

How to Find the Best Air Conditioner

# POPULAR JUNE 1962 MECHANICS 35 CENTS



*This Boat Flies!*

**Valiant Owners Report**

**Two New Rotary Engines • Build an Arc-Spot Welder**

**Big Boom in Radio-Control Models:**

**— Rigs for Planes • Plans for an R/C Racing Hydro**

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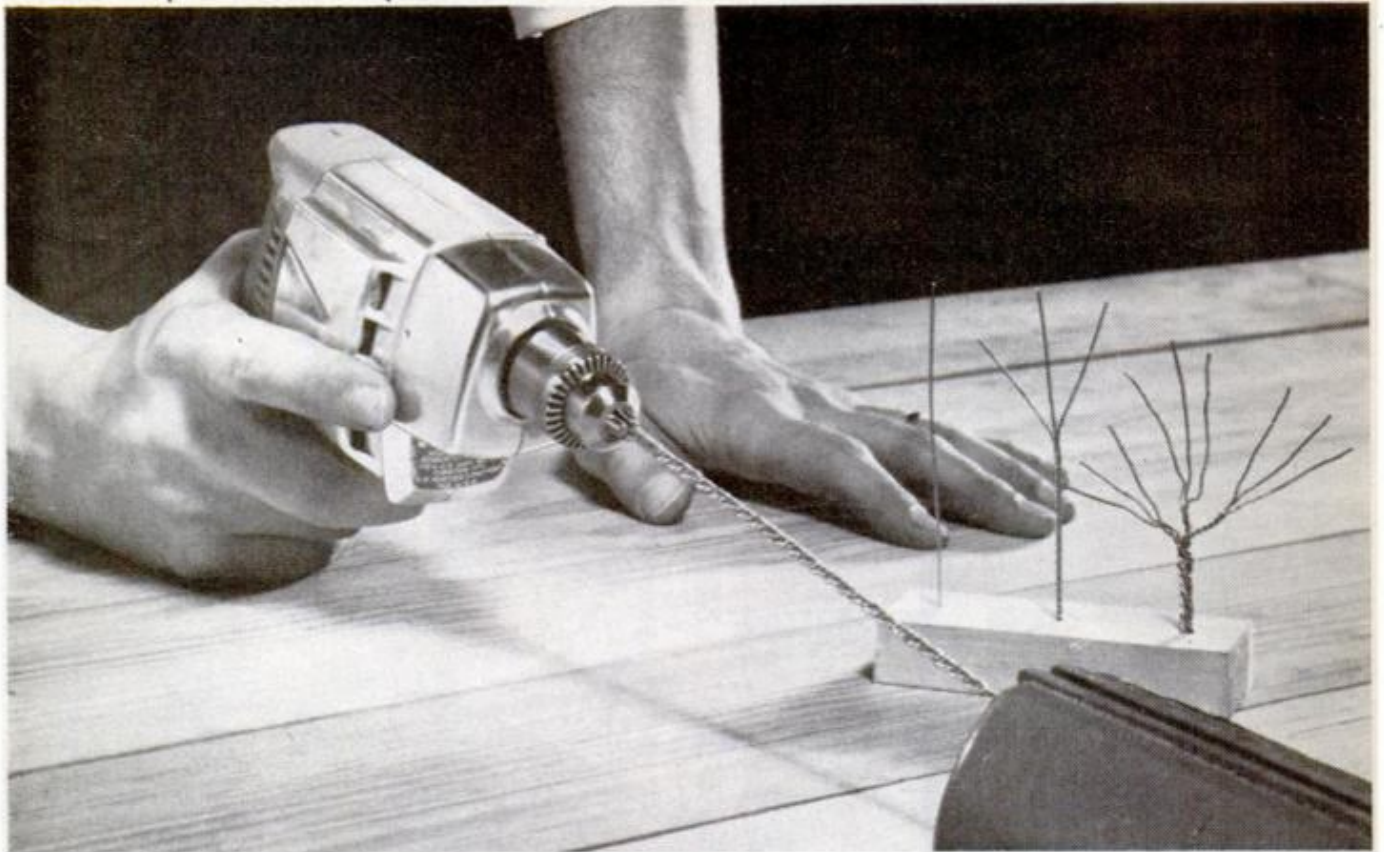


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3XC6-5HC-URF 1



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So protect *your* boating fun with 3-T *Nylon* Super Rib trailer tires. That way you won't be dropping anchor—along the road. Goodyear, Akron 16, Ohio.

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**GOODYEAR**

# POPULAR MECHANICS®

JUNE 1962  
VOL. 117 NO. 6

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## Next Month . . .

Which will it be—a desperate flight on Airtransit 13, some scuba searching, or a joy ride on a new water scooter? Or perhaps you'd rather relax and read what Oldsmobile owners have to say about their new cars. Or learn how to mix, pour, color and texture concrete—with enough skill to avoid cracking and crumbling later. Watch for all these possibilities—in the July PM.

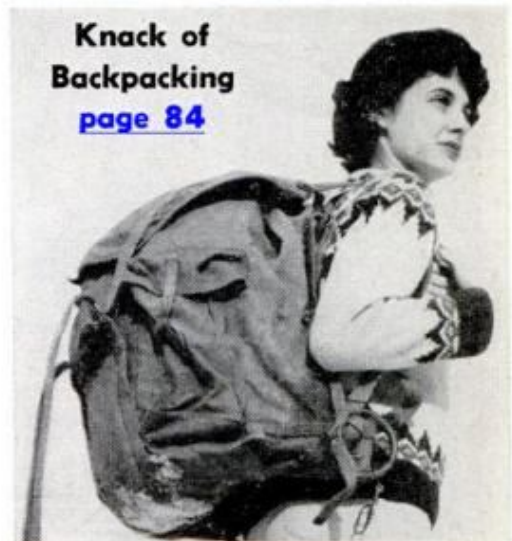
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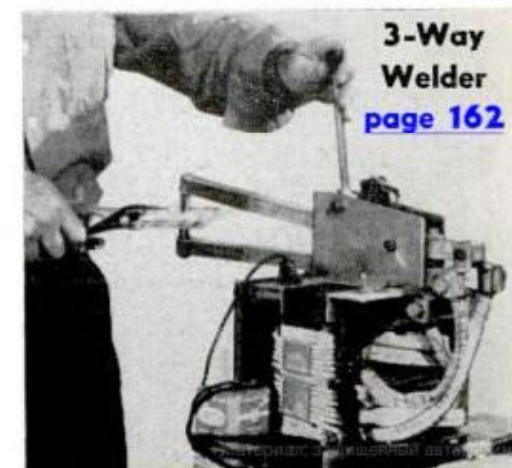


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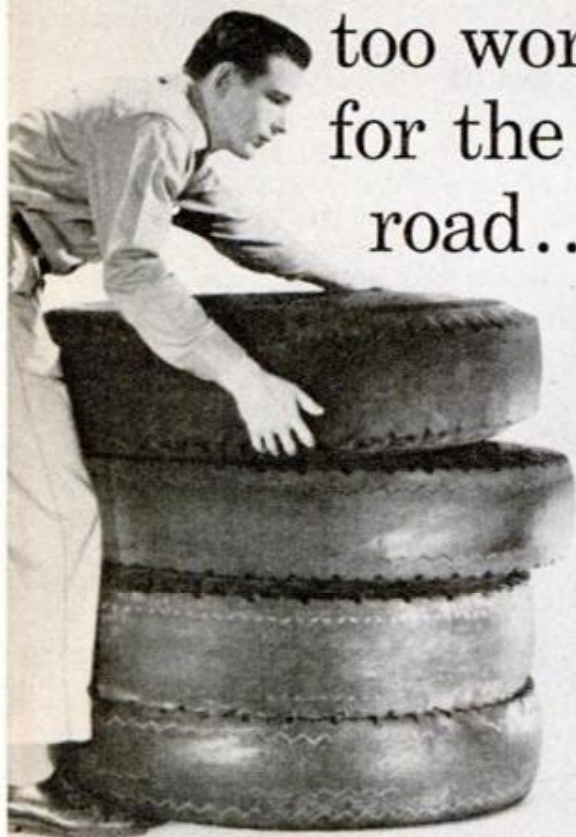
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# Over the editor's desk

## Good Skate

I made this ice boat after seeing an article on page 165 of the November, 1959 PM. Powered with a 2-h.p. engine and with a top speed of 20 m.p.h., it features tiller stick



control for acceleration, brake and steering.

Weighing less than 100 pounds, it can be disassembled without tools for easy loading in a car by one man. Old-fashioned shoe skates serve as runners.

Peoria, Illinois JOE D. SEVERNS

*Skillful crafting, Joe, particularly in view of the fact that the original article was nothing more than a news photo of an entirely different configuration.*

## Old-Time Extras

Before your March issue came out, I wanted to write a letter on the virtues of my old car. You beat me to it with your *Old-Time Touches* article. My '49 Ford today would be called a compact, yet the car has more kneeroom in back than many new ones and trunk space which has never been crowded. It has its original (and excellent) starter, generator, shocks, springs, radiator, etc.

The "extras" are wheels I can strap chains on, inside hood release, fine circle instrument panel (gauges, of course), tail-lights easy to view, not surrounded by

chrome and, best of all, a sun visor I would hate to part with. It keeps the sun off your lap and your eyes in the line of travel (who wants to look at planes while traveling?). Also helps against snow and freezing rain. Glad to see that your magazine recognized that such "old-time touches" were driving aids.

Milwaukee, Wis.

R. L. KNABEL

## Rangers in Viet Nam

I found the article on U. S. Ranger activity in Viet Nam (April PM) most interesting, and am pleased that it will appear in such a widely-read magazine as *Popular Mechanics*. The President is interested in having this type of activity publicized.

Washington, D. C. C. V. CLIFTON,  
Major General, U. S. Army,  
Military Aide to the President

## Way-Out Electrons

Mr. Dempewolf (*The Way-Out World of Solid State*, Jan. PM) evidently is way out when he assigns only four electrons to silicon, five to arsenic and three to aluminum. The atomic numbers of these elements are 14, 33 and 13 respectively; this means that silicon contains 14 protons in its nucleus and 14 electrons in its orbits (shells). Similarly, arsenic has 33 electrons in its orbits, aluminum 13 in its orbits.

Since the inner orbits of these elements are full of electrons, it is the electrons in the outer orbit of each element that *apparently* govern the electrical properties. Silicon contains four, arsenic five and aluminum three electrons in the outer orbit.

Toronto, Ont., Can. DAVID PINKUS

*And that's where Editor Dempewolf was, Dave, in the outer orbit discussing the valence electrons whose numbers obviously do not correspond to the nucleus elements in the periodic table.*

## More Waterways Skirmishes

Your *Bitter Battle of the Waterways* (March, PM) inspired my first letter to any magazine . . . Only six percent of Ohio waters are available to, or acceptable for, skiing, as compared to 100 percent available for fishing. And that six percent is restricted to certain hours and/or days, and must be shared with pleasure boaters, scuba divers, duck hunters, sailboaters, sun bathers and the like, not to mention the poor worm-drowners, who drop anchor wherever they please and woe be it to anybody who comes within a football field's length of them . . .

You mentioned "more deaths in the water than on the highways in New York," yet

(Continued to page 10)



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# EVER HEAR A WHEEL BEARING BACKFIRE?

When an engine backfires, you know it. But a wheel bearing backfire sort of creeps up on you. After repacking, for example, you may notice grease leaking, or a clicking noise as you drive. The "click" turns to a "crunch" and the bearing soon crumbles. What went wrong? Was it repacked right?

## CHECK THESE REPACKING HINTS

**Handle bearings with care.** Work with clean hands, tools and surroundings. Clean bearings with solvent and flush with clean kerosene. Lay them out on clean paper; keep lubricants clean; and clean the housing thoroughly before replacing bearings. Never spin dirty bearings and never spin bearings with compressed air.

**Inspection.** Examine bearings carefully for broken or cracked components; flaked areas; indications of overheating and brinelling. Replace if necessary. **Lubrication.** Use the correct lubricant; apply carefully to both bearings and housing.

**Install new National seals.** To avoid leaks that can ruin brake linings and cause premature bearing failure, *always install new oil seals.* Handle them carefully. Do not hit directly with a hammer. **Adjustment.** With ball bearings, snug only until bearing is seated and wheel doesn't wobble. With tapered bearings, tighten until wheel does not spin freely, but still turns before being backed off.

## REPLACE WITH THE FINEST

Even the most careful service is only as good as the replacement parts. You'll be using the best with BCA Ball Bearings, Bower Roller Bearings and National Oil Seals because they're used as original equipment by automotive manufacturers. For longer service and dependability, stick with these three and you'll never hear a wheel bearing backfire.

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failed to mention which group was responsible—the week-end fishermen who are unskilled and untrained in boating safety . . . Columbus, Ohio ROBERT E. HARTMAN

. . . look at U.S. Coast Guard figures for a recent six-month period: 1581 boats involved in accidents (which killed 588 persons) out of a total of 2,831,531 power boats in the U.S. Of these 1581 accidents, only 120 (7.6 percent) involved boats of 10 hp. or less. These were probably innocent fishermen run down by speedboat morons . . . Perth Amboy, N. J. R. B. WALKER

. . . Both powerboaters and fishermen are pains-in-the-neck for sailors. Powerboaters buzz up, causing us to rock, lose the wind in our sails and our drive. Fishermen anchor 14 and 16-foot boats around our racing marks; in many instances, one sailboat can slip between two fishing boats, while another has to turn aside and go around, losing ground . . .

Culver, Ind. D. E. LEWIS

. . . Get those hot rodders off the lakes. Fishing's a quiet sport but those menaces are making it tough . . .

Long Branch, N. J. EDWARD WEINTRAUB

*Watch for a stimulating final round in this waterways war, in the next issue!*

## Mystery Plane



Enclosed photograph is of an old airplane. I can no longer remember its name, and where it was built is also a mystery to me. Perhaps some of your readers could identify it.

Lyndhurst, N. J. S. R. CASTLES

*It looks like an old double-engine Bernali, but we couldn't swear to it. Perhaps some of the airplane detectives among PM's readers could make a more exact identification, and even pin down the age of the interesting looking beast.*

## Who Fingering Them First?

In re the fine article on the Canadian Mounties by Mr. Linkletter (March PM), there is no doubt the RCMP is one of

(Continued to page 12)

# A BOY NEEDS A DAD HE CAN BRAG ABOUT!



Remember when you were a kid — and your Dad was the strongest, smartest, bravest guy in the world? "That's my Dad," was your big claim.

Now you're the "Dad"—and that's *your* kid looking up at you.

You're a hero in his eyes. You *know* that. But how do you look in your own eyes? Are you using your abilities to build a secure future for your family — to give them the good living and advantages that could be theirs? Maybe you

lost a few years in military service — or a lack of formal education has shut you out of the big-pay jobs that could be yours.

So, you're trying to fit into a job that's too small for you.

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- Accounting
- Business Administration
- Business Management
- Clerk Typist
- Creative Salesmanship
- Managing a Small Business
- Professional Secretary
- Public Accounting
- Purchasing Agent
- Real Estate Salesmanship
- Salesmanship
- Salesmanship and Management
- Traffic Management

### CHEMICAL

- Analytical Chemistry
- Chemical Engineering
- Chem. Lab. Technician
- General Chemistry

- Oil Field Technology
- Pulp and Paper Making

### CIVIL ENGINEERING

- Civil Engineering
- Construction Engineering
- Highway Engineering
- Professional Engineer (Civil)
- Reading Struc. Blueprints
- Sanitary Engineer
- Sewage Plant Operator
- Structural Engineering
- Surveying and Mapping
- Water Works Operator

### DRAFTING

- Aircraft Drafting
- Architectural Drafting
- Drafting & Machine Design
- Electrical Drafting
- Electrical Engineer Drafting
- Industrial Piping Drafting
- Mechanical Drafting
- Sheet Metal Drafting

### ELECTRICAL

- Electrical Appliance Servicing
- Electrical Engineering

- Electric Motor Repairman
- Elec. Engr. Technician
- Elec. Light and Power
- Practical Electrician
- Practical Lineman
- Professional Engineer

### HIGH SCHOOL

- Good English
- High School Diploma
- High School General
- H. S. College Prep. (Eng'g & Science)
- High School Math
- High School Science
- Short Story Writing

### LEADERSHIP

- Industrial Foremanship
- Industrial Supervision
- Personnel-Labor Relations
- Supervision

### MECHANICAL and SHOP

- Diesel Engines
- Gas-Elec. Welding
- Heating and Air Conditioning
- Industrial Engineering
- Industrial Instrumentation

### Industrial Safety

- Machine Shop Practice
- Mechanical Engineering
- Plumbing and Heating
- Professional Engineer
- Quality Control
- Reading Shop Blueprints
- Refrigeration and Air Conditioning
- Tool Design
- Tool Making

### RADIO, TELEVISION

- General Electronics Tech.
- Industrial Electronics
- Practical Radio-TV Eng'g
- Radio-TV Servicing
- TV Technician

### RAILROAD

- General Railroad

### STEAM and DIESEL POWER

- Combustion Engineering
- Power Plant Engineer
- Stationary Diesel Engr.
- Stationary Steam Engines

### TEXTILE

- General

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Occupation \_\_\_\_\_

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Los Angeles, Calif. CHARLES J. RUBEN

*Right. St. Louis fingered them first—by about eight years.*

### Not-So-Special Specialists

In regard to Mr. Perg's letter on unmechanical stories (Editor's Desk, March PM), I am inclined to agree with him but only to a certain extent. Articles such as *PM Shoots the .460 Magnum* (March PM) are both interesting to the layman and informative to the hunter . . .

Hewlett, N. Y. JEFFREY F. ZWERLING

It's a funny thing. For over 60 years, PM has been telling its readers about shop crafts, boats, radios, sports, skills, hobbies, science, industrial processes and almost any subject of interest you could name—long before the rash of follow-the-fads "specialty magazines." Should PM suddenly crawl into the home workshop and close the door on other subjects? It would be a shame. If we had, PM readers would have missed a lot of good reading recently

—articles which the specialty magazines, with all their so-called experts and pretense of thoroughness somehow overlooked.

No automotive magazine, for example, has offered readers the pinpoint evaluations of the world's toughest car testers—the owners themselves, who drive millions of miles everywhere in the U. S. PM prints their findings. No boating magazine has published plans for a hydrojet speedboat. PM has. We doubt that you have been shown how to test tape recorders in the store before you buy, by either a consumer magazine or a radio periodical. You have, by PM. No sports magazine brought you the scientific truth—based on wind tunnel and batting-machine tests—on the changes that have been made in baseballs. PM did.

You'd never know whether—or how—an American family could survive in the wilderness on what they could collect on 10 minutes' notice, unless you read PM. You never were told—and shown—the true story on the safety glass in your car, anywhere but in PM.

These are just a few samples of PM's *specialty*—personalized reporting in depth by people who live the stories they write for you.

*The Editors*

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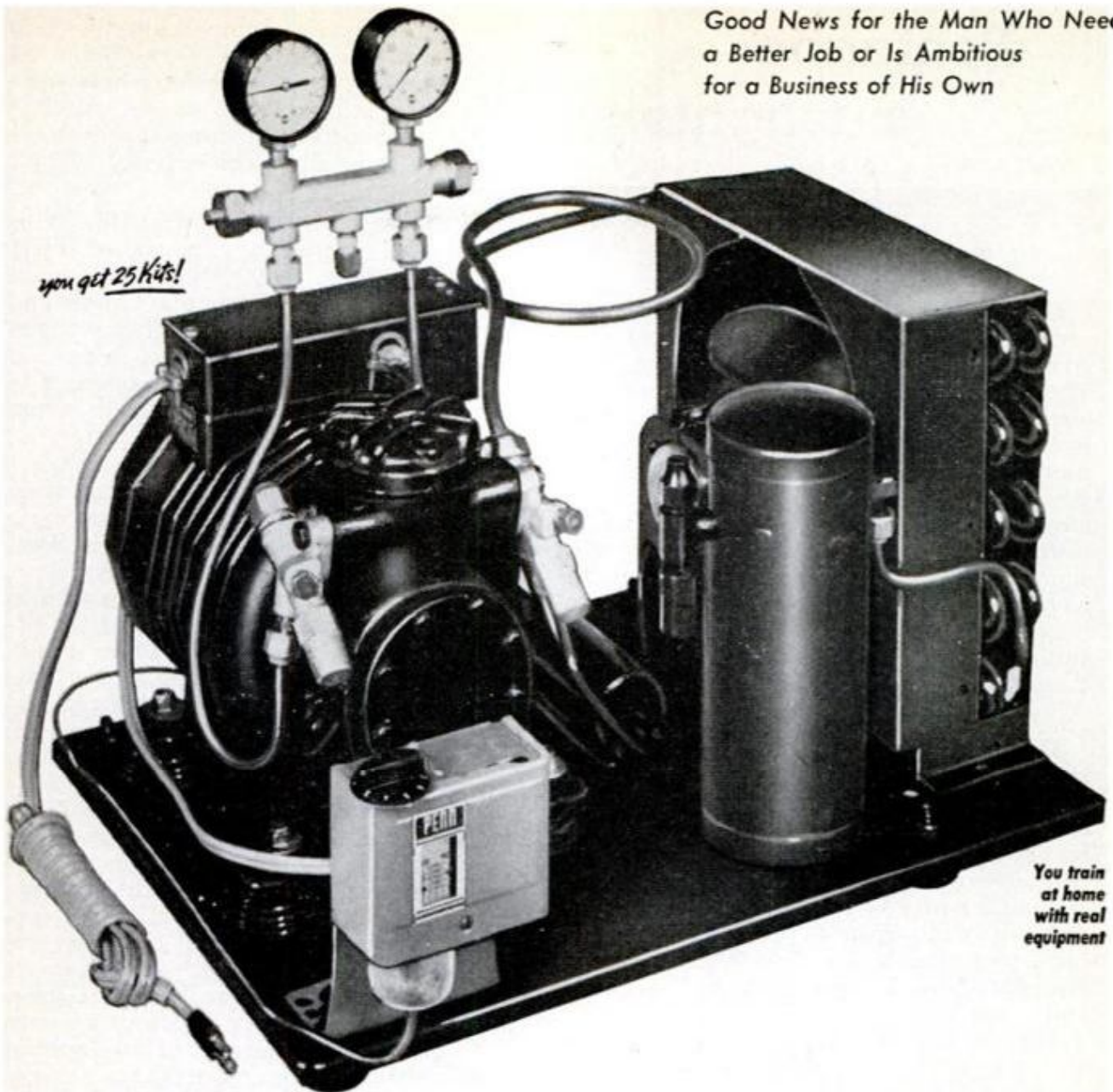
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with real  
equipment

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—Accredited by National Home Study Council—

# Pentagon sidelights

By William R. Kreh

**Underwater shelters?** Instead of going underground during a nuclear attack, Army engineers want to go underwater. The engineers are urging development of combat vehicles and mobile construction equipment that can be completely submerged in water and still retain enough power to fish themselves out after an atomic attack. In some places, the engineers say, it may be impossible to build shelters to protect men and equipment from nuclear blast effects. So the Army hopes that industry will design combat vehicles that can be submerged to hide them from a nuclear blast.

**Tiny radio transponders** are being attached to the parachutes of Navy and Marine Corps jet pilots, so that they can be detected by radar should they be forced to bail out. The parachute radio transponder is attached to the parachute's shroud lines and automatically starts sending out signals when the chute is opened. A Marine pilot recently ejected at 35,000 feet, about 25 miles off the Pacific coast. An FAA control-tower operator picked up the device's signals on his radarscope and a helicopter had him picked up in 20 minutes.

**Speaking of parachutes**, two sailors at the Miramar Naval Air Station, Calif., used some ingenuity to come up with a method for testing the device on Navy ejection seats which automatically opens the pilot's parachute when he falls to the 10,000-foot level. The Navy men, J. L. Adkins and R. L. Parmer, fastened an altimeter inside a Plexiglas-covered vacuum box. To test the parachute device, it was put in the box, the cover sealed on, and air pumped out until the altimeter indicated a vacuum equivalent to that of 20,000 feet altitude. The air was slowly valved in until the mechanism triggered off. The altimeter then told at what simulated altitude the device worked and appropriate adjustments were made.

**A well two miles deep** is being sunk by the Army at Rocky Mountain Arsenal, Colo. It'll be used to dispose of the arsenal's chemical wastes. When finished, 400 gal-

lons a minute can be pumped into the deep hole, which tapers from a 24-inch diameter at the top to an 11-inch diameter below the 2000-foot level. The liquid wastes will flow into a 1000-foot-thick sandstone layer sandwiched between shale and granite.

**Adjustable steel-tube shoring** for ships will be used by the Navy instead of wood. The steel tubing, which periscopes when not in use, is easier to store and handle and can be used more than once. When wooden shoring is used, it must be cut to needed sizes and usually can't be used again. The shoring is used to brace bulkheads when ships are damaged or being repaired.

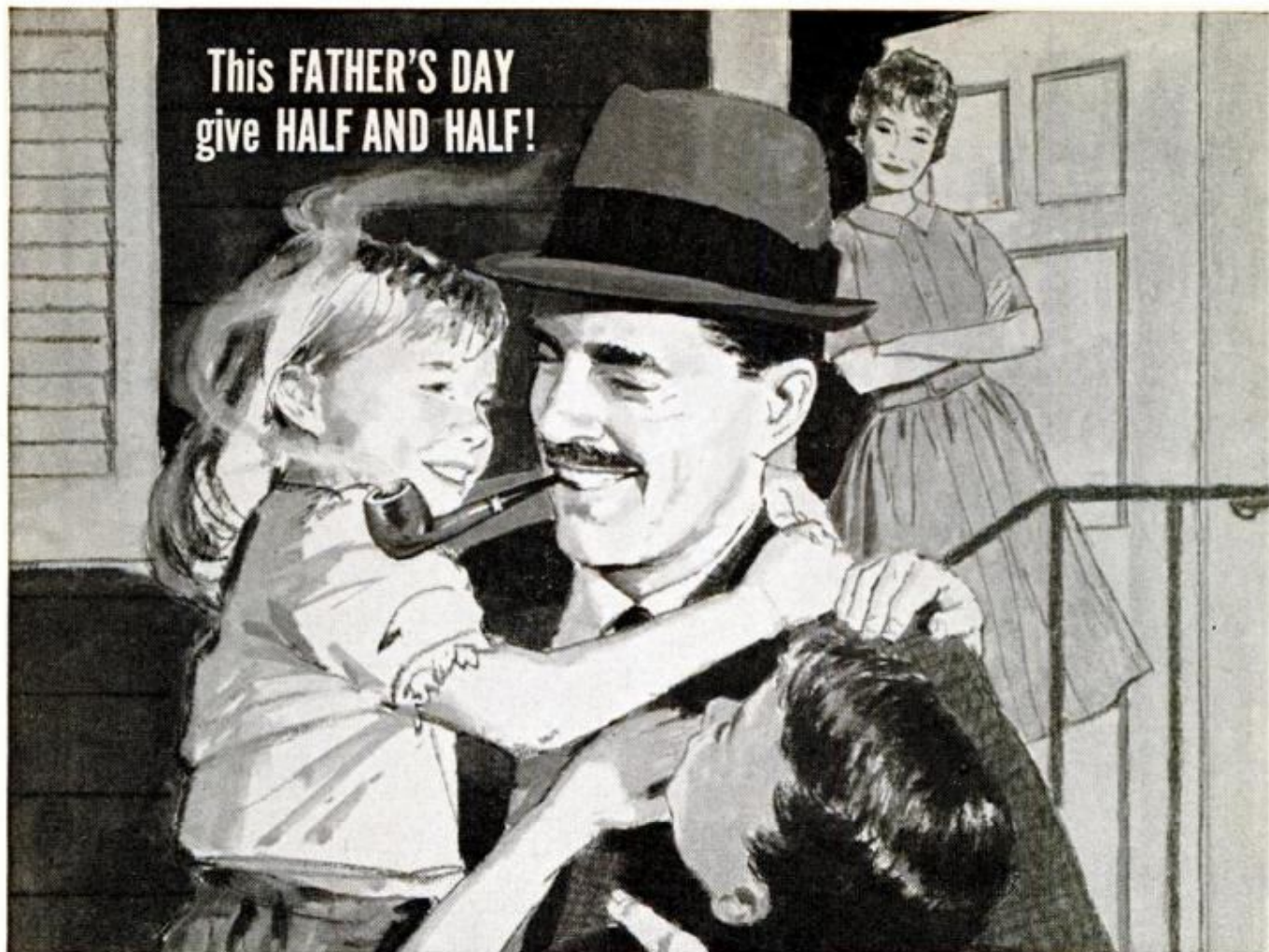
**For a really smooth ride**, go along when they transport a missile. Accompanying a *Minuteman* from the Boeing plant in Seattle, Wash., to Vandenberg Air Force Base, Calif., an Air Force sergeant placed a penny on a bracket on the side of the 63-foot-long missile transporter. Many rough roads, six days and 1100 miles later, the penny was still in place, proving the air-suspension system on the 20-wheel vehicle really babies its valuable passengers.

**Aircraft grease** has been giving the Navy some trouble. It seems dust, grime, salt spray and other contamination gets into the can after it is opened. And then people sometimes use the wrong kind where specialized grease is needed. So now the Navy's experimenting with a system it hopes will solve both problems. Grease will come in cartridges like fountain-pen refills. The cartridges will fit into special grease guns. Grease guns, grease cartridges and grease fittings on airplanes will all be color-coded to help maintenance men get the right grease into the right fitting.

**Disaster cosmeticians?** That's what 14 Air Force men at Travis Air Force Base, Calif., call themselves. They're medical personnel from the Travis hospital and their part-time job is creating carnage. They're the ones who make up the "victims" for the realistic training exercises held at the base for training medical and civil defense personnel. During a recent exercise, which simulated a transport crashing on takeoff into a nuclear-weapons-filled railroad siding, the disaster cosmeticians furnished 134 "victims." It took them 4½ hours and involved 16 gallons of morticians' wax for make-believe swelling, lacerations and fractures; three dozen tubes of glue to simulate burns; three gallons of Vaseline colored red to fake dried blood and tissue, and some 40 tubes of grease paint. ★ ★ ★



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## Sidelights on aviation

Aeroflot, which has been called the "world's worst airline" (PM, April, 1961) may be the first with the worst supersonic transport. Russian experts here are predicting that the Soviets will remodel a supersonic bomber to accommodate passengers and fly this mongrel around the world next year as a showcase of how far ahead in aviation the People's Republic is.

Jet noise is just as annoying, if not more so, to old-timers in airport neighborhoods as it is to newcomers, a recent Air Force study shows. They just never get used to it.

Questioning 2500 residents over a five-year period indicates that the noise is almost invariably associated with fear of a crash. Complaints are most numerous when the noise is most frequent, loudest and most fear-inspiring.

In the wake of the recent Supreme Court decision holding the airport owners responsible for damages when property owners abandon their homes because of the noise, the problem has become more acute. Some airports are talking about buying up all the property around the airports as the less-expensive alternative to fighting a series of individual damage suits through the courts.

Then there are sonic booms. The record-breaking supersonic flight of an Air Force B-58 *Hustler* back and forth across the country was also a coast-to-coast window-breaking flight. It raised again the question of what to do about these shock waves.

One group has found a use for them. Rangers at Glacier National Park in Montana asked jet fighters from an Air Force base in Washington to skim over the mountains near heavily traveled park roads. The idea was to produce shock waves that would pack the snow, lessening the danger of snow slides. They said the snow-packing flights are most successful on clear days following snowfalls.

If all this weren't trouble enough, the birds are fighting back.

A report from Switzerland tells of a small military plane that was attacked by two giant golden eagles and damaged so badly that it was forced to make an emergency landing in the mountains.

Kevin V. Brown

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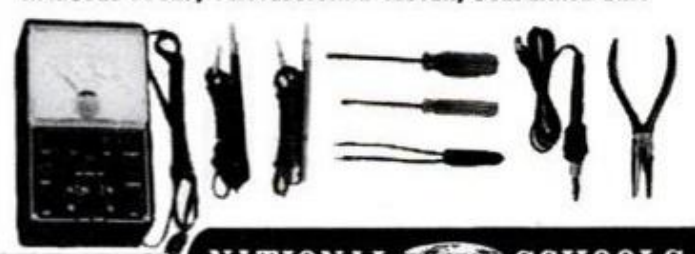
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## Items from all outdoors

The first month of summer finds the New Products File stuffed with good-looking new equipment for summer sports. Here are a few of the good ones you may have missed:

**Vynac** is the newest of the synthetic rope fibers, and produces a rope that won't rot or absorb water, is inert to acids, corrosion or weathering, is significantly stronger than the finest Manila yet less costly, and has less undesirable stretch than the other synthetics without sacrificing the strength, shock and tensile resistance that make the synthetic ropes so popular. It comes in a wide range of colors, and in sizes from an eighth of an inch to three inches. It's made by Saltare Industries of 3354 North Crawford, Chicago 47, Ill.

**Pontiac Motors**, recognizing that a lot of their owners use their cars to pull boat and camping trailers, have announced a new set of optional heavy-duty equipment for installation at the factory. You can get a heavier frame, heavy-duty shocks and

springs, oversize tires and heavy-gauge wheels, special axle ratio and transmission, and extra-capacity engine and transmission cooling systems. The equipment is available for either Pontiacs or Tempests, and is recommended for people who plan to tow rigs weighing over 3000 pounds (1000 on the Tempest), or where the tongue load is more than 200 pounds regardless of total weight.

“**On the Ball**” is a chemical coating for golf balls which is intended to reduce aerodynamic skin friction, therefore giving more distance on drives and approach shots for less-than-expert golfers. Golf balls are designed for optimum aerodynamic efficiency for optimum golfers; “On the Ball” adds a plus factor for lesser players. Tests show it can increase distance up to 30 percent on some approach shots. It's in the stores for \$5 a bottle, made by Merix Chemical Co., Chicago 49, Ill.

**One free item**, if you can handle it. The National Park Service offers to give you a live buffalo if you can prove to them that you can support it properly. Takers?

*Dick Kiepatnik*

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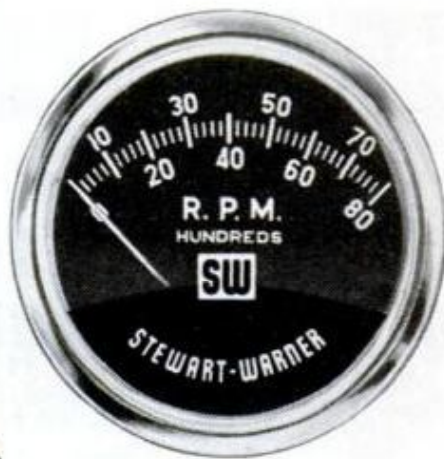
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POPULAR MECHANICS



## ac·cel'er·a'tor

One who or that which accelerates; specif.:

**a** On automobiles, a foot-operated throttle. **b** (*pron.* ak-sel'er-a'ter; *L.* ak-sel'er-a'tor) *Anat.* Any muscle or nerve that hastens a motion. **c** *Chem.* A substance that hastens a reaction. **d** *Physics.* Any device used to impart high speeds to charged particles. (Webster's New Collegiate Dictionary)

 All the above is true, as far as it goes. What it doesn't say is that an Impala Super Sport has even more going for it than performance. It's a swinging car in every way. Bucket seats, special interior, distinctive exterior trim, all part of the Super Sport kit, optional at extra cost on Impala Sport Coupes and Convertibles, and it proclaims to the world that this machine doesn't take a back seat to anybody. To understand, you'll just have to try an Impala Super Sport, that is, step on that accelerator. You'll be impressed, or our name isn't Chevrolet Division of General Motors, Detroit 2, Michigan.

# CHEVROLET IMPALA

# Science overseas

By William Kreh

**How hot is lightning?** Two Russian scientists say it's 20,000 degrees C. They report it produces a shock wave with a pressure of 1000 pounds a square inch.



**By boring a 150-yard tunnel** through the Istall glacier in northern Sweden, experts hope to find out how the glacier moves debris from one spot to another and how it erodes the land surface.



**Don't drive in the city** if you have a weak heart. That's the advice of a German physiologist who studied heart behavior of 300 motorists while they were driving.

He took continuous electrocardiograms and readings on pulse rates and blood pressures, then reported:

Driving under normal city conditions caused severe stress, increased blood pressure and pulse frequency, oxygen deficiency of the heart muscles and rhythmic disturbances. Open-road driving with clear vision and no traffic caused no undue stress on the heart.



**Canadian winter wheat** is actually alive, and lively, compass. Its roots always grow north and south because of Earth's magnetism. Farmers are now advised to sow it in an east-west direction so the wheat will put out more roots and thus control soil erosion and produce higher yields.



**They are not against smooching**, but the authorities in Venezuela have started a campaign against the kissing bug.

It is a small insect found in parts of Latin America that transmits a parasite that attacks the muscles of the human heart. The infection can be fatal.



**The world's third-ranking rocket power?** Japan may soon claim the title.

Its scientists have developed a new solid-fueled rocket, the Lambda, to succeed the highly reliable Kappa which has supplied a wealth of material during the International Geophysical Year. The Lambda will be able to rise to an altitude of 620 miles, com-

pared to 217 miles for the Kappa or 149 miles by Great Britain's Skylark.

Another new rocket, the Mu, will be capable of carrying a man into space, and will be tested in 1965.



**French engineers plan** to railroad boats from the Marne River to the Rhine River. The boats would travel in a huge water-filled hopper.

Reason for this outlandish (and overlandish) undertaking? The rail trip would take 52 minutes, compared to the eight hours now required for the boats to pass through 22 locks from one river to the other.



**Geologists really struck pay dirt** recently near a small town in the Sierra Madre Mountains in Mexico. They found five new minerals all at one spot and at one time. The new minerals were found in a tellurium deposit near Sonora and are compounds of lead, zinc, manganese, manganese-zinc and iron.

About 30 new minerals are found each year throughout the world, but it's rare to find more than one at one spot.



**A pair of tweezers** that is a soldering iron has been developed in England for delicate work in soldering printed circuits. The tweezers are six inches long and weigh only one ounce.

The steel shafts are insulated for handling. The prongs, made of nickel, are heated by electricity.



**Map a fog-shrouded island?** The Australian Antarctic ship *Thala Dan* has finally mapped the fog-and-snow-bound Oates Land which previously defied mappers' skills.

All but 50 miles of the 3000-mile coast of this Australian Antarctic Territory has now been mapped. The area recently surveyed comprised 20,000 square miles and thrust up hundreds of snow-covered mountain peaks, some more than 10,000 feet high.



**"Sir, there's a warehouse** off the bow!

This could be a seaman's cry if plans in Japan work out. Shipping has increased so much in that country that ships often have to wait outside harbors for docking space.

A possible solution to the problem will be to build large floating piers and warehouses.

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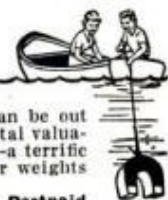
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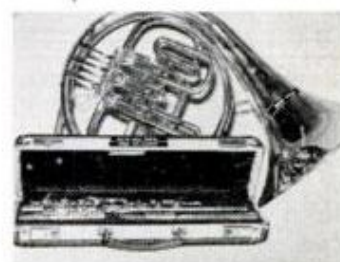
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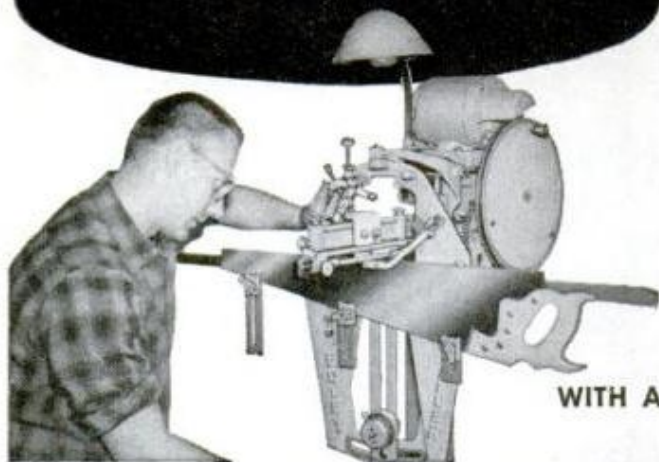
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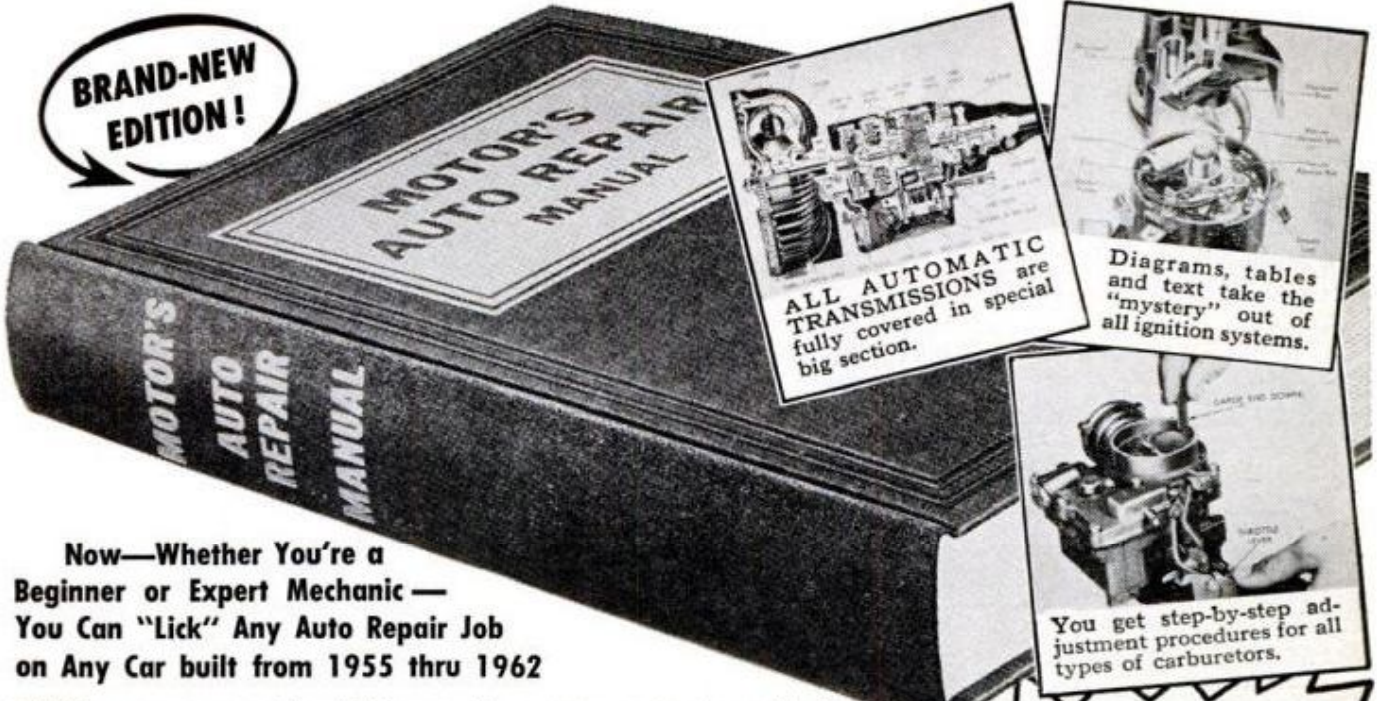
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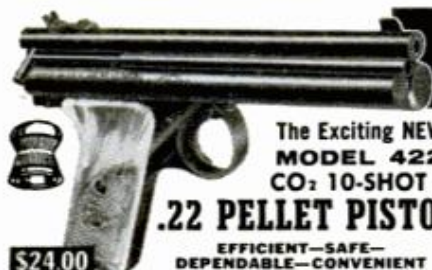
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# Science bulletins

"Hup! Tup! Trep! Foh!"

Soldiers marching. Then, without warning, two fall in pain to the ground. Their ankles are broken! Why?

The answer to this question, which centers around people getting bone-tired, is being sought at Southwest Research Institute, San Antonio. Scientists there are applying a plastic coat to skeleton skulls, then subjecting the skulls to stress. The plastic coat reflects the degree and pattern of stress by changing color when viewed under polarized light.

Bone-fatigue, the scientists know, sets up conditions that could snap an astronaut's head in the stress of takeoff, that does make marchers fall.

What makes people bone-tired? The Institute's research may give the foot soldier a different kind of break.

The inside story on rust reads like a script for a horror movie. There are exotic chemical reactions; there are sudden spurts of gigantic growth; there's destruction.

But, on with the show. Here's what happens, for example, when the paint rubs off your fender, and air and water vapor hit the iron.

The oxygen in air causes a protective oxide coating to form over the metal. This coating, according to Dr. Earl Gulbransen of Westinghouse Research Labs, sprouts tiny whiskers, each less than one-millionth of an inch in diameter, and 30-millionths of an inch high. There are more than one billion whiskers per square inch.

Now here comes the Frankenstein and monsters-gone-wild stuff: When moisture hits these whiskery spots, they erupt into broad, blade-shaped platelets of iron oxide up to 3000-millionths of an inch high. They spread over 50 times more area and 250 times more volume than do whiskers formed in dry oxygen.

Hydrogen ions are the culprits, says Dr. Gulbransen. They enlarge the corrosion sites, destroy the protective coating of oxide and set the rust reaction in motion and, well . . .

That's the way the fender crumples.

James Biery

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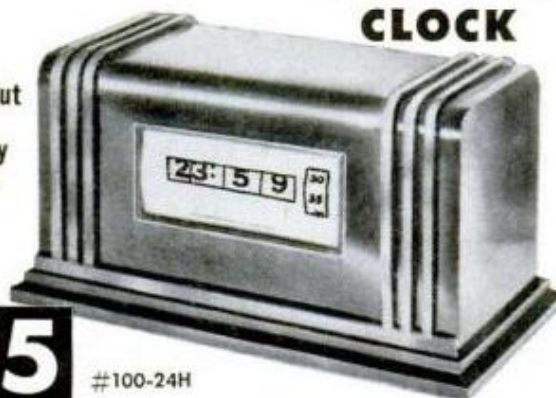
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# Tune in on the inventors

One of the most interesting inventions across the desk this year is an improvement on one of man's oldest measuring devices, the sundial. Developed by Paul Snider, of Louisville, Kentucky, it's a spherical sundial that gives a surprisingly accurate time measurement. The invention, which resembles a small globe, works by "sighting" on the sun; it need not be fixed, only oriented for direction. The globe is simply turned until the sun shines through a pair of diametrically-opposed slots, and aligning the slots puts the time scale into position under a fixed pointer to give the time.



Inboard boat fans will like a new shaft-bearing strut designed by Archibald Dixon of Bay Shore, Long Island, N. Y. His invention replaces the familiar exterior strut on inboard propeller shafts with a streamlined housing which has a shaft bearing in the center, but also extends on below the shaft for six inches, ending in a bracket which supports a skeg to protect the propeller. Mounted on Dixon's own boat, the rig has produced good performance with near-immunity to the inboarder's biggest problem—shallow water.



Any mechanic who has worked with a floor jack to hoist an auto engine off the frame will appreciate the value of a new engine lift which won patent No. 3,002,745 for Linwood Via of Waynesboro, Va. The lift mounts on the frame itself, then raises the engine from its mounts with a lifting screw. Since the lift is fastened to the frame, it can't slip out from under the engine if the car moves. With that big safety factor, the lift can be put in place and used by one mechanic from beneath the car.



Encouragement for discouraged inventors: Miss Beulah Henry of New York City, has just received her 45th patent on a new return envelope. In 40 years of inventing, this lady Edison has patented devices ranging from a toy cow and a pneumatic doll to a duplicating typewriter ribbon and a new umbrella—all while living in a New York hotel room. Feel better?

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# Fastest-Growing Occupations

The number of workers in the professional occupations has skyrocketed in recent years. Here's a brief summary of the fine opportunities this field can offer you

by B. Richard

**I**N 1870 NEARLY 75 out of every 100 professional workers were doctors, ministers, lawyers or teachers. Today, only 40 out of every 100 workers in the professional fields have jobs in these classifications.

The reason for this is the massive change in our economy that gave rise to thousands of job opportunities in science, engineering and related fields. In fact, new professional jobs are constantly being created because of our constantly changing business and social structure.

The professional occupations include jobs ranging from architect to musician. There is no handy definition to describe jobs in the professional category, but, in general, all professional jobs have four factors in common: rewarding and responsible work, potential for high earnings, prestige and the necessity for long periods of education and training.

A college degree is not always a requirement to enter into a professional job. However, experience and training leading to a comparable knowledge is almost always a requirement, and the trend is toward placing more emphasis on the values of education and training.

Included here are summaries of opportunities in two of the most important of the job classifications in the professional category: law and accounting. Accounting is the second largest professional job classification for men, and law is unique in offering outstanding opportunity for large earnings. These two occupations will serve as examples of the many professional and administrative job opportunities that can lead to substantial earnings and a secure future for those who are willing to undertake the necessary training.

## ACCOUNTING —

More corporation presidents today started their business careers as accountants than through any other professional field, except for law.

Accounting is truly a key profession, one of the major stepping stones to management. It is the second largest field of pro-

fessional employment for men, and in 1958, 400,000 accountants and auditors were at work in this country.

Because accounting is a highly specialized profession, education and experience play an important part in the advancement of the beginner. While there is a fine opportunity in accounting for men with all types of backgrounds, the untrained accountant is likely to be assigned a routine job with little chance for promotion. A college education is not a prerequisite for a successful accounting career and most states have no specific requirements even for CPA candidates, but a thorough education in accounting techniques is essential.

Many fine correspondence courses are available for those desiring a background in this field, and these courses of instruction can be taken without interrupting your present job. Such courses have helped a great many experienced accountants pass their examinations to become certified public accountants (CPA's).

Business schools and colleges offering courses in accounting also provide excellent preparation for those desiring to get started in this field and for those who are in a position to devote more time during the day to their studies.

Today it is possible for beginning accountants to start at salaries up to \$450 per month, provided they have a good educational background. With experience, accountants can progress to supervisory positions and salaries increase with responsibilities. Accountants in industry have the opportunity to progress to highly responsible positions such as company treasurer, comptroller and to top management jobs.

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

(Continued to page 34)

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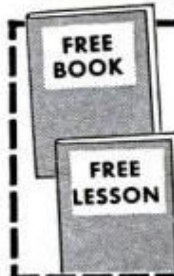
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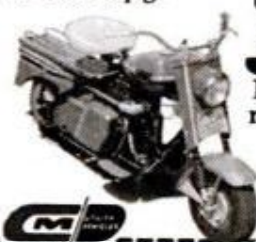


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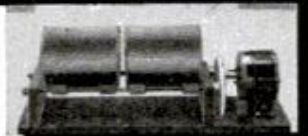
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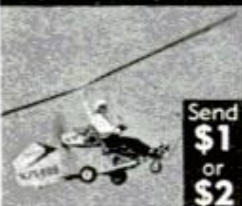
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**AMAZING OFFER!** 200 United States stamps — including commemoratives, airmails, high denominations to \$1.00. Only 10¢ to approval applicants! Illustrated bargain lists free. Mystic Stamp Co., Dept. 80, Camden, New York.

100 **OLD** United States between 1861 and 1935. \$1.00. Roush Stamps, 51 Chestnut, Mansfield, Ohio.

**FREE** Monaco nudes. Approvals. Stamp Ranch, 902 Addison, Chicago 13, Ill.

**PENNY** Approvals! Regardless catalogue! Kloster, 4164—52nd St., San Diego 5, Calif.

60 **DIFFERENT** U. S. (30 commemoratives) 25¢. No approvals. Seidenberg, Appleton, Wisconsin.

225 **STAMPS** For only 10¢! This mammoth value includes airmails, pictorials; stamps from strange countries cataloging up to 25¢ each! Also approvals. Mystic Stamp Company, Camden 80, New York.

**FREE** 50 Worldwide, mailed with inexpensive approvals. University Stamps, P.O. Box 44-592, Miami 44, Florida.

100 **DIFFERENT** United States commemoratives, 1/2¢ to 10¢ values—used \$1.00; Mint \$4.95. No approvals. Gil's, Box 12BA, Brooklyn 29, N. Y.

215 **DIFFERENT** Worldwide 25¢. Fiume, Korea, Laos, Russia, Transvaal. Approvals. Bobb's, Box 3045, Saint Louis 30, Missouri.

**PENNY** Approvals, 1,000 foreign stamps mounted in Scott order. No assorting! Bulot Approvals, 1359 Coney Is. Ave., Brooklyn 30, N. Y.

**MINIATURE** Collection Queen Elizabeth mint sets (Antigua, Caymans, Mauritius, Montserrat, Virgins, St. Kitts)! 21 lovely pictorials, only 25¢! Attractive approvals! Gannon Stamps, Box 931, Canton 1, Ohio.

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**SENSATIONAL** Penny approvals! Pictorials, topicals, etc. Write today! Schmidt, Box 1128, Richmond, Calif.

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**SELL** Stamps to our readers. Your ad in this space will be read by thousands of stamp buyers. I'll prove that to you. Write now for Folder "S." F. W. Johnson, Classified Advertising Manager, Popular Mechanics, 200 E. Ontario St., Chicago 11, Ill.

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ADULTS: 105 Canadian 10¢; approvals. Daleti, Box 832, Moncton, New Brunswick.

105 DIFFERENT U.S. only 25¢ Approvals. inc. Shelton, P.O. Box 187-KP, Hempstead, N. Y.

FREE Stamp, catalogs \$2.50! Collection building particulars. No approvals. Holtzman, 95 Terrace, Levittown, Penna.

"OLD Glory" in flaming colors! U.S.A. flag giant beauty from Honduras. Enormous United Nations Mexican stamp. Plus strange gorilla issue. Duke of Windsor. Morocco lovely Macao flowers, wild buffalo stamp and others, 10¢ with approvals. Sunny Stamp, Apopka 2, Fla.

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GIGANTIC Collection free. Includes triangles, early United States, animals, commemoratives, British Colonies, high value pictorials, etc. Complete collection plus big illustrated magazine all free. Send 5¢ for postage. Gray Stamp Company, Dept. PM, Toronto, Canada.

WEIRD Diamond shape coffee stamps. Lively flower triangle! First American big commemorative. Greenland, Idol Dancer, etc. 10¢ with approvals. Capital Stamp Co., Ferrysburg 2, Michigan.

1000 WORLDWIDE Mixture with commemoratives, pictorials \$1.00. No approvals. Delorme, 954 Chatham East, Windsor, Ontario, Canada.

RARE Hawaii stamps, all over 69 years old. From Monarchy and Republic. 10 different in set \$2.50 ppd. Others available. Stewarts Hawaii, Dept. PM, 1140 Kona, Honolulu, Hawaii.

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BUY Your U.S. stamps at 10% less than most other places. Catalogue 20¢. New-Way Stamp, Lawrence, Mass.

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REAL Old U.S. seconds, Bargain prices. K. Swartz, Maiden Bridge, New York.

V A T I C A N, Israel, United Nations. Pricelists, Zampino, 2055 West Tenth, Brooklyn 23.

FREE Russian with approvals. Richard Stroud, Box 162, Limestone, Maine.

SUMMER Special 1000 worldwide stamps \$1.00. 3500. \$3.00. No approvals follow. Harrison's Stamps, 1435 First Ave., Oakland 6, California.

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SCREWBALL Fish in natural colors; Pan, the Goat man; Egypt, Mother's Day; Crawley Bugs set; jets; Somaliland flower garden; French Model; U. S. Revolutionary War free while purchasing approvals. Stamp Farms, MS-45, Oxford, Wis.

101 DIVERSIFIED British Commonwealth 10¢. Approvals included. Niagara Stamps, St. Catharines 501, Ontario.

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FREE! Send now for catalog of new and used photographic bargains. Dept. 1-H-6, Central Camera Company, 230 So. Wabash Ave., Chicago, Illinois.

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REPAIRS Photographic equipment. Free booklet. A1, 1803 Victory Drive, Springfield, Ohio.

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COLOR Movie fans! Low cost—high quality processing our specialty, 8mm. just \$1 (or \$3 with fresh film). Mailed back next day. Craftsmanship guaranteed. Send exposed reel or request free mailers and price list of complete photo-finishing services. Direct Mail Photo, Box 8352-PM, Pittsburgh 18, Penna.

8x10, 20¢ with this advertisement. Don's Photos, Box 84, Brooklyn 19, N. Y.

KODACOLOR developed and each print enlarged \$1.75. Black and white 30¢, up to 12 exp. Kodachrome 8mm. movies or 20 exp. slides 79¢. Send film now or write for free mailers, circular, and free Kodak film offer. Prompt service. Photo King, Box 7185, Dept. 235, Jersey City 7, N. J.

KODACOLOR 12 Exp. \$2.39; 8 exp., \$1.85. Reprints 15¢. B&W 12 exp., 85¢. Indiana Photos, Box 707PM, Muncie, Ind.

2 BLACK And white prints from each picture on roll. 8 exposures 45¢; 12 exposures 60¢. Forty-two years of satisfied customers. Quick service. Lens Photos, Dept. J-4, Janesville, Wis.

KODACOLOR Film 120-127-620, including processing and prints, \$2.95. MBG Photo, Box 537, Toledo 1, Ohio.

A FREE Kodak roll returned with each black and white or Kodacolor developed and printed, fast service, lowest prices, guaranteed quality send for free mailers. Economy Photo Service, Dept. P. M., Box 1111, Albany 1, N. Y.

FAST, Hi-quality finishing. Kodacolor rolls: eight jumbo prints \$1.98. Twelve \$2.49. Twenty \$3.49. Reprints 15¢. Also low B&W prices. Custom Quality Studio, Box 4838, Chicago 80.

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FILMS Developed 49¢. Get-acquainted black-and-white offer. 8 to 12 exposures in jumbo size, 49¢ with this ad. Service 10 to 4. No limit. Bring in or mail. Add 1¢ sales tax. Dean Studios, Dept. A, 913 Walnut St., Des Moines, Iowa.

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MOVIE Camera film: 8mm. roll \$1.50. 16mm. 100' \$3.00. Free processing. Better Films, 742 New Lots, Brooklyn, N. Y.

MOVIE Film! Free catalog! ESO-R, 47th Holly, Kansas City 12, Missouri

16MM. Sound, projectors, films. Sale, rental, exchange. Visit store or write for catalog. National Cinema, 71 Dey St., New York City.

LADY Wrestling. Movies, photos. Free list. Peerless, Box 171-M, New York 13, N. Y.

8MM. Home movies. Free catalog. Midwest Enterprises, P.O. Box 2062, Milwaukee, Wisconsin.

HUNDREDS Choice 16mm sound films. Bargain. Gaines, 13735-PM Victory, Van Nuys, California.



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**TRANSPARENCIES Wanted.** Up to \$500.00 each. For information write American Color, P.O. Box 46372, Hollywood 46, Calif.

**LINCOLN Story** in 500 color slides: Hogdenville, Knob Creek, Gentryville, Rockport, New Salem, Springfield, Washington, Gettysburg, statues, memorials, etc. Sample slide 35¢. Catalogue free. Willems, Box 1515-A, Chicago 90.

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**PLAY Piano** instantly. Newest method course. Send only \$1.00: Music Advisor, 15 Almond St., Gloversville, N. Y.

**VIOLINMAKERS, Repairers.** Fine tone woods and supplies. Also headquarters for violins, guitars (regular and electric) double basses. Send for wholesale price lists. International Violin Co., 414-MPM E. Baltimore Street, Baltimore 2, Maryland.

**SEND Songpoems.** Needed immediately for songs and recordings. Free professional appraisal. TV-Soundcrafts, Box 550G, Radio City, New York 19.

**12" LP Self-teaching record** demonstrating how to play the guitar, accordion and piano \$1.00. Vavro Institute, Inc., South St. Paul, Minn.

**SONG Poems** wanted. Surprising ethical offer. Free recording. Successful Songs, Box 608, Danbury, Connecticut.

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**POEMS** Wanted for musical setting and recording by America's largest song studio. Send poems. Free examination. Five Star Music Masters, 630 Beacon Building, Boston.

**GUITARISTS—Play any song.** New system, 1,001 chords, \$1.00. Trebb Sales, Lcraire, Ohio.

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**LOW Quotes:** Stereo tapes, components, recorders. HIFI, Roslyn 6, Penna.

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

**PIANO Tuning** pays. Learn at home in 30 days. Diploma granted. American Tuning School, Gilroy, Calif.

**SONGPOEMS** And songs wanted! Mail to: Tin Pan Alley, Inc., Box 405, Radio City Station, New York 19, N. Y.

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

**ACCORDIONS, Chord organs, guitars!** Buy direct—save to 1/2. Famous makes. Free home trial. Easy terms. Trades. Free catalogs. Mention instrument. International Music Mart, Dept. R, 2003 Chicago Avenue, Chicago 22.

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**CONVERT** Any television to sensitive, big-screen oscilloscope. Only minor changes necessary. Plans \$2.00. Relco, Box 10563, Houston 18, Texas.

**DON'T** Buy hi-fi components, kits, tape, tape recorders until you get our low, low return mail quotes. "We guarantee not to be undersold." Wholesale catalog. Easy time payment plan. 10% down—up to 24 months to pay. Send 10¢ to: Hi-Fidelity Center, 220-M E. 23 St., New York 10, N. Y.

**RECORDING** Tape wholesale bargain list. West Pacific Distributing, 1301 N. W. Gilson, Portland, Oregon.

**SILENCE** Annoying TV commercials. Inexpensive method revealed for \$1.00. Norm's 1135 W. Arrow, Claremont, Calif.

**LEARN** While asleep with amazing "Electronic Educator" endless tape recorder. Details free. Research Association, Box 24-PX, Olympia, Wash.

**GOVERNMENT** Surplus radios, parts. Picture catalog 10¢. Meshna, Malden 48, Mass.

**FIX** Your own TV. Save 80%! Send for free illustrated chart showing how! We'll include giant electronics catalog. Zalytron, 220-M West 42 St., New York City.

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

**SAVE** Dollars on radio, TV-tubes, parts at less than manufacturer's cost. 100% guaranteed! No rebrands, pulls. Request bargain bulletin. United Radio, 1000-M, Newark, N. J.

**RADIO** Course only \$14.95. Includes all tubes, parts, tools, instructions. Write for full information. Progressive "Edu-Kits" Inc., Dept. 572B, Hewlett, N. Y.

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**MONEYMAKER, Hi-fi** dealers and technicians. Full details. No obligation. William N. Greer Associates, Fifth Floor, Imparcial Building, San Juan, Puerto Rico.

**GLOBAL** Tape Recording Exchange Hobby Club. Most rewarding hobby known for all ages, music, educational knowledge, or small talk. Write Mailway Co., 216 W. Jackson Blvd., Chicago 6, Ill., or 51 W. 35th St., New York 1, New York.

**BIG Savings!** Stereo music on tape. Free bargain catalog, blank tape, recorders, Norelco speakers. Saxitone, 1776 Columbia Road, Washington, D. C.

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**TV, Radio** tubes and parts wholesale. Brand new list free. R. T. M. Co., 508 Clifford St., Flint 3, Mich

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**SOURCE** List directory. For the needs of a nation. Price \$1.00. Buyers Service, 3702 Aurora, Indianapolis 27, Indiana.

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**EARN** Money raising bait at home for us. Guaranteed market! Red Wigglers, Warsaw 20, Indiana.

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**LEARN** To sharpen, repair, and service lawn mowers, also straighten crank shafts intact. Wirt's, 2419 Gnahn, Burlington, Iowa.

**BRONZE** Baby shoes. Genuine electroplating process. Equipment, mountings, instructions. Send \$1.00 for valuable book "Your Guide To Success" bronzing baby shoes, plus complete catalog. Hollywood Bronze Supply, Dept. B60, 3445 Union Pacific Avenue, Los Angeles 23, California.

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**FREE** Sample for magic beautiful green lawn growth. Free catalog showing how to make big money at home business. Sure-grow Company, 1019-6th North, Seattle, Wash.

**HIGH** Earnings cleaning, repairing, watches! Illustrated instructions. Kester, Deckerville, Michigan.

**OPERATE** Profitable home mailorder business. Details free. Alto Distributors, Box 253, Palo Alto, California.

**\$100.00 WEEKLY.** Sparetime home mail order business. Successful beginners plan. L & D, 109 W. 42nd, New York City 36.

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**FRANCHISES** Make profits! Operate your own exclusive franchised business. Write today for free interesting details. National Franchise Reports, W-528, 333 North Michigan, Chicago 1.

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**BUSINESSES**, Resorts, motels, investment property, ranches. Our special service dept. at your disposal. No obligation. World's largest. 58 years' service. Strout Realty, 7-MB S. Dearborn. Chicago 3, Ill.

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**TO \$100.00 Weekly**. Sparetime, home operated mailorder business. Successful beginner's plan. Everything supplied. Lynn, 10420-M National, Los Angeles 34.

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**COPUBLISH** Mail Sale Advertiser, leading mail order paper. Details, latest copy, dime. Vanroy Shirk, Lebanon, Penna.

**OPERATE** Profitable mail order business. Write Walter Service, 4159A East 112th, Cleveland 5, Ohio.

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

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**WORLD'S** Largest wholesale supply. Buy from 679 American, European, Japanese wholesalers. Tailormade suits from Hongkong. 123 dropship catalogs. Rock-bottom prices. Free details. International Buyers, 216-MM Jackson, Chicago 6, Ill.

**11,000 NEW** Prospects daily. Baby record books, shoes, albums. Sell mailorder. Use our literature. Write: No-Co-Ro, Capitola, Calif.

**OPERATE** Home mailorder business. Vosacek Printing, 4444A1 Ute, San Diego, 17, Calif.

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

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**WANT** To make big money at home? \$10.00 profit in an hour possible with invisible mending. Make tears, holes disappear from clothing, fabrics. Steady year-round demand from cleaners, laundries, homes. Details free. Fabricon, 1585 Howard, Chicago 26, Ill.

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**EARN** Money raising fishworms for us! Write: Oakhaven-38, Cedar Hill, Texas.

**MAKE** Money from old tires. Operators clearing \$400 weekly. Equipment costs \$800. Get facts. S & S Patents, Inc., 3511 N. Lincoln, Chicago 13.

**DRIED** Mushrooms \$4.50 pound for large canning company. Receiving warehouse in United States. Growers wanted on contract, everything supplied. Dehydrated Products & Chemicals, No. 548, Calgary, Alberta, Canada.

**VENDING** Machine catalog. Rakes, 609P Spring Garden, Philadelphia 23, Penna.

**YOU** Saw it on "The Price Is Right" NBC-TV show. The all-new Freezer-Fresh "Dairy Bar on Wheels," the most complete high-income producing soft ice cream mobile unit available today. A minimum investment and you are your own boss earning \$8000 to \$12,000 in 7 months. Dept. PM, Tri Metal Works, Inc., Riverton, N. J.

**GARDEN** Golf. Start amusement center. Invest now. Brockway, Box 3762, Portland 8, Oregon.

**AMAZING** Profits in exterminating. Full time, part time. Free details. Baylab 21-M, Cambridge, Maryland.

**SIMPLE**, Pleasant mailorder can net \$12,000 year. Write: Rutward, 2010 Bryant, Columbia Station, Ohio.

**10,000 PROFITABLE** Formulas, recipes, trade secrets. Details free. Colen, 7731-M6 Yates, Chicago 49.

**MANAGE** Motel or resort. Men, women, couples can make \$400 to \$1,000 monthly plus apartment. Pick own location with our employment assistance. Learn at home. Free booklet. Motel Managers Training School, Dept. PMC-62, 612 So. Serrano, Los Angeles 5, Calif.

**FREE** Bulletin. Foreman's Qualifications for Success. Bid. 2630 Midvale, Los Angeles 64, California.

**BECOME** Tax consultant. Graduates earn \$1,000-\$3,000 every tax season preparing returns evenings. State approved. Union Institute, Lakewood M-2, N. J.

**MAKE** Telephone surveys spare time! Free home-business details. No selling, choose your own hours. Telephone Institute, Dept. HC176, 1038 So. La Brea, Los Angeles 19.

**MAKE** Extra money. Big steady earnings, repeat business. Sell advertising book matches, full or part time. New 1962 line. Show glamour girls, colorama, tenorama; dozens more. All sizes. Free master outfit, sales helps, leads, no experience necessary, no investment. Write today. Superior Match, Dept. MX662, 7530 Greenwood, Chicago 19.

**LEARN** Landscaping and the growing of plants. Start a profitable business part or full time. Free information without obligation. National Landscape Institute, Dept. MC-62, 11826 San Vicente Blvd., Los Angeles 49, Calif.

**EXPORT-Import** opportunity, profitable, world-wide, mail-order business from home, without capital; or travel abroad. Established world trader ships instructions for no-risk examination. Experience unnecessary. Free details. Mellinger, D706, Los Angeles 25.

**SECRETS!** Secrets! Mail order success revealed by internationally famous expert who discovered how to make home business fortunes. Beginners: Get free copy "How to Make Money in Mail Order." Disclosed free advertising, profitable products, everything! No obligation. Write Mailco, 1554 Sepulveda, Dept. D706, Los Angeles 25.

**DOLLS!** Dolls! Dolls! We teach you to make, repair, dress and sell. Study at home. Earn while learning. Free booklet. Doll Hospital School, Studio MC-62, 11826 San Vicente Blvd., Los Angeles 49, Calif.

**NEW** Swiss watches \$2.95. Illustrated bargain catalog free. Cosmos, New York 35, Dept. 816.

**MAKE** Big money. Own and operate your own fix-it shop. Service household appliances, motors, mowers, etc. Every neighbor, every stranger your prospect. Millions of appliances everywhere need fixing. \$5.00-\$6.00 per hour often charged by appliance service technicians. Christy's shop manual home training program, illustrated lesson manuals, professional testing equipment sent on special pay later plan. Write for free book. No obligation. Christy Trades School, Dept. A-2603, 3214 W. Lawrence, Chicago 25.

**PROFIT** With Popular Mechanics' subscription plan. No investment, no experience needed. Earnings begin immediately when you obtain subscriptions for Popular Mechanics, Good Housekeeping and others. High commissions, bonus. No experience needed. Deal directly with the publisher. Write Popular Mechanics, Room 2B, 250 West 55th St., New York 19, N. Y.

**LARGE** Profits manufacturing national advertised products in home. Free information. Andrews, East 3823 Liberty, Spokane 27, Wash.

**EARN** Extra cash selling live fishworms from your own lawn. Sensational new "Worm Out" brings them up in broad daylight. No digging! Eight ounce package will produce hundreds. \$2.00 postpaid. Worm Out, 2715N Wymer, Boise, Idaho.

**MUSHROOMS** Quicker, easier, cheaper. Spawn (seed) plus newest manureless growing, various processes, marketing. \$1. Literature free. Luxor, 641 South 19th, Newark 3, New Jersey.

**INTERNATIONAL** Mailorder business made easy. Complete setup service, not just instructions. Hermes, 152 West 42, New York City 36.

**PROFITABLE** Franchises available. New refreshing Sunjoy dehydrated soft drinks. Fast selling. Repeat sales. Spare time. Send \$1.00 for samples, details, sales leads. S. & T. Associates, Box 974, Adelaide P.O., Toronto, Canada.

**START** Your own business on credit. Your own boss, 1199 dealers sold \$5,000 to \$25,500 in 1961. We supply stocks, equipment on credit. 200 home necessities. Sales experience unnecessary. Pleasant, profitable business backed by world-wide industry. Write Rawleigh, Dept. F-U-PPM, Freeport, Ill.

**SELL** Greeting cards. Make extra money. Christmas, all occasion assortments, stationery, gifts, jewelry, name imprinted Christmas cards. Experience unnecessary. Salable samples on approval. Free catalog. Write Hedenkamp, 361 Broadway, Dept. PM-75, New York.

**\$50 WEEK** Spare time possible with herbs. Grow inside-outside or gather wild. Free details. Whitlow, Dept. A-6, 726 Fairwood, Dallas 32, Texas.

**MUSHROOMS** Quicker, tastier, delicious. Spawn ("seed") plus newest manureless growing, marketing, various processes. Complete beginner's kit \$1. Free facts, gladly. Faith Mushroom Co., 932 River Road, Edgewater, N. J.

**WANTED**—Cartoonists. Amateurs, professionals. Over 200 markets. Information free. Maler-B6PM, 11620 Landsdowne, Detroit 24, Michigan.

**FANTASTIC!** Material costs 2 1/2¢, sells \$2.00. Hearing-aid battery recharger (saves 75%). Sample, details \$2.00. Wilson, Box 8386, Birmingham 8, Alabama.

**CANDLE** Making kit, wax, metal mold, color, wicking, instructions \$8.95 prepaid. The Candle House, 4900 CY Ave., Casper, Wyo.

**LEARN** Expert candle decorating, candlemaking. Free details on home instruction method. Candle Institute, Dept. X-703, Fallbrook, Calif.

**UNUSUAL** Opportunity selling fiberglass waterfalls, fountains & garden ornaments. Medium volume yields high income. Jabon Studios, 14847 Bessemer Street, Van Nuys, California.

**\$34.70 TWO** Hours manufacturing concrete products. No selling. Castings =3, Box 1721, Rapid City, South Dakota.

**NOW!** Amazing home mail order business. Details. Kukitz, 369 Spruce St., Coplay, Penna.

**HAVE** Worthwhile mailorder business. Write Rocky Service, N6740 Waterworks Rd., Norfolk 2, Va.

**PACKAGE** At home for profit! We supply everything. No selling. Free home business details. HPC 2212BL Jesse Street, Los Angeles 23.

**ORIGINAL** Ideas for making money. Daring, practical. Exciting particulars, free! Idea House, 46 Asnuntuck, Thompsonville, Conn.

**CASH** From sawdust, tin-cans, newspapers. Over 200 methods. Instructions \$1.00. Charles Company, 42-AK, Norwood, Ohio.

**LEARN** Restaurant accountancy—cost analysis one week. Tremendous profitable demand. Free literature—lesson. National, 146 Capri, San Antonio 1, Texas.

**VITA-SHEEN** Shampoo concentrate. Pint makes 1 gal. extra quality "Golden Rich Shampoo". Makers have been manufacturing superior quality shampoos over 35 years. Send \$1.75 for pint sample now. Delivery charges prepaid U.S.A. Vimco Distributing Company, 314 E. Broadway, Centralia, Ill.

**WORK** At home packaging merchandise. Very profitable. No selling. Everything supplied. Details free. D'Amico, 209 W. Jackson, Chicago 6.

**MAKE \$25-\$100 weekly.** Send \$1 for products sample, refundable. Kay Products Sales, Box 204, Jefferson Valley, N.Y.

**NEW, Exciting home business.** Easily learned. Pays real well. Free literature. Megargel, 10730 Dowry, Tampa 7, Fla.

**INTERESTING Mailorder "Newsletter".** Absolutely free. Nell H. Tasker, Shamokin, Pennsylvania.

**START Making money sharpening saws, tools, knives, scissors, clippers, surgical instruments, etc.** Make \$6.00 per hour. Worldwide users. Grinding outfits \$34.95 up factory to you. Manual furnished. Easy payments. Write Treyco, N. Tonawanda 25, N. Y.

**MAKE Stepping stones.** Tremendous profit. Crabtree, 11025 Jefferson, Newport News, Virginia.

**SELL Jokes, novelties by mail.** Catalogs, details \$1.00. Lachter, 15171-25 Ave., Whitestone 57, N. Y.

**MUSHROOMS Quicker, easier, tastier.** Lambert's pure culture bottle spawn for 50 square feet, \$3.75; 100, \$5.90; 200, \$9.50. Newest manureless growing, various processes, marketing samples. Everything free with orders. Russomanno Co., 517 Nye Ave., Irvington 11, N. J.

**LIQUID Molding rubber, shells, flower-craft.** Free information. Chaney's, 5415-A San Jose Blvd., Jacksonville 7, Fla.

**\$7500.00 YEARLY Operating mailorder business.** Free details. Request free wholesale catalog offer. Coats, Box 1247A6, Ontario, California.

**AMAZING Profits selling mailorder folios.** Free details. Rutward Publications, Columbia Station, Ohio.

**YOUR Own business! Start small! Grow fast!** Unlimited multi-million dollar market. Begin at home, expand to own factory. Sell direct, wholesale, retail. Former manufacturer national line top quality cosmetics, now retired, has compiled formulas for dozen superior creams, lotions etc. Complete simplified instructions only \$3.00pp. Box 1276, Arcadia, Calif.

**LOVE Is money.** 25-year old company will start you in business bronzing, Pearl-Koting, electroplating baby shoes. Free booklet. Dept. PM6, Box 5036, Inglewood, Calif.

**OUTSTANDING Profits possible.** Experience unnecessary. No canvassing. Respectable field. Little time needed. Rush \$1 for complete details, examples of fine profits actually made. The Den, Box 3003PM, Steinway Station, Long Island City 3, New York.

## MONEYMAKING OPPORTUNITIES

**PIANO Tuning learned at home quickly.** Tremendous field! Be independent! Information free. Empire School, Dept. P, Champaign, Ill. (Founded 1935.)

**"HOW You Can Make Money in Rentals."** Landlord reveals trade secrets. Send \$2.00 for bargain booklet to: Money in Rentals, 675 North Hamilton, Pomona, California.

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

**2,500 BIG-Mails \$1.00!** Details free! Hamilton's, Box 1374, Las Cruces, New Mexico.

**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.

**\$35-\$65 WEEKLY Assembling artificial lures at home for stores.** Materials supplied free. Write: Lures, Box 1280, Fort Walton Beach, Fla.

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

**FABULOUS Profits raising earthworms.** Picture folder free. Excello, Kosciusko 6, Mississippi.

**CIGARETTES—Make 20 plain or filter-tips for 9¢.** Facts free. Moberly, Box 4012, Owensboro, Kentucky.

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

**VENDING Machines.** No selling. Operate a route of coin machines and earn amazing profits. 32-page catalogue free. Parkway Machine Corporation, Dept. #26, 715 Ensor Street, Baltimore 2, Maryland.

**EARN Money raising fishworms for us!** Write: Oakhaven—59, Cedar Hill, Texas.

**YOUR Own, easy-to-start, home mail-order business, sparetime.** Fascinating; profitable! Information free. Alfano, 19-PM Pine, Closter, N. J.

**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, MP-528, 333 North Michigan, Chicago 1.

**LEARN The secrets of repairing junk batteries, generators, starters, profitable, easy, at home.** Free particulars. Batterymen, 3465 Forrest, Santa Clara, Calif.

**MAILORDER Business learned easily.** Write: Easco, Box 323, Grand Rapids 1, Michigan.

**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 brings in \$20 a day. Write for full particulars free. Rush name on postcard to Warner, Room CL-2-D, 1512 Jarvis, Chicago 26, Ill.

**FREE! Directory extraordinary money-making home businesses!** Southern Specialty Supply, 1912-PM, Corpus Christi, Texas.

**MAKE Up to \$200 a week or more.** Set your own pace! Get paid top rates every day for each name on lists of past due accounts you send in to us for our firm to collect. General Finance Company, 304X Pickwick Bldg., Kansas City 6, Mo.

**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-D, Chicago 26.

**LEARN Jewelry making at home.** Inexpensive art metalcraft course teaches how to make all types cuff links, earrings, tableware, etc. of silver, gold, copper. Send postcard for free booklet. Interstate Training Service, Dept. L-3, Portland 12, Oregon.

**MAKE \$5,000 Yearly sparetime raising mink, chinchillas, nutria, etc.** Free booklet reveals proved plans. Write: Furs, 588 Mt. Pleasant Road, Toronto 1, Canada.

**ATTENTION! Aluminum concrete yard ornament molds—donkey cart planters, beautiful bird baths, urns, etc.** Prices slashed. Write for information, 25¢. Knapp's, 4257 Josephine Street, Denver 16, Colorado.

**EXPERIENCE Unnecessary.** Earn money with any camera. Twenty different, unusual methods. Information free. Hothem, 106 West Eighth, Columbus 1, Ohio.

**FREE! Money making kit selling guaranteed hosiery.** Sibla, Maspeth 78, N. Y.

**DOLLARS In the mail.** Details 10¢. Bour, 926 Lincoln Way, McKeesport, Penna.

**MAKE Big money raising fishworms.** Free information. Downeast, PM-1, Box 149, Bangor, Maine.

**PRACTICAL Mail order.** Start small. Money-maker, 722-P6, East Silver Spring, Milwaukee 17, Wisconsin.

**CASH From newspaper clippings!** Detailed instructions \$1 (refundable). Reiss, Dept. P, Box 94, New York 52, N. Y.

**EARN \$100.00 Weekly by mail!** Write: Baker, Box 108-P, Sugar Land, Texas.

**MONEY Same day. Not just plans.** No investment. Carry no stock. \$1. Refundable. Rusken-9A, Box 3843, Cleveland 10, Ohio.

## EXPORT — IMPORT

**LEARN Importing!** Get "Foreign Bargains" directory, \$1.00. L. J. Finn Company, 140 Virginia Park, Detroit 2, Mich.

**RECEIVE—Import catalogs! Circulars! Drop-ship opportunities!** Get listed—25¢. Importico, Enka, North Carolina.

**IMPORT Ebony wood carvings direct from Africa.** We can furnish you with authentic price list of 110 items, brief description, approximate size, complete shipping information. Send \$1.00 to: Weslyn Supply Co., 35 Hood St., W. Lynn, Mass.

**SILK Picture and fan.** Each one \$1.50, three \$4.00. Send money to Japan Merchandise Co., N0933 Takasagocho, Katu-shikaku, Tokyo, Japan.

## SCIENCE & CHEMISTRY

**AMAZING New book of science experiments, formulas, and catalogue of laboratory supplies.** Only 35¢. National Scientific Co., 13 S. Park Avenue, Dept. PM-6, Lombard, Illinois.

**EXPERIMENTERS' Dream catalog.** For advanced amateurs in all sciences. It's free. Frey Scientific, 273 Orange St., Mansfield 2, Ohio.

**ROCKETS: New illustrated catalog 25¢.** Single and multistage kits, cones, engines, launchers, trackers, technical information, etc. Fast service. Estes Industries, Penrose 7, Colorado.

**CHEMICALS And apparatus for industrial, analytical, and private laboratories.** Catalog 35¢. Dept. M-50, Biological Supply Co., 1176 Mt. Hope Ave., Rochester 20, N. Y.

**232 PAGE Catalog \$2.00.** Laboratory Materials, 7319 Vincennes, Chicago, Ill.

**ILLUSTRATED Catalog: Chemistry, mineralogy, biology 25¢.** Tracey Laboratories, Evanston, Illinois.

**UNUSUAL Chemistry books, courses, kits! Rare chemicals, cheap! Catalog 25¢.** NSC, Box 11133, Palo Alto, Calif.

**LABORATORY Conversion charts with bigger catalogue—25¢.** Hagenow Laboratories, Manitowoc, Wisconsin.

**30,000 CHEMICALS In stock.** Your order shipped today anywhere. Metropolitan Chemical, 21 W. 60 St., New York City 23.

**ROCKETS, Kits, supplies, propellant chemicals.** Illustrated catalog 25¢. Central Rocket Company, Waupaca, Wisconsin.

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**10,000 PROFITABLE Formulas, recipes, trade secrets.** Details free. Colen, 7731-MF Yates, Chicago 49.

**UNUSUAL Formulas, home businesses.** Write Southland, 401-C E. Jackson, Orlando, Florida.

**FORMULAS For latest money-making discoveries.** New! Good! Valuable literature free! Miller, Chemist, 1517-D, Tampa, Florida.

**FORMULAS—All kinds.** Amazing big catalog, 10¢. Kemixal, Park Ridge, Ill.

**LATE.** Modern manufacturing formulas. List free. Moon Chemical, Martville, New York.

**SELECT List of modern, useful formulae.** List free. Box 161, Waco, Texas.

**RESILVERING Mirrors.** Lookout Mirror, Copper Mirror. All \$1.00. Neiko, 3462-K Merchandise Mart, Chicago 54.

## PLASTICS

**BOXES, Plastic.** 200 sizes. Free list. Althor, 170 Bay 23 Street, Brooklyn, N. Y.

**EZ-MEND! False teeth repair kit.** Save dollars! Do it yourself. Write for free dental plate cleaner. Grant Laboratory, Haas Bldg., Los Angeles 14, Calif.

**VACUUM Form, easy.** Instructions \$1.00. F. Barnes, Box 1971, San Diego 12, Calif.

**NEW Liquid casting plastic, clear, colors.** Embed real flowers, butterflies, photos, coins. Send 25¢ for two handbooks "How to Cast Liquid Plastics" and "How to Make Extra Money at Home." Castolite, Dept. G-101, Woodstock, Illinois.

**PLASTIC Embedding and molding made easy with new Instruction Manual, \$1.00.** Catalog 25¢. Castacraft Corp., Dept. M-662, P.O. Box 555, Palo Alto, Calif.

## AGENTS WANTED

ENGLISH Chamois—low tannery prices. Good profits. Chantana, Lakeland, Florida.

FREE Sample. Beautiful curios! Sell on sight! Apartado 9036, Mexico City.

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

MAKE Up to \$50.00 a day soliciting delinquent accounts. Terrific commissions. Write today. National Credit, 304Y Pickwick Bldg., Kansas City 6, Mo.

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.

BIG Profits. Stamp social security plates, key protectors. Sample 50¢. Catalog free. General Products, 11 No. Pearl St., Albany 7, N. Y.

\$20.00 FIRST Day introducing distinctive personalized doorplate assortment. Complete sales kit free. Reeves, Attleboro 7, Mass.

AUTOMOTIVE Wagon jobbers! New aerosol chemical! Dries ignition systems, penetrates, prevents rust, lubricates. Works like magic! No selling. We give you free samples for your customers, guaranteed to produce orders that repeat. Excellent profits. Details. Product Research, Blue Bell, Penna.

SHOW Your free sample. I give you amazing Leth'R-Test footwear. Show on your feet to 10 people and 5 will buy on sight because of beauty, quality. You'll see! Only \$1.99 to \$4.99, none higher. Guaranteed for one whole year. Highest commissions. Rush your size, state if man's, woman's. Perfect-World Co., Dept. 137, Cincinnati 12, Ohio.

NEW "Magic knife" slices frozen foods, even bone—pays up to 100% profit! Rush postcard for free double-your-money details, special starting assortment discount offers: Dalo, Dept. B-602, 4333 N. Pulaski, Chicago 41, Ill.

AGENTS—300% Profit selling genuine gold window letters; stores and offices. Free samples. Metallic Sign Letter Co., 1217-D West Newport, Chicago.

MAKE Most extra cash with world's biggest line everyday greeting card assortments, gifts. Introduce friends, neighbors, to over 150 assortments, 500 big moneymakers. Pocket up to 100% profit plus big cash bonus. Free giant color catalog; samples on approval. Write Arrow Greetings, 513 Fourth Ave., S., Dept. 83-P, Minneapolis, Minn.

BURGLAR And fire alarms. Salesmen wanted. L&M Manufacturing, 419 Canavan, San Antonio 21, Texas.

SELL Greeting cards. Make extra money. Christmas, all occasion assortments, stationery, gifts, jewelry, name imprinted Christmas cards. Experience unnecessary. Salable samples on approval. Free catalog. Write Hedenkamp, 361 Broadway, Dept. PM-74, New York.

SELL Curios direct from Africa. Tom toms, masks, etc. Different, profitable. Perry, P.O. Greendale, Salisbury, Rhodesia.

MAKE Money by obtaining permission for shipments of guaranteed hosiery on free trial. Complete outfit, instructions free. J. Vogel, 2441 McMillan, Rock Island, Illinois.

VE8 Odorless moth block. Sells 29¢ & \$1.59. Send \$2.00 for starter. Victory Chemical Co., 148 Fairmount Ave., Phila. 23, Penna.

EXOTIC Earrings! Details free. Pair, \$1.00. Ohga, PM-359, Sigakenkusatu, Japan.

STOP Looking! If you like to sell institutions, industry, retail outlets, get details sensational liquid plastic coating now in its 12th year. Use inside-outside, wet or dry surfaces. Top commissions. Write immediately! Seal-Kote, Box 115, Wooster, Ohio.

AGENTS—Dropship or direct sale small plastic adder for shoppers. Details free. Sample \$2.00. Black Eagle, Box 467-P, Brockton, Mass.

TERRIFIC Profits! Sell itself! Golden brass social security card. 3-Color U.S. flags and eagle. Rush \$1.00 (agent's price) for your engraved Perma-Card. Print name, address and Social Security number. Free carrying case and complete sales kit. Perma-Card, P.O. Box 704-CA, North Miami Beach 62, Florida.

DISTRIBUTE Catalogs. Information, sample 25¢. Rusken-9B, Box 3843, Cleveland 10, Ohio.

YOUR Ad in this space will get some good agents for you. Yes, I'll prove it. Write for Folder "A" right now. F. W. Johnson, Classified Advertising Manager, Popular Mechanics Magazine, 200 E. Ontario St., Chicago 11, Ill.

## BUY IT WHOLESALE

FREE Wholesale tool catalogs, Black & Decker, Millers Falls, Billings, Toolkraft, Gold Bond house paint, ladders, wood screws, \$2.00 deposit, refunded on \$10.00 order or refund on catalogs returned. Factory Outlet, P.O. Box 172-PM, Norwalk, Conn.

BULOVA, Benrus watches like new \$5.95 up. Hundreds of other bargains, 30 page illustrated catalog free. Cosmos, New York 35, Dept. 812.

FREE Wholesale catalog! Tools, toys, appliances, housewares, etc. A. Stogsdill, 3 Ivan Place, Alexandria, Virginia.

PLANT Operators. Buy your water treatment chemicals below wholesale price. Water Service Company, 118 North Nashville Avenue, Sheffield, Alabama.

WHOLESALE! Hair pieces for men, small \$59.50, medium \$69.50, large \$79.50. First quality human hair, featherweight. Information: Alamon Importing Co., Route 5, Box 340, Greenville, S. C.

100,000 TERRIFIC Bargains! Tremendous discounts! Wholesalers, 1265-MR Broadway, New York 1, N. Y.

FOR Better health and enjoyment use Ultra-Bio scientific multivitamins. Two months supply only \$3.49. Retail \$6.95. UB Products, 465 Westview Place, Coytesville, New Jersey.

KAPOC Filled decorative pillows for home or car, 13x13 solid colors or prints. 4 for \$3.00, plus 25¢ each postage. Ridge Fabrics, 597 Ridge Road, No. Arlington, N. J.

DEALER Costs. All 1962 cars, \$1.00. Petros, 5404-PM South Mozart, Chicago 32.

NEW Deluxe below wholesale catalog. Automobile catalog and others. Furniture, clothing, housewares, appliances, refrigerators, freezers, washers, dryers, television, radios, luggage, binoculars, hi-fi, stereo, phonographs, recorders, cameras, projectors, musical instruments, sporting goods, toys, tools, typewriters, watches, jewelry. Huge discounts on thousands of name brand items. For free specimen list of actual factory prices—postcard: Selbyco, Decatur 15, Illinois.

FREE! Name brands catalog! Your own high profit business. Sell name brands, full or part time. No inventory, no investment. More than 2,000 name brand items; lowest wholesale prices. Watches, jewelry, cameras, hi-fi, stereo radios-phonos, appliances, housewares, hardware, power tools, luggage, musical instruments, garden equipment, sporting goods, toys, many others. 8 floors of name brands. Million dollar inventory. Orders shipped complete in 24 hours! Send for free, beautifully illustrated catalog now! Separate wholesale price list. H. B. Davis Corp., Dept. PM, 145 W. 15 St., New York 11, N. Y.

WORLD'S Largest wholesale supply. Buy from 679 American, European, Japanese wholesalers. Tailormade suits from Hongkong. 123 dropship catalogs. Rockbottom prices. Free details. International Buyers, 216-M Jackson, Chicago 6, Illinois.

USED And new watches \$2 up. Free list. Southern Watches, 5-PM So. Wabash, Chicago 3.

LARGEST Wholesale supply source in U.S. 15 free catalogs. Furniture, clothing, appliances, housewares, automobiles and accessories, tools, sporting goods, hobby supplies, farm equipment, imports, new products, bargain merchandise. Free details. Associated, Box 108-DD, Lincoln 1, Nebr.

BUY Wholesale. W. Cohen, 4841 North Albany St., Chicago 25, Ill.

ELECTRIC Guitars, amplifiers, wholesale. Free catalog. Carvin PMW, Covina, Calif.

2,000 PAGES Wholesale catalogs! Write: Mosaser, Box 47-B, Newark, Ohio.

OVER 5 Gross assorted, nuts, bolts, washers, screws, fasteners in plastic box \$1.50 prepaid. Over 15 gross assorted \$3.50 prepaid. Factory Outlet, P.O. Box 172-PM, Norwalk, Conn.

## SALESMEN—DISTRIBUTORS

MAKE \$40 A day full or part time with the greatest new opportunity in America today. Beaver Shoes made of Everon. Look like leather, wear far longer. \$1.99-\$5.49 retail. Big commissions. Beaver Shoes, Dept. PM-662, Beaver Meadows, Penna.

SILICONE Eyeglass cleaner 49¢ retail. Big profits. \$1.00 for 3 samples prepaid. Free literature. Brite View, Dept. PM-6, Box 2262, East Chicago, Indiana.

MAKE Extra money. Big steady earnings, repeat business. Sell advertising book matches, full or part time. New 1962 line. Show glamour girls, colorama, tenorama; dozens more. All sizes. Free master outfit, sales helps, leads, no experience necessary, no investment. Write today. Superior Match, Dept. M662, 7530 Greenwood, Chicago 19.

HIGH Commission and bonus. Earn \$100 to \$300 weekly. 30 year old company has openings. List delinquent accounts for collection. Experience not necessary. Permanent. Write Merchants Protective Agency, 1015E Walnut, Kansas City, Mo.

MAKE Extra money selling advertising matchbooks. Free catalog and sales outfit. Matchcorp, Dept. PM-62, Chicago 32.

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-74U, New York 16.

AMAZING Opportunity. New low priced fire alarm protects homes, farms, offices, factories, etc. No wiring—hangs like picture. Pays up to \$1,100 a month. Free kit. Merlite (Alarm Dept.), 114 E. 32nd St., Dept. F-66U, New York 16, N. Y.

\$1,000.00 A Month for making dramatic 3-second demonstration of amazing lightweight Presto Fire extinguisher. New chemical used by airforce snuffs out fires instantly. Only \$4.95. Terrific commissions. Millions want it. Free kit. Merlite, 114 E. 32nd, Dept. P-66U, New York 16.

EARN Big commission full or part time. Build profitable business of your own selling America's largest line low priced business printing and advertising specialties. 360 page catalog samples hundreds of items used daily by business people. Imprinted ball pens low as \$7.95 for 100. Big line low priced union label political printing included. Free sales kit. National Press, Dept. 8, North Chicago, Illinois.

MAKE Up to \$50.00 a day soliciting delinquent accounts. Terrific commissions. Write today. General Finance, 304V Pickwick Bldg., Kansas City 6, Mo.

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.

WE Need agents to sell monuments, markers. Make 30%. Free details. Dobson Memorials, Fort Payne, Alabama.

**REPUTABLE** Direct salesmen needed. Quality product. Sound program. Sundstrand Sales Company, 315-24th St., Rock Island, Illinois.

**BONANZA** (Brand) mechanic's hand soap. Exclusive territory. 25¢ starts. Doc's Laboratories, Burnet, Texas.

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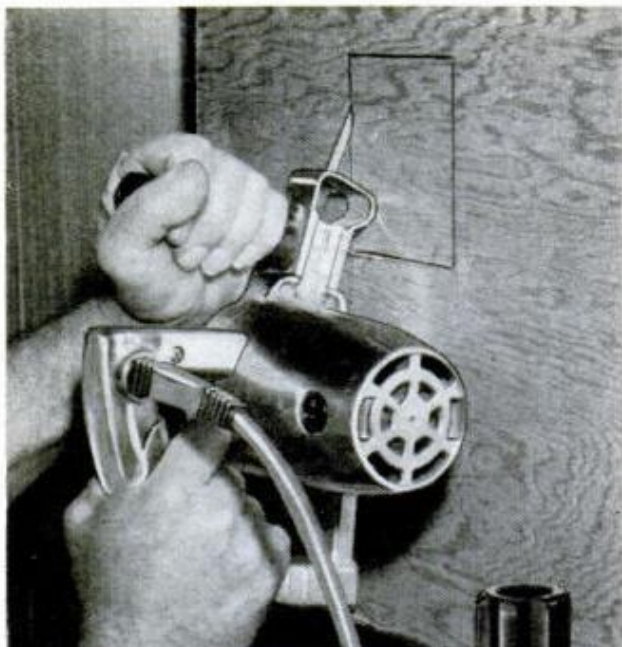
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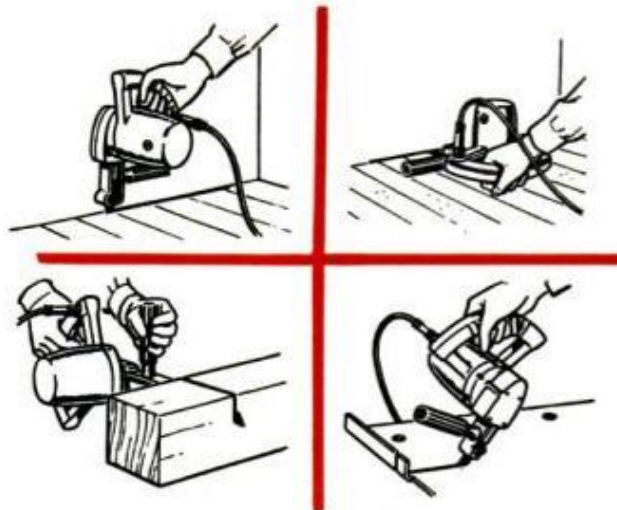
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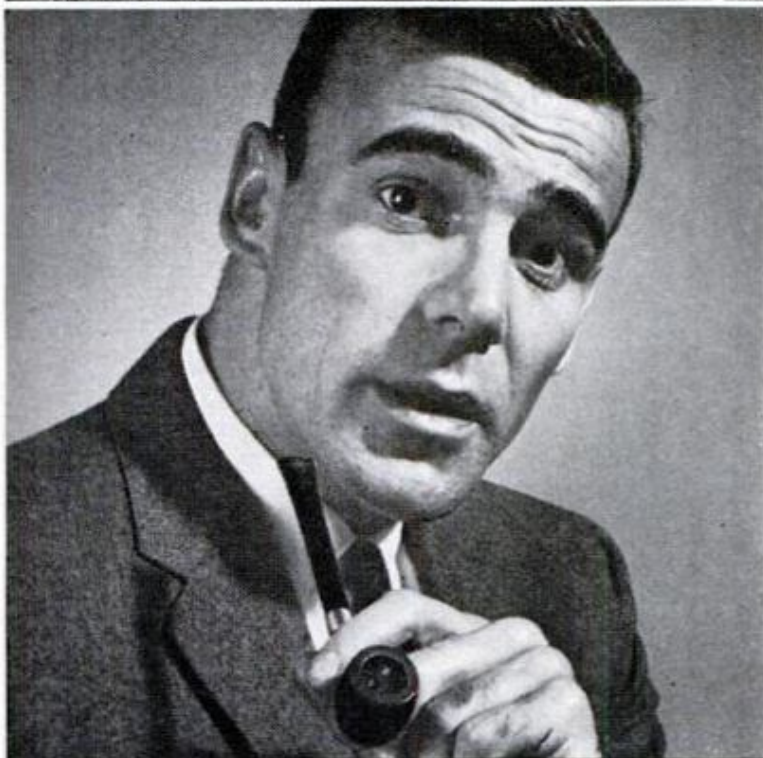
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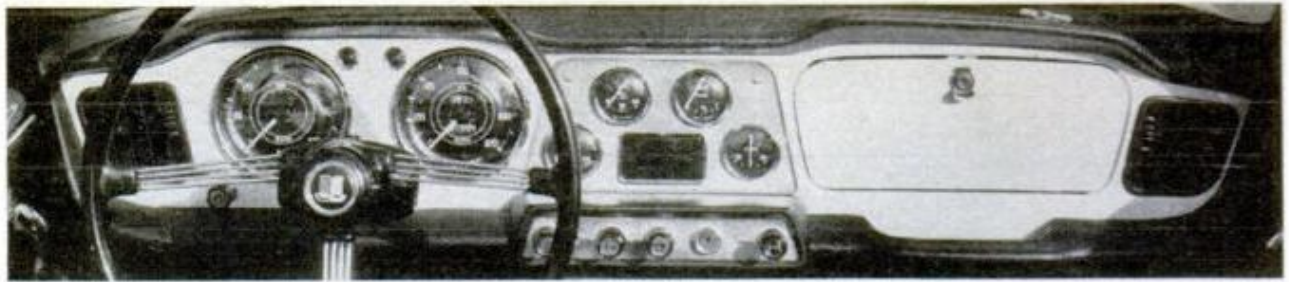
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## SPOTLIGHT on the TRIUMPH TR-4

By Dick Williford



**D**EVOTED "wind-in-the-face" sports car purists can still find a side-curtained roadster or two. Most ordinary motoring mortals feel they're too drafty.

That may be treason, but the Standard-Triumph people are taking no chances. Their TR-4, latest in a nine-year series of sports roadsters, incorporates wide, roll-up windows in a new body styled by Michelotti of Italy. Although less chunky-looking than earlier TRs, the "4" is mechanically similar and unmistakably a Triumph.

Despite the concession to creature comfort, hundreds of racing and rally friends won by the earlier TR-2s and 3s will probably forgive the maker who now offers for \$2849 P.O.E. improved performance and better cornering.

Beneath the forward-hinged hood is the reliable TR four-cylinder, overhead valve pushrod engine with displacement increased from 121.5 cubic inches to 130.5. This has upped horsepower from 100 @5000 to 105 @4750, and raised torque output from 118 foot pounds @3000 to 128 @3350.

This power boost chops the old TR-3's acceleration times across the board: 20 to 40 m.p.h. time is shaved from 9 seconds to 7½; 0 to 50 acceleration from 8 seconds to 7¾, and 0 to 60 down a second to 11.

The TR-4 cuts the quarter-mile well under the TR-3's time of 18 seconds. Top speed is no higher than the TR-3's 110 m.p.h., but the "4's" extra power is felt throughout the entire driving range.

The new windows fit snugly to the windshield frame but seem rather loose where

they join the fabric top. Large panes are used without vent windows or guide channels. This makes for excellent visibility but at the cost of some vibration of the glass.

The absence of window vents or channels gives a real sporty look when the bolt-on windshield is removed and a racing windscreen added for club events.

The TR-4's vinyl canvas top must still be removed, not merely lowered. The hinged, folding top supports swing back and stow neatly behind the rear seat backrest.

The TR-4 also comes in a unique hardtop model (\$2999 P.O.E.) which has a separate, rigid rear window and frame that fits snugly to rear door window edges. A metal top panel bridges the open space above the cockpit between the windshield and rear window structures. An optional fabric top is also available to cover the same area.

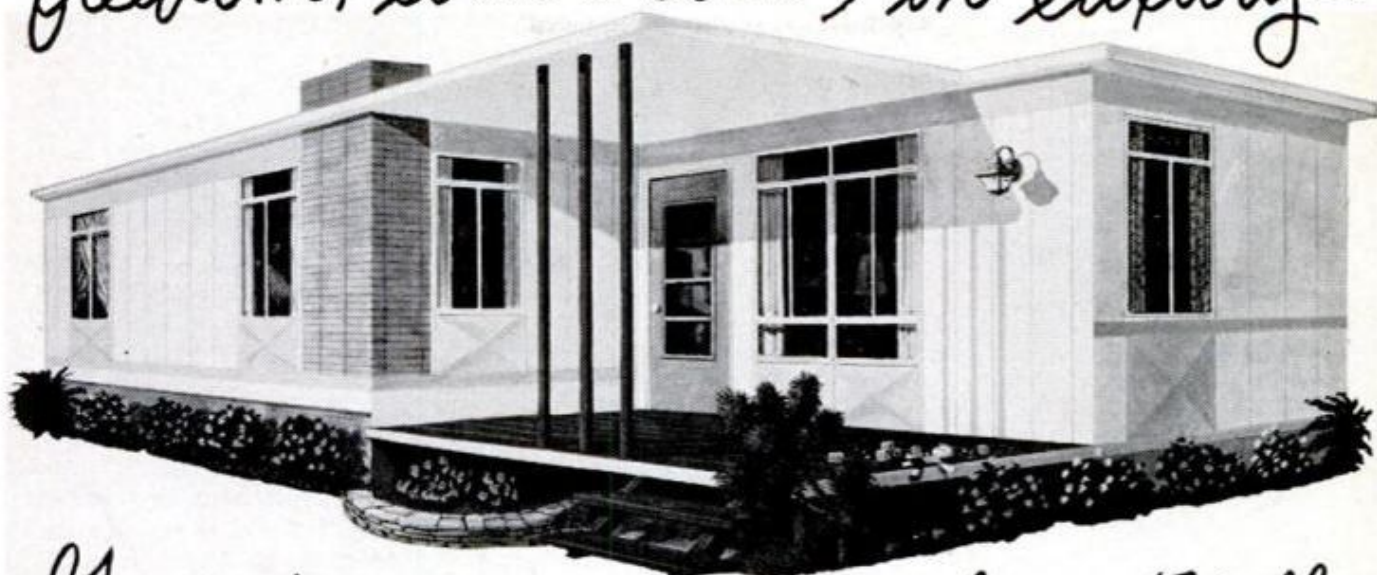
No longer cut down to accommodate the outboard elbow, doors are extra-wide and fully-trimmed, but they could stand sound deadening treatment to eliminate the "clang" when slammed.

There's still only room for small children or luggage in back of the two seats, but the forward area of the passenger compartment has a lot more head and legroom. Seats are the familiar TR leather buckets—comfortable for the average person although the backs aren't high enough to give a really big man proper shoulder support. Seat-adjusting mechanisms work smoothly.


Just a bit rough at lower r.p.m., the engine smooths out at high speeds. Its re-

(Continued to page 62)

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**SQUARED-OFF** styling gives the TR-4 really useful, easy to get at and larger trunk space than TR-3

sponse is good at all speeds and the car will really accelerate when you punch the throttle. Gas mileage on PM's test car was 19-plus in city driving with a tight, new engine. On the open road, steadier-speed fuel mileages ranged up to 32 m.p.g. as the engine began to loosen up a bit and over-all consumption was 24-plus for 1000 miles.

All-around handling and stability in cornering is noticeably improved thanks to wider track; increased from 45 to 49 inches in front, from 45½ to 48 in. at the rear (add another inch on both ends when wire wheels are fitted). New rack-and-pinion steering minimizes road shock; the column length can be adjusted from under the hood, and it telescopes on impact at the wheel.

Ride falls between firm and soft and "bottoming" is difficult to induce. The "4" takes corners faster than older TRs; a slight backing-off on the throttle sets it back on original line if it wanders. The first driving impression reminds one of piloting a TR-3 with the optional antisway bar fitted.

The redesigned gearbox has well-spaced ratios (1st: 3.139 to 1; 2nd: 2.01 to 1; 3rd: 1.325 to 1; 4th: 1.00 to 1), and a much shorter stick-throw.

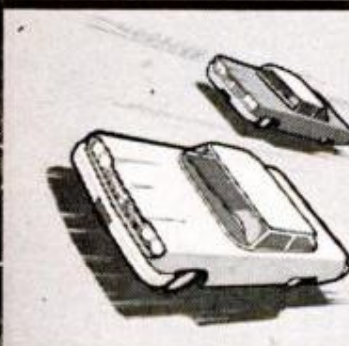
Like most sports-car transmissions, it's pretty noisy and stiff, but former TR-3 drivers will appreciate the new synchromesh on first gear.

In city traffic the car's a real touring coupe: tight, solid, quiet and comfortable. Above 55 though, engine roar, a louder exhaust note and wind noise combine and build with speed.

More expensive (by \$174) than the TR-3, still available at \$2675 P.O.E., the "4" is clearly out of the "around \$2500" price class in which the "3" hotly competes with Sunbeam's Alpine, the MGA-1600 and Fiat 1200 Spyder. For that extra money, however, the buyer gets new styling as sleek as the MG's or Fiat's, roll-up windows for weather seal like the Alpine's, and a car that will outrun all three. ★ ★ ★



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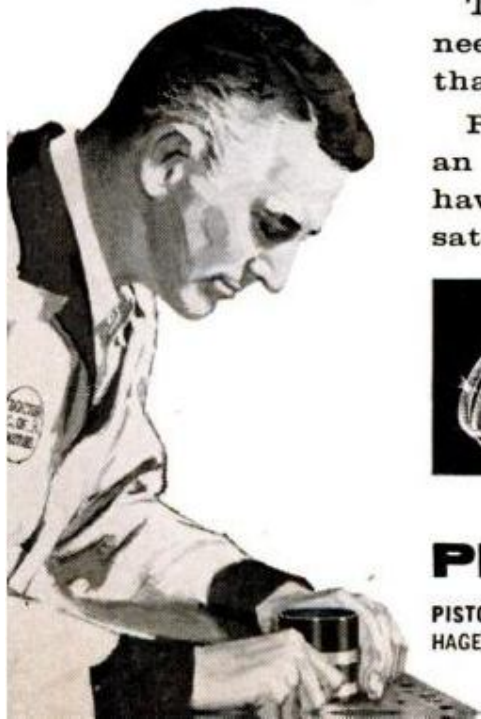
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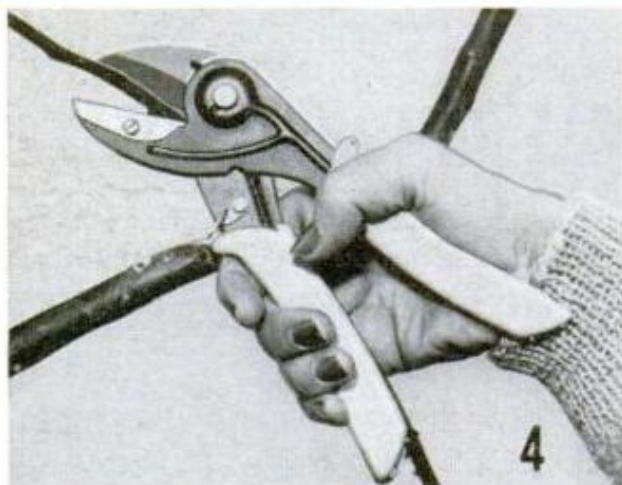
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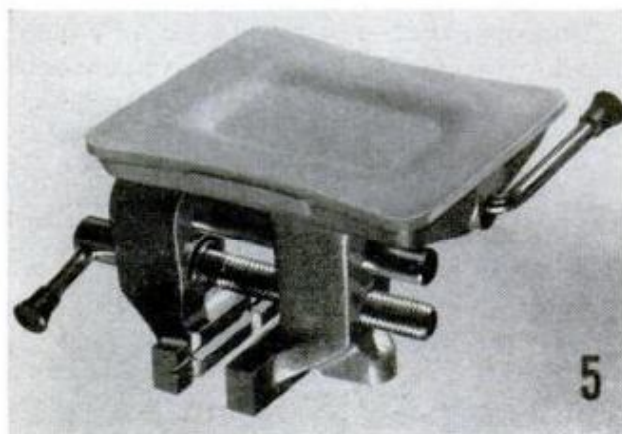
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**2. REUSABLE FILE HANDLES** of acetate plastic, fortified with metal ferrules, are available in six different sizes, accommodating all conventional sizes of hand files. Extremely tough, a nonslip handle is driven onto file with a few quick blows. Handle has hole in top for easy hanging. Eastman Chemical Products, Inc., 260 Madison Ave., New York 16, N. Y.

**3. ONE-PIECE DIAL-THE-CUT** dado head with high-speed-steel teeth is said to require fewer sharpenings, and is easier and less costly to sharpen. If a tooth is accidentally damaged, it is quickly replaced. Head is set up by simply dialing width of groove or rabbet—from ¼ to 13/16 in. Price, \$19.95 by Boice-Crane Co., 943 W. Central Ave., Toledo 6, Ohio

**4. ANVIL-TYPE HAND PRUNER** features tempered steel blade for fast, clean cuts, plus a replaceable anvil. When not in use, tool may be protected by the clear plastic pouch. Pruner is designed with a natural cutting angle head, and grips of soft vinyl insure tireless pruning. Priced at \$1.79 with case. Made by Stanley Tools, 195 Lake St., New Britain, Conn.

**5. VACUUM-HELD VISE** may be anchored to any smooth, nonporous surface (horizontal or vertical, even overhead) by a flip of the finger-tip control lever. Called Vacu Vise, it has great gripping power without using clamps or screws. The 2½-in. jaws are grooved to hold work more firmly. Retail price \$6.95. General Slicing Machine Co., Inc., Walden, N. Y.



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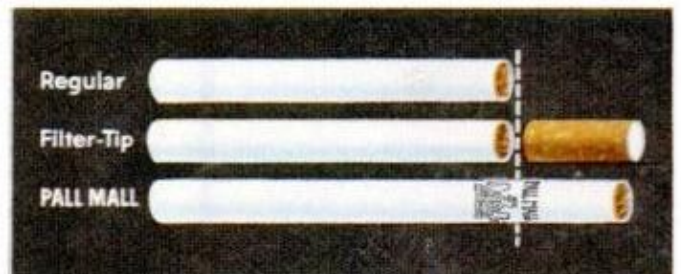
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# THIS BOAT FLIES!

**POPULAR  
MECHANICS**

JUNE

1962

By  
**Richard F. Dempewolf**



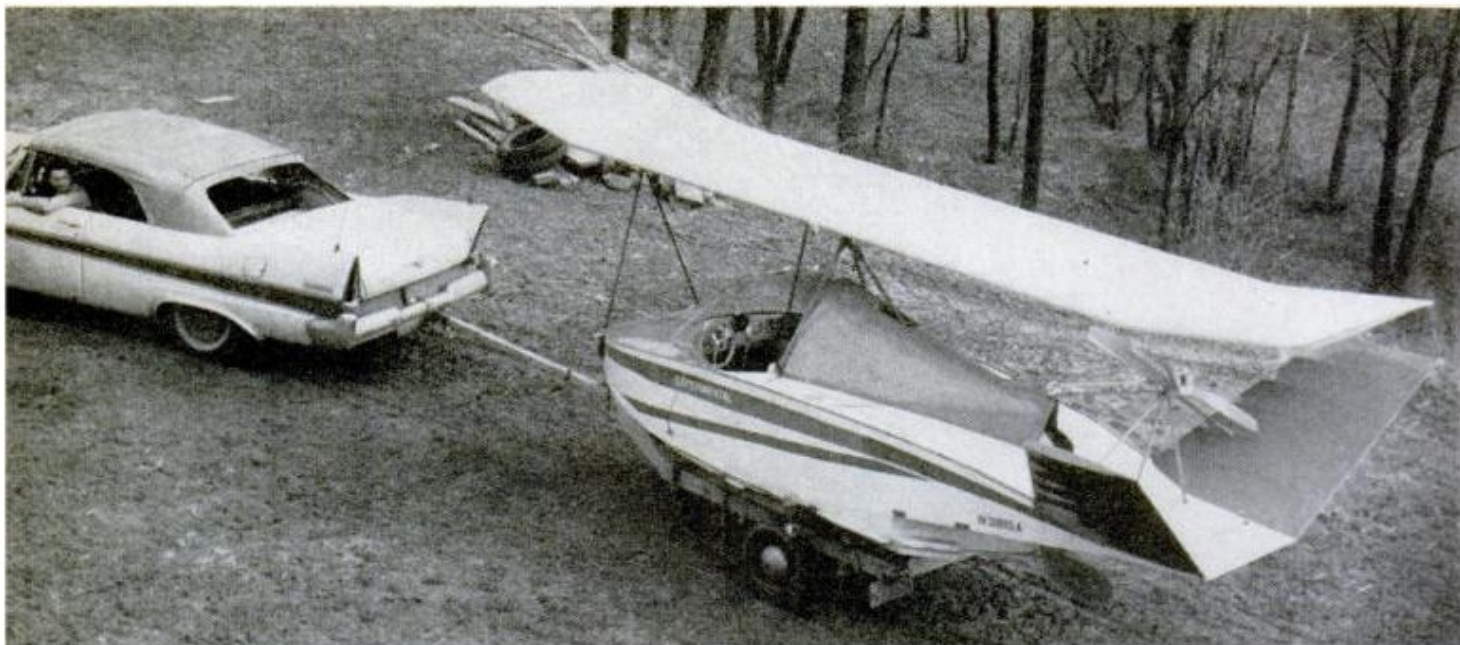
**FLYING BOAT** rests in Chesapeake Bay, scene of its initial test hops. Final tests are due this year

**L**IKE THOUSANDS of other boating enthusiasts, Bob Baier and John Fletcher head for a Chesapeake Bay dock on nice days, with car and boat trailer. At the shore, they back the trailer down a gravel ramp into the water. Their craft is quickly floated, a few details of rigging are attended to, and the sleek planing hull is tied up to a long pier.

Either man may ease himself into the cockpit behind an ordinary

**WINGDINGY PROTOTYPE** (note extra housing behind pilot's seat) proved concept of adjustable wing, V-tail





**1. EN ROUTE** to waterway, WingDingy's wing is folded parallel to hull and trailered same as any other boat



**2. AT WATERWAY**, wing is easily set in place and secured with wire cables. It will now tilt or dip

steering wheel, while the other slips in beside him on the passenger's side. A flick of the switch and a push of the starter button starts the 100-horsepower engine with a roar. After jazzing the foot accelerator a few times, lines are cast off and the hull leaps forward through the water.

Within 20 feet it is planing. Some 12 seconds and 450 feet later, the twin steps on each side of that hull are kissing the wavelet tops with a satisfying staccato tattoo, at something like 60 miles an hour. But this incredible boat has just *barely* taken off.

And "take off" is not just a figure of speech. The speedboat is *flying!* A unique variable pitch wing—that was swung to a fore-and-aft position for its highway journey on the trailer—is now lifting the boat off the water. In a few minutes, Baier and

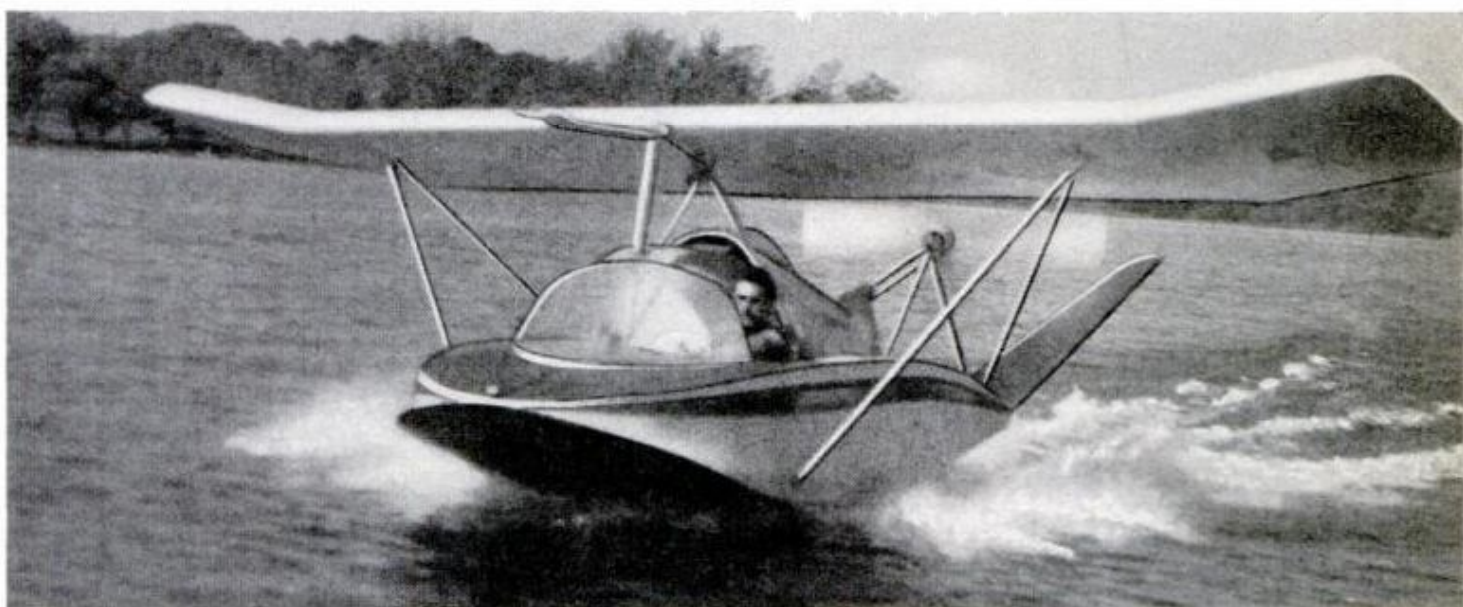
Fletcher can be cruising cross-country 15,000 feet high, at 125 m.p.h. Or they can puddle-jump over the mastheads of sailboats to favorite fishing spots in any of the Chesapeake's millions of bays and inlets.

Official name of the new two-way vehicle is, appropriately, "WingDingy." The prototype already has shown its mettle during more than 100 hours in the air, plus endless hours of skimming along the wave-tops of inland waters at high speed.

Actually, the curious little craft is not a newborn babe. Its inventor, George Spratt, whose father was an associate of the Wright Brothers, launched (and flew) the first version of it in the late '30s. His tiny mosquito-like craft consisted of a light, stripped-down hull with a wing on the top. A small aviation engine in the rear was shafted to a



**3. SET AFLOAT,** WingDingy is backed off trailer at water's edge from shallow bank or from launching ramp



**4. THERE SHE GOES!** Pusher prop powers WingDingy across water. When speed is sufficient, she takes off

pusher propeller that faithfully coughed up revolutions when you pulled the starter rope through a hole in the plywood seat-back. Spratt built the whole ingenious assembly in his Connecticut barn. But it flew, and it speed-boated—for six years, while the engineer-inventor ran it through a rigorous testing program to see if his principles were sound.

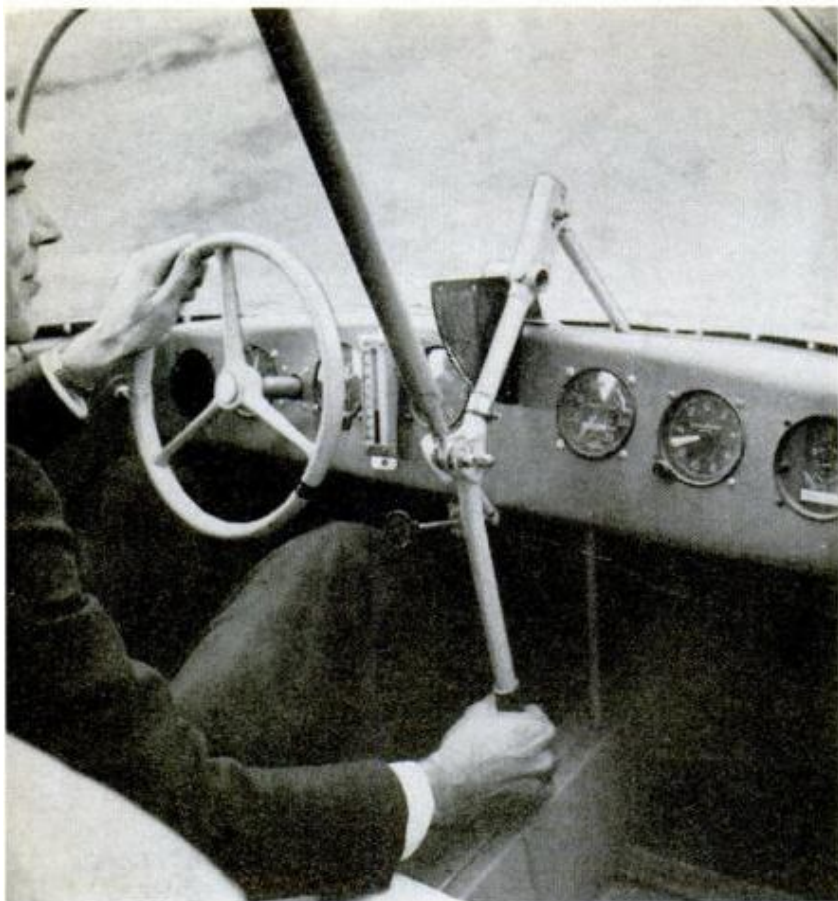
They were. Consolidated Aircraft took out a license to develop Spratt's wing control system for their roadable Convair 103. That was the automobile-airplane that flew through the newsreels and Sunday supplements until nearly 1950, when Convair moved out of the personal-aircraft field.

And there things stood, until a year or so ago, when inventor Spratt and three former Piasecki aeronautical engineers, Edward

Keast, Baier and Fletcher, put their heads together and formed their own Seafight Corporation. Object: To put a WingDingy in the garage (it just fits) of every boating and outdoor enthusiast in the country.

The old one-man flying boat was dusted off and trailered down the highway to a roomy new building in Newtown Square, Pa., where draftsmen on one side of a partition scribed out reams of new engineering drawings. On the other side, the old WingDingy began to acquire a new look.

Today, the stout little craft is a slick, roomy two seater. If you imagine the wing off, you're looking at a beamy, but obviously fast, stepped-hull speedboat. The step does not go clear across the hull bottom, however. It consists of two planing platforms, one on each side, like water skis.



**WINGDINGY'S CONTROLS** include steering wheel, which tilts wing for turns, and speed stick, which controls pitch of wing. In production models, stick will be replaced by small switch

**PITOT TUBE**, located on wing directly above cockpit, is standard equipment on aircraft. Its air intake is translated into air speed which is shown on air-speed indicator in cockpit



"This is still a test prototype into which we are building ideas and changes regularly," Baier explains. "The production prototype, which we hope to have in the air sometime this year, will have a narrower twin-fin tail with a horizontal airfoil between, for greater stability. The wing and hull will probably be aluminum. The cockpit will be fully enclosed and incorporate all of the best design features that prove out in the tests."

The test plane, however, is no slouch for looks or performance. Its steel-framed plywood hull is trim and the fabric-covered 22-foot aluminum wing, with odd dihedral at the tips, has a sturdy appearance. "She grosses out at something over 1200 pounds," says Baier. "There's space and payload allowance for two people with luggage—or they can leave the luggage home and take Junior."

The powerful little Continental engine, located low in the hull for stability, will send the ship scudding through the skies at a maximum 129 m.p.h. Its 25-gal. fuel capacity gives it a range of 400 miles. The five-foot "pusher" propeller sits between the tips of the tail fins, where no "jay-waders" can stroll into it.

Climb aboard, and you're in for more surprises. The black dash panel might be for a boat until you read the names over the neat row of instruments: Air Speed, Altimeter, Climb Rate, Bank and Turn, Tachometer, Oil Heat and Pressure, and Fuel Pressure.

But, with its regular steering wheel, automobile-type foot throttle, leather bucket seats and broad, curving windshield, you feel just as though you were about to drive the latest thing in sports cars.

According to Bob Baier and John Fletcher, it's just about as easy and as much fun to "drive." Whether on the water or in the air, you steer it the way you would a car, step on the gas to make it climb. The speedboat passenger compartment remains horizontal whether the craft is climbing or coming down for a landing. When it executes a turn in the air, the wing may bank 30 degrees but the hull tends to continue straight and level, dangling comfortably below it like a sailor's hammock in a high





**WIRE CABLES** hold the wing in place for flight. The wing is anchored at the center post behind the cockpit. In production models, the builders plan to eliminate the cables, and control the wing entirely from the post

sea. What's more, it's impossible to make the WingDingy loop or perform unusual maneuvers. The harder you try, the more it keeps straightening itself out. By the same token, it can't stall out, or fall off in a spin. Hence the owner's claim that "anyone can 'drive' it."

What makes all this possible—including the unique controls and cockpit design—is George Spratt's "Controlwing." The parasol-type member is joined to the boat by a single universal "pivot" joint atop a pylon behind the cockpit. This is the only major connection between the boat and the wing.

When Baier and Fletcher want to stow the craft in a garage or run it down to the beach on a highway trailer, they unhook two pairs of wire cables, swing the wing around until it covers the boat like a fore-and-aft sunshade, and anchor it in position with a toggle bar.

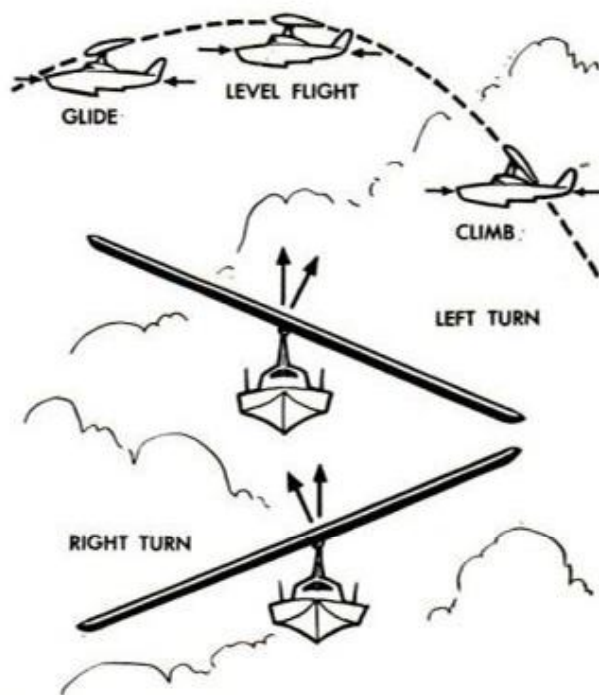
At water's edge, it is swung back, the cables are hooked up and it's ready to go. On the test prototype this procedure takes the two men about 10 minutes. "On the production model," Baier reports, "it will be a matter of seconds, since there will be quick disconnects. And there's no reason why someday it can't be a push-button operation just like a convertible car top."

When you're ready to take off in the WingDingy, you set a speed control at "Landing-Takeoff" position and step on the gas. The wing automatically assumes a low-speed angle of attack as the wind crosses it

and, in just about 12 seconds, you're on your way skyward.

High enough? Set the speed switch for "cruise" and off you go, with wing and wind in balance and your foot on the accelerator determining altitude. If a cross-wind gust comes along, no need to correct for it. The wing does it for you, tilting, dropping, recovering, according to the forces exerted

(Continued to page 196)



**DIAGRAM SHOWS** principles of pitch-and-tilt wing



By Jim Whipple



## Ford's Cardinal is no dead pigeon. Look for new shapes on old compacts in '63

That elusive bird, Ford's Cardinal, although withdrawn as a candidate for production in the U.S., is not a dead pigeon by any means.

The four-cylinder, front-drive "super compact" (i.e. four-passenger capacity, under 2000-lb. weight) is no stillborn Edsel. It was not cancelled because Ford top management feared drastic price cuts by Volkswagen or buyer reaction to front wheel drive.

A simpler and less dramatic explanation is that Ford doesn't feel that the sales prospects at this time would justify the cost of setting up assembly lines and channels of distribution for cars and parts.

Ford, like others, felt the decline in demand for strictly economy cars during the past few months and decided to sit this one out. Another factor yet to be reckoned with is the appearance in quantity of economy compacts on the used-car market. Ready availability of clean, used compacts at \$800 to \$1000 could make the launching of a smaller car like the Cardinal, selling at \$1700, a really rough proposition.

However, we may very well see the Cardinal for sale in the states as an import—much like Ford-of-England's Anglia or GM's German-built Opel. Henry Ford II pointed out, when announcing the Company's decision not to produce the Cardinal in the U.S., that the Cardinal was not conceived solely for the U.S. market and that it could be produced by either Ford of England or Ford of Germany—or both. In Germany, Ford needs a car to compete with Volkswagen, just as Volks needs its new VW 1500 to compete with Ford of Germany's Taunus M17.

Meanwhile, back on the home front, Chevrolet is breaking all records, selling at this writing 30 percent of the industry total compared to Ford's 21 percent. These figures include all Ford and Chevy models including T-Birds, Corvairs and Falcons.

On the basis of the traditionally sized Chevy and Ford (i.e. Galaxie vs. Impala, Bel Air, Biscayne). Chevrolet outsold Ford more than two cars to one—101,000 to 48,000 in February—the latest month for

which figures are available at this writing. Throwing in the intermediate-sized Fairlane adds 22,000 to Ford's total. Adding Chevy II sales increases Chevy totals by 21,000. For the same month period Plymouth sales (minus Valiant) totaled 17,000 plus.

Remember when Ford and Chevy used to race neck and neck right down to the wire? Not so many years ago these two giants were finishing as close as 10,000 or 20,000 units apart in a combined annual volume of 2.5 million cars.

A look into a cloudy crystal ball called 1963 reveals changes of an evolutionary rather than revolutionary nature.

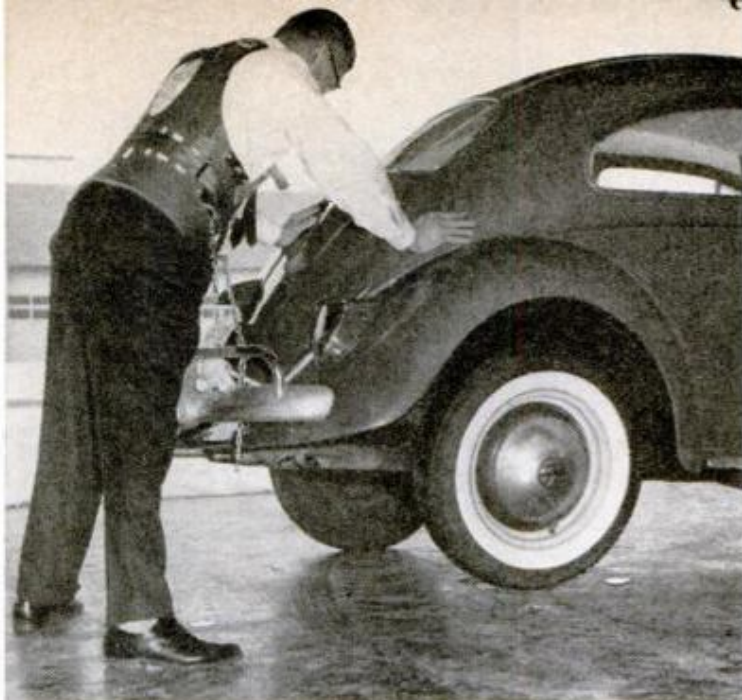
Barring Studebaker's expensive (\$4500) limited production glass-fiber-bodied sports car Avanti (rhymes with Chianti of course!), there will be no new nameplates. Nor, as far as we can see at this time, will any disappear.

1963 will be a year of catching up, as the industry waits to see how many of its thirty different cars catch on, or hold on as the case may be. At present some of the thirty are selling below the break-even point (i.e. in fewer numbers than it is profitable to tool up and produce).

Several of the compacts, now in their third year of production with only minor face lifts, will be due for major styling changes.

In the case of high-volume cars like Falcon, the change will be necessary because the dies from which sheet metal panels are produced wear out and lose their accuracy after 1.5 million or so stampings. On less popular compacts like Valiant, the change will be made because the manufacturers feel that the styling, if not the dies, is tired and needs a change.

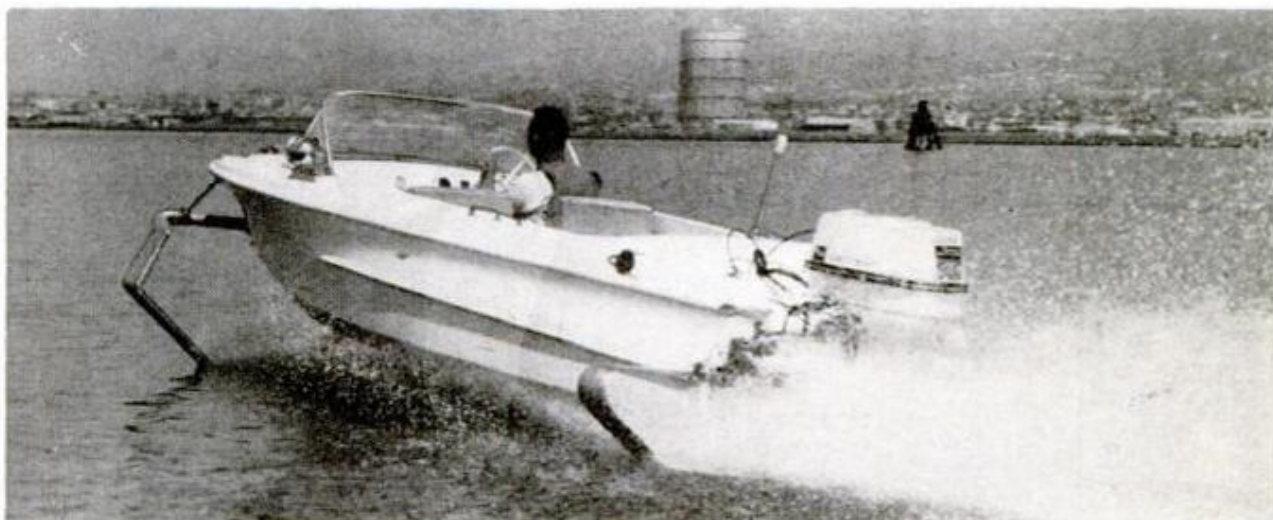
One '63 straw in the wind: Cadillac's new engine block will be 100 pounds lighter but will still be made of cast iron (displacement remains 390 cubic inches, horsepower 325). Aluminum, at least in mass-produced piston engines, has not proved worth the extra cost when reasonably light engines can be precision cast of iron. The public won't pay extra for a premium metal unless it gives premium results. ★ ★ ★



## Hip Frame Raises Load-Lifting Capacity

A new hip pack designed by Bell Aero-systems Company attaches at the wearer's center of gravity and permits a load to be supported directly by the legs rather than the shoulders.

The stiff-but-flexible fiberglass frame allows the average man to tote impressive loads; one test engineer lifted loads up to 600 pounds and carried loads of 300 pounds over distances.



**ON HYDROFOILS**, above, boat shows normal running attitude with long-shaft outboard. Below, 'foils retracted for low speeds



## Small-Craft Hydrofoils

Newest thing in add-on hydrofoils for small boats is a three-point aluminum kit outfit that will increase average boat speed from 10 to 20 miles per hour, and which any boater can install with drill, wrench and screwdriver.

Reversing the usual hydrofoil layout, the new outfit puts one 'foil forward and two astern on either side of the transom. The 'foils are mounted with a shock-absorber and shear pin to prevent damage from obstructions. The kits retail at \$375, f.o.b. Up-Right Hydrofoils 1013 Pardee, Berkeley, Calif.

**OWNERS  
REPORT**

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Poor workmanship  
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**VALIANT'S HORIZONTAL FILLER** neck has been regurgitating fuel on fenders for 2½ years now, to the tune of owner protests

# Swift, Roadable Valiant:

*Marginal and boldface comments by Jim Whipple, PM's Auto Editor*

**At \$47.35 extra, the additional horses cost about \$1 each, making this the best power-boost buy in Detroit** →

**Valiant leads its compact price class in combination of ride, handling and performance** →

**V**ALIAN'T APPEARED in the second wave of U.S.-built compacts in the 1960-model year and won considerable approval as the most versatile of the "Big Three" compacts with which it shared the spotlight in the fall of 1959.

Since that time Valiant has broadened its scope, offering a two-door hardtop and a two-door sedan in addition to four-door sedan and four-door wagon. Another significant change was the addition of a 145-horsepower version of its slanted six-cylinder power plant even though the standard engine of 101 horsepower was more powerful than the standard engines of three out of four of its competitors.

PM hastened to take the pulse of the new Valiant with an owners report (PM, May 1960, p. 89). Comparisons between the 1962 report and that earlier one make for interesting reading.

First of all, we find that Valiant is still liked for the same reasons. Back in 1960 owners mentioned Handling Ease (60.9 percent) Riding Comfort (45.8 percent) and Performance (38.3 percent) as the best-liked features in one-two-three order.

The identical characteristics turned up in the top three places on the 1962 "best-liked" list with percentages as follows: Handling Ease—66.4; Riding Comfort—29.9 and Performance—24.3.

On the debit side of the ledger matters have changed some-



**NOT EVERY OWNER** approved all of Valiant's styling. Front end got most praise, rear fender fins got most boos

## It has winning ways, but owners complain of low mileage and poor assembly

what. Back in 1960 the three leading complaints were: Poor Workmanship (20.0 percent), Body Leaks (19.6 percent) and Poor Gas Economy (15.7 percent).

In the current report Poor Workmanship still tops the list with 10.7 percent of all owners mentioning it. Disappointment with fuel economy follows (9.6 percent) and Insufficient Headroom (8.8 percent) appears third on the complaint list.

But note that *all* complaint percentages are *lower* and that percentage of complaints on Poor Workmanship is down to almost half of the 1960 figure.

As a check on fuel consumption PM ran constant-speed tests with a fuel meter on a V-200 Signet with 101-horsepower engine and automatic transmission, with these results:

26.8 miles per gallon at 30 m.p.h.  
 23.1 miles per gallon at 40 m.p.h.  
 22.6 miles per gallon at 50 m.p.h.  
 21.1 miles per gallon at 60 m.p.h.  
 17.5 miles per gallon at 70 m.p.h.

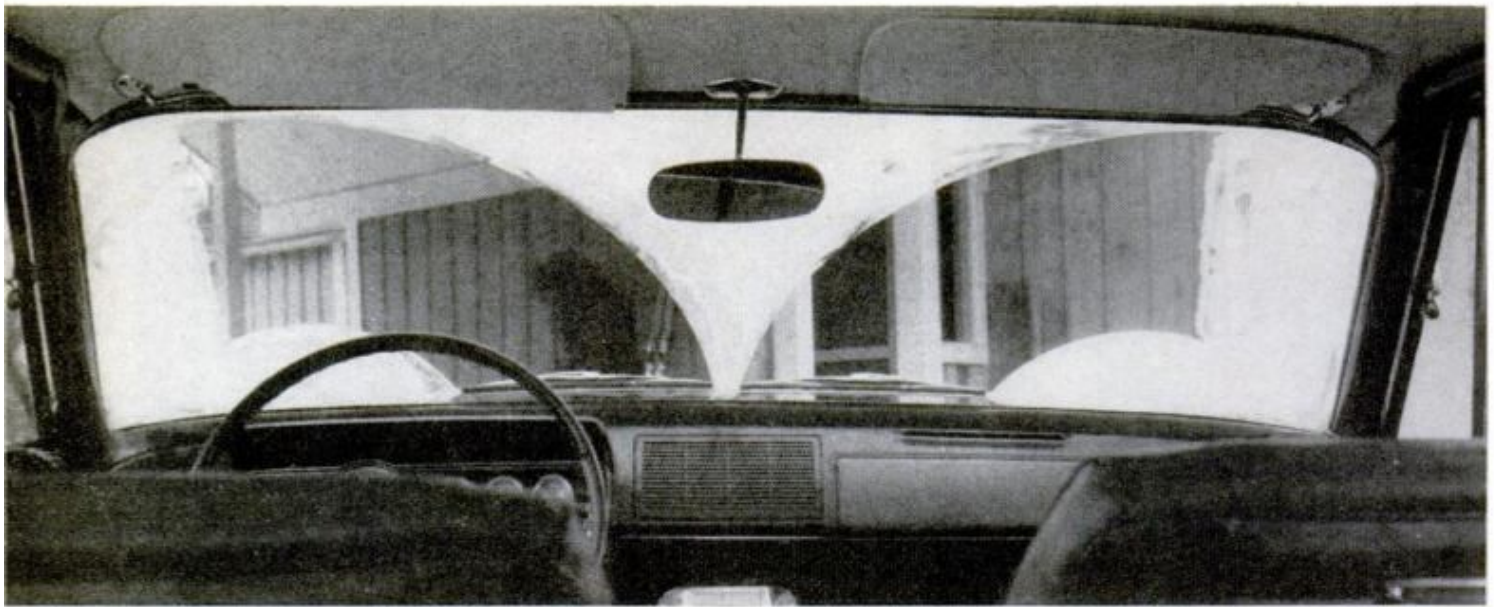
Over-all mileage was 17.83 miles per gallon. Most of the driving was done with snow on the roads and unfavorable temperatures in the low 20s.

Now to the heart of the matter—what the owners themselves have to say about their 1962 Valiants.

*Let's begin on the bright side. Here, in the order of frequency of mention, are the five features most owners liked best.*

← **Most workmanship complaints were on little things—poor trim fit, loose handles, under-dash rattles—items that annoyed rather than alarmed. Payoff is that 80.2 percent of owners would buy another Valiant, only 7.9 percent would not**

← **In top tune and in good weather this power team should do about two m.p.g. better**



PM DOPED the windshield with glass cleaner, then turned on wipers to approximate viewing area under snowy conditions. Unwiped blind spots at sides and center make driving in winter difficult if not hazardous

**We agree. Valiant has an all-too-rare combination of a taut, precise relationship with the road and a really comfortable ride** →

**Valiant's long-trip comfort is a pleasing surprise, but so is Rambler Classic's and Chevy II's** →

"It handles well on the highway and in snow."—Michigan clergyman.

"I like its very precise, almost effortless handling and great road stability."—Connecticut bookkeeper.

"It just has a fine, down-to-earth automobile feel—not like a tank or a go-cart."—Michigan tool and die worker.

"Handles like a sports car."—Georgia engineer.

"Like the easy handling on curves and corners."—Pennsylvania executive.

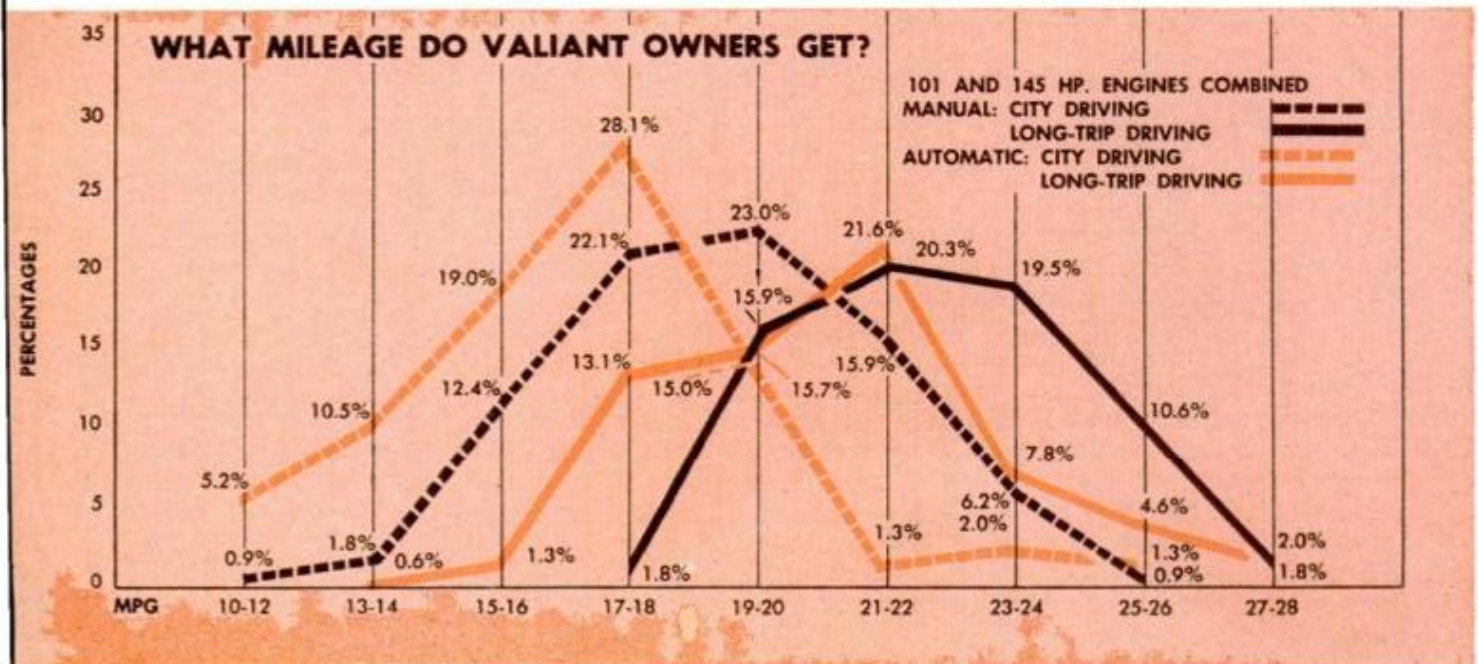
"It gives an extremely smooth ride on long trips, allowing you to arrive without being tired."—California supervisor.

"Very satisfying to drive, not at all as tiring as you might expect a compact to be on long trips."—Connecticut salesman.

"It rides with the comfort of larger, more expensive cars."—Alabama banker.

"The ride is firm, but well-controlled with no tendency to break loose in the curves."—Ohio draftsman.

"Good cruising speed to 75 m.p.h."—Idaho minister.





**LEGROOM'S ADEQUATE**, but 6-ft. 3-in. editor found headroom a "hat's-off" problem



**VALIANT'S TRUNK** swallowed bike with 20-inch wheels, thanks to its high forward end, plus spare tire buried under floor

"It outperforms many V8s (145-hp. Six) and is a pleasure to drive. My Buick sits in the garage."—Ohio electrician.

"I like its lines—it does not have a 'cracker box' look, but more of a Continental design."—Texas Army Medical Corpsman.

"Clean, neat styling with no unnecessary chrome."—New York Coast Guardsman.

"The body lines make it look like a sports car."—Arizona displayman.

"It's roomy for a compact car—a real woman's shopping car."—Pennsylvania housewife.

← *The lines are a happy blend of a number of European styling themes that make the car quite individualistic. It arouses strong likes or dislikes*

← *Its big, low silled trunk just gobbles those giant grocery bags*

**VALIANT OWNERS' RATINGS:**

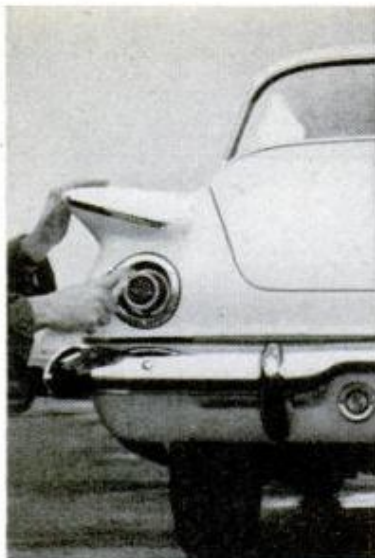
EXCELLENT 60.2%  GOOD 32.7%  FAIR 5.4%  POOR 1.7% 



<b>Satisfied with automatic economy?</b>	101 Hp.	145 Hp.
About as expected	43.3%	61.5%
Better	12.8	14.2
Not as good	43.9	24.3
<b>Satisfied with manual economy?</b>	101 Hp.	145 Hp.
About as expected	57.8%	69.3%
Better	16.9	11.5
Not as good	25.3	19.2
<b>Best-liked features</b>		
Handling ease	66.4%	
Riding comfort	29.9	
Power, performance	24.3	
Styling	20.6	
Compact size	18.4	
Economy	18.2	
Roadability	12.1	
Parking ease	11.6	
Visibility	8.2	
Roomy interiors	7.9	
Solid construction	6.5	
<b>Most-frequent complaints</b>		
Poor gas mileage	9.6	
Insufficient headroom	8.8	
Difficult entry/exit	6.2	
Interior workmanship poor	5.9	
Flush-mounted gas filler pipe	5.1	
Exterior workmanship poor	4.8	
Water leaks	4.0	
Car too light	3.4	
Rearward visibility poor	2.8	

<b>Had mechanical trouble?</b>	
No trouble	64.9%
Some trouble	31.1
Considerable trouble	4.0
<b>What was trouble?</b>	
Carburetor	6.5
Alternator	6.2
Automatic transmission	4.0
Automatic choke	3.1
Heater	2.0
<b>Best-liked exterior features</b>	
Grille	10.7
Front-end treatment	10.2
Smooth, clean styling	9.7
Minimum chrome trim	4.8
Rear deck, trunk design	4.2
Hood styling	3.7
Colors	2.3
<b>Least-liked exterior features</b>	
Rear-end treatment	8.5
Protruding rear fenders	4.0
Rear windows	3.1
Cheap side trim	3.1
Trunk styling	2.8
Grille	2.5
<b>Best-liked interior features</b>	
Upholstery	24.0
Instruments, panel	20.6
Bucket seats	15.8
Comfortable seats	13.6
Heater/defroster	4.8
Push-button transmission	4.2

<b>Least-liked interior features</b>	
Ash tray design and location	11.9%
Glove compartment	8.2
Instrument panel	4.2
Recessed floors	2.8
<b>Did consider buying another compact?</b>	
Falcon	33.5
Corvair	20.5
Comet	18.9
Rambler American	14.1
Chevy II	7.1
<b>Did consider buying a full-size car?</b>	
Plymouth	58.3
Chevrolet	10.0
Ford	10.0
Dart	8.3
<b>Valiant is only car in family</b>	63.8
<b>Decision to buy Valiant based on:</b>	
Performance	57.3
Economy	56.5
Size	49.2
Styling	40.7
<b>How is dealer service?</b>	
Excellent	59.5
Average	31.5
Poor	9.0
<b>Would buy another Valiant?</b>	
Yes, would buy	80.2
No, would not	7.9
Undecided	11.9



**BUMPER OFFERS** scant protection for hard-to-clean taillamps. Low backup lamp soon muddies



**COUNTING DRIVE-SHAFT TURNS** per revolution of wheel to check rear axle ratio might well be standard procedure for owners getting unaccountably low fuel mileage or poor performance. Valiant had proper 3.23:1 gearing

**Here we go again—that old devil oversell! It's not impossible to get 24 m.p.g. with a stick shift Valiant but not in the Colorado Rockies!** →

**It was just the reverse for PM's long-legged Auto Ed.** →

**The raised doorsill is a requirement of unit construction combined with low-roofed car bodies. Detroit believes most people would rather step down and vacuum out rather than own a high, 'unstylish' car. So do we** →

**We suspect that ill-fitting parts are as much to blame as careless workmen** →

**Valiant owners lose enough gas to drive about a quarter mile every time this happens** →

"I am 6 ft. 4½ in. tall and can still sit very comfortably in my car."—Arizona government worker.

*Every "pro" has its "con," and owners are quick to voice disappointments. So here we have the initial group of five complaints—in the order that they were mentioned.*

"I'm not getting enough gas mileage—19½ over-all—the dealer claimed 24 miles per gallon."—Colorado machinist.

"The gas mileage was a great disappointment. It doesn't run well on regular gas—19 m.p.g. with 101-hp. engine."—California homemaker.

"City driving mileage is much too low. I expected to get 18-20 m.p.g. instead of 12."—Washington, D. C. naval officer.

"The mileage (17-18½ m.p.g.) is less than I expected of an 'economy' car."—New York engineer.

"Not enough headroom in the front seat, but okay in the rear."—South Carolina mechanic.

"The 'step-down' body is the biggest cause of discomfort in getting in and out."—Missouri railroad employee.

"I don't like the recessed floor; it's hard to get in and out of. Also it's hard to clean sand and dirt off the floor without a vacuum."—Florida housewife.

"Workmanship is poor where trim and headliner fabric joins."—New York business manager.

"The rubber around interior of windshield looks rough—sloppy installation."—Pennsylvania clerk.

"I have become convinced after examining most other compacts that the Valiant has the poorest finish, workmanship of any."—Missouri minister.

"There's sloppy workmanship on the interior, trim, etc.; windows rattle."—New Jersey art director.

"The paint discolors around gas-filling inlet."—New York sales engineer.

"Gas tank usually overflows when filling, due to angle of pipe into tank through trunk."—New York mechanical engineer.

*Thinking positively again, here is the second group of best-liked features, numbers six to ten, in order of frequency of mention.*

"Every time I go out, I don't have to reach in my pocket to buy gas."—Florida retiree.

(Continued to page 198)



# How to Keep That Pool Clean

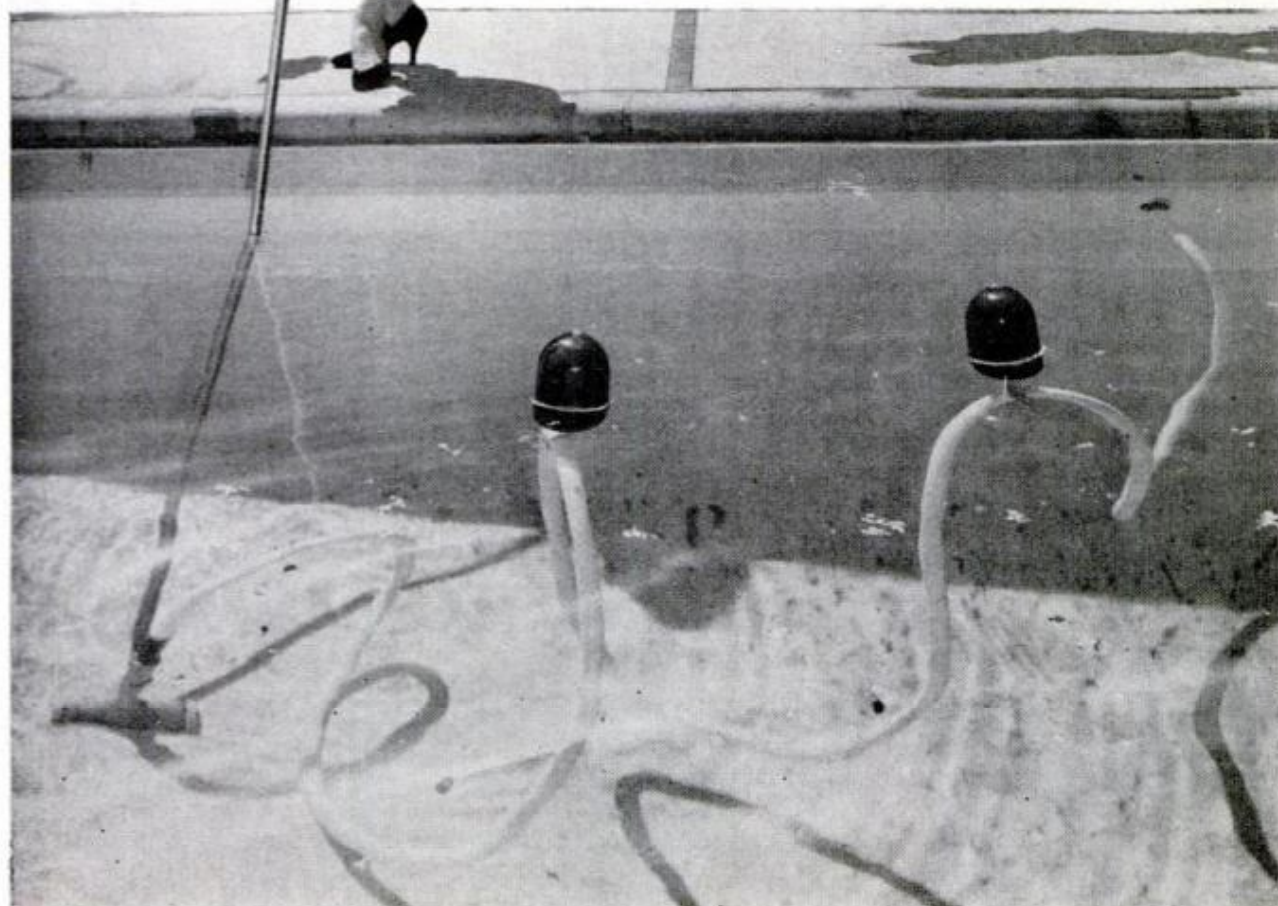
By  
William and Ellen Hartley

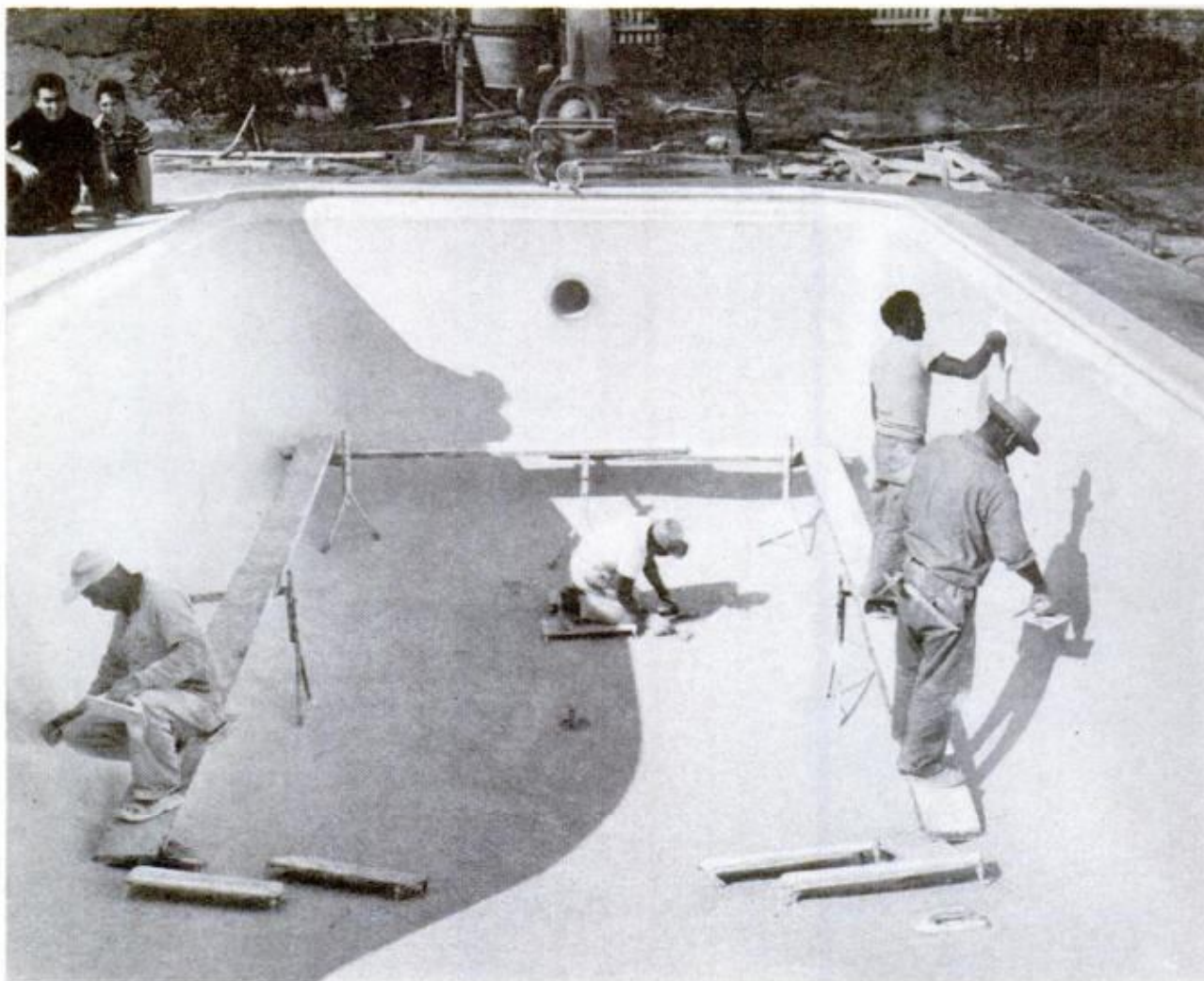
*Even the kids' wading pool can be a back-yard health hazard. Here's how to protect your family fun*



**M**OST ATTRACTIVE swimming pool in the West could well be the title of the famed Glenwood Springs warm-water pool in Colorado. A constant flow of 82-degree hot spring water through the natural stone pool makes it an attraction the year around. Yet in 1959 the pool was found to be harboring the microorganism *Mycobacterium balnei*, the cause of an epidemiologic investigation that had kept public health investigators busy for

**FLOATING HOSE** prevents tangles with built-in pool "vacuum"





over a year. The rate of flow and mineral content of the water had precluded chlorination; the organism flourished in the rough stone walls, and at least 262 swimmers who abraded their skin against the stone suffered a serious skin ulcer condition.

The Glenwood Springs pool is as clean as it looks today, thanks to new smooth walls and a filter and chlorinating system previously thought unnecessary, and to the pool management's cooperation with investigators, who found the management blameless. The case, admittedly, was exceptional, but it could happen anywhere, in any pool, and for every public pool covered by health authorities, there are countless private pools—at least a million and a third—which aren't supervised by anyone but the owners, and can present a real health hazard.

An entirely new clinical entity, swimming-pool granuloma, is blamed on abrasions in unsanitary pools, and a considerable number of other diseases and conditions may be caused by contaminated pools and pool areas or contact with diseased persons through the medium of pool water. How can a swimmer or pool owner protect himself and his friends? Simple good pool management, covering the five basic points of sanitation:

1. The water must be—and remain—clean. All three pool types—fill-and-use pools, like most portable types; continuous-flow pools like that at Glenwood Springs; recirculating pools, with filters—all need some kind of disinfection. Chlorinated city water won't do the job, nor is the risk lessened by showering your swimmers before entering the pool—no shower can remove all the danger, though it helps. The only answer is in some kind of water disinfection.

2. Construction of the pool is a factor. The National Swimming Pool Institute, at Harvard, Ill., suggests several points: Surfaces should be smooth and hard, except in shallow areas, where a nonslip finish is best for waders. The basic over-all design should permit easy, uniform circulation of water, easy draining and cleaning, and a "scum gutter" or "skimmer" should work to remove surface waste from the water. The recirculating system (which includes most "built" or "sunken" pools) should filter the entire contents of the pool in 18 hours or less.

3. The filter, which removes impurities from the water in a recirculating pool, is all-important. For details on filters and their operation, see page 136.

▶  
**FAMILIAR** garden-hose-type pool cleaner uses water pressure to operate carpet-sweeper action, collects waste in a bag just like indoor cousin. Chemical sinks floating dirt to bottom for easy pickup

◀  
**SANITATION** can be partly built into your pool. Make sure surfaces are hard and smooth; inlet-outlet positions allow proper circulation; scum gutter or skimmer is installed to remove debris from surface

▼  
**"FILL-AND-DRAW"** pools need the same precautions as "built" pools; need both frequent water changes and disinfection. A big portable pool can have a recirculating filter and disinfecting system, too





**ORDINARY HOUSEHOLD BLEACH** keeps back-yard pool safe, but any chlorinating system needs testing

4. While automatic disinfecting systems are ideal, simple chlorinating additives that anyone can use will prevent algae and bacteria effectively. A child can drop in tablets or liquid disinfectants, and make the necessary safety tests in minutes with a simple test kit. On warm, sunny days when the pool is in use, the water should be tested several times a day, since it deteriorates quickly on such days.

The same simple test equipment will give the pH factor of the water — its acid or alkali content, which should be kept in a neutral zone between 7.4 and 8.0. Too much acid — a reading below 7 — and swimmers will suffer eye burn and nasal congestion, and the water will smell badly of chlorine.

Maintaining a proper chlorine and pH balance, though, can be tricky. For 95 to 150 dollars, a small percent of the cost of a good pool, you can install an automatic system that will do all the work for you, and which will pay for itself in chemicals saved, cleanup trouble, and remedial sanitation. Bigger units even control the filter.

Other chemicals will do the disinfecting job, though chlorine is by far the most common. Experiments have proved iodine and bromide equal — perhaps superior — to chlorine, with less odor, taste and irritation.

5. Pool housekeeping is as important as any other factor. A sunken pool should be cleaned with a water vacuum and a waste precipitating chemical, and drained regularly for a thorough cleaning. Four to six times a year is par, whatever the pool's location. While it's drained, you can repair cracks before swabbing the walls and floor with a chlorine solution.

Wading pools, portable back-yard pools, and the like can be kept clean easily, but



**SIMPLE POOL TESTER** checks chlorine concentration and pH against a color chart; takes two minutes

many owners don't take the trouble. As a result, their children's pools are sources of infections of the skin, ears, eyes and the respiratory and digestive systems. *The smaller the pool, the more care it needs, since the smaller body of water is most quickly polluted.*

First, change the water often, even daily, if possible. Stress pool cleanliness to the children, especially the younger ones. Disinfection is simple. Ordinary household bleach at the rate of one pint to 1200 gallons of water daily will keep the water safe. Give the bleach half an hour to get into solution before using the pool. Better still, get a simple chlorine-tablet-and-test-kit outfit and use it with regular draining and cleaning. Regular means several times a month, at least, even with the biggest portable pools, unless you use a filter.

Unfortunately, most swimming-pool owners concern themselves mostly with "athlete's foot," which has nothing to do with either athletes or feet, and which has almost nothing to do with swimming pools. The foot baths in swimming pool locker rooms are more to keep the water clean than to avoid the common fungus infections, though they help, as does a regular washing and disinfection of the walks and floors around the pool. Much more important to the pool owner is the realization that, unless properly cared for, his swimming pool will quickly become, literally, a huge bacterial culture for his family and friends to swim in.

Swimming pools, of course, are fun, but without care and policing, they can endanger health. With proper attention to basic sanitation, the pool again becomes a safe delight. ★★★



## Loop-the-Loop Bridge Approaches

Spiral ramps at each end of a new million-dollar toll bridge take automobiles on two complete loops before they can enter or leave the 77-foot-high structure.

Spanning the Ondo Strait, the Ondo

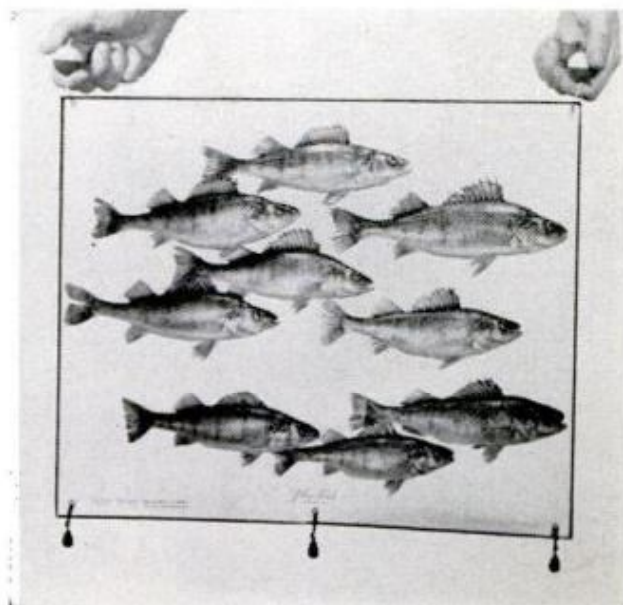
Ohashi Bridge connects the islands of Kur-ahasijima and Honshu. The bridge, which took two years to build, allows 1000-ton class ships to pass beneath it. The bridge is 564 feet long, not counting the ramps.

## Snap-in Extra Gas

Owners of Volkswagens and other imports can carry reserve fuel in the Junior Gas Can, a 2-gallon, zinc-coated emergency container that doesn't steal storage space—it snaps into the spare tire's wheel rim. Its flat shape also makes for easy storage under a boat seat. The Junior has a collapsible spout that requires no funnel and a self-locking cap to stop leakage. Price \$9.95 from Midwest Imports, Box 988, Chicago 90, Illinois.

## Decoy Lures Fish

One way to beat the odds in fishing is to attract the fish to your spot. The Tru-Fish decoy, designed for that purpose, is a 17-by-22-inch sheet of clear plastic imprinted with full-color reproductions of nine yellow perch. Lowered into the water it attracts schooling panfish and bigger predators who feed with or on perch. Floats and weights hold it upright; tether line controls its depth. It sells for \$4.78 from Tru-Fish, 2930 E. Bonnie Brook, Waukegan, Ill.



# Discover the Fun of

WHEN WE BEGAN to cover our vast new state of Alaska, we learned to camp and fell in love with it as a sport. Like most campers, we soon had a mountain of conventional camping equipment, which we spread out nightly in camp grounds and roadside parks and packed up each morning as we went on our way. We thought it was great, mostly because it never occurred to us to try any other way.

Then one evening eight years ago we sat talking with a mountaineer friend who had just returned from a successful climb of

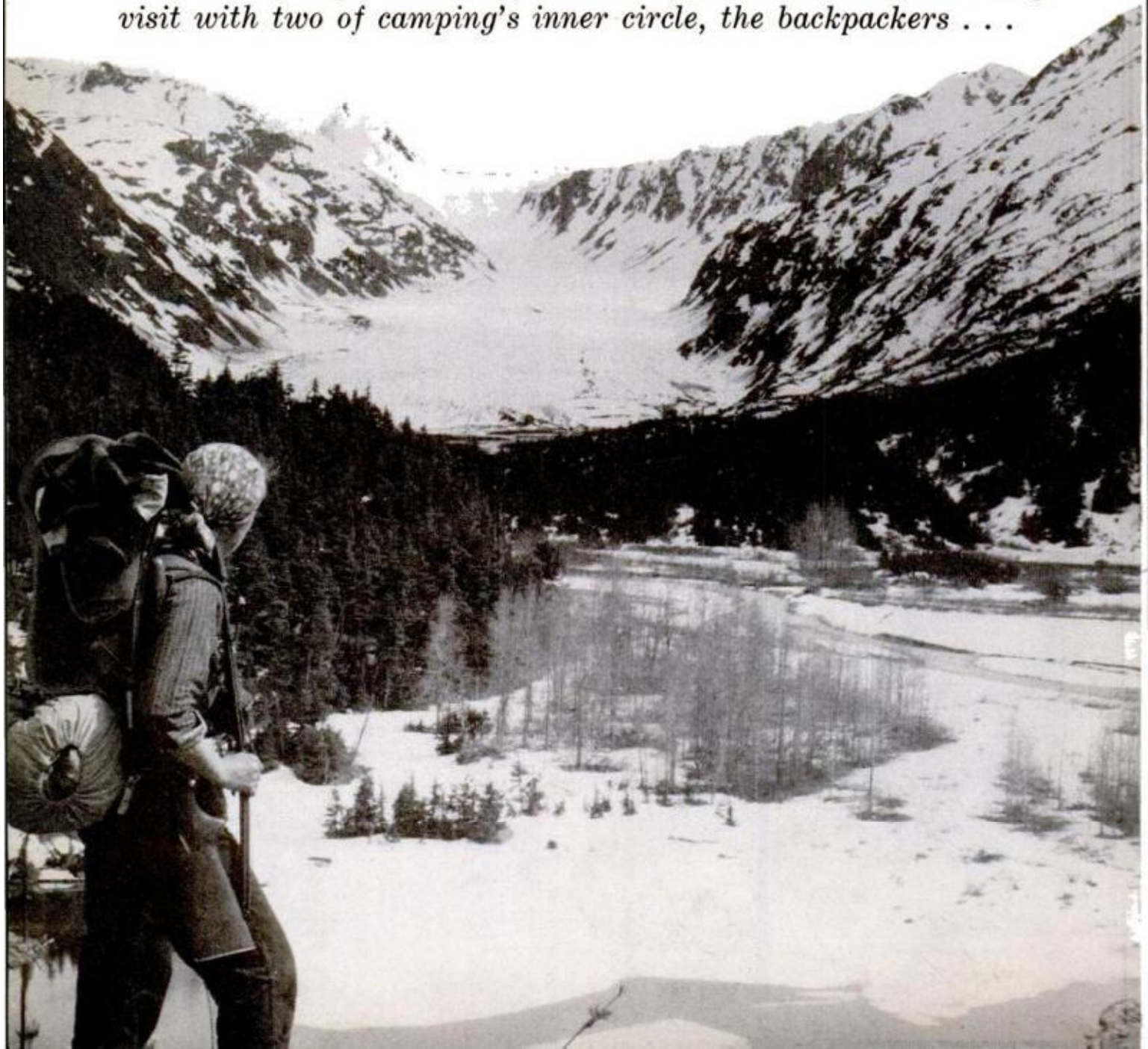
Mt. McKinley. His tales of the trek through the wilderness and the climb itself held us spellbound.

"It's a great life—the wilderness life," he said, his tanned face beaming. "What you two should do is spend your summers hiking the back country here in Alaska. You wouldn't have to climb mountains. Hiking itself is a lot of fun."

Well, why not?

We could start backpacking—doing our camping away from crowds for a change . . . fishing remote streams . . . exploring

*Every sport has its purists—witness the dry-fly fisherman, the bow hunter, the sailboater. Despite their self-imposed limitations, they have more fun than anyone. Here's a rewarding visit with two of camping's inner circle, the backpackers . . .*



# Backpacking

the wilderness . . . having a chance to rely on our own resources. It sounded great.

"All you'll need to get started is a two-man mountain tent and some packs," our friend continued. "I'll get you the addresses where you can order them.

"There's a new pack on the market you'll want. It has a contoured aluminum frame and nylon packsack. When it's packed right it allows you to walk straight—not bent over like you have to with a rucksack or old-style packboard."

When our backpacking equipment ar-

**By Bob and Wilma Knox**



**FRAME, OR SKI PACK**, is among the easiest to carry; holds load on aluminum frame and rests weight on a canvas strap on the back. This model is Army surplus

**"EVEREST" FRAME** is fine for heavy toting; weighs almost nothing itself and works like the frame. This aluminum and canvas model doubles as a camp chair





**ULTRALIGHT** two-man tent weighs only five pounds; packs in 6-by-16-inch roll; sets up in a few minutes

rived it was a revelation to a couple of car campers. The packs were unlike any we had ever seen. They weighed under three pounds, fit like a glove, and carried more than far heavier packs. The tent was made of nylon and Egyptian cotton, and had a sewed-in floor and mosquito-net door to make it just about bugproof and weather-proof.

Rolled, the tent measured sixteen by six inches and, along with sectional aluminum poles and aluminum stakes, weighed just over five pounds. It was easily set up—the poles inserted A-frame fashion in tabs along the front—and it could be securely anchored; both features are of immense help for getting through a stormy night.

We learned the value of another piece of equipment on a 12-day hike through the Chilkoot Pass country. Three days out one of us fell while fording a swift glacial river and nearly drowned. Among other emergencies, this meant continuing minus a sleeping bag lost in the river.

Our three-quarter-length, 28-ounce air mattresses saved the day. We covered them with ponchos, for warmth underneath, and spread one sleeping bag over the two of us. Despite temperatures below freezing it was a comfortable, warm arrangement.

The sleeping bag itself was no great loss since we were using surplus Army bags—adequately warm but heavy and bulky. The mountain bags we now use are made of rip-stop nylon, constructed mummy fashion, filled with two pounds of down, and weigh three pounds each. They are warmer but lighter and far less bulky.

While tents, packs, air mattresses and

sleeping bags are important to the back-packer, the item he uses most is his boots. We learned the importance of proper foot-gear on a fall hike up Penguin Creek, in the Chugach Mountains near Anchorage. Overhead, the scenery was a melody of colors, but underfoot the ground was slippery from frost and dampness. One of us took a bad tumble that might have meant a trip-spoiling injury. We lost no time in having those boots equipped with rubber lug soles.

These soles help us on everything from hard-surfaced roads to icy mountainsides. Inside the boots, we wear light cotton socks, (always a natural fiber next to your skin) covered with heavy wool or part wool socks, an arrangement we have found highly practical. We also use foam rubber inner soles. These provide extra cushioning and have another value in fording swift, glacial streams where it is impossible to see your footing. Now when we ford, we remove our socks and inner soles, replacing them on the other side. The boots offer protection crossing and the dry socks and inner soles mean comparatively dry feet when we resume walking.

Aside from footgear, we have few preferences in clothing. On a short trip we don't carry changes, and for a two-week trip, never more than one change of socks and underwear. We prefer to do laundry occasionally rather than add weight and bulk. We dry it on our packs as we move along.

Tricks to save the last ounce of weight weren't part of our backpack knowledge when we made our first long hike. Our packs bulged with a large supply of canned

(Continued to page 180)





**BACKPACKERS** learn early to pick light supplies. Dehydrated food at right weighs 24 ounces; same amount in stack at left weighs 7½ pounds, but the food value is the same; the excess weight is all in cans and water



**STOVE**, with two pots, deep lid and windscreen rack, weighs only 40 ounces. Aluminum bottles carry gas; four ounces will last at least 45 minutes

**ALUMINUM FOIL** may be the backpacker's best friend; it makes a thousand temporary utensils but weighs little. Here's the author's folding reflector oven



JUNE 1962



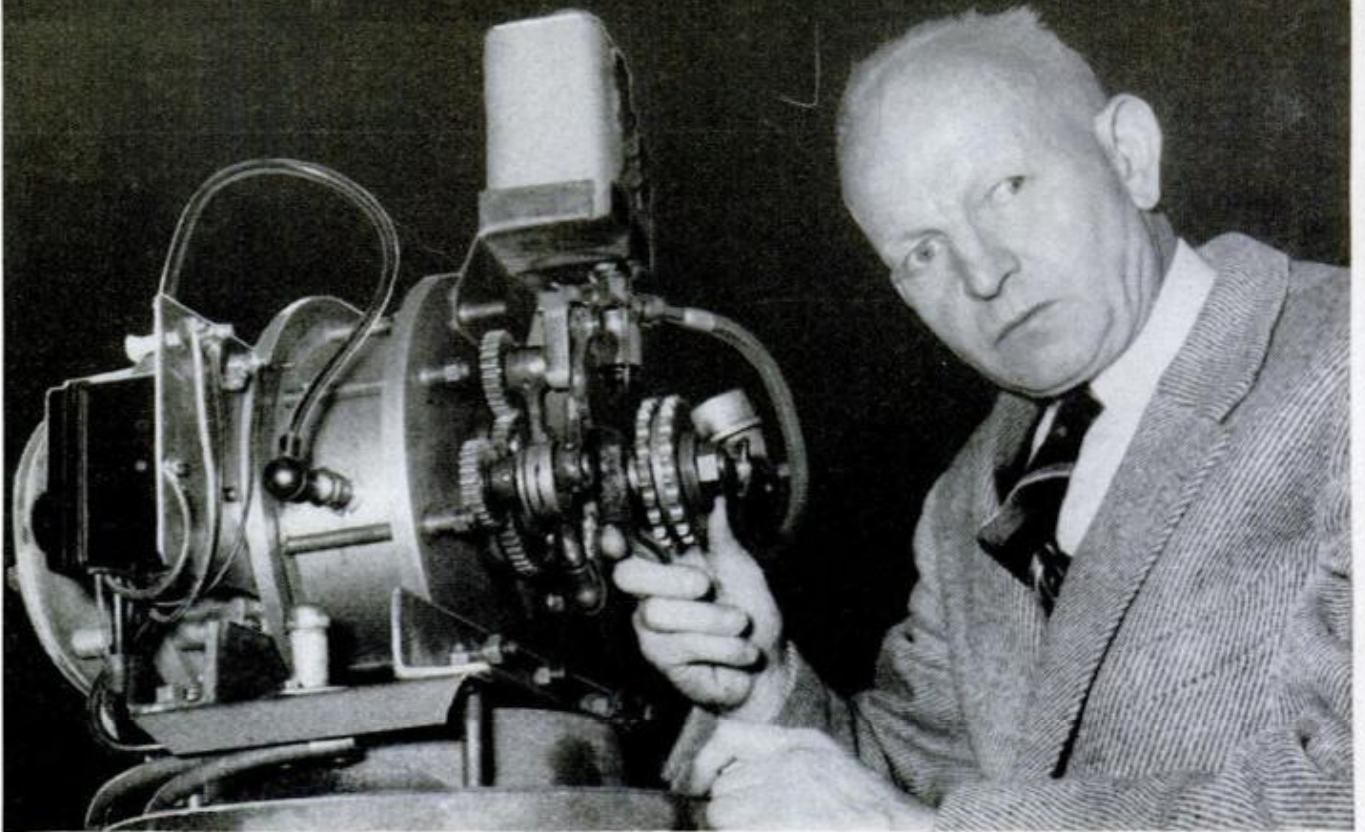
**LIGHTWEIGHT** goose-down-filled sleeping bag, right, is lighter and smaller than bulky synthetic-filled bag, also keeps sleeper warmer on coldest nights

**BOOTS** with rubber lug soles, worn over the right combination of socks, are the most important item in the wardrobe for comfort and safety on the trail

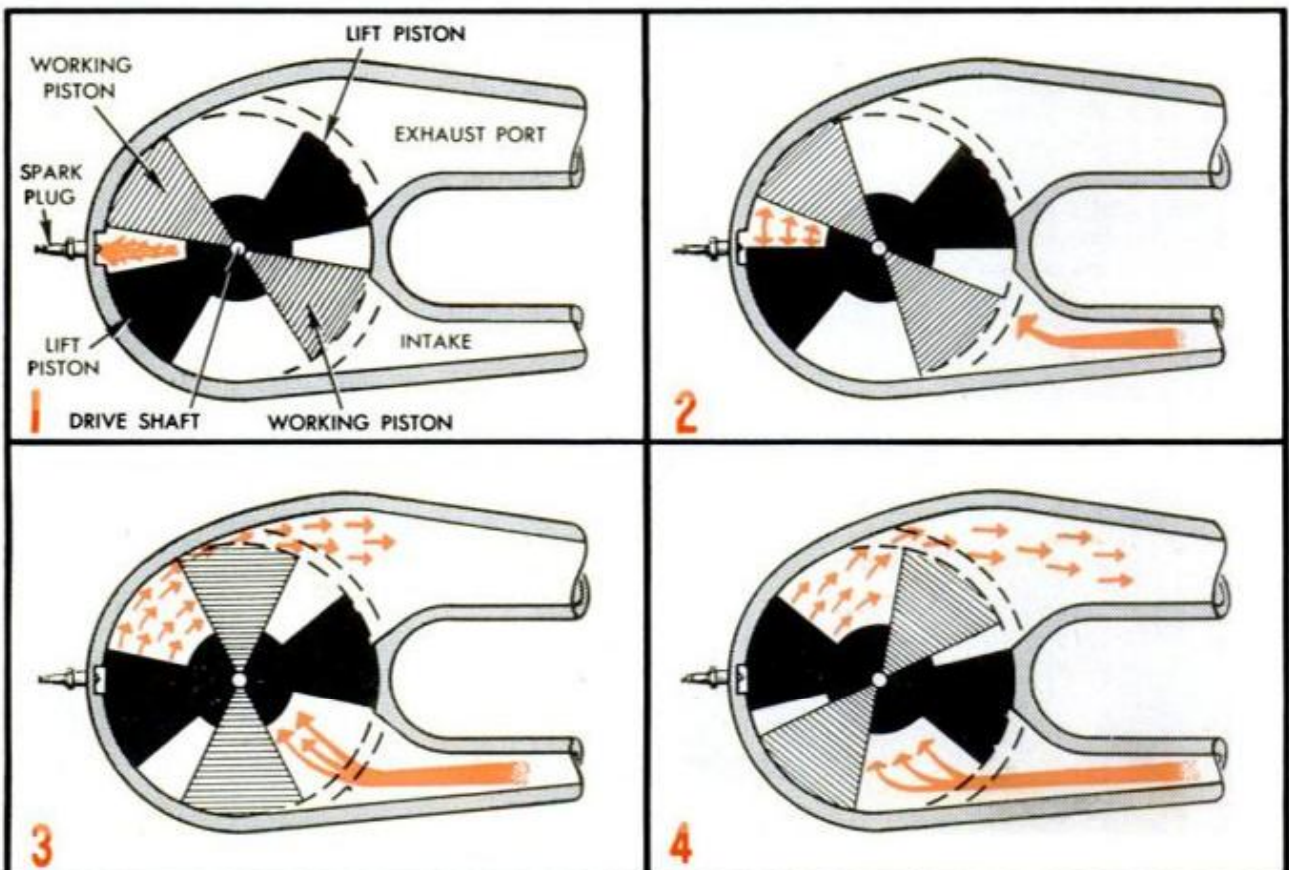


87

# Those Rotary Engines:



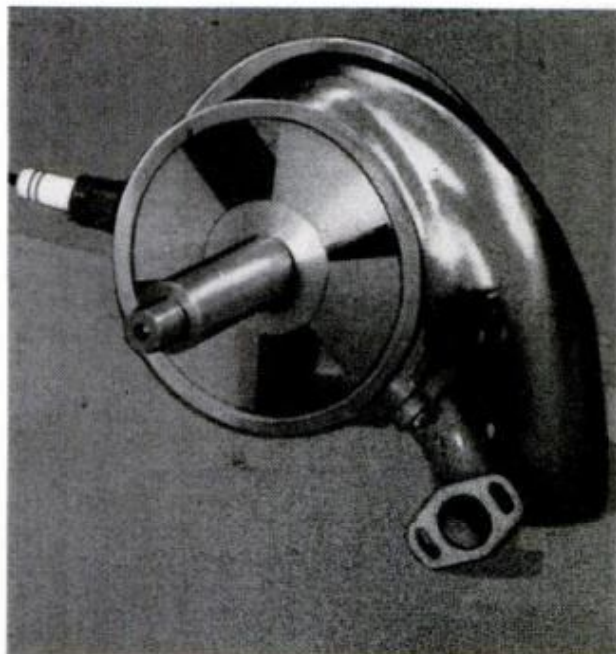
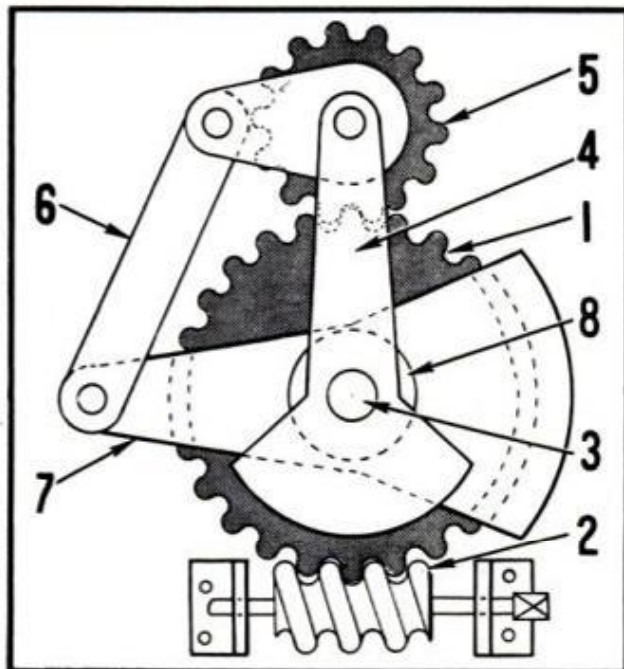
EUGEN KAURTZ holds the drive sprocket of his unusual rotary combustion engine. Note control gearing  
**MAJOR INTERNAL PARTS** of the Kauertz engine. Wedge-shaped pistons rotate clockwise in the drum-like housing as text explains. Actual prototype has an external water jacket which is not shown in these drawings



# Round Two

By **Heinz Schlichting**  
PM's International Editor

*New design solves sealing problems which have plagued rotaries, produces over two horsepower per cubic inch of displacement*



**LEFT ABOVE,** Kauertz control gearing. As working piston turns crankshaft (3) clockwise, its lever arm (4) moves gear (5) which also rotates clockwise through contact with teeth of sun gear. Since smaller gear (5) has only 14 teeth to sun gear's 28, it rotates twice as it travels around rim of big gear, pulling or pushing connecting rod (6) to control relationship of working piston lever (4) and lift piston lever (7) which is connected to hollow shaft (8). **Right above,** small version of Kauertz engine with end plate removed shows working and lift pistons, two concentric shafts, spark plug, small intake manifold and larger exhaust manifold

**TWO AND A QUARTER** horsepower per cubic inch! One horsepower for each 4.5 ounces of engine weight! Constant torque throughout a speed range of from 60 to 4000 r.p.m.!

These are some astounding claims made by West German engineer Eugen Kauertz for his two-vane, four-cycle rotary internal combustion engine, which has no valves. It does have four power strokes per revolution of the crankshaft—for each working chamber, if you will! Yet the inventor says there are no unbalanced masses, and the 'valve' timing can be changed while the engine is running!

Such claims should be enough to make engineers anxious to know more. More impressive to laymen, though, might be the fact that a large American corporation, known for its practical and hardheaded business operation, is now a working partner on the development of a power lawn mower which will use the Kauertz engine.

With a displacement of only 46.8 cubic inches and only 22 parts, the prototype of

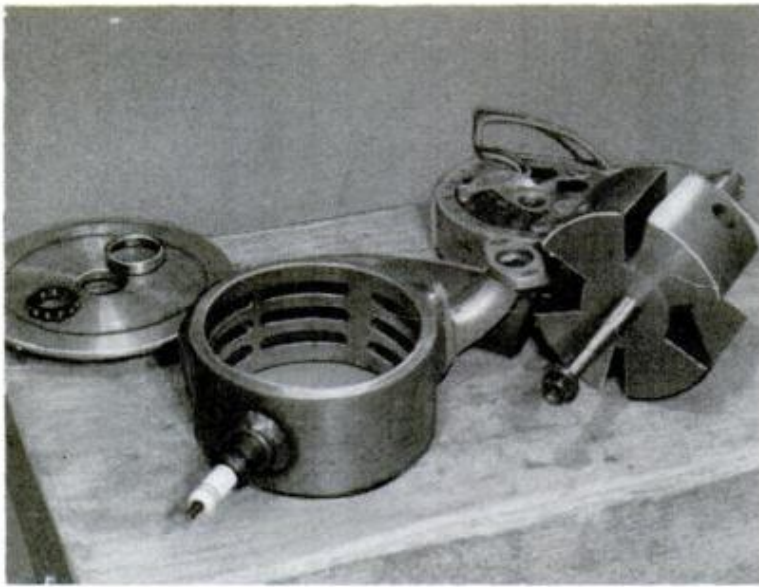
the Kauertz engine has been test-rated at 105 horsepower at 2800 r.p.m.

That such performance is more than a matter of idle curiosity to engineers becomes obvious when you compare it with a relatively efficient (and far more expensive) conventional piston engine—the plant that powers a Ferrari Grand Prix racer. With the aid of multiple carburetion, ultra-high compression, overhead camshafts and magneto ignition, the Ferrari manages to crank out one horsepower for every 1.64 cubic inches of displacement.

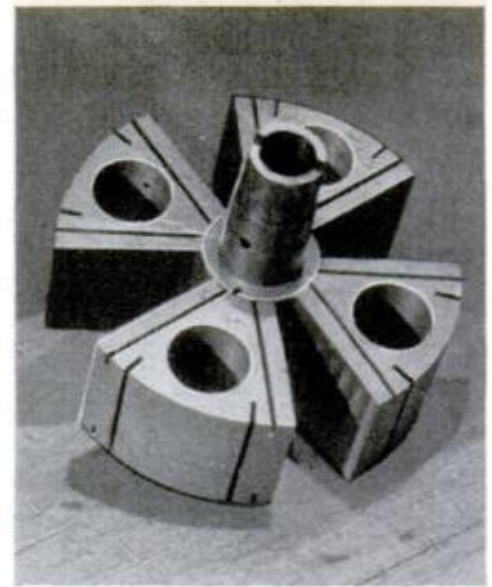
And it is displacement that is the standard of measurement for internal combustion engines—how much power can be extracted from a given unit of fuel.

On the question of fuel consumption, inventor Kauertz claims that the 3 oz./H.P.h. test results obtained with his first prototype are only about a third the usual value obtained with conventional piston engines.

How does the Kauertz engine work? The diagrams on page 88 show the basic principles. The working chamber, equivalent



**DISASSEMBLED ENGINE.** End plate and bearings are at left of main chamber housing containing exhaust port slots at left, intake slots at right. Note pistons far right; spark plug in foreground



**HEART of engine is vane piston assembly.** Here lift pistons attached to hollow shaft are at top left and bottom right in photo

to the entire cylinder block of a piston engine, is a round drum closed at either end and completely water jacketed.

The two shaded wedge-shaped vanes make up the working piston which is fixed to the drive shaft. The two black vanes make a reaction or "lift" piston, which is fixed to a sleeve or hollow shaft that revolves freely around the drive shaft.

To understand how the opposed vanes swivel on their common axis, visualize a pair of electrician's pliers and another set of jaws in place of the handles. Or study the photograph on page 91.

Note from the diagram on page 88 that there are four spaces between the opposed pairing of black and shaded piston vanes. As these pistons rotate around their common axis, they move at different rates of speed so that the spaces between vanes grow alternately larger and smaller, changing displacement just as cylinders in a conventional internal combustion engine do when the pistons rise and fall.

Each space, then, acts like a "cylinder" so that each single-chamber Kauertz engine is in effect a four-cylinder engine.

Now let's follow one of these "cylinders" through its four cycles.

Figure 1, on page 88, shows ignition of the gases compressed between working piston and lift piston.

Figure 2 shows the two pistons moving apart as they are driven by expanding gases. Note that in the chamber 180 degrees opposite the pistons are also drawing apart, increasing their displacement and commencing the intake stroke.

The working piston travels in a clockwise direction and as the burning gases expand, it is driven faster than the black

lift piston. In spite of the explosive force driving these pistons apart, the black lift piston is also traveling a clockwise direction, but at a slower rate of speed. The control mechanism that effects this differential motion is the secret of the Kauertz engine, as we will explain in a moment.

In Figure 3, the combustion stroke is completed and the burned exhaust gases flow, via slots in the chamber wall, into the exhaust ducts. Meanwhile, 180 degrees away, the intake stroke is nearing completion.

Figure 4 shows the shaded working piston as far ahead of the black lift piston as it can go. Then the control mechanism will reverse the sequence and permit the black piston to "catch up" and squeeze out the exhaust gases while compressing the mixture which is almost completely drawn in below.

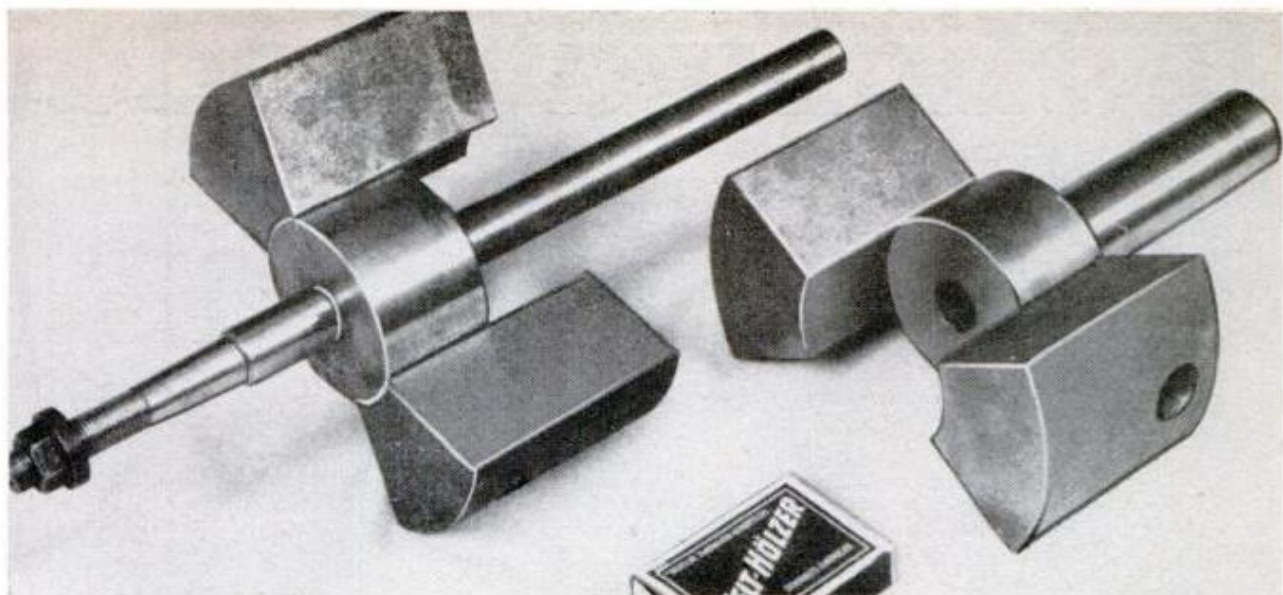
As each space, or "cylinder," between the opposed pistons makes a 360-degree trip around the working chamber, it is compressed twice and expanded twice, for the full four-cycles.

Thus, since there are four spaces between pistons, we have a four-cylinder, four-cycle internal combustion engine without valves!

The pistons themselves, in passing over the intake and exhaust slots, perform the valve function, just as the reciprocating piston in a two-cycle outboard engine covers and uncovers ports as it moves up and down in the cylinder.

The all-important control gearing that prompts the wedge-shaped pistons to "cycle" while rotating in the same direction is shown in the drawing on page 89.

When explosion forces tend to move working and lift pistons apart (Figure 2,



**VANE PISTONS** are machined to such close tolerances that all four vanes appear to be solidly attached to a hub in other photos. Here they are shown apart to give you an idea on how they fit together in a way which lets them operate independently. Matchbox (shown in foreground) gives you a relative idea of the size

page 88), levers (7) and (4) are pushed together as in drawing on page 89 (or pulled apart 180 degrees further on). The appropriate push or pull on the crank by connecting rod (6) forces gear (5) in its clockwise "walk" around planetary gear (1). This in turn exerts *additional* turning thrust on lever (4) thus gaining in total torque (power) on crankshaft (3).

Thus, the Kauertz engine's external gearing not only governs the compression and expansion cycles of the vane pistons but harnesses almost *all* the force generated between them. In terms of more familiar reference, it's as if the pressure on the cylinder head of a conventional auto engine were somehow harnessed to the crankshaft.

Thus, the power of the exploded mixture is used almost completely. This feature, combined with the ease of exhausting burned gases through a large port area (120 degrees of chamber wall) instead of through the conventional small exhaust valve, adds to efficiency. So does the elimination of forces needed to reverse the direction of travel of the piston and the column of exhaust gases. The elimination of valve mechanism also increases efficiency by reducing friction and eliminating the expenditure of energy necessary to push valves open against spring pressure.

The worm gear (drawing on page 89) changes the position of the sun gear (1) and changes the timing of compression at the spark plug, in case different fuels are used. Kauertz says his engine could be adapted for diesel operation by increasing compression (i.e., decreasing the space between pistons) and substituting an oil injector for the spark plug.

Sealing of pistons is accomplished by free-riding blades set in the slots (see photo, page 90). The blades along the radial edges of the piston vanes ride in slots that are shallower at their outer ends. Thus centrifugal forces hold the sealing blades in tight contact with end walls of the engine chamber while the same centrifugal force holds the blades on piston's outer edge against the curved inner surface of the working chamber.

The four power strokes for each revolution of the shaft make the Kauertz very flexible and produce high torque. So uniform is the torque curve, the inventor claims that it would make reduction gearing unnecessary. At only 60 r.p.m., the Kauertz engine could propel an automobile at 3 miles per hour.

PM has not participated in the tests which have been made on this engine under operating conditions, and we must take the inventor's word for practical claims. In theory at least, the engine is less complicated in its working than the famous Wankel in that there are no complex internal eccentric mechanisms to lubricate and cool, and there are no troublesome sealing problems caused by the changing shape of the internal chamber which requires the sealing blades to resist changes in thrust at the same time that they seal the edge of the rotor.

It would seem that the recent outcropping of rotary combustion engines such as the Wankel (PM Dec. 1961, page 69) and the ones described here and on page 97, may signal that the dominance of the conventional reciprocating engine may at last be threatened by more efficient successors.

# Is Highway Radar



**S**UPPOSE YOU ARE cruising along a highway, confident that you're within the speed limit, when a state trooper flags you to a stop. A radar speedmeter has caught you traveling 66 m.p.h. in a 50 m.p.h. zone, he says, and he hands you a summons.

You probably won't give him an argument, much less hire a lawyer to protest your innocence for, as one Virginia patrolman explains, "Most people are stumped by radar."

Even so, after you have paid your fine, doubts may arise. Regardless of the apparently conclusive speedmeter reading, you may feel that you were *not* speeding when you were nabbed by radar.

There is a chance that you would be right!

Contrary to popular belief, highway radar can be dead wrong—even when it is

operated by the most conscientious policemen. There is no doubt that radar is an effective tool for promoting traffic safety. Its presence on highways has dramatically reduced death rates by reminding motorists to keep within the speed limits. But it is not a foolproof device for determining whether an individual is speeding.

One expert, J. Kelly Johnson, a Connecticut radio and electronic engineering specialist and former radar consultant to the Secretary of Navy, recently told *Popular Mechanics*:

"Police radar has all the usual unreliability of electronic equipment plus several faults peculiar to centimeter wave and doppler equipment.

"It is used by officers completely ignorant of its principles and limitations, and its graphic records are accepted as evidence

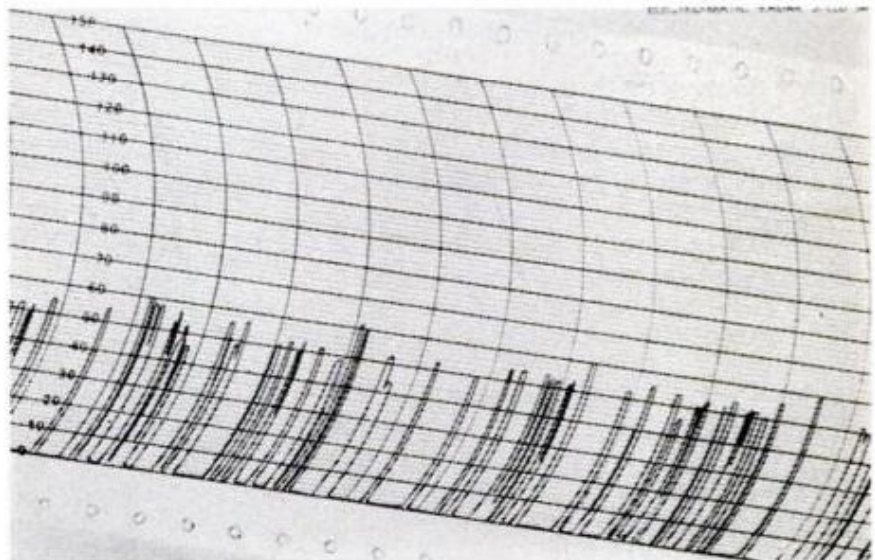
# Foolproof?

By  
Charles Remsberg

**SPEEDMETER**, mounted in police radar car, tells officer the speed of a car that has entered the radar beam. The beam itself does not report speed. It gives the beat, or the difference in frequency between the beam that is sent out and the beam that returns from a moving object. This beat is displayed in miles per hour on the meter



**GRAPH** makes a record of speeds of moving objects in the beam. It can be brought into court as evidence, though it usually is not unless the police are requested to. Perhaps most important is that graph records the beats themselves (as well as displaying them as miles per hours). Study may show beat was not made by car at all!



by judges who have not the foggiest idea of what they actually record.”

Johnson and other experts concede that radar arrests in the overwhelming majority of cases are legitimate. But, they point out, because of radar's subtle weaknesses, innocent motorists can be nabbed inadvertently, causing unwarranted loss of licenses and insurance benefits, as well as money.

Should you be fingered by radar when you are *positive* you were driving within the law, this basic information on the speedmeters and their limitations may be of help in establishing you were, indeed, within the limit.

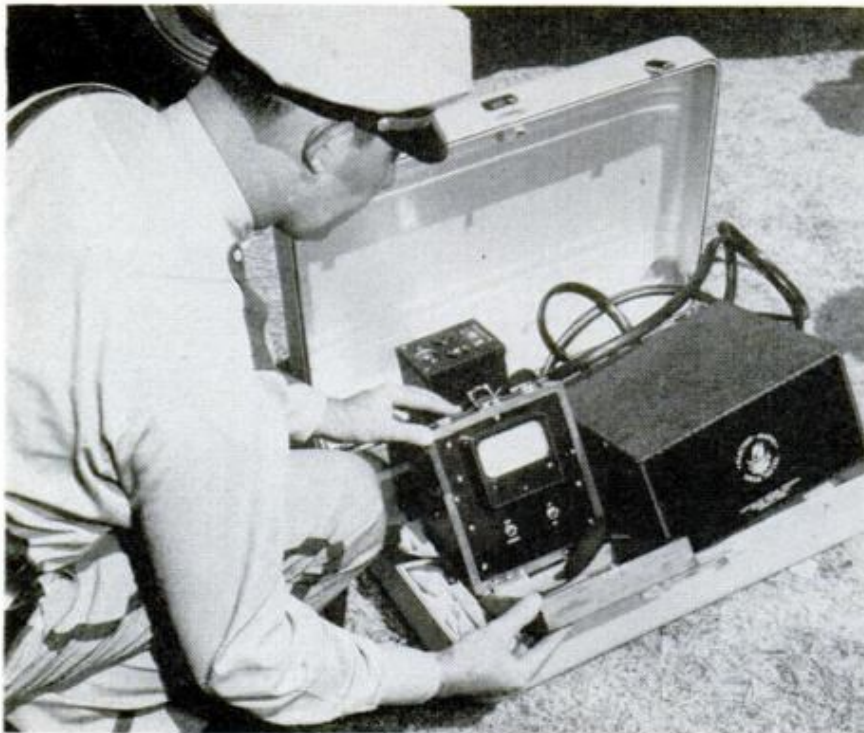
Radar speedmeters, first used for traffic monitoring in 1947, in Glastonbury, Conn., are relatively simple devices. The most popular model today consists of a black metal box (containing transmitting and re-

ceiving apparatus) and a speed indicator. When operating they are connected to the squad car battery.

The box, with antenna aimed down the highway, is usually set in the open trunk of the squad or mounted on a tripod at roadside. The speed indicator is usually set up in the radar car where the policeman on duty can watch it.

Speeders are detected when they interrupt the transmitted beam radio waves. Electromagnetic energy in form of radio waves traveling at 186,000 miles per second continuously radiates from the antenna at a frequency of 2455 megacycles and bathes the highway in an invisible cone about 17 to 20 degrees wide. If this radar beam strikes a *stationary* object in its 200-foot range, it reflects back to the receiver an “echo” with the same frequency as the

# CAN RADAR SORT OUT



**RADAR SET**, shown in its case, should be tested each time it is set up and taken down, according to instruction manuals. This is not always done. Nor, as trials have proved, is the testing procedure always as thorough as it is supposed to be

beam being transmitted. (A recently introduced transistorized unit is claimed to have a detection range of 500 feet).

If the beam hits a *moving* object—a car or truck, for instance—the echo will be of different frequency. In line with the doppler principle, the frequency will be greater than that transmitted if the object is moving toward the speedmeter and less if it is moving away.

Since the antenna monitors both the waves transmitted and those received, it is able to sense the throbbing that occurs between radio waves of different frequencies. This throbbing—or “beats”—can be converted into miles per hour, with 7.31 beats per second representing 1 m.p.h. Thus a car whizzing into the ghostly beam at 60 m.p.h. produces a beat frequency of 438.6 cycles per second.

The speed indicator is marked off in miles per hour, however, and not beats per second. When the shift in frequency is measured, the indicator needle, activated by electrical impulse, swings up to the appropriate speed.

Teams of police usually use this radar. If the officer working the radar detects a speeding car, he radios a description of the vehicle and its speed (as registered by the radar unit) to a fellow officer manning a “catch car” down the highway. This second lawman flags the motorist—or, in rare cases, gives chase—to issue the summons.

In all, some 1350 city, county and state police units throughout the U. S. operate radar sets. Radar is credited with as high

as 80 percent of all speeding arrests in some states and is responsible for more than 90 percent of the convictions in cases in which it figures.

Radar readings should be accurate within 2 m.p.h., according to the major manufacturer of police units, Automatic Signal Division of Eastern Industries, Inc. Changes in battery voltage, deterioration of parts and too great a distance between set and highway can cause greater inaccuracies, however. Dr. John Kopper of Johns Hopkins University, a frequent state’s witness in radar trials, explains that such distortions *favor* the motorist. In other words, they cause the set to record less than the true speed of the auto.

Other factors, though, can work the other way. And this is what bothers radar’s critics. For one thing, radar can register over-the-limit speeds not because a speeding car is detected, but because of outside disturbances influencing the speedmeter.

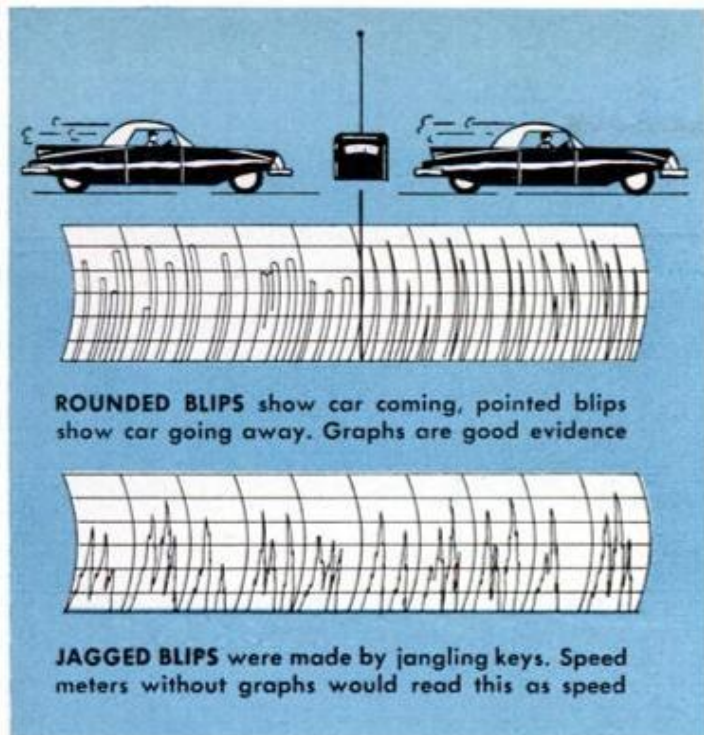
In one New York trial, Dr. Kopper admitted that various electronic devices can produce radar readings with no car in sight. Fluorescent lights, ham radio sets, diathermy machines, neon signs, large birds—all can activate the speedmeter, if they are operating nearby.

“You can get readings from waving tree branches, possibly (or when) a boy runs in front of the machine and waves his hand. . . .” Even a car radio or an automobile telephone can cause “sudden jerks of the needle. . . .” Kopper further testified.

Tests have demonstrated that by jangling



## EACH CAR?



keys in the radar beam, you can make the indicator needle whoosh up to 45 m.p.h. Vibration from a ringing bicycle bell has spawned readings of 30 m.p.h. And the use of a police radio can spike the needle up to 45. In short, police radar can respond to many sources of energy other than cars.

Some observers see no potential harm in this. They contend that since speed readings do not represent an accumulation of response and since a moving auto is a stronger energy source, the radar device will be unaware of these chance disturbances when a car breaks into its beam.

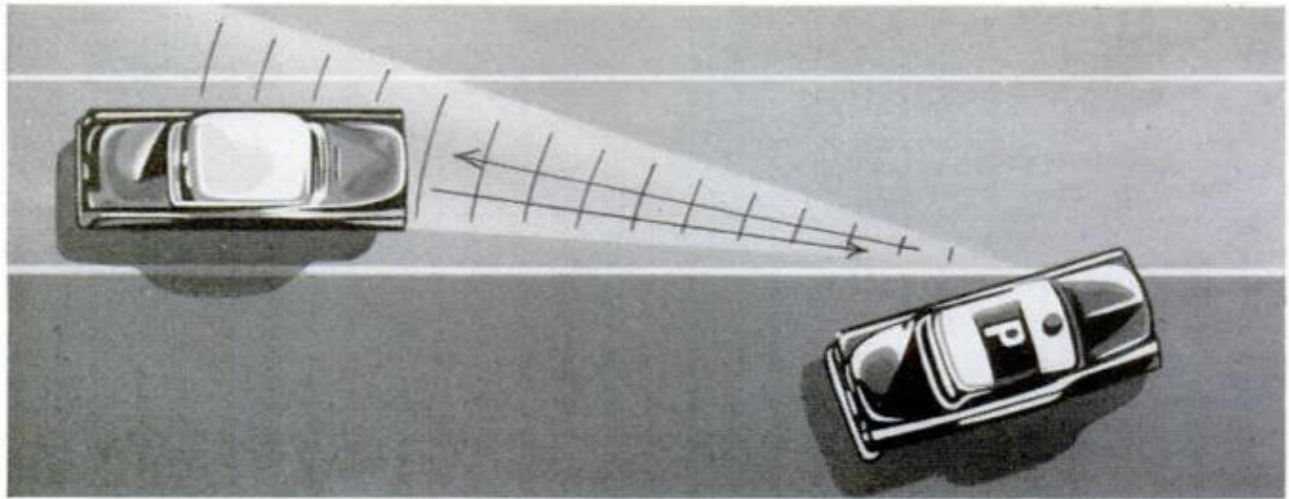
Other experts contradict this. According to William Coombs, former section head of the electronics division of the Denver Research Institute and, with attorney Philip Carosell, co-author of a radar critique: "Outside influences may be capable of dominating the response." Some common disturbance could sweep the indicator needle up past the speed limit when your car is in the radar beam traveling at a legal pace!

There's also a chance you could be pinched for a speeding infraction committed by another driver. One of radar's idiosyncrasies is that if several cars are in its beam at once, it clocks the speed of the fastest. But the basic components of the speedometer can't do anything further to identify a lawbreaking vehicle. That's a job for the policeman in charge.

"If there are a number of vehicles in range while a reading is being taken," reports J. M. W. McBride of the electrical engineering department of Queens Univer-



# BEAM OF CONTENTION



**ANTENNA** continuously sends and receives radio waves. Beam goes out from 200-500 feet, covers 17-20 degrees

sity in Belfast, Ireland, "then it may not be easy to decide accurately which one is producing the indicator reading."

Even the proponents of radar advise that it not be used on crowded highways. But trial testimony has revealed that in many cases—especially in speed traps—the advice is ignored.

In addition, an estimated 20 percent of the agencies using radar deliberately angle the sets to scan both sides of the highway at once. Others do so unwittingly. This results in all cars—coming or going—being registered on the speed indicator. The radar will pick out the fastest car but the needle will give only its speed, not its direction. This means that if you happen to enter the beam at the same time as a speeder headed the other way, a misjudgment by the radar police officer could leave you puzzling over a ticket that should have gone to the other driver.

More trouble can come from the way radar sets are tested before being used.

J. H. Ruiter, senior member of the Institute of Radio Engineers, recommends a three-point check that police should make before using sets: 1. See that the speed indicator registers a steady zero with no moving objects in view; 2. use tuning forks calibrated to simulate speeds on both

sides of the limit to see if the speedometer responds correctly; 3. run a squad car through the radar beam and compare the car's speedometer reading with the indicator reading.

However, trials in Arkansas, New York, Ohio, Indiana and other states reveal that many police agencies ignore the second step, considered by some experts to be the most conclusive. In most cases, police rely on the less reliable test of driving a squad car through the beam. Or, worse, they use radar sets to test police car speedometers which, in turn, are used to check radar sets. This vicious circle invites error.

Why are such practices followed? Possibly it's because radar training for many is superficial. For instance, a Washington state trooper testified in one trial that: "The sum total of my training consisted of a simple operation of testing and warming up the speedometer and locating the box in the trunk."

A judge commented: "The lack of training creates a doubt of whether (the policeman) could properly interpret what the meter reflected."

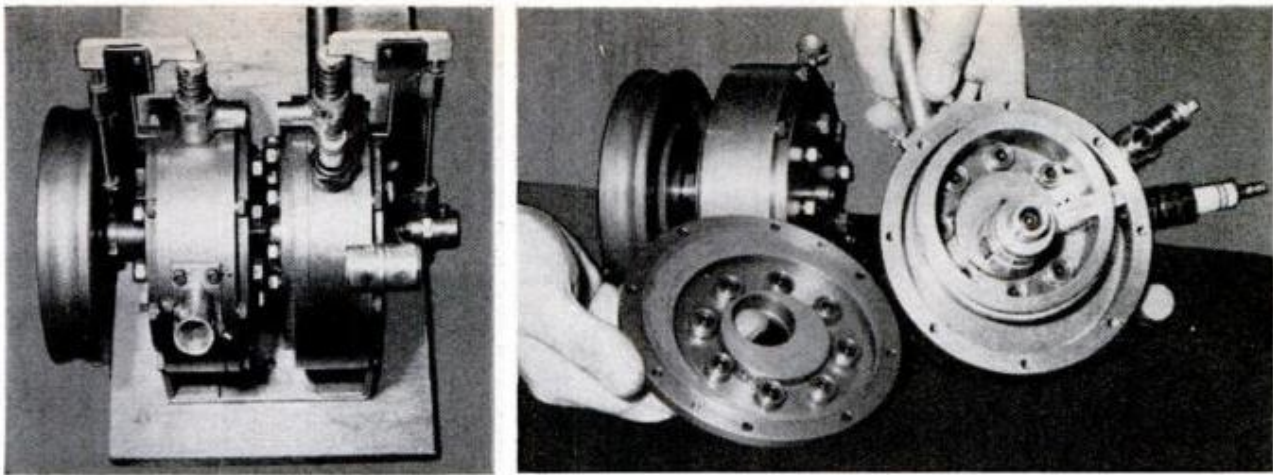
That doubt could be removed with proper training for testing and use of the radar sets, and by the use of a piece of

(Continued to page 192)

## WHAT ABOUT THOSE RADAR DETECTORS?

*"Detecting devices on sale now will not save the motorist," says Frank G. McCartney, Pennsylvania State Police Commissioner. "We arrested a driver in one of the northern counties and he told us he had in his car four detectors—he was a salesman for the New York firm that makes them. But we caught him going 75 in a 50-mile zone; he was tuned into the wrong frequency."*

*"The best way to avoid arrest still is to stay within the legal and safe speed limits."*



**LEFT, ASSEMBLED ENGINE.** Right, combustion chamber with end plate removed showing ball bearing on which inner ring revolves eccentrically around drive shaft, and the sealing blade which rotates concentrically

## Vane Pump Rotary Engine

ANOTHER NEW rotary engine recently developed in Europe is the experimental product of two Swiss mechanics, Otto and Erwin Amrein. A four-cycle internal combustion engine, it is based on the familiar principle of the vane pump.

The operation is less sophisticated than that of the Kauertz engine shown on page 88. The Amrein engine has two barrel-like chambers, one for intake and compression, and one working chamber in which the power stroke and exhaust takes place.

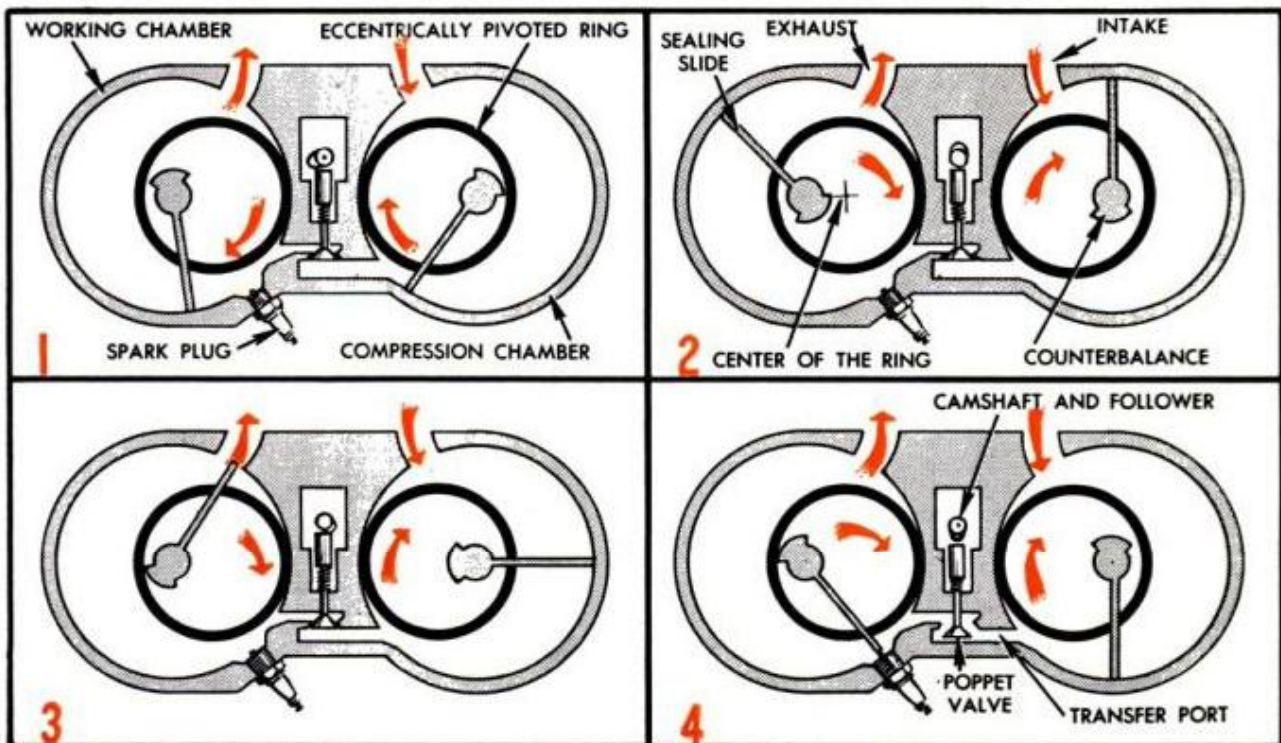
The equivalent of conventional pistons

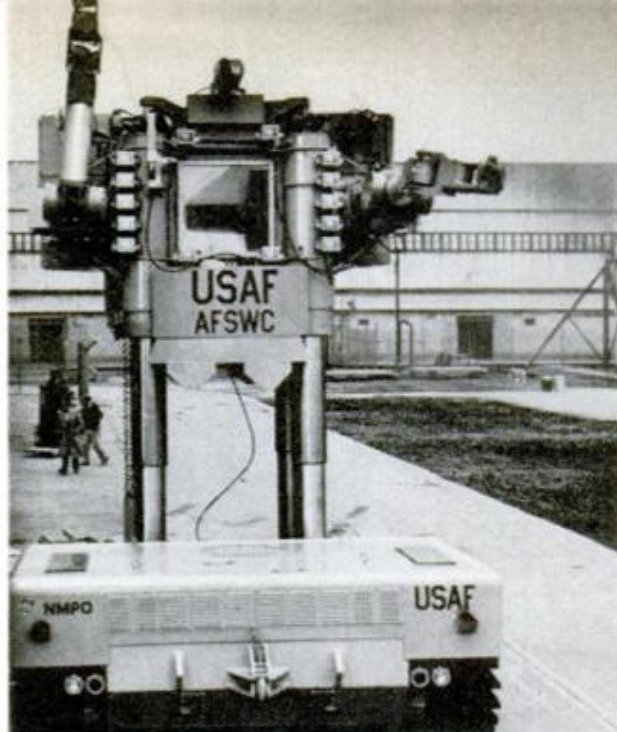
are the sealing slides or blades fixed to the crankshaft which revolve concentrically in the barrel-shaped chambers.

As the blades rotate, they propel free-wheeling metal rings (heavy black lines) that are carried on small bearings inside their rims (see drawings). These rings rotate around axes eccentric to crankshaft axis, thus providing irregularly-shaped chambers through which sealing slides run.

Thus far the Amrein brothers have a working prototype which seems promising but they have not completed tests. ★★★

**CHAMBERS**, drawn side-by-side for comparison, actually mount coaxially around drive shaft on which sealing slides are fixed. Cycle 1. Shows ignition in left chamber at right of sealing slide plus beginning of exhaust stroke to the left of it. 2. Power stroke is well under way in left chamber, intake is commencing in compression chamber. 3. Working chamber combustion process is complete, while both compression and intake are advancing. 4. Maximum compression in right chamber as poppet valve opens to let compressed fuel mix through transfer port into working chamber; at the same time exhaust stroke is beginning in left chamber



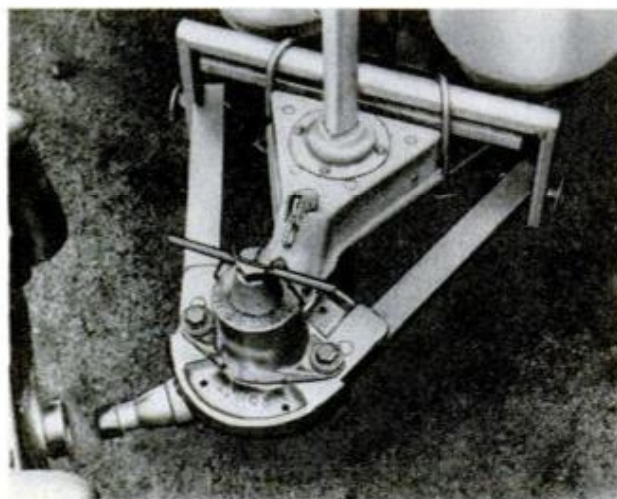


## A Man's Inside That Monster

Built for the Air Force to work close to radioactive nuclear rockets of the future, an 85-ton robot is operated from inside by a man who sits in the shielded cabin and operates its 16-foot arms.

Called the "Beetle" by the manufacturer, General Electric, it will undergo a series of tests in cooperation with the Atomic Energy Commission. It is intended for use with Project Rover, a nuclear-rocket program for developing nuclear-rocket propulsion systems for long-range space exploration. Nuclear rockets, just like nuclear submarines or ships, would have greater range capacities than other propulsion systems.

The Beetle will allow last-minute adjustments on the launching pad without exposing ground personnel to radioactivity.



## Automatic Towing Controller

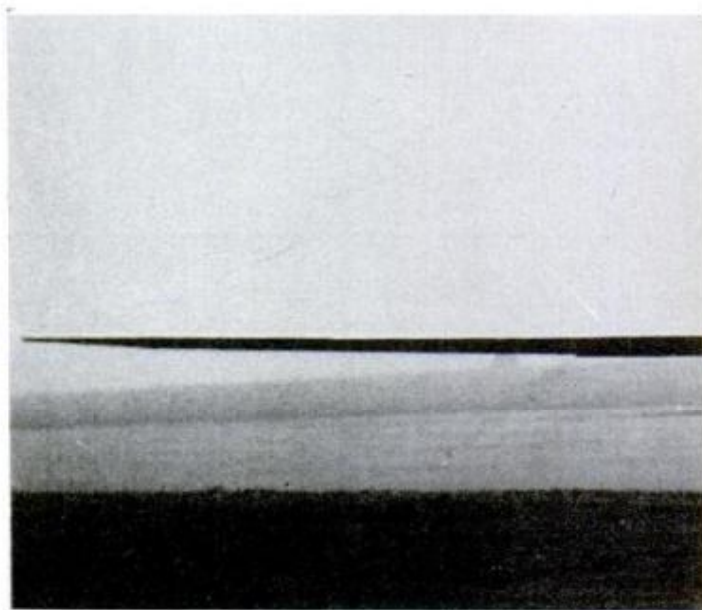
Eliminating the bounce and sway that often accompanies trailer towing, a new hitch is designed to hold the towing car on a straight course and the trailer upright, even on curves.

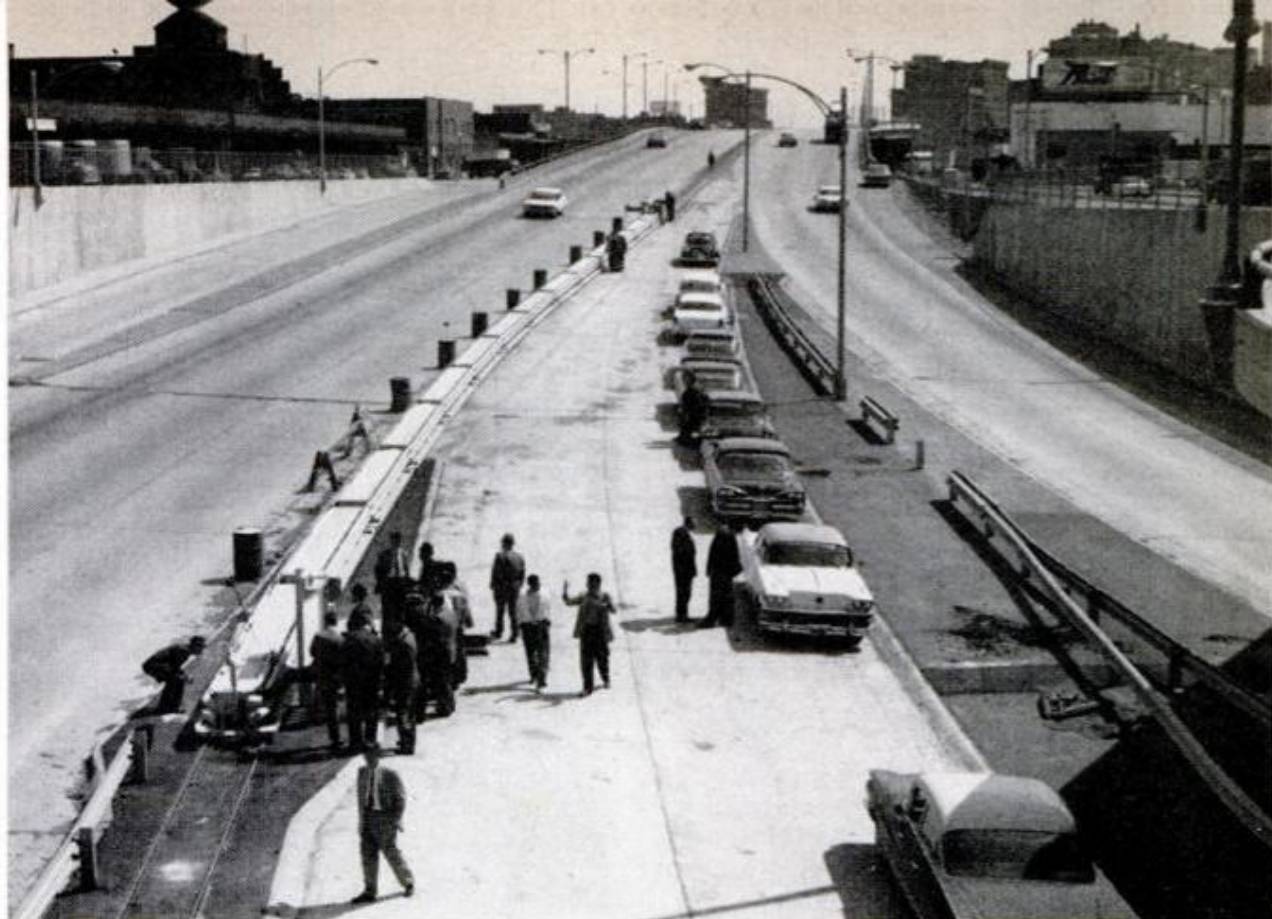
On turns, a special pintle-and-cam action depresses the 9300-pound main spring and develops horizontal stiffening action which prevents leaning toward the outside of curves. It adjusts to any size trailer; no part need be removed when uncoupling. The "Robot" is made by Curtco Engineering, P.O. Drawer 519, Colton, Calif.



## Flying Bicycle Gets Off Ground

—But Not Enough





### "Zippers" Direct Rush-Hour Traffic on Expressway

"Zipper" curbings, on rails, are directing rush-hour traffic into reversible lanes on the new St. Louis expressway. Resembling low-slung armored trains, the mobile dividers open and close five major entrances in the six-mile downtown section and divert traffic into the rush-hour lanes. Each train

has 14 cars; each car is 24 feet long, two feet high and three feet wide. The cars carry flashing lights and heavy guard rails; an overhead signal system tells drivers when the lanes are open. When not in use, the "zippers" are run onto storage tracks in the expressway's median strip.

Here's another try for the \$14,000 offered by a Londoner for the first man-powered aircraft to fly a figure 8 for a mile.

A team from Southampton University designed and built a pedal-powered glider with a two-bladed propeller, and Derek

Piggot, an instructor of gliding, pedaled it six feet off the ground for several yards—about 5200 feet short of the required distance. Both Piggot and the university, however, said they had great faith in their long-winged plane, and would keep trying.



# Develop Your Inventing Ability

Successful creative thinkers follow a pattern you can use to solve problems

By Eugene Raudsepp

Director, Psychological Research, Deutsch & Shea, Inc.

**O**NLY A SELECT FEW are able to invent." This belief, with us for years, now has been shown up for just what it is—a myth.

A few programs in creative thinking have shown that you can develop inventive ability far more than you may believe possible.

While individuals may vary greatly in methods, there is a pattern used by hundreds of inventors and creative individuals. By taking direction from them, you can start now to become more creative in solving everyday problems. Here are the steps:

## General Preparation

- There must be motivation—a great interest in the problems and a strong desire to solve them. You'll be most effective in areas where your interest is a near passion.

Once you've solved problems creatively, you'll find that success is satisfaction enough to motivate further creative effort.



"How can this be done better?"

If you build a record of several minor successes, you'll acquire the necessary self-confidence to tackle bigger problems.

- General background knowledge is vital. Other things being equal, the person who has a broad knowledge of many fields and an abundance of accumulated experience can come up with new, significant creative ideas more easily and more rapidly than can the individual who has only a detailed specialized knowledge of one field.

Inventors (or their biographers) have clearly shown that thorough immersion in one field has to be counterbalanced by a breadth and versatility of experience and knowledge in many other fields. To increase your fund of total experience:

- a. Set aside time to read in fields other than your own.

- b. Start reading in subjects close to your

own and gradually spread out. Always ask, "How can I use this?"

- c. Take notes while you read.

- d. Keep an indexed file of clippings, notes and ideas; study them occasionally.

- e. Try a problem outside your field. This increases familiarity with ideas and sources of reference outside your own interest.

- f. Have hobbies that require mental effort—like chess, bridge and puzzle solving. While exercising your problem-solving ability, they relax you and open your conscious mind to "flashes of insight" from the subconscious.

- g. Travel has the same effect as hobbies, removing you from familiar patterns and allowing new ideas to emerge.

- h. Unremitting exercise of your creative powers is essential. Approach every problem creatively. Ask "How could this be done differently or better?" Ask yourself as many questions as possible, then attempt answers by yourself.

## Specific Preparation

The better you understand a problem, the more approaches you'll find to tackle it.

- Read all you can about it, critically and imaginatively. Sift fact from opinion, but be generous toward ideas that seem unorthodox; imagine what would happen if these ideas were really true.

- Seek out all sources of information. Don't be discouraged by others' failure; conditions may have changed, and what didn't work once may work now.

- If the problem requires mastery of new knowledge, learn as much as you can about the new subject.

## The Problem Approach

In these days, there shouldn't be too much trouble finding a problem. Simply ask: "What am I doing that could be done more effectively, better, cheaper, or differently?" Or ask: "What's wrong with this?"

The real difficulty, though, often is to spot the **real** or **important** problems. List them by importance, difficulty and possibility of solution—then choose those that are most important and interest you most.

## How to Define Your Problem

An incorrect definition can tie you down to a restrictive error that prevents an effective solution. Your initial definition should be tentative; further information may be needed to truly define the problem.

- State the problem in a simple, broad way so that it doesn't limit your thinking.
- Strip away all side problems or conditions and as many modifying adjectives, adverbs and phrases as possible.



**Always carry  
a notebook;  
ideas may strike  
at any hour**

- Don't suggest a solution in the definition. Look beyond the immediate problem to its fundamentals.

- Keep asking: "What are the actual boundaries of the problem?" and "What are the unusual aspects of the problem, those that everybody takes for granted . . . and can they really be taken for granted?"

- Break down the variables while keeping the total problem in mind.

## After the Problem Is Defined

- Prepare a problem sheet on which you write your problem statement(s).

- List all approaches that might solve the problem, no matter how insignificant. Don't dwell too long on any one approach.

- Don't sidetrack the "inventive current" with extensive searches for data.

- Look for analogous situations in other areas, remembering that none will fit your problem precisely.

- Let your imagination soar; don't allow reason and logic to bind you.

- Refuse to be downed by failure.

- Don't be alarmed by a sense of stress; it may help you find the best solution.

- Sustained inventive thinking usually yields enough material for a systematic outline and leaves your subconscious with a wealth of material to work on. After a few days away from the problem, you may find you're more productive.

- The next time you tackle the problem, go over ideas listed previously. If you start on a new train of thought, follow it.

- If you still make no progress, re-examine your problem with reference to the problem definition(s). Is it too broad, preventing anchorage points? Is it too limited,

narrowing your field of thought? Should you divide your problem into subproblems and work on them one at a time?

## Stimulating the Creative Process

In order to increase your powers of observation during creative problem solving:

- Suspend critical thinking when you're thinking creatively. Nothing can stifle the creative process more than critical judgment applied early. Criticism, judgment and evaluation should be applied to the new idea at the end of the creative process.

- Try setting idea-quotas for yourself.

- Always carry a notebook; ideas may strike at any hour.

- Orderliness also applies to creative thinking. Plan your steps and keep records.

- Plan regular practice and development efforts for improving your facility for grouping knowledge into new combinations.

- Proper mood is important, but it's best not to wait; pick up a pencil and work.

- If you're not making headway, do something different. Organize so you have long periods at hobbies or alone and in silence. The flash of insight occurs most often in a relaxed or dispersed attention. Fatigued or half-waking conditions often yielded ideas inventors value most.

- Sometimes it is not advisable to discuss your ideas with others during preliminary stages. A too-early discussion might make the idea disappear or give you false leads. Conversely, talking with people who work in the same area may give you added enthusiasm. And explaining a problem to people unfamiliar with the area may clarify your thinking. Experience will guide you.

- After solution of a difficult problem, you may experience the "avalanche effect," when new ideas (sparked by the solution) come in a flood. Record the ideas promptly.

- Determine the physical conditions for your best work, then try to duplicate them.

- Develop a "retrospective awareness" of the periods when you solved your problems. Learn why some methods succeeded and others failed by retracing your routes.

- Schedule your creative problem-solving periods for those times when you have the most favorable mental set for producing ideas. We all have rhythms and peaks and valleys of output. Keep records so you can set aside peak periods for concentration and less productive times for study.

- Either find a place to work that's free of distractions or learn to concentrate so thoroughly that nothing distracts you.

- Be prepared for the "moment of surprise" when sudden insights come to you. Record them and utilize them.

And be prepared for another surprise—you're an inventor now!

★ ★ ★

# Big Boom in R/C Models

By Eric Jensen

**T**HE PLANE, at times only a dot in the sky, had completed an amazing series of precision maneuvers. Four-point rolls, inside and outside loops, Immelmans, all performed with almost flippant ease. Now the exhibition was over and the pilot brought the craft down into the rectangular landing pattern of the airport. After a beautiful approach, the plane touched down within a designated 50-foot-diameter circle. When the landing roll was finished, the plane turned and taxied to our feet.

To our feet? Exactly! For while the

**CARRIER DECK LANDING** is simulated. Retaining hook drops, engages sandbagged cords to halt model plane





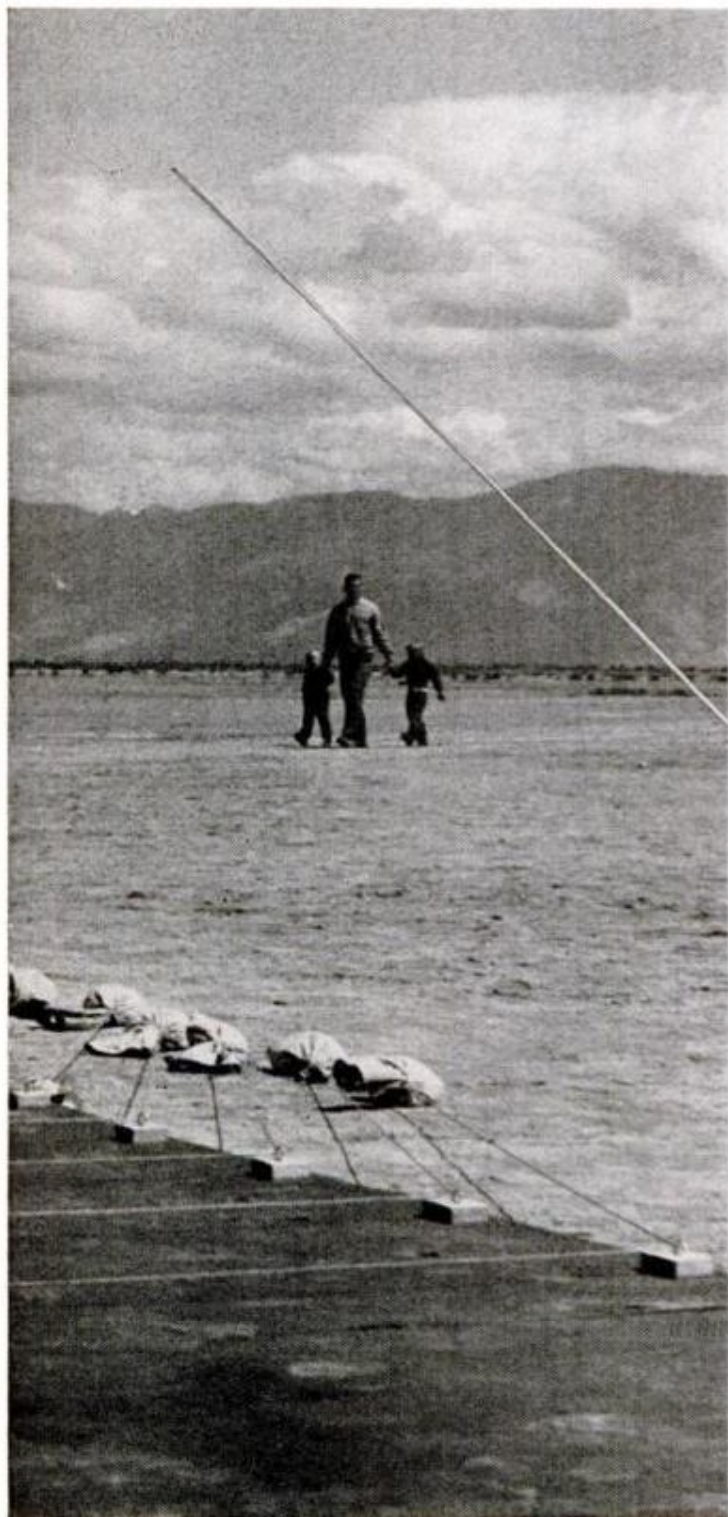
sensation of realism made it difficult at times to believe that this was not a man-carrying aircraft, the fact is that the wingspan of the plane was a mere 48 inches, and it was powered by an engine with a piston displacement of one-half cubic inch. Extreme maneuverability for such small size and weight is what multicontrol has brought to the world of model aircraft.

Radio Control (or R/C) is not really new. Even prior to World War II, a few expert enthusiasts had demonstrated its possibilities. It was not until after 1946

however, that the movement really got under way. Early radio-controlled aircraft demonstrated the feasibility of these principles by controlling only the rudder. In 1956, multicontrol hit the model field. Recently, modelers have brought multicontrol to a high state of perfection. Another device, the compound escapement, has enabled even the pilot with only a single-channel rig to expand his control from a single rudder control to control over the motor and the elevator.

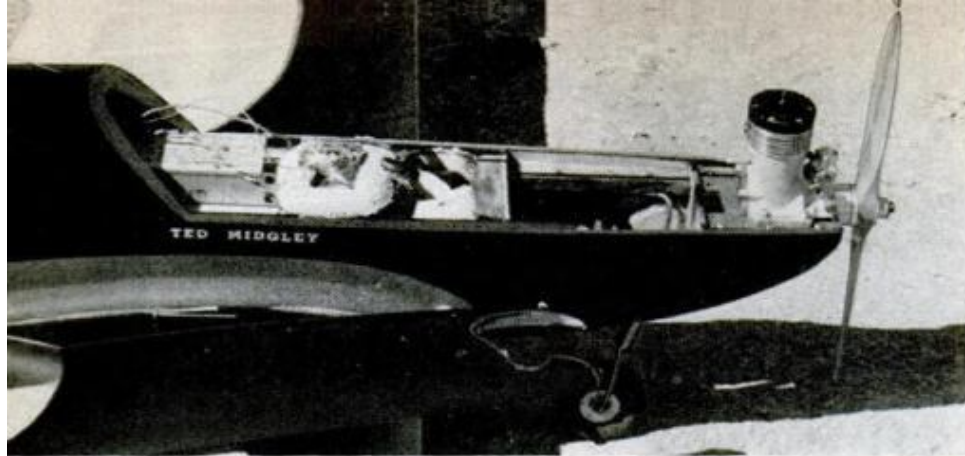
By 1960, thousands of modelers were

**RIGHT AFTER TAKEOFF**, the "pilot" paces his plane until it stabilizes and then begins using the radio controls

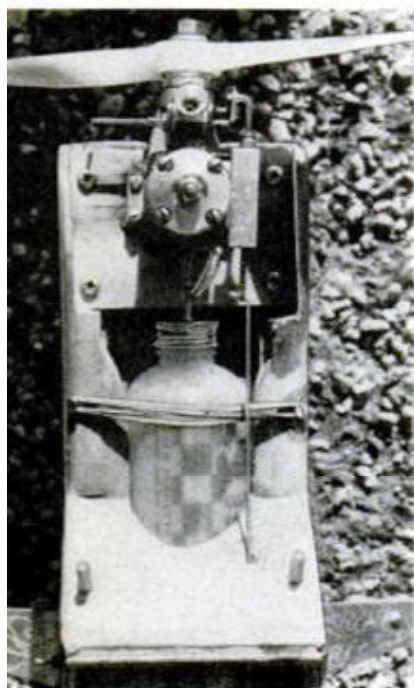


For more excitement in the R/C field, see the rousing story of "White Heat" on page 124. There's a big boom in R/C boats, too!





**CANOPY** and motor cowling are removed to show small size of radio compartment. Foam plastic is used for shock absorption



**MOTOR**, far left, with throttle control installed. Note the slight offset to compensate for torque. Thumb operates the controls



**RADIO-CONTROL** scale model, right, is a prize-winning quarter-scale Cub. Powered by two engines, it also drops parachute

shifting to the more elaborate multichannel systems. This year, significantly, the British modelers have dropped the rudder-only classification in their contests.

Because early R/C equipment was weighty and cumbersome, large planes were required to lift the radio gear. Present-day refinements, including transistors, printed circuitry and other miniaturizing devices have permitted safe control over smaller and smaller aircraft. This new equipment makes possible the use of radio control with planes having less than a 30-inch wingspan. The new motors are also a contributing factor. The smallest Tee-Dee (for T-D, abbreviation for Thimble-Drome) engine while not yet used for R/C work, has only .010 displacement, weighs a scant half-ounce, yet develops 27,000 r.p.m.

For the beginner in R/C, a working knowledge of the operation of servos and escapements is essential. He would do well to start with a slow, stable plane and work his way up to a hotter craft. The advanced models require the fine touch of an experienced pilot, and as with real planes, getting 'em down at mile-a-minute speeds is sometimes harder than getting 'em up!

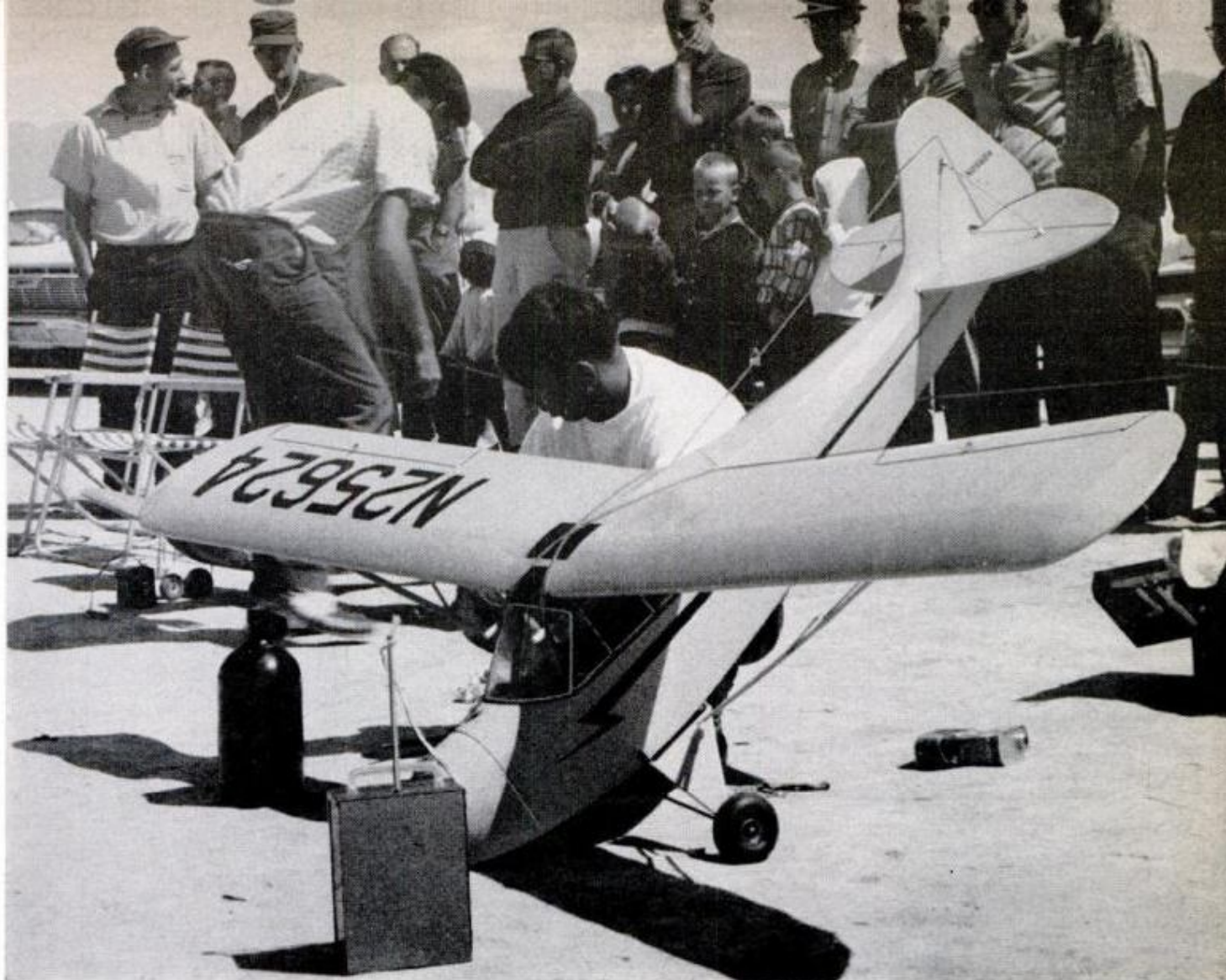
The transmitter operates in the Citizens

Band, opened to modelers in 1958 by the FCC. A license is required to operate in this band, but the license costs nothing and no test is required. The application for this license is available from the FCC, Washington 25, D.C. Be sure that the transmitter has been certified, or you may have to pay a licensed technician for this service. The frequency-controlling circuits may not be adjusted except by a person duly licensed as second-class commercial or higher.

The transmitters use what is called a modulated carrier wave. One or more tones can be transmitted, singly or in groups, to actuate different controls in the model. While the carrier frequency is being constantly transmitted when transmitter is on, tones are sent out only when keyed.

Power sources for these transmitters have also changed. Once bulky batteries were used but these have given way to smaller nickel-cadmium batteries operating through power converters for added voltage boost.

One major problem remains for the modeler, and this is the limiting factor imposed by the narrow frequency allocation by the FCC. Interference caused by operating too many planes in one area can cause one



modeler to accidentally control another fellow's model! Some R/C enthusiasts with dual hobby interests have obtained amateur radio licenses, and can take advantage of additional spectrum space to avoid this sort of interference.

In the model itself, the receiver is carried on a cushion of foam rubber. The receiver can be a simple one-stage affair, or a 10-channel set with tuned reeds which resonate with the audio frequencies the transmitter sends out. Here's what happens from reception of a one-channel signal, to the maneuver of the plane.

The transmitted radio wave is first received on the antenna which protrudes from the model's fuselage. It is passed through the receiver and detected and amplified by small tubes or transistors. Up to now, the radio wave has been treated in much the same manner as a radio signal received on your radio set at home. Instead of going to a loudspeaker, however, the radio wave goes to the coil of a relay which closes when the signal is received. This movement is transmitted via linkages to a control surface, such as the rudder. This is done through an ingenious device called an escapement. A twisted rubber band serves

as "power plant" for the escapement. When the relay releases the trigger, the rubber band turns the rotor, moving the rudder. When current is off, the rudder returns to its neutral position.

If you add more triggers, you have what is called a compound escapement, and it is this, plus multichannel transmitters and receivers, that has touched off the big boom in R/C models. A self neutralizing escapement is one that returns to the center position when the current is stopped. Other types consist of electric motors to operate the escapement instead of the rubber band, and you can actually use an escapement to operate other escapements, extending the range of control, called "cascading" the escapements. Such a rig requires a quick-witted pilot to remember how many times to key the transmitter to produce a desired effect in flight. An inexperienced pilot can cause an air disaster in this field, too!

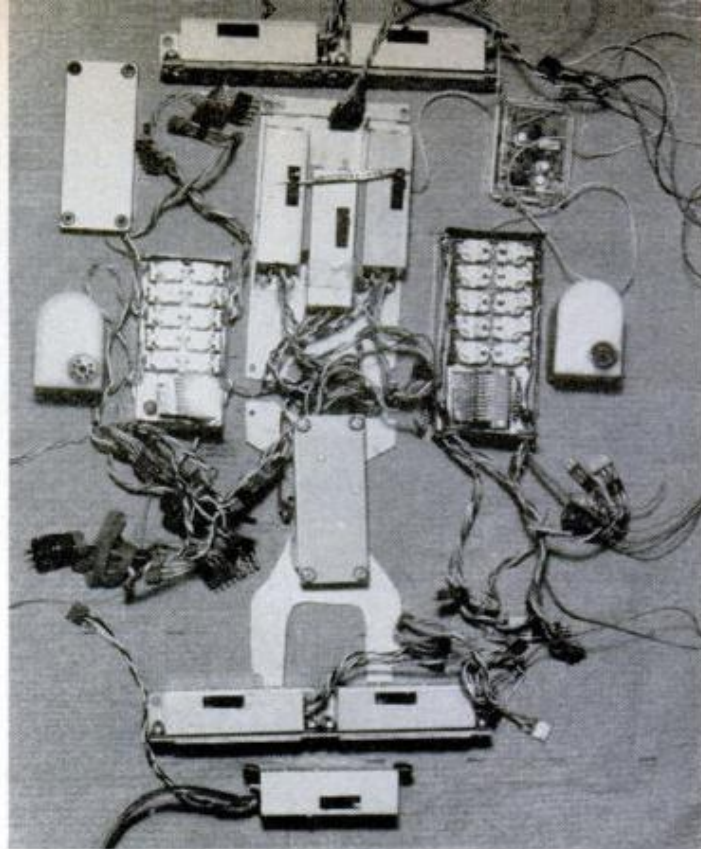
While these single-channel units are cheaper than the new multitone outfits, they are obviously limited in their ability to provide smooth, immediate and simultaneous movement of control surfaces and motor. The multi equipment replaces the escapement completely, using instead,

small motors, commonly known as servos.

In the multi systems, the transmitter doesn't just transmit the single carrier frequency, but transmits up to 10 tonal frequencies superimposed on the carrier. The receiver feeds the detected signals to a tone-sensitive reed relay, having 10 reeds of different lengths. When the signal reaches this relay, the correct reed or reeds will vibrate, causing the correct servo motor to operate, working its own control on the aircraft. The servos are connected through torque rods and move only a fraction of full rotation to do their work.

The radio-control equipment for the model builder will vary in price from about \$70 for single-channel equipment to about \$300 for multichannel gear. The builder can save considerable money by buying used equipment or working from kits.

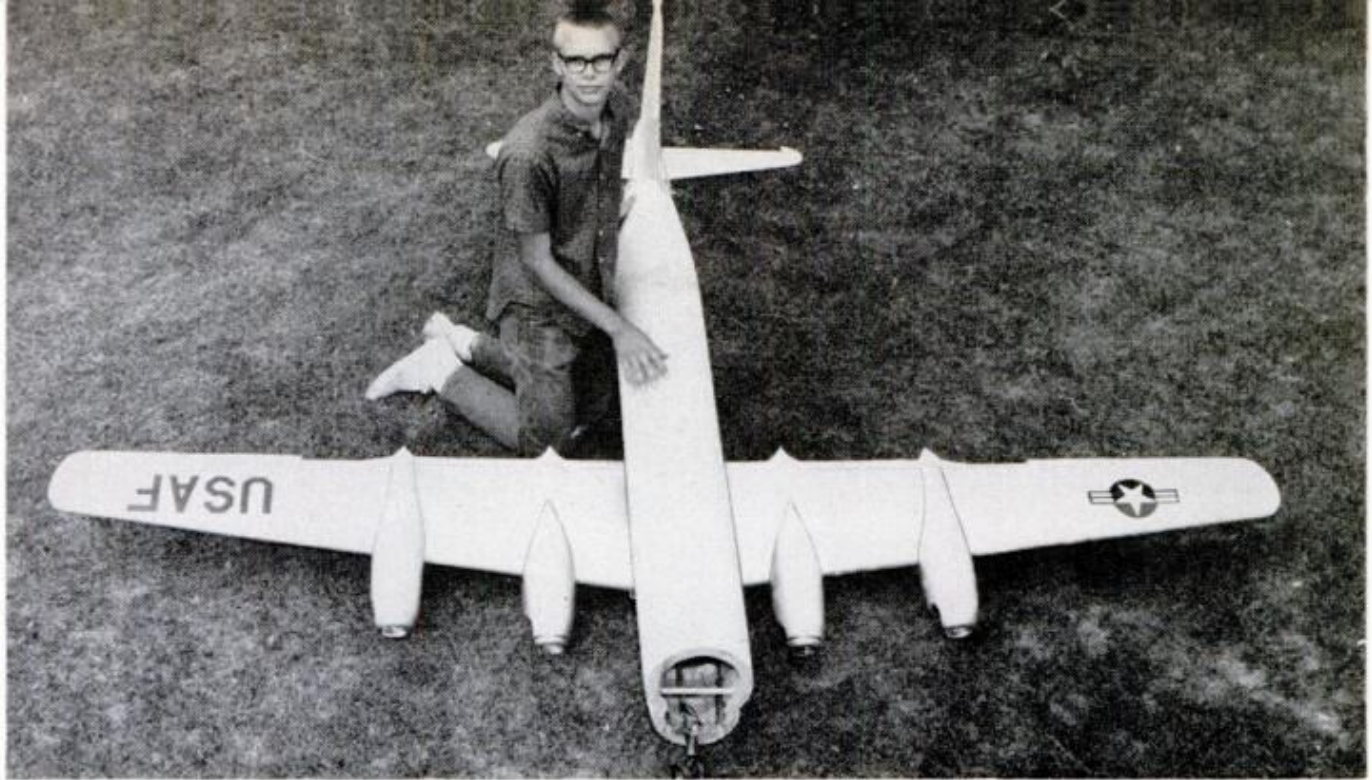
Installation of the equipment in the plane depends on the particular model. The plans that come with the model state the best location for radio gear. You can mount the batteries and receiver on a light piece of plywood and secure the plywood with rubber bands to serve as shock mounts, or



**COMPLETE RADIO-CONTROL** setup for four-engine tanker, shown in same layout as plane will use

**START OF A** single channel rise-off-ground flight. As speed increases, tail section rises. Plane then lifts off, picks up speed still more, rudder will begin to respond to radio control and the plane is on its way





**TEN-FOOT WINGSPAN** scale model of Boeing KC-97 tanker is shown with nose section removed. Requires two men to fly. Photos and drawings from Boeing helped in building this very elaborate scale model

mount the board on a foam-rubber mat. The receiver should be equipped with a detachable, multipronged plug feeding into the escapement or servo. The escapement or servo can be mounted aft of the receiver and you will want another detachable plug coupling it to the plane's control surfaces. This will enable you to remove the receiver without disconnecting the escapement or servo from the controls.

Before obeying that impulse to run out in the field with your model, test it thoroughly in the shop. This will give you a chance to familiarize yourself with the various controls before you get the plane in the air. There's nothing quite as discouraging as seeing your plane meet the runway with its propeller, just because you thought you were giving it "up" when you really gave it "down"! Out in the field, you will find that you can get better range and control if you properly polarize your antennas. All this means is that if the antenna on your model is a vertical whip, hold your transmitter so that the antenna is vertical. If your model has a wire antenna which runs horizontally from the cockpit to the vertical stabilizer, hold the transmitter so its antenna is horizontal also.

In the air, give the model a chance to stabilize in flight before attempting to apply any severe corrective signals through radio control. As with real aircraft, observe caution when near the ground, for altitude will give you a chance to correct some errors.

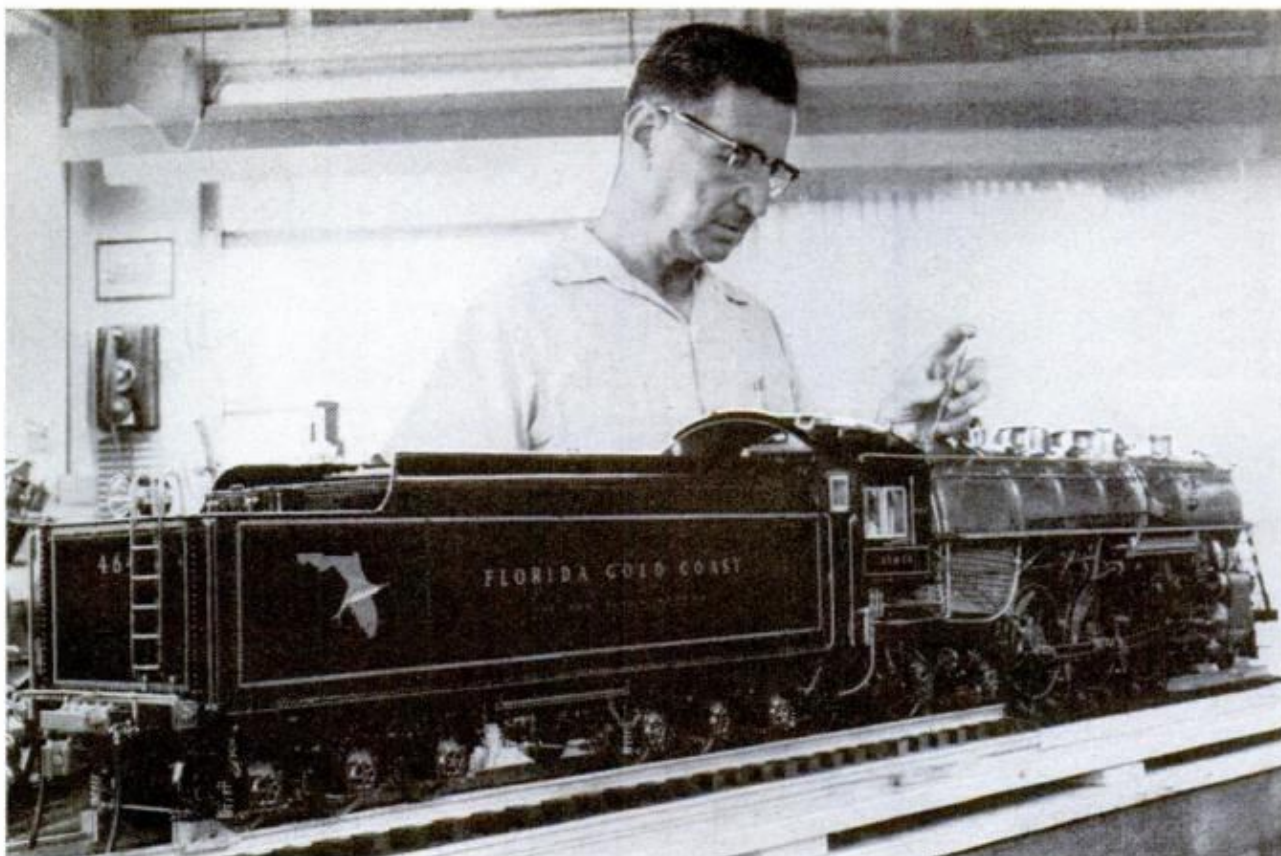
If you enter contests with your model, you will probably be flying under the rules of the Academy of Model Aeronautics.

There are three categories under these rules: *Pylon flying*, a speed race around two pylons, or ground markers, set one-tenth-mile apart; *scale*, in which the appearance and flying characteristics of the larger counterparts are emulated; and *pattern*, in which precision pattern and stunt flying are required. It is in this last category that multichannel excels.

The type of plane you select will determine the type of flying you'll do. Speed is not usually obtained with the highly stable and well stressed two-wing models used for stunting. The speed jobs are streamlined to lower wind resistance, and often look more like darts or rockets than the prototype models used in scale events.

One of the most spectacular models ever built is a 10-foot replica of a Boeing KC-97 tanker. It has already captured prizes at three science fairs for 18-year-old Karl Magleby. It has four engines and a 20-channel R/C outfit to operate everything from flaps to a small transmitter which sends back data on engine performance and G-forces. It requires a pilot and copilot, each with a separate 10-channel transmitter. The plane has a parachute that drops on command, a radar set which moves the elevators full up when an obstacle passes in front of the plane, and a working fuel transfer system!

Only the experienced modeler can build and fly such a superplane. But even a simple one-channel affair can be a challenge. Why not try it? One warning: Once the bug bites, you'll forever run a fever at the distant whine of a model plane. ★ ★ ★



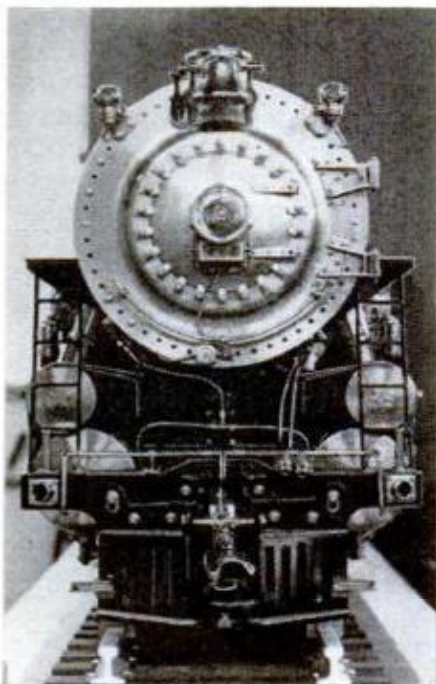
**BOB BEEKMAN** puts finishing touches on model engine that he spent 12,000 hours building. All parts work

## Takes 10 Years to Build Model of Steam Locomotive

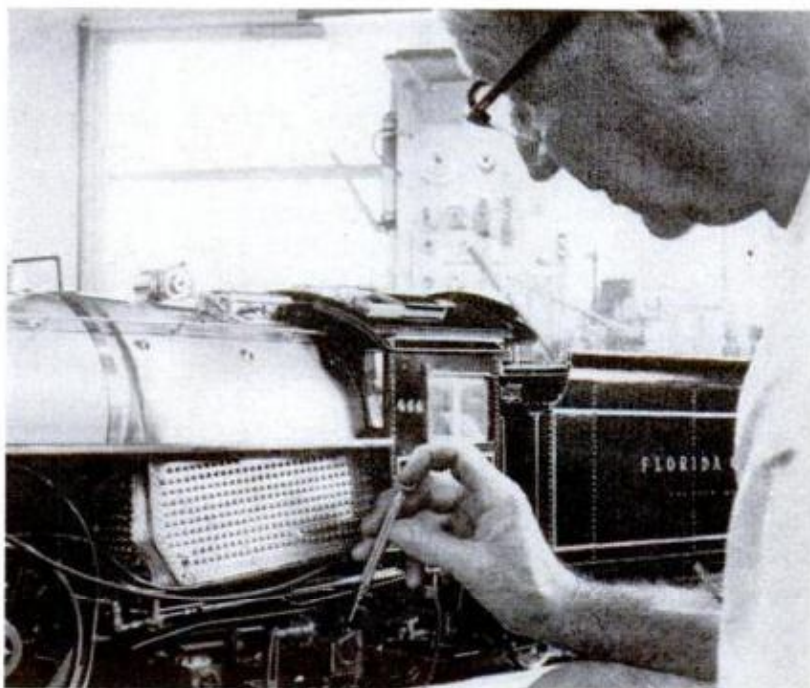
After retirement 10 years ago, Bob Beekman of Fort Lauderdale, Fla., set out to fulfill a lifelong ambition—building a miniature model of a steam locomotive, with every part a working one.

A model of an engine on the Florida

East Coast Railroad, it is made of stainless steel, bronze and cast iron, to a scale of  $\frac{3}{4}$  of an inch to one foot. The locomotive-and-tender combination is  $72\frac{1}{2}$  inches long and weighs 220 pounds. Beekman estimates he has spent about 12,000 hours building it.



**HEAD-ON VIEW** of engine shows meticulous detail. Engine burns oil



**BEEKMAN SPENT** as much as 10 weeks designing and building single part for model engine. Tender alone has 4800 individual parts

## PM Shopping Guide

# Air Conditioners

By Gordon L. Williams

**REMOTE CONTROL** for air conditioner. User pushes button, twists knob to set air direction, increase or decrease cool air movement into room. Such accessories add little to value, add to price



**W**HILE THE best time to buy an air conditioner is after August 1, when prices drop, these buying guides will stand you in good stead any time.

Before you go shopping, answer these questions about the unit you want.

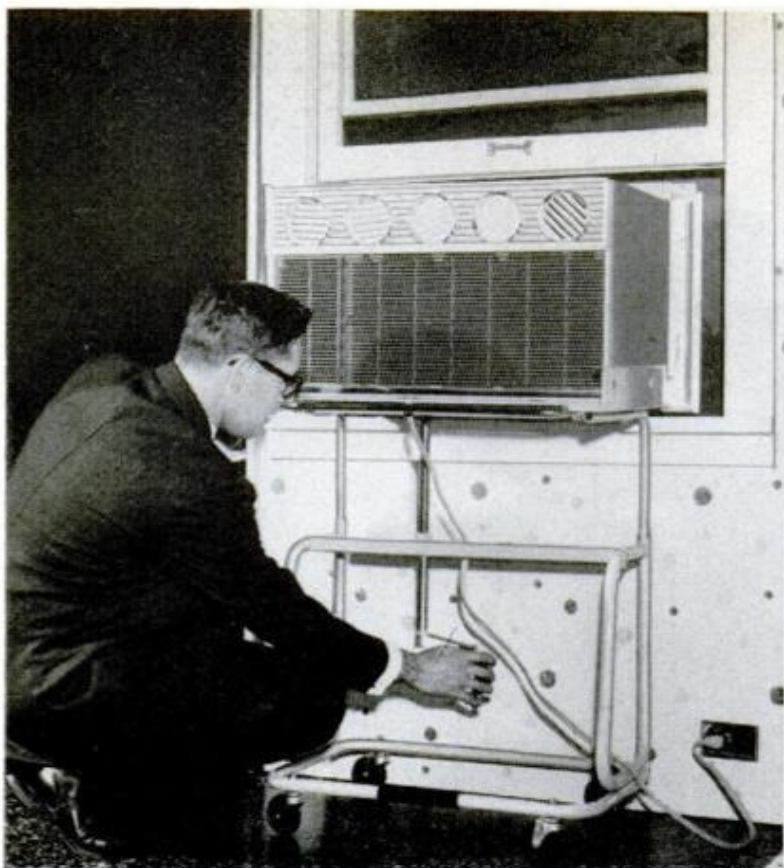
**1. Size.** The British Thermal Unit is the standard. The more BTUs, the greater the cooling power. Measure the area you want cooled, then use chart on page 112 to find the size you need. Remember, too small a unit won't do the cooling job; too large a unit won't dehumidify.

**2. Voltage.** Units under 8500 BTUs can go on a 115-volt line; anything bigger will need a 230-volt line.

**3. Amps.** You'll avoid overloads

and be able to use the more efficient 10, 12, or 15-amp units if you run the conditioner on a separate circuit. If you must plug into a multi-outlet circuit, you'll have to stick with a unit of 7.5 amps or less.

**4. Installation.** Unless you're building a new home where a central system is practical, your choice is limited to window or through-the-wall installation, or to a portable model. Through-the-wall costs most, but permits the unit to be left in place year-around. You'll have a wider choice of models with a window installation, and it is cheaper. However, you can't mount a conditioner in every window, most windows can't be closed with unit in place, and window units frequently must be removed in win-



**PORTABLE COOLER**, rolled from window to window and room to room, requires no installation. Such units usually lack cooling power of permanent installations, however. Make sure carriage is sturdy enough

ter. Portables can't match the cooling power of a permanent installation.

**5. Dimensions.** Measure height, width and depth of spot where you want to install the conditioner. Units vary in size.

Which make is best? Conditioners are essentially alike but they do vary in quality. To be safe:

—Stick with a dealer you trust or shop two or three stores.

—Stick with well-known brand names.

Now you're ready to buy. If you want to set a spending limit, tell it to the salesman, and remember that your limit must include cost of unit, installation (\$15-\$30 for window installation in most areas) plus any rewiring or rebuilding.

Complete this check-list before choosing.

1. If BTU rating isn't stamped on the unit, insist on seeing a manufacturer's specification sheet on which guaranteed rating is printed.

2. Listen to unit at all speeds. If it sounds unduly loud in the store, it will sound louder in a bedroom.

3. Controls should not be hidden

behind doors or grilles but readily accessible, legible and easy to understand. Knobs should be sturdy. (Try pulling each knob to make certain it doesn't come off in your hand.) You should be able to reach all controls without much bending or reaching. On window units, top-mounted controls should be set far enough forward so they won't be blocked by lowered shades.

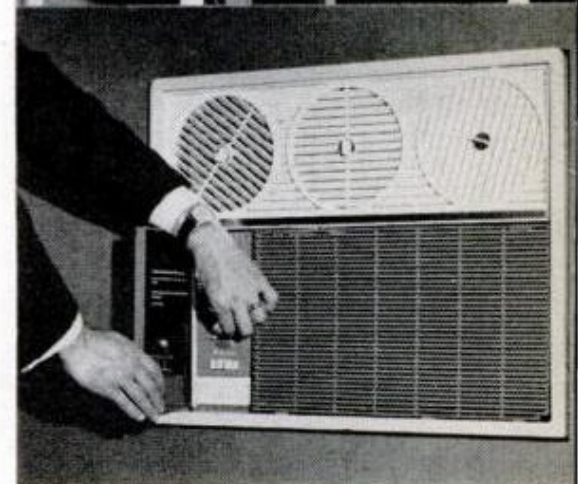
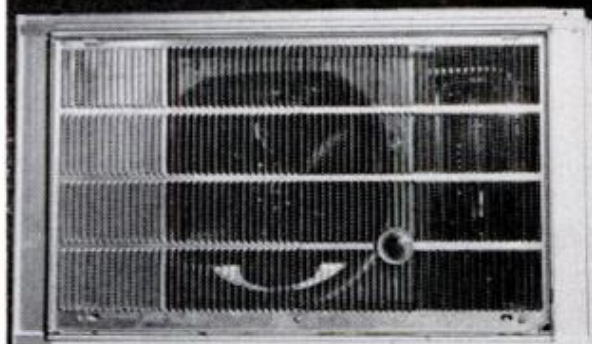
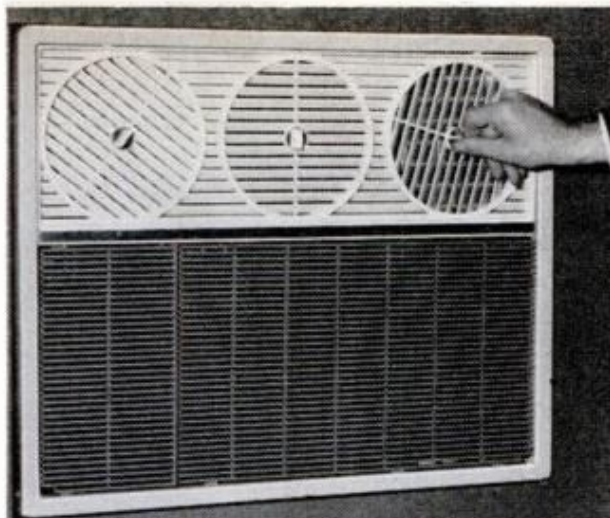
4. The unit should distribute air evenly over a wide area, without strong drafts. You should be able to adjust louvers horizontally, vertically and individually so that air can be aimed in several different directions at once.

5. Better air conditioners offer at least two operating speeds—a high for normal cooling, a low for nighttime use, plus, occasionally, a third speed for superfast cooling. Get at least two speeds.

6. Is the thermostat which regulates degree of cooling adjustable? Some can't be adjusted; others offer up to 10 or 12 temperature-control settings. Get at least two.

7. Any conditioner should ventilate a room or exhaust stale air, though





**LOUVERS** come in all types, shapes and sizes. No matter the type, the important thing to find is: Will they move vertically and horizontally, and can individual louvers be moved to send air in different directions at once?

not necessarily both. Don't buy a unit which can do neither for you'll lose a major benefit of air conditioning.

8. Both the replaceable glass wool filter, or the metal mesh or plastic permanent type are about equally effective. But find out how often a replaceable filter must be replaced

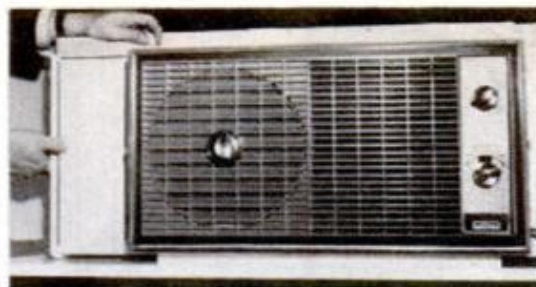
**CONTROLS** are mounted in a number of places. Pull knobs to see if they are sturdy, that they won't come off in your hand. Make sure controls for window units extend out far enough so a lowered blind will not block them

under normal operating conditions and how much a replacement costs. If it's a permanent filter, is it easy to remove and replace and, above all, is it washable? You should be able to remove filters without using tools or having to remove control knobs.

9. Better units tackle the rust



**FILTERS** should be easy to remove without the use of tools or having to remove control knobs



**ADJUSTABLE** side panel makes window mounting easier. It can be pulled out to make fit



**BTU RATING** should be stamped on unit; if it isn't, see manufacturer's specification sheet

problem by using metal parts made of aluminum or galvanized steel, usually covered with baked-on enamel. Try running a finger nail over the cabinet. You shouldn't be able to scratch the paint. To find if metal parts are rustproof, consult manufacturer's specification on sheet. Look into the unit's interior for the silvery glint of galvanized steel.

10. When service is needed, must the complete unit be removed from its mounting or can the chassis alone be lifted out of the shell?

11. Standard warranties cover the

entire unit for a year, the sealed refrigeration system for five years. Better warranties include labor charges for the first year.

Accessories such as remote controls generally aren't worth the money. But there is one exception—the instant mount. It permits do-it-yourself installation for window units. Check mount for sturdiness and rust resistance and make sure it fits your window.

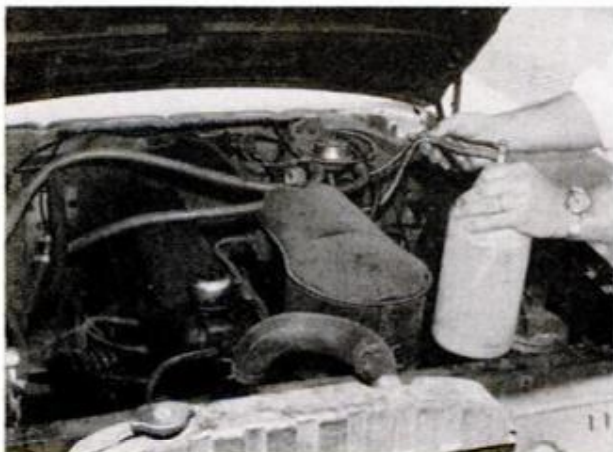
One final tip: If the salesman balks at your check-list or dodges your questions, walk out.

## ROOM AIR CONDITIONER ESTIMATING CHART

If the area to be cooled is:

If the area to be cooled is:	Use this size unit:
100 to 200 sq. ft.....	5500 to 6000 BTU
200 to 300 sq. ft.....	6000 to 7500 BTU
300 to 400 sq. ft.....	7500 to 9000 BTU
400 to 500 sq. ft.....	9000 to 11,000 BTU
500 to 750 sq. ft.....	11,000 to 14,500 BTU
750 to 900 sq. ft.....	14,500 to 16,500 BTU
900 to 1000 sq. ft.....	16,500 to 18,000 BTU
1000 sq. ft. and over.....	18,000 BTU and over

In certain situations your computations will have to be altered. Add 10 percent to your total BTU requirement for each of these conditions that apply to you: Picture window or several unusually large windows exposed to the sun; roof or ceiling not insulated; summer temperature in area is consistently above 90 degrees F. Also, a single room air conditioner can cool several rooms in a home which has an open floor plan. Be sure to include the dimensions of all rooms you want cooled.



## HOT . . .

**HOT DRINKS** are mixed from powdered ingredients in tubes, top, and hot water from jug under hood

## Drink While You Drive

Hot and cold drinks can be poured while driving, from two dispensing systems that can be built into the dashboard.

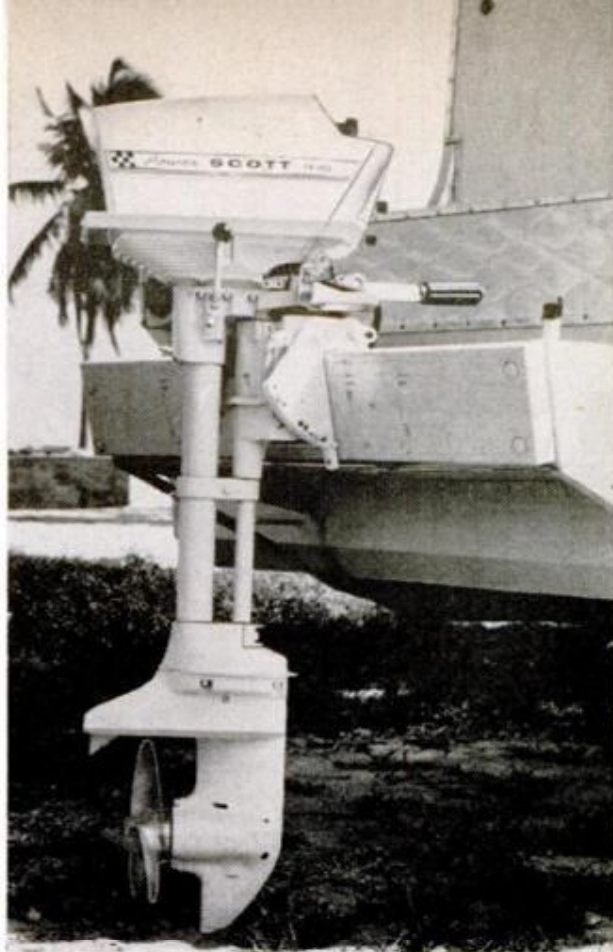
The hot-drink dispenser (Keeney Research, 2600 W. 50th St., Chicago, Ill.) includes tubes of powdered coffee, tea and soup. The cold dispenser (Frigie Car Fountain, Yakima, Wash.) pours pop or ice water.

## OR COLD

**COLD DRINKS** are pumped from vacuum jug on floor with help of tube connected to engine vacuum pump



JUNE 1962

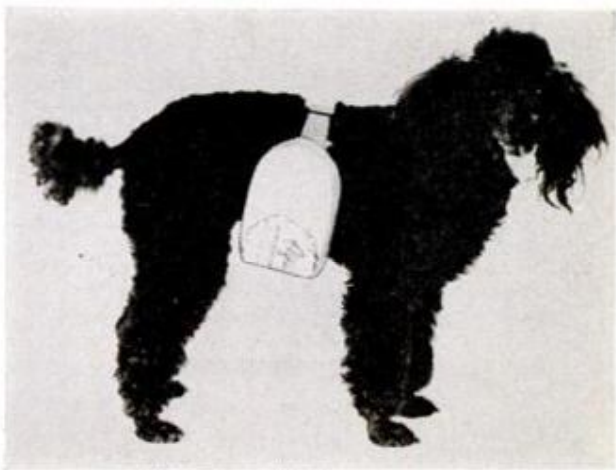


## Outboard Work Horse

Specially designed for low-speed, high-thrust operation, a new heavy-duty work outboard is fitted with a heavy, extra-long lower unit with a 16-to-41 gear ratio and an over-sized 13-by-7-inch propeller. The power head is a stock 14.1 Scott outboard engine. The combination produces maximum thrust at half the usual fuel consumption. It's made by Scott Outboards, 2700 Winter St., NE, Minneapolis.

## It's a Dog's Life Belt

Well-dressed boating dogs will wear life belts for '62. Dogs are good swimmers, but can tire and drown in an emergency. Belt comes in choice of three sizes for \$5 from Aqua-King Mfg. Co., Ft. Worth, Tex.



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**OUTDOOR SCRUBBER** with 12-inch plastic-bristled brush attaches to hose to wash outdoor areas. Control valve regulates water and suds. Price is \$5.95; by Osrow Products Co., Hazel St., Glen Cove, N. Y.

**SNACK GRILL** makes miniature sandwiches out of bread slices or pastry mixes that can be baked or toasted with meat or fruit fillings. Costs \$29.95; made by Sunbeam Corp., 5400 W. Roosevelt Rd., Chicago 50, Ill.

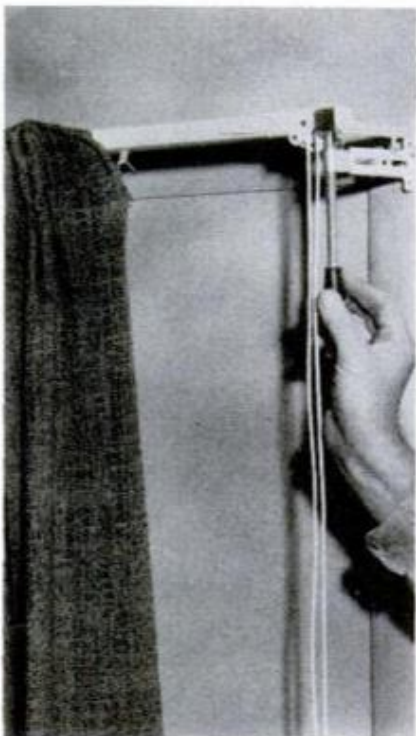


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## WHAT'S NEW FOR Your Home



**HOME HI-FI SYSTEM** plays through ductwork of hot-air furnaces. Connecting 50 feet of lamp cord from unit to speaker leads of hi-fi amplifier, radio or TV set converts hot air registers to loudspeakers. Costs \$49.95; made by Roger Mark Corp., 153-159 W. Ohio St., Chicago, Ill.



**DRAPES ADJUST** without alteration within three-inch range up or down by adjuster fixture attached to standard wall bracket. Turning a knob actuates screw mechanism to change drape height. Made by Cabinet Top Industries, Inc., 968 Ft. Wayne Ave., Indianapolis, Ind.

POPULAR MECHANICS



**CORDLESS ELECTRIC MOWER** provides 1½ to 2 hours mowing time on one battery charge. It is powered by a 12-volt d.c. motor which is weatherproofed. The 12-volt battery is explosion and spillproof. A battery charger which plugs into any electrical outlet is included with each mower; charging time is 12 to 16 hours. The unit has a removable key. The Reo mower is made by Motor Wheel Corp., LaGrange, Ind.



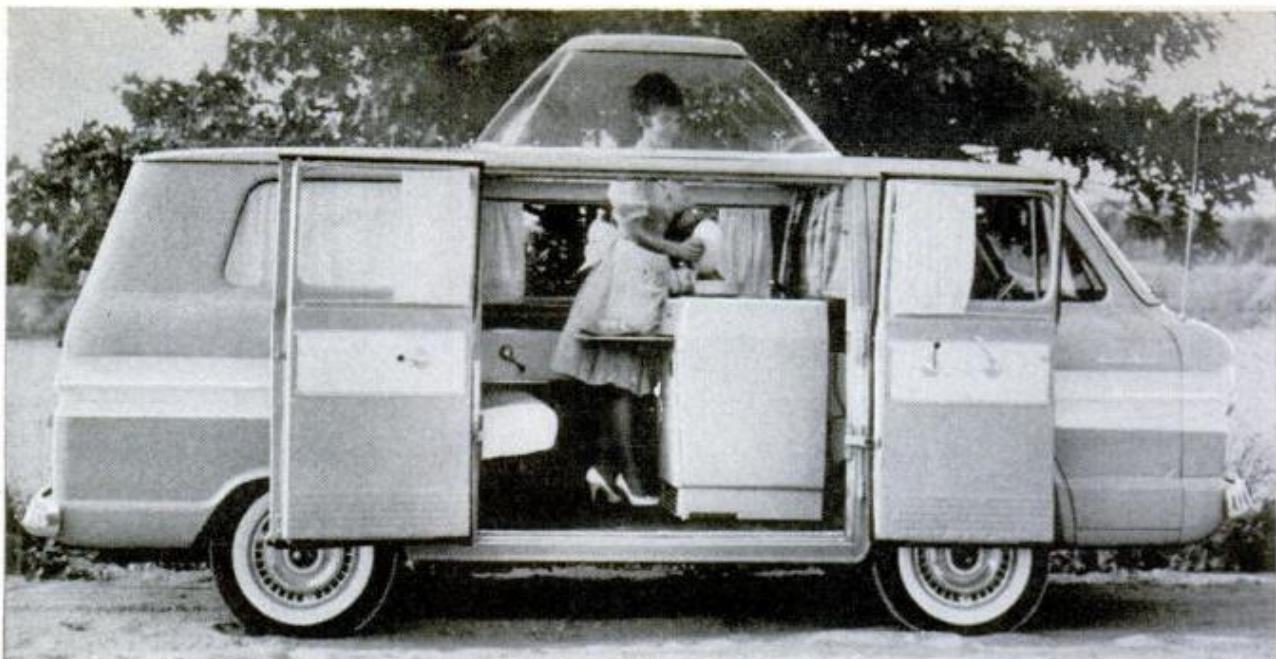
**WATER FILTER-PURIFIER** provides fresh, pure water for all drinking, cooking and mixing needs. It attaches to the kitchen sink and filters out chlorine, bacteria, algae, sediment, sand, rust, radioactive fallout matter, objectionable tastes and odors. A replaceable filter cartridge (\$3) is changed without tools. The purifier costs \$49.50 from Water-Gard Corp., 5444 W. Washington Blvd., Los Angeles 16



**AIR-OPERATED CLOSER** keeps cabinet doors safely closed without any kind of catch and permits full use of storage space. A light touch activates the aluminum closer and silently shuts the door; a knurled nylon knob may be adjusted to vary the speed of closing. The closer costs 65 cents, including three screws for installation, from Ideal Brass Works, Inc., 291 E. Ninth St., St. Paul 1, Minn.



**ROLLING TELEPHONE "BOOK"** provides fingertip accessibility for three dozen telephone numbers at home or in the office. The spring-loaded unit attaches easily to any telephone and rolls out of sight like a window shade when not in use. Made of aluminum, the compact roller file fastens to the base of the phone. Price is \$1.98 ppd. from Wentworth Bungalow, 2629 N. Palo Verde, Dept. 33, Tuscon, Ariz.



**TRAVILLE'S DOME** gives stand-up room plus 22 square feet of visibility; can be replaced by flat panel



**HOME CRUISER'S TOP** collapses neatly. Licensed as station wagons, campers can legally travel all streets

## Stand-Up Campers

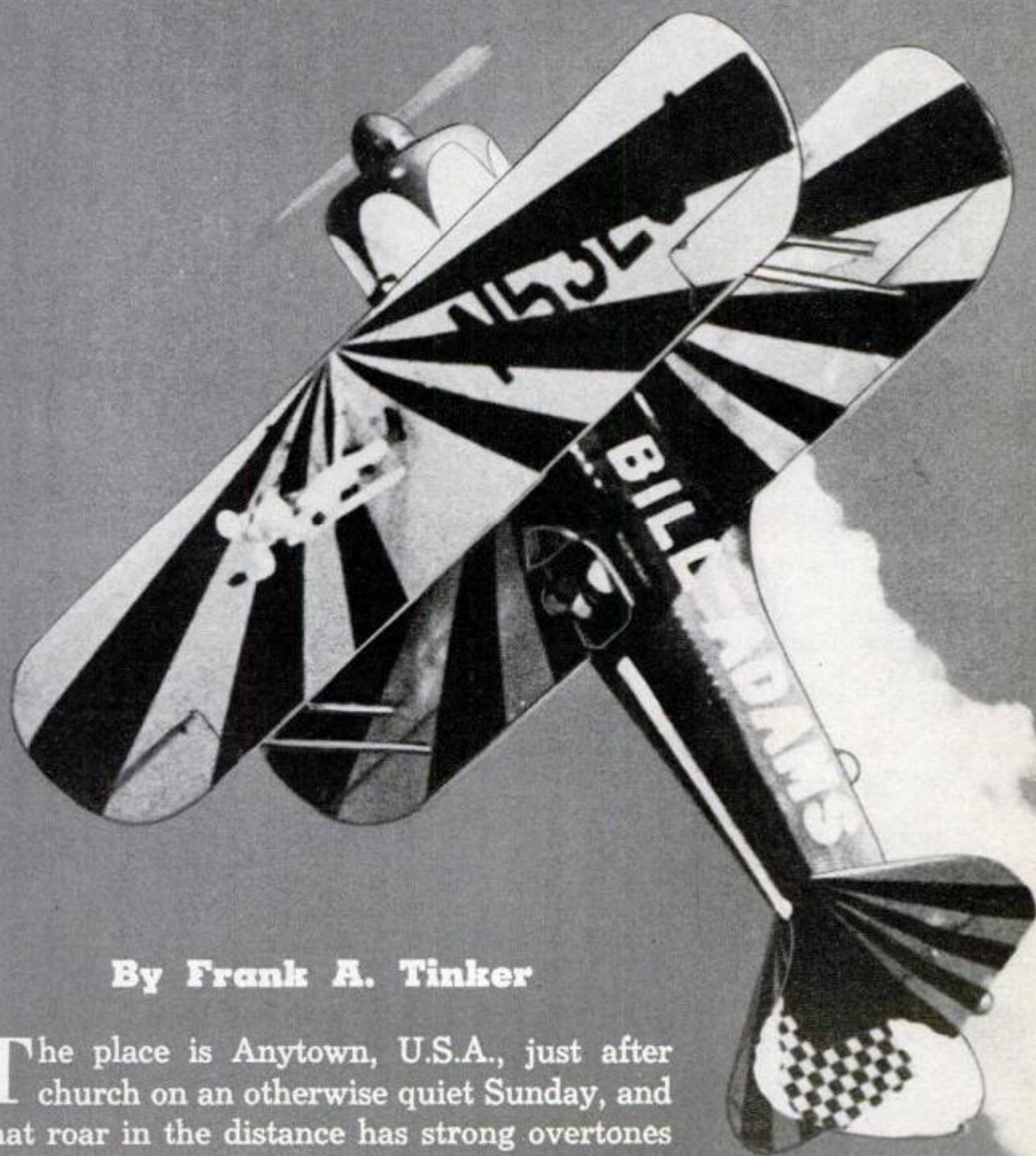
The boom in outdoor vacations has resulted in some space-stretching conversions of American compact buses to rig them as campers.

The Home Cruiser, built by Travel Equipment Co., New York City, uses Falcon (\$3350) or Corvair (\$3650) vehicles; the Traville (Detroit 26, Mich.) Vista Camper converts the Greenbrier Sports Wagon (\$4163). Their novel roofs allow stand-up cooking. Both sleep four adults and contain full kitchen, water storage and toilet facilities.

**TRAVEL TOP RAISES** in a jiffy to over six feet of stand-up space. Sliding windows in dome have screens



# Here Come the Barnstormers!



**By Frank A. Tinker**

**T**he place is Anytown, U.S.A., just after church on an otherwise quiet Sunday, and that roar in the distance has strong overtones of an old-time circus parade and, in a way, that's exactly what it is. But the gaping townspeople soon find that all the racket comes, not from a herd of elephants and a circus band, but from a single old Stearman biplane. But what a plane! Flying at minimum altitude and surprising speed, its blue-and-white fabric fairly glistens, its oversize engine has an astounding "blat," and a streamer of white smoke

## Wingstands, Anyone?

**JUDY COLE**, mother of three, straps herself onto top wing of Stearman where she will stand while biplane does rolls and loops and flies upside down past stands. Why does she do it? "Because it's fun!"



twists behind it as the pilot clears the town's settled area doing slow rolls repeatedly, slowly, effortlessly.

No wonder dazzled citizens, literally by the hundreds of thousands, have followed this spectacular Pied Piper to local airports all over the country to see the rest of the circus. And they are not disappointed. Awaiting them is a thrilling capsule of the most colorful—and nearly bygone—part of aviation, the barnstormers. Here are elderly planes doing things modern ones cannot approach, pilots displaying skills no longer taught, and daredevils who make the ordinary circus stunts pale by comparison.

Shows such as this move fast. And one of the fastest—and best—is the Cole Brothers Air Show. Barely have the spectators settled in their seats with a bag of popcorn than they are jolted out of them again by the sight of several twisting dots falling from a Piper Cub high overhead. One of these is handsome Brad Parlin, a graduate of the 101st Airborne Division, who takes such dives so easily that he frequently naps until moments before he goes aloft.

Another sky-diver from a local club may jump at the same time, arms outstretched. Brad, who has followed him out of the plane a split second later, maneuvers above while falling free until his position is precisely right, then folds his own body and dives past so closely he snatches a baton from the other's hand! Smoke trailing from both jumpers makes this an easily followed, hair-raising stunt.

If Brad seems indifferent, the next performer, Judy Cole, makes up for it. This petite mother of three bubbles with antici-

pation as she mounts the top wing of the fabulous Stearman. Cables attached to her skin-tight suit fasten to rings in the structural members, her feet slip into roller-skate straps, and her back is braced by an upright which also locks into the spar. Standing erect, she spreads her arms like a bird as the plane goes blasting aloft. It loops, rolls and roars past the bleachers on its back while Judy waves gaily in the 180 m.p.h. breeze.

"How—and why—do you do it?" asked a stout Midwest matron as trim-figured Mrs. Cole, looking more like a sister than a mother to her children, jumped down from the wing after a ride.

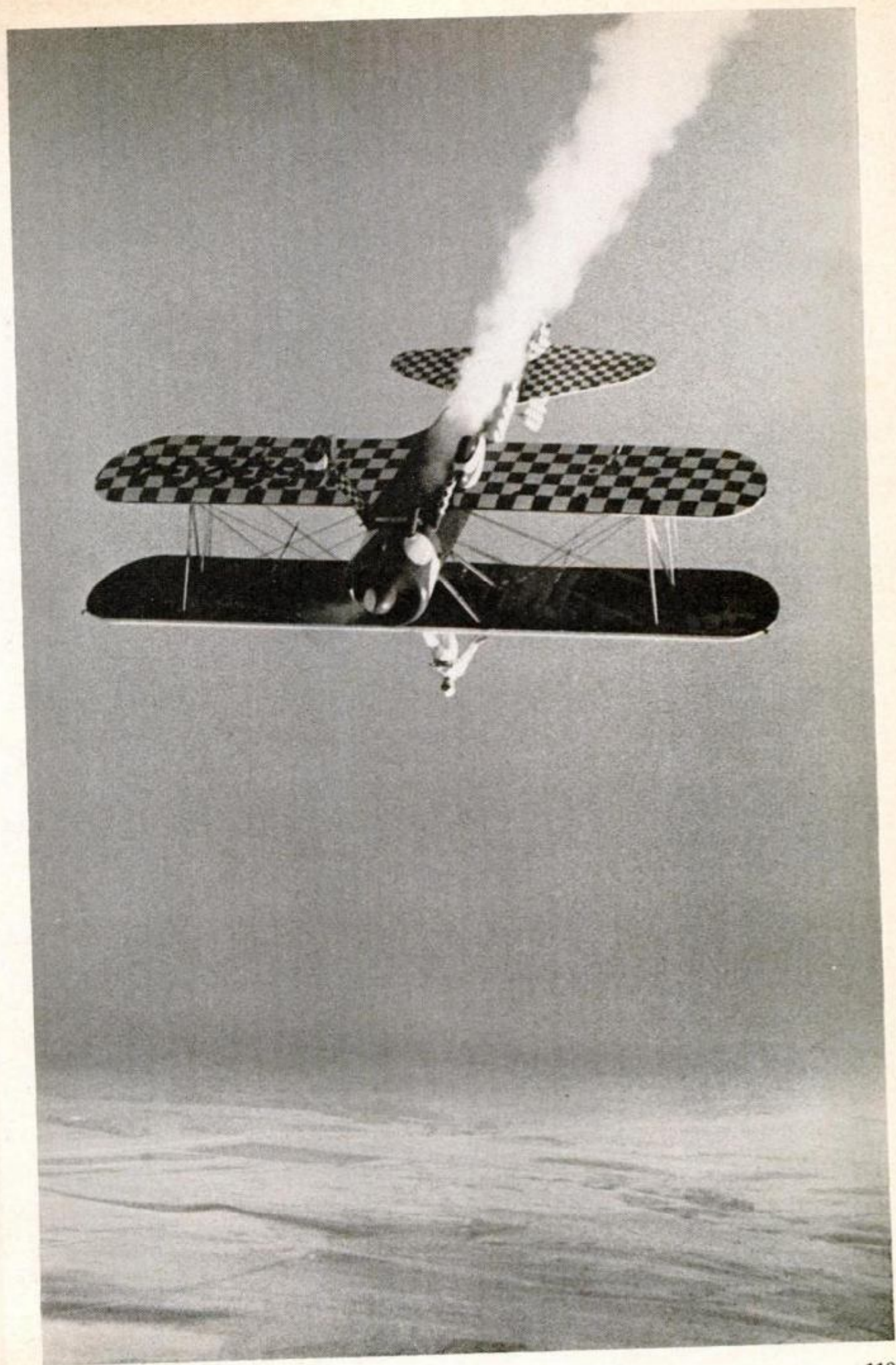
"Because it's fun!" Judy told her.

Judy married Duane Cole, leader of the troupe, when she was barely out of school. Two decades and three children later, at an age when most women try nothing more adventurous than a new hair style, Judy volunteered to ride the Stearman's wing when the regular performer left the show. Today, in her fourth season, she still swears she loves it.

Her children are all part of the show. John, 16, does the announcing, Rolly, 22, flies the Cub they use for the parachute drops and pick-up stunts, and sneaks in a few spins and rolls of his own and Karen, 9, skips about between the planes while mamma dangles overhead.

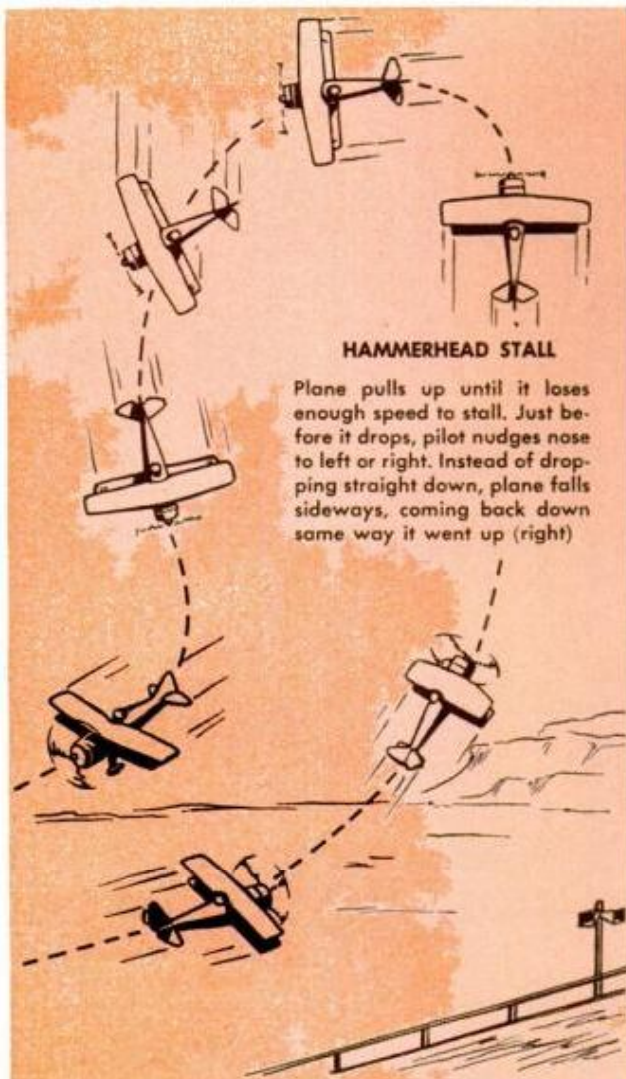
Following Judy's ride, her husband, Duane, puts on a show-stopping exhibition of precision aerobatics in a Taylorcraft whose wings have been shortened by several feet and whose special engine rates at 100 horsepower.





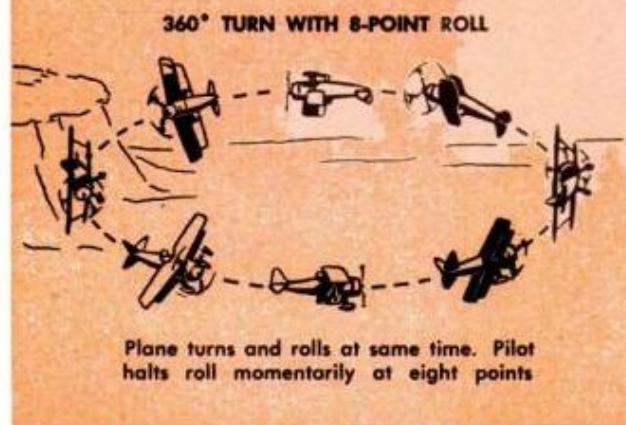
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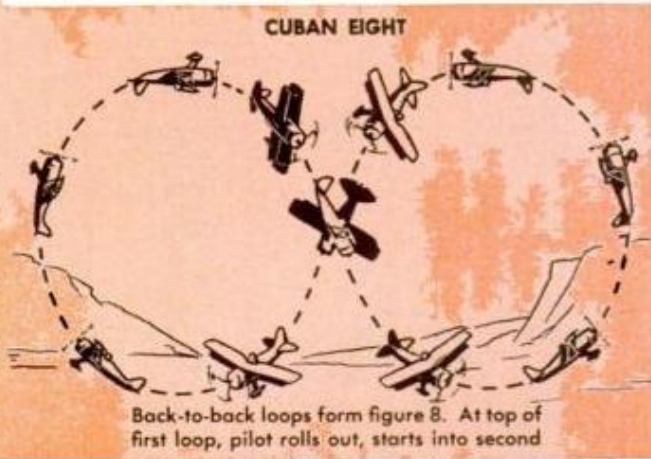
**HAMMERHEAD STALL**

Plane pulls up until it loses enough speed to stall. Just before it drops, pilot nudges nose to left or right. Instead of dropping straight down, plane falls sideways, coming back down same way it went up (right)



**360° TURN WITH 8-POINT ROLL**

Plane turns and rolls at same time. Pilot halts roll momentarily at eight points



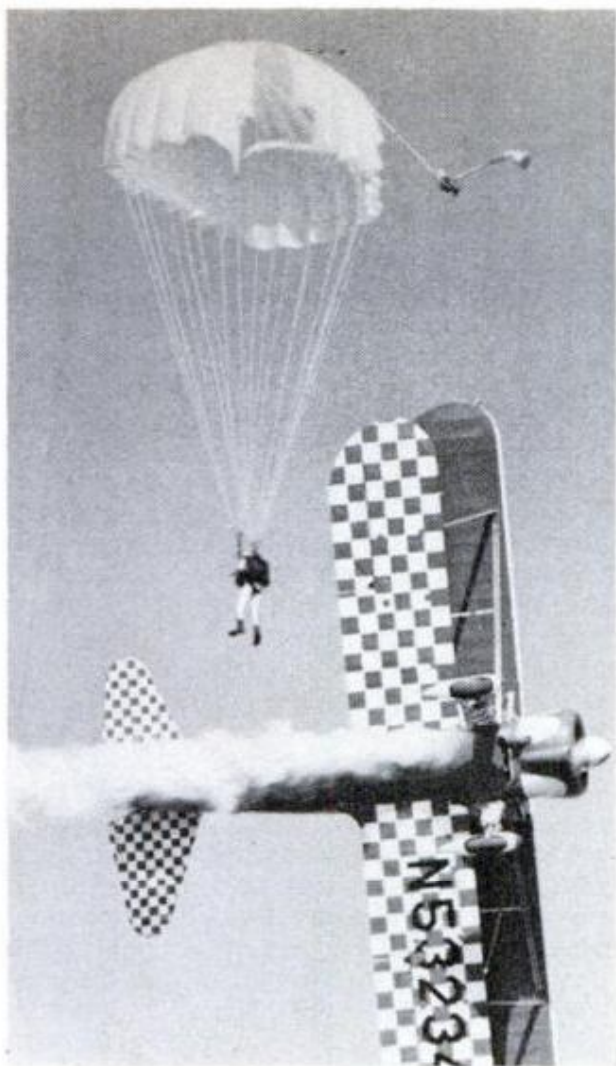
**CUBAN EIGHT**

Back-to-back loops form figure 8. At top of first loop, pilot rolls out, starts into second

**AERIAL ACROBATICS**, almost a lost art, are performed expertly by Cole's Show. Inverted takeoffs, square and outside loops, and three maneuvers diagrammed above are part of a show rich in nostalgia and thrills

Seemingly guided like a toy on a string, Duane's little plane climbs out inverted from takeoff, does square and outside loops, eight-point rolls while at the same time making a complete circle in front of the stand, and leaves even the expert light-plane enthusiasts in the crowd shaking their heads in disbelief. But Duane is quite a pilot. In the First International Aerobatics Contest sponsored last winter in Phoenix, Ariz., by the Experimental Aircraft Association, Duane won the cham-

pionship. His son, Rolly, came in third. Duane is intensely interested in his barnstorming profession, but very matter-of-fact about it all. During one show he climbed to altitude, then switched off the engine and went through his aerial gymnastics while the prop hung motionless! Back on the ground, he was asked why he had made things doubly difficult. "Had a headache," said the stocky, cocky trouper. "Couldn't stand the noise the damned thing was making." Such a dead-



**MORE TRICKS!** Sky diver, when his chute finally opens, is circled by Stearman streaming smoke. Air lift is made from back of speeding auto that sometimes must get up to 90 m.p.h. to keep up with pick-up plane

stick routine is now part of every show with Duane setting the plane down at the precise point where his takeoff roll began and, still without power, coasting slowly to a halt at the exact position it occupied before starting!

It is Duane's mastery over his plane which provides the lasting thrill to aviation veterans. A product of the prewar barnstorming days, Duane recalls his first flight instruction with a wry grin. Depression days had put him on the road with so many

other lads, and a bleak Christmas day found him stranded in Phoenix with a dollar and a half to his name. At the local airport he located a gent with a Monocoupe who was equally broke and bought his first half hour of flight from him.

After World War II, four of the Cole brothers put together their first show. At that time they were only one of many outfits which threatened to litter the landscape, but they soon earned a reputation for extraordinary skill. One of their stunts

# Show has never had an accident . . .

called for three of them to fly formation while inverted, the center plane cutting a ribbon stretched a few feet off the ground with its vertical stabilizer!

When the competition became downright murderous, however, they had to sell their aircraft piecemeal to stay in business. They hit bottom in Humboldt, Neb., when exactly \$28 was all that was left to divide between them. First Lester, then Marion, left the show for the more settled life of executive flying, in which they are still active. Whenever the present show is in their area, however, they usually drop around to 'wring out' the equipment.

Duane, meanwhile, has kept this extraordinary exhibition going through thick and very thin to its present popularity.

## Nostalgia of a County Fair

The Cole Bros. show, like its counterparts everywhere, has the nostalgic atmosphere of a county fair, with barbecued chicken, tomfoolery, and the ever-present tingle of risk. If there is a break, it is usually filled by one of the military precision teams, the Air Force's Thunderbirds or the Navy's Blue Angels. Then Rolly does a long spin in the Cub, with the crowd hollering for him to pull out. He does, and Brad Parlin is awakened again to transfer from a speeding convertible to the same plane, a stunt considerably more tricky than it sounds. Clinging to a rope ladder which dangles from the cockpit of the souped-up J-3, he also scoops a flag from the runway.

The finale to the whole affair is a solo by Bill Adams, whose Stearman first lured the crowds from their TV sets and whose gentle hand kept Judy Cole from whipping off into space during their wing-riding act. Now his hand is much less gentle as he proves beyond any doubt why he is rated as one of the world's top aerobatic artists. No sooner is the Stearman airborne than it is rolling and climbing almost vertically. When he has a few hundred feet between him and disaster, Bill starts an incredible routine, maneuver following maneuver without break. Cuban "eights" written in perfect penmanship with smoke, rolls performed while going straight up, snap rolls to the outside or inside, inverted and knife-edge flight a few feet off the ground—all these are reeled off with precision and flair, directly in front of the bleachers. At either end of a stunting run along this stretch he pulls up in a hammerhead stall which brings him rocketing down across the field in the opposite direction, with sufficient speed for another caper.

Like Duane, Bill has long been obsessed with airplanes. Flying with the Cole Bros. show was his boyhood dream, and he started hanging around airports, doing odd jobs for flying time until he could get his license. Crop-dusting finally gave him the money to buy a Stearman of his own, long hours of practice and a phenomenal native ability finally landed him a substitute spot in the show. When Marion Cole retired, Bill bought the famous plane which had won the world's aerobatic title.

This primary trainer biplane, built before World War II, has had affection and care lavished upon it which perhaps only a stunt pilot would appreciate. Its hand-rubbed finish, reflecting 15 years of elbow grease, adds critical knots to its speed. In addition to its beauty, the ordinary 220-hp. engine was replaced by a 450-hp. Pratt and Whitney, one of the most raucous and dependable power plants ever manufactured. Bill equipped the plane with a scavenging oil system for inverted flight, added an extra set of ailerons so that both upper and lower wings provide control, and cleaned up its design with wheel pants, smooth pressure cowling, and an enclosed front seat. Additional bracing in the wings and fuselage makes the originally sturdy airframe practically indestructible aloft, although after every show Bill has a session of tightening bolts and fittings.

## Pampered Planes

This concern with the planes is a habit of everyone in the show. They have never had an accident. Duane has said that if they ever do, his aerial circus will pull down its big top for good. During the 1940s and 50s so many doubtfully qualified pilots and planes were stunting that the business inevitably got many black eyes. This culminated at Flagler, Colo., when an unauthorized pilot rolled and crashed into the crowd, killing a score of spectators. Today, a newcomer would have a hard time getting permission to stage any aerial exhibition not 100 percent safe.

Even the best-laid shows go awry, however, and this one has had its moments. Coming through an outside loop, an especially violent maneuver, the pressure once blew out all the windshields in Duane's cockpit. On another occasion, in the middle of an inverted pass, his gas line broke, starving the engine and creating an imminent possibility of fire.

What happened then?

"Nothing," Duane shrugs. 'I rolled 'er over and set 'er down.'

(Continued to page 176)

## Golf Cart Goes to Work

Popular on golf courses, the three-wheel cart that carries golf clubs and golfers has now appeared in a utility-vehicle version for airports, cemeteries, parks, housing projects and motels.

Its 10-horsepower engine gives it a top speed of from 7 to 10 miles per hour. Other features include a 5-gallon fuel tank, a transmission with forward, reverse and neutral positions, and a tiller steering bar with a 2-to-1 gear ratio.

The cart has a carrying capacity of more than 15 cubic feet. It is made by Toro Manufacturing Corp., Minneapolis, Minn.

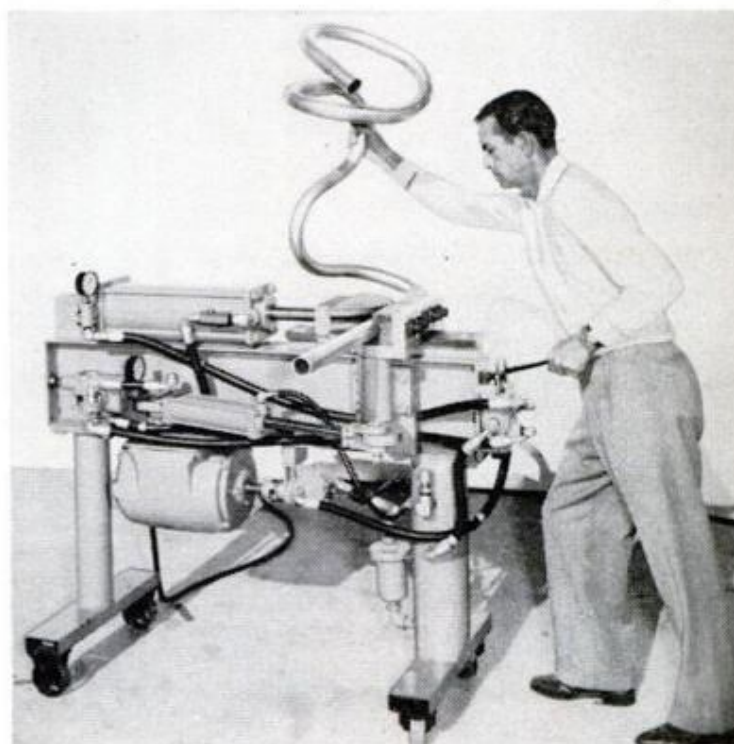


## New Twist in Benders

Tail pipes or head pipes are custom bent like so many fancy pretzels with a new, portable bender. The machine also corrects and straightens out bends up to 20 degrees.

Exerting 3000 pounds per square inch, the Huth Tube Bender handles 1 $\frac{3}{4}$ -inch 18 gauge or 16 gauge, or 2-inch 16-gauge mild steel or galvanized tubing without adjustment. Dies are available for other sizes and gauges.

Using the bender, it is possible to design pipes, giving an exhaust, for instance, custom treatment. Patterns are made from the car with wire, and stock pipe is bent to shape. Manufacturer: Huth Mfg., Inc., 1617 West Magnolia Boulevard, Burbank, Calif.

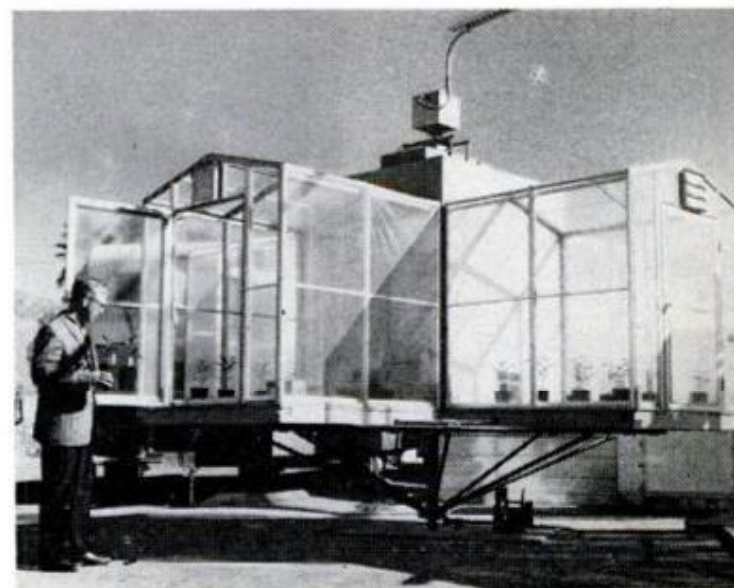


## Greenhouse Roundhouse

To study the effects of air pollution on plants, researchers at the University of California built a greenhouse that goes 'round and 'round, 15 times an hour.

The rotation insures the same light conditions for all plants while the researchers expose citrus seedlings in each of the four compartments to synthetic air pollutants. The project is specifically investigating the effects of fluorine and ozone on citrus trees.

Air conditioning maintains uniform temperatures and humidity within the compartments.



X436

SHOP AND CRAFTS



Drawings by George Blow

HERE'S WHAT the skeleton of the hull looks like, consisting of jig-sawed interlocking plywood formers





# *White Heat V*

## Radio-Controlled, Gas-Driven Hydroplane

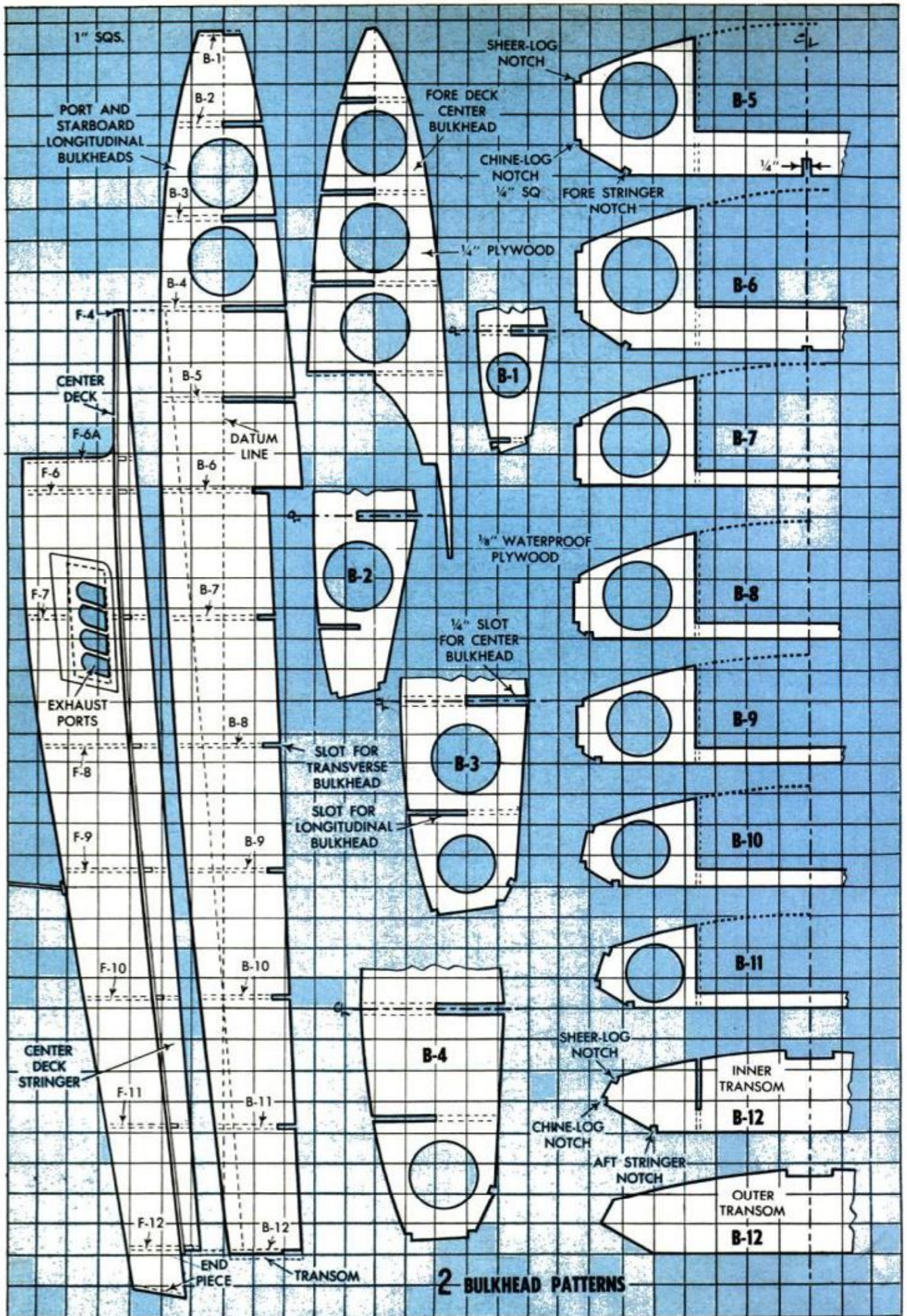
By Tom Perzentka

**P**OWERED BY a pint-size,  $\frac{3}{4}$ -hp. gas engine, this 42-in. R/C, single-step hydroplane is capable of thrilling straight-away speeds yet can be throttled down to a minnow's pace. It's small enough to carry and large enough to race and control on rough water. It planes beautifully, it's easy to start and is economical to build. It's a modelmaker's dream—sleek and streamlined from the word go.

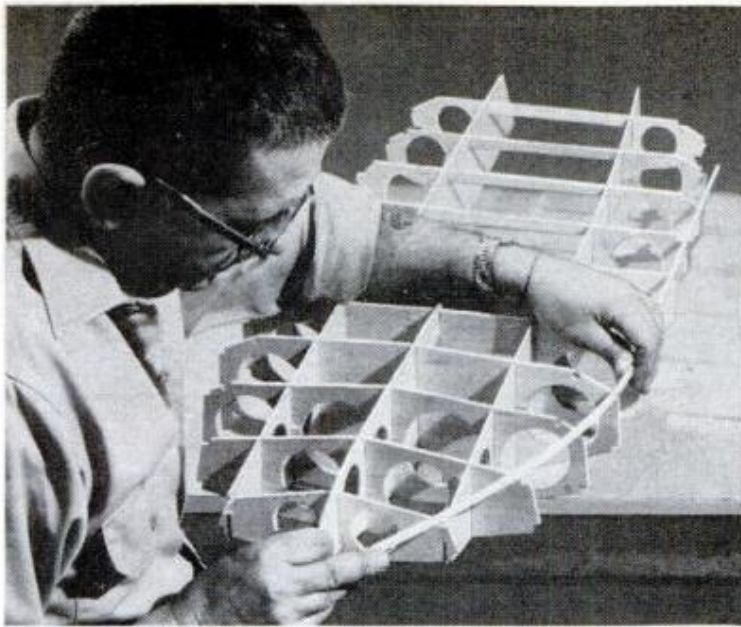
Power is provided by an Ohlsson and Rice gasoline engine, a pigmy power plant which weighs only  $3\frac{3}{4}$  lb. complete with recoil starter, cooling blower, magneto, carburetor and gas tank.

In studying the construction of the hull itself, you'll notice in Fig. 1 that the bulkheads fit together like the dividers of an egg crate, all interlocking in self-aligning, half-lapped slots. Your first step is to make full-size paper patterns for the 12 transverse bulkheads, or formers, the single foredeck center bulkhead and the two

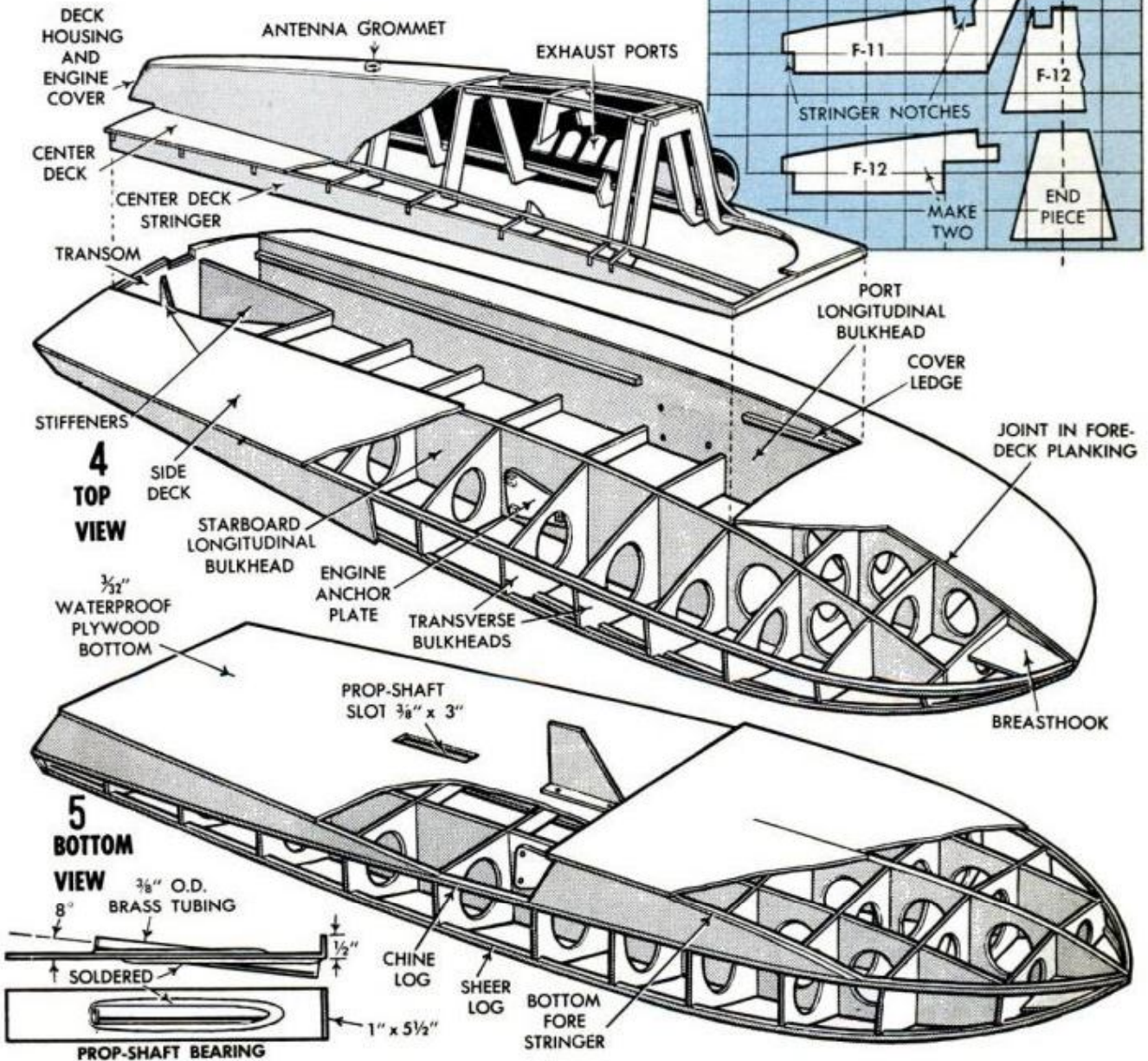
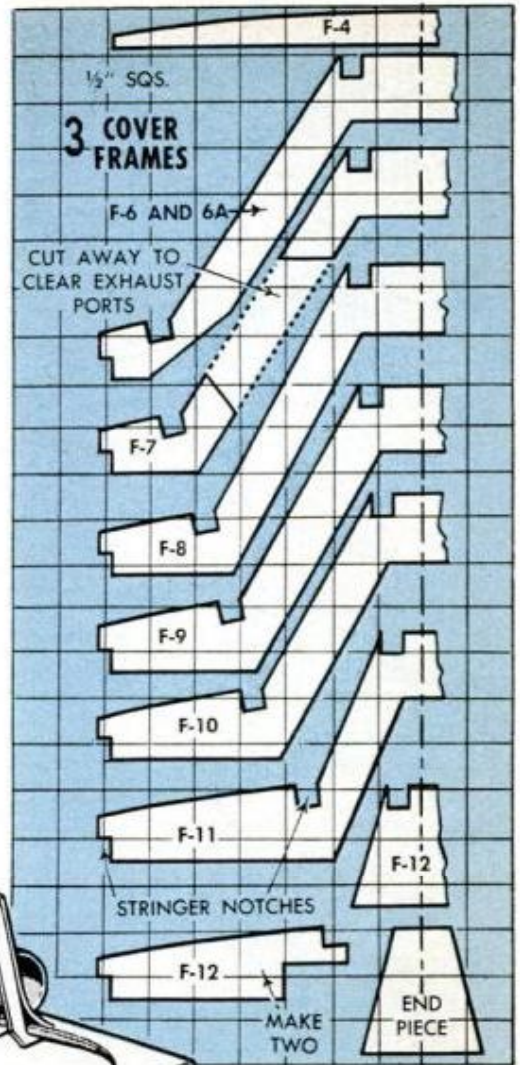
identical longitudinal bulkheads, or engine bearers. Counting the double-thick transom, there are actually 13 formers, but the two transom patterns differ only in that the inner one is notched. All the patterns are presented on squares in Fig. 2 for enlarging by the square method. Note that the formers are given as half patterns since they are alike each side of the centerline. Each former is numbered and keyed with the slots in the engine bearers to show right where they go. If you want to save yourself some work, you can buy full-size patterns, ready for pasting on the wood and sawing out. Except for the foredeck center bulkhead, or bow piece, which is cut from  $\frac{1}{4}$ -in. material, all the others are cut from  $\frac{1}{8}$ -in., 3 or 5-ply aircraft-grade plywood. A hole saw does a quick, neat job of forming the weight-reducing holes in the formers and if used, the holes should be cut before the formers are jigsawed to shape. The engine bearers, being identical, can be cut both at one time by tacking the material together. The engine is mounted in the hull on a special aluminum casting which is

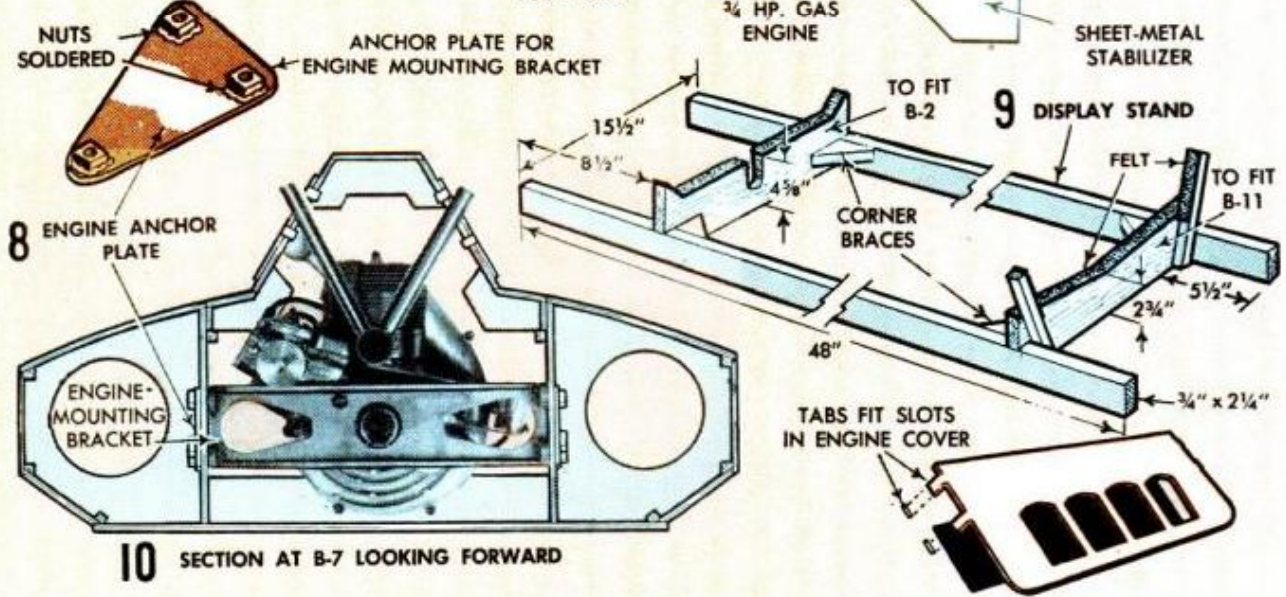
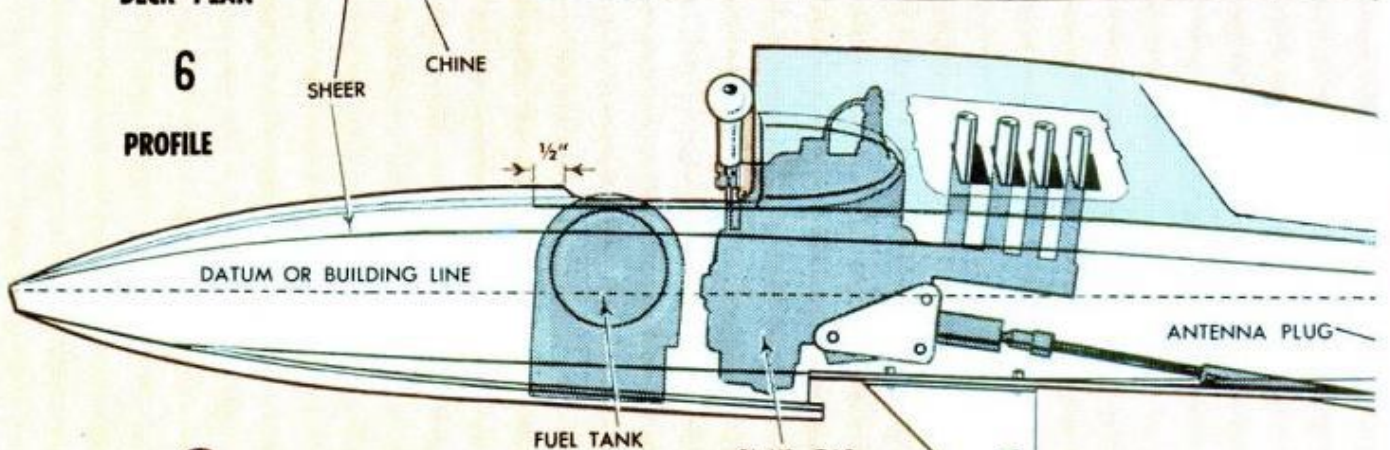
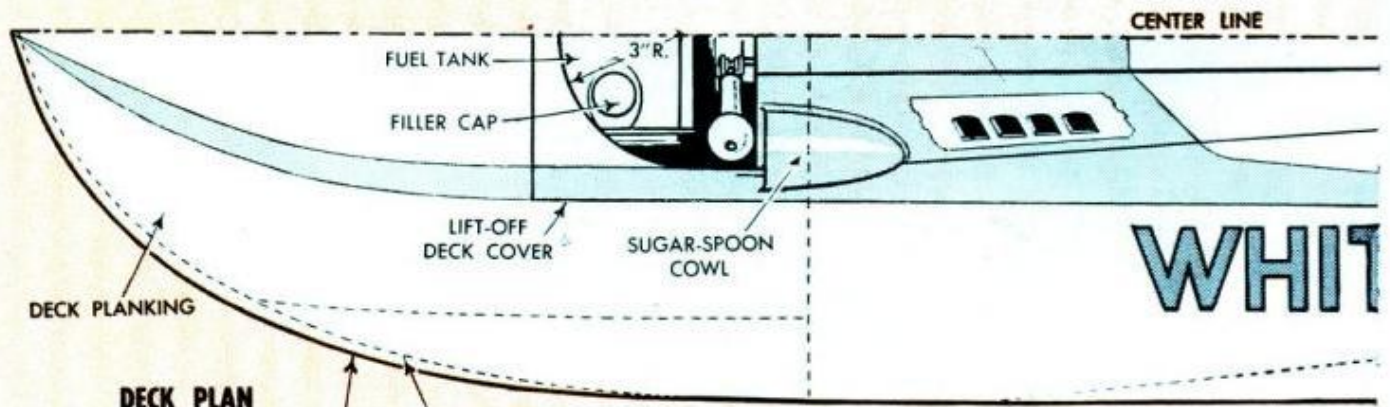






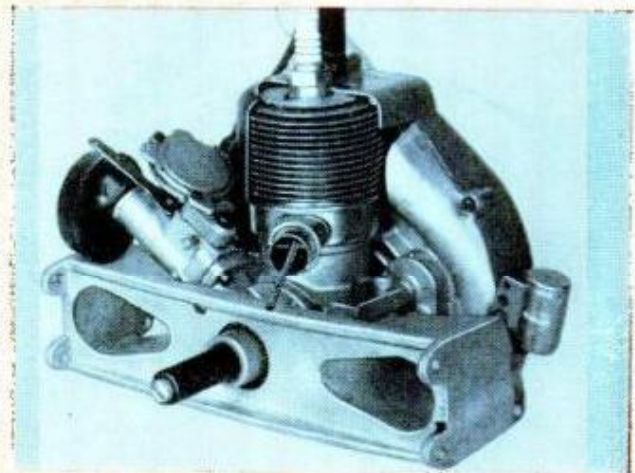
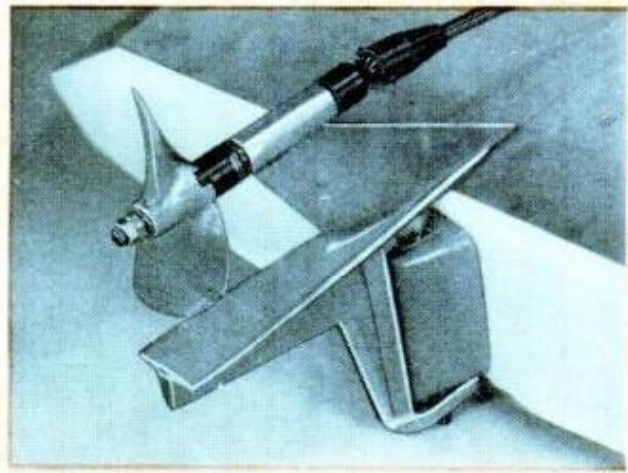
**CHINE AND SHEER LOGS**, soaked in water, are glued in notches cut in outer corners of the formers. Here the sheer piece is being checked for fit. These members are applied in full lengths



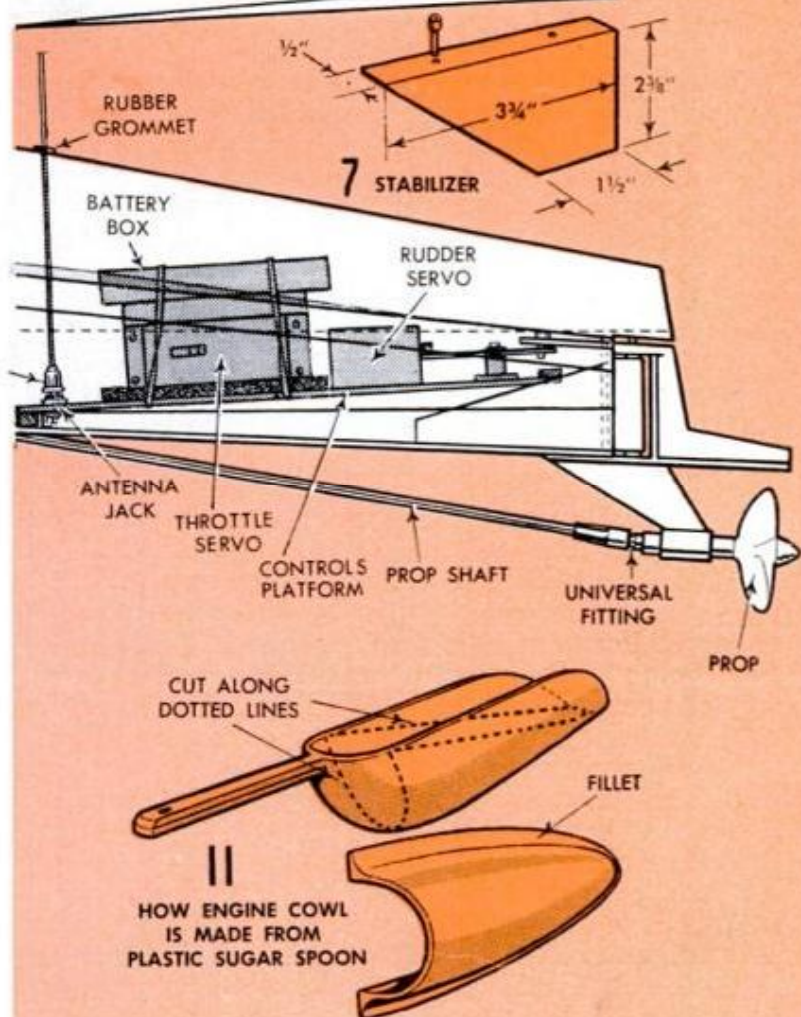


**THE STRUT AND STRUT** bracket which bolt to the transom, are castings you get in a kit. Also includes prop

**ENGINE-MOUNTING CASTING** bolts to engine bearers to provide rigid and necessary support for engine

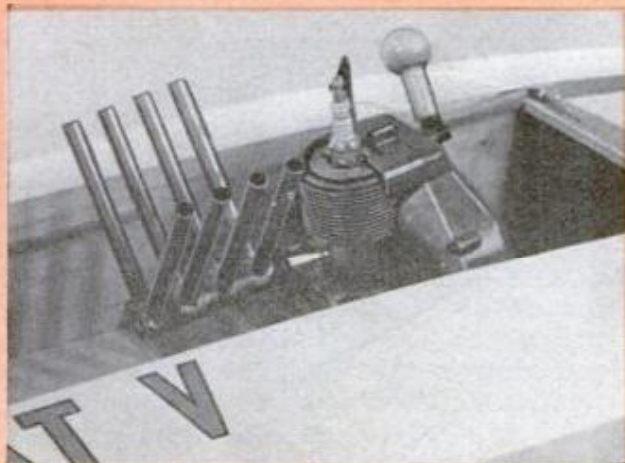


# HEAT V



II  
HOW ENGINE COWL  
IS MADE FROM  
PLASTIC SUGAR SPOON

ANOTHER PART in the kit is the chrome-plated manifold which takes place of original engine manifold



installed between bulkheads 6 and 7, Fig. 10. It is best to have this casting on hand so that the holes for bolting it to the engine bearers can be located and drilled at this time. The engine mounting casting, as well as the stuffing box, strut bracket, strut, manifold, prop, shaft and universals, is part of a kit which is available from Octura Models, 8148 Milwaukee Ave., Niles 48, Ill. The engine is available from the same source.

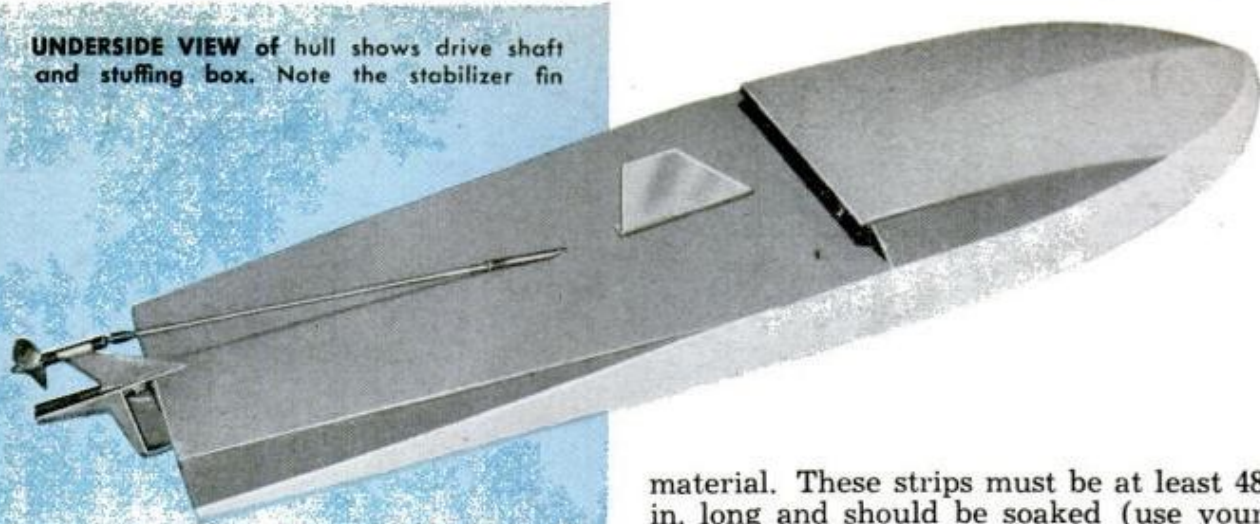
With all the formers cut out, start checking them for fit with the slots in the center bow piece and the engine bearers, making certain that the parts are flush top and bottom when in place. When all fit to your satisfaction, they can be glued. Make a number of spacer sticks beforehand from scrap wood to help align the formers in final gluing and also cut pieces for reinforcement at the bow. Use a waterproof glue or an epoxy adhesive for gluing. The formers are glued in place in stages, formers 1, 2, 3 and 4 being assembled first to the center bow piece and set aside to dry. Use the spacer sticks to assure alignment of the formers and check for squareness with the bow piece before the glue dries.

The second stage of assembly involves the gluing of formers 5 through 12 in the slots of the engine bearers. This requires a level surface, such as the top of your table saw, on which the engine bearers can be set on edge during assembly. After gluing, weight or clamp the assembly to hold it flat in contact with the work surface, check as before for squareness with the bearers and allow to dry.

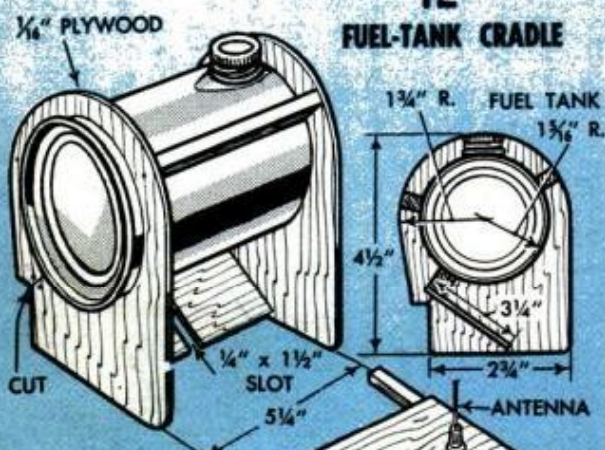
Now both preassembled sections can be joined together by gluing formers 1, 2, 3 and 4 in the bow slots of the engine bearers and adding reinforcing (breasthook) blocks where indicated. Check the after plane on a flat surface to make certain the assembly has not developed a twist.

The chine and sheer logs are installed next, Figs. 4 and 5, using 1/4-in.-square pine, spruce or hard balsa for both the inner aft stringers and the fore stringers. Again check for alignment of the bottom when doing the final gluing. The outer chine logs, also the upper sheer logs, are laminated of four 1/16 x 1/4-in. strips of the same

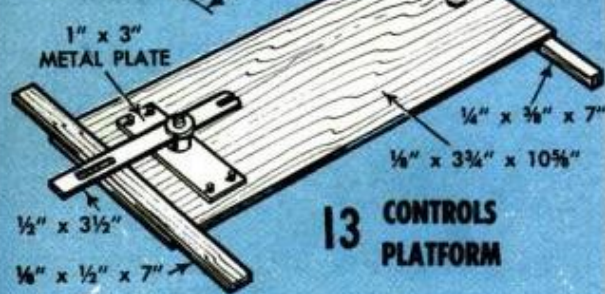
**UNDERSIDE VIEW** of hull shows drive shaft and stuffing box. Note the stabilizer fin



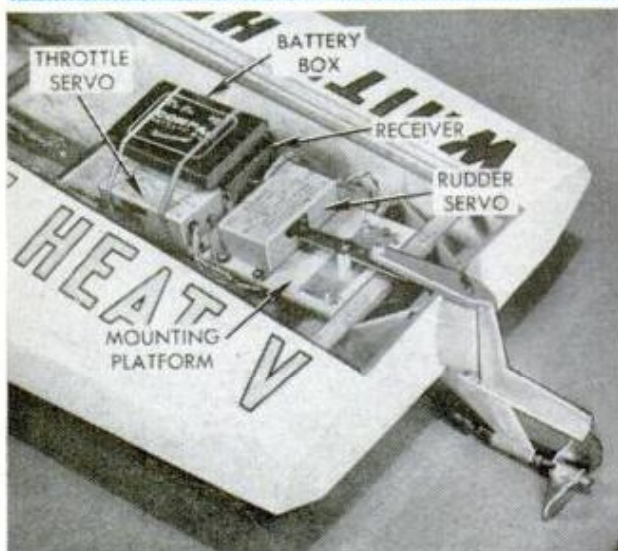
**12 FUEL-TANK CRADLE**



**13 CONTROLS PLATFORM**



**COMPONENTS** of controls include throttle and rudder servos, receiver and battery box



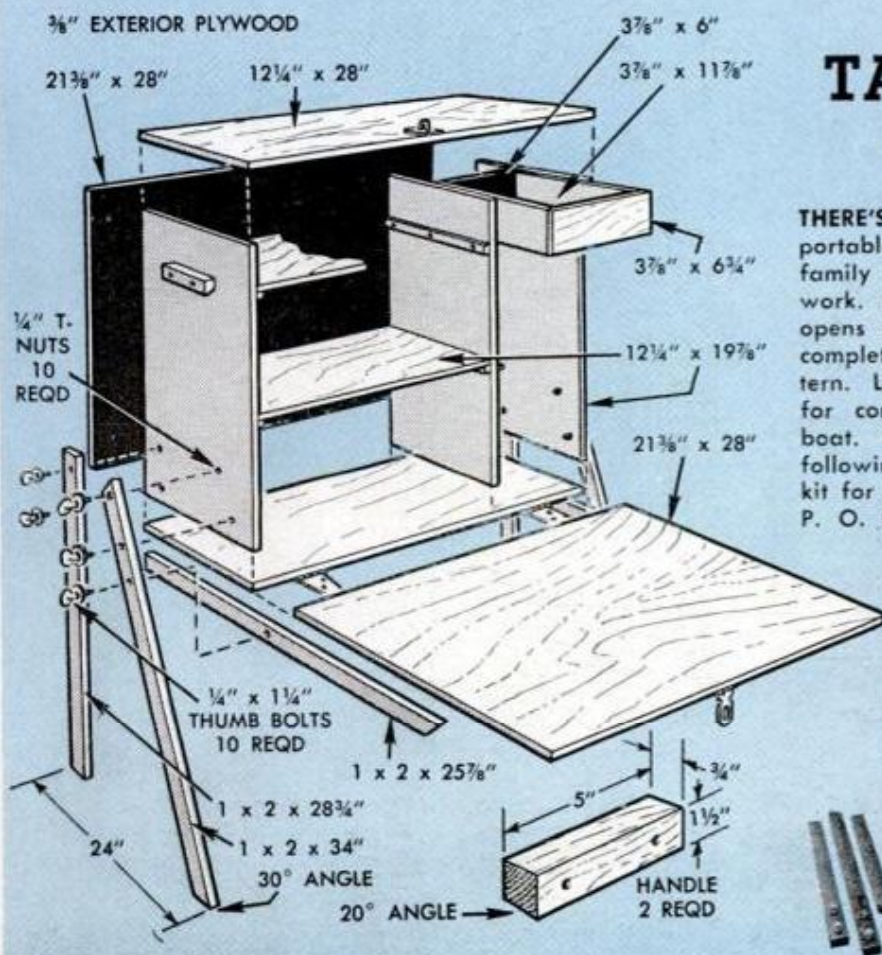
material. These strips must be at least 48 in. long and should be soaked (use your bathtub) before being glued in place. Use clamps or rubber bands cut from an inner tube and allow to dry in place before cementing or gluing. Again check hull alignment before allowing to dry. It is important that the outer chine logs are unbroken from stem to stern as any break will show up in the finished hull. Now, using a small hand plane, remove the excess chine and sheer-log material to conform to the corresponding hull section.

Make a sanding block about 1 x 4 x 12 in. and cover it with a medium-grade sandpaper. Proceed to sand the chines and sheer members as if the hull were a solid block, taking care not to catch the block on the formers and possibly break a glued joint. Sight down the area being sanded to be certain you are not sanding any hollows or flattening any lines in the framework. When all exterior edges have been sanded and blended, the hull is ready for planking.

With the exception of the bottom planking which is  $\frac{3}{32}$  in. thick, all planking is  $\frac{1}{16}$ -in. aircraft grade (waterproof) plywood. The wedge-shaped nonstrips on the after plane are installed first (see Fig. 5). Cut the plywood roughly to shape and glue in place, using clamps, clothespins and rubber bands to hold it. Sight from the bottom edge of former 12 to the bottom edge of former 6 to determine alignment. Also check squareness of formers to engine bearers before allowing to dry.

The after-plane bottom planking is installed next. As maximum width of plywood is 12 in., the planking is applied in two pieces and the joint is centered on one of the engine bearers. Here glue blocks are added along the outer face of the bearer and Du-Bro model fillets installed along the inside face for reinforcement. Again double check alignment of hull before allowing the glue to dry. Use clamps, clothespins, rubber bands to hold the bottom planking in place. Follow by gluing the nonstrips on the bow section, using the same

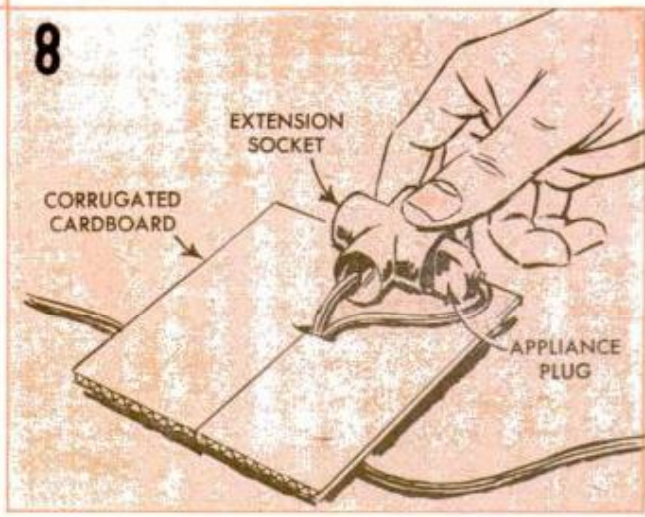
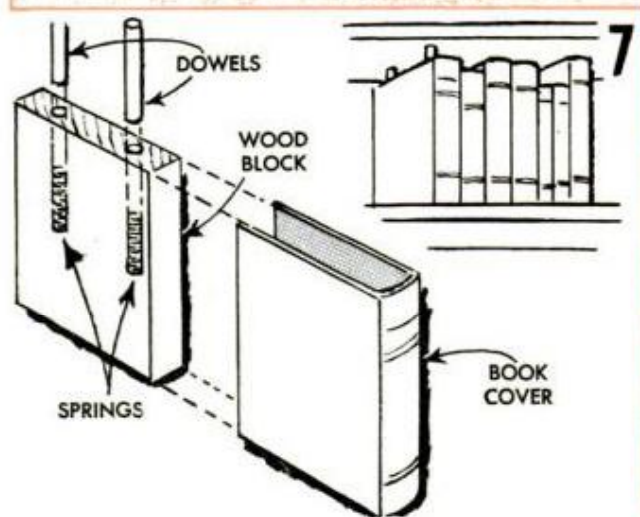
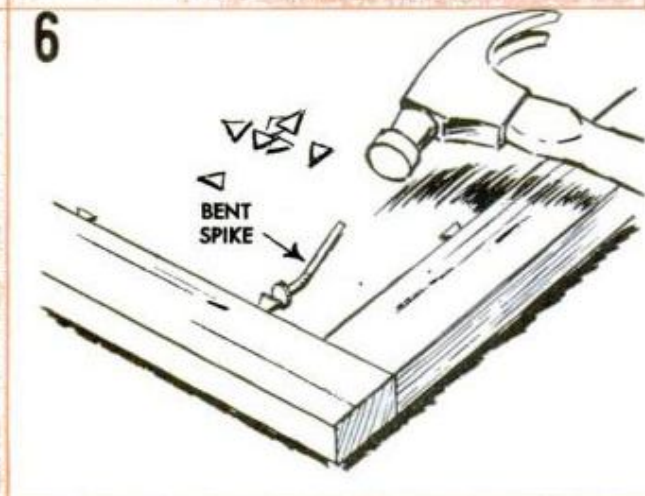
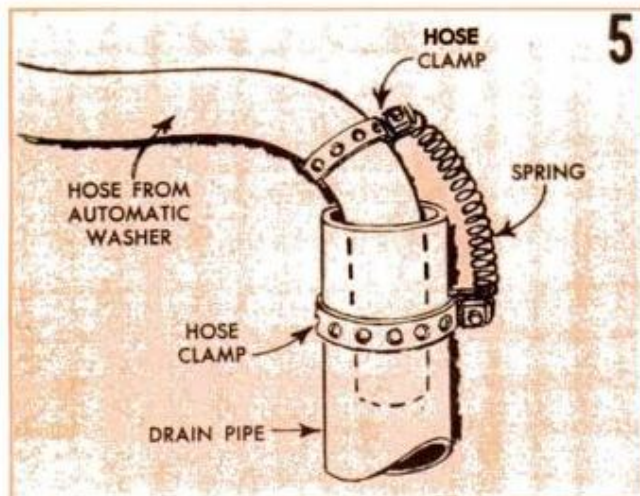
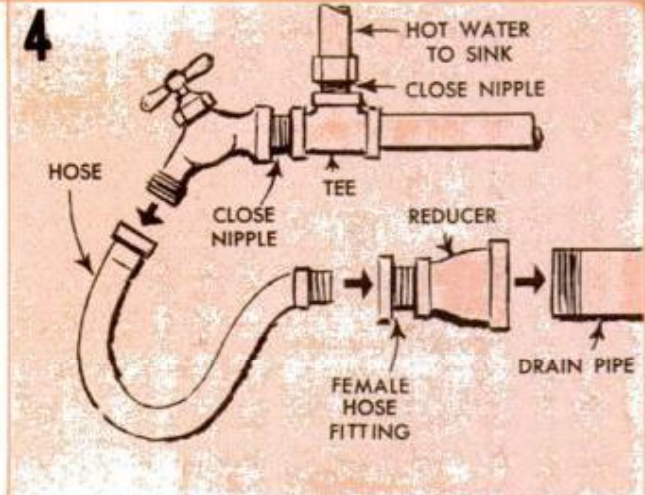
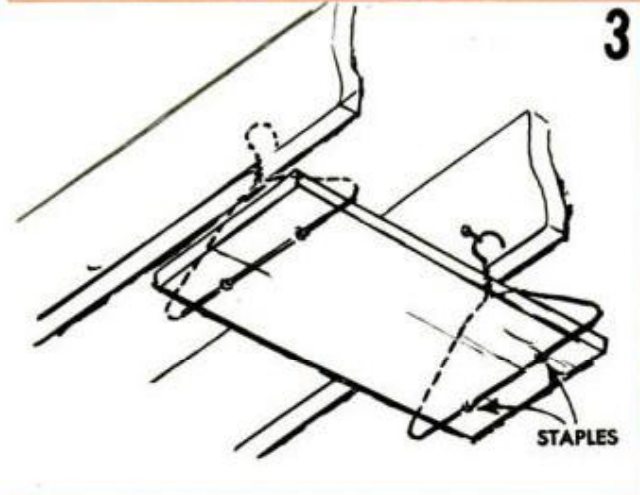
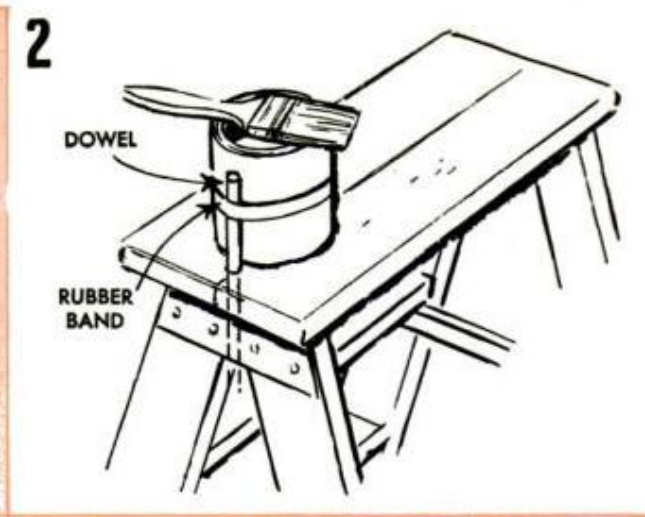
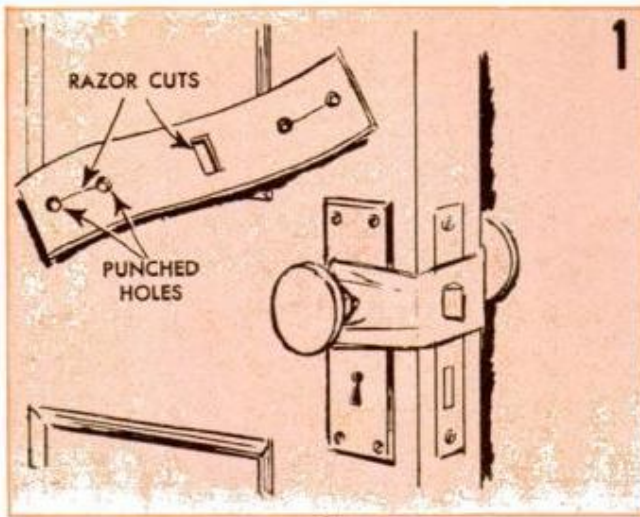
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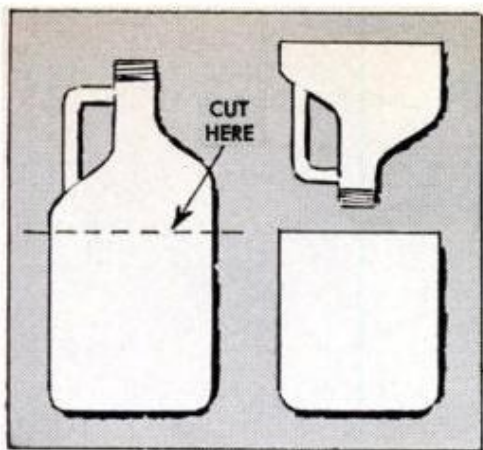


## TAKE-ALONG KITCHEN

**THERE'S A PLACE** for everything in this portable kitchen to make camping out on family trips twice the fun and half the work. Little more than a box on legs, it opens up to provide a pint-size kitchen complete with foodstuffs, stove and lantern. Legs detach, counter lid folds shut for convenient toting in car trunk or boat. You can make one from scratch following the details or buy a ready-cut kit for \$19.95 from Compers Kitchen Co., P. O. Box 6062, San Antonio 9, Texas







# Solving

## HOME PROBLEMS

**1. NOISY DOORS** can be made slamproof by installing rubber bumpers cut from old inner tubes. Strips should be  $1\frac{1}{2}$  in. wide and long enough to reach the knobs on both sides of the door. With a razor blade, cut a small hole for the latch and slit for knobs

**2. NO-TIP HOLDER** for paint cans can easily be added to top step of your step ladder. Drill a  $\frac{3}{8}$ -in. hole near one side, drive a snug-fitting wood dowel through the hole and snap a heavy rubber band over can and dowel. Drive dowel down flush when not in use

**3. TEMPORARY SHELVES** needed in the basement? Just hang two wire coat hangers from the joists and slip a board the width of the hangers between them. For longer shelves, use a series of hangers hung in a line, but be careful not to overload these units

**4. BY ADDING A FAUCET** to the hot-water line under sink cabinet, waste pipe can be flushed periodically with hot water under pressure to keep it free of grease. Short length of garden hose fitted with a reducer fitting to fit waste pipe is all you need

**5. DRAIN HOSE** from an automatic washer will often slip out of the drain pipe after being loosened by vibration from the washer. To prevent this, fasten hose clamps to both pipe and hose, then connect the two with a short length of screen-door spring

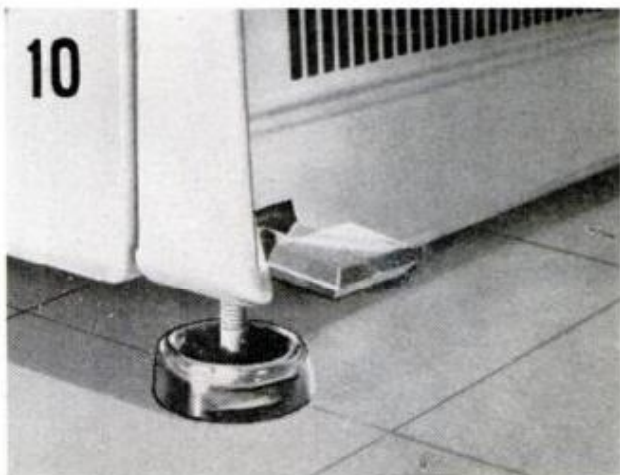
**6. GLAZIER'S POINTS** are difficult to drive with an ordinary hammer. You can make a simple tool for this job by grinding or filing off half the head of a spike, cutting the shank short and bending it at a slight angle to the flattened side of the head

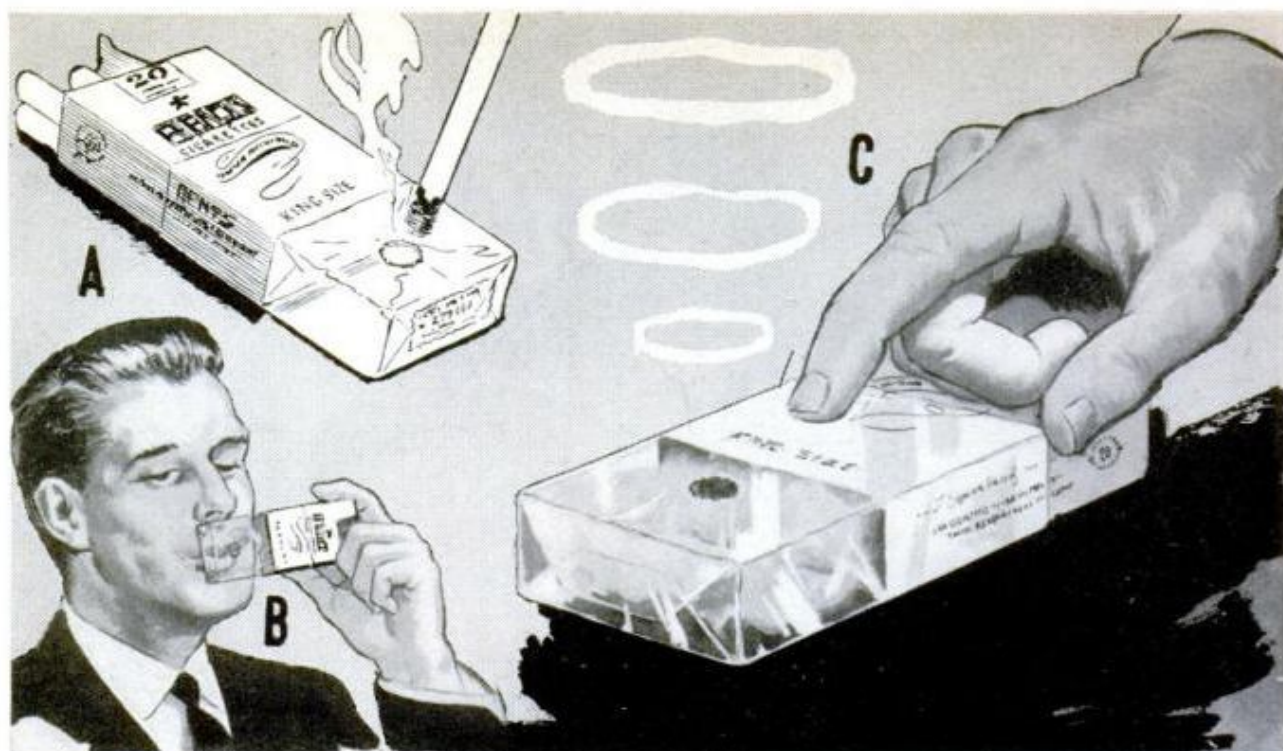
**7. DUMMY BOOK END** looks like any other book but serves only to hold books erect on unfilled shelf. Old book cover is glued to wood block and two holes are drilled in top edge for loose-fitting dowels. Springs in holes cause dowels to bear against shelf

**8. APPLIANCE PLUG** won't separate from an extension socket if you secure the two with a piece of stiff cardboard. Cut a small hole in the center for the wires and run a slit from this hole to the outer edge, then pass wires through the slit to the hole

**9. PLASTIC BOTTLES** in which bleach is sold can be cut to make a handy funnel, complete with a handle. The bottom part of the bottle is excellent for washing small objects in strong solvents and chemicals, as it is impervious to many of these

**10. CASTER CUPS** placed under refrigerator leveling screws will prevent damage to the floor and provide extra clearance so that you can use a vacuum cleaner hose attachment for cleaning. A heavy piece of foam rubber inside the cup will help silence motor noise





## Smoke Rings at Your Fingertips

You've tried many times to blow the perfect smoke ring but you always got a puff that didn't ring. Okay, try this: Slide the cellophane wrapper on a pack of cigarettes part way off the bottom so that it forms a sealed, transparent chamber. Using the tip of a lighted cigarette, burn a hole in the cellophane (A) and blow a mouthful of smoke into the chamber through this hole

(B). Now, to produce a smoke ring, hold the cigarette package in a horizontal position and tap the cellophane lightly with one finger at a point near the hole (C). The larger the hole, the larger the rings, but you will be able to produce more rings from each filling if you use a smaller hole in the transparent chamber.

—D. O. Van Gilder

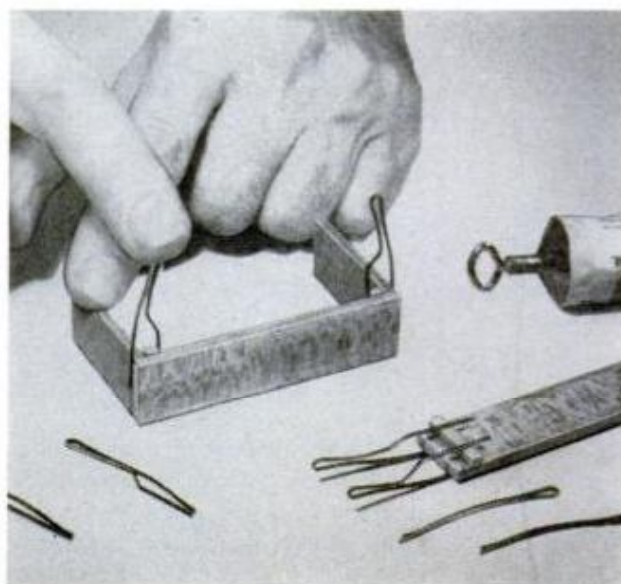
## Stray Dart Trap

Here's a dart-board accessory which will protect the points of your darts and eliminate stooping to pick them up from the floor. Simply bend a rectangle of hardware cloth to form a trough and mount it on the dart board as pictured.



## Those Bobby Pins Again

Builders of miniatures often have need for tiny clamps to hold parts while glue sets. Bobby pins solve this problem as one leg can be bent outward so that the pin will span the joint and exert the right amount of pressure.





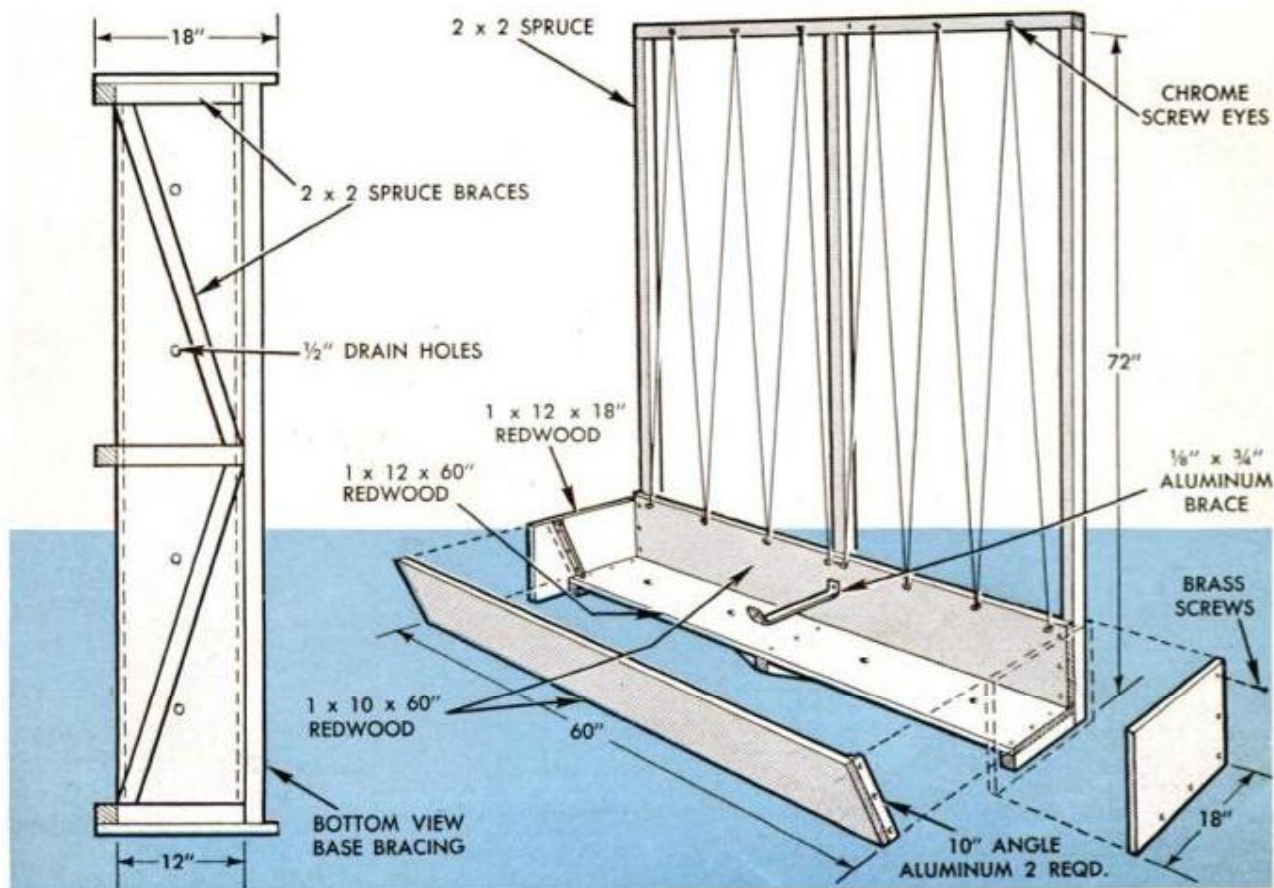
# Redwood Climbing Planter

By Don Mathesius

HERE'S A PLANTER so big and rugged that it's truly a movable bed for climbing flowers or vegetables. Simple construction makes this an easy week-end project costing only about \$15.00.

First, cut all lumber to the desired lengths. Then drill and countersink holes for the brass screws, and drill four  $\frac{1}{2}$ -in. holes in the bottom panel for drainage. Give all wood at least two coats of a redwood finish, making sure that you apply it to end grain and the drainage holes to prevent wood rot.

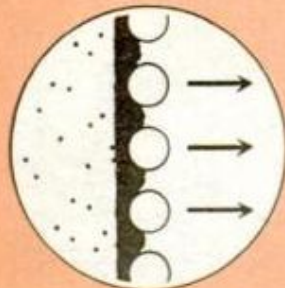
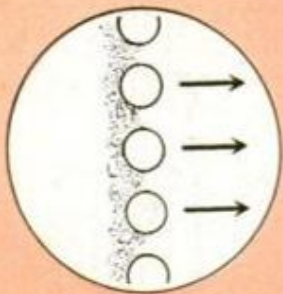
Use 16d galvanized nails to assemble the trellis framework and  $1\frac{1}{2}$ -in. flatheaded brass screws for the box. Install screw eyes as desired and string with plastic clothesline. For outdoor use, cover the bottom of the box with a 1-in. layer of gravel to insure good drainage before filling with dirt. If used as an indoor room divider, add a metal or plastic liner to the box.





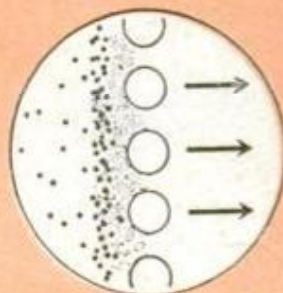
## FILTERING

**DIATOMITE** is mixed with water to form a slurry which can be circulated through filter and deposited on the cloth septum



**IF SEPTUM** were used without diatomite, filtration would be much less efficient and the surface would then soon become plugged

**PRECOAT** slows down the formation of a seal. By periodically adding small amounts of diatomite, filter runs can be extended



# All About

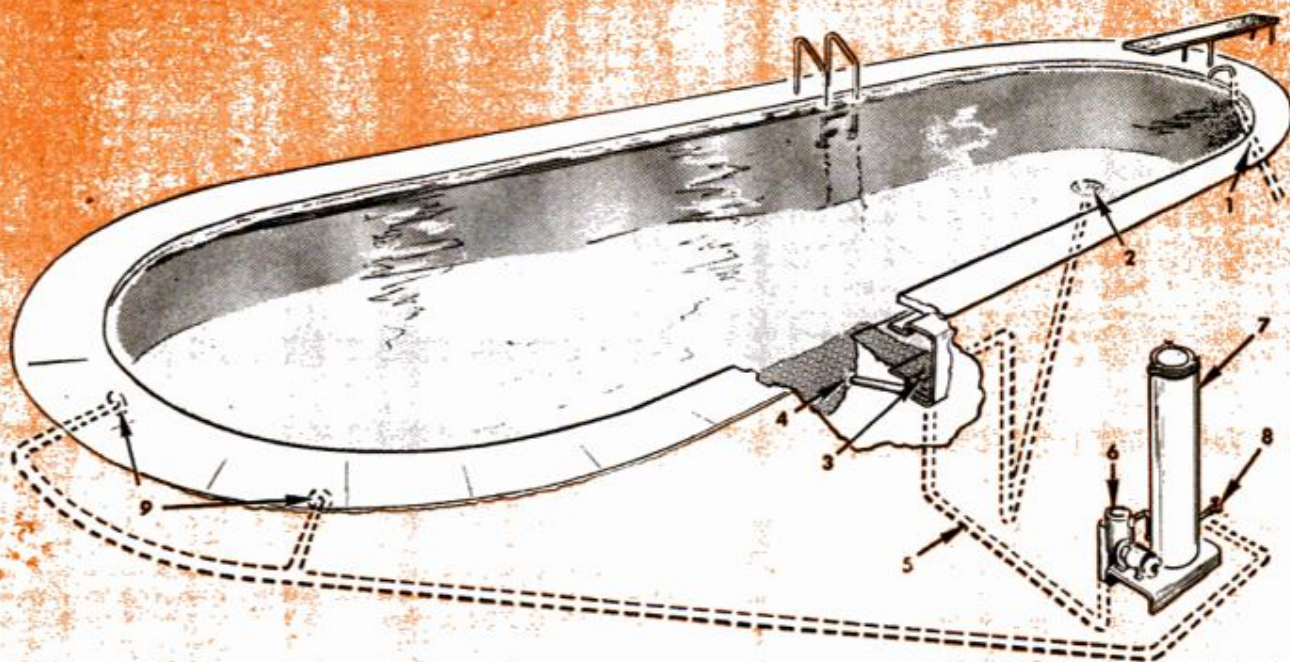
By Ernest E. Hickman

**WITHOUT PROPER FILTRATION,** that inviting crystal-clear water in your pool would quickly turn into liquid smog. Airborne dirt, bacteria and the salts left by water-treatment chemicals are always working to cloud the water, and the only way to maintain clarity is to "turn over" the whole pool once every 24 hours.

While efficient filters will remove a certain amount of bacteria from the water, the primary purpose of pool filtration is to restore clarity. A good pool filter can do no more than eliminate most of the causes of pollution. Purification is a job for chemicals (see "How to Keep That Pool Clean," featured on page 79).

A pool filter simply strains the water through a very fine sievelike material which traps the particles that would otherwise cause clouding. Sand filters are too coarse to catch extremely small particles so a floc is usually used to coat the grains so that they can snag small particles much as flypaper catches flies.

## 2 PLUMBING OF TYPICAL POOL



1. FILLING SPOUT
2. MAIN DRAIN (LOWEST POINT IN POOL)
3. SKIMMER
4. VACUUM-CLEANER FITTING
5. MAIN SUCTION LINE
6. STRAINER AND PUMP
7. DIATOMITE FILTER, PRESSURE TYPE
8. DRAIN FOR BACKWASHING FILTER
9. POOL INLETS

**ALL FILTERS MUST BE** served by the proper size pipe, and water velocity through the pipe shouldn't exceed 10 ft. per sec. While steel pipe is sometimes permissible above ground, copper or polyethylene is preferred. Pipe shut-offs should be fullway valves

# Swimming-Pool Filters

**Diatomite filters.** Diatomaceous earth, also called diatomite or filter aid, is a powdery material made up of the intricate fossil-like skeletons of microscopic water plants. When used in a pool filter, a thin layer of this material is deposited on a cloth septum (Fig. 1), forming a screen with 2,500,000 openings per sq. in. The largest particles which can slip through this screen measure  $1\frac{1}{2}$  microns (a micron is only  $\frac{39}{1,000,000}$  in.), and such filtration is fine enough to remove most of the larger bacteria from pool water.

Diatomite filtration produces water of unbelievable clarity. As an example, one movie studio installed a diatomite filter for use with underwater photography tanks, but immediately ran into trouble. The diatomite proved so efficient that underwater color pictures looked as though they had been faked on a regular sound stage. (The problem was finally solved by adding blue dye to the water.)

Since diatomite will cling to a vertical surface or even the underside of a horizontal surface, the septum (supporting ele-

ment) can be made in almost any shape. This makes it possible to cram a lot of filter area into a small space, Fig. 4.

The septum probably has been the subject of more experimentation than any other part of the filter. Many materials and designs have been employed with varying degrees of success, but synthetic fiber fabric seems to be the most promising for residential pool filters. Such elements are too thin to collect deeply embedded dirt, can't fissure and pass unfiltered water, aren't effected by pool chemicals and are flexible enough for easy cleaning.

Unfortunately, a few manufacturers have gone overboard in trying to make diatomite filters compact, and have failed to allow enough space for unrestricted water flow between surfaces or the formation of a good filter cake. Others have exaggerated the filter area by basing it on the size of the cloth before folding or lapping and disregarding impermeable supports. If the filter element is too frequently lapped, the filter will present too much resistance to flow and require frequent cleaning.

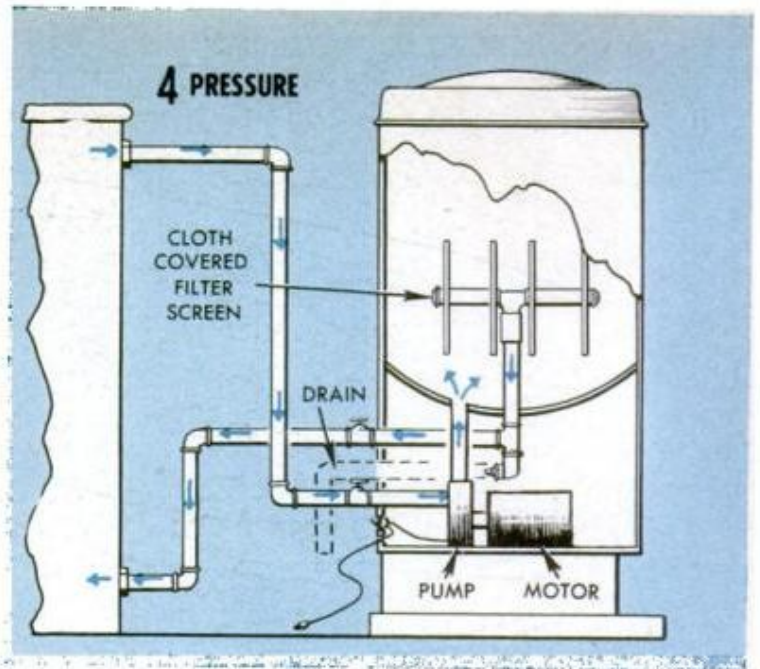
3



IF YOU CAN SEE this 2-in. disk through 8 ft. of water, the pool meets NSPI standards for clarity

There are two types of diatomite filters available. In a pressure filter, Fig. 4, water is pumped into the filter tank before filtration. In a vacuum or suction filter, Fig. 5, water is pumped away from the tank after being filtered. The pressure type is more popular for residential pools.

The precoat, or initial layer of diatomite, is formed by circulating a slurry of diatomite into the filter. Water, always seeking the course of least resistance, distributes the diatomite evenly over the elements. About 1.6 oz. per sq. ft. will provide a coating approximately 1/16 in. thick. At frequent intervals during the filtration cycle, small amounts of diatomite



WHEN PUMP IS LOCATED ahead of the filter so that it pushes water through, the filter is a pressure type

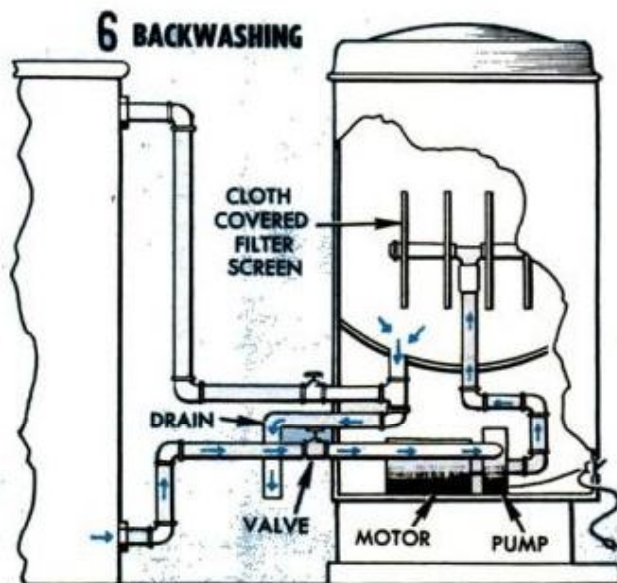
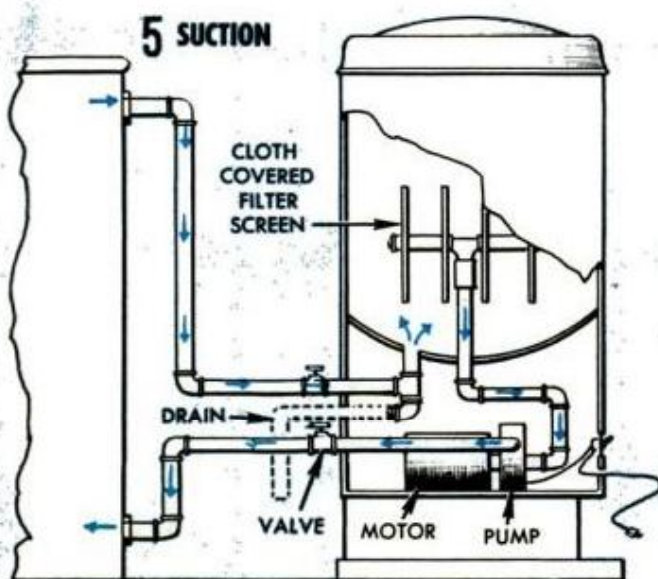
are added to prevent the precoat layer from becoming plugged.

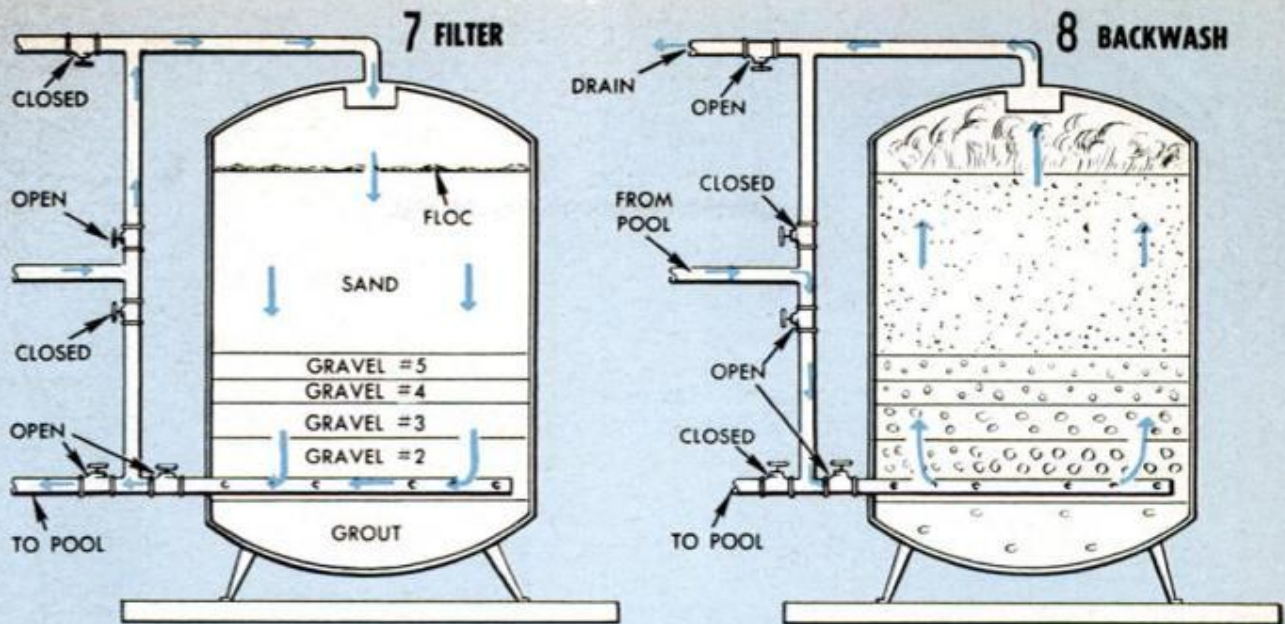
Normally, a filter run (cycle) ends when accumulated dirt clogs the element enough so that the pressure drop across the filter reaches a predetermined point. (This varies with different filters.) A good filter of the right capacity will operate for about 7 days before this point is reached.

A diatomite filter is cleaned by reversing the flow of water, or backwashing, Fig. 6. This breaks up the filter cake which is drained off as waste.

**Sand filters.** Since the passages in a sand filter are much larger than many of the particles to be trapped, a floc is usu-

YOU CAN RECOGNIZE a suction, or vacuum, filter by location of the pump on the return line to the pool





**FILTER AREA** of a sand filter is always much smaller than that of a diatomite filter in similar size tank

**SAND FILTERS**, like diatomite filters, are backwashed by reversing the direction of flow through the filter

ally used to catch the smaller particles. This floc is a gelatinous coagulation formed by the action of aluminum sulphate (alum) and the slightly alkaline pool water. It permeates the upper layer of a bed of sand, turning each grain into a sticky trap for passing particles and holding them by a combination of mechanical and electro-chemical attraction. A proper floc requires from 1 to 3 lb. of alum for every 10 sq. ft. of filter area. This is usually injected into the filter intake by means of a venturi tube.

There are two principal types of sand filters: Pressure, Fig. 7, and gravity, Fig. 9. The only difference is that in one case water flows by gravity through a bed of sand then through graded gravel, while in the other a pump is used to push it through these same materials. Most swimming pool filters are of the pressure type.

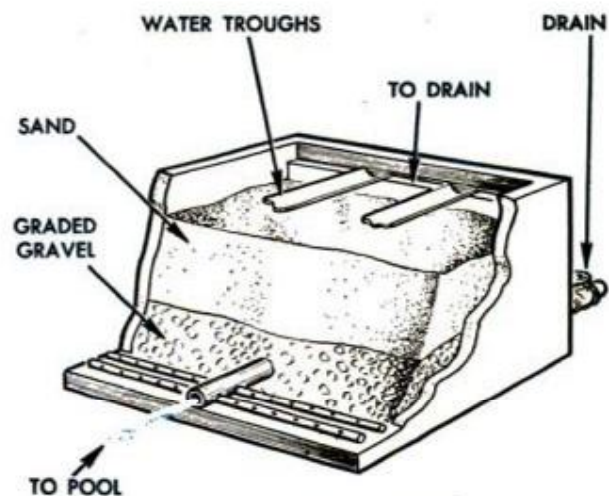
A sand filter should be backwashed at least once every 7 days to prevent packing, Fig. 8, and this takes a lot of water. A flow of 10 gal. per min. for each sq. ft. of filter must be maintained until the water leaving the filter is clear. This usually takes from 5 to 15 min. The high flow rate required for backwashing (twice the flow rate for filtering) is often arranged by using a multiple tank setup, with the same pump supplying all tanks during filtering but backwashing only one at a time.

The sand and gravel bed should be checked periodically, since dirt penetrates deeply into the sand bed during filtration and cannot always be removed by backwashing. This dirt combines with sand and chemicals to cause the formation of agglomerates (called mudballs), cracking of

the filtering surface and shrinkage of the filter bed from the sidewalls of the tank. Such conditions not only hamper effective filtering, but permit the filter to become a breeding ground for organisms which may contaminate the water. If you discover mudballs in your filter, it's time to remove the old sand bed and replace it with a new one.

**Filter capacity.** Two factors determine the capacity of a pool filter: Rate of flow and filter area. The maximum recommended flow rate for a pressure-type diatomite filter is 3 gal. per min. for every sq. ft. of filter area, and for a vacuum type, 2¼ gal.

**GRAVITY-TYPE SAND** filters are hardly ever used with today's pools. Pressure-type is much more common



**9 CONCRETE TROUGH SAND FILTER**

For a sand filter, the maximum rate is 5 gal. per min. per sq. ft. At these flow rates, there should be enough filter area and matching pump capacity to run the whole poolful of water through the filter in 18 hrs. or less. Remember that these are minimum specifications, and a filter that meets them but still needs cleaning more often than once every four days is too small.

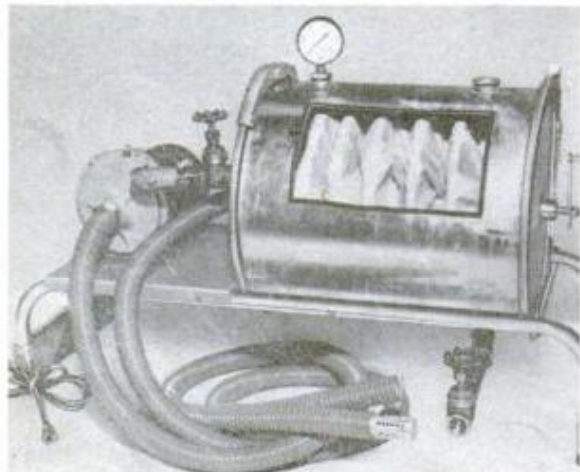
**Choosing a filter.** The filtration system and plumbing, Fig. 2, will account for at least 25 percent of the cost of a conventional concrete pool, so be sure to take this into consideration when deciding what size pool you wish to build. Both sand and diatomite filters have good points. A sand filter will cost 4 to 5 times as much as a diatomite filter per sq. ft. of filtering area. However, it will also be cheaper to operate and its higher flow rate will enable you to turn over the whole pool in about half the time required by a diatomite filter.

A diatomite filter will provide more efficient filtration, removing particles measuring  $1\frac{1}{2}$  microns vs. a sand filter's 12 microns. Some people feel that such high efficiency is unnecessary, since a particle must measure 80 microns to be visible with the naked eye at 10 in.

There is one big advantage in diatomite filters. They are smaller, lighter and can be installed almost anywhere. Since sand filters of comparable capacity are much larger and heavier, they often present installation problems. A quality filter may cost twice as much as its economy counterpart but will last much longer.

A growing number of communities have enacted swimming-pool ordinances which include filter specifications. Instead of specifying particle size or distribution, most use the Nation Swimming Pool Institute's visual test which stipulates that a 2-in. disk with alternate red and white quadrants, Fig. 3, must be visible through 8 ft. of water. ★ ★ ★

**DIATOMITE FILTERS** are small, light and can be installed almost anywhere. Pressure-type is most popular



# Make Your Own



**COME ON IN!** The water's clear as crystal after being run through this small but efficient diatomite filter. It's easy to make and can be operated by a child

**BACK-YARD PLASTIC POOLS** do not require large filters. This compact unit, only 18 in. high, is perfectly adequate for the small children's pool shown here

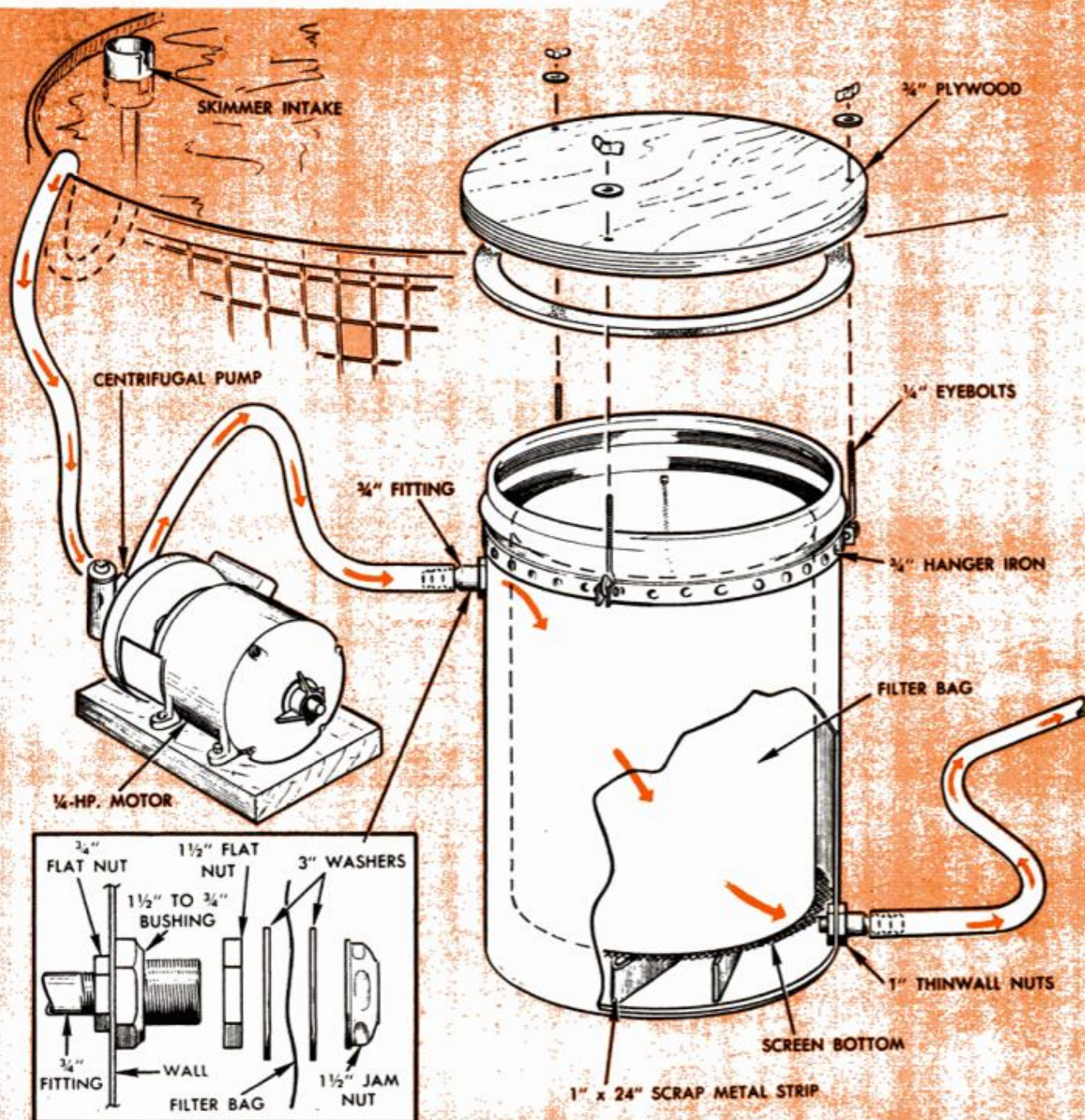


**By Walter E. Runkel**

**F**OR AS LITTLE AS \$25.00 you can add a filter, vacuum cleaner and skimmer to any small, above-ground children's pool. The diatomite unit described here has a filter area of 3 sq. ft. which is adequate for most of the shallower 10 to 20-ft. plastic pools.

The filter tank is an old popcorn-oil can 11 in. in diameter and 17 in. high. Any fractional-horsepower motor can be used to drive the small centrifugal pump, which can be purchased for \$8 from the Labawco Pump Co., Belle Mead 7, N. J. First, cut a circular piece of  $\frac{3}{4}$ -in. plywood about 2 in. larger than the diameter of the can and attach it to the top of the can lid. Next, using  $\frac{3}{4}$ -in. hanger iron, mount three eye

# SKIMMER FILTER



bolts equidistant and near the top of the can so that they extend through registering holes drilled in the plywood disk. Replace the regular seal of the can lid with a 5/16 x 3/8-in. strip of sponge rubber and use wing nuts on the bolts to pull the lid down tight.

The intake fittings are detailed above. A 3/4-in. standard metal fitting for coupling plastic pipe to metal pipe is used to connect hoses to both inlet and outlet. Input to the pump is a 1-in. hose and all others are 3/4-in.

The filter bag is 8 1/2 in. in diameter and 14 in. high, but can be made larger if you use a larger container for a tank. Make the bag of ticking, sewing the seams with nylon

thread and adding a zipper across the top. This bag sits on a false bottom of screen wire supported by a strip of sheet metal 1 in. wide, bent zigzag fashion and placed on edge in the bottom of the can. Before using the filter, give it a couple coats of enamel to prevent corrosion and seal any leaks around fittings with roofing compound.

Make the skimmer from an No. 2 soup can, cutting a hole in the bottom for a short piece of 1 1/4-in.-dia. pipe. After soldering the pipe in the hole, cut a 1/2-in.-wide slot in the side of the can for about three quarters of its length, paint the unit and couple

(Continued to page 194)

## BOATING SHORT CUTS

### Reel Storage for Ski Line

Here's an easy way to avoid that tangle of line in the cockpit after a session of water skiing. Instead of laboriously coiling the ski line in the bottom of the boat, simply treat the ski handle like a fish and reel it in. This ski-line reel is made from three lengths of  $\frac{1}{2}$ -in. hardwood dowel and two pieces of 1 x 2. Since the dimensions aren't critical, you can make it either long and narrow or short and wide, depending on the shape of your boat's storage compartment. The middle dowel extends below and seats in an oarlock mounted near the transom. One of the end dowels extends upward and serves as a crank-handle for the reel. At the end of the day, simply tie the boat end of the line to the middle dowel and crank the line in, using one hand to guide it onto the reel. Store the line on the reel until the next time you get the skiing urge, then just reel it out.

—*Jackson Hand*



### Balloon Buoys

A Kentucky sailing club has found that large weather balloons make excellent course markers for their sailboat races. Available in 8 and 13-ft. sizes, the Neoprene balloons are military surplus items and have several advantages over the buoys commonly used as markers. Not only are they cheap, but being so light, they float high and are visible at greater distances. Best of all, they won't damage a boat if someone cuts a turn too tight and accidentally runs into the marker. The balloons are anchored with sash weights tied to  $\frac{1}{8}$ -in. cotton or nylon line.

—*G. E. Hendrickson*



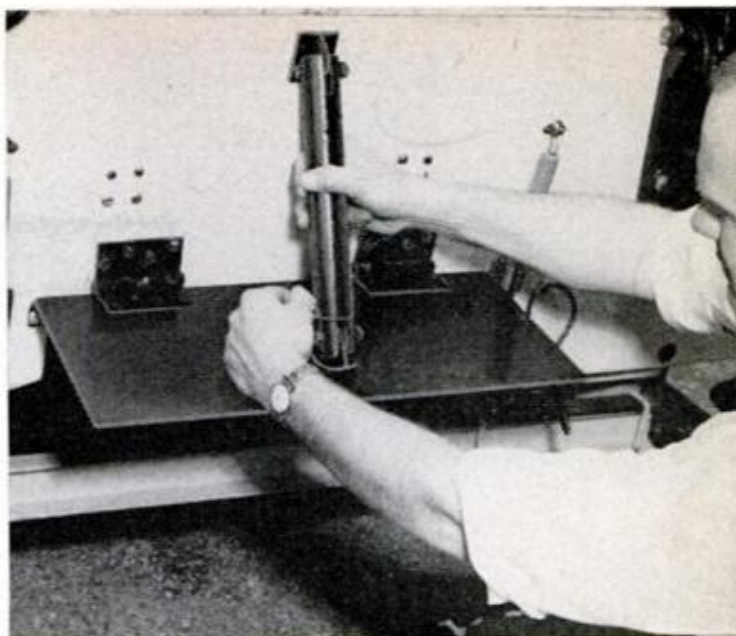
A boat cover, whether made of canvas or plastic, will more than pay for itself in the long run. However, the cover shouldn't fit so tightly that it prevents the air from circulating since this encourages rot.

### Seal Tanks to Save Gas

Between outboard outings make it a practice to disconnect the fuel line from your gas tank to retain vapors in the fuel. In hot weather, the temperature inside the tank may go as high as 140 degrees. At such temperatures the more volatile gases in the fuel will boil off and be lost if the tank is unsealed. Loss of these volatile gases lowers the running qualities of the fuel and makes it more difficult to start the engine, especially if it is cold.







## Planer Plate for Catamarans

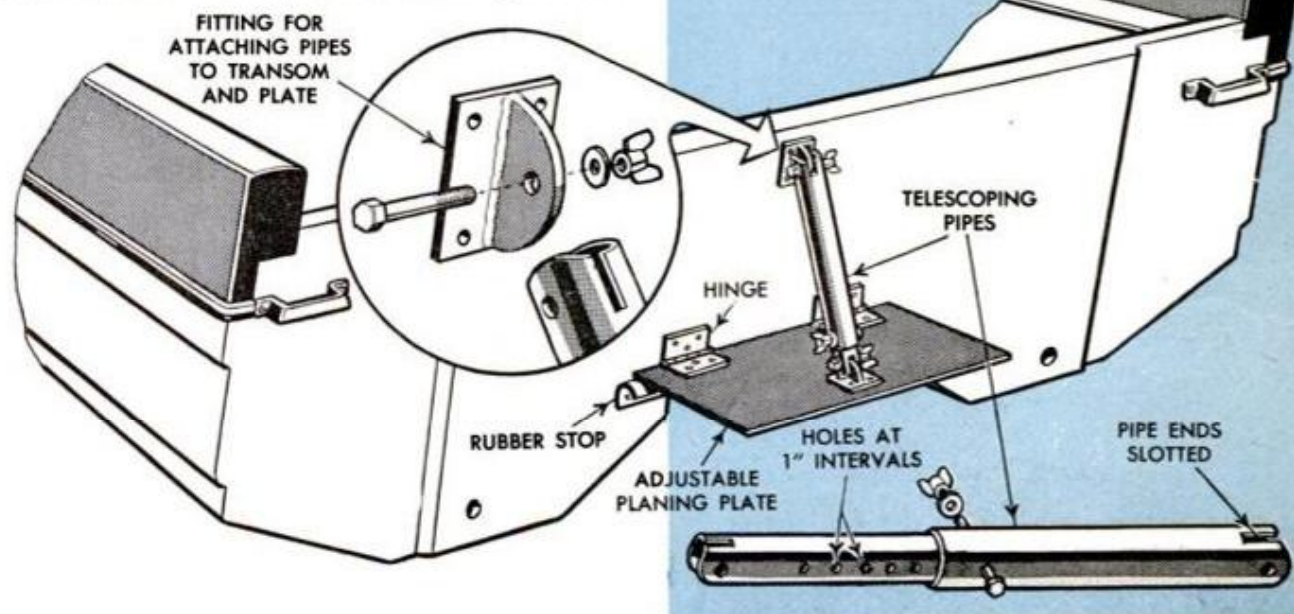
IF YOUR CAT is slow to plane it may need an after plane, a plate which extends over the tunnel opening so that water rushing out of the tunnel pushes against it and lifts the boat at the transom.

The \$7 after plane illustrated here is made from a 1/4-in. aluminum plate mounted with a pair of sturdy door hinges. Two pieces of telescoping pipe, preferably 1-in. and 1 1/4-in., provide support and adjustment for the plane. Holes are drilled at 1-in. intervals in the smaller pipe so that a bolt can be inserted to lock the plane in the position at which the boat performs best. These pipes are attached to the plane

and transom with the fittings shown below.

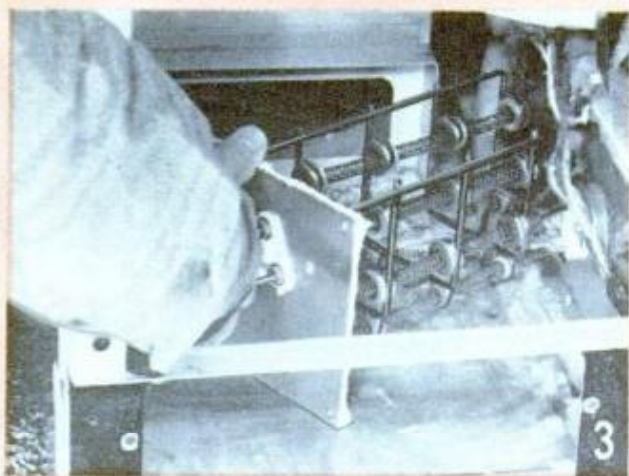
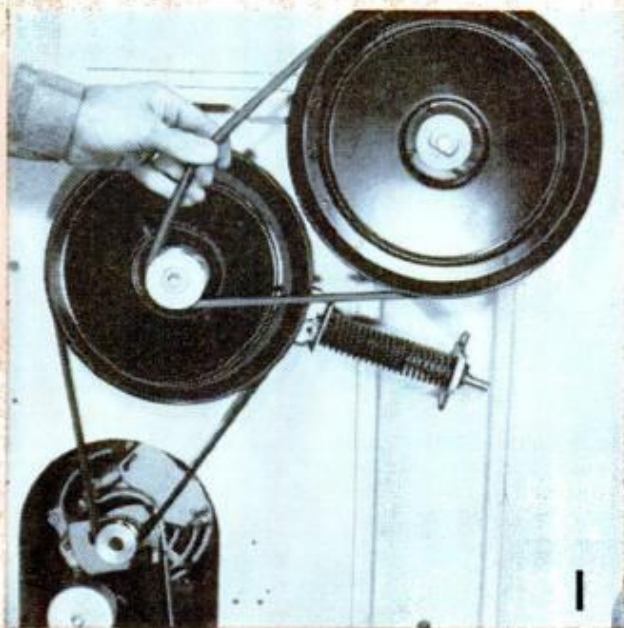
Make the plate itself 4 in. longer than the distance across the top of the tunnel opening between the two hulls. To determine the width of the plane, measure the distance between the top of the tunnel and the bottom of the hulls, then add 1 1/4 in. This extra 1 1/4 in. is necessary because the plane must be mounted 1 1/4 in. above the opening to provide room for the rubber stripping below the plane. This rubber spray deflector is 4 in. wide and as long as the plane. It is attached to the transom with a 3/4-in. metal strip so that it covers the opening between plane and transom.

**SLOTTED ENDS** of telescoping pipe must be rounded to permit movement when pivoted to mounting brackets



## ELECTRIC DRYER

# Household



**A**LTHOUGH the automatic washer, dryer and electric ironer have almost completely automated home laundering, you could be back to hand laundering if anything goes wrong with any one of the units. This is especially true of your electric or gas dryer. Comes that morning when washed clothes are put in the dryer, it's switched on and nothing happens. It could mean an overloaded circuit, resulting in a blown fuse or a tripped circuit breaker. Take a look just to make sure.

Or, maybe when you switch the dryer on, the tub turns at half or less of its normal speed. This won't do, as something might break and the unit would have to operate several times its normal cycle in order to dry the clothes. So you pull the unit away from the wall and check the mechanism that drives the tub. Older units will have a drive something like that pictured in Fig. 1, where the belts are tensioned by a spring arrangement that ordinarily maintains the proper tension automatically. Some such units require adjustments, of course. To work properly the belt tension should be about that of the fan belt on your car, that is, you should be able to depress the belt about  $\frac{3}{4}$  in. or so at the midpoint between the pulleys. Less than this amount is too tight. More is too loose, allowing the belt to slip. Adjust to the proper tension. If the belt is badly worn or frayed, replace it.

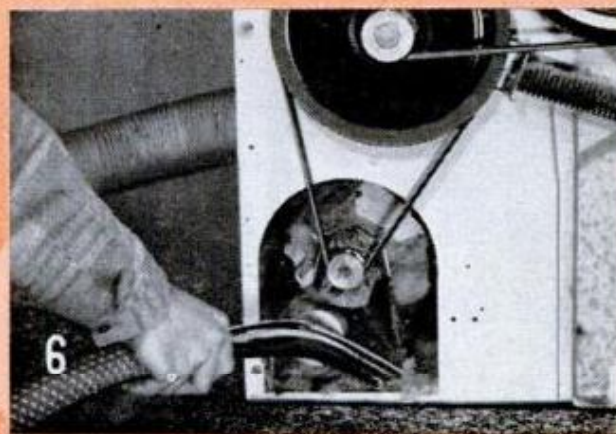
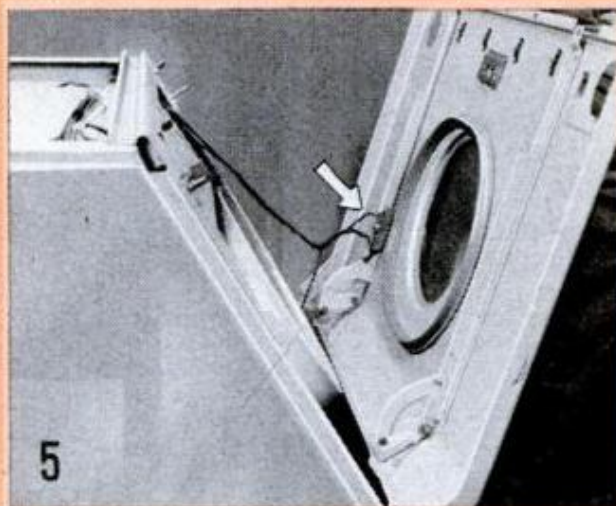
But if the tub revolves okay and there's no heat, then you'll have to probe further. Disconnect the power supply and

# Appliance Fix-It File

in the electric dryer remove insulation (carefully, remember!) as in Fig. 2 so that you can disconnect and remove the heating element, Fig. 3. Here again only one machine is pictured. It will differ from other makes but, if you work carefully, you should have no trouble removing the element. Heating elements of most machines are not repairable, so if you see a broken wire there's nothing to do but replace the element unit. If no broken wires turn up, then look closely to the terminals. Be sure they are clean and tight.

Most dryers, old and new, are equipped with a switch which will stop the dryer if the door is opened while it is running. If you find your dryer will run when the door is opened, then it may be necessary to remove the top and the front panel, Figs. 4 and 5, to reach this switch pointed out by the arrow in Fig. 5. Usually it's a sealed switch, so if it's faulty, the best thing to do is replace it. The cost is nominal when compared with its safety value.

While you have everything open give the whole machine a thorough cleaning. You'll be surprised at how much dust, lint and plain dirt a dryer will gather on the working parts in the course of time. Pick up the dust and lint with the vacuum, Fig. 6, and wipe off all other parts with a clean cloth. If it says "oil" anywhere on any of the rotating parts apply a couple of drops. And when you put things back together be sure—repeat—be sure, you have everything accounted for and placed where it belongs.—*John Pennington*





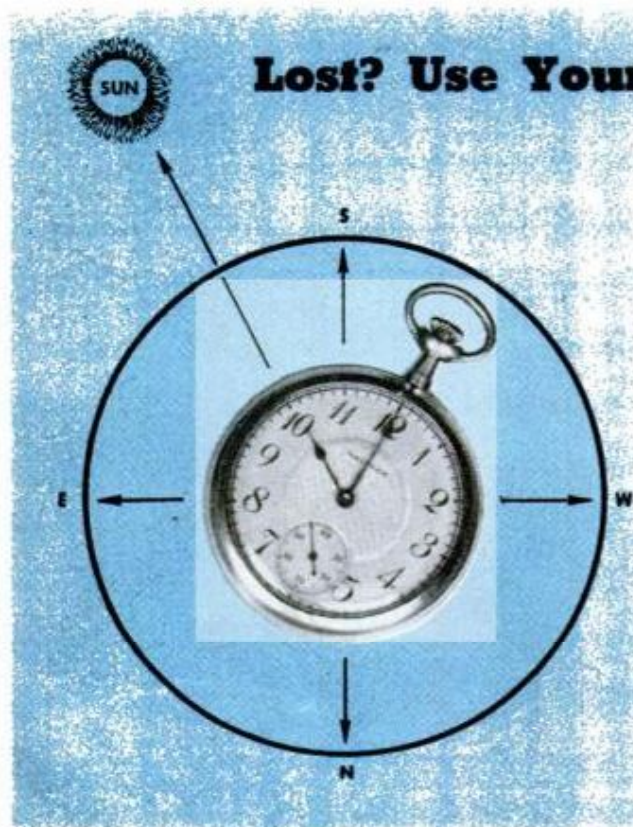
## V for Cleanup

Clearing the lawn of paper litter before mowing is easy enough with a stick with a nail in the end. But pulling the impaled litter off the nail is the messy part considering that such litter could include sticky candy wrappers and other unsanitary paper. I have found a way to do it which requires only one hand and lets me carry a container with the other. I cut a V-notch in the edge of a cardboard carton and simply draw the end of the stick through the V-notch to remove the litter which automatically drops into the carton. Beats wearing a glove on a hot day or carrying a burlap bag.—*Wayne Judy*

**Chipping old putty** from a window sash before installing new glass can be done much quicker and easier if you coat the putty with rubber cement and ignite this with a match. When the flames die out, you'll find that the putty is soft, pliable and easy to remove.

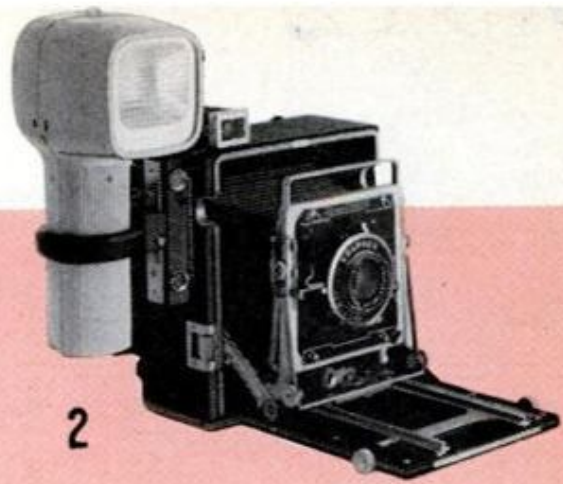
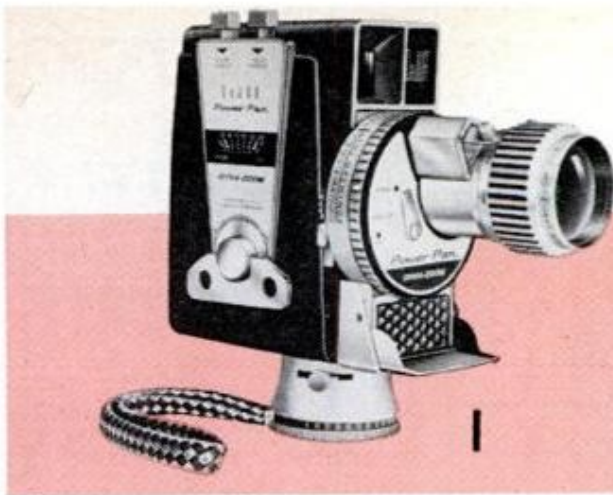
## Tip a Canoe—Not You

A canoe is virtually impossible to capsize when equipped with these removable outriggers. Assembled in a jiffy from two lengths of 2 x 4 and a couple of inner tubes, the outriggers are merely clamped in place for quick removal. Simply clamp the 2 x 4s to the coaming in the proper position with C-clamps, slip the partially inflated inner tubes over the ends and add more air if necessary.—*Jack Cushman*



## Lost? Use Your Watch as a Compass

Knowing this woodsman's trick can save a lot of discomfort, anxiety, possibly even life itself. If you become lost in the woods, you can use your watch to locate directions, provided it's set on standard time and the sky isn't completely overcast. Hold the watch in the palm of your hand face up. Keeping the face horizontal, turn the watch until the hour hand points toward the sun. South will be about half way between the hour hand and twelve o'clock. If the sun is near noon (12 o'clock) or only slightly past, wait an hour or so to get a more accurate reading. Depending on the time of day, this method should provide you with sufficient information to find your way out of the woods. On your next hunting or fishing trip, check this stunt with a compass. You'll be surprised how accurate it is.—*O. A. Nelson*



# NEW FOR SHUTTERBUGS NEW

**1. POWER-PAN CAMERA** makes a panning expert even out of the shaky amateur. Push a button and camera turns steadily and evenly up to 120 deg. Besides power panning, there is a push-button power zoom lens, plus automatic electric eye, to take guess work out of home movies. Priced from \$139.95. DeJur-Amsco Co., 4501 Northern Blvd., Long Island City 1, N.Y.

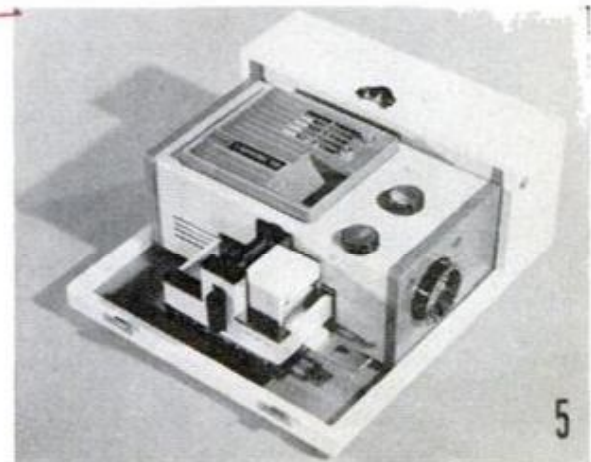
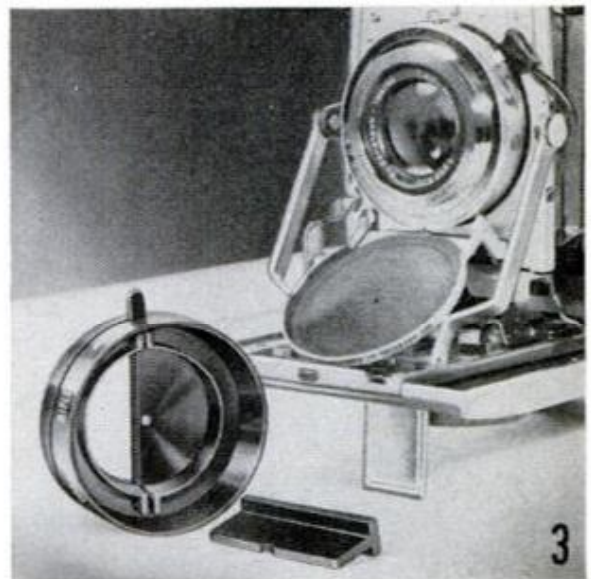
**2. LIGHT, ONE-PIECE** electronic flash unit is a versatile light source using rechargeable nickel-cadmium battery or regular a.c. current. Weighing only 34 oz., unit provides 80-watt-sec. power. Two-way switch cuts power by one half. Complete with battery charger and a.c. cord, \$109.95. Interstate Photo Supply Corp., 300 Park Ave., S. New York 10, N. Y.

**3. DIVIDER FOR LAND CAMERA** makes it feasible to take 16 half-size pictures on a roll of film—with print size approximately  $1\frac{3}{4} \times 2\frac{3}{4}$  in. Besides shooting wallet-size prints, device has many trick applications. A subject may be shown, for instance, shaking hands with himself. Priced at \$4.95 to \$5.95. Palaflex Corp., 60 W. 46 St., New York 36, N. Y.

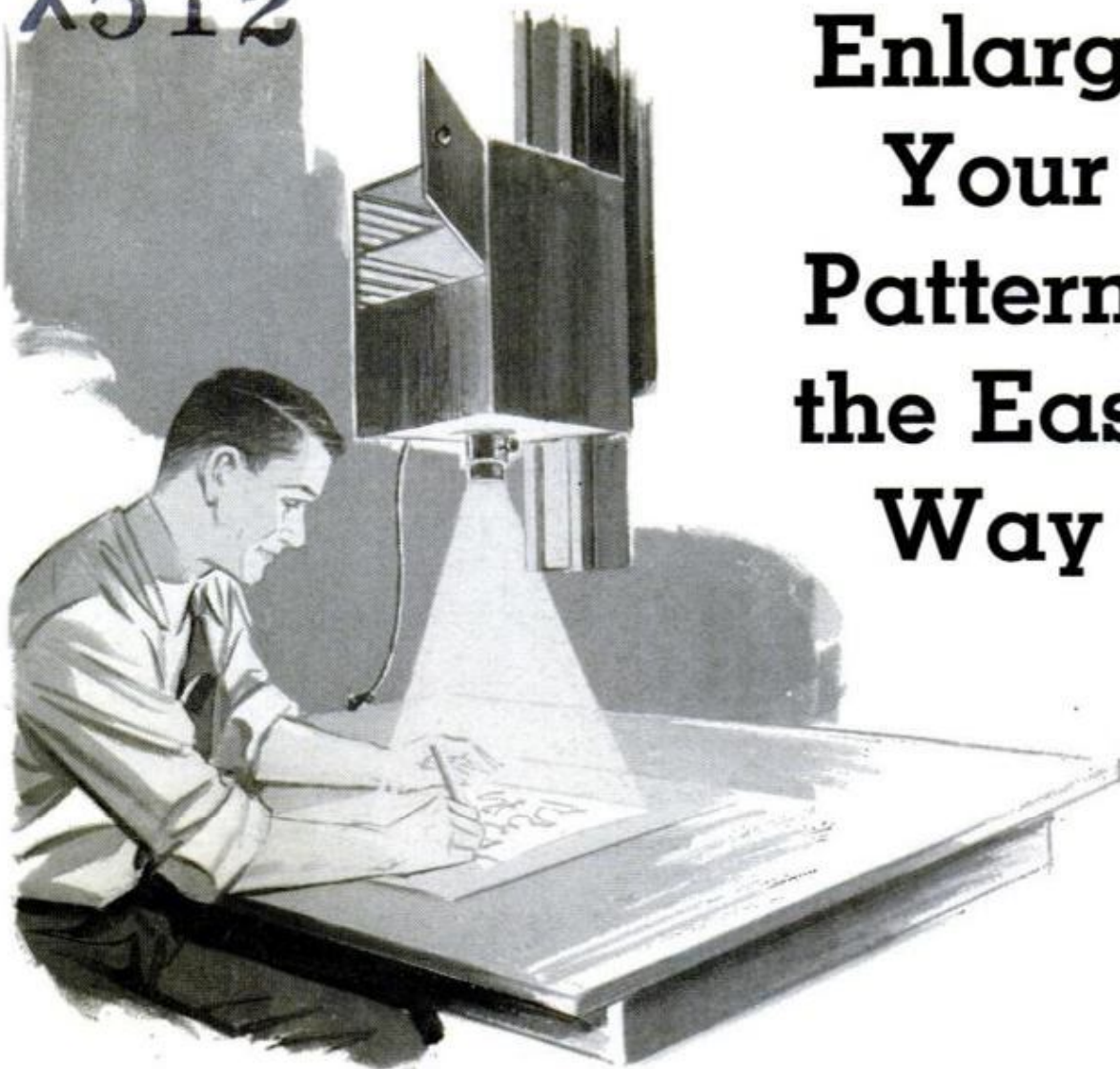
*Copy Kamister's Monthly Sues  
same address*

**4. THIS 35-MM. ELECTRIC-EYE** camera has combination range and view finder with automatic margin control. Electric-eye exposure meter couples to diaphragm opening, and meter needle is visible through the view finder. Fully hinged back permits quick film changes. With 48-mm. F/2 lens, price is \$109.95. Konica Camera Co., 76 W. Chelen Ave., Philadelphia, Pa.

**5. READYMATIC 500 PROJECTOR** is a budget-priced slide projector using a 500-watt light. Each slide is projected by a simple push-pull of the changer arm. The slides are inserted directly into projector gate. Maximum cooling is provided by a powerful blower which goes on whenever the power cord is plugged in. Eastman Kodak Co., Rochester 4, N. Y.



# X512



## Enlarge Your Patterns the Easy Way

*Tired of enlarging magazine patterns by the square method? What you need is this opaque projector. Just insert the copy, focus for size and trace the image*

**C**OSTING LESS than \$25.00 to build, this straight-shot opaque projector makes the time-consuming job of enlarging patterns a simple one. Not only is it faster, but the projected pattern will be an exact enlarged copy of the original which is a distinct advantage over enlarging patterns by the slow, square method.

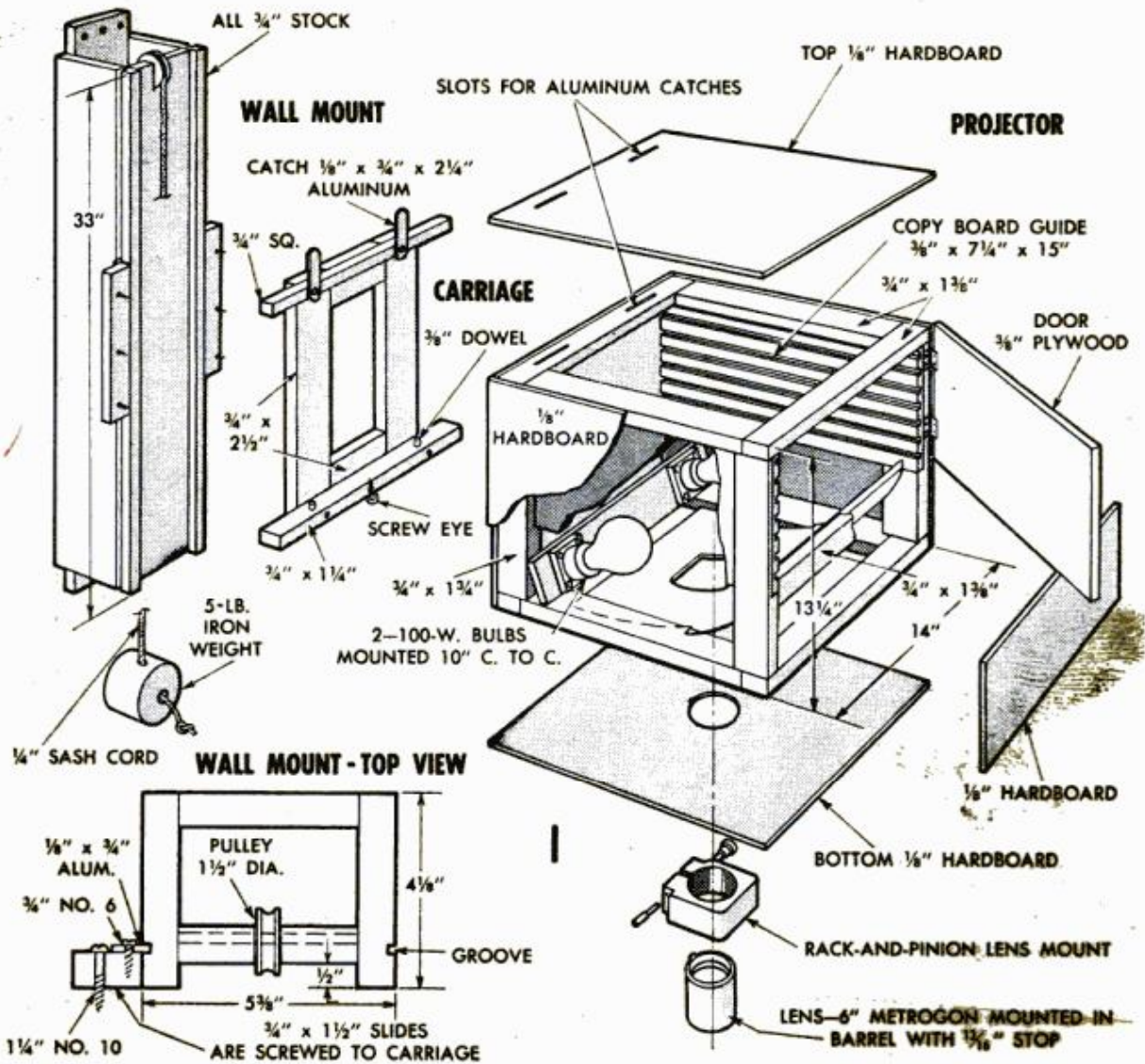
All straight-shot projectors such as this produce a reversed image. When working with this box, the artist usually traces the projected drawing on tracing paper, then flips the paper over and retraces the drawing on the actual art work.

A projector works like a view camera in reverse. In a camera, the image is formed on a ground glass by reflected light passing through the lens. In an opaque projector, the image or copy, greatly enlarged, is formed outside the projector by light reflected from the copy. At a given distance

from the lens, the image can be brought into sharp focus by a rack and pinion.

Any f:4.5 or faster objective lens of 6-in. focal length would be suitable. While photographic enlarger lenses work well, they are generally quite expensive. The lens used in this projector is a 6-in. Metrogon which recently became available through military surplus channels. The Metrogon is used extensively in wide-field aerial photography, and this wide-field capability makes it very popular as a projector lens. Both the Metrogon lens and the necessary hardware for building a rack-and-pinion lens mount may be obtained from Edmund Scientific Co., Barrington, N.J.

You can buy this 6-in. Metrogon in its original aerial-camera mounting for \$12.50. This is an f:6.3 system, but by removing the shutter you can increase the speed to

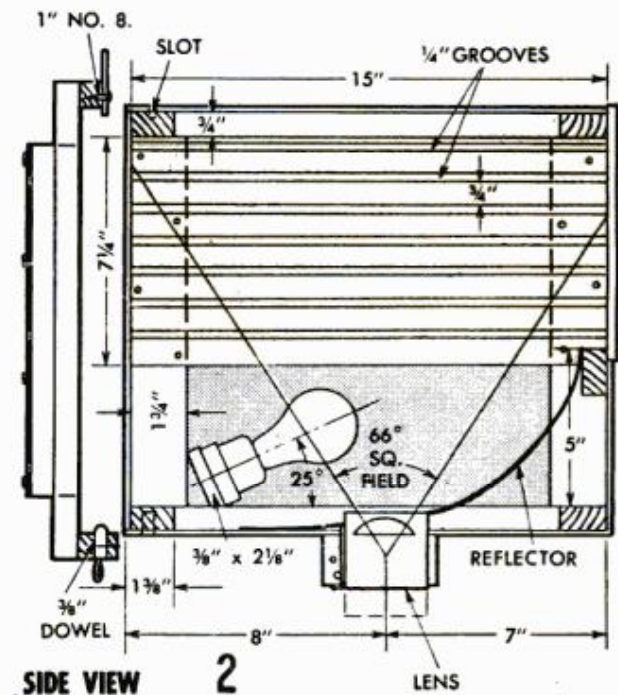


f: 3.5. If you plan to use the lens mount and barrel dimensions given in Fig. 3, the original lens cells will have to be machined to the minimum diameter. The lens cells can also be purchased already machined and mounted in the barrel for \$22.50.

To frame the projector box, Figs. 1 and 2, cut pieces of  $\frac{3}{4}$  x  $1\frac{3}{8}$ -in. stock to the proper lengths for top and bottom members. A shorter piece of this stock fits between the two front vertical corner members and holds the raised end of the metal reflector. Vertical corner members are cut from heavier  $\frac{3}{4}$  x  $1\frac{3}{4}$ -in. stock, and  $\frac{3}{8}$  in. of the thickness is cut away to receive the two  $\frac{3}{8}$ -in. copyboard guides flush as indicated. Cut  $\frac{1}{4}$  x  $\frac{1}{4}$ -in. grooves  $\frac{3}{4}$  in. apart in these guides and mount them on the corner members. The copyboard is simply a piece of glass cut to fit inside the box and slide in the grooves. Assemble the frame, using  $1\frac{1}{2}$ -in. screws when threads go into end grain, 1-in. screws in other joints.

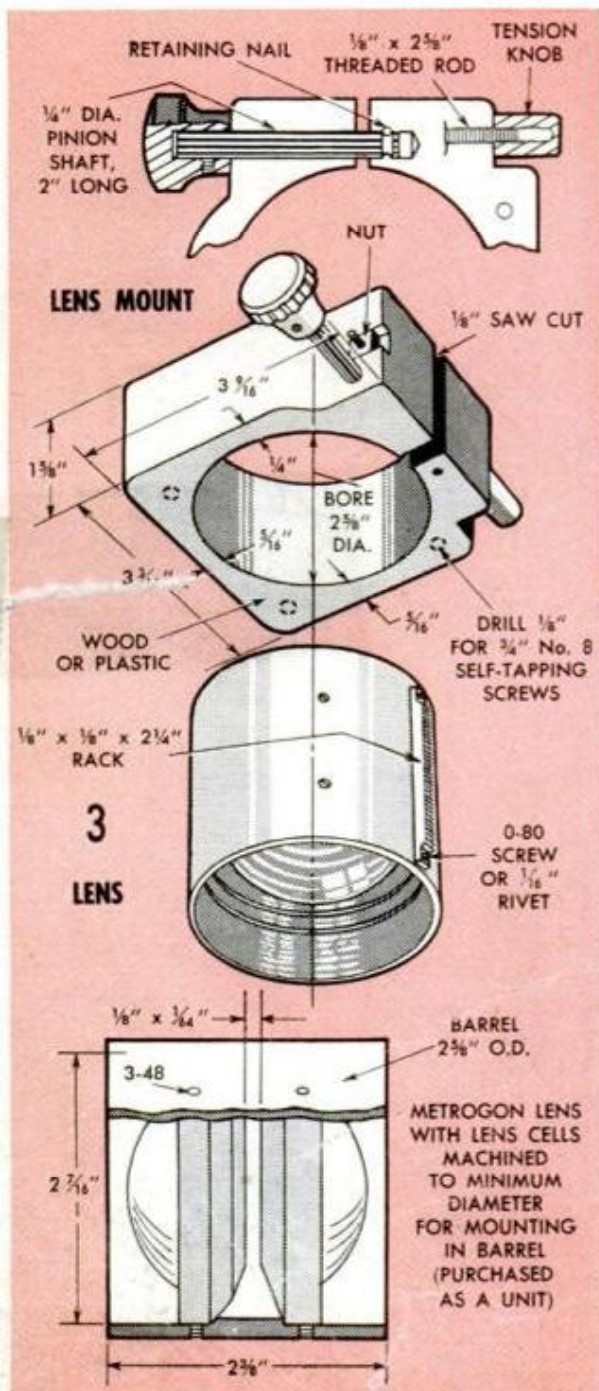
The metal reflector, Figs. 1 and 2, is curved to direct light upward and inward toward the center of the copy. To make it,

WALL MOUNT for the opaque projector may be made longer than the 33 in. given above if desired





**METROGON LENS** has good correction for flatness of field over large angle, and is perfect for projector



cut the sheet to the right width, bend it to the proper curve and temporarily place it inside the box with the raised edge against the  $\frac{3}{4}$  x  $1\frac{3}{8}$ -in. support just below the door. Locate the notches in the sides and cut out for the lens barrel, then remove the sheet and cut these out. Nail the raised edge of the reflector to its support and use one nail at each side notch to act as a stop holding the reflector to the proper curve.

The board holding the light sockets goes in last. Mount the sockets on the board before installing it, then nail the board to the frame at the correct angle. The cord can be led out through a hole in the back.

Once you have installed the lamp board, the frame can be covered with  $\frac{1}{8}$ -in. hardboard, using countersunk  $\frac{1}{2}$ -in. screws as fastenings. Before attaching the bottom panel, cut a slightly oversize hole for the lens barrel. Mount the  $\frac{3}{8}$ -in. plywood door with suitable butt hinges, then finish the box by cutting slots near the back of the top for the aluminum catches which hold the projector on the sliding carriage, and drilling slightly oversize holes in the bottom cleat for the  $\frac{3}{8}$ -in. dowels.

The carriage, Figs. 1 and 2, is attached to the wall mount by means of  $\frac{1}{8}$ -in. aluminum strips which fit into grooves in the sides of the mount, allowing the carriage to slide up or down for rough focusing. To make this operation easier, the carriage is counterbalanced with a 5-lb. iron weight inside the wall mount. A rope attached to the screw eye on the bottom of the carriage runs over a pulley near the top of the wall mount and down inside to the weight. Before securing this mount to the wall, complete the lens and experiment with rough focusing, holding the box at different heights until you have determined the proper location for the wall mount.

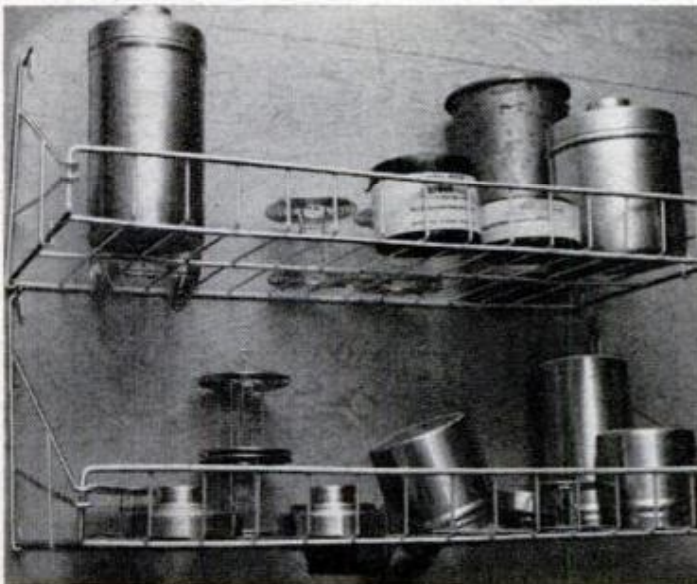
The rack-and-pinion lens mount is the most difficult part of this project. If you use a wood block, make sure that it is straight-grained and perfectly dry. After band sawing the block and drilling the hole for the lens barrel, drill the hole for the pinion shaft, which is a 2-in. length of  $\frac{1}{4}$ -in. pinion wire. Be especially careful when locating this hole, since tension is obtained by squeezing the rack rather than the barrel. The saw cut should be exactly  $\frac{1}{8}$  in. wide to hold the rack. To hold the pinion shaft in place, a retaining nail must be driven into the mount so that it fits into a notch near the end of the shaft, Fig. 3. Tension is controlled by a  $\frac{1}{8}$ -in. threaded rod which extends across the saw cut and into a nut firmly seated in a slot on the opposite side. When you have completed the lens mount, attach it to the hardboard panel on the bottom of the box. ★ ★ ★



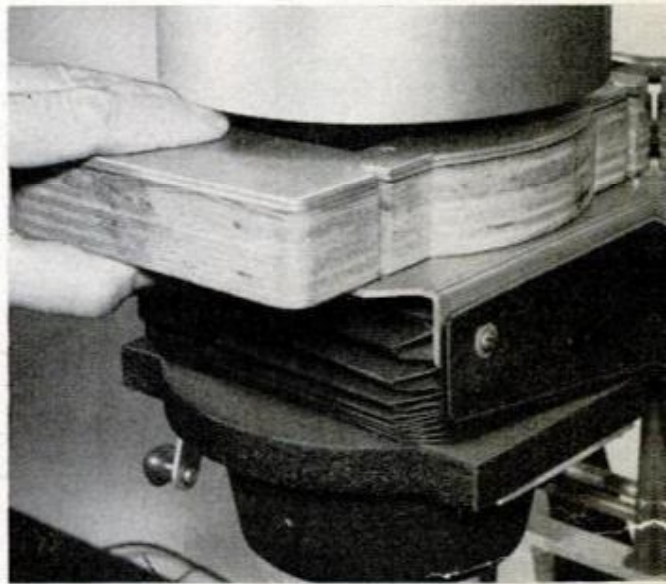
## DARKROOM HINTS



**NECKTIE BOX** provides handy non-tip holder for all those small bottles which photographers use in retouching prints. The box will hold several bottles of different spotting colors. To assemble, simply outline the base of each bottle on the box cover and cut out. Holes make snug-fitting wells for the bottles

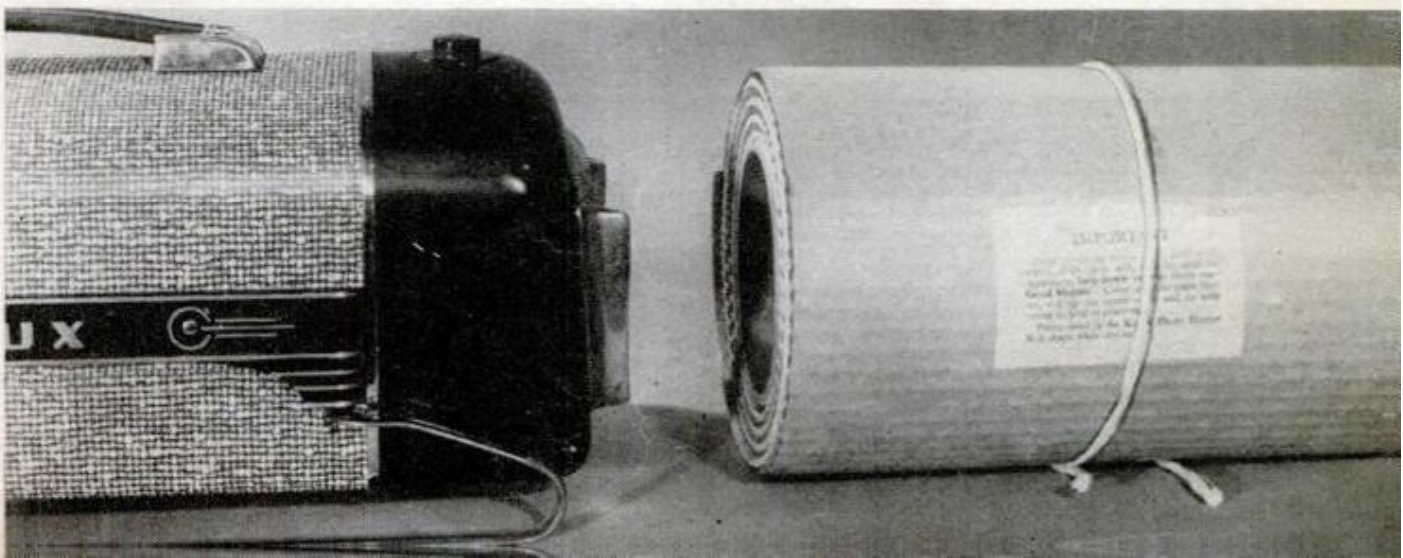


**METAL-RIBBED SHELF UNITS** are useful as darkroom storage racks, particularly for equipment requiring good drainage. All that's needed is to drive a couple of nails into the wall and slip the shelf hooks over them. The beauty of it is, too, the racks may be folded and stored



**REDUCTION PRINTS** are difficult to make on some enlargers since there's insufficient bellows draw. But many may be equipped for reducing by cutting a block the same shape as negative carrier and placing it underneath

**FOR RAPID PRINT DRYING** with a blotter roll you can simply place the roll of prints close to the blower end of a vacuum cleaner and turn it on. The circulation of air coming from cleaner will quickly dry the prints. If there is a filter in the tank, you should be sure that it is clean prior to using the sweeper as a blower



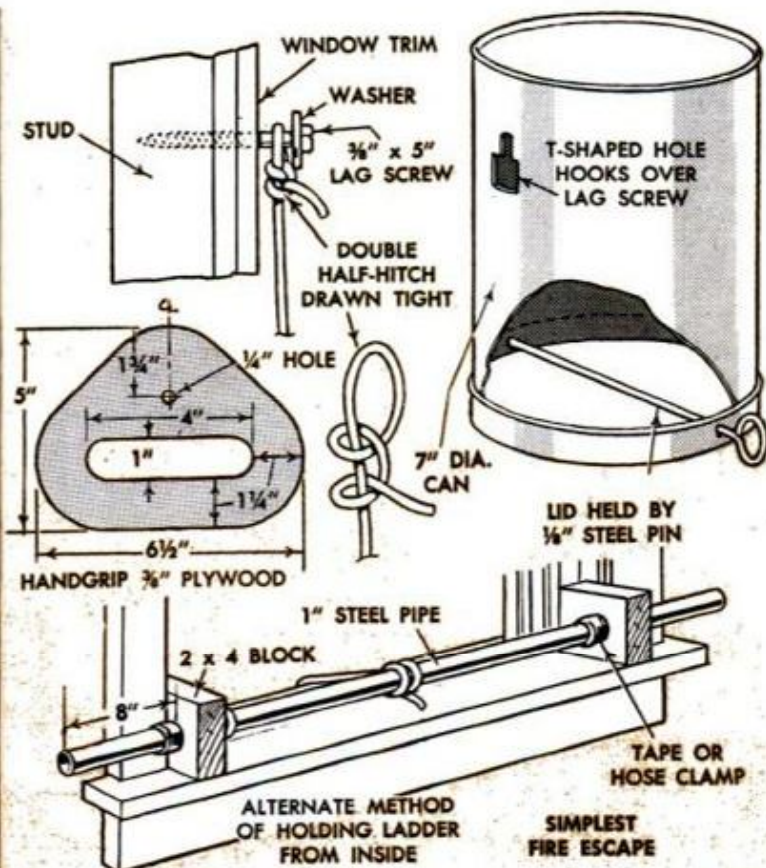
# X543 F-I-R-E!

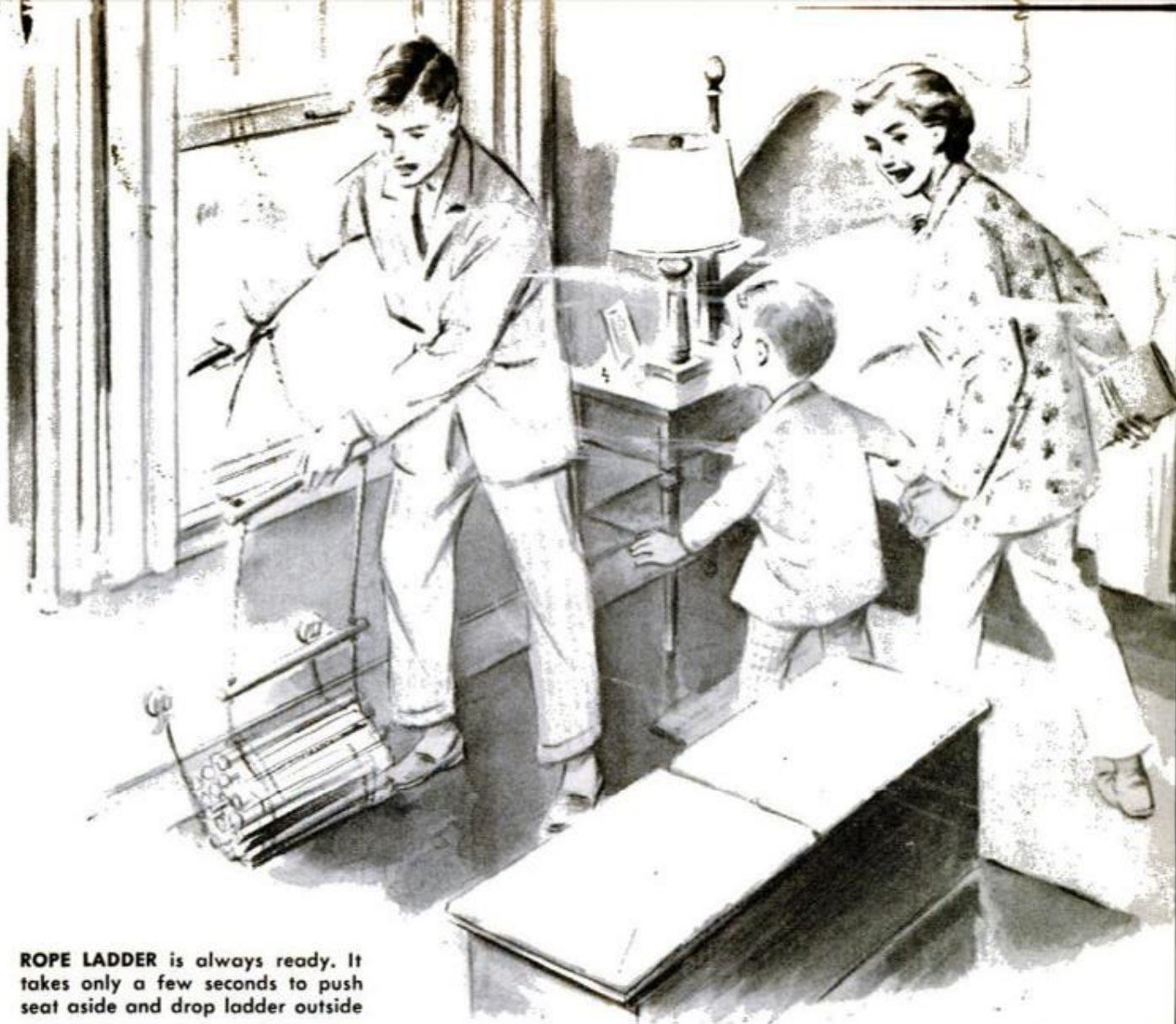
*When you're awakened by that first drifting wisp of smoke and find you are trapped in an upstairs room, don't jump. Go safely down a ladder you've made for just such emergencies*

**By E. R. Haan**

**F**IRE THAT STARTS at night in your home may burn for hours without being discovered by passersby or giving you a warning by the smoke seeping under a door or down a hallway. Any smoldering fire in the basement, walls, or elsewhere can flare suddenly into a conflagration that spreads rapidly throughout the house. By the time you, or some one of your family, are awake and aware of the danger you may be trapped upstairs with only seconds to get out. It's a long way down from even a second-story window, even though you may hang from fingertips and then drop to the ground. Broken legs, arms and other crippling injuries can result from jumping from a window or off a porch roof. Don't risk it. Have an escape ladder always ready for such an emergency.

One of the simplest and most reliable escape ladders is the single-rope unit detailed. It's installed

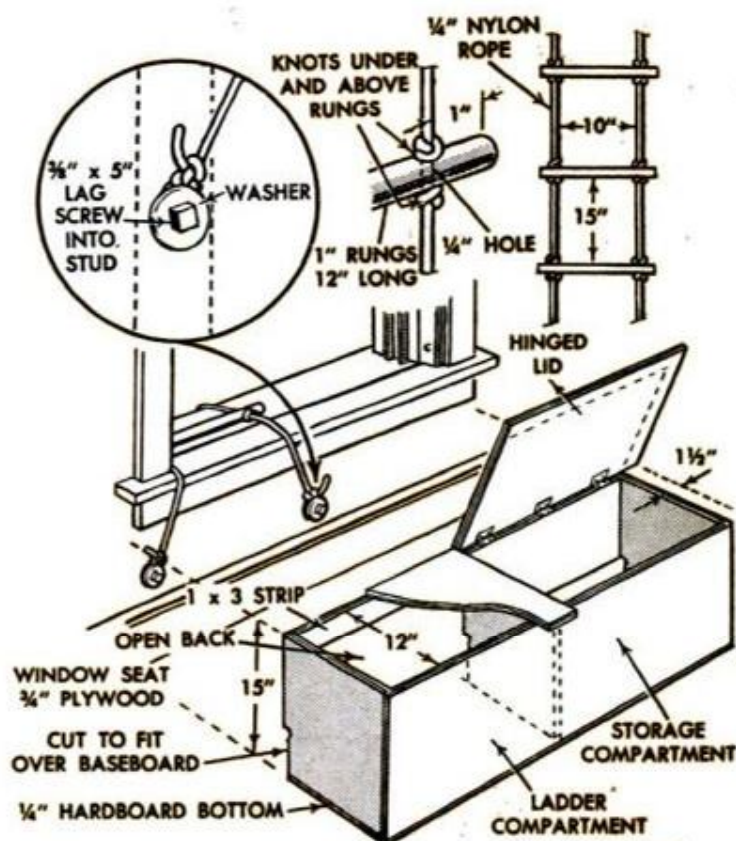


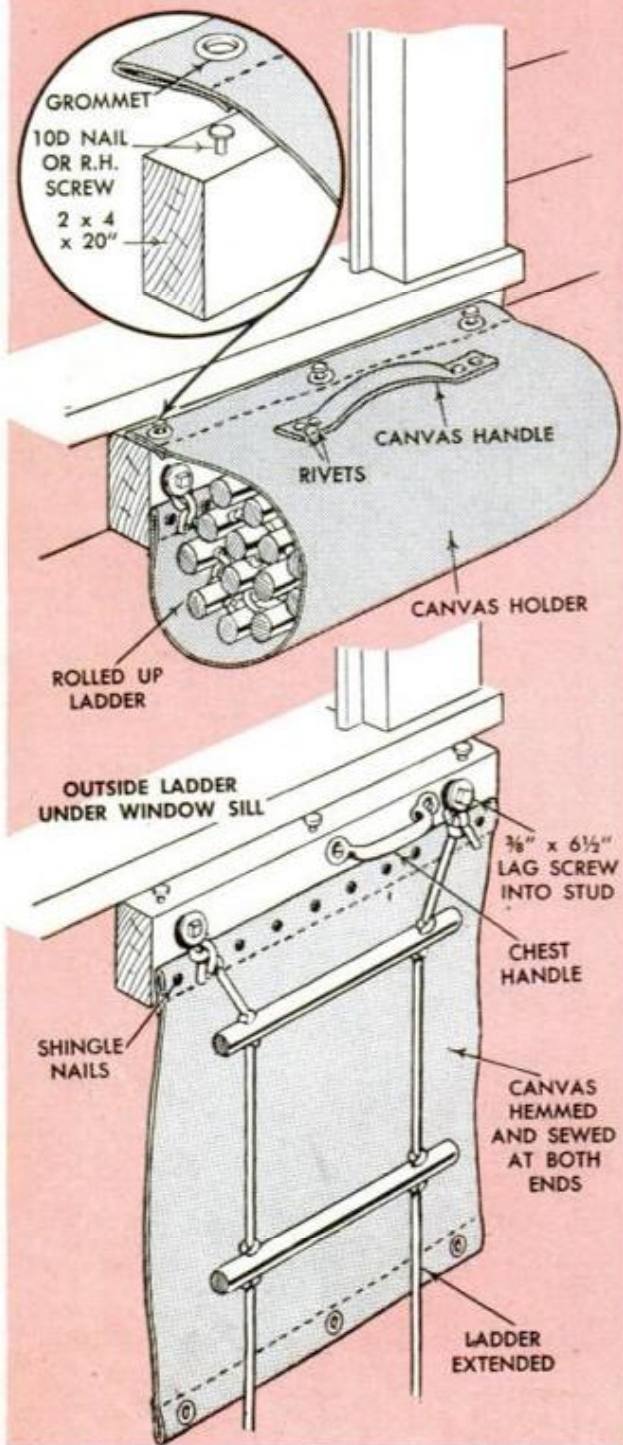
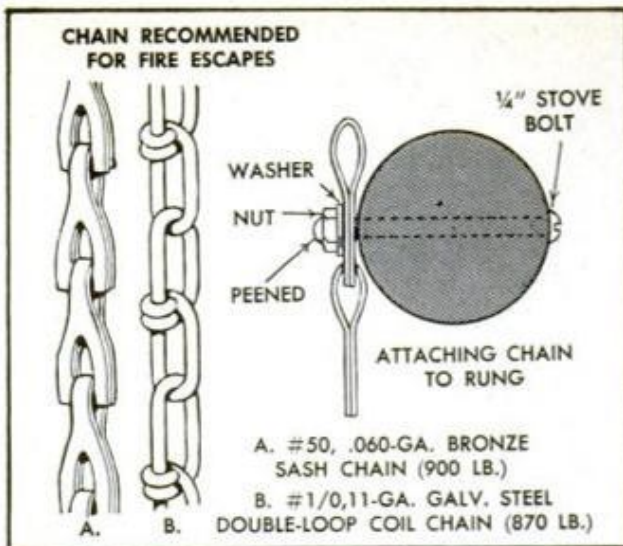


**ROPE LADDER** is always ready. It takes only a few seconds to push seat aside and drop ladder outside

on the outside of the window casing and drops full length ready for use when you pull the pin that holds the cover of the can in which it is stored. The  $\frac{1}{4}$ -in. nylon rope has a tensile strength of 1500 lb. On a frame building the rope is tied to a lagscrew turned securely into a hole drilled through the window casing and into a stud behind it. For attachment to a brick wall the lagscrew is turned into an expanding screw anchor seated in a hole drilled in the mortar between two courses of brick. A large washer under the screw head prevents the rope from slipping off when in use.

Handgrips are safer to grasp and hold than are knots tied in the rope. The grips are made of  $\frac{3}{8}$ -in. waterproof-bonded plywood and are spaced about 15 in. apart. Knots tied in the  $\frac{1}{4}$ -in. rope on either side of the handgrips hold them in place. The grips also serve as foot or knee holds, enabling the user to obtain additional holding





power when letting himself down hand over hand to safety.

The press-lid can in which the ladder is stored, is inverted when in use and is held on the lagscrew by means of a T-slot cut in the side as in the details. The pin that holds the lid from slipping off under the weight of the ladder stored inside, goes through both lid and can as indicated. A large eye is bent at one end so that the rod can be pulled out with minimum effort.

For a portable arrangement, the rope can be held on a length of 1½-in. steel pipe that spans the window as shown in the lower detail. Two blocks, bored to slide on the pipe, are spaced to fit just inside the trim pieces. They are then fixed in position on the pipe with tape or hose clamps.

The double-rope ladder fitted with hardwood rungs, is easier to use than a single rope fitted with handgrips, especially for older members of a family. It is similarly attached to lagscrews driven into studs and can be located either inside or outside a window as suggested in the details. The ropes pass through holes in the rungs which are held in place by knots. For small children it may be advisable to space the rungs closer than the 15 in. indicated. Where the ladder is anchored and stored inside, a window seat may be used to conceal it. Part of the seat can be fitted with a hinged cover and utilized as a storage compartment.

While the inside location of the double-rope ladder provides greater protection against the elements, it can be installed outside just under a window sill as detailed. The rolled-up ladder is held by a piece of canvas, which when loosened by simply pulling up on the handle, allows the ladder to drop instantly.

The piece of canvas is doubled at the ends and sewed for extra strength. One end is nailed to the cross piece and three grommets are fitted in the hem at the other end. The latter slip over 8d nails or round-head screws driven into the top edge of the cross piece. As the nails extend only slightly and are close to the sill they cannot catch in clothing. A heavy chest handle screwed to the cross piece at the location indicated provides a firm handhold on the way out the window. Note that the double-rope ladder is located at the right side of the window (viewed from outside) as is the single-rope ladder.

Where chain is preferred to rope use the types and sizes given in the upper detail at the left. The chains listed provide more than ample strength for the purpose. The obvious advantage of chain is that it is fireproof. Attachments of rungs to chain is shown in the detail. ★★★

## Hose Holds Mirror

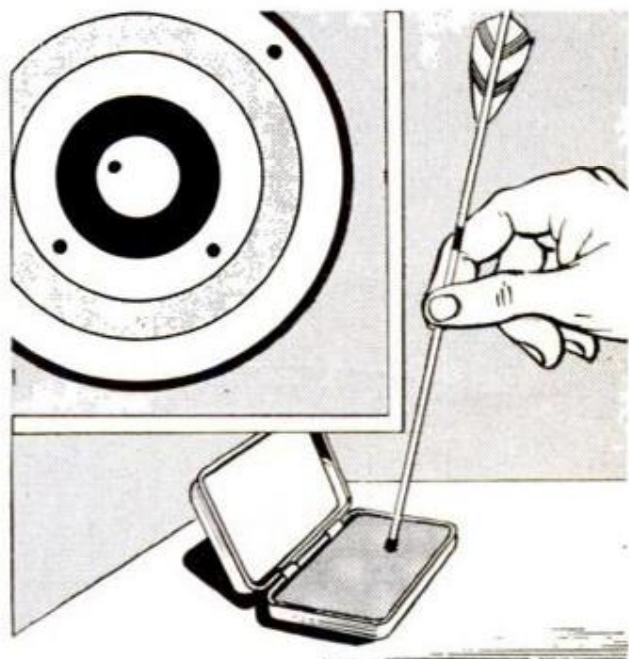
If you're one of those hardy campers who never shaves on a long trip, then you won't be interested in this. But if you do shave regularly, then it's a good idea to figure out where you're going to hang the shaving mirror before you go. Of course, you can always prop the mirror on a camp stool or hang it from a tree limb but that's only making a project of inconvenience. A better way is to tack a holder for the mirror to one of the tent poles. Make the holder from a length of garden hose, cutting the ends at an angle and slitting the hose along the length as pictured. Or you can make a holder from a length of aluminum tubing or form one by bending sheet metal around a piece of pipe or a dowel. Smooth the edges after cutting and bending.—G. E. Hendrickson



## Spots Mark the Spot

When practicing on the indoor archery range, using safety arrows, there may be some question as to scoring due to the difficulty of determining with certainty just where the arrows strike the target face. One way to make scoring easy is to glue disks of  $\frac{1}{16}$ -in. felt to the arrow tips. Then before nocking each arrow, press the felted tip lightly on a standard stamp pad. When the arrow tip strikes the target face the inked tip will leave a round spot with sharp edges, eliminating any doubt about the exact point of impact. If there are contestants, then each can ink his arrow tips on a pad of a different color. This will eliminate guesswork when scoring. Immediately after use the ink should be removed from the felted tips by dipping in a solvent such as carbon tetrachloride.

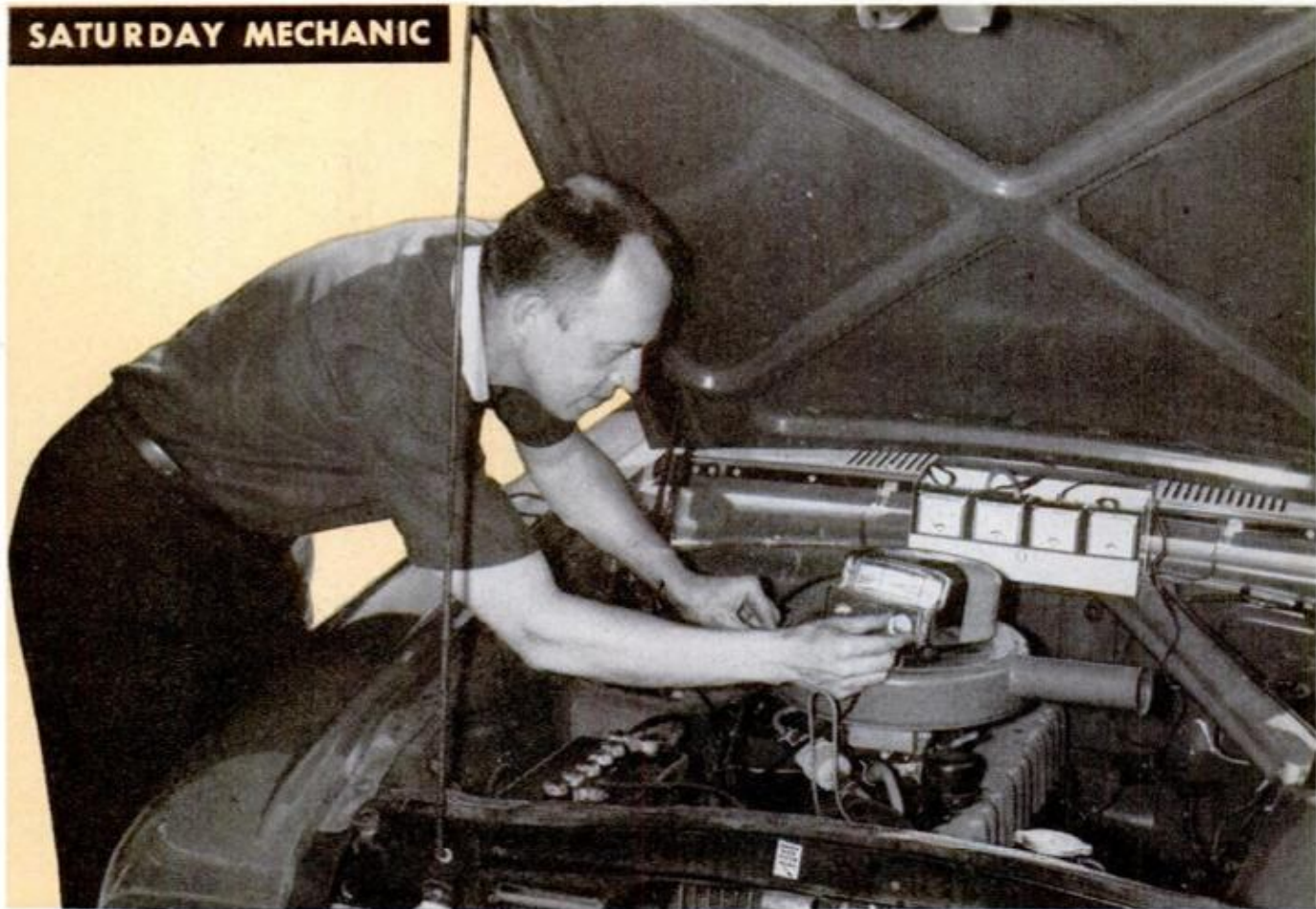
—W. C. Wilhite



## Umbrella Basket

Here's how one small commercial grower of choice "glads" solved the delicate problem of handling and transporting the fragile blooms from the row to the packing bench. He cut and fitted a cardboard cone over the brace ribs of an old umbrella as indicated by the dotted lines in the detail. The cone forms the bottom of the basket. The umbrella is then placed alongside the row in the inverted position as illustrated and the cut blooms are laid with the cut ends of the stems all in one direction around the full circumference of the umbrella basket. In this way the delicate blooms, cut fresh from the plant, are not crushed or the stems bent by being stacked. When filled the improvised basket is easily carried wherever desired.





COMBUSTION ANALYZER is most accurate for setting fuel-air mixture when making idling adjustment

## IS YOUR CAR WASTING FUEL?

*Simple fuel-system checks can point the way to adjustments that give you a cleaner engine, more miles per gallon*

ANALYZER in use to check exhaust gases. Just connect pipe from pick-up unit to tail pipe of the car



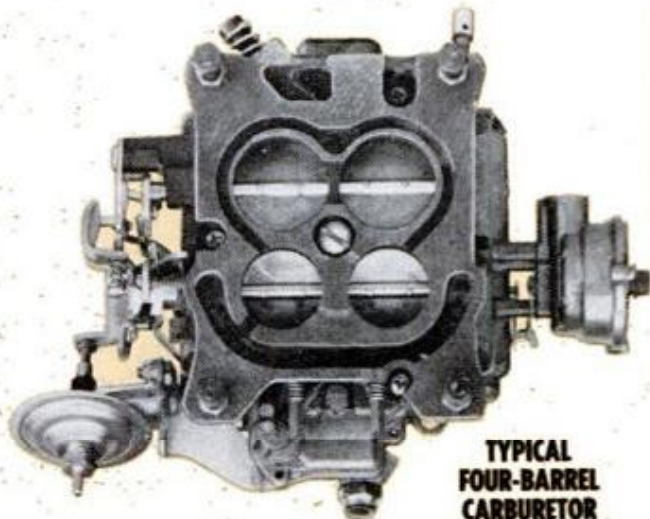
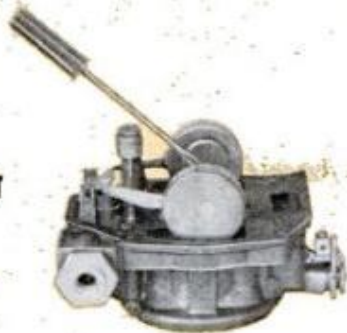
**By William J. Hector**

**A** TUNE-UP IS NOT COMPLETE without a close check on the fuel system which consists of the air cleaner, fuel pump, carburetor, fuel tank and the connecting fuel lines. Proper functioning of the fuel system is of equal importance with that of the other systems in your car, electrical, lubrication, ignition and cooling. It's the periodic attention to all these systems that maintains a car at top efficiency.

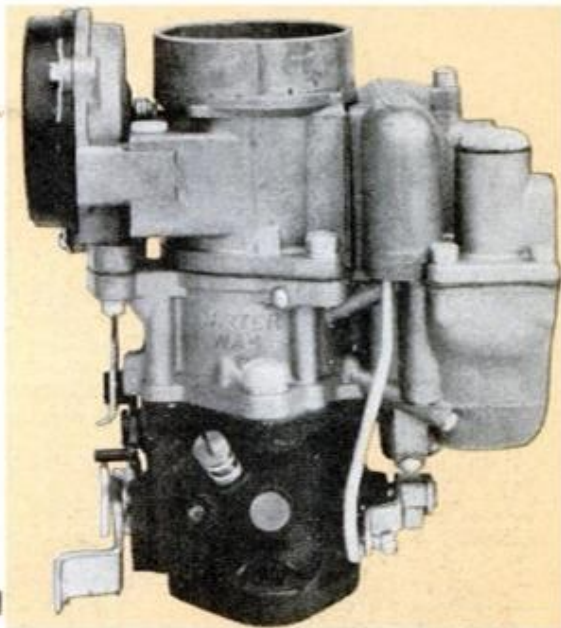
Most of the fuel-system checks are quite simple to carry out. Of all the test instruments available to the Saturday mechanic, few are more useful than the vacuum gauge. It can measure intake-manifold vacuum and check fuel-pump pressure, and in these two checks alone it gives a fairly reliable over-all check on engine efficiency.

The fuel pump should be pressure-checked, capacity-checked and vacuum checked, if it's a vacuum-booster type. It will help to attach a T-fitting between the

### CARBURETOR FLOAT ADJUSTMENT



TYPICAL  
FOUR-BARREL  
CARBURETOR



SINGLE-BARREL  
CARBURETOR

**SINGLE AND FOUR-BARREL CARBURETORS** are standard on 4s, 6s and V8s. Correct float adjustment is important

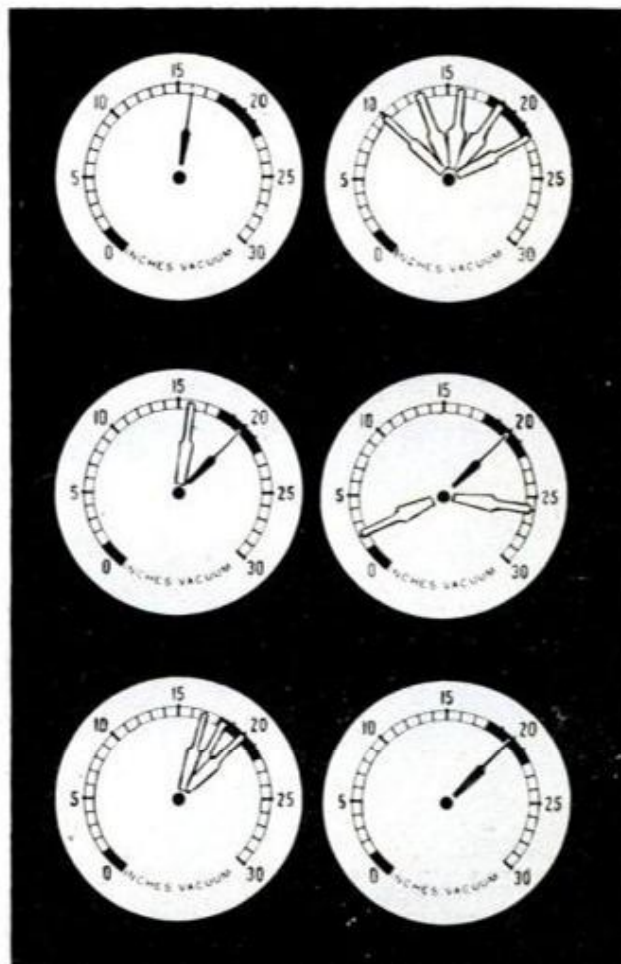
### VACUUM-GAUGE REACTIONS

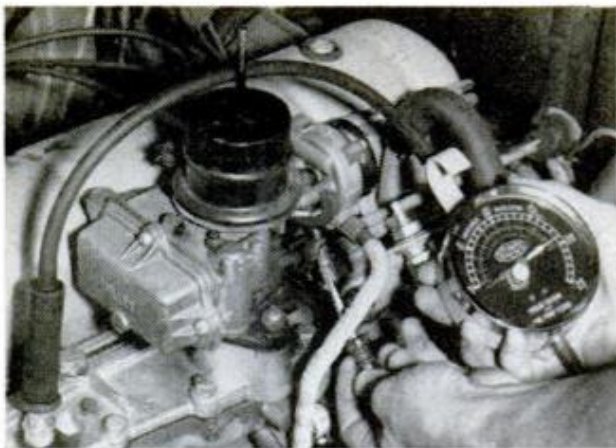
In the two upper views of a vacuum-gauge dial, the low, steady reading at the left, which affects all cylinders alike can indicate loose tappets and possibly late ignition or valve timing. If, on the other hand, the pointer pulses regularly it usually indicates that one cylinder only is affected—possibly by a sticking valve or fouled plug.

If pointer wavers or is erratic, center, left, it can indicate similar trouble in more than one cylinder. Also, possibly a rich carb mixture, spark incorrectly adjusted or very wide plug gaps. Unsteady, broad sweeps, center, right, increasing with speed may indicate valve-spring trouble. If pointer steadies with an increase in speed, ignition or carb may be at fault.

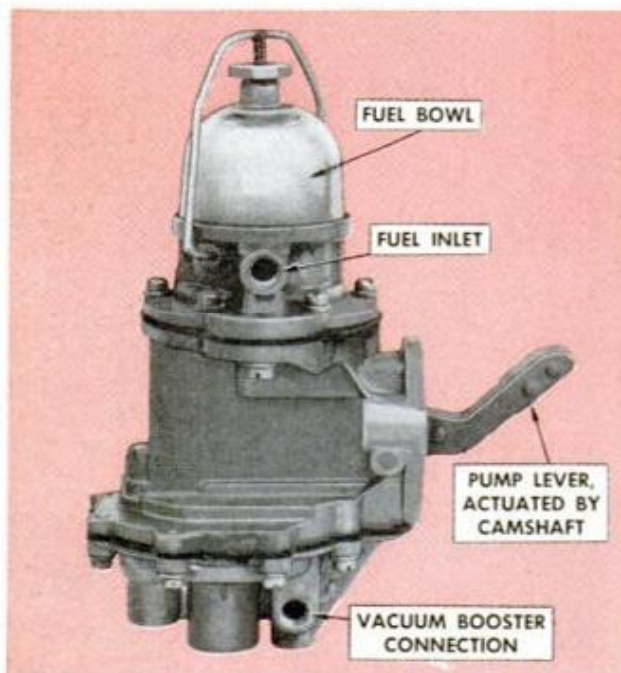
Fairly broad sweeps of the pointer, lower left, when throttle is opened and closed can generally be taken as a normal reaction. If the swing is within a limited range it is possible that leakage exists somewhere in the engine. Lower right, when timing ignition with the gauge, advance to the highest steady reading, then back off distributor  $\frac{1}{2}$  in. (pointer showing  $\frac{1}{2}$  in. less vacuum). Normally this reading will be within the correct range.

NOTE—Black pointer indicates steady reading. White pointers indicate changing, or erratic reading. For clarity only the vacuum pointer is shown. The pressure pointer comes with the vacuum gauge.



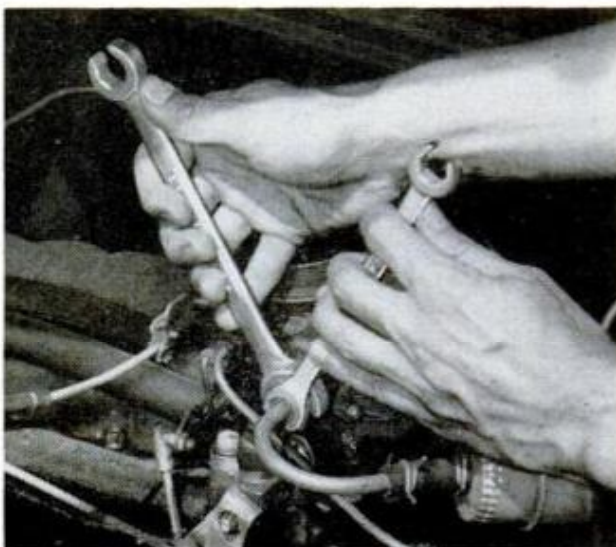


**IDLE-MIXTURE ADJUSTMENT** can be set accurately with a vacuum gauge. Turn the screw slowly, in or out



**FUEL PUMP** with booster keeps windshield wipers going under heavy acceleration, when vacuum is low

**FLARE-NUT WRENCHES** should be used in pairs when removing and replacing fuel lines. These special wrenches do not distort or round lobes of fittings. If you have to use end wrenches, work very carefully



carburetor and the fuel line. Disconnect the wire from the ignition coil at the distributor cap and ground it to the engine block. Crank the engine and take a reading. This (it's a pressure reading) should range from three to five pounds per square inch (p.s.i.) A low reading can mean the fuel pump is defective but don't take that as final. Make another check. Disconnect the gauge from the fuel line, allowing gas to flow into a calibrated container. Crank the engine (ignition off) for 15 seconds. You should get about four ounces of fuel in the container. If much less, look first for a clogged vent in the fuel-tank cap. If this checks out okay, then disconnect the fitting at the vacuum-booster side of the fuel pump. If oil is present, the diaphragm in the booster is ruptured. Now, connect the vacuum gauge with a fitting and check out the reading with a chart for that particular pump. If it's still low, there is always the possibility of an air leak in the fuel line, or more rarely, some foreign object in the fuel tank that can partially clog the screen. The reason for making all these checks is to rule out all other possible causes of low readings before you condemn the fuel pump. Always try to prove it defective before you replace it.

### Adjusting Carburetor

Carburetors have several adjustments which should be checked periodically. On 4 and 6-cylinder engines you will find single-barrel carburetors with only one idle-mixture adjustment screw. On the V8s you will find either a two or four-barrel carb. A tachometer gives greater accuracy when setting idle speed to the recommended figure. The idle-mixture adjustment will likely change the idle speed, so it is necessary to recheck. There are three methods of setting the idle mixture, manual, vacuum gauge and combustion

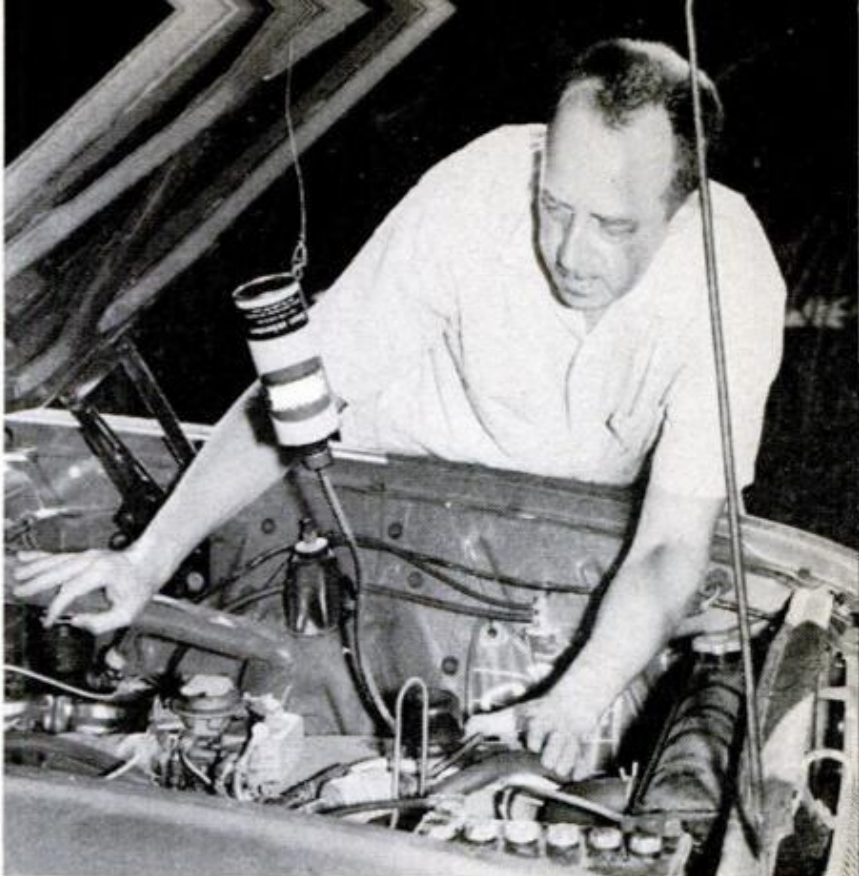
**ON SOME ENGINES** you'll find a plug turned into a tapped hole—a provision made for the purpose of attaching a vacuum gauge or other test equipment. Don't forget to replace plug when test is finished







**SINGLE-BARREL CARB**, above, is standard on 4s and 6s. Right, if used regularly, carb detergents will dissolve gum deposits



analyzer. Adjusting manually is, of course, considered the least accurate but you get a fair approximation simply by turning the idle-adjustment screw in until the engine begins to idle rough, then reverse the screw one half to one full turn, or until the engine smooths out. Although many experienced mechanics use this method consistently, a better way—for the Saturday mechanic—is to use the vacuum gauge. Disconnect the windshield-wiper hose from the intake-manifold connection, or, if you have electric wipers, you probably will find a screw plug in the intake manifold which you remove to attach a vacuum-gauge fitting. Start the engine and warm it up to operating temperature. Now, adjust the idle mixture to give the highest steady reading which usually ranges somewhere between 18 and 22 in. of vacuum. When you're making this test turn the screw very slowly, in or out, as the case may be. Keep in mind that spark-advance adjustment of the distributor will have some effect on the vacuum reading. Some mechanics use this method for setting the timing. To carry it out, you loosen the clamp on the distributor base and rotate the distributor slowly to a point where you get the highest steady reading. Then retard the advance one-half inch of vacuum and repeat the adjustment of the idle mixture with the vacuum gauge.

The third method, considered the most accurate, utilizes the combustion analyzer, which gauges the amount of heat produced by the fuel-air mixture. If the mixture is too lean, acceleration will be affected; if it's too rich, miles-per-gallon of fuel will be

reduced, and you risk such side effects as plug fouling and crankcase dilution. The analyzer allows you to set the idle mixture to that in-between point that gives the desired efficiency, assuming, of course, that the engine and the other systems are in reasonably good condition and functioning properly.

After 20,000 to 30,000 miles carburetor gaskets soften and fuel-inlet nozzles become worn, the latter condition increasing fuel consumption. A carburetor in this condition should either be overhauled (using an overhaul kit) or replaced with a rebuilt unit of the same type and model number. Before you remove a carburetor do a thorough job of wiping away all grime from around the fittings and the body flange. Otherwise some of this material may become dislodged during removal and replacement and fall into the intake mani-

(Continued to page 178)

### TOOLS

- Vacuum gauge
- Tachometer
- Combustion analyzer (optional)
- Flare-nut wrenches
- Perforated container for carburetor dip
- Fuel filter

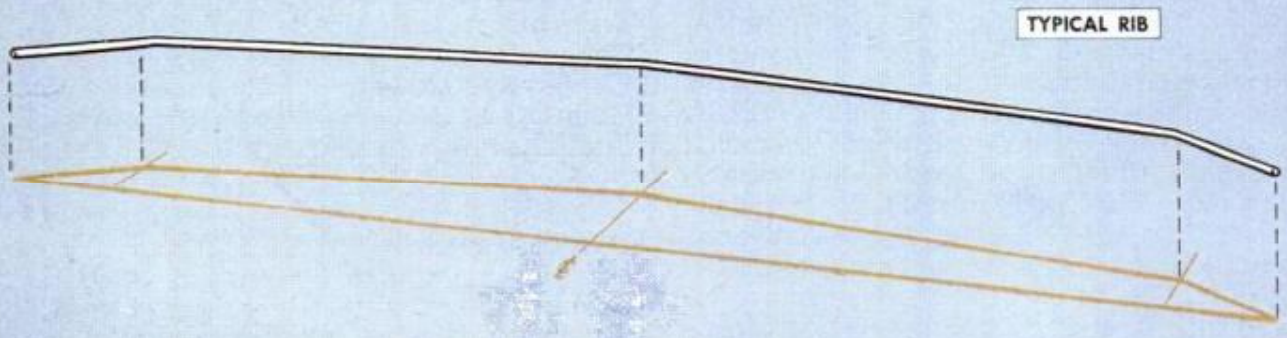
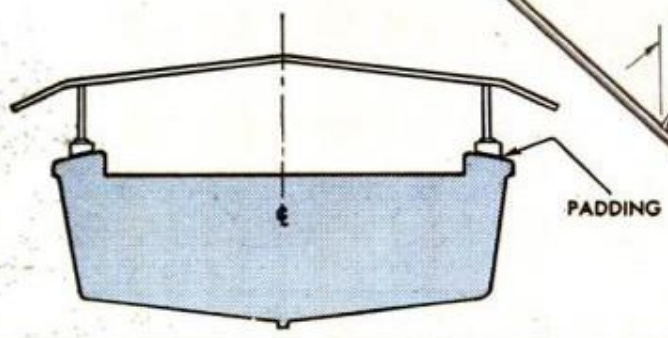
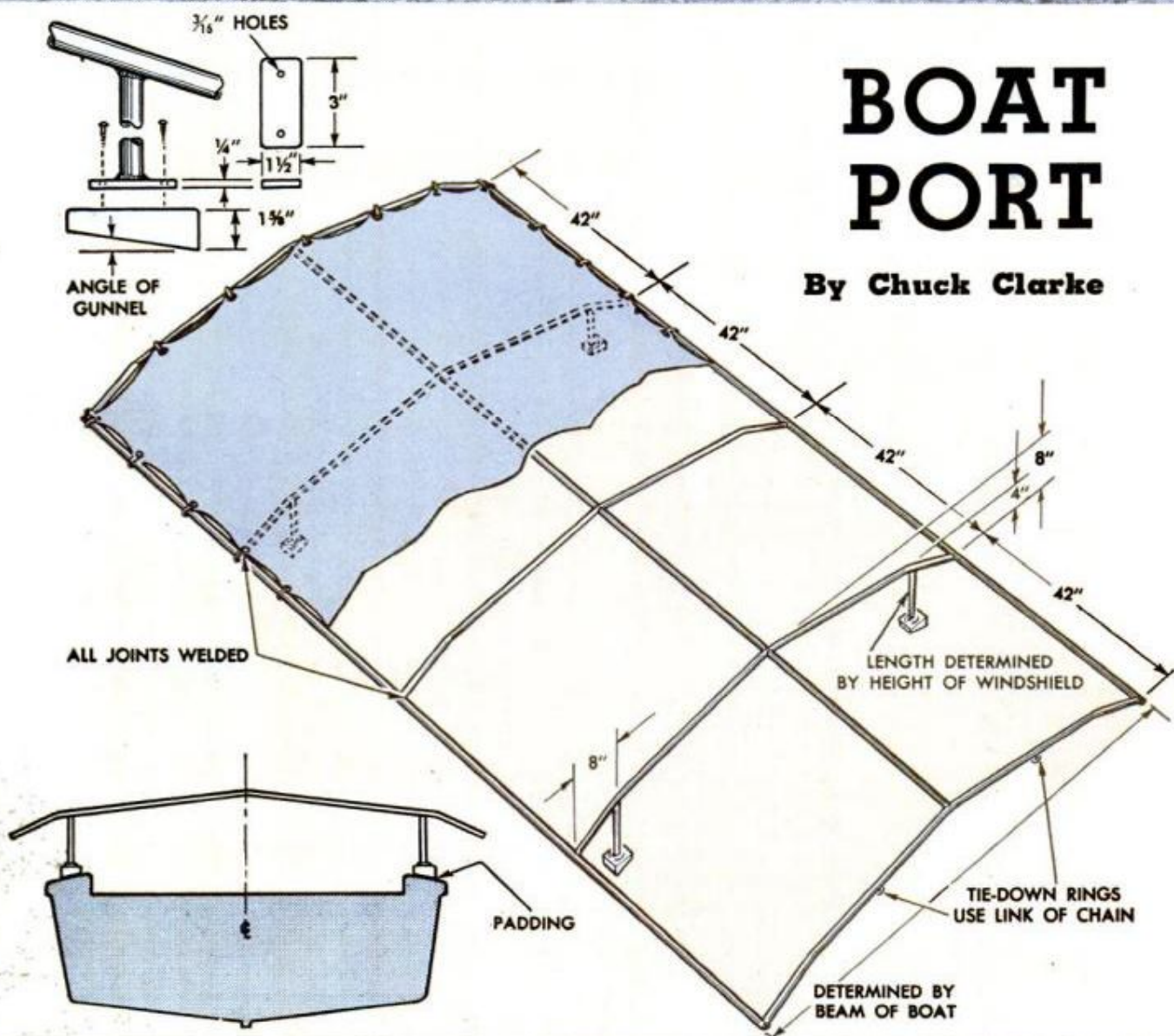
### MATERIALS

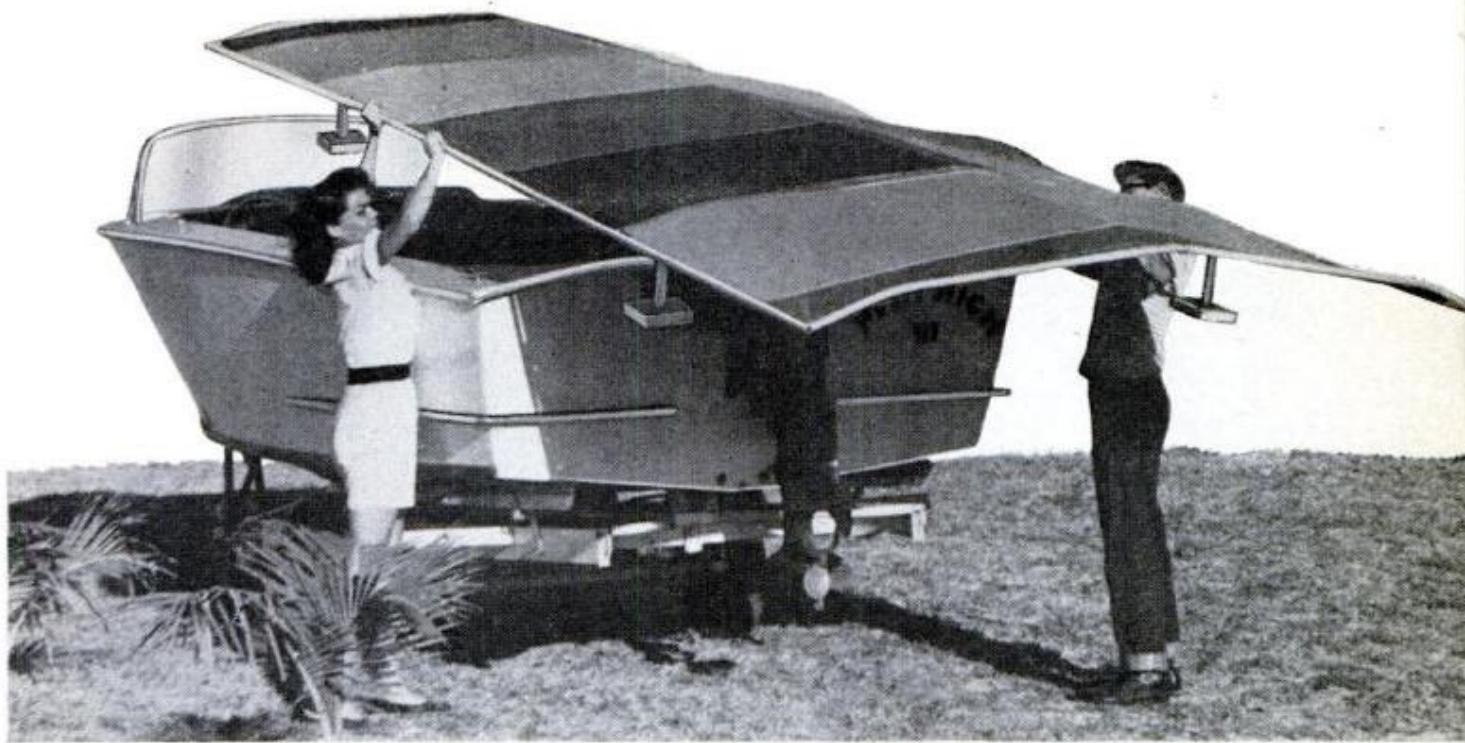
- T-fitting (optional)
- Calibrated container (measuring cup)
- Carburetor overhaul kit
- Carburetor dip or cleaner



# BOAT PORT

By Chuck Clarke



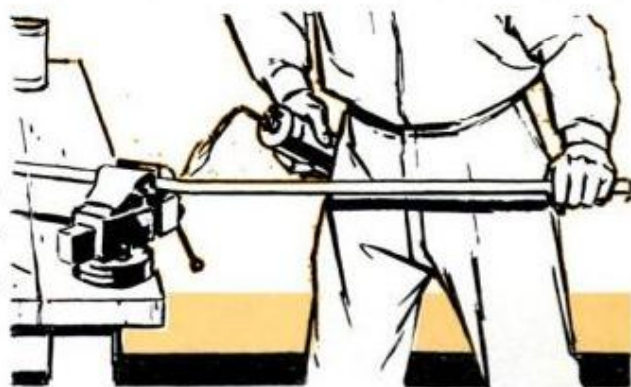


**BETTER THAN PERMANENT STRUCTURE**, this light shelter can be moved with the boat and taken off in seconds

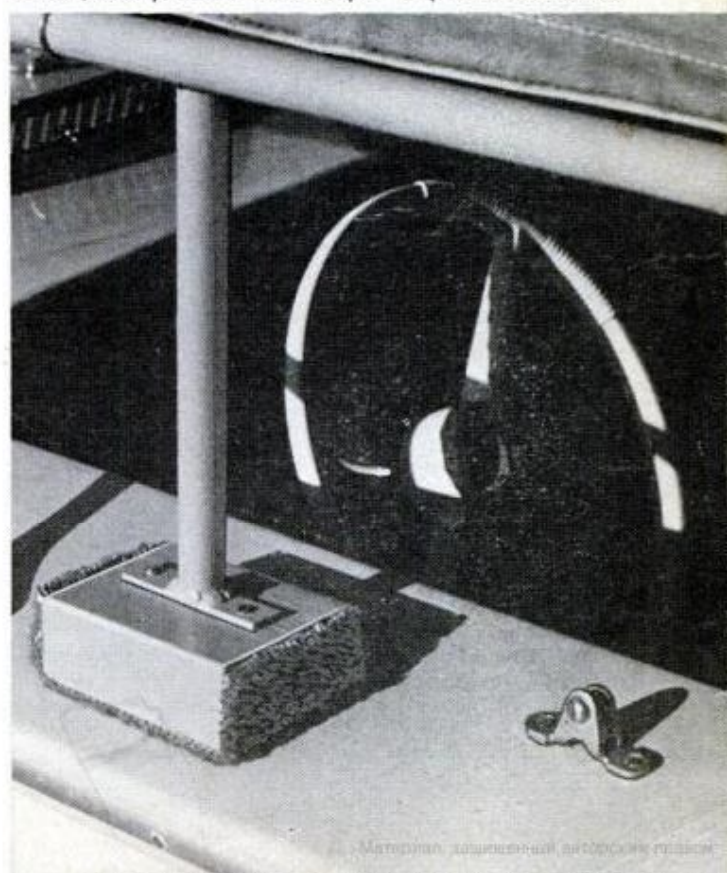
**C**OVERING A BOAT with a tarp and forgetting it is asking for trouble. Without free circulation of air, condensation on the underside of the tarp is trapped inside and dampness soon results in ruined finishes and rotted wood. Here is where a raised, lift-off cover will afford the best seasonal protection at low cost. With the cover overhanging the boat all around, only a hard driving rain can put water inside.

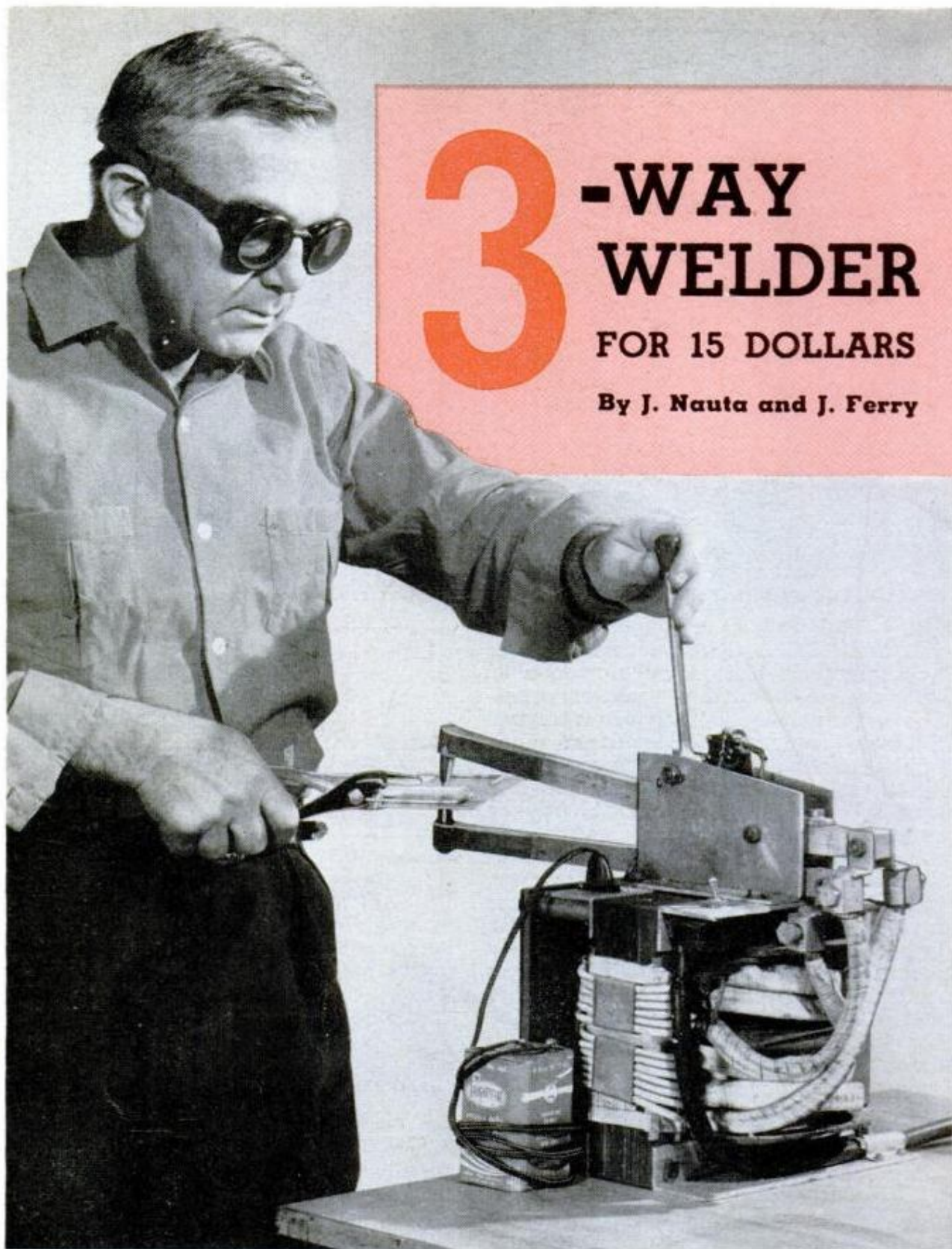
As you can see in studying the drawings, it's nothing more than a framework of pipe covered with awning fabric and fitted with legs to rest on the gunnels where it is held securely with tie-downs. The original was made of 1/2-in. black pipe, welded together and painted with rust-preventative paint. Over-all dimensions, of course, must suit the particular boat, but while an awning shop will make a cover to your specifications, it is generally less expensive to make use of a stock size awning.

To find the over-all length of the ribs, you'll do best to draw a full-size pattern on the floor with chalk, which also will serve as a master pattern to follow when bending the ribs. While the latter can be bent cold, the pipe will bend more easily if it is first heated at the points of bend with a torch. In cutting the legs make them long enough to clear the windshield and motor, say 2 in. Wooden pads added to the legs and padded with carpet protect the boat finish. The awning cover may be lashed to the pipe framework with clothesline or attached with loops of No. 14 copper wire. Links of chain welded to the framework at the ends serve as tie-down rings. ★ ★ ★



**HEATING PIPE**, above, makes bending easier. Feet, below, are padded with carpet to protect the finish





# 3-WAY WELDER

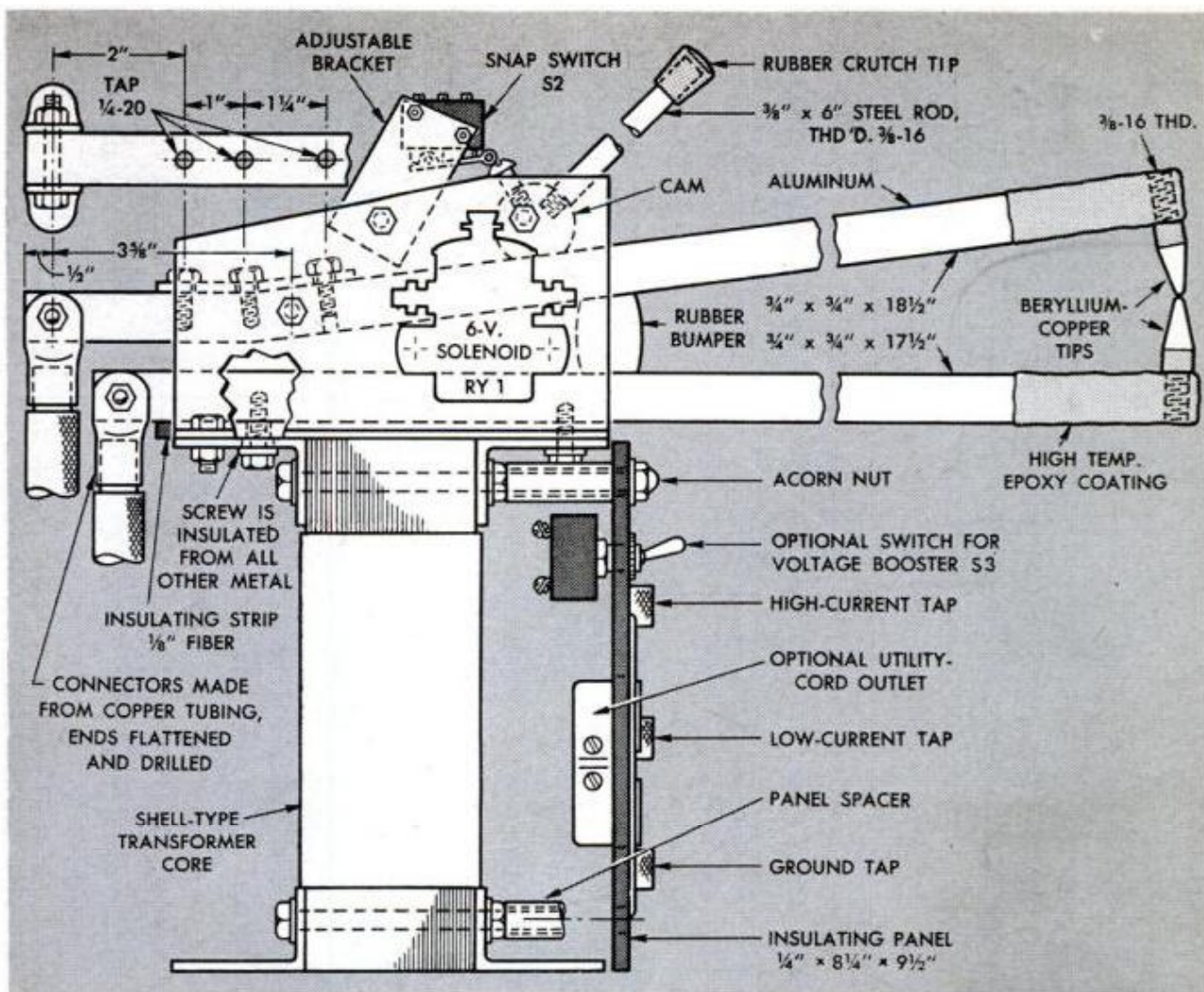
FOR 15 DOLLARS

By J. Nauta and J. Ferry

**A**S A SPOT WELDER this combination unit will join ferrous metals up to  $3/32$  in. thick. It works especially well on stainless steel due to low heat and electrical conductivity of this metal. For heavier work it is used as an arc welder. A carbon-arc torch may be plugged in and used for brazing, silver soldering, aluminum welding and welding thin sheet metal as well as heating metals for bending. The voltage

booster can be used to eliminate power-robbing voltage drop when portable electric tools and equipment must be used on a long extension cord. The voltage booster requires no extra coils, only a switch and receptacle connected into the circuit.

The original welder was operated on 115-v. circuits without damage to wiring or service box. Miniature 30-amp. circuit breakers are substituted for ordinary fuses



which won't take the momentary heavy current surges.

The shell-type transformer core used on the original welder was purchased from a dealer in scrap metals. The core should weigh about 30 lb. and the cross-sectional area of the main center leg should be at least 6 sq. in. or slightly more. There also should be about 2 in. of space separating the legs so there will be room for the coils.

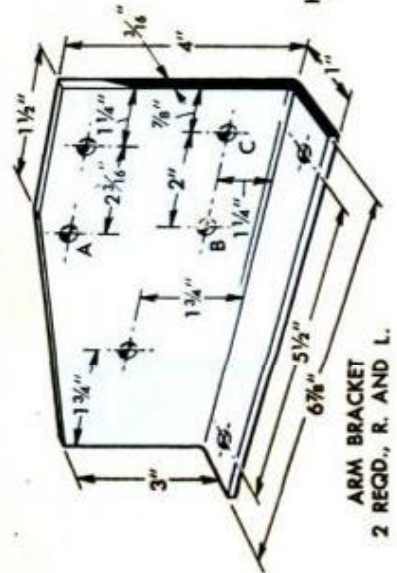
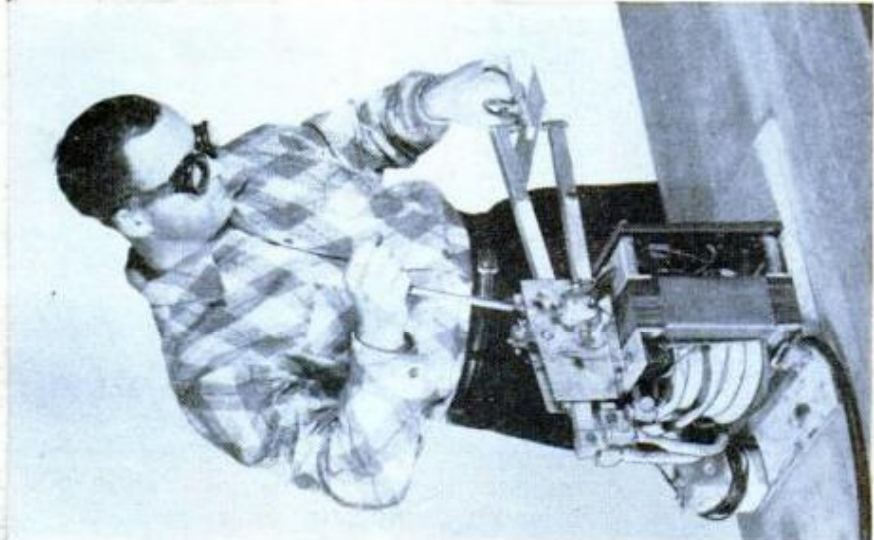
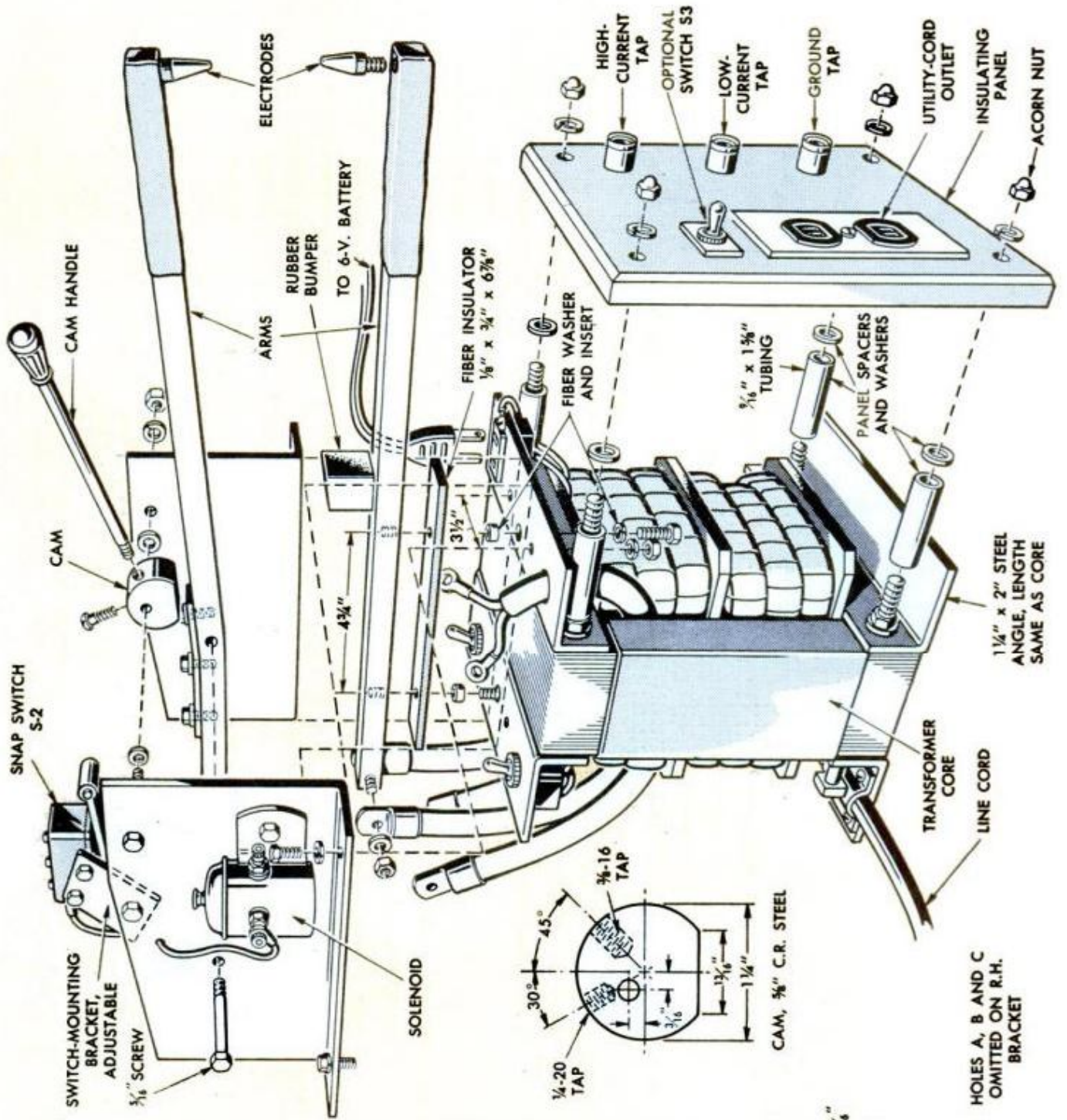
A wooden form slightly larger than the center leg of the core will be needed for winding the primary and secondary coils. The primary and secondary should be wound adjacent to each other with an insulating separator between. They may be wound one on top of the other but this will make it more difficult to control the arc-welding current. For operation on 115 volts the primary consists of 104 turns of No. 10 magnet wire. For operation on 230 volts, 208 turns of No. 13 magnet wire should be used. When winding the coils, thin Fiberglas cloth and polyester resin is used as insulation between the layers of wire and also to wrap the coils.

The arc-welder secondary requires 42 turns of No. 6 wire while the spot-welder secondary consists of a double strand of No. 00 flexible welding cable, three turns,

the ends of which are connected directly to the spot-welder arms with heavy copper lugs. Three strands of No. 4 cable could be substituted for each No. 00 cable if necessary. If there is a lack of winding space, it will be necessary to strip the heavy rubber insulation from the cables and wrap the bare wires together with adhesive tape. This winding is put in place after the transformer laminations are assembled and permanently clamped together.

The reactor, which is wound on one of the outside legs of the core after assembly, consists of 14 turns of No. 8 rubber-covered wire. This coil is connected in series with the arc-welder secondary to oppose the welding current. As the reactor is wound on the outside leg of the core, 14 turns are necessary to reduce the welding voltage by seven and the welding current is reduced about 40 percent as the heavy current flowing through the reactor greatly reduces the magnetic flux flowing through the leg on which it is wound.

The spot-welder arms can be made of 3/4-in. square aluminum or copper. Brass is not suitable as it will quickly overheat. The lower arm is mounted directly on the transformer top as in the details and is insulated from it with a piece of 1/8-in.



HOLES A, B AND C OMITTED ON R.H. BRACKET

ARM BRACKET 2 RECD., R. AND L.

fiber. The mounting screws must also be insulated with fiber washers and short lengths of fiber tubing as in the pulled-apart detail. No insulation is necessary for the top arm and when mounted, it is grounded to the transformer frame and core. A rubber bumper forced between the two arms serves as a spring to open the arms when the cam handle is moved back. Beryllium-copper electrodes for the spot welder can be bought for about \$2.00. Each should be about 1/2 in. in diameter and about 2 or 3 in. long. The tapered shank may be cut and threaded 7/16 in. to turn into tapped holes in the welding arms. The holes in the arms should be drilled at a slight angle to cause the points of the electrodes to close at an angle rather than in line. The arms should be coated for a distance of about 6 inches from the ends with a heat resistant epoxy cement to prevent sparking and burning should the work accidentally touch the arms.

An auto-starter relay is needed to control the momentary heavy surge of current when the spot welder is turned on and off. The top cover is removed, drilled through the center and reamed out to about 3/4 in. This allows the solenoid armature to open about 3/8 in. and stops arcing at the contacts. A rubber button is cemented to the exposed end of the armature and serves as a push button for manual operation. Automatic electric operation of the relay is also provided by connecting a 6-volt battery and snap switch in series with the solenoid winding. The switch is actuated when the cam handle is moved. The switch must be adjusted to close after the work is held firmly between the electrodes. It should open just before the electrodes release the work to prevent sparking and burning.

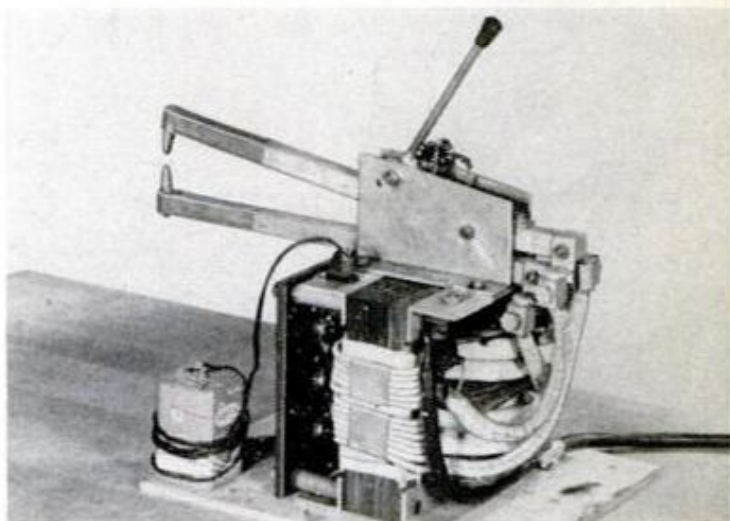
The arc welder has two heat ranges, high, which is over 100 amp. with 1/8-in. a.c. electrodes, and low, which gives about 60 amp. with 3/32-in. electrodes. Don't tap the arc secondary for lower current ranges as this will increase, not decrease, the current draw. With a shell-type transformer the orthodox magnetic-leakage method of current control cannot be used, so a reactor is used to decrease the magnetic flux through one leg of the core when the low range is plugged in. The reactor, of course, is connected to oppose the main secondary.

The welder is designed only for intermittent use, such as it would get in the average small shop. If it is used for too long a period at a time, the 30-amp. circuit breakers will trip.

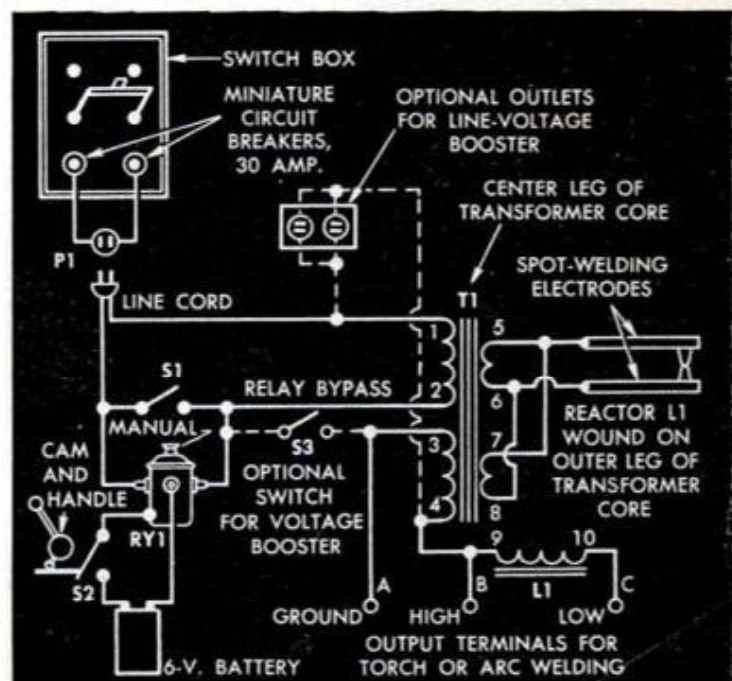
When first testing out the transformer the primary should be checked for no-load current input. This should be 1 amp. or less if the windings are not shorted. ★ ★ ★



SWITCHES AND TAPS on insulating panel should be labeled for easy identification and to prevent error



NOTE 6-V. BATTERY which provides automatic operation of relay. Relay also can be operated manually





## Coming Up Next

**MODEL GYROPLANE.** Control-line model planes may be old hat to you, but did you ever see a control-line model gyro? No? Then look at the photo above. In July PM we'll tell you how to build one like it. Yes, you read it right the first time—a control-line flying gyro!

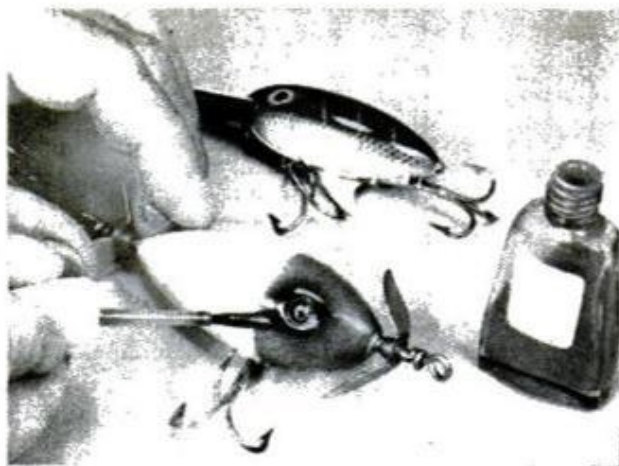
**CONCRETE AROUND THE HOME.** We'll venture to say that there are tricks in concrete pouring and finishing you may not have seen before. Almost anything can be used in finishing concrete—a piece of tubing, a coffee can, small stones, plastic sheeting. See the July PM.

**POOLSIDE CABANAS.** One is kite-styled but we hasten to say it won't fly away while you're changing. Both are built of hardboard and pipe and are anchored to solid ground. The novelty is in design and color patterns, both of which "belong" with any pool. Coming in July PM.

**LAWN EDGER.** Does away with the wearisome stoop labor of clipping grass where your mower won't reach. Utilizes an old vacuum-cleaner motor for power, a power hacksaw blade, a couple of pie tins, a few pieces of iron, screws, a long, three-wire power cord. Details next month.

**SINGLE-POINT THREAD CUTTING.** Ever hear of a single-point thread? No, and never has anyone else. The term refers to the tool bit, not the thread type. This shop feature for July goes into methods of cutting common thread forms on a small screw-cutting lathe.

## FISHING HINTS



### They'll Bite on This . . .

The lure of fishing is not always in the lure that has that unmistakable, much-used look, especially from down deep where there are discriminating fish that are fish. If you're angling for the biggest one in the lake and not in the story, why not offer him something worth a mouthful of hooks? Old, beat-up plugs that are color-dull and water-worn can usually be touched up with fingernail lacquers of which there are almost an infinite number of shades. Just match the color with the original and paint it on with the applicator.—*Bil Toman*

### . . . But Not This

If you've ever tried to shoot a fly into a tiny, sheltered cove or under a tree root with the wind in your face, you may guess right away what that lump of sugar pictured below can do for light spinning gear. Or did you? The lump of sugar (it's standard size) adds just the right amount of weight to enable you to cast a fly as far as you can put a light spinning lure into a fair wind. Seconds after the fly settles the sugar dissolves, the slip knot holding it will pull out on the long retrieve and leave everything ready—for the next lump of sugar. And if anything in fins of legal size rises to the fly, try not to forget about the lump-of-sugar kink. It could come in handy again.

—*Joseph B. Stephens*





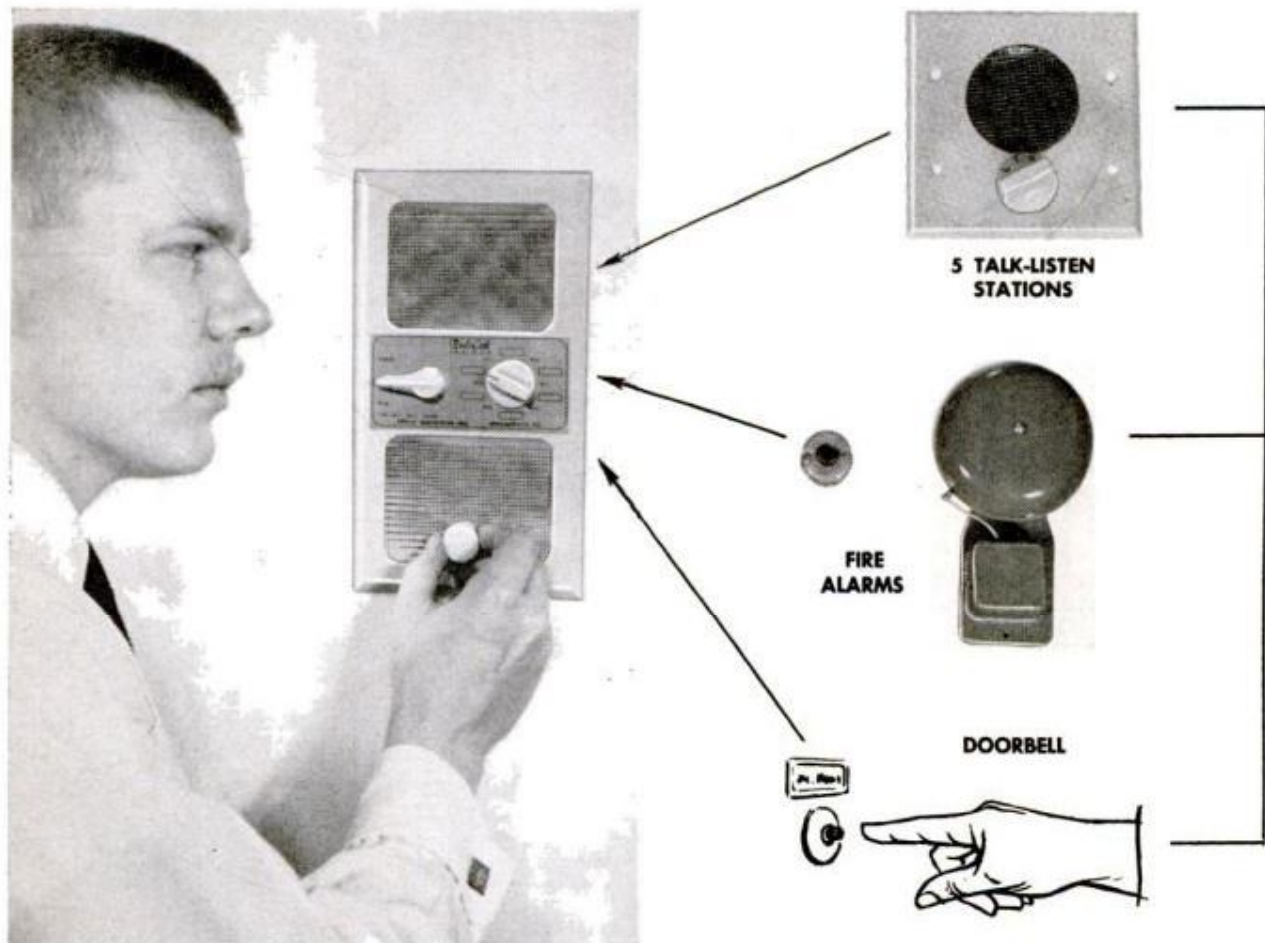
# X354

# RADIO

# TV

# HI-FI

## ELECTRONICS



## Three-in-One Home-Com

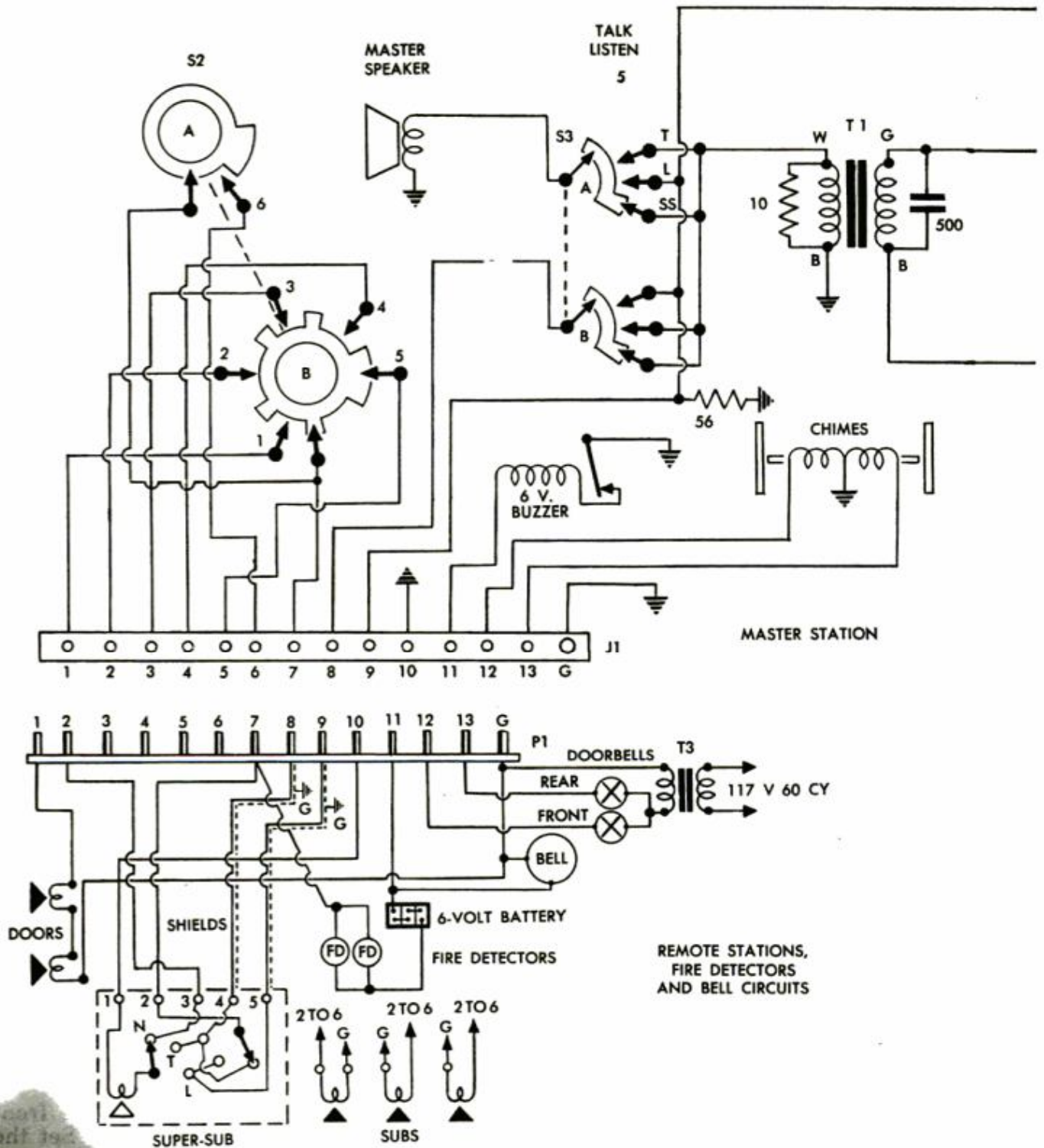
**A**S A STEP- and yell-saver around the home, this multipurpose intercom system is hard to beat. And its built-in fire alarm feature is in itself worth more than the cost of components (about \$35) in the peace of mind it can bring.

When the system is used as an intercom, the master station can speak to any of the remote substations, and the supersub can control its own talk-listen functions. The unit can even be set up for one-way operation from the nursery, so you use it as a baby-sitter! If you like, you can arrange it so that one substation can hear another substation. An outdoor station can be installed at the front door, so you can actually answer the door without opening it, and hold a two-way conversation with callers.

Did we mention doors? The unit connects into your present doorbell system, or

you can run new wires if you choose. A built-in chime sounds from the master to let you know if there are callers at the door. You get a "bing-bong" at the front door, and a "bong" at the back. Set the control switch, and the chimes will sound through every substation in the system!

The fire alarms are operated by a six-volt battery, because in many fire situations, the house wiring circuits will be knocked out by the fire. The small fire detector buttons can be placed in various hazardous places in the home, such as the garage, the attic and the basement. They are parallel connected, and should any one be set off by heat, the battery powers a small buzzer in the master station. The buzzer volume can be regulated by the master, and it will sound through each station in the system. Should fire break out when you are away from home, you can alert your neighbors



## PARTS LIST

**MASTER STATION**  
 3 tube sockets, 2 seven, 1 nine-pin  
 3 tubes, 6AX7, 60C5, 35W4  
 S1—SPST volume control  
 S2—rotary, 2 deck, 5 pos. (shorting arm)  
 S3—rotary, 2 ckt, 3 pos.  
 T1—16-ohm to load  
 T2—50C5 to 16-ohm load

### Resistors

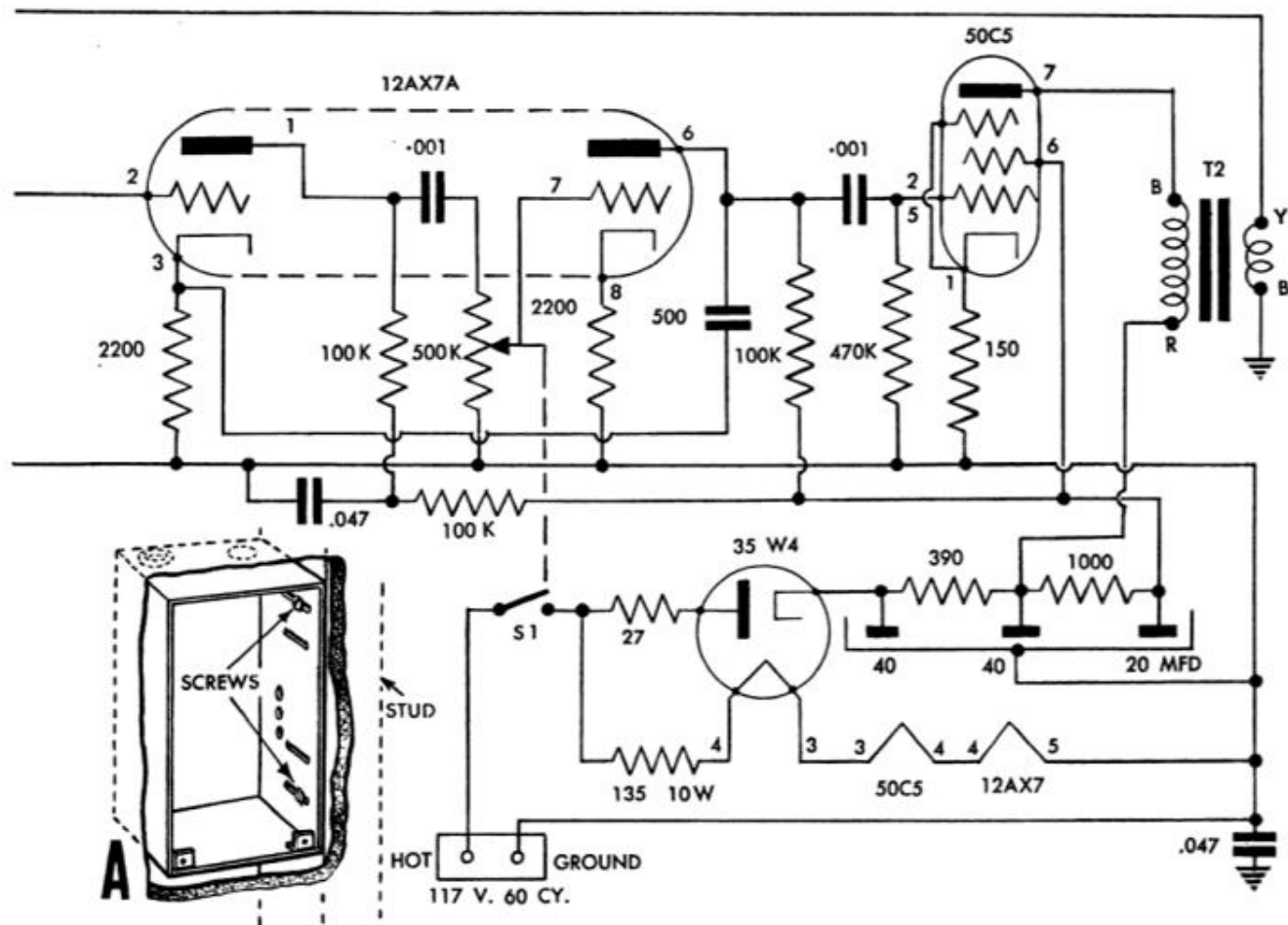
1K, 1/2, 1 req.  
 27, 1/2, 1 req.  
 150, 1/4, 1 req.  
 2.2K, 1/2, 1 req.  
 100K, 1/2, 3 req.  
 470K, 1/2, 1 req.  
 390, 1, 1 req.  
 10, 1/2, 1 req.  
 133, 10, W.W. 1 req.  
 56, 1/2, 1 req.  
 500K pot. 1 req.

### Capacitors

.0005 mfd ceramic, 2 req.  
 .001 mfd ceramic, 2 req.  
 .047 mfd molded, 2 req.

**NOTE:** Any major feature can be omitted changing the effectiveness of the fire alarm.

40-40-20 elect., 150 wvdc, 1 req.  
 J1, P1, Cinch #13219, 13220, 1 each  
 Speaker, 2 1/2-inch, 16-ohm  
 Recessed a.c. connector and cord, TV type, 1 each  
 Terminal strips, 3-5 connector.  
 Chime set, with transformer, 6-v. buzzer, 1 each  
**SUPER SUBSTATION**  
 Speaker—2 1/2 inch, 16 ohm  
 Front plate—double switch plate  
 Grill—Perforated metal, to fit  
 Terminal strip—Cinch #1775  
 Control switch—2 ckt. 3 pos. rotary  
**Substation**  
 As above, less terminal strip and switch  
**Outdoor sub.**  
 Same as sub. add Bud CU-83 chassis, and calk openings.  
**Fire Alarm**  
 6-volt battery, Burgess #TW-1  
 Alarm bell, 6-inch diameter  
 Fire Detector, Firestat Corp., Evanston, Ill.  
 Complete parts kit including drilled and punched chassis, screened control panel and complete bill of materials available from Experimenters' Supply Co., Dept. HC, 1924 Columbia St., Chicago 26, Ill.



by installing the separate alarm bell mounted outside the house. It works from the battery also, and sounds a loud alarm the neighbors can hear.

**Constructing the Unit System.** The master station is basically a three-tube amplifier and control switching circuit. While there is nothing critical in parts placement, arrange your layout so that all controls are accessible at the front panel. The master speaker should also face front. While it would seem advantageous to place the fire-alarm buzzer and the doorbell chimes close to the speaker, the unit is sufficiently sensitive to permit mounting of the chimes at the rear.

Construct the amplifier circuit on an angle bracket or L-shaped chassis. It is held to the panel assembly by the control mounting nuts for switch S2 and S3. Bring the leads for the speaker and the volume control potentiometer down to the proper position for mounting these components. All external wiring is brought to jack J1, at the rear of the unit. Mating plug P1 permits easy disconnect for service. Be sure to polarize the a.c. input to avoid a hot chassis.

The substations are constructed by mounting the speakers to the backs of wall switch plates which have been punched with enlarged holes to fit the speakers. Perforated metal grilles are fitted between

the speakers and the plates to protect the speakers. A two-circuit, three-position switch is used in the supersub, and a five-terminal strip permits easy connecting to the cable.

**Installing the System.** The wiring can be run outside the walls of an already built home by following base boards. If this is done, you can mount the chassis box to the outside of the wall and then attach the chassis-panel to the front. If you prefer a neater built-in appearance, locate the master station site, and cut a hole in the plaster to fit the cabinet. Be sure a vertical stud support is near enough to the cutout for the box to be fastened to it. The wiring to the external circuits, such as remote units and fire detectors, as well as the chimes for the doors, can be run either up to the attic from this cutout, or down to the basement. Check your local zoning regulations first.

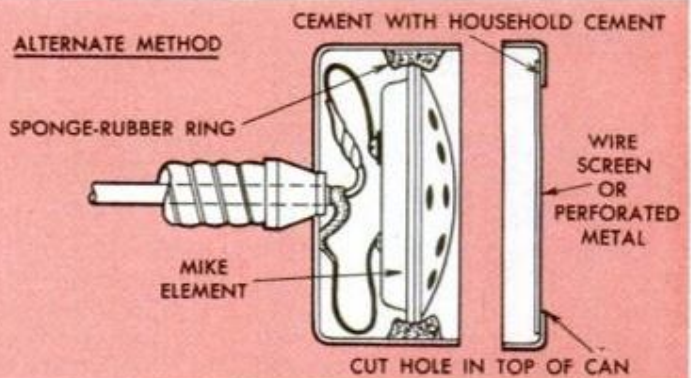
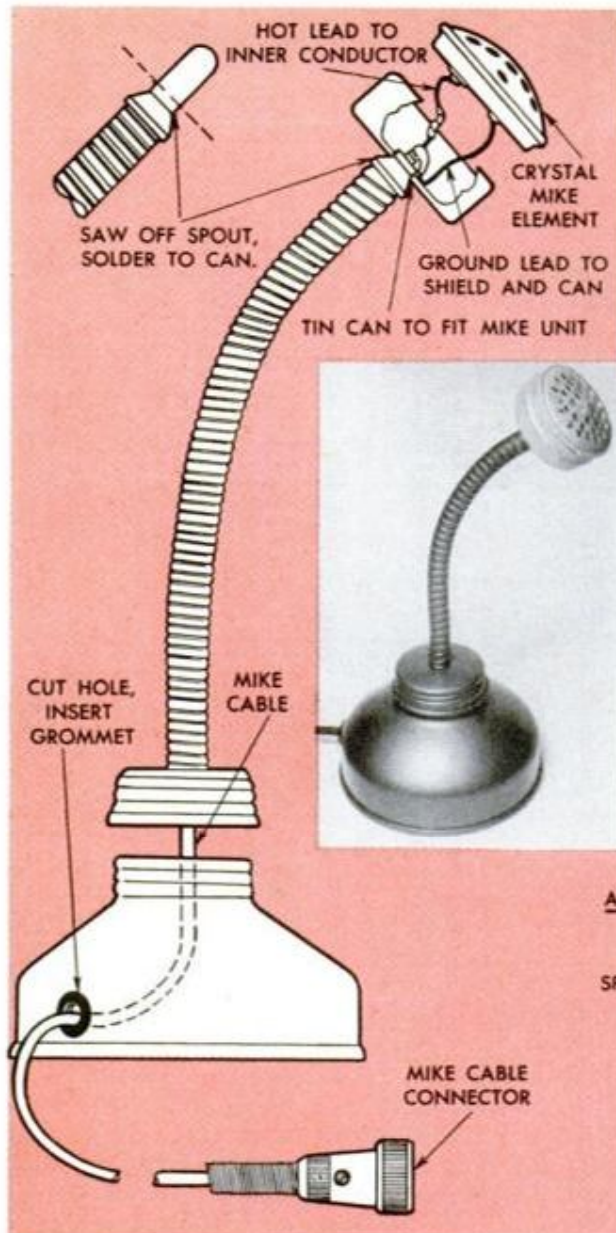
Drilling through top or bottom plate, as the case may be, will permit you to run your wiring from the master box to the various remote locations. The remote wiring should all be connected to P1, and the master unit can be permanently installed. You can combine the outside door speakers with their respective doorbell chime buttons by locating the speaker cutouts high enough on switch plate to permit you to drill a hole for momentary contact push button. ★ ★ ★

## Flexible Mike From Oil Can

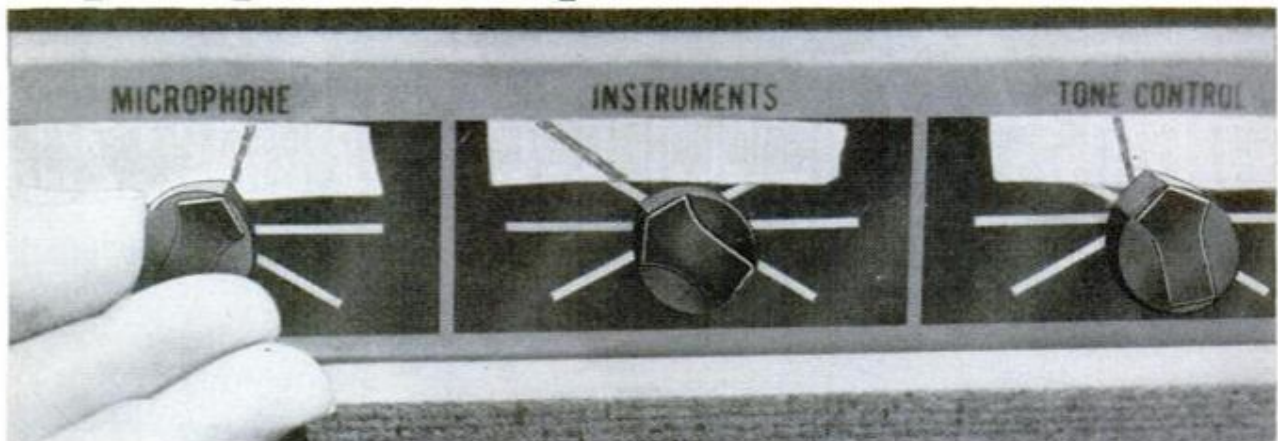
Using an old oil can, you can make an attractive microphone base that will provide "hands-free" operation in the ham shack, PA system, or tape-recording operations.

Start by selecting a small tin can that will fit your crystal mike element, and cut a hole that will fit the oil can spout. Saw the spout from the oil can and solder it to the mike can. Drill a hole in the oil-can base and insert a rubber grommet. Pass the mike cable through the grommet and up the flexible spout to the upper can. Carefully solder the mike cable to the microphone element, and to prevent stray pickup, be sure that the ground braid is also soldered to the tin can, placing the entire unit at ground potential.

An alternate method shown below is a bit more elaborate, but the results will look and perform better. Set the mike in a sponge ring, and cut a hole in the can top. Glue screening inside the hole. Carefully mask and paint to finish.—Art Trauffer



## Tape Tip for PA Systems



Many clubs, schools or other institutions have public-address systems which are set up in meeting rooms. Occasionally, it is necessary to remove the unit and transfer it temporarily to another location. When the amplifier is returned, the controls have to be reset to their original positions. In

some cases, where numerous microphones and speakers are used, this gets to be a job for a sound engineer.

A small strip of adhesive tape over each control can be marked with the proper control setting before removing the unit. Later, it is a simple matter to reset properly.

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*Add longer life . . .*  
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*Add ease to big motor handling . . .*  
**NEW POWER-TILT.** New remote-operated hydraulic unit permits tilting a "75" up or down with the flick of a dashboard switch. A great aid in beaching, mooring or trailer launching. Does not interfere with regular trip-up action. Kit contains all necessary parts for installation.

# New KODAK MOTORMATIC



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Now with built-in flash, it's the most complete automatic!**

The KODAK MOTORMATIC 35F is your kind of camera—your hand gets the fit and feel of it quickly, like a fine tool or gun. Wind the motor drive, sight your photo target, and rapid-fire 10 pictures in a row without taking the camera from your eye. Or, snap off a shot at a time—this camera always keeps you ready for your *next* shot.

This most complete of the automatic cameras takes care of details, lets you concentrate on taking pictures. Electric eye automatically sets the fast  $f/2.8$  lens to suit your choice of shutter speeds, from  $1/40$  to  $1/250$ . A low-light signal in the big viewfinder warns when light's too dim.

And here's a welcome surprise! Flick a button and the flash reflector flips open, ready to take an AG-1 "peanut-size" bulb. As you aim and focus for flash, you *automatically* dial the correct exposure setting from 5 to 25 feet.

All by itself, the KODAK MOTORMATIC 35F Camera does the jobs of many separate accessories. With film and a pocketful of "peanut" bulbs, you're ready to get the picture—any time, anywhere!

Less than \$120 buys you this most complete of the automatics—with two high-energy batteries and special flashguard. See it at your Kodak dealer's soon.

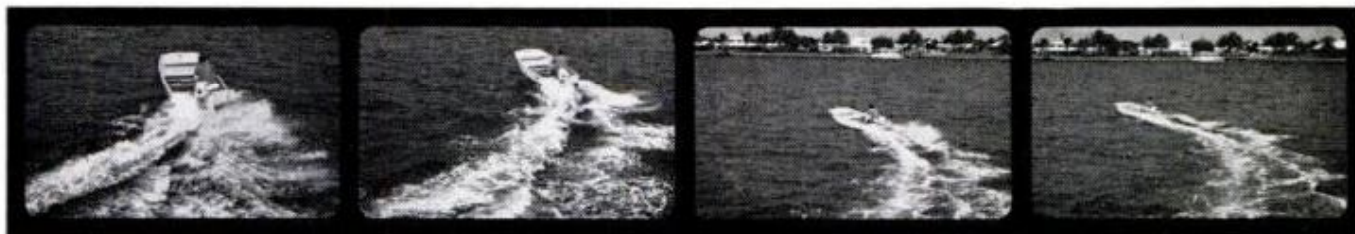
# 35F Camera Catches Skid Test!



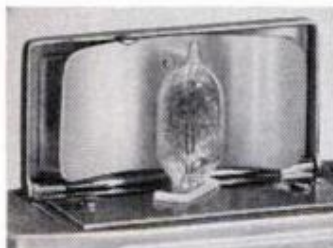
**POWER DRIVE** lets you take a 10-shot sequence in 10 seconds . . . without lowering the camera from your eye. Power drive cocks shutter, advances film, counts exposures.



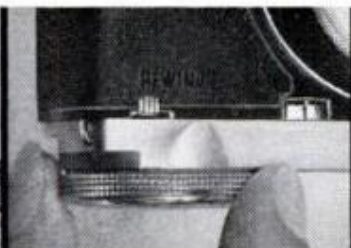
**FOLLOW THE ACTION . . .** capture it! Even while you're shooting, the electric eye analyzes the light, automatically feeds any necessary corrections to the lens.



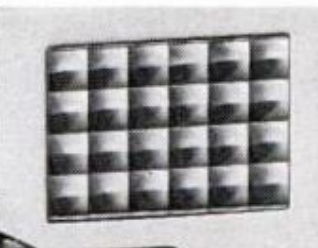
# IN 10 SECONDS!



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**POWER DRIVE** • Wind—and you're ready to rapid-fire 10 shots without lowering camera from your eye. Power cocks shutter, advances film, counts exposures.



**ELECTRIC EYE** • Automatically sets fast  $f/2.8$  lens. When light fades, low-light signal in viewfinder suggests you try a slower shutter speed or flash.



**LENS** • Fast KODAK EKTANAR  $f/2.8$  Lens—the keen-eyed Kodak quality you want for brilliant color shots.

*Price subject to change without notice.*

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# CLINIC FOR HOMEOWNERS

## Flooding Basement

*Q—During exceptionally heavy rains, water comes up through the floor drains in my basement and covers the floor for a depth of 2 in. or more. A friend of mine tells me that this water is coming from the downspouts which empty into tiles at the corners of the house. Is he right, and if so, what can I do to correct this?*

—A.A., Mich.

*A—*There's a good possibility that your friend is right. Of course we can't be sure without knowing the layout and direction of the drain, or drains, from the downspouts. However, assuming that both floor drains and downspouts empty into a common drain which leads to the storm sewer, it is possible that this common drain has become partially clogged by debris or tree roots. When such clogging is severe enough to prevent the drain from taking the full flow from the gutters, then excess water will back up into the basement through the floor drains. If this deduction is correct, you should have the drain rodded out to clear the obstruction.

Another common cause of basement flooding is an overloaded or partially clogged storm sewer which causes water to back up directly into the basement through the floor drains. In such cases, it may be necessary to install a sump pump or "standpipes" of the type which screw into special threaded fittings installed in the floor drains. Be sure to notify your street department when basement flooding occurs, since cleaning the storm sewer may remedy the trouble.

## Soil for Window Boxes

*Q—I am planning to build a window box and would like to know what type of soil, or soil mixture, I should use in it. Some of my neighbors have had the soil in their garden plots tested and they say that it is moderately acid. What's the best way of correcting this? I want to build an average-size box and place it on a window near the northeast corner of the house. In this location, it will be in direct sunlight only an hour or so each day. What plants do you think I should grow in the box?*—B.P., Ind.

*A—*You can make a good soil mixture for a window box from approximately equal parts of sharp sand, fine peat moss and enriched garden soil. Mix these in-

gredients thoroughly before placing them in the box. When mixing, add a half pound or so of a complete chemical fertilizer. To correct the excess acidity, mix in about a cupful of hydrated lime.

According to your description of the location of the box, it should be treated as a northern exposure. Plants which ordinarily do well in boxes with a northern exposure are asters, geraniums, hydrangeas, pansies, lobelias and violas. Wax begonias and petunias also can be added to this list, though they are not as well suited for such a location.

## Repairing Field-Stone Masonry

*Q—Our house has walls of field stone, and the mortar is beginning to loosen in some of the joints near the top on the north side. Many small pieces of mortar have already fallen out, leaving unsightly openings. Could you tell me how to go about repairing this wall?*—J.T., Pa.

*A—*This is really a job for an experienced stonemason, and the cost should be nominal unless a major repair job is necessary. However, if you wish to attempt the work yourself, the first step is to remove all loose mortar from defective joints, brushing away dust and fine particles. Large openings should be undercut slightly with a chisel wherever possible. Next, prepare a fairly stiff mortar, and dampen the sides of all openings where new mortar is to be applied. Trowel the fresh mortar into these openings, pressing it in with some force to assure that the depressions are completely filled. Finish the surface of the mortar by brushing lightly with a whisk broom.

## Planting Petunias

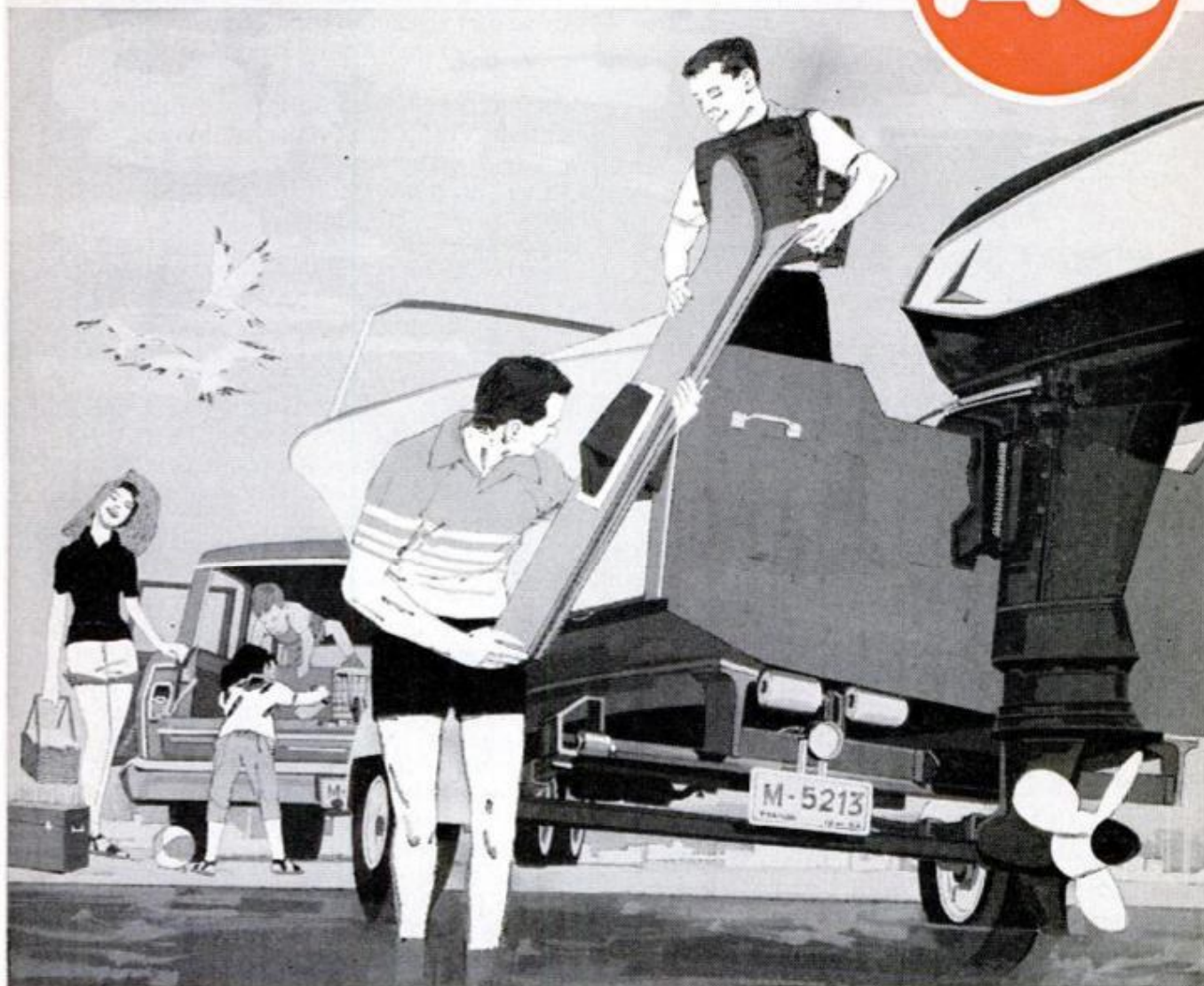
*Q—Can I plant petunia seeds and expect the plants to bloom the same year?*  
—L.S., Minn.

*A—*It's possible that plants grown outdoors from seed will bloom in your locality, but we doubt that this method can be relied on from season to season. To assure yourself of blooms, we think that perhaps it would be better to purchase transplants.

As a service to Popular Mechanics readers in solving the hundreds of problems pertaining to a home—inside or out—you are invited to present your problems to The Clinic Editor for his helpful advice. Address your questions to The Clinic Editor, Popular Mechanics Magazine, 200 East Ontario Street, Chicago 11, Ill.



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**you get ACTION with**



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with new AC Fire-Ring Spark Plugs**



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erosion and wear—heat bonded inner seals that positively protect against gas leakage and overheating. In addition, AC Marine Spark Plugs give you special boating benefits such as waterproofed packaging, rust-resistant finish and spin-on gasket.

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Give your home beautiful oil paint luster, and enjoy convenient, easy water clean-up of new P&L "6-T-1" House Paint.

An exclusive Pratt & Lambert formulation with linseed oil in solution, "6-T-1" House Paint brings you all these advantages and more . . .

"6-T-1" House Paint brushes on easier and sets up faster than ordinary oil paint. It can be applied over chalked old paint in otherwise good condition without using a prime coat. "6-T-1" resists blistering . . . can even be applied while surface is damp. "6-T-1" House Paint can be thinned when necessary with plain tap water. And brushes and equipment wash out in a jiffy with ordinary soap and water.

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*The paint of professionals  
for over a century*



## Here Come the Barnstormers!

(Continued from page 122)

Bill Adams also faces some trying circumstances along the show route. Some of the airports they visit are nearly a mile above sea level and on a hot day their pressure altitude (the actual weight of the air) is equivalent to a standard 7000 feet or more. At two such places recently, rounding out at the bottom of an inverted approach, Bill found himself pushing forward on a nearly dead stick, trying vainly to keep the plane from mushing downward. Before ground effect and the 450 straining horses brought him out of it, he was raising dust with his prop.

But what of the future? Will there be air shows like this next year and the next? Duane Cole could have scheduled twice the number of performances this year if the talent and equipment had been available, so great was the demand. But barnstormers like the Cole Bros. are rarities nowadays. Where would young show pilots develop now? asks Duane. The military services no longer give aerobatic training in prop-driven aircraft.

Suitable planes are also hard to come by. The Stearman which used to be available for a few hundred dollars now costs \$10,000 by the time it is properly equipped, providing one can be found which has not been crop-dusted, misused, or crashed. Several companies are now experimenting with "full acrobatic" models, notably the PJ 260, but few meet the "show" qualifications. Most of the best, like Adams' Stearman, were originally designed and put together in the early 1930s!

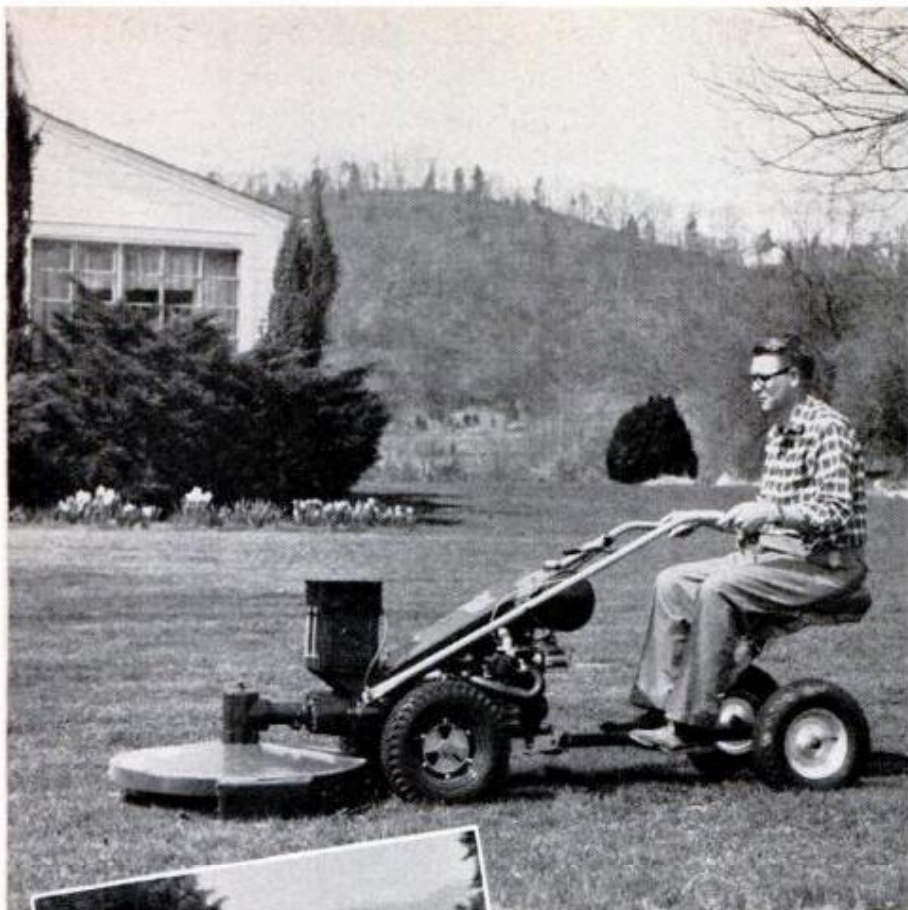
Thus the Cole Brothers Air Show may live up to its billing and become one of the last, if not the last, of the barnstormers. If it does, more's the pity. The kids of Mandan, Monroe, and Podunk then may never get to see what real flying was like in its golden age. ★ ★ ★

## Jet Pilots Cover Rear by TV

Blind spots to the rear of Air Force B-52 bombers—areas that are awkward for the pilot to see from his cockpit position—are now covered by a closed-circuit television system.

A TV camera, installed in the tail section, scans the rear approach areas—the rear, sides, top and underside—and transmits the picture to a TV monitor in the pilot's control section.

The airborne equipment, developed by Boeing Airplane Co. and Foto-Video Electronics, is being used aboard the Boeing B-52G models.



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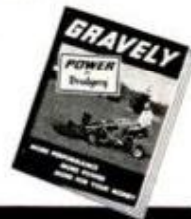
SNOWBLOWER



CART

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*Be sure it's a genuine Channel-lock. Look for the trademark on the handle Write for catalog showing complete line of pliers. Made Only By Champion DeArment Tool Company, Meadville, Penna.*

## Is Your Car Wasting Fuel?

(Continued from page 159)

fold. Work carefully when disconnecting the throttle linkage and keep all the parts in order. Although, with extraordinary care, you can loosen and tighten fittings with an end wrench it is better to use a flare-nut wrench which does not distort the fittings or round the lobes.

### Overhaul Kit

If you use an overhaul kit instead of a replacement carb, have everything at hand and then disassemble your old carb according to the instructions that come with the kit. Keep all the parts in order. Carburetors accumulate a thick, varnish-like coating in the throat and in the air and fuel passages. It's commonly called "varnish" and there's a special solvent that dissolves and removes the stuff in seconds. A dip and a swish or two in the solvent and you have a sparkling clean carburetor body, all ready for the installation of the kit parts. Carb solvents are available in a special container with a dip rack for very little more than the cost of the liquid alone. Clean both the old carb casting and the new kit parts in the solvent before assembling.

### Float Level

With the kit you'll get a float-level gauge. It's a piece of stamped cardboard which serves as a gauge for establishing the correct relationship between the fuel level and the fuel rise in the carb float chamber. Maximum fuel economy and top performance are the dual rewards of precise adjustment of the float level. Once you're sure you have the correct adjustment, reassemble the carb, using the kit parts. You may find it somewhat easier, when replacing the carb on the manifold seat, or boss, to connect the fuel lines and draw the nuts finger-tight. Be sure that the new seat gasket is correctly positioned and that the edges are not turned under at any point. Draw the fittings uniformly tight, using a flare-nut wrench, and reassemble the throttle linkage. Be especially careful to draw the screws holding the flange to a uniform tension. And remember that after the new gasket becomes fuel-soaked you can get an extra half turn or so on each of the screws. Don't forget it.

Finally service the air cleaner before replacing. If it's an older, oil-bath type, fill to the proper level with oil specified by the manufacturer. Replace the filter element in other types. ★ ★ ★

# How to be a WRECK-LESS driver... by *Vip*



A more practical way to safeguard your life is with good shock absorbers. Wornout shocks cause dangerous swaying . . . loss of braking and control by allowing your tires to leave the road. Have your shocks checked regularly. For the safest, most comfortable ride of all . . . insist on Gabriel Shock Absorbers.



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Now you can use this ONE power-feed shop to turn rough lumber into moldings, trim, flooring, furniture . . . ALL popular patterns. RIP . . . PLANE . . . MOLD . . . separately or all at once with a one HP motor. Use 3 to 5 HP for high speed output. Low Cost . . . You can own this power tool for only \$30.00 down payment.

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SOCKET WRENCH**

Retail value **\$1.85**

at volume outlets  
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SCHILLER PARK, ILLINOIS

## The Fun of Backpacking

(Continued from page 86)

meat and dried foods that sunny morning we hit the Bird Creek Trail just off Turnagain Arm.

Six hours later, too weary to stand upright, we actually crawled on hands and knees through the last remaining thickets of alder and down a slope to a camping spot beside the creek. The squirrels near Bird Creek must still be living high on the things we left for them in an effort to lighten our packs for the return trip.

Now we never carry a can of anything, even on a one-day trip, and seldom any ordinary dried foods. Yet, despite the items we don't take, we eat well—even luxuriously.

The secret of our backpacking diet is the truly excellent dehydrated food developed in recent years. After testing many brands, we have settled on one which offers a variety of excellent dishes at moderate cost, including courses such as Spanish rice and baked beans, easy-to-fix salads, flaked vegetables and desserts. These are all processed so they are infinitely lighter than ordinary dried foods, yet have adequate seasoning and amazing flavor quality. Each item is sealed in a light, tough plastic bag. These packages passed the final test on the trip where one-third of our food was dunked in the glacial river. The "groceries" came out dry and unharmed.

### Soaking the Steaks

Probably the most revolutionary light food has been made available to the general public this past year. A new freeze-dried process offers steaks, pork chops, stews, and other foods in packets that weigh only a few ounces each. Soaked in water they return to their original size and flavor and are ready for cooking. Even eggs—the bugaboo of dried foods—are made table ready and flavorful with only the addition of hot water.

To round out our menus we carry many staple items from the grocery store. These include margarine, flour, nuts, whole dried milk, cheese, bacon, brown sugar, instant coffee tea, bouillon and dehydrated soups. We repackage these in plastic freezer bags to reduce weight and bulk.

The backpack cook soon learns to make one item do the work of two. Why take both pancake and biscuit flour when biscuit mix not only makes wonderful hotcakes, but is also fine to roll trout in, or to use in making desserts. Instead of taking both bacon and shortening, we save bacon drippings for the small amount of frying we do.

(Continued to page 182)



## Now you can paint your house in color and be sure it will last . . . with new "Dutch Boy" Latex House Paint

Now there's a new kind of paint that ends all the old problems of conventional colored paints. It's "Dutch Boy" Latex House Paint. Use it and your house will stay looking bright and fresh for years. Made with "Dutch Boy's" own acrylic resins, tests have shown it to be outstandingly resistant to sunlight and oxidization. In fact, this new paint retains its color so well you can come back and touch it up years afterwards, and not see the difference. When it's time for a new paint job, you'll only have to repaint the weathered side. Keep the same color and you may never have to paint your whole house at one time again!

"Dutch Boy" Latex House Paint is probably the most convenient paint ever developed for the weekend painter. You don't have to wait for ideal weather. Use it right after a rainstorm if you like. And you can stop and start anywhere. Lap marks won't show.

It's easier to use, too. "Dutch Boy" Latex House Paint flows off the brush, without paint drag. And this one paint is all you need for almost any surface—wood, stucco, brick and even composition shingles.

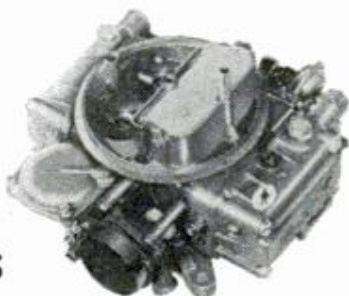
More advantages: Brushes and equipment clean up with just soap and water. And you can eliminate most of the blistering and peeling problems that used to be caused by trapped interior moisture. "Dutch Boy" Latex House Paint breathes—allowing moisture to escape, yet sealing out the weather.

If you'd like to find out more about this remarkable paint, check with your nearest "Dutch Boy" dealer, listed in the Yellow Pages. Or write for informative free booklet to: NATIONAL LEAD COMPANY, General Offices, 111 Broadway, New York 6, N. Y.

**Dutch Boy**  
LATEX HOUSE PAINT®

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When you make your own carburetor or ignition repairs and parts are required, be sure to use *genuine* Holley parts. Your Authorized Holley Distributor or Dealer, listed in the Yellow Pages, has a complete stock of Holley carburetor minor overhaul kits, tune-up kits, ignition parts, and brand-new replacement carburetors. All are engineered and built to exacting *original equipment* standards. BE SATISFIED . . . BUY HOLLEY!

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Brown sugar is used for sweetening and to make both syrup and dried-fruit jam right on location.

Our "trail kitchen" has developed over the years by trial and error until we believe we have the lightest possible and yet most practical. The gas stove we carry—timberline is low in the north and firewood scarce—is one of several light-weight models on the market, and weighs just 18 ounces. Made in Sweden, it is a simple thing that operates without pumping. The tank holds half a cupful of white gas and it will operate for 45 minutes to twice that long, depending on how it is adjusted. Two pots, a deep lid, the stove, and wind-screen rack weigh only 40 ounces. We carry the gasoline in aluminum bottles with extra-tight screw lids.

For cooking over an open fire we carry two nesting pots with a long-handled lid that doubles as a skillet. When we are lucky and catch some trout, we augment this with a skillet made of heavy-duty foil, shaped over a forked stick.

## Folding Foil Oven

It was a longing for pie out on the trail one day that led us to build a reflector oven out of heavy-duty aluminum foil. Weighing almost nothing and costing little more, the oven can be folded flat for packing and replaced when the inside becomes blackened. Other foil items include individual wash basins cupped into bowl shape; and foil pie plates, which make amazingly sturdy dinnerware—and certainly the lightest.

Each of us has one short-handled aluminum fork and spoon which clip together, a many-bladed Swiss Army knife, for all knife purposes; and one large-sized polyethylene cup that serves for soup, coffee, cereal and the like.

We found it necessary to find some small plastic containers with spillproof lids. The answer was plastic baby bottles. They are inexpensive and readily available, and cutting the nipple away leaves the rubber rings as a gasket. Another baby item suggested by a pharmacist friend are diapers for use as absorbent hand towels and dish towels. To cut bulk in washing needs further, we take a half or whole bar of plain white soap, which can be used for dishes and skin and laundry. One of those small, square, flat sponges that has a sandy scraper on one side does double duty as a dishrag and pot scraper.

Experience has convinced us that backpackers should carry a well-stocked first-aid kit—and know how to use it. Our closest brush with tragedy was the near-

(Continued to page 184)



## Lamp Outshines the Sun

So bright it will be used to simulate the sun in earthbound space experiments, a new lamp about the size of a baseball is nearly three times as brilliant as the sun.

The 5000-watt xenon arc lamp developed by General Electric has a visible spectrum closely simulating sunlight, and its total spectrum, including ultraviolet and infrared, approximates solar radiation.

Life of the 5000-watt lamp is about 1000 hours. It sells for \$1250 and is seen as having applications in searchlight and projection equipment and as a source for a solar furnace.

## Teeth Measure Strontium-90

Amounts of strontium-90 that lodge in the bones of children as a result of fallout from nuclear tests can be determined by analyzing their baby teeth.

Levels of the radioactive isotope in bones and teeth are virtually identical, according to Dr. Louise Reiss of the Greater St. Louis, Mo., Citizen's Committee for Nuclear Information. Strontium-90, a cause of leukemia and bone cancer, tends to settle in the bone, like calcium.

Dr. Reiss studied the strontium-90 content of teeth from more than 1000 children born in the St. Louis area from 1951 to 1954.

# The proof is in the puffing!

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R. J. Reynolds Tobacco Co., Winston-Salem, N. C.

## The flavor most favored in the U.S.A.

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easy  
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right!

Scientific tilling action breaks toughest soils evenly *without* breaking down soil structure ... with non-winding, self-sharpening tines that are guaranteed against breakage. For quality tilling and cultivating at its best, go **ROTICUL!** Two models: Super 4 hp/ Deluxe 3 hp.

Makers of Simplicity Garden Tractors, Simplicity '725' Riding Tractors, Wonder-Boy Riding Lawn Mowers



**Simplicity**

## SUPER ROTICUL tiller-cultivator

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**Quick way to strip paint**



**Wonder-Paste**  
PAINT REMOVER

Easy to remove any finish—  
paint, enamel, varnish, shellac, lacquer  
latex and rubber-base paints

Just apply Wonder-Paste with a paint brush. It softens up paint and other finishes all the way through. No hard scraping. Stays moist and workable indoors or out. Does not run on upright surfaces. Great for refinishing woodwork and furniture.

### Clean brushes fast

Imperial Brush Cleaner will make hard-caked brushes like new. Acts instantly—no long soaking. Leaves bristles springy and glossy.

Get Wonder-Paste and Imperial Brush Cleaner at paint and hardware stores.

- Send 25¢ for illustrated Refinishing Manual.

Write for free literature.

WILSON-IMPERIAL CO., 118 Chestnut St., Newark 5, N. J.



drowning in the glacial river. The injured person had a severe case of shock but, because one of us had taken a first aid course, we were able to treat him successfully. You realize quickly you're on your own when you hike into back country.

On the lighter side of backpacking—the side that usually presents itself—we include both fishing and camera gear. The true fisherman and the true camera bug have to make the greatest sacrifices when it comes to backpacking. We force ourselves to keep our fishing lures and gadgets to the minimum and use telescopic rods that collapse to a foot in length and are equipped with simple reels. Camera gear again is a highly personal choice. We use one compact, lightweight camera and leave the gadgets home. A light substitute for a tripod is the C-clamp holder sold by camera shops, which will clamp onto trees or even tent poles.

Deciding which of all this gear to take along and which to leave at home presented our biggest problem in the beginning. To be sure of having what we need, we now load our packs with the help of a check-list. This makes our packing a matter of minutes instead of hours. And we have found that, with minor adjustments or substitutions, our particular lightweight gear serves as well in the Big Bend country of Texas as it does near the Arctic Circle in Alaska.

Since much of our hiking in the north is across country, a compass and a detailed map of the area we plan to travel through are always part of our equipment. These go in the pack last, where they will be easy to reach. Then we tie down the straps and we're ready to hit the trail again. ★ ★ ★

### QUOTE:

*"I like to compare basic research to mountain climbing in an unexplored range. Considerable preparation, training, and strong motivation are required to get to the upper altitudes, even if no one particular stretch of the way is particularly difficult. But, once there, it is relatively easy for one to see vistas, or even to stumble across new riches that people of equivalent ability—but who have stayed behind—have no responsibility to see or to find.*

*"The new breakthroughs in scientific and technological achievements, such as the discovery of fission and the development of the technology to utilize it, will come most surely in the field of basic research."*

DR. GLENN T. SEABORG, Chairman,  
U. S. Atomic Energy Commission



## WILL THE MAN WHO BOUGHT THE BLACK & DECKER 1/4" DRILL PLEASE STAND?

Who has the Black & Decker 1/4" Drill? That's right . . . all *four* have different Black & Decker 1/4" Drills . . . each one designed to match a specific type of drill use and user. Which one precisely fills the bill for you?

**A. THE 1/4" CORDLESS ELECTRIC DRILL . . .** the world's first and only completely portable drill. There's nothing like it for maintenance work on land or sea. No cord. No plug. No outlet. The power is in the handle of this shockproof Cordless Drill.

**B. THE 1/4" PROFESSIONAL ROLLER BEARING DRILL . . .** the first 1/4" drill in the industry with all roller bearings. That sweet surge of 20% more power at the business end will please any pro. So will the cooler-running, friction-free operation that saves time, saves money and means longer drill life.

**C. THE 1/4" DELUXE DRILL . . .** gives the advanced amateur and craftsman a fistful of power to handle the most demanding jobs in wood, steel, masonry or plastics. Compare it with any

other drill in the medium price range for over-all quality and over-all performance.

**D. THE 1/4" UTILITY DRILL . . .** for the home handyman who wants Black & Decker quality at the lowest possible price tag. A sturdy, economical tool, the Utility Drill will provide years of usefulness with ample power to drive all B&D 1/4" drill attachments.

Look to Black & Decker to give you the widest choice in power tools . . . in drills, drill kits, saws, jig saws, sanders, routers, and hedge and lawn trimmers.



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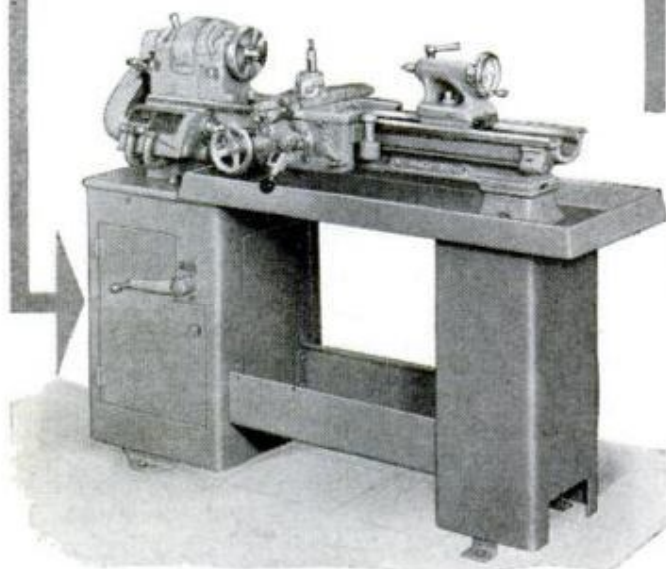
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# South Bend

10" LATHES

*with new  
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- New, trim floor legs . . . reinforced construction of welded, heavy gauge steel . . . maximum rigidity with minimum weight . . . no increase in price!
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South Bend 22, Indiana

*Building Better Tools Since 1906*

Time payment plan  
available. Up to 36  
months to pay.



## White Heat V

(Continued from page 130)

technique as before and then with a block plane and sanding block, trim the excess material flush on the nontrips. Leave the edges square on the bottom planking.

You are now ready to glue on the side planking which is a critical part of the hull construction. Using a 48-in. length of  $\frac{1}{8}$ -in. plywood, cut it roughly to size. Make certain the aft-plane bottom is flat, either by clamping the hull to the saw table as before or by sight aligning. Make register marks on the frame and the side planking and clamp the latter temporarily in position. The planking is glued in place in stages, first the rear half, then the front. This is done by removing the clamps from the aft portion first, applying glue to contacting surfaces of the hull framework and re-clamping. With this done, proceed to release the clamps holding the forward portion of the planking and repeat. Plank the opposite side of the hull in the same manner, making certain no twist develops in the hull while clamping. Use a sharp block plane and sandpaper to trim the side planking fair with the sheer logs and flush with the nontrips.

### Plank Bow Bottom Next

This brings you to the bow bottom planking. This is applied in two pieces also, centering the joint in this case on the longitudinal bow member. Fit, glue and clamp one half. Check alignment and let dry. Then add the other half. Trim off the excess, leaving the edges of the planking square, port and starboard, and overhanging at the step about  $\frac{1}{4}$ -in. A  $\frac{1}{4}$ -in.-model fillet is glued along the underside of the overhang. Finally, glue the transom braces in place at the stern and add  $\frac{3}{16}$ -in. sq. strips of pine, spruce or hard balsa along the inside of the engine bearers, see Fig. 4, to serve as ledge strips to support the removable cowling, or engine cover.

The machine screws which are used to fasten the engine-mounting casting to the engine bearers, are turned into anchor plates attached to the outside of the bearers. The plates, which are cemented in place with epoxy, are detailed in Fig. 8 and are made to suit the hole spacings in the casting. Next, spot the location of the slot for the stuffing box which is on a centerline roughly 14 in. from the transom, and cut the opening. Then mount the engine in the hull, bolting it to the mount with four 8-32 screws, and install the strut bracket and strut at the stern. Now, to determine the proper angle of the strut, remove the prop shaft from it and replace with the drive

shaft, passing it through both bearings and letting the end project toward the front of the boat. When at the proper angle, the end of the drive shaft should be about  $1\frac{3}{4}$  in. below the step. If it isn't, shim the strut bracket as necessary. Now remove the drive shaft from the strut and reassemble.

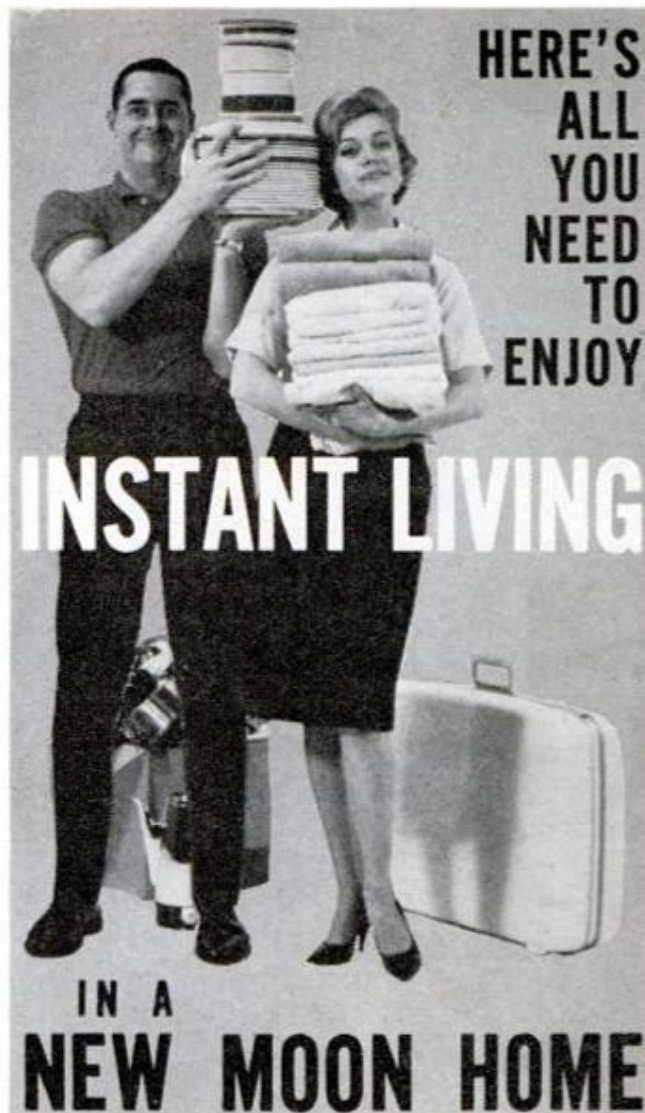
Remove the strut and slip the drive shaft through the stuffing box. Place the upper universal ball joint in the engine coupling and insert the drive shaft. Remount the strut on the bracket and adjust the drive shaft so it has about  $\frac{1}{64}$  in. end play between the upper and lower universal joints. Tighten the setscrew on the shaft just enough to mark it. Then loosen the screw and remove the strut and drive shaft. File a  $\frac{1}{32}$  in. flat  $\frac{3}{16}$  in. long on the shaft at the mark and reassemble and tighten the setscrew. Bed the stuffing box in place with epoxy cement to assure a watertight seal. The sheet-metal stabilizing fin, Fig. 7, is located  $3\frac{1}{2}$  in. aft of the step and is attached with two short machine screws passing through holes in the bottom planking. At this point, give the inside of the hull a light, single coat of Evercoat marine plastic.

### Decking Completes Hull

Now to plank the deck. This is done with four separate pieces of  $\frac{1}{16}$ -in. plywood. Two of these are long strips which are applied flush with the inside of the engine bearers and run the full length of the hull. Cut them oversize and glue in place, using rubber bands or brads to hold them. The remaining area at the center of the bow is filled in with two separate pieces, fitted carefully and with the joint centered on the bow piece. Thickness of the engine bearers at this point is increased with the addition of glue blocks to the inside to provide support for the fill-in planking. When completed, carefully trim excess flush with the side planking.

Now to build the cowling, or removable engine-and-controls cover. This fits down inside the engine bearers and rests on the ledge strips provided. The pattern for the outside stringers is given in the profile view of the cowling, Fig. 2. The stringers are cut from  $\frac{1}{8}$ -in. plywood and notched at the points shown for nine formers. Patterns for the latter are given in Fig. 3 which must be enlarged full-size for cutting from  $\frac{1}{8}$ -in. plywood. Note that these are notched to fit the stringer notches and also notched for four  $\frac{1}{4}$ -in.-sq. longitudinal stringers. As you will see in studying the cutaway view in Fig. 4, the lower stringers run full length, while the upper ones stop at former 6. Glue the assembly together right in the hull, being careful that the parts don't adhere to

(Continued to page 188)



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the hull. Then apply the deck planking first, Fig. 6, followed by the side planking. Openings in the latter for the manifold exhaust ports are made afterwards and covered with sheet-metal plates. The latter are held by tabs which pass through slots in the planking and clinched on the back. Fillets are added at the joint where the deck and side planking meet, port and starboard. Finally, fit and glue the cap piece, trim flush when dry and round the edges.

One thing still to be added on the port side of the cowling is the carburetor air scoop. This covers an opening in the cowling, and Fig. 11 shows how it is fashioned from a plastic sugar scoop. Cement it in place with epoxy and use fillets to blend in with the rest. When dry, carefully cut an opening in the plywood behind it, leaving formers 6 and 6A intact. Finally, coat the inside of the cowling with a thin coat of marine plastic. This completes the hull. The original was sprayed with several coats of lacquer over a primer. A two-tone color scheme of white and red was used. Fig. 9 details a display stand for your model, and Fig. 12 shows how to make a cradle for the fuel tank. Note  $\frac{1}{4}$ -in. slot which fits over the center bow piece.

Install servo mounting board as shown, Fig. 13, making sure tiller pin is engaged in servo arm. Connect the throttle control wire to the carburetor throttle arm.

#### How to Test Engine

The engine can now be tested. Mix white gas and outboard-motor oil in the ratio of 1 gal. to  $\frac{3}{4}$  pt. Fill tank  $\frac{3}{4}$  full, making sure the gasoline line is connected to the carburetor. Open the needle valve  $\frac{1}{2}$  turn and hold a finger over the carburetor-throat opening. Pull engine over slowly; carburetor should be  $\frac{1}{2}$  open at this time.

When the engine starts, control the speed with the throttle. If the engine appears to run rich, close the needle valve to the proper setting. Close the throttle until the engine just ticks over, not slow enough that the starter pawls begin to drop in the ratchet. Note the throttle opening at this point. Open up the throttle full for a second to clear it out and then close it to the same opening as before. If it continues to run at this setting, stop the engine and connect the throttle control cable from the servo to the low-speed setting, giving the previously determined throttle opening.

Connect R/C (radio-control) equipment to servos and install the propeller, making certain the prop is locked on the shaft.

Start the engine with the servo set for low speed. Lower propeller in water and open throttle part way. If the engine dies,

(Continued to page 190)

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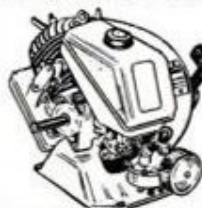
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open needle valve slightly and restart. If engine takes load, open throttle to full opening. *Caution*—be sure you have a good hold on your boat and brace yourself during this first test as the thrust can catch you off guard.

With the propeller fully submerged and with full throttle opening, adjust needle valve to get maximum r.p.m. Allow the throttle to return to the idle position and see if the engine will turn the prop at this setting. If the engine stops, increase the throttle opening until the engine will just turn the prop at idle or slow-speed setting. This is the starting point for your runs under R/C.

Make sure you have at least  $\frac{3}{4}$  to  $\frac{1}{2}$  tank of fuel. Make certain the shorting wire is connected to the engine ignition system and working. Make sure the throttle control wire is connected and the tiller pin is engaged. Lastly make sure your R/C equipment is functioning and operating the controls as it should.

#### Ready for First Run

Start the engine and double check all functions, rudder, throttle and engine shut-off. Release the boat with the throttle at idle position. It should move along with the bow riding low on the water. Check steering at this stage. Increase throttle

opening slightly and bow should rise slightly. Again check steering, both right and left. Maneuver the boat so there is several hundred feet of water ahead of it. Open the throttle gradually with the rudder in neutral or straight ahead position. The bow should rise up now and the boat should start planing. Leave the throttle setting and with boat just planing, make a turn to the right or left, making sure enough space exists between the boat and the shore for such a turn. If space is not enough, either cut the throttle or stop the engine. If turn is successful, straighten out the rudder and if there is enough stretch of water available, increase throttle opening. After you get the hang of running and controlling your boat, then try some full-throttle straightaway runs. If the engine appears to be running rich at full throttle, bring the boat in and lean out the carburetor setting slightly. Check the idle position before releasing for another run.

You will find in some cases, such as in dead-calm water, that in opening the throttle full with the boat down in the water, the prop will cavitate or tear a hole in the water. Slow down the engine until the rooster tail drops down and the bow starts to come up. Open the throttle gradually and the boat will climb up into a planing position. Now open the throttle full. ★ ★ ★

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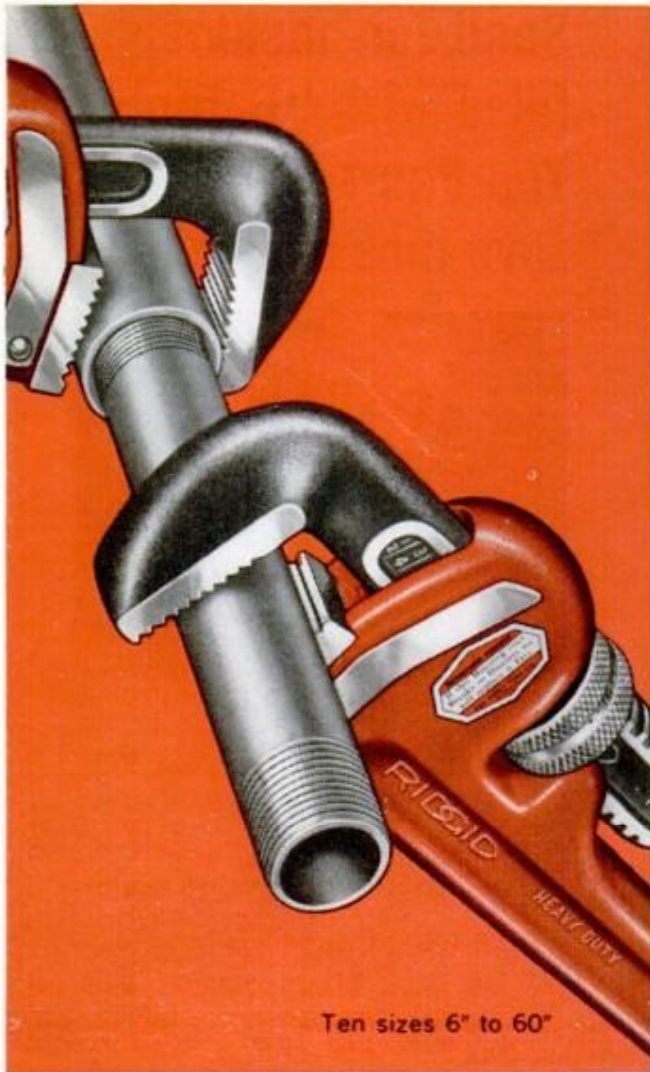
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## Is Highway Radar Foolproof?

(Continued from page 96)

equipment—a graphic recorder—which is used by many, but by no means all, police departments. This recorder is activated at the same time as the speed indicator, but its inked stylus traces blips not speed and makes a permanent record. The blips of course can be translated to speed readings.

Proper reading of these blips can tell a car's direction, for one thing. Cars going produce a blip with a sharp point; those coming induce a rounded blip.

Also, the graph can tip the police to the fact that there are outside disturbances. Each disturbance has a different pattern from cars.

Unfortunately these graphs are not always made available in court. Some police manuals advise officers not to offer the charts as evidence unless asked to do so. Most important, not all police use graphic recorders. They are listed as optional equipment in the manufacturer's catalog and some agencies (the Chicago police department, for one) have not bothered to buy them.

### Thrown Out of Court

Because of radar's potential for giving misleading information—a few judges have thrown speedometer evidence out of court. Judge John Knox of Greenwich, Conn., for one, has refused to admit evidence based on radar since the day in 1955 he happened to rattle a ring of keys in front of a set and saw the needle jump wildly. "I just can't believe the machine is completely accurate," he explains.

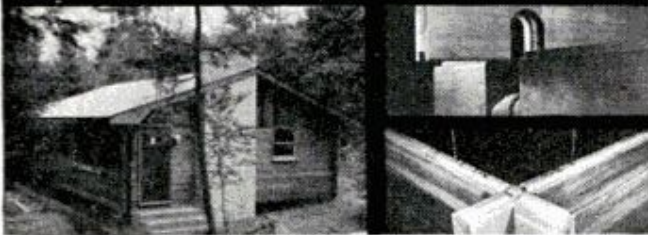
Despite the potential for error, most jurists have embraced radar devices as accurate gauges of speed, ever since the first reported court case, in Delaware, in 1953. In some states, including Kansas, New York, New Jersey and Nebraska, it is no longer even necessary for expert witnesses to testify to radar's scientific principles before readings can be submitted as evidence; they are accepted as matter of factly as are fingerprints, ballistics reports, or blood tests.

There is, of course, no doubt that wherever radar is used, it contributes to the climate that makes drivers stick within the law. Says a Texas police sergeant:

"Radar has gone a long way toward giving drivers the feeling of the omnipresence of law enforcement officers, and in that way has made them more likely to drive within the legal speed limit." As a result, accident and traffic death rates have taken encouraging dips where radar has ap-

(Continued to page 194)

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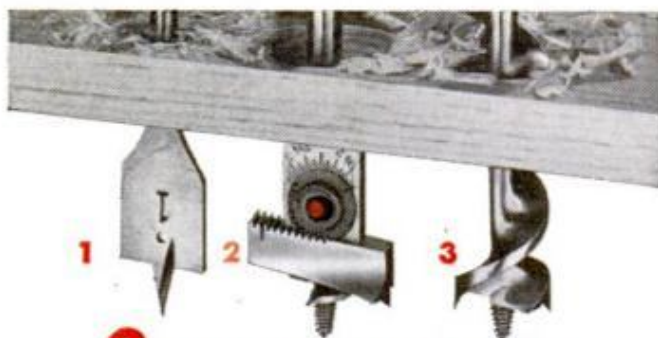


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2. Irwin No. 22 Micro-Dial expansive bit. Fits all hand braces. Just dial your size. Bores 35 standard holes, 7/8" to 3". Only \$4.00. No. 21 small size bores 19 standard holes, 5/8" to 1 1/4". Only \$3.60.

3. Irwin 62T Solid Center hand brace type. Only 16 turns to bore 1" holes through 1" wood. Double-cutter boring action. Sizes 1/4" to 1 1/2". As low as \$1.05 each.

**EVERY IRWIN BIT** made of high analysis tool steel, heat tempered, machine sharpened and highly polished, too. Buy from your independent hardware, building supply or lumber dealer.

**Strait-Line Chalk Line Reel Box**  
only \$1.25 for 50 ft. size

New and improved Irwin self-chalking design. Durable aluminum alloy box. Practically damage-proof. Fits pocket or hand. 50 ft. and 100 ft. sizes.

**IRWIN** every bit as good as the name  
at Wilmington, Ohio, since 1885



peared. A year after it was introduced in Delaware, for instance, highway fatalities dropped from 103 to 80. In North Carolina, they dropped from 1118 to 991 and, in Tennessee, from 849 to 749.

With similar results reported elsewhere, the authorities can hardly be expected to abandon radar because of its potential for error. Perhaps further research will make it more infallible. But until then—if you get picked up by the radar patrol and you were *positive* you were within the speed limit—bring your knowledge of radar principles and of radar's limitations to bear on your case.

Ask to see a graphic record. Question how the set was tested. Question the appropriateness of using the unit on a crowded highway.

Question whether the people operating the unit and judging its evidence have had the training to learn about radar principles and limitations. In short, make sure that radar—beneficial though it is in creating a climate for safe driving—is giving you a fair shake. ★ ★ ★

## Make Your Own Skimmer Filter

(Continued from page 141)

it to the inlet hose with a piece of radiator hose. Bend the hose so that the skimmer remains in an upright position when hanging in the water on the side of the pool. Mount the skimmer so that the water level is about the middle of the slot. With this arrangement, the water level can vary slightly without the pump losing its prime.

To clean the bottom of the pool, remove the skimmer and attach a long-handled vacuum-cleaner nozzle to the input hose with a section of flexible vacuum-cleaner hose. (Be sure that the nozzle is equipped with a brush; otherwise it will stick to the bottom of the pool.) Keep the nozzle and hoses under water while connecting the cleaner so as not to lose pump prime.

Before using the filter, prime the pump by filling the input hose and then turn on the motor. Next, connect the skimmer to the input hose, being careful not to lose prime, and feed about 4 1/2 oz. of diatomite into the skimmer. At first, the pump should push about 600 gal. per hr. through the filter. Flow rate can be checked by letting the outlet hose run into a bucket of known size and counting the number of seconds it takes to fill it. When the flow rate decreases to about 200 gal. per hr., it's time to take the filter apart and clean it. Normally, you can clean the bag by rinsing it in cold water, but occasionally it should be given a good washing in hot soapy water. ★ ★ ★

16" size  
0" to 1/4"  
parallel jaws.

# BIGGEST PLIER MADE

**DIAMALLOY**

Ask for  
HL 116P  
Diamalloy  
Groove-  
Joint  
Pliers

Sizes down to 4  
in. Handiest tools in  
your kit. Chrome finished.  
"There is nothing finer  
than a DIAMOND". Made  
only by makers of famous  
Diamond Wrenches and  
Pliers.

Write for free tool catalog  
**DIAMOND TOOL**  
and Horseshoe Co.

DULUTH MINNESOTA EST. 1908 TORONTO ONTARIO



"For heaven sake, stop, Mr. Finchley! All the guy wants is to give you the can of Mac's No. 13 radiator rust inhibitor you left back at the service station."



**BUY GREAT NECK HAND TOOLS**  
... for long-lasting performance

**Precision Balanced  
NAIL HAMMER**

One-piece, forged steel, rubber-cushioned, no-slip grip

**GREAT NECK SAW MFRS., Inc.**  
MINEOLA, N. Y. — SEE YOUR LOCAL STORE

**WORLD'S MOST EXCITING LOWEST PRICED CAR**  
**KING MIDGET FOR 1962**

Drive it for 75c a week.  
Rider Agents Wanted.  
Send 25c for 32 page book, full details, dealer price. Or send \$1 (refunded first order) for this plus Service and Repair Manual and 16 5x7 photos of car and factory.

**MIDGET MOTORS CORP.**  
ATHENS 1, OHIO

**EMERSON ELECTRIC**

**PORTABLE WELDER**  
High Capacity ... Low Price

Ideal for farm, home workshop. Cuts, brazes, solders, welds. One man can carry... only 68 lbs. 9 welding heats up to 180 amps ... 3/32" to 3/16" rod sizes. Write today for prices and receive **FREE WELDING SELECTOR GUIDE**... gives working data you need in seconds!



DEPT. PM-6

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8100 Florissant • St. Louis 36, Mo.

The Riviera touch for your home swimming pool? You can have it by building one of the simple poolside cabanas you'll see in the July Popular Mechanics. One version is portable and the other is an unusually attractive modern "kit" design.

screens, upholstery, carpets...  
hundreds of other uses.

You name 'em!



**Swingline 101 Staple Gun**

Staples practically anything. Exclusive push-button loading and built-in staple extractor. At your stationery, department or hardware store.

only **4<sup>95</sup>**

**FREE!** New 8-page "TIPS FOR TACKING" Booklet  
SEND FOR YOURS TODAY! ... shows you how to save time, money and effort — with a SWINGLINE AUTOMATIC STAPLE GUN



**Swingline INC.**

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# CATCH FISH IN THE WEEDS!



ONE OF FISHING'S  
"DEADLY DOZEN"  
—Popular Mechanics

**LOUIS  
JOHNSON CO.**

1549-G Deerfield Road • Highland Park, Ill.



## STOP WATER DAMAGE...



Wood  
Plywood  
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Asbestos siding  
Concrete blocks  
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**Prevents warping, swelling, mildew, mold,  
water stains, seepage, dampness, rot.**

**Keeps moisture out 5 years and longer.**

Use on all woodworking jobs, boats, patio furniture, planter boxes, shutters, screen doors, window sash, shingle roofs. Stops seepage in basement walls, concrete silos, foundations. Waterproofs canvas, tarps, tents, awnings, leather boots, shoes, outdoor clothing. Won't harden or crack leather or fabrics. Perfect underseal for oil base or alkyd paints. Deep penetrating, colorless. Apply by brush, spray or roller. At paint or hardware stores or order direct. 16 oz. spray can \$1.89, Qt. \$1.75, Gal. \$5.35, 5 Gal. \$25.25, ppd., tax incl. Send check or money order to **E. A. Thompson Co** 1355 Market St., San Francisco 3, Calif. No COD's please. (Since 1929.) Dealer and jobber inquiries invited.

## This Boat Flies!

(Continued from page 71)

on it, in an aerodynamic "homing instinct" to maintain equilibrium at all times. In a way, the wing is a built-in shock absorber. You just sit there, with your speedboat prow on a horizon that won't go away.

Want to turn left or right? Turn the steering wheel, that's all. No aileron controls, no banking, no over-corrections on the "stick." No "stick." Above you, the wing has neatly tipped sideways, while the aircraft swings out slightly, like a pendulum beneath it. But you're turning. You turn sharper by turning the wheel farther. This tilts the wing more.

### Landing Is Easy

When you're ready to come home, let up on the gas and the wing will glide you down. With speed control set at "approach glide," the tiny ship soars in. Near the surface, the control is moved to "landing" position, the wing flares to a level landing and you plane across the water until the hull settles in. On the water, you steer it just as you would in the air.

In this fantastic craft, the pilot actually does precious little flying beyond steering and tromping the gas pedal. The wind and the wing together do most of it for him. Even the "speed control" is a simple device which exerts or relieves a load on the wing to modify slightly the normal angle of attack it would assume by itself.

Most of the "gee whiz" features of the WingDingy were achieved by its earlier developers, but the job of making it a flyable family commodity wasn't easy.

### Months of Testing

For months, the men towed balsa-wood models around a Chesapeake yacht basin beside a speedboat. They rigged a unique floating platform on the roof of Baier's car, on which the model was mounted. Read-out instruments dangled through into the car like tassels. While Baier drove, Fletcher read out the good or bad news about the newest change as the car "flew" the model plane down suburban Philadelphia highways.

Today, however, a newer, bigger, air-worthy and seaworthy WingDingy is a fact. Soon after you read this, the test flights on the two-passenger experimental prototype for certification by the Federal Aviation Agency will be under way on the Chesapeake waterways. They'll be completed this summer. And if all goes well, according to Bob Baier, you can start looking for the first flying speedboats to show up in neighborhood garages shortly thereafter. ★ ★ ★

# EVERLITE\* World's THRIFTIEST Light Plants

(Item 869-10T)



## NEW TRANSISTOR ALTERNATOR REPLACES GENERATOR

Now a Service Free Light Plant built with a transistorized alternator. Offers 30% greater efficiency—more power for less fuel. Terrific service life—no brushes to arc and burn. No more commutator to wear, no collector ring trouble. And best of all it costs no more to "go modern with Everlite." Thrifty 1000 watt, 115v. AC plant powered by a rugged easy starting 4 cycle engine—leader priced. Model 869-10T. Wt. 65 lbs. as illustrated **\$179.50**

\*Trade-Mark Registered

All sizes available—can finance. Write for catalog. Special models for public utilities—Approved for Civil Defense. Write.

**MASTER MECHANIC MFG. CO., Dept. A-662, Burlington, Wis.**

Southern Customers write Dept. A662, Box 65, Sarasota, Florida

# HELP or INFORMATION?

Do you need help or information for any repair or remodeling Idea Projects you are undertaking? A complete list of Lumber Dealers who are cooperating with Popular Mechanics to bring you information and quality products is available. To obtain this list of the dealer nearest you, write:

**Service Bureau, Popular Mechanics**

200 E. Ontario Street

Chicago 11, Illinois

## EXCLUSIVE DOUBLE-BEARING HEAVY DUTY PUMPS

IRRIGATE • DRAIN • CIRCULATE • SPRAY

Use 1/4 HP motor or larger . . . 1 HP for up to 5,200 GPH; 1,000 GPH 60" high; or 3,000 GPH from 25" well. 1 1/2" inlet; 1" outlet. Stainless shaft.

TYPE X—2 oil-less bronze bearings. **\$10.95**

TYPE XB—Ball bearing model. **\$12.95**

Best for belt drives. . .

Postpaid if cash with order.

Don't delay—send for yours today!

**MONEY BACK GUARANTEE**

Centrifugal and Gear Pumps in All Sizes

**LABAWCO PUMPS, Belle Mead 2, N. J.**



# Dazzling new!



## BSA SUPER ROCKET

New outstanding power and acceleration matched with new improved brakes. Truly one of the most beautiful motorcycles ever made—now with brilliant metallic red tank, chrome tank panels, chrome fenders, and dozens of other highly chromed parts to dazzle its way into your heart.

## BSA MOTORCYCLES

The most popular motorcycle in the world

Write to the nearest address for a colorfully illustrated free catalog of the new 1962 models.

Catalog offer limited to U. S. residents only.

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**BSA INCORPORATED**

Dept. P62

639 Passaic Ave.

Nutley, New Jersey

Harry's

Saturday just went up in smoke

What happened to Harry could happen to you or me or anybody. Wheeling out the power mower to make a quick pass at the lawn, he never gave the crankcase oil level a second thought. The tragic result is that smoking ruin at Harry's feet . . .

motor and bearings burned to a crisp. Unhappily, this sad and costly scene is repeated a thousand times over every Saturday of the Summer. Maybe you've had your turn, maybe you're next. Of

course, the whole business can be prevented. The General Plastics MOT'R SAV'R is designed to do just that. The MOT'R SAV'R provides you with an auxiliary, automatic-feed

oil reservoir which, because of its unique construction, lets you know at a glance when it's time to add.

Install it on any mower in two minutes and you're set for years. Works just fine on a lot of other

4-cycle motors too. Slip it off your mower and onto your garden tiller, snow blower, auxiliary

generator or what have you. Inexpensive too. Just \$4.95. Makes a lot of

sense when you think about it . . . good Saturdays are hard

to come by.

—Money-Back Guarantee

## GENERAL PLASTICS, INC.

P.O. Box 225 Auburn, Maine

Please rush me .....MOT'R SAV'R(s)

Check Enclosed

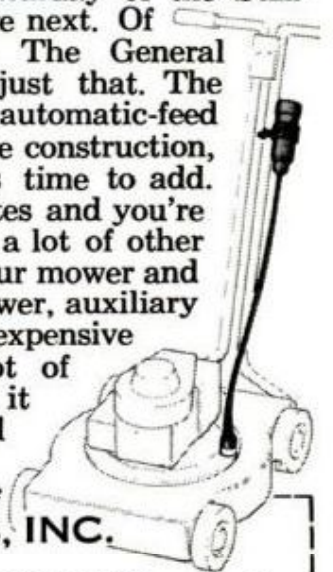
NAME \_\_\_\_\_

C.O.D.\*

ADDRESS \_\_\_\_\_

Bill me later\*

\*plus modest mailing and handling charges.



## Owners Report on the Valiant

(Continued from page 78)

"It runs on a nickel and gives you back change."—Minnesota grocery salesman.

"It holds the road better than any other compact and better than a lot of full-size cars."—California lab worker.

"I like its stability on turns, no sway of body; it gives you a feeling of confidence in handling the car."—New York foreman.

**We know a top-notch sports car race driver who feels the same way.**

"It's a very 'roadable' automobile."—Washington minister.

"I like the easy maneuverability in parking."—Pennsylvania electrician/teacher.

"It's much easier to park on city streets."—North Carolina railroad worker.

"It has good visibility in front."—California physician.

"Allows for a comfortable driving position with good vision."—Michigan engineer.

**Better than many other compacts on driving position.**

"Lots of inside room without being bulky outside."—Texas radio station manager.

"It's exceptionally roomy inside and in the luggage compartment for a small car."—Massachusetts soil scientist.

Returning to the darker side, here are complaints numbering six through ten,

listed in their order of mention. They shape up like this:

"The construction is very poor. With all our know-how in the U. S., we should be able to make a better car for the same price."—California machinist.

**Some auto makers can turn out a better assembled car—on the average—than Valiant. We have a hunch that '63 Valiants will be vastly improved in this respect.**

"Actually the Valiant is an excellent little car, if you can take away the water leaks, wind noise around windows, and poor assembly."—California salesman.

**Here's where the dealer can come through like a hero—if he's not forced to sell the car at too low a price and thus eliminate the reserve for mechanics' time.**

"Water leaks in at windshield corners."—Indiana inspector.

"It's a little too light on wintry roads—needs weights in trunk."—Iowa nurse.

"Seems light for winter driving, but probably to be expected from a compact."—Connecticut draftsman.

"It has poor vision on both sides and the back due to design of the body."—California school custodian.

**He's got a point. You can't see back end of car from driver's seat, thus you are sometimes forced to park "by ear."**

(Continued to page 200)



## Now! The oil that protects you if you forget to change

There's a chance you *may* forget. So give yourself *protection reserve* with Pennzoil Z-7. Regardless of price, you can't buy a finer oil.

Pennzoil Z-7 is 100% pure Pennsylvania oil refined to become the world's *richest* motor oil. The addition of Z-7 makes it so *complete* you never need buy expensive additives. Your car performs better, your engine lives longer. Insist on Pennzoil. For the nearest dealer, write Pennzoil, Oil City 61, Pa.



### When to change oil:

Winter —  
every 30 days\*  
Summer —  
every 60 days\*

\*But never exceed car manufacturers' recommendations for the driving conditions prevailing.

PENNZOIL Z-7 — world's richest, most complete motor oil . . . now with *protection reserve*



# SURPLUS SALE

GOVT SURPLUS  
EXCESS INVENTORY  
BANKRUPT STOCK

## 115-V A-C GENERATORS

• Many other Surplus Plants.  
• Item #626. Brand new heavy duty 1,200 rpm 115-v, 60-c, 3000-4000-w ball-bearing generator. Wt. 260 lbs. Govt. Cost over \$600. SALE... **\$139.50**



## DIAL TELEPHONE

• Item #716. Std. phone, same used on all phone systems. Use as extension to main phone and on private systems. Directions furnished. Wt. 8 lbs. Cost \$25.00. SALE... **\$7.95**



## AIR COMPRESSOR EQUIPMENT

• Make your own outfit. For painting, tires, shop use, etc. Save to 60%.  
• Compressor, \$21.50. Gov't Tank, \$10.95. Gauge, \$1.75. Paint Gun, \$11.50. Auto Switch \$4.75. Air Regulator \$3.95.



## HYDRAULIC SURPLUS BARGAINS

• Great savings. Build loaders, diggers, presses, etc. Brand new equipment.  
• 895 Pump, 1000 lb., 14 spm. .... \$41.60  
• 12-v Battery Hyd. Pump ..... 18.49  
• Hand Hyd. Pump and Cylinder ..... 27.95  
• 839 Hyd. Cyl. 3x8" 2-way ..... 19.70  
• Hyd. 2-way 1000-lb. Valve ..... 18.00

## HIGH CURRENT POWER CORD

Amazing buy in 3 conductor No. 1 ga. super-flexible (259 strands per conductor) portable neoprene insulated power cord. Will handle up to 150 amperes. Ideal for heavy construction projects, large farm motors, long welding leads, etc.  
• Consists of 150' on light metal reel. Neoprene insulation. Overall diam. 1 3/8". Shipping wt. 250 lbs. Govt. cost over \$200. SALE... **\$94.90**

## EXAMPLE BARGAINS IN 1962 CATALOG

• 840. 6-24 volt DC Gear Motor. .... \$ 5.31  
• 53. Finest 7x50 Binoculars ..... 24.15  
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• 12. Fish-Worm Shocker ..... 3.49  
• 172. Engine Driven Weed Sprayer... 109.95  
• 25. 1-Ton Hand Hoist & Puller.... 19.95

## SPECIAL OF THE MONTH!

### AUTOMATIC CLOCK SWITCH

• Marvelous G.E. 115-v 60-c telechron. Automatically turns on-off radios, stoves, signs, furnaces, air conditioners, fans, etc., any time of day or night. Has special feature of calendar clock to advance setting each day when used on sign lights. Finest micrometer movement switch. Handles to 25 amps. Attractive dust-proof case. Size 10x5x2-in. Wt. 4 lbs. Original cost \$35.50. SALE... **\$5.98**



### STORAGE BATTERY WINCHES-HOISTS

• Item #311. 12-v Gov't. reversible, ball bearing 2000-lb. capacity winch. Holds 40' 3/4" cable. For trucks, docks, boats, etc. 55 lbs. Cost over \$250. SALE... **\$49.95**



ALL ITEMS THIS AD FOB LINCOLN  
Write today for large 1962 catalog.

## SURPLUS CENTER

DEPT. 808, LINCOLN, NEBR.

1-1/3 MILLION STROKES and still like new!

## WRIGHT Quality RATCHET

THE HEART OF EVERY WRIGHT SOCKET SET

- Oil-proof, non-slip rubber grip
- Short handle swing for tight places
- Popular prices--professional quality

At leading dealers--or write:

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Dept. PM 62 Barberton, Ohio



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FREE! The "Story of the Shoe", tells about safety of this flail-type mower. Proven safe for over 13 years in Industrial and Military use. Now--available for domestic use. Not a reel--not a rotary.

### MOTT Hammer-Knife MOWER

Unique flail-type principle combines safety and cutting efficiency to give you the best mower on the market. Before you buy--Find out why you should get MOTT. You owe this to your family and friends. Write for your Free, "Story of the Shoe" today.

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## KILLS USING NO CHEMICALS GASES, ETC.

- MOSQUITOES • MOTHS, MILLERS
- FLIES, GNATS • FISH FLIES, ETC.

OVER 1/4 ACRE HANGS ANYWHERE

No insect recovery. Guaranteed. Beautiful outdoor lighting. Plug into any 110 volt socket.  
NO AREA CONTAMINATION  
Safe, beautiful. Complete with fly attractor. Dead insect catcher. Cord. Directions. Etc. Low cost.

SING SING BUG CHAIR, INC.  
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Lickity log splitter eliminates the drudgery of splitting logs up to 48" lengths, any diameter. Does splitting with 18 ton hydraulic power. It's fun to operate. Highly profitable for FIREWOOD MERCHANTS, Farmers, Estate Owners, Country Clubs, Parks, Cities. Write for complete details without obligation to:

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Works in seconds!



Loosens Rusted Bolts nuts, screws, "frozen" parts!

## LIQUID WRENCH

SUPER-PENETRANT

The super-penetrating rust solvent that quickly loosens rust and corrosion.

AT ALL HARDWARE AND AUTO STORES

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## 4-WAY WELDER \$14.95

WELD-BRAZE-SOLDER-CUT Complete

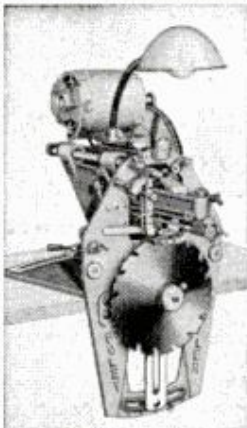
NO OTHER WELDER AT THIS PRICE  
Complete with SAFETY FOOT SWITCH, FULL FACE SHIELD, twin carbon arc torch, welding rod holder, clamp, carbons, welding & brazing rods, flux, fuses, instruction book. FULL YEAR GUARANTEE. More than a quarter million in use in homes, garages, farms, shops, factories. NOW anyone can weld, braze, solder, cut, heat, without experience. Does 100! jobs on all metals. Save & earn money. Make & repair auto bodies, parts, fenders, trailers, boats, metal furniture, fixtures, ornamental iron, farm equipment, garden tools, bicycles, toys, etc. Operate on any properly wired 110 V AC line. SEND ONLY \$2. Pay postman \$12.95 plus C.O.D. charges. Ideal lifetime gift for hobbyist, mechanic, hot rodder, homeowner. Order on 10-day money-back guarantee.

FOUR WAY WELDER CO. DEPT. F2-F, 1810 S. FEDERAL ST. CHICAGO 16, ILL.

# Make \$20 to \$30 a Week EXTRA MONEY!

With the high prices of food, clothing and everything else, just think what you could do with extra money every week! Turn your spare time into CASH--sharpening saws with a Foley Automatic

Saw Filer pays from \$3 to \$6 an hour. Start in your basement or garage--no experience necessary. "The first saw I sharpened with my Foley Filer came out 100%"--writes Clarence E. Parsons. No canvassing--"I advertised in our local paper and got in 93 saws--says M. L. Thompson. With a new model 200 Foley you can file all hand saws, also band and both combination and crosscut circular saws.



## FREE BOOK Shows How to Start

It explains how you can get business from home owners, farmers, carpenters, schools, factories, etc. "I get work from 20 and 30 miles away"--says Charles H. Smith. Free Book, "Money Making Facts," tells how to start. Time Payment Plan. Send coupon today--no salesman will call.

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616-2 Foley Bldg., Minneapolis 18, Minn.  
Send FREE BOOK--"Money Making Facts," and Time Payment Plan.

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"Because of the slanted trunk, I cannot see past the back window when backing up."—Michigan housewife.

*Checking-out the last group of best-liked features, here are numbers eleven to seventeen listed in their order of mention.*

"The quality of workmanship is much, much improved over earlier models."—New York banker.

"I like the tightness of the body and relative rigidity."—Pennsylvania engineer.

"Steering is better than any car I've had."—Colorado metal worker.

"The new dashboard is a jewel, with sensible speedometer and gauges, and good night lighting."—California physician.

**The instrument panel designer must have been a man who likes to drive.**

"I like the push-button shifting; dearly love the passing gear on the 101-h.p. engine."—Washington nurse.

"It's got nice transmission action, smooth, yet positive with no slippage."—Michigan machine repairman.

**There has to be some slippage in any liquid coupling, but Valiant's automatic is as efficient as any in its class.**

"It has good brakes in wet weather."—California nurse.

"There's plenty of trunk space."—Connecticut state prison officer.

"I like its good starting in extremely cold weather. We've had temps as low as  $-22^{\circ}$  and the car kicked over right away."—Illinois personnel manager.

*Back to the brickbats—the last of the complaints, numbers eleven to seventeen—listed in order of frequency mentioned.*

"Replace the oil pressure warning light with a gauge."—California forklift operator.

"As in most cars, there is only a light for oil pressure. I would like to see them start putting in regular oil pressure gauges again."—Minnesota clerk/student.

"Our main complaint is that we have difficulty starting it in the cold, even though we have a headbolt heater."—Montana newspaper editor.

"It would not start on first try when left set for 8 hours or more; dealer service has helped some, but it still acts up sometimes."—Pennsylvania electrician.

"It is underpowered with the 101-hp. engine."—Michigan physician.

**Wonder if he's driven any 85-horsepower compacts lately?**

"I consider over-all finishing very poor for best model of car sold."—New York investigator.

"I'm losing paint in different spots; mostly below door where salt and snow stick to car and when I wash car, paint comes off!"—Illinois meterman.

"The shift operation is no better than the hand-shift cars of the 1930s."—Illinois sales representative.

"The doors squeak and do not line up."—Alabama salesman.

"The low front bumper makes the grille vulnerable to larger cars' bumpers."—Maryland professor.

"Front bumper endangers rather than protects fenders when stressed on ends."—Kentucky sales representative.

**Like several other compacts Valiant has thin, graceful "compact" bumpers, hardly adequate to cope with the chromed bulldozer blades found at front and rear of heavy medium-priced cars.**

"If the windshield wipers covered more of the outside edges of glass area, it would be better."—Iowa insurance agent. ★ ★ ★

## Binoculars Spot Air Pollution

A detection system for smoke and dust pollution in the atmosphere has been built into a unique binocular by a West German optical company. The device, which uses special filters in three different densities, permits the observer to measure the degree of pollution optically. This eliminates the need for complicated, expensive and non-portable electronic measuring systems for use in remote areas and in places where only occasional readings are needed. The binoculars are made by the Dr. F. A. Woehler Optical Works, of Kassel, West Germany, and were introduced at the German Industrial Exhibition.

## "Ashes of Universe"

Neutrinos, "ghost" particles of the atomic nucleus, are the ashes of the universe, according to Dr. Hong-Yee Chiu.

The universe will eventually dissipate most of its usable energy in the form of neutrinos, which are massless, chargeless particles, according to the scientist, who is on the staff of the National Aeronautics and Space Administration's Institute for Space Studies and Yale University.

Recent developments in elementary particle physics, when applied to the interiors of stars, show the importance of neutrinos in energy dissipation. The process for neutrino production is known as the annihilation process; the star loses energy by creating an electron and positron pair that subsequently annihilate into a pair of neutrinos. The neutrinos then leave the star, carrying energy away.

Neutrinos from the sun hit Earth at the rate of 200 billion per square inch per second.



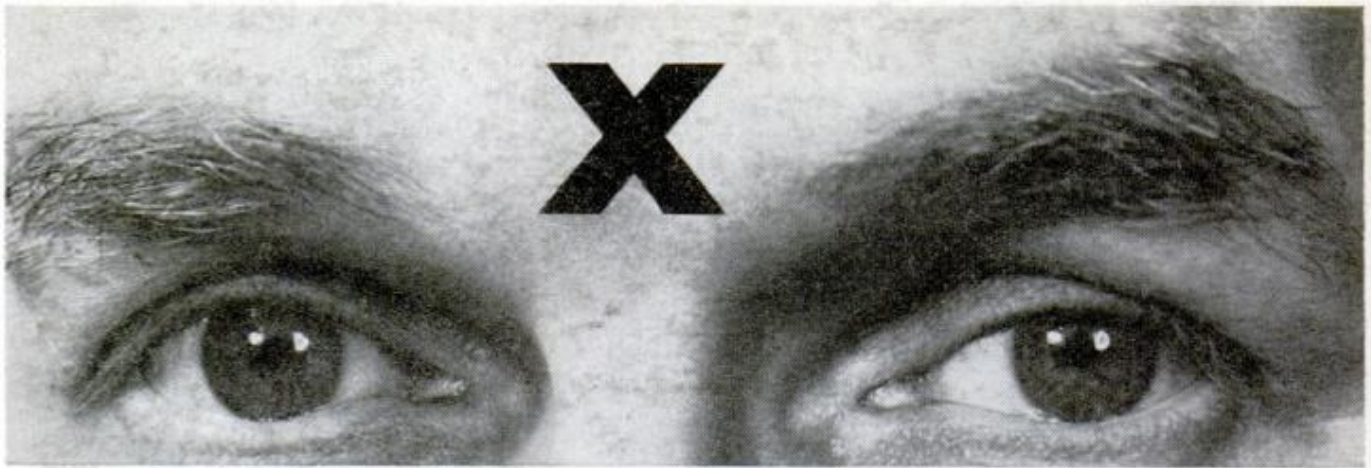
Pat Pigott, in his Champion-sparked Rosebud Racing Team Lotus, winning the Formula Junior race at Sebring, Fla.

Winners of 9 out of 10 major races  
use Champion spark plugs  
because Champions have no equal  
for performance!  
Why settle for less in your car?



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\*American Workers' Fact Book, U. S. Dept. of Labor, 1960

†American Economic Review, Dec., 1960

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- Air Conditioning
- Architecture
- Arch. Drawing and Designing
- Building Contractor
- Building Estimator
- Carpenter Builder
- Carpentry and Millwork
- Heating
- Painting Contractor
- Plumbing
- Reading Arch. Blueprints

### ART

- Commercial Art
- Magazine Illus.
- Sign Painting and Design'g
- Sketching and Painting

### AUTOMOTIVE

- Automobile
- Auto Body Rebuilding and Refinishing
- Auto Engine Tuneup
- Auto Electrical Technician
- Diesel Engines

### AVIATION

- Aero-Engineering Technology
- Aviation Engine Mech.
- Reading Aircraft Blueprints

### BUSINESS

- Accounting
- Advertising
- Bookkeeping and Cost Accounting
- Business Administration
- Business Management
- Clerk Typist
- Creative Salesmanship
- Managing a Small Business
- Professional Secretary
- Public Accounting
- Purchasing Agent
- Real Estate Salesmanship
- Salesmanship
- Salesmanship and Management
- Traffic Management

### CHEMICAL

- Analytical Chemistry
- Chemical Engineering
- Chem. Lab. Technician
- General Chemistry

- Oil Field Technology
- Pulp and Paper Making

### CIVIL ENGINEERING

- Civil Engineering
- Construction Engineering
- Highway Engineering
- Professional Engineer (Civil)
- Reading Struc. Blueprints
- Sanitary Engineer
- Sewage Plant Operator
- Structural Engineering
- Surveying and Mapping
- Water Works Operator

### DRAFTING

- Aircraft Drafting
- Architectural Drafting
- Drafting & Machine Design
- Electrical Drafting
- Electrical Engineer Drafting
- Industrial Piping Drafting
- Mechanical Drafting
- Sheet Metal Drafting

### ELECTRICAL

- Electrical Appliance Servicing
- Electrical Engineering

- Electric Motor Repairman
- Elec. Engr. Technician
- Elec. Light and Power
- Practical Electrician
- Practical Lineman
- Professional Engineer

### HIGH SCHOOL

- Good English
- High School Diploma
- High School General
- H. S. College Prep. (Eng'r'g & Science)
- High School Math
- High School Science
- Short Story Writing

### LEADERSHIP

- Industrial Foremanship
- Industrial Supervision
- Personnel-Labor Relations
- Supervision

### MECHANICAL and SHOP

- Diesel Engines
- Gas-Elec. Welding
- Heating and Air Conditioning
- Industrial Engineering
- Industrial Instrumentation

- Industrial Safety
- Machine Shop Practice
- Mechanical Engineering
- Plumbing and Heating
- Professional Engineer
- Quality Control
- Reading Shop Blueprints
- Refrigeration and Air Conditioning
- Tool Design
- Tool Making

### RADIO, TELEVISION

- General Electronics Tech.
- Industrial Electronics
- Practical Radio-TV Eng'r'g
- Radio-TV Servicing
- TV Technician

### RAILROAD

- General Railroad

### STEAM and DIESEL POWER

- Combustion Engineering
- Power Plant Engineer
- Stationary Diesel Engr.
- Stationary Steam Engines

### TEXTILE

- General

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City \_\_\_\_\_ Zone \_\_\_\_\_ State \_\_\_\_\_ Working Hours \_\_\_\_\_ A.M. to P.M. \_\_\_\_\_

Occupation \_\_\_\_\_

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