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POPULAR MECHANICS

MARCH, 1961

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SPECIAL: 38 PAGES on BOATS



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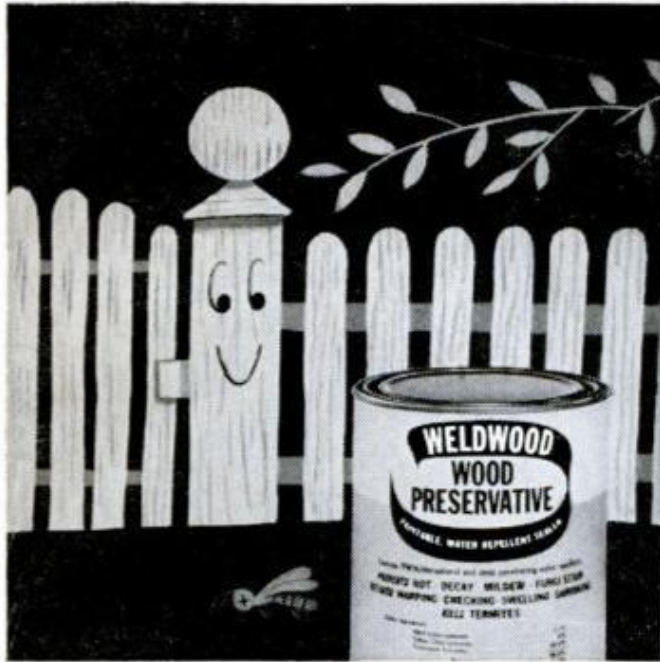
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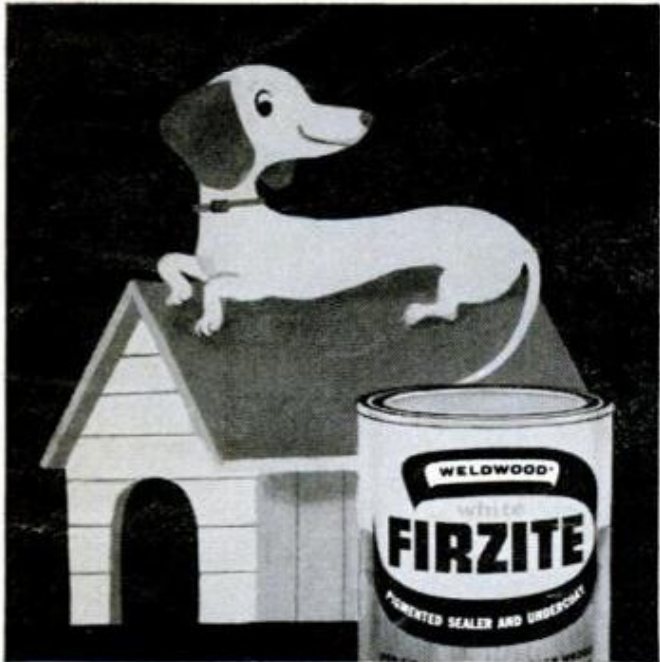
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MARCH 1961



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This One



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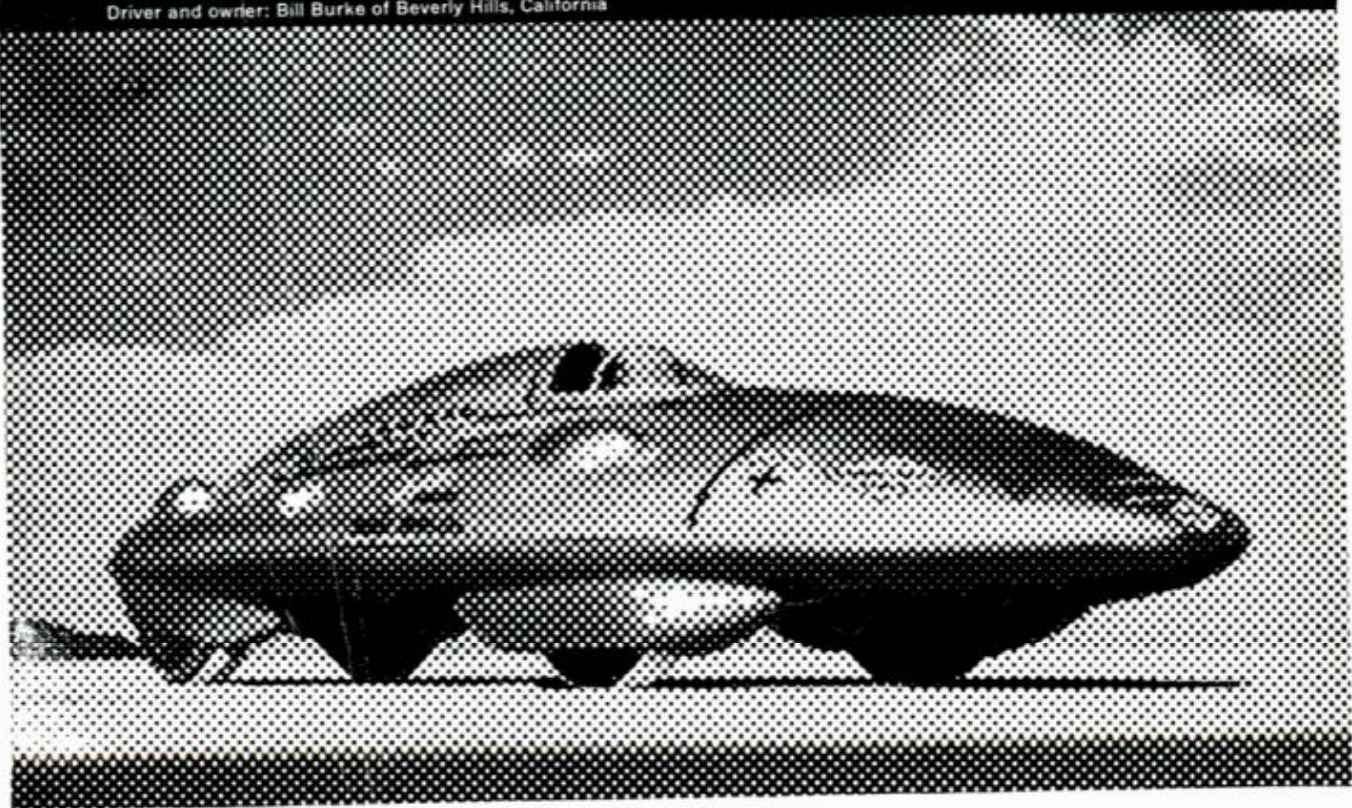
Pumpkin-seed-shaped SCI Special slices to Class D record of 205.949 miles per hour across the salt of Bonneville, smashing the ten-year-old mark by over 43 mph. The engine: a 156-cube Ford Falcon in-line six. The spark plugs: Autolite. Lesson for the day?



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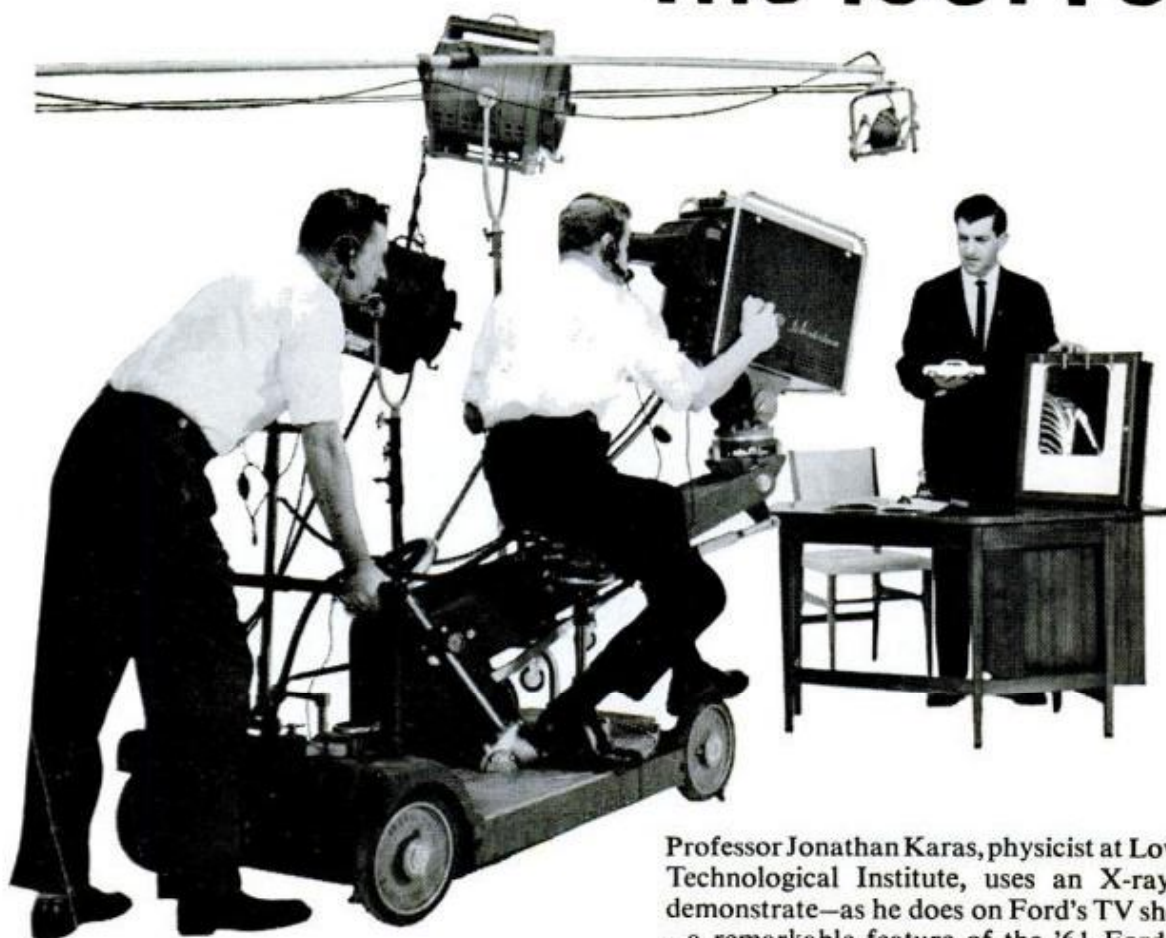
Turn to detailed index on page 6. Sources of additional information on items in this issue are shown on the Where-to-Find-It List, available without charge by writing the Bureau of Information, Popular Mechanics, 200 E. Ontario St., Chicago 11, Ill.

Next Month...

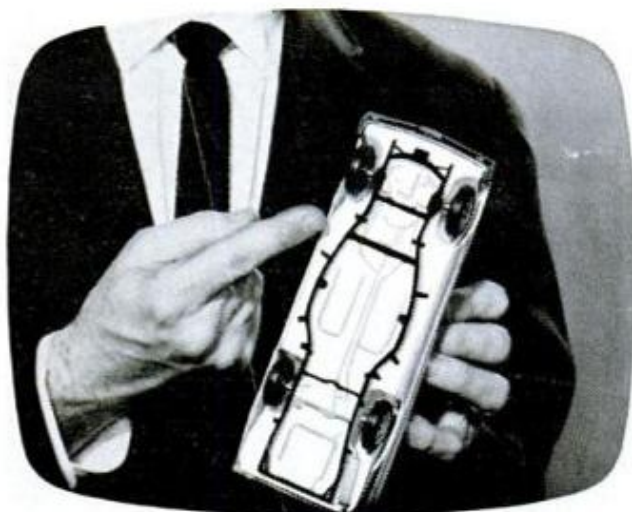
YOUR OWN SWIMMING POOL, complete with filter, for only \$229? Complete plans for it are in the April issue's special section of back-yard projects. . . . In the same issue: Owners Reports on the joys and sorrows of operating the 1961 Chevrolet and the 1961 Rambler American, based on over two million miles of daily-use driving experience. . . . Also: "Is This the World's Worst Airline?"

TV's Professor Jonathan Karas tells why

The 1961 Ford



Professor Jonathan Karas, physicist at Lowell Technological Institute, uses an X-ray to demonstrate—as he does on Ford's TV shows—a remarkable feature of the '61 Ford.

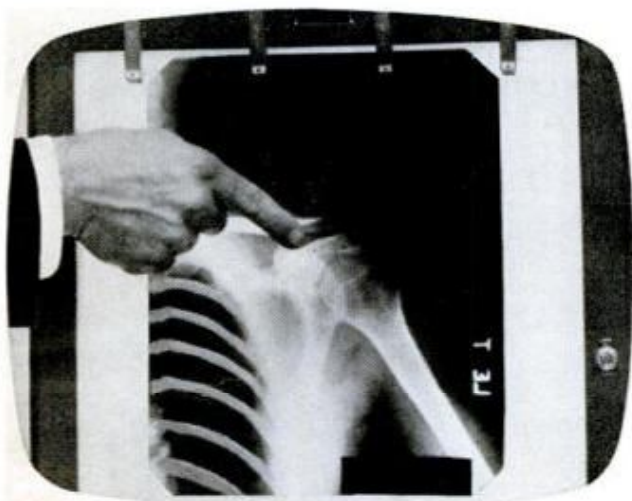


"Other cars require a chassis lubrication every one to two thousand miles costing up to \$45 in 30,000 miles. But Ford's famous ball-joint has a special sealed-in lubrication, very much like the human shoulder joint."



"Here it is, the crucial part of Ford's suspension. This unit is a ball-joint, protected by molybdenum disulfide grease, a new lubricant that Ford helped develop. It forms a molecular bond with the metal."

is built to go 30,000 miles between chassis lubrications



"This is a human shoulder joint. The reason it works so well and so dependably is that nature provides what is, in effect, a sealed-in lifetime lubrication."



"And this is a photograph of a ball-joint on the '61 Ford. Let me show you how Ford engineers took a tip from nature to give you more carefree driving."



"And this polyurethane ring, another Ford development, seals in the grease so well that Ford can go 30,000 miles between chassis lubrications. And these cost only about \$4—take about 20 minutes."



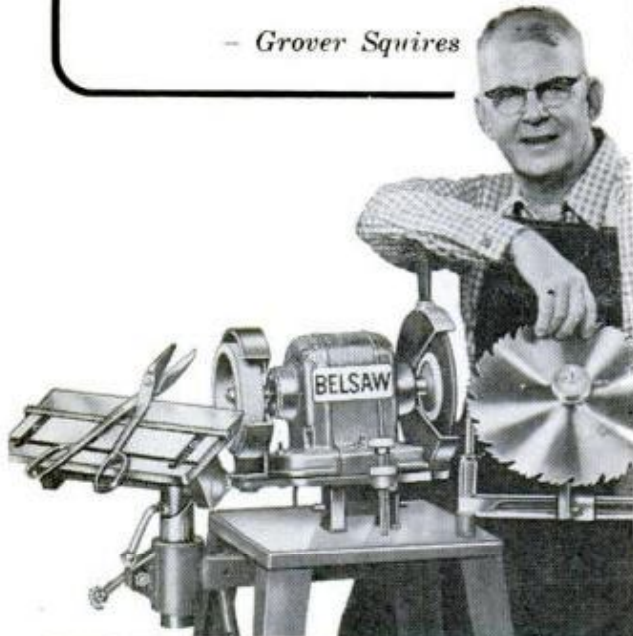
"Sealed-in lubrication is just one feature that makes the '61 Ford *beautifully built to take care of itself*. Two others are: self-adjusting brakes, and Full-Flow oil filtration . . . you change oil only every 4,000 miles."

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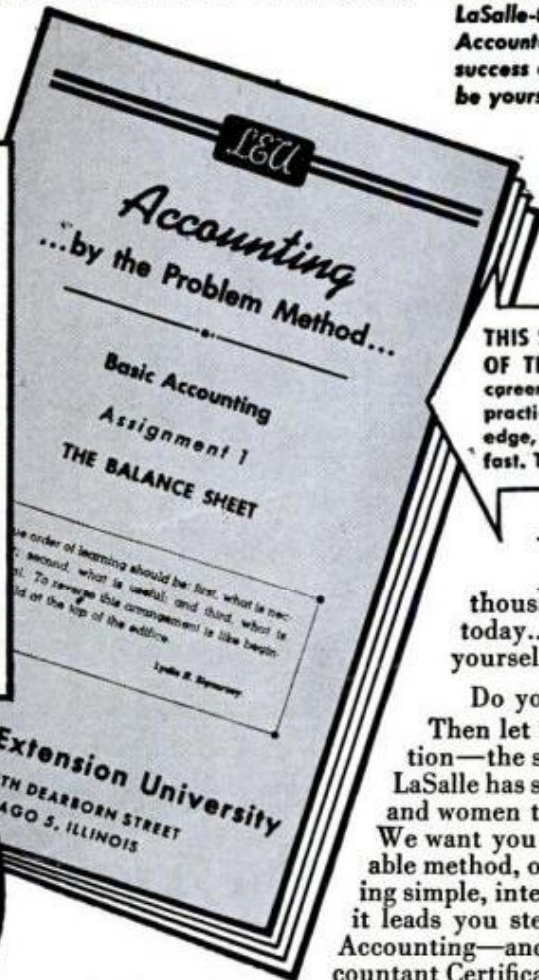
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NOTICE—It is the intention of this magazine to provide its readers with information regarding the latest developments in the mechanical arts. Except where otherwise indicated, this magazine has no information as to any unexpired patents in respect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

This Worm Turned!

Science is going to right an injustice it did some shy little deep-sea creatures when it called them worms. The mistakenly named *Pogonophora* (bearded worms) are now scientifically classified as "enterocoelous coelomates." Before long, zoologists hope they will be named the latest phylum, or subdivision, of the animal kingdom. Research has shown them to be animals (though they do look like worms) and very strange animals indeed.

Pogonophora have no mouths, digestive systems, excretory organs, or means of breathing. They range in length from 4 to 14 inches with diameters of less than 1/25

of an inch and, for the most part, are confined to the deepest sea floors. They settle there and, by secreting a plasticlike material known as tunicin, build fairly close-fitting tubes around themselves. The tubes are built up from year to year, so they generally have successive joints. Standing straight up from the sea-floor ooze, the tubes might be mistaken for stems of white grass. The longest seen, secreted by an ambitious, 14-in-long *Pogonophora*, was nearly 5 feet tall. The tube is home, and the animals never leave, but presumably spend their lives crawling up and down inside it.

Zoologists can only speculate on how these creatures live without the usual methods of eating. They do have brains, come in two sexes, and lay as many as 30 eggs at a time. They have rather long tentacles at the top of their bodies, which give the appearance of beards. These number about 200 in one species. Russian zoologist A. V. Ivanov suggests that the tentacles are protruded through the end of the tube to trap decomposition products of deep-sea bacteria. He believes the tentacle nets are equipped with some sort of digestive organs and pass on into the body only what can be completely absorbed by the body. Thus, there is no need of internal digestion, nor are there wastes to be eliminated.



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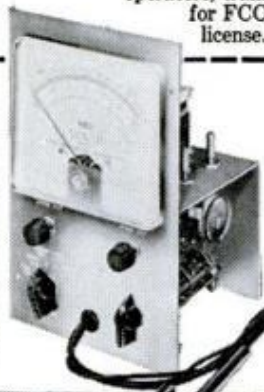
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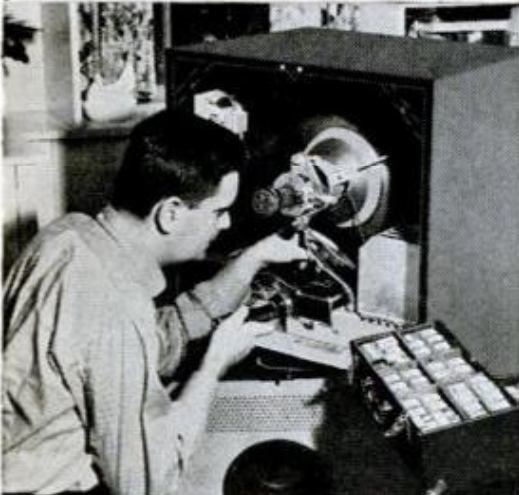
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No mechanical part will last forever. By the time you have driven your car 50,000 miles, the crankshaft in your engine will have made 150,000,000 revolutions. Piston rings will show signs of wear. Engine bearings will wear, too, and your engine may begin to burn increasing amounts of oil.

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Over the Editor's Desk



PERHAPS we have been hiding your light under a bushel. This thought struck us the other day as we were reading over a well-rounded bushel of recent correspondence from PM readers.

There was a refreshing feeling of conviction and accomplishment in almost every letter. And, space willing, in future issues we plan to publish more comments from readers than we have in the past. That way, more of you will share with fellow readers your successes in building projects, your solutions to home maintenance or improvement problems, and your opinions—pro or con—about the ideas presented in PM articles.

✓ ✓ ✓

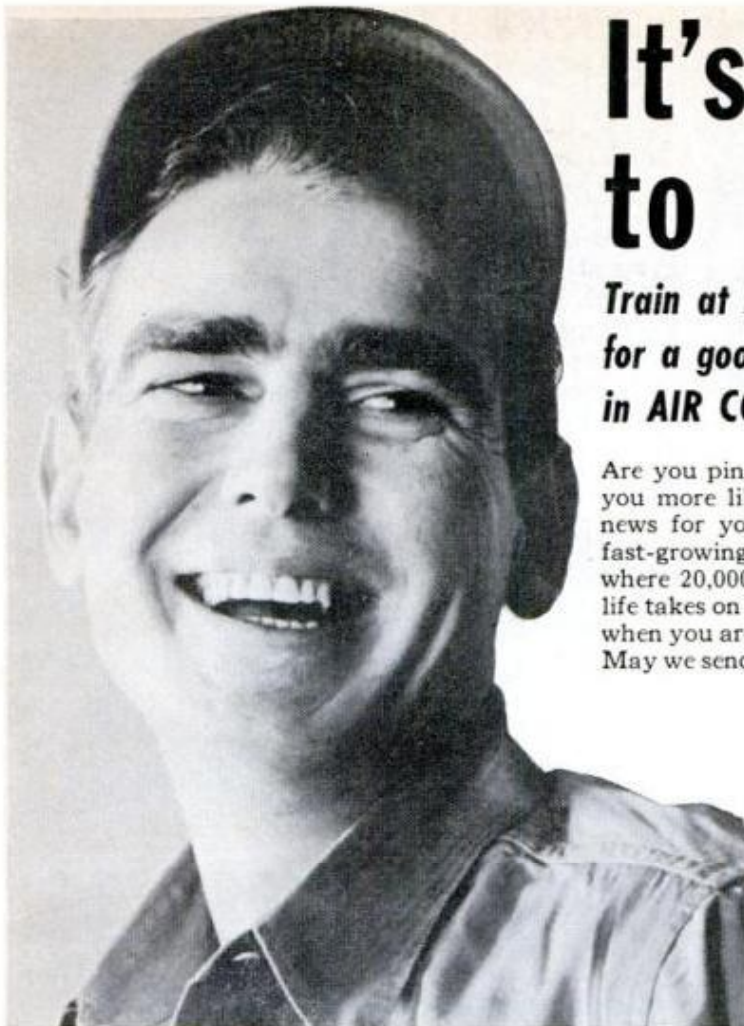
Take the letter we received recently from Norv Wallen of Mansfield, Mo. Accompanying it was his photo of the 24-foot houseboat he built from PM's plans. Norv added a multilayered coating of fiberglass to the craft, with colors premixed in the resin. He also placed the hotplate and heater fuel tanks alongside the outboard motor mount, thus eliminating the need for a rear deck hatch which might leak.



And how does the boat behave? Very well, reports Norv. Loaded, she draws only five inches, and she will move along easily at over 10 miles per hour.

That's nowhere near as fast as the sleek Go-Cat featured on page 162 of this issue. Then again, it's a lot faster than the three hours it took to maneuver the Go-Cat out the window of the *Popular Mechanics* building, where it had been carefully constructed—from bow to ski tow bar—under

(Continued to page 12)



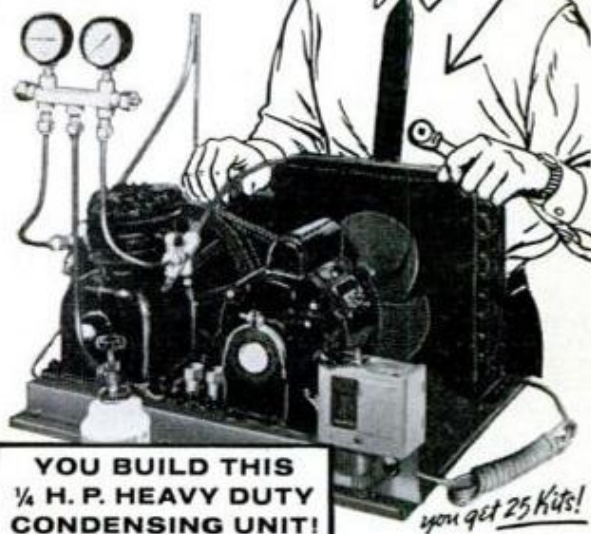
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the watchful eyes of *PM* editors Earl Wo-
beck and Wayne Leckey.

Have to give the boys credit, though. They did measure the window before they built the boat.

✓ ✓ ✓

Reader Francis Hare of Montreal felt you should have a look at his Big-Family Ranch Home, constructed from *PM*'s prize-winning 1956 design. It's shown here, but not visible is the extra bedroom, enlarged living room and a full basement Francis added to accommodate what he calls "our very big family."



At the rear of the home stands a *PM* trailer built by Francis and his wife in 1954. Since that time, six members of the Hare family have used the trailer to log 15,000 miles of "wonderful vacations" in Nova Scotia, Winnipeg and Minneapolis.

✓ ✓ ✓

Ready for some shorter-range vacation cruising is young Tim Chaplin, shown here piloting a sidewalk jeep built from *PM*'s 1958 plans. His dad, pleased reader

(Continued to page 14)



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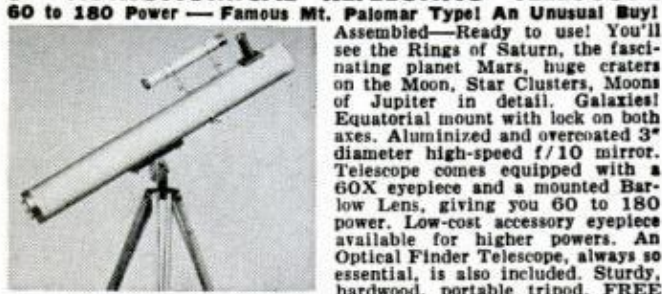
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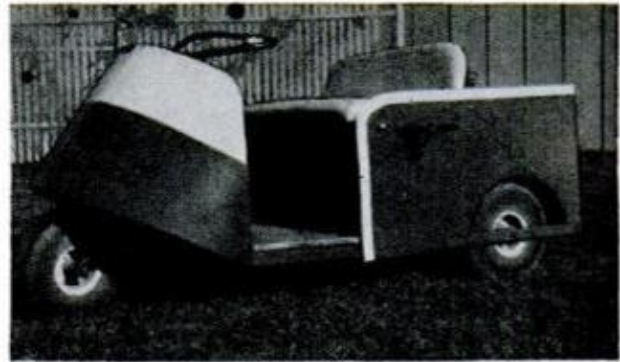
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G. A. Chaplin of Lawndale, Calif., reports that the jeep has stood up well under a year of severe usage.

Equally proud of results is reader Aaron Stuckey of Unionville, Mo., who sends in a photo of a golf cart built from our April 1958 plans. He writes that, with a four-



cylinder Anglia gasoline engine and transmission used in place of an electric motor, the cart has enough power to climb a mountain.

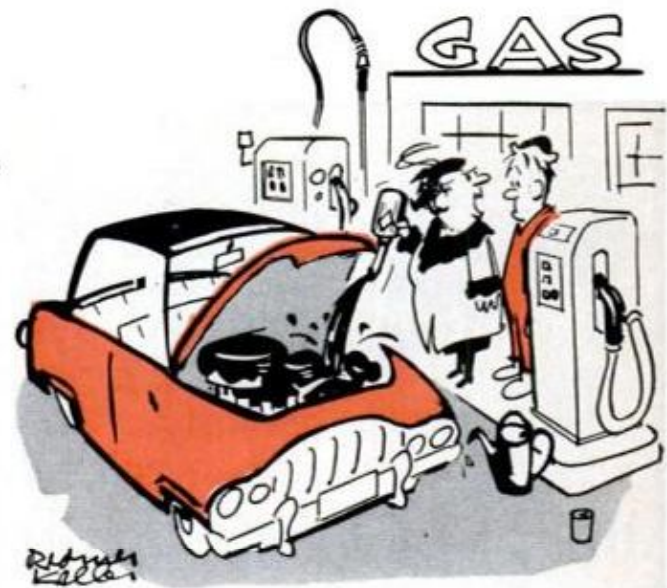
✓ ✓ ✓

Speaking of mountains reminds us that we have yet to work our way through the small mountain of correspondence fired in by you readers who want to argue the merits or demerits of adopting the metric system (Dec. '60 PM).

There's not enough space (metric or otherwise) left in this month's column to do those letters justice. With luck, though, we'll be able to bring you excerpts from some decimating arguments next month.

See you then

The Editors

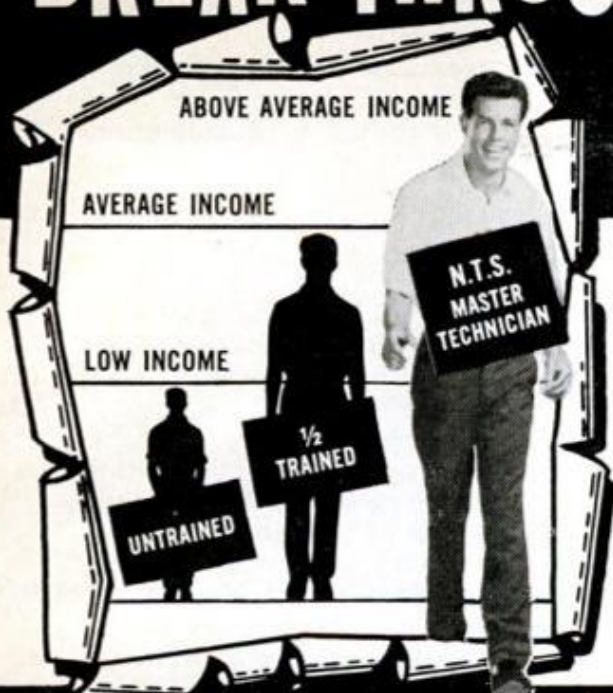


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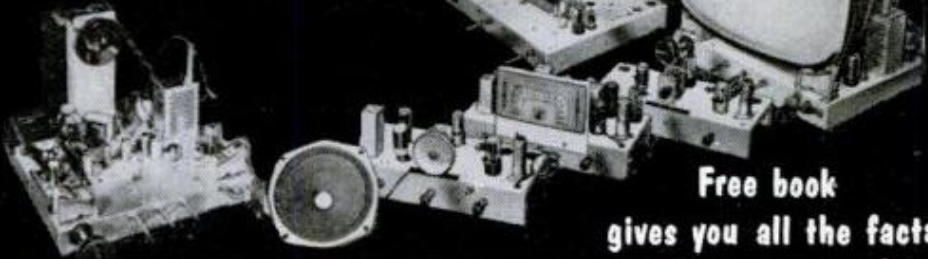
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Sidelights from the PENTAGON

By William R. Kreh

IONS. ANYONE? The Navy is working on an idea that someday may make it possible merely to flick on a switch and become a happier person. At New London, Conn., Navy scientists say that negatively charged ions might be used to keep morale high aboard submarines where months of close confinement fray men's tempers and make crewmen irritable.

An ion is an atom with an electrical charge. A normal atom is neutral. If it loses an electron, it will have a positive charge. If it picks up an extra electron, it will have a negative charge.

The Navy says the air contains large numbers of both types. If negative ions predominate, they cause an increased sense of well-being, while if there are more positive ions in the air, irritability and anxiety ensue. Evidence from tests on submarine crews shows that the negative ions can be as effective as tranquilizers in providing that happy feeling.

The Navy stumbled across the theory by accident. Researchers were working out ways to remove dust, smoke and fumes from submarines periodically. Their experiments often changed the ion distribution and produced the apparent effects in sailors that the Navy is now trying to verify. Thus far, three companies have built machines for generating the negative ions.

It seems Buck Rogers has been wrong all these years. The Air Force has found that the idea of getting around in space by mounting jets on a man's back doesn't work. It has been tested during weightlessness tests, and scientists have found that the jets cause uncontrolled tumbling because the force isn't lined up with the body's center of gravity.

A better device, they say, is an air gun that shoots air from either the breach or barrel. The spaceman points the gun in the direction he wants to go and pulls the trig-

ger. When he nears his destination, he presses another trigger and air blowing in the opposite direction slows him down.

Now here's an exclusive hobby. An Army private at Fort Sill, Okla., collects rare horseshoe nails. Included in his collection of more than a hundred is a bimetallic nail from Switzerland. The heat from the hoof of a running horse caused the nail to arch slightly and hold the shoe tightest when most stress was placed on it. Two other prizes are a silver nail from the stables of the Hapsburgs of Austria and a gold one which Henry III of France used for shoes of his favorite horses.

Know who's got the lousiest job in the Army? A master sergeant at the Walter Reed Army Institute of Research in Washington, D. C., wears a special vest in which lice are cultivated close to his body. It's all part of research into making better insecticides to protect soldiers in the field.

About 12,000 sailors and their families were shot in a Memphis, Tenn. drive-in recently. Navy medics took a cue from the success of drive-in movies, restaurants and banks and set up an ambulance and invited all local Navy personnel and their dependents to drive up and get their annual flu shots. They averaged about 700 vaccinations an hour. Corpsmen stationed themselves on each side of the ambulance, and all that the drivers and their passengers had to do was drive in, roll down their windows, roll up their sleeves and stick out their arms.

What are Army gunners using these days to protect their ears from the noise? Many ingenious alternates to old-fashioned cotton have been tried. Members of the Fourth Army pistol team at Fort Sam Houston, Tex., use pencil erasers soaked in glycerin, filter ends snipped off cigarettes or .38 and .45 caliber cartridge cases.

The moon has inspired poets and lovers for ages but, in the electronic age, it's a nuisance. An Air Force early-warning station in Greenland recently showed that the U.S. was under a mass ballistic-missile attack. It turned out that the "attack" was merely the moon rising over the horizon. Electronic computers at the station have since been "told" what the rising moon looks like so it won't happen again.

The Army has developed a nonburning rubber. It's used by soldiers for protection against flamethrowers and atomic radiation hazards. ★ ★ ★

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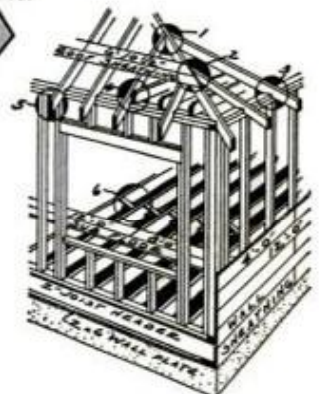
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from the world of

By James Biery

WHICH NATION will be the world's third largest steel producer in 1970? After studying evidence in 130,000 pages of Chinese scientific and technical journals, a team of U.S. Scientists has concluded that it will be Communist China. In their report to the American Association for the Advancement of Science, the U.S. team also noted a hundred-fold increase in the number of Chinese geologists in the last decade, coupled with the discovery of vast new mineral resources. These factors would combine with China's growth rate during the next 10 years to bring it to a position just behind the U.S. and the U.S.S.R. in industrial strength.

Sharp changes in the amount of space dust encountered by the Explorer I satellite could only be caused by a cloud of micro-meteorites traveling in closed orbit around the Earth. So concludes Dr. Albert Hibbs of the Jet Propulsion Laboratory at Pasadena, Calif., after studying data obtained from the U.S. satellite as it changed altitude on its 224 to 1573 miles-from-Earth orbital trips. Dr. Fred Whipple of Harvard College Observatory suggests the cloud is formed of dust scattered from the moon when it is hit by meteorites.

Moon dust might be a hazard to any space vehicle that tries to land there, report scientists at the Boeing Airplane Co., Seattle, Wash. They recently made a heat map of more than a million square miles of the moon. Scanning its surface with infrared detectors, they found the dust layer is not uniform in depth. Some craters retain heat from the sun much longer than do the plains of the waterless seas. This indicates that the craters, covered by a thinner layer of dust, would be a better place for a spacecraft to land than the plains, where thicker layers might even swallow a spaceship.

If man is to survive the radiation in space near the Earth, he might well make his space junket through an area where an aurora is occurring. Drs. C. W. Gartlein and G. Sprague of the IGY Auroral Data Center, Cornell University, say radiation in such zones is likely to be less dangerous to man than that of the rest of Earth's very high atmosphere. ★ ★ ★

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TUNE IN ON THE INVENTORS

TAKING an old saying literally, Samuel Hughes of Cullman, Ala. has gone and done it—he's invented a better mousetrap. The box-shaped trap looks like a small birdhouse, but has a disposable sticky-paper floor. Mr. Mouse walks in after the bait, but hangs up on the floor like a fly on flypaper. Then you peel off the paper, mouse and all, and get rid of it any way you like. Mr. Hughes has patent 2,962,836.

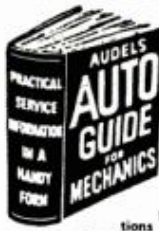
Another pest-control device is built into a selective bird feeder that won patent 2,965,070 for George Myrick of Baltimore, Md. Built for bird fanciers who want to feed small songbirds but not the bigger, less desirable species, the feeder has a counter-balanced perch connected to a door over the food compartment. The weight of a small songbird won't activate the mechanism, but a heavier bird tips the balance and closes the door on the food.

A similar principle in a different application was patented by Henry Farber of Bayside, N. Y., who was assigned 2,963,107 for his supplemental vehicle brake—a third brake that will work on any car or truck. The Farber device engages and holds the regular brakes when the car door is opened, leaving them engaged until the driver manually releases them. It works on a rod connected to the door hinge; opening the door stretches a spring to engage the brake. The inventor believes the device is simple enough that no special mechanical ability is required to install it.

One of the oldest ways to protect valuable small objects from theft is to stuff them in a pillow or a mattress. If you like that method, then you'll like the new pillow patented by Wallace Bounds, of Bellevue, Wash. Mr. Bounds' invention (patent 2,962,731) features a built-in center pocket that is sealed on each end by a flat spring closure similar to those found on some tobacco pouches. The pocket is just big enough for money, jewelry, or other small valuables or, more practically, some handkerchiefs or a transistor radio.

Copies of the original patents may be ordered for 25 cents each from the Commissioner of Patents, Dept. of Commerce, Washington 25, D. C.

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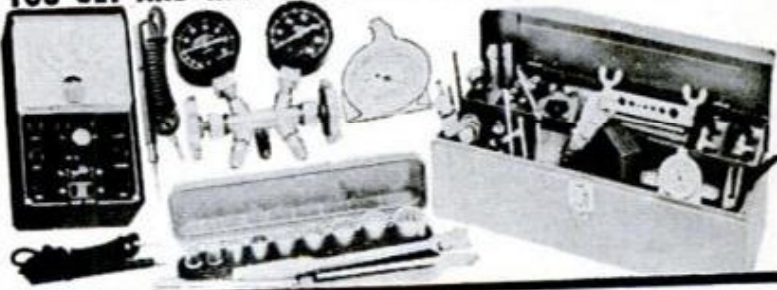
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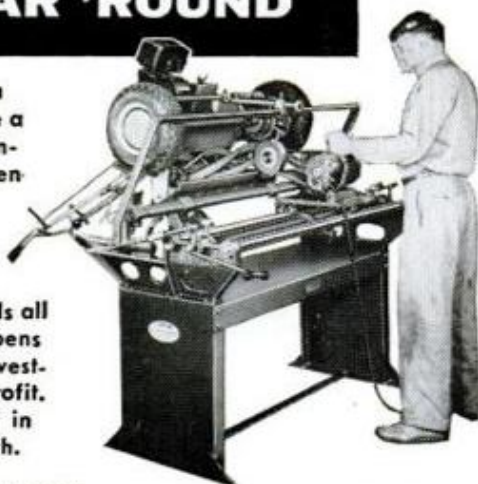
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SIDELIGHTS ON AVIATION

By Kevin V. Brown

TRAGEDY BREEDS its own silver linings. The recent air collision over New York City, which caused a record 134 deaths, accelerated a series of projects to improve air navigation and traffic control. The ultimate purpose is to give the pilot an accurate indication, not only of where his plane is, but where all other planes are as well.

One idea is to bounce radio signals from the plane off the ground to be received by all other planes. It would be especially effective for warning of climbing and descending aircraft.

Another idea is to bounce signals off the troposphere. This technique, used for many years in northern ground-defense lines, has been found to be successful for moving stations, i.e. aircraft. Results would give airliners long-range voice reception of exceptional clarity, especially over the North Atlantic range where present communications sometimes break down.

Meanwhile, a psychologist at the Air Force's Human Engineering Laboratory suggests that perhaps pilots, because of the mass of communications information they must absorb in flight, should have a third ear. Two aren't enough, he says, at today's supersonic speeds. His plan is to translate voice vibrations into mechanical vibrations which a pilot can feel by placing a small plate in contact with his skin.

The system would allow jet pilots to perform many manual functions while absorbing certain types of information (simple emergency signals, perhaps) through vibrations. It could also be used as a back-up system when normal communication channels are disrupted.

If crashes cannot be eliminated altogether, however, researchers hope to minimize them by learning more from each one. The Federal Aviation Agency has ordered all commercial airliners to carry voice recorders in the cockpits to preserve the last few minutes of conversation in the cockpit of any doomed plane. And perhaps the final word came from Col. John Stapp of the Air Force, who has conducted tests since 1948 on the human body's ability to withstand G forces. He suggests that all airliner seats should face the rear because survival chances are multiplied in a crash. Military air transports are now built this way.

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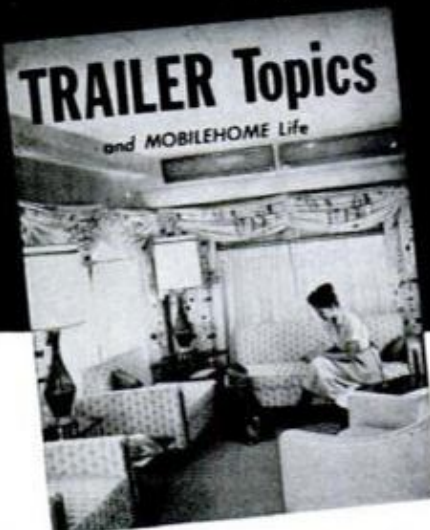
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Keeping up with the ATOM

By James Biery

GI's ARE GETTING a weapon that fires nuclear warheads yet can be carried by one man. A larger version of this new Davy Crockett rocket can be fired from a jeep launcher. It has a barrel about six feet long topped by a 30-inch bomb equipped with aerodynamic fins. As in a recoilless rifle, two explosions are set off in the barrel; one to fire the warhead, the other to offset the recoil. Wilber M. Brucker, Secretary of the Army, says the weapon, which gives atomic power to the foot soldier, "dwarfs in fire-power anything we have ever known in the immediate area of the battle line."

All told, the U.S. has a stock pile of atomic weapons equal to 50,000 bombs of the type that destroyed Hiroshima. Ralph Lapp, a nuclear scientist formerly on the Atomic Energy Commission staff, says the U.S. has the capacity to make 30,000 more such bombs in the next six years. The Hiroshima bomb exploded with the force of 20,000 tons of TNT; improved bombs of the same weight can now explode with the force of 20 million tons of TNT.

Without breaking the present ban against testing atomic weapons, the U.S. will be able to carry out experiments that, up to now, required the intense radiation produced only by A- and H-bomb blasts. The Department of Defense is constructing an unusual "pulsing" reactor that will take the place of nuclear explosions in testing radiation effects on human beings and military equipment. The reactor will undergo, for a split second, almost a runaway reaction, delivering intense neutron and gamma radiation; then it returns to normal levels of operating power. It will be installed at the Naval Medical Center, Bethesda, Md.

Cheap nuclear power to provide electricity for factories and homes is about 10 years away, according to Sterling Cole, director of the United States International Atomic Agency. Cost of this power is falling faster than that of conventional power, he says, but it is still high. Nuclear energy will not become economically practical for use in day-to-day living until "the latter part of this decade." ★ ★ ★



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ITEMS FROM ALL OUTDOORS

By Dick Kirkpatrick

BOAT-SHOW CROWDS this year will do a lot of their crowding around two new boats. Both are very unusual, though for different reasons, and both, strangely, were built by outboard-motor manufacturers, again for different reasons.

EVINRUDE Motors stops the shows every year with a spectacular boat-of-the-future display by their designer-visionary, Brooks Stevens. His 1961 effort is the "Heli-bout," half helicopter, half runabout, which explores the possibility of an airborne pleasure boat. The owner could take off from his back yard, fly to his favorite water, then go boating. Power is supplied by their big V-75 outboard, modified to drive the rotors through a flexible shaft and cooled by a radiator while airborne. Crazy? Maybe, but maybe not, either. It's interesting to anyone but a trailer salesman. The Stevens boats always make a striking display that's well worth seeing.

SCOTT surprised everyone—even industry intelligence experts—by bursting into the New York show with the news that they're breaking the traditional taboo against the manufacture of boats by a motor company. They introduced the new "Flying Scott," a very good-looking 17-foot fiberglass runabout that is designed specifically for their 75.2-horsepower motor. You buy the completely rigged, perfectly-balanced outfit—even a trailer if you wish—like buying a car.

The Scott boat was designed by Dave Beach, McCulloch's marine architect (see page 160), and is reported to have unusual performance qualities for an outboard—level ride at all speeds, smooth turns without cavitation, sliding or digging, and torque-free steering. Since boat, motor, prop and all are carefully engineered for each other, the company claims an increase in efficiency that is "the equivalent of 15 to 20 additional horsepower." The boat package includes so many fine points of design and accessorizing that to list them here would make this column read like a Scott ad. Head for the nearest big boat show and see both boats. They're worth it. ★ ★ ★

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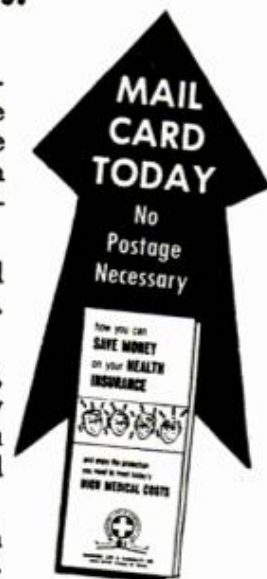
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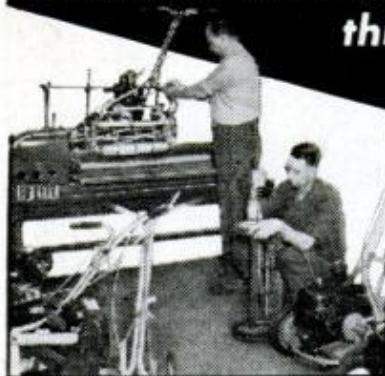
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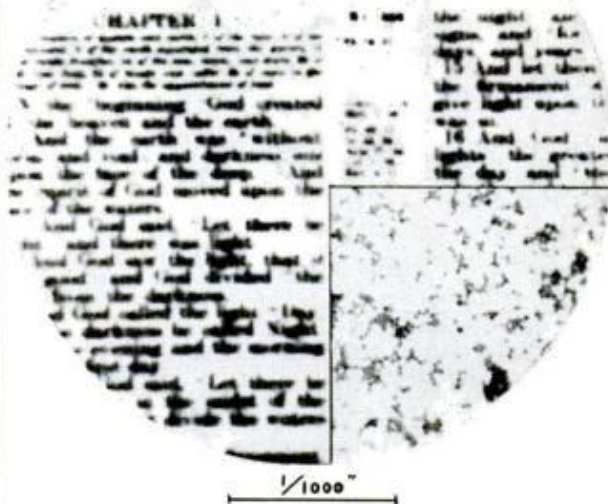
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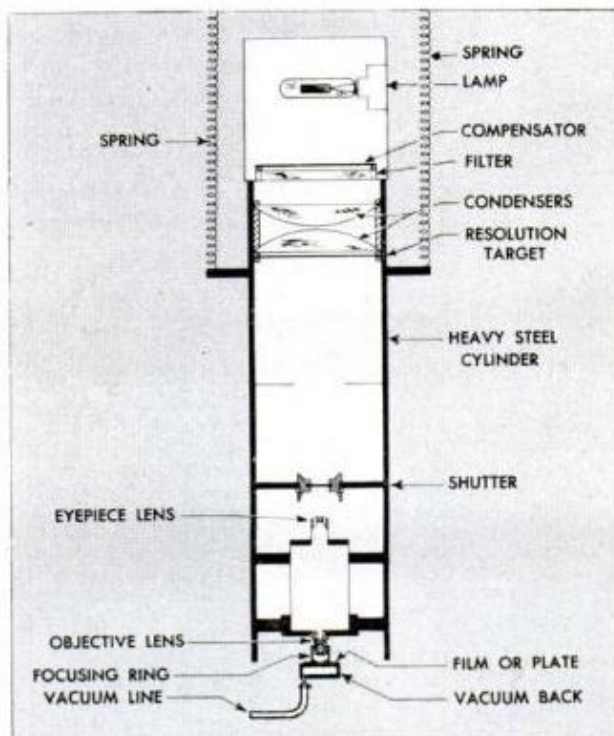
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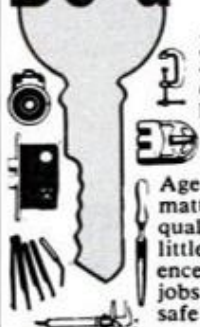
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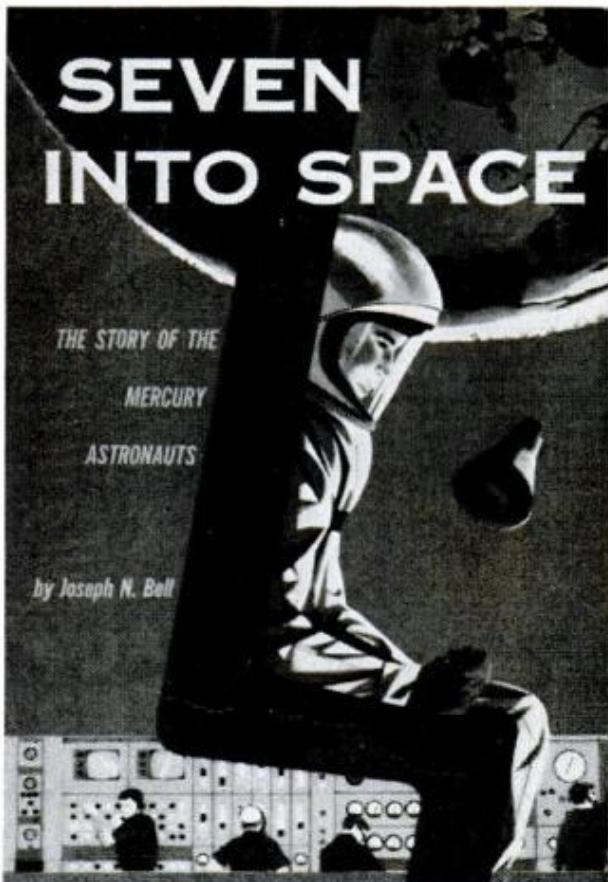
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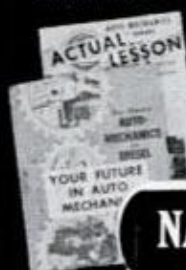
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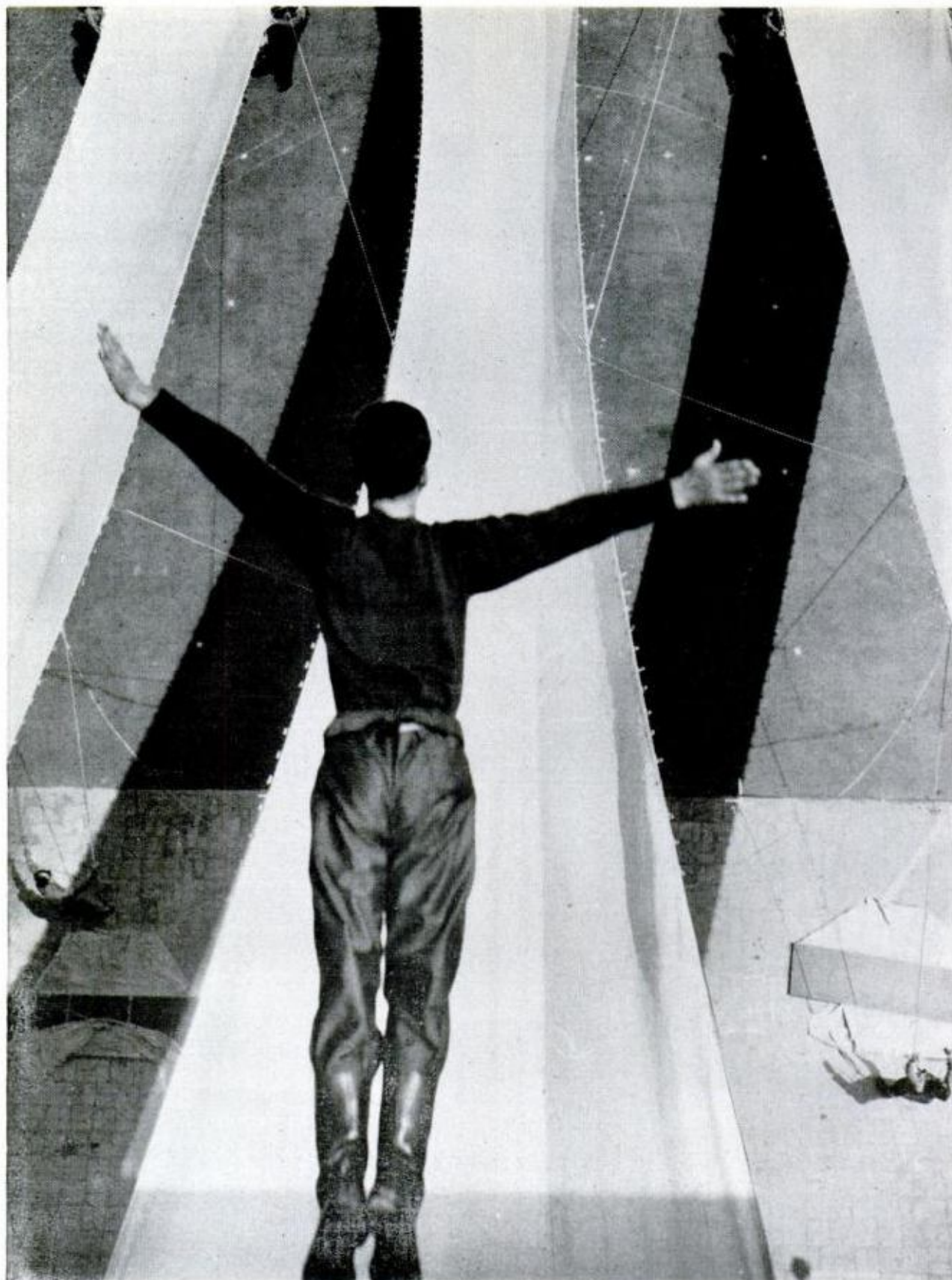
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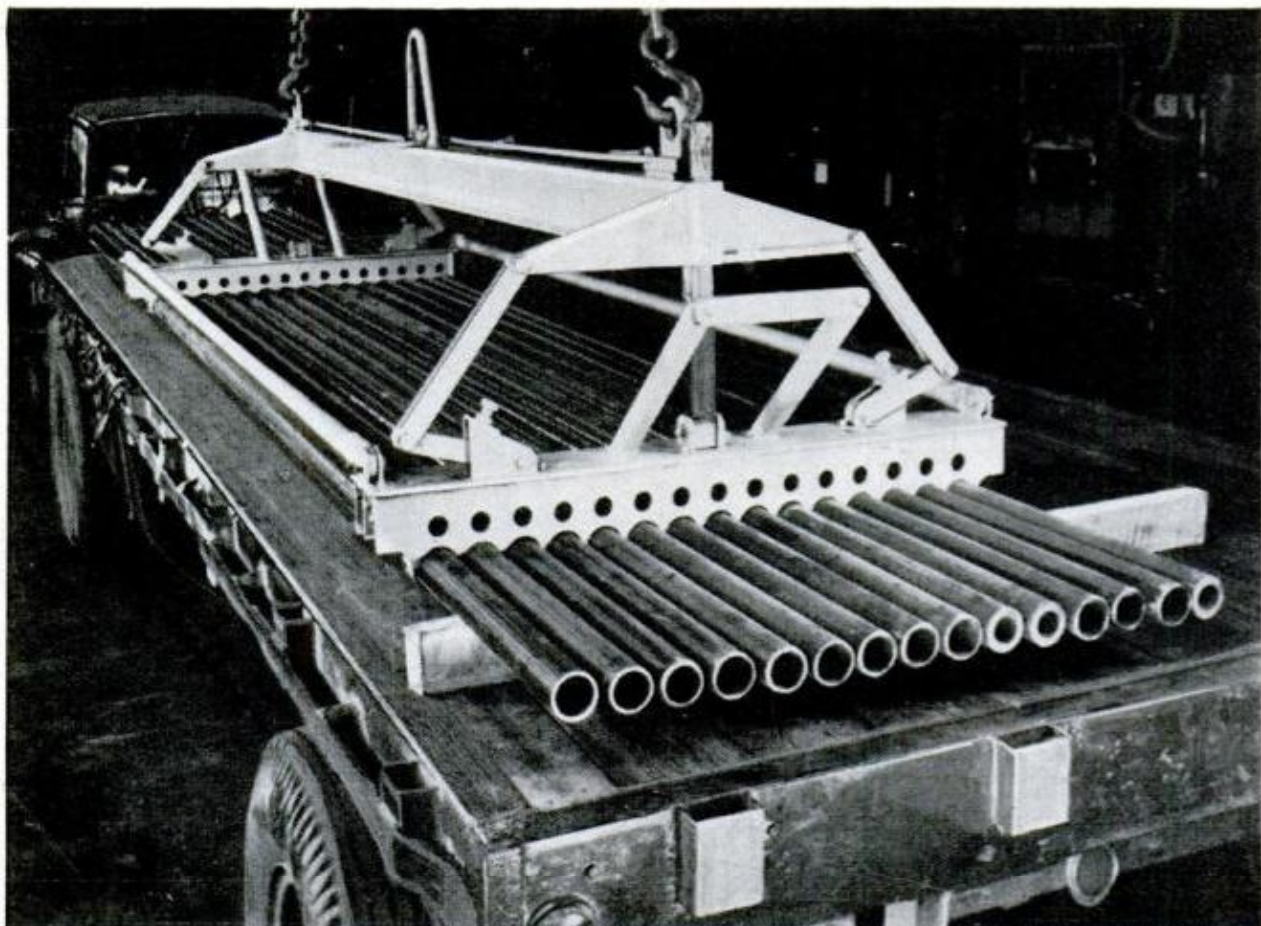
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Clutchless Garden Tractor Is Versatile Yard Helper

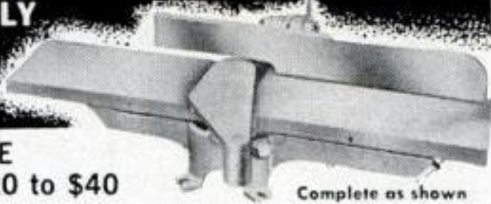
Spraying and light grading are only two of the many yard jobs that can be performed by a garden tractor rigged with a variety of accessories.

The tractor, manufactured by Panzer Products, Inc., Waynesboro, Va., features a clutchless transmission; a lever provides forward or reverse. Powered by a 5 $\frac{3}{4}$ -horsepower engine, the machine has three forward speeds in addition to reverse. All-gear steering gives the vehicle a six-foot turning radius. The machine has an automobile differential and independent rear-wheel brakes.

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MARCH 1961



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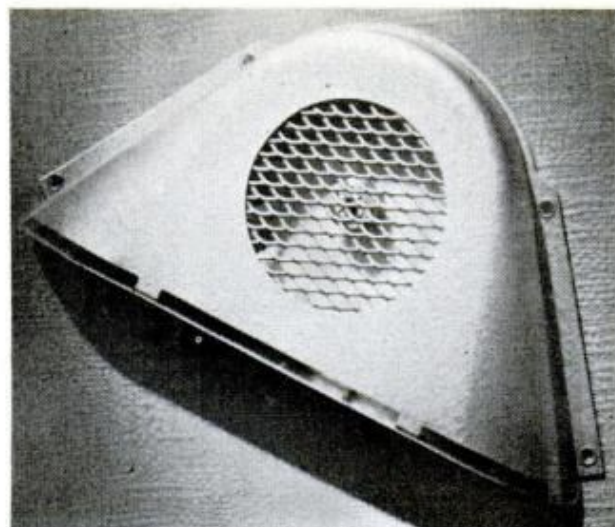
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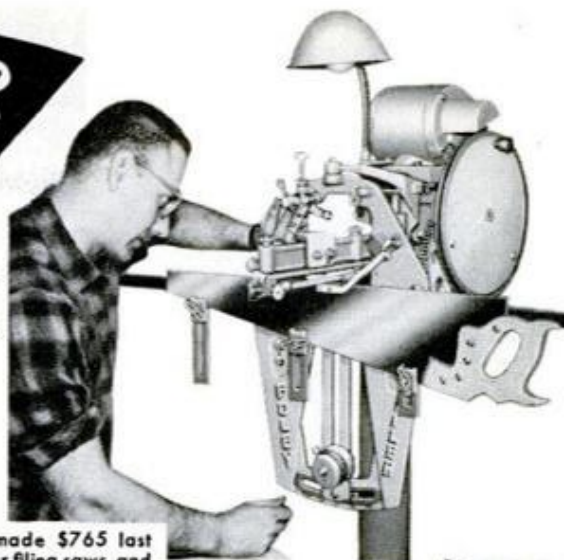
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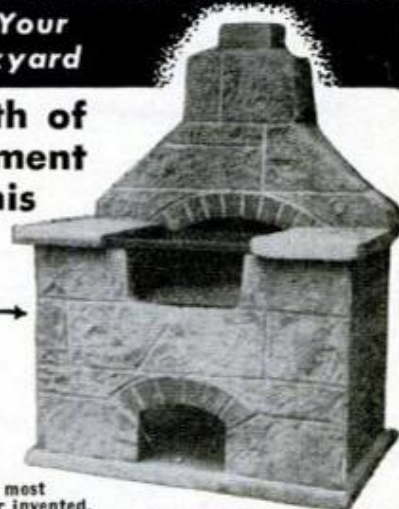


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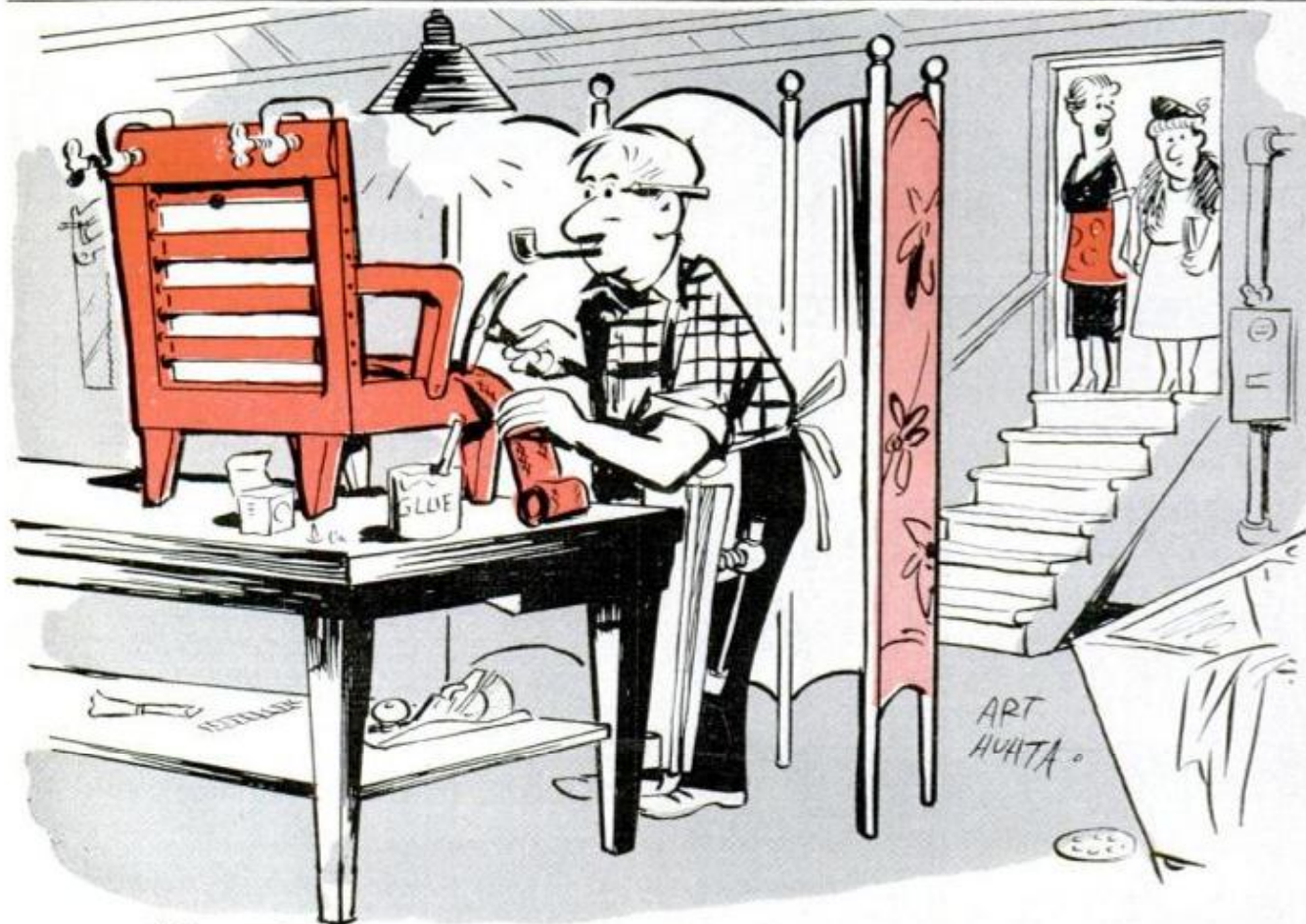
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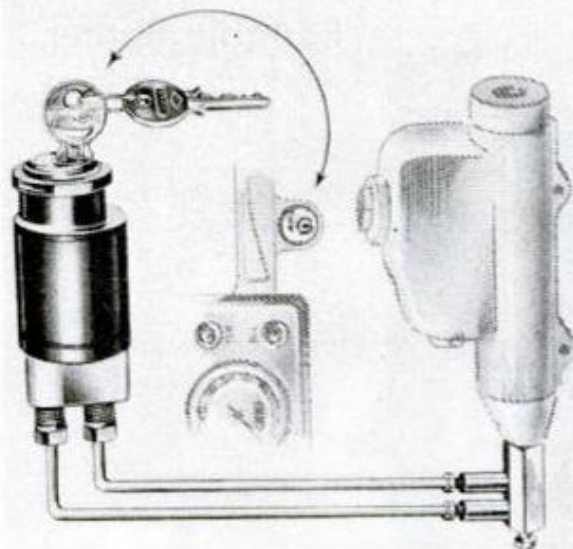
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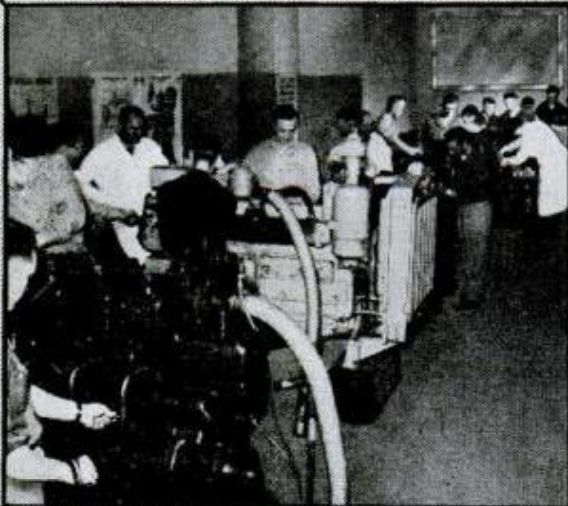


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CRYSTAL Radio kit \$1.00. Amplifier and speaker for same \$6.95. Catalogue. Clearco Crystal Company, 2966 No. 4th, Milwaukee 12 Wisconsin.

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 free. Hi-Fidelity Center, 1797M First Avenue, New York 28, N. Y.

FREE! Giant wholesale catalog on electronics, hi-fi, transistor, scientific hobby, optics, photographic, housewares, jewelry, tools, novelties, toys. Write: Lektron, 241M Everett Ave., Chelsea 50, Mass.

FREE 444-Page 1961 Allied electronics catalog! See products and values available only from Allied. See everything in stereo hi-fi systems and components; latest money-saving build-your-own Knight-Kits; tape recorders; TV accessories; public address systems; world's largest stocks of parts, tubes, transistors, test instruments, tools, books. Only \$2 down on orders up to \$50. Write for value-packed free catalog! Allied Radio, 100 N. Western Ave., Dept. 96-C1, Chicago 80, Ill.

SENSATIONAL Speaker hi fi or stereo. Better than speakers costing hundreds. Plans \$2.00. Glen Ridgway, 9002 East 31st, Independence, Mo.

9 VOLT Rechargeable batteries. Dealers price \$2.19. Toreis, Manvel, Texas.

OPERATE Transistor radios and circuits without batteries. Experimenters, repairmen, anyone can use! Dial voltage needed, up to 15 volts. Plugs into household outlet. Can't be damaged by short circuit! Order battery eliminator \$10.88. Seco, 5015 Penn So., Minneapolis, Minnesota.

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

RADIO Course only \$15.95. Includes all tubes, parts, tools, instructions. Write for full information. Progressive "Edu-Kits" Inc., Dept. 566B, Hewlett, N. Y.

SAVE On Citizens radio. Dealer discounts. Write Promotion Engineering, Box 84, Waseca, Minnesota.

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

ALL Transistor radio. 9 volts. Loud speaker. Built in antenna. Complete with battery and carrying case \$9.95. 9 volt transistor batteries 75c, 3 for \$2.00. Personal pocket radio. Operates lifetime without batteries or electricity. \$3.50. Guaranteed. Darshell Sales, 115 W. Chelton Avenue, Philadelphia 44, Penna.

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AMERICA'S Leading franchise firms are listed in the NFR 1961 Franchise Annual. Use it as your guide to franchise profits. Send one dollar today. National Franchise Reports, DM-528, 333 North Michigan, Chicago 1.

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YOUR Own spare time home-operated business. Take over your area as our service distributor keeping retail stores supplied. Nationally advertised 31-year-old line pays up to \$20.00 hour. Under \$100 for merchandise gets you started. For samples, highly successful plan, write Novo, 3855 Lincoln, Desk C-85, Chicago 13.

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BE Independent, be secure, have your own big money mail order business. Earn \$10,000 and up annually. Start from home. Start small and grow big. We set you up—show you how—guarantee results. You never invest one cent in inventory. All orders shipped for you. Collect cash in advance. Exciting details free. National Mail Order Corp., Dept. E1, P.O. Box 828, Wayne, N. J.

NATURAL Molding rubber, extra thick. Free samples. W. Wooley, 2801-A Latrobe, Peoria, Illinois.

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HOME Business Digest. World's oldest! Make money by mail, part-time, hobbies. Only \$1.00 brings sample copy—plus big bonus offer! Nu-Mart Enterprises, PM Box A, Yuba City, California.

NEW! Plastic laminating machines. Business or hobby. Details. Burr Plastic, 330 East Center, Kalamazoo, Mich.

DOLLARS From dolls. Doll Hospital School, Studio MC-31C, 11826 San Vicente Blvd., Los Angeles 49, Calif.

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LEARN The secrets of repairing junk batteries, profitable, easy, at home. Complete instructions \$3.00. Batteryman, 3465 Forrest, Santa Clara, California.

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RETIRE Now with profits from a tape recorder. Free details: The Davella Recording Company, Spring Arbor, Mich.

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MUSHROOMS In 14 days. "Magic" pre-plant trays, 3 for \$5.25, 6 for \$9. Express charges collect. Free literature. Spawn plus newest manureless growing, marketing, \$1. Luxur, 641 South 19th, Newark 3, N. J.

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

MINK Raising information free. Complete. Lake Superior Mink Farm, Superior, E1, Wisconsin.

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GROW Mushrooms. Cellar, shed and outdoors. Spare, full time, year round. We pay \$4.50 lb. dried. We have 29,000 customers. Free book. Mushrooms Dept.: 173. 2954 Admiral Way, Seattle, Wash.

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\$600.00 PROFIT! Mailing catalogs! Sample, instructions 25¢. GPO, Box 972, New York 1.

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BIG Mail order profits laminating clip-pings, photos, I.D.s, documents, without heat, press, glue. Permanent Seelux instant, self-sealing plastic sheets. Details, generous sample 25¢; \$5.00 value trial only \$1.00. Utility Products, Cincinnati 2, Ohio.

EASY To sell. Get our plastic sign sales kit. Every business a prospect. Interior signs of all types. Top commissions. Write for information. 25¢. Plastisigns, 454 Donovan Road, Kansas City, Kansas.

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

JAPAN: Direct mail-order 26 page catalogue; dolls, novelties, business information, manufacturers' names, addresses, \$1.00; Japan's Trade Directory, 3000 companies, \$3.00. Send cash. Clarence Yamagata, 814 Toginbiru, Marunouchi, Tokyo.

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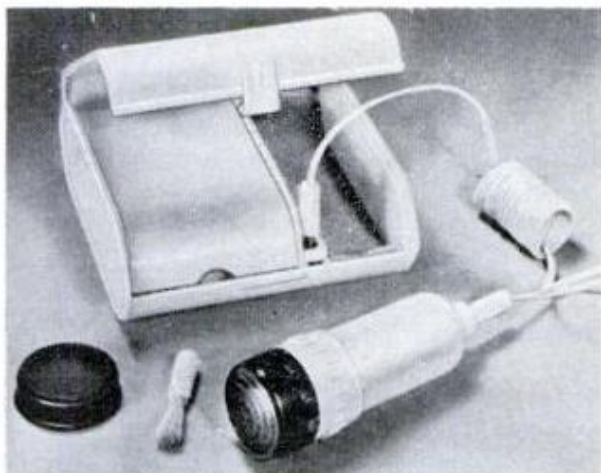
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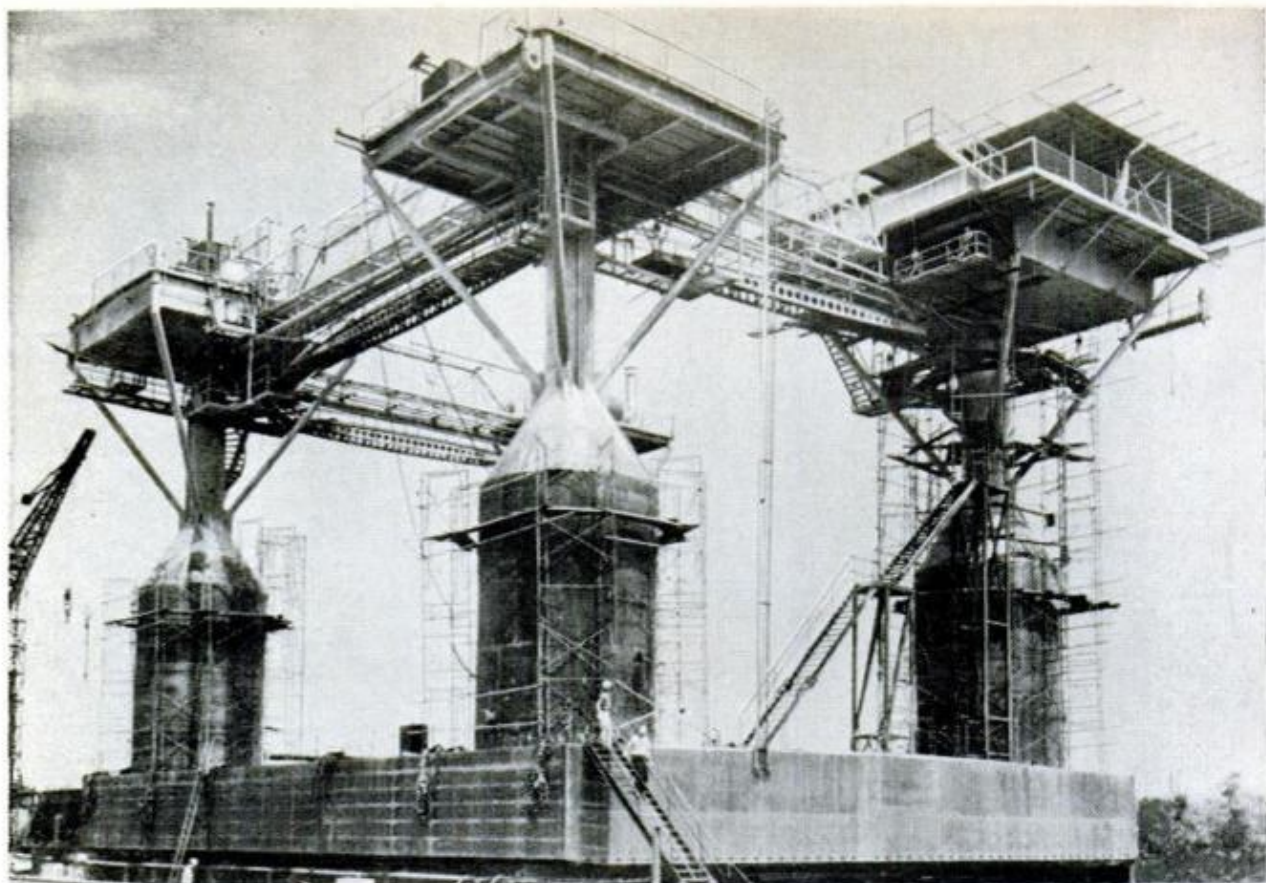
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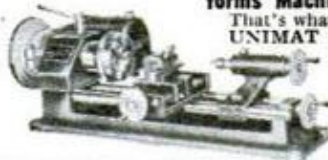
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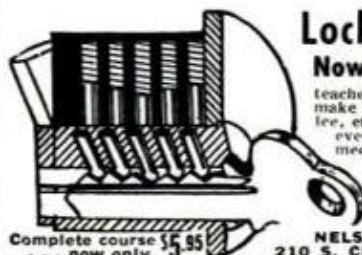
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MARCH 1961

ENGINEERING



U.S. AIR FORCE Photo. Missile headed for outer space. Courtesy of Space Technology Laboratories, Inc.

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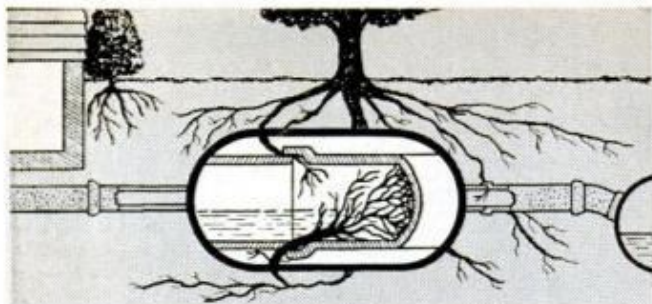
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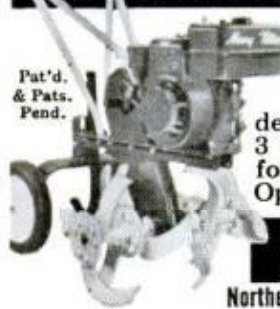


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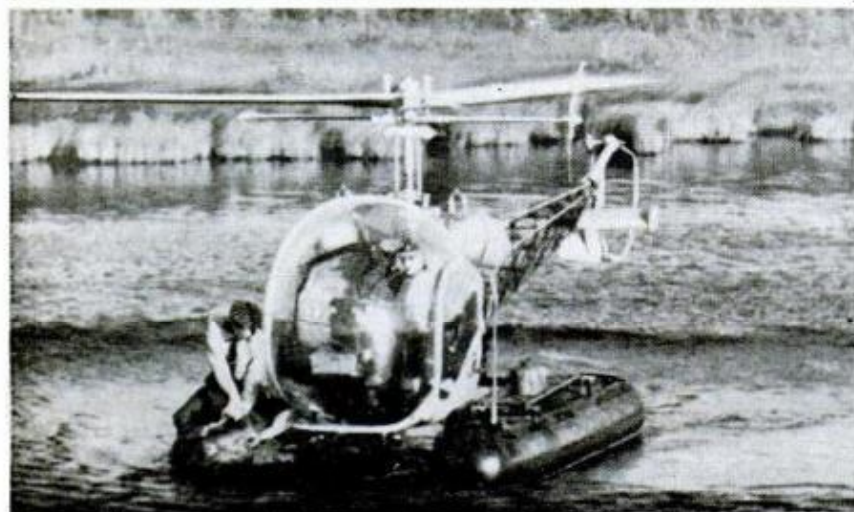


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Moose Taggers Work From 'Copter

Tagging or marking big game for biological study has always been a dangerous, time-consuming and expensive job. One of the toughest problems in that area was the handling of large, evil-tempered, and invariably unwilling moose. But two enterprising Canadian game biologists, D. W. Simkin and E. H. Stone, solved that problem and multiplied their number of tagged animals by using a helicopter. From the air, they find the big animals along lake shores, then herd them with the 'copter into the lake, driving them into deep water. Then, while the beasts are helpless (though they are excellent swimmers), they taxi the chopper in and one man simply leans over the moose's head and clamps a tag on his ear.

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Camera Fits in Ring

Taking pictures is as easy as lifting a finger for 22-year-old Dietrich Cura, a chemist in Hamburg, West Germany. His ring holds a homemade camera that is about a half-inch wide. It takes four pictures on a disk of film the size of a fingernail. The disk is placed in the camera back which Cura turns to expose a quarter of the negative at a time behind a tiny lens. The camera cost about \$1.50 to make. Though it has no view finder, Cura can snap most subjects in focus. Forty-two of its pictures fit on a postage stamp.

	
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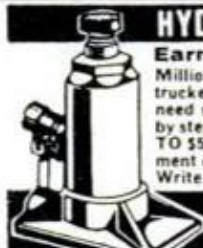
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200 Experts Predict the Future In Aeronautics and Astronautics

Some 200 researchers and engineers in aeronautics and astronautics report that their industries must make many advances during the next few years in order to win the aerospace race with the U.S.S.R. Their report was released by the Aerospace Industries Assn.

Aircraft speeds, they predict, will have to level off at about four times the speed of sound in the atmosphere, due to frictional heat. This speed, however, will allow an airliner to fly between New York and Los Angeles in 51 minutes. Re-entry velocities for missiles will, for a short time, create temperatures as high as 10,000 degrees F.—hot enough to melt a diamond.

Training for space flights will be given increasing attention. Three times the manpower now working to solve problems of human existence under severe environments such as those found in space will be on the job in 1970. The present annual expenditure of \$40,000,000 for simulating conditions in space will be doubled during the same time.

Use of conventional electronic equipment will decline due to the demand in the aerospace industry for micro-miniaturized parts and for molecular electronics.

During the 1960s, these experts say, emphasis will be placed in the 1000 to 10,000-megacycle range of the radio frequency spectrum, due to the need for higher data rates in telemetry and data link.

There will be increasing demands for more precise positioning and tracking of airborne and surface vehicles by means of automatic controls. Course and speeds of vehicles will be transmitted at short intervals to surface traffic monitors where high-speed computers will compare the vehicle's track against the prescribed track and furnish corrective signals as necessary.

Relationships between time and space will be more widely understood. Space buoys orbiting the sun will contain atomic clocks and transmit time signals to supplement electro-optical observation of planetary positions in the star field for accurate interplanetary navigation.

Systems are required to detect and plot submarine traffic over entire ocean areas in order to prevent ICBM attack launched from beneath the sea. The experts say a technological breakthrough in high-altitude submarine detection is urgently needed.

Techniques and equipment will have to be developed for handling and storing radioactive materials, exotic fuels and in processing toxic materials such as beryllium, which is used in space-vehicle construction.

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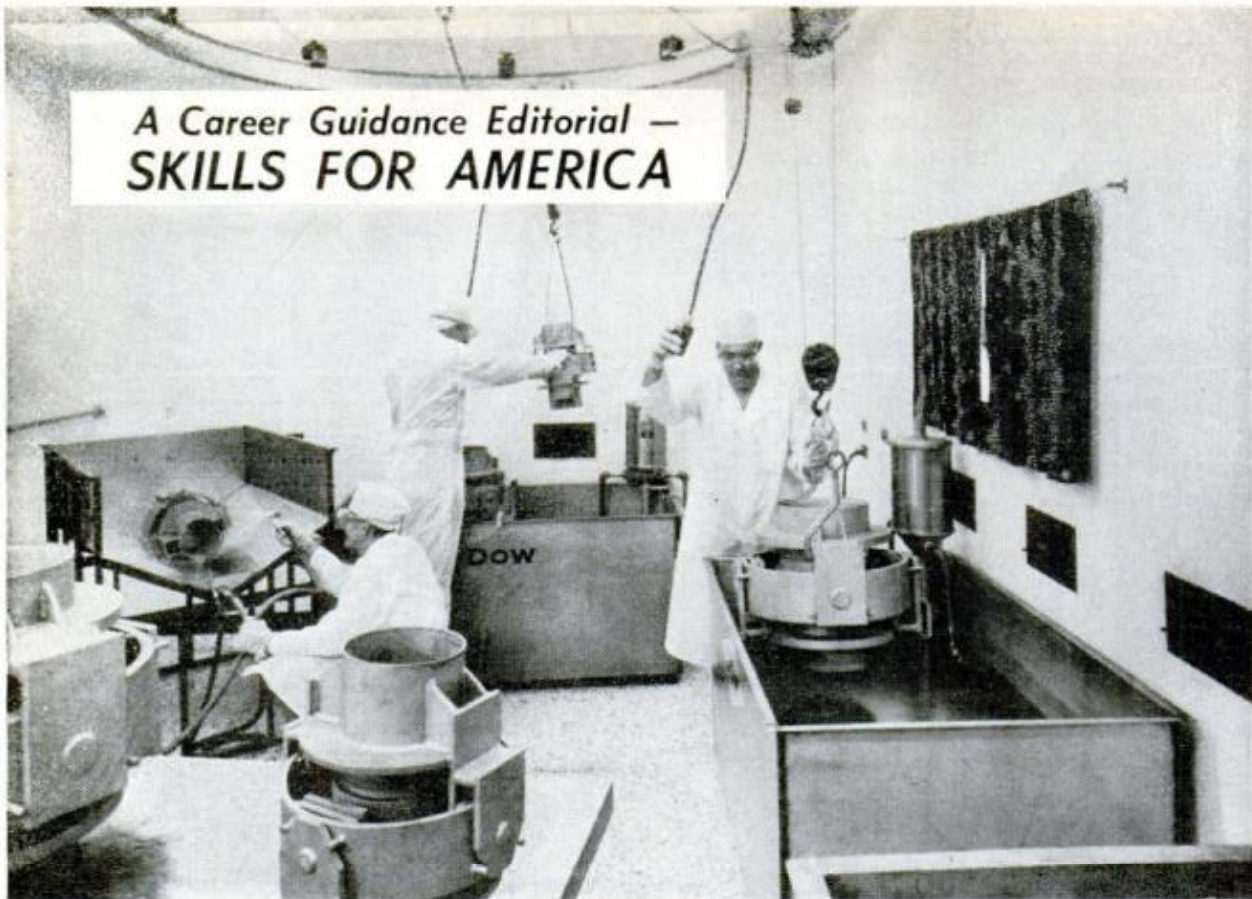
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OPPORTUNITIES IN A

**The aerospace industry—already as many employed as the
gigantic auto industry—engineers, technicians needed**

by Ralph H. Eshelman

Sometime in the next few months the concrete expanse of an isolated launching pad may suddenly erupt with the metallic staccato of a public address voice. No other sign of life is visible as the control officer counts out the last fateful seconds.

Trista ahdeen. Trista dvah. Trista tree—pale! (Three hundred one; three hundred two; three hundred three—fire!)

As the Russian count up ends, a gigantic missile, with an ungainly cylinder poised in its nose, lights up with a shattering roar. It mounts a pillar of flame and, veiled in a crimson cloud, pierces the sky to disappear over the distant Urals.

In a few hours the wire services around the world will be buzzing with excitement. Soviet scientists have blasted a man off into outer space.

To most of us, Russian scientists may seem to grow a little taller with each new spectacular. At the moment they obviously

have a bigger bang in propulsion. Many of their achievements stem from this advantage, American authorities note. But they confess that it will be sometime in 1962 before our Saturn is ready to close the booster gap.

Meanwhile, now that we're fully committed to the space race, there are several questions disturbing thoughtful Americans. Do we have the manpower, or more specifically, the brainpower to win?

A team of experts at the government space center in Huntsville, Ala., is feverishly pushing design and development engineering of big rocket ships such as Saturn and Centaur. By 1962, Centaur should be ready to fire 730 pounds of equipment as far as the moon. By 1964, clusters of Saturn rocket engines may be ready to boost even larger loads far beyond earth's atmosphere.

This is an example of what brainpower is already accomplishing for us.



Chrysler Missile

Compressed air is forced into instrument compartment of missile shell as inspectors and technicians look for leaks

DYNAMIC NEW INDUSTRY

And while the experts at Huntsville are working on our immediate space objectives, a group of youthful Boeing engineers in the northwest coast are busy mapping out a "blue sky" program. They are laying out an engineering blueprint in a series of eight steps: a manned earth satellite; a scientific colony on the moon; a counter-moon satellite observatory; unmanned interplanetary probes far out into the solar system; instrument probes into the deep void of space; and manned planetary exploration.

Such plans are but the beginning. Next step is the "hardware" to convert them into reality. That means a real opportunity and adventure ahead for men who can respond to this kind of pioneering.

There will be engineering jobs of many kinds: design of space vehicles and the equipment to go in them; propulsion engineering, ranging from chemical fuels to the nuclear field, magnetics and even research into plasma—the fourth state of matter.

There will be important jobs for a host of test engineers and many trained technicians. These latter are skilled people who

assist engineers and scientists.

The American Society lists some 22 areas of specialization, ranging from astrodynamics, structures and materials, through physics of atmosphere, human factors engineering and bio-astronautics. In size, the aerospace industry is expanding steadily. Already it employs as many people as the vast automotive industry.

But job requirements are more exacting than those in any other industry. There are and will be few routine jobs, reports the Aerospace Industries Association. Instead, emphasis is on the specialist, from the electronics technician to the astro-physicist.

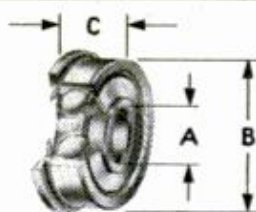
In 1959, the industry employment was 451,000 workers in 30 plants around the country. Those with specialties—in engineering, tooling, research—comprise 65 percent of the total. Only 35 percent of the jobs were in hourly manufacturing work.

So, getting into this field without special education or training may be difficult. There are quite a few doors to try, however. The federal government offers many opportunities, especially the Air Force and Na-

(Continued on page 78)

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tional Aeronautics and Space Administration. Both will play big roles in space developments.

For instance, civilian employees with NASA now number 16,000 and run the spectrum of jobs. Over 5000 engineers, scientists and technicians are on the Von-Braun team at Huntsville. The "blue-sky" research center at Langley, Virginia has another 3000. And almost as many are delving into such fascinating subjects as nuclear propulsion, ion and photon engines at Lewis Propulsion Labs in Cleveland, and other such centers are being expanded.

Monetary rewards are usually greater in private industry than in government service. But there may be a greater personal satisfaction in working on the whole program, rather than developing pieces of the jigsaw puzzle. The top pay in government is about \$20,000 a year, while leading engineers and scientists can command double or triple that in private industry. Technicians and engineers may begin at around \$5000, and wages for experienced people in straight manufacturing jobs are in line with other industries, last year's average being \$110 a week.

These figures underline the emphasis on advanced education. Physical sciences and math are the cornerstones of the new engineering and space science. Electronic computers are taking the drudgery out of handling masses of detail figures, but most engineering developments are preceded by the usual drawing up of designs, testing and failure; laborious redesign. So the demand for trained people, and, especially for those with advanced educations, will zoom. The shortage of such highly-qualified specialists is so great, that once you have a degree, chances are that you can support yourself with a fellowship or research grant while studying for a more advanced degree.

It is possible for you to get into this field without a college degree. Especially so, if you have training or experience in electronics, lab test work, computers, or break into the missile or rocket field while in the Air Force or Navy.

In 1957, for instance, the aerospace industry employed 84,900 engineers and scientists and 594,600 technicians. These technicians do not necessarily need a college degree, but over half the engineers, scientists and technicians working in the specific area of research and development have degrees.

Recently, Dr. George A. Arthur, president of the American Aeronautical Society said: "... much of the predictions for space technology are in the future. We talk of programs in the next 5, 10, 20 years. This all presupposes that we are able to main-

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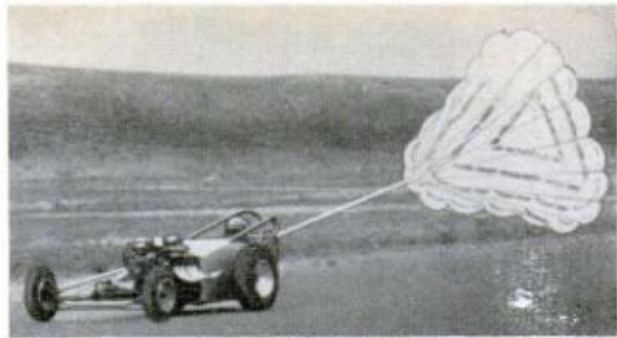


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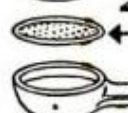
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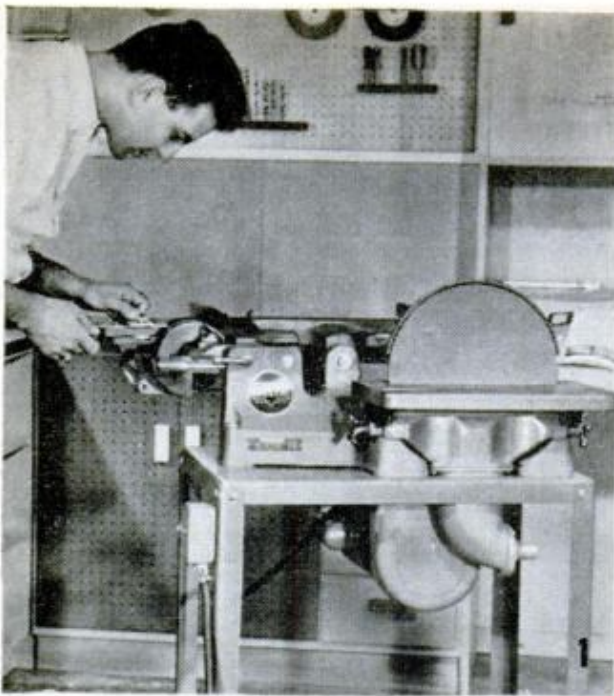
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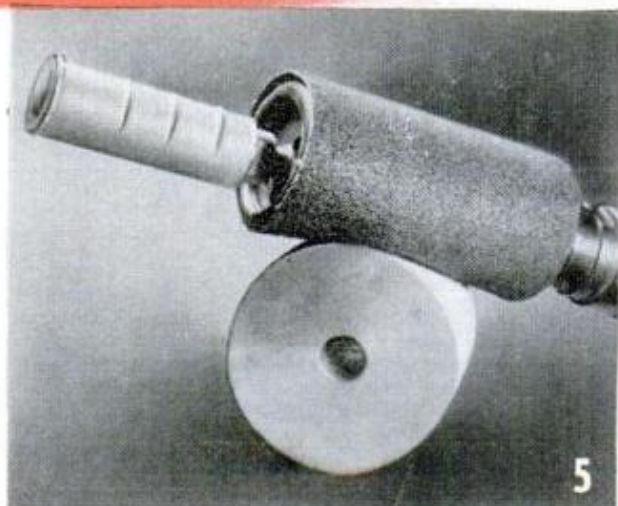
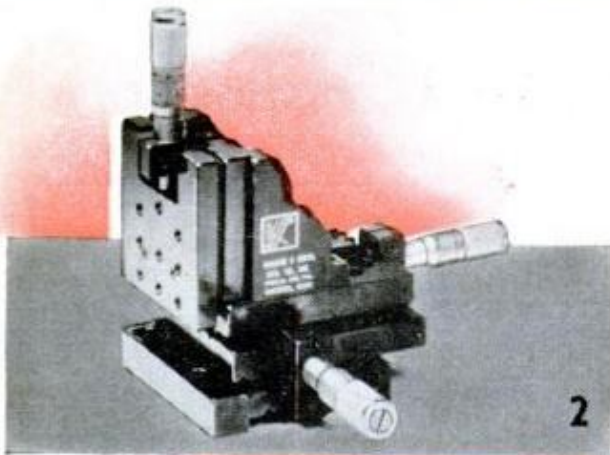
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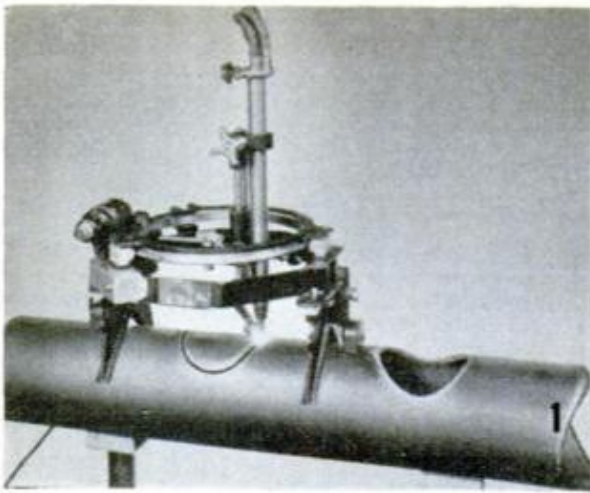
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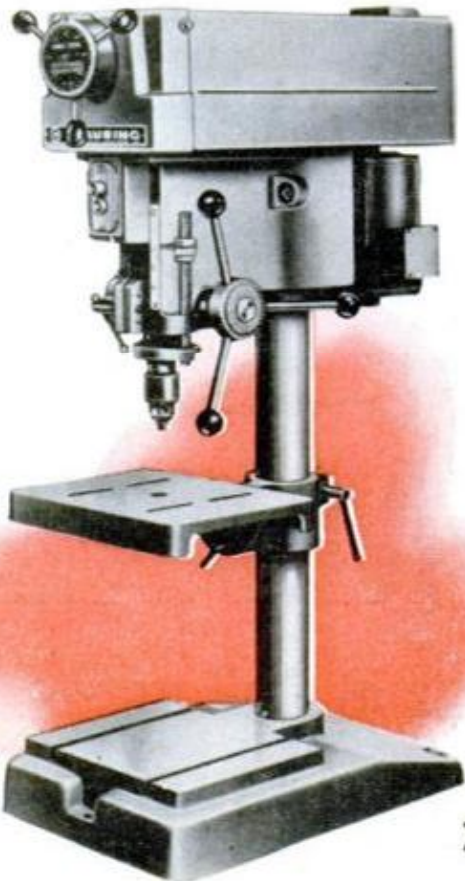
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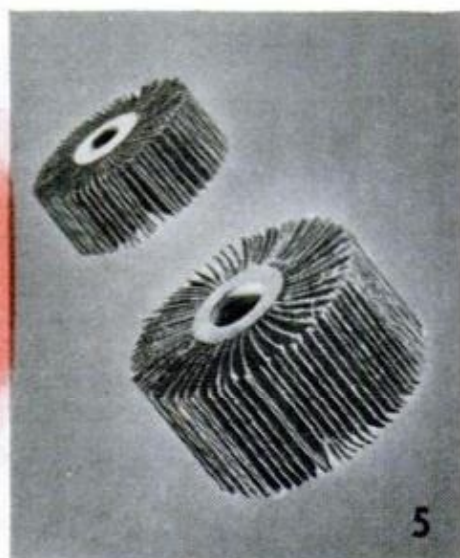
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SHOPPING FOR TOOLS



1

1. DUAL-HEAT SOLDERING GUN has a soldering tip of copper which is iron plated for durability. Has prefocused spotlight to illuminate work in poor light and for working in close quarters. Available individually or as a kit which includes gun, a supply of solder, wire cleaning brush and sturdy case

Weller Electric Corp., 401 Stone's Crossing Rd., Easton, Pa.



2

2. BUILD-IT-YOURSELF KIT becomes a sawhorse, toolbox and tool tray self-contained in one unit. Easily assembled from parts kit which comes cut to size and partially fabricated. Tray is large enough to provide storage for average household hand tools. Can also be used for sewing-room bench

Handyman, P. O. Box 392, Forestville, Calif.

3. HOLE SAW is designed to cut seven hole sizes from 1 to 2½ in. in diameter in wood, metal and plastic. Can be used with portable electric drill, hand brace or drill press. Built-in blade selector assures accuracy in choosing the right blade to cut a hole of the required size. Has automatic ejector

Great Neck Saw Mfr's., Inc., Mineola, N. Y.



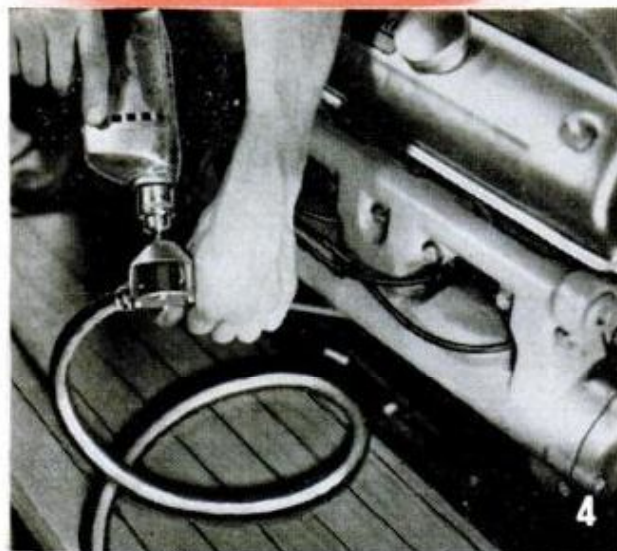
3

4. SELF-PRIMING PUMP is designed to be operated by a small portable electric drill. Pumps oil, water, antifreeze and many other liquids of similar viscosity. Pump chamber, or case, is of molded nylon for high impact resistance and passive reaction to liquids. Plastic bearings require no lubrication

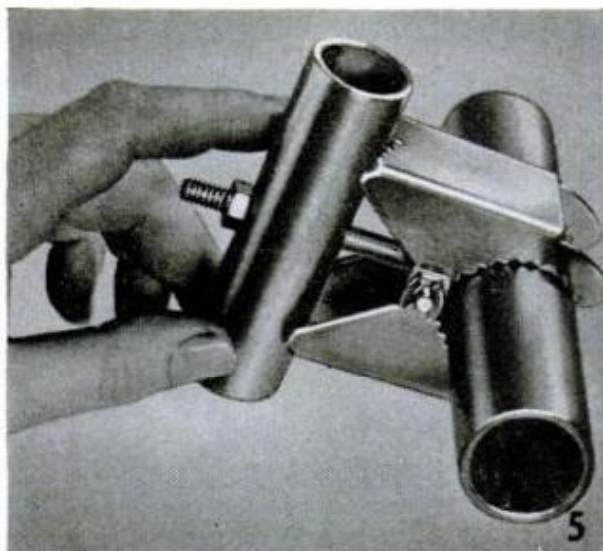
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5. RIGHT-ANGLE TUBE CLAMP holds pipes or tubes of different diameters firmly together at right angles. Useful and timesaving in any application requiring temporary or even permanent assembly of metal tubing or pipe, such as used in display frameworks, sign supports, partitions, lighting fixtures

Hunter Spring Co., Lansdale, Pa.



4



5

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Need a pickup in your business? Here's America's lowest-priced pickup—bar none! \$22 to \$260* less than conventional pickups! Proven gas economy with the 144 Falcon Six engine. Big 7-ft. box carries over ¾-ton payloads!

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FORD DIVISION, Ford Motor Company,

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MUSTANG ENGINES

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Spotlight on the

MERCEDES 190

By Jim Whipple



"WHY DOESN'T somebody build an economical, sensibly-sized family car of top quality that's fun to drive and that will last for years and years?"

If you've ever asked yourself this question, well, I have good news for you—somebody does build a car pretty close to your specifications. That "somebody" is Daimler Benz, a German firm that's been in the auto business since the 1880's, and the car is the current Mercedes Benz Model 190 four-door sedan.

The 190 sells for \$3441, New York P.O.E., and at that price is complete with heater-defroster, sun visors, arm rests, directional signals, horn ring and a clock. In the MB scheme of things there are no "standard" and "deluxe" models. Everything necessary for safety and comfort is on the basic car.

PM's test car had two extras; a reclining mechanism for the right front seat at \$42, and genuine leather upholstery, (and thick leather too!), at \$310 additional. The basic upholstery is a very durable woven fabric.

With an over-all length of 177 inches the MB 190 is a true compact car, two inches longer than Studebaker's Lark and three inches shorter than Falcon.

Wheelbase is 104.3 inches, just two inches shorter than Valiant and 3.7 inches shorter than Rambler and Corvair.

With these closely parallel dimensions, however, similarity comes to an end. When you drive the MB 190 you feel that it is a larger-than-compact car, although certainly not a clumsy one, and that it is a heavier car. (Its 2650 lb. puts it right in the middle of the weight range of the U.S. compacts.)

Probably the big reason for this impres-

(Continued to page 92)

POPULAR MECHANICS

Shock Tunnel Blasts Air to Test Spaceship Shape

In rarefied atmospheres which simulate those believed to be on Mars and Venus, various-shaped model spaceships are being blasted with shock waves—waves of air that travel up to 35 times the speed of sound.

This work is going on at the General Electric Research Laboratory, Schenectady, N. Y., where a tunnel containing two separate test chambers of identical high-speed air flow has begun operation. The two test chambers permit many different types of measurements to be made under identical conditions.

The tunnel is a device for putting a large amount of energy into a quantity of gas. A mixture of hydrogen and oxygen, diluted with varying amounts of helium, is ignited, producing a controlled explosion. This explosion ruptures a stainless-steel diaphragm separating the burning mixture from low pressure air in the rest of the tube. The

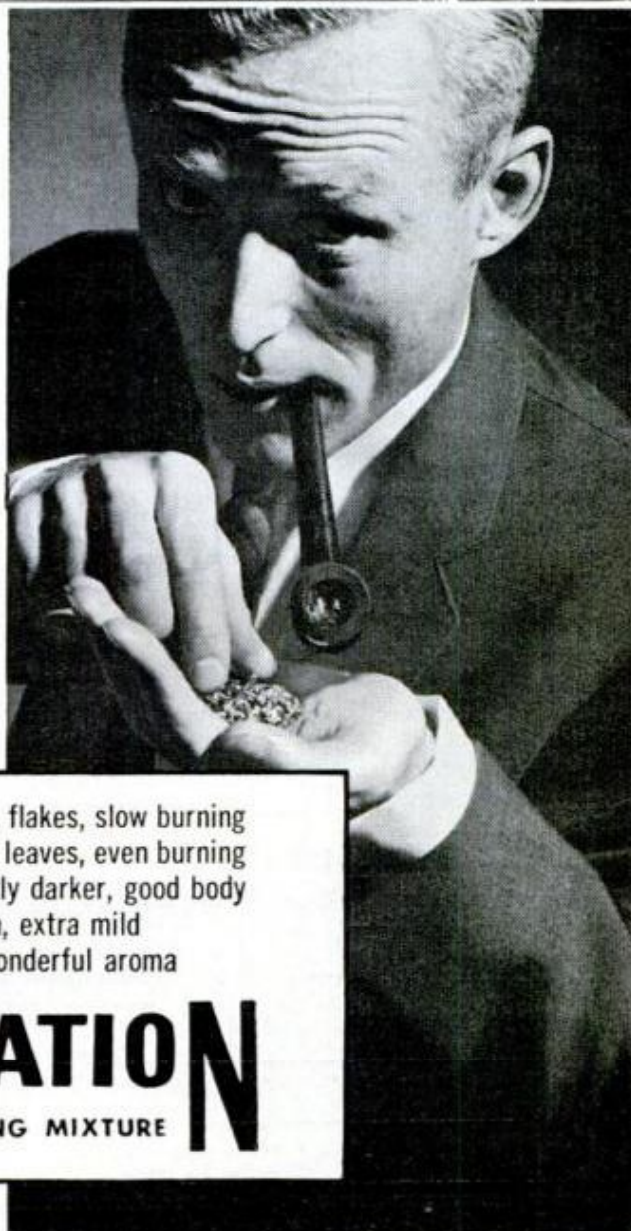
shock produced travels the 100-foot length of the tube and bounces back from the far end. For a few thousandths of a second the air at this end of the tube is compressed to an extremely high pressure and temperature. Two nozzles opening off the end of the tube allow the highly compressed air to expand and flow over the small models being tested.

Dr. Henry T. Nagamatsu, tunnel designer, has made many tests at flows between Mach 20 and 25, and is working in the range of Mach 25 to 35. Research at these speeds is of importance primarily for space vehicles, since Mach 35 is about the speed needed for escape from earth's gravitational field. Even higher speeds, up to Mach 50 in air, are probably attainable in the shock tunnel. In addition to high speed, practically any desired atmospheric conditions can be provided and re-entry into any known atmosphere simulated.

Take a close look at the flakes

IN REVELATION, YOU'LL SEE
FIVE OF THE WORLD'S GREAT TOBACCOS

Notice the different cuts and colors in the flakes? Each one adds its own personality, and when they're all together, a secret recipe does something rare for the flavor. Try it soon and get some new pleasure in your pipe.



Kentucky Burley—dark flakes, slow burning
Virginia Bright—bright leaves, even burning
Old Belt Bright—slightly darker, good body
Latakia—deeper brown, extra mild
Perique—very dark, wonderful aroma

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ELECTRONICS CATALOG**



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Front seat reclines for lounging

sion is that the 190 has a totally solid feeling. Even when on roads so rough that the wheels are bounced off the ground there is no sensation of the body shaking. This car has one of the sturdiest bodies ever put on an automobile.

Doors, hood and rear deck fit perfectly and there are no unsightly gaps between them. A typical Mercedes touch is to machine each door hinge for precise alignment and then equip it with a grease fitting, so that the lubricant can be pumped into the hinge where it will do some good, rather than slopped over the outside.

The 190's front seats are individual, semi-bucket-types with pleated backs and cushions over a firm base. They are designed with driver comfort uppermost in mind. Although they seem a bit firm at first, contrasted with the soft seats of so many American-built cars, after a few hundred miles you begin to realize that the Diamler Benz people know the real secret of comfort—proper support.

The driver's seat has plenty of fore-and-aft travel but could benefit by some device to raise or lower it slightly.

Like the driver's seat, the passenger's adjusts on a fore-and-aft track. As a result, when there are only two or three occupants of the car, the front seat passenger can lower away and create a very comfortable lounge for snoozing.

Driving the 190 is a pleasurable experience for those who enjoy handling a well-engineered and capable machine. I'll grant that the 190 sedan is no sports car, but it has many sports car virtues such as crisp, precise steering, a well-designed suspen-

(Continued to page 94)



DIRTY SLUDGE DID THIS DIRTY WORK: Sludge clogged this oil intake, preventing oil from circulating. Result: engine wear, poor mileage, finally a major overhaul. That's why you . . .

ADD BARDAHL

Unburned carbon, varnish and dirt foul up oil and engine parts. BARDAHL, added to your oil, cleans out this power-robbing sludge. And BARDAHL lubricates like no other oil—won't burn off or squeeze out. Your car runs better . . . gives better mileage. Add BARDAHL every oil change.



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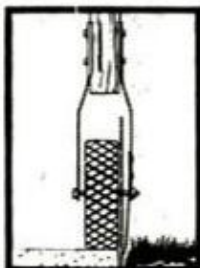
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TOOLS BY WOOD



Here's how to look expert at lawn care without really trying. You push the TRU BLU Edger to turn the rubber-tire drive wheel. It turns the shear wheel to snip off overgrowth along walks, drives, around trees, close to walls. Does neat professional work in minutes. \$5.50 in hardware and garden stores. Other models from \$3.25 to \$6.25.

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WHEELBARROWS • SNOW TOOLS

THE WOOD SHOVEL & TOOL CO., Piqua, O.

sion system that keeps the car solidly on the road, and a smooth, easy-acting column gearshift.

The independent front suspension is mounted as a separate unit on a sub frame which in turn is insulated from the car's main body-frame.

Rear suspension is independent too, with an axle that's pivoted at the differential. The differential is supported from the body frame. Springs are coil all around.

Riding qualities of the 190 are a fine example of the best in European design.

The feeling of total roadworthiness—the combination of precise control, firm stable ride and catlike grip of the road—is hard to describe, because no American car quite has it. It's one of the big reasons why the 190 is well worth a price that's \$1000 to \$1200 higher than that of U.S. compacts.

Four Efficient Cylinders

Another source of pleasure is the 190's four-cylinder engine. With a displacement of only 115 cubic inches, it is smaller than all U.S. compact car engines. Yet thanks to its excellent design—"square" bore and stroke, overhead camshaft, efficient combustion chamber, it delivers 90 horsepower.

Performance is about what can be expected from an engine of this power and a car of this weight. The 190 accelerates to 60 m.p.h. in 16.5 seconds, a faster time than the six-cylinder 101-horsepower Lancer tested by *PM* (Jan. 1961, p. 147) which made it to 60 in 17.4 seconds.

The engine is nearly vibration free and its noise level up to 60 m.p.h. is not bothersome. The MB's engine gets an "A" for cold weather starting; after three days standing outdoors at -10° F., it caught within five seconds.

Cruising speed for the 190 is a comfortable, rock-steady 65 m.p.h. This required a reading of about 73, as the speedometer on the test car proved 10 percent optimistic.

The instrument panel is trim and readable with legible white-on-black dials. A neat touch is a warning light (white) which reminds you that the manual choke is in use.

Gasoline economy is good on the 190, with an average of 19.9 miles per gallon for hard and fast over-the-road driving plus city traffic.

To sum up, the Mercedes Benz 190 sedan is a well-balanced, compact family car with "timeless" styling, high quality (but not plushness), in every detail. It is pleasant to ride in, fun to drive and not too expensive to own. If given proper routine maintenance it should easily provide 10 years or 100,000 miles of prideful ownership. And, as a bonus the 190 will retain a higher market value for a longer time. ★ ★ ★



J. L. Wadleigh says Uniflex Colored Aluminum Coating will add at least another ten years of service to this roof. Uniflex is made by Alcoa Refining Co., Cleveland, Ohio.

Her contractor recommended **UNIFLEX COLORED ALUMINUM ROOF COATING**

Mrs. Frank Arnett, of Snyder, Texas, relies on the advice of Contractor J. L. Wadleigh for maintenance of her property. Last year, after a damaging hail storm, Mr. Wadleigh recommended Uniflex Colored Aluminum Roof Coating, made with ALCOA® Pigments.

Mrs. Arnett had this to say: "The old asphalt composition shingles were in bad shape. I used Uniflex to avoid having to put an entire new roof on my home. I think Uniflex is as good as a new roof . . . actually better than adding the weight of a new one on top of the old . . . and certainly more economical than taking off the old one and replacing it. And appearance is improved. I chose 'Autumn Red,' one of six beautiful shades, and it blended beautifully with the color of my house."

"West Texas weather," said Wadleigh, "is a test for any paint or finish. We have desert-type conditions in the summer. But the real advantage of an aluminum coating is the watertight seal around shingles and other roofing materials—it protects

the roof from blowing rains and high winds. And reflective aluminum reduces attic heat."

Effective in any climate, a good colored aluminum coating like Uniflex stays firm on top, soft and pliant underneath; will not run or crack. It is ideal for built-up composition roofing, asphalt shingles, tar paper, slate. Also seals and protects concrete, cinder block and stucco as well as corrugated steel, sheet metal and weathered, galvanized surfaces. These coatings come ready mixed; require no thinning or heating. Apply with ordinary roofing brush or stiff bristle paint brush.

ALCOA does not make roof coatings, but we will be happy to refer you to reputable manufacturers who do. Send coupon for our booklets.

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AC's superior sealing qualities



positively protect against combustion gas leakage
and engine-damaging pre-ignition

With AC Spark Plugs you get superior gas sealing features that assure longer peak spark plug performance, maximum engine efficiency and economy.

First of all, there is AC's exclusive copper-glass conducting seal that fuses the terminal screw and center electrode to the insulator in a gas-tight bond. Then there is AC's famous shell shrinking process that tightly compresses gaskets placed between the upper and lower shoulders of the insulator to pre-

vent gas leakage between insulator and shell.

Combustion gas leakage causes spark plugs to overheat, resulting in rapid electrode wear, engine-damaging pre-ignition and eventual spark plug destruction. AC Fire-Ring Spark Plugs give you full protection against these dangers—do a better job than ordinary spark plugs using cements or compacted powder seals. Next time your car needs a spark plug change, get top performance and smooth, long-lasting power by getting a new set of ACs.

AC SPARK PLUG  THE ELECTRONICS DIVISION OF GENERAL MOTORS



Fire-Ring spark plugs

They must be the best!

By Joseph N. Bell

PM photos by Joe Fletcher

THEY TRACK DOWN THE HIT-AND-RUNNERS

LAST YEAR one of every 10 Americans involved in half a million traffic accidents ran away from the scene. In a single week recently, New York City had a hit-and-run *death* every day.

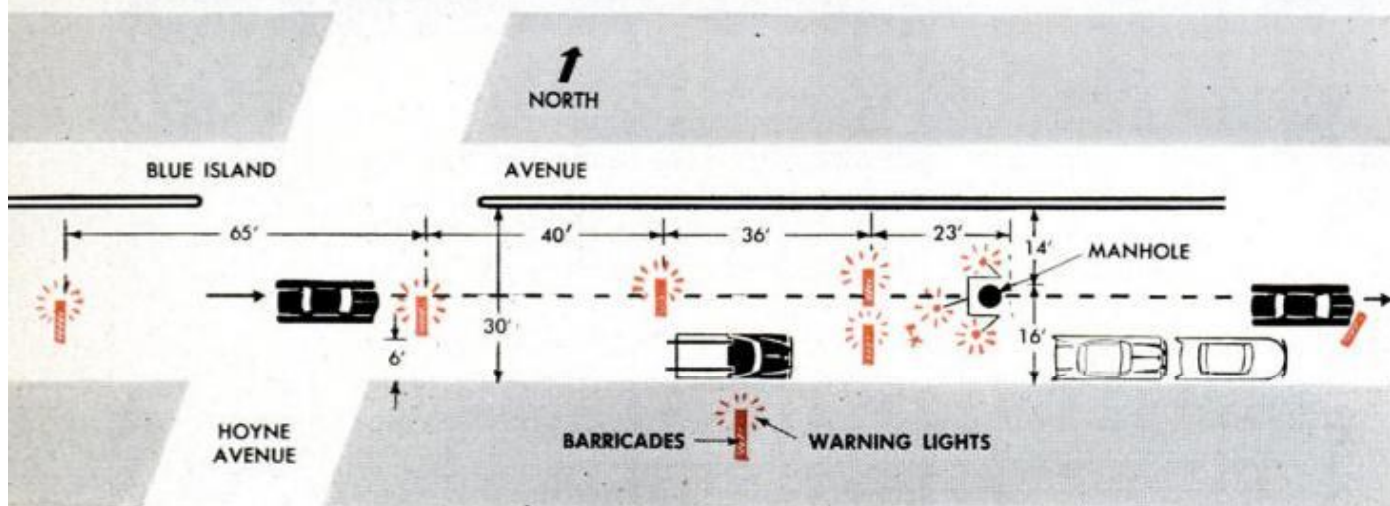
Only one deterrent makes any real sense to the hit-and-runner. That's the danger of being caught and having to pay a much worse penalty than had he stayed to face the music. Recognizing this, police are coming up with more effective methods for apprehending hit-and-run killers. They still have a long way to come—as do our jurists, who persist in letting off too many guilty drivers with a slap on the wrist. But the chances of a hit-and-skip driver getting away with murder now are considerably less than his chances





No bright lights or rubber hoses these days; skilled interrogation by experts like Sgt. Barney Glavin and Lt. Ed Berger proves more effective, as it did in this case

Police reconstruction of the "Conrad" car's path of death. Car plowed through 100 feet of barricades, struck four out of five lighted sawhorses and two warning lights, then it hurtled across the open manhole



Impatient for some lab findings, Officer Jim Clark borrowed his daughter's microscope, ran his own test on paint scraps



were just a few years ago.

Particularly is this true in Chicago, where a hard-working Hit-and-Run Accident Investigating Unit under Lt. Edwin Berger has compiled an outstanding record of tracking down hit-and-runners. Of all criminal cases, few are as difficult to solve as the hit-and-run. It is almost never premeditated, is seldom witnessed, and leaves little in the way of tangible evidence for police, who usually have to pick up a cold trail. Despite this, the crack Chicago Hit-and-Run Unit solved 19 of its 23 cases in 1959.

How? Let's follow a recent fatal hit-and-run case in Chicago and find out. The date is Sunday, March 20, 1960. The weather: cloudy, crisp, with a touch of dampness in the air.

8 a.m.—A slender, dark-haired, middle-aged factory worker whom we'll call John Conrad goes to bed in his second floor flat on the south side after being up all night. Conrad's deaf-mute wife and his three children are getting up for breakfast about the time he turns in.



Carrying the scraps of headlamp lens and chrome trim picked up at the death scene, Officers Joe Neurauter and Tom Ross check with Gus Citron at Illinois Auto Parts to learn the make and model of the killer car

5 p.m.—Conrad arises, eats supper, watches television and consumes three quarts of beer. His family drifts off to bed.

11 p.m.—A nephew of Conrad's—call him Bill Simpson—drops by and suggests they go out for a drink. Conrad agrees. They leave in Conrad's 1957 Dodge Coronet.

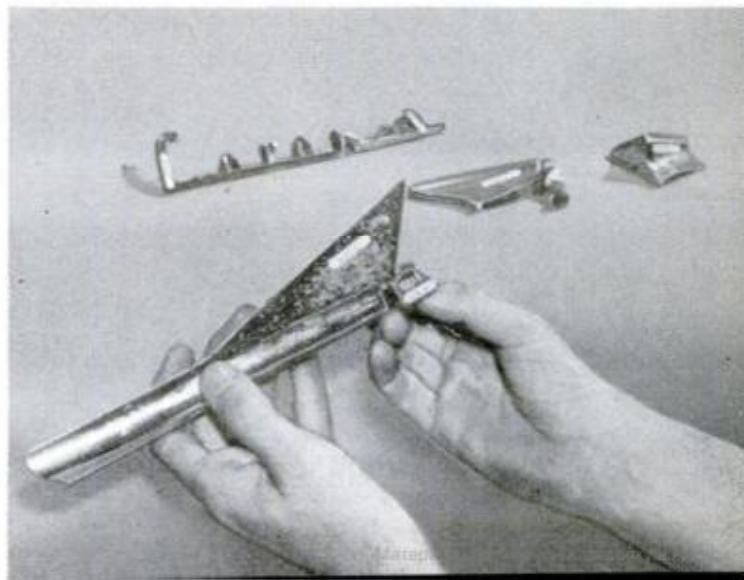
Midnight—Donald Hurto reports for work at the Illinois Bell Telephone Company. Hurto, 26, married and the father of a year-old daughter, is employed as an ap-

prentice cable splicer. Hurto is assigned to a crew splicing the ends of two cables to form one continuous cable so a large south Chicago area can switch from manual to dial operation. The work is taking place underground—beneath a normally busy street, deserted at this hour on Monday.

4 a.m.—In a bar several miles from the Conrad apartment, Simpson and Conrad are shaking dice with the bartender. Conrad, who has been drinking heavily, leaves

Positive identification of the car was made by micro-analyst Claude Hazen in the Chicago Police Crime Lab

Scraps of trim, tagged at the scene of the accident, match the chrome remaining on the Conrad car





Officers Neurauter and Ross found this damaged Coronet amid the automobiles shown on page 97. Wrong car

the other two, weaves to his car and drives away.

4:15 a.m.—Conrad arrives in front of another bar that is still open. He decides not to go in, and pulls away from the curb. After driving around several blocks, he finally turns into Blue Island Avenue.

4:16 a.m.—The single electric bulb lighting the work of Donald Hurto's splicing crew begins to dim. The light—along with a series of six warning lights surrounding the open manhole where the crew is working—is powered by a small gasoline gener-

ator that is apparently running low on fuel. Hurto climbs laboriously out of the manhole and refills the generator's gasoline tank. The task completed, he begins to lower himself once again into the manhole.

4:21 a.m.—Conrad comes careening down Blue Island Avenue. His eyes are heavy, his thinking fuzzed with alcohol, his vision fogged. Dimly he sees lights in the street ahead of him. Then, suddenly, he no longer sees the lights, but feels a series of strange thuds, accompanied by loud noises of metal

(Continued to page 292)

Found—and impounded as evidence—the Conrad car, with the damning scraps of chrome trim taped in place



Thirty-six-year-old Stanley Hiller, Jr., is one of the pioneer helicopter inventors and manufacturers in the U.S. In 1944, he built and flew this country's first aircraft driven by two rotary blades turning in opposite directions. He is president of Hiller Aircraft Corp.



My Most Exciting Moment

By Stanley Hiller, Jr.

IN THE EARLIEST DAYS of helicopters, there were many exciting moments, and since we could not afford the services of a full time test pilot, many of those moments were mine in a very personal way. Our beginnings were in the early 1940s, but the work had all the uncertainty of the Wright brothers' age, conducted often in secluded garages, like ours in Berkeley, Calif.

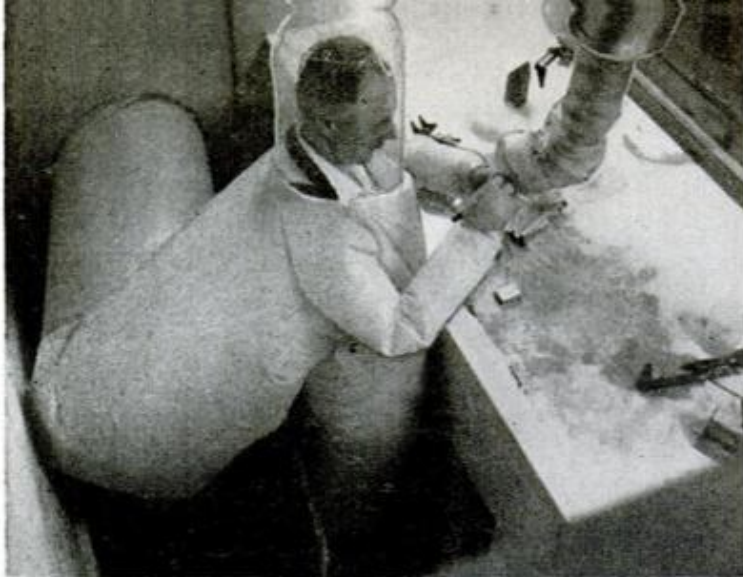
Early test flights were not always contemplated with relish, and although some of them ended in jubilation, a few ended abruptly in a clattering of twisted blades and exploded transmissions.

But first flights (and crashes) are not the most vivid memories. There was a phone call on an evening in 1951 which seemed to be the culmination of all preceding exciting moments. Our small technical group had experimented for nearly 10 years, and had finally accumulated the knowledge and technique to put into production our first salable civilian helicopter, the Hiller 360. And yet, it was painfully clear we could never afford the technical progress necessary to stay alive unless the armed forces accepted the concept of vertical flight, and helped us in its development.

I had spent many hundreds of hours on airliners between our modest new factory in Palo Alto, Calif., and Washington D. C., camping on the doorsteps of the military, trying to convince them of the potential of the helicopter. We had little success. Evaluations following World War II had not been convincing, and some officials stated categorically that helicopters, with their innate weaknesses, could never be practical military vehicles.

That night in 1951, I had returned to my Washington hotel room, exhausted from plodding the corridors of the Pentagon, and I planned to retire early. The phone rang and on the other end of the line was a good friend in the military who had been following our many months of presentations to the Army, Navy and Air Force. He needed only to say, "Stan, I think you've made it."

Many negotiations and reappraisals yet lay ahead, and in the succeeding 10 years we passed through other critical periods in our growth. But from that moment, integration of our aircraft into military service began on a large scale. From that moment I was convinced, for the first time, that we and the helicopter industry were here to stay.



Proper Attire in Atomic-Energy Plant Is Tails

Just getting into work clothes is a big job for some at England's Atomic Energy Authority laboratory at Harwell. Operators who handle radioactive material in sealed cells slip into their pressurized decontamination suits after crawling to them through a long tunnel, the tail of the suit.

The operator slides into the tail, feet

first, through a hole in a door leading to the cell. He puts on the suit lying down. When he stands up the tube is inflated due to the difference in air pressure outside the cell. To get out, he sits down, takes his arms out of the sleeves and crawls out the tail on his back. Air is supplied through the tube.

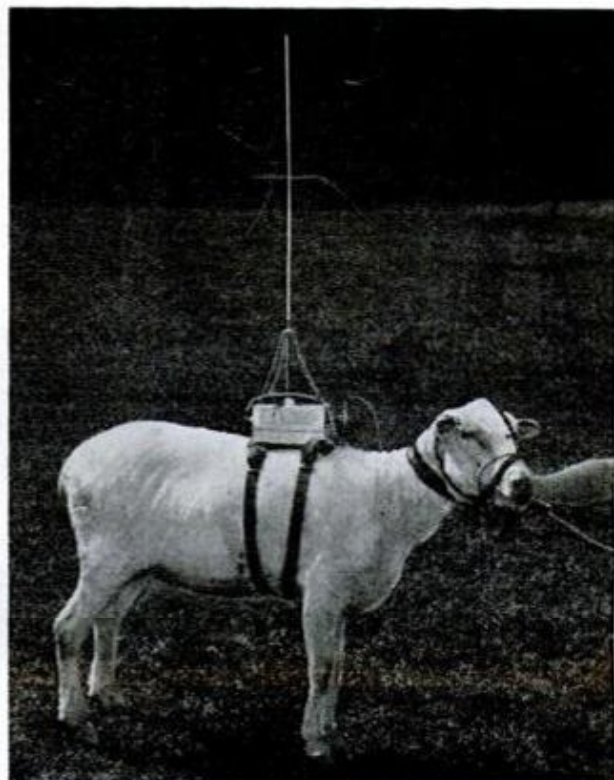
Space Suit for Earth Use

Designed like a space suit to give the wearer a self-contained environment, a new protective suit has numerous applications in industries where hostile environments are encountered by employees. It can be used in handling toxic missile fuels, in chemical processing in areas of poisonous fumes, in fire fighting, mining, and in nuclear plants.



Hey, Bo Beep!

Australian herders don't lose their sheep. They strap a radio transmitter to the back of the hardiest animal in a flock—the one the others follow—and his intermittent *bleep-bleep* signal is pinpointed with a directional finder by the herder. He keeps track of his sheep—there are 120 million in Australia—even though they may be wagging their tails dozens of miles from home.





Navy Sub Spotter With Stinger in Its Tail

First production model of the Navy's new P3V-1 antisubmarine plane is scheduled to start operations this month. Chief feature is a bullet-shaped tail extension which houses MAD (magnetic anomaly detector) equipment capable of detecting metallic objects beneath the ocean surface. Electronic devices for locating submarines will also be

installed in the airliner-size interior. Other features include new wide-vision cockpit windows and circular windows along the fuselage, each allowing 180-degree visibility. Later models will be armed with rockets, torpedoes and depth charges. The prop jet P3V-1, which cruises at 400 miles per hour, resembles the Electra airliner.

Treated Leather Resists Scuffs

Shoes made from leather that has undergone a new treatment are reported to be five times more resistant to scuffs than are those made from ordinary shoe leather. The treatment employs urethane polymers to give the abrasion-resistant quality. An eight-year-old boy wore the shoes below, giving them hard wear for one month. The shoe at left was made from treated leather; the shoe at right was not.



MARCH 1961

Little Gun—Big Punch

Newest piece of portable firepower for the infantry is the Army's 40-mm. grenade launcher, the XM79. Fired from the shoulder, the six-pound launcher throws a six-ounce high-explosive projectile a quarter of a mile, effectively filling the gap between close-range hand grenades and minimum mortar range. The projectile is designed to destroy gun emplacements, bunkers, and troop concentrations.



103



Above, Corvair coupe converted. Bows and side pieces rest on the new vinyl top surrounded by packages of parts comprising the kit



Side frames are salvaged from original top structure and covered with padding. They lock easily in place by means of fittings from kit



Above, inventor Joe Brodowski latches on roof bows prior to stretching vinyl-fabric top over padded framework to complete the job

Below, one person alone can easily snap the top in place for a wind and watertight fit



Build Your Own Convertible

BEHIND THE modest façade of Flip Top Enterprises, at 112 Cass Avenue, Vassar, Michigan, strange transformations take place. The Chevrolet Corvair coupe driven in yesterday, emerges tomorrow—not as a coupe—but as a handsome convertible a few pounds lighter.

The conversion is as easily done on a Corvair 700, Monza or standard 500 coupes. What's more, anyone with a bit of metal-shop experience can do the job himself by purchasing a \$135 kit which includes the finished vinyl-fabric top and all the necessary machined parts.

Conversion begins by welding lengths of 1¼-inch iron pipe under the body sills where they remain well concealed. This makes up for the structural strength which will be lost once the top is removed.

The metal top is then cut off with a power chisel or a hacksaw. The raw edges are covered with rustproof aluminum trim plates and mounting-pin sockets are welded into place.

When the top is cut away, the original main cross member between the coupe door posts is salvaged and becomes the center cross support for the convertible top. A tubular steel rear-support member comes with the kit.

The salvaged side-window and door frame pieces make it possible to lower and raise all the windows. On the 500 coupes, however, the rear windows are fixed.

Complete templates show exactly where to cut the top of the standard coupe and how to attach the fittings that permit the side window frames to be used.

The vinyl-fabric top is fastened in place across the windshield header and at the rear decks by means of a row of closely-spaced snap fasteners.

Of course, you do not get a pushbutton convertible, but it takes only five minutes to put up or take down the top, and its stow-away characteristics leave passenger space unchanged.

"Take-down"-top framework pieces and the folded vinyl fabric store away neatly in the Corvair's luggage compartment



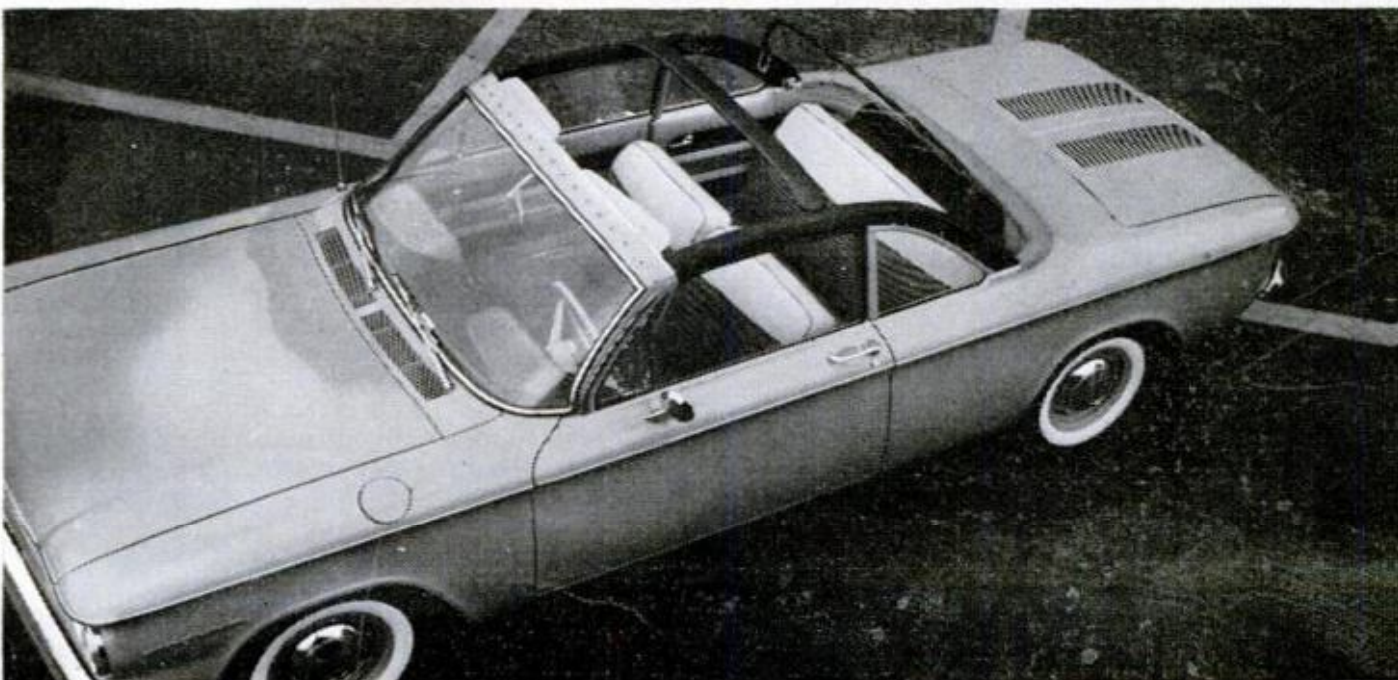


With steel tubing welded under the chassis for added support and rigidity, and side pieces and bows in place with the top snapped on, here's the completed picture—as handsome a convertible as one could want



Clean, uncluttered lines of the Corvair coupe are a natural for convertible treatment—plus the fact that “sports,” like the one above, have the added pleasure of knowing they’re driving hand-crafted models

Bird's-eye view below, minus top, shows original top bows and window frames, padded and in place. Use of original side frames permits all windows to be lowered—keeps them absolutely rattle free when raised





By Jim Whipple



Alternators replace batteries . . . well almost. The moment of truth comes for imported cars

All too seldom do practical improvements in automobiles receive the attention they deserve. A typical real plus feature that's taken for granted is the alternator that replaces conventional d.c. generators on all Chrysler Corporation cars.

This virtually foolproof device was "stunt-tested" recently when engineers drove a Plymouth and a Valiant from Detroit to Chicago without batteries. Once the cars were started and warmed up, the batteries were removed and the cables taped up. Alternator output was enough to run ignition, lights, heater, radio and wipers even with engines idling in traffic.

The point they proved was simply that an alternator-equipped car needs its battery only to turn the engine over. The drain on the battery is therefore greatly reduced and the wearing cycle of constant charge and discharge is cut down. This means that average battery life is tripled. Like Ford's 30,000-mile lubrication, the alternator is another "tremendous trifle" that helps the car owner where he really needs it—in his wallet.

Incidentally, don't expect anyone other than Chrysler to come up with alternators for quite a while. Though Chrysler didn't invent it, the Corporation has covered the device with 17 different patents protecting the design. This prevents other manufacturers from duplicating it at any reasonable cost. (The alternator is available for \$35.) But Chrysler may give other manufacturers a chance at it later.

Reading between the lines while scanning the PM Owners Report questionnaires disclosed that many a compact-car buyer is being boosted into paying the full package price for his car as listed on the Federal sticker.

Meanwhile, on the other side of the showroom, another salesman cheerfully makes a deal and "shaves" the "suggested" price of a full-size model.

This is all quite legal, of course, but once again the practice of charging full price for one car and "discounting" the next via flexible trade-in allowances only serves to confuse, frustrate and annoy the

public as they run around looking for the best "deal."

Often the "best buy" in town turns out to be a real headache because allowance for proper new car preparation or "make ready" has been traded away. Not long afterward, the furious customer, with rattles, squeaks and minor adjustments that the service department never seems able to fix—blames the dealer, when that harassed individual has already "spent" the mechanic's time in the form of that big price reduction handed to the buyer.

A rugged weeding-out process is underway in the imported-car field as sales continue to drop sharply. The total for the first eleven months of 1960 was 466,451 as compared to 559,201 for the comparable period of 1959.

Although sales have dropped from '25 to 40 percent for some makes, Volkswagen has actually climbed from 104,954 in 1959 to 144,472 for the first eleven months of last year.

Mercedes Benz and Volvo also show strength, ranking fourth and fifth in November sales, the highest ranking in their sales history in the U.S. Fiat moved up to third place for the same period.

If a conclusion may be drawn from this, it is that the most suitable, durable cars with the best dealer supports are exhibiting real staying power in the face of the massive competition from U.S. compacts. The "wierdos"—those cars really not appealing to anyone but the novelty seekers, are fading away.

Among the probable victims, however, are some good little cars that are simply not properly merchandised, advertised or backed by a strong enough dealer organization. We'll be sorry to see them go, but then, that's the way the fender crumples.

There may be good news ahead for compact owners. Firestone has announced the development of a two-ply tire for compact cars in the not-too-distant future. The advantages are lighter weight and somewhat softer riding qualities. Nobody mentioned it, but we might also hope for lower costs.

★ ★ ★

The Medicine Is Neutrons

. . . in this unique hospital, where an atomic reactor is used to research, diagnose and treat disease

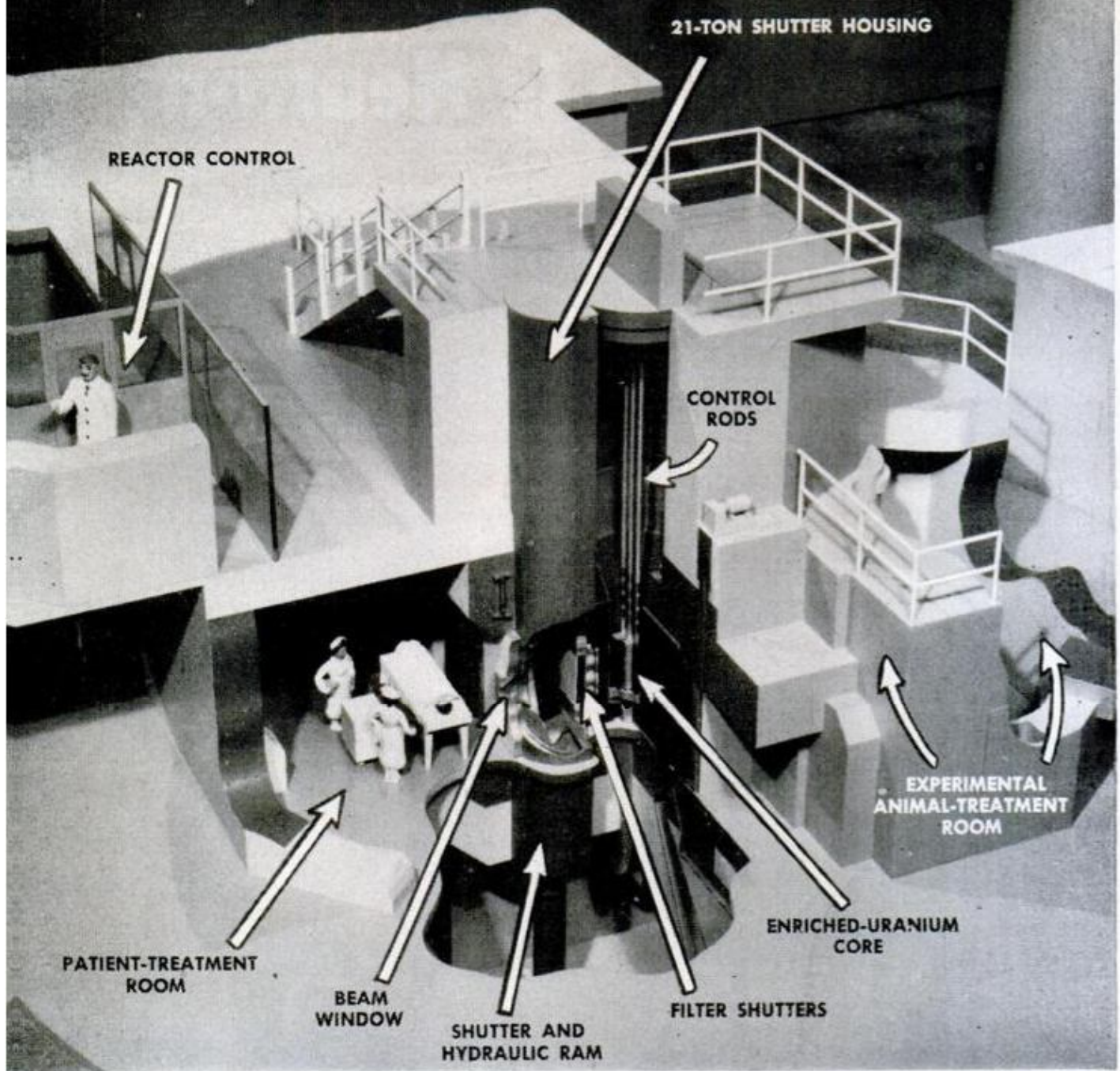
By Richard F. Dempewolff

EVEN IN THE PATIENTS' AREA of the new medical center at Brookhaven National Laboratory in Upton, L. I., a visitor senses instantly that this is no ordinary hospital. Each room is a pie-shaped wedge on the periphery of a circular structure 72 feet across. Each door opens onto a central pavilion. In the center of this area is a circular chest-high counter. Behind it you will usually find three or four nurses on duty. From this focal point a single nurse can, if necessary, see every one of the 12 patients in her pavilion through the doors that surround her. Also, a special call system permits two-way conversation between any patient and the nurse's station.

Four such pavilions sit at the ends of corridors like lollipops on sticks, roughly forming a figure "H" if viewed from the air. They are connected by a maze of passageways to a sprawling

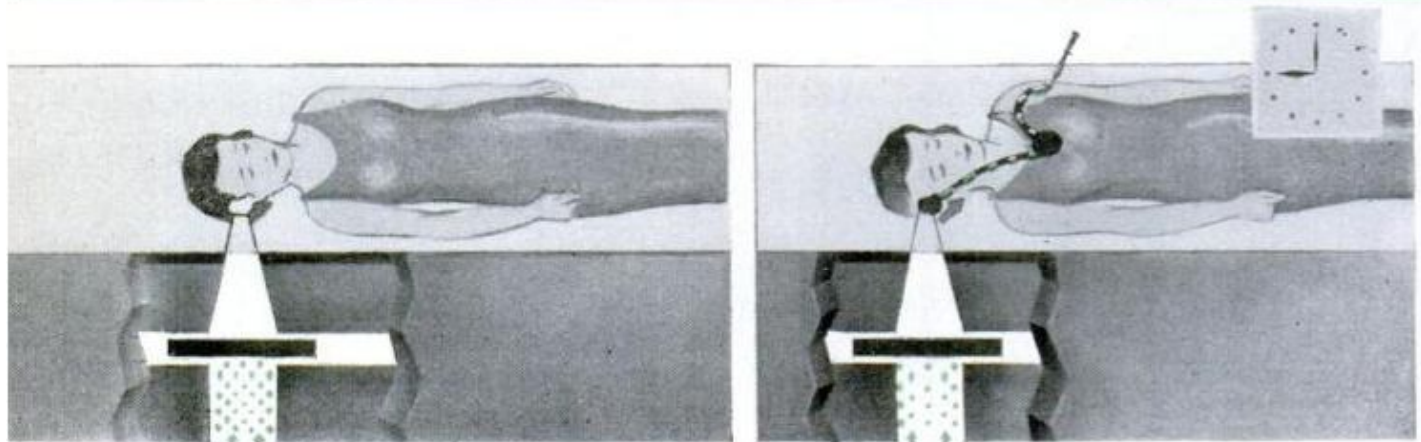
GEIGER COUNTER measures radiation in thyroid gland of cancer patient who has been given radioactive iodine

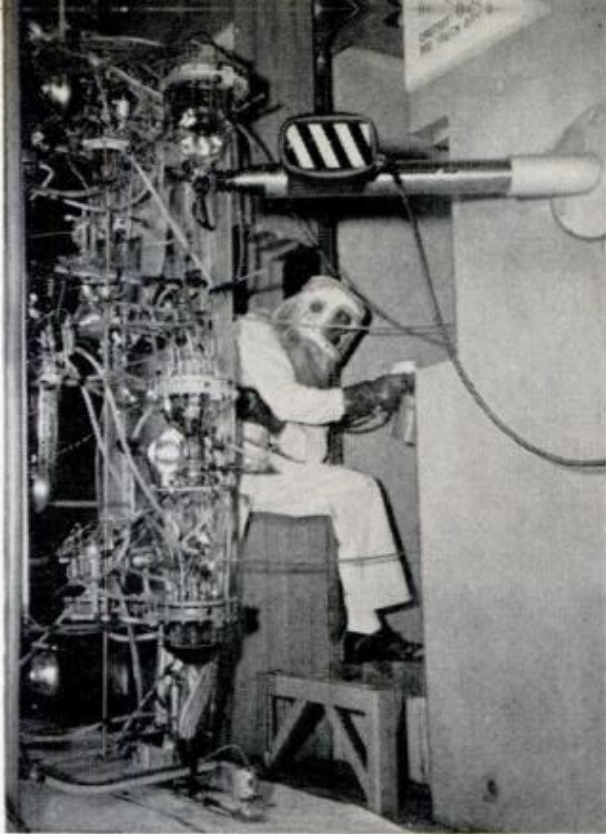




CUTAWAY MODEL of reactor area where uranium is used to treat patients and conduct experiments on animals

SEQUENCE SHOWS neutron-capture therapy. Patient with brain tumor is positioned so beam will penetrate precise area of growth. Injection of boron compound goes through blood stream to tumor, which attracts it





IN BROOKHAVEN'S "hot labs," short-life isotopes are made for diagnosis and treatment of disease. After test sample (right) is inserted in "rabbit" and irradiated, it must be handled by long tongs or gloves

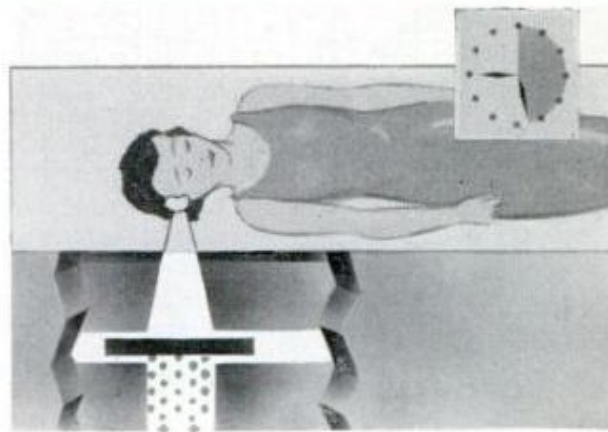
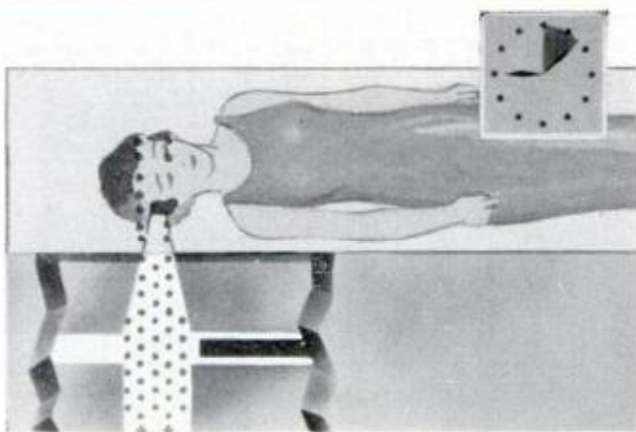
acre-and-a-half honeycomb of laboratories, offices and libraries. Here, a visitor prowls past frosty "cold rooms," constant-temperature and controlled-humidity vaults, rooms bristling with strange instruments and mechanical devices resembling transparent people, miniature menageries of dogs, rabbits and other animals in cages and pens. Door signs along the way are the tip-off to what goes on here: "Hot Area—Keep Out"; "Isotope Receiving, Preparation, Administration"; "In-Vivo Counting Room"; "Decontamination Suite."

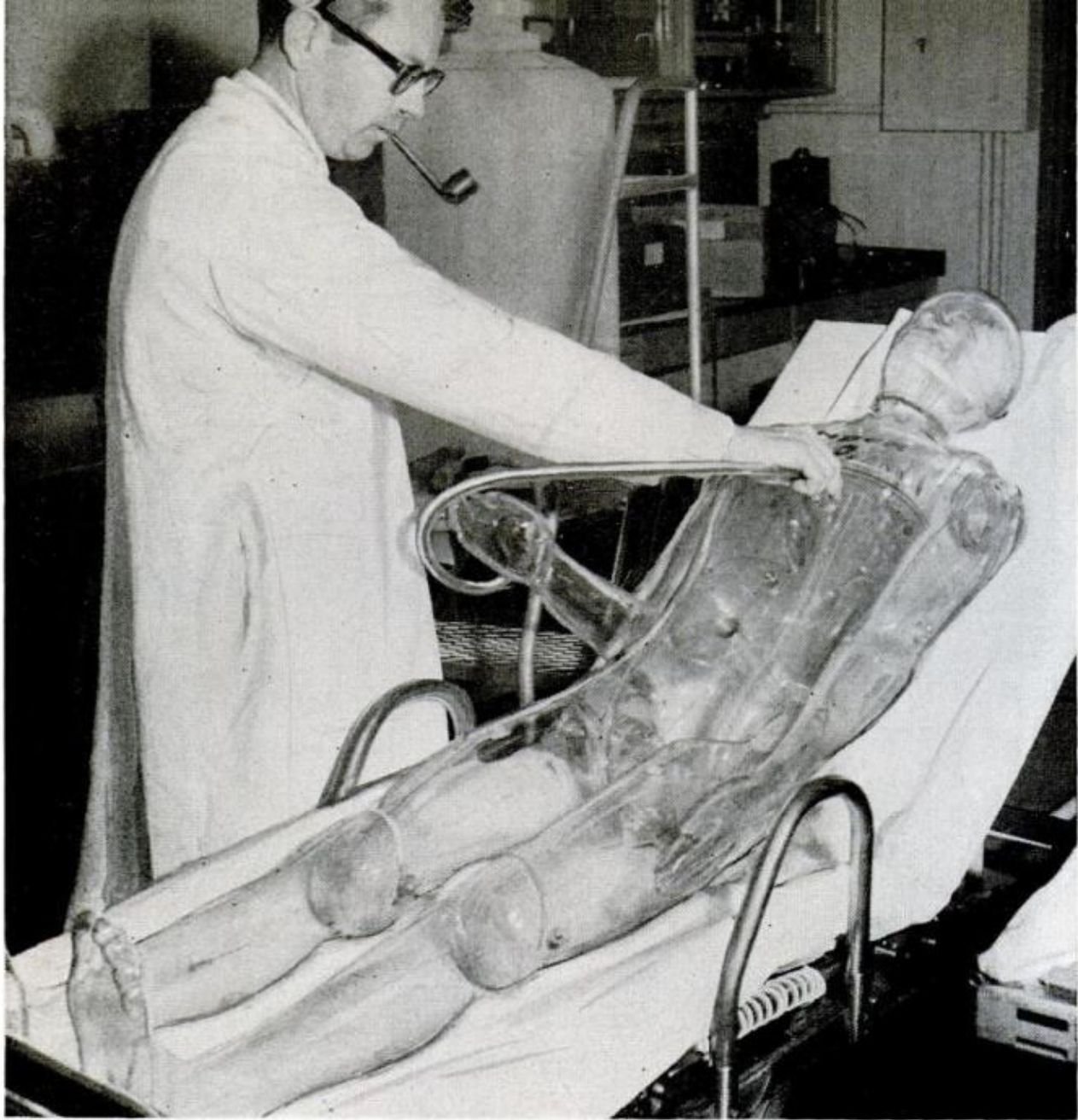
But the real heart of this new \$6,500,000 hospital-of-tomorrow lies inside a giant steel drum that looks like a fugitive from a fuel-tank farm. The gleaming, windowless building, 60 feet in diameter and 54 feet high, is connected by airlock passage-

ways to the rest of the medical complex. It houses the world's first medical reactor—a unique atomic pile. According to Dr. E. E. Stickley, physicist engineer with the laboratory's medical department, "Every salient aspect of the engineering and design of this device was considered in relation to its use in the study of man and his diseases."

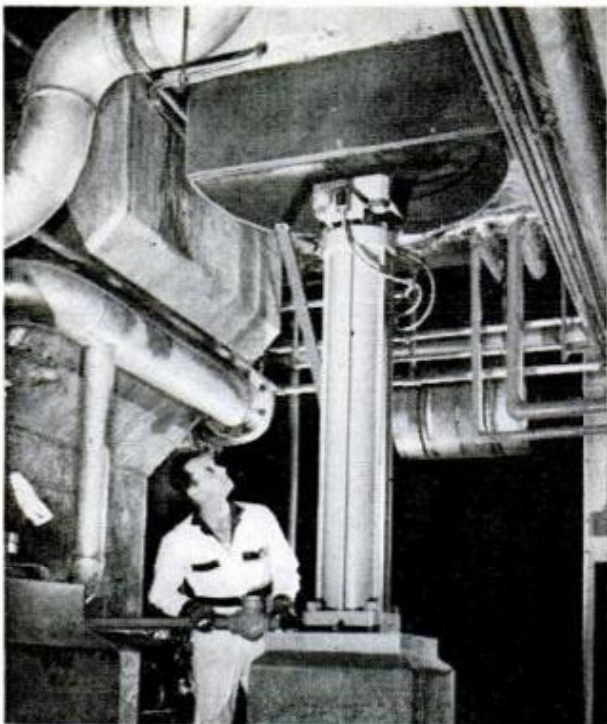
Unlike the gigantic block of concrete that characterizes the exterior of most big reactors, this one, known locally as "the MRR" (for medical research reactor), has a cluster of roomy vaults huddled close to its hot core of enriched uranium. On two opposite faces, encased in thick shielding walls of dense concrete, are the irradiation treatment rooms—one for patients, one for experimental animals. In each vault, a

SHUTTER RELEASES neutrons which bombard boron. Boron particles penetrate surrounding cancerous cells, destroying them without damage to healthy cells. Therapy is over in minutes, but preparation took days



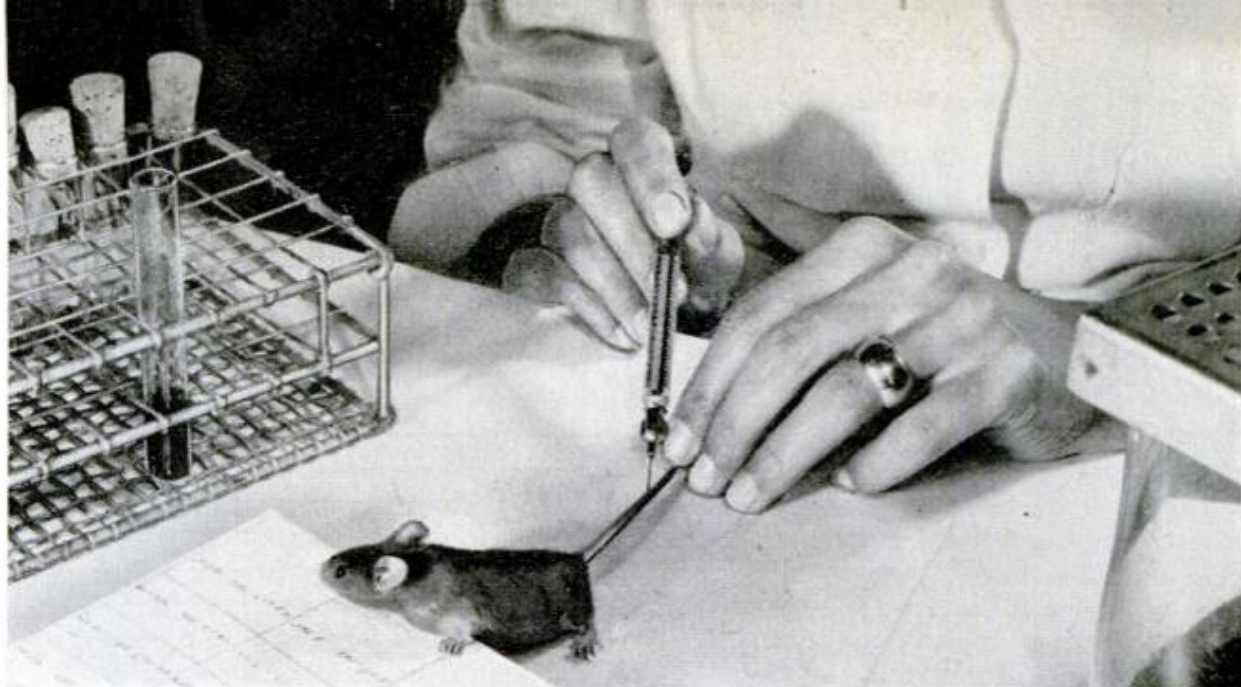


▲ **TRANSPARENT "PATIENTS"** used in rehearsals are built in human form with hollow internal organs which, when filled with solutions, simulate living tissue



← **IN BASEMENT** of reactor building are huge hydraulic jacks which, in three seconds, can open or close 21-ton shutters covering openings to uranium core

AERIAL VIEW of Brookhaven shows "lollipop" → shaped nursing units (right) near hospital service area. Tall circular structure (top, left) is the reactor



MOUSE IS INJECTED with blood plasma from rat exposed to radiation in experiment on radiation sickness

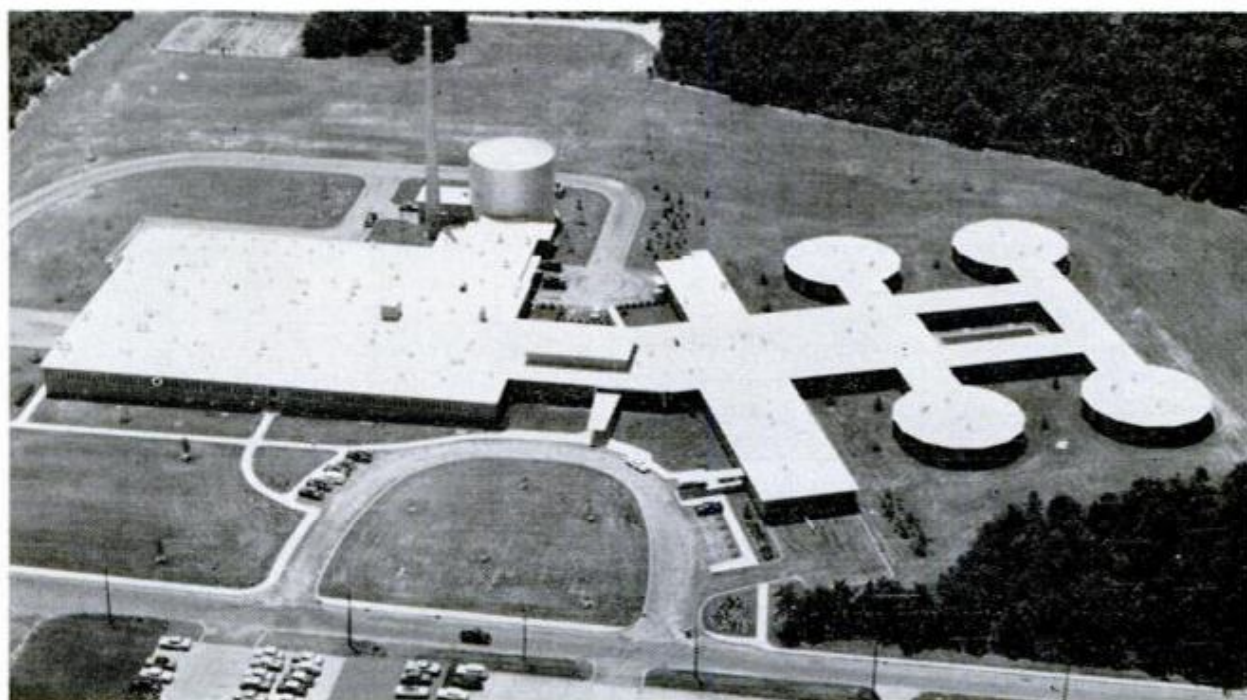
port in the reactor-shielding wall is located so that a patient or laboratory animal on a wheeled table is lined up with it at precisely the right height. Through these holes streams of neutrons from the core pass through the heavy concrete into the treatment rooms. The powerful beams are unleashed or chopped off by a pair of massive 21-ton "shutters" that slide up and down through shafts in the shielding wall.

A third face of the reactor is equipped with a cave known as the "wide-beam cell" embedded in the shielding wall. Here, large objects, and entire animals, can be subjected to the complete gamut of reactor radiations. "By using curtains and filters of various substances in the neutron port," explains Dr. Stickley, "we can convert the beam into different radiations."

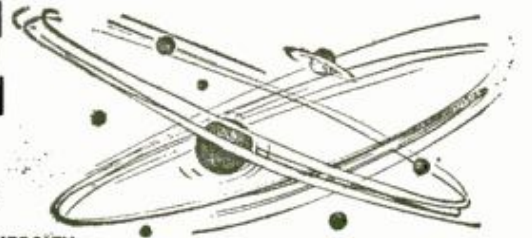
On the reactor's fourth face are the "rabbit holes" — channels like dutch ovens — leading into the core. Here, while a patient lies waiting in the treatment room, doctors can irradiate small samples of material to make short-life radioisotopes for instant use. Similar channels open into the treatment rooms. "There is no reason," says Stickley, "why we can't install moving belts that will carry chemicals through the pile from the rabbit holes on the outside wall to the ports in the treatment rooms. If we can work fast enough, it may be possible to use isotopes with a half-life so short that they'll give up radiation to the first organ to which they are piped."

Ever since the turn of the century, scientists have known that radiations from

(Continued to page 283)



AN EYE ON SPACE



By **Dr. Dan Q. Posin**

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

THE CANALS AND MOONS of Mars may be manmade.

To solve the canal puzzle it is possible to put telescopes above the Earth's atmosphere in an Earth satellite. The telescopes would have to be of considerable power, and the satellites of a high degree of stabilization. Also needed is a sensitive aligning system and a radio transmission installation.

However, to solve the problem of the Martian moons, a space-device has to be fired to the vicinity of Mars—a Mars probe. This probe must contain a camera adapted to a telescope, and also a rather intricate TV transmitter. Needless to say, the televising of views from the region of Mars, some 40 or 50 million miles away, is not a simple task; but it can be done. The principal item of equipment on the probe would be a paraboloidal transmitting antenna (like an automobile headlight) which would be constantly pointing toward Earth. Such an antenna of aluminized plastic would go up folded, but would inflate in space to a diameter of about 40 feet. It would be able to form and transmit detailed views of Mars and its moons.

But a more breath-taking space device to Mars will be an actual spaceship carrying Earthlings to Mars. An eight-man spaceship is within the capabilities of today's science and engineering. In fact, a design has been worked out by the Boeing engineer, Philip Bono, who showed that everything depends on the development of one engine type, a special 1½-million-pound thrust engine, using hydrogen and oxygen as propellant. A total of seven such engines would be needed for all three Earth-escape stages. The spaceship would be 248 feet tall and 82 feet wide, with a launch weight of 8,300,000 pounds. This spaceship would contain a huge 80,000-pound pay load, including about four tons of exploratory equipment and a two-ton land vehicle for touring Mars.

The spaceship could lift itself nonstop to Mars. There is no need for assembling the ship at an orbiting space station. With the coming of powerful fuels and engines, space stations are fast losing their appeal.

As the giant spaceship nears Mars, a cluster of four 20,000-pound reverse-thrust engines would fire to slow the ship down. These engines would also be needed on the return trip to Earth.

The journey to Mars, mostly a coasting operation, would take 259 days. The time to launch a coasting spaceship to Mars is the first few days of May, 1971. If this is done, the relative positions of Earth and Mars will permit a launch and coast to occur in such a way that 259 days later the spaceship will snuggle up to Mars, matching its speed in space with a few fuel-burning maneuvers. At landing time, moreover, in January, 1972, Mars will be close to the Sun, and so its temperatures will be fairly pleasant.

The explorers will have to remain on Mars 479 days until it again is in proper space relation to Earth for the economical launch-and-coast journey. Another 259 days would bring the travelers back to Earth. The spaceship would carry its own launching platform for leaving Mars, devised from the landing glider.

Millions of dollars, years of work, risk and suffering, are all part of the project. But think of the moment when the Earthlings land on Mars and look upon its canals, then gaze upward and divine the nature of the Martian moons. Did someone put them there? What sort of being inhabit, or may once have inhabited, that world of Mars? ★ ★ ★

More Horses Per Gallon?



A PM editor checked the characteristics of a new gas supplement in hundreds of miles of driving, by instrument tests, and through interviews. You'll be surprised at his conclusions.

By Thomas E. Stimson, Jr.

ONE MORNING recently I poured two ounces of a red fluid into the fuel tank of my '61 Buick LeSabre, filled up with premium gasoline and left Los Angeles for San Diego. This was to be the second of two round trips, at the same road speeds and with the same traffic and weather.

What I was doing was checking on some enthusiastic reports I had heard about a new fuel supplement.

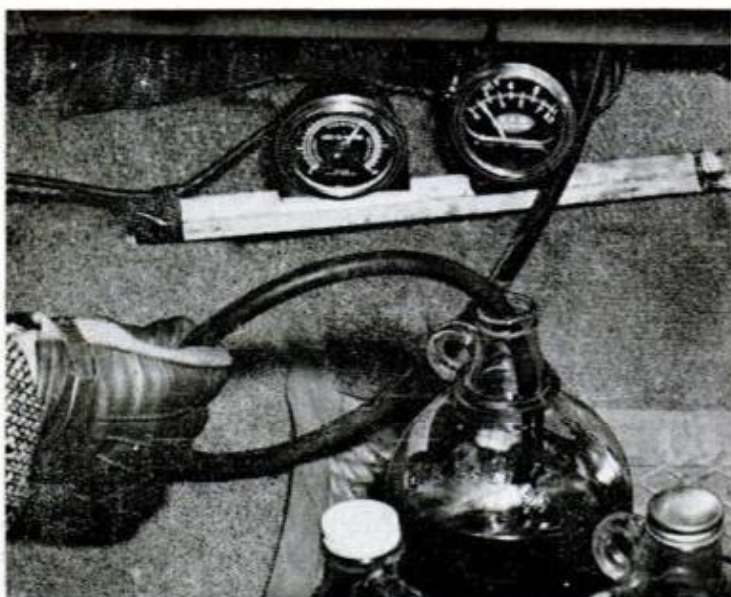
I'd heard that the stuff "homogenizes" gasoline so that you get more power and economy. Bob Carnes, the sports-car builder, told me he raised the top speed of his "Stiletto" on a quarter-mile drag from an original 111 m.p.h. to 118 m.p.h. simply by adding the supplement to his fuel. He said his engine and plugs stayed cleaner. In ordinary driving he got better economy. He suggested I try it.



EXHAUST FUMES are drawn off and bottled so they can be analyzed for content of smog-producing particles of hydrocarbon



PM TEST CAR, above, is being linked to dynamometer controls. Report of its performance, with and without supplement, is shown on opposite page. Below is the rig which R. N. Metcalf, supplement manufacturer, uses to test mileages of fuel samples. Ten percent increase usually is obtained with supplement



Now, I've heard plenty of stories about all kinds of auto gadgets that give more power. Not all of them do. I've even investigated a "200-mile-per-gallon" carburetor.

But, like some other supplements, this one had some impressive recommendations. A truck rental outfit wrote that it was saving up to \$9000 per year in fuel for its 60 units. Another trucking company reported it was using higher gears over its entire route by using the supplement. The Denver police had switched to it 100 percent. Some drivers were able to change from premium to regular gasoline, with no ping and no loss of performance.

You can see why I wanted to test the material myself.

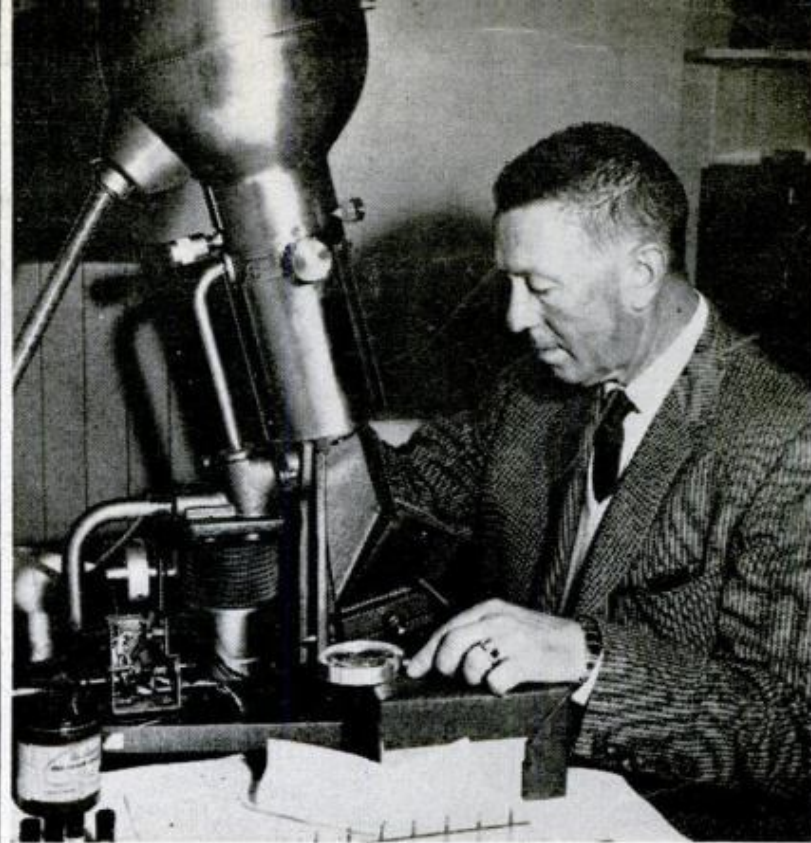
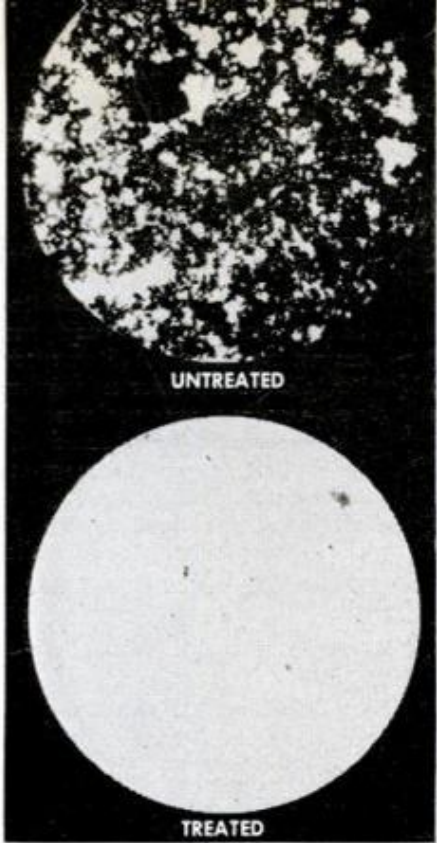
Test Results

I drove both test trips at a steady 65 on the way south, at a fairly steady 60 on the return. Counting local traffic miles in San Diego I racked up 344 miles on each trip. On ordinary premium fuel I averaged 14.1 miles per gallon. Using the supplement I got 15.5 miles per gallon, a 10-percent increase.

Premium fuel costs 34.9 cents per gallon where I live. That's almost 2.5 cents per mile for gasoline. On scratch paper I figured that when I used the supplement (a quarter's worth treats 20 gallons) I was getting an extra 28 miles from a 20-gallon tank. That's a real saving. The extra miles cost less than a cent a mile.

A friend of mine drives a '60 Rambler station wagon and he has been complaining about "no push" when crossing the Hollywood hills into the San Fernando Valley. I put some supplement in his fuel tank and he phoned me the next day. He wanted some more. He said he had crossed the hills with power to spare.

Some people are apt to think they are getting better performance just because someone told them they will. But there's a scientific way to find out if it's true. I put my car on a dynamometer with untreated gasoline and the meter showed that I was developing 120 hp. at the rear wheels at 3000 engine r.p.m. I went back the next day, this time with supplement in the gasoline, and got a



ELECTRON MICROSCOPE shows the difference in untreated and treated fuel. Untreated sample contains many black particles that consist of colloidal suspensions of gums and resins. Treated sample shows particles have been driven back into solution or have been greatly reduced in size. Metcalf is shown operating the 'scope. Independent report, below, shows the PM test car picked up seven horsepower using supplement

NICSON
AUTO MAINTENANCE CO.
 4546 East Washington - Los Angeles 22, California
DYNAMOMETER TEST

NAME Popular Mechanics Magazine Date December 14, 1960
 ADDRESS 3460 Wilshire Los Angeles
 Make of Vehicle 1961 Buick Le Sabre Mileage 4662

NO SUPPLEMENT BEFORE	WITH SUPPLEMENT AFTER
POWER (60 MPH)	POWER (60 MPH)
R.P.M. <u>3000</u> H.P. <u>120</u>	R.P.M. <u>3000</u> H.P. <u>127</u>
Fuel Mixture <u>13-8-1</u>	Fuel Mixture <u>13-8-1</u>
Horse Power <u>120</u>	Horse Power <u>127</u>
Vacuum <u>0"</u>	Vacuum <u>0"</u>
CRUISE	CRUISE
R.P.M. <u>2000 - 40 MPH</u>	R.P.M. <u>2000 - 40 MPH</u>
Fuel Mixture <u>14-2-1</u>	
Vacuum <u>12"</u>	



WEAPON AGAINST SMOG? Exhaust from the same car was caught in glass wool filters after it had idled one hour on regular gas, another on supplemented gas. Untreated gas caused filter at left to pick up a gram of weight. Treated gas gave off fewer unburned solids that cause smog, filter stayed white

reading of 127 hp. An extra seven horses at the rear wheels is an important gain. I decided that my friend with the Rambler wasn't kidding himself. For compact cars, especially, any increase in horsepower makes a big difference in performance.

The fuel supplement began to look like big news, so after I finished my tests I flew to Denver, Colo., to talk with Robert N. Metcalf, president of Fuels Research Corp. He and his technical consultants had investigated the principle of using supplements of various compositions over a period of years, and finally developed several which have unique properties. The stuff is inexpensive (in wholesale amounts, a fraction of a cent's worth treats a gallon of fuel) and it's nontoxic to the skin. I was told it consists of organic, nonmineral compounds that leave no ash when burned. Patents have been applied for.

Metcalf told me the supplement, which he calls GS-1000, is one of a family. He has a separate supplement for diesel fuel, another for jet fuel, and others for hydrocarbon rocket fuel and Bunker C.

One of his consultants explained how GS-1000 works.

"Modern cracked gasolines contain gums, resins and polymers that are too expensive to remove at the refinery," he told me. "These unstable compounds tend to clump up. They become colloidal materials suspended in the fuel and they don't burn very readily. A typical gasoline may contain clumps of these materials up to 100 microns or more in size. They are visible as black patches under an electron microscope.

"One of the effects of this fuel supple-

ment is to put these particles back into solution or at least break them down so that they burn more readily. When you look at a sample of gasoline that contains GS-1000 under the electron microscope you can find virtually no black particles. Everything has been reduced to less than a tenth of a micron in size.

"Depending on its condition, an engine burns from 70 to 85 percent of the gasoline that is admitted to its combustion chambers. The rest is exhausted as carbon, vapors and even raw gasoline. With the supplement, from 90 to 95 percent of the gasoline is burned in the combustion chambers. That explains why the treated fuel produces more power and creates less carbon," he said.

The consultant said another effect of the compound is to make use of water that may be contained in a gasoline. Instead of settling out in the bottom of the tank or at the fuel strainer, the water is kept in suspension. Under the high-temperature conditions within the cylinder the water is converted into superheated steam and thereby yields additional power. The same effect is often noticed on a foggy day.

If treated fuel burns more completely, does it tend to reduce smog-forming particles in the exhaust gases? The answer, which appears to be an unqualified yes, should provoke thought in California where a recent law says all cars must soon be equipped with afterburners or devices to consume the unburned fuel that is now exhausted into the atmosphere. I saw a report from the Truesdail Laboratories of Los

(Continued to page 276)



Plane With a Brain Warns Navy Fleets of Enemy Aircraft

Named after a legendary American scout, the Grumman W2F-1 Hawkeye will range up to 200 miles from Navy task forces and, with its unique rotodome-radar, provide early warning of attacking aircraft. Operating in teams for maximum coverage,

the planes would fly an oval course at 25,000 feet or higher. This is one of the Navy's largest carrier-based aircraft. Its rotodome, which is part of the plane's airborne tactical data system, can be lowered when the plane is stored below decks.



Tiny Cycle—Big Rider

Tiny but strong enough to carry a full-size passenger, the Scrambler can be carried in the trunk of a car or luggage compartment of an airplane and used for transportation at the end of the road or at an airport. Built by Go Kart Manufacturing Co., the two-wheeler is powered by a four-horsepower, two-cycle engine (or, in another model, by a two-and-a-half-horsepower engine). The four-horsepower model has a top speed of 32 miles an hour and will travel 75 miles on a gallon of gas. Total weight of the Scrambler is 55 pounds.



Sunny Side Up—on Paper

Cooking an egg on a paper plate is a bit of kitchen magic that can be performed on a new RCA Whirlpool range. The secret is a blower mechanism built into the range. Air from the blower mixes with gas and moves out the side of the burner where the mixture ignites. More air is forced up the central part of the burner and moves out horizontally above the flame, forming a cushion of air between flame and pan. The air cushion causes the pan to heat evenly without hot spots and at a low setting keeps the paper plate from burning.



**BASED ON 1,023,938
OWNER-DRIVEN MILES**



Editorial comments in boldface type by Jim Whipple, PM's Auto Editor

Photos by Don Honick

FOR MOST OWNERS, the new Lancer is their first experience with a compact car.

To a man (and woman), their reaction was one of pleased surprise.

Many of them apparently felt that in order to gain the lower initial cost and economy of a compact, it was necessary to give up riding comfort and adequate performance.

They discovered, however, that far from depriving them of these virtues, the Lancer has an excellent ride, travel-wise roadability and more than satisfactory performance.

Ease of parking and good vision down the

low, sloping hood came in for plenty of praise too.

For those who drive in cities or crowded suburbs, the psychological effect of switching from a "big" car to a compact (most Lancer owners traded from "full-sized" cars of 1955 through 1959 vintage) was something like changing from boots to tennis sneakers.

"Look, Ma, I'm dancing!" is the general attitude of those who found new fun and freedom dodging nimbly through traffic in their Lancers.

One illusion owners had when they slid behind the wheel of their new Lancers was

WHAT LANCER OWNERS LIKE . . .

Handling ease	71.2%	Styling	20.1%
Comfortable ride	42.2%	Economy	19.8%
Power, performance	23.1%	Easy to park.....	19.5%

Owners Like Lancer's Big-Car Comfort, Roadability



that they would become virtual strangers to their old friends at the local filling station.

They seemed to believe that the Lancer was a dead cinch to deliver 25 miles per gallon, summer or winter, uphill or down, on city streets or muddy country roads.

A surprising number of those who expressed disappointment reported they were getting over 20 miles to the gallon.

Sixty percent of all the Lancer owners said that they were getting over 20 miles per gallon on long trips with manual transmission; 30 percent didn't know.

Yet 36 percent said that mileage was not as good as they had expected. Some of the low-mileage figures reported can be attributed to a combination of winter driving conditions and faulty tune-up. For others the problem may very well be uneconomical driving habits.

Delighted as they are with Lancer's smooth ride and easy handling, a number had complaints about workmanship, headroom or minor points of design.

However the car's virtues far outweighed its faults to the 77.6 percent of owners who gave it an *Excellent* rating. Some 20 percent felt that it was at least *Average* and only a slim 1.5 percent said it was *Poor*.

For a closer look at the Lancer as its owners' see it, here, in the order of frequency, are quotations on the five best-liked features.

"It handles and corners extremely well"
—New York chemist.

"The Lancer is truly the poor man's Jaguar; it's the best handling car at high speeds that I've ever driven."
—Georgia financier.

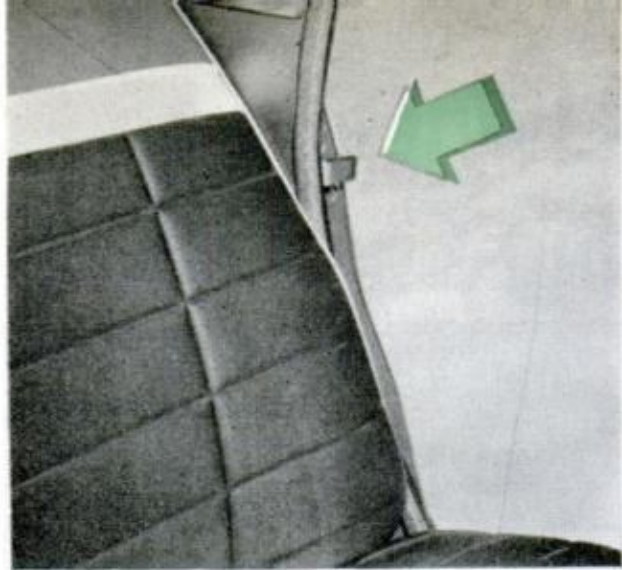
"Lancer is a simple basic car, not overpowered and undercontrolled—it's fun to drive again."
—Ohio baker.

WHAT THEY DON'T LIKE . . .

Poor workmanship	12.3%	Lack of head and legroom	6.6%
Poor gas economy	12.0%	Water leaks	4.5%
Gasoline filler inlet	6.9%	Transmission controls	3.9%



Wide front door opening provides good entry but protruding door latch (arrow) is a coat catcher



Rear door opening allows passengers to slide right into seat. But it, too, has snagging latch

"Like the riding comfort, roominess, handling and the fun of driving it."—Kansas real estate salesman.

Fun of driving. Now we're getting down to basic values. What better recommendation for an automobile than to say it changes the business of driving from a boring chore to an enjoyable pastime?

"The rear seat ride is surprisingly comfortable."—New Jersey retiree.

"Excellent ride, lack of sway on curves."—Alabama letter carrier.

"Comfortable to drive, is not fatiguing on trips."—Iowa teacher.

"The squad car I drive is a big, medium-priced job, and to me the Lancer with Torsion-Aire is just as comfortable to ride in."—Wisconsin police officer.

This is true. Lancer's suspension manages to keep the car level and sway-free yet it retains soft spring action, something few if any other systems can do. There's a touch of real genius in the Torsion-Aire design.

"Has amazing pickup at speeds up to 85 m.p.h."—South Carolina minister.

Easy does it, Reverend!

"I like Lancer's ability to cruise at 60 to 70 m.p.h."—Florida nurseryman.

"Three-speed automatic transmission gives me superb performance."—Iowa teacher.

Lancer's 170 cubic-inch-displacement engine seems to deliver solid power without too much noise.

"Lots of power, pulls a small house trailer as easily as my pickup and does it on less gas."—Michigan crane operator.

"I like the styling. The car doesn't try to look like a plane or a rocket."—New York doctor.

"It has a zippy look."—Georgia accountant.

"Like its clean, uncluttered lines."—Florida foreign-car distributor.

This fellow handles a sleek line of sports cars, and he appreciates Lancer's rakish continental look that distinguishes it from most other cars.

"Gas bill has been reduced about 50 percent since I bought the Lancer,"—North Carolina printer.

"I travel about 30,000 miles a year and my cost of operation is much lower."—Connecticut salesman.

"I do not believe the high-mileage stories I hear, so my 20 miles per gallon over-all (with automatic transmission) is satisfactory."—Kansas government worker.

This man has the right idea. Few cars of Lancer's weight and engine capacity will do better under average driving conditions.

"The car fits into my garage and can be parked in an average space."—New Jersey manager.

"Lancer is easy to park, yet drives and handles like a big car."—North Carolina mechanic.

This convenience factor combined with the feeling of "big car" capability on the highway will keep Lancer and cars like it on the market for a long time to come.

However, few cars are perfect and Lancer is no exception. Here are the five most common complaints in order of frequency of mention.

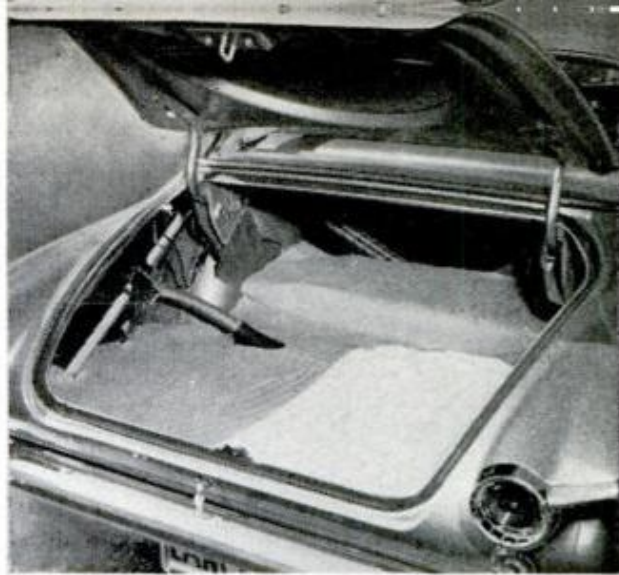
"Some of the finishing touches were a little thrown together and sloppy."—California ranch manager.

"The parts, particularly the doors, do not fit well. This shows inside and out."—Ohio clerk.

"Some cases of careless workmanship, otherwise it is fine."—Iowa carpenter.



Designers of handsome front end should have moved parking lamps away from this mud-catching location



Roomy trunk results from locating tire under floor. This unfortunately makes filler pipe placement a problem

"Has the look of being put together by apes instead of conscientious production people."—Michigan engineer.

"I think it's high time that Detroit concentrated on better inspection of new cars at the factory. There have been a dozen or so small details on which the dealer's service department had to make up for factory carelessness."—Illinois advertising executive.

This is a particularly perplexing problem where a basically excellent car like Lancer shows up with annoying minor flaws that require time and money way out of proportion to the original cost of production to correct. Chrysler Corporation is well aware of this problem but hasn't been able to lick it completely and still keep the costs in line.

And it isn't all the factory's fault. Some dealers do a much better job than others of backstopping production flaws. Then too, some buyers force the dealer to cut the price so low in order to make the sale that the allowance for "make ready" or correction of minor malfunctions is "given away." And some customers are so eager for delivery that they don't allow the dealer time for proper make ready. It is worth noting that all faults mentioned by Lancer own-

ers were relatively minor ones. Nobody's brakes failed, nor did a transmission crack up or an engine burn out.

"Very poor mileage (17 over-all) considering what I expected from advertising and car's size and weight."—New York salesman.

"Gas consumption is a little too high for a car of this size."—Minnesota conservationist.

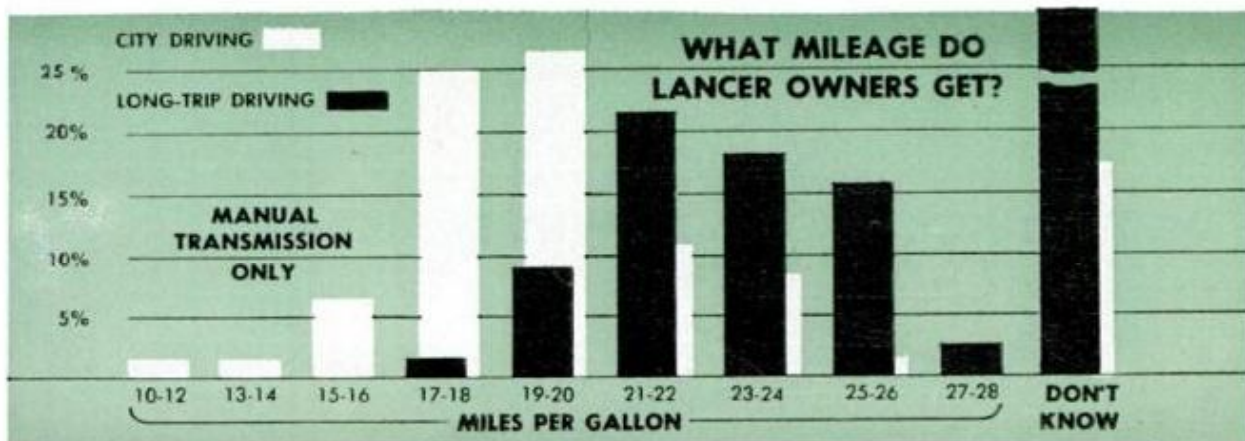
"I got better gas mileage (he reports 17 over-all) on my '55 Plymouth."—Connecticut teacher.

"I was told I would get up to 30 miles per gallon."—Georgia electrical contractor.

Figures compiled from all the questionnaires show that most owners of automatic-transmission-equipped cars got between 16 and 20 m.p.g. in city driving. Of those reporting manual transmission mileage, 80 percent said they were getting between 21 and 26 m.p.g. in long-trip driving.

Few cars achieve over-all fuel economy which matches the unrealistic mileage promised in some advertising and sales pitches. Then again, there are such things as wasteful driving habits.

(Continued to page 278)



BASED ON 885,099
OWNER-DRIVEN MILES



Buick Special's performance-plus-economy

Editorial comments in boldface type by Jim Whipple, PM's auto editor

Photos by Don Honick

FOR THE past few years many American motorists have been living like Goldilocks in the house of the Three Bears. First of all cars were too big; Goldilocks sank into the cushions and tried vainly to see the road over and beyond the massive hoods.

Then came the compacts, and like the Baby Bear's chair, they seemed just a bit too small and Goldilocks couldn't find quite enough room for her knees and elbows.

New owners of the Buick Special, like the fastidious little girl in the nursery rhyme, owned the "full-sized" cars, looked at the little cars, then tried the Special and found it, "Just Right!"

A few of them, with extra long memories recalled the cars of the early 1950s that

were just about the same size as the Special and complimented "Detroit" on a return to the realm of common sense.

According to an overwhelming number of owners answering *PM's* questionnaires, Buick is to be congratulated for more than just the common sense dimensions of its Special.

A record-breaking 85.4 percent of all owners reporting rated the Special as "Excellent"!

No other American car has received an "Excellent" rating this high in recent years. Only Volkswagen topped the rating with a 95.6 percent "Excellent" in its owner's report (*PM*, Oct. '56).

Another amazing fact was that a number of owners who reported some trim flaws

WHAT BUICK SPECIAL OWNERS LIKE . . .

Handling ease	62.2%	Economy of operation	18.1%
Power, performance.....	53.2%	Styling	16.9%
Comfortable ride	44.7%	Parking ease.....	16.0%



a happy surprise for owners

and mechanical difficulties still held to an over-all "Excellent" rating. For them, the car's happy blend of the best features of both large and powerful cars with the space saving and economy of the small cars seems to far outweigh the inconvenience of taking the car back to the dealer to look after squeaky fan belts or stuck door locks.

But let the record speak for itself. Here, in the order of frequency mentioned, are quotations describing the five best-liked features.

"Easy handling for city driving and short country trips."—California real estate broker.

"Handles as though it were equipped with power steering and power brakes."—Indiana factory worker.

"Rides like a large car, handles like a sports car."—Texas restaurant owner.

"Car has the old 'dartability' in a pinch."—Minnesota shoe store owner.

Special's 112-inch wheelbase doesn't seem to affect its maneuverability compared to shorter wheelbase compacts like 108-inch Corvair, yet the extra four inches—plus other things—give it a better ride.

"There's plenty of power for mountain driving, yet does not eat up my gas mileage."—Colorado freight-traffic manager.

"Here is a car with sports car acceleration and handling ease, without sacrificing comfort, economy or roominess."—California shop foreman.

"This is the car I've been waiting for. It handles like a big car, is full of pep, has a good ride and gives me plenty of mileage on regular gas."—Tennessee technician.

"Special's aluminum V-8 engine is one of the greatest achievements yet. Didn't expect this engine to be nearly as good as it is. It has more pickup than most full-sized cars and with manual shift its performance is exceptional."—Georgia monotype operator.

WHAT THEY DON'T LIKE . . .

Insufficient gas economy	7.5%	Transmission	5.1%
Car too light weight	5.7%	Windshield wipers	4.8%
Poor workmanship	5.4%	Too-low road clearance	4.8%



"This Buick is big enough for comfort and good performance, small enough for economy."—Arizona metallurgist.

Light weight is what he means not small size alone. Special's aluminum engine and transmission parts plus the weight-saving unit body construction have added to performance by taking off pounds—result, more zoom for your dollar.

"Despite my six-foot-three height, I can take long trips in comfort, and the Special takes rough, unsurfaced roads like a rabbit."—California post office worker.

Seriously, he doesn't mean that it hops around!

"There is no car comparable for easy driving and riding quality. This is the smoothest riding of all the compacts—it's unbelievable."—Connecticut traffic manager.

"My eighty-three-years-young mother says the ride is so comfortable she doesn't even need a back cushion."—Ohio elementary teacher.

"Special is very easy to handle in city traffic and comfortable on long trips."—W. Virginia soil conservationist.

Special's ride is indeed quite comfortable. However the comfort isn't due as much to marshmallow softness as to firm control preventing pitch and sway. Fatigue results from muscles constantly tensing to resist abrupt movements, not from jiggles of a firm suspension.

"The Buick Special's engine has given me what I've been looking for—a combination of power and economy."—S. Carolina mechanic.

"This car is a revelation. Driving it to work saves me \$3.00 per week over the car I traded."—New York butcher.

"Gives me comfort for vacation trips

plus economy for every-day commuting."—New Jersey telephone lineman.

Amen. Here's down-to-earth reasoning from the man up on the pole.

"I like the easy handling and comfortable ride, and the V-8 is a real power plant combining both power and economy."—Virginia welder.

Cars like Special that save by eliminating bulk—designing the weight out rather than adding power—will fill the roads of the future. We're about to see the horsepower race give way to the efficiency race.

"I appreciate the styling; not extreme, but definitely smart."—Ohio school teacher.

"I think the big improvement was in getting rid of those damned fins. The simpler lines from front to rear are much better."—Vermont insurance man.

We'll buy that, too.

"For a change they've produced a car with smooth lines and no excessive chrome."—California physician.

"This is a handsome and well-designed car with beautiful proportions."—New Jersey housewife.

Now, if the engineers and stylists could only get back to single headlamps . . .

All is not perfect to Special owners, however. Here are quotations illustrating the five most frequently mentioned complaints.

"My Special uses more gas on long trips than it should."—Arkansas insurance salesman.

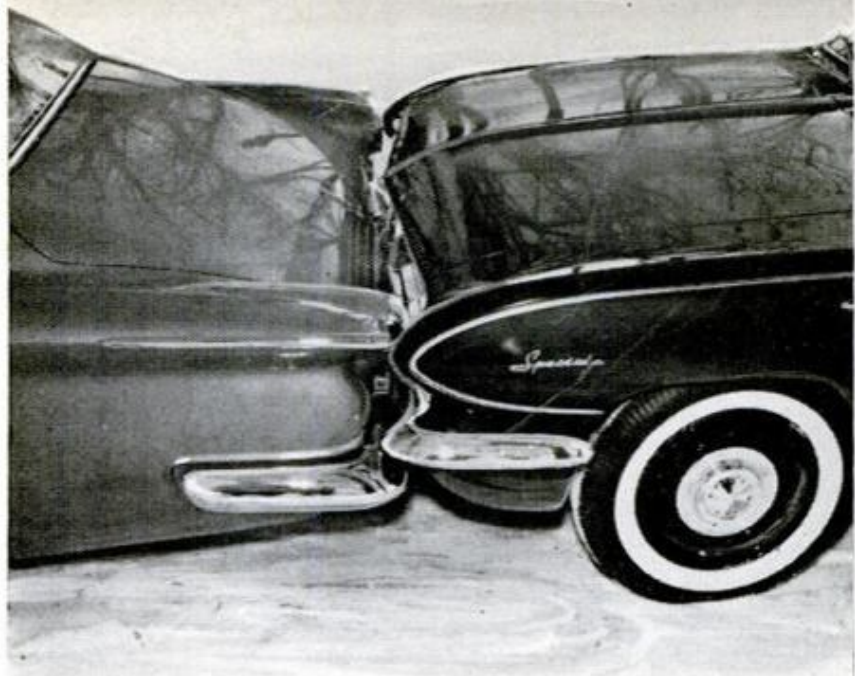
"Not as good mileage as I expected."—Mississippi physician.

"After the big mileage claims made by dealers and radio-TV commercials, I expected to get 22 m.p.g. and I am frankly disappointed."—Tennessee railroad conductor.

Good rear seat entry space for size of car and comfortable seat height, illustrated at far left

Overlapping windshield wipers, at left, provide good coverage, but some owners wish that they had more than one or two speeds

Big trouble from small bumpers. Many owners feel that Buick bumpers are inadequate, and they haven't been hit yet. Even a small tap in traffic will mean a big bill in the repair shop



"Figuring my mileage on the basis of two tankfuls, I am getting only 14 m.p.g., which I think is unsatisfactory."—Wisconsin secretary.

According to the returns the average owner of an automatic transmission Special was getting between 15 and 20 m.p.g. in city traffic and between 19 and 22 on the open road. Manual transmission car owners of course reported better mileage. We maintain for the weight of the car and its performance that these figures aren't bad. PM's test Special logged 17.5 m.p.g. for combined city and turnpike driving.

"Car is too light. Should be 300 or 400 pounds heavier. Handles well except on snow and ice."—Virginia highway engineer.

"Light weight requires sand-bag ballast in trunk for slippery driving."—New Jersey retiree.

Special's weight distribution is more even than on most big cars. On other side of coin several owners reported superior traction. It would be a nice idea if compact car manufacturers would make limited slip differentials available but they don't. So man the sand bags!

"I have noticed a few spots where paint

is a bit thin and flecks of rust are becoming apparent."—Louisiana geologist.

"Air-leaks around the doors, general sloppy assembly work. Of the first 30 days of ownership, 20 days in garage for minor repairs."—North Carolina pharmacist.

"Finish of upholstery is rough."—West Virginia carpenter.

"Too many loose bolts and screws. Need better factory supervision over car assembly. Also many thin paint spots on car body."—Washington accountant.

"Dealer's difficulty in taking care of some of the bugs in this car may be due to the fact that it is a new car and his men haven't learned all its quirks. However, it is annoying to have to lose time having the same thing repaired several times."—Idaho minister.

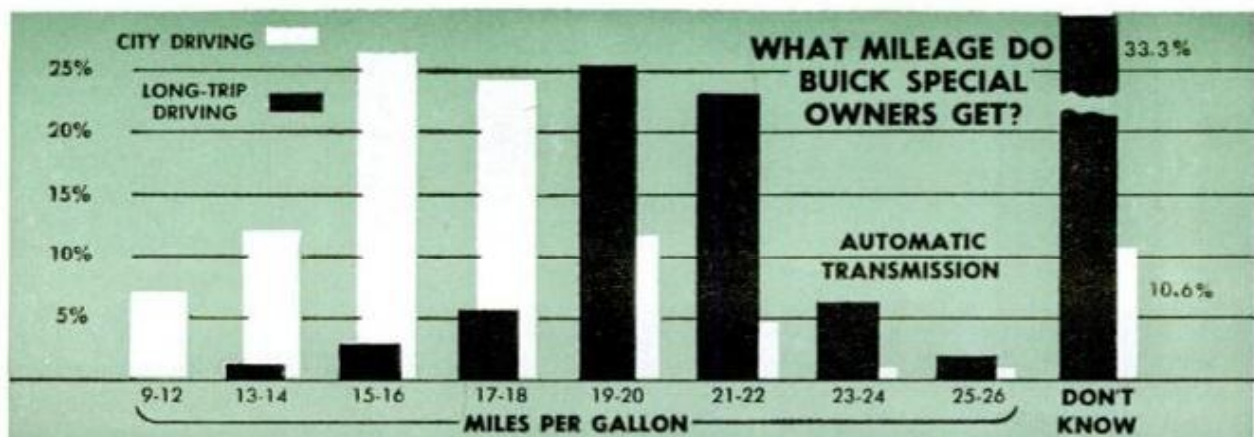
"Caulking on windshield and rear window show poor workmanship."—Ohio post office clerk.

"Car constructed too cheaply. Too many rattles."—California engineer.

"More care should be taken in applying paint."—Michigan office manager.

These are the new-car blues. Whenever

(Continued to page 286)





Giant Jet Spray Sweeps Clean

Using the same technique that you employ on your driveway, two workmen with a high-pressure jet-spray nozzle clean the bedrock foundations of Wanapum dam in Washington. Special grips make handling possible, and the powerful spray clears away dirt, dust and stone chips, leaving a clean, solid bonding surface for the million cubic yards of concrete that will form the dam.



Plastic Seats For Airliners

Lightweight plastic-molded contour chairs may open up air travel to as many as 200 persons per flight. Two hundred seats, six abreast, can be installed in modern jetliners, such as the 707 or DC-8, compared to around 100 currently carried on cross-country flights. The seats are designed primarily for tourist-class passenger sections, which are now carrying more passengers than first-class sections. The seats will allow more passengers to occupy the same space. The entire seat, which weighs 15 pounds, can be reclined all at once.



Tractor Bucket Does Four Jobs

Produced for several sizes of tractor shovels, a "four-in-one" bucket can handle normal excavating and loading, bulldozing, clamshell pickup and scraping and grading. The hydraulically adjusted jaws of these buckets enable an operator to handle a variety of jobs that might otherwise require several specialized construction machines.

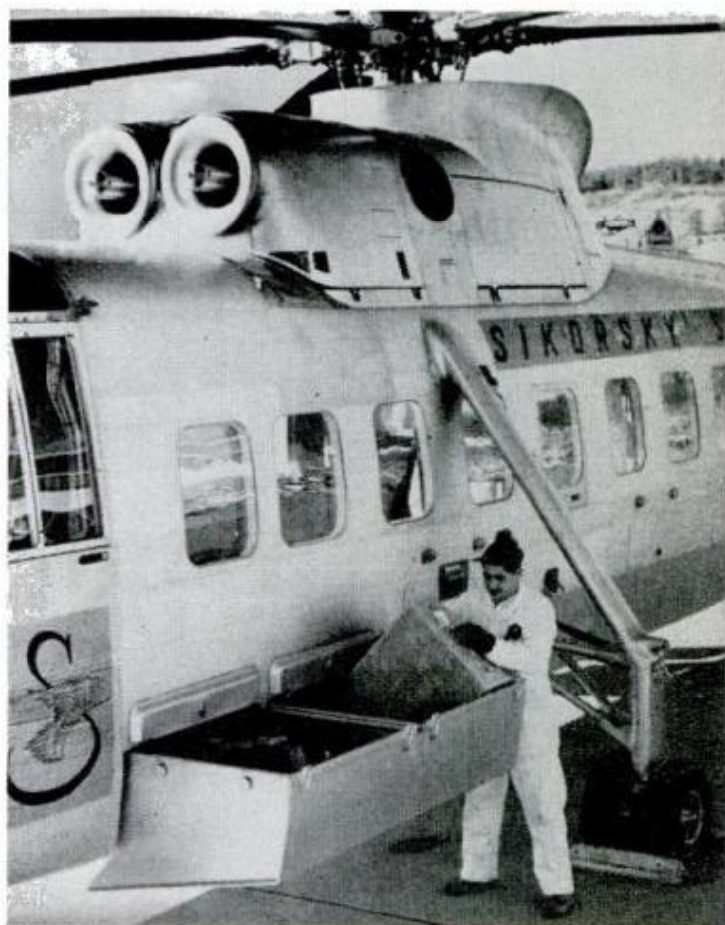


Twin-Turbined Copterliner

Reportedly twice as large and 30 percent faster than any helicopter now serving on helicopter airlines, the Sikorsky S-61L will carry up to 28 passengers and cruise at 136 miles per hour. It is powered by two gas-turbine engines that produce a low noise level. Special features include interior seating similar to regular airlines and a removable baggage pod located on the underside of the fuselage behind the cockpit. It can be rolled out onto a dolly and wheeled inside a terminal. Because of its increased seating capacity, the S-61L is expected to lead to lower operating costs and eventual subsidy-free operations for copterlines.

This Watch Lights Up

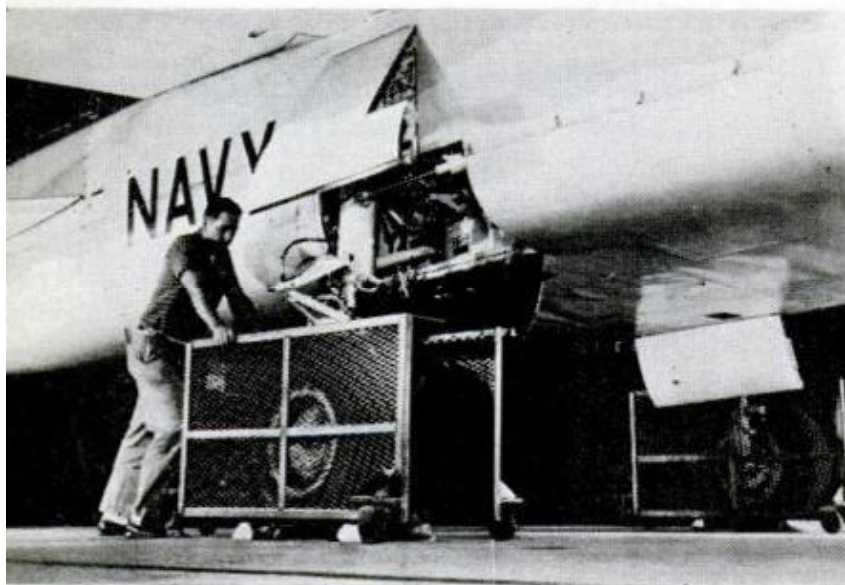
Press a button on the side of a new Swiss watch and its face lights up. The illumination is given by a tiny bulb set in the face. It is powered by a rechargeable nickel-cadmium cell built into the case. The cell can be recharged with the aid of a special lead which attaches to the side of the watch and to an ordinary flashlight battery. The cell needs recharging only every three or four months.





Light, Rugged Bug Tackles Any Terrain

With 35 horsepower to pull its 1100-pound weight, the Crofton Bug has a rated pay load of one-half ton. It features as standard equipment, two front seats, a three speed transmission, four-wheel hydraulic brakes and semi-elliptical springs all around. For more rugged use on the ranch or farm, a six-speed transmission, power take-off, limited-slip differential and dual rear wheels are available. Rear seats and a top are offered for the sports minded.



Blowout Catchers

Blowouts in jet-airplane tires usually occur about 20 minutes after landings when tires reach peak temperatures and pressures. Under emergency landing conditions or after excessive brakings, temperatures and pressures rise more than five times normal. To protect ground crews, the Navy is using special protective cages that roll easily into place and fit snugly around the jets' wheels. Made of meshlike metal, the cages are strong enough to protect the crews from flying rubber, yet pourous enough to allow cooling.



Ice Lance Method Cools Coal Hot Spots

Constant headache in any large coal-storage area is the danger of spontaneous combustion. Fires are started by heat and pressure at the bottom of the pile and are supported by air circulation between the lumps. Some storage yards compact the coal with rollers to keep air out, some treat the pile with calcium chloride solution, and some just try to keep it wet and keep it moving. Fires start anyway. Three power department employees at The Dow Chemical Co., Midland, Mich., have worked out a solution. They drilled holes in a section of pipe and formed a point on one end. They fill the pipe with dry ice, cap it, and drive it into any hot spot that develops in their coal pile. The dry ice cools the hot spot, then, melting, releases carbon dioxide gas which smothers any fire.

Are We Flying Junk?



Half a college football team was killed in 1960 crash of WW II cargo plane that FAA labeled unfit to fly

By Frank A. Tinker

A pilot says many of our planes are over-age and under-serviced

THE ANCIENT C-46, a tired old relic of World War II, taxied slowly through the dense night fog at Toledo Express Airport. The pilot was following the thin beam of a flashlight waved by an airport mechanic, because the fog was too thick to make the short trip to takeoff position unaided.

Inside the plane were 48 people, including the crew and 35 members of the California State Polytechnic College football team which was returning home after a game that day.

At the runway, the pilot could see only three runway lights, or a maximum of about 1000 feet down a 7000-foot runway. But he gunned the engines, and the plane lumbered toward the takeoff.

The time was 10:30 p.m., Saturday, Oct. 29, 1960. On Sunday morning the front page of every newspaper in the country told the story of what happened next. The plane was hardly off the ground before its left wing dipped. Within seconds it crashed in a shrieking explosion, tore in half, and killed 22 of the people aboard, including the pilot and 16 members of the football team.

It was a minor miracle that the 26 others aboard escaped. It was shameful tragedy that any were killed at all. In view of the evidence uncovered in the subsequent in-

vestigation, the plane should not have flown—even in ideal weather—because the Federal Aviation Agency found that it was “not in airworthy condition.”

Within two weeks, the FAA charged that the plane had been overloaded, had taken off in weather far below authorized minimums, was equipped with an unmodified military-surplus aircraft engine that had not been properly inspected or maintained; that the pilot, who had made flights the two previous days, had flown in excess of maximum hours permitted by Civil Air Regulations within a given period of time, and that he had, in fact, been suspended three months before for previous violations of CAR rules; and that the company which owned the aircraft had a long series of violations, chiefly falsifying reports required by CAR, and that it had not exercised “the degree of care, judgment and responsibility required of an air carrier.”

A shocking list of indictments, but the most shocking thing about them is that they are not unusual. The simple truth is that the Toledo crash made Page One only because of the dramatic impact of the death of half a football team. To those close to the situation, it's common knowledge that aviation regulations are violated quietly, flagrantly and regularly, especially among the

DANGEROUS CARGO



As old planes get older, they are assigned rougher loads in inverse proportion to weakening condition

nonskeds, or nonscheduled airlines — the limbo of aviation.

Many of the planes that fill our air today should have been junked long ago. Many of the pilots who fly them can't get jobs with scheduled airlines, or prefer not to. Many of the owners who operate these planes and hire these pilots do so because, in the nonsked jungle of cutthroat prices, it's the only way they can stay in business.

There has been so much recent press-agentry about the shiny new jets joining our civil air fleet that the other side of the ledger has been completely overlooked. Fully half of the commercial aircraft aloft in this country in 1959 were pre-1947 models. There are still five times as many DC-3s—the old goony bird of World War II — operating on *scheduled* domestic runs, for instance, than Boeing 707 jets. An overwhelming majority of the aircraft used for hauling the large military freight contracts are ancient C-46s and DC-4s, patched up to last literally from flight to flight. In all, there were 488 new aircraft ordered for delivery to U. S. scheduled lines between 1958 and 1961, but there is a total of 1827

LEAKY LINES



Pool of oil is sad insignia of misused aircraft, indicating poor maintenance or plane too old to fly

aircraft plying these routes at present, so the replacement even in this fortunate segment of civil aviation is not excessive—except in cost.

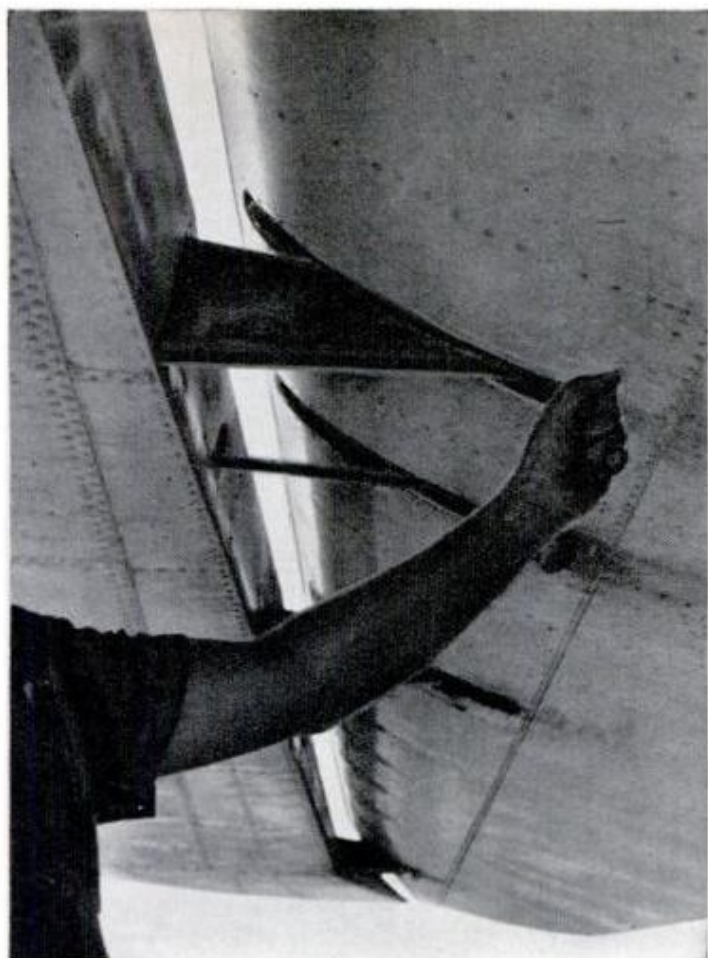
These scheduled lines, with their government subsidies, are the only part of the industry which can obtain financing for new equipment. The smaller, supplemental, irregular, contract carriers, or what-have-you outfits, with less resources, must rely on outmoded clunkers which require less cash on the line, although more upkeep—which they don't always get.

Part of the result is grotesque: A nonsked aircraft pulls up at the ramp at Norfolk, Va., the door is swung open — and drops completely off, clattering to the concrete in front of a clutch of understandably apprehensive passengers. The crew is too ashamed to emerge from the plane.

At Travis AFB, a pilot pours the coal to a heavily-loaded airline C-46, and one prop simply disintegrates, the engine drops off the wing mount and the aircraft taxis over it.

Neither of these incidents would have been merely embarrassing had they happened in flight. Two others did.

LOOSE CONNECTIONS



Serious source of danger is fittings on old control surfaces, which often crystallize or work loose

A civil C-46, carrying a high-priority military cargo, left the runway of a southwestern Air Force base and was several miles airborne before the pilot noticed a looseness in the elevator controls. He informed the tower, returned to the field and tried to make a wheels-down landing, using power and trim tabs for control. It was no use. The plane porpoised, bounced uncontrollably, then dove viciously into the concrete, killing the crew. A subsequent investigation showed that a crucial bolt in the control linkage had not been safetied and had worked loose after a few moments of flight.

Another airline cargo plane, airborne over Utah, spun into a cornfield with another load of Air Force freight. Almost incredibly, the investigation showed that one of the wings had simply fallen off in flight.

Good maintenance is expensive, but it is precisely this — and lots of it — which the older planes need to remain serviceable. As the aging equipment makes this job more and more demanding, some of the reputable repair shops will not even bid for the work at the low price level required.

In a matter of a few weeks' operation, the

SLIPSHOD SERVICE



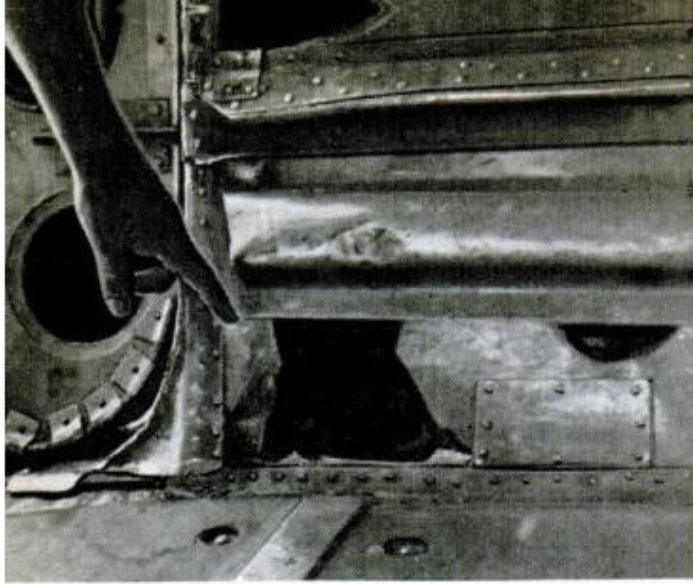
Aging planes require almost constant maintenance; economy usually allows only enough for next flight

following informal, incomplete list was compiled at a single company base:

An aircraft sent out directly from one of the less-reputable repair shops had no lubrication on the wheel bearings; it overheated on the third or fourth landing and the brake failed completely.

Another, again only recently discharged from the sick bay, ran a consistently astronomical and dangerous oil temperature; the investigating mechanic had to use a chisel to pry loose the completely gummed oil filter on an engine which had been "squawked" for weeks by pilots as a potential hazard.

A prop on an engine, which likewise had been the subject of many complaints for its vibration, was casually twisted by a mechanic at an outlying base after it had been sent back to duty from the main shops as being serviceable. The whole blade wobbled in his hands. Uncovering the hub, he found that the gears and cogs which alter pitch and hold the prop in place were a mess. Only a few remaining splines were preventing the blades from flying through the cockpit or falling among hapless pedestrians below.



Awkward cargo and indifferent, unskilled loaders take their toll on cabin interior of freight planes. Constant banging by heavy pieces, and no repair at all, leave few of the structural braces undamaged

Where the average scheduled passenger flight in relatively new, well-serviced aircraft loses an engine only once in a blue moon, three failures on consecutive flights have been recorded in this lower stratum of nonsked aviation. One nonsked line, more representative than exceptional, is reported by its pilots to have had 79 engines fail in flight within a six-month period.

Certainly none of this has happened overnight or arrived unexpectedly. After the heyday of nonscheduled air transport which immediately followed the war, the increasing competition and necessary sacrifice of quality caused a disastrous series of crashes which gave the whole industry a bad name. A particularly lucrative field for these operators was the influx of Puerto Ricans to New York. Using DC-3s and C-46s (the same aircraft being used today) and the cheapest maintenance available, these lines forced the fare between San Juan and Newark to less than half that of the regular scheduled lines. And in less than two years of hectic, hair-raising operation, a half-dozen crashes on this single route had killed 124 persons.

Due to the furor caused by the early post-war crashes, many of the marginal companies faded from the picture, but enough of them survived on government contracts or charter operation that the bidding for business remained so keen it became a poor, wry joke within the industry.

Adding to the struggle is the fact that the larger companies now find themselves with a surplus of planes and crews and are invading the same field wholesale. They frequently bid for business only to keep their equipment and personnel active, sometimes openly taking a loss in the process. Prices under such an arrangement may be an initial boon for the traveling public, but they force the competing air-

lines into cheaper and cheaper operational practices which eventually turn the seeming profit into a deficit in terms of service and safety.

Many of the hazards of such cheap operations are peculiar to aviation and are unseen and unintended, yet they are nonetheless painfully present. One aircraft radio receiver, for instance, was written up on the plane's log as being unable to receive a station from more than 20 miles away. The repair agent, who must handle 20 or 30 such aircraft under his low-pay contract, took the set out of the plane, tested it hurriedly in his shop, and got good reception from the control tower—200 yards away. He approved its reinstallation in good faith. But the flight crew found when they were well out on an instrument flight that their all-important communication with control facilities was suddenly as before—nil.

Usually, planes in this fix must go on to the next stop blindly, where the same process of haphazard repair is apt to be repeated, *ad nauseam*, until one day someone gets in serious trouble with the craft. In the meantime, every other plane using the airways is endangered by the inability of these crews to receive instructions from the control centers. In Los Angeles and other saturated air centers, FAA controllers have complained frequently and bitterly about such poorly equipped craft fouling their traffic.

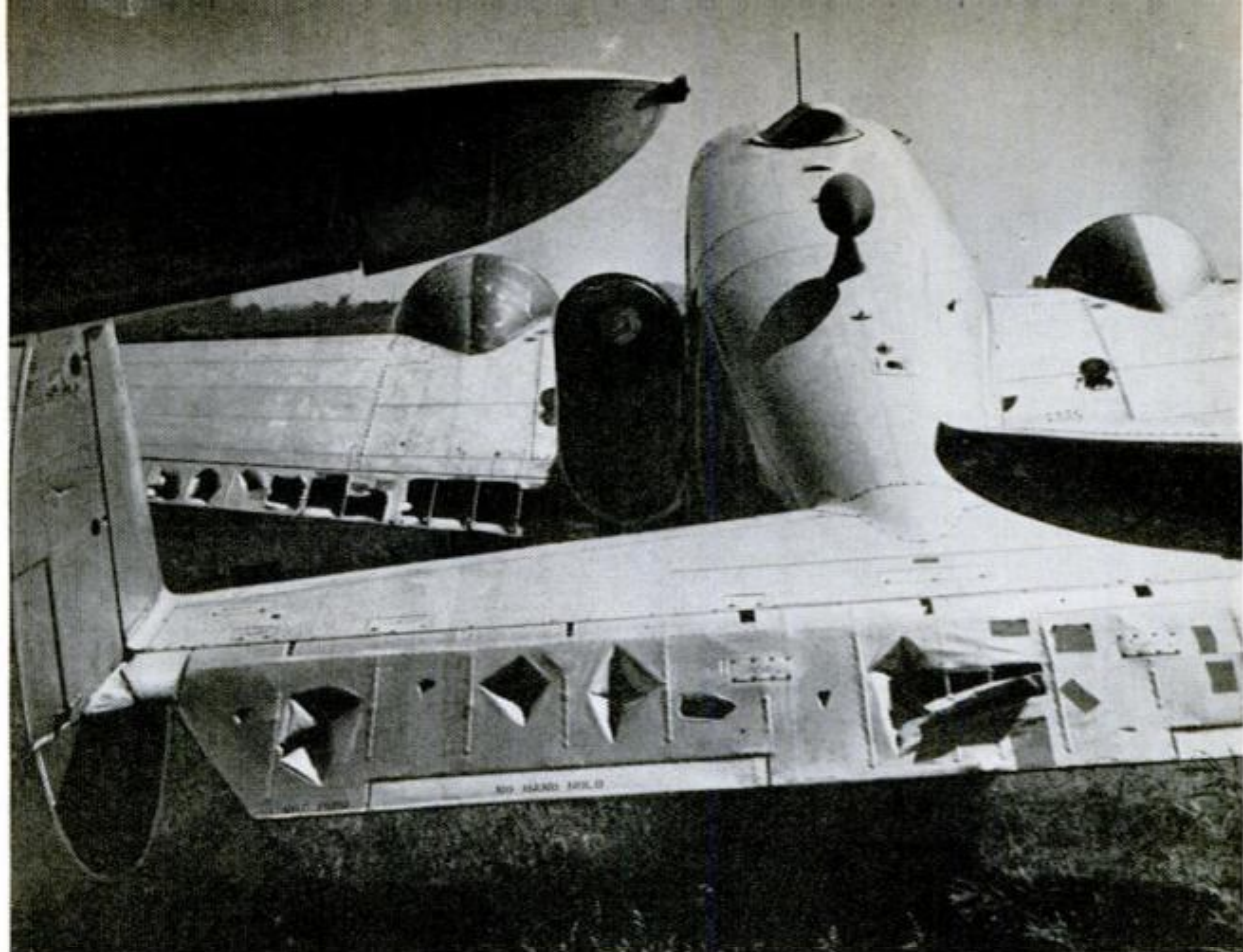
Short-Cut Maintenance

Again, such maintenance does not mean that the mechanic is incompetent, but that he simply cannot afford the time or help to do the job thoroughly. The same thing could, and does, occur with new aircraft, but figures show that the older planes require much more of this critical maintenance. In addition, they are more difficult to work on, being a mass of patches and odd parts.

As a result, the log books of some of these aircraft are filled with everything from bitter suggestion to downright invective by pilots who have fought their way through dangerous episodes with them. The reaction to these comments varies. One chief mechanic in Detroit showed pilots last winter how to avoid blowing fuses when starting engines which had not been preheated. His solution: the old meter-cheating device of inserting pennies in the fuse gaps! At the same station, other mechanics were scolded for having called pilots' attention to dents in the fuselage, low wheel struts, and engine malfunctions.

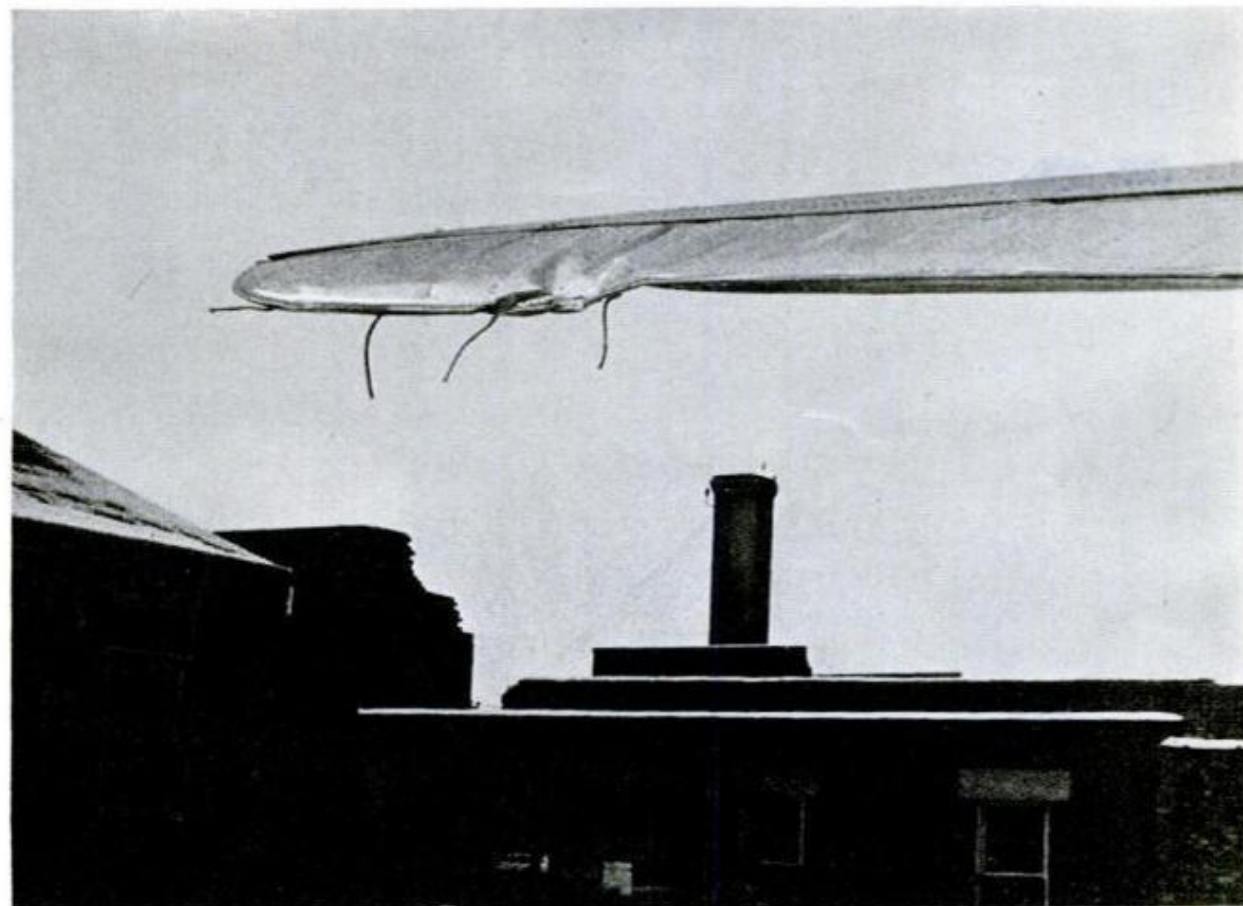
"Let 'em find out for themselves!" they were told.

(Text continued to page 262)



Old planes never die. They just wait in bone yards to become spare parts for other old planes still flying. Doors, panels, tires and miscellaneous fittings are bought from junk dealers and used aloft again

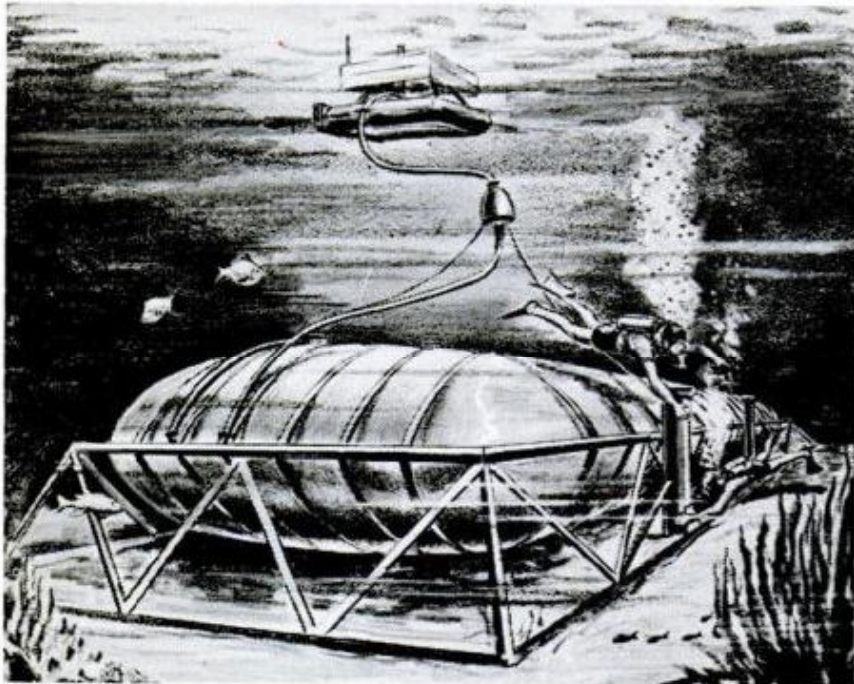
No Purple Hearts are awarded for wounds suffered in cargo battlefields. Regulations require repair and inspection before next flight, but after umpteenth wound, scars begin to show and plane still flies





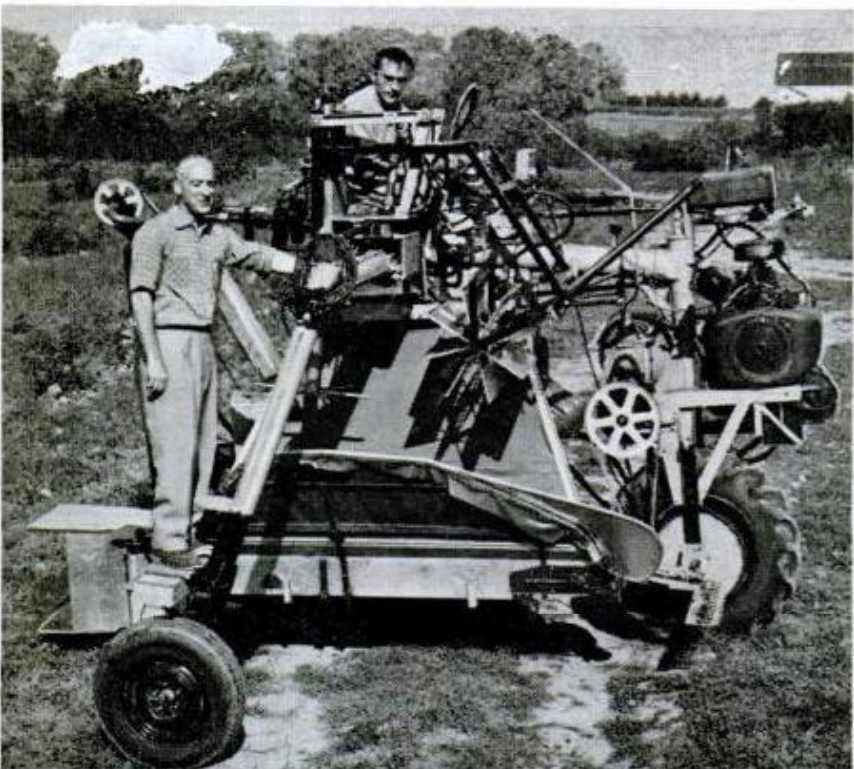
Hot Air Lights Fire

Blasting out air heated to 800 degrees C., a fire-lighter ignites wood or charcoal in seconds; harder materials take only a little longer. Air is heated by an 1800-watt electric element wound through a porcelain former. There is no open flame, and when the element is switched off, the blower fans the fire and cools the nozzle. The lighter requires a starting key.



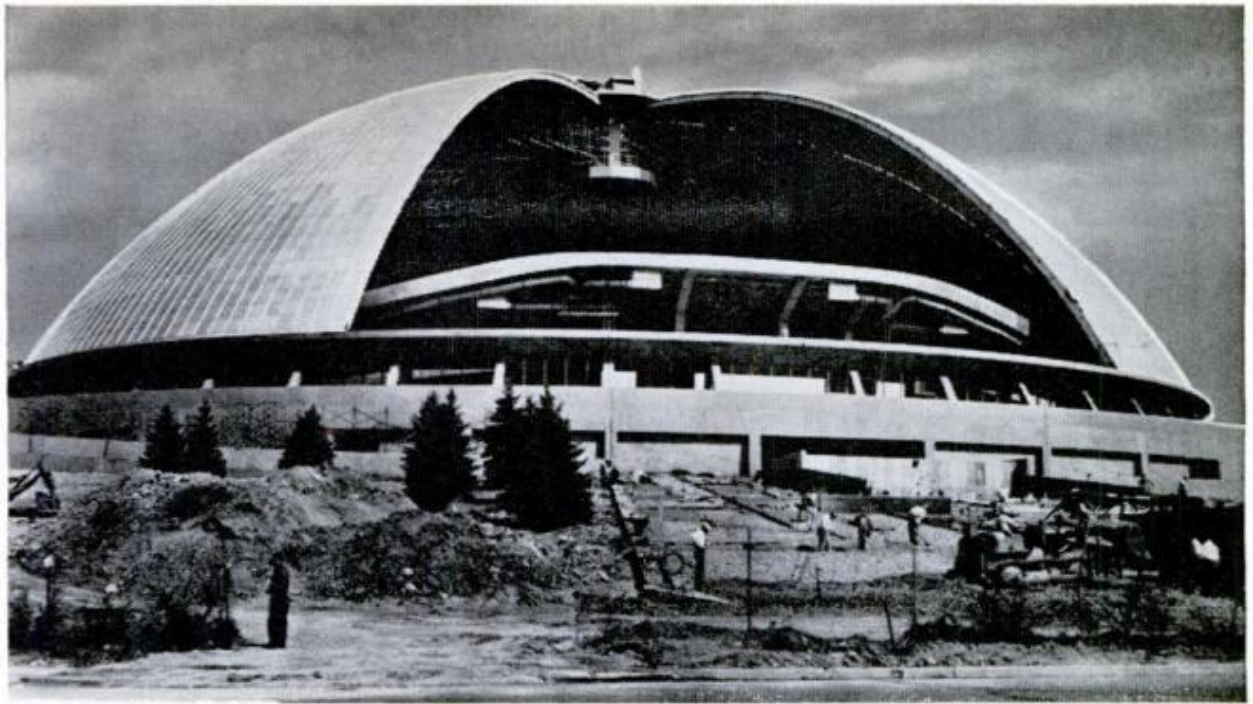
Underwater Fuel Tank

Navy ships, subs and aircraft may be refueled at sea from underwater storage tanks anchored miles from shore. The purpose is to establish convenient and secret refueling stations for any warship that is low on fuel or whose base has been destroyed. Tests have been made on a 1200-barrel prototype tank in the Gulf of Mexico. Full-scale rubber tanks would hold as much as 25,000 barrels and the worldwide system up to one million gallons.



Grape Harvester

Harvesting grapes by hand is one of the costliest operations involved in grape production, accounting for about 46 percent of the expense. However, a mechanical grape harvester may soon alter the picture radically. The gasoline-powered machine is operated by two men and instead of picking the grapes, it shakes them off the vine from which they tumble onto a conveyor belt. The belt carries them to a container at the rear. With refinements, the machine may harvest up to 40 tons of grapes per day, its inventors predict.



Retractable Dome Covers Indoor-Outdoor Auditorium

Taking shape in the formerly blighted "Lower Hill" area of Pittsburgh, the new Public Auditorium of Pittsburgh and Allegheny County is the largest dome in the world—and the only retractable one.

The 415-foot, 136-foot-high stainless steel cover will provide indoor-outdoor all-weather facilities for 14,000 people. The six huge overlapping sections can be swung shut in only two and a half minutes.





Pilot, after disengaging himself from harness and radio cords, begins hacking at window the way iceman hacks at hunk of ice



After breaking through safety glass with knife, pilot pushes window out with feet. Total time: one minute and 50 seconds



How to Carve an Exit

When a cockpit window in an S2F Grumman Tracker, an anti-submarine carrier-based aircraft, was due for replacement, opportunists at the Oakland (Calif.) Naval Air Station decided to run a test.

Under ordinary conditions, aircraft windows are not broken indiscriminately. But, since it was going to be thrown away anyway, why not?

The idea was to see how long it would take a pilot to break through the window in case all other means of escape were cut off when the aircraft was downed at sea. In the test, using only a knife and brute strength, it took the pilot exactly one minute and 50 seconds.

To set it up, the pilot was fully strapped in position, his shoulder harness fastened, seat belt adjusted and head set plugged in. All normal escape hatches were jammed or obstructed.

At the word "go," the pilot disengaged himself and whipped out his survival knife. After describing a circle on the window the size he wanted for his emergency exit, he began hacking and cutting at the tough, laminated safety glass and its plastic membrane and filler.

When he had an opening, he used his gloved hands to pry it open further. Then, with a giant "heave-ho," he blasted it all the way open with his feet.

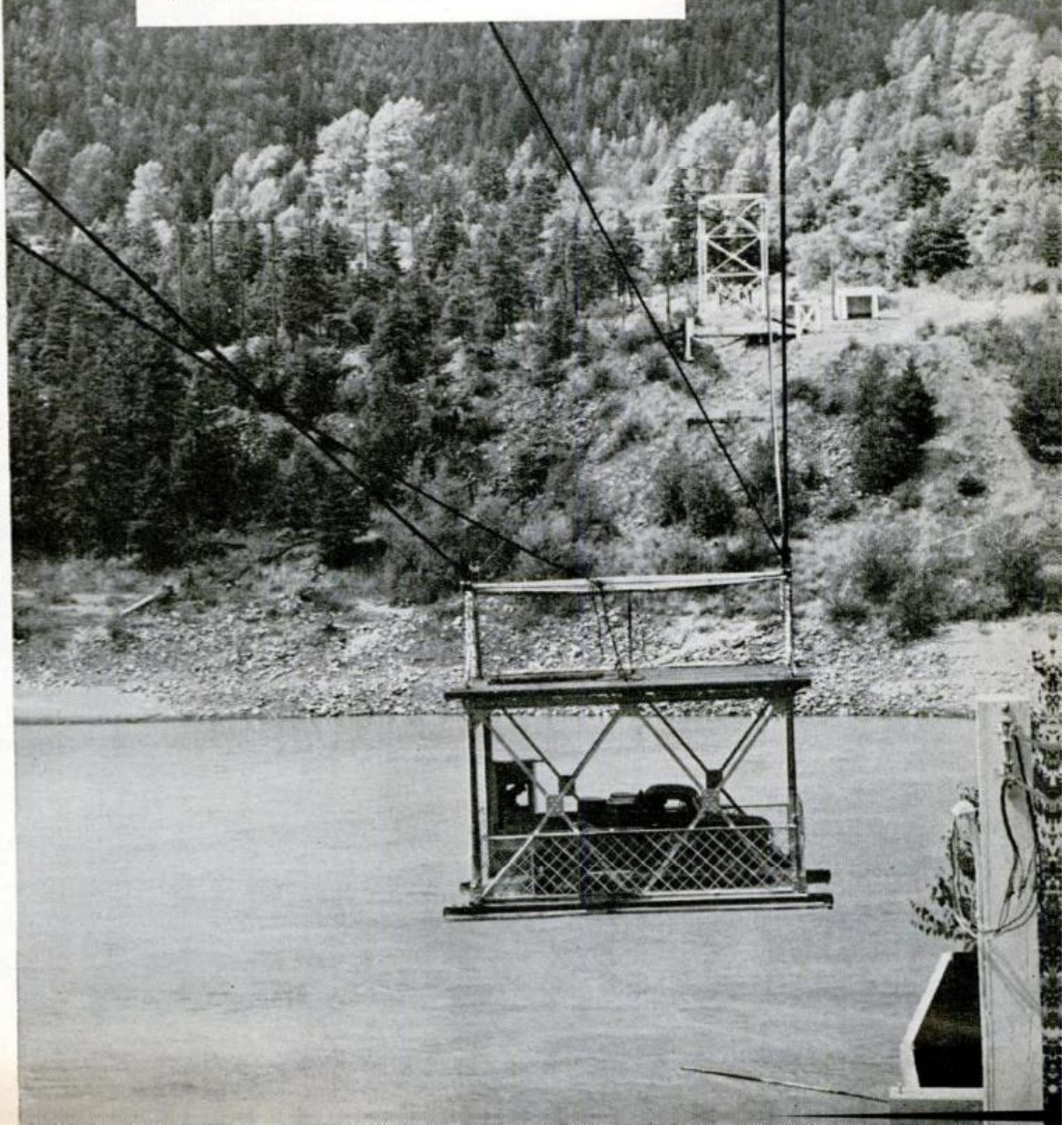
The pilot, who weighs 200 pounds without his flight gear, crawled through the opening head first. Smaller pilots could use an even smaller opening.

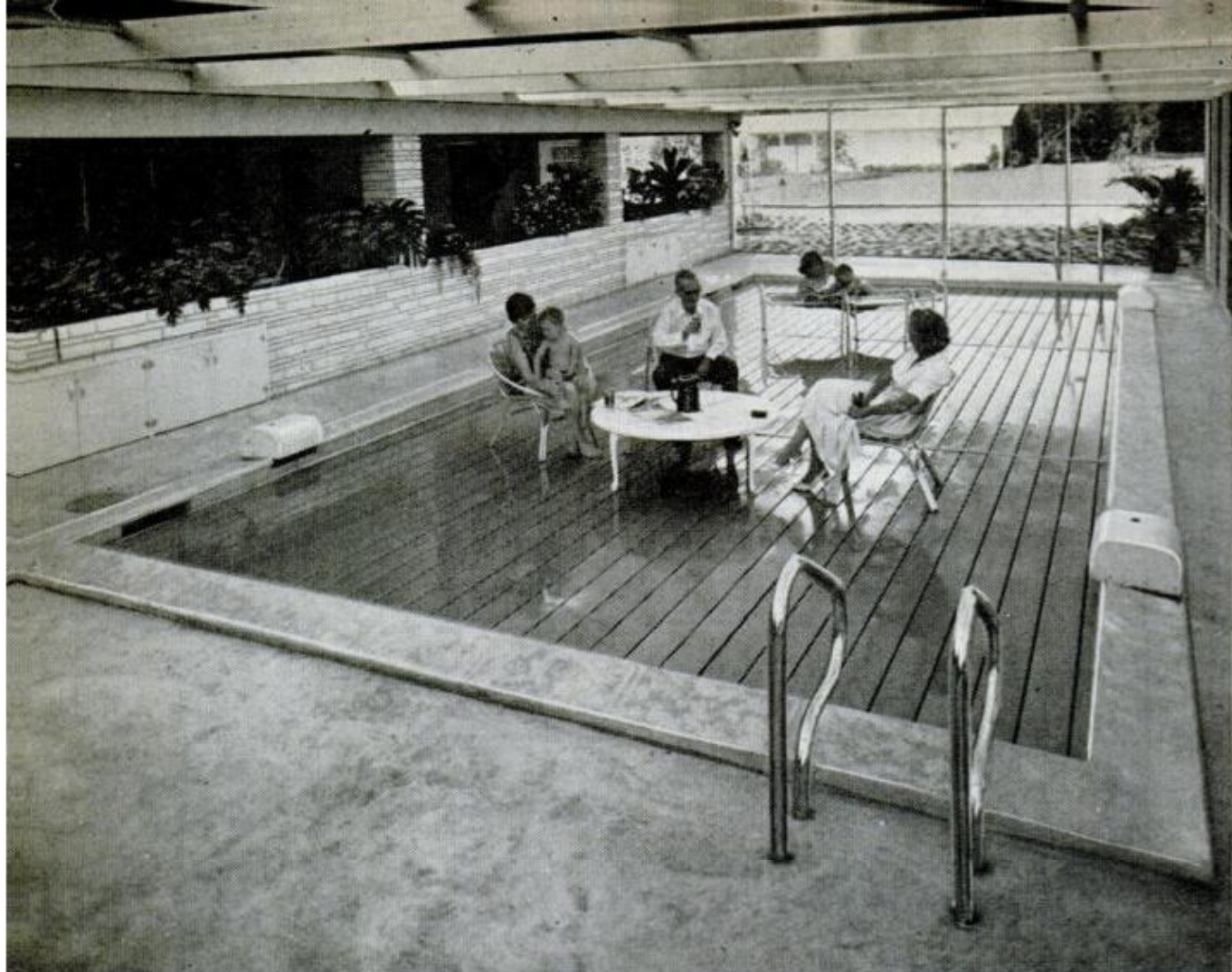
Actually, a crash when such escape methods would be necessary is unlikely. If the crack-up were severe enough to jam the normal escape hatch, it would probably wipe out the entire cockpit area as well. The crew could then use the rear escape hatch, and in less time than it takes to batter out a window.

However, even though the Navy has made no official pronouncement on the impromptu test, it shows that even accepted procedures can, with a little ingenuity, be supplemented. ★ ★ ★

Cables Complete Gap in Highway

SWOOPING across the Fraser River in British Columbia, an aerial tram carries cars and trucks between Boston Bar and North Bend. It's the only way for vehicles traveling on Canada Highway 1 to cross the river here. The cable car is electrically powered, and has a standby gasoline engine for emergency use. Carrying one car or truck and 10 people 175 feet above the river, the tram crosses the 1250-foot-wide canyon in a minute and a half.





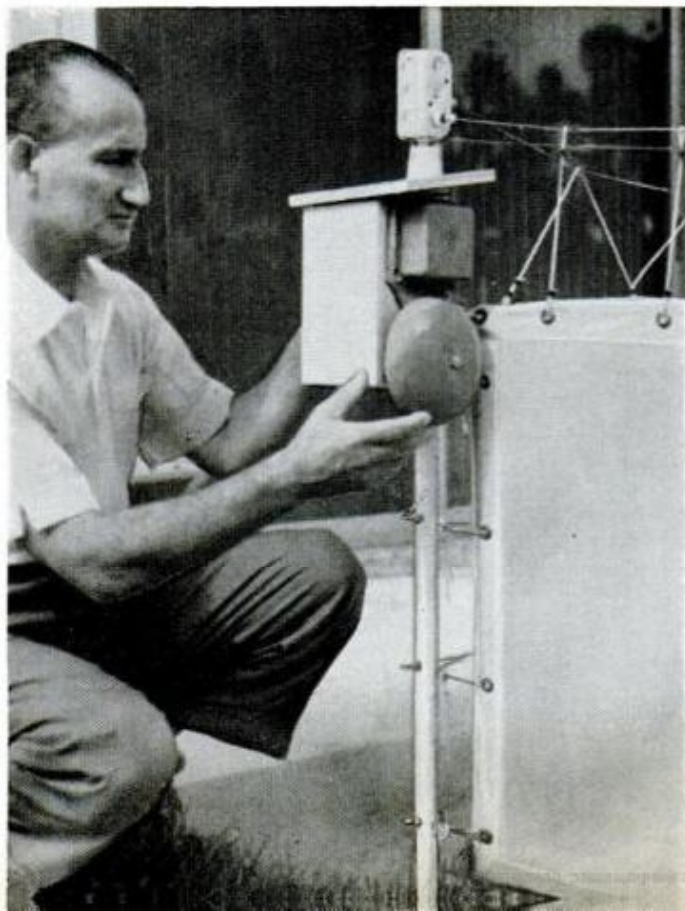
ALUMINUM PATIO locks in place over swimming pool and forms a platform capable of supporting 3000 pounds

These Pools Are Safe

ACCIDENTS ARE NOT likely to occur in swimming pools protected by either of two devices invented by a pair of pool owners in Miami, Fla.

Marine engineer Raymond Pearlson built an aluminum platform which can be locked over the pool, making it impossible for children to swim when no older person is around. The platform, in this position, doubles as a patio. It also can be lowered on four electric-motor-driven cables into the pool, giving a shallow pool for children, or a deeper pool for adults. The control box is installed some distance from the pool and requires a key to operate.

John Fazio, beach manager at the Deauville Hotel, fenced a pool with nylon. A bottom strand of wire keeps children from crawling under. Pressure on a strand of wire at the top sets off an alarm bell that is loud enough to be heard above street sounds.





WADING POOL is obtained by lowering patio a few inches. Up and down movement is controlled by motors

NYLON FENCE has a wire strand running along top and bottom. Inventor Fazio, left, shows bell that rings loudly when the top strand is depressed as some youngster attempts to enter pool. Fence is snapped closed





BIRD under magnifying glass cocks quizzical eye at Dr. Brown's stethoscope. The hospital is always full



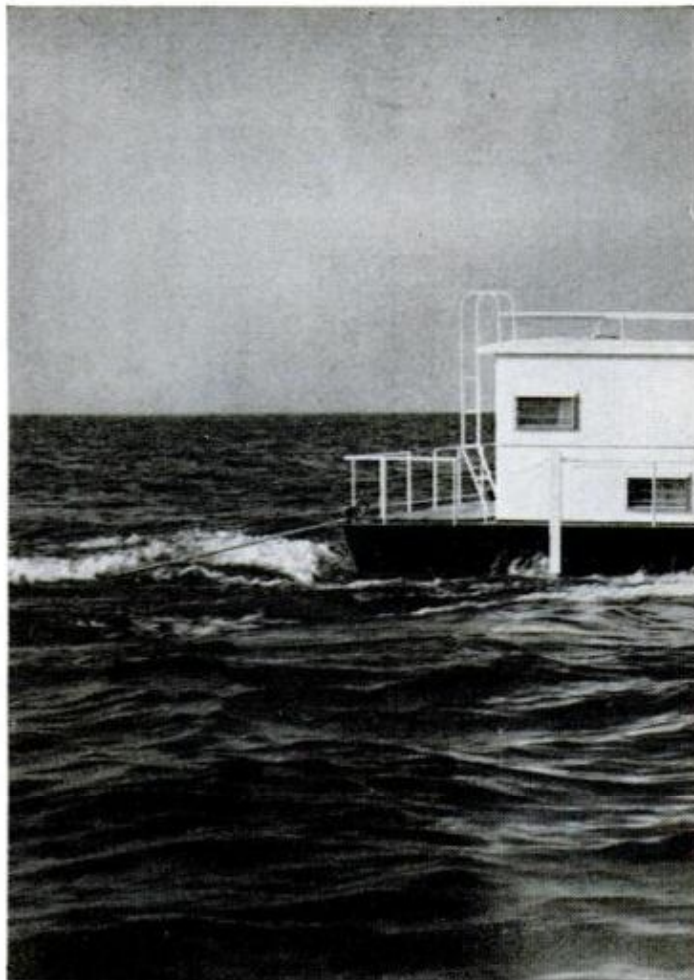
RESPONDING to tender care, an ailing bird takes his medicine without hesitation from an eye dropper

Hospital Is for the Birds

When birds are injured or sick in the area of Chicago, Ill., their owners flock to a bird hospital operated there by Dr. David S. Brown. He opened a pet shop 27 years ago that has, over the years, been turned into a bird-care center. His hospital, equipped with incubators, oxygen tents and operating rooms, is staffed by a couple of college-trained ornithologists and several assistants. On occasion, an ambulance picks up patients in critical condition.

Floating Coast Guard Station

Working to keep up with the continuing boom in pleasure boating and water sports in their waters, the Coast Guard is trying a rescue station built into a houseboat. First used at Put-In-Bay in the Lake Erie Islands, a popular boating area 10 miles from the nearest regular station, the experimental support unit proved a "tremendous success." The boat is a seven-ton steel-hulled production model built by the River Queen Boat Works. Despite its size, (42 foot-length with a 13-foot beam) the big hull needs only one and a half feet of water to operate. Power is a 75-horsepower outboard motor. In operation, the floating station has a crew of six, carries full rescue equipment and radio communications equipment, and tends its companion craft, a 40-foot rescue boat. Crew members, accustomed to service facilities aboard their usual craft, live in the lap of luxury in the "trailer-on-a-keel," with Naugahyde interior surfaces, inlaid linoleum floors, a tiled bath-shower, foam-rubber built-in furniture, a complete built-in galley and a spacious sun deck that they're too busy to use. The houseboat isn't luxurious by yachtmen's standards but plenty comfortable to a Coast Guardsman. If continuing tests prove successful, more such stations may be built.



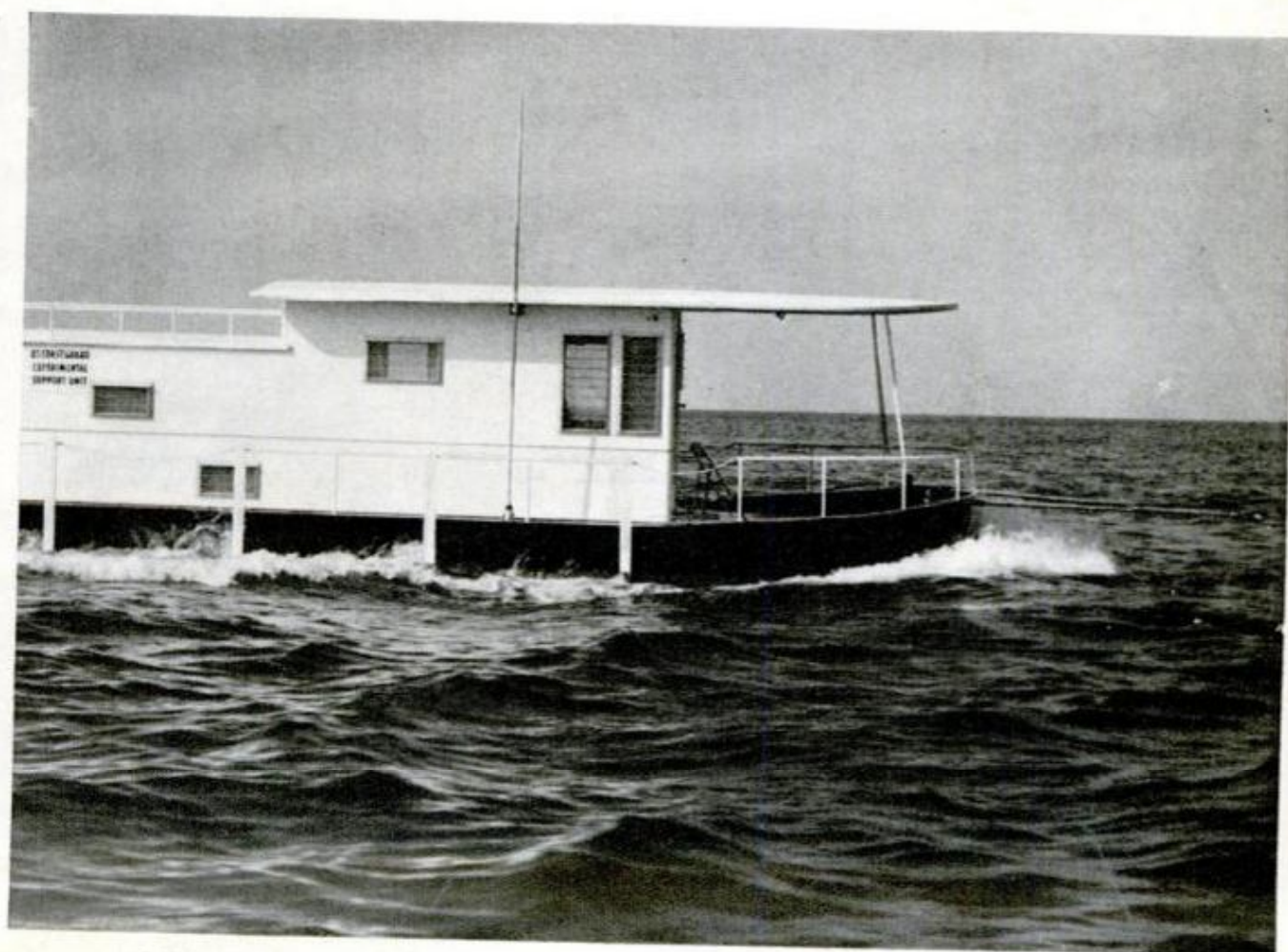
POPULAR MECHANICS



PARAKEET that has lost its feathers is given a fast swabbing down



LIKE STUDENT DOCTORS watching an operation in a surgery arena, birds perch on a ring on Dr. Brown's head to watch him wield his scalpel

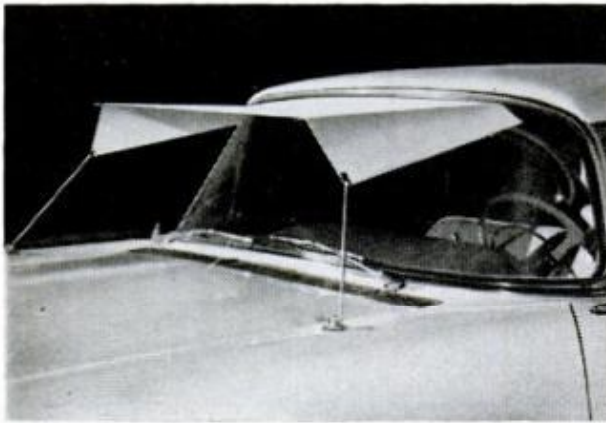


MARCH 1961



Plastic Shields Fuse Makers

Technicians working with low-energy initiators in the experimental fuse unit at the Picatinny, N.J., arsenal face hazards they can't see. The low-energy explosives are so sensitive to electromagnetic fields that they may be detonated by impulses from the generator of a passing car, or static electricity coming from clothing of synthetic material. As a first line of protection, the men work protected by a Lucite shield; only their hands are exposed. Other protective measures include: grounding of all machinery, a floor of conductive rubber that is grounded and shielding telephones to prevent emanation of electric waves.



Guard Protects Windshield

Overnight parking in winter often results in a windshield covered with snow or ice. Made especially to help cope with this problem is a visorlike guard that protects the windshield against the elements. It is quickly and easily mounted by means of suction cups and is just as easily removed and stored when not in use.

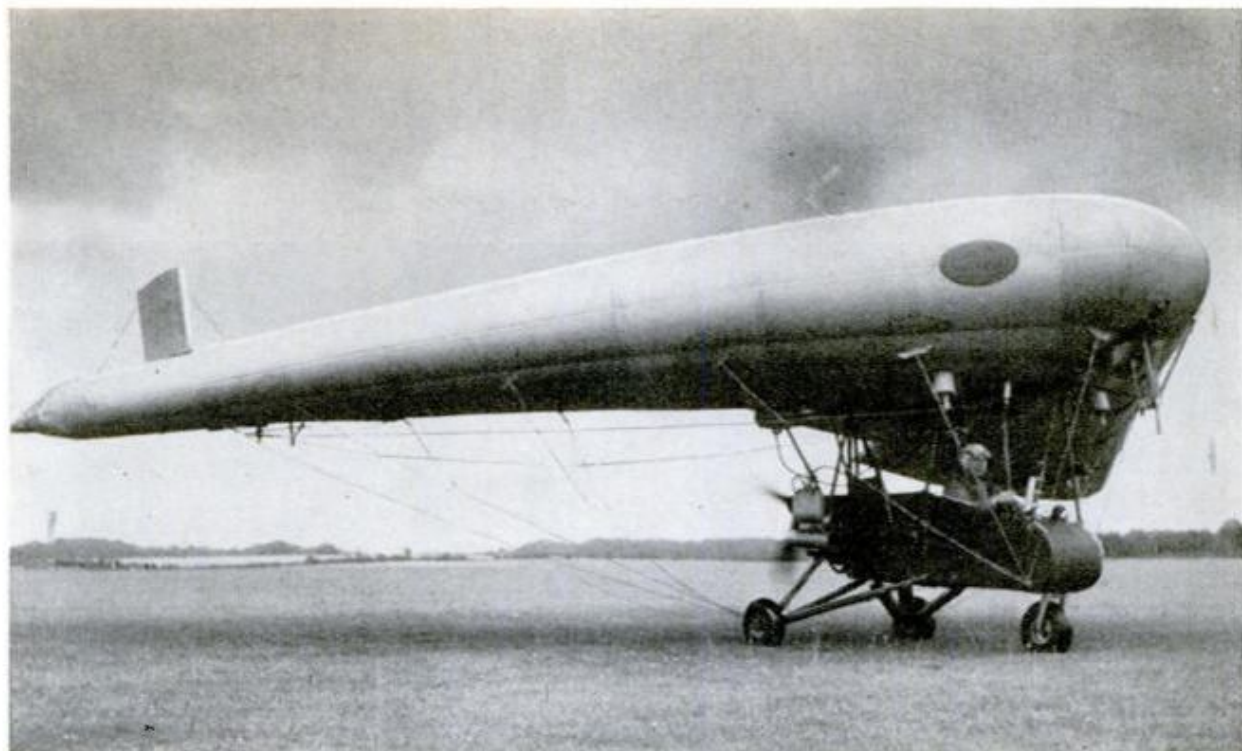
☐ One man, operating a new English-made machine for fashioning plastic shoes and heels, can turn out 125 pairs an hour.

Electric Cart Makes Rubbish Collection Easier and Faster

Gliding silently to and from back yards in Claremont, Calif., a small electric cart helps speed the collection of rubbish. Operated by the pickup man, who rides in back and guides the cart by moving a tiller with

his knees, the cart is loaded with the rubbish from three or more houses before it is driven to meet the large rubbish truck and transfer its load. Here, the battery-powered cart dumps hydraulically.





Liaison Plane Blows Up Before It Goes Up

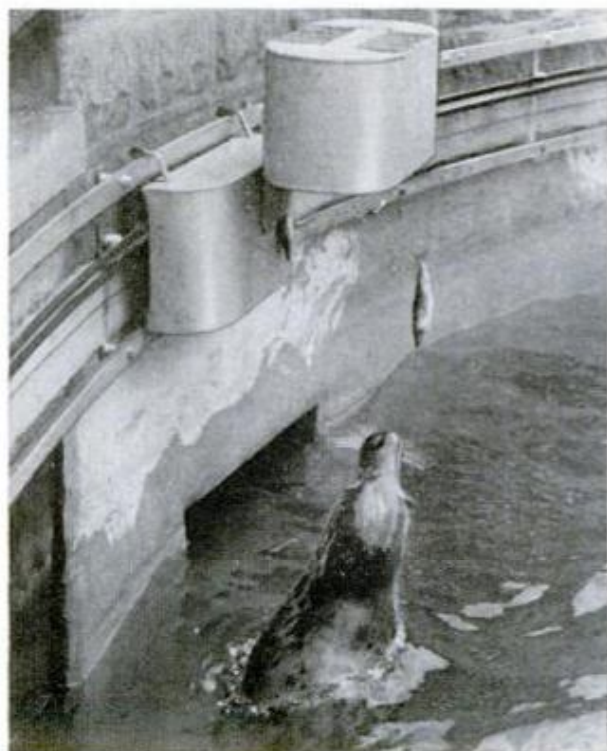
Inflation reaches new heights each time a new English observation plane takes to the air. In fact, it needs air in it before it can fly through it. Developed for the British

Army, it is essentially an open-air cockpit with a pusher propeller, and a huge inflatable wing made of a rubberized fabric that can be easily packed when deflated.

Seals Leap for Fish Thrown by Traveling Dispenser in Zoo

When the three seals in the London Zoo want a meal of fish, they have to work for it, and thus keep sleek and trim. A metal container, which holds eight fish and is controlled by a switch panel operated by the

keeper, moves around the edge of the seal pool on a rail. The seals, following the container, rush toward it when the keeper releases a fish through a trap in the bottom. The trap dispenses 40 pounds of fish a day.



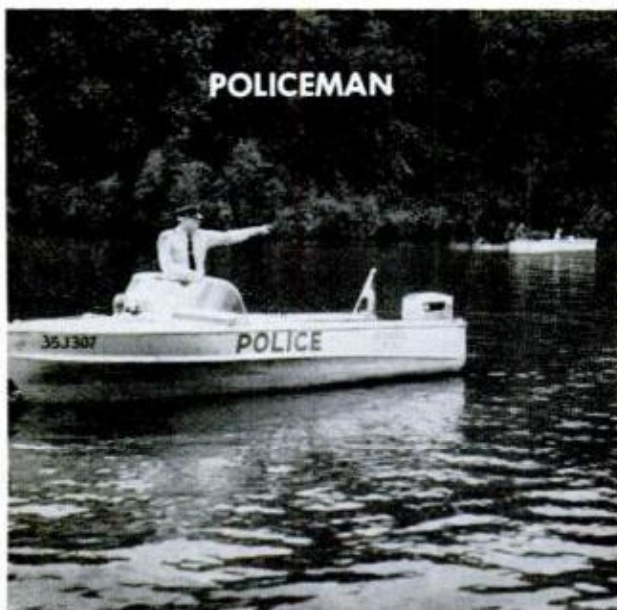


Beginning on these pages.....



Life on the Mississippi ... **The Town That Spends**

By Richard Dunlop



...PM's 1961 Special Boating Section



Its Summers Afloat

*Mark Twain wouldn't recognize his river now—
and if you like the idea of easy living afloat,
take a look at the way they do it around Winona*

ONLY TEN YEARS AGO families in upper Mississippi River towns went to the North Woods for summer vacations. The river flowed broad and unhurried from St. Paul down past Dubuque, its waters untroubled by houseboats, zooming runabouts and stately cruisers. If you had predicted that one day waterborne newsboys would be delivering papers to houseboat families, that boat-in restaurants would spring up along the river bank and that pleasure craft would become so numerous on the river that police would have to take to boats to direct the traffic, you'd have been called a crank. But then somebody discovered the vacation paradise which flows right past the towns' front doors.

Today in Winona, Minn., alone there are better than 1500 boats in a community of 7000 families. At least 300 families spend their summer week ends and vacations living on houseboats. Some take to houseboat living with such vim that they put in the whole summer on the river. On weekday mornings Dad jumps in the family runabout and commutes to work in town.

"Anybody who can afford a second car can afford a houseboat," one father of a houseboat family told me while his wife peeled potatoes for dinner. Outside on deck their small daughter fished hopefully for catfish. When the wife had peeled the potatoes and placed them on her galley stove to boil, she put the peels in a bag.



Not a boat race; just two Winona families out for a Sunday afternoon spin in their "summer cottages"

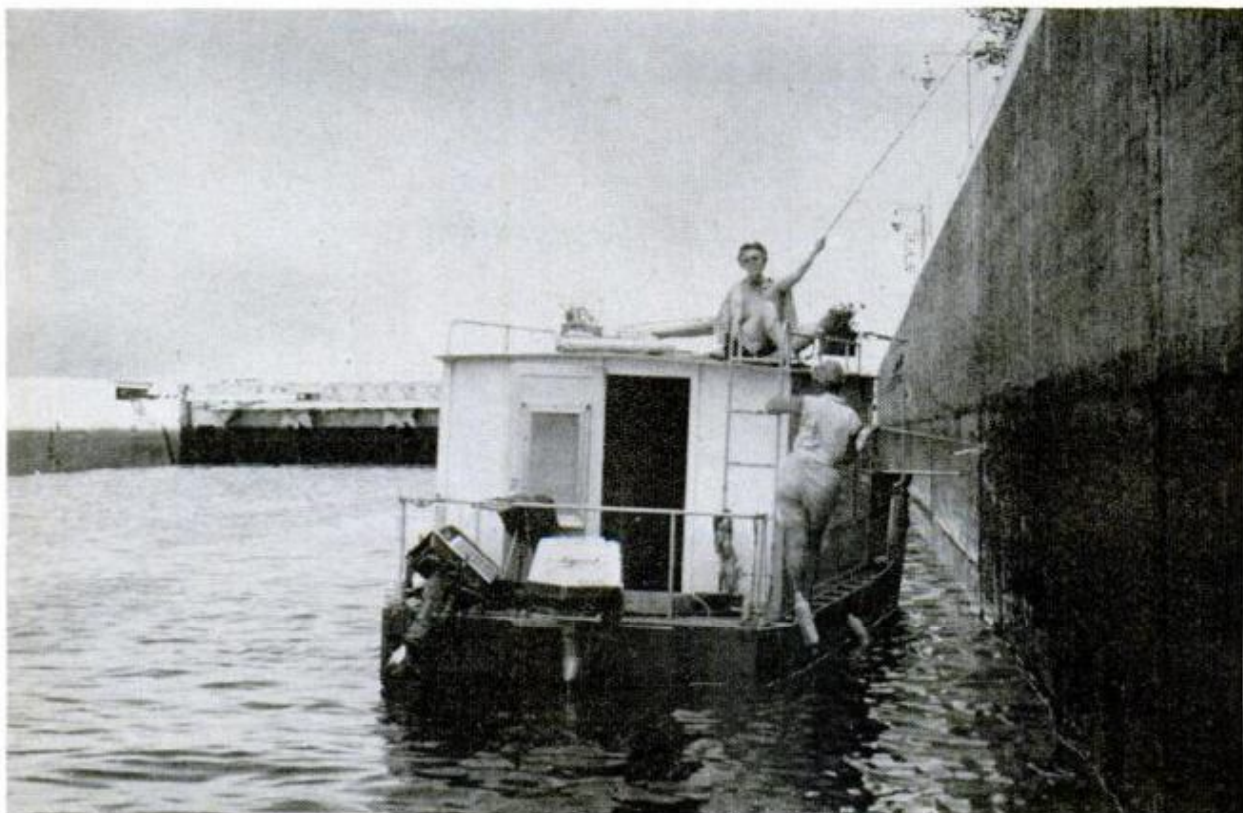
"One problem of river living is getting rid of the garbage," she said. "Some folks wait until they're under way in midstream and slip it overboard, but you just let the law find you doing that. With so many people living on the river it would be nothing but floating garbage if everybody did it."

Last summer the captain of a big Mississippi River passenger boat was fined \$100 because a member of his crew dumped garbage in the river.

"At least nobody tosses tin cans into the river without puncturing them to be sure they sink," said another houseboat wife. "Otherwise they can float down to the next lock and jam the gates so they won't mitre. Then there's a traffic snarl of boats waiting till the engineers fix the locks."

Locking through is one of the problems of water living. On a sunny Sunday afternoon scores of boats will be waiting their turn at each of the river's famous Corps of Engi-

New use for a mop—as a fending pole while locking through for a picnic on a special sand bar downstream





Giant barge tows remind boaters that it's still a working river, too. Wave and smile, but keep your distance

neers locks. To families in Winona, La-Crosse, Red Wing or Prairie du Chien the question comes up whether to lock through and picnic on a deserted sand bar or remain on the town side of the lock and eat lunch on a crowded sand bar.

"We prefer to lock through," one boatman said, "unless one of those big tows of maybe 20 or more barges is going through ahead of us. That always seems to take a turtle's age."

On the other hand, some families make a point of puttering about the locks so that the kids can see the big tows close up. Tow captains wave at the youngsters just as riverboat captains used to do in the halcyon days of steamboating. To river boys and girls of today tow men are heroes, and well might they be, for their barges carry more freight up and down the river than the steamboats of yesterday ever did.

Every season scores of brand-new house-

Upstream at Red Wing, summer residents of Boathouse Village elect their own mayor, and make their own laws





Metcalf photos

Housekeeping becomes houseboatkeeping. There's work to do, but in a friendly, informal outdoor atmosphere

boats appear in Upper Mississippi marinas. Used houseboats are also snapped up as soon as they go on sale. Even when the 21-year-old *Folly*, a clumsy pioneer houseboat, foundered at its moorings in a late fall storm, an enterprising boatman paid its owners \$50 cash for it. He raised the *Folly* and used her as a storage place for his hunting and fishing gear.

Some people build their own houseboats, or they buy metal or wooden hulls and complete the boat. One man built the river's only side-wheel houseboat. It is powered by an old truck engine and, as its owner admits, "drives like a tank." On a Winona street eight neighbors put down eight identical hulls in their eight back yards. The hammering and sawing started at one end of the block and moved right down the street as the men and boys worked together in the spirit of an old-fashioned barn-raising to shape first one hull and then another. Afterward each family finished its boat to suit its taste and interests.

Working together is not limited to building houseboats. Red Wing boasts of a boathouse village of 119 structures, housing 250 boats. Other river towns may prefer marinas, but here boatmen drive their runabouts and cruisers into water garages

much as they would put away the family car on shore.

When a new man joins boathouse village, everybody pitches in for a boathouse raising. For a first year's dues of \$72 and annual dues of \$20 thereafter, a man is given 19-foot frontage on the boom, which is river language for the floating-dock streets that extend between the rows of boathouses. Inside his boathouse he has room not only for his boat but for cool river living space. Some boathouse village citizens put in wall-to-wall carpeting, TV sets, refrigerators and stoves. They sit around and play cards, fish, "neighbor back and forth" and take frequent spins up and down the river in their boats.

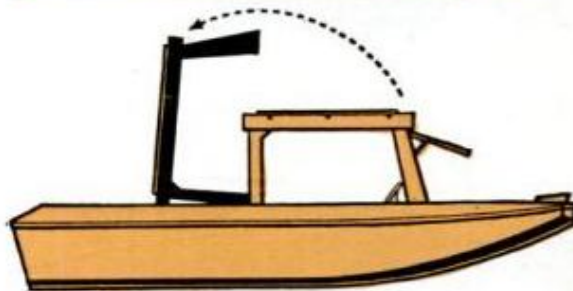
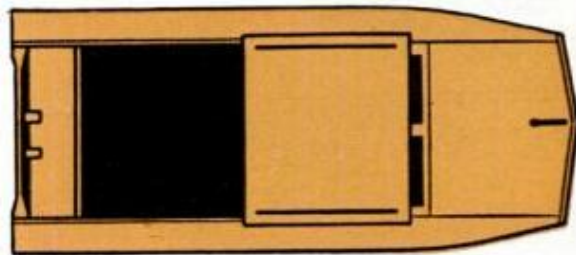
Boathouse village is governed by the Red Wing Yacht Club and elects a mayor to spearhead the administration. His Honor has two big problems. One is Old Man River, which in the spring rises in a fearful fashion. Then tall posts called "gin poles" are supposed to keep the booms and houses from washing down the river. The houses and booms climb higher and higher on the poles as the water lifts them so that they are never inundated. The other big problem is boat-rodding down the watery avenue.

(Continued to page 250)

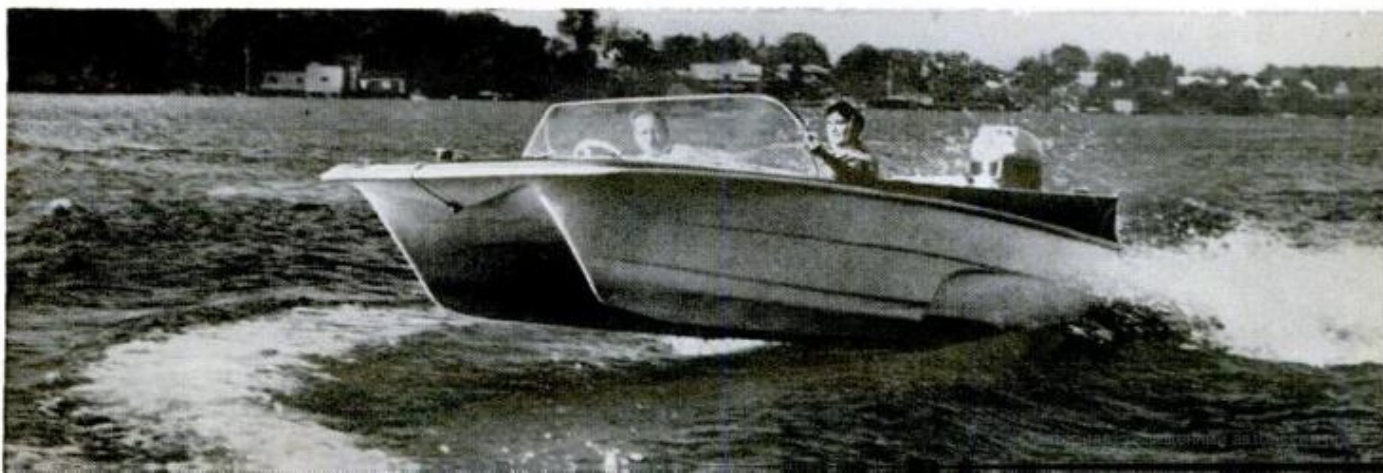
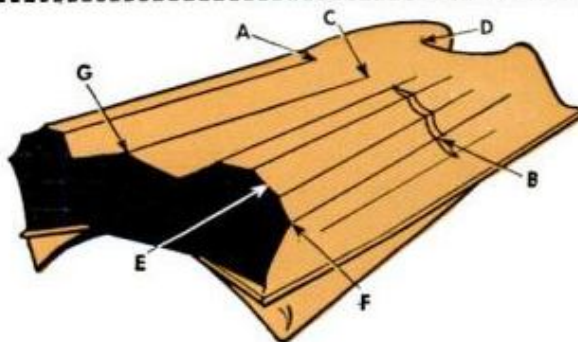
NEW FOR '61



MOST VERSATILE boat in this year's shows may be the Duracraft "Alaskan," a big-for-its-size, rugged aluminum utility boat developed from the work boats the company builds for Alaskan rivers. Only 16 feet long, but seven across the beam with a shallow, fast bottom, the boat promises enormous load-carrying capacity for its 350 pounds. A broad, 20-inch-high transom allows almost any power combination; the unbalanced fisherman's rig—maybe a 40 and a 5—would be perfect. The top has side curtains for bad weather, folds back for front loading and comes off if you want an open runabout for water skiing



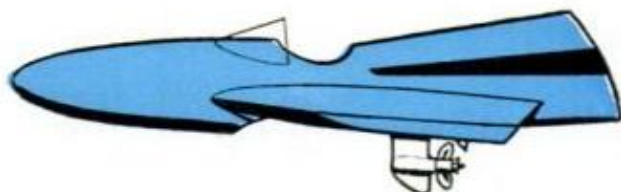
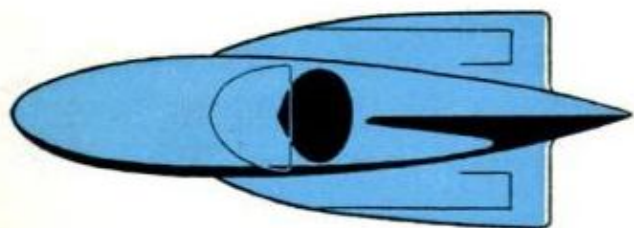
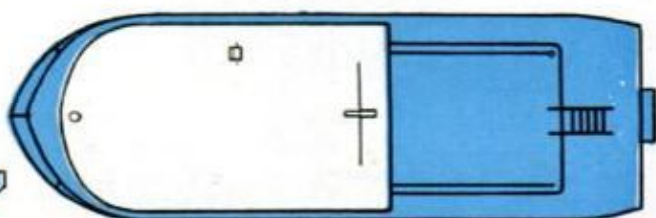
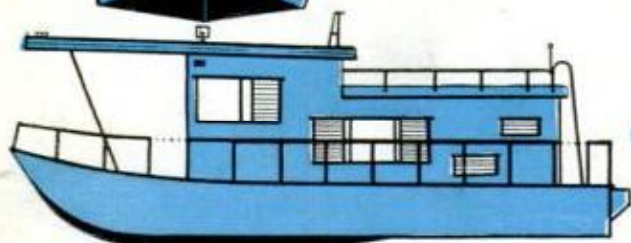
ANSWER to the problem of running a catamaran on a single outboard may be in the patented design of Custom-Craft's new "Delta Ray," a 17-footer with cat speed and performance on one motor. Hull diagram shows design features: A, pressure keepers; B, air-breathing step; C, aerodynamic tunnel; D, spray deflectors; E, nontrip turning surfaces; F, high-speed spray rail. Riding on four points and an air cushion, the hull gives a smooth, fast ride but still allows sharp turns at high speeds and doesn't miss the second motor



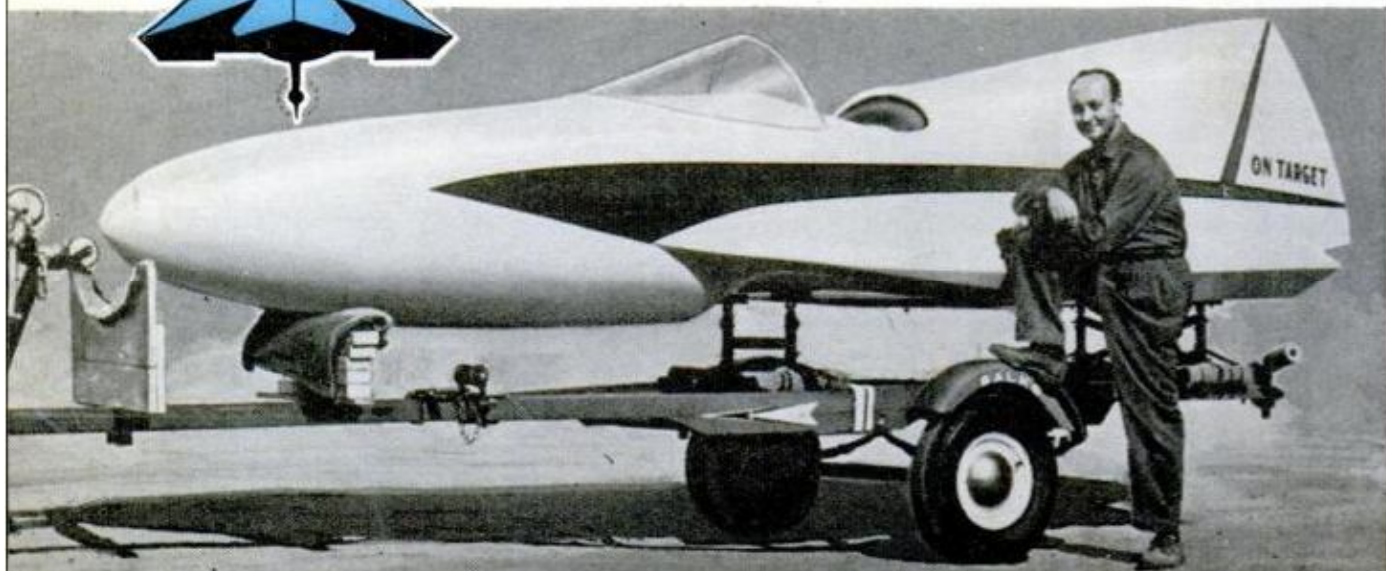
NEW FOR '61

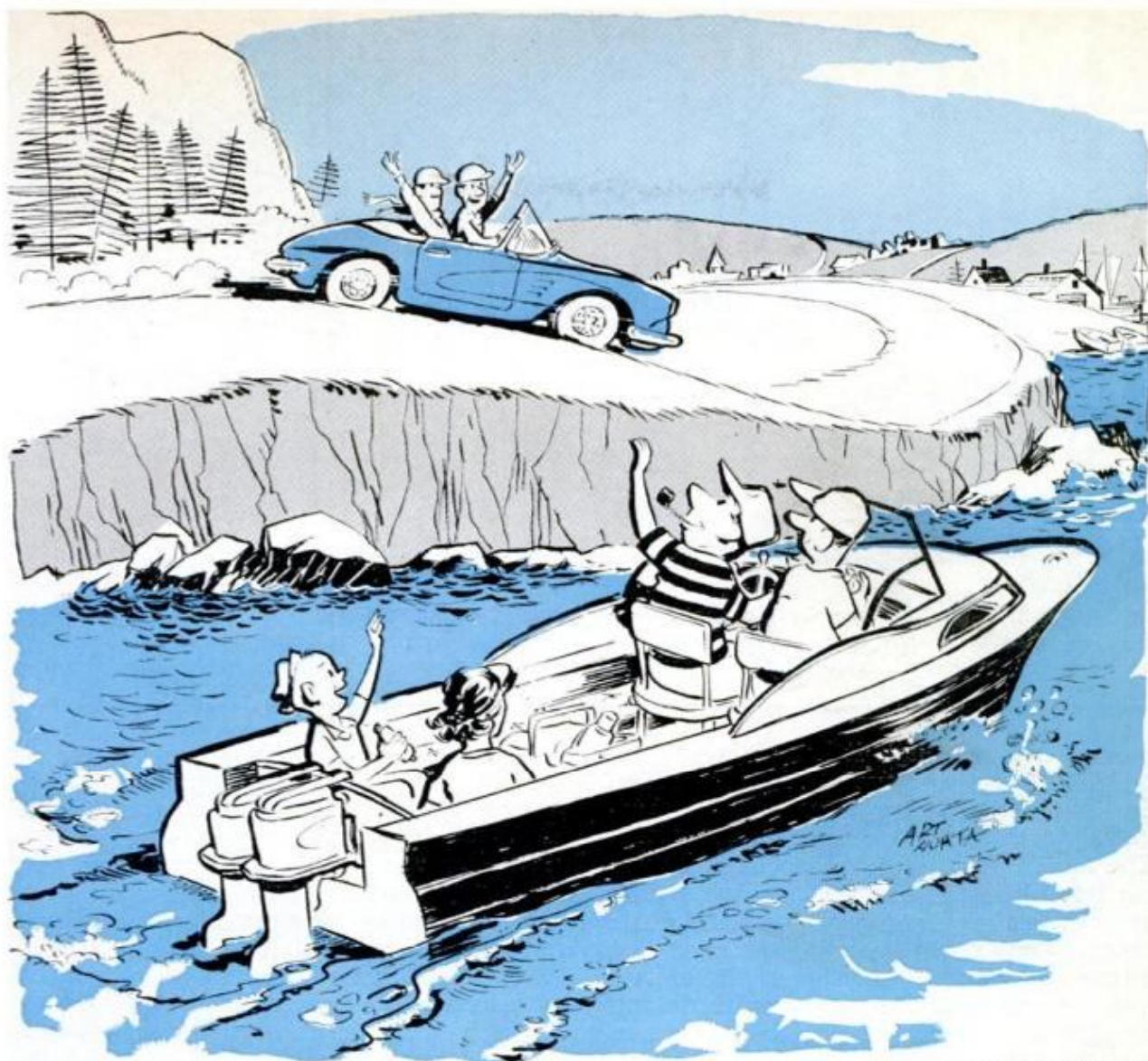


NEWEST houseboat, but under a familiar name, the River Queen "Ohio" model hides its best feature under the water line. It's an improved, modified-"V" bottom for better performance, especially in rough water. She's 34 feet long and 11 feet across the beam and is available with outboard or inboard power



WILDEST design departure is Tomahawk's experimental "On Target," an 18-foot three-pointer (one forward, two aft) with the motor enclosed and locked in position. A small forward rudder steers through an aircraft control stick





Drawings by Art Huhta

The Sports-Car Sport that Went to Sea

Here's a boating activity you probably haven't tried yet—and you're really missing something. It's predicted-log competition, the boating equivalent of point-to-point sports-car driving

THERE'S SOMETHING about boats, even eight-foot sailing prams, that makes their owners want to race them against other boats; boating people seem to thrive on competition. Most boats, though, don't lend themselves to racing, especially the big runabouts, day cruisers and cruisers. What's more, people—especially families—don't fit into powerboat racing either. Any way you look at it, it's hardly a family activity. You wouldn't enter your 18-foot outboard cruiser in a powerboat race any

more than you'd drive the family station wagon at Indianapolis, and for much the same reason.

But where there's a will, there's a way, and where there are boats, there can be a predicted-log competition—a contest in which speed makes no difference in the results. Any number of people in almost any kind of boat can compete, and the whole friendly operation becomes a social event not unlike a sports-car rally.

Actually, predicted-log competition isn't



INCOME TAX TIME? Nobody smiles like that over a tax form. It's the family skipper working out his predicted log, with the junior skipper looking on



TWO SCHOOLS OF STARTING don't always get along. The running starter and standing starter don't like each other's waves, but they're off on time anyway

a race at all, though it has many of the thrills. There are several big differences. For instance, the boats don't even start together—you can take off any time you like. The important thing is to arrive at the finish line on time. Though the boats start separately, they finish together. And while there's always a winner, there aren't any losers, for simply competing in the contest is a big lesson in piloting, seamanship and navigation. The predicted-log boatmen along our coasts may very well be the best small-boat navigators in the world. Anyone who can finish in the money in a predicted-log contest will find navigation a snap, even in fog or in the dark.

But most important—and the biggest attraction that the sport holds for anyone interested in boating—is the happy fact that the whole family can go along, enjoy the day on the water with other boaters, have a picnic lunch aboard, and have a whale of a good time right through the contest. There are few sports “widows” among predicted-log people.

The basic rules of predicted-log competition are very simple. A group of boaters—a cruising club, for example—selects a course for a run of 25 miles or so, a good afternoon's trip. Giving a couple of days' notice, they announce the course, divided into legs between control points indicated by such markers as buoys or lights, and set a finish time. The contestants, working backward from that information, decide on the speed they'll travel and determine what time they must start. Then the problem is to start at exactly that time, run the course

at the predetermined speed, and finish at the time given—but *without any time-piece or distance-measuring device aboard*. That's the biggest difference between predicted-log competition and the point-to-point sports-car contest, and the rule that makes the whole thing such an intriguing and habit-forming business.

Before the contest, each skipper turns in to the officials a log predicting his starting time, time between control points and total running time. Once filed, the prediction can't be changed. The logs are kept secret from the other contestants, but nobody runs the contest at the same speed, anyway, so your opponents' predictions don't mean much. Trial runs over the course before the contest are strictly forbidden.

Each boat that is to participate is assigned an official observer—almost anyone but your mother can serve—who is a friendly but neutral representative of the committee and who will be your built-in conscience. His job is to keep the only watch on board and log your time between control points and over the finish line. He can be a member of another boat's crew, a noncompeting member of the club or, better still, an interested nonboater. (What better way to make a first cruise than as part of a friendly competing group?) If manpower is short, a contest can be held on an honor system. These are usually “one-legged” contests, that is, they are run only from one point to another with a starter to get you off on your predicted time; the usual contest is run over a course with from five to eight legs. Having the observer aboard is part of



EN ROUTE AND ON COURSE, dad's grabbing his lunch on the run while he watches his speed, but the family and the observer enjoy a pleasant picnic under way



EVERYONE FINISHES AT THE SAME TIME—if all calculations are right, but of course they aren't. And everyone wonders if the other guy isn't doing better

the fun, though, and it's a fine way to get to know other boaters and club members.

On that subject, one of the finest types of predicted-log contest is held between members of two or more clubs, who exchange noncompeting observers, then celebrate the day and salute the winner at dinner afterwards.

To prepare for the contest, the skipper must learn his boat's performance well enough to operate it consistently at a given speed. The first job is to select a speed at which your boat runs comfortably and well. There's no speed limit, though the official rules specify a six-mile-an-hour minimum speed. With most planing hulls, the best speed is a medium cruising speed, at which the boat is up on a plane but not at full cruise. Once you've decided on that, you run the boat at that speed over a measured course to determine the time it takes to cover a given distance. Many harbors have a measured mile marked off, or you can run any known distance between two points and work out the time for any distance from that figure. If you covered three miles at 4200 r.p.m. in nine minutes, you know your speed at that throttle setting will be one mile in three minutes.

A tachometer is a big help in such calculations, since it lets you run your motor at a constant r.p.m. However, you can compete without one by learning to "feel" how fast your boat is moving and to recognize the sound of the motor and boat at the speed you want. Using tachometers can make the contest so easy that many clubs and boating groups are outlawing them

along with timepieces and speedometers to make the event more interesting.

Having determined your mile-per-minute speed at your chosen throttle setting, try the same setting in different wind and water conditions and at different angles to the wind and waves (or currents and tides, if your boating water has them). You'll soon learn to compensate with the throttle for varying degrees of resistance.

Since weight is a big factor in a boat's speed, especially with lighter boats, be sure to do your practicing with the boat loaded about the same as it will be on the day of the contest. Make a note of the difference in speed when the load is changed—you might draw a 350-pound observer some time! And remember to keep the boat trimmed at all times. Trim affects boat performance even more than a few pounds of weight, so always keep her level and square on the water.

An important piece of information for any but a one-legged contest is the time it takes your boat to round a control point. Pick a distance (the rules usually require that you turn within 200 feet of control points), and always try to circle your control points at that distance. Time yourself through different turns until you know how long it takes to get around. Then translate that time and turn into a degrees-per-minute figure. If a 90-degree course change takes 120 seconds, then you'll make a 30-degree turn in 40 seconds, and so on.

Armed with that information, you can now make a prediction of the time you'll need to cover each leg, turn around each

control point, and reach the finish line. You don't need complicated instruments or great navigating skill—just an accurate chart or map and a good measuring device. To make things easier, you can get time tables which give the time it takes to run a given distance at a given speed. They're a big help. If navigation isn't your strong point, you can have a friend do the computing. However, he must go along as a member of your crew; no professional help.

Equipment needed for predicted-log? Except for charts and measuring tools, hardly anything. As a matter of fact, you're probably overequipped right now, because your boat's clock and speedometer must be removed or covered. Tachometers, again, are optional, but they're a good thing for any boat to have if only to keep down the fuel bills. You do need a compass, especially for contests where a big leg is too long to navigate by sight. Also, it's a good thing to make sure your course is as straight as the

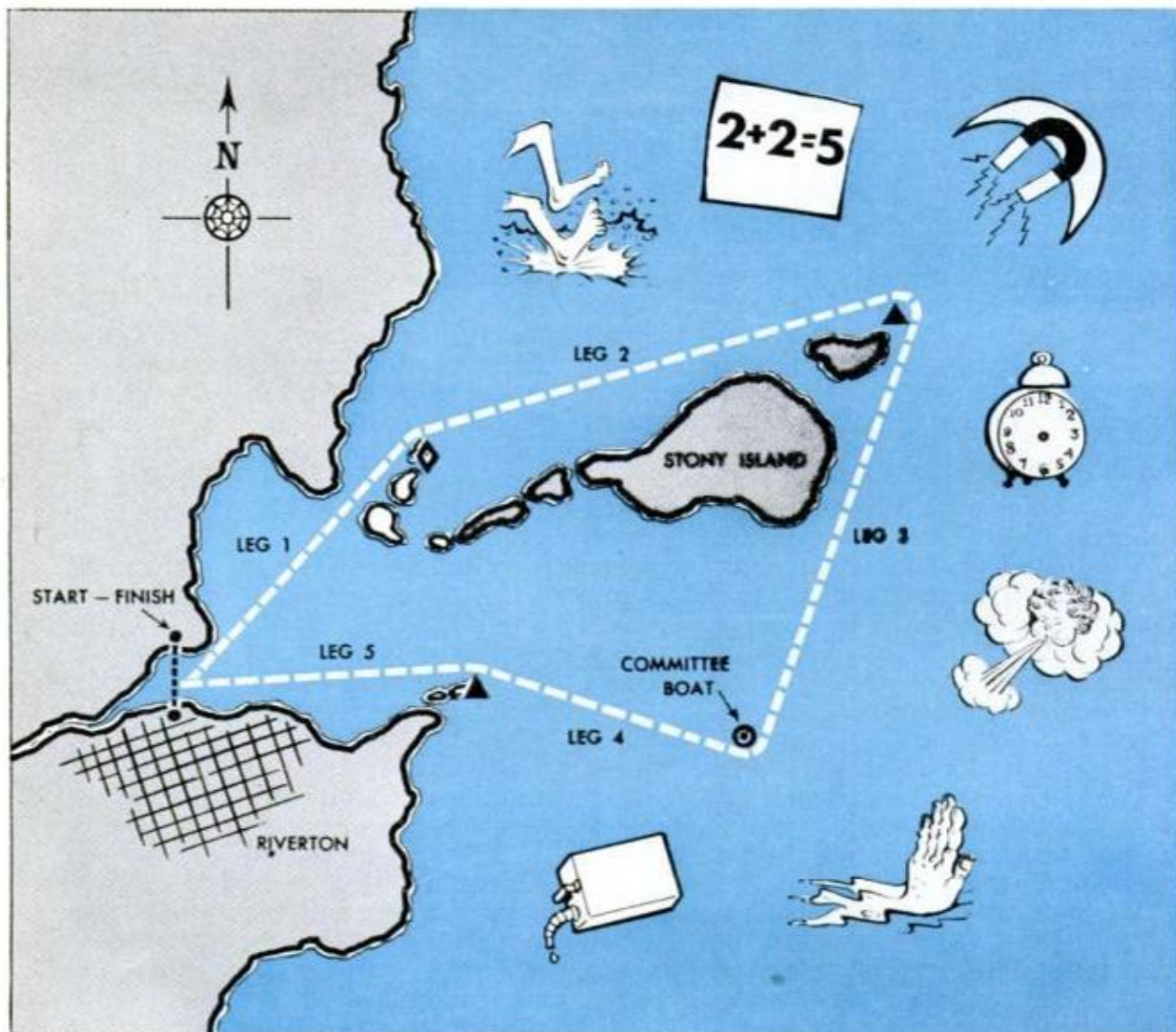
line you drew on that chart. But that's about all—you need less equipment for a predicted-log contest than you'd use for a Sunday afternoon cruise.

Your crew? Anyone who wants to come along, as long as you leave a seat for your observer. But remember, as skipper, you're responsible for your crew's conduct, so pick them well.

The course for a predicted-log contest can be laid out almost anywhere that there's room for boats to run. Ideally, it should be roughly circular and at least 25 miles long with legs of at least five miles each, and should begin and end at a point near your harbor or launching area. If there isn't that much room, however, there's nothing to keep you from running up a river and back, or even back and forth across a small lake with control points spaced around the shore line. If you're making your own rules, you can make an overnight or weekend cruise

(Continued to page 270)

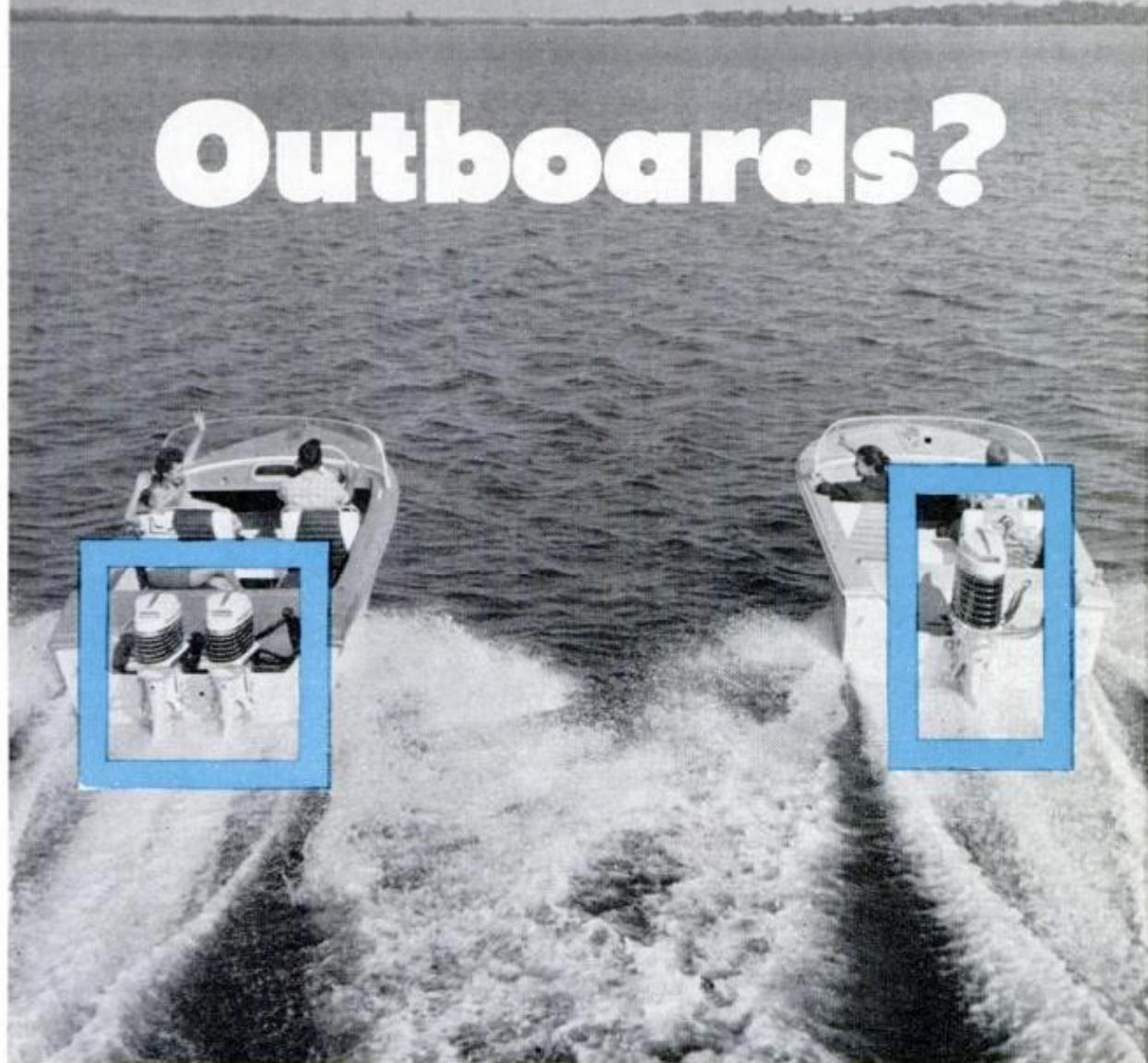
HERE'S A POSSIBLE predicted-log course, out of a harbor, around four control points, and back home for the finish. Where a natural control point is missing, as at one point here, a committee boat or other marker can be used, so if you don't have an island, make one. Wind and waves, current and tides, fuel and time and the chance of an error are the obstacles, but they're not insurmountable—not if you've figured it right





How Many

Outboards?



Kiekhaefer Corp. photo

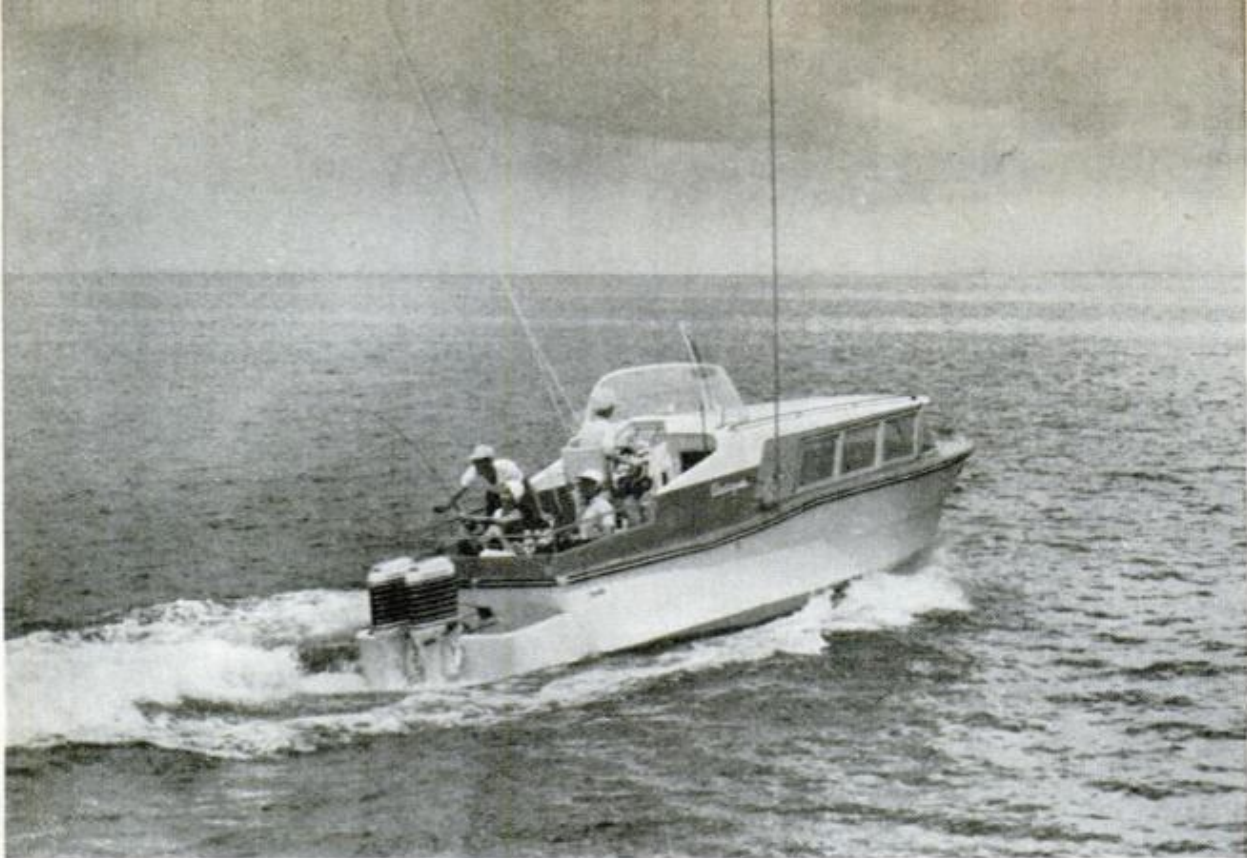
**Two plus two equals four the world around—
except with outboard motors, where 20 plus 20
can equal as little as 25 or as much as 50**

By Dick Kirkpatrick

YOUR BOAT IS GROWING. No, not the one you're pulling out of winter storage for the coming season—it's the same as it was when you put it away last fall. But if you're an average boater, this one is bigger than the last one you owned, and your next one will be bigger still—and more powerful. In the five years from 1955 to 1960 the size of the average outboard

boat grew from 13½ to 15 feet, and the motor horsepower increased from 10½ to 27½. And that's including all those 12-foot fishermen's boats with five-horse motors. In the 20-horse-and-over class, average horsepower has increased three and a half times.

The growth is logical. A boat two feet longer than yours will hold another person,



DUAL motors are in their element on this big sport fisherman, where power and reliability are big factors

a lot more fishing tackle, and another couple of gas tanks—maybe have a bit more comfortable cabin and more cockpit space for sunning or fishing or picnicking afloat. And the extra horsepower is good, too. It means more speed for skiing, getting across the lake for groceries, or maybe just a little more of the thrill of driving a fast boat of your own.

As the outboard boat has grown up, the outboard motor has been forced to grow with it. There's no real "horsepower race" among the outboard manufacturers in spite of the conversation down at the boathouse. It's just an heroic effort by a bunch of very good engineers to keep up with your demands on their product. And they're doing a pretty good job, too. You asked for speed,

SINGLE big motor is at its best on this light runabout where speeds over 30 make drag the big problem



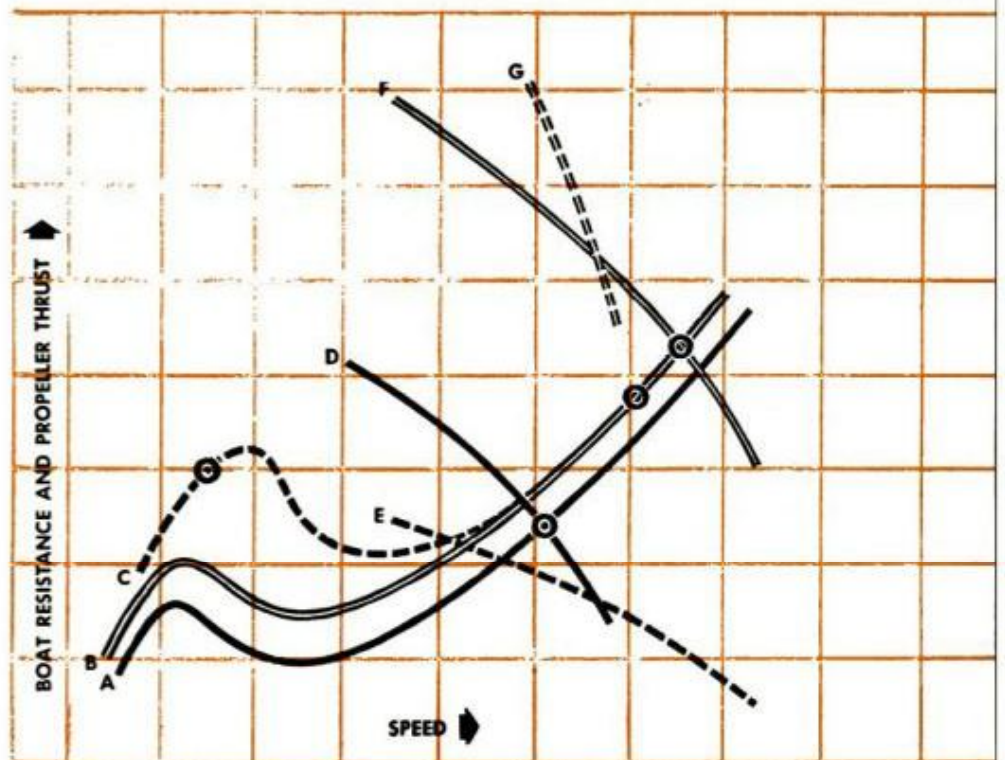


UNBALANCED duals are perfect for fishermen—40 horses to get there, then six for lower fishing speeds

and now there's a *stock* boat and motor combination—the big Evinrude 75 and a class F runabout, officially a pleasure boat—that could whistle two men down the lake at 78.9 miles an hour if you want it to; that's the pleasure boat record set by Chuck Parsons in that combination. You can buy a class F rig anywhere. You asked for power, and there's Henry Verrier's 40-foot seagoing cruiser planing across Long Island Sound at 23 miles an hour with twin

Johnson 75s on the transom. Five outboard boats poured *eight hundred horsepower* into a big moving job recently at Silver Springs, Florida, and shoved a 400-ton underwater stage over a mile in less than an hour against five-mile-an-hour currents and a 25-mile-an-hour wind. Each was rigged with dual 80-horsepower Mercury motors, and they performed a feat usually left to tugboats, but in inland water that no tug has ever navigated.

SAMPLE performance chart for a boat with both single and dual motors. With one (A) or two (B) motors, resistance is similar, but higher with two. Single motor thrust (D) meets A at the highest speed for that rig; dual peak is where dual motor thrust curve (F) meets B—only about 25 percent faster. E is one motor with the wrong prop; G is duals with the wrong props; C is another boat that's harder to plane. E can't plane boat C, G must exceed maximum rpm's to drive boat B. Charts like this let outboard engineers predict performance of motor-prop combinations on any outboard boat





25 HP — ONE MAN — 19 MPH



DUAL 25s — ONE MAN — 25 MPH



40 HP — ONE MAN — 24 MPH



DUAL 40s — ONE MAN — 31 MPH



60 HP — ONE MAN — 33 MPH

The motor manufacturers have the power combination for almost any boat you might buy, but when you graduate up into the 40-horse-and-up class, you're faced with the big question: How many?

It's easy to figure that, if one 40-horse motor drives your boat 25 miles an hour, two 40s will raise your speed to 50. But they won't. It would take *four* 40s, if you could get a transom that wide, and then it might not work. Nobody has tried that yet. And 40 plus 40 equals 80 on paper, but not on a boat. If a single 40 drives your boat 25 miles an hour, dual 40s will only increase your speed to 30 or 32.

Okay, so double the 40 in one motor and get an 80. It still won't double your speed, but it'll beat the dual 40s. Then try to pull a really heavy load—several water skiers, for instance. Doubling the horsepower rating of the motor won't double the propeller area, and for real lugging power you need lots of prop digging in. On one motor it would take a prop about the size of your steering wheel. That wouldn't do. You might be able to manage both power and speed if your outboard had an aircraft-type variable-pitch propeller that you could change from the cockpit. But that variable-pitch prop is still on a drawing board somewhere.

And another thing to think about—what if you're bucking a wind and heavy water, running back to your dock to beat a storm, and that big 80 conks out on you? Sure, it's unlikely. They build 'em pretty good these days, but it could happen. And they don't put oarlocks on 18-foot cruisers. You'd be pretty happy if there was still one motor left to get you home.

Obviously the boater must weigh the advantages of each type of rig and make his own decision. The big points to consider are cost, speed, power, safety, economy of operation, weight and space, and driving ease. Let's look at them:

COST is the first problem you'll hit—and it's a big one. You'll pay up to 30 percent more for the same number of horses in a dual rig, and then you're not through. Add extra shipping charges, since they'll be priced FOB the factory. Then add the cost of another set of remote controls. You'll have to double the throttle and shift equipment, and add at least 80 percent to the single rig cost. Installation cost for the remotes won't bother you if you rig your own, but if you have it done, figure 30 to 50 percent higher installation cost. You'll need at least two fuel tanks, and may need two generators and two batteries for your duals, though some motors will operate dual on one of each. Score one point for the single.

SPEED is a big one for most boaters in the outboard class. The speed equation is an easy one: Thrust goes *down* as speed increases; drag goes *up* as speed increases. An outboard lower unit going through water creates a lot of drag; two lower units present just twice as much. A big single motor, with only one lower unit, can go faster because that lower-unit drag is cut in half—it's just that simple. Under 30 miles an hour, that drag factor is fairly unimportant, but over 30—an easy speed

PM's author runs his own test, using different power and load combinations on a versatile Alumacraft 18-footer. See results

for many outboard runabouts—it becomes deadly. Score another point for the big single motor.

POWER is fairly unimportant on a light runabout once it's up on a plane, but on a heavy boat or when pulling water skiers up out of the water, it becomes very important. Dual motors, simply by swinging more propeller area, can apply more horses to the job of moving that weight. Also, some big cruisers are simply too big for any single motor. If you're interested in thrust, score one for the duals.

SAFETY. If you're going out onto big water where power failure can hurt you, a second motor can be a big safety factor, if only a psychological one. On water where there's a problem with sudden storms, tricky tides or strong current, or if you're going off the beaten path into wilderness country, the second motor is a good idea. At the same time, modern outboards are very reliable—much more so than their owners. Only four percent of the boating accidents in 1960 were caused by structural and mechanical failure combined; only a small percentage of those failures could be attributed to the failure of the outboard itself. But if you want to be sure, count one for duals.

FUEL ECONOMY isn't as important as you might think. Flat out, two 40s burn only a little more fuel than one 80; neither rig turns in very efficient performance unless you use it right. One thing—for low-speed running, you can tip up one of a set of duals and run the other. This becomes a big factor if you're doing very much fishing from a big boat. But score fuel economy as even.

WEIGHT AND SPACE difference are important only if your boat trims so delicately that a few pounds make a big difference. Two medium-power outboards will weigh around 300 pounds; an equivalent single around 250. Strain on the transom is about the same, since the weight is better distributed with duals. The extra space taken up by two fuel tanks and two batteries may make a difference, but in general, score this one even, too.

DRIVING EASE is hard to compare, but becomes a factor if you don't like handling two sets of remote control levers. One set handles easier, but you can get used to two. Steering with the throttles is nice if you want to turn shorter than usual, but it's of questionable value and takes some practice.

Torque isn't the problem it once was. Motors are balanced better these days to compensate for it, and you can get counter-rotating motors for dual rigs. The new geared and boosted steering systems cut down the torque problem, too. So give singles the edge on driving ease for new boaters, but duals for old hands who like lots of levers.

THE SCORE comes out singles two, duals two, three even, unless you count weight and space in the single-motor column. And it boils down to this: If you want speed and low original cost, the big single is for you. For big-boat power and a spare motor, go to duals. If you're in between like most of us, you'll have to weigh the factors and decide which will be best for *your* boat. You're the one who has to drive it. ★ ★ ★

TESTS were run at top cruise speed with stock props. Boat did well with all motors, but note inconsistent power-speed ratio



25 HP — FOUR MEN — NO PLANE



DUAL 25s — FOUR MEN — 19 MPH



40 HP — FOUR MEN — 21 MPH



DUAL 40s — FOUR MEN — 28 MPH



60 HP — FOUR MEN — 30 MPH



A Marine Architect Looks at the Problem

By David Beach

Marine Architect, McCulloch Corporation

AT THE SCOTT test station at Bayport, Minn., we've spent a lot of time trying for new ways to measure and evaluate the performance of motors and propellers, hoping to help you get the most out of your boat. Static tests, with the motor running in a tank, yield a lot of valuable information, but *you* don't run your motor in a tank. To duplicate all the conditions under which you use your outboard, we built the self-propelled dynamometer boat, or thrust boat, on the opposite page. A motor to be tested is mounted in the center well in a dynamometer frame with hydraulic load cells which accurately measure either thrust or drag of the motor at any speed—easily maintained by the outer motors. By making an algebraic graph of the thrust-speed curve of a motor, we can predict the effectiveness of any propeller-motor combination as a driving force on a boat.

In our testing, we have learned that the addition of another motor to a given boat doubles the horsepower applied, but also doubles the lower unit resistance. At higher speeds, this drag seriously affects the total thrust produced on the boat. At the speeds attainable by light boats, drag values are an appreciable fraction of the total boat resistance, so two lower units increase the over-all drag greatly. This is the greatest penalty of the dual outboard installation.

You do get acceleration advantages with dual motors, however. Drag is low at low speed, so at lower speeds you make better use of your horsepower with a matched pair of smaller motors with their larger propeller areas.

Many other factors enter the comparison of single and dual outboard installations, but the marine architect and outboard engineer are chiefly concerned with the balance of thrust against appendage or lower unit drag and the effect of these forces on your boat.

A word on reliability and the safety factor in the dual installation. The American outboard motor has become as mechanically reliable as the engine in your car—but who hasn't wished at some time that he had a second engine in his car? The two-cycle outboard is, unfortunately more dependent on your attention to maintenance than is your four-cycle automobile engine. Take care in selecting your fuel—especially the oil—and be sure to use the right spark plugs and to carry spares. If you keep your motor up, it won't let you down.



Clark Dean, Infinity, Inc. photo

Scott test engineer Glenn Anderson drives Dave Beach's thrust boat. Twin 60s power the boat for a test on the 25 mounted in the center dynamometer frame. Dials on center dashboard are operating instruments for drive motors; big shock-mounted dials on cockpit sides are a hydraulic pressure gauge to show thrust and drag, low and high-speed speedometers and a tachometer, all for the test motor. Box at the driver's left holds his "secretary," a portable tape recorder; dial above that is trim-indicating tube. Movie camera records all readings.



PM's Go-Cat

IT'S RUGGED, ROOMY AND FAST. YOU CAN BUILD IT AS A RUNABOUT OR CABIN CRUISER FROM EASY-TO-FOLLOW PLANS PRESENTED IN THIS AND NEXT THREE ISSUES.



PART I



Designed by Warren Gale, noted Florida outboard catamaran custom builder and designer.

ACKNOWLEDGING the current demand for beamier, smoother-riding boats that are well nigh impossible to capsize, *PM* has come up with its version of just such a dreamboat in its 16-ft. catamaran, *Go-Cat*, premiered in this issue. A very adaptable design, it can be built as a runabout or as a cabin cruiser, Figs. 1 and 2. Not only did this fast cat exhibit the very best of these characteristics in the builder's trials, but sudden port and starboard turns on rough water, at full bore, failed to incline (heel) the craft more than 10 deg.

The performance shots in color shown on the front cover and opening pages of the story, amply demonstrate the *Go-Cat's* capacity for speed, excellent maneuverability, family-size accommodations and stability. All this and sharp eye appeal too. The boat has taken a full year to complete, starting in Nov. 1959 when Warren Gale, noted catamaran designer, was commissioned to draw up plans of a craft that would be



LENGTH: 16' BEAM: 7' 9"
SPEED: 35 MPH (2-40's)

(Data from full-size model built in *PM's* shop under supervision of boating editor, Earl Wobeck)



DOCKING Go-Cat is no problem with the wide-set twin motors, while boarding the boat or stepping up to a dock from the wide side decks is easy and safe



WATER SPORTS are the twin-hulled craft's real dish. Plenty of power and speed for pulling skiers and spacious cockpit for stowing and using equipment



STABILITY keynotes the many fine handling characteristics of Go-Cat. Even when put into a hard turn at full throttle as shown, she stays on her feet



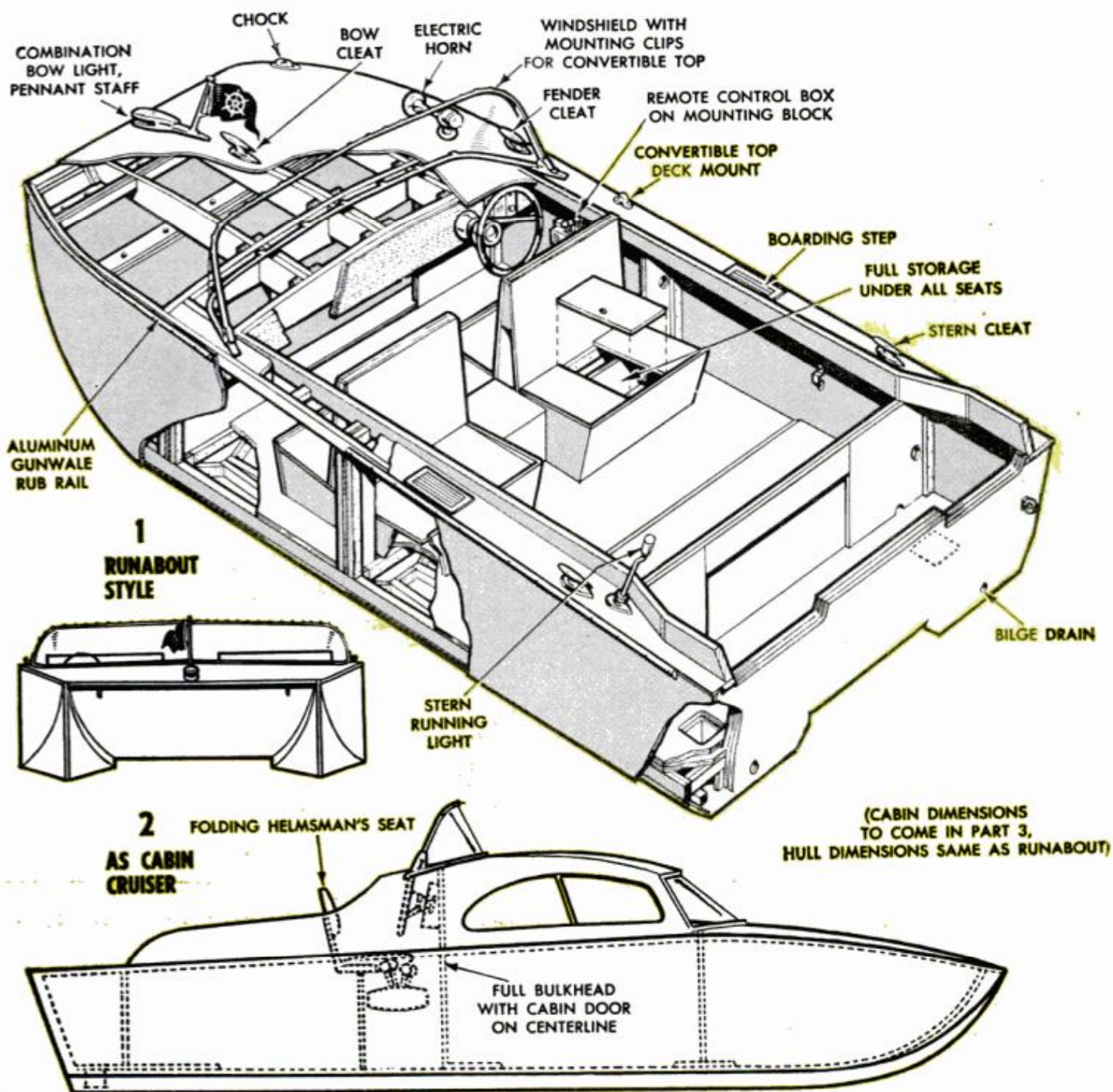
LAUNCHING and retrieving a catamaran is just as easy as it is for other types of craft, an 1800-lb.-capacity tilt-bed trailer being just right for Go-Cat

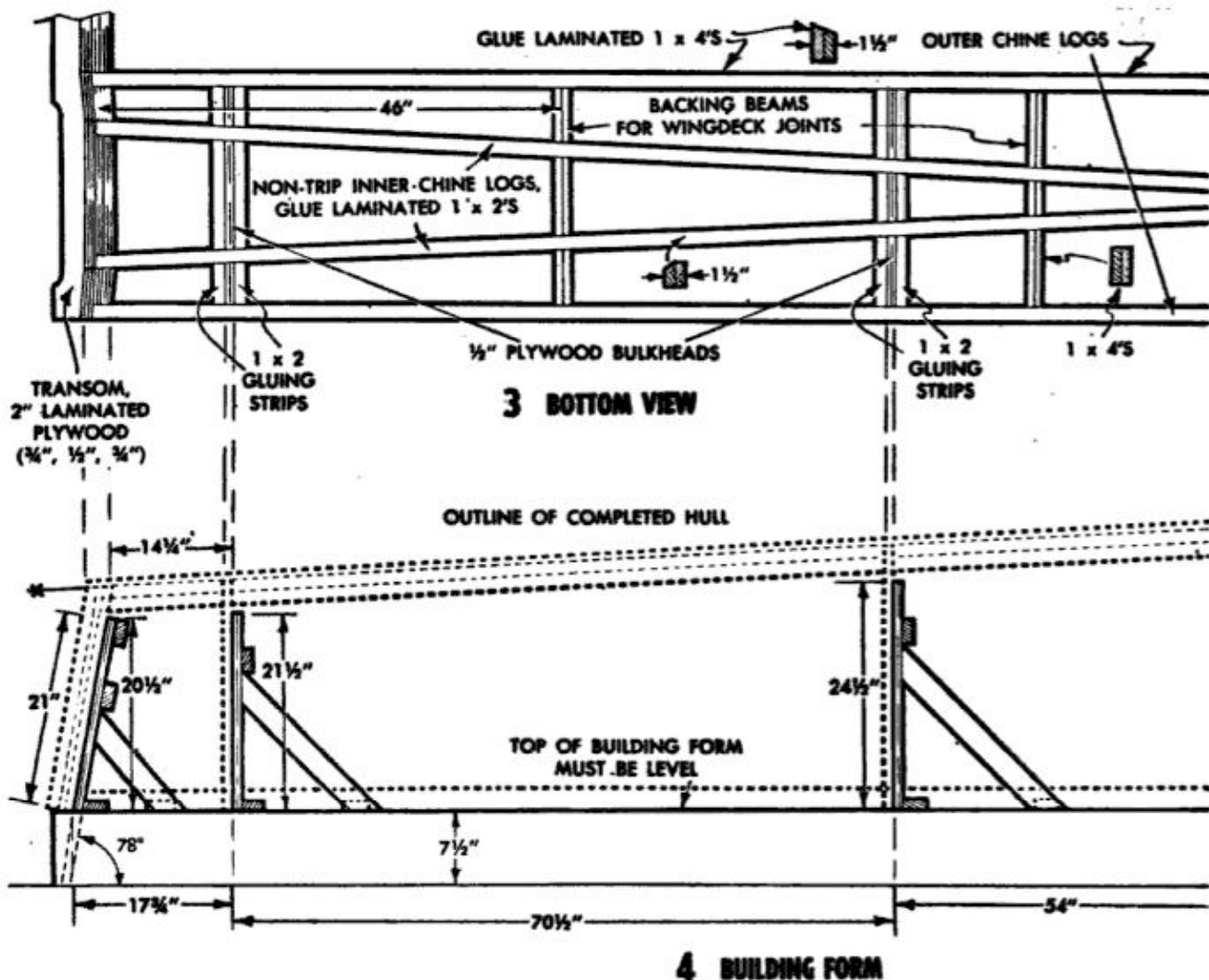
fast, quick on its "feet" and rugged enough to remain operative if caught in a storm, yet easy enough for amateurs to build. The construction period was painstaking, what with numerous modifications and changes in building procedures having been made to improve the boat and eliminate difficult construction. After outfitting and equipping it late in Oct., 1960, the cat was tested under a variety of sea and load conditions on Lake Michigan and on more sheltered waters. Performance on all counts exceeded expectations. Now, the finished product is offered to you in the form of easy-to-follow construction plans.

Although Go-Cat is a big boat, with

nearly an 8-ft. beam running almost the entire 16-ft. centerline length, much of the construction centers around the narrow port and starb'd hulls (actually, hull halves). These are joined together by the wing deck, the planking that joins the two hulls together as shown in Fig. 1. Since the overall dimensions of the individual hulls measure only 26¼ in. wide, 31⅝ in. deep and 16 ft. long, they could be built in a garage or ground-level workshop and then joined together outside for completion.

Both hulls are built upside-down on the same building form as in Figs. 3 and 4, one at a time. The latter should be erected on a concrete or wooden floor, so that once it



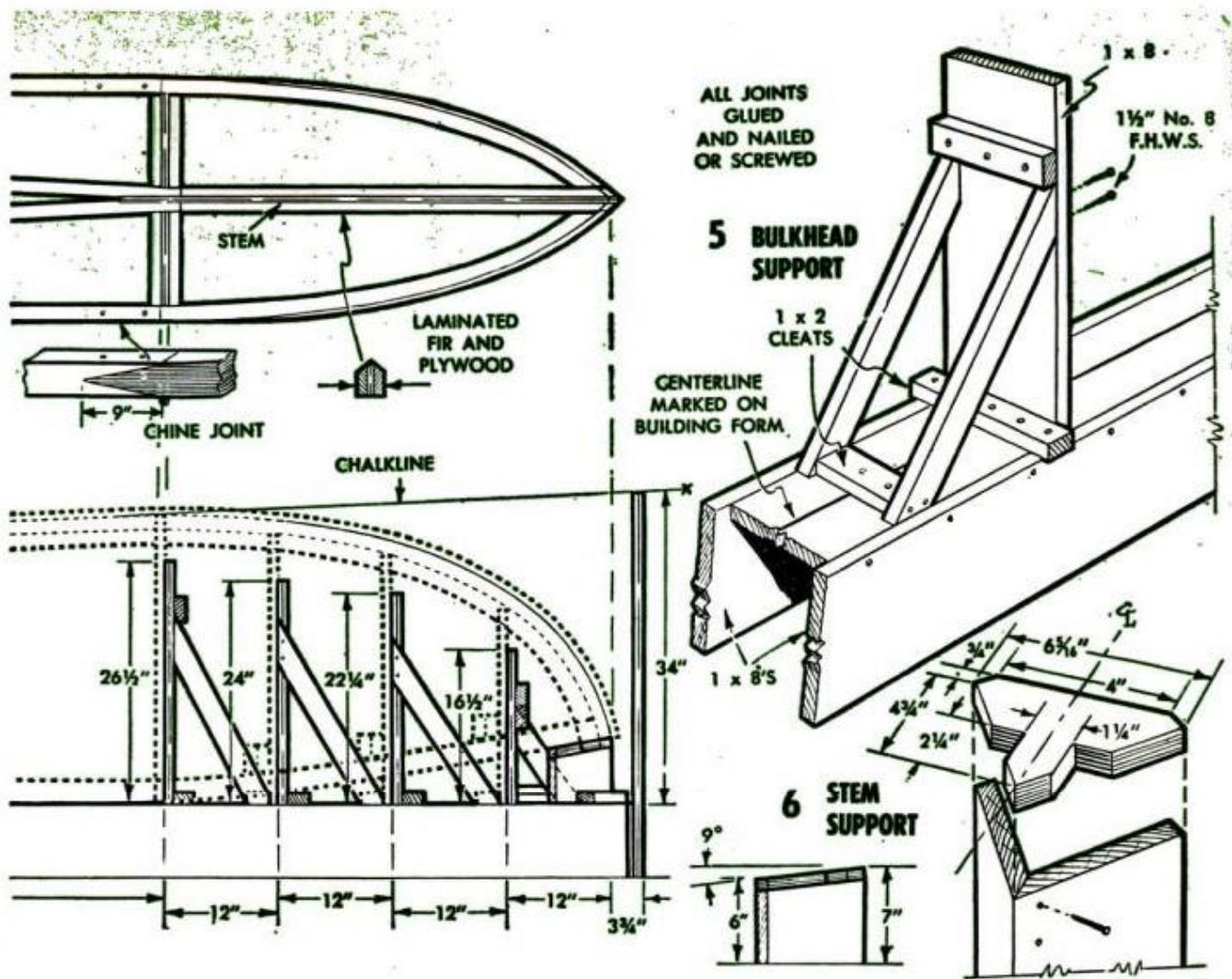


is made level and anchored in place, the form will remain in position. Our form was held firmly in place to a concrete floor by means of wooden blocks screwed to it and cemented with Plastic Mastic, Figs. 7 and 8. The blocks were pried up easily when the boat was completed. As in building most any boat, the temporary form on which the structural members are mounted is extremely important. If the form is not made accurately and kept rigid, much time will be wasted truing up members.

Figs. 5 and 9 show how the building form is constructed. Before fastening the bulkhead supports to the form, a centerline must be marked on the top. It is very useful when centering the bulkheads on the form and serves as a checkpoint when locating other parts. Note that all bulkhead supports are set up at right angles to the form, except for the 78-deg. transom support. The stem support is detailed in Fig. 6.

Some comments on the materials and building procedures for *Go-Cat* are appropriate at this time. All plywood should be marine grade—AA. Exterior plywood is not recommended because of delamination problems created by occasional large voids

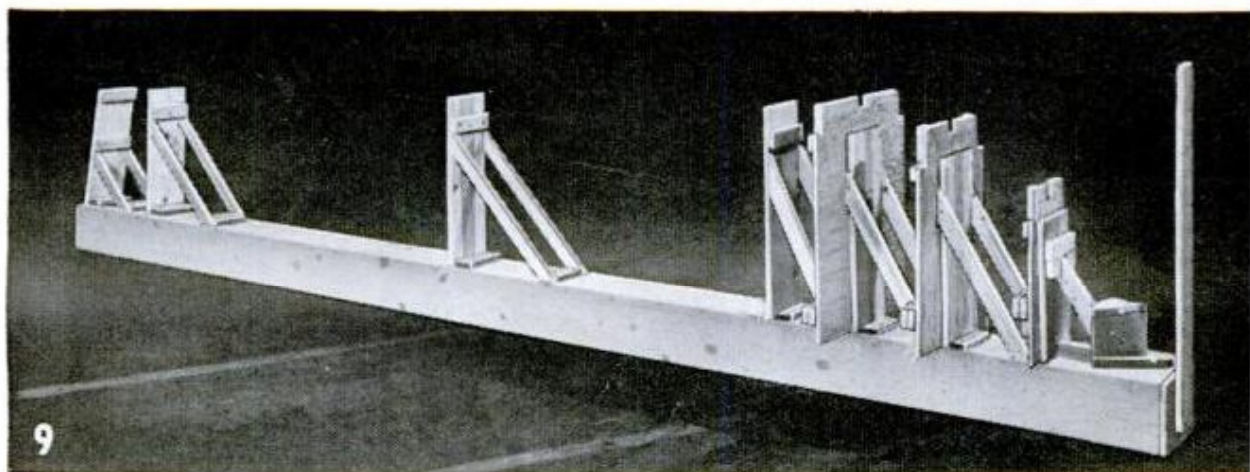
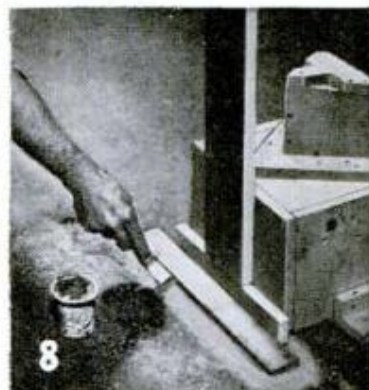
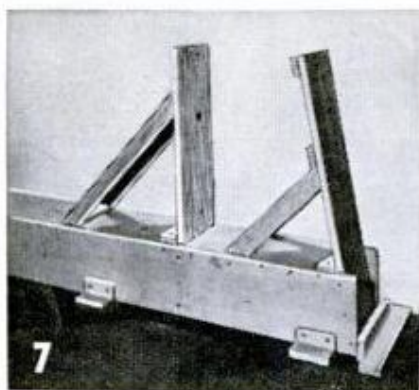
in the plies. Interior plywood should never be used in boat construction. Good boat-building lumber of the required dimensions is not always available locally. However, fir is a good wood for structural members, and clear grades usually are available in porch flooring, some types of partition lumber, rafters and stair treads, though sometimes it is necessary to make up large members by laminating. Where added strength and resistance to splitting is desired, the latter procedure is best anyway. Second-choice wood for structurals include spruce, cypress and yellow pine. While urea-formaldehyde plastic-resin glue such as Weldwood's, is used extensively, waterproof resorcinol glue is fast becoming the preferred adhesive for its superior bonding qualities, especially where hardwood surfaces are concerned. It also is absolutely waterproof and is not affected by fungus, mold or bacteria, which in some tropical areas may affect bonding qualities of plastic resin glues. Therefore, it is strongly recommended that builders living in hot climates use a resorcinol glue. For a good bond, both surfaces of a joint should be coated with glue. Bronze annular-ring

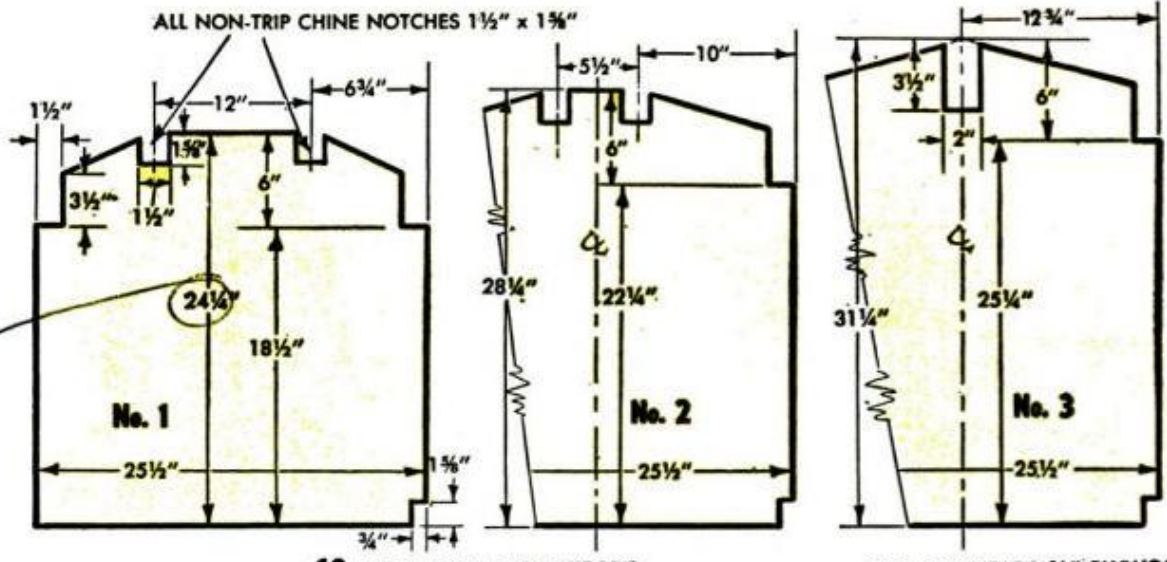


7. STERN END of building form is shown, with supports for No. 1 bulkhead and the transom attached

8. BROAD FILLET of epoxy compound puttied around cleats screwed to building form, holds it in place

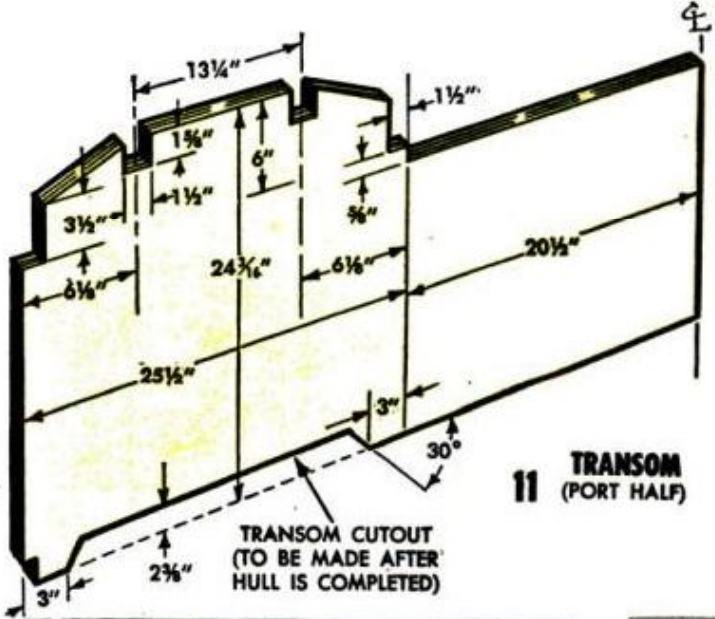
9. COMPLETED form with temporary bulkheads in place, ready to receive construction bulkheads



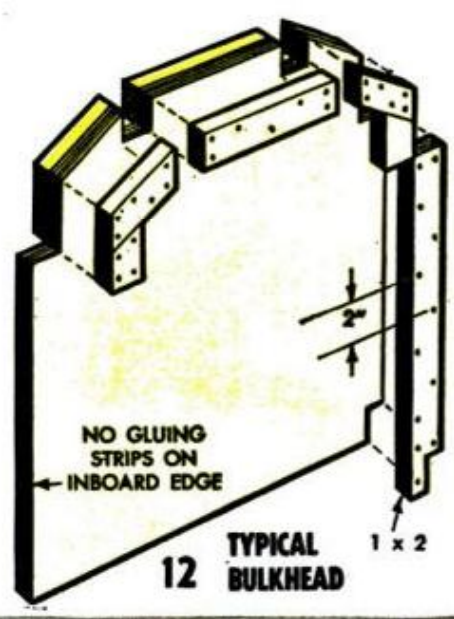


10 PERMANENT BULKHEADS

(ALL BULKHEADS $\frac{1}{2}''$ PLYWOOD)



11 TRANSOM (PORT HALF)



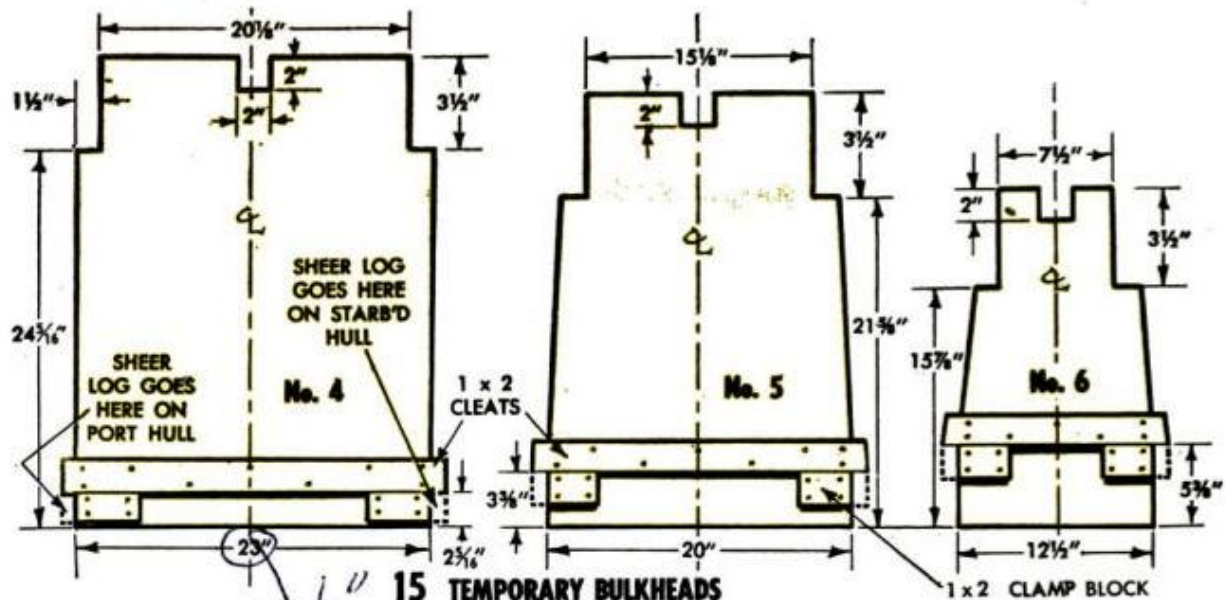
12 TYPICAL BULKHEAD



13



14



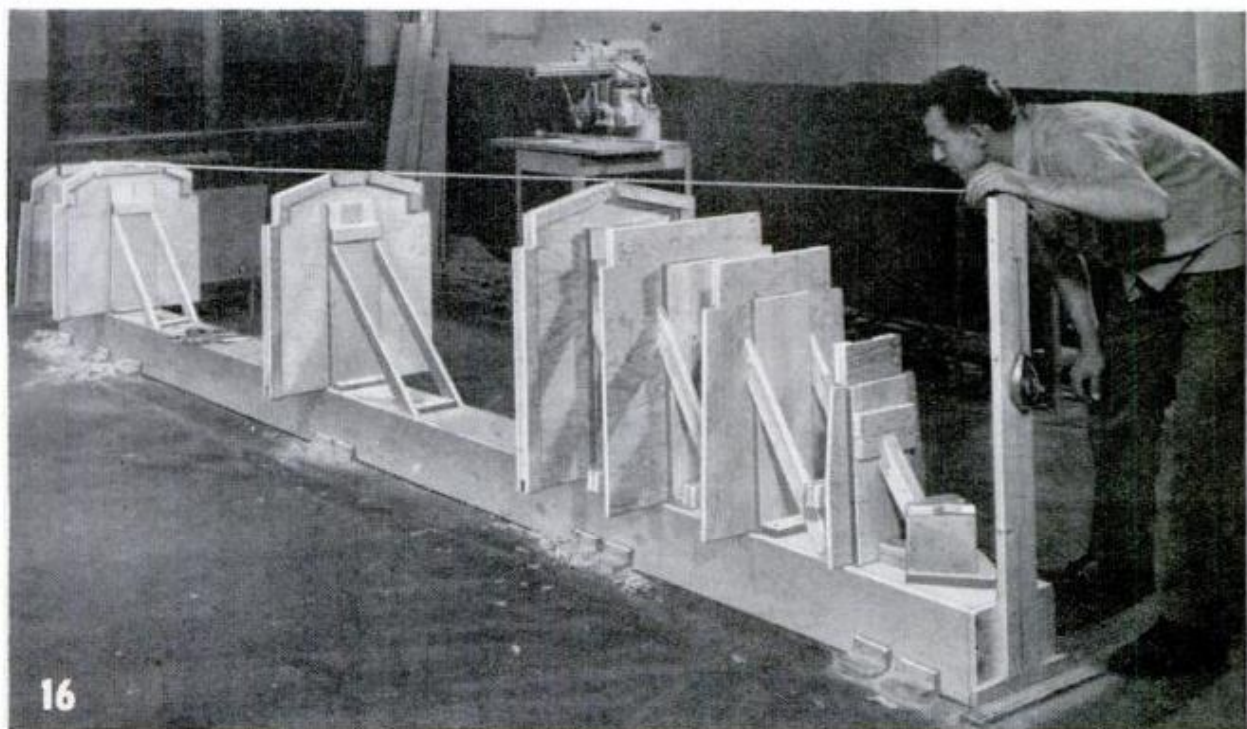
Stronghold nails are used throughout, with the addition of bronze screws or bolts in certain areas as indicated in the drawings. Be sure screws are bronze, as brass is too soft and will twist off when driven hard. Although 2 doz. adjustable clamps were used when laminating the outer chines, the number could be cut in half by applying two or three laminae (layers of plywood and spruce chine pieces, Fig. 23) at one time, using nails and only a few clamps at the extreme forward end to apply the required pressure. Over-all fiberglassing is optional, though the bottom should be glassed to the water line. At the very least all exterior joints should receive a covering of fibreglas tape to protect the edge grain.

A complete glass job on all exterior surfaces will cost about \$100 and add 100 lb.

For those who wish to build *Go-Cat* as a cabin cruiser, the final decision to do so can be put off until the boat is ready for installation of the foredeck, which would not extend aft of bulkhead 3. The hull dimensions are the same in either case.

After the building form has been completed, trued and fastened down, the next step is to cut out the plywood permanent-construction bulkheads and temporary bulkheads from the dimensions given in Figs. 10, 11 and 15. The temporary ones actually are a part of the building form and may be cut from interior plywood 1/2 in. or more in thickness. Note that 1 x 2 wooden

VERTICAL ALIGNMENT of transom and bulkheads is checked with chalkline stretched between transom and upright at front of form. Bottom edges of bulkheads must be in line with one another from transom to No. 3

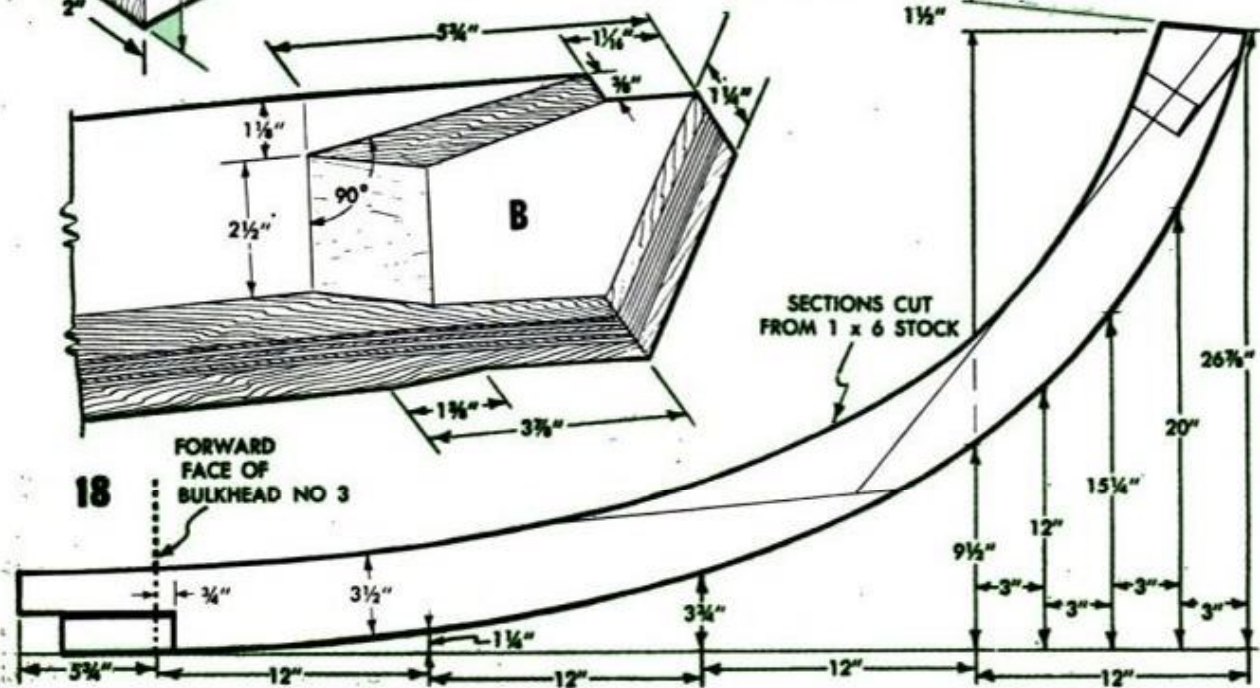
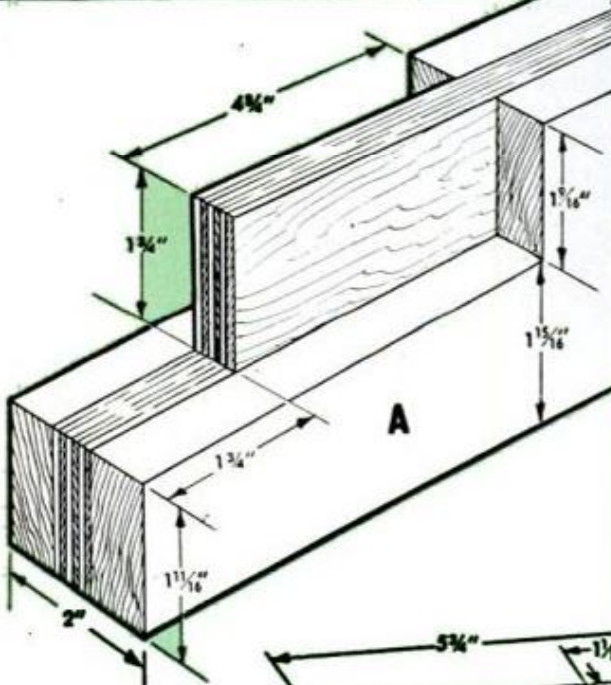




strips are glued and nailed on both sides of construction bulkheads around the edges, Figs. 12 and 14, on only the inboard side of the transom and none on the temporary bulkheads. This is necessary to provide adequate bulkhead gluing surfaces.

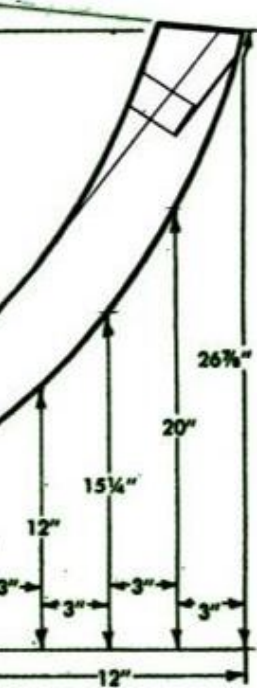
Incidentally, if you don't have sufficient space indoors to set up the building form but want to get started before it is warm enough to permit gluing outside (70 deg. F.), bulkheads, chine laminae and many other parts may be cut to size and then assembled on the form later. Since many of the parts that go into the two hulls (actually hull halves) are the same for both, much time can be saved by cutting them in pairs as in Fig. 17. Parts having edges that

STRAIGHTEDGE clamped to bulkheads, left, guides portable electric saw for fast cutting of angled bottom edges. Below, stem notches that take laminated chine are cut out with wood chisel and rawhide mallet



18 FORWARD FACE OF BULKHEAD NO 3

SECTIONS CUT FROM 1 x 6 STOCK



must be at right angles to one another, can be cut quickly and accurately on a table or radial saw, Fig. 13, making all cuts that require the same setting at one time. To allow for the 102-deg. angle of the transom and slight angle of the bottom planking, the bottom edges of the transom bulkhead are cut to 105°. After the bulkheads have been cut to size but before gluing strips, clamp blocks and cleats are attached, a line marking the centerline of each as indicated should be traced clearly on the bottom edge and the side facing away from the support to which the bulkhead is to be attached. This also includes the transom bulkhead. Next, the chine and sheer notches are cut, being careful not to cut them deeper than the given dimensions.

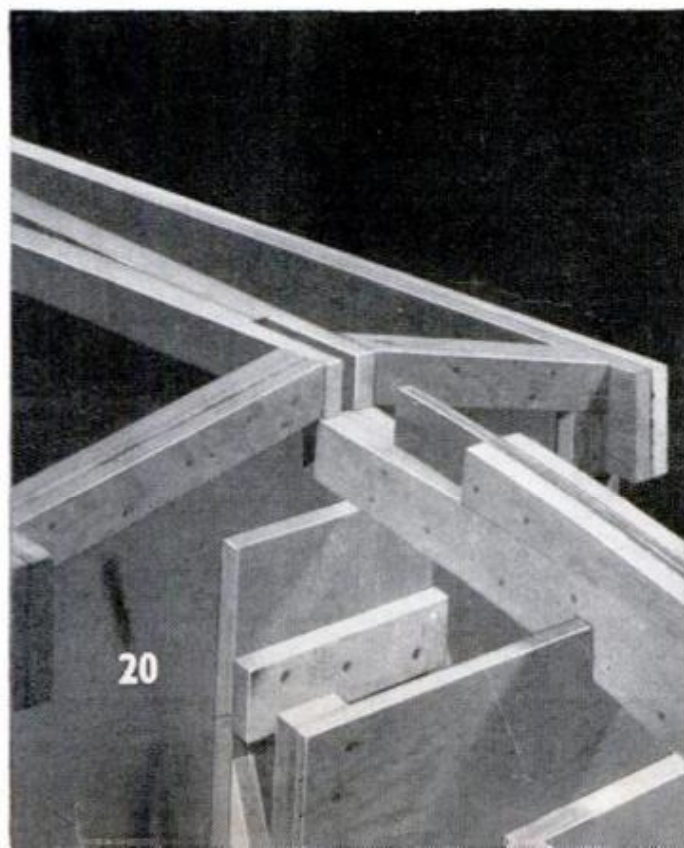
Having completed the bulkheads, you now are ready to mount them on the building form. In doing this, first they should be tacked lightly to their respective supports, so that vertical and lateral alignment can be checked as in Fig. 16. A chalk line stretched over the centerline between the transom and the upright at the forward end of the building form should rest lightly on each of the centerlines traced previously on the bottom edges of the bulkheads. Incorrect alignment may be due to a high spot on the form at a bulkhead location, a bulkhead not resting squarely on the form, or one side of the form being higher than the other. Actually, the form need not be perfectly level or straight throughout, as long as the bulkhead locations form a straight line from end to end on the building form and that the top of the form at

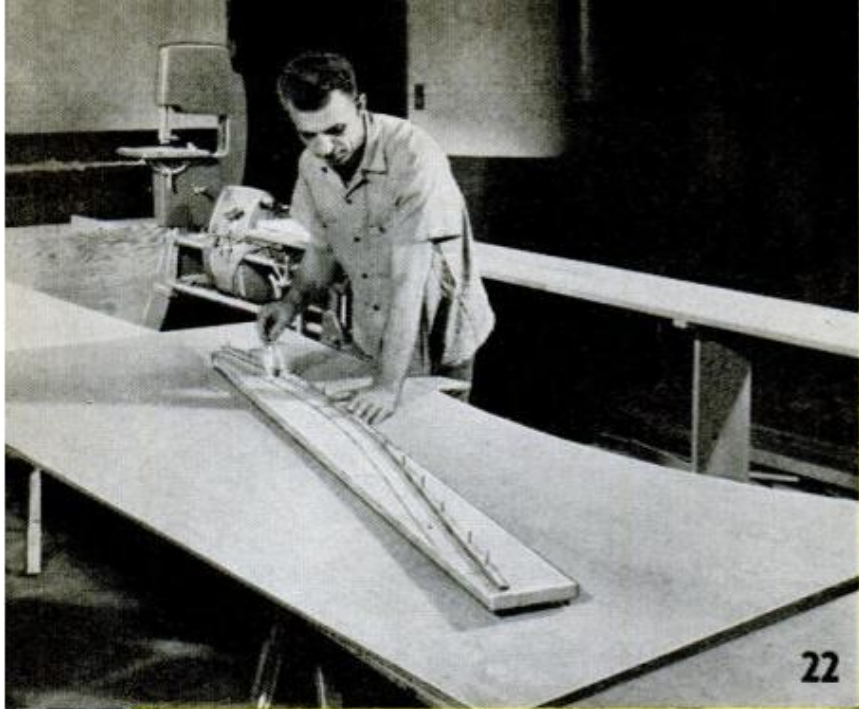
these locations is level transversely. Also, the bulkheads must be perfectly parallel with one another. To correct misalignment, it may be necessary to place a shim under a bulkhead at one location or cut away some of the form at another location. The temporary bulkheads that go in the bow section serve only as forms over which the laminated chines and the sheer logs are bent, therefore the same painstaking care in setting them up is not necessary. When you are satisfied that all bulkheads are in proper alignment, each one is fastened in place with four screws.

The straight portions of outer chine logs (transom to bulkhead 3) and inner nontrip chine logs are laminated next, the former from 1 x 4s and the latter from 1 x 2s. Lumber used for the chines should be knot-free and straight, two 12-ft. lengths being glued and nailed together for each chine. An attempt should be made to locate the nails so that they are not in wood that will be removed later when fairing them to take the bottom planking. This applies to other members that are to be faired as well. C-clamps or adjustable clamps may be used to apply pressure where nails are lacking, or where they fail to draw the two pieces tightly together. If you are short on clamps, it is a good idea to glue up only one chine within a 24-hr. period, to remove the temptation to use them too sparingly.

When the chines for one hull have been laminated, they are nailed temporarily in the notches on the bulkheads for fitting the stem-to-chine joint and fairing, using common nails. Before fitting the inner

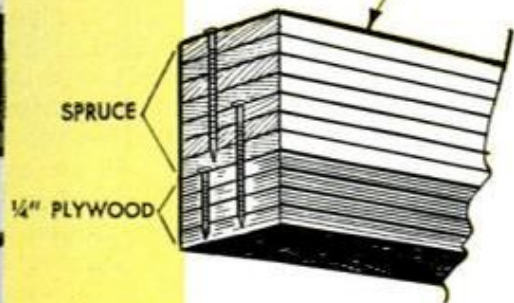
AFTER NONTRIP CHINES have been notched to receive afterend of stem, Figs. 9 and 10, mating surfaces of the joint, transom and bulkhead notches that receive the chines are coated with glue and nailed in place



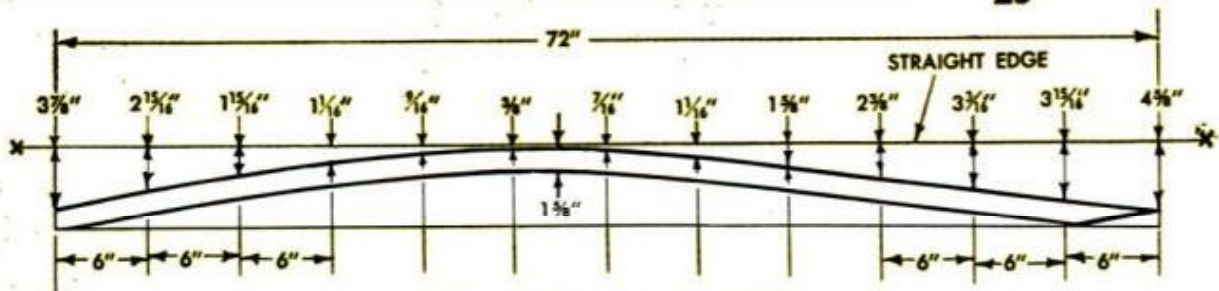


22

CHINE BUILT-UP FROM
4 PIECES 1/4" PLYWOOD
AND 7 PIECES 5/16" (APPROX.) SPRUCE
GLUED UNDER PRESSURE
ON BUILDING FORM
IN THREE GROUPS



23



CHINE LAYOUT ON 1 x 6 SPRUCE

MATERIAL LIST

LUMBER (Straight and free of knots, all dimensions net—first choice of wood specified; fir, spruce, cypress, or yellow pine may be substituted in most cases.)

- 2 pcs. 3/4"x15 5/8"x16' fir: sheer logs
- 10 pcs. 3/4"x15 5/8"x12' spruce: gluing strips, misc.
- 8 pcs. 3/4"x3 5/8"x12' fir: outer chines
- 8 pcs. 3/4"x15 5/8"x12' fir: inner chines
- 7 pcs. 3/4"x5 5/8"x12' spruce: laminated chines, stem laminae
- 4 pcs. 3/4"x5 5/8"x12' fir: sub-decks, coaming
- 6 pcs. 3/4"x5 5/8"x8' spruce: breasthook, kingplank, deck crossbeams
- 8 pcs. 3/4"x3 5/8"x8' spruce: wing deck battens, forward deck beam, misc.
- 4 pcs. 3/4"x7 1/2"x16' pine common lumber: building form

PLYWOOD (marine grade—AA)

- 4 pcs. 1/4"x4'x8' laminated wing deck, chine laminae
- 3 pcs. 3/8"x4'x8' fore deck, seats
- 1 pc. 3/8"x4'x12' bottom planking, side decks
- 2 pcs. 3/8"x4'x16' bottom planking (nontrip), topside planking
- 5 pcs. 1/2"x4'x8' construction bulkheads, stem, wing-deck battens, temporary bulkheads, misc.
- 3 pcs. 3/8"x4'x8' wing deck, transom to bulkhead #3
- 1 pc. 3/4"x4'x8' transom laminae

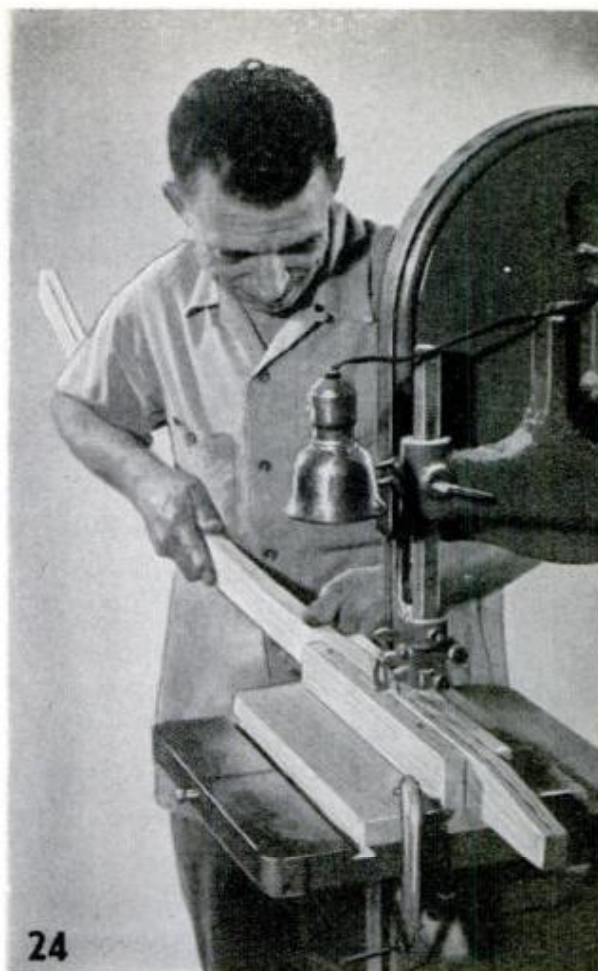
FASTENINGS AND MISC. (Screws and bolts, bronze or stainless steel; nails, Stronghold annular-thread bronze, except as noted.)

- 20 lb. Weldwood plastic resin glue, or equivalent amount of resorcinol glue
- 4 lb. 1" long, .109-dia. nails: topside planking to sheer log, laminated wing deck, side decks, misc.
- 12 lb. 1 1/4" long, .109-dia. nails: all 3/8" planking, except above and at curved areas
- 8 lb. 1 1/2" long, .134-dia. nails: curved 3/8" planking, breasthook, chines, stem, misc.
- 5 lb. 2" long, .134-dia. nails: 3/8" planking, misc.
- 1 lb. 4d finishing nails: building form
- 1 lb. 4d coated common nails: building form
- 2 lb. 6d coated common nails: building form
- 1 lb. 8d coated common nails: building form

- 1 gross 1 1/4" F.H. No. 9 steel wood screws: building form, bulkhead supports
- 2 gross 1 1/2" No. 10 F.H. wood screws: transom, misc.
- 1 gross 1 1/4" No. 10 F.H. wood screws: transom, misc.
- 25 pcs. 5/32"x1" brass stove bolts: laminated wing deck to battens
- 75 pcs. 5/32"x1 1/2" brass stove bolts: laminated wing deck to battens
- 100 pcs. 3/16" brass washers for above bolts
- 1 pc. 12"x96" laminated plastic, mahogany or light walnut finish: dash lamina
- 1 qt. contact cement for above
- 1 gal. wood preservative: 1 coat on all wood and plywood inside hull
- 6 16-oz. spray cans Barcotone No. 1007 pebble gray multicolor paint: cockpit finish coat
- 3 qts. semigloss white marine paint: cockpit undercoat, 2 coats
- 1 small tube lampblack for tinting above
- 1 pt. surfacing compound, Lakerfill plastic putty: filling holes over nail heads, scratches in planking, etc.
- 12 sheets 30-grit sand paper: feather edging fiberglass overlaps
- 12 sheets 80-grit sandpaper: finish sanding
- 25 yds. 38" wide, 9-oz. fiberglass cloth, Taylor & Art Plastics, or equivalent quality: topsides, decks (one piece)
- 6 yds. 44" wide, 9-oz. fiberglass cloth: wing deck
- 4 yds. 50" wide, 9-oz. fiberglass cloth: fore deck
- 8 gal. Boat "A" polyester resin, Taylor & Art Plastics, or equivalent quality: for above cloth
- 1/2 pt. epoxy resin: fiberglass-glued joints specified in text
- 1 qt. fiberglass surfacing compound, Tapox Bond, or equivalent: filleting inside corners on wing-deck bottom, misc.
- 4 oz. bright red polyester coloring pigment: last two resin coats applied to decks
- 8 oz. white polyester coloring pigment: last two resin coats on topsides, bottom of hull
- 3 pts. bright red epoxy paint: decks and coaming
- 2 qts. white epoxy paint: topsides, curved section of wing deck

chines in their notches, facing sides at the forward ends must be beveled to leave a combined width of 2-in. at the extreme forward end, the width of the notch in the top of bulkhead 3, (bottom when the hull is upright). A $\frac{1}{2}$ x 4-in. notch then is cut in the center of the forward end of the combined chines (not glued as yet), as shown in Figs. 3 and 20. The closeup, Fig. 20 and over-all view, Fig. 21, show clearly how this joint goes together. Note that the forward ends of the chines fit flush with the gluing strips facing the stem.

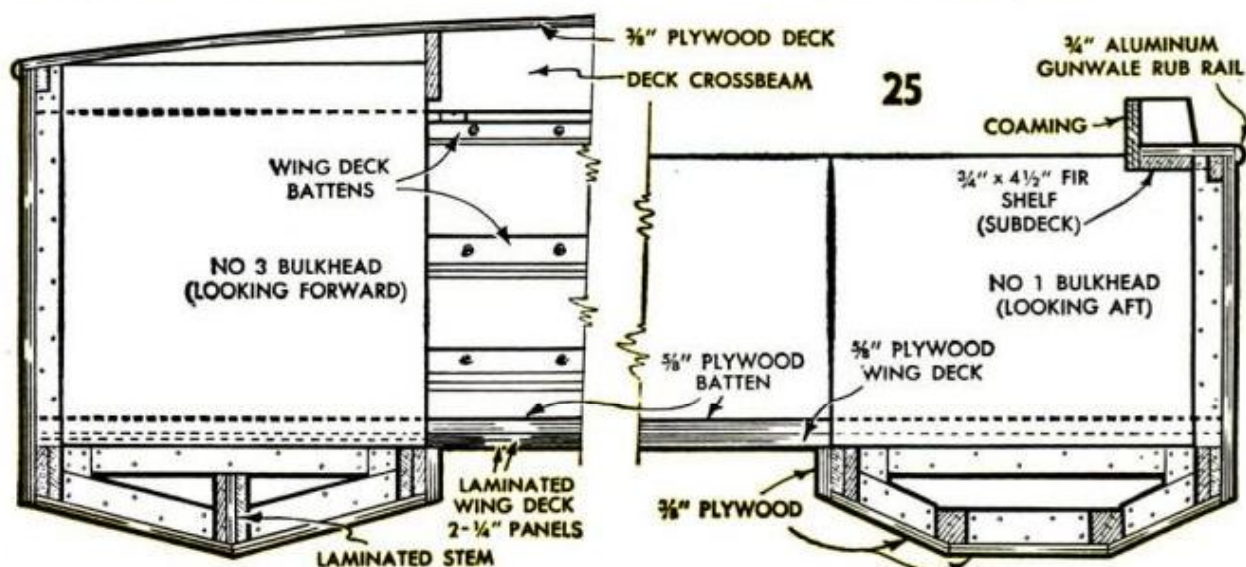
While the stem is next in the assembly sequence, you may want to postpone it until after the laminae for the chines are cut from the 1 x 6 stock, as the large waste pieces can be used for the outer, solid-wood laminae of the stem. The dimensions for the chine layout are given in Fig. 23. When making the layout, select a knot-free board having at least one edge that is straight. Spruce is preferred for its light weight and resistance to splitting and fracturing. Draw a series of parallel lines at right angles to the straight edge, spaced 6 in. apart. The dimensions that will give a plot of the chine curve are then dropped from the straight edge as indicated, after which a batten is curved to intersect the plot points and tacked in place. After tracing the chine curve on the board, a compass is set to a $1\frac{5}{8}$ -in. radius and a second line is drawn as in Fig. 22, giving the width of the chine. A line connecting the last 6-in. division with the $4\frac{5}{8}$ -in. vertical, defines the forward end of the chine lamina. This first piece or blank then is cut out carefully on a bandsaw, or with a saber saw and used as a pattern for the remaining 13 blanks needed. Each blank is slit in half to make bending easy and give greater strength to the chine. Our blanks were halved on a bandsaw, using a jig as a means of guiding the pieces straight into the blade as shown in Fig. 24.



JIG CLAMPED to table of bandsaw, makes easy work of cutting spruce laminations used for chine layout

This job also could be done with a table saw. Each laminated-chine section is built up from 4 pieces of $\frac{1}{4}$ -in. plywood, to which 7 pieces of spruce lamina are glued under pressure on the building form, the pressure being applied by nails and clamps. No steaming or wetting is necessary. The procedure of laminating the chines will be gone into in complete detail in Part II.

(Continued to page 274)



THEY BUILD BOATS

This California boating and boat-building group has solved a problem that has long dogged others. Here's how they did it . . .

By Floyd McCracken

BOATERS AND BOATING GROUPS have always faced the problem of getting the most boat for the money. The obvious answer, especially for the boater on a limited budget, is to build it, but it's an answer that creates new problems—like how?

Seven years ago members of the Convair Recreation Association, made up of employees of the Convair Division of General Dynamics Corp., San Diego, Calif., found themselves wanting boats. The models they wanted, however, cost from \$1000 to \$1200.

This was more than most felt they could pay, and yet they were unwilling to sacrifice quality. The construction they had set their hearts upon called for fiberglass, but none in the group boasted any skill or experience in working with the material, and there wasn't a boatbuilder in the group.

They decided that, since designing and building complex airplanes is their business, the challenge was worthy of their combined effort. They selected committees for design, materials and facilities. E. Dale Cromartie was chairman of all committees. For design they went to the floats of the R-Y-3, a seaplane built for the U.S. Navy. These floats already had been tested and had proved their worth.

After experimenting with and modifying the basic design slightly to meet their purpose, the committees came up with plans for a 16-footer that Cromartie says could be called a full-planing hull with extra freeboard. It could be used as a skiff, a runabout or a cabin cruiser, with either an inboard or outboard motor. Cromartie says it operates best with a 35 horsepower outboard, which will drive it around 35 miles an hour.

Although construction methods and materials are interesting, the genius of the group's operation is found in a plan that provides for each boat to be built under direction of a different expert. And the plan makes its own experts at the same time.

To start things, each prospective boat builder signed in on the bottom of a numbered list on the company bulletin board. When enough had signed on, the first five ganged up to build number one's boat (with outside help for the first one). Then numbers two through six went to work on a boat for number two, and so on down the list. After a couple of cycles, the top man on the list had worked on enough boats to be able to supervise the work on his own, and the program became self-perpetuating, with each

BY "CHAIN LETTER"



Beaching their flotilla during an outing, Convair group members show off a few of their boats. They've built over 700 on their 16-foot pattern alone, in the most painless boat-building operation imaginable

Key to the club's method is the master list where employees sign on for a place in the chain—and a boat





1. The top five get together and a crew is formed to build Jack Brock's boat (he's second from right)
2. Brock, foreground, and Pete Beyrer brush the first layer of glass cloth into the 16-foot mold
3. Five hours later, Brock, left, and George Menus trim the finished basic hull. It's easy with a good mold
4. Fitting out the shell goes fast, and the new boat is ready to go. Total cost of the boat is about \$300
5. Next man on top of the list, Pete Beyrer decides on a 25-foot cruiser. Mold at left is for Sabot

boat builder having four assistant apprentices in his crew.

The first drafting and shop job facing the enthusiasts, after deciding on their hull, was the devising and building of a female mold in which their materials could harden. Before they had produced a workable mold they had spent \$1000. This has been repaid by small charges for its use.

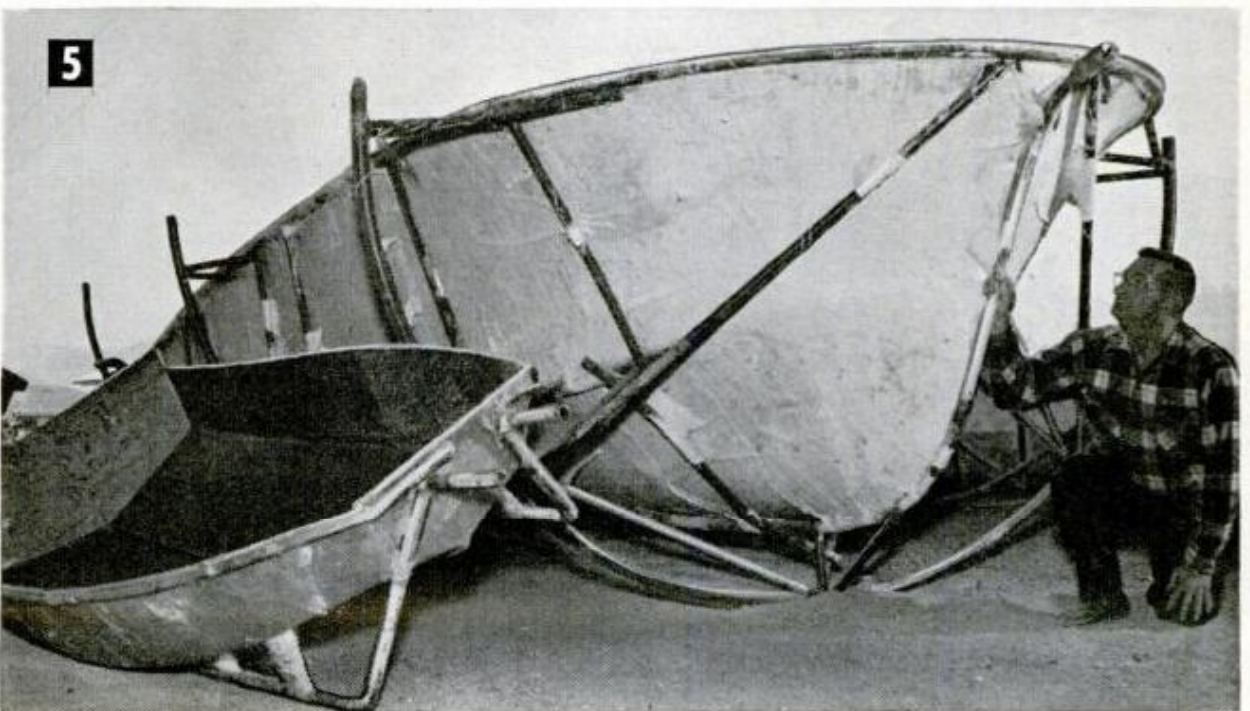
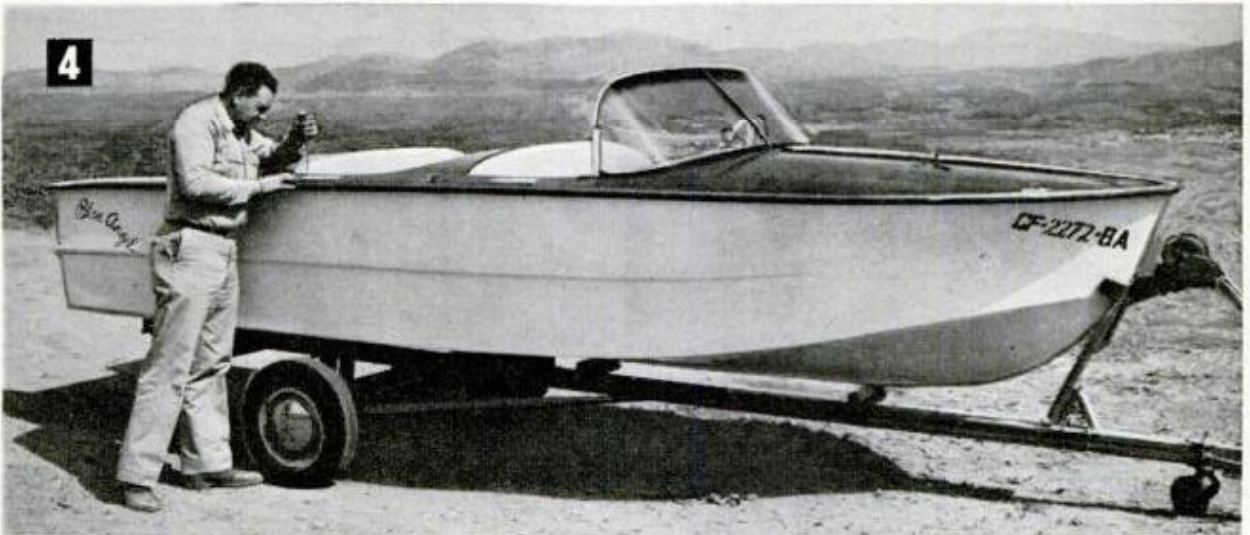
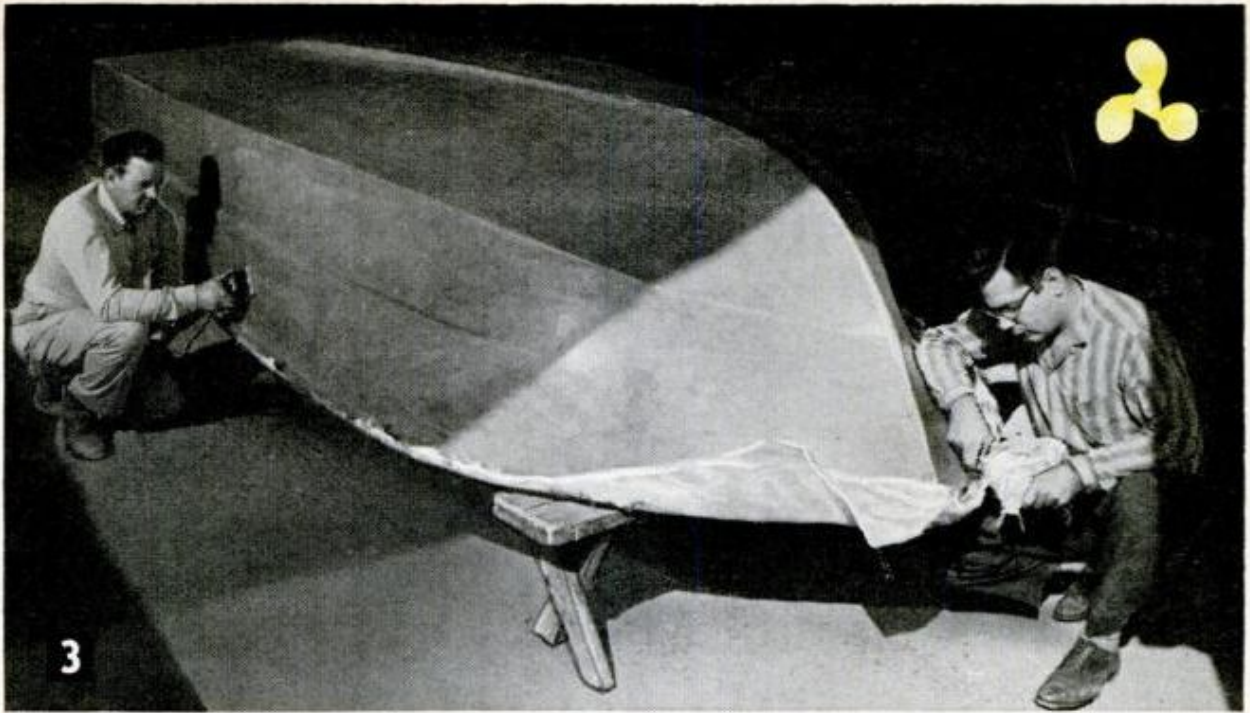
A clean, waxed mold is essential to the success of construction of these hulls. Over the mold's surface they spread a layer of either woven or matted fibreglas; both have proved satisfactory. This material comes to the shop in bolts, similar to the cloth bolts displayed in stores.

Over this is spread a coating of either polyester or epoxy resin, which is purchased in buckets. An ordinary paintbrush spreads the resin well. Two and sometimes three additional layers of fabric and resin, applied alternately, are added to the first, giving the hull a thickness of $\frac{3}{16}$ to $\frac{1}{4}$ inch. Some owners have added extra layers in areas where wear and stress are greatest.

Only five hours are required for an ex-

(Text continued to page 268)







IF YOUR BOAT TAKES A DIVE . . .

the motor can run again—provided you retrieve and resuscitate it at once

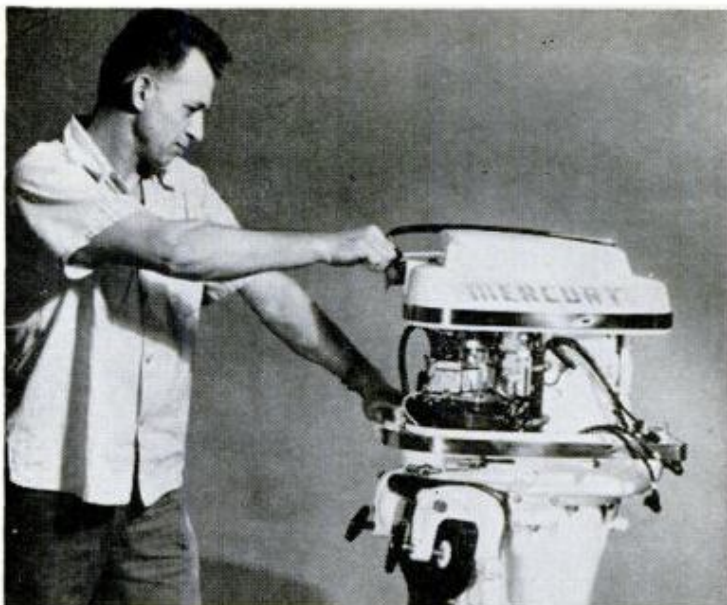
WHEN WATER gets in the cylinders of an outboard motor, many bad things begin to happen. First, it stops running, and you can hope it stops before water-compression damage is done to the crankshaft or powerhead. Then, corrosion sets in, the rate of which depends upon the length of time the motor is submerged, temperature and salinity of the water and length of time exposed to the atmosphere after it is retrieved. This same sequence of events can occur, whether the motor gets dunked as a result of a boat capsize, loose

clamp screws that permit it to leap off the transom on a sharp turn, or simply because of momentary boarding of the boat by surf or a following sea. Even a heavy rainfall on an uncovered boat can fill it to the point of sinking below the level of the carburetor air intake. Once a motor has been retrieved, no time should be wasted in getting it in working order again. Usually, this work can be done by yourself. If internal damage is evident, the motor should be placed under the care of a skilled outboard mechanic at once to prevent wet parts from rusting.

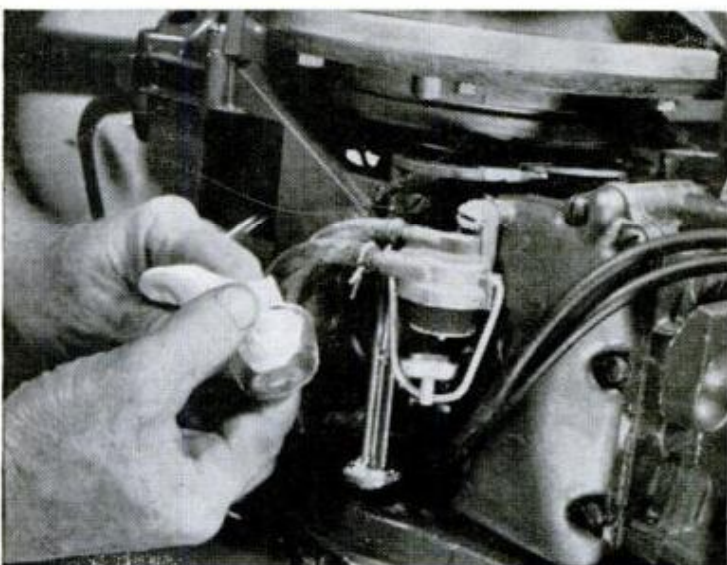
NOT THE LEAST of getting dunked motor running again, is rescue of boat. Unless it is small enough to be righted easily, the boat should be towed slowly to shallow water, after making sure motor will remain on transom



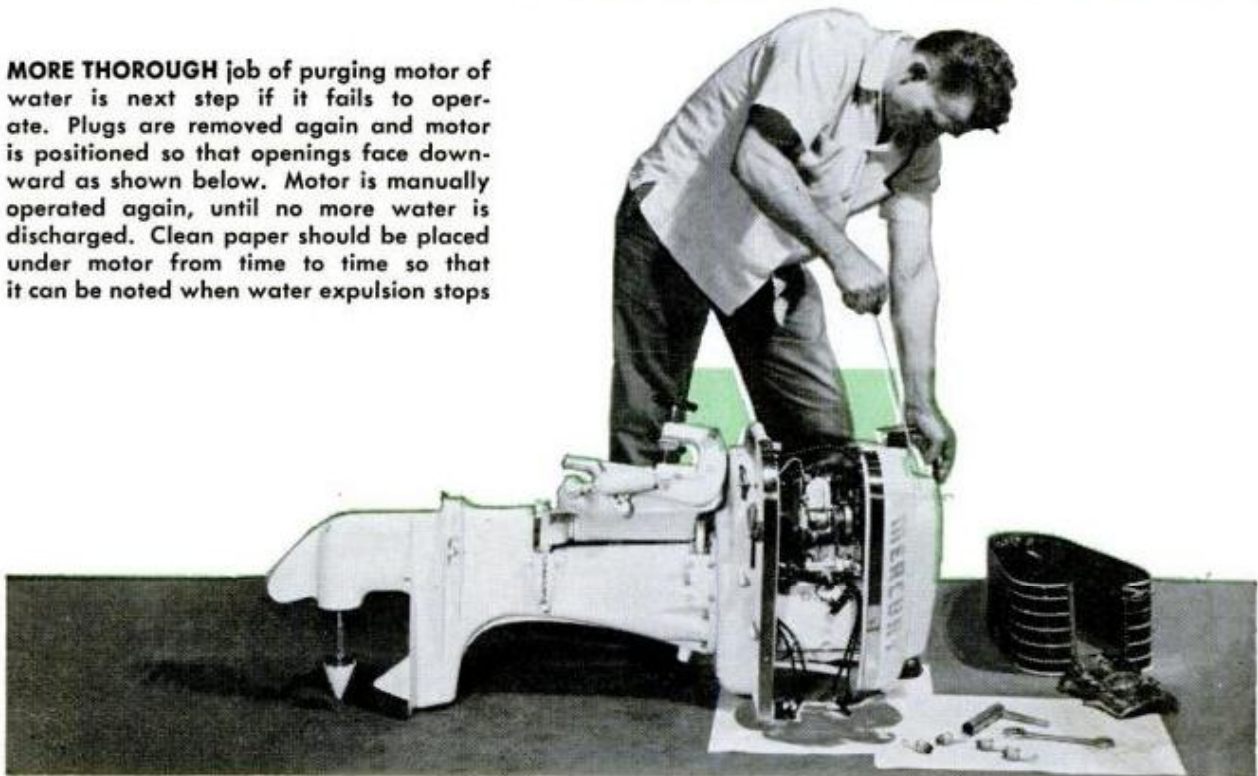
AFTER MOTOR is clamped in upright position, first step is to remove plugs, rotate flywheel slowly, noting by "feel" whether crankshaft is bent or silt contamination has occurred. If dunked in salt water, motor must be flushed with fresh water. If no internal damage or contamination is evident, water remaining in cylinders is discharged by pulling manual starter rapidly

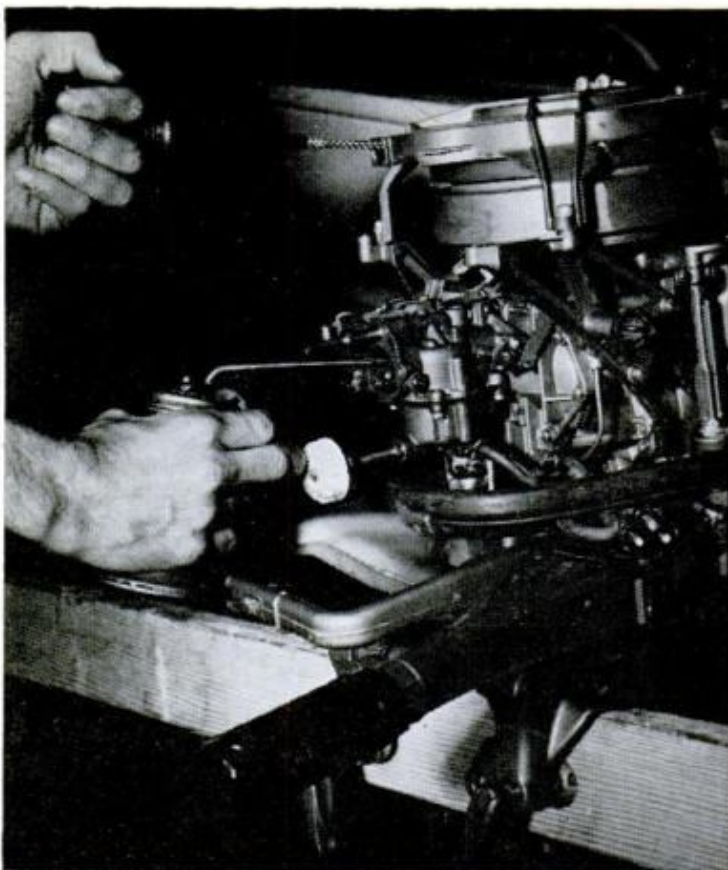


IF MOTOR was submerged only momentarily and was not running at the time, it may be possible to start it after completing above step and cleaning the sediment bowl and fuel-filter element. Internal heat produced by combustion when motor is running, will help to evaporate moisture from other parts. Of course, water-pump intake must be submerged when doing this



MORE THOROUGH job of purging motor of water is next step if it fails to operate. Plugs are removed again and motor is positioned so that openings face downward as shown below. Motor is manually operated again, until no more water is discharged. Clean paper should be placed under motor from time to time so that it can be noted when water expulsion stops

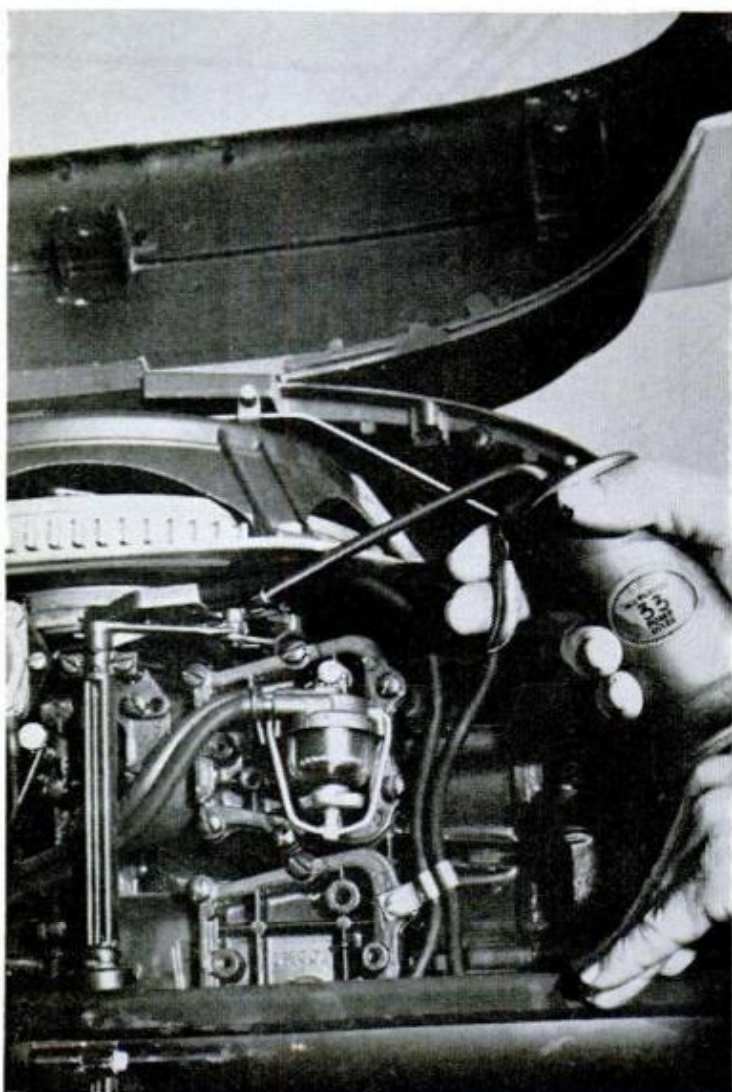




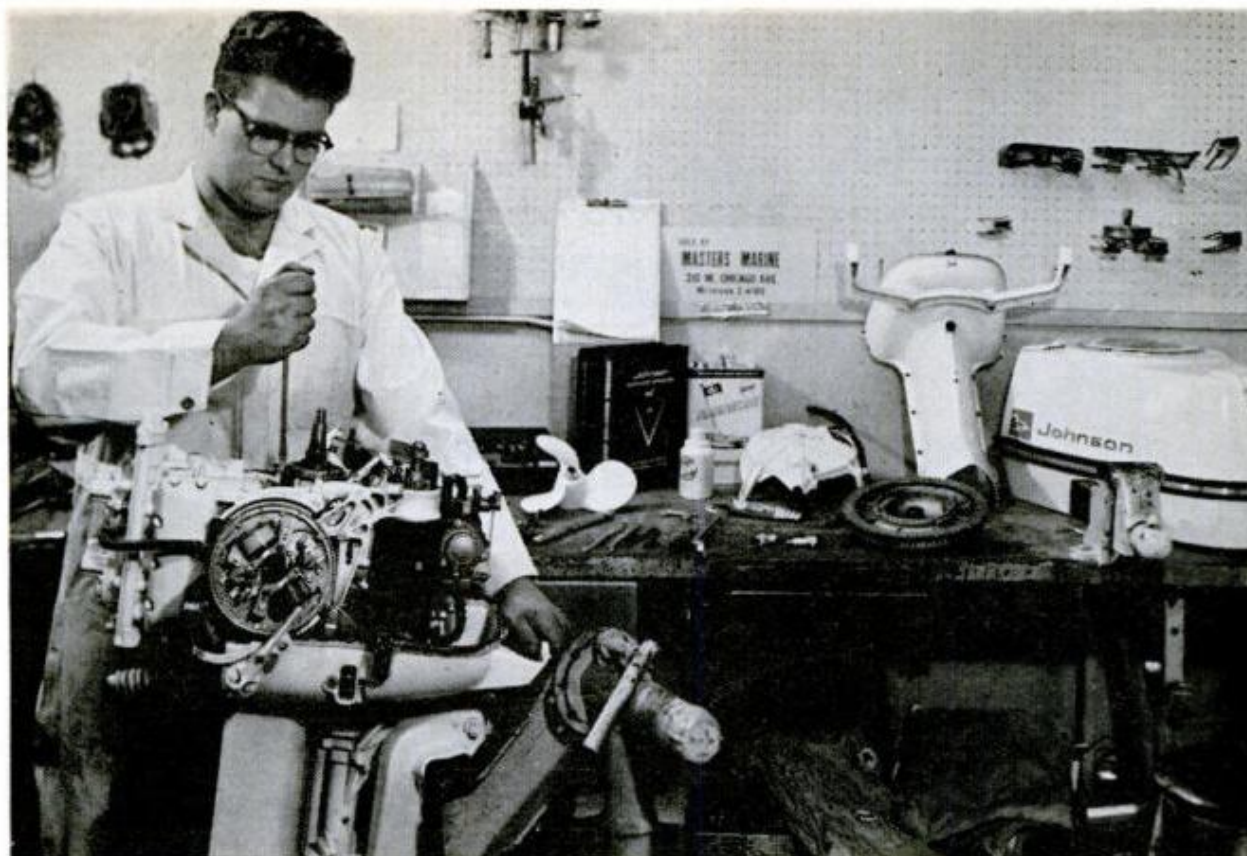
HAVING FLUSHED motor clean and freed it of remaining moisture, next step is to lubricate and give corrosion protection to internal parts. With pump-type oiler, inject several drops of outboard-motor oil directly into carburetor air intake, while operating manual starter. At same time, inject small amount of oil into each cylinder through plug openings. To avoid possible occurrence of short circuit in armature plate when restarting (which may cause extensive damage in some models) flywheel should be removed at this time and magneto parts cleaned and dried

PM's SERVICE CHECK LIST FOR DROWNED MOTORS

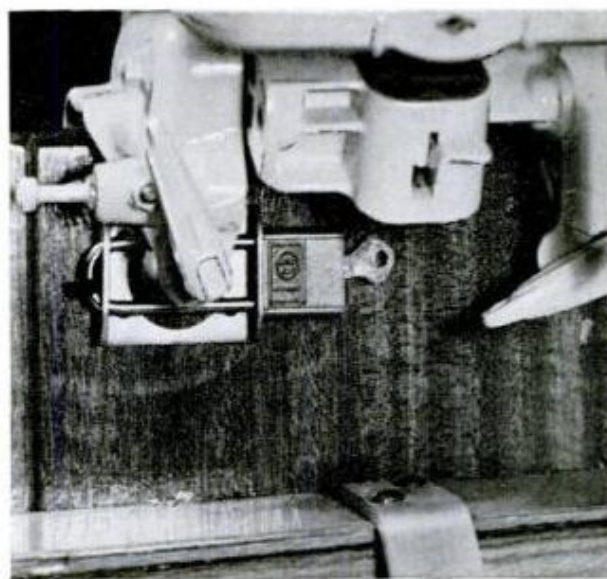
1. () Retrieve motor at once, being careful not to drag it on lake bottom.
2. () Remove shroud and spark plugs, check for internal damage by pulling slowly on manual starter. If grittiness or resistance to pull is noted, have motor serviced by dealer immediately. Same applies if motor doesn't start upon completing next five steps.
3. () Flush motor and expel water by operating manual starter, first with motor in upright position, then horizontal.
4. () Inject oil into plug holes and carburetor air intake, while working manual starter. Clean plugs.
5. () Remove flywheel and dry out magneto parts by facing motor powerhead into sun.
6. () Lubricate working parts. Spray-coat all surfaces with silicone lubricant.
7. () Reassemble motor and start. Run it until you are sure all remaining moisture has been evaporated.



TO COMPLETE SERVICING, plugs are cleaned and motor lubricated, paying particular attention to linkages. Non-working surfaces should be coated with a silicone lubricant such as is available in spray cans. Liquid and spray lubricants do double job of displacing minute droplets of moisture remaining on parts, while lubricating working surfaces. Before attempting to restart motor, it is wise to empty and flush fuel tank. Water may have entered through vent and contaminated fuel supply. Fuel lines too, may have to be flushed by forcing unmixed gasoline through lines



MOTOR THAT FAILS to operate upon completing servicing steps just covered should be taken to service shop for complete disassembly and repair or replacement of defective parts. As with water purging and lubricating service administered at home, this work should be done as quickly as is possible. Telling service manager details of dunking may result in better job and minimize repairs



BENEFITTING FROM OLD "SAW," "Don't lock the barndoor after the horse has been stolen," wise outboarders use lock to prevent motor from flipping off boat, such as the two devices shown in the photos at right. Upper one shows patented lock, the mounting plate of which is screwed to transom, with the plate opening centered on motor-clamp screw. Lock shackle is of removable type, which engages pair of holes in flange at each end of plate. Lock not only prevents accidental loss of motor but also makes theft exceedingly difficult.

Second device shown, consists of bow eye bolted to transom, padlock and length of chain looped through bow eye and steering bracket of motor. Chain is short enough to prevent motor clamp screws from sliding up and off transom but has enough slack so as not to interfere with steering of motor



SHOP NOTES AND CRAFTS

ARTIST'S EASEL

Adjusts up and down, tilts forward and backward and is steady as a tripod. Costs less than \$5 to make from oak

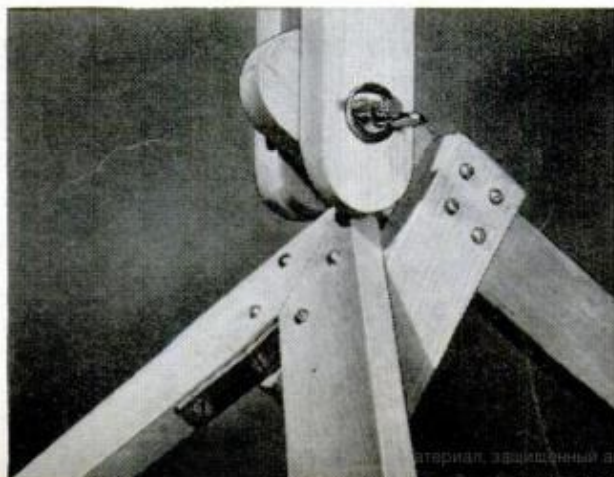
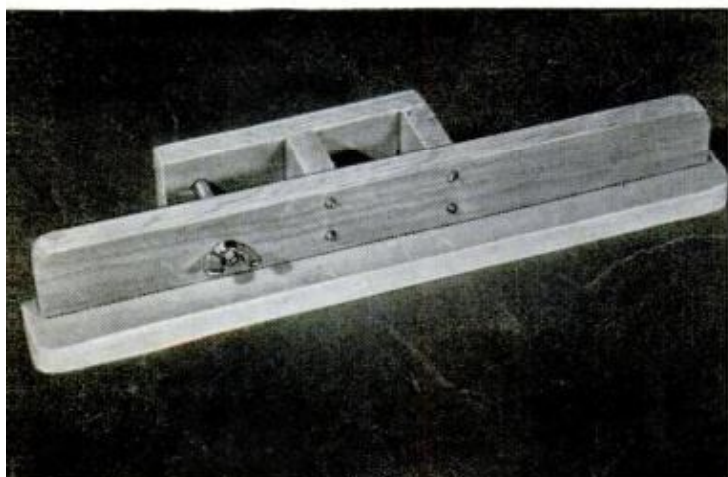


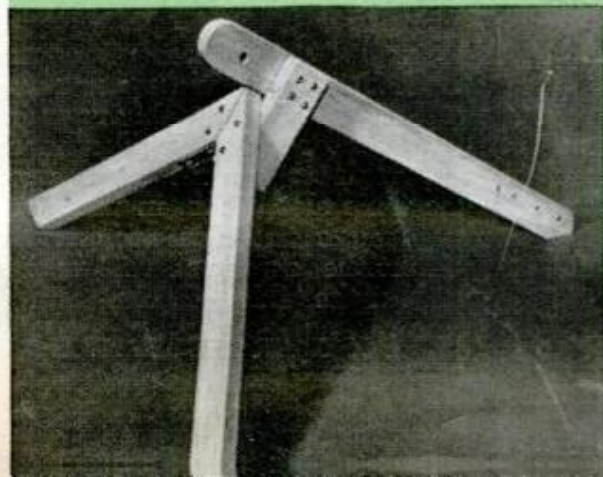
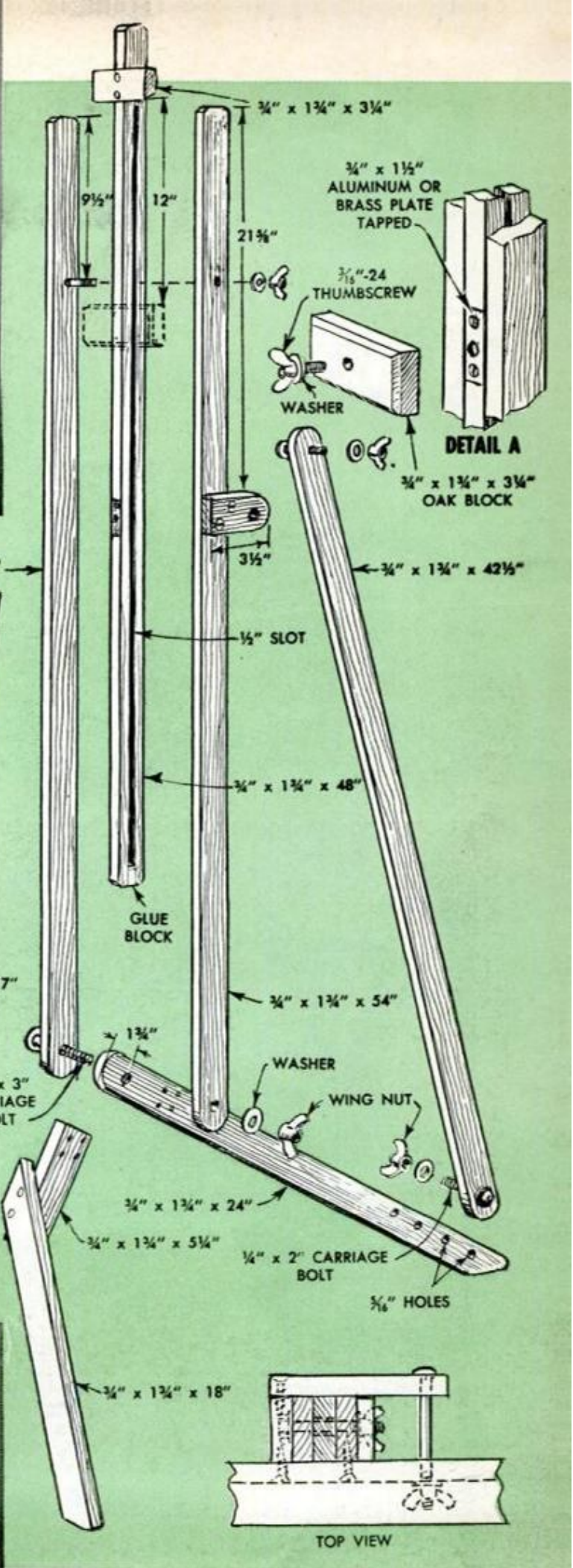
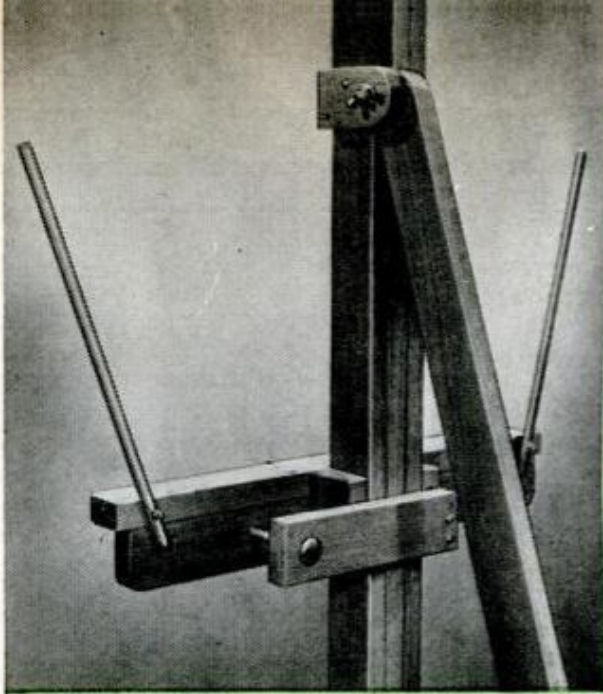
IF YOU DABBLE in paints, you may come up with a masterpiece with this neat home-studio easel. It's fully adjustable, will accommodate a canvas up to 6½ ft. high, weighs only 12 lb. and folds up to stand in a corner. The whole thing is made from stock 1 x 2 oak and is so simple to make you can get by with a handsaw, drill and screwdriver.

Make the tripod unit first, mitering the two front legs 45 deg. and joining them with a metal angle bracket. Two side blocks hold the three legs together. The two 54-in.-long verticals and the rear support members are drilled at the points indicated for carriage bolts and wing nuts and the ends rounded if you wish. The series of holes in the rear leg of the tripod is located to provide a forward and backward tilt to the easel when the position of the support brace is shifted. One of the holes should bring the easel to a perpendicular position. The slot in the adjustable vertical member is cut by sawing in from the end and then later inserting a glue block to close the end of the slot. Of course, a blind slot can be made if you have a table saw by slowly raising the blade up through the work. Last to be made is the canvas holder, or tray. The two dowels screwed to the tray are called picture fingers and help steady the canvas when painting is done at the outer edges. The clamp block shown in detail A permits the tray to be clamped at a lower position than is possible with the block attached to the upper end of the slotted member. This is desirable when painting from a seated position.—Manly Bannister

UNDERSIDE VIEW of the canvas holder, or tray. The carriage bolt and wing nut clamp the sliding holder at the desired position on the verticle uprights

CLOSE-UP VIEW shows how easel upright members are pivoted and clamped to tripod with wing nut and bolt. Tripod legs are held with screws and glue







QUICK AND EASY

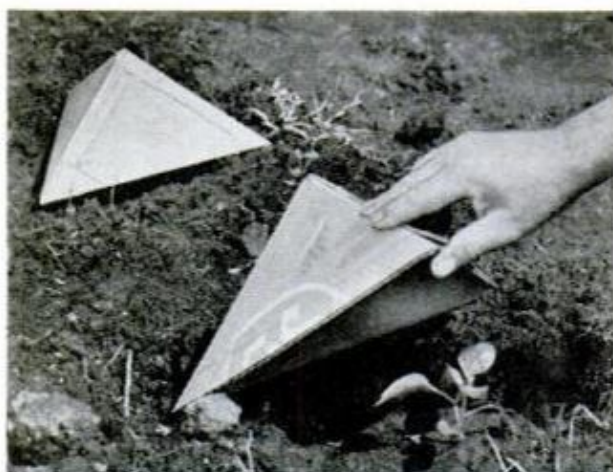
Use Paper Clamp on Balsa

Modelmakers who assemble models from balsa-wood parts have clamping problems. The unfinished wood is so very soft that the slightest pressure concentrated in a small area results in a dent that is very difficult to remove without altering the finish dimension of the stock. As a rule a paper, or stationery, clamp supplies sufficient pressure for gluing and if you pick the right size, it won't leave a mark or dent on the surface of the wood. Use only the smaller sizes of clamps on thin stock.—Bil Toman



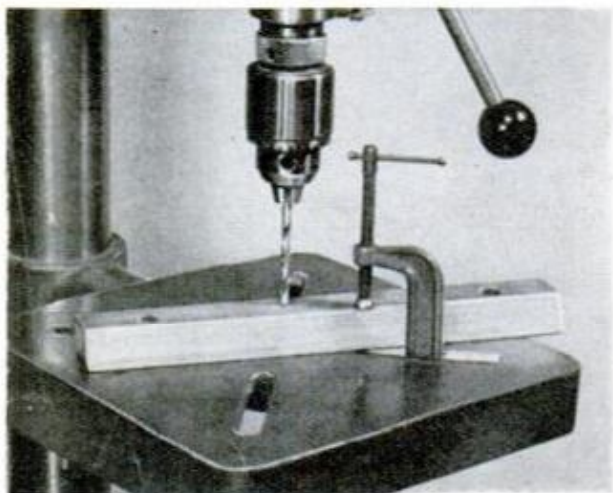
C-Clamps Serve as Handles

Often a C-clamp, or a pair of C-clamps, can be made to serve as a handle or handles for lifting loaded fuel drums, baskets or wooden boxes, anything that has a rim on which the clamp can be tightened so that it will hold reliably. The body, or frame, of even a small C-clamp provides a good handhold for lifting, pushing, or rolling a round container such as a fuel drum on its rim. Of course, one has to make sure that the rim of the box, barrel or basket is sufficiently rigid to withstand the offcenter stresses of the clamp handle.



Protecting Seedlings

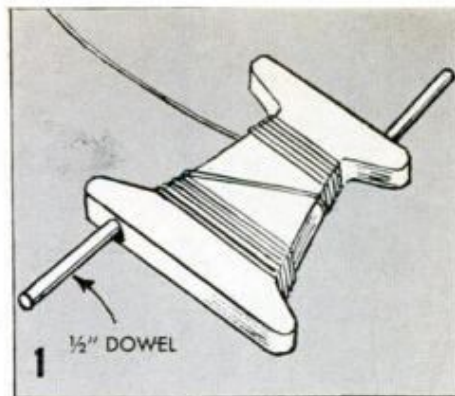
When a sudden weather change promises frost you'll need protection for those early seedlings in a hurry. Rather than trust newspapers that may blow away or a cloth covering that may bend or break the tender stems, just grab a cardboard carton or two and cut the corners out to form pyramids like those pictured. Center these over the plants, press down to embed the edges and then bring some loose soil up over the sides to anchor the protectors in place. Leave the protectors on overnight but remove as soon as the temperature rises.



Holding Drill-Press Work

Why struggle with bolts or strap clamps to hold a workpiece on the drill-press table? Use a small C-clamp and grind away the sides of the lower pad until it will just slip through the table slot. You can't beat it for holding small workpieces. On some types of small pieces you can use as many as four altered C-clamps in this manner. Remember to be careful to grind off each web just enough to permit it to drop through the table slot. Then, in use, drop the clamp through the slot and turn it slightly so that the lower pad will engage the underside of the table.—R. Hanscom

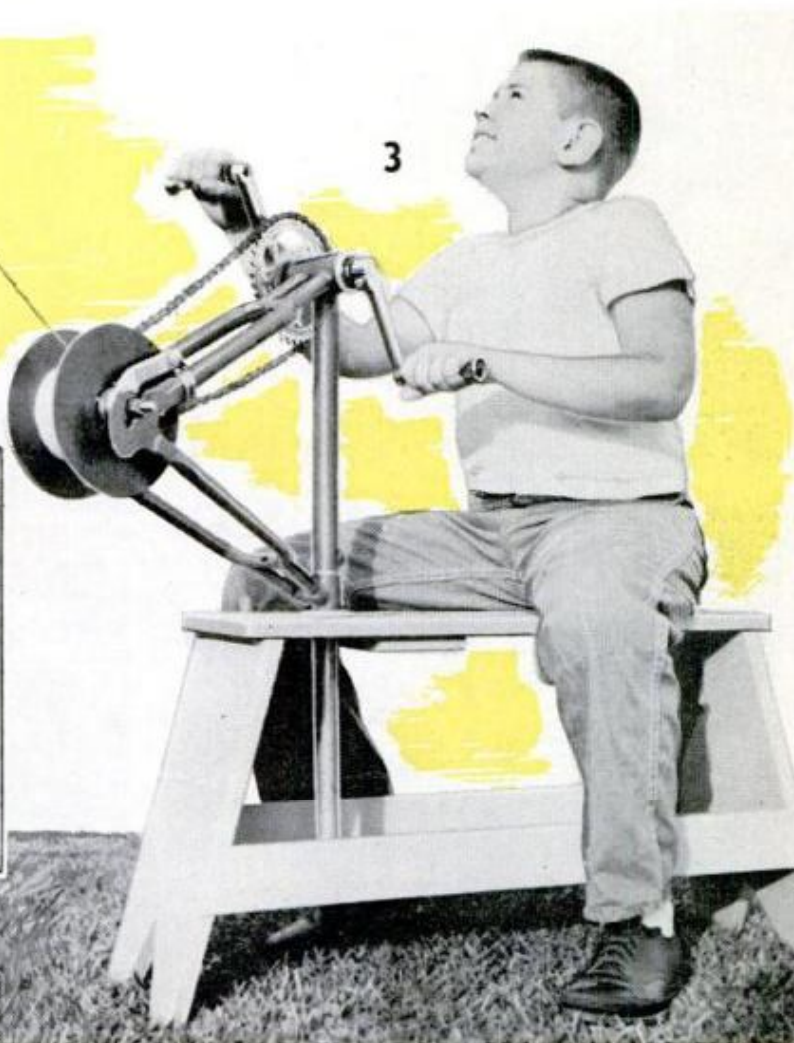
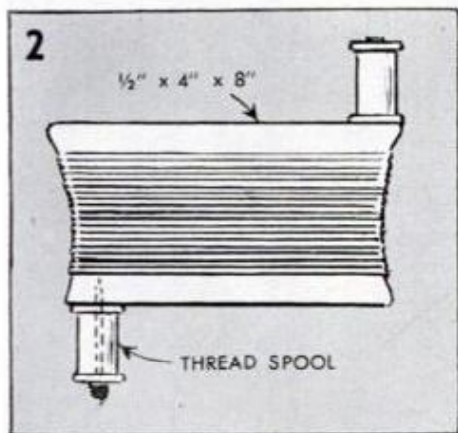
KITE WINDERS

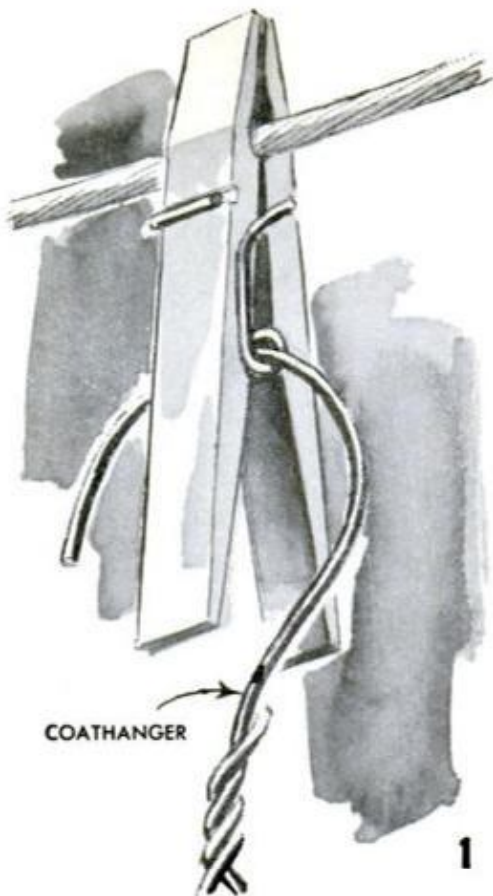


1. Better control of a kite in wind gusts is possible with this tapered reel. Automatic decrease or increase of take-up and let-out speeds are obtained simply by angling the reel so as to direct the windings to the narrow or wide end of the spool respectively—G. E. Hendrickson

2. Here is a standard-type kite-string reel that can be made in a few minutes, using a 4 x 8-in. board cut from one end of a plum crate for the reel and two empty thread spools for handles. The concave ends of the reel curve to a maximum depth of 1/2 in. The end of the string is tied in a loop around the reel, so that it can't be lost accidentally when the last turn is let out.—John M. White

3. Mounted on a saw-horse-type seat and made to swivel from side to side in a pipe post, this clever chain-driven winder will appeal to the serious kite flyer. As you see, it is made from parts of an old bicycle. The front half of the frame is cut away at the seat post and at the sprocket hub, and the coaster brake from the rear wheel is made into a reel, or drum, by bolting two 8-in. hardboard disks to the flanges of the cone hub. The rubber treads are removed from the pedals and the spindles used for handles. With the bike braking action retained through the use of the coaster brake, you can pay out the kite string as fast or as slow as you wish.
—Lewis La Point





1

1. BLOUSES AND WASH DRESSES dry best on clotheshangers, but it is downright disappointing to find one blown to the ground and soiled occasionally. To prevent this, insert the hook of the hanger in the wire loop of a spring-type clothespin and clip it to the line as shown at left

2. NEED A BOOKMARK? Next time you are looking for something to mark the place where you've left off reading, cut the corner from a used envelope and slip it over the page corner. Having two sides of the page to cling to and no projecting edges, this marker is not likely to become dislodged

3. CARD TABLES can be joined together temporarily, as when using two or more for playing cards or serving food, by applying a 6-in. strip of cellulose tape along the sides as shown. When the setup is no longer needed the tape is merely peeled off without marring the finish in any way

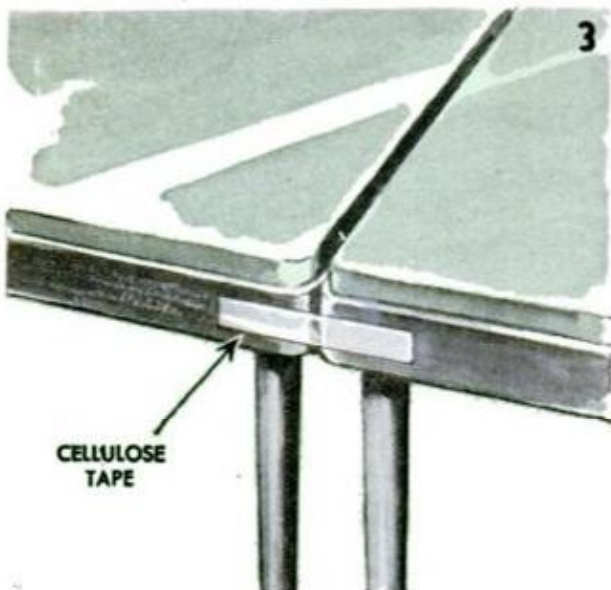
4. THIS POTTED ROSE BUSH is yours for the doing. Cut any small wild shrub having several branches, prune it to the size desired and tape artificial roses to the branches with dark green cloth tape. Mount the "rose bush" on a wooden block that will fit in the pot and fill with gravel

5. A HAND SUPPORT BOARD like the one shown, is a real help when doing oil paintings by the numbers. It is a 4-in.-wide board cut a few inches longer than picture width and fitted with $\frac{1}{2}$ x $\frac{1}{2}$ -in. cleats nailed across the ends, to raise the board off the work and prevent smearing

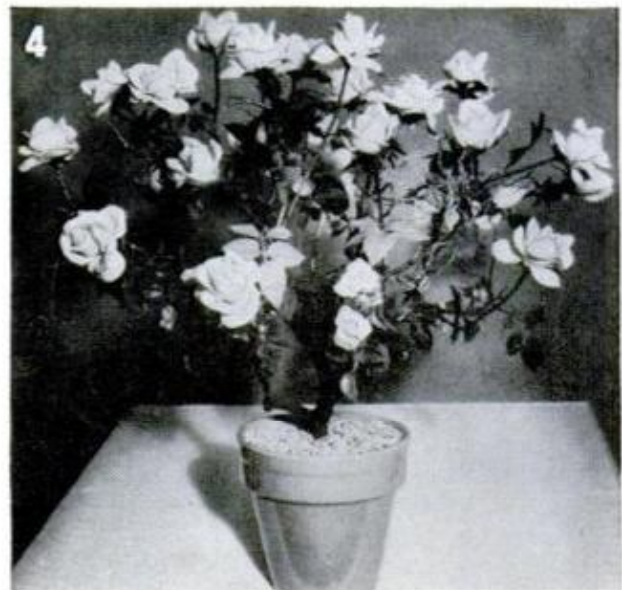
6. BUILT-IN PINCUSHIONS in thread spools let you store sewing needles right with the thread so that both are always handy. Simply press a short length of clothesline in the spindle hole. It's easy enough to push the piece out when you want to place the spool on a sewing machine



2



3



4

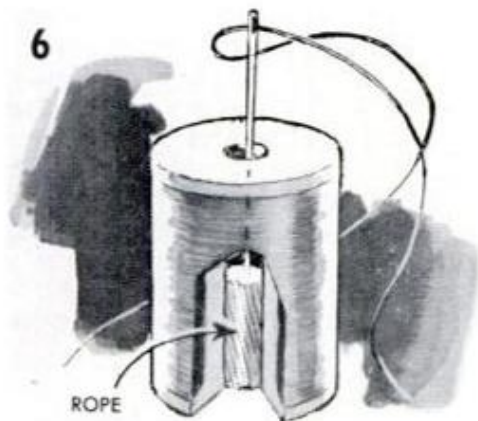
7. POTTED PLANTS have more room on a window sill and do not mar its surface, if a ¼-in. plywood shelf is cut to fit on top of it. A roundhead screw driven into the stop at each side, prevents the weight of the plants from tipping the shelf

8. TO RAISE A DROPLIGHT having a cord that is too long, form an M-shaped clip from a short length of stiff wire or paper clip and loop the excess cord through the two legs as shown. Before doing this, make sure the cord's insulation is intact

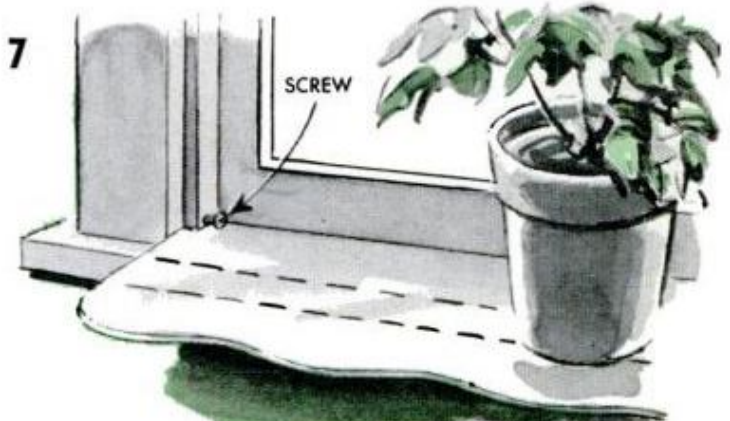
9. ARE YOU ANNOYED by rust stains that are left on sinks and tubs by cleanser cans? Then wrap a wide strip of adhesive tape tightly around the bottom rim each time a new can is placed in use, pressing the tape firmly against the metal



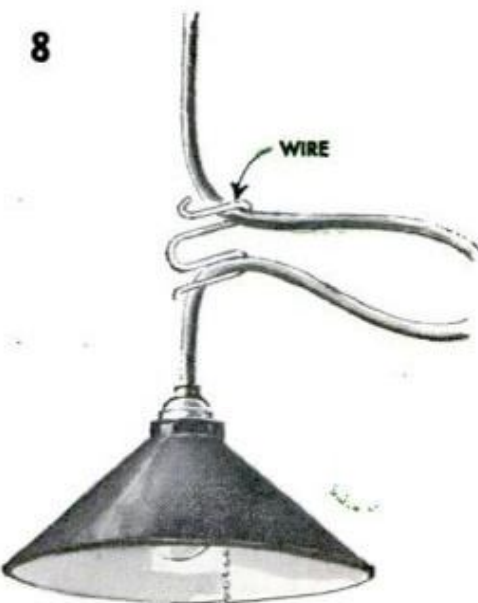
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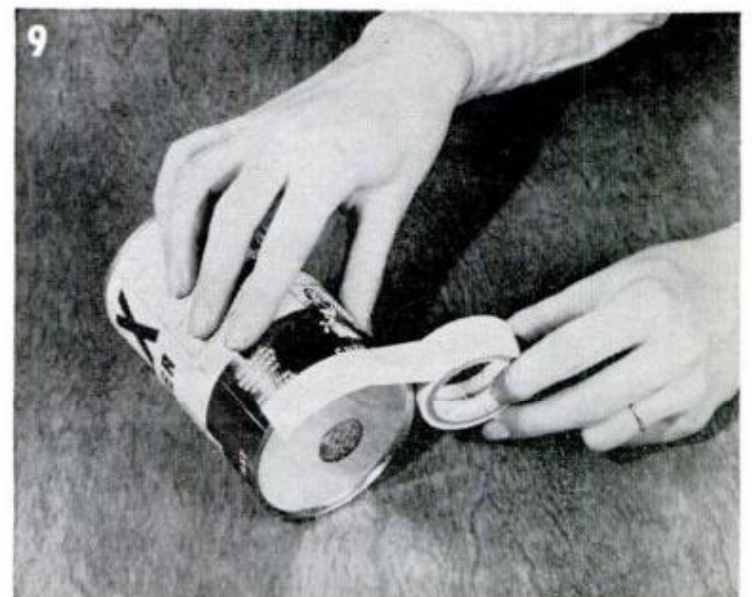
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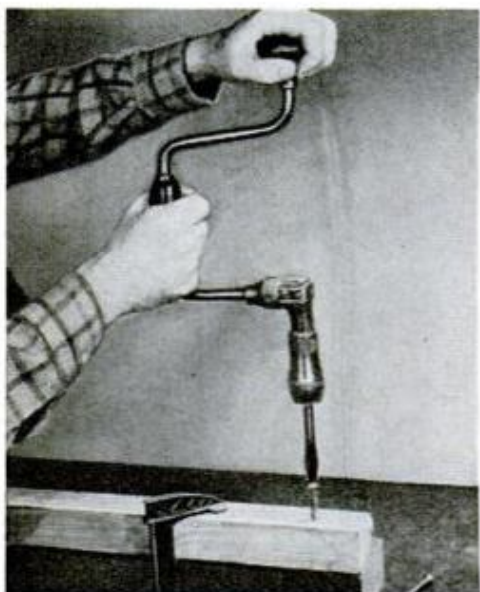
EASY

Leverage is utilized in countless modern applications from prying off friction can lids to moving mountains. Here are simple ways to lessen effort

By Walter E. Burton



WHEN YOU PRY the lid from a paint can or a jar of preserves you are making practical use of the old principle of leverage

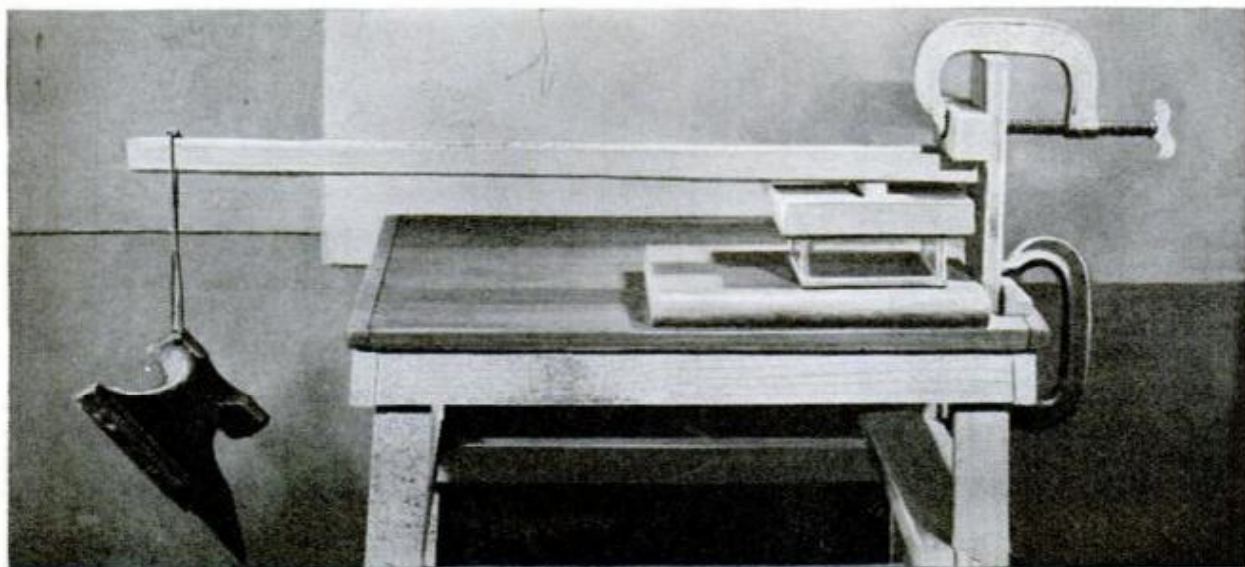


BIT BRACE gives you plenty of power to turn auger bits or a special screwdriver simply because it's a form of lever

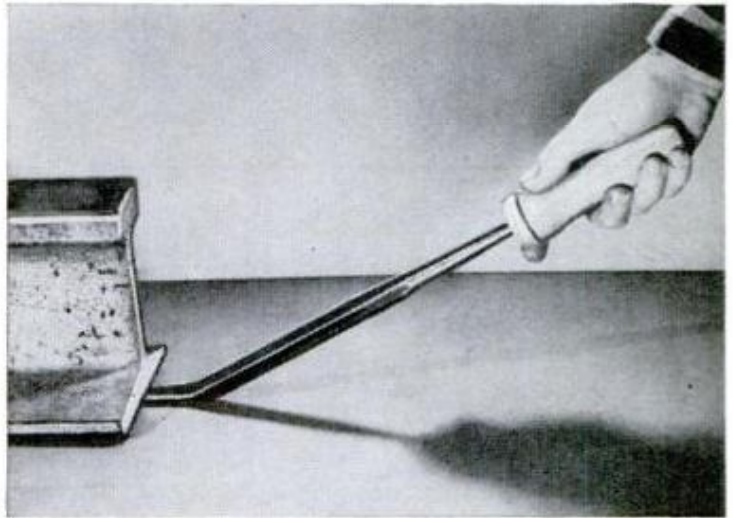
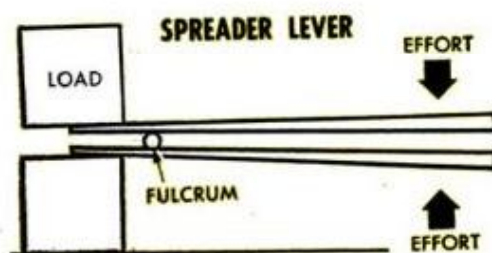
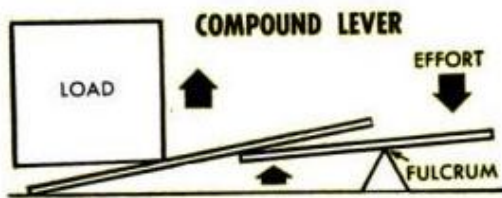
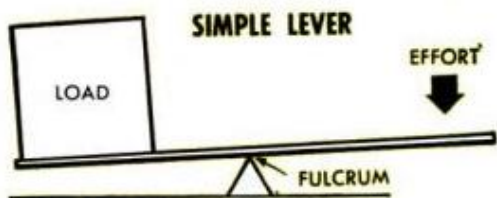
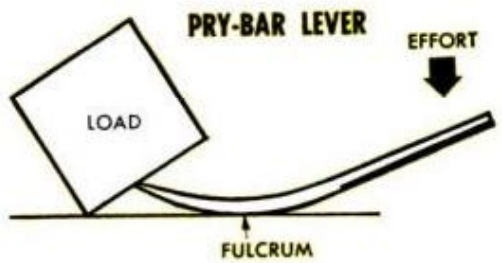
EVERY TIME you drive your car, spade the garden, pull a nail or drive a screw you are making practical use of the old principle of leverage. With a lever you can lift or move almost anything in your home—even your home itself if you care to go to the trouble! Use a lever to lift or move a piano, refrigerator, stove or heavy piece of furniture. Don't put the load on your back when a lever will do.

Note the four sketches on the opposite page. They detail diagrammatically four different ways of applying leverage by using straight and curved levers. The curved prybar provides a rocking fulcrum which is an advantage in that it gives a higher lift than a straight bar. But note also that as the lever comes down the fulcrum shifts progressively farther from the load, making greater effort necessary. You'll note this when you pull a nail with a claw hammer. As the fulcrum rocks away from the load a progressively greater pull is required. Also, the nail will bend unless you raise the fulcrum with a block as pictured. Other applications are shown in the photos.

HERE YOU SEE a lever used as a clamp for assembling a small plastic box. Advantage of method is that with this setup pressure is applied equally to all cemented joints. Setup can be assembled in a few minutes

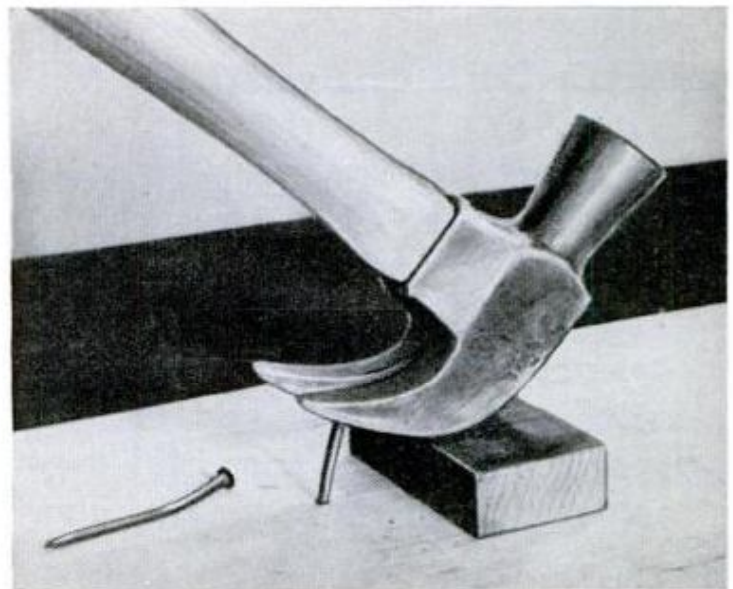


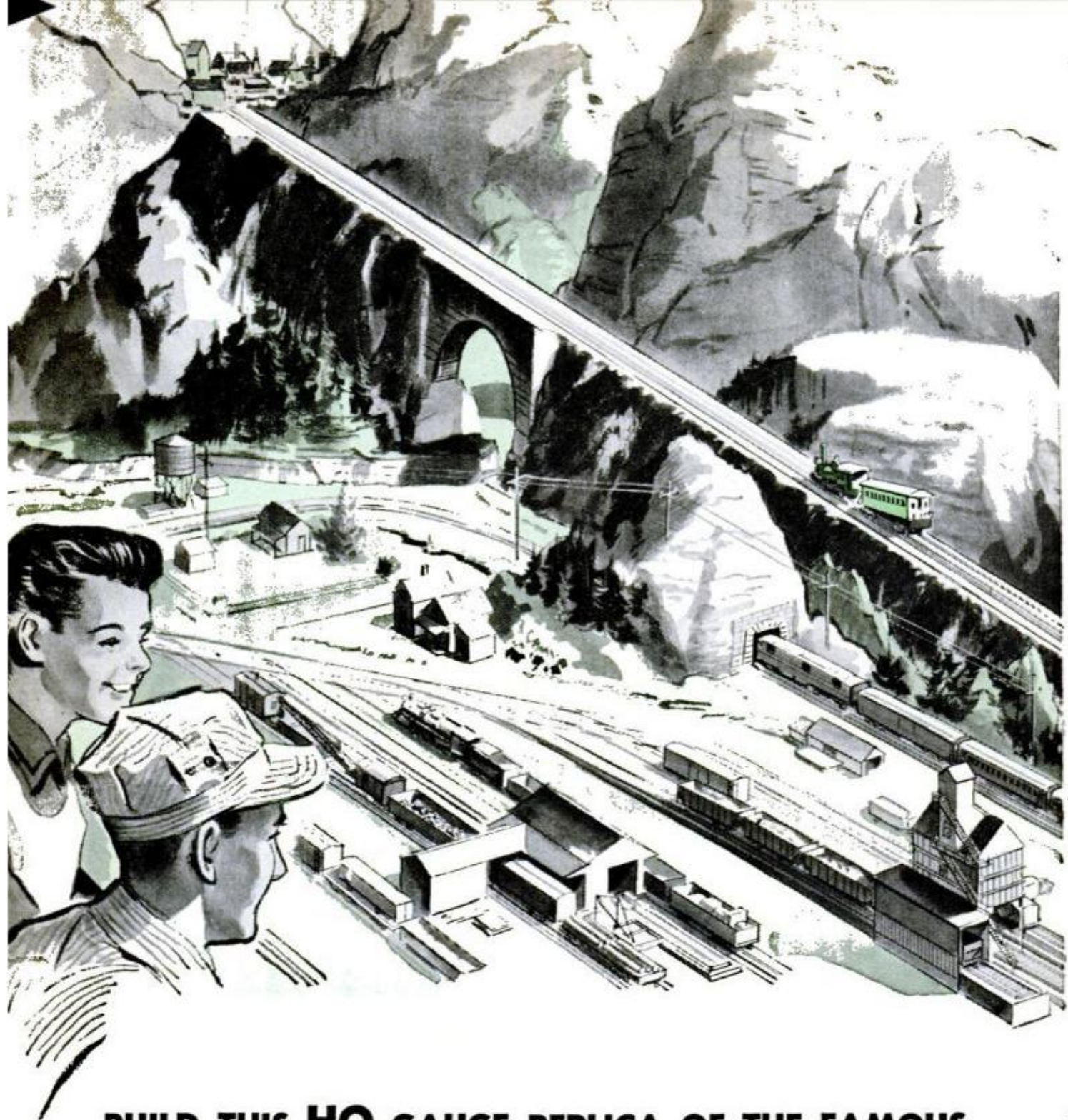
DOES IT



TWO APPLICATIONS of the rocking fulcrum. Above, it's an advantage in that it gives a higher lift without a fulcrum block.

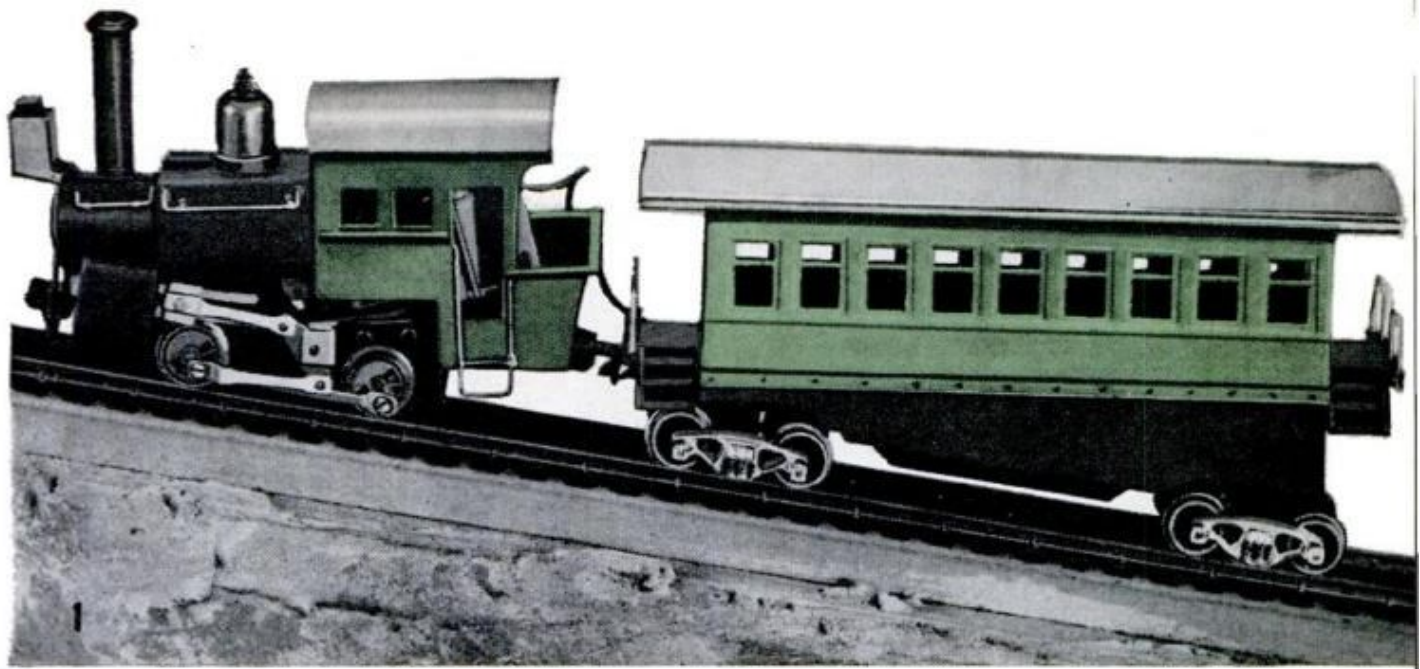
Below, in pulling a nail you need to place a block of wood under hammer to prevent bending the nail as it is withdrawn





**BUILD THIS HO-GAUGE REPLICA OF THE FAMOUS
PIKES-PEAK RAILROAD**

Designed to augment your present HO-ga. layout, this realistic accessory will add an interesting side light to your operating system. Wired for continuous operation, the little engine and car climb and descend the mountain automatically

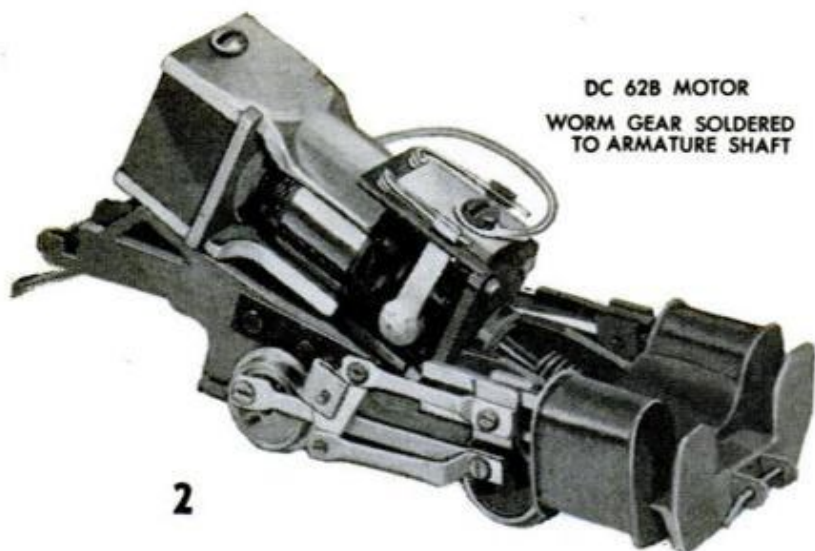


ENGINE AND CAR ride level up and down the mountain due to wedge shaped construction of the supporting frames. Car and engine were always painted in bright attractive colors



PATTERNED after the famous Pikes Peak cog railroad, this HO-ga. model of the real thing was built by Frank Beatty, Art Director of *Popular Mechanics*, himself an avid model railroader. While designed to operate without a cog, the model easily climbs and descends a 15-degree grade uninterrupted through the use of momentary bumper switches located at each end of the incline. Contact with a switch automatically reverses the rotation of the motor in the engine which sends it back down or up the incline. Two rheostats control the speed of the train, one as it climbs the incline, the other as it backs down. Operation is continuous and independent of the rest of the HO system.

To make the frame of the locomotive, cut out the parts with a fine-toothed hacksaw, following the full-scale patterns shown in Fig. 3. The main section of the frame is made of $\frac{1}{2} \times \frac{1}{2}$ -in. channel brass, and should be shaped by slow and careful work with a file. To complete the motor mount, cut the two cover pieces out of $\frac{1}{16}$ -in. brass plate. The bearing plate is next. Cut this plate from $\frac{1}{16}$ -in. brass and solder two small wedge-shaped pieces to the underside of the plate, Fig. 3. These blocks support and align the base-plate screws, which in turn hold the motor in place. The wheel axles float



DC 62B MOTOR
WORM GEAR SOLDERED
TO ARMATURE SHAFT

2

HERE IS THE ENGINE chassis complete, ready for installation of the cab, boiler and other accessories

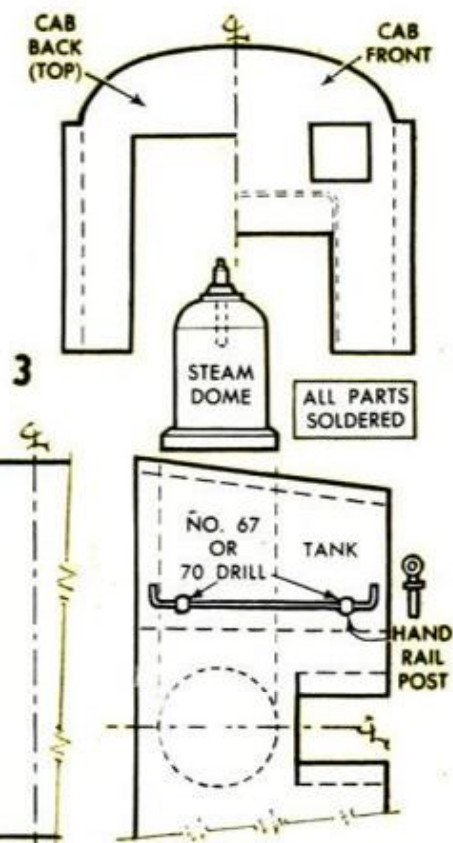
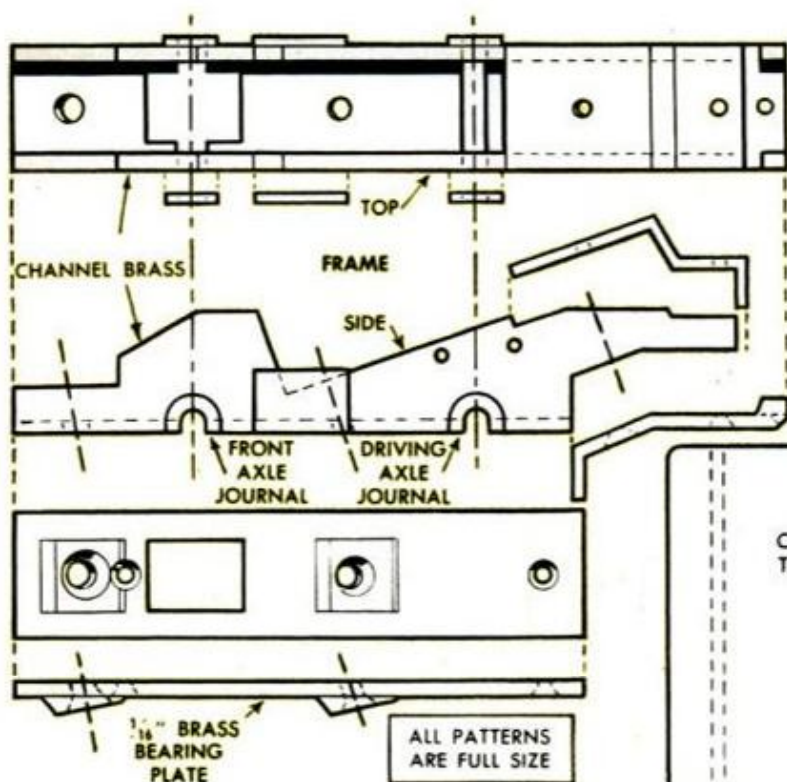
in journals which are formed by drilling the channel frame at the points indicated and sweat-soldering brass washers over the holes. Washers are later filed off flush.

The motor, a d.c. 62B Pittman, is held in place on the main frame by screws extending through the frame and into the motor mount. The worm gear on the armature shaft meshes with the gear on the axle. The worm gear must be purchased separately. It should fit snugly on the armature shaft; but, if the fit is too snug, it will be necessary to reduce the diameter of the shaft with fine emery cloth. The gear can be pressed on

the shaft by using a drill press to exert a steady, even pressure. After meshing the worm and wheel accurately, cut off the shaft projection. Two sets of 36-in. scale wheels, the front set geared and the rear set plain, may be purchased from a hobby shop. The wheel axles drop into the journals and are held in place by the base plate. On one side the wheels are insulated from the rails to prevent shorting out the circuit. Wheels on the other rail conduct current to complete the circuit. The cylinder assembly should be made from .012 or .010-ga. sheet brass. Use a pair of sheet-metal snips to cut out the

parts and follow the full-scale patterns given in Fig. 5. Shape the pieces over wooden forms and solder them together.

The drive-rod assembly is put together with small rivets, which are available at most hobby shops. Using the full-scale patterns, cut out the pieces. Use No. 0-80 machine screws and No. 0-80 side-rod screws in the driverod assembly. Their positions are shown in Fig. 4. The riveted parts should fit together snugly, but the rivets must not be drawn so tight that they prevent free movement. A good stunt is to place a piece of paper between the two parts when riveting and later pulling it out. This will keep the rods from binding but still make a snug fit. As you assemble the

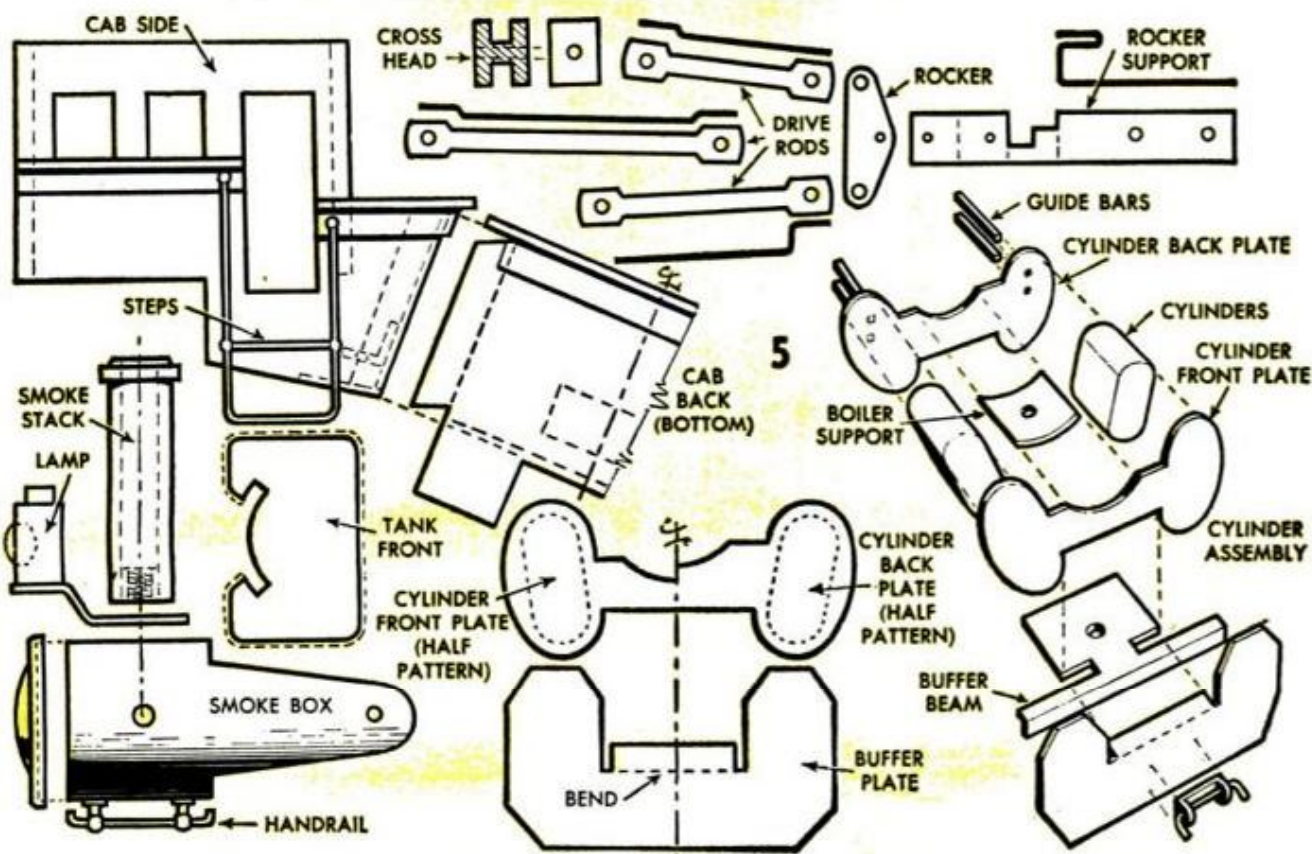
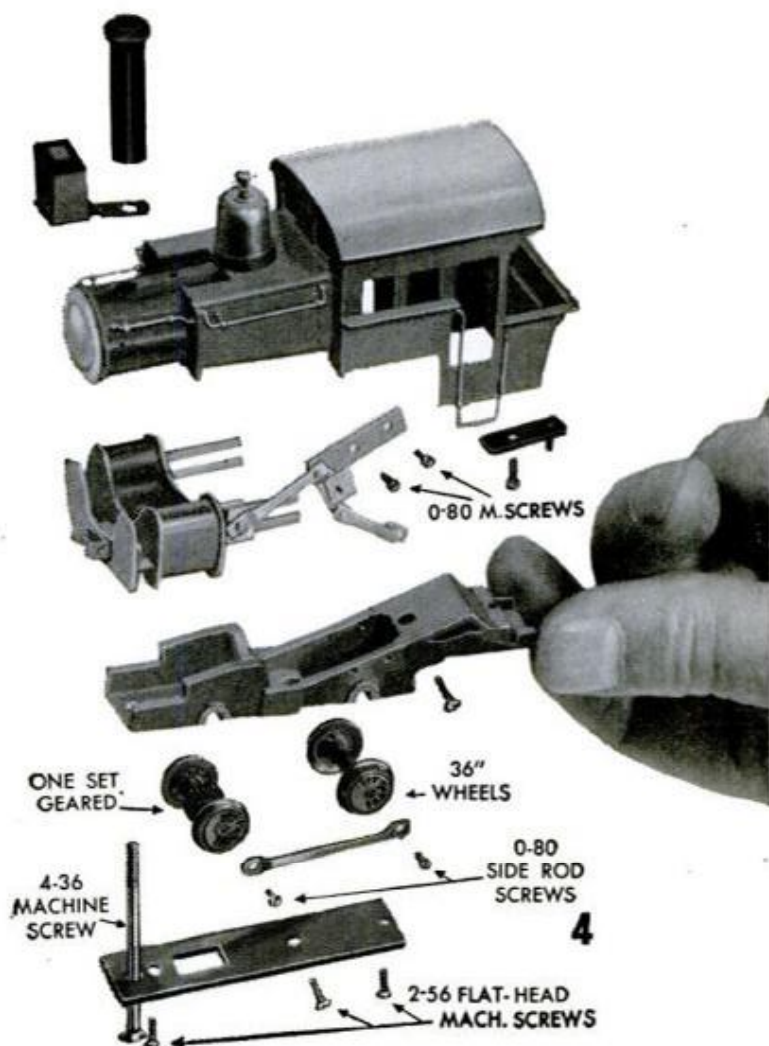


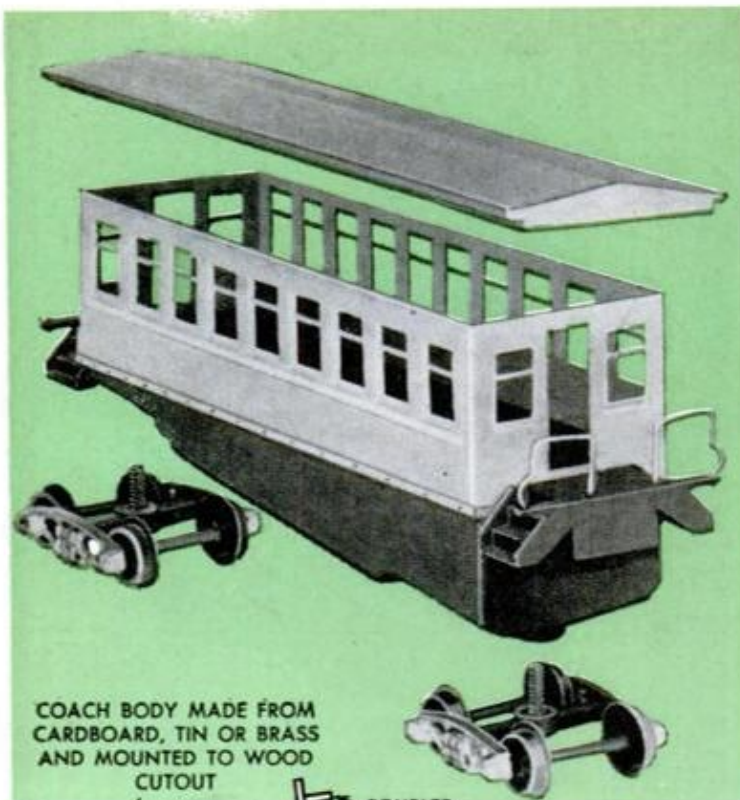
parts, keep checking them to make certain everything fits together properly and operates smoothly. The frame, cylinder and drive-rod assemblies, and the motor are shown in position in Fig. 2.

The cab of the locomotive is next. Using the full-scale patterns presented in Figs. 3 and 5, cut out the parts. The dome of the steam whistle is machined from a solid piece of $\frac{5}{16}$ -in. brass rod, and can be shaped either in a lathe or drill press. If you use a drill press, chuck the rod and use files to shape it. The smoke stack is a short length of $\frac{1}{8}$ -in. brass tubing, and the bottom end is filled with solder, drilled and tapped for a No. 4-36 machine screw. Solder also is added to the top of the stack and filed to the shape shown in Fig. 4.

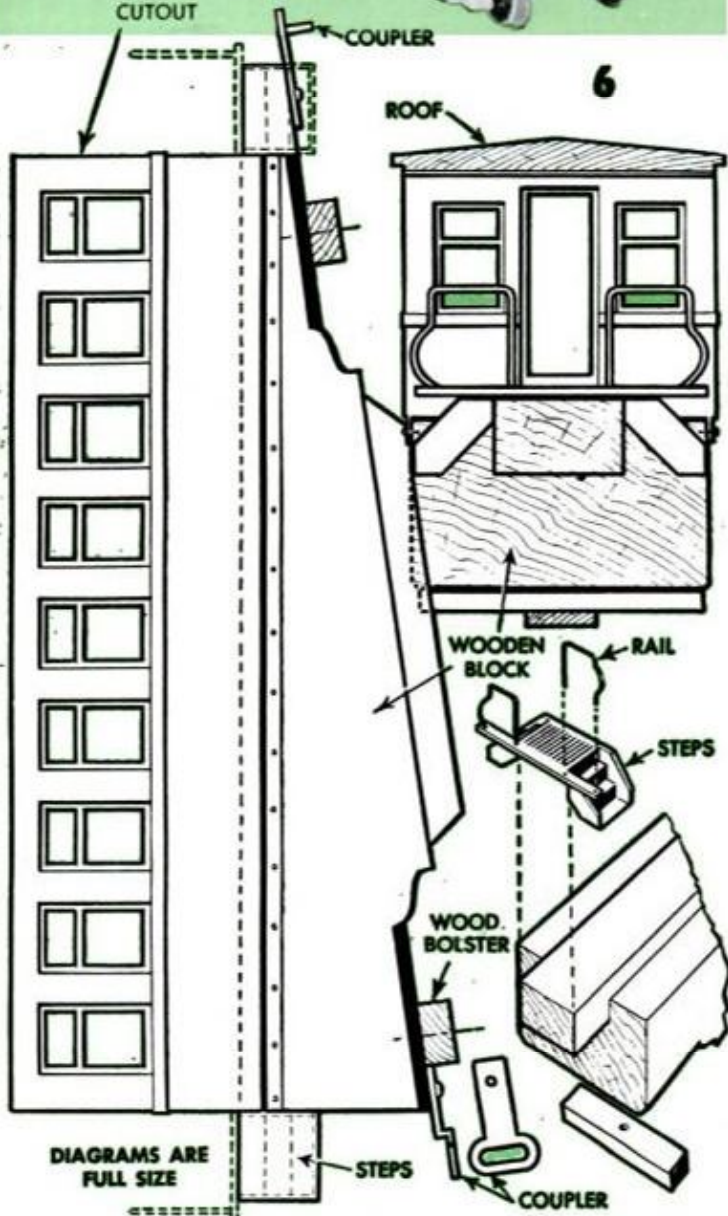
Use a piece of $\frac{5}{8}$ -in. brass tubing to form the body of the boiler. Then cut out the front boiler plate from sheet brass and peen it to a convex shape, Fig. 4. The hand-rail posts can be picked up at a hobby shop, and at the same time enough fine steel wire for the boiler hand rails. Once you know the wire size, drill the posts, push the wire through the holes and shape the rails following Fig. 3.

All the other cab parts are cut





COACH BODY MADE FROM CARDBOARD, TIN OR BRASS AND MOUNTED TO WOOD CUTOUT



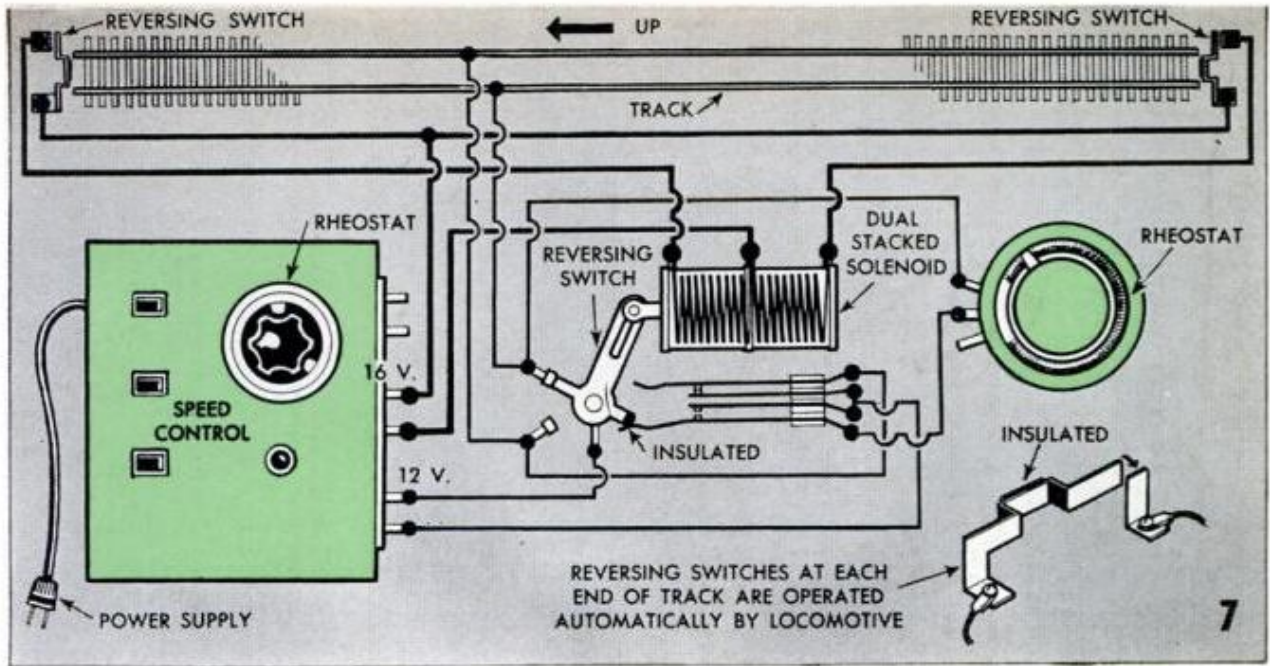
from sheet brass and shaped over wooden forms. Rough cut the windows and doors first by drilling holes within the scribed openings and then filing to size. It is best to form such openings and other duplicate parts two at a time by sweat-soldering the parts back to back. This method assures identical units and the parts are easily separated when completed by heating. In beginning to assemble the parts, you'll do well to first spot-solder the pieces so you can check the fit before final soldering. As you solder, it is a good idea, too, to wrap a wet cloth around sections already soldered.

The passenger car details are shown in Fig. 6, and the patterns are all full size. Starting with the base, cut it out of a wooden block. Top of base and step supports are easier to form from a separate piece of wood. Insert this piece into a groove cut in the base, then shape the entire base as one piece. The roof either can be purchased from a hobby shop or cut out of wood. The coach body may be made of metal, cardboard, or wood. Even the sides of an old model coach may be used. You'll probably want to purchase the steps, two sets being needed. Fasten them to the platform ends of the wooden base. Cut off short lengths of steel wire for the step railings and form them as in Fig. 6.

Attaching the Trucks

Next, attach two sets of double trucks to the base. These also must be purchased from a hobby shop. The couplers are cut from sheet metal and a small rod soldered to one of them. Screw the couplers to the wooden base and nail two wooden bolsters in the positions shown, Fig. 6. Finish the locomotive and coach in any color you like. You may want to paint the cab and body of the locomotive red, the lamp yellow and leave the whistle a polished brass. Underparts are best painted a dull black—the same goes for the smoke stack. Model coaches usually are painted bright colors—a color that contrasts with the engine is best. Fig. 1 shows the finished job.

The length of the incline may be as long or short as you want to make it. Just mount the HO-

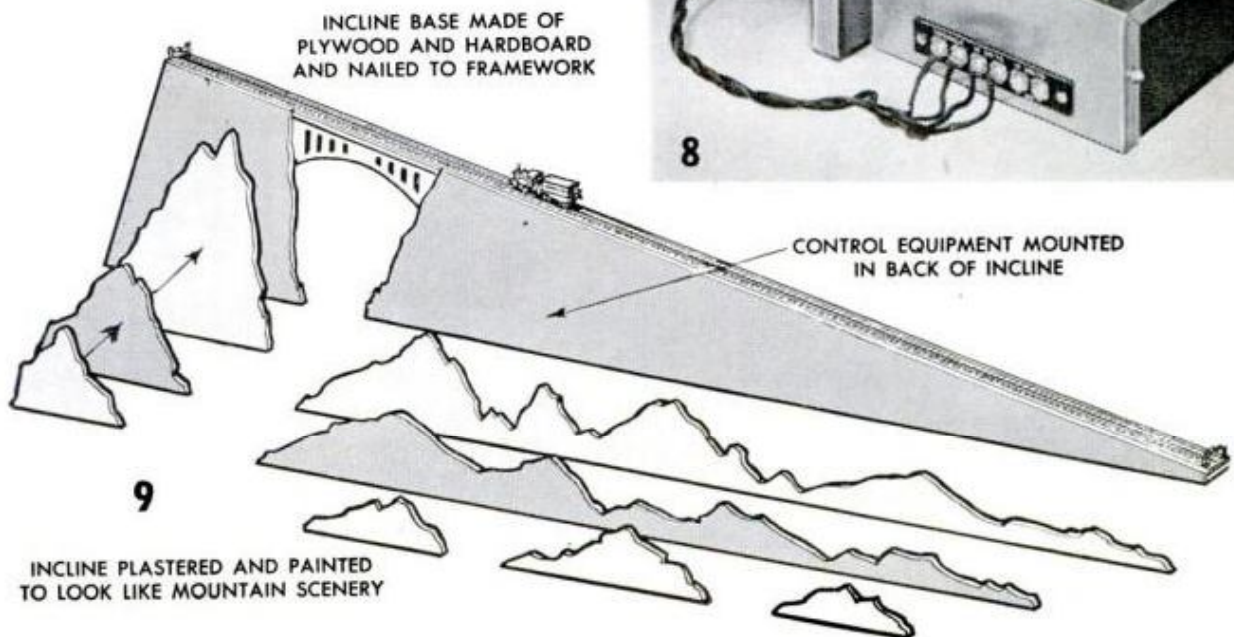


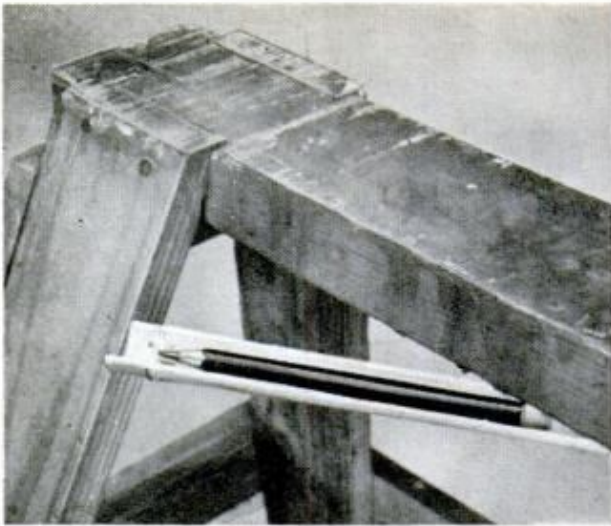
gauge track on a 1x4 wooden base and nail vertical supports to the incline at 2-ft. intervals. To create the mountains effect, nail additional vertical supports to the framing and slant them outward. You can use scraps of wood, hardboard or other paneling material to cover the framework, Fig. 9. Scrap material is glued and nailed to the base, creating whatever scenic background is desired. For texture and form, a spackling compound is applied to the surface and then the entire background is painted. Figures, trees and other background accessories are added to make the scene realistic. It's up to you how simple or elaborate you care to make it.

Besides the standard power supply, which includes terminals for both 16-v. and 12-v. direct current and a rheostat, you

(Continued to page 272)

ELECTRICAL CIRCUIT includes two rheostats to control speed when train reverses direction on incline



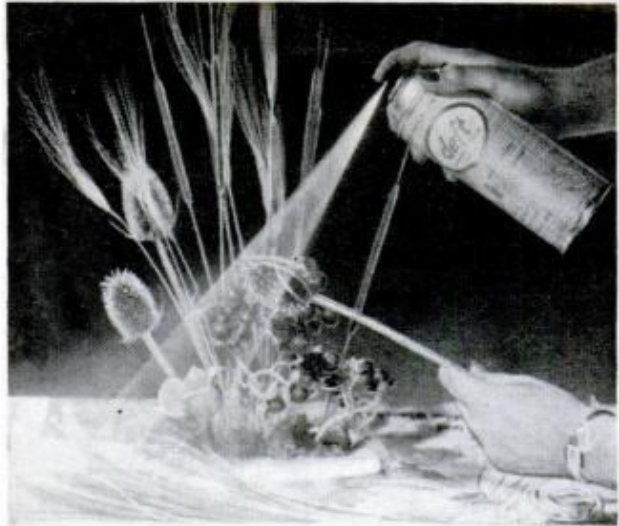
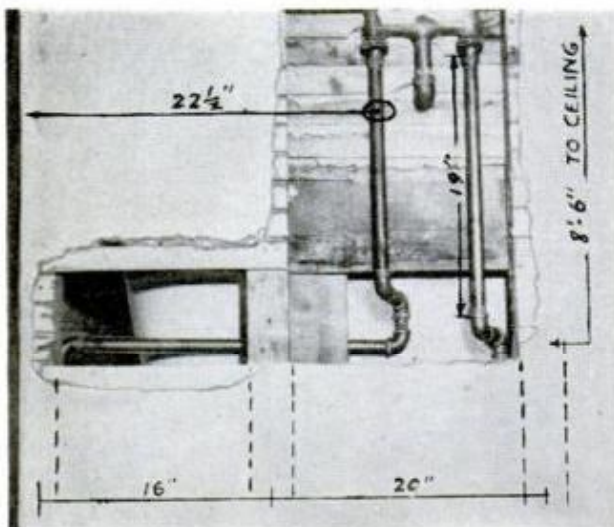


Bamboo Tray Holds Pencil Under Sawhorse or Bench

Have trouble keeping a pencil handy in the workshop? If you wear glasses, there isn't room behind your ear for the ordinary lead pencil do-it-yourselfers usually prefer. Cut a piece of bamboo lengthwise and use one of the halves for a tray. Drill a body hole for a screw near one end and attach to the underside of a sawhorse beam or the bench top and you have a pivoted tray.

Photo of Hidden Plumbing Pinpoints Future Repairs

When one homeowner found it necessary to rip out a wall to get at the bathtub plumbing, he took time to take a picture of the wall cutout before replastering. He marked on the photo the actual distances of the various pipes and studs from an established point and filed it away for safe keeping. The photo provided a handy reference for pinpointing future repairs in the event he had to again open up the wall. Such a situation would arise only in cases where an access panel is not provided or feasible.—A. Capotosto



Spraying Dried Flowers Brightens Winter Bouquet

Dried floral arrangements that have come to look like the last rose of summer in the middle of winter can be brought back to "life" with a coating of clear spray-type wood finish. Not only does the clear coating give the bouquet a bright new luster, but it adds longer life to the brittle flowers and at the same time makes them more dust free.

Compartmented Food Trays Handy at Service Bench

Ever wonder what you could do with the neat foil trays you get with packaged frozen dinners? One excellent use for them is keeping small parts separated when taking an appliance apart for repair. Being compartmented, the trays do a fine job of keeping tiny screws from being mixed up with other parts, and a couple such trays will be found especially handy at a radio and TV service bench, where a number of sets may be worked on at the same time and where the chance of misplacing parts is all the greater.—Lorna L. Squires



NEW FOR SHUTTERBUGS

1. AIM AND SHOOT is all that's needed to take pictures with this new Polaroid camera. Lens opening and shutter speed adjust automatically. Meter provides wide range of exposure control—from ordinary room lighting to bright sunlight. New viewfinder and range finder operate together through the same window

Polaroid Corp., 741 Main St., Cambridge 39, Mass.



2. BALSUNC SLIDE PROJECTOR and tape recorder synchronizer is a new unit that makes it easy to produce sound-slide shows. It is designed to work with the Balomatic projector and any recorder having stereo playback. The taped commentary is synchronized with the projector making entire operation automatic

Bausch & Lomb Inc., Rochester 2, N. Y.

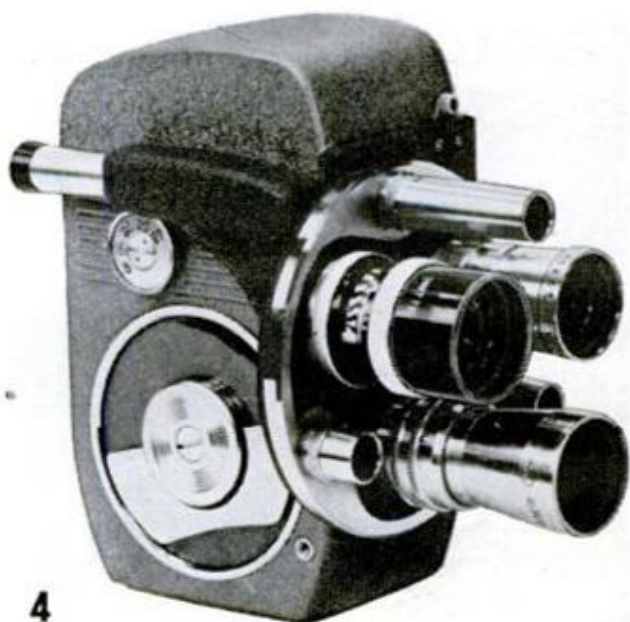


3. SPRAY-ON ADHESIVE is meant to replace dry mounting tissues used to bond prints, drawings and art work onto backgrounds. The adhesive is supplied in aerosol spray cans, and you simply spray the back of the print, position it, cover it with clean paper and apply a pressing iron set at "rayon" temperature

Strauss Photo-Technical Service, 930 F St., N.W., Washington, D.C.

4. VOSS MOTION-PICTURE EXPOSURE METER screws into all standard 8mm turret D mounts, or it can be mounted on the camera by means of an adapter that fits the accessory shoe. The meter is furnished complete with a sunshade and a protective screw-in cap, and has a range of film speeds from ASA 6 to 200

Voss Photo Corp., 28 School St., Yonkers, N. Y.





NEGACOLL PLASTIC is heated slowly in double boiler, stirring every 20 min. or so to break up any lumps



HEATED PLASTIC is cooled to casting temperature by pouring it through air, above. Bowl with plastic is placed in container of ice water between pourings to accelerate cooling. Below, subject combs hair straight back to ease job of applying plastic matrix



MAKING LIFE MASKS THE EASY WAY

with a new type of modeling plastic that's fun to work with

By H. Blake Chatfield

FACE MAKING, life masks of real live models that is, is just about as easy as applying pancake makeup when the methods of MGM's chief makeup man, William Tuttle, are used. This story and accompanying pictures tell how anyone can make a plaster-cast mask of the face of a family member or friend, faithfully and accurately reproducing the minutest detail.

First, a negative mask of the subject's face is made, using a special model-making plastic called Negacoll. This product may be applied directly to the skin without discomfort or danger to the model. No coating of cold cream or petroleum jelly is necessary, and the eyelids and lashes do not have to be covered with cigarette paper as had to be done when the old plaster-cast method was used. While an overcoating of casting plaster still is used to give body to the mask, it is insulated from the face and hair by the plastic coating.

The plastic material goes on warm over the face and cools as it sets up, in contrast to the heating up of casting plaster as chemical changes take place during its hardening process. Additionally, the plastic is so easily kept away from the nostrils that it is unnecessary to use straws in the subject's nostrils for breathing.

Proof of the comfort with which face masks can be made by this easy method are the dozens of masks which line the walls of Tuttle's office. The gallery includes Lana Turner, Elizabeth Taylor, Clark Gable, Fred Astaire, Wallace Beery, Esther Williams and many others. By actual count



Model for life mask is Yvette Mimieux, star of MGM picture, "Where the Boys Are," a March 1961 release

LIFE MASK bears exact likeness of subject, including eyebrows, lip lines and line at corner of mouth

more than 500 of Hollywood's motion-picture stars have been "masked" in this new technique.

Before using the plastic material, Nega-coll, it must be pre-heated in a double boiler for at least three hours. When melted, it must be stirred every 20 minutes to dissolve the lumps. After thorough cooking, the plastic is cooled by pouring it from one enameled bowl to another. The cooling process can be hastened, if between pouring, the bowls are dipped into a third container filled with ice water. Prior to using the material on the face of the subject, its temperature should be tested on the wrist.

The subject should be made ready to receive the material before the cooling process begins. No special preparation of the face or hair is necessary. Women may comb

their hair straight back to facilitate removal of the plastic matrix. Since the weight of the cast will flatten down hair, a fluffy hairdo will not be reproduced. The subject should be seated, not lying down, during the matrix-making process. In this way the life mask will look most natural. The skin will hang in its usual way. Some method of supporting the back of the subject's head should be found for his maximum comfort, such as high-backed chair. Cover the subject with a cloth to protect the clothing. Although the plastic material will peel off anything after it has set up, the plaster over-coating is more difficult to remove.

When the plastic material has cooled sufficiently to be used without discomfort to the subject, it must be applied quickly, as congealing will occur upon further cooling.



LOWER PART OF FACE is coated with plastic first, followed by ears, sides of forehead and hair as far back as ears. Eyes are covered last, after which entire face is recoated with plastic to a depth of $\frac{1}{2}$ in.

Using a 1-in brush, paint it directly onto the face, beginning on the cheeks. Work back and up to the ears, the forehead, and then onto the hair, painting from front to rear to capture a more accurate impression of the hairline. Work swiftly, but carefully, trying to keep air bubbles out of the mixture. After the forehead and hair have been covered, paint the chin and mouth, then the bridge of the nose and around the nostrils. Since the plastic material is slow to run and easy to place around each nostril, the space between them also can be covered without getting plastic into the nose.

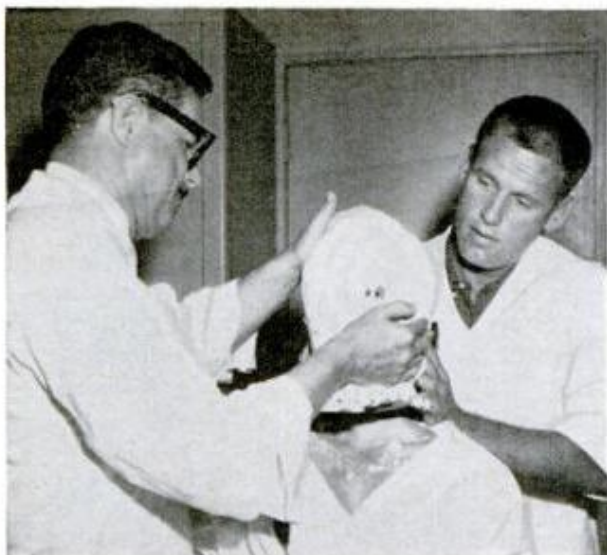
Next, the eyes are covered. These are left until almost last by Tuttle as a concession to the subject who watches the process in a wall mirror. All low spots (eyes, ears and mouth) should be painted before the plastic begins to set up, as this will help to avoid air bubbles in the matrix at these critical

points. Last to be covered are the areas under the chin and on the neck. After the entire front of the head has been covered, go back over the plastic where necessary to build it to at least $\frac{1}{2}$ -in. thickness. In any undercut areas, such as the chin and nose, build the undercut to extend across the front of the mask for strength.

After the face is completely covered with plastic, the mask is reinforced with an overcoating of casting plaster. This plaster may be made up by an assistant while you are building up the thickness of the plastic underliner if the subject is in a hurry to see the results or is growing impatient. To speed the drying of the plaster overcoating, from one to three tablespoonfuls of salt may be added to the mixture. This cuts the hardening time about in half. The exact amount of salt to be used depends upon the heat and humidity. Before putting on the

AFTER PLASTIC MATRIX has hardened, casting plaster is applied to reinforce the matrix. This is spread on to a depth of $\frac{3}{4}$ in. Start at top of head and work down toward neck, being careful not to block nostrils





MATRIX MASK IS REMOVED by pushing in the direction of subject's feet and then tilting it up and away from neck and chin. Note in photo at right, negative mask gives optical illusion of being positive (male) mold

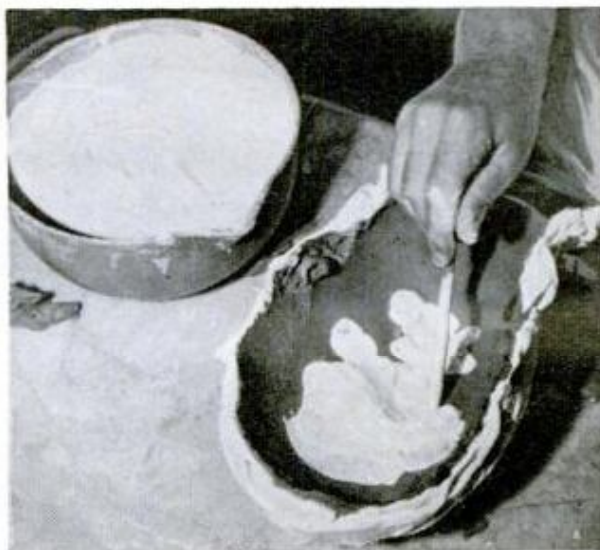
plaster, you may tip the subject back slightly to keep the plaster from dripping off the plastic undercoat. Test the plastic material for hardness with your fingers. When it has set up, spread on a $\frac{3}{4}$ -in. covering of plaster with a putty knife or a wooden kitchen spoon. Start at the top of the head and work down toward the neck, being careful not to block the nostrils or go beyond the limits of the plastic matrix. At this point it is well to advise your subject that the mask will begin to get heavier and will seem to be falling off the face. Assure him that this will not occur and that the plastering process will take just a few minutes more. It is important to keep the plaster away from the hair of the subject.

The plaster should set up hard in about 10 min. Toward the end of this period, begin working the plastic material free from the back of the ears and along the

hairline. When the plaster has hardened, remove the negative (female) mold or matrix by pushing it slightly in the direction of the subject's feet and then pulling the mask up and away from the neck and chin, slowly and carefully.

The positive (male) final cast of the matrix should be made without delay, as the plastic will crack if left for any time. Place the negative mold face down on a ring of modeling clay to hold and protect it. With some of the clay, plug up the holes in the mask left by the nostril openings. Then prepare another batch of casting plaster, adding the plaster a little at a time to cold water, while stirring constantly but slowly to remove lumps and avoid air bubbles. The mixture will harden very quickly upon reaching the consistency of thick cream so you will have to work swiftly once it is prepared. Using a small, soft

WHEN MAKING FINAL CASTING, mask is placed down on ring of clay and plaster is brushed into low spots, such as eyes, ears and mouth. Then, enough additional plaster is added to build shell of $\frac{1}{2}$ in. minimum thickness





WHEN FINAL PLASTER cast hardens, matrix is turned face up on protective rubber pad and overcoating is chipped away, above. Below, plaster scored by knife tapped with hammer, falls away in big pieces



PLASTIC MATRIX is stripped off mask easily, below, starting with undercut of chin and peeling backward



brush, paint in the low spots to keep out air bubbles. As soon as they have been brushed in, the mold is poured about half full of plaster which is then spread evenly around the inside to form a shell of $\frac{1}{2}$ -in. minimum thickness. If there is no objection to having a heavy life mask, the mold may be filled completely with casting plaster.

After the positive cast of the life mask has dried, turn it face up on a piece of rubber padding and begin taking off the plaster over-coating. This is done by scoring the front of the overcoating with a kitchen knife, after which the latter is tapped with a hammer, cracking off the plaster overcoating in large pieces. Next, strip off the plastic material. Small pieces left on the mask should be removed carefully with a knife.

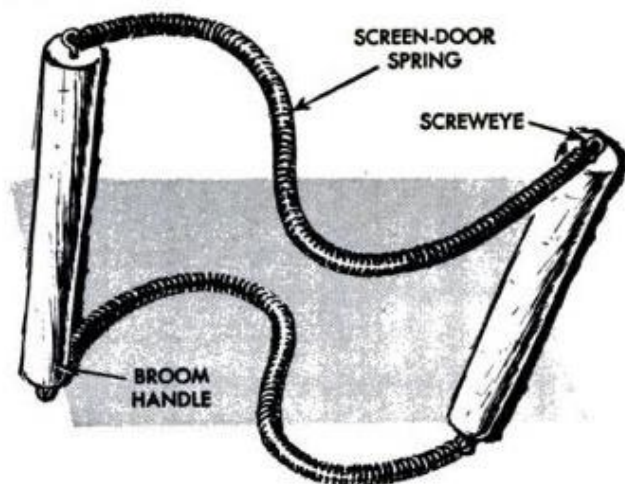
Unless your life-mask casting is perfect, it will have to be "pointed", or touched up, to remove projections caused by air bubbles in the plastic. These can be removed easily with a knife or sand-paper. Indentations in the mask caused by air bubbles in the final pouring should be treated in this manner: First wet the cast in the touch-up area, brush in a thin plaster mixture to the level of the surrounding surface and sand flush when the plaster becomes hard. Finally, after the mask has completely cured, give all surfaces one or two coats of shellack or lacquer to protect it from moisture and dirt. It may then be given a final coat of enamel or paint, or it may be left unpainted.

The plastic material may be used again and again if it is removed soon after casting. It will have some plaster sticking to it, so heat the plastic to a liquid state in the double boiler, remove from the flame and let it cool. The plaster will settle to the bottom when the plastic hardens and can be scraped off. It is best to run the plastic through a meat grinder so as to break it into small pieces which will melt easily without forming large lumps the next time you use it. Store it in an air-tight container in a cool place. ★ ★ ★

REUSE OFFSETS COST

While the initial cost of Negacoll is somewhat high, the fact that it can be reused over and over makes it economical per use. For this reason mask-making lends itself to group use by several families, schools or club groups whereby the cost can be prorated. You can purchase the material by mail from Virginia Van Veen, 5 Beekman St., New York 38. It retails for approximately \$30.00 for a 5-kg. (11 lb.) can.

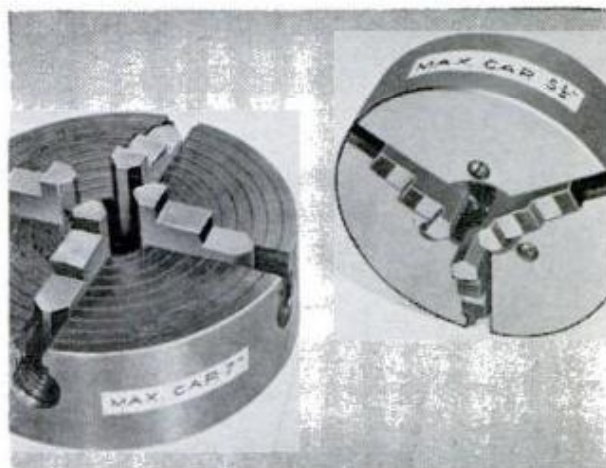
MUSCLE BUILDER



STRENGTHEN SHOULDER and arm muscles with this exerciser. Just a few minutes a day does it. Can be made from items you may already have at hand

Maximum Capacity of Chucks Indicated by Labels

There's no need to reverse the chuck jaws to determine maximum capacity of the chuck when you have the various sizes labeled as pictured. Handy in school shops and small custom machine shops where a number of chucks are kept on hand but where there are no toolroom facilities for storage on labeled compartments or shelves. Probably the simplest and easiest way to label the chucks is to letter the maximum capacity on a strip of adhesive tape and attach to the body of the chuck where the label won't interfere with normal use.



COMING UP NEXT...

Add a Future to Your Garage. To you your garage, any garage, may be only a place to put the car, but did you ever think of it as having a future? Intriguing, isn't it? Just hang onto the thought 'til next month's issue of **PM**.

Mr. Doit and Bungle. You'll get a bang out of this monthly feature, a **PM** first. Our cartoonist looks in on the doings and bunglings of do-it-yourself neighbors and then sits down with his sketch pad. Educational? Yes, but it's also what a cartoon feature is supposed to be — funny.

Spring Tonic for Your Car. Sure, you've heard and maybe read about all the things one should do to dewinterize your car. Drain this, they'll say, flush that and perhaps tighten or loosen something else. Okay so far—but this article goes farther.

Build Your Own Toolpost Grinder. A shop man takes a few pieces of pipe and fittings, a couple of sealed ball bearings, a motor from an office machine and builds an accurate toolpost grinder. Next month he'll tell you how you can make one like it.



SCRAPE AND BRUSH inside of roof gutters before applying coat of antirust primer



SANDING DISK chucked in electric drill is best way to clean metal surfaces such as you find on window air conditioner



FUEL-OIL TANK should be thoroughly cleaned with wire brush before applying a rust-resistant paint. Use a strong detergent to remove oil spots from the surface of tank



BACK-YARD GYM SET is kept in tip-top condition with antirust paint. Bright colors should be picked for finish coat



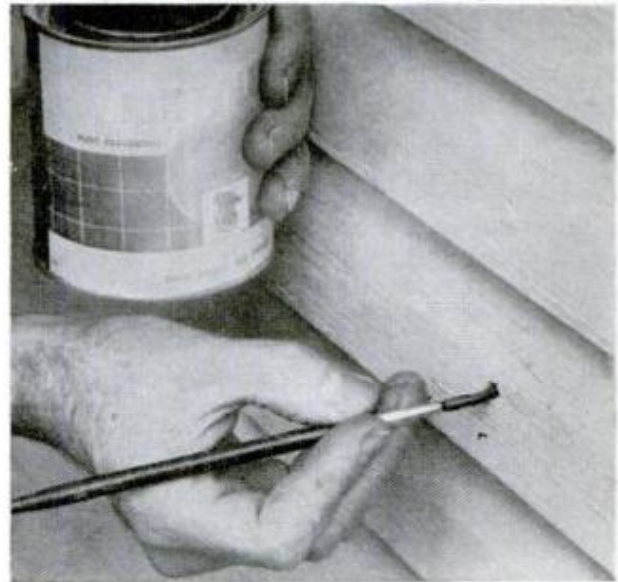
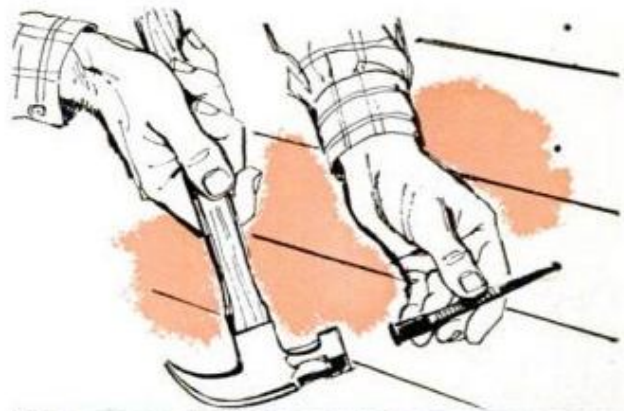
SAVING METAL WITH RUST-EATING PAINTS

By *Walter E. Burton*

MODERN metal paints and primers—particularly primers—enable you to make rust virtually a part of the protective coating, instead of merely painting over it or having to remove it down to bright metal. Rust-penetrating protective coatings are compounded to work their way through rust, displacing air and moisture as they go, until they reach and join the sound metal beneath. Then they harden and protect the metal from further corrosion.

There also are primers designed to form a tight-adhering, corrosion-resistant film on unruled steel, galvanized surfaces, aluminum, copper and other metals. These make it possible to paint galvanized downspouts, gutters and other galvanized surfaces without first treating the metal chemically or waiting for it to weather. The primers also make it easy to change the color of metal doors, window sash, and other articles to match surrounding areas. While the composition of one brand of rust-preventive paint may differ considerably from that of others, the uses and methods of application are much the same for all.

Undoubtedly you have had the experi-



NAIL HEADS in wood siding are set slightly below surface before spotting with primer prior to repainting



ALUMINUM PAINT with antirust properties is popular for painting rural mailboxes. Clean first with steel wool

ence of painting over rusted metal only to find that, while the paint film remained intact, further rusting took place beneath it. More than likely, the rusting continued because you had sealed moisture and air, plus perhaps some corrosive chemical, such as salt, in the pores of the rust. Even on a bright new steel or iron surface, trapping moisture and oxygen under paint can result in eventual corrosion. In general, manufacturer's directions accompanying such paints, which principally are primers, advise the user to scrape and wire-brush the rusted surface, leaving a more or less uniform coating of firm rust. If there is grease or oil present, it must be removed before maximum paint adhesion can be expected.

Finishes for application directly to rusted surfaces can be divided into two classes:

1. Primers which must be covered later by a finish coat if maximum service is to be obtained. 2. A combined primer and finish in various colors. Some manufacturers offer finish-coat enamels or other paints to go with their primers. Others say that any paint having good weathering resistance, such as ordinary house paint or aluminum paint, can be used. Straight antirust primers for use on rusted metal usually come in some one color, such as dark red and the desired finish color is provided by the second coat. If the final coat is of a light color, an intermediate primer of a lighter color may be desirable. A single coat is said to give good protection; two or more can be used where severe conditions, such as extreme dampness or heavy rust exist.

The following preparation is recommended for iron and steel:

1. Use a chipping hammer or scraper to remove sizable chunks of rust, scale, mill scale and old paint, and to break off the little domes of rust that defy a wire brush.

2. Vigorously wire-brush the rusty surface to remove fine scale and any other loose material the scraper may have missed.

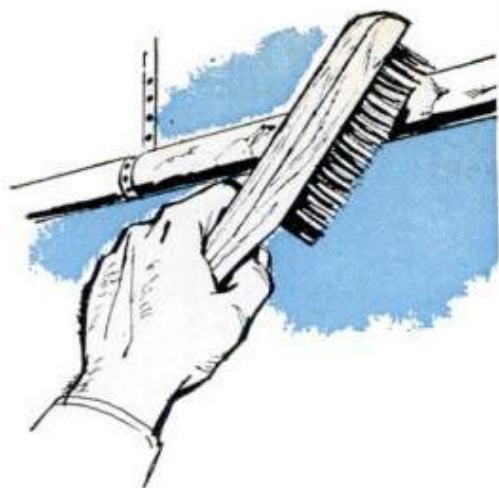
3. Dust surface by brushing or blowing.

4. Apply rust-penetrating paint with brush, spray or roller. Apply a uniform coating, and if possible, work the paint into the surface. If grease or oil is on the rusty surface, scrape off any large accumulations, then clean surface thoroughly with a solvent, or scrub it with a grease-cutting detergent. Dry the metal, scrape and wire-brush it, and proceed as described above.

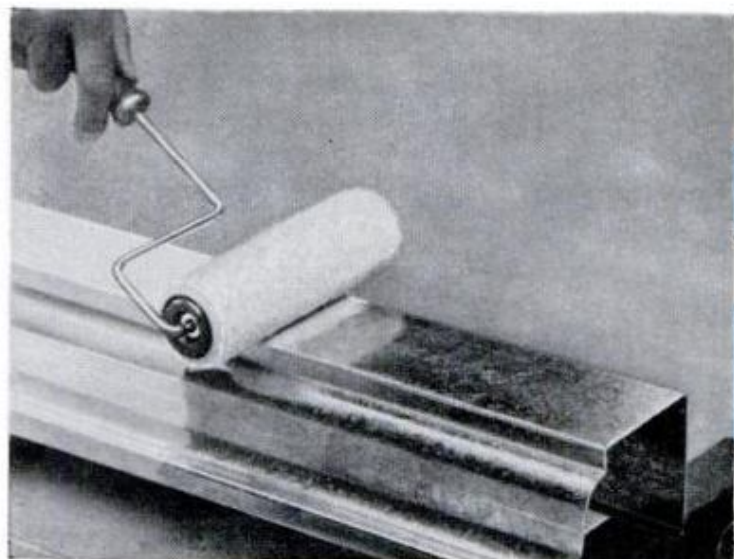
5. After the primer has set for a day, or longer, apply whatever top coat the manufacturer recommends.

If you are painting a sweating water pipe or other constantly wet surface, wipe off excess water with a cloth, then use an electric fan and perhaps a heat lamp or two to dry the metal further. Or wait for winter when low humidity stops the sweating. Some antirust primers are formulated to be usable over damp, rusty metal.

In preparing the surface of bright steel, clean off any dirt, especially oil or grease. Use a primer designed for clean iron and steel. In the case of aluminum, if new, clean as for bright steel. If weathered, wire-brush or sand lightly, wash with detergent, rinse and dry. For galvanized iron use a strong detergent to remove oil and grease, especially if the zinc coating is new. Then use a primer specially designed for galvanized surfaces. For rusted chrome plate, smooth the rust with fine abrasive cloth and prime as for rusty iron. It's not the plating but the steel under it that rusts. For copper and brass, remove any grease or oil. Oxidized surface is likely to hold paint well. If bright finish is desired under a clean protective coating, clean tarnished metal with fine abrasive cloth. ★ ★ ★



BASEMENT WATER PIPES need painting regularly with rust-resistant metal paint

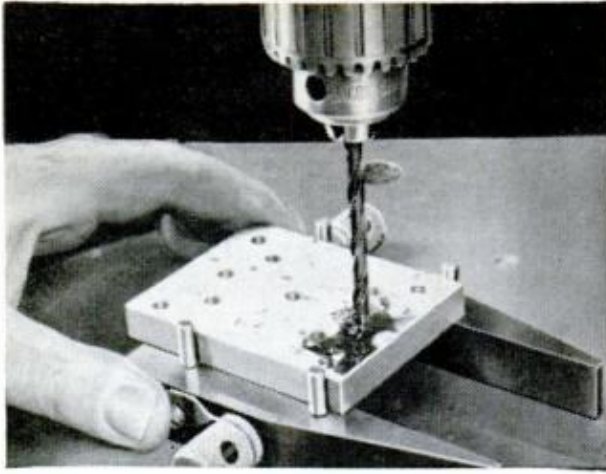


NEW GUTTERS are easier to prime before putting them up. Use a detergent first to wash off oily film on galvanized metal



FILE WILL REMOVE those little domes of rust and smooth ironwork for repainting

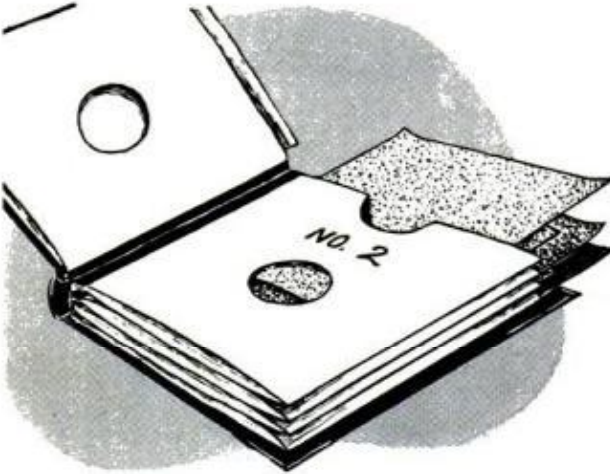




SHOP SHORT CUTS

Clamp Holds Drill-Press Work

Small squares and rectangular workpieces to be drilled are rather difficult to hold with conventional clamps on the drill-press table. Use a machinist's clamp having two steel pins in each jaw and you'll get the job done easily and more accurately. The jaws of a machinist's clamp are machined all over to the same dimensions, they lay perfectly flat and hold the workpiece securely when the screws are tightened.—H. J. Gerber



Sandpaper Filing System

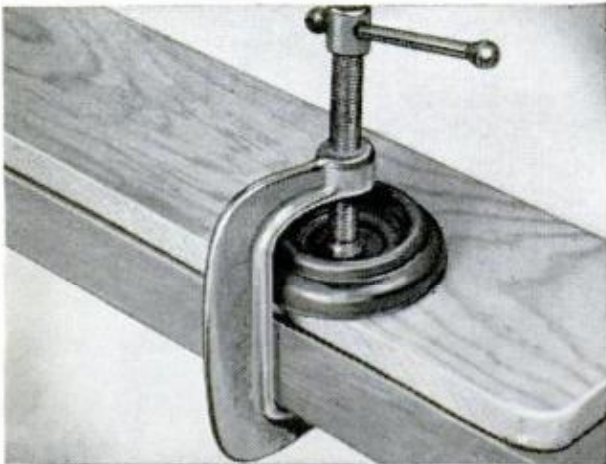
No doubt you have often wished for some simple way of storing sandpaper where any grit size you might need would be readily findable and the sheet always in good condition for use, clean and unwrinkled. Then why not use a record album? It's ready-made, inexpensive and suits the purpose to a "T." Several sheets of a single grade of sandpaper can be kept in each album envelope and you can mark the sizes on the envelope or read them through the round opening. The album protects the sandpaper and stores anywhere, even in a drawer with tools.—Robert E. Williams



Wrench Serves as Caliper

Suppose you need to know the diameter of a piece of tubing, pipe, or any other round of metal or wood and there's nothing at hand but an adjustable wrench and a folding rule. You can't measure the round accurately with either tool, but by combining the two in the simple setup pictured you can come so very close that the measurement will do for all practical purposes. Don't tighten the wrench jaws on the tube; just run the adjustable jaw up lightly, measure between the tips of the jaws and you have the diameter right on the nose.

—William Swallow



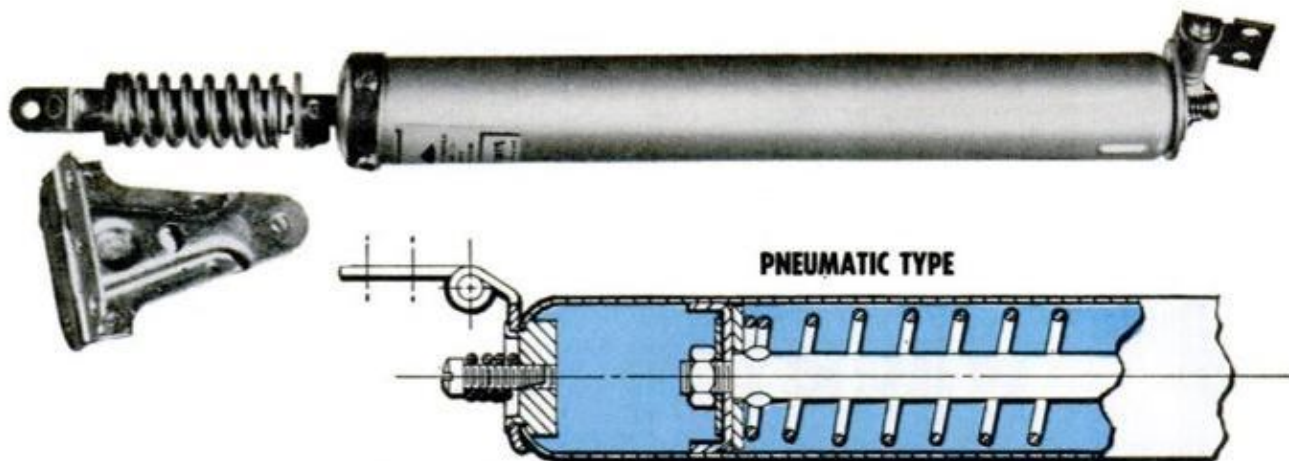
Caster Cup Pads Clamp

Indentations of the regular C-clamp pad are difficult if not impossible to remove without changing the dimension of the stock either by planing or sanding. You can easily avoid this damage by placing a plastic or rubber caster cup under the regular C-clamp pad before tightening the screw. The caster cup does two things: protects the surface of the work from dents and distributes the clamping pressure over a much greater area. The caster-cup pads can be used with nearly all the common sizes and types of C-clamps.—Bil Toman.

WORK IT GREEN

NOW SCIENCE has come up with a method of stabilizing green wood by a chemical process which makes it possible to work unseasoned stock to final dimension and finish it without danger that the finished piece will warp, shrink, or swell. The process, developed by U.S. Forest Products Laboratory, utilizes a chemical having the property of diffusing into the microscopic structure of wood and displacing natural moisture. This new method of chemical stabilization has only slight effect on color and on working and gluing characteristics of various hardwoods used in gunstocks and also turning and carving stock. It does affect common finishing materials which dry slowly with poor adhesion on the rather waxy surface of treated wood. Only resin-base varnishes should be used for finishing. These varnishes also lock the chemical in the wood where it remains to prevent dimensional changes in the finished work.





A LOOK INSIDE DOOR CLOSERS

EVERY TIME that storm door bangs shut or the inside door stands open behind you it's a reminder that you need door closers. But before you rush out and buy one, two or a dozen closers it's a good idea to know what you're going after.

Door closers are available in many sizes and types, each one designed for a specific job. Pneumatic (air) closers are inexpensive and handle a lightweight storm or screen door very nicely. But the heavier doors, such as your front door or the grade-level door, call for hydraulic closers with plenty of power. Both the pneumatic and hydraulic closers operate similarly in basic principle. A spring pulls the door closed after it is opened. The spring reacts against

a plunger that forces either air or liquid through small openings. In this way the opening and closing of the door is closely controlled throughout the swing.

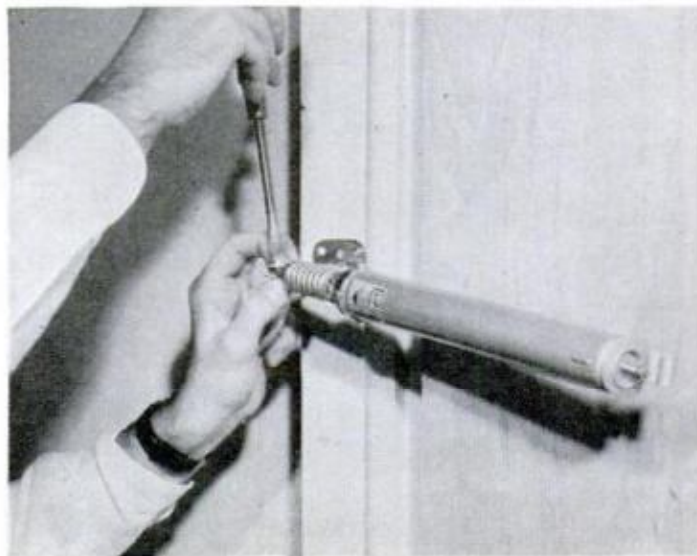
Closers should offer only slight resistance on opening the door but should act instantly when the door is released, regardless of the angle at which it is standing. A closer that juts out from the door almost perpendicularly uses more space but provides good leverage. This toggle-joint arrangement is usually found on the hydraulic-type door closers.

Nearly all closers adapt easily to either right or left-hand doors. If the room is arranged so that a person goes through the door and continues straight ahead, a 100-

1 AFTER DECIDING HEIGHT for closer, mark and drill holes for the base plate, making sure the plate is parallel to the floor. Before installing closer, be sure door doesn't bind

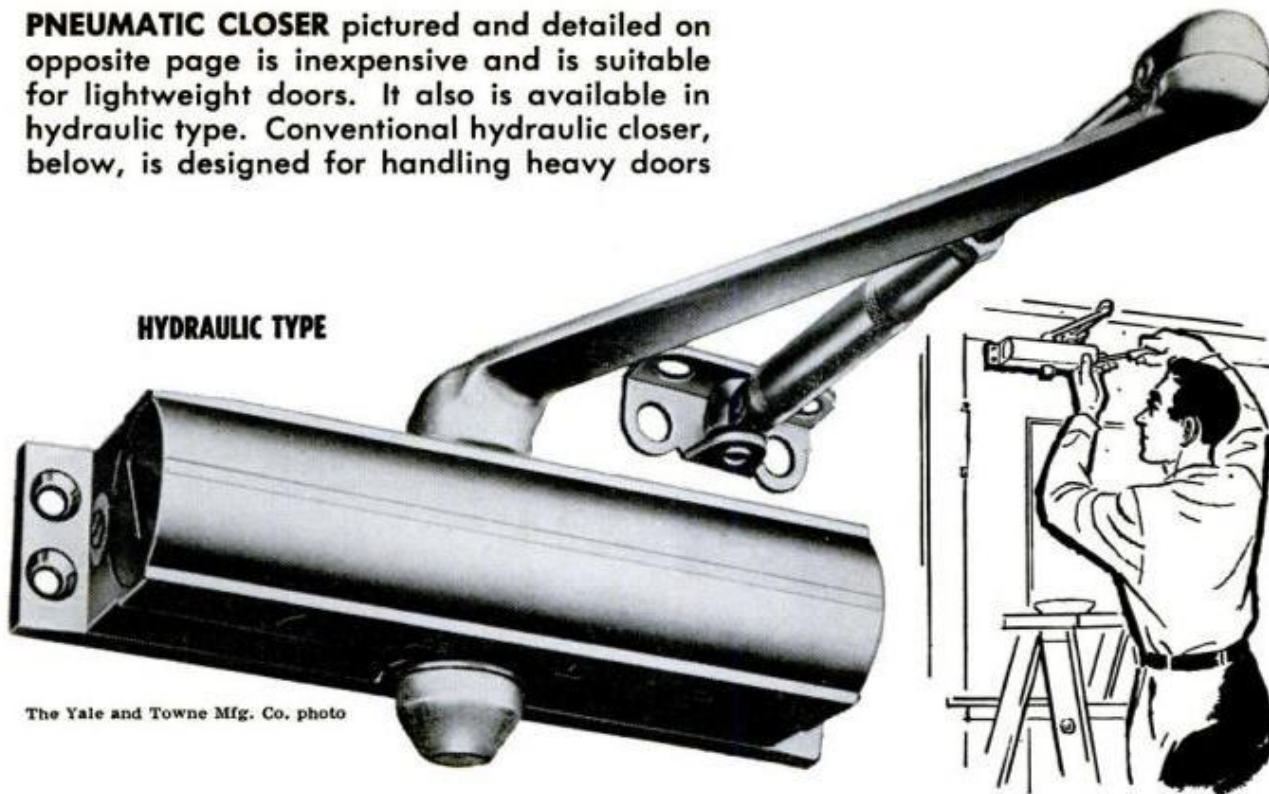


2 ONCE BASE PLATE is firmly fastened to the door jamb, attach plunger rod to plate and check horizontal position. A screw and nut are provided to attach cylinder and plate



PNEUMATIC CLOSER pictured and detailed on opposite page is inexpensive and is suitable for lightweight doors. It also is available in hydraulic type. Conventional hydraulic closer, below, is designed for handling heavy doors

HYDRAULIC TYPE



The Yale and Towne Mfg. Co. photo

degree closer is ample. But if there's a change of direction at the door, a 140-degree closer is necessary to avoid undue stress on the door, frame and closer. It is best to mount the closer on the hinge edge of the door. A soffit bracket provides the greatest closing power but takes up more space. A corner bracket places the closer near the hinge edge of the door, reducing leverage and requiring a strong closer.

Some closers have a delayed action that momentarily retards the initial speed of a closing door as it swings shut. And many

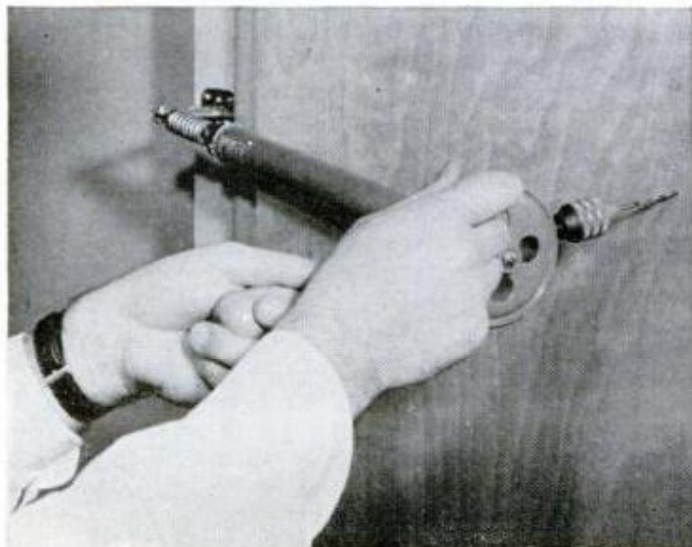
closers are supplied with a holding mechanism to keep the door open at any angle.

Closers are not the remedy for sticking doors. Before a door closer is installed the door should be made to swing freely and any defect in the latch should be corrected as otherwise the closer will not operate properly. When installing closers make sure that all screws are anchored in sound wood and turned in tightly, but never so tightly that they strip in the wood. Usually manufacturers furnish complete installation instructions with each closer. ★ ★ ★

MARK SCREW LOCATIONS for the cylinder after closing the door. Then drill the holes. On hollow doors a wood block should be attached first to give more support to the cylinder

ADJUST THE SPEED at which door closes by turning screw at the end of cylinder. An air bypass lets all air out of cylinder and gives enough pull to close the door all the way

E. R. Wagner Manufacturing Co. photo



WORKSHOP HELPERS

Rolled Metal Cuts Easier

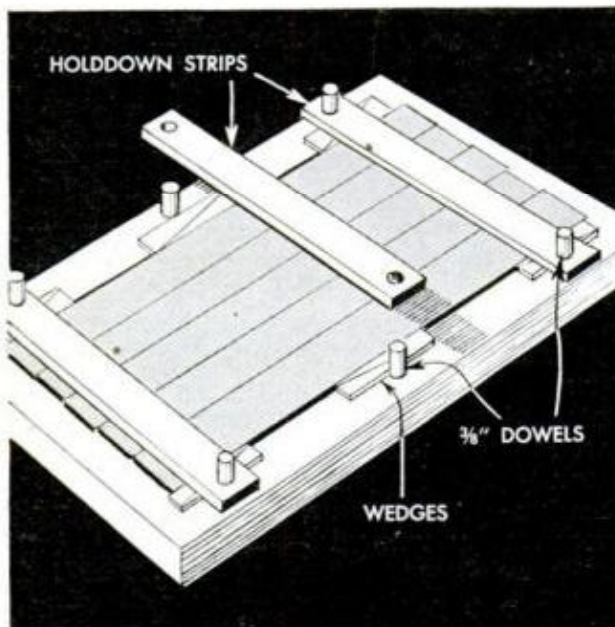
Next time you cut a strip of sheet metal lengthwise with tinsnips use the tinner's trick of rolling the sheet loosely before making the cut. There's less distortion of the metal along the cut and less tendency of the metal to curl. Not only that but the sheet is easier to handle and you're less likely to injure your fingers along the cut edges. The trick is especially helpful when cutting a long strip.—W. H. Reddick



In an emergency you can cut circular openings or other holes in light sheet metal by using a stubby knife blade and hammer. Pencil outline of hole, drive knife blade through metal and guide it along pencil line while tapping blade with hammer.

Edge Clamp for Thin Stock

Modelmakers and others who occasionally have need to edge-glue a number of strips of thin stock can put this wedge clamp to good use. It's designed to prevent buckling of the edge-glued strips when clamping pressure is exerted. The detail tells the whole story of its construction and you can make it any reasonable size to suit the purpose. Use a piece of $\frac{3}{4}$ -in. plywood for the base, cutting it about $1\frac{1}{2}$ in. larger each way than the panel. Make wedges of hardwood of the same thickness as the stock to be glued. The hold-downs should be of $\frac{1}{2}$ or $\frac{3}{4}$ -in. hardwood for greater stiffness. Before clamping the work cut two pieces of waxed paper slightly larger than the panel and place one on the base and one over the panel to prevent the work from sticking to the hold-downs and base.

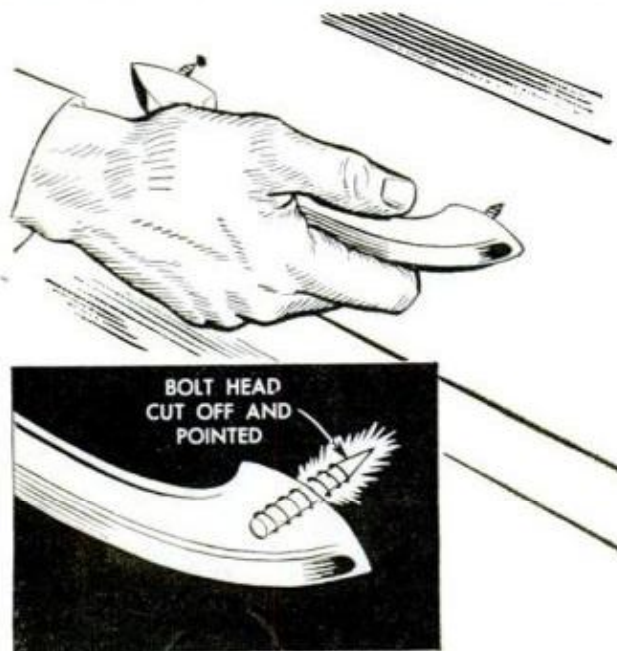


Spacing Drawer-Pull Holes

Say you have the problem of locating and spacing screw holes for a number of identical drawer pulls. This must be done accurately and you can do it by using one of the drawer pulls as a marker. Turn out the regular screws and then locate two ordinary screws, or stove bolts, of the same thread size. Cut the heads off the screws and grind the cut ends to sharp points. Turn these altered screws into the tapped holes in the drawer pull and there's your marker.

—Wilfred C. Nise

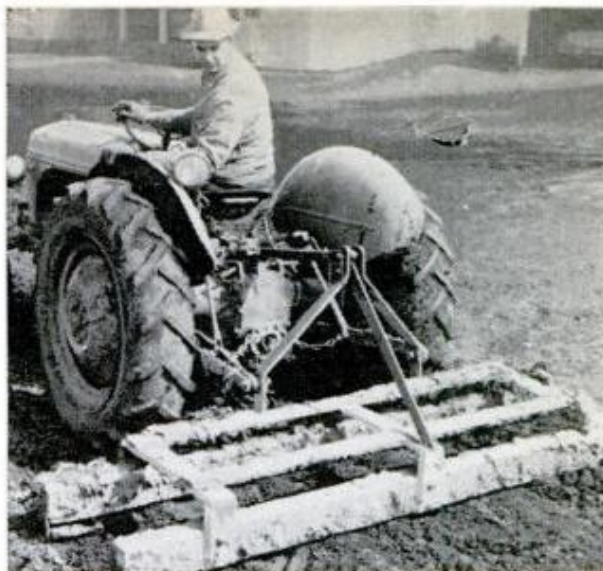
The fast way to prevent wood screws from turning or backing out by stress or vibration is to use a staple gun. Hold the gun so each staple will straddle the screw-head and be driven neatly in the slot.



FARM TIMESAVERS

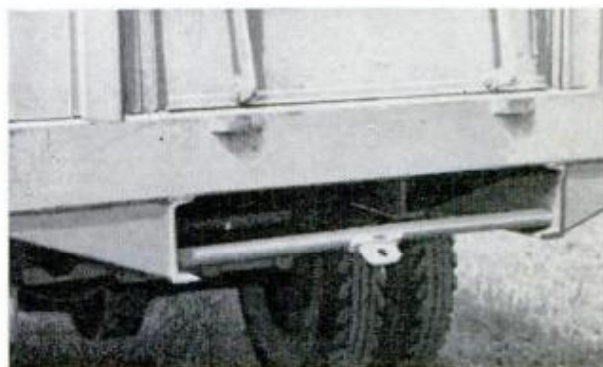
Mud Drag Levels Farm Lots

In the early spring when the frost goes out, farm lanes and feed lots often get muddy and badly rutted and if they are allowed to dry without leveling, may become almost impassable. That's when you need this hydraulically controlled mud drag. Once over the farm lane or through the feedlot early on a good drying day and you have a smooth lane and a passable feedlot for the rest of the spring and summer. The drag is made from heavy steel angles, channels—anything you can lay hands on about the farmstead that will serve the purpose. The whole thing is joined by welding.—C. F. Marley



Trailer Hitch on Farm Truck

At combining and corn-picking time a lot of lost motion often can be avoided by tandem-hitching trailers or implements to the farm truck. Doubling up in this way can save a lot of time on runs to and from the fields, especially when combining grain ahead of a predicted storm when every minute counts. Usually a suitable hitch of sufficient strength and rigidity can be attached to the frame of the truck in the manner pictured.—A. M. Wettach



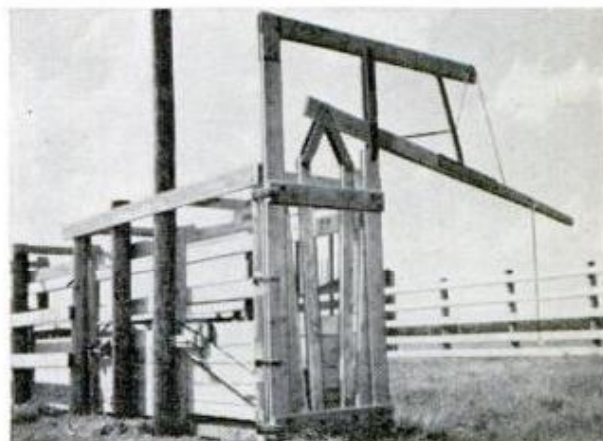
Combine Hopper Holds Feeds

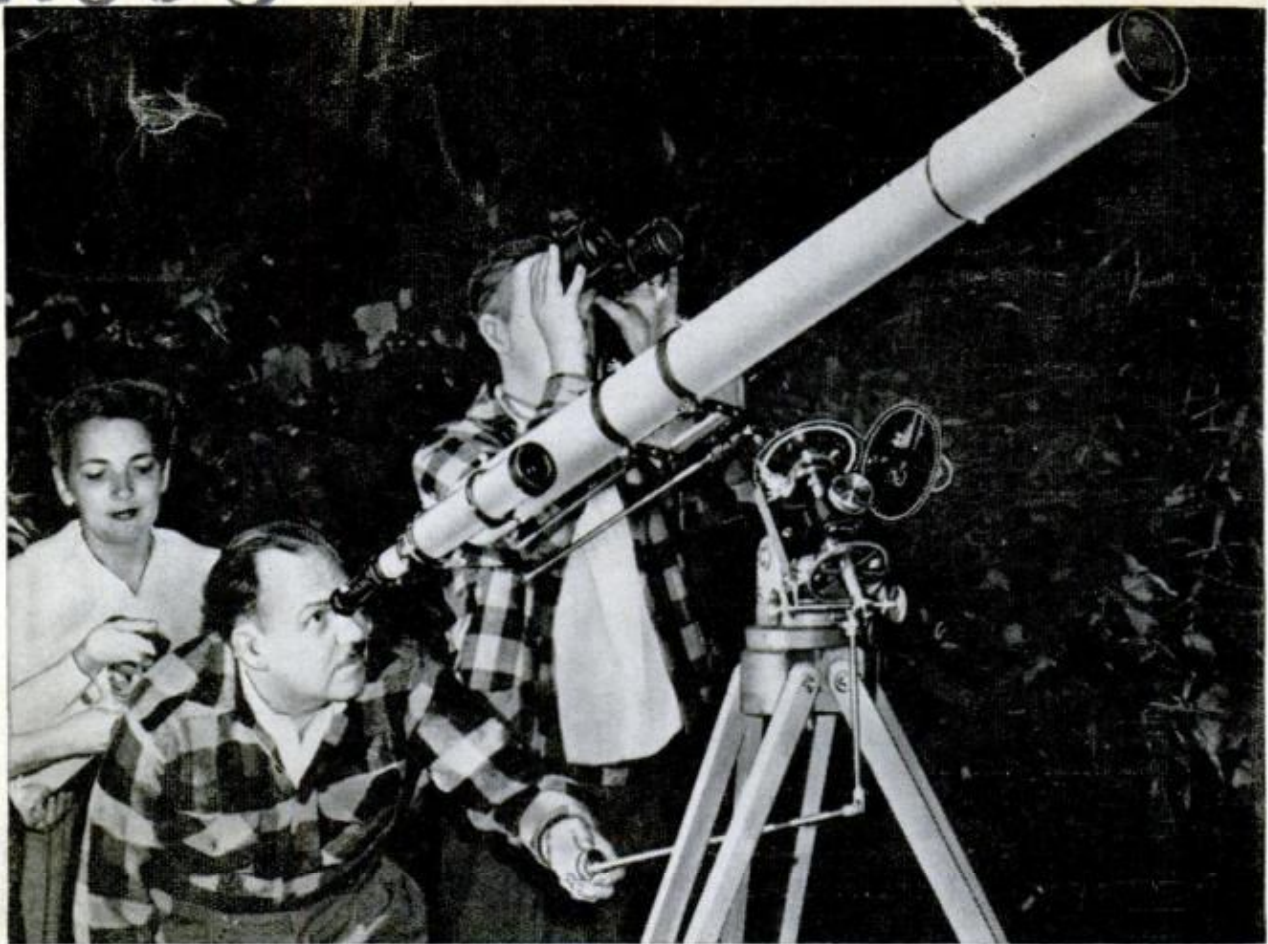
Handling quantities of dry feeds without waste and loss of time is one of the first problems of poultrymen. Here's the way one successful manager of a large laying flock does it. He obtained a large tank, or hopper, from a discarded grain combine, disassembled it and reassembled the whole unit inside the laying house. Filled once a week from an auger-type elevator, the hopper assures a constant supply of feed right where its needed and without waste. Dry feeds flow from the hopper freely. No agitator is needed.



Cattle Chute Has Stanchion

Built by agricultural engineers of Iowa State University, this cattle chute features a quick-acting stanchion operated by a lever having a ratchet latch which can be released by means of a trip rope. Animals can be individually stanchioned and safely controlled for the administration of special insect-eradicating sprays or for medication by a veterinary. Unit is built mainly of hardwoods and has a cleated floor with a level about 6 to 8 in. above grade. Corner irons, braces and heavy posts add rigidity.

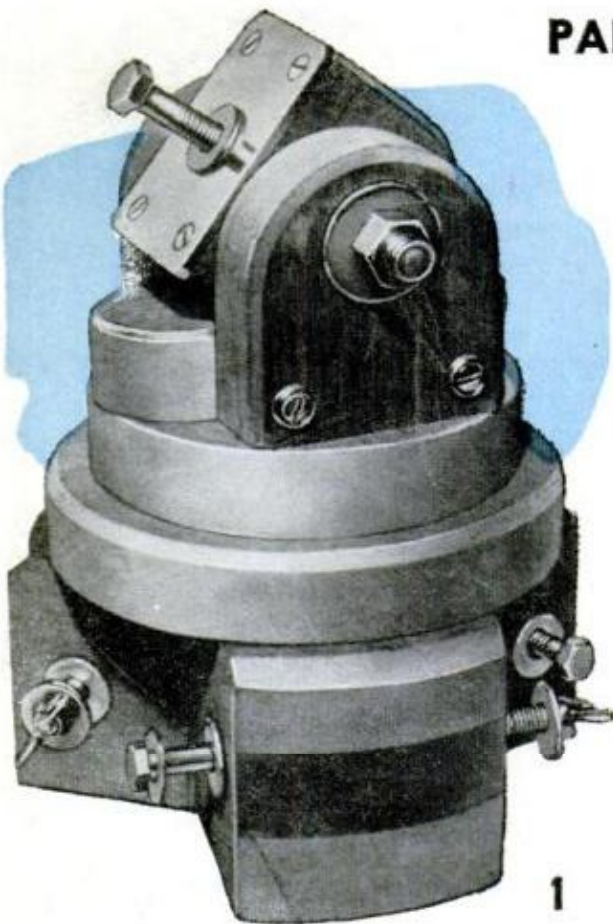




SPACE-AGE TELESCOPE

PART I—Building the Mounting

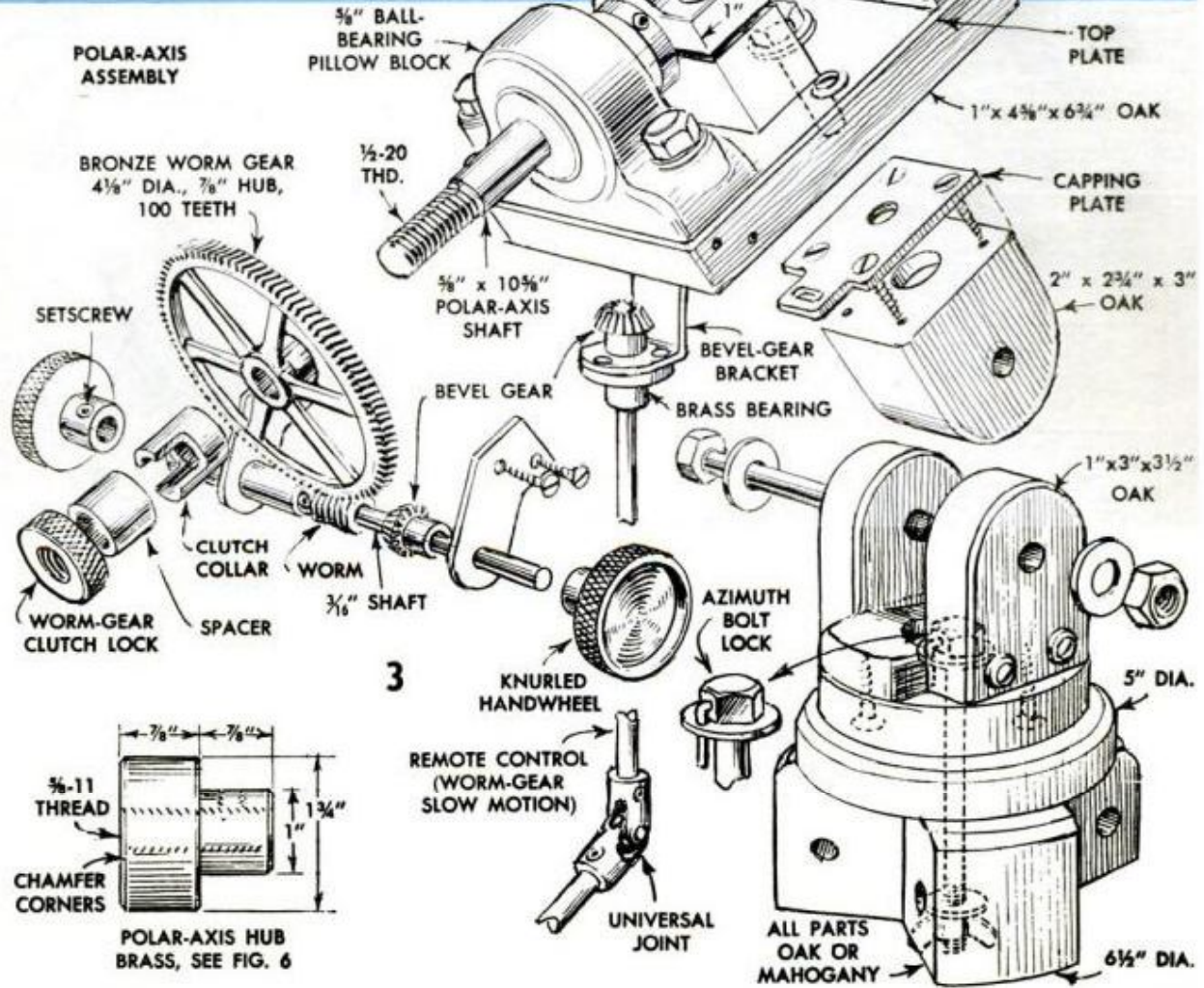
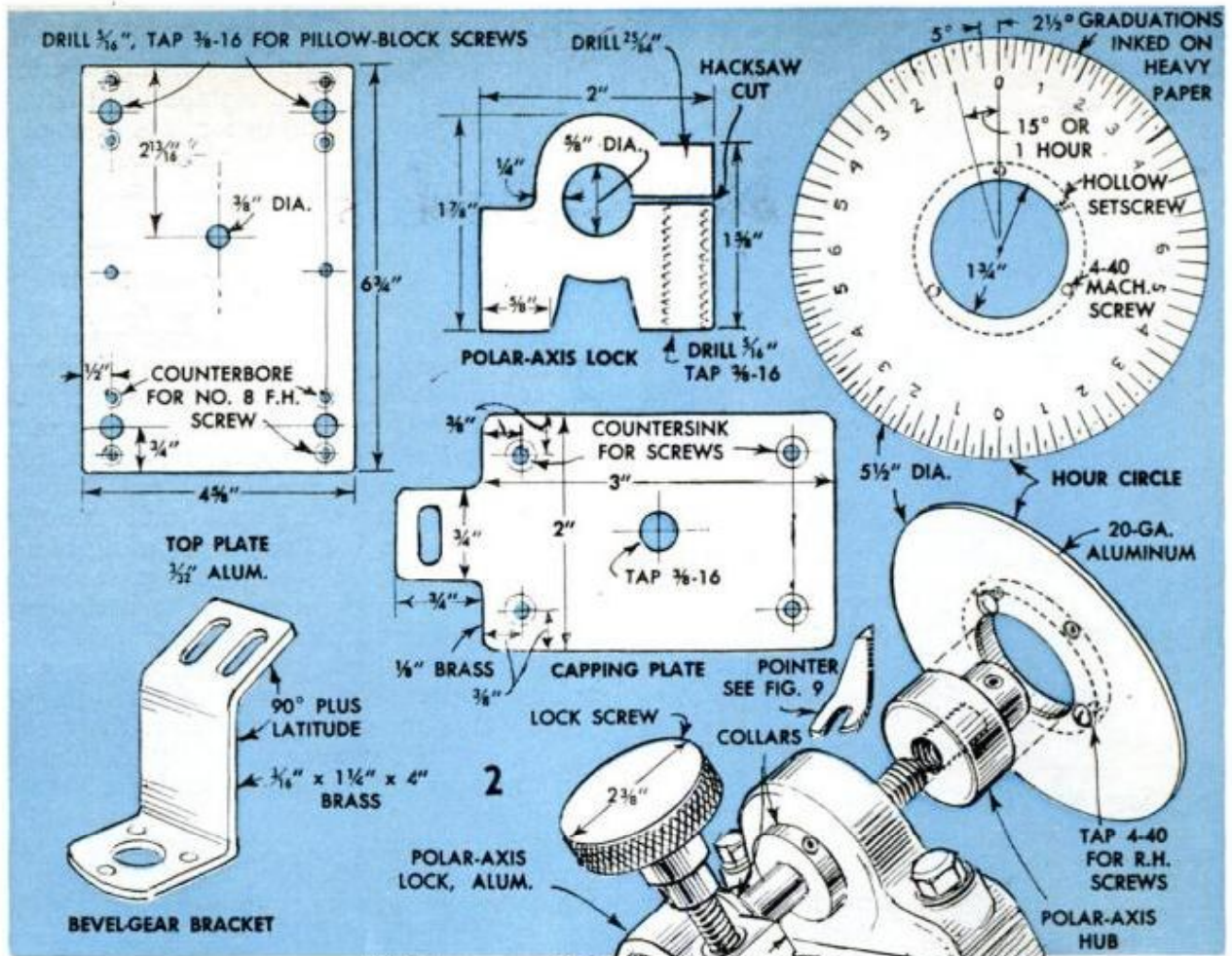
By Manly Banister

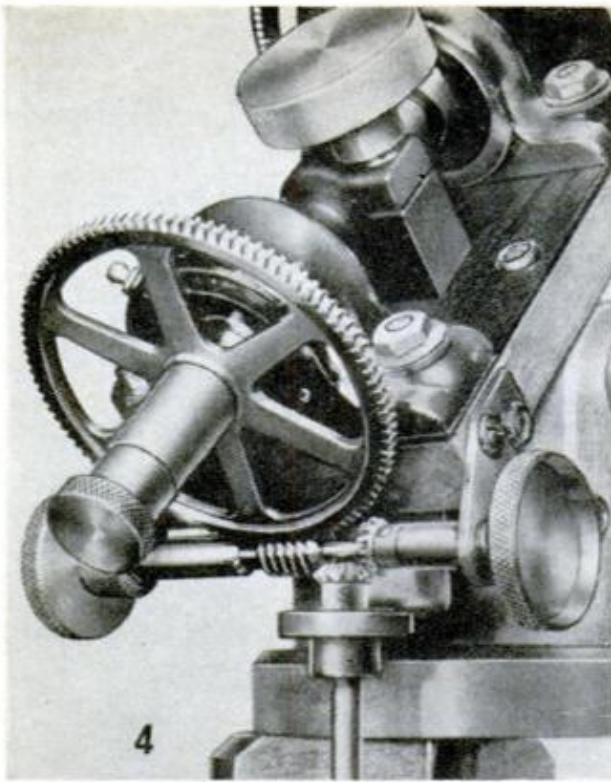


BUILDING THIS TELESCOPE can introduce you directly to the space age. It's a 3¼-in. refractor type having an objective lens system rather than a light-focusing mirror as in a reflecting-type telescope. It's portable, weighs only 50 lb. fully assembled with a tripod and can be easily moved from place to place for the most advantageous observation of objects in the heavens.

In return for the time and labor you'll spend building it you'll get an instrument having an optical system of sufficient power to bring under observation certain double, also double-double, stars in their separate components, reveal distant nebulae in interesting detail, show you the moons and belts of the huge planet Jupiter, the color rings of Saturn, the faint star companion of Polaris and let you meet the earth moon almost face to face. This means your shop-built scope is no toy-box affair, but is rather an optical instrument capable of practical scientific observation.

You purchase the optical system and cer-



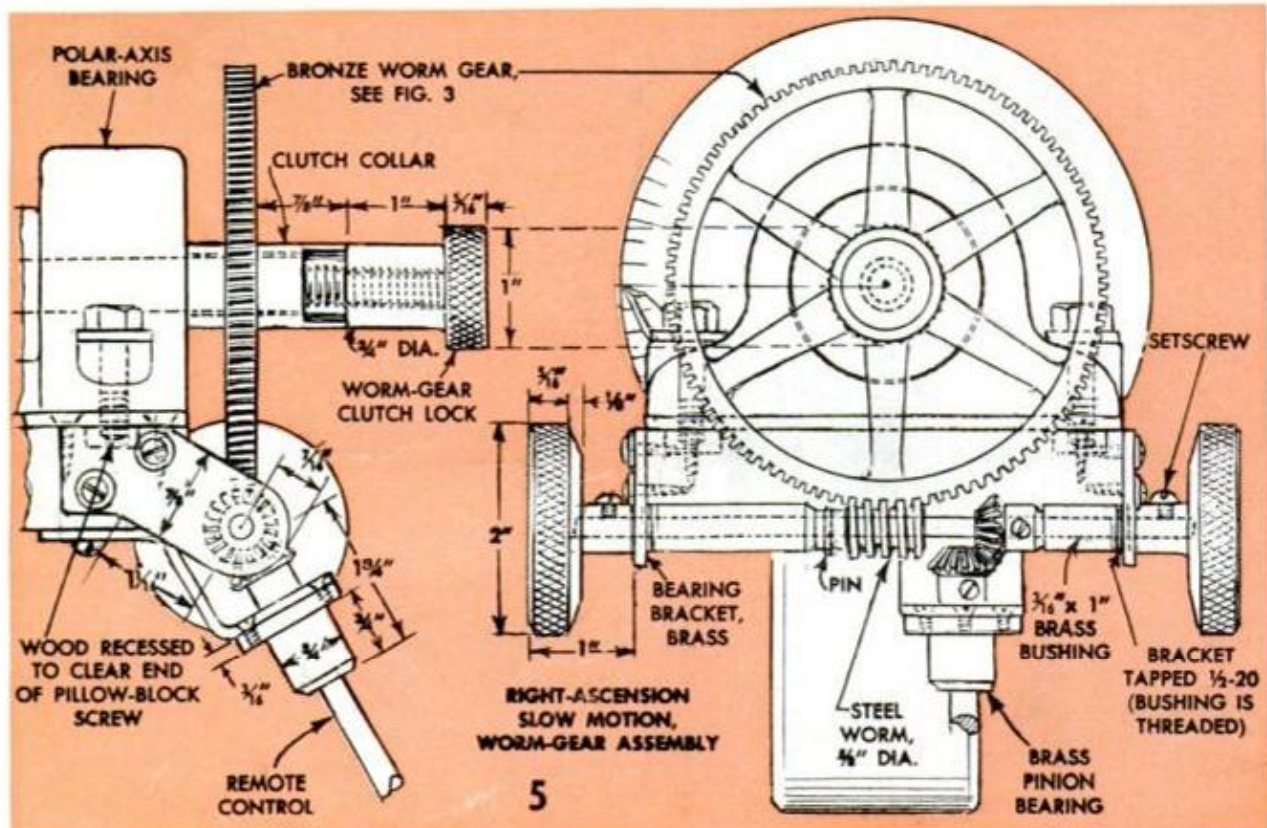


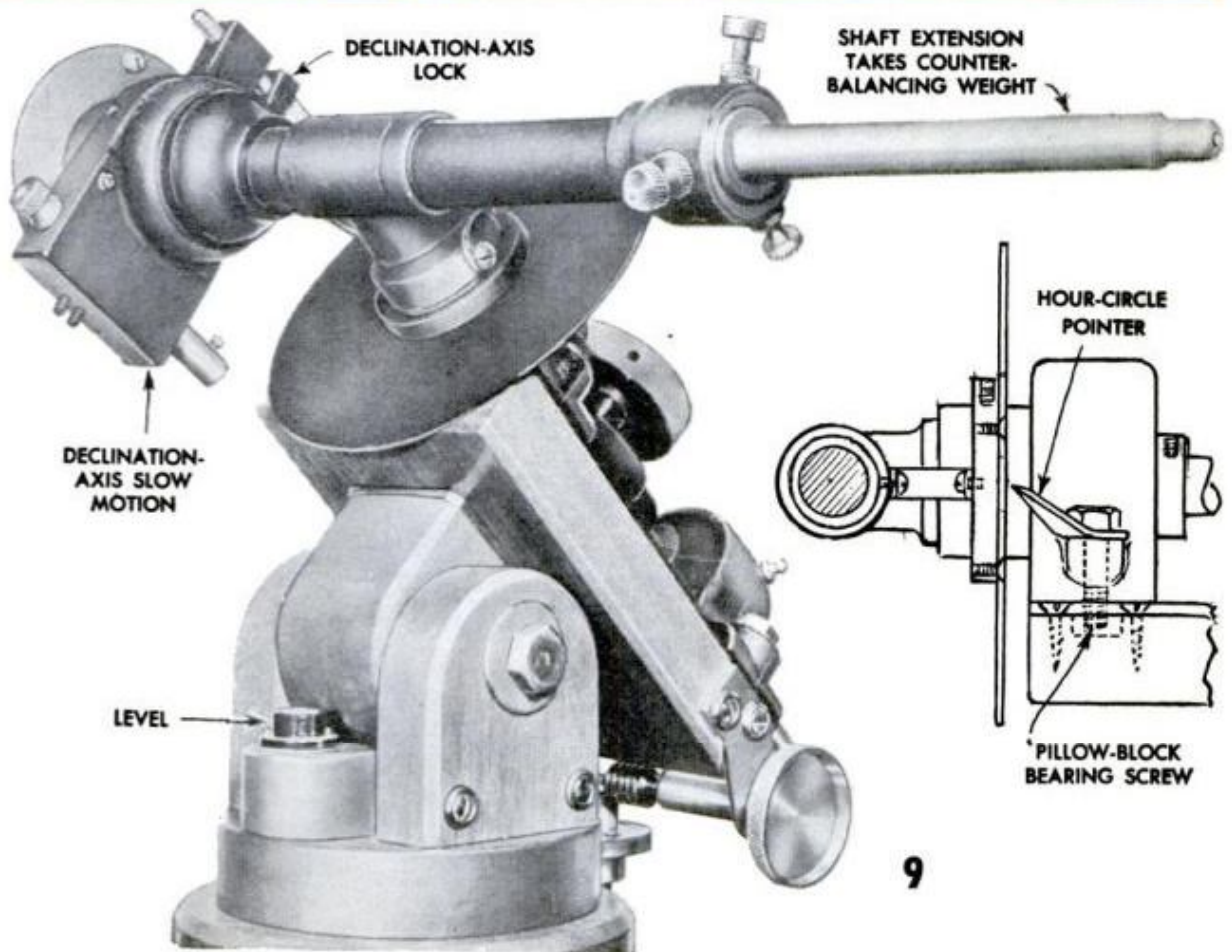
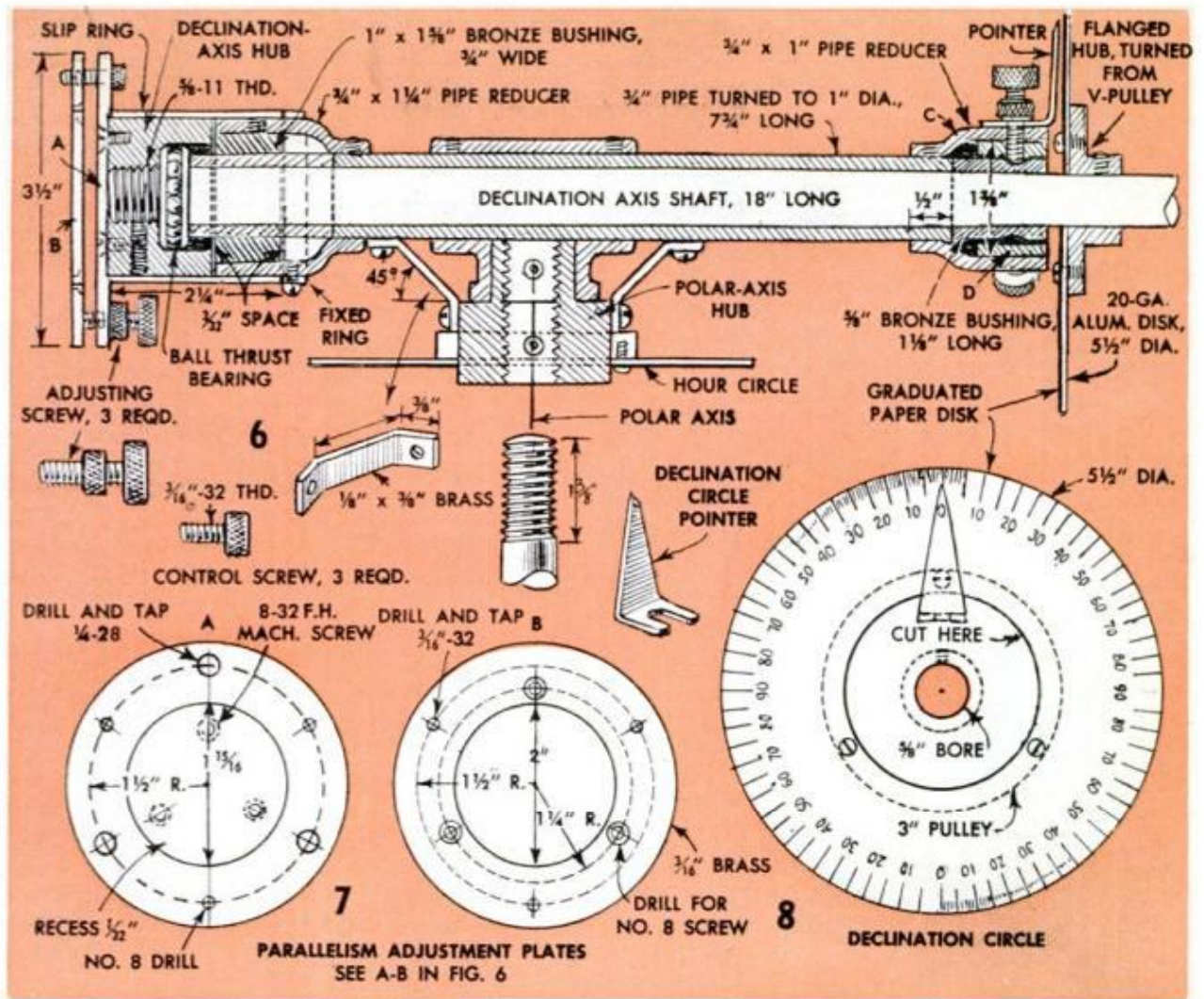
THIS VIEW of the polar axis pictures the worm and worm-gear slow motion assembly and the clutch lock

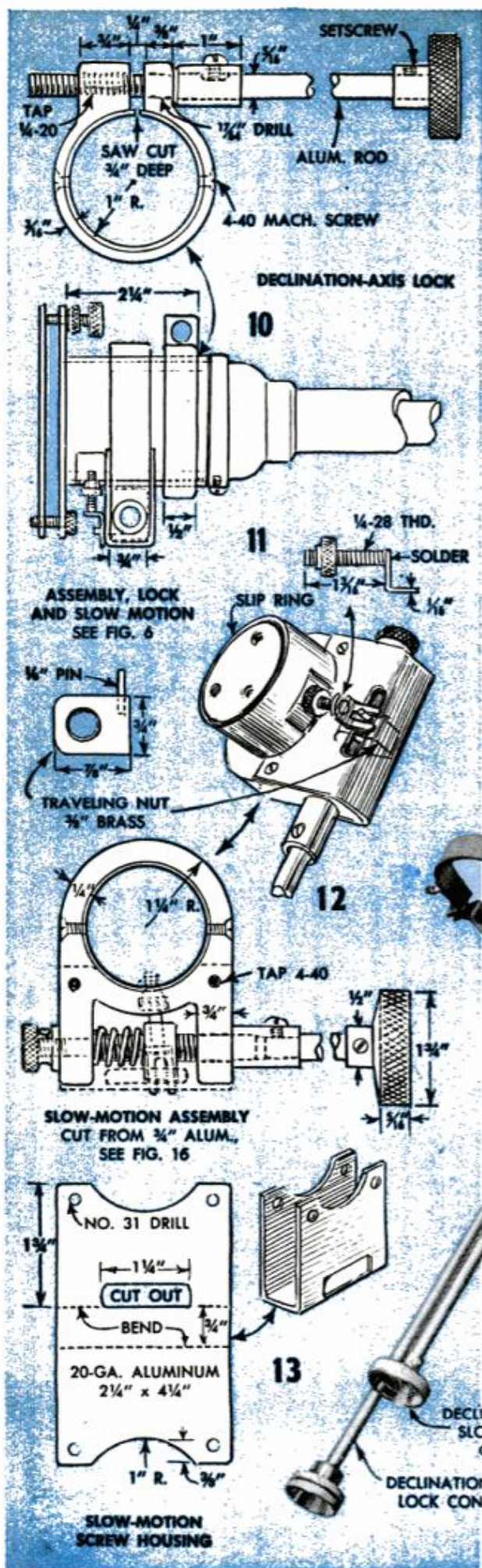
tain other parts you can't make without special equipment and then take it from there in your own shop. Construction begins with the polar-axis assembly which is a part of the equatorial mounting. It is detailed in Fig. 2 and shown with the parts in relationship in Fig. 3. Also note that the top members of the tripod are shown in

Figs. 1 and 3. These parts are shown only for orientation with the polar-axis assembly and will be further detailed in Part II. The polar-axis assembly consists of a spindle, or shaft, two pillow-block bearings, a compression, or pinch-type, lock, a worm-gear slow motion and an hour circle. A careful check of Figs. 2 and 3 will show how these parts are made and assembled. The whole thing is mounted on an oak base as in Fig. 3 and the final assembly will be made clearer if you compare with the two views in Fig. 5 and also the assembled view in Fig. 4. Note from these views, for example, that the $\frac{3}{8}$ -in. capscrews which hold the pillow blocks are turned into tapped holes in the top plate, Figs. 2 and 3, and that the base is attached to the swiveling block, or azimuth block, which is a part of the tripod, by a single capscrew turned into a tapped hole in the brass capping plate. Note also the slotted projection on the capping plate, Fig. 2. This takes an adjusting wood screw (not shown) which allows the whole assembly to be shifted slightly in relation to the tripod. The polar-axis lock, Figs. 2 and 3, is not attached to the base plate. One important point in connection with the axis spindle: You will note that the distance that the threads are run on each end is not given. Normally this length of run will work out about $1\frac{3}{8}$ in. both for the $\frac{5}{8}$ -11 and the $\frac{1}{2}$ -20 threads, but before cutting the threads complete a trial assembly and then determine the exact run of the threads from the assembly itself.

Now note the polar-axis hub, detailed



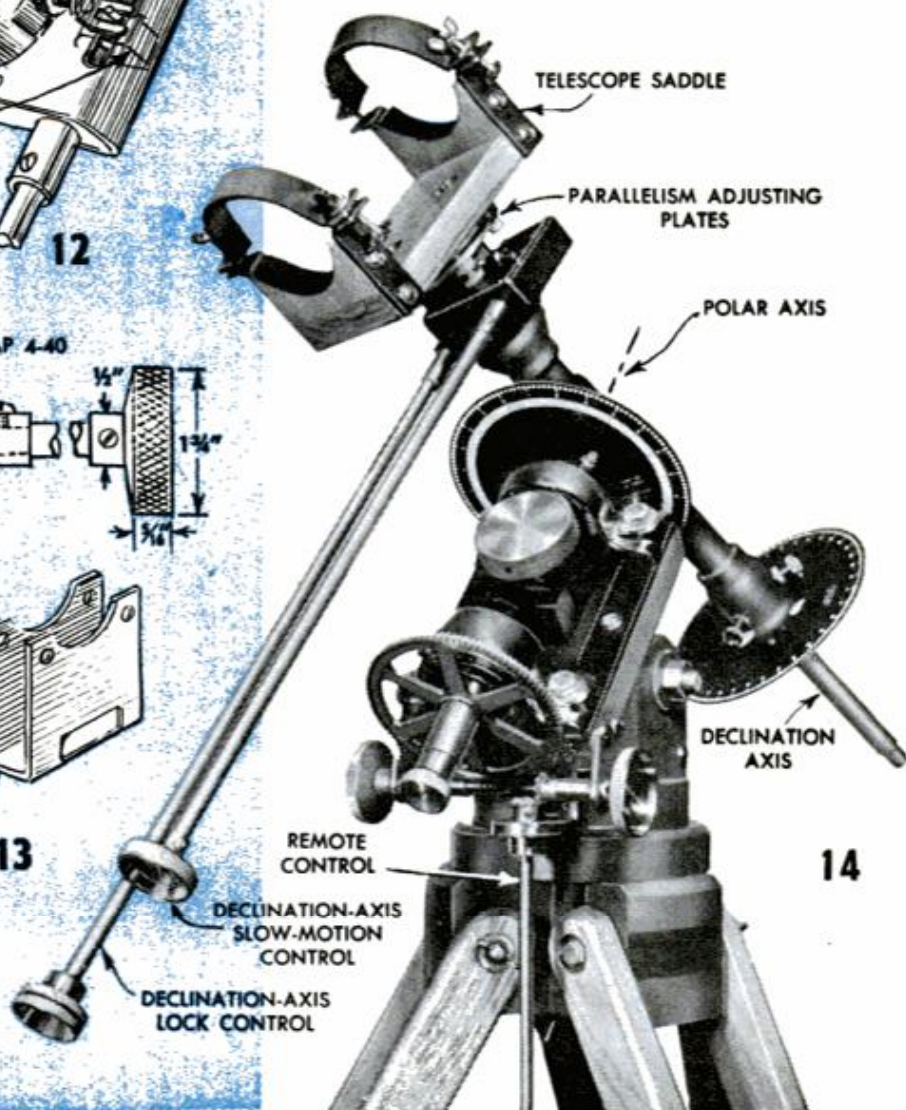




and shown in the assembly in Fig. 3 and in position in Fig. 6. See also Fig. 9, a view which will help to orient one as to the position and relationship of the two axes. The hub is machined all over and is center-drilled and tapped for a 5/8-11 thread. Note that the body takes the machined ring which holds the hour circle, or disk, Fig. 2. The ring must be bored to a close slip fit over the body of the hub.

Comes next the making and assembly of the worm, worm gear and the worm-gear clutch-type lock, Figs. 3, 4 and 5. Of course, there are several ways of making a clutch-type lock to serve this special purpose but the lock detailed is simple to make and has been found fully effective when used with ball-bearing pillow blocks. In operation the lock permits the worm gear to free-wheel on the shaft when released. When tightened it causes the gear to rotate the shaft, or polar axis.

The worm and gear assembly also is fitted with a remote slow-motion control, Figs. 3, 4 and 5, which actuates the worm drive through a bevel gear, one member of which is mounted on the worm shaft and the other on a bracket, Figs. 2 and 5. The bracket



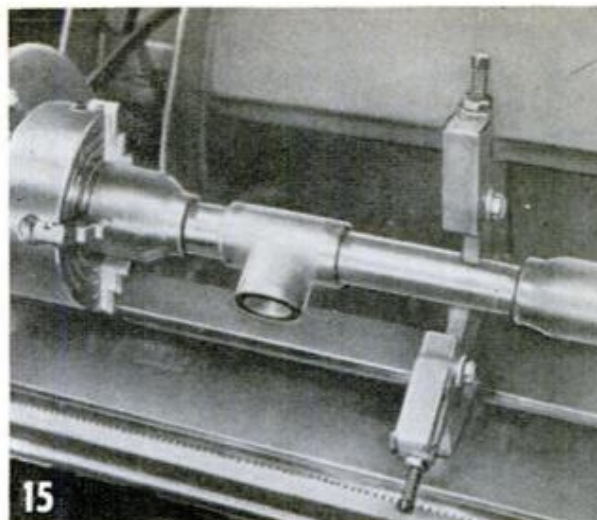
carries a flanged sleeve bearing for the upper end of the vertical bevel-gear shaft, Figs. 3 and 5. In Fig. 3 the bevel-gear assembly is purposely shown incomplete for clarity, but note in Fig. 5 that the worm shaft is carried in two sleeve bearings, one end of each being threaded and turned into a hole tapped in each bracket. The sleeve bearing carrying the remote-control shaft, Fig. 5, is attached to the bracket with four 6-32 flathead machine screws.

The hour circle, or disk, Fig. 3 and also pictured in Figs. 9 and 14, consists of a metal disk faced with a paper disk on which the graduations are inked as in Fig. 3. After inking the paper disk is cemented to the metal disk, which is then attached to the ring with roundheaded machine screws as in Fig. 2. The ring is drilled and tapped for three hollow setscrews which hold the disk in place on the polar-axis hub. The pointer, Fig. 2, is fashioned from 20-ga. brass or aluminum and is attached by slipping the slotted end under a pillow-block bearing screw as in Fig. 9.

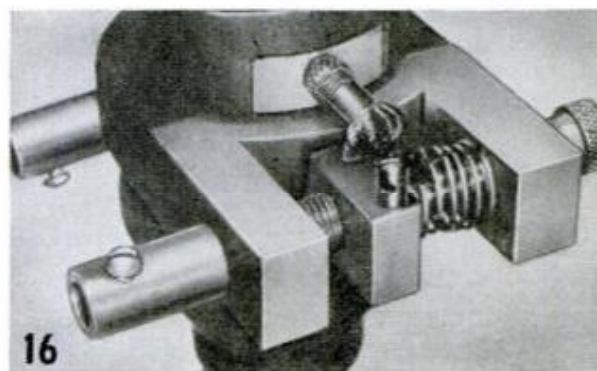
Declination-Axis Housing

Work on the declination-axis assembly begins with the housing, Fig. 6. This is made from standard $\frac{3}{4}$ -in. pipe and fittings. One thing to remember when working with pipe and fittings: There are allowable variations in the sectional dimensions of pipe and corresponding fittings; for example, note that the $7\frac{3}{4}$ -in. shaft housing is turned to 1 in. diameter, Fig. 6. The point here is, be sure you get a piece of $\frac{3}{4}$ -in. pipe that will permit you to turn the outside diameter to 1 in. The housing and reducers are machined all over and the reducers are bored out at the small ends to slip over the ends of the housing. Then the big ends are bored out to take bushings which carry the declination-axis shaft. Now, before you get farther into the construction, note especially the assembly at the large end of the housing. The reducer carries a bushing and also the declination-axis hub in which a ball thrust bearing is seated. The whole thing is supported in position by means of a slip ring which is seated against a fixed ring. The slip ring is $2\frac{1}{4}$ in. long and the hub is approximately $1\frac{7}{16}$ in. long. But the diameter of the hub and the diameter of the bored seat for the bearing you will have to determine from the parts. As an example, if the rough diameter of the big end of the reducer will permit machining down to $1\frac{7}{8}$ in., then you obtain a piece of brass or steel tubing having an inside diameter of $1\frac{7}{8}$ in. and machine the outer diameter of the hub to a slip fit inside the slip ring. The diameter of the counterbore that takes the thrust bearing must be determined from

(Continued to page 258)

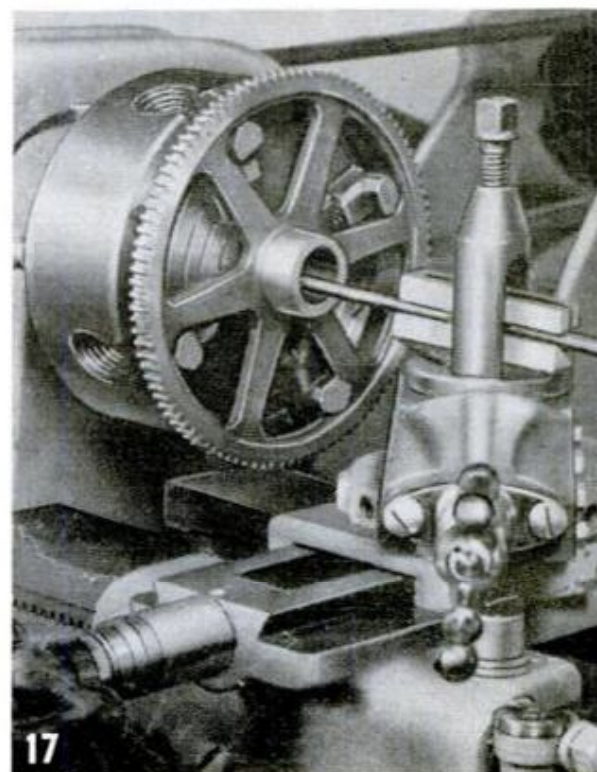


DECLINATION-AXIS housing set up in the lathe for machining the reducers at ends. Parts are of pipe and are machined all over. Note the use of steady rest



DECLINATION-AXIS slow motion unit shows position of yoke and screw thread actuating the traveling nut

WORM-GEAR HUB being bored out to sliding fit on the polar axis shaft. Gear is mounted in 4-jaw chuck





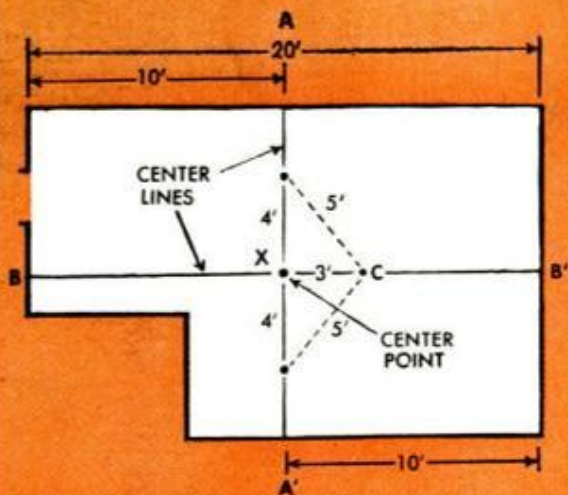
WHILE PICTURED REMOVED to show how individual tile fit in rubber grid, tile are actually bonded securely

NOW-RUBBER-GROUTED CERAMIC FLOOR TILE

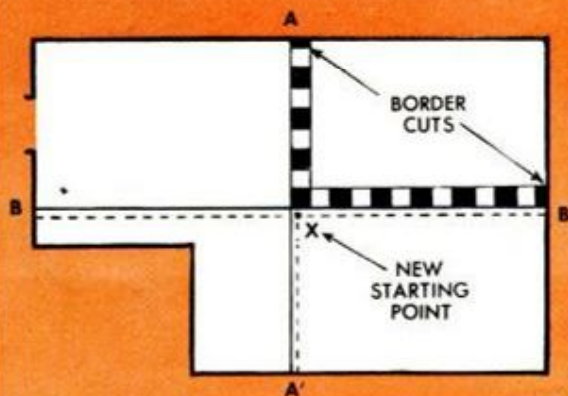
ONE OF THOSE "why hasn't it been thought of before" products has made its debut on the market in the form of a flexible ceramic floor tile called Ceramaflex. A new concept in ceramic mosaics developed by Romany-Spartan Research has done away with conventional grouting and brought about a ceramic tile pregrouted in live rubber. This rubber mounting deadens sound and offers a cushion of rubber which has a definite resilient feel under foot. In addition, this unique flooring is highly slip resistant since the individual tile are slightly higher than the rubber grout joints, and the rubber grid is claimed to be impervious to stains and will not stretch, deteriorate or harden. Heavy appliances will not dent the surface, and the tile never needs waxing, only a damp mopping. Each 9 x 9-in. unit is surface sealed when you get it to prevent wearing in dirt and grime during installation. Tile

comes in 12 attractive and colorful patterns.

Each unit measures precisely 9 x 9 in. and is made up of sixty four 1 x 1-in. ceramic mosaic tiles permanently bonded in a preformed grid of live rubber. In being pregrouted, so to speak, installation is fast and simple since there is no waiting for the material to set such as is typical of regular ceramic tile. Cutting is done with tile nippers and a sharp knife, and the tile is applied to the subfloor with a special adhesive troweled with a notched spreader. The floor area is divided in quarters and the adhesive is applied to one quarter at a time. After it becomes tacky (15 to 30 min.) the tile is laid, starting at the center point of the floor with the running edges set precisely to chalk guide lines snapped on the floor. The photo sequence on the following two pages shows how relatively simple it is for the handy homeowner to install this tile.

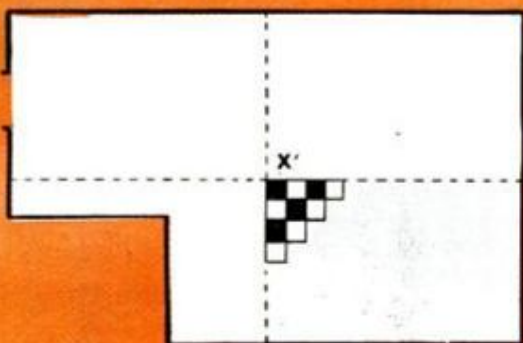


FLOOR AREA TO BE TILED is divided in quarters by center lines. The latter must be at exact right angles to each other which is assured by using the 3, 4, 5-ft. triangle method, above

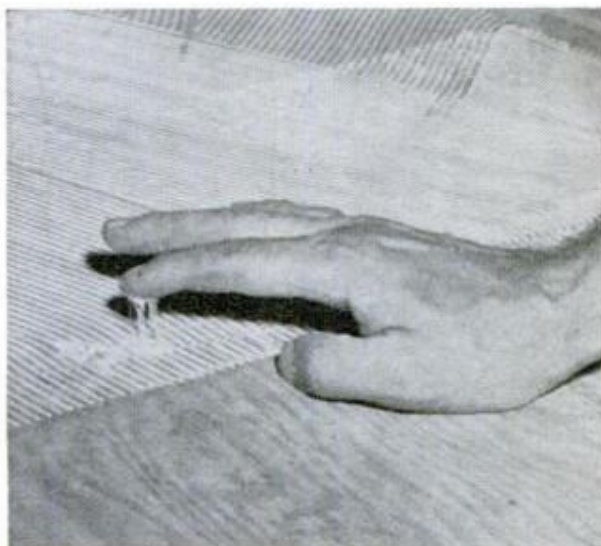


IF YOU FIND that by shifting the center lines 1 in. one way or the other it will enable you to cut the border tile with a knife through the rubber grout line, relocate them accordingly and snap new chalk guide lines

TILE JUST A QUARTER at a time, starting at the intersection of the new guide lines and working outward. You can skip the border tile for now and install them while waiting for the adhesive on the second quarter to get tacky



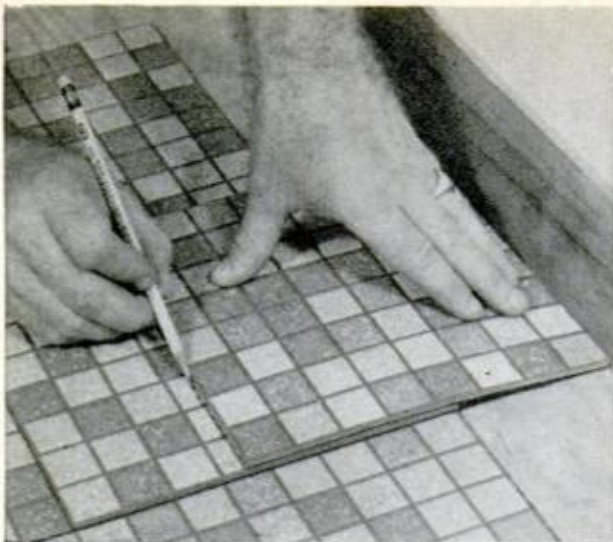
STEP 1. Carefully trowel adhesive on one quarter of area. Work close but do not cover the chalk lines



STEP 2. After troweling adhesive, let it get tacky for 15 or 30 min. before starting to lay the tile

STEP 3. Do not twist or slide the tile in position. Butt edge snugly against adjacent tile and press down

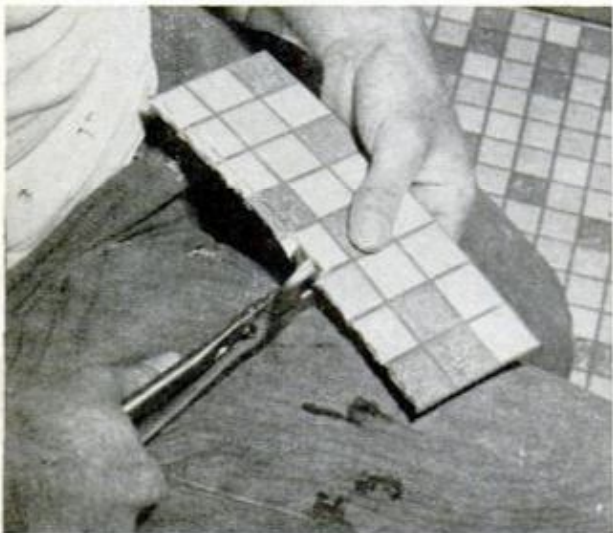




STEP 4. To measure border tile, place tile to be cut exactly on top of last full tile. Then butt second tile against wall, draw line at edge to mark bottom tile



STEP 5. Job of cutting border tile is easy when it can be cut through rubber grout line. Insert tile as close as possible to final position and press down



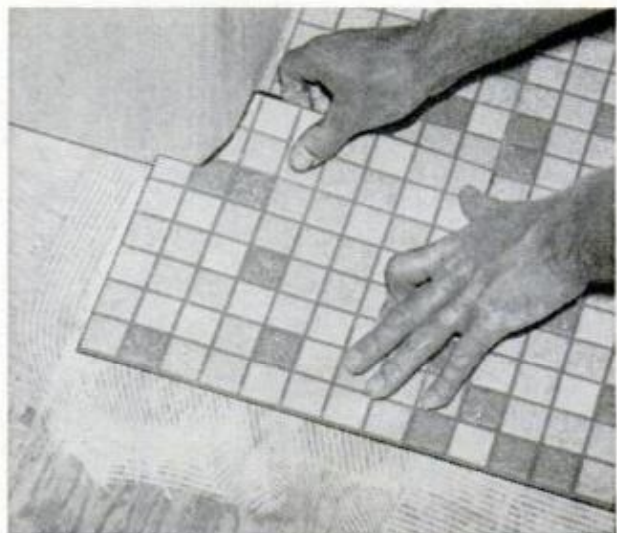
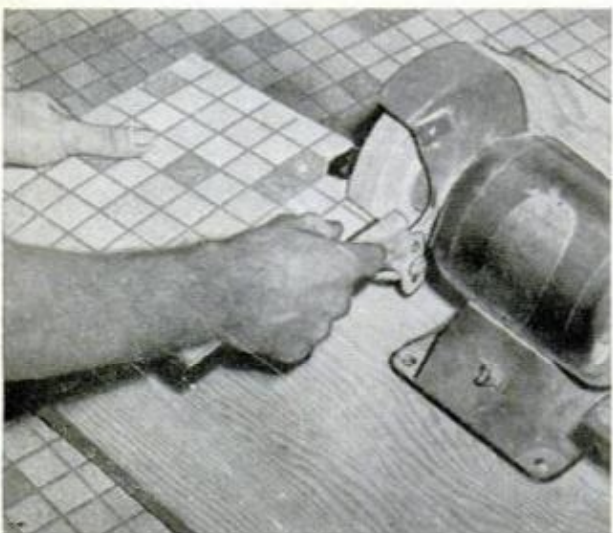
STEP 6. When tile itself must be cut use tile nippers and nip each individual tile one at a time. Then slice rubber grid with knife along nipped edge



STEP 7. Nipped edges of border tile that will not be covered by base shoe, or quarter round, must be ground smooth before pressing tile in position

STEP 8. Nipped edges are easily ground smooth on any 3450 r.p.m. electric grinder. Make nipped cut about $\frac{1}{8}$ in. outside finished mark on face of tile

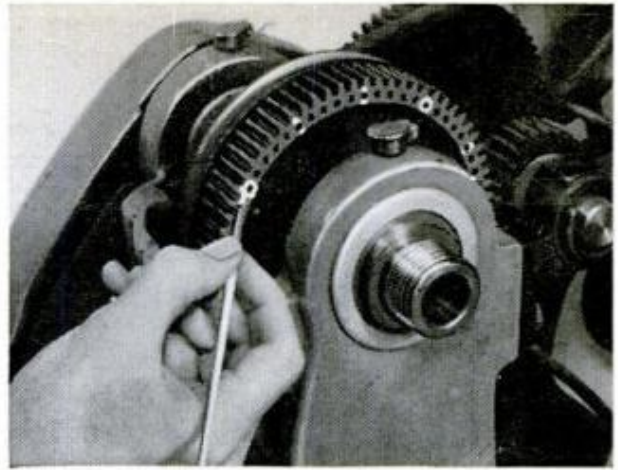
STEP 9. Ground joints around door casings and other places are finally calked with compound matching color of rubber grout lines. Solvent cleans tile



KEEP THESE IN MIND

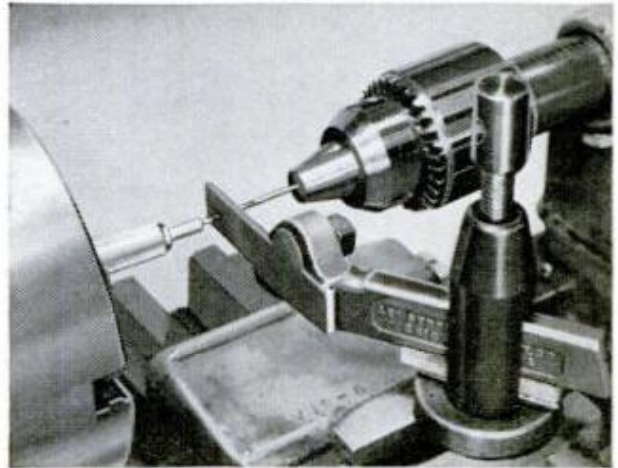
Paint Marks Index Holes

When you're indexing a job requiring close spacings it's easy to miss a hole on the index ring and spoil the work. One way to avoid trouble is to index the indexing ring, as it were, by making the count and then indicating each hole to be used with a circle or spot of oil paint. The spots or rings of paint will stay on long enough to serve the purpose, after which they are wiped off.—R. Hanscom



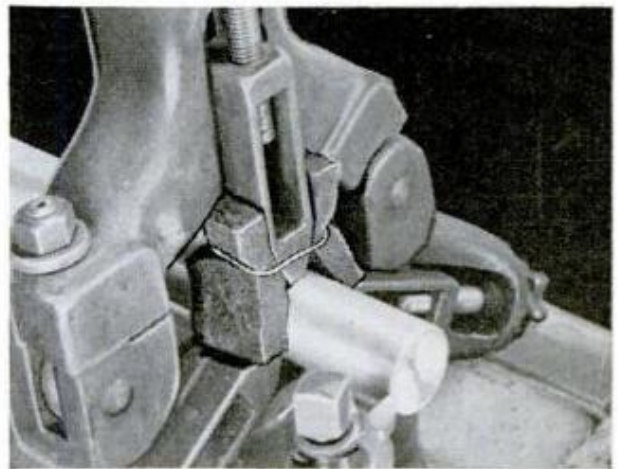
Support for Twist Drills

Twist drills in the smaller sizes often tend to wander when used for center drilling in the lathe. To prevent this make a guide by drilling a hole, with the drill to be used, near one end of a short length of 1/16-in. flat steel, and then file the piece down to fit the cutoff tool holder. Place the drill in the chuck, the guide piece in the tool holder and insert in the tool post loosely. Insert the drill in the hole in the guide, run the carriage back until the guide bears against the chuck jaws. Then tighten the toolpost screw and you have the guide centered.



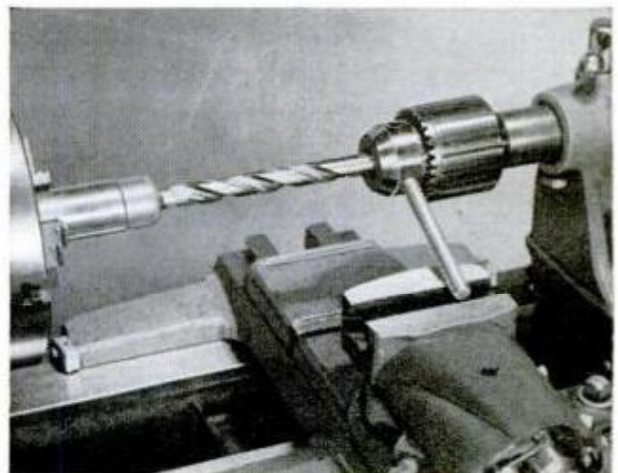
Felt Oilers Prevent Scoring

Even though the jaws of the lathe steady rest are perfectly smooth there is always some danger of scoring a finished surface, especially soft metals. This can be prevented by fitting two felt oilers to the vertical jaw so that the ends of the felts ride the surface of the work constantly as it rotates. The oilers are cut to approximately the same width as the rest jaws from 1/4 or 1/2-in. felt and are held in place with a loop of fine wire twisted tightly around the felts and the jaw. Saturate the felts with a light machine oil.—H. J. Gerber



Chuck Locked in Tailstock

If you've ever had the drill-chuck arbor turn in the tailstock sleeve when drilling in the lathe, you know about the scoring that can result on the surfaces of the inside taper. In a few seconds the damage is done and the sleeve may not be accurate thereafter. In light drilling with small-diameter twist drills the trouble seldom occurs, but when you use a large twist drill it's best to take a precautionary step, such as that pictured. The rod is inserted in the hole in the chuck body with the outer end bearing on the toolpost slot, preventing the chuck from turning.



Apartment-Size Ham Shack

By Byron G. Wels, K2AVB/9

Photos by Don Honick



Modular units tastefully grace an apartment wall. Units can be moved to different positions with ease



Opening the cabinet unit reveals the amateur radio station. The compact gear can be easily concealed

TO SOLVE THE PROBLEM of space for ham equipment in a small apartment, *PM* consulted an interior decorator, Sarah Pagoria, who immediately came to an important conclusion: Ham equipment is not intrinsically decorative, and concealing the gear is the only solution short of going off the air.

In the early days of amateur radio, it was customary for the operator to have a small hut or "shack" in the back yard of his home. As the trend toward urban living increased, the ham found that back yards weren't as easily obtainable, and he was relegated to a room in the house, a corner of his bedroom, or more frequently, the attic or basement.

The urbanite of today, having a two or three-room apartment, finds that even an inconspicuous corner of a room becomes conspicuous in the eyes of his wife, if exposed amateur equipment graces a table. Presented with the prospect of giving up

his hobby or giving up his wife, the typical ham might be hard put to make a decision.

To keep hams on the air, our designer chose the functional groupings of the Founders Furniture Co., Inc. We installed typical ham equipment in each of the settings. We demanded, in each case, maximum operating ease and compromised in sufficient manner to permit an aesthetic design that would please even the most finicky XYL (wife, to the uninitiated). The result is that the equipment is readily available for operating, yet completely concealed when not in use.

It is quite apparent from the photographs that kilowatt stations do not lend themselves to this sort of treatment. While it is true that the ham may sacrifice "talk power" in the smaller units, we compensate for this by utilizing an excellent antenna system which in some measure makes up for the decrease in available power. Most women will go along with a fancy rotary



In the desk unit of this wall-divider section are the Knight-kit R-100 receiver, the Neil Beta six-meter transmitter, the Viking 6N2 converter and the Lafayette microphone—a compact, complete amateur station

Right, a book shelf with glass doors houses complete station. Tape book bindings inside glass to simulate shelf full of books when cover is closed. Tape recorder provides log information





A station in a box: Hallicrafter's SR-34, a complete six and two-meter transceiver, takes up little space

beam on the roof, if it means less ham operating equipment in the apartment or house. Point out to the landlord (if you have one), that this big antenna actually protects the house from lightning by keeping the air around it deionized.

Another important factor, not seen in the photographs, is the wiring. It is necessary that the furniture be slightly modified for the equipment and, as the modifications consists of hole-drilling, it is better that these alterations be made while the wife is away from home. Holes are required for power cords and for antenna feed lines, as well as for necessary control cables such as those on antenna rotators. These holes can be drilled carefully and placed in such a manner as to be completely hidden when the equipment is installed.

Further compromise must be worked out from the viewpoint of how the equipment looks when in use. It is impractical to install the transmitter at one end of a wall grouping and the receiver at the other.

Before you invest your hobby dollars in such auxiliary equipment as furniture, look around your house. The ideas presented on these pages may apply to a piece of furniture which you now possess. Perhaps, with a little modification, that old bureau could be made to house the ham station. Maybe with a slight nudge, your imagination can find a way to convert the old console TV. Book cases, hi-fi cabinets, even old refrigerators have been used at one time or another, although the aesthetic quality of a refrigerator is dubious at best. Still, hams DO talk about "cool kilowatts"!

The other choice? On page 227 is one photograph of a more standardized ham station, just to show the contrast. This is the station which is now installed at *Popular Mechanics*. It is equipped to operate in the six-meter band and the two-meter band, phone or CW.

Hams are a stubborn lot when their hobby is concerned. It is this fact more than any other that makes them valuable during emergency situations. Should an equipment failure force a ham to go off the air, he will not rest until the problem is rectified and the station can be put back in service. Many hams have solved the "no-space" problem by installing mobile rigs in their cars. This article does show, though, that fixed-station operation need not be sacrificed completely by space restrictions in the home. ★ ★ ★

Lafayette HE-10 receiver (center) fits into a night table. Left, a close-up of the desk on the preceding page shows the neat and orderly layout



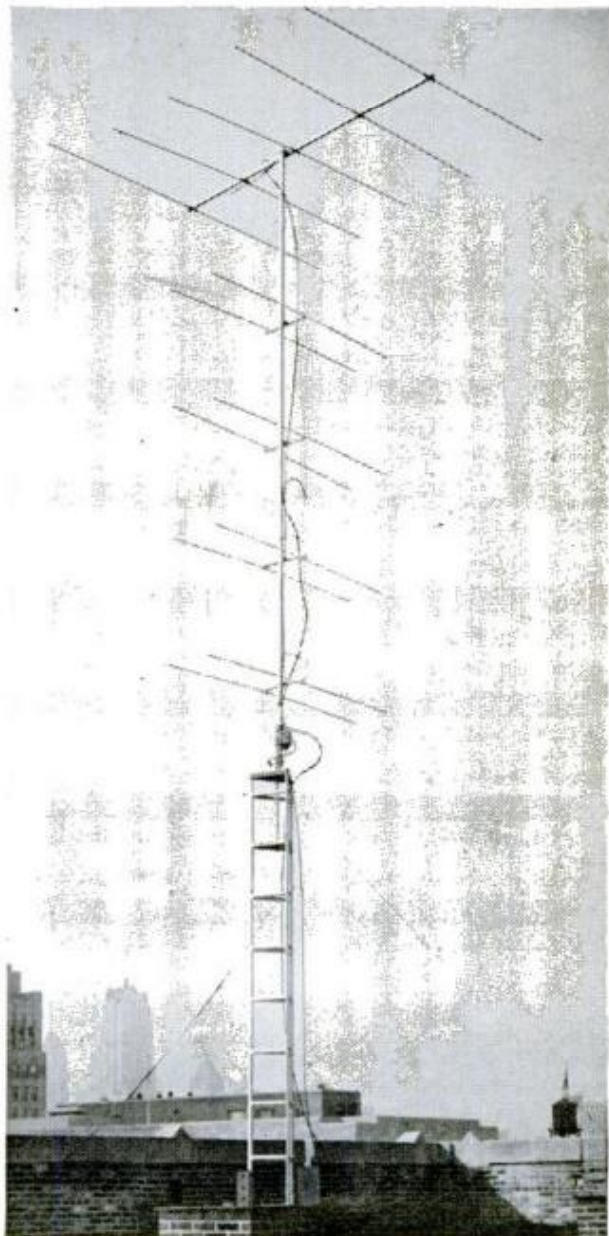


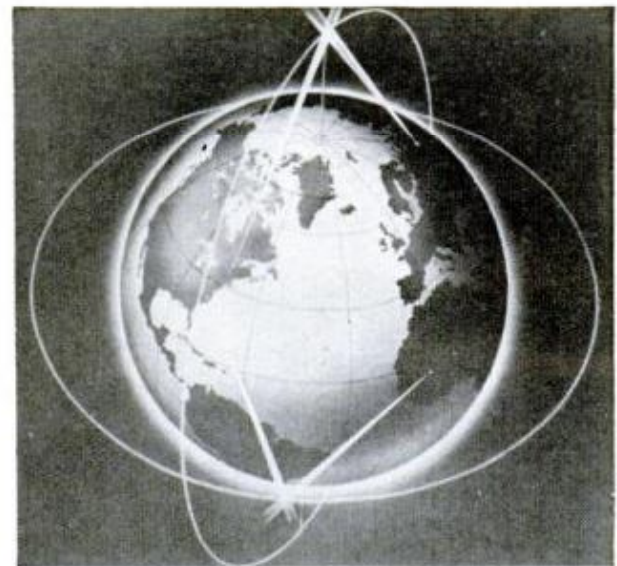
Operator is surrounded by equipment undergoing a complete on-the-air test. Operating efficiency is as important a factor as size when selecting a set



Hallicrafter's transceiver above, fits into a desk drawer. When not in use, lower it into the drawer and lock desk to prevent the curious from tampering

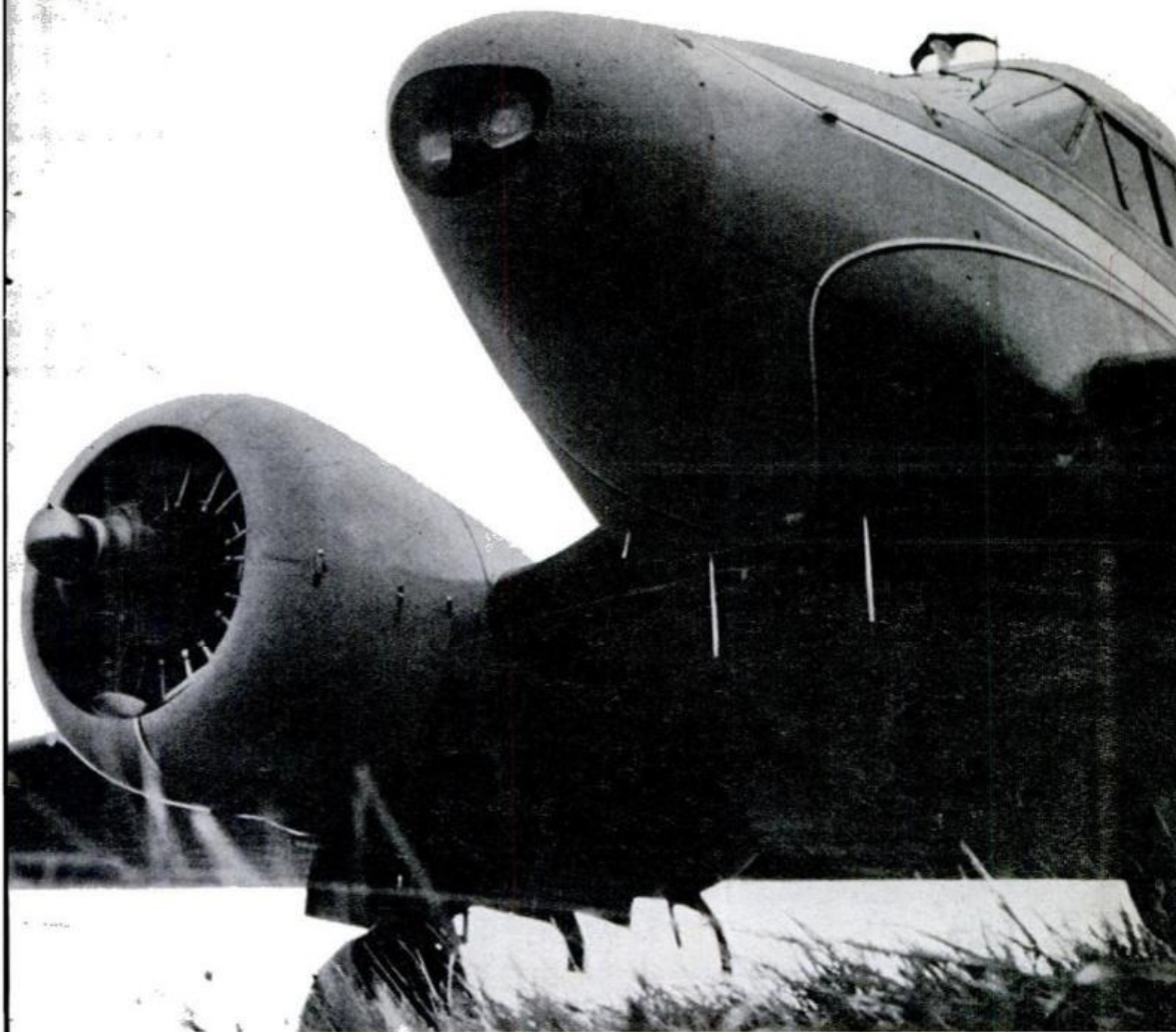
On the roof, the Tri-Ex tower supports the Hy-Gain six-meter Yagi and the Cush-Craft two-meter colinear. Alliance's Tenna-Rotor completes the antenna system





Top, an infrared device permits communications over hundreds of yards. It actually transmits modulated heat waves which are detected by infrared sensing device. Above, a possible sign of things to come. This Army truck is a radio central which handles calls from subscriber stations. It's all done with radio, and the system may someday replace "land lines" and the familiar telephone poles we have today

Top, Sam Harris gets his beard trimmed by a scissors operated by a moon-bounced signal. QRV Sam? Center, to further the relaying of radio messages over long distances, orbital scatter belts will be ejected from orbiting rockets. Radio signals will then be bounced for greater range. Above, NEAR (National Emergency Alarm Repeater) plugs into wall outlet, buzzes to warn residents of emergency info on radio



The Beechcraft Super 18, one of the most reliable and popular planes ever built

Spark your car with Champions— the plugs that power more aircraft the world over!



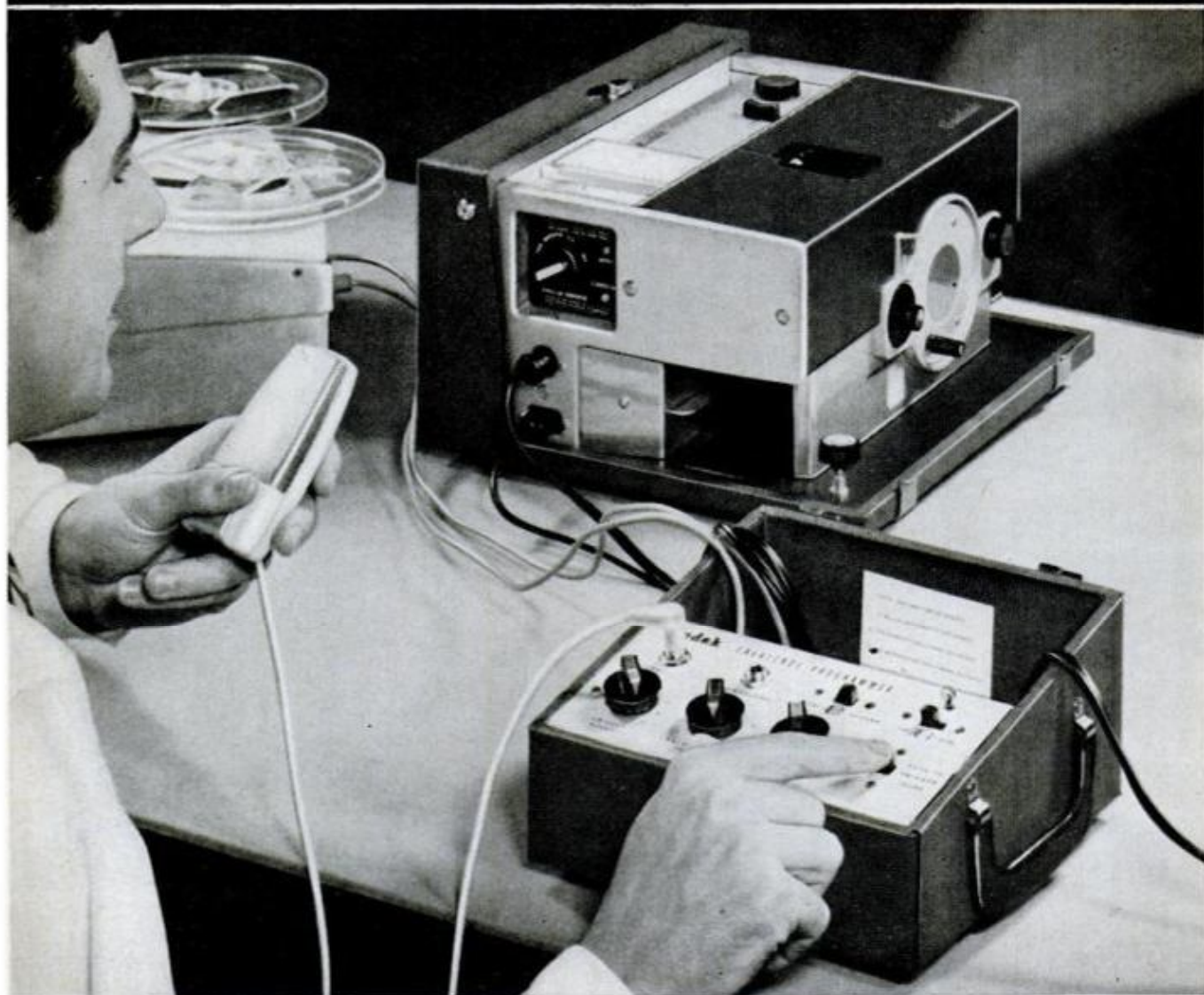
Twice as many car makers specify Champions for dependability. Above: Rambler American.

Airplanes can't risk misfiring spark plugs on take-off—or in the air. That's why dependable Champions are an overwhelming first choice with airlines and pilots. And *you* can't afford misfiring plugs when passing in today's parkway traffic. Put a new set of Champions in your car every 10,000 miles. They'll deliver greater dependability, safer passing power . . . and save money on gasoline!



CHAMPION

New Ideas in Photography



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New Kodak Programmer lets you add voices, music, sound effects to any series of slides

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In playback, the same hookup is used. Your taped narration comes through just as you recorded it, and the taped signals cause each slide to change at the correct moment.

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from Kodak

Vacuum Coating Helps Tiny Reflectors Put More Light on the Subject

A tissue-thin layer of aluminum—*only two molecules thick*—gives the small, built-in reflector on this Brownie Starmite Camera (see photo at right) its bright, mirror-like finish.

Vaporized aluminum is deposited on the reflectors as they turn on racks inside big vacuum ovens.

The result: reflectors for Brownie Starmite and Starflash Cameras provide more reflected light than many units twice their size. An invisible lacquer coating prevents fingerprints from injuring the sparkling mirror-bright surface.

These pint-size reflectors from Kodak pay off in smaller cameras and clearer pictures for you.



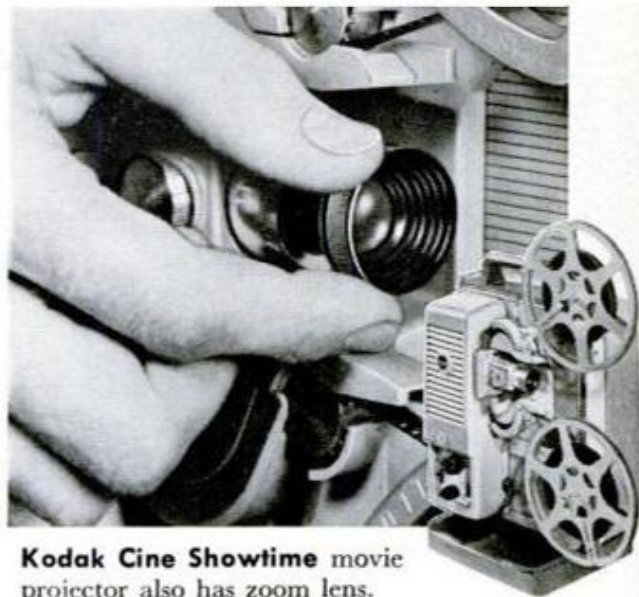
Only 2 inches in diameter, the reflector on this Brownie Starmite Camera has a Lumiclad "mirror finish" that enables it to reflect and direct more light than some units twice as large.



Zoom lens on Kodak Cavalcade slide projector.

New Zoom Projection "Shrinks" or "Stretches" Your Living Room

Zoom projection is here—and it can "shorten" or "stretch" your living room when you're showing slides or movies. Just set up your projector at the most convenient point—for a few guests or a



Kodak Cine Showtime movie projector also has zoom lens.

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Reducing Noise

Q—I have a wall through the center of my basement. One half of the basement area is devoted to laundry and utility rooms, the other half is a recreation room. Both sides are very noisy when there is anything going on, either in the recreation room or the laundry and other areas. Noise seems to bounce off the center wall, so to speak, and reverberates throughout the whole area like echos in the mountains. Is there some way to soften up the racket, make it less objectionable?—M.M., Mich.



A—You did not tell us what material was used on both sides of the center wall, but to produce the effects you so graphically describe, it must be some dense hard-surfaced material. Also the wall must be unbroken, that is, with no offsets or hangings such as pictures, tapestries, wall cabinets or other decoration. Any of these would tend to modify the effect. We are assuming, of course, that the other three walls of each room, or area, are of poured concrete or concrete block. At such long range and with so little detailed information on which to base a suggestion, it is difficult for us to say just what is the simplest and least expensive procedure. Perhaps it might be worthwhile to try

(Continued to page 246)



Races through 2x8's even at 45° angle



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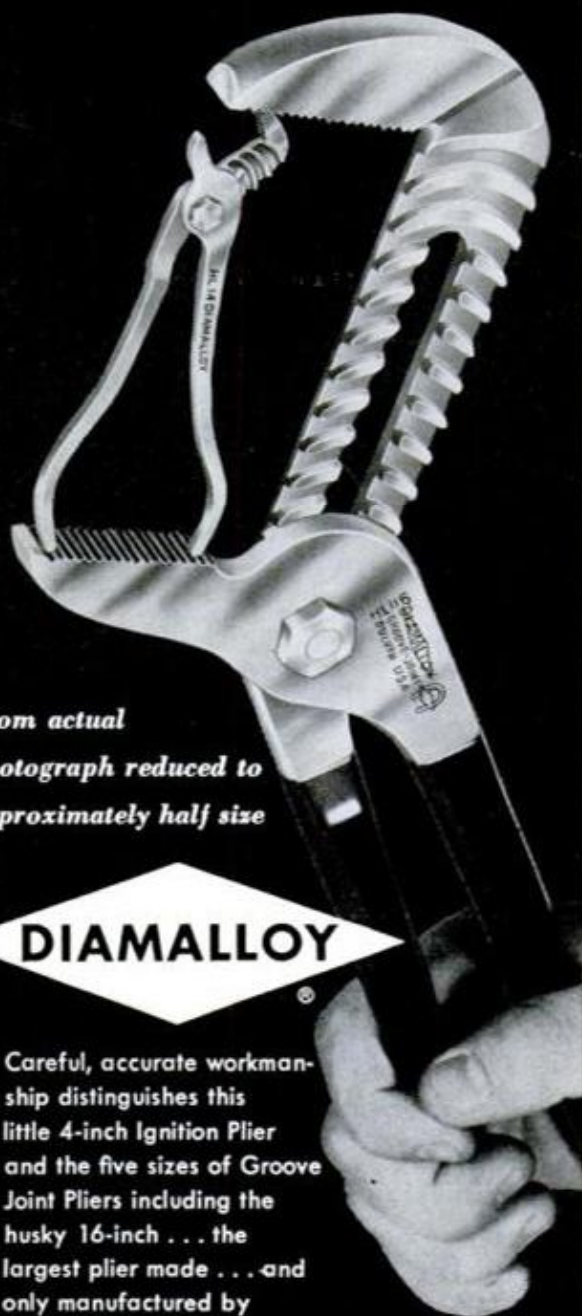


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covering the masonry walls from the ceiling down to within about 3-3½ ft. of the floor with acoustical tiles. These can be attached to almost any surface with cement. From the lower edges of the tile to the floor, fill in with a wood wainscot, using Western red cedar or cypress. We also are assuming that your basement is as dry, or drier, than the average as otherwise we could not recommend the use of acoustical tile. The two woods suggested are not affected appreciably by dampness.

Red Oak for Framing

Q—I plan to build a new home later this year and I'd like to use native red oak for all the framing, floor joists, studding, plates, rafters and the like. But now, after I have done all the planning and have arranged to have the lumber milled at a local sawmill, I'm told that oak is not suitable for framing, that it is always full of insects and some kind of acid that rusts out the nails and that it will not last 20 years. What about it; are all these stories true?—A.H., Ia.



A—There is some truth in everything you have been told about red oak used as framing, except possibly the statement that "it will not last 20 years" might be open to question. Red oak was widely used in early construction for hand-split shingles, or shakes as they were usually called, and also for siding, or clapboards. It is true that some red oak trees are insect infested and if material cut from such a tree is used for framing you risk trouble later on. Oak woods contain acids, mostly tannic acid, which will corrode nails badly when activated by moisture. If the wood is kept dry no such action takes place. If you must use oak, then we would suggest that you consider only white oak, or post oak as it is known in some sections, or burr oak, a wide ranging variety having nearly all the desirable properties of white oak. Either of these woods cut from sound, disease-free trees and properly seasoned should make excellent, long-lasting framing lumber. After seasoning, the wood should be treated with a wood preservative containing the chemical pentachlorophenol. We note from your letter you say you plan to build later this year and that you have arranged to

(Continued to page 248)



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Sealed Power Stainless Steel
oil rings stop oil pumping

have the lumber milled at a local sawmill. This raises the question about whether you have allowed enough time for your lumber to season properly. Kiln drying can speed up the process and possibly make the lumber available to you within the year, but we doubt if there will be time for proper air seasoning of the stock.

What's Condensation?

Q—My home was built about 10 years ago and I have just paid out money for repairs due to what was called condensation of moisture within the walls. This ruined the insulation and a lot of the studding and sheathing. What is condensation? Where does the moisture come from? My location is high and dry with good drainage in all directions. Water from the heaviest rain drains away in a very short time.
—H.R., Ky.



A—Drainage and location have nothing to do directly with condensation of moisture within the walls of a home. The moisture that caused the damage came from the air in the rooms; not from the outside or from the ground. All air contains moisture, even air over the driest desert contains some moisture. And moisture is constantly being added to the air in the modern home of tight construction. It cannot escape readily. Expansion of the warmed air in the rooms and other related causes produces a condition known as vapor pressure in which moisture is forced into and through the walls. During the colder months this moisture is cooled to the dewpoint somewhere in the wall. It condenses and becomes the cause of the trouble you have experienced. Prevention calls for an impermeable barrier under the plaster or other wall covering or on the surface on the room side of all outside walls and also on ceilings. In new homes barriers are usually located on the room side of the studs and may be a separate membrane or a facing on a batt-type insulation. In homes already built several coats of oil-base paint on a plastered wall provides a fairly effective vapor barrier.



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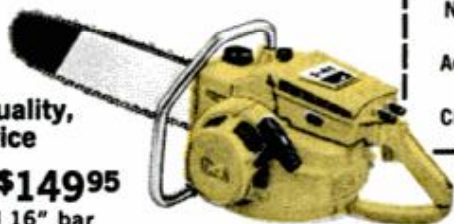
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Life on the Mississippi . . .

(Continued from page 148)



The Folly, once swamped and sunk at her moorings. Ed Allen raised her and put the old boat to good use

"Let a boat come in too fast," said one citizen, "and waves raise Cain with the drums on which the whole town floats. Drums that break loose become serious navigational hazards."

As river-town families took to the Mississippi for sport and recreation, merchants found that their business fell off sharply in the summer, so they too took to the river in pursuit of their boat-happy customers. Storekeepers arranged deliveries to houseboats, and even newsboys tossed their papers on the decks from boats. Boat-in restaurants sprang up on the river bank where boatmen could dock for a hamburger and a cup of coffee or a Sunday dinner. More prepossessing boatels were built at many marinas where a floating family can find everything from gasoline for the boat to a chocolate soda or a room for the night.

In Winona a caterer outfitted a launch and offered to serve dinner aboard houseboats or on one of the river's hundreds of sand bars. Usually several families will get together for a sand-bar picnic. Kids race over the low dunes and play Huck Finn or hunt for buried treasure in the thickets while dad fishes for bass, sunfish, pickerel or crappies. The whole family waterskis or

swims. Some just laze around in the sun or sit in the shade of the houseboat and watch river life go by. When the caterers have the steaks broiled over charcoal, the potatoes and beans baked and the salad tossed, the families sit down and dine royally while watching the vast river sweep by. This is river living with a touch of luxury thrown in.

"In case it rains," explains Ray Meyers, who operates the catering service, "we tie the houseboats side by side and hustle the food on aboard. With, let us say, four houseboats tied together we end up with a cozy pavilion on the river where the rain can't get at us."

Last summer a new riverboat, the *Hiawatha Belle*, was launched at Winona as a floating club. It cruises up and down while folks dine and dance in the cool of a river evening. But most river entertaining is done right on a family's boat with mother doing the cooking.

"We pay back all our winter social debts with summer houseboat parties," one young wife said candidly. "It's less pain and strain and everybody finds it easy to have fun on the river."

(Continued to page 252)



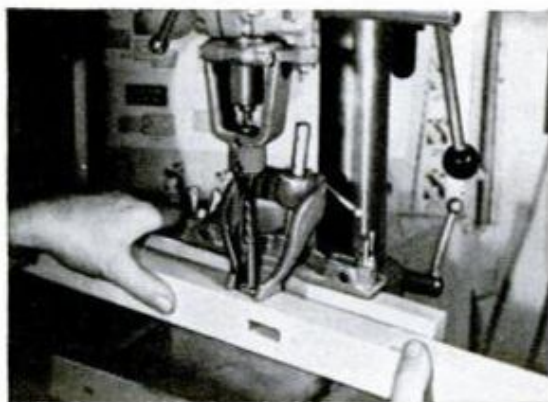
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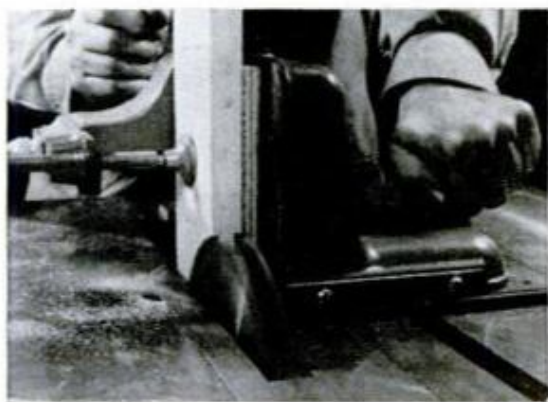
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Not all the houseboats stay afloat. This one, now resting on pilings, became a summer cottage ashore

Houseboaters have an easy-going friendliness. If a new boat pushes into a stretch of the river, folks will bring their own boats alongside and jump aboard for a cup of coffee and a chat.

"You try and board a typical cruiser like that," a houseboater explained, "and you'll get a chilly reception. We're different that way."

Houseboaters are different from cruiser families in other ways too. They don't bother with rubber-soled boating shoes, for one thing, and also ignore the tradition of saluting flags and saying port, starboard, head and galley.

"You don't care if the kids track sand all over your boat," one houseboat wife said. "Believe me, you just try that on a fancy cruiser and hear the captain scream!"

Some families started out with a cruiser but switched to a houseboat because they cost less to buy and operate. Most made the switch because owning a houseboat is like owning a floating cottage. They will sleep more people and provide more cooking and eating space, and they are ideal for landing on sand bars—all a man has to do is beach the front end and toss an anchor ashore.

Other families reject both cruisers and houseboats to spend their boating hours on pontoon rafts with a motor mounted on the back. They weld steel drums together and lash the deck to them. Some rafts are open

to the sky and resemble diving platforms powered with outboard motors. Others have a canopy and often are screened in so that the family can tie up at the bank and relax in the evening without being bothered by insects.

"Tied up to the bank is a wonderful place to sit and talk about the nine-foot catfish that the divers who inspect the dam footings say they meet down in the depths," said one raft owner.

Houseboats, cruisers, rafts, pontoon boats, runabouts—all observe the same speed limits and rules for navigating the river. Let a teen-ager go boat-rodding on the river, and the river police will stop him. They hand him a ticket just as traffic cops on shore ticket a reckless motorist. But throttle jockeys, as they are called by boatmen, are not the rule and the main job of the police is directing traffic around the locks and helping out in emergencies.

Pleasure boats of all descriptions share alike the feeling of impotence when a giant tow comes boiling down the river and they are in the way. They know what it is to meet a tow of lumber in a narrow cutoff, too. But they also know together the coolness of the river. It can be 95 in town, and the wife and kids are wearing jackets out on the river. They know also the magnificent scenery of the Upper Mississippi where

(Continued to page 254)



28 CARS WANTED IT! TEMPEST WON IT!

(Motor Trend's CAR OF THE YEAR Award goes to Pontiac's Tempest!)



The Motor Trend Magazine Car of the Year Award to Tempest marks the second time in three years that the Pontiac Motor Division has received this honor. The editors who selected it are (left to right): Robert Ames, Associate Editor. James Miller, Managing Editor. Don Werner, Editor.

These men edit one of America's leading car magazines—Motor Trend. What they know about cars can help you buy your next new car with complete confidence. They study all the different makes. Compare. Drive. Then they make one award for the year. The Motor Trend Car of the Year Award. This year these editors voted solidly for Pontiac's newcomer --the Tempest. The one car

that will give the car buyer top performance, ride and economy for his nickel. Read what these experts say!

Don Werner—"We studied the design features of 28 American cars. The Tempest pulled ahead of the whole crop of '61 cars. The flexible drive shaft is a fantastic innovation. It's the most sensible, dependable power train we've seen."

Bob Ames—"Equalizing the weight on the front wheels and the weight on the rear wheels (with the front engine/rear transmission) gives the Tempest great traction and ride. Pontiac engineers scored a great breakthrough with the Tempest."

Jim Miller—"The Tempest 4-cylinder engine and the triple alloy steel drive shaft team up as a smooth, going combination. I had to look under the hood to

convince myself they hadn't sneaked in a V-8. And that 4-cylinder engine should do wonders for gas economy."

Take it from this group of sharp automobile experts. They don't throw roses unless they mean it. Tempest took the Car of the Year Award because it's a winner. Check the facts! 110 to 155 h.p. from a gas-saving 4-cylinder engine! Big car balance = big car ride! Independent wheel suspension. Rear transmission. 15-inch wheels at no extra cost! Priced with the compacts. See your Pontiac dealer.

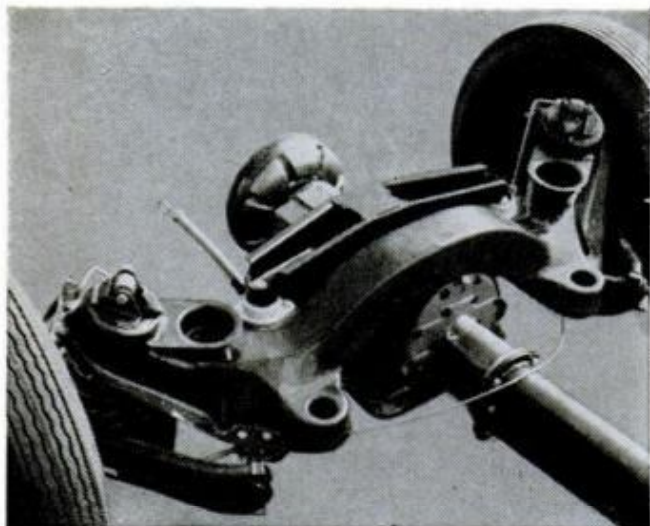
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2. What does this symbol stand for?

The symbol stands for complete engine protection. Quaker State Motor Oil, super-refined from 100% Pure Pennsylvania Grade Crude Oil, keeps your car on the road, out of the repair shop. Insist on Quaker State—available most everywhere. For your nearest dealer's name, call Western Union Operator 25.

ANSWERS: 1. *Transaxle (illus: 1961 Pontiac Tempest).*
2. *Complete engine protection.*

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



bluffs rise from the water's edge and shifting light keeps water and sky in constantly changing relationship to each other. They enjoy the same water sports.

Boating families have to learn the same tricks of current and wind and practice vigilance against snags and shoals. They have to put aside some ingrained habits learned ashore. For example, a smoker who habitually flips burned matches into the toilet at home soon learns that he had better not do it aboard a houseboat or cruiser. A matchstick can jam a marine toilet in no time at all.

Steamboat Museum

Towns which have once again made the river an integral part of their way of life are, naturally enough, taking a new interest in the boating past. The Wilkie family, has taken an old steamboat, veteran of 56 years of service, and berthed it on the levee in downtown Winona. They renamed the boat the *Julius C. Wilkie* and transformed it into a steamboat museum where homefolks and tourists can see such things as a real steam calliope and the pilot wheel and whistle from the *Wenonah*, which in the grand old days towed showboats up and down the river. The engine room of the old steamer was left intact so that visitors can see the original engines, which were powered by steam from twin hand-fired coal boilers and drove the vessel's 18-foot paddle wheel. It is all a far cry from the tows and pleasure boats that abound on the river today.

Every July thousands of river families flock to Winona for Steamboat Days. They parade in honor of the old paddlewheelers and then settle down to an exciting four days of motorboating, racing, regattas and shows held right on the levee. The celebration winds up with a fireworks display on the riverfront. Five hundred boats mill about in the river off the levee, their owners enjoying the fireworks and trying to keep out of the way of falling embers.

Boating families on the upper Mississippi celebrate Steamboat Days as a means of paying tribute to the old days while thoroughly enjoying the pleasures of the new.

★ ★ ★

☞ Carcasses of two 2600-year-old seals found entombed in ice in Antarctica have been returned, frozen, aboard a U.S. ice breaker to the United States for study.

☞ Maybe there's something good about smog, after all. Two Los Angeles scientists have found that mice living in an atmosphere of smog are less susceptible to infection by the influenza virus.

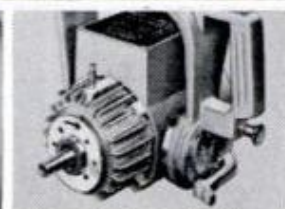
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stop saw instantly



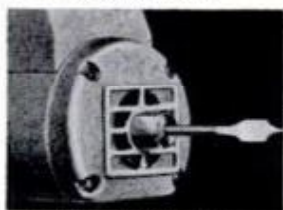
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quietly, smoothly

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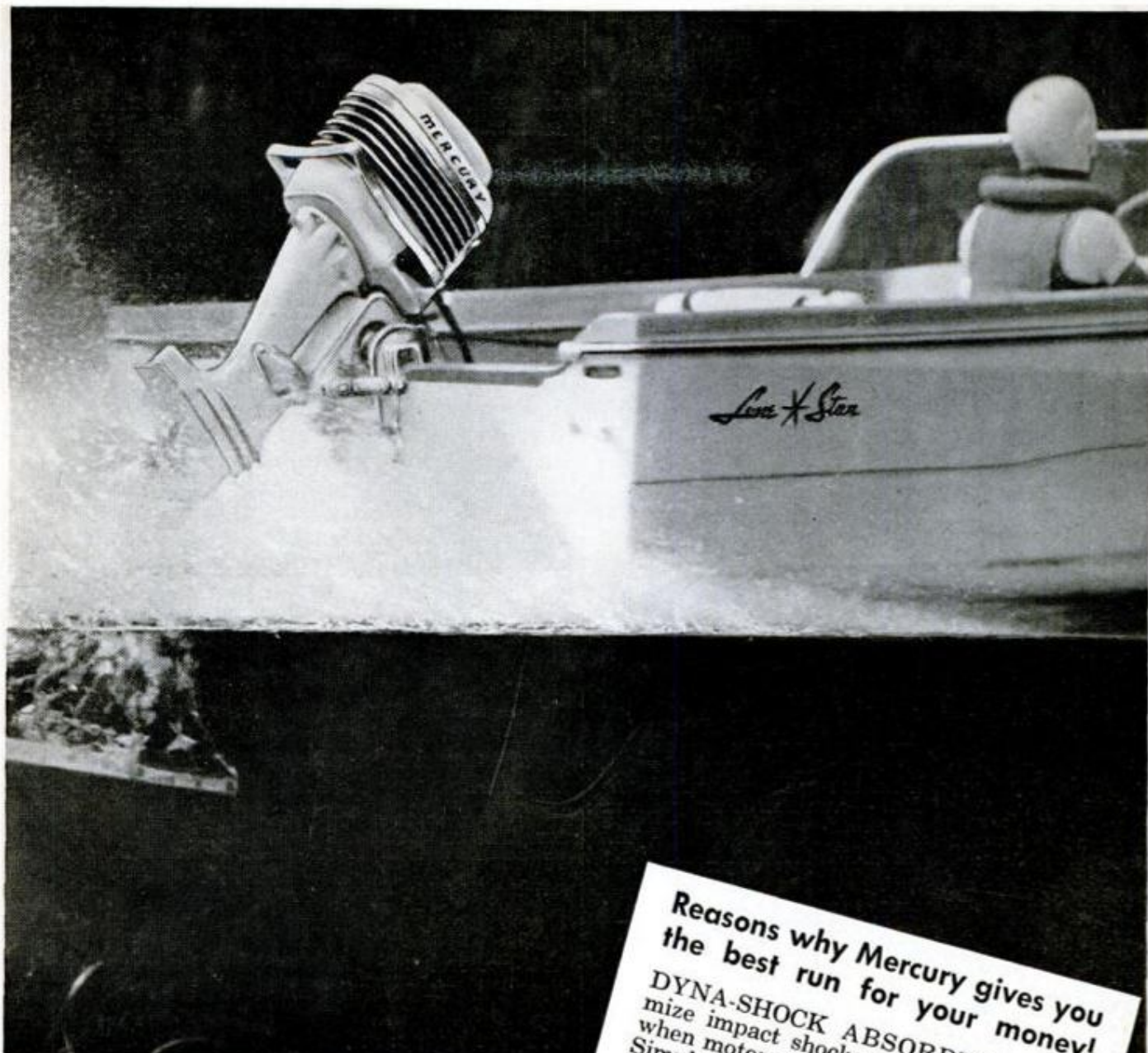
Only Mercury offers patented Glide-Angle Design twins — plus three 4-cylinder en-

gines in 40 to 50 hp classes — plus 6-cylinder family outboards! See your Mercury dealer . . . check his liberal trades, easy terms!

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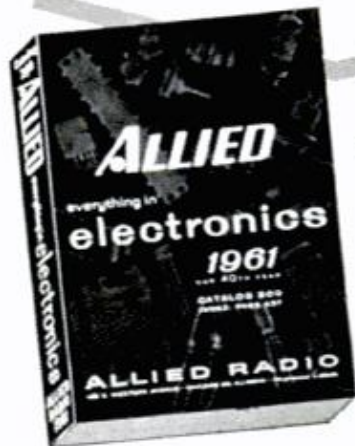
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Space-Age Telescope

(Continued from page 219)

the bearing itself. Note also that when the assembly is made the hub is drilled and tapped for a setscrew that runs down on the threaded end of the declination-axis shaft and that a space or clearance, is allowed between the slip ring and the fixed ring and between the hub and the end of the housing. This is given as $\frac{3}{32}$ in. but can be as little as $\frac{1}{32}$ in. The parts A and B, Figs. 6 and 7, are adjustable plates which carry the telescope saddle, Fig. 14. Plate A is attached to the declination-axis hub in the final assembly. Plate B is held in place by three adjusting screws and three control screws, Fig. 6. Each adjusting screw has a locking, or jam, nut and serves as a push screw, its end bearing against plate B. The control screw passes through a clearance hole in Plate A and turns into a tapped hole in Plate B so that it can serve as a pull screw. Note in Fig. 7 that the plates are recessed $\frac{1}{32}$ in. on one face.

Declination-Axis Shaft

The declination-axis shaft extends (the right-hand end in Fig. 6) as in Fig. 9 to take counterbalancing weights, the outer end being shouldered and threaded $\frac{1}{2}$ -13 to take a nut and washer which hold the weights in place. Note in Fig. 6 that the reducer C is shouldered to $1\frac{3}{8}$ in. inside diameter and carries a bushing D. This is a drive fit as it serves to provide additional thickness at the machined end of the reducer for the tapped holes taking the adjusting screws, the ends of which bear against the bronze bushing carrying the declination-axis shaft. The bushing is grooved to take the ends of the three adjusting screws. This assembly provides a means of squaring the declination-axis with the polar axis. The declination circle, Fig. 8, consists of a metal disk to which is cemented a paper disk graduated as in Fig. 8. Both hour and declination circles are available ready made. The circle, or ring is mounted on a hub (turned from a V-pulley) and fits on the shaft extension as in Fig. 6. A pointer is then fashioned from sheet brass or aluminum as in Fig. 8 and is held in place under one of the shaft adjusting screws as in Fig. 6.

As will be seen from Fig. 9, the declination-axis assembly is fitted with a locking arrangement consisting of the clamp, Figs. 10 and 11, the slow-motion assembly, Fig. 12, and the housing, Fig. 13. The completed assembly is shown in position in Fig. 14, also Fig. 9. Obviously this assembly must be in place before final assembly of the dec-

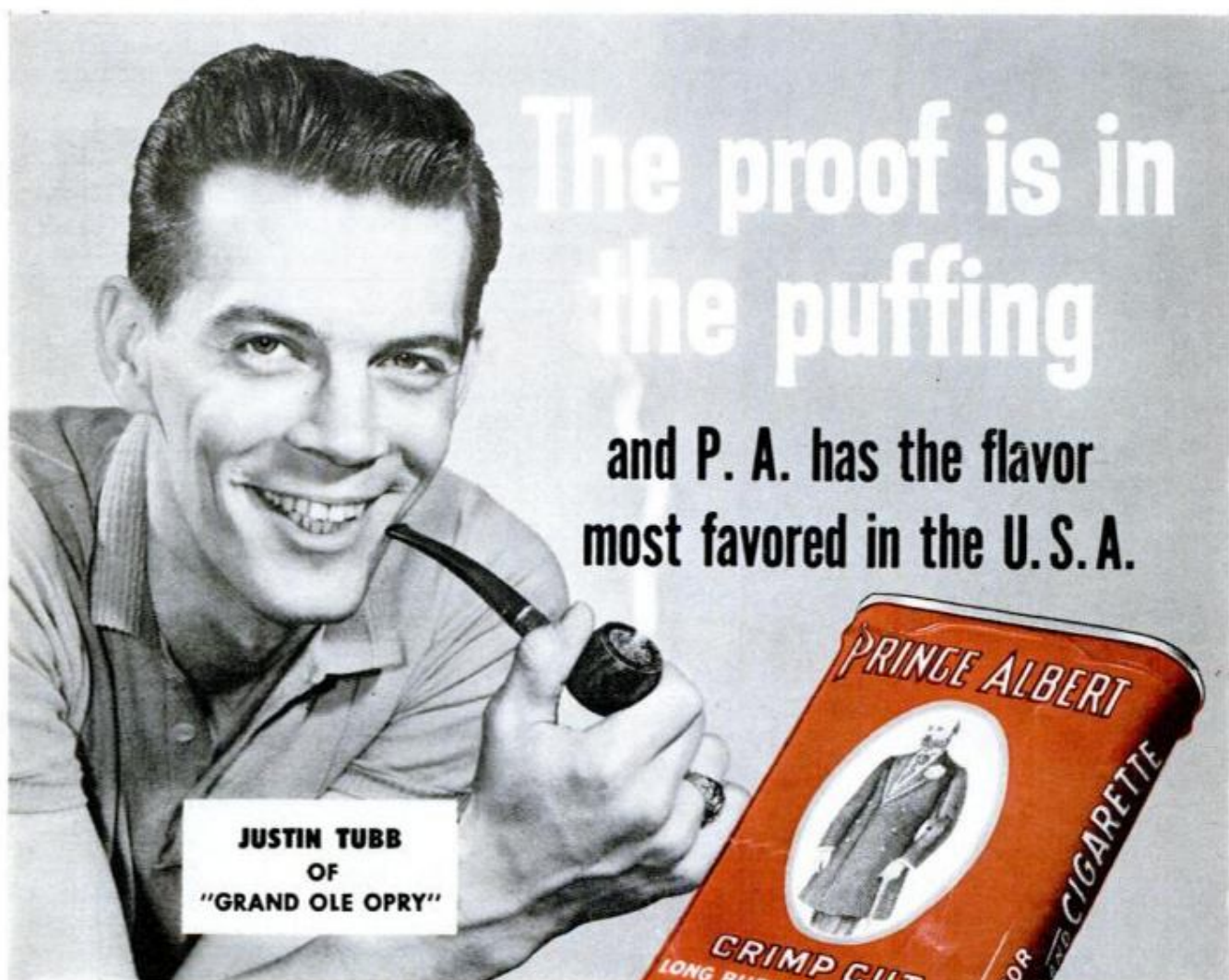
(Continued to page 260)

Tougher Plastics Family Emerges

Newest of the polymer plastics, polybutene-1, is entering the plastics field as a heavy-duty version of its close relative, polyethylene—familiar as plastic film and in plastic "squeeze bottles." The new material is similar to polyethylene, but shows higher tensile strength for stronger pipe and tubing and for films with greater tear and impact strength—up to twice that of polyethylene in some tests. The new plastic was demonstrated for the American Chemical Society by its inventor, Dr. L. M. Welch, of Houston, Tex.

Better Rainproofer for Army

U. S. Army field tests have showed that a new chemical water-repellent finish for combat clothing may have wide use in civilian rain clothing. The finish, called "Quarpel," was developed by Quartermaster Corps technologists in their search for a water repellent finish that would "breathe," yet repel heavy rainfall and remain in the fabric after cleaning or laundering. Quarpel-treated fabric withstood seven days of one-inch-per-hour rain without leaking, but will last as long as the fabric without needing retreatment.

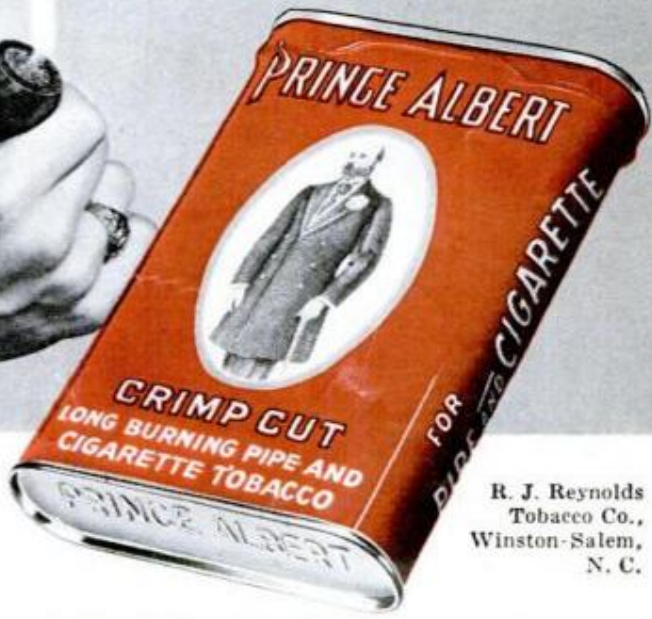


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lination axis can be made. When in position the assembly in Fig. 12 provides a slow and extremely sensitive adjustment of the declination axis while the lock, Fig. 10, holds the adjustment at any desired point. Slow rotation of the axis is accomplished by means of the traveling nut on the control screw which moves the declination-axis hub through a stud having a yoke soldered to the outer end. A pin on the traveling nut engages the yoke as in Figs. 11 and 12. The fit of the yoke over the pin should be quite close so as to reduce backlash to the minimum. The mechanism provides a range of movement of 25 to 30 degrees which is ample to meet the requirements. The slow motion housing, or frame, is pictured in Fig. 16. Other stages in the process of machining and assembling parts of the mounting are shown in Figs. 15 and 17.

(To be continued)

FAMILY-SIZED SWIMMING POOL for \$229. It's yours by following the complete plans you will find in the April issue.

Navy Radio Waves Penetrate the Sea

When its very low frequency radio station on the coast of Maine is completed, the Navy will be able to punch communications down to submarines operating in the ocean deeps, a feat its higher-frequency stations have not been able to perform.

Establishing the VLF station at Cutler, however, has required equally outstanding feats of engineering. It will be the world's most powerful station of its type and will cover a peninsula of nearly 3000 acres. The antenna, now under construction, looks like two huge six-pointed stars; each half, or star, measures 6200 feet from point to point. It will be supported by 26 towers, and each half will be comprised of a central tower 980 feet high, six middle towers each 875 feet high, and six outer towers 800 feet high. The towers are designed to withstand winds of more than 150 miles per hour.

The transmitter building will be located between the stars. At the base of each central tower will be a small building, containing antenna tuning and control gear, and tower de-icing equipment. The transmitter will have an output power of two million watts, 40 times the power of any major commercial radio station.

The antenna's ground system will contain 200 miles of copper wire. Luckily the station is on the sea—a good electrical conductor—or the amount of wire would have to be much greater.

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No. 44—COMBINATION MITER BOX AND CORNER CLAMP
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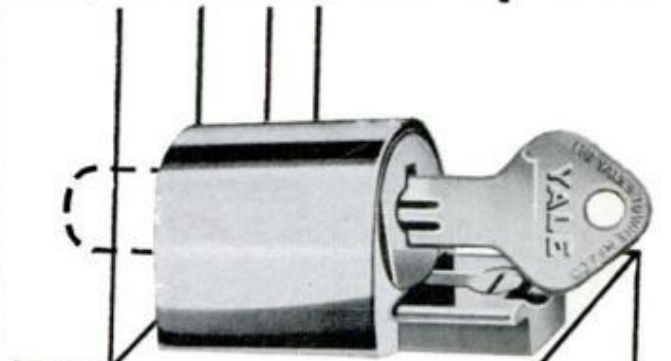
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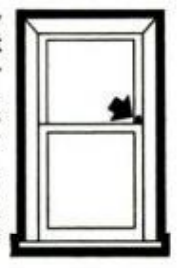
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 - No. M-90 (Wt. 5 oz.) Has pull of 15 lbs. on steel block... **\$ 3.50**
 - No. M-47 Hot Pad Magnets, 10 for \$1.00... **50 for \$ 4.87**
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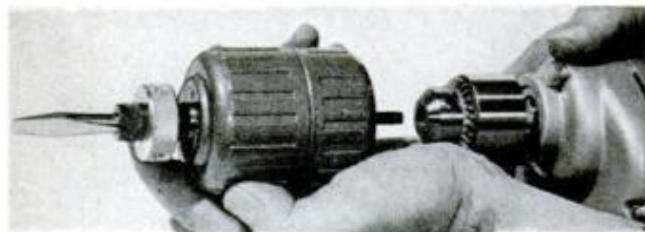
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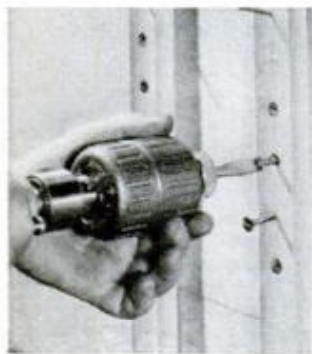
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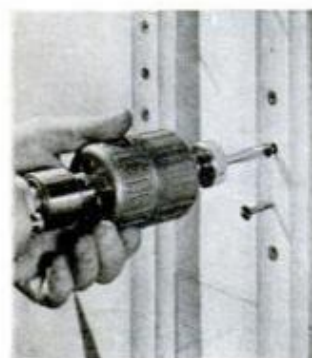


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Are We Flying Junk?

(Continued from page 132)

A pilot given an elderly plane from these shops noticed the left prop icing heavily during flight through a storm area. On landing he found a main connection in the line was not even attached; the anti-icing fluid was pouring down over the hot cylinders. An understandably suspicious look at the engine then revealed one large air-intake hose detached and flopping, and the fire-warning thermocouple simply hanging loose, swinging in the wind. None of these things could have been seen during the pilot's preflight check, but must have required a considerable effort to overlook with the cowling lifted for the regular shop inspection.

Major Maintenance Costly

These are items which could be fixed relatively cheaply en route, of course, but other major repairs are extremely costly when done away from the home shops. Some older aircraft with two-stage blower systems are sent by eastern companies to fly over western terrain with the high blower not only inoperative, but wired off. In the case of the C-46, high blower use is recommended above 9500 feet. Some of the western airways have minimum instrument altitudes of 14,000 feet!

To replace a blower is a major job, however, and more than a few pilots have been implored to limp home with engines sick from this cause. A pilot who could not get a reasonable manifold pressure on one such engine was told that the gauge was simply inaccurate. "Bring it home and we'll look at it," was the order. But bringing it home meant clearing the Cascade and Rocky Mountain ranges.

The pilot made a college try from the northwest airport for the sake of the company, and his job, and the backfiring engine blew the top inspection plate off, cascaded oil, and finally quit. Stalling around the pattern, the plane made it back to earth almost in one piece, where subsequent inspection showed that, as the pilot had suggested, the blower had loosened dangerously in its mounting. Even had the engine kept running, the plane could never have climbed over the rocks between there and its home shops at the reduced power this faulty engine was actually delivering.

Theoretically, if one engine fails on a C-46, the craft should still be able to maintain 7800 feet altitude (above sea level) at maximum weight, regardless of age or condition. A C-46 killed 53 of its 81 occupants

(Continued to page 264)

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at a comparatively youthful aircraft age, when it lost an engine coming out of San Juan, Puerto Rico, and the pilot could not keep it at *any* altitude over the sea. The author has recently been in command of some of the same aircraft and a passenger in others which refused to stay aloft under any circumstances with only a moderate load aboard when one engine was deliberately and carefully cut; others would hold more than the altitude of which they were theoretically capable. The point is that age does make a difference and that aircraft, like pilots, withstand that age in varying degree.

Lest it be assumed that such material failures are only occasional, on the same charter passenger flight during which the pressurization quit and left the passengers and stewardess dizzy from lack of oxygen, it was found that the beacon—the most important anticollision light, would not function. The cause appeared to be a blown fuse, for which a spare was not aboard—a frequent neglect in these climes. With a dubious ingenuity, the crew packed metal foil around the fuse to permit the current to bypass it, without regard to the overloading of the circuit. Which was more dangerous—continuing the flight under the risk of fire, or flying a crowded airway at night without a beacon? Neither was acceptable, and certainly neither should have been necessary, but such a choice is often faced by captains in this part of aviation.

The service time of engines and other important parts of the aircraft are supposed to be logged so that their total use can be known. Yet many parts and accessories in such companies have to be purchased from surplus stocks, foreign operators—anywhere a buck can be saved. These parts are simply used until they fail, which is frequently.

Pilots Bet on Conk-Outs

From the quality of such maintenance and supply originated the bet which was freely taken among the pilots around northwest airports not long ago: even odds that at least one of every six engines belonging to a company which originated its flights there would not finish the trip. Winnings were about evenly divided.

The same overloading proven years ago is still common today, but the increased age of the aircraft makes it even more serious. Due to much-improved government scrutiny of passenger operations, most of these overloadings take place on the cargo lines. The weight limit for one aircraft's cargo compartment floor is 165 pounds per square inch. Some of this flooring is now

ancient and shredded, but engines have been carried recently which weighed upwards of 3000 pounds and met the floor at only a few small points. In addition, these excessive loads were put aboard by inexperienced, underpaid loading crews. Thus one pilot had to fly through turbulent mountain currents knowing that only one bolt was left holding a large engine to the floor, the others having been torn away by the violent tossing of the loosely secured load. Another load came free on takeoff, slid to the tail of the craft, and the pilots made it around the pattern only by using full power and both holding the control column forward with their knees.

But aren't there regulations to govern this? Isn't the Federal Aviation Agency supposed to insure safe flight operations? True, and undoubtedly most safety agents do their best in this regard. There is, however, no exact standard by which the age or general disrepair of an aircraft can be used to judge its airworthiness. Both the C-46 and DC-3 have been given an unlimited life by this agency, in the absence of any proof that the planes simply disintegrate with time.

"Better" Planes Grounded

One such agent who recently inspected aircraft at a company's outlying station promptly grounded those which the pilots actually considered among their better planes. After all, they had only a few cracked windows, thin exhaust stacks, weak flooring—every one of these being items which had been appearing as complaints on the log books for some time. Copies of these complaints should have crossed the desk of this official in a daily maintenance report submitted by the airline; whether they did or not is a matter of conjecture. (All malfunctions of aircraft thus reported to the FAA by the airlines are considered confidential. The instances cited here come almost entirely from the experiences and conversations of one pilot, the author.)

Many of the regulations themselves have grown largely from the experience of the same pilots and planes, rather than being self-evident truths. Thus they differ widely in their application. For the R-2800 engines on most C-46s, for instance, some military quarters have assigned 800 operating hours as a safe life. Others say 1000. Civil carriers have now persuaded the FAA to extend this as high as 1500 logged hours, with an additional groaning 25 thrown in as an "emergency" measure to get the plane back to the home shops. Pilots on some of these

(Continued to page 266)

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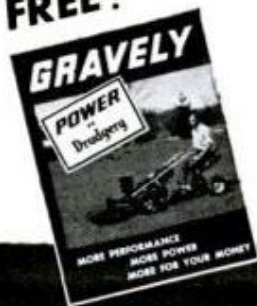
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lines, in order to get more pay, log only part of their flying time, however, which means that the actual time on the aircraft flown is considerably greater than that its log book shows.

Competition Breeds Cost-Cutting

Traditionally, major airlines have been several long leaps ahead of government in the technical operation—which is safety—of their aircraft. In most cases, they write the manuals governing the use and maintenance of their planes; officialdom usually nods wisely and approves. On the lower levels, a new operator going into business simply buys the approved manual of operations of another company and inserts his own name where applicable.

To find the cause of the over-all hazard, a careful look at the whole is more useful than accusing any particular part. Inevitably the answer seems to come back to the matter of high costs and cut-rate competition. Our national economy is based on competition, however, and one of the jobs of the CAB is to insure that it remains a prominent part of aviation. The monetary, short-term savings are apparent. A Congressional committee estimated last year that it would cost just three times as much to buy our military airlift at "fair" rates as it now costs by letting the contracts out competitively. The government paid \$39,000,000 for aerial transport on a contract that would have cost \$136,000,000 at standard rates.

No Solution in Sight

Yet under present conditions most companies have not been able to buy modern equipment nor even maintain the old craft properly. To award these lucrative contracts arbitrarily would simply be to furnish tremendously expensive equipment free of cost to favored companies. A hopeful note appeared in the invitations for bids given out by the Air Force to civilian contractors this year; requirements were laid down that the contractor had to have modern, high-performance aircraft either operational or on order. In addition, he had to prove himself to be financially sound, which eliminated a large percentage of past bidders. As yet, however, the contracts this year have still gone largely to those companies flying—guess what? That's right: C-46s and DC-4s.

Somewhere in the middle of the dilemma lies an answer, perhaps. Meanwhile, America's flying junk creaks wearily overhead, cluttering the airplanes and creating a hazard which grows with every year. ★ ★ ★

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APRIL ISSUE

MARCH 1961

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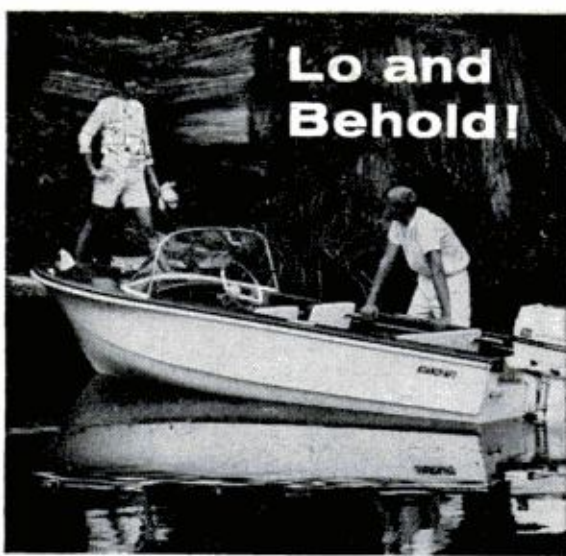
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Boats by "Chain Letter"

(Continued from page 177)

perienced team to lay the fabric and resin, after which the materials are allowed to set 24 hours before being removed. The cast is broken loose from the mold by the pressure of water fed in through a system of pipes built into the mold's walls. The hull now is taken away, usually to the owner's home, for finishing and fitting.

The amateur boatbuilders have turned out more than 700 of these craft, each costing around \$300. Owners estimate a saving of \$700 per boat, or a total of more than \$490,000 for the entire operation. As an extra dividend, during the boatbuilding work many have developed enduring friendships of the kind often found among any group of devoted hobbyists.

They also have built a lesser number of eight-foot Sabots, which make a fine "pram" for sail or outboard use.

Having pretty well satisfied the yearnings of the group for smaller boats, the workers have undertaken development of a 25-foot cabin cruiser that will sleep seven. Materials for this hull are the same as those used in the smaller craft. The first hull for this model has been cast and is being fitted with a 215-horsepower inboard motor. It is expected to cost about \$3000, compared to \$8000 or more for a comparable commercially built cruiser. Those signing for these hulls will purchase kits that will contain all the materials needed for their projects.

Hulls composed of fiberglass and resin are light, and yet they have withstood landing shocks and collisions with a minimum of damage. They have proved completely resistant to teredos and other forms of marine life that infest wood hulls and cling to steel. Moreover, they require little upkeep.

There never has been a fatal accident charged against these cooperatively built boats, many of which make frequent fishing trips 20 miles and more across the open ocean. ★ ★ ★

Hi-Fi Recordings Aid Heart Testing

Some 35,000 Chicago school children were tested for heart disease by the use of hi-fi tape-recording equipment. Tapes of their heart sounds were made at the rate of 250 a day, according to Louis deBoer, executive director of the Chicago Heart Association. Physicians listened to the playbacks at the rate of 140 an hour. Most heart diseases in children have heart murmur as a symptom, deBoer said. The test-use of recordings allowed the screening of a large number of children efficiently.

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IMPROVE ENGINE PERFORMANCE WITH A **Stewart-Warner** ELECTRIC Fuel Pump



The Sports-Car Sport That Went to Sea

(Continued from page 154)

out of it or, better still, make a contest out of a group cruise as an added attraction. It's hard to imagine a situation where a course can't be laid out one way or another.

Once the course is laid out, the instructions are circulated, and you've filed your predicted log, you're ready to start.

The start is a pretty informal thing, since you'll probably be starting alone and the starter is in the boat with you. Most contestants prefer to get their boats to the chosen speed, then time their flying start so they hit the line at just the right speed and exactly the right moment. You can keep your watch until you cross the line, then you hand it to the observer, who then has the only timepiece aboard. He logs your exact starting time (though it doesn't affect your score as long as it's within two minutes of your prediction), and you're off. Some contestants prefer to start from a standstill right at the starting line, having calculated the time it takes to accelerate to their chosen speed. Needless to say, two boats starting at about the same time, one standing and one flying, cause some confusion but it's all part of the game.

En route, everyone can relax and enjoy the ride except the skipper, who must watch his boat like a hawk. His navigator works, too, but can take time out for a chicken leg and a Coke. The most relaxed person aboard is usually the observer, whose only concern is to log control points when he's told and to keep a poker face through the trip. At control points, the skipper tells his observer to stand by, then gives the exact passing moment by saying, "Ready . . . mark!"

Seat-Cushion Navigation

Out on the course, the tricky part of the contest is compensating for unforeseen changes in wind, weather and wave action, all of which will affect your running time. That's why you run the measured course under as many different conditions as possible—to learn to predict the unpredictable. With no instruments, you soon learn to drive "by the seat of your pants," judging wind and waves by sight and feel, and adjusting your throttles accordingly.

The finish of a predicted-log contest can become a bit complicated, but again, it's part of the fun. Theoretically, if every contestant has figured it right and run his boat as planned, every boat will cross the finish line at exactly the same time. This, of course, never happens, but the preset finishing time does tend to pull all the boats

into a group as they near the finish. The temptation to worry about the boats ahead and behind is a powerful one, especially if you're a half mile ahead of the local champion. It's better to trust yourself, but the strain can put you on the rack. The observer, neutral or not, usually manages to become pretty involved with the contest and with "his" boat, and must watch his actions and words closely to keep from giving you an idea of how you're doing.

On top of all that, several boats approaching the finish line at the same time will produce a bit of a chop with their combined wakes. The chop slows everyone, so some fast thinking and adjusting of throttles can go on in those last moments, even though the rules allow you to pass the finish point anywhere within 500 feet. As he passes the finish point, the skipper repeats his "mark" signal for the last time, and the contest is all over but the scoring.

Scoring is done by percentage of error. You take the difference between the actual time and the predicted time, in seconds, then determine the percentage of error by dividing the error, in seconds, by the predicted time in seconds. As an example, on a four-hour predicted time, you missed your time by three minutes. The error, 180 seconds, divided by 14,400, the number of seconds in four hours, gives you .0125. Multiply by 100 to get the percentage, and you have 1.25 percent—a remarkable score, good enough to win or place in almost any predicted-log contest. But it's easier on paper than it is on water.

And When You're Ready . . .

The official rules for predicted-log contests are set up by the Cruiser Commission of the American Power Boat Association. The rules are strict and precise for sanctioned contests by member groups, but are flexible enough to allow any group to modify them to any individual need. Any group that is an A.P.B.A. member can qualify for sanction, and the winner can be eligible for any of a large number of fine trophies offered by the association.

For information on predicted-log contests and for the book, "Power Cruiser Contest Rules and Instructions," you may write the current chairman of the A.P.B.A. Cruiser Commission, Donald R. Rimbach, at 136-37 37th Ave., Flushing 54, N. Y. The books are \$1.00 each. They contain the complete rules, plus a lot of helpful information on the more complicated calculations necessary for big-time contests, and show sample log forms. A big buck's worth, and a good group to be in touch with. Tell them *PM* sent you.

And good luck with *your* contest. ★ ★ ★

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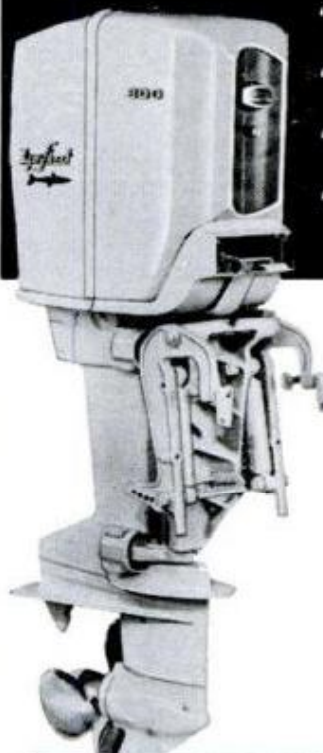
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(Continued from page 195)

need a second rheostat and a reversing switch, Fig. 7. A dual-stacked solenoid is included with the reversing switch. Also, at each end of the track, a bumper contact switch is closed automatically by the train. These are momentary switches that are activated every time the train bumps the insulated side of the contacts, Fig. 7. All of this equipment, with the exception of the bumper switches, may be purchased from a hobby shop or an electrical supply source. The complete setup, Fig. 8, may be mounted under the incline base, Fig. 9. Bell wire should be used to hook up the switching circuit. Follow the wiring diagram given in Fig. 7, soldering all connections to assure good contact. ★ ★ ★

Material List

LOCOMOTIVE

- 1 d.c. 62B Pittman motor
- 1 Worm gear
- 1 pr. 36" scale Kemtron, L 636, geared wheels
- 1 pr. 36" scale Kemtron, L 635, plain wheels
- 8 pc. Hand rail posts
- Wire for rails
- 1 pc. Channel brass, ½"x½"x4"
- 1 pc. 6"x12" .012 or .010-ga. sheet brass
- 2 pc. 6"x12" .008-ga. sheet brass
- 1 4-36 1½" machine screw
- 2 0-80 side rod screws, short
- 2 0-80 side rod screws, long
- 5 2-56 F.H. machine screws
- 1 2-56 R.H. machine screw
- 1 pc. ⅝"x1½" brass tubing
- 1 pc. ⅝"x1" brass tubing
- 1 pc. 5/16"x½" brass rod

PASSENGER CAR

- 2 pr. Steps
- 1 pc. Wood roof, 4"
- 1 pc. Wood base, 6"
- 1 Metal coupler
- 2 Sets Boxcar truck wheels
- Sides of car—make from metal, wood or cardboard
- Wood for car base and bolster

TRACK INCLINE, MISCELLANEOUS

- 1 B50 Rheostat, 50 watts
- 1 Tenshodo reversing switch
- 1 Power supply, model 3 Throttle Pack
- 3 pc. HO-gauge track, 3 ft.
- 4 pc. Track joiners
- 1 pc. 3/16"x4" brass rod
- 5 lb. Spackle
- Bell wire for circuit
- Lumber for incline framework
- Scraps of hardboard, wallboard, etc. for the mountain scenery
- Nails, screws, solder and paint

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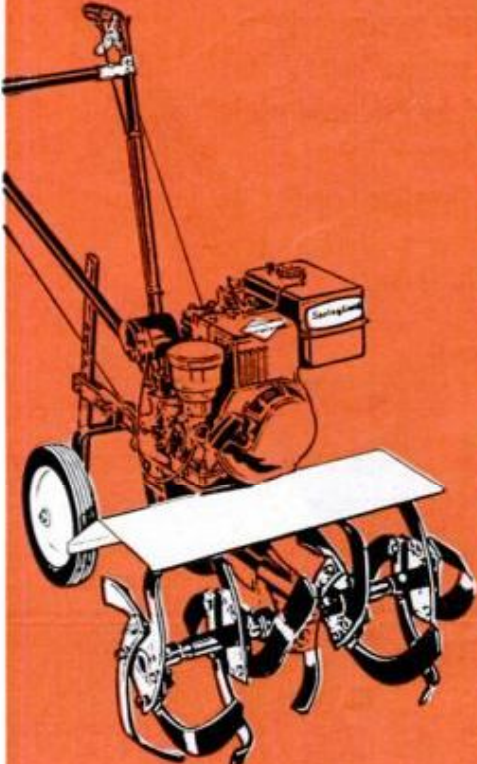
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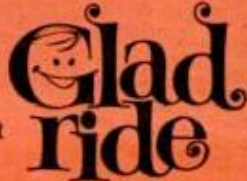
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PM's Go-Cat

(Continued from page 173)

The stem is laminated from two outer thickness of $\frac{3}{4}$ -in. solid lumber and a center lamina of $\frac{1}{2}$ -in. plywood, cut in one piece from the dimensions given in Fig. 18. The easiest way to make a layout of the stem is to use the bottom edge of a panel of $\frac{1}{2}$ -in. plywood for the setup line (line in the drawing from which all vertical dimensions are extended to the stem) and then extend all verticals from it, starting in the right-hand corner with the $26\frac{7}{8}$ -in. dimension. Note that the plywood lamina extends the full length of the stem. After it is cut out, sections of solid stock are laminated on each side of it. The shapes of the sections shown are only a suggested way of making up this lamina. It can be made up of more pieces arranged differently. However, similar joints should not occur in the same locations on both sides, for greatest strength. The notch at the after end of the stem is made as shown in detail A. The dimensions for the chine notches cut in the sides of the upper, forward end of the stem, are given in detail B. A sharp $\frac{3}{4}$ -in. wood chisel and rawhide mallet are the best tools for this job, Fig. 19. Nails that are in the way are pulled out with pliers, after clearing enough wood away with the chisel to get a good grip on the heads.

Fairing of each pair of chines that take the angled bottom planking can be done accurately by first stretching a chalk line very tight between the transom and bulkhead 3, then snapping it to mark the lower end of the bevel on the outer chine. When doing this, the line must be held exactly on top of the chine corners at the transom and bulkhead 3. Saw kerfs spaced 2 in. apart are then cut in the chines exactly to the depth marked by the chalk line on the outer chine and to the glue line on the inner chine. The handsaw used for making the kerfs, is held so that each stroke cuts into the outer corners of the inner and outer chines simultaneously. With the chines so marked for fairing, most of the waste is planed off, leaving about $\frac{1}{16}$ in. thickness of kerfed wood for final fairing with a wood rasp. The rasp is worked across both chines on each stroke, except where they are spaced too far apart at the forward end. While doing this, the surfaces being worked on should be checked frequently with a straightedge. The inner and outer chine pair on each side of each hull is faired in the same manner. Bulkheads also, may be faired at this time.

Part II will cover chine laminating, fairing the laminated chines, planking and joining the two hulls together.



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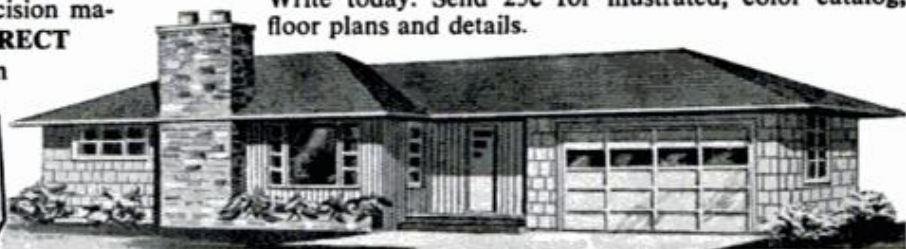


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More Horses Per Gallon?

(Continued from page 116)

Angeles concerning a typical car, a '59 Chev that was borrowed from a rental agency. Smog content of its exhaust was analyzed, then the car was driven for 300 miles on treated fuel and the exhaust analyzed again. The report shows that emission of hydrocarbons from the tail pipe was reduced by more than 50 percent.

In addition to his fuel supplements Metcalf is producing some lubricating supplements. One is for motor oil, another is for automatic transmissions and power-steering units. One of their effects is to increase the lubricating quality of an oil by reducing the sizes of particles to less than the thickness of the oil film.

Police Report

While I was in Denver, Metcalf took me out to visit Otto Heppner who had recently retired as materials technologist for the city and county of Denver. Heppner had overseen the original testing of the new compounds by the Denver Police Department and had kept lengthy notes on the results. It turned out that the entire city-county fleet of some 550 vehicles is using the supplements. The fleet rolls up about 5,000,000 miles per year.

Heppner said that a few months ago three police cruisers were fueled with gasoline that contained no supplement, just as a test. The drivers didn't know about this switch but they all complained that the cars didn't have their usual power.

He told me that city-county fleet had been able to change from premium fuel to the cheaper regular grade by using the supplement. The net saving from this alone amounts to around \$14,000 per year.

Here's where I can get into an argument. Denver is the "mile high city" and a lot of smart drivers know that they can change from premium to regular at high altitudes. The main reason for buying premium is to prevent detonation in a high-compression engine, and most high-compression engines don't detonate at high altitude where the air pressure is less. I wondered whether the switch to regular fuel couldn't have been made without using the supplement.

Metcalf says he doubts it. He says that in Denver he uses regular grade plus supplement and gets no ping, that without the supplement his Lincoln cackles badly. He says a lot of Denver drivers have discovered this.

He showed me a report by the Police Department dated April 5, 1960, that reads in part "These cars averaged 2.2 more miles per gallon when the GS supplement was

added. All cars were tested on 'regular' gasoline. The supplement permitted advancing the timing on all cars to an average of five degrees above the setting required for regular gasoline without the supplement, and to within one degree of the timing setting required for premium gasoline."

Let's say the argument is a draw. You can use regular gasoline in Denver although you *may* need to retard the spark to prevent knocking. Let's say, too, that with the supplement it's possible to keep the spark advanced and thus get good performance.

The report from the police garage also said that carburetor maintenance had been greatly reduced by use of the fuel supplement because of less gum and carbon in the throttle throats. In regard to the oil supplements the report stated that "since using the automatic transmission supplement, transmission repairs have been reduced by over 50 percent." For motor oil the report says that the oil supplement "has reduced valve lifter troubles in our cars by 90 percent and completely eliminated the sticking of lifters in motorcycles. Crankcase sludge has been reduced by 50 percent and replacement of crankcase breather caps by 75 percent."

Saves Labor

Those are pretty strong statements and yet I was going to hear more. I phoned Sherman Logsden, power-plant engineer at the Martin Company's Denver plant where the big Titan ICBMs are built. Martin has been using the fuel and oil supplements for a year. Logsden was enthusiastic about them.

He said they were getting a 22 percent fuel-saving by adding diesel supplement to the fuel used by the 500 hp. diesel generators that power the test stands. He reported up to 16 percent economy in the gasoline engines that are on 24-hour-a-day pumping duty.

"But the biggest advantage," Logsden said, "is the increased time between overhauls. Originally we had to tear down the big diesels every 3000 hours. Now we are running 5000 hours between overhauls. This is almost a 50 percent saving in labor."

Some of this sounds too good to be true and yet I'm convinced it's all true.

Metcalf is conducting further research on the problem of keeping down particle sizes so that more of the fuel can be turned into power—research which is now possible using the electron microscope.

But that's in the future. Right now Metcalf is busy preparing for large scale production of the present supplements. ★★

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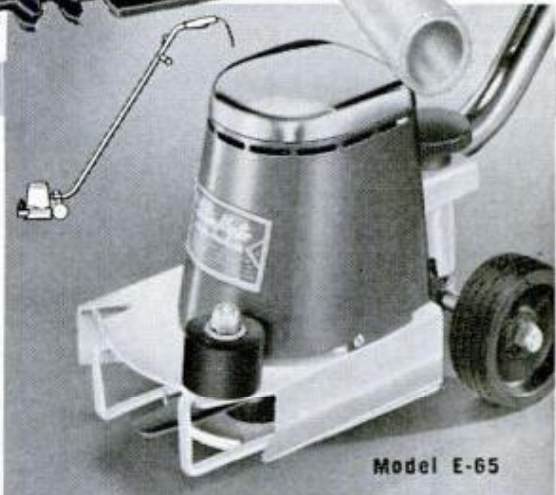
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Model E-65

Model 1370 De Luxe Starflyte Hedge Trimmer. Cuts in either direction. 32 precision ground teeth, 13" Swedish Blue Steel cutter bar. Auxiliary handle fits right, left, rear. 115 volt, AC, 850 spm. **\$29⁹⁵**

Model E-65 De Luxe Starflyte Edger-Trimmer. Full 6" swath, precision setting 1" to 2" cutting height. Wide rubber wheels end rutting. Safety switch, anti-scalp guard. 115 volt AC motor, 8000 rpm. **\$36⁹⁵**

Model K-10 De Luxe Starflyte Garden Tiller. 6 1/2" swath, 6" deep cut with 8 hardened steel tines. Full 1/3 HP 115 volt AC motor breaks up clods, aerates, conditions soil. Safety switch, storage hanger. **\$44⁹⁵**



Model K-10

Quality at Popular Prices

LAWNMATE LAWN and GARDEN TOOLS



Model 1310

Model 1310 Hedge Trimmer. 12" swath; 16 teeth, 13 inch cutter bar. 115 volt AC motor, 850 spm. Only 5 lbs.! . . **\$27.95**

Model T-70 Model E-60



Model T-70 Grass Trimmer. 5" swath trims near trees, walks, borders. 115 volt AC motor, 12,000 rpm no load speed . . . **\$17.95**

Model E-60 Edger Trimmer. Anti-scalp guard, 1" to 2" height of cut, 6" swath with tool steel blade. 115 volt AC **\$24.95**

PORTABLE ELECTRIC TOOLS, INC.
1200 East State Street, Geneva, Illinois

In Canada: 452 Birchmount Rd., Scarborough, Ont. Please send me complete information about your new Starflyte Lawnmate Lawn and Garden Tools

Name _____
Address _____
City _____ Zone _____ State _____
Favorite Dealer _____

Owners Report on the Lancer

(Continued from page 121)

SUMMARY OF OWNERS REPORT

LANCER

Excellent 77.6%

Average 20.9%

Poor 1.5%



Economy—manual transmission		Least-liked exterior features		Did consider "big" low-price car	
As expected	50.0%	Rear deck and fenders.....	9.3%	Yes, did consider.....	40.6%
Better	13.8%	Rear end	8.1%	No, did not consider.....	59.4%
Not as good.....	36.2%	Gasoline filler pipe.....	2.4%	What make considered?	
Economy—automatic transmission		Best-liked interior features		Chevrolet	30.9%
As expected	45.7%	Upholstery	32.0%	Dodge Dart	25.4%
Better	15.1%	Seats	20.4%	Ford	22.2%
Not as good.....	39.2%	Dash panel, instruments.....	19.2%	Plymouth	19.8%
Best-liked features		Least-liked interior features		How is dealer service?	
Handling ease	71.2%	Glove compartment	9.3%	Excellent	61.7%
Comfortable ride	42.2%	Ash tray	9.0%	Average	27.3%
Power, performance	23.1%	Lack of head and legroom.....	6.0%	Poor	11.0%
Styling	20.1%	Headliner	3.6%	Would you buy from him again?	
Economy	19.8%	Did consider different compact?		Yes, would buy again.....	59.6%
Easy to park.....	19.5%	Yes, did consider.....	68.1%	No, would not	9.9%
Roadability	14.7%	No, did not consider.....	31.9%	No answer, don't know.....	30.5%
Most-frequent complaints		What make?		Car traded in?	
None at all	30.5%	Falcon	29.4%	Dodge	21.8%
Poor workmanship	12.3%	Valiant	24.1%	Plymouth	18.0%
Poor gas economy	12.0%	Corvaire	18.0%	Other Chrysler make	3.9%
Gasoline filler inlet.....	6.9%	Comet	13.7%	Chevrolet	7.5%
Lack of head and legroom.....	6.6%	Rambler	7.6%	Other G.M. make	5.4%
Water leaks	4.5%	Miscellaneous	7.2%	Ford	9.0%
Transmission	3.9%	Lancer only car in family?		Other Ford Co. make.....	3.0%
Had engine trouble?		Yes, it is.....	55.0%	Other U.S. make	5.7%
No trouble	89.2%	No, it is not.....	45.0%	Foreign make	4.5%
Some trouble	9.6%	Make of other car		Next car will be?	
Considerable trouble	1.2%	Another Lancer	1.2%	Lancer	24.2%
What was trouble?		Dodge	17.1%	Dodge	12.0%
Carburetor, timing	2.4%	Plymouth	6.0%	Other Chrysler Corp. make	7.5%
Rough idling	1.2%	Other Chrysler make.....	5.1%	General Motors make	2.1%
Valves, tappets	0.9%	Chevrolet	4.8%	Ford Co. make	2.7%
Best-liked exterior features		Other G.M. make.....	7.5%	Foreign make	0.9%
Grille	23.6%	Ford	3.6%	Other U.S. make	0.6%
Front end	13.8%	Other Ford Co. make.....	2.7%	A compact car.....	6.9%
Simple, clean, smooth lines.....	11.4%	Foreign	3.6%	Undecided, don't know.....	43.1%

"Gas tank overflows when being filled."
—California retiree.

"Impossible to fill gas tank without spilling."
—North Carolina college professor.

"The most idiotic thing is having the gas tank filler pipe in the side so gas splashes on fender and leaves a stain."
—California lawyer.

Lancer's gas tank is located far forward to permit spare tire stowage beneath trunk floor. This, in turn, makes for an unusually large trunk—and a balky filler pipe. It would have been worth the manufacturer's time to solve this problem, which also appeared on Valiant last year.

"Should have a little more legroom in back seat."
—Wisconsin cheesemaker.

"Rain leaks in windshield, two front door jambs, at one rear door."
—Florida insurance underwriter.

"There are a few leaks around the doors."
—Alabama hotel manager.

Leakage appears to be another facet of factory's quality control problem—an assembly rather than a design flaw.

Now for some more items on the plus

side. Here are the best-liked features ranking seven through twelve.

"Lancer seems to be well-balanced when driving on slippery or icy roads."
—Massachusetts bus operator.

"Holds road very well on sharp curves."
—California railroad conductor.

"Terrific roadability. In this respect it will do as well if not better than any big car."
—Idaho salesman.

"The Lancer is a real road car; it holds the turns at high speeds as if it were on tracks."
—Florida drapery installer.

"Road-holding ability amazing! I drove 750 miles in one day by myself without being tired."
—North Carolina chemist.

And so it goes. We could fill the rest of the report with such enthusiastic references to Lancer's roadability. Despite its small size and light weight you can hurl the Lancer over rough roads at high speeds all day without undue discomfort or tension. In this respect it is a real sports touring car.

"Enough space for family even though a compact car."
—Pennsylvania nurse.

(Continued to page 280)

WELD - BRAZE - SOLDER - CUT

REPAIR MOST EVERYTHING MADE OF METAL

Home Appliances, Auto parts, Farm-garden equipment, toys. Make and repair playground equipment, lawn chairs, tables, ornamental iron work, gates, wagons, etc. Solder, heat, bend, and straighten with terrific heat from arc torch.

Cut and weld up to 1/4" steel plate. A million uses for Home, auto, farm, inventors, factories, etc.

Works from any home 110 volt plug-in. Complete with dark welder's mask, arc torch, supply of carbon welding and brazing rods and complete Welding Instruction Book. Efficient—durable—1 year guarantee. WL only 4 lbs.

SEND ONLY \$3

(cash, ck. mo.) and pay postman \$11.95 plus C'OD postage on arrival or send \$14.95 and we will send postpaid. Ideal gift for mechanically minded home owners, relatives, friends. Order now for early delivery. Available only from:

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Dept. DPM-3

Kearney, Nebraska

(Item 24)



World's THRIFTIEST Light Plants

700 Watts, push button start, 115 v. 60 cyc. AC. 2.2 HP, easy starting Briggs eng. No wiring necessary; just plug in and operate. Plenty of current for any oil burner, freezer, brooder, emergency lights, etc. which require up to 700 watts. Ideal for television and radios. Complete with voltmeter and built-in winding to charge auto batteries. (Item 24) Wt. 75 lbs. Easily fits in car trunk. Be prepared if storm

\$149.50

knocks out power lines. Reg. \$275. 1500 Watt Plant (Item 45) same as Item 24 but larger generator and engine with 50% greater output. **\$199.50**

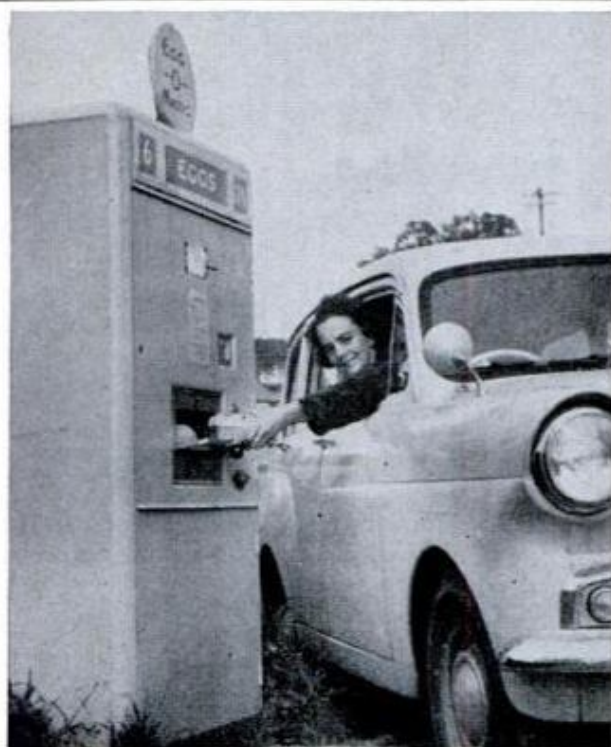
ELECTRONIC BRAIN IDLER Now Available On All Our Plants—Write

MASTER MECHANIC MFG. CO., Dept. A-361, Burlington, Wis.
Southern Customers Order from Dept. A-361, Box 65, Sarasota, Florida



DRAINS cellars, cisterns, wash tubs; \$7.95 IRRIGATES - CIRCULATES - SPRAYS

1,001 uses. Stainless shaft. Won't rust or clog! Use 1/6 HP motor or larger . . . 3/4 HP for up to 2,400 GPH; 450 GPH 80' high; or 1800 GPH from 25' well. 1" inlet; 3/4" outlet. Coupling included free. **\$7.95.** **HEAVY DUTY BALL-BEARING PUMP.** Up to 5,200 GPH; or 3,000 GPH from 25' well. 1 1/2" inlet; 1" outlet. **\$12.95** Postpaid if cash with order. **MONEY BACK GUARANTEE** Centrifugal and Gear Pumps in All Sizes
LABAWCO PUMPS, Belle Mead 7, New Jersey



Roadside Egg Vendor

Mechanization, as it must to most things, has come to the selling of eggs along the lanes and roads of England. Pop a half-crown (35 cents) into the machine and out comes a carton containing a half-dozen eggs.

MARCH 1961

PAINT THRU RUST

Spray it...



brush it

NEW additive* lets you paint over tight, non-scaling rust because it penetrates through to the metal; seals against further rusting... PROTECTS LONGER THAN ORDINARY "RUST PAINTS." Rustmaster enamel available in colors. *Patent applied for.

RUSTMASTER



Pacemaker In Paints

The Glidden Co. • Cleveland 14, Ohio • West Coast: The Glidden Co., General Paint Co., 1000-16th St. San Francisco 7, California • In Canada: The Glidden Co., Ltd., Toronto, Ont. Rustmaster also sold by dealers for CLIMATIC HEALTH & MILLIGAN • ROYAL • MOUND CITY.

"It was to be our second car, but we use it a lot more than our large car. In fact we are leaving for Florida soon and plan to take the Lancer."—Illinois retired executive.

"Everyone says it is a big little car."—South Carolina life insurance manager.

People are amazed at the space that turns up in Lancer—for passengers' legs, feet and elbows as well as for luggage.

"I like . . . the amount of room there is in this size car."—Iowa nurse.

"The solid feeling of the body is what I like."—Pennsylvania clergyman.

"Power steering is not necessary."—New Jersey salesman.

"Steers easily, brakes well."—Minnesota beautician.

Very few owners need power steering, almost no one should require power brakes. This is one of the real plusses of lighter weight and good design.

"I especially like the nylon fabric upholstery. It's very soft and one's clothes slide across rather than stick as they do to some fabrics."—Michigan housewife.

"Attractive upholstery and appointments."—Illinois credit manager.

"Cushioned foam rubber seats covered with a durable nylon material."—New Jersey tavern owner.

As a matter of fact this seat upholstery gives a real luxurious feeling and appearance that's a bit above the plastic door paneling and headliner.

Switching back to the complaints, here, in order of frequency, are items seven through fourteen.

"Needs more horsepower on the highway."—Ohio accountant.

"Has enough power for city travel, not enough for highway travel."—Alabama senior clerk.

"Not enough oomph in passing."—New York dentist.

We don't buy this complaint. If you switched to a Lancer from a powerful V-8 you may have to change your passing habits but you'll find that you don't miss many opportunities in a day's drive. For another \$43 you can get Lancer equipped with the 145 hp. engine used in Plymouth Six. This job will match muscles with most standard low-priced V-8s.

"Rear-view mirror placed at a position (from top of windshield frame) obstructing view."—Iowa teacher.

"Location of mirror is bad, anyone sitting in center of front seat bumps his head against it."—Minnesota truck driver.

"Interior mirror always in the way."—Georgia teacher.

This mirror can be a problem. Manufacturers might provide screw locations (filled) for alternate mounting of mirror bracket at either top or bottom of frame.

"Everything rattles that isn't welded on."—Alabama office worker.

"This car isn't very rattle-free by a long shot."—Ohio floor installer.

"Very poor door and window fitting and adjustments."—California oil worker.

Cause: poor quality control on assembly or lack of proper dealer make ready. The remedy: time consuming correction plus a few more ounces of pride.

"Heater is too large, gives too much heat, should be forced outside air."—California security officer.

"Heater should work at driving speed without blower."—Nebraska gas worker.

Here's where we perform a real service. You can turn off heater-defroster blower in any position by pulling out (gently, please) the push button that you've just selected. Factory goofed, left this out of manual.

"Increase area cleared by windshield wipers."—New Jersey engineer.

"Door latch on center post is poor design. I've torn my coats while getting into the car."—North Carolina salesman.

"Poor fitting glove compartment and ash tray."—Ohio salesman.

All is not lost, though. Here are some additional best-liked features.

"The trunk is plenty roomy."—Michigan factory worker.

"Plenty of trunk space."—Illinois salesman.

Lancer's trunk (and Valiant's) is both roomy and convenient.

"Driving view good down over the hood."—Pennsylvania teacher.

"Very good brakes."—Nebraska farmer.

"Brakes extremely well."—Florida architect.

The gentlemen are right, Lancer has sufficient lining area and braking action that's smooth and requires light pedal pressure.

"I like the alternator. I've had heater, lights and electric wipers going all at once and ammeter showed no discharge."—Ohio printer.

"I like the new alternator for keeping the battery charged."—Wisconsin store manager.

Few people realize what a great improvement the alternator is over the conventional d.c. generator. With it batteries will last about three times as long.

(Continued to page 282)



**Men who know
GLAZIERS' TOOLS
say the BEST are
Red Devil Tools.**

HOUSE BEAUTIFUL'S
PRACTICAL
GARDENS
AND
OUTDOOR LIVING



A GUIDE TO
DELUXE
OUTDOOR LIVING

NOW ON SALE AT YOUR NEWSSTAND \$1.25



**"How come you're allergic to house paint
but not to boat paint?"**

MARCH 1961

The Miracle of Transistors Brings You



**110 AC
FROM
BATTERIES**

**ESB
PACKAGED POWER**

ACTIVERTER

©1960

**Dependable Power
for Hundreds of Uses**

Now — using a totally new concept in electronic design — the ESB engineers have developed a revolutionary, fully transistorized inverter-charger, the ESB ACTIVERTER. This major breakthrough in "packaged power" means that you can now have the convenience and the utility that 110 Volt AC current can bring, and you can have it wherever you can take a 12 Volt storage battery!

Just connect the ESB ACTIVERTER to a battery and you can have 110 AC instantly, anywhere, for many hours. You can plug in portable electric power tools, an electric blanket, electric lights, even a television set! A flick of a switch and the ESB ACTIVERTER fast or slow charges 6 or 12 Volt batteries.

Compact, Rugged, Truly Portable

The compactness of the ESB ACTIVERTER design makes it possible to have a 12 Volt storage battery, an inverter, and a battery charger all in one self-contained and portable package. One PAK-O-POWER ACTIVERTER model provides a source of 110 Volt AC, with an output rating of 500 Watts, in a package the size of a portable picnic cooler! Because solid-state electronic components are used throughout, ACTIVERTERS are both rugged and lightweight. There are *no* moving parts, *no* vibrators.



4 Sizes — from 150 to 500 Watts

MODEL I-152 INVERTER — Inverter only, operates from direct connection to 12 Volt battery or through cigarette lighter socket of cars with 12 Volt systems. Output ratings: Intermittent Use — 150 Watts, 1.5 Amps. AC... Continuous Use — 125 Watts, 1.2 Amps. AC. Shipping Weight: 8 lbs.

MODEL IC-252 ACTIVERTER — Inverter-Charger operates from direct connection to 12 Volt battery. Output ratings: Intermittent Use — 250 Watts, 2.3 Amps. AC... Continuous Use — 200 Watts, 1.8 Amps. AC. Shipping Weight: 15 lbs.

MODEL IC-202P PAK-O-POWER — Inverter-Charger with compartment for 12 Volt battery. Completely self-contained unit. Output ratings: Intermittent Use — 250 Watts, 2.3 Amps. AC... Continuous Use — 200 Watts, 1.8 Amps. AC. Shipping Weight less battery: 22 lbs.

MODEL IC-506S PAK-O-POWER — The Multi-Service Inverter-Charger-Car Start unit, with large 12 Volt battery compartment and Car Start leads. Completely self-contained with built-in fast and slow charger — Charging rate: 60 Amps. for 6 Volt, and 40 Amps. for 12 Volt batteries. Output ratings: Intermittent Use — 500 Watts, 4.0 Amps. AC... Continuous Use — 300 Watts, 2.5 Amps. AC. Shipping Weight less battery: 55 lbs.

**ESB
PACKAGED POWER**

THE ELECTRIC STORAGE BATTERY CO.

Makers of

Willard - Exide - GRANT - WISCO - Jordan

The Electric Storage Battery Co.
Automotive Division — Dept. PM-2
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I want to use 110 Volt 60 Cycle AC for _____

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Name _____

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City _____ Zone _____

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Work within a whisker of shrubs, fences!

Simplicity®

ROTICUL

3 H. P. TILLER-CULTIVATOR



Finger-Tip Control! Patented Power Reverse!

It takes a *quality* tiller to do precision tilling. Roticul tills within a fraction of an inch of fences, hedges, etc., with full operator visibility, quick responding finger-tip controls, full power reverse to end exhausting pull-back. Scientific tilling action; non-winding, self-sharpening tines guaranteed against breakage. Write for free catalog!

SIMPLICITY MANUFACTURING CO.
6140 Spring St. • Port Washington, Wis.

Maker of Simplicity Garden Tractors, Honda Six Riding Lawn Mowers, Simplicity 700 Riding Tractor



A PARKER HACK SAW for any day in the week

The Parker model you want, saws easier, holds blades more rigidly, and fits your pocketbook. Unconditionally Guaranteed.

Manufacturers of World-Famous Trojan Saw Blades and Frames

PARKER MANUFACTURING CO.
WORCESTER 1, MASS., U. S. A.

Now for some minor complaints to balance off the report.

"Doors hard to close, very flimsily constructed."—Alabama druggist.

"Doors are difficult to close at extremely cold temperatures."—Nebraska quality control man.

We agree with above cold weather complaint. At -15° the lubricant on internal latch parts keeps them from latching tight.

"Tire size too small, 15-inch tires would give better road clearance and better wear."—New Hampshire government administrator.

Clearance is a result of chassis design as much as wheel size. Lark with 15 inch wheels has only 0.7 of an inch greater clearance than Lancer. He's right on wear though; 15-inch tires will outlast 13-inchers if the weight on them is the same.

"I've had a lot of trouble with windows, they roll up and down very hard, and they rattle."—Wisconsin electronic technician.

"Door windows rattle."—California guard.

"Parking lights are in a poor position, get covered with mud and slush too quickly."—New York engineer.

That about sums it up for Lancer, a highly pleasurable car rated excellent by 77.6 percent of its owners, 30 percent of whom had no complaints at all. Except for quality control problems of the factory and some minor design flaws this car would probably be an unqualified favorite. ★ ★ ★

WAITING FOR YOU in the April issue will be two million-mile owners' reports, on the 1961 Chevrolet and Rambler American, plus how-to's on converting your garage for modern living needs, and giving your car a spring tune-up.

Relative of Deadly Radioisotope May Lead to Better Bone Studies

Strontium 85, a safe relative of the deadly Strontium 90 of fallout fame, is being tested for use in a new method of diagnosing diseases of the bone. The technique, known as an osteogram, uses tiny amounts of the radioactive isotope, injected into the body and traced by scintillation counters as they are absorbed and deposited in the bones. Studies show that the rates of absorption vary in diseased areas from the rates in normal bones. The same method will also be useful in following progress of repair of bone fractures, as well as in basic studies of bone chemistry.

The Medicine Is Neutrons

(Continued from page 111)

natural elements like radium and artificially produced beams like X-rays, destroy cancerous tissue more readily than normal tissue. During the past few years, the development of nuclear reactors has enabled medical men to use radiating neutrons—the most penetrating of all particle beams—from the hot cores of atomic reactors, to destroy some types of abnormal growths in people. They have also been able to create radioactive isotopes by exposing certain liquid and solid stable elements to neutron bombardment in the piles. When removed, these materials radiate particles and gamma rays themselves, some for only a fraction of a second; others for thousands of years. When injected into cancerous organs, the radiations of shorter-lived isotopes can kill the surrounding diseased tissues.

The "Dark Ages" of Nuclear Medicine

Until now, however, medical explorers in this field have had to use nuclear piles designed for anything but medical therapy. Patients have had to be lowered into pits improvised by removing blocks from a reactor's heavy shielding, or placed awkwardly in front of ports designed for materials testing and other purposes. Some of the best short-life isotopes couldn't be used because by the time they were carted from experimental reactor ports, their most useful radiations would be spent.

All that has been changed by the MRR at Brookhaven. Today, under Dr. Lee E. Farr, medical director and chairman of the Medical Department, a large staff of resident scientists, visiting research scientists from universities throughout the country, and specialized scholars and technicians, are working with a new medical weapon. Not only are the facilities designed especially for research in atomic medicine, but the reactor core itself—a cluster of vertical fuel elements two feet in diameter and 26 inches high—has been engineered to deliver an external neutron beam some 50 times more intense than Brookhaven's big general-research reactor.

One of the reactor's primary uses will be in the treatment of a particular type of brain cancer, glioblastoma multiforme, by means of a tricky "neutron capture" method developed over the last 10 years on the big general-research reactor. What makes it work is boron—an element that has the unique ability to absorb neutrons. (That's why boron is used in reactor control rods.) Oddly enough, boron also has

(Continued to page 284)

MARCH 1961



America's Biggest Garden Tractor Value!

Brawny, hard-working power quickly responsive to every operating demand for all-season time and labor savings! Dependable 7 hp engine, new transmission with 3 forward speeds 1.3 to 5.2 mph, plus reverse. New design features stronger frame and handlebars, rugged construction throughout, improved balance, easier maintenance, Simplicity proved quality. Write for free catalog!

SIMPLICITY MANUFACTURING CO.
6140 Spring Street • Port Washington, Wisconsin

Maker of Wonder Boy Riding Lawn Mowers, Roticut Tiller-Cultivator, Simplicity '700' Riding Tractor

THE SIGN OF QUALITY IN PACKAGED FASTENERS

The Southern Screw Company logo is a circular emblem with a stylized "S" and the words "Southern SCREW COMPANY" and "STATESVILLE - NORTH CAROLINA". Below the logo is a box of screws with a label that reads "SOUTHERN WOOD SCREWS #2 X 8". The box is shown at an angle, with a large white arrow pointing from the logo towards it. Below the box, the text "BUY 'EM BY THE BOX ... AND SAVE!" is written in a bold, sans-serif font.

Wood Screws • Stove Bolts • Machine Screws
Machine Screw Nuts • Tapping Screws • Carriage Bolts
Drive Screws

SOLD THROUGH LEADING HARDWARE AND
BUILDING SUPPLY DEALERS EVERYWHERE

283

an almost magnetic affinity for brain cancer cells. When injected into the bloodstream of a patient, it quickly but temporarily concentrates in abnormal brain tissue. Patients at Brookhaven Medical Center are given a boron injection. A few minutes later, when most of the element has found its way to the tumor, a beam of neutrons from the reactor is directed at the growth. When neutrons bombard the boron, it becomes unstable and breaks up. In this "fission" event energy is released in the form of alpha—particles which are able to penetrate only adjacent cells. Hence, these emanations destroy the surrounding cancerous cells with a minimum of damage to healthy cells.

A Research Hospital

The doctors at Brookhaven emphasize that everything about the hospital is new and experimental. "Our job," says Dr. Stickley, "is to learn *how* to use reactors in medical applications."

In the Medical Research Center's first full year of operation, 115 patients were admitted. Besides direct neutron therapy from the reactor, radioactive isotopes of 11 different elements were used in the diagnosis and treatment of their diseases, which included certain types of brain, blood, bone and abdominal cancer, rheumatoid arthritis, hypertension, diabetes, Parkinson's disease and thyroid disorders.

Since the Brookhaven hospital is purely a research center, no one may be examined or admitted by his own request. Each patient, following referral by his own physician, is accepted with a specific goal in view involving a particular disease and the state of it. "Most of our cancer patients," a Brookhaven official explains, "have already undergone one or more operations and X-ray treatments, and are terminal cases in the last stages of incurable forms of the disease. Many are considered to have only a few days or weeks to live."

Even with odds like that working against them, the Brookhaven doctors have managed to show results that even they call, cautiously, "encouraging."

One early patient, treated for brain tumor, was still going strong 18 months later and had returned to his home and family to take up a relatively normal life again. More recently, a bed patient who had been wheeled into the hospital, walked out under his own power to return home for at least a brief new lease on a life.

"We don't talk about 'cures' around here," the doctors emphasize. "The best we can do perhaps is to increase a patient's comfort and pleasure while he lives."

Administering neutron-capture therapy to a patient is a swift affair. The entire

treatment may be concluded in half an hour or less. But preparations can consume days and involve complete step-by-step rehearsals. Among the curious gadgets used back in the labs are the "phantoms"—life-size hollow "men" of transparent plastic. These are filled with water and chemical solutions that simulate living tissue in radiation reactions. The phantoms have hollow, transparent organs inside, too, each of which can be filled separately with elements of varying radiation-absorption qualities. "The idea," explains Dr. Stickley, "was born during the atom bomb experiments, when we filled teflon bottles with tissue-equivalent liquid to measure radiation effects."

The plastic "people" are used in dry runs to calculate dosage requirements for patients in all kinds of radiation experiments, and sometimes to figure out the best position for the patient in front of the beam port in the treatment room. The weird-looking dummies are actually experimental patients in many ways. They are used to determine the radiation-absorption characteristics of the wide variety of stable elements and isotopes used in diagnosis and treatment. Fluids in the phantoms are bombarded with neutrons from the pile, and effects observed and analyzed.

Radiation-Counting Room

Since everyone is radioactive to a degree, and radiation effects are cumulative, it is important to know just how close to the limit of tolerance a patient is, before and after putting him under the beam. At Brookhaven, this is done in a curious room with ceiling and walls made of steel, cadmium, lead and copper. Inside this shielded, crypt-like vault, the background count of cosmic radiation runs to a mere 10 to 15,000 every 10 minutes—about 100 times less than the normal background outdoors. Here, under a "whole body counter," patients recline while the complex counter picks up accurate radiation measurements from the entire body at once, rather than just from a blood sample as is usually the case. "This way," says Dr. Stanton Cohn, physiologist and radio chemist on the research team, "you get everything. Besides enabling us to determine radiation in patient metabolism, the room is used to check radiation counts in animals and phantom experiments. We also use it to check people from other parts of the country and people in the laboratory, as opposed to the normal count of people outside. We keep track of a lot of radiation levels among certain significant groups."

When a patient is admitted to the hospital, his treatment is set for a specific day and time. Meanwhile, the medical people may be running through pre-treatment ex-

periments with both animals and phantoms.

On the specified day, the pile operator runs down a check-out procedure like an airplane pilot. Water level in the pile is checked, then pressure. The complex heat exchangers operate from 10,000 to 3,000,000 watts—power up to the output of six Chrysler 300's or 60 Volkswagens. Communications nets are tested, along with the primary control system, plus three backup systems and a spare. Thirty minutes before zero hour, control rods are pulled and the pile is activated to "idling" speed—delivering about one kilowatt of power.

In a small preparation room in the reactor building, the patient has been readied. Minutes before the scheduled time, he is wheeled into the treatment room, followed by a medical team of surgeons, orderlies and nurses. Each member moves with precision and speed, groomed by painstaking rehearsal. The patient is carefully positioned in front of the beam port. To control the size of the beam, doctors have inserted a frame of paraffin and lithium fluoride in the opening, and a special combination of shutters has been arranged in the channel to produce the proper beam quality.

Patient Left Alone

A few minutes before treatment, the operator has brought the pile up to full power. At the proper instant, everyone except the patient evacuates the treatment room and the chief surgeon triggers the huge shutter, which slides downward in its shaft, exposing the port. During the brief minutes that the port is open, everyone, excepting the patient gets less than a week's allowable exposure.

Safety measures at the Medical Research Center are highly developed. Everything is sealed off from everything else. Humming pumps keep the reactor building itself under constant negative pressure, so that no stray radiation can ever leak out. No one enters or leaves this building except through airlocks.

Despite the occasional hazards and the many unknowns in this scientific frontier, new knowledge has already begun to pour from the center. Under newly devised treatments, dogs exposed to potentially lethal doses of radiation, have recovered successfully. Interesting studies of hypertension cases, based on the fact that common salt plays an important part in the disorder, have resulted in research using radioactive sodium as a tracer element.

The Medical Research Center's 32 MD's and 16 other scientists are learning that specific radiations can play a part in many of man's ailments, and their aim at Brookhaven is to poke into all of them. ★ ★ ★

WISS CUTS BEST



New Wiss Hy-Power Pruners with vinyl "comfort grips" cut the toughest limbs with ease—protect your hands! No. 907-G (illustrated) 7" long, \$3.25. Others from \$2.95 at hardware, department, and garden supply stores.

OTHER FINE WISS CUTTING TOOLS

GRASS SHEARS

No. 701
\$2.75



Easiest cutting, fastest cutting grass shears you've ever used, with molded vinyl handle grips and special closing latch. Others from \$1.49 to \$5.50.

TIN SNIPS

No. V-13
\$2.50



Only seven inches long, these "mighty midget" snips cut metal, vinyl, rubber, leather. Others 10" to 17" in aviation, combination and solid steel styles.

J. WISS & SONS CO., NEWARK 7, N. J.

World's Largest Manufacturer of Shears, Scissors, Pinking Shears, Skalloping Shears, Metal Cutting Snips and Garden Shears

Owners Report on the Buick Special

(Continued from page 125)

SUMMARY OF OWNERS REPORT BUICK SPECIAL

Excellent 85.4%

Average 12.5%
Poor 2.1%



Satisfied with economy?		Best-liked interior features		Special only car in family?	
As expected.....	50.3%	Upholstery.....	16.9%	Yes, it is.....	44.1%
Better than expected.....	16.6%	Dash panel, instruments.....	16.0%	No, it is not.....	55.9%
Not as good.....	33.1%	Roominess.....	13.0%	Make of other car	
Best-liked features		Seats.....	12.7%	Buick.....	11.8%
Handling ease.....	62.2%	Least-liked interior features		Chevrolet.....	8.8%
Power, performance.....	53.2%	Ash tray.....	5.1%	Other G.M. make.....	6.3%
Comfortable ride.....	44.7%	Lack of leg and headroom.....	3.6%	Ford.....	3.0%
Economy of operation.....	18.1%	Dome light.....	3.3%	Other Ford Co. make.....	3.3%
Styling.....	16.9%	Did consider another compact?		Plymouth.....	1.8%
Easy to park.....	16.0%	Yes, did consider.....	58.9%	Other Chrysler Corp. make.....	1.2%
Compact size.....	16.0%	No, did not consider.....	41.1%	Other U.S. make.....	3.3%
Roominess.....	12.1%	What make?		How is dealer service?	
Roadability.....	9.1%	Falcon.....	23.6%	Excellent.....	70.1%
Most-frequent complaints		F-85.....	20.5%	Average.....	25.6%
None at all.....	33.2%	Comet.....	18.5%	Poor.....	4.3%
Low gas economy.....	7.5%	Corvair.....	16.4%	Would you buy from him again?	
Car too light weight.....	5.7%	Rambler.....	11.3%	Yes, would buy again.....	62.6%
Poor workmanship.....	5.4%	Tempest.....	8.7%	No, would not buy again.....	3.9%
Transmission.....	5.1%	Valiant.....	8.2%	No answer, don't know.....	33.5%
Low road clearance.....	4.8%	Lancer.....	3.6%	Car traded in	
Had engine trouble?		Lark.....	2.1%	Buick.....	29.6%
No trouble.....	86.6%	Considered low-price "big" car?		Chevrolet.....	12.1%
Some trouble.....	12.2%	Yes, did consider.....	33.5%	Other G.M. make.....	10.6%
Considerable trouble.....	1.2%	No, did not consider.....	66.5%	Ford.....	7.2%
What was trouble?		What make?		Other Ford Co. make.....	3.9%
Carburetor.....	3.3%	Chevrolet.....	72.0%	Plymouth.....	4.2%
Timing, missing.....	2.1%	Ford.....	18.0%	Other Chrysler Corp. make.....	3.6%
Ignition system.....	1.2%	Plymouth.....	4.5%	Import.....	8.4%
Best-liked exterior features		Considered medium-priced "big" car?		Other U.S. make.....	4.5%
Clean, simple lines.....	23.2%	Yes, did consider.....	13.9%	Next car will be	
Absence of fins.....	10.3%	No, did not consider.....	86.1%	Buick Special.....	49.3%
Lowness.....	7.2%	What make?		Buick.....	4.8%
Streamlined appearance.....	6.9%	Buick.....	23.9%	Other G.M. make.....	1.2%
Least-liked exterior features		Oldsmobile.....	15.2%	Ford Motor Co. make.....	0.3%
Bumpers.....	6.9%	Pontiac.....	13.0%	Chrysler Corp. make.....	2.1%
Rear end.....	5.4%	Dodge.....	10.9%	A compact car.....	41.7%
Protruding front end.....	4.5%	Mercury.....	6.5%	Undecided.....	

a car so completely new as Buick's Special is put into mass production it takes some time to perfect all phases of manufacture and assembly. Many owners reported that they found no imperfections whatsoever.

"I do not like the fact that the automatic transmission drops back into low gear at a certain high speed."—North Carolina druggist.

"Only drove the car 2800 miles and the transmission bearing is already burned out."—New Jersey construction supervisor.

"After only 3342 miles, I got a low rumbling noise, apparently from the transmission, and it seems to be getting worse."—Wisconsin service station manager.

"There is a definite whine in the automatic transmission while in idle."—Minnesota accountant.

"Get a whine from the transmission at 40 to 45 m.p.h."—West Virginia minister.

Manual transmission owners reported no problems.

"Windshield wiper action is not quite adequate for driving in heavy rain."—Oklahoma accountant.

"Windshield wipers have only one speed."—Louisiana laboratory technician.

"One-speed wipers wipe too fast. Should be variable."—Michigan retail manager.

He's right, variable-speed wipers should be standard, just as twin taillights are.

Now here are the best-liked features of the Buick Special, running from sixth through twelfth in order of frequency of mention.

"This little Buick is great in maneuverability, parking, turning around and general city driving."—Michigan retiree.

"I love the room inside, the compact styling, its economy and the way it runs. To size it all up in a word, it's the most wonderful car on the road today."—Ohio truck driver.

"The Special's 188-inch over-all size was just what I'd been waiting for. I got fed up driving my full-size ark to work and it was too big for my garage. This in-between size suits me to perfection."—New Jersey manufacturer.

(Continued to page 288)

WAR SURPLUS AND OTHER BARGAINS SAVE UP TO 90%



SOUTH WIND HEATER & ACCESSORIES

Manufactured for govt. antarctic expeditions for jeeps and half-tracks. Heating unit puts out over 20,000 B.T.U.'s. Late recirculating type. Burns any type gas. 6 volt system. Fuel consumption extremely low, 1 gal. per 8 hrs. Terrific for trucks, etc. With service & installation manuals & many components. Approx. GOVT. COST \$550. Shpg. wt. 50 lbs. gross. NEW. \$39.95. Limited quantity. Also available in 24 volts. \$39.95.



CHRONOMETRIC TACHOMETER

Built to U.S. Navy & Air Force specs. Jaeger Watch Co. For counting revolutions per min. of any rotating shaft. Can be used on speeds up to 10,000 RPM. Accuracy to 1/10 of 1%. Complete with male & female tips & leatherette hand case. GOVT. COST \$87.50. LIKE NEW. Only \$19.95 ppd.



ELECTRIC STORAGE BATTERY WINCH

Fully reversible with heavy-duty, 2-way drum switch. Heavy-duty motor, 150 to 1 reduction. Drum will handle 60 ft. of 1 1/4" cable. Can be operated manually by hand crank. Use on 6, 12, 24, 32 V. battery. Lift cap. 2000 lbs. plus. Complete with mounting flange, safety locking brake and leads. Ready to install & operate. Dim: 17" long x 9" wide x 7" high. For jeeps, trailers, boats, trucks, etc. Approx. GOVT. COST \$400. NEW. \$46.50



COMPLETE 2-WAY TELEPHONE SYSTEM

For that extra phone in the home, shop, farm, school, etc. Excellent intercom with 2-way buzzer system. Mfd. by Western Electric. Can carry clear conversation for miles. Not a toy. Wt. 11 lbs. Complete with battery & 50' weather-proof wire—ready for use. All this for only \$13.95.



DELCO DC GENERATOR

12 V., 50 AMP. Pedestal mounting. Rugged, ball-bearing construction. 3/4" shaft with key & keyway. 3600 RPM max. Shpg. wt. 55 lbs. Great for boat, truck or battery charger. Approx. GOVT. COST \$97. NEW. \$17.95.



140-1 REDUCTION GEAR

For beaching boats, winches, hoists. Ideal for motor in golf or boy's electric car. DC motor & clutch. Easily reversible wiring diagram furnished. Hi torque, 1" speed. Runs on 6-12 or 24 V. Wt. 65 lbs. gross. Approx. GOVT. COST \$300. LIKE NEW, \$12.00. Matched splined gear for above—\$3.00 ea. *225-1 Reduction Gear—\$13.50

DC JET GENERATOR ARC WELDING KIT

Complete with GE Type CM-77 Generator 130 volts D.C., 400 Amp., 3000 RPM up; ampere rating is for continuous duty, intermittent amperage is 500 to 600 amps., also 2 rheostats, 1 voltage regulator, 1 volt-meter, 1 electrode holder, 2 ea. 25 ft. lengths No. 0 welding cable, 1 welder's mask, 1 toggle switch, 10 lb. vacuum packed 1/4 in. welding rods, pair welder's gloves & spline coupling. All units guaranteed pre-tested. Wt. 110 lbs. Approx. GOVT. COST \$700. All items, now only \$64.50.

*G.E. Generator noted above can be purchased separately. Makes deluxe heavy-duty welder comparable to the finest commercial welders available. Wt. 90 lbs. Approximate GOVT. COST \$400. Gen. alone—\$49.50.



"DELUXE 11" ARC WELDING KIT

Consists of 200 AMP. Gen., voltage reg., ammeter, shunt, adjustable helmet, electrode holder, pr. welder's gloves, 30' welding cable, reactor coil, toggle switch, rheostat. Approx. GOVT. COST \$850. Units guaranteed pre-tested. \$34.95 complete.



HEAVY-DUTY CABLE

—Size No. 0. Four layers insulation. Fiberglass jacket. Use as positive and negative electrode cables for arc welder. High amperage, late government spec. Approximate GOVERNMENT COST \$40. 50' lengths—\$14.50.



BENDIX GEROTOR PUMP & MOTOR

NEW! Use wherever fluid pumping required. Excellent for hydraulic installations and fuel transfer pumps, etc. Has 3/4" pipe connections, built-in relief valve adjustable up to 1500 lbs. Max. cap. 6 GPM. 1 1/2 H.P., 24 V. motor. Use on 12 to 32 V. Approx. GOVT. COST \$350. \$12.95.

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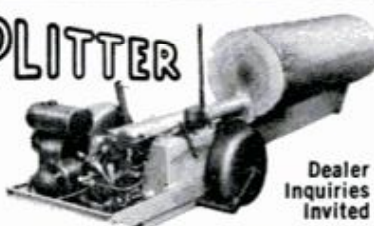
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Professional
Paint Spray
Outfit \$29⁵⁰*

Outfit No. 680
Fits any 1/4 hp motor
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Prices slightly higher—West Coast

Do it yourself and pay for a Speedy Sprayer from the savings on the first paint job! Sprays fences, screens, shutters, furniture rough walls, floors, big jobs in minutes instead of hours. Finish is smooth, flawless. A real professional tool proved by 40 year's use. Get a Speedy Sprayer!

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W. R. BROWN CORP.

Our 40th Year of Portable Paint Sprayers
2635 N. Normandy Ave., Chicago 35, Ill.

FREE! Write for "How to Spray" and catalog.

Special's size is approximately that of cars in its price class 10 or 12 years ago. Does anyone know why they ever got so big?

"There is ample room in this car without excess bulk. I was tired of driving a car as large as a freight train."—N. Carolina telephone employee.

"It handles well in the mountains and in the terrible wind storms we have in this part of the country."—Wyoming sheet metal worker.

"Even though light in weight, it sticks to the road and goes through little snow drifts without any trouble."—Ohio bookkeeper.

"I am particularly impressed with its cornering ability at high speeds."—Alabama Army officer.

"I ordered power steering on my Special but would not have done so had I tried the car without it. This car just doesn't need it."—Wisconsin physician.

That's another advantage of the weight-saving aluminum engine, less weight on front tires, less steering effort required, better distribution of weight, better handling.

"Good road visibility both front and rear."—Tennessee locomotive engineer.

"I highly appreciate the excellent visibility, though this is due more to the general engineering than to the styling."—Kentucky contractor.

"My wife likes the easy steering and she can see over the steering wheel even though she is short."—Louisiana technician.

Here are some additional owner complaints in order of decreasing frequency, numbers six through twelve.

"Car is too low for country roads or broken-country driving."—Tennessee minister.

"Car is too low—scrapes on dirt driveways."—Rhode Island technician.

"I bought this car realizing that it was built strictly for highway driving and would not meet the demands of open country or off-the-road travel. Since the Special's center of gravity is too low for this purpose, I still own and will keep an older car for driving in rough country."—Nebraska geologist.

Special's clearance of 6.5 inches (at center) is not unusually low. The 15-inch wheels, now available at the factory, help some.

"Gas tank is lowest part of the car and is now full of dents. Small wheels fall out of sight into every chuckhole in the road."—Idaho machinist.

"Too hard to get in and out of."—New Jersey clerk.

(Continued to page 290)

SURPLUS SALE

GOVT. SURPLUS
EXCESS INVENTORY
BANKRUPT STOCK

STANDARD DIAL PHONE

• Item #716. Genuine W.E. modern, hi-efficiency dial phone. Use for extension to main line on private system. Use several for complete private system. Work on any system. Shipping weight 8 lbs. Cost govt. \$29.50. SALE.....



\$7.95 FOB

AIR POWER GREASE GUNS

• Item #1427. Super special genuine Lincoln automatic air power grease guns. Ideal for farmers, contractors, etc. Operates off any compressor at 40 to 50 lbs. pressure. Grease tractor, cars rapidly with professional results. Takes hard work out of greasing. List \$60.80. SALE.....



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FARMER-CONTRACTOR PUMP

• Item #200. 2 1/2" size, 16,500 gph. New ball-bearing centrifugal irrigation-contractor pump. 280 gpm 65 ft. head. 6" pulley, 2 1/2" intake, 2" discharge. Wt. 37 lbs. Govt. cost \$98. SALE.....



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POWER PLANTS—GENERATORS

• Deluxe Govt. units 115-v. 60-c. Large selection. Typical values. Write for detailed catalog.
• 1000-watt, 115v, 60-c plant... \$169.95
• 1500-watt, 115-v, 60-c plant... 189.95
• 2500-watt, 115-v, 60-c plant... 259.95
• 3000-watt, 115-v, 60-c plant... 249.50
• 7500-watt, 115/230-v, 60-c plant \$95.00
• 750-watt, AC generator, only... 59.70
• 2000-watt, AC generator, only... 119.50
• 5000-watt, AC generator, only... 209.25
• 12,500-watt, AC generator, only... 329.00



GEAR SPEED REDUCER



• Item #1302. Ratio 20 to 1. Finest precision quiet gears. Ball bearing. Use with AD frac. h.p. motors for speeds down to 20 RPM. Dozens uses—window displays timing, band saws, etc. Heavy cast Al case. Govt. cost \$47.50. SALE.....

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PRESSURE AIR TANK

• Item #446. Steel alloy tank for skin divers, air outfits, hydraulic system reservoir, filling tires, etc.
• 400 p.s.i. Internal volume 280 cu. in. (1 1/4 gal. 1/4" pipe thread port. Size 5 3/4" x 13 1/2". Weight 5 lbs. Govt. cost \$9.00. SALE.....



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SPECIAL OF THE MONTH!

TURBINE WATER PUMP



• Item #204. New Govt. units. Fine for boat bilge pumping, irrigation, sump pump, etc. Finest roller Timken bearings, precision impeller, 1 1/2" intake and discharge ports. 3/4" shaft.
• Pump is self priming on low heads such as bilge pumping. Size 12"x10"x18". Wt. 32 lbs. Est. Govt. Cost \$97.50. SALE.....

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BATTERY ELECTRIC WINCH

• Item #317. New design battery gear reduction winch. Works off 6 or 12 volt storage battery. Powerful unit. Use on jeeps, trucks, docks, etc. Can be started, stopped, reversed with push buttons up to 20 ft. away from unit. Rating 2000 lbs. or better. 12-volts. Size 19"x9"x7". Wt. 65 lbs. Govt. cost \$315. SALE.....



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from \$24.95 Models for almost all 15-75 hp outboard motors. Ask your dealer or write manufacturer.

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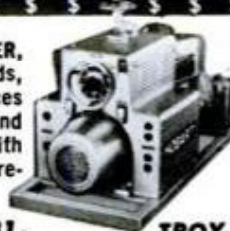
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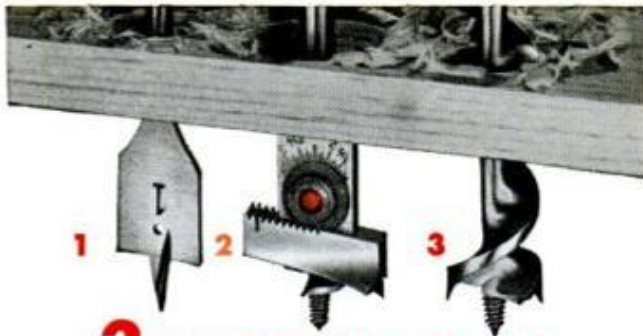
NEW AC SHOP TYPE WELDER, the 180 amp. "Hustler" welds, cuts, burns holes, hardsurfaces and heats metal for bending and forming. Comes complete with accessories. Meets REA requirements.

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NEW WELDER/POWER COMBINATION the 200 amp. "Power/Weld" furnishes DC current for welding and 110/220 volts AC power for running lights, tools, etc. Can be invaluable in a power failure emergency.

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1. Irwin Speedbor "88" for all electric drills. Bores up to 5 times faster in any wood, at any angle. Sizes $\frac{1}{4}$ " to 1", \$.75 each. Sizes $1\frac{1}{8}$ " to $1\frac{1}{2}$ ", \$1.25 each.

2. Irwin No. 22 Micro-Dial expansive bit. Fits all hand braces. Just dial your size. Bores 35 standard holes, $\frac{7}{8}$ " to 3". Only \$4.00. No. 21 small size bores 19 standard holes, $\frac{5}{8}$ " to $1\frac{1}{4}$ ". 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 $\frac{1}{4}$ " to $1\frac{1}{2}$ ". 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.

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Your Choice of Wood or Popular Fiber Glass

Both types now available. Wood boats protected by amazing Boat Life Process, preventing hull deterioration. New catalog is a *must* for anyone considering a boat. Write today for yours FREE. Penn Yan Boats, Inc., 34 Street, Penn Yan, N. Y.

"Would like the car just a bit higher—so low now it is awkward getting in and out."—Massachusetts tire dealer.

"The only thing I don't like about my Buick is that it's hard to get in and out of. I think the seats should be a little higher too."—California brick mason.

This is a legitimate complaint, but it's also an equally legitimate design problem. It is difficult to make a car compact for maneuverability and low for better roadability yet keep it easy to get into as well. Doors with flip-up roof panels are very expensive.

"Interior light does not go on when door is opened."—Ohio auditor.

Buick could afford to put this feature on standard as well as deluxe models.

"Too many rattles and squeaks. Too much body noise when riding in car; air noise around windows and doors is clearly audible and you can hear the gasoline sloshing around in the tank when car is in motion."—Michigan factory superintendent.

"Do not like having to use key to lock the door."—Virginia statistician.

"I miss the ease of locking doors without keys."—Ohio postman.

These are longtime GM owners used to all push-button locks.

"Had a bad noise somewhere in the rear end and the Buick garage couldn't find the cause."—Ohio bus driver.

"There is a bad vibration coming from drive shaft or rear end. The garage men either didn't know how to fix it or are giving me the run around."—New York cook.

"At low speeds in high gear, due to short piston stroke, the engine jerks."—Iowa dairy farmer.

She lugs well above 10-12 m.p.h. in high. Below that, try second gear.

"Buick has to do a little better on body construction. Some road noise and rattles."—Minnesota salesman.

Now let's accent the positive, here are comments on some more best-liked features ranging from 13th through 18th in order of mention.

"This car has a great little transmission, combining all the smoothness of a torque converter without the 'mushiness'."—Michigan engineer.

"Car is so quiet at 45 to 50 miles per hour, you can hear the clock ticking (no joke)."—Michigan office worker.

Hear that, Rolls Royce? Hurrah for our side!

"Built well. Not tinny. No leaks etc."—Texas insurance agent.

"It really is a pleasant sensation to get

POPULAR MECHANICS

into a new car like my '61 Special and not have it squeal, creak, grunt and groan like the jungles at night."—Connecticut machinist.

"The brakes on this car are the best I have ever had on an American car. They compare closely to an Austin-Healey I once owned."—Virginia civil engineer.

Pedal pressure required is a wee bit high. Some might feel the need for power brakes.

"I have owned four Buicks and believe this to be the best Buick of all."—Michigan purchasing director.

"It's a quality car to suit the budget of those who can't afford a high-priced car."—New Jersey teacher.

She comes close to the mark here, although list price of equipped Specials is about \$3000.

"The weight is very evenly distributed. I was going to buy snow tires, but it gets me around very well without them."—Ohio fireman.

"First car I ever owned that is not nose heavy. Does not fish tail in high winds. Balance front and rear is very good."—Michigan field engineer.

"Handles well on rough and gravel roads."—Iowa warehouse worker.

Now, to balance off the report here are the final group of complaints.

"With a vent pane open it is hard to hear another person in the car talk."—California bakery manager.

"Red lights indicating amperes, oil pressure and temperature don't tell a man much. A set of dial gauges would be much better."—Kansas army sergeant.

"The 'idiot lights,' giving temperature, oil pressure and amps, just don't make sense. By the time the lights come on you can be in real trouble. I hate 'em."—Wisconsin vice-president.

Gentlemen, you are so right! Hope Detroit gets your message soon.

"Hard starting on cold mornings."—New York teacher.

"Bumpers too skimpy. Tail pipe is too prominent."—West Virginia chamber of commerce executive.

"Should have better bumper protection fore and aft."—New Jersey pharmacist.

They are right again, take a look at picture on page 125.

Well, this winds up the report. Owners are enthusiastic about the Special, which after a little seasoning and assembly-line shakedown, will be a very fine car indeed. It seems well on the way to filling an important spot in the U.S. auto market, one that's been vacant too long. ★ ★ ★

Schupack's Amazing Tool Bargains! Save up to 100%!*

87 Mounted Wheels & Miniature Cutters. Regular \$11.00 value **\$5.95** P.P.

For cutting and grinding on wood, metal or plastic. Includes 26 mtd. wheels and points on 3/32" shanks; 24 miniature cutters on 3/32" shanks; 25 short shank min. cutters. 12 Bristle Brushes on 3/32" shank. Will fit all electric drills and hand grinders.

FLEXIBLE SHAFT—ONLY \$6.50 P.P.

Fits all electric drills & hand power tools 35 3/4" long. Oilite bearings. Core of specially wound, high carbon steel wire in flexible steel casing. Will accommodate tool shafts up to 1/4" dia. For lathes, electric drills, etc.

2 DRUM SANDERS With 12 Bands in Assorted Grits, 1/2" dia. x 1" long on 1 1/2" arbor with 12 bands... **\$1.50** P.P.

One drum, 1" dia. x 1" long on 1/4" arbor with 6 extra sleeves **\$1.00** P.P.

12 Miniature Cutters. For cutting wood, plastic or metal. Assorted shapes on 3/32" shank... **\$1.50** P.P.

2 Circular saws. On 2 Mandrels—all at one low price. 1" diameter saws on 1/2" Mandrels. For cutting wood, plastic or soft metals **\$1.50** P.P.

10 Morse Taper Shank Drills asstd. sizes up to 1". Brand new. **\$6.75** P. P.

10 Straight Shank Drills up to 1-7/32" asstd. sizes. Brand new. **\$7.25** P. P.

SPECIAL—101 PIECES for ELECTRIC GRINDERS Grinding Wheels, Cut-off Wheels, Sanding Discs, Mounted Stones, Honing Stones, Rotary Cutting Burrs, **\$1.50** P.P. Mandrels, other items.

12 MOUNTED WHEELS and points on 1/4" Shank **\$2.95** 36 for 7.50 p.p.

For grinding on plastic, wood, soft & hard metals. Regular Value \$8.40. **18 Mounted points** on 3/32" shank **\$2.50**; 12 mtd. wheels on 1/4" shank **\$3.60**.

12 India Silicon Carbide and Arkansas Stones—Squares, Rounds, Triangles. An assortment from 3/4" long to 6" long. Fine, medium and coarse. A real **\$9.00** value. **\$4.25** P.P. 12 for

18 Rotary Cutters **\$5.85** P.P.

\$13.50 Value. Assorted size cutters on 1/8" or 3/32" shank. Will fit all hand grinders. Ideal for cutting wood, metal or plastic.

10 HIGH SPEED STEEL REAMERS—Straight and Taper Shanks—all brand new and in excellent condition. Reg. \$25.00 value. **10 for \$4.50** P.P.

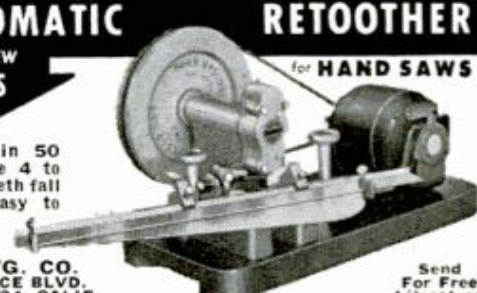
7 H.S. and carbon drills from 6" to 12" in length. Assorted sizes up to 1/4" diam. for drilling in hard to reach places. A reg. **\$1.95** P.P. \$10.00 val. for only

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For surest results always use **GENUINE**

PLASTIC WOOD

Handles like putty—hardens into wood!

They Track Down Hit-and-Runners

(Continued from page 100)

on metal. Blearily, the thought penetrates Conrad's brain that he must have hit something. But he does not stop. All he wants now is to get home—quickly. The intensity of his desire clears his head a bit, and—several miles beyond the accident scene—he turns into his own street, miraculously missing the cars parked there.

4:22 a.m.—Donald Hurto's headless body falls at the feet of the other crew members working in the manhole. The shock is overpowering. One man becomes hysterical; the other helps him from the manhole, then races for a telephone. The street is empty of all but parked cars as he emerges, but the six barricades that had been set up around the manhole are smashed and scattered about the street.

4:50 a.m.—Patrolman Kenneth Nelson arrives. Within minutes, other police patrol cars have come and removed Donald Hurto's remains and his hysterical co-worker—now in a state of shock—to the Presbyterian Hospital.

5:05 a.m.—Police at the scene notify the Hit-and-Run Unit of the accident. By the time Officers Jim Clark and Joseph Neurauter, accompanied by Sgt. Howard Hansen, arrive, the victim's body and his shaken co-worker are gone. All that remains is one of the men who had been working with Donald Hurto and a street scene of destruction. No witnesses—and few tangible clues.

A radio message is flashed to all Chicago police: "Be on lookout for damaged vehicle in vicinity of fatal accident." A group of patrolmen fan out to scour the neighborhood for suspicious vehicles. The hit-and-run officers begin a painstaking search of the accident area. An hour later, they examine the results: scattered fragments of an automobile headlight lens; a splintered strip of chrome, wrenched from the side of a car; a fragmented piece of chrome molding; a torn scrap of canvas—part of the guard around the open manhole—into which paint fragments from the death car had been ground; a small pile of tiny, jagged pieces of metal.

There is also a very significant absence of skid marks. Officer Jim Clark tells his partner: "This guy was so drunk he didn't even see the barricades and try to stop. I'd guess that he'd been drinking in a bar close by, because he couldn't have driven far in that condition without getting into trouble."

7:45 a.m.—Officers Wayne Steffen and Frank O'Brien begin canvassing auto parts stores with the chrome found at the acci-

dent site. The fourth dealer says, "I think these came from a 1957 Dodge Coronet sedan."

The officers find a car of this make and model and compare their fragments. They seem to match. One is a right-front extension molding, the others are broken sections of a hood ornament and the chrome-trim letters Coro-. There's a strip of what looks like black paint inside one of the pieces of molding.

Having tentatively identified the make of car, Steffen and O'Brien turn over the glass and metal fragments to the Chicago Police Crime Laboratory for detailed analysis.

9:30 a.m.—All insurance and commercial credit firms in the Chicago area are alerted to watch for any claims made on 1957 Dodge Coronets with damage on the right front side.

10:45 a.m.—Officers Clark and Neurauter arrive back at police headquarters with the torn and paint-flecked piece of canvas found at the accident scene. But the Crime Laboratory technicians can't work on the canvas immediately. So the two impatient detectives stop by Clark's home, pick up a 500-power microscope belonging to 11-year-old Nancy Clark, and set up a lab of their own in the cluttered quarters of the Hit-and-Run Unit in downtown Chicago.

The flecks which appeared brownish black to the naked eye are unmistakably gray in the microscope lens. The radio message on the death car is modified again to "color probably gray"—and the canvas is turned over to the Crime Lab.

2 p.m.—John Conrad is awakened by his wife, Esther. He felt sick in the morning and went to bed instead of reporting to work. Esther, out on an errand, saw the damage to her husband's car. She rouses him to ask the cause of the damage and the yellow paint ground into the fender. John says he doesn't remember being in an accident. He dresses, goes to the street, examines the car, and returns—still insisting he has no idea what caused the damage.

4 p.m.—Teams of hit-and-run investigators, reporting on a new shift at 3:45, are briefed on the wanted car and assigned patrol areas to search for it. Investigators are told to check out all 1957 Dodge Coronets they find, regardless of color or damage. The Chicago afternoon newspapers play the Hurto death on their front pages.

8 p.m.—Officers begin a painstaking catalogue of possible death cars. The National Auto Theft Bureau Manual discloses that motor numbers of 1957 Dodge Coronets run from 32255001 through 32292657. Officers check Illinois license registration books and

begin to make out cards for every car falling within the Coronet motor number bracket registered in Chicago and vicinity. A quick estimate shows that the total will run in the hundreds.

Tuesday, March 22, 8:00 a.m. — Orders are issued to the Hit-and-Run day crew to call on the 12 Dodge sales and service agencies in Chicago to see if any vehicles have been brought in for front end repairs.

8:30 a.m.— Work continues with a new shift compiling the Coronet card file. While one group of investigators works with the registration books, another group takes the cards already completed and begins to check them out, one by one.

10 a.m.—Sgt. Hazen of the Crime Lab calls to notify hit-and-run investigators that a microscopic examination of Donald Hurto's clothing disclosed light gray paint on the right shoulder of the victim's coat.

Noon—Lt. Ed Berger breaks down the south side of Chicago into areas and assigns a hit-and-run squad to each area to check every street, alley and parking lot for the suspect vehicle, on which a full description is now available.

2 p.m.—Calls begin to pour into police headquarters—most of them anonymous—tipping police on the location of the wanted car as described in the newspapers. Each lead is meticulously checked out. None of the cars show the damage known to exist on the murder car. Routine investigation continues.

Thursday, March 24, 7:15 a.m. — Traffic Patrolman William Lange, on a routine patrol, notices a car improperly parked in a south side residential area. Spotting damage to the car's front end, he examines the car closely, finds that it fills all the requirements, including the estimated damage.

Lange hurries to his radio and checks to see if the wanted vehicle has been located. It hasn't. Lange returns to the car again. As he checks it over, a slight, mild-mannered man appears from a nearby house and asks what Lange is doing.

"Are you the owner of this car?" queries Lange.

"Yes," replies John Conrad.

"Then I'll have to put you under arrest," Lange tells Conrad, "for illegally parking your car."

Lange questions his prisoner about what caused the front-end damage. Conrad claims he doesn't know—that he'd been in some sort of accident but he didn't know what he had hit. Lange tells Conrad the evidence indicates he struck and killed Donald Hurto. He handcuffs Conrad—who offers no resistance—and takes him to a

(Continued to page 294)

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1500 PSI Dbl. Action HYD. CYLINDER
Has 2-3/8" bore, 19" stroke, 1-1/4" shaft, 30 1/2" lgh. Gov't cost approx. \$75.
NEW LOW PRICES No. H-53AU - USED . 1275
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A spring loaded, poppet type valve. Pressure balanced. Off in neutral. Has 1/4" tube ports. Cost Gov't approx. \$30

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Ideal for garages, shops, on boats, jeeps, trucks, etc. Has a 24 to 1 ratio through a worm gear drive, a free-spool, pull-out clutch and a three-speed crank. Comes with 18 ft. of 3/16" steel cable.
Lifts up to 2500 lbs. **3795**
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Drives through a 6-gear train that rotates on self-lubricating, high speed roller bearings. Has 180° offset drive. Take-off shafts are 1-1/4" and 3/8" diam.
Overall size: 6" x 4" x 2 1/2". **995**

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Ideal for preliminary survey work. Reads approximate elevation or depth of any point on the horizon. Gives degree of incline or decline. 2-3/4" in dia. by 5/8" thick. In new condition complete with leather carrying case.
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nearby store where he phones the Hit-and-Run Unit.

8:15 a.m.—Officers Clark and Neurauter arrive at the Conrad car, bringing with them the parts torn from the murder car. The broken pieces of chrome match perfectly.

The officers ask Conrad's permission to take his car to the Police Garage for examination by Crime Lab scientists. He agrees. Conrad is taken to Police Headquarters.

10 a.m.—Officers take a breather after intensive interrogation of Conrad, directed by Sgt. Barney Glavin of Hit-and-Run. The suspect's story is disconnected and contradictory. He says he went out alone about 10 p.m., Sunday, visited several taverns, then . . . "I started to feel that I didn't want to have any more to drink. . . . The last thing I remember is being eastbound on 26th Street and stopping for a light."

10:30 a.m.—The Crime Lab calls Hit-and-Run. Paint samples, tire imprints and matching metal have been removed from the Conrad car for laboratory comparison tests. Photographs and samples of possible blood and brain tissue have also been taken from the right front fender.

10:45 a.m.—Hit-and-Run officers Robert Schoene and Robert Murphy—accompanied by Patrolman Clarence Kerr who is expert in deaf-mute sign language—call at the Conrad apartment. Nervous and distraught, Esther Conrad tells the officers her husband left the apartment Sunday evening with his nephew, Bill Simpson. She insists he returned home at 4:15 a.m.—six minutes before the accident took place—woke her, and they had coffee together. "I asked him later what happened to his car. He didn't remember anything wrong—said he only had two or three drinks of whiskey while he played cards in a tavern."

Nephew Bill Simpson comes unsuspectingly into the apartment. He readily admits being with his uncle until 4 a.m. Monday, when Conrad, "under the influence" left him to drive home alone.

2 p.m.—The Crime Lab reports that: (1) microscopic examination shows the metal fragments found at the death site fit the Conrad car perfectly; (2) human blood and hair were found in several places on the front of the Conrad car.

2:30 p.m.—Faced with his nephew's testimony and the Crime Lab report, Conrad changes his story. He says he told the original version to protect his nephew. He admits being with his nephew until 4 a.m. and drinking heavily. He says further: "Yes, I struck something that night. As I was on my way home, I heard a loud noise.

I blacked out and continued on. I don't know what I hit, but it was certainly a loud noise. . . ."

4 p.m.—At the 35th District Station, Conrad is booked on the following charges: Negligent driving; failure to make a police report; leaving the scene of an accident involving death; leaving the scene of an accident involving a fixed object; and reckless homicide.

March 25, 1960, 9:30 a.m.—Inquest is held at the Cook County Morgue. Verdict by a coroner's jury: "Defendant shall be held to the grand jury for reckless homicide." Conrad is fingerprinted, photographed and turned over to the Sheriff of Cook County pending the grand jury hearing.

The aftermath of the Donald Hurto death follows the pattern of many hit-and-run cases. Conrad was indicted early in May for reckless homicide and found guilty in a bench trial a few weeks later. He was sentenced in June to five years probation, after the victim's widow pointed out that her husband's death couldn't be avenged or his life restored by sending to jail a man who is the sole support for three small children and a wife who can't work. The judge concurred grudgingly, but warned Conrad that if he is reported drinking just once during his probationary period, he will serve out his entire sentence in jail.

Thus did alert detectives, backed by speedy and positive laboratory techniques, track down within three days a hit-and-run driver who had left behind him only death and a few scattered fragments of metal.

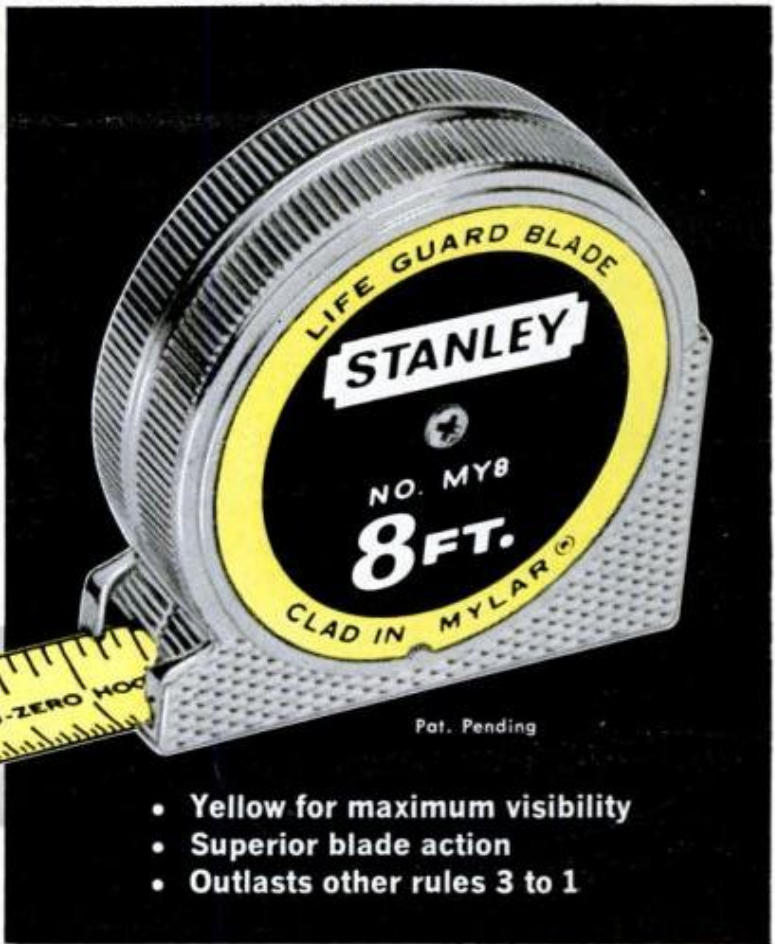
★ ★ ★

AIRLIFT TO THE SOUTH POLE. Ride with a *PM* editor as he spans the icy wastes on what may be the longest aerial life-line ever operated. You'll find his entertaining story in the April issue.

Poison, Peanut Butter and Soda Straws Work Against Fire Ants

Kepone (a poison), soda straws and peanut butter may spell the end of the fire ant as a destructive pest in the South, according to experiments at Alabama Polytechnic Institute. The powerful but slow-acting poison is mixed with the peanut butter and packed into short lengths of the soda straws. Livestock and wildlife ignore the straws, but fire ants clean out the peanut butter within 24 hours. They carry the mixture to their mounds, where it eventually kills the entire population of the ant colony.

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Petroleum Refinery Operator
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Domestic Heating with Oil & Gas
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Heating, Drawing & Estimat'g
Plumbing
Plumbing, Drawing & Estimating
Plumbing & Heating
Plumbing & Steamfitting
Practical Plumbing
Refrigeration
Refrigeration & Air Conditioning
Steamfitting

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Salesmanship
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SHOP PRACTICE

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Gas Welding
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Physical Quality Control of Metals
Practical Millwrighting
Reading Shop Blueprints
Resistance Welding Technology
Rigging
Safety Engin'g Technology
Sheet Metal Worker
Tool Design
Tool Engineering Technology

Toolmaking
Welding Engineering
Technology

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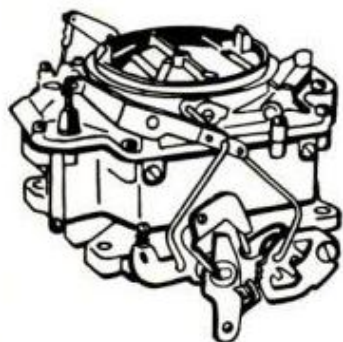
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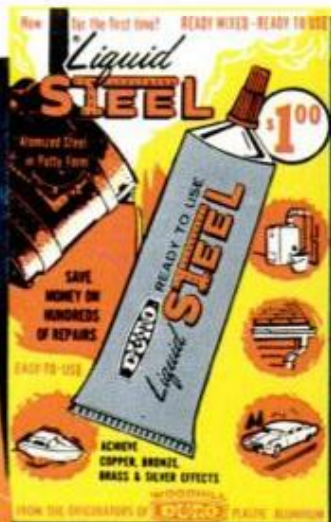


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