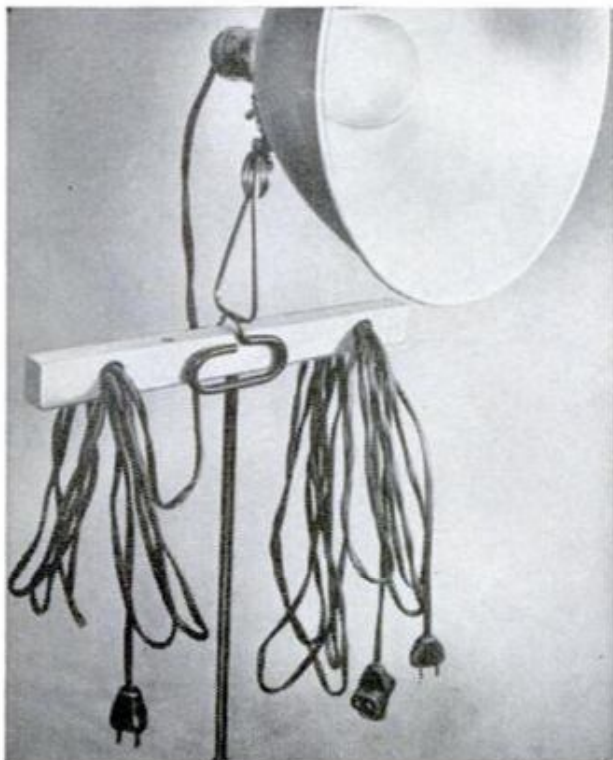
Where's the best place to display your prize photos when it is not permissible or feasible to mount them on a wall? One apartment photographer found that a folding screen offered the best place. Besides providing a portable wall that could be moved about and used as a striking room divider, the two sides of the screen permitted as many as 24 mounted prints to be displayed. Such three-section screens can be purchased or one can be made, using panels of wallboard. Map tacks are used to hold the mounted prints to the screen.

—Charles Scott

Crossarm on Light Stand Increases Usefulness

Not only will a wooden crossarm on a folding light stand permit one or more photo reflectors to be clamped to it, but it will serve to store the reflector cord as well as an extra extension cord. Blind holes 1-in. deep are drilled in each end and one edge of a length of 1 x 2 so it will fit over the light stand either in a horizontal or vertical position. The cords store in $\frac{3}{4}$ -in. holes.

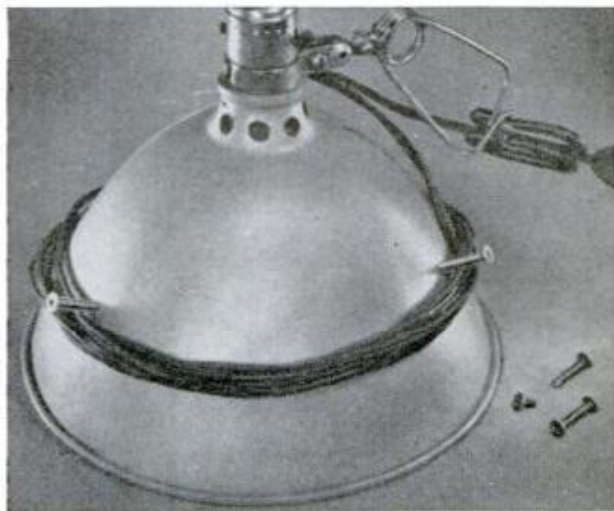
—Bil Toman

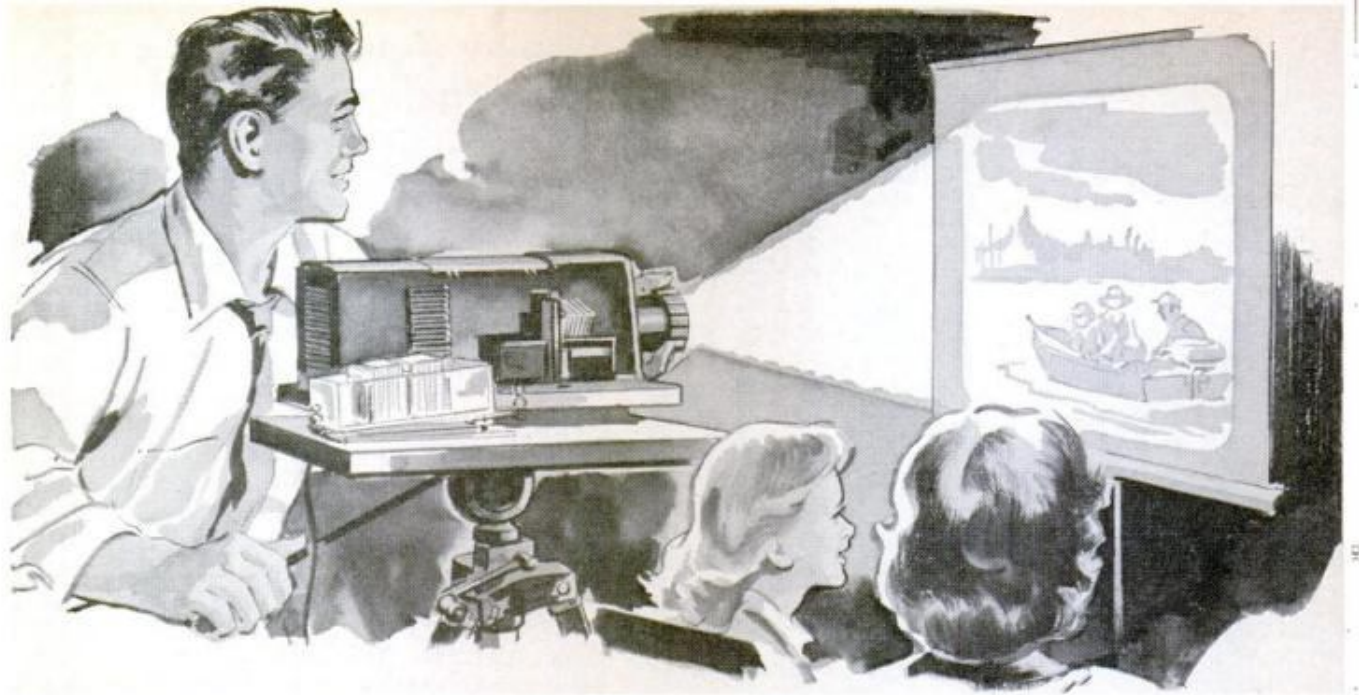


Keeping photo developer at the proper temperature during hot weather is less of a problem for the amateur darkroom finisher if he makes use of a can or two of liquid coolant. The coolant has the cooling effect of dry ice and the sealed cans are "recharged" each time by simply placing them in the freezer compartment of a refrigerator. In use, the cold can is placed in a plastic bag and set directly in the photo solution.

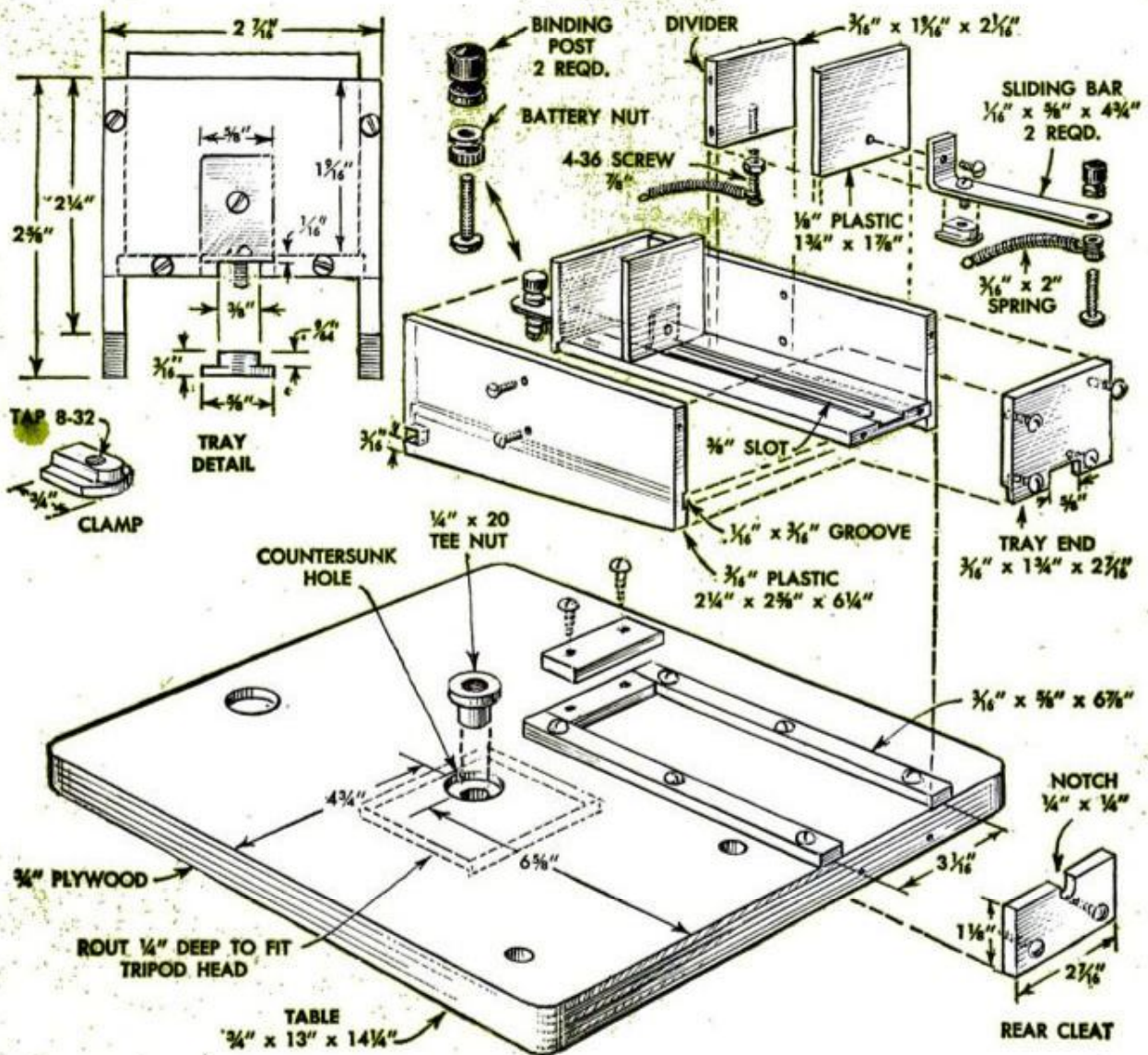
Clamp-On Reflector Has Own Cord Reel

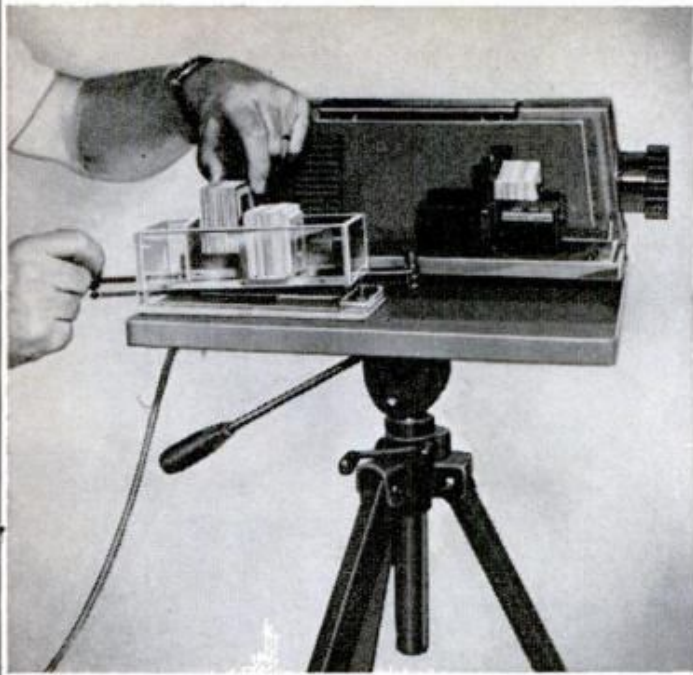
One good place to store the cord of a clamp-on photo light is around the reflector. You can do this by adding three loose-leaf ledger binding posts to the reflector. Each post consists of a threaded tube and a short threaded bolt and is available in several lengths, either in aluminum or brass, at most stationery stores. Drill three $\frac{1}{8}$ -in. holes in each reflector, spacing them as indicated in the photograph below. After inserting the bolt from the inside, screw the tube on from the outside. The cord is stored by wrapping it around the reflector and against the binding posts.





TRIPOD PROJECTOR





TABLE

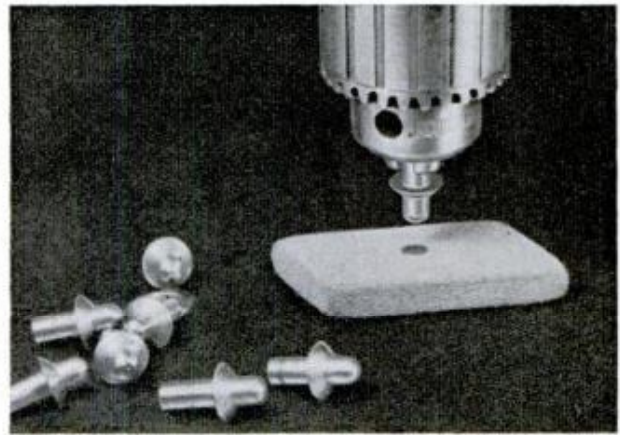
YOUR TRIPOD need not stand idly by when you get ready to show your vacation color slides. In fact, if it's husky enough it's the perfect answer to the problem of finding a suitable table for the projector. Since most occasional tables are so low that the projector must be tilted, the image is usually distorted on the screen, particularly when the projector has a short focus lens. But by being adjustable, your tripod lets you elevate the projector to just the right height, and its pan head makes it easy to swing the image to center it on the screen.

All you need to adapt your tripod to the purpose is this simple table top which is attached by merely screwing it onto the tripod mounting screw, or stud. The plastic slide tray is optional although it is particularly handy when the projector accepts up to 36 slides. Between the changer and tray, a total of 108 slides can be handled. The over-all size of the table is determined by the particular projector. Mark the spacing of the projector feet and drill shallow holes for them in the table top. The flanged nut (a standard $\frac{1}{4}$ -20 Tee nut) that receives the tripod screw is located at the center of balance. The balancing point is easily determined by placing the projector and tray on the tripod table and resting all three on the edge of a hand saw. The underside of the table is recessed $\frac{1}{4}$ in. deep to seat the tripod head snugly. This can be routed or chiseled out as the case may be. The optional slide tray is assembled from $\frac{3}{16}$ -in.-thick rigid plastic following the details. Finish the table to match the color of the projector.—Howard R. Clark

DECEMBER 1960

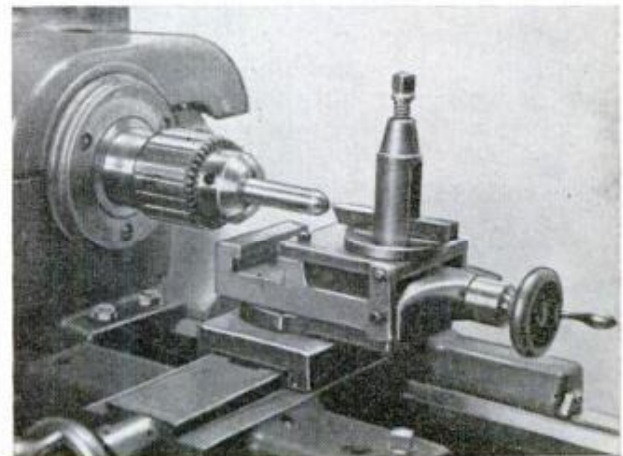
Eraser Polishes Convex Forms in Drill Press

Final polishing of small convex surfaces can be done in your drill press, using a rubber ink eraser. First, spot, or "dimple," the eraser with a twist drill to provide a recess for the work. Then chuck the workpiece and center the eraser under it. Shift the belt on the cone pulleys to give the spindle a speed of 3000 to 5000 r.p.m. Use very light pressure on the work to avoid heating the eraser, possibly burning the rubber and distorting the recess in its surface. When one recess becomes worn, spot another and proceed.—H. J. Gerber

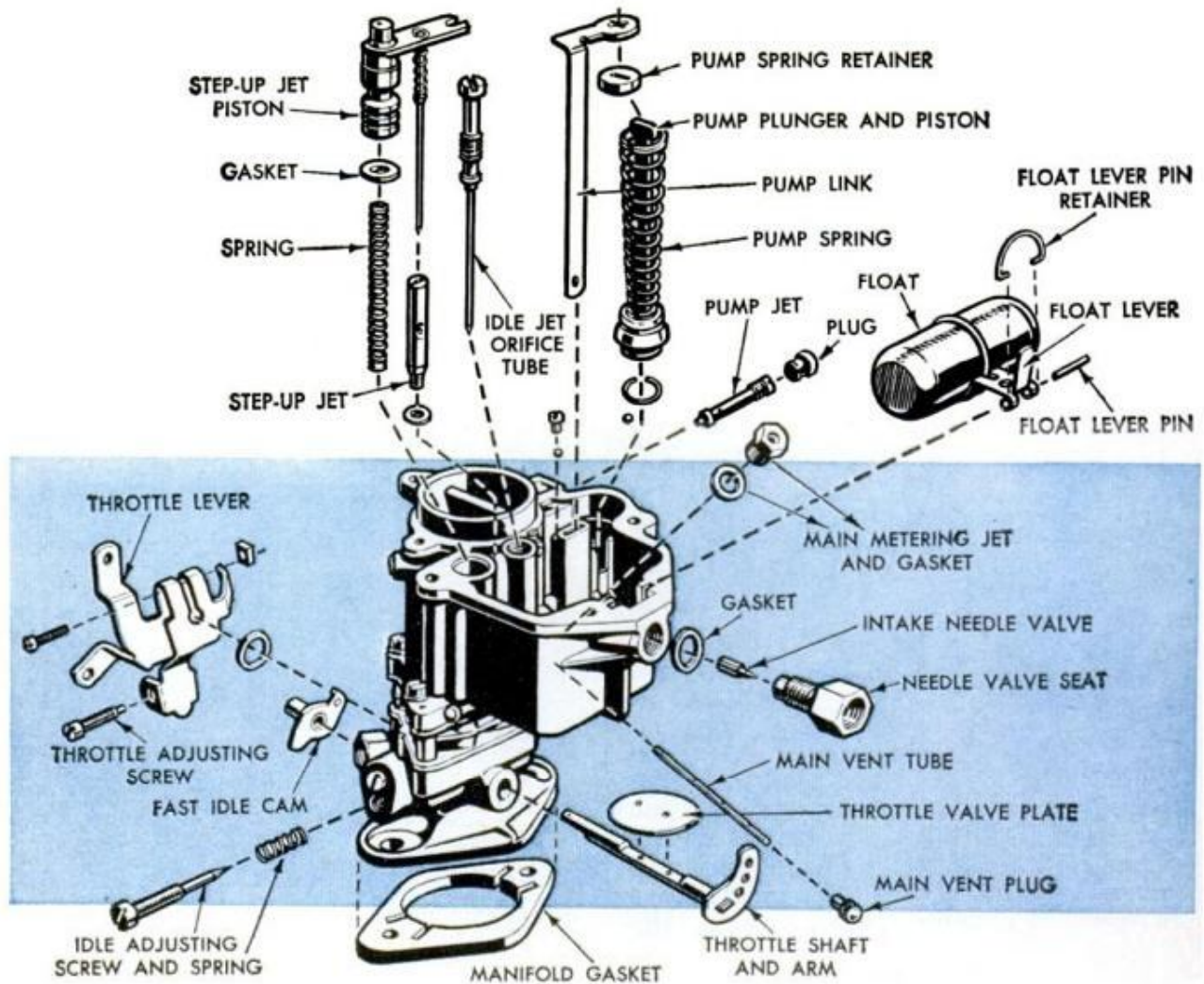


Lathe Attachment Is Aid In Turning Half Sphere

To turn a true spherical surface, or half sphere, on the end of a rod the point of the cutting tool must be set on the axis of the work. Also provision must be made to manually rotate the tool outside the center of rotation of the compound rest. These are the requirements and on some small lathes it is necessary to make an attachment that permits mounting the tool in this position. The attachment consists of a saddle made from flat-steel parts and mounted by means of four capscrews turned into tapped holes in the compound.—H. L. Campbell



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THOUGH NO TWO makes are exactly alike in every respect, the carburetor shown in exploded view above may be considered a typical example of the single-throat downdraft type used on many automobiles today

YOU CAN OVERHAUL YOUR CARBURETOR

By Guerrino Amati

THERE IS a certain satisfaction to be had in changing your own spark plugs, installing new points and in generally keeping your car humming. But, to many a do-it-yourself mechanic, that strange looking thing sitting on the engine—the carburetor—is too much to tangle with. Actually, though it is fairly complicated, many of its parts, shown above, are accessible enough to be removed with ordinary tools so that a quick, general overhaul requires little more than a fundamental understanding of the carburetor's operation and a bit of common sense application. Essentially a carburetor is a tube through which air and fuel are drawn, mixed, converted to a vapor and conducted to the engine's cylinders. Its principal parts are thus best understood in relation to their functions in creating and

conducting this vapor to the cylinders.

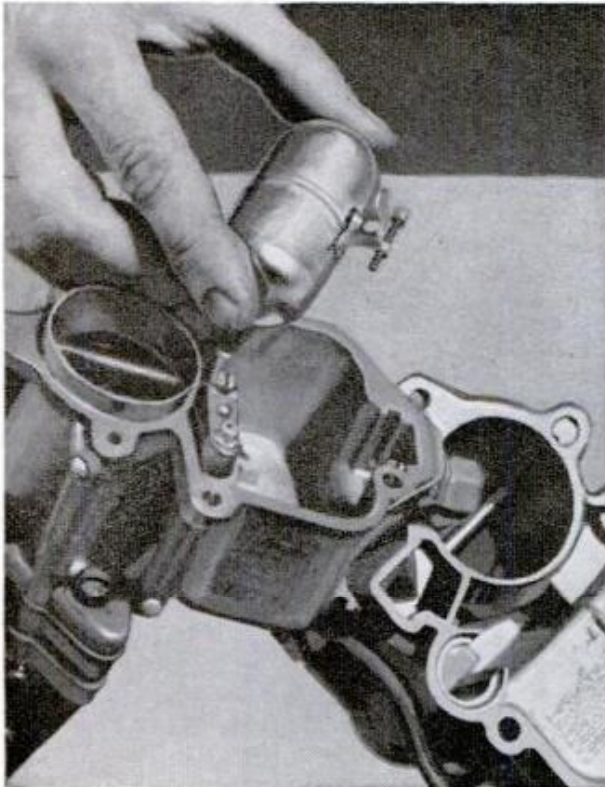
The Float Bowl and most of the other parts and components of the carburetor are immediately accessible upon removal of the air horn. Beginning with the float bowl assembly, pull out the lever pin retainer first. The float, lever pin and lever will then lift out easily and the intake needle valve and its seat are removed with a small wrench. This assembly is designed to maintain an optimum level of fuel in the carburetor on which the engine feeds. Fuel from the pump forces its way past the intake needle valve and into the bowl. As the fuel level in the bowl rises, the float also rises and pivoting on its lever pin presses its lever back against the valve to shut off the flow of fuel. As the fuel is used up, the level drops, the float releases the valve

CARBURETION depends on a steady fuel supply from the float bowl. Here, float rise is being determined by means of a gauge

and the action is repeated. In your overhaul replace a leaky float and bent pins and levers which can't be straightened out. Bent pins and levers may cause the float to bind against the sides of the bowl. Worn, pitted intake valves must also be replaced. Once everything is in order, use a simple gauge, included in most repair kits, to determine whether or not the float will rise to the proper level. Consult your car manual for the correct float level.

An engine running from idle to a speed of 20 m.p.h. is operating on its low-speed circuit. Fuel flows from float bowl through the idle orifice tube and combines with air drawn down the air horn through one of the carburetor's internal passages. A twist of the screwdriver and the tube will pop up under the released tension of the step-up piston spring. In cleaning the parts of this circuit, blow out all openings and internal passages with compressed air. The idle-adjusting screw and its spring may be cleaned with solvent and a stiff brush. The throttle valve plate should move freely under light pressure. Do not insert a wire or any other object

SIMPLEST of the various assemblies, the float and its parts lift out upon removal of the retainer pin



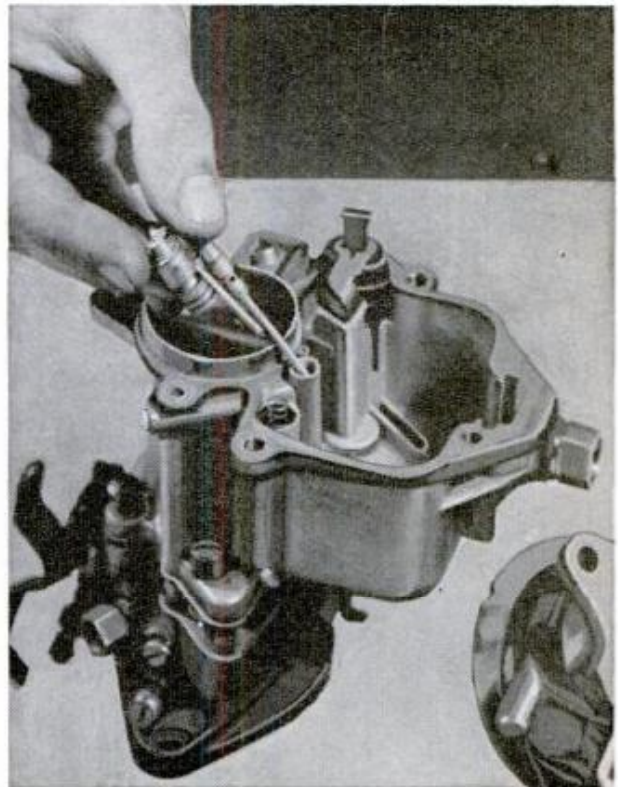
DECEMBER 1960



into the opening of the idle orifice tube as this is likely to increase the size beyond its critical tolerance.

The High-Speed Circuit, part of which you have removed with the idle orifice
(Continued to page 234)

CARBURETOR "changes stride" from low-speed circuit to step-up assembly, shown being removed as a unit



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STRONG PLUG SPARKS

*Boating
Annual, 1961*

MEAN TOP R.P.M.'S

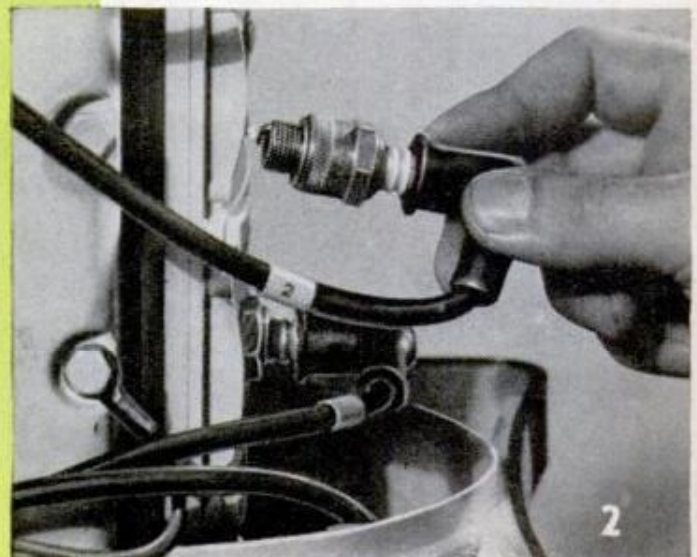
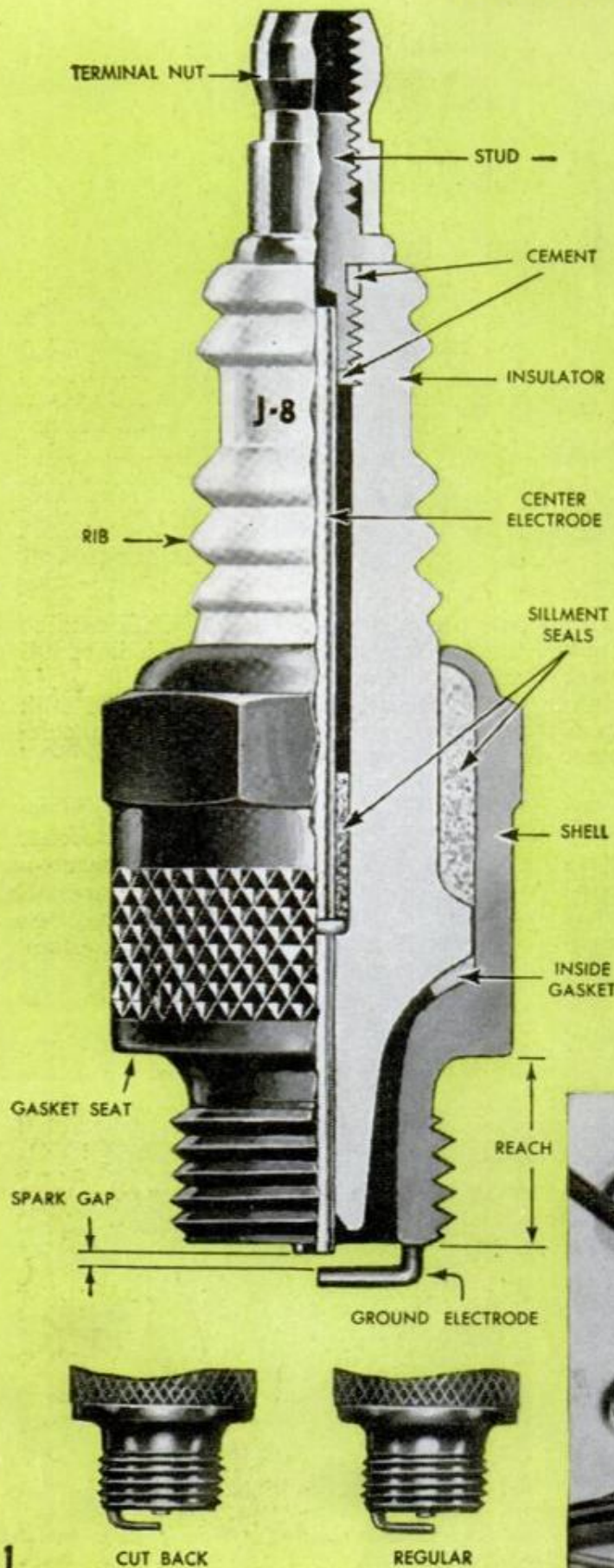
By Earl F. Wobeck

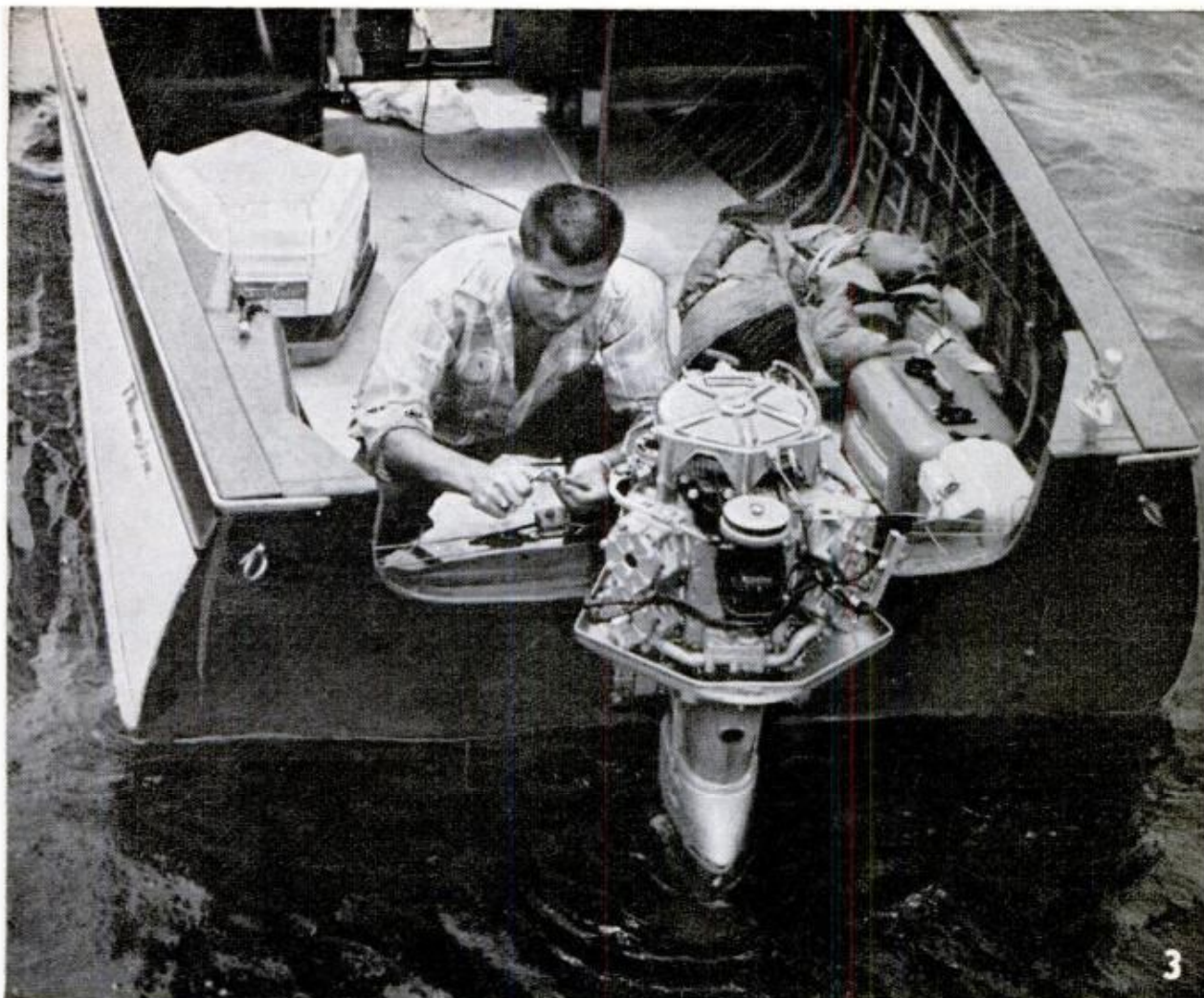
OUT ON "Lake Anywhere," there is an outboard boat homeward bound after a successful day of fishing. The skipper notes that his twin 35's are acting more sluggish than usual, shrugs his shoulders and mutters to himself, "Must have tanked up on some poor gas again." A series of coughs are heard, followed by two or three sputters—then, a deep, deep silence.

The tale of this outboarder, like so many others who fail to give their motors proper servicing at regular intervals, could have a sad ending. In a real situation, the outcome would depend upon the weather, sea conditions and how well the skipper is prepared for such emergencies. But the objective of this story is to help boaters avoid engine failure, giving inside information direct from spark-plug manufacturers on how you can avoid excessive plug fouling and get better outboard performance.

The king-size spark plug pictured at left, shows a cross-section of all the parts that make up a plug of modern design. A careful study of their interrelation

A GOOD PLUG should give a strong spark when held $\frac{1}{8}$ in. away from motor

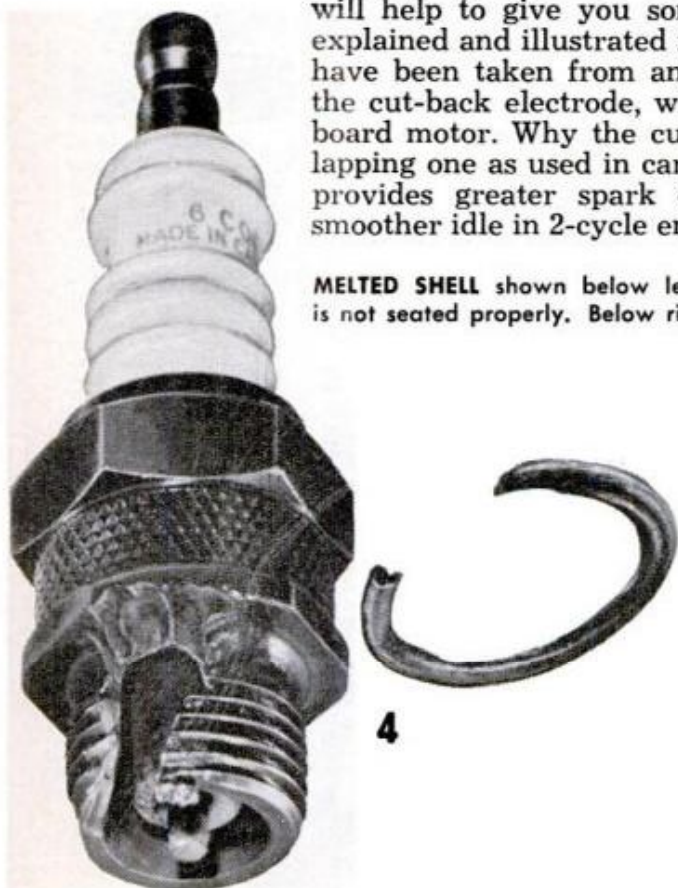




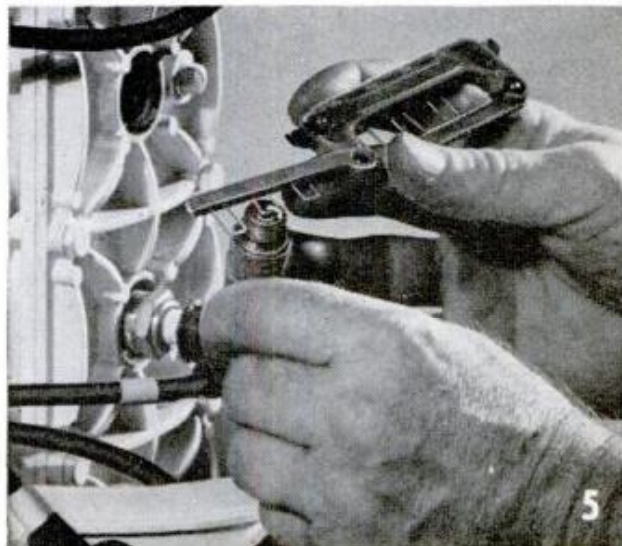
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will help to give you some insight into the fouling problems to be explained and illustrated in the story. This plug is of a type that could have been taken from any gasoline engine, except for one feature—the cut-back electrode, which means it is designed for use in an outboard motor. Why the cut back electrode instead of a regular, overlapping one as used in car engines? An offset ground electrode simply provides greater spark exposure, encouraging easier starting and smoother idle in 2-cycle engines, which use a somewhat slower burning

MELTED SHELL shown below left, is startling example of what happens when plug is not seated properly. Below right, wire feeler gauge is best for checking gap spacing



4



5

gasoline-oil fuel mixture. When factory assembled, most plugs are intended never to be taken apart for reconditioning. Any cleaning that is to be done, must be accomplished with all parts intact.

Spark plug improvements of recent years, include multiple ribs on the insulator, preventing buildup of a continuous layer of moisture-laden dirt. On the old smooth insulators, the latter frequently caused shorting or electrical "flashover" extending from the terminal to the steel shell and resulting in misfire and hard starting. The insulator itself now is made of a tough ceramic that is highly resistant to cracking and heat. The old porcelain insulators were quite brittle and more conductive of electricity. The center electrode is welded together from two lengths of wire, the upper one of which is steel, the lower one, a special alloy that resists corrosion and deposit of combustion byproducts. Sillment seals and special cements that are impervious to moisture, prevent plug components from vibrating loose. A thin, non-corrosive metal plating on the shell, is one of the most recent innovations that not only helps to merchandise them but prevents formation of unsightly rust. A big advance in spark-plug design is the manufacture of plugs in a wide range of

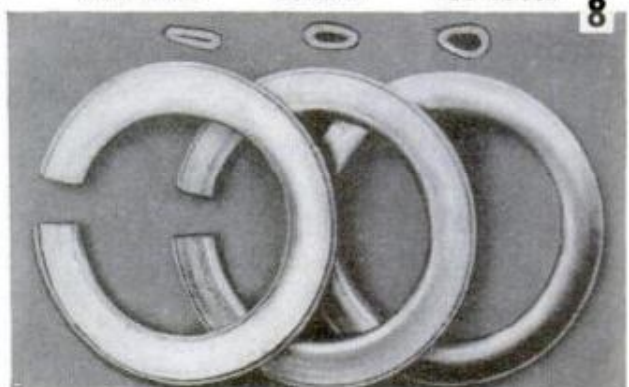
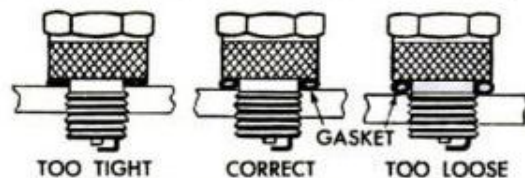
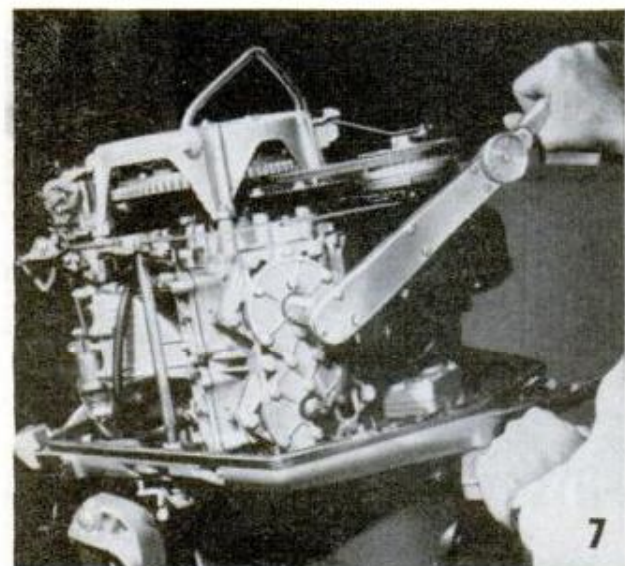
heat ranges. To avoid excessive fouling at low speeds, and pre-ignition (firing of compression stroke ahead of time) at high speeds, the spark plug insulator nose temperature must remain between definite limits. About 1700-deg. F. is the upper limit, while 700 deg. approximates the lower limit. The temperature of the insulator nose and electrodes is controlled primarily by the length of the tapered portion of the insulator exposed to the combustion chamber. A long taper makes the heat travel a longer route before being dissipated in the coolant, a short one simply allows the heat to be dissipated more rapidly, keeping the plug cooler as indicated by the blue arrows in Fig. 10. Since temperature conditions vary according to work load, outboard use and size of engine, it is important to match these requirements with a plug that will not overheat, at high speed, yet minimize fouling at low speeds. When buying plugs, look for the "heat" type in the plug type number usually found imprinted on the upper body of the insulator. Cold plugs have low numbers, hot plugs the higher numbers. When replacing plugs that have given satisfactory service, be sure the new ones you buy are of the same heat range.

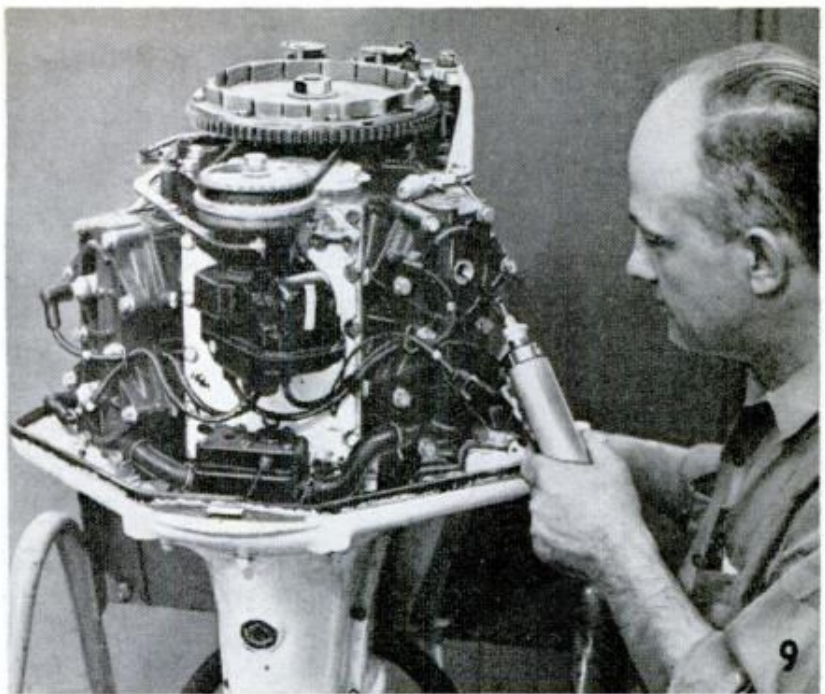
If your outboard motor (or motors in the case of a twin installation) begins to



CONDITION OF USED SPARK PLUGS often provides clues leading to source of motor malfunctioning. Wave patterns in blue dots indicate engine performance as observed on screen of ACilloscope, spark-plug analyzer

FIGS. 7 AND 8, torque wrench should be used to install plugs so that seat gaskets are compressed correctly. Gaskets prevent leakage from combustion chamber, transfer heat from plug to head, to cooling system



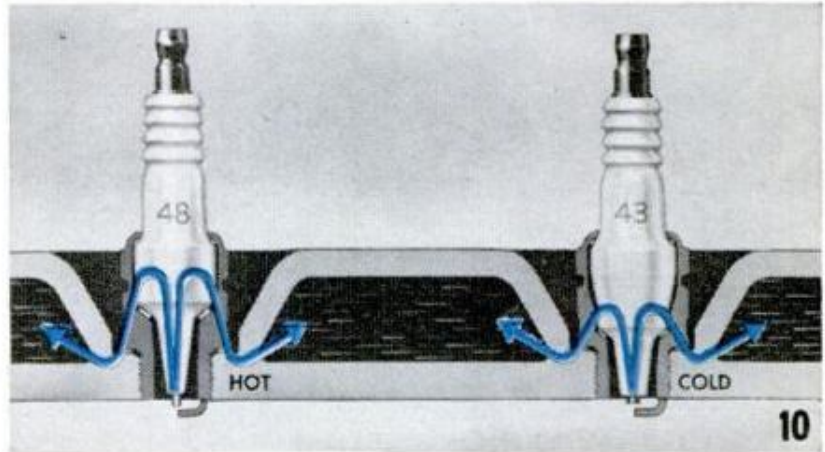


Champion Spark Plug Co. photo

ABOVE, MEDICAL PROBE LIGHT is handy for looking into combustion chamber through spark-plug openings for evidence of carbon deposits

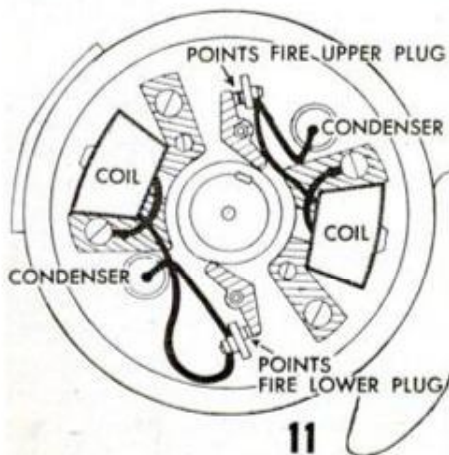
start hard, or misfires, check out the more obvious sources of trouble before getting into fouling problems and determination of whether spark plugs of the correct heat range are being used. First, determine if adequate voltage is reaching the plugs by holding the ignition terminal a short distance from the plug terminal as in Fig. 2. Voltage should be sufficient to jump a 1/4-in. air gap. No plug can fire properly if voltage available from the ignition system is inadequate. If spark plug covers or boots are installed, check them for cracks or brittleness. Dirt

(Continued to page 244)

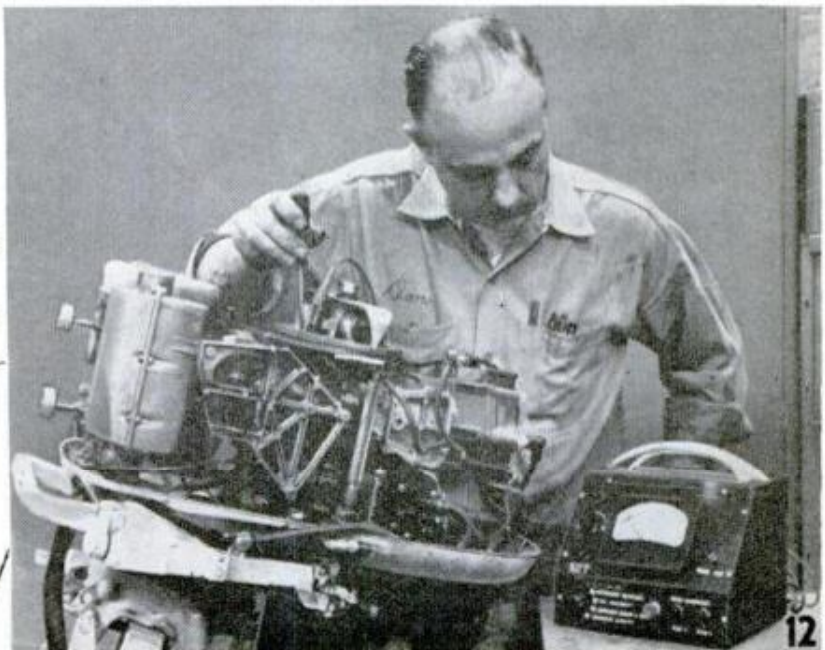


ABOVE, BLUE ARROWS indicate long and short routes heat must travel through hot and cold plugs respectively, before being dissipated

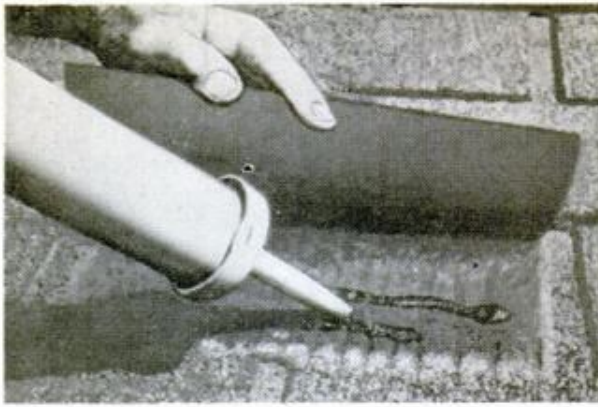
PROPER TIMING of ignition system, Figs. 11 and 12, not only results in smooth-running engine but ups power and the fuel economy as well



11



12

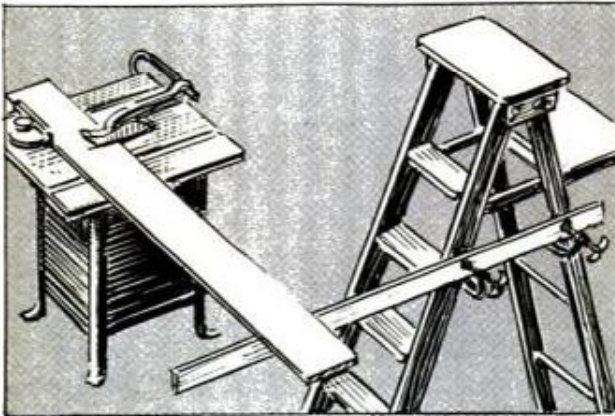
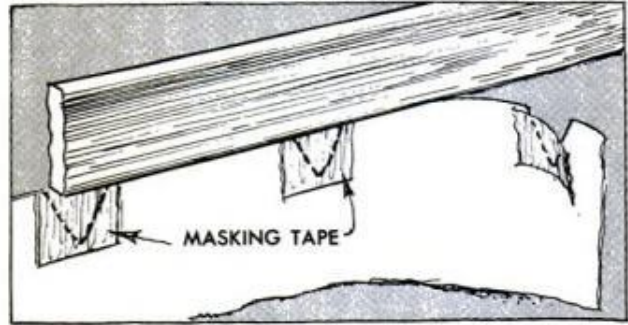


Cement Anchors Shingle Tabs

After a severe windstorm had flipped up many of the shingle tabs on one side of the gable roof of his home, one owner cemented all the tabs down securely with roofing cement applied with a caulking gun. Of course, this remedy would not apply to later types of composition shingles having self-sealing tabs, but it is effective on older composition shingles. The work should be done on a warm day so that turned up tabs can be pressed down without breaking.

Go Easy on Masking Tape

Generally it is possible to save a lot of masking tape on any painting job where you have to mask out large areas for spraying or brushing to the edge of another color. Simply cut spaced notches along one edge of the masking paper and then stick it in place with short pieces of tape rather than a continuous strip. Substantial savings are made in this way.—L. Shepanik



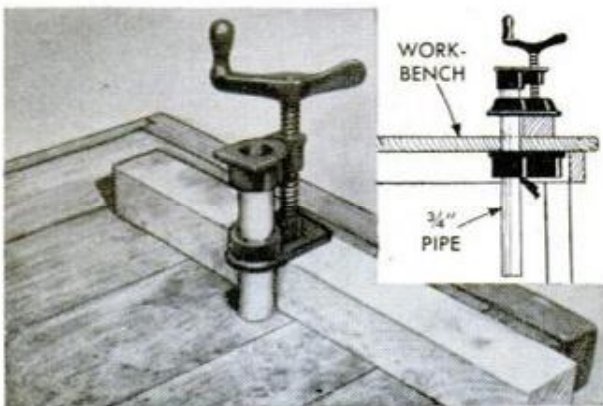
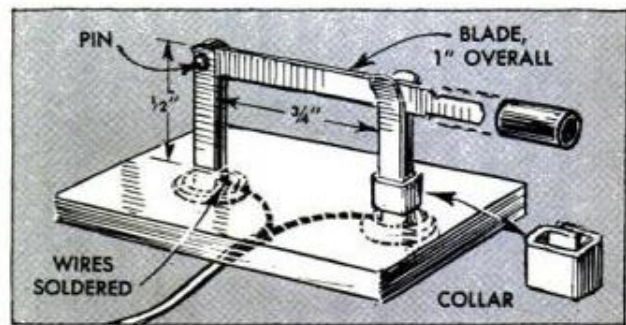
Ladder Serves as Work Support

Easy and safe crosscutting of long boards on a circular saw calls for a support for the outer end of the board. Lacking a conventional outboard support for this job you can quickly improvise one by using a step ladder as the stand and then clamping a 1 x 4 strip to two legs of the ladder to form a slide for the end of the board. Be sure the 1 x 4 is located at the same height as the saw table and that it is level.

—Robert L. Sargisson

Knife Switch for Electric Toys

Three brass paper fasteners and a piece of 1/8-in. plastic make a simple knife switch for battery-operated toys. Two fasteners, inserted through slits in the plastic base, form terminals, a fixed contact and a pivot for the blade, which is made from one leg of the third fastener. The blade has a handle cut from rubber tubing. The other leg forms a collar for the fixed contact.



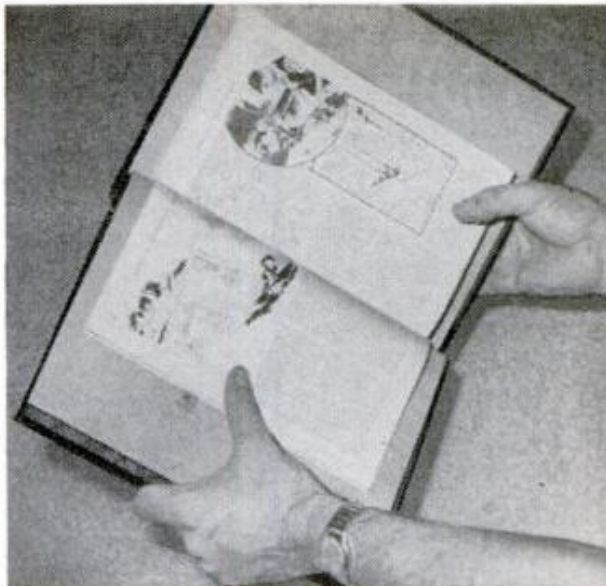
Pipe Clamp Is Bench Top Aid

Workpieces of fairly large size can be held rigidly on top of the work bench by installing a pipe-bar clamp in the bench top so that the clamp can be operated in the vertical position. All you do is drill a hole through the bench top, unscrew the cap on the end of the pipe bar, and slide off the moveable clamp jaw. Then drop the pipe bar through the hole in the bench top and reassemble with the moveable jaw underneath as in the detail.—H. Hanscom

Spring-Back Binders Protect Clippings

Popular Mechanics readers who cannot save the complete magazine because of a lack of space may find this hint useful for saving their favorite articles for reference. Just clip the desired pages and insert them in a spring-back binder like the one pictured. The pages need not be punched and are easy to insert or remove. Simply spring the covers open, insert the clippings and release.—M. C. Anderson

To keep a diamond sparkling, clean it daily in detergent. Rinse in clear water and dry with blotting paper. Also, have the mounting checked periodically by your jeweler.



Save Bottle-Cap Inserts

Before you toss out bottle caps take time to pry out the cork inserts. These have many practical household uses as you will readily discover for yourself. The photo suggests one or two applications. There are, of course, others. For example, cement an insert to the bathroom doorknob to prevent it from banging against the plastered wall. Or, cement four inserts to the base of the electric mixer for more quiet operation. They make dandy bumpers for hinged lids.—Bil Toman

When you hang the weekly wash in the basement to dry during stormy winter weather, drying can be speeded up by placing an electric fan so that the air blast is directed parallel to the clothesline.



COMING UP NEXT...

Driving In Snow. S-n-o-w! Makes you think of skid chains, shovels, sand, sleet inside your coat collar and maybe a late dinner, doesn't it? But learn how to avoid this sort of thing by reading the timely driving tips in the January issue

Shoji Screens. A shoji screen is more than a conversation piece. It's functional Oriental design at its best. It goes anywhere, with most furnishings. The article coming up tells you how to build not just one, but several of glass fiber

How To Install Docking Lights. Only the skipper who has docked his packet in the dark can tell you what docking lights will do for a boatman in the tight places. That's why we picked an experienced skipper to tell you about them

All About Twist Drills. No matter whether you sharpen one twist drill a year or a hundred a day, this article is a must for the shop man. Tells how to sharpen the many kinds of drills and also how to use them on various types of work.

HERE ARE THE FINE POINTS OF

X314

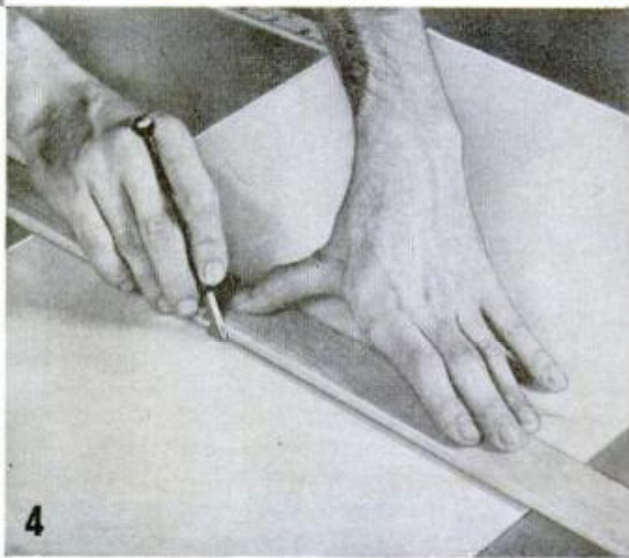
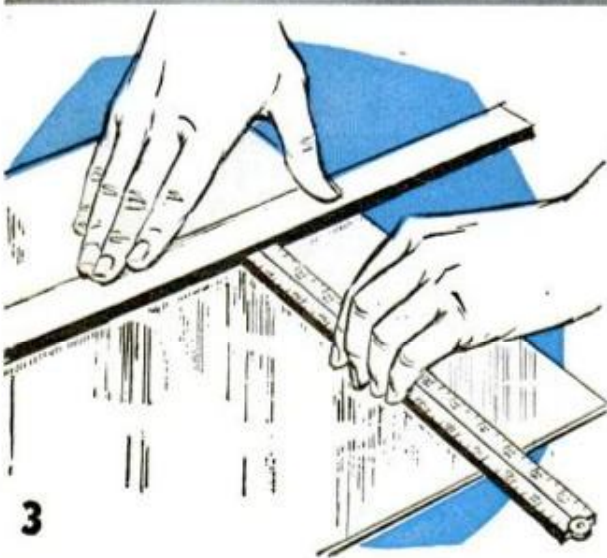
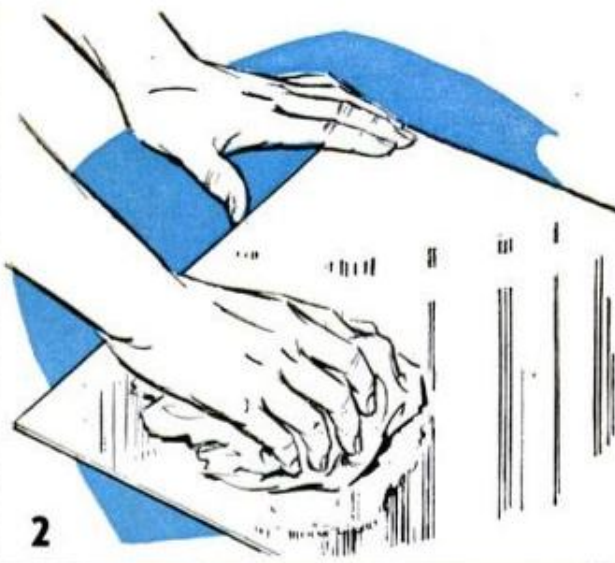
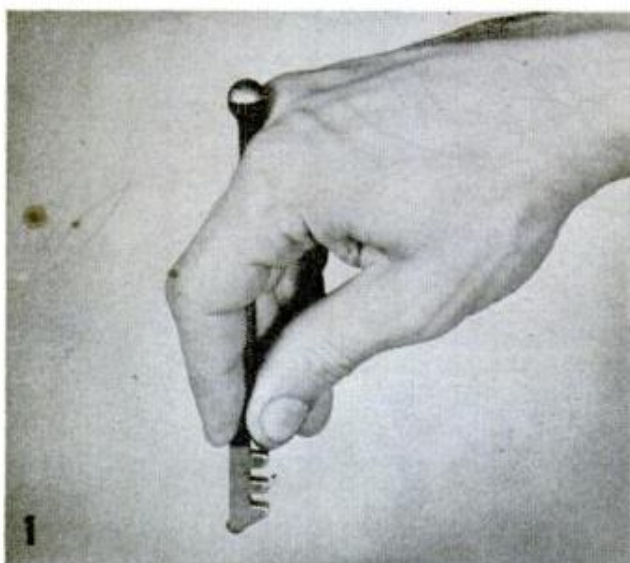
By C. W. Woodson

MAKING A CLEAN, sharp score to a uniform width and depth throughout the length of the cut is the trick—the whole trick—in cutting glass. Fill this single requirement and you'll get a perfect break every time. That clean, sharp score is the result of several preparatory steps. These are simple to carry out but each calls for close attention to detail.

First, there's the method of holding the wheel-type glass cutter, Fig. 1. This cutter is the type most commonly used. Note in Fig. 1 that the handle of the cutter is held between the first and middle fingers and that the handle is shaped to make this the most comfortable grip. If you hold the cutter between the thumb and first finger, you tend to lose control when making the cutting, or scoring, stroke. In actual practice glaziers usually incline the cutter slightly when making the scoring cut, as in Fig. 4. The slight inclination gives some-

what better control of the cutter when working against a straightedge.

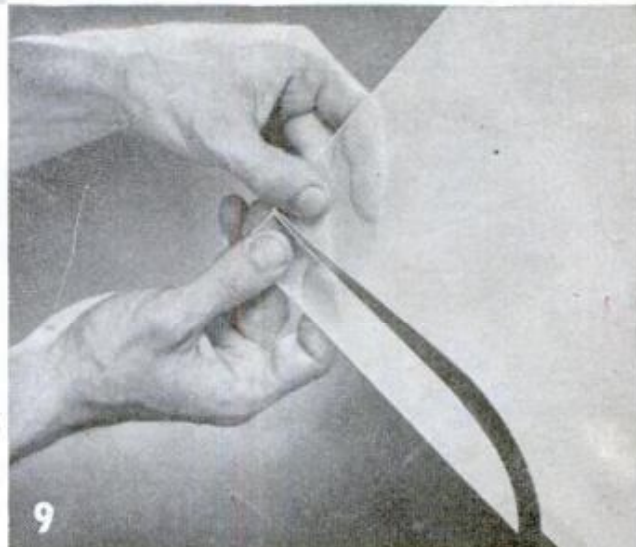
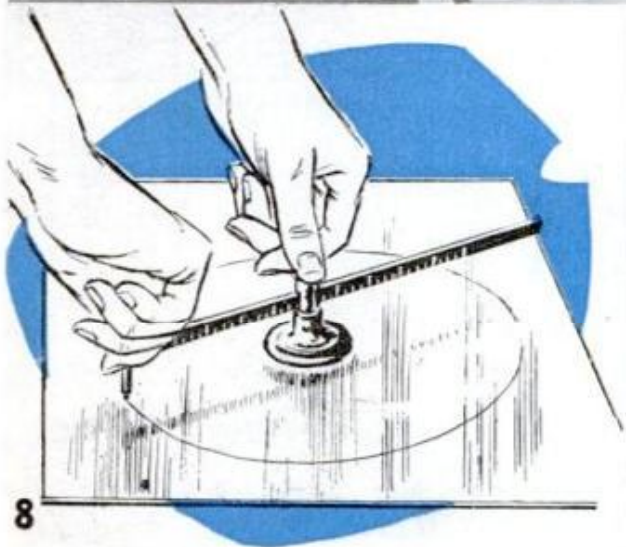
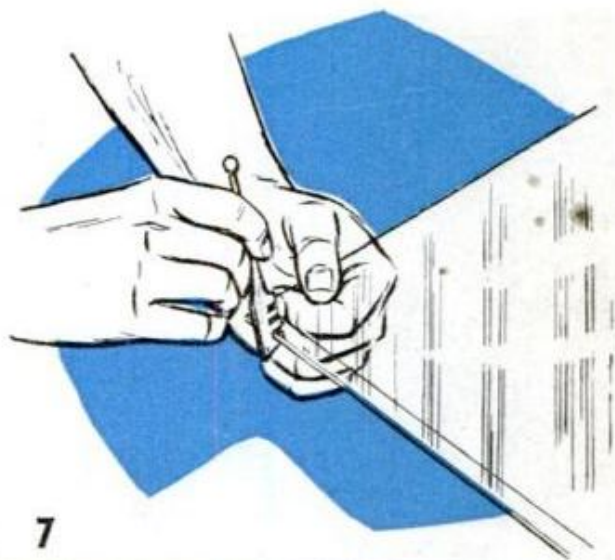
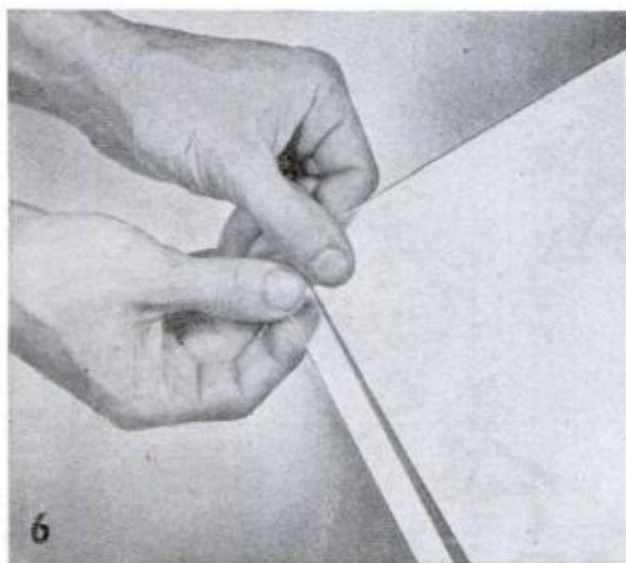
Before cutting, the sheet of glass must be cleaned thoroughly. This is important for if there is a coating of dust or a grimy film on the surface you cannot get a clean score. Fine dust usually can be wiped off with a damp cloth as in Fig. 2, and then the surface should be wiped dry. But if the glass has been stored for some time, the surface is likely to be coated with a cloudy film of grime that will not ordinarily wipe off easily. The film must be removed by scrubbing vigorously with an artificial sponge and a medium washing-powder solution as in Fig. 5. After scrubbing, rinse the surface of the glass with clean water and wipe dry. If you are cutting old window glass that may have been cleaned with a wax-type cleaner, wipe the surface with a solvent after scrubbing to make sure that all the wax coating has been removed.



CUTTING GLASS

The next step in the procedure is to locate the straightedge accurately. A yardstick will serve as a straightedge as it is about the right width and thickness. In ordinary work, positioning the straightedge can be done as in Fig. 3. Place several layers of newspaper or a desk blotter on a level surface such as a bench top or table top and lay the glass on top. Then measure from one edge with a rule, near one end as indicated. Do the same at the opposite end of the piece to be cut. When taking these measurements don't forget to allow for the offset of the glass-cutter wheel in its frame, or yoke. Usually this is about $\frac{1}{16}$ in. but may vary with different types of cutters. Check to make sure. Also, if there is any doubt about the squareness of the piece of glass you are to cut, check the corners with a square.

With the straightedge in place you're ready for scoring, or cutting, as it is generally called. Place the wheel of the cutter at the edge of the glass farthest from you,

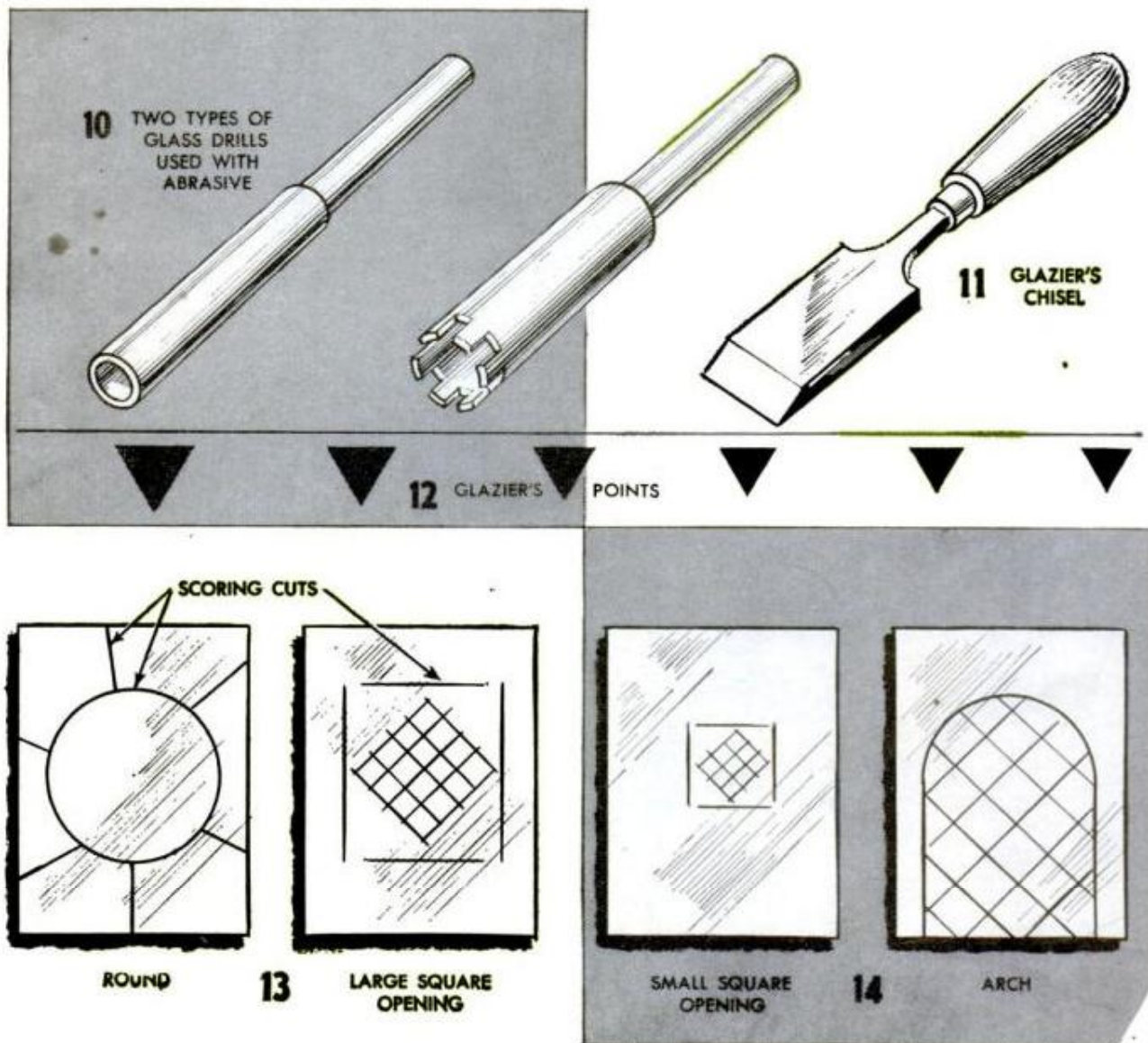


hold the cutter as in Figs. 1 and 4, and make the cut along the straightedge in one sweeping stroke, keeping light and uniform pressure on the cutter and holding the straightedge firmly in place. Now, before the cut gets "cold", pick up the sheet by a corner and grasp the edge with both hands, a thumb and forefinger on each side of the score as in Fig. 6. Exert a light breaking pressure to snap the sheet into two pieces along the score, or cut. If the score is continuous, the sheet will break true along the cut. But if you hesitate or skip at any point, it will break short as in Fig. 9.

After the first cut you measure again as in Fig. 3 and make the second cut to get the piece of a width and length you want from the sheet. Don't attempt to cut a small square or rectangular piece from the corner of a larger sheet. Glass will not break two ways simultaneously even though the cuts are perfect. You can cut close to an edge and still get a perfect break as in Fig. 6, but if the distance from the cut to the edge is less than $\frac{1}{2}$ in., then it is better to make the break with the glass cutter as in Fig. 7,

or use glass pliers, Fig. 19. When cutting to measured sizes, as in cutting panes for window sashes, allow at least $\frac{1}{16}$ in. for expansion of the glass and for bedding in putty.

Round, square and rectangular openings can be cut in glass sheets and circular panes are easily cut with a circular glass cutter as in Fig. 8. After the circular cut has been made, straight cuts are made from the four edges of the sheet as in the left-hand detail, Fig. 13. Then fractures are started by tapping lightly with the ball end of the glass-cutter handle on the underside of the sheet and directly under each straight cut. Once the cracks are started, the pieces can be broken away, leaving the circular pane. A square opening in a sheet, relatively large or small, also can be cut as in the right-hand view of Fig. 13 and the left-hand detail in Fig. 14. First you cut the outlines of the opening but note that the cuts are not completed to the corners. Next, tap the underside of the glass sheet with the ball end of the cutter handle at the center of each cut. The purpose of this step is to

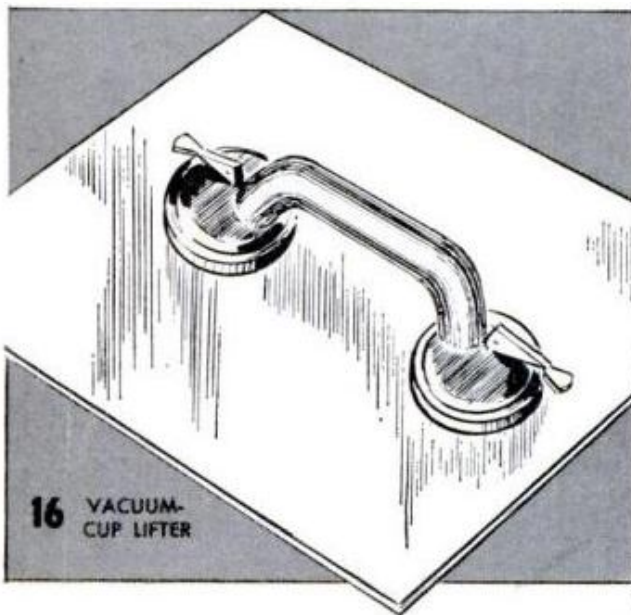


start a crack at each of the four points. Then you make the diagonal cuts in two directions and equally spaced as indicated. Tap these cuts from the underside to start cracks, or fractures, in both directions. Then simply knock out the center square. If the cuts are complete and the breaks well started, it will drop out when tapped lightly with a mallet. Then you can break away the triangular corners that remain. Finish the rough edges with an oilstone. By a similar procedure you can form an arch in a sheet of glass by first completing the semi-circular and straight cuts to one edge as in the right hand detail, Fig. 14. Then cross-hatch the waste with spaced cuts and start fractures by tapping as before. This must be done very carefully as otherwise the sheet may shatter. By starting fractures on all the diagonals and working from the edge of the waste, it is possible to remove the waste one piece at a time until you reach the top of the arch. Breaks along curved cuts are not always as smooth as along a straight cut. It usually is necessary to fin-

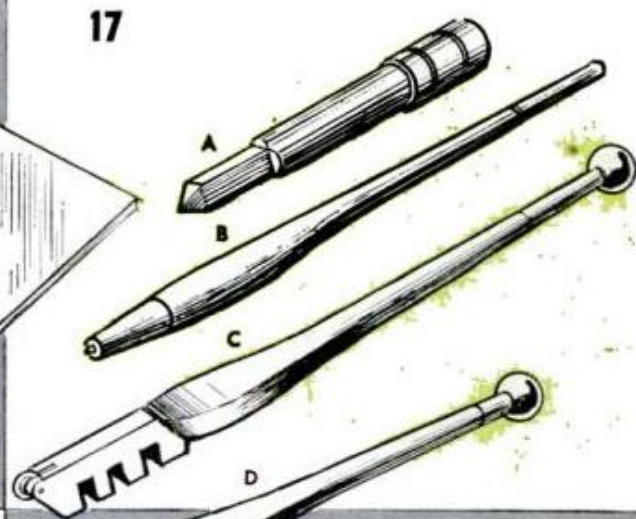
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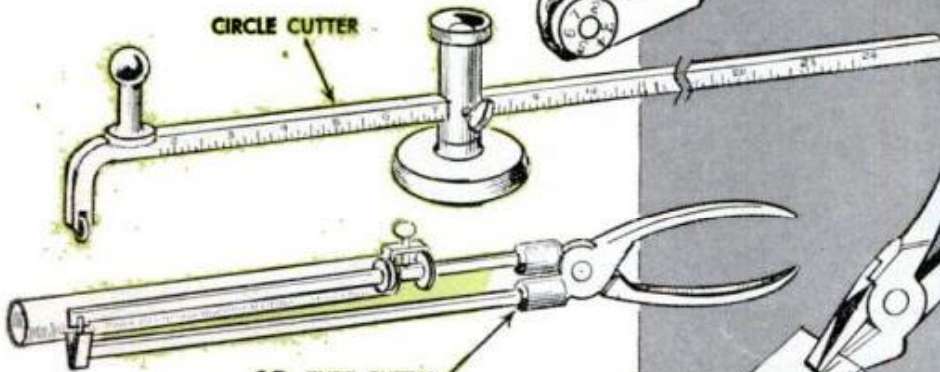
DRILLING HOLES through glass is done in a drill press, using suitable drill and mixture of abrasive and oil. Use slowest speed, lift drill frequently



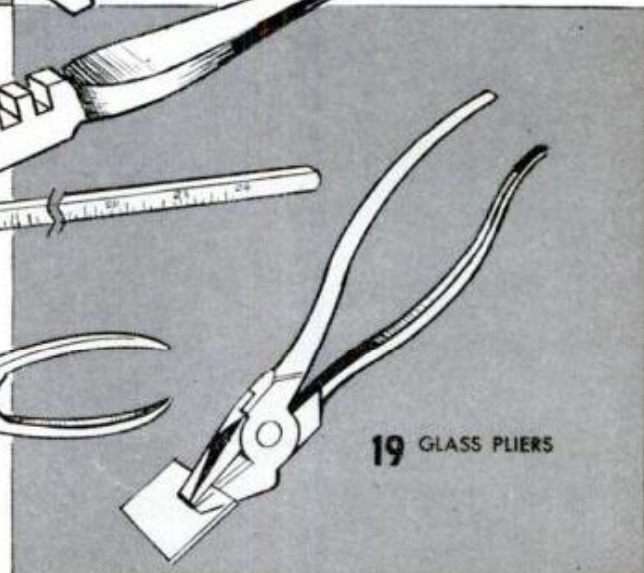
16 VACUUM-CUP LIFTER



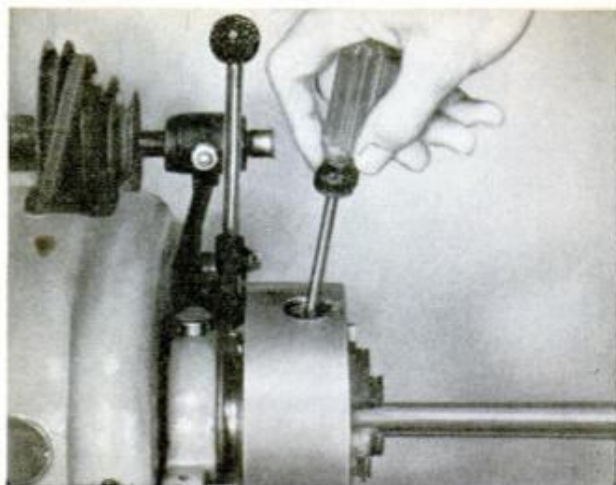
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18 TUBE CUTTER

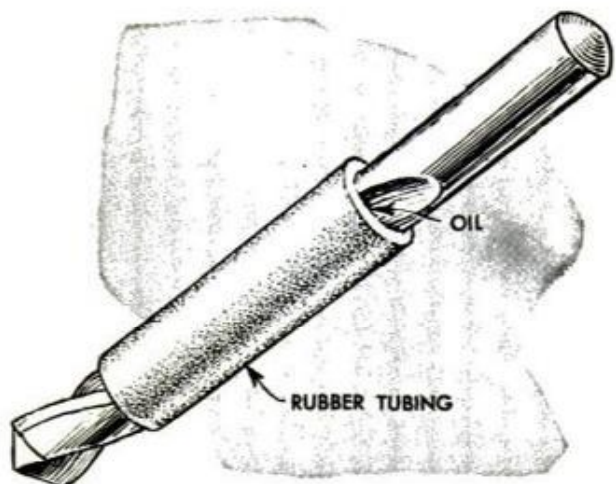


19 GLASS PLIERS



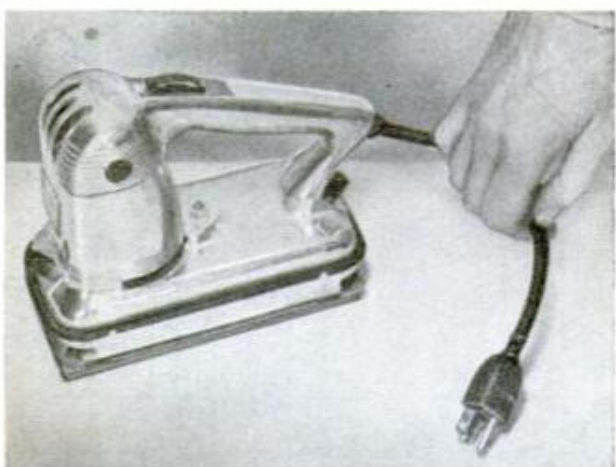
Chuck Adjusted With Screwdriver

When the job requires movement of chuck jaws through a wide range, either when centering work or in chucking parts of various sizes, you'll find a screwdriver much faster than the regular chuck wrench for running the jaws in and out. Be sure to select a screwdriver with a blade of just the right width to fit diagonally into the square socket of the adjusting screw. You don't use the driver for tightening the screw, but merely to run it in or back it off fast. If you're careful, you won't damage the chuck screw in any way and you'll save a lot of time.—R. Hanscom



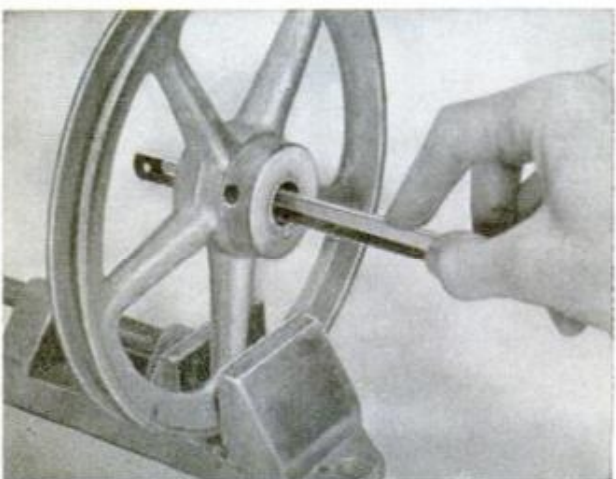
Lubricant Fed to Drill Bit

Where you have only an occasional job of metal drilling the main problem is that of getting lubricant to the point of the drill continuously and in a uniform amount. Applying a few drops with an oil can occasionally won't do. The oil will be thrown off the rotating bit before it reaches the point. A better way is to slip a length of rubber tubing over the drill and then pump several drops of lubricant into the flutes before starting the machine. The rubber tube will conduct the lubricant down the flutes to the point without loss.—Daniel Bousha



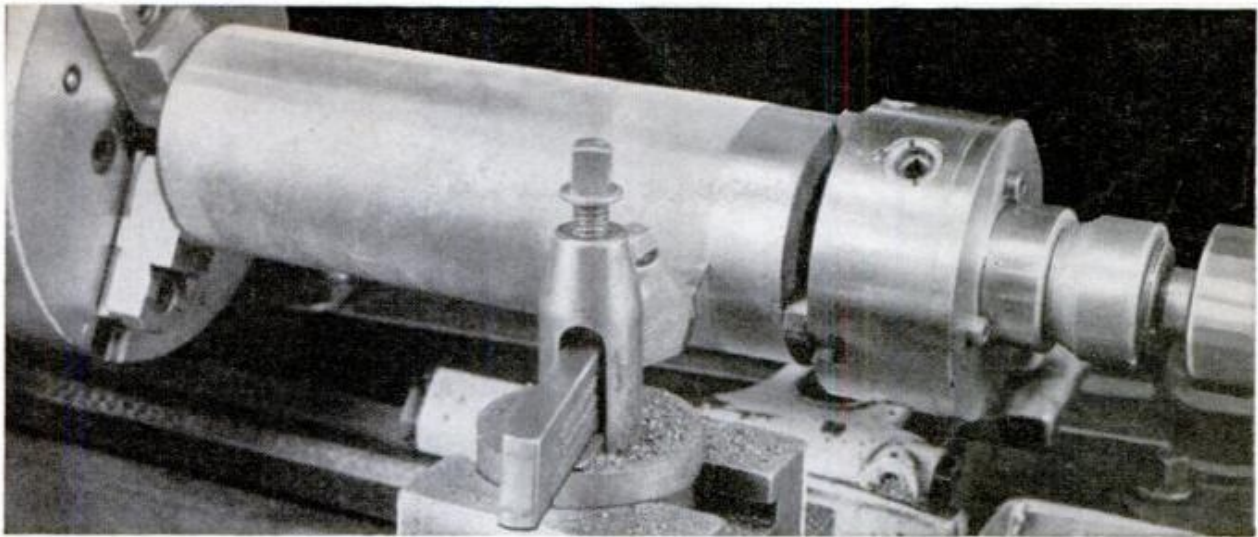
Short Power Cords for Convenience

Shortening the power cord of portable electric tools such as sanders, drills, and saws to about 12 in. and then fitting a grounding plug makes these tools much more convenient to handle and store, especially where the tools are kept in individual carrying cases. Each tool is then operated by plugging it into one end of a long heavy-duty cord which leads from a nearby outlet. This preferably should be a three-wire cord so that the tool is always grounded when connected to the power source. Long, three-wire power cords are readily available.



Backing Stiffens Hacksaw Blade

Although it's not an orthodox procedure one sometimes finds it convenient or necessary to use a hacksaw blade without the frame. The average hacksaw blade is not stiff enough for accurate work, especially if you have to use considerable pressure. If you take the time to cut a strip from sheet metal, bend it lengthwise to a tight U-shape and then force it over the back of the blade, you will find that the strip stiffens the blade so that you can make a very accurate cut with it. Cutting a key way as pictured is an example of what can be done with a blade backed in this manner.



Chuck Supports Tubular Work on Tail Center

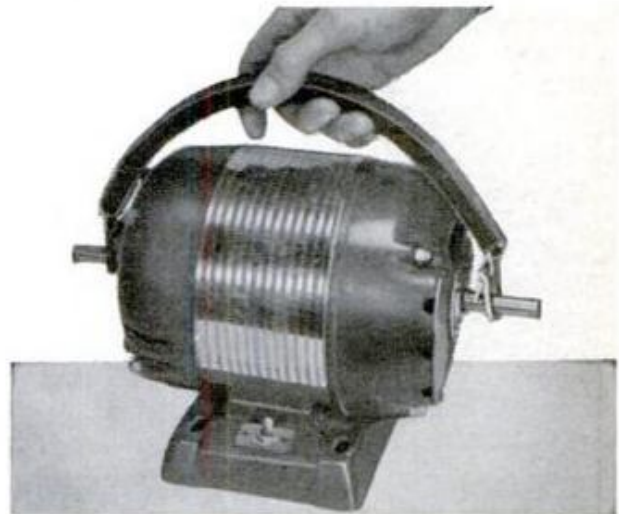
When the inside diameter of tubular work is too large to permit the outboard end of the tube to be supported on a pipe center, a small three-jaw chuck will fill in nicely. First the hub of the chuck backplate is lightly chamfered internally to provide a seat for accurate bearing on a small pipe center. Be sure to run the chamfer at

the correct angle. Then, using the internal jaws in the chuck, stand the work on end, place the chuck and tighten the jaws. If the tubing has been saw-cut to length, deburr the end before mounting the chuck. Then make the setup between centers as pictured, with the smaller chuck supporting the work at the tailstock end.

Flexible Battery Carrier Serves as Motor Lifter

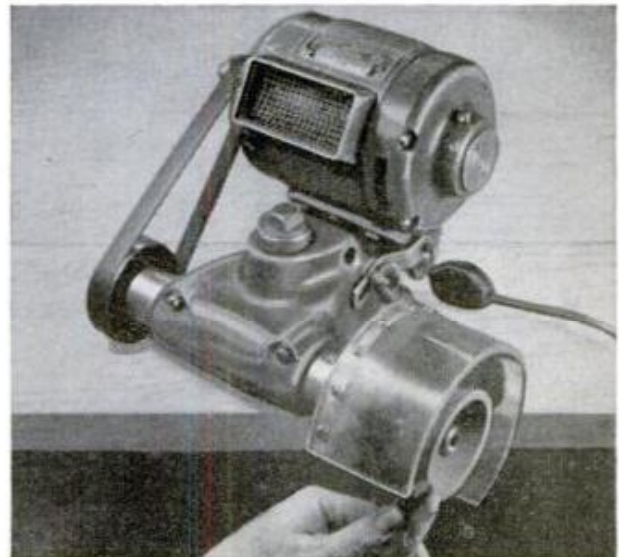
Motor repair shops and home workshop owners who use one motor for driving machines at different locations will find an ordinary flexible battery carrier handy for lifting and carrying small motors with double shafts. The holes in the lugs of the battery carrier will fit over both $\frac{1}{2}$ and $\frac{5}{8}$ -in. diameter shafts easily and permit the motor to be carried safely in an upright position with one hand. Small diameter pulleys need not be removed from the motor when using the carrier.

—H. Hanscom

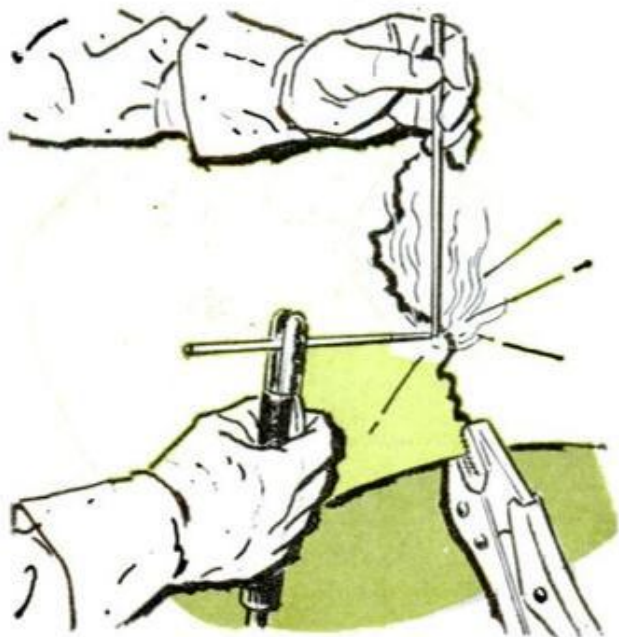


Lathe Toolpost Grinder Handles Bench Work

Due to the variable speeds and the various types and grades of grinding wheels which can be used, a lathe toolpost grinder mounted on the edge of the workbench gives you a versatile high-speed unit for handling those delicate freehand grinding jobs. To mount the grinder simply drill a hole through the bench top near the outer edge, or at the end of the bench top if you prefer, and fasten the grinder in place with a single bolt. Although it is pictured at approximately a 45-degree angle with the edge of the bench top, the grinder also can be located at right angles and shimmed higher if desired.

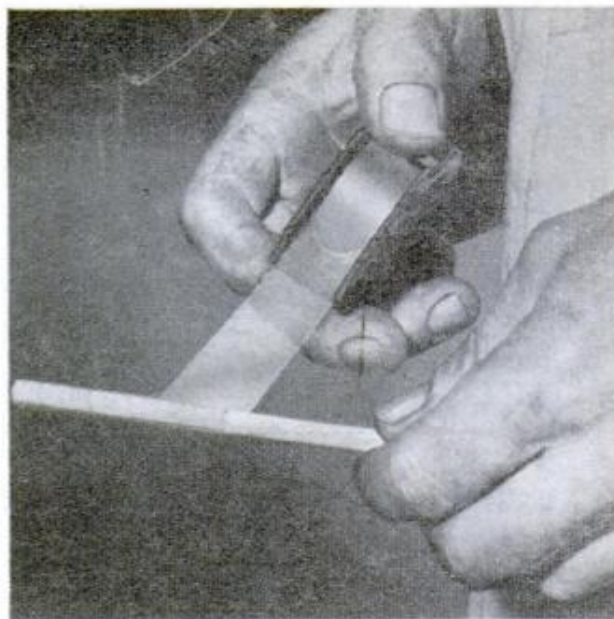
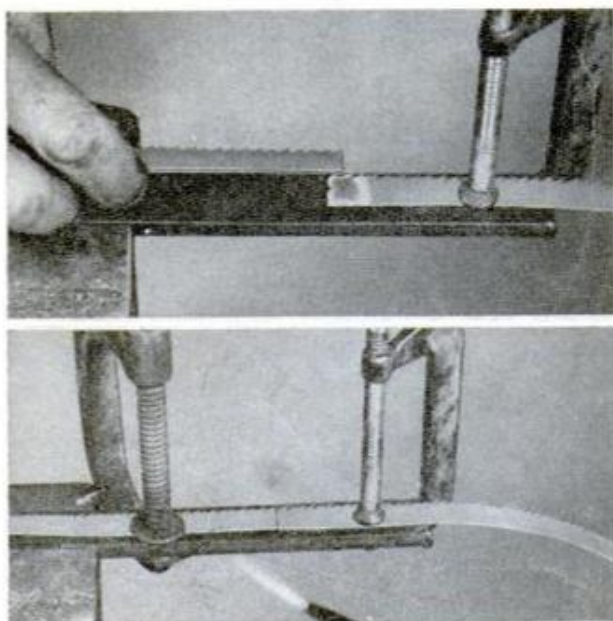


Eight Handy Tips



When welding light sheet metal with the arc there is a tendency for the metal to burn away rather than join. To prevent this the sheets are sometimes overlapped, but as a rule a better way is to use two welding rods. Hold one rod on the surface being welded and start the arc against the rod and about $\frac{1}{4}$ in. above the tip.

To join ends of a broken bandsaw blade, file a bevel $\frac{1}{2}$ in. long on each end of the broken blade. Then clamp the ends to a flat-steel bar with the beveled ends overlapping the exact length of the bevels. Apply a suitable flux and a small square of silver solder. Then play the torch flame along the bottom of the clamping bar.



When emergency repairs are needed where there is a lot of moisture, you're less likely to have trouble making a weld under these conditions if you keep the rod dry by wrapping it with cellophane tape. If the repair is a long, wide crack, then it's usually best to lay an extra rod in the crack to serve as a filler strip.

When necessary to use the arc welder for cutting light sheet metal one fairly good method of eliminating slag and making a clean cut through the metal is to dip the rod in water before striking the arc. Repeat the dip if the cut is long. Of course, steady holding of the rod also contributes something to the smoothness of the cut.



For Welding Shops

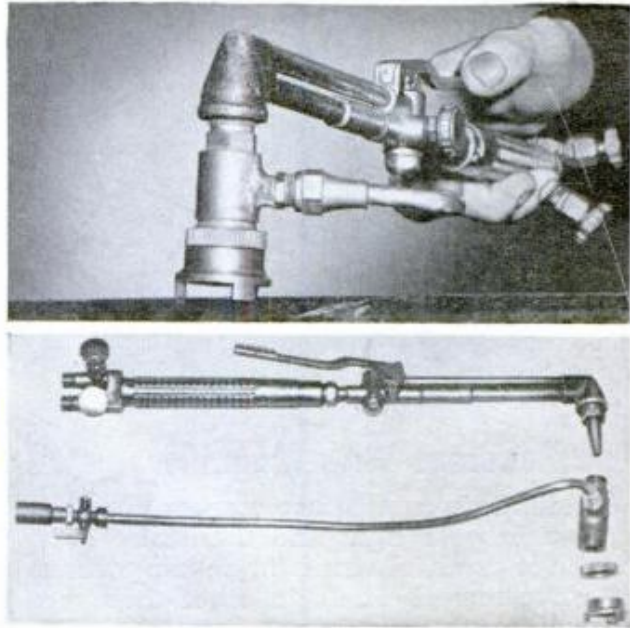


On occasion it may be necessary to cut metal where it is difficult or impossible to work with a hacksaw. In such hard-to-get-at places the arc often can be used to solve the problem. When making any cut under difficult conditions with an arc, always keep the fire hazards in mind. Clear away flammable material before attempting cut.

Threaded end of a broken bolt is easily removed from a tapped hole simply by welding a short length of metal rod to the broken section to serve as a "wrench." Hold the length of rod on the broken end of the bolt and strike an arc about $\frac{1}{4}$ in. up from the end. Work down to the end. This will prevent slag from filling exposed threads.



DECEMBER 1960



To cut under water the tip of a burning torch must be protected. The two photos above picture one way of making a suitable protective sleeve, or shroud. The sleeve is made from pipe fittings and tubing, the latter conducting compressed air to the tip. The sleeve is fitted with a depth gauge having three prongs which allow air to escape.

Before welding aluminum the work must always be preheated. One way to determine the proper temperature is to smoke the surface with raw acetylene flame until it is blackened. Then adjust the torch to welding flame and heat until soot is burned away and the metal returns to its normal color. It is then preheated for welding.

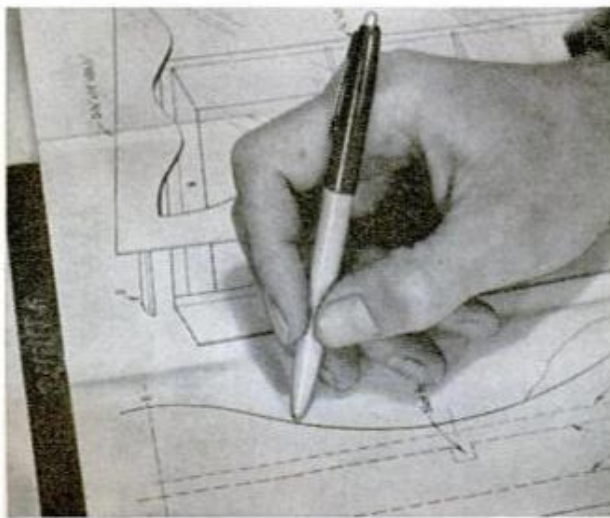


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True Readings With Magnifier

Graduations on a micrometer are difficult to read in poor light and there also is a chance of error in taking the reading when the mike must be held in other than the normal position. One way to minimize the chance of error is to attach a small magnifier to the mike with a rubber band. A magnifier of the type having a plastic bezel is just the thing as it is of ample size and is not easily broken. The rubber band holds the magnifier securely, yet permits it to be held at the proper distance for accurate reading of the graduations.



Ball-Point Pen Serves as Stylus

When all the ink in the cartridge of a ball-point pen has been used, the pen itself makes an excellent stylus for making clear tracings with carbon paper or on a mimeograph stencil. The ball point of the pen rolls smoothly on any tracing surface without wrinkling or cutting through under considerable pressure. The rolling point makes it easy to trace some drawing free-hand, without using a ruler or draftsman's curve. Should the ball stick in its socket and refuse to roll, dip in lacquer reducer.

PIPE BAR CLAMPS Get Bigger Bite

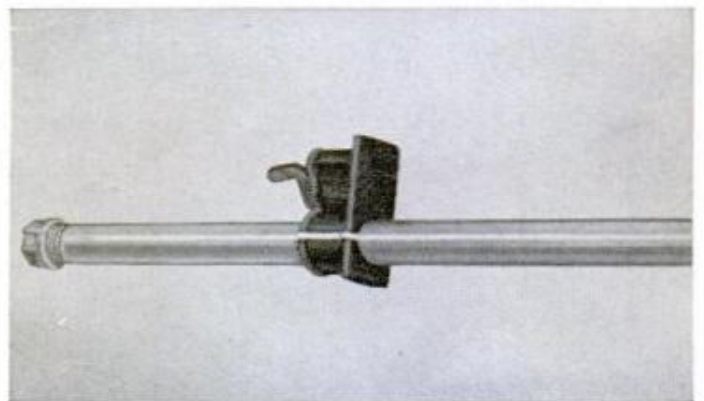
FACING THE JAWS of bar clamps with large wooden pads gives the clamps greater capacity in work thickness and also a soft, smooth jaw face that won't mar, indent, or crush the work. Large wooden pads can be made for any type of bar clamp, those with wooden bars, pipe bars and also steel-bar clamps having I-shaped, T-shaped, or rectangular steel bars. The pad detailed on the opposite page is made for the pipe-bar clamp and can be made with a round hole through which the pipe bar is passed, or it can be made with a U-shaped opening which allows the auxiliary wooden pad to be removed and replaced without having to unscrew the end cap on the pipe bar and slide off the moveable jaw in order to remove the pads.

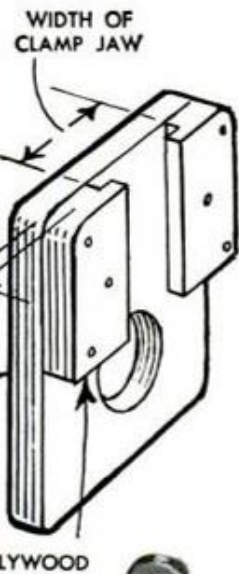
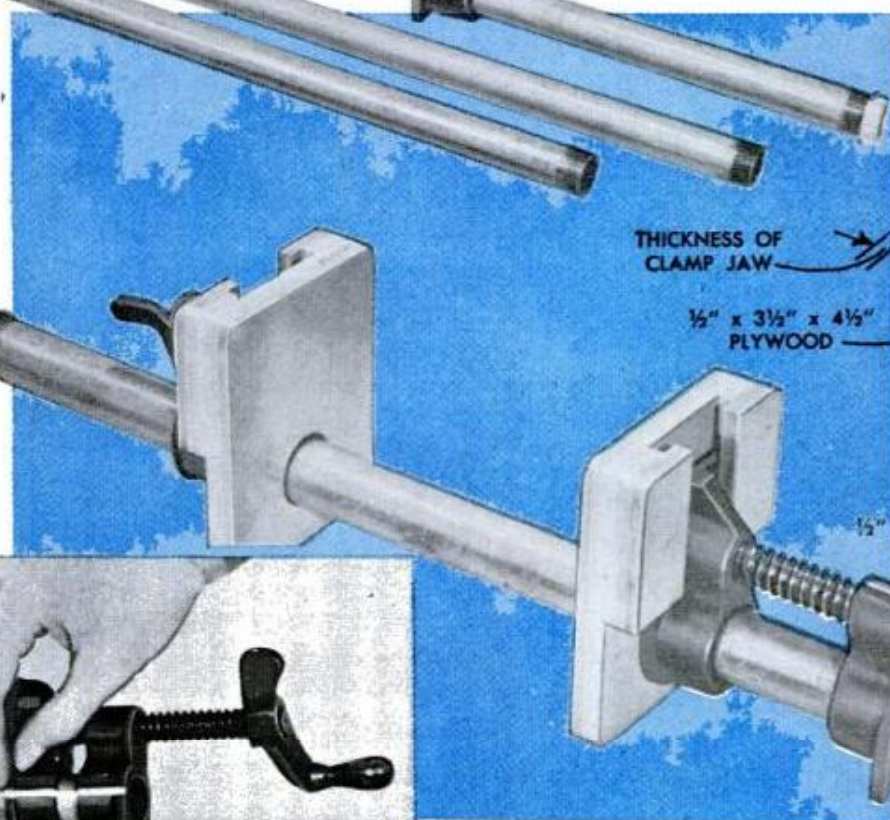
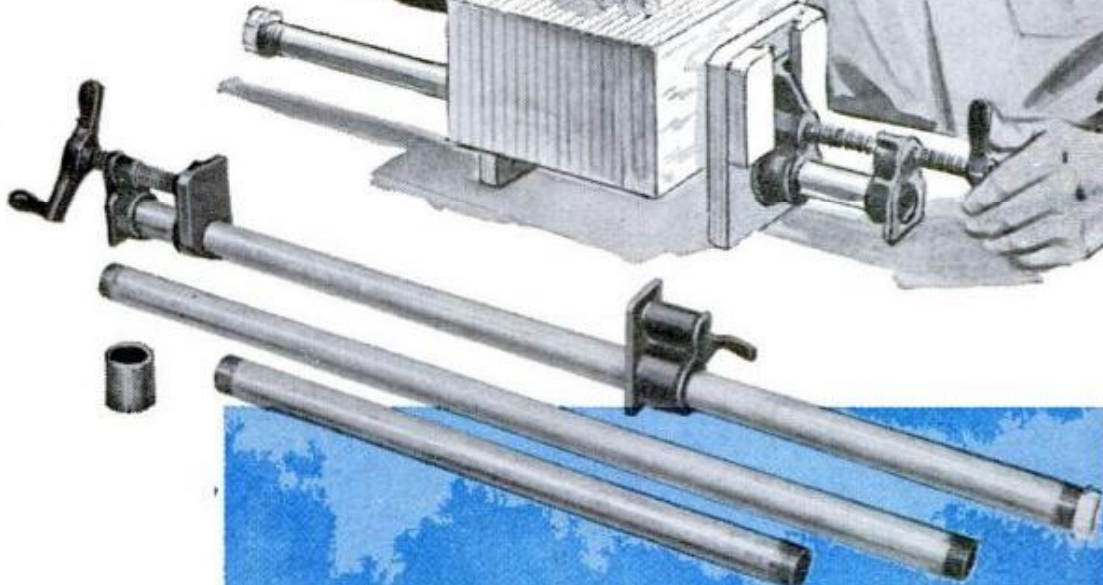
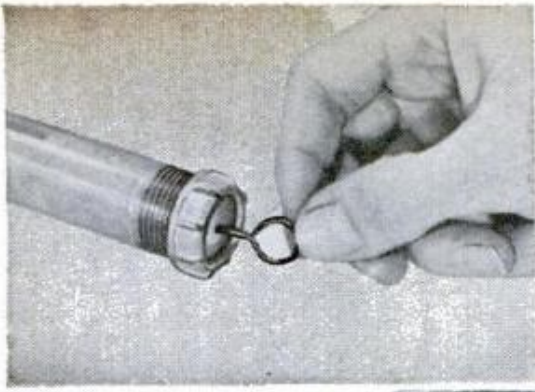
Often, when you're all set to edge-clamp a large panel consisting of several pieces which are to be glued together, you discover that the moveable, or sliding, jaw of a pipe clamp is not in line with the fixed jaw. That's a time when you may wish you had an extra pair of hands to get things lined up before the glue begins to set. To avoid this, file a narrow flat along the length of the pipe bar, then paint a thin stripe in contrasting color on the flat and over both jaws as in the photo below.

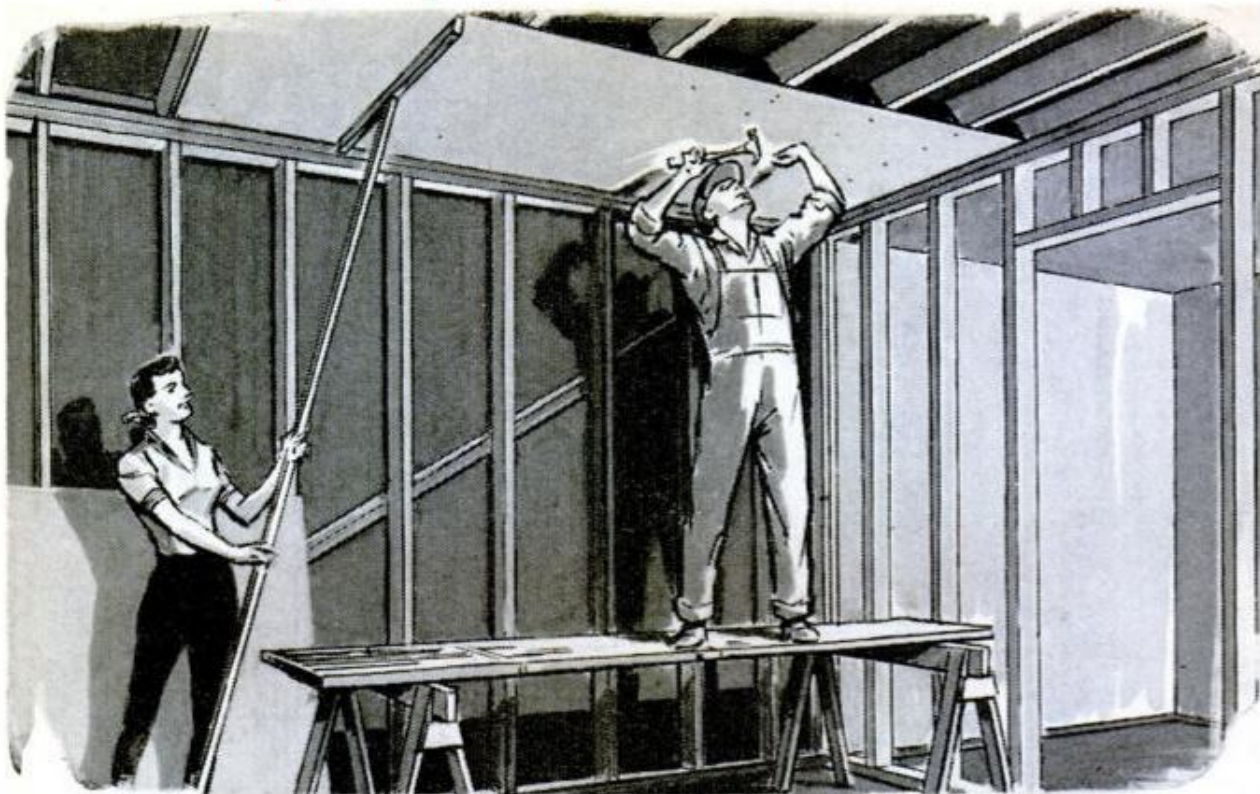
When you fit pipe-clamp fixtures to pipe bars it's a good idea to provide three lengths of pipe as in the center photo, opposite page. Then you have three bar lengths for each clamp.

Then there's the problem of storing pipe-bar clamps. One simple way is pictured in the upper photo, opposite page. Cut a metal disk to fit inside the end cap, or stop, center-drill it, then form an eye from heavy wire. Insert the end of the wire in the hole and bend over. Then screw the whole thing back in place and you have a hanger.

—R. Hanscom







HOW TO CUT, NAIL AND

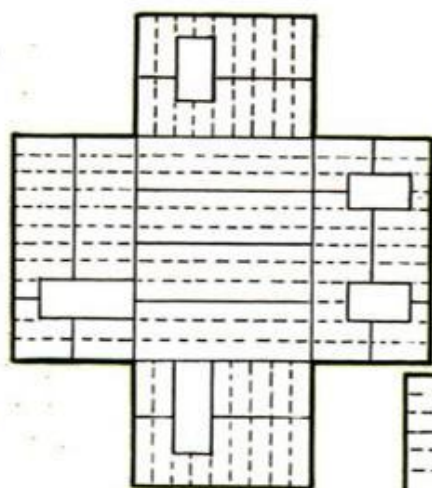
YOU CAN ARGUE the merits of dry-wall versus plaster but from the standpoint of do-it-yourself application, there's little room for question—plastering, generally speaking, is off limits for the inexperienced homeowner. It's just beyond the ability of the average do-it-yourselfer. But drywall is something most any handyman can tackle with professional results. It's all in knowing how to cut the board, nail it and tape it.

Selection of the type and thickness of the wallboard depends, of course, on the nature of the job at hand and on the thermal and insulating qualities demanded.

Thus, for installation over an existing wall or ceiling which is badly cracked, $\frac{1}{4}$ -in. board is usually preferred. The $\frac{3}{8}$ -in. and $\frac{1}{2}$ -in. boards are mainly used in new construction. A $\frac{5}{8}$ -in. thickness also is available for single-layer construction. If desired, insulating qualities also are provided by a special aluminum foil lamination on the back surface for use on the interior faces of exterior walls. This reduces heat loss in winter and heat gain in summer. Remember, the thicker the wallboard used, the stronger the wall will be, the less sound will be transmitted through it and the greater its fire resistance.

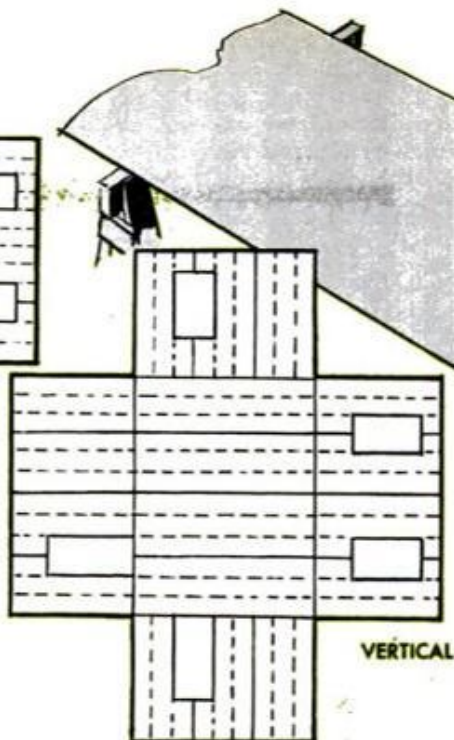
WALLBOARD PANELS are easily cut by placing them on a flat surface, scoring the face paper with a sharp knife and bending them downwards to break the core. Finish cutting by slicing through the back paper



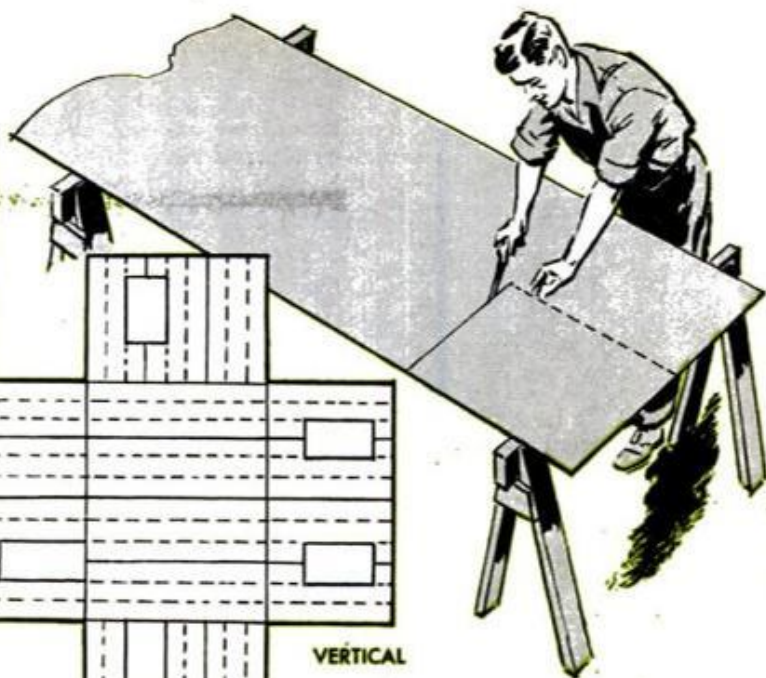


HORIZONTAL

NO GUESSWORK involved when the room is measured and the layout of the wallboard panels is carefully planned and plotted in a sketch like the one above



VERTICAL



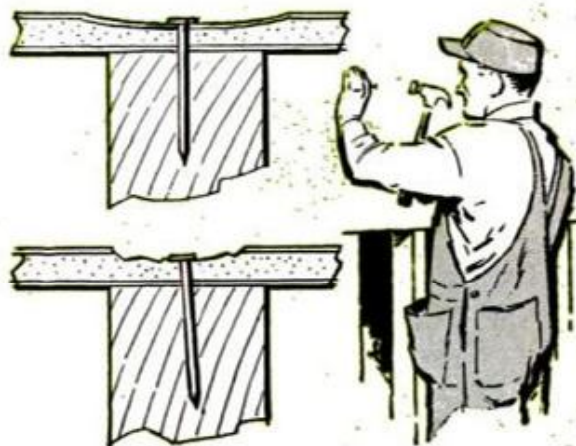
TAPE PLASTERBOARD

A little planning goes a long, long way and in putting up wallboard, this is bound to result in a much better looking job. To begin with, see that the framing is plumb and level. Existing framing particularly. Sagging or deteriorating members may cause difficulties in the application of the wallboard. Double up studs at all corners for edge or end nailing and be sure that all headers supporting fixtures, such as sinks, cabinets etc., are in place. Inside corners also should be checked for nailing supports and all bridging should be securely nailed. Now, once you have all doors and window frames in place and set for the proper thickness of the wallboard and trim to be used, the preliminaries are over and you are ready for the next step.

For the relatively inexperienced do-it-yourselfer, it is usually a good idea to work from a placement sketch like the one shown above. The walls and ceiling of the room are drawn in a flat plan scaled $\frac{1}{4}$ in. to the foot. The doors and windows are drawn in and the layout of the panels is determined. If the ceiling height is 8 ft. 3 in. or less, a horizontal application of the wallboard panels will result in fewer joints, easier handling and less cutting. For greater

heights, or if the wall is 4 ft. wide or less, vertical application is more practical. Wallboard in 12-ft. lengths often is used as it results in fewer butt-end joints that must later be concealed. In many cases, panels of this length will entirely span a wall or ceiling, eliminating butt joints entirely. However, in determining whether to use 8, 10 or 12-ft. lengths, take into consideration the area in which you are working, and, of course, whether or not you will have someone to give you a hand. The longer lengths will require at least two men, whereas one man can easily handle the 8-ft. panels alone.

The only tools needed to apply wallboard are a sharp knife, a hammer, a straight-



PROPER NAILING procedure is vital to final appearance and durability of the finished wall. At the right, a well-driven nail set in a dimple formed by the head of the hammer. Below, poorly driven nail leaves paper broken and torn exposing gypsum core



TAPE is cut to the length of the joint, centered and pressed into place with the knife. Though excess cement is removed, be sure to leave enough cement under the tape to insure a permanent bond

CHANNEL formed by the tapered edges of the wallboard is filled fully and evenly. On the care taken in joint finishing depends the entire appearance of finished job



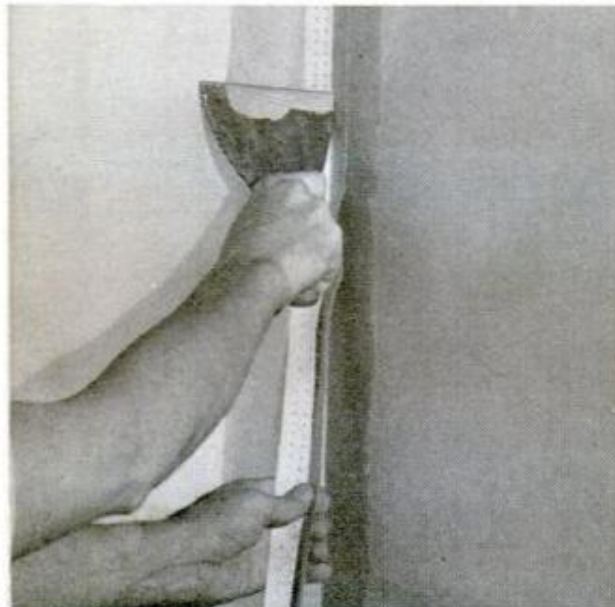
AS SOON as the tape has been embedded a thin covering of cement is applied over it, completely concealing it. While this is drying, panels may be checked for looseness and for protruding nails



WHEN the base coat of cement has dried, a second and third coat are added. The edge of each coat is feathered beyond the edge of the previous and each is then sanded



SUCCEEDING COATS of topping cement are feathered two or three inches beyond edges of previous coat



edge, a joint-finishing knife with a broad, flexible blade (like a large putty knife) and a keyhole saw.

Of course, the final appearance of the wall and the service it will give will depend on a good nailing job. This in turn depends on a proper selection of nails for the particular job. Below is a list of the proper nails to use, depending on the thickness of the wallboard selected.

$\frac{5}{8}$ -in. wallboard	6d wallboard nail (not a broadhead nail used for lath) or 1 $\frac{3}{8}$ -in. annular ring nail
$\frac{1}{2}$ -in. wallboard	5d wallboard nail or 1 $\frac{1}{4}$ -in. annular ring nail
$\frac{3}{8}$ -in. wallboard	4d wallboard nail, or 1 $\frac{1}{4}$ -in. annular ring nail

For the best results, nails should be driven straight into the wallboard and into the supporting member. The nailhead is set slightly below the surface of the board in a dimple created by the head of the hammer. **Above all, the head should not break the surface of the paper.** This is important. Before settling down to work, try driving a few practice nails through a piece of scrap and into a piece of 2 x 4. This will give you the feel of the hammer and of the resistance offered by the wallboard. Proper placement of the nails also is important. For example, never drive a nail less than $\frac{3}{8}$ in. in from the edge of the panel. On ceiling applications, spacing should be 7 in. o.c. On walls, the nails should be 8-in. apart. Always start nailing in the center of a panel

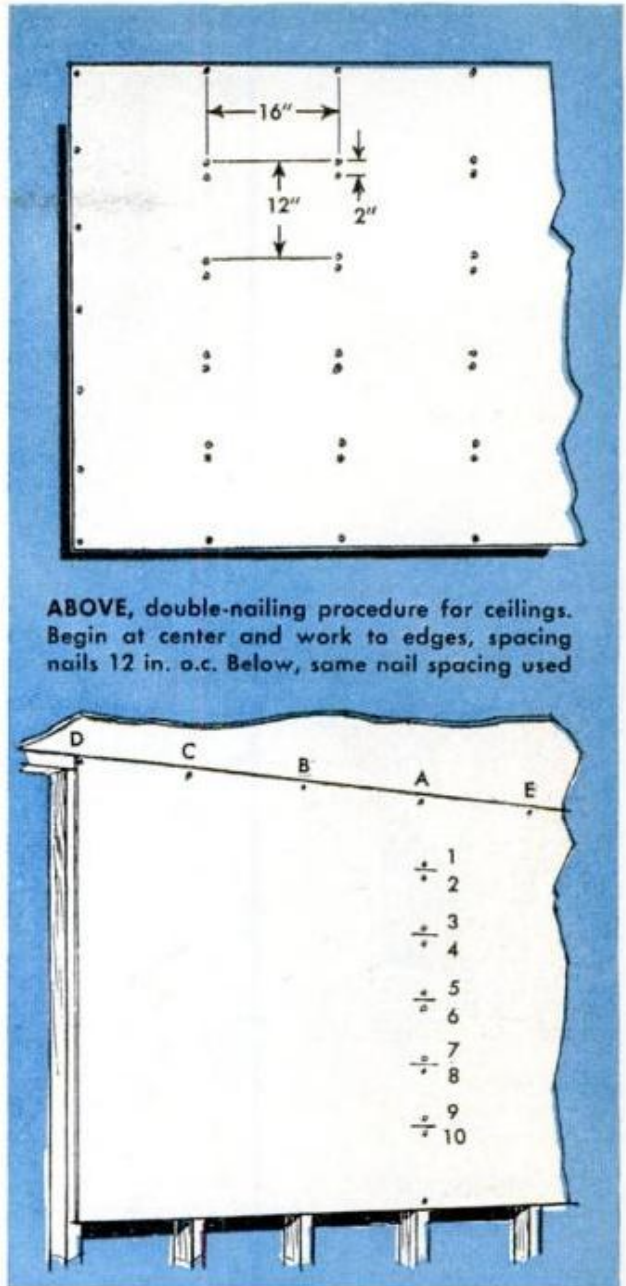
TAPE EMBEDDED into initial coat of cement must be pulled straight and even to be completely concealed



and work toward the edges, and hold the board firmly against the studs and joists with the free hand while nailing. The double-nailing system, illustrated at the right, provides an ideal means of avoiding loose panels. This system consists of driving the nails in pairs 2 in. apart with each pair 12 in. o.c. This same nail pattern may be used on ceilings as well as walls.

As a rule, it is a good idea to begin applying the ceiling first. Although two men usually work on a ceiling together, one man alone can easily install the wallboard by nailing a 1 x 2 wooden cleat to the wall just below ceiling level. This provides a support for one end of the panel while a long T-support is used to raise and hold the other end against the joists. To cut the panels to size, lay them flat on sawhorses or on a table and score the face paper with a sharp knife. Then break the gypsum core by snapping or bending downwards and cut through the back paper. (Remember, whenever possible the panels should be applied horizontally in lengths great enough to span walls and ceiling without end joints.) Once the ceiling is up, top wall panels are nailed in place and butted against the ceiling. In wall areas, butt joints should be centered above and below windows and doors and whenever a butt joint is made in the field of the wall, it must be made over a stud. Of course, where horizontal application is impossible or impractical, a vertical plan is followed.

Wallboard panels can be formed to almost any curved surface by placing a stop at one end of the curve and then gently and gradually pushing the other end of the board, forcing the center against the framing until the curve is complete. For sharp

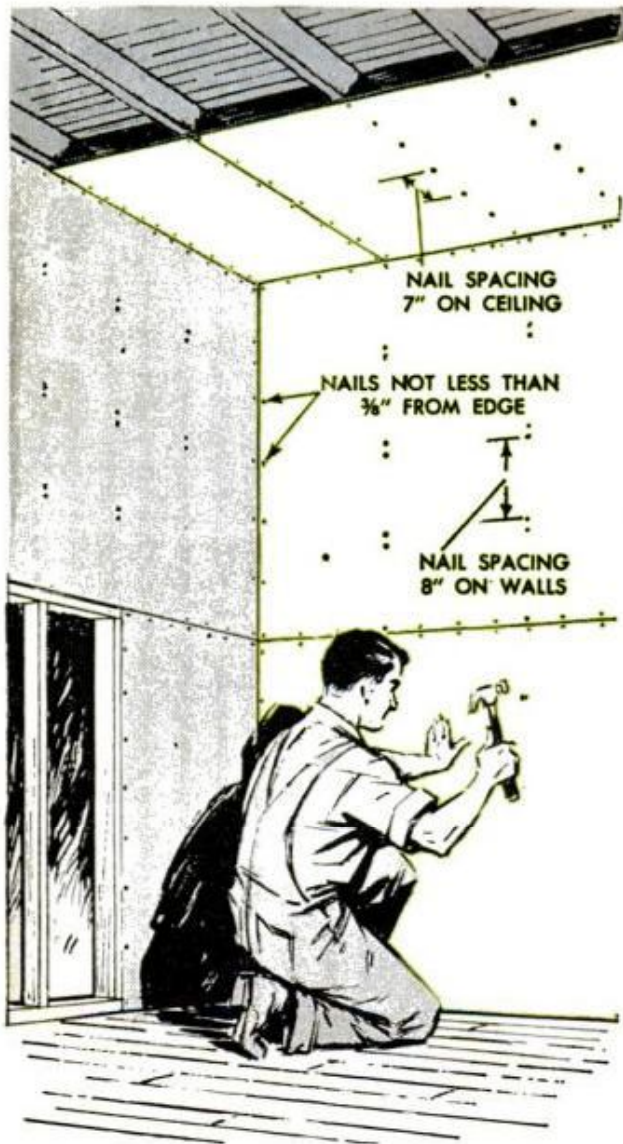


ABOVE, double-nailing procedure for ceilings. Begin at center and work to edges, spacing nails 12 in. o.c. Below, same nail spacing used

OUTSIDE CORNERS are concealed with three additional coats of cement feathered to a smooth finish

MADE ESPECIALLY for drywall construction, metal corner bead insures a strong, rigid outside corner





curves moisten the surface and the back of the panel thoroughly and allow the water to soak well into the gypsum core. This will allow it to be bent to a shorter radius. When dry, it will regain its original hardness. For arches, measure the total width of the arch, cut a strip of wallboard to this measure and score the back at 1-in. intervals. Break the core at the scorings and nail the panel to the framing at alternating segments. To locate the exact position of electric switches and outlets, hold the panel in place and, using a wooden block to protect the face paper, tap around the approximate location of the outlet with a hammer. This will leave a mark on the back of the panel to serve as a guide in sawing the opening.

A new method of applying wallboard uses a special mastic which is applied directly to the framing members. The advantage of this method lies in the fact that only half as many nails are required, and since the panels are bonded to the framing, the risk of loose boards is greatly reduced. It is particularly good when 1/2-in. or 5/8-in. panels are used over a fairly large area. Although it produces a superior single-layer drywall construction, the average homeowner finishing only a room or two will find it more expensive because of the added cost of the mastic, gun and pump.

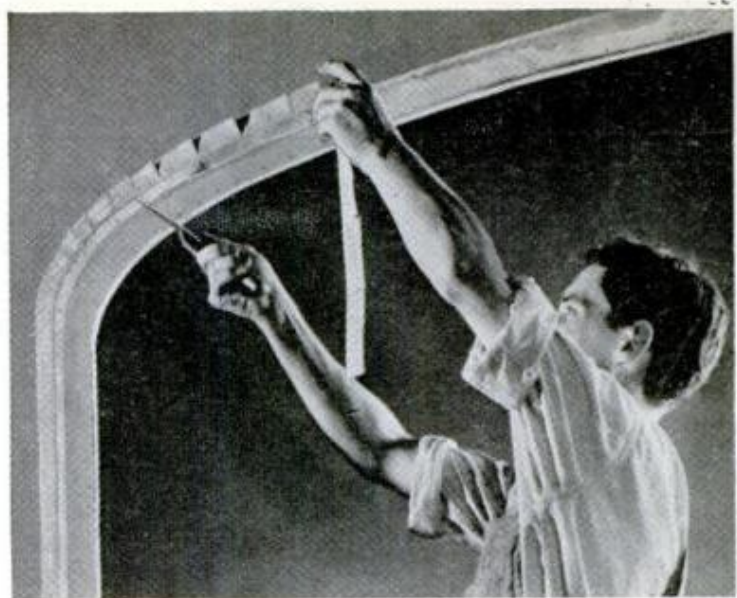
As with any project, the beauty of the finished work is the prime objective, and in this case the joint finishing will either make or mar the job. In mixing the cement, pay attention to the instructions on the package pertaining to the amount of water

NAILS SHOULD NEVER be less than 3/8 in. from board edges and spaced 7 in. apart on ceilings, 8 in. on walls. Be sure to hold boards firmly against frame members during nailing to insure against looseness

LARGER OPERATIONS may adopt the method of using a special mastic. This is applied directly to the frame members with a gun not unlike a caulking gun. Below, the gun is filled and a bead of mastic applied to studs



FOR ARCHES of considerable depth, wallboard is bent by scoring the back surface and breaking the core along the kerfs. For shallower arches, as above, panels of wallboard are mounted, one on each side of the arch frame and cut to shape. Tape edges are cut at intervals to permit it to follow the curve of the arch and the segments are later cut away



needed. When properly mixed, the cement will be somewhat dry and mealy and not as smooth as might be expected. Allow it to "set" for the length of time specified—usually about 30 minutes. It may then be stirred vigorously to break up any lumps and, if necessary, thinned with a bit more water. The best consistency is a little thinner than putty. Now inspect the walls for protruding nail heads and loose panels, rest these and begin to tape. Using a broad-bladed joint-finishing knife, butter the cement into the joints, filling them fully and evenly. Cut a piece of special joint tape to

the proper length and press it into the cement with the knife, removing the excess cement at the same time. Now cover the tape with another layer and while this is drying cover all the nail heads and fill the dimples into which the nails are set. After a period of 24 to 48 hours, a thin second coat of special topping cement may be applied to all joints and nail heads, feathering it beyond the edges of the first. Sand this second coat and apply a third, feathering ever further. A final sanding and you are ready for application of sealer and paint.

★ ★ ★

Number of Square Feet of Wallboard Required for Walls and Ceilings for 8-Foot Rooms
(no allowance made for openings)

		LENGTH IN FEET →															
		8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
WIDTH IN FEET ↓	4	224	244	264	284	304	324	344	364	384	404	424	444	464	484	504	524
	5	248	269	290	311	332	353	374	395	416	437	458	479	500	521	542	563
	6	272	294	316	338	360	382	404	426	448	470	492	514	536	558	580	602
	7	296	319	342	365	388	411	434	457	480	503	526	549	572	595	618	641
	8	320	344	368	392	416	440	464	488	512	536	560	584	608	632	656	680
	9	344	369	394	419	444	469	494	519	544	569	594	619	644	669	694	719
	10	368	394	420	446	472	498	524	550	576	602	628	654	680	706	732	758
	11	392	419	446	473	500	527	554	581	608	635	662	689	716	743	770	797
	12	416	444	472	500	528	556	584	612	640	668	696	724	752	780	808	836
	13	440	469	498	527	556	585	614	643	672	701	730	759	788	817	846	875
	14	464	494	524	554	584	614	644	674	704	734	764	794	824	854	884	914
	15	488	519	550	581	612	643	674	705	736	767	798	829	860	891	922	953
	16	512	544	576	608	640	672	704	736	768	800	832	864	896	928	960	992
	17	536	569	602	635	668	701	734	767	800	833	866	899	932	965	998	1031
	18	560	594	628	662	696	730	764	798	832	866	900	934	968	1002	1036	1070
	19	584	619	654	689	724	759	794	829	864	899	934	969	1004	1039	1074	1109
	20	608	644	680	716	752	788	824	860	896	932	968	1004	1040	1076	1112	1148
	21	632	669	706	743	780	817	854	891	928	965	1002	1039	1076	1113	1150	1187
	22	656	694	732	770	808	846	884	922	960	998	1036	1074	1112	1150	1188	1226
	23	680	719	758	797	836	875	914	953	992	1031	1070	1109	1148	1187	1226	1265

New Kits for Christmas

By Byron G. Wels

FOR NEW AND DIFFERENT Christmas gifts that will continue to "give" for years, why not consider electronic kits for your shopping list? This year you'll find a wide range of new kits designed for everyone from Junior to Grandpa, for the lowliest beginner and the highest hi-fi addict.

Here are test results from just a few of the new kits:

The Heathkit AJ-10 FM-AM tuner went together quickly and easily. Even with the AFC switch in the off position, there was no drift, even after a full hour of playing time.

Another attractive gift from Heath is an intercom unit. The novelty in this circuit stems from its flexibility. While the use of

multiple remote stations is not unique in itself, this unit permits the remotes to institute calls to the master. This is accomplished by a relay circuit, energized by a battery in the remote. The panel switching set-up allows private conversations between remote and master or between remote stations.

Lafayette has also brought out a unique and useful transistorized telephone amplifier. The compact box contains a five-transistor amplifier, driven by an inductive pick-up coil. Both sides of a telephone conversation are amplified via a loudspeaker. The unit is adaptable to other applications. For example, it has been used in the laboratory to amplify the signal from a portable

Stereophonic music system can relax the tensions that an executive faces every day. Music must be unobtrusive, and the system must require no attention. FM tuner (on bookshelf) is pretuned to a station broadcasting soft music with no commercials. Preamplifier (under tuner) is set for low volume. Music comes through matching loudspeakers all day, does not interfere with usual office routine





Busy office gets help from the new electronic kits. As telephone conversation is carried on, both sides are picked up and amplified. Secretary can hear and record the entire conversation. Intercom unit (rear) permits up to five remote stations to be used. Remotes can institute call

tape recorder. Secretaries can transcribe with the Lafayette amplifier instead of an earphone.

Stereo equipment has frightened away many would-be audiophiles because of the high prices. Lafayette has removed this objection with the KT-126 kit which provides four watts of stereo output and costs less than \$20.00. Not intended to compete with the higher power, more expensive amplifiers, this kit is adequate for a beginner in stereo, or for converting monophonic equipment to stereo.

New transistor radio kits are available from Knight and Eico. Both feature printed circuit boards. The Knight unit is housed in a plastic and metal case, the Eico in leather. Both units were tested in the PM electronics laboratory. The Eico unit has a larger speaker, additional transistor stage and larger antenna, making it somewhat more selective and sensitive, and improv-

Transistor radios are popular for beach or pool-side. Upper kit has a plastic case, lower unit is covered with leather. Both utilize printed circuitry





Component installation uses stereo preamplifier atop FM-AM tuner. Combination rests on one of the two matched loudspeaker systems. Tuner can be purchased as a kit, semikit, or fully wired and tested



ing the audio quality. But it is also somewhat more expensive. The advantage of the Knight unit is that it can be slipped into an ordinary purse. The Eico is about the size of a purse.

Acrosound has produced a preamplifier in kit form with some novel features. The two-tone panel separates left and right control functions, and the function switch provides equalization for all popular recording characteristics. The mode switch is operated in conjunction with nine lamps. As you switch positions, the lights indicate the channels and speaker combinations in use. Enough input jacks are available on the rear apron to cover any equipment you have or intend to own. Internally, the preamplifier boasts two prewired printed circuit boards. These not only facilitate assembly, but reduce the possibility of errors.

The Acrosound preamp was

Basic stereo amplifier has prewired printed circuit board to make assembly easier

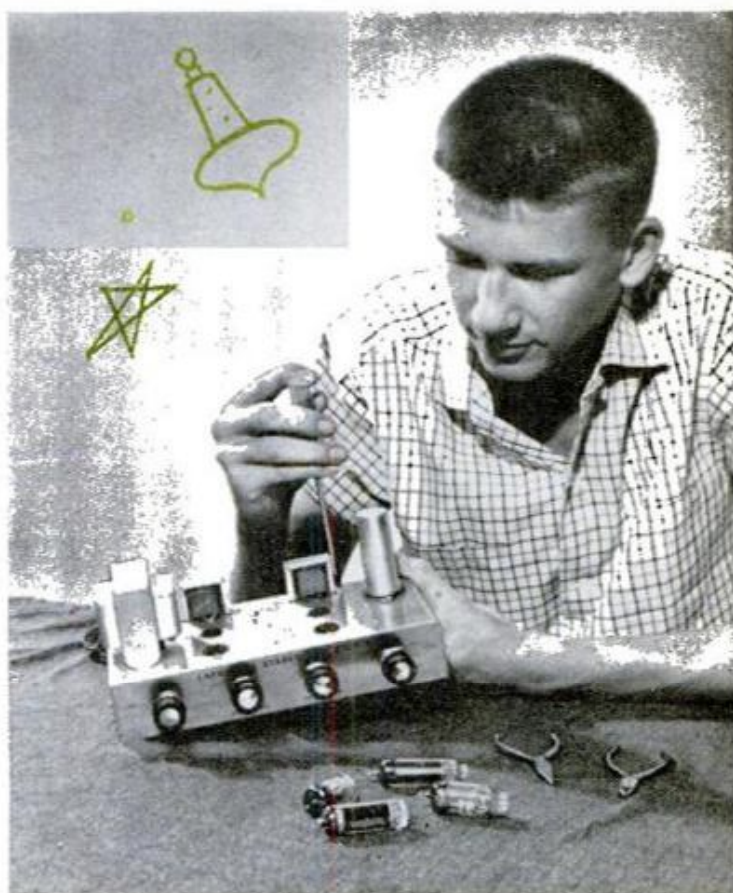


Clock radio kit can be preset to shut off radio after user falls asleep to music, start radio in morning. After 10 minutes of radio, an alarm buzzer sounds. Rear outlet can turn on electric coffee percolator

tested by using it to drive a Dynaco Stereo 70 basic amplifier. Basic amplifiers in general, are designed for out-of-sight installation. However, the chromium plated chassis and the brown perforated cover make this unit attractive enough for full-view display. The audio output transformers are conservatively rated, with the result that they operate well inside the point of possible distortion. It seems that the Dynaco engineers have underrated the unit to be sure that it performs as well as the specifications. According to our tests, it out-performs them.

Paco has produced an FM-AM tuner kit. FM tuners have been a sore spot for the manufacturers, as the critical front end is always a source of trouble. Most firms today get around this problem by wiring and sealing the front end, leaving it to be assembled into the balance of the kit which the

Low-cost stereo amplifier can be built in one weekend, using basic electronic tools





Complete kit of parts for this stereophonic preamplifier includes a matched pair of pre-wired printed circuit boards. Finished unit works with basic amplifier, provides all control and selector functions needed

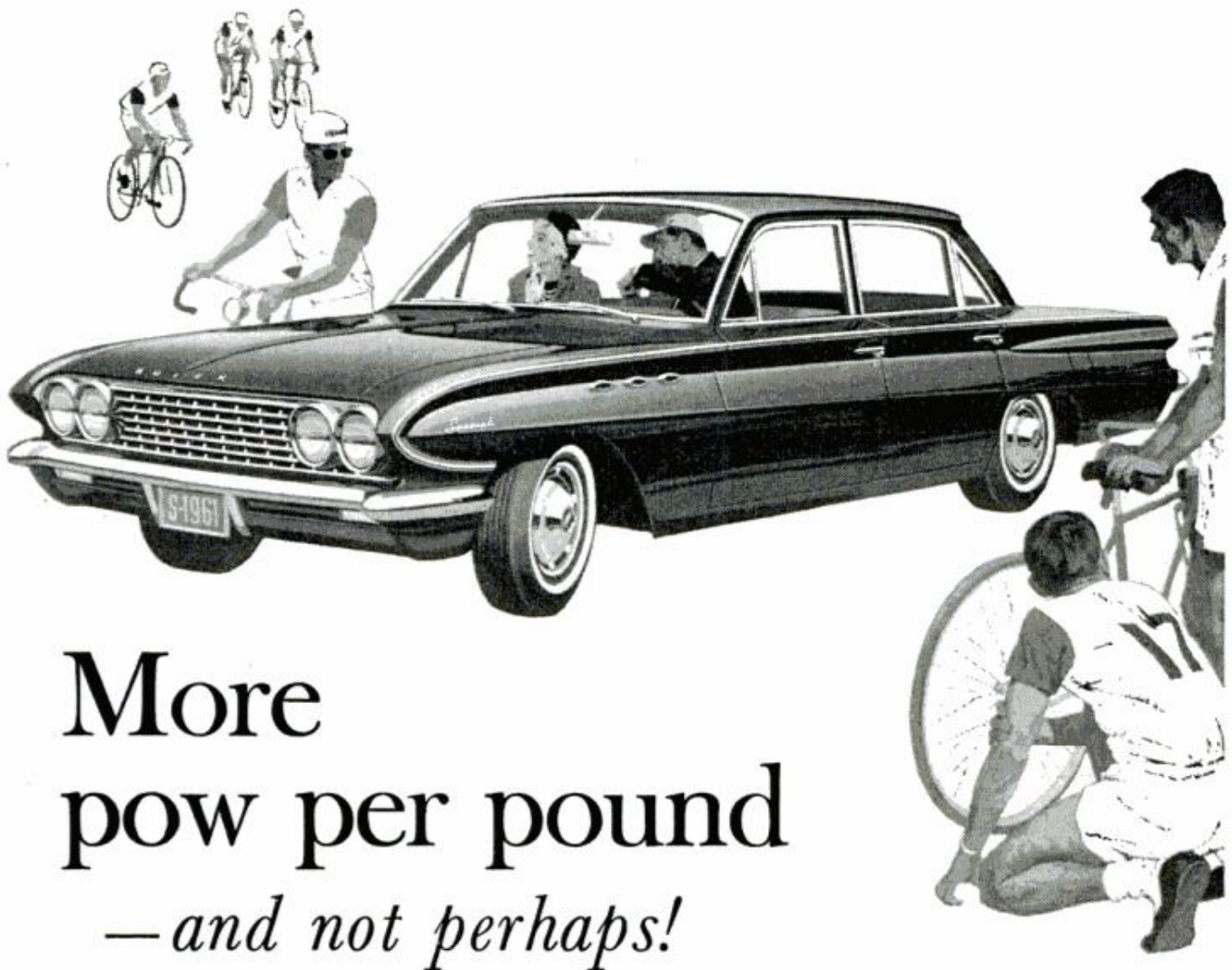


Swiss craftsmanship and precision are available in this turntable kit. All parts demanding precision workmanship are prefabricated. Builder assembles these into high quality addition to hi-fi installation



Educational kit is designed to teach electronic fundamentals. In building, use of electronic tools is learned. Instruction book outlines series of experiments designed to prove many of the basic electronic laws

(Continued to page 220)

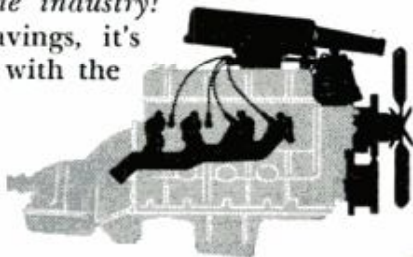


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WHY IS THE BIGGEST NEWS in '61's new-size cars Buick's snappy Special? Styling for one. It's got the full-size Buick's Clean Look of action — and Buick room and ride. This on a 112" wheelbase—that nips in and out of tight spots like a scooter.

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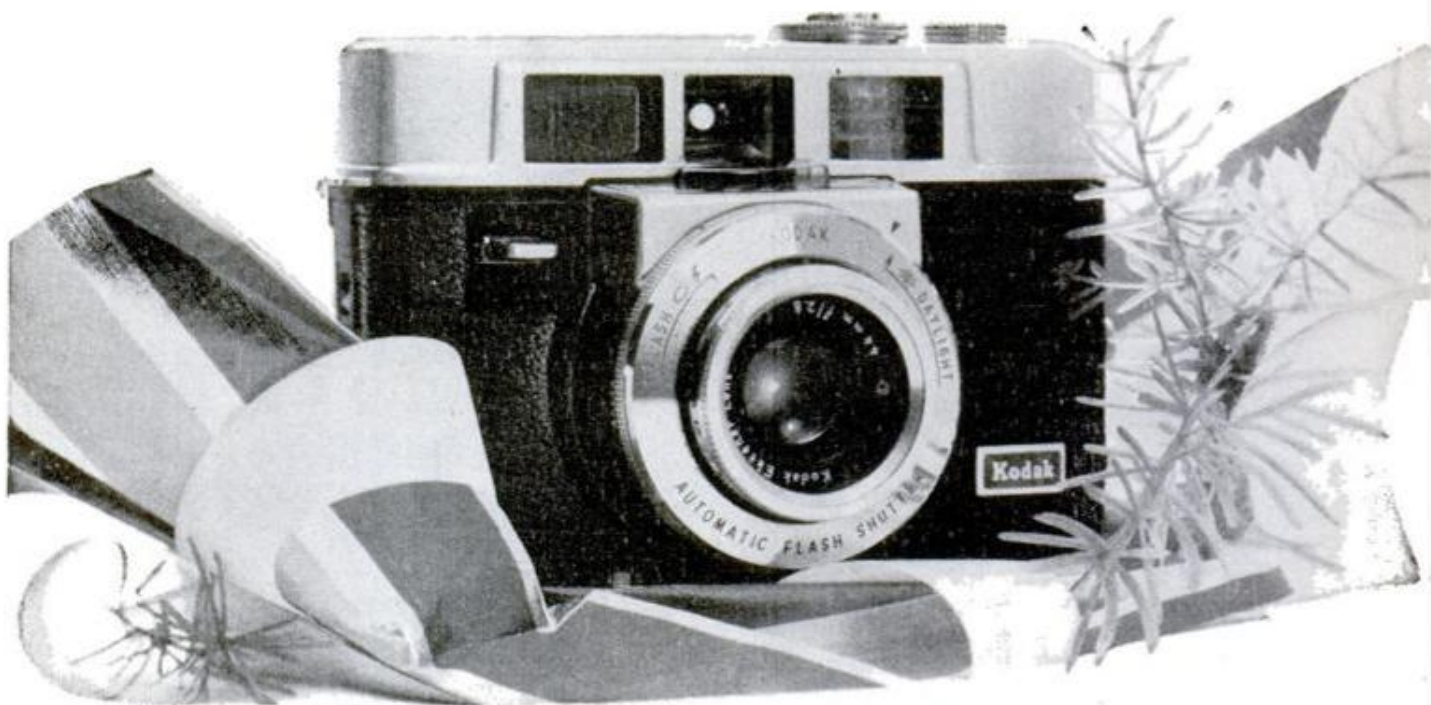


compacts. Sports Cars Illustrated magazine has already predicted it will be "the most widely copied engine in the next 10 years."

BUT THERE'S EVEN MORE to the Special's zip. It's Buick's new Aluminum Dual-Path Turbine Drive* (weight: just 100 pounds)! Made just for a new-size car, it's the liveliest, simplest, most compact automatic made. Its "dual path" principle is like having two transmissions continuously working as a team—one a turbine drive for smoothness, the other a direct mechanical connection for more go and gas savings.

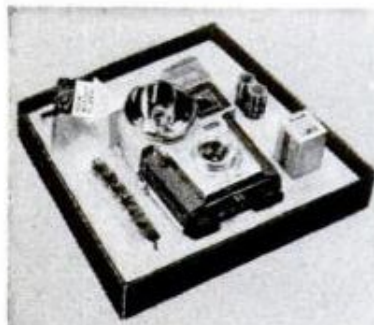
IN A NUTSHELL, the Special gives you small car pleasure without small car penalty. Why not take a Special spin today and prove it for yourself? Buick Motor Division—General Motors Corporation. **Optional at extra cost.*

BUICK SPECIAL



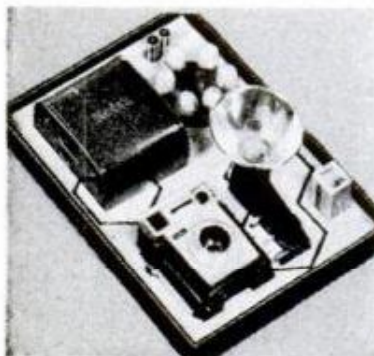
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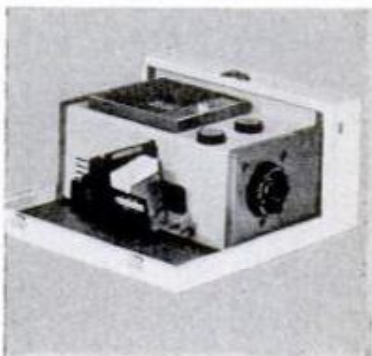
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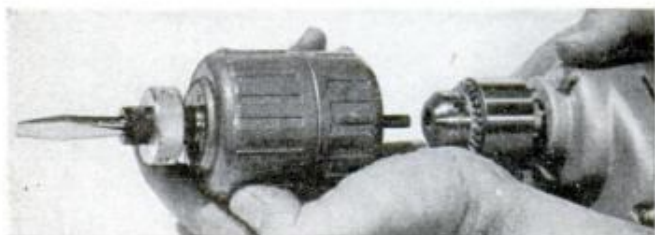
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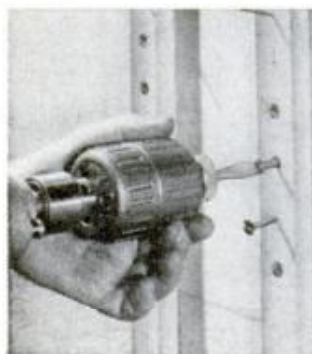
See Kodak's "Ed Sullivan Show" and "Adventures of Ozzie and Harriet"

Kodak
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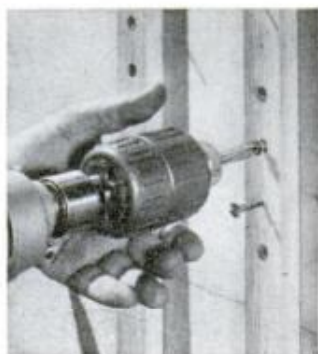
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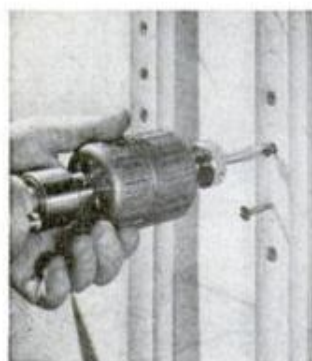


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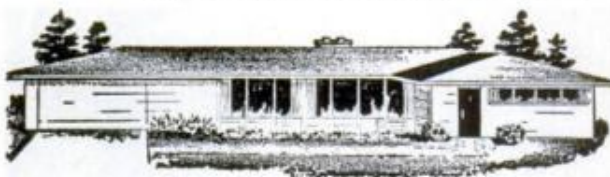
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Oil-Finishing Walnut

Q—I have a solid walnut dining table and four chairs, from which I have removed the original finish. I would like to refinish all pieces in oil. But to my questions as to how to go about this I get conflicting answers. Some say never to attempt an oil finish; others direct me to apply linseed oil, wipe off the excess and I have an oil finish. Is this correct?—O.P., Wis.



A—No. You have oil on the wood, of course, but not an oil finish. We always hesitate to recommend an oil finish on old work as so much time, labor and other factors are involved. Yet many crafters seem to feel that an oil finish is the ultimate in a quality finish on wood. In some respects, it is the quality finish, on a surface that is as nearly perfect as you can make it. That means sanding, more sanding and still more sanding until all the minute imperfections are eliminated. Then you're ready to think about oil finishing. Early cabinetmakers who used oil as a finishing material—not all of them did use oil—employed several methods of application, also varying combinations of materials. Some used pure boiled linseed oil alone. Others used a mixture of pure linseed oil and turpentine. Still others mixed pure linseed oil with an equal amount of copal

(Continued to page 214)




Again, Choice of the Newest!

Spark plugs are selected for new-car installation only after exhaustive tests covering hundreds of thousands of hours. Tests range from heat conductivity of the insulator design to fouling and pre-ignition. Because AC Fire-Rings were best in these laboratory and road tests, they were selected for original equipment on the 1961 Buick Special, Oldsmobile F-85, Pontiac Tempest and Chevrolet Corvair. That's why ACs are on more new cars than any other brand. Best for replacement, too.

They must be the best!

AC Fire-Ring
Spark Plugs



AC SPARK PLUG 
THE ELECTRONICS DIVISION
OF GENERAL MOTORS

Now—Use the Finishing Secret of
World-Famous Furniture Manufacturers

WATCO DANISH OIL FINISH

NEVER BEFORE AVAILABLE TO YOU



PROVED BY
PROFESSIONALS
—YET SO EASY
FOR YOU TO
APPLY ON
FURNITURE,
PANELING,
CABINETS
AND DOORS

For the first time available to you is the original time-proved WATCO Danish Oil Finish used by international names in luxury furniture. WATCO is used to produce the same beautiful, natural wood finish you see in the finest furniture and paneling—yet, it's so easy to use...in one simple application you can seal, prime and finish new wood.

Secret is in the polymerizing oils in WATCO that give you the toughest and richest oil finish of any in existence. Use it clear to bring out gorgeous color and natural grain, or use with stains. Save wasted hours spent sealing and sanding...save money, because you need only WATCO!

Get envied, superior results...the remarkable natural wood finish that resists stains and mars.

American Walnut Manufacturers Association recommends WATCO... may be used on all woods... specifically walnut, oak, birch, cherry, teak, mahogany, knotty pine and cedar.



**1 Easy
Application**

**PRIMES!
SEALS!
FINISHES!**

Sold in 16 oz. aerosols, pints,
quarts, gallons and 5 gallon tins

**WATCO®
DANISH
OIL
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Now available through
leading retail lumber
dealers, paint and
hardware dealers and
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dealers.

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1756 22nd Street, Santa Monica, California; U. S. Manufacturers of Watco Products for Wood and Masonry.

varnish, thinned the mixture with pure turpentine and added a small amount of drier. This latter combination of materials produces perhaps the finest type of oil finish, but is somewhat more difficult to apply. Use of oil alone requires long drying periods between applications, as much as two or three weeks, depending on conditions. But the oil, copal, turpentine and drier mixture is much faster and, properly applied, "builds" more rapidly and fills the grain of the wood in a manner similar to French polishing. In applying this latter type of mixture use a saturated pad and lay on the material with a circular motion. Some finishers prefer to use a pad of fine steel wool rather than fabric. After covering the surface once over with all the oil it will take, wipe off the excess lightly and allow to dry. Then repeat the process several times until the surface shows the quality and luster desired. No filler or stain is used in this finishing process, even on open-grain woods such as walnut. There are, of course, specially prepared oil-finishing materials now available which you may find even more satisfactory than compounding the ingredients separately.

Cold Chimney

Q—My two-flue chimney is on the outside north wall and in extremely cold weather fumes from the oil-burning furnace seem to come back into the basement. My serviceman says he believes this is due to what he called a "cold" chimney and he has recommended a change in the burner cycle in order to maintain a somewhat higher flue temperature, or, in other words, release more heat to the chimney. He may be right, but it seems to me that this will be a rather expensive remedy. Do you know of any other?—T.W., Pa.



A—Your serviceman is undoubtedly right when he refers to a cold chimney as a cause of the trouble and the change he has recommended would be our recommendation, assuming, of course, that the flue is not partially clogged with soot, a bird's nest, or other partial obstruction, and that there are no other contributing factors peculiar to the installation. One thing is certain: You should make every effort to remedy the condition immediately, as there

(Continued to page 218)



To everyone from 8 to 80

THREE TIMES MORE SHOOTING FUN!

To Gramps it means fun plinking around his home—to Dad, target shooting in the basement—to young Bill, his first lessons in safe gun handling. To the whole family—including Mother and Sis—a Crosman CO₂ gas-powered pellgun means unlimited shooting pleasure.

Controlled range and power lets you shoot more often, in more places, all year 'round. These safer, quieter, cleaner guns cost less than a penny a shot to use—so accurate that shooting champs use them to keep fit between matches.

Choose from today's most complete gas-powered line: Crosman Pellgun Rifles and Pistols, and Hahn western-style Super BB Rifles and Revolvers... a right gun for everyone. Priced from \$14.95.



WRITE for free literature. Crosman Arms Co., Inc., Dept. PM-0712, Fairport, New York.

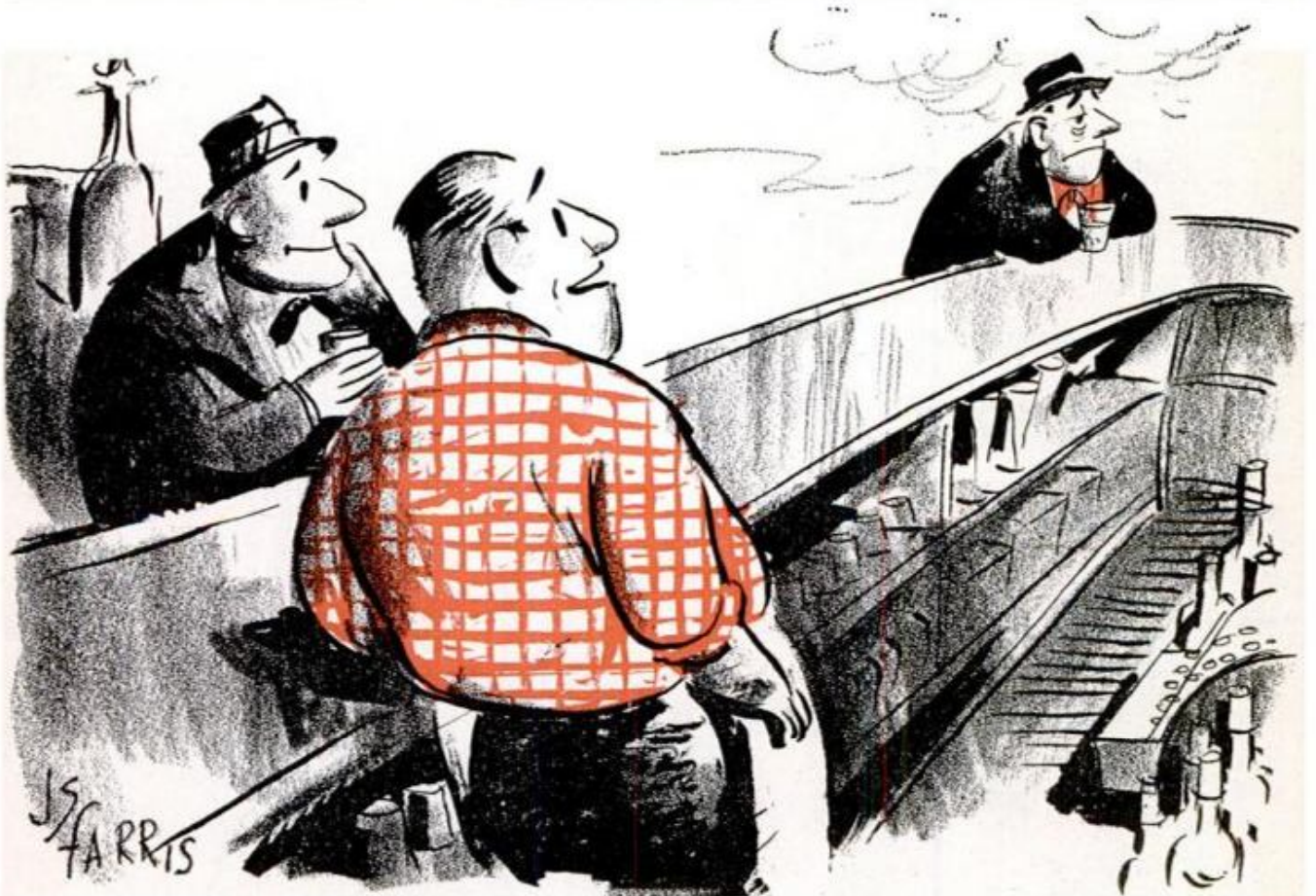
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Crosman CO₂ GAS **HAHN**
PELLGUNS BB GUNS



WORLD'S LARGEST MANUFACTURERS OF CO₂ GAS-POWERED RIFLES AND PISTOLS



"Poor guy—he offered his brain to science and it was rejected."

SHOCKPROOF!



AN
INDUSTRY
FIRST

NEW MILLERS FALLS NYLON SAFE-T-DRILL

an important SAFETY-FIRST in power tools

NEW NYLON HOUSING. Provides extra insulation against electric shock. Extra strength, too. Made of a specially rugged Nylon—Du Pont Zytel 31%.



INSULATED SPINDLE. Unique polycarbonate insert forms hub of spindle gear—fully insulates spindle, chuck, and thus all attachments used with drill.

INSULATED TRIGGER SWITCH and Locking Button round out the exterior sheath of insulation. Operator is completely protected against electric shock.



SPECIALLY DESIGNED MOTOR. Nylon insulated wire and Mylar® armature slot insulation give extra measure of internal protection.



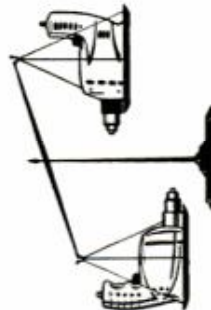
SURGE TESTED. Powerful surges of high voltage current reveal an "X-Ray" of each drill's electrical condition on an oscilloscope. Internal insulation must be flawless to pass this rugged safety test.



DELTRIN® NOSEPIECE. This remarkable material has exceptional toughness and scuff-resistance. Withstands wear under heaviest use—assures precision fit and alignment of attachments for years.

QUICK-CHANGE ATTACHMENTS. A full line—many with new Millers Falls, on-and-off-in-seconds feature—convert the Safe-T-Drill to a power workshop of 14 basic tools and many accessories.

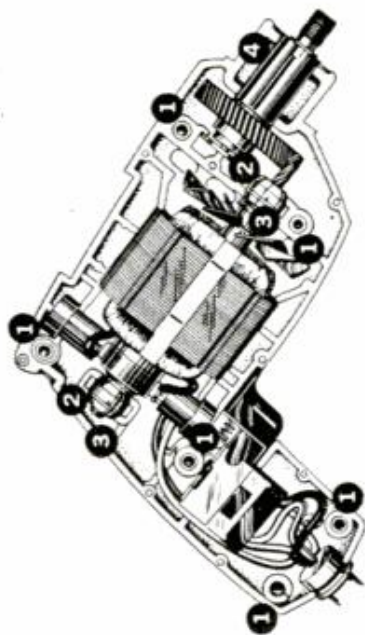
2.7 AMP. MOTOR. Plenty of power to drive power-hungry attachments like 5½" portable circular saw, finish sander, hedge trimmer, sabre saw.



LIGHTWEIGHT. Nylon housing cuts weight drastically—produces drill 20% lighter than comparable aluminum models.



COMFORTABLE GRIP. Even after sitting in a sizzling summer sun—or lying in sub-zero winter snow—the new Millers Falls Safe-T-Drill won't burn or freeze your hand. It's always pleasant to touch and hold.

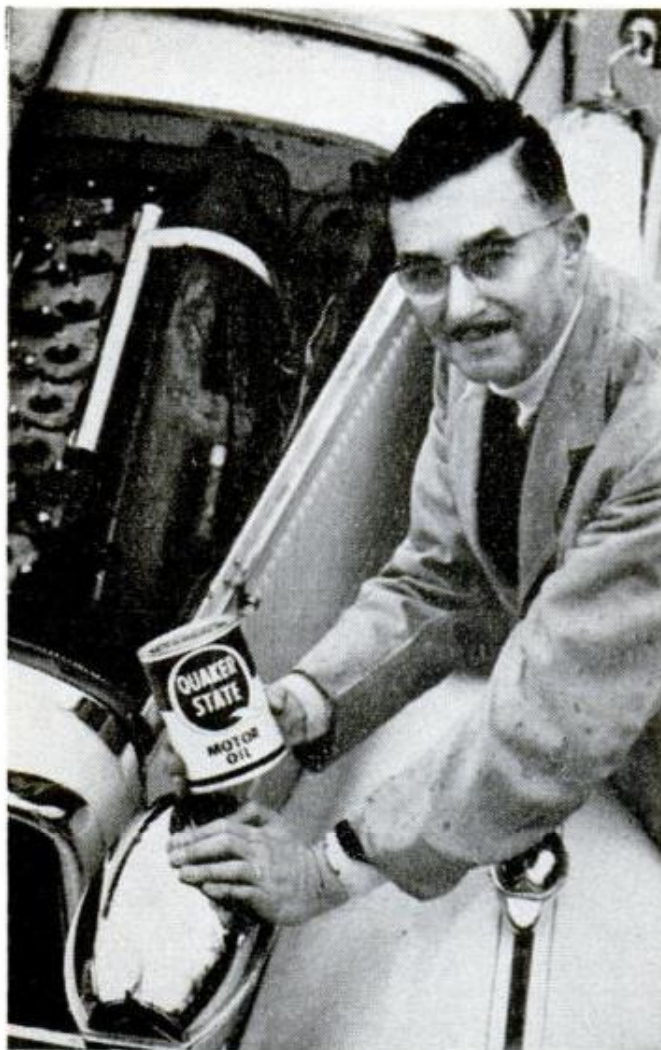


1. Self-locking metal inserts provide never-comes-loose grip for screws . . . assure tight drill housing.
2. Spring-loaded, self-aligning armature bearings keep motor shaft true and free running—even under stress of heavy load.
3. Oversize oil reservoirs insure ample lubrication.
4. Porous iron spindle bearing withstands heavy abuse.
5. Induction hardened gears maintain high efficiency of teeth.



If you like the latest and best in fine tools, you'll like the No. 1144 Safe-T-Drill. Ask your dealer to let you see and try it soon. Write also for free descriptive folder: Millers Falls Co., Dept. PM-35, Greenfield, Mass.

A JOINT DEVELOPMENT OF MILLERS FALLS COMPANY AND E. I. DU PONT DE NEMOURS & COMPANY (INC.)



J. LeRoy Forsythe, of Millhelm, Pa., services the engine of his rare front-wheel-drive 1929 Ruxton.

"Quaker State protects the engine of my classic Ruxton, and my new car, too!" one of the earliest front-wheel-drive cars, this handsome Ruxton Series 1003 has a special body by Budd. After 30 years and 75,000 miles, its straight 8 engine is in superb condition, thanks to expert care. Car experts everywhere depend on Quaker State for long-lasting lubrication and complete protection for cars old and new. Super-refined from 100% pure Pennsylvania Grade Crude Oil, it is the finest motor oil your money can buy.

Available most everywhere . . . always ask for Quaker State by name.

For the name of your nearest dealer, call Western Union by number and ask for Operator 25.



QUAKER STATE OIL REFINING CORP., OIL CITY, PA.
Member Pennsylvania Grade Crude Oil Association

(Continued from page 214)

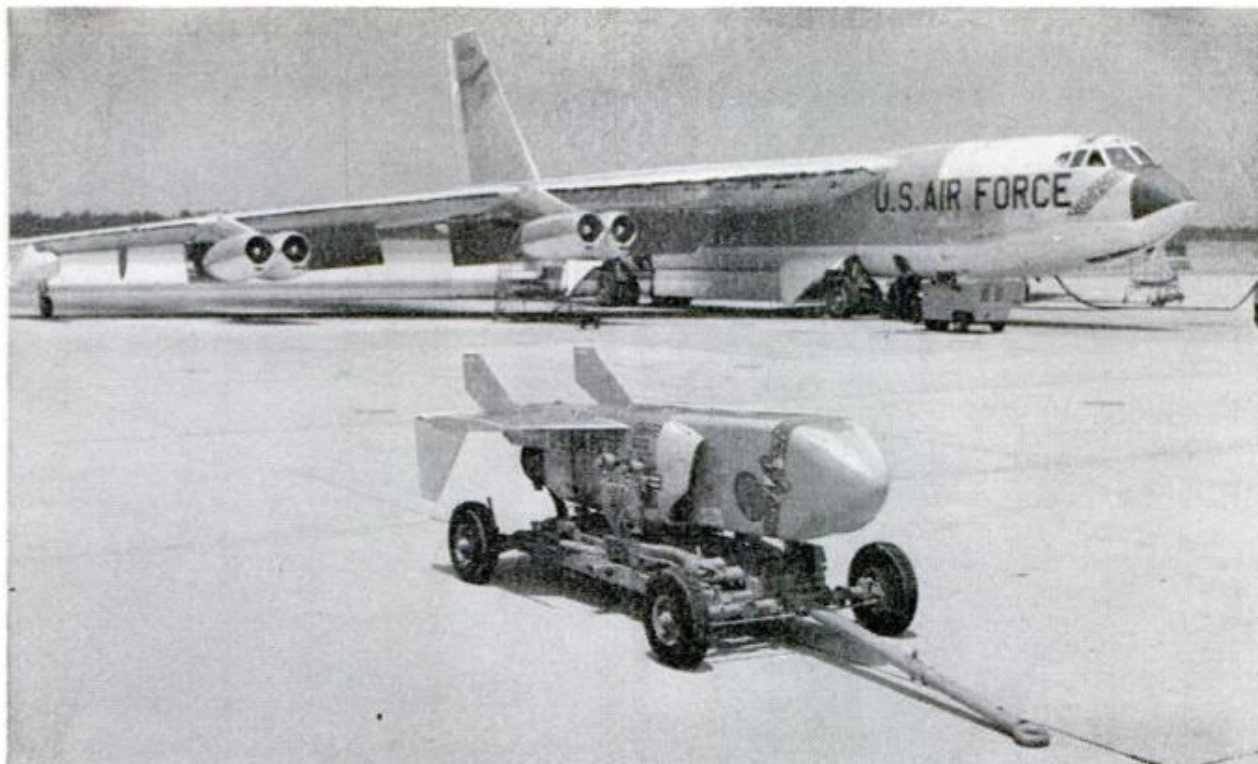
is always the possibility of a dangerously high concentration of carbon monoxide gas. Even though this possibility may be remote, it should never be minimized or overlooked. We would check closely the condition of the flue. If the chimney is an older type and is unlined, the inside of the flues may have been plastered. If this is so, then there is the possibility that a piece of plaster may have loosened, broken away and partially clogged the flue. If a large tree overhangs the top of the chimney, this could be a partial cause of the trouble. Also, your basement may be air-locked, that is, closed so tightly that the natural draft in the chimney is affected. We would investigate all these possible causes and again we would caution you to take immediate steps to correct the defect.

Cleaning Old Brass

Q—How does one clean brass and prevent it from tarnishing? I have several old pieces and one late piece which seem to have tarnished badly. Also my front door lock is of brass and although I have attempted to clean it several times, it still discolors rapidly and appears dull and dingy.—H.S., Del.



A—You do not describe the pieces other than the door lock, or say whether they are large or small. This makes it rather difficult for us to outline suitable procedures. Brass that is merely tarnished and is not badly corroded or otherwise discolored is quite easily cleaned and polished either by hand methods or by means of a power-driven buffer. First it usually is best to wash the pieces in a mild, soapy solution and when dry polish with a suitable prepared polish—there are a number of good polishing compounds available—or polish with a power-driven cloth buffing wheel mounted in a wood lathe on an adapter, or mounted on a bench polishing head. The wheel should be charged with a fine polishing rouge, which is an abrasive in cake form. If you polish by hand methods with a polishing compound it is important to clean the work thoroughly after polishing to remove all the polishing compound. Then wipe all surfaces again with a clean, dry cloth and apply a coat of clear metal lacquer according to instructions on the can.



McDonnell Aircraft Corp. photo

Decoy Missile Fools Enemy Air Defenses

Carried aloft in the bomb bay of a B-52 and dropped when approaching an enemy air-defense zone, the Quail diversionary missile will confuse enemy defenses. Powered by a jet engine, it flies a similar flight

path and at the same speed as the bomber, thus presenting an extra blip on the enemy radar screen. When used in large numbers, these decoys puzzle the enemy and force him to waste ammunition.



The EXTRA WEIGHT in this Atlas 10" Saw Means GREATER ACCURACY in the Work You Do

Because it has more beef—because it's heavier and huskier throughout—the Atlas gives you far greater accuracy in every job you do. Compare these Atlas features with those of any other 10" saw:

- Massive grey-iron cradle, saw arm, and trunnions. Atlas has the heaviest, most rigid mechanism of any 10" saw. Saw alone weighs 165 lbs!
- Precision-ground, solid steel arbor— $\frac{3}{4}$ " diameter at the big, lubricated-for-life ball bearings.
- Double locking lift-off fence—cast aluminum for lasting accuracy.
- Big cast aluminum mitre gauge—keyed to table for greater cut-off capacity.
- 6" diameter cast iron handwheels.
- Dual V-belt drive—for full power transmission.
- Big table capacity—20" x 27 $\frac{1}{2}$ ", or 59 $\frac{1}{2}$ " x 27 $\frac{1}{2}$ " with two extensions.
- Removable motor mount for easy portability.

Why settle for less? You can own an Atlas for only \$139.75! Write for details today.



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ATLAS PRESS CO.

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KALAMAZOO, MICHIGAN

REPLACE OR REPAIR YOUR HOLLEY CARBURETOR AT NEW LOW COST!

**BRAND NEW
HOLLEY PEP
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COMPETITIVE
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You can give your car new power and pep at low cost with a *genuine* Holley PEP Carburetor. These inexpensive PEP Carburetors are brand-new, factory built to the exacting *original equipment* specifications. They are simple to install. . . complete, easy-to-follow instructions are furnished. PEP Carburetors are available for all Ford-built cars and the most popular American Motors models.

**GENUINE
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IN OLDER
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These low-cost PEP Kits contain everything you need to restore new *power, economy and performance* to a mileage-worn carburetor. PEP Kits are available for all Holley and Ford-designed carburetors. Each includes genuine Holley parts: needle and seat assemblies, gasket kits, power valves and accelerating pump diaphragms or pump plungers, along with complete instructions. See your Holley Distributor or Dealer today.

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When you make your own carburetor or ignition repairs and parts are required, be sure to use genuine Holley parts. Your Authorized Holley Distributor or Dealer, listed in the Yellow Pages, has a complete stock of Holley carburetor minor overhaul kits, tune-up kits, ignition parts, and brand-new replacement carburetors priced competitively with rebuilds. All are engineered and built to exacting *original equipment* standards. It will pay you to buy or specify Holley Parts.

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11955 E. Nine Mile Rd. • Warren, Michigan
ORIGINAL EQUIPMENT MANUFACTURERS FOR OVER 55 YEARS

New Kits for Christmas

(Continued from page 208)



Three new kits teach youngsters rudimentary electronic experiments. Other new kits allow children to build intercoms, wireless broadcasters, various radios. All safely built and used as no soldering is required. Completed kits operate on batteries. Cartoons make instruction manuals easier to follow

builder wires. Paco packages this kit in three ways. The experienced builder who has the necessary equipment and know-how to build and align FM front ends can build the entire unit. A less skilled kit builder buys the kit with the critical work completed, aligned and tested. A novice, afraid of the wiring, can buy the unit completely wired and tested by the factory.

The Knight clock radio has a preconstructed clock-work assembly. The radio section (five-tube superhet) is built on printed circuit boards.

Thorens has a turntable kit that offers Swiss precision to the do-it-yourselfer. Thorens provides the construction parts, but the components are Swiss-made.

Electro-Voice has produced a small bookshelf speaker system. Called the Esquire, the unit boasts an eight and a twelve-inch speaker and is finished in natural woods.

If someone on your shopping list has no knowledge of electronics, Heath solves the problem with a new educational kit. Building the kit teaches the use of fundamental tools and techniques. The finished unit then is used to illustrate the principles of electronics, such as Ohm's Law, power problems and many others.

The new kits for Christmas are designed to be more than symbolic presents. They provide hours of relaxation during construction, and when completed continue to give fine service for many years. ★★★



...there's a world
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in every
ERECTOR
set! [®]



The finest toy ever invented — and world-famous for over 50 years! Erector sets contain all-steel parts to make, literally, up to **thousands** of different models, many with exciting electric motor action. Builds latest missiles and jet aircraft, plus bridges, hoists, merry-go-rounds, ferris wheels and giant robots that walk step-by-step. Makes models 5 feet high! Teaches youngsters engineering principles and methods. Fun and instructive! See your Gilbert dealer today!



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Fully illustrated — over 50 different sets

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CRESCENT OPEN END AND BOX WRENCHES



Crescent Open End and Box Wrenches are drop-forged from special analysis alloy steel, precision machined to insure accurate opening sizes, and handsomely finished in chromium plate. These fine wrenches provide world famous Crescent quality at popular prices. Open End Wrenches are available in 13 sizes from $1/4''-5/16''$ to $1-1/8''-1-1/4''$; Combination Wrenches in 14 sizes from $3/8''$ to $1-1/4''$; and Double Offset Box Wrenches in 9 sizes from $3/8''-7/16''$ to $7/8''-1-1/16''$.

Sold singly or in sets by Hardware Dealers everywhere.



Crescent is our trade-mark, registered in the United States and abroad, for wrenches and other tools. Sold by leading distributors and retailers everywhere and made only by
CRESCENT TOOL COMPANY, JAMESTOWN, N. Y.

The Metric System—PRO

(Continued from page 138)

metric system in the United States, with gradual conversion to its use in all household, business, scientific, industrial, sporting, engineering, and even artistic affairs, would result in better economy, efficiency, and mutual understanding in all our activities, either with ourselves or with people in other parts of the world. This is a scientific era, and the metric system is at the very basis of scientific advance because of its convenience, simplicity, and uniformity.

Slowly and surely the metric system will become accepted throughout the world, and may become a major factor in promoting mutual understanding and effective communication between people everywhere. The English-speaking peoples are causing themselves unnecessary inconvenience, lowered efficiency, and reduced economy in clinging to an ancient system of measurement derived in old Egypt from human body references, which regardless of what standards are agreed upon, must be standardized if there is to be honest trade or if scientific advance is to occur. This standardization is essentially a matter of voluntary agreement. If it is made on the basis of the metric system, it will have the advantages of being in accord with world usage, scientific usage, and of being simple, easy to use, systematic, and precise. Let's get at it, in our schools, and in our businesses, and gradually it will be in use, helpfully for all.

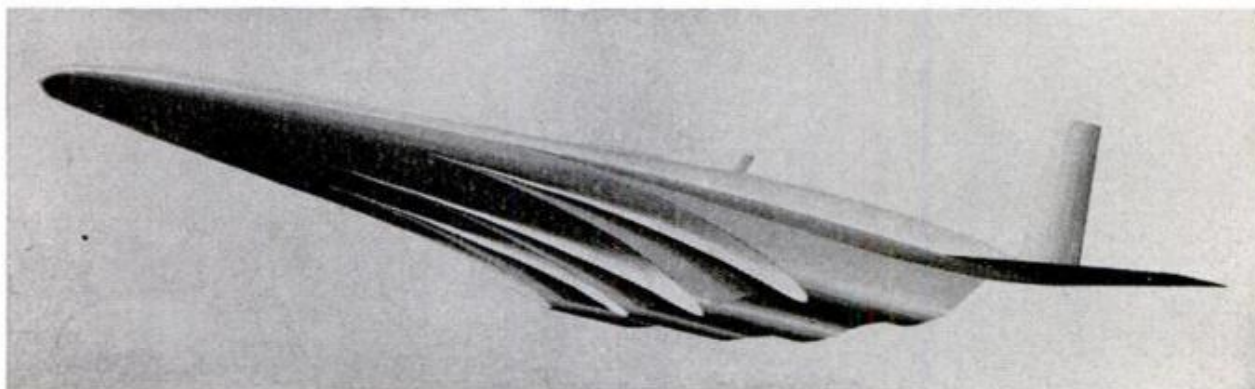
★ ★ ★

Weather Warning System Charts Lightning Static

Weathermen, detecting gleams in the sky, are learning where tornadoes come from. They are operating, experimentally, an automatic warning system that pinpoints the discharge of lightning as far as 2000 miles away and relays the information to headquarters in Kansas City, Mo. Six detector stations in neighboring states are equipped with radio receivers that pick up static generated by lightning. Simultaneously, the stations record the time and compass direction and relay the information within one-tenth of a second to the headquarters operated by the Air Weather Service. An electronic device displays the information on a map of North America where an observer can follow increasing electrical activity that may indicate developing thunderstorms or tornadoes. When more stations are operating, it is thought the warning system will be valuable in tracking electrical disturbances over oceans.



Jet fighter-bomber, capable of 1500 miles per hour and pinpoint bombing from sea level to 75,000 feet, would take off straight up. Once airborne, special valves would divert engine thrust backward for propulsion



Called "ultimate" design, dream bomber would orbit earth at 200,000 feet and 17,000 miles per hour. Powered by eight engines, four of them burning nitrogen, it would carry fighter plane, piggy-back fashion

Designer Describes "New Generation" of Planes

Alexander Kartveli, aircraft designer for Republic Aviation Corporation (he designed the World War II P-47 Thunderbolt, among others), claims the potential of aircraft design has not been fully exploited.

Unpredictability of tomorrow's air needs demands that the search for tomorrow's aircraft continue, he says. He offers four weird-looking types, based on Republic studies, as members of "new generation."



Weirdest design is almost all engine. Nuclear-ramjet aircraft, with 8500-mile range, could be based in U.S., strike anywhere



Flying wedge, powered by two ramjet and two turbojet engines, would be used for stratospheric reconnaissance at 120,000 feet

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PSST . . . Any gal
can take a hint. "Hide"
this ad in an
obvious place—get
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Special you want!

(Special offer ends Dec. 31, 1960.)



**Heavy-duty sabre saw—only \$46.95
PLUS 7 assorted blades worth \$4.90—FREE!**

Fastest selling heavy-duty sabre saw on
the market! Cuts scrolls, curves, wood,
metal. Special blades cut flush up to a
wall and to $\frac{5}{8}$ of an inch along a wall.



MODEL H75



MODEL H131

\$5.00 off on 3-amp 1/4-inch drill!

Christmas Special: only \$19.95

Regularly priced at \$24.95, here's the most power-
ful $\frac{1}{4}$ " drill for the price on the market. Features
rugged, balanced construction, non-slip pistol grip,
3-jawed geared chuck, 3-wire cord.

Electric tools built for the professional.

Christmas Specials



MODEL H37

NEW! Finishing sander... only \$34.95 PLUS—2 packs of sanding sheets... FREE! Sands and fine-finishes table tops, cabinets, bookcases and many other kinds of furniture. Ideal for small work areas.

Heavy-duty builders saw—now \$54.95 PLUS—\$2.65 combination rip/crosscut blade... FREE! This 6½" saw lets you tackle any cutting job... a breezeway, porch, playroom, fence! Features rear controls; exclusive "free-start" blade guard that never jams.



MODEL H268

NEW! Bench grinder... only \$46.95 special introductory price! Reg. \$49.95. You save \$3.00 and get two grinding wheels and two special tool rests, too! ¼ hp, general purpose grinder. Perfect for sharpening tools, skates, removing rust—a "must" in your workshop!

Stanley Electric Tools, Div. of The Stanley Works, New Britain, Conn.

Prices slightly higher in Canada. Subject to change without notice. Canadian Plant: Hamilton, Ont.



MODEL H634

priced for everyone

STANLEY

®

The Engine That Was Born Again

(Continued from page 148)

from Seal Rock, because ships couldn't get close enough to put down a gangplank or use a crane. Many washouts of the road and severe damage to the wharf on several occasions forced discontinuance of this operation in 1914, when the little locomotive had her last fire put out until her recent rescue from ruin by rust.

A shed had once sheltered the engine, but it had rotted away. Floods in 1942 and 1943 had piled rock and mud around the relic, leaving it buried so deep that it was first thought there was nothing there but boiler and stack. Pick and shovel work disclosed that she was complete, however, and sitting on tracks!

Fifteen different pick and shovel expeditions were required to uncover the little locomotive entirely. Each trip in and out required a crossing of the river, and at first a rented boat was used. Later, Henry built an eight-foot flat-bottomed boat that made a very efficient ferry for men and equipment.

June 9, six months after the job began, Henry brought his flatbed truck to the site, fording the Mattole. That day, using the access road they had built, he and his crew hauled out the saddle tank and any other parts they could remove from the engine.

Ten days later the engine was hauled out and, as it weighed six tons, this was no laughing matter. With no lifting equipment available, a sloping pit was dug in front of the locomotive, deep enough to accommodate the truck. Then the flat-bed was backed into position, and the locomotive was winched slowly onto the truck. To do this, Henry and Gus, with a crew of helpers, built a windlass, using the principles of a post puller, and multiplied their strength with three sets of blocks.

The truck was flooded out in the river, as was a helping tractor, and they only got out when another truck was added to the combination.

They weren't through at the site even then, for what good is a train without tracks? More back-straining pick and shovel work uncovered some of the rails that were under three feet of dirt, but an even tougher job was encountered in picking up the rails that went "around the horn" along the river and ocean. These rails were the "light" variety, weighing 25 lb. to the yard, and a standard 30-foot long, which is a clumsy bundle to handle any way you look at it. Most of this section of rail—the longest section of the road

—was within a few feet of water, so a raft was built on a group of eight empty oil drums. An outboard motor and hand-poles powered the craft, which was kept as close to the shore as possible. As rails were dislodged on shore, they were shifted to the raft, which was tricky, for in the rough water the raft was as frisky as a cake of soap in a washing machine.

Later, when everything had been trucked to his ranch at McKinleyville just north of Arcata, Henry made a careful examination of his engine and found that it needed much more than just a face-lifting. It was rough on the outside, but the insides had, so to speak, gone up the flue.

The owners of Bay Tank and Boiler Works in Eureka offered their facilities to Henry with the proviso that he do all the work, and he gratefully accepted. For the next 13 months he cut, welded, cleaned and fitted until he could do no more, and the locomotive was removed once again to the ranch.

Meanwhile, Henry had enrolled in a night class in woodworking so he would be better equipped to build a new engine cab. It was well that he did, for he was suddenly given a caboos by a sympathetic lumber company. This caboos, about 60 years old, had originally been a passenger coach, but somewhere along the line a cupola had been mounted on top and the inside fitted for caboos duty. Henry and Gus have already started to reconvert this car into a coach again.

Sunday, May 22 of this year, Henry pulled the throttle on his little locomotive and moved it out of its shed. This was the first time it had moved under its own power since 1914. It only had a 300-foot run because that's all the rail that had been salvaged in usable condition.

Train fanciers for hundreds of miles around come to see old No. 1 in her new finery, and find it hard to believe that a few years ago an alder tree grew in her cab and the boiler was a home for pack rats.

Henry and Gus are now on the alert for more rail and spare parts. Especially rail, for it pains them to think of the engine all fired up and no place to go. So if you have a few old lengths of light rail lying around in the attic, get in touch with Henry. His ambition now is to run his slim-gauge pike all the way around the pasture. ★ ★ ★

☛ Solar energy is helping to dry corn in experiments conducted by the U.S. Department of Agriculture; sun-heated air circulated through a silo, dries the grain faster and at less expense, compared to unheated-air systems.

16-page
gluing
guide

FREE



16 illustrated pages give hints and tips on how to glue what to what—and the right glue to use for every job indoors and out. Send a stamped, self-addressed envelope for your free copy. The Borden Company, Dept. PM-120, 350 Madison Ave., New York 17, New York.

NO MUSS... NO FUSS!
KRYLON SPRAY
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DRY IN MINUTES!
IF YOU PRIZE IT... KRYLON-IZE IT!

SERVICE
FOR YOUR B&D
TOOLS



Check the Yellow Pages under "Tools-Electric" for the location of the nearest Black & Decker factory service branch or authorized service station.

Free tool inspection when requested • Genuine B&D parts used • Factory-trained technicians • Standard B&D Guarantee at completion of recommended repairs • Fast service, reasonable cost, always.

Or write for address of nearest of the more than 50 branches and service stations to: THE BLACK & DECKER MFG. CO., Dept. 8012-S, Towson 4, Md.

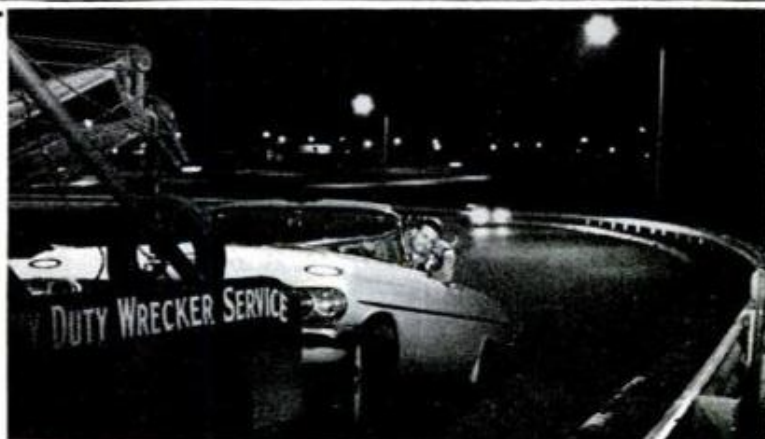


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Quality Tool Service

TURNPIKES MURDER "SISSY" ENGINE BEARINGS



Long, hard turnpike driving proves there is a big difference in engine bearings. "Sissy" brands burn out, but Michigan Bearings stay on the job. They're "Turnpike Tough." All materials are specially chosen to assure maximum fatigue strength, high thermal conductivity, corrosion and oxidation resistance, superior embeddability and surface action. Michigan Engine Bearings are machined to tolerances as close as .000125 plus or minus—fit perfectly at every point.

Michigan Bearings are made to rigid standards of perfection by Detroit Aluminum and Brass, for over 35 years a principal supplier of original equipment bearings for leading cars, trucks, buses, marine, aircraft and industrial engines, farm and off-the-road equipment. Insist on "Turnpike Tough" Michigan Bearings... the bearings preferred by men who know the difference.



made by

Michigan
ENGINE BEARINGS
Detroit Aluminum and Brass Corporation, Detroit 11, Michigan

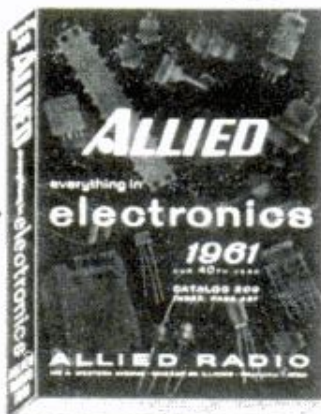
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The Metric System—CON

(Continued from page 139)

"thought" for a long time. This would simply put America out of business for a long time. Surely, books could be written on why this should not be done.

Now, I ask, who are these people so interested in changing our system of measurements?

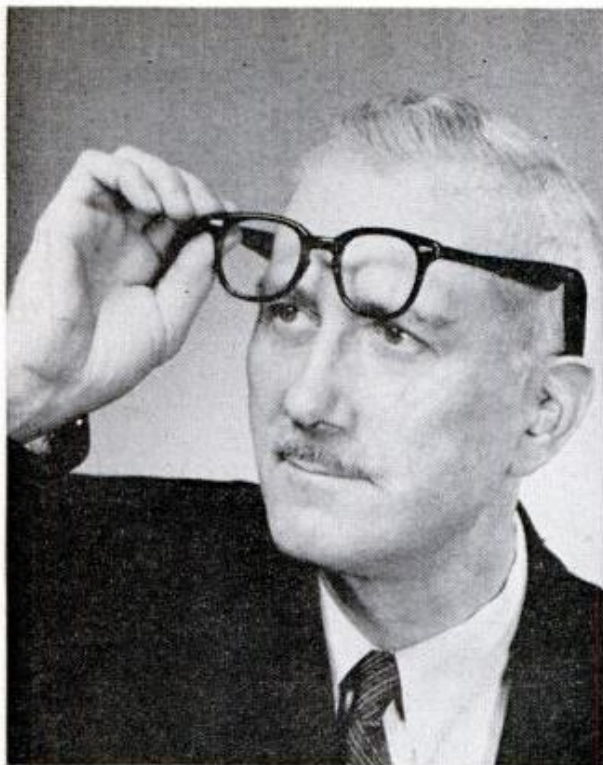
Surely, the general public is not asking for a change. What difference does it make to them how the ounce, pound, ton, inch, yard, mile, pint, quart, gallon and so on came about or their relationship to each other or to the metric system? If the thought is to remove fractions from our measuring system, the metric system will not do it. I just can't imagine a housewife who normally requires a pound of pork chops asking for 453.5924 grams or asking for 5 hectograms. She would probably ask for a "little light of ½ kilo"—and if it were sandwich bologna, she would probably ask for ½ kilo. I am also sure that our people do not want their present machines and equipment made obsolete by the unavailability of parts with present dimensions. I can't visualize our housewife agreeing to this philosophy.

Certainly industry is not asking for this change. It would be ridiculous to say our measuring system has been a handicap in our industrial development and growth. What metric system country has done better? The use of decimals instead of fractions within the one-inch measurement gives us the same mathematical simplification as does the metric system. When working to a tenth, hundredth, or thousandth, no one is too interested in an inch or any of its fractions—nor what its relationship is to the meter. We must agree that adopting the metric system will not improve quality nor reduce cost by increasing quantity. This takes machines and personnel.

If we were an exporting nation, then the adoption of the metric system might make sense. But I am afraid there is a big question as to whether we are or will be. But even if we were, domestic versus export demand must be considered. At least up to now, as far as I know, export demand appeal has never influenced the design of our automobiles, refrigerators, washing machines and such products. This is probably true also for our airplanes, diesel locomotives, buses and trucks. Conversely speaking, this is not true for imports. Frequently foreign manufacturers have designed for the American market.

Although none of our people would benefit by a change to the metric system, the

(Continued to page 230)



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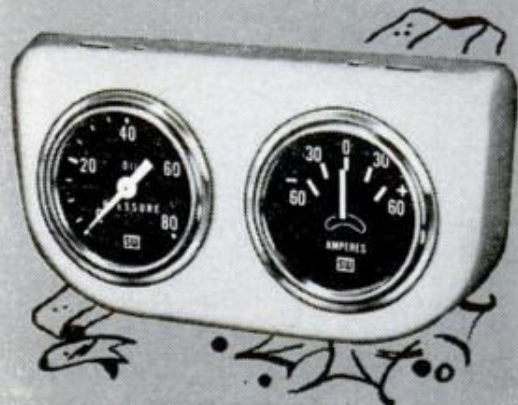
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foreign manufacturer could benefit. With lower labor costs, he could ship his products (which are produced to the metric system) to fill orders, large or small, for customers in the United States. This could be catastrophic to the United States unless some way could be found to compete with these countries without lowering our high standard of living.

In conclusion, I should like to point out that in medical science as well as in religion, Latin is used as a common language due to its international usage. But I haven't as yet heard of any movement to change our language to Latin. Surely, it would not be any more out of order, nor less confusing and costly, to change our system of measurements. Today, the metric system is doing an excellent job in this country's laboratories—let's keep it there! ★ ★ ★

Leaf Wall Decor

(Continued from page 152)

Caution: In working with muriatic acid avoid contact with the hands and clothing and do not inhale the fumes.

Stems are formed from 3-in. lengths of $\frac{1}{16}$ and $\frac{3}{32}$ -in. brass welding rod, spot-soldered to the backs of the leaves. Use as little solder as possible here for appearance sake. The branch itself is formed from half hard seamless brass tubing of telescoping diameters, $\frac{1}{8}$ to $\frac{1}{16}$ in. You'll need about 18 in. of each size. The tubing is cut into 4-in. lengths and made into tapering branches by inserting one section into another and soldering.

Offshoots of the main branch are formed in the same manner, after which they are joined to the main branch by sawing the large ends at an angle, filing concave and soldering. Four offshoots of the main branch should be made. Holes are made in the branches 2 in. apart for attaching the leaves. Insert the stems and use a spot of solder to hold them. Finally, three angle brackets are soldered to the branches for hanging. After all the stems have been soldered in place they are bent to give a natural effect. Dark-oak stain applied to the branches will tone them just enough to make them look like the real thing, after which the entire decoration is sprayed with clear plastic to keep it bright. ★ ★ ★

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Overhaul Your Carburetor

(Continued from page 181)

tube, consists of the step-up piston assembly, main metering jet and the main vent tube, with a diffuser hole and air passage which are an integral part of the carburetor body. At about 20 m.p.h. partial vacuum in the carburetor begins forcing fuel through the main metering jet, through the main vent tube and out the diffuser hole into the throat of the carburetor. At 30 m.p.h. this circuit has completely taken over leaving the low-speed circuit inoperative. The richer fuel mixture needed at high speeds is provided by the step-up piston assembly. With an increased throttle opening vacuum pull in the carburetor drops and is not enough to hold the step-up piston down in resistance to its spring. It is forced up, raising the step-up rod with it and allowing fuel to flow through the step-up jet in addition to that flowing through the main metering jet, thus enriching the mixture for more power. Be extremely careful in removing the jet assembly not to bend the idle orifice tube or the step-up rod. Remove all gum deposits with solvent and then blow all passages out with compressed air. Now, this may all sound a bit complicated but you'll find that the general overhaul involves nothing that can't be mastered with a bit of application and practice. Just bear in mind that most of these parts are made of soft brass and are easily damaged by improper handling.

The Accelerator-Pump Assembly is the last of the fairly complicated parts you'll have to deal with. This circuit acts as an intermediary between the low and high-speed circuits. It consists of a small cylinder which is part of the carburetor body, into which is fitted a spring mounted plunger (or rod) and piston. The piston itself is an inverted leather cup made of a special leather. A small amount of air is trapped between the surface of the fuel in the cylinder and the cup and when the accelerator linkage is activated, it forces the plunger and cup down, compressing the air which in turn forces fuel through the pump's outlet valve, into the pump jet and out into the carburetor throat. With its several parts the pump assembly is open to a number of malfunctions. For example, a worn cup will allow trapped air to escape, the amount of fuel will be lessened, the engine will be slow in turning over and the high-speed assembly will be unable to take hold. The engine will most likely "flat out" and be unable to exceed a certain low speed. In this case both the cup and the plunger spring should be replaced. If either intake

or outlet valve leaks or cannot be made to work properly, it must also be replaced. The hand choke on older cars requires no more than that the valve plate move freely in response to a pull on the linkage and that its breather valve be clear. Automatic chokes are mainly subject to leaky gaskets and tubing and accumulations of dirt impeding the flow of warm air from the exhaust manifold to the thermostatic coil. With all parts clean and the carburetor re-assembled, you're ready to remount it on the engine and tune it up. Even though you don't have precision equipment, it isn't difficult to learn to set the carburetor "by ear." Remember, set the idle adjustment screw for mixture and **then** set the speed until the engine purrs with a minimum of "rock" and vibration. ★ ★ ★

Hydrogen Gun Bombards Material Being Tested for Spaceship Use

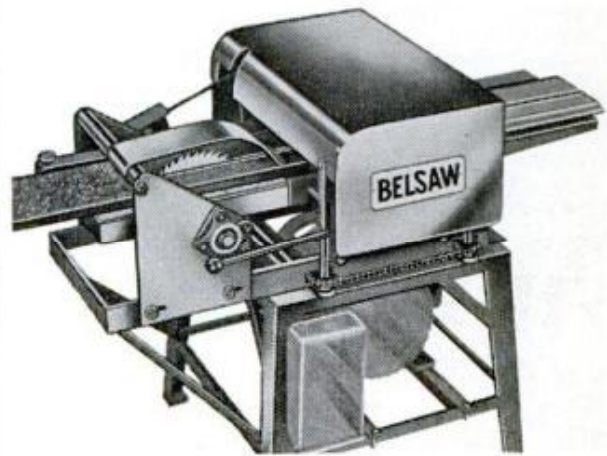
Scientists developing skins for future spaceships are building a hydrogen gun that will fire plastic projectiles at various materials to test how they would stand up under a meteoroid bombardment in outer space. Analysis of the impacts is expected to lead to better design and material choice, says Dr. Robert Perry, chief of the Re-entry Simulation Laboratory of Republic Aviation Corp., at Farmingdale, L.I. In addition, sequence cameras will photograph free flight of the projectiles to provide information on flight phenomena. The gun works in this manner: Hydrogen, heated by an electrical spark discharge to 15,000 degrees F. in a chamber, ruptures a metal diaphragm and forces the projectile down a shotgun-like barrel. It shoots out at 26,000 miles an hour and travels 25 feet before bombarding the test material.

Treated Corn Needs Less Water

University of Illinois scientists introduced a chemical to the roots of corn plants and have grown corn with a third less water than was used by untreated plants. W. J. Roberts, Illinois State Water Survey engineer who originated the project, suggests the technique may eventually increase the usefulness of available water in areas where the supply is limited. He and university botanists used a fatty alcohol that forms a film a molecule thick on water surfaces. (This chemical had been used to reduce evaporation from water-supply reservoirs.) They believe the chemical forms a protective film at the opening in the plant from which water evaporates and plan to use fatty alcohol tagged with radioactive tracers to test this theory.

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Train Your Own Horse

(Continued from page 136)

body and neck in line. Make sure he learns to stop readily when given the command "Whoa" and to back up from this position.

Another method to teach reining before the colt is ridden is by standing at his left side with the right rein in the right hand and the left rein in the left hand. He can be taught to rein in either direction by pulling and giving slack on the direct rein—one on the side he is to turn—and giving slack at the same time on the indirect rein. This teaches the colt to neck rein.

Mounting the horse: A gentle horse can be mounted for the first time with little trouble. By holding the rein next to you quite short in comparison to the other rein, it will cause the animal to move in a short circle if he is going to move at all. It will also keep him from trying to run away and give you an opportunity to get settled in the saddle. Most gentle horses won't buck at all if handled properly; others will only jump a little. By holding his head up and the left rein short, you can restrict their bucking and make them move in a short circle until they settle down.

Your additional weight will be new to the horse and you should give him an opportunity to become accustomed to it. Sometimes it is good to mount and dismount several times before you try to ride.

Don't overwork your horse at the beginning. An hour, the first few times, is sufficient and don't push him too hard during the hour. It is much better to work him a short time regularly than to work him hard and long at irregular intervals. It is a good practice to exercise the colt a few minutes each time before you attempt to mount.

Doing figure eights is a good way to start teaching a horse to rein, but don't always turn him the same way, and vary the size of the figures so he will be learning to rein rather than learning a particular pattern.

The use of your legs is a valuable asset in getting the horse to do what you want. For example, press both legs to start forward, and when turning, press against his body with the leg opposite the direction you want him to turn. Shift your weight in the same direction. Some horses are trained to turn so well in this manner that reins are not needed.

Turning along a fence will teach him to turn short and on his back feet. After he has learned to rein at a walk, you can advance him to a trot and then to a slow lope.

Training your own horse can be very satisfying, and it isn't too difficult as long as you use plenty of patience. ★ ★ ★

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Richard ©

"... and in case the penicillin doesn't work ..."

What's New for Dinner

(Continued from page 126)

substances so that bread that is a number of days old would still retain its freshly-baked appeal.

Somewhat similar studies are being made at the food technology department of the Davis campus of the University of California. Here the problem is to impart a fresh, yeasty essence to "instant" bread that has been developed by the Army's Quartermaster Corps. The new bread uses a chemical leavening system instead of yeast and so requires no lengthy rising time. In fact, no more than 40 minutes elapse from the time the dry mix is stirred with water until the fresh loaves are removed from the oven. The only trouble with the bread is that it doesn't smell like bread. That's what the U.C. people are trying to remedy.

Aseptic canning is something else that is being studied at Davis. In the ordinary canning process, food gets a final cooking in the can so as to kill any micro-organisms that might otherwise cause deterioration. In aseptic canning, food that has been pre-cooked is given a final cooking at 220 degrees F. for 15 seconds while it travels through a heat exchanger. Then it is cooled immediately and is sealed in cans that have been sterilized in superheated steam. One advantage of the process is that foods retain more of their original nutritive values. Another is that their flavors are more like those of the fresh product.

Other canning studies at Davis include the use of a nitrogen atmosphere during the cooking and canning processes. The nitrogen blanket keeps atmospheric oxygen away from the food and so prevents the discolorations often caused by oxidation. Davis also is studying essence recovery—the trapping of vapors that are lost during the cooking process. It may be that these can be condensed and returned to the food just before it is canned, restoring lost flavor and, possibly, any vitamins that escaped.

Still another way of preserving foods, already in limited commercial use, is a combination of both the dehydration and quick-freezing processes. The food is first dried to about half its original moisture content and is then frozen in the ordinary way. The process retains many of the advantages of each method and avoids most of the disadvantages. The dehydrofrozen product weighs less and takes up much less space than a frozen product, yet has a better flavor, texture, appearance and color than a completely dehydrated food. Apples, cherries, peas, carrots, lima beans and celery have been preserved this way.

No other process, it has been said, offers

preserved food of comparable quality at such a low cost, but the relatively low cost applies only to such bulk users as restaurants and military installations. Unfortunately for the retail purchaser, packaging costs do not diminish proportionally with size. The average housewife is apt to want no more than five ounces of dehydrofrozen apples, knowing that they will swell to a 10-ounce amount when she soaks them in water. In any event, dehydrofrozen foods are not yet available at retail.

Sonics, or the use of sound waves, appears to have a big future in the food industry. In one application, sound waves are being used to homogenize whole milk which is then frozen and stored until needed. Fresh milk can thus be available at any time to the crews of submarines or ships on lengthy voyages. The sonic treatment overcomes the previous objection to frozen fresh milk, in which the butterfat separated out and coagulated.

Sonics, too, is helping tenderize meat. An enzyme preparation that does this has been on the market for years but its tenderizing effect is mostly confined to the meat surfaces. Recently a patent was granted for a technique that uses sound waves to drive the enzymes all the way through the meat, achieving a uniform tenderizing effect.

Sound waves have been used experimentally at Stanford Research Institute to speed up and improve the washing processes by which vegetables and fruits are cleaned before processing or marketing. The sonic treatment removes many of the traces of pesticides that are found on fresh produce, and helps to remove the detergents used in the washing processes.

For years the Army Quartermaster Corps has been looking for better ways of preserving meats, and as of now it is still hunting. Dehydrated meats have not been too successful. For a time it appeared that irradiation (exposing steaks and roasts to beta or gamma rays) might be the answer. The irradiated foods could be stored without refrigeration and looked good and tasted good. But recently it was found that experimental animals that were fed a diet of irradiated foods developed all the symptoms of severe vitamin deficiency. Irradiation doesn't seem to be the answer at present. The final solution may still be some improved form of dehydration, possibly with vitamins and flavor enzymes provided in an encapsulated form.

All in all, food technicians have a host of new ideas on which they are working; today it seems that you'll be buying the products of some of these ideas at the grocery store and judging them for yourselves in the next few years. ★ ★ ★

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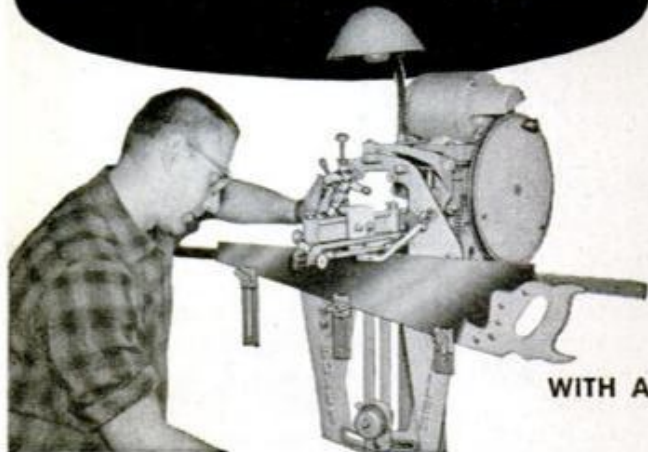
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Fine Points of Cutting Glass

(Continued from page 191)

ish the edges by hand-grinding with an oil-stone or with a power-driven grinder. If you use the power grinder, be careful not to heat the glass or it may shatter. Use very light pressure and remove the glass from the wheel at short intervals, to permit heat of grinding to dissipate.

The methods described apply not only to common glass, or window glass, in standard size sheets and in single(ss) and double strength(ds), but also to plate glass in sheet sizes that are easily handled and cut by hand methods. If you have occasion to cut glass which comes with one side textured or embossed or otherwise patterned, the cut should always be made on the smooth side.

Special Tools

Professional glaziers use the special tools shown in Figs. 10, 11 and 12 and also in Figs. 17 through 19. The glazier's chisel, Fig. 11, and the points, Fig. 12 are used only when glazing wooden window sashes. The chisel is used for removing hardened putty. The points are driven into the rails, stiles and muntins of wooden sashes to hold the glass panes in place. Drills of the type shown in Fig. 10 are used in a drill press as in Fig. 15. In practice, a dam of putty is built up around the point where the hole is to be drilled to hold a mixture of abrasive and oil. Then the work is set up as in Fig. 15, using either one of the drill types shown in Fig. 10. The drill is raised at short intervals to permit the point to pick up a new charge of abrasive. Another type of glass drill, used without abrasive and only in professional work, is shown in detail A, Fig. 17. Details B, C, and D show different types of glass cutters. The diamond cutter, detail B, is quite widely used in professional work. The cutter is a genuine industrial diamond. Cutter C is the common wheel type most widely used. Some cutters of this type are now available with carbide wheels. Cutter D is simply a variation of cutter C with a rotating, or turret, head in which are fitted several cutting wheels. The circle and tube cutters are special tools for professional work. The vacuum lifter, Fig. 16, is handy where it is necessary to lift and place fairly large sheets of double-strength or plate glass.

★ ★ ★

Science has come to the aid of migrating birds, many of which have flown into the light of a lighthouse off the coast of Dungeness, England, in past years. The new light will be tinted blue, a color that does not attract birds.

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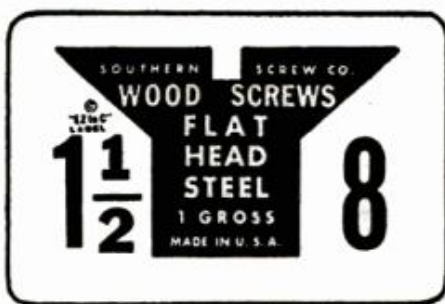
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Bonneville's Magnificent Trials —and Errors

(Continued from page 106)

speed car across country, and a small fleet of auxiliary vehicles was brought along as tenders. One Land Rover served as an emergency repair shop for small jobs; another carried various chemicals for fighting different kinds of fire.

Land Rovers Service "Bluebird"

Two Land Rovers were rebuilt to service *Bluebird* at each end of the course, each carrying electric batteries for starting the jet engine, air compressors for renewing its compressed-air supplies and the fans for cooling its disk brakes. One truck carried fuel, another the radio telemetry equipment, still another the tires that would be used for one run.

Bonneville Speedway is on the salt flats along the Utah-Nevada border and is an immense flat wasteland having a hard crust of white salt. It is considered the world's best course for high-speed automobiles. The salt is cool and provides ideal traction.

For speed record attempts, a 120-foot-wide path is dragged, scraped and swept with power machines to bring the salt to utmost smoothness, and a black line is painted down the centerline. This year the course was 11½ miles long, with the measured mile and the measured kilometer being located in the middle of the distance. The length of the course varies from year to year, depending on the firmness of the salt at each end. In a good year, with heavy rains during the preceding winter, a firm course as long as 13 or 14 miles can be laid out.

Attempts for new records are timed by the U. S. Auto Club, the American representative of the Federation Internationale de L'Automobile. Timing is by the light beam-photo cell method.

Must Make Two Runs to Qualify

To qualify for an international record, a driver must make a second run, in the opposite direction, within an hour of his first run. His official speed is the average speed of the two runs.

Campbell plans to be back at Bonneville next fall with a reworked *Bluebird*. Mickey Thompson will be there too, either in *Challenger I* or *Challenger II*, a jet-engined car that he is beginning to put down on paper. Neither driver will be shooting for 500 miles per hour this year, but that's the speed that each of them has in the back of his mind. Ultimately someone is going to drive a car that fast. ★ ★ ★

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1 5/8"	2 3/4"	1"	38"	11 lbs.	\$12.95
1 1/2"	8 1/2"	3/4"	13"	8 lbs.	\$ 7.50
2 3/8"	18"	1 5/8"	26"	11 lbs.	\$17.95
2 1/4"	9"	1 1/2"	24"	12 lbs.	\$14.95
3"	9"	1 1/8"	18"	10 lbs.	\$15.50
2 1/2"	3 1/4"	3/4"	11"	L.C.	\$ 9.95
3 3/4"	10"	1 1/4"	27"	21 lbs.	\$24.50
3 1/2"	8 5/8"	1 1/4"	20 1/2"	12 1/2 lbs.	\$17.95
3 3/4"	2 1/8"	1 3/4"	31"	15 lbs.	\$24.50
4 7/8"	8"	2"	22"	35 lbs.	\$29.75

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Strong Plug Sparks Mean Top R.P.M.'s

(Continued from page 185)

and grease inside the boot may cause a direct short over the surface of the insulator. Next, check the gap spacing of the electrodes to be sure the correct gap is being used. A round-wire feeler gauge like the one shown in Fig. 5, is best for this purpose because there is little chance of committing an error. For example, to set a gap of .037-in., use the .040-in. wire as a "no go" and the .035-in. wire as a "go" gauge. If the gap is too large, tap the ground electrode gently with any blunt lightweight metal object, or force it down with the wire gauge. If the gap is too small, open it with the gauge. Never attempt to bend the center electrode, and do not use a pair of pliers on the side electrode because the jaws will leave sharp ridges on it.

Plugs that are not seated properly, also may be a source of trouble. If they are too loose, or have particles of dirt between the gasket and seats on the engine, compression loss and a certain amount of "blow-by" may result. The latter is particularly bad since it causes overheating of the plug, which in extreme cases can melt a hole in the plug shell as shown in Fig. 4. To be sure that a plug is tightened properly, it is best to use a torque-indicating wrench and apply the recommended foot pounds of pressure. If a torque wrench is unavailable, screw in the plug by hand until it is finger-tight, being sure the plug is seated on its gasket snugly against the engine block. Then, with a plug wrench tighten it one-half turn, if the plug is of 14 m.m. size; one-half to three-fourths turns if it is an 18 m.m. Check the manufacturers' recommendations for other sizes. When a plug is tightened correctly, the gasket should flatten to about one-half its original thickness as indicated in Fig. 8.

Ignition timing also affects engine performance, although checking this is a job for your dealer service man. A recently improved way of doing this is by means of a Stevens contact tester, and a timing fixture that looks much like a juice-can opener as shown in Fig. 12. Removal of the flywheel and spark plugs is necessary to expose the breaker points and armature plate, Fig. 11, so that the timing fixture and tester leads can be attached. This method of timing the ignition is more accurate than the old one of using a feeler gauge to check and adjust breaker-point gap.

The condition of used spark plugs often provides clues that lead to the source or sources of engine trouble, Fig. 6. The wave

pattern in the blue dot next to each of the plug conditions illustrated, indicates the respective engine performance as observed on the screen of an ACilloscope spark-plug analyzer. A plug that appears normal has a light powdery covering on the electrodes and inner walls of the shell ranging in color from brown to greyish tan. There are no globular combustion deposits and almost no evidence of electrode burning. Such a plug could be cleaned and reinstalled, if it does not have too many hours on it. Otherwise, a set of such plugs can be kept on the boat as spares, so that you don't have to clean plugs out on the water the next time they foul out, as the hapless lad shown in Fig. 3 is doing.

Lead fouling can be recognized by the formation of various shades of brown or grey as a normal plug, except that there are large concentrations of deposit, sometimes nearly filling the cavity between insulator tip and shell hole. Lead fouling usually is troublesome only at higher speeds or heavy-load operation when plug temperatures become high. The engine will start normally and run without trouble at low speeds but will miss when full power is applied. Gradual, steady opening of the throttle when such missing occurs, sometimes burns off light lead deposits and clears the plug, but frequently the deposits become glazed and the plug must be replaced. Lead fouling usually is caused by use of highly leaded or premium fuels, which should not be used in an outboard. The best fuel is marine white gasoline, not the camp stove variety. A good brand of regular gasoline having low lead content is second best.

Another type of fouling is oil or carbon fouling, with traces sometimes of other oxides. This can be broken down into two subclasses of dry and oily carbon fouling. The dry type is recognizable as a fluffy dry coating of black deposit on the insulator tip and electrodes. Usually, it is caused by overly rich fuel mixtures, but long periods of trolling, or idling also can be the culprits. Low engine speeds result in inefficient combustion due to low crankcase and combustion chamber turbulence as well as low combustion chamber temperature. Overly rich layers of atomized fuel resulting from low turbulence fail to burn completely, leaving an excess of carbon to coat the combustion chamber and the parts of the plug exposed to it. The plug insulator tip temperature, being too low to burn off the carbon, allows the latter to build up on the insulator tip until it forms a conductive path from the center electrode

(Continued to page 246)



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to the shell. At this time missing occurs and finally, complete shorting out of the plug. If the engine can be accelerated before shorting occurs, spark plug temperature will rise and the carbon most likely will burn off the insulator tip and clear the plug.

The oily type of carbon fouling is recognizable by a greasy black coating covering the entire firing end of the plug. This may result from an oil-rich fuel mixture, extended periods of idling or trolling, or simply because of the fact that the plug is of a heat range which is too cold for the engine. In the latter case, the insulator tip never reaches a temperature high enough to prevent carbon accumulation. Late model outboard motors that are equipped with thermostatically controlled cooling systems, have overcome this type of fouling to a great extent.

In bad cases of fouling, where the carbon and lead deposits are so extensive that they form a bridge from the insulator tip to the shell, a "dirty engine" is indicated. By dirty engine it is meant that pistons, valve ports and other parts within the combustion chamber are covered with carbon deposits. This diagnosis can be confirmed by peering into the combustion chamber through the spark-plug holes, using a medical probe light (or pen light) as shown in Fig. 9. Details A and B show the appearance of a clean piston crown as compared to one that is deposit laden. By rotating the prop to place the pistons at bottom dead center, you can look right into the valve ports. According to Champion engineers, exhaust ports are sometimes found to be blocked by as much as 50 per cent due to carbon deposits. The carbon deposits shown in Detail B, fly off the piston crown in big chunks when the engine is running and are blown or thrown against the plug since the latter usually is located directly over the intake or vertical side of the piston baffle (raised portion of the crown). The plug location, though quite vulnerable to this type of failure, is considered necessary because it is directly in the path of the compression charge, providing the best ignitability for good idling. It also is centrally located to provide the fastest burn at full throttle. If an engine builds up combustion chamber deposits again shortly after cleaning, it is time to look for a new brand of oil, according to AC Spark Plug engineers. In this connection, it is very important that you use oils which are intended for outboard motors or other two-cycle engines. It may be necessary to try more than one brand before satisfactory results are obtained.

Electrode wear simply means loss of metal from the center and ground elec-

trodes, resulting in excessively widened gap spacing and smaller, less effective surfaces for producing a spark to ignite the combustion charge. Electrode wear is the direct result of overheating, which can be detected by a dead white or light gray coloring on the insulator. Sometimes combustion oxides will be fused onto the insulator surface itself. Use of a colder type plug usually will relieve electrode burning, especially if it is apparent under continuous heavy duty operation. If electrodes tend to burn in light duty use, the engine should be checked for proper coolant circulation. A carburetor that is set extremely lean, or improper spark timing can cause excessive electrode wear. Improperly installed plugs and low engine r.p.m. at full throttle due to the use of the wrong propeller size for the boat application, also may be the cause of overheating and consequent electrode wear. Other than these basic difficulties, most of which can be remedied easily, rapid electrode wear simply means that the plugs are too hot and should be replaced with colder ones.

The service life of spark plugs usually can be extended with proper periodic cleaning and regapping. Recommended procedures are outlined as follows:

1. Remove oily deposits by brushing with a suitable petroleum solvent.
2. Dry the plug thoroughly.
3. To remove remaining oxides, have the plug cleaned in an air-abrasive blast cleaning unit at a service station. Abrasive should be applied only about 2 to 3 seconds, being sure to wobble the plug in the rubber adapter during cleaning so abrasive can reach all areas of the firing end.
4. Reset gap to manufacturer's specifications, bending only the side electrode.
5. Check the sparking efficiency of the cleaned plug as in Fig. 2.
6. If the latter check is satisfactory, re-install the plug with a new gasket. ★ ★ ★

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Chairman, Irrigation Department
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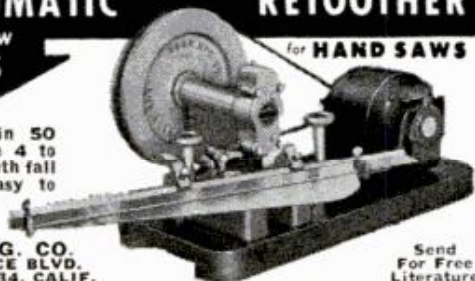
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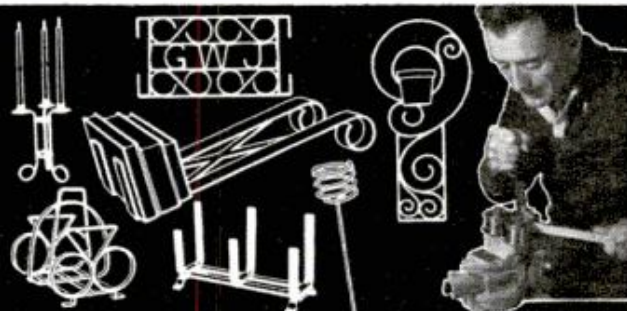
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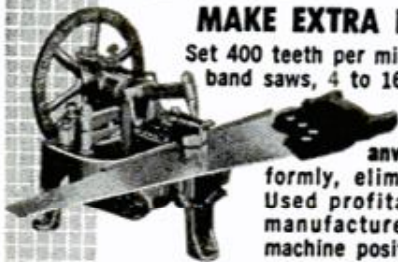
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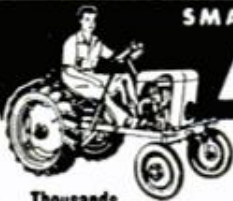
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(Continued from page 96)

the proton bullets like beads on a string. Radio frequency booster stations along the way speed them up to one-third the velocity of light, and they are swept into the "third stage"—the huge circular tunnel—with an energy of 50-million electron-volts.

Once in the half-mile raceway, the proton "bunches" are smoothed out. The beam is guided into orbit by a string of 240 strong-focusing magnets. These monsters, each about seven feet long, C-shaped in cross section and weighing more than 16 tons including copper coils, are the real core of the Synchrotron. The vacuum pipe carrying the proton beam is only 7 inches wide by 2 3/4 inches high. It rests like a stretched-out doughnut inside the jaws of the magnet.

"The strong-focusing principle is relatively new," explains Julius Spiro, one of Brookhaven's top engineers. "It enables us to reach 30 BEV with magnets a fraction the size of those used by the Russians in their gigantic machine, which has yet to reach its advertised 10 BEV as far as we know." Half the magnets have jaws bowed outward for vertical focusing; the rest bow inward to keep the beam tight and true horizontally. Each magnet section bends the proton beam 1.5 degrees.

While the magnet ring keeps the bullets on course as they *zing* around the big circle, 12 radio-frequency stations along the way give them an 8000-volt kick every time they pass—for a total 100,000 electron-volts per circuit. By the end of the one-second acceleration period, and some 300,000 revolutions, the flying protons have achieved 30 BEV of energy and are moving at approximately 186,000 miles per second (the speed of light)!

Once the AGS has produced its high-energy beam, the idea is to do something with it. This is accomplished in two ways. At various places around the ring, "flags" of material—copper grids, quartz plates, and so on—containing atoms that scientists want to study, can be flipped into the path of the proton beam inside the vacuum pipe. In the ensuing collision, atomic debris flies off and is painstakingly examined.

More interesting and productive is the "ejection" system that is expected to go into operation soon. Using powerful magnetic force, the beam will be bent out of the circle and shot into a 250 by 100-foot "target building" piled high with concrete blocks to contain radiation from the atomic collisions. The particles will be directed against targets and the explosions analyzed.

(Continued to page 250)

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When proton bullets hit target nuclei, subatomic particles fly off in all directions—some of them striking and smashing other particles in secondary collisions. Since many of these tiny bits of matter are born, shoot away at the speed of light, and “decay” into other particles or spent energy all within a fraction-of-a-millionth of a second, it takes some tricky equipment to watch them go. In the Brookhaven target building, scientists will use a variety of devices:

Colliding particles will zip through stacks of photographic plates, etching their routes and collisions in three dimensions through the layers of emulsion. Scintillation counters will produce tiny splashes of light as particles pass through their crystals or liquid solutions. Each flash, picked up by photoelectric cells, will be recorded for later study—revealing important data on the decay times of various particles. Another device is the “bubble chamber.” In one 80-inch bubble chamber, the tank will contain liquid hydrogen under pressure at —414 degrees F. When a target is hit by the beam, and pieces of atomic nuclei penetrate the liquid in the tank of the chamber, the flying bits make the frigid hydrogen “boil” along their routes, due to the “heat” they generate. These bubbly tracks are photographed by special cameras located behind a glass wall of the chamber.

Out of it all will come more knowledge about the amazing structure of our universe. An advisory panel on high energy accelerator physics put it neatly in a note to President Eisenhower: “. . . We are peeling an onion layer by layer, each layer uncovering in a sense another universe; unexpected, complicated and—as we understand more—strangely beautiful.” ★ ★ ★

Do You Know This Old-Timer?

(Answer to quiz, page 33)



Pope-Toledo circa 1901-02

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The Magic Box That Reads Russian

(Continued from page 112)

trusting machines. Even geniuses have found it impossible to express some ideas with high fidelity in a different language from that in which they were first put. Undetected errors in translations could do more harm than no translations. More rather than fewer bilingual persons will continue to be needed.

M.I.T.'s great mathematician, Prof. Norbert Wiener, thinks "the boundaries of words in different languages are too vague and the emotional and international connotations too extensive" for machines to handle well. But M.I.T.'s famous pioneer in computing machinery, Dr. Vannevar Bush, believes that machines may be made to exercise as good judgment about words as some people do, "particularly when they get to translating in a subject which they do not understand."

Although machine translations can be produced more cheaply—and faster than anyone can read them—no one yet knows how to make a machine produce as smooth and accurate a translation as a bilingual person can.

The obstacles, in fact, are so numerous that one of the most widely known pioneers in machine translation, Professor Dostert of Georgetown, has suggested that a National Institute of Language Science, similar to the national institutes of health, is needed to direct the attack on them.

Theoretically, according to Prof. Richard P. Feynman of the California Institute of Technology, all of the information in all of the books in the world could be so compressed that it could be carried around in your hand. Hence, it would be ridiculous to conclude that translating machines cannot be made smaller than those now used.

An interpreting telephone—such as that described in *Popular Mechanics* 50 years ago—would not have to read, but would have to understand speech. IBM is working on a Stenewriter now with which it hopes to produce printed English versions of Russian speeches as they are received by radio. In principle, too, a reading machine called the Perceptron, developed at the Cornell Aeronautical Laboratory, could be made to hear. The interpreting telephone also would have to speak.

Mountains of both basic and applied research remain to be done. As this magazine's editor wrote when the interpreting telephone first was envisioned, however: "Every great invention has appeared impossible to the many and difficult to most before its arrival, and very simple afterwards." ★ ★ ★

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Modelmakers in a Tizzy

(Continued from page 86)

proved under the National Defense Education Act and is being widely used in American schools.

Nowadays, Junior gets to play with model kits because Dad has his own. They provide "a legitimate source of pride, satisfaction and serenity," explains Dr. William Menninger, the mental health authority, commenting on the fact that modeling is becoming a prescription for relaxation.

It's not only father or son, but father and son when modelers get into railroading and powered aircraft models. Modelmaking is one of the few really big father-son sports, and this is particularly true of flying models. A real "first" in this field is a realistic flying model of the 1911 Curtiss Pusher, turned out by the L. M. Cox Manufacturing Company. Even the old bamboo braces and taut fabric are simulated in plastic. Another Cox model is a break-apart trainer. When it crashes, the sections fly apart to prevent damage. You merely reassemble them with rubber bands.

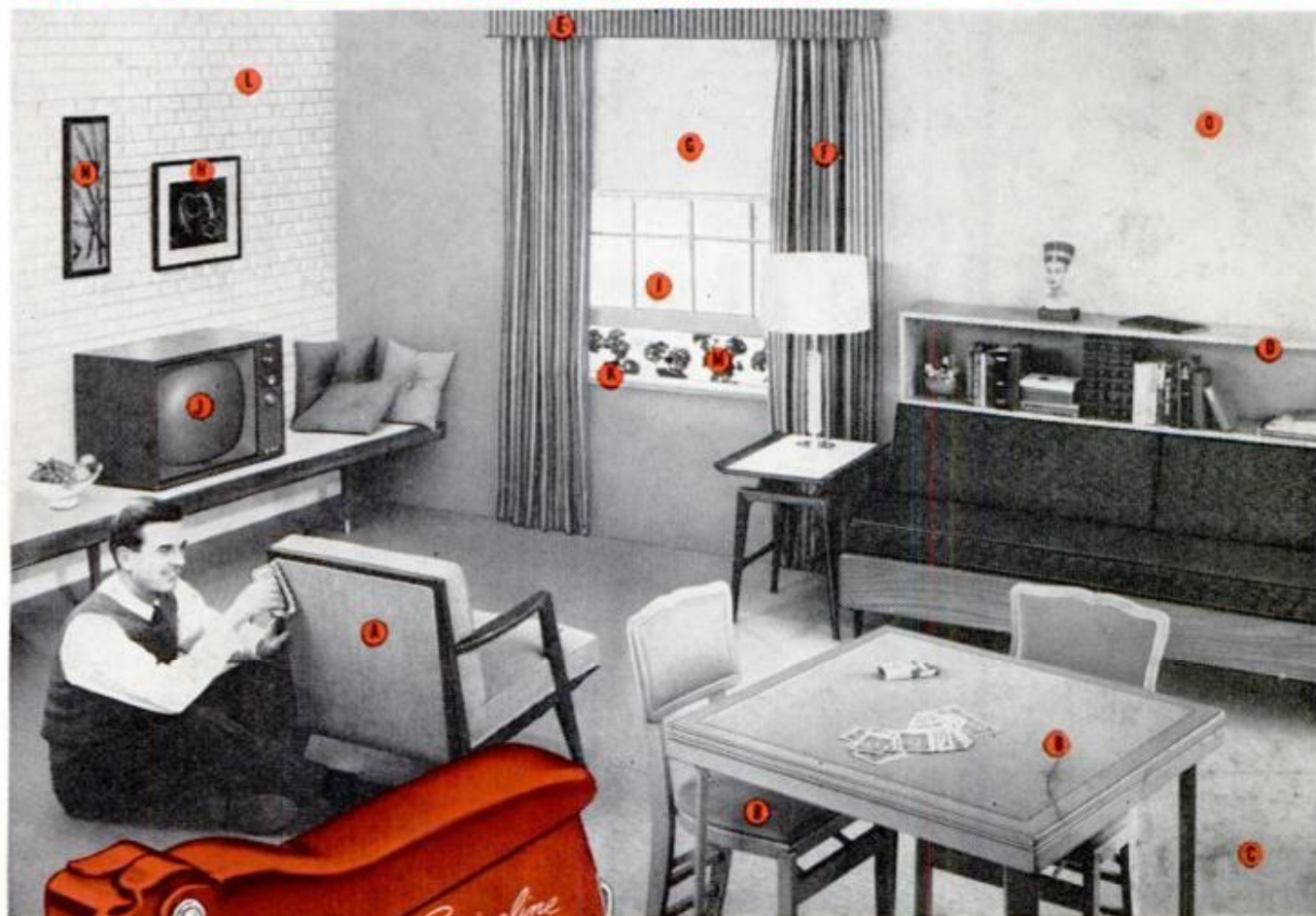
Today, adults are every bit as involved as their kids. As a matter of fact, people over 21 put together more than 40 percent of all models in this country! ★ ★ ★



Owl Aboard

Two wide-eyed, two-faced plastic owls have joined the crew of a "Texas Tower" built off San Diego, Calif., for Navy oceanographic studies. The high steel tower became a favorite gathering and roosting place for seagulls, who in turn became a noisy and unsanitary nuisance. After all the usual gull-shooing methods failed, the owls, which are made as decoys for crow hunters, were obtained and installed at the top of the tower. The gulls left in a huff and haven't returned.

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