

Do Drivers or Gimmicks Win Mobilgas Runs?

Inside Report from a PM Editor Who Competed

POPULAR MECHANICS

JULY 1963
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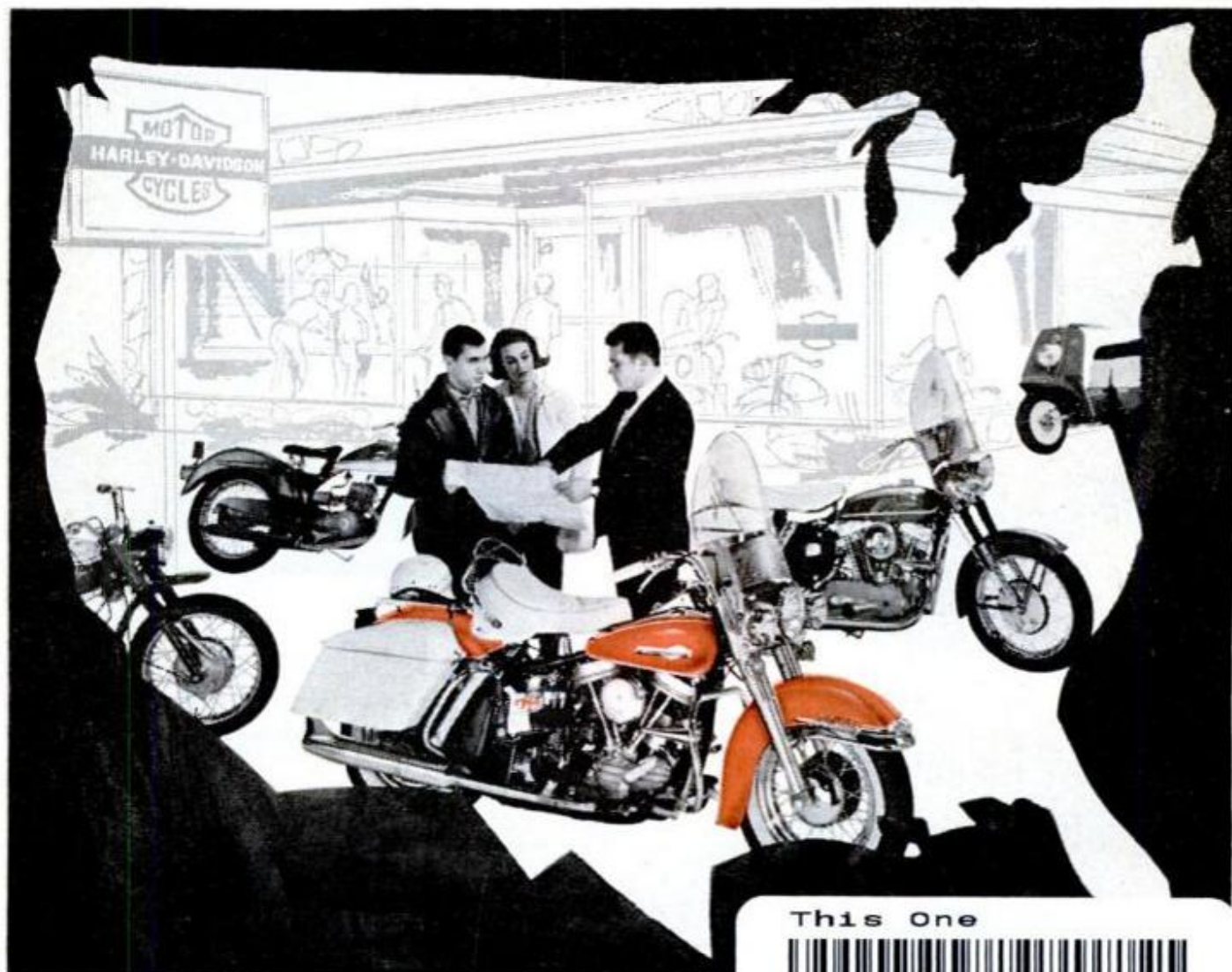
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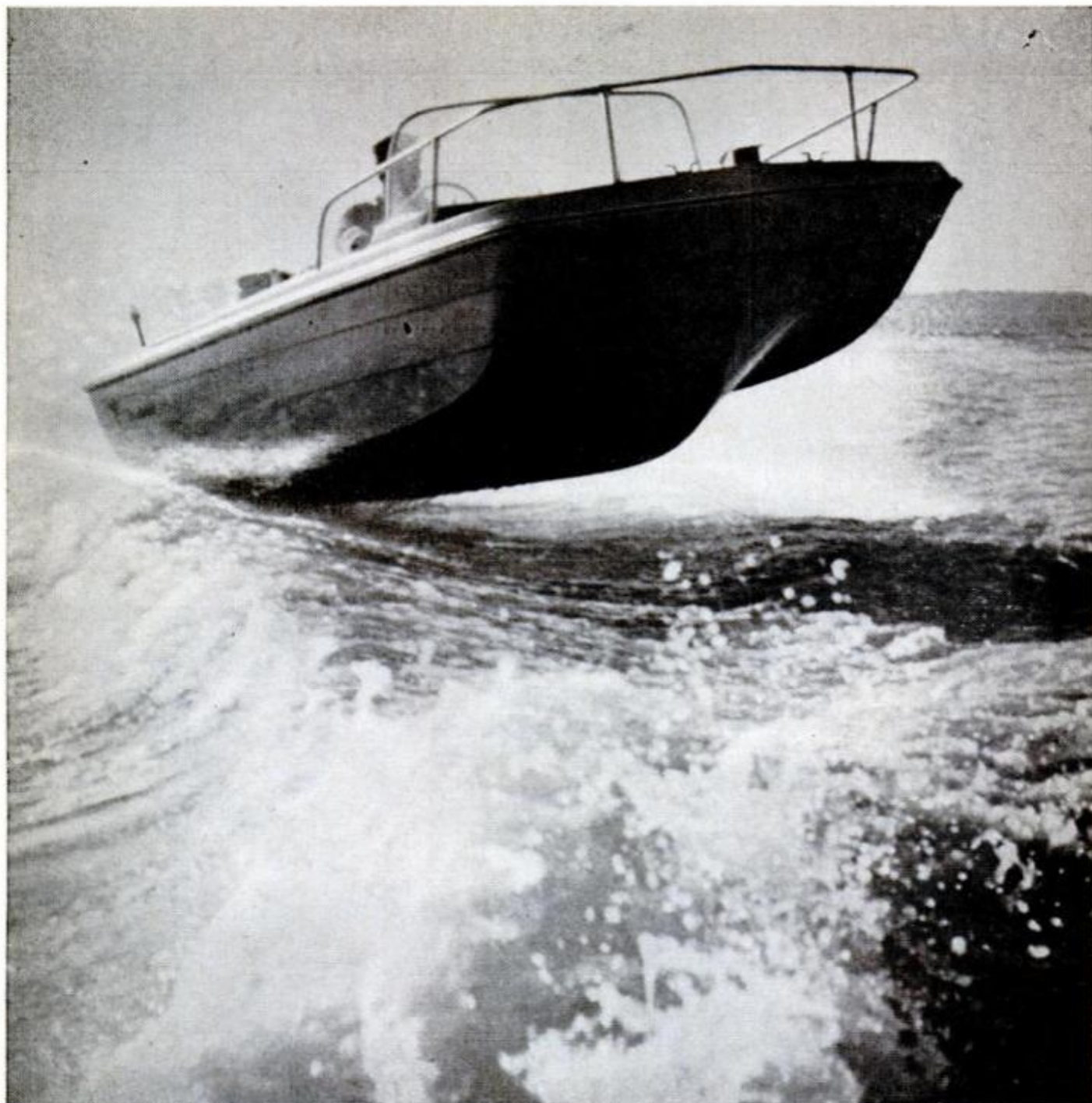


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NEXT MONTH—Submarine rescue operations four miles deep are on the way, spurred by the Thresher disaster in April. Read about it in August PM, along with the Navy's exciting plans for sea-bottom sub depots. You'll find previews of the '64 cars, unique games for boaters, tips on buying used cameras. Get your copy early

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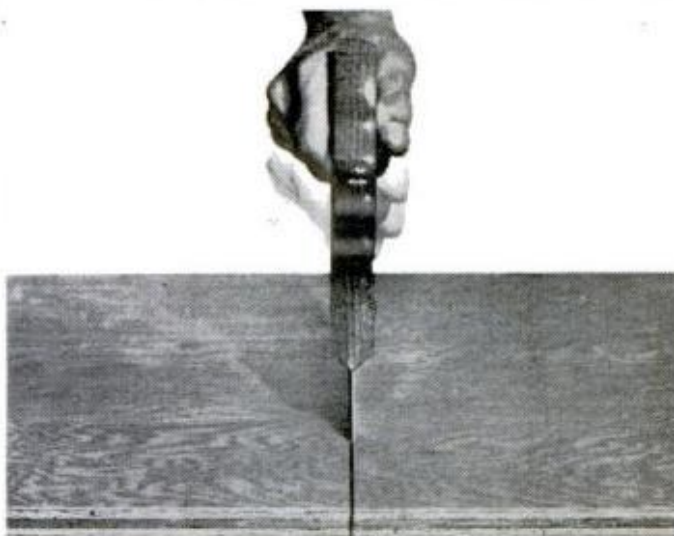
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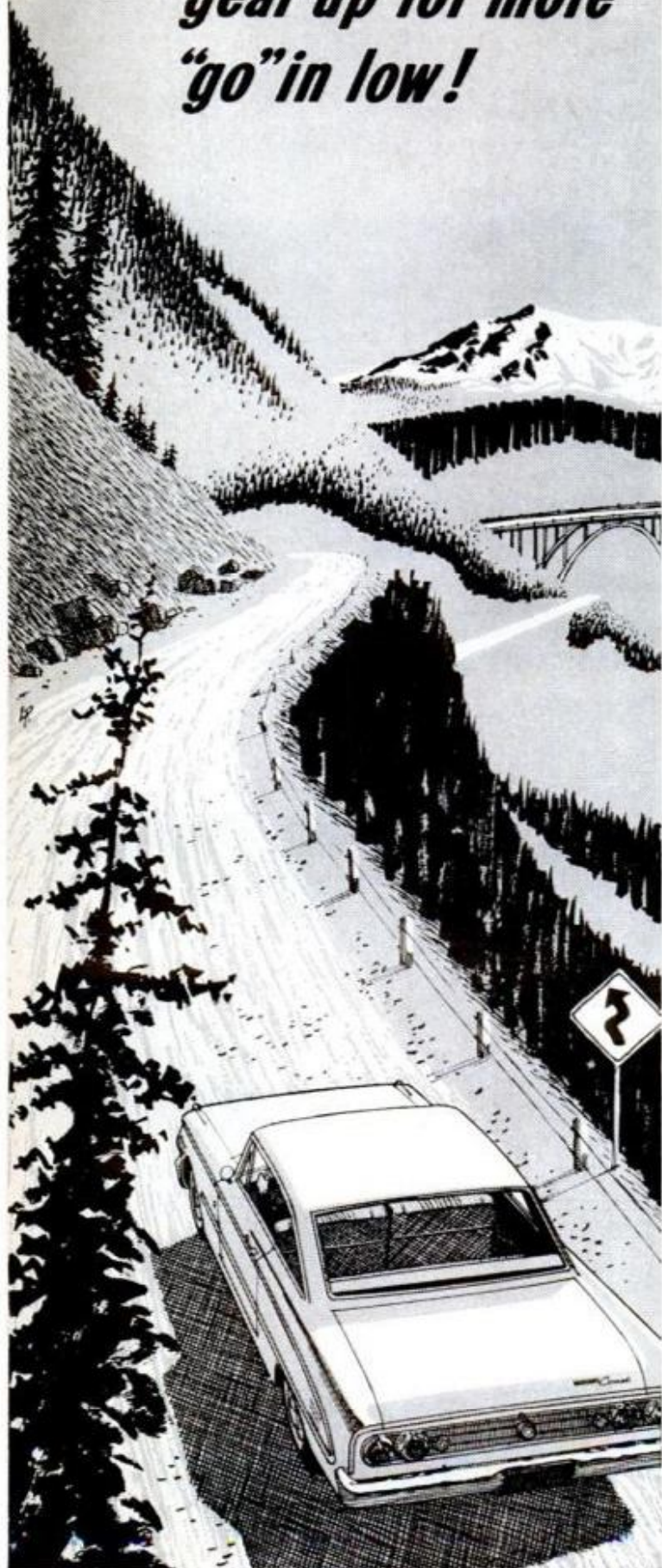
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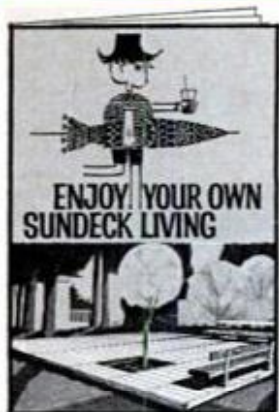


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Over the Editor's Desk

Tower Does the Trick

I have found that the toy in *Marble Tower Toy Will Occupy Youngsters for Hours* (page 158, April PM) really does the trick.

Enclosed is a photo of my grandchildren enjoying it. You'll note that I have added



an oblong tin cover at the top since the children were putting the marbles in handfuls on the top of the trough, spilling them on the floor. You'll also note that my rig has two troughs for marbles, rather than just one.

Honolulu, Hawaii

A. K. JIM

Aftermath of Hurricane

A reader of *PM* for many years, I was disappointed in *Hurricane Killers Learn Where to Aim* (page 114, March PM).

This account gives the impression that the idea of controlling a hurricane by cloud seeding originated with the Weather Bureau in 1961. The idea originated with Drs. Langmuir and Schaefer of General Electric, and on October 13, 1947, "Project Cirrus," a joint Army, Navy and Air Force study, seeded a hurricane off the Florida coast.

The statement in the article, "To the

jubilant weathermen, this was ample proof that a way to lick a hurricane had been found," gives the impression that control of hurricanes by cloud seeding is just around the corner.

I believe that most scientists would agree that . . . if hurricane control is possible, it is probably still a long way off.

Cambridge, Mass. BERNARD VONNEGUT

Responds author C. P. Gilmore: "All seeding, of course, is based on Dr. Langmuir's brilliant pioneering experiments in the field.

"Although hurricane clouds were seeded in 1947, the Weather Bureau work within the past few years has grown largely out of new evidence accumulated during the 1950s by the heavily instrumented planes of the National Hurricane Research Project. This work led to the discovery of the critical area which might be sensitive to seeding, as reported in the article."

The "jubilant weathermen" statement was edited too jubilantly. Author Gilmore's copy referred only to the success of their experiment—namely, changing water to ice. This experiment, he points out, did indeed show that the technique they used was promising in the battle against hurricanes.

Best Rest

Your magazine is the best bargain I have ever had. I started to buy it in January, 1962, and I still enjoy it.

Your slide rest (*Compound Slide Rest for Your Wood Lathe*, page 190, Feb. PM) is ideal. I made a wood-turning lathe last year that was designed to turn metal with the proper tool holder; at last I've found the tool holder.

Jamestown, N. Y.

JERRY FARR

A Word from the "Old Men"

Having read and collected every issue of *PM* since 1928, this is the first instance that I am writing a letter of protest for the way you choose to use words referring to us modelers in a highly competitive sport: "No one knows why, but most model boats are built and launched by older males" (*Hobbies a la Carte*, page 118, April PM). Inasmuch as you did not take time to find out, please let me enlighten you why.

The individual about to launch the hydro is Tommie Mandarville, who does not particularly care to disclose his age, but he is a grandfather and has been racing boats 30-some years. In that time, the maximum speed has gone from 45 m.p.h.

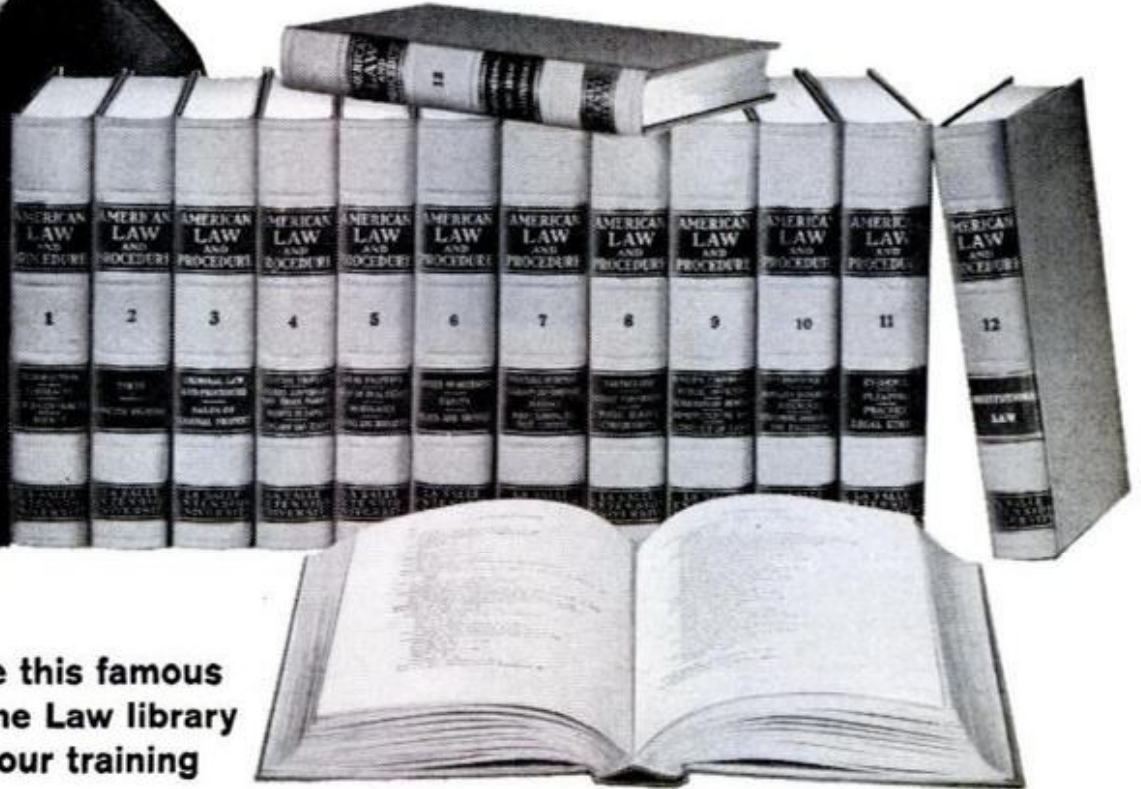
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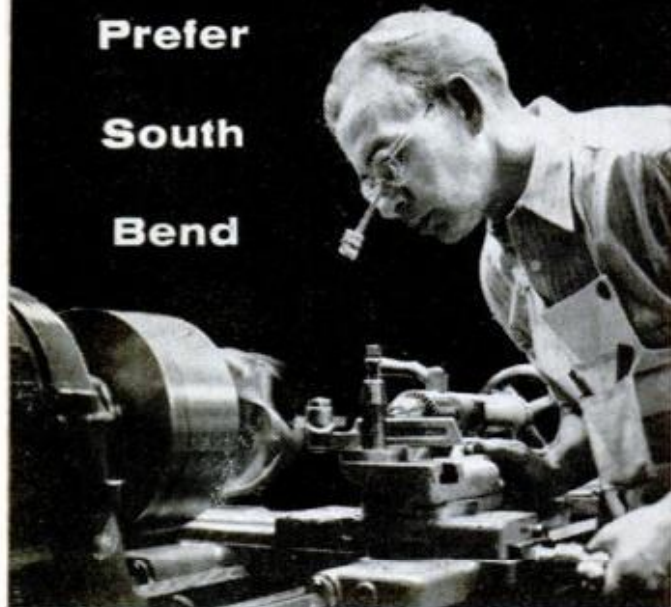


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to 104 m.p.h. It took a lot of hard work and experimentation to achieve this.

These engines require precision instruments, lathes, drill presses and skill in metalworking, reading blueprints and a good knowledge of woodworking. Consequently the younger generation rather jumps into a souped-up car and races around drag strips.

Use any parts of this letter if you choose to write about us "old men." I still like *PM* the best.

Plainview, L.I., N.Y. L. WEINSTOCK, E. E.

We do choose to write about old men right now, partly because our secretaries make it plain to us that some of us have reached that classification, too. So when's the next meeting of the club?

New Light on Gas

I am a policeman and patrol one of the very heavily traveled freeways in Cleveland, Ohio. We are constantly faced with the problem of the individual who runs out of gas. When he finally gets his can of gas, he is unable to get it into the tank because of the receded filler pipe for his tank.

I take my five-cell flashlight, remove the lens, reflector, batteries, cardboard tube and bottom cap—which leaves me with a very efficient funnel. Afterwards, I let it dry a few minutes and it's back in business.

Cleveland, Ohio THOMAS H. MORRILL

And we'll pass along your helpful tip to our readers, hoping, of course, that they don't forget both flashlight and gas can at the same time.

Foiled Goose

You reported tests of a JRF-5 Grumman Goose equipped with hydrofoils (page 116, April *PM*). A reader might get the impression that this was a Grumman project.

This hydrofoil installation was designed, developed and tested for the Navy by the Edo Corporation, College Point 56, N. Y. College Point, N. Y. SIDNEY C. SMITH

The Lid's Off

Re: page 87 in your May issue (*First Pleasure Drive to Panama*). I hope he didn't drive too far with that open trunk lid. Otherwise that rocky road would have bumped the lid right off the hinges. Right? Chicago, Ill. KEN GREENBERG

Right. But since it didn't fall off, we're pretty sure he closed it after he put the camera and tripod back in.

The Editor

POPULAR MECHANICS

This story actually happened. The man's name has been changed and this is not his photograph, but the facts are true.

"Your name is on the list"



Doug Mott was not surprised. The recession was on and the assembly line where he worked was almost at a standstill.

And then, strangely, the boss began to smile. "You know how the Engineering Department sends us blueprints and then we have to send them back for revision because they just aren't practical to produce?" Doug nodded . . . wondering. "That's waste . . . and we can't allow it to continue. That's why we thought that if we had a man who knew assembly and production — and drafting, too — he could act as liaison man between engineering and production. You know production, Doug . . . and you're studying drafting with I.C.S. You've got a *new* job. Congratulations!"

Doug Mott now heads a drafting room. But he will never forget the day his name was on the list to be laid off.

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The studies at Ohio State University are significant in military and agricultural aviation where low-altitude flight is becoming more necessary.

The new X-21, the plane with a wing full of holes, is being flight-tested at Edwards Air Force Base, Calif., while engineers back at the factory (Northrop Corp.) try to figure out how to keep the holes from getting clogged up.

The experimental craft, a remade B-66 twin-jet bomber, is equipped with wings with sliverlike slots to suck in the bound-

ary layer of air that clings to the surface, creating drag. By sucking it in, the slots smooth out the airflow, increasing lift, range and pay load by 50 percent.

Meanwhile, of course, slots could suck in a lot of dirt and debris and become clogged. Until a way is found to keep the dirt out, maintenance crews just cover up the wings when the plane is grounded.

Red ink and airlines are old friends. Government subsidies keep many of them operating. While startling, because of their immense popularity with passengers, it really should come as no surprise to learn that the manufacturers have not yet made a profit on any of the commercial jetliners and, according to one airline president, the airline industry as a whole made a net profit last year of only 24 cents per passenger flown.

The supersonic B-70, reported in a PM story last month, may eventually have to be landed with the aid of arresting gear, the same as on aircraft carriers. Several versions of such a gear are now under development, for this superbig craft.

Kevin V. Brown
Aviation Editor

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JULY 1963

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Sidelights from the **SERVICES**

By William R. Kreh

Teiteiripucchi is out, the Navy says. This tongue-twister happens to be the name of one of the many islets of Eniwetok atoll that now form the outer extremities of a deep Pacific bullseye for ICBMs launched from the Pacific Range in California. But who can pronounce or spell a target name like that? And that's why the Navy, with evident relief, now refers to Teiteiripucchi as "Gene."

Besides Teiteiripucchi, other small atoll islands originally had names such as Bokonaarappu, Elugelab and Muzinbaariku, given them by Marshall Islands natives long ago. Colorful as they may be, these names had no place in the atomic age, so now names of islets in the atoll read like a classroom rollcall:

The boys are Keith, James, Sam, Fred, Van, Oscar, Tom, Irwin, Henry, Glenn, Leroy, Bruce, Clyde, Alvin, Mack, David, Elmer and, of course, Gene. Where there are boys, girls are bound to follow, so there's Pearl, Nancy, Kate, Flora, Daisy, Clara, Belle, Edna, Lucy, Mary, Olive, Irene, Tilda, Janet, Yvonne and Wilma.

"Sunset over Chinimi" may be a little more romantic than "sunset over Oscar," but when a missile roars off the pad in California, it's quicker and more efficient for missile men to report impact between Vera and Leroy than between Rigili and Aaraaanb—correction, Aaraanbiru!

✓ ✓ ✓
A 20-pound bag of groceries at Andrews Air Force Base, 20 miles from Washington, D.C., will be underweight at the Washington Monument by about .0125 ounce, or the weight of one raisin. And a ton in Los Angeles weighs 17 ounces less than at the Pentagon. By the same token, a ton at Key West, Fla., would be 2¼ pounds light and one at Seattle, Wash., 21 ounces heavy. These are some of the first facts to come out of a worldwide Air Force survey of variations in the force of gravity. A network of Air Force "gravity-base measuring stations" has been set up across the nation while traveling teams are covering other areas overseas. Gravity is known to vary with altitude, latitude and the density of the earth, but precise data has been lacking. The Air Force is vitally interested in knowing these variations because the relatively minute differences affect the

course of ballistic missiles. By knowing the variations over the globe, it can feed corrections into ICBM guidance systems. Basic measuring point for the gravity survey is the Commerce Department in the nation's capital.

✓ ✓ ✓
A new science is being pushed by the Navy. It's "biodigmatics," or the science of developing devices from an example set by nature. The word "bionics" already has been coined to describe electronic devices lifted from Mother Nature, but Navy scientists claim this science is much broader than that. Thus the new word. Some items that could come from biodigmatics include a movable pile fabric patterned after the way a dog makes his hackles rise, a wall hanger patterned from the way a woodpecker supports its weight with claws and tail, and an underwater adhesive like the one used by starfish to hang onto rocks.

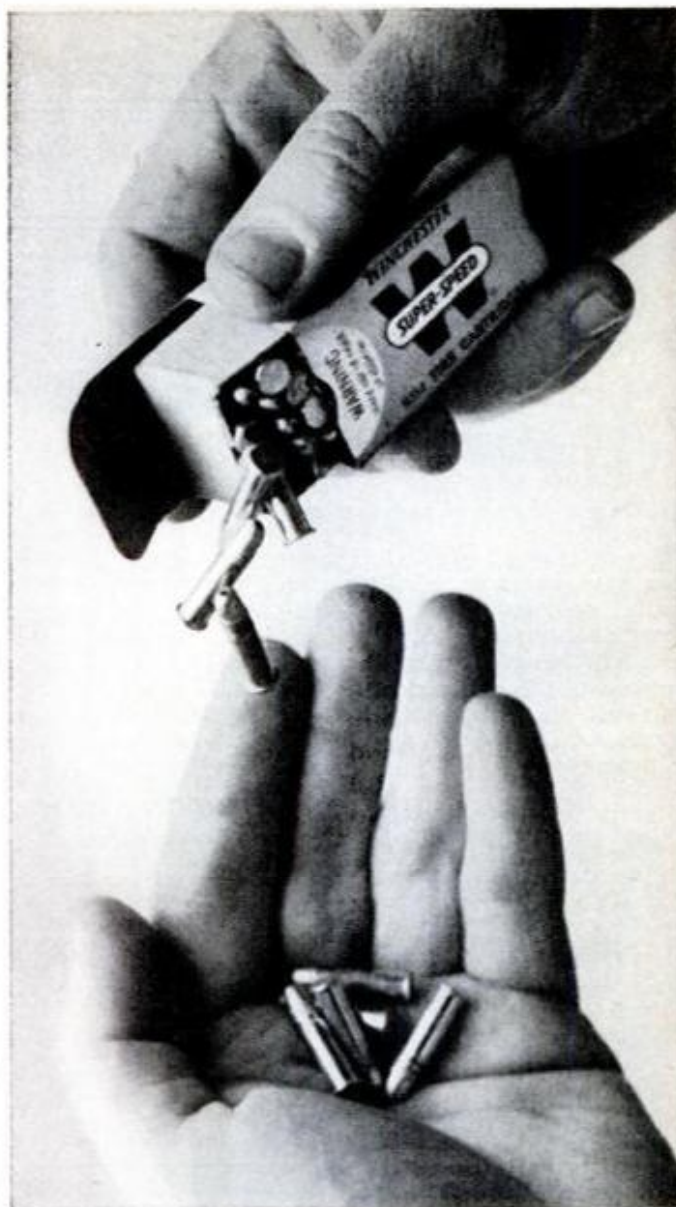
✓ ✓ ✓
Combat appetites are under study by the Army. Does a soldier prefer ham and eggs or pancakes before entering battle? Would a paratrooper rather drink coffee or hot chocolate before leaping behind enemy lines? Do troops eat more or less when under stress?

Answers to these and other questions on the preference and eating behavior of combat soldiers when they're in danger are being sought in a special study being made at Fort Bragg, N.C., where the stresses of going through paratrooper and ranger training are as near to actual combat as can be found in peacetime. Results of the experiment will be used to set up new guides for ration planning in combat.

✓ ✓ ✓
Don't pluck those chickens. The Army is teaching its guerrilla fighters how to skin chickens, feathers and all, in one piece so they won't have to pluck them. Loose feathers, it seems, are ideal clues for an enemy to use in tracking positions.

✓ ✓ ✓
An air-tight record has been set by the nuclear submarine *Scorpion* which kept a "sealed atmosphere" for 70 consecutive days. This beats the old mark of 60 days set in 1958 by the NS *Seawolf* and by several *Polaris* A-sub subs which have kept closed up for 60 days while on patrols. Although the A-sub *Triton* stayed down 84 days on her around-the-world cruise in 1960, she frequently used her snorkel breathing device for ventilation. The *Scorpion*, however, manufactured or regenerated all of her air during her underwater stint. The Navy won't say when or where the *Scorpion* made her record-breaking cruise.

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Items from All Outdoors

Conservationists in eastern Pennsylvania are proud of themselves these days, and with good reason. Many years of fighting pollution of the Delaware River has produced results. The annual shad migration has returned after a 50-year absence. In Frenchtown, N.J., we talked with an old timer who said, "It's like when I was a boy. Everybody is on the river fishing." In New Hope, Pa., once the hub of the shad fishing industry, one net yielded 296 shad, the largest single netting since 1896.

Deer are protected from death along highways in The Netherlands by the use of mirrors, a method that could well be adopted by U.S. Fish and Game authorities. Two tiny metal mirrors are mounted on posts set opposite each other on highway shoulders. Approaching headlights reflect light into the woods at a 90-degree angle. Deer about to cross the road freeze until the light passes, eliminating danger.

Fishing tips have filled many books, but there is always something new. F. L. Mattfelt of Atlanta, Ga., sent us one that worked effectively for us on bass. Two quarter-inch strands of chamois, an inch long, are split halfway down the middle to make a lure that wriggles like live bait in the water. The chamois is treated with cod-liver oil to keep it supple, and is attached to the snap link above the hook, because, as Matt claims, "Fish invariably strike short." One of the best fishing tips we've heard is from *The Pennsylvania Angler*. Jim Hayes says, "When fish aren't biting . . . go home."

New for Outdoors . . . Kamper's "Konnie" Saw has a 16-inch blade and weighs only six ounces. Far superior to the axe for cutting firewood, it costs \$3.50 from Rich-Con Corp., 327 Richmond St., El Segundo, Calif. . . . Shrimp for fishing bait is now freeze-dried and packaged by West Indies Ocean Products, and is available in most tackle stores for about 69 cents. It eliminates bait-storage problems, and when wet it regains its original flavor and odor. We tried it recently on blue cod in Monterey, Calif., and caught 29 in two hours.

STUART JAMES
Outdoors Editor

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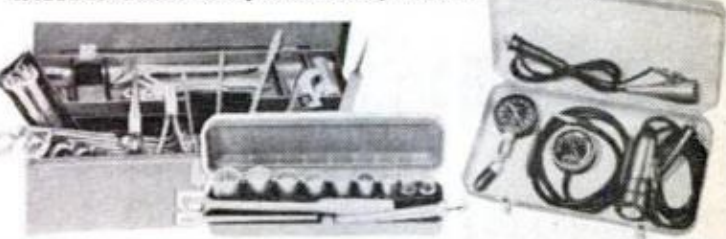
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Baldness is now being treated successfully by surgery. I was recently invited to witness the placing of hair grafts to cover a patient's receding hairline. The surgeon, Dr. Ralph Berger, who is associated with the developer of the technique, New York University Medical School's Dr. Norman Orentreich, took about 10 follicle-bearing plugs of skin and flesh out of the back of the patient's head, and after trimming away excess fat, planted the plugs in holes punched in the balding area.

The plugs were 3.5 mm. in diameter and about four or five millimeters deep. Each plug contained one to two dozen hairs. The grafts heal in a couple of weeks and new hair comes in two to three months later. Up to 15 punch grafts can be made at a time in a dermatologist's office under local anesthesia, more in an operating room.

Life on Mars, if it exists, is subject to possibly a million times more radiation during solar storms than organisms on earth, according to an Air Force scientist. Also, Martian life would have to survive on a water-vapor supply less than 1/1000th of that in our atmosphere. Even under these rigorous conditions, scientists think Mars is the planet most likely to contain some form of life, possibly microscopic organisms, but nothing like *homo sapiens*.

Artificial bats are keeping moths out of some Canadian cornfields. Researchers put a transducer, rotating at 600 revolutions a minute, about 20 inches above corn growing in a test field. Two interrupted sound pulses from the transducer, corresponding to the ultrasonic pulse rate of a cruising bat, have apparently scared off the moths.

Why do women live longer than men? Science doesn't yet know the answer, but if present trends continue, the death rate for males will soon be twice that for females. Women now have a life expect-

ancy of more than six years over men, says the U.S. Public Health Service.

Agents causing the rising death rate in men 45 to 64 include heart disease, cancer, and high blood pressure. Hormones may also be a factor. Researchers at Cornell found that the male hormone testosterone shortened the lives of both male and female rats, while the female hormone estrogen prolonged the lives of male rats.

Wired for sound. Gemini astronauts will bring back the most complete reports yet on man's physical and mental reactions in space. Two magnetic tape recorders will make second-by-second recordings of electrocardiograph heart readings, blood pressure, respiration, body temperature and brain and muscle reactions of the spacemen.

The tail of a whale may hold a cure for sinus. Researchers in Brazil found that a liquid made from the center part of a whale's tail has anti-bacterial properties; when its heated fumes are inhaled it relieves sinus inflammation.

Barbecued cadmium may be your downfall if you use makeshift equipment in back-yard cooking. In one case a family became violently ill after eating steak, baked potatoes and salad. Investigators found that the steak had been grilled on an old refrigerator shelf. Heat caused cadmium in the plating material to poison the meat. Since many household items are coated with cadmium metals, your best safeguard is to use only regular barbecue grills.

Rare molecules which exist only in scorching-hot temperatures are now being preserved for study by a seemingly upsidedown technique—instant freezing. Scientists at Armour Research Foundation shoot a molecular beam from the 5500-degree heat of a vacuum flask at a specially prepared target. Liquid helium freezes the target to four degrees above absolute zero and the molecules are trapped and held in suspension by an inert gas, frozen argon.

They're "baking" trees in a slow "oven" out West. A scientist at the University of California found that fruit-tree viruses can be destroyed by keeping young seedling trees in a greenhouse for several weeks at 100 degrees F. Buds from the treated plants can then be grafted onto orchard trees.

The method may result in changing
(Please turn to page 20)

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Science Worldwide

(Continued from page 18)

the official botanical descriptions of some fruit trees. Characteristics such as rolled leaves and weeping growth habit, assumed to be genetic in nature, proved to be symptoms of latent virus disease.

Quick press job. A new crease can be put in Pop's pants in 30 minutes with a valet stand that includes an electrically-heated trousers press. A time switch on the British device cuts off current automatically, making scorching impossible.

Not so fresh. A fossilized egg believed to be 20 million years old was discovered north of Tokyo, Japan, by construction men digging 33 feet underground. Geologists dated the find from the stratum in which it appeared. A cross-section of the egg, about as big as a hen's egg, showed yellow yolk surrounded by blue-tinged white.

Whiffs of carbon dioxide make hot-house vegetables grow faster, experiments in Britain show. The gas is supplied by burning propane, or paraffin, or by using chunks of dry ice.

Did tektites come from the moon or are they volcanic in origin? Scientists differ, but a pretty, young geologist with the U.S. Geological Survey may soon settle the controversy. Mrs. Cynthia Mead, 28, believes the glassy chunks of matter were flung out from the moon ages ago in a gigantic meteor strike.

She's now studying them with a new scientific tool, the electron probe, which can measure tiny particles deep inside tektites only three microns (three 25 thousandths of an inch) in width.

Electricity may free armies from an ancient enemy—mud. Cornell University scientists, sponsored by the Army Engineers, are now trying to capitalize on the known phenomena that putting an electric current into wet soil causes water to migrate to a point where it can be drained off.

They're experimenting with an electric grid 15 to 20 feet wide, beneath which will be a series of pipes. With the grid negatively charged and the pipes positively charged, water should rise to the surface where it can be drained away.

A curtain of air bubbles was used by explosives experts in Canada recently to protect a new bridge during nearby demolition operations. Compressed air released from perforated pipes sunk in the water around the blast area screened off the explosion; riverside instruments registered almost no vibrations during the explosions.

Smoochers beware! The degree of passion in a kiss can now be measured. Three students at the University of Miami have put together a device, called the Kissometer, which "measures the intensity of human osculation." Kissers hold charged electronic probes and when their lips meet the circuit is complete. It classifies kisses from a low-level "dead fish" up to "Wow!"

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which rings a bell and flashes lights. All in the interest of science, they say.

Largest optical telescope in the southern hemisphere is being planned by five European nations. The instrument will have a 140-inch diameter lens, will cost about \$8,000,000 and will be completed by 1970. It will be located in either South Africa or Chile. Nations involved are the Netherlands, Belgium, West Germany, France and Sweden.

The weight of the ink in two words added to a 30-volume encyclopedia can be detected by a new ultrasensitive instrument developed by Westinghouse Electric. Called a quartz crystal microbalance, the device is expected to find many uses in space-age industries.

They're dusting water in Australia. Scientists there have found that regular dusting of water reservoirs with a dry, finely powdered cetyle alcohol cuts evaporation losses by 50 percent.

It's an old custom. "The man bearing the name Puzur Haya accepts the girl named Ubartum as his wife. Witnesses were Urdamu Zida Bulani, son of Ur Meme, and Olduga, son of Urdamu Zin." So reads a marriage certificate inscribed on a stone found recently in Iraq. Believed to be about 4000 years old, it proves there's nothing new in nuptials.

A downtown Tokyo area is getting an electronic sign that registers and reports the surrounding noise level. City officials say that if people hear how much noise they're making they might be more quiet.

Rear-view mirrors in automobiles may be obsolete. A German inventor has developed a "retroscope" which acts like a reverse periscope. He claims it does away with blind spots to the rear of a car, and also cuts down on the glare of headlights approaching from behind.

Tomb germs which had lain dormant for more than 1200 years came to life recently after being placed in an incubator. The bacteria were taken from the sealed tomb of a Maya Indian chief in Guatemala. They had remained inactive for 12 centuries because of lack of moisture, light and food. None have so far been identified, says Dr. Joseph R. Valenta of Smith Kline & French Co., who made the discovery.

John P. McNeel
Science Editor

RCA introduces a new easy way to learn electronics at home

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By Jim Whipple



U.S. Automakers Favor Racing Three to Two, But Does Racing Actually Result in Better Cars?

Does racing improve the breed? Now that racing and rallying are being pursued at full throttle by three of America's five motormakers this question might well be asked by American car buyers.

Successful motor car competition costs important money. The sponsor must lay out \$7500 for a grand National stocker; the quarter-mile commando puts up \$3500 or more for his full-house, two-door hardtop—all this after the manufacturer designs and tools performance hardware.

The days when you could buy a bread-and-butter V8 and compete by adding a couple of carburetors and some mail-order pistons are long gone. To build engines of over 400 horsepower that will push a Pontiac, Dodge, or Chevy at 150-plus m.p.h. on the Grand National circuit takes a combination of size, strength, and reliability that few home-town garages have equipment to produce.

What's even more important, stock car racing means production parts, not hand-tooled jewelry worked up on a scratch pad by some backshop genius. If you want to compete for the shiniest marbles and biggest headlines in racing, you've got to homologate.

That awesome term simply means "to produce the part you race with," and be able to prove it to governing bodies such as NASCAR and FIA (Federation International des Automobiles).

The manufacturer doesn't have to bankrupt himself by making shiploads of a particular racing goody, but he must catalog the item and sell it retail as a production option. That doesn't mean that it will be reasonably priced (although it might be) or that it will be "off-the-shelf" at any dealer's. If you're a regular stock car entrant or have acquitted yourself reasonably well in national rallies, Plymouth should be able to find you some aluminum fenders, or Ford should make quick delivery on a set of Bendix disk brakes for your hot *Falcon Sprint*.

Plain and simple touring types can get these goodies too, but you may find yourself at the end of a long list for something in short supply. Homologation means pro-

duction, but not always mass production.

This last point brings us back to the prime question: Does racing improve the breed? Occasionally racing experience results in the improvement of a mass-produced part that goes on every car. When it does, the answer is an emphatic "Yes!"

Ford, the top gun among manufacturers in racing today, provides examples.

Item: In developing a "bottom end" on their racing engine, Ford found that cross-belted of the main bearing bulkheads kept crankshafts from leaving the scene at sustained high r.p.m. They found it feasible to do this on all their high performance engines on the line—without passing any extra cost to the consumer.

Item: Ford found a new and better design for connecting rods that made them hold together in racing. Tooling up for hundreds was just as expensive as for thousands, so all buyers of their high performance engines get the new rods.

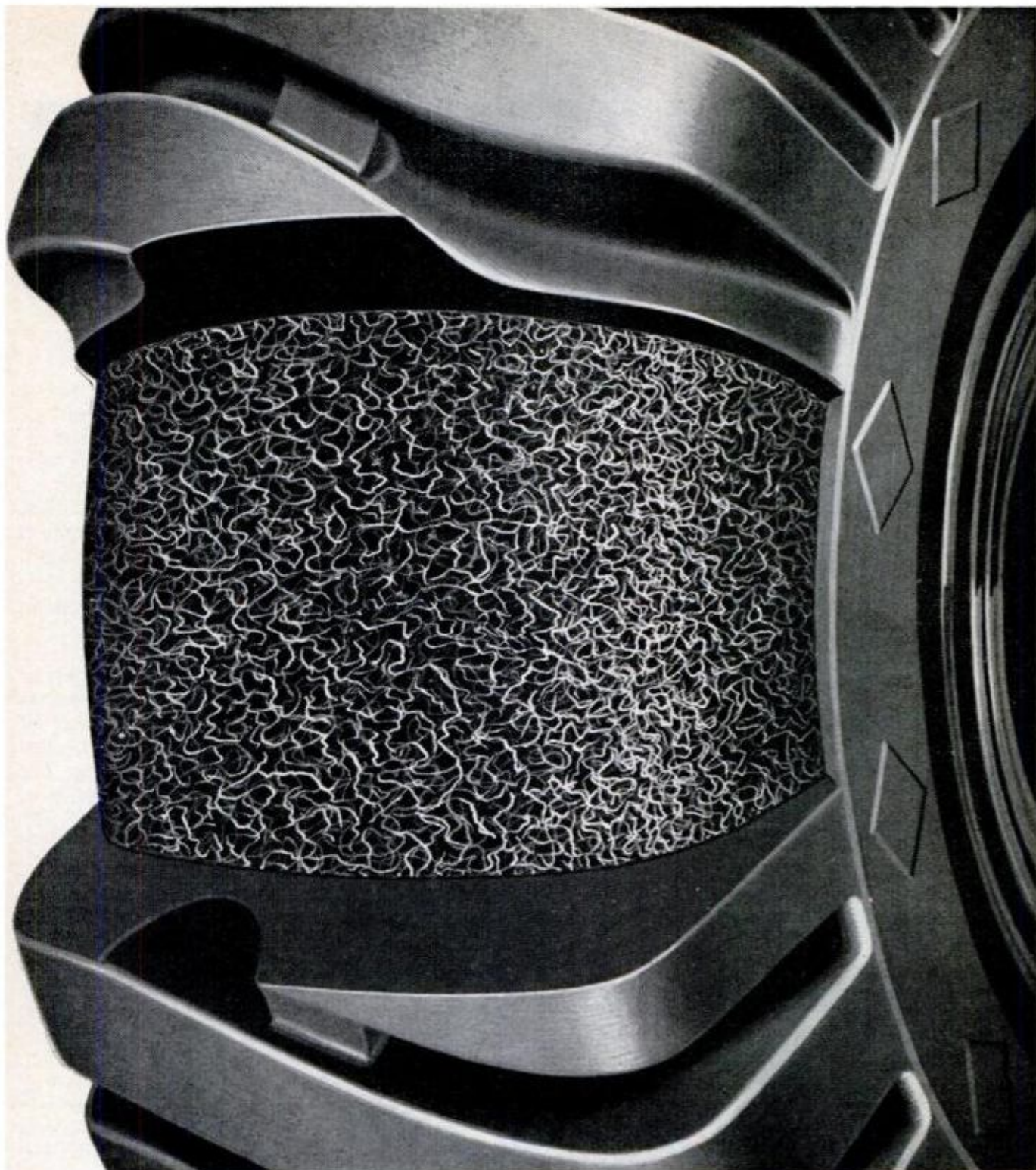
Granted, these race-developed goodies don't show up yet on Aunt Martha's *Fairlane Six*. But the route for rub-off has been established and whenever tooling changes are made, the race-bred improvements can be phased into design for the whole line.

Even a non-racing manufacturer, of which General Motors currently is our most conspicuous example, can research items that add to an engine's, or chassis' performance and reliability.

Dayton's Speed Week provided a case in point when a racing manufacturer (Ford) trampled the entries who were using the products of a non-racing manufacturer (Chevrolet). Engine failures at high speed in the long grind were the problem.

There is little doubt that the non-racing Chevrolet engineers will come up with solutions to such problems—even if they have to act "unofficially." For Chevrolet to lose face in the eyes of thousands of race fans could mean lost sales.

Were it not for racing, neither Ford nor Chevrolet engines would need to be as good. And that stiffer connecting rod would never have an opportunity to grace Aunt Martha's *Fairlane!*



Steel bodyguard stops tire killers cold

6 million short lengths of steel wire are embedded in the undertreads of off-the-road Goodyear tires. They guard the body against cuts and bruise breaks from sharp rocks, stabbing stumps, slashing scrap metal and other tire destroyers.

This steel bodyguard also retards cut growth. And it helps prevent separations too, because it actually "zip-

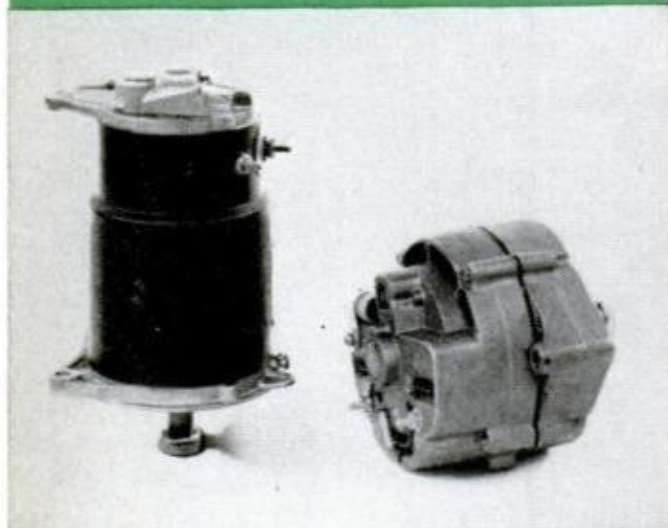
pers" the tread to the tire body.

This steel bodyguard is a Goodyear *bonus*. Doesn't cost a penny extra in most of the popular sizes. See your Goodyear Dealer or Goodyear Service Store. Goodyear, Truck Tires, Akron 16, Ohio.

Another reason why: more tons are hauled on Goodyear truck tires than on any other kind.

GOODYEAR

Test your automotive I.Q.



*Do you recognize these two pieces of equipment?
Which is most likely to be found on today's cars?*



What does this symbol stand for?

An alternator (top right) is now found on many new cars, replacing the old-time standard generator (left). The life preserver is the symbol of Quaker State Motor Oil—the best engine life preserver. Made from 100% pure Pennsylvania Grade Crude Oil, Quaker State gives every car longer-lasting lubrication, top protection. Insist on Quaker State—your best engine life preserver.



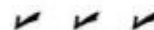
QUAKER STATE OIL REFINING CORP., OIL CITY, PA.

Tune in on the Inventors

Fishermen who favor live bait should, theoretically, get a full day's sport with one or two minnows using the fishing lure developed by Otis E. McClanahan of Clyde, Ohio. A transparent capsule, to which is attached a hook and line, holds a live minnow, as described in patent 3,087,272. The capsule is open at one end to keep the minnow supplied with water.



Scuba divers can now glide undetected through the water, powered by a pressure-volume gas engine, instead of electric motors with cables, or storage batteries. Called the Seacycle, the apparatus is steered by a control on the front fins. Ballast can be blown slowly and exhaust bubbles dispersed for maximum security. Patent 3,084,654 went to Edgar N. Rosenberg and Stephen F. Moran, both of San Diego, Calif.



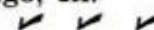
Water walking could be the next sport fad if the public takes to the "water walkers" invented by Ira N. Wheat of Grand Prairie, Tex. Shaped like skis, but with recesses inclined forward along the undersurfaces, the buoyant boards won patent 3,084,356.



Simulating trips through space to select and train astronauts can be accomplished in a space trainer developed by William B. Luton of Dallas, Tex. The machine, which won patent 3,083,473, simulates the sensations of an actual space trip, including vibration, heat, pressure, speeds and an "earth horizon." It also duplicates roll, yaw and pitch motions.



Are your bones alive? Your surgeon can find out with a new device for "measuring oxygen tension in bone." A hole is drilled in the bone and a specimen removed for electrical analysis. This tells how much oxygen is present, whether a fractured bone has enough blood and is thus alive. Patent 3,083,706 went to Charles F. Woodhouse of Chicago, Ill.



The death toll in air disasters could be substantially reduced if a new aircraft parachute invented by Russell K. Lamm of Berkeley, Calif., proves feasible in use. The chute could lower the passenger section by means of cables attached to seat frames, or it could bring the entire craft to earth; patent 3,084,891.

each of the single headlamps acts as a bumper. In addition, a bar below the grille is designed to intercept low bumpers of other cars which may slip beneath the lamp ring bumpers.

At the rear of the car, the trim surrounding the tail lamps is of bumper stock. But what the stylists have done to this rear is very unlike the T-bird. Observed from high on a ladder, the slanting recesses for the tail lights give the rear deck a faint resemblance to a delta wing. From ground level, though, these deep recesses make the car look as if part of it were running away from the rest. But even though the unconventional rear lines bear no apparent relationship to the turbine power plant, they are not easily forgotten. Perhaps that's the idea.

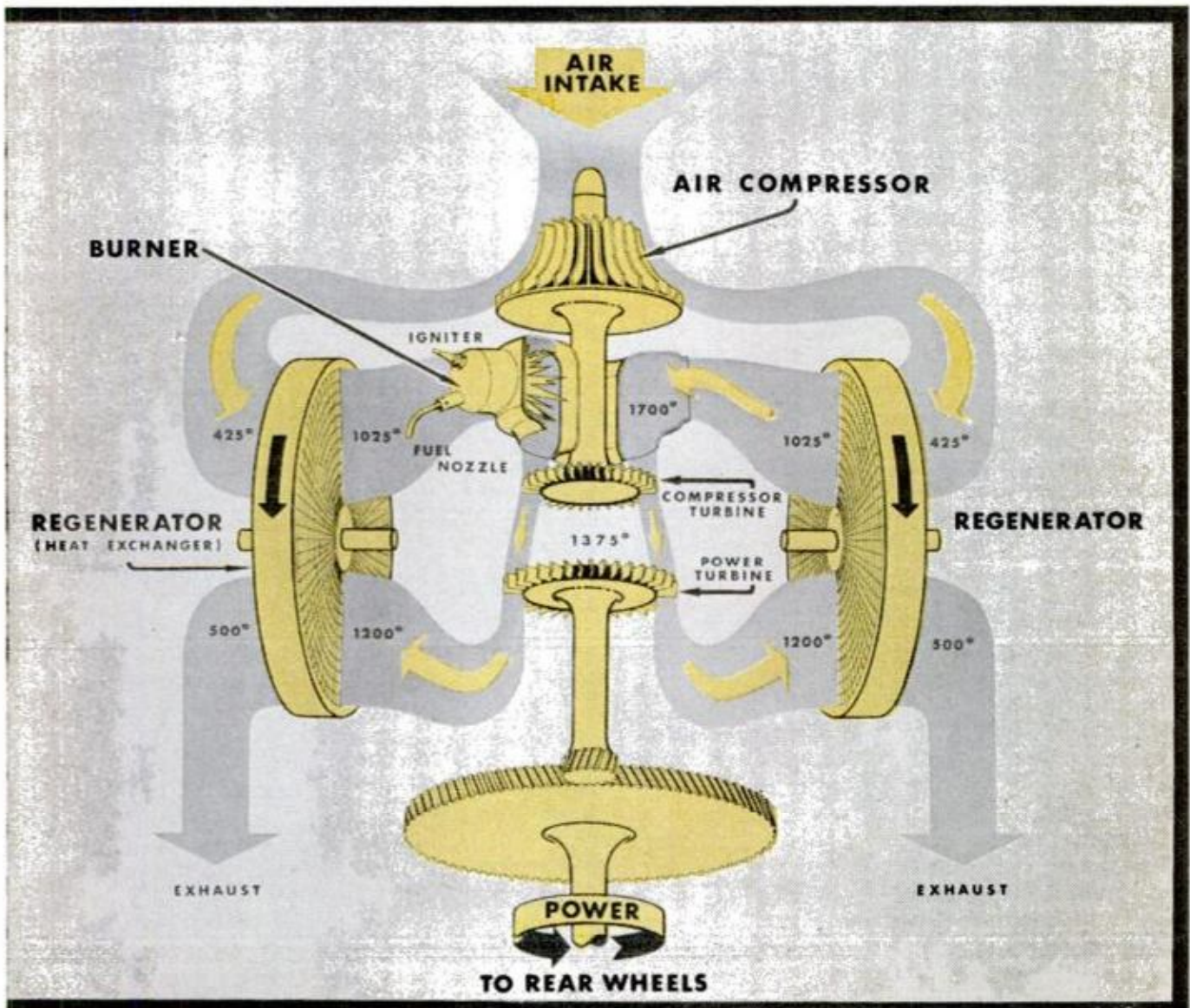
Interior trim styling is even more unconventional. A long tunnel or hump with radial "turbine-blade" trim at either end splits the car down the middle like a giant aluminum cigar tube. This tube appears

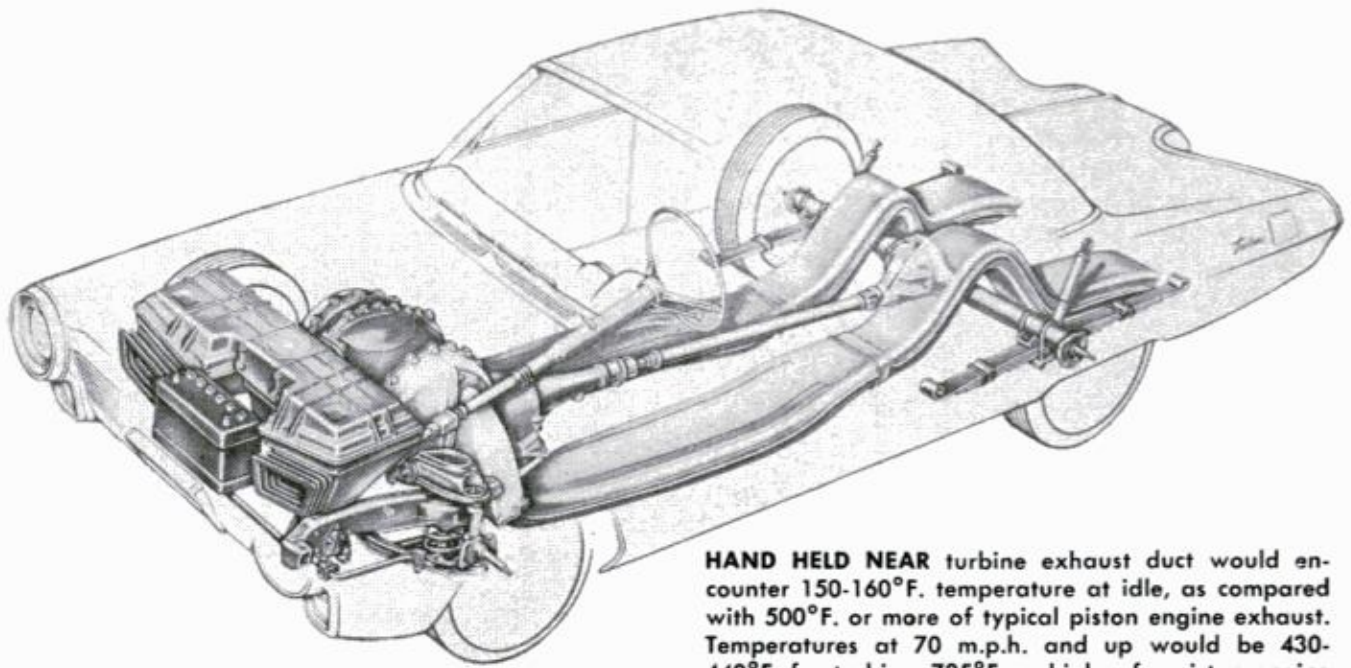
to be for looks as it is far higher than the conventional driveshaft clearance would require and is not the exhaust "pipe" for the power plant. As with previous versions, the turbine is mounted between the front wheels and drives through the rear wheels. The actual path of the turbine's hot spent gases is back through two flat aluminum ducts under the right and left floor pans and out below the rear sheet metal (see picture, next page).

The forward end of the console tube contains the gear selector and hand brake levers as well as controls for heater, lights and windshield wiper-washer. The instrument panel is just that, a group of instruments (including a turbine inlet temperature gauge) in three big "pods" clustered around the steering column.

The gear selector can be used "eyes-off", because each position can be found by feel. Reverse and Low are at front and rear of the slot while Drive and Idle (the turbine's neutral) are in the middle.

THE TURBINE'S power plant in schematic shows how air is compressed, heated in regenerators, ignited and expanded to drive turbine wheels





HAND HELD NEAR turbine exhaust duct would encounter 150-160°F. temperature at idle, as compared with 500°F. or more of typical piston engine exhaust. Temperatures at 70 m.p.h. and up would be 430-440°F. for turbine, 725°F. or higher for piston engine

Once you settle in the driver's seat, you notice that the pedals are nearer the floor with less play than you'll find on conventional cars. You can almost operate both throttle and brake with your right heel on the floorboard.

Firing up with a turn of the key brings the distinctive turbine whine, but it's a lower-keyed sound than in the previous Chrysler turbines.

The Turbine Gap

Pushing the accelerator after shifting to drive, you sense a slight gap between the time your foot goes down and the car begins to accelerate. It's more of a gap than you'll find on automatic drives with conventional engines. But the "turbine gap" is not an awkward pause. It could easily be measured in the span of a second or two.

At low to moderate cruising speeds, the gap between command and response on the throttle still seems to be there. But, when the speed starts to catch up to the power your right foot demands, it really comes on strong. *PM's* aviation editor, Kevin Brown, who flies jet fighters, felt that there was a direct comparison.

"It starts slowly", he said, "but with the power on full and the whine in your ears it's a happy feeling to sit there and wait for the speed to build up." And build up it does. Chrysler engineers acknowledge that the best performance is in the higher speed ranges. Top speed is over 110 m.p.h. Acceleration from 0-60 m.p.h. will take about 13-14 seconds. Fuel mileage will range between 15 and 19 m.p.g. with white gas, diesel #2 or JP4 fuel.

The turbine is a smooth-running car, although the shift points in the three-

speed planetary automatic transmission can be felt slightly.

The transmission is much like a standard Chrysler Corporation automatic, except that there's no fluid torque converter. The flow of gases to the power turbine, as it is directed by the movable vanes, itself acts as the "cushion" or coupling for a transmission of power already made smooth by the nature of the turbine, within which a continuous flow of expanding gases contrasts with the explosive pushes of the piston engine.

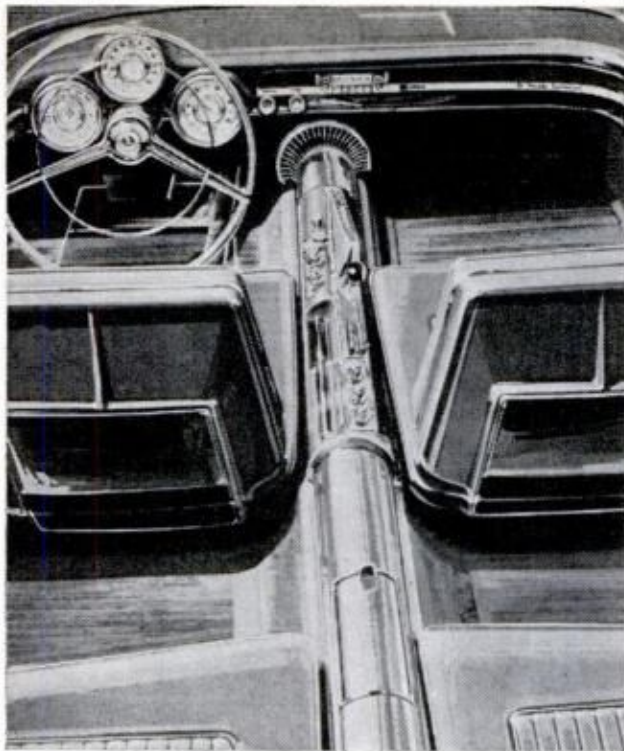
The car itself is a conventional unit construction with independent front suspension and a solid axle attached to leaf springs at the rear. Up front, however, the springs are coils instead of the typical torsion bars seen on Chrysler products for the past six years.

The ride is very good and power steering makes guiding the Turbine smooth and effortless. There's very little vibration in the car and it's not startlingly different in behavior. There is however, the inimitable whine which at first will be the car's greatest distinction.

Chrysler spokesmen claim that the noise could be reduced, but they want it as is to attract attention to the car. Maybe so.

Whether they can make it quiet enough to slip into your driveway late at night without waking the neighbors has to be proven. The present car is much quieter than the 1962 examples. Compared to a piston engine, turbine's noise is more noticeable at low speeds, quieter above 55 m.p.h.

The turbine itself is 10 inches narrower and two inches lower than last year's version. It weighs 40 pounds less (410 pounds vs. 450) and its torque has



DECORATIVE TUNNEL splitting interior is primarily for looks, but does house convenient ashtray in rear

been upped from 375 ft.-lb. to 425.

Horsepower is 130 at 3600 r.p.m. (output shaft) while last year's model spun out 140 horsepower, but at a 4750 r.p.m. Chief difference is that the new turbine has dual regenerators (i.e. the rotating, stainless steel matrices which soak up exhaust gas heat and preheat the intake air to boost efficiency and drop fuel consumption.) But the turbine principles and operational cycle remain the same.

A compressor turbine powers a rotary compressor which draws in fresh air through the intakes and sends it through the hot metal of the regenerators for preheating. It then enters the combustion chamber (burner) into which fuel is injected and ignited. The burning fuel raises the temperature of the gases and increases their energy level.

These hot gases pass through the first stage turbine which drives compressor and regenerators, then through the power turbine which drives the car. Leaving the power turbine, the gases pass through the regenerator honeycombs, giving up much of their heat and flow out the exhaust.

The future of the Chrysler Turbine Car will soon be in the hands of the motoring public (a very limited slice of it). Chrysler engineers feel confident that it can be produced successfully and will be more than competitive in reliability, economy and performance.

Whether the panel of average motorists who will be driving the first 50 turbines agree, remains to be seen. ★★★

JULY 1963



Better than a screwdriver

and far less costly than having your car laid up for radiator repairs.

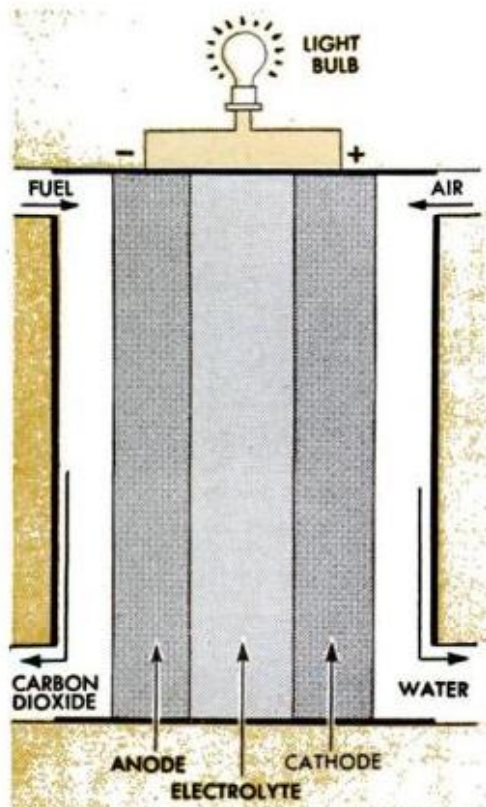
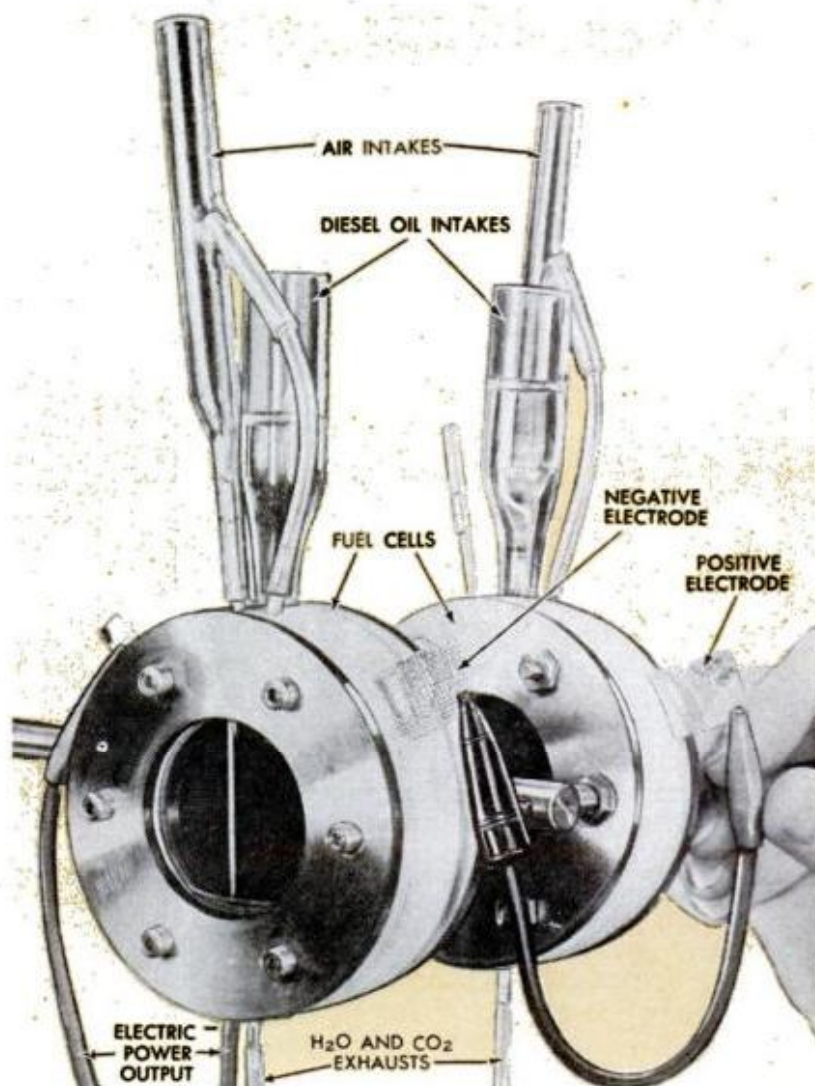
Mac's Sealer and Stop Leak stops radiator leaks fast...even high pressure leaks up to 20 lbs. It mixes with any anti-freeze and is served at better service stations everywhere. (Not recommended for people.)

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

New Diesel Fuel Cell

DIESEL OIL is combined with air in a new General Electric fuel cell to generate electricity directly. Two cells are shown connected in series. Fuel is dropped in on top; water, carbon dioxide exhaust out the bottom. Power output leads go off to drive a small electric fan

BASIC CONSTRUCTION of the hydrocarbon fuel cell: Diesel oil comes in one side, air from which oxygen is taken on the other. They are "burned" in the cell to produce electricity. The exhaust of water forms on the air-intake side, carbon dioxide on the fuel side of the cell



TWO LITTLE METAL DOUGHNUTS in a new fuel cell turn diesel oil directly into electric power. There is no flame, no moving parts, little heat and great efficiency. In addition to diesel fuel, this General Electric cell can use gasoline or propane.

Initial applications of the diesel cell will be as a portable power source for space and military use. Later on, according to GE, the cells may turn up in the family car.

Up to now, the most successful fuel cells have used hydrogen as fuel. A hydrogen cell will be aboard the Gemini spacecraft. But hydrogen is expensive and inconvenient to use, particularly if fuel cells are ever to be found outside of industrial and military applications.

One of the great advantages of a fuel cell is its efficiency. An ordinary internal-combustion engine turns about 20 to 25 percent of its fuel into usable power. Large turbine electric generators convert about 40 percent of their fuel into electric power. Fuel cells, on the other hand, convert 50 to 70 percent of their fuel into electricity.

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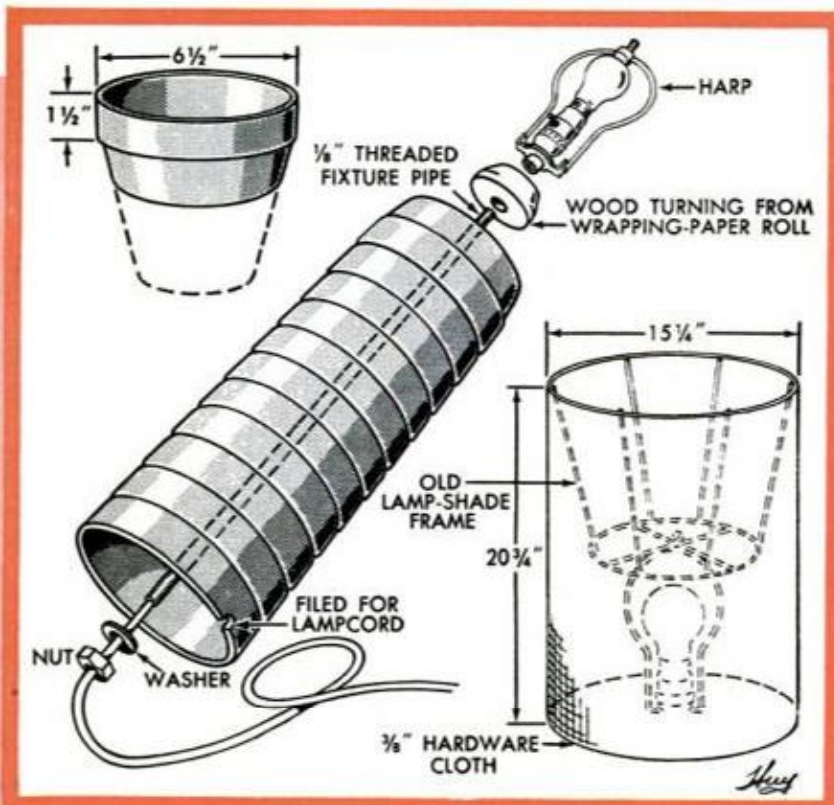
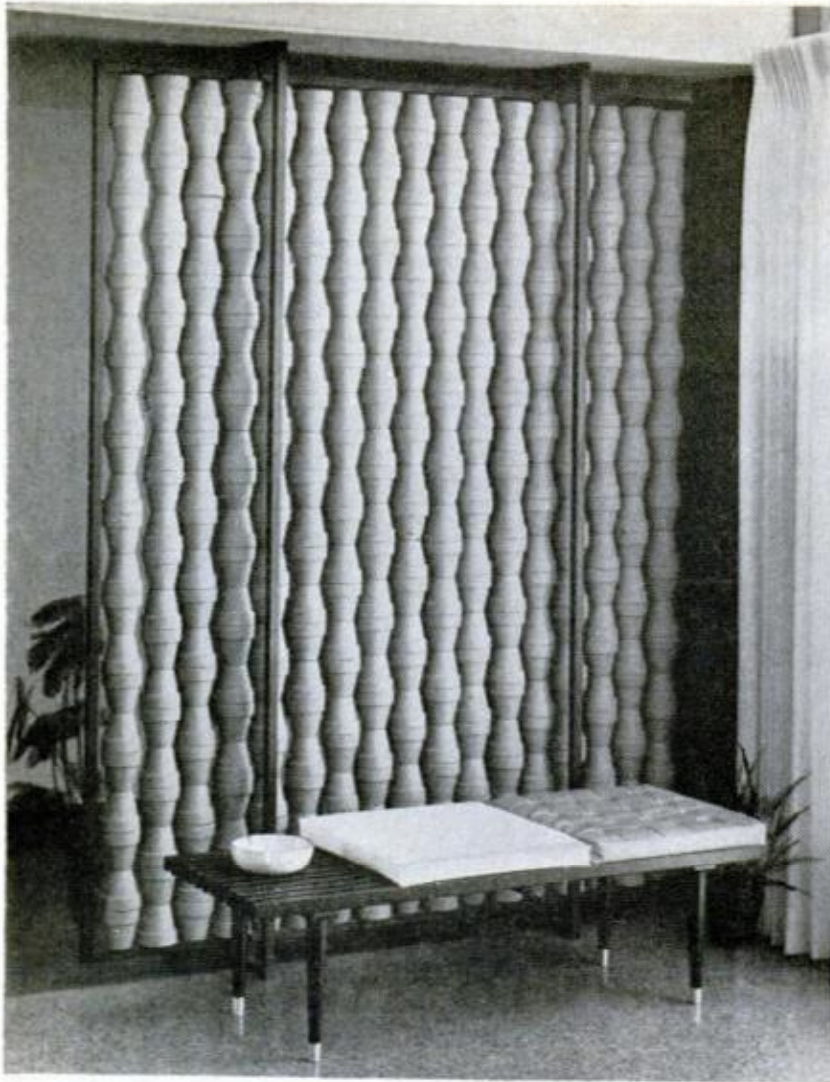
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Going to Pot

WANT a novel way to decorate a family room or rumpus room? Why not go to pot—flower pot, that is?

You can make an attractive room divider like the one at left by stacking 3-in. clay flower pots on $\frac{1}{2}$ -in. metal rods or pipes, and mounting them in a wood frame. Stack the pots so their bases and tops alternate, and stain the wood a dark color. For an informal table lamp (below), stack a number of larger pots—either standard or shallow—to the desired height, and run the wiring through the drainage holes. In making the shade, fasten the hardware cloth to the inverted lamp-shade frame with solder or epoxy. Use plaid cloth as a covering, as its pattern will blend with that of the hardware cloth.



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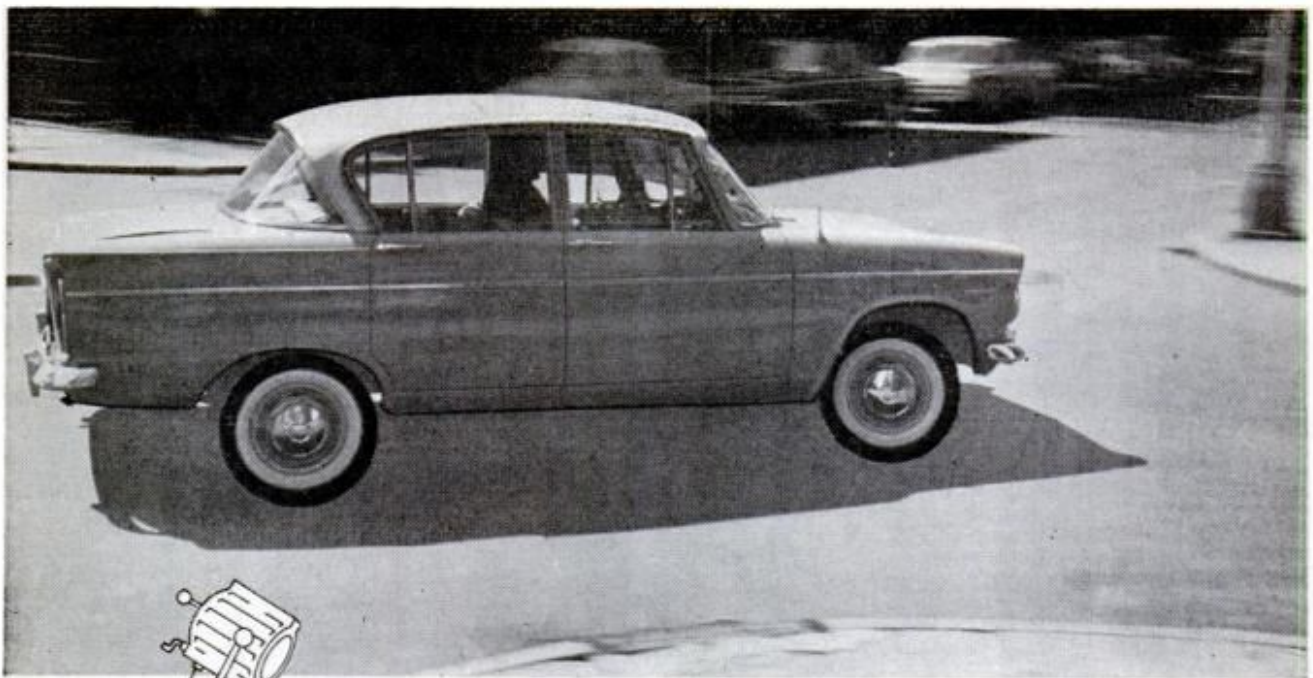
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Spotlight on the **Hillman Super Minx**

What does a U.S.-made automatic transmission on a small import do for economy and pickup?

By Ed Nelson

IF YOU GET your automotive "kicks" from fast manual shifting, you may yawn at the Rootes Group's new Hillman Super Minx Automatic. But if you see your car as a machine to move you from place to place with easy comfort and economy, you can cheer. It's the first small import with an optional U.S.-designed automatic transmission.

Hillman uses Borg-Warner's Model 35, built near London but designed in Muncie, Ind. The John Bull version accepts controls from either right or left. It's set up for faster running—to about 5500 r.p.m.—and uses a 9½-inch torque converter instead of the 11-incher it accepts for use on the Sixes from Studebaker and American Motors. Even with the smaller converter, you feel like there's a baby grand on the floor beside you.

Before Rootes turned to the Warner box, British Motors Corp. had used it for several years in the MG Magnette, Austin, Riley and Wolseley. Ford of England joined the parade some time ago with its Zephyr. But Hillman is first with it on these shores.

For a 97-cubic-inch Four, the Hillman's pickup was adequate. From a standing start, we got to 30 m.p.h. in an average 6.55 seconds, to 50 in 14.15, to 60 in 21.20 and to 70 in 33.25. Under full throttle, shifts came at 32 and 51 m.p.h. For comparison, a standard four-speed manual-shift Hillman Minx did 0-30 in 6.2 seconds, 0-50 in 15.2, 0-60 in 21.8.

After a thousand test miles in the soft lap of a U.S. "luxury compact," the Hillman's ride and handling were especially appealing. The Minx takes the tightest corner smoothly and without wallowing, with 48 percent of the weight on the rear wheels. We whipped it from side to side on deserted pavement

(Please turn to page 36)

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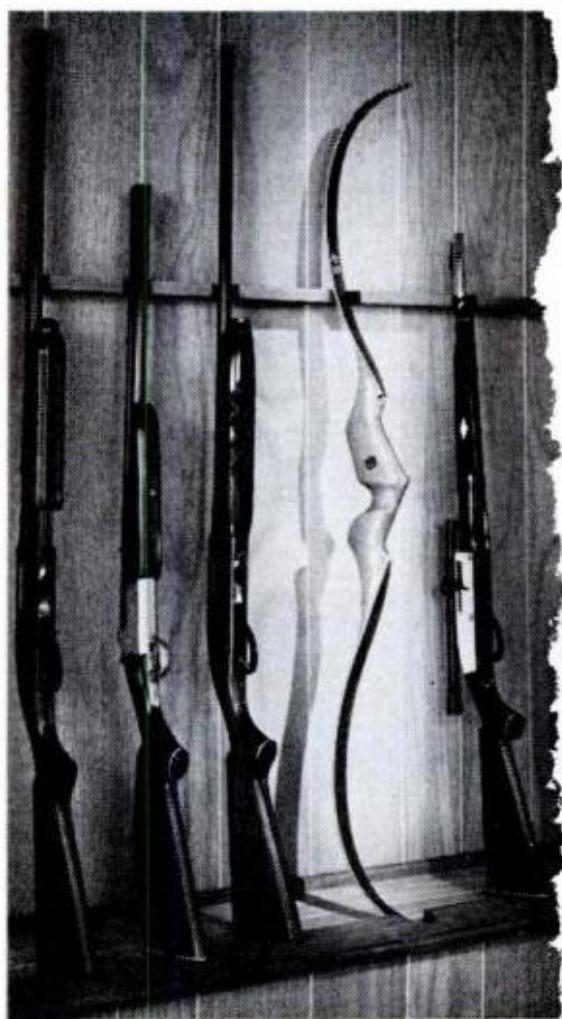
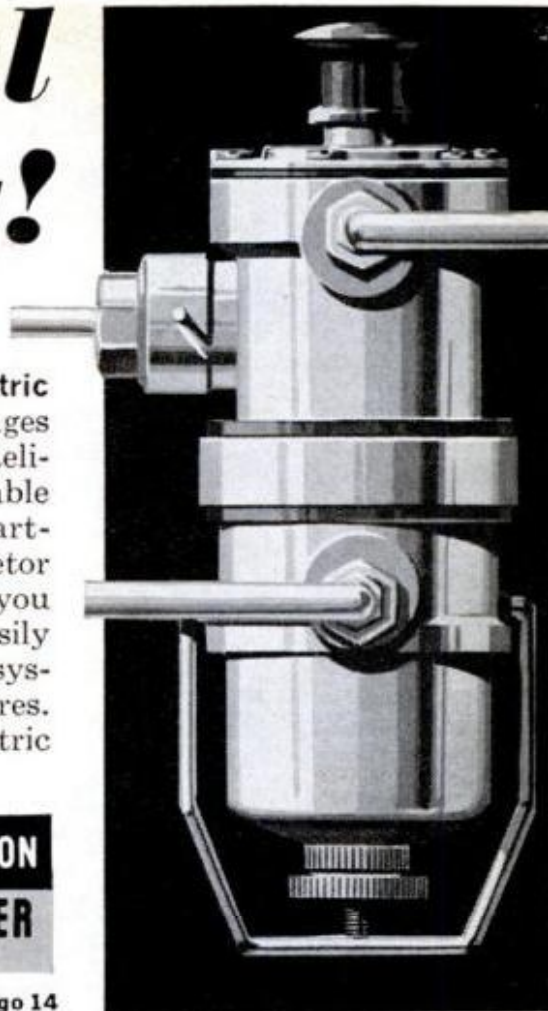


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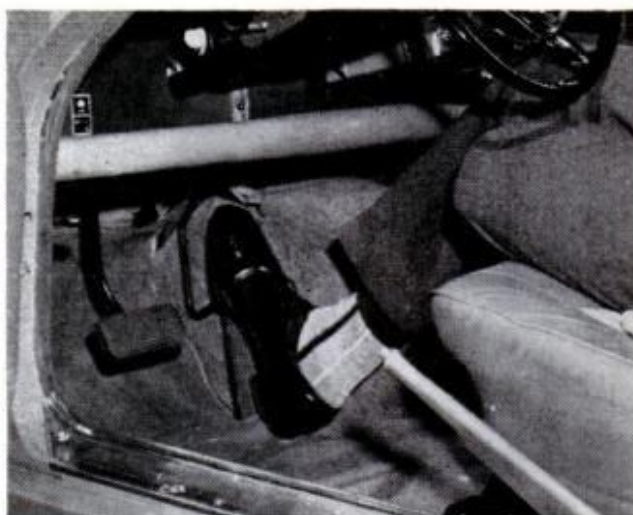
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Spotlight on the Hillman Minx

(Continued from page 34)



FLOOR SPACE for your left foot isn't bad, but the gas pedal location—well back from the toe board—makes you draw the right foot up uncomfortably

and couldn't find a sign of rhythmic sway. Even allowing for the contrast with Detroit power steering, however, I'll still say the Minx's manual system felt too heavy. The wheel snaps back to center almost violently. The car tracks well, however.

You might expect the stiff British suspension to sacrifice comfort on bad surfaces. Not so. There's never a control problem, either. Seats are high and comfortable, although springs aren't deep.

The main objection to driving position is with a mysterious Rootes' insistence on locating the gas pedal way back from the toe board. When your left leg is comfortable, the right is drawn up like a stork's and is unsupported. The headroom, despite high seats, is good.

A happy gimmick common to several imports is the signaling system. Don't pump the floor dimmer switch; pull up on the turn signal. You'll flash your brights at other drivers even if the main headlight switch is turned off.

Generator and oil pressure are on idiot lights while dashboard controls are left in the dark. A large, drawer-style ash tray is handily located in the center front, but ours fell out with little provocation.

Front disk brakes were effective, if hard. You stop sharply without feeling any pull to either side. Over-all fuel consumption with the automatic was 19.2 miles per gallon. With the straight stick model it was 22.5 m.p.g.

At \$1975 P.O.E., the Super Minx offers good, economical transportation without imposing severe austerity. The B-W transmission (\$199 extra) simply makes pleasant driving easier. ★★★



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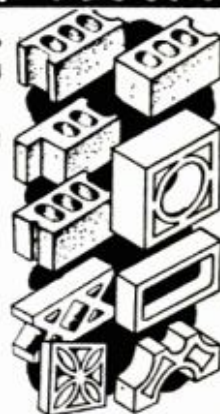
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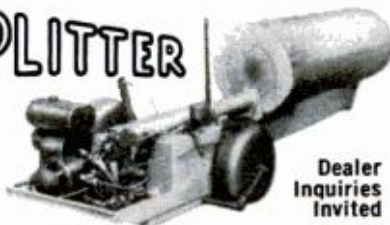
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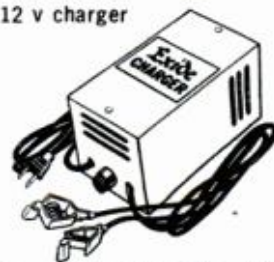
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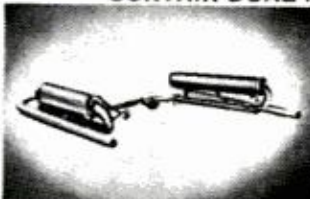
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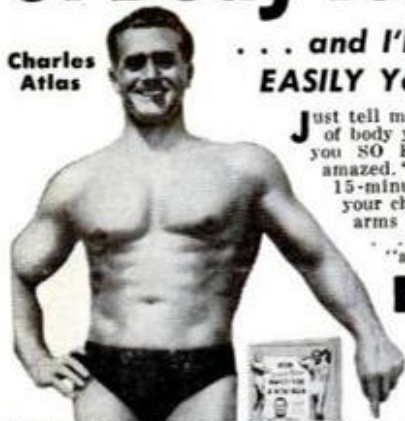
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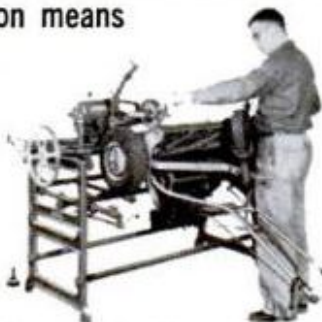
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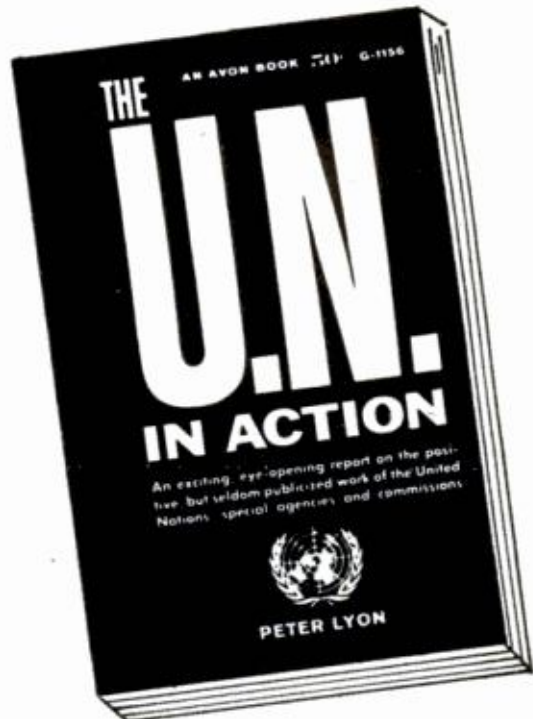


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AMAZING Business printing values. Samples. Print Shop, Box 576, Greenville, R. I.

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

1,000 RAISED Cards \$3.75. Two-color \$4.90. Rush delivery. Satisfaction guaranteed. Bixler, Benson Ave., Frankfort, Kentucky.

BETTER Printing. Reasonable. Free estimates, samples. Lakeside Press, Park Rapids, Minnesota.

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

SPEEDY Mimeographing also Verifax copies. Prices free. Camera Corner, Box 217, Pittsford, N.Y.

QUALITY Printing. Lowest prices! Free samples. Dowling Products, Dept. PM73, Pittsford, N.J.

BUSINESS Cards. Low prices, samples rushed. Garner's, 6486 Gale, Long Beach 5, Calif.

24 HR. Offset printing, 8¹/₂"x11, white or colored Bond; 100—\$3.45; 1000—\$5.95; 5000—\$17.95. Free samples! Print, 17032 Miles, Cleveland 28, Ohio.

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

1000 BUSINESS Cards, raised letters \$3.75 postpaid. Samples. Routh, PM-7, 3910 Kipling, Greensboro, N.C.

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NEW 1962-63 Illustrated printing equipment and supply catalog. This 9"x12", 336-page book is the most complete catalog of the century. Contains everything used in the graphic arts industry including thousands of offset, letterpress, binders, rubber plate and stamp, composing room, silk screen, art and engraving supplies and equipment. Includes paper cutters, folding machines, printing and proof presses, padding presses and many more. Send \$2.00 to cover mailing. Refund with first order. Also available is our latest 184 page type catalog—add \$1.00. American Printing Equipment & Supply Co., Dept. PM-42-25 Ninth Street, Long Island City 1, N. Y.

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

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

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

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SAN FRANCISCO Confidential mail address. 25¢ remailing. Kirk Enterprises, 470 27th Street, San Francisco 14, Calif.

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KEY WEST Confidential remails 25¢. Williams, Box 80, Summerland Key, Florida.

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

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

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

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

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

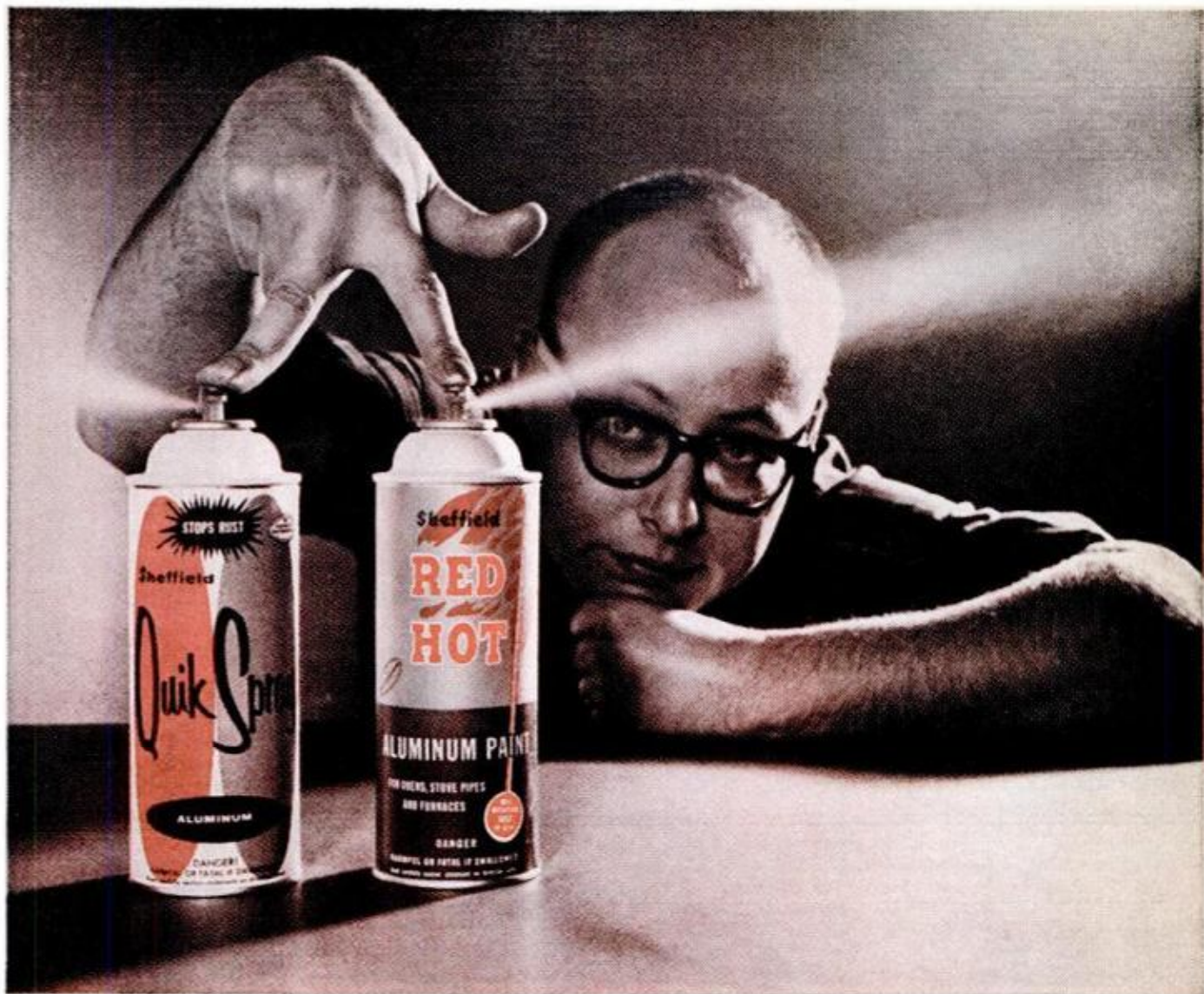
"STAMMER, Stutter, No More." (Dr. Young.) Write: Gaucho, Box 9309-S7, Chicago 90.

SENSATIONAL English "no-razor-pull" safety razor with 5 blades (up to 10 shaves each) \$1.95 postpaid. Try it on money-back guarantee. Erickson, Box 157-PM, Muskegon Heights, Mich.

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TOBACCO

CIGARS And tobacco bargains. Free list. Tobacconist, 220 N. Clark, Chicago 1.



Let's assume you're lazy (but neat)

Try Sheffield's new aluminum spray paints

There's nothing wrong with being lazy. There is something wrong with letting things go to pot. To avoid this without getting overheated, may we suggest one of the great milestones in automation—push-button painting with aluminum. Sheffield has two dandy brands on the market:

Sheffield Quik-Spray restores and rust-proofs lawn furniture, garden tools, railings, fixtures, pipes, fencing—what else have you been putting off? It's easy and it's fun. And it's a lot cheaper than replacing expensive surfaces ruined by rust. Recommended also for brick, block and masonry surfaces.

Sheffield Red Hot, for ovens, heating pipes, chimneys, furnaces, boilers, automobile mufflers and engine blocks, is well named. Sheffield says it withstands at least 1,600° of heat, and guarantees that it won't discolor,

blister, peel, chip or crack. Users report a smoothly fused aluminum surface.

Alcoa does not make aluminum paint, but Alcoa® Pigments are used in all the good brands like Sheffield. Ask your dealer.

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Please send free booklet, *Painting With Aluminum*

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Sure, he bought the Sprayit 600 for his weekend painting projects—screens, shutters, furniture, the boat. But she has found dozens of uses too—moth-proofing clothes, spraying roses, inflating toys, even doing a bit of painting herself. It's easy to get the Sprayit habit! A do-it-yourself family will find many uses for a smooth running, integrally powered Sprayit 600. It's just one of a complete line of portable Sprayit paint spraying units for home, shop and farm. *Thomas Industries Inc., Sprayit Division, Dept. PM-7, 207 East Broadway, Louisville, Ky.*



SPRAYIT®

Epoxy "Roots" for Nails

"Any manufacturer or craftsman," according to Navy researchers, "can improve the holding power and durability of screws by filling the prebored lead holes with liquid epoxy."

Their experiments could lead to the development of screws, nails and other fasteners that virtually "grow" to the wood into which they are driven.

The research indicates that certain polymers have the ability to cross-link with other substances, such as cellulose, the basic constituent of wood.

A natural outgrowth of the Navy research may be highly retentive fasteners that, once driven, cross-link with the wood. Meanwhile, the use of epoxy as a cross-link compound can be immediately applied in the woodworking industry and by home craftsmen.

Study Heating of Nose Cones In "Atmosphere" of Mars, Venus

The world's smallest telemeter is being used to measure the extreme heat encountered by space vehicles entering the simulated atmosphere of Mars and Venus.

A quarter of an inch in diameter and about a quarter of an inch long, the instrument is a tiny model of a nose cone and heat shield with a thermocouple attached. When the model is shot down a range area filled with gases which simulate the atmosphere of the planets to be explored, the thermocouple emits signals which reveal the surface temperature of the nose cone in entering each planet's atmosphere.

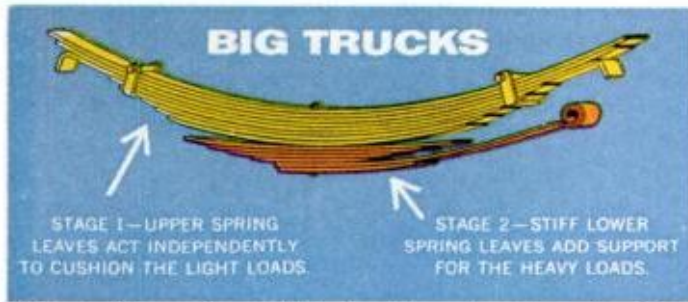
Research scientist James L. Summers of the National Aeronautics and Space Administration's Ames Research Center says, "Manned interplanetary flight obviously is a long way off, but we want to get knowledge that will let us prepare for vehicle shielding for the unmanned vehicles that will be used for interplanetary travel in the near future."

Thorium May Become A-Fuel

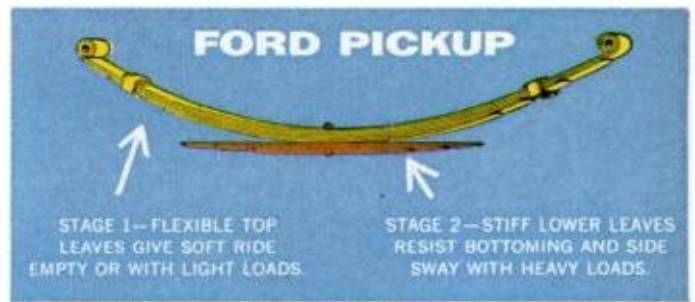
Thorium, one of the heavy metals, may rival uranium as atomic fuel of the future.

Rice University scientists have stated that there is four times more thorium than uranium in the earth's crust, and its future use will depend upon finding thorium in concentrated quantities.

The relative crustal abundance of thorium is 12 parts per million, while uranium is only 3 parts per million, according to Rice scientists, Dr. A. S. Adams and Dr. John J. W. Rogers. Thorium can be converted by neutrons into fissionable U-233.



Rugged two-stage, big-truck spring is actually two sets of springs in one. As top leaves deflect they get added support from lower leaves.



Rides right, loaded or light! The two-stage rear springs in Ford pickups automatically adjust to changing loads to cushion cargo and driver.

FOR GREATER DURABILITY, EXTRA LOAD PROTECTION...

BUILT LIKE THE BIG ONES with two-stage leaf springs '63 FORD PICKUPS



NEW CAB COMFORT Ford's Custom Cab puts 5 inches of foam cushion under you... 27 pounds of insulation around you for a softer, quieter ride. New fully-synchronized transmission, too!

FROM AXLE TO AXLE, BUILT LIKE THE BIG ONES!

The two-stage springs of Ford pickups mean more than a smooth ride, light or loaded. They mean big-truck ruggedness. Ruggedness that extends clear through the chassis for extra durability, extra savings! See your Ford Dealer today!

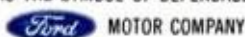


I-beam axle gives big-truck strength and durability, holds wheel alignment, saves tires!



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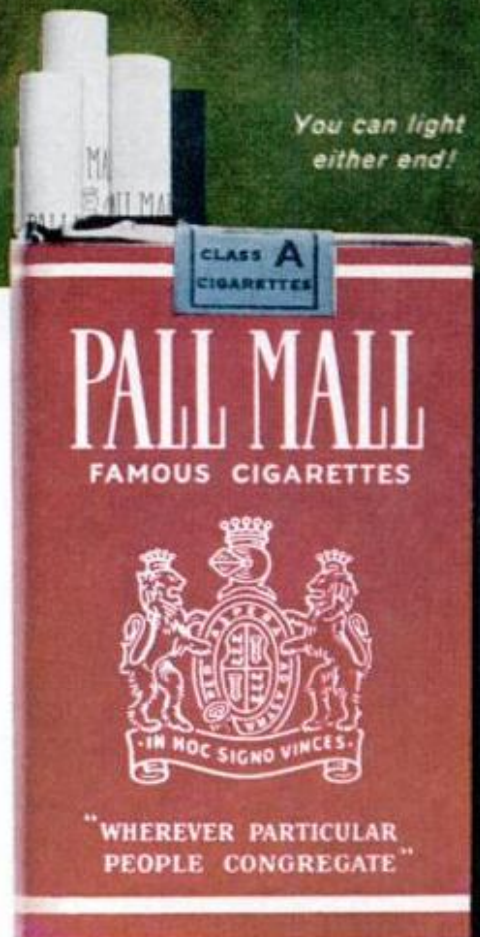
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either end!*

***So smooth, so satisfying, so downright
smokeable!*** For flavor and enjoyment you just
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to your taste. Never too strong. Never too weak. Al-
ways just right! Enjoy satisfying flavor... so friendly
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fine tobacco tastes best.
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travels the smoke naturally
... over, under, around and
through the finest tobaccos
money can buy. Makes it mild
but does not filter out that
satisfying flavor!



THE ECONOMY RUNS...



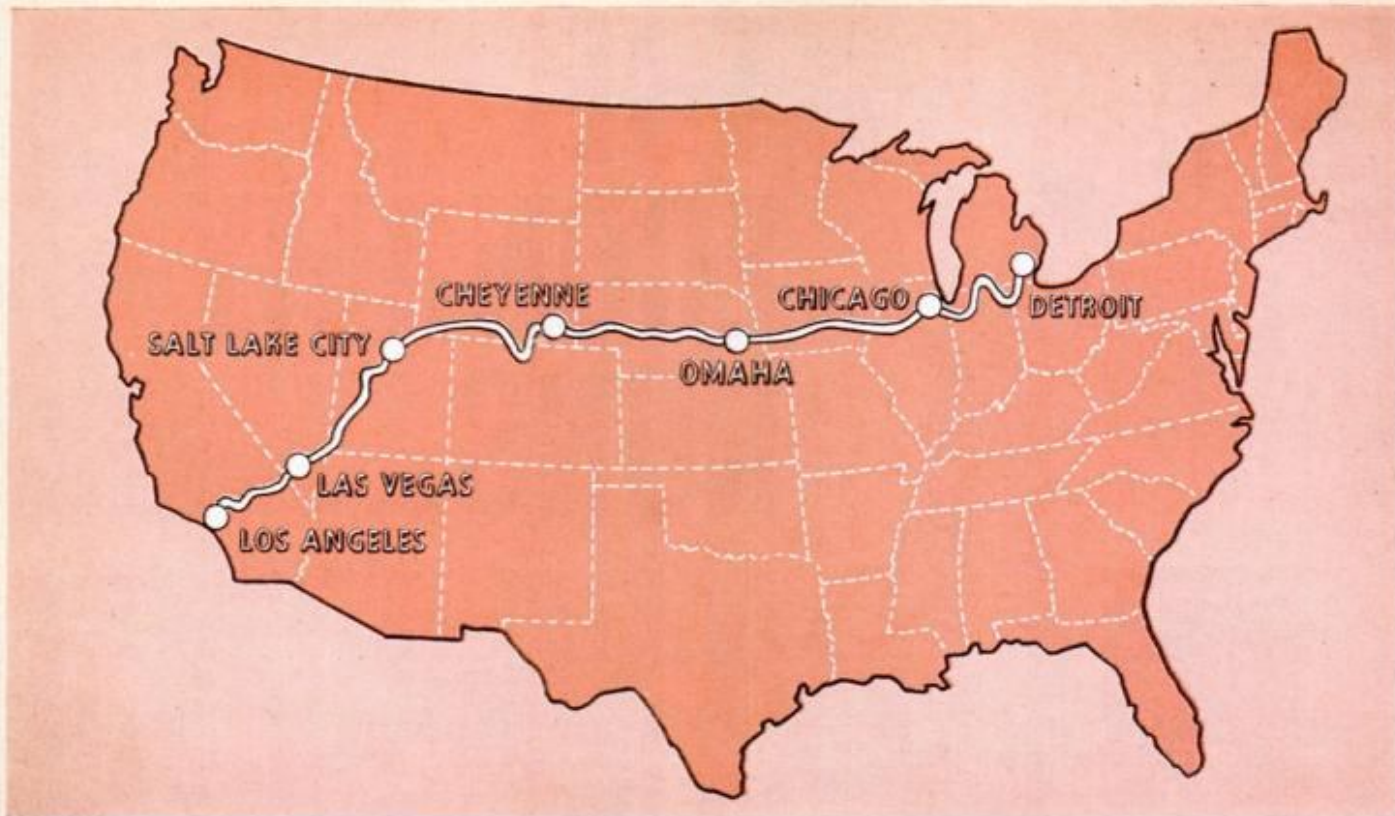
DO DRIVERS OR GIMMICKS WIN THEM?

PM's auto editor competed in the '63 Mobil Economy Run to find out what it takes to rack up those high mileage figures

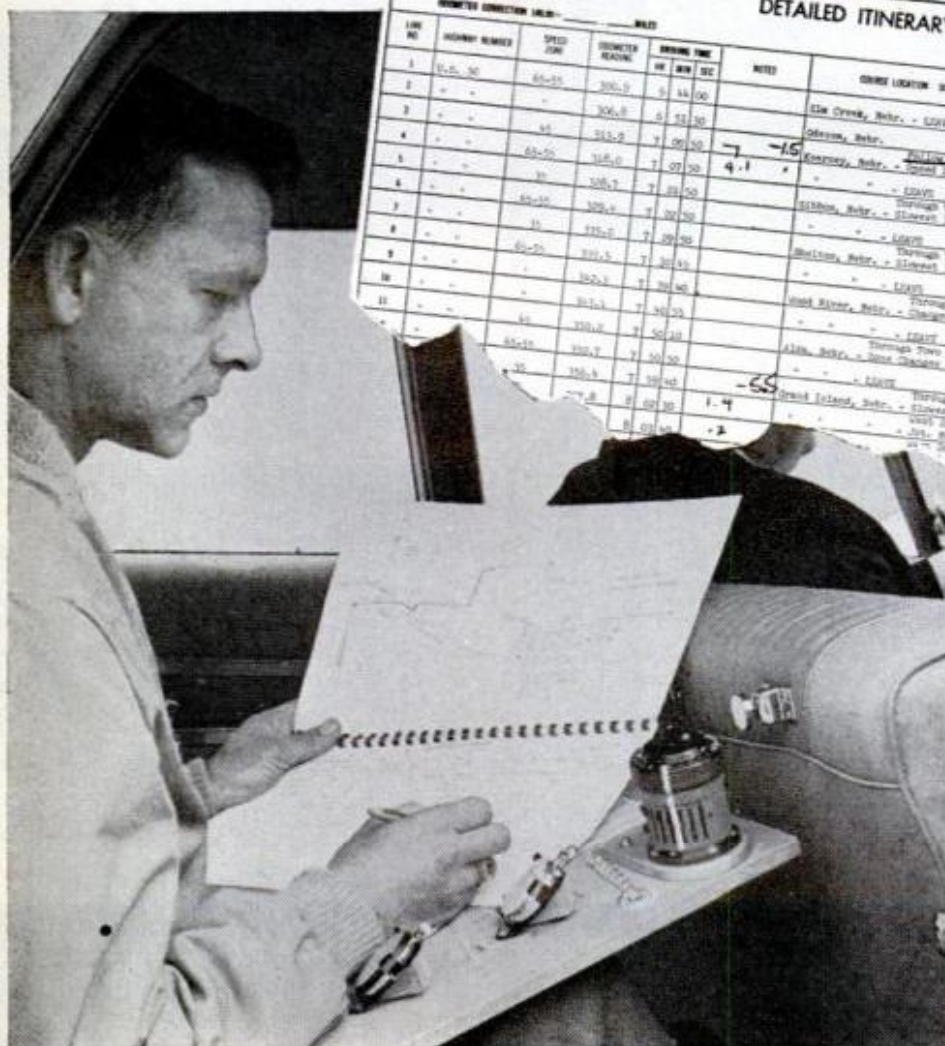
By
Jim
Whipple

WHAT DOES IT TAKE to win a big cross-country economy run? Must you sandpaper your feet or drive in your socks for a more sensitive feel of the throttle as some people think? Or do winners rely on cars gimmicked to the hilt with 50-pound tire pressures, super-lean carburetors and long-legged axle ratios creeping along at five knots?

I've always wondered what methods economy-run drivers use to coax 20 to 28 m.p.g. out of cars in a cross-country trek involving everything from rush-hour city traffic to climbing the Rocky Mountains and



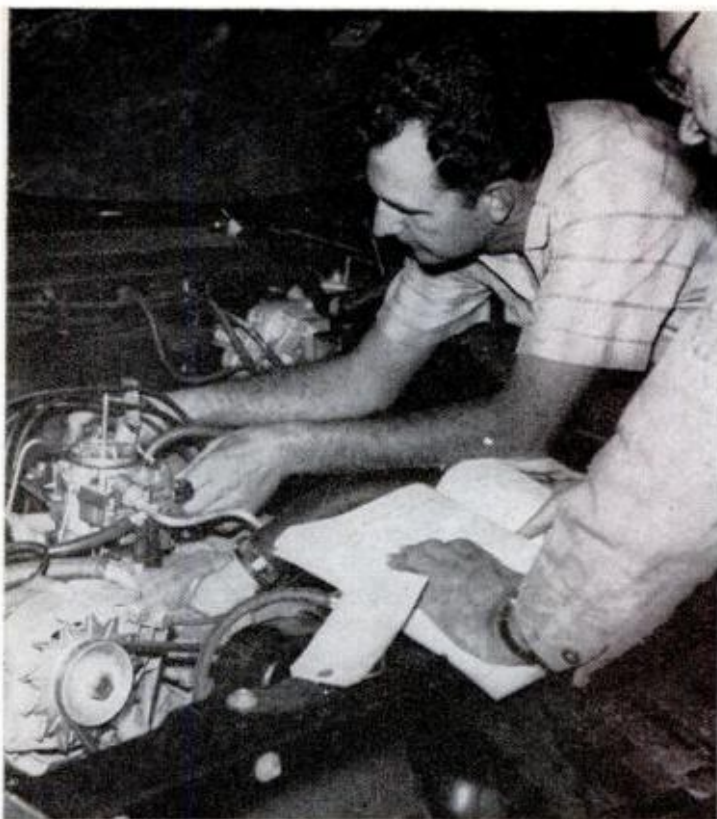
OUR ROUTE led through the Sierras and desert to Las Vegas, up through the Rockies to Salt Lake, up over the Continental Divide to Cheyenne, down the eastern slope to Omaha, through Iowa farms to Chicago and Detroit



DETAILED ITINERARY

DATE: April 2, 1960 PAGE NO. 5

LAW NO.	MILEAGE NUMBER	SPEED ZONE	METER READING	DRIVING TIME		NOTES	MILE	DISTANCE
				HR	MIN			
1	U.S. 30	60-75	300.0	5	14	00		
2	"	"	306.0	6	53	30		
3	"	55	312.0	7	00	30		
4	"	60-75	318.0	7	07	30	4.1	
5	"	30	320.7	7	23	50		2720
6	"	60-75	325.0	7	30	30		2640
7	"	15	325.0	7	30	30		2640
8	"	60-75	327.5	7	30	45		2520
9	"	30	327.5	7	30	45		2640
10	"	60-75	330.0	7	30	45		2640
11	"	30	330.0	7	30	45		2640
12	"	60-75	332.7	7	30	55		2620
13	"	30	332.7	7	30	55		2620
14	"	60-75	335.0	7	30	55		2560
15	"	30	335.0	7	30	55		2560
16	"	60-75	337.5	7	30	55		2560
17	"	30	337.5	7	30	55		2560
18	"	60-75	340.0	7	30	55		2560
19	"	30	340.0	7	30	55		2560
20	"	60-75	342.5	7	30	55		2560
21	"	30	342.5	7	30	55		2560
22	"	60-75	345.0	7	30	55		2560
23	"	30	345.0	7	30	55		2560
24	"	60-75	347.5	7	30	55		2560
25	"	30	347.5	7	30	55		2560
26	"	60-75	350.0	7	30	55		2560
27	"	30	350.0	7	30	55		2560
28	"	60-75	352.5	7	30	55		2560
29	"	30	352.5	7	30	55		2560
30	"	60-75	355.0	7	30	55		2560
31	"	30	355.0	7	30	55		2560
32	"	60-75	357.5	7	30	55		2560
33	"	30	357.5	7	30	55		2560
34	"	60-75	360.0	7	30	55		2560
35	"	30	360.0	7	30	55		2560
36	"	60-75	362.5	7	30	55		2560
37	"	30	362.5	7	30	55		2560
38	"	60-75	365.0	7	30	55		2560
39	"	30	365.0	7	30	55		2560
40	"	60-75	367.5	7	30	55		2560
41	"	30	367.5	7	30	55		2560
42	"	60-75	370.0	7	30	55		2560
43	"	30	370.0	7	30	55		2560
44	"	60-75	372.5	7	30	55		2560
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46	"	60-75	375.0	7	30	55		2560
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48	"	60-75	377.5	7	30	55		2560
49	"	30	377.5	7	30	55		2560
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66	"	60-75	400.0	7	30	55		2560
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74	"	60-75	410.0	7	30	55		2560
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76	"	60-75	412.5	7	30	55		2560
77	"	30	412.5	7	30	55		2560
78	"	60-75	415.0	7	30	55		2560
79	"	30	415.0	7	30	55		2560
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82	"	60-75	420.0	7	30	55		2560
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84	"	60-75	422.5	7	30	55		2560
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87	"	30	425.0	7	30	55		2560
88	"	60-75	427.5	7	30	55		2560
89	"	30	427.5	7	30	55		2560
90	"	60-75	430.0	7	30	55		2560
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92	"	60-75	432.5	7	30	55		2560
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110	"	60-75	455.0	7	30	55		2560
111	"	30	455.0	7	30	55		2560
112	"	60-75	457.5	7	30	55		2560
113	"	30	457.5	7	30	55		2560
114	"	60-75	460.0	7	30	55		2560
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124	"	60-75	472.5	7	30	55		2560
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139	"	30	490.0	7	30	55		2560
140	"	60-75	492.5	7	30	55		2560
141	"	30	492.5	7	30	55		2560
142	"	60-75	495.0	7	30	55		2560
143	"	30	495.0	7	30	55		2560
144	"	60-75	497.5	7	30	55		2560
145	"	30	497.5	7	30	55		2560
146	"	60-75	500.0	7	30	55		2560
147	"	30	500.0	7	30	55		2560
148	"	60-75	502.5	7	30	55		2560
149	"	30	502.5	7	30	55		2560
150	"							



TUNEUP of eight man-hours is permitted before the run under the close supervision of U.S.A.C. observer who checks operations in car maker's own shop manual



GASOLINE is metered into special Mobil Run tank by a U.S.A.C. official at two daily fuel stops. Gas is measured in 1/50th gallon increments at topoffs

traveling over truck-filled, two-lane roads. Similar cars in the hands of regular drivers make only 14 to 22 m.p.g.

This year I had a golden opportunity to discover where that "extra" economy comes from. Dodge invited me to drive one of the official entries in the Mobil Economy Run from Los Angeles to Detroit. During 5½ days (it seemed longer) and 2654 miles at the wheel of Car No. 29, a 6-cylinder Dodge 330 sedan, I learned a great deal about what makes the economy run tick. And I drove with my shoes on all the way.

In the process I managed to squeeze an over-all 23.69 miles per gallon out of Car No. 29's 225-cubic-inch engine. To my amazement, this placed me second among the four cars in Class E (standard size six cylinder) behind the winning Plymouth Savoy Six (24.33 m.p.g.) and ahead of both Chevrolet Biscayne (22.61 m.p.g.) and Ford 300 (21.50 m.p.g.).

Winning the Mobil Run involves a number of special techniques, but drivers with supersensitive feet and cars with gadgets or special economy tuning are not among them. I doubt if toes as sensitive as fingers would do much good (a foot as solid as rock would be much better). And any modification whatsoever of the engine, transmission or chassis is not only forbidden, but prevented by round-the-clock vigilance on the part of the United States

Auto Club observers. You must run your car dead stock.

The nearest thing to an exception is tire inflation. Mobil inflates *all* tires to four pounds more than manufacturer's recommended figures. The air used is "standard", i.e. pure and bone dry to eliminate as much expansion as possible.

Another item not required is great physical stamina or athletic ability. The ordinary driver is a desk-bound engineer whose biggest athletic event may be a round of golf or a week-end stint behind his lawn mower.

This year, eight of the 36 cars were driven by women, two of whom won first in their classes.

What is required of drivers and co-drivers in large measure is a high degree of concentration, better-than-average judgment of traffic and highway conditions, and a thorough mastery of the techniques of driving smoothly and efficiently.

For above all else, the Mobil Run is an exercise in precision driving, a giant rally. However, it differs from the normal Time/Speed/Distance rally in that the possibilities of getting off route (lost!) are all but eliminated.

All cars must complete the same course within the same time limit. This year's Run was 2654.7 miles that had to be completed in not more than 60.39 hours of running time. This works out to an aver-

age of 43.77 m.p.h. for the entire trip.

The objective, of course, is to finish each day's run as close to the allotted time limit as possible without running beyond it and incurring a penalty. On the other hand, to finish too early would only increase the average speed of the car and raise the fuel consumption as well.

For me the Mobil Run began on the morning of Thursday, March 28, at a motel in Pasadena, Calif., less than 48 hours before the first car was to leave the Mobil Impound.

Here I met the Dodge-Plymouth team, a group of 11 engineers and technicians who were to man Chrysler Corporation's six official entries. These six included a Valiant and Dart sedan, both with 170 cubic-inch, 101-horsepower engines; a Plymouth Six matching the 145-horsepower Dodge Six that I was to drive, and a pair of Dodge and Plymouth V8s. These cars were equipped with automatic transmissions, as were all other cars in the 1963 Mobile Run.

Although the Plymouth and Valiant teams were competing directly with the three Dart and Dodge teams, all 12 of us cooperated during practice and on the Run itself. The unspoken feeling was, "It would be great to beat Plymouth (or Dodge), but the main job for everybody is to finish ahead of the guys driving Brand X!"

Our team did all right for itself with Dodge and Plymouth splitting first and second place honors in two classes and the Valiant missing first in its class by .03 of a mile per gallon.

U.S.A.C. OBSERVER sat beside me every minute to check on speed limits and "write up" unsafe driving or the smallest infraction of traffic regulation

To a degree, the team's success was due to car weight advantages of 200 to 600 pounds, and the greater fuel economy of a three-speed-plus-torque-converter automatic transmission over a two-speed unit.

Engine displacements were evenly matched in the case of the compacts at 170 cubic inches for all cars in Class B, while the Class E Sixes ranged from 223 to 230 cubic inches. (Dodge and Plymouth share the same 225-cubic-inch engine).

Den Mother and Mules

To give the team every possible competition advantage, operations chief Bob Cahill, a Chrysler engineer (known to the group as "Den Mother") set up shop in Pasadena some three weeks ahead of the Run. The "Den Mother" and his boys used this time in practice and preparation.

In addition to half a carload of maps, graph paper, slide rules and pocket calculators, the Dodge-Plymouth competitors brought "mule cars" which were exact replicas of the cars to be used in the Run.

Run cars themselves had been purchased by U.S.A.C. operatives in various parts of the country and shipped to Mobil's Pasadena Impound. Neither contestant nor manufacturer has any idea where his actual entry car will come from. My Dodge, for example, was picked out of a dealer's stock in Missouri. Once the car is selected it never leaves sight of a U.S.A.C. observer. All this precludes any mechanical hanky panky which would make the car anything less than a randomly selected,

LOSING YOUR WAY is almost impossible on the Mobil Run as all route changes are marked with signs and guides as well as being spelled out in the Mobil Log





GRADES, like this one in the Rockies, may look level but your foot goes down, down, down on the accelerator as you buy altitude with gasoline

pure stock product of the assembly lines.

From the time the car is selected until the Run is completed it is either in a guarded garage or within sight of a U.S.A.C. observer around the clock.

However, contestants do get a chance to check out their cars. As a matter of fact the authorized driver-contestant is permitted 1500 miles of break-in mileage with a U.S.A.C. observer at his side and stamped lead seals on hood and trunk.

To bring the Run cars up to reasonable equal condition, U.S.A.C. permits a maximum of eight man-hours for tuning or

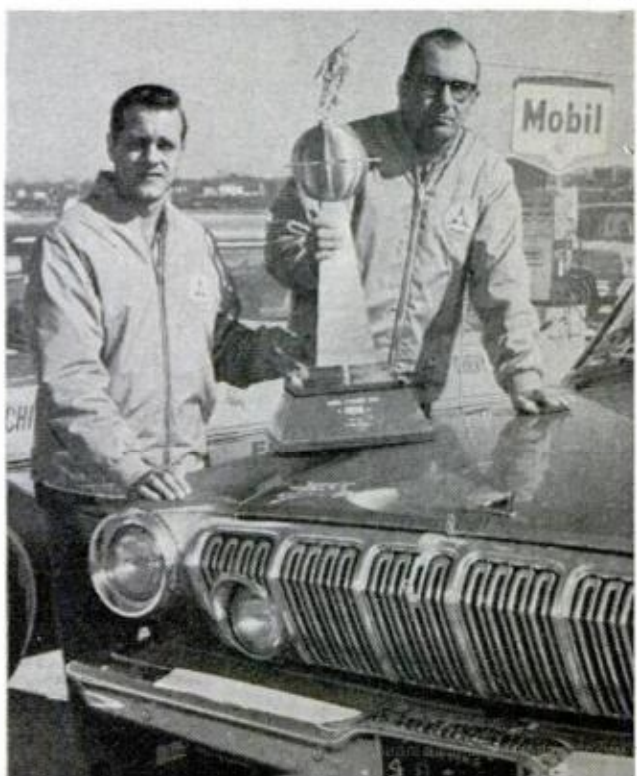
checking the car during or after break-in. Entrants may also align and balance wheels in addition to eight hours of work permitted on the engine. Entrants are permitted to check the distributor and set the timing to their preference as well as set spark-plug gaps and point dwell.

But work on the carburetor is limited to adjustment of the idle speed and the idle air screw. If there is an imperfection inside the carburetor, nothing can be done about it and the car becomes a "bad" car which must either be used as is or with-

[\(Please turn to page 190\)](#)

YOUR ENEMY is a truck crawling up a grade. Stay behind and you drop below your precious average speed. Blast around him and you've used precious fuel

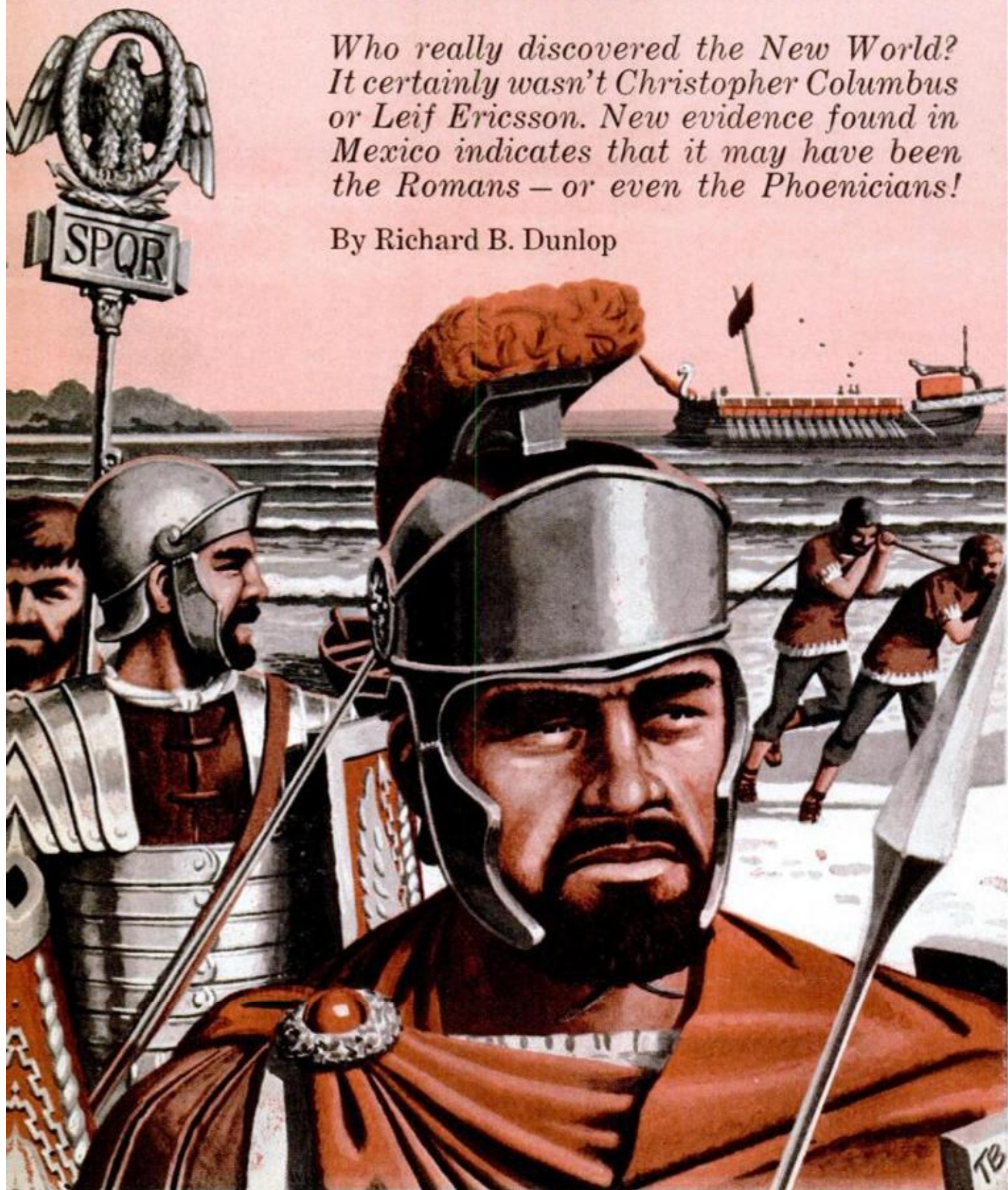
THE END finally comes for brain-bushed navigator Mallwitz and this nerve-shattered driver, leaning on our Dodge and clutching our second-place Mobil trophy



Did the Romans Discover America?

Who really discovered the New World? It certainly wasn't Christopher Columbus or Leif Ericsson. New evidence found in Mexico indicates that it may have been the Romans – or even the Phoenicians!

By Richard B. Dunlop





SMALL CLAY HEAD "of odd physiognomy" is one of the best-authenticated indications that Europeans visited America centuries before Columbus. It was dug up at a "controlled" archaeological site in the valley of Toluca, west of Mexico City. Experts say it is a Roman head of the Second Century A.D.

IT WAS A TENSE MOMENT. The archaeologist had carefully dug through three floors of ancient stone and cement. Beneath the third floor he found two graves, undisturbed for centuries.

Buried in the graves were several items of ceramics and jewelry including, as the archaeologist wrote later, "a small clay head of odd physiognomy." For several years the archaeologist kept the head. Then, in 1959, Dr. Robert Heine-Geldern of the University of Vienna, one of the world's foremost archaeologists, visited him and took photographs of the head. Later, from Vienna, he requested that the head be sent to him.

Dr. Heine-Geldern subsequently wrote from Vienna: "I showed the small head to Professor Boehringer, President of the German Institute of Archaeology . . . and he confirmed my thesis, that is, that the small head is Roman and corresponds to the year 200 A.D."

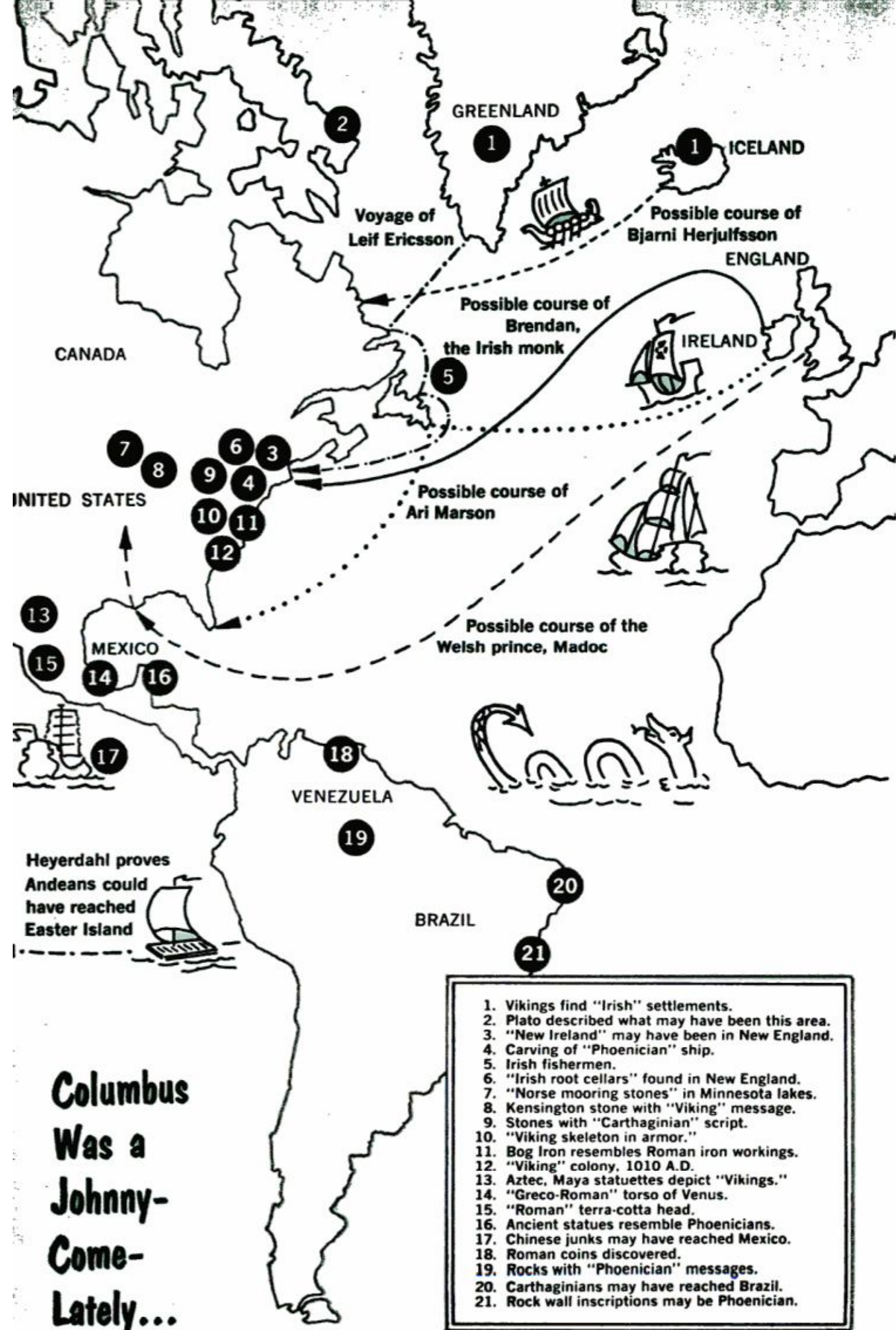
It was perhaps the most noteworthy archaeological find in years. For the little Roman head had been found by Dr. Jose Garcia Payon in a previously undisturbed grave which dated back at least to 1100

A.D. And that grave was not in the Old World of Asia, Africa or Europe, but in a high valley west of Mexico City.

Dr. Garcia Payon, archaeologist of the University of Jalapa, had found what appeared to be the first authenticated Roman artifact in the New World unearthed in a scientifically controlled site.

Somehow, between its manufacture in the Roman world of the Second or Third Century A.D. and its burial in Mexico before 1100 A.D., the tiny head had crossed an ocean. It was seemingly indisputable evidence of a link between the Old World and the New, centuries before the voyages of either the Viking Leif Ericsson or Christopher Columbus.

The dramatic discovery of a Roman head in Mexico raises again the question of who *really* discovered America. Who was Quetzalcoatl, the "white god," who—long before Columbus—visited the Mayans, the Aztecs and the ancient Andeans? Could he have been a Roman or Greek, a Phoenician or Carthaginian, a Viking or an Irishman? Did he come from Wales, or Scotland or China? There is at least some indication that all of these peoples reached



**Columbus
Was a
Johnny-
Come-
Lately...**

1. Vikings find "Irish" settlements.
2. Plato described what may have been this area.
3. "New Ireland" may have been in New England.
4. Carving of "Phoenician" ship.
5. Irish fishermen.
6. "Irish root cellars" found in New England.
7. "Norse mooring stones" in Minnesota lakes.
8. Kensington stone with "Viking" message.
9. Stones with "Carthaginian" script.
10. "Viking skeleton in armor."
11. Bog Iron resembles Roman iron workings.
12. "Viking" colony, 1010 A.D.
13. Aztec, Maya statuettes depict "Vikings."
14. "Greco-Roman" torso of Venus.
15. "Roman" terra-cotta head.
16. Ancient statues resemble Phoenicians.
17. Chinese junks may have reached Mexico.
18. Roman coins discovered.
19. Rocks with "Phoenician" messages.
20. Carthaginians may have reached Brazil.
21. Rock wall inscriptions may be Phoenician.

the New World years before Columbus.

Some archaeologists accept the Roman head as proof that a Roman vessel either by design or error sailed to the Americas. Dr. Heine-Geldern went to Mexico and assisted Dr. Garcia Payon in establishing the Greco-Roman origins of the head. However, he does not believe the head arrived on a Roman ship. He argues that Roman traders and possibly ambassadors not only reached India, but Southeast Asia and China. He goes on to say that his own studies of various sites indicate there was extensive trade between Asia and America from 700 B.C. to 220 A.D. Enormous four-masted Chinese junks sailed from island to island through the South Seas and probably crossed the wide Pacific to visit Mexico.

Later, with the collapse of the Han Empire, the ships of such cities as Kattigara took up the profitable trade with far-away America. The little Roman head, says Heine-Geldern, may have been carried over to Mexico on one of these ancient trading ships.

There remains, according to Heine-Geldern, "the possibility of a pure accidental import across the Atlantic Ocean." A Roman ship carrying the little head enroute to Britain could have been carried off course by winds and currents to Mexico. The discovery in the 1880s of what is apparently a Greco-Roman torso of Venus on the Mexican Gulf Coast by the German anthropologist Seler may indicate that this was the fate of one or more Roman ships. The Venus is now in the Berlin Museum, but unfortunately there is no definite record of exactly where and how the torso was discovered.

In the 19th Century a hoard of several hundred Roman coins was discovered on a beach in Venezuela. Most experts believe the coins to be the collection of a Spanish colonial coin fancier, but they were found in a cash box resembling those known to be carried on Roman vessels. The coins were minted from the reign of Augustus to the Fourth Century A.D.

That the Greco-Roman world knew of the Americas is suggested by no less an authority than Plato, who lived from circa 427 to circa 347 B.C. The learned Greek wrote that far to the west of the British Isles were other islands beyond which, at the edge of the sea, stretched a great continent. In 150 B.C., the Roman historian Pausanias wrote that west of the Atlantic there was a group of islands whose inhabitants were red-skinned and whose hair was like a horse's mane.

The Roman consul, Metellus Celer, has left us an even more fascinating account. In 62 B.C. he was Roman proconsul in



PRE-COLUMBIAN visitors may also have left this head, said to be Roman, in Mexico. But details of its discovery are still in doubt
—COURTESY CHICAGO NATURAL HISTORY MUSEUM



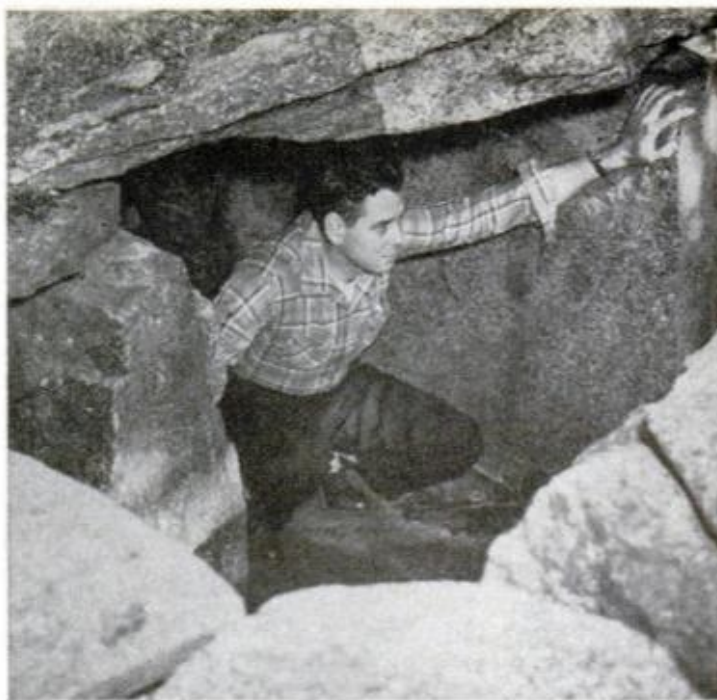
WHEELED TOY from Mexico indicates the Aztecs knew the wheel, possibly from early explorers, but failed to recognize its importance
—COURTESY AMERICAN MUSEUM OF NATURAL HISTORY



STATUES suggest the Vikings visited Mexico. Archaeologists cannot date them, however, because their discovery site was "uncontrolled"



MOORING STONES like this one at Follins Pond, Mass., are found at many Viking sites in the New World. A hole drilled in the stone held a mooring bolt



MAN-MADE CAVES, found throughout New England (this one is in North Salem, N.H.) may have been "root cellars" built by pre-Columbian Irish settlers

Gaul when the king of the neighboring Suevi brought him several strange people with red skins and black hair and presented them to him as a gift. The Roman asked where the men had come from; he was told they had been blown by high winds across the sea and cast up on the shores of Germany.

From the New World comes intriguing if controversial evidence that the Phoenicians, the great sailors of the ancient world, made it across the Atlantic. Near the little town of Gavea close by Rio de Janeiro, Brazil, there is a towering rock wall. Three thousand feet high on this cliff is an inscription long attributed by local inhabitants to the Indians.

Then Bernardo da Silva Ramos, retired industrialist, scholar and archaeologist, arrived on the scene. He inspected the curious characters and pronounced them Phoenician. Translated, the message reads, "Tyre, Phoenicia, Badezir, Firstborn of Jethbaal . . ." This inscription very possibly is more than 2000 years old because a check of ancient dynasties showed that Badezir ruled Phoenicia from 855 to 850 B.C. and was the son of Jethbaal, who ruled from 887 to 856 B.C.

The Brazilian government officially maintains that the writing is merely weird weatherings on the rocks. This position seems absurd to many anthropologists, who ask how rocks could erode to form not only Phoenician language, but also correct Phoenician history.

Moreover, the inscriptions are not the only ones found in Brazil. Ramos, in years

of searching through the Amazon jungles, discovered and copied some 2800 separate writings. He had the stones translated from Phoenician into English. Did a hoaxer risk malaria and curare-tipped arrows to scatter these marked stones? Or did, as Ramos claimed, generations of Phoenician "Kilroys" leave the record of their New World travels?

Central and North America also contain indications of Phoenician visitors. In Yucatan and other parts of Mexico, Mayan and Aztec ruins have yielded hundreds of ancient statues which depict men with the hooked noses and beards of the ancient Phoenicians.

Then, in 1948, an elderly doctor found inscribed stones near Mechanicsburg, Pa., which Cornell University experts said might be Phoenician. The stones were sent on to philologists at the University of Strasbourg in France, who said the characters show a resemblance to Carthaginian script. Carthage was a Phoenician colony. Some of the stones apparently bear the first few characters of the Phoenician alphabet: aleph, beth, gimel, dalet.

Other possible mementoes of the Phoenicians in the New World include the carving of a ship at anchor on the rocks of Lake Assawampsett, Mass. The boat's mast remains erect although the sails are lowered; this indicates a Phoenician design. Vikings lowered sails and masts both when at anchor.

Near Clarksville, Va., James V. Howe found a deposit of worked "bog" iron on

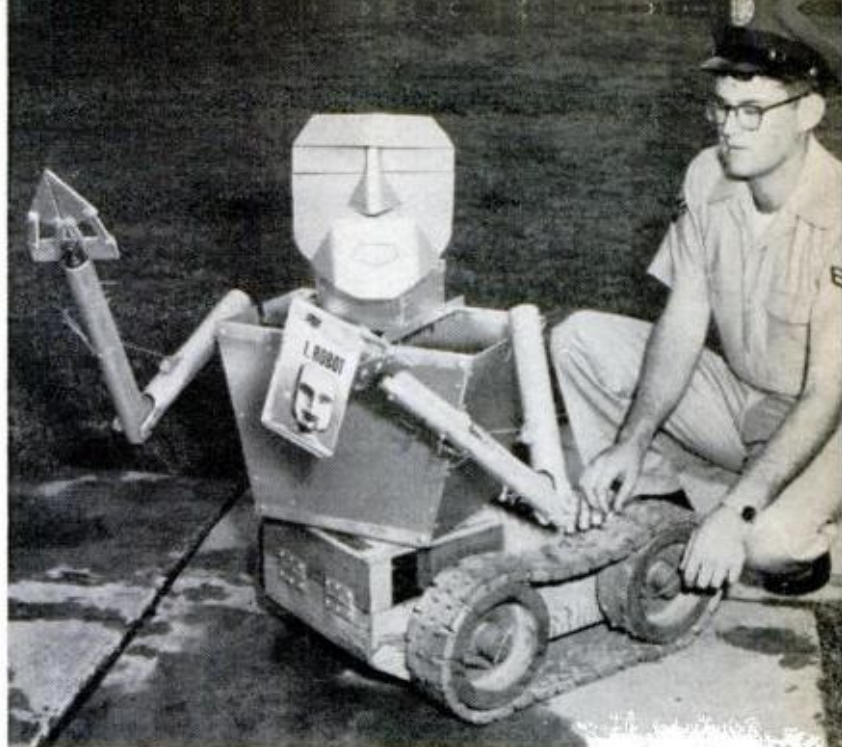
[\(Please turn to page 186\)](#)

Robot Is Linguist

If Airman Second Class Benton A. Durley ever needs a substitute for roll call, his electro-mechanical robot could conceivably answer "present" in 78 different languages.

"Mr. Syrmatron" can't vote, but is capable of 3000 movements, travels at a speed of 45 feet per minute, and can ask and answer 10 different questions. With minor adjustments, it can speak a few words in 78 different languages. The robot cost \$400 and took 500 hours to build.

Now at Lackland Air Force Base, Tex., Airman Durley built his first robot when he was 13.



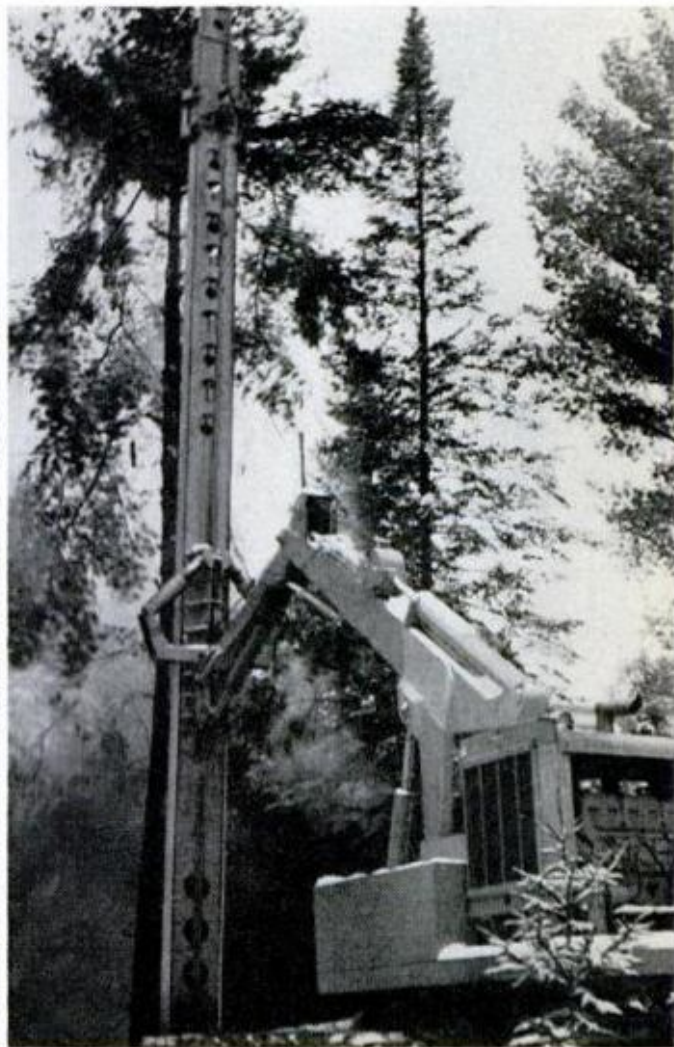
Mechanical Paul Bunyan Outdoes the Legendary Lumberjack

Now at work in the pulpwood forests of Ontario, a mechanical monster can swiftly cut and pile timber.

A telescoping mast extends from 40 feet up to 70 feet, depending on tree size, and is placed vertically along the trunk. Grapple arms run up the trunk shearing off limbs, then grab the tree at the top of the

usable trunk while a top shear cuts off the tip. The arms then travel down to the center of gravity and grab the trunk again while a butt shear slices through the base.

The trunk is then lifted up and dropped on a stack. The driver sits in a heated cab, handling the hydraulic controls. The machine is made by Beloit Hibob Corp.



Nimble Olds F-85 Pleases Owners; Mileage, Transmission Draw Fire

Boldface and marginal comments by Jim Whipple, *PM's* Automotive Editor

Nobody mentioned it specifically, but we'd suspect that the prestige of driving a medium-price name plate has something to do with choosing an Oldsmobile F-85 over a Rambler or Ford, for example

MOST OWNERS of 1963 Olds F-85 replying to *PM's* survey were looking for a car with better performance than the average compact car could offer. Yet they also wanted an easier-to-park package than you'll find with most V8s.

So it is not too surprising to learn that of the 56.7 percent who considered another compact, some 38.4 percent looked over the Buick Special. Another 26.6 percent checked out the Chevy II and 22.6 percent considered the Tempest. The Special and the Tempest are almost exactly the same size as the Olds F-85, while Chevy II is shorter but a mite bigger on the inside.

The feature "best-liked" by owners was handling ease which topped the list for 59.3 percent of all owners. Per-



Owners Like

*Handling Ease (59.3%)
Performance (38.5%)
Styling (34.3%)*

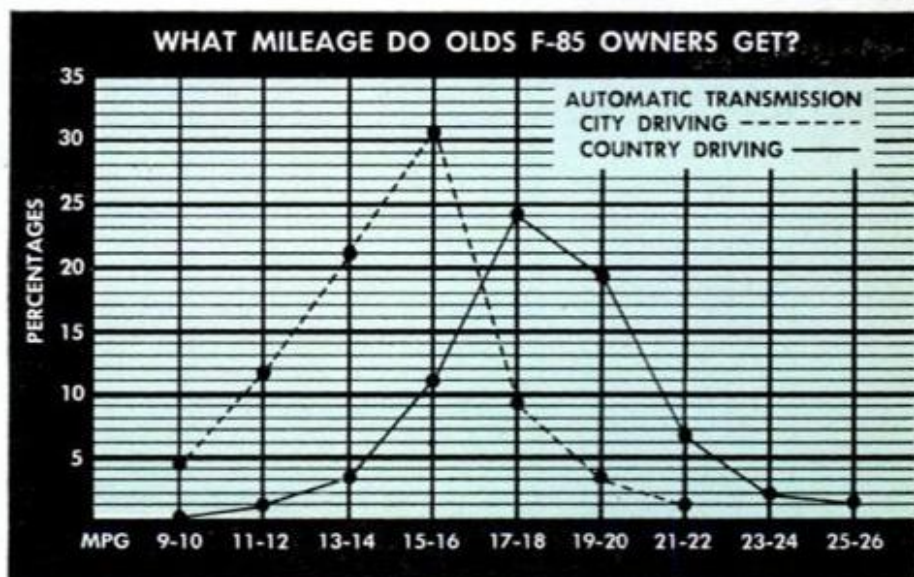
and Dislike

*Gas Mileage (14.1%)
Auto Transmission (12.2%)
Inferior Paint Work (7.1%)*

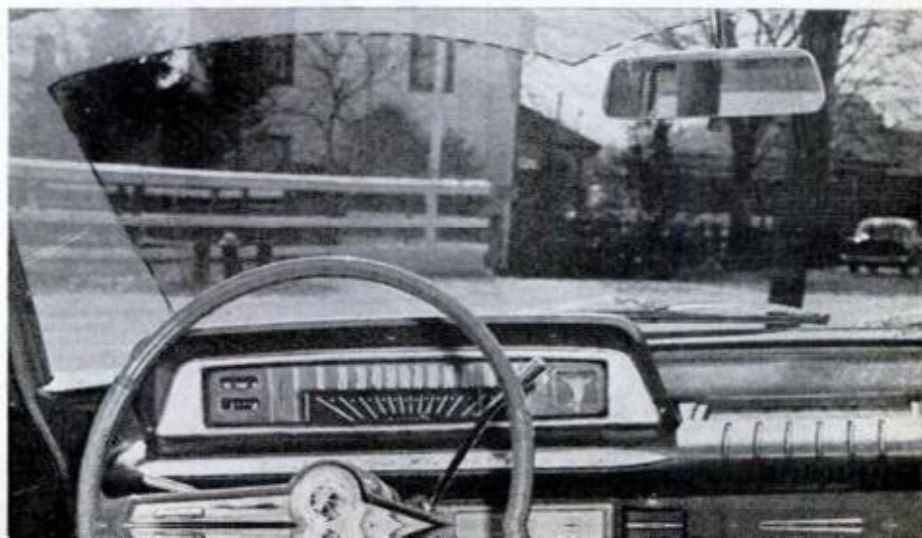


IT'S POSSIBLE to get a 4x8-foot sheet of plywood into the F-85 wagon, but as with most small wagons, it must rest on one or both wheel arches and extend out of the tailgate

MOST AUTOMATIC transmission owners got 15 and 16 m.p.g. in city driving and in the area of 18 on long trips



SMALL ASH TRAY drew complaints and windshield wiper pattern on the test car left a substantial blind spot just forward of the left A pillar





OWNERS PRAISED dashboard, upholstery, general interior decor, and over-all styling of their F-85s. Plushy Olds seats leave you close to ground when disembarking

Crowded streets should make handling ease → more popular. Owners are also looking for cars that look bigger than they are and park smaller than they look

True. F-85's acceleration and speed keeps it abreast of the "standard" V8s, i.e., Ford, Chevy, Plymouth. But it matches their thirst, too →

formance (38.5 percent), styling (34.3 percent) and riding comfort (28.8 percent) followed in that order.

The leading complaint was poor gasoline mileage, mentioned first by 14.1 percent of all owners. The automatic transmission drew fire from 12.2 percent of the owners and 7.1 percent complained about poor paintwork.

During nearly a thousand miles of all types of city traffic and thruway driving, PM's test check car, an F-85 deluxe two-seat wagon with a 155-hp. engine and automatic transmission, averaged 13.10 miles per gallon over-all. This could be expected to improve slightly as the engine loosened up. The test car had 14-inch wheels, although 13-inchers are standard.

After figures were corrected for an odometer that read 3.3 percent high, steady speed mileages were:

24.14 miles per gallon at 30 m.p.h.

23.58 miles per gallon at 40 m.p.h.

20.95 miles per gallon at 50 m.p.h.

19.03 miles per gallon at 60 m.p.h.

16.46 miles per gallon at 70 m.p.h.

Now let's see how the owners themselves commented on their F-85s. On the list of items owners praised, here are the five mentioned most often:

"I like the quick response and over-all handling in traffic."—North Dakota airman.

"Turns in a small radius."—New York news photographer.

"Handles well on road and in parking."—Ohio engineer.

"It's easy and pleasant to drive—never tires one on long trips."—Ohio office worker.

"It's a small car, but no 'second fiddle' on the highway."—Ohio livestock technician.

"It's fast and powerful with so few horses."—Alabama switchman.

"I like the square, Thunderbird-type roof (Cutlass coupe). Also, the F-85 is longer than other compacts, low, and is a very good looking car."—California laboratory technician.

"Like the over-all styling, the clean, unbroken lines."—Ohio teacher.

"The body lines are very sharp looking."—California missile worker.

"I like its conservative styling."—Michigan factory inspector.

"Gives a very good ride for a small car."—New Hampshire seaman.

"It combines most of the features of a big car (ride, quietness and handling), yet has the advantage of a small car."—New York engineer.

"Most of all I like the size—not too long and awkward, yet not cramped nor small like other compacts."—Connecticut legal secretary.

"It's small, but not too small, and it has the comfort and luxury of a big car."—New Mexico house painter.

"Perfect for size, and the only size for people who are 65 or over."—Iowa retiree.

Owners complained as well as praised. Here, in the order of their frequency, are the five complaints mentioned most often:

"I was hoping for greater economy than my 16 m.p.g. over-all."—Maryland printer.

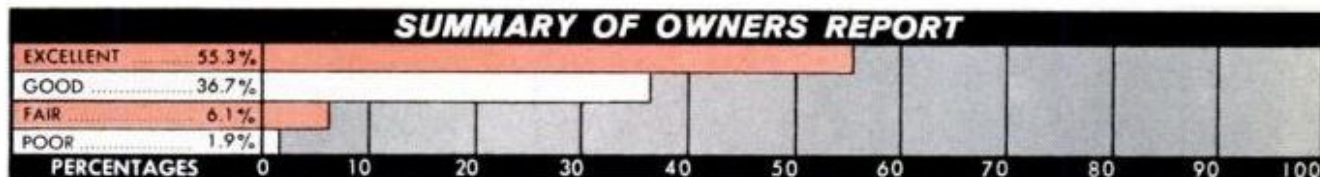
"Poor gas mileage for a compact."—Tennessee salesman.

"Must use high-test gas and, moreover, mileage isn't as good as my previous car."—Connecticut data processing salesman.

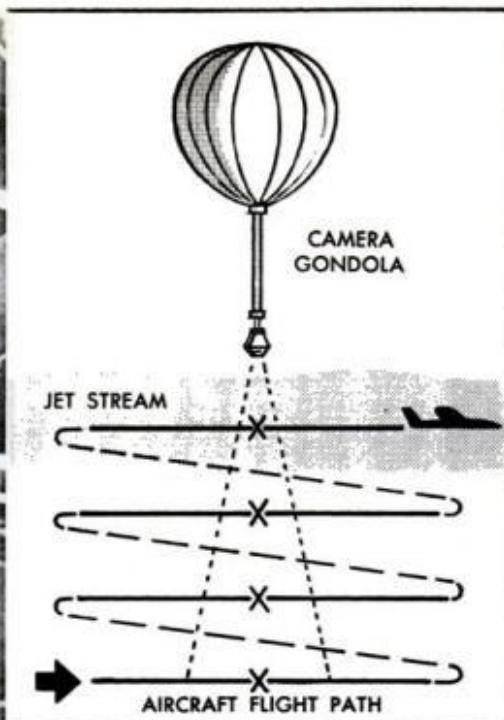
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← **It's longer than some other compacts, but equalled by Special, Tempest, Dart and Lark, and is smaller than Fairlane and Meteor**

← **If Olds F-85's interior dimensions are adequate for you, you'll never get that "I'm driving a little, bouncy, underpowered car" feeling**



Mileage experience	Mechanical trouble, if any	Did not consider 43.3%
About as expected 43.5%	Carburetor 6.1%	What make?
Better 16.4	Automatic choke 2.9	Buick Special 38.4
Not as good 40.1	Idles too fast 2.6	Chevy II, Corvair 26.6
Best-liked features	Automatic transmission 1.9	Tempest 22.6
Handling ease 59.3	Transmission fluid leak 1.9	Falcon 9.6
Power, performance 38.5	Least-liked exterior style features	Comet 5.1
Styling 34.3	Grille 4.2	Consider buying a full-sized car?
Riding comfort 38.8	Tail lights 3.2	Did consider 41.0
Size 26.0	Rear end 2.2	Did not consider 59.0
Parking ease 12.8	Bumpers 1.6	What make?
Gas economy 10.6	Best-liked interior style features	Chevrolet 40.6
Roominess 9.0	Bucket seats 24.0	Oldsmobile 29.7
Interior decor 7.7	Upholstery 19.6	Ford 9.4
Visibility 7.4	Dashboard 9.6	Pontiac 7.8
Specific complaints	Comfortable seats 8.0	Plymouth 3.9
Poor gasoline mileage 14.1	Console 4.2	Family's other car, if any
Automatic transmission 12.2	Least-liked interior style features	Oldsmobile 11.9
Inferior paint job 7.1	Ash trays 8.3	Chevrolet 9.0
Insufficient headroom 6.4	Idiot lights 6.1	Other General Motors make 7.0
Difficult to start in cold weather 6.1	Unlighted ash trays 4.5	Ford 5.1
Hard to get in and out 6.1	Factors influencing purchase of	Other Ford Motor make 5.4
Insufficient legroom 4.2	Olds F-85	Plymouth 2.2
Car too light; sways in wind 3.2	Styling 40.4	Another Olds F-85 1.9
Doors don't fit; close too hard 3.2	Size 26.0	How is dealer service?
Best-liked exterior style features	Price, trade-in, resale 23.0	Excellent 57.9
Clean, straight lines 14.4	Power, performance 17.6	Average 32.6
Long, lean, low design 7.4	Previous Olds ownership 15.7	Poor 9.5
Simple, conservative lines 7.1	Easy handling 15.1	Would you buy another F-85?
Rear end 5.8	Did you consider buying another compact?	Yes, would buy 83.0
Big car look 4.5	Did consider 56.7	No, would not buy 8.0
Good use of chrome 4.2		Undecided 9.0



Candy-Striped Plane Is Target for High-Flying Camera

Novel markings on an Air Force RB-57 jet will aid a study on high-altitude photography. Like a test pattern, the stripes will be used as a target for sharpening up pictures taken by a camera slung from a balloon that may rise to altitudes as high

as 100,000 feet. Atmospheric interference has spoiled many pictures taken this high.

The plane will fly predetermined routes at varying altitudes in tests to discover and define the effects of air turbulence on high-altitude reconnaissance photos.



Bullfrog Bow

A modified crossbow for hunting bullfrogs has been developed by Buster Resmondo of Hawthorne, Calif.

He reduced the bow's original 80-pound thrust by half, added a spinner reel with 150 feet of line, and uses a plastic spear to bag his game. A spotlight aligned with the sight permits night hunting.

Resmondo also uses the crossbow for casting bait and lures.



Stair-Climbing Chair

Elderly or infirm air passengers may now board or deplane via a chair that climbs or descends stairs using rubber treads that grip the steps.

Held in place by a safety belt, the passenger is powered up or down by a 12-volt battery. The seat is self-leveling.

Called the *Stepulator*, it has been introduced by United Air Lines at major air terminals in the United States. The airline estimates that more than 200 of their passengers need some kind of special assistance boarding aircraft every day.

Pod for Chopper

Carried like a huge pod, an all-purpose cargo and personnel van is attached to the underside of a Sikorsky S-64 *Skycrane*.

It can transport 68 troops, 48 litters or 55 commercial passengers. The van can be parked at an air base or battlefield and picked up later.



Sea-Bottom Armor

Claimed to be the first flexible underwater pipeline manufactured in the U.S., a new armored cable can transport nearly all liquids and gases, including water and natural gas.

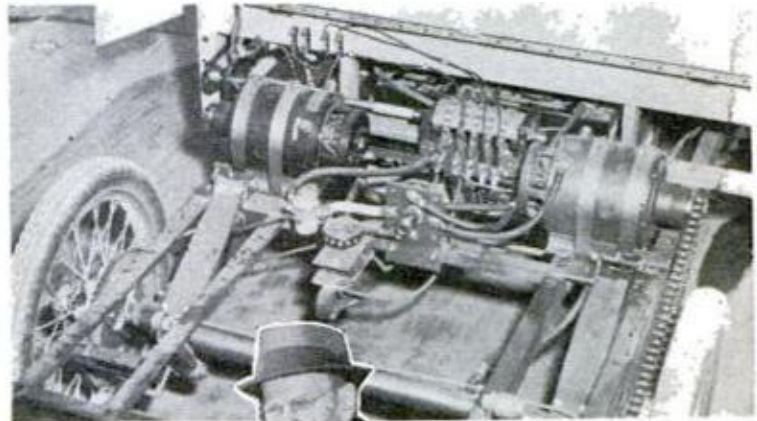
The Simplex cable is the solution to the need for a pressure-proof pipeline that can be laid down in unlimited lengths without the danger of breaking of its own weight or from shifting.



Battery Buggy

A pair of 12-volt, series-wound starter motors move George Vasen's homemade electric car at 25 m.p.h. along Quincy, Ill., streets—where they're level. Power comes from four 6-volt auto batteries. There's enough in a single charge, Vasen says, to last for 25 miles of travel. The car has a 65-inch wheel base.

The Vasenmobile meets all requirements for an Illinois license.



Carnival of New Way-Out Watercraft

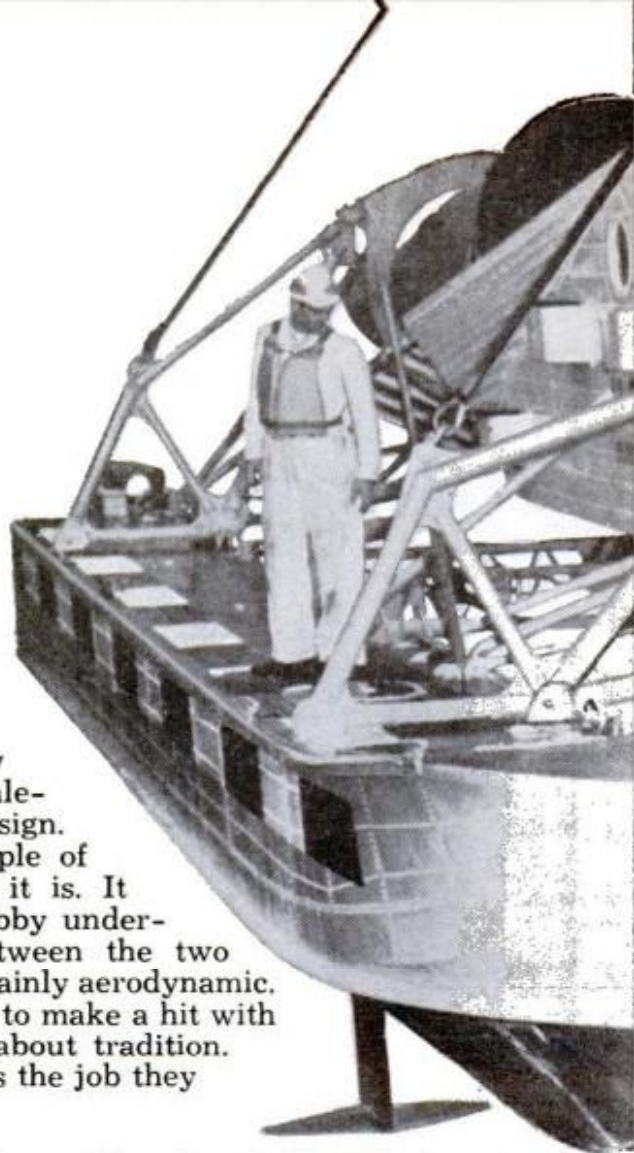
Who says that naval architects are conservative? These wild designs hardly give a nod to tradition

SOME OF TODAY'S hottest new special-purpose boats almost defy description in ordinary boating terms, yet they look like old-fashioned whale-boats beside Boeing's new HTC experimental design.

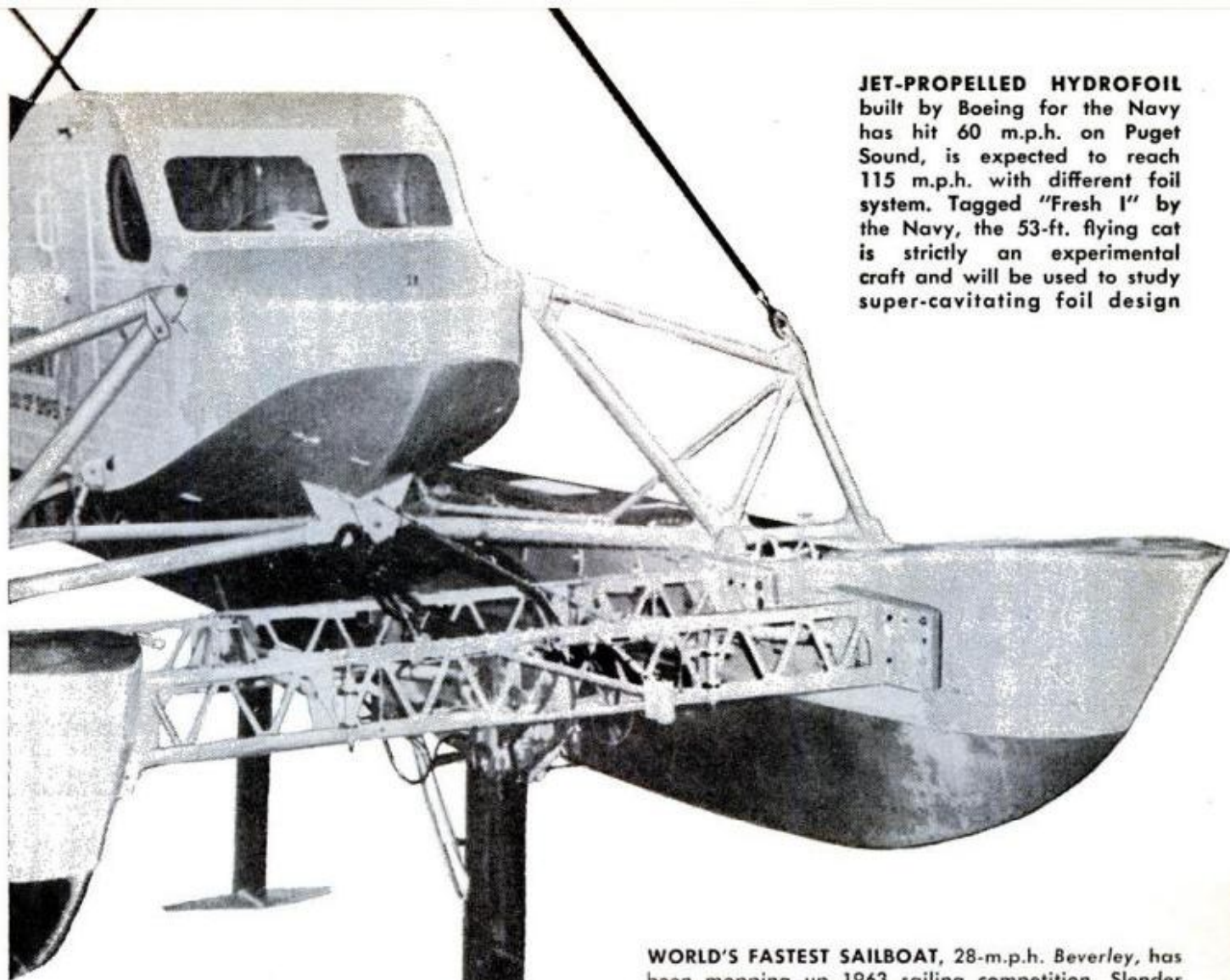
This jet-propelled hydrofoil reminds most people of a low-flying plane, and that's just about what it is. It actually flies above the surface supported by stubby underwater wings. The fuselage/cabin suspended between the two pontoons never touches the water, so its lines are mainly aerodynamic.

A boat no longer has to look "boatlike" in order to make a hit with the public. Most new boaters couldn't care less about tradition. They're far more interested in whether a boat does the job they want it to do, regardless of radical appearance.

28-FOOT HYDRO MARINER cruiser for pleasure market has beam-width surface-piercing foils that retract hydraulically, giving boat docking draft of only 1 foot. It features car-style cockpit, picture-window cabin aft



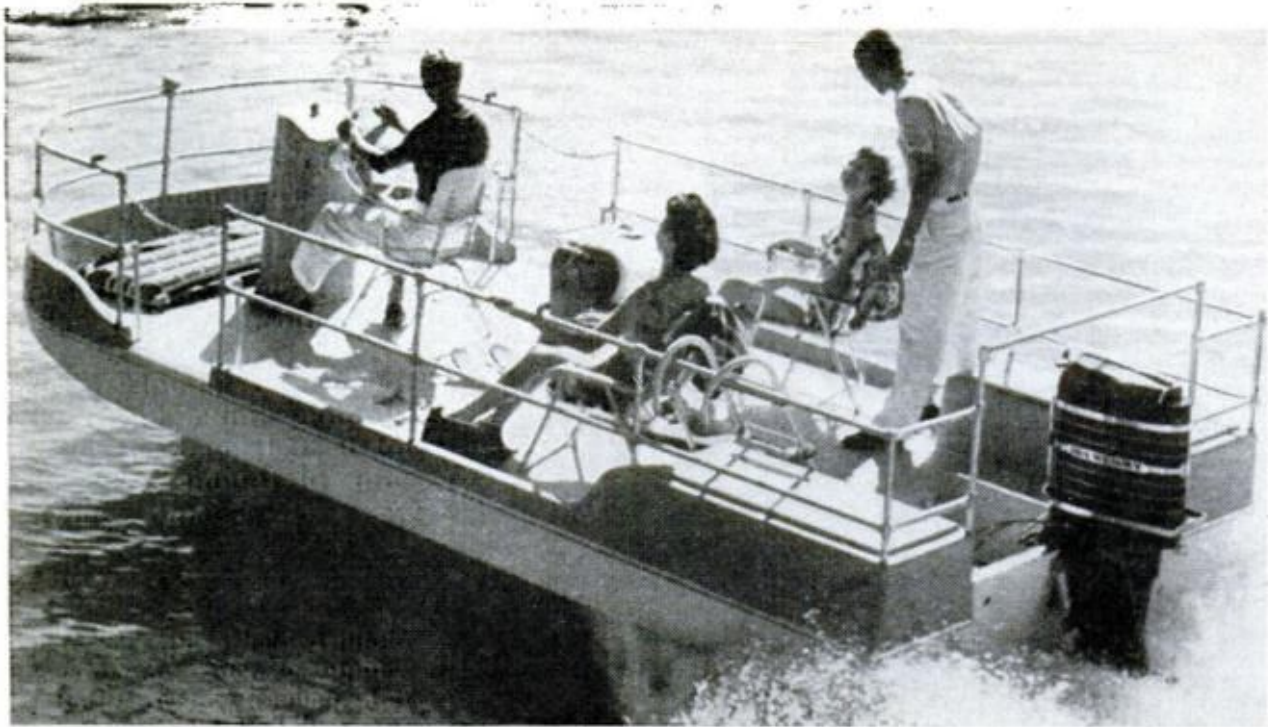
JET-PROPELLED HYDROFOIL built by Boeing for the Navy has hit 60 m.p.h. on Puget Sound, is expected to reach 115 m.p.h. with different foil system. Tagged "Fresh 1" by the Navy, the 53-ft. flying cat is strictly an experimental craft and will be used to study super-cavitating foil design



WORLD'S FASTEST SAILBOAT, 28-m.p.h. *Beverly*, has been mopping up 1963 sailing competition. Slender hulls linked by aluminum tubing and nylon trampoline produce a fine blend of speed and stability

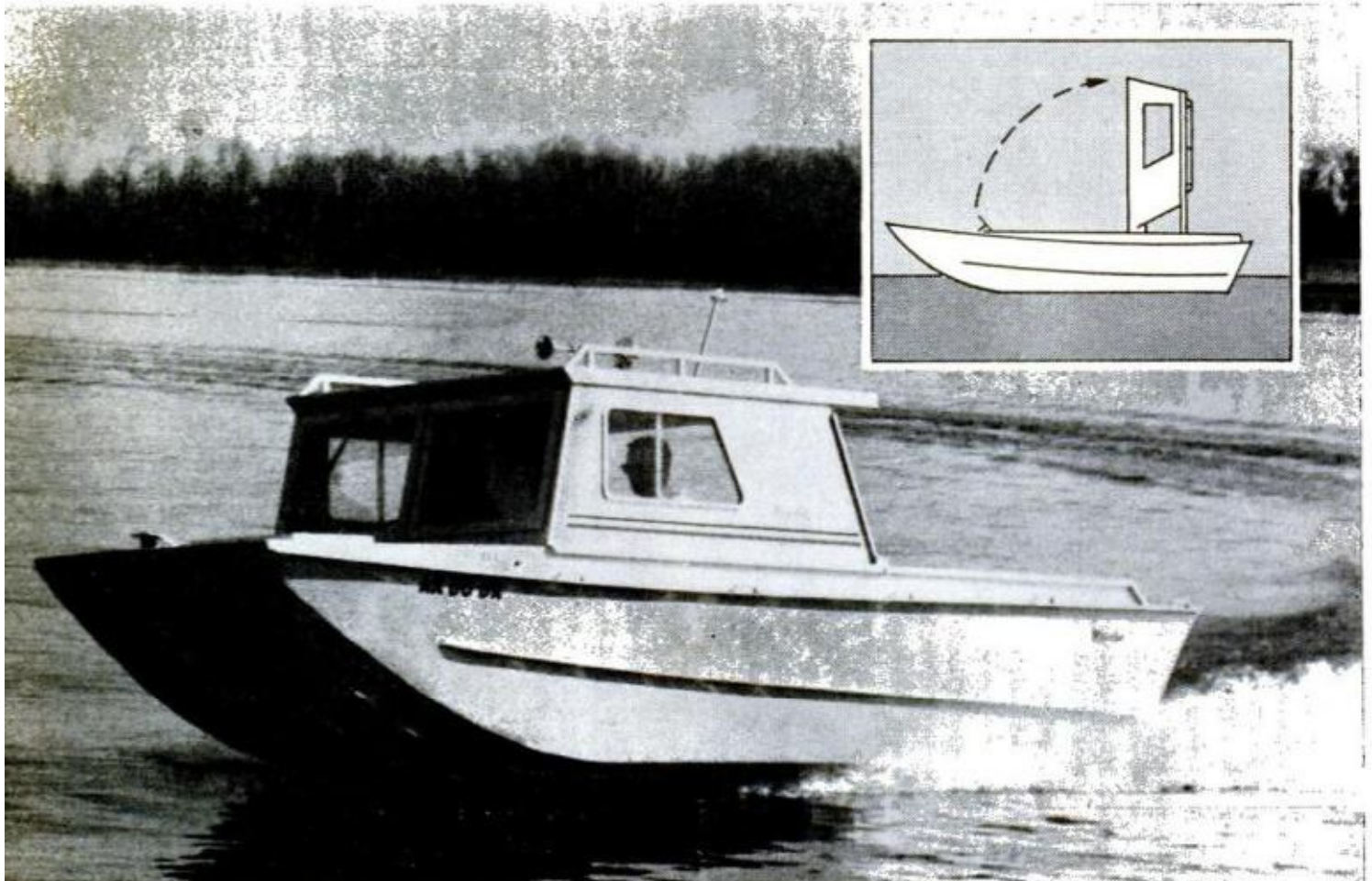


Carnival of New Way-Out Watercraft



DECK BOAT from Anchor Plastics features streamlined-pancake topsides concealing a high-speed hull with full-length tapering keel which draws only 8½ inches of water. It will support 20 adults or pull four skiers with a 75-hp. rig. Tipping the scales at 1140 pounds, it's also available with outdrive

FLIP-TOP CRUISER built by Monark has hinged cabin for easy front loading. Remove two bolts and you can take the cabin off. Drop an 80-hp. motor on this 19-foot boat and it will cruise at 30 m.p.h. while carrying half a ton of cargo. Foam flotation over aluminum bottom gives extra stiffening



THOROBRED, blue-water member of Culver's flat-bottomed cat line, is beamy 19½-foot boat with whopping 28 inches of freeboard. The 8-foot foredeck provides covered sleeping space for two, and 6 by 10 cockpit should take four enthusiastic fishermen without crowding



OAHU, another Culver cat, is designed for river and lake use. Drawing only 3 inches of water, it's 18 feet long and all open deck. Like the Thorobred, it rides on fiberglass pontoons filled with polyurethane foam. A deck-mounted bridge protects skipper and his passenger



SKI BARGE from Kenner Boat Co. is big open 530-pound fiberglass hull controlled from a streamlined console located just ahead of the motor. A 65-hp. motor will push this roomy 15-foot, 9-inch boat to 39 m.p.h., getting you to that special fishing or diving spot in a hurry



Mountain Climbing .. *Family Style*



Mom, Dad, kids, cats and dogs get into the act when the American family goes rock scaling

A YOUNG ROCK CLIMBER rappelled down the face of sheer rock with the agility of a goat. On solid ground, he removed his rappel sling and paused to look around.

The towering cliffs of the Shawagunk hills, a jagged granite outcrop some 70 miles north of New York City, were covered with people. There were housewives in slacks and sneakers; businessmen in knickers and colorful berets; eight-year-old children dangling on ropes and clinging like flies to tiny outcroppings of rock; college students; teenagers; Girl Scouts, and a few people old enough for rocking chairs. Down below were pre-schoolers scrambling over rocks, enough dogs and cats to start a pet store, babies in playpens and carriages.

"This isn't mountain climbing," the young man said, shaking his head. "It's a nursery!"

Sponsored by the Appalachian Mountain Club, week-end

classes in climbing for beginners attracts this strange assortment of Alpinists to the Shawagunks from spring to late fall. As many as 100 novices turn up on a busy day. The cost is only 50 cents a session, and most of the instructors are veteran climbers from the American Alpine Club.

To insure complete safety in their classes for beginners, the A.M.C. has each novice climb with two experienced climbers. They use a rope on novice climbs, with "belays" securing them to the face of the cliff above and below. How this is done we'll explain presently. If the novice should fall, he could drop only about two feet.

Beginners Should Fall

"The best thing that can happen to a roped beginner is to fall," says Brownell Bergen, an IBM computer specialist who climbs on week ends. "He can't possibly be hurt, and it gives him a confidence in his rope that he cannot get any other way."

The beginner's only equipment is old clothing and a pair of sneakers. When he is assigned to a pair of climbers, he is first instructed in the two basic climbing knots: the bowline used by the men on each end and the butterfly used by the man in the middle.

When the three are tied into the rope, the leader prepares to climb. There are six grades of climbs; the first three not

requiring a rope. Four requires a rope, five is difficult and six is extremely difficult. Among mountaineers there is a seventh grade called "inaccessible." This is supposedly impossible, but—according to Sierra Club veteran David Brower—is a term used to describe climbs "subsequently made by girls in their teens."

The leader starts up. At 20-foot intervals he stops to place a *piton*. This is a flat metal spike with an eye at one end that is driven into a crack in the rock with a short-handled hammer. A *carabiner*, a steel oval ring with a spring-hinged gate on one side, is hooked into the eye of the piton. The rope, a continuous-core nylon made to hold 4600 pounds, is slipped into the carabiner. If the leader should now fall, the piton and carabiner will act as a pulley and the man on the rope below can stop the descent.

At the end of the first pitch (the length of the rope from leader to second man), the leader places a piton and secures the rope. He braces himself, shouting, "Off belay," then takes a turn of the rope over his buttocks and is ready to support the next climber. He shouts, "On belay," and the novice starts up. It is now that the beginner learns, through experience, that strength is not important to climbing. He climbs on his legs and uses his hands for balance. He leans away from the rock to give more area of traction for his feet. He

WALKING DOWN a steep rock face, a novice learns the basic body rappel. The climber simply slides down the rope, controlling descent with one hand

WITH HER FATHER protecting her with a body belay, a young climber moves out onto the rock face with confidence, knowing the rope will stop any fall



learns to move slowly, picking out the way, his weight poised over his feet or just above them. He learns not to stretch for holds that will exhaust him, but to work easily with short, intermediate holds. But most important, he realizes that he is being carefully guarded by the belays above and below.

At the top, the novice is taught the body rappel. The rope is doubled and fixed to a sling at the top. The climber passes the rope between his legs, around his left leg, across his chest, over his right shoulder and under his left arm. In this manner he can walk down the steepest cliff, braking or playing out the rope with his left hand. The leader belays him with a second rope to nullify the terror of taking the first step into space, but once

he is out on the face of the cliff he feels completely secure and can enjoy the exhilaration of running down backwards.

When he reaches the bottom he is no longer a novice. He has experienced the basics of rock climbing and is ready for the intermediate class.

A visit to the Shawagunks is enough to convince anyone that climbing is a family sport. Any doubts are quickly dispelled by the sight of a six-year-old girl scaling a 300-foot exposure, Dad belaying from above and Mother calling encouragement from below.

As a European Alpinist expressed it, "In Europe many people climb mountains. It is a part of our heritage. But it takes Americans to turn a mountain into a playground."—Stuart James ★★★

WANT TO CLIMB A CLIFF?

Wherever there is a piece of rock that goes straight up and is sturdy enough to hold a piton, you will find Americans climbing it. Mountain clubs across the country are eager to expand their membership and welcome novices interested in learning the basics of rock scaling. The Appalachian Mountain Club arranges transportation and lodgings for any interested beginner who wants to climb in the Shawagunks. The telephone number in New York is MA 4-1886. In other parts of the country similar arrangements can be made by writing to the club in your area.

SIERRA CLUB
1050 Mills Tower
San Francisco, Calif.

CHICAGO MT. CLUB
2901 South Parkway
Chicago, Ill.

APPALACHIAN MT. CLUB
5 Joy Street
Boston, Mass.

WISCONSIN HOOFERS
University of Wisconsin
Madison, Wis.

SEATTLE MOUNTAINEERS
Box 122
Seattle Wash.

COLORADO MT. CLUB
1400 Josephine St.
Denver, Colo.

IOWA MOUNTAINEERS
30 Prospect Place
Iowa City, Iowa

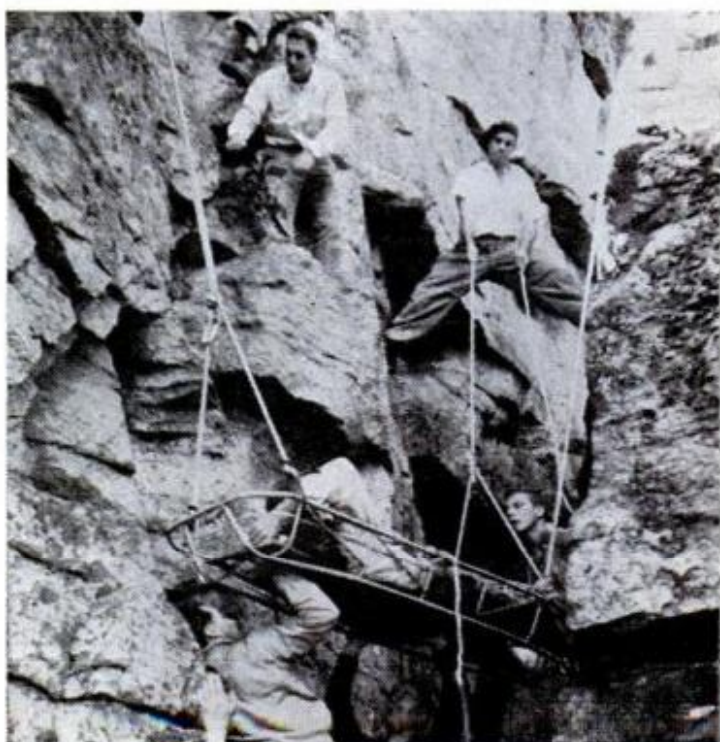
WASATCH MT. CLUB
62 East 2nd Street, So.
Salt Lake City, Utah

WYOMING MOUNTAINEERS
828 South Oak St.
Casper, Wyo.

A LONG WAY from the kitchen stove, a housewife in slacks and sneakers inches across the face of a precipitous cliff on her first day on the rocks



PRACTICING RESCUE techniques, a group of veteran climbers lower a specially designed stretcher to the ground, simulating actual emergency procedure

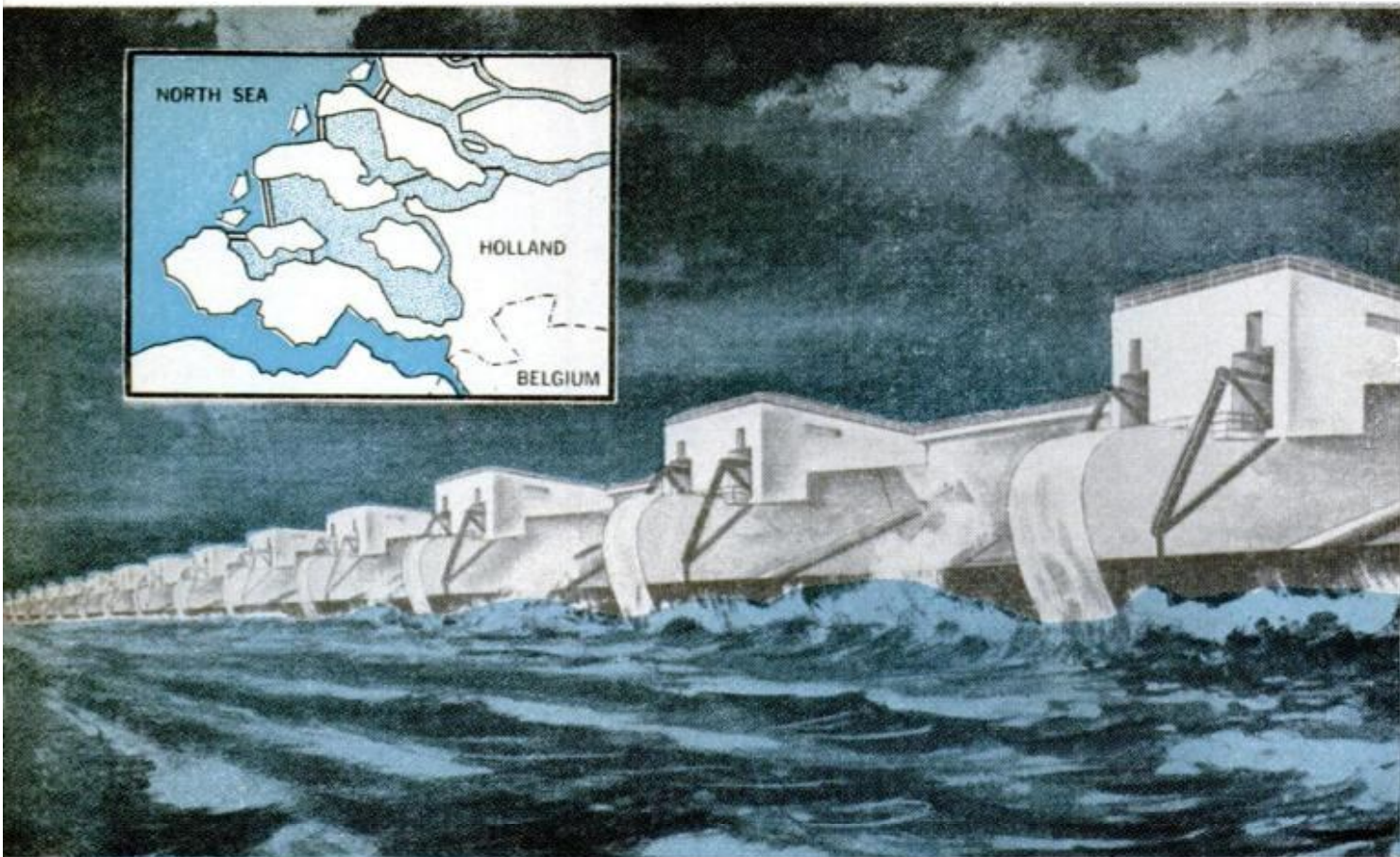
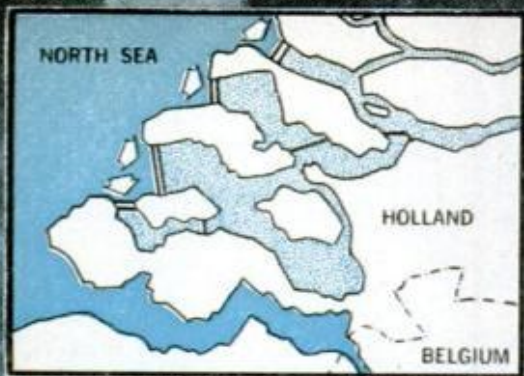




SUSPENDED ON ROPE and slings, an expert climber seemingly defies gravity as he slowly works under overhang. His life depends on pitons (metal spikes) that he hammers into the rock

AFTER DRIVING A PITON into a crack in the rock, the climber attaches a carabiner (a hinged steel ring). He then slips the rope through ring, and man below can hold if he should fall





Clamshell "Dikes" Tame the Ocean

By G. B.
Rubinstein

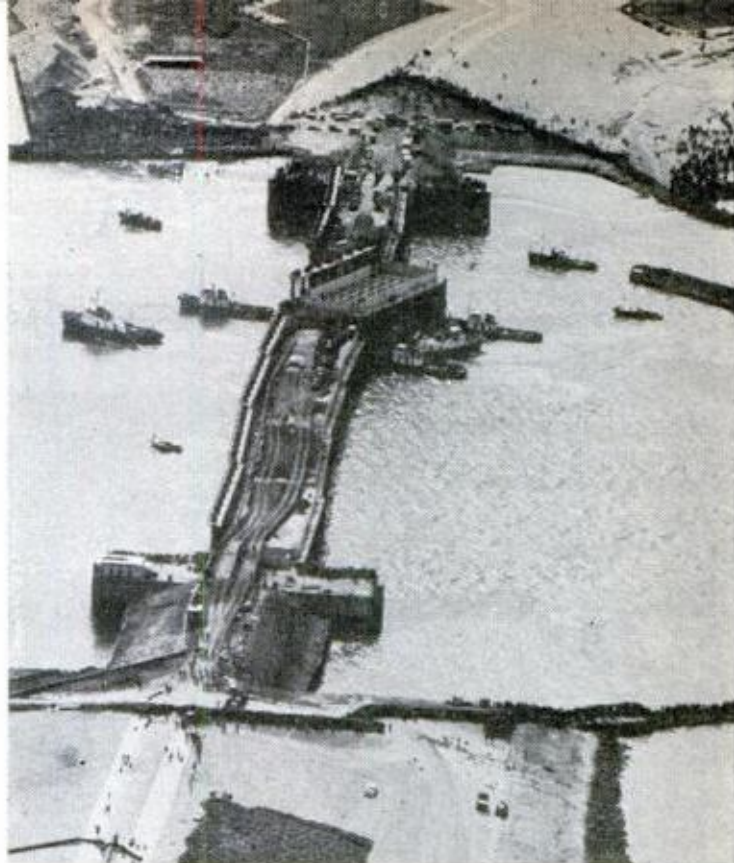
THE DIKES OF THE NETHERLANDS, symbol of a tiny country's centuries-old struggle against the North Sea, may soon be obsolete, at least in the Province of Zeeland. As part of their ambitious 25-year "Delta Plan," the Dutch are now building dams across four Zeeland estuaries. The dams will prevent the sea from reaching dikes that now protect the estuary islands and mainland areas below sea level.

One dam, the Veersche Gat has already been closed, shutting off an ancient seaport, Veere, from the open sea. The central portion of the 1.7-mile dam, linking Walcharen and North Beveland islands, consists of seven 5000-ton caissons which were towed into position by tugs. After the caissons were closed, suction dredgers spouted two and a half million cubic meters of sand on the bottom of the dam.

The 2.8-mile Haringvliet dam between the islands of Voorne and Goeree will be completed next year. Seventeen sluices will regulate the flow of water and ice into the sea from the Rhine and Meuse Rivers by means of twin gates raised and lowered radially by hydraulic action (see drawing, opposite page). The third dam, Brouwershavensche Gat, will be completed in 1970, and the fourth, across the Eastern Scheldt, will be sealed in 1978.

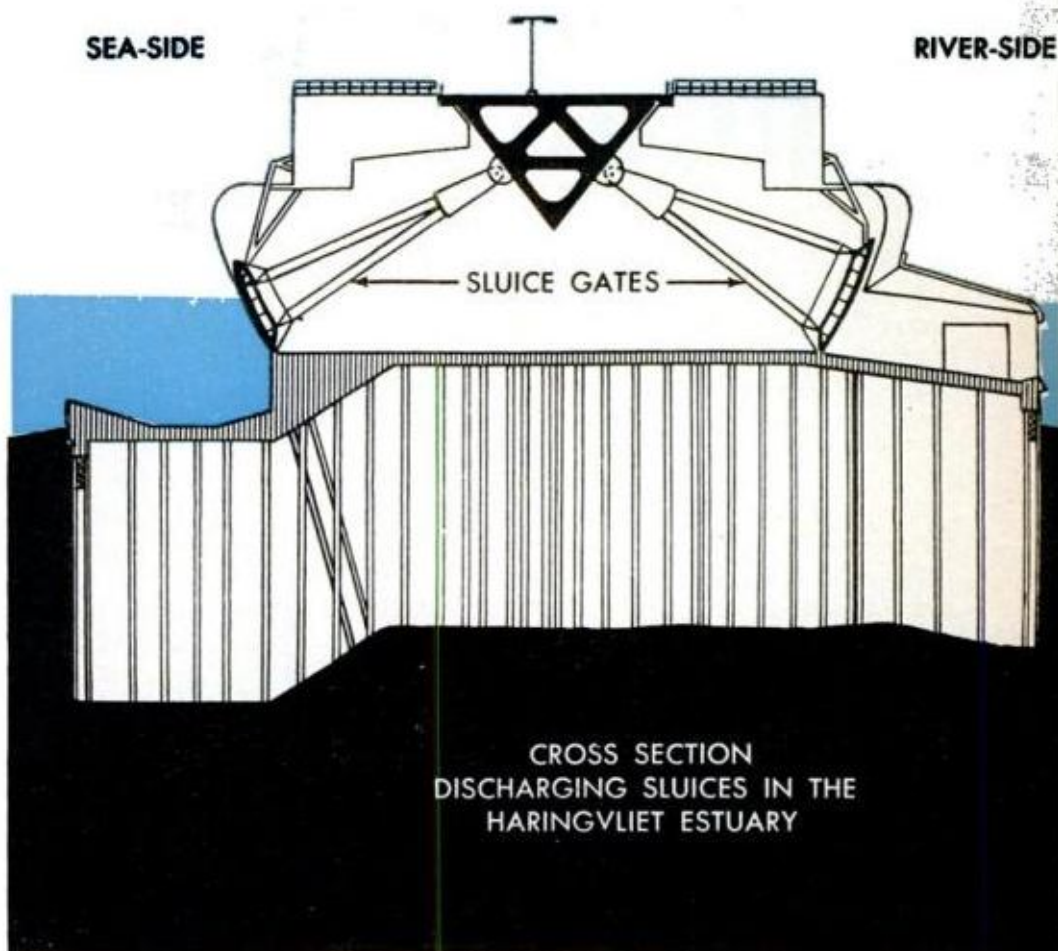
Delta Plan will cost the Dutch two and a half billion guilders (about \$694,445,000). It will shorten the country's coastline by about 437 miles and add some 44,500 acres to its area.

The gigantic scheme was adopted after the 1953 hurricanes, which created one of the worst flood disasters in Netherlands history, taking 1800 lives. When Delta is finished, the present inland dike system and new artificial lakes will provide high-way and recreational facilities for millions of Dutch.



CAISSONS, looking like floating apartments, were towed into the Veersche Gat by tugs. Dam ruined the local fishing industry

CROSS SECTION of one of 17 sluice gates that will regulate flow of ice and water through Haringvliet, opposite page. Gates will be raised by hydraulic action. Specially built piers will break up ice from the Rhine and Meuse Rivers



THIS HAND-HELD SET fits the hand easily and comfortably and the push-to-talk switch is a wide, easy-to-use bar. Controls are also convenient with knobs located on the front panel



Two-Way CB Radios

Don't let pretty cases and meaningless features trap you into buying a poor CB radio. This point-by-point analysis shows you what features are really important

By Len Buckwalter and Larry Steckler

TWO-WAY CITIZENS BAND (CB) radios range from the 3-transistor hand-held set to the 3.5-watt base station (which used to be called a 5-watter before a recent FCC ruling changed it). Prices range from \$8 to \$250.

All of these sets operate on the Citizens Radio Band which crams 23 channels between 26.96 and 27.23 megacycles (millions of cycles).

Effective range (not to be confused with the "ideal conditions" range found in specifications sheets) can be as little as 100 feet or as much as 15 miles. The simplest units don't even have a volume control; the most complex include exotic features like squelch, selective calling and noise limiters.

You have one major decision to make before you even walk into the store. Do you want a hand-held or a larger not-so-portable station? If you're looking for a simple, wireless intercom for your home

or for house-to-garage, one of the little 3-transistor sets is all you need. If you're going to be talking to your neighbor down the block—100 yards or so—better get at least a 6-transistor unit. For longer distances, more than two or three city blocks, you'll have to get at least a 1-watt portable. And for real distance, get a 3.5-watter.

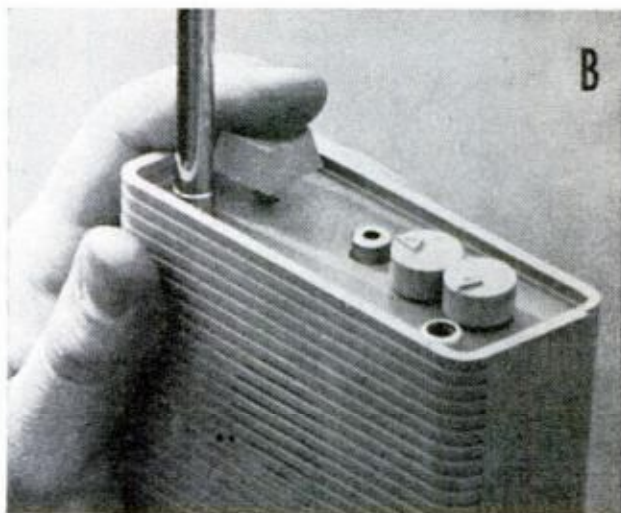
Want to talk from home to your car? You'll need a 3.5 watter which will operate on 12-volts d.c. To double the use of such sets, get one that has a combination power supply—12 volts d.c. and 115 volts a.c. Then you can use it in your home too.

If you've decided on a hand-held set, make sure it's easy to hold, fits your hand comfortably, and you can operate the push-to-talk button easily with the hand that holds the set. Antennas on these models telescope down into the set. Sometimes the antenna doubles as an on-off switch—collapsing it turns off the set. But if you forget to collapse it, the set

A. LIFT A SMALL COVER on the back and you can get at the batteries. Are they this easy to get at in the sets you look at? Are they shielded from the rest of the receiver to protect against corrosion? Is polarity marked in the case for correct replacement?

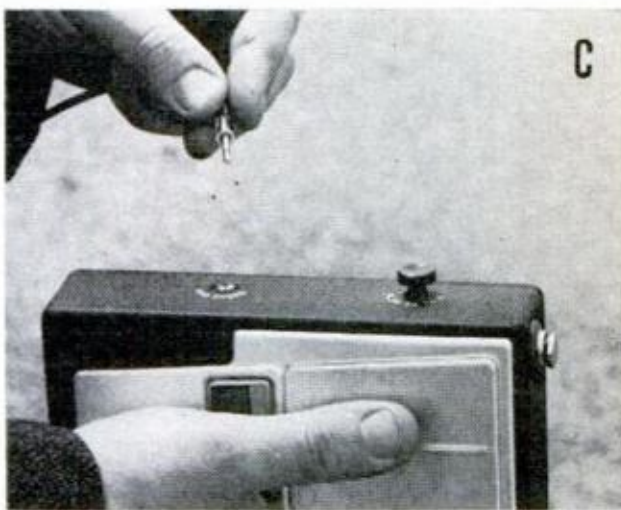


B. PUSHBUTTON atop this CB set is hard to use without weakening your grip on the set itself. In addition, if you are not careful, your finger will hit the antenna and damp out the signal you want to send. Watch out for features that may be inconvenient to use

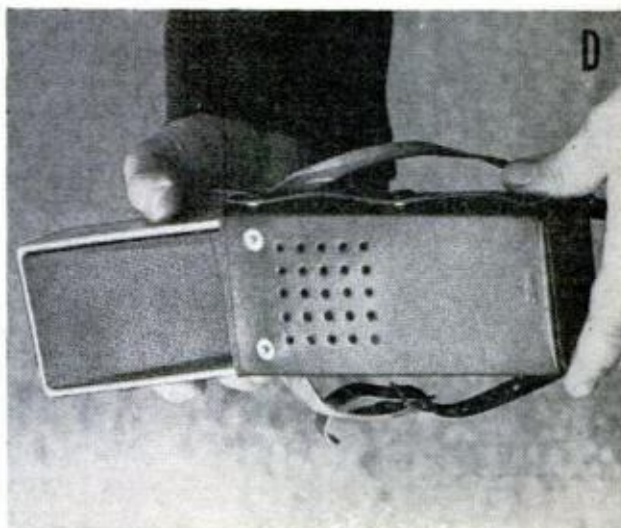
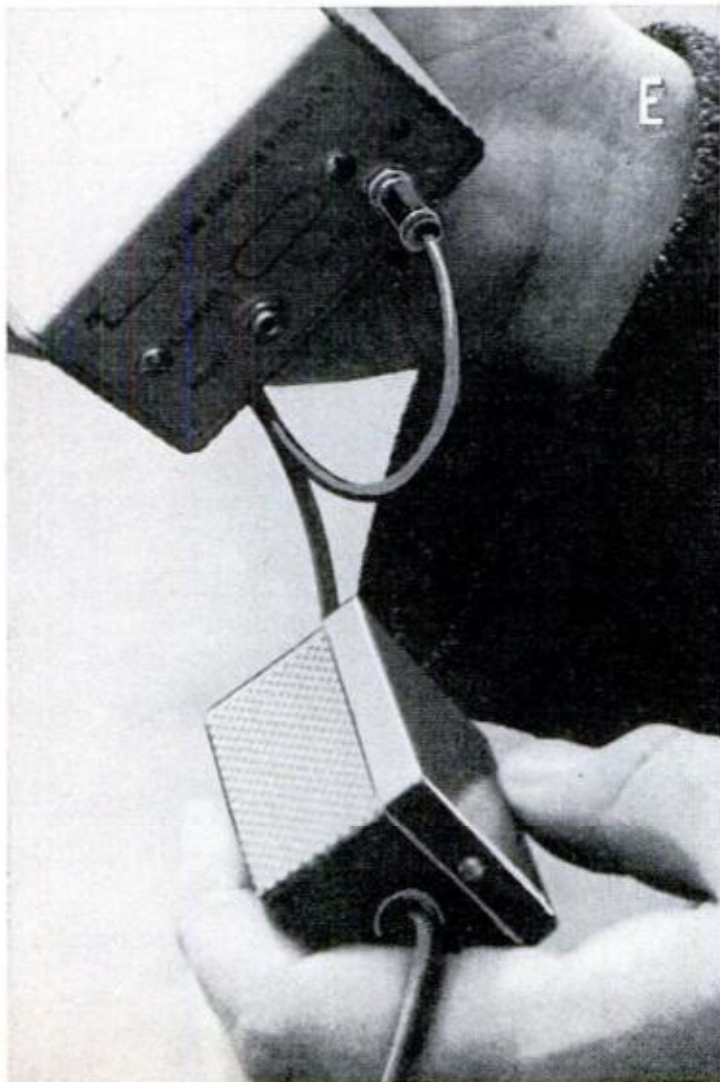


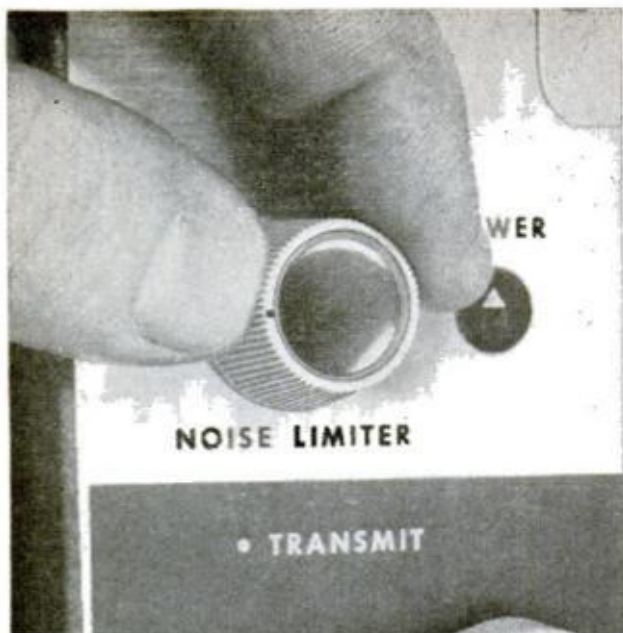
C. EARPHONE JACK on the side of a CB radio is something you need whenever you're in a noisy area or don't wish to disturb others. And if you're waiting for a call, it's a lot more comfortable than having to hold the set up to your ear for five or ten minutes

D. LEATHER CARRYING CASE is least expensive protection you can buy. It will guard against a broken case should the set fall off a table or drop onto a cement walk. It also gives you a carrying strap that you won't find on the CB transceiver itself



E. CB SET with rechargeable battery cuts operating costs by 90%. The recharger plugs into the set and overnight, gets it ready for another eight hours of use. Batteries can be recharged some 300 times and total life can run to 2000 hours or more





NOISE LIMITER found in many of the 3.5-watt sets reduces ignition noise and other pulse-type disturbances. In some sets it works automatically

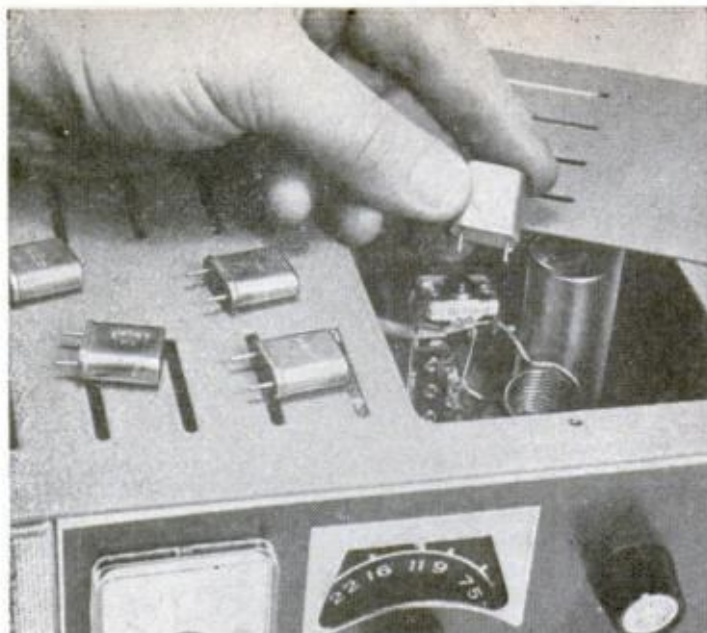
stays on, wearing out your batteries.

While hand-held sets are limited to single-channel operation, the larger ones are designed for multi-channel use by a twist of a switch. This is important if you intend to rely on CB radio to summon help to a disabled boat or car. If the one channel you have available on a single-channel set is crowded, you can't switch to another.

When you have a CB radio in your car or boat, make sure you get a microphone with a push-to-talk button. If you don't, you're going to have to reach down and flip a switch every time you want to transmit, and again when you're done sending and want to listen. This can be downright dangerous if you're trying to drive at the same time. With one hand holding the mike and one hand holding the wheel, you just don't have a hand left to throw the switch.

Receivers: Superheterodynes and superregeneratives are the two types you will encounter. In areas where the bands aren't crowded—fringe suburban and farmlands—the superregen is fine. But in urban built-up areas, it lacks selectivity, and you'll have to get a superhet.

Transmitters: Big or small, the basic difference is in power output, and the greater the power output, the greater the range. In some higher-priced sets power is improved by adding a speech compressor. But no matter what, power is limited to less than 3.5 watts output from the transmitter according to the latest FCC ruling (it will go into effect any day now and supplements the old "5 watts input to the final" ruling). To get this maxi-



CRYSTALS that can be easily changed by the set owner provide an advantage. It makes a multi-channel set out of 1-channel unit. Easy access is vital

imum output, an input of about 5 watts to the final amplifier is needed.

Batteries: If you're getting a hand-held set, batteries determine operating costs. Try for a set that uses standard flashlight or zinc-carbon penlight cells (working life, 50-100 hours). Then you'll be able to get replacements at the hardware store.

You'll also be able to get alkaline and mercury replacements (working life, 150-300 hours) for standard zinc carbon cells.

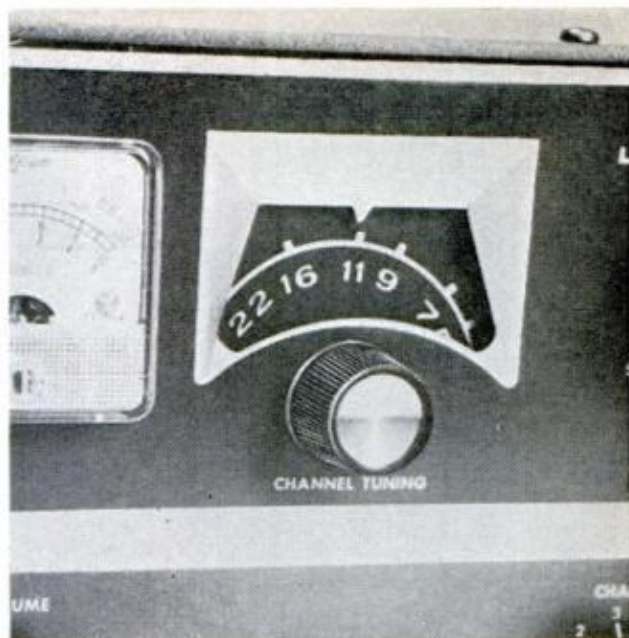
Initial price will be higher, but they'll give longer life. Because of the longer life, the mercury and alkaline cells often cost you less on a cost-per-hour basis. And you also get longer shelf life. If the set sits for six months without usage, zinc-carbon cells tend to go dead. Mercury and alkaline cells can usually sit for two years without losing any power.

Rechargeable nickel-cadmium batteries are another money-saving feature. By connecting up a recharger after each day's use you can get a total of 2000 hours or more life.

Circuit extras: These are more common in the larger, costlier sets. In more expensive hand-held units (\$45 and up) you can get a squelch control which will kill background static while you are waiting for a transmission. On the larger, still more expensive fixed units, squelch is almost standard equipment, and some manufacturers offer noise limiters which kill ignition and other pulse-type interference (a must in cars and boats).

Kits: Savings here are about 30% when compared to factory-wired sets. Performance is just as good.

Finally, do not buy any CB set unless



GOOD VS BAD. Selector switch that crystal-controls both transmitter and receiver (above left) is easy to use and absolutely accurate. Continuous tuning dial (right) on superregenerative sets only approximates channel settings.

the manufacturer states in a seal on the body of the transceiver that it meets all FCC specifications for Part 19 or Part 10 of the FCC rules and regulations. This protects you against unlicensable gear.

When checking out a specification sheet (available at the store), you'll have to weed out advertising claims from facts. In the box at the right is a spec sheet for a typical hand-held CB transceiver. Here is what it tells you:

This set is a superhet. Means more selectivity than a superregenerative type.

There's an rf stage which will give you greater sensitivity and ability to pick up a weaker, more distant signal than a set that does not have an rf amplifier.

4- μ v (microvolt) sensitivity. Signals as weak as this will give a listenable level from the set's speaker. The lower this figure, the more sensitive the receiver.

150-mw (milliwatts) power output is about the same as the average transistor radio. Outputs below 50-mw may be too small for noisy areas, and such sets must include an earphone jack. Outputs greater than 150-mw are wasted and shorten battery life.

Squelch control is an extra, rare in hand-held sets. Indicates better than average receiver circuitry.

In the transmitter section, crystal control is standard. The set cannot be FCC-approved if it is not crystal controlled to a .005% accuracy.

Four transistors in this section of the set is above average. Many sets have 2—3 transistors here and operate well.

Power output of 100 mw is the maximum allowed for unlicensed sets. Lower

power output is available, but generally will be too weak for more than 100 feet or so of range.

Range of 1-3 miles is under ideal conditions. Actual range may be 1/4-1/2 mile.

Modulation level of 50% or better is vital to clarity and good range.

Speaker doubles as microphone which is standard procedure in these sets.

Telescoping antenna folds into the set when not in use.

Weight is determined by construction of case. Heavier units are often sturdier.

If there is a carrying case, buy it for the added protection it offers. ★ ★ ★

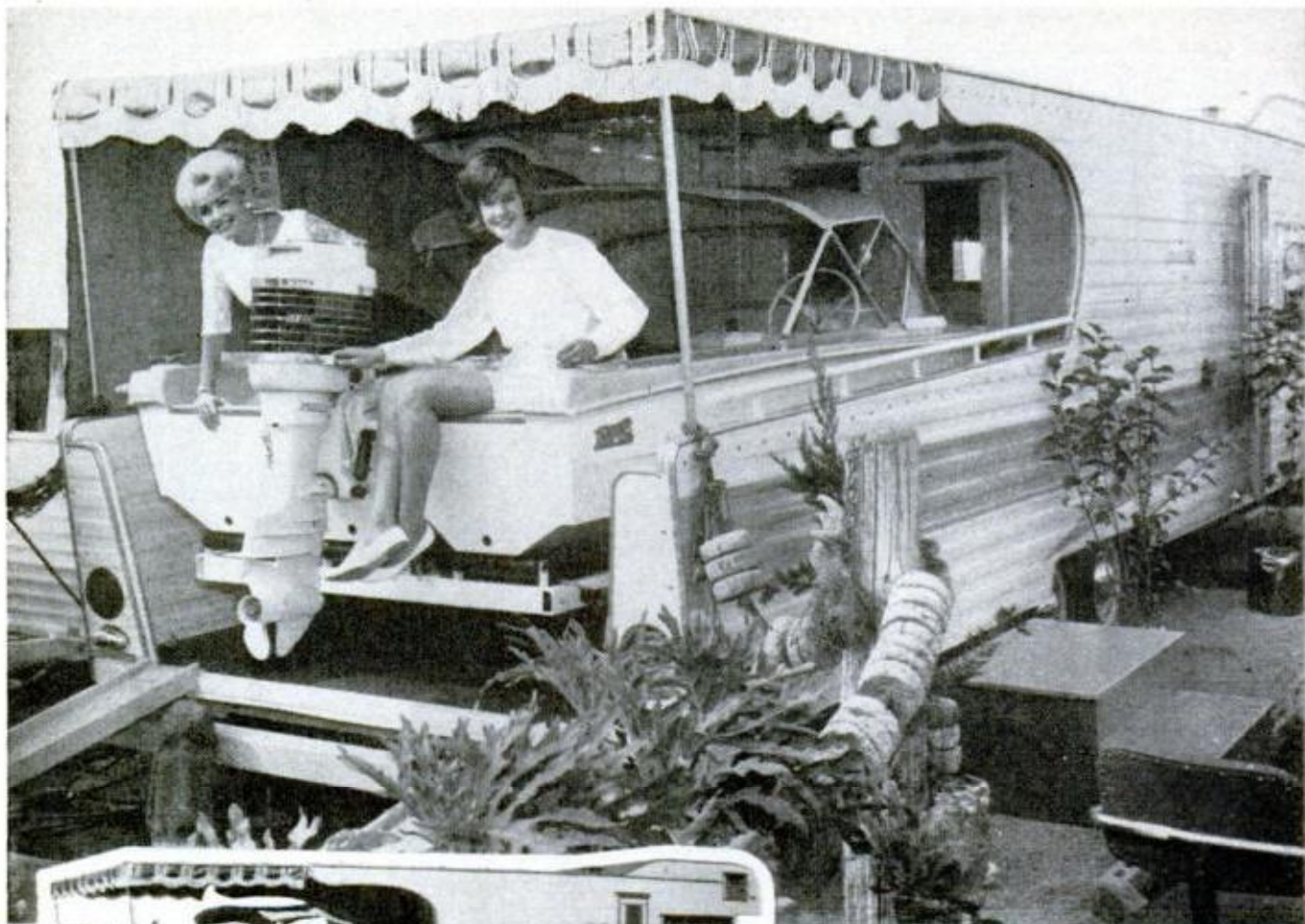
TYPICAL CB SPECIFICATION SHEET

RECEIVER SECTION:

Type: Crystal controlled superhet
 Seven transistors
 Rf stage: Yes
 Sensitivity: 4 μ v for 10 db signal-to-noise ratio
 Audio Power Output: 150 mw
 Controls: On-off switch, volume, squelch, push to talk

TRANSMITTER SECTION:

Crystal controlled
 Four transistors
 Power Output: 100 mw
 Modulation level: 50-75%
 Range: 1-3 miles
 Microphone: 3.2-ohm speaker
 Antenna: 40-inch collapsible whip
 Battery life: 75 hours
 Size: 6 1/2 x 3 1/4 x 2 1/2 inches
 Weight: 3 pounds
 Carrying case: None



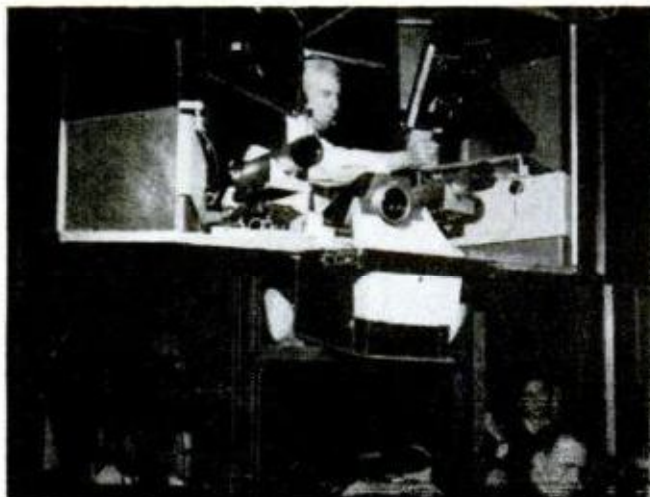
Portable Port

Just 33 feet from stem to stern, a new highway cruiser features a covered boat port-patio for toting a 14-foot catamaran which may be purchased with the trailer. It's made by Fireball Trailer Mfg., Inc., 12435 Lopez Canyon Road, San Fernando, California.

Forest-Fire Fighters Learn How from Armchairs

Developed for training U.S. Forest Service personnel, a simulator projects pictures of fire situations on a huge screen while other instructors play "roles" in

the fire and loudspeakers carry their voices and other fire noises. The trainees get experience in sizing up the fire, planning an attack and assigning equipment.



Golf by Color Slide

Combining color slides of famous golf courses with an electronic system that computes ball direction and distance from the impact, a new "driving range" allows amateur golfers to play indoors. The ball hits the nylon screen of the Golf-O-Tron. Then the next slide, showing the same hole from the new position, is projected.



Nuclear-Powered Dirigible?

With passenger and crew space located inside the airframe, instead of slung from a gondola, an atomic-powered dirigible has been proposed by a college professor.

Designed around a reactor now under development by General Electric, the huge airship would cruise, theoretically indefinitely, at about 100 m.p.h., propelled by two counter-rotating props in the stern. It would get lift with helium.

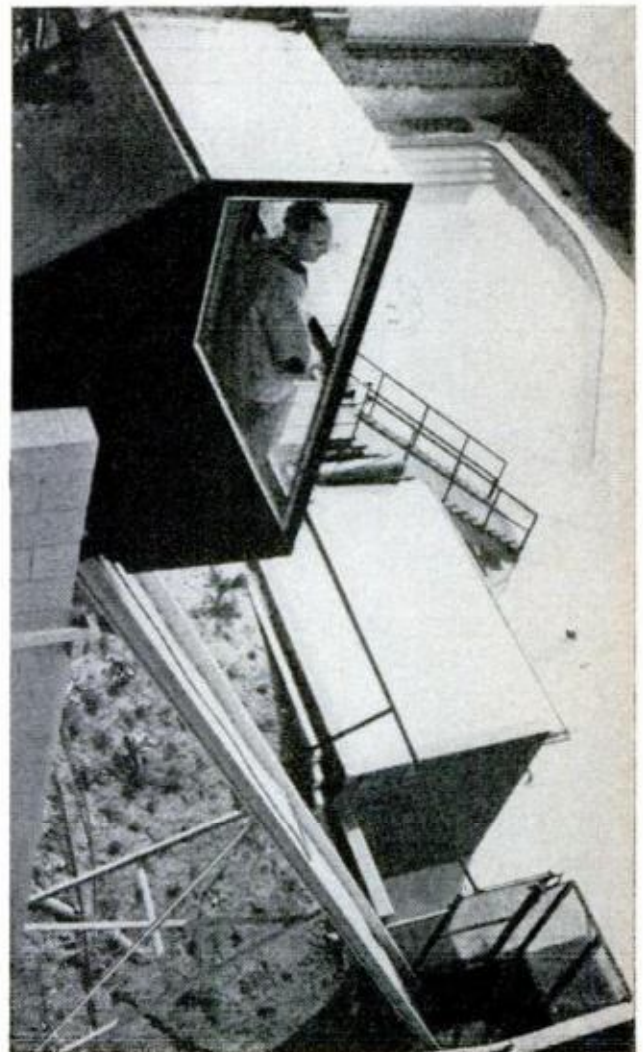


Start on Top

Shown here out of the water, a starting block for water skiers would be submerged just below the surface to allow skiers to begin their runs in an upright position. It's adjustable for varying depths. \$34.95. Carr Manufacturing Co., Big Rapids, Mich.

High and Outside

Glass-enclosed, a small elevator rides along the outside of a Los Angeles, Calif., apartment building from the second floor to its swimming pool. Another elevator, also outside and glass-enclosed, rides from the second level to the other floors of the 6-story building.



Ocean-Bottom Homes for Skin Divers

Can man live beneath the sea? For seven days these two proved Homo Aquaticus can be a reality

By Captain
Jacques-Yves
Cousteau

ON SEPTEMBER 14, 1962, I watched two men return to live in the sea, the element from which the beginnings of man emerged some millions of years ago.

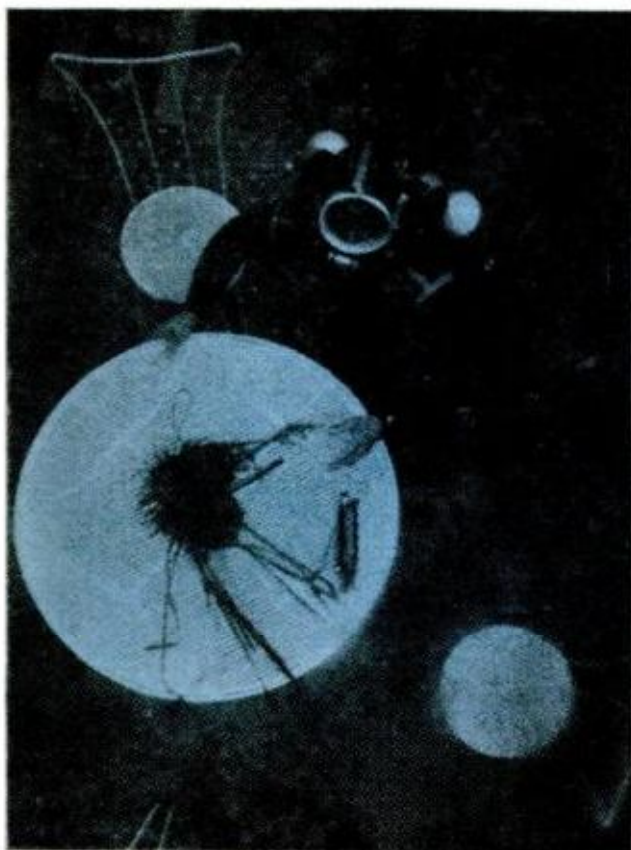
While this was the start of an experiment to prove that man can live and function in the pressures beneath the sea, to me it was much more. It was the culmination of years of work and belief; the birth of *Homo Aquaticus*—the fish man.

I am not a scientist, I am an explorer. As director of the Musée Océanographique in Monaco, it is my duty to explore the world beneath the oceans, bringing back facts and artifacts. But this has never been enough. My goal has always been to free man from the slavery of the surface, to invent ways and means of permitting him to escape from natural limitations, to breathe in an unbreathable element and resist higher and higher pressures. And not only to resist, but perhaps to adapt himself, to move about, react and live within the sea and take possession of it.

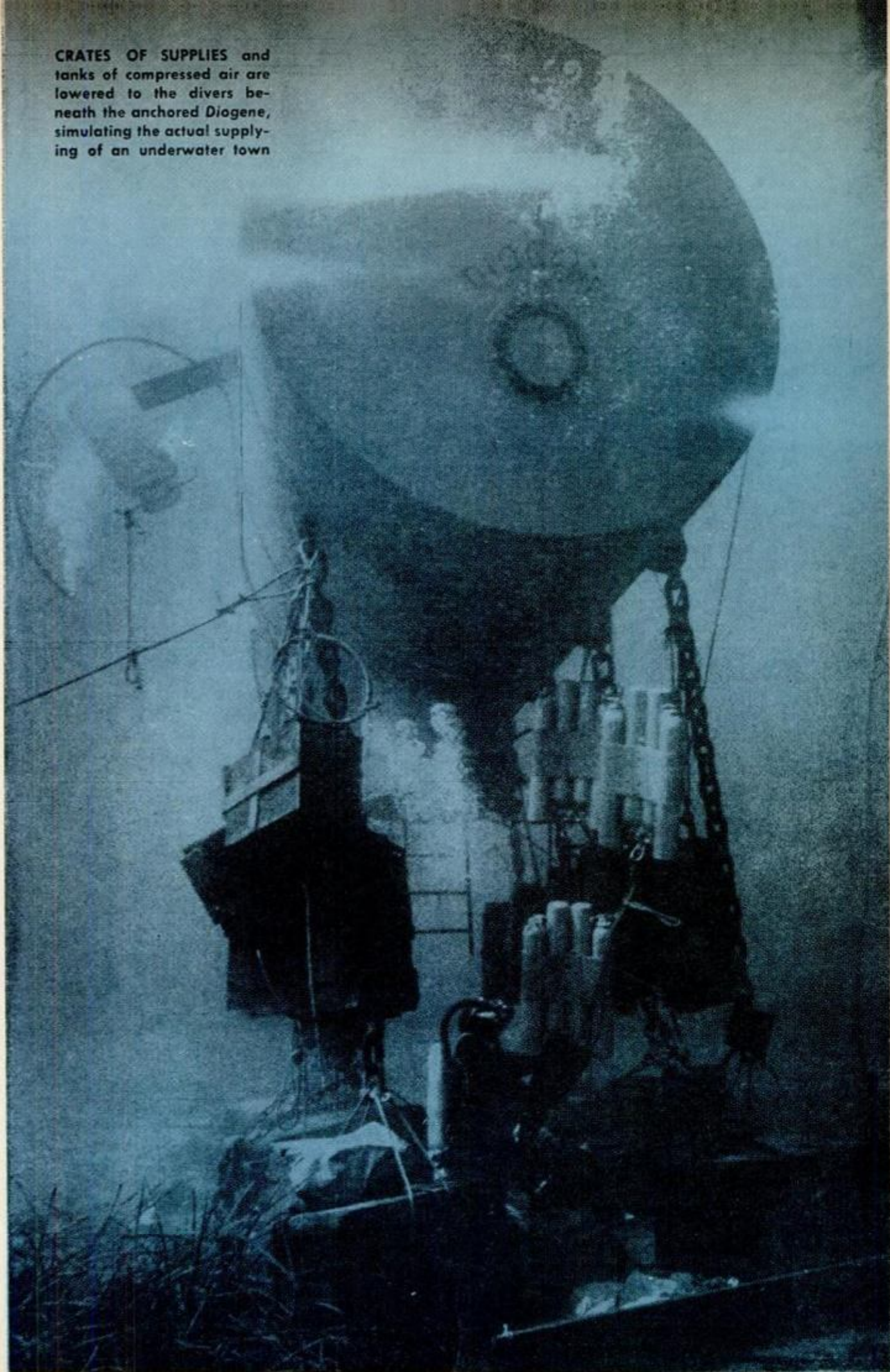
It has begun. Two men, experienced divers Albert Falco and Claude Wesly, remained underwater for a full week.

PERCEPTION AND DEXTERITY tests were given to the two oceanauts on the sea floor. Both divers completed the various tasks at normal surface speed

OCEANAUTS ENTER AND LEAVE the chamber by an open tunnel in the bottom. Like an overturned glass in a pan of water, interior pressure keeps out water



CRATES OF SUPPLIES and tanks of compressed air are lowered to the divers beneath the anchored *Diogene*, simulating the actual supplying of an underwater town



They lived in a 17-foot cylinder, eight feet in diameter. This "house" was supplied with air compressed to equal that of the sea outside, and the men went out into the water with Aqua-Lungs to work five hours each day. Our experiment was a success.

It began, for me, when I made my first dive with a face mask in Toulon, and I saw the world that was beneath the surface of the sea. After that came the invention of the Aqua-Lung, which I developed with Emile Gagnan. This cut the umbilical cord. A diver was no longer connected to the surface by lines and air hoses. He was no longer held to the bottom by lead shoes. With the skin suit and flippers and self-contained compressed air, he was free to move about in the manner of a fish. But there was one major problem that remained—the time limit of submersion.

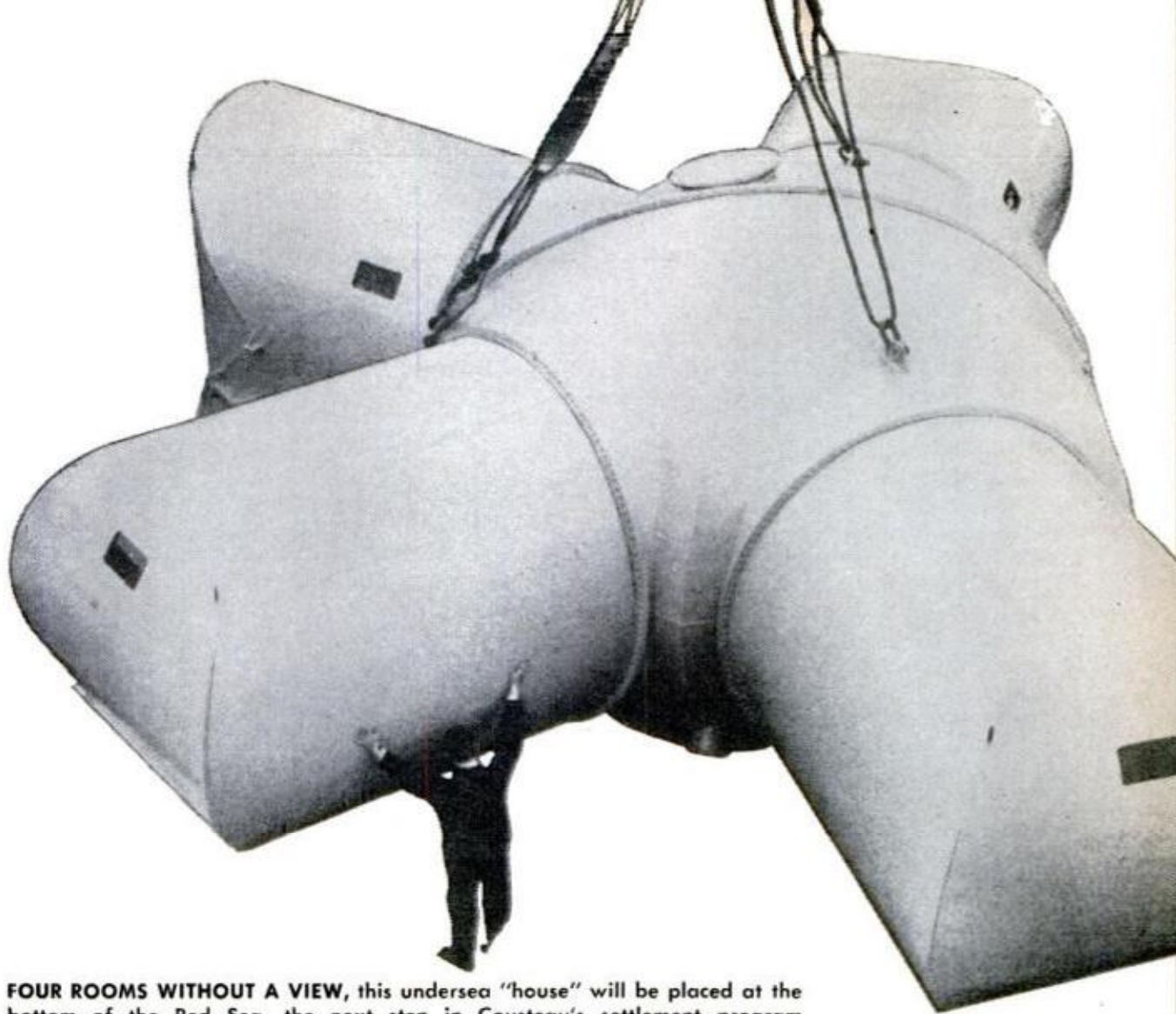
At atmospheric pressure on the surface a diver breathes 30 quarts of air per minute. Thirty feet beneath the water, where the pressure increases at the rate of 44 pounds per square inch for each 100 feet of depth, he requires 60 pounds of air per minute. An air supply sufficient for 100 minutes on the surface will last

only 12½ minutes at 230 feet beneath the water. Coupled to this problem is the body's reaction to pressures at extreme depth. In surface breathing, the blood and tissues normally dissolve the gases which constitute the breathing mixture. Under increased pressure (underwater) the blood dissolves more and more oxygen and nitrogen. This is a gradual change as the diver goes down and the body adapts to the change, reaching a level, or saturation. As the diver surfaces and the pressure is lessened, the dissolved gases gradually escape. If he surfaces too quickly, the internal pressure of the gases is stronger than the external pressure and the gases escape violently, forming bubbles in the blood, nerve tissue and bone marrow, causing paralysis, convulsive spasms and sometimes death. The diver must therefore surface slowly, going through stages of decompression.

In a five-hour dive at 75 feet, the diver must take three hours and 32 minutes to surface. This fact of life is what made our time for work and exploration extremely limited. The only solution, I decided, was to create a living quarters on the bottom of the sea so that divers could stay down for weeks at a time, adapt to

DOCTORS, WHO ARE ALSO EXPERT DIVERS, made daily visits to the oceanauts for a medical check, keeping complete records of their acclimatization





FOUR ROOMS WITHOUT A VIEW, this undersea "house" will be placed at the bottom of the Red Sea, the next step in Cousteau's settlement program

the environment and not be concerned with the need for decompression.

So, we designed and built our first underwater "house," and christened it *Diogenes*.

The walls of our cylinder were of sheet metal only .16 inch thick. They would be stabilized by equipressure, creating a pressure within the chamber equal to the pressure of the water outside. On the floor of the cylinder was a tunnel opening on the water, with a ladder for entering and leaving. The cylinder was actually like a glass upturned in a pan of water, nothing more.

Off the coast of Marseilles, we towed it into position, sank it to the bottom in 33 feet of water—the equipressure established as it went down—and anchored it with heavy chains to huge blocks of pig iron.

On the surface were our two research ships, *Espadon* and *Calypso*. This was the lifeline to the shelter. Hot water for a shower was piped from the boats through a plastic tube, and meals were cooked on the boats and sent down in ordinary pressure cookers. The remainder of the equipment operated from the main con-

trol on the Island of Frioul. There was electricity to operate the four infrared lamps to heat the chamber, and for their radio and phonograph. There were also three telephones, a television set for receiving the National Programme, and a special line for our closed-circuit television camera.

When all was ready our divers—the first oceanauts—went below and took up residence. For the first hours it was like an apartment house, with doctors, technicians and photographers coming and going. But then they were alone, and at my headquarters on the Island of Frioul, the rest of us settled before the closed-circuit television to watch and listen to everything the divers did and said in their ocean-bottom home.

Our project was simple, but exciting. No man has ever lived beneath the sea for more than 12 hours. In a submarine, atmospheric conditions are created, so the occupants are actually on an island beneath the sea. Our oceanauts would live under hydrostatic conditions. The shelter would keep them dry and supply them with an air mixture they could breathe, but the pressures would equal

the sea pressure. We wanted to know the physiological and psychological effects of these conditions on the human body.

Falco and Wesly were chosen for this task for many reasons. They are both excellent and experienced divers. Falco is our best diver, so he was made the leader because I know he won't take chances foolishly. Besides, Wesly is entirely devoted to him and will follow him in anything. It was Falco who went down 800 feet in our experimental "sea saucer" to explore the pitch black canyons off Port-Vendres. Both men are steady and without fear.

But on the first night Falco awoke from a nightmare and could not return to sleep. He's recorded his feeling in his diary:

"I must get out. I feel suffocation, anguish, panic. A band is throttling me. I wake up. I go to the exit and look at the water. I check the gauges one after the other. All is normal. Claude sleeps peacefully. I go back to bed, but I cannot sleep. I feel quite alone, isolated, trapped. I have an irrational fear. What if the porthole were to break? I wish I could sleep. The noise of the air escaping from the water is infernal—much more apparent than by daytime. The bubbles

burst incessantly, as in a huge kettle. It is like the noise of huge pebbles hurled on the beach by tremendous waves. Claude is sleeping very well."

This was the only period of panic. The next day they began their period of work; two hours in the morning and afternoon, one hour in the evening. The major project is to build a large fish trap—a wire enclosure for collecting and holding fish. The two men left the shelter in the morning and "went to work." They had no trouble in handling materials or using tools. This in itself was a revelation, outdating the haphazard use of nets for fishing. As Falco wrote in his diary: "The fish are extremely docile. We could herd them with ease into a fish cage 10 times the size of the one we've built."

Following each work period our two doctors, an endocrinologist and a physiologist who are also expert amateur divers, went below to put Falco and Wesly through psychotechnical tests, such as placing together cubes of various colors. There was also a complete physical examination.

The record shows that the fatigue of the oceanauts was at its worst at the end of

(Please turn to page 182)

Strange Sounds of the

IN ANCIENT SEAS, countless eons ago, animals began making noises.

Underwater sounds went undetected until recently chiefly because vibrations within the water are imprisoned by the water-air surface film.

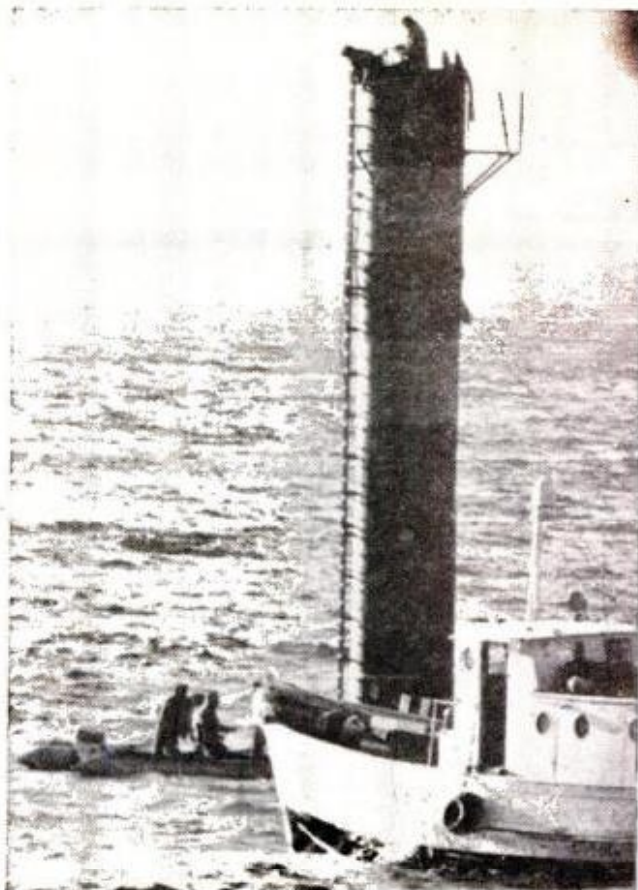
A fish's swim bladder, a gas-filled bag, picks up and amplifies vibrations in the body. A wide variety of fishes make special use of it, with definite drumming muscles extending from the backbone or skull to the swim bladder. Contractions of these muscles throw the swim bladder into vibration, producing sounds. The croaker and its kin produce a roll of rapid grunts or croaks. Older and larger fishes pitch the note more than an octave below younger and smaller ones of the same kinds, showing that their voices change as they grow!

Along our Atlantic shores in Chesapeake Bay, the normal influx of migrant croakers ready to spawn kept sleepless a large number of Navy personnel and scientists during the spring and summer of 1942. A hydrophone network had been

installed to warn coastal defenses if any Axis submarine approached. In late May the croaker invasion began, and during the evening hours the loudspeakers of the warning system sent out sounds resembling pneumatic drills in concrete.

By the time the din had been traced to the croakers, the Bay held between 300 and 400 millions of these fish. The coastal defense system is now equipped with croaker-proof filters.

The sea is full of sounds, for all manner of living things from shrimps to whales call back and forth. Men eavesdropping on the underwater world with the help of hydrophones have come up with every possible comparison: buzzing, cackling, chirping, clucking, crackling, croaking, drumming, grinding, groaning, grunting, moaning, snapping, squawking, squeaking, whining and whistling. In addition they have listed noises suggesting coal rattling down a chute, the dragging of heavy chains, a loose bearing on a reciprocating engine, the irregular put-put of an outboard motor about to stall, steaks sizzling,



OBSERVATION TUBE for viewing undersea life is put into position off the southern coast of France as part of Cousteau's oceanographic research program



LOWERED INTO PLACE to cap the 180-foot tube, this floating island will house scientists studying the habits of sea life from within the submerged tube

Skin Divers' World

the dull roll of a soft-shoe dancer on the top of an empty barrel, and a band saw cutting through sheet metal.

The use of sound varies greatly between the sexes. The male satinfin shiner defends a definite territory with thumping sounds. For a female, though, he purrs.

Among the loudest recorded calls are those of the male toadfish in mating season. He roars like a foghorn, repeating the sound at 30-second intervals. A pet sea robin makes a purring sound when rubbed, but emits a burst of unpleasant noise when annoyed.

Dr. Marie Poland Fish of the Narragansett Marine Laboratory (University of Rhode Island) noticed that among 26 different kinds of call-makers only three raised their notes above 1600 cycles per second. These stridulatory sounds went as high as 4800 c.p.s.—almost four octaves above middle C. The "growl" of toadfishes off Bimini in the Bahamas, however, ranges as high as 6000 c.p.s.

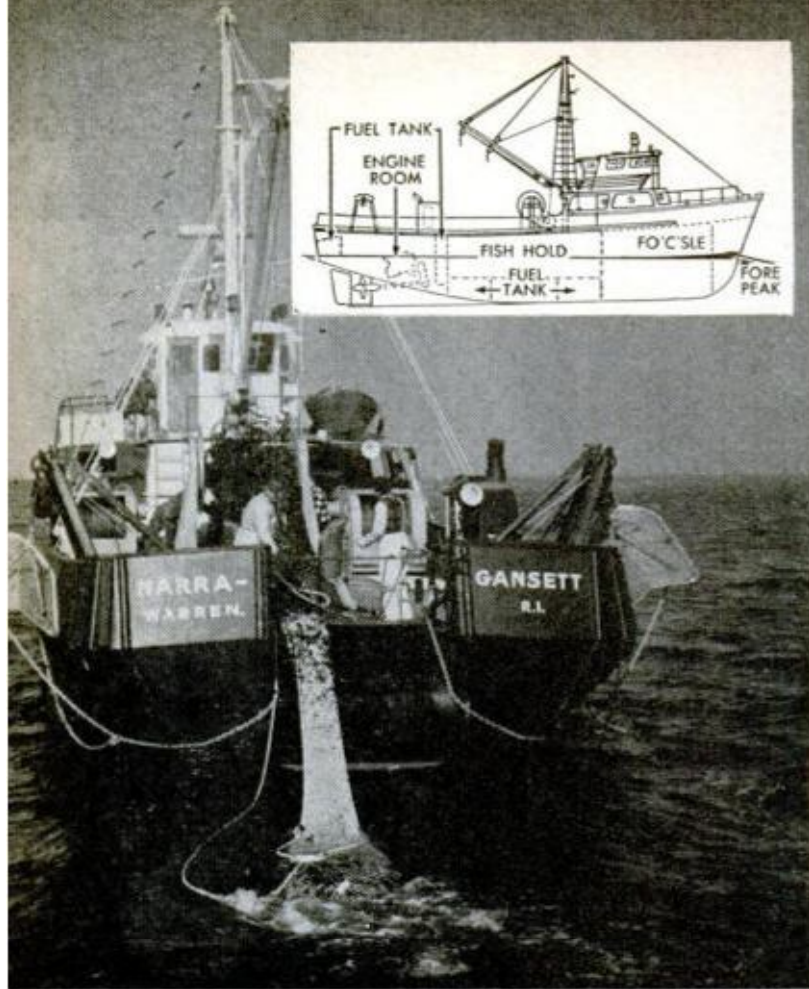
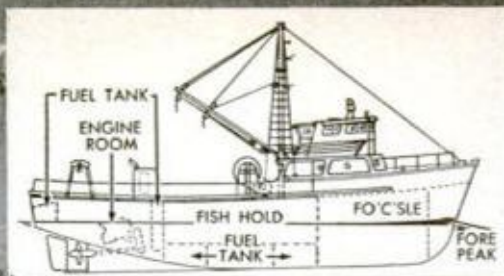
A fish hears perfectly with inner ears close to the brain. Those living around coral reefs must suffer at times from the

din, for of all underwater noises the most widespread and persistent come from small animals in sea crannies. They are not fishes but shrimps, which rarely grow much beyond two inches. These noisiest neighbors in the world of the skin diver are called snapping shrimps or pistol shrimps because one claw is greatly enlarged and modified to form an effective water pistol.

Dr. John C. Lilly, an experienced neuropsychologist, is exploring the possibility of interspecies communication between man and dolphin. Whether the animals will prove able to learn simple English more easily than Dr. Lilly and his associates can learn to bark, squawk, click, whistle, creak, blat and quack like porpoises, remains to be seen.

Learning to identify and make use of underwater sounds is a new scientific game. The denizens of the seas are infinitely varied and mysterious. Their voices, coming from the deeps, fairly cry for attention.

—Condensed from *The Senses of Animals and Men* by Lorus J. and Margery Milne.



Convertible Fisher

The *Narragansett*, an 83-foot automated fishing vessel, can be converted to trawler, seiner or drag fisher in less than a day.

Built by Blount Marine Corp., Warren, R.I., *Narragansett* features trawl doors in the stern, and a 130-horsepower diesel winch and boom for hauling nets in any weather. She is also equipped with radar, fish-finder recorder and sonar. All equipment is operated off a single console overlooking the deck.

The main propulsion engine is a 380-horsepower Caterpillar D-353, which drives a 60-inch Hustad controllable pitch propeller through a gear-belt system. The craft has a speed of 11.2 knots. Her 5000-gallon fuel tanks allow a cruising range of 2500 miles. The fish load capacity is 4800 cubic feet, and there are provisions for lobster tanks.

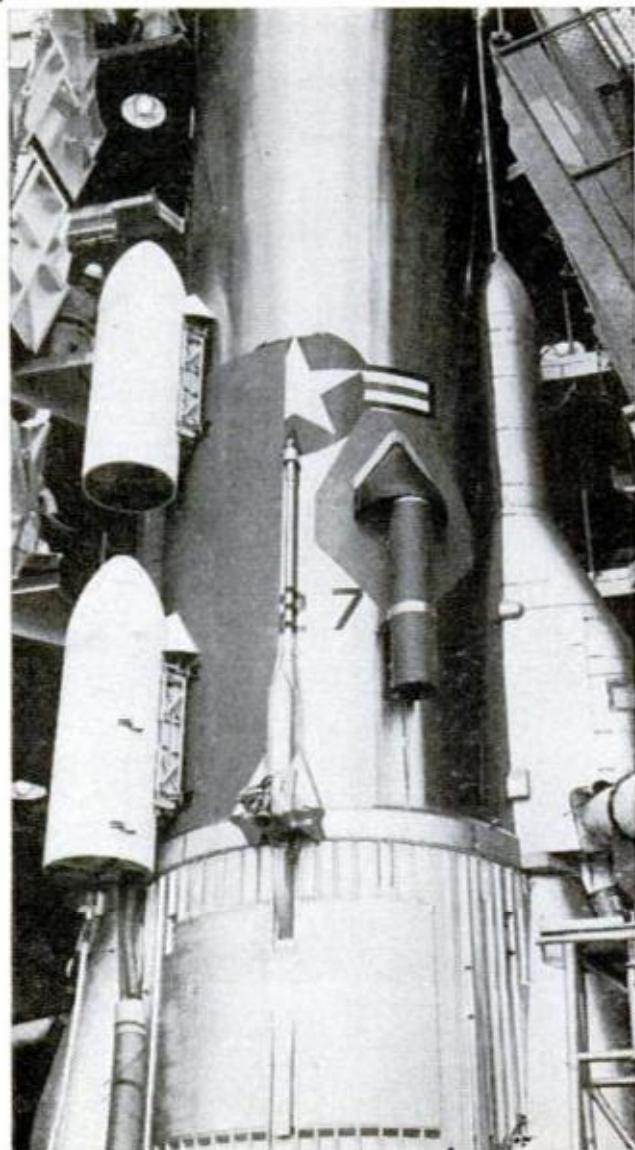


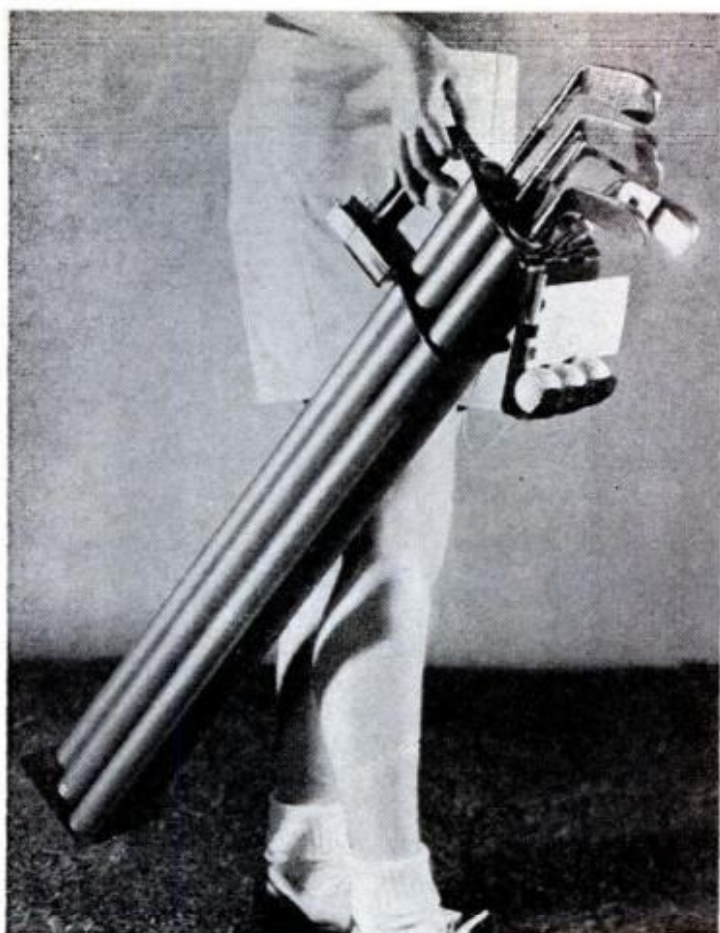
It Parks—Sideways

Wheels that extend from under his car's chassis let a Belgian designer-engineer drive sideways into the tightest of parking places. Spending more than \$40,000, he added to his Chrysler Imperial such gadgets as radio controls so he can call his car to him at the curb and radar to slow it if it nears others in a fog.

Hitchhikers into Space

Instruments for supplementary experiments in space can now be sent aloft in pods riding piggyback on Atlas ICBMs. The units, each carrying several experiments, can radio data from as high as 600 miles. The standard General Dynamics pod is 8½ feet long and has a payload of 350 pounds. One type is recoverable, the other burns up on re-entry.





Lightweight Golf Bag

Weighing a little over a pound, a plastic golf bag has individual tubes for five clubs and special compartments for balls and tees, cigarettes and valuables. Designed for lady golfers by W. J. Gamin Co., Jackson, Mich., it sells for \$7.50.



Big Wheel

Operated by pedaling a chain-driven rear wheel against the inside of its large wheel, an unusual unicycle is steered by the rider's leaning to right or left. It's a product of Cap's Cycle Shop, New Westminster, B.C.

Light-Beam "Rifle" Zeroes In on

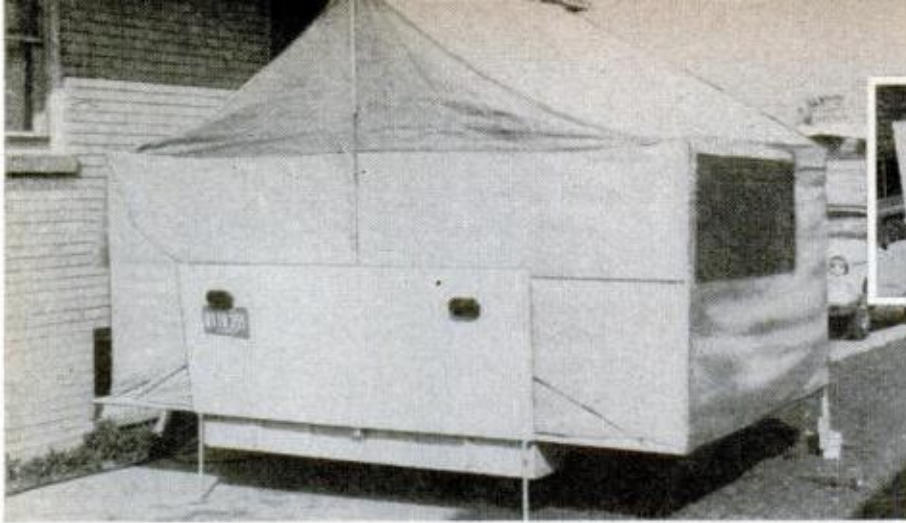
What looks like a new infantry weapon is actually a laser range finder that measures distances by firing light beams at targets—up to seven miles away.

Light leaves the right barrel of the unit

Targets Seven Miles Away

at a speed of 186,000 miles per second and is reflected back into the telescope (left barrel). A timer computes the distance. The Colidar (coherent light detection and ranging) is made by Hughes Aircraft.





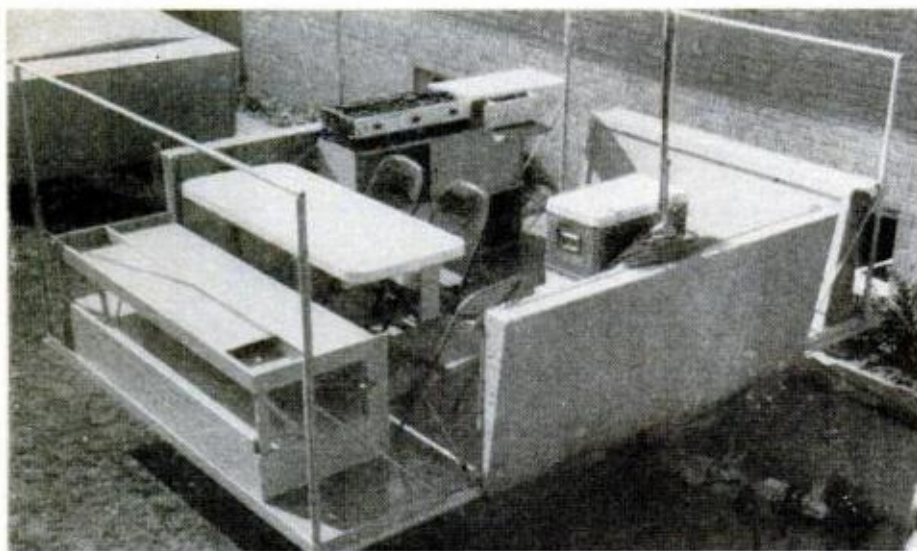
EASILY ERECTED by one person, tent slides up on metal rising track when sides of trailer are pulled out. Closed for travel, trailer is 50 inches high, 6 feet 7½ inches wide

Six Can Eat and Sleep in Camper

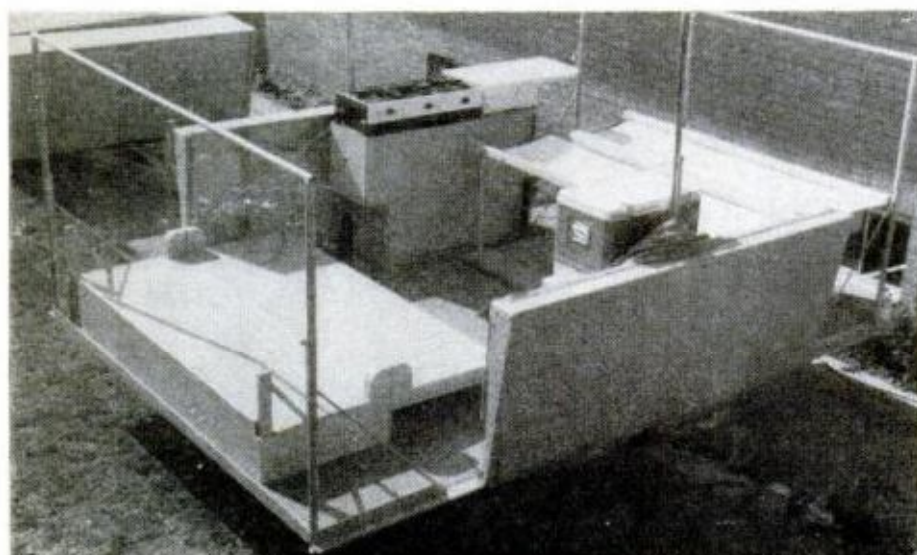
UNFOLDING RAPIDLY at a campsite—and then converting easily from kitchen-dining room to bedroom for six—a new camping trailer offers floor space of 7½ by 11 feet.

Designed by David Melbye of Oak Lawn, Ill., the unit has a three-burner stove, refrigerator, storage space, benches, bunks, table and two storage drawers under the trailer.

The aluminum-bodied camper, made by Rollar Corporation, Evergreen Park, Ill., sells for \$795 unfurnished, \$995 furnished.



SET UP AS KITCHEN and dining area, one pair of bunks fold to provide seating at plastic-topped table. The stove, ice box and cabinets are portable to afford easy storage when unit is closed. Heavy-weight duck covering is removed to show interior



CONVERTING to sleeping area in less than 10 minutes, four bunks fold out, and the table disappears beneath one of the bunks. Area beneath bunks on right is large enough for sleeping bags

Driving Opel's New Kadette

By R. F. Raguse



Photographs by
Heinz P. Schlichting

EVERY MORNING during a two-week winter test in Germany, PM drivers found they needed a push to get the Kadette up out of the driveway. Gas consumption was excellent considering the weather, but performance made carburetor appear to be set too lean. Plain lines drew flattering attention

THE OPEL KADETTE from General Motors' West German subsidiary might be called the European Chevy II. It is mechanically simple, with a water-cooled, in-line, OHV four-cylinder engine up front, driving rear wheels. Departures from the ordinary are in the rear suspension and drive shaft.

The plain-Jane Kadette gave test drivers the *impression* of more room for four than the Volkswagen, with which it's sure to be compared. But, actually, the VW seat room is nearly an inch wider. Despite quiet styling, the test Kadette outside PM's European office for two winter weeks drew lots of attention from passers-by.

The 60.6-cubic-inch engine has a full-flow oil filter, 7.8:1 compression ratio, and 46 horsepower—twice that of its pre-war namesake. Its 200-watt generator strained to keep the six-volt battery up. The drive shaft runs from the transmission almost to the differential, up forward of a single universal joint. Opel's rigid rear axle is attached slightly off center on elliptical leaf springs by pivoted control arms to limit its motion. But the extra unsprung weight requires stiff springs.

With only 1477 pounds curb weight, the Kadette out-accelerates the VW. At 1820

pounds test weight, PM's unit did 0-62 (0-100 kilometers an hour) in 28.2 seconds. Top speed was 74.1 m.p.h. But light weight has its darker side: We had to be pushed out of a snowy drive every morning.

On good roads, Kadette rack-and-pinion steering and independent front suspension are fun to use. Cornering stability is fine but steering gear in front of the block is vulnerable to deep-rutted roads. Turning diameter is less than 33 feet. All four forward gears are synchromesh but even experienced drivers needed several tries to engage reverse, which often clashed.

In Europe's worst winter in years, the Kadette gave us 28.9 m.p.g. overall, but testers felt the mixture was over-lean.

After Opel was committed to the Kadette, along came the Morris 1000, Renault Dauphine, and DKW with more original designs. Last August Opel finally showed 40 Kadettes, but none reached dealers until October. Even so, its conservative lines, economy and reasonable performance may still outshine competitors. GM won't admit import plans, but for comparison the current Opel Rekord costs about \$500 more here than in Germany. The Kadette goes for \$1269 there.

Diaries of Destruction

Will Their Secrets Make Flying Safer?



Robot spies that withstand searing heat and giant impact, are pinpointing air-crash causes

By Frank A. Tinker

TUESDAY IS THE TAIL END of the exodus from Miami for its week-end vacationers. Last February 12th was no exception. Northwest Airlines' Flight 705, a Boeing 720B jet, had 38 passengers aboard when it took off that afternoon and melted into a threatening sky. A standard radar departure gave a 'steer' around weather.

The Miami ground controller was helping veteran pilot Roy Almquist by radio to avoid the worst of the buildup when the heavy weather obliterated the plane's 'blip' on his scope minutes after takeoff.

Then, at 48 minutes past one, Flight 705 reported, "We're just out of 17,500 (feet) and standing by. . . ." After this, silence. Further transmissions from the controller went unanswered. Those few words were the last clue to the big jet's fate until its wreckage was found by searchers next day

splashed over the Florida Everglades.

Civil Aeronautics Board investigators and rescue teams dodged alligators, snakes and other wildlife getting to the site aboard tracked "weasels," able to negotiate the shallow water and bogs of the Florida badlands. But this investigation contrasted dramatically with most air crash probes you've read about. Instead of salvaging every scrap of metal and fabric, and piecing it together in an attempt to find from the assembled wreckage the most likely cause of the disaster, this time the crash detectives sought and found a single item about the size of a basketball.

This was the flight recorder, an instrument that traces the plane's movements during its flight and fatal plunge. It is a diary of destruction, a second-by-split-second account of just what the aircraft

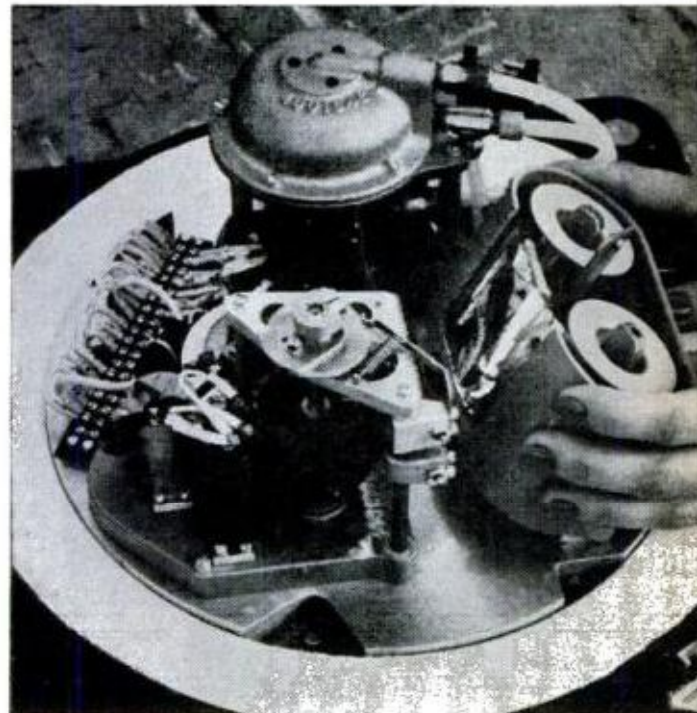
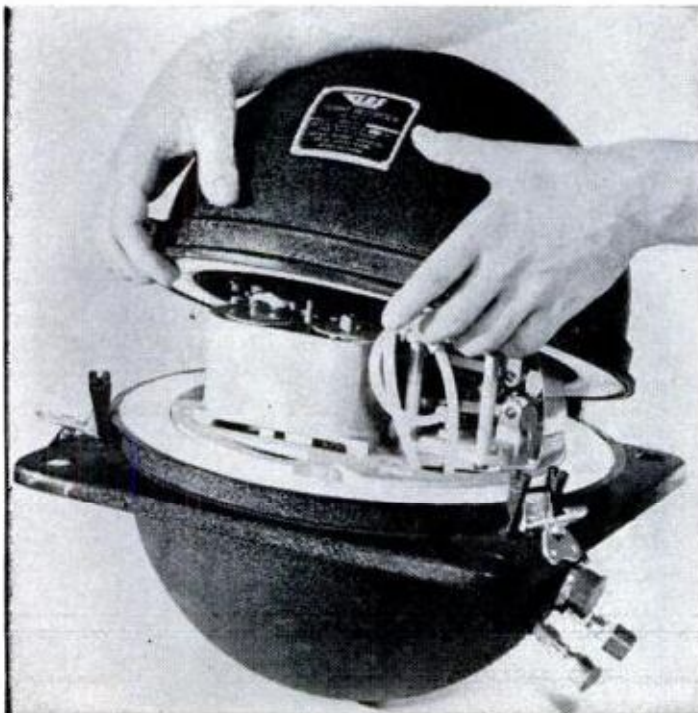


AIR CRASHES, like ill-fated Flight One (left), may not be in vain. Its flight recorder (below), though damaged, solved this crash, may help prevent others



RECORDER'S CASE, when new, looks like this. It is constructed doubly thick to withstand G-forces of 100 and insulated to withstand heat of 1000° C.

RECORDER'S INSIDES include metallic tape that is inserted just like roll of film, and mechanism to record information on four aspects of each flight





EVERGLADES CRASH last February was typical of new trend in accident investigation. Crash detectives searched first for jet's flight recorder, went back later to clean up wreckage. But recorder told them all they needed

did in its crucial final moments of flight.

The recorder's tracings are the investigators' primary tool because, as happened in the Everglades crash when all on board were killed, the instrument's voice often is the only one to return from the grave and explain what happened.

Flight 705's recorder was flown immediately to CAB headquarters in Washington for the "readout," which would tell its tragic tale and perhaps reveal which part of the aircraft's system had failed.

Despite the impact which shredded the craft, the recorder did its job. It showed that after the last transmission the jet climbed as planned to 19,400 feet. The pilot reduced his airspeed to 250 knots to lessen the impact of the turbulent air.

But this was no ordinary storm. A tremendous buffet of descending air must have struck the craft, for the recorder at this point showed a sudden negative (downward) force of 3.5 times that of gravity. Aircraft wings are stressed primarily for opposite loads, and this blast far exceeded the design limits. Thirty seconds later, according to the spy, the plane nosed over. Its speed built to 620 m.p.h. and the indicator went off the graph with

10,000 feet still to go in its drop to destruction. The sturdy black box passenger thus pointed an accusing finger at the violent turbulence aloft.

During the half dozen years recorders have been in use, they have proven their value many times over. They have been battered, burned and crushed beyond recognition, but still usable. They have been pulled from burned-out hulks and from crashes in which scarcely any other fragment of the plane equalled their own size.

The secrets these mechanical spies have revealed are important and often surprising. The recorder tape taken from American Airlines' ill-fated Flight One of March 1, 1962 is typical. This plane crashed in Jamaica Bay, N.Y., after takeoff from Idlewild, killing all 95 aboard. Although the instrument was badly damaged (photo, page 109), it was usable for readout. The sketch (right) shows its tracings.

As interpreted by the CAB experts, the tracings showed that lift-off came at 28 seconds past 10:07. Nine seconds later, only 80 feet off the ground, a gentle left turn was started, because pilots must comply with Idlewild's noise-abatement program: "... do not delay turn. . . ." At 48 seconds

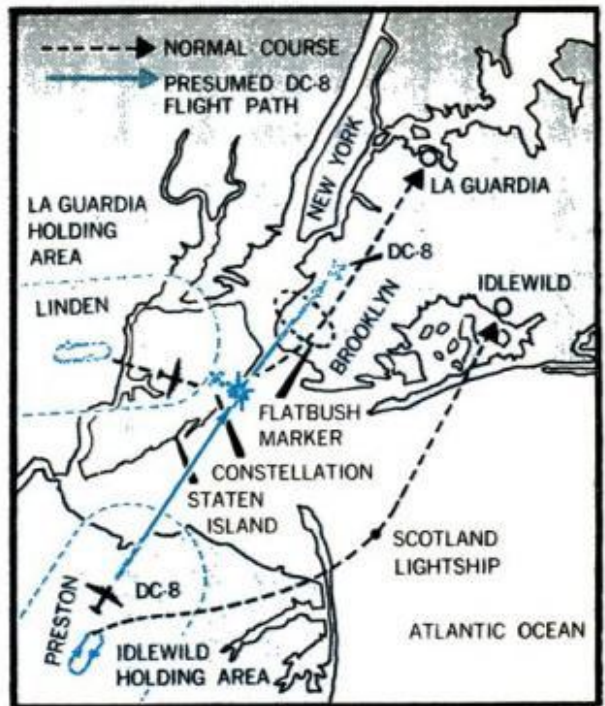


SOME RECORDERS are carried in plane's wheel well, others in radio rack. Employee points to niche which carried recorder of F-27 that crashed in Salt Lake

past the minute, the controller instructed Flight One to contact Departure Control. Six seconds later a second turn to the left was begun and at one second after 10:08 the pilot reported on Departure Control's frequency. All this can be compressed into a few millimeters of tape.

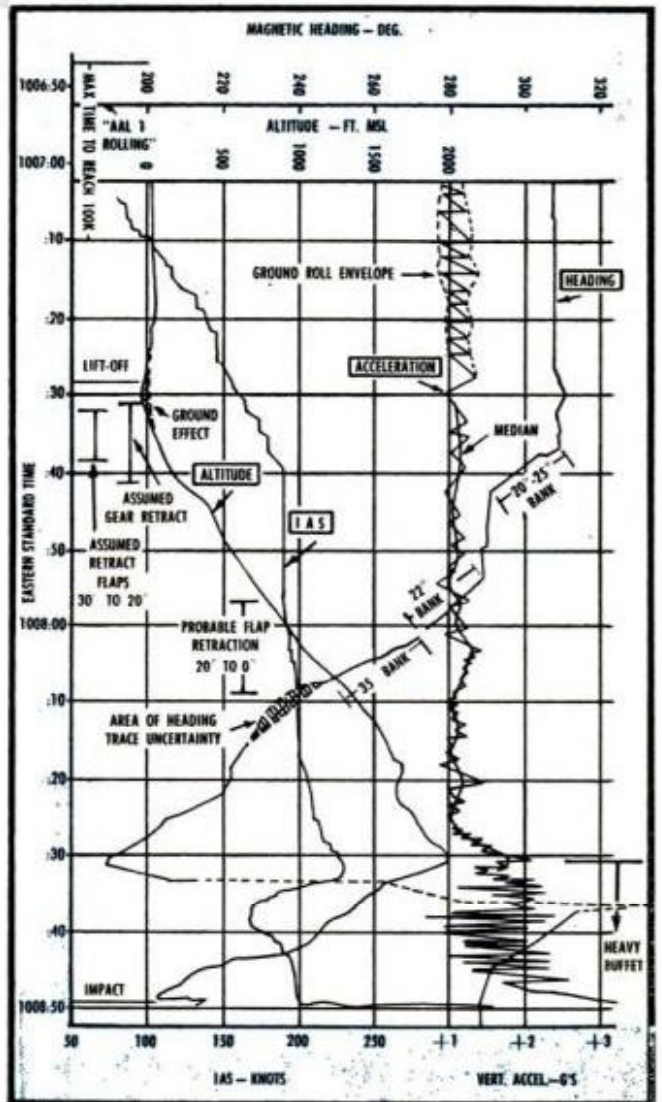
When flaps were raised, a surge in airspeed from 190 to 200 knots left its mark on the recorder. The plane was in a bank—shown by the rate of turn in the heading trace. At seven seconds past 10:08 that rate suddenly tripled! Twenty-four seconds later, the direction of the turn seemed to reverse itself instantly—an impossibility with large planes. Interpreters reasoned that here the gyro compass spun as the bank approached the vertical and its balance mechanism was upset. The acceleration trace shows heavy stall buffeting. Unnaturally high airspeed indicates a possible sideslip. Some of these maneuvers were confirmed by witnesses, but the actual details could be distinguished only by the recorder itself.

At 49 seconds past 10:08, less than two minutes after takeoff, the Fordham University seismograph recorded the final impact of Flight One. It was also the last



WORST CRASH in history occurred when a DC-8 collided over Staten Island with a Constellation. Recorder showed it flew past holding area section into path of La Guardia-bound plane

FLIGHT-ONE tracings gave investigators detailed account, in fractions of seconds, of short, tragic flight from roll-out to crash. (Details in text)





READOUT MACHINE aids investigators. Tape is smoothed out under glass, tracings are magnified on screen, and computer measures each minute marking

OTHER RECORDERS may also be placed in planes. Investigators would like more channels on present flight recorders, plus voice and maintenance recorders



moment of life for 87 passengers and 8 crew members.

After tests with similar planes, duplicating the maneuvers described by this recorder, the CAB concluded that a malfunction in the rudder control system must have thrown the plane out of control.

The precision and impartiality of the recorders are often uncomfortable. The mid-air collision of a Douglas DC-8 and a Lockheed *Constellation* over Staten Island, N.Y., which killed 128 persons in 1960, is a case in point. CAB experts recovered the fire-blackened DC-8's recorder. The *Constellation*, a piston-engine plane, didn't have one. Reading back along the tape from the moment of impact, experts could follow every maneuver of the plane and compare them with separately recorded instructions given by air-traffic control on the other end. Together they told a dramatic tale.

Approaching New York in zero visibility, United Airlines' Flight 826 from Chicago, a four-engine jet, had been cleared at 10:15 to "Preston Intersection." This is a precise imaginary point where signals from two omni range stations intercept one another. The assigned route was along Victor Airway 123; altitude 25,000 feet.

But at 10:25:09, the New York control center changed instructions. "United 826 cleared to proceed along V-30 until intercepting V-123 and that way to Preston. It'll be a little quicker."

The plane's recorder dutifully traced the

change in direction. But the 11 miles thus saved meant that the descent had to be steeper. At that same moment the TWA *Constellation*, a four-engine piston plane flying as Flight 266 from Columbus, Ohio, was heading for an area only five miles North of Preston, under direction of La Guardia airport's radar controller. If all had gone according to plan, the DC-8 would have pivoted eastward over Preston while the *Connie* went on in to land.

At 10:30:07 the center controller advised the DC-8: "Descend to and maintain 5000 feet." A few minutes earlier its recorder had begun to show a continuing increase in airspeed as it slipped down through its shortened route. It passed through 14,000 feet—losing 7000 feet in three minutes, according to the recorder.

"Look like you'll make Preston at 5000?" the controller asked.

"Er, will head it right down . . . (then a garbled word or two)."

At 10:32:16 the *Connie* was one minute from its holding pattern at Linden, N.J. Control again contacted the jet: "United 826, if holding is necessary at Preston, (use) southwest one-minute pattern. . . ."

Now the recorder showed the jet's speed at 410 knots, almost twice as fast as the rule book specifies. Then there was an abrupt slowing as the pilot probably used reverse thrust.

At 10:33:01 jet Flight 826 advised it was passing through 6000 feet. Control an-

(Please turn to page 176)

Mountain Cats on Treads

Steep slopes and rugged terrain are simple obstacles for a new group of mountain tractors. Traveling on rubber tracks (which are actually motorcycle tires), these rough-country rovers climb 45-degree slopes with ease.

The machines, which have six-horsepower engines, are steered by hand controls that operate friction clutches.

Shown at right is the *Kodiac* (\$775) built by National Mfg. Co., Colorado Springs, Colo.; below is the *Power Track* (\$750) by Power Track Co., Denver; and the controls at lower right are on the *Bobcat* (\$650) by Bobcat Industries, Fountain, Colo.

The machines weigh from a little under 200 pounds to 300 pounds.



Airborne Police Dog

Alsation dogs, trained for police work in Britain, are now learning to chase criminals from helicopters.

A special kennel built into the side of the aircraft carries a dog on the mission. When the fugitive is sighted, the whirlybird swoops down, and the dog jumps out and gives chase.

The new method, according to the police of Oxford (where it is being tested) is especially valuable when the hunted man is sighted in rough terrain where cars can't go and the helicopter can't land. The dog can jump out, keep the man cornered until the helicopter can find a landing place, and the police then make an arrest. The dogs are called hover hounds.





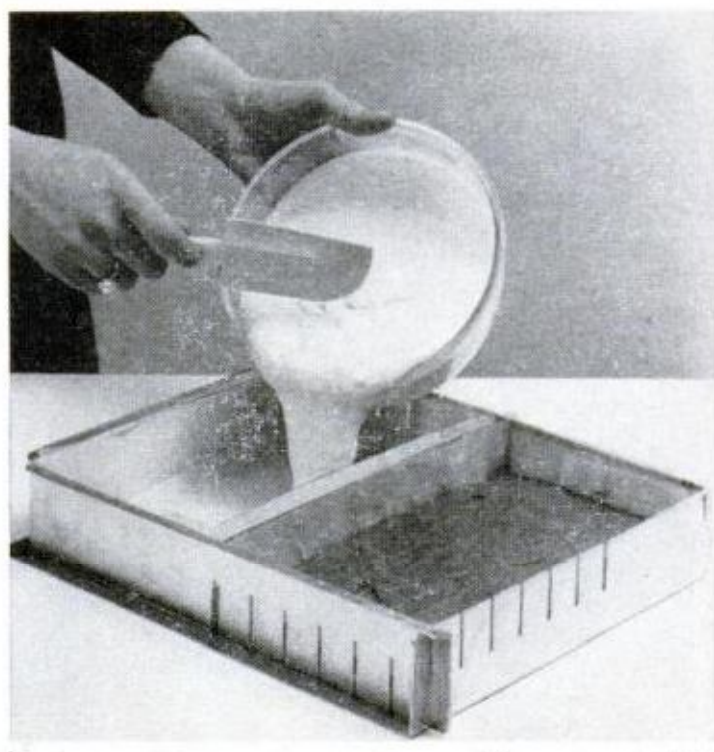
New For Your Home

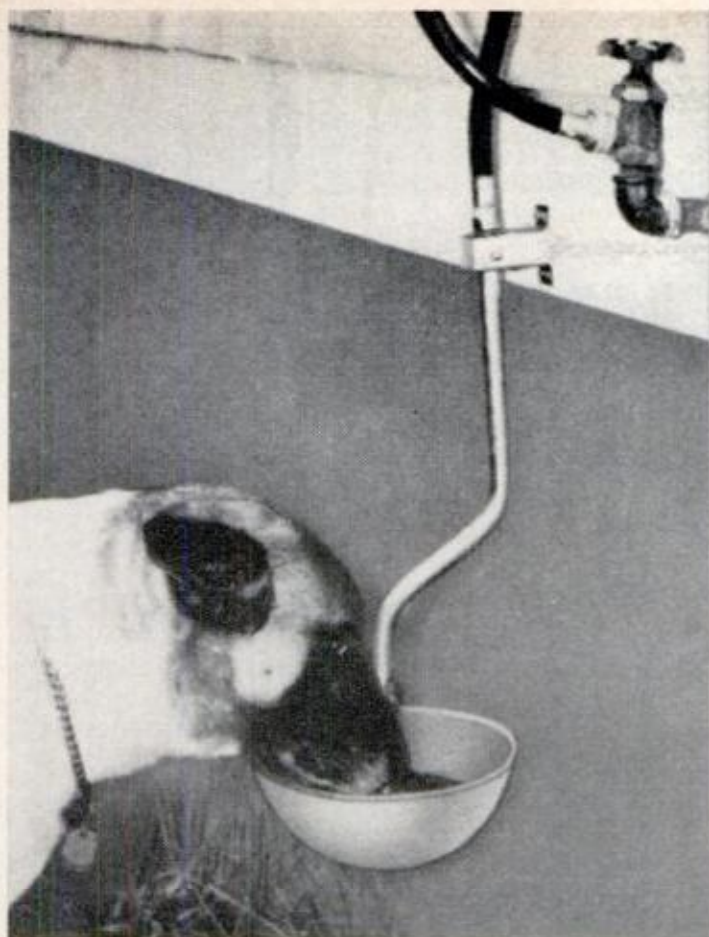
BROADLEAF WEED KILLER with plastic trigger strap fires at a lawn weed; a foamy tracer momentarily marks treated spot. Deadly on yard dandelions, the 23-ounce pressurized can contains over 500 shots. Price: \$1.49 from S. C. Johnson & Son, Racine, Wis.



NEW TREADS for worn mower tires (of auto tire rubber) slip on without removing mower wheels and fit standard tires from 8½ to 11 inches across on reel mowers, lawn carts, tillers. Cost is \$3.95 a pair. Gates Rubber Co., 999 S. Broadway, Denver 17, Colo.

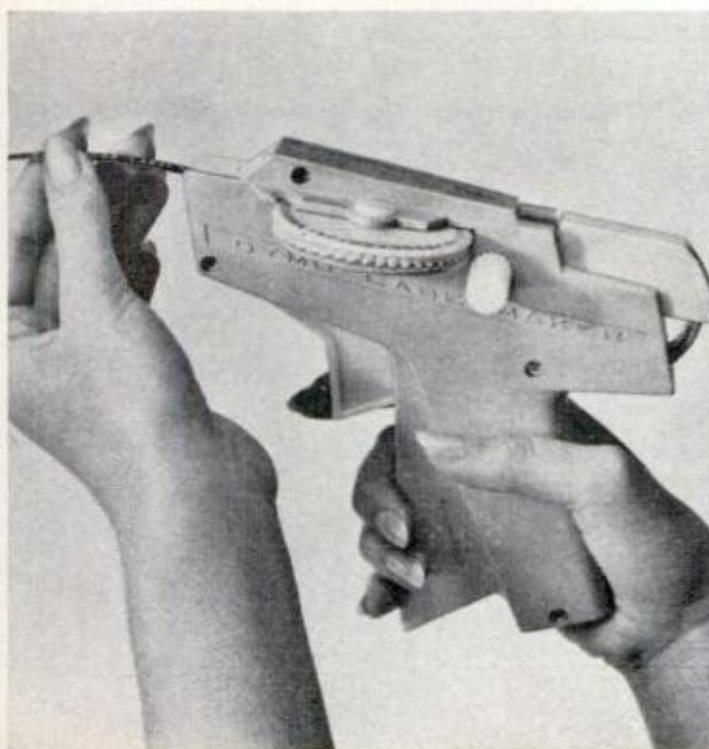
BAKING PAN of aluminum becomes 49 different sizes when detachable sides and center divider are adjusted, or it bakes two different cakes at once. Wax paper lining prevents leakage through slots. Price is \$3.95; The Lighthouse Inc., Dept. 78, Plymouth, Mass.



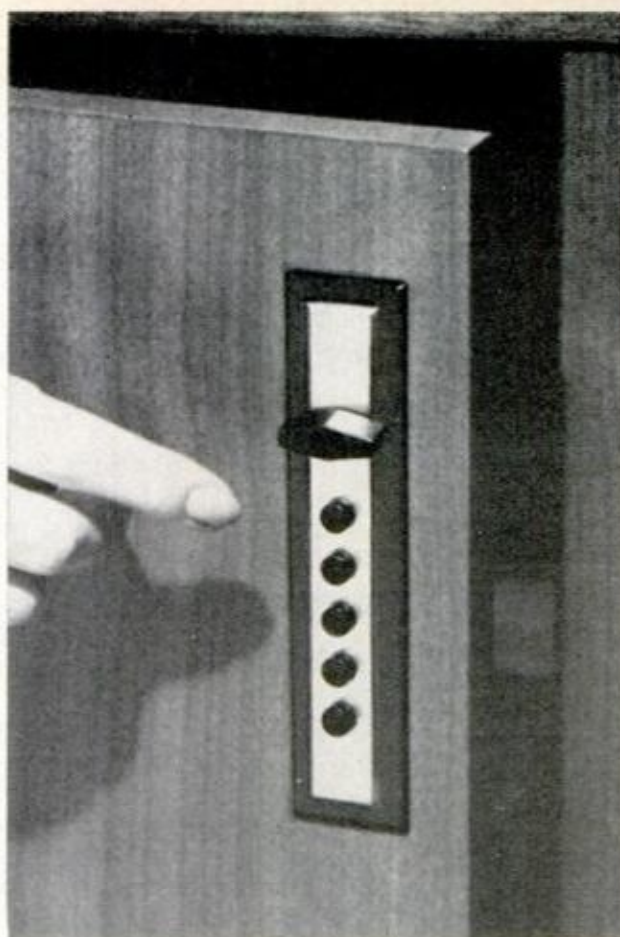


AUTOMATIC DRINKING FOUNTAIN for pets refills as your dog drinks, providing a constant supply of fresh water. Height is adjustable. Price of \$7.70 includes 2-foot hose, couplings, bracket, pipe, valve and bowl. By Turen, Inc., Dept. 101, Danvers Mass.

LABEL MAKER with alphabet wheel makes raised white letters on colorful plastic adhesive tape. Dial a letter, squeeze handle; fast-finished label is snipped by its cut-off blade, ready to apply to any surface. By Dymo Industries, Box 1030, Berkeley 1, Calif.



JULY 1963



PUSH-BUTTON LOCK quicksets to any of 1080 combinations, your finger being the key. Push any or all five buttons in the order you select, flip the drawer or door knob right to open or left to lock. Costs \$8.95; Simplex Lock Corp., 150 Broadway, N.Y. 38, N.Y.

CLOTH PRINTER unit of self-inking roller, and separate base with template top, prints up to four lines of permanent marking. Label-maker labels (left) are fixed to base, then camp clothes, etc., are inserted and roller used. Unit with label tape costs \$5.95 from Dymo.



115



Adapt for FM Stereo at One-Third the Cost

WHEN CONNECTED to your present FM tuner and stereo amplifier, this compact adapter will bring you FM stereo broadcasts.

The cost is about \$20 and you get the expensive extras you can't find in commercial adapters selling for less than \$60.

The 2-tube circuit includes a neon indicator that lights when you're tuned to a stereo broadcast. Then there's a silencing circuit that cuts off the tuner unless you are tuned to stereo. Best of all you get the full 20-15,000-cycle response that the station is transmitting.

There is one decision you have to make before you start. Do you need a power supply? If you can tap off 6.3 volts *a.c.* at 0.6 amp. and 180 to 200 volts *d.c.* at 7 ma. from your existing equipment, you won't have to bother building one. If these voltages are not available, add on the power supply circuit shown in the schematic.

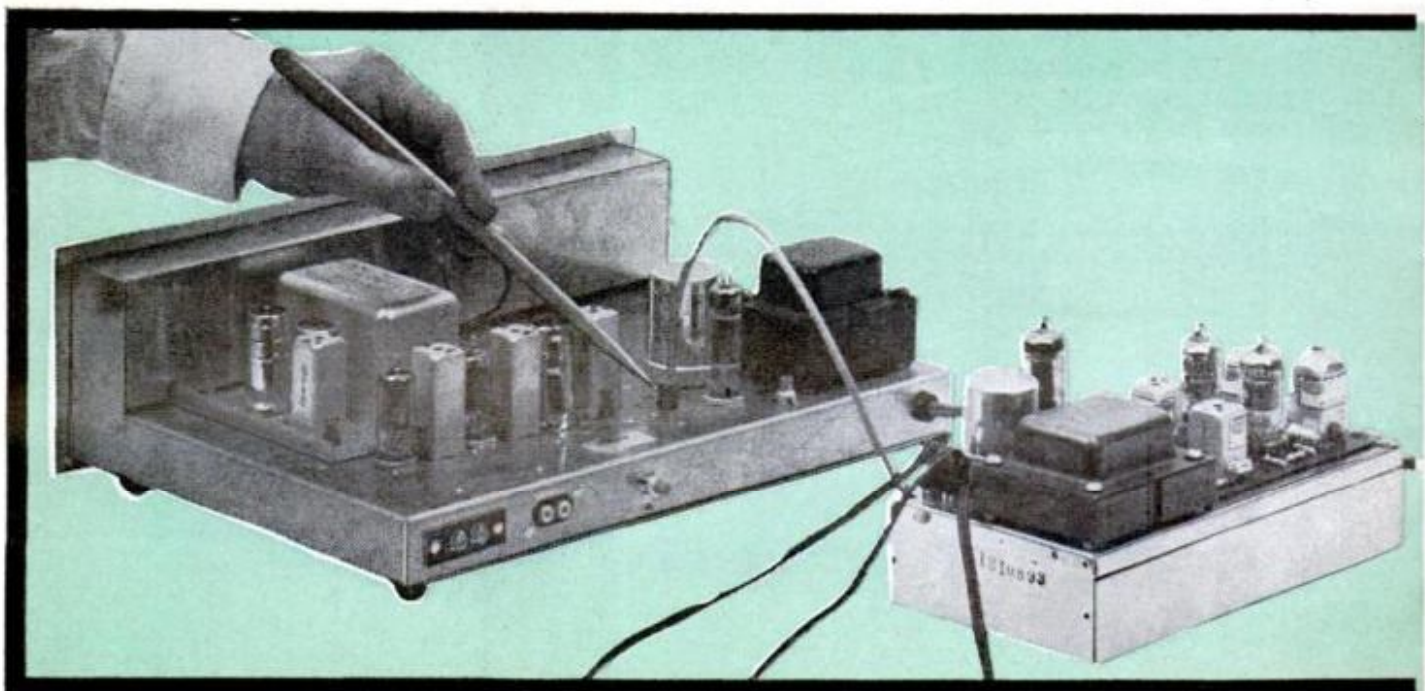
The schematic diagram shows the wiring in detail and the parts list can be filled by most electronics supply houses.

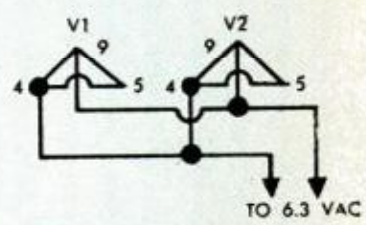
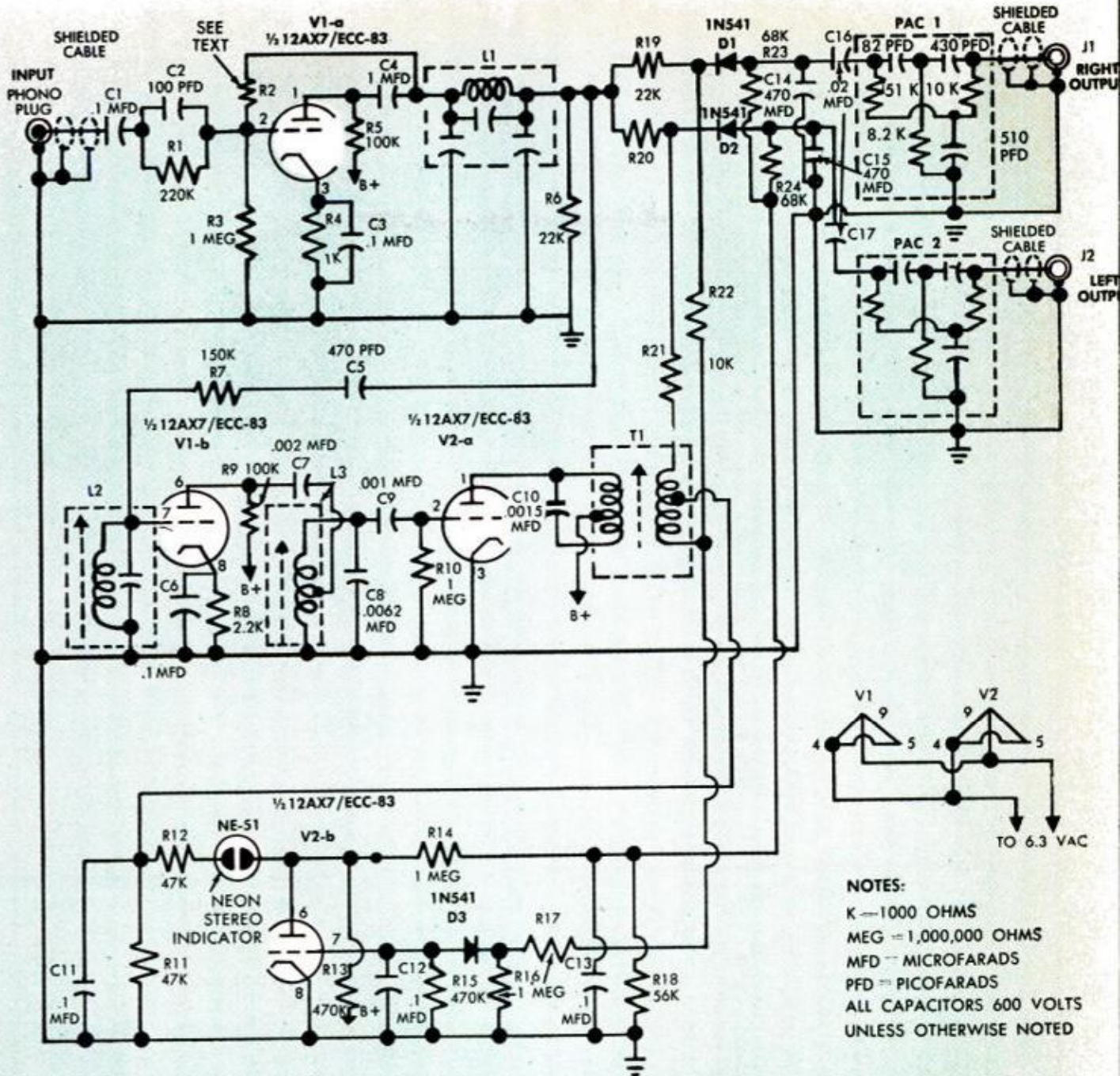
Your most difficult job will be aligning the adapter after it is completed. You'll need two things for this: a stereo program being broadcast and an audio *a.c.* vacuum-tube-voltmeter (*vtvm*).

Start off by connecting the adapter's input plug to the FM tuner's multiplex output jack. Then turn on the tuner and adapter and tune to a station you know is broadcasting stereo. Watch the tuning indicator on the FM tuner and adjust for the strongest signal.

Now connect the audio *a.c.* *vtvm* to either end of transformer T1's primary and slowly adjust the slug in the transformer for a maximum reading on the meter. Then, leaving the meter connected to the same spot, adjust L3 and L2 for a maximum voltage reading. Work back over T1, L3

THERE'S ONLY ONE CONNECTION to make to the FM tuner. Take the shielded lead with the phono plug on the end and push it into the multiplex jack

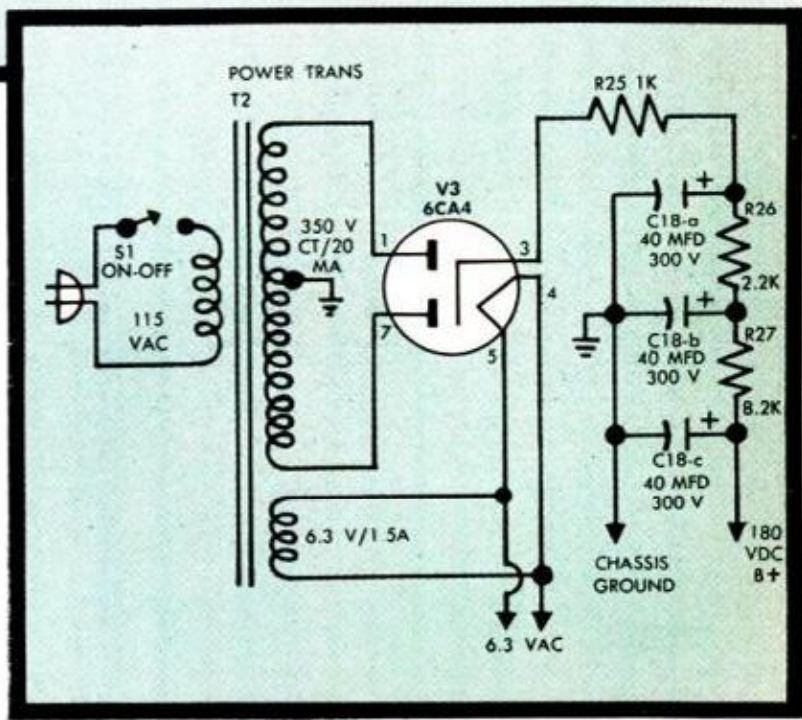


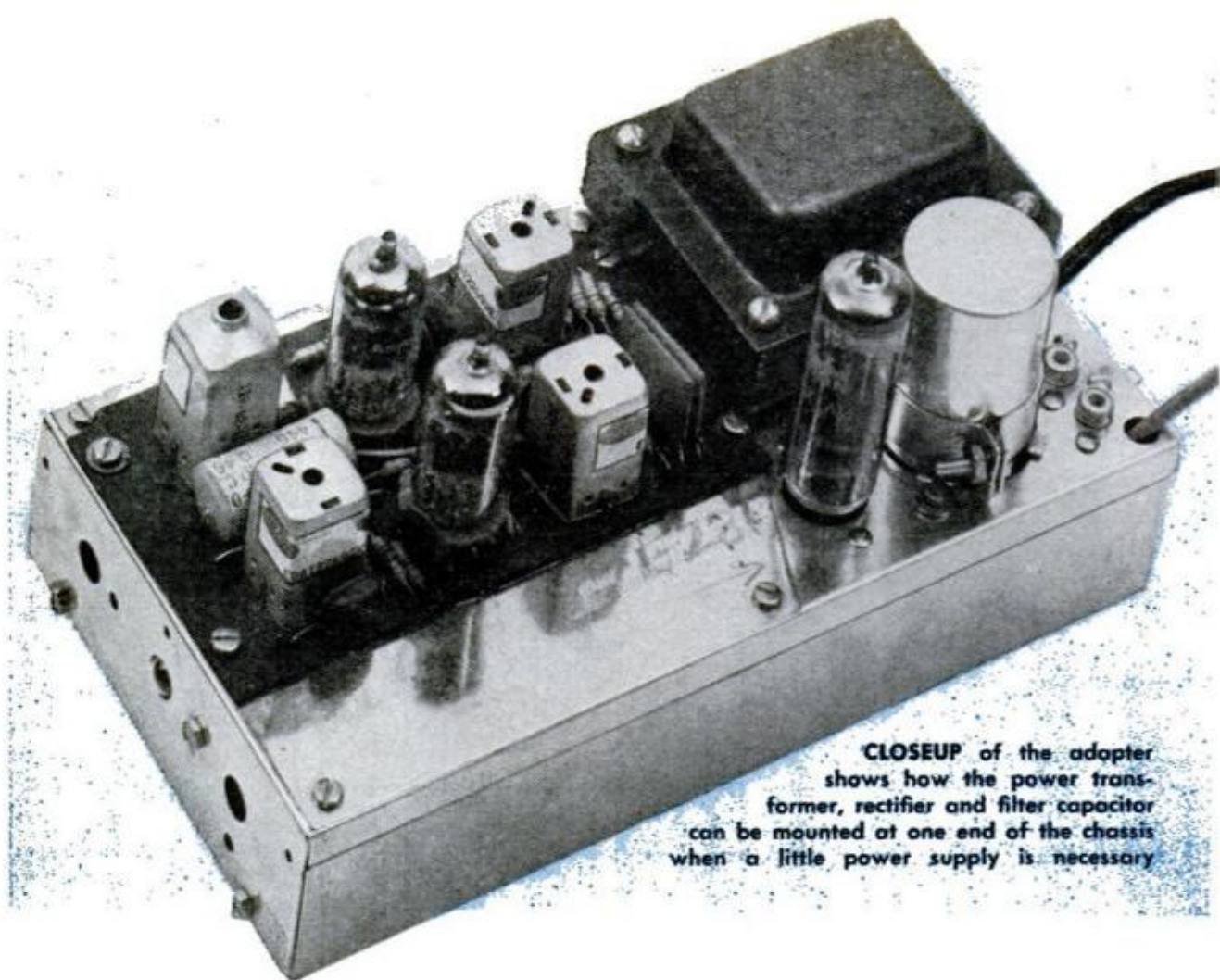


NOTES:
 K—1000 OHMS
 MEG = 1,000,000 OHMS
 MFD = MICROFARADS
 PFD = PICOFARADS
 ALL CAPACITORS 600 VOLTS
 UNLESS OTHERWISE NOTED

COMPLETE CIRCUIT of the 2-tube multiplex adapter. There are four stages as each tube is a dual triode. Note the automatic neon stereo indicator lamp

YOU NEED THIS power supply only if you can't tap off the needed voltages from your tuner or amplifier. It can be built right onto the adapter chassis





CLOSEUP of the adapter shows how the power transformer, rectifier and filter capacitor can be mounted at one end of the chassis when a little power supply is necessary

Parts List

- R1—220,000 ohms
- R2—3 megohm pot (see text)
- R3, R10, R14, R16, R17—1 megohm
- R4, R25—1000 ohms
- R5, R9—100,000 ohms
- R6, R19, R20—22,000 ohms
- R7—150,000 ohms
- R8, R26—2200 ohms
- R11, R12—47,000 ohms
- R13, R15—470,000 ohms
- R18—56,000 ohms
- R21, R22—10,000 ohms
- R23, R24—68,000 ohms
- R27—8200 ohms
- All resistors, 1/2-watt carbon, 10% tolerance
- C1, C3, C6, C11, C12, C13—0.1 MFD
- C2—100 PFD
- C4—1 MFD, 100 volts, molded paper
- C5, C14, C15—470 PFD
- C7—.002 MFD
- C8—.0062 MFD
- C9—.001 MFD
- C10—.0015 MFD
- C16, C17—.02 MFD
- C18—Three section electrolytic, 40—40—40 MFD, 300 volts
- All capacitors ceramic rated at 200 volts or better unless noted
- V1, V2—12AX7/ECC83
- V3—6CA4
- T1—Miller transformer #1357
- T2—Power transformer: 115-volt primary; 350-volt 20-ma ct. and 6.3-volt 0.6 amp. secondaries
- L1—Miller coil #1358
- L2—Miller coil #1351
- L3—Miller coil #1356
- J1, J2—phonojacks
- D1, D2, D3—1N541 diodes
- S1—spst toggle switch
- PAC 1, PAC 2—Erie PAC 1101. If not available use separate components as shown in schematic
- Neon lamp assembly including NE-51 lamp
- Phono plug, 5-foot length of shielded cable, two 9-pin miniature tube sockets, 5 x 6 x 2 inch chassis

and L2 at least three times. Disregard the neon lamp which will light before maximum reading is reached.

Next, connect the left and right outputs of the adapter to an unused pair of inputs on your stereo amplifier and listen for separation (how isolated one channel is from the other). Use a 3-megohm potentiometer for R2 and adjust it for maximum separation. From this point on no further adjustments will be needed.

The automatic nature of the adapter can now be tested. Tune across the FM band and note the complete absence of sound until you hit a station broadcasting in stereo. If you tune rapidly, the neon indicator may blink once or twice as you hit transient noise peaks between stations. This is normal and should be disregarded.

Bad-Signal Rejector

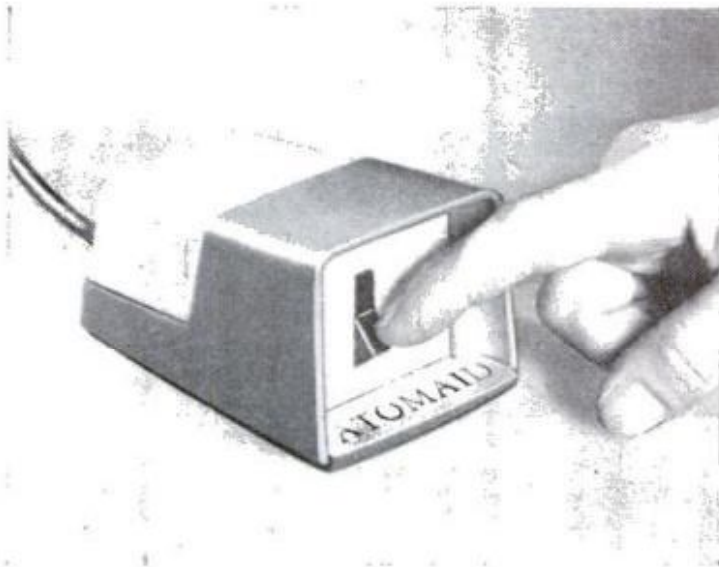
Another built-in feature of this adapter is that it will reject any stereo signals that are too weak to give good reproduction. So if a signal is picked up and heard, it will be reasonably strong and sound good. Nevertheless, if you prefer to listen to weaker stations, even though they may be noisy, you can lower the rejection point by decreasing the value of the 1-megohm resistor connected between T1's secondary and D3.—Leonard Feldman

NEW IN

Electronics

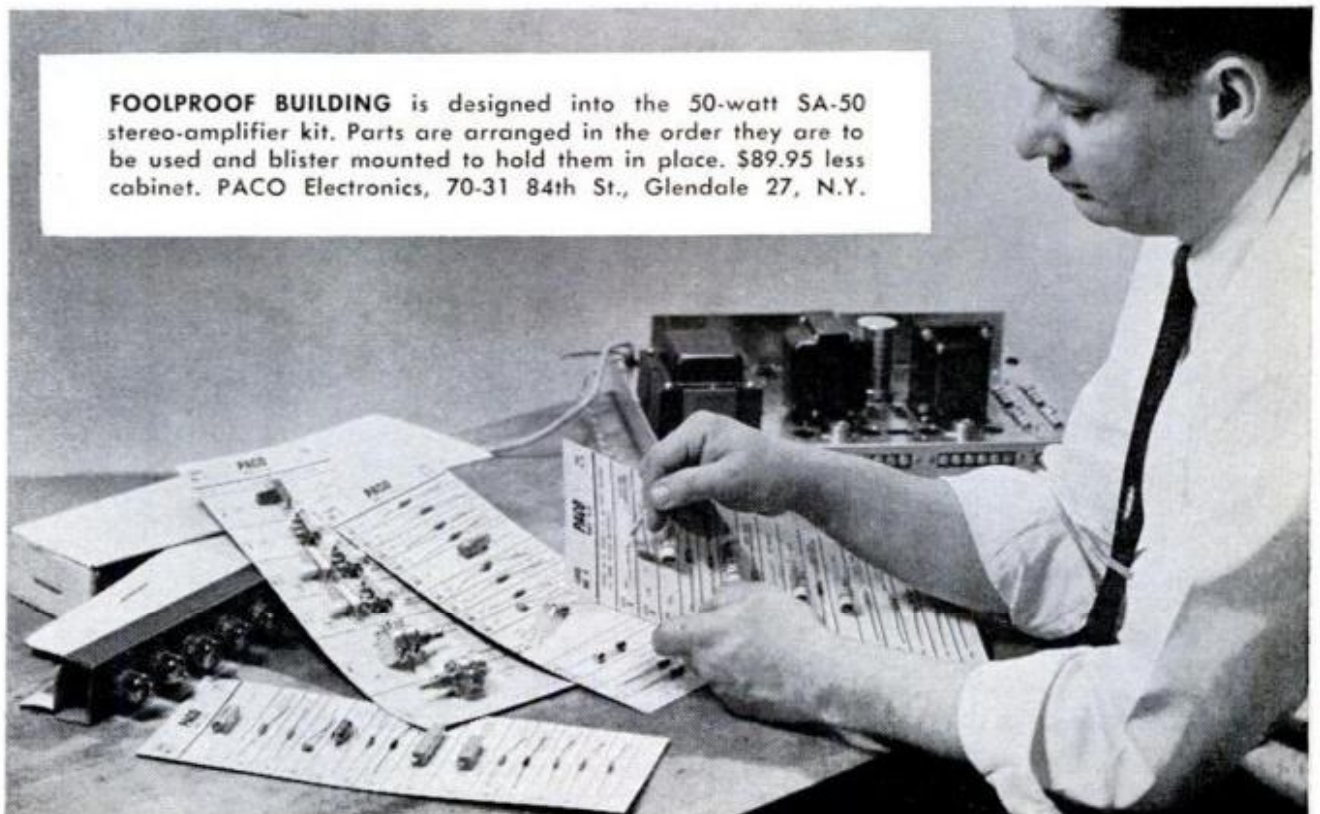


ADD FLUORESCENT LIGHTING the easy way. Just screw in a Saturnlite. It has a 22-watt circular lamp with the light output of a 75-watt bulb. \$12.95 from Saturn Mfg. Corp., 414 Main St., Woodbridge, N.J.



ATOMAID turns anything electrical on and off by remote control. Plug the appliance to be controlled into the receiver (above right) and plug the receiver into any handy outlet. The transmitter stays by your side. Push the button for on and off. \$59.95 for the pair of units. Gentronics, 3226 16th Ave. W., Seattle, Wash.

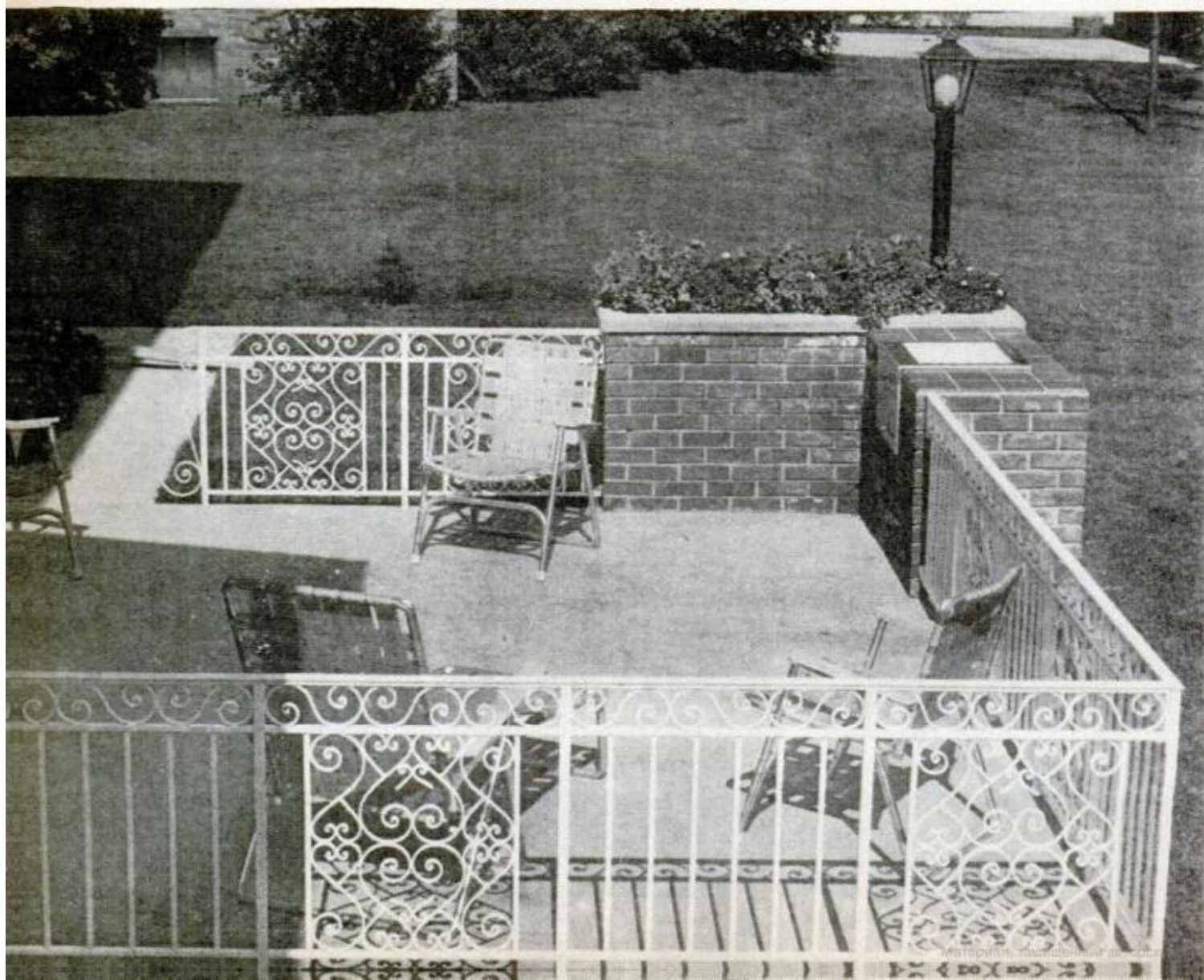
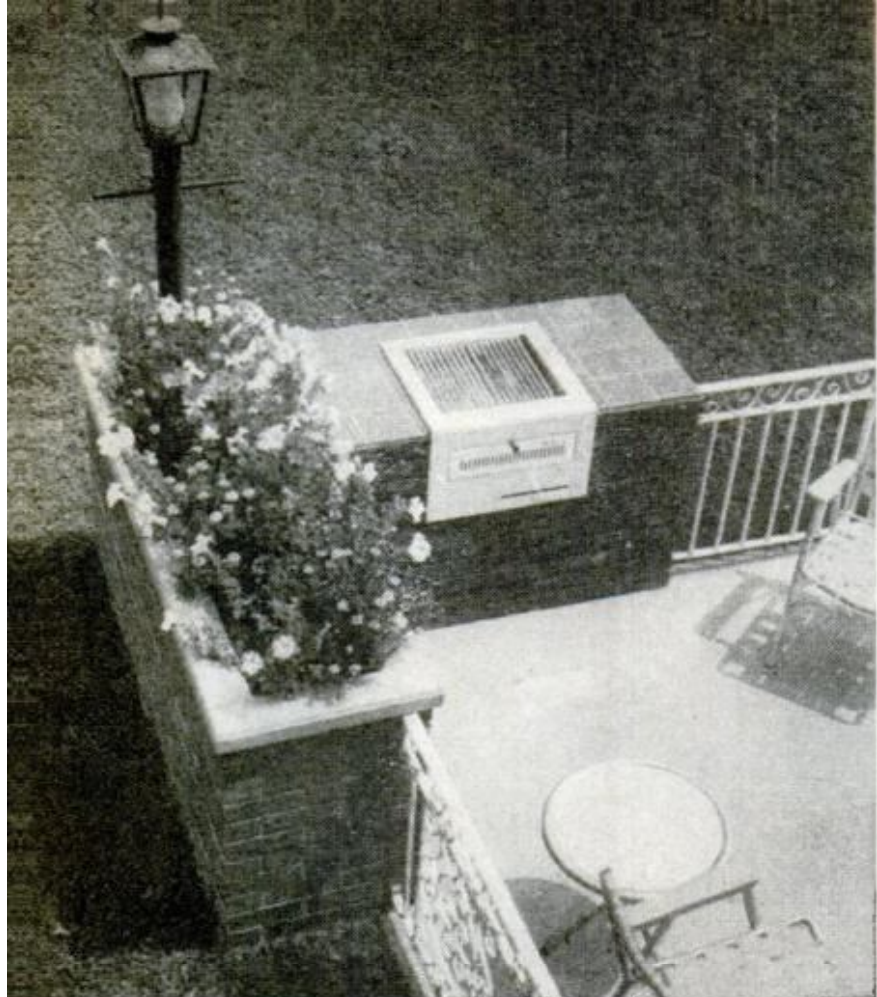
FOOLPROOF BUILDING is designed into the 50-watt SA-50 stereo-amplifier kit. Parts are arranged in the order they are to be used and blister mounted to hold them in place. \$89.95 less cabinet. PACO Electronics, 70-31 84th St., Glendale 27, N.Y.



COOKOUT BAR AND PLANTER

Table-top grill in
a brick barbecue-
planter can bring
a blend of beauty
and utility to your
patio dining area

ILLUMINATED PLANTER, teamed up with
a built-in barbecue grill, makes cookouts
more tempting than ever, day or night



LIKE SO MANY PATIOS, ours was nothing but a concrete slab. Unattractive, uninviting, it was like sitting out in left field.

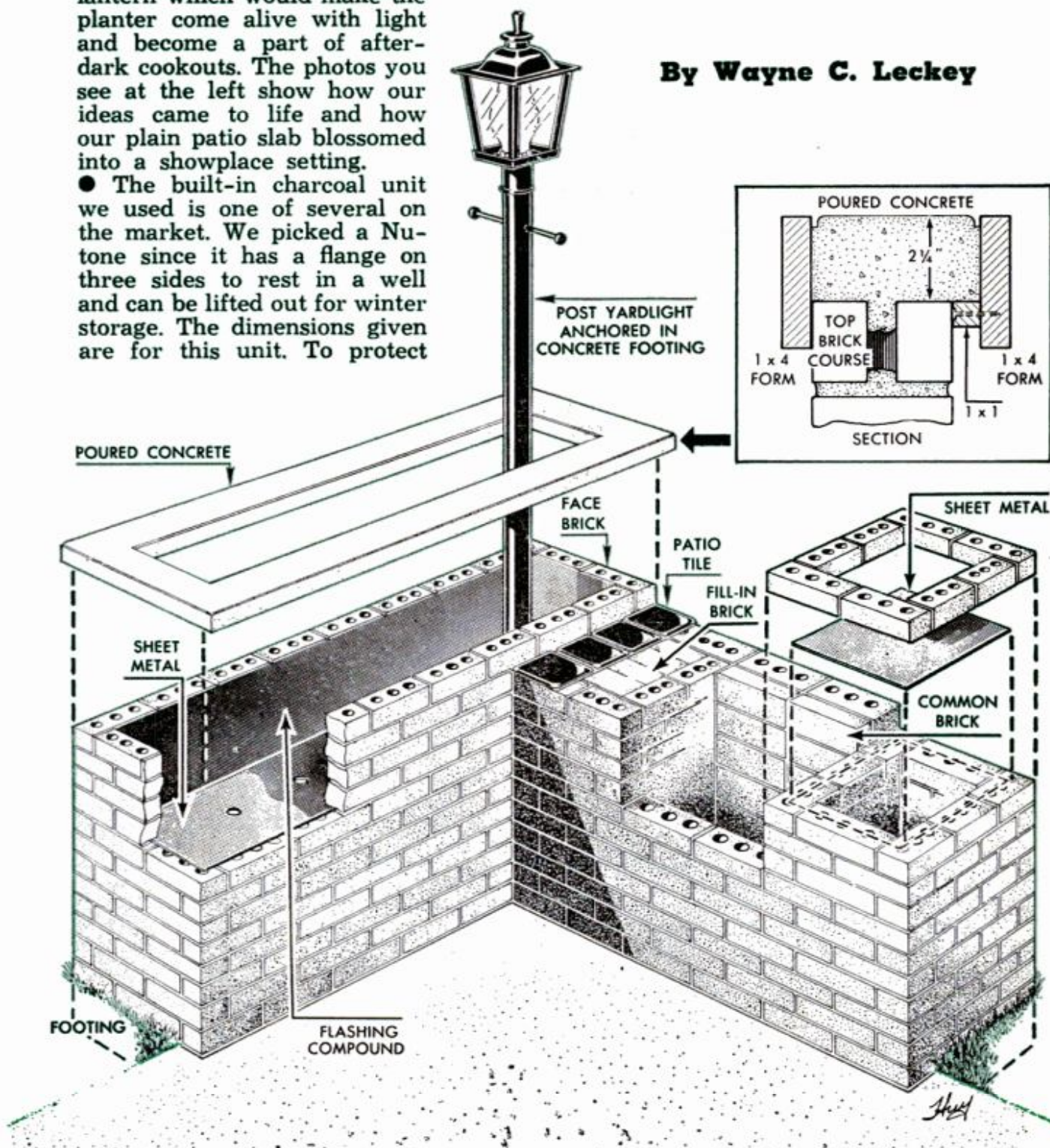
We had it poured when the house was built and couldn't wait to do something with it. We liked the idea of a planter to add a touch of living color. We liked the idea of a table-top grill with counter space alongside to set things. And we liked that fenced-in feeling you get with a railing. We wanted a post lantern which would make the planter come alive with light and become a part of after-dark cookouts. The photos you see at the left show how our ideas came to life and how our plain patio slab blossomed into a showplace setting.

● The built-in charcoal unit we used is one of several on the market. We picked a Nutone since it has a flange on three sides to rest in a well and can be lifted out for winter storage. The dimensions given are for this unit. To protect

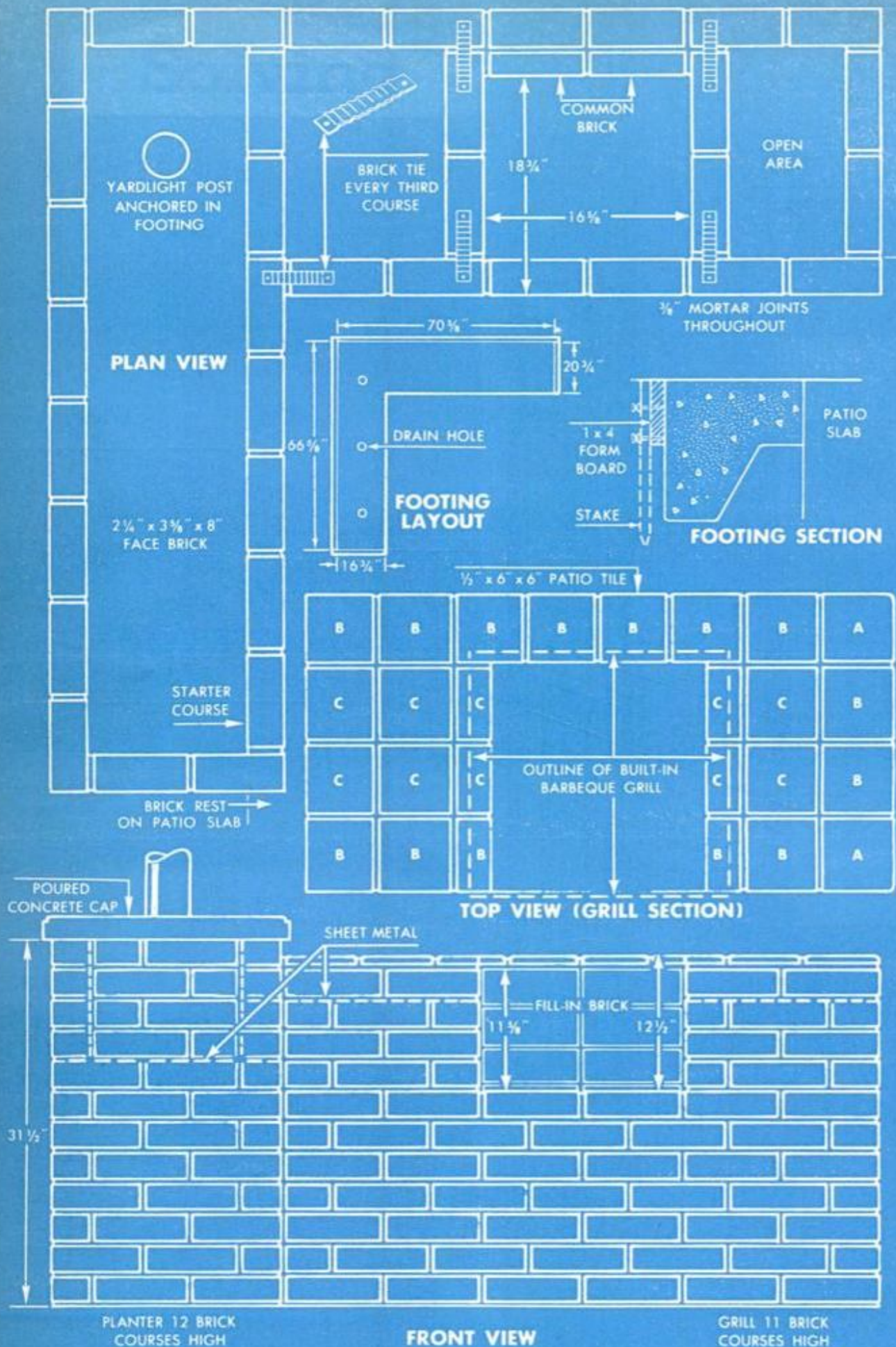
it from rain, we keep the grill covered between cookouts with a piece of sheet plastic, hemmed along two edges for weighting with curtain rods. I tiled the counter top with regular hearth tile and applied a liquid dressing to protect it.

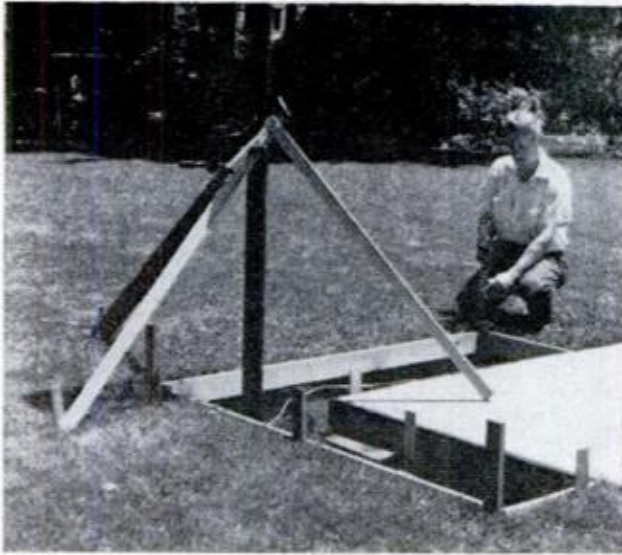
● Although I had never laid brick, I was surprised to find it wasn't the skilled job I anticipated. As long as I kept the corners plumb, the rest was a case of keeping the courses running straight and level,

By Wayne C. Leckey

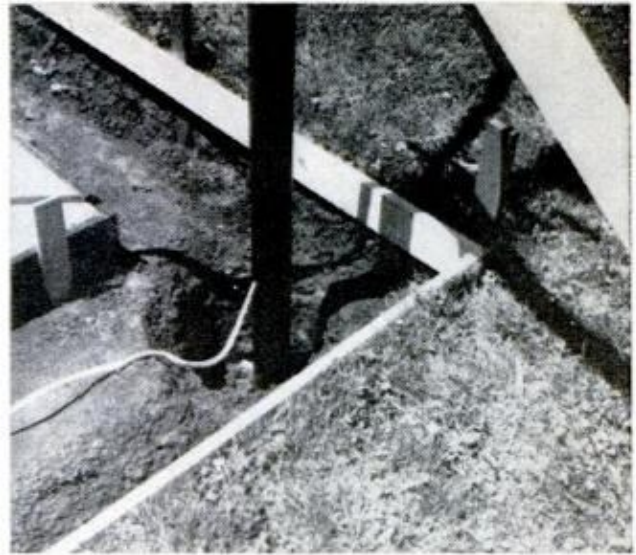


SHOP AND CRAFTS





MY FIRST STEP was digging out for a footing, staking a form level with the patio slab and erecting a post lantern which will be anchored in the footing. Braces keep it standing plumb, both directions



HOLE IS DUG for post lantern inside footing excavation. Note heavy plastic covered wire entering post. Wire was buried in footing, runs underground and wired to switch located at the rear entrance

much as you would in stacking a set of building blocks. My yardcart made a dandy little box-on-wheels for mixing the mortar, and the four bricklaying tools I had to buy were just a trowel, a level, a joint raker and a ball of string.

● My first job was to provide a concrete base at one corner of the patio slab, and from the sequence photos on this page, you can see how I first had to dig an L-shape hole about 18 in. deep and line it with a 1 x 4 form set level with the top of the slab. The post lantern had to be set in position at this time too since it was to be anchored in the footing. After running plastic-covered cable from a switch in the house to the lantern and then burying it below ground, I plumbed the post and then braced it to hold it so. With the braces nailed to stakes, I used a couple of C-clamps to clamp the braces to the post.

● It was convenient for me to order ready-mix concrete and it saved me the job and mess of mixing it myself. However, you could make use of packaged dry mix. It took $\frac{1}{2}$ yard of concrete to fill the form, and since it serves as only a footing, I merely struck it off with a board flush with the form and patio slab. The overall size of the footing given in the blueprint is based on the use of 8-in. bricks with $\frac{3}{8}$ in. mortar joints.

● In studying the blueprint, you'll note that the planter is made one course higher than the grill section. Also that a sheet-metal bottom is placed in the planter when you reach the 8th course and that the grill well is left open at the front after you reach the 7th course. A total of 418 face brick is required, plus 28 common brick. The latter are used as fill brick directly

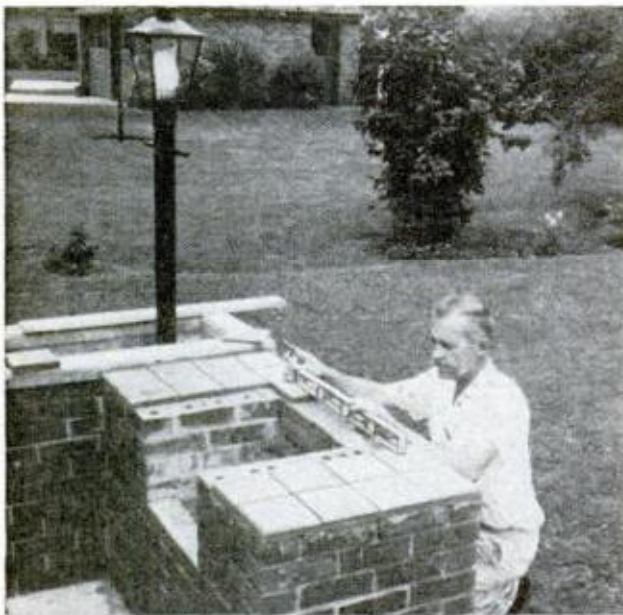


POST IS CHECKED (above) to be sure it's plumb prior to pouring footing. I used a couple of C-clamps to clamp the braces to the post. Below, form has been filled and I'm smoothing it off. It required about half a yard of ready-mix, will vary with footing depth

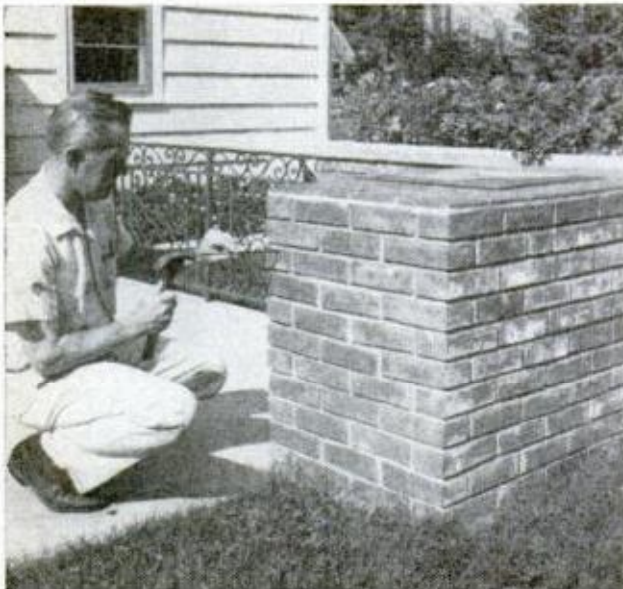




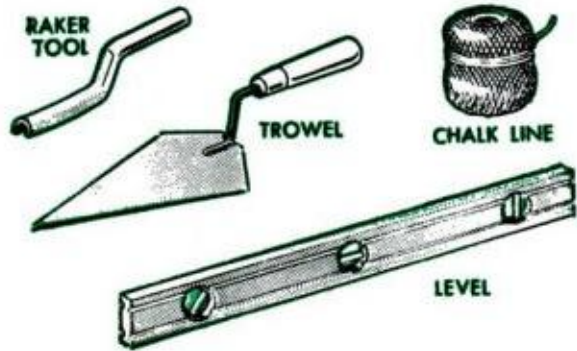
I'VE POURED THE CAP around the top of the planter and am finish-troweling it. Mixture should be made on the soupy side and spaded with a stick so you won't have any voids in edge of finished cap



HERE I'M ON THE HOME STRETCH—tiling the top of the grill section with hearth tile. Constant checking with a level pays off in producing a flat counter top. Below, with the cookout-planter completed, I'm making holes in the brick with star drill for lead anchors which I used to attach the wrought-iron railing



BRICK LAYING TOOLS NEEDED



ASIDE FROM ORDINARY TOOLS, such as a hammer, saw, shovel, etc., here are the four basic tools you'll need to lay your bricks. You can fashion your own raker tool by notching the end of a flat-steel bar



PROTECTED BY RUBBER GLOVES, above, I'm hosing off an acid bath which is used to remove mortar smudges from the brick and tile. It's best to do this the following day, at least before the mortar gets too hard. Below, final victory at last—setting the grill in place. Unit merely rests in the open well



under the tile counter top and at the rear of the well. Five of the face brick will have to be cut. The plan view shows the order in which the bricks of the starter course are placed on the footing. The pattern as given repeats every other course. At points where the brick courses merely butt, rather than interlap, I used brick ties. These are corrugated strips of sheet metal which are embedded in the mortar of every other course as you go along. Your brick dealer has them.

I used bagged mortar mix to which you merely add water. It took approximately five sacks. Don't mix it too soupy or it won't cling in buttering the bricks. Buttering is a term used when the mortar is applied to the ends of the bricks in cementing them end to end. If too thin, the mortar will slide off before the brick can be set in place.

● Make a dry run of your first course, placing the 37 bricks in the order given, $\frac{3}{8}$ in. apart and without mortar. This will give you an idea how evenly they space out on the footing. Note that the bricks rest on the edge of the existing patio slab. This is necessary so you later can attach the wrought-iron railing. Always keep the bricks you are working with dampened. Dry bricks will draw the water out of the mortar too fast.

Now to actually lay the bricks: Start with the planter section and place a trowel of mortar on the footing where the first brick will rest. Tap it down with the trowel handle until you have a $\frac{3}{8}$ -in. layer of mortar under it. Place a level on this corner brick to check it. Proceed with the second brick the same way, spreading a layer of mortar for it as before. Grab the brick with the left hand and butter the end with mortar. Then set it in place, tapping it down gently and easing it against the first brick until you have a $\frac{3}{8}$ -in. joint between. Excess mortar which oozes out is scraped off flush with an upward swing of the trowel.

● While the same number of bricks is used in the second course, placement shifts $\frac{1}{2}$ brick, so to speak, so that the new vertical joints will straddle those of the course below. Procedure varies also in that the five outside corners are built up like steps two or three courses ahead of the rest. Here it is important that you check them for plumb, both directions. If you keep the corners rising plumb, you can't go wrong with the rest. In filling-in each course between the corner bricks, you now lay your bricks to a string (chalk line) stretched taut and aligned with the very outer edge. This is done by weighting the string with a brick at each end.

● Raked mortar joints give your work a

professional look and you should stop to do this after about every third course. Raking is done with a special tool which is used to rake or scrape the mortar from the joints to a depth of about $\frac{1}{4}$ in. before the mortar hardens.

● The sheet-metal (18 ga.) bottoms which block off the two open end wells in the grill section, as well as form a bottom for the planter, are cut to lap the brick about half their width. The metal is embedded in a layer of mortar as you proceed. In the case of the planter, drain holes are made in the metal bottom beforehand, as well as a hole to slip it down over the lantern post. Once the top course of the grill section is reached, the blocked-off wells are filled with a layer of common bricks, mortared in place, flush with the rest. Since two full bricks make the depth of the grill well too deep, a lining of common bricks, placed on edge, is mortared against the back wall of the well.

● Hearth tile, $\frac{1}{2}$ in. thick and 6 in. square, comes with two edges rounded (A in the blueprint) one edge rounded (B), and plain (C). Each is priced according to shape, the plain being cheapest, and the blueprint shows you how many of each it takes to tile the top of the grill counter. These are laid in mortar, the joints being struck (troweled) concave with any suitable object. Only the tile along the two sides of the well require cutting. The rest space out perfectly.

● I made a simple wood form for the cap around the top of the planter and cast it right in place. The inner form was simply wedged in place and the outer one clamped to it. The clamps were left in place while the cap was poured. I greased the wood so the form would pull off easily. Here your concrete mix should be made somewhat soupy and spaded good as it is put in the form so you won't have any air pockets (voids) in it when you remove the form. The holes in the brick give good anchorage to the poured cap.

● As final steps, I troweled a heavy coat of flashing compound on the inside of the planter, being careful not to block the drain holes in the bottom. Then, wearing rubber gloves, I washed the outer face of the brickwork by scrubbing it with a fiber brush dipped in a diluted solution of muriatic acid (10 parts water and 1 part acid) and hosed it off with water. The acid removes all the mortar smudges from the face of the brick, as well as the tile.

● The wrought-iron railing is a stock pattern ordered to fit. Here, again, there are any number of makers of similar railing. If you want the design we used, you'll have to get it from Tennessee Fabricating

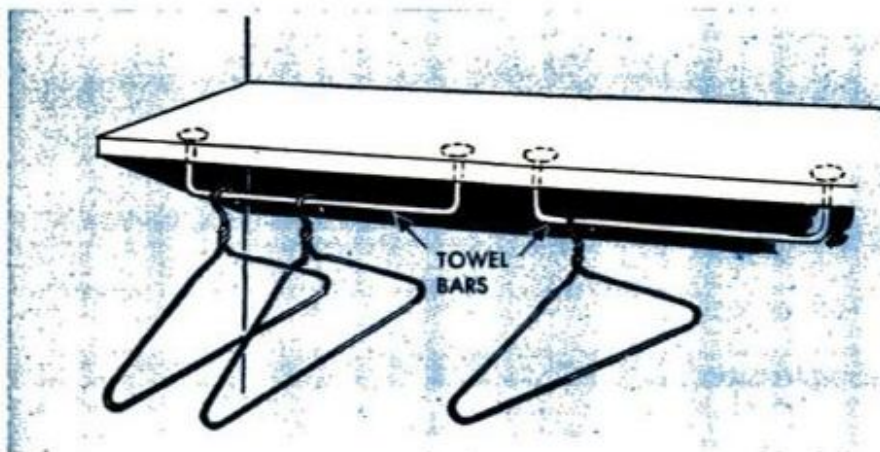
★ ★ ★



WINDOW BRIDGE for your ladder can easily be made by drilling holes near the ends of the side rails to hold a length of pipe which will reach across the window. Pad the pipe with pieces of garden hose

Solving HOME PROBLEMS

SCREW-TYPE NUTCRACKER is much more efficient than the lever-action type because the gradual pressure makes it possible to crack the shell without crushing the kernel. If your wife doesn't have one, lend her a C-clamp from your shop. It works fine

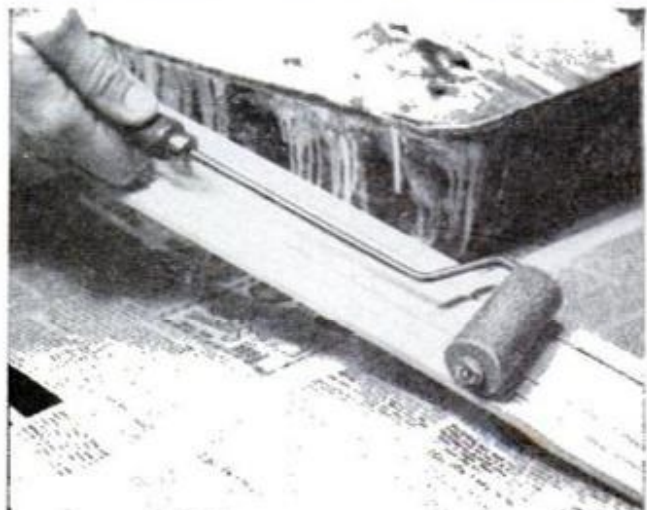


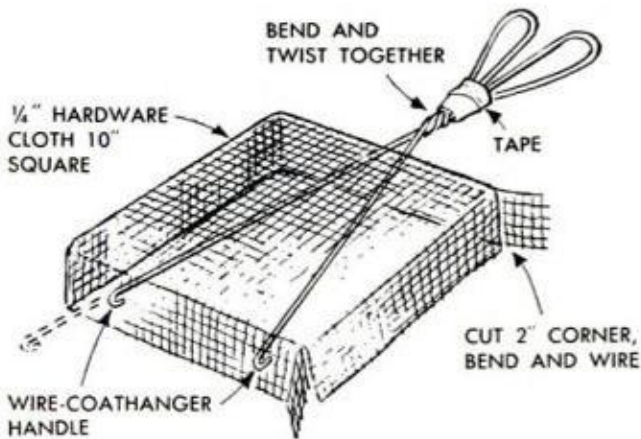
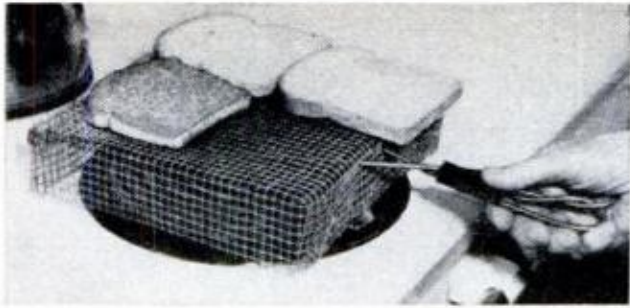
IF YOU WANT to hang garments in a closet which isn't equipped with the usual wall-to-wall clothes rod, just mount towel racks on the underside of the closet shelf. These will hold a number of hangers each. However, be careful not to overload racks with heavy garments

TO AVOID STAINING your hands when applying dye or one of the new self-polishing waxes to your shoes, insert one end of a rolled-up newspaper in the toe and wedge other end in the heel to form a handle

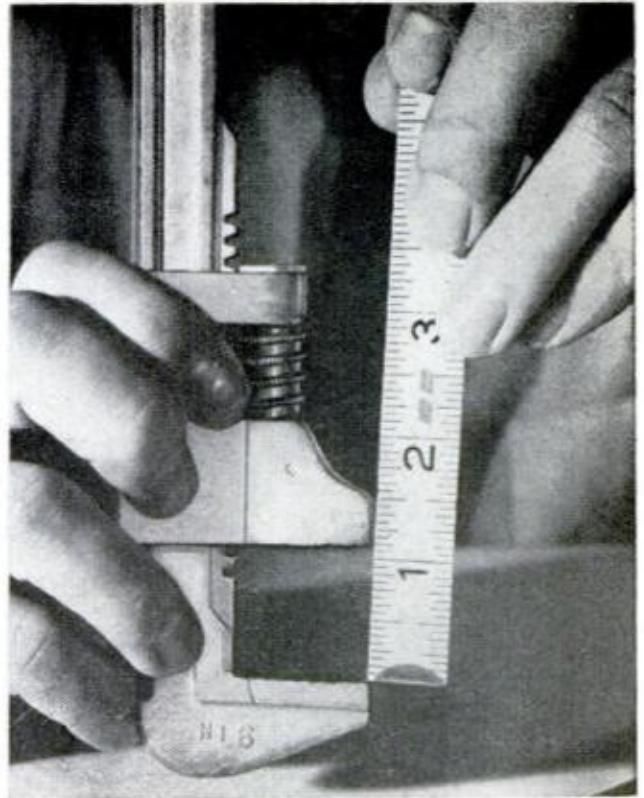


FOR A NOVEL stippled enamel finish on small paint jobs, use a miniature paint roller made from a foam plastic hair curler. Just bend a steel rod as shown, thread the end for a retainer nut and add a handle

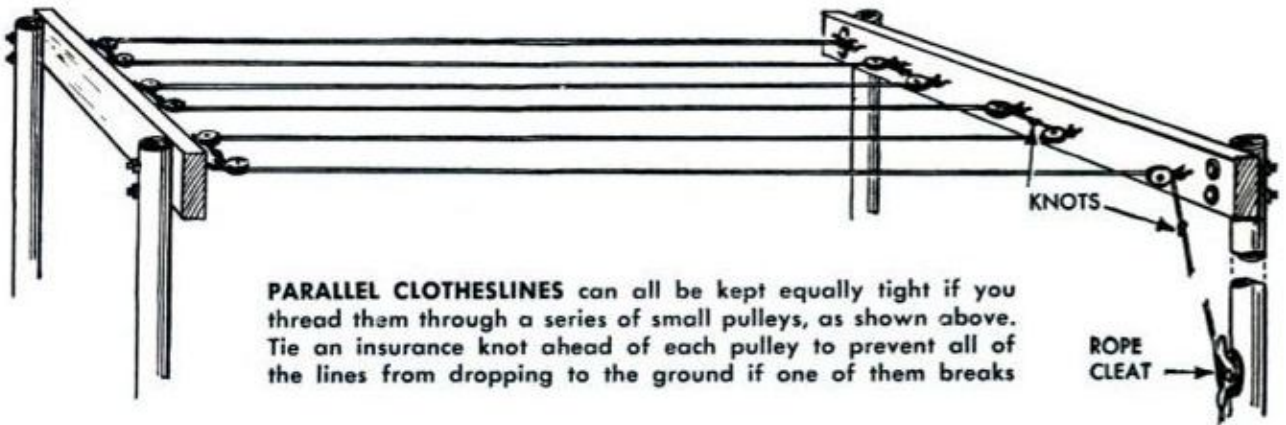




OLD-TIME TOASTER comes in handy as a standby when your sleek electric model goes on the blink, is fine for camp or cottage use. Make an open box of $\frac{1}{2}$ -in. hardware cloth and attach coat hanger handle

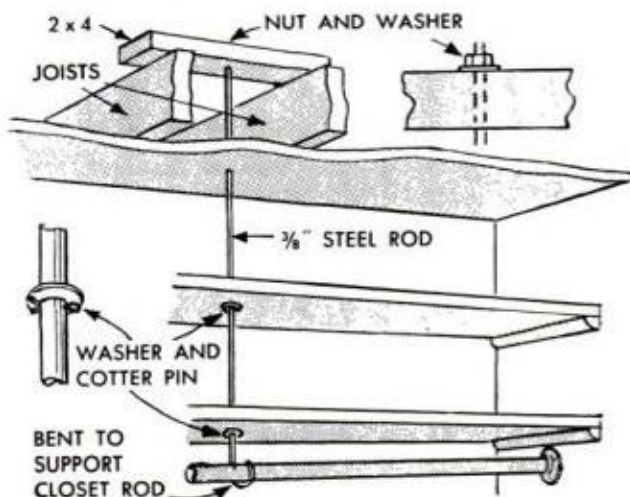


YOU CAN MEASURE the outside diameter of a pipe with a monkey wrench by simply tightening the jaws of the wrench over the pipe, then slipping the pipe out and measuring the opening with a common ruler



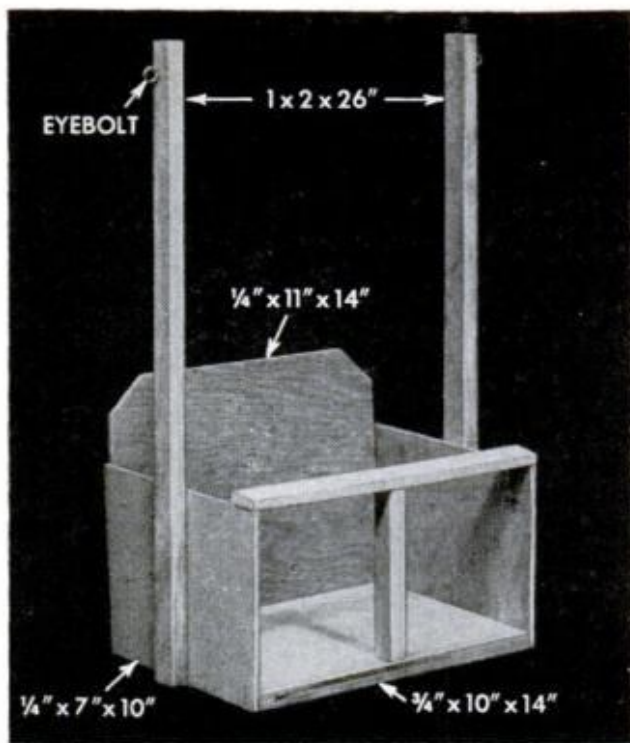
PARALLEL CLOTHESLINES can all be kept equally tight if you thread them through a series of small pulleys, as shown above. Tie an insurance knot ahead of each pulley to prevent all of the lines from dropping to the ground if one of them breaks

LONG SHELVES won't sag if you brace them with steel rods which pass through the ceiling and fasten to cleats running across the joists. Use a washer and cotter pin under each shelf to hold the edge level



YOU WON'T HAVE TO worry about misplacing your fishing license if you tape it inside the lid of your tackle box with invisible cellophane mending tape. This tape resists moisture and won't come unstuck





Tot Seat for Back-Yard Swing

BACK-YARD SWING SETS are more popular today than ever before, yet many don't provide a safety seat for small children. The boxlike tot seat shown here is designed to fit over the seat of a regular swing and clip to the chains. It can be attached or removed in seconds.

The dimensions given will fit most swings, but it's a good idea to check these against your youngsters' swing before beginning construction so you can change them if necessary. Space the 1 x 2 cleats underneath the seat so that the regular swing seat fits snugly between them. Don't add the eyebolts in the 1 x 2 uprights until after you have completed the seat.

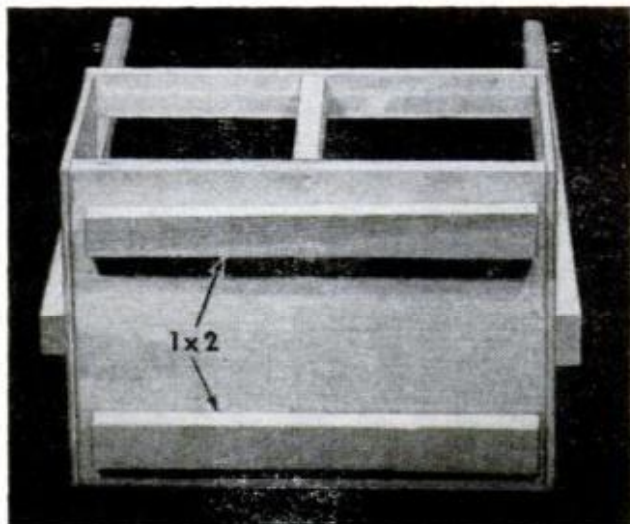
HARNESS SNAP through eyebolt locks each upright to the swing chain, making it possible for mother to install the tot seat in a matter of seconds

Then, with the seat in place, locate them so that they will fit through the chain links without bearing weight.

Be sure to round all exposed edges and sand thoroughly to avoid any splinters. Finish the tot seat with a couple of coats of bright-colored non-toxic exterior enamel to match the frame of the swing set. For very small children, you might consider upholstering the seat with foam rubber and weatherproof vinyl.

If you wish to use the tot seat as a separate swing, hanging it from a tree branch or 2 x 4 frame, make the sides and back of 3/4-in. plywood for greater strength.—*Hartwell J. Kennard*

TWO CLEATS nailed to the bottom surface are spaced far enough apart so that the regular swing seat will fit between them and hold the tot seat in place



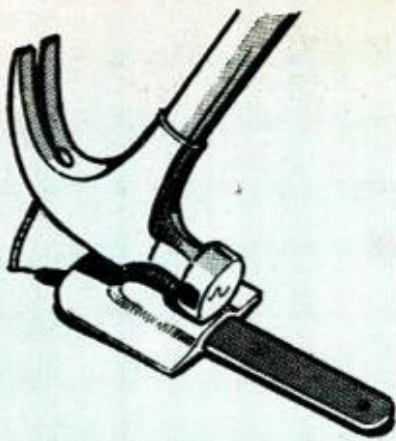
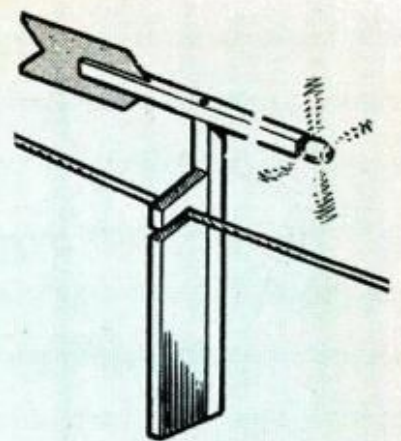


PLATE SCRAPER makes a perfect rubber cushion for protecting wood surface when removing a nail with a claw hammer. Slip it under the hammer head so the thickest part acts as a pad

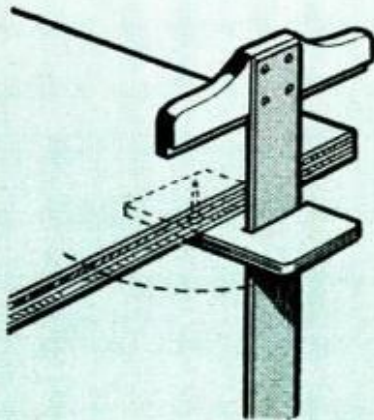


HANDY HOLDER for single-edge razor blade can easily be made by cutting deep notch in one end of large cork, then gluing cork to shop wall, cabinet door, etc.

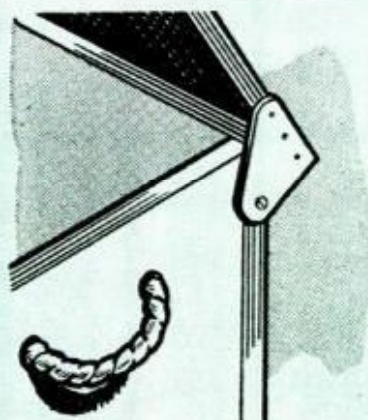


TOY WINDMILL can be hooked over a clothesline if there is no other suitable support available. Nail the staff to a deeply notched board and the weight will hold mill in upright position

SIMPLE AS THAT



SLOTTED TURN BUTTON for holding T-square is a useful addition to any drawing board. Make it from a 3 x 6-in. piece of 1/4-in. plywood and mount tight enough to hold in either position



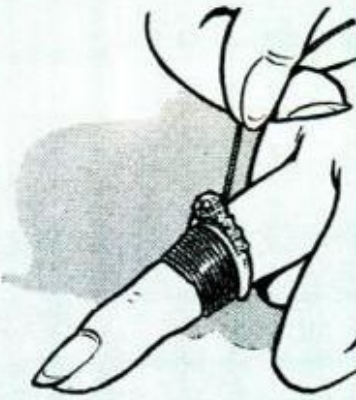
PLYWOOD TRIANGLES make fine hinge substitutes for use on toy chest. Drill a pivot-screw hole in one corner and drive nails through opposite edge into the chest cover



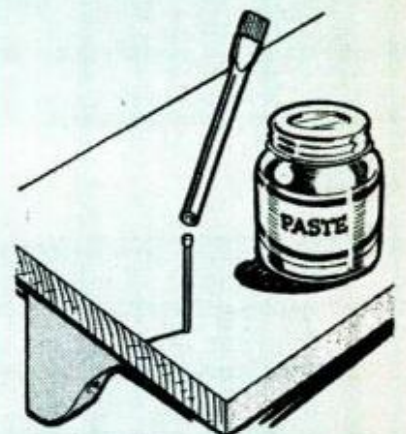
MAINTAIN that chisel edge on your paintbrushes by clamping the bristles in a large paper clip, as shown. This will also provide a hanger for suspending brushes from hooks or nails



LONG-LASTING acid brush for use in soldering jobs can be made by slitting the chisel end of a slip-on pencil eraser to form acid-holding "bristles." (Rubber is almost acid-proof)



TO REMOVE a tight ring, wrap finger with string to compress knuckle, then push free end of string under ring and unwind it so that ring is pushed along and off finger



SMALL PASTE BRUSHES used with library paste are easy to misplace. To make a holder for such a brush, simply drive a brad into shelf where paste is kept and slip handle over it



Easel Tracing-Projector

Like an artist at an easel, you can now draw enlarged, reduced or same-size copies from patterns, sketches and photos

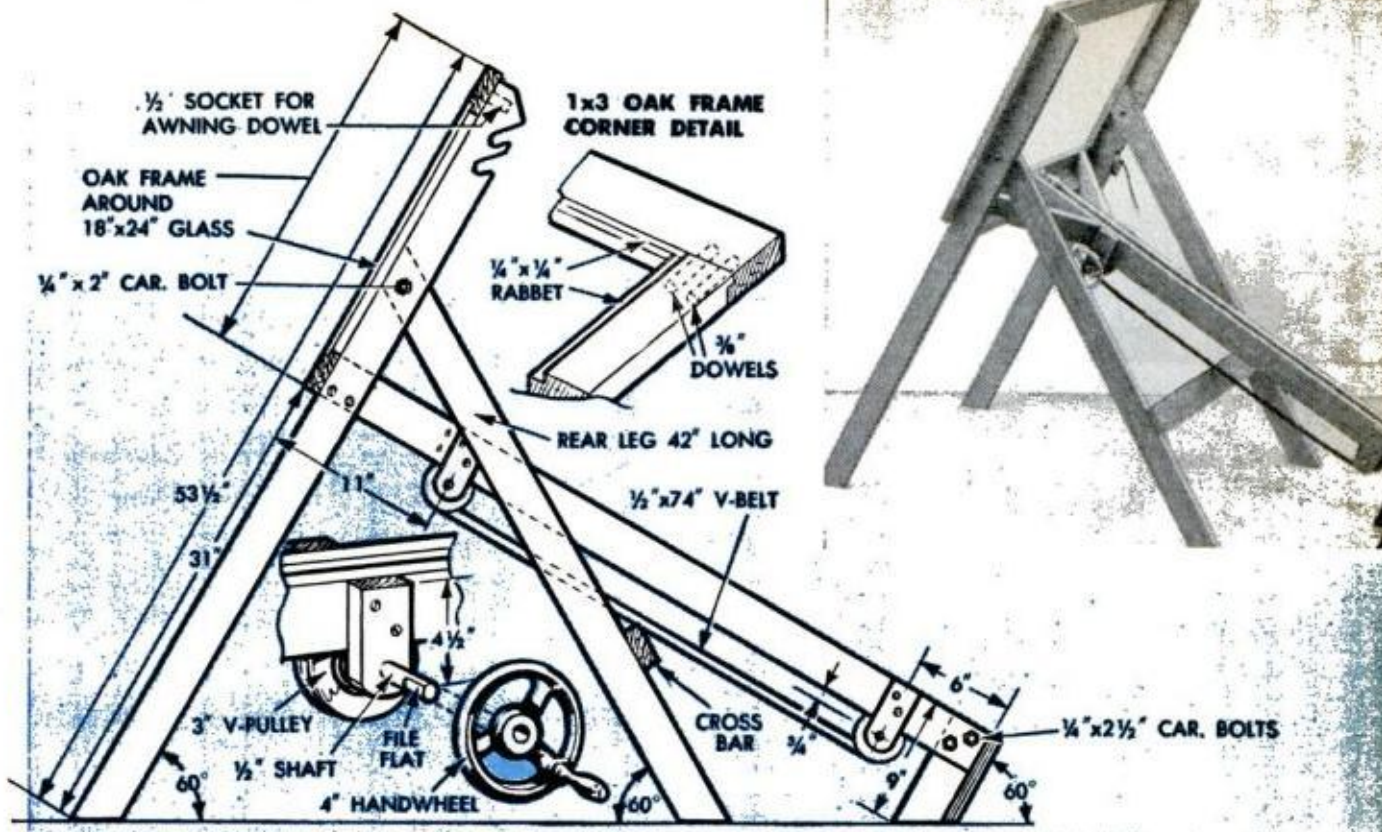
By Manly Banister

FREE YOURSELF from tedious copying methods involving graph squares or pantographs. With a comparatively small investment in time and materials, you can build this direct-copy easel-projector that enlarges patterns or sketches up to $5\frac{1}{2}$ times, or reduces to one-third original size.

You get extra speed and convenience, too, since the image is projected from *behind* upon a glass screen covered with tracing or layout paper. Thus the original is seen and traced *unreversed*, and neither

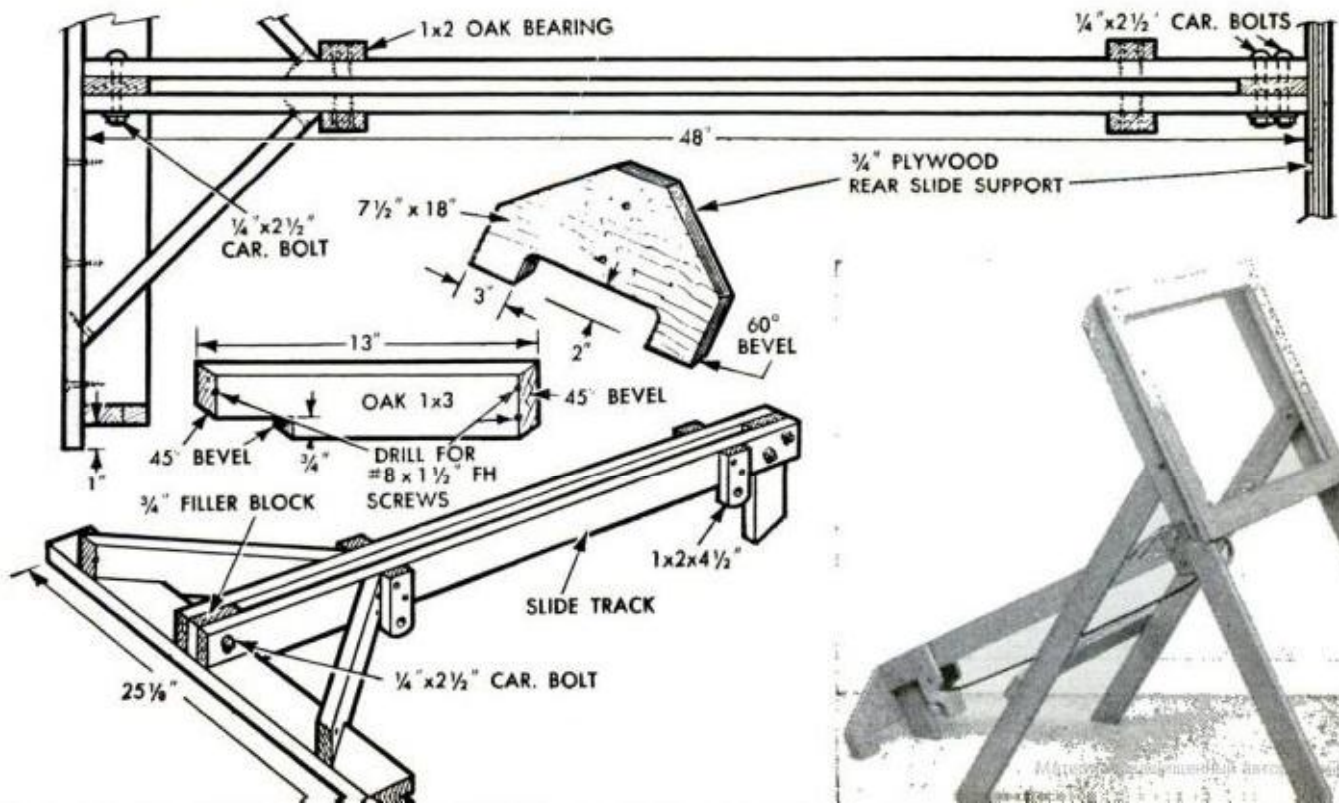
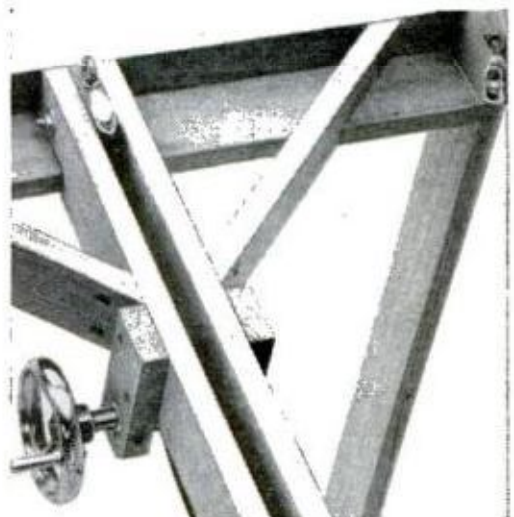
your hand nor your head can get in the way of the projected rays to block out part of the image.

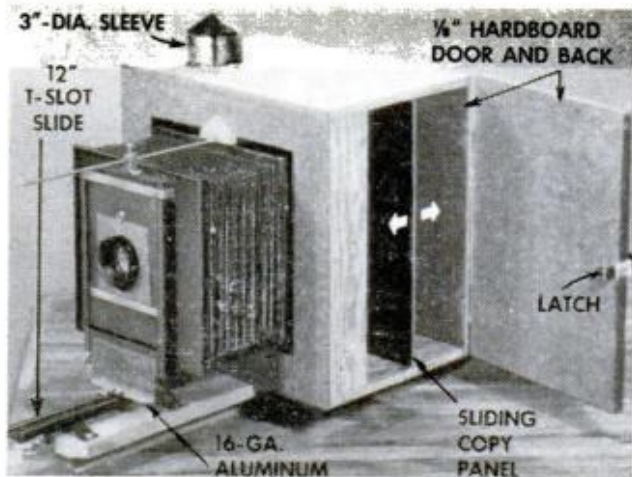
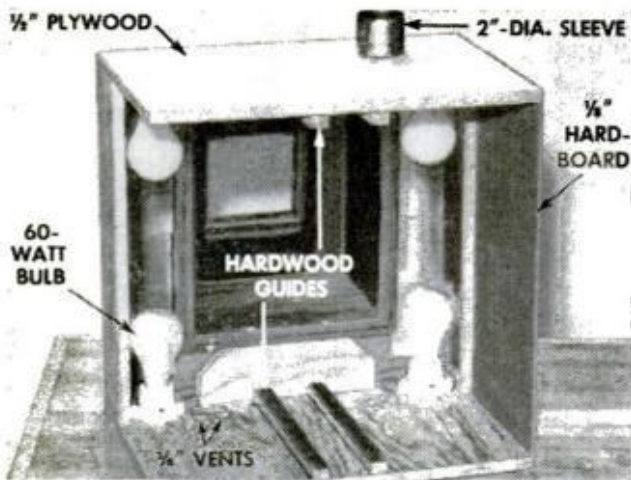
The heart of a projector is, of course, the lens—and for an artist's or draftsman's purposes, it must be of good quality to provide complete coverage of the screen without distortion. Any good camera or enlarger lens of at least 6-in. focal length and an aperture of F:8 or larger can be used, if you already own one. If you must buy a lens, Edmund Scientific Co., of Barrington, N.J., offers a war-surplus



6-in. F:3.5 Metrogon lens (Stock No. 60129) for \$29.50. Mounted in a specially-machined barrel, the lens has a square-field angle of 66 deg. that will cover 12 x 12-in. copy at 2x magnification, or an even larger area at reduction sizes. For \$10 less, they offer the same lens in its original mounting, which can be used with a little adaptation.

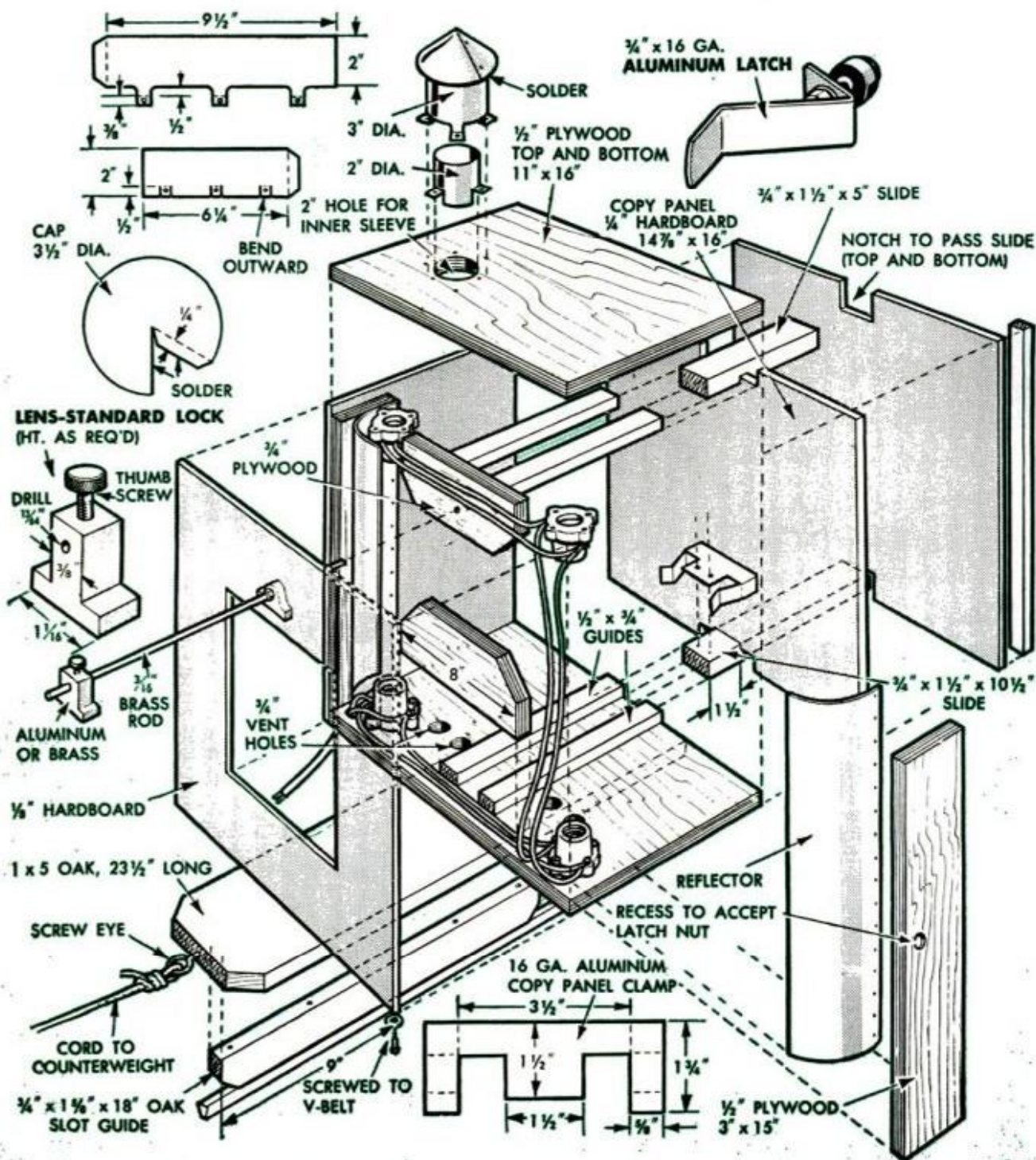
The easel-projector consists of two parts: the main frame and the sliding lamphouse. Build the easel first, using stock 1x3 oak or other hardwood. The tracing frame can either be glued up with doweled corners as detailed above, or cut from a single sheet of 3/4-in. birch plywood, with an opening 1/4 in. smaller on all sides than the glass. Frame this opening with battens to form a well for the 1/4-in. thick polished plate glass to nest in. Fasten the glass in place with a washer at each





REAR VIEW OF LAMPHOUSE with bellows installed but before the copy panel and back are in place

COMPLETED UNIT FROM FRONT, mounted on oak carriage which rides in frame slot for positioning



corner, held by a small wood screw. Don't tighten these washers against the glass—they should turn freely.

Next, construct the slide unit and attach it to the rear face of the easel with No. 8 1½-in. F.H. wood screws. Make certain the units are at exact right angles. Then attach the H-shaped leg unit.

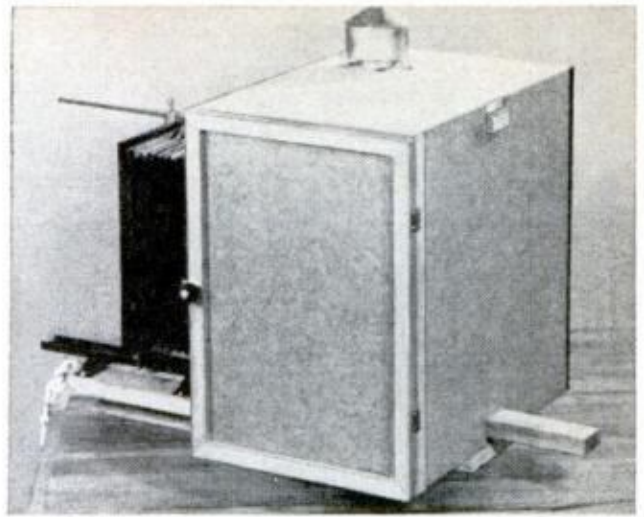
For top performance of the V-belt drive, install bronze bushings in the bearing blocks. Mount the upper pulley first, with V-belt installed. Assemble the rear bearing unit around the V-belt, then stretch the belt taut and C-clamp the rear bearing blocks to the slide while driving retaining screws. This insures tightness of the drive belt.

The projector unit consists of the lamphouse, bellows unit and carriage. You can pick up an old bellows at a camera shop for next to nothing—holes in it won't matter since it needn't be light-tight. A bellows from an 8x10 camera is preferable: it won't cut down the field of view when making reductions. It should extend at least 12 in. (If you can't find a suitable bellows, you could improvise one from nesting hardwood boxes or sheet-metal cylinders.)

Cut a window in the front lamphouse panel to accept the rear frame (camera box) of the bellows. In the pilot model, this box-window is 10-in. square, but no height is given on the plans for the 8-in.-wide plywood spacer blocks to which the box is screwed, top and bottom; these must correspond to the window size. Note that the blocks are set back from the front panel to pass the socket wires. (If your bellows has no box, attach it to the front face of the lamphouse.)

The reflectors—which can be aluminum or tin-can stock—butt against the camera box and are tacked along the side edge only. Wire four porcelain lamp sockets in parallel, bring the wires out the lower lefthand corner at the front, and attach them to an on-off toggle switch mounted on the front leg. To dissipate the heat from the four 60-watt bulbs, air is drawn through holes in the bottom and exhausted through the double-sleeve ventilator at the top. If you don't want to make the sleeves of sheet metal, as shown, facing page, you could use different-size tin cans.

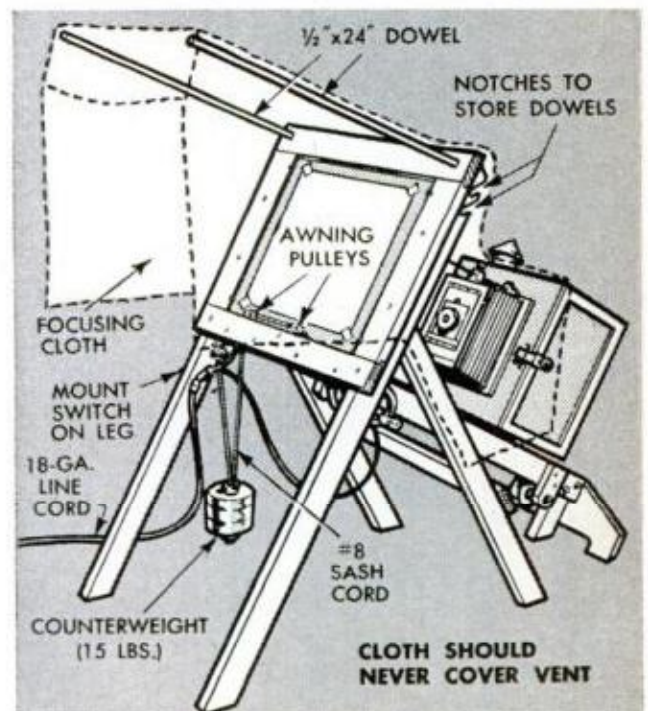
Since the projector rides at an angle of 30 deg., you'll need a clamp to keep the copy panel from slipping backward, and a guide rod so the lens standard won't sag. The clamp is quickly cut and bent from aluminum. For the lens-standard support, pass a metal rod (threaded at one end) through the front of the lamphouse and the bellows box support inside. A nut outside and another inside hold it firmly;



FRAMED-PANEL DOOR is hinged to strip glued along back's edge. Copy-panel slides pass through notches



FOOT OF SLIDE FRAME is bandsawed from plywood; table was tilted for 60-deg. bevel at base. Dowel-supported cover (below) permits use in lighted room



you can glue on an extra plywood block, as shown, if you wish to increase the anchoring thickness. You'll have to drill a small block of aluminum (or other metal) to serve as a siding lock.

You need some kind of track for the lens standard to slide on—unless, of course, you're already working with a complete bellows unit. You could either make a wooden track, or buy the 12-in. T-slot slide shown, mounting it with screws to the lamphouse carriage. It's Edmund Scientific's No. 40305 (\$3).

On the easel shown, three 5-lb. barbell weights serve as counterbalance. A compound pulley system is used (even though it requires double the weight) because the weight-drop distance is shorter than the lamphouse-travel distance. The compound system drops the weight only 6 in. for every foot of projector travel.

To save time in future operation, index the machine so you'll be able to set it quickly for the magnification or reduction desired, then bring the image to sharp focus from the front of the screen by cranking the projector up or down the slide. The following table, calculated for a 6-in.-focal-length lens, gives you basic settings. Both lens-to-screen and lens-to-copy distances are measured from the center of the lens system to the front

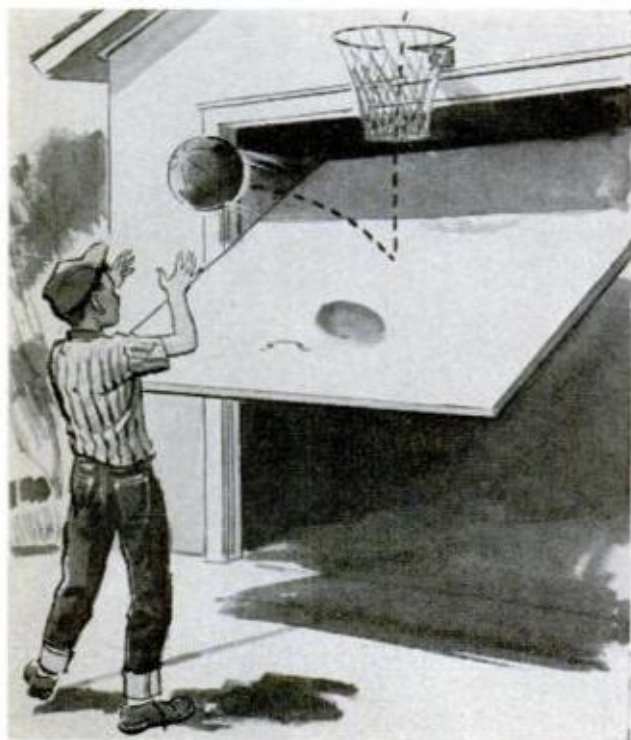
surface of whichever panel is involved.

Lens-to-Screen Distance	Lens-to-Copy Distance	Magnification
36"	7.2"	5x
24"	8"	3x
18"	9"	2x
12"	12"	same size
9"	18"	1/2x
8"	24"	1/3x

Start with the bellows fully retracted against the lamphouse and the copy panel set for about 3x enlargement. Scribe two short vertical ink lines one inch apart in the center of a sheet of white paper and fasten it to the copy panel with masking tape. Focus this image on a sheet of tracing paper taped to the screen. Adjust copy panel and focus until the inch-marks space out to exactly 3 in. on the screen. Scribe a pencil-mark across the bottom copy-panel slide where it emerges from the back of the lamphouse. Using this as "home position" for the copy, try the lens at various extensions, marking the front slide at 2x, 1x (same size) and 1/2x. To set up for 1/3x, slide the copy panel all the way to the rear of the lamphouse and extend the bellows nearly as far as it will go forward. To index for 4, 5 and 5 1/2 magnifications, back the lens to zero position against the lamphouse. ★★★

Garage-Door Bounce Board

Got a single-panel swing-up door on your garage? If you center Junior's practice-shot basket above it and cock the door half open, as shown, the door will return the ball after each score or miss.



Posthole-Digger Depth Gauge

Same-length fence posts won't need trimming if they're set in the ground the same depth. Slit a section of hose and position it on the handle of the posthole digger to serve as a depth gauge.

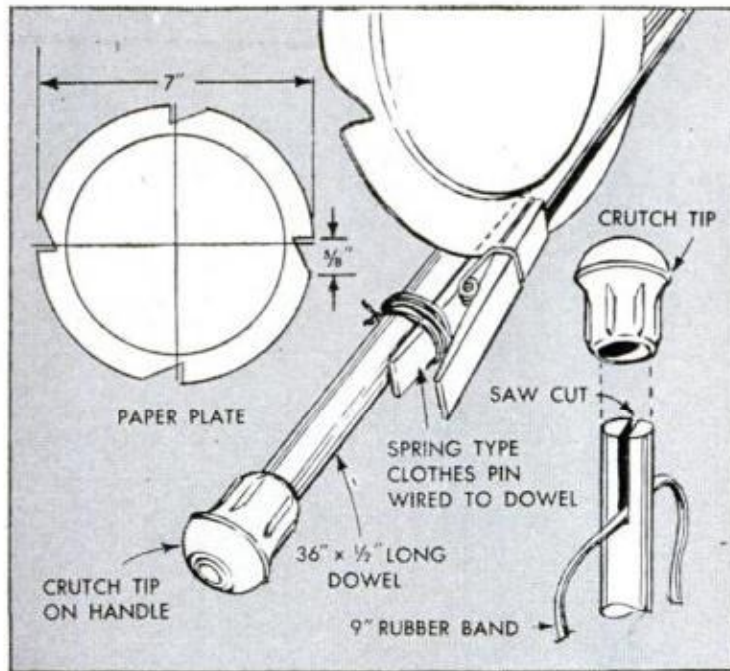




Fun with Flying Saucers

A terrific toy for the kids, this paper-plate launcher will also be a hit with Dad since it can serve as a poor man's substitute for a skeet range. Banging away at flying paper plates may not be as exciting as picking off mallards, but it does wonders for the shooter's eye. All you need is a 36-in. length of $\frac{1}{2}$ -in. dowel, a couple of crutch tips, a spring-type clothes pin and a 9-in. rubber band (which can be obtained at any hobby shop). Notch the plates as shown, and you're ready to go.

—Ralph L. Phillips



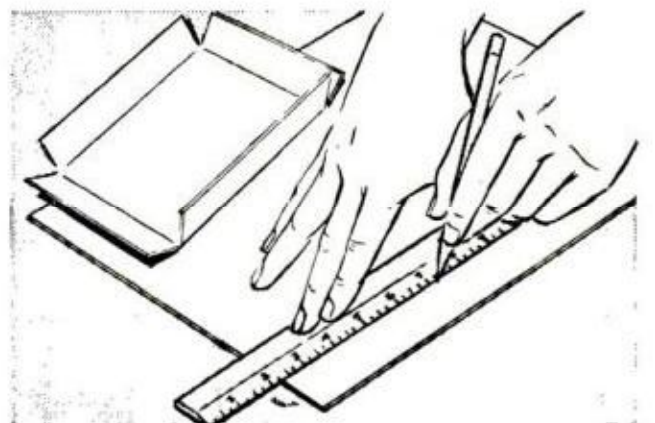
Use Eraser as Lining Gauge

Many draftsmen sign their drawings with a rubber stamp giving their name, address and other pertinent data. This is usually located in one corner of the sheet. For neat, uniform spacing of such stamps on the paper, use an eraser as a non-slip stop and a lining gauge. Simply line up the upper edge of the eraser with the edge of the sheet, press down on it lightly to hold it in place and apply the inked rubber stamp.



Try Ball-Point Pen for Scoring

The next time you have to make up a special cardboard box to hold an odd-size gift or protect a small item which must be sent through the mails, you'll find that the cardboard will fold more easily and neatly if you score it along the folding lines with a dry ball-point pen. Of course a pen which still contains ink can be used for this job, but it will leave a line along each crease. It's a simple trick, but it works.—G. E. Hendrickson





Recessed Pantry For Cramped Kitchens

Your canned goods go direct from grocery bag to full-view storage in a between-studs cabinet

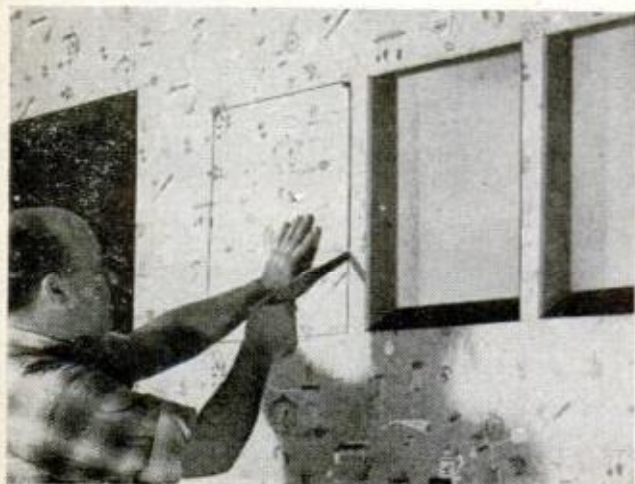
By Herbert R. Pfister

DO CANNED GOODS and small food packages (such as pudding and soup powders) fight a losing battle for space with pots and pans in your wife's kitchen?

Do they get lost in a jumble at the back of deep, dark cabinets? By utilizing space you didn't know you had, you can create storage shelves tailor-made for these items.

DRAW GUIDE LINES for top and bottom cuts and drill corner holes. Studs guide blade for vertical cuts

ONCE BOTTOM SHELF is in place, cement pairs of side panels to studs to support higher shelves



No matter how small the kitchen, there's bound to be one bare partition wall you can cut into. Since these cabinets are tucked between the studs, they don't take an inch of room space. The cabinet shown at left was located high enough so doors clear the heads of people seated at the table, yet low enough to keep the top shelf within reach.

The four-section version detailed below will hold from 50 to 60 cans, depending on size. Standard soup cans fit five abreast, jars or No. 2 cans, four abreast. And since the shelves are only one can deep, you can check your supplies at a glance.

Cutting the openings is simple, particularly with dry-wall construction. You must locate at least one stud to begin your layout, then drill holes at the corners of the marked-out openings for the insertion and turning of the keyhole saw.

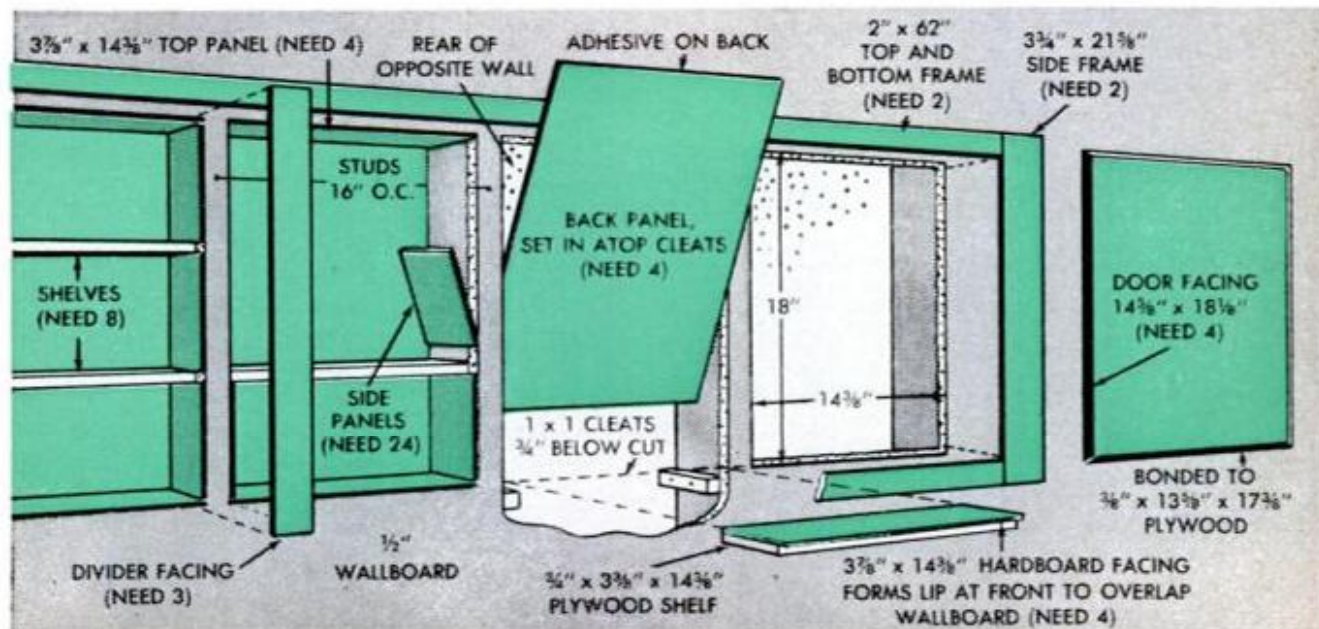
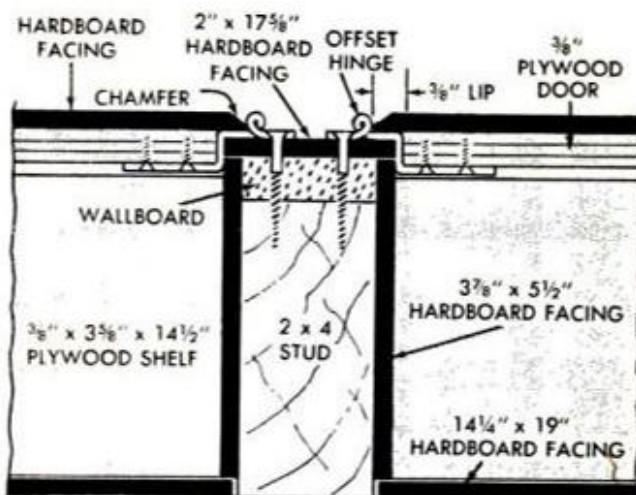
For simplicity and appearance, face the studs and exposed sections of the rear wall with $\frac{1}{4}$ -in. prefinished hardboard. A wood grain finish is shown here, but a solid color could be used if it matched your kitchen decor better. You can lay out all the pieces needed for four compartments on one 4x8-ft. panel. Cement the pieces in place with an adhesive made for this purpose. Just apply it to the back with a notched spreader.

The most important part of the construction is the fastening of the base cleats. Use epoxy glue as well as nails, since these cleats support most of the weight of the loaded shelves.

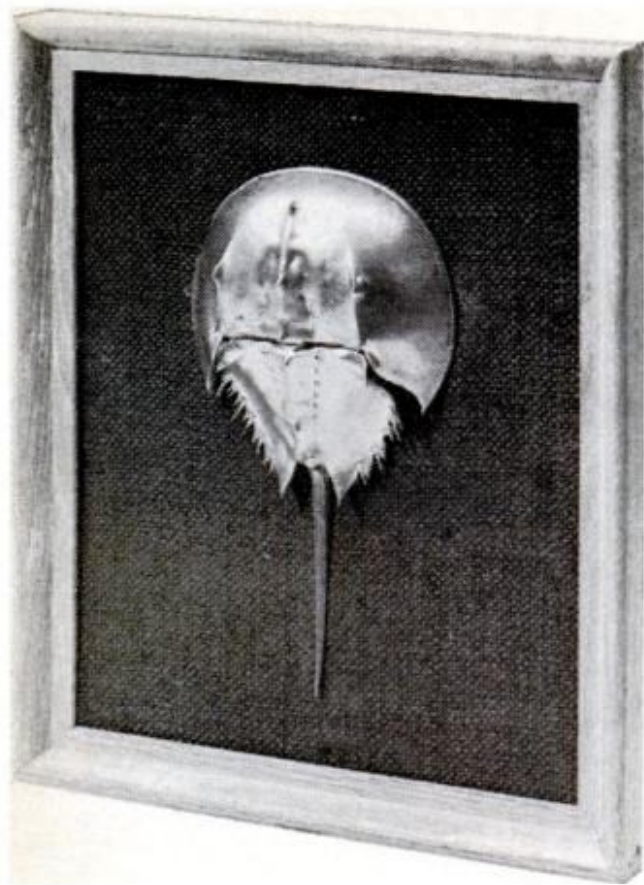
If the wall is papered, as here, before you apply the divider and frame facing, slice and strip off enough of the paper to assure a good bond with the actual wall surface. You could paint the few hardboard edges that show, but the natural brown makes a neat trim. ★★★



BOND DOOR FACING to plywood so it projects equally on all sides; this forms a $\frac{3}{8}$ -in. lip that overlaps the opening, as shown below. A 25-deg. chamfer dresses up the edge. Apply C-clamps or weights



3-D Frame-O-Rama

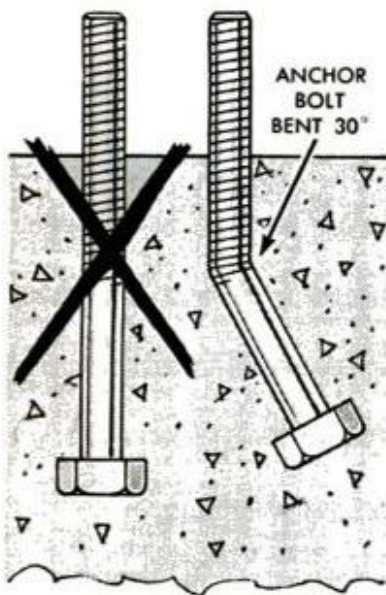


Attractive wall decorations needn't put a strain on your budget, for as any smart decorator will tell you, a little bit of ingenuity is often a good substitute for money. All you need is a picture frame.

First, cut a piece of hardboard to fit into the frame and cover it with any coarse fabric, such as burlap. Mount the fabric with wallpaper paste, then tack the covered panel in the frame.

Now comes the ingenuity. The subject of your frame-o-rama can be any common object with a pleasing shape—flowers, pods, sea shells, hand tools, even baby shoes. Sometimes you can leave the object its natural color, but usually the effect will be more striking if you spray it with an aerosol paint. The king crab shown here was sprayed with gold paint and mounted on green burlap for contrast.

Use common household cement to mount the object, applying it liberally to all surfaces that touch the panel. Weight it lightly while the cement sets, then hang it in a place of honor.—Philip F. Huy



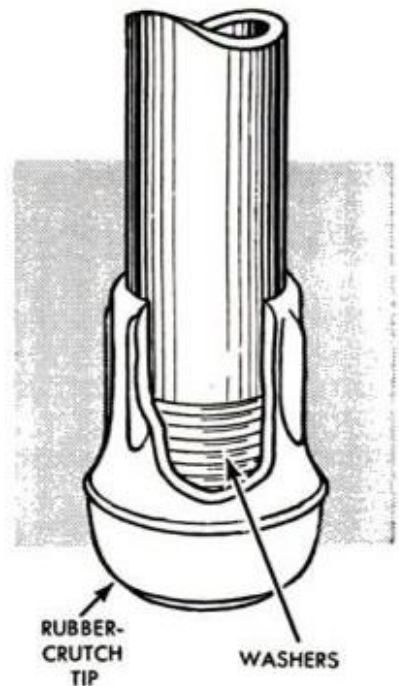
Bend Anchor Bolts

Anchor bolts placed in wet concrete are sometimes accidentally bumped and loosened, though this may not be detected until much later. You can avoid having this happen by bending the shank of each bolt 30 deg. before setting so that it won't turn and loosen.



Char Boot Laces

Got a new pair of hunting boots? Before you use them, take a minute to char the ends of the rawhide laces with a match. The ends will shrink and harden, making it much easier to push them through the eyelets when lacing your boots. Try it with your next pair.



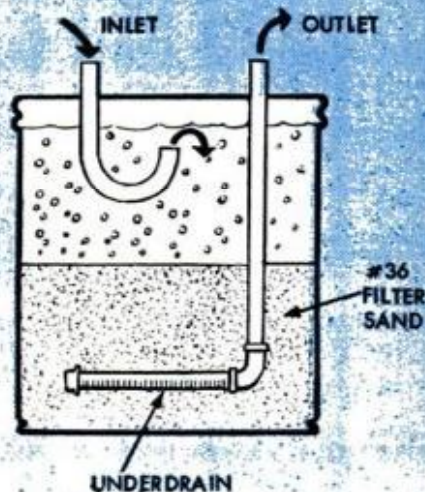
Shim Table-Leg

A kitchen table and an uneven floor makes a perfect rock-and-roll combination. To correct this, slip crutch tips over the tubular metal legs, placing several washers inside the one which will go on the "short" leg. When you move the table, remove the washers.

Low-Cost Filter for Above-Ground Pools



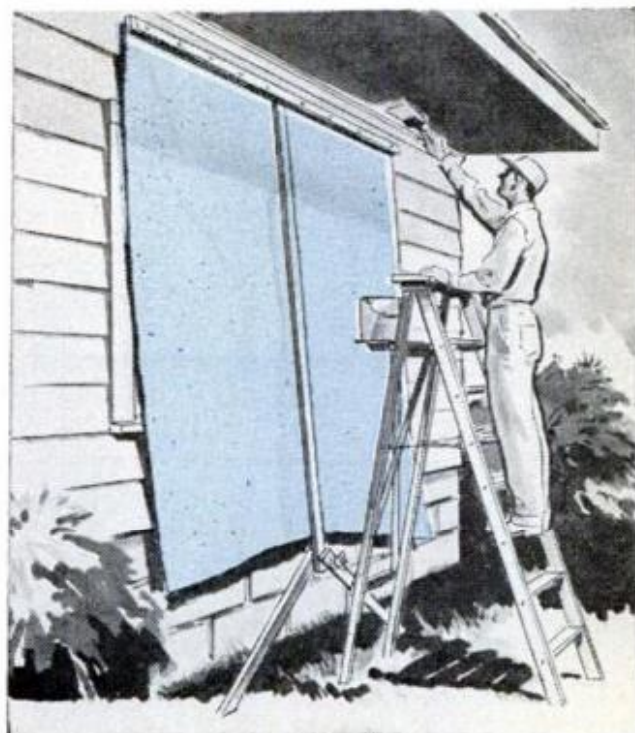
Here's a back-yard pool filter that's simpler to operate and to clean than any we've seen in its price class. To set it up, you connect three hoses. To prime it, you fill it with water from a garden hose. And to clean it, you back flush by reversing two hoses and let it pump itself clean. It's designed for above-ground pools up to 15 ft. in diameter, capacities up to 5000 gals. Price is \$46, from dealers, or from Hydronics Mfg. Corp., 3827 N. Kedzie Ave., Chicago 18, Ill.



Prop Holds Drop Cloth to Protect House from Paint Spatters

With this drop-cloth stand, it's no trick at all to protect the walls while painting under the eaves of your house. Make the stand from 1x3's. The upright is 2½ ft. shorter than wall height, the cross-piece 6 ft. long, the legs 3 ft. Fasten the crosspiece to the upright with five No. 8 screws, but use only one ½-in. carriage bolt with a wing nut to fasten the legs. This permits moving them to adjust for height or uneven ground. Drive a row of 10d nails through the crosspiece and leave their points exposed. In use, the drop cloth goes up over the crosspiece and is pressed onto the nails. Bottom of the cloth is tacked to the upright.—C. H. Hardy

Small dents in your automobile may be removed with a heat lamp like those used for fast drying of paint. Concentrating the beam on the damaged area will make small dents pop out, and will even reduce many larger dents.—Harvey Muller



TOY ROTARY DUPLICATOR

GUMMED TAPE

FELT-COVERED
1-GAL. PAINT CAN

1"-STOCK

RUBBER BAND
(2 REQD.)

SPACER (2 REQD.)

FELT

$\frac{1}{8}$ " DOWEL

PRESSURE
ROLLER

DOWEL

CLOTH PADDED
CLOSET POLE

SPACERS

PLYWOOD DISK
HAND WHEEL

THREAD SPOOL

A FELT-COVERED 1-gal. paint can forms the stencil drum, and a short length of cloth-padded closet pole is the pressure roller for this toy duplicator. Drill holes in the centers of the can ends to take the dowel, and glue shorter spindles into holes drilled in the pole ends. The two side supports are drilled and slotted to receive these four spindles. Loop rubber bands around the drum spindle and a tack at each side, as shown, to keep the stencil pressed against the inserted copy paper as you crank the pressure roller. Cement the felt on the can and padding on the roller so the ends butt and don't lap. Brush duplicator ink on the felt—sparingly—before wrapping the stencil around the drum. Even a legal-size stencil, which must be trimmed for width, is too short for the ends to meet, so to mask off the exposed felt at the gap, tape a strip of plain paper between the ends of the stencil.—Trevor Holloway



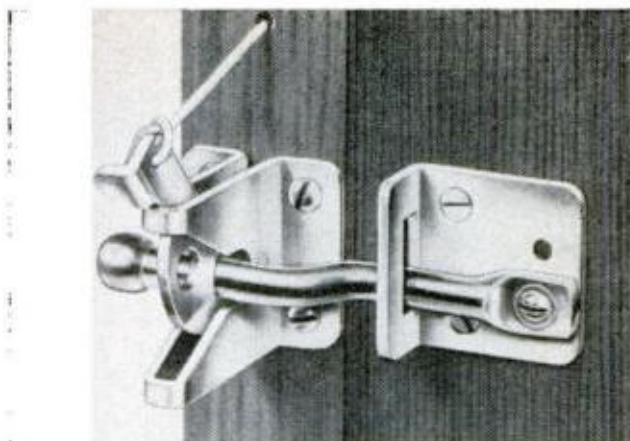
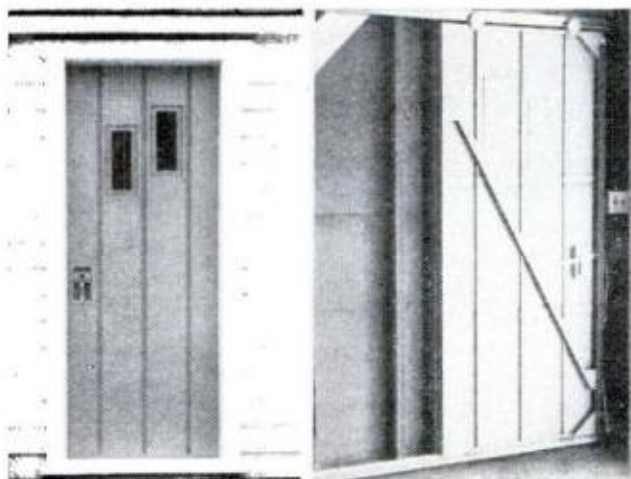
By Arthur Maher

OIL-FREE LIQUID is specially formulated for treating flat-finish furniture. Gave excellent results in PM tests. Available in spray cans (\$1.49) for treating existing pieces, and gallons (\$3.25, FOB Bklyn) for new or refinished pieces. Industrial Finishing Products, Incorporated, 465 Logan Street, Brooklyn, N.Y.

HIDE-A-WAY DESK can be recessed into a wall or surface-mounted by means of an accessory frame. Door folds down to become a writing surface. Inside contains stationery pockets, seven shelves, two drawers. Measures 4x16 $\frac{1}{4}$ x30 $\frac{1}{4}$ -in. Sells for \$37.95. Swanson Inc., 607 S. Washington St., Owosso, Mich.

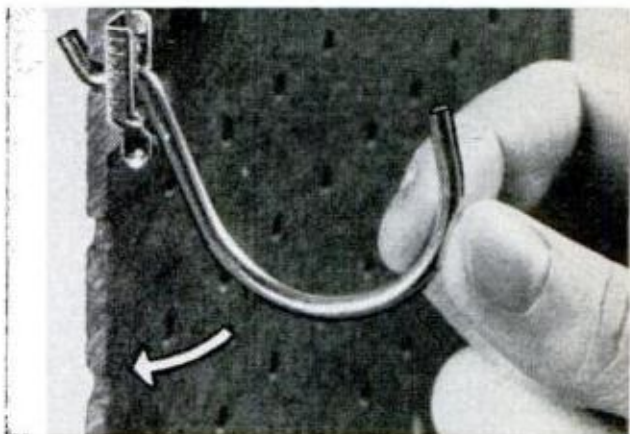


STEEL SERVICE DOOR is said not to stick or warp. Since it slides, instead of swings, it won't damage your car, interfere with passage around the car or hit the tracks of overhead-type doors. Needs 2-ft. 8-in. by 6-ft. 8-in. opening. For details, write Taylor Garage Doors, 19800 Fitzpatrick, Detroit 28, Mich.



NEW GATE LATCH designated No. V21A Adjust-O-Matic, has a cross bar that pivots, to compensate for sagging or misalignment of gate or post. Makes installation line-up less critical. String permits opening from back side of gate. Sells for about \$1.00, at dealers. National Manufacturing Co., Sterling, Ill.

PEG-LOK HOOKS are offered in a wide variety of shapes and sizes, for storing tools and other items on $\frac{1}{8}$ -in. perforated hardboard. Each hook has a spring clip that holds it firmly in place. Won't rock or pull out. Easily removed without marring board. Sample costs 10¢. Peg-Lok, Inc., Cumberland, R.I.



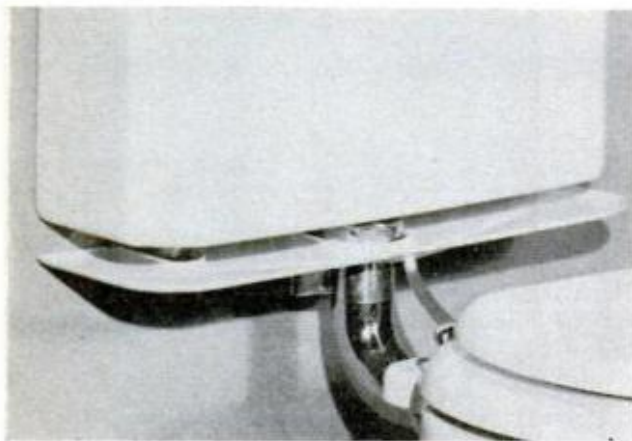
PLASTIC-BOTTOM GLIDES are threaded to permit easy leveling of furniture. Work with straight legs or legs that splay up to 23 deg. Made in $\frac{5}{8}$ -, $\frac{3}{4}$ -, $\frac{7}{8}$ - and 1-in. sizes for metal legs, plus a "universal" size for wood legs. Set costs \$1.00 postpaid. Franklin Metal & Rubber Co., Jacksonville Rd., Hatboro, Pa.



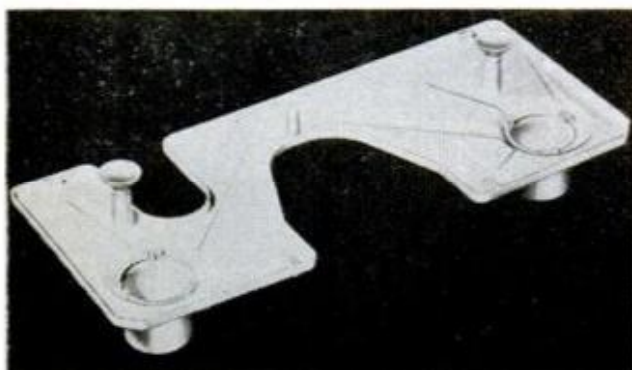
Stop Toilet-Tank Sweat



STYROFOAM lining, called Jayelite, prevents tank walls from cooling and thus stops condensation



DRIP TRAYS, such as a Dri-Flor, catch moisture and collect it in removable cups or drain into bowl of toilet. You can install such a tray in minutes



THE PROBLEM: A steady drip-drip-drip of water on your bathroom floor caused by moisture condensing on the flush tank. *The solution:* Take your choice of the half dozen listed here.

Drip trays. While a metal or plastic tray mounted underneath the tank won't stop that condensation from forming, it will keep water from dripping on the floor. Some trays are equipped with a drain tube which empties into the toilet bowl; others have removable plastic cups in which the water collects.

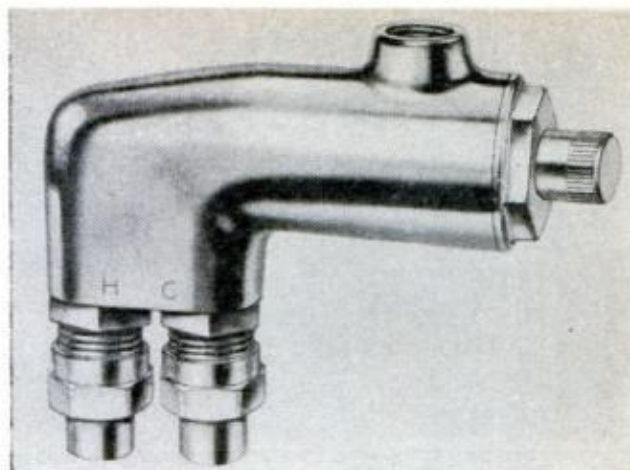
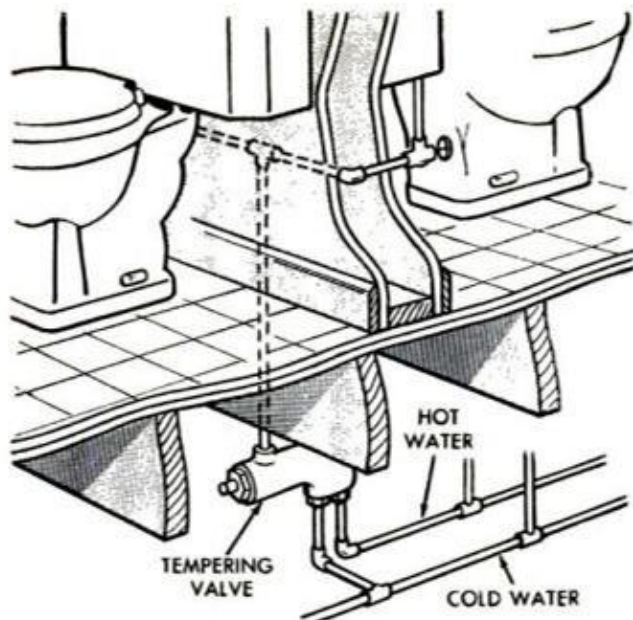
Anyone can install a drip tray in a few minutes. Just slip aluminum strips up behind the tank and bend them over to engage the tray, then adjust the tray so that it's perfectly level.

Foam insulating liners. Sold in kit form, these consist of several sheets of foamlike material and a can of waterproof glue or mastic. To install a liner, shut off the water supply to the toilet, empty the tank and clean the inside surfaces with an abrasive cleaner. Next, wipe all these surfaces absolutely dry so that the glue or mastic will be sure to adhere well.

Some kits contain precut laminated sheets that require very little trimming for a good fit. Usually, it won't be necessary to remove any of the tank's internal plumbing in order to install the foam liner. However, if you require a little extra space to manipulate the liner, take out the float valve.

In order to provide effective insulation, the lining must be in full contact with all surfaces and the joints sealed with cement. Otherwise it will allow the cold water to come in contact with the tank and cause spots of condensation.

Tempering valves. Another method of eliminating condensation is to raise the temperature of the water before it reaches the flush tank. A specially designed mixing valve installed in the cold-water line supplying the flush tank allows you to connect a hot-water line to it so that the water delivered to the tank will be at approximately room temperature. If the



surface of the tank is no colder than the surrounding air, condensation won't form.

Tempering tank. Designed to accomplish the same job as a tempering valve, a tempering tank is simply a reservoir in the cold-water line supplying the flush tank. Theoretically, water allowed to stand in this tank will be warmed by the surrounding air. However, this won't work if large amounts of water must pass through the tank within a short time. Also, condensation will form on the tempering tank so this type of installation simply changes the location of your problem from the bathroom to the basement.

Thermostatic heating unit. One of the simplest solutions to a condensation problem involves no plumbing modifications. An electric immersion heating unit with self-contained thermostat will keep the water in the flush tank at a sufficiently high temperature to prevent the formation of condensation. Just hang the unit in the tank and plug it into an outlet.

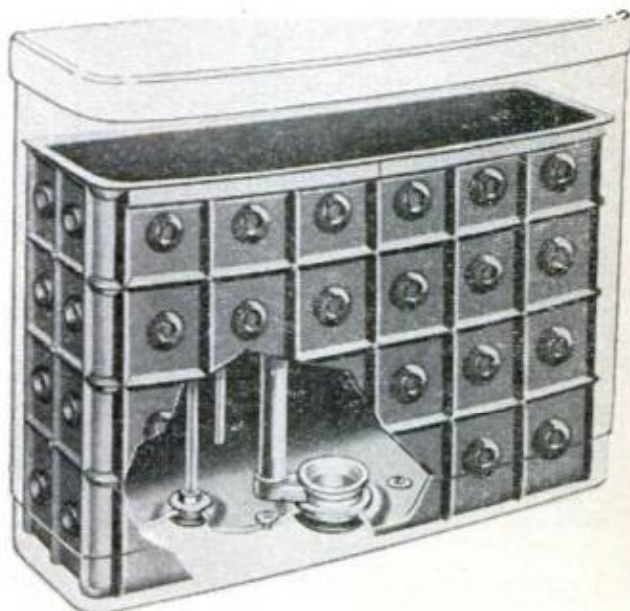
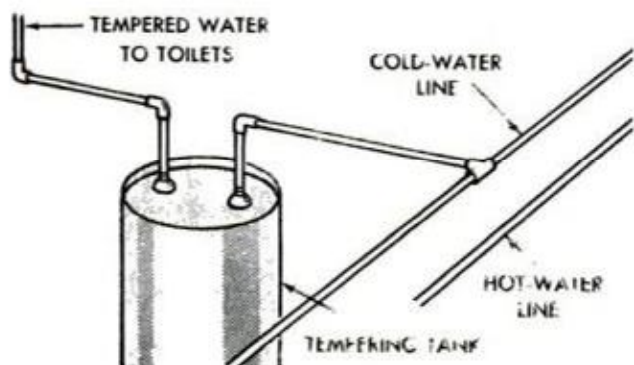
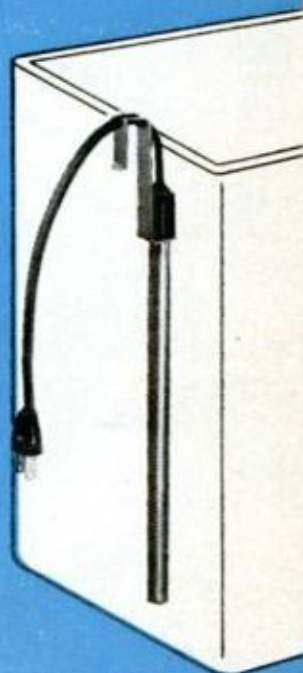
Double-wall tanks. When replacing old fixtures, give some consideration to installing a dripless tank featuring two walls with an insulating sealed air space between. Such tanks can only be used with the matching bowls which they are designed to fit.—*E. R. Haan*

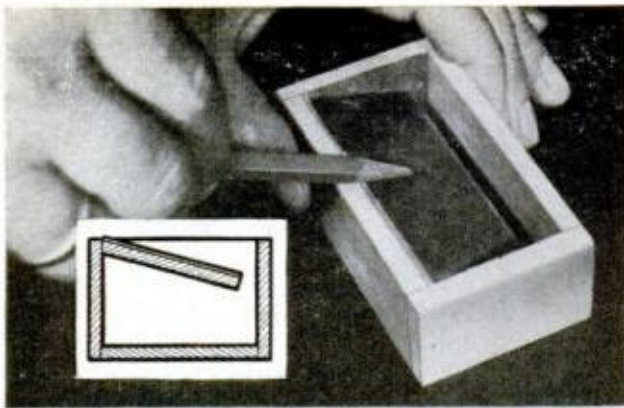
TEMPERING VALVE

will deliver water to the tank at room temperature. It connects to both hot and cold-water lines, mixing thermostatically

HEATING UNIT hangs inside tank, has self-contained thermostat to keep water at the correct temperature. Called Drip-Ban, cost of operating is low

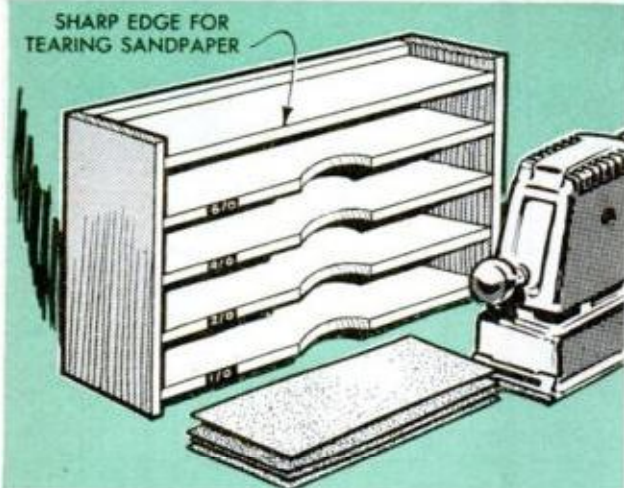
DRIPLESS TANKS have two walls with sealed air space between. Tank shown here has molded rubber liner forming inner wall of chamber





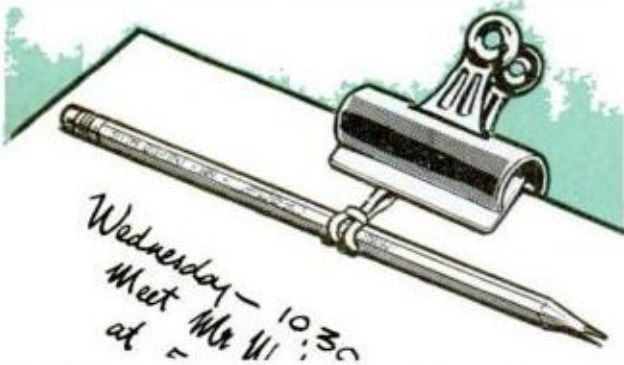
Pencil Pointer Traps Grit

Many draftsmen tape sandpaper to their drawing boards to keep pencils needle sharp or to flatten a point for shading. Lead-laden grit, however, invites smudging. It won't if you glue the sandpaper to a slanting shelf suspended in a box, as shown. When the sandpaper clogs, tap the box to sift the lead inside. Make the box of $\frac{1}{4}$ -in. stock, $1\frac{1}{4}$ in. high, 2 in. wide and $3\frac{1}{2}$ in. long, and assemble with glue and brads.—*John Lammers*



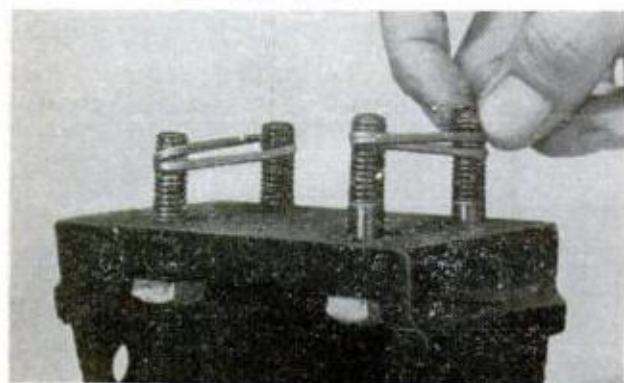
Sandpaper File for Pad Sanders

Most orbital or reciprocating sanders take one third of a 9x11-in. sheet. To save time measuring each sheet before tearing, and to keep a supply of all grits at hand, make a shallow sandpaper file like the one shown. Use $\frac{1}{4}$ -in. thick hardboard for all parts but the top shelf; this should be $\frac{1}{2}$ -in. hardwood, with the top front edge left sharp. Cut shelves $3\frac{5}{8}$ in. wide and recess the top one so the back and one end will serve as stops to position the paper for folding and tearing.—*King Basham, Jr.*



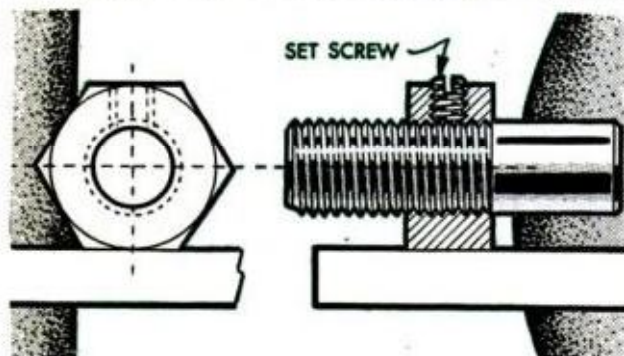
Corraling a Wandering Pencil

End the hunt for a strayed pencil when you're using a clipboard for check lists or on-the-job notes. Just knot a rubber band around the pencil's mid-point and snap the projecting loop under the clip. The band won't interfere with normal use of the pencil, and it's less bother than a snarl-prone length of string running from the pencil to the clip's hanging hole.—*G. E. Hendrickson*



Anchoring those Anchor Bolts

Attachments for many wood- and metal-working machines often have special bolts or studs for mounting. Since these bolts mate with tapped holes on the machines, no nuts are provided to keep them in place when the attachments are stored. To prevent loss and to be sure they're in the right positions (if of different lengths) anchor the bolts by snapping a rubber band around them as shown.



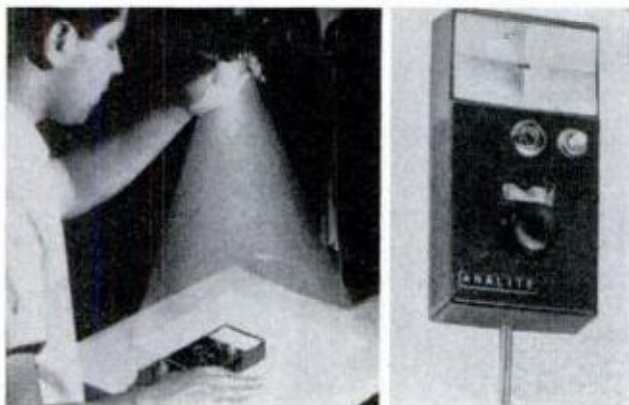
Nut Serves as Non-Tip Holder

Need to grind flats on a small part such as a stud? Don't try presenting it to the side face of the wheel by gripping it in your fingers. Turn on a large nut that's been tapped for a setscrew, and tighten the screw against the stud. This gives you a flat base to hold against the pedestal tool rest. If you need hex flats, use a hex nut.—*Donald Kimberling*

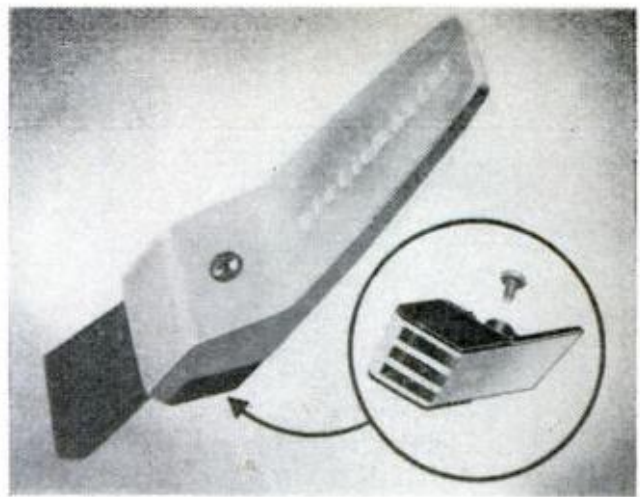


GUIDE-O-MATIC 8-mm movie cameras feature automatic loading like that used in self-threading projectors. You insert film, motor does the rest. Battery driven. Priced from under \$150. DeJur-Amsco, Northern Blvd. & 45 St., L.I. City 1, N.Y.

WHEN YOU MAKE A PERFECT ENLARGEMENT, the Analite (below) "remembers" exposure data for brand of paper used. It then gives correct exposure for other negatives printed with same paper. Price is \$24.95. Durst (USA), 37-14 48th Ave., L.I. City 1, N.Y.



CONTAFLEX SUPER B 35-mm camera (below) has control for normal and flash pictures. User sets flash guide number, range finder sets lens. Costs \$259. An 8x30B monocular that screws into Super B lens mount is also offered, at \$99.00. Equivalent to 400-mm telephoto. Carl Zeiss, 444 5th Ave., N.Y., N.Y.



STATICMASTER BRUSH, model 1C50, has a cartridge that neutralizes static charge of negatives, slides, lenses to insure dust-free surfaces. The brush sells for \$4.95. Replacement cartridges are \$2.95 each. Nuclear Prods., 10173 East Rush Street, El Monte, Calif.

BUILT-IN VIEWFINDER of this cadmium sulphide exposure meter shows exact area measured. Gives exposures of 8 hours to 1/4000 sec., for ASAs of 6 to 12,000. Called Miranda Cadius, it sells for \$44.95. Allied Impex, 300 Park Ave. South, N.Y. 9, N.Y.



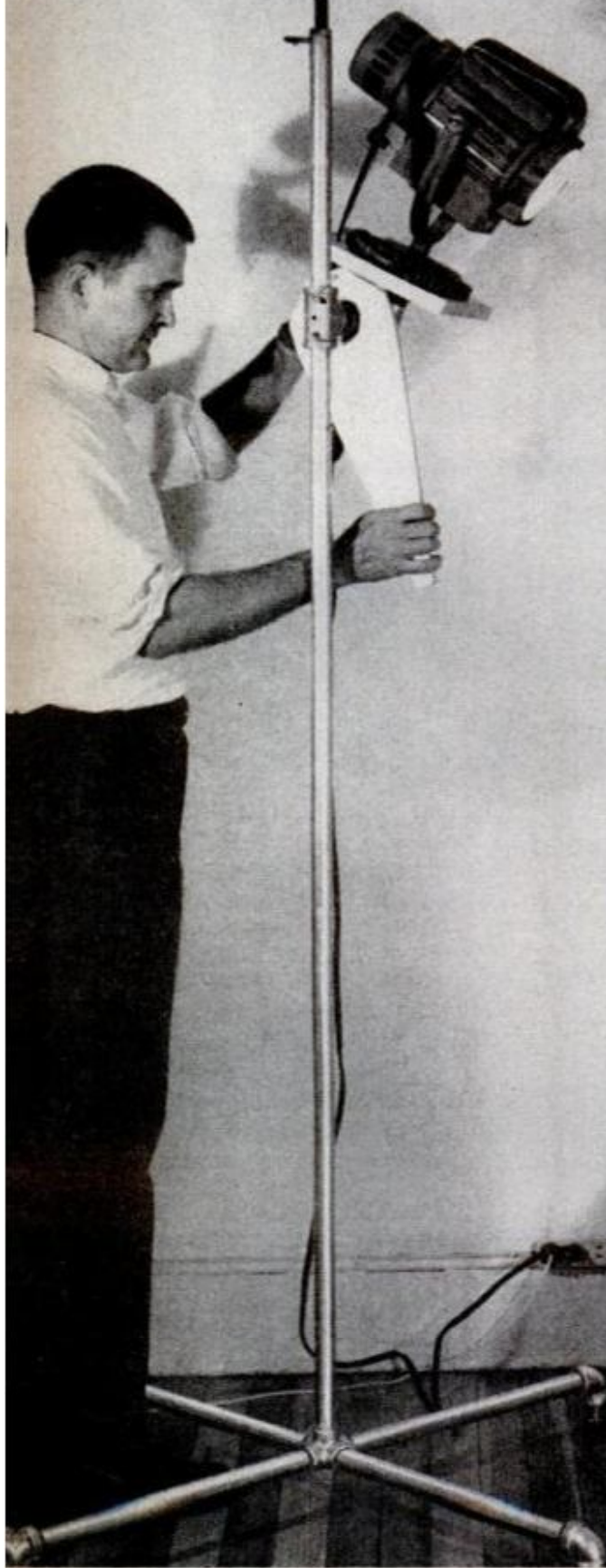
BY MASKING THE LENS of your Polaroid camera with the device below, take 2, 4 or 6 shots on one frame. After a little experimenting, you get attractive montage-like prints. For models J66, J33 and 800 series only. Price: \$3.98 postpaid. Splendore Multiplex, Inc., P.O. Box 42, Inwood, Long Island, N.Y.

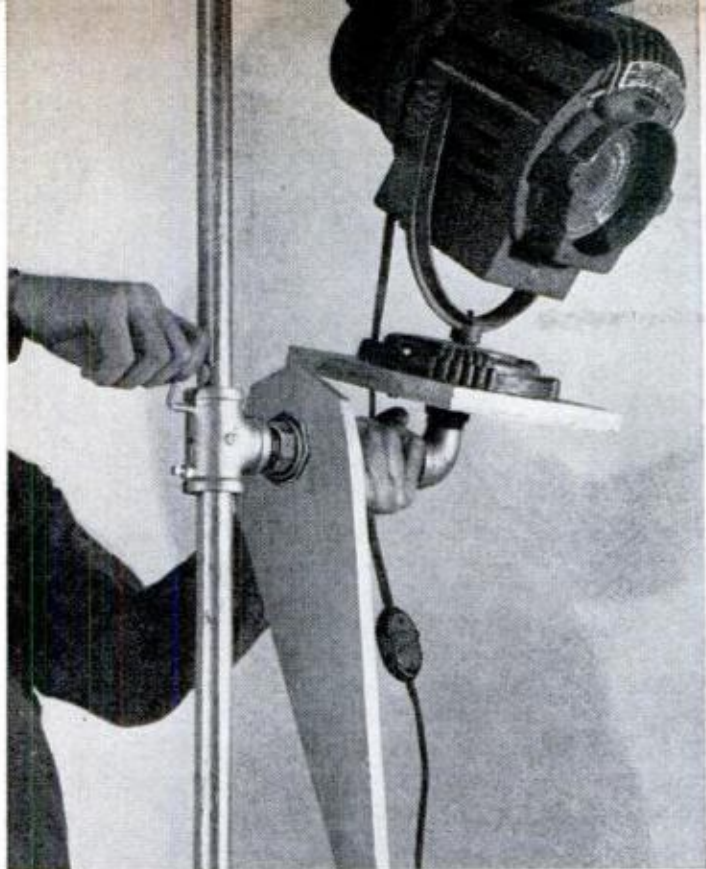


Pipe-Fitting LIGHT STAND

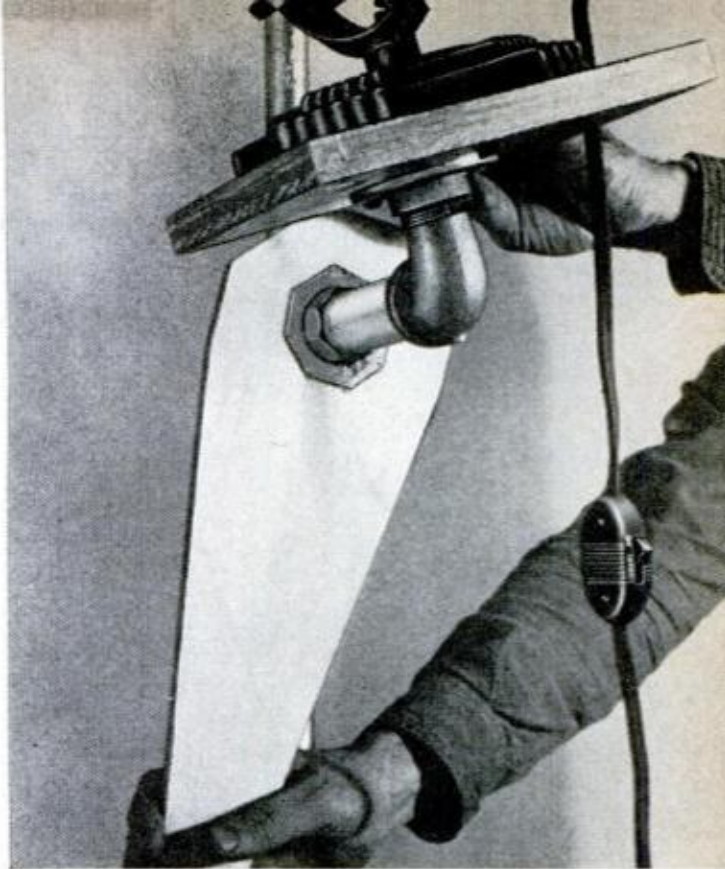
Seven dollars' worth of pipe fittings, some scrap plywood and four furniture-leg cups will equip your home studio with a pole-type light stand sturdy enough to support a heavy spot. Whole thing comes apart for storing

By J. Ramsey





LOOSENING BOLT permits up or down movement of the spotlight. Setscrew at bottom prevents wobble, and is adjusted so arm slides freely without binding



A SCRAP PLYWOOD HANDLE provides leverage for easy operation of the union nut which locks the spot at any angle. Handle is fastened to the nut with epoxy

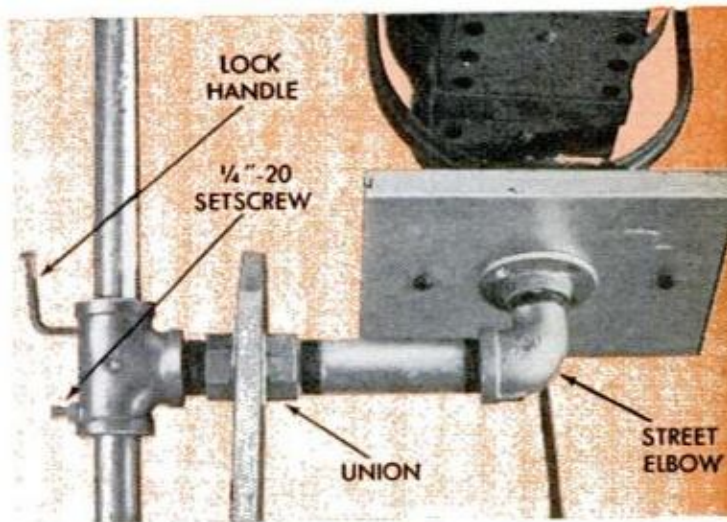
ADDING that professional highlight to family portraits usually requires a studio-type spot high overhead. But the common frail light stand suitable for holding a photoflood is far from sturdy enough to support such heavy photo lamps.

This led me to make the pole-type one you see. I used pipe fittings so it not only could be taken apart for storing, but also so it could be jacked against the ceiling for extra rigidity.

The pipe and fittings I used are listed below. Assemble them as shown in the photographs. Cut the handle at least 18 in. long from $\frac{1}{2}$ -in. plywood, the platform from $\frac{3}{4}$ -in. plywood. Then cut a hex-shaped hole in the handle to fit over the union nut and cement the handle to the nut with epoxy.

The pipe extension is capped with a rubber crutch tip. The $\frac{1}{4}$ -20 bolt that locks it in place is 3 in. long and is bent 90 deg. to form a handle.

ONE-INCH TEE on the movable arm slides on $\frac{3}{4}$ -in. center post without reaming. Setscrew is fitted with a locknut. The lock handle is a bent 3-in. x $\frac{1}{4}$ -20 bolt



FIVE-WAY FENCE FITTING joins legs to center post. Feet are capped with 1-in. plastic chair leg tips

MATERIALS LIST

For Adjustable Arm

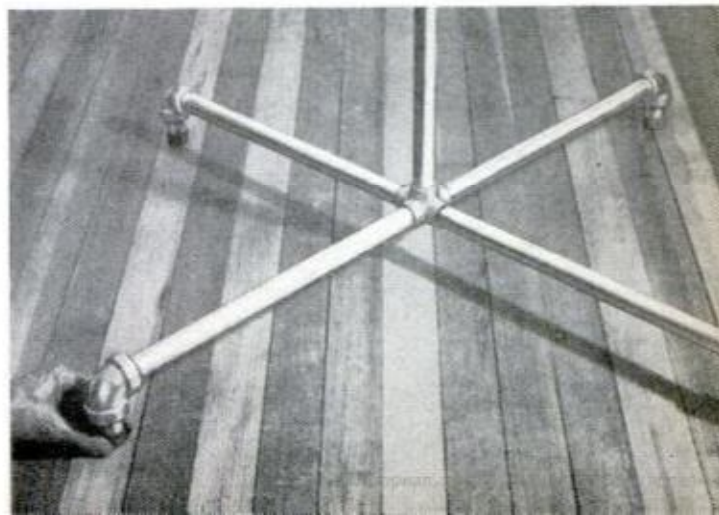
- | | |
|-----------------------------------|-----------------------|
| 1 pc.—1"x6" nipple | 1 pc.—1" union |
| 1 pc.—1"x1 $\frac{1}{2}$ " nipple | 1 pc.—1" street elbow |
| 1 pc.—1" tee | 1 pc.—1" floor flange |

For Legs and Center Post

- 4 pcs.— $\frac{3}{4}$ " elbows
 4 pcs.— $\frac{3}{4}$ "x1 $\frac{3}{8}$ " nipples
 1 pc.— $\frac{3}{4}$ " 5-way fence fitting
 4 pcs.—1" plastic chair tips
 12'— $\frac{3}{4}$ " pipe (4-18" legs plus 6' center post)

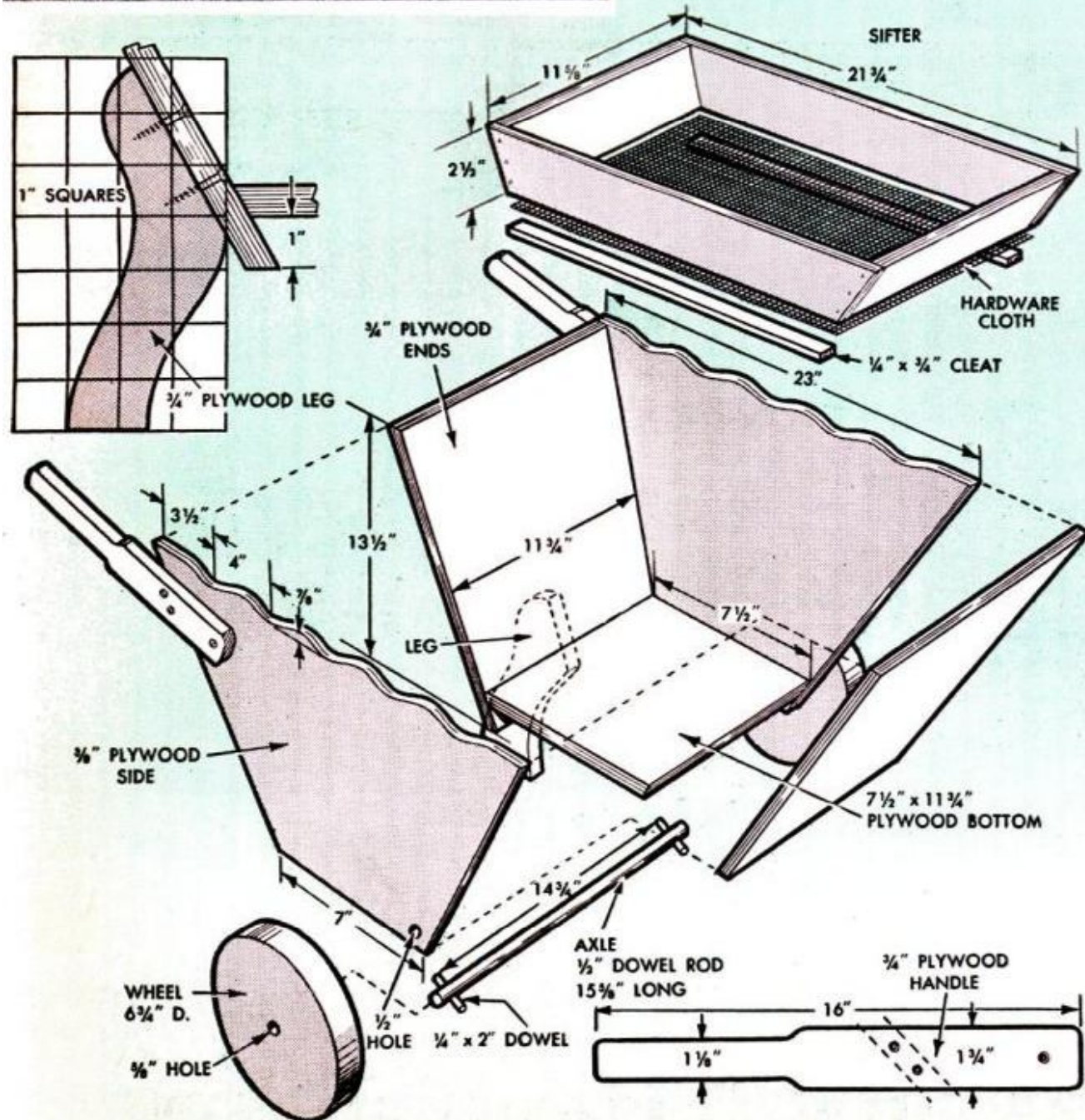
For Adjustable Ceiling Anchor

- 3'— $\frac{3}{8}$ " pipe
 1 pc.—rubber crutch tip



POTTING BARROW

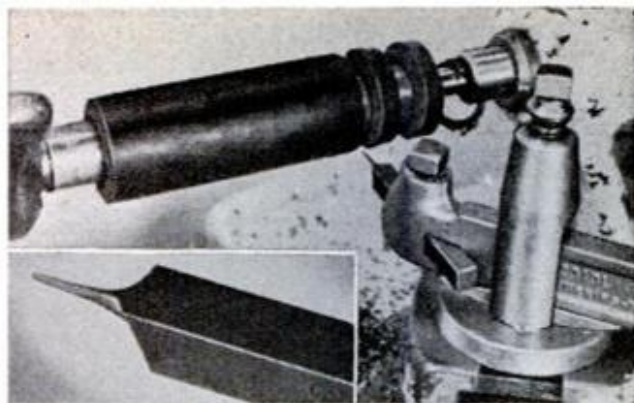
THIS GARDEN CART, made almost entirely of exterior plywood, can do anything a wheelbarrow can do (but on a smaller scale) plus a bit more. Tipped forward, it becomes a scoop for sweeping leaves and trash, and, thanks to its removable sifter, it's ideal for preparing potting soil. Cut the required parts according to the diagram, and assemble with waterproof glue and finishing nails, except where screws are indicated. Lay out the scalloped edges with a compass or use a jar lid as a template. Whole thing can be made larger by merely increasing dimensions proportionately.—C. Sinapi



SHOP SHORT CUTS

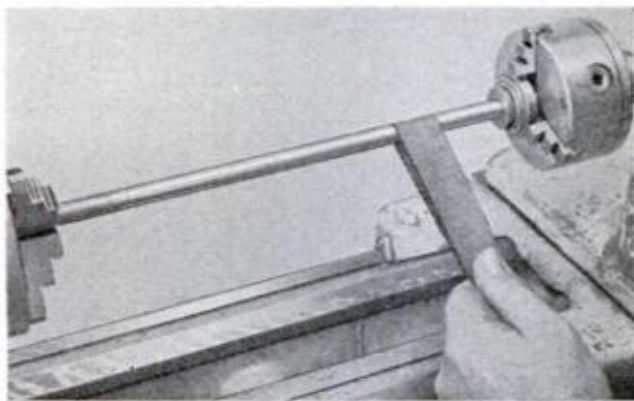
Rubber-Hose Slicer

Cutting rings from a length of rubber hose in a lathe is no trick when you use a specially ground, knife-edged tool. Just slide the hose tightly on a regular mandrel, mount between centers and then grind a tool to a knife edge as pictured in the inset. Set the tool at 90 degrees with the lathe axis and feed straight in.



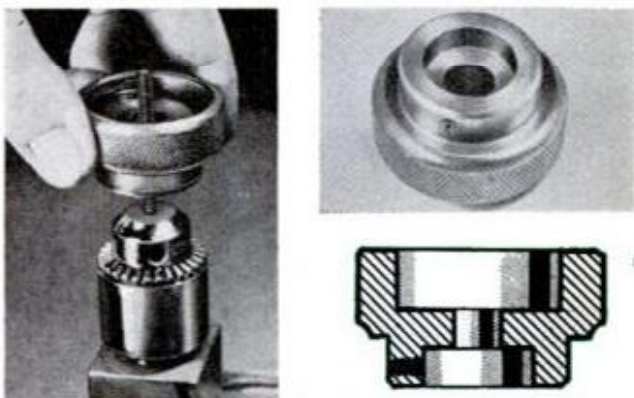
Extra High Shine

Hand polishing rods or turnings chucked with a long, unsupported overhang can be hazardous should the rod suddenly bend under pressure. The safe way is to turn a tapered arbor to fit the tailstock sleeve and thread it to take a small universal chuck. Then mount a ball bearing in this chuck to carry the free end of the rod. Now you can put polishing pressure on the abrasive loop without risking injury.



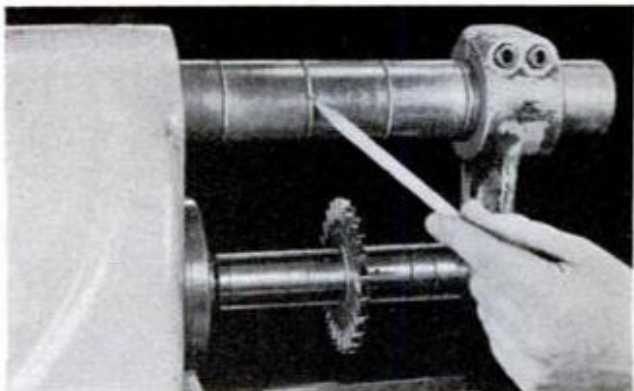
Thumb-Screw Die Stock

Getting a button die off to the right start can be a trial-and-error sort of thing unless you use this shop-made die stock. Then it's easy to start a true thread. Turn the stock in the lathe as in the sectional view, shoulder, face off, knurl the larger diameter, then drill through for chip and work clearance. Recess from both faces, the smaller recess taking the die. Drill and tap for a locking screw.



Overarm Dirt Traps

Fine metal chips and abrading grime tend to collect on overarms of milling machines and may be carried into the arm-support bore and the yoke bore when these parts are moved. One method of trapping these abrading materials and reducing wear is turning a series of spaced grooves in the arm as pictured. These grooves will effectively trap chips and any abrasives that may collect.



Carbide Wheel Dressers

Don't discard worn or broken carbide tool tips or tools; they make good grinding wheel dressers. The hard-metal tips will true an out-of-round wheel almost as quickly as a genuine diamond dresser. The carbide tips can be held in an ordinary C-clamp and supported on the grinder tool rest. Mounted carbide tips can be hand-held or used with the mounting resting on the tool rest.—F. Greenwald





Set-and-Forget SPRINKLER SYSTEMS

By Bernard Gladstone

IT ISN'T DIFFICULT to understand the growing popularity of underground sprinkling systems. Widespread availability of low-cost, easily handled plastic pipe makes it possible for any handy homeowner to install his own system. Climate is no longer a problem since this pipe won't be damaged by freezing. And what homeowner would prefer to drag a slippery garden hose through the wet grass, shifting sprinklers from place to place, when he can get the job done more effectively by just turning a valve.

But in the past, even the best sprinkling systems required someone to turn that valve. Today, you can connect the system to an automatic control unit which turns the water on and off at the desired times. Once a sprinkling program has been set up, the watering cycle will be repeated automatically every day, every other day or as often as you wish (depending on the flexibility of the control unit you select).

Convenience isn't the only reason that automatic sprinkling systems are becoming popular. If you live in a community where water pressure is inadequate during peak hours, you can set the control to water your lawn during the night or early morning hours. This also cuts down

on wasteful evaporation of the moisture.

Some control units even include special sensors which read the moisture content of the soil and interrupt the watering cycle, skipping days after heavy rains.

Your basic plumbing layout and choice of sprinkler heads won't be affected by the method of control used. In fact, many people start with a manual system, then convert later to an automatic system by simply adding a timer unit and replacing the manual valves with those designed for automatic control.

Choosing Your Sprinkler Heads. There are four different kinds of spray heads you can use: stationary, pop-up, pop-up rotor and large diameter impact-type sprinklers. The first three are designed to sit flush with the surface. The fourth sticks up out of the ground and is often set on a riser pipe to gain added distance.

Stationary spray heads throw up a fine mist which will cover a radius of anywhere from 7 to 10 ft. The main objection to these heads is that grass tends to grow over them and interfere with the spray.

Pop-up spray heads also sit flush with the ground when the water is off. However, as soon as the water is turned on a riser in the center pops up and water

INSTALLING THE UNDERGROUND PIPE



WHEN DIGGING TRENCHES, cut sod neatly with spade, then fold it over on one side while pipe is laid



LAY PIPE loosely in trenches. Where possible, curve it around corners instead of using elbows or tees



STAINLESS-STEEL clamps which are used to lock fittings in place are similar to automobile hose clamps



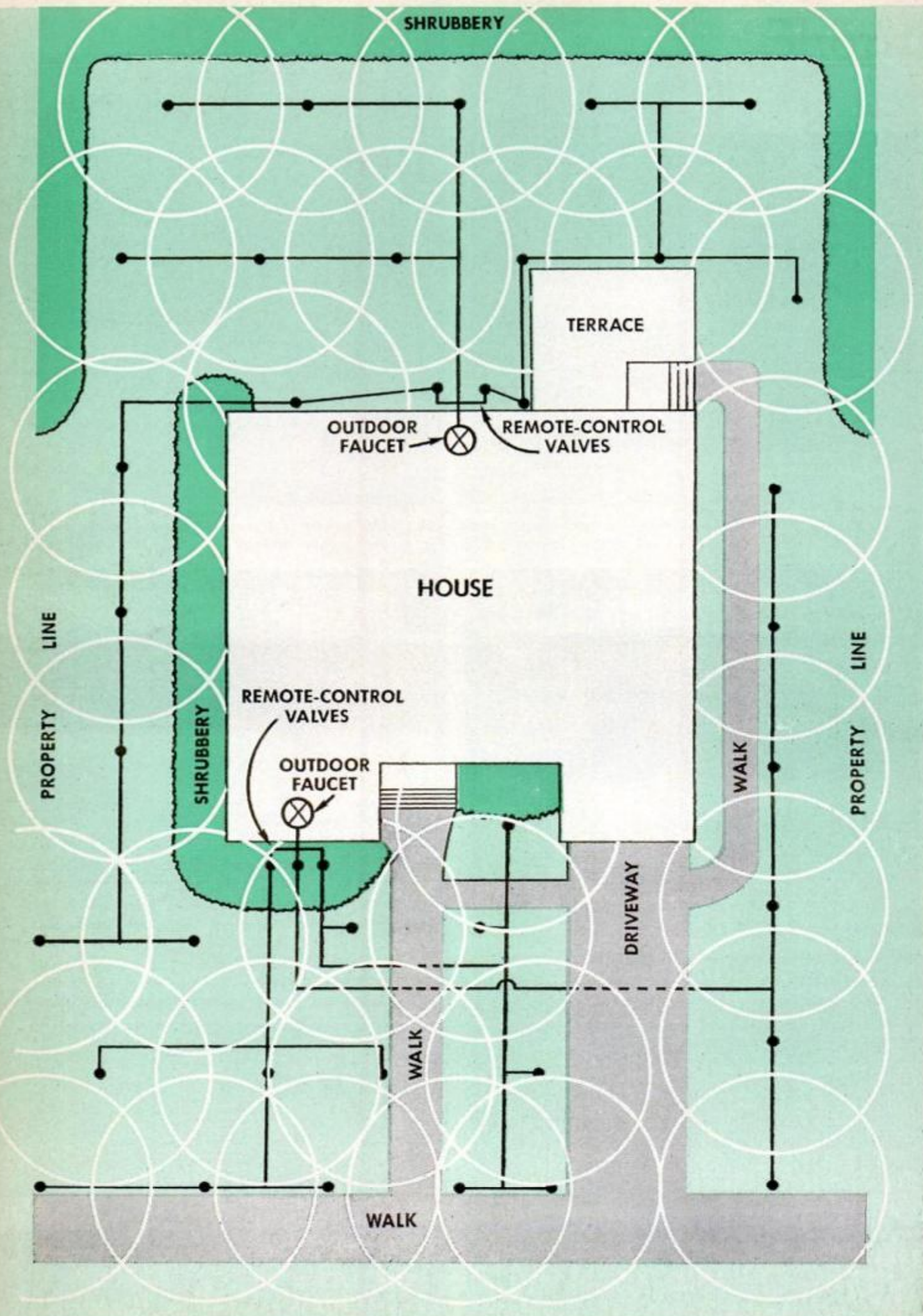
MAKE ALL CONNECTIONS before burying system. Turn on sprinklers to spot any leaks or other defects

SPRINKLER HEADS at through locations are mounted on reducing tees with short nipple serving as riser



HEAD AT END of pipe line is mounted on a reducing elbow instead of tee. Nipple is threaded into head





is sprayed out from this, enabling it to clear the surrounding grass easily. With this type, there is less likelihood of clogging the spray orifice with dirt. Pop-ups usually cover a larger radius than stationary sprays—up to 15 ft. in some cases. Most sell for a little under \$2 each.

Pop-up rotors were originally developed for use on large turf areas, (golf courses, ball fields, etc.). They differ from the conventional pop-up sprays in that the center riser contains a number of nozzles or orifices which throw out a series of streams rather than a fine overall spray. This riser rotates steadily and scatters the streams over a large radius.

Made of brass, pop-up rotors are much more expensive than the ordinary pop-ups, but cut down considerably on the cost of a sizable installation. Each rotor head will cover a much larger circle, meaning that fewer heads and fittings will be needed. Since each head sprays a larger area, however, such a system will require a longer watering time to put down the same amount of water. This slow rate of application does have one advantage: there is less likelihood of waste due to run-off, because the soil has a chance to absorb the water as fast as it falls.

All pop-ups, stationary or rotary, come in models which cover a full circle, half-circle, quarter-circle, three-quarters of a circle and one-third of a circle. This means that heads can be spaced along walks, driveways or property lines, without throwing water onto areas where it is not needed or desired.

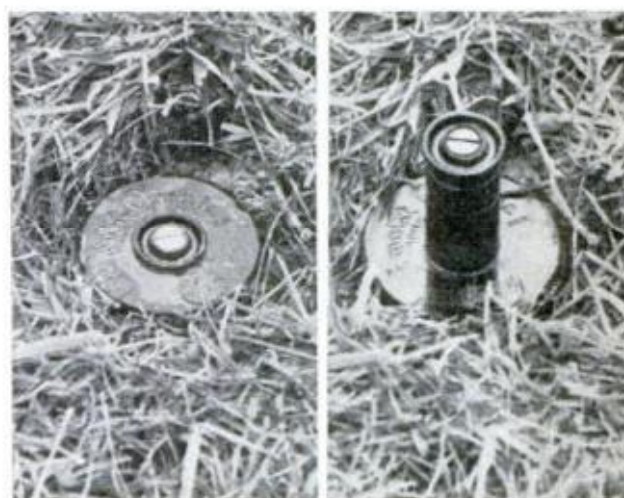
An impact-type sprayer, or rainer, usually has a built-in regulator which permits you to set it for any part of a circle. It rotates slowly while throwing out a single long stream which will reach up to 50 ft. Better models have built-in deflectors which break up part of the spray so that water is scattered equally over the entire area.

These rainers may be installed in the shrubbery beds next to your house and aimed out over the lawn so that they cover overlapping arcs. The beauty of this system is that you can bury your pipe in the soft earth along the wall of the house without having to dig into your lawn. However, you're bound to waste a lot of water because the large arc covered by each head will mean that you're certain to throw a lot of water out into the street or sidewalk, or onto your neighbor's property. Also, these large-diameter spray heads will never distribute the water as evenly as a series of closely spaced pop-up sprays.

Planning Your System. Once you've decided on the type heads you'd like to



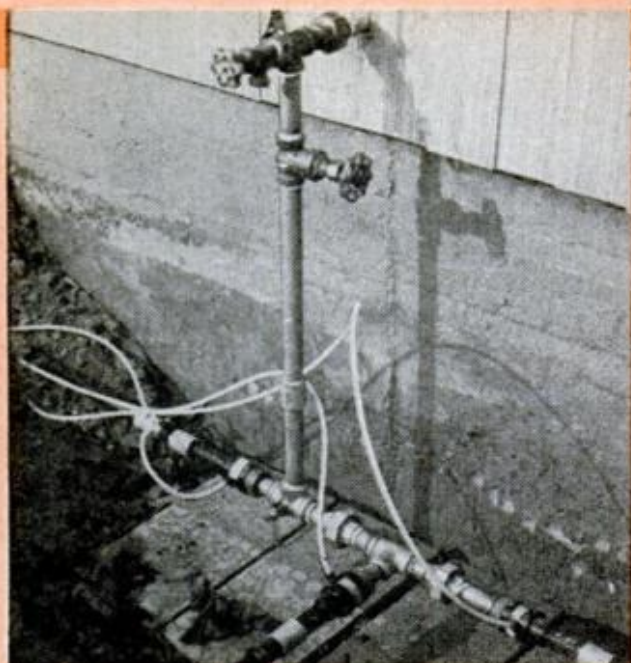
POP-UP SPRAY HEAD comes up about 1 in. when water is turned on, enabling spray to clear nearby grass



POP-UP ROTOR HEAD rises about 2 in. and rotates slowly, spraying water out in a number of streams

IMPACT-TYPE SPRINKLER is usually installed on top of high riser pipe which can be hidden in shrubbery





TEE INSTALLED ahead of hose bib allows connection through gate valve to three ganged hydraulic valves



CONTROL LINES for the hydraulic valves should be run in the same trench as the pipe where practical

use (or to help you determine which combination of heads will work best on your particular lawn layout) you'll need a scale drawing of your home grounds. Use graph paper to simplify the job. Draw in the outline of your house first, then indicate all walks, driveways, trees, shrubbery and other natural obstructions. Also, be sure to mark all water outlets.

Lay a sheet of tracing paper over this plan and draw circles of the proper diameter for the spray heads you plan to use. The center-to-center spacing of these circles should be no greater than the maximum spacing recommended by the manufacturer of the spray heads.

Check the manufacturer's spec sheet to find the required pressure and number of gallons per minute required for each spray head. With this information as a guide you'll be able to decide how many separate circuits will be needed. Just add up the flow in gallons per minute required for all sprinkler heads, then lay out sections so that no one section calls for more than about sixty to seventy percent of the total flow available at the outlet. (The rest will be lost through friction.)

To measure the flow available, open your outside faucet wide while keeping all other faucets closed, and let the water run into a large container. Using the second hand of a watch, figure how many gallons flow out in twenty seconds, then multiply by three to get the flow in gallons per minute.

To increase the flow and water pressure available, it's a good idea to remove the old 1/2-in. hose faucet and replace it with

a gate valve. This type of valve offers much less resistance than a globe valve. If this substitution doesn't give you an adequate flow, then you may find it advisable to run a separate 3/4-in. line direct from your water meter to the sprinkler system.

Remote-Control Valves. There are two types of automatic valves available: those operated by a solenoid and those actuated by hydraulic pressure.

Hydraulic valves are connected to the control unit by small-diameter copper or plastic tubing. When the timer calls for the valve to be opened, a small pilot valve in a chamber in the valve body is opened to bleed water off through the control tubing. This lowers the pressure inside the valve chamber so that a diaphragm is forced open by water pressure in the line, thus permitting water to flow through.

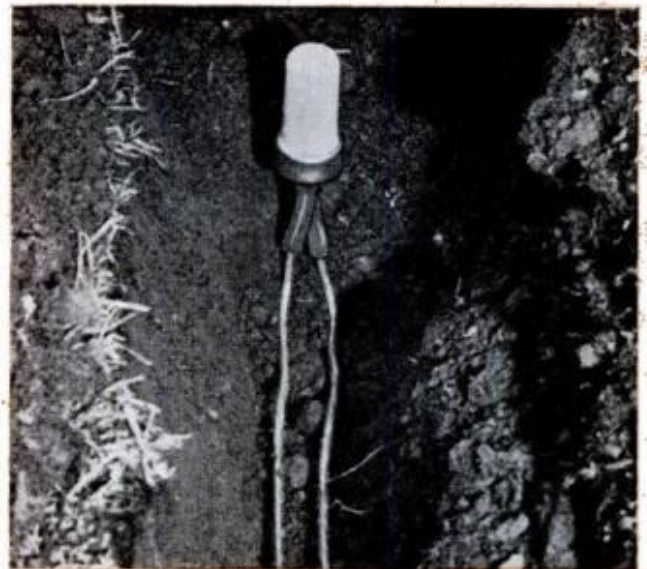
To stop the flow, water is forced into the chamber from the control line so that pressure is built up on one side of the diaphragm. Since the area of the diaphragm is much smaller on this side than on the line side, the pressure is great enough to force the valve shut against water pressure in the line.

Electrically controlled valves are actually hydraulic valves with a solenoid mounted on top. When this solenoid is energized, it opens a small orifice which bleeds water off from above the diaphragm to lower pressure on that side. Pressure in the line then forces the valve open and holds it open until the solenoid closes the orifice once more. This permits pressure to build up above the diaphragm and

AUTOMATIC HYDRAULIC CONTROL . . .



HYDRAULIC CONTROL unit can be mounted on any wall, inside or out. Metal pipe protects plastic tubing



MOISTURE-SENSING Hydrostat is connected to control unit and check valve with two copper vacuum lines

closes the valve located in the main line.

Most remote valves of either type are now designed for direct burial underground, meaning that a single supply line can be run to all parts of the property with a valve located wherever branch circuits must be controlled separately. However, keep in mind that if you use buried valves, you'll have to buy quite a bit of wire or control tubing. Also, should trouble develop at some later time, you'll probably have to do a lot of digging in order to locate the source.

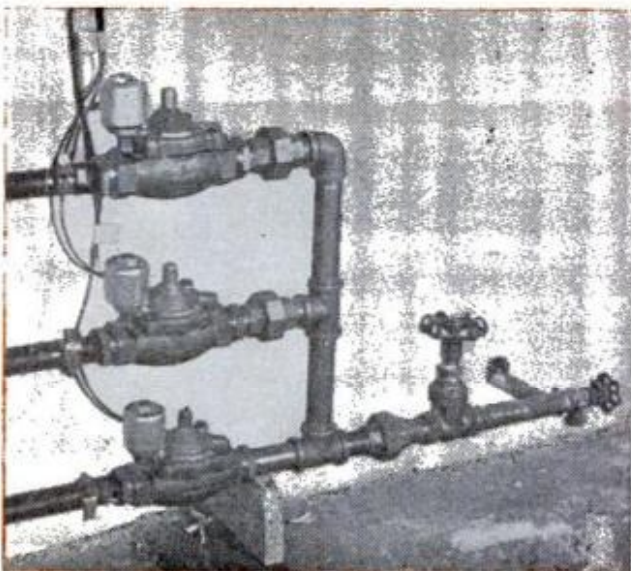
It's much easier to set up your system so that all remote valves are ganged

together at one central point near the clock control. Though you could bury them all together in this one spot, your best bet is to locate them aboveground along the side of the house or inside the garage so that all valves can be quickly inspected, repaired or replaced.

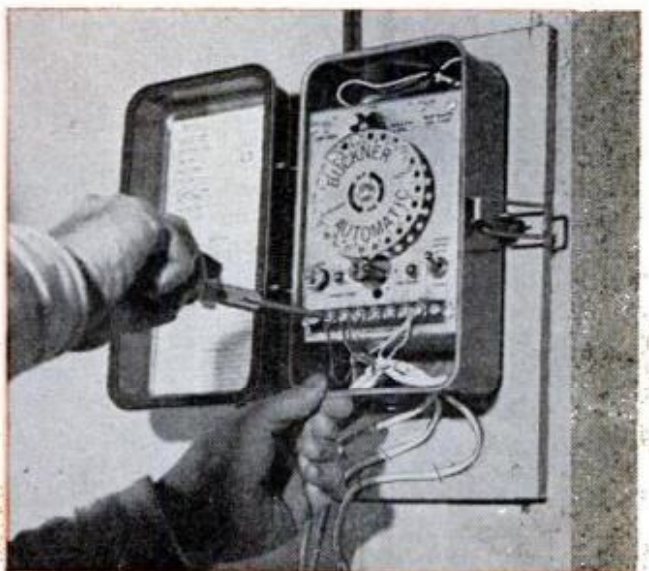
Automatic Controls. The control units used to actuate these valves are actually motor-driven clock timers which can be preset to any watering schedule desired. These are made in many different sizes and models, from small units which can handle only two or three valves, up to large commercial models which will

AUTOMATIC ELECTRIC CONTROL

LOW-VOLTAGE wires from each valve are attached to numbered terminals on the automatic control unit



VALVES GANGED inside garage are easy to check and repair. Note solenoids which control water flow



handle as many as twelve circuits.

The most popular home-size models are those designed to handle either four or six circuits. If you pick a system which uses hydraulic valves, you'll find that the timer comes with small nipples projecting from the bottom of the case. These are connected by tubing to each of the valves. If you're working with an electrical system, then you'll find a conventional terminal board with numbered screws for attaching wires from each valve.

The best control units will enable you to set the clock to turn the sprinklers on every other day (or even every third day) as well as every day. You should also be able to vary the length of time each section is on, since some areas may need more water than others.

To make trouble shooting and testing easier, there should also be a simple method for turning the system on and off manually when necessary. Deluxe electric control units with a six-station capacity will cost from \$80 to \$100. Comparable hydraulic control units are somewhat more expensive and will cost between \$125 to \$150.

For the ultimate in automatic control, you can buy a control unit which will sprinkle only when the soil is dry enough, or which will skip days when the soil is naturally damp. These little "brains" are being produced by two companies.

The Tork o-Stat, made by Tork Clock Co., consists of a cup which holds a mixture of sand and salt. When rain falls, this mixture becomes wet enough to conduct electricity and closes an open circuit between two electrodes wired into the bottom of the cup. A relay wired into the automatic control is then actuated so that the sprinkling system is bypassed for that day. However, during an extremely heavy downpour the salt-sand mixture may occasionally be washed out of the cup completely. Also, the electrodes in the bottom of the cup tend to corrode eventually and require replacement.

Hydrostat, made by Moist O'Matic, is available only with that company's Imperial control unit (for use with their hydraulic valves). It consists of a ceramic vessel which is buried in the ground and connected by copper vacuum lines to the control unit. When the soil's moisture content is low, it triggers the timer so that the sprinkling system will go off, but not until the hour predetermined by you. Should rain fall prior to the time when the sprinkler is supposed to go on, the Hydrostat signals the control to skip the watering sequence for that day. Complete with Hydrostat, the Imperial sells for about \$175. ★★★

AUTO CLINIC

Q Light leaking around the instrument cluster of my 1962 Ford is distracting. Can I do anything about it?—J.P., Oklahoma.

A Try this. Loosen the instrument cluster housing and squeeze a layer of regular household calking compound between the cluster and the dash. It should do the trick.

Q Suddenly, my 1960 Falcon has developed a squeak in the clutch pedal. Lubrication doesn't help. What will?—H.H.S., California.

A The squeak is probably coming from the clutch pedal assist spring. But it's no great problem. Take your car to your Ford dealer or, if you wish, you can do the job yourself if you've the right tools. Remove the assist spring and slip a 1½-inch long, ¼-inch diameter rubber tube over each hook end of the spring. This will stop the squeak. Naturally, upon putting the spring and retainer back into the car, you should reset spring tension.

SERVICE TIPS: Chevrolet tells us there have been complaints of over-bright high beam indicator lights in their 1963 models. If you are bothered by this light at night, Chevrolet suggests you have it replaced with a one-candle power bulb (type 53, Chevrolet part No. 131282). The bulb used originally was two candle-power.

Some owners of 1961 Oldsmobiles equipped with Guide-Matic write us their headlamps occasionally switch beams when accessories—horn, wipers, turn signals—are operating. Olds advises against attempting to eliminate this "flicker"; it's caused by rapidly-changing current which induces a spurious voltage to the Guide-Matic, but is nothing to be concerned about.

As a service to the readers of Popular Mechanics in solving problems relating to their cars or to driving in general, you are invited to submit your question for answering either through this column or by mail. Address Auto Clinic, Popular Mechanics Magazine, 575 Lexington Avenue, New York 22, New York.

Keep Your Headlights on the Beam



By Morton J. Schultz

MOTORISTS who are alert to every unusual sound, smell or mechanical falter in their cars will inevitably discover what seem to be strange goings-on in their headlight system. Erratic operation usually takes one of two forms:

1. The headlights alternate between

bright and dim, depending on engine acceleration. This condition is called *headlight flare*.

2. At steady acceleration, the headlights change in brightness, giving about the effect you'd get from a light bulb fed by 25-cycle alternating current instead of

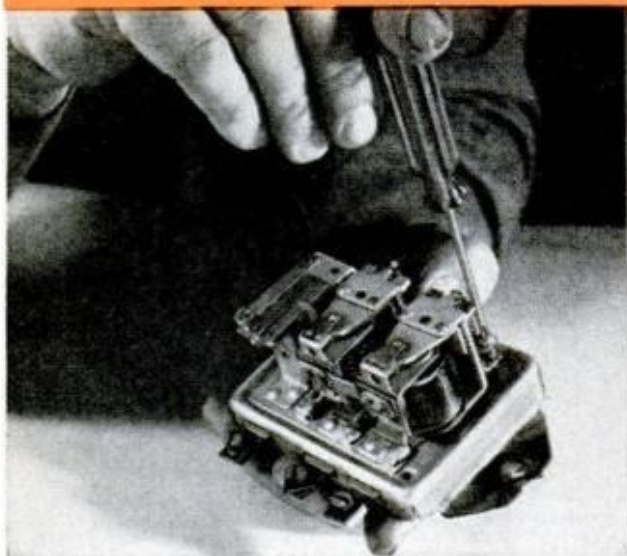
VOLTAGE CONTROL CHECK: Hook one lead to the regulator's battery terminal, ground other to its box



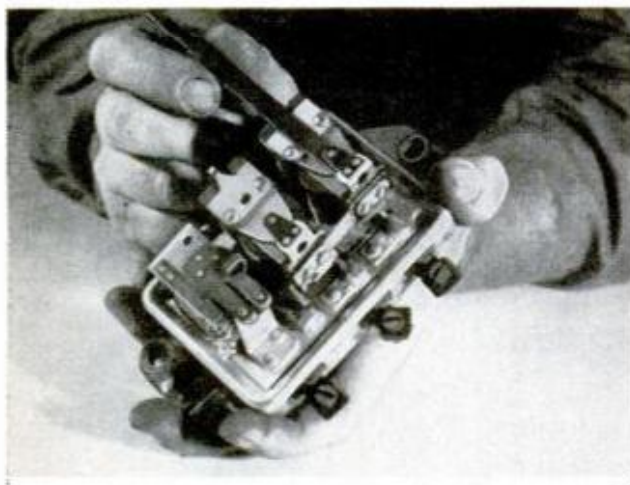
VOLTAGE OUTPUT CHECK: Hook voltmeter up across battery posts as shown, crank engine for 30 seconds



FIXING THE REGULATOR



CORRECT THE SETTING of the voltage-control unit by turning the adjusting screw—preferably while regulator is still on car, engine is running and voltmeter is hooked up. Control unit in three-unit regulator shown is the end one with light wire winding. Some types may have tang instead of screw



REMOVE OXIDATION from voltage control unit's contact points with an ignition-point file moved back and forth lengthwise to the unit's coil as shown

FINISH CLEANING with crocus cloth. When oxidation is gone, wipe points with linen tape saturated in carbon tetrachloride to remove all foreign matter



the common 60-cycle AC. This is called *headlight flicker*.

A certain amount of headlight flare is normal; you needn't be concerned unless the condition is excessive. But any type of flicker in headlights points to a definite malfunction in the charging system or lighting circuit and should be attended to.

Brightness of filament-type headlamps varies in proportion to the voltage supplied. As this voltage varies (and vary it must during any starting-idling-acceleration cycle of the engine) lights will become alternately bright and dim. This type of flare is inevitable. For example, with the engine off and the headlights on, a battery in good shape is supplying a full 12 volts to the headlamps—assuming your car has a 12-volt charging system. (It's half that with a 6-volt system.) But as you crank the engine, the brightness decreases because battery voltage is being taken from the lamps to feed the starter. As much as three volts may be needed to crank the starter in 12-volt cars, or up to 1½ volts in 6-volt cars.

As the engine idles after starting, lights flare back up to original brightness because the battery is again supplying its full voltage to the lights. Then, as you rev up the engine, "flare up" becomes more pronounced. The generator has taken over the job of supplying electricity to meet the car's needs. A generator in good condition supplies more voltage than a battery—from 14 to 15.2 volts in a 12-volt car, and up to 7.6 volts in a 6-volt car.

Thus, the amount of voltage supplied headlamps in a 12-volt car during one cranking-idling-acceleration cycle could vary from a low of 9 volts to a high of 15.2. Any wonder headlights flare?

There is, however, such a thing as abnormal flare, though it's difficult to describe where normal ends and abnormal begins. Generally, if lights become unusually bright as the engine is revved from idle, flare is abnormal.

There's one sure check. If a battery in good condition needs water more than four or five times a year—that revving flare is abnormal. The generator charging rate is too high, causing excessive battery gassing. This condition should be corrected immediately, since too much voltage running through the electrical system will shorten headlamp filament life and damage distributor breaker points.

A high charging rate is usually caused by improper adjustment of the regulator's voltage-control unit. It can also be caused by high resistance in the charging circuit. To check the control unit, warm up the engine to operating temperature, turn it off, and hook up a voltmeter as shown

on page 157 (lower left photo). In cars equipped with alternators, connect one meter lead to the ignition terminal of the regulator, and ground the other. Remember this important point in making voltmeter hookups: if the car is negative-grounded, the negative lead of the meter goes to ground; if the car is positive-grounded, ground the positive lead.

The test is simple. Start the engine and turn on headlights and other accessories to put a load on the battery. Increase acceleration slowly until the needle stops climbing. The maximum reading (14 to 15.2 for a 12-volt car; 7 to 7.6 for a 6-volt car) should remain constant. A reading higher (or lower) than these ranges means the voltage-control unit is set incorrectly. If the condition hasn't gone far enough to ruin the points, you can obtain the proper setting by adjusting the points, as shown top left. Some regulators have a small tang instead of a screw on the bottom of the spring controlling the contacts. You bend this tang in one direction to decrease the charging rate, in the other direction to increase the rate. Setscrew or tang should be manipulated until the proper reading is obtained on the voltmeter. (Regulators used with alternator-equipped cars have only one unit instead of the three shown here.) If you can't get a proper reading, the regulator is damaged beyond repair.

If the regulator checks out but abnormal flare persists, the cause is probably defective or poorly-connected wiring, which results in high resistance. Check for worn areas and breaks in the insulation of cables and wires to and from the battery, starter, generator (or alternator) and regulator. Check all connections and grounds for tightness and make sure no foreign matter, such as paint, is spoiling contact (see photos next page).

Or the high resistance might be in the headlight circuit itself. The check for this is demonstrated in the bottom photo, right. The voltmeter should read at least 9 volts for a 12-volt system, with no more than a .2-volt drop over a 30-second period. (For a 6-volt system, the figures are 4.5 minimum reading and .1 maximum drop.) Any other reading indicates that wiring or connector should be replaced.

Headlight flicker has become a major service problem in late model cars—especially those from 1959 on. If the afflicted car has an ammeter, you can actually see the ammeter needle fluctuate—at a fixed rate—over a wide sector of the scale. (Flicker can occur in cars equipped with either an alternator or generator.)

Flicker in a car's dome or map light is a normal thing. It occurs when the volt-

DISCONNECTING HEADLIGHTS



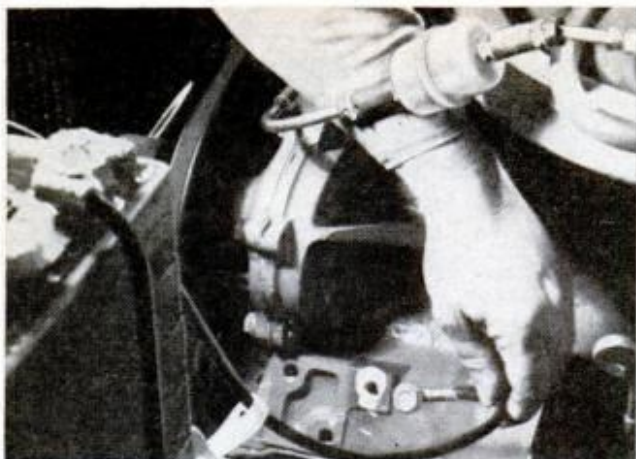
ALMOST AS SIMPLE as replacing a household bulb: Remove panel (page 157), then retaining ring (above)



SEALED BEAM UNIT pulls out, towing its wire after. Unplug the connector from prongs. If you don't touch aiming screws, new lamp won't need adjustment

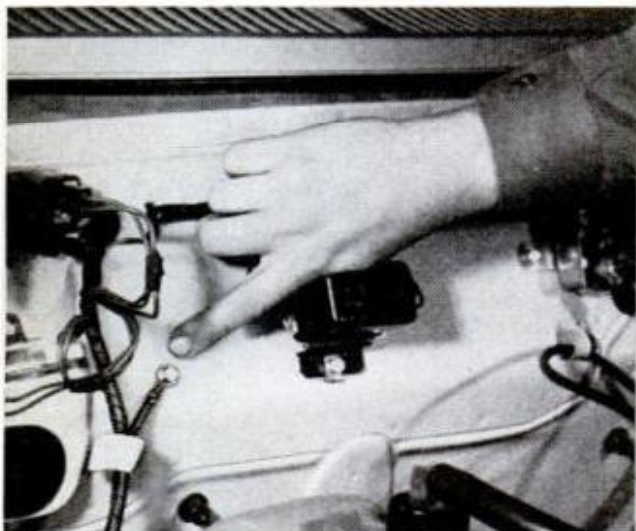
TO CHECK FOR HIGH RESISTANCE, hook one voltmeter lead to battery ground, probe other into connector. Turn headlights on, idle engine and take reading



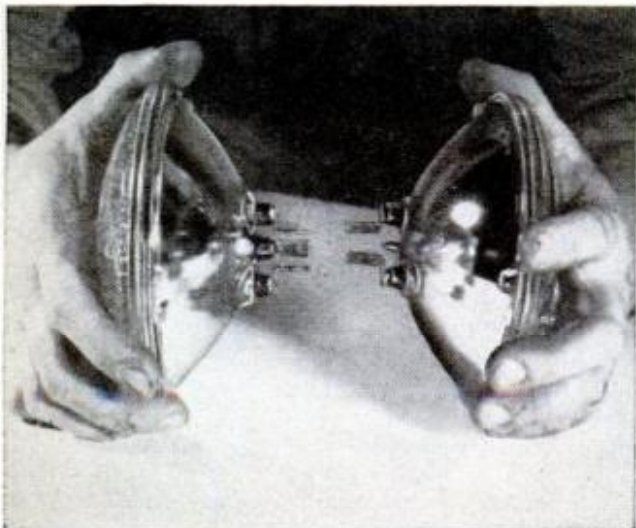


CHECK ALL CONNECTIONS for tightness and absence of foreign matter. Paint run beneath a battery ground connection, as here, is a major cause of high resistance. Scrape to bare metal before reseating ground

SECOND GROUND on every car is connection that grounds the engine to chassis. In car below, this ground is on the firewall, but it may be on a fender. Look for wiring harness, often near regulator



DUAL HEADLIGHT SYSTEM uses two types of lamp. Outside lamps have two filaments, for low or high beam, and have the numeral 2 molded into the lens. Inner lamps just have filament for high beam and are marked 1. You can't plug them in wrong connector: No. 1 lamp has two prongs while No. 2 has three



age control unit of the regulator first cuts in—especially when the engine is cold. During a cold start, battery voltage is low, but generator (or alternator) output and field current are high. This variation increases oxidation of the voltage control unit's contact points. The resulting lag in contact results in a greater change in armature voltage and increases the flicker. No need for concern, though, unless oxidation has reached a point where it causes flicker in headlamps as well.

Since headlamp flicker can result from a number of causes, methodical checking is in order. First, check for loose connections or damaged wiring. Breaks in light wiring insulation can produce momentary shorts, causing lights to flicker. If a break is found, either wrap the damaged area with friction tape or replace the wire.

Next, check battery capacity, since a weak battery could cause flicker when it receives greater charge from the generator or alternator. Warm up the engine, disconnect the lead wire at the coil or distributor (so the engine won't start during the test) and hook up a voltmeter with the negative lead of the meter connected to the negative post and the positive lead to the positive post, as shown in the lower right photo on page 157.

Crank the engine for no longer than 30 seconds. As in the headlamp-connector probe test previously described, the meter should maintain at least a 9-volt reading for a 12-volt battery, with no more than a .2-volt drop. (Incidentally, to insure accuracy, you should run this capacity check *before* testing the headlamp connector.)

If the battery checks out, the trouble is most likely caused by too much oxidation of the voltage control unit's contact points. The cleaning of these points is shown on page 158. After the carbon-tet. treatment (take care not to breathe the vapors), dry the contacts with a strip of linen tape. Be sure contacts are open when the tape's removed so threads don't catch between the points.

Of course, there are other headlamp malfunctions than flare and flicker. If the lamps are dim when the engine is idling or off, most likely the battery is partially discharged or defective, and should be recharged or replaced. If the lamps stay dim when the engine is run above idle, the cause is probably high resistance in the lighting circuit, or a faulty voltage control unit. If lamps burn out frequently, the voltage control unit's setting is too high, or there are loose connections in the lighting circuit. Loose connections may also be responsible when lamps simply won't light, but it's more likely a discharged battery.

Then again, troubleshooting may establish that lamps don't light because of open or corroded contacts in either the dash or the dimmer switch. There's an obvious way to discover which of the two is at fault: Turn the dash switch on and operate the dimmer switch. If the instrument panel lights are on but the headlamps fail to light, either the dash switch or the wire from the dash switch to the dimmer switch is defective. Replace the wire first, since it's less expensive to do.

If the lamps still don't operate, install a new dash switch, as shown at right. When replacing any switch, always disconnect the battery ground cable first.

If, during your switch test, the lamps operate only with the dimmer switch in one position, then that switch or the wire from it to the dash switch is at fault. Again, replace the wire first.

Safe headlights are, of course, properly-adjusted headlights. Much has been written about do-it-yourself headlight adjustment, but this isn't recommended. There's too much room for error, and it's best to spend the dollar or two it costs to have lights adjusted by a specialist with accurate equipment. ★★★

HOW THE PROS USE LIGHTS

On the topic of headlight safety, all motorists can take a page from the truck driver's manual. Here are four of their tricks for night driving:

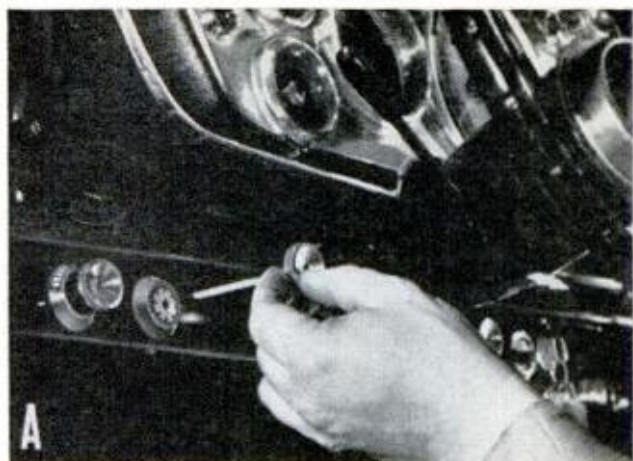
1. Drop your brights as soon as approaching lights appear. If you wait until the oncoming car is too near, that driver's eyes may not have time to adjust to the last-minute switch.

2. When meeting another car over the brow of a hill, drop your brights just before breaking over. If the other driver does the same, you're both spared that sudden blinding glare.

3. While it may be necessary to flick your lights a few times to remind the other fellow to dim his, it's bad practice to blast him with your brights if he fails to respond. Blinding headlights make a driver pull instinctively to the left, away from the shoulder or guard rail. With both of you blinded, the danger is doubled.

4. Truck drivers actually carry on conversation with their lights when passing one another in the same direction. Here's how it works:

When approaching another car from the rear, dim your lights to take your brights out of his mirror. When you're ready to pass, flip them up and immediately back down. If the other driver is on to this stunt, he'll flip his brights down and up again to tell you he knows you're about to pass. As you start around, keep your lights down until you're abreast, then switch to brights to see the road ahead. The other driver flips to dim as soon as you're far enough ahead to cut back in. This tells you to come over and also takes his brights from your mirror.



DEFECTIVE DASH SWITCH? Before replacing it, disconnect battery ground cable. Then, (A) pull shaft of control knob (in off position) straight out after depressing release button on switch housing under dash. (B) Remove mounting nut with long-nose pliers, then reach behind dash and pull switch down. (C) Disconnect switch from molded terminal

REPLACING DIMMER SWITCH is even easier. Just lay back the floor mat and remove mounting plate screws. Disconnect the wire terminal block from the switch



"Antique" Cobbler's Bench



By Jackson Hand

WHAT'S made the cobbler's bench the most popular piece of Early American furniture? No doubt its sheer simplicity. This quaint piece is a project anyone can knock together, for rustic, less-than-perfect joinery only adds to the antique effect.

Except for the legs and drawer bottoms, the bench is made entirely of pine shelving. Use a common grade, not clear, as a few knots and blemishes will make your

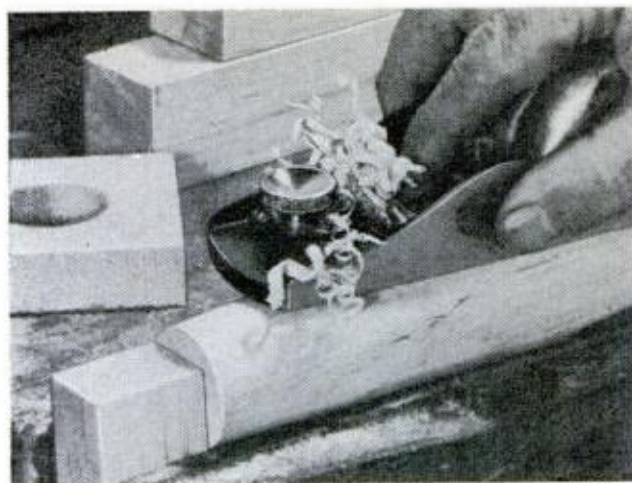
"antique" look more authentic.

Make the seat of three or more 40-in. lengths of 1 $\frac{1}{8}$ -in. stock, edge-glued to the required 19-in. width. Simple, butted joints are sufficient, but you may prefer to strengthen them with two $\frac{3}{8}$ -in. dowels per joint. Make the raised shelf the same way, from two 19-in. lengths of 1x8.

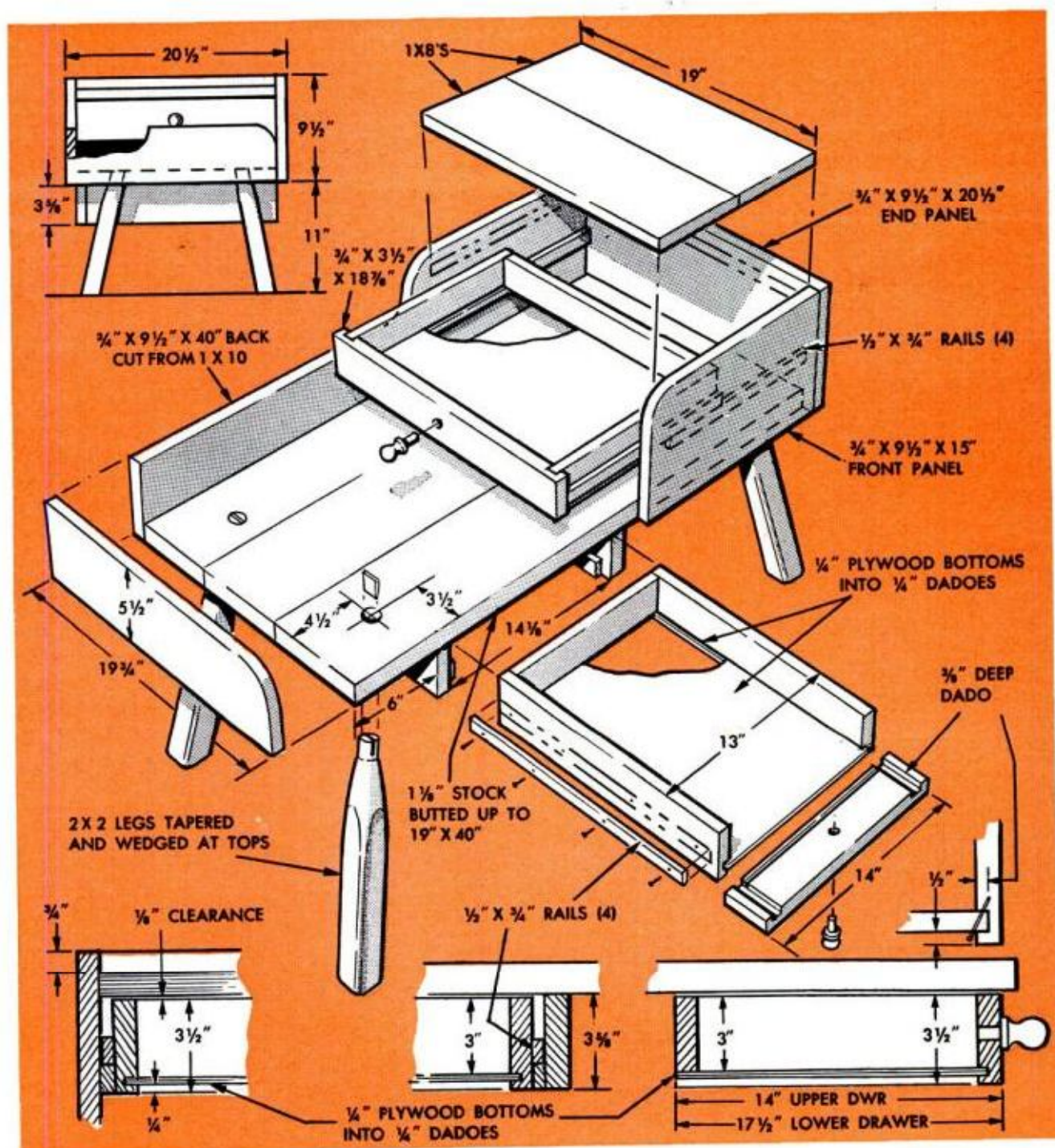
Fastest way to make the back, front and high end of the bench is to cut them out of 1x10s, making the curved cuts with a sabre saw or coping saw. Make the lower end from any suitable $\frac{3}{4}$ -in. board.

If you don't have a drill press, boring the 1¼-in. holes for the legs can be a problem, as the legs are splayed approximately 15 deg. toward the ends of the bench and about 5 deg. toward the front and back. To assure uniform angles, make a jig from a block of wood. Using a brace and expansion bit, bore a 1¼-in. hole through the block at the correct angle. Then, clamping the block at each corner of the seat in turn, bore the holes in the seat, using the hole in the block as a guide.

To make the legs themselves, start with maple 2x2s and taper them at one end to fit into the holes in the bench seat. A lathe makes fast work of this job, but a block plane gives a more rustic, antique effect (see photo, right). Remember to allow for wedges. Make the legs about 11 in. long.

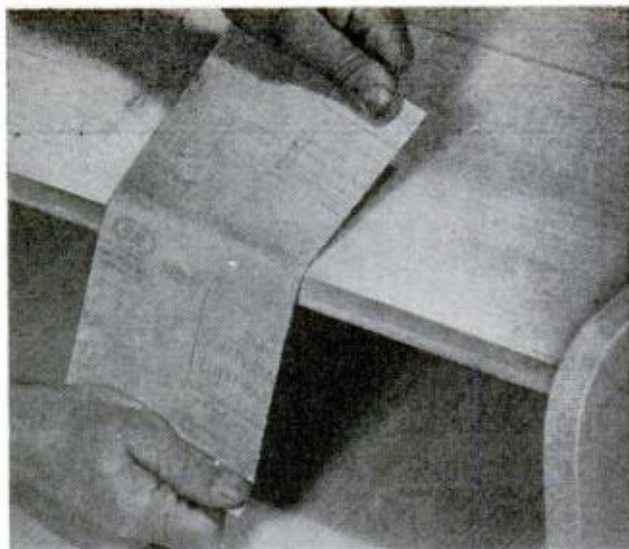


FOR MORE ANTIQUE EFFECT, taper the legs with a block plane instead of a lathe. Piece of scrap with a 1¼-in. hole in it makes convenient template





TO ASSURE SMOOTH-SLIDING DRAWERS, position runner strips with a hardboard or plywood spacer. Before fastening in place, sand and wax top edges



BEFORE STAINING, round all edges slightly with medium sandpaper, especially in places which, on a real antique, would probably show signs of wear

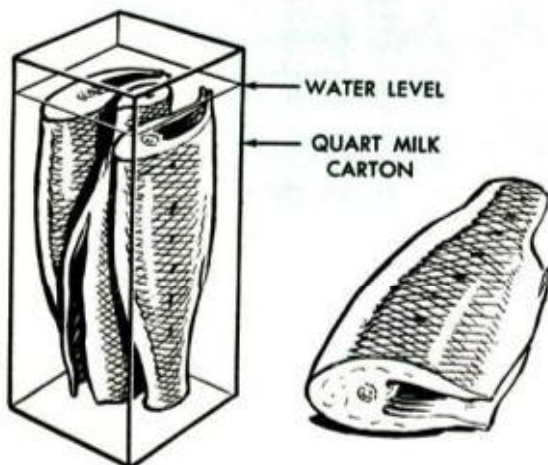
To assemble the bench you'll need white glue and 8d nails, which can be "antiqued" as follows: place the nail on an anvil or steel plate and strike the edge of the nail head with a hammer. Then turn the nail 90 deg. and hit it again. When driven home, the nails will look hand-forged. A drop of potassium permanganate solution (available at drug stores) when applied to the nail heads, will rust them and darken the wood around them.

Make the sides and ends of the drawers from $\frac{3}{4}$ -in. stock, and assemble with glue and finishing nails. The drawer bottoms, which are $\frac{1}{4}$ -in. plywood or hardboard, are dadoed into the front and sides. Make the drawer rails from $\frac{1}{2} \times \frac{3}{4}$ -in. strips, and turn the pulls yourself, as store-bought knobs may look out of place.

After a thorough sanding, finish with a colonial pine stain and several coats of paste wax. ★★★

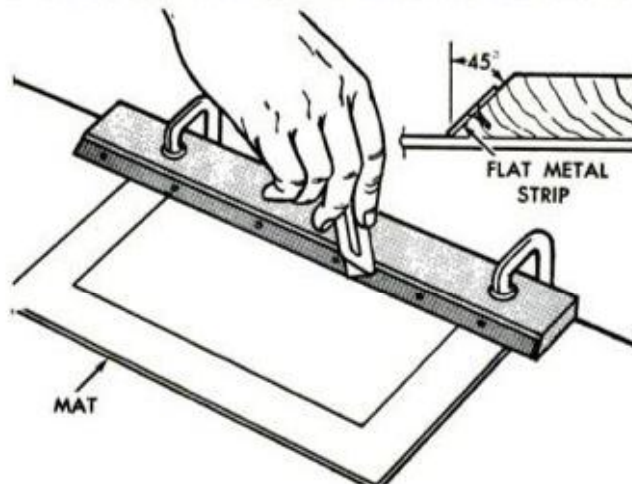
Freeze Your Catch

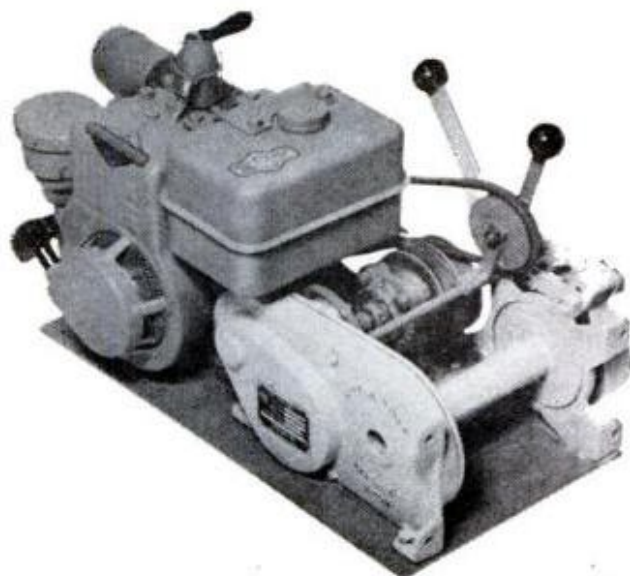
When you've had a particularly successful day of fishing and decide to freeze part of your catch, you'll often find that some of the fish are too large for the usual cartons available at stores. To avoid cutting these big ones down to a less impressive size, try freezing them in cardboard milk cartons. Pack as shown below, then cover with water to prevent dehydration. Most fishermen will find that 1-qt. cartons offer sufficient capacity, but for that big one that didn't get away, use a half-gallon carton.



Mat Cutting Made Easy

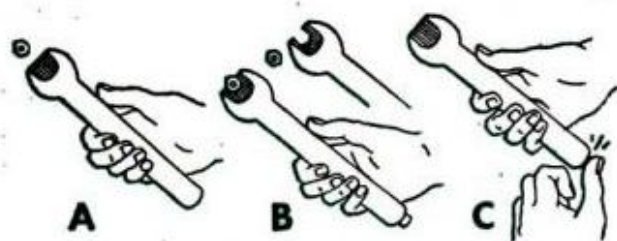
Without specialized (and expensive) commercial equipment, it's almost impossible to bevel-cut picture mats accurately. However, you can get a perfect cut every time with the easy-to-make guide shown here. Just bevel-cut one edge of a strip of wood to a 45-deg. angle and face this edge with a flat metal strip. To use, align the metal edge with the cutting line on the mat and secure to the edge of your table or cutting board with a pair of small C-clamps. Then run a razor blade along the board, holding it flat against the strip.



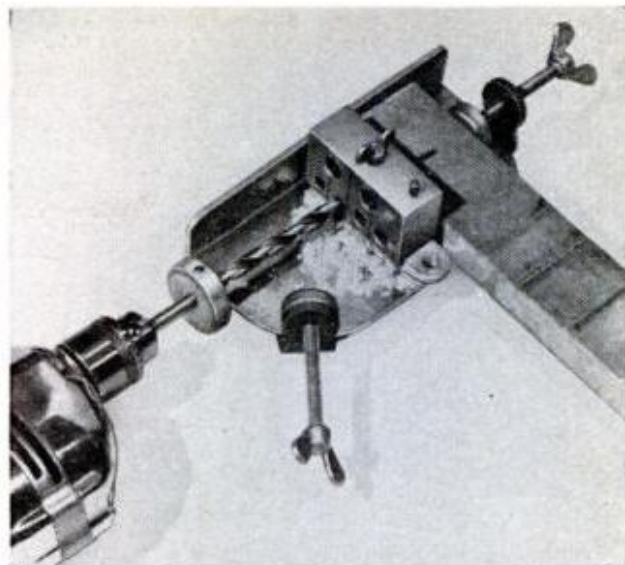


GASOLINE WINCH is rated at 1500-lb. single-line lift, 4000-lb., multiple-line lift. Powered by a 3-hp. air-cooled, 4-cycle engine that starts by hand pull. Drum takes 250 ft. of $\frac{3}{16}$ -in. 4200-lb. test cable. Unit weighs 85 lbs., measures 15½ in. high, 19 in. wide, 25 in. long. Prices on request. Tiger Mfg. Co., 2312 Pacific Coast Highway, Long Beach, Calif.

WHEN THE METAL STRIPS between the jaws of this self-adjusting spanner (drawing A) are pushed against a nut (B), they move backward into the handle to form a snug-fitting crescent. Pushing the back of the handle (C) returns strips to position. For nuts up to .87 in. Messrs Hipo KG., R. Pooper & Co., Hamburg 6, Karolinenstr 3, West Germany



JULY 1963

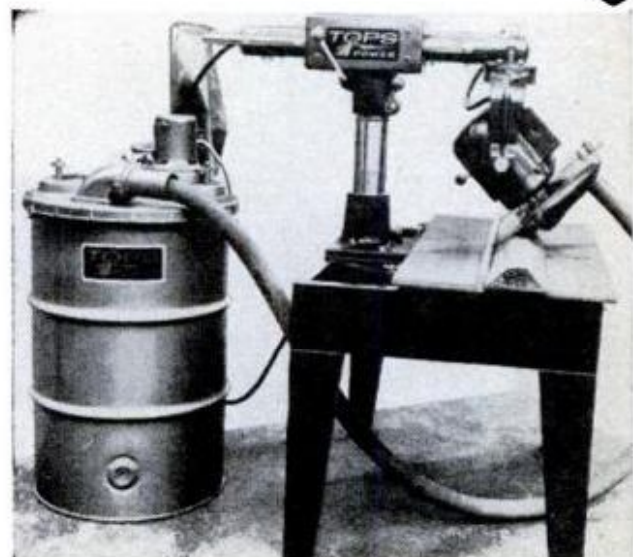


MANCO DOWELING JIG makes accurate joints with $\frac{1}{4}$ -, $\frac{5}{16}$ - and $\frac{3}{8}$ -in. dowels. Comes with drill bits in those three sizes, depth collars and shims. Works with pieces of any width or length, even if thicknesses don't match. Priced at \$14.95 postpaid, from the Bramen Co., P.O. Box 98, Beverly 15, Mass.

ACCU-POWER SCREW DRIVERS have ratchets that speed the work. PM editors also found the pistol-grip handles make for comfortable, firm gripping, especially when extra torque is required. Two blade sizes— $\frac{1}{4}$ x 4¼-in. and $\frac{3}{16}$ x 3-in. Set of two costs \$3.50. Rosenberg Bros. & Co., Smithtown, L.I., N.Y.



DUST COLLECTOR is designed for heavy-duty service. Comes equipped with a waste container, but can also be used with a 55-gal. drum instead. Connects to dust removal nozzle on any radial saw made by Power Tools Inc. For details and prices contact Power Tools Inc., 315 South Green St., Chicago 7, Ill.



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SAND CASTING AT HOME

By Manly Banister



ASSEMBLED BELOW is equipment you'll need to melt metals. Left, blast furnace with electric-motor-powered fan and gas line. Right, set of clay-graphite crucibles (smallest is for silver and gold). Fore-ground, homemade skimming spoon and two types of crucible tongs. Center, technical-grade borax, and mortar and pestle for powdering charcoal. Hanging at right, flint-and-steel lighter for furnace, and tongs for hot castings. Furnace shown is Model 353, Kansas City Specialties Co., Box 6022, Marysville, Kan.

WORKBENCH FOUNDRY



MAYBE you never thought casting non-ferrous metals was a home workshop process. But sand casting can open up a whole new hobby field to you.

It's a craft that requires special equipment—some of which you make yourself. You *could* even build your own blast furnace, but that's not within the scope of this article, since complete casting outfits are available. The Foundryette line, made by Kansas City Specialties, starts with a \$35 kit that will handle up to 1½-lb. castings (fine for the jewelry craftsman) and goes up through six outfits, the largest of which will melt 50 lbs. of red brass. The outfit shown at the bottom of the facing page was \$55 complete (not including the bricks around the furnace, to prevent accidental tipping, or the ⅛-in. sheet asbestos bench pads).

Even with "complete" outfits, there are a few pieces of equipment you must make. Most of these are detailed on the following pages. Although a flask (the buckled-together wood frame shown packed with sand, at left) comes with each commercial outfit, you'll have to make your own molding board. That's the platform the flask sits on. You'll need two for each

flask. For special purposes, you may have to make flasks of additional sizes, and two construction methods are shown on page 170. The bottom half of the flask is called a drag; the top, a cope.

The rammer is a lathe project. Make one to the size shown in the sketch, and another 1½-2 in. in diameter, for use with smaller flasks. Just turn a hardwood cylinder to a dumbbell shape, making sure there's a comfortable hand-grip between the bells. Then saw one bell to form a wedge and sand smooth. The skimming spoon seen at bottom left is easily made by heating the end of a 2-ft.-long, ¼-in. steel rod in the blast furnace and forging a spoon shape on an anvil. You need a skimmer because, when charging a crucible, you add a pinch of technical grade borax (the type you buy at a photo-supply shop) and a spoonful of powdered charcoal; these prevent oxidation, but the crust they form on top the molten metal must be skimmed off before pouring.

When making patterns, leave them slightly oversize to allow for filing and smoothing the cast metal. Remember that patterns can't have undercuts: Since you form the casting mold with moist sand,

THREE BASIC FORMS OF ONE-PIECE-PATTERN CASTINGS

PINE PATTERNS . . .

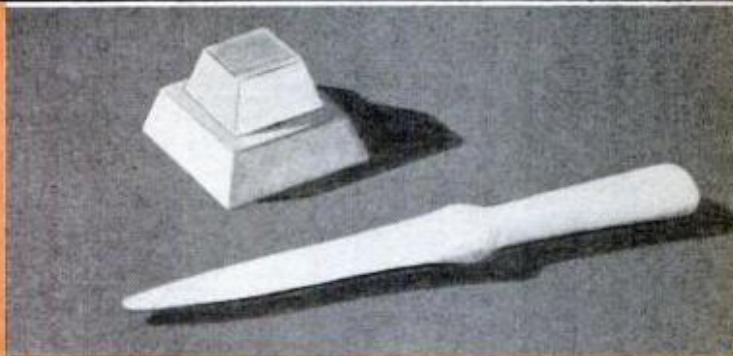
. . . are easiest—unless you want to duplicate an existing object, such as simple jewelry, in which case you can mold from the original. Patterns for such things as buttons and brooches can be molded in clay and shellacked when dry. If you plan to use the clay or pine patterns only a few times, one coat is enough; otherwise, give them three. Either way, sand the top coat smooth and rub powdered graphite over the surface to keep the sand from sticking. Pine patterns must be smoothed before finishing

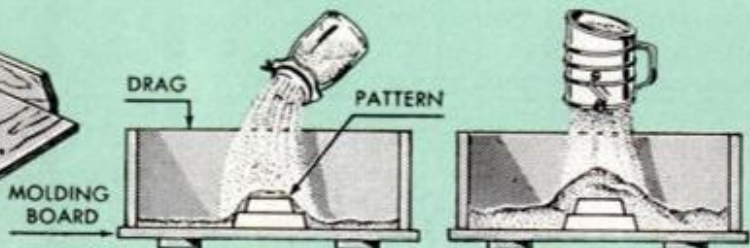
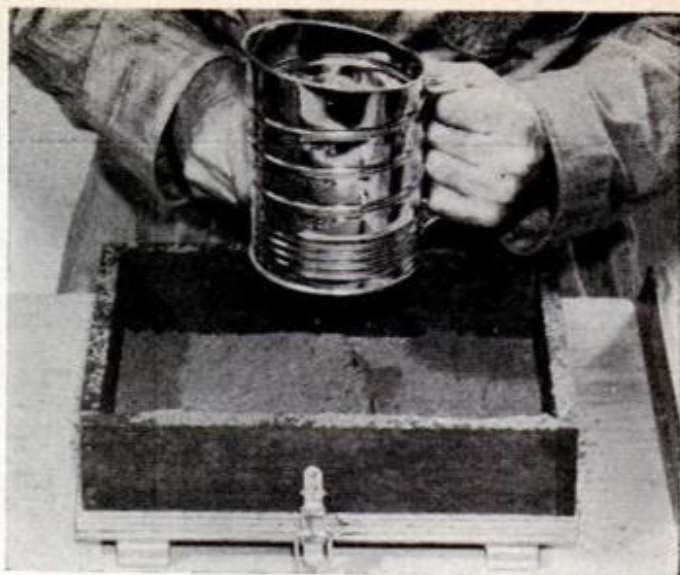
ROUGH CASTINGS . . .

. . . fresh from the mold, still have sprue and riser metal attached by gate bands. The mushroom-shaped top on the riser is the metal that remained in the pouring basin when pouring was stopped because metal had reached top of riser. Saw off all waste close to the final shape and file the joint smooth. Save this sawed-off metal for "foundry returns." It's not only economical, but spares you having to estimate how much extra metal you'll have to add for the sprue and riser on the next pouring

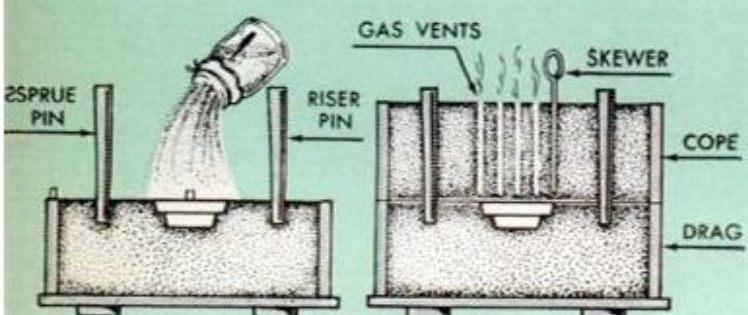
FINISHED ALUMINUM . . .

. . . is ready for service right after polishing. File the rough casting all over, then smooth with emery cloth and polish on a cloth wheel charged with white rouge. Though both items here were cast from one-piece patterns, the letter-opener was trickier as it has a round cross-section that normally requires a halved pattern (see page 171). After practice on simple items like these, try custom castings such as paperweights in the shape of your initials or drawer pulls in special designs you can't buy

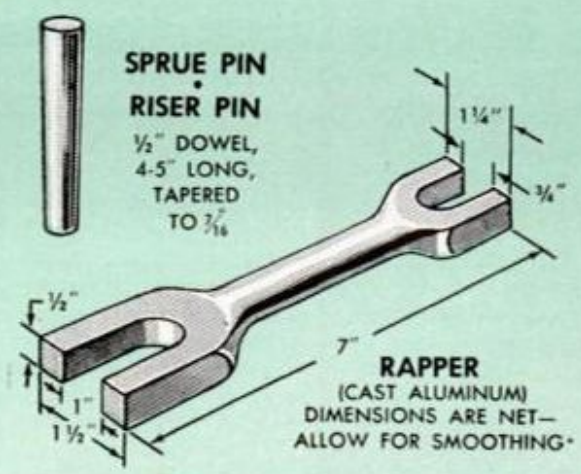




1. SPRINKLE PARTING DUST OVER PATTERN AND COAT FACE OF MOLDING BOARD
 2. USE FLOUR SIFTER TO LAY 1-IN. DEPTH OF SAND OVER PATTERN AND BOARD

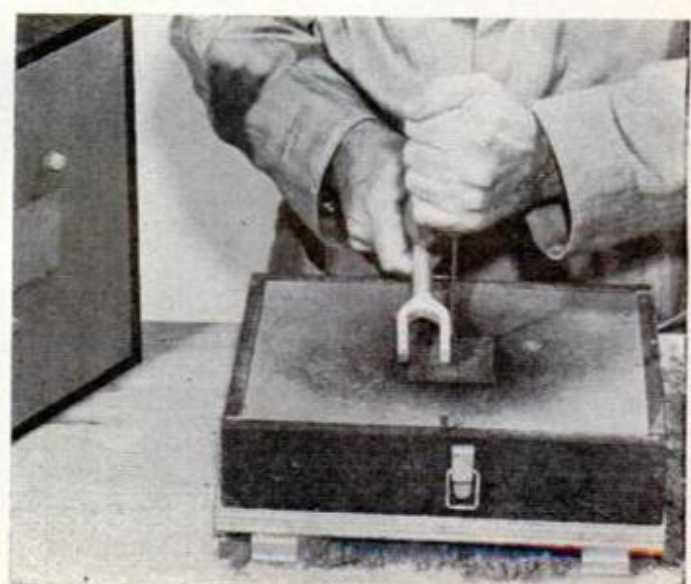
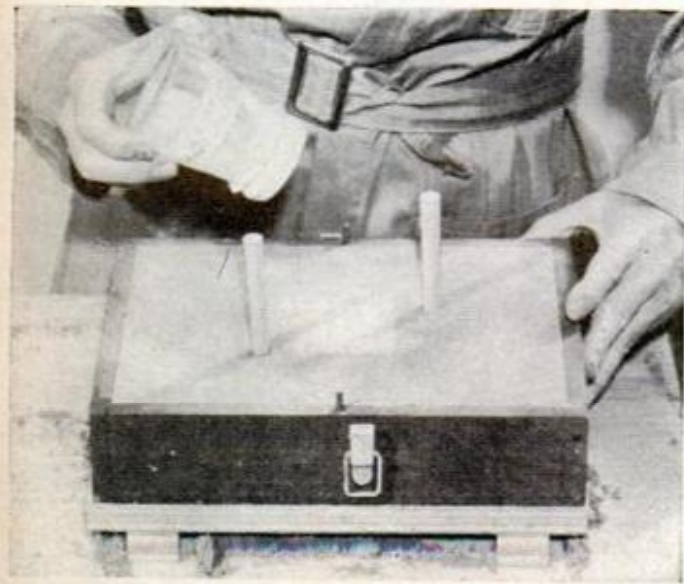


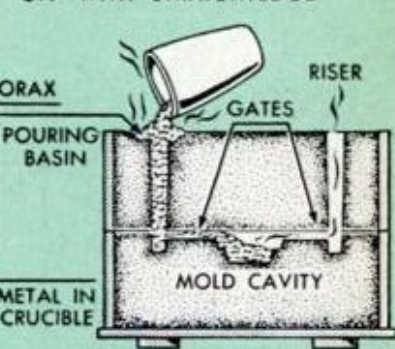
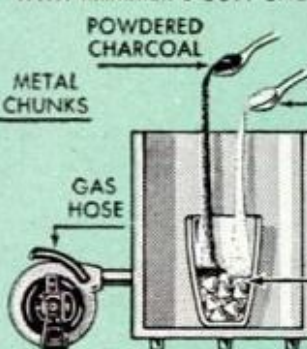
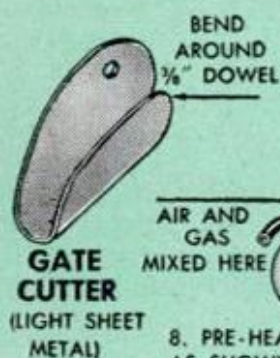
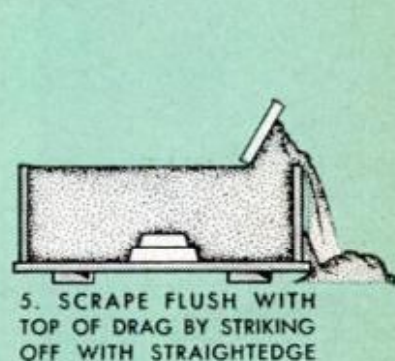
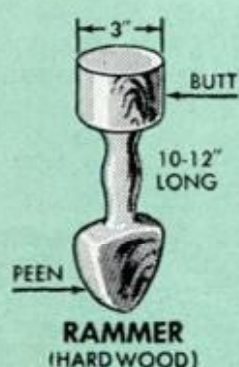
6. FLIP DRAG OVER ONTO SECOND BOARD, INSERT PINS AND COAT WITH DUST
 7. REPEAT STEPS 2, 3, 4 AND PIERCE SAND TO JUST SHORT OF PATTERN FACE



**SPRUE PIN
 RISER PIN**
 1/2" DOWEL,
 4.5" LONG,
 TAPERED
 TO 3/16"

RAPPER
 (CAST ALUMINUM)
 DIMENSIONS ARE NET—
 ALLOW FOR SMOOTHING



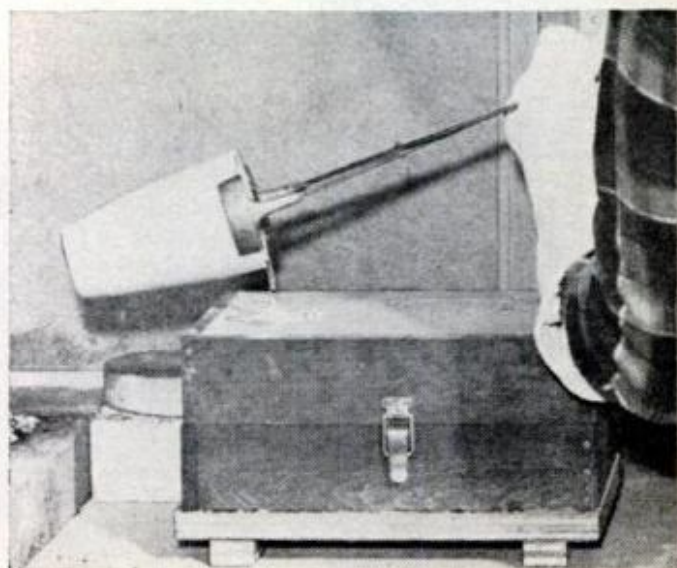
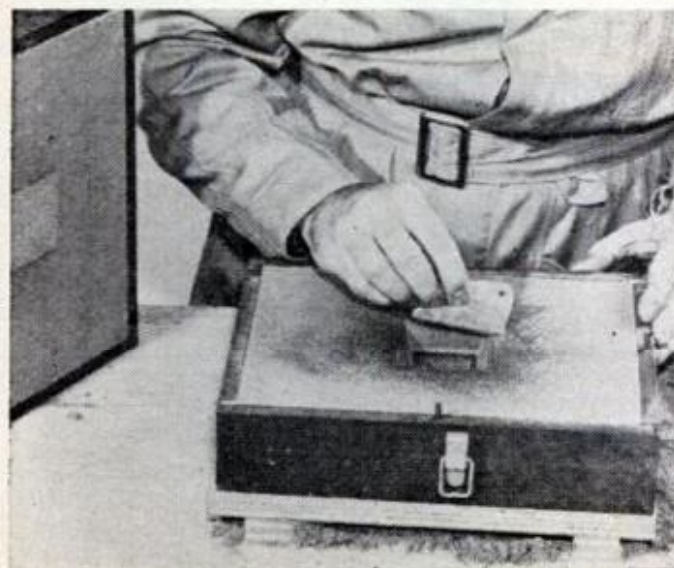


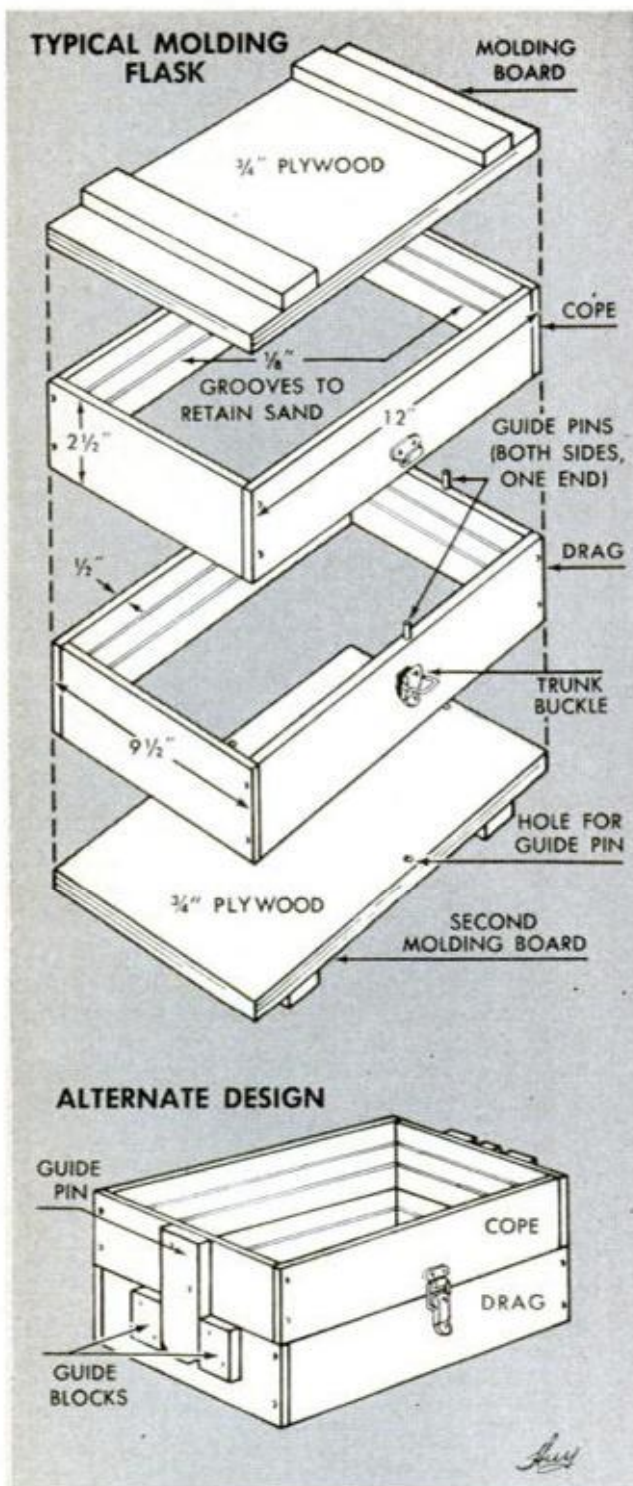
8. PRE-HEAT CRUCIBLE AND METAL AS SHOWN, TILL INTERIOR OF FURNACE SEEN THROUGH PORT IS RED

9. TURN OFF FURNACE, PUT CRUCIBLE INSIDE, ADD METAL, POWDERS, RELIGHT FURNACE. COVER

10. REMOVE COPE, PATTERN AND PINS. CUT GATES, REPLACE COPE. POUR METAL TILL IT FILLS RISER

Shel





you must be able to lift the pattern out of the sand without wrecking the mold.

Making and using a sand mold is fully demonstrated in the picture story on the preceding pages. Molding sand is included in commercial casting outfits, and more can be cheaply purchased at an industrial supply house. Don't use just any sand. Molding sand is specially-graded and mixed with a binder (usually bentonite) so it will hold the shape of the mold and withstand the heat of molten metal.

It comes damp. Keep it in a covered can so it won't dry out. Though you can use it again and again, it must be tempered before each use. That is, you must add water to get a workable consistency. Sprinkle from a jar with holes punched in the lid, and work the sand with a trowel until, when you clench a handful, it compresses into a mass that holds its shape and shows the imprint of every line in the palm of your hand. When the mass is broken, it should make a clean break, with sharp faces.

To make the mold, place the drag on a molding board with the guide pins inserted in mating holes, as shown at left. Center the pattern with its largest flat side down and sprinkle parting dust (from a bottle capped with loose-weave cloth) over both pattern and board. This keeps the sand from sticking to these surfaces.

After ramming the drag as shown at the top of the previous page, lay the second molding board on top and carefully flip the entire unit. Remove the first molding board, which is now on top. The upside-down pattern is at the top of the sand with its bottom face exposed.

Insert the two tapered pins you've prepared, pushing the smaller end into the sand just far enough to hold the pin erect. Space the pins about $\frac{3}{4}$ -in. from the pattern at opposite sides. Sprinkle the whole top surface of the drag with parting dust

PROPERTIES OF NON-FERROUS METALS

Metal	Approx. Melting Pt. in degrees F.	Specific Gravity*	Weight per Cu. Inch	Shrinkage, inches per foot
Aluminum	1250°	2.70	1.555 oz.	3/16
Babbitt	462°	(depends on alloy)		1/8
Brass	1616°-1949°	(depends on alloy)		3/16
Bronze	1800°	(depends on alloy)		3/16
Copper	1870°	8.8	5.069	5/32
Gold	1945°	17.1	9.85	—
Lead	630°	11.37	6.549	5/16
Pewter	425-440°	(depends on alloy)		1/32
Silver	1760°	9.87-10.55†	5.685-6.076†	1/8
Tin	455°	7.298	4.199	1/12
Zinc	787°	7.15	4.118	5/16

*Multiply the figure in this column by the weight of water to find the weight of an equal volume of metal. Water weighs 62.4 lbs. per cu. ft., 0.576 oz. per cu. inch †Depends on previous treatment

and set the cope on top; there should be mating holes in the cope's bottom edge, to take the flipped drag's three guide pins.

Ram sand into the cope exactly as you did to fill the drag, except that this time you don't ram as hard, for fear of displacing sand from the drag. Let the rammed sand heap above the top of the cope—at least to the top of the wooden pins. This provides a higher "head" on the pouring metal—more weight in the sprue and riser to press down and pack the mold.

Now, lift the rammed cope carefully off and stand it on end to one side. The pins lift out with it. With a large watercolor brush, wet the sand around the edge of the pattern so it will be less likely to crumble when the pattern is withdrawn. Use an ice pick for a "rapping pin", tapping the point gently into the center of the pattern's exposed face, then rapping as shown in the photo on page 168. Rap both lengthwise and breadthwise of the pattern so that it moves slightly, loosening in the mold. (Since this makes the mold slightly larger than the pattern, you needn't concern yourself with shrinkage of the metal when making small castings).

Brace your wrists against the edge of the drag, grasp the ice pick and carefully lift the pattern straight up. If part of an edge should crumble, repair it by applying moistened sand, slicked down with a palette knife. Then, with your homemade cutter, scoop a trough from the edge of the mold cavity to the depressions made by sprue and riser pins. These "gates" allow free flow of metal into and out of the cavity. Rap the protruding ends of the pins and pull them through from the top side of the cope. With a spoon, scoop a pouring basin around the top of the sprue, then replace the cope on the drag. The flask is now ready for pouring.

Since aluminum melts at a relatively-low 1250-deg. F., it's a good metal to

HOW MUCH METAL DO YOU NEED?

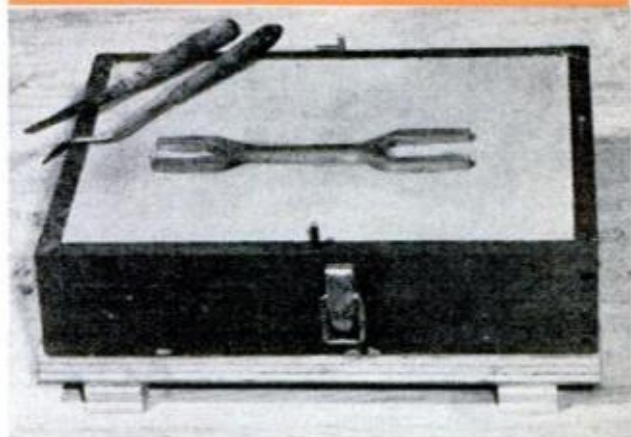
Constants let you calculate the amount of metal required for a given casting when the weight and material of the pattern are known. Procedure: Weigh the pattern, then multiply the weight by the proper constant as listed below.

Pattern Lumber	Constant for Aluminum	Constant for Brass or Bronze
Sugar Pine	6.50	18.75
Mahogany	4.25	12.50
Cherry	3.75	12.75

EXAMPLE: A pine pattern weighs 5 oz.: $5 \times 6.50 = 32.5$ oz. of aluminum for the casting. Add to this sufficient metal for the sprue, riser and gating system plus a little "for the pot".

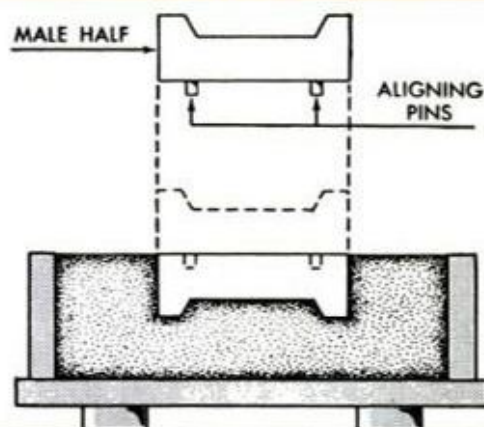
CASTING ROUND PATTERNS

IN ONE PIECE

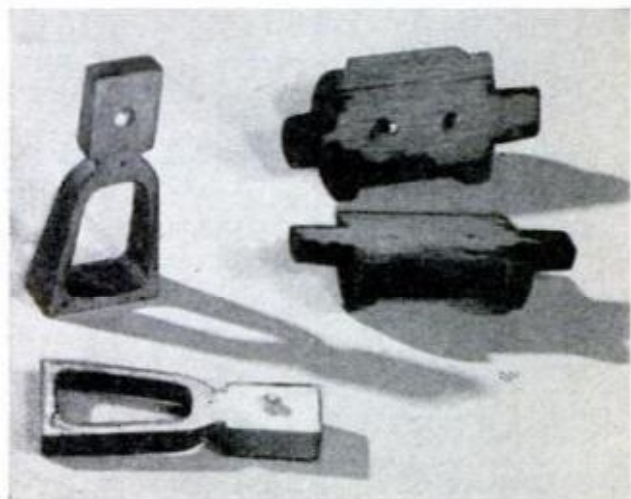


THIN PATTERNS—not more than half an inch thick, like the one for the rapper—can be handled in one piece. Ram them in the drag as usual, but when you flip the drag over, cut sand away to centerline of pattern (using palette knives like those shown) to form shallow basin with pattern half-buried in bottom. Slick down sand with small trowel before sprinkling parting dust. Add pins and cope, then ram

IN TWO PIECES



THICKER PATTERNS—or tricky shapes—must be split in two and provided with aligning pins (dowels, rod or brads). The half without pins is rammed in the drag and flipped, just like a one-piece pattern. The pin half is set atop it, the cope is added, rammed, then lifted off for careful removal of both halves



practice with. It's also plentiful—you can use old cast aluminum pots, or pistons from an auto wrecking yard.

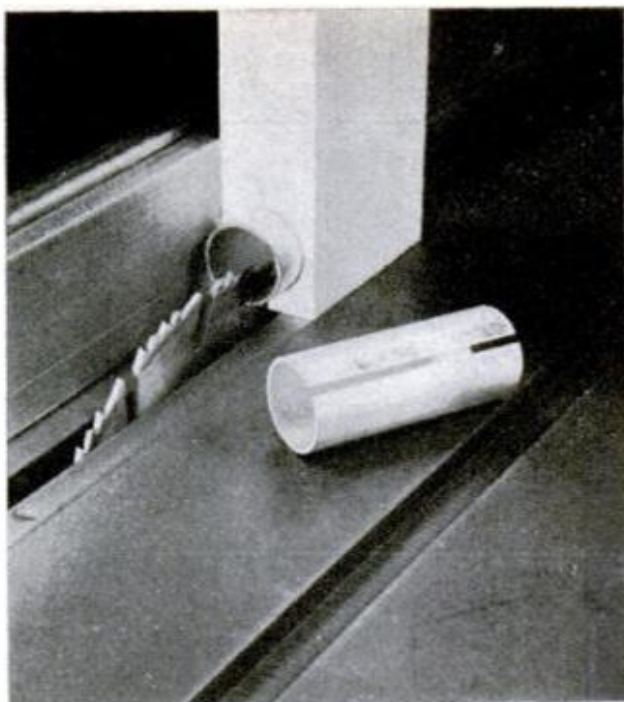
From the tables below, you can calculate the amount of metal for a given project—and the heat required to melt it. Always make a generous estimate: Any excess is easily disposed of, but if you run short you've spoiled the casting. Once you start to pour, the slightest pause may let oxides form in the gate, plugging it. You must pour steadily until you see molten metal at the top of the riser.

Never let metal solidify in the crucible. Pour the surplus immediately into a coffee can partly-filled with sand, and scrape out the crucible with your skimmer.

For large castings, you may not be able to melt all the metal at once. If you must add new chunks, be sure *they're* preheated as shown in the sketch on page 169. Moisture in the furnace atmosphere condenses on cold metal and flashes into steam, spattering molten metal on contact.

For safety's sake, position the flask as close to the furnace as possible, to avoid transporting the molten metal. And as protection from spillage or spatter, you should wear asbestos gloves and apron, and a face-shield or goggles.

When a number of small castings must be made, you can mold several patterns at once. Just stagger them along opposite sides of the drag's centerline. After ramming, dig a "runner" channel straight between sprue and riser, and cut individual gates to each molding cavity. You can then cast all items with one continuous pouring of molten metal. ★★★



Slots in Metal Tubing

Want clean, accurate slots in short lengths of non-ferrous tubing? You can cut them in a single pass on your bench saw if you make this simple holder from scrap stock. You'll need a bit the same diameter as the outside of the tubing—or slightly larger. Unless the hole it makes is a snug slip fit, don't bore clear through—the blade's cutting pressure might push the tubing out the back. Set the rip fence to center the blade on the tubing. The first cut slots the wood, too, but doesn't spoil the holder. This technique can also be used if you want to slice the tube for two half-round sections.—R. J. DeCristoforo

NEXT MONTH IN SHOP AND CRAFTS

SCOOT-CAR. Powered by an auto starter motor and a 6-v. battery, this miniature sidewalk speedster has two forward speeds and will hit 12 m.p.h. when wide-open. At operating speed, it runs on two wheels like a bicycle; two small outriding wheels provide support during acceleration and cornering. You'll find detailed plans in the August issue

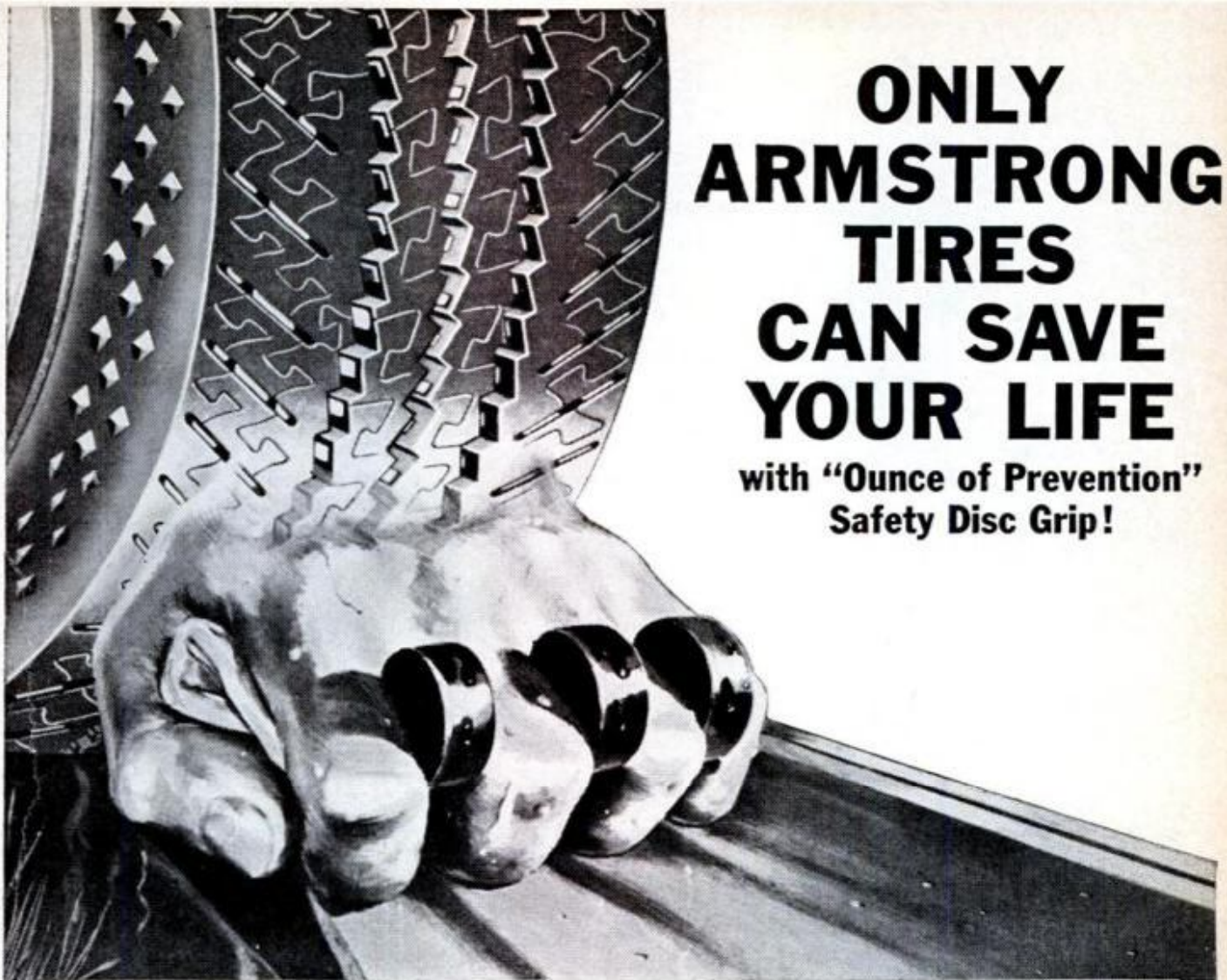
BUILD YOURSELF A BOAT DOCK. Don't miss this one if you're thinking about building a dock. A no-punches-pulled comparison of materials, plus plenty of plans and cost-cutting time-saving construction tips. Everything from the simplest plank-and-piling pier to an elaborate diving float that can double as a party boat. It's all in the next month's PM

HOMEMADE WOODTURNING LATHE. It's not elaborate, and it won't take all the jobs that an expert might want to attempt. However, this lathe has one outstanding advantage: you can build it for around \$10. Fine for the beginner, it has a faceplate capacity of 8½ in. and can accommodate work up to 34 in. between centers. Look for the plans next month

MODEL ROTOR SHIP. Anyone familiar with the history of sailing craft has heard of Anton Flettner's amazing rotor ship which sailed across the Atlantic in 1924. In next month's PM you'll find a novel wind-driven model which combines Flettner's rotor idea with a windmill effect. Instead of being cylindrical, the vertical rotor has an S-shaped cross section

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ORDINARY TIRES

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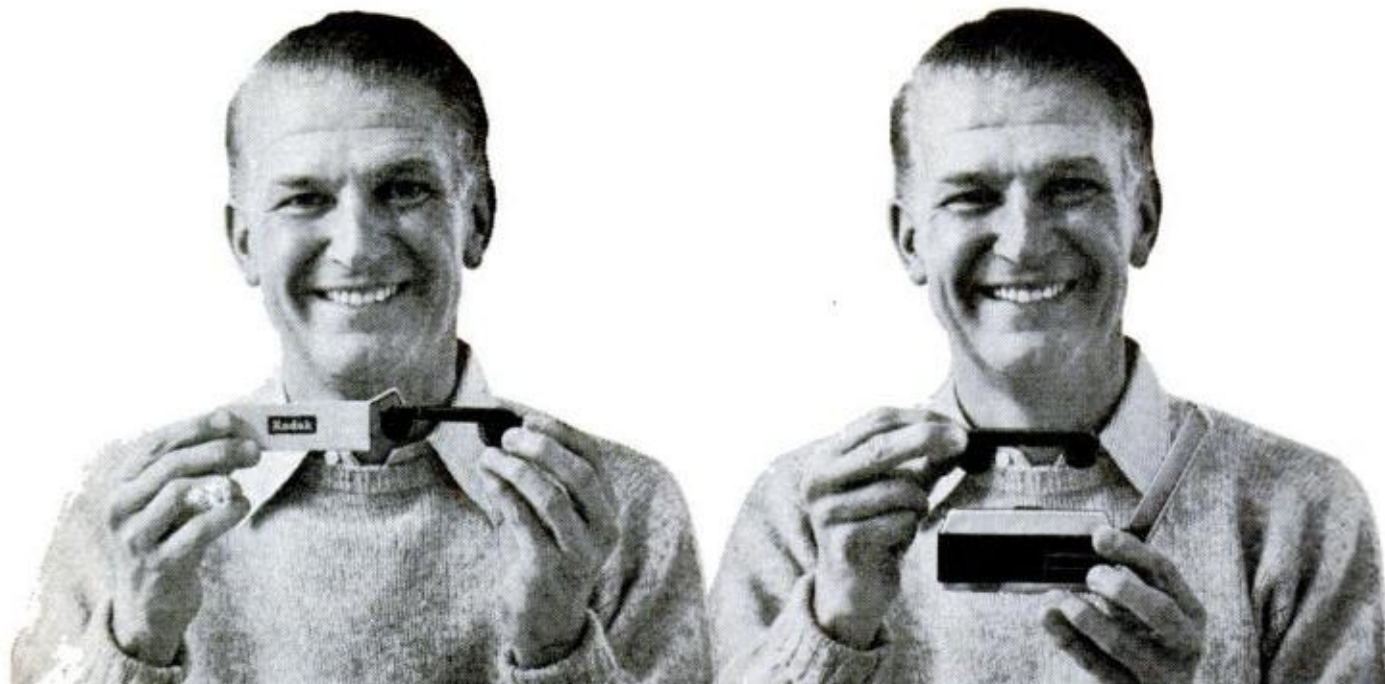
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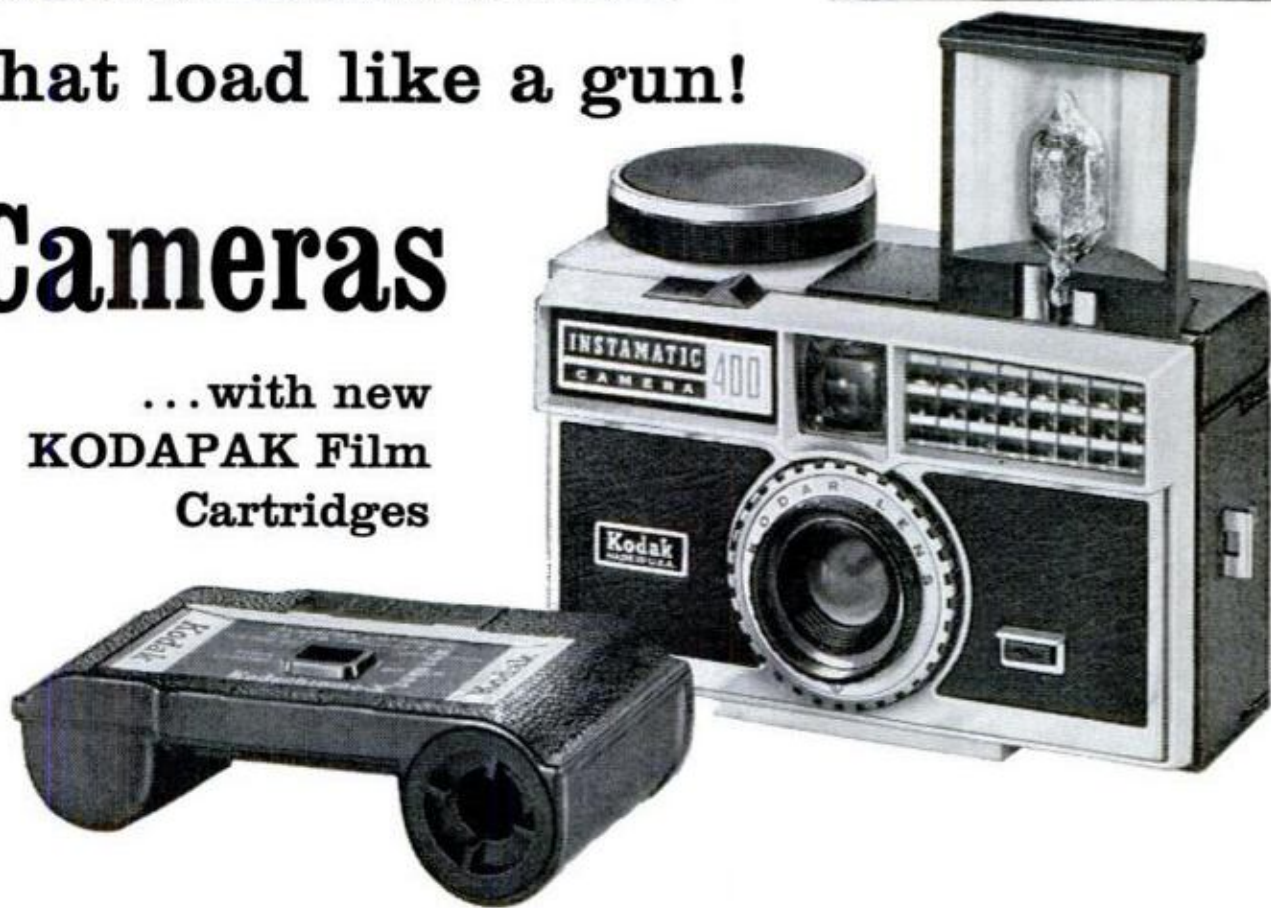
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JULY 1963

175

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Diaries of Destruction

(Continued from page 112)

swered: "Roger 826, Roger, and you received holding instructions at Preston. Radar service is terminated. Contact Idlewild Approach Control. . . ."

At this moment the controller thought his radar showed the jet nearing Preston. But the recorder told a tragically different story. At the speed it was moving, the craft had passed Preston and was eight or nine miles beyond, following V-123 directly toward Flight 266. La Guardia Approach Control saw it coming, frantically advised the *Connie*: "Trans-World 266, traffic at two-thirty, six miles, northward." Because of the thick weather, the pilot could not see the big jet.

Then, "That appears to be jet traffic off your right now, three o'clock, one mile, northeastbound. . . ."

Watch Helplessly

The controllers now could only watch helplessly as the blips merged, halted for an instant, then one continued curving northward briefly while the other entered a right turn and dropped from their screen.

What did the robot spy aboard the DC-8 have to tell when it was scraped from the Brooklyn street into which it fell? One, that the jet apparently had overflowed the Preston intersection before the pilots had identified this point on their omni range receiver. Several other planes reported that one of the intersecting omni range stations was erratic that day. The fact is that 826 was still bowling along at 301 knots when it whistled out of the clouds and sheared off the right wing of the *Connie*. Perhaps at the last minute the pilots aboard the DC-8 saw the other plane—the recorder showed their craft in a 50-degree right bank at impact. Time sequence on the tape indicates that the plane flew past its holding pattern, with its high rate of speed and the change of route as contributing factors. Repercussions from this accident continue today.

The durable spy that told this tale from beyond the grave is no ordinary tape recorder. On the most common type, a metal tape runs between two drums and the readings are engraved on it with several sharp needles. Others use magnetic tapes. Their readings usually are obtained from sensing devices plugged into the craft's instrument circuits, feeding the recorder's stylus with impulses. Tapes last some 200 flight hours. Since they move only a fifth of an inch every minute, a lot of data is packed in a short space.

Usually each instrument makes a mark once or twice a second. The line of tra-

cing it produces is called a parameter, and there are four parameters showing altitude, air speed, vertical acceleration (G-forces) and direction. In addition, there is a time indicator in fractions of seconds which tells when each of the markings occur. From these items much can be divined if properly interpreted.

In the CAB's head offices, the readout is done by experts in several ways. They may use a glass overlay with scales printed on it. Each mark on all four parameters is matched against the fraction of a second at which it occurred. Final analysis is performed on a new machine that scans the tapes with a power-driven optical system. It also projects the readings on a viewing screen and feeds the data to a computer.

Often there are witnesses, but stories obtained from them may be wild and conflicting. At Chicago's Midway Airport, when TWA's Flight 529 crashed on take-off in September, 1961, investigators talked to 150 persons who claimed to have heard or seen the craft as it approached. The stories varied so widely that they gave only a vague idea of the plane's behavior.

Tapes Wound on Reels

The tapes are wound on reels like film in a camera. They are enclosed, along with other apparatus, in double-thick shells with thermal insulation between the layers. Some are box-shaped and others round. They have on occasion protected the tapes from 1100-degree Centigrade heat and forces of 100 times the pull of gravity. At least one recorder was immersed in salt water for 36 hours.

In 65 incidents investigated by the CAB during the last two years, only one recorder was damaged too badly to use. In many others, even though damaged, the recorder made vital contributions.

Even small clues obtained from a recorder have been used to help eliminate suspected causes of a crash. In May, 1962, a Continental 707 seemed to disintegrate in flight over Iowa. There were no significant voice transmissions recorded in ground stations; nothing to indicate what had gone wrong. Excessive air turbulence was suspected. But the flight recorder, though damaged on the outside, was still readable and showed that although the plane passed through 40 minutes of moderate turbulence during the flight, for five minutes immediately preceding its death, it was in smooth air. Shrapnel found in the victims' bodies later indicated an explosion, and further investigation showed that a bomb had blown the craft apart.

Though a long-sought boon to investigators, some pilots at first were not happy

(Please turn to page 178)



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Diaries of Destruction

(Continued from page 176)

at having an "iron spy" aboard. It has, however, proven to be their staunch ally. In many minor reported violations—deviation from assigned routes or altitudes, excessive speed, low flying, etc.—when the pilot had only his word against that of his accuser, the recorder has backed him up.

Today, the recorder is an item on the pilots' check list for most airliners. The sealed unit is never touched except at the home shops where it is installed. A cockpit warning light tells the crew when its power supply is shut off, and the recorder's case is often painted with luminescent colors so that it can be located easily in any wreckage.

Can Be More Helpful

Helpful as it has been, the recorder can be made even more effective. There are channels available on some tapes for as many as 60 other parameters. The additional information most often requested by investigators would include engine-power settings, air temperature (to establish true air speed), angle of attack, of sideslip, of roll and of pitch, positions of control wheel and rudder pedals, trim and flap positions, autopilot, hydraulic and electric-power systems, cabin pressure and cockpit oxygen.

Also, there is considerable support for including cabin voice recorders and maintenance recorders. The voice recorders would record all conversation in the cockpit whether it went out over the air or not. Some believe the last words of the crew could be of vital significance. The pilots aren't so sure they want an eavesdropper, and the airlines back them up. The latter are afraid pilots might go to hand signals which could also become dangerous. It seems likely, however, that the voice recorders may go in the planes with the provision that they would be used only for accident investigation.

The maintenance recorders have nearly universal approval. At least two airlines, TWA and Trans-Canada, are experimenting with them now.

If all three recorders were installed, investigators would have an exact record of the individual flight, what the crew said, and an exact record of structural defects that may have preceded the flight.

Their purpose is not to tattle, but to help ferret out the reasons for accidents and thus prevent their recurrence. Only the unknown is truly frightening. As long as accidents can be explained, even by robot spies, aviation will advance and so will passenger safety. ★★★

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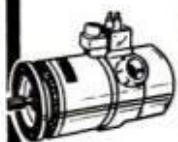


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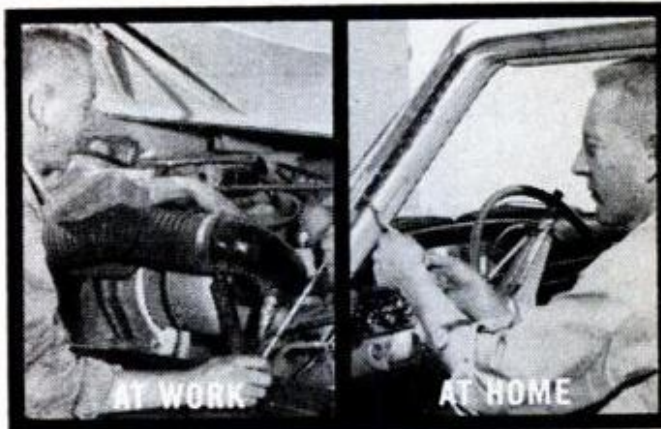
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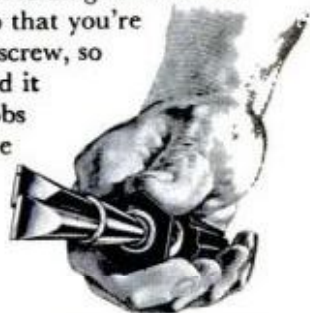
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Weather Control by Asphalt

Rain-making by raising soil temperature may be a practical method for making arid land useful. Tests in Arizona involved coating the earth's surface with thin 10-foot squares of black asphalt; soil one-half inch below them became 19 degrees F. warmer than in adjacent uncoated areas.

Covering large areas of dry land near a sea or large lake with this asphalt might produce useful changes in local weather, suggests Dr. James F. Black of the Esso Research and Engineering Company. The system could increase the intensity of the sea breeze, bringing in moist air from over the water and lifting it to where the water vapor condenses into clouds and then falls as rain.

Peppered Space

Interstellar space is peppered with tiny flakes of graphite—not ice crystals, say two English scientists. Dr. F. Hoyle and Dr. N. C. Wickramasignhe of Cambridge University report that the graphite specks are formed on the surface of cool carbon stars.

Their theory attempts to explain what causes light to become reddened as it travels between stars. They say that the values calculated for reddening by graphite flakes conform closely with observed phenomena.

The scientists report that there are about 1000 of the right kind of carbon stars in any one galaxy to produce enough graphite flakes to account for the reddening. The flakes are the same as the "lead" in a pencil.

Throw Oil on Troubled Soil

Agricultural output can be increased throughout the world, including areas where food supplies are low, by treating croplands with a petroleum mulch.

This is the picture for an agricultural help developed in three years of research by the Esso Co. The firm reported that field tests of spraying a petroleum mulch over seeded areas to achieve moisture retention and higher soil temperatures—both desirable for getting the most crop from seed and soil—resulted in yield increases ranging from 10 to 111 percent on a variety of crops.

Some examples of increase, achieved in the U.S., Europe, South America and North Africa, were: Melons \$231 per acre increase in crop value; carrots, \$560 and sweet corn, a \$40 increase per acre.

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Ocean Bottom Homes

(Continued from page 102)

the second day and the beginning of the third. The graph begins to rise from there on. Between the fourth and seventh days they became progressively better adapted to their living conditions. We now assume that a man underwater for two weeks will perform his work most efficiently the second week. After the fourth day both men performed the Angiboust time reaction tests (bolting together a disassembled structure) in the same time it has been performed on land.

We had intentionally put both men on the same diet of foods they would have required on land, but after the second day they requested lighter foods. We deduced from their preferences and remarks that future oceanauts would refuse fats, sauces and bread and would drink little. Because they use up comparatively few calories in their environment, their diet will be largely grilled meats, fruit and green vegetables.

By eliminating the need for decompression, the divers were able to go to a depth of 180 feet and spend more time in leisurely exploration.

"This is the first time in 20 years of diving," reported Falco, "that I have the time to see. The seaweeds, for example, are absolutely fantastic, particularly at night if one takes a searchlight. The bottom is alive with sea horses, sea anemones, shrimps and fish laying eggs. It is as though we are really present at the birth of fish."

On the third day a startling thing took place. It became apparent to all of us on shore. Falco and Wesly were losing interest in the surface. They stopped listening to the radio or watching television, and they did not bother to read. Falco wrote in his diary:

"I don't care what happens on the surface, nor does Claude. Time has no meaning. I know what day it is, because they tell me, but I could not care less."

Besides this, both men expressed annoyance at the interference from above. They were establishing a routine and did not want it disturbed. Falco wrote:

"This first experiment is too push-button. I visualize the next one differently. We must be alone. They should give us air, replacement bottles, and say to us: 'There are fish around you, get on with it.' If we feel like seeing people we will call them."

The two men had become assimilated in their environment. Life beneath the sea had claimed their complete attention.

One mistake during the experiment

convinced us of the need for relay air-bells. These are barrels open at one end and held to the bottom in the same manner as the large shelter. The barrels are lowered into the sea, and halfway down the water is emptied by compressed air until equipressure is established. The barrel remains suspended in the water with an air reserve in the upper half. The mistake I mention was sending down a bottle of compressed air that was only half-filled. Claude was using this bottle at 60 feet, when he suddenly ran out of air, and Falco had to help him back to the shelter, sharing his air. In the future we'll try a series of emergency air-bells.

On the seventh day the doctors went down for the final time. They had both oceanauts breath a desaturating mixture of 80 percent oxygen and 20 percent nitrogen, which, after two hours, let them surface without decompression stages.

The experiment was ended, and it was a complete success.

What of the future? Our next step is a four-room house at the bottom of the Red Sea. The oceanauts will have less contact with the surface and they will stay down longer. They will have stores of food and will do their own cooking. Their work projects will be more extensive. There will be the harvesting of sea plants, mineral prospecting and the herding of fish.

This is our next step, but our plans go much farther. We are actually moving toward an alteration of human anatomy to give man unlimited freedom underwater.

Artificial Gills

Scientists in the U.S. are now working on a sort of artificial gill in a small capsule. It would allow the oceanaut to regenerate his blood with oxygen without breathing air. The "gill" might be fitted under an arm and linked with the aorta by surgical manipulation.

To prevent lungs collapsing under pressure, it may be possible to pack the rib cage surgically with a noncompressible, sterile plastic.

These things do not seem strange when you realize that for the first nine months of his life the human being lives immersed in fluid in the womb.

I envision a race of *Homo Aquaticus*, future generations born in underwater villages, finally adapting to the environment so that no surgery will be necessary to permit them to live and breathe in water. It is then that we will have created the man-fish.

I will not live to see it. I will die earth-bound. But a new world is there to conquer, and I have helped to start the breakthrough. ★★★

JULY 1963



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CLINIC FOR HOMEOWNERS

Q Recently I repainted the siding on my home, after cleaning off peeling old paint and blisters, mostly on the north wall. I used a new "breathing" paint, was told it was the cure for my trouble. But now the paint is peeling again, both the old and new are coming off. What do I do now?—T.N., N.H.

A When the so-called breathing paint is applied over old paint it can hardly be considered a cure for the trouble you describe; helpful, perhaps but not a 100 percent cure. The main reason is that the moisture coming through the wall still is being entrapped under the old paint film. This condition is difficult to deal with at best, as you have the old under the new, and in patches. It is likely to continue to peel in the areas where the old paint is still on the wall under the new, although those areas covered only by the breathing paint may permit some moisture to escape and thus reduce the peeling, at least to some extent. The logical remedy, of course, is to remove all the paint from the wall, both the old and new, and then apply the breathing paint. We hesitate to suggest this as it's a messy, tedious job even though you use a paint remover, but it would undoubtedly get rid of the trouble.

Q I have a deep well and my pump is below grade in what I suppose is called a sump. Moisture seems to gather on the underside of the concrete cover, in which there is a manhole, and drips constantly. I had thought of attaching boards in some way to the underside of the cover, but would this prevent the moisture from gathering and dripping?—D.S., Ohio

A It's unlikely that the remedy you suggest would be effective. Perhaps you could construct a framework over the open manhole and cover with fine screen to provide ventilation, but a better way, we think, would be to apply the heavy masticlike material made expressly for coating water pipes to the underside of the concrete well cover, or curb. This material prevents condensate from forming on cold-water pipes in basements and it should prove satisfactory for your purpose. It's available from, or through, your paint dealer. Be sure to follow application instructions.

Q A length of concrete walk leading to the back door of my new home, which is about two years old, is breaking up, that is, a top layer about $\frac{3}{4}$ to 1 in. thick or more has loosened from what appears to be an under layer about 2 in. thick or a little over. This seems to be solid. I was told this is due to the concrete freezing after being poured. Is this true, and what can be done to repair the damage?—H.J., Mo.

A It could be that the damage was caused by freezing, but we think it more likely that the walk was poured in two stages, the top over a grout after the latter had partially or wholly taken the initial set. The later pouring did not bond properly to the first. You do not say how long the walk is, but it might pay, if the walk is short or only a part of it involved, to break up the top, remove it and finish with a concrete patching material which will bond to the solid under layer. Be sure to follow instructions for mixing and applying the patcher to assure a satisfactory bond with the old.

Q The center beam in my basement is supported on 6 x 6 wooden posts. The beam is wood, and measures 6 x 8 in. The concrete floor comes right up to the wooden posts, covering up what is underneath. There seems to be no settling and the posts appear to be sound, but isn't this an open invitation to termites and possible rotting?—S.M., Nebr.

A Perhaps, but why worry? If the posts appear to be sound and there is no sign of undue settling, cracked plaster, sagging floors and the like, then we see no problem or any reason to make changes. Yours is very evidently an older home and was built at a time when center beams and posts of wood were commonly installed. If you wish to go further with a closer check, tap the posts with a hammer near the floor on all four sides. If you get a solid "ring" at each hammer tap on each post then we think it best to let well enough alone.

As a service to Popular Mechanics readers in solving the hundreds of problems pertaining to a home—inside or out—you are invited to present your problems to The Clinic Editor for his helpful advice. Address your questions to The Clinic Editor, Popular Mechanics Magazine, 575 Lexington Ave., New York 22, N.Y.

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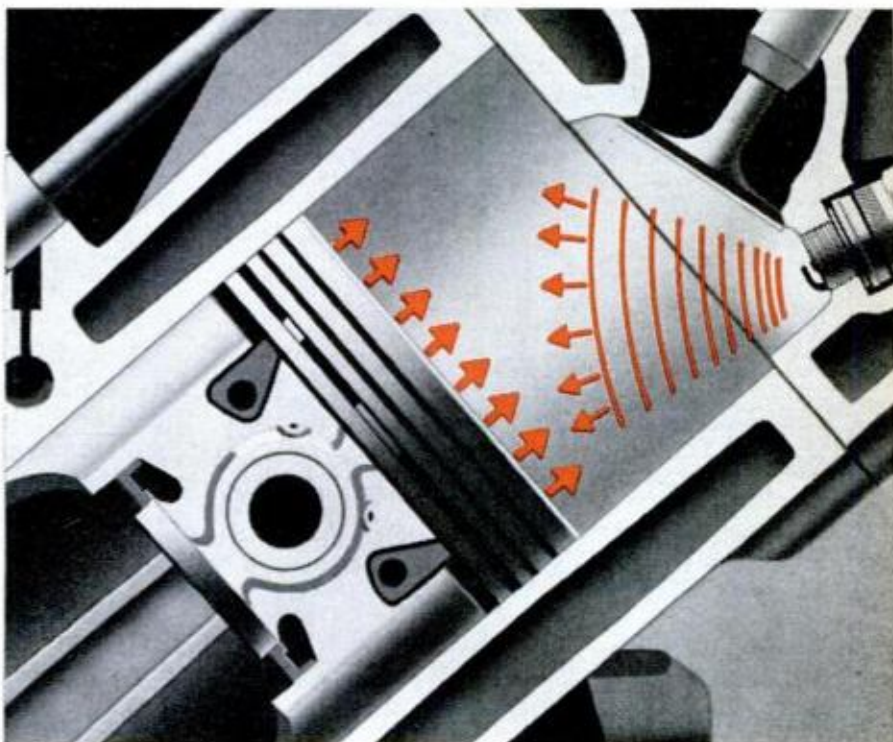
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Romans in America?

(Continued from page 74)

his farm. Digging deeper into the site, Howe unearthed nails, nail headers and threaded nuts similar to those found in Roman iron workings in frontier Germany. He also dug up a bronze drinking cup which is identical to several discovered in the ruins of Pompeii. Tests of the iron show that it was produced by the direct process used in ancient days in Europe.

It is probable that for many centuries after the decline of the Mediterranean civilizations few Europeans made it across the Atlantic. Contacts across the Pacific were probably extremely rare as well, although Thor Heyerdahl established in his famous voyage that the Incan mythological figure, Kon-Tiki, fleeing from persecution in an area now identified with Peru, could have reached Easter Island.

Some experts believe that the legendary white god of the Mayans, Aztecs and Andeans may have been an Irish monk. At least there are indications that Irish sailors beat the Vikings to the New World. Irish fishermen knew the western Atlantic, and sailed to the Grand Banks off the coast of Newfoundland.

The good monks may have reached Yucatan, too. The monk Brendan's account tells of drifting through gloomy fogs, spotting huge icebergs and observing animals with "catlike heads, eyes of the color of a bronze cauldron, fuzzy pelts, boars' tusks and heavy spotted bellies." Back home they thought he'd lost his senses, but actually he was describing the walrus.

Irish Monks in Florida

Probably the monkish party landed on rugged Newfoundland to bury one of their number who died at sea. They sailed southward to either the Bahamas or Bermuda, then cruised westward for eight days to come ashore on a "land odorous, flower-smooth, blessed." Brendan explored inland, perhaps present-day Florida, for 40 days, then returned to Ireland.

Other testimony that the Irish were ahead of the Vikings comes from the Vikings themselves. The *Flateyjarbok* states that the Vikings found the Irish in Iceland and Greenland when they reached those islands. They found them also in "Great Ireland," which some scholars believe is present-day New England. It may have been the Irish who constructed the strange stone ruins spread through New England, which have been called "root cellars," and were supposedly used by early English settlers to store vegetables.

Those at Pattee's Caves at North Salem, N.H., alone cover 30 acres, which led one

Irish-oriented expert to observe tartly that some of his colleagues must think the first English settlers had a "helluva lot of roots to store." The structures are similar to the rock ruins left in Europe by its early inhabitants.

In the course of the slowly passing centuries the Vikings reached the New World. The name of the first Norseman to sight North America is lost in the shrouded North European past, but almost certainly was not Leif Ericsson. It might have been Ari Marson, an Icelandic tradesman who was sailing from Limerick, Ireland, to his home port when a shrieking Atlantic storm blew him off course to so-called Great Ireland. Ari was seized by the inhabitants in this remote land, probably Irish, and baptized a Christian against his wishes.

First Viking Discoverer

In 986, shiploads of Norwegian colonists on their way to Greenland may have been blown to the New England coast. That same year Bjarni Herjulfsson was sailing to Greenland from Iceland when north winds blew his ship onto a southerly course. After sailing south for several days, Bjarni turned west with the hope of reaching Greenland. He voyaged to the west until he sighted a wooded, hilly land, which could have been Cape Cod, or the coast of Labrador. Lost in the west Atlantic, Bjarni Herjulfsson became probably the first Viking who sighted the North American coast.

Leif Ericsson may not have been the first Viking, but he was a formidable voyager. He bought Bjarni's ship, and with a crew of 35 sailed westward to colonize the new land his predecessor had discovered, sailing directly across the watery miles between Greenland and Labrador in four days. He continued to Nova Scotia, then turned south to what was either Martha's Vineyard or Cape Cod, a place which he called Vinland.

Other Vikings followed Leif. His brother Thorwald journeyed to the Vinland settlement only to be killed in a battle with the Indians. He lay in his grave for centuries until 1831, when, according to some accounts, he was turned out of the ground at the corner of what is now Fifth and Hartley in Fall River, Mass.

Unfortunately, nobody made a study of the "skeleton in armor" which was destroyed in a fire in 1843. The ornaments, belt parts and rings are still in existence, but because they were made of brass, most historians have maintained that the skeleton was that of an English colonial. They argued that the Vikings did not work brass. Recently, however, more knowledge

(Please turn to page 188)

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Romans in America?

(Continued from page 186)

about medieval trade routes indicates that the Vikings could easily have obtained items of brass from the British Isles.

Possibly the Vikings sailed as far south as the Yucatan coast; when Cortes reached Mexico centuries later the Aztecs told him stories of seeing ships which glistened like the scales of a snake and which contained tall, fair-haired, blue-eyed men. Aztec and Mayan statues obviously are representations of Vikings.

To a North American, the most fascinating of the Viking explorations was that of 14th Century Paul Knutson, who was sent out to search for survivors of the once-thriving Greenland colony. Knutson and his men set out for North America and vanished. In 1898, a farmer, Olaf Ohman, who knew nothing of this expedition, was digging out an old aspen tree from his farm near Kensington, Minn. His pick laid bare the roots and struck a large rock. On it were inscribed characters which Ohman, a Swedish immigrant, recognized as runic.

Branded A Fraud

O. J. Breda, professor of Scandinavian languages at the University of Minnesota, who first translated the stone, branded it a fraud. Ohman placed it by the door of his granary and used it for a stepping-stone and to straighten nails. There it remained until 1907 when Hjalmar Holand came to see it and commenced his research which finally resulted in the stone being removed to a place of honor in the Smithsonian Institution.

Holand made a translation as follows: "We are 8 Goths and 22 Norwegians on exploration journey from Vinland round about the West We had camp by (a lake with) 2 skerries one day's journey north from this stone We were (out) and fished one day After we came home found 10 men red with blood and dead AV(e) M(aria) save (us) from evil"

I have added the words and letters in parentheses to make the meaning clear.

Possibly Paul Knutson entered North America through Hudson Bay. At least Norse mooring stones, halberds and fire-steels have been found at Minnesota points such as Lake Park, Hawley, Nelson Lake, Big Cormorant Lake, Ten Mile Lake, Barrett Lake and Alexandria. Wherever the Vikings went by water they chiseled holes several inches deep in a rock or boulder on the shore to hold a bolt for mooring their boats.

Two ancient manuscripts from the Abbeys of Strat Florida and Conway in Wales declare that the Welsh prince,

Madoc, reached the New World in 1170 A.D. He set sail from a North Wales port with 120 settlers and later returned to lead a larger force of several hundred colonists and 10 ships to the faraway land he described in such glowing terms.

Welsh Perhaps in Alabama

Where did the Welsh go? They very possibly landed on the coast of Alabama on the point where Fort Morgan was built to guard the entrance to Mobile Bay. What happened to the Welsh colony? Indian legend and ethnological indications suggest that they may have gone up the Mississippi to the Ohio Valley, where Indian tribes claimed to have white ancestors. Tribes also told the first Anglo-American settlers of a furious battle that took place on Sand Island in the Ohio River in which the "white Indians" were defeated by the "red" Indians.

In the late 14th Century, Antonio Zeno, an Italian seafarer, wrote a letter to his brother Carlo in Venice, telling of an extraordinary voyage. He claimed that he had gone with Prince Henry Sinclair, Earl of Orkney and Caithness in Scotland, on a voyage to the New World. As they were taking on fresh water and food, the natives attacked and killed several sailors. The Europeans sailed away to another point where they landed 10 days later.

Discovery Forgotten

According to Zeno, Prince Henry was so enamored of the beautiful countryside that he stayed behind with some of his men when the ships returned to Scotland. How he got home is a mystery, but he must have done so since it is a matter of record that he died there in 1404. Zeno's letter was published in 1558, caused a sensation, and was then forgotten.

Romans, Phoenicians, Chinese, Vikings, Welsh and Scotch may all have made Christopher Columbus a Johnny-come-lately to the New World. Perhaps the most interesting possibility of all is that Columbus very well knew this. The great navigator had sailed to Iceland, knew what English, Irish and Welsh sailors said about the Atlantic, and heard of the voyages to the Northwest Atlantic made a few years previously by the Portuguese Joao Corte Real, voyages which cartographic research indicates reached the Gulf of St. Lawrence in 1473.

But after Columbus' famous landfall, his predecessors who sailed across the Atlantic and the Pacific—and their mementoes, from the strange "root cellars" of New England to the tiny Roman head found near Mexico City—all have become merely "pre-Columbian." ★★

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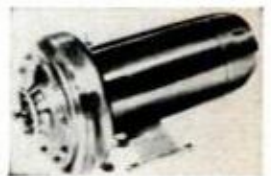
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Mobil Economy Run

(Continued from page 69)

drawn. Here's where the manufacturer's quality control enters the picture.

My teammates informed me that both my Dodge Six and the Plymouth Six were excellent cars, as their economy potential had been checked during the last miles of break-in against the "mule car," another Dodge Six set up to factory specs.

Practice sessions with mule cars are important because they permit drivers to develop a "feel" for the most economical cruising speeds under varying conditions. Some teams use fuel meters in the cars so that drivers can polish their techniques and make immediate comparisons, checking results on the spot. Another aid on the mules is a vacuum gauge which tells the driver how low the vacuum in his engine's intake manifold has fallen during acceleration or hill climbing.

Using a Vacuum Gage

There is only one reason to consult the vacuum gauge and that is to develop a "feel" for the engine and keep the vacuum reading above 10 inches of mercury. Below this level a step-up jet in the carburetor opens and permits additional gasoline to enrich the mixture. The engineers told me that it was more economical when pulling steeper grades to downshift into the 1.45-to-1 intermediate ratio which would speed up the engine, but also increase the vacuum and allow the step-up jet to close.

Proving-ground studies had shown the optimum economy speeds for pulling various grade percentages. On the Dodge Six I was advised to let the speed drop off from about 47 to 37 m.p.h. whenever we estimated grade steepness had increased from two to five percent. At six percent it was more economical to shift into intermediate range and increase the speed to about 42 m.p.h.

I was able to practice such grade techniques for about two hours before the Run commenced. I would have liked about 20 hours of it, complete with fuel meter, to put me in shape for the climb over the Sierras and Rockies that filled the first three days on the road.

Kicking the Gears

In traffic practice I was schooled in the technique of "kicking" the automatic out of the 2.45-to-1 low ratio at under 5 m.p.h. and getting into the 1.45-to-1 intermediate gear, thus dropping engine r.p.m. and saving gas. It was done by ear. When the ascending whine of the transmission reached a certain pitch I knew it was

ready and that if I lifted my foot off the pedal quickly the car would upshift. Doing this too soon would keep the transmission in low and slow the car down.

Acceleration was accomplished as slowly as possible, avoiding by all means the "pump shot" or jet of fuel from the carburetor's accelerator pump that's intended to cover the quick loss of vacuum caused by opening the throttle rapidly.

Thus, whenever passing became necessary the problem was not to blast around the slower car, but to float by at my own preferred speed, as long as it was safe.

At no time during the Run was it necessary to drive unsafely, but there were times when courtesy to fellow motorists went out the window. On dual-lane divided highways I often spent as much as a minute in the passing lane while tourists lined up behind me in fuming frustration, waiting to pass.

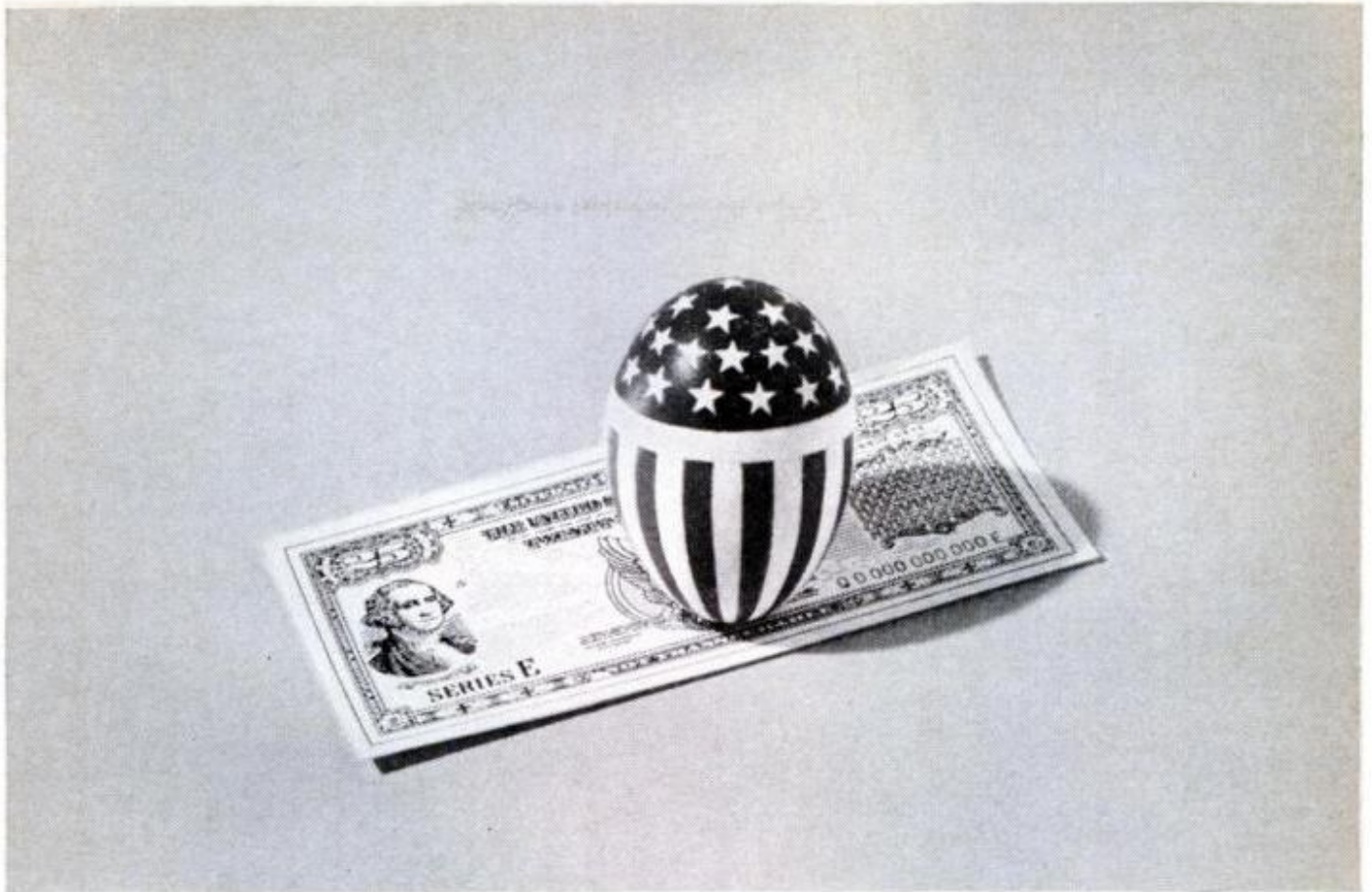
Altogether I had about five hours of practice in the eastern suburbs of Los Angeles before the start of the Run.

Although terrain, traffic and scenery changed from mile to mile, the routine inside Car No. 29 varied little from day to day as the Run progressed from Los Angeles to Las Vegas to Salt Lake City to Cheyenne to Omaha to Chicago, then on to the windup in Detroit. These big cities were the overnight stops, for rest and rehabilitation of the groggy crews. The Run cars remained sealed and guarded overnight just as the contestants left them. In the mornings they would leave in the reverse order of their arrival.

Three in Each Car

Each car carried three people, the driver, the U.S.A.C. observer (who was switched from one car to another twice each day), and the co-driver in the right rear seat. Actually the co-driver is a driver in name only, as he is permitted to drive only in case of driver illness; however, his role as navigator is extremely important. It is the navigator's primary job to see that his car uses the full time allotted for the day's run. To finish too early would mean that too much fuel had been burned in driving faster than necessary; to finish late means a penalty from U.S.A.C. officials in the form of gasoline added to your total tankage used during the Run, and don't forget that *not using* gasoline is the point of the whole affair. My navigator, Paul Mallwitz, was a Chrysler engineer and extremely proficient at his job. On the Omaha-Chicago leg of 499 miles and a running time of 12 hours and 9 minutes, Paul brought us in to Chicago just 90 seconds before our time ran out!

(Please turn to page 194)



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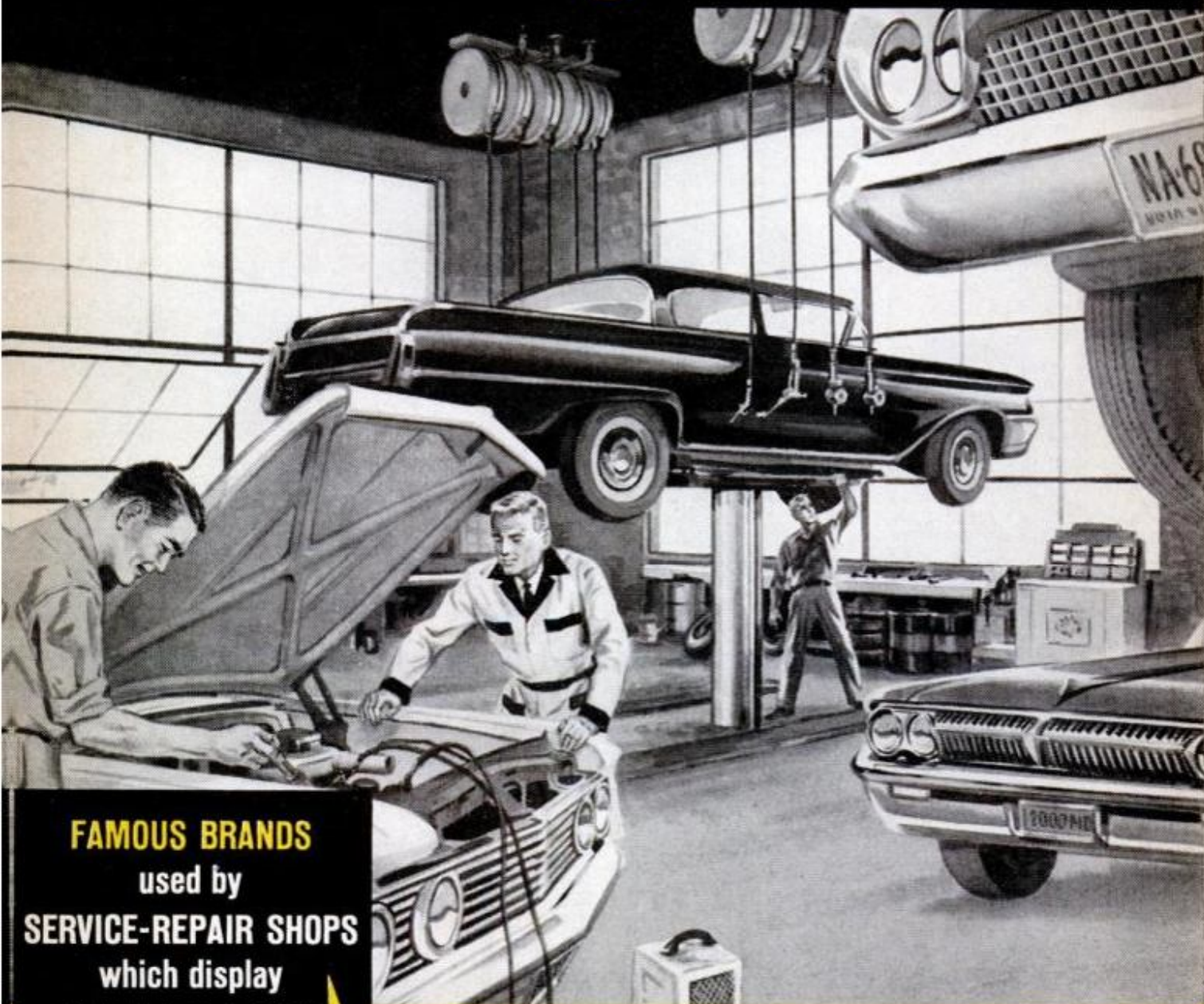
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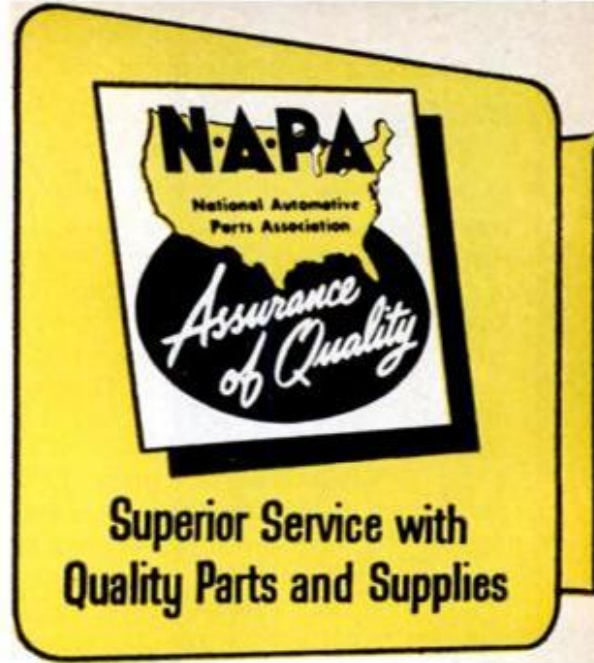
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Mobil Economy Run

(Continued from page 190)

Almost equally important is the navigator's other job: briefing the driver on upcoming route changes and traffic conditions. All day long the navigator feeds his driver information from the Mobil Log, a printed listing of every turn in the route, stop sign, town, major intersection and speed-limit change with the indicated mileage between each point and the altitude at each point.

Thus if you are in Grand Island, Neb., and must make a right turn onto a new route, the navigator tells you in time so that you can get in the right lane smoothly to turn without stopping or downshifting, both of which are gas wasters.

Make-up Penalty Stops

Paul also kept me alerted for speed-limit changes and compulsory stops at intersections. Both stops and speed limits must be carried out perfectly or the observer will penalize you. A missed stop sign or a not-quite-complete stop can be made up by making an extra, unnecessary stop. I did one of these in California, but waited for my "make-up" stop until I had to slow down for a right-angle turn thus wasting as little fuel as possible.

Have you ever driven 2600 miles, making every stop a full stop and every 20-m.p.h. school zone and not 21 or 23 miles per hour? Try it sometime, if only for a few hours, and you'll have some idea why the Mobil Run turns what might be a pleasant sightseeing trip into a tense, nerve-chewing grind.

To bring their drivers to the end of the day's run within a few minutes—seconds for the nervy ones—of the allotted time, most navigators use the Curta, a miniature, crank-operated calculator that looks like a pepper grinder.

Calculating Navigator

Into his Curta Paul set our odometer error (97.5 miles per indicated 100) as a correction, then added the multiplier. This latter figure was the number of minutes required to complete each mile at our daily average speed in miles per hour. The daily average was arrived at by dividing running time into total distance of the day's run.

The multiplier usually ran about 1.4 minutes for each true mile. By turning the crank once for each mile indicated on the odometer, Paul could find the correct cumulative total time if we were to be on schedule at a particular mileage. He constantly compared this artificial or average

time against the actual time recorded on the stopwatches clipped to his work table. For example, after 10 miles Paul's calculator should show a time total of 14 minutes. However, if traffic prevented us from making our ideal average of 43 m.p.h., the stopwatches might read 15.5 minutes; we would then be 1.4 minutes late. Thus the Mobil Run becomes not just a contest with other cars on the road, but a race between the calculator and the clock. The navigator's job is to tell the driver the correct speed to keep feeding enough mileage into the calculator to keep it up with the stopwatches.

That's why coming 499 miles from Omaha to Chicago within 90 seconds of a preset time represents a day's work for two men. If you're still not convinced, try it on your next long trip.

Here then is the Mobil Run; a driver trying to maintain speeds requested by his navigator over unfamiliar roads, through strange towns, at altitudes from below sea level to 9000 feet, obeying every speed-limit change and posted traffic regulation under the watchful eyes of an official observer on the seat beside him, and doing it all with as small a throttle opening and as few stops as possible.

Nor can you study or pre-run the route because the Mobil Logs are issued at the end of each day for just the next day's run. That's all you know in advance.

Time Cushions

Our team held meetings after each day's run—sort of skull practice sessions—to estimate the time it might take to go through larger towns and cities on the next day's run. The object was to enable the navigators to build up a "cushion" of plus time ahead of the 1.4 minutes-per-mile formula so that running speeds below the daily average could be made up smoothly and gradually.

Paul was constantly asking for slight speed changes in the open country. I might run at 51 m.p.h. for 20 minutes and, finding traffic favorable, then be able to drop to 48 and save precious fuel.

What made driving through traffic-clogged cities and towns all the tougher was that we aimed to run close to the posted speed limits, losing as little off the average speed as possible. The urge to run through changing traffic lights was almost unbearable. Rules permitted moving through an intersection on yellow, but if your observer caught the light changing to red while you were still in the intersection you were penalized. Driving the Run through towns and cities became a constant guessing game as to

whether you could make it to the next light before it changed to red, or whether you should slow down, waiting for it to cycle back to green again just as you reached it. Thus I found myself "playing" the third or fourth light ahead of the block I was in, as well as trying to keep from downshifting, running over the white line or tangling fenders with another car. Not a restful way to drive, believe me!

This is what it takes to average 23 to 24 miles per gallon across country if you obey all traffic laws. What does the Mobil Run prove? Basically it shows that any standard American production car can make phenomenally good mileage at reasonably fast average speeds if fantastic amounts of concentration and a fair amount of brain power are expended on the part of two people.

Mobil is simply supporting the manufacturer's claim that such a car, properly broken in and well tuned, can do it.

Lessons Mobil Teaches

What did I learn that might make me a more economical driver in everyday motoring? Basically this: If you are intent on reaching a destination on time, do a little planning for your trip. Unless you're traveling on turnpikes, 45 to 50 miles an hour average (not counting time stopped for fuel or lunches—which are "time outs" on the Mobil Run) is about all you can make legally in a mixed bag of city-country driving throughout the U.S. To conserve fuel, simply make up time by increasing speed where you can do it most economically. Roll fast in the open country, and "think your way" through traffic rather than accelerate and bull your way through; save your passing until you can do it both safely and without full throttle acceleration. Play it that way and you can probably come within two or three miles per gallon of the Mobil Run averages and have a much less exhausting drive than I did.

Was the Mobil Run fun, despite the nerve strain and fatigue? You bet! Next year, I'll be back at it shooting for first in my class! ★★★

Nitrogen Helps Date Fossils

Scientists can now tell a fossil's age by determining how much nitrogen it contains. Describing the method as an auxiliary to the radiocarbon test for dating fossils, a British researcher reports that once the nitrogen content is known, it's easy to determine the amount of organic carbon present in such fossils as bone, antlers and teeth.

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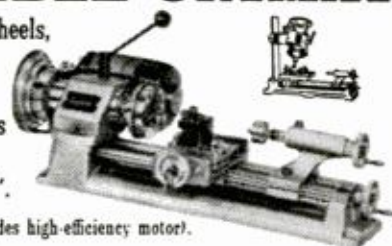
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Owners Report—Olds F-85

(Continued from page 79)

"I was told I would get from 20 to 25 m.p.g. The best I have gotten is 18.1."—Illinois optometrist.

If he knew what the average owner was reporting, he'd be less inclined to worry about 18.1 m.p.g.

"Too much power is lost in the lower gears of the automatic transmission—it's a slow starter!"—Maryland engineer.

"Automatic transmission does not change smoothly."—Georgia pharmacist.

"The transmission shifts back and forth between second and third gears at a certain speed."—Kentucky executive.

And in thick, slow-moving traffic this unhappy habit will drive you nuts!

"Automatic transmission is terrible at low speeds (20 miles and under) when used with light throttle. Transmission is even worse after standing a period in zero weather; almost won't start car moving, especially in reverse, until warmed up."—Michigan engineer.

"The exterior paint job is poor. It looks as if the body was painted while dirty."—Arizona customs inspector.

"The outside paint isn't wearing as well as it should."—New Jersey teacher.

"I would like more headroom in the front seat."—Pennsylvania construction supervisor.

He's right. It needs more room.

"Not enough headroom!"—Ohio chemical engineer.

"This automobile is hard to start in cold weather."—Indiana construction worker.

PM's testers found that it took two or three tries when mercury was below 40°F.

"It's very hard to start in cold weather after sitting out overnight."—Michigan contractor.

Here, in the order of their frequency, are items 6 through 10 that F-85 owners praised:

"Easy handling in traffic, easy parking."—Virginia salvage yard manager.

We'd agree that the F-85 is a nimble, pleasant car to drive in city or town except for the jerky up and downshifting of the transmission.

"Great for city driving and parking! Even San Francisco's hills are no problem!"—California accountant.

"Good handling in traffic, easy to park."—Wisconsin heavy equipment operator.

"It is economical on gas."—Texas custodian.

Depends on what you compare it with.

"More room than I expected."—Minnesota engineer.

"My husband is 6 feet, 200 pounds, and I'm chubby too, but we have lots of room and comfort."—Ohio secretary.

"I like most the beautiful and comfortable interior. It has most attractive and comfortable black leather seats."—North Carolina insurance agent.

Sorry chum, but that top-grain cowhide you think you're sitting on came right out of a test tube!

"There's good front visibility."—Minnesota methods engineer.

Keeping the scales balanced, here are numbers 6 through 10 of the items that F-85 owners complained about:

"It's too low to the ground which makes it difficult to enter and leave."—New York housewife.

In this respect, the F-85, and its body-mates Buick Special and Pontiac Tempest, are less easy to enter than several shorter and cheaper compacts.

"It's difficult for a tall man to slide into driver's seat. Would prefer a movable steering wheel."—New York engineer.

"I've had trouble with the carburetor since I've had it."—Arkansas housewife.

"Injector is not perfected and there's poor service at Olds dealer."—Michigan hardware store owner.

He's talking about the turbocharged Jetfire engine which requires special anti-knock fluid.

"Passenger compartment is too short! Not enough rear legroom. My son (6-foot 2-inches) cannot ride in rear seat, has to 'stoop' and pull up his knees."—New York operating engineer.

True enough. If you've a long legger in front, you can't have one in the back at the same time.

"It's hard to handle in a strong crosswind."—Texas office clerk.

"The doors are too hard to shut."—Missouri income property owner.

This was true of PM's test station wagon.

Our list of owner compliments for the F-85 is completed with numbers 11 through 16, listed in the order of their frequency:

"It holds the road well."—Pennsylvania controller.

"The road handling is excellent."—Iowa salesman.

Agreed, the F-85 has a good, stable suspension, does not toss, weave or sway on rolling blacktop roads.

"I like the roadability at speeds in excess of 60 m.p.h."—Indiana machinist.

"I like the smooth transmission."—Illinois masonry contractor.

He must do little driving below 30 m.p.h.

"Transmission is extra smooth; super and low ranges excellent for engine braking."—New York college instructor.

"I like the solidness and over-all construction."—Illinois billing supervisor.

There were no rattles in PM's wagon, a body type normally prone to all sorts of little chirps and clatters.

"The heater and defroster are excellent."—Maine student.

"Like the quietness of engine and lack of road noise."—Pennsylvania salesman.

"I like its superb workmanship throughout."—Minnesota salesman.

Wrapping up reactions of the PM owners, here are items numbered 11 through 16 on the complaint list:

"I've had trouble with the automatic choke—difficulty starting."—Vermont medical professor.

"Does not idle smoothly—has a definite miss that the dealer cannot correct or locate."—Idaho salesman.

"Poor service on car before delivery due to poor inspection at factory and dealer's."—California phone repairman.

Some dealers do take time to do a thorough "make ready" job on cars before delivery, but they can't cut price to the bone and turn out a perfect car, too.

"I think the 1000-mile inspection by most dealers is a farce! It's a waste of the owner's time and I also think the factory never gets its money's worth out of this."—Texas engineer.

"Instrument panel squeaks and rattles terrifically."—Oklahoma stevedore.

"Windshield makes noise as body flexes."—Ohio model builder.

There's been a similar creaking noise on every Buick Special, F-85 or Tempest we've ever driven. It seems to come from the instrument cluster mounting.

"Water comes up through between the fender and the hood during rain and hits the windshield."—Pennsylvania salesman.

"Left tire throws mud in the bumper and then wind blows it up on my hood, windshield and top of car."—Texas longshoreman.

"The gas tank is too small—only 16 gallons."—California traffic manager.

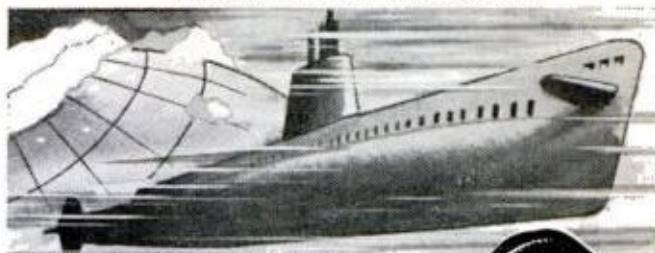
Perhaps a more economical engine would solve this problem.

There you have it, what a representative group of owners think of their F-85s after driving their new cars a collective total of 1,344,877 miles in them. ★★ ★

JULY 1963

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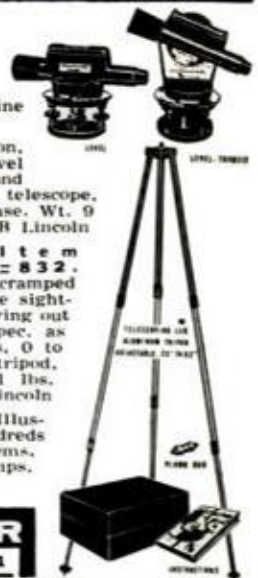
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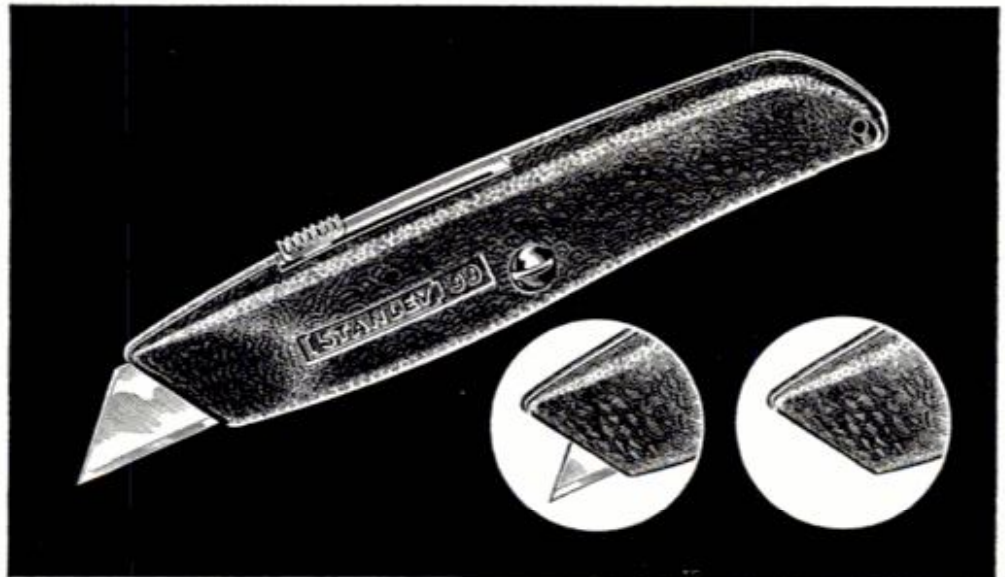
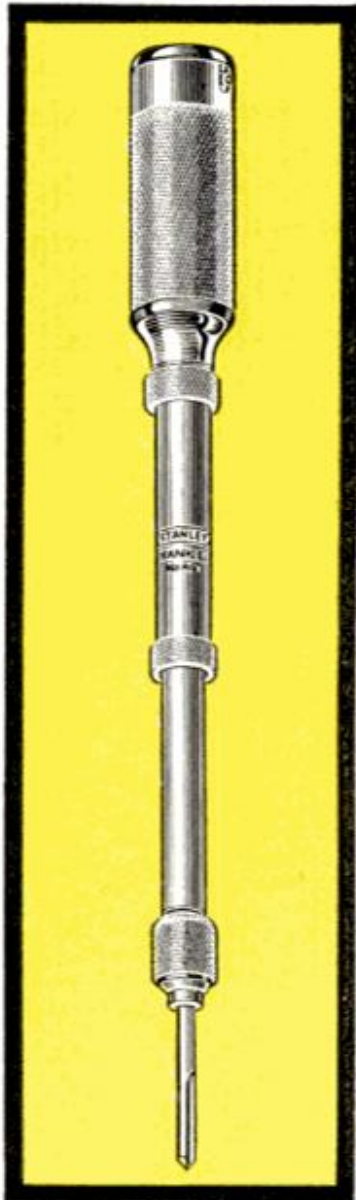
- Railroad
- Textile
- Other (please specify)

Name _____ Age _____ Sex _____
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 City _____ Zone _____ State _____
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 Employed by _____ Working Hours _____

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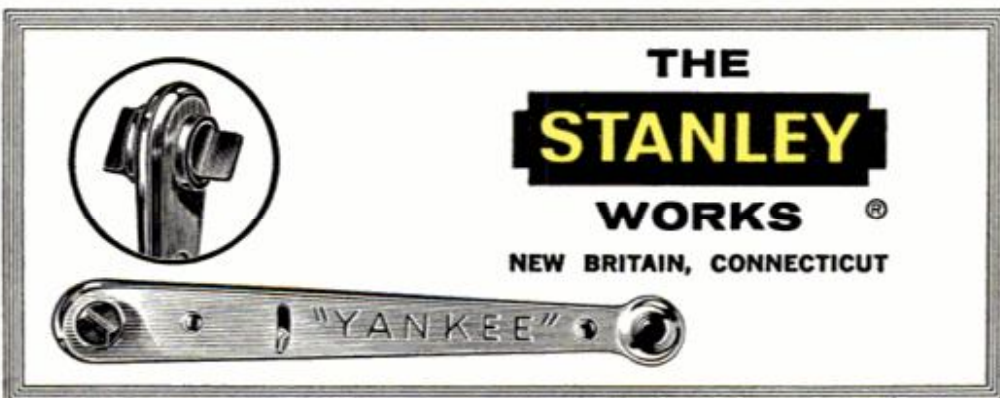
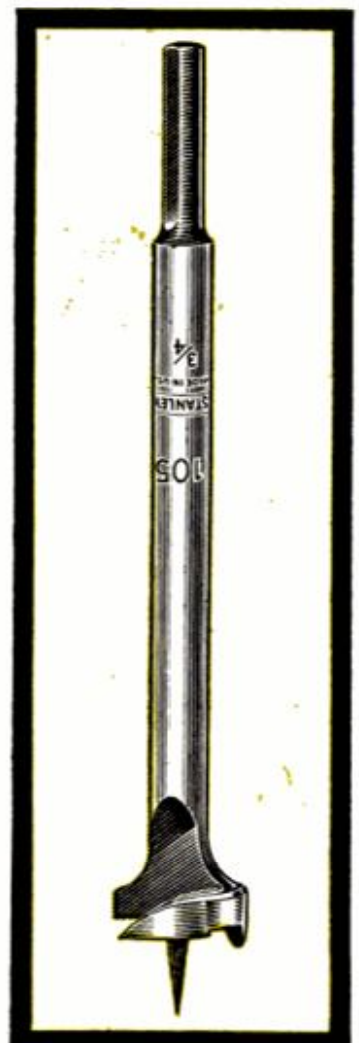
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