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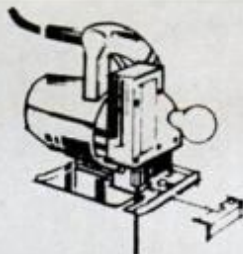
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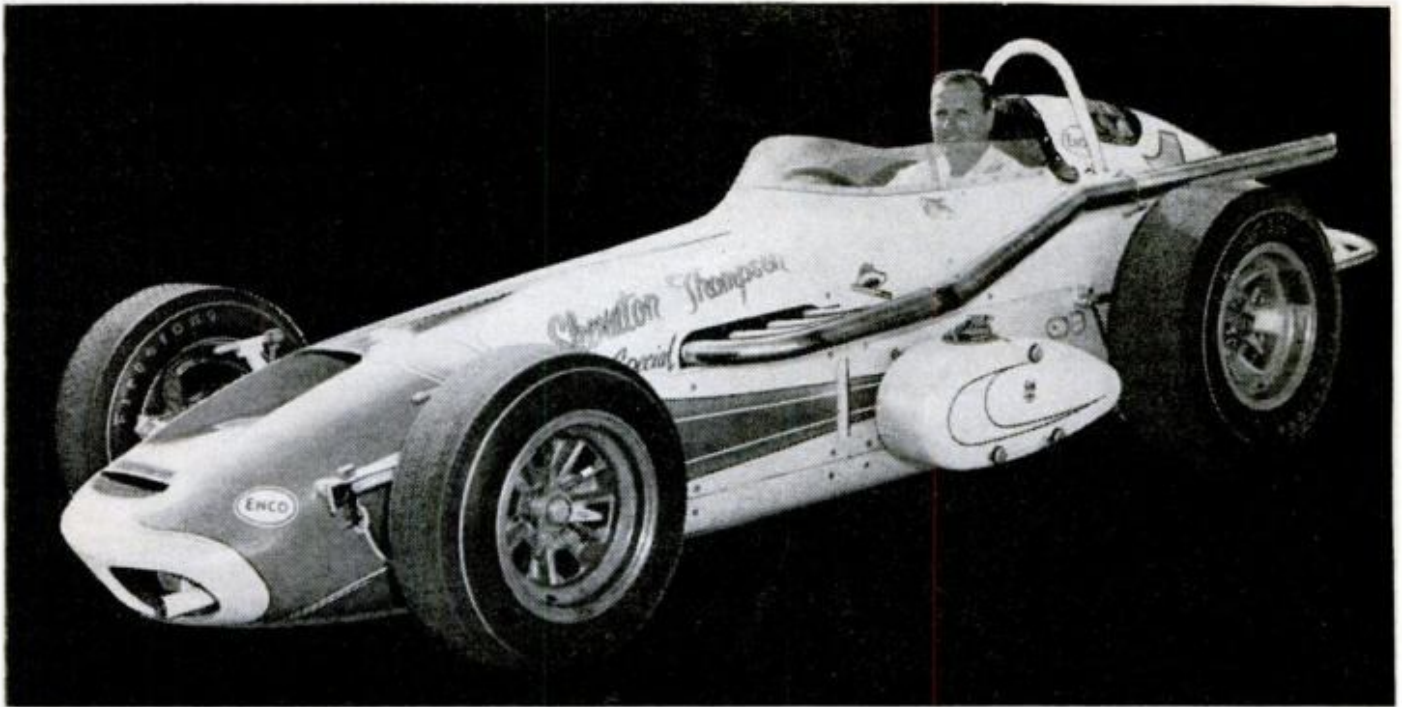


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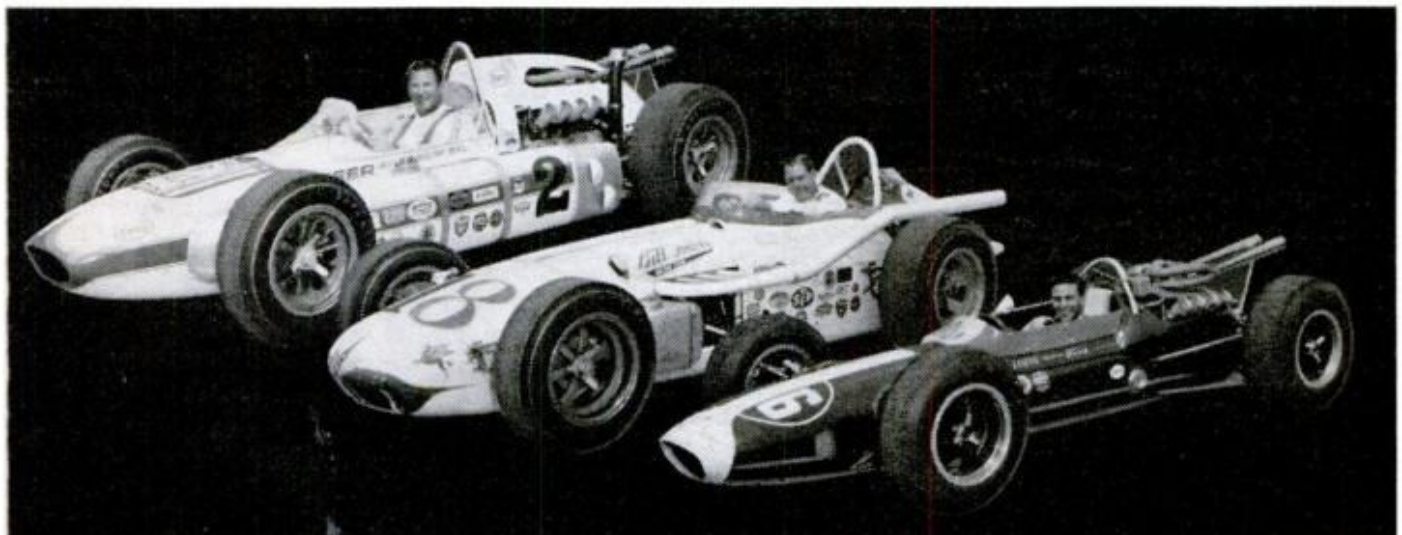


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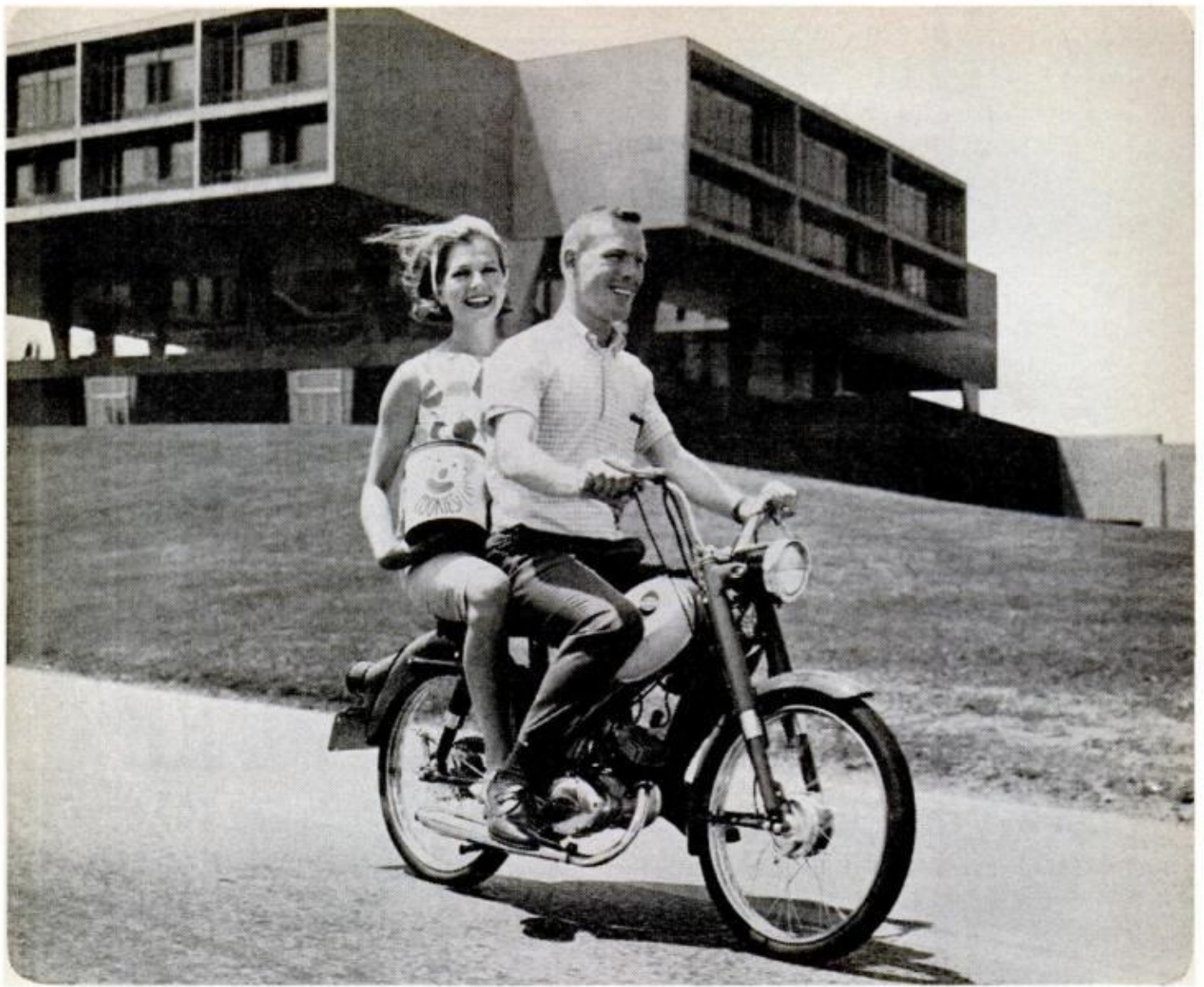
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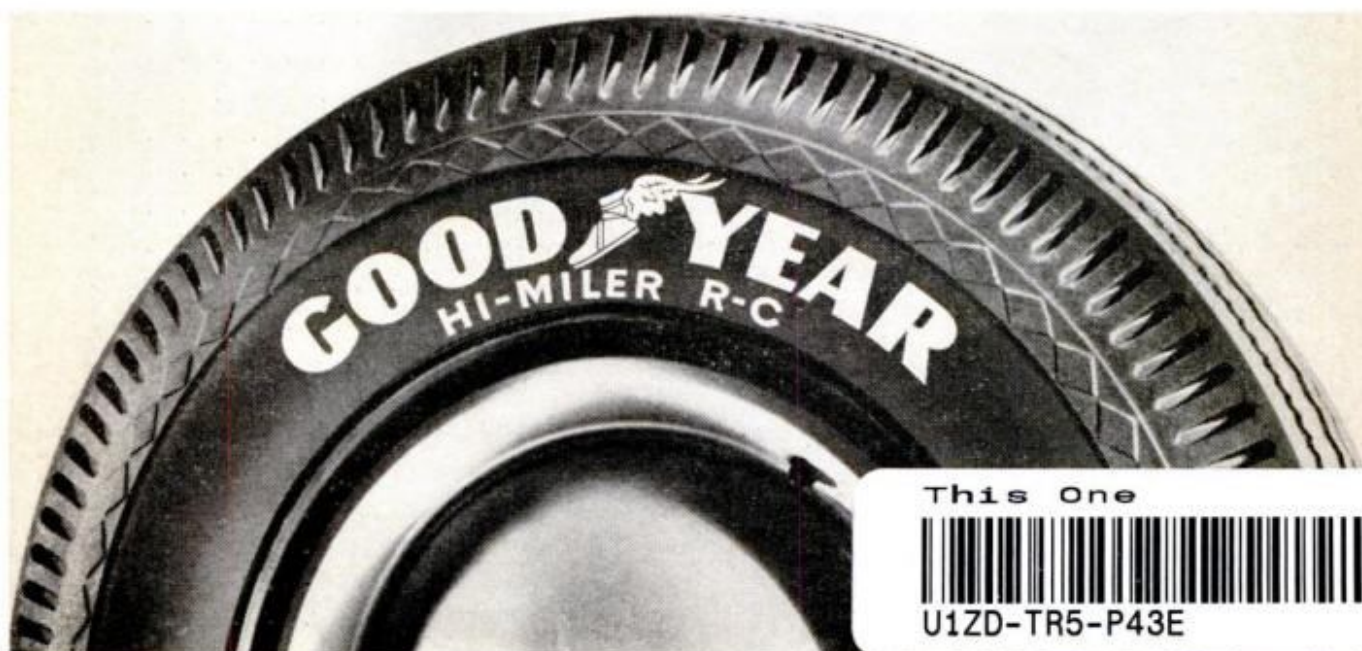
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SEPTEMBER 1964  
VOL. 122 NO. 3

575 LEXINGTON AVE.  
NEW YORK, N.Y. 10022

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

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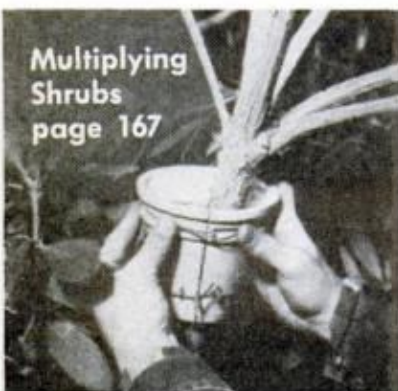
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SEPTEMBER 1964

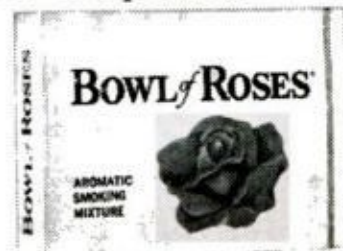


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## Over the Editor's Desk

### Seven-Stone Builder

For the sake of economy, I made the *Folding Kayak* (page 152, June '63 PM) eight feet long, rather than 10. This length is adequate as I am only seven stone (and 13 years old).

It took me three days to build without help at a cost of just under five pounds,



and I must say it was worth every penny as I have had hours of fun using it on the local canal.

Bristol, England

STEPHEN RICHARDS

### Don't Worry—He Got Back

I have a question regarding *Riding the Navy's Floating Slingshots* (page 84, June PM): Where is the author now?

According to the article, he did "two catapult take-offs, three 'touch-and-go' landings and one full-stop landing." I feel they had better make another full stop somewhere as fuel must be running low. Cape Cod, Mass.

G. F. HANDEL

The author, PM's aviation editor, Kevin Brown, is back at his typewriter with the rest of us at 575 Lexington Avenue, New York City. Commander Jones flew the plane to a landing field after the last carrier take-off.

### To the Last Drop

Having just read the Reader's Digest condensation of *Those Handy Aerosols Can Be Dangerous* (page 85, March PM), I am anxious to have information on one point.

Can one not render an "empty" can safe by taking it into the open air, pointing the nozzle downwind and pressing the button

(Please turn to page 8)

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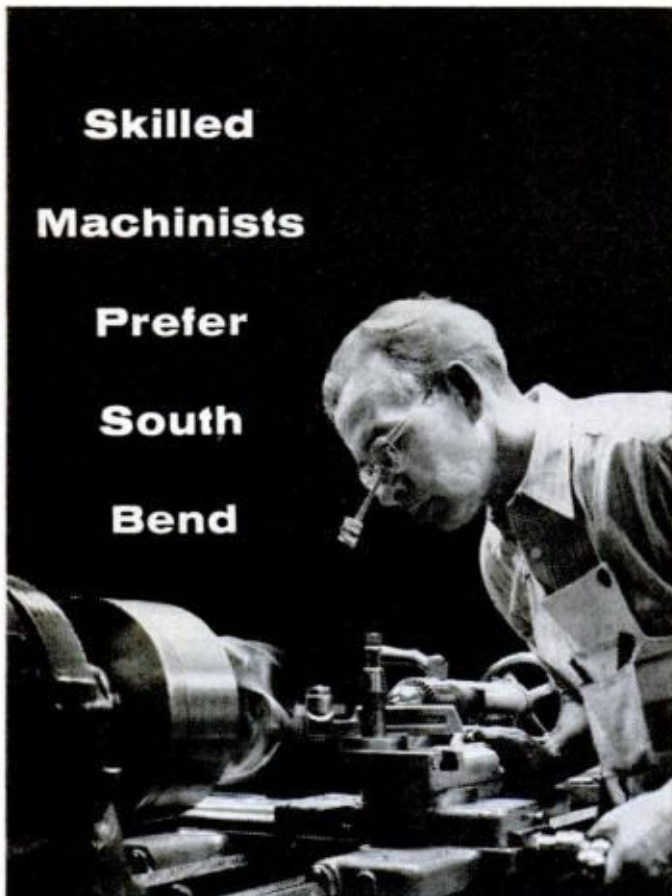


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## Over the Editor's Desk

(Continued from page 6)

until no further vaporized gas comes out?  
Chester, N.S.

REG. F. NICHOLS  
Captain, Royal Navy

You are partially right in this assumption, answers Dick Dempewolf, author of the article. However, a certain amount of propellant always remains in the can in liquid form; a few degrees rise in temperature vaporizes it, and the can is again under pressure. Another hazard lies in the fact that the nozzle may have clogged, leading a person to believe the can is empty when it may be almost fully loaded.

## Mechanical Foundations

Thanks to your magazine, my son Bill, 15, built this boat—a great success. (PM-38, Aug., 1962, PM)

I have four sons, ages 12 to 17. PM is the



foundation in mechanical development for the Lake brothers. I certainly am indebted to you.

Gloversville, N.Y.

J. G. LAKE

## Ja, Der Komma Doesn't Belong

Zomevun ist goofen mit der explainin-article of der Formula V Volkswagengorounddertrackinandwinnicar (Formula V Racer, page 98, June PM). If you removin der "blower, (comma) damper and air cleaner" as ist stated under picture on page 99, you makin chust couple of laps und —boom!—back to der Volkswagenmotor-sellin agency for maybe new engine to replace vun burnt up by some dumpkopf puttin der comma in der wrong place in dot zentence.

Seriously, enjoy your articles very much as well as all the other swell information in PM.

Felton, Pa.

GEORGE Y. EDWARDS

Zomevun ist bin using der komma-

(Please turn to page 10)

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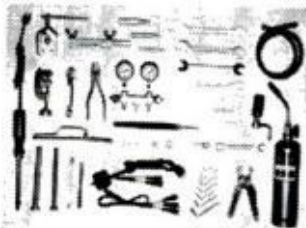
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## Over the Editor's Desk

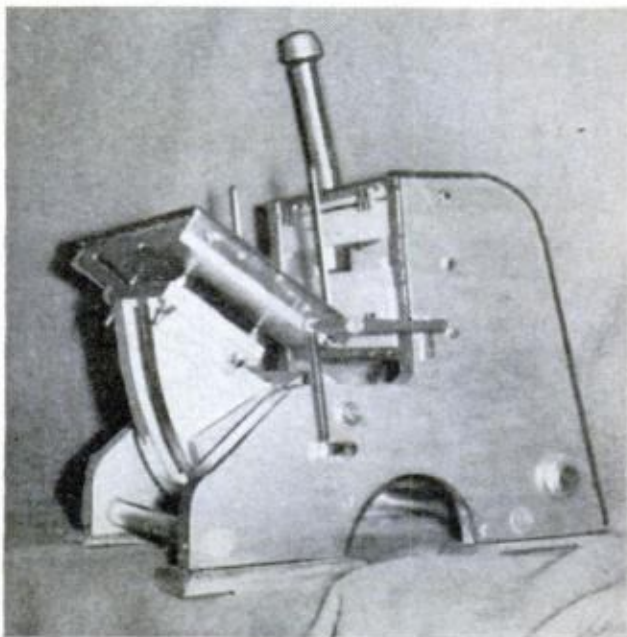
(Continued from page 8)

*schprinkler mitout being careful. Der blower stays in, der damper kums oudt.*

### Grip on the Press

Here's a picture of the *Linoleum-Block Press* (page 190, June 1961 PM) which was built in about two months—part time and as the spirit moved.

An improvement has been added—grippers which are so necessary on commercial job presses to hold stock against the platen



as the sheet is released from the type form after the impression has been made.

A steel rod has been attached parallel to the bottom edge of the platen. The adjustable grippers were added to this rod. Middletown, Conn. PAUL O. KRUMM

### No Line Is End of Line

I have finally come to the end of my patience with you. You iced the cake by printing the mess found on page 86 of the July PM titled *There's a (One-Handed) Catch to Fishing*. You say, "Fly casters can be artists, but the best take a back seat when 'noodlers' are on the scene."

This is quite true, just as it is with the noodler's cousins—giggers, electric shockers and seiners who go after game fish.

Perhaps in a coming issue we'll see an article on "Big Game Hunting in the Zoo." Mustang, Okla. MIKE MASOPUST

*Offhand, Mike, we'd say you've never tried noodling. It's a wee bit tougher to catch a trout by bare hand than it is by rod and reel. Give it a try and then let us know if you still think it's as easy as using gigs, electricity or seines.*

*The Editor*

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## Sidelights from the **SERVICES**

By William R. Kreh

**Never late.** A new clock that will lose less than a second every 300,000 years is being developed by the Navy. It will use a hydrogen maser which pulses so consistently that it will vary only one part in ten million million.



**Quick take-off.** Strategic Air Command B-52 crews are using the old air-circus technique of nose-to-tail take-off to practice quick getaways in case of surprise attack. The bombers are thundering down SAC runways barely 15 seconds apart, a neat trick considering the turbulence created in the wake of their eight jets.



**Navy shots** have been heard half-way around the world. The Naval Ordnance Laboratory recently finished experiments in which the sounds of bombs exploded underwater off Perth, Australia, were picked up at Bermuda, some 10,000 miles away. In one test, the New Zealand Naval Research Laboratory detected an underwater explosion off Cape Town, South Africa, 6000 miles away, just two hours after the charge went off. In all, more than 120 depth bombs were set off at 66 sites between Bermuda and Australia by ships and planes. Information collected by the project will help improve sonar and underwater communications systems by showing the Navy the best frequency and level of sound to use.



**Salt on sand** makes a good runway, Army engineers have shown. In a recent exercise in California, a desert wasteland was transformed into an assault airstrip within 24 hours by spraying a salt brine solution on a leveled strip. The brine, applied by a spraying truck, formed a hard crust from which large cargo planes flew.



**A memory machine** developed for the Air Force was "shown" 18 photographs—three views each of six people. In a matter of seconds, it "learned" their features. Another group of 18 photos—three different views of each of the same people—was then fed into the machine. Each time the machine named the person in the picture correctly. In short, it could pick out pictures of people it "knew" from photos of them in entirely new positions.

The demonstration was a press preview

of Conflex I, a "conditioned reflex" machine built for the Air Force.

In another test, Conflex I learned the names of six states, all beginning with "M". Then, when it was shown the names in a variety of forms—abbreviated, written-out, typed, hand-printed and hand-written—it correctly identified the states.

The machine is being used by the Air Force to study the pattern-recognition idea, which has a variety of possibilities. Its ability to recognize photos, for example, may make it invaluable for sifting thousands of aerial reconnaissance photos for specific details. An advanced version might also be used for spotting and identifying aerial or ground targets. It could work as well from radar images.



**Don't tell** the GIs, but Army tests have disclosed that a soldier carrying a 110-pound load can walk a 2½-mile course at the same pace as one with nothing on his back. In fact, the Army says it has found that "in many cases the weight factor made no difference in (the) effectiveness" of the soldier. The results contradict many previous studies, investigations and scientific experiments. It has been a rather widely accepted rule that 40 pounds is the top load that a soldier should carry under the most trying combat conditions.



**Tracking rats** as they scurry about their business in dense jungle is a problem. An Army medical research unit in Malaysia manages it by first catching wild rats, then saddling them with tiny radio transmitters and turning them loose. Tell-tale transmissions let them keep up with each rat constantly—where he goes, when he goes and how fast.

Object is to plot the pattern of transmission of two diseases that beset troops in jungle war. One is scrub typhus, believed to spread by triple play—rat to chigger to GI; the other a fever and jaundice combination known as letospirosis, believed to be spread by rats.



**Trampolines** may prove to be the latest thing in Army fortifications to protect a command post against high explosives. Instead of breaking, they yield and snap back. One "trampoline" roof built for experiment is 14 feet in diameter, made of one-inch nylon rope worked into a basket weave. Laid over a hole in the ground ten feet in diameter and covered with canvas and a little earth for camouflage, it is surprisingly resistant to explosive blast. A timber roof weighing ten times as much would scarcely give as much protection to men inside such a shelter.



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**Athlete's foot** may well be on its last legs. Clinical tests show that a new drug—tolnaftate—kills the various fungi that cause the skin condition.

One investigator—Dr. Harry M. Robinson, Jr., of the University of Maryland School of Medicine—reports that many of the cases he cured had been unresponsive to other forms of therapy. Tolnaftate, an odorless and colorless chemical compound, is applied directly to the skin, which is an advantage.

"If you have a choice," Dr. Robinson told *PM*, "it's better to avoid introducing drugs into the system." One antibiotic that has proved itself as an antifungal agent, for example, has to be taken internally and may produce side effects such as headache and diarrhea.

The producer of tolinaftate, the Schering Corp., says the drug will not be on the market "for some months yet." It will be a prescription item.

**If farmers** were to revert to the farming methods of 10 years ago, the annual food bill for the average American family would go up \$288. So says the University of California's dean of agriculture, who backs up his statement with these facts: Since 1940, research has increased livestock production by 70 percent; per-acre crop production by 70 percent, and output per man-hour by 400 percent.

**Marked for trouble.** Records at one large Veterans Administration hospital indicate that tattooed patients more often than not come from broken homes. They also have a higher than average incidence of marital troubles and involvement with the law, say the V.A. doctors.

**Radios** implanted in false teeth are being used in an Australian study of arthritis and other diseases of the jaw. Tiny transmitters are powered by batteries less than 1/64th of a cubic inch in size that will last for a year. Transmissions, say doctors at Melbourne's dental hospital,

report jaw movements and tooth pressure, information which can then be related to jaw complaints.

**Metal dowsing.** A civil engineer engaged in excavation work at Los Alamos has the ability to locate buried pipelines that even electronic devices may have missed. He does it with two bent wires, holding one loosely in each hand and slightly above his head as he slowly traverses an area. When the wires begin to turn in his hands and point toward each other, he knows he's standing over buried metal. The uncanny thing, say colleagues, is that he's almost always right.

**Pass the pot liquor.** Juice from turnip greens, a vegetable prized in the South but largely ignored in the North, shows promise as a preserver of meat flavors. A researcher at Florida State University reports that the extract slows the normal breakdown of meat fats.

**A computer brain** and a flexible arm with microswitch fingers enable a robot to "stay alive" at the Johns Hopkins physics lab. Called "The Beast," the wheeled, two-foot high robot "senses" when its batteries are beginning to run down. It then feels its way along a wall until its fingers find an electrical outlet, plugs itself in and gets a revitalizing charge. "The Beast" has no function other than to satisfy the impish sense of humor of the Hopkins scientists.

**Two-year-old boys** have the most accidents. That was the finding of four New York doctors who made a study of some 9000 suburban kids under the age of seven. The lads of two had an accident rate 75 percent greater than children in any other age-sex category.

**More girls than boys.** That was the result when fruit flies mated in an orbiting Russian satellite. Not only were the number of females born higher than normal, say Soviet scientists, but the males were undersized. These findings have renewed concern about possible biological effects of space flight.

**Women** never listen to what you tell them. That truism was put to the test in a recent experiment at Montana State University. Men and women were given simple problems to solve, after which they formulated instructions for later subjects to follow and dictated them into tape recorders. In the second group, the women consistently had more success than the

(Please turn to page 16)



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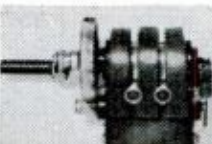
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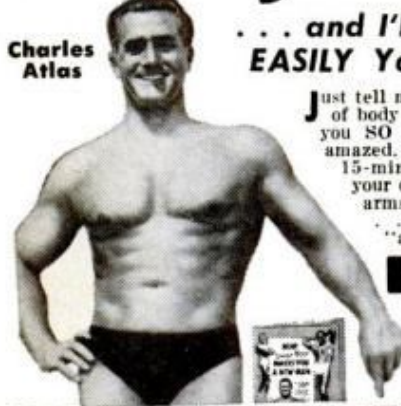
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## Science Worldwide

(Continued from page 14)

men in solving the problems, indicating, say the testers, that they were better at receiving information (and disproving the truism).

The normal life cycle of an insect pest, the imported cabbageworm, can be upset by exposing it to flashes of light lasting less than a thousandth of a second. As a result, report Department of Agriculture entomologists, the worm tends to develop from a pupa in its cocoon into an adult butterfly at a time when it normally would have entered a dormant state called diapause. The scientists say that if insects in their natural environment can be made to bypass diapause and develop into adults "ahead of schedule," they would probably be so out of step with nature that they would perish.

Ford Motors in England uses a special manikin to test cars for comfort. He's fitted with 97 "nerve cells," little metal sandwiches that, when pressed, send an electric current to a measuring instrument. Readings are then analyzed for indications of strain and fatigue.

Someday we may watch night ball games under the blaze of man-made suns. That's one of the potential applications of a new type plasma-jet generator developed by physicists at Columbia University. The generator is capable of producing a steady, small jet of plasma—the gaseous form of matter that makes up the sun and other bright stars. The jet is said to be three times brighter than any other light source yet developed by man. And it reaches 20,000 degrees F., which is a lot hotter than the surface of the sun and hot enough to cut through concrete and boil tungsten. The jet gives promise of many industrial uses.

Parachutes are being used to lay ocean phone cables. A British company reports attaching fabric chutes to the heavier sections of cable (where the repeaters are connected) to permit them to sink at about the same speed as the lighter sections. This prevents damaging bends and loops from forming in the cable.

Reverse osmosis—a new method of desalting ocean water—is being tested at a 1000-gallon-a-day plant in San Diego. Sea water, under pressure, is forced through a membrane of modified cellulose acetate, removing salts and minerals. Be-

(Please turn to page 20)

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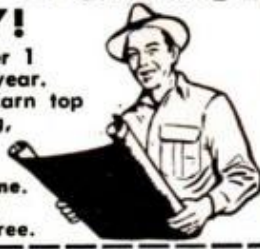
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## Science Worldwide

(Continued from page 16)

cause a dense solution (sea water) is made to flow into one more dilute (fresh water), you have *reverse osmosis*.

"Though the process is just out of the lab," an official in the Office of Saline Water told PM, "we have high hopes for it. It's the cheapest method yet developed because it involves no phase change such as water-to-vapor conversion."

For a report on other methods being tried, read *Fresh Water From the Sea: Can We Afford It?*, August PM.

✓ ✓ ✓

The world's largest building is taking shape at Cape Kennedy. Its purpose: to shelter the huge Saturn V rockets that will be used to ferry U. S. astronauts to the moon. It will be 524 feet high (high enough to house the rockets in a vertical position), 513 feet wide and 710 feet long. It will have four doors, each 460 feet high—lofty enough to admit a conventional 45-story building.

✓ ✓ ✓

Man the shovels. The U.S. Geological Survey says chances are still good for the production of mercury in the virtually abandoned mines of California's New Almaden District. In the past, many favorable areas were passed up because exploration was largely guided by concepts now known to be unsound. The U.S. imports some 3,800,000 pounds of mercury a year.

✓ ✓ ✓

A gargantuan siren has proved that the special glass windows of the Gemini spacecraft can withstand the pressures and acoustic vibration they will encounter during the early phases of flight. Tests were made at the Martin Company's acoustic laboratory with a siren powered by two turboprop aircraft engines.

✓ ✓ ✓

Archeologists report discovering one of the world's oldest metal processing plants in Israel. The smelting pits, anvils and grinding equipment, thought to date back to the 10th century B.C., indicate a high degree of skill in the manufacture of swords, knives and spears.

✓ ✓ ✓

The Savannah, U.S. nuclear passenger-cargo liner, recently completed her first overseas voyage. The ship reportedly used only two pounds of her 750-pound uranium fuel charge on the 10,000-mile trip.

*John F. Pearson*  
Science Editor

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# INVENTORS' CORNER

By Joseph H. Kraus

**Pipe tobacco in plugs** to slip into a pipe is suggested by Greg Roska of Canton, Ohio.

Too bad you were not a pipe smoker back in 1924 when you could have purchased pipe tobacco in cartridge-type refills in every store selling tobacco. Available in tobacco wrapped and rice paper wrapped units, the cartridges were short-lived. Differences in pipe size made them impractical.

**Keeping an airplane level** while making a tight turn is the problem on which E. L. Miller of Waco, Texas, seeks advice.

Of course you could keep the wings of a plane level simply by making a slow, wide turn. You can do the same thing with a bicycle. Why do you suppose auto highways are banked on curves? Same reason for airplanes.

**Cigarette-matchbook combination** to avoid searching for matches is suggested by Yalmer Sabo of Cleveland, Ohio.

A patent search would reveal half a dozen patents in which a book of matches is attached to a packet of cigarettes. Since fire regulations for the shipment of matches and for cigarettes differ, a cigarette manufacturer would need to modify his package, packaging procedures and shipping techniques for this customer convenience. So far no manufacturer has been agreeable to this idea.

**Zipper envelope** with inserted "pull-thread" for opening is suggested by Mrs. D. Parker of Yardley, Pa.

Among the earliest patents ever issued by the U.S. Patent Office is one for a zip-type, easy-opening envelope. Since then dozens of patents have been issued for variations of the same idea, though none have been marketed successfully.

**Fire lighter** patents have been applied for in the United States and Japan by John W. Logan of San Pedro, Calif. "What are its possibilities?" he asks.

Readily available on the market are many fire starting agents such as starter fluids, propane torches, pressed-charcoal blocks (they may be started with a single match) and inexpensive, electrical fire starters for outdoor grills. Yours would

have to have some advantages—such as price or effectiveness—to be salable.

**Fruit picker** was patented by Herman A. Felsing of Middletown, N. Y., who asks whether he should invest in advertising to try to sell the invention. The patent expires in 1967.

With only three more years of life remaining on this patent, I do not recommend that you invest money with companies which promise to list it for sale, nor even advertise it. Too bad you did not try to market it yourself. Only four companies are listed as making fruit pickers today, indicating, perhaps, that the market potential is not good.

**Fuel-less engine;** designs and calculations utilizing centrifugal force are forwarded by Benno Wieler of Fort William, Ontario, Canada. Engineering needed to complete it.

The ability of your engine to generate energy is not detailed enough for a clear understanding of its operating principles. The rate of conversion from centrifugal force to horsepower hours is no greater than the amount of energy required to bring the mechanism into motion. Also, there would be conversion losses.

**Tablecloth holder** to store a cloth under table, by Mrs. J. W. Fox of Leesburg, Ga.

It seems a bit complicated for the performance of a rather simple job. Furthermore, there are dozens of tables to which your holder could not be attached. I would recommend a patent search, then a prototype which you might show to friends to test its acceptance.

"Do any Inventors' Shows still exist?" asks Don Nelson of Denver, Colo.

A new Inventors' Congress program currently is being stimulated by the U.S. Dept. of Commerce, Office of Invention and Innovation, Washington, D. C. The charge for space at such shows is usually less than \$10. Sometimes, as in North Dakota, the charge includes a certificate, pass, association membership, breakfast, dinner and a banquet at which awards are presented. Following is a list of cities, dates and contacts for upcoming inventors' shows:

Hastings, Nebraska, Sept. 24-26. Hastings Chamber of Commerce.

Fargo, North Dakota, Oct. 23-25. W. E. Kittler, Box 491, Bismarck.

Little Rock, Arkansas, Oct. 30-Nov. 1. Harry Clark, Arkansas Industrial Development Commission and Arkansas State Chamber of Commerce.

Aberdeen, South Dakota, Jan. 31-Feb. 2.

(Please turn to page 24)

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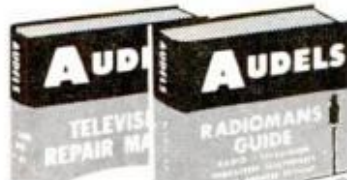
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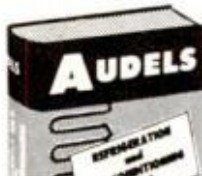
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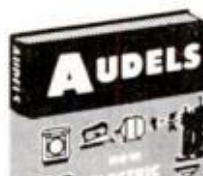
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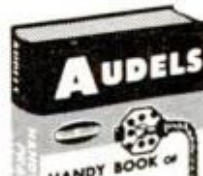
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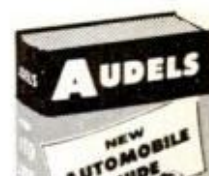
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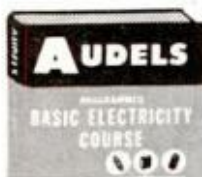
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## Inventors' Corner

(Continued from page 22)

*South Dakota Industrial Development and Expansion Agency.*

*Columbia Heights, Minnesota, Feb. 21-23. Midwest Inventors' Assoc., Inc., P.O. Box 3575, St. Paul.*

*Missouri (city to be announced), May 7-9. Lawrence A. Schneider, Missouri Division of Commerce and Industrial Development, Jefferson City.*

*Douglas, Wyoming, May 15-17. Douglas Chamber of Commerce.*

*Also probable are Lewistown, Mont.; Seattle, Washington; and cities (as yet undetermined) in Colorado and Illinois.*

## NEW PATENTS

Display device used by NASA in the scoreboard for both manned and unmanned space flights won patent 3,137,082 for Graydon A. Phlieger, Jr., of Cocoa, Fla. Operation of the system is so fast that the information on time, the orbit number, the elapsed time in orbit and the time to retrofire—calculated by a computer which compares the spacecraft's path with a predetermined one—is flashed as events are actually occurring.

Dispersing "chaff" (metal foil thrown out of airplanes to confuse radar operators) by sending rockets containing the chaff into the air space ahead of the airplane won patent 3,137,231 for Francis M. Johnson of Dayton, Ohio. The plane carrying the chaff, as well as following planes, is thus protected from radar.

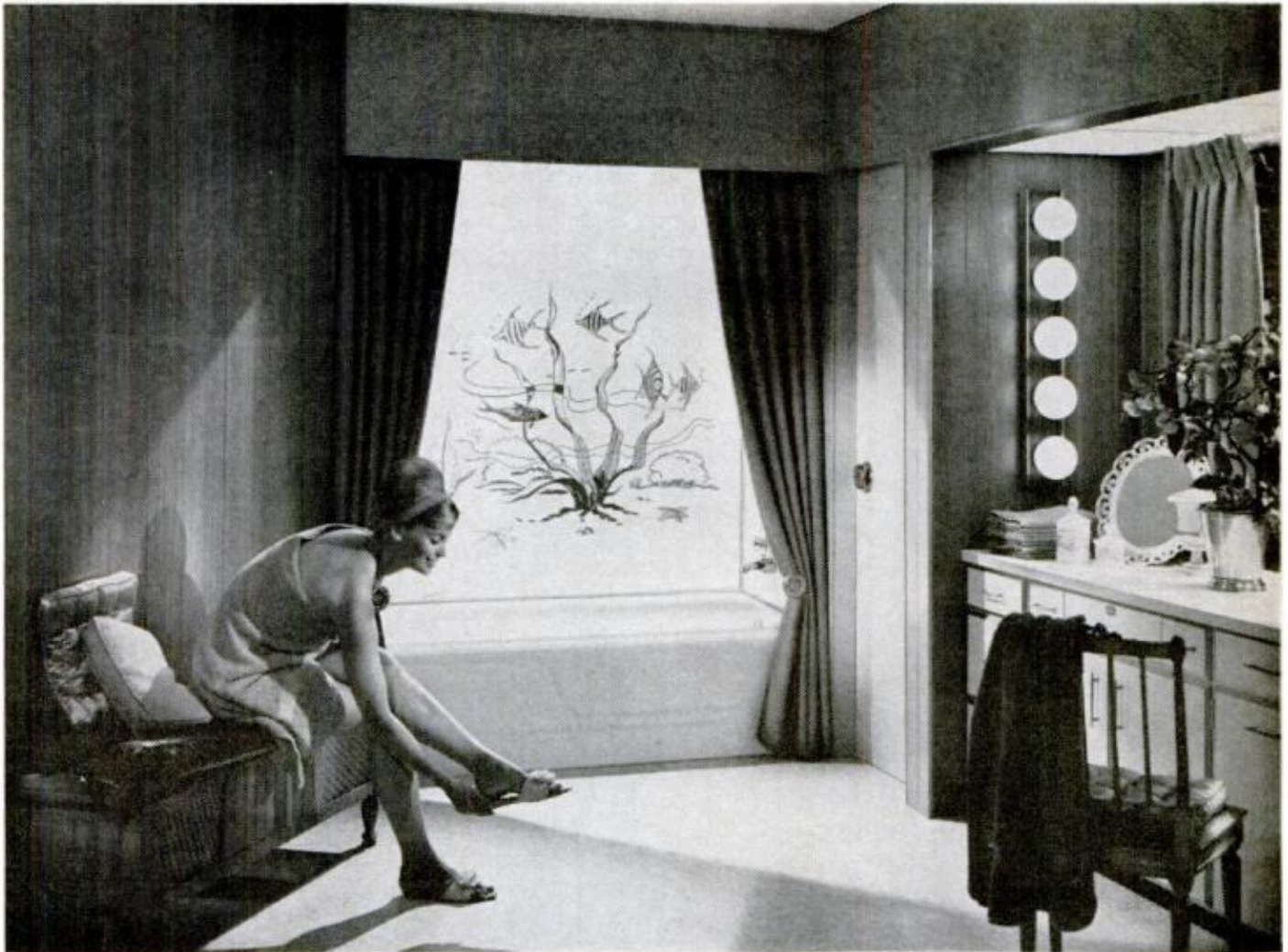
Hydrating dried fruit is effectively accomplished by first exposing the dried fruit to steam under normal pressure, then plunging the partially hydrated fruit into cold water. Patent 3,139,345 on this went to Fredoon S. Nury of Richmond, Calif.

Pulse rates can be measured with light. The method, which employs a photoelectric cell that picks up the amount of light passing through certain tissues in the body, won patent 3,139,086 for Francis W. Botsch of Framingham, Mass., and Michael J. Sacco of Shrewsbury, Mass.

Wrinkle-resistant cotton fabrics will retain a crease better when processed according to a method which earned patent 3,138,802 for Nelson F. Getchell of Great Falls, Va. Only part of the treatment is done at the textile plant. After the clothing is made, heat completes the process.



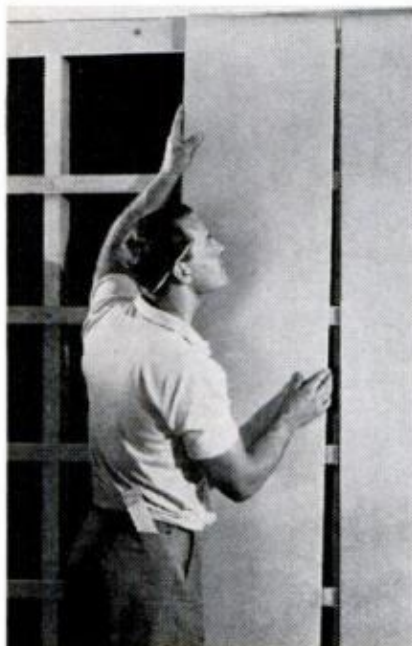
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Air races died in 1949 after a lingering illness, but there may be a resurrection.

The miracle could take place in Reno, Nev., Sept. 12 to 20.

There some locals and other aviation enthusiasts have put together more of the long-lost American art forms of pylon racing, cross-country speed runs and old-fashioned, all-out aerial exhibitions.

The races died, the doctors would say, from a series of complications. In the late 1940s the military jets all but destroyed any chance prop-driven planes had of winning races. Secondly, crashes plagued the races from their inception, but the crash that broke the public's back may have been the one when Bill Odom spun out of a high-speed turn in his souped-up P-51 and crashed into an apartment building killing a mother and her child.

### Install New Rules

The new promoters, while they can't guarantee there will be no crashes, have tried to eliminate the consequences by installing the race course out in the country and by putting the spectators in the infield where the wide-swinging planes can't get at them. Also, they have eliminated jets altogether, narrowing the competition down to planes that are truly competitive.

Whether these were really the reasons for the demise of the races is still speculation, and many old-timers wonder why they ever stopped. They were a source of excitement then and nostalgia now.

The original purpose, back in the early 1920s, was the same as it was at Indianapolis for automobiles—to test new designs against one another in direct competition. Probably another, more pertinent, reason helped bring on the end—rising costs.

But, those were the days . . .

Those dashing, daring heroes of the air, men like Speed Holman, Frank Hawks, Benny Howard and the great Jimmy Doolittle, smiled and waved from the open cockpits, donned their helmets and goggles and roared off into the wild blue yonder to thrill a wide-eyed generation of fans.

Speeds like 200 miles per hour around the pylons were astronomical in those days of Model-Ts and dirt roads. By the late 1930s it had grown to a record 463 m.p.h., a mark that still stands for prop planes.

Meanwhile, streaking cross-country, were such giants as Amelia Earhart, Roscoe

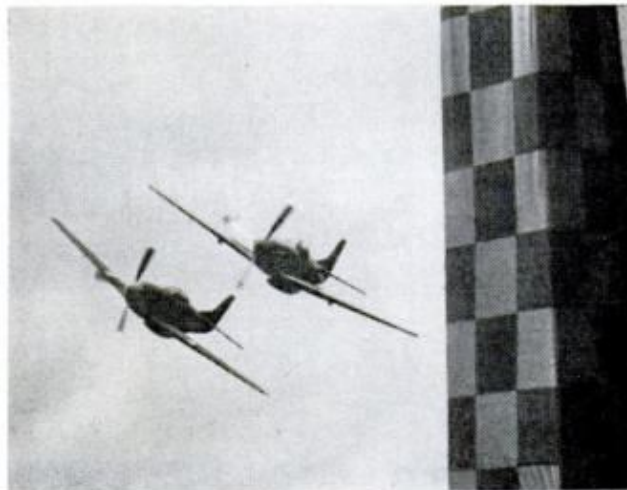
Turner, Jacqueline Cochran and Paul Mantz. Where are the Turners and Cochrans of today? There's just no place for them to test their strength.

Reno might change all that. Besides the usual spectator sports of aerobatics, ballooning and soaring, the meet will feature, most of all, a \$10,000 cross-country race from Florida in P-51 *Mustangs*, F8F *Bearcats*, P-38 *Lightnings*, P-39 *Cobras* and F2G *Corsairs*, and the pylon races over a 10-mile course for midgets, stock private planes and an unlimited class of former fighters, all privately owned, and most highly modified.

One expected entrant, Charles Eyford III has souped up the Rolls-Royce engine in his P-51 so that, he claims, it can cruise indefinitely at 3200 r.p.m. and 100 inches of manifold pressure. Originally, the engine was red-lined at 63 inches.

A British *Sea Fury*, built to chase—and catch—buzzbombs across the English Channel during World War II, may be there, and several F8F *Bearcats*, the last and perhaps fastest of the American prop planes, are scheduled.

But the promoters still aren't satisfied. The midgets certainly bring costs down where many more average pilots can afford them—and they do very respectfully,



TWO P-51S practice a tight turn around a pylon

too, streaking around their 2½-mile course at 200 m.p.h. And for those who just want to race stock planes—Pipers, Beeches and Cessnas—there's a race for them, too.

But what's really needed, they say, is a return to the original purpose—testing new ideas. They would like to create an altogether new class, larger than the midgets, in which individual ingenuity was the competing factor and home-builts again would have a chance.

We may have a miracle yet.

Kevin V. Brown  
Aviation Editor

these small specks



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By Ed Nelson



## Sweet Note in the Sour Smog Battle. Refrigerating Racing's Hottest Drivers

The sweet smell of smog is something a Long Island bus company hopes to promote. The company announces it is putting a special additive in their diesel fuel to produce a "lovely floral fragrance" from bus tail pipes.

A less romantic effort to minimize the smog problem is a new jiggle-pin valve rumored for all the '65 Ford line. It replaces the crankcase vent valve now on most American cars. Although the positive crankcase ventilation and its vent valve help to reduce crankcase emissions, the valve clogs easily and needs frequent service. Some cab fleets check it weekly.

Ford's idea: Substitute a valve with smoother flow for fewer deposits and with a jiggling pin to help it unclog itself. Sounds sensible.

Meanwhile, out in California where smog is a burning question indeed, the Motor Vehicle Pollution Control Board has formally okayed four manufacturers' units to control exhaust pipe emissions. The use of an approved unit (more are yet to come) will be required—much to Detroit's discomfort—on all new cars sold from the '66 models on.

The new tack-on units are from four pairs of companies: American Machine & Foundry with Chromalloy Corp.; Arvin Industries with Universal Oil Products; W. R. Grace & Co. with Norris-Thermador Corp.; and Walker Manufacturing Co. with American Cyanamid.

The AMF-Chromalloy unit is an after-burner (a spark plug keeps a flame going to consume exhaust by-products). The others all attack emission by passing it through a catalyst—a chemical that oxidizes unburned hydrocarbons (HC) and carbon monoxide (CO). In most, extra air is drawn in to help oxidation and there's usually a bypass that takes over when contamination isn't large. With AMF-Chromalloy's Smog Burner, the bypass also opens if combustion heat gets too high.

Officials now estimate raw exhaust has about 1400 parts of HC per million parts of the gases and 38 thousand parts per million (3.8 percent) of CO. California's standard holds it to 275 ppm of HC and

1.5 percent of CO—or less. Some experts feel that this standard should have been tightened down to about 190 ppm of HC and 1 percent of CO. Further, they feel that it should include some standard for oxides of nitrogen, which is generally held responsible for reactions that turn hydrocarbons into eye irritants and crop destroyers.

But how do the four approved systems stack up against existing standards? And what will they cost? One staff report to the board gave these results:

AMF-Chromalloy—221 ppm HC and 1.17 percent CO. Estimated to cost about \$16 a year plus tune-ups (mostly idling adjustments).

Arvin-UOP—262 ppm HC and 0.69 percent CO for a basic system, 186 ppm HC and 0.62 percent CO for a modified model. Costs about \$26-\$40 per year. May last two years before catalyst needs replacing.

Grace-Norris—272 ppm HC and 1.19 percent CO. Costs about \$34 per year.

Walker-Cyanamid—225 ppm HC and 0.73 percent CO. Costs about \$28 a year plus tune-ups to avoid need for bypass.

Chrysler also has a smog-reducing Clean Air Package—really a string of small engine modifications—which seems on the verge of approval. *Popular Mechanics'* exclusive test of the CAP last November (p. 124) indicated it brought HC down to 232 ppm and CO to as low as 1.2 percent.

Flaming death may be gradually on the way out for auto racing, and it's about time. The latest hope comes from driver Paul Goldsmith and the United Aircraft Corp. It's a "cold suit," a mesh suit laced with plastic tubes that carry cold water—or nearly any other coolant. Paul says it'll let drivers wear asbestos suits in complete comfort without even perspiring, although cockpit temperatures over 120 degrees have been measured. Up to now, drivers wearing asbestos suits sweat off as much as 10 pounds during a long race. No wonder many refused to wear the clumsy, hated suits. But with Goldsmith's new cooling rig, objections should disappear. Paul got the idea, by the way, from a story about a similar suit for astronauts.



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# Items from All Outdoors

When fish are biting, all the rules and special techniques go out the window. We happened to fish the Yuba River in northern California in July, and the trout were hitting wet and dry flies, small spinners, salmon eggs, hellgrammites, worms—and they were biting all day. We went a step further, and tried a lady bug on a No. 12 hook, floating it down through a trough of fast water and into a pool. And we took our limit with ease. An odd thing we noticed on the Yuba was a fisherman casting salmon eggs and having no trouble keeping them on the hook, something that has always plagued us. We asked him his secret, and it turned out he simply uses a high-quality egg that is hard-skinned and does not fall part. They're Bonn's Salmon Eggs, sold by Neptune Fish Products, Seattle, Wash. They're expensive, sell from 85 cents to \$1 a jar, but they're worth it.

We visited Gordon MacKenzie, one of California's top trap and skeet shooters,

and he predicts that the new over-and-under shotgun will largely replace the regular double with wing shooters, for the simple reason that the over-and-under is easier to aim with accuracy. Gordon also showed us the finest hunting knife we've ever seen. It's called a Buck Knife and it can be hammered through a quarter-inch stove bolt without dulling the edge. They're costly, ranging from \$14 to \$22. You can get their brochure from Sports & Hobbies, 552 Fremont Ave., Monterey, Calif.

After years of backpacking and quietly scorning camping comforts, we finally made a trip in an Apache Camper Trailer. This is actually like hauling a motel room with you. We timed ourselves in breaking camp. It took 45 minutes to clean up and pack away the gear, and exactly 10 minutes to fold up the camper and have it on the trailer hitch, ready to roll.

After three weeks of camping with two kids we recommend one revision in the supply lists. You need peanut butter, lots of peanut butter!

STUART JAMES

Outdoors Editor

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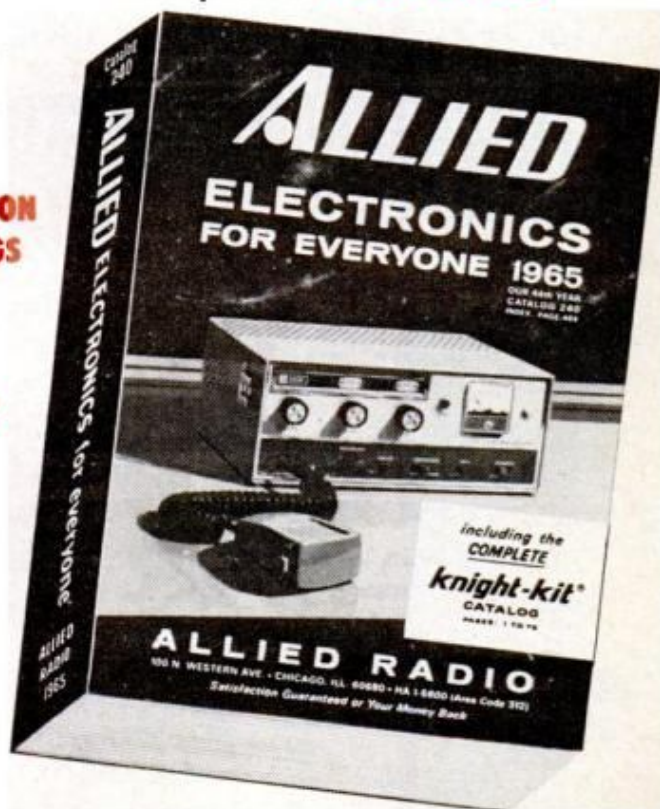
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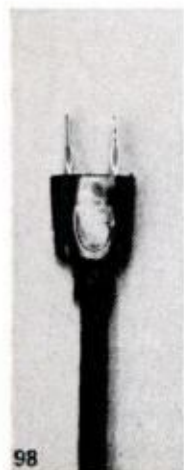
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SEPTEMBER 1964

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31



## Spotlight on the Mercedes Diesel



**JOUNCING OVER THIS** old viaduct sent Mercedes' wheels off the road surface, but control and the solid-feeling suspension remained undisturbed

*The 190-D now can have an automatic transmission. How effective is it? How good is economy?*

**By Ed Nelson**

**Y**OU DON'T ASK for drag-strip performance from a diesel engine—not even a Mercedes. And it's just as well. You wouldn't get it anyway from the Mercedes 190-D. But you do get Mercedes-Benz quality and comfort.

You also get fine economy to go with the distinctive guttural gargling noise which is characteristic of this car's diesel engine. And now you can add (for about \$350) the convenience of an automatic transmission.

This automatic—based on a simple hydraulic coupling for efficiency—makes full use of the two planetary gear sets to get four forward ratios. That means the 121-cu.-in. engine can be kept up near its

most efficient speed. Rated at an unexciting 60 horsepower at 4200 r.p.m., it can't afford to stray far from that speed during shifts.

Smooth shifting? Well, this automatic is about as smooth as an impulsive kid on a pogo stick. And even when you call for only mild acceleration, it feels reluctant. It can, however, be downshifted handily for engine braking. Normally you start in Second and move up automatically, but from a dead stop you can use a throttle kickdown to First. When I tried, however, there was a lag of more than a second before any action.

But economy is excellent, even when

[\(Please turn to page 34\)](#)

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## Spotlight on the Mercedes

(Continued from page 32)



**TO START THE DIESEL**, hold the pre-heat control out until indicator (at left) glows. Then pull harder. The engine will kick over promptly—although noisily

the engine is buzzing up around its peak output most of the time. Several hundred hard miles gave these results: 24.6 m.p.g. during an extended bout with Manhattan traffic, 32.1 m.p.g. on a highway tour that included our acceleration tests. And I didn't coddle the throttle in either case.

The car has a leisurely approach to acceleration. Flat out, I got it from 0 to 60 m.p.h. in 25.3 seconds. Indicated top speed was 74 m.p.h., and the speedometer proved quite accurate. The manufacturer claims only 77. The designer of that thermometer-like speedo, for my money, should be condemned to try reading its vague calibrations throughout eternity.

A more serious problem for 190-D owners who don't plan ahead is the scarcity of sources for diesel fuel, I tried stations with acres of paving beside a well-traveled highway, figuring them for truck stops. No luck. Near the docks on New York's west side, things were better. A couple of days later I started out on a holiday trip, figuring to fuel up for a highway mileage figure after leaving Manhattan. But after several hours prowling a deserted shipping area (looking for an open truck stop), I had to head back to the west side and start over.

One note of cheer: The 190-D boasts a fuel-gauge warning light. It may be a luxury on other cars; it's practically indispensable on this one. The light comes on when there's about a gallon of fuel left, enough for 25 or 30 miles.

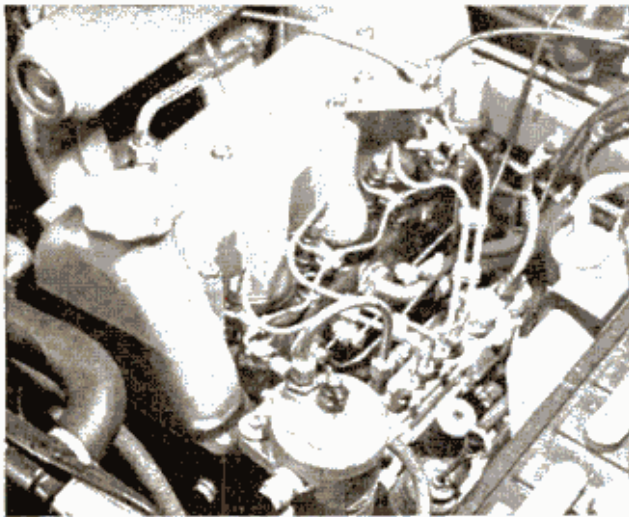
Roadability and handling are excellent. There's little lean and cornering is stable, especially through wide, fast bends. The standard recirculating ball steering system

(Please turn to page 37)

POPULAR MECHANICS

## Spotlight on the Mercedes

(Continued from page 34)



THE DIESEL'S FUEL injector system, with the injector pump and all the attendant feed and return lines, give 190-D's engine the look of a plumber's nightmare

has a shock absorber that effectively isolates road shock without removing road feel. It doesn't remove engine vibration, however; the wheel actually quivers during idle.

The ride, typically European, is tight and solid. Some road harshness gets through to your bottom, but the bigger hazards—railroad tracks, sudden dips, even chuck holes—cause a minimum of trouble. I went smartly over a viaduct so poorly built that the wheels left the road at the approaches, but the suspension refused to bottom, and control was never in doubt. And although there's a total of 80 inches of overhang front and rear, there's not a bit of the loose wallowing common to many luxury barges. (And with a base POE tag of \$4047, even the 190-D qualifies as a luxury car.) You can turn around, incidentally, in a street less than 38 feet across.

By the old American Motors definition, the 190 (under 200 inches over-all) qualifies as a compact. But there's nothing crowded about the interior. I stand over 6 ft. and I actually found the front end spacious. I can't say that about many cars.

### Spacious Comfort

Even with the driver's seat run well back, rear legroom is okay. The back of the rear seat is recessed so far that it's no snap to clamber out, but that may be the price you pay for seating comfort.

Headroom fore and aft is great. I'd even have gone along with the boss' idea of wearing a top hat for a demonstration photo if it didn't feel so damn silly. I'm just not the top-hat type.

(Please turn to page 38)

SEPTEMBER 1964

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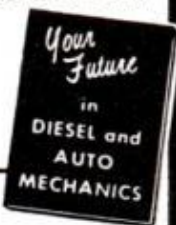
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## Spotlight on the Mercedes

(Continued from page 37)

Besides being spacious, the interior is generally well fitted. Heater, lighter and clock all are standard equipment. So are two sun visors and a locking glove box.

There are gauges for water temperature and oil pressure, idiot lights for amps, hand brake and the fuel gauge. The ignition switch includes a steering lock.

The controls, unlabeled, are recessed within rolls of padding at the top and bottom edges of the dash. M-B literature crows about this safety padding, rightly as far as the dash and steering wheel are concerned. But pillars and window sills, covered by a light thickness of leatherette, are basically hard as the landlord's heart. There's a whole gang of assist handles—fine for apprehensive in-laws.

### Big Box in Back

Vision is generally good, but you can't see the road up close because of the fat hood housing the massive diesel Four. It takes lots of cast iron to contain the stresses of the 21-1 compression ratio.

The trunk is cavernous—great for salesmen or campers. There even seems to be a well on the left side for a second spare. Here's a space they might have used for more fuel capacity. Over a long holiday weekend, 18 gallons is hardly enough to take you back to your friendly neighborhood diesel dealer. The tank isn't well baffled either, judging from the happy jig the needle does on the fuel gauge.

Crowning touch on the 190-D is the Mercedes' hood ornament, a simple, handsome, three-pointed star in a ring. It's enough of a classic for Mercedes to have had to take steps to prevent its theft. To foil vandals, it's mounted on a sturdy coil spring. ★★★

## Crop Damage Seen from Air

Farmers can detect one type of crop damage through aerial photography, according to the U.S. Department of Agriculture. When crops are hurt by soil salinity due to high water tables, the extent and severity of the damage can clearly be seen in photos taken from a height of about 4000 feet.

In tests on cotton land in Texas, six levels of soil salinity were identified through different shades of photographic tone. Agricultural experts say if salinity damage is detected at an early stage, much of the crop can be saved.

Investigators used a K-20 aerial, hand-held reconnaissance camera and aerial infrared film with an 89-A dark-red filter.



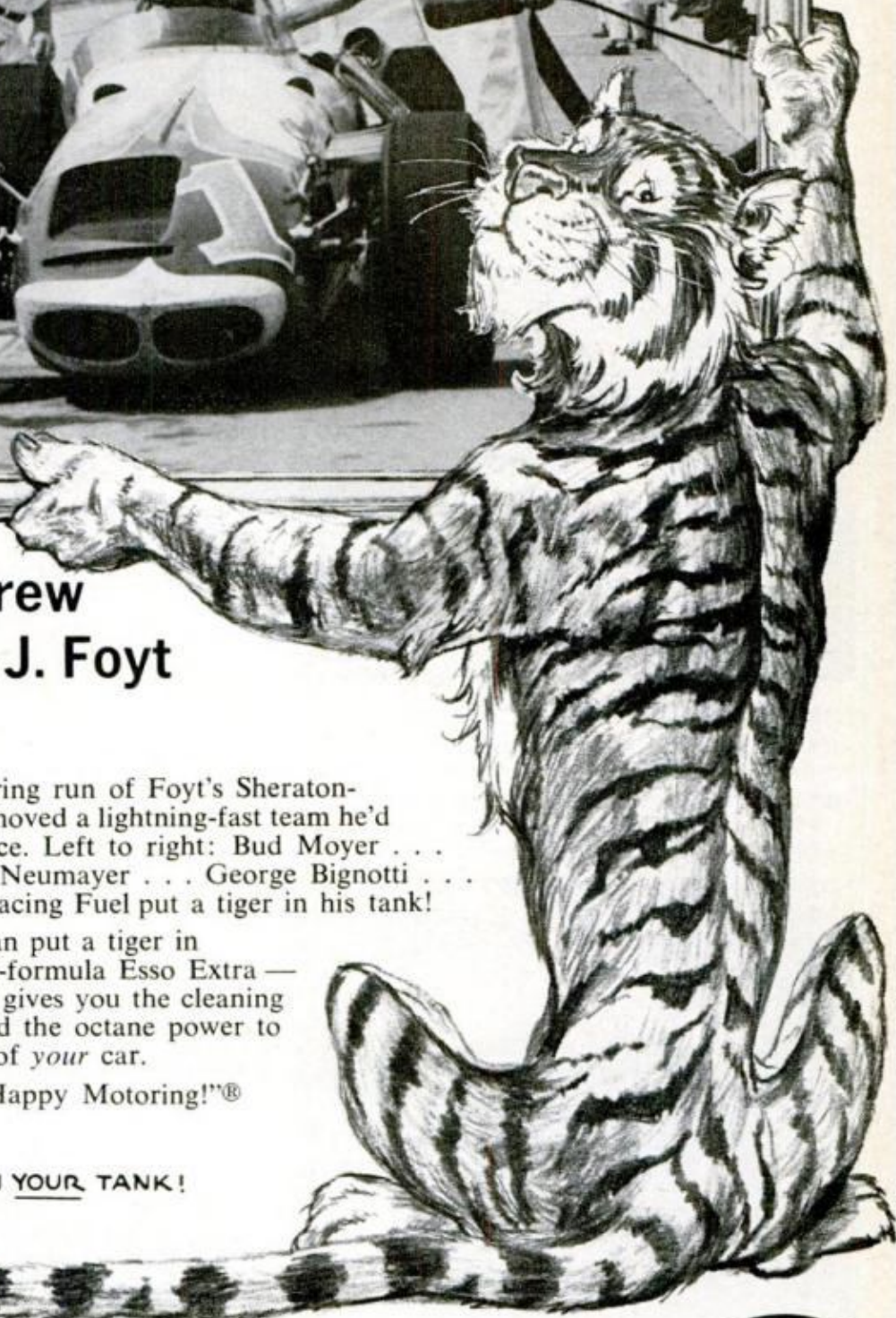
## Meet the pit crew that helped A. J. Foyt win at Indy

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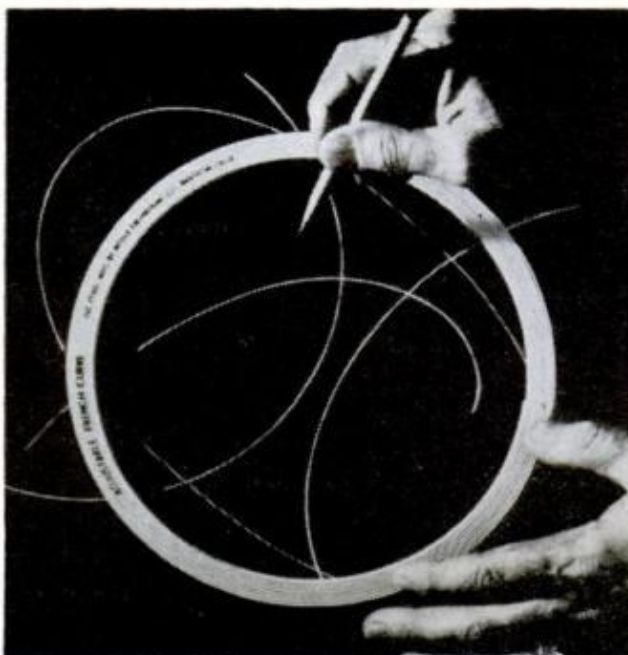
**FAST DRYING WOOD STAIN** dries for re-coating in five minutes, can be finished in 30 minutes. Applied by brush, spray, wipe or dip. Manufacturer says it will not raise the grain of the wood. Comes in 9 color, which can be intermixed or reduced to achieve almost any desired shade. A pint retails for \$2.25. Watco-Dennis Corp., 1756 22 St., Santa Monica, Calif.



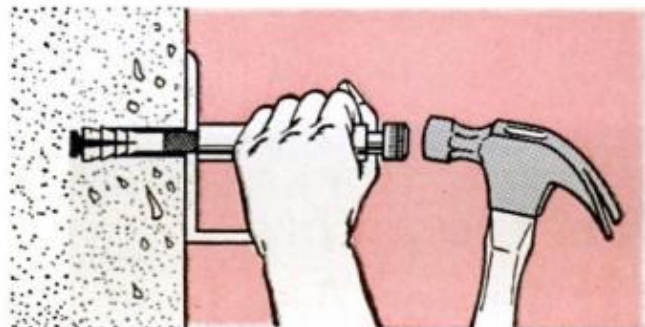
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*In an interview with PM boating editor Art Mikesell, a veteran 12-Meter crew leader, George O'Day, reveals how the new designs and a new Olympic course will affect the outcome of this year's America's Cup challenge*

## **America's Cup Skipper Predicts 1964 Winner**

**Mikesell:** George, just what effect will the introduction of the Olympic-type course have in the '64 challenge?

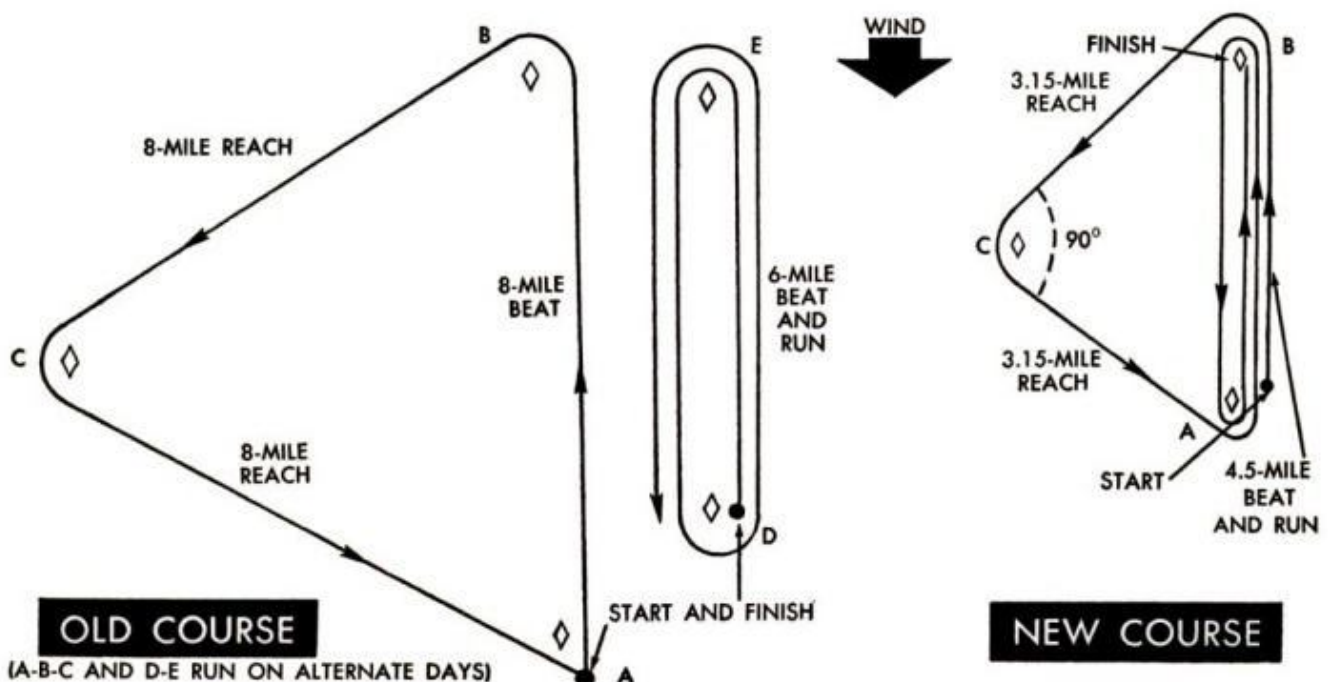
**O'Day:** Well, this course is new to the 12-meters, as you know. It has six legs, and they're shorter than those of either of the old courses. In 1962 the windward leg on the windward-leeward race was six miles long, and we did it twice. In the triangular race, each leg was eight miles long. Now the windward leg is 4.5 miles long, very short by comparison. To analyze the effect of this, look at what happened in 1962.

*Weatherly* never built her lead up in the first four miles, except for two or three boat lengths. It was in the last two or four miles—depending on the course—that we opened up our big margins. This year, you're going to round a mark and find your competitor right on your tail.

**Mikesell:** What influence will this have on tactics?

**O'Day:** I think the Olympic-type course is going to change the whole tactical approach of sailing the America's Cup. This year you'll see a lot more short tacking. It's like comparing a thoroughbred and a quarter-horse. Up through 1962, the 12-meters and the J boats before them were like thoroughbreds—trained for the long distance. This year a 12-meter has to be more like a quarterhorse. It's got to be able to start and stop very, very fast; it's got to be able to tack fast; it's got to have more all-around ability because of the nature of the course. With two broad-reaching legs, where the wind is well aft of the beam, there's going to be a lot of tacking downwind. And there's going to be a lot

[\(Please turn to page 44\)](#)





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## America's Cup

(Continued from page 42)

of tacking going to windward. The most important single thing in this course is who has the mark when they turn it. As I look at it, everything you do during the race is to get yourself the advantage of the mark. And this means there's going to be tacking all over the place.

**Mikesell:** Then there will be even more emphasis on the crew?

**O'Day:** No question about it. There's going to be more in-fighting; the crew is going to have to be more highly skilled than ever before, with greater stamina. The boys on the crews this year all seem to be 6 feet, 3 inches, over 200 pounds, and they're getting into pretty tough physical shape.

**Mikesell:** What makes a good 12-meter crewman? Is it a matter of pure beef, strength and stamina?

**O'Day:** Strength is needed, but to use the 1962 illustration again, the Australians were stronger, perhaps even faster and more alert in a lot of ways. *Weatherly's* crew was a little bit slower, but had the finer polish and finesse. They were able to trim their sails just a little bit better at all times. In timing the boats which I did as an observer, I found that *Gretel* was taking 10.1 seconds to go from one tack to another. Going at the same speed, *Weatherly* was doing it in about 8.4 seconds, so every time they tacked from light to medium air, *Weatherly* was picking up a little bit—about a second or a second-and-a-half. If you do this 20 times on the windward leg, this amounts to 20 or 25 seconds. And you have to remember that the difference between the fastest and slowest boat is only about one second per mile.

**Mikesell:** The new boats this year include several minor changes in design. What do you think are the two most significant improvements in the '64 twelves?

**O'Day:** Actually, to judge what's happened in '64, you have to look at what happened in '62. We found that *Gretel* was probably the fastest 12-meter afloat that year. Her design was an improvement on *Columbia*, which was available to her designer, Alan Paine, in Australia. Therefore, when it came to designing this year's American boats, those things learned on *Gretel* were incorporated into the new boats. One of the things that I would say is most significant is the flat running surface aft. This will make a boat "surf" on the sea a lot better. It will give much more reaching and running ability. *Gretel* had this, *Weatherly* didn't. *Gretel* was using it when she roared right by *Weatherly* in that

(Please turn to page 46)



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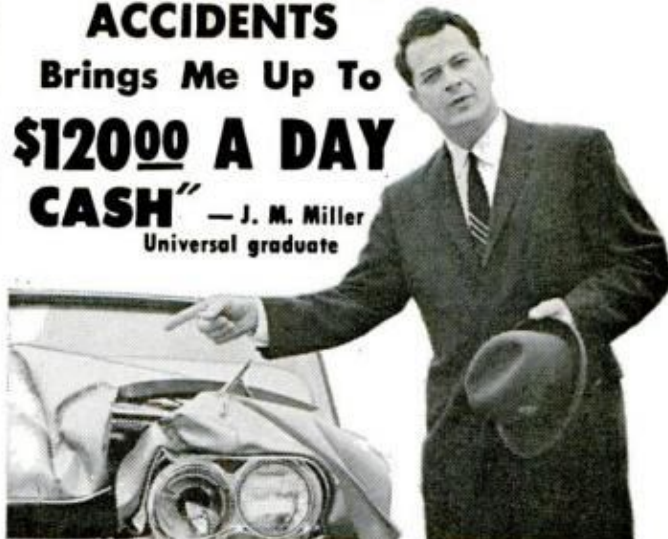
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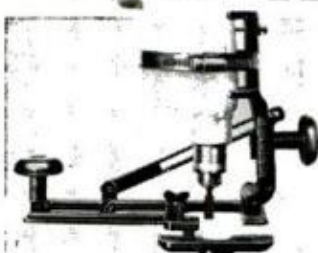
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## America's Cup

(Continued from page 44)

famous second race in '62. The other change, of course, is in the rudder shape—getting the power of the rudder down lower to the bottom of the keel so that you have the biggest part down the lowest where it will do most good.

**Mikesell:** Have you noticed any improvements in this year's gear over '62?

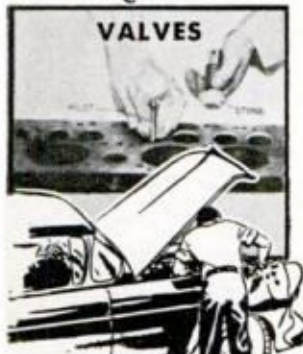
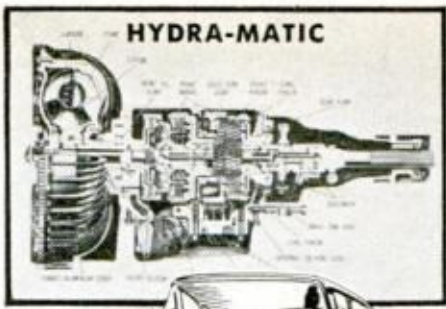
**O'Day:** I have seen a couple of minor improvements. The Australians showed us that we had to go to double-gear coffee grinders—the big winches used to control the jibs and spinnakers. As a result of *Weatherly's* losing that race to *Gretel* in '62, all the new Twelves have double-gear, linked-together coffee grinders. It seems to be a must, at the moment. The other improvement was worked out on *Weatherly*. It's a very short second spreader, which is the piece of metal or wood that holds the rigging apart in the upper part of the spar. By shortening that down, we were able to get bigger jibs on the boat. The two new boats have this shorter spreader aloft and are carrying somewhat bigger jibs, though of course no bigger than what *Weatherly* had in '62.

**Mikesell:** To what do you attribute the success of *Eagle* to date?

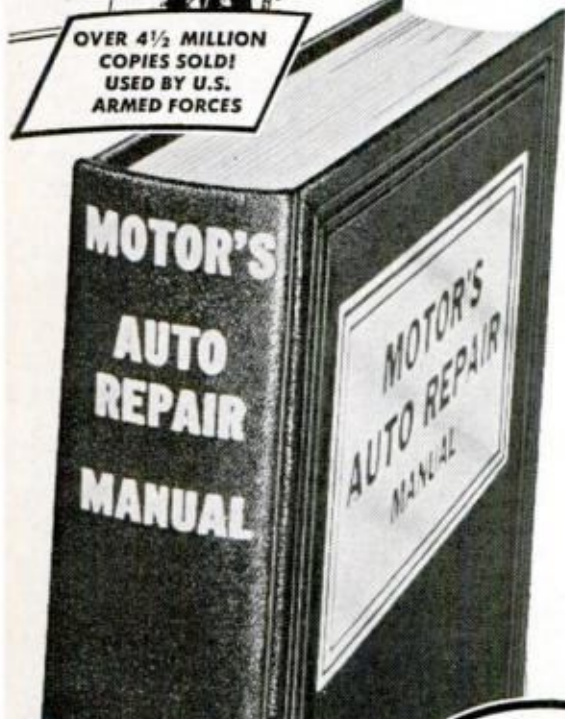
**O'Day:** The success of *Eagle* can be attributed to several things but principally important is Bill Cox, a flawless organizer of people and of gear, down to the most minute details. In '62 Bus Mosbacher had a terrific organization working for him. Cox had bettered this by far and has all the lessons learned from '62 in his favor. The gear on *Eagle* is far better than *Weatherly* ever had, and the organization has been working diligently since last November. This year seems to be proving the year of the organization boat.

**Mikesell:** Finally, the big question. Do you think we'll retain possession of the cup or is the Olde Muggie going to take an ocean voyage this year?

**O'Day:** I'm going out on a limb, but with all due respect for my English friends, I don't see how we can lose the Cup—this time. Our three best boats are getting into high gear a lot earlier, and when Americans get into high gear, they just get better and better and better. And the facilities available to us are an advantage. When something is wrong, you can easily test it out in New York in the tank the next day, or have a sail made within 24 or 48 hrs. It's going to be just too much for England to overcome in a short period of time. I think they'll be good, though—there's no question about it. ★★★



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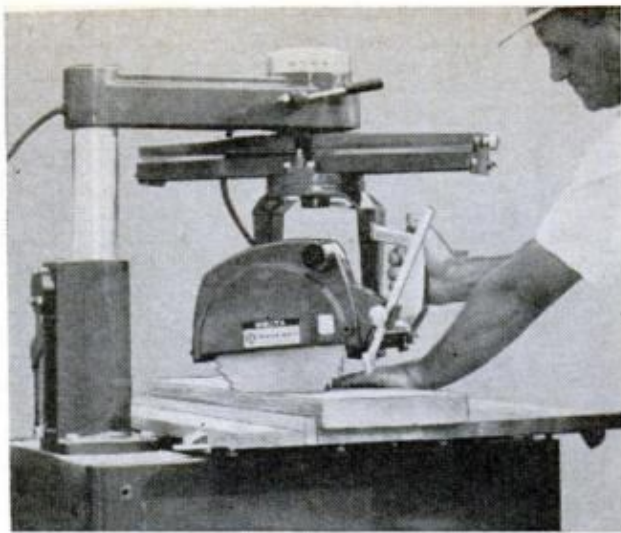
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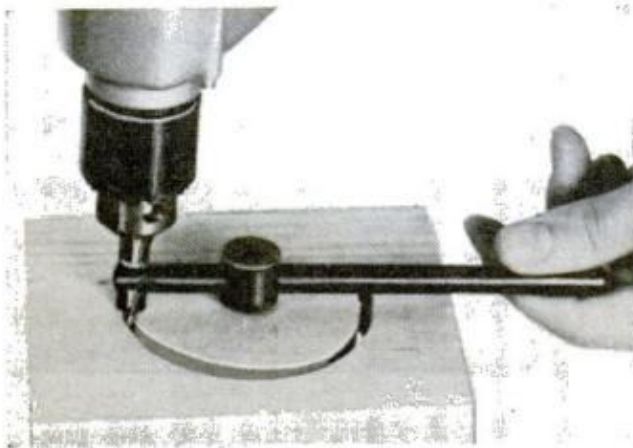
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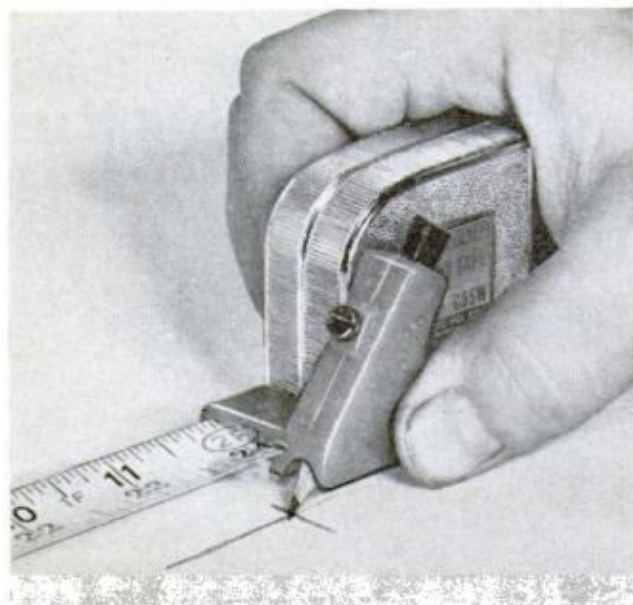
**SILKEN COMPASS CUTTER** enables an electric drill to cut rings, disks and circular holes up to 12 in. in diameter. A spiral router bit does the cutting, guided by compass-like device shown below. Cuts wood, plastic, hardboard, laminates, some metals. \$3.98. Howard Silken, P.O. Box 242, Oceanside, N.Y.



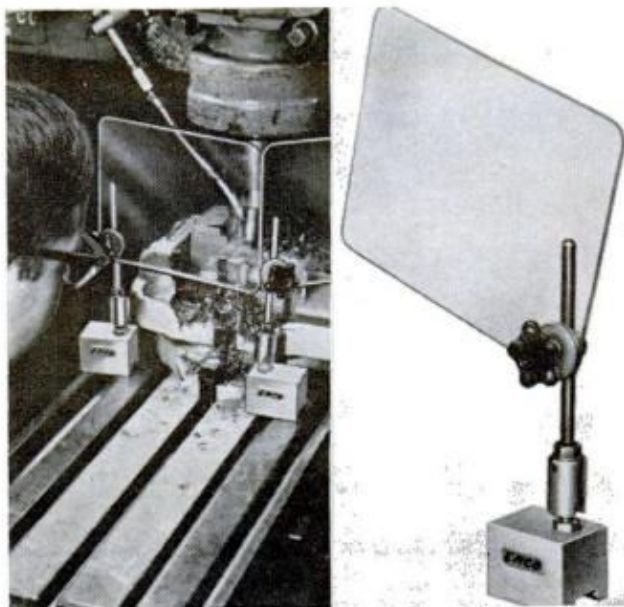
**FOUR SCREWDRIVERS IN ONE:** This handy tool has two double-ended bits, giving a choice of two sizes in both regular and Phillips-head. The tips slide into the barrel, which, in turn, fits into the handle. The Four-In-Hand screwdriver sells for \$3.00 from P.A.T. Inc., 2150 Niagara Street, Buffalo, N.Y.



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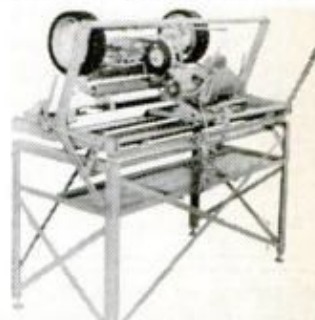
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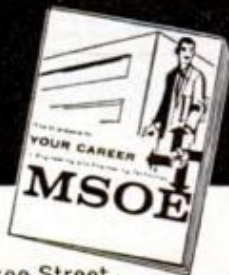
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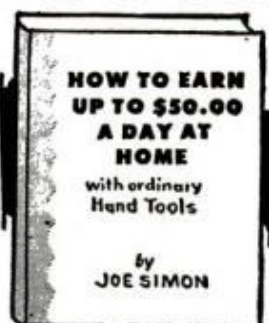
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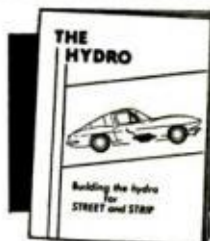
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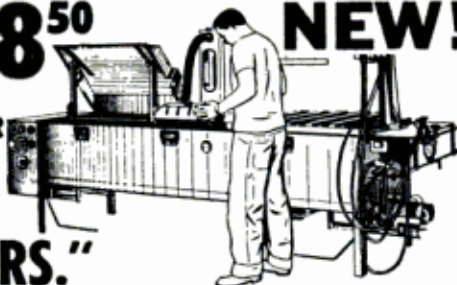
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**BECOME Tax consultant.** Our students earn \$1,000-\$3,000 every tax season preparing returns evenings. State approved. National Tax Training School, Monsey R-2, New York.

**BEAUTIFUL Curios free!** Send 20¢ stamps mailing. Sylvia Ml, Apartado 9036, Mexico City.

**WORK** At home caring for children. \$50.00 weekly possible. Parents pay you. Guardian Method, 120-P South LaSalle, Chicago 60603.

**"START Your Own Business Annual."** 700 opportunities, \$2.00, Wright, Box 32, Alameda, California.

**IMPORT-EXPORT Business made easy.** Complete setup service, not just instructions. Hermes, 152 West 42, New York City 10036.

**400% PROFIT!** Sell our directories, folios, manuals! Circulars supplied! We drop-ship! Mashburn's, Enka, N.C.

**DAZZLING Rings!** Sellable samples, \$2.00! Jewelers, Box 141, Little Rock, Arkansas.

**GIANT Three-foot stuffed clown doll, tremendous bulldog \$1, each!** 24 giant toys \$24. F.O.B. Free catalog. Ace, 536 Broadway, N.Y. 10012.

**COLORGLAZED Concrete pottery made without molds.** Patented method. Cemetery products, novelties, tiles. Basement leak-sealing. Money-making projects. Booklet, details free. Men only. National Potteries Company, Grand Rapids, Minnesota.

**MADE \$10,000.00 Typing at home.** Guaranteed proof. Amazing information. 15¢. Lenore Feigen, 30 L Washington, Oak Park, Ill. Dept. PM.

**SELL Books by mail, 400% profit.** Royal, Box 450-X, Cleveland 27, Ohio.

**SUCCESS Book can change your life.** \$3.00. Frantz, 2022 Robin, Garland, Texas.

**SHARPEN And serrate steak knives, scissors, pinking shears, etc. for profit.** One low cost machine. Free details. Beaver Machine, Box 121 Gardena, California 90247.

**MAKE Money mailing mothers our postcards.** Particulars free. Wesley, Western Springs, Ill.

**STOP Wasting your time and money on folios.** 640 Potent pages, "How to Run Mailorder Business Profitably." Power-packed—Dynamic—Convincing. \$5.95 postpaid. Ideas Unlimited, Box 2385, Fullerton, California.

**EARN \$3.00 hourly, assembling lures for stores.** Materials supplied free! United, 3173-PM North Delaware, Indianapolis, Indiana.

**MAKE \$2,500.00 up, within 6 months operating your own mailorder business!** Proven, "Mailorder Program" does it—or get back double your cost! You can't lose! Amazing details free! Contacts, 58 Sunset, Montrose 6, New York.

**DIRECT Rock bottom wholesale sources!** Buy for pennies, sell for dollars! Free details. Joric, Dept. 409, Box 6751, Portland, Oregon 97266.

**"MAILORDER Bookkeeping cards."** Samples free. Neil H. Tasker, Shamokin, Pennsylvania.

**NATIONAL Land Development Company, expanding your locality.** No franchise fee. We help finance. No direct selling. Exclusive territories. Full or part time. Write to home office. Land Sales Corp., 206-K, Bloor St., West, Toronto 5, Canada.

**\$140.00—Day's homework! (Proof!) No experience!** Ideagraphy, R6, Wellsboro, Pa. 16901

**FREE One ingredient formula easily makes one of World's largest selling cosmetics.** Amazing profits. Write, Verdun Specialty Sales, 201 East Holbrook, Flint, Mich.

**MAILORDER Newsletter locates specific products to sell.** Free information: ERA, 52 Shelley, Port Chester, New York 10574.

**OPERATE A home ad market.** Simple. Profitable. Details—Box 331, Harlingen 1, Texas.

**CAPITAL Available! Simplified methods.** Tested sources. Details free. National Counselor, Harlingen 17, Texas.

**PROFITABLE Mail order business.** Be independent. Details free. Ideal, Box 357-DF, Valley Stream, N.Y.

**MILLIONAIRE Possible! Fabulous offer free!** Universal, Box 675, San Antonio, Texas 68206.

**MAILORDER—What makes it tick?** Free booklet! Methods, 1801FD, Lafayette Hill, Pennsylvania 19444.

**FREE Booklet! Profitable, spare-time business bronzing, Pearl-koting baby shoes!** Complete set-up on credit. Kiktavi, Box 34861-BY, Los Angeles, California.

**MAKE Money growing fishbait.** Free information. Fain's Bait, Edison, Ga.

**START your own Mail Order Business.** Free details. Lauro Distributors, Box 222-B, Brooklyn N.Y. 11211.

**FREE Details: How to make money in mail order.** No obligation. Kayco, Dept. 438, 16943 Denver, Gardena, California.

**TO \$100.00 weekly! Mailing catalog!** Sample, instructions, 25¢. Costar, GPO Box 972-PM, New York 10001.

**NET \$12,000 a year using Classified Ads.** Burns, 640 So. Minahan, Napa, Calif.

**BAKE New greaseless doughnuts in kitchen.** Stores buy output. Start spare time. Profit 29¢ dozen. Small appliance. Free recipes. Montgomery, 3605 South 15th, Minneapolis 7, Minnesota.

**PROFIT With Popular Mechanics' subscription plan.** No investment, no experience needed. Earnings begin immediately when you obtain subscription for Popular Mechanics, Good Housekeeping and others. High commissions, bonus. No experience needed. Deal directly with the publisher. Write Popular Mechanics, Room 9B, 250 West 55th St., New York 19, N.Y.

## MONEYMAKING OPPORTUNITIES

**PAINT Signs for yourself—others!** Easy with our letter patterns, supplies. Also "Raised Letters." Paulow, Crystal Falls, Michigan 49920.

**LEARN The secrets of repairing junk batteries.** "Fabulous Profits" at home. Details. Batteryman, Prunedale P.O., Salinas, California.

**CIGARETTES. Make 20 plain or filter-tip for 9¢.** Factory-fresh pipe tobaccos. Mild tropical flavored Philippine cigars. Facts free. Moberly, Box 4027, Owensboro, Kentucky.

**VENDING Machines. No selling.** Operate a route of coin machines and earn amazing profits. 32-page catalogue free. Parkway Machine Corporation, 715 PMM Ensor Street, Baltimore 2, Maryland.

**EARN \$240.00 a month at home, spare time, doing only two \$5.00 invisible mending jobs a day.** Big money paid for service that makes cuts, tears disappear from fabrics. Steady demand. Details free. Fabricon, 1532 Howard, Chicago 26, Ill.

**BIG Money raising fishworms and crickets.** Free literature. Carter Hatchery, Plains, Georgia.

**AMAZING Successes through franchises!** Become exclusive franchise holder your territory. Information rushed. National Franchise Reports, WP-528, 333 North Michigan, Chicago 1.

**EASY To start rubber stamp business at home in spare time.** Make up to \$9.80 an hour without experience. Facts free. Write Roberts, 1512 Jarvis, Room CR-2-HH, Chicago 26.

**EARN \$1000.00 month operating Book-keeping Tax Service.** Details free. Universal Bookkeeping, Box 664, Springfield, Missouri.

**BECOME A Notary Public!** Win extra income, prestige, business contacts. Details free. Stationers Exchange, P.O. Box 617, Kilgore, Texas 75662.

**BOOKKEEPING System.** Substantial profit selling Start Service. Kern, Box 263, North Hollywood, California.

**MAKE Plastic novelties for extra income.** Low cost home training now available. Write for free booklet. Interstate Training Service, Dept. D-3, Portland 12, Oregon.

**MAKE Money** writing short paragraphs! No tedious study! I tell you what to write, where and how to sell, and supply list of editors buying from beginners. Many small checks add up quickly. Write to sell, right away. Send for free facts. Benson Barrett, Dept. C27-U, 6216 Clark, Chicago 26.

**WANTA Win** a contest? We'll help! Puzzles, prizes, pointers and particulars. Send buck for year's trial subscription. Prizewinner, Box 11569, St. Petersburg, Fla. 33733.

**MEN—Women!** Start money-making plastic laminating business at home in spare time. Material that costs 11¢ brings back \$2.58. No canvassing or selling but mail orders bring in \$20 a day. Write for full particulars free. Rush name on postcard to Warner, Room CL-2-HH, 1512 Jarvis, Chicago 26, Ill.

**ATTRACTIVE Mail offers.** Free literature. Eaton's, 708PM Gold, Centralia, Wash. 98531.

**495% PROFIT** Selling mailorder manuals. Details Free. Rutward, 180 Bryant, Columbia Station, Ohio.

**MAKE Figurines, plaques, lawn ornaments, molds, plastercraft kits, liquid rubber.** Sample and catalogue 10¢. Wooley Company, Box 29-B, Peoria, Illinois.

**RAISE Rabbits and fishworms** on \$500 month plan. Free details. White's Rabbitry, Mt. Vernon, Ohio.

**EQUAL Chance** to win valuable oil leases in government monthly drawings. Winners pay 50¢ acre. Sell for large profits. Free Details. Midwest Oil Lease Service, Box 362, Wichita 1, Kansas.

**HOW To raise cash** to start a Business. Counselor, Box 331, Harlingen 5, Texas.

**BABY In your family?** Profits and fun from Bouncing Baby Sitter. Details Free. Box 203PM, Noroton, Conn.

**IMAGINE:** Your own business without investment, rent or inventory—just big profits for your spare time. I'll send you free trial outfit containing 5 full size-home needs, cosmetics worth \$4.18 retail and big catalog of over 200 other products every home needs and buys every day. Show to friends, take easy fast orders. Write: Blair, Dept. 31AT, Lynchburg, Va.

**LEARN Oil Burner repairing** (Home Studying) free information. Marlin Institute, Box 6695, Portland, Oregon 97266.

**EARN Money** evenings, copying and duplicating comic cartoons for advertisers. Adservice, Argyle 1, Wisconsin.

**MINK Raising** information free. Lake Superior Mink Farm Inc., Superior, EE1, Wisconsin.

**INVESTIGATORS** Earn big incomes. You can be an investigator. My plan puts you in business. T. F. Trader, 210 Fifth Ave., New York 10, N.Y.

**ASTOUNDING Profits** for mailorder beginners. Helping newcomers, our specialty. Carriage House, Box 4108-H, Memphis 4, Tennessee.

**DROP Ship** your way to mailorder fortune! Complete details free! Bevco, 363-PM, Sam, Johnstown, Pennsylvania 15902.

**EXCLUSIVE 77 page guide** tells how to build profitable mail order business. Write Buchwalter Sales, 834 175th Street, Dept. 49, Hammond, Indiana. 46324.

**FREE:** How to find new products for mail order. Economics, Box 230, Port Chester, New York 10574.

**HOW To raise cash** to start a Business! Free details. Counselor Reports, Harlingen 5, Texas.

**TREMENDOUSLY Profitable** moneymaking offers. 25¢. Hermann, Box 189-M, Jamaica 31, N.Y.

**BIG Profits** growing fishbait. Free information. Fain's Bait, Edison, Ga.

**BECOME A reading tutor** in 14 weeks. Earn \$5 to \$10 hourly. Free details. Reading Arts Academy, 1100 West "Q", Wilmington, Calif.

**ADDITIONAL Income opportunities** are all around you if you only knew what to look for: Free details, T & D, Box 236PM, Pasadena, Calif. 91105.

**TO \$100.00 Weekly possible.** Mailing catalogs. Sample, instructions 25¢. House, 1810-L Romain, Columbia, S.C. 29210.

**EARN At home, learn profitable photo oil coloring.** Free booklet. Hollywood Enterprises, 1023P North Hyperion, Hollywood, California 90029.

**100 RADIO Stations** selling products on commission basis! List \$10. Box 452, Salisbury, Maryland.

**START Your own home mailorder business, sparetime!** Easy! Fascinating, profitable! Alfano, 19-PM Pine, Closter, New Jersey.

### PROFITABLE OCCUPATIONS

**CHROME Plating.** Instructions, equipment and supplies. Platers' Supply, P.O. Box 565, Lugo Station, Los Angeles, Calif.

**BAKE New greaseless doughnuts** in kitchen. Sell stores. Free recipes. Michael, 3605 South 15th, Minneapolis 7, Minn.

**BIG Money** raising fishworms and crickets. Free literature. Carter Wormery, Plains, Georgia.

**EARN \$240.00 A month** at home, spare time, doing only two \$5.00 invisible mending jobs a day. Big money paid for service that makes cuts, tears disappear from fabrics. Steady demand. Details free. Fabricon, 1586 Howard, Chicago 26, Ill.

**SHARPEN Scissors, pinkers, clippers.** Inexpensive machines, supplies. Blackhaws, Sheldahl, Iowa.

**VENDING Machines.** No selling. Operate a route of coin machines and earn amazing profits. 32-page catalogue free. Parkway Machine Corporation, 715 PMP Ensor Street, Baltimore 2, Maryland.

**INVESTIGATE Accidents.** Earn \$750 to \$1,000 monthly. Men urgently needed. Car furnished. Expenses paid. No selling. No college education necessary. Pick own job location. Investigate full time. Or earn \$8.44 hour spare time. Write for Free Literature. No obligation. Universal, CPM-9, 6801 Hillcrest, Dallas 5, Texas.

**FREE Book "990 Successful, Little-Known Businesses."** Work home! Plymouth 77J, Brooklyn 4, New York.

**MAKE Money** writing short paragraphs. Information free. Barrett, Dept. C27-UA, 6216 No. Clark, Chicago 26.

**MONEY—Become a finance broker** full or part time. Ra-Mar, Box 482, Desk #3, Oklahoma City, Okla.

**FREE Report: "609 Unusual Successful Businesses."** Box 1001-PT, Evanston, Ill.

**LEARN Civil and criminal investigation** at home. Earn steady, good pay. State age. Institute Applied Science., 1920 Sunnyside, Dept. 166, Chicago 40, Ill.

**OPERATE Restaurant or diner.** Free booklet reveals profitable plan. Write Restaurant Business School, Dept. EC-94, 1920 Sunnyside, Chicago 40, Illinois.

**MEN-WOMEN.** "Everybody likes fine candy." Make professionally home. (Our 51st Year.) Ragsdale Candies, B107, East Orange, New Jersey.

**WHOLESALE Magazine subscriptions.** Highest commissions! Bonus! Box 151XA, Freshmeadows, N.Y. 11365.

**"PROFITABLE" Home profits guide 35¢.** Humphreys, 3210 Purcell, Grand Prairie, Texas 75050.

**BECOME Independent** with your own franchise business. Thousands earning handsome incomes. Request interesting facts today. National Franchise Reports, PM-528, 333 North Michigan, Chicago 1.

### AGENTS WANTED

**PRINTING.** Advertising salesmen—Excellent moneymaking sideline selling decalcomania name plates, small quantities. Automobile initials, sign letters. Free samples. Ralco, XL, Boston 19, Mass.

**YOUR Own business—Used suits \$1.50; overcoats 65¢; mackinaws 35¢; shoes 12½¢; ladies' coats 30¢; dresses 15¢.** Enormous profits. Catalog free. Nathan Portnoy Associates, 2109-AA Roosevelt Road, Chicago 8, Ill.

**ESTABLISH Your own business.** Low prices on used clothing, shoes, household goods. Unlimited profits. Free catalog. Northwestern Distributors, 2129 No. Western Avenue, Chicago 47, Illinois.

**DOES A \$10,000 a year shoe business** sound good to you? Absolutely no investment required. Write for full details. Chester Shoes Dept. 822, Brockton, Mass.

**MAKE Big money** soliciting delinquent accounts. Prospects everywhere. Terrific commissions. General Finance Co., Dept. SG-73 Pickwick Bldg., Kansas City, Mo. 64108.

**EXOTIC Earrings!** Details free. Pair, \$1.00. OHGA, PM-547, Sigakenkusatu, Japan.

**CHRISTMAS Cards—Business and Personal.** Customer's name imprinted. Earn unusually high commissions from this medium- and high-priced line. Free sample Album. Process Corp. (our 43rd year). 3434A S. 54th Ave., Chicago, Ill. 60650.

**RUN Spare Time Greeting Card-Gift Shop** at home! Show friends samples of new 1964 Christmas. All-occasion greeting cards, gifts! Take orders. Earn to 100% profit. No experience needed. Try without cost! Special fund raising plans for organizations. Rush name for samples on approval. Regal Greetings, Dept. 173C, Ferndale, Michigan.

**MAKE Tremendous Spare Time Income.** As much as \$100. a week, selling Quality Gifts, Novelties and Christmas Greeting Cards. Write for Samples on approval. Robinson Cards, Dept. 502, Clinton, Mass.

**FREE Samples!! 60% profit!! Fast sellers!!** K & K Distributors, Box 205B, Orchard Lake, Michigan.

**ANYONE Can sell famous Hoover Uniforms** for beauticians, waitresses, nurses, doctors, barbers, others. Miracle fabrics—Nylon, Dacron, Wash 'N Wear cottons. Exclusive styles, top quality. Big commissions, real future. Equipment Free. Hoover Uniforms, Dept. S-3020, Textile Bldg., Cincinnati 2, Ohio.

**FREE \$1.25 Everlasting Rose Arrangement** given to introduce new Christmas money-makers. \$75.00 profit on hundred \$1.25 Card Assortments. 230 exciting card, gift sellers. Biggest profits; bonuses. Personal Christmas Album Free. Assortments on approval. Creative, 4401, Cermak, Dept. AD-CC, Chicago 23.

**NEED \$75 to \$175 cash?** Easy to make big cash profits with Southern's Exciting Anniversary Collection Christmas Cards—newest personalized, religious greetings. Write for Free Anniversary offer; Sample Outfit on approval. Southern Greetings, 478 N. Hollywood, Dept. N-94, Memphis 12, Tennessee.

**MEN! Women!** 60% profit on cosmetics. Famous nationally advertised Hollywood Cosmetics pay 60%. Make \$25 day up. Hire others. For free samples, details, write Studio Girl, Glendale, California. Dept. 23J48.

**MAKE** Extra money, show friends, neighbors. Gifts stationery, Christmas, all occasion cards. Experience unnecessary. Salable samples on approval. Free catalog, free name imprinted. Christmas card album. Hedenkamp, 361 Broadway, Dept. PM-88, New York.

**WILL** You test new items in your home? Surprisingly big pay. Latest convenience for home, car. Send no money. Just your name. Kristee, 138, Akron, Ohio.

**EXTRA** Cash aplenty! Show 'em and you'll sell 'em—sensationally beautiful, handpainted plastic photo enlargements, personalized compacts, costume jewelry. Take orders—collect 40% commission. Self-selling sales kit free. Novelco, 3343 North Avenue, Chicago 47.

**AMAZING** Christmas card profits! Make 75¢ on \$1.25 assortment; \$75.00 on 100. Extra bonuses. 230 new, money-makers. 50 Name-Imprinted Christmas Cards and beautiful \$1.25 everlasting rose arrangement free with approval assortment. Creative, 4401 Cermak, Dept. CC-505H, Chicago 23.

**NEW!** Kennedy souvenir keychain. Sample 50¢. Free details, Hayes, 16 Allenwood, West Roxbury 32, Massachusetts.

**BUSINESS** Kit free! Postcard puts you in business! Complete line 275 shoe styles, jackets! New discoveries pay big commissions. No investment. Send for free kit. Mason, Chippewa Falls, K-491, Wisconsin.

**RAISE** Rabbits for us on \$500 month plan. Free details. White's Rabbitry, Mt. Vernon, Ohio.

## SALESMEN—DISTRIBUTORS

**SELL** Advertising book matches. Write us today, we put you in business by return mail; handling complete line ad book matches in demand by every business right in your town! No investment; everything furnished free! Top commissions daily! Superior Match, Dept. M-864, 7530 S. Greenwood, Chicago 19, Illinois.

**MAKE** Extra money selling advertising matchbooks. Free catalog and sales outfit. Matchcorp, Dept. PM-94, Chicago 32.

**MAKE** Big money taking orders for stark Dwarf fruit trees. Everybody can now grow giant size apples, peaches, pears, in their yards. Also shade trees, shrubs, vines, roses, etc. Outfit free. Stark Bro's, Desk 30195, Louisiana, Missouri.

**100% PROFIT** Nationally advertised cosmetics for negro market. Sells fast. Free sample offer. Valmor, Dept. KD, 2451 Michigan, Chicago 16.

**TOP** Company in business printing and advertising specialties field will set you up in your own big profit business. No investment. Steady income. Full or part time. Repeat orders pay full commissions. Everything furnished free. Write for details. Kaeser, 953 Martin Place, Dept. Y-59, Cincinnati 2, Ohio.

**NEW** Portable 49¢ meal! No Refrigeration, cooking, mixing. Details free. Enclose \$1 for three meals. Comixid Corporation, New Canaan 9, Connecticut.

**IF** You're interested in making money in selling, see the hundreds of exceptional opportunities in Salesmen's Opportunity Magazine. Send name for your copy, absolutely free. Tell us what you're selling now. Opportunity, 848 N. Dearborn, Dept. 17, Chicago 10, Illinois.

**\$5,000 FOR** Part of your free time. Your own business. Free selling outfit. Opportunity to profit 8 ways including cash commissions. Monthly bonus, bonds, free insurance. Age no barrier. Full time or part time. No obligation. Write Ortho-Vent, 1148 Brand Road, Salem, Va.

**DISTRIBUTORS** Wanted. Stainless razor blades. Buhl, Box 34, Princeton, Florida.

**MONEYMAKING** Opportunities galore. Buy hosiery direct. Kimel Hosiery, B335PM, Matthews, N.C.

**A Dollar** gets you \$4.00. New invention, the Ever-Wear Seal, enables anyone to fix leaking faucets forever. Send \$1 for package of five Seals, then get dollar back on first order. Or send name for Free Sample and Sensational New Sales Plan. Ever-Wear, Dept. CPM 964, Lake Geneva, Wis.

**\$1000.00** A month for making dramatic 3-second demonstration of amazing lightweight Presto Fire extinguisher. New chemical used by Air Force, snuffs out fires instantly. Only \$4.95. Terrific commissions. Millions want it. Free kit. Merlite, 114 E. 32nd St., Dept. P-66A, New York 16.

**GET** New Shirt outfit free! \$90 weekly on 5 average orders a day. Famous quality made-to-measure dress and sport shirts at \$4.50 up, sell to all men. No experience needed. Full or part time. Write: Packard Shirt Co., Dept. 109, Terre Haute, Ind.

**SENSATIONAL** New longer-burning light bulb. Amazing free replacement guarantee—never again buy light bulbs. No competition. Multi-million dollar market yours alone. Make small fortune even spare time. Incredibly quick sales. Free sales kit. Merlite (Bulb Div.) 114 E. 32nd, Dept. C-74A, New York 16.

**IMPORTED** Shoes, made to U. S. Standards. Also, U. S. made work clothing, cosmetics. Samar Trade, Chicago 12, Illinois.

**EXTRA** Special! 200,000,000 homes and autos need this carbon monoxide detector. Sample \$1.00. BeJo, Box 1420M, Cedar Rapids, Iowa.

**ATTRACTIVE** Promotional item restaurants need. Kohr, Box 111-B, Clearwater, Florida 33517.

**CALENDARS**, Novelties. Full or part time. Liberal commissions. Fleming, 6535-A Cottage Grove, Chicago 37.

**SALESPEOPLE**. Add gold wire name lines. Double your earnings in an extra hour. Robinson, Box 1, Oregon City, Oregon 97045.

**100% MARK-UP** New "Write-Lite" ball-point pen flashlight combination designed for police, detectives, nurses, pilots. Anyone who writes at night. Sample \$2 prepaid. Arimo Company, Wickenburg, Arizona.

**BIG 25%** Commissions Spare time! Independence, dignity, selling calendars, advertising. AAAI Firm. Beautiful color catalog free! Nationwide Co., Arlington, Texas.

**DISTRIBUTORS** Wanted. Packaged magnetic strip. Magnetico, 617 Seventh Street, San Francisco, California 94103.

**SMOKE** Your head off without inhaling. New Life-Saver Cigarette Holder offers big profits, easy-sell. Sample, literature \$1.95. Life-Saver Smoking Devices Co., Box 350P, Cooper Station, N.Y., N.Y. 10003.

**SALESMEN** needed—"VAAN" Shavers, Electrical Model H-5 (UL Approved) 12.95, sample 7.50. Battery Model DW-3 9.95, sample 5.95. Dept. B, Kegonsa Distributors, Inc., McFarland, Wis. 53558.

**EARN** Big commissions full or part time. Show America's largest line low priced business printing and advertising specialties. Big free sales kit samples hundreds items used daily by business people. Build profitable repeat business. Start right now. National Press, Dept. 8, North Chicago, Illinois.

## EMPLOYMENT INFORMATION

**DIRECTORY** Reports. Construction, aviation, shipping, oilfields, government, manufacturing, trucking, etc. foreign—stateside. Helpful information plus job-getting tips on preparing application letters. Unconditional money-back guarantee. Only \$3.00 (\$3.25 airmail) Research Services, Box 6768-PM, St. Louis, Missouri 63144.

**DIRECTORY** Of Foreign-U.S.A. job possibilities. Most occupations. Up to \$1600.00 monthly. Often free transportation. Benefits. Money back guarantee. Send \$1.50 (\$2.00 airmail). International Employment, PM-9, Box 22038, Indianapolis 22, Indiana.

**QUICK**, Easy, inexpensive preparation for all Government jobs. Free details. F & E Specialties, 1007 Rosecenter, Fenton, Michigan.

**TREMENDOUS** Opportunities—U.S.A.—Overseas—Choose Jobs—Locations—Transportation—Free Details. Occupations, International Airport, Box 100-C6, Jamaica 30, N.Y.

**POLICE** Officer positions open. New York City. Inquire: Burns, Box 74, Brooklyn, N.Y. 11234.

**FOREIGN** Employment. Construction, other work projects. Good paying overseas jobs with extras, travel expenses. Write only. Foreign Service Bureau, Dept. PM, Bradenton Beach, Fla.

**HELP** Yourself! Help Alaska rebuild. Contracts now being signed. Experienced men needed in all construction work. Send \$3.00 for current listings of companies, hiring now! Northern Crafts and Trades, Box 1175, Seward, Alaska.

**ENTER** Show business! Book explains how to start, what to do; helps you progress fast, confidently; lists 1000 contacts. \$2.00. Wallace, Dept. 394, Box 628, Montreal, Canada.

**FOREIGN**—U.S.A. Hot listings. All-year jobs now hiring. Transportation. Family relocation. Stamped returnable envelope. Global, Box 286-A, Oroville, Calif.

**RESUMES** Written to make employers want you. Executive Resumes (D) Suite 1507, 744 Broad Street, Newark, N.J.

**AUSTRALIA!** Your skills needed in zooming Australia! More opportunities! Government-assisted passage. Details \$1.00. Irving Heyer, 239 NE "D", Grants Pass, Ore.

**JOBS**, Ships. \$100.00 weekly. Beginners, men, women. Seamans Service, Box 41M, New York 21, New York.

## MUSIC AND MUSICAL INSTRUMENTS

**SONG** Ideas wanted. Write with active, professional songwriters with publisher contacts. Records made. Share royalties. Send ideas—free examination. Songwriters' Associates, 236 W. 55 St., N.Y. 19-P.

**SONGPOEMS** Wanted. Send poems for offer. Nashville Music Institute, Box 532-PM, Nashville, Tennessee.

**RECORDS!** Discounts on all LP's. Free details. Citadel Record Club, 545 Fifth Ave., Dept. 2, New York 17, N. Y.

**POEMS** Wanted for musical setting and recording. Send poems. Free examination. Crown Music Company, 49-C West 32 Street, New York 1

**ELECTRIC** Guitars, amplifiers, wholesale. Free catalog. Carvin, PMM, Covina, Calif.

**GUITAR**, Banjo Making books, Plans, woods, necks, tools. List 15¢. Satinwood, 510 East 11th Street, New York 9, N. Y.

**POEMS** Needed. Surprising offer. Free recordings. Successful Songs, 6 North, Danbury 4, Connecticut.

**SONGS** Wanted. Pay royalties. Send thirty cents for copy. Song Request Magazine, Mount Morris, Michigan.

**FOLK** Guitars, banjos. Catalogue 25¢. Main, 4139 Main, Skokie, Ill.

**PIANO** Self-Teaching Book. Includes popular, classical, harmony, theory, chords, scales. Price \$5.00. LaPont Publishing, Box 606-P, Franklin, Michigan.

**POEMS Wanted.** If accepted, you receive contract guaranteeing you free musical setting, sole ownership of complete song, and your record released for sale to the public. Silverstone Records, 6311 Yucca, Studio 3, Hollywood, California 90028.

**DRUM** Outfits, guitars. Buy direct, save. Alas Instrument Co., 874 Broadway, New York 3, N.Y.

**SONGPOEMS Wanted!** Collaborate with professional songwriters equally. Share royalties. Songwriters Contact, 1619-D, Broadway, New York 19.

**SWISS** Musical movements—boxes. Mechanical, electrical, Spielman, 131 West 42nd Street, New York 10036.

**ACCORDION-O-RAMA.** 874 Broadway, New York 3, N. Y. Tremendous discounts. Top brands. Free brochure.

**ACCORDIONS,** Guitars, drums. Wholesale prices. Free catalogue. Allied, 406 East 189th Street, Bronx, New York 10458.

**POEMS** Wanted for musical setting and recording by America's largest song studio. Send poems. Free examination. Five Star Music Masters, 6-M Beacon, Boston 8, Mass.

## RADIO, TELEVISION AND ELECTRONICS

**TAPE** Recorders, hi-fi components. Sleep learning equipment, tapes. Unusual values. Free catalog. Dressner, 1523 Jericho Tpke, New Hyde Park 3, N. Y.

**33¢ RADIO & TV** tubes. Free list. Cornell, 4213-17 University, San Diego 5, California.

**TRANSISTOR** Radios repaired: \$5.00. Covers repair, return postage. Guaranteed. Mail radio, \$5.00 to D & W Electronics, 124 Hilltop, Baxter, W.Va. 26560.

**ASTOUNDING** Government Surplus illustrated electronics catalog 10¢. Meshna, Nahant, Mass.

**RECORDS,** Tapes at cost! Factory sealed. Box 1601-M, Des Moines, Iowa 50306.

**AMPEX** Recording tape, third off. Information: Box 342, Columbia, Missouri.

**SARKES** Tarzian's galaxie tensilized Mylar: 1800"/1.69, 2400" 2.79, 3600"/3.89. Postpaid. Free all-components, tape catalog. Pofe, 1716-PM Northfield, Muncie, Indiana.

**FREE** Electronics catalog. Typical bargain. Fifty piece radio and television assortment of parts only 98¢, value \$15.00. Electrolabs, Department C-608B, Hewlett, New York 11557.

**HEAR** Aircraft emergencies, tower, weather, 9 transistor portable AM-FM-Aircraft receiver (VHF) \$26.50. Other bargains. Free details. Transco, Box 13482, North County Station, St. Louis 38, Missouri.

**TRANSISTOR** Semi-kits. Many projects available. Free catalog. Paulin Sales, Box 122C, Upland, Calif.

**DIAGRAMS,** Service material, radio, television, \$1.00. Supreme Publications, 1760 Balsam, Highland Park, Illinois 60035.

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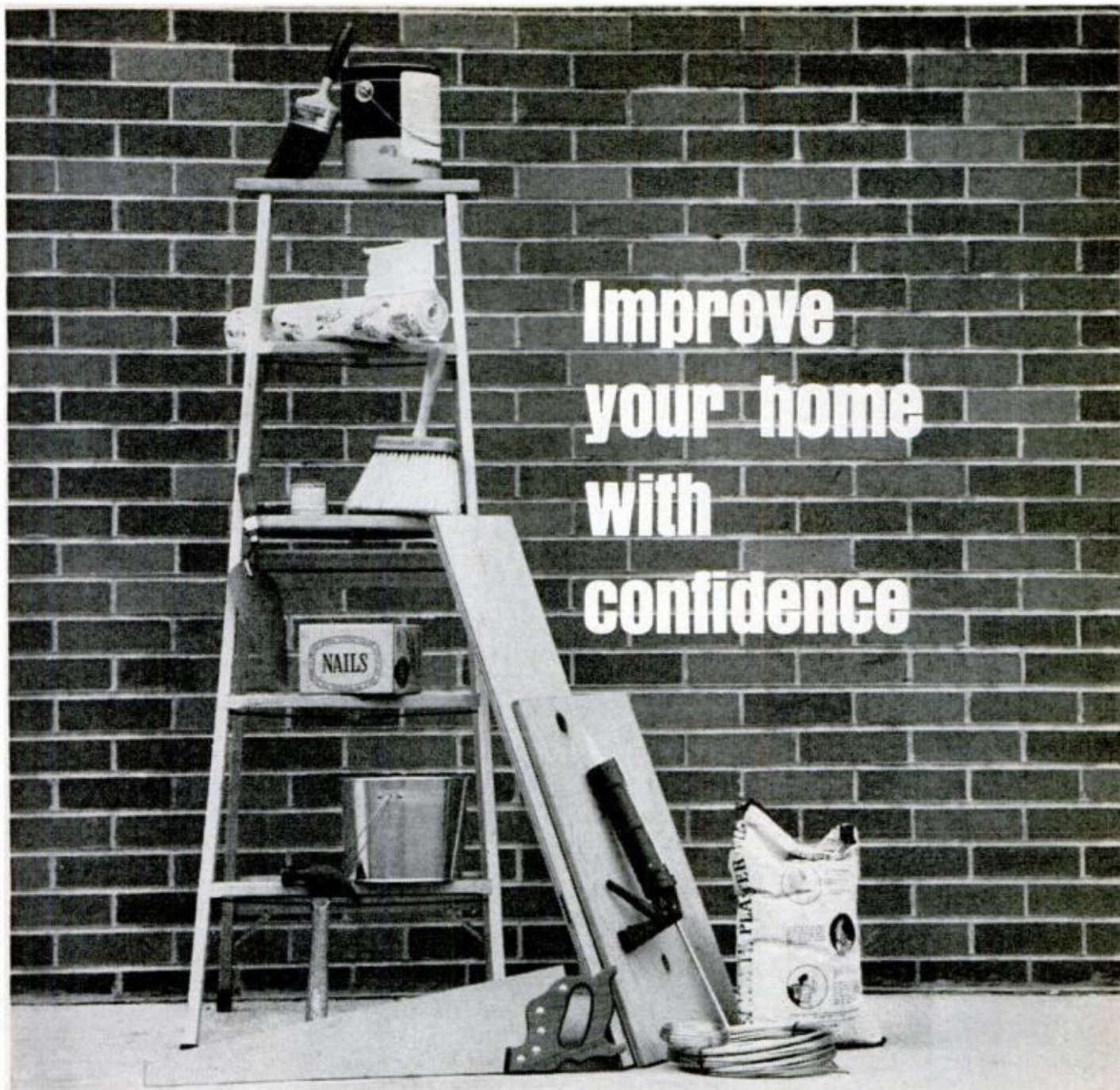
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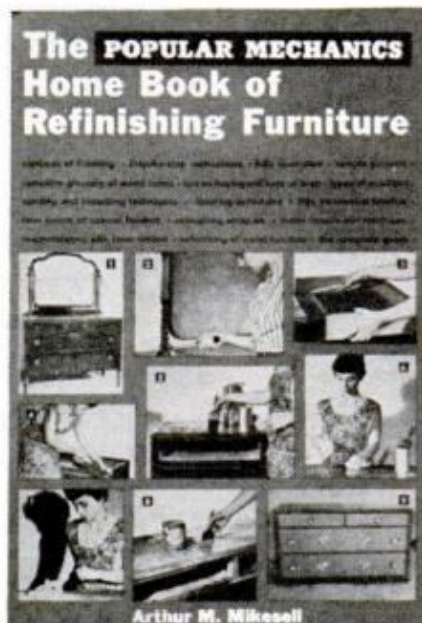
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With the protective metal casing removed, it can be used as a single-burner stove, and with the addition of a lantern head it can be used as a lantern. Made by Adams Bros. Mfg. Co., Pittsburgh, Pa., it sells for \$19.95.

## How Hard Is Your Water?

If you've wondered whether the water in your area is hard enough to cause trouble, here's a simple and relatively accurate test you can make:

Get a small quantity of pure liquid soap. This is available at most drugstores (ask for tincture of green soap Lilly No. 100, or U.S.P. XV soap). Add the soap, one drop at a time, to one ounce of water in a small bottle. After each drop, shake the bottle vigorously. Continue adding soap until a good quantity of lasting suds appears.

The number of drops you added to the water before lasting suds formed is an approximate indication—in grains of hardness per gallon—of the hardness of your water supply. Anything under three grains is considered soft water, but hardness may range as high as 100 grains. This simple test may indicate whether you require a water softener.

POPULAR MECHANICS



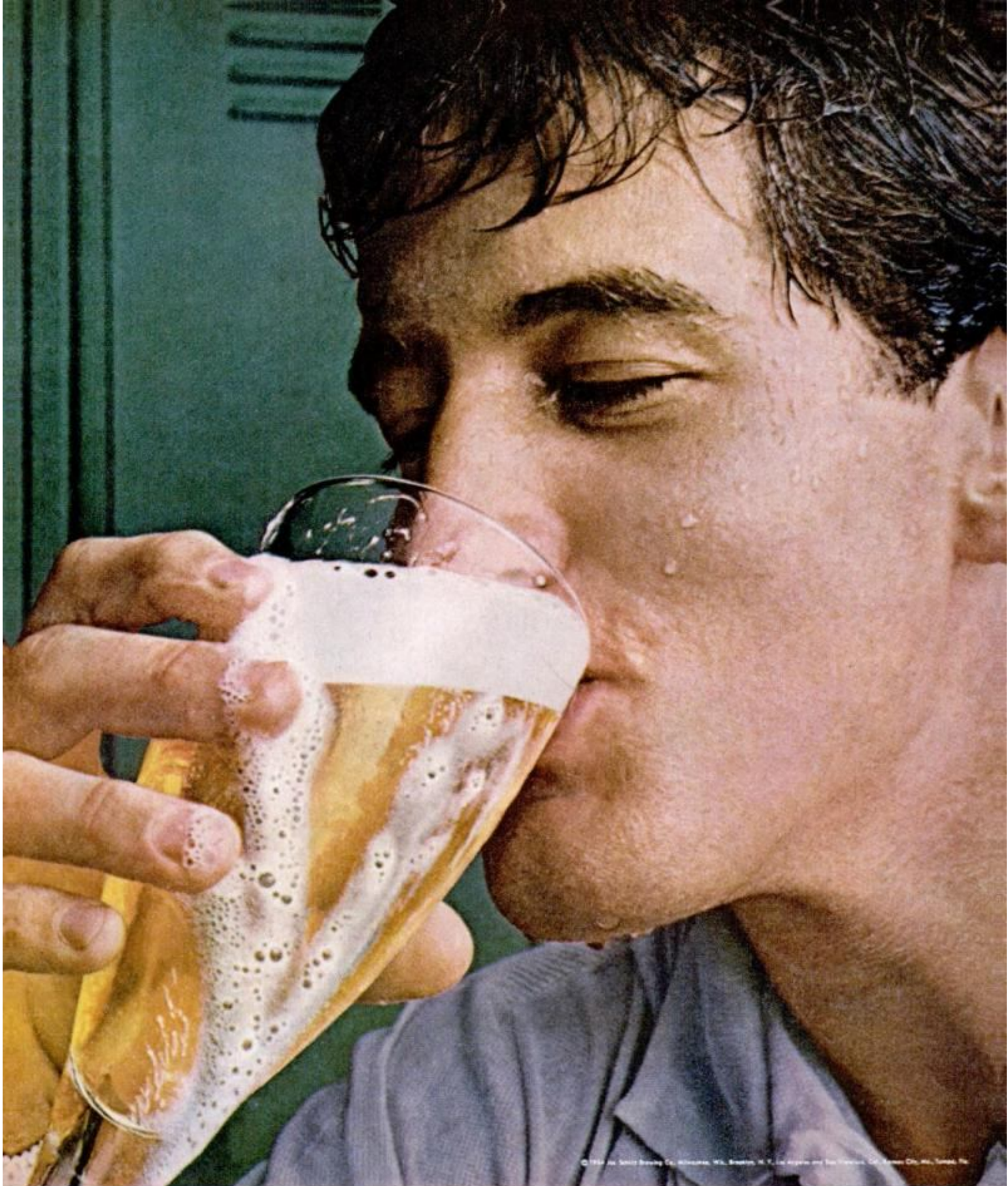
### ***The RANGER has arrived!***

This new White Owl shape stands above the crowd. The Ranger is Texas-tall and slim as a branding iron. It corrals flavor and mildness as no other cigar ever has, and there's peace of mind in every puff. As with

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*Schlitz gets to a man's thirst quick. No guesswork about flavor. Comes at you with gusto. Satisfying Schlitz.*

# real gusto



*in a great light beer*

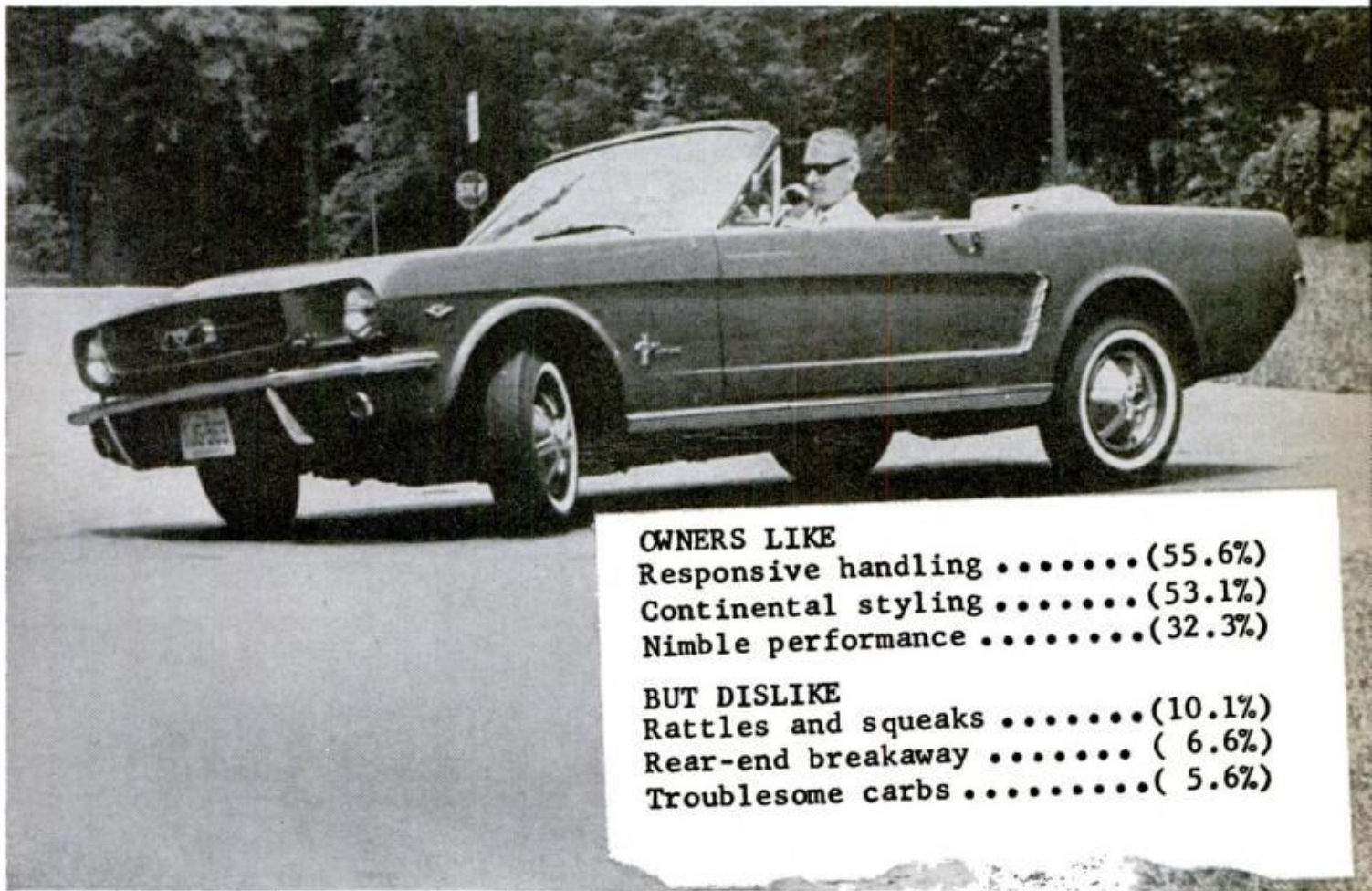
The Beer that made Milwaukee Famous simply because it tastes so good.

A Nationwide Survey on the  
Ford Mustang Based on  
850,000 Owner-Driven Miles



# Ford Mustangs

## How Their Owners Rate Them



**OWNERS LIKE**  
Responsive handling ..... (55.6%)  
Continental styling ..... (53.1%)  
Nimble performance ..... (32.3%)

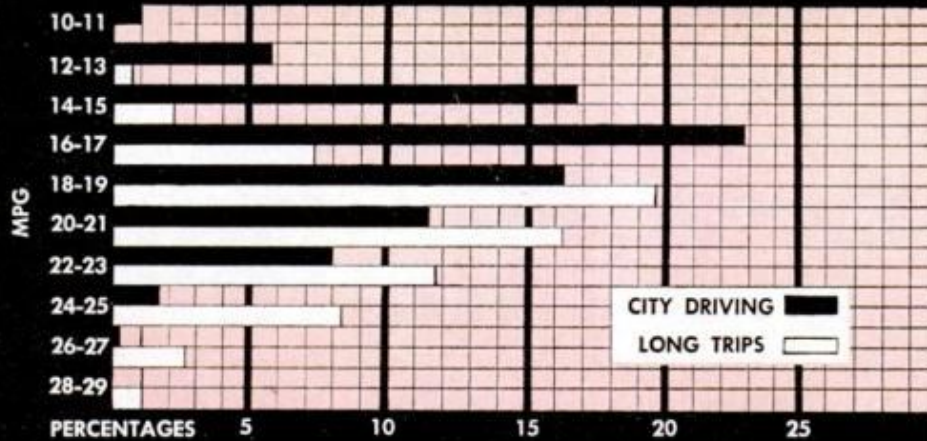
**BUT DISLIKE**  
Rattles and squeaks ..... (10.1%)  
Rear-end breakaway ..... ( 6.6%)  
Troublesome carbs ..... ( 5.6%)

*Marginal and boldface comments by Ed Nelson,  
PM's Automotive Editor*

**T**HERE ARE NO WARTS on the snub nose of the new Ford Mustang. And even if there were, its excited owners probably wouldn't notice. They love it that much. They'll speak of how much they enjoy its no-lean cornering, nimble performance, firm brakes and snug buckets. But a real note of affection creeps in when they start praising that long-hooded continental styling—and what it means to them.

Some almost find the Mustang a personal Fountain of Youth. A Pittsburgh housewife said, "I feel five years younger driving it." And she was outdone by the mortician who told us, "It

## WHAT MILEAGE DO MUSTANG OWNERS GET?

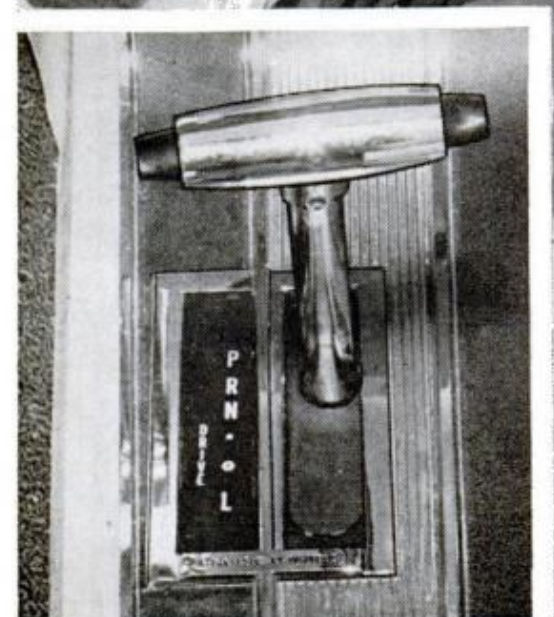


**UNUSUALLY WIDE RANGE IN REPORTED m.p.g.** Figures ranged from 8 in city driving up to a phenomenal 31 on long trips. Part of the discrepancy may be due to the large number of engines and transmission options available



↑ **GOOD** roadholding is feature most praised by owners. Lean is moderate. A heavy-duty suspension is available optionally; it makes the ride a bit harsher, but gives you excellent handling

**OPINION** was split on dash design. Asked about interior, 6.3 percent liked dash best and 6.3 percent like it least. The shift quadrant (inset) has no pointer to show what gear you're in





will never replace our Buick in some ways, but my wife and I feel 20 years younger in the Mustang." Several enthusiasts agree with the Minnesota travel agent's praise: "For my money, Ford has made only three cars—the Model T, the Model A and the Mustang."

Then there's the Ohio tool and die maker who rationalizes his delight this way: "It's a good compromise between cramped, underpowered sports imports and the normal American car in which I feel like I'm sitting on a box and aiming a big piece of iron."

Other owners talk of "having something *new* around our area." They tell how "other people love it" and "it attracts attention." Responsive handling and clean, rich interiors get praise. So does the price.

To get these responses, *Popular Mechanics* asked a thousand owners what they thought of their new Mustangs, what trouble, if any, they'd had, what their gas mileage was like, whether they'd buy another Mustang.

The affection Mustang owners have for their car doesn't blind them to its faults, however, though they often seem to rate them as relatively inconsequential: Rattles and squeaks bring the most complaints—but still only 10.1 percent. An extreme sample is the Alabama businessman who says his car "sounds very much like one that has gone a million miles." More soundproofing is needed, he believes.

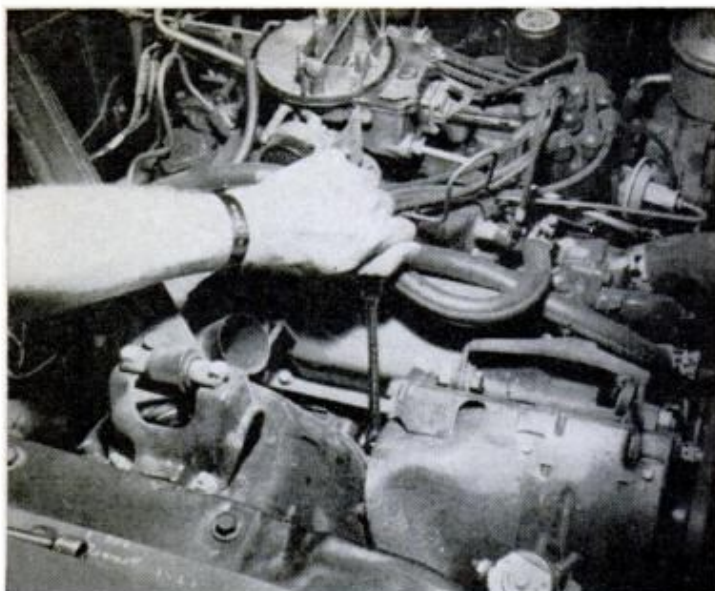
Some owners felt the rear end was too light. It sounds as though they're thinking of it breaking loose on curves. Our test car had a distinctly noticeable, but not dangerous, rear axle hop. Even with an optional engine and automatic transmission, the 3120-lb. convertible had only 56.4 percent of its weight on the front wheels—about normal. Of course the chopped-off rear end looks lighter than it is. For the sporty look, Ford took a Falcon-esque wheelbase and moved the passenger package well back. The result is a long hood and short rear deck.

A remarkable 80.6 percent of the owners rated their Mustangs Excellent. With the other cars we have tested during the '64 model year, an average of only 66.5 percent felt that

← **The advertised base price is certainly right—although you can option your way up toward the clouds if you choose to**



**TRUNK IS SMALL BY U.S. STANDARDS**, large compared to those of many sports cars. Only 2.4 percent of owners called for bigger one. Spare is easy to reach



**MECHANICS MAY SWEAR**, although owners didn't, about inaccessible spark plugs. You'll need a fistful of extensions to reach them. And watch your knuckles

way. Tops until the Mustang came along was Pontiac with Excellent votes from 72 percent of its owners.

During our own test of a 260-cu.-in. Mustang with automatic transmission, we used an electric fuel meter to check steady-speed gas consumption. Here are the results:

- At 30 miles an hour, 25.53 m. p. g.
- At 40 miles an hour, 23.70 m. p. g.
- At 50 miles an hour, 21.98 m. p. g.
- At 60 miles an hour, 20.93 m. p. g.
- At 70 miles an hour, 17.85 m. p. g.

Over all, including a liberal dose of city driving and repeated gas-gobbling acceleration tests, we dropped to an average 14 m. p. g.

From 40-60 m. p. h. we averaged 4.45 seconds; from 50-70 was 5.33 seconds. From a standing start (without pre-revving the engine or standing on the brakes before starting), we reached a true 60 m. p. h. in 9.63 seconds. The speedometer was surprisingly accurate.

*But the real story is in what the owners themselves have to say about the Mustang. Among their praises, here are the five most often mentioned:*

"Handling is far better than I anticipated."—California engineer.

"Handles very well on the road; I noticed this especially on curves."—Kentucky telephone switchman.

"Ease of handling and lovely response."—Wisconsin surgeon.

"I've been a Ford man for 13 years and this is the first one that doesn't look like a box."—Michigan inspector.

"It has fresh new styling."—Wisconsin telephone operator.

"It's smart looking with a young, sporty flair."—New York teacher.

"The smartest looking sports car."—Connecticut fuel dealer.

"I have a 260-cubic-inch engine and think it has plenty of zip."—Connecticut machine operator.

"It's fun to drive, small and peppy. (I never recovered from owning an MG.)"—Ohio engineer.

"I like the ride. With the light body, I thought it would ride harder."—New Jersey truck driver.

**Agreed. Our test car's cornering was surprisingly flat. But for sporting driving it still needs the heavy duty suspension** →

**Make that 'sports type' and I'll go along** →



"Surprisingly comfortable ride for a short wheelbase."—New Jersey attorney.

"I wanted an American car that would give good economy with sports car features, and I got it."—Delaware Air Force officer.

"I like the gas mileage. 18½ m. p. g. over-all."—California commercial artist.

*Owners' complaints, while far less common, are more specific than their praises. Here are the five most frequent "knocks":*

"I get some noisy rattle from the muffler."—Illinois teacher.

"Door locks are loose and rattle."—Oklahoma clothing retailer.

"The right headlight and antenna were loose when I got it. There's still a noisy rattle at times, but I think it can be fixed."—Kansas receptionist.

"The car may be too light for its power. Often on wet or smooth surfaces the wheels spin considerably."—New York florist.

"The rear end is too light and jumps around on bumpy roads."—Michigan insurance salesman.

"I've had carburetor trouble and a rough idle. It hasn't been corrected yet."—Ohio retailer.

"For one or two people it's very good, but not for more."—Ohio machinist.

"A large man cannot sit in the driver's seat."—Wisconsin surgeon.

"The only thing to change is the non-movable seat on the passenger's side."—Maryland mail carrier.

"Would you tell me why that front seat on the passenger's

(Please turn to page 202)

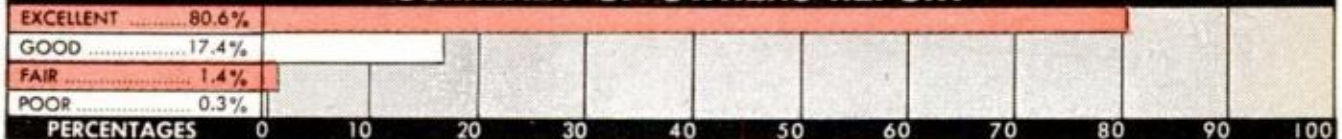
← You can feel breaks in the paving, but the car takes very bad roads fast and well

← Not unusual, especially early in the model run of a new car. Customer noise is one of the best cures for noisy cars

← Not true of our test car, but so many owners agree that we can't fight about it

← Long, lanky drivers had no complaint, but girth may create a problem with the jutting steering wheel

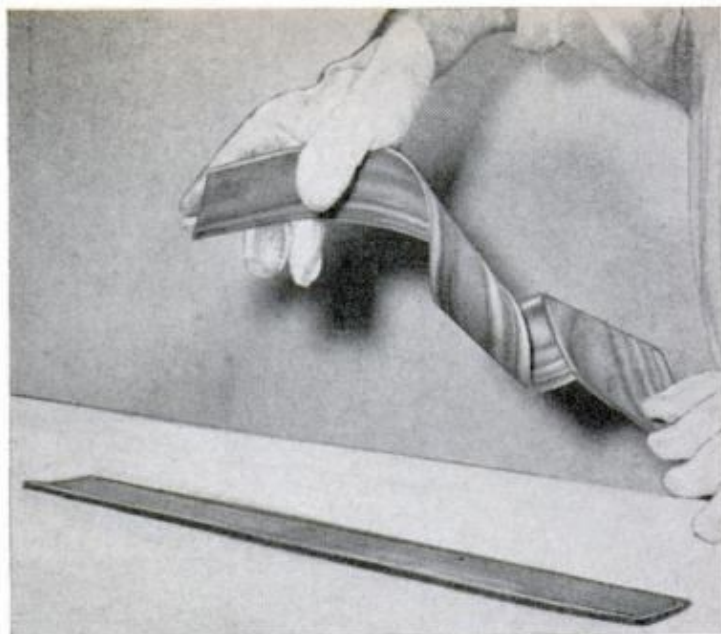
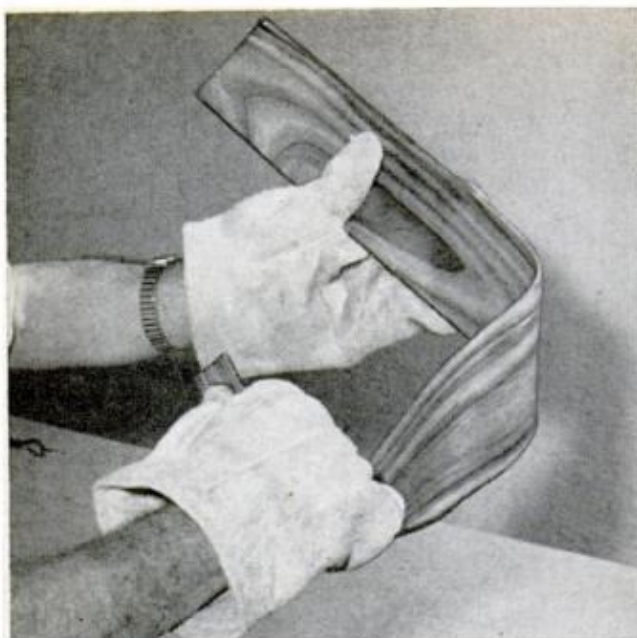
### SUMMARY OF OWNERS REPORT



<b>Fuel economy</b>	
About as expected	46.7%
Better	44.8
Not as good	5.5
<b>Best-liked features</b>	
Handling, roadability	59.4
Styling	53.1
Power, performance	32.3
Ride	20.5
Economy of operation	14.9
Size	10.8
Comfort	9.8
Bucket seats	7.3
<b>Specific complaints</b>	
Rattles and squeaks	10.1
Rear-end breakaway	6.6
Lack of interior room	5.6
Nonadjustable front passenger seat	4.5
Paint	3.8
Gearshift rattle	3.1
Gas cap	2.8
Tires	2.8
<b>Mechanical trouble, if any</b>	
None	74.6
Carburetor	5.6
Transmission	2.8
<b>Best-liked exterior style features</b>	
Long hood	11.5
Simple lines	9.0
Front end	5.6
Grille	4.5

<b>Least-liked exterior style features</b>	
Grille	5.6 %
Bumpers	5.2
Rear end	3.4
<b>Best-liked interior features</b>	
Bucket seats	40.6
Upholstery	7.0
Dashboard	6.3
Comfort	6.3
Instruments	3.8
Console	3.4
Roominess	3.4
<b>Least-liked interior features</b>	
Head and leg room	15.6
Nonadjustable front seat	9.7
Dashboard	6.3
Idiot lights	2.4
Hump in back seat	2.4
No rear ashtrays	2.4
<b>Decision to buy Mustang most influenced by:</b>	
Styling	61.8
Price	38.5
Size	14.2
Economy of operation	12.2
Power, performance	10.4
Ford reputation	9.7
Wanted sports car	9.0
Newness	4.5
Ease of handling	3.8
<b>Consider a different car?</b>	
Yes	47.9

<b>Other make considered</b>	
Ford	8.0%
Corvaire	6.3
Chevrolet	5.2
Volkswagen	3.1
Pontiac	3.1
<b>Is Mustang family's only car?</b>	
Yes	37.2
<b>Make of family's other car</b>	
Ford	20.8
Chevrolet	7.3
Falcon	4.9
Thunderbird	4.2
Oldsmobile	3.8
Cadillac	3.8
Mercury	3.4
Pontiac	2.8
<b>Make of car traded in</b>	
Ford	23.6
Falcon	10.4
Chevrolet	8.3
Thunderbird	4.2
Pontiac	2.4
Comet	2.4
Rambler	2.4
<b>How is dealer's service?</b>	
Excellent	56.0
Average	32.6
Poor	7.6
<b>Would you buy another Mustang?</b>	
Yes	86.4
No	4.9



THREE OR FOUR minutes after a bath in liquid ammonia at -30 deg. C., this strip of wood veneer starts to become flexible, grows more so as it warms up. Note that worker must wear asbestos gloves to protect his hands from the ammonia, as well as the intense cold. Process is still limited to thin wood

## New Dunking Technique Produces Wood with an Incredible Twist

By Rod Cochran

WOOD STRIPS DIPPED IN LIQUID AMMONIA can be bent into any sort of pretzel shapes—and they will permanently retain those “impossible” twists and curls.

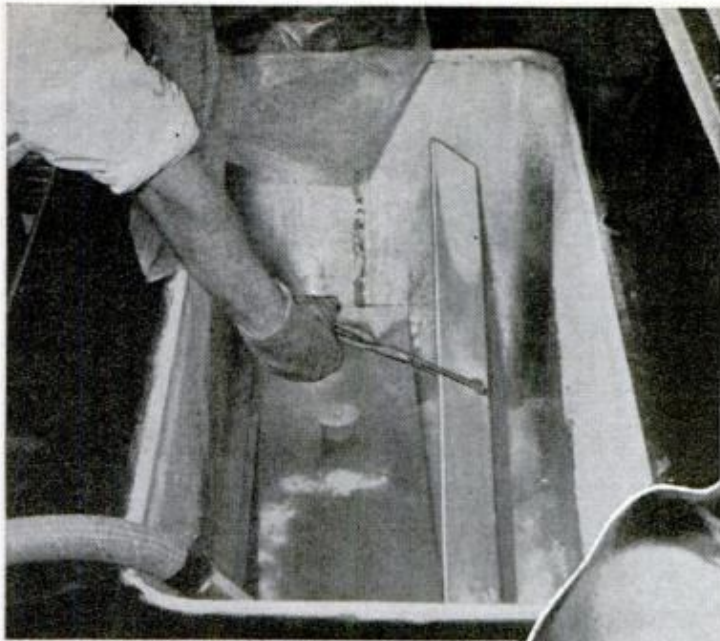
The technique is already being used for sculpturing, and scientists at the New York State College of Forestry, where the process was invented, feel that it can be employed in making many other kinds of wood products.

Their reasoning is based on experiments conducted by Dr. Conrad Schuerch, chairman of the college's Forest Chemistry Department. Dr. Schuerch found that after a 15- or 20-minute dunking in liquid ammonia (a common fertilizer), birch tongue depressors become leathery and could be bent and twisted into seemingly impossible shapes, which became permanent as the ammonia dried. Later, he used strips of ash, birch, elm, cherry and hickory veneer.

Unlike steam-bent wood, these ammonia-treated strips do not try to spring back to their original shape, even when placed in water or steam. This is because the ammonia temporarily alters the bonds within the cells and lignin of the wood, allowing the cells to slide past each other when the wood is bent. As the ammonia evaporates, new bonds form, and the wood returns to its original consistency.

At present, the new process is limited to sculpting of  $\frac{1}{8}$ -inch strips. Some plasticising of  $\frac{3}{4} \times \frac{3}{4} \times 12$  inch wood has been done and Dr. Schuerch feels thicker woods can be bent if they can evacuate air from the wood first.





**DUNKING TAKES PLACE** in a freezer (left) to minimize vaporization of ammonia. Wood is handled with tongs. Plastic sheet and vacuum-cleaner exhaust help control ammonia fumes rising from surface of ammonia

**MODERNISTIC WOOD SCULPTURE** (below) is easy with ammonia treatment. Here, Prof. George Earle, art instructor, shows some wildly contorted shapes that would be impossible with traditional steam bending



# **SPECIAL REPORT: Cockpit-Testing the**

**PM's aviation editor takes it off in 250 feet and hangs it on its props at 32 miles an hour**

By Kevin Brown

**I**T'S THE WEIRDEST AIRCRAFT I've ever been in. The fuselage and tail section are ordinary enough, but the wings are ridiculous. The outboard sections seem normal, but the inboard sections dip down in semicircles, coming up again to join the fuselage. Inside these horizontal half-moons, the engines are suspended on braces—backwards. The propellers are at the rear.

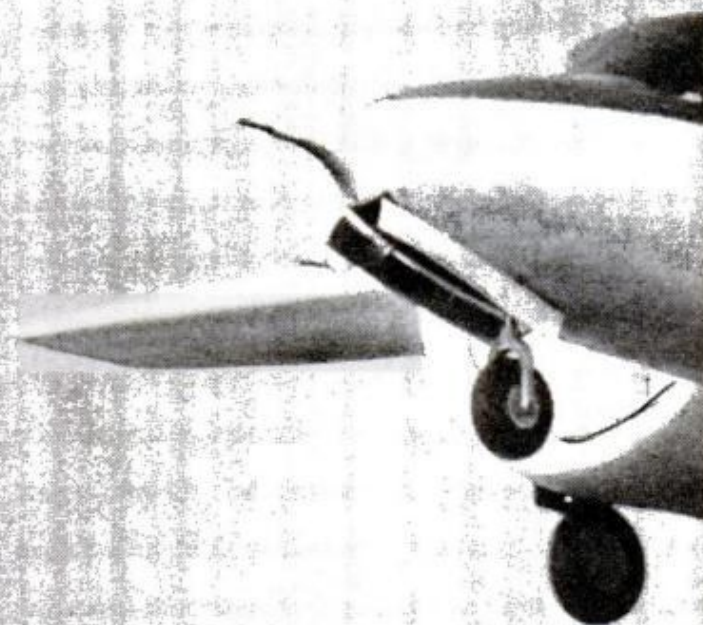
I taxied it to the end of the runway, performed a warmup, then jockeyed into position at the very edge. The power went on full with a roar—and I had to glance out the window to make sure the engines didn't fly off the mounts—then the brakes were released and I started down the runway. Before I crossed the first taxi strip, the nose came up, the plane wavered slightly, but I was airborne—in less than 250 feet, and in a slight crosswind.

That was my first take-off in a channel-wing aircraft, a plane whose story is almost as unbelievable as its configuration. Conceived as a short-takeoff-or-landing vehicle (STOL), its first pilotless model flew in 1927, twelve years before

Igor Sikorsky got the first helicopter off the ground. Yet, figuratively at least, the channel wing is still having trouble getting into the air. Hardly anyone wants to believe it will fly.

Yet it does, and perhaps the most unbelievable part of the story is the unshakable faith—and boyish enthusiasm—that the man who created it still has in it.

His name is Willard Custer of Hagerstown, Md. He is a simple man as is his



**EARLY VERSION OF CHANNEL WING, almost a skeleton, shows basic configuration, twin channels with reversed engines suspended on braces. Propellers pull air through channels at high speeds, reducing pressure, increasing lift**



# Legendary Channel-Wing

theory. Conventional airplanes get their lift by pulling their wings through the air. The channel wing gets its lift by pulling the air over the wing. Custer claims, in fact, he really doesn't need the rest of the wing — the channels alone would get the vehicle in the air.

The advantage of the channel wing, as with any STOL, is ability to take off and land in short distances. The special advantage, says Custer, is that it does so

without the complex internal mechanisms necessary for flaps, or tilting wings or engines, found on other STOLS. The channel wing has no internal mechanisms at all, except for the ailerons. Nor does it require any exotic materials. It's as if you took an ordinary wing and stamped the channels into it.

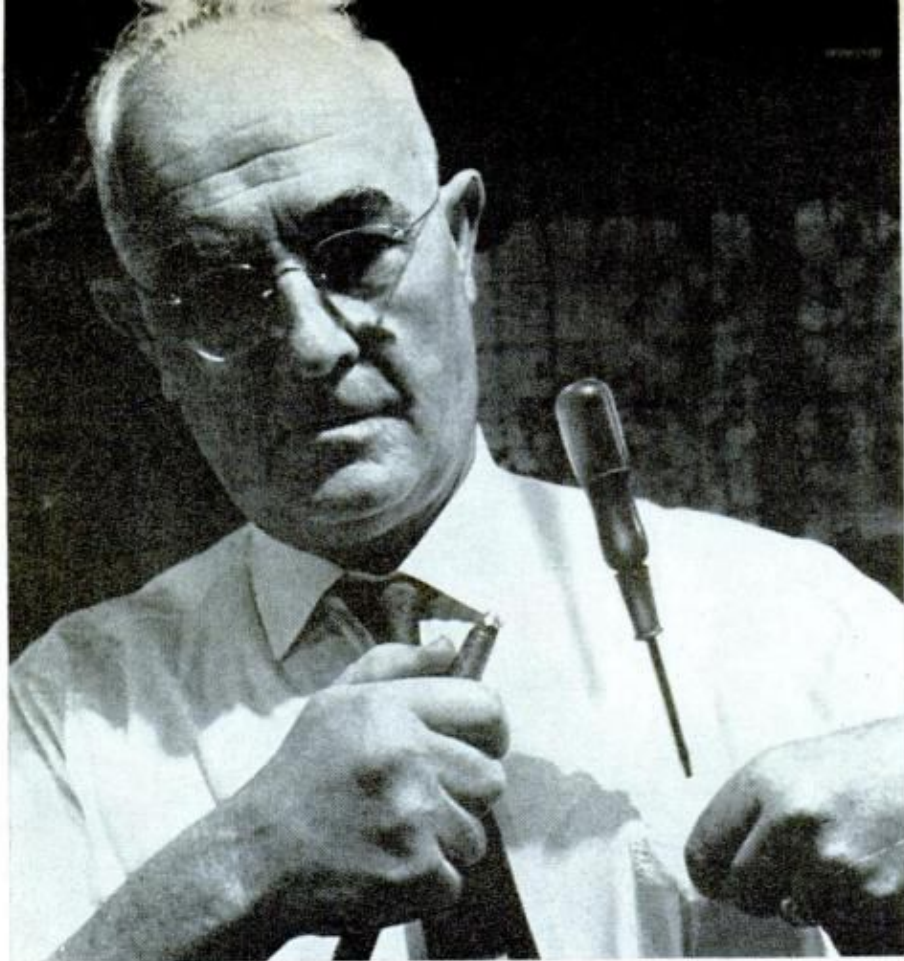
Further, the channel wing can fly straight-and-level well below ordinary stalling speed, without creating the drag

**CUSTER CHANNEL WING FLIES AGAIN**, a remarkable testament to a remarkable man who spent nearly 30 years trying to develop unique design for aircraft



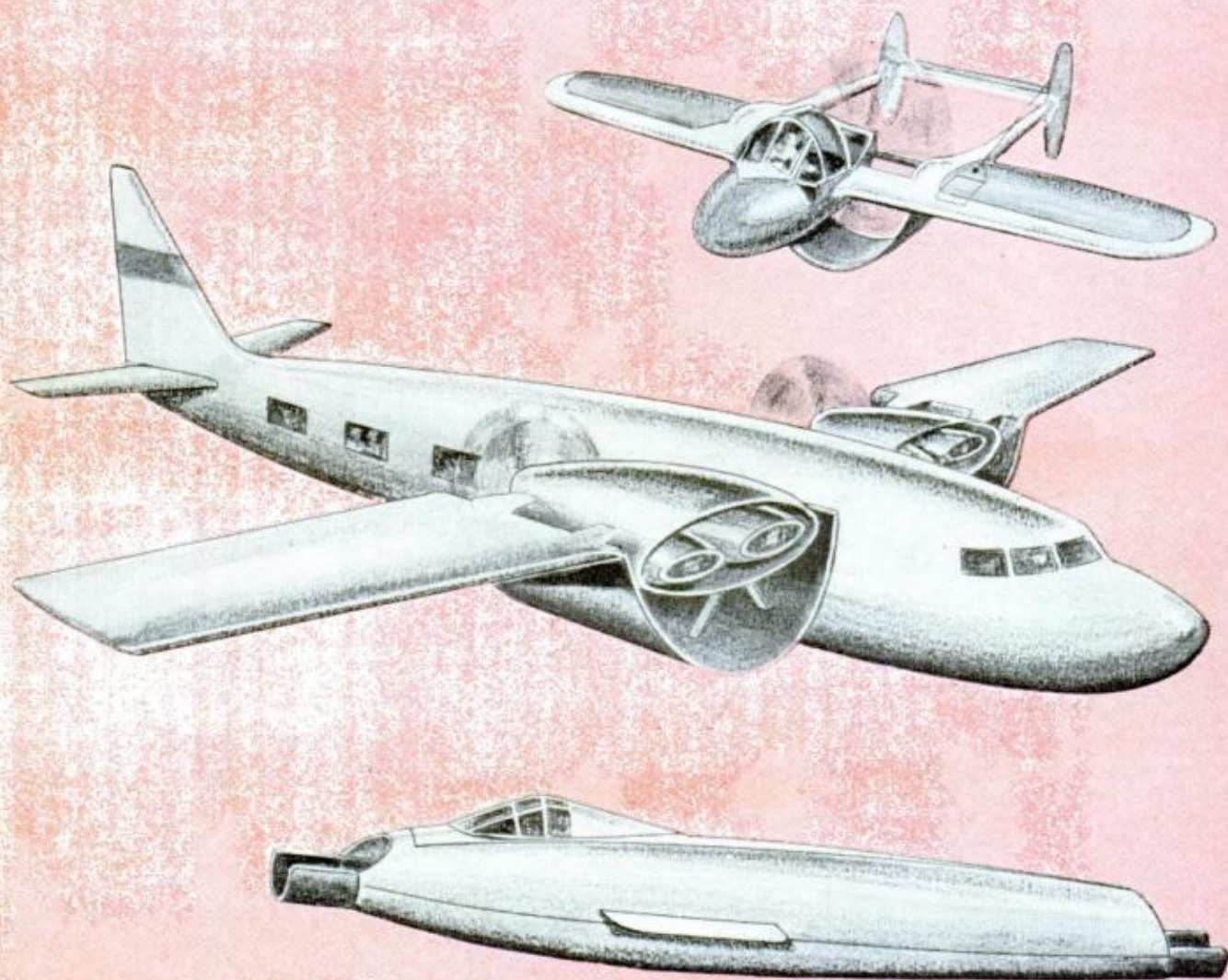
**LATEST VERSION IS HAND-MADE** improvement of prototype (above). Picture here shows it on its first taxi test last June. Author flew it on its fifth test flight, when the craft had a total flying time of just one hour and 45 minutes





**WILLARD CUSTER** demonstrates channel-wing theory. Blowing high-speed compressed air over top of screwdriver reduces pressure, creating lift. It will remain suspended as long as air holds it up. Channel-wing gets lift by blowing air through channel

**FUTURE VERSIONS** of channel wing aircraft include single-engine two-seater for private or business use, four-engine 20-passenger airliner for small-town service, and wingless jet that swivels tail channel for directional control the same way as missiles





**MAJOR ADVANTAGE** of channel wing is its ability to take off and land in small areas. Here prototype's nose starts rolling at 200 feet, clears runway within 250 feet. Prop sucking air through channel doubles the lift

inherent in flaps. And it does this without using the excessive power necessary for tilting wings and engines. Theoretically, it is getting both lift and thrust from the engines, where conventional aircraft get only thrust from engines and lift from the wings.

We had a chance to check these theories in the air, but the story of the channel wing would be empty without first telling the remarkable story of this man's long, lonely struggle to get it into the air.

It would be easy to play word games about Custer and his last stand—legitimate, in fact. Willard Custer is the great-grandnephew of General George Custer who made the legendary Last Stand at Little Big Horn in 1876. Custer's own story, however, has all the elements of an American legend all by itself, except—so far—complete success.

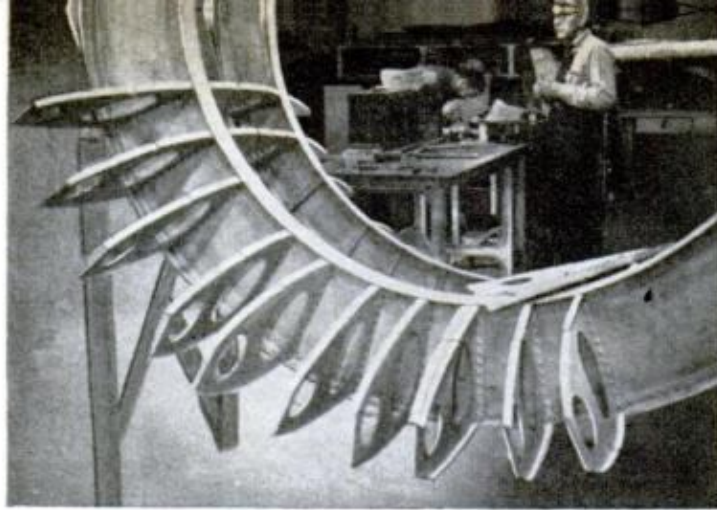
Born in 1899, the son of a blacksmith, he was too poor to go beyond high school. He was four when the Wright Brothers made history at Kitty Hawk and, as long as he can remember, he has wanted to fly. He read voraciously—"every aviation book I could get my hands on." But, be-

cause of his modest background, the closest he could get to his goal was as an auto mechanic. Even today, because of his do-it-yourself education, he has trouble explaining his theories to aeronautical engineers. Said one: "Don't worry if he confuses you. Just believe that he knows what he's talking about."

Custer's dream, he's fond of telling visitors, began one day in 1925 when he took refuge in a barn during a violent summer storm. The wind tore the roof off the barn and, for the next 15 years, he wondered why.

"The barn wasn't flying, it wasn't even moving. What made that roof move through the air?"

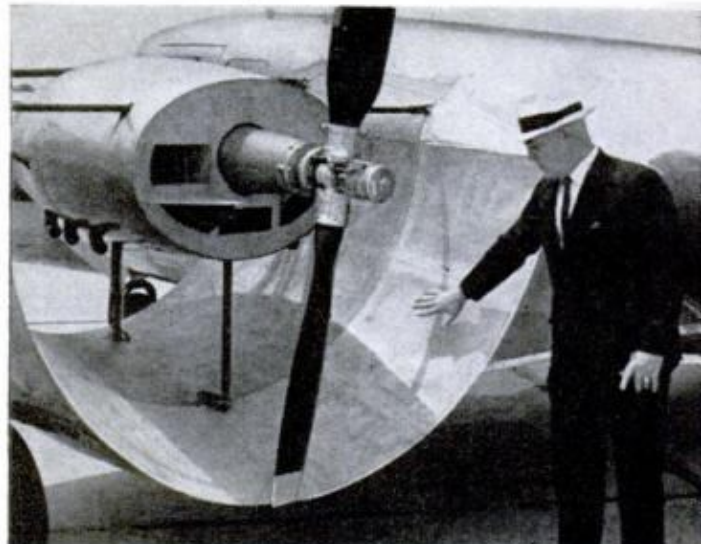
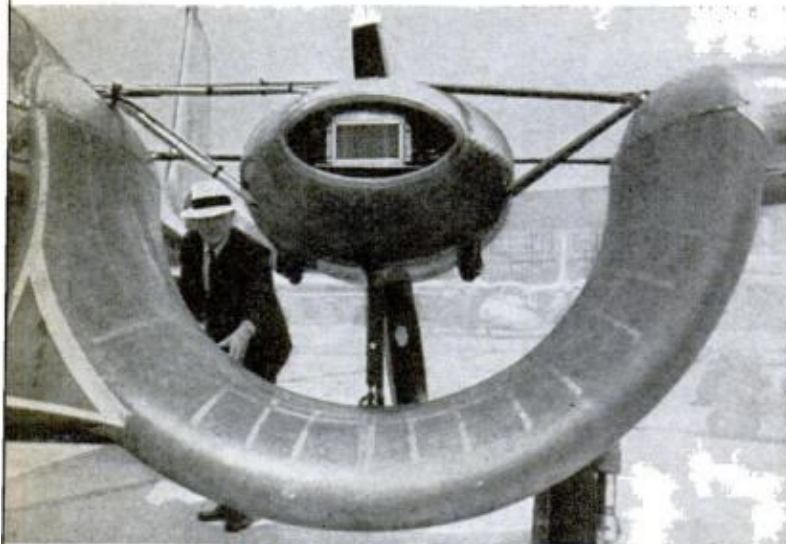
What evolved, of course, were his theories about moving the air over an object versus moving the object through the air. His first attempt to prove them were disastrous. He bolted an aircraft engine to the floor of his shop and constructed the first of his channels, a ramshackle three-sided affair with square corners. He couldn't afford tooling for a curved channel, so he just bolted three flat surfaces together.



**CUTAWAY VIEW** of channel shows it is made same way as wing sections, with usual spars and ribs. There are no exotic materials in channel, shape alone determining amount of lift

**FRONT VIEW** (below left) shows cambered surface which helps maximize lift. Channel's leading edge has glass-fiber skin. Fairing at fuselage was added on production model

**REAR VIEW** shows how close prop skims trailing edge to get maximum amount of boundary-layer control. Custer couldn't get engine he wanted for this plane, hence bare prop hub



When he started the engine, the propeller began pulling air through the channel. He almost destroyed the shop. But let him tell it, and see if you can follow it:

"I didn't know what power I was dealing with. I was dealing with atmospheric pressure. That's 14.7 pounds per square inch at sea level, and 14.7 pounds per square inch is more than a ton of pressure per square foot. Just figure it out—144 inches times 14.7 pounds.

"Why, when that prop started sucking air through the channel, it created a vacuum. Nature abhors a vacuum and wants to fill it up. All that pressure on the outside of the channel crushed it. Not only that, the windows broke and the walls sagged. If I didn't have the door open, the whole shop would have come down."

Translation: It's a law of physics that, when air speeds up, pressure is lowered. The prop sped up the air through the channel, reducing pressure inside it, while the air outside the channel remained static at a normal 14.7-p.s.i. pressure. The difference in pressure was enough to crush the rinky-dink channel.

"The solution," Custer continued, "was to build the channel strong enough so it

wouldn't crush. So, with the vacuum inside it, it would rise like a cork in water."

That was his dream, to produce this "crush-proof" vacuum channel and adapt it to aircraft so they could "rise like a cork in water."

Meanwhile, he had a job and a family to think about. He moved from working on autos to selling them and, with his natural enthusiasm, he became pretty good at it—averaging more than \$100 a week during the 1930s when that sum was a mint. But he couldn't shake the dream.

So in 1937 Custer made his last stand. He quit his job and decided to devote the rest of his life to the channel wing. He borrowed some money from friends, ringing doorbells, button-holing people on the street—and making some enemies. Eventually he formed a corporation and sold stock. But, by his own estimate, for nearly 30 years he has been broke "about every six months." He recalls one three-year period when he and his wife and four children ate only what they could grow in the garden behind their home. While former friends crossed to the other side of the street to avoid him, his family stuck

[\(Please turn to page 216\)](#)



## Flex Wing Trailer

Flex Wings, towed by helicopters, can carry aloft Jeeps and other small Army vehicles, increasing the load the helicopter could otherwise carry alone.

The Jeep is driven to a clearing, attached to the Flex Wing which is connected to the helicopter by cable. The Flex Wing is towed a short distance until it gets sufficient aerodynamic lift in its wing to rise off the ground, hauling the Jeep up with it.

Pay loads as high as 1300 pounds have been towed aloft.

For a report on the Flex Wing used as an aircraft wing, see *I Flew the Pterodactyl Flex Wing*, page 85, Nov. 1961 PM.



## Rakish Two-Wheeler

Rakishly styled, the new DKW Wondercycle has a 50-cc., two-cycle engine with only eight moving parts. Five models, ranging from 2 to 4.2 hp., are priced from \$299 to \$419. The West German product is available through Kramer-American Distributing, 14401 Sylvan St., Van Nuys, Calif.



## Jungle Radio

Designed for use in rugged terrain, a new lightweight sending-receiving radio enables dismantled or airborne troops to operate from forward areas without the burden of carrying heavy electronic equipment. Called the AN/PRC-64, it successfully passed development tests in Hawaii.



# New 152-m.p.h. Challenger for the Title of *World's Fastest Train*

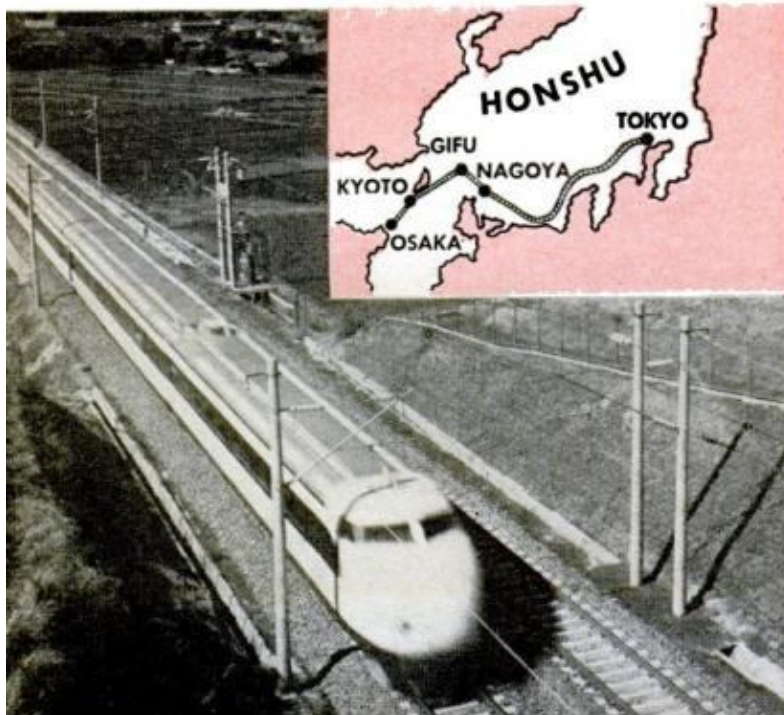
By Elliott McCleary

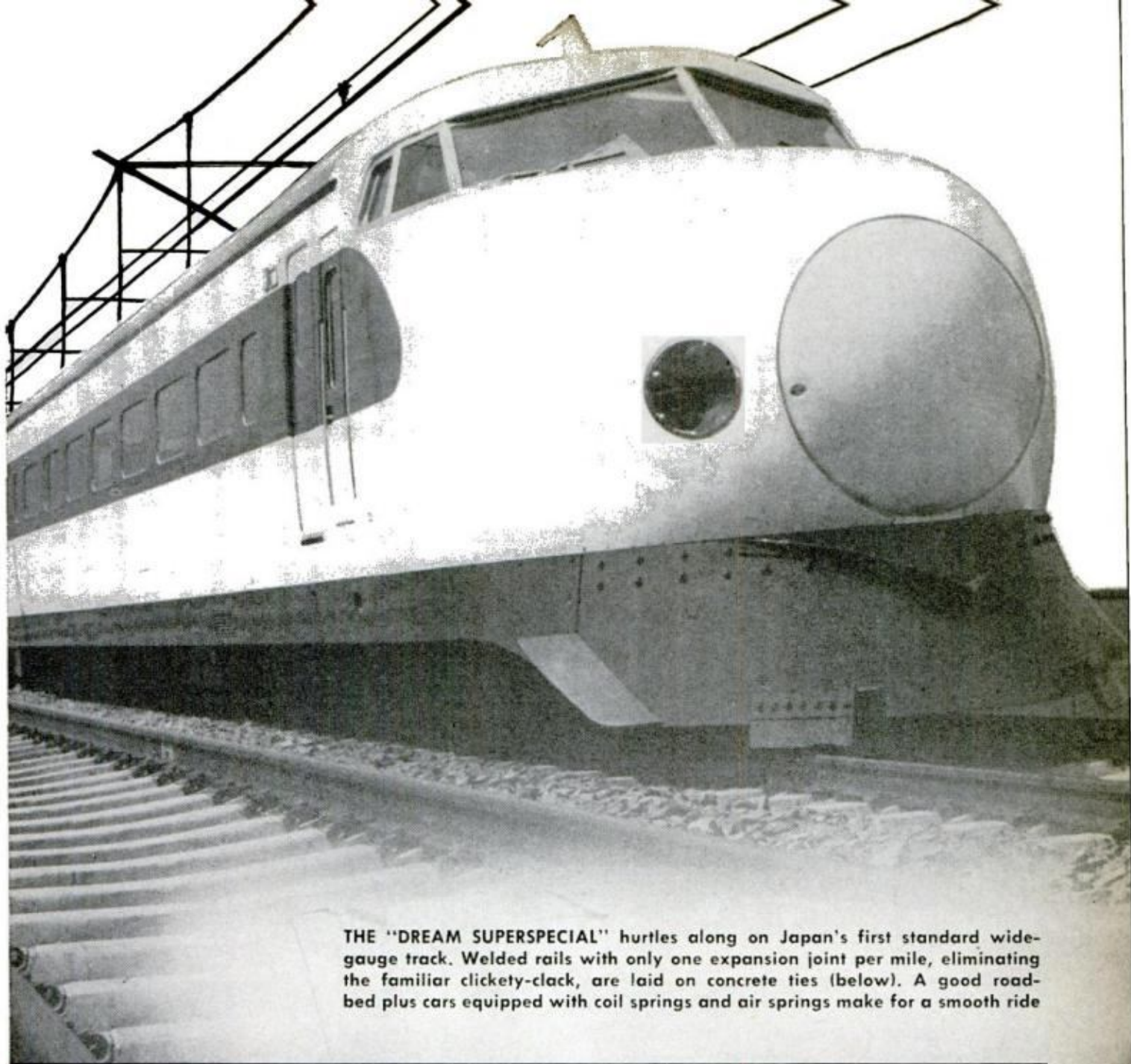
IN JAPAN THE TRAIN is no creaky relic. This fall, service will be started on a new line between Tokyo and Osaka that promises to be the world's fastest. Twelve-car streamliners will average 80 m.p.h., covering the 320 miles in four hours—a time that railroad officials plan to reduce gradually to three hours by having trains maintain a speed of 125 m.p.h. for long stretches.

That means that Japan's "Dream Superspecial" is an odds-on favorite to leave France's *Mistral*, record-holder for scheduled trains, in the dust; the *Mistral* averages 82.5 m.p.h. on the 195-mile run between Paris and Dijon. Only the flat-out speed record of 206 m.p.h., established by a French train in a special test in 1955, will elude Japan's new Superspecial, which has clocked 152 m.p.h. in trial runs.

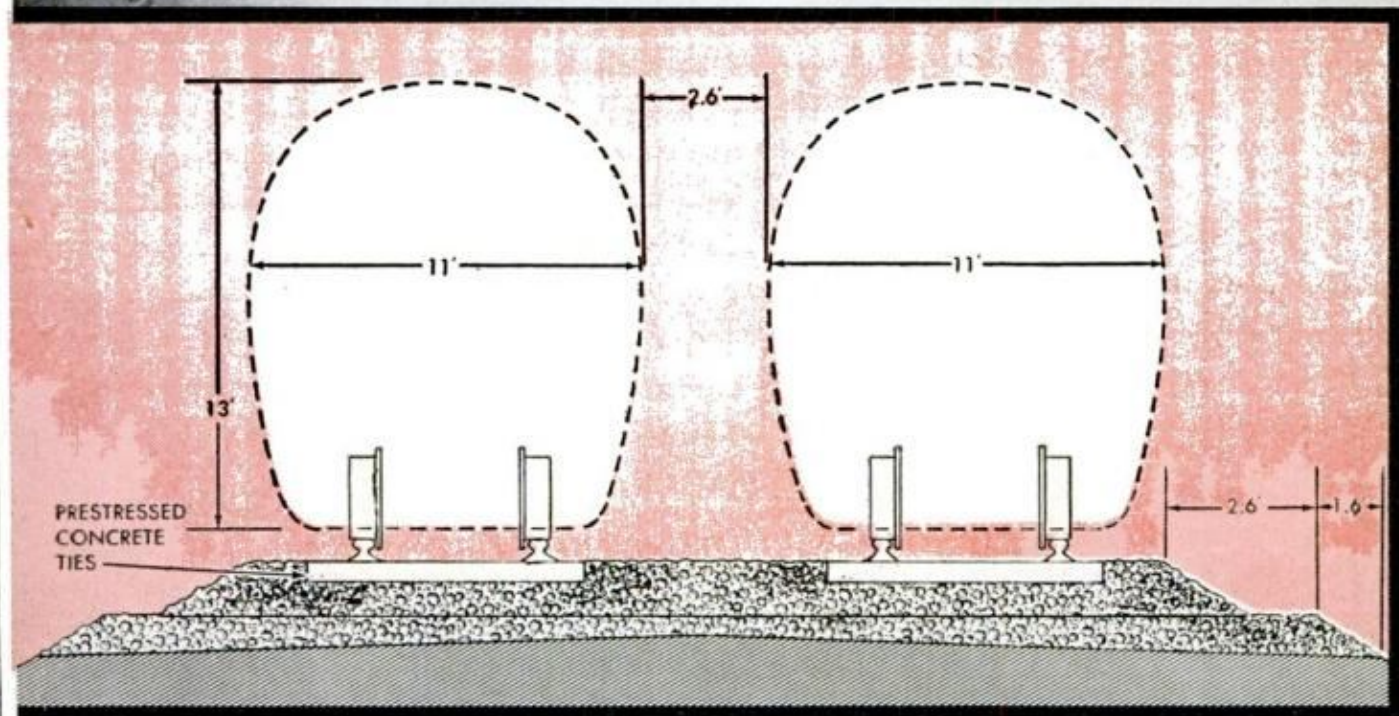
The high operating speeds necessitate a relatively straight track—no curve is more than  $\frac{4}{100}$ ths of a degree—and special safety mechanisms. Besides several different electronic warning devices, there's Automatic Train Control. If the engineer isn't quick enough, A. T. C.—a transistorized track-to-cab control system—will slow the train automatically if it's too close to the one ahead, resume speed when danger is past, pick out the right track in moving into a station and bring the train to a stop.

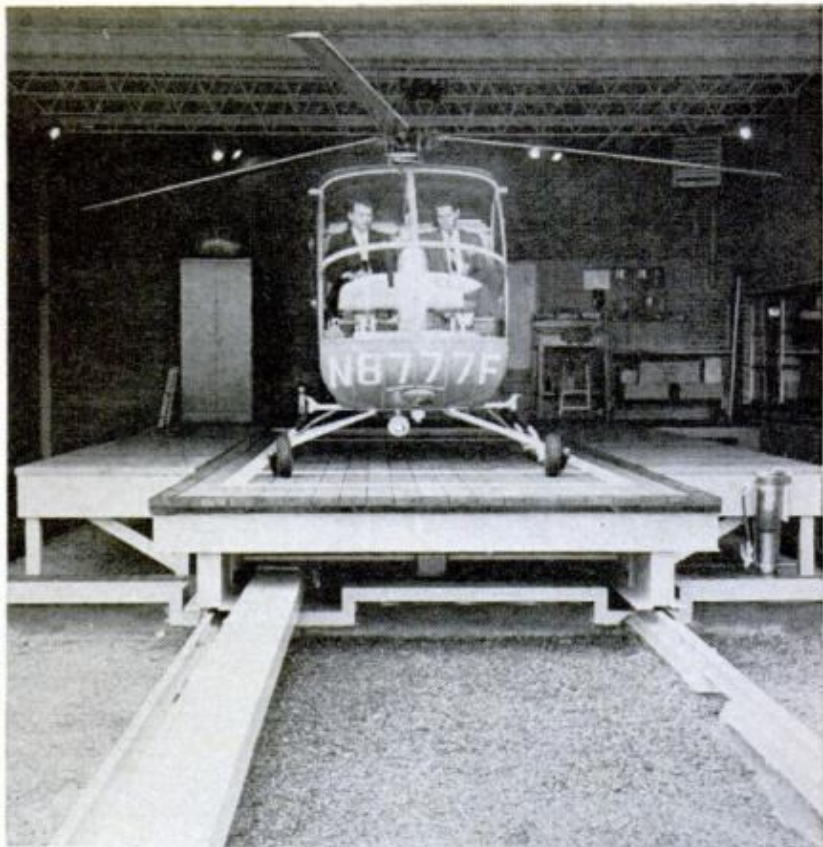
**THE NEW RAILWAY** brings needed service to industrialized area (inset) that contains 40 percent of Japan's population. Cars (below, right) boast of phone service and seat radio earphones, and are pressurized to spare passengers the discomfort of popping ears when train passes another or enters tunnel





THE "DREAM SUPERSPECIAL" hurtles along on Japan's first standard wide-gauge track. Welded rails with only one expansion joint per mile, eliminating the familiar clickety-clack, are laid on concrete ties (below). A good road-bed plus cars equipped with coil springs and air springs make for a smooth ride





## Helicopter Flies from Sliding Deck on Roof

Launching a helicopter from the roof of the *Peoria Journal Star* building is largely a matter of pushbutton punching.

While still in the roof-top hangar, the pilot pushes the button. The hangar doors open, and a 10-by-20-foot deck section

slides forward carrying the helicopter while the pilot starts the engine. The hangar doors close behind, and as the deck section approaches the take-off platform, the launching area lights up. On the copter's return, the sequence is reversed.

## Safe Sipper

With two caps—one a cup and the second with its own plastic straw—a new plastic drink dispenser is virtually spill-proof. Priced at 98 cents, Kwik-Sip is available from Nevil Enterprises, Savoy-Hilton Hotel, 58th and 5th Ave., New York.



## Easy for Skiers

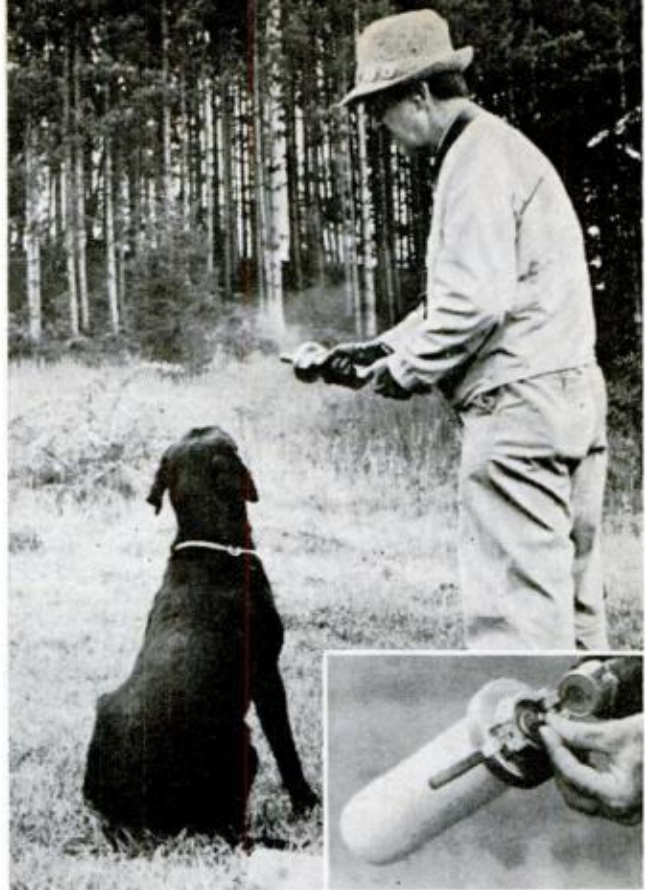
Bow and stern ladders for skiers are features of the new 15-foot Jet Sport fiberglass boat. Powered by 78 or 100-horsepower engines, the jet boats sell for \$2495 and \$2695. Fox Jet Craft Boats, 7644 Knox Ave. South, Minneapolis, Minn.





### Heads-Up Golf

Keeping a golfer's head properly positioned is the purpose of the Headshrinker, a new practice aid. The metal ring reminds him not to sway or duck as he swings. Price is \$9.95 from L. A. Supply Co., 2261 So. Atlantic Blvd., Los Angeles, Calif. 90022.



### Teaching Aid for Field Dogs

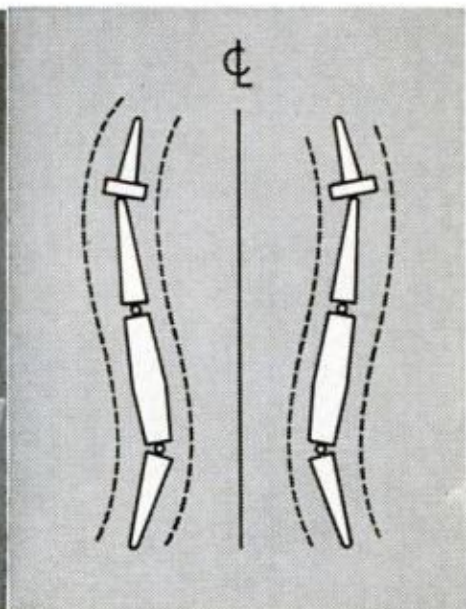
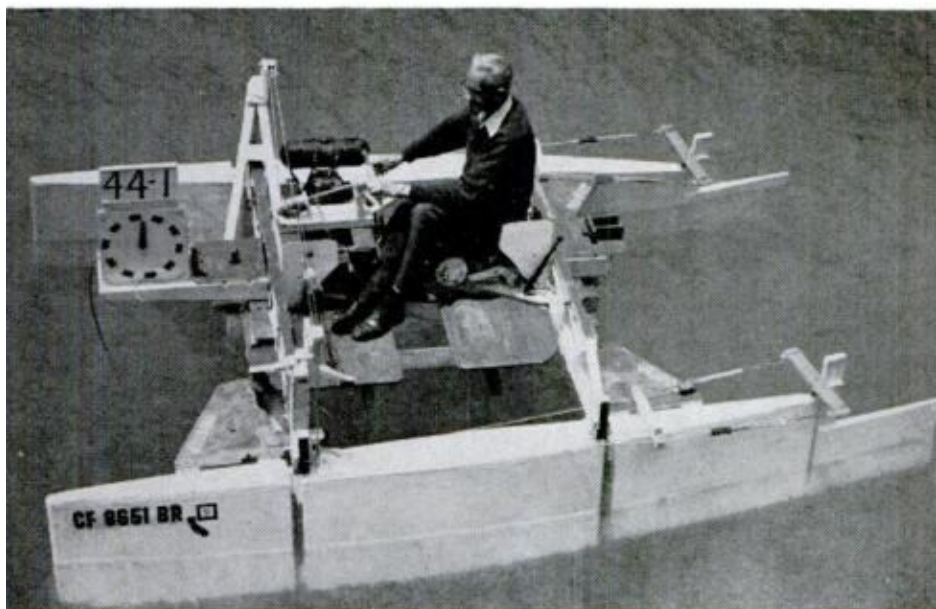
Firing a plastic "bumper" up to 100 yards, a new trainer accustoms a dog to the report of a gun and teaches him to retrieve. The cartridges are .22-caliber blanks. Price is \$29.95; Abercrombie & Fitch, Madison Ave. and 45th, New York.

### Catamaran Wiggles Through the Water Like a Fish

Literally swimming like a fish, a catamaran built by Glenn Bowlus of California undulates its three hinged sections to produce forward motion without the use of a propeller.

A small gasoline engine mounted on the

deck between the twin pontoons creates the wiggle in the sections through a series of gears. A rudder is attached to the rear of each pontoon. Bowlus has found that the undulating motion does not cause any turbulence or cavitation.



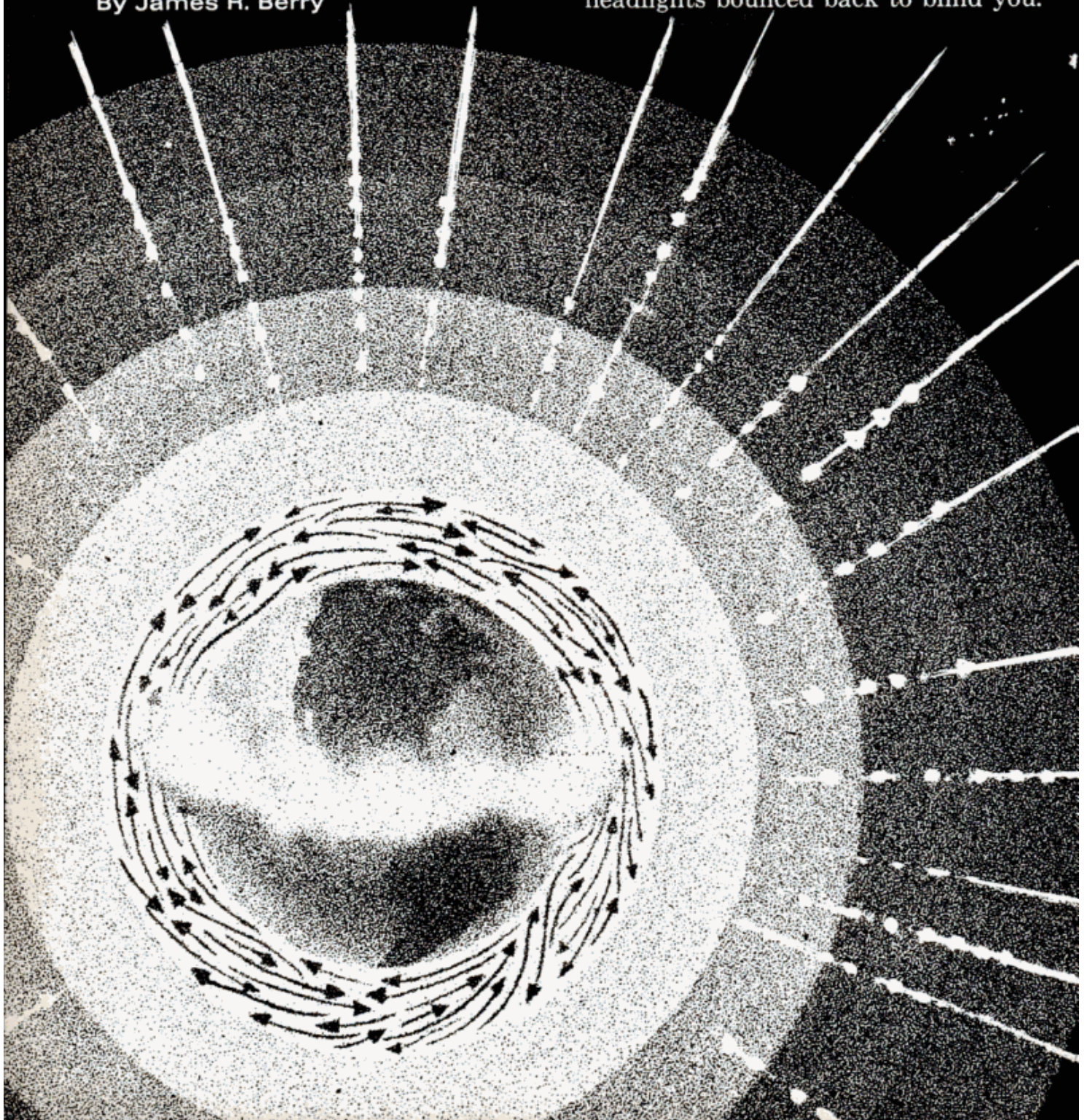
# Our Star-Gazing Satellite

*At 500 miles, this space eye will surmount distortion that keeps earth's astronomers from unlocking space secrets*

By James R. Berry

**I**F YOU'VE EVER driven in fog at night, you can appreciate the feelings that must sometimes overcome our astronomers. Remember how it was?

Though you knew that all kinds of objects—houses, trees, other cars—were in front, you could barely see to the end of your own hood. Oncoming lights shimmered and blurred—and your own headlights bounced back to blind you.



# with 20-20 Vision

In short, you saw little.

Astronomers, too, see very little of "what's out front." But the fog that plagues them is of a very different sort. It's actually three different phenomena:

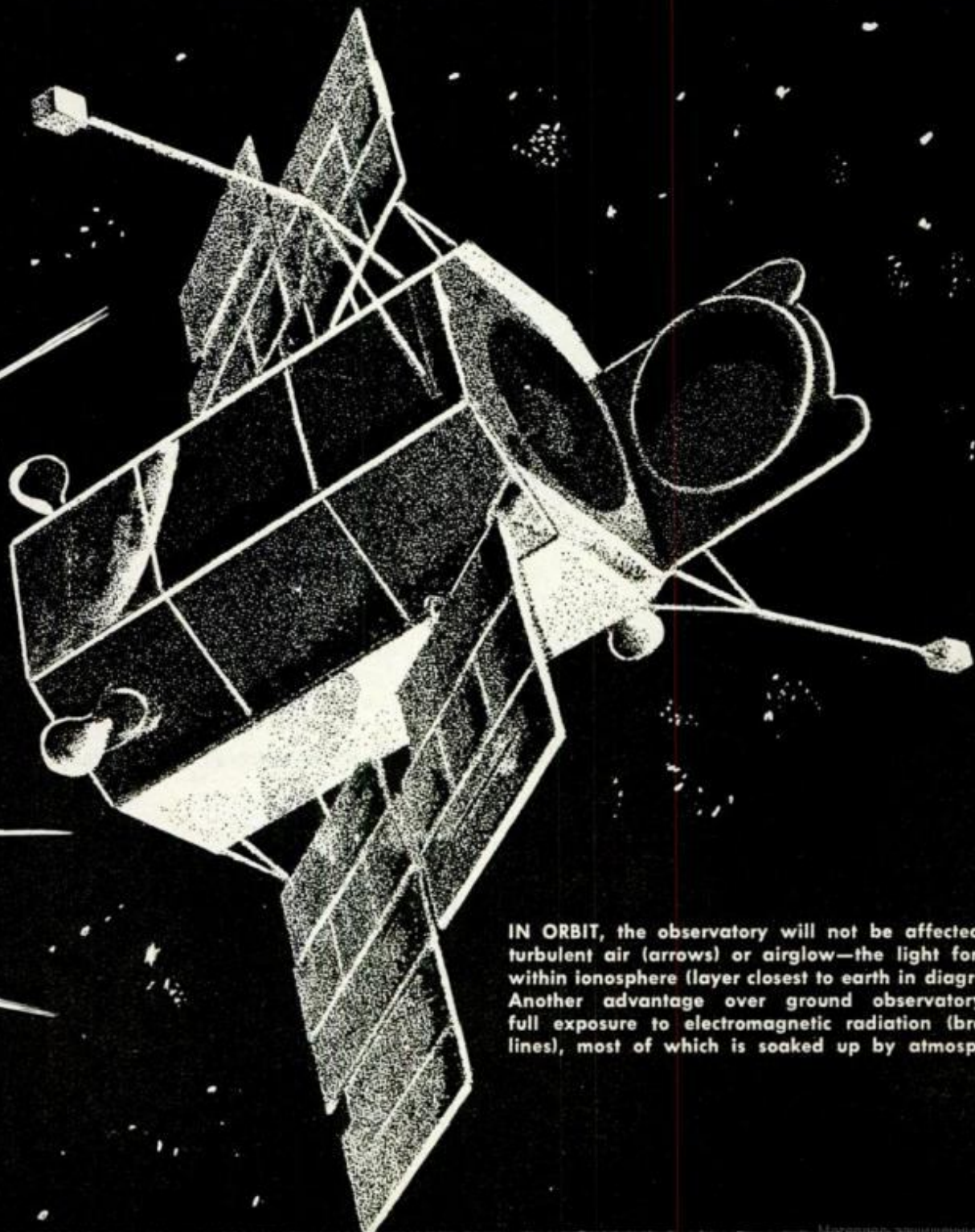
- *Absorption:* Earth's atmosphere soaks up most of the electromagnetic radiation such as radio waves, X rays and ultra violet light that flood the cosmos.

Only two small bands freely get

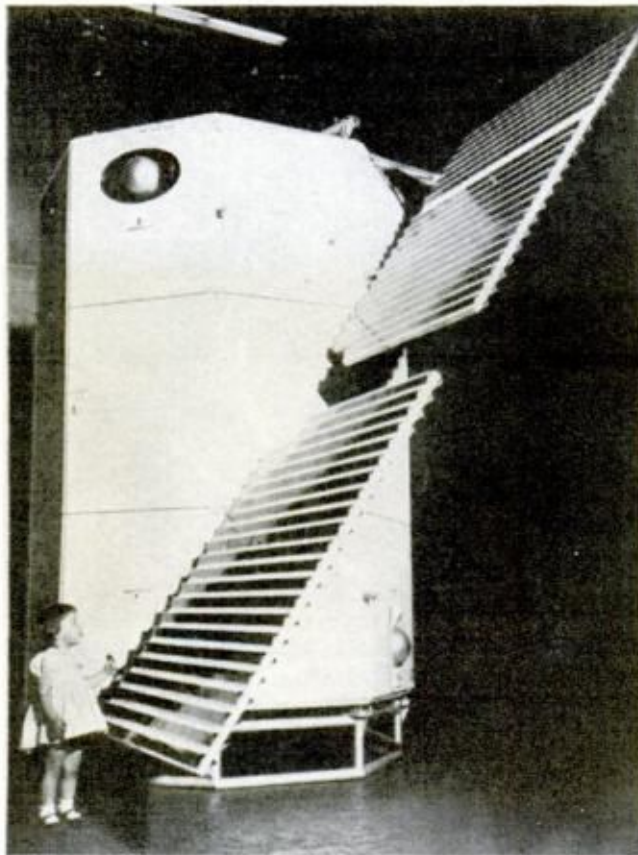
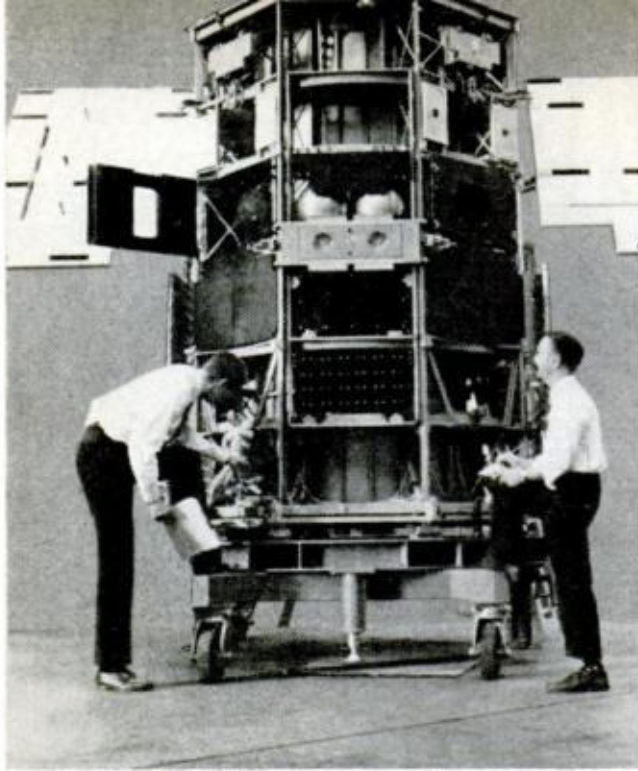
through: visible light and some radio waves.

- *Airglow:* At night one of the atmosphere's layers—the ionosphere—releases energy in the form of dim light called airglow. It fogs photographic plates and obscures faint objects. Background light from cities sometimes adds to the problem.

- *Distortion:* The atmosphere is a tur-



IN ORBIT, the observatory will not be affected by turbulent air (arrows) or airglow—the light formed within ionosphere (layer closest to earth in diagram). Another advantage over ground observatory is full exposure to electromagnetic radiation (broken lines), most of which is soaked up by atmosphere



**SATELLITE** without its skin (top) reveals complex system of instruments that will be used to control it. Telescopes are housed in hollow center. The vehicle (above), almost 10 feet high and 6 in diameter, towers over child. It will get power from solar cell paddles that jut from two of its sides

**HERE'S WHAT** will happen after observatory is placed in orbit: (1) Sensors draw bead on sun and gas jets rotate satellite around sun-to-earth axis; (2) Star trackers—preset telescopes—spot pattern of stars, jets stop vehicle's roll; (3) Satellite is aimed at first target and telescope sunshade swings open

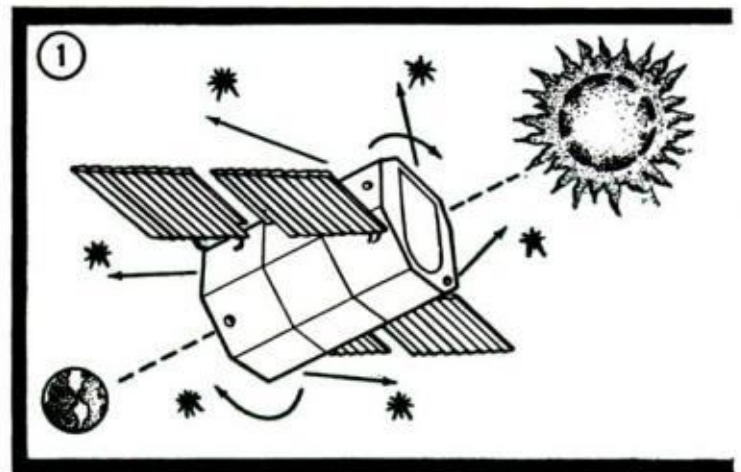
bulent mass of moving air currents that cause light from the heavens to shift and dance. Sometimes this shimmer is so bad that stars will bounce in and out of a telescope's field of view.

These three phenomena are what provide the blur when earthbound astronomers attempt to peer at the stars with precision. But, by this time next year, the problem may have been licked by an Orbiting Astronomical Observatory satellite that's scheduled for launching in mid-1965. It will be the heaviest and most complex unmanned satellite that the U.S. has yet put up. Boosted to a height of 500 miles or more, the OAO will be well above the blurring effect the atmosphere has on earth-based telescopes.

The observatory will be able to peer at stars and planets with unprecedented sharpness. "Above atmospheric distortion," says Dr. Kenneth Franklin of New York's Hayden Planetarium, "a 10-inch telescope can discern images as sharply as a 200-inch telescope on earth."

Before OAO, scientists tried to surmount atmospheric difficulties by using balloon telescopes, high-altitude rockets and fly-by space probes. Balloons hoisted telescopes above atmospheric distortion. But balloons were no help against airglow and absorption, which occur where air is too thin to provide lift. Though rockets carried small instruments sufficiently high, they could provide only a brief "look" at selected targets.

So far, fly-by probes, which make use of instrument-carrying rockets aimed at nearby planets, represent the most ambitious attempts to get ringside reports on celestial bodies. OAO, however, will have a number of advantages over such space shots.





- OAO can make periodic observations. "On Mars and other planets the surface conditions and colors change regularly," says Walter Scott, OAO program manager for Grumman Aircraft, prime contractor in the project. "To really find out what's happening, you need intermittent observations over a year's time or more." A fly-by, on the other hand, reports only during the few hours it is near its target. Once past its objective, the rocket becomes an elaborate piece of interstellar junk.

- OAO will be capable of sending back 100,000 pieces of information a second. Contrast this with the 10 pieces a second that the fly-by Mariner II radioed back to Earth when it was in the vicinity of Venus. The tremendous difference between the two capabilities is explained by Dr. James Kupperian, OAO project scientist at Goddard Space Flight Center, headquarters of the undertaking: "The farther away you put a space vehicle, the more power it needs for telemetering and the less information it relays back."

#### Analyzing the Moon's "Ruby"

- OAO can cover unexpected events such as that recently reported by astronomer James C. Greenacre at Lowell Observatory, Arizona. He was mapping the 27-mile wide Artistarchus moon crater when he was surprised to see a spot of glowing red from the crater's floor. "I had the impression I was looking into a large polished ruby," Greenacre relates. Since then, other astronomers have spotted red puffs, too.

Speculation about their cause ranges from volcanic gas to dust thrown up by meteor strikes. If OAO is in orbit and the red phenomena appear again, the satellite can take a look and tell us what they are.

A fly-by—limited to one target—isn't capable of such flexibility.

The OAO satellite, now being put together at the Grumman Aircraft plant on Long Island, is eight-sided, stands almost 10 feet high and is six feet across. When it's fully loaded with its telescopes—there'll be a pod of them at either end—and other instruments, it will weigh about 3300 pounds.

#### Ultraviolet View of Universe

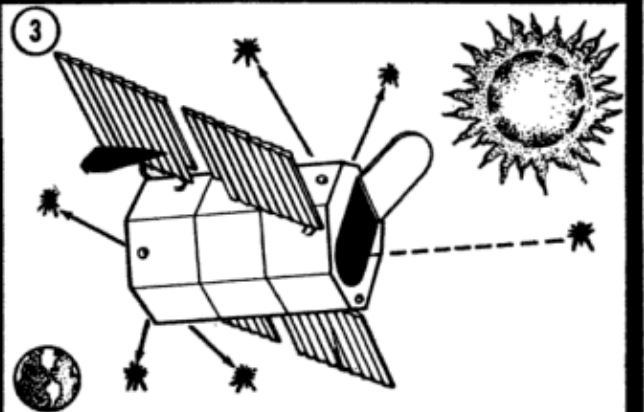
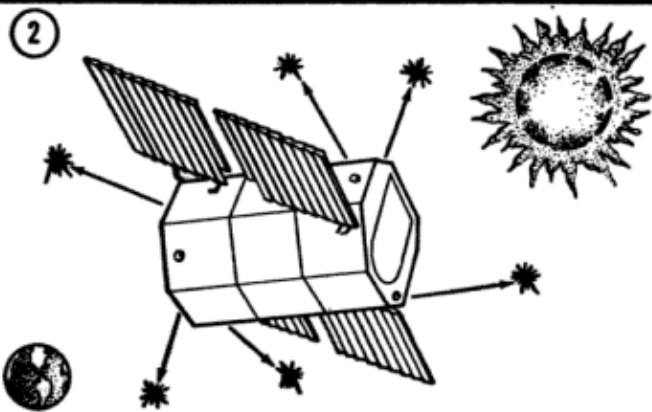
OAO's telescopes will be equipped with detectors sensitive to ultraviolet (UV), a radiation band not visible from earth because of atmospheric absorption. Consequently, OAO will see the universe in what is literally a new light.

The space eye's four 12-inch scopes will examine earth's atmosphere and use the findings as a yardstick to measure the composition, density, temperature and depth of the gaseous envelopes around the other planets.

It will also be used to probe the mystery of the origin of our solar system. The four planets closest to the sun—Mercury, Venus, Earth and Mars—are small bodies with an average density about that of rock. Called terrestrial planets, they have three moons among them and are relatively close together.

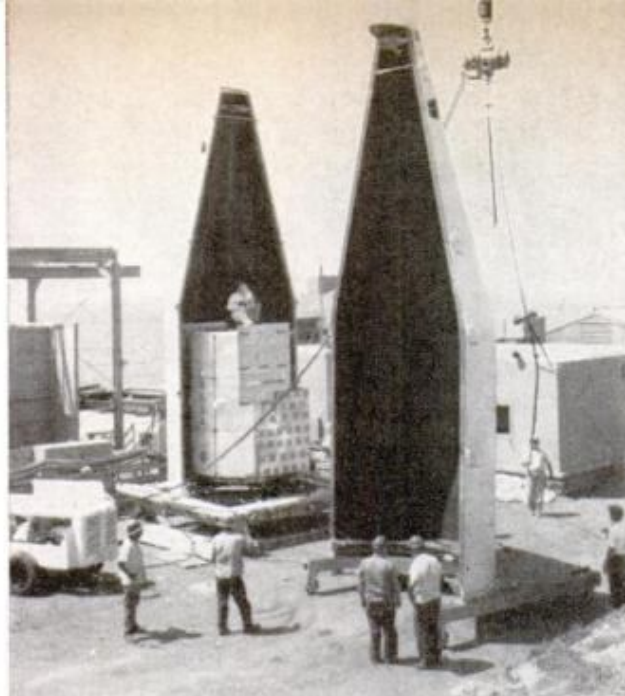
Farther from the sun are Jupiter, Saturn, Uranus and Neptune, the so-called gas giants. Compared to the terrestrials, they are huge but much less dense. They possess 28 moons among them and are enormous distances apart.

Why are there two distinct types of planets? What do they indicate about the solar system's origin? By spotting similarities and differences in planetary composition, mass and surface features, the





**MODEL** of the telescopes to be used in mapping project. The TV camera sensitive to ultraviolet light, called a Uvicon, juts up from bottom of instrument



**SATELLITE** on half-shell. Model rests in half of fiberglass nose fairing, which will ride atop Atlas-Agena D rocket. Launching is set for Cape Kennedy

OAO may answer those questions.

OAO will also examine the maverick Pluto, the outermost planet which is thought to be about as large and dense as Mars; this would tag it as a terrestrial. But, as it has been too far away for a clear look, opinions about it differ. According to one theory, Pluto is really a gas giant that shines light from a small, highly reflective patch. Other hypotheses suggest that it is a dead sun, or a moon torn from a gas giant. Astronomers are hoping that OAO's sharp eyes will settle the arguments.

The space observatory will be used to investigate other problems, too. For example, few astronomers believe that the Mars canals are irrigation ditches dug by intelligent life. But what are they? And the planet Jupiter—what is its composition and what are the spots that appear on its surface?

Though astronomers are anxious to get a good look at our solar system, they're even more impatient to see what lies beyond it. "We may find whole galaxies and systems of matter we never dreamed of," says Nobel Prize winner Willard Libby.

Two of the far-out problems assigned to

OAO involve "super stars" and "young stars." Young stars are thought to be the hottest objects in space. But the hotter an object is, the more it radiates in ultraviolet light. Astronomers make a stab at young stars' temperatures—and consequently the rate at which they're burning—by looking at them in visible light and extrapolating into the UV band. Result: an educated but unsatisfactory guess.

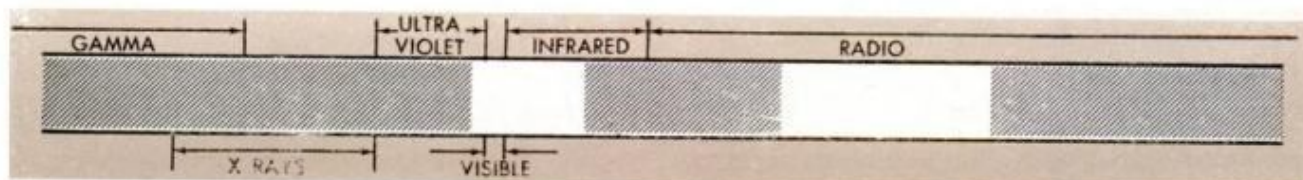
### Are We Eons Older?

Fleeting glimpses of young stars by rockets, however, indicate that such stars aren't as hot as had been thought. The universe, therefore, could be eons older than estimated. OAO will telemeter the intensity of young stars' UV radiation to earth. With more accurate temperature readings to work with, scientists can get closer to determining the age of the universe.

Super stars are more of a mystery. Years back, radio astronomers found that large sectors of the sky were bombarded with tremendous amounts of energy, causing an ear-splitting roar in their head-

(Please turn to page 212)

**CELESTIAL RADIATION** ranges from gamma rays (left) to radio waves. Only some radio and visible light waves (clear zones) penetrate the atmosphere



# Those Odd Aches

*You may be healthier than you think. Those mysterious pains may be merely a case of Garage Door Syndrome, milk leg or TV Bottom*

By Theodore Berland



**CORONARY?** No—but it looked like it until the doctor diagnosed *Garage Door Syndrome*

**I**N ATLANTA, GA., a man, gasping for air and suffering terrible chest pains that radiated to his fingertips, somehow got himself to a doctor.

It felt like someone was using his breastbone for an anvil.

"Strongly suggests coronary pain," thought the doctor as he examined his nearly collapsed patient. But before sending him to the hospital for the usual six weeks coronary confinement, the doctor

asked a few pointed questions.

In minutes he knew the man was not dying. He was instead suffering from a clear case of *Garage Door Syndrome*.

Describing this medical baffler, the doctor, Jack C. Norris, wrote that "the condition occurs during the first cold spell of winter. The garage door, which has remained open for the summer, is closed. Necessarily, it must be reopened in order to get the automobile out.

"Without thinking, the victim, either with his right or left hand, gives the door a jerk upward to open it.

"This 'snatch,' as it might be called, places a quick pulling strain on the muscles."

The snatch action strains muscles, tendons and ligaments of the arms and shoulders. Ten or twelve hours later—usually during the night, just as in a heart attack—the acute pain hits like a sledge hammer.

A believer of preventive medicine, Doctor Norris suggests two ways to avoid the non-fatal condition:

One: Lift the garage door "carefully and slowly with both feet flat on the ground, and using both hands."

Two: "Thoroughly oil the springs and roller tracks of the door so it will move easily and without resistance."

As a postscript to his report, the good doctor adds: "I had my second attack before recognizing the cause. It is self-limited and usually cures itself."

Garage Door Syndrome is but one of a host of odd ills that can hit suddenly even when you are looking. Many are like it, in that they result from unusual strains on muscles, bones and nerves.

Take Tractor Back, or compression of the spine produced by riding power lawn mowers.

*SWITCHING from a large car to a sports model can put strange kinks in the driver*



*TV VIEWERS occasionally find that actors' illnesses can be contagious*

Or Wheelbarrow Back, from too much do-it-yourself with a wheelbarrow.

The new suburbanite who gets both of these from putting in his own swimming pool can later suffer Diving Board Disk after the water is in.

These three ailments were cataloged by a Chicago chiropractor, Dr. Paul B. Stoxen. Another Chicagoan, Dr. Jerome F. Straus, Jr., MD, has warned of what happens when drivers switch from full-sized to compact cars.

He's had patients limp into his office with pains in the chest, hip or back a day or two after getting new cars. In some cases straight stick and lack of power steering are just too much. Others suffer from the low silhouettes of their new sports cars.

"The enthusiast," said Doctor Straus, "may tend to forget that he is using the muscles of the chest and shoulder girdle in a fashion to which he is not accustomed."

He cautioned fellow doctors in a letter to the Journal of the American Medical Association that they might see more and more cases of Jaguar Chest or Corvette Hip.

During World War II, and in Korea, thousands of soldiers lined up for sick call because of, well, pains in their seat.

New doctors who saw these boys in agony were sure at first they were malingering. Then, convinced not, they were sure the intolerable pain came from some sinister affliction of the innards. Finally,





**DOWN** goes hover jumper A. J. Grady — without a chute. Usual jump is 12 feet, though it's often more when wind or terrain keeps the chopper higher



**JUMPER** hits ground beside an injured person. Here the terrain would prevent the helicopter from landing, and victim may be miles from help coming across land



**FLOTATION CHAMBERS** in most aluminum and some fiberglass canoes will keep a swamped craft afloat, even with passengers aboard. Sponson canoe (inset) with air chamber on each side from bow to stern is almost impossible to tip

# Best One for You?

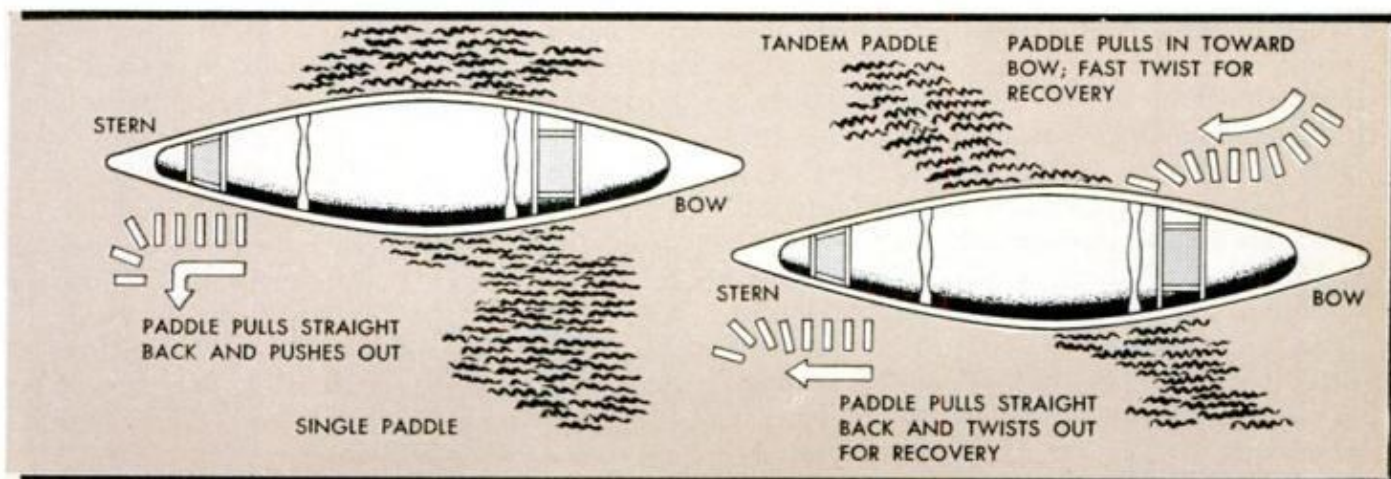
they are also more easily repaired. Fiberglass canoes frequently—but not always—weigh a little more than aluminum canoes of the same length.

A narrow-beamed, round-bottom canoe with a small, flat shoe keel is ideal for river and streams. It requires some balancing skill, but it is fast, easily paddled by one man, and is highly maneuverable among boulders and in white water. For lake travel, where there is the chance of

choppy water, the wide-beamed canoe with a flat bottom extending to both ends, and the larger lake keel is the ideal. It does not tip easily, and the longer keel helps to eliminate yaw when paddling, and resists the wind. The lake canoe should have bow and stern cut as low as possible. The old-style crescent ends act like cumbersome sails in a strong breeze.

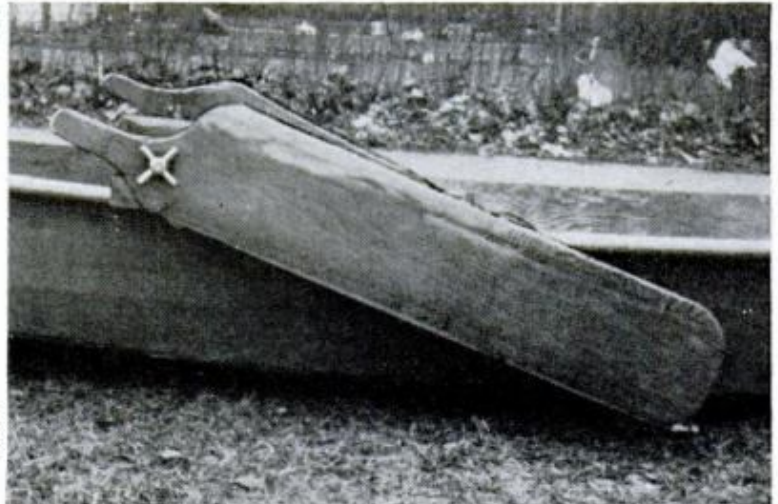
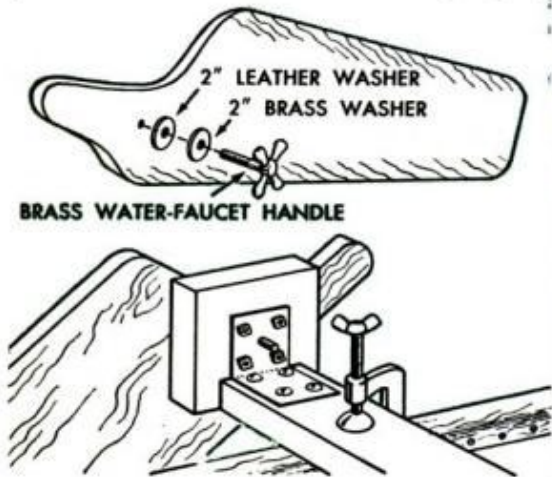
For family canoeing, where safety is a major factor, the most popular make of

**POWER OF STROKE** is in pull to point even with body. As paddle passes hip, single paddler makes J-stroke to compensate for turning of hull. With two men, stern man uses same stroke with less twist; bow man pulls toward self





**SQUARE ENDER**, made of aluminum, is driven here by three-horsepower outboard. However, it will take up to  $5\frac{1}{2}$  horsepower. Note the spray rails just above the waterline of the canoe



**LEEBOARDS** on both sides of canoe take place of centerboard for sailing. Main crosspiece in homemade boards is C-clamped to gunwales. Bolt (with faucet handle brazed to end) holds each board tightly against tapped plate.

aluminum canoe incorporates sealed air chambers that make the craft unsinkable. There is also the sponson canoe that has an air chamber on each side, extending from bow to stern. This raises the cost of the canoe about \$80 over the average, but it is virtually impossible to turn it over, and even when swamped it will ride high enough in the water to be paddled to shore.

A canoe is easily adapted to an outboard motor. A motor mount costs about \$15, but it is simply a piece of heavy plank bolted to the hull and extending off the stern to accommodate the motor clamp, and it can be built for almost nothing. A one-and-one-half to three-horsepower motor is recommended for a regular canoe. For greater speed, the square ender, a canoe cut off at the stern, will accommodate a five-and-one-half horsepower motor. It is also possible to install an air drive with a two-horsepower engine, and this rig will navigate in two inches of water.

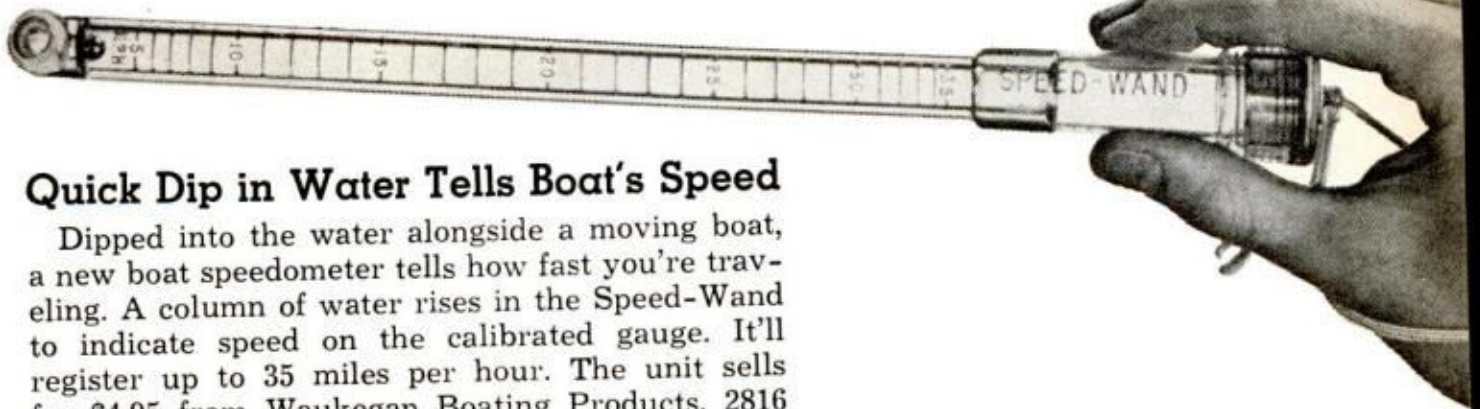
Paddling a canoe is simple if you remember that all the power of the stroke is in the pull up to the body. The recovery, whether you use the "J" or "8" shaped stroke, is simply for steering and ease of removing the paddle from the water.

Position of the paddler is governed by water conditions. In calm water it is comfortable to paddle from the seats. In rough water it is best to kneel, bringing the weight closer to the waterline, and move more to the center of the boat. A lone canoeist can usually handle his craft in rough water by paddling from the center, but to keep a straight course against strong winds, he moves to the extreme bow.

Sailing a canoe in a good wind was described by one sailor as "like doing a toe dance on a toothpick." A novice should begin with a commercial rig, complete and ready to be easily installed, that has a short mast and about 40 square feet of sail. This will run about \$135. As he gains experience he can graduate to a larger mast and up to 75 feet of sail, and finally to two masts that spread 100 feet of sail.

A pair of outriggers increase safety for the beginning sailor and young paddler. They are easily improvised with two lengths of 2 by 4, two innertubes and four C-clamps. Simply lay six-foot lengths of 2 by 4 evenly cross the center of the canoe, clamp them to the gunwales, and stretch the innertubes over their ends. They will make the canoe as stable as a raft. ★★★





## Quick Dip in Water Tells Boat's Speed

Dipped into the water alongside a moving boat, a new boat speedometer tells how fast you're traveling. A column of water rises in the Speed-Wand to indicate speed on the calibrated gauge. It'll register up to 35 miles per hour. The unit sells for \$4.95 from Waukegan Boating Products, 2816 Washington St., Waukegan, Ill.



## Attention Getter

Equipped with both a pistol-grip handle for aiming the spotlight and a swing-up handle for carrying, a new emergency light also has a rotating red beacon in a plastic dome.

Three manganese batteries keep either light burning for six hours, or both lighted simultaneously for two hours. The unit may be plugged into an auto cigarette lighter. A suction cup anchors the lantern to any smooth surface.

The Guardsman Lantern is made by Mallory Battery Co., Tarrytown, N.Y., and sells for \$19.95. It also comes with a blue dome light for volunteer firemen.

**Two species of redwoods**—giant sequoia and the taller coast redwood—have flourished in California for 40 million years.

## Winter Sportster

Whizzing along on two skis and three steel-cleated belts, a new snow vehicle can do everything on snow that a boat can do in water, according to the manufacturer.

The Skee-Horse has a 14-horsepower, two-cycle engine that can drive it 30 m.p.h. The cleated belts are covered with rubber and roll on 12 dolly wheels.

The Skee-Horse will be introduced this fall by Johnson Motors, Waukegan, Ill.



*An addition to your home can look as if it had been there from the beginning. Add beauty as well as living space with . . .*

# Built-Outs

**W**HEN ADDING A ROOM to your house, the key to a successful, attractive job is to blend the addition smoothly into the existing structure.

The new room should not, as is too often the case, become an unsightly bulge that appears to have been tacked on as an afterthought. Instead, it should look like part of the original plan. The new room should belong.

On these pages, we've shown how a noted designer has applied the above principle to five typical American houses. These range in architectural design and styling from the post-World War II suburban ranch (below) to the familiar urban

two-story that went up by the thousands during the 1920s (top, pages 120-121).

In some cases, as in the houses below and at the bottom of page 120, only a room or two has been added, and the house changed so subtly you'll have to look twice to find the additions. In others, as on pages 122 and 123, the size of the original house has been doubled by the addition of a complete second story or a new wing. The houses have changed so radically, it's hard to believe they weren't merely torn down and replaced. But in all cases, note the one common factor: Old and new have been so skillfully blended that you can hardly tell where one leaves

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## Garage Becomes Living Space

*Here, the architect has followed a tried-and-true procedure by converting a built-in garage into a new living or family room, then building out a new garage (right), or an economical carport (bottom right). Front windows are replaced with a more Colonial-looking small-pane type. End wall of new garage is tastefully disguised by replacing single, plain window of the old garage with two shuttered small-paned windows similar to those on the front. Optional touches which further enhance the motif are the window box, new posts next to the entryway, a more Colonial-looking entry, and a brick fireplace.*

*For the budget-conscious, this job can be done in stages. For example, first the garage would be converted inside, then the new garage or carport added when budget permits.*



# That Belong

off and the other begins.

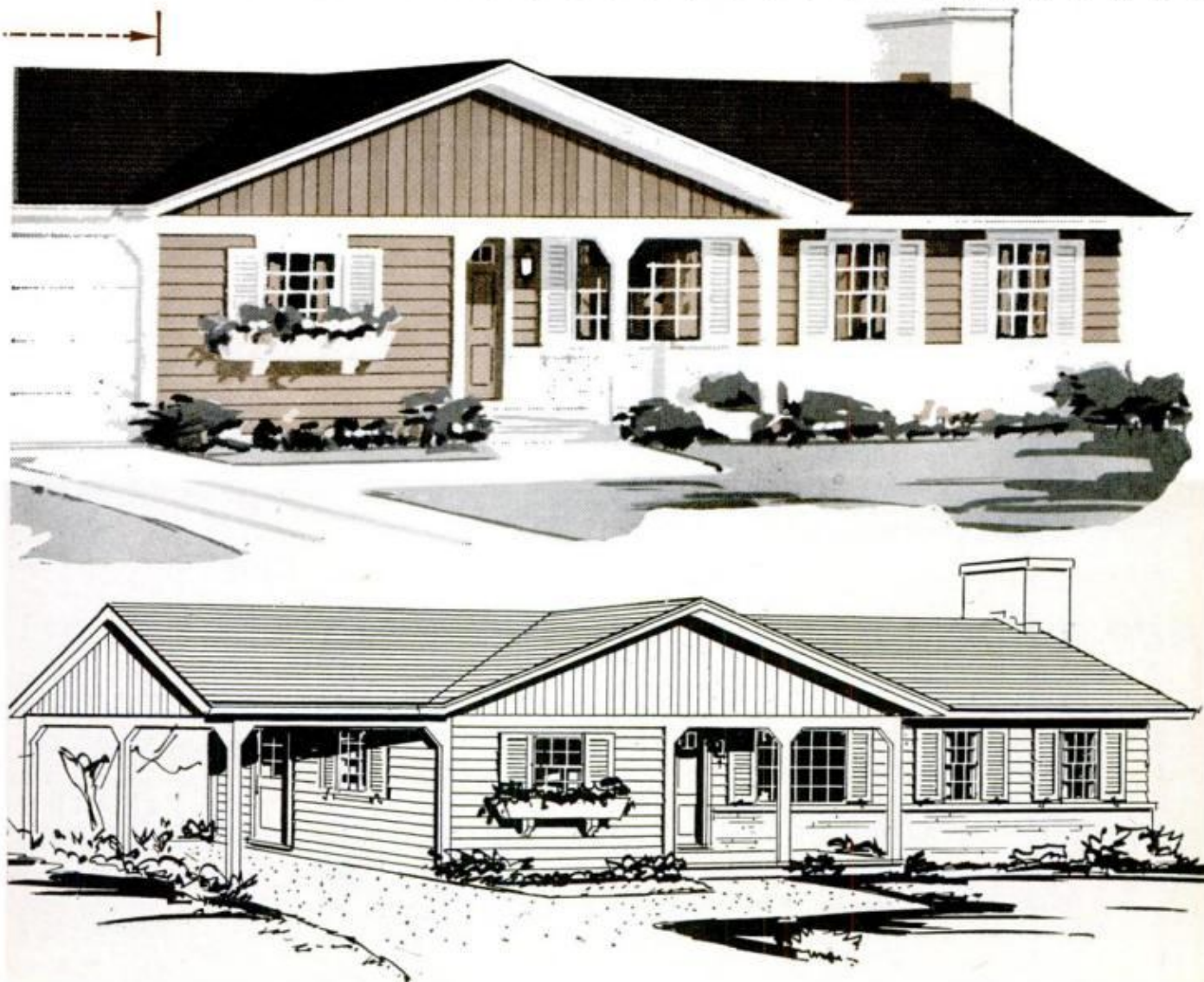
Whether or not your house is exactly like the ones shown, two of the methods by which this blend was achieved are especially worth studying, as they can be used to advantage on any house.

## Right Siding Important

First, note how the siding materials on the additions match those on the original house. This is much more important than it may seem, because the usual tendency is to do exactly the opposite—to put, say, a clapboard-sided addition on a shingled house, or to use 8-inch clapboards on the addition, when the house

was sided with four-inch. This practice, which calls too much attention to the new room, is usually compounded by not aligning the old and new sidings. The latter practice creates an unpleasant jog where the old and new structures meet.

Second, the plans put as much as possible of the existing structures to work. Thus, when a built-in garage was available, it was turned into a new living room. And, where possible, a new room was put on the second floor rather than the first. Besides helping to achieve the desired harmony of design, this approach eliminates a lot of excavation and foundation work that would raise the cost of the job.



## Two-Story Grows Forward

Despite the restrictions of a narrow city lot, adding a new storage room or child's bedroom to this two-story is fairly simple. The new room is merely framed above the sun porch.

In one of the sample remodelings at right, the new room has been cantilevered a foot or so to gain maximum interior space. In the other, the floor alone has been cantilevered to create a sun deck. In both, the house has been completely re-sided to assure the necessary blending of old and new (see text, page 119). However, this could also be accomplished, for less money, by running shingles out over the addition.

Of particular note in this job is the dramatic effect of a simple change in window treatment. Replacing all windows with small-paned ones and adding shutters gives a Colonial exterior. Using casements, with large glass areas, gives a modern look. In both treatments, the brick stoop is replaced by simple concrete steps, and the doors replaced by new ones appropriate to the styling.

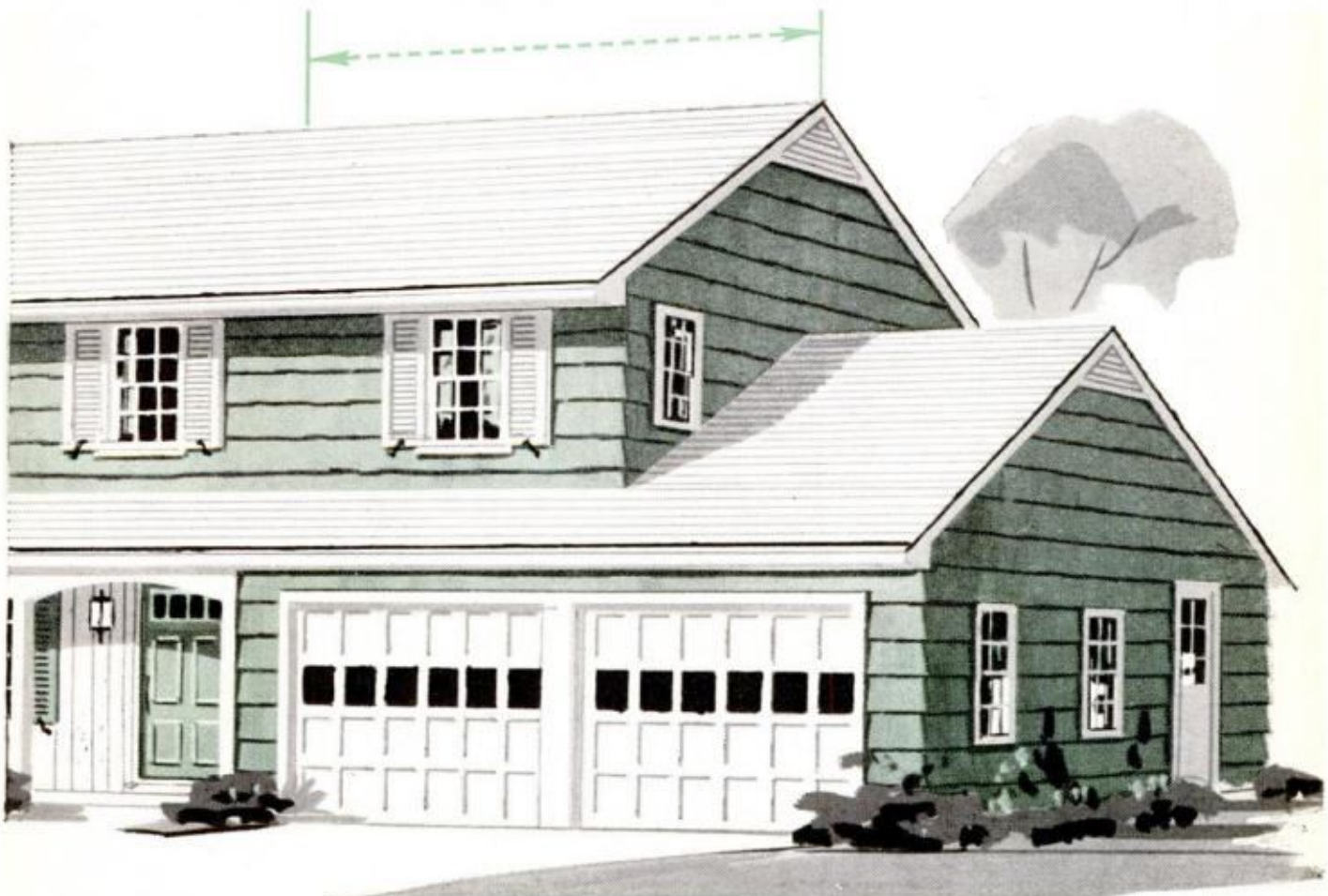
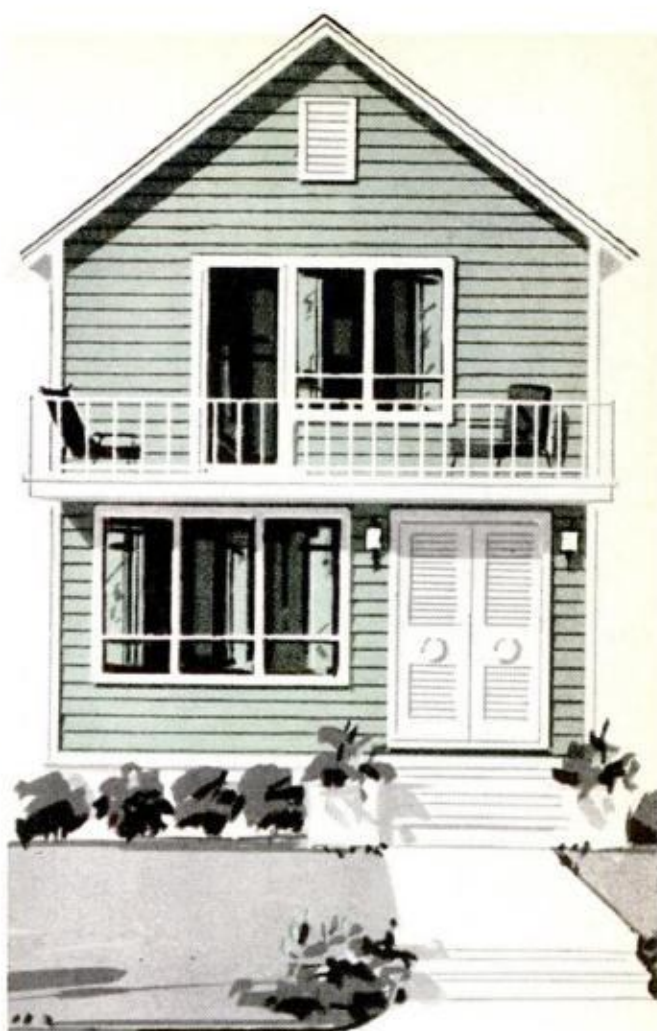
Incidentally, the louver installed over the new room will ventilate the attic more efficiently than the original window.

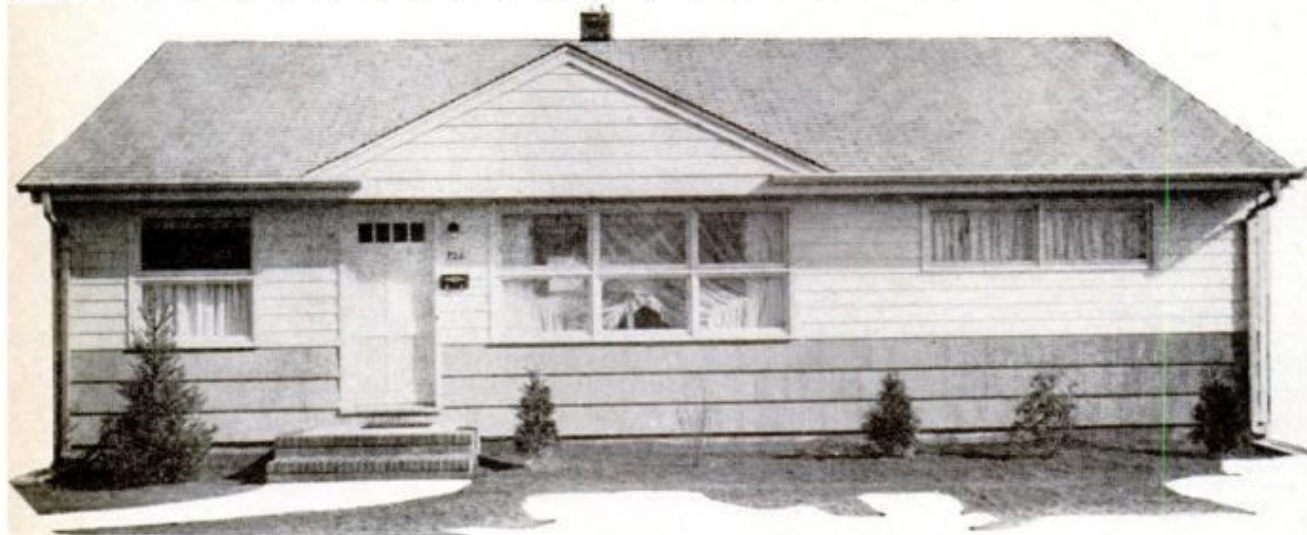
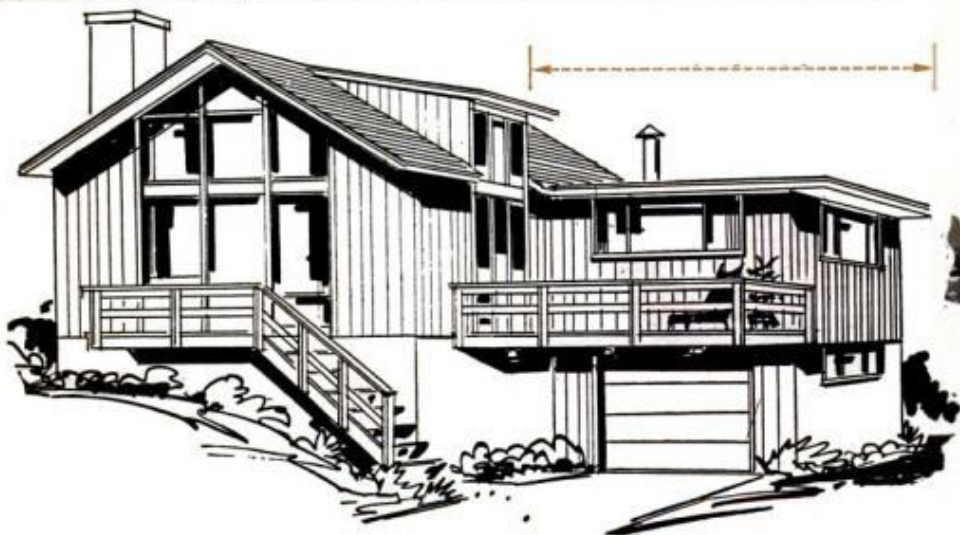


## Add a Room and Shrink a House

You might call this job an example of subtraction by addition. Adding a new bedroom on the second floor makes the house larger. But it now appears more compact because the longer second story accentuates the horizontal lines of the house. It seems more low-slung—closer to the ground, as an architect might say. This effect is strengthened by extending the garage-roof overhang over the front entry. The interior framing is likely to be critical in jobs like this, since the new bedroom will need sturdy support. While the exact form of this support depends on the house's construction, it would probably include a steel girder, pipe columns and/or a beefed-up lintel over the garage doors.







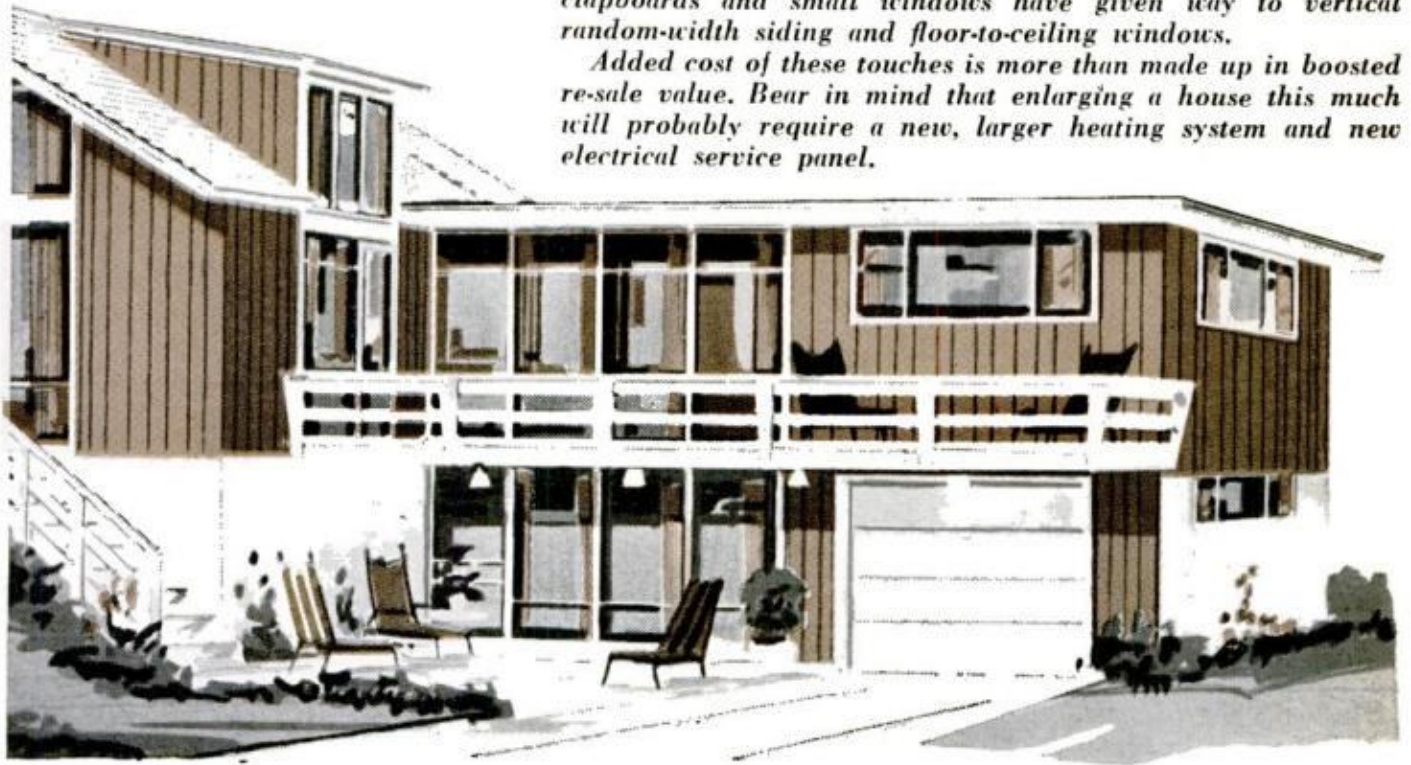
## ***From Ranch to Colonial Two-Story***

*Building a complete second story on top of a ranch house is, admittedly, expensive. But it can be cheaper than building from scratch, as you've already paid for the land, foundation, first-floor framing and finishing. Besides, it provides an opportunity to change what was just a fairly attractive house into a truly distinctive one. You'll have to put siding on the new second story, so why not cover the mixture of sidings on the original house at the same time? Then, you can replace the original windows with Colonials to match those on the second story, or simply put shutters on the old ones. The new entry and the fireplace can be omitted to save money.*

# Addition Creates Brand-New House

In this elaborate job, a new two-level wing is made economical by a sloping lot (minimum excavation). Wing can be just a garage and extra bedroom (far left), or include several new rooms. To achieve a bold contemporary treatment, original clapboards and small windows have given way to vertical random-width siding and floor-to-ceiling windows.

Added cost of these touches is more than made up in boosted re-sale value. Bear in mind that enlarging a house this much will probably require a new, larger heating system and new electrical service panel.

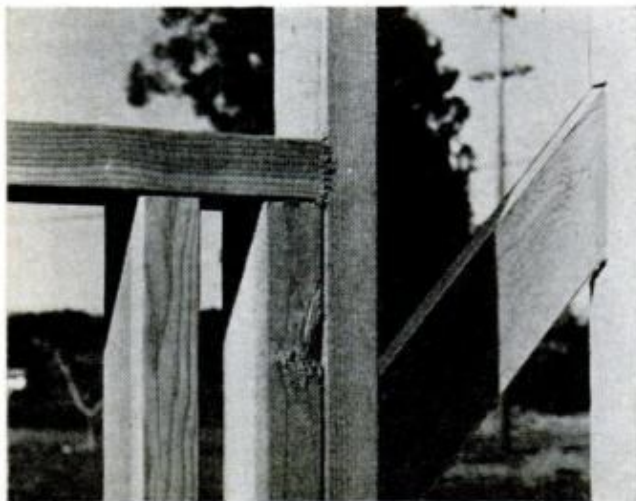


# FRAMING BASICS FOR BUILT-OUTS

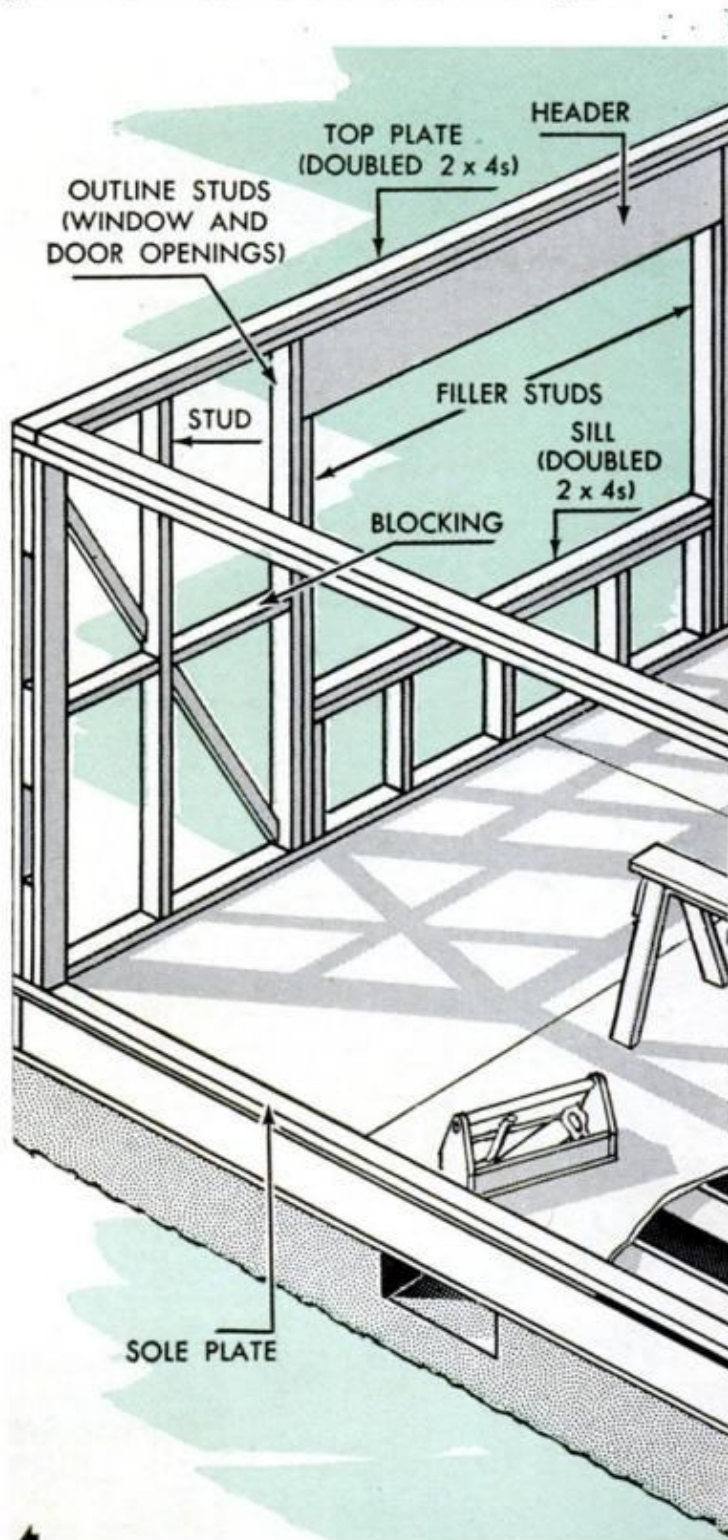
Wary of doing your own construction work? Don't let mere size scare you: Erecting a frame for those added walls is a simpler project than many you've tackled in your shop. And it can be a one-man job!

**UNLESS YOU'VE TRIED** house framing before, you may consider it too big a job to tackle by yourself. Perhaps you've watched construction crews assemble wall frames flat, then tip them up for final anchoring. For this technique you'd have to enlist the help of a couple of neighbors, and this isn't always convenient.

If you build the frame vertically to start with, however, it becomes a one-man job. You just have to know the proper assembly sequence, as shown on page 128—plus a few professional tips such as those demonstrated in the photos on these pages. The frame not only holds up the roof, but

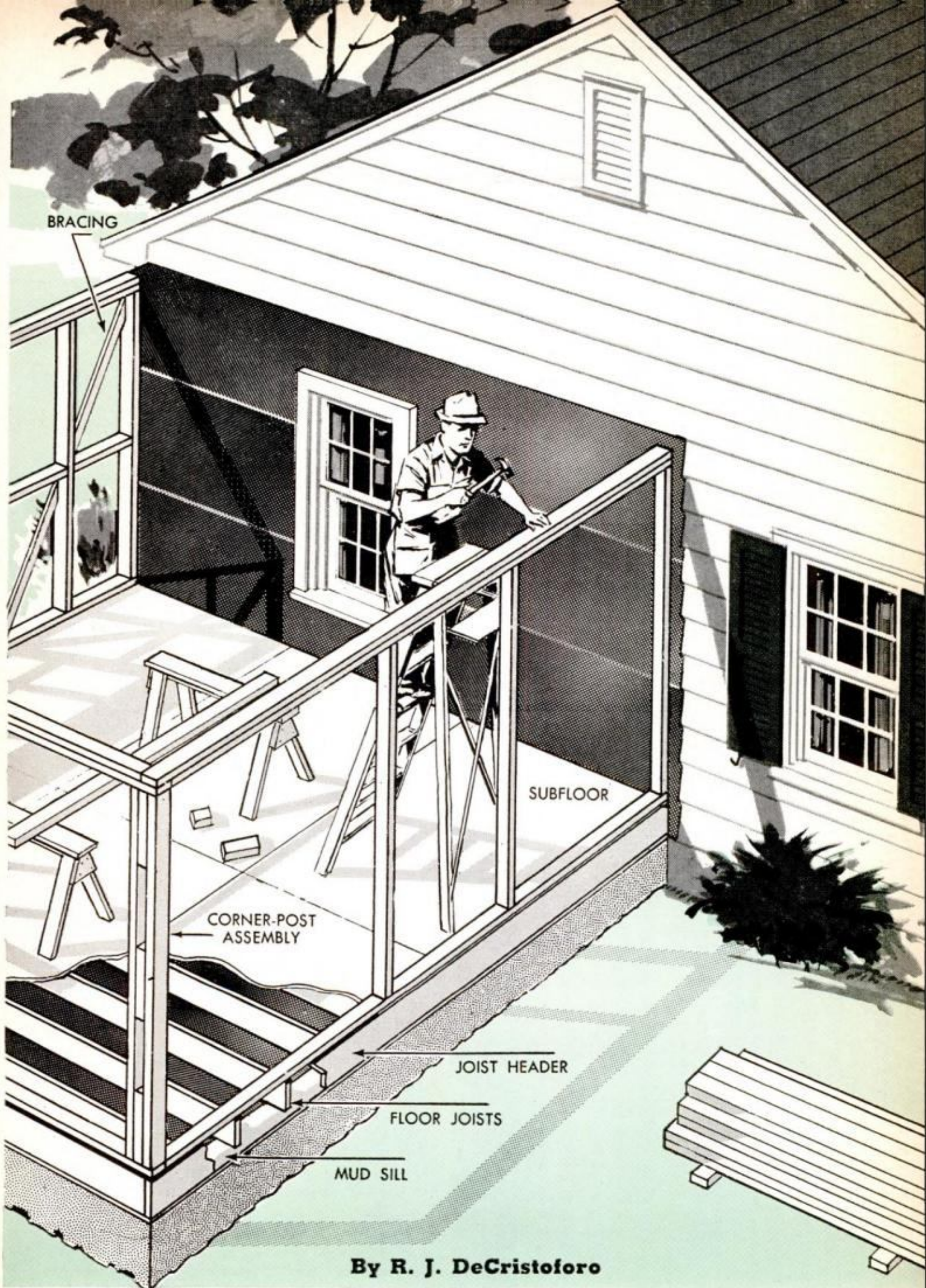


**LOWER HALF OF SILL** (to frame window opening) can be cut full width to slip between studs (above). Sill can then be nailed through outer face of outline stud as well as down into short studs beneath



**UPPER HALF OF SILL** is fastened the same way. In this alternate treatment to one sketched above, each filler stud is in two pieces, eliminating need for long filler under the header plus short one under sill





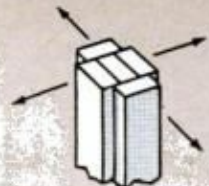
## HOW PARTITION AND CORNER POSTS ARE BUILT UP AROUND FILLER BLOCKS



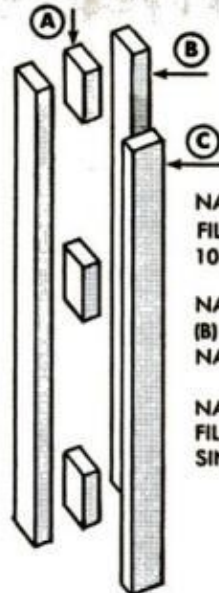
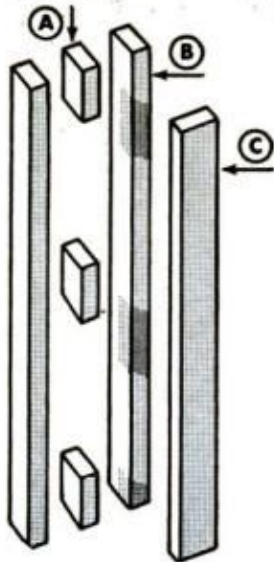
**CORNER POST ASSEMBLY**



**WHERE PARTITION MEETS SIDEWALL**



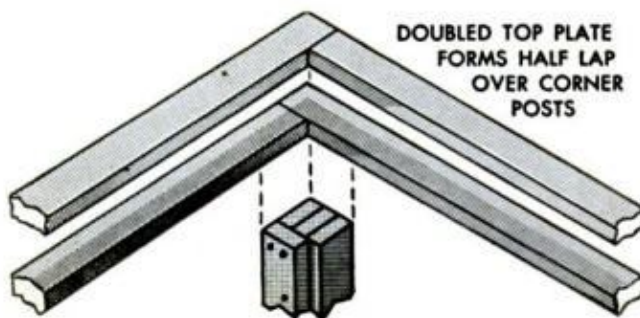
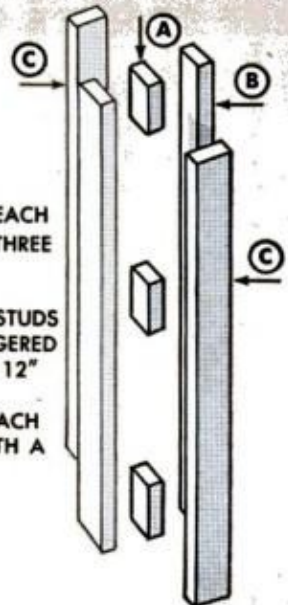
**WHERE PARTITIONS CROSS**



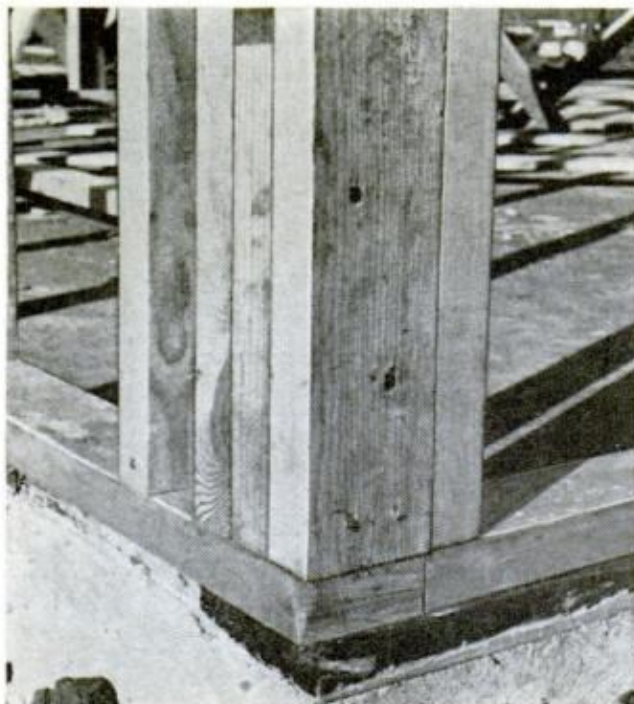
NAIL STUDS (B) TO EACH FILLER BLOCK WITH THREE 10d NAILS

NAIL STUDS (C) TO STUDS (B) WITH 10d STAGGERED NAILS AND SPACED 12"

NAIL STUDS (C) TO EACH FILLER BLOCK (A) WITH A SINGLE 10d NAIL



**DOUBLED TOP PLATE FORMS HALF LAP OVER CORNER POSTS**

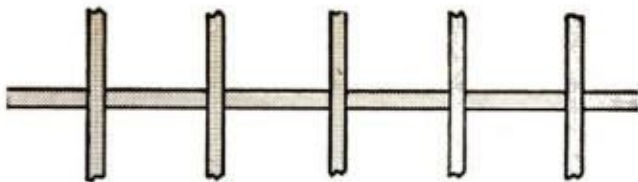


provides a nailing base for both inside and outside "skins." So even if you never add a room (or expand a garage) it's a good idea to know what a house skeleton is like, so you'll be able to locate the various members when you want to hang a cornice, panel a wall, or cut through for a new door or window.

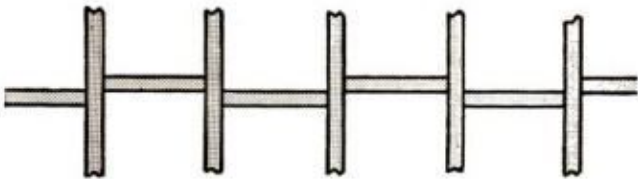
The secret of good frame construction is knowing *which* nails to use *where*, and *how many*. Maybe sheet-metal joiners like those we showed in last month's issue (pages 137-141)—or perhaps even instant-fix adhesives—will set the framing methods of the future, but as of now the humble nail is still king. The strength of any wood assembly depends on how the parts are fastened, and when you consider the rigidity and durability required by a house frame, it's amazing that standard assembly technique calls for simple butt joints, and that the recommended nails are so small—and so few.

Examination of house frames that fail under severe storm conditions almost always reveal that poor nailing was at fault: the members did not break, they pulled apart. Using nails that are too big can be as risky as using fewer nails than the

**CORNER POST ASSEMBLY** is toe-nailed to sole plate just like studs. Here, sole plate is nailed to a mud sill that was "floated" in pour of concrete garage slab. Otherwise plate must be anchor-bolted



BLOCKING CAN BE INSTALLED IN LINE OR STAGGERED WHICH IS EASIER TO NAIL



recommended number. Nails too large for the size of lumber being joined can cause splits or cracks which may not develop until the joint has been covered up.

The nailing schedule on page 128 gives the *minimum* recommended size of nail for joining standard framing members (nominal 2" thickness). In each case, the next-largest size could be used so long as it gives no evidence of causing splits. In fact, with woods of comparatively low density—cottonwood and northern cedar, for example—the larger-size nail would be preferable, especially in such critical areas as bracing, joists and studs. These woods have low nail-holding power.

While you're buying nails, treat yourself to a new hammer. That light, smooth-faced affair you use in your workshop will slow you down. A framing hammer is heavier (at least 20 oz.), has a long handle—and a corrugated face to keep the hammer from glancing off the nail. This rough face will mar the wood when you drive the nail home, but you're building a house frame,

## LET-IN BRACING IS BEST



**DIAGONAL BRACE** is 1x4, set into notches cut across outer edge of studs (above). Notching in-place sole plate is difficult, so builders often recess 2x4 block between studs to anchor end of brace (below)

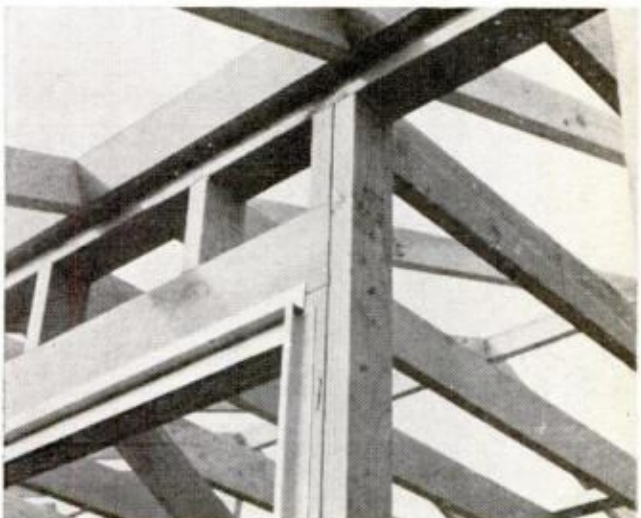


## TAKE YOUR CHOICE OF HEADER TREATMENTS

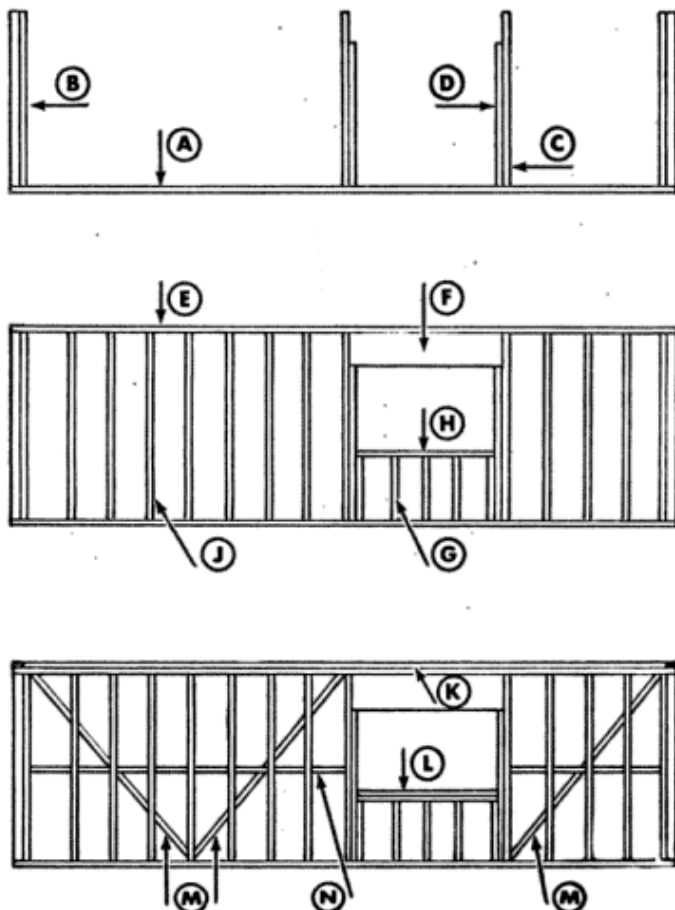
**FULL HEADER** fills entire space above opening, up to top plate. Number of nails depends on width of header: Six are used here for 4x12. This technique is used more and more, regardless of span length



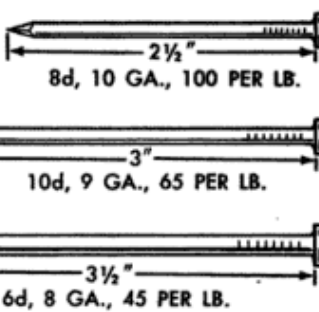
**OLD-STYLE HEADER** leaves gap to be filled by short studs. Less expensive—unless you count labor costs for extra work. Width of timber depends on span: from 6 in. for two-stud spaces to 10 in. for 4 or 5



# SEQUENCE OF ONE-MAN NAILING SYSTEM FOR ERECTING OUTSIDE WALLS



## COMMON NAIL SIZES



- 1ST. NAIL DOWN SOLE PLATE (A)
- 2ND. SET UP CORNERPOST ASSEMBLIES (B). CHECK WITH LEVEL ON TWO ADJACENT FACES AND USE TEMPORARY BRACING TO MAINTAIN ALIGNMENT
- 3RD. MAKE ASSEMBLY OF OUTLINE STUDS (C) AND FILLER STUDS (D) FOR WINDOW (OR DOOR) OPENINGS AND SET UP AS DESCRIBED FOR CORNER POSTS
- 4TH. PLACE LOWER PART OF DOUBLED TOP PLATE (E)
- 5TH. FIT IN HEADER (F). FULL 4 x 12 REGARDLESS OF SPAN
- 6TH. CUT AND FIT SHORT STUDS (G) UNDER OPENING
- 7TH. ADD LOWER PART OF DOUBLED SILL (H)
- 8TH. FILL IN WITH STUDS (J)
- 9TH. ADD TOP PART OF UPPER PLATE (K)
- 10TH. ADD TOP PART OF SILL (L)
- 11TH. ADD BRACING (M)
- 12TH. ADD BLOCKING (N)

MEMBER	NAIL SIZE	HOW MANY	NAILING METHOD
Joist Header to Floor Joists	20d	3	Into end joist
		2	Into other joists
	10d		Toe-nail into sill every 16"
Plywood Sub-floor	8d		Along all edges, space 6"; 12" along joists
Sole Plate	16d		Into joist header and joists, space and stagger 16"; space 16" along border joists
Posts	10d	3	Through basic studs into each filler block
		1	Through remaining stud (or studs) into each filler block
		about 8	Into basic studs, space and stagger about 12"
Studs	8d	4	Toe-nail twice on each wide surface
Bottom Part of Top Plate	16d	2	Through plate into each stud
Top Part of Top Plate	10d		Space and stagger 16" apart—two at each end
Diagonal Let-in Bracing	10d	2	At each stud crossing
		3	At each end
Header	10d	4-6	Through outline stud into header
Window Filler Stud	10d		Nail to outline stud, space and stagger 16"
Lower Part of Sill	10d	2	Into each stud under it
Upper part of Sill	10d		Into lower part of sill, space 8"
Door-Opening Filler Stud	10d		To outline stud, space 16"
		2	At bottom into sole plate

not a fine cabinet: the mars won't show.

Good carpentry, however, is important. Studs and posts that are off vertical, and headers that aren't horizontal, may not *show* any more than the hammer scars, but they'll create problems later on. Choose the straightest, soundest lumber for post assemblies and for outline and filler studs. When you set up the initial pieces, use a level on two adjacent faces, and don't skimp on temporary bracing to keep them plumb. One of the distinct advantages of working vertically (instead of assembling frames on the subfloor and tipping them up into place) is that alignment is easier to check. A level or plumb line isn't much help with a flat assembly.

Check yourself on measurements, especially when outlining door and window openings. An amateur can easily make a mistake when cutting a header to length because he forgets the filler studs. True, the actual rough opening is between the faces of these filler studs, but the header must pass across the top of them, so its length is the distance between the *outline* studs. On the other hand, don't measure so precisely that you must force the window into place. A label pasted on the window gives the exact dimensions. ★★



## CELLAR-STEP GREENHOUSE

THE OUTSIDE STAIRWAY leading to the basement of the home of Mr. and Mrs. J. B. Armstrong, Winston-Salem, N.C. originally ran parallel to the house, making it awkward to turn the corner into the doorway with a ladder or other cumbersome object. The obvious solution, a new stairway perpendicular to the building, offered an attractive bonus—a place for the greenhouse the Armstrongs had always wanted. There's now a total of 19 ft. straight access to cellar storage. Excavated to the same level as the basement floor, the 7 x 7-ft. greenhouse has an eastern exposure and has kept plants safe at temperatures down to zero. There is no door between the basement and the greenhouse, and though the basement is unheated, this opening helps to moderate temperatures in the greenhouse during the winter months. Some heat would be advisable, of course, in a northern climate.

Plate glass,  $\frac{1}{4}$ -in. thick and set into a steel framework, formed the roof. The cost of the glass was about \$1.50 per sq. ft. new, but the expense can be halved by purchasing used glass, as from a store remodeling job. With smaller panes,  $\frac{1}{8}$ -in. double-strength window glass would be adequate—except where the glass must support heavy snow loads.

Drains at the front of the stairs and inside the greenhouse prevent flooding.





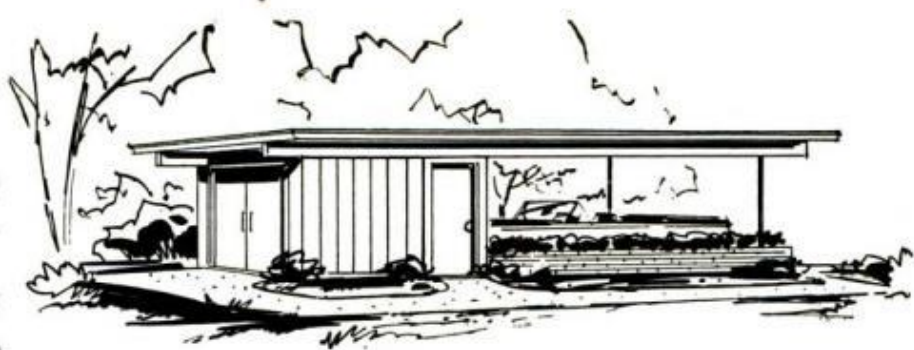
## DOUBLE-DUTY STRETCH FOR GARAGE OR CARPORT

**T**ODAY'S GARAGE is more than just a place to keep the family chariot. It's a storage room for rakes, lawn mowers, bicycles, charcoal grills and dozens of other items. So, if you'd like to design more *usable* space into your present garage, or build a new one that will serve you better, here are some ideas you can adapt—in whole or in part—to suit your needs.

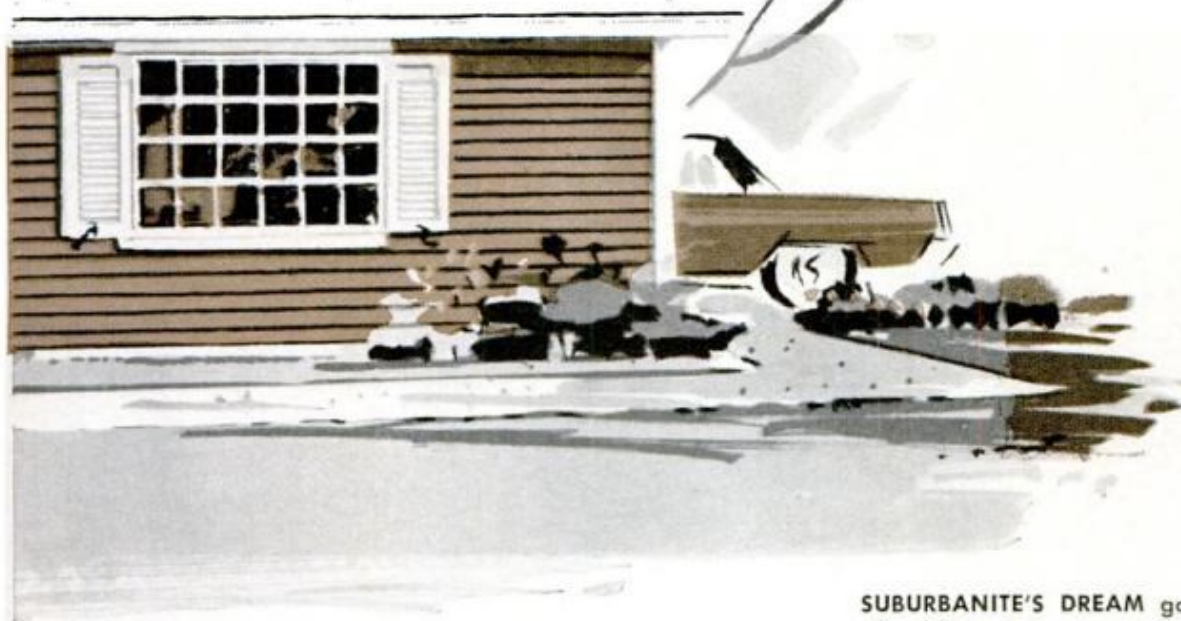
You'll note on these pages that we show a number of ways you can combine both car protection and general storage, for both

garages and carports. What each plan tries to do, essentially, is to make it possible to reach the car, or cars, without climbing over, under or around the garden tools, or to reach the garden tools without squeezing around the car. Sounds trivial, but it can save you hours of time on a busy weekend, plus a lot of aggravation.

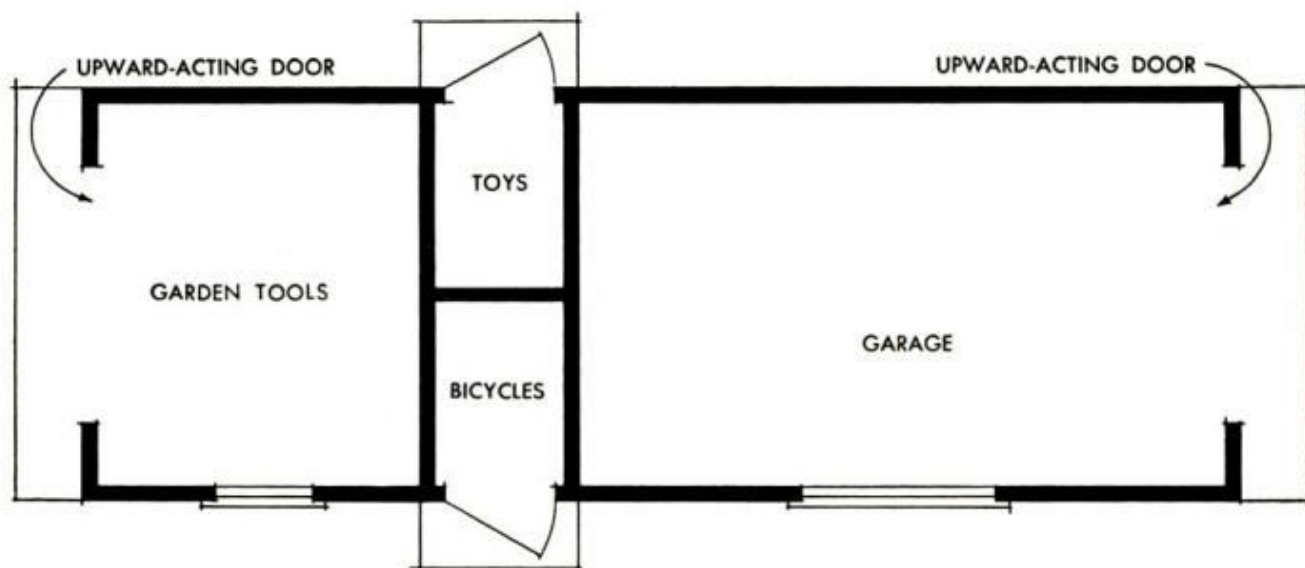
When studying the designs, incidentally, note how a few homey touches like a window or a cupola vent can make a garage look more like it belongs with the house.

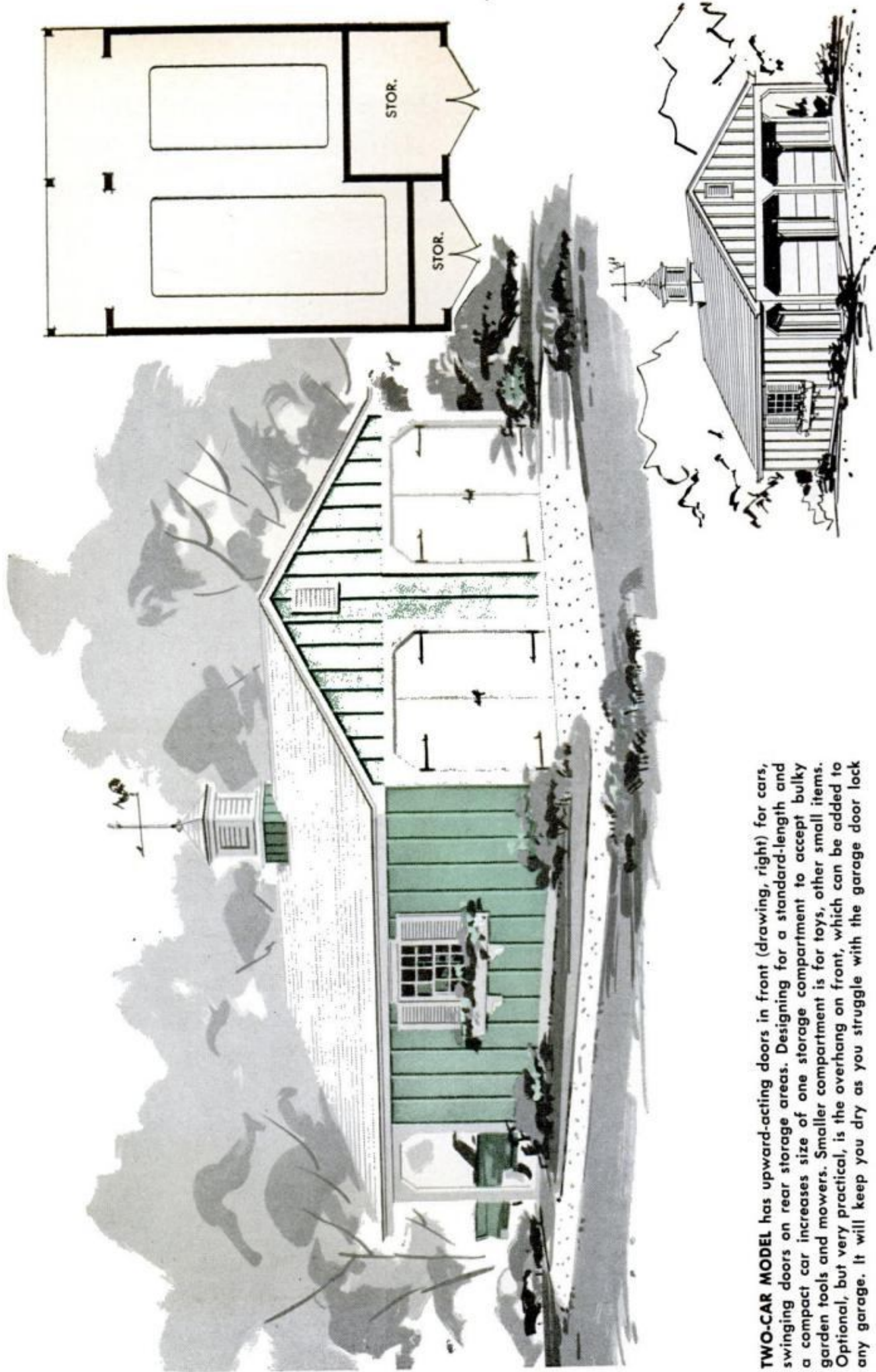


**CARPOT VERSION** has contemporary flat roof, retains separate entries to the compartments for garden tools, big toys



**SUBURBANITE'S DREAM** garage is the result of adding storage compartments to rear of the existing structure. Garden-tool area is big enough for a riding tractor, has full doors

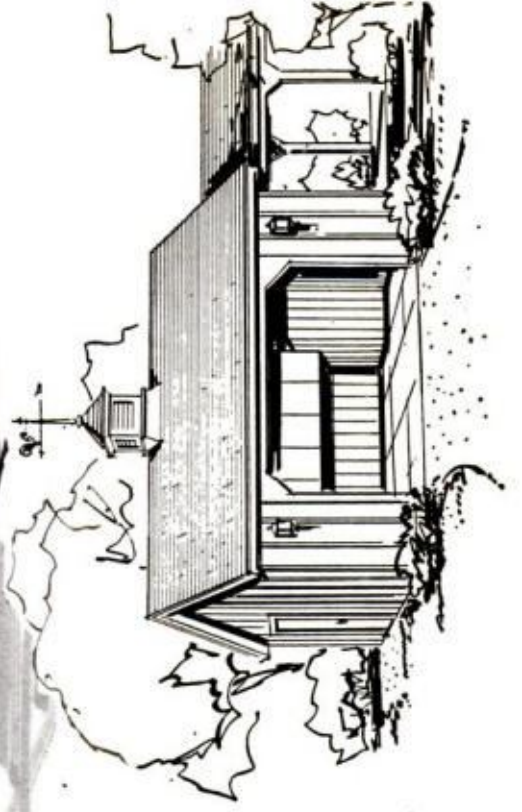
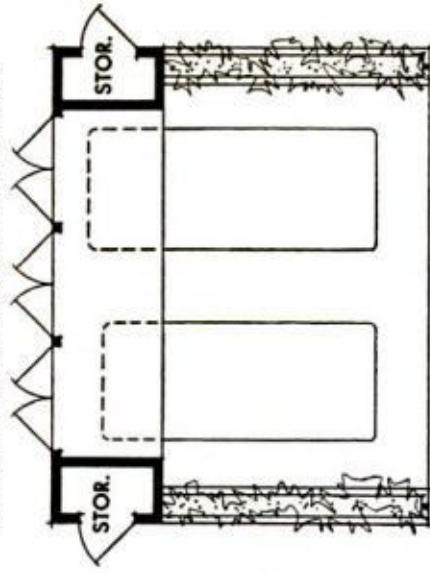




**TWO-CAR MODEL** has upward-acting doors in front (drawing, right) for cars, swinging doors on rear storage areas. Designing for a standard-length and a compact car increases size of one storage compartment to accept bulky garden tools and mowers. Smaller compartment is for toys, other small items. Optional, but very practical, is the overhang on front, which can be added to any garage. It will keep you dry as you struggle with the garage door lock



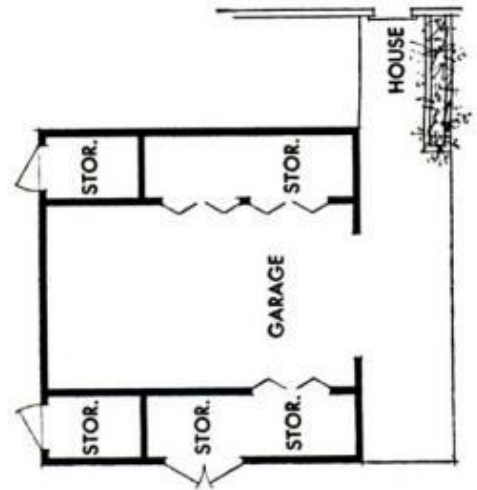
DOORS TO STORAGE ABOVE AUTO HOODS



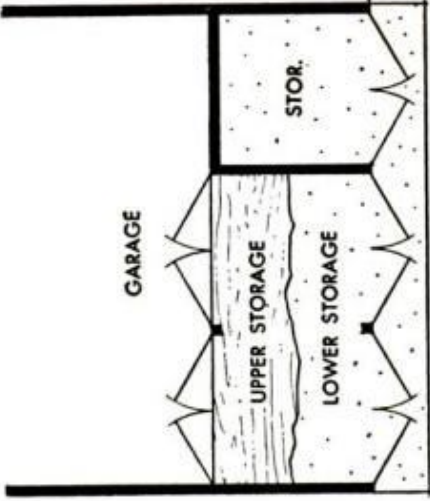
**ECONOMICAL CARPORT** will go nicely with a contemporary house. Main roof supports in rear double as storage compartments for large items. Cabinets for small items are built into rear wall, are off the floor so car hoods fit under them. Access to cabinets is from the rear. Same ideas adapt to traditional motif, as in drawing at right. Carport is connected to house by breeze-way. The roof is peaked instead of flat. Trim, siding are traditional



**SIDE WALLS** of modern single-car carport, below, have been widened into four generous storage areas. Two of these open outward, to the rear, one opens inward (for storing car tools), and one opens both inward and out. Note that broad front overhang of garage roof has been extended to the house, permitting you to reach the car dry in any weather



POPULAR MECHANICS



**AMATEUR MECHANICS** will like this design. One of the storage compartments built onto rear wall has been split into two sections (floor plan). Upper section opens inside the garage, making it ideal for holding jacks, tire irons and other auto tools. Lower section, plus a large compartment for garden tools, are reached from outside, through rear



## Pave Your Back Yard for Family Fun

Though it may take a while to get used to the idea, paving part of your back yard with concrete makes good sense. The smooth surface provides a safe place for the kids to skate and ride their bikes, serves as an outdoor dance floor when you're partying, and perhaps best of all, the small, saucer-shaped grass plot that remains, makes lawn tending a snap. For maximum length in a small area, it's best

to pave a circular walk, as was done in the yard shown above. After deciding on the size and shape of the area to be paved, level the ground, using stakes and chalk-line as a guide. Then hose down the soil and tamp it thoroughly. After that, place the forms; lay down a bed of gravel and pieces of welded wire fabric to reinforce the concrete. For a large area, ready-mixed concrete saves work.

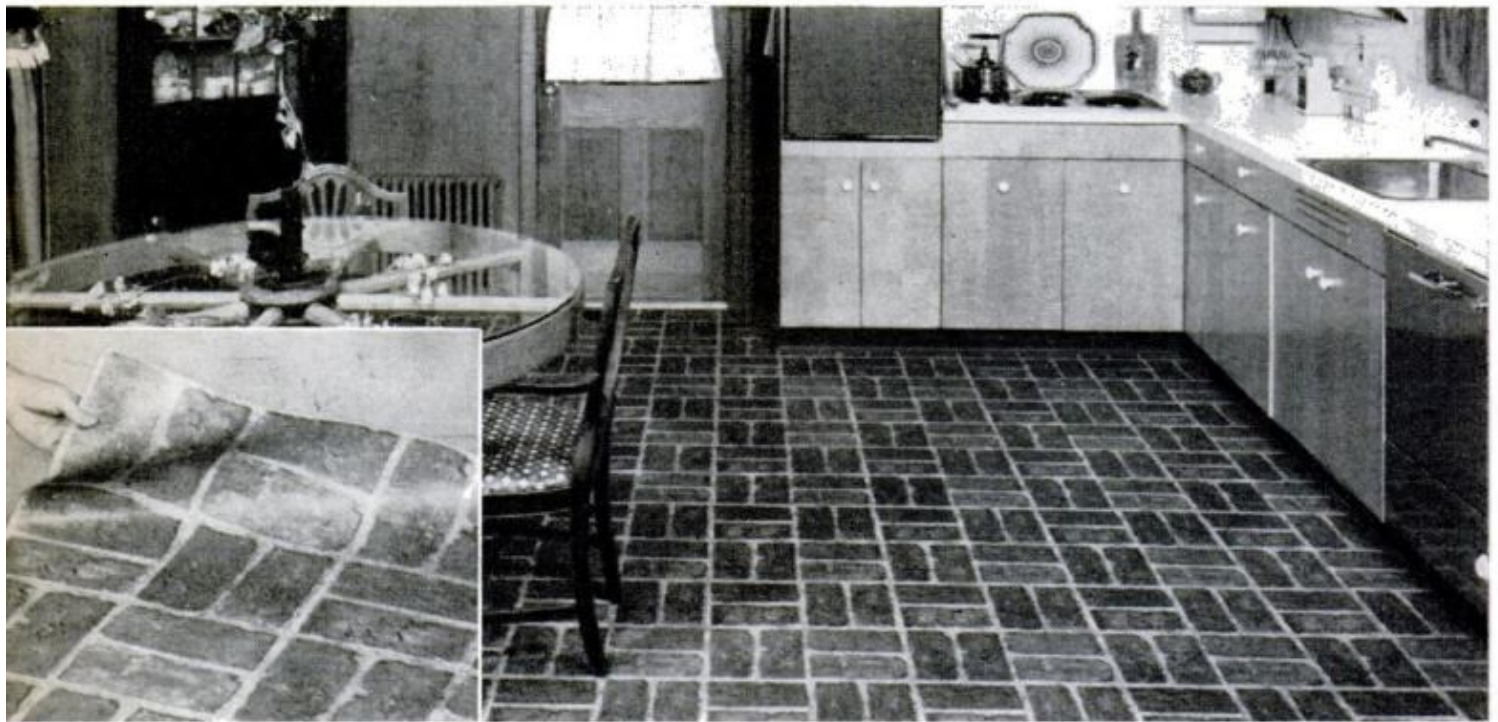
## Adjustable Screen Adds to Poolside Comfort

A louvered screen that separates a swimming pool and driveway may be closed when privacy is desired, or when the wind is uncomfortably gusty. In hot weather, opening the louvers transforms the pool area into a breezeway and provides an extended view of lawn and plantings. The vertical louvers are 4-in. planks

placed on end and beveled to lap smoothly when closed. Each louver is anchored, top and bottom, by a brass rod that fits into a pair of brass cups mortised in the supporting wood frame. A sliding wooden rod attached to the louvers permits adjustment. Potted plants or shrubs add a decorative effect.—*W. Radcliffe*



# New Building Materials

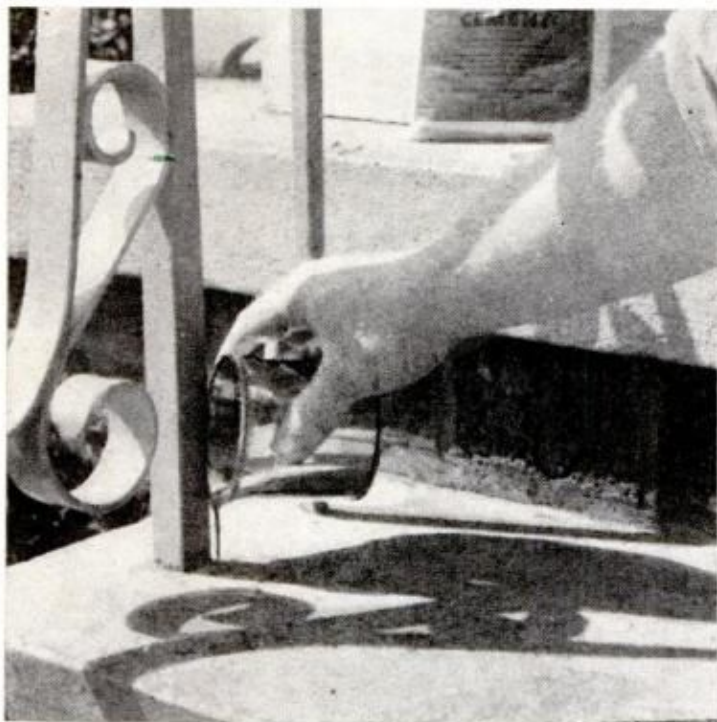


**BRICKS IN SHEET FORM:** Sandura's Luran Regency Antique Brick flooring has a smooth surface, yet looks surprisingly like real bricks and mortar. The brick pattern is reproduced photographically, then covered with a protective layer of clear vinyl. Material comes in six-foot widths that are solvent-welded together on the floor. Retail price around \$5 a square yard, not installed

**MAINTENANCE-FREE SIDING** from Insulite has a baked-on finish (white, green, beige or gray) that's guaranteed not to need painting for 10 years. Made in 12-in. by 16-ft. horizontal strips and 4 by 8 and 4 by 9-ft. panels. Strips are nailed on top edges only. Bottom edges are held on by alternating strips of adhesive. Cuts cleanly, easily. Costs \$65 and up per square for new construction



# Speed Up Remodeling



**CEMENT COMPOUND** expands as it sets to hold railings, brackets, bolts, etc. in concrete, masonry or metal. You mix with water, then pour. Sets hard in 15 minutes, is harder than concrete in an hour. Por-Rok (Hallemitte Mfg. Co.) costs 45 to 69 cents a pound

**ADHESIVE-BACKED COVE**, called Strip 'N Stik, protects the floor around and under your bathtub from water damage. Made by Marken Plastics in white, gold and black. After cutting to length, you remove paper backing and press in place. \$1.98 for 5½ feet



*They include a glue-on no-paint siding, a faster way to join C-I pipe and a flexible "paneling" that you can cut with scissors*

**By Arthur J. Maher**

**T**HE FIRST STEP in any remodeling project should be a review of the latest building materials. New ones appear all the time, and you may find a manufacturer has anticipated your needs with a product that will save you a few dollars, or give a better job for the time and money you're prepared to spend.

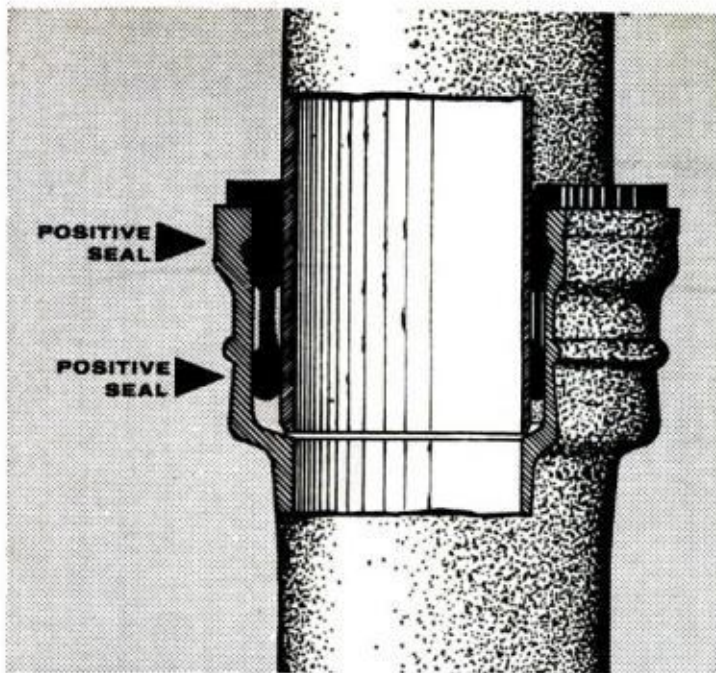
For example, a new prefinished siding called Vinyl-Bond (photos, bottom left) eliminates a paint job while lowering future maintenance costs. It's made of Insulite, a material similar to hardboard but softer, and is applied with nails and adhesive. The factory-applied finish is an industrial coating used on railroad cars, storage tanks and the like.

For a highly durable floor, there's Armstrong's Vistelle Corlon tile. Originally designed for industrial and commercial floors, this material is said to offer unusual resistance to staining and burns, and to recover within 24 hours when dented by a sharp heel. It's made in 9x9-inch tiles (⅛-inch thick), comes in 10 colors and runs about \$2 a square foot, installed.

When adding ventilated soffits, you can avoid a lot of framing with Soffitsote panels. These are 8- and 12-foot lengths of 1½-inch Homasote with factory-fitted screened vents. Widths are 12, 16 and 24 inches. Instead of being nailed to lookouts, the panels are held in place by steel angle brackets and tees like those used in suspended ceilings. Soffitsote is available either preprimed or prepainted for an average price of 18 cents a square foot.

While the list of new building products doesn't end here, we haven't the space to include them all. A representative sampling is shown in the photos at left and on the next three pages.

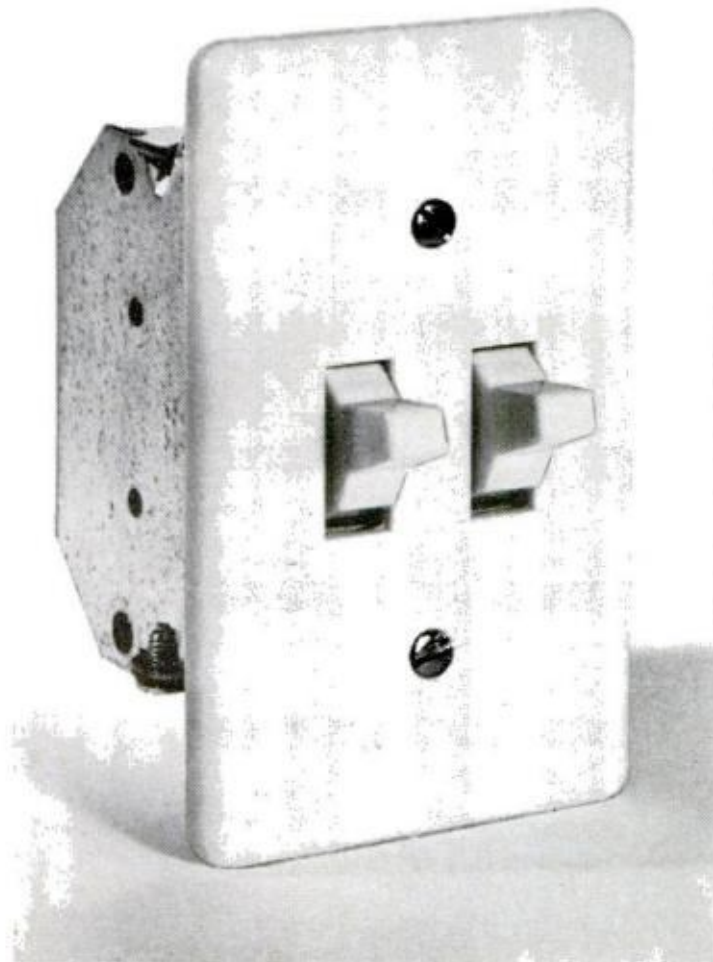




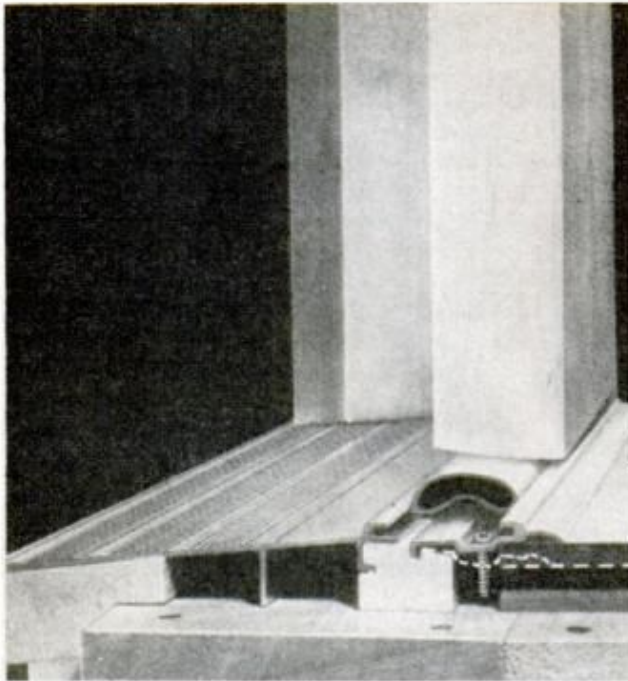
NEW JOINING METHOD for hubbed cast-iron soil pipe does away with lead and oakum. Seal is provided by Neoprene gasket (80 cents and up) that's lubricated and placed in hub. Lubricant (\$1.20 a qt.) is then applied to inside of gasket and next pipe inserted. Jacklike tool and stop (\$30 for both) pull joint together. Dual-Tite system was introduced by Alabama Pipe, Western Foundry, Anniston Foundry

A WIFE PLEASER: American Olean offers a line of 4¼ by 4¼-inch ceramic tiles that have decorative patterns burned into the finish. They are designed to blend with current solid colors, and are ideal for accenting a bathroom wall, tub enclosure, kitchen backsplash, entryway, etc. Available in 19 patterns, glossy or matte surfaces, from contractors only. They add 2 percent or more to cost of the bathroom tile

COMPACT SWITCHES: Rodale Manufacturing Co.'s Space Saver switches are installed in same manner as conventional switches. However, they're so small two will fit into a single-gang box, three or four into a double-gang box. Eliminate need to enlarge the wall opening for an extra switch. About 40 cents



## New Building Materials



**ADJUSTABLE THRESHOLD:** This prebuilt exterior door frame, called Adjust-A-Sill, sets right on the subflooring. By simply turning a few screws, you adjust the threshold to thickness of any finish floor from  $\frac{3}{8}$  to  $\frac{3}{4}$  in. The unit comes complete with jambs, preprimed outside casings, and full weatherstripping, for \$25 to \$30. Will accommodate  $1\frac{3}{4}$ -in. doors



**FIRE-RETARDANT ADHESIVE** for asphalt and vinyl-asbestos floor tile will not support combustion. The manufacturer, Templar Oil Products, says it contains no flammable solvents and requires no thinning. Can be used above or below grade. Applied with brush, roller or trowel. Gallon is good for up to 250 sq. ft. Bulldog FiREtard sells for about \$5 a gallon

# TWIN PARTITION CLOSETS

**Problem: Small adjacent bedrooms with inadequate closets. Solution: A wall-full of storage with almost no loss of floor space**

**A PARTITION WALL**—one that merely divides a big space into two smaller ones—is four inches of nothing. Sure, it creates privacy, but look at the floor space it eats up by the time you shove furniture against both sides! If you don't have space to spare—and who does, these days?—you can make the most of what you've got, with no loss of privacy, by folding built-ins into a dividing wall, facing alternate units in opposite directions to serve each of the rooms.

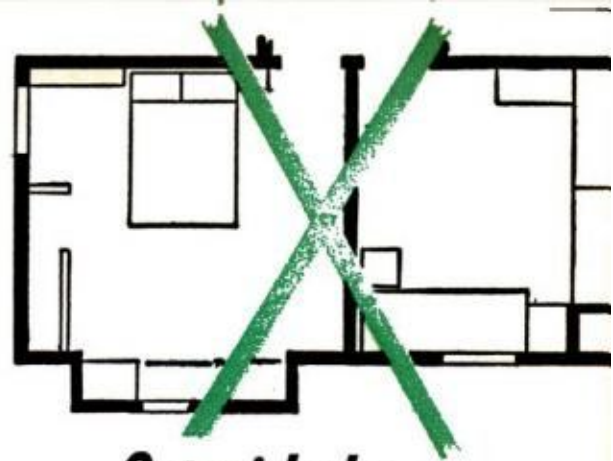
In the set-up shown on the next page, a non-load-bearing partition was replaced with full-height built-ins, but you can adapt the idea to other situations. You may merely want to cut away a section of an existing partition, to insert the double closet unit. If the wall supports ceiling joists, of course, you'll have to bridge the resulting gap with a header, which may

mean omitting the overhead storage compartments. Or if you have a large room that you want to convert into two bedrooms for a growing family, here's the ideal divider for you. It takes less than two feet of floor space down the center of the room—and every inch is put to work.

With the floor plan shown here, there was the additional problem of inward-opening doors set close together, so the thick closet section had to stop short of the entrance wall, to permit the doors to open fully. Even this space was put to use, however. It became a built-in bookcase for one of the two rooms.

Construction calls for 2x2s for top frames, bottom frames, drawer runners and vertical stiffeners. Use 2x4s to tie the unit to the wall, and as the uprights for the frame between the closets. You'll note on page 142 that the 2x2s are notched into





***Out with the  
dead wall...  
In with a  
two-faced  
working  
wall***

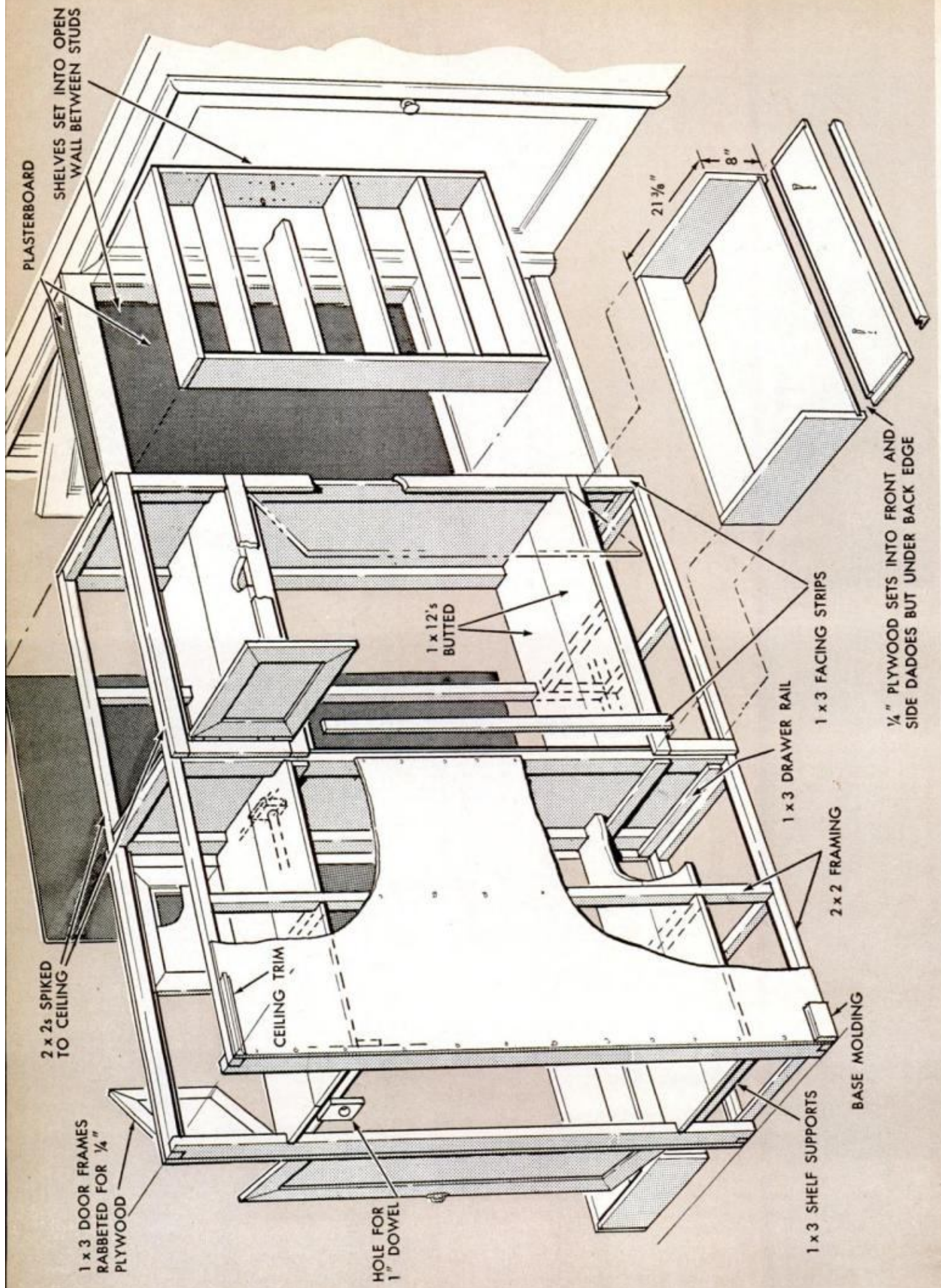


**By Hank Clark**

**IN THIS EXAMPLE,** the two bedrooms are in a converted attic. Already small, their potential space for a wardrobe closet was further diminished by the eaves-slope which left room for only cramped, low storage. When the plain partition was replaced with floor-to-ceiling built-ins, both rooms benefited as shown in the photos

**For plans, please turn the page** ▶





PLASTERBOARD

SHELVES SET INTO OPEN WALL BETWEEN STUDS

2 x 2s SPIKED TO CEILING

1 x 3 DOOR FRAMES RABBETED FOR 1/4" PLYWOOD

CEILING TRIM

HOLE FOR 1" DOWEL

1 x 12's BUTTED

1 x 3 DRAWER RAIL

1 x 3 FACING STRIPS

2 x 2 FRAMING

1 x 3 SHELF SUPPORTS

BASE MOLDING

21 3/8"

8"

1/4" PLYWOOD SETS INTO FRONT AND SIDE DADOES BUT UNDER BACK EDGE

the wall-tie 2x4s both top and bottom. In most other cases, though, members meet in simple butt joints. The frame as shown gives you a rigid form for nailing on plasterboard or any other drywall panel.

Two studs of the old partition were left in place to support the bookcase. If you're building from scratch, spike a sole plate to the floor, from the end of the closet unit to the far wall, and erect a couple of studs to hang the bookshelf unit between. For flexibility, we left the shelves loose within the 1x8 box frame, drilling pairs of holes in both side members to accept shelf-support inserts—or dowel stubs—to permit adjustability as storage needs changed. If you'd prefer to skip this boring job (and that's not just a pun) you could mount adjustable shelf standards, instead; but we'd suggest you either recess them into grooves or notch the shelf ends around them, to avoid unsightly gaps.

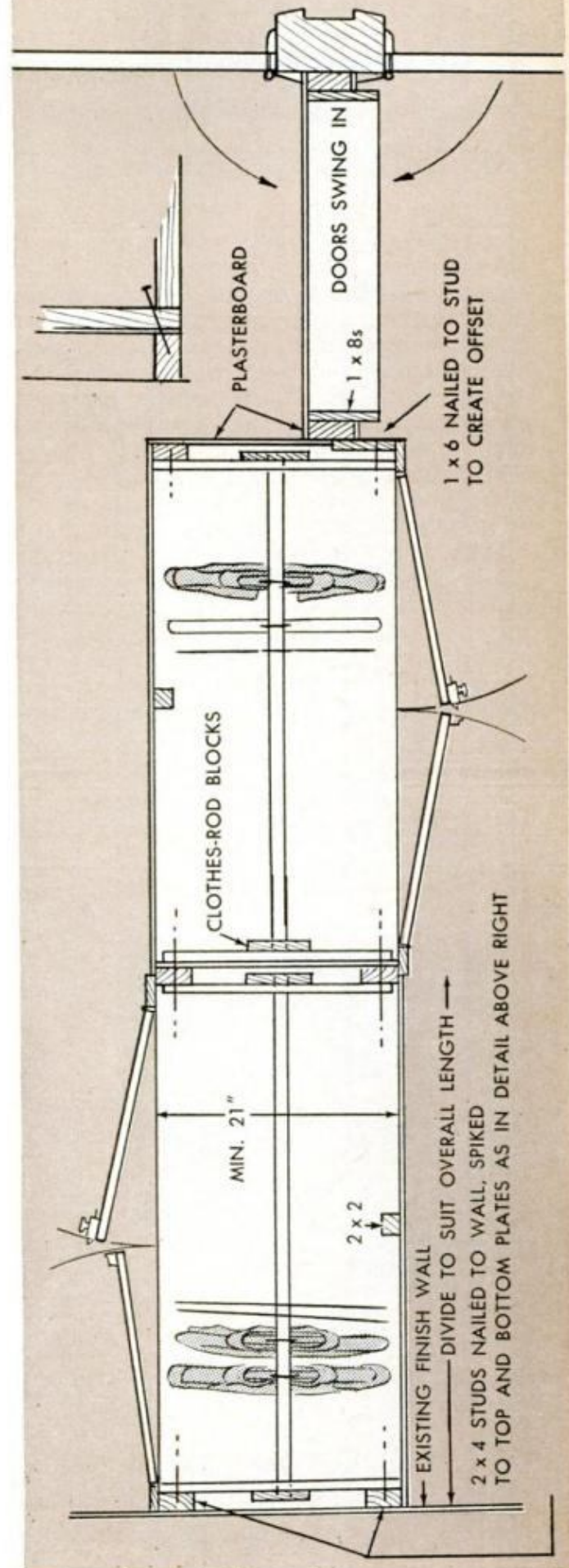
We used pine facing strips to finish off around the doors and other exposed lumber—such as the face of the studs, recessed at either side of the bookcase. Pine 1x3s also served to frame the door panels for both the top and wardrobe compartments. These were mitered at each corner and rabbeted on their inner edges to receive 1/4-in. plywood panels. If you'd rather have a sleek, modern look—with less work—these doors can be simple panels of 3/4-in. hardwood plywood. With an 8-ft. ceiling, you could even cut the doors and drawer front from the same panels, so the grain would run unbroken from floor to ceiling.

Closet floors and shelves are just pine shelving laid on 1x3 cleats nailed across the frame. But, in addition, the front edge of both upper shelves rests on a 1x3 apron. When the 1x3 facing strip is then applied to cover this edge, the resulting offset provides a stop-rabbit for the wardrobe doors. So they'll close with extra firmness. you may want to center a small stop block on the top face of the closet floor, as well. For the clothes rods, insert 1-in. birch dowels or 3/4-in. galv. pipe into drilled blocks nailed to the upper-shelf cleats, as shown in the plan view at right.

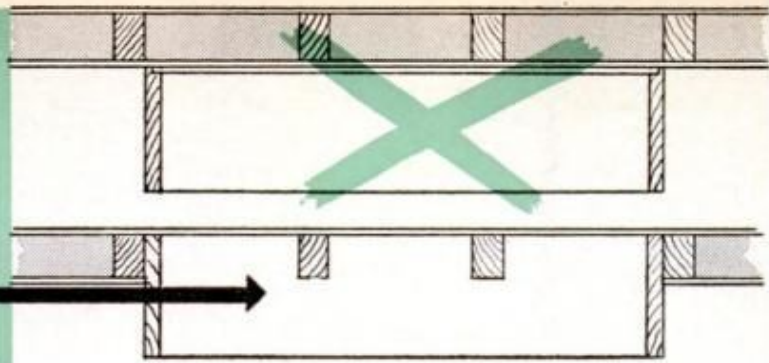
A panel of either plywood or plasterboard will partition off the two closets—unless you want to leave this open as a "secret passage" between the rooms, until the kids grow up.

Each wardrobe has a big lower drawer for storage of bedding. No width dimensions are given for drawers or doors in the assembly sketch at left, because these will be determined by the length of the partition required. The drawer pull can be simply a wood strip with the lower edge rabbeted to form a finger grip (as shown above left), or use commercial pulls. ★★ ★

## PLAN VIEW OF PARTITION



# In-a-Wall BOOKCASE



FREE-STANDING BOOKSHELVES, shoved against a wall, seldom look as if they belong. Unless the wall is perfectly square with the floor, the bookcase leans away, leaving a gap behind. And there's a limit to how high you can stack such shelves before yelling "Tim-m-m-ber!"

But worst of all, in today's cramped rooms bookcases are space-grabbers, drawing the wall further forward.

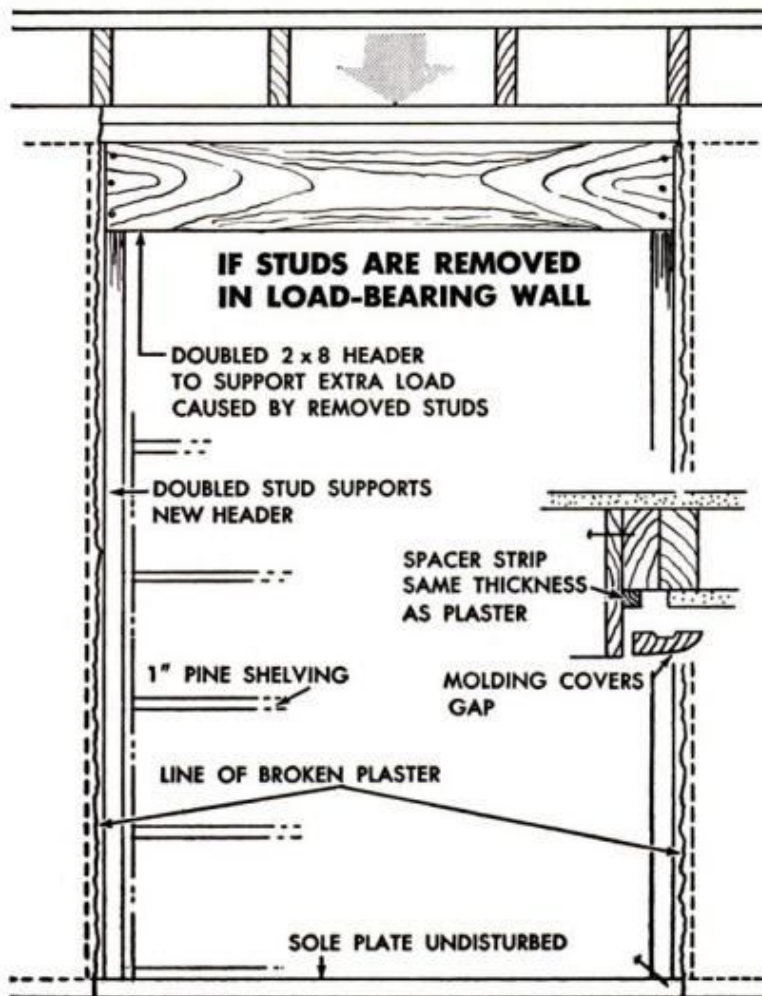
All these problems are solved if you sink your shelves *into* the wall, taking advantage of the 4-in. hollow behind the plaster (or wallboard). The diagrams above show how much space you save with standard 8-in. shelves: Recessed, they eat up only *half* as much floor space.

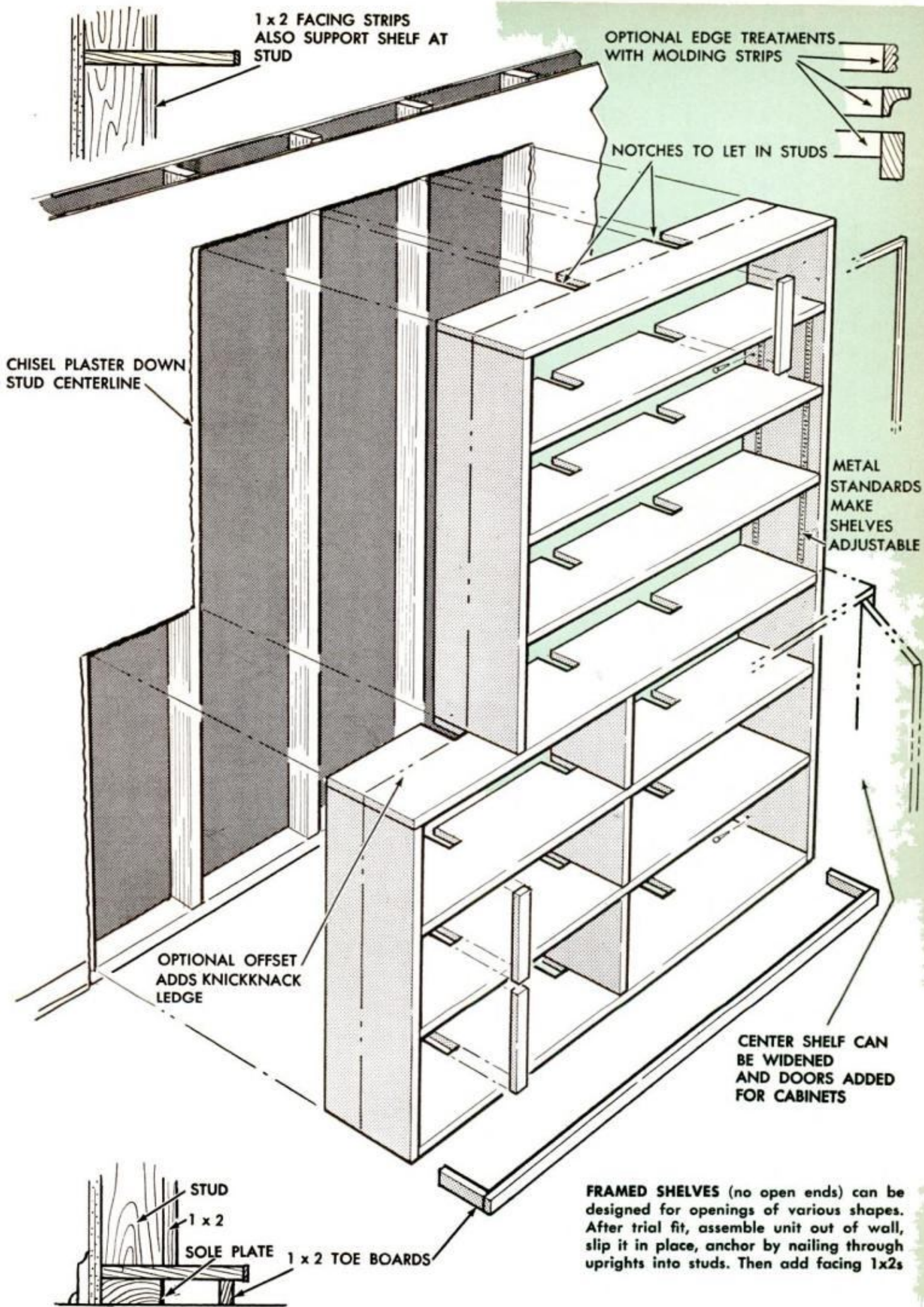
This trick applies to partition walls only, of course. You'd never cut into an exterior wall because of insulation and vapor-bar-

rier problems. But most homes have plenty of unused space along partition walls—and some of these walls aren't even load-bearing. In such cases, you can simply trim away the studs within the opening. But where the wall is a structural part of the house—supporting ceiling joists—you'll actually *add* strength by notching your shelves around the studs you bring to light when you cut away the finish wall.

Since these studs are rarely top-grade lumber, you may have to dress them up a bit. When the books are in place, only the front edges of the studs will show, so facing strips, glued on and painted, are an easy solution. If the rear face of the opposite wall is naked lath, you'll want to mask it with panels of  $\frac{1}{8}$ -in. hardboard, fitted between the studs, before you insert the shelf assembly.—*Hank Clark*

**TWO METHODS** are shown here. Below, only wall surface is removed, and shelves are notched to let in studs. For stud-less bookshelf, you cut away studs within the opening, but if wall is load-bearing you must treat opening like a doorway (right)





CHISEL PLASTER DOWN  
STUD CENTERLINE

1 x 2 FACING STRIPS  
ALSO SUPPORT SHELF AT  
STUD

OPTIONAL EDGE TREATMENTS  
WITH MOLDING STRIPS

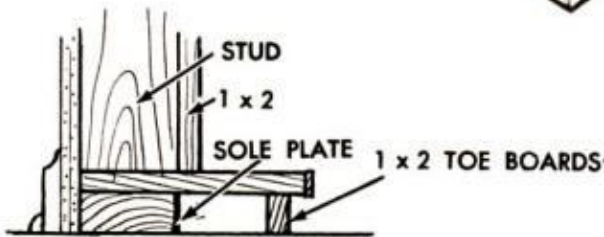
NOTCHES TO LET IN STUDS

METAL  
STANDARDS  
MAKE  
SHELVES  
ADJUSTABLE

OPTIONAL OFFSET  
ADDS KNICKKNACK  
LEDGE

CENTER SHELF CAN  
BE WIDENED  
AND DOORS  
ADDED  
FOR CABINETS

FRAMED SHELVES (no open ends) can be  
designed for openings of various shapes.  
After trial fit, assemble unit out of wall,  
slip it in place, anchor by nailing through  
uprights into studs. Then add facing 1x2s



# EL GATO

## TWELVE FEET OF TWIN-HULLED SPEED

### Part I

**Sleek, stable and speedy, this easily-built plywood catamaran is demountable for car-topping**

**E**VERYTHING ABOUT this small cat is easy. The slim 80-lb. hulls are light enough for car-topping and small enough to be stowed on the rafters in your garage during the off-season. Furthermore, with a beam of only 2 ft., the hulls don't require a large building floor for construction.

It's even easy on your pocketbook. You can build *El Gato* for only \$275, complete with sail. That's about \$500 below what you'd pay for a commercial fiberglass cat of the same size. (In case you're wondering, "gato" is Spanish for cat.)

Single-handing *El Gato's* cat rig is a breeze, yet the 4 x 5-ft. cockpit is roomy enough to hold two or three people if you care for company. Two men can have the boat assembled and ready to sail in only 15 minutes; it's just a matter of tightening 12 bolts and stepping the mast. In short, *El Gato* is a fast, fun and frugal way of getting into the hottest thing under canvas today—the sailing catamaran.

General instructions regarding the selection of materials and fastenings are given on pages 150 and 151. Remember that all joints should be both glued and screwed. Before you begin construction, go over the plans carefully to make sure that everything is perfectly clear. Then start by assembling the bulkheads.

Working one frame at a time, lay out one half of the bulkhead directly on the 1/4-in. plywood. Since you will need duplicate bulkheads for the twin hulls, tack a second piece of plywood directly under the first so that you can saw both out at the same time. After cutting one half, separate the two pieces of plywood, flip the

**LENGTH: 11 ft. 10 in., o.a.**

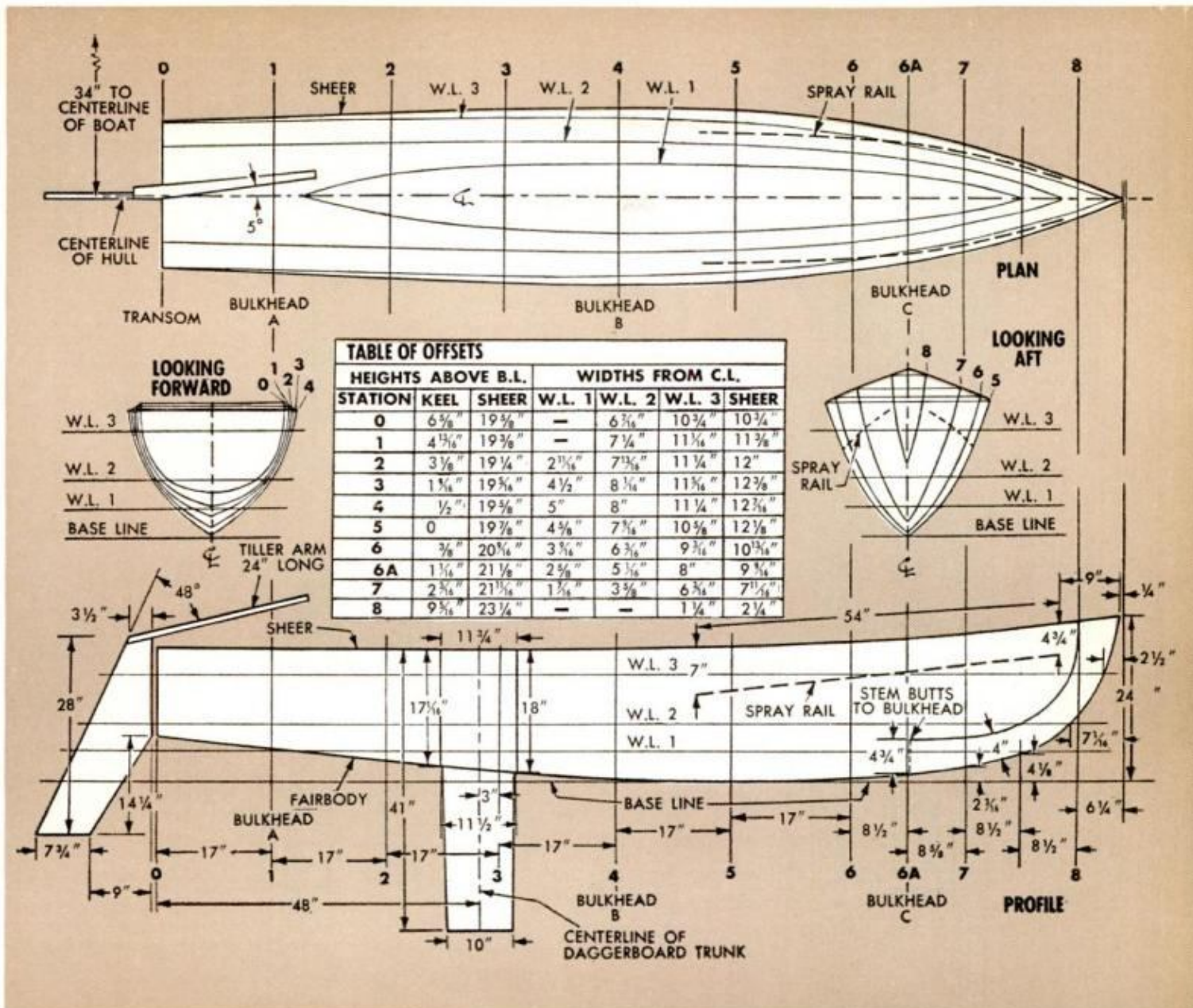
**BEAM: 7 ft. 10 in., o.a.**

**SAIL AREA: 120 sq. ft.**

**WEIGHT: 200 lbs.**

**CONSTRUCTION: Plywood**

**DESIGNERS: Seymour Paul  
Glen L. Witt**



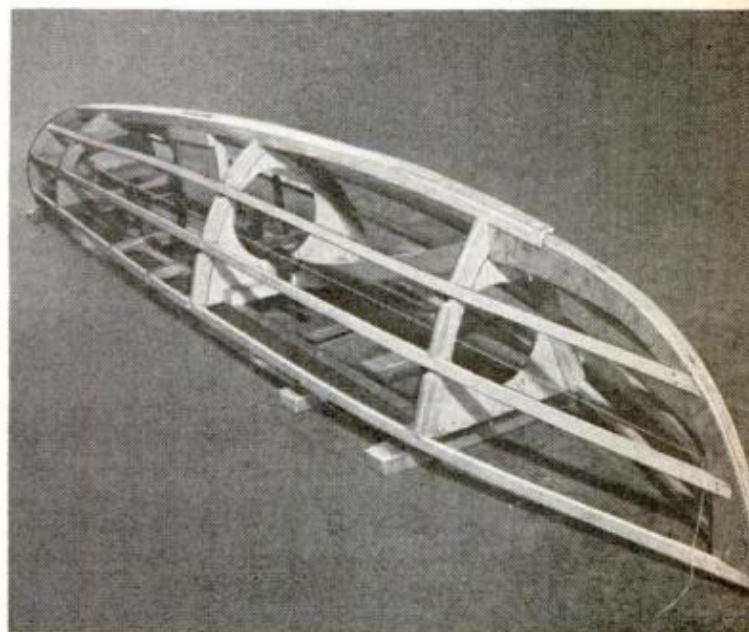
top one over, relocate it on the centerline and use it as a cutting pattern for the other half.

The framework for each bulkhead should be cut from 1-in.-thick material trimmed to a minimum width of 1 1/2 in. After coating mating surfaces liberally with glue, nail through the plywood into the frame with 1-in. nails. Secure a 1 1/2 x 1 1/4-in. cleat at the top of each bulkhead on the side opposite the framework. When cutting the framing for bulkhead C, remember to notch it for the stem since this member is designed to fit between the framing pieces and butt to the plywood.

Follow the same procedure with the transom, but be sure to notch the framework for the ribbands, sheer clamps and keel before assembly since these don't extend through the plywood. Space the ribbands evenly between the keel and sheer clamps.

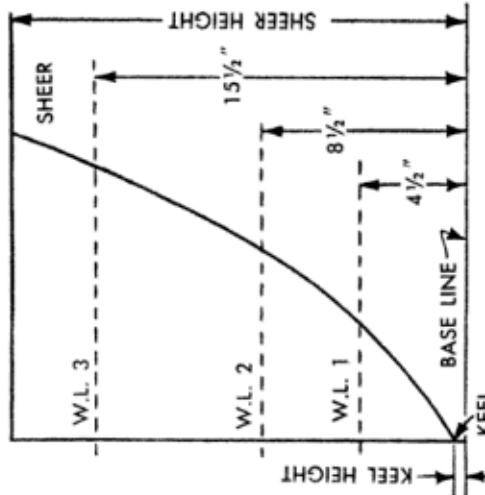
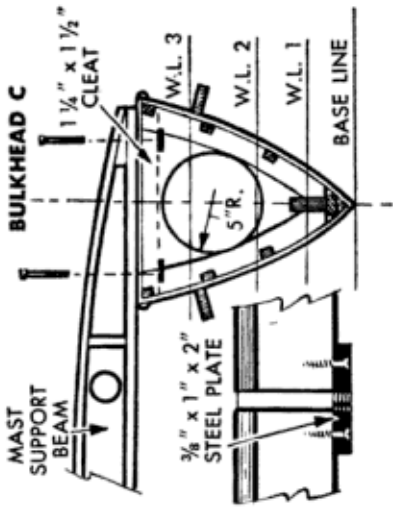
The stem is built up from two laminations of 1/2-in. plywood. Coat matching

**ONE BIG ADVANTAGE** in building a catamaran is that you can use the same building form for both hulls. Note brace between bulkheads B and C which holds them in line while framing is being installed



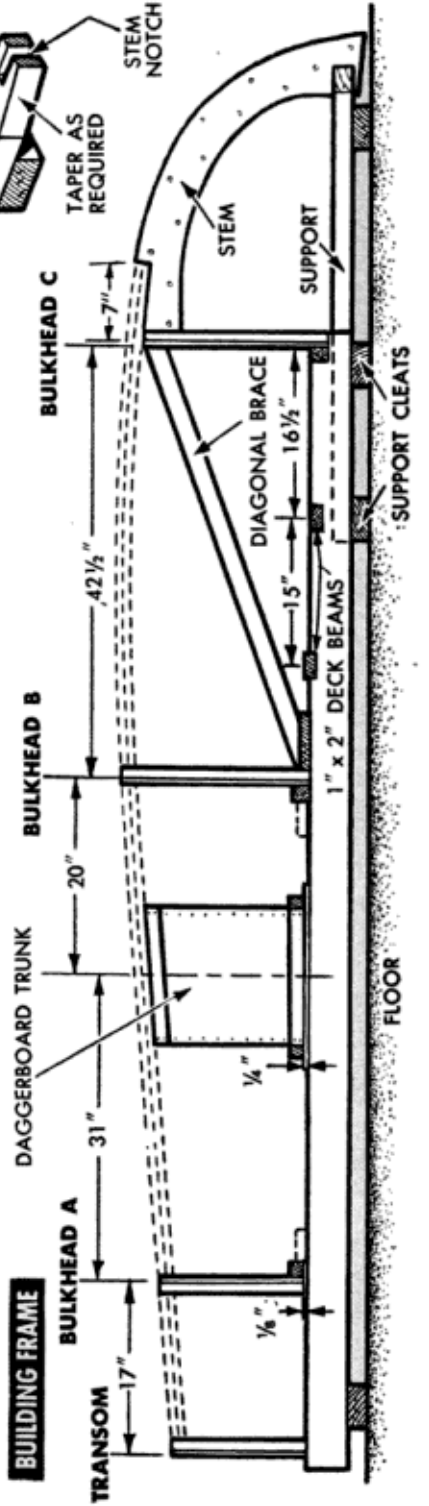
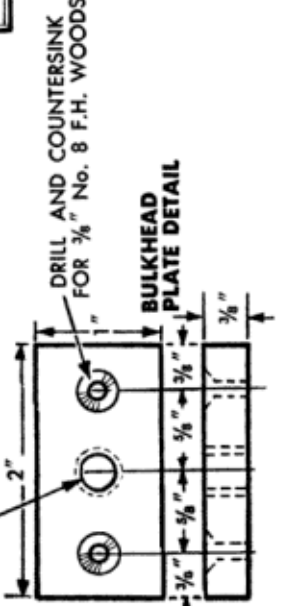
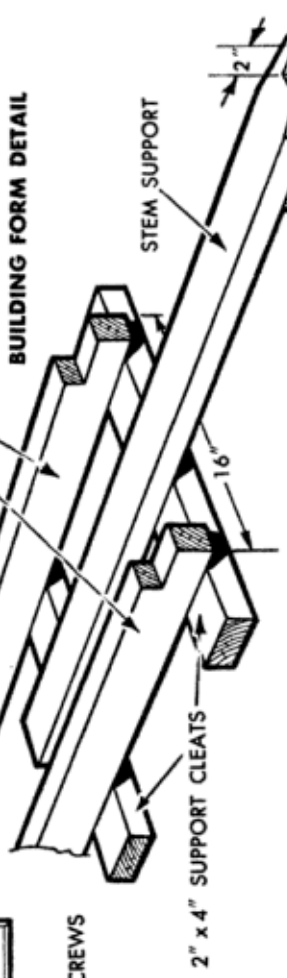
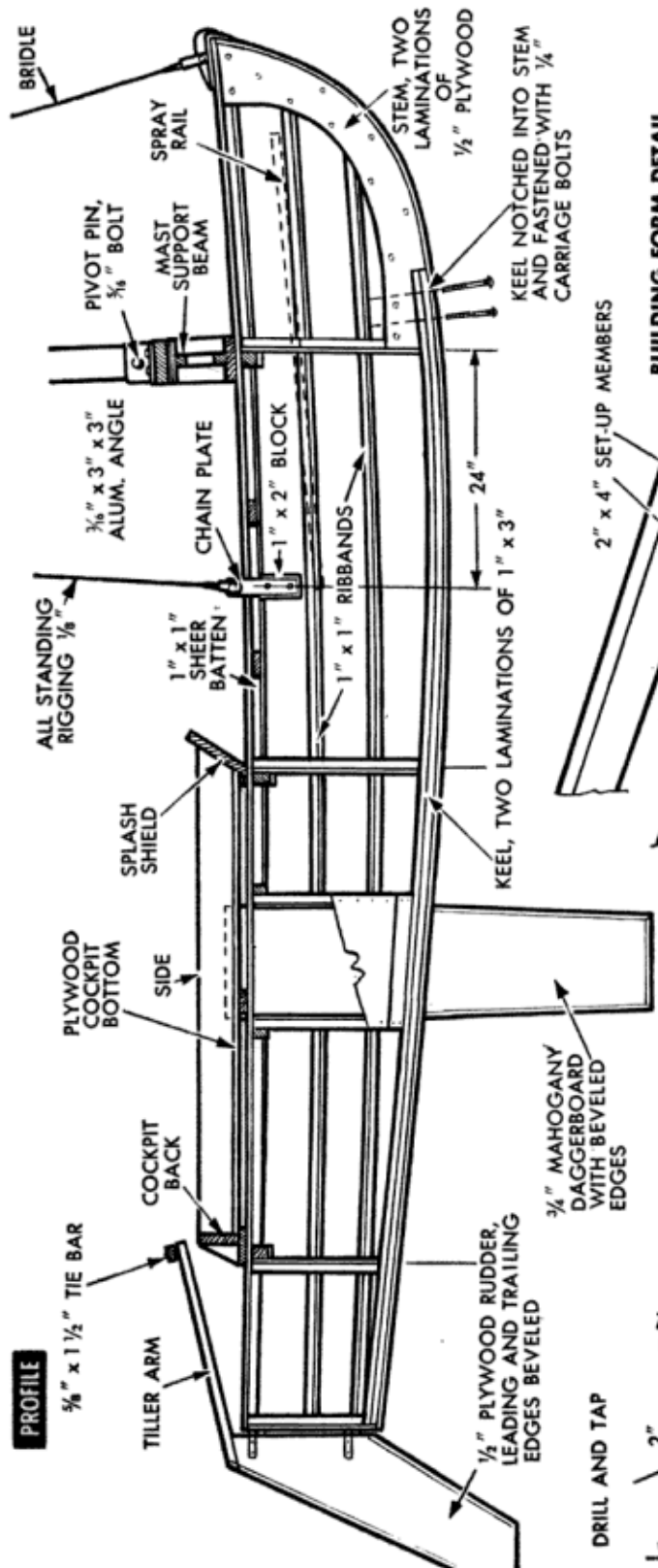


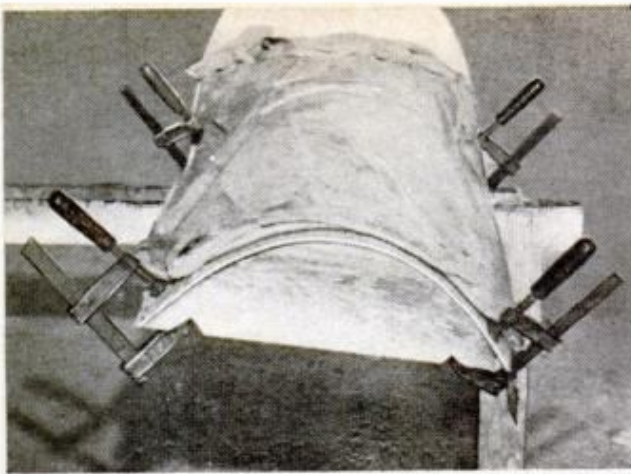




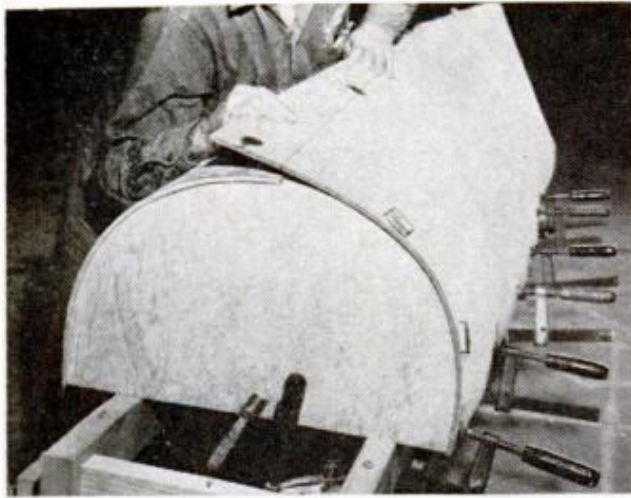
METHOD OF LAYING OUT BULKHEADS AND TRANSOM IS SHOWN ABOVE. THE HEIGHTS OF W.L. 1, 2 AND 3 ARE THE SAME AT EACH STATION. THE HEIGHTS AND WIDTHS OF EACH STATION ARE NOTED IN THE TABLE BELOW. USE A BATTEN TO DRAW THE ARC FROM KEEL TO SHEER. ALL BULKHEADS ARE SYMMETRICAL ABOUT THE CENTERLINE.

STATION	HEIGHTS		WIDTHS		
	KEEL	SHEER	W.L. 2	W.L. 3	SHEER
O	6 5/8"	19 5/8"	—	6 3/8"	10 3/4"
A	4 3/8"	19 3/8"	—	7 1/4"	11 1/8"
B	1/2"	19 3/8"	5"	8"	11 1/4"
C	1 1/8"	21 1/8"	2 3/8"	5 1/8"	8"





**PRE-FORMING PLANKING** over a bending block, above, makes it easier to install. When mounting planking, below, hold to sheer with clamps or screws



surfaces liberally with glue and nail the two pieces together with 1-in. nails spaced 3 in. apart.

Use  $\frac{1}{4}$ -in. plywood for the sides of the daggerboard trunk and 1 x 1-in. cleats to form the slot. Note that the vertical dimensions for the trunk layout are taken from a straight line which isn't parallel to the sheer. After coating the cleats with glue, nail them to one of the sides. Then nail a  $1\frac{1}{2}$ -in.-wide bed-log on the opposite side of this piece at the bottom. Assemble the other half of the trunk with only the bed-log and upper cleat.

The inside of the daggerboard trunk must be either painted or covered with fiberglass before the two halves are assembled. If you decide to use fiberglass, lap it over the 1 x 1-in. cleats which form the slot and cover the inner surface of the other half completely. Then, while both surfaces are still tacky, fasten the two halves together with 1-in. nails. To complete the trunk, attach the 1 x  $1\frac{1}{2}$ -in. fore and aft beams, notching them to fit around the sheer clamps.

Once you have completed the bulkheads, transom, stem and daggerboard trunk, you are ready to assemble them on the build-

ing form. This form may be either fastened directly to the floor or mounted on a pair of saw horses to raise it to a more convenient working height. A cord or wire stretched down the centerline between the stem and transom will assure accurate positioning of the bulkheads. Be sure that bulkheads are correctly spaced and perfectly vertical to the form, then brace them to the form or to one another to prevent movement during construction. Finally, slip the stem between the framing of bulkhead C so that it butts to the plywood and fasten it with several 1-in. nails, using the stem support member to hold the bow end.

The keel is actually two laminations of 1 x 3-in. stock mounted one at a time on the frames. It tapers evenly from bulkhead B forward to a width of  $1\frac{1}{2}$  in. at bulkhead C. Before mounting the first keel lamination, bevel the keel notches in the bulkheads so that the keel will fit flush against the framework. Also, cut the daggerboard slot in both laminations.

Fasten the initial keel lamination to the bulkheads and daggerboard-trunk bedlogs with glue and  $1\frac{1}{2}$ -in. screws, then coat this liberally with glue and apply the second directly over it. After the second lamination is in place, bolt the keel to the stem with  $\frac{1}{4}$ -in. carriage bolts. To avoid fairing problems later, recess the heads of the bolts deeply and locate screws on the centerline of each bulkhead.

## Materials List

**LUMBER.** All lumber should be clear first-grade "four-quarters" finished as full as possible. Thus, lumber noted as 1" will usually have a finished thickness of from  $\frac{3}{4}$ " to  $\frac{7}{8}$ ". All other thicknesses are net, as are all widths. All lengths given allow for cutting and trimming to size. This list is intended as a general guide only and should not be used to purchase materials until the dimensions have been checked against the work and reviewed for possible options. Considerable over-all saving will result from grouping pieces having the same width and thickness to be resawed to required size later. The use of lighter lumbers, such as Sitka spruce or Philippine mahogany, is preferable to framing with white oak or other heavier species.

No. of Pcs.	Size	Item
2	1" x 8" x 9' 6"	Bulkhead, transom and daggerboard trunk frame
1	$1\frac{1}{4}$ " x $1\frac{1}{2}$ " x 12'	Bulkhead top cleat
12	1" x 1" x 12'	Sheer and ribbands
4	1" x 3" x 11'	Keel laminations
2	1" x 5" x 4'	Cockpit sides
1	$\frac{1}{2}$ " x 8" x 8'	Cockpit splash shield
1	1" x 4" x 8'	Cockpit back
2	1" x $1\frac{1}{2}$ " x 4'	Cockpit side cleats
1	1" x $3\frac{1}{2}$ " x 8'	Cockpit back cleat
1	1" x $1\frac{3}{4}$ " x 8'	Cockpit splash shield cleat
1	1" x 2" x 6'	Cockpit center batten
1	1" x 6" x 8'	Mast beam upright
1	1" x 4" x 8'	Mast beam base
1	$\frac{1}{2}$ " x 4" x 8'	Mast beam top
1	1" x 12" x 8'	Daggerboards
Misc. blocking as required		



**SPRAY RAILS** molded to a width of about 2 in. must be fitted to the hull by trial and error to assure perfect fit. Mount with screws driven from inside hull

The 1 x 1-in. ribbands should be spaced evenly at bulkhead C, approximately dividing it into thirds on either side of the centerline. Where they contact the stem, a long taper and slight twist will be required in order to make them mate properly with the planking. Secure them with glue and one 1½-in. screw at each point.

Mount the 1 x 1-in. sheer clamps in the same way. It's important that these members form a clean curve with no irregularities. Bevel each one to fit against the stem, and after removing the stem support, fasten as you did the ribbands. Finally, hand-fit the two deck spreader beams between the sheer clamps forward



**AFTER PLANKING** the hulls, it's a good idea to make a couple of cradles to hold each one upright during rest of construction. Make these from scrap plywood

of Bulkhead B, and you are ready to begin fairing.

Fairing is really just bevelling the framework so that the planking will fit flush against it. Starting along the keel at the stern, file notches which follow the contour of the bulkheads and then use a plane to bevel the edges of the keel to the depth of these notches. When fairing bulkhead framework, undercut the edges slightly to avoid projections. Once the framework is faired, cut notches in each bulkhead next to all longitudinals to enable the bilge water to drain aft and install drain plugs on either side of the keel

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

## and Plans Information

**PLYWOOD.** Exterior Douglas fir is satisfactory in all cases, though some may prefer to use mahogany for appearance. Naturally, marine plywood (solid core) is preferable for planking and may be substituted for exterior plywood. Likewise, you can make the boat lighter and slightly faster without decreasing the structural strength materially by using 3/16" plywood for planking. Regardless of thickness, however, all plywood should have a minimum of three plies, and any thicker than 3/8" at least five plies.

No. of Pcs.	Size	Item
1	1/2" x 4' x 8'	Stem laminations, rudder
1	1/4" x 4' x 8'	Bulkheads, transom, daggerboard trunk sides
2	1/4" x 4' x 8'	Decking
2	1/4" x 4' x 12'	Planking
1	3/8" x 4' x 6'	Cockpit floor

**FASTENINGS.** All fastenings should be bronze or hot-dipped galvanized. Brass isn't recommended due to its tendency to fracture under stress. Nails should be annular-ring type (Stronghold, Anchorfast or similar).

<b>Screws:</b> Flatheaded woodscrews	
1" No. 8	5 gross
1½" No. 8	3 gross

<b>Nails:</b> Annular ring, bronze	
1" No. 12	5 lbs.

<b>Bolts:</b> Carriage-type, with nuts and washers	
1/4" x 4½"	2 required
1/4" x 5"	2 required

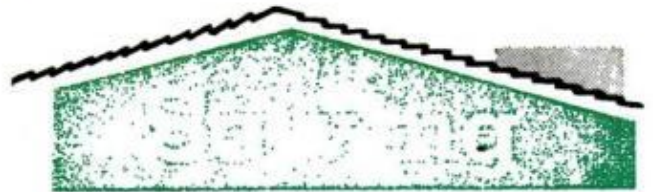
**Glue:** Resorcinol or urea resin type, either 1 gal. or 5 lbs., depending on type selected

**Specialty Items:**

- Plates: 3/8" x 1" x 2" brass or galvanized steel with tapped hole, 12 required
- Bolts: 3/8"-dia. USS machine bolts, bronze or steel, with flat washers. Check lengths against work:
- Cockpit to hull—3½" long, 8 required
- Mast beam to hull—4" long, 2 required
- Mast beam to hull—7" long, 2 required

**PM PLANS.** If you are planning to build *El Gato* and would prefer to work from larger plans than those appearing in the magazine, enlargements of the plans included in parts I and II of this article will be available after Oct. 1. Printed on four 22" x 28" sheets, these will also include details for making a car-top carrier and a single-piece spruce mast. Just send \$4 to Popular Mechanics Boat Plans, Bureau of Information, 575 Lexington Ave., N.Y., N.Y.

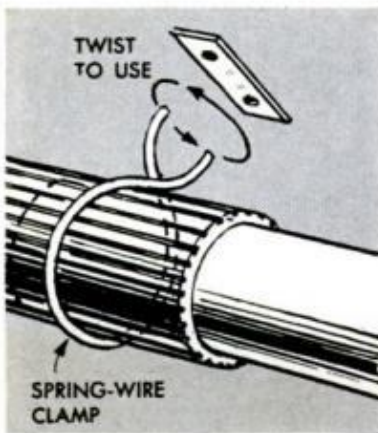
**PATTERNS.** You may obtain full-size cutting patterns for the stem, daggerboard, daggerboard trunk, rudder, tiller arms, cockpit back, cockpit sides, cockpit splash shield, mast support beam and half sections of the bulkheads by sending \$10 to Glen L. Marine Designs, 9152 E. Rosecrans, Bellflower, Calif. 90707. The complete naval architect's plans plus the patterns described above are priced at \$20 and are available from the same address.



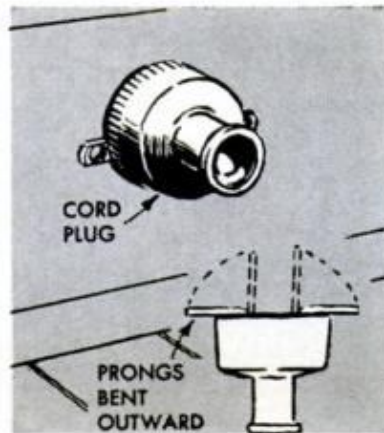
## HOME PROBLEMS

**EYEGLASSES** carried in the breast pocket of a shirt or jacket may slip out when you stoop over. To prevent costly breakage, bend the barrel of a pencil clip to fit the bow and clip the glasses in place

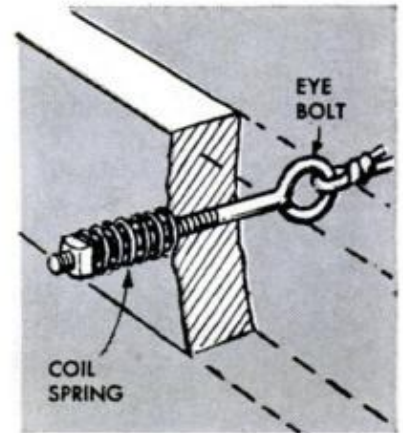
**IF YOU CAN'T** find the dustpan at the moment and a newspaper is used as a substitute, part of the sweepings will not go under the paper when you remember to first wet the edge so it adheres to floor



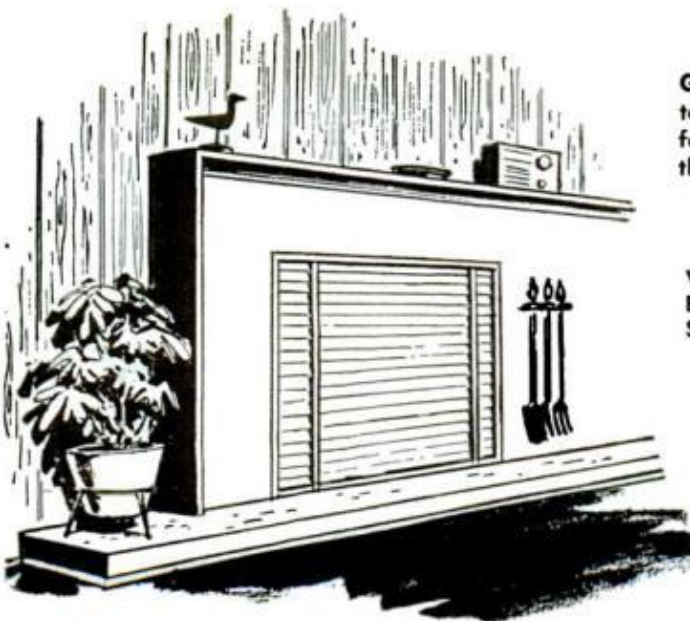
**WHEN REPLACING** the drain hose on a washing machine, you'll find that it's much easier to remove the spring-type clamp if you drill a metal plate to fit over the ends. A twist of the wrist will open the clamp



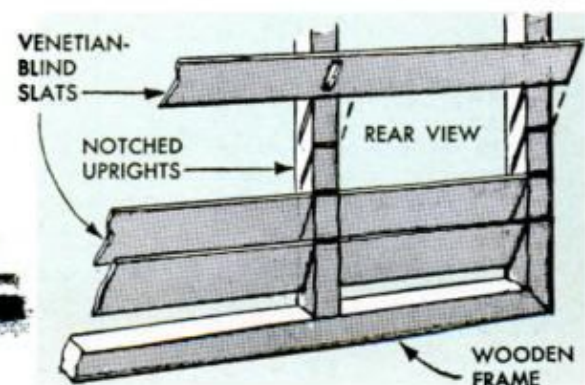
**IMPROVED** door stop is just a large rubber electrical plug with the prongs bent outward. Mount it by driving small screws through the holes in the prongs and into the baseboard. It's fine for basement or laundry doors

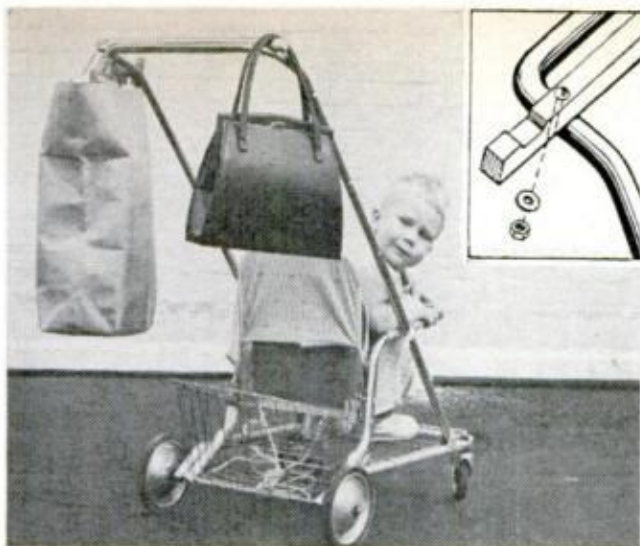


**CLOTHESLINES** will stay taut if you secure them to spring-mounted eyebolts. Drill a hole in the crosspiece for a 6-in. eyebolt and slip a 2-in. spring over the bolt before adding the nut and washer. Result? No slack

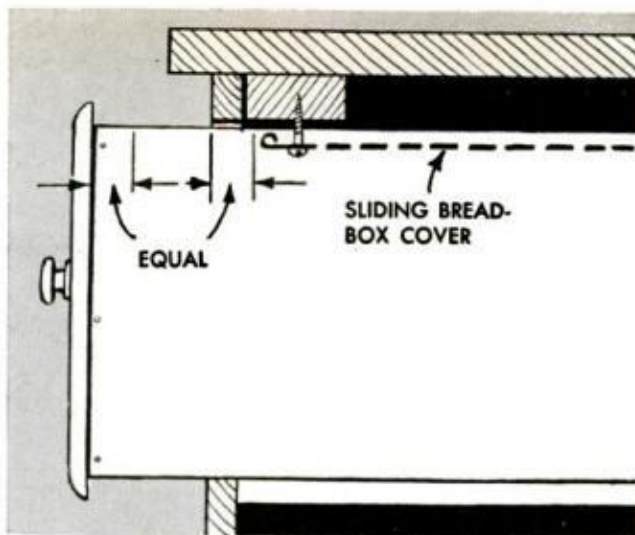


**GOT AN OLD** Venetian blind you don't know what to do with? Use it as a smart summertime screen for your fireplace. Discard the tape and insert the slats in slanting slots cut in 1 x 2 frame

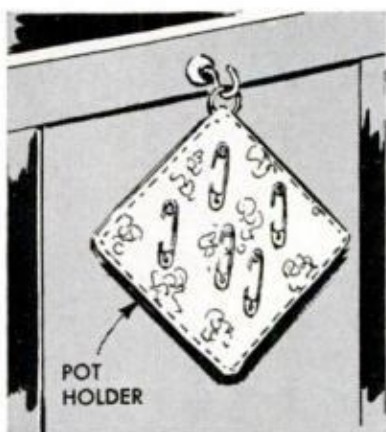




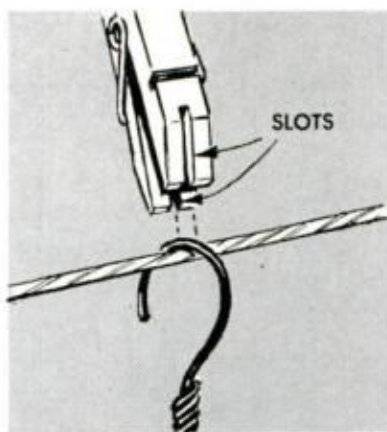
**MOUNT A LENGTH** of 1 x 1 stock on the handle of a stroller and your wife will have a place to hang her shopping bag or purse when walking the baby



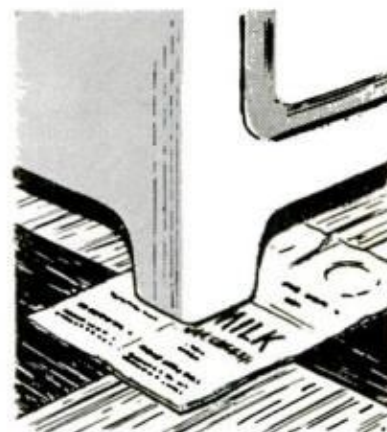
**NO MORE TROUBLE** opening the sliding tin cover of your kitchen bread drawer if you drive a stop screw through cover and up into block mounted above it



**KEEP SAFETY PINS** handy in the nursery by using a pot holder as a hanging pincushion. Screw a cup hook into the end of the crib for the pot holder and you'll always have a safety pin within reach when you need it

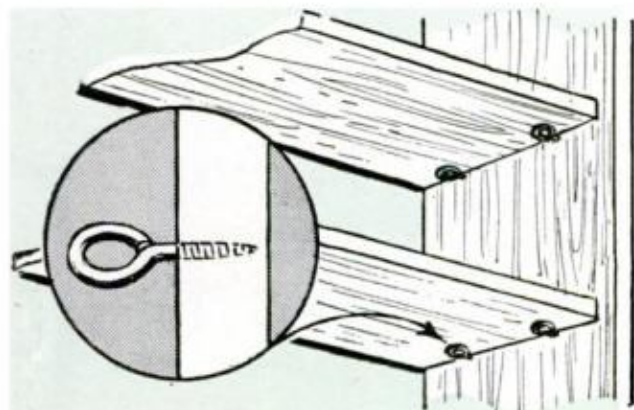


**SAW A SLOT** in the end of an ordinary spring-type clothespin and you can clamp a wire coathanger to a clothesline when airing garments on a windy day. Such clamps will prevent sliding and maintain proper spacing



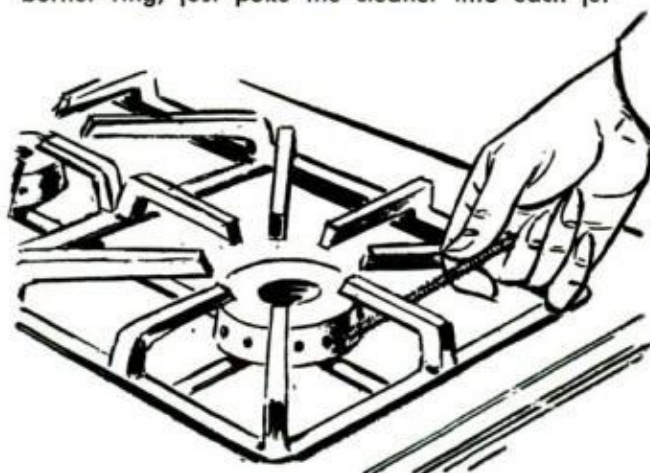
**HEAVY FURNITURE** will be much easier to slide across the floor if you slip a flattened milk carton under each leg. The wax carton not only saves work but avoids scratching polished floor. Rinse cartons well before folding

**YOU DON'T HAVE TO** buy special shelf brackets when adding an extra shelf to kitchen cabinets. Just use two screw eyes at each end of the shelf, turning them into the side pieces as shown below



SEPTEMBER 1964

**PIPE CLEANERS** do an excellent job of cleaning the burner jets on a gas range. Once you have removed all the grease which builds up on the burner ring, just poke the cleaner into each jet

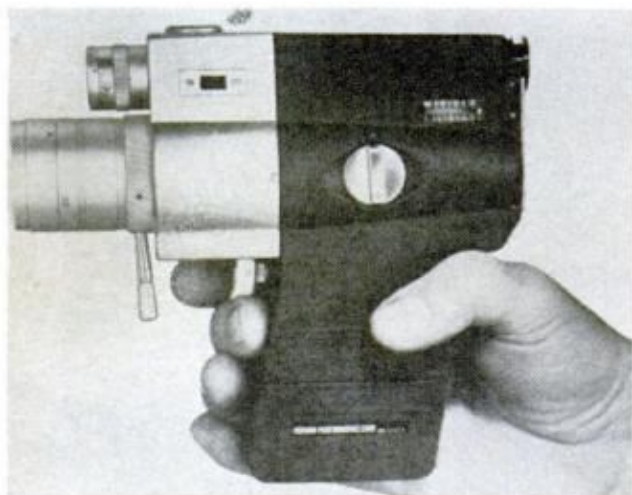


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# New for Shutterbugs

By Arthur J. Maher

**DESPITE MODERATE PRICE** of \$89.95, this automatic 8-mm movie camera has many desirable features. These include electric drive, F:1.8 12-30-mm zoom lens, reflex viewing that eliminates parallax, and a CdS electric-eye. Vernon Photographic Corporation, 144 East Kingsbridge Road, Mount Vernon, N.Y.



**AUTO/SHARP** projector for 35-mm to 2¼x2¼ slides focuses itself. After you focus the first slide, a servo mechanism determines focus for those that follow and automatically adjusts the lens for each one. Also features remote-control feed. Price: \$229.50. Honeywell, 4800 E. Dry Creek Road, Denver, Colorado

## PHOTO HINTS

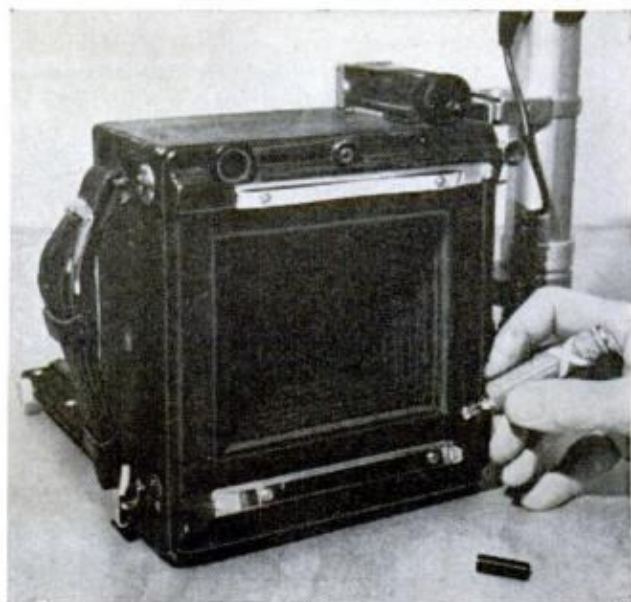
### Ever-Ready Film Case

Taped to the strap of your camera case, a 35-mm film can offers about the handiest way to carry an extra cartridge of film. It's light and compact, and makes it almost impossible for you to take your camera without also taking the extra film.



### No More Fogged Negatives

It's important to keep the inside of your camera dull black. Otherwise, extraneous light entering the lens during exposure will be reflected sufficiently to fog your emulsion. This problem can be avoided by inspecting your camera's interior periodically and blackening any worn spots in its finish with an ink marker.





**DIAL YOUR FILM SPEED:** To set the exposure control of this camera to the desired ASA, you rotate a telephone-like dial on the front. This regulates amount of light reaching the electric eye. When you take a shot, a motor advances film. Under \$80. Bell & Howell, 7100 McCormick Road, Chicago, Illinois

**SINGLE-FRAME SLR:** Olympus Pen-F is the first 35-mm single-lens reflex to use single-frame (half-size) format. Among its features are interchangeable lenses, a 50-90-mm zoom lens and synchronization for electronic flash at 1 sec. to 1/500th. Under \$140. Scopus, 257 Park Avenue South, New York, New York

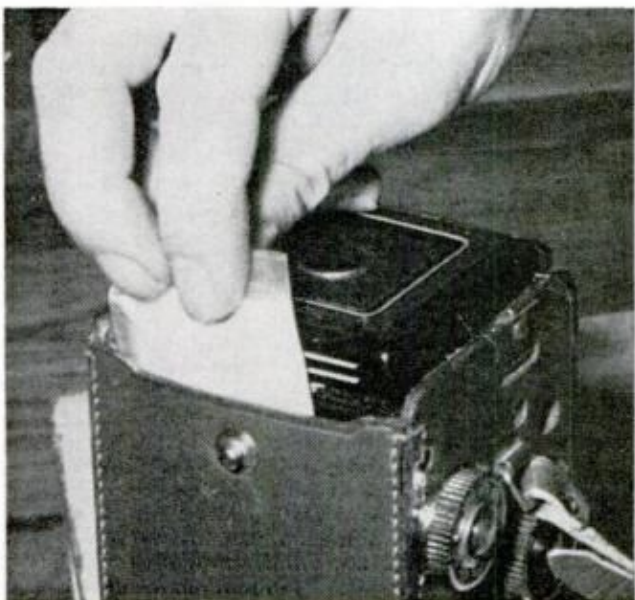


**YEM-45 EXPOSURE METER** is a compact CdS instrument that can be used hand-held or mounted in the accessory shoe of your camera. Gives ASA settings of 3 to 6400, shutter speeds of 15 sec. to 1/2000, apertures of 0.7 to 32. Sells for less than \$23. Yashica, 50-17 Queens Boulevard, Woodside 77, New York.



## Always Carry Lens Tissue

One of the most frequent causes of unsharp pictures is a dirty lens. Yet, the item most often left at home by the photographer is—lens tissue. To insure a ready supply of clean tissues, cut a small plastic bag in half and place several folded tissues in the bottom half. Then fold the bag into a flat packet and slip it into your case.



## Clip Tames Focusing Cloth

For view camera work, focusing cloths are virtually indispensable. But they have an annoying habit of falling off at the wrong time, particularly outdoors on a breezy day. A ten-cent spring paper clip, available at your stationery store, will hold a pesky cloth where it belongs, even while you remove or insert the film holders.



# A DESK IN

By Steve Ellingson

ANY HOME could use this versatile unit. It (and its matching chair) will blend with all furniture styles. Folded, the unit stays out of your way—even in a cramped room—quietly earning its keep by serving as a stand for a vase or lamp, and by storing bulky items in its generous hutch. It also makes a sturdy projection stand.

But when you need a desk or work table, the unit swings into action. It lifts its lid to offer a deep storage recess, dimensioned to take office-type file folders that'll keep your household records or personal correspondence in good order.

The big leaf raises, and a hidden gate leg

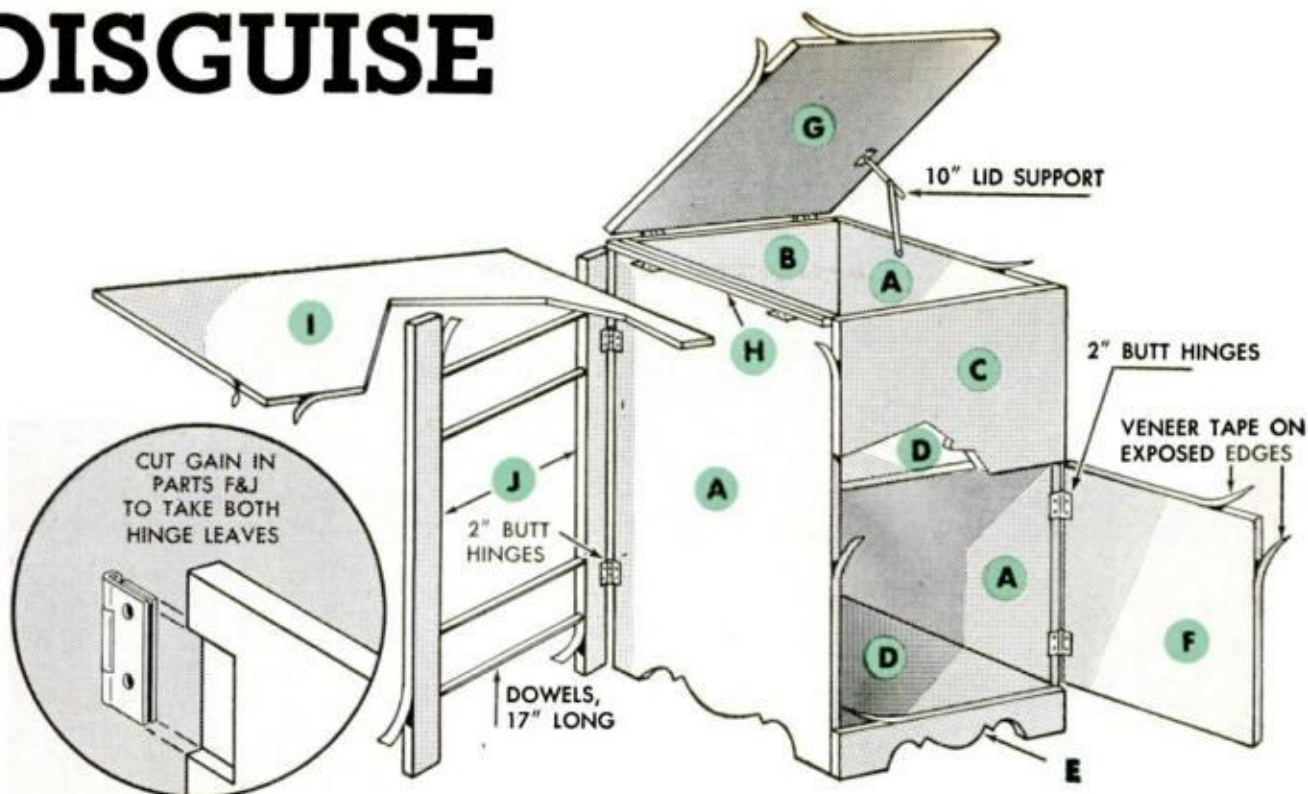


**RAISE LID** for access to file cabinet, swing drop leaf up onto gate leg, and stand becomes desk for home account-keeping

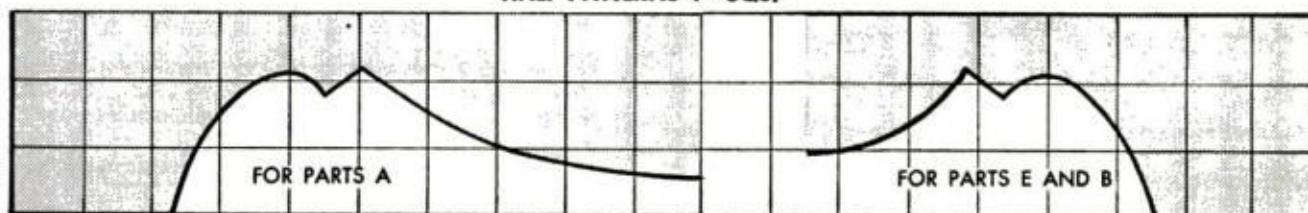




# DISGUISE



HALF PATTERNS 1" SQS.



pivots out to support the leaf firmly for use as a writing or typing table. This is also an ideal perch for a portable sewing machine or a movie editor, which—like the typewriter—could be stored in the hutch when not in use.

The chair (plans next page) is designed for a standard 13 x 13-in. box cushion and 16-in. brass tapered legs with angled attaching plates.

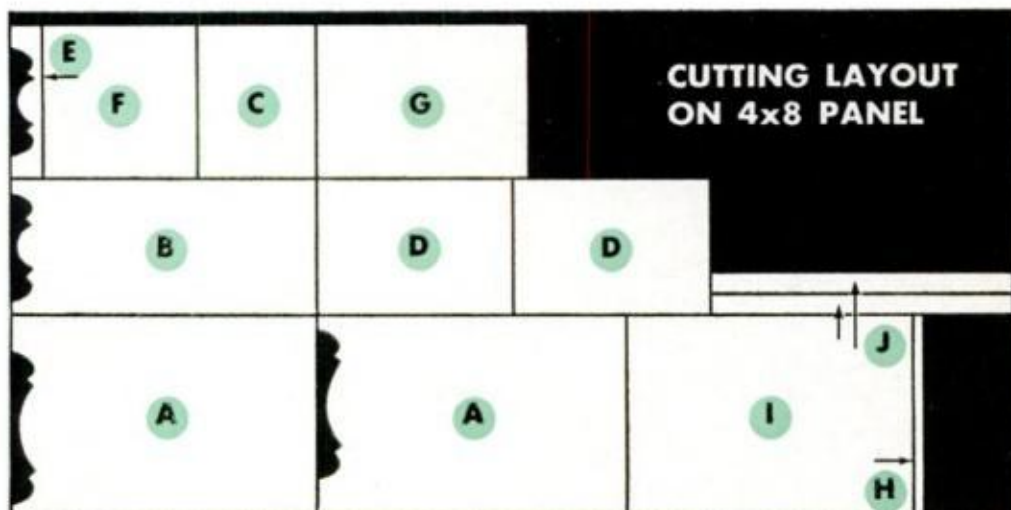
The construction has been kept *simple*—without any tricky joints or critical fitting. Your biggest chore will be gluing veneer tape to all exposed edges of the

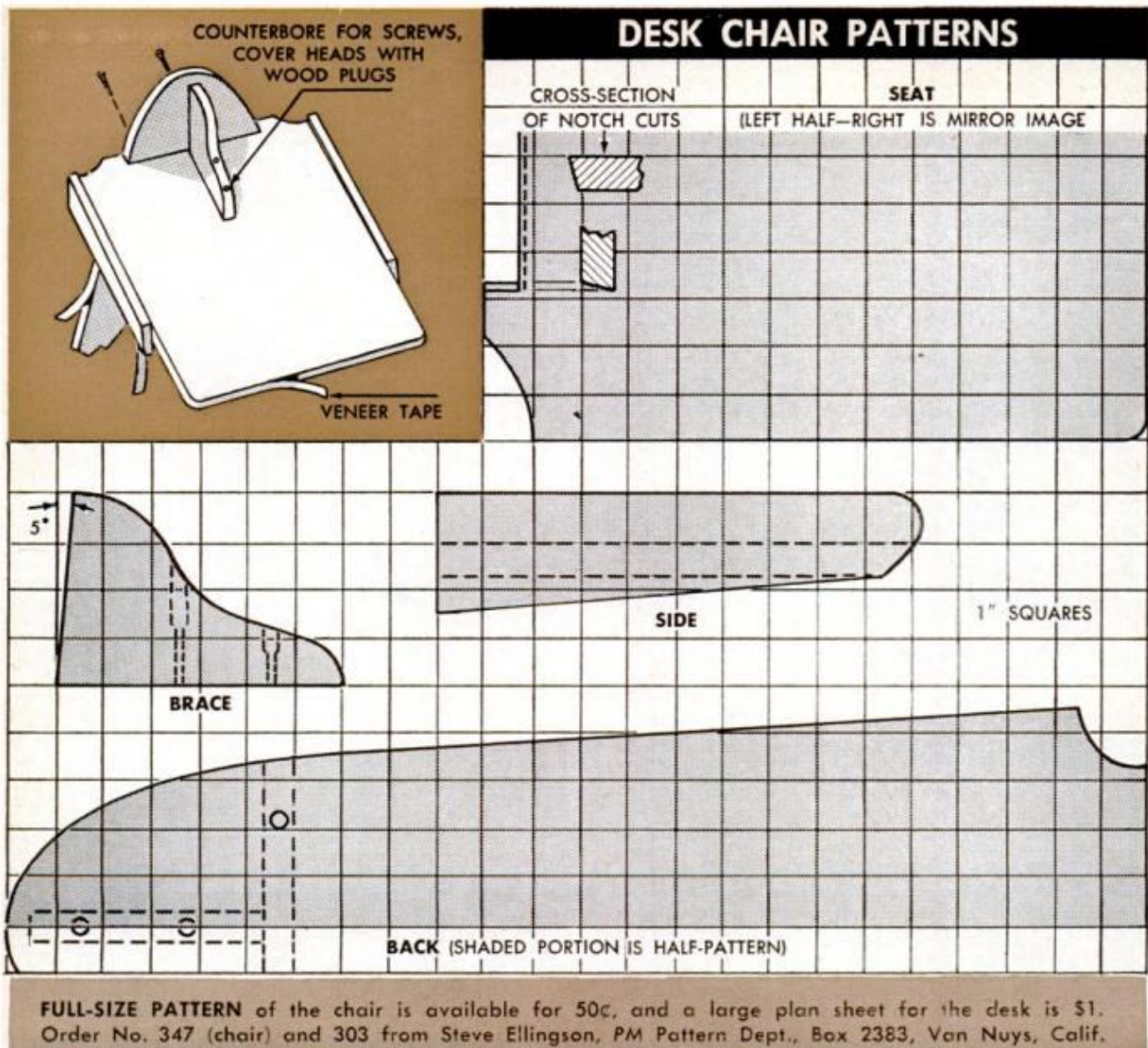
plywood. Choose a  $\frac{3}{4}$ -in. panel of any hardwood veneer that has an attractive grain pattern. The dimensions of each part are listed below, next to a key letter relating the parts to the layout diagram and to the assembly sketch above.

As suggested in the layout, the scroll design is not centered on the bottom edge of the *side* panels. On good-one-side plywood, you'll want to shift the pattern  $\frac{3}{4}$  in. to the *right* for the left side and to the *left* for the right side. When you nail the front scroll piece to the side edges, its thickness brings the scroll back to center.

## Materials Key List

- A 19" x 29" (2)
- B 13" x 29"
- C 11 $\frac{1}{4}$ " x 14 $\frac{1}{2}$ "
- D 13" x 18 $\frac{1}{4}$ " (2)
- E 3" x 14 $\frac{1}{2}$ "
- F 14 $\frac{1}{2}$ " x 14 $\frac{3}{4}$ "
- G 14 $\frac{1}{2}$ " x 20"
- H  $\frac{3}{4}$ " x 19"
- I 19" x 27"
- J 2" x 28 $\frac{1}{8}$ " (2)





# Stack-or-Pack Bookcase

THE COLLEGE STUDENT, apartment dweller, or anyone else who is frequently faced with the job of moving, will find these unique bookcases well suited to his needs. They are made in individual two-foot-square units, the sides of which are grooved so that 1/4-in. plywood lids can be inserted to convert each bookcase unit into a rugged, easy-to-move packing box. At the new location, the lids are removed and stored out of sight behind the bookcase. Best of all, since the books remain in place on the shelves, there's no need to go through the usual chore of unpacking and re-arranging once you arrive.

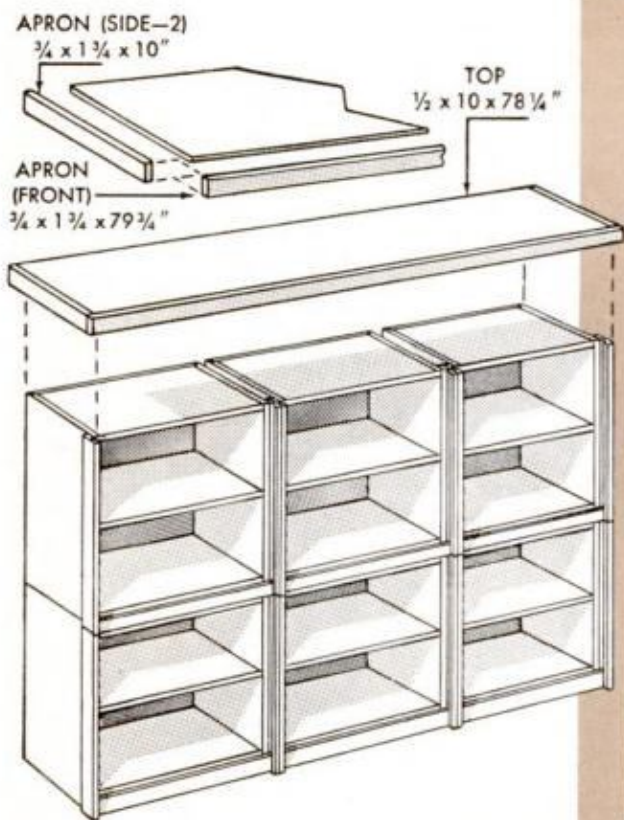
The sectional units are held together by their own weight and by a shelf which fits over the top units like the cover of a box. As shown, six bookcases provide 24 lineal feet of shelf space. If this is insufficient, more units may be added, but for the sake of good stability, don't stack more than

two—and don't forget to change the length of the top shelf.

As can be seen in the drawing, making the bookcases is a straightforward job, with no special joints or other difficulties. The back edge of each side piece is rabbeted and the front guides are grooved to accept the plywood lid, but the rest of the pieces are simply cut to size and butted together. For better appearance and durability, you can set the shelves into dados cut in the sides.

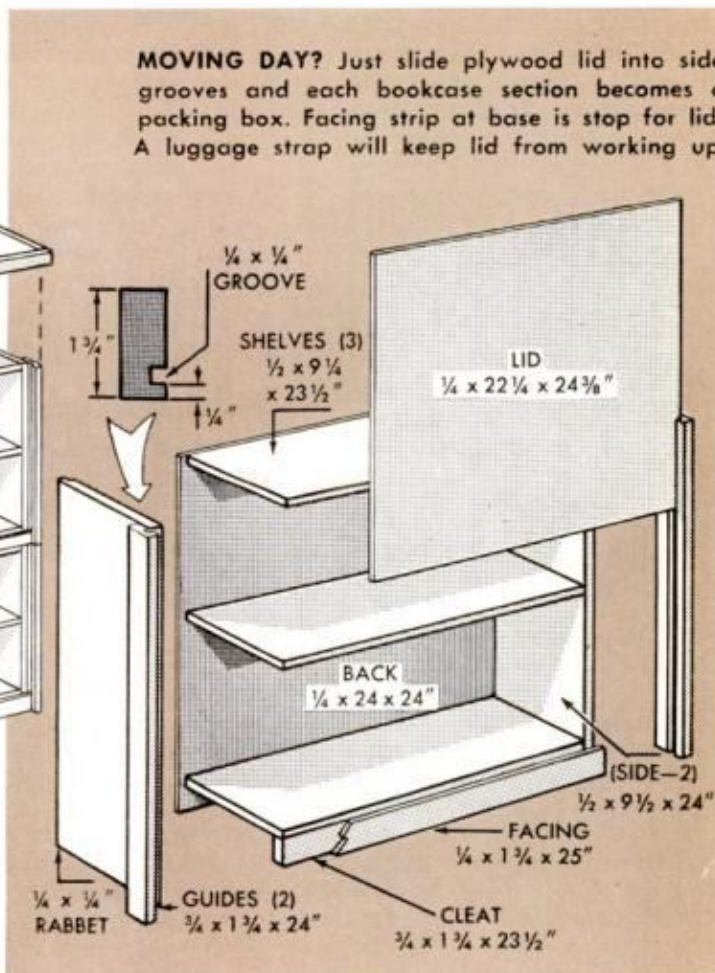
The choice of finish is, of course, a matter of personal taste, though a particularly attractive antique finish results when white paint is applied, stippled with a wadded cloth and allowed to dry. Follow with a light coat of thinned brown paint rubbed off with paper toweling to produce an antique effect. An application of furniture wax completes the job.

—Stanley E. Engstrom

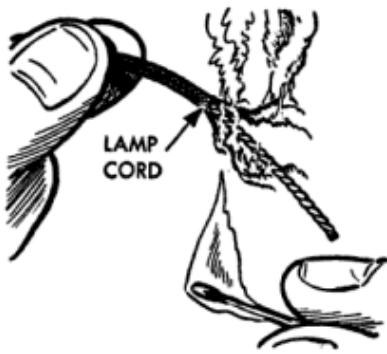


TOP BINDS UNITS together and provides unbroken surface. Aprons are glued and nailed to panel edge, fit snugly over the upper sections

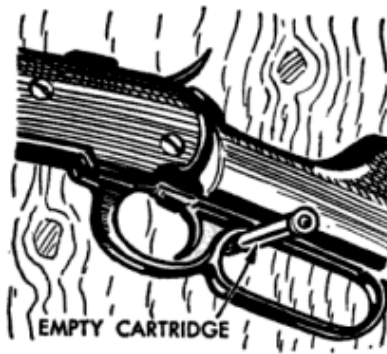
**MOVING DAY?** Just slide plywood lid into side grooves and each bookcase section becomes a packing box. Facing strip at base is stop for lid. A luggage strap will keep lid from working up



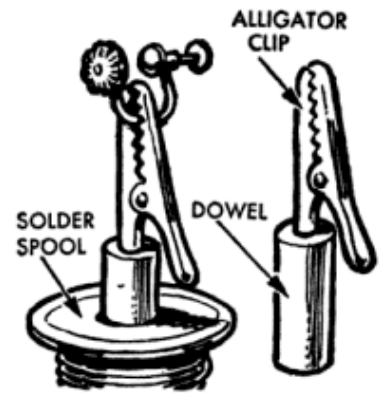
# TAKE A HINT FROM READERS



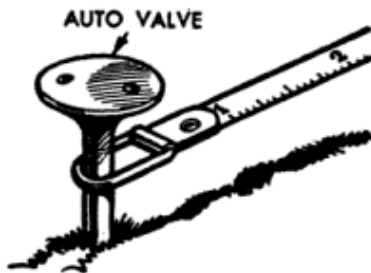
**REMOVING THE FRAYED** covering from silk lampcord when making connections to a socket or plug can be done faster with a match than a knife. Twist the threads between the fingers and hold a lighted match to the pigtail a second or two



**WHAT'S MORE APPROPRIATE** to use for pegs when mounting a firearm on a wall than empty cartridges? First drive flat-head nails, one at the end of the gun's forearm, another behind the trigger guard, and slip the shell casings over them



**TAKING ADVANTAGE** of its weight, a spool of solder makes a dandy nontip work holder for tiny parts. Select a short length of dowel which fits the hole in the spool and then bore a hole in the end of the dowel to take one leg of a small alligator clip



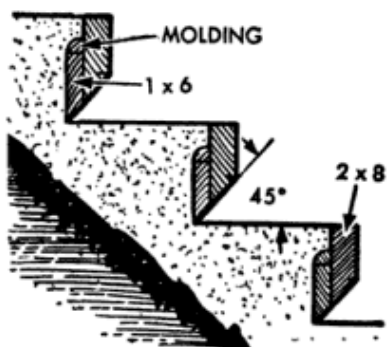
**MEASURING DISTANCES** with a 50 or 100-ft. tape is a tricky job when you are working alone. But with the help of an engine valve it's easy. Insert the valve stem through the tape loop and push the stem into the ground at the point of measurement



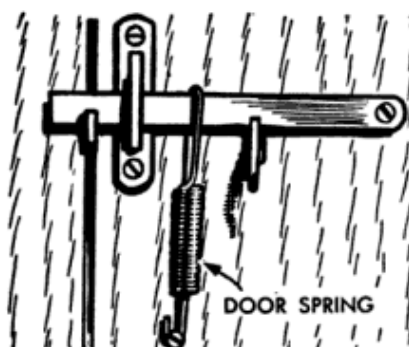
**FOOD BLENDERS** and other electrical appliances are often made with a base having three or four legs. If the legs become damaged, neat replacements can be made in a jiffy. Simply drill a hole in the center of a toothpaste cap and insert a bolt



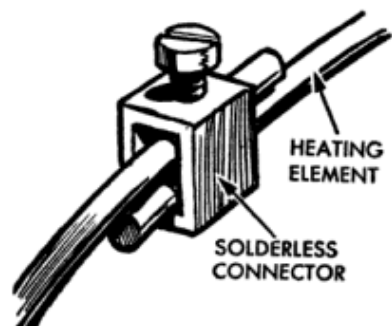
**THE DELICATE POINTS** of an expensive pair of draftsman's dividers can be protected at little cost (when the instrument is not in use) by slipping on an eraser cap as shown. The slight pressure of the divider spring will hold the eraser tightly in place



**HERE'S AN IMPROVED** way of building forms for concrete steps that lets you trowel the full tread back to the riser, and casts a decorative nosing in each step at the same time. Just nail 1x6s and quarter-rounds to the back of 2x8s and bevel lower edges



**BARN DOORS** and other out buildings that have thumb latches will lock with a more positive action if a coil spring is attached to the latch bar. The downward pull keeps the bar from jumping out of the notch in the striker when the door slams



**HOW DO YOU** repair a burned out heater element? Naturally you can't solder the two ends of the coil together but you can rejoin the ends and have the heater back in working order in a jiffy by clamping the ends in a solderless connector, above



# TOOLS TO LIVE BY

From boy to man the pride and satisfaction of skilled work starts with fine tools. To get the best takes so little more . . . only pennies per tool . . . and guarantees confidence in use for generations.

When you reach for that hand tool, you want the best money can buy . . . the reason so many more experienced handymen use P & C . . . and why over 14,000 quality stores stock P & C from coast to coast.

## **P & C TOOL COMPANY**

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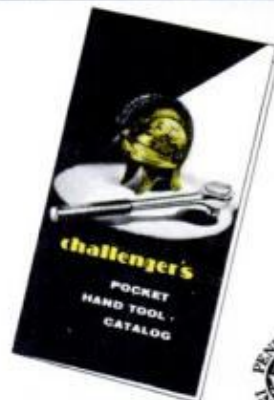


**24 PIECE 1/4" and 3/8" SOCKET SET**  
Actually two big sets in one. Includes; 17 sockets from 3/16" up to 1" in size, Ratchet, Spinner handle, 2 extensions, plus spark plug socket and adapter for 3/8" to 1/4" sockets.

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**CHALLENGER TOOLS, 3001 EAST 87th STREET CLEVELAND 4, OHIO**

*Duplex fits your job best . . .*

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Mechanics, electricians, carpenters, plumbers, hobbyists and homeowners—

32 models . . . from portable cantilevered tray

cases and lock boxes to general purpose roller cabinets. Durable all steel . . . deluxe finish.



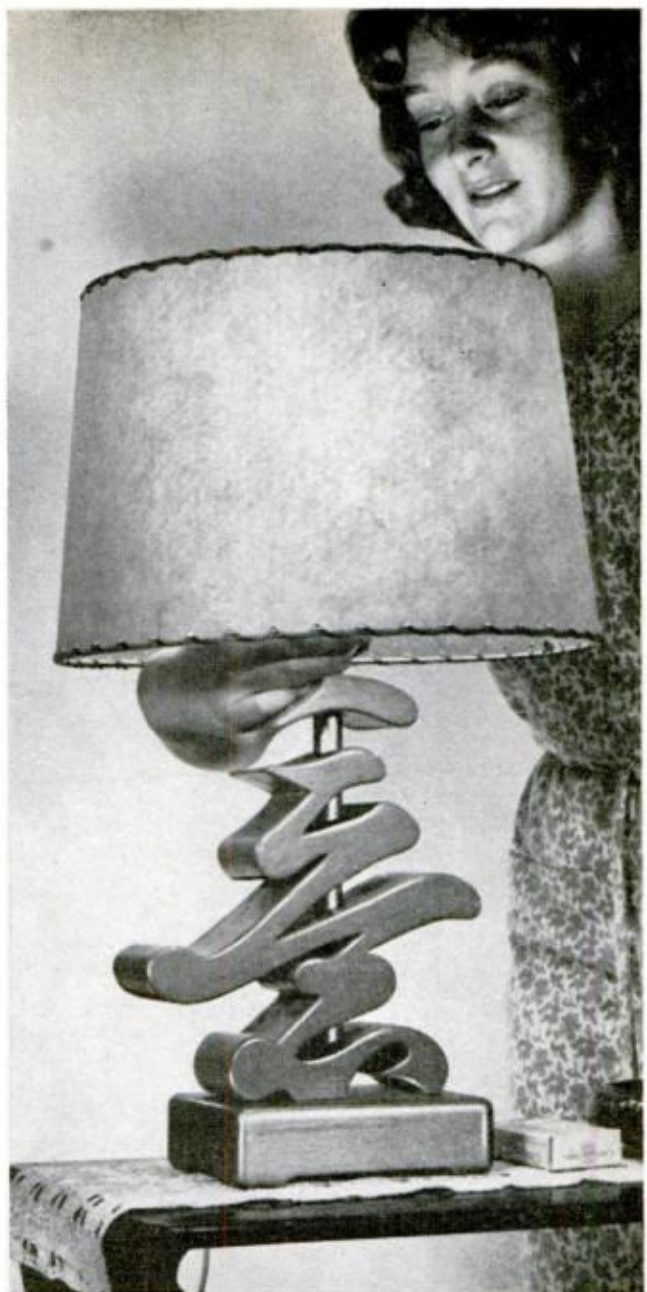
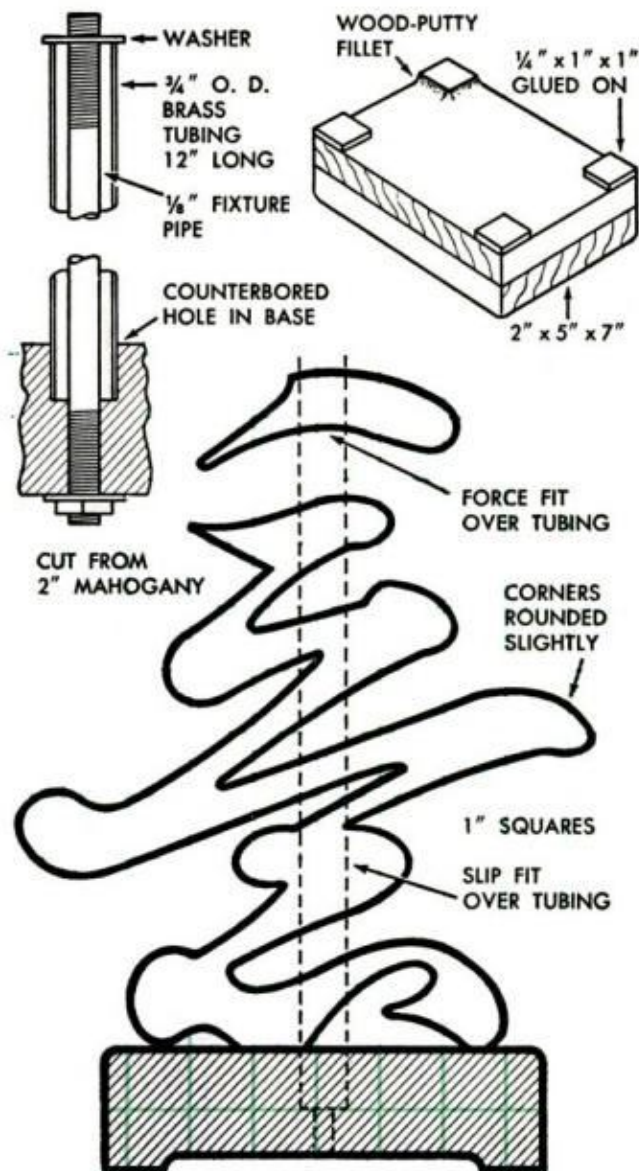
**DUPLEX**  
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See the Duplex Display at your Hardware Store Today!

# IDEOGRAPH TABLE LAMP

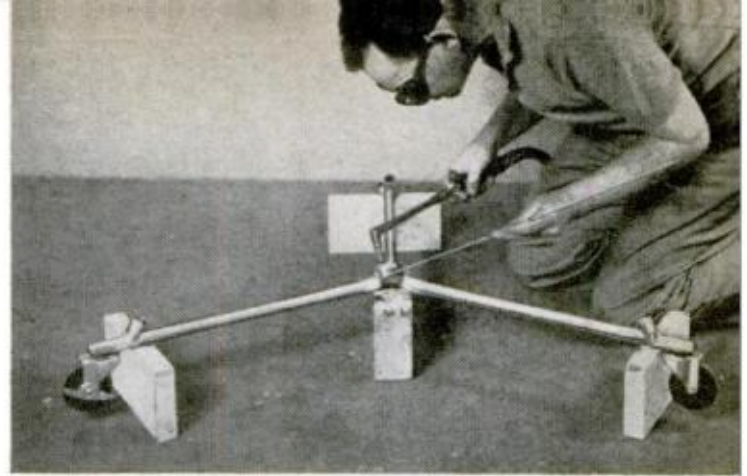
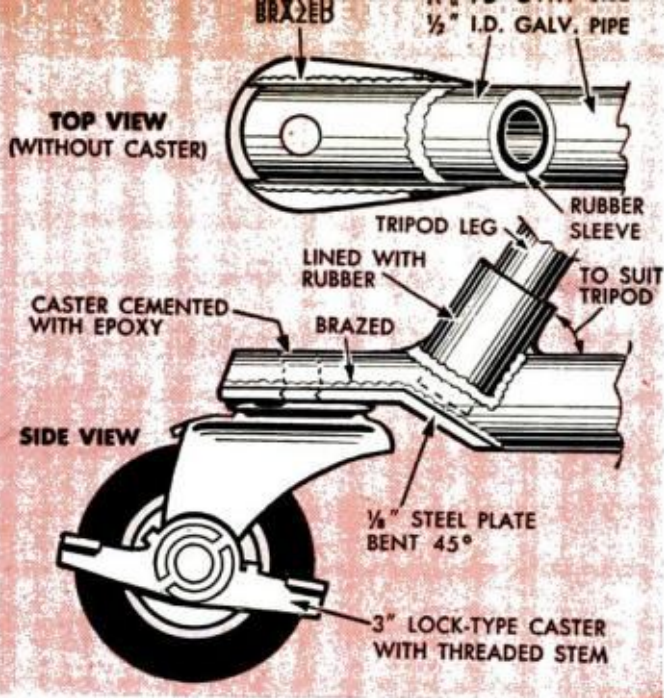
YOU MIGHT THINK that this lamp is simply a sort of free-form design, but actually it's the Chinese ideograph "I", which means "thought." To make the lamp you'll need a piece of mahogany or other hardwood about 11-in. long. If you find it difficult to obtain a block a full 2 in. thick, you can glue together two or more pieces. Before bandsawing, drill the block endwise for the  $\frac{3}{4}$ -in. tubing through which the lamp cord and threaded pipe pass. The lower end of the tubing seats in a counter-bored hole made in the built-up wooden base. All corners should be rounded with a rasp and sandpaper. For an attractive finish, paint the symbol Chinese red, tubing and base either gold or black. Top off the lamp with a Chinese red or black fiberglass shade.—*John Burroughs*



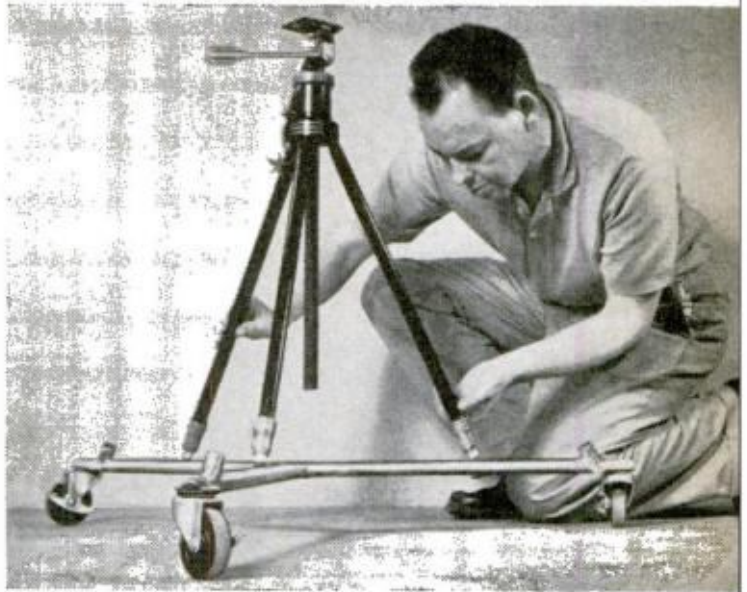
**"DOLLY-IN"  
ON THE  
ACTION  
WITH YOUR  
TRIPOD ON  
WHEELS**







**AFTER MITERING** the legs so they meet at a 120 deg. angle, make sure they are of equal length. Then drill vent holes in each leg and braze the joint



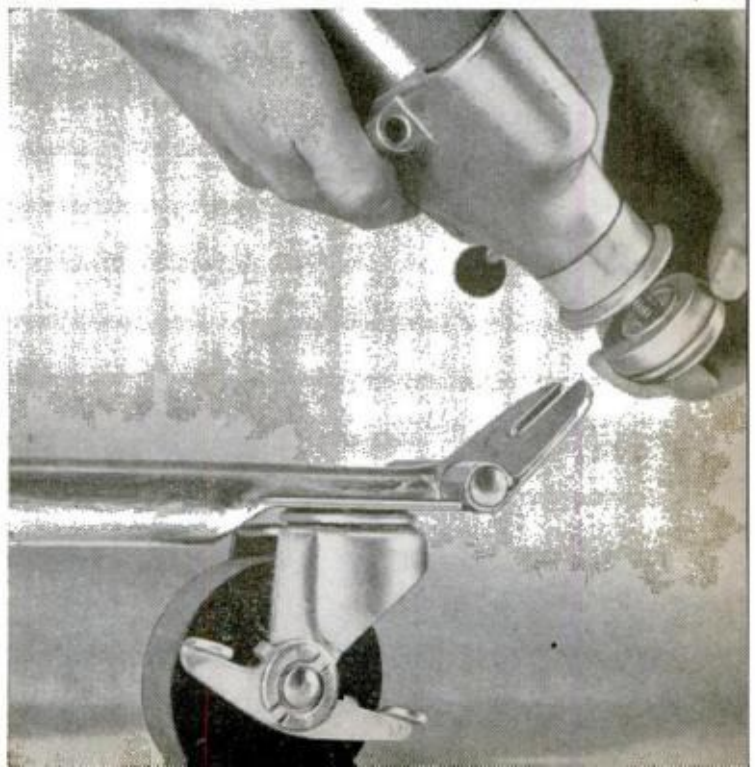
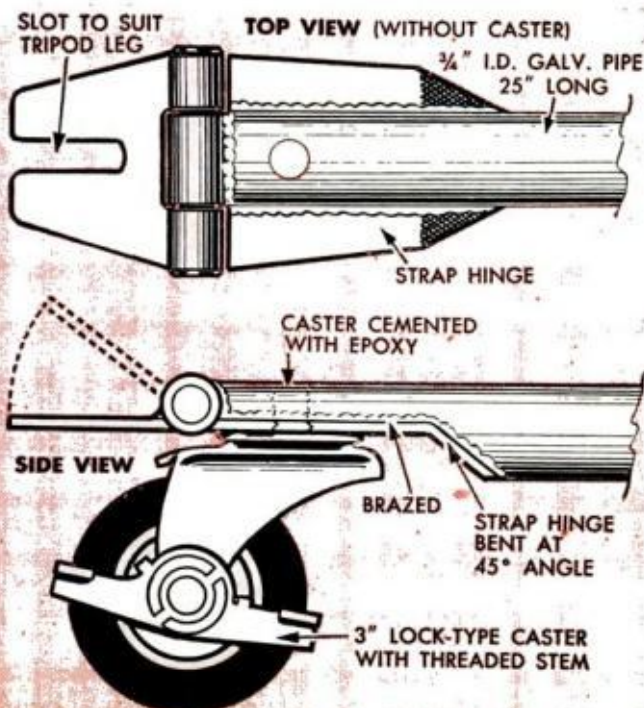
**FOR LOW-ANGLE SHOTS**, a second set of leg sockets are required. The exact location of these is determined by the tripod itself in its fully closed position

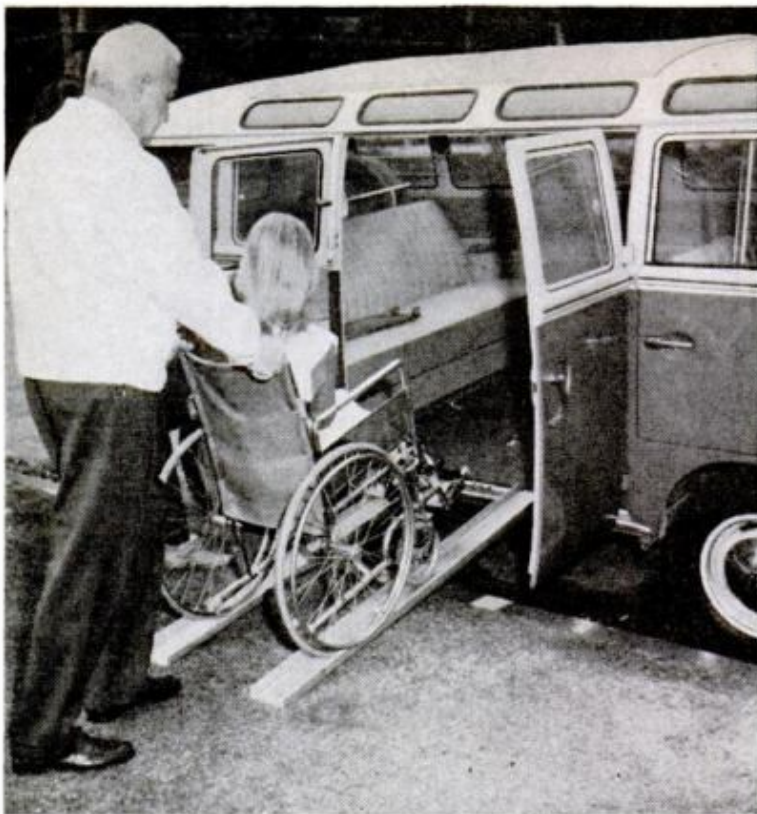
**TRIPOD LEGS** having retractable rubber feet fit into dolly's slotted tabs. If the tripod has threaded spikes, drill the tab and secure spike with wing nut

**TEAM UP** your tripod and movie camera with this three-wheeled dolly and you'll be able to duplicate those smooth "dolly-in" close-ups that you've envied in commercial films. Assembling the unit is a matter of brazing together three pieces of pipe, attaching casters and then rigging a way to attach the legs of your tripod. If your shop lacks welding equipment the work can be done by a garage. Unlike commercially-made models, the dolly does not fold for portability. Admittedly, this makes it a bit awkward to carry, but by being non-folding, it's a lot easier to build and the finished unit is as sturdy as can be. Smooth rolling calls for ball bearing casters and rubber wheels, with step-on brakes. If you cannot obtain these locally, order from Master Mechanic Mfg. Co., Burlington, Wis., at \$1.75 each plus postage.

—John Burroughs

### IF TRIPOD HAS RETRACTABLE FEET





**CORRECT POSITION** for wheelchair while vehicle is moving is with chair footrest firmly against the rear of the front seat



# Wheelchair Ramp for VW Bus

BEING CONFINED to a wheelchair, my daughter is unable to get around by car without help. But lifting her from the wheelchair into a car proved both tricky and foolhardy.

I overcame this problem by devising a way to load wheelchair and all. Though designed for the Volkswagen Microbus, it can be adapted to any of the new side-door vehicles.

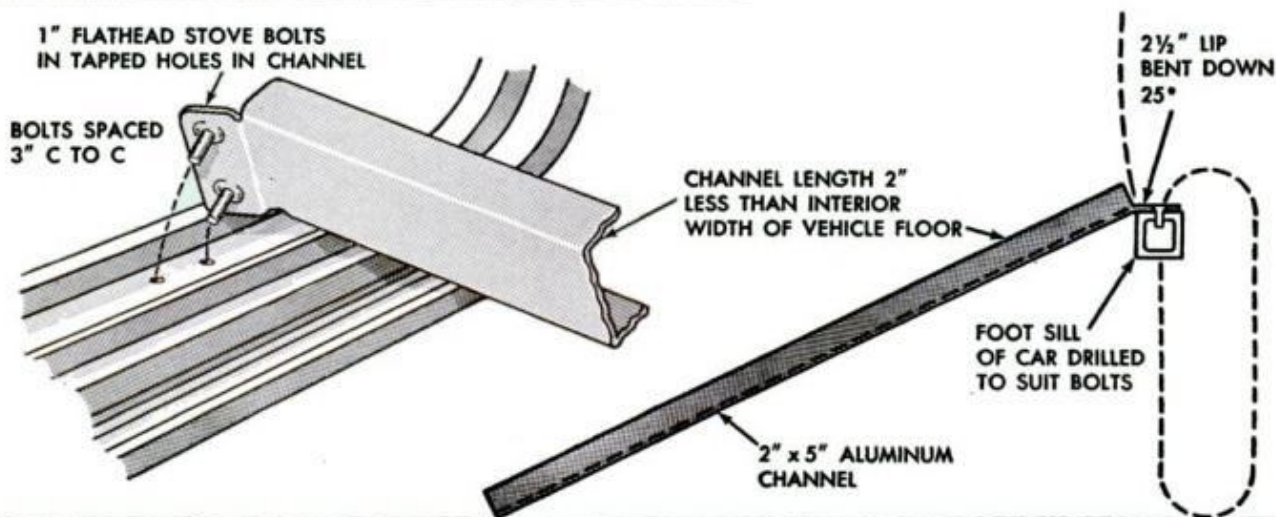
The loading ramps, which are 5 in. wide and have 2-in. sidewalls, may be available in your area as stock items. Or, if necessary, any sheet metal shop can bend them from  $\frac{1}{4}$ -in. aluminum or  $\frac{1}{8}$ -in. steel. Since they must fit crosswise into the vehicle when not in use, make them 2 in. shorter than the vehicle's inside width.

In use, the ramps are held to the vehicle's door sill by two 1-in.-diameter pins. These should project at least  $\frac{5}{8}$  in., and can be bolts turned into tapped holes in the channel. The pins fit into anchor holes in the body.

Molded rubber tie-down straps with a hook at each end (available at most truck or marine supply houses) or straps cut from an inner tube, may be used to secure the wheelchair to the vehicle (photo, left). The straps are held by U-bolts or eye bolts in the floor.—Paul White.

1" FLATHEAD STOVE BOLTS  
IN TAPPED HOLES IN CHANNEL

BOLTS SPACED  
3" C TO C



# Propagating By Air Layering

You can get as many as five small shrubs from one large one by using this ancient Chinese system

**A**IR LAYERING of shrubs isn't anything new. The Chinese developed this method of propagation hundreds of years ago, and the "pot layering" illustrated here is simply an American adaptation of this old system. My experience with it has been confined to camellias, rhododendrons, azaleas and coniferous evergreens, but I'd be willing to try it on almost any woody plant.

Essentially, pot layering is simply starting a cutting while it's still attached to the parent plant. After making a cut in the branch to be removed, a slitted pot is mounted on the branch over the cut and filled with a potting mixture. Then, after waiting about a year for a good rootball to form, the branch is removed and either repotted in a larger container or, under the most favorable conditions, set out in the garden. The system is almost foolproof. And it's good for the parent plant. Once pot-layered branches are removed, dormant buds quickly develop into new branches until root system and foliage balance again.

—O. E. Hopfer



1. **POT USED** must be sawed half way through. Plastic or asphalt-impregnated sawdust pots are suitable



2. **UPWARD CUT** penetrating about one third of the diameter of the branch won't weaken it seriously





**3. WEDGE CUT OPEN** with a nail. Otherwise, it will callus over and prevent the formation of rootball



**4. CUT HOLE** in the bottom of the pot to accommodate the diameter of the branch. Make this a close fit



**7. TIE CORD** around the branch below the pot to prevent it from sliding. Use nylon; it resists rotting



**8. POTTING MIX** consists of two parts leaf mold and one part peat moss. It's loose and water-retentive

**11. NEW PLANT** may be planted in garden if perfect conditions are assured, but repotting is recommended



**12. LARGE CAN** with sufficient holes punched in bottom for good drainage is fine for repotting plant



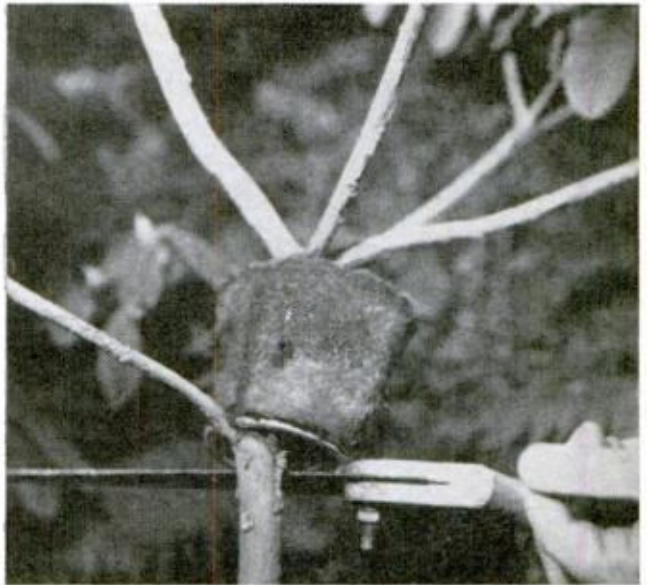
**5. POSITION POT** over the branch so that the cut is in the center and can be covered with potting mix



**6. TWIST WIRES** around top and bottom of the pot, being careful to match sawed edges for a snug fit



**9. AFTER A YEAR,** check root formation. If roots haven't formed, make sure cut is open and rewire pot



**10. USE PRUNING SAW** to cut off branch just below pot, leaving pot bottom in place to protect roots

**13. FERTILIZE** with 45-percent nitrogen mixture, since rootball is still too small to support the foliage

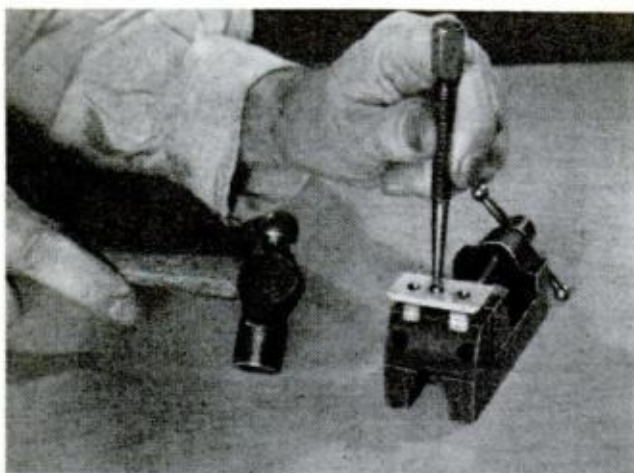
**14. KEEP PLANT** in new pot for another year, protecting from direct sun and wind, and fertilizing monthly





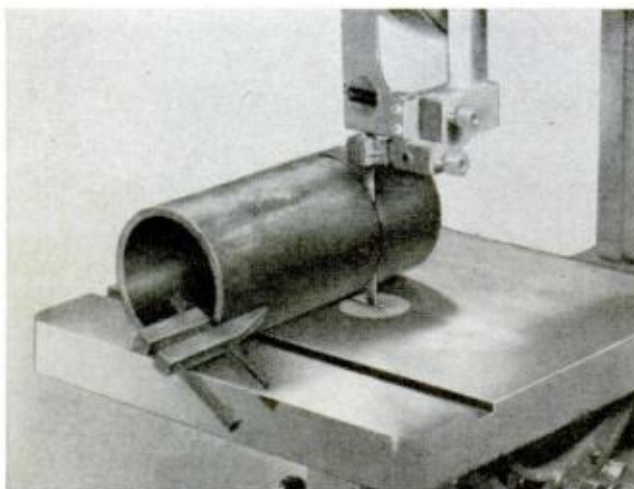
## Plate Sorts Parts

It takes only seconds to find just that part you're looking for when you have one of these handy sorting trays on your workbench. It's a throw-away-type aluminum pie plate with a 1-in. hole cut in the center. You just set it over a jar, pour the small parts around the rim, and slide unwanted items toward the hole so that they fall back into the jar.—*K. Patterson*



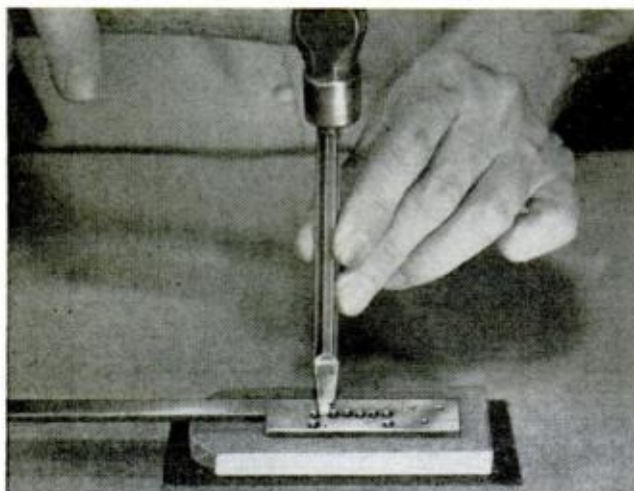
## Bearing Trues Hole

A simple way to make an accurate, smooth hole in soft metal such as brass or aluminum, is to drill the hole a few thousandths of an inch undersize and then drive a steel ball bearing of the desired size through the hole. A large nail set having a cupped end which fits the curvature of the bearing, is an ideal driving tool. For greatest accuracy only a new, unworn ball bearing should be used. It is important to lubricate the bearing with machine oil before driving it through the hole.—*Walter E. Burton*



## Clamp Prevents Accidents

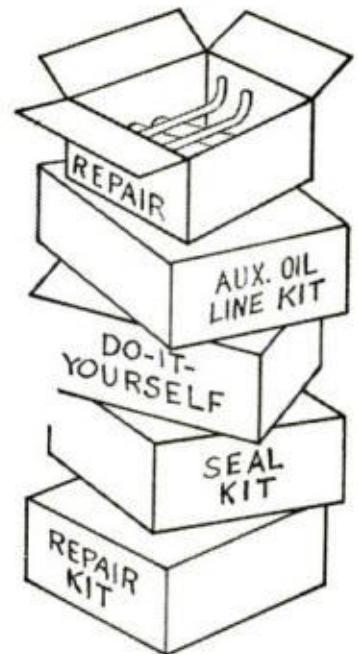
If you've ever cut pipe or other round stock on a bandsaw, chances are you pinched a finger or broke a blade when the saw teeth caused the work to turn suddenly. A machinist's clamp or C-clamp fastened to the work as shown, bears against the saw table to prevent this movement. When the cut reaches the center of the work, stop the saw, remove the clamp and reposition it pointing in the opposite direction. In the case of solid stock, place the clamp directly across the work's diameter.—*Manly Banister*



## Punch Saves Time

The usual method of cutting large openings in unhardened steel plate or sheet stock is to drill a series of holes and then saw through the intervening webs. The web cutting is less of a chore if you use a punch rather than a saw. Such a tool can be made easily by grinding the end of a broken cold chisel so that it has a thin, flat tip just a bit longer than the thickness of the metal you wish to cut. The holes must be drilled so that they are close together, but not intersecting. If one hole overlaps another, the punch may jam.

# **AUTO-REPAIR KITS SAVE YOU MONEY TWO WAYS**



Nobody likes being taken for a sucker, yet the auto-repair game fleeces thousands every year. Sometimes the big bill is legit—often it's a gyp. But with kits you can beat it both ways

**By Morton J. Schultz**

**M**OST MECHANICS are honest, hard-working guys who try to gain and keep their customers' trust and respect. But the reputation of the many is often hurt by those few who victimize their customers by purposely making big jobs out of little ones.

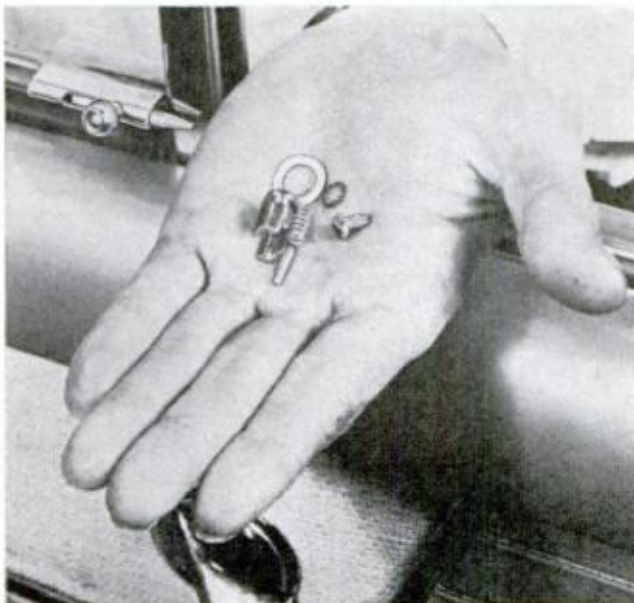
Would you trust a mechanic if the following incident happened to you?

"That cost me \$16.25," Jack Phelps said, pointing to the slide-lock on his Ford's vent window. "The old slide-lock was broken; to fix it, the mechanic told me—after he did the job—that he had to remove the entire vent window, take the glass from the frame, throw away the old frame and put in a new frame with a good lock."  
"Why didn't you stop him?" we asked.

## **BROKEN SLIDE-LOCK ON WINDOW**

**GARAGE BILL: \$8.75 PARTS + \$7.50 LABOR**

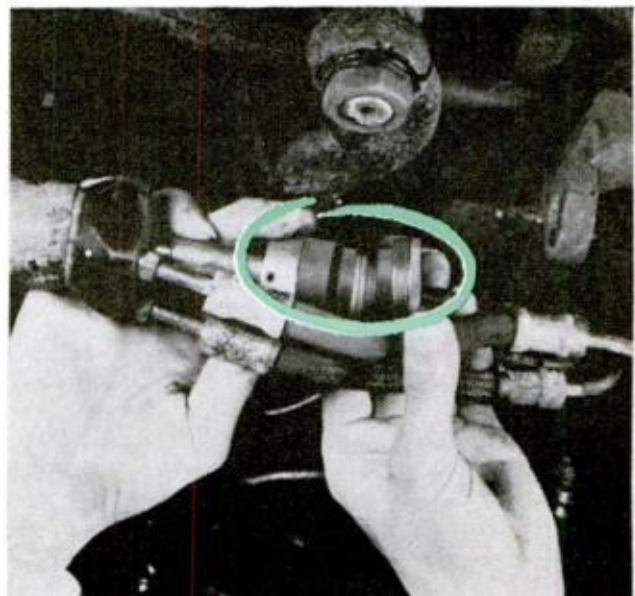
**DO-IT-YOURSELF KIT: \$4**

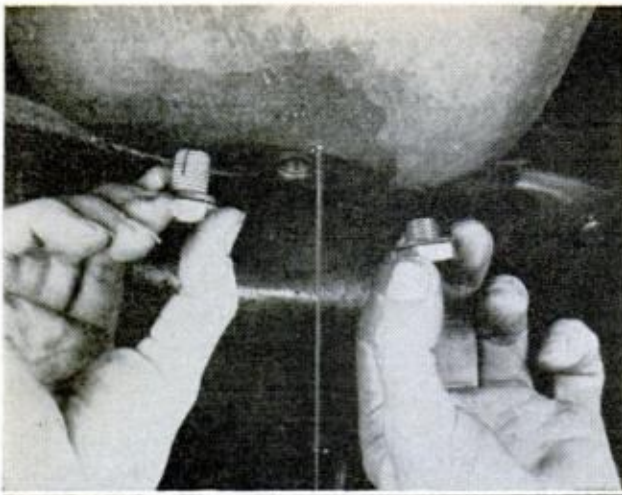


## **LEAKING POWER-STEERING UNIT**

**ESTIMATE: \$8 REPAIR, \$40 REPLACEMENT**

**SEAL KIT (CIRCLED): \$4**





### STRIPPED PLUG THREADS

ESTIMATE: \$5.50 RETHREAD AND NEW PLUG

SELF-TAPPING PLUG: 50¢



### RATTLING WINDOW

GARAGE ESTIMATE: \$10

CHANNEL SHIM: 25¢-50¢

"Well, maybe it *was* partly my own fault," he admitted, "but I just never dreamed such an insignificant thing would cost that much money, so I didn't bother to ask the price beforehand. Anyway, it was on a list of other things I wanted done to the car. I just told him to fix it.

"Later, I wanted to find out if I'd been robbed," Jack continued, "so I went to an automotive parts house and was told there's a \$4 kit that lets you replace the slide-lock without replacing the frame. Any 15-year-old kid could do the job in 10 minutes."

Jack was quite right in assuming that an experience such as this was in part, at least, his own fault. Too many car owners fail to question the price and extent of a job beforehand. But the thing that leaves them most vulnerable to the big bill is their ignorance of the fact that a wide variety of repair kits can be bought.

The parts-repair situation breaks down into two distinct categories: on the one hand you find yourself paying for a job that's *done the most expensive way*. Here you're most likely getting a fast shuffle—though it's always possible your mechanic didn't realize he could have repaired or replaced a small part instead of an entire component.

In the second category, there's the repair that's so obviously simple (once you have the parts and instructions) that you'll decide to *do the job yourself*. Here, there's no question of a dishonest estimate: you simply find *you* can do what the mechanic would be doing, so you save the perfectly legitimate labor cost he'd charge you.

Either way, knowing about repair kits can save you money. And the first questions, of course, are "How many different

types are there and how easy are they to buy?" Mr. D. S. Meyers, president of Garden State Auto Parts in Bradley Beach, N. J. gave me the answers.

"Most car owners know, of course, that there are rebuild kits for *major* parts of a car, such as the carburetor or generator. The kits and the cost to install them never approach the price of a new part.

"However," he went on, "it's the smaller items that—when they go bad—often bait the trap—parts like this slide-lock of your friend's. As he discovered, buying a kit to repair or replace only what's gone *bad* can mean a big saving. Incidentally, there's a kit to repair the pivot-type vent lock, too.

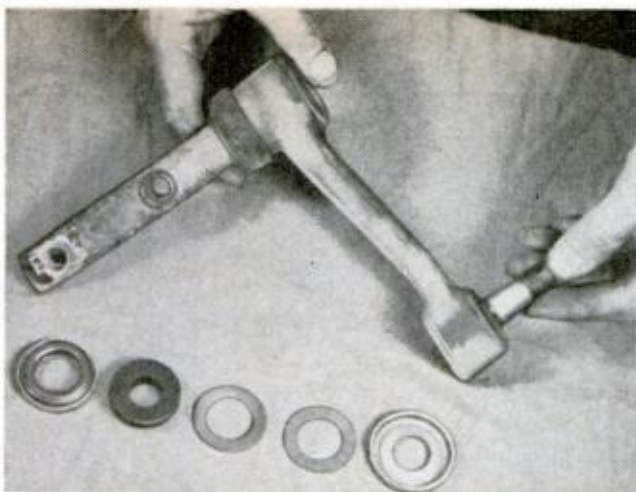
"Our purpose is to sell parts—big and small. We don't care whether we sell them to the mechanic or to the general public."

If your town isn't big enough to have a yellow pages directory, you may encounter difficulty locating sources for a wide range of kits. In such cases, you can order kits by mail from such suppliers as Garden State or, in the west, Lucky Auto Supply, 620 E. 111th Place, Los Angeles, Calif. 90059. And, from coast to coast, every town of any size has an auto supply store (Pep Boys and Western Auto are two familiar chains) which will stock some of these kits and could order others for you.

But how did mechanics feel about kits? I consulted a number of them and found that they all knew of such kits and often made use of them. When I explained why I wanted this information, most agreed that making the public kit-conscious would help, not hurt them. One told me:

"I'd like to have your story in the hands of every car owner. Hurt us? Heck no! The more the public becomes aware of what repairs *should* cost, the more careful

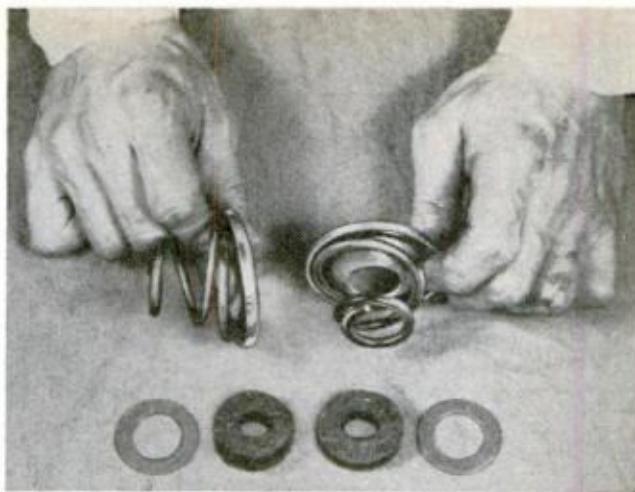




### LOOSE IDLER ARM

GARAGE ESTIMATE: \$12 PARTS, \$3 LABOR

DO-IT-YOURSELF PARTS: \$10



### BAD BALL JOINT

GARAGE ESTIMATE: \$17

REPAIR KIT: \$10.50

they'll be to pick a reliable garage for their work, and that'll drive these get-rich-quick guys out of business."

But how many gyp-artists are there among mechanics? I decided the only way to find out was to tackle a cross-section of mechanics who *didn't* know me, passing myself off as a mechanically-ignorant car owner with a problem. Object: to see if any would tell me a part had to be replaced—and at what cost—when only a simple repair was needed. I found, of course, both categories of the kit-repair situation well represented: there were many honest estimates that seemed to be based on the price of the kit involved, plus a standard labor charge. But there were far too many inflated quotations, as well. Let's take these fast-shuffle examples, first.

● "How come I'm getting a leak here?" I asked, pointing to the power steering cylinder of a Ford which had purposely been "doctored" for effect.

"Everything's fouled up inside," the mechanic said. "The cylinder has to come off to be taken apart. Maybe I can fix it—but if I can't, you'll need a new cylinder."

"How much is all this going to cost me?" I queried.

"Well, if I can overhaul it, it'll run about \$8. If I can't fix it, it'll run you about \$40 for a new cylinder."

"See you soon," I muttered. "Can't leave the car now—have to go to work."

The facts are these—

Everything was not fouled up inside because the only part inside that could cause a leak was a bad seal; the cylinder would not have to be taken apart to fix; certainly it would not have to be replaced as long as the piston was in good shape, which it was.

The \$8 "overhaul" estimate wasn't badly out-of-line because you'd expect to pay something for labor, and a power-steering cylinder seal kit will cost you \$4. It consists of a number of bushings, washers and o-rings encased in a metal collar that tightens against the cylinder. These parts are shown on page 171, and installation is simple enough for you to do the job yourself. Several mechanics we spoke to swear that it definitely seals up the cylinder. So why did the guy mention an "overhaul"? You never need to perform a major overhaul job for a simple leak.

● "Stripped the threads in my oil-pan drain," I told the next mechanic. "What can you do?"

"Well, I'll probably have to rethread the hole and use a new oversize plug. It'll run you about \$5.50 for the new part and labor."

You can do the job yourself for \$5 less should you strip the threads on any part of the car—not only the oil pan. There is an oversize, *self-tapping* plug available for all cars which costs only 50¢. You just screw the plug into position with a socket or end wrench. The plug cuts its own threads. You then remove the plug, clean away all metal chips from its slots and replace the plug.

● Here's what I told the next garage: "The window in my car is rattling to beat the band. It's annoying, and I want to get it fixed before going on vacation. What's the extent of it?"

"Well, the channeling is loose," he said. "I'll have to pull the door apart and fix it. Shouldn't run you much over \$10."

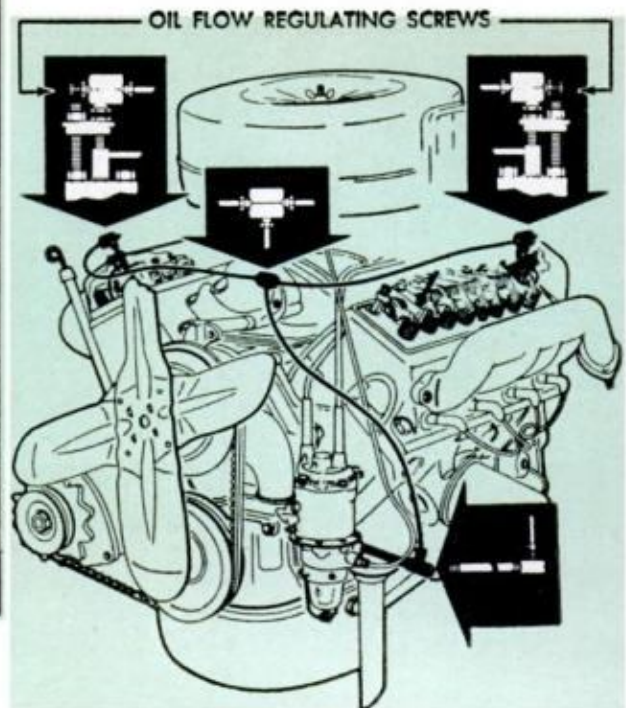
Things seemed to be going from bad to worse. Although there is no kit as such to repair a worn channel, there's a channel



## ROCKER-ARM RAP

**DESLUDGE FEE (EACH TIME): \$12**

**AUX. OIL LINE KIT: \$5**



shim available that costs pennies. All you do is slip it down the length of the old channel, as on the facing page. It's a felt-lined item that fits in the channel and not only stops rattling windows but weatherstrips and insulates the area, as well. Ten dollars, indeed!

● I loaded my trunk with the heaviest junk I could find and pulled into a garage with a decided sag to stern.

"Better replace those original shocks with heavy-duty ones," the guy advised.

Heavy-duty shocks might cost anywhere from \$32 to as much as \$115 a pair, depending on the car. But you can buy, instead, overload springs that fit around your present shocks. These are only \$9.95 a pair. Admittedly, they're not as strong as heavy-duty shocks, but they'd have been adequate for my needs.

So far, our examples have been from the *most-expensive-way* school of estimates. Let's look now at a few cases where the repair kit isn't that much cheaper than the parts estimate, but where installation is so simple you can save the labor costs by doing the work yourself.

● You know that the idler arm is used on the right side of a steering linkage to balance off the Pitman arm, which is on the car's left. If the idler arm loosens up or otherwise goes bad, which is not an infrequent occurrence, you'll get play and looseness in the steering, and rattles and sag, among other things.

Here's how my garage check went:

"From what I can tell, the car has a bad idler arm," the mechanic said as he road tested the Olds F-85.

"Doesn't sound like much," I replied. "What's the job entail?"

"Not too bad," he agreed. "The idler arm and bracket have to be replaced."

"How much?" I asked.

"About \$15," he answered. "Runs about \$12 for the parts and \$3 for labor."

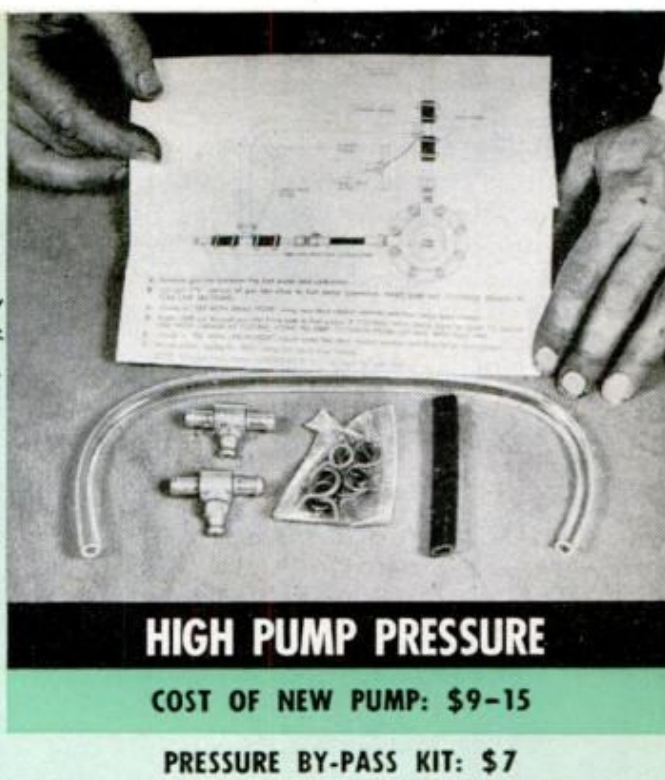
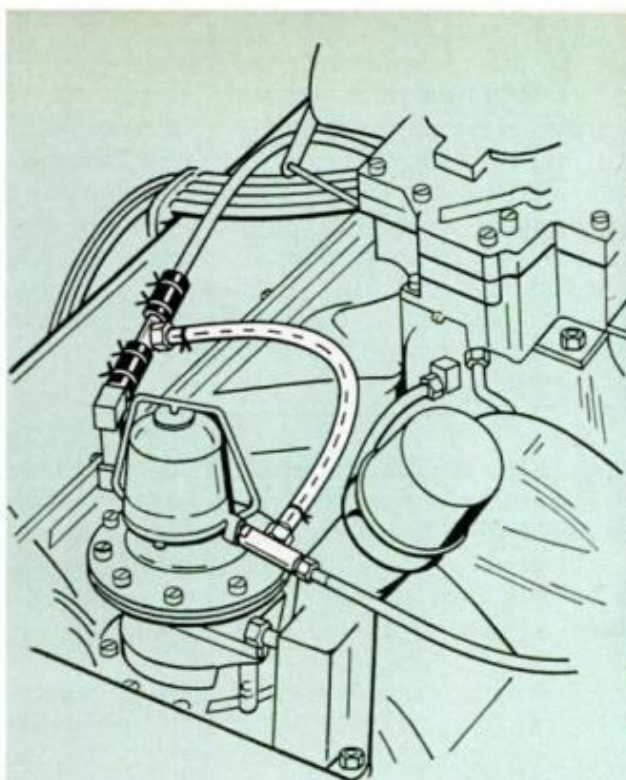
"See you soon."

Well, at least this guy was forthright enough to pinpoint the cause as the idler arm. When idler arm problems arise, the mechanic could tell you it was anything, and who'd know the difference?

Anyway, the difference between \$15 and \$5 is \$10—and that's what you can save with an idler arm repair kit. One is available for any car equipped with an idler arm and it lets you add parts that build up the arm to take out all looseness, sag, and rattle caused by wear. With the instructions packed in the box, there's little trouble in making the repair yourself.

● If a ball joint in your car should go bad, the advice you're likely to receive from a mechanic is to replace the part, and this would cost you about \$17. There are, however, ball-joint repair kits for most cars. The one shown on page 107 costs \$10.50. The reason there's two of everything in the kit is that when you repair one ball joint, you should renew its mate.

● Fords and Chevys have long been bothered by noisy rocker arms and pushrods. It happens when the oil lines to them get sludged up, and they starve for oil. The repair practice is to perform an overhaul job to get at the lines, which are internal, and de-sludge them. The price, if no parts are needed, is about \$12—not



## HIGH PUMP PRESSURE

COST OF NEW PUMP: \$9-15

PRESSURE BY-PASS KIT: \$7

too steep, but this is the kind of job that has to be done frequently. Once you do have it done there's no guarantee that the lines won't get sludged up again after a few hundred miles.

The simple-to-install kit that's designed to eliminate this problem *permanently* costs about \$5. It consists of a line that taps into a plug already in the oil galley of these cars, to the right of the fuel pump. The line extends to a "T" from which two other lines tap off. These go to the rocker arm covers where there are also plugs into which the oil flow regulating screws of the kit are tapped. No drilling is required in most cases, and nearly anyone can do the job himself.

The amount of oil fed to the rockers can be controlled by adjusting the regulating screws. The ideal feature is that all lines are external so if they should get plugged up, it becomes a simple matter to remove and clean them.

● Even problems that we've come to take for granted and learned to live with may have kit solutions. For example, we covered vapor lock in detail in our July issue since it's a common hot-weather complaint. But did you know there's a kit on the market that reportedly eliminates vapor lock by reducing excess fuel pressure? It's a by-pass system, packaged under the name Fuel-Trol, and many users claim it extends gas mileage, as well.

To sum up, here's a set of guide lines for the next time your car needs repairs:

1. Don't be shy—question your mechanic. Ask him what's wrong, how he's going to fix it and how much it will cost you.

And don't settle for vague generalizations.

2. Before handing the job over (especially if it sounds like a major repair) you might be wise to check the first diagnosis against another one. There's no law that says you can't go from one shop to another to verify a mechanic's findings—and compare prices.

3. After you have the facts in hand, call or write your nearest supply house and tell the man what the problem is. Ask him if there's any kit available which would permit repair of the item instead of a major overhaul.

4. Compare the price the mechanic gave you with the price of the replacement part or kit. You'll nearly always find a substantial difference.

5. If practical, buy the kit yourself. If you want to go ahead and do the job, fine—many times it's a simple thing and the instructions that come with the kit are generally explicit.

6. If you *don't* want to do the job yourself, take the kit and car to a mechanic and tell him "I want this put on that." But get a price for labor. If it seems too high, there are many other mechanics around, so don't be afraid to walk out.

7. Above all, before dealing with a mechanic, especially when it involves major work, make sure he has a reputation for reliability and honesty. You can do this by asking your friends who they use—or by checking with the local Chamber of Commerce or Better Business Bureau. If there have been complaints about the way your man runs his business, these offices should have a file on him. ★ ★ ★

# AUTO CLINIC

**Q** After a recent trip, I discovered my 1962 Chevrolet's automatic transmission almost empty of fluid. It was full *before* I started. There's no visible leak. Can this thing burn fluid?—C.A., Mich.

**A** No it can't, but loss of fluid is serious and could have led to a "burned up" transmission if you'd been less careful about checking. If you're sure the transmission is not leaking externally, then it has an internal leak. The probable weak area in a '62 Chevy is the transmission modulator. Fluid may be leaking back through it to the manifold and then out the exhaust.

**Q** My '64 Oldsmobile Jetstar 88 has a steering problem which the dealer can't solve. I continually have to correct the wheel, because when steering from left or right to straight ahead the wheel will not return to center without effort—and this with power steering. In other words, I'm always overcorrecting or undercorrecting the wheel. The mechanic has checked the power steering, aligned the wheel, and lubricated the steering mechanism. Any suggestions?—L.T., N.J.

**A** There is an adjuster plug in the Olds steering gear assembly, and when it is run up too tight it'll cause a drag such as you describe.

**Q** My 1964 Pontiac Grand Prix is equipped with a magnetic pulse transistor ignition system. I bought a Sun tachometer and while installing it myself, I accidentally connected the wire that should be on the primary of the coil to the battery side. Now, the car won't start, and the Pontiac dealer tells me the amplifier of the transistorized ignition is burned out. He refuses to repair it under the guarantee. My contention is that connecting the wire in the wrong manner couldn't have been the cause, because it was hooked up for only a second. What do you say?—J.C., New York.

**A** All owners of cars with transistorized ignition systems and/or alternators could well take a lesson from your experience. Any wrong hook

up in that car's electrical system—even for a *fraction* of a second—is enough to cause a reverse flow of current back through the system that will damage and burn out parts beyond repair. If you're not sure how to make hook ups, don't try. The expense of fixing damage caused by a faulty connection is often greater than the cost of a professional installation would have been.

**Q** I'm having trouble with the turn indicator of my 1961 Austin A55. When I flick the indicator rod for a left or right turn, it doesn't stay in place unless I hold it. Can this be repaired or should I buy a new unit?—D.W.W., Canada

**A** Austin turn indicators have several small springs in them that can cause this problem if they lose tension. It's usually best, then, to just replace the unit with a new one and not fool around trying to repair it. However, there's one thing you could try first. I've seen units cured of this problem by tightening the horn down. A loose horn could keep the indicator from making a good contact. If this doesn't work, replace the unit.

**Q** My 1961 Mercury Meteor 600 with automatic transmission doesn't seem to want to shift. Any ideas?—L.J.G., Wisc.

**A** The governors of these Mercs have been known to pop their buttons on occasion. It's possible it's happened in this case, so before looking for a major cause inside that gear box, take off the governor plate (you'll find it on the outside of the transmission). This will reveal the piston. Try to move that piston back and forth. If it doesn't move, this is the cause of your problem, so replace the governor.

**Q** I've replaced five oil pressure senders on my 1959 Studebaker Lark V8. After several thousand miles, they all started to leak oil past the plastic-to-metal seal. How come?—N.Q., Kan.

**A** Sounds to me like "bootleg" senders which do not seal properly.

I suggest you go to a Studebaker dealer and make sure he gives you part number 1545220. If he can't, say no thanks and order direct from Studebaker, C.O.D.

**Q** I'm being plagued by oil leaks coming from the pan of my 1962 MG Midget. I've replaced the gasket several times with no result. Must the drip continue?—R.W.M., Texas

**A** This is not a new problem with the MG. As a matter of fact, an oil leak of this type is quite prevalent with this car. It happens primarily because of the type of adhesive used by MG mechanics in installing the gasket. It just doesn't hold properly. One hotshot foreign car guy I know stumbled on a cure, although I'll bet many of the MG dealers won't agree because it's not by the book. He used aviation permatex as an adhesive. Works like a charm.

**Q** I own a 1963 Plymouth Eight that has an objectionable metallic noise telegraphed from (I think) the engine. It seems most pronounced at about 50 or 60 miles per hour, although you can hear it at lower speeds. I've gone to four different mechanics and they haven't found the answer, although it's cost me money. What do you say?—A.J., Canada

**A** I say you ought to tighten your collar to choke off that noise. The steering column of your car has a tubing jacket that extends down to the steering mechanism. A one-inch shaft goes through this jacket and attaches to the steering chuck assembly. There's supposed to be a rubber collar around this tube. If it's ever been removed and left off, or if it has slipped down, that tube is hanging loose. It vibrates enough to telegraph a clatter into the car. Get a new collar and put it on, or place the slipped old one back in position and tighten it up.

**Q** A couple of hub caps of my 1958 Cadillac click with each rotation of the wheel. Other owners of this model tell me they have the same problem. Can you tell us what's causing it and how to stop the racket?—R.W., Calif.

**A** The hub caps are "walking," and there's no known cure. But you may be able to *lessen* the noise. Prevent metal-to-metal contact by sticking any type of tape around the wheel where the cap seats against it. You can also try lubricating the wheel and hub cap with lubriplate. Put the stuff on the cap disc where it fits into the wheel.

## Monthly Service Tips

★ Dodge reports that some of its early-production 1964 Darts with V-8 273 CID engines may have been sold with an incorrect choke that could be producing a mixture equivalent to 3 index marks too rich. The result could be loading-up of the carburetor, poor mileage, flooding and any other problem associated with a rich choke. The two chokes involved, the Carter 170-AV-816S (part number 2463573) and Carter 170-AX-801S (2463159) look alike; the only way to tell them apart is by referring to the Carter part number stamped on the circular cover which travels with the choke rod. The AV is the right one. If you have the AX, return the car to the dealer. By the way, if he tells you he's never heard of such a thing, ask him to check Dodge service bulletin No. D64-37.

★ If your Oldsmobile F-85 is experiencing brake roughness or a vibration in the steering wheel during brake application, the cause might well be insufficient torque on the front brake anchor pin bolts. Make sure that the bolts are torqued to the high end of the specification, which is 100 to 110 foot pounds.

★ Incorrect timing of 1964 Tempests with the six cylinder engine is likely unless you know how to interpret the marks on the timing tab attached to the engine front cover. The markings on the tab are in *two degree increments* from the "O" marking. The timing tabs are designed with the greatest number of graduations appearing on the advance ("A") side of the "O" marking. It's on *this side* of the timing tab "O" marking that all BTDC settings fall. The correct timing setting on the Tempest six engine is 4° (two marks) BTDC.

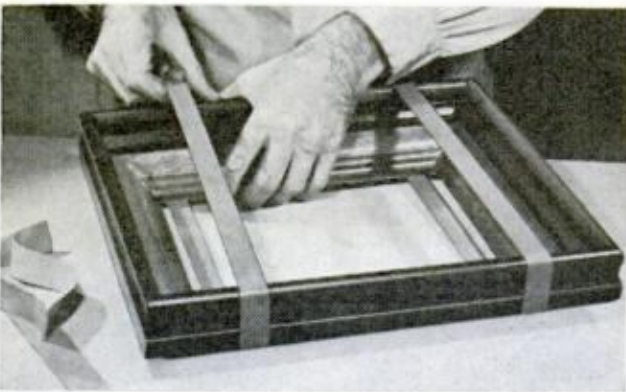
As a service to the readers of Popular Mechanics in solving problems relating to their cars or to driving in general, you are invited to submit your questions for answering either through this column or by mail. Address Auto Clinic, Popular Mechanics Magazine, 575 Lexington Avenue, New York, New York 10022

# It's a SNAP with Pallet Bands



**PALLET BAND** stretched around bed near the foot board holds bedding in place even when you toss and turn

ORIGINALLY USED to keep cartons in place while being moved on pallets, these kingsize rubber bands also have scores of uses in the home and shop. You can get them from 56 to 113 in. long in dozen quantities from M. F. Murdock Co., 310 Water St., Akron, Ohio.



**PICTURE FRAME** is easy to repair. Simply apply glue to miter joints and clamp frame together with bands

**GLUING JOB?** Unlike most conventional clamps, pallet bands will hold the work without marring the finish

**YOU'LL FIND** pallet bands easier to use than cord for holding pads and covers on furniture to be moved



# SHOP SHORT CUTS

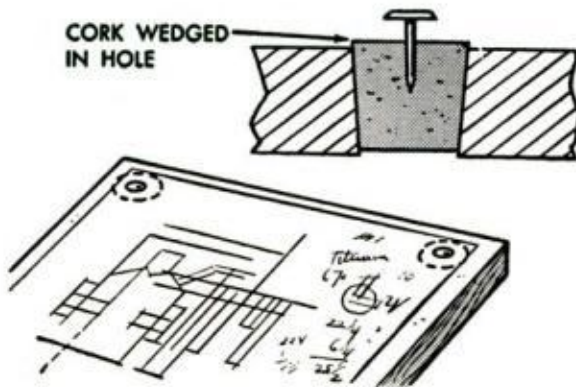
## Rubber-Band Clip Board

A scrap of any tempered or plastic-coated hardboard makes a fine writing surface for on-the-job note-taking. Two bands, cut from an old inner tube and snapped onto each end do double duty: they hold the sheets of paper firm and keep the board from slipping on a table top.



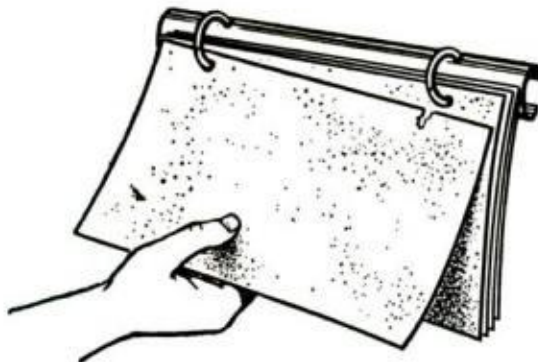
## Cork Inserts for Easy Tacking

It's handy to thumbtack a sketch sheet to a wooden drawing board—but removing those tacks is a good way to get a painfully-broken fingernail. Tacks will seat flush, yet draw back out with ease, if you try this: Drill holes through the corners of the board and force plain bottle corks in, trimming even with the top surface. Replace as needed.—G. E. Hendrickson



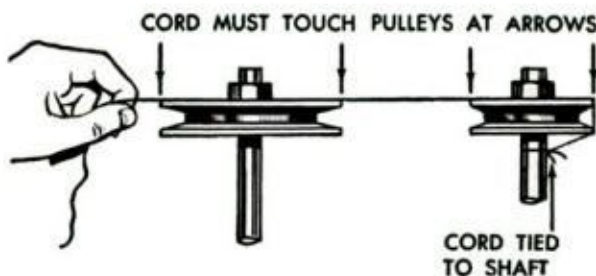
## Binder Ring Holds Sandpaper

Save the ring clamp when a student in your family discards a loose-leaf binder. Mounted on the shop wall, the clamp will keep an assortment of sandpaper sheets handy. Punch or drill small holes close to one long edge, so you can slip the sheets on the rings. Then, simply thumb through until you find the one you want, and give it a tug to pull it free.



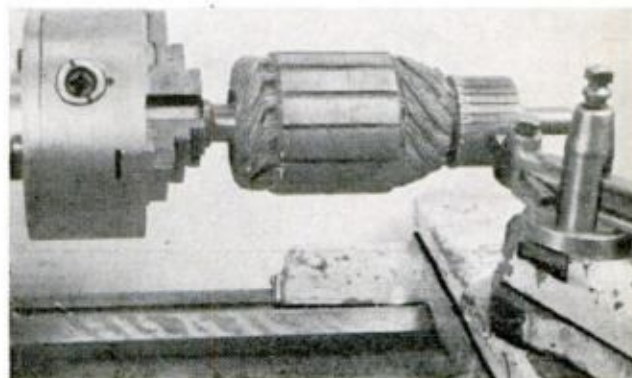
## Cord Checks Pulley Alignment

V-belt pulleys don't have to be very far out of alignment to cause rapid wear on both the pulley rims and belt. To check, stretch a cord across the upper faces of the two pulleys. If they're aligned, the cord will touch at the four points shown. If you now rotate each pulley 180 deg. and check again, you'll detect bent shafts or improper mounting, too.—H. J. Gerber



## Lathe Repairs Commutator

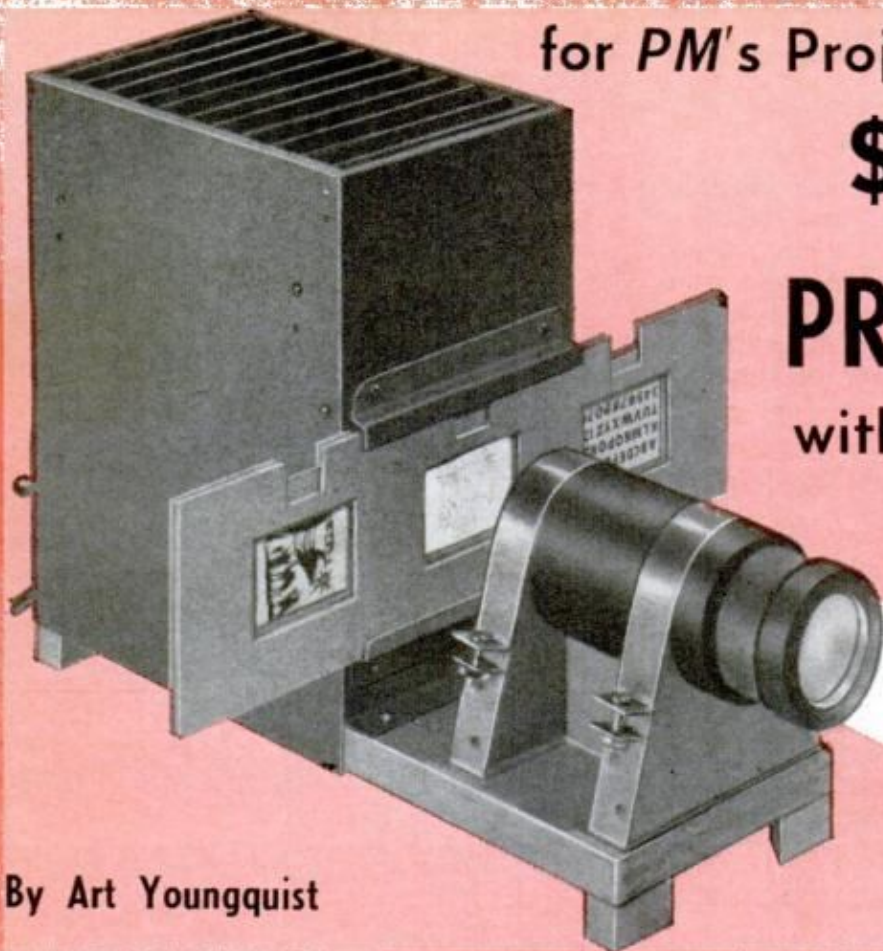
A small engine lathe and an ordinary V-threading tool bit make fast work of undercutting mica separations on a commutator. Hold the armature in the universal chuck by means of the shaft at the opposite end from the commutator. Clamp the tool bit sideways in the holder and position it on center with its face pointing toward the headstock. Make your cuts by feeding the carriage from right to left.



for *PM's* Project-a-Plans . . .

# \$7 SLIDE PROJECTOR

with Kaleidoscope Attachment



By Art Youngquist

**Ever since we introduced our projection system for pattern enlarging, readers have wanted plans for a cheap, home-built projector. Here it is—and you can use it to show your color slides, too!**

**U**NLESS you're a color camera buff, chances are you don't own a slide projector. That's why, in the two years *PM's* been running clip-out, Project-a-Plan transparencies, we've always duplicated the pattern on conventional graph squares. The old way's a lot of work, we know, but it's better than nothing. We've since learned from our readers, however, that many who don't own a projector *rented* one before tackling big projects like the Christmas lawn cutouts we've presented in our December issue the past two years.

So we decided that before the next batch of Christmas plans was due we'd present a simple, inexpensive projector—to save the fuss and expense of such rentals. The one we've come up with is ideal for our 35mm-size plans—and it has two bonus features that recommend it, as well, to anyone who's not interested in pattern enlarging. It's perfectly adequate as a standard projector for color transparencies. (If you already have an expensive rig for your slide shows, our model would make a rugged second projector for the kids.)

*And:* a homemade kaleidoscope attachment converts it into a spectacular toy that'll give your youngsters (and you) a rest from plain ol' black-and-white TV.

Unless you already have a lot of parts on hand, it might be a chore for you to gather together the lenses, lamp and electrical parts shown in the Materials Lists on page 184, so we've arranged to have a well-known optical company assemble an inexpensive but complete kit. All you'd need in addition would be some scrap pieces of plywood and  $\frac{1}{2}$ -in. aluminum sheet. This is the type used for hot-air ducts; so you could probably pick up some scraps at a local sheetmetal shop. It's so soft you can cut it with household scissors, though they'd be awkward for cutting the lamp-house holes. If you don't own a drill-press fly cutter, your sheetmetal man could cut these holes for you.

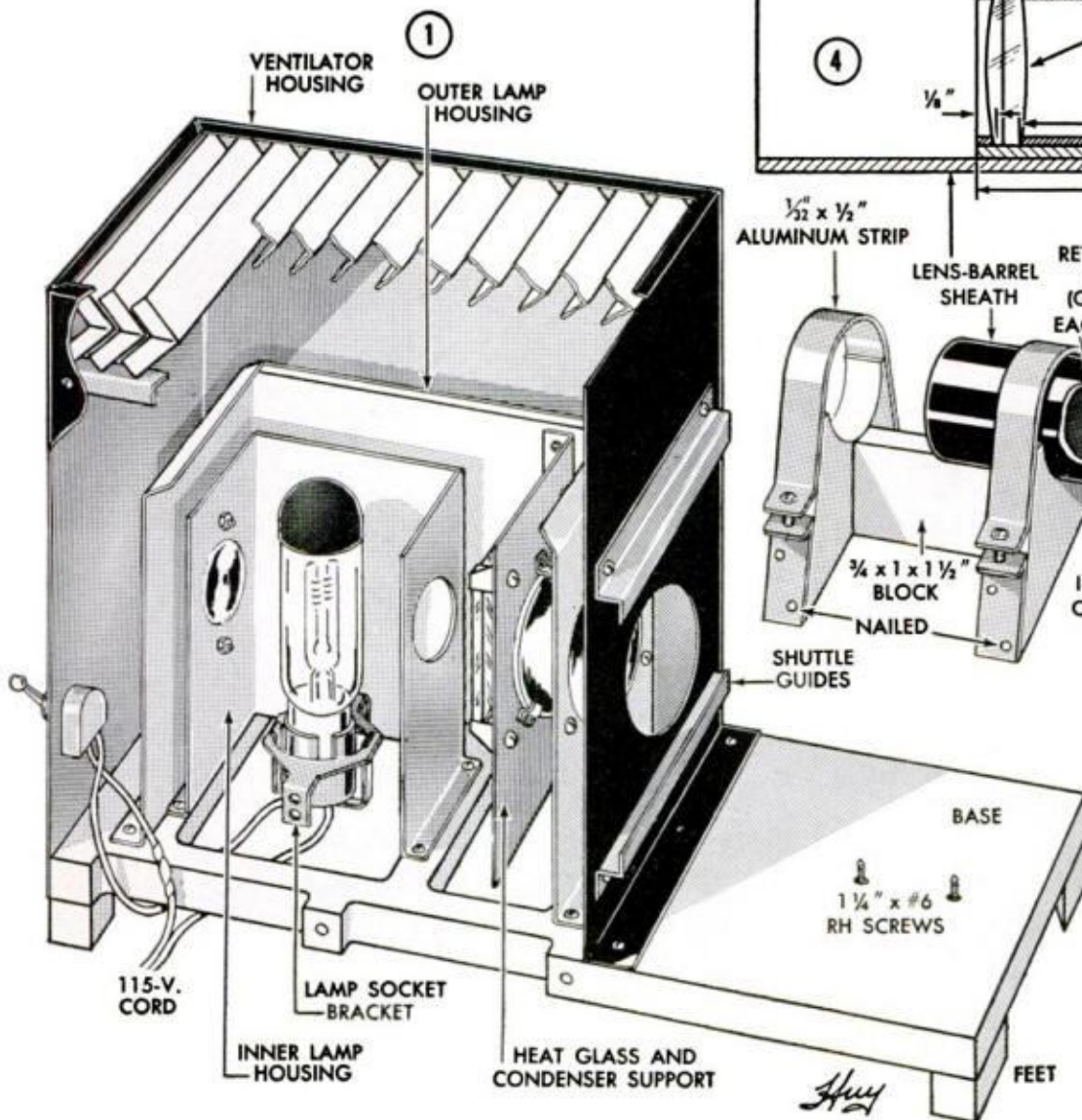
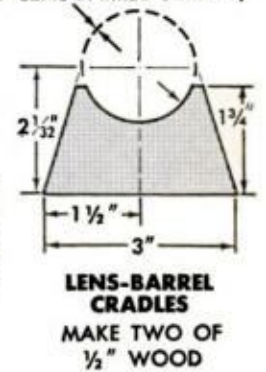
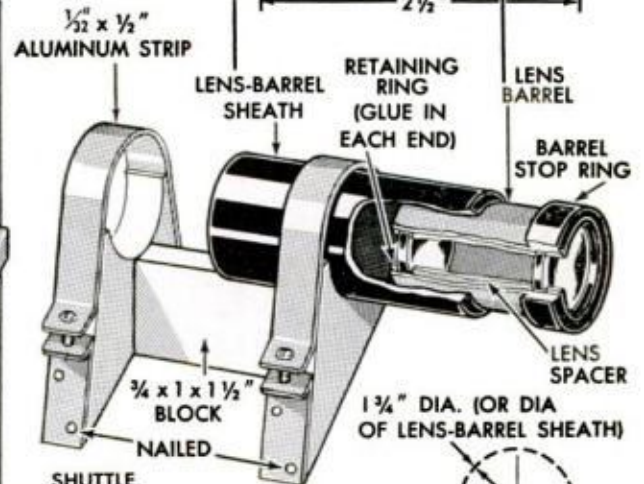
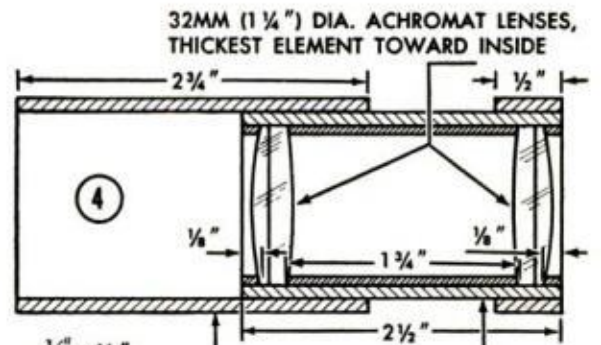
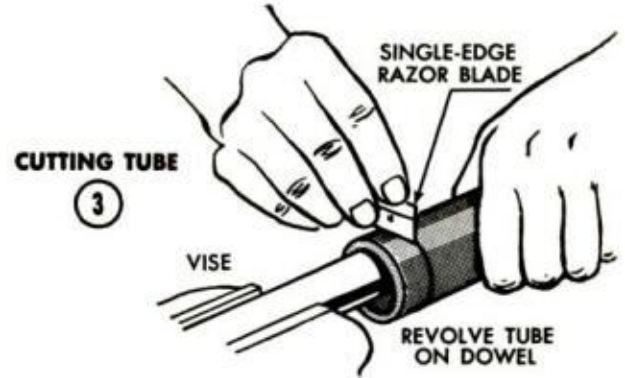
When laying out the plywood base, mark an accurate centerline, because all housings and lenses must be aligned to this mark. After cutting out the vent holes, glue small wood blocks to the base to lift the projector and encourage air circula-

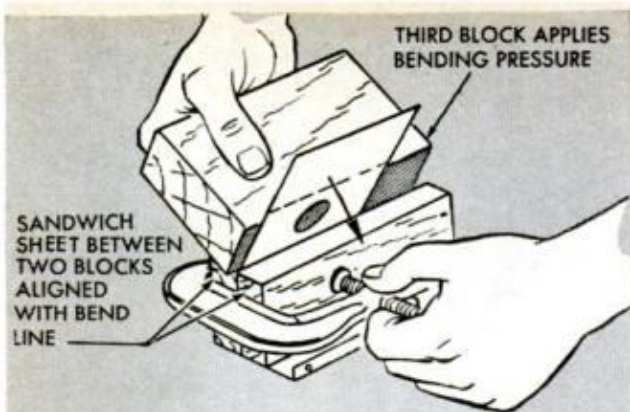


tion. The triple lamp housing is designed to cool the bulb by natural draft during prolonged projection, since it would be too complex and costly to add a blower.

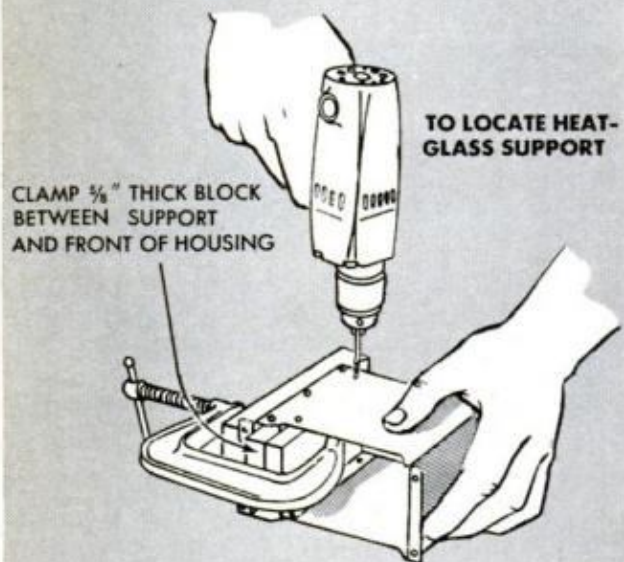
A demonstration of the best way to bend the aluminum parts is shown on the next page. For greatest accuracy, you can cut bending blocks to the exact width between the bending lines—for example, a 1 3/4-in. block for the inner lamp housing. You'll note on the patterns that some of the 1/8-in. holes are located with precise dimensions. You can drill these before bending, then locate the others from the drilled holes on assembly. The best way to position the heat-glass support within the outer lamp housing, for example, is to space it away from the front of the housing with blocks of the proper thickness.

The thick heat-absorbing glass is fastened to the rear of this partition with corner clips cut from the pattern on page 182. The glass should fit loosely to allow for expansion as it heats up. At the front of this partition, attach one of the condenser lenses so that its greater convex protrudes through the cut-out. The exact length of the clips must be determined by trial.





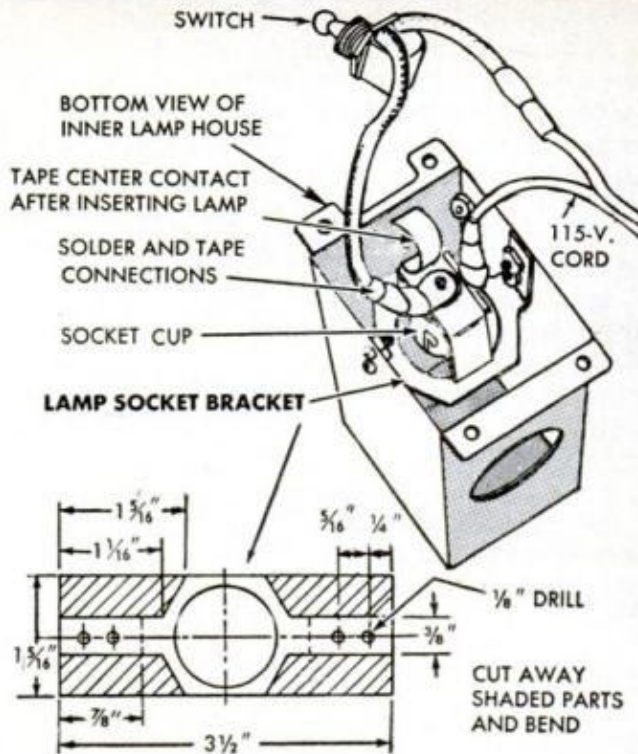
**USING WOOD BLOCKS FOR SHARP STRAIGHT BENDS**



CLAMP  $\frac{3}{8}$ " THICK BLOCK BETWEEN SUPPORT AND FRONT OF HOUSING

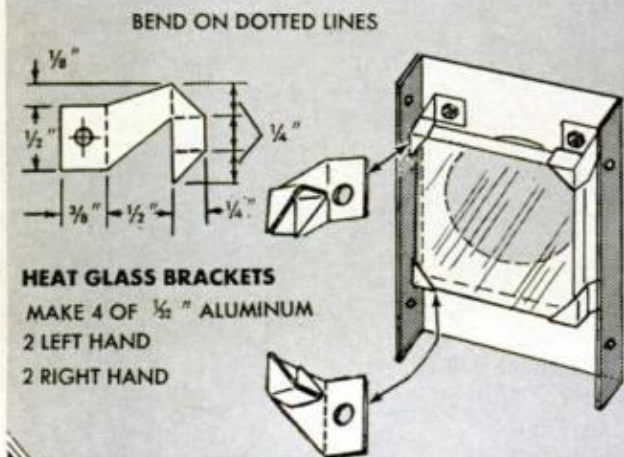
TO LOCATE HEAT-GLASS SUPPORT

## LAMP SOCKET ASSEMBLY



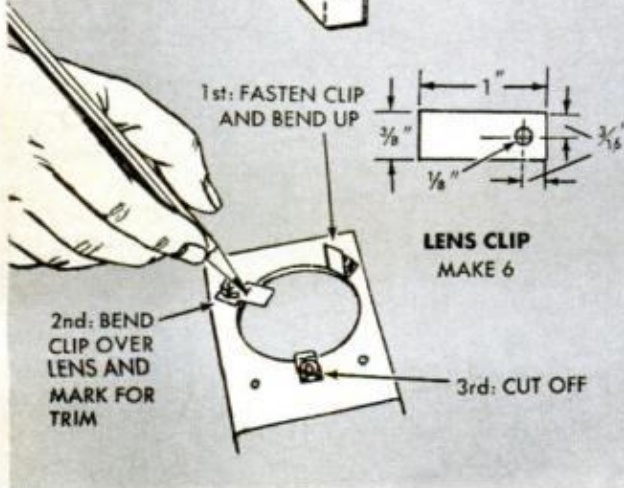
**BRACKET PLATE** with hole comes with kit. Shape and bend as shown and bolt across inner lamp housing. Solder one lead from switch and one from line cord to lamp socket terminals, wrap with electrical tape

## HEAT GLASS SUPPORT



BEND ON DOTTED LINES

**HEAT GLASS BRACKETS**  
MAKE 4 OF  $\frac{1}{2}$ " ALUMINUM  
2 LEFT HAND  
2 RIGHT HAND



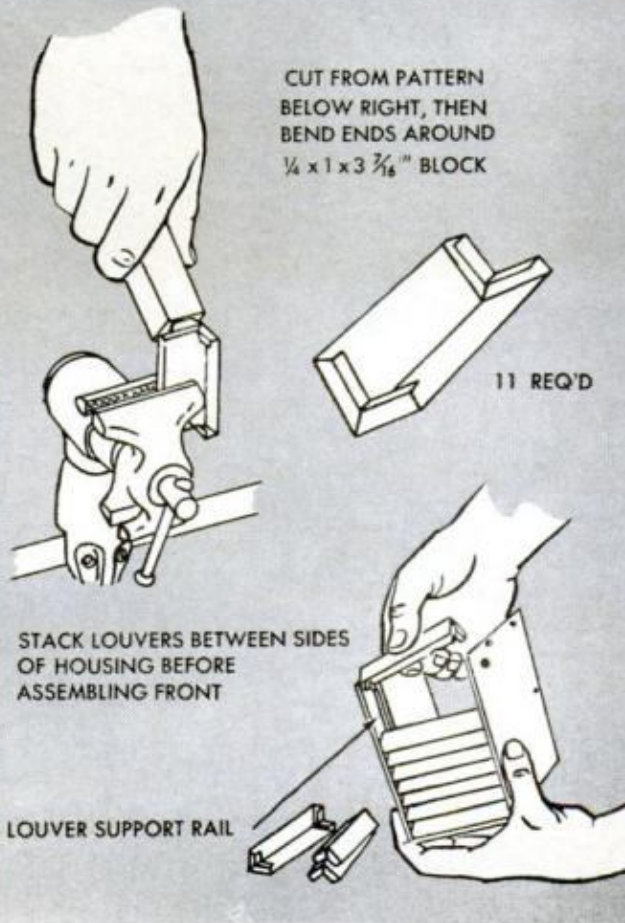
1st: FASTEN CLIP AND BEND UP

**LENS CLIP**  
MAKE 6

2nd: BEND CLIP OVER LENS AND MARK FOR TRIM

3rd: CUT OFF

## LOUVER ASSEMBLY



CUT FROM PATTERN BELOW RIGHT, THEN BEND ENDS AROUND  $\frac{1}{4} \times 1 \times 3 \frac{1}{8}$ " BLOCK

11 REQ'D

STACK LOUVERS BETWEEN SIDES OF HOUSING BEFORE ASSEMBLING FRONT

LOUVER SUPPORT RAIL



## PROJECTOR

- 1 1/2 X 18 X 22" soft aluminum  
(or scrap pieces to fit individual patterns)
- 1 1/2 X 4 X 10" plywood
- 1 1/2 X 4 X 6" pine
- 48 4-40 X 1/4" RH machine screws with nuts
- 12 4-40 X 3/4" RH machine screws with nuts
- 2 #6 X 1 1/4" RH wood screws
- 4 #4 X 1/2" RH wood screws
- 1 optics kit #70,677\* containing:
  - 2 32 x 171mm achromat lenses
  - 2 2" dia. condensing lenses
  - 1 2 X 2" heat absorbing glass
  - 1 150-watt projection lamp
  - 1 lamp socket
  - 1 blank for socket bracket
  - 1 lamp reflector
- 3 pc. tubing for projection lens mount
- 1 120-volt toggle switch
- 1 10 ft. 2-conductor lamp cord with plug

## KALEIDOSCOPE

- 1 1/2 X 3 1/2 X 7 1/2" plywood for support base
- 1 1/2 X 3 1/2 X 5" pine for brackets and feet
- 2 6-32 X 1" machine screws
- 2 8-32 X 1 1/4" machine screws with wingnuts
- 1 1/16 X 6 1/2 X 6 1/2" cardboard
- 1 1/2 X 4 X 4" cardboard
- 10 ft. 3/4"-wide masking tape
- 1 Kaleidoscope parts kit, #70,676\*

\*Both kits are available from Edmund Scientific Co., 101 E. Gloucester Pike, Barrington, N.J. 70,677 is \$6.50, 70,676 \$4, ppd.

Bolt them in place, bend them up, lay the lens in place, bend them over it and mark them for trim, leaving just enough projection beyond the final bend to hold the lens securely. Remove the clips, snip them off, and reinstall.

After bending the louvers, paint both sides of them with a heat-resistant black paint, or use plain stove blacking. Use the same paint on the inside of the inner lamp housing.

To install the lamp, insert it through the hole in the bracket and squeeze the two spring clips on the socket until you can snap their ends inside the bracket hole. Position the lamp's two coiled filaments so they straddle the base centerline. The cut-out in the base permits access to the bulb whenever it must be replaced.

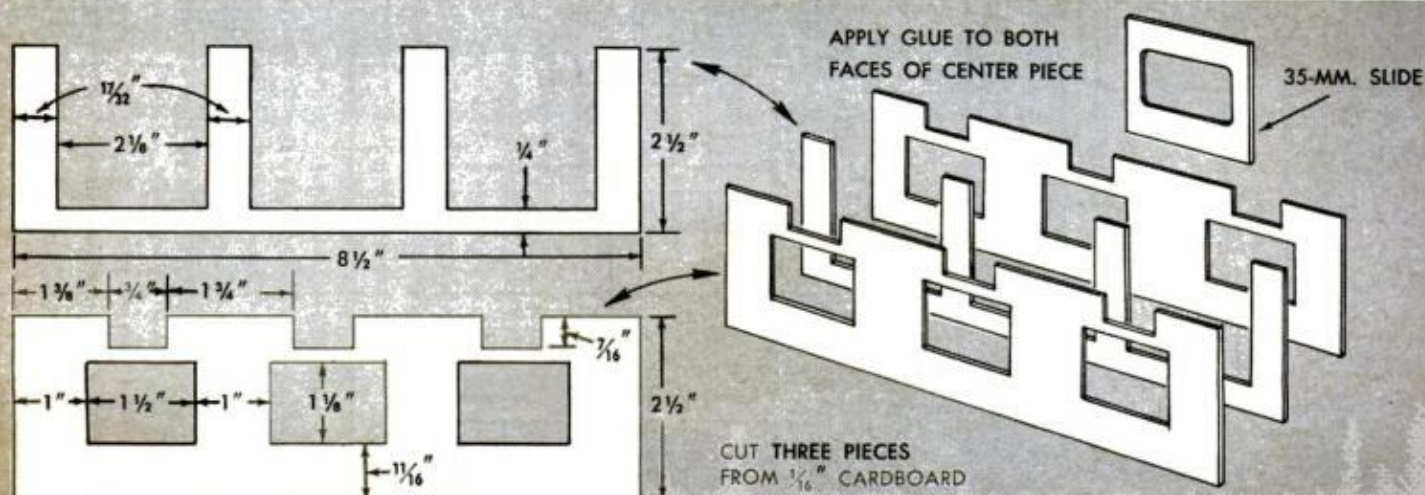
Temporarily bolt the back of the inner lamp housing to the base through the existing holes; then align the centerlines on the base and the front of the housing before marking through the holes in the front flange. Now place the outer housing over the inner one, leaving a 3/8-in. gap between their back panels (see Fig. 1, page 181). Again, align centerlines and mark the base for the mounting holes. Remove both housings for the drilling operation.

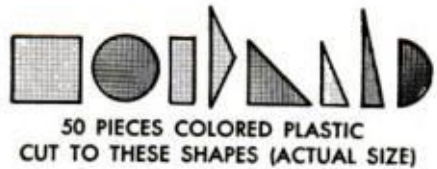
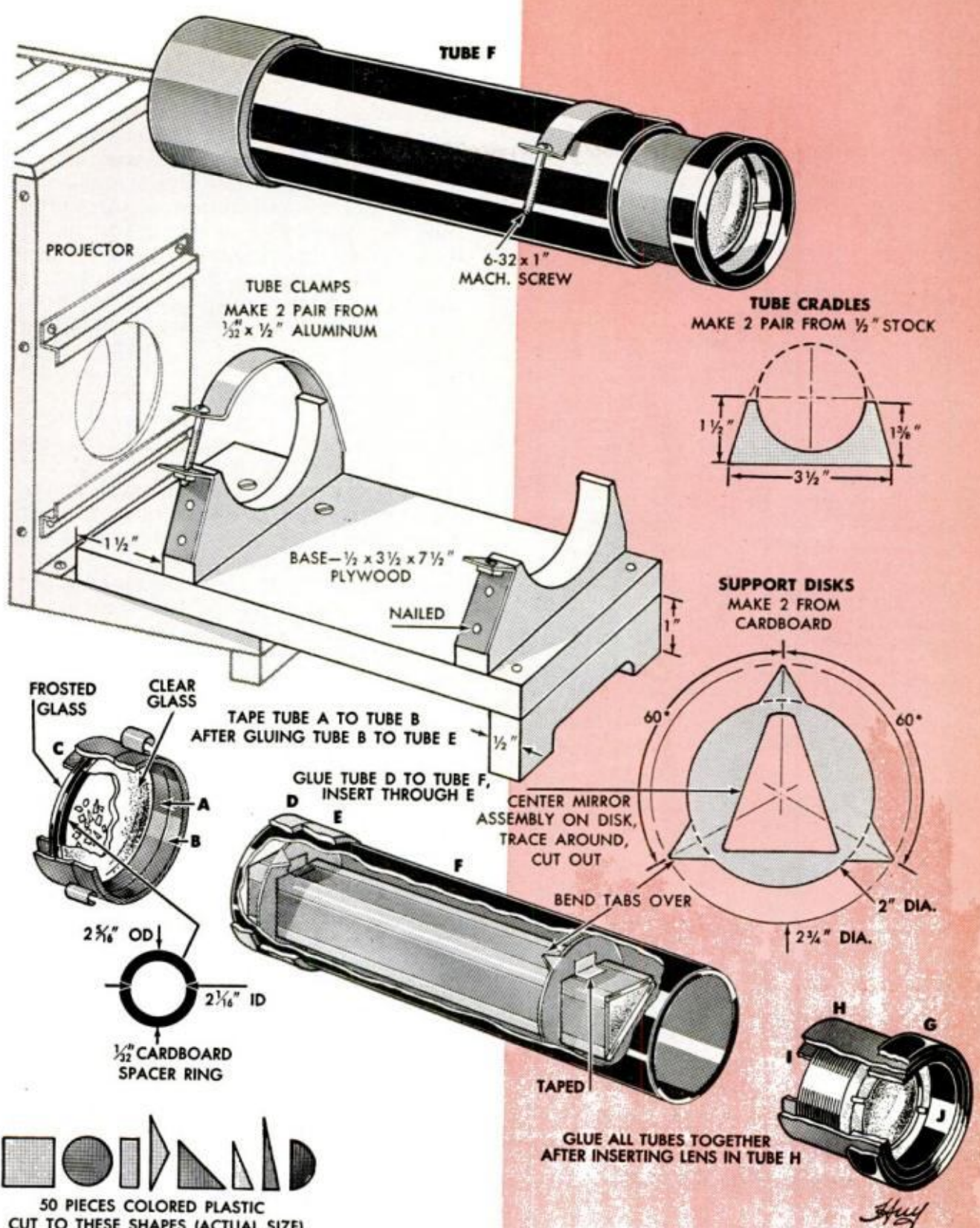
Assemble the louvers, shuttle guides and toggle switch before attaching the front of the ventilator housing. The flanges slip over the sides. The front's bottom flange is the only part of this housing that is bolted through the base. The sides and back extend down to cover the edge of the base and are attached with four #4 x 1/2-in. RH woodscrews.

If you bought the parts kit, you have all the materials required for assembling the

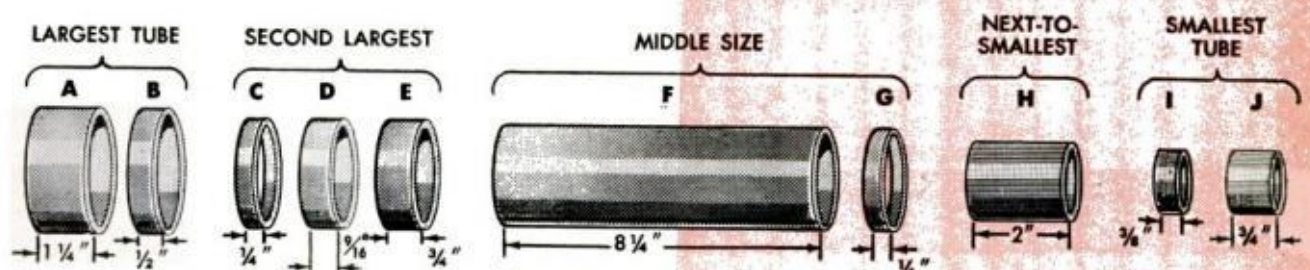
## HOW TO ASSEMBLE THE SLIDE SHUTTLE

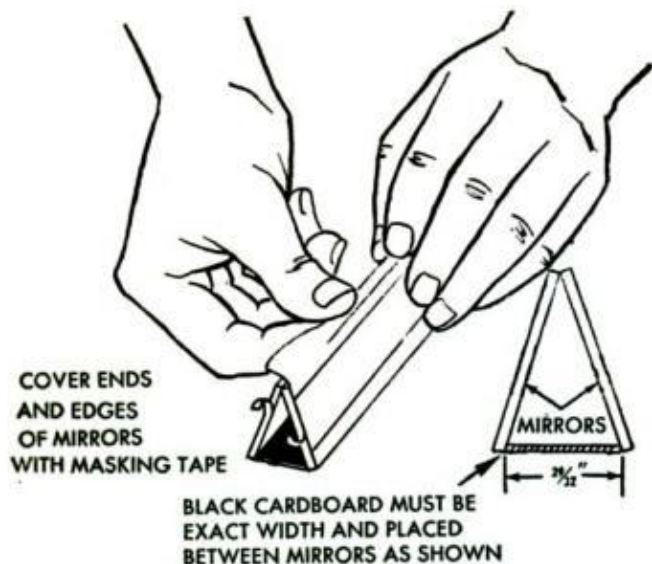
DESIGNED FOR THREE STANDARD SLIDE MOUNTS, the shuttle is positioned in front of the lens by manual adjustment. Assemble the three pieces dry and insert a slide in each pocket for a trial fit before applying glue. Place weight on assembly and be sure glue is dry before inserting slides again, to avoid sticking. Shuttle should slide snugly within the guide channels. It can be left unfinished or painted a flat black



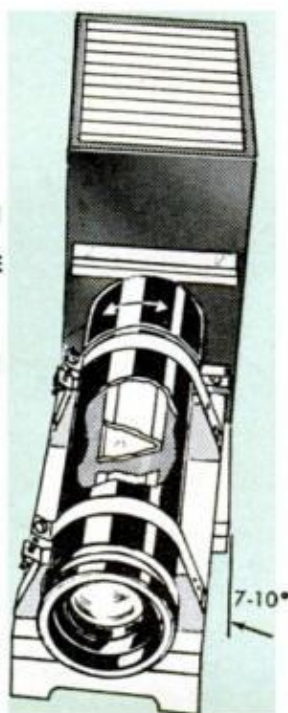


**CUT SEGMENTS FROM FIVE TELESCOPING TUBES**

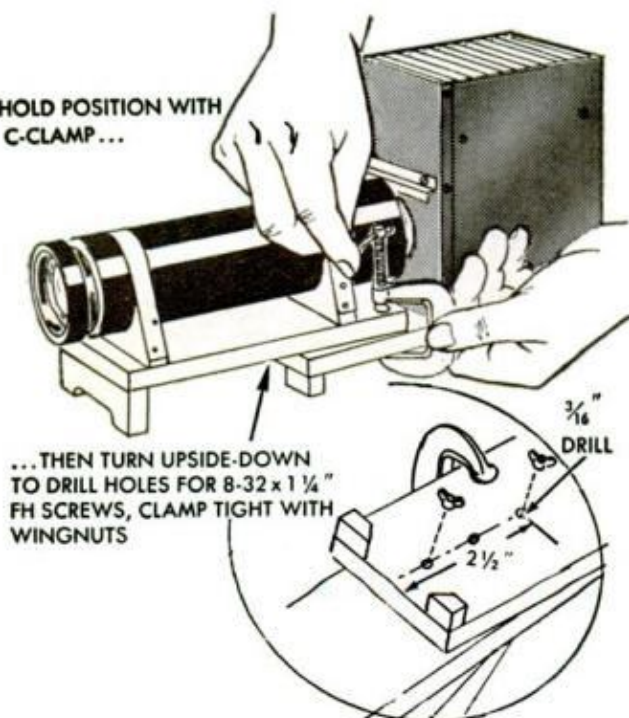




TO JOIN UNIT TO PROJECTOR, TURN TUBE TILL MIRRORS ARE POSITIONED AS SHOWN, THEN OFFSET KALEIDOSCOPE BASE AT ANGLE TO PROJECTOR BASE TILL IMAGE IS UNIFORMLY BRIGHT. SHIFT KALEIDOSCOPE TO ELIMINATE SHADOW SPOT AT CENTER OR EDGE OF IMAGE



HOLD POSITION WITH C-CLAMP...



projection lens. The only way to space the two 32mm cemented achromatic lenses is to sandwich them between two  $\frac{1}{8}$ -in.-wide rings and a  $1\frac{3}{4}$ -in. section cut from the smallest of the three tubes supplied, as shown in Fig. 4, page 181. To assure square cuts when slicing the tubes, use the techniques demonstrated in Figs. 2 and 3. Don't attempt to cut all the way through the tube on the first rotation. Cut a little deeper each time around. Center the larger section inside the middle-sized tube, clean the lenses thoroughly and insert one at each end, setting them firmly against the edge of the inner tube. Then apply glue to the outside of the  $\frac{1}{8}$ -in. rings and press these firmly against the lenses.

Focusing is accomplished by sliding this entire assembly in and out of the largest tube, which remains stationary in the lens-barrel cradles. The fit should be snug enough to hold the focus once it's set. If loose, glue a turn or two of wrapping paper around the lens tube. When fastening the cradle assembly to the base, make sure the lenses are centered on the centerline.

To prepare Project-a-Plan transparencies for enlarging, you simply cut them from the magazine page and coat them with vegetable oil. These paper transparencies fit standard 35mm slide-mounts. You can buy the kind you fold over and seal with a hot iron at any photo store.

### Kaleidoscope Spectaculars

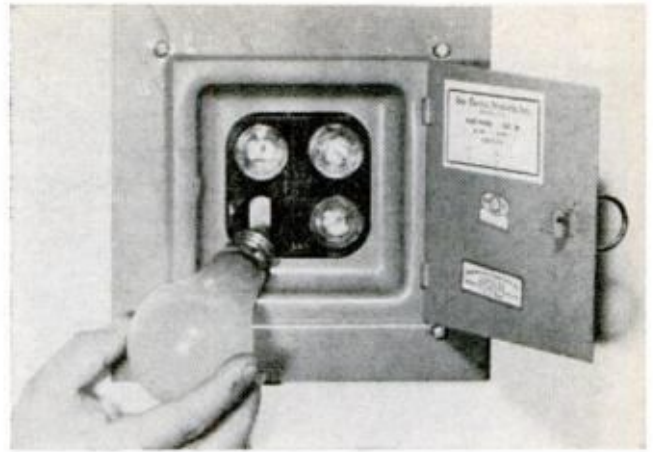
No separately-prepared projection material is necessary where the kaleidoscope attachment is concerned. The "action" is self-contained, consisting of tumbling plastic fragments sealed between glass at the rear of the unit. They fall together in random groupings that—when fanned out by multiple reflections—blossom into those colorful circular designs you remember from the hand-held squint-in toys of your childhood. Blow these ever-shifting patterns up to wall size, however, and you've got a home-grown color-spectacular!

The mirror unit must be assembled and positioned with some precision. The strip of black cardboard shown in the top sketches on this page should be taped between the faces while the mirrors are joined at their upper edges. It should be at least  $\frac{1}{16}$  in. thick. If you can't find such a piece with one black face, coat the upper side with flat black enamel or poster paint, before taping. Also cover the back edges of the mirrors with thin strips of tape, to avoid unwanted reflections. Slip the two support disks onto this triangular assembly, tape them in place and insert the entire unit into tube F. The fit should be

(Continued on page 198)

# Bright Ideas for the Amateur Electrician

**Save on fuses** by screwing an ordinary light bulb into the defective circuit while you track down the short. The customary practice of replacing the blown fuse with a fresh fuse can be a costly waste, since replacement fuses will blow one after the other until the trouble has been eliminated. A light bulb, however, will burn brightly as long as the short exists. Once you fix the short, the bulb goes out or burns dimly, depending on the load the circuit carries. Then it's safe to replace the bulb with a new fuse.—*F. S. Saunders*



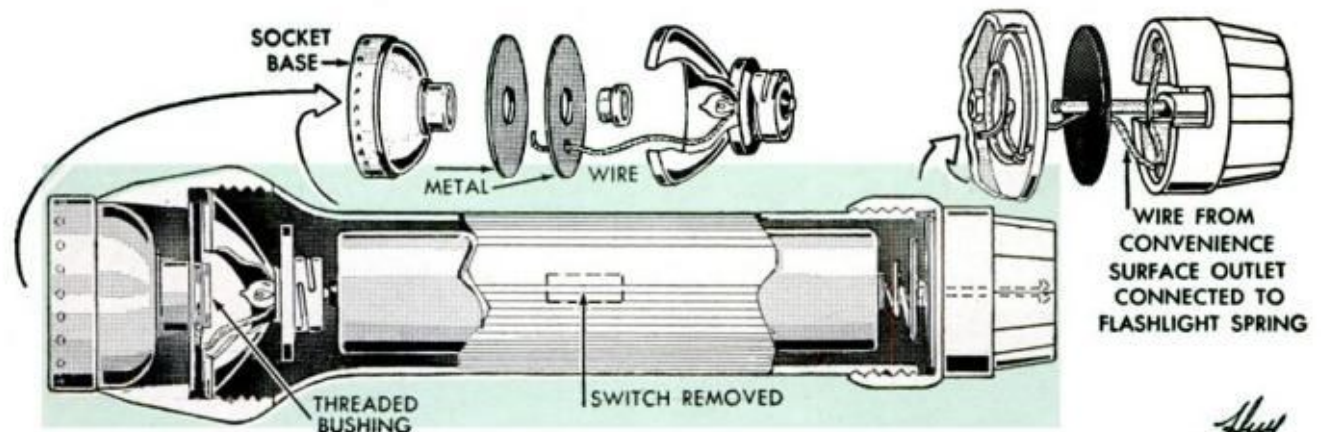
**Neat test probes** can be homemade from dried-up ball-point pens at next to no cost. The cheaper types have no metal cartridge, only a writing tip; the body serves as the ink reservoir. With pliers, pull the tip free, then drill a hole in the closed end and wash out any residual ink.

Pass the lead wire through the body and wrap a turn or two around the tip. Force the tip back in place, jamming the bared wire tight. Use a different color pen for the second probe, to identify polarity. The opposite ends of the two leads are, of course, soldered to a test light.

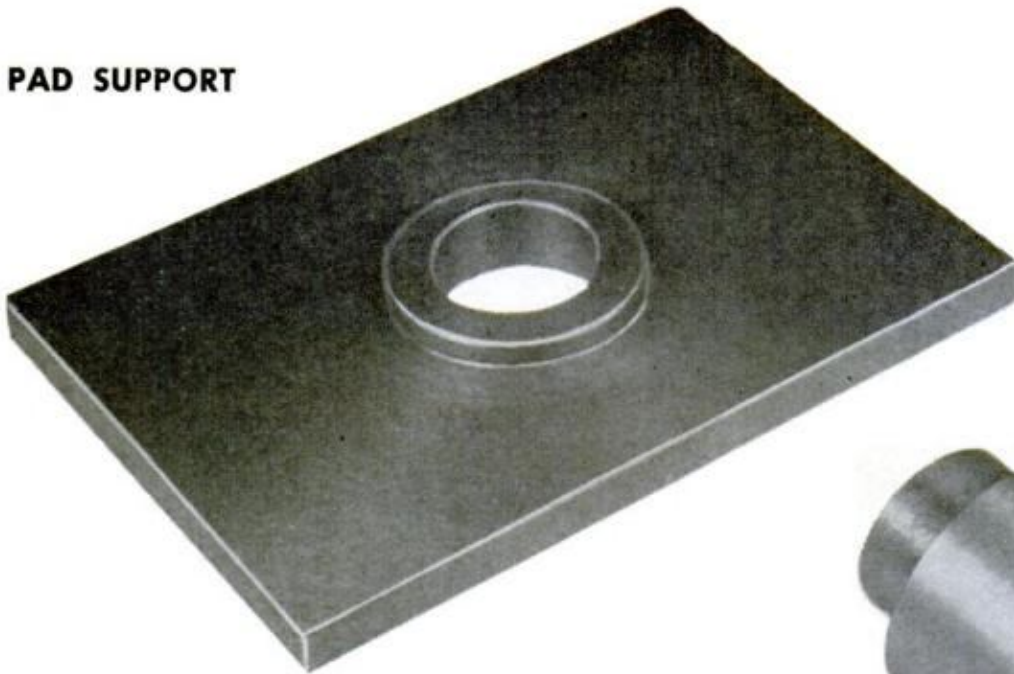


**Test for shorts** with safety! If you touch a shorted-out appliance or lamp, you can get a nasty shock; it's less painful to do your checking with this simple short-circuit tester made from a cheap plastic flashlight. Mount a single outlet on the bottom, wiring both contacts to the spring that presses against the battery. The cut-away and pull-apart sketches of the front of the flashlight, below, show how to equip the plastic body with a metal rim. Remove the front lens and cut two disks of scrap metal to fit the lens seat. Solder a bare

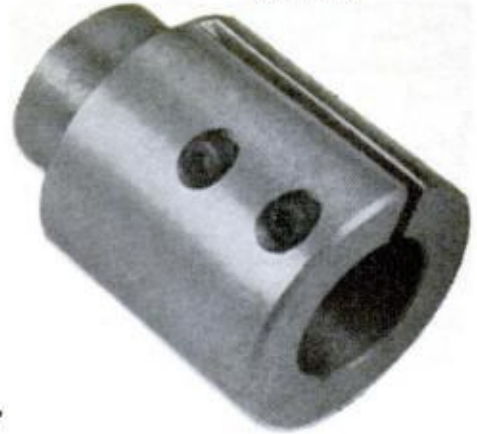
wire to the base of the bulb and sandwich the free end between the two disks. Seat a socket base against the plastic rim, drawing its threaded nipple tight against the disks by means of a brass bushing inserted through the disks' center holes. To use the tester, just plug the cord from the suspected appliance into the rear outlet and touch the rim of the socket base to any metal part of the appliance. If the lamp lights (you can see it through the hollow bushing) the appliance is shorted out.—*Joseph Braunstein*



## PAD SUPPORT



## SPLIT SLEEVE



# TAILSTOCK SPINDLE ADAPTERS

By H. J. Gerber

A SMALL ENGINE lathe can be more versatile than you expect. Machine a couple of simple adapters like those shown above and you can set up all the tough jobs shown on these pages—and more.

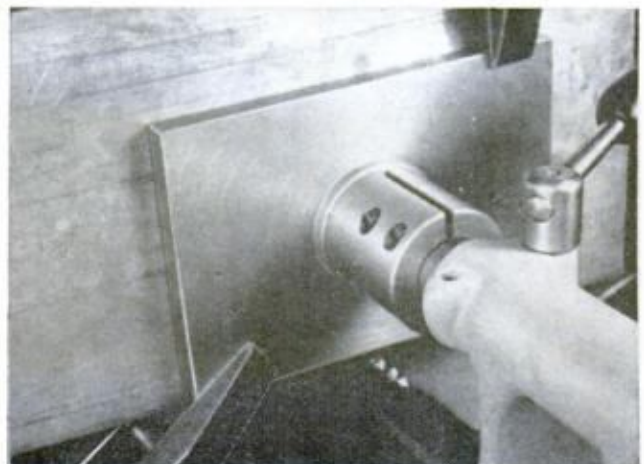
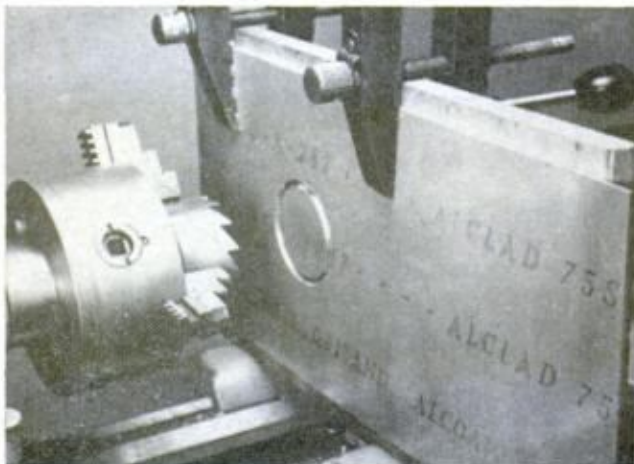
The main adapter is a split sleeve that's been bored out to fit snugly on the tail spindle. The slot is cut down one side only and stops short of the shoulder; two holes are drilled across the slot and tapped for Allen screws. Slip the sleeve on the tail spindle, tighten the screws to narrow the slot, and the adapter is ready for use.

Actually, two split sleeves are needed for the jobs shown here. One of them

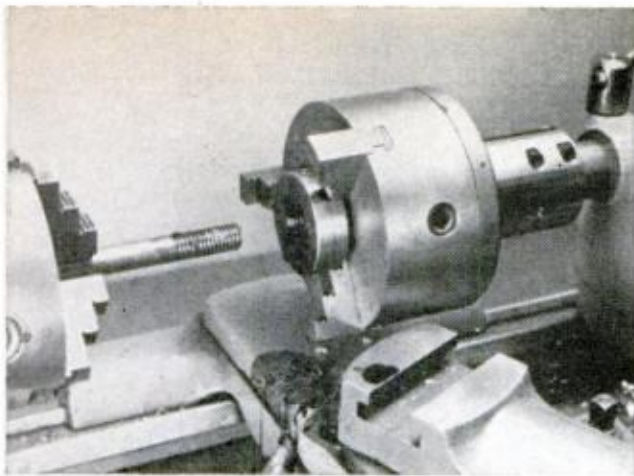
works solo while the other (above) fits into a plate steel pad. The solo sleeve differs only in having its turned-down end *threaded* to match the pitch of the lathe-spindle nose, so that your lathe chucks and other accessories can be screwed onto it to perform jobs like those at the right.

The pad is for clamping work that can't be chucked. Make it a size to clear the lathe bed when it is slipped onto its unthreaded sleeve. The pad's hole should be accurately bored at right angles to its outer face. This means that work clamped tight to this face will be square with tools chucked in the head spindle.

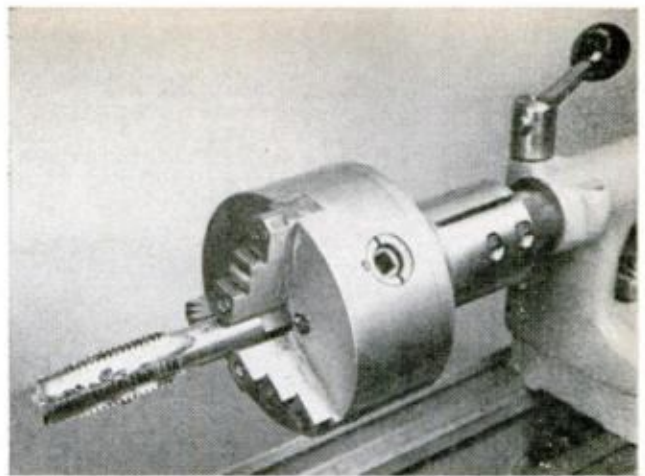
**CLAMPED TO PAD**, with panel of plywood between, aluminum plate is held firm for piercing with hole saw in universal chuck on head spindle. Rear view, left, shows how sleeve clamps on tailstock to hold pad square to lathe axis. Another use: clamp small awkward work in a drilling vise and clamp the vise to the pad's face







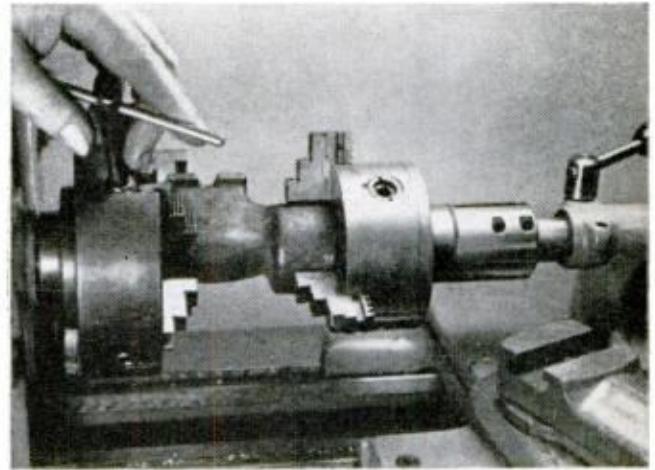
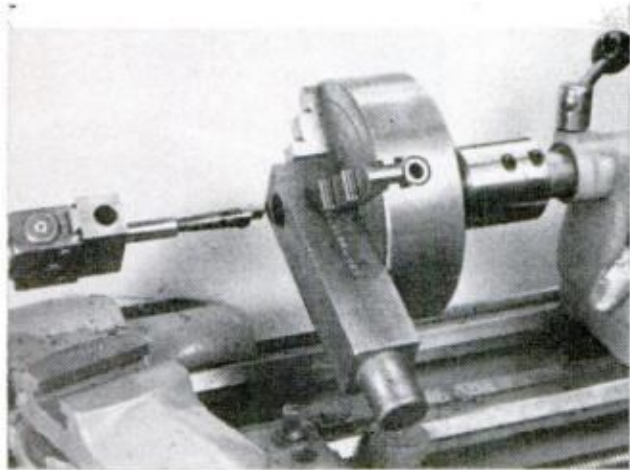
**STANDARD BUTTON DIE**, gripped in universal chuck with jaws reversed, makes quick, accurate job of threading. There's no risk of die or chuck slipping under heavy torque produced by operation of this kind



**LARGE-DIAMETER TAP**, normally difficult to chuck on tail spindle, is held with ease in a universal chuck screwed on the threaded split-sleeve adapter which is similar to the unthreaded version used with pad

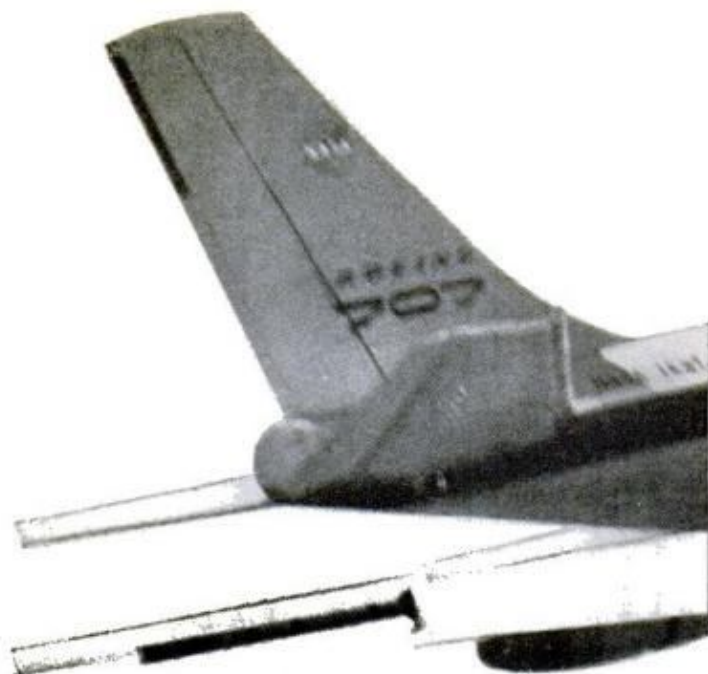
**CROSS BORING JOBS** that are too big to swing on the head spindle are easily held in four-jaw chuck on tail spindle. Boring tool is held in adjustable boring head seated in taper socket of head spindle

**SYMMETRICAL END** of tricky casting is held in universal chuck on tail spindle while offset end is seated in independent chuck on head spindle. This done, tail chuck is released and replaced with boring tool



## NEXT MONTH IN SHOP AND CRAFTS

- ★ **WHY PUT UP WITH A WET BASEMENT?** Whether your moisture problem is annoying condensation or serious flooding, there's a good chance you can solve it yourself with a minimum of work and expense. The October issue of *PM* tells you how to track down the cause and gives step-by-step directions for correcting it. Here's a "must" for all homeowners
- ★ **THIRD HAND FOR YOUR SHOP.** How many times have you wished you had a third hand to hold a tricky soldering or welding job while you worked on it? In next month's *PM* you'll find complete plans for an adjustable metal-work holder built around a heavy-duty magnet. When not holding down a job on your bench, the magnet doubles as a "magnetic broom"
- ★ **NIGHT STAND WITH SWING-AWAY TRAY.** Breakfast in bed will be even more enjoyable if you build the attractive night stand featured in next month's issue. A roomy tray concealed under the top swings out over the edge of the bed, putting everything within easy reach. Breakfast over, the tray swivels back out of sight. You'll see all the plans in October
- ★ **HOMEMADE SHEET-METAL BRAKE.** It only costs about \$20 to build, yet this sturdy roller-action metal bender can handle 20-ga. sheet iron the full 18-in. width of the table. With the proper forming block or mold, you can make angles, radius bends, reverse bends—in fact this bender is practically a complete sheet-metal shop. (The first of two installments)

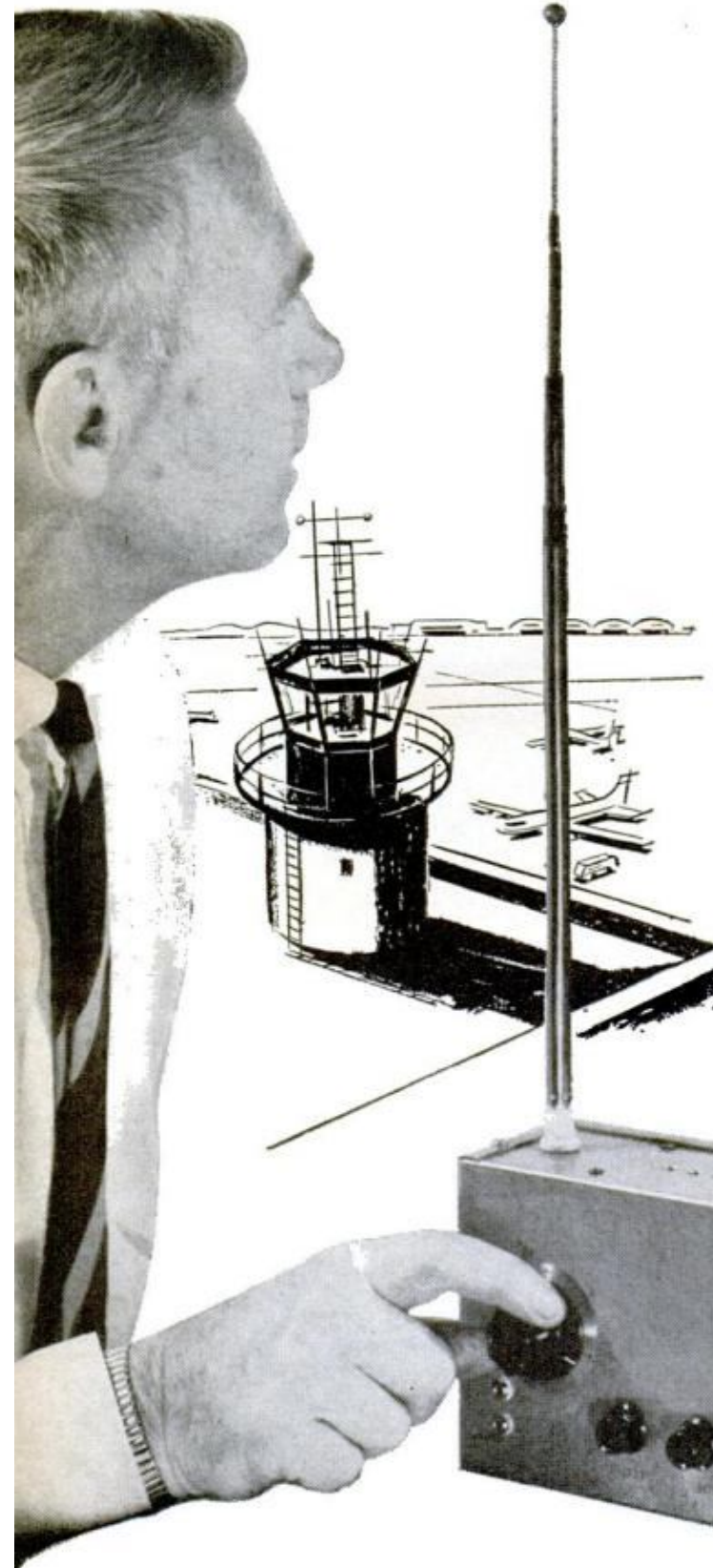


## Build This

*This \$25 receiver tunes in on the airliners, lets you listen to both pilots and control towers*

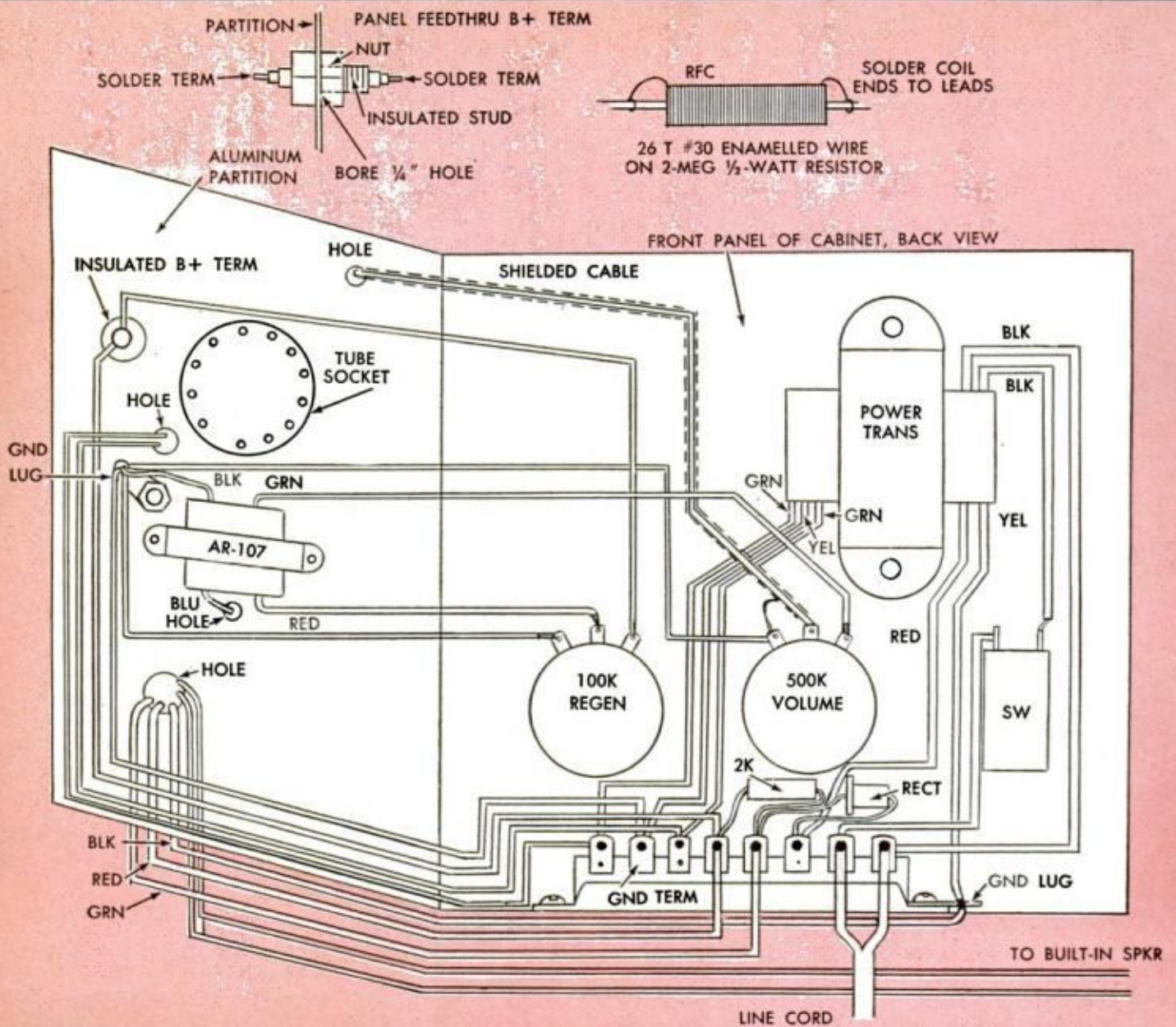
By Harold P. Strand

**L**ISTENING TO COMMUNICATIONS between the tower and aircraft in flight and during landing and take-off can be extremely interesting and sometimes exciting if trouble happens to develop. The tower sends weather data and general flight instructions to each plane. The pilot replies with data on weather conditions encountered, his present altitude and he



**COMPLETE CIRCUIT** of 1-tube receiver. Note that although only one vacuum tube is used, there are actually three separate tube functions. This is made possible by using the Compactron tube





**PICTORIAL DIAGRAM** shows the wiring in the main body of the receiver. The detail shows the home-made rfc (choke) and B+ feed-thru insulator

knob for a proper fit on the shaft.

The dial plate is a 2-inch diameter disk with engraved markings from 0-100 over a 180 degree arc. If you have trouble getting such a dial, make one from sheet aluminum and put your own markings on it to indicate the frequencies you find most commonly used.

After wiring is completed and you have checked the unit carefully, plug it in and turn it on. After a few seconds you should hear the rustling noise which is typical of regenerative receivers and most high-frequency radios. The regeneration and volume controls can be adjusted to suit, and at some dial position or another you will pick up both tower and aircraft transmissions.

This is not continuous from any point, so it may be necessary to wait awhile for

a transmitter to cut in, and then if you are tuned right you will hear them. I tested the receiver at a point about 10 miles from an airport, and signals came in extremely loud and clear. In some cases a plane may be some distance away and the message may be low in volume. In this event plug in an earphone and you'll probably be able to hear the pilot thanks to the increase in gain.

To check the frequency range and make adjustments by squeezing or pulling apart the turns of the antenna coil, use a signal generator or grid-dip meter to tell you just what frequency you are tuned to.

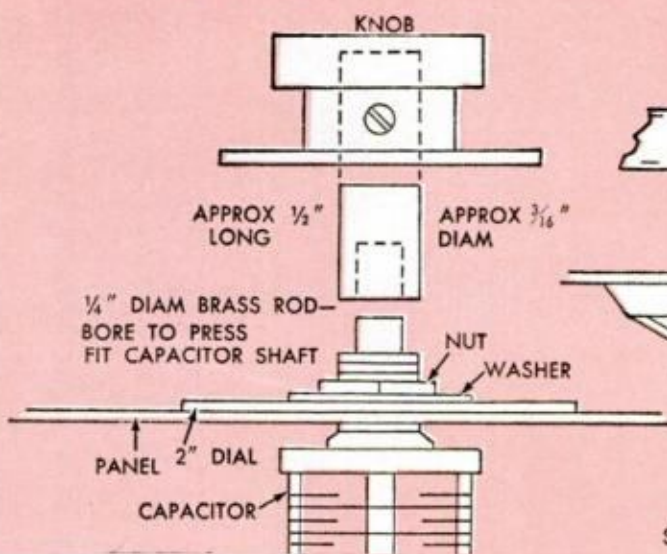
If you start from scratch the total cost of all materials will range between \$25 and \$30. Of course, if you already have some of the parts on hand, this figure can be reduced. ★★★

### PARTS LIST

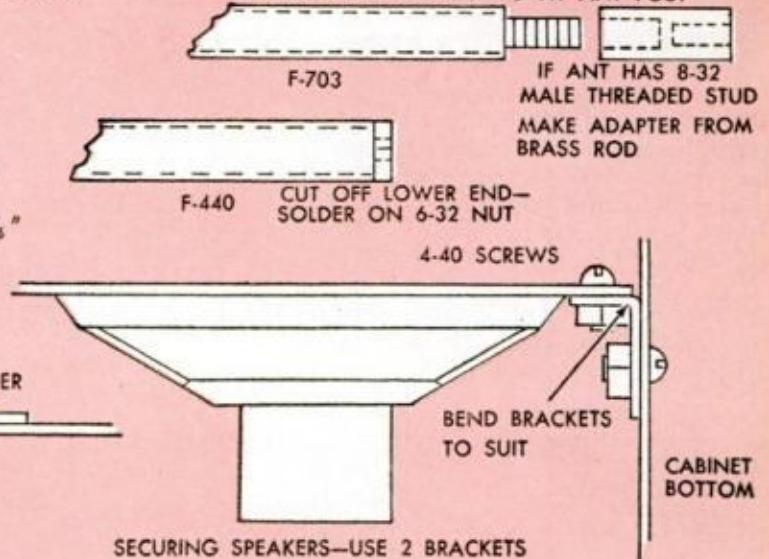
- R1—3.3 megohms, 1/2 watt resistor
- R2—potentiometer, 500K, linear taper, carbon
- R3—potentiometer, 100K, linear taper, carbon
- R4—47K, 1/2-watt resistor
- R5—120 ohms, 1/2-watt resistor
- R6—68K, 1/2-watt resistor
- R7—100K, 1/2-watt resistor
- R8—100 ohms, 1/2-watt resistor
- R9—2K, 1-watt resistor
- C1—5 PFD, disk ceramic capacitor
- C2—100 PFD, disk ceramic capacitor
- C3—3.3 PFD, disk ceramic capacitor
- C4—8 PFD tuning capacitor (Johnson 160-208)
- C5—.001 MFD, disk ceramic capacitor
- C6—.005 MFD, disk ceramic capacitor
- C7, C8—.01 MFD, disk ceramic capacitors
- C9—50—30 MFD, 150 volts, electrolytic capacitor
- J1, J2—jacks and plugs (Lafayette MS-370)
- RECT—silicon rectifier 750 ma, PIV 200 volts or more
- RFC—wound on 2 megohm, 1/2-watt resistor

- S1—spst toggle switch with solder terminals
- T1—Argonne AR-107 transformer (Lafayette)
- T2—Argonne AR-138 transformer (Lafayette)
- T3—Merit P-3064 or Stancor P-8181 transformer
- Feed-thru insulator (Johnson 135-44)
- Speaker, 2 1/2-inch diameter
- Whip antenna (Lafayette F-440 or F-703)
- Feed-thru insulator terminal (H. H. Smith 1507)
- Case, 7 x 5 x 3 inches (Bud Cu-2108-A)
- Terminal strip, 4 insulator lugs, 1 ground lug (Cinch Jones 54-C)
- Terminal strip, 8 insulated lugs (Cinch Jones 2008)
- On-off switch plate knob with 1 1/2-inch diameter skirt and pointer line; 2 small knobs 1 1/16 or 3/4-inch diameter; line cord and molded plug; rubber grommet for 3/8-inch hole; 4 rubber knob feet 1/2-inch diameter; scrap aluminum .050 x 2 3/4 x 5 1/2 inches; scrap aluminum .025 x 3/8 x 2 1/4 inches; 2-inch diameter dial plate; brass rod or tubing as required for bushing for tuning capacitor shaft; aluminum window screening.

KNOB BUSHING TO FIT CAPACITOR SHAFT

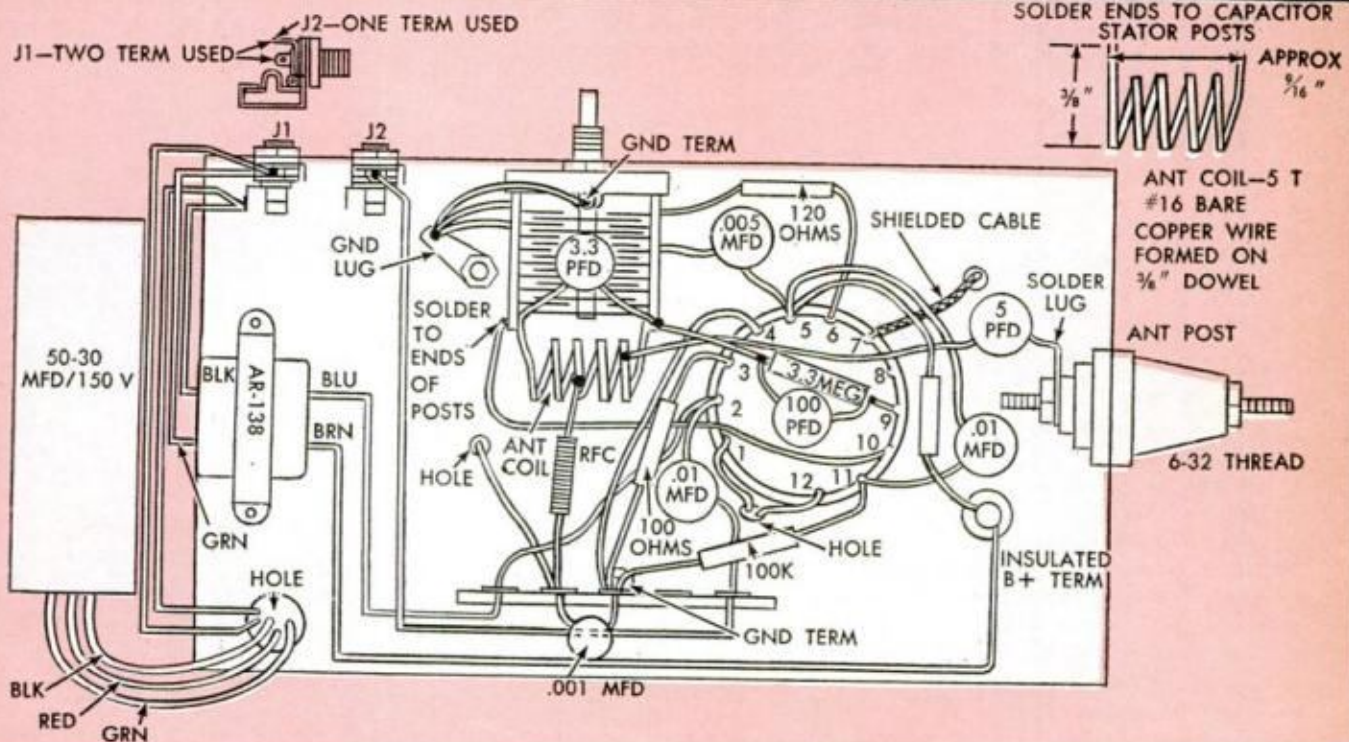


ADAPTING WHIP ANT TO FIT ANT POST

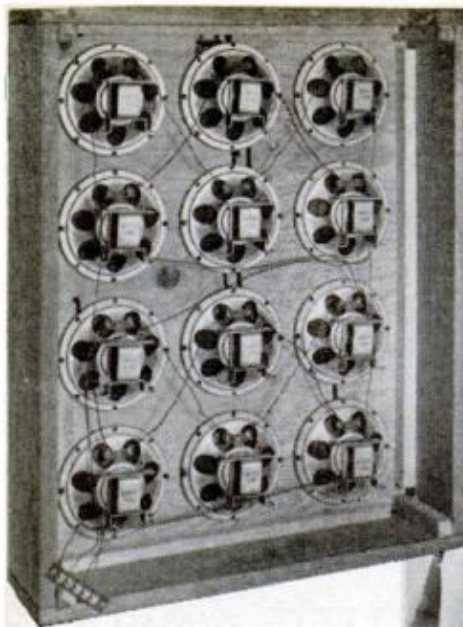


**THE CRITICAL WIRING SECTION** of the receiver is shown below in pictorial arrangement. Keep wiring in this section as short and as direct as possible or you will not get utmost sensitivity from your set

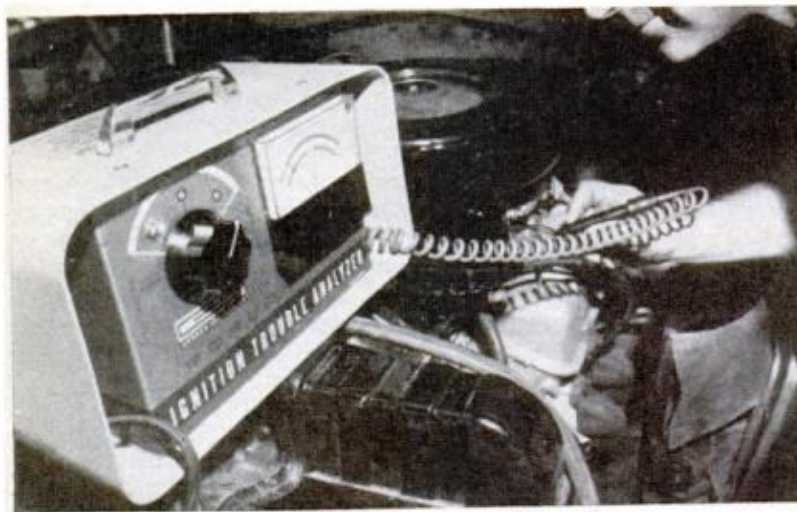
**THREE VIEWS** above show potential trouble spots. First there's the bushing for the tuning capacitor; second, the brackets for speaker mounting and, last, two ways of adapting the whip antennas to fit



# New in Electronics



**MID-CHANNEL SPEAKER** System is the new way to achieve pure stereo listening. The 3SP system fills that hole-in-the-middle with acoustical blending of the sound of 12 speakers in a single cabinet. Six reproduce the left channel and six the right channel. Conar Instruments, Washington, D. C.



**ELECTRONIC BRAIN** checks out any automotive ignition system in less than 5 minutes. Tests starter, coil, condenser, rotor, cap, points, plugs, battery and all ignition wiring. The meter gives direct read-out on engine performance, point condition and spark plug efficiency. All tests are made with ignition system under full load. The analyzer is powered by system being tested, making it completely portable and independent of a.c. outlet. Built-in protection prevents damage to unit if it is hooked up backwards. Magnetized rubber feet hold analyzer to hood or fender without scratching. \$129.95 from GorDon Industries, Minneapolis Minn.

**OUTDOOR HIGH-FIDELITY** is a cinch with the Sonocaster. Molded-plastic crack-proof case shields the 8-inch speaker from the weather. Carrying handle is molded into the case. Driver cone is actually two speaker cones in one—an 8-inch diameter cone for maximum bass response and a 2½-inch cone to handle the high frequencies. Mechanical crossover divides the audio frequencies at the 6000-cycle point, feeding lower frequencies to the large cone and higher ones to the small cone. Frequency response is from 70 to 13,000 cycles and the speaker will handle up to 30 watts of audio power. It has an 8-ohm impedance rating. Sonocaster is made by Electro-Voice Inc., Buchanan, Michigan



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help you get  
peak engine power**

AC Spark Plugs clean themselves as you drive. ACs are the only spark plugs with the thin recessed Hot Tip insulator that heats faster to burn away fouling deposits. This helps prevent misfiring and loss of engine power. AC's cleaner sparking helps boost power... performance... mileage. Tune up your car for powerful action with AC Fire-Ring Spark Plugs.

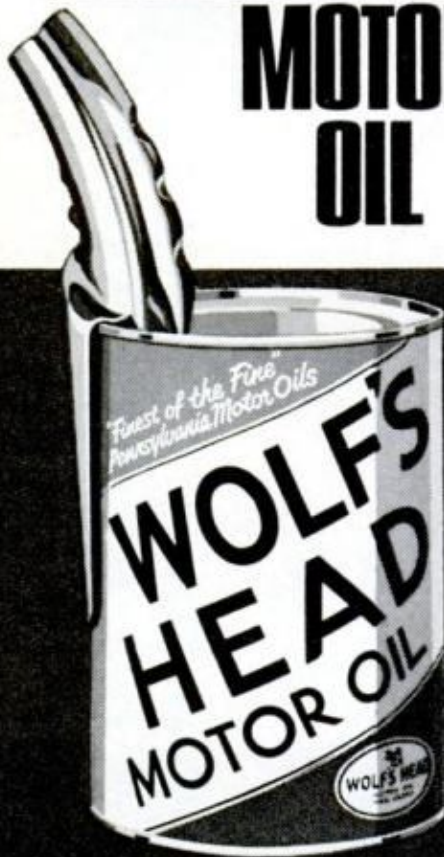


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It pays to be particular about  
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**WOLF'S HEAD OIL REFINING CO.  
OIL CITY, PA.**

## Twin-Hulled El Gato

(Continued from page 151)

at the transom (top sketch, page 148).

Planking the hull is probably the most difficult step in construction, but you won't run into any real problems if you adhere to the following procedure. Since the 1/4-in. plywood is stiff and difficult to bend without soaking, it's important that you "pre-form" it on a 2-in. bending block cut to the contour of the transom. After cutting the 4 x 12-ft. sheet lengthwise, place one half over two of these bending blocks spaced about 6 ft. apart and cover it with burlap sacks. Then, after pouring hot water over the burlap-covered plywood and allowing it sufficient time for it to penetrate, slowly bend the planking to the arc of the form.

Clamp the panel in place and allow it to dry overnight. When removed from the form, the plywood will retain most of its curvature, making it possible for one man to plank the hull with ease. If 3/16-in. planking is used, the process will be even simpler since the thinner plywood is quite a bit easier to bend.

When fitting the planking to the hull, tack or clamp it to the sheer clamp and lean against the side to press it into position along the keel. Then mark it and rough-cut it to shape. You'll find that there is very little surplus at the ends and the width will be as much as a 1/4-in. shy in some places along the keel. However, this can be taken care of with a filler strip once the planking is installed.


The excess planking forward of the daggerboard opening on the initial panel will be bevelled after installation, and you can use a back saw to cut the planking along the keel centerline aft of this point.

Coat all mating surfaces with glue, and after locating the panel on the framework, begin fastening it in place about midway along the sheer clamp. Moving from this point toward the transom, work the roll in at the transom with either clamps or screws not fully tightened. Secure the planking to the transom with 1-in. screws spaced approximately 1 in. apart. The planking need not be screwed to the bulkheads or ribbands, but should be secured to the sheer clamp with 1-in. screws spaced 3 or 4 in. apart.

As you work forward, the planking will tend to buckle, but these kinks will gradually disappear. If they don't, it's probably because you have anchored one portion so securely that the planking can't bend to adjust to the slight compound curve. Now turn the hull, remove the building form and start the second hull.

(Concluded next month)





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the  
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***CHANNELLOCK, INC. Meadville, Pennsylvania***

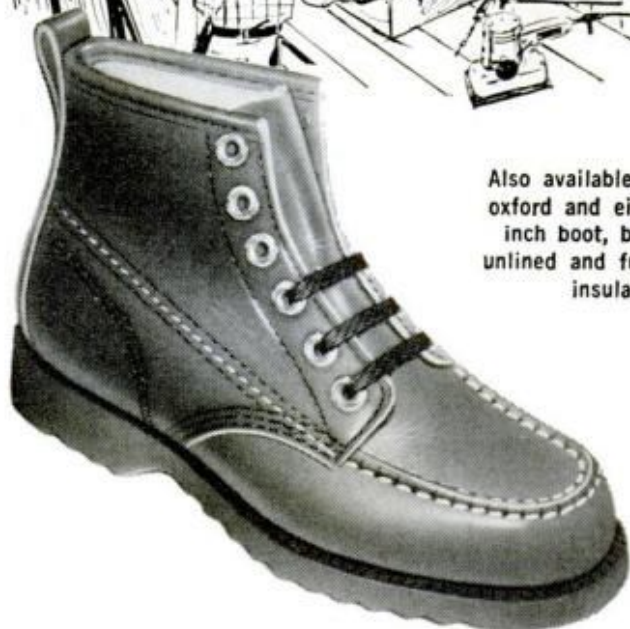
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PERFORMANCE PROVED . . . IN ACTION

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## Slide Projector for \$7

(Continued from page 186)

snug enough to keep the assembly from shifting; if necessary, tape the bent-over tabs to the inside of the tube.

Cut the design fragments from four sheets of colored plastic (included in the kit) and place them within the spacer ring you've previously cemented to the smooth side of the frosted-glass disk. Cover with the clear disk, then pinch the assembly tight, tip it vertical and rotate it to make sure the fragments are free to slide around between the glass disks. Insert the assembly into tube A so the frosted disk seats against ring C; then slide body tube F in behind it until it—and the taped end of the mirror assembly—butt against the clear glass.

To lock the rotating design section to the stationary body tube, you glue tubes B and E together with their front ends flush, then slip this assembly down tube F to butt against tube D. Now seat tube A on tube B and wind masking tape around the joint. This permits quick detachment of the design section in case you want to add more fragments, alter the proportions of colors, and the like.

Now remove the projection lens and bracket from the projector and place the kaleidoscope, clamped in its own cradle, in front of the projector. To find the best offset position, aim the projector at a screen or blank wall in a darkened room, just as if you were showing a slide. Move the kaleidoscope lens in or out to focus the design. Then pivot the unit slowly to the right until the projected design is uniformly illuminated. The angle, as shown on page 186, will most likely be about 7-10 degrees. You'll note that when you bring half the design into sharp focus, the other half remains somewhat fuzzy. This can't be helped, since the portion of the design that's projected from a mirror image is out of the lens' focal plane. Since a projector, unlike a camera, can't perform with a small aperture, you can't get sufficient depth of focus to eliminate this problem. But it doesn't spoil the effectiveness of those colorful, ever-changing designs.

When you're satisfied you've achieved the best focus and illumination, fasten the two base plates with a C-clamp, flip the assembly over and drill two holes for machine screws. (One of the existing projector-lens holes can be continued through the kaleidoscope base if you wish.) It's so simple a matter to remove the kaleidoscope and return to slide projection that you might even want to insert an interlude of kaleidoscope "movies" into your regular slide shows for friends and family. ★★

its size."—Michigan professional driver.

"The transmission is perfect . . . easy to shift."—Michigan pattern maker.

**With his 260-cubic-inch V8, he gets the new, all-synchromesh box. But low gear is non-synchro in the box that comes with the small engine.**

"The best body ever on a Ford, and I've been riding them since 1916."—South Carolina farmer.

"The body work seems very good. Doors close solidly, which is something new for a Ford."—California telephone worker.

**Rigidity is there. Not all owners found door closure that solid, but complaints were rare.**

*Winding up on the dark side, here are numbers 11 through 15 of the complaints. They are in the owners' own words, with the most common complaint first:*

"It's a little hard to get into after my wife has driven it with the seat moved up."—Minnesota shop teacher.

**You might mention this to her.**

"The vent window is so pointed it's somewhat dangerous to get in if you aren't careful."—Washington mail carrier.

"There isn't enough legroom in back."—Washington crane operator.

"I've always had a bigger car so I don't like the way the Mustang seats people in back."—Ohio factory worker.

**That's the price if you want sports styling.**

"The spare tire takes too much room in the small trunk."—Ohio test engineer.

"The luggage compartment is too small, yet there isn't enough legroom for rear passengers."—New Jersey jeweler.

"Poor attention to finishing details: The convertible top didn't fit; the rear bumper had deep scratches, and there were thin spots in the paint."—Ohio industrial worker.

"I found unfinished gutter work."—Michigan salesman.

"When the car came to the dealer, there were three minor things wrong. It should have been checked better at the factory."—Illinois draftsman.

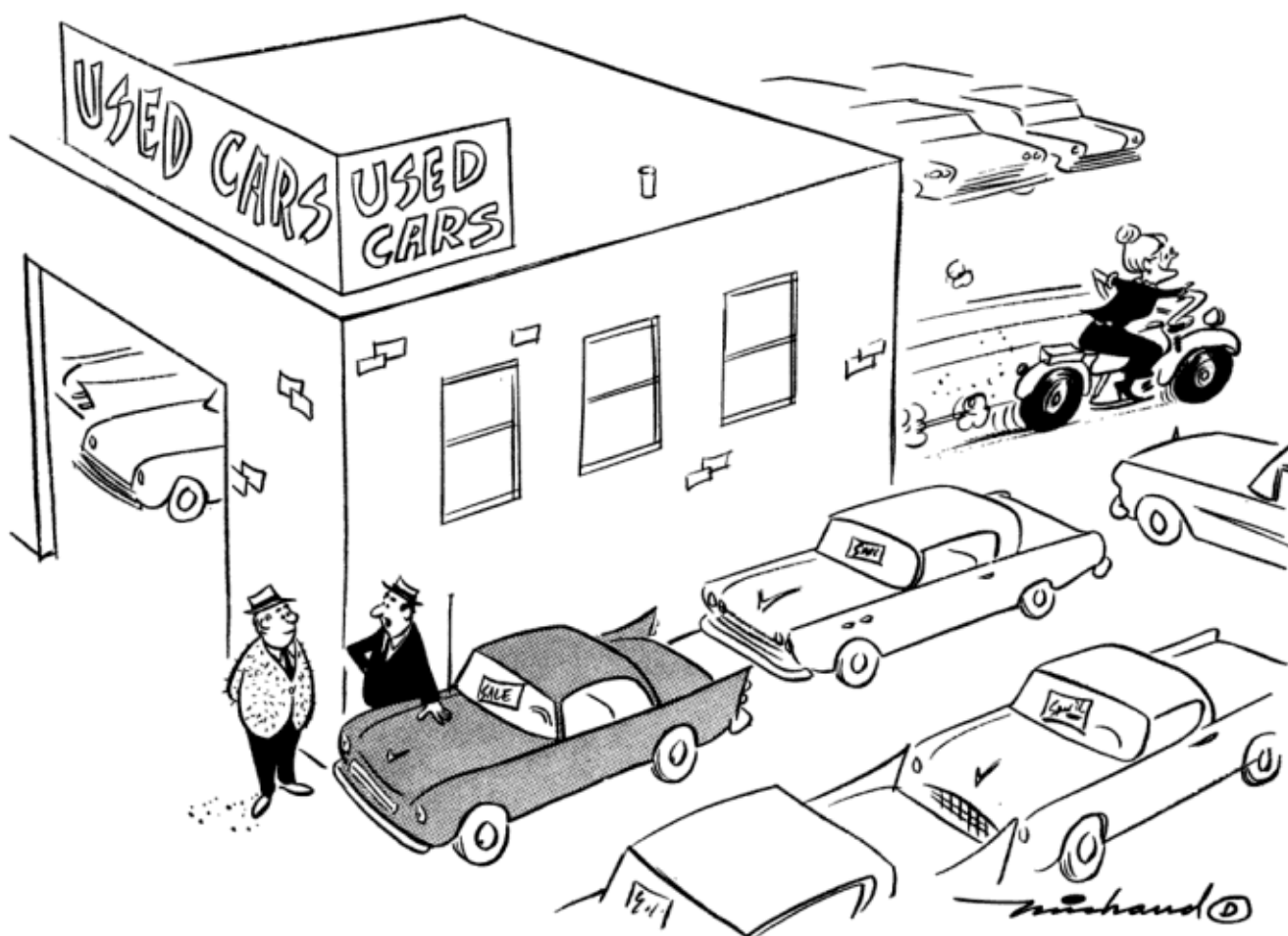
**Almost all new models have such ailments and the owner's fortunate if all are minor.**

"The transmission stick is hard for a woman to use."—Alabama teacher.

"It's difficult to shift to First."—New York salesman.

*So there you have it—the reactions of Mustang owners who had totaled more than 850,000 miles in America's newest car.*

★★★



**"This beauty was just traded by a little old lady school teacher."**

## Those Odd Aches

(Continued from page 105)

pencil-thick arteries of the thigh.

Questioning established that her problems came six days before, after watching television for two hours.

"And how did you sit?" the doctor asked.

"Why as I always do," she answered, "with my legs tucked under me. That's my favorite position."

Another of Doctor Naide's leg-pain patients was a 68-year old man whose favorite TV position was with his leg thrown over the arm of the sofa. Four weeks before he had fallen asleep in this position.

Both of these people had arterial thrombosis. Like thrombophlebitis, it's caused by lack of action.

In fact, says the influential British Medical Journal, "Like most human inactivities, television is not devoid of hazard."

It points to the hundreds of patients who walk stiffly to their doctors for treatment of Television Neck from viewing in a chair of the wrong height and of serious ills that come from viewing while slouched in chairs and "kinking the heart."

This is akin to the new disease reported

this year by a New York doctor. He calls it TV Medicitis and explains, "Certain television viewers watching medical dramas, by identifying with the actors, tend to 'catch' the disease being portrayed."

"It's most insulting, too," said Dr. A. M. Aibinder, "when they insist on getting the treatment they saw administered on TV."

## Neckties Are Disturbing

And doctors in Sweden, England and the U.S. have shown how the flicker of TV screens will provoke seizures among certain epileptics. And some epileptics are even affected by the diagonal patterns of rep neckties. (Blocks of diagonal lines, especially when moved, disturb most people, in fact.)

Then there is the poor chap with coccygodynia. You can spot him easily: he sits down cautiously, slumps in his seat, keeps shifting his position, then gets up gingerly.

When he finally goes to the doctor, he says he'd rather stand, thanks. If questioned, he'll admit inability to lie comfortably on his back in bed at night and hating long car rides.

Doctors have nicknamed this Television Bottom. Like Jeep disease, it's a pain in the seat. But this is caused by a spasm of muscles around the coccyx, or "tail"

# New! STANLEY GRAVITY PIVOT HINGES

*for dwarf cafe-type doors*

Modern as tomorrow in appearance, cafe-type doors deserve hinges that assure care-free and quiet operation in the modern manner.

The new #150 Stanley Gravity Pivot Hinge returns doors to the center of the opening automatically by gravity . . . holds doors open on either side of the opening for safe, convenient passage . . . has an adjustment feature that makes door alignment easy. And these hinges quietly scoff at rough usage, because the door weight is carried on tough, silent nylon bearings. At your Hardware or Building Supply dealer's.



THE  
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WORKS

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of the spine. And it's due to sloppy posture, which, when corrected, clears it up.

Before leaving television ills, we must mention Saturday Night Palsy. This comes from falling asleep, usually after a few beers and *Gunsmoke*, with your arm flopped over the hard back of a chair. When you awake you may find your hand paralyzed.

Something similar happened to a magazine editor. He came home from the office one night and suddenly realized he had no feeling in his hand. He rubbed it and massaged it, soaked it and heated it. Nothing helped.

At the doctor's finally, he found that his paralysis was caused by his new glass-top desk. It wasn't a psychological effect. It was real: The sharp edge of the glass pressed into a nerve and blocked it off.

The same thing happens in Saturday Night Palsy, only at home and with a chair. Both heal in time if the cause is removed.

If you're more refined and turn to stereo rather than the Big Eye for amusement, don't be smug.

A Los Angeles doctor who is also a musician finds that hi-fi sounds affect you in profound ways. If you're "with" the music, your palms will sweat and your

adrenal glands will pour out hormones, the ulcer-producing kind. If you're not with it, the music has no effect on you.

Then there's the New York executive who comes home at night with a headache, nausea and jitters. He has trouble sleeping. And his wife notices that he's not as romantic as he used to be.

Hundreds of dollars are spent for dozens of examinations and tests. Finally his problem is unmasked. He simply—but painfully—is suffering Noise Hangover.

The talk around him, the buzzing and ringing of telephones, the clatter of typewriters and high heels in his office, and the sounds of buses, auto horns, delivery trucks and jet airliners are just too much. He works at Times Square, which, at a usual sound level of 92 decibels, is one of the world's noisiest intersections.

### Other Strange Ills

There are other strange occupational ills.

"As a practicing industrial physician for the past 40 years," one doctor wrote in a medical publication, "I have been intrigued with the frequency of symptoms involving the left shoulder."

Time and time again, men would shuffle

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

## New! Contemporary KNOBS and PULLS

*that beautify cabinet doors*

For the lady of the house! Exquisite contemporary styling . . . pleasant to the touch . . . attractive finishes. These new, decorative Stanley Knobs and Pulls will make it easy for her to enhance the appearance of cabinets in kitchen, den, recreation room . . . anywhere. She can choose satin copper or bright chrome finishes to complement any cabinet material, any interior decor. See these new knobs and pulls — and other Stanley cabinet hardware — on display in the "Stanley Hardware Center" at your nearby Hardware or Building Supply dealer.



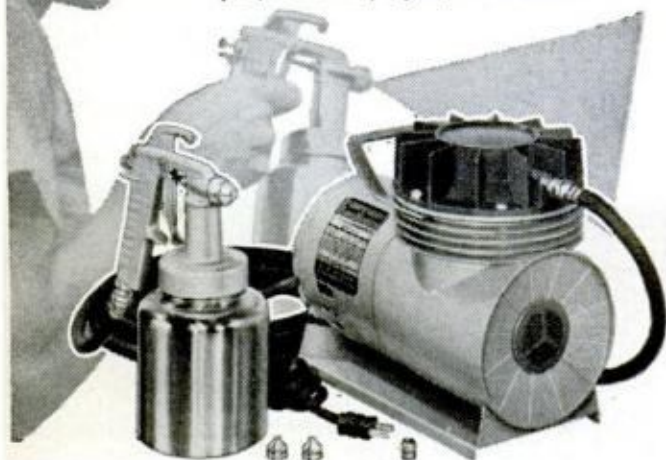
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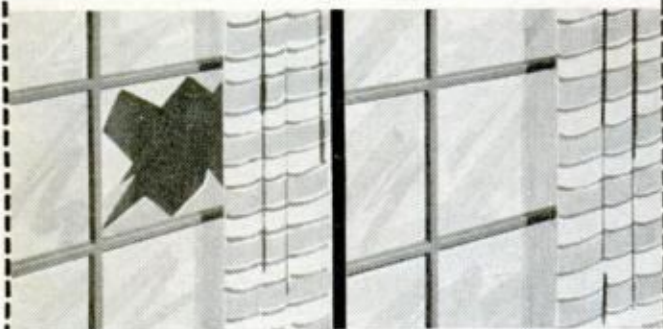
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SUBSIDIARY OF *Plough, Inc.*

## Those Odd Aches

(Continued from page 205)

into the offices of Dr. I. S. Klemes of New York, holding their left shoulder. The medical conditions that could be the cause of their anguish made a list as long as their painful arms.

Then, when the doctor was talking to one of his patients with Left Shoulder Syndrome, it came to him. He was a milkman. After dropping off his bottles he would get back in the truck and write up the order in his book.

And he always wrote while leaning on the truck window with his left elbow. Advised the doctor: "Don't lean on your left elbow any more."

The cure worked.

Left Shoulder Syndrome is simply a bursitis caused by the pressure of leaning. This irritates the shoulder joint. Other joint irritations caused by pressures and twisting produce Tennis Elbow, Miner's Elbow and Tailor's Bottom.

### Women Ache, Too

And don't think women are immune from odd ailments.

A Baltimore housewife, considered a meticulous housekeeper, awakened one night with an aching, throbbing pain in her forearm. She got up, walked around the house for a while, and then went back to bed.

The arm still bothered her. But now it was numb.

In the morning, she found her hand stiff. Massaging helped loosen it.

The neurologist who examined her later found no muscle disease, normal reflexes and good circulation. X rays showed her spine normal, too.

Questioning brought out that the woman had just lost her maid. So she was forced to wash, sweep, cook, etc., by herself.

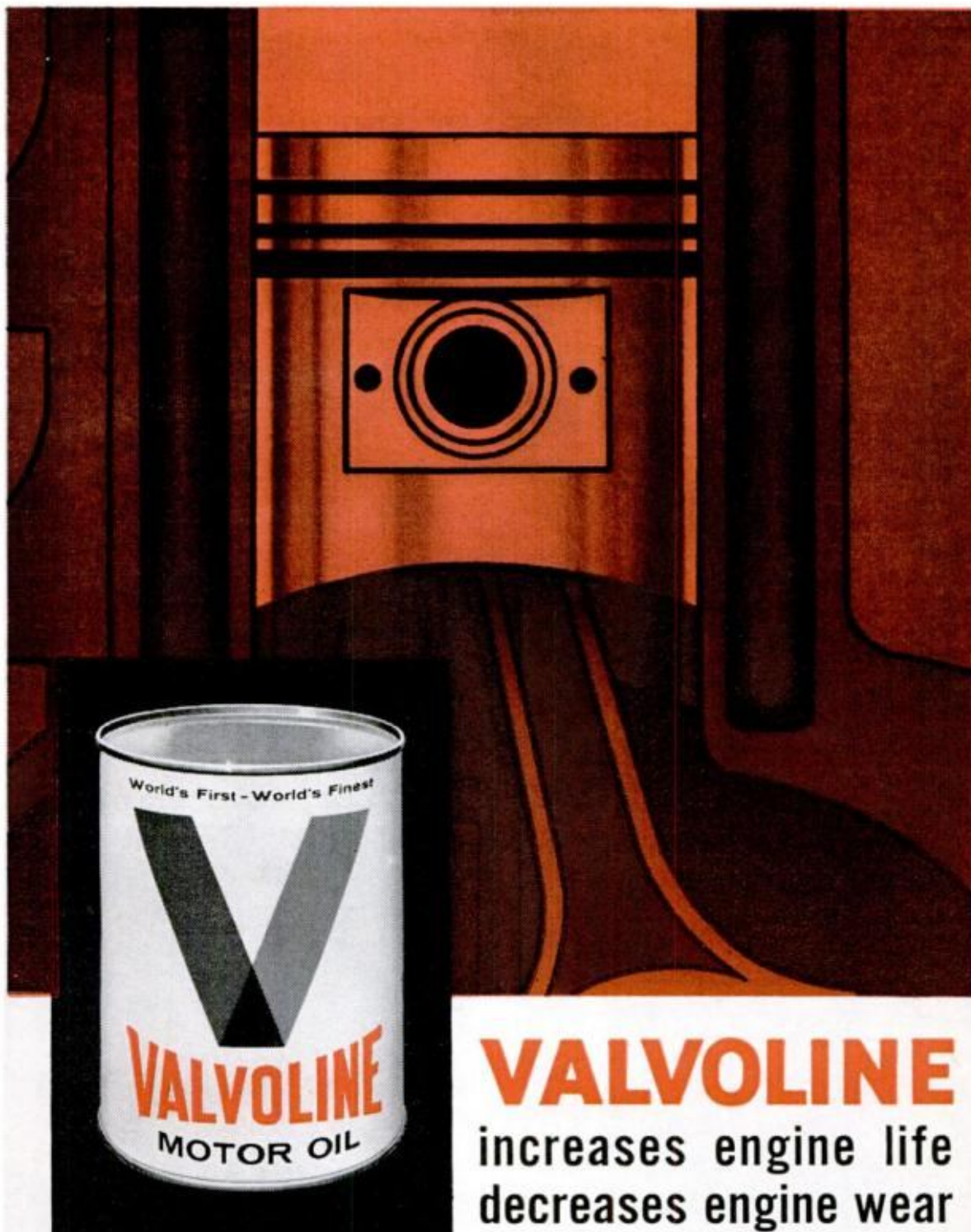
Luckily, Dr. Frank R. Ford, of the Johns Hopkins Hospital, had seen cases like this before. He remembered the woman who had the same problem twice a year, when she cleaned house. And the dairy farmer's wife who worked from dawn to dusk and who suffered these same symptoms for 30 years.

All were victims of Tired Arm Syndrome.

It usually afflicts middle-aged women. It comes with painting, moving into a new house, bowling, riding a horse with a tough mouth, working in a factory and enthusiastic gardening.

It's the arm's equivalent of shin splints. The only treatment is rest.

(Please turn to page 208)



Valvoline Motor Oil with miracle Chemaloy actually cleans your engine as you drive! And keeps it clean. Because bearings, piston rings, valves and other vital engine parts are kept clean, your engine resists wear . . . delivers top power. So change to Valvoline with miracle Chemaloy. Enjoy longer engine life, savings on gas and repairs. Ask for Valvoline—symbol of quality since 1866—at service stations, garages, new car dealers.

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Double Header 2-in-1 putty knife tool removes old putty and special "V" blade applies smooth strip of putty, No. C94 \$1.19 each. Five Way Styrene plaster patcher and joint knife, No. 26 \$1.19 each.

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No. C22 \$2.69 each.

Strip-Zum, a new tool to shave off painted and unpainted wallpaper.

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Popular best quality Hyde fix-up paint-up tools are sold in leading hardware, paint, building supply and lumberyard stores. Tools not available will be sent postpaid upon receipt of check or money order. **WRITE FOR FREE CATALOG**

**HYDE  
TOOLS**

SOUTHBRIDGE, MASS., U.S.A.

## Those Odd Aches

(Continued from page 206)

And, speaking of gardening, it can bring on the newly-labeled Gardener's Disease. Its official name is sporotrichosis and it is not as rare in the U.S. as doctors once thought.

It begins as a movable bump on your finger. It doesn't hurt, but gets bigger, turns pink, then purple, then black—and finally is an open sore.

Within weeks other bumps develop in a line on your arm. They also turn from pink to black. Sometimes they spread all over the body.

Rarely fatal, this is a fungus infection. It comes with a scratch from thorny plants like rosebushes and barberry bushes. Fortunately, it is easily treated by medicines.

Then there is Barber's Finger, a mild, itchy skin reaction to scissors.

Miserable as it is, it's far better than the rare disorder known as ainhum.

This is an affliction of certain African natives: A thin band of fiber slowly forms around the little toe and after a while the toe falls off.

The disease is painless, incurable and of no known cause.

You think you've got troubles? ★ ★ ★

## For Young Climbers



There's good climbing, even without the time-honored apple tree in the back yard. A new climber for children has a web of climbing bars that offer easy-to-reach handholds and four candy-striped sliding poles. Made by Miracle Equipment Co., Grinnell, Iowa, the Spider Climber is priced at \$149.



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Works on 110 volt plug in 10 WAYS! WELDS, BRAZES, SOLDERS, CUTS, MELTS most ALL metals! HEATS, SOFTENS, LOOSENS, THAWS, BENDS most ANYTHING. COMPLETE READY TO USE WITH face mask, clamps, arc torch, rod holder cables—and supply of welding, brazing carbon, solder rods, flux

and ARC WELDING INSTRUCTION BOOK—Tells how YOU can use for CARS—HOME—FARM—SHOP or FACTORY all 10 WAYS—NO EXPERIENCE NEEDED! (cash, ck, M.O.) and pay **SEND ONLY \$2.00** postman \$12.95 plus COD postage or send \$14.95 for PP del. in USA. BEST WELDER FOR THE MONEY IN THE WORLD. FREE: EXTRA "Helpers" dark goggles if you order from this ad. Sold ONLY by **MIDWAY WELDER, Dept. DPM-9, Kearney, Nebraska.**



## Shrinks Hemorrhoids

## New Way Without Surgery Stops Itch — Relieves Pain

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In case after case, while gently relieving pain, actual reduction (shrinkage) took place.

Most amazing of all—results were so thorough that sufferers made astonishing statements like "Piles have ceased to be a problem!"

The secret is a new healing substance (Bio-Dyne®)—discovery of a world-famous research institute.

This substance is now available in suppository or ointment form under the name Preparation H®. Ask for it at all drug counters.

SEPTEMBER 1964

## How to Improve A Tune-up Without Even Trying



Your engine tune-up can turn out to be a "dud" in almost no time if the replacement ignition parts won't stand up. So, to protect your investment, insist on genuine Holley Ignition Parts. They're made to original equipment standards—or better. They cost no more but they last longer. It pays to be fussy about tune-ups.

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If you do a lot of stop-and-go driving, your engine's worst enemy—sludge—is building up fast. You can't see it—but it's there. Sludge clogs oil passages and increases engine wear . . . adding to your repair bills. Now you can guard against sludge—with Du Pont M.O.A.—the exclusive Du Pont development that prevents sludge formation on engine parts. One can of M.O.A. added to your crankcase at each oil change helps keep your engine cleaner, quieter and smoother-running under all driving conditions. M.O.A. goes to work instantly to keep oil passages open and sludge-free. Don't let deadly engine sludge bring you poor performance and high repair bills. Reduce engine wear with Du Pont M.O.A.—at service stations or wherever auto supplies are sold. Just \$1.65\* a can.

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## CLINIC FOR HOMEOWNERS

**Q** I want to lay a walk of old, salvaged bricks and I'm wondering how best to go about the work. Should I simply excavate to a depth equal to the thickness of the brick and lay them directly on the earth in mortar, cement, or what?—K.F., Pa.

**A** The best procedure is to excavate a good 4 to 6 in., depending on the type of soil and the drainage and then fill the excavation with sufficient sand to bring the top faces of the bricks about ½ to 1 in. above the grade level when they are laid on the sand bed.

It's advisable to tamp the bed before laying the bricks. Bricks laid on a sand bed can, of course, be mortared (with a cement mortar) if desired, but ordinarily this is not necessary. In making a walk in this manner it is advisable to cut the sides of the excavation vertical and also to keep the width of the excavation uniform. In this way there will be no necessity for loose fill at the edges of the walk, which may wash away during heavy rains. It is not advisable to lay a brick walk, either with or without mortar, on a slope having a fall of much more than 1 in. to the foot, especially if the walk must extend directly down the slope.

**Q** I've heard several times about the advisability of sealing storm windows, the older kind you take down and put up each season. What's the best way of doing this, and why is it so necessary?—A.N., Minn.

**A** The purpose of sealing the older type storm sashes is to prevent leakage of cold air into the space between the inner sash and the storm sash, thus maintaining—as nearly as possible—a dead air space between the two which serves as a barrier to passage of heat and cold. This also tends to prevent condensation of moisture on the panes of both the inner and outer sashes. Such a barrier is most effective when both inner and outer sashes are tight. There are several ways of sealing the outer sash. There are self-adhering strips of sponge rubber available which are easily installed along the inside edges of storm sash frames. Another way, in

some respects best in very old window frames, is to staple  $\frac{1}{8} \times \frac{1}{2}$  in. strip of ready cut felt to the inner faces of the storm-sash frame, keeping one edge flush with the edge of the sash frame. Use screen staples or a staple gun and drive them about 4 to 6 in. apart. Miter the felt strip at the corners. Install the storm sashes with turn-buttons, using six to each sash, and three to each side. Draw the turnbutton screws tight after the sash is in place in the window frame.

**Q** I intend to paint my basement floor. It's in good condition and the basement is dry. There's no seepage through the floor or the walls. Should I use a water-thinned paint or a regular concrete floor paint?—W.E., Tex.

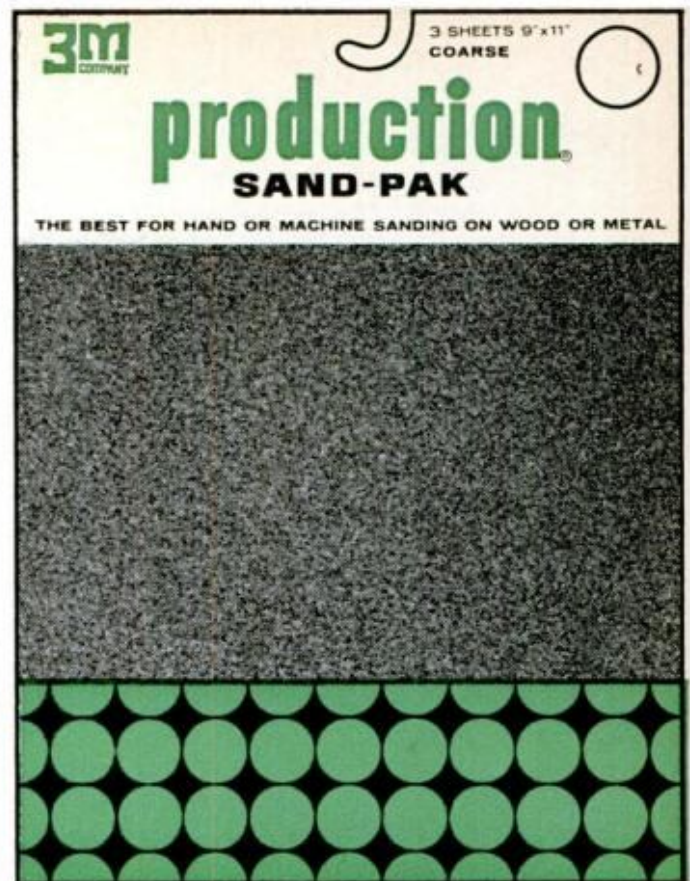
**A** You have a choice of what are generally known as solvent-thinned paints, epoxy and latex paints which are specially formulated for the purpose. All can be expected to give reasonably good service but should be chosen with an eye to the conditions. On your floor, which you say is relatively dry, you would get somewhat better service from an epoxy concrete floor paint. Main disadvantage of such paints are the fumes which generally are flammable. Pilots on your furnace or boiler, gas clothes dryer and water heater must be turned off and left off until the paint is dry. All windows and doors in the basement should be left open during the drying period as otherwise the fumes tend to invade the floors above where they may be objectionable. On the other hand, while the present latex paints may not quite match the older regulars in durability, they do offer exceptional ease of application, fast drying and there are no flammable fumes or other odors that may be temporarily objectionable. In either case, be sure to follow the manufacturer's instructions for preparation of the floor and application of the paint.

**Q** When does one divide and transplant iris plants?—J. G., Mich.

**A** It's rather late in your locality for dividing and transplanting iris as this generally should be done in late July and might be delayed up to perhaps mid-August but no later. In your locality it's perhaps best to wait until next year.

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 Home Clinic Editor for his helpful advice. Address your questions to The Home Clinic Editor, Popular Mechanics Magazine, 575 Lexington Ave., New York 22, N.Y.

SEPTEMBER 1964



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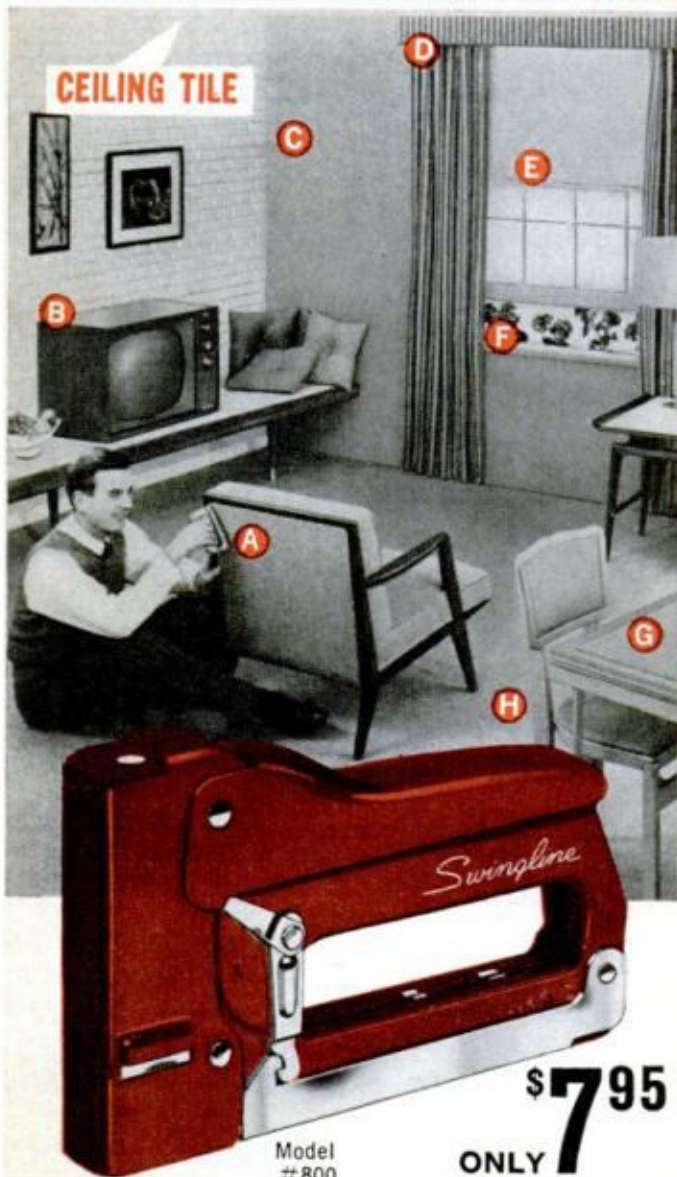
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- New LOKTILE Staples. Special coating binds ceiling tile securely.

For ceiling tile, fencing, and all the jobs around the house! The first and only all-purpose staple gun ever sold at this low, low price. Does all those time-consuming, hard-to-do chores quickly and easily both inside and outside your home.

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World's Largest Manufacturer of Staplers for Home and Office.

## Our Star-Gazing Satellite

(Continued from page 102)

phones. But visual probes of the same sector turned up nothing unusual.

Then, in 1963, an Australian team of radio astronomers used new techniques to pinpoint the precise location of such a radio source. Caltech astronomer Maarten Schmidt aimed the 200-inch Mount Palomar telescope at the designated spot—and found a dim speck that had always been taken for a star. But further observations showed that this object was 100 light years across and *two billion* light years away. (Sirius, for example, the brightest star in the sky, is only about nine light years from us.) Seeing anything at such a tremendous distance proved that it was the most brilliant object in the universe.

About 10 of these super stars have been found to date; one is thought to be 10 billion light years away. OAO's instruments will get a fix on some of these stars and tell us something about their composition, temperature, speed and other features.

### Data Better Than Pictures

The orbiting observatory is engineered to keep functioning for from nine months to a year. But even if it performs for only a few months, the material it transmits will take years to process. "The information will be fed to computers and tabulated," explains Walter Scott, OAO program manager. "The satellite could send us TV pictures of the universe, but they really wouldn't be as useful. But OAO's first job after launching is to stabilize itself. Once it's oriented we can hold it still for sighting, turn it or return it to a former position for a second look."

Once in orbit, the space eye will be tumbling. When one end points to the sun and the other to the earth, sun sensors will trigger gas jets. Squirts of nitrogen will push the satellite into an accurate sun-to-earth line.

Next, the observatory achieves a precise stabilization by finding and locking on certain guide stars. More puffs of gas will rotate the satellite around the sun-earth axis until the six star trackers—small telescopes preset before launching—each spot a certain guide star.

At this point, three 17-pound steel flywheels take over stabilization control. If OAO budes, the star trackers detect the change. The flywheels start turning, causing the satellite to move in the opposite direction. When the guide stars are zeroed in again, the flywheels brake, halting OAO. When all the guide stars are aligned, three 10-inch flywheels assume command

(Please turn to page 214)

A wall panel that's  primed for painting  
 and eliminates taping,   
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 and sanding! 

# New G-P Paint Panel!

There's none of the mess of plasterboard. No unsightly joints. No waiting between installation steps. No sanding or other types of surface preparation.

You just nail Georgia-Pacific Paint Panel in place. One coat of paint covers beautifully.

Georgia-Pacific Paint Panel is a brand-new factory-primed hardboard panel. The panels are U-grooved 16 inches on center. Cost? Just \$3.99 each.

The light weight makes it easier to handle

than plasterboard, simplifies cut-outs.

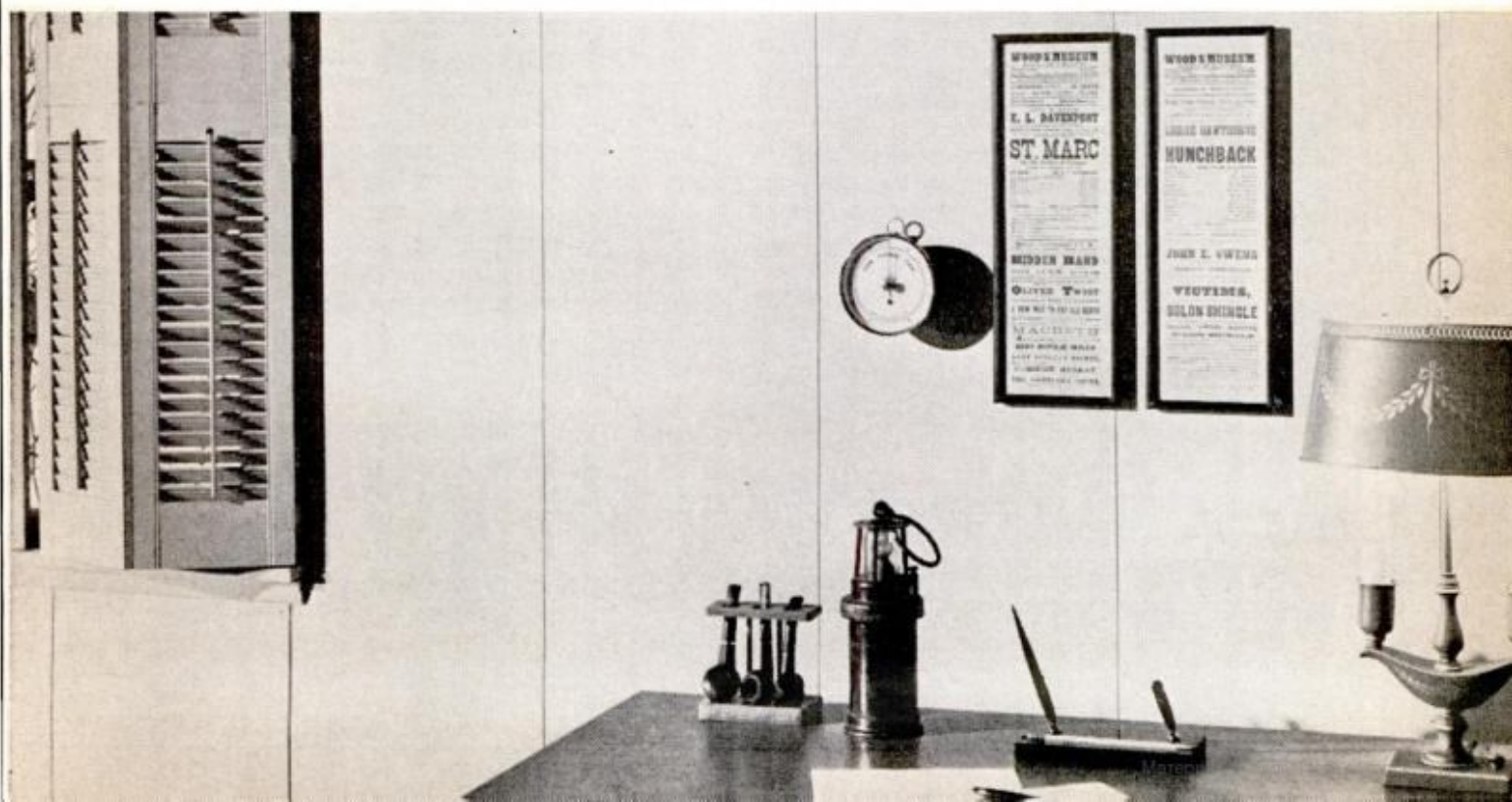
Where do you buy it? For the name of your nearest Georgia-Pacific Paint Panel dealer call Western Union Operator 25.

For more information write GEORGIA-PACIFIC, Paint Panel, Dept. PM-964, P.O. Box 311, Portland, Oregon 97207.



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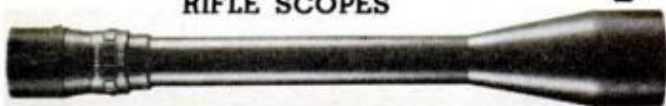
# FREEZE IT! THEN USE IT!



## SUPER TOUGHNESS AND B&L QUALITY AT \$49.95

Not that you would want to freeze one of these fine new scopes by packing it in dry ice, but we did. We subjected a new Balvar 8A scope to a seven-day deep freeze to be sure the new scope line would give you top performance under the roughest field conditions. Mounted on a Winchester Model 70 .375 Magnum at 40 degrees below zero, it checked out perfectly. We not only froze it... we baked it, soaked it, slammed it, scraped it and dropped it! It performed beautifully after all this torture. Here's the kind of scope you've wanted for years — a wonderful combination of the finest American-made instrument quality, and hard, tough design at new low prices! New alloys, new lubricants and new production methods have made it possible to give you scopes that stay in mint condition for a lifetime. New V-mount design always maintains zero, even under toughest recoil and allows you to switch your scope from rifle to rifle. You can't buy better optical or mechanical quality at any price. Your dealer can tell you why the shooting world is so excited about the new B & L scopes. There's a 2½X or 4X at \$49.95, 2½X to 5X at \$79.95, and a 2½ to 8X at \$99.95. For 85-page manual, "Facts About Telescopic Sights", send 25¢ to Bausch & Lomb Incorporated, Rochester, N. Y. 14602.

**BAUSCH & LOMB**  
RIFLE SCOPES



## Our Star-Gazing Satellite

(Continued from page 212)

for vernier accuracy.

About four hours after launching, the star trackers will have anchored the observatory in space. Scientists will then send it a position command. Flywheels will start turning and OAO will aim its telescopes on a preselected slice of universe. A protective sunshade cover will open like a giant eyelid—and the space eye will be on the job.

### Eyeballing the Cosmos

One of its first general assignments will be to map the cosmos. "When you make a star map," explains Dr. Kupperian of the Goddard Space Flight Center, "you really don't choose anything particular to look at—you just scan the sky. Like fishing with a net, you just scoop up whatever's there." This project is called Celestscope (from *celestial telescope*) and is the responsibility of Smithsonian Astrophysical Observatory in Massachusetts.

The plan is to map the universe in sectors two degrees square. The star trackers will aim the observatory with an accuracy of one minute of arc—1/60th of a degree. (A pea seen at arm's length cuts a 30-minute arc.) Three 12-inch telescopes will focus the light from a sector into UV-sensitive TV cameras called Uvicons. As OAO points at each sky sector, the Uvicons (each sensitive to one-third of the UV band) will pass their images to a data storage memory unit, a computer that stores electronic impulses.

The fourth telescope holds a spectrometer, an instrument that determines the chemical make-up, temperature and speed of stars by analyzing their component light waves. The information gathered by the spectrometer is also stored. Then OAO moves on to another sector.

When the satellite observatory passes over one of the three ground control stations (in Ecuador, Chile and North Carolina), the stored images will be telemetered to earth and fed to computers.

During the course of this project, OAO will undoubtedly spot unusual or unknown celestial objects. When it does, scientists will turn the observatory around to permit its second battery of telescopes to have a look. Since these scopes view an area two *minutes* of arc square instead of two degrees square, they will pick up detailed information on specific objects. With luck, the observatory may sight gas clouds condensing into a star.

A "close-up" of such an event would probably rewrite the existing literature on the conception and birth of a star. ★★

## Computer Timepieces

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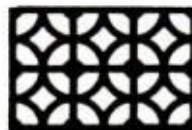
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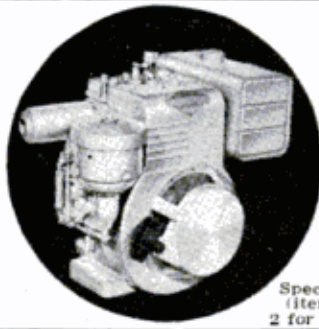
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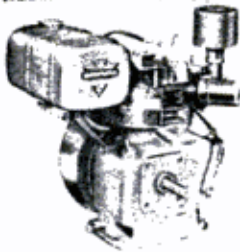
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## Channel-Wing Plane

(Continued from page 92)

with him. They are still with him. A daughter is his secretary, one son is his chief mechanic and the other his test pilot.

They have survived some bitter disappointments. Custer's first full-scale model was demonstrated for the Army Air Corps in 1943. It flew without wings, but the Army didn't believe it and didn't buy it. So, about every four or five years after that, after going back to the drawing boards and producing newer and better models, Custer put on more demonstrations, all in vain. About the only major attention he got during this period was from *Popular Mechanics* (see "The Wing That Fooled the Experts," *PM*, May, 1947). We put the plane on the cover.

Throughout all his experimenting, remember, Custer was doing his own research, building his own test equipment and creating his own models—with only a high-school education.

Finally, about 1960, he decided to stop researching and start producing an aircraft that could be certified by the Federal Aviation Agency. The result was the CCW-5 (Custer Channel Wing, 5-passenger). He has two of them, a prototype, which is a rebuilt version of the old *Baumann Brigadier*, and a production model, which is practically a hand-built version of the prototype with several improvements. I flew both of them, and I flew the new production model on its fifth flight when it had less than two hours total time on it.

Before describing these flights, let's go over Custer's ideas again, from a more scientific viewpoint. After visiting Hagerstown, I stopped off at the Devore Engineering Service on Long Island. They are FAA designated engineering consultants who studied the CCW to make the necessary tests and reports for government approval. They translated Custer's rough explanations into engineering terms for me and they are retranslated here in layman's language.

A conventional airplane gets 80 percent of its lift from the upper surface of its wing. The air is static but, as the wing moves through it, it is displaced above and below the wing. As it is displaced, it speeds up to get back where it was. Following the law of physics, as it speeds up it lowers the pressure. The wing is built so that the air moves faster above the wing than below it, causing a greater pressure loss on the upper surface. The difference in pressure gives it its lift.

Now, if you placed a propeller behind

(Please turn to page 218)



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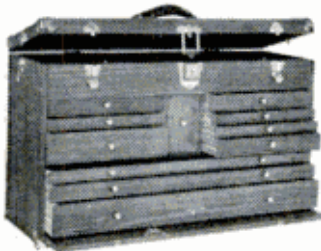
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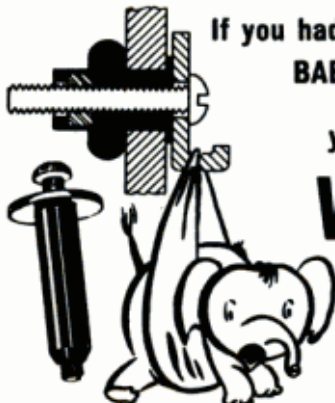
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CL-188R

## Channel-Wing Plane

(Continued from page 216)

the wing, it would speed up the air across it even more. But, if the propeller hub were centered on the trailing edge, the prop would be pulling the air off equally above and below the wing, cancelling any advantage.

What Custer has done, in effect, is to move the propeller above the wing so it pulls the air only from the upper surface. Then he wrapped the wing half-way around the propeller to maximize the advantage.

Custer speaks of creating a vacuum in this channel, but it is never really true. However, in engineering terms, he has made a breakthrough in raising the lift coefficient. This is the ratio of lift over drag. Most conventional aircraft have a coefficient of about 1.5. With huge flaps, slots and other auxiliary equipment, some can raise it to 3. The Custer Channel Wing has broken through to an unheard of lift coefficient of 5.

The CCW-5 is too heavy (4200 pounds.) for its power (two 260-horsepower engines) to rise vertically "like a cork in water," although some of the earlier, lighter versions have done it. However, it is definitely a STOL, even though its power-to-weight ratio is about the same as conventional twin-engine aircraft that require about 3000 feet of runway.

As I mentioned, we covered only 250 feet on my first take-off. The rest of the flight was a little frustrating. (I made two flights, but the two aircrafts' performances were so similar—the improved production model is a shade better—that it's more practical here to speak of the two flights as one.)

We had a list of performance specifications, worked out on paper by Custer and his crew, but they are based on an ideal CCW-5. The two planes he has are compromises, built with what material they could get with what money they had. Only one, for instance, has counter-rotating props. They couldn't get the counter-rotating engine for the other, giving it a "heavy" right wing.

The point is that the present CCW-5s did not live up to the specification forecasts. But, if someone had a spec sheet at Kitty Hawk, perhaps the Wright brothers would have been embarrassed. Just as the Wrights had a sound idea, with perhaps not the best possible hardware for it, so the channel wing still seems short of its ideal development.

After take-off we climbed at full power, at about 28 inches of manifold pressure

(Please turn to page 228)



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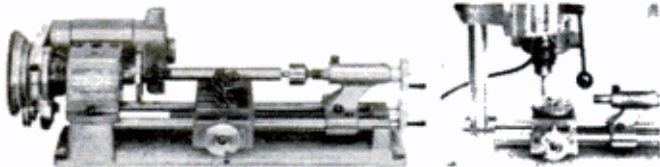
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## Channel-Wing Plane

(Continued from page 218)

and 2600 revolutions per minute, averaging between 85 and 90 m.p.h. and a rate of climb of about 500 feet per minute. Occasionally, we could raise it to 1100 f.p.m. but it didn't hold. The specs call for 2200 f.p.m.

### Poor Cruising Speed

We leveled off at about 4000 feet and practiced the usual simple maneuvers, turns and stalls, and through it all the CCW performed amiably, if not nimbly. It never did indicate more than 115 m.p.h. air speed at cruising, at about 23 inches and 2300 r.p.m., although the specs rate it at 180 m.p.h. cruising and 200 m.p.h. maximum. The prototype, in fact, is red lined at 150 m.p.h.

It was somewhat sluggish on the controls, especially in turns, although I'd blame most of this on the inboard ailerons, right next to the channels. Custer took them off the ends of the wings because he eventually wants to take the ends of the wings off. In fact, he wants to take the wings all the way off, and control roll with the engines. Well . . .

The CCW stalls at about 63 m.p.h. smoothly enough, nothing at all violent about it for a relatively large aircraft, and it characteristically drops off to the right, but recovers easily. In fact, power off, the CCW is a conventional aircraft, and the engineering studies bear it out. The channels react as if they were straight wing sections, and the CCW has a glide ratio almost identical to any other aircraft of the same weight and configuration.

So, to answer the obvious question, if it loses power the CCW will glide down the same as any other airplane.

### It's a Power-On Aircraft

Power on, however, it's different, and here pilots have to learn an altogether new technique. For normal flight, the CCW is flown normally. For slow flight, however, the power is reduced. Then, as the plane loses speed, the nose comes up to hold altitude, and power is slowly put back on. It's like releasing the clutch and applying the accelerator on a standard-shift automobile. As the power comes back on, it is not so much now producing thrust as it is lift by sucking the air out of the channels. Slowly the airspeed indicator comes down, past 63, past 60, past 50, past 40 and, on our flight, down to 32, before the nose finally dropped through in a stall.

The angle is steep, even awkward (about 20 degrees), but there isn't any question that this two-ton aircraft will fly well be-

(Please turn to page 230)



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## Channel-Wing Plane

(Continued from page 228)

low its power-off stalling speed.

Coming in for a STOL-type landing (it makes normal landings the same way any airplane does), the CCW indicated about 60 m.p.h. at about 300 feet above the edge of the runway, then began losing speed and altitude. It was indicating 45 m.p.h. when it touched down, hard but not uncomfortably, about a third of the way down the runway, rolling another 500 feet or so.

In sum, the CCW-5 lives up to its slow-speed specifications, but falls short on the high side. We asked Custer and the engineers about this after the flights, and their answers jibed: The improvements are still on the drawing boards.

### Proposed Improvements

Here are some of them:

Both agree on an adjustable horizontal stabilizer, to replace the fixed stabilizer and movable elevator now on the plane. Immersed in the propwash, the trimmable stabilizer would give it greater pitch control, shorter take-offs and, more important, reduce the extreme nose-high attitude during slow speed by half.

The Devore people would like to put spoilers outboard of the ailerons for greater control, especially during slow speeds. The wings stall at the tips first, and the stall works inboard, which was part of Custer's reason for putting the ailerons inboard where the airflow could get at them longer.

Custer, however, is inclined toward stubbier, laminar-flow wings, and eventual elimination of them. ("The Wright brothers put those things on.") He also wants flaps that retract into the fuselage for cruising, and extend into the propwash for almost vertical takeoffs and landings. Devore's engineers see this only for military applications.

Both agree, and enthusiastically, that what the CCW needs most of all for greater efficiency are turboprop engines. This, they claim, will get back some of the high-speed losses, although Devore doubts that it will ever top conventional aircraft with the same power plants. ("When you gain something on the low side, you lose something on the high side. You don't get something for nothing.")

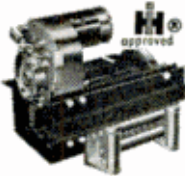
Finally, the ultimate solution, both are convinced, is to build each configuration for specific missions individually. Devore said, "Custer took another plane and put his wing on it, when the plane should have been built around the wing."

(Please turn to page 232)

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## Channel-Wing Plane

(Continued from page 230)

Three specific configurations, with three specific missions, are now on the horizon. Custer foresees a single-engine version (his first pilotless model was single-engine) for private use or small-scale business use, able to land on farms or remote forest areas where no airports exist.

He also foresees the most exotic configuration of all, a channel jet without any wings or tail section. The engine would be buried in the fuselage, with the scoop in the nose and the exhaust in the tail. Channels would then be put in both the nose and the tail, doubling, he says, the lift capacity, because the craft would be, without any external appurtenances, a flying bullet, getting directional control by swiveling the tail channel, the way missiles control direction by swiveling the tail nozzles. The Devore firm, however, sees a "fantastic future" for a four-engine, two-channel passenger plane that could be the long-sought replacement for the venerable DC-3. Carrying 20 passengers, it could drop into and fly out of airports with no more than 300 to 500 feet of runway, making scheduled stops at just about any small town in the world. The engines, they said, are already built—turbines paired to drive one propeller through a gear box. The gears would allow the props to be turned either way, clockwise or counterclockwise.

### Has Orders for Planes

But that's all in the future. Custer claims he already has 40 orders for CCW-5s in its present configuration (at about \$75,000 each). Interest runs high among oilmen and foresters who must land in remote areas and patrol long stretches at slow speeds. Whether it's the CCW-5 or some future version, the channel wing—after nearly a lifetime of effort, by one self-educated man—seems at last to be getting off the ground. We asked Custer how he could keep faith in one idea for so long. How did he keep going after each disappointment?

"At first I just got mad," he said, without bitterness. "Then I realized that I was just too far ahead of my time and went back to work."

If he was, or still is, too far ahead of his time, time alone will tell. If he was, then he'll join the long ranks of American pioneers who worked in obscurity and were lionized in death. If he wasn't and his channel wing never really gets off the ground commercially after such a long, lonely agony of devotion, then, to coin a phrase, it will be a flying shame. ★★★

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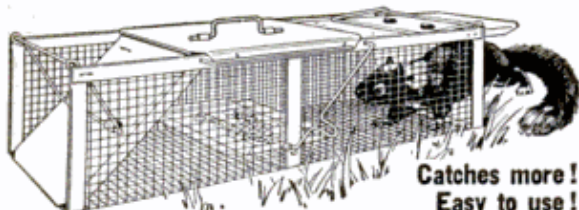
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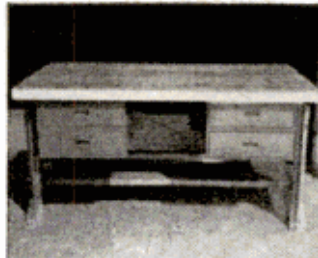
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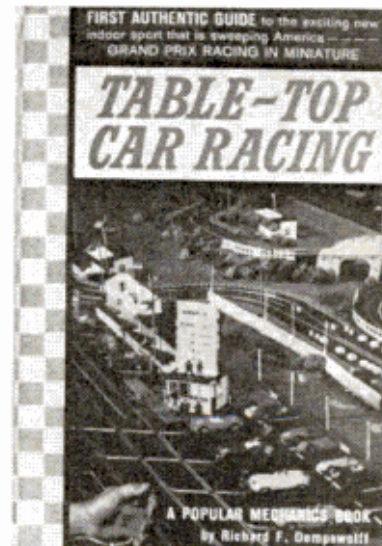
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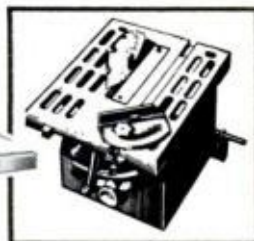
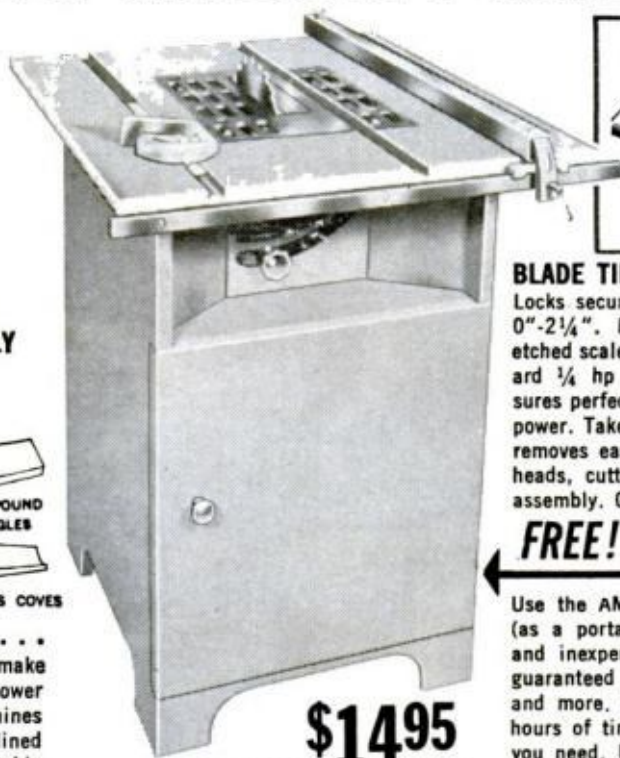
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