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64 BOATING CHANGES

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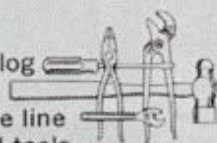
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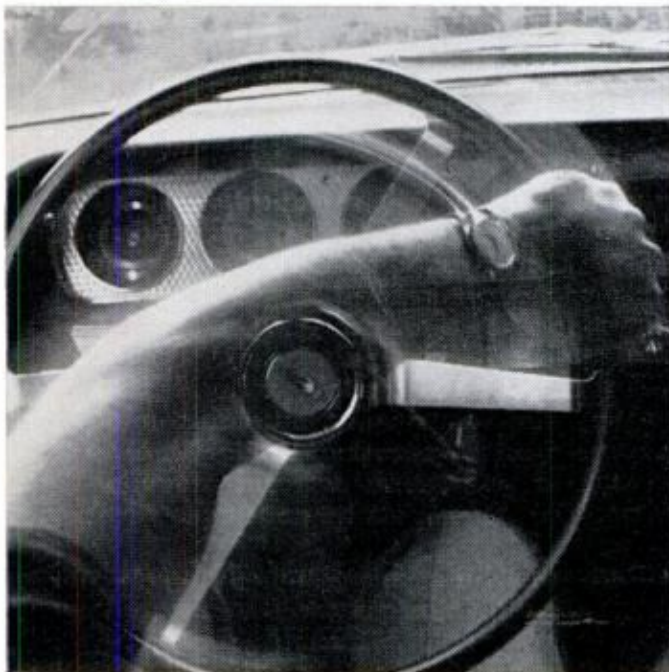
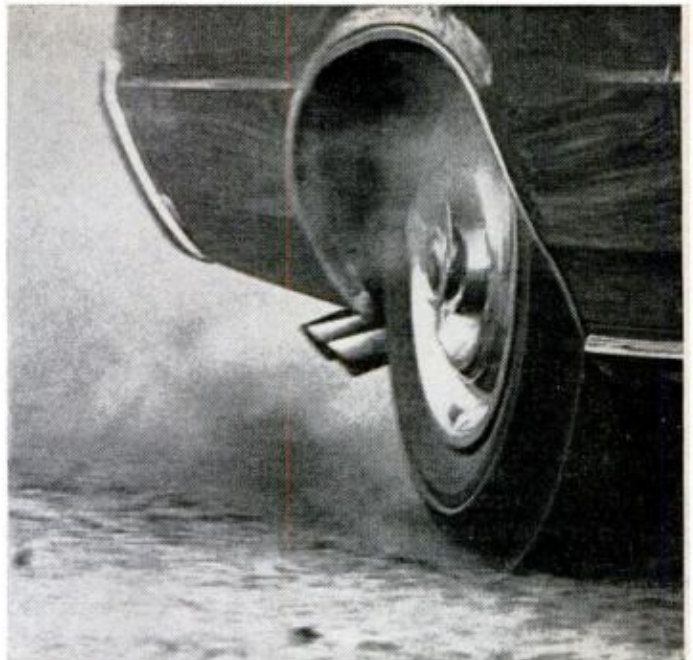
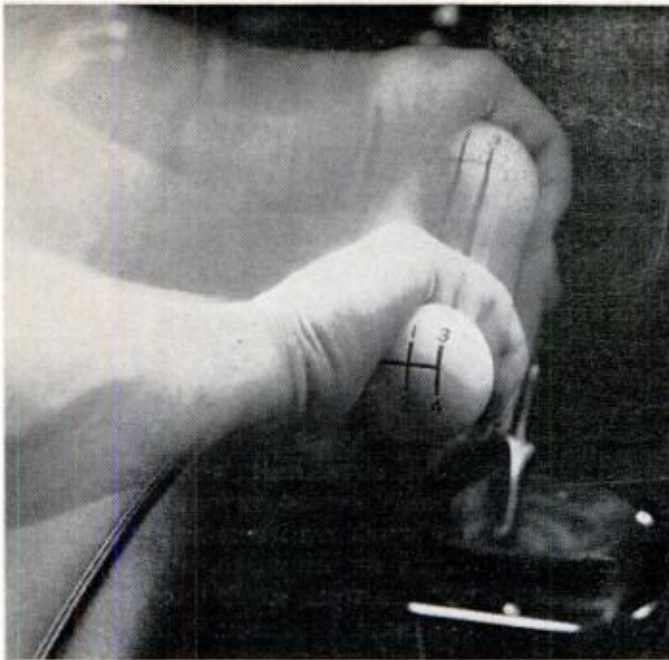
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MARCH 1964

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VOL. 121 NO. 3

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

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Shingles
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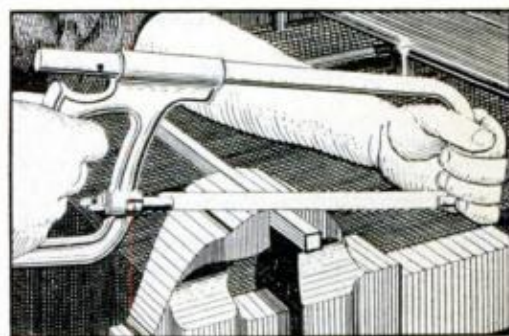
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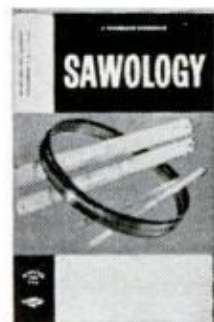
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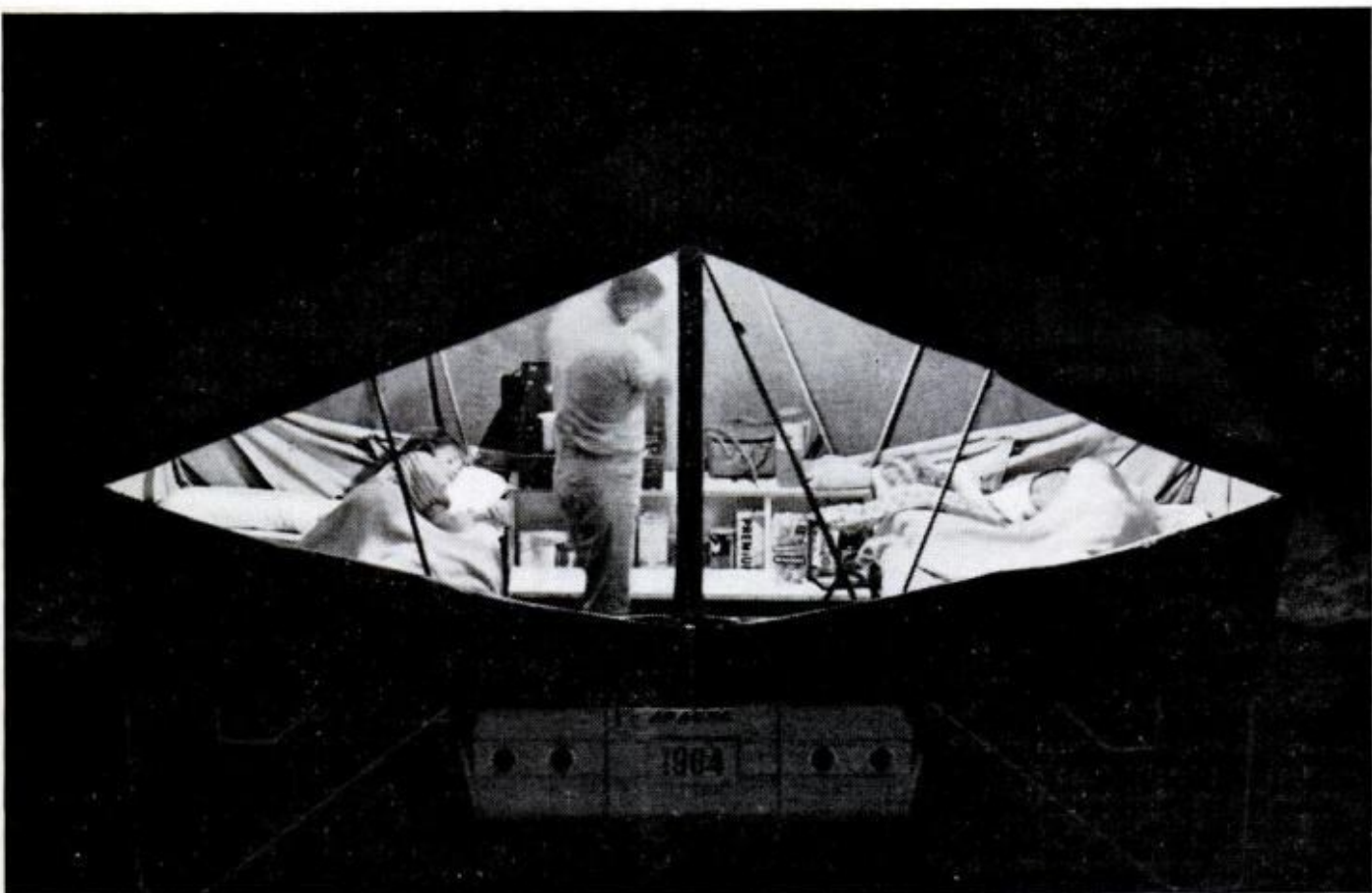
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Over the Editor's Desk

Fat Tire in the Mountains

Here are the results of a few pages of April *PM* plus the time and effort of an old-time tool maker.

I made three scooters (*Fat-Tire Scooter for Sportsmen*, page 151). Now when I invite someone to go fishing with me in the high country of Colorado, they rarely decline. Any one of the scooters will go any-



where a man has the nerve to ride it. In October an elk was brought down out of the mountains on one.

I powered all three scooters with four-horsepower engines. Two were made with tubeless Terra-Tires, and one with a nine-inch-wide tube tire.

I truly have enjoyed—and intend to further enjoy—the scooters. Thanks for the idea.

Wheat Ridge, Colo. BEN L. GOLDEN

No Substitute for *PM*

Your magazine is such a great wealth of information, hints, projects and entertainment that I would find no substitute for it. The simplicity and care which mark all the articles make me wish you people at *PM* would have a go at world politics!

I've taken *PM* ever since I discovered it in Kenya and since I've been in England—and I'll keep it up when I go to Australia soon. Never missed a copy yet.

Exeter, England A. J. VIDLER

Instant Gunslingers

The article *Duffer to Sharpshooter* in

90 Minutes (page 82, Dec. *PM*) seemed very brief. There must be more detail involved in acquiring this skill of sight shooting than was given in the article.

Los Alamos, N.M. EDWARD J. ROURKE

"Actually, the article covered the basics of this technique quite thoroughly," responds *Outdoors* Editor Stu James. "Like most forms of shooting, it is quite simple—and the major requirement for perfection is a lot of practice. I was skeptical . . . but after one day of trying it, I had to admit it worked—and amazingly well.

"Point the gun, look directly above the target and shoot. That's it. Before a day is over, you can swing around, sight and break a wafer the size of a 25-cent piece."

Tube for Spout

I read all of *PM* with interest, but of special note was the letter from the policeman who dismantles his flashlight to make a gasoline pouring spout (*Editor's Desk*, page 10, July *PM*). Another good way is to use a length of bicycle inner tube; it will fit on two or five-gallon gas cans.

St. Johns, Mich. J. P. MORIARTY

Gunning for Hanks

Sam Hanks may have been a topnotch race driver, but any half-rate drag driver in the country could soundly trounce him with equal cars in a contest of straight-line acceleration. His times are agonizingly slow (*Racing Champ Track Tests the Hot-Engined Ford, Chevy, Dodge, Pontiac, Plymouth*, page 85, Jan. *PM*).

Although Mr. Hanks obviously gets a bang out of hot machinery, he does not care much about the cars' condition. I have never seen cars tested so abusively and put through such a torture test. It was all very entertaining, though, what with overheating engines, oil-starved pistons and crash-stop-ruined tires.

Mr. Hanks' evaluations of these automobiles were a little too glowing and he seemed to find more to praise about the handling qualities of American cars than one is accustomed to hearing. Sure, the lap times were impressive, but they were achieved not with fine handling, but rather with an abundance of brute horsepower. Dudley, Mass. JOHN M. HARVANEK III

And who filled your tank with nitro, John? As we pointed out, these cars were early-run models with only a few hundred miles on them. Engines were factory-stiff. Rings hadn't worn in. Carbs were "as is." Distributors hadn't been re-set to compensate for seating of the points. And

[\(Please turn to page 10\)](#)

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"At the age of 52, I feel that a new life is beginning, thanks to the opportunity you offered." Robert Hughes, Costa Mesa, California.



"Only through your help was I in a position to apply for my new job, much less be accepted for it." —Robert F. Kinney, Butte, Montana.



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Hanks had never driven these cars before, let alone practiced in them. Mister "Top Eliminator" at the National Drags might be slow, too, under these conditions.

One driver dragged our test Plymouth at Willow Springs a couple thousand miles later and turned 95.5 m.p.h., four miles faster than the engine went when tight.

As for "overheating engines, oil-starved pistons and crash-stop-ruined tires," the rugged Detroit iron wasn't hurt. You are right, of course, when you say Hanks "seemed to find more to praise about the handling qualities of American cars than one is accustomed to hearing." Could be, he was on the right track.

One sports car driver killed himself spinning off Willow Springs a few weeks after Sam ran our tests there. This chap had a 298-cube engine, away under the "brute horsepower" of our '64s. So maybe Hanks has just a trace of that "fine handling" that you deny him, after all.

In your test of the '64 high-performance options, you state, "Except for Pontiac, every car PM tested can be made even hotter than our test cars, with additional factory equipment." What about the 370-horsepower Pontiac option?

Pullman, Wash. SAMUEL E. COOK

Although not available to us for testing, it does exist, so our statement was wrong. And the 425-hp. Ford tested had two four-barrel carbs, not three two-barrel carbs as listed in our specs chart. Both errors came from manufacturers' public relations offices, but we should have caught them.

We thoroughly enjoyed your January story on testing the 1964 "street performance" automobiles.

Your selection of Sam Hanks as a "tester" certainly indicates your interest in providing your readers with credible testing techniques.

One phase of the story we would like very much to clarify: Sam is quoted: "The Dodge was running out of fuel badly on Turn Two, the long sweep to the right. . . I think the fuel was floating away from the main jets, as often happens in stock car racing."

And right he was. The car in question was a showroom stock and had been prepared only for street use and not set up for the difficulties encountered at Willow Springs Raceway. During a subsequent test at the same track, we adjusted the float level and cured the problem.

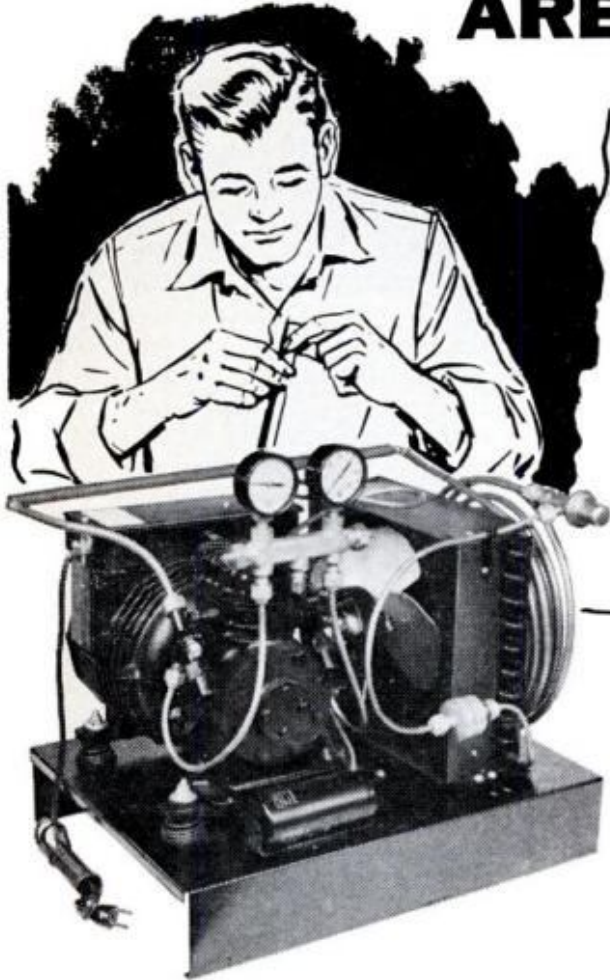
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| 3. I prefer a job that has lots of variety rather than "the same old routine" every day. | <input type="checkbox"/> | <input type="checkbox"/> |
| 4. I like to work without someone always "looking over my shoulder." | <input type="checkbox"/> | <input type="checkbox"/> |
| 5. I'd like to be my own boss—with a business of my own. | <input type="checkbox"/> | <input type="checkbox"/> |
| 6. I'm more interested in practical kit training experience than "book theory". | <input type="checkbox"/> | <input type="checkbox"/> |
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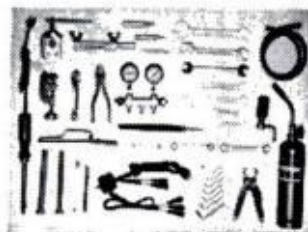
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There's plenty of loot in outer space, say experts of the National Aeronautics and Space Administration. They estimate that the asteroid Ivar could yield \$50 trillion worth of platinum metals; and Ivar is only one of millions of asteroids circling the sun between Mars and Jupiter. Asteroids are believed to be fragments of planets which blew up long ago. Future spaceships may pull up alongside these drifting chunks of matter so astronauts can chip off samples.

Gas eruptions on the moon have apparently been spotted by U.S. observatories, bearing out Russian reports of lunar eruptions. Three reddish spots were seen near the crater Aristarchus by astronomers at Lowell Observatory in Flagstaff, Ariz., last October. A month later, the same phenomena were seen near the rim of the crater. Nobel Laureate Dr. Harold C. Urey believes the eruptions are caused by a form of carbon unknown on the earth.

Monarch butterflies migrate hundreds of miles to escape the winter cold. Two young boys in Ware, Mass., W. Chandler and Timothy Lincoln raised butterflies this summer and tagged them before release in the hope of pinpointing migratory habits. Fourteen days after releasing one group, a tagged Monarch was picked up more than 1200 miles away in Venice, Fla.

Earth's greatest river, the Amazon, is getting its first modern survey. A joint U.S.-Brazil government team is measuring the flow of water and silt, taking the river's temperature, mapping part of it and making other hydrographic studies of the 3900-mile-long stream.

Playing it cool Down Under. Six 70-pound blocks of ice came in mighty handy recently for workmen trying to install a 3000-pound safe in an Australian bank. The safe's location was partly below floor level and situated so that no ordinary lowering technique would do the job. A bright

young engineer called for chunks of ice to bring the lower surface up to floor level, slid the safe onto the ice and then waited and mopped. It took a week for the ice to melt, lowering the safe into position.

Law clerks may become victims of automation. A Univac computer was recently installed by a New York legal research firm and over a three-year period crammed with more than a million summaries of legal decisions. For a fee, it will come up with numerous precedents for any desired type of case.

Seventeen prison inmates in California recently went for more than 14 weeks without solid food. The men weren't on a hunger strike; instead they were participating in experiments with a liquid diet which may be used in the U.S. space program—and may ultimately feed hungry people around the globe. All 17 remained in good health on two and a half quarts of synthetic liquids a day, which contained all the nutriments necessary for life.

First nuclear ship for Japan is on the drawing board and has a launching target date of sometime in the summer of 1969. The 6350-ton vessel will be an oceanographic survey ship specially designed for research work in the polar regions.

Electronic circuits that can heal themselves have been developed. Two types are now being tested. In one, metals which break under stress grow "whiskers" across the circuit breaks. In the other, the heat of a failing connection melts an alloy nearby which "solders" the break.

A real constant in a changing world has been found by a Scottish scientist. He studied ancient specimens of parchment and leather, including fragments from the Dead Sea Scrolls and a piece of woolly sheepskin found in Central Asia, and has found that the average diameter of fine wool hasn't changed since 400 B.C.

Cosmic radiation apparently reduces the hatching rate of eggs laid by offspring of flies exposed to the rays 20 miles above the earth, two doctors from India report. No increase in the mutation rate, however, was apparent.

Surgery can relieve the pain in knee joints swollen from rheumatoid arthritis, according to the Journal of the American Medical Association. Dr. Howard P. Aidem and Dr. Lenox D. Baker of Duke University Medical Center reported that they

(Please turn to page 14)

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Science Worldwide

(Continued from page 12)

removed diseased membranes from the knees of 24 patients. The operation arrested the rheumatoid process and prevented joint destruction.

Hard objects swallowed by children and careless adults can now be removed without surgery. Two medical instruments which include powerful magnets have been developed by General Electric for extracting sharp metal objects from the body. Both devices consist of a stainless steel cable encased in plastic. One of these instruments will remove objects from the stomach.

Card trick. German hydrographers studying oil pollution of the sea are dropping thousands of special cards onto the ocean to find out how fast oil patches drift on the surface. The cards, encased in double plastic envelopes, are used because they float flat on the water's surface and simulate the movement of oil patches better than bottles. It was found that the drifting speed of the cards was about four percent of the wind velocity.

Inkless fingerprinting is claimed by a

Japanese police scientist. Shinmei Sakito, deputy chief of the national police laboratory in Tokyo, says his electronic fingerprinting device eliminates dirty fingers. One need only place his fingers for a second on a special sheet of paper charged with static electricity. The sheet is put in a "developing" box containing iron and glass powder. This brings out the prints on the paper with "more clearness than ink," Mr. Sakito claims.

Telephones for deaf-mutes who are also blind have been developed in Israel. The device, still in the research stage, consists of an apparatus in which the five fingers of the "speaker" rest on vibration-sending keys, and the fingers of the "listener" rest on sensitive vibration-receiving diaphragms. A code system is used for "talking." The signals can be transmitted by both radio and telephone.

Handy-sized instrument for continuously sampling the air breathed by individual workers in research and industry has been developed in Britain. Although intended to assess exposure to radioactive particles and vapors, it is also suitable for other toxic dusts, fumes, vapors and gases. A filter disk traps potentially toxic sub-

(Please turn to page 16)



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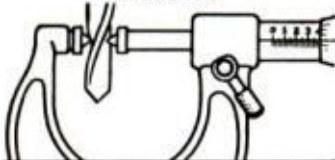
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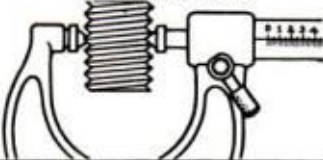


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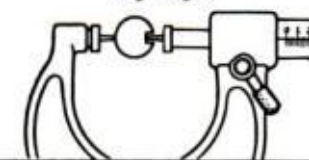
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(Continued from page 14)

stances which can later be examined by micro-chemical analysis or by Geiger counter. The device is carried on the person by a shoulder strap. Air is drawn into the instrument by a diaphragm pump through a sampling head that is pinned to the worker's lapel.

A film-chewing editor in Hollywood has been found to have skin that "develops" in the sunlight. The man sought help after areas of his skin began turning blue-gray when exposed to the sun. Doctors found he had a condition known as argyria, caused by silver in the body. Further investigation revealed that the man had a habit of chewing pieces of film while he worked at his television station job. Film coating contains silver—and when he went out into the sun he was literally "developed" in the same way that film turns dark in the sunlight.

Gasoline by the brickful may be the fuel of the future. Chemists at the Southwest Research Institute have developed a means of encasing gasoline in microscopic capsules which form a leak-proof sponge. When the fuel is needed, you simply squeeze it out.

Blimps back? A West German group may be instrumental in bringing the airship back into the air transportation industry. It plans to build one as a tourist attraction. The helium-lifted craft will carry 80 passengers.

Bubonic plague, the "black death" of the Middle Ages, is still a dreaded scourge—in Asia and Africa. Some 1420 deaths were reported last year by the World Health Organization, a drop in the bucket to the 100,000,000 dead during a 6th Century outbreak. The U.S. averages about one case a year, a Public Health official told *PM*, most of them reported from New Mexico, Arizona or California.

Too fat? Here's a formula to find out if you need to shed a few pounds, devised by a metabolic researcher. Subtract your waistline (in inches) from your height. If the difference is 33 or less, you're too heavy; if it's 38 or more, you can add a few pounds. Thus, if you are five feet, nine inches, with a 32-inch waist, you subtract 32 from 69 to get a score of 37.

John P. McNeel
Science Editor

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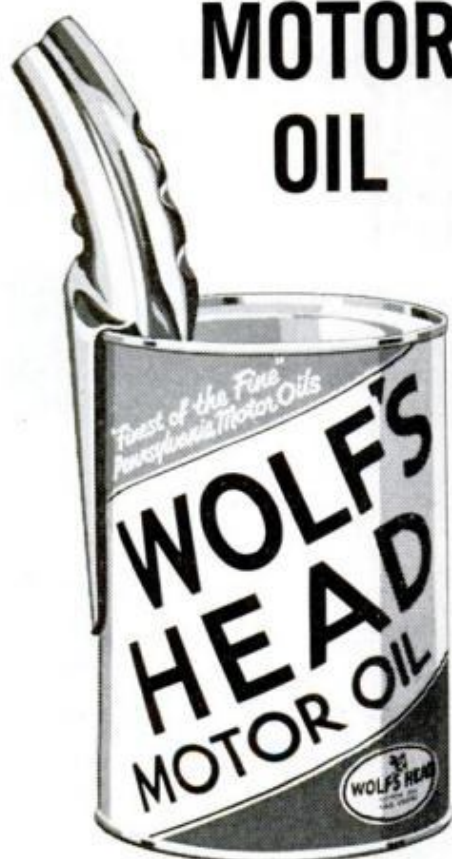
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Russia is looking forward to challenging U.S. yachtsmen for the coveted America's Cup. This fact was brought out in a recent meeting we had with J. Anthony Boyden, owner of *Sovereign*, the British challenger for the 1964 Cup race. "The Russians are racing 12-meter yachts of their own design on the Black Sea," Boyden said. "We've been told by neutral parties that they seem to be quite fast. We invited them to race against us, but nothing came of it and now we're much too busy getting ready for the Cup challenge. People at the Russian embassy in London have stated that there is great interest in a challenge against the U.S. This, I think, would make a rather exciting Cup race."

Trap shooters with enough back-yard space for banging away at clay targets are often discouraged by the resultant debris that is difficult to clean up. You can eliminate the mess, save money, and have some exciting shooting by using ice cubes for targets. You launch them with a regular sling shot, and the broken pieces simply melt away.

Tips from readers. Bob Finke of Lombard, Ill., uses small plastic pill containers, inexpensively obtained from a drug-gist, for keeping fishing flies and lures in his tackle box. Also used for soaking leaders and keeping live bait, they are airtight and will float if dropped in the water . . . Paul Brey of Ontario, Wis., clips a tiny mirror to the bill of his hunting cap to give him 360-degree visibility. He writes: "Try this trick before you laugh too loudly. Last year I shot an eight-point buck that was sneaking away from behind me. The mirror did the trick."

Modern archers using fiberglas bows and arrows are better marksmen than the famed Robin Hood or Tamerlane. This is the finding of Dr. Paul Klopsteg of the Smithsonian Institution, who recently completed a study on the evolution of archery. He also makes the interesting point that there are more archers in the U.S. today (over six million) than were in all the Indian nations at any one time.

STUART JAMES

Outdoors Editor

POPULAR MECHANICS

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Mr. Burnett and one helper serviced this \$140 "after-supper" job. The national price guide

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To own a business is much easier than you think. We show you how . . . step by step. The 24 page fully illustrated booklet we'll mail you (with no obligation) explains how most of your gross profit becomes a clear net profit to you.



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job, do servicing evening or weekends, or you can line up jobs for your servicemen to do while your customer list grows . . . then switch to full time. One small job a day brings a good starting income . . . and you operate from your home phone.

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All six services are rendered "on location" in homes, offices, hotels, theatres, churches, clubs, motels and institutions. These superior, safer and convenient methods spread Duraclean dealerships throughout the world.

National Magazine advertising explains

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Many men have said to us, "I can't afford to give up my job till I know I have a sure thing . . . a sound business that will provide both security and a better living for my family."

That made sense to us so we worked out such a plan. You can start small and grow big just as we did. A third of a century ago Duraclean was an idea . . . but it caught fire and spread rapidly to a worldwide service. It spread because it was based upon (1) superior processes and (2) proven customer-getting methods. You don't experiment. You use tested, proven methods. You have our backing and "know how."

Our first service, the care of carpets and upholstery, exemplifies these superiorities. It not only cleans; it enlivens the fibers . . . revives dull colors. Pile rises with new life. Furnishings are used again in a few hours.

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You have pre-tested newspaper and yellow-page ads, commercials, and a full mailing program.

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Government figures show \$750 million yearly potential just in rug and furniture cleaning. You have five other services . . . fully explained in the free booklet.

A few hundred dollars establishes YOUR OWN business. A day's profit more than takes care of the monthly payments we finance for you.

We furnish electric equipment and enough materials to return your TOTAL investment. It is surprisingly easy to learn this business. You can decide from the information we will send you whether to apply for a dealership. So, with no obligation whatever, mail the coupon TODAY.

Own a Nationally Advertised Business

Your Services Are Endorsed by McCall's Magazine, American Research & Testing Laboratories and by leading Carpet Mills & Furniture Makers

What Dealers Say:

Langdon Lawson: National advertising is tops, creates leads. In September, working alone, jobs totaled \$1,475.

Charles Randal: Business keeps growing. Made as much as \$120 in one day.

D. Kern: Duraclean's proven-best process and the continuous help from headquarters gave me a big jump on all competition.

George Byers: For University, my total billing was \$2,416. Total expenses \$814.

Gerald Wehrauch: Three persons called me—saw Duraclean advertised in magazines.

Edward Hoy: A smoke damage insurance claim bill was \$186. All work was done by me in exactly 8 hours and 2 minutes.

W. C. Smith: Earned \$650 one week. Volume keeps getting bigger.

Service man for dealer C. Weed: Furniture was filthy black. When through, I was amazed how clean.

John E. Frost: First 2 months I grossed \$1,000 part-time.

Loren Farris: I'm proud to be independent at 30. I wish I had known about Duraclean earlier.

Earl Davis: Our sales increased \$17,660 this year.

Ed. Kramsky: In 2 years, now have two assistants, a nice home and real security for my family.

Resale Service

If, because of illness, moving or for any reason a dealer wants to sell, we maintain a service to locate buyers and to help him sell.

Dealerships resell at up to 10 times the dealer's cost. R.D.K., after 5 months, sold for \$2,000 above his cost. L.L., after 30 months, got \$7,116 more than he had paid. The value of your dealership and franchise grows monthly.

FREE BOOKLET tells how to Start Your Own Business

With no obligation, we'll mail you a letter and 24 page booklet explaining this business . . . how and why your income grows . . . how we help finance you.

Then decide if this opportunity fulfills your dream of independence and a much bigger income.

Your location could be taken tomorrow . . . so mail coupon today.

FIND OUT—NO OBLIGATION



Mail this coupon TODAY It may put you in business

Duraclean Co., 4-163 Duraclean Bldg., Deerfield, Ill. 60015

With no obligation, mail letter with 24 page illustrated booklet explaining how I can increase my income and family security with a Duraclean Dealership.

Name _____
 Address _____
 City _____ Zone _____ State _____



Sidelights from the SERVICES

By William R. Kreh

Eyes got a secret. Veteran security people in the Pentagon were agog when papers and military documents bearing stamps reading "For Blue Eyes Only" crossed their desks. Familiar with "Confidential," "Top Secret" and "Secret," the secretary with brown eyes was green eyed until she learned that "Blue Eyes" was the code name used for the commander of the Blue forces in war game maneuvers then being held.

Bouncing radio waves off artificial clouds of gas is being studied by the Army as a possible solution to the communications problem faced in jungle warfare. Tests at White Sands Missile Range have recently involved relaying radio signals from one point to another via a man-made gas cloud. Chemicals are shot aloft in a Raven rocket and at a set altitude are released to form a cloud against which sig-

nals can be bounced. Forces in Southeast Asia have had difficulty with short-range communications because heavy foliage blocks the radio waves.

Petite but potent. A nuclear artillery shell that's only six inches in diameter has been developed for the Army and Marine Corps. The shell, smallest atomic weapon yet, carries a warhead with an explosive equal to several hundred tons of TNT. It's fired in the two services' standard 155-mm. howitzer.

What next? Now it's instant cottage cheese. The Air Force is testing dehydrated cottage cheese for use in overseas areas where the real stuff isn't available. First reports are that by adding a little water to the dry product, you can't tell it from the fresh dairy food. Air Force researchers are also working on dehydrated hot dogs and sausages.

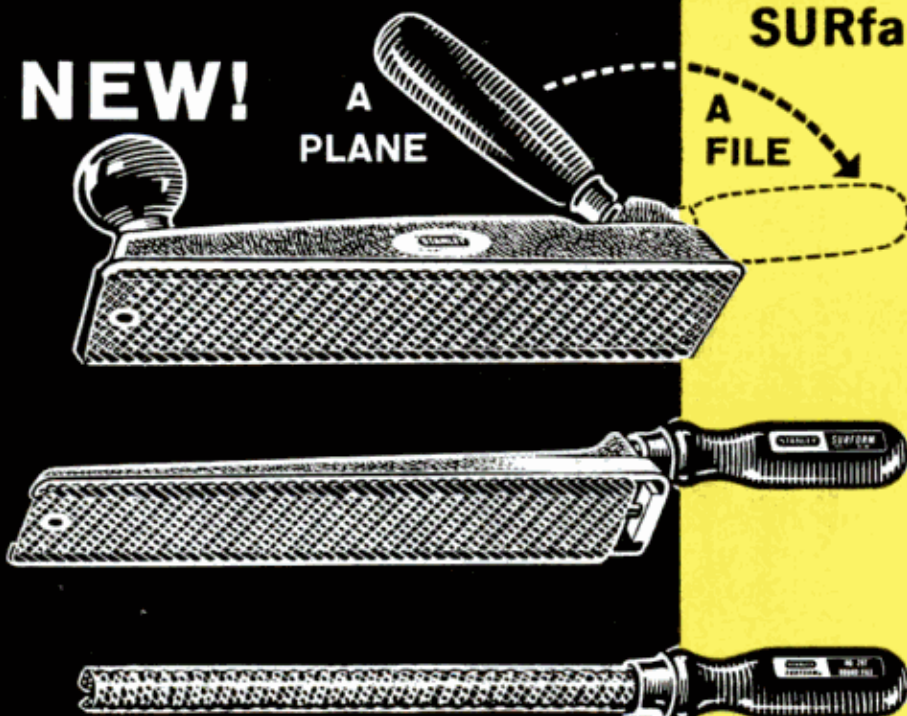
Buried battleship. The USS *Indiana*, which earned nine battle stars in World War II, is being laid to rest. Part of her will be buried high on a desert mountain-side overlooking Salt Lake City. Her 12-inch steel plating is being shipped to Utah to be used to build an underground room

Easy-to-use

NEW!

A PLANE

A FILE



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SURface FORMing tools

Save time forming and trimming wood, plywood, composition boards, plastics, asphalt tile, aluminum and other materials.

2-WAY TOOL—

Adjustable, 2-position handle converts in seconds to a file...to a plane. **No. 285**

FILE TYPES—

No. 295 Standard File works faster on wood than a rasp. New Offset Handle protects fingers and allows full stroke. **No. 297** Round File is ideal for enlarging holes and forming decorative cuts.

THE **STANLEY** WORKS

NEW BRITAIN / CONNECTICUT

for radiation research at the University of Utah College of Medicine. A total of 210 tons of the pre-atomic-age steel, coated with a nonradioactive paint, will be used as walls to screen out background radiation in the new research lab.

Possible solution to one of the greatest hazards facing low-flying helicopter pilots—power lines and other cables—may be a new device developed for the Army. It is an electronic warning system that's capable of spotting a one-quarter-inch-diameter steel cable 1300 feet away. The system includes both an audible alarm and a screen which shows the location of the obstacle in relation to the aircraft.

Underwater suburbia. This May or June, a team of Navy men will take up living in a capsule 200 feet beneath the sea near the Navy's research tower at Argus Island near Bermuda. At intervals, the men will leave the capsule—called Sealab 1—to perform tasks in the open water nearby and then return to the capsule when their work is completed.

Military trainees learning to fire artillery pieces no longer need expensive live ammunition. A Navy scientist has invented

a system for firing projectiles from artillery weapons using compressed air. It consists basically of a cylinder of compressed air which is fastened to the gun barrel. Trainees follow the same procedures they would follow for firing an actual combat gun, but compressed air instead of powder drives the projectile.

A special hood that lets sailors breathe air on the way to the surface after escaping from a submerged submarine has been adopted for use in the Navy. The new escape apparatus can be used in depths to 300 feet. Before this, submariners had to hold their breath enroute to the surface. Since this last breath they took was usually just before entering the sub's escape lock, there could be times when smoke or chlorine gas present in the lock might cause choking or coughing on the way to the surface.

A vacuum telescope is being designed to help Air Force researchers study the sun. The entire telescope will be sealed in a vacuum to eliminate the normal distortion caused by the sun's rays. Scientists hope the telescope will provide extra accurate observations of the sun, vital to any study of solar flares.

TOOLS...

of 1,001 uses

POCKET TYPE—

Compact . . . fits apron or overalls pocket. Fast and handy for trimming on the job. No. 399

PLANE TYPE—

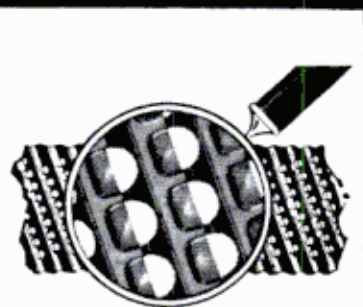
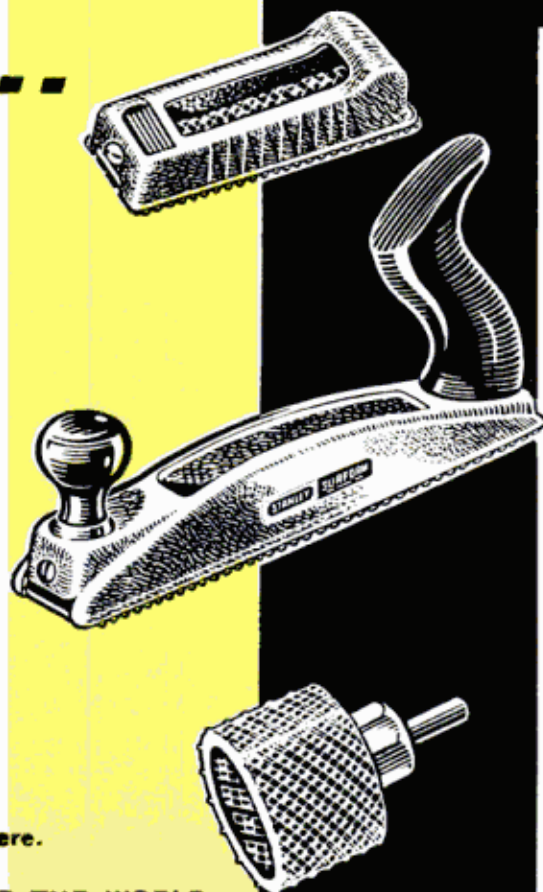
Use like a plane. Comfortable handle and knob assure positive control. Takes same size blade as 2-way and standard file type. No. 296

DRUM TYPE—

Recommended for use in drill press. For contour, circular or straight cuts . . . shaping, cutting, forming, milling operations. No. H386

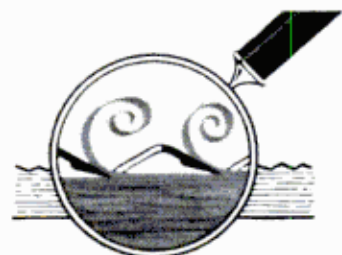
See these at better stores everywhere.

STANLEY—THE TOOL BOX OF THE WORLD



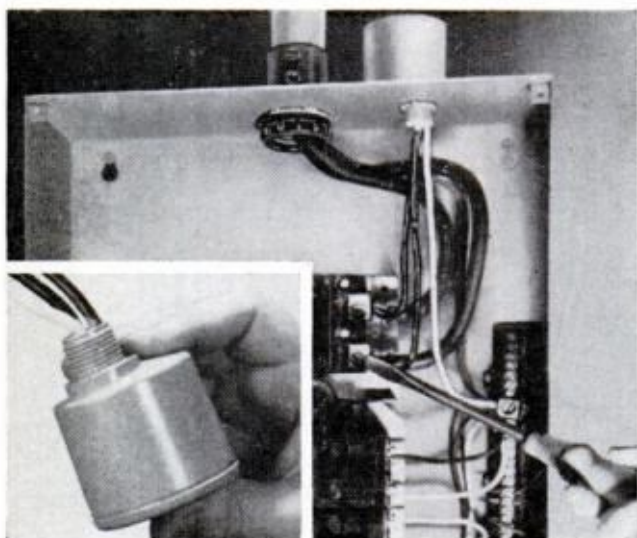
HOW THEY WORK

450 razor-sharp teeth give controlled depth of cut. Clean cutting. No clogging.



New on the Market

AEROSOL CALKING can is filled with a rubberized sealant that is said to give a permanent waterproof seal and to keep its resiliency in all kinds of weather. Applied without tools, around air conditioners, aluminum doors and windows, gutter joints, etc. Costs about \$1.29. Armstrong, Lancaster, Pa.



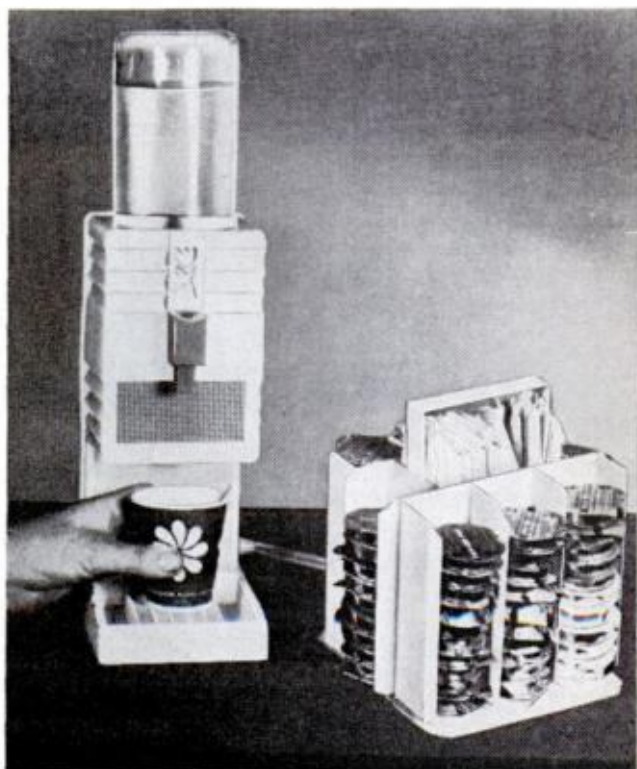
HOME LIGHTNING PROTECTOR (inset) is a switch that responds to sudden power surges in your house wiring. When lightning enters the circuit, the protector diverts it harmlessly to ground. Manufacturer claims you won't even see a flicker in your lights. About \$8.95. General Electric, Schenectady, N.Y.

LIQUID GLASS AUTO POLISH is made of glass melted by X-rays, says the manufacturer. The company claims this product removes road film, dirt, oxidized paint, etc. and leaves a coating so hard it can only be removed by sanding. Retail for \$2.50 a pint, from Volz Enterprises, 602 Ferris St., Ypsilanti, Mich.



TO PROTECT THE PAINT on the top edge of your car door, and to make the door feel cooler in hot weather, press an Auto-Sil-Shield into place. Made of fluted plastic with an adhesive backing. Cost \$1.25 a pair, prepaid. Falcon Products, Incorporated, P.O. Box 331, 27 E. Okeechobee Rd., Hialeah, Fla.

HOT DRINK DISPENSER: With the No. 6 Snak-Bar, you can have hot chocolate, coffee, soup, tea, etc. on hand at all times. Heats and measures the necessary water instantly. Sells for \$34.95. Prepared beverage powders also available for 7½¢ a packet. Allen Electronics, Inc., 305 Plane Street, Newark, N.J.





This car set 26 dragstrip records. What's a drag?

Visualize a quarter-mile strip of roped-off pavement. Bring 2 cars up to the starting line at one end. Start them off.

Then time how long it takes each to travel to the other end. Also record their speeds as they cross the finish line.

That's one of the elimination heats in dragstrip competition. A million-fan sport, sanctioned by national organizations, operating under clearly defined rules, scrupulously observed.

It calls for tremendous acceleration. It also calls for expert drivers.

Tom Grove of Oakland, California, for example.

In one season, his "Melrose Missile" (a Plymouth Super Stock with factory-option engine) broke 26 track records.

Cars from Chrysler Corporation have a fabulous record in dragstrip competition. It further confirms the excellence of Chrysler Corporation engineering, developed through years of research and testing. For example: The superiority of Chrysler Corporation automatic transmissions over others including stick shifts!

For personal confirmation of this excellence take a ride in one of our new '64's. Engineered for greater response, dependability, performance and safety for you.

Plymouth • Chrysler • Imperial • Dodge

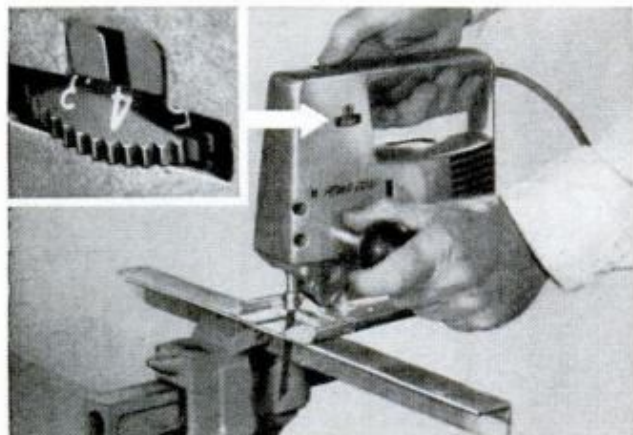


SEE BOB HOPE AND THE CHRYSLER THEATRE, NBC-TV, FRIDAYS

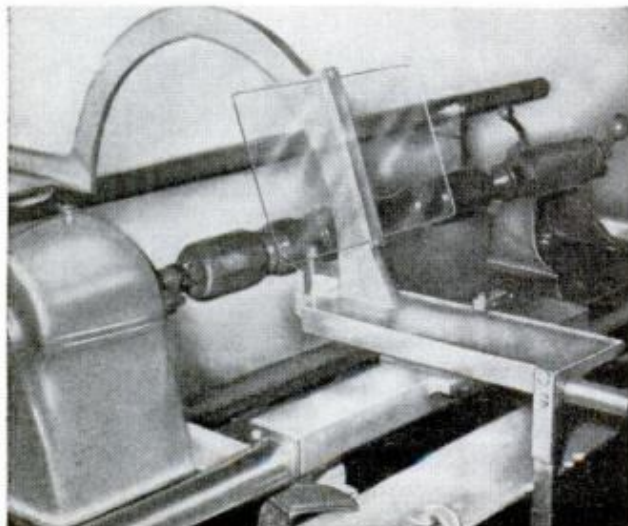
Shopping for Tools

By Arthur J. Maher

RAZOR-LIKE SCRAPER is said to remove any wall covering—painted or unpainted—without the aid of water or steam. Its thin, sharp blades are also ideal for such jobs as stripping paint from windows and tile or removing decals from your windshield. Sells for \$3.98. Extra blades cost 39¢ for two. Marketing Research, Inc., 1056 Home Ave., Akron 10, Ohio



DUSTLESS SANDER: The manufacturer of this 3-in. belt sander says it's the first of its size with built-in dust pickup to sell for under \$70. The tool, designated Model 595, also features a flat-faced design that permits flush sanding against walls and in corners. Weighs only 10 lbs. Made by the Skil Corporation, 5033 Elston Avenue, Chicago 30, Ill.



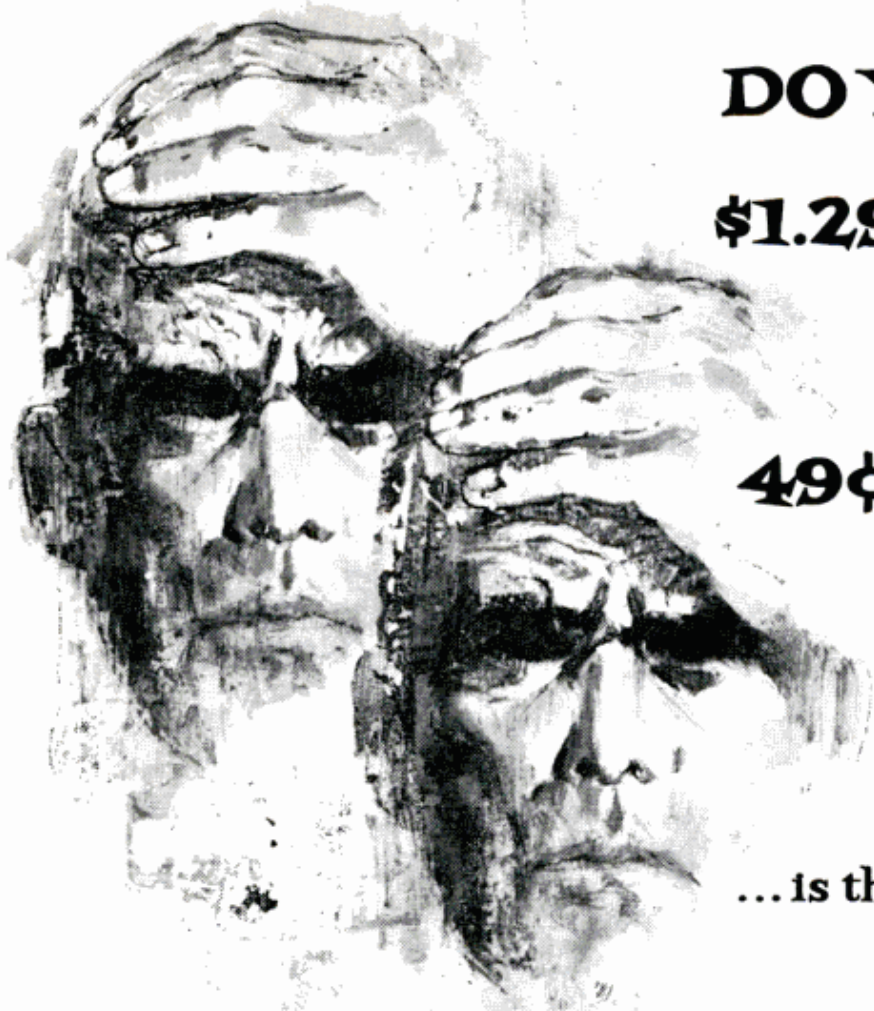
FAST-WORKING PAINT ROLLER called the Dual-Coater, has a dense, kinky pile that picks up an unusually large amount of paint. Manufacturer claims it extracts a paint's maximum hiding power on the first pass, reducing the number of passes required and often covering in one coat. In 7-in. (\$1.69) and 9-in. (\$1.98) sizes. Elder & Jenks, 50 Church St., N.Y., N.Y.



VARIABLE-SPEED SABER SAW: A control dial on this Power-Kraft saw lets you match the blade speed to the material you're cutting. Among other advantages, this gives much longer blade life in cutting steel, for example, and permits you to cut thermo-plastics without fusing the cut. Costs \$48.99 with 7 blades. Available from Montgomery Ward, Chicago 7, Ill.



ATTACHMENT FOR WOOD LATHES enables you to duplicate any table leg, chess piece, etc. made by the conventional chisel-and-rest method. A cutting tool like that on a metal-turning lathe replaces the usual hand-held chisel. The cut is controlled by a pattern, which you can buy or make yourself. Handles work up to 12 in. diameter and 42 in. long. It also has a plastic shield to protect your eyes. \$157.50, from Gizco, Box 1103, Perry Annex, Whittier, Calif.



**DO YOU HAVE A
\$1.29 HEADACHE
OR A
49¢ HEADACHE**

... is there really a difference?

Does it really make you feel better to pay \$1.29 for one reliable brand of buffered aspirin when you can buy an equally reliable brand for 49¢?

There are many people who figure high price as the only measure of fine quality.

"But it ain't necessarily so."

Ask the millions of families from coast to coast who have been saving big money through the famous Hudson Vitamin and Drug Catalog.

That's right... these American families rely on Hudson for high quality, laboratory tested household drug products and vitamins at sensible prices.

Just look at some typical Hudson values:

DRUG PRODUCTS

Buffered aspirin, nationally advertised, sells for as much as \$1.29 per 100 tablets*... the Hudson price only 49¢ per 100 tablets.

Non-caloric sweetener tablets, nationally advertised, sell for as much as \$3.49 per 1000 tablets*... the Hudson price for its comparable Sweetoc is only \$1.60 per 1,000 tablets.

Popular cold tablets, nationally advertised, sell for as

much as \$3.98 per 100 tablets*... the Hudson price only \$1.35 per 100 tablets.

VITAMIN PRODUCTS

A high potency polyvitamin formula, nationally advertised, sells for as much as \$6.60 per 100 capsules*... the comparable Hudson formula is only \$2.45 per 100 capsules.

And these are just 4 examples of savings that you can enjoy by buying DIRECT-FROM-HUDSON. The 64 page Hudson Vitamin and Drug Catalog lists many more... cold tablets, non-caloric sweeteners, laxatives, nasal decongestants... more than 100 formulas from which to choose

The Catalog is FREE. Send the coupon and Hudson will mail the Catalog to you without obligation. No salesman will call. You compare the prices and decide for yourself.

Let your common sense guide you... as it has the doctors, dentists and nurses who first "discovered" Hudson savings over 25 years ago.

And then, if you still wish to pay higher prices, go ahead. Perhaps it makes some people feel better—*psychologically.*

**HUDSON
VITAMIN (HVP) PRODUCTS**

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Hudson Vitamins have been awarded the
McCALL'S Laboratory and USE-TESTED SEAL

WORLD'S LEADING DIRECT-BY-MAIL
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*Fair Trade price in areas where Fair Traded.

MARCH 1964

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Please mail my FREE copy of the new 64-page Hudson Vitamin and Drug Catalog. No obligation, no salesman will call

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the best
GRIP
money
can buy..

Pliers with the P&C Brand are "tools to live by"... made by men who respect fine work. Choose your pliers from a wide selection of "The Best Tools Money Can Buy."



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SOLD IN MORE THAN 15,000 STORES

Sidelights on

AVIATION

C. P. Gilmore, who survived the mission he describes in the story beginning on page 108 (*I Was Shot Down by an American Jet*), also survived a ride in a pressure chamber, that 20th-century horror chamber known and feared by all World War II pilots.

It may or may not be any consolation to them, but the chamber hasn't changed a bit. While aircraft speeds have gone past Mach 2, the old pressure chamber is still chugging along, anchored to the ground, and "flying" men up to 100,000 feet.

For those who have never been in one—and it's just as well—the chamber is a huge pressurized tank built so that the pressure and oxygen inside can be regulated to simulate any altitude up to 100,000 feet. The men inside feel both the loss of pressure and the loss of oxygen. They wear oxygen masks to make up for the loss of oxygen, but as they go up and the outside pressure becomes less than their body pressure, body gases escape and their ear drums pop.

Coming down is worse. With body pressure equalized at 40,000 feet, say, and the chamber starts dropping and the pressure builds up, it tries to get back into the body. The ear drums suffer most. They just can't take that kind of external pressure without help and, in 20 years, nothing new has been discovered to make them pop back. It's still "work the jaws, swallow hard or hold your nose and blow."

Gilmore had to go through the chamber before the Air Force would let him ride to altitude in a B-57. Others in his group were mostly flying personnel there for their annual check-outs. The chamber's purpose is to familiarize flying personnel with problems of high-altitude flying and, more important, to weed out personnel who are physically unqualified.

The chamber ride lasts only an hour or so, but the students must take two days of class preceding it. There the instructors do their best to scare them with tales of how death will come in seconds if the oxygen mask isn't working properly.

"Why, just last week we lost a man . . ."

Lots of luck. It's like going to the dentist. You don't enjoy the trip, but it feels great when it's over.

Kevin V. Brown
Aviation Editor

POPULAR MECHANICS

Материал, защищенный авторским правом

lights

*Your Chevy's "eyes" are important to you! When lights are the problem, think of this: There can be as many as 43 different lights on a late model Chevrolet! Some "see" for you, some for your passengers. Some "talk," warning you of things that need attention or to signal other drivers. Yes, 43 lights, from "head" to "tail," each for your safety, convenience or comfort. When replacement is necessary we recommend Genuine Chevrolet Replacement Parts to give your Chevy that new car "eyesight" again. More than 75,000 other Genuine Chevrolet Parts are available through Chevrolet dealers, leading independent garages and service stations throughout the country. Be sure to ask for them by name... Chevrolet Division of General Motors, Detroit, Mich. Always remember... **It pays to keep your Chevy the Chevy-est.***



Look for this sign.



SPOTLIGHT ON THE SAAB 96



LIKE THE SWEDES who build it, Saab is at home in the snow. Front-wheel drive acts to pull the car around slippery curves and up slippery slopes

By Ed
Nelson

AT FIRST THOUGHT the Saab seems absurd—three cylinders, no valves, and the shape of a troubled Easter egg. Live with the car and study its mechanical unorthodoxy; you'll wonder why more aren't built this way.

Nothing about the Saab is conventional. The post-war child of Sweden's jet aircraft manufacturer, Svenska Aeroplan Aktiebolaget, Saab provided a way to bring aircraft engineers down to earth and give factory hands some work when the jet rush slacked off. Obviously the designers didn't come all the way back; Saab's puffy, buglike shape fairly shouts of wind-tunnel performance. Air drag is minimal; excellent gas mileage (30 m.p.g.) is possible even with brisk driving.

Again and again, the Saab will outpull VWs on hills; its top speed is about 80 m.p.h. and it cruises easily at 70 or 75. Pretty good for only three cylinders.

Outside, the Saab certainly qualifies as a compact, yet the passenger package is roomy. Individual front seats are comfortable and the back angle as well as seat location are adjustable. Legroom is good. The big point about the interior is the absence of any crowded feeling. It could handle four and a half passengers; the back seat can take two adults and a slim 12-year-old or even three moderately sized adults.

Steady She Goes

The Saab's 98-inch wheelbase is $3\frac{1}{2}$ inches shorter than Volkswagen's, so the Swedish entry does bounce on rough roads. But the bounce is well controlled. The action is busy, but there's little tossing or wallowing. Agreed, the car isn't as comfortable as a big U.S. unit. But I wouldn't hesitate to start on a day-long drive—although I might not care to keep it up day after day. There's almost no cornering lean; what you feel is the independent lean of your own body.

Thanks to the engine's location ahead of the front axle (58% of the empty weight is on the front wheels), the Saab is

[\(Please turn to page 32\)](#)

A MESSAGE TO ELECTRONIC BUFFS—

DON'T JOIN THE ARMY UNLESS



unless you want to build a career in Electronics. The sky's the limit in this field, if you have the right training. The Army is the place to get that training. And the Army will keep you trained as you move up to positions of increasing responsibility.

unless you want your future to be automation-proof. No matter how far automation goes, men with electronics training will still be in demand in tomorrow's Army.

unless you want premium pay for doing work that you'll enjoy. As you advance in grade and increase your skill, you can earn from \$50-100 extra per month in proficiency pay.

unless you want to travel... adventure...and responsibility. Army electronics specialists are stationed in many countries throughout the Free World. Doing work that is exciting, stimulating, and vital to everyone's safety.

unless you care enough about your Country to serve it.

If that sounds like just what the doctor ordered, talk to your Army Recruiter soon. And ask him about Army electronics training.

If you're good enough to get in...a proud future can be yours in the new action

Army

Spotlight on the Saab 96

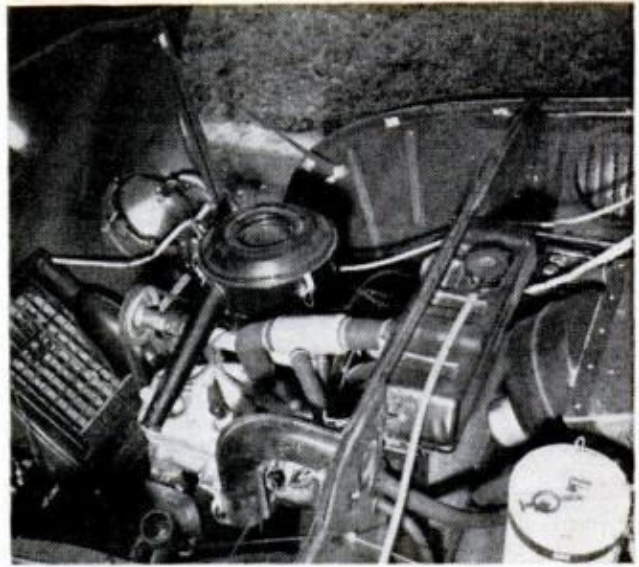
(Continued from page 30)

stable in cross-winds that would make trouble for most rear-engine imports. The front drive system calls for little change in driving habits.

If you drive twisting roads with considerable aggressiveness and verve, you'll get used to accelerating rapidly through the curves. The front-engined Saab can be driven forcefully with far more success than most rear-engined cars. Just keep power on in the curves as long as you have any traction. It's no accident that the Saab is one of the champion rally cars in contests through snowy Alpine passes and on all kinds of winding back roads. The only disadvantage comes when, in one of the lower gears, the wheels are hard over and you apply full power, as you might do when pulling into a steep driveway, for example. You feel some of that power tugging at the steering wheel, throbbing and pulsing. It's from the universal joints in the front drive trying to straighten out the spindles.

Front suspension is by independent coil springs, ball joints and rubber bushings. But the rear axle is unusual: a flat horse-shoe bar pivoted in the center with a wheel trailing on each side, each with a shock absorber and trailing arm to keep it located laterally. You get the effect of independent rear suspension without any

SO ROOMY is Saab's front compartment that you sometimes forget how compact the car really is. Seat belts circle waist and cross chest for extra safety



HUGE HOOD yawns conveniently wide to reveal unique three-cylinder, two-cycle engine sitting up front ahead of its fan, radiator, front axle and gearbox

swinging or cambering to cause wander. There's a glued-to-the-road feel at high speed, even over old, rough concrete.

Pickup from the three cylinders doesn't match that of a U.S. V8, of course. But the car's staying power on hills is surprising for an engine of only 59.1 cubic inches displacement—paltry even compared to the VW's 72.74.

Two-Cycle Principle

The Saab's power flow is on the two-cycle principle, like an outboard motor. Every piston downstroke is a power stroke. (In the conventional four-cycle engine, of course, only every other downstroke provides power.)

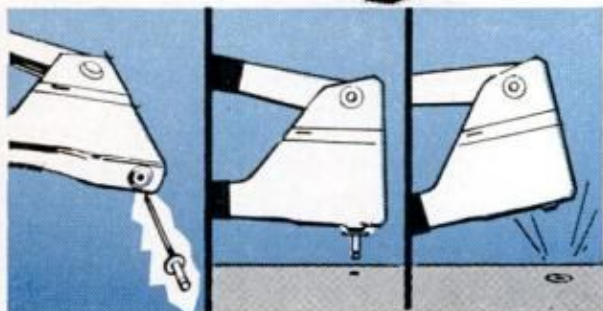
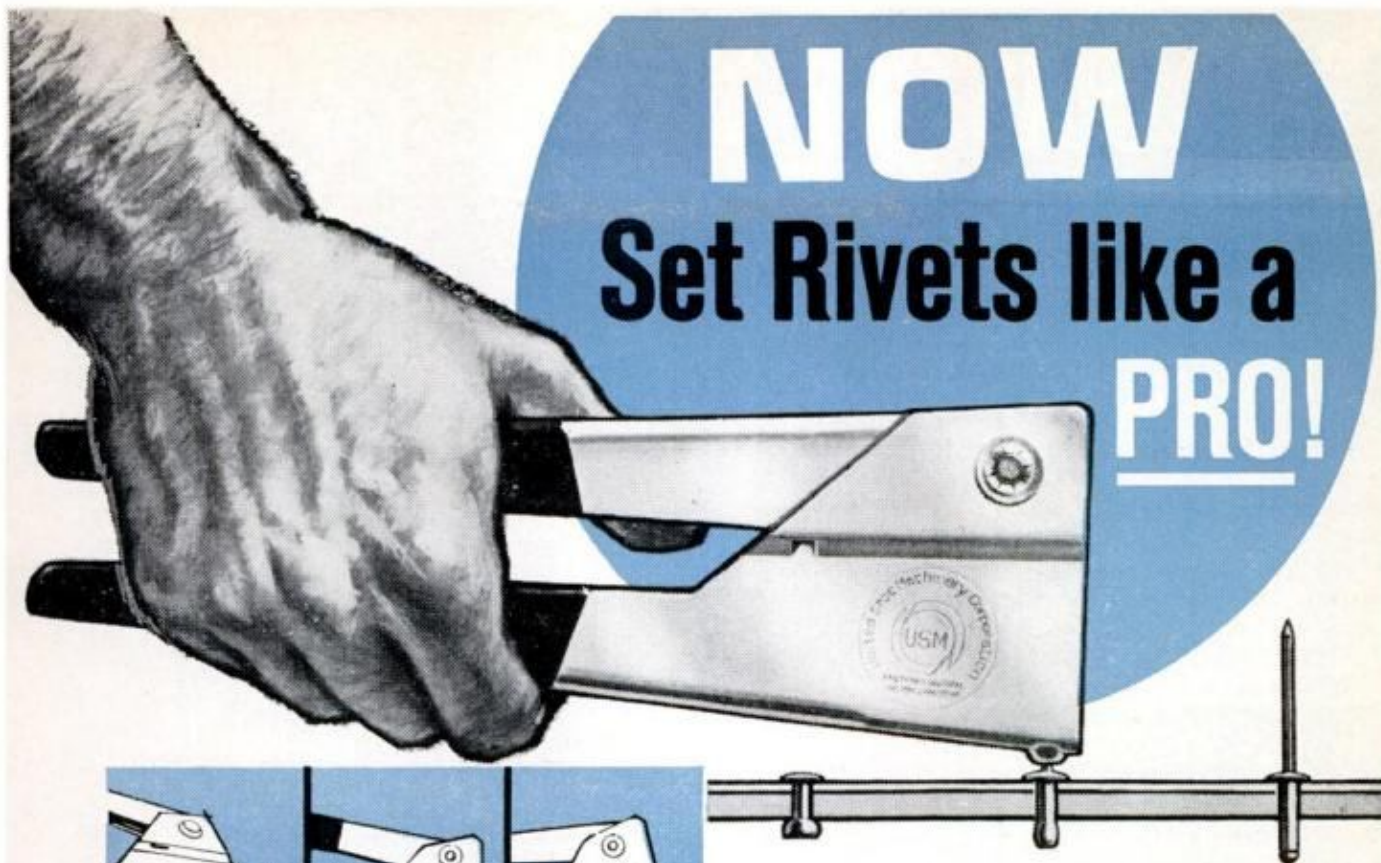
The result: the Saab's three cylinders almost equal six in the four-cycle engine, and the Saab seems to run more smoothly than four-cylinder, four-passenger imports we've tried.

When a plug fires, the burning fuel-air-oil mix drives the piston down (and partly compresses a waiting charge sealed under the piston in the crank chamber). Near the end of the stroke, the piston exposes an exhaust port to let burning gases out. They're boosted on their way as the intake port (the top end of a bypass from the crank chamber) is exposed next and the new, partly compressed charge jets in. The rising piston, besides compressing the new charge for ignition, helps draw another into the crank chamber below.

Since the crank chamber is part of the fuel system, it isn't used as an oil sump. Oil is mixed with the fuel and air to reach the crankshaft, mains, rods and piston bearings. This oil mist travels through the engine only a fraction of a second before it's burned, thus costly additive-type lubri-

(Please turn to page 34)

NOW Set Rivets like a PRO!



Easy to use as 1-2-3!

1 — Insert Rivet. 2 — Place Rivet in Hole of Material to be Fastened. 3 — Set Rivet.

Because PROFESSIONAL SKILL is Built Into "POP"® RIVETS and the "POP" RivetTool!

That's right! Now you can set rivets in seconds without anvil or hammering — From one side only — and make strong, neat, fully professional fastenings every time. Yet no skill or experience needed.

IDEAL FOR DOZENS OF FASTENING JOBS IN HOME AND SHOP!

Replaces — Screws • Nuts and Bolts
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Solid or Tubular Rivets.

Complete kit with "POP" RivetTool, "POP" Rivets, back-up plates (for soft materials) and instructions, only \$5.95.



SEE YOUR LOCAL HARDWARE DEALER FOR A FREE DEMONSTRATION



FASTENER DIVISION

United Shoe Machinery Corporation

1362 River Road, Shelton, Connecticut

MEN PAST 40

Afflicted With Getting Up Nights, Pains in Back, Legs, Nervousness, Tiredness

If you are a victim of the above symptoms, the trouble may be due to Glandular Inflammation. Glandular Inflammation very commonly occurs in men of middle age or past and is often accompanied by despondency, emotional upset and other mental and nervous reactions . . . often signs that the glands are not functioning properly.

Neglect of such conditions or a false conception of adequate treatments may cause men to grow old before their time . . . loss of vigor and possibly lead to incurable conditions.

NON-SURGICAL TREATMENTS

Most men, if treatment is taken in time, can be successfully treated for Glandular Inflammation by a New NON-SURGICAL treatment method perfected by the Excelsior Medical Clinic. It has proven so successful it is backed by a Lifetime Certificate of Assurance.

Men from over 1,000 communities in all parts of the country, have been successfully NON-SURGICALLY treated. They found soothing and comforting relief and better health.

RECTAL-COLON DISORDERS

Are often associated with Glandular Inflammation.

REDUCIBLE HERNIA

is also amenable to a mild Non-Surgical treatment.

Either or both of these disorders may be treated at the same time you are receiving Glandular Inflammation treatments.

Write For New FREE Book

It's fully illustrated. Gives excellent factual knowledge about diseases peculiar to men and women. Tells HOW and WHY New Modern NON-Surgical methods are so successful. Write Today.



Excelsior Medical
Clinic Dept. B6150
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Gentlemen: Kindly send me at once, your New FREE Book. I am interested in full information. (Please Check Box)

- Glandular Inflammation Hernia
 Rectal-Colon

Name.....
Address.....
City..... State.....

Spotlight on the Saab 96

(Continued from page 32)

cants are unnecessary in the Saab.

Exhaust ports eventually carbon up from the oily fuel mix, and need cleaning about every 30,000 miles. But the engine is so accessible that the job is relatively easy. The huge hood is hinged at the front; by removing two hinge pins and a retaining strap you can, in five minutes, take the whole hood off. It leaves the engine almost as if it were sitting on a workbench.

When the fuel gauge gets to the Reserve mark, a red warning light winks on. You have a fat, safe three gallons left—close to a hundred miles of driving. Fill-up starts with a quart of 30- or 40-weight oil in the gas tank. Follow it with seven-and-a-half or eight gallons of gas. Oil consumption works out to about what you'd get with normal changes in a four-cycle engine.

Smooth As Silk

The Saab engine runs almost electric-motor smooth under load. With no heavy oil between cold bearing surfaces, the car kicks over with no more starter drag in January than it has in August. When combustion is incomplete or when the engine idles, the burning oil smokes and the engine pops strangely. But combustion under load is more nearly perfect, smokeless and smooth.

Saab buyers can choose between three- and four-speed transmissions. We figure the four is the better deal, with hotter acceleration, better hill climbing and synchromesh First. But it costs an extra \$100.

Free-wheeling prevents the engine from over-revving on a long downhill run. That's important because using engine drag for braking would involve a closed

(Please turn to page 38)

SAAB'S STRANGE SHAPE will grow on you, especially as you discover that its aerodynamic lines are giving you both more miles per gallon and higher speed



234

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Spotlight on the Saab 96

(Continued from page 34)

throttle, shutting off much of the lubrication as well as fuel. Excessive heat and bearing wear would result. Without effective engine braking, you'll use the air-cooled, finned-drum service brakes a lot. Don't worry; they're thoroughly competent. And since the Saab weighs only about 1800 pounds, a good deal less than competitive American makes, the braking effect is strong.

With the two-cycle engine, there's no deep sump under the engine. With the driving wheels in front, there's no drive-shaft. Coils instead of leaf springs, and the curved rear axle, eliminate other underbody encumbrances. The result: a flat steel underbody pan, ribbed like a strong toboggan and flowing from the front bumper to the rear. Road clearance, 7½ inches, is good but if Swedish Saab drivers find a rutted snowy road with the center ridge still too high, they just charge. The tobogganlike underbody and front drive combine to take them where few other cars can go.

It's A Midget-Model, Too

Among the options is one that, for \$8.50, lets you convert the seats into a bed. A system of interlocking plywood panels shims up the seats until they're more or less flat, after the front pair is moved into the rear and the rear bench is dismantled and located amidships. For level sleeping, you'll still have to park on a slight downgrade, but at \$8.50 you have to expect to do some things for yourself.

That removable back seat has another advantage: It opens the front wall of the spacious trunk so you can haul a longish load—like a ladder—inside the car.

About the only drawbacks are the disconcertingly noisy idle (it pops and burbles like a four-wheeled percolator while you wait at a light) and the steering, slightly stiffer than many another front-drive car. Considered as a package, the Saab impressed me as very worthwhile—serviceable, economical, ahead of most of its competitors for big-car space, performance and touring capacity.

If they're so great, why don't we see more of them in the States? Saab's careful Swedish management allots its U.S. importers only about 5000 units a year. Rather than spread them thinly over areas sparse in service facilities, the importers concentrate sales east of the Mississippi (plus Colorado) where roads, traffic and weather combine to make the most of this little car's capabilities. The POE price: \$1895. ★★★



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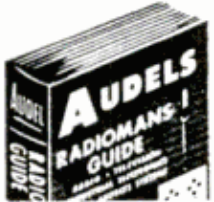
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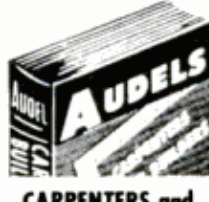
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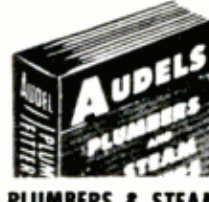
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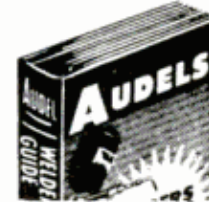
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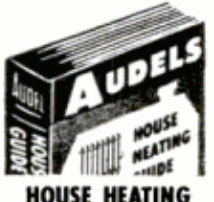
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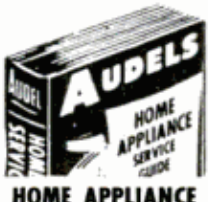
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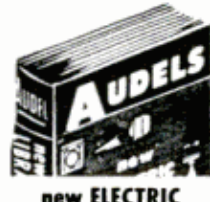
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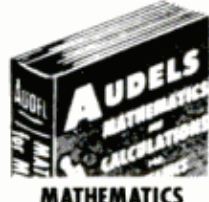
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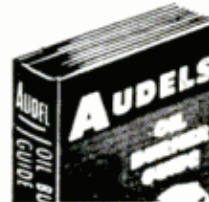
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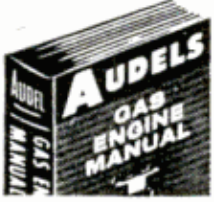
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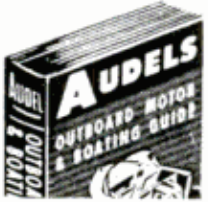
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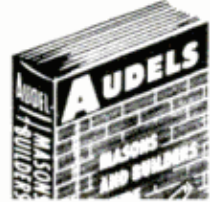
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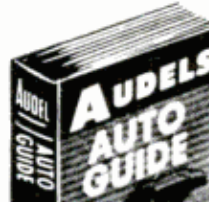
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INVENTORS' CORNER

By Joseph H. Kraus

Mr. Kraus has been helping inventors solve their problems since 1919. Readers may send queries on ideas, inventions and patents to him, care of *Popular Mechanics*. Questions of general interest will be answered in this column. Please include all information necessary to understand the proposed idea or invention, plus your return address.

Thermal-power apparatus, patent 3,048,006 submitted by Guy H. Goodman, Huachuca City, Ariz.

Your thermal tower would yield energy which might be harnessed, but output will depend on the locale, terrain, construction materials, relative diameters, internal resistance and many other factors. A big question is whether it will produce power at a profit. I can see no purpose to the helium envelope surrounding the tower. That all gases including air, will produce the same results is a well-known law of physics. The only thing you are doing here is to introduce another heat transfer technique which adds to losses and decreases efficiency. You are in a fine spot for a pilot plant; why not build one and test your theories.

Flying boat which could be produced for about \$500, described by James P. Decker of Chalmette, La.

You seem to have tossed a number of wishful thoughts into a nest and expect them to hatch into a patentable design. Flotation gear is cumbersome because it must support the weight of the craft, fuel and passengers. Knowing these weights you could easily calculate the size of the flotation gear regardless of the type of construction. Further study is indicated before you risk any money on a patent. So far you have nothing more than a dream.

Garbage-can cover with a spring-fitted lid; diagram and description submitted by H. L. Avery of Groton, Conn. The springs clip to the handles or may be attached without cutting holes in either the lid or can. Is it marketable?

About a half dozen such devices are on the market. Your design is a poor substitute. Forget it.

Anaerobic environment (living in the ab-

sence of free oxygen) for microorganism cultures can be produced with a device described by Robert Z. Evans of Beaumont, Tex. He wants to offer it to a plastics manufacturer. How can he do this and still be protected without a patent?

Other than an agreement with a manufacturer who is willing to handle the item on the basis of your claim of originality and performance, a patent is your only protection. Few manufacturers would invest in an unpatented article. Why not get some of your co-workers to help you finance the patent costs in exchange for a percentage interest? Any patent attorney could work out the details.

Automatic gas pump delivers gasoline from unattended pumps, submitted by James L. Hodges of Hoboken, N.J. Has the idea any merit?

If you could protect all of the many variations on this idea by winning just one or two patents, the investment might be worth it. But the basic thought on which you would like to get protection already is in use in many areas. Anyone could apply it to a gas pump. The much safer coin-operated pumps already are in use. Any protection you might get would be narrowly confined to the details you might specify. This is not worth the risk. On the other hand, if you could develop an automatic safety device to prevent cheating, you might chance the investment.

Rotating aircraft landing wheels prior to touchdown is described, with diagrams, by John H. Grim of Falls Church, Va. His own search reveals that nothing like it has been patented before. The idea was submitted to a firm in Boston which reported that it was good but not feasible. What about it?

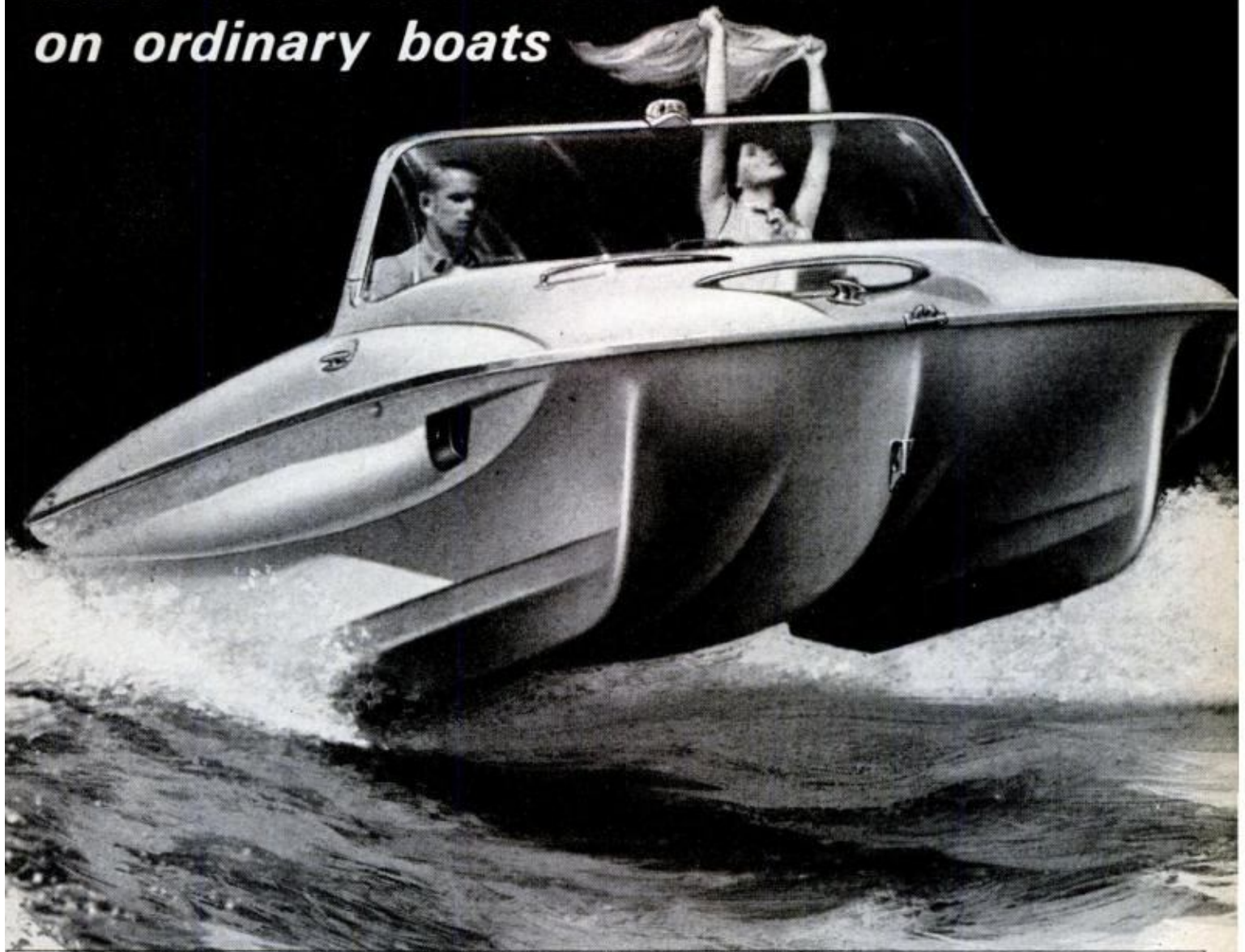
It is impossible to imagine what your Boston contact meant by these comments. How can an invention be good but not feasible? Your search should have revealed that suggestions for putting landing wheels in motion before touchdown have been patented. Shouldn't this make you wonder why they are not used? What, if any, are the proven advantages and what are the unfavorable aspects? Before investing in a patent, you should find answers to these and many other questions.

Gasoline engines—diagrams and descriptions sent in by G. T. Shannahan of San Antonio, Texas. He would like to do something with at least one of them. What should he do?

Except for the ignition system shown in one of the plans, your engines seem to be

(Please turn to page 45)

Why Johnson Boats have a 3-POINT LEAD on ordinary boats



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(Continued on next page)



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with hose and sponge keeps it looking factory fresh. No fuss-budgety maintenance!

Stowaway Room. Stash *all* your gear in storage bins under the gunwales; tuck valuables into two keyed lockers. Your Johnson stays uncluttered! In the pilot's seat, every operating function is at your fingertips: electric starting, "Electramatic" one-hand throttle and shift, power-lifting windshield of safety plate glass, power-tilting lower unit, engine compartment blower and bilge pump, lights, horn, instruments — even a cigarette lighter!

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systems is Johnson's cable steering with stainless steel nylon-covered cable. Needle and ball bearings make steering effort negligible.

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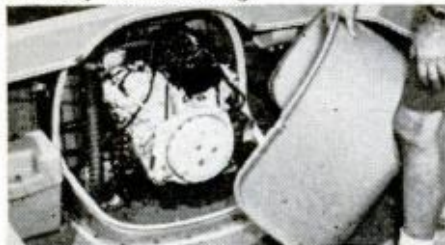
All this (and more!) is standard equipment on the Johnson Deluxe! But even the lowest-priced Johnson Boat is complete, ready to go, nothing more to buy but gas and oil. Model for model, they're the "standard" by which other pleasure boats measure standard equipment!

First in Dependability..



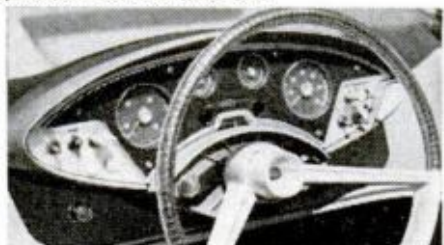
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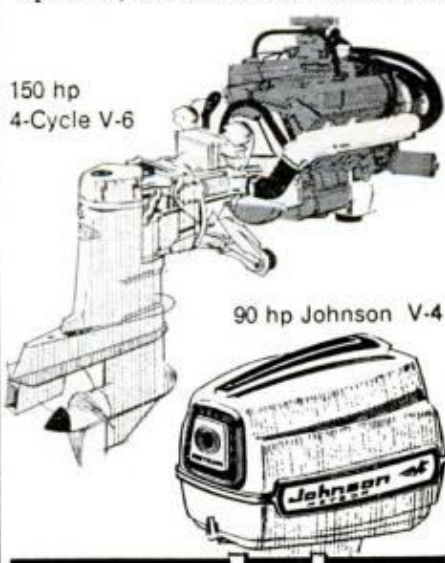
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Montgomery
Dixie Marine
938 S. Perry St.

Northport
Bennett's Marine
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Sheffield
Martin Marine
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Twin Lakes Marine
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No. Little Rock
Wylie Cavins
3304 E. Broadway

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Duvall's Marine
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Long Beach
Harbor Marine
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Yates & Cochran
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Darcy's Marina
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Wright Marine
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Denver
Tom Roath Marine
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Inventors' Corner

(Continued from page 40)

departures from the experimental crankless engines which have been well reported during the past five years. You should study these engines, then produce a working model of the one which to you seems to have the best potential. The pump and rotary system designs might be considered to be variations of the basic concept. It is not easy to introduce a new engine. The best potential probably is for small equipment, lawn mowers, outboards, portable pumps and similar power plants. Your ignition system is worthless for many reasons; it will foul quickly. Forget it.

NEW PATENTS

Stopping the spin of an orbiting satellite by putting into it a lattice of magnetic metal rods which act against the earth's magnetic field is described in patent 3,114,518 won by Robert E. Fischell of Silver Spring, Md. The system is being used in more than a dozen spacecraft.

Typewriting mistakes may be corrected with a double-stripped ribbon—one strip inked for typing and one with white opaque for masking errors—which was described in patent 3,114,447 granted to William H. Wolowitz of Washington, D.C.

Exploring the earth's crust may be undertaken with a new nuclear-powered drill which would penetrate crustal areas like a needle. The drilling core sustains a chain reaction and heat energy is directed downward. Patent 3,115,194 went to William M. Adams of Livermore, Calif.

X rays in color may be possible with a system developed by Bernard M. Fine of Lynn, Mass. According to patent 3,114,833, the exact colors of body parts would not necessarily be reproduced, but variances in color tone would pinpoint objects in the body, such as glass fragments.

A patent convention, or agreement, among European countries is a distinct possibility within a few years. Depending on its form, the agreement may greatly simplify European patent applications by U.S. inventors, substituting one patent application for the individual applications now necessary for each country. All is not clear sailing, however. If a continent-wide agreement is achieved, embracing some 17 countries, the convention would probably welcome foreign applications. A much narrower pact among the six Common Market nations might exclude foreigners.

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By Jim Whipple



Are Durability Runs Proof or Merely Pudding?

Studebaker's Move: First Step to a Comeback?

Four out of five Comets recently completed a controlled test run of 100,000 miles in forty days at over 100 miles per hour, at the giant NASCAR racetrack in Daytona, Florida. At the end of the run the engines were torn down and miked up for measurement of wear. Only the piston pin clearance had reached the limit beyond which replacement was indicated.

Valve springs had nearly reached this point. Piston-to-bore clearance remained within production (new part) tolerance with an increase of only .001 inch. Main and con-rod bearings were well within the replacement limit. Failure of one valve spring resulted in disqualification of the fifth car at 76,000 miles.

According to Mercury Division officials these engines were right off the Ford Motor Company's assembly line and "subjected only to normal quality control inspection."

It should be noted that with special lazy axle ratios of 2.70 to 1, the engines weren't required to rev up beyond 3600 r.p.m. which is far below their 6000 r.p.m., 271-horsepower peak. This meant that they were not stressed to anywhere near their design limits.

Basically, the durability run was equivalent to 1000 hours on a dynamometer at constant load and part throttle. Any auto company whose engines won't make this run successfully should turn to producing baby buggies and bottle caps.

So, it must follow there are some things that the Comet run did not prove. We suspect, first of all, that any U.S. car could have equaled Comet's feat.

Secondly, it doesn't prove that four out of five engines will go 100,000 miles without repair or loss of efficiency if those miles are piled up in average ownership with its sludge-building stop-and-go driving pattern, and the cylinder-scoring routine of cold weather starts.

Incidentally, while the Comets were running at Daytona, a distant cousin, Ford-of-Germany's Taunus 12M, was running around on a French airport. The little

65-horsepower V4, driven at its normal cruising speed of 65 miles per hour, went for 221,475 miles without an engine or driveline failure of any kind. Anyone for a million miles?

Studebaker is neither gone nor forgotten. Dealers have reported that sales in the U.S. actually increased after the announcement that final production of cars was to be moved to Hamilton, Ontario.

Studebaker has not pulled out by moving assembly operations to Canada. The company is still making engines and body sheet metal parts in South Bend. By relocating their production lines, the automotive division can produce at low volume (30,000 cars a year) profitably.

Studebaker's best chance for a comeback is to stick to a good specialty model (or two) and plug it hard. Willys was forced to drop out as a conventional passenger car, but has made a profitable comeback with its 4-wheel-drive Jeep vehicles and Wagoneer station wagon. Incidentally, Jeeps are now Kaiser Jeeps.

Presently, Studebaker has a nice roomy sedan in its Cruiser which makes a very efficient taxi, plus the unique sliding-roof station wagon. We feel that these nonsense cars rather than the raucous, racy Avanti (which was dropped) will be the comeback cornerstones.

Speaking of comebacks, Chevy II pulled a strange one recently when Chevrolet Division announced the revival of the Nova hardtop sports coupe, which had been dropped from the lineup for '64. It seems that the public didn't agree with Chevrolet marketing experts who felt that Corvair and Chevelle would overlap Chevy II. In fact, word was around the industry that Chevrolet execs were intent on phasing out Chevy II altogether.

But, the brass had done their work too well, if not wisely. Buyer demand, relayed through dealers, brought the Chevy II hardtop back. It seems the car is good and the price is right. Anyway, it's happy proof that if you yell loud and have money in your hand, Detroit will listen.

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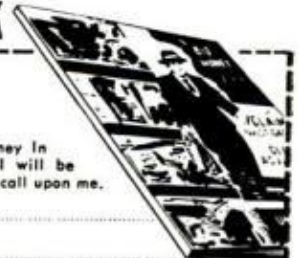
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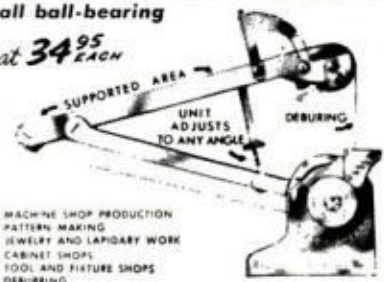
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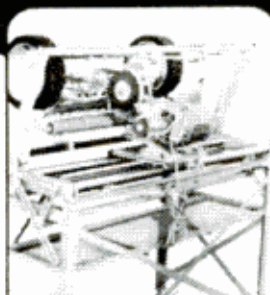
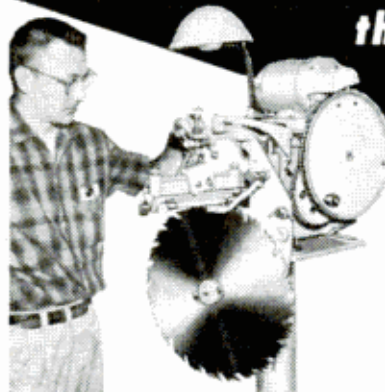
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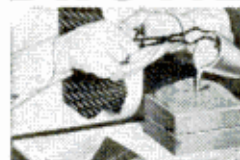
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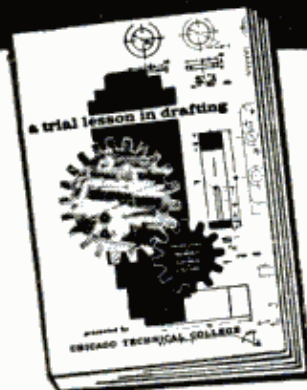
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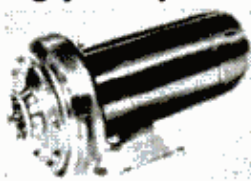
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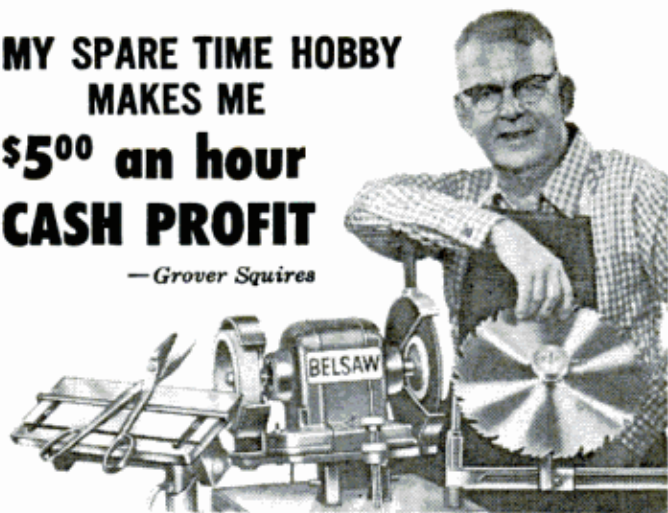
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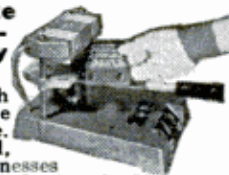
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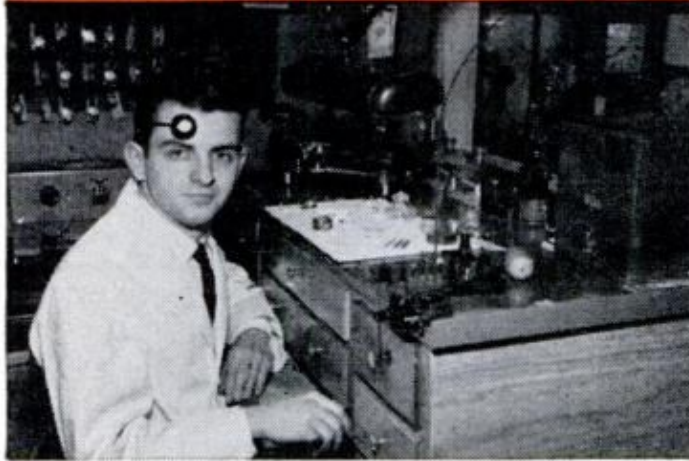
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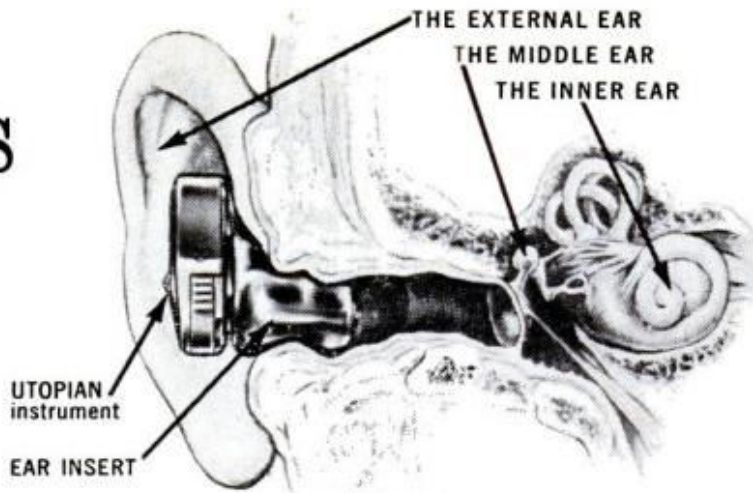
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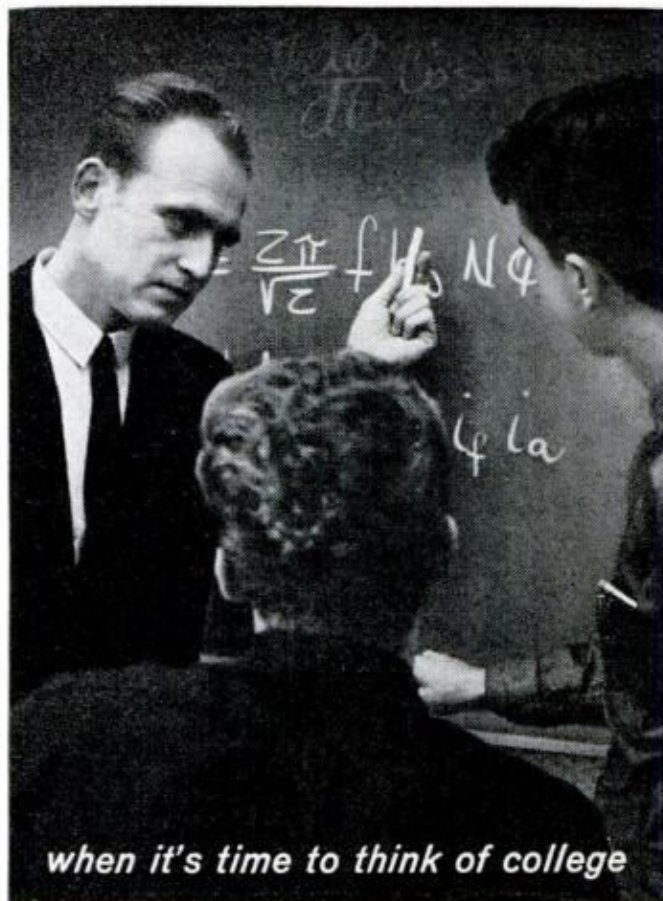
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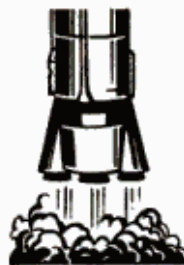
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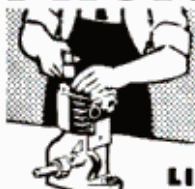


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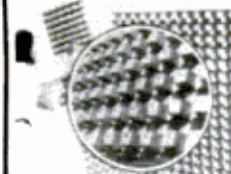
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FABULOUS Gifts from around the world. Holly Hill House 10616 Bridgeport Way, Tacoma, Wash. 98499.

SEND \$1.00 for complete details of a financial plan operable from your home. Absolutely no selling, canvassing or personal solicitation. Money back guarantee. Brunox Enterprises, Box 286, Villa Park, Illinois.

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RECEIVE Gifts, samples, magazines, catalogs, opportunities, 10¢. Directory, Adkins, Texas 78101.

YOUR Name sent to 1000 importers, publishers, mailers, wholesalers, etc. on our mailing list. Year \$1.00. Dixie Mailers, King, N. Car.

LOANS By mail. \$100-\$600. Anywhere. Confidential. Write Union Finance, Dept. PM, 323 E. Camelback, Phoenix, Arizona.

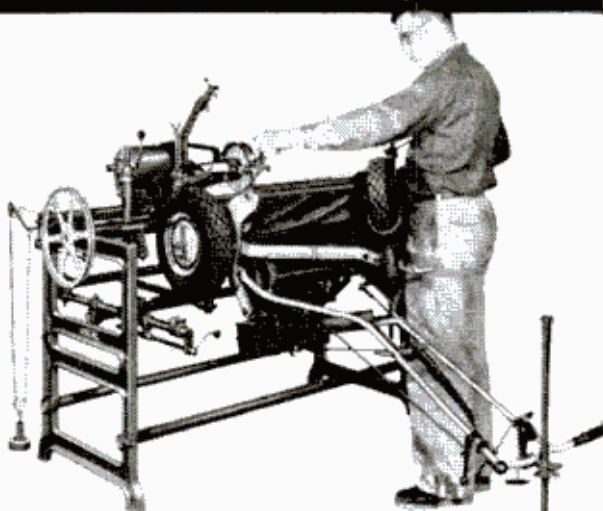
CESSPOOLS. Septic tanks restored to newness by miracle crystal pellets. Free literature. Electric Sewer Cleaning Co., Allston 34, Mass.

FREE Wholesale catalog! 100,000 products. Tremendous discounts! Taylor Distributors, Newton 2, New Jersey.

CIGARETTES—Make 20 plain or filter-
tip for 9¢. Facts free. Moberly, Box 785, Owensboro, Kentucky.

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

IDEAL 900 Lawnmower Sharpener

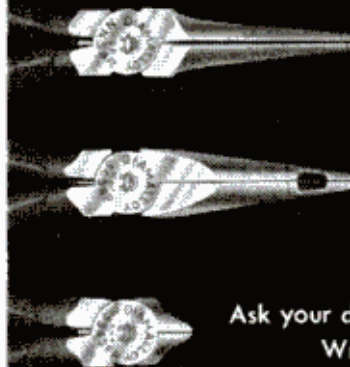


"Two-Way" Grinding Option
means bigger profits for you!

The Ideal sharpens *any* reel-type mower by either "Hook" or "Straight-Line" methods. No limitations, every job perfect with no hand filing. Ruggedly built, screw adjustments can't slip, 1/2 hp. motor. Write for Full Details.
The Fate-Root-Heath Co., Dept. PM-3, Plymouth, Ohio

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"There is nothing finer than a DIAMOND"

Ask your dealer for Diamond Tools.
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DIAMOND TOOL and Horseshoe Co.

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ESTABLISHED 1908



Tortiga 32-ft Yacht Express, one of 15 models by Owens for 1964



Owens dramatizes its 1964 line of cruisers with REGATTA Metallic Pigmented Finishes

To enhance the eye-filling flair of its 1964 line, Owens Division, Brunswick Corporation, selected new Regatta Metallic Finishes such as Antique Metallic Gold Eggshell, Electric Metallic Blue Eggshell and Metallic Blue-Black Eggshell for superior highlighting and reflecting qualities.

Darrel D. Fish, Owens' chief stylist, writes, "Not only did we achieve shape definition, but we were able to introduce new, rich shades and tones of colors to the exteriors of our cruisers. Interior textured-glass sliding-door panels also were painted on the textured side, to achieve a brilliance not possible with ordinary finishes. Metallic pigmented finishes have given us a new, exciting, decorative tool."

Made with Alcoa® Aluminum Pigments, Regatta Metallic Pigmented Finishes are products of Baltimore Copper Paint Co., maker of marine finishes since 1870. Famous for weather protection, corrosion resistance and superior appearance, good aluminum me-

talic finishes like Regatta do a lot for any boat, old or new. Maybe yours won't look like a Tortiga 32-ft Yacht Express—but a coat of sparkling aluminum will point it in that direction. Ask your dealer.

Alcoa does not make metallic pigmented finishes, but Alcoa Aluminum Pigments are used in the best brands. For a copy of our booklet, please send the coupon.

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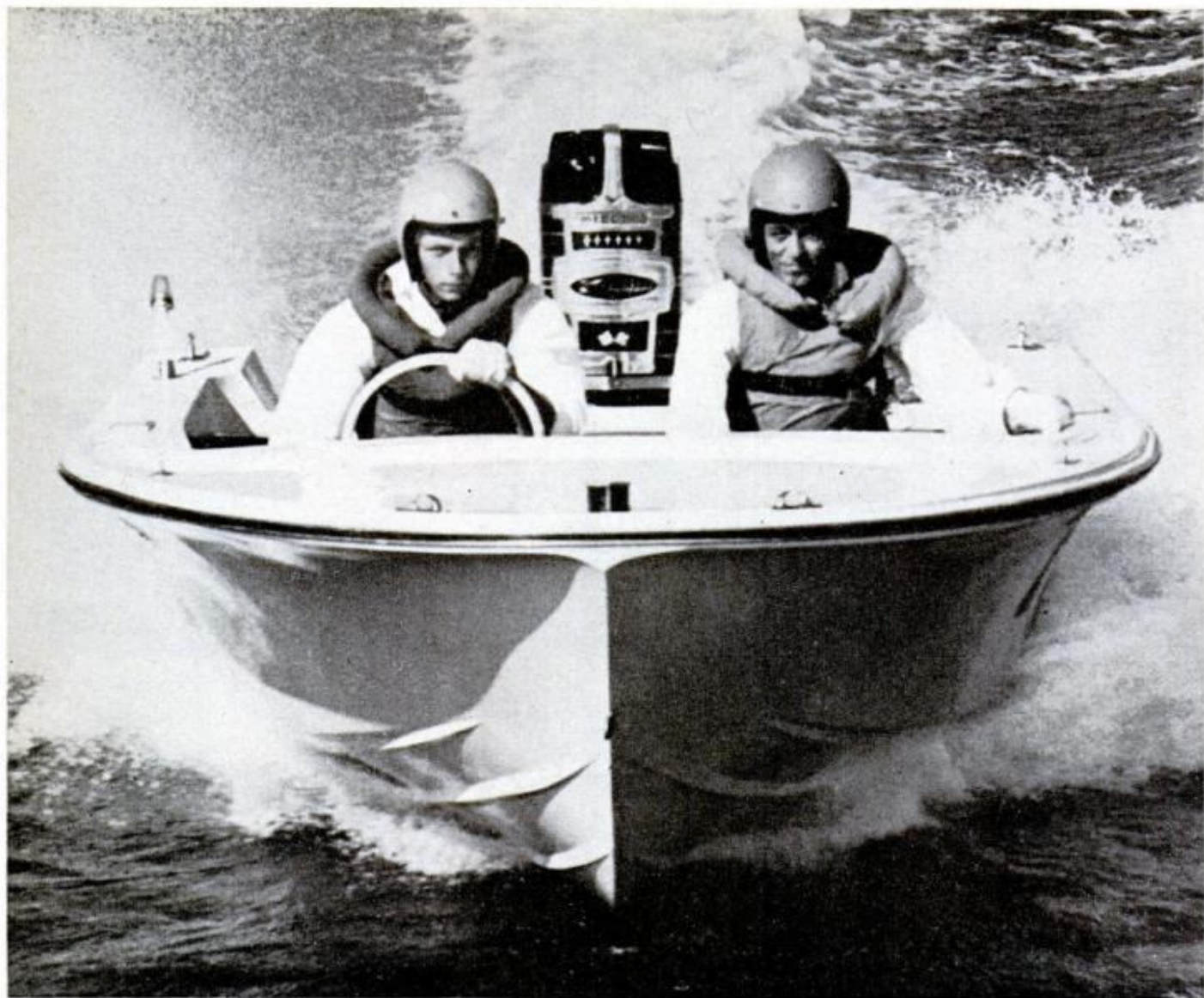
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870-C Alcoa Building, Pittsburgh, Pa. 15219
Please send your free booklet, *Painting With Aluminum.*

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Fast, did last!

You may hear competitors say that "Mercs are good racing motors but they won't hold up." It's true that Mercs win most of the races. And that proves they *do* "hold up."

The races Mercs win are more a test of endurance than they are of speed. For years Mercs have proved their durability by winning grueling marathons like the Miami to Nassau Race, the St. Louis to New Orleans Race, the Albany to New York Race (where, incidentally, last year Mercs took 29 out of the first 30 places) and the Ketchikan, Alaska, to Seattle . . . world's longest (730 mi.), world's roughest (20 ft. seas) ocean race.

When Brooke Russell and his son Ronald (above) decided to enter the Albany-New York Race, they also prepared to try a record-breaking 1,500-mile-run from their home in Miami to New York.

And break it they did . . . with a single production-line 100 hp Mercury! In 42 hours and 46 minutes they averaged 33.5 mph up the Inland Waterway and across open ocean . . . setting the fastest record for any single-engine craft of any kind! From there . . . on up the Hudson to Albany.

Then, the amazing Russells ran their same production Merc 1000 in the 135-mile Albany-New York Race and placed in their class. In eight days father and son covered better than 1,770 miles with a trouble-free single-engine Mercury rig.

Unusual? No. It isn't unusual for Mercurys to log over 20,000 miles per month under full-throttle endurance tests at the Lake X, Florida proving grounds, where testing never ceases. Lake X tests prove what the world's racing records prove. You get more RUN for your money with Mercury . . . 100, 85, 65, 50, 35, 20, 9.8, 6 and 3.9 horsepower outboards and MerCruiser Stern Drives . . . 110 to 310 horsepower gasoline; 60 and 100 hp diesel.

MERCURY



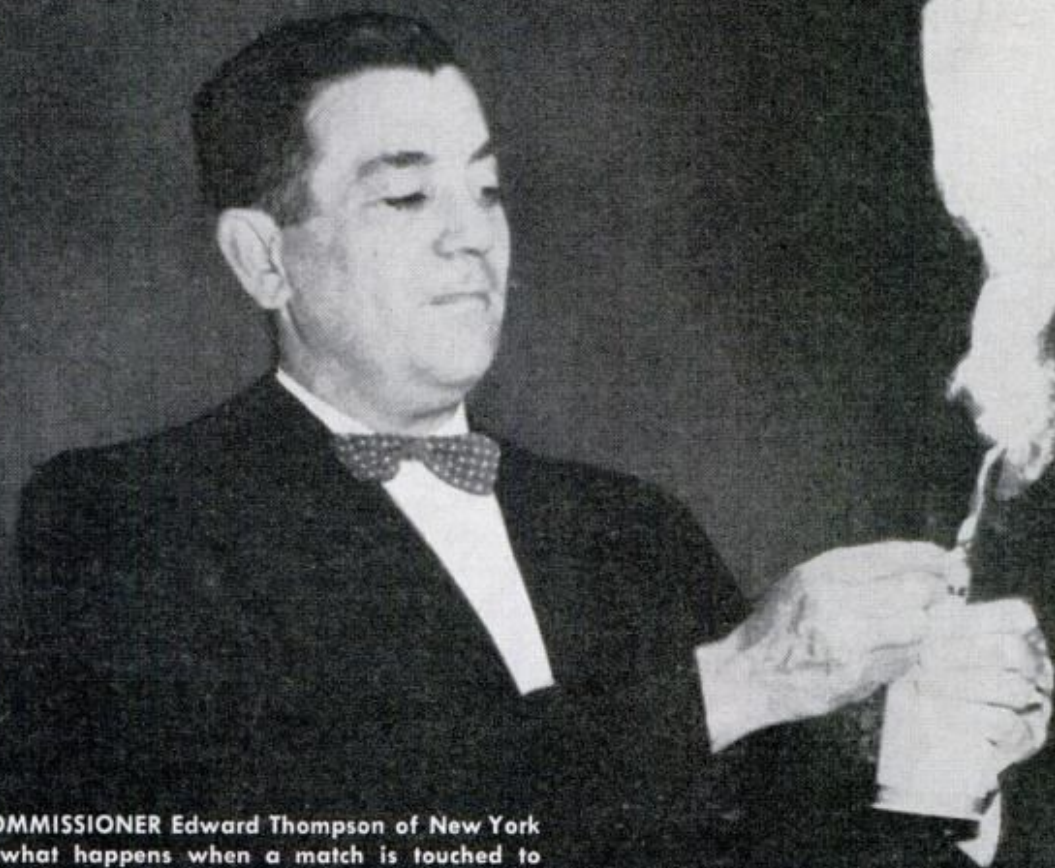
**SILVER
ANNIVERSARY FLEET**

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Those Handy Aerosols Can Be **DANGEROUS**

Some may blow up, catch fire, even kill unless you read — and interpret — the labels carefully

By Richard Dempewolff



FIRE COMMISSIONER Edward Thompson of New York shows what happens when a match is touched to propellant from an aerosol shave cream, at an industry demonstration and hearing staged last Fall

ON A HOT AFTERNOON last August, a 40-year-old mother of three strolled through her backyard, in Willow Grove, Pennsylvania, tossed an empty bug-spray can on a waste paper fire, and turned back toward her kitchen door. A dull explosion echoed through the neighborhood. A piece of flying metal from the rent can spun through the air, sliced the woman's jugular vein and, 15 minutes later, she was pronounced dead at the local hospital.

Even more tragic, perhaps, though

no fatality resulted, was the fate of the youngster spraying canned "snow" on his Christmas tree. When the spray died down, he warmed the can in hot water to "jack up" the propellant. Then he took it out, shook it—and lost an eye and half of his lower jaw to flying shrapnel from the exploding container. Ironically, the label on the can read "Merry Christmas".

In Florida, a mother cleaning a bottle warmer with rust-remover from an aerosol can, missed her target. The spray shot into the mouth of the infant

on her lap. The baby died.

Fortunately, such events have been relatively few up to now. But warnings are in the wind. The late Frank Burkett, Loss Prevention Engineer for a large insurance company, told a gathering of doctors recently: "Even though the aerosol industry's accident injury record (so far as the public is concerned) has been excellent, there have been remote cases where costly physical injuries have occurred. The problem is similar to lightning—just as no one can tell where it will strike, neither can it be predicted when some incident will occur during the use of an aerosol product."

As more and more household products go into pressurized cans and bottles, the opportunity for isolated tragedies grows. Everything from whipped cream cookie decoration to milady's hair lacquer is now finding its way into the handy gadgets. Shave cream, toothpaste, deodorants, polishes, waxes, rabbit and deer and mouse repellents, pesticides (including rat poison), lubricants, cleaning fluids, de-icers, paints, ether car starters—to name a few familiar home products—can now be dispensed right where you want them at the touch of a forefinger to a valve button. Some new products make you wonder—like the pressurized vermouth for damp-spraying martini glasses and canned air for blowing dust off things so that people don't have to strain at drawing a deep

breath, or wielding a dust cloth.

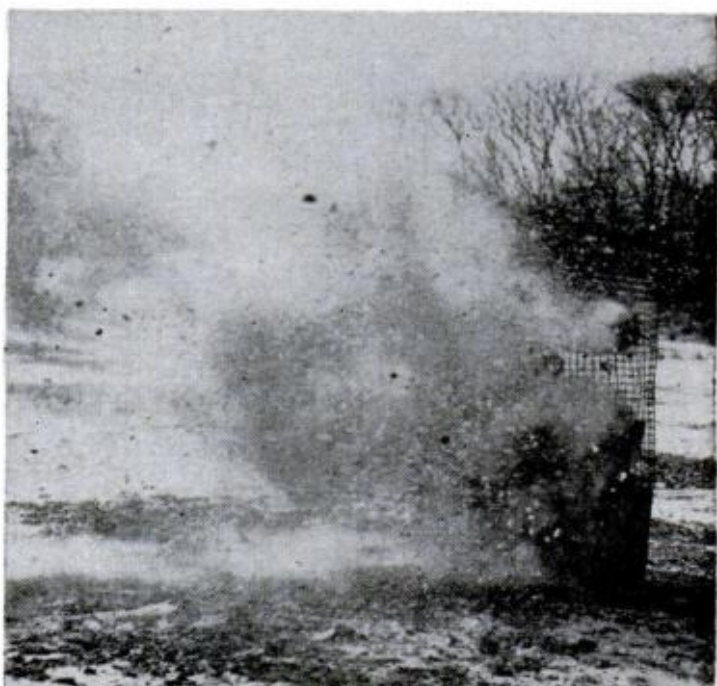
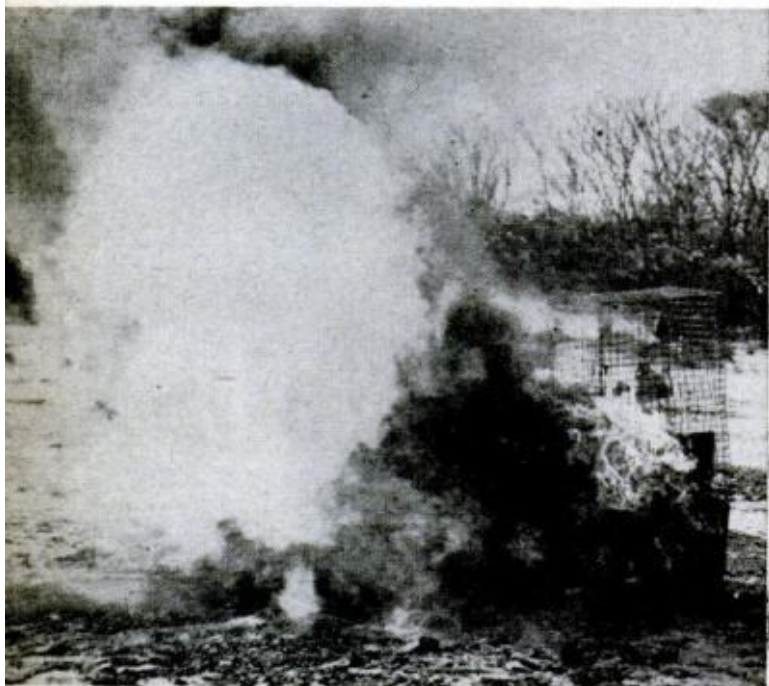
The era of the great squirt began in the early 1940's with the first appearance of bug sprays in pressurized containers. In 1947, a handful of manufacturers sold 5,000,000 cans. Last year from 140 packagers more than a billion aerosol containers went to market in the U.S. alone; some in glass bottles, some in plastic-coated jars, most in "tin plate" or aluminum cans. And the boom is still booming, in an endless procession of products. One manufacturer is currently perfecting a spray-on bandage for cuts. It should be along shortly.

All this is a tremendous boon for convenience-oriented Americans. Unhappily, too many people don't bother to read the fine print warnings that usually (but not always) appear on the labels. And few realize the possible hazards involved in the wrong application of some aerosol products—which is not always obvious from the skimpy label information.

What makes an aerosol tick, anyway?

When a product is put into the container, a "propellant"—usually a liquefied gas—is sealed in with it. Some of the liquid gas instantly vaporizes, filling the space above the product and exerting pressure not only against the sides of the container, but also against the remaining liquid gas and the product beneath it. It is this pressure that keeps the remaining gas in liquid

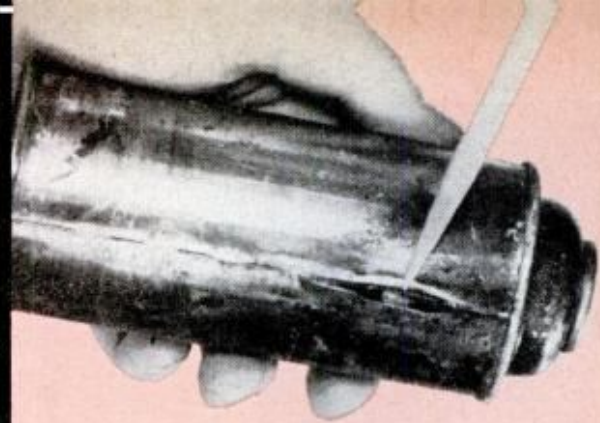
THUD-LIKE explosion of fully charged aerosol cans sends clouds of smoke mushrooming. Heavy steel mesh stops pieces of flying metal, seen clinging to inside of incinerator. Both explosions below were flammable aerosol products



form, and that forces the product up the dip tube to the valve orifice at the top. When you press the button, pressure of the vapor forces the liquid contents through the valve and into the atmosphere via the tiny hole in the button. As more space appears inside the can, more liquid gas vaporizes to fill it and maintain the pressure. As long as the button is depressed, the contents will spray away until the last drop of propellant inside the container has vaporized (see diagrams for various types of dispensers).

What many people do not understand is that even when the product is exhausted, there is still vapor left inside the container. All you need do to make a bomb out of that "empty" is to warm it up—on a trash fire, for instance. Rising temperature will expand the remaining gas until the can no longer is able to contain it. Some of the most violent aerosol container accidents are attributable to this single cause. Last year an attendant at a village incinerator in Mamaroneck, N.Y., opened the 8-by-12-inch oven door to stoke his fire. An empty aerosol can "went off" and a piece of it destroyed one of his eyes. Industry sources cite a report that in Ohio a man raking leaves flipped an "empty" onto his burning pile. It promptly burst and sent a sharp piece of debris slashing through a large leg artery. The man died before help arrived. In another "incident",

NEATS FOOT OIL in aerosol preparation, sprayed across candle, shoots a seven-foot blowtorch flame demonstrated by New York City Fire Chief Brennan



HEATED beyond can's failure limit, this one split a seam and pinwheeled out of incinerator



BOMB BURST pressures built up inside by heat, tore this can into blossom of knife-like petals



EXPLOSIVE expansion forces unpeeled this can to produce sharp-edged metal projections



BLOWN OUT bottoms of heated aerosol containers show how they can become rockets



RIGHT WAY to use aerosols is illustrated in these photos. Most fine sprays (left) and coarse window cleaners (center) are held upright so product instead of propellant comes out. Cream foams operate other way around . . .

an apartment house incinerator was demolished when someone chucked a bunch of empty aerosols down the chute. Fortunately, no one was present when it disintegrated.

What can you do with empty containers to make them safe? Most labels warn against puncturing them—and rightly, since the small remaining pressure can squirt what's left of the product all over you and your clothing. Some ingredients injure fabrics; some are injurious to skin.

The Chemical Specialties Manufacturers Association, a spokesman for the industry, suggests that empties be placed in your rubbish pick-up "where it is hoped that the commercial incinerator to which it is delivered will be equipped with crushers in advance of burning." This is fine—if your town incinerator has a crusher.

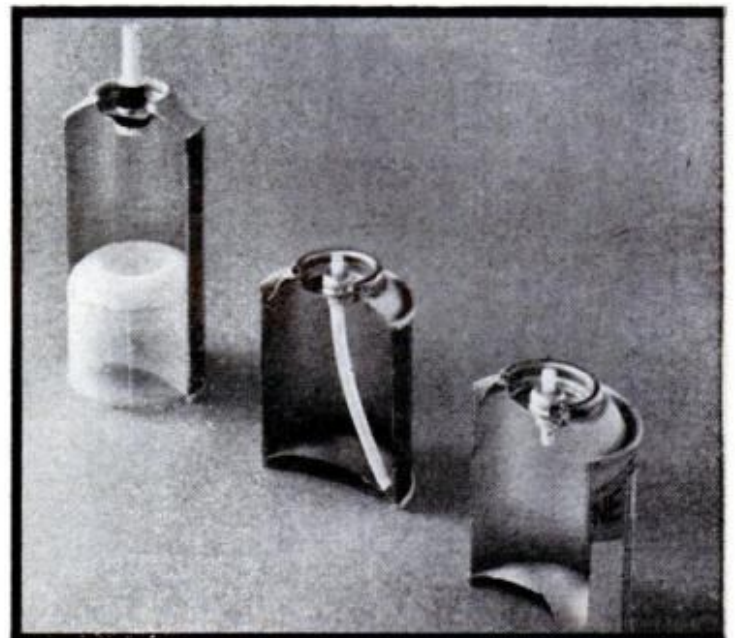
Industrial users employ a "puncture box" which safely encloses the can and pierces it at the same time. While far and away the best answer, these boxes are not cheap or readily available. A partial solution recommended by *Aerosol Age*, an industry magazine, suggests holding the "empty" in a kitchen sink full of cold water, and puncturing it with a beer can opener. However, if the product happened to be a sticky one that clogged the valve and left the can partially filled, you might wish you had scuppers in your kitchen.

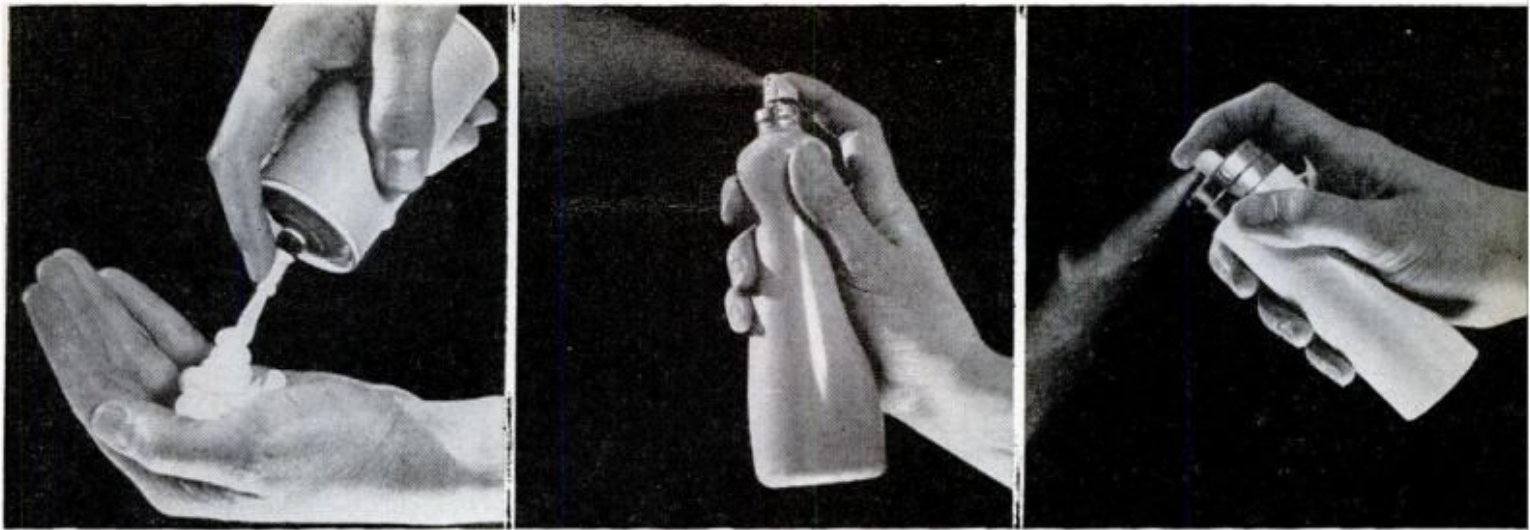
According to Safety Engineer Burkett the only safe way for an ordinary citizen to dispose of an empty aerosol can is to exhaust it as follows: Wrap the can in old clothes or newspaper and stow it in the refrigerator freezer overnight. In the

morning, get out the bundle and make a small opening in the wrapping to expose the container bottom. Take it outdoors, point the bottom away from you and, with a beer can opener, puncture it. "The low temperature," he explained, "reduces pressure to a minimum so that the can may be exhausted safely."

While "empties" have figured in many of the worst aerosol accidents—probably due to the innocent way they show up in rubbish along with bean and beer cans—they are not the only culprits. Actually, *any* pressurized dispenser full or empty will blow up if the contents are heated sufficiently. And the violence of an aerosol

CUTAWAYS of aerosol containers show three types. Gas operated piston expells product in left one. Long tube is for spray (center), short one for foam





... since can's dipstick is short. If triggered in upright position separated gas, often flammable, will escape. Cosmetic sprays (center) are designed for upright operation, as are dry powder sprays such as talcum (right)

container exploding is hard to imagine until you've seen it happen.

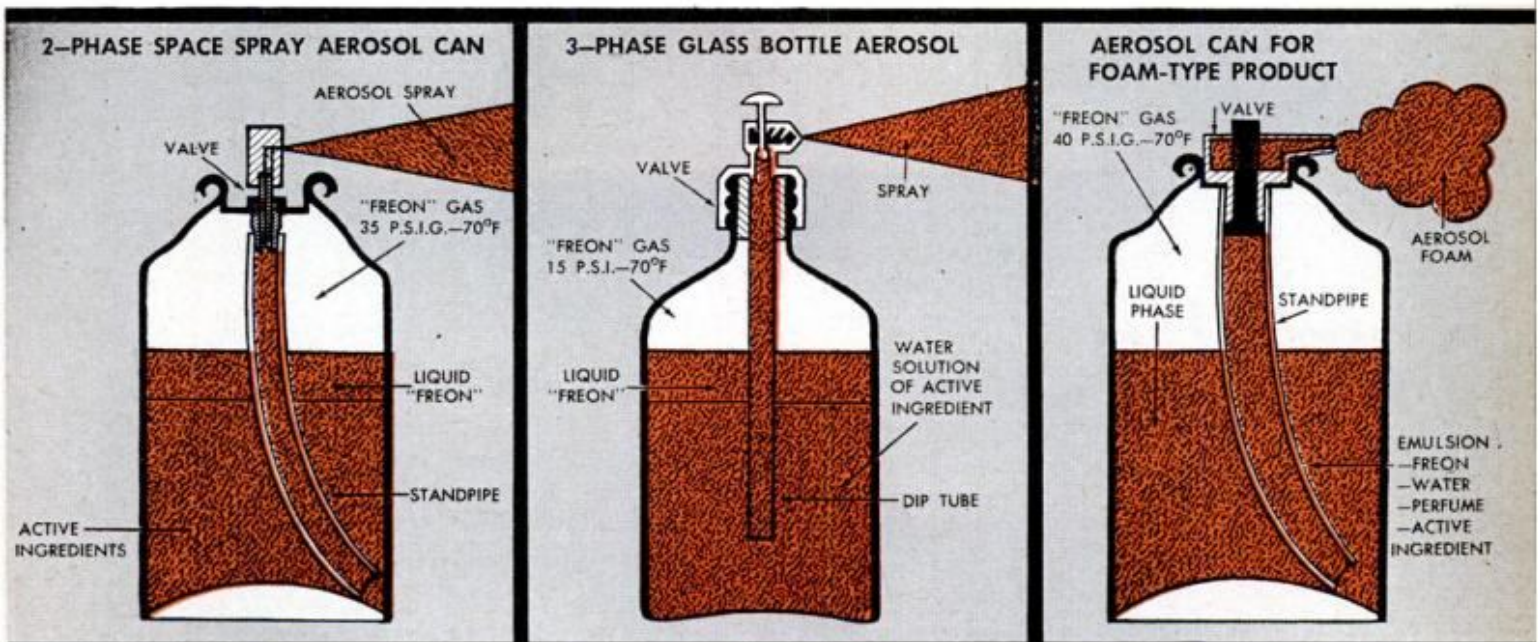
During some insurance company tests recently, a number of cans were tossed on an open bonfire. Several ruptured their bottoms almost instantly, and shot like rockets for a measured 300 feet through the air. A pickup truck, 150 feet from the blaze, received two direct hits, both of which pierced the tailboard. On another occasion, a laboratory assistant was determining the pressure content of a two-piece container in a glass basin containing a hot water bath. Suddenly the sections separated at the weld. The upper half of the container penetrated a four-inch concrete

ceiling, and fragments of shattered glass from the basin sank into the woodwork 30 feet away. Luckily, no one was hurt.

With the help of Dr. William J. McKenna, chief chemist of the Bureau of Explosives for the Association of American Railroads, the author ran some private tests recently, out on the flats of South Amboy, New Jersey. The accompanying pictures show some of the results. On a bitter cold December morning a number of aerosol products were tossed on a fire contained in a heavy gauge wire incinerator with flip-up lid. Most of them went off like land mines, blowing fire, ash, shav-

[\(Please turn to page 230\)](#)

DIAGRAMS show make-up of three types of aerosol product dispensers. Two-phase (left) is for simple gas-and-product like bug spray. Three phase is used in emulsified products. At right is typical system for a foam product





PM
OWNERS
REPORT

A Nationwide Survey
Based on 1,022,435
Owner-Driven Miles



Owners Praise Pontiac's Plush Handling, Chrome-Free Style

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

SINCE 1959, PONTIAC HAS JUMPED from sixth to third place in industry sales (and this does not include Tempest) which puts only the "low-priced" giants, Chevrolet and Ford, ahead of it.

To understand this phenomenon you need only listen to a cross-section of satisfied owners reporting to *PM*, 89.3 percent of whom stated that they'd buy another Pontiac. Here's a typical comment.

"I am especially happy with the 1964 Grand Prix. In all respects it is one of the finest automobiles I have ever driven."

According to the owners, styling is one of the outstanding features of the Pontiac this year. One owner sums it up this way:

"Pontiac's approach seems to be to let the car sell itself with restrained and tasteful styling. The exaggerated styling and 'juke box' chrome used on some other cars offends the eye, while their advertising claims offend the ear and insult the intelligence."

Pontiac owners also feel that "the price is right" as witnessed by these words from a Michigan toymaker: "I investigated the T-Bird thoroughly and felt that the Grand Prix was

The real test of styling is time. Compare, for example, a '60 Pontiac with some of the "tinny-funny" cars of the same year →



TAILLIGHTS ARE HIDDEN behind closely spaced chrome bars—a slick styling touch which makes lenses hard to clean, however. System, limited to Grand Prix models, has huge back-up lamps protected by massive bumper

YOU CAN MAKE the big Grand Prix leave the ground at rough railroad crossings, but it recovers nicely, doesn't bottom. Stability and suspension drew praise; some owners felt rear springs were weak

PM'S FIFTH WHEEL gives precise test speeds and distances. Tiny hub-mounted generator feeds current, proportional to speed, to super-accurate ammeter, marked in miles per hour

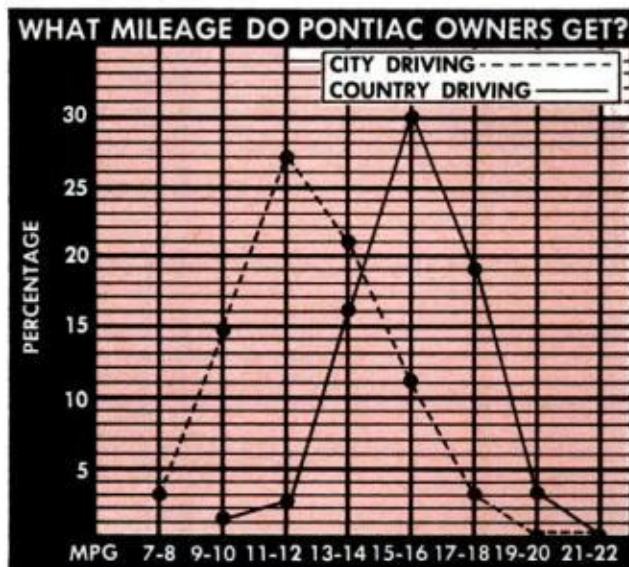


Owners Like

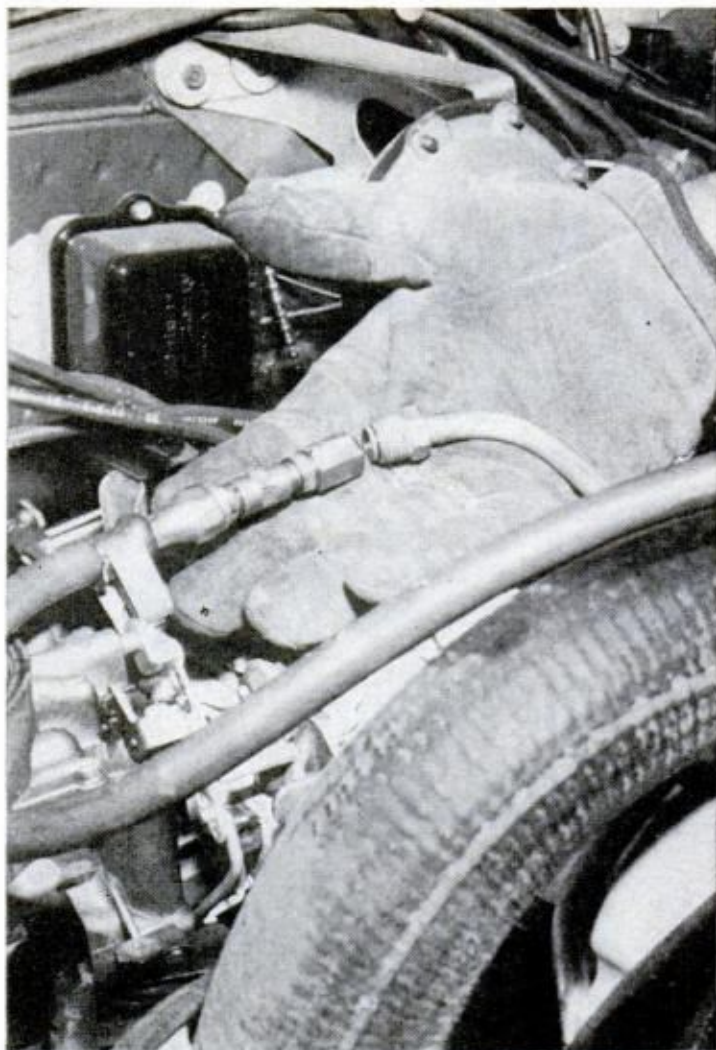
Smooth, easy handling (41.6%)
 Plush, quiet ride (40.5%)
 Simple, elegant styling (36.8%)

and They Dislike

Erratic braking action (8.9%)
 Imperfect paint job (6.9%)
 Troublesome transmission (5.2%)



ALTHOUGH THE BIG PONTIAC is no gas miser, 60 percent of owners surveyed expected the mileage they got: 17-18 m.p.g. in the country, 10-11 in town



A KEY TO LOW MILEAGES graphed at left: Four-barrel carb needs king-size $\frac{3}{8}$ -inch fuel line, the first we've found too big for PM's fuel meter fittings

Minor brake problems seem to run through the U.S. auto industry like measles in a one-room school →

much finer in quality of ride and handling. Even if T-Bird had been less instead of more money, I'd have bought a Grand Prix."

All owners did not glow with praise, however. There were a certain number of complaints. Brakes caused problems for 8.9 percent of all owners reporting, while 8.3 percent protested the low fuel mileage delivered by their cars.

To run a parallel check on Pontiac's fuel consumption, *PM* hooked up the pressure-feed fuel meter to the test car, a Grand Prix with four-barrel carburetor and 10.5 to 1 compression ratio. The car weighed in at 3950 before adding 450 pounds for driver, observer and equipment. Constant speed fuel consumption worked out as follows:

18.8 miles per gallon at 30 m.p.h.
 18.1 miles per gallon at 40 m.p.h.
 15.7 miles per gallon at 50 m.p.h.
 13.6 miles per gallon at 60 m.p.h.
 10.1 miles per gallon at 70 m.p.h.

Over-all fuel mileage in an unfavorable cold-weather test period was 11.3 miles per gallon.

Performance figures, on the other hand, were dramatic. *PM* coupled 4400 pounds of car and crew to the electric speedometer, picked up the stop watch and let out the cork.

Here's proof that Pontiac is no paper tiger. You get your money's worth if it's zoom you're looking for →

The Grand Prix accelerated to 60 m.p.h. in just 8.5 seconds. Acceleration from 40 to 60 m.p.h. took just 4.7 seconds while



A HAPPY FEATURE OF THE POWER SEAT on the test Pontiac: Besides gliding fore and aft to adjust for leg length, it tilts around a pivot point at the rear for an almost limitless range between sitting upright and near-reclining

the jump from 50 to 70 took 6.1 seconds.

The majority of Pontiac owners do not enjoy quite so spectacular a passing punch, however. The smaller Catalina, which has a standard engine of 235 horsepower, was the choice of 52.2 percent of all owners reporting.

No matter what model they chose, the majority of Pontiac owners are either frankly delighted or well satisfied with their cars. Some 72.0 percent rated their Pontiac as Excellent followed by 25.2 percent who said their cars were Good. Only 2.1 percent felt that their choice was Fair, while a miniscule minority of 0.7 percent gave Pontiac a Poor rating.

Now let's look over the list of things owners praised, taking the most popular first. Here are the first five:

"It handles like a much smaller car, brakes beautifully and does not dip or dive in panic stops."—New Jersey foreman.

"I like the way it handles on the crooked roads here in West Virginia."—West Virginia mayor.

"A touch controls the car; it handles well on curves."—Virginia student.

"I like its responsiveness and ease of handling."—North Carolina Army officer.

"It drives as well as my Cadillac and rides as smoothly."—Michigan housewife.

"I like its riding qualities, stability and comfort. It's all

Ratings like these add up to a smash hit. It's no 90-day wonder, either. Pontiac rated high in PM's '59 and '62 owner reports



Pontiacs feel taut to the road, hold the "line" with precision, yet—and here's the beauty part—do not require a harsh-acting suspension



If her thinking prevails, Cadillac designers may see less of their favorite golf courses



Next time you see a Pontiac Grand Prix parked beside a Cadillac, ask yourself which one wears the \$6500 price tag? →

And no matter what the language, the word is always "Go!" →

Perfecting brake action and making them fade-proof should top Detroit's engineering priority list →

If his passenger load is as light as his foot and he's not in hilly country, he should get about 17 m.p.g. →

automobile for my money."—Ohio mechanic.

"You can take a long trip with it and still be almost as relaxed as when you started."—Wisconsin laborer.

"To look at my 1964 Pontiac you would think it cost a million dollars."—Michigan truck driver.

"I like the good looks and freedom from excessive chrome. It sports just good, clean lines."—Arkansas dentist.

"It's got a spirited engine which can talk in six different languages if put to the test."—Michigan accountant.

"There's plenty of reserve power when needed."—New Jersey restaurateur.

"It's very good on cornering."—Michigan resort owner.

Naturally, owners found items they were unhappy about, too. In the order of their frequency here are numbers one through five from the negative list:

"The brakes pull the car in high-speed stops."—Virginia salesman.

"Brakes screech when coming to an abrupt stop. New brake shoes have been installed, but they haven't corrected this condition."—Michigan salesman.

"Right front brake locked."—South Carolina sales manager.

"It eats gas like it was going out of style."—Ohio accountant.

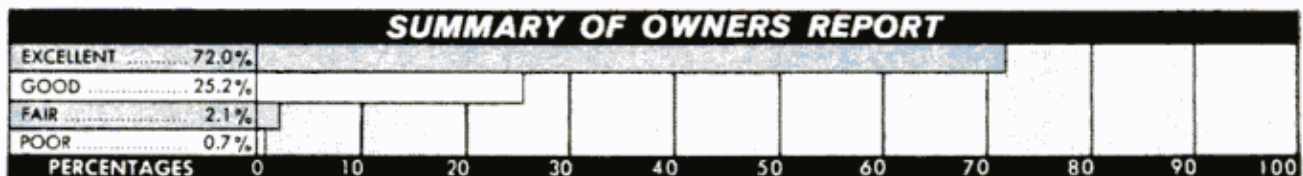
"I am very careful not to pump or floorboard the accelerator. I feel that I should get better mileage—15 m.p.g. on trips."—Michigan correction officer.

"Very poor gas mileage as compared to our 1962 Pontiac—8 m.p.g. in city driving."—Connecticut lab technician.

"Paint is poor on the car I have. There are too many places where the primer shows through."—Wisconsin press operator.

"The paint job is careless; there are lots of air bubbles and

(Please turn to page 226)



Fuel consumption experience	
About as expected	60.5%
Better than expected	16.8
Not as good as expected	22.7
Best-liked features	
Handling ease	41.6
Riding comfort	40.5
Styling	36.8
Power, performance	29.9
Roadability	12.4
Interior trim	7.2
Quietness	6.2
Wide track	5.8
Trouble-free operation	4.8
Specific complaints	
Poor gas mileage	8.3
Paint finish	6.9
Transmission	5.2
Rattles and squeaks	4.1
Insufficient room	3.8
Poor factory check	3.8
Poor suspension	3.8
Wind noise	3.4
Had mechanical trouble?	
No trouble	71.7
Yes, had trouble	28.9
What was trouble?	
Brakes	5.8
Automatic transmission	2.7
Electrical short	2.4
Windshield wipers	2.1
Carburetor	1.4

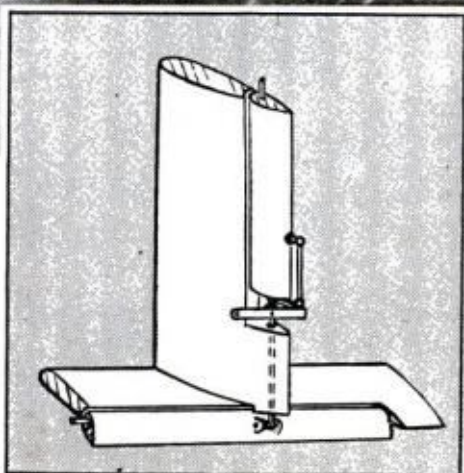
Best-liked exterior style feature	
Grille	17.9%
Clean, sleek, smooth lines	11.3
Rear end	5.5
Taillights	5.5
Least-liked exterior style feature	
No chrome on sides	5.8
Fenders	5.5
Grille	5.5
Taillights	2.4
Best-liked interior style feature	
Dash, instrument panel	26.5
Bucket seats	14.4
Upholstery	13.7
Interior room	5.5
Least-liked interior style feature	
Insufficient room	5.2
Carpet	3.8
Dashboard	3.8
Idiot lights	3.8
Decision for Pontiac most influenced by:	
Previous ownership	43.0
Styling	34.4
Price, trade-in	25.3
Dealer's service	10.7
Consider a different full-size car?	
Yes, did consider	51.9
No, did not consider	48.1
Other full-size make considered	
Oldsmobile	29.8
Chevrolet	29.1
Buick	23.0

Make of car traded in	
Pontiac	47.7%
Chevrolet	13.8
Other General Motors car	9.6
Ford	4.8
Other Ford Motor Co. make	2.4
Chrysler Corporation makes	4.5
No trade-in	11.3
Is Pontiac family's only car?	
Yes, it is	47.0
No, it is not	53.0
Make of other car in family	
Another Pontiac	5.2
Chevrolet	10.3
Other General Motors make	13.7
Ford	9.3
Other Ford Motor Co. make	3.8
Plymouth	4.1
Other Chrysler Corp. make	4.5
Other U. S. make	7.6
How is dealer's service?	
Excellent	56.1
Average	38.2
Poor	5.7
Would you buy from him again?	
Yes, would buy again	77.7
No, would not	17.1
No answer or undecided	5.2
Would you buy another Pontiac?	
Yes	89.3
No	2.8
Undecided, don't know	7.9

Speedier Color Prints

With the unveiling of Kodak's Rapid Color Processor, Model 11, home printing of color transparencies has become much faster and more convenient. The unit sells for about \$200—around \$1000 less than its commercial counterpart—and takes less than eight minutes to give a finished 8 by 10 or 11 by 14 print on Professional Ektachrome paper. (Tray development takes 23 to 33 minutes.)

In operation, the exposed paper is pre-wet, then placed on a revolving drum. Chemicals (the same five used in tray development) are poured into a tray under the drum—four-ounce batches, one at a time, with hot-water rinses in between. They are used to exhaustion and then discarded. Temperature is maintained at about 100 degrees by keeping hot water inside the drum.



Low-Cost Auto-Pilot for Foils

A passive stabilizing system for use on submerged hydrofoils has been designed by Daniel Savitsky of Stevens Institute. It involves a mechanical linkage between a flap on the trailing edge of the strut and the foil elevator. Atlantic Hydrofoils Inc., Stony Brook, N.Y., plans to offer the system in a foil kit for 15-foot boats for about \$300.



**A Nationwide Survey
Based on 714,809
Owner-Driven Miles**

Falcon Owners Love It's New Style, Old Thrift

**Marginal and Boldface Comments by Jim Whipple,
PM's Automotive Editor**

THE '64 MODEL represents Falcon's fifth year in the auto market, and it appears more popular than ever. A solid 90.9 percent of owners reporting to *PM's* questionnaire on the '64 Falcon said that they would buy another one. In 1962 the percentage voting for repeat purchase was 87.5 percent (*PM* April 1962, p. 92). Back in 1960 when we polled owners of the first Falcon (*PM*, April 1960, p. 98) only 36.6 percent declared that they would make their next car a Falcon, while 41.7 percent remained "Undecided".

Since 1960, Falcon's character has changed considerably. That first year it started out as strictly an economy car, with two and four-door sedan models, just 85 horsepower and no frills. Today, Falcon has a full line including not only practical Sixes but a simulated wood-trimmed station wagon, luxury hardtop, convertible—all available with a V8 of 164 horsepower, power steering, power brakes and air conditioning.

But the Falcon still appeals to many owners for the same old and basic reasons in spite of new-found power and glamour. In the words of a Michigan salesman: "I like the economy and ease of driving in heavy traffic. The cost of maintenance is very little. For the average working man this car is hard to beat."

A Virginia office manager, though, testifies to Falcon's new image as a performance car. Here's what he said of his V8: "I like the get-up-and-go, the passing and handling ability. I drove 870 miles in 15½ hours and the car held up beautifully."

From an Ohio factory worker who traded in his '63 comes praise of the '64 Falcon's "big car" personality. "The added weight of the '64 Falcon along with the V8 and the new ride gives it as near to a big car ride as you could get," he says. "It's got plenty of zip, too."

In spite of changes, Falcon seems to have lost none of its earlier practical virtues. A letter carrier from Georgia comments: "I drive it on a rural mail route. I like it because it is narrow, very easy to steer in and out at mailbox stops, high enough off the ground, and there's good vision out front." After logging 6700 miles in two months he's had plenty of running time in which to form these opinions.

Fuel economy is still important to Falcon owners. Some 40 percent of them reported it as the major factor in their decision to buy a '64 Falcon. And, after driving the car for a while, 34.6 percent cited economy as the "best-liked" feature.

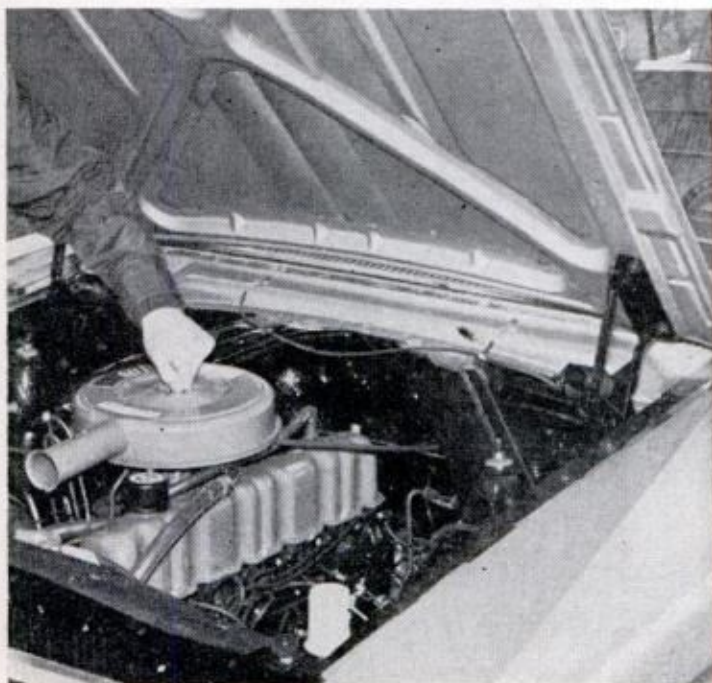
High expectations of economy, however, explain the major





ACCESSIBILITY of engine components is still a useful Falcon feature. Even the new 260-cubic-inch V8, not shown here, is easy to reach for tune-ups, repair

IT LOOKS LONG for '64 but still "parks short," a fact duly noted by many owners. Most new owners liked '64's over-all lines but some objected to square stern



Owners Like

Nimble, quick handling	(50.5%)
Its saving ways	(34.6%)
Sleek styling	(27.5%)

Owners Dislike

Disappointing gas mileage	(7.2%)
Careless assembly	(5.7%)
Rattles, squeaks	(5.3%)



FEW OWNERS complained about lack of passenger room, but some objected to the inconvenience of depressed floors which require stepping over the sills



SMALLER WHEEL in more forward location pleased *PM*'s testers, added to owners' favorable reaction to driving ease. New instrument panel drew praise

Falcon is upholding its economy reputation very nicely

complaint lodged against the '64 Falcon by new owners; 7.2 percent complained of "poor gas mileage."

To check on this important area, *PM* hooked up its fuel meter to a Falcon Six (101 horsepower) with automatic and got the following constant speed mileages.

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

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

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

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

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

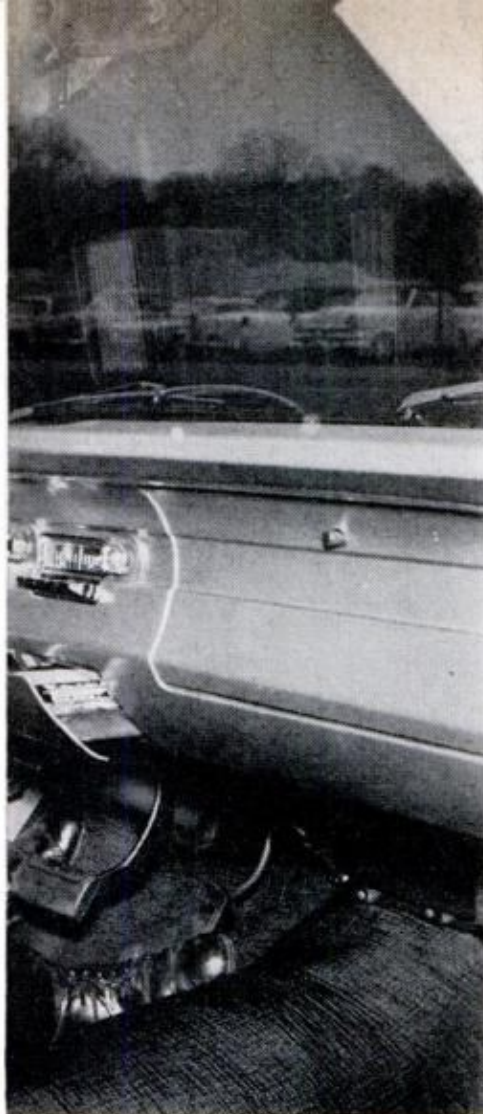
A check of performance using the electric fifth-wheel speedometer gave the following results in acceleration times: 0 to 60 m.p.h., 16.0 seconds; 40 to 60 m.p.h., 9.7 seconds; 50 to 70 m.p.h., 13.1 seconds.

Do owners love the Falcons as well as they used to? A look backward to an earlier *PM* owners report proves that they do. In 1962, 62.8 percent rated their Falcons Excellent, 31.0 called them Good, 5.3 said they were only Fair, while 0.9 percent rated their cars as Poor. In 1964 the percentages were 65.6 Excellent, 30.1 Good, 2.7 Fair and 1.6 Poor.

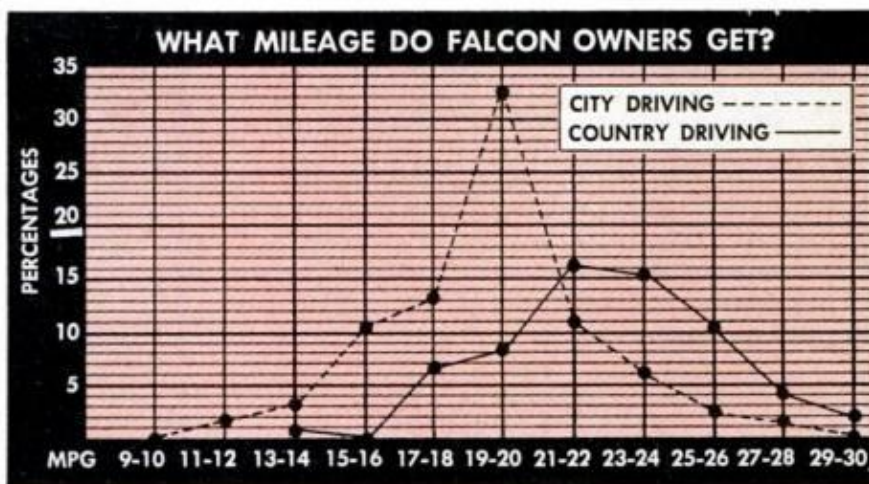
Now, let's see what Falcon owners say about their 1964 models. Here then are the first five best-liked features in order of their frequency of mention:

"It handles like a sports car with real roadability."—Michigan draftsman.

Proof of this consistent owner approval is the fact that 34% of '64 Falcon owners had → traded earlier models



THE SLIGHTLY LARGER trunk in the 1964 model had adequate luggage space for most Falcon owners, although many of them wished for a less obtrusive spare tire and a different location for the gas filler pipe



FUEL MILEAGES of all owners reporting averaged out as shown in the graph above. Six-cylinder engines made up 76.3% of total, the V8s comprised 20.5%. Some 3.2% of the Falcon owners didn't report mileages

"Handles much better than my 1963 Falcon. I do a fair amount of expressway driving and this car doesn't get blown around like my 1963."—Michigan insurance agent.

"What I like most is the handling and big car feeling."—North Carolina scientific researcher.

"The size and placement of the steering wheel has improved the new Falcon over my 1962."—Ohio engineer.

"I like the high mileage I get per gallon of gasoline—31 m.p.g. on long trips."—Michigan factory foreman.

"I like the economy; I drove through mountains on only trip I've made with it so far and got 19.6 miles per gallon with a V8 and four-speed stick."—Virginia storekeeper.

"The gasoline mileage is very nice—21 m.p.g. in city driving."—Michigan packer.

"I like the Falcon better than our other one because it is bigger and has better lines and design."—Ohio clerk.

"I like the sculptured look of the body."—New Jersey metal finisher.

"The new styling is outstanding. It has changed so much that it's hardly recognizable as a compact car. For this reason I am proud of my new Falcon."—Georgia secretary.

"The body style is good this year. I hope they don't change it for a few years."—Michigan market manager.

"For the size of the car it gives the very best ride. It is very comfortable in all respects."—New Mexico service manager.

He's right of course, but we'll bet he doesn't know why the old wheel was made so big. Ford designers wanted to simulate the feeling of a big car, thus a big wheel . . . so help us!

Here's a perfect example of an optical illusion: The '64 Falcon is just one-half inch longer than previous models. But those long, horizontal lines pressed into the side panels make the new one look a whole lot bigger

Amazing improvement in ride was made on major change in '64 Falcon without a chassis or suspension design. The secret? Careful tuning of existing components →

He might like better mileage, but with that engine size in the hills of West Virginia, his 21 m.p.g. looks pretty good →

PM's test Falcon was a random rental car but seemed quite tidily put together →

"It has a superior all-around ride."—New Jersey sales promoter.

"Excellent riding qualities for a small car."—New Jersey salesman.

"The car is very peppy. It has a 200-cubic-inch 6-cylinder engine and moves out just about as fast as a friend of mine's V8 Falcon."—Michigan production control manager.

"The V8 with four-speed transmission is a tight little car with enough power to get away from the light without lagging behind."—Michigan salesman.

Every bouquet must have its brickbat so here are the first five complaints in the order most frequently mentioned by owners:

"Gas mileage isn't as good as I would like. It's 21-plus m.p.g. over-all with 170 C.I.D. engine."—West Virginia electrician.

"My Falcon Six doesn't get as good gas mileage (18.5 with stick shift) as expected or claimed by company through advertising."—Ohio garage owner.

"The gas mileage has not come up to my expectations; it's 21 m.p.g. over-all. This may be due to low total mileage and may improve when I have a checkup."—South Carolina retiree.

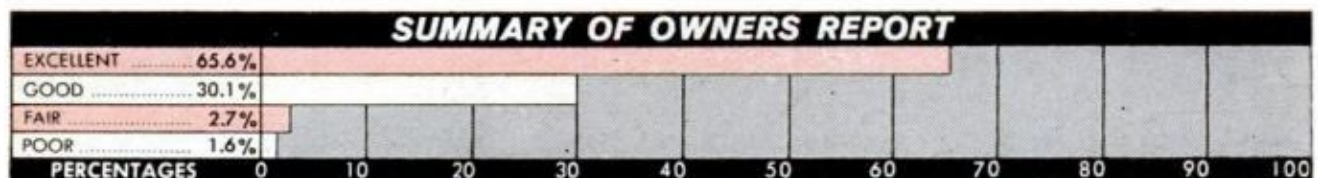
"It could be built and checked over with more care before delivering to the owner."—Wisconsin insurance representative.

"Not enough attention to details; door handle fell off, workmanship is bad on carpeting, seats."—Rhode Island salesman.

"The car rattles all the time. I believe the people on the assembly line weren't too careful when assembling the car."—Colorado sheet metal worker.

"It rattles and the rear end bumps. It was loosely built."—South Carolina textile worker.

(Please turn to page 236)



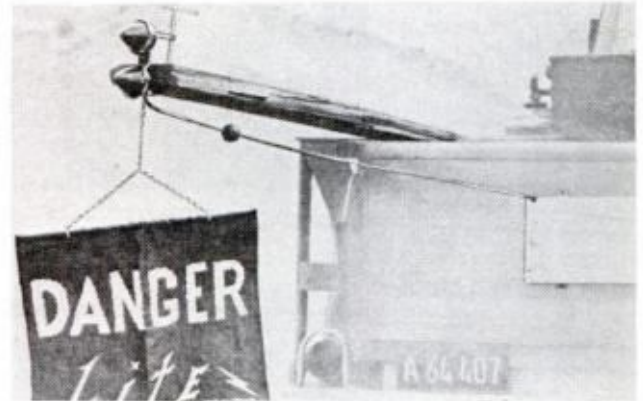
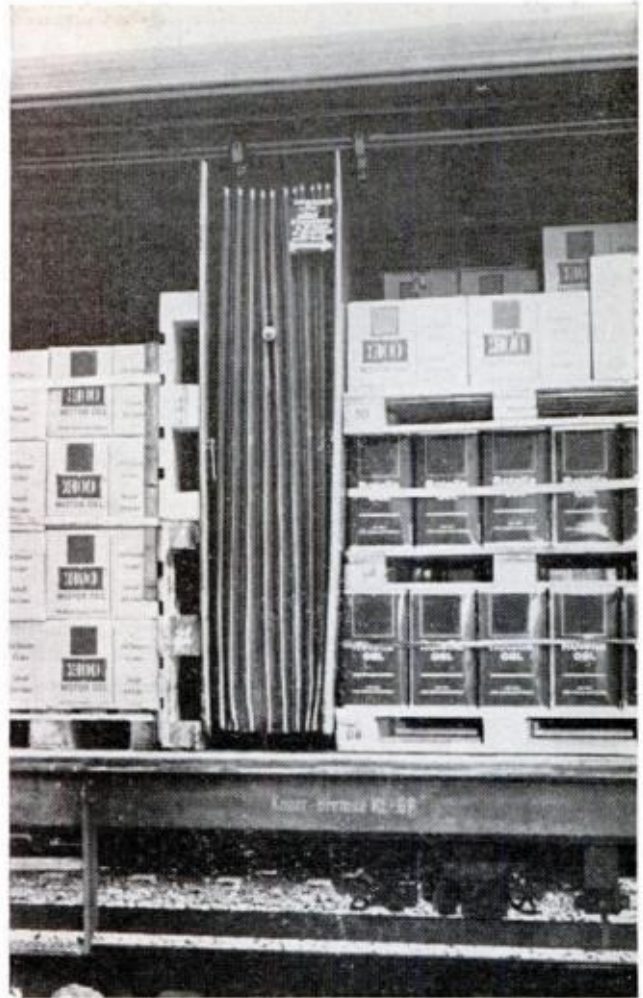
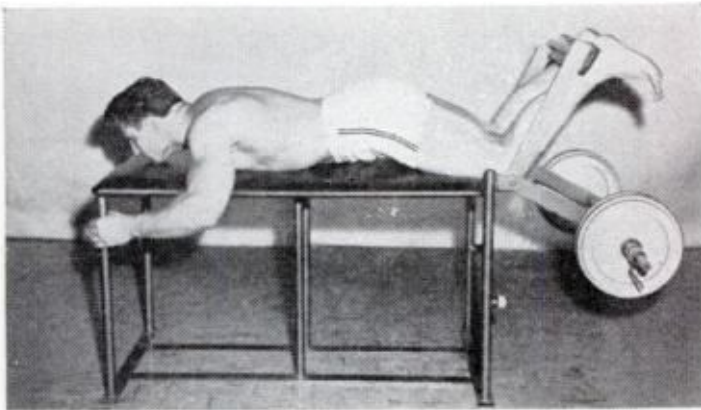
Fuel mileage experience	Best-liked exterior features	Considered another compact
About as expected 54.0%	Clean, smooth lines 9.5%	Yes, did consider 41.9%
Better than expected 24.2	Paint finish 6.5	No, did not consider 58.1
Not as good 21.8	Grille 6.1	Other compact considered
Best-liked features	Roofline 5.0	Corvair 20.4
Handling ease 50.5	Least-liked features	Chevy II 12.1
Economy, gas mileage 34.6	Trunk shape 10.2	Valiant 10.8
Styling 27.5	Grille 4.6	Rambler 6.4
Riding comfort 26.6	Gas filler location 4.2	Comet 5.1
Power, performance 20.3	Best-liked interior features	Volkswagen 3.2
Roominess 11.4	Instrument panel 25.9	Chevelle 2.5
Size, compactness 11.0	Bucket seats 13.1	Tempest 2.5
Ease of parking 7.8	Roominess 10.7	How is dealer service?
Roadability 5.3	Least-liked interior features	Excellent 57.2
Driver vision 4.2	Lack of back seat room 6.1	Average 38.0
Interior styling 3.8	Glove compartment 5.7	Poor 4.8
Solid, sturdy 3.8	Instrument panel layout 5.0	Would you buy from him again?
Specific complaints	Decision to buy Falcon most influenced by:	Yes, would buy 69.2
Poor gas mileage 7.2	Economy 40.0	No, would not buy 9.4
Poor workmanship 5.7	Styling 30.5	Undecided or no answer 21.4
Rattles and squeaks 5.3	Price, trade-in value 27.8	Make of car traded in on Falcon
Windshield wipers 3.8	Previous ownership 25.5	Falcon 34.2
Location of manual choke 3.0	Size 14.1	Ford 15.9
Too light on highway 2.7	Dealer service 10.2	Other Ford Motor product 3.4
Insufficient headroom 2.7	Considered full-sized car 26.3	Chevrolet 5.3
Underpowered 2.7	Makes considered	A GM compact 3.8
Poor interior paint 2.3	Ford 65.2	Other GM product 5.0
Mechanical trouble, if any	Chevrolet 27.5	Other Chrysler product 3.0
No trouble 79.9	Plymouth 4.9	Would you buy another Falcon?
Carburetor 3.4	Buick 3.2	Yes, would buy 90.9
Engine knock 1.9	Rambler 3.2	No, would not 4.2
Automatic transmission 1.5		Undecided 4.9

Air Cushion for Freight

Plastic sacks filled with air are now added to German freight cars to protect the contents from damage in transit. The sacks, suspended from the roofs of the cars, keep pieces of freight from smashing together when cars are jolted.

Table for Legs

Development of leg muscles is the purpose of a leg exerciser made by David George, 18, St. Louis, Mo., high school student. The steel unit was designed and built by the youth as an arc welding project in a technical high school.



Long-Load Light

A safety light and flag combination for long-overhang loads is stored in its own container when not in use. The light is wired to the vehicle's circuit. The Danger Lite Flag is sold for \$29.50 by W. H. Braley, Box 7079, Stockton, Calif.

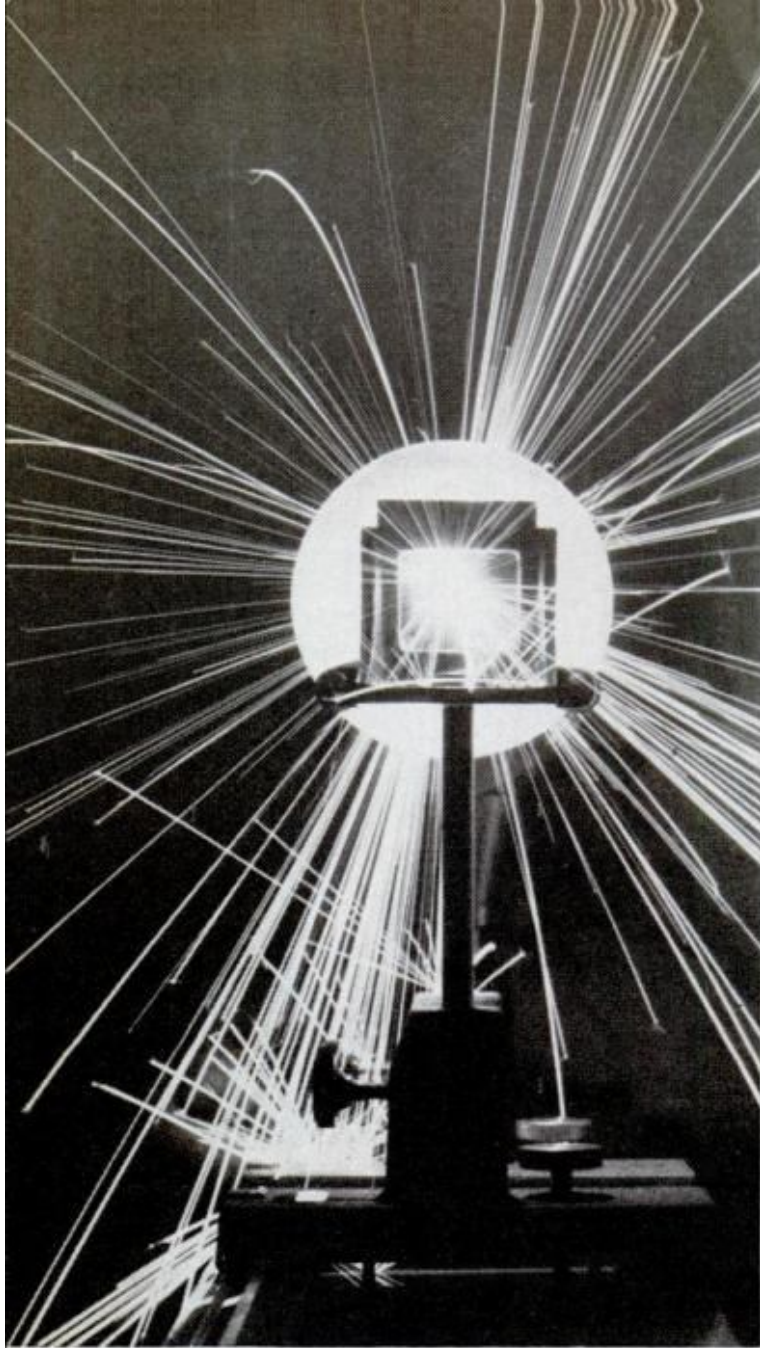
Navy's First

First operational hydrofoil ship in the Navy is the *High Point*, a 110-ton craft built by the Boeing Co. Two 3100-hp. gas turbines drive it over 45 knots on foils; a diesel powers it when it's hull-borne and the foil struts are retracted.

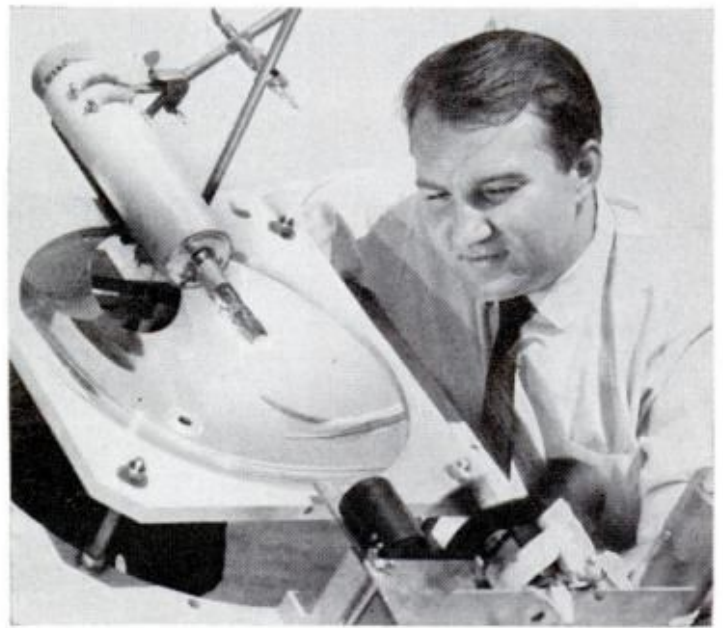
Here's Why Those

The difficult they may do today, but the impossible will wait for quite a few tomorrows. Here's what lasers can really do—now

By Theodore Berland



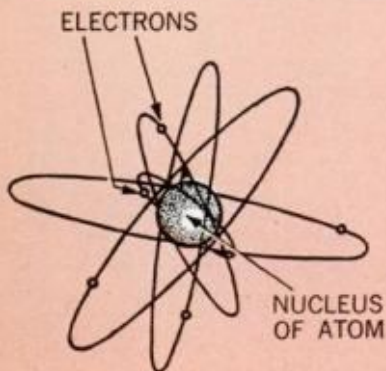
CAMERA was unharmed in head-on snap of laser piercing tantalum shield; beams show spectacular power at point of contact, are harmless elsewhere



SUN-POWERED calcium fluoride laser at RCA Laboratories uses 12-inch mirror to focus solar rays. It's a forerunner of lasers designed for use in spacecraft

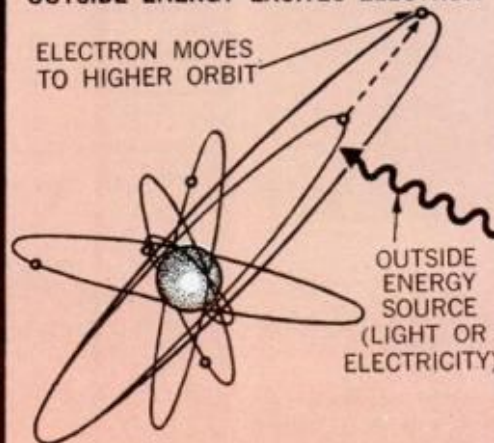
SOURCES of laser power are electrons whirling around atomic nuclei. When power is applied, electrons jump to higher orbits. In falling back to original path, they emit photons, which fall in step with triggering light

NO LIGHT EMITTED BY STABLE ELECTRONS IN ORBIT



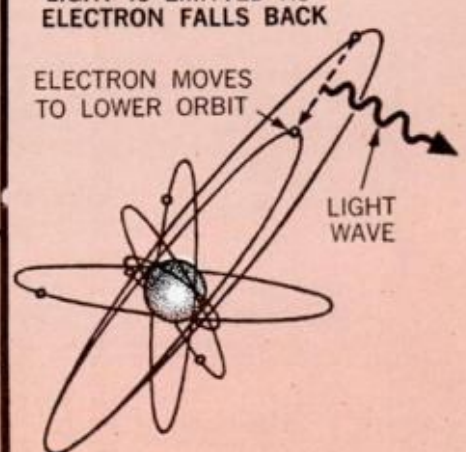
OUTSIDE ENERGY EXCITES ELECTRON

ELECTRON MOVES TO HIGHER ORBIT



LIGHT IS EMITTED AS ELECTRON FALLS BACK

ELECTRON MOVES TO LOWER ORBIT



Do-Everything Lasers Don't-Yet

WITH TYPICAL American overstatement, the laser has been touted as another instant miracle. (Remember the wild predictions about the coming wonders of atomic energy?)

In the last three years a stream of newspaper and magazine articles have promoted the laser as everything from a wonder weapon to a magic tool that will transform our industrial society.

Here are only a few wild prophecies.

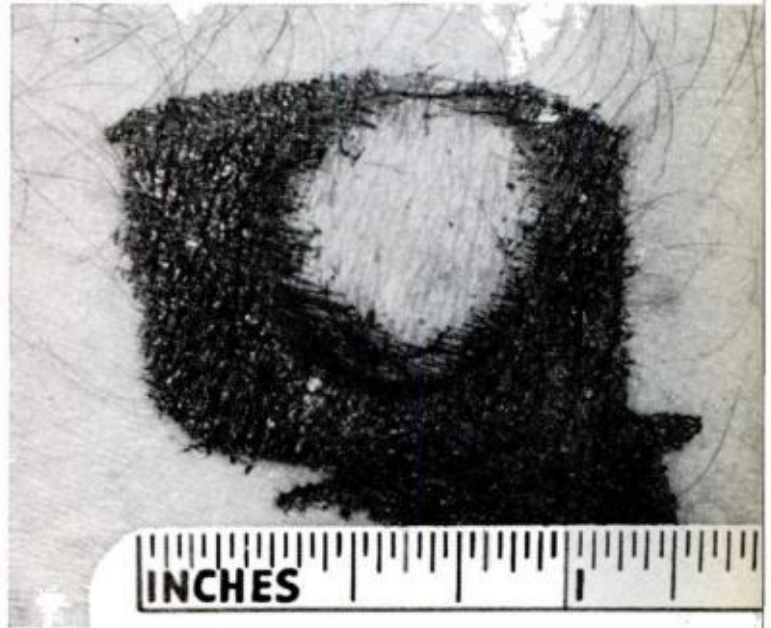
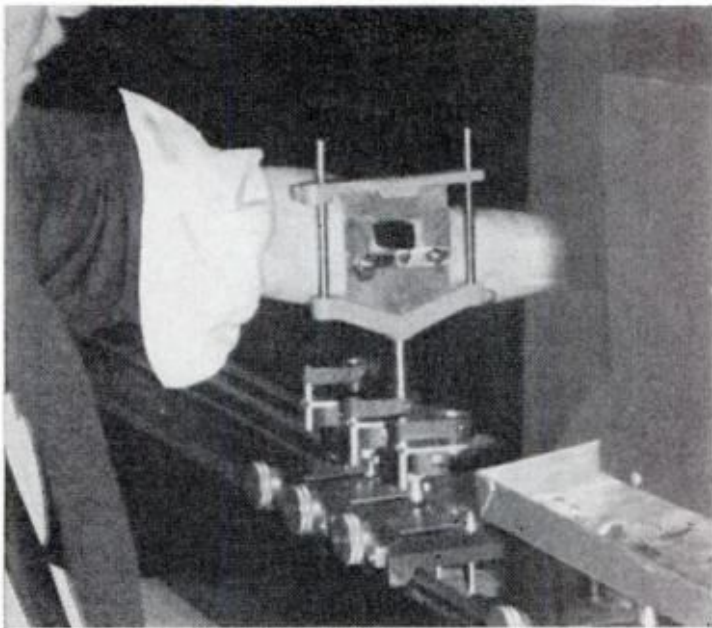
- Lethal laser beams will power that Buck Rogers weapon, the death-ray gun.

- As a perfect anti-missile missile, the laser will soon be able to knock down intercontinental ballistic missiles.

- All the world's communications channels—telephone, TV and radio—will be carried simultaneously on one laser beam.

- Surgical techniques of an unheard-of delicacy will revolutionize medical science.

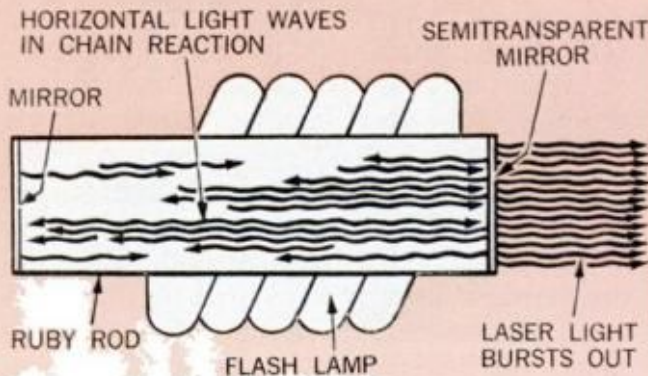
No doubt the laser is the hottest tech-



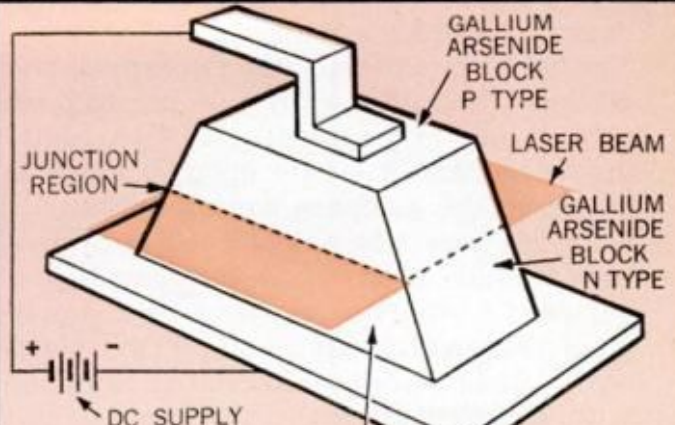
SPLIT-SECOND laser burst vaporizes patch of carbon black on researcher's arm, leaves skin unharmed. Dermatologists hold high hopes for lasers in research on skin disorders; most promising work is in skin tumor therapy

MIRRORS, one lightly silvered, at both ends of ruby laser reflect photons back and forth until they achieve power to burst out in coherent beam of light

INJECTION LASER, made of a crystal of gallium arsenide, works on a direct current; it will be used in data-transmitting jobs and in space communications

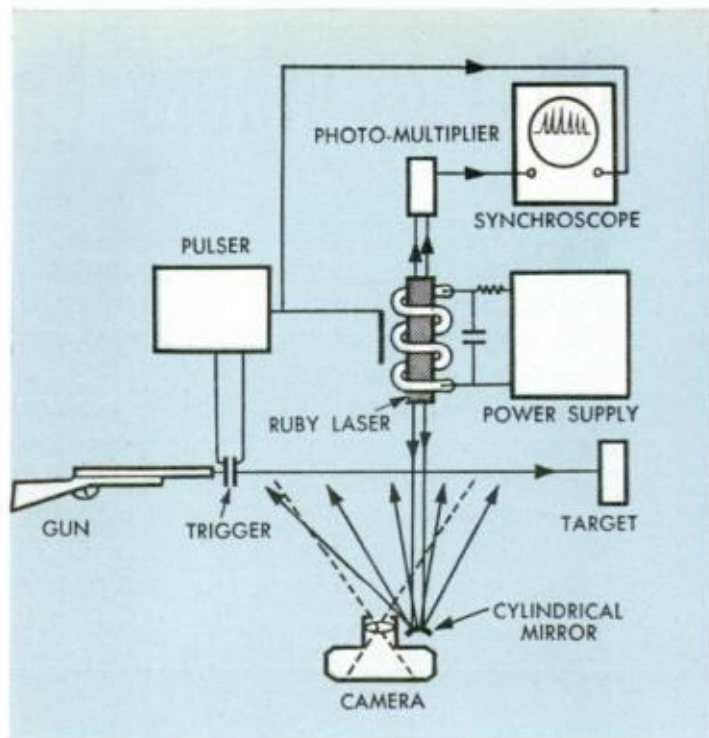
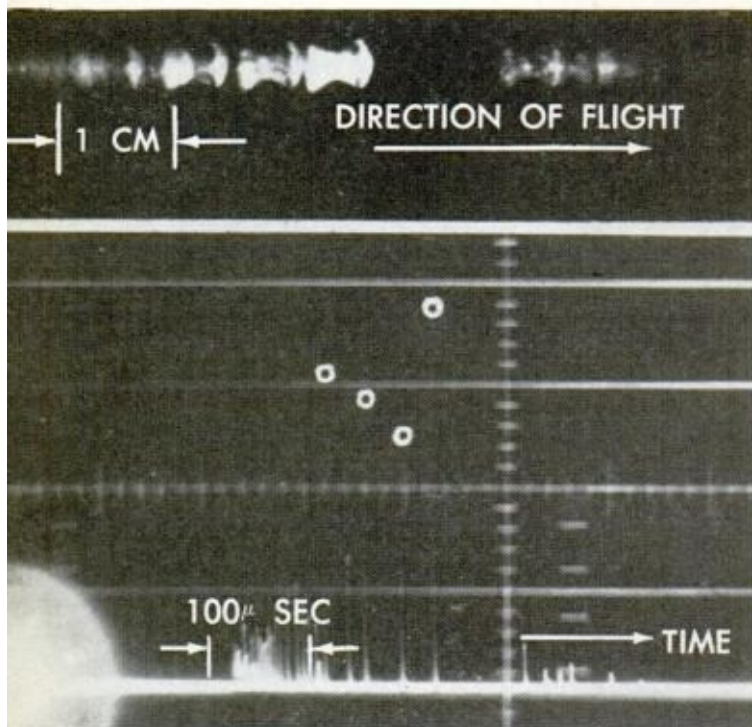


COHERENT LIGHT FROM LASER



INJECTION LASER

BLOCK ENDS ARE PARALLEL AND SMOOTH



BULLETS IN FLIGHT were captured on film by scientists at the University of Tokyo using a camera triggered by a ruby laser. Image of bullet can be seen at top of photo, left; small circles are spikes of laser light

nological development since the transistor. But its potentialities aren't going to be realized overnight. Like the transistor, it will take time, money and lots of research.

At present, the laser (rhymes with gazer) has severe limitations—which may or may not be overcome in the future. One is that power requirements for such things as, say, an anti-missile laser would be prohibitive; unlike atomic fission, lasers do not create power, they burn it.

Dr. Arthur Schawlow, one of the scientists who worked out laser theory, has been quoted as saying that practically the nation's entire power supply would be needed to destroy a single ballistic missile by laser beams.

But Dr. Schawlow, now at Stanford, doesn't think this is a permanent handicap. The light beam doesn't have to explode the warhead, he told me. "It only has to burn a small hole in the metal skin. The resulting vapor would create enough shock to shake up the guidance control system."

Clouds would be shield enough to protect missiles from any laser now in development. An even greater power supply would be needed to burn off a heavy cloud cover. And missiles could even be equipped with mirrored surfaces which could deflect the beam away from the target.

Despite these limitations, however, the Department of Defense is pouring huge

sums into laser research. The reason is obvious. A laser beam traveling at the speed of light (186,000 miles per second) would make a 1500-m.p.h. ballistic missile seem a relatively slow-moving target.

The same kind of handicaps will keep the death-ray gun confined to the comics, perhaps for years. A doctor at Children's Hospital in Cincinnati discovered that a little lamp black powdered onto bare skin absorbs the total power of a 50-joule laser beam. Clothing also can stop a laser, at least temporarily.

But the Army reportedly is investing heavily in ray-gun research. Footsloggers of the future, like attacking missiles, might wear armor with reflective surfaces or carry mirrored shields.

What Lasers Can Do

In spite of all the promotional overstatement, the laser does carry tremendous promise for the future. Look at its achievements:

The laser's pencil-thin red light beam *has* cut instantly through sheets of steel; it *has* vaporized a hole through diamond, the hardest known substance in the universe; it *has* carried communications signals over several miles, and it *has* been accepted as the most accurate of all measuring devices.

It has even lit up a small patch of the



LENSELESS PHOTOGRAPHY: Helium-neon laser light beamed at an original snapshot of little girl resulted in blurred negative, left. Laser beam trained on the negative in a lensless projector produced the clear image at right

moon, an achievement which points to the possibility that the lunar surface someday will be accurately mapped working from the surface of earth.

One of the most beneficial laser applications to date has been in the field of eye surgery, specifically in retinal cases. The disease called detached retina, for instance, is one of the major causes of blindness. It begins with the retina's tearing a little here and there; eye fluid then gets behind the tiny rips and begins pushing them open; if left untreated, the entire retina is pushed away.

German doctors developed a technique for using scar tissue from burns to weld the retina in place. Ordinary light on a sharp focus was used to create tiny burns.

The laser does this too. But it is better for two reasons. Its light is far more powerful than conventional light; its thousandths of a second bursts are faster than

any eye movement, making it unnecessary to immobilize the eye. And it creates no heat, dispensing with the need for anesthesia and making the operation an office treatment rather than a hospital chore.

With the same technique, lasers can also kill tumors. Dr. Paul E. McGuff of Tufts-New England Medical Center is investigating the laser's ability to destroy animal cancers and human cancer cells raised in cultures.

Other medical research techniques are also under study. At New York University lasers are beamed down backwards through microscopes to irradiate sections of living cells. With such "microsurgery," says Dr. Norman M. Saks, tiny structures can be knocked out without harming the rest of the cell. Then the cells can be studied to see if and how they grow.

At Boston University Medical Center, laser microscopy is used in chemical



PRACTICAL LASERS, such as this 2.5-pound model, are put to many uses. Perkin-Elmer's small gas laser, which costs about \$3000, is used for precision measurements and for testing optical components



BURNING THROUGH a sheet of stainless steel, the beam of a laser developed by Raytheon Co. bursts a balloon 10 feet beyond. Dot of light in balloon is laser light, captured on film in its duration of $1/2000$ th of a second

analysis research; tiny post mortem samples of brain and pancreas are burned to vapor which is then passed through electrodes and the spark is then analyzed by spectroscope.

But just what is the laser by the way? And how will its remarkable abilities be used in the future?

The name itself is synthetic—scientific shorthand for Light Amplification by Stimulated Emission of Radiation. Like atomic fission, the laser gets its phenomenal energies from individual atoms; and it makes use of a kind of chain reaction.

But unlike fissioning, a laser does not split and destroy atoms; it uses them over and over again to create the photons of light which make a laser beam "lase."

Light rays—like TV, radio, X rays and radar—are part of the electromagnetic spectrum. All these are forms of energy, each traveling in waves of its own individual frequency and length.

Ordinary light is diffuse; a light bulb or the sun gives off light rays of various colors which travel in all directions in a mad scramble. The laser's remarkable powers derive from the fact that it shoots a beam of controlled or coherent light, in which the individual rays radiate in step, like a regiment marching in column formation.

An outside power source, from a direct current or even from a photo-flash, is used to trigger the lasing process. In the well-known ruby laser, chromium atoms are the target. When a current or light hits

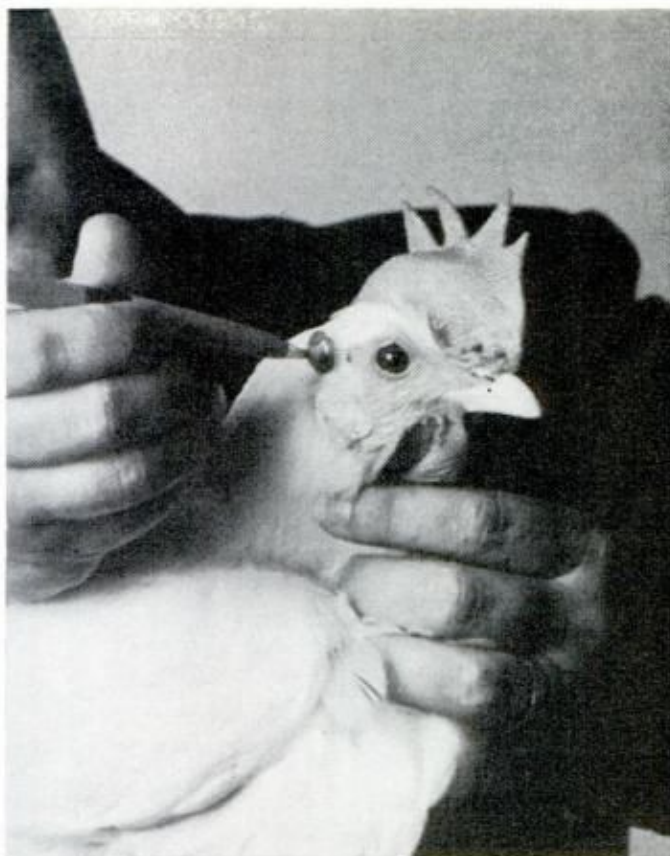
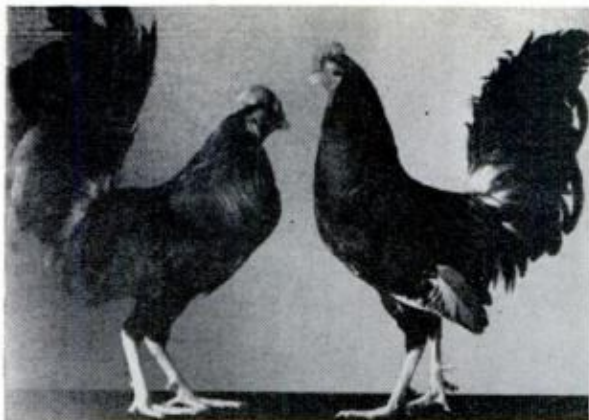
these chromium atoms, their electrons are kicked into a higher orbit around the atomic nucleus. They may remain in this extended orbit for a millionth of a second before falling back into their original paths. As they fall, excess energy is released in the form of photons of light.

At this point, the photons are as incoherent or chaotic as any other light. Some go off at odd angles and are lost. But those traveling in horizontal paths are captured by the triggering light source. To keep the waves in step, the laser is equipped with mirrors at both ends—one of which is more heavily silvered than the other. The mirrors reflect the photons back and forth in a rapidly accelerating chain reaction or cascade of light.

As they plunge back into the pool of excited electrons, more photons of light are emitted. Once the photons reach a certain amplification—billions of times—they burst through the weaker mirror in a coherent beam of powerful light. (All the actions just described actually take place in a split second.) Laser beams can be pumped to temperatures billions of times hotter than the surface of the sun.

In the extremely rapid development of laser technology—the first laser was put together in 1960—discoveries that are exciting one day are old-hat the next. At this writing, the most powerful laser puts out a beam of 1500 joules (a joule is one watt for one second), but this may be com-

(Please turn to page 206)



Contact Lenses Bring Peace to the Chicken House

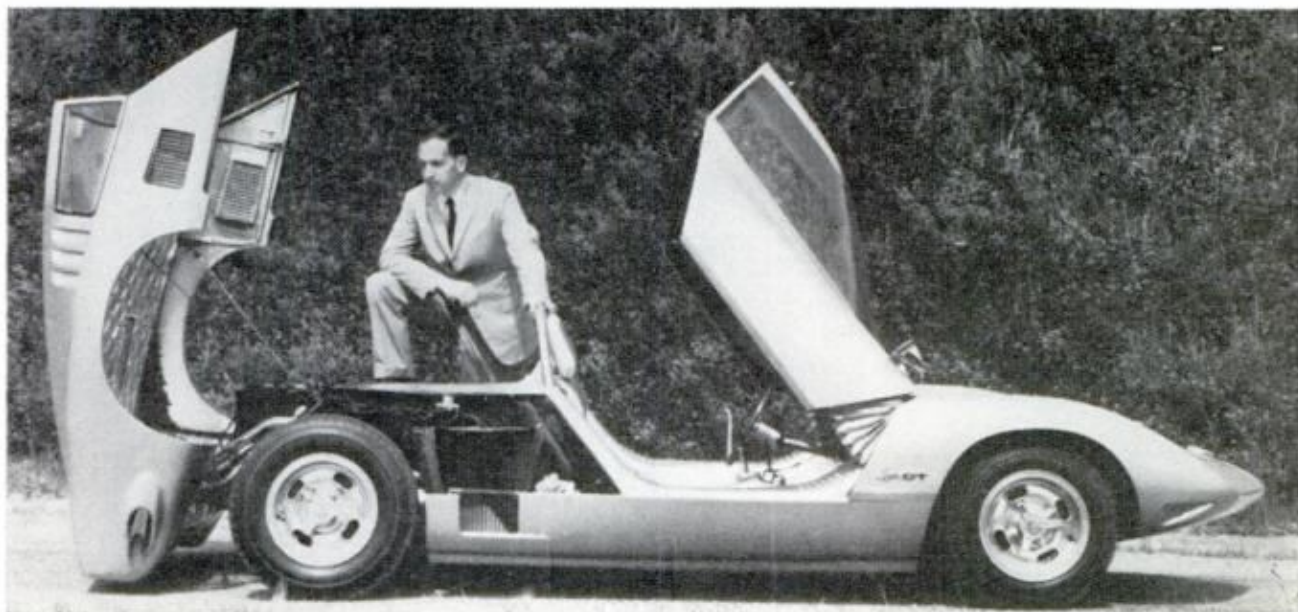
Thanks to contact lenses, the time-honored pecking order may disappear from the hen house. Poultry growers find that contact lenses designed to distort chickens' vision instead of correcting it make the birds more amiable. The lenses, made of

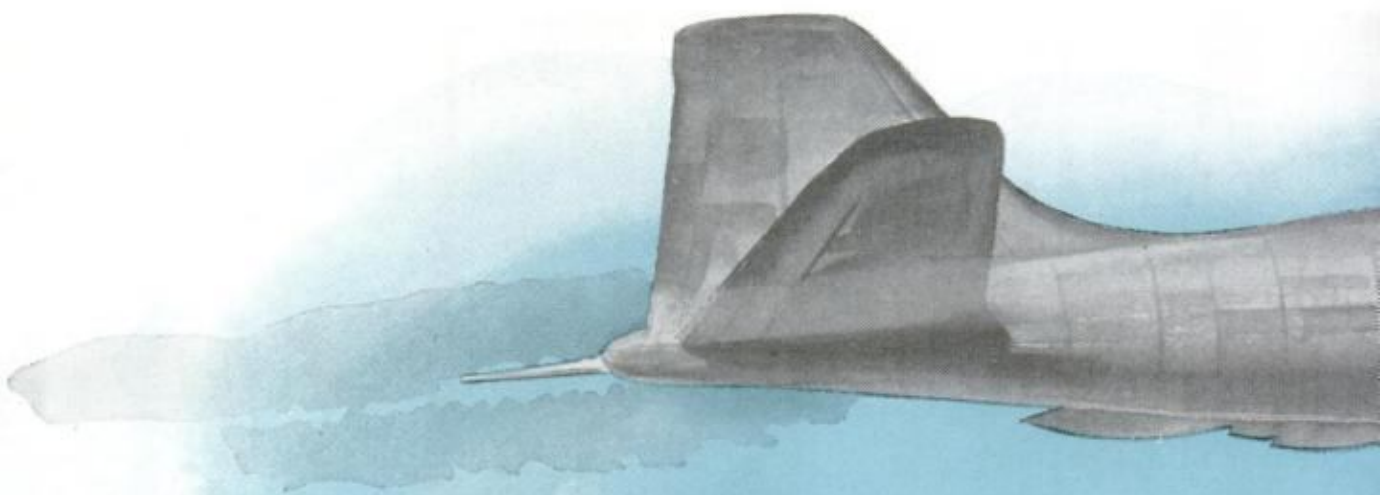
red plastic, are put in the birds' eyes at age six to eight weeks (photo, right), can be left in permanently. With lenses in place, two Claret cocks lose their natural belligerence (left, above); with lenses removed, they immediately fight.

Dream Car Opens Up Like a Clam

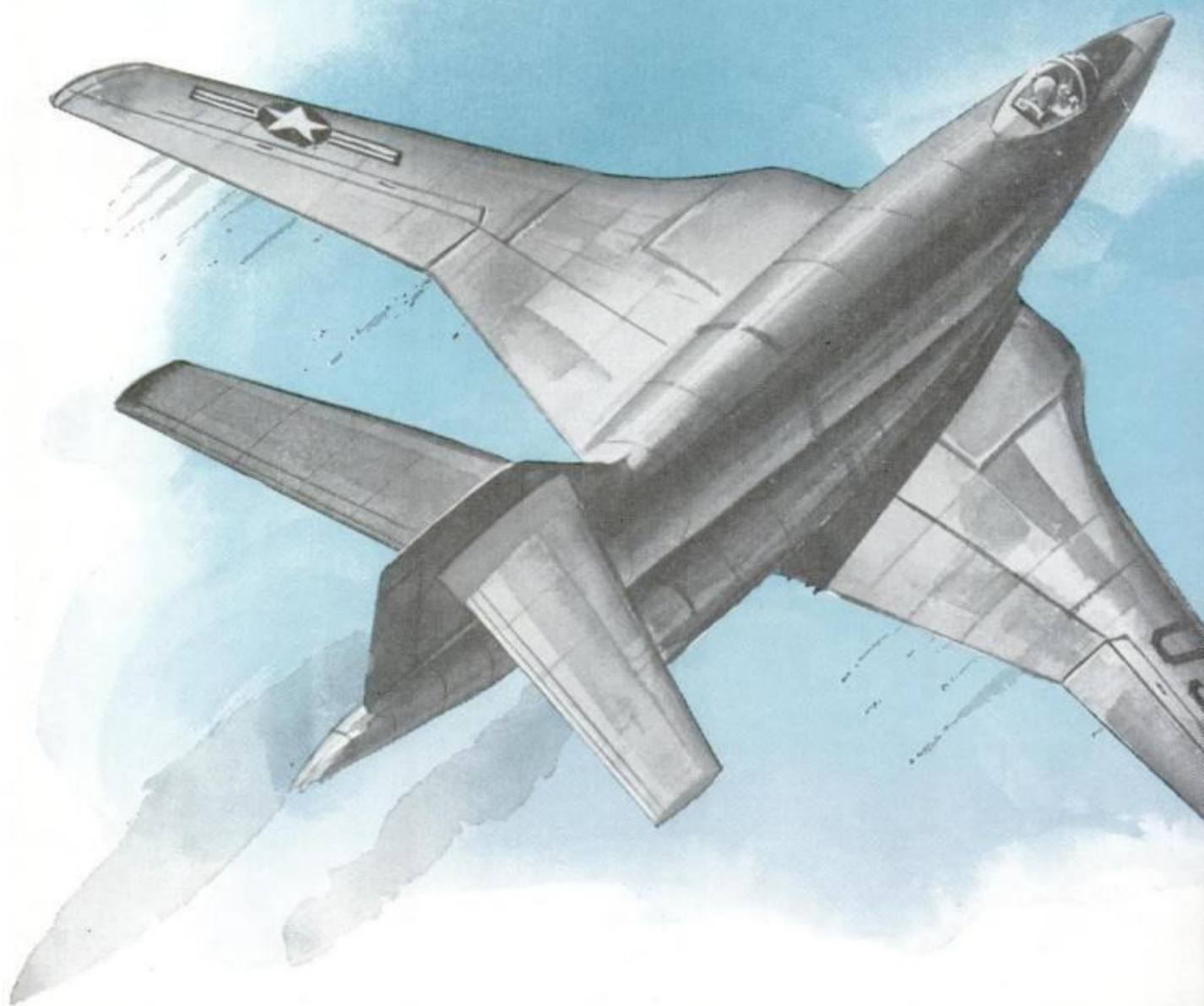
Among the Chevrolet dream cars touring auto shows is the Monza GT. It uses a standard Corvair rear-mounted engine, but there the similarity stops. The engine is forward of the rear axle instead of being

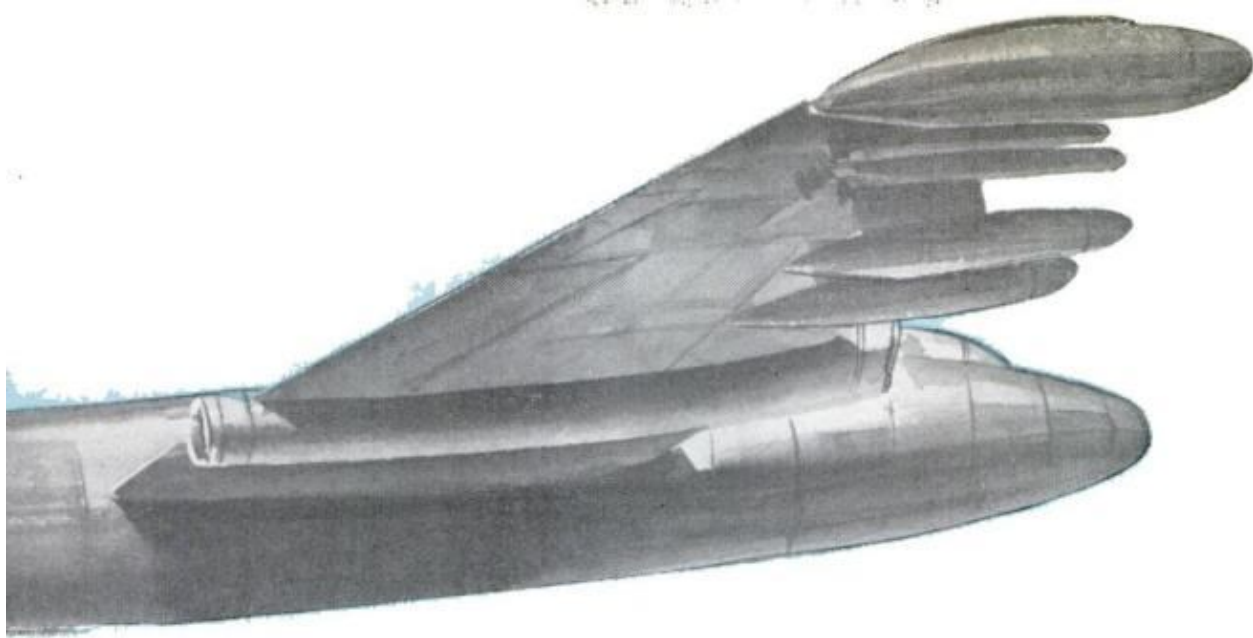
in the overhang area, for better weight distribution. The change became possible with seating limited to two places. The forward half of the body swings up for entry, the rear for engine access.





I Was Shot Down by





an American Jet

Friendly enemies test America's air defenses against sneak bomber attacks; here's how

By C. P. Gilmore

BOMBING MISSIONS traditionally start in the frosty dawn. That's the reason the whole thing seemed out of character to me. We had a leisurely lunch, rode to the flight line, checked out one of the sleek, droop-nosed B-57s waiting there, and climbed aboard as casually as though we were setting off on a sightseeing trip.

The other thing that gave it a sense of unreality was the mission itself. We were off to bomb New York.

Within the next three hours, I knew, we and the dozen other ships of the squadron would become "it" in a dangerous game of hide-and-seek, played at high altitudes and high speeds, involving hundreds of men and millions of dollars worth of equipment. The game also involved the defense of the North American continent.

Across Canada and down the U. S. coasts stretches a giant chain of radar stations. If an attack ever comes, these watchmen will spot it and sound the alarm. Fighter pilots who stand by 24 hours a day in hangars across the country will race to their planes and streak into the sky to meet the invaders.

It's a smooth-working, efficient system. In practice alerts it operates beautifully. But what would happen under pressure—when the radar operators aren't expecting anything; when the men who scramble the planes aren't primed to push the panic button; when pilots must react instantly and without any warning?

There's a simple way to find out. Launch an attack, using friendly aircraft. Launch it without warning. Don't tell the radar operators, the controllers, or the pilots that it isn't real until they've gone through the whole thing—everything, that is, except the actual shooting down of the attacking aircraft.



AUTHOR GILMORE dons oxygen mask in altitude chamber. He had to pass test here before Air Force would allow him to ride in high-altitude bomber

Stop them just before they do that.

The risky element is, of course, that you've got to have target aircraft—the simulated enemy planes that almost get shot down. That's the group I was with—the crack 4713th Defense Systems Evaluation Squadron based at Stewart Air Force Base near Newburgh, N.Y. Ground-based defense crews call them “The Friendly Enemies.” They constantly fly against air defenses, testing readiness, probing weak points, spotting potential holes.

Pilot of the ship I rode was Art Jepson, a tall, blond, good-looking captain who looks as though he was picked for the role by Central Casting. As he taxied out and took off, it occurred to me that the countryside looked like a movie set, too. A thin haze hung over the low mountains in the distance, but the sky was as blue as I've ever seen it, and the fall air had a cool, lovely feel.

Art didn't talk much as we climbed to 35,000 feet, headed southeast over Connecticut and Long Island, then out over the Atlantic. He didn't have time. Without the navigator who usually rode in the seat I was occupying, he had to do the whole job himself—fly the ship, navigate, keep in touch with the ground. All I had to do was enjoy the flight—and sweat out the possibility of actually getting shot down.

Since hundreds of Air Force planes criss-

cross the country constantly, nobody paid any attention to us. We had filed a flight plan, so coastal radars knew who we were. But they didn't know that after heading out for a little more than an hour (by that time we'd be some 800 miles out and beyond coastal defense radar) we'd turn around and—without warning—come back.

Every U. S. military plane carries a black box called SIF—Selective Identification Feature. When radar picks up an unidentified aircraft, the operator sends out a special signal. The SIF answers automatically in a pre-arranged code that tells coastal defense the plane is friendly. When we reached our turn-around point, Art flipped off our SIF. Now New York sector Air Defense Command would have no way of knowing we were friends. They'd classify us as unknowns—and act as though we were hostile.

Before we had left the ground, Squadron Commander Lt. Col. L. W. Feagin had explained to me how our raid would work. One man in the New York sector, he said, was expecting us. In the trade he's called the trusted agent or “eyes only” officer. It's up to him to identify us as fakers—friendly target planes—rather than hostiles. Since waiting too long could be dangerous, he usually identifies target aircraft as fakers reasonably soon after they're spotted. Through most of the exercise,

ON FLIGHT LINE Capt. Jepson (left) checks out author on cockpit procedure prior to takeoff. Part of procedure includes knowing how to eject from plane



then, radar operators and fighter pilots know that the raid is an exercise. Sometimes, though, to test the system under actual combat conditions, he waits until the last moment. I didn't know just how long he'd wait to tell the fighters that came up that we were really friends. But I hoped he had his mind on business that day.

Art interrupted my uneasy thoughts. "We're getting close to the IP," he said over the intercom. That's the initial-penetration point, I had been told. Ground radar should sight us soon now. The squadron of bombers that had taken off with us had fanned out, and each would hit its IP along a broad front about the same time. Radar scopes along the east coast would light up like Christmas trees with unknown targets.

Facing me in the cockpit was a bewildering array of knobs, scopes, dials and other electronic equipment—the ship's electronic counter measures. Just below my feet—where the bombs would be normally—was more than a million dollars worth of the most sophisticated ECM equipment in existence. In World War II, planes shot at each other with bullets. Not anymore. Since all weapons are now electronically controlled, the side that overwhelms the other electronically wins the battle. Our ECM equipment was our only hope for getting through.

The ship had one big handicap—me. Normally, the navigator is also the EWO—Electronics Warfare Officer, or, in pilots' language, the scope dope. He manipulates the ECM equipment to throw interceptors off the scent.

Since I was in the spot usually reserved for the EWO, Art had to operate what ECM he could from dual controls in the front seat, while at the same time attending to all of his other jobs. I wasn't a complete liability: before we took off, he showed me how to operate the chaff dispensers. These gadgets—wing-mounted cylinders that look like auxiliary fuel tanks—spit out bundles of aluminum foil strips on command. The strips reflect radar signals all out of proportion to their size.

When a fighter headed toward us, we could do three things. We could noise jam—transmit static to fill his screen with hash so he couldn't find us in all the clutter. We could use a new kind of jammer called a spoofer that transmits false range information to his radar. And we could throw chaff at him. This would put two targets in the sky—us and the chaff. Since we'd keep moving while the chaff stopped, this wouldn't fool him for long. But a fighter, to make a kill, must lock in on a target and hold it while his computer figures out how to aim the missile. If we could keep breaking his radar lock—with

B-57 BOMBER fires up for takeoff. Starting charge for jet engines produces cloud of black smoke. Bomber flew out over Atlantic, beyond radar range, then reversed course and used evasive action in attempt to "bomb" U.S.





one device or a combination of them—we might keep him from getting a shot.

"Ground radar has us," Art grunted into his mask. I didn't see anything, but one of his black boxes apparently told him we had been spotted.

"Aren't we going to do anything about it?" I asked after a few minutes. I could envision the wild activity on the ground, and I didn't like the picture. Bells were ringing and lights flashing in weapons control centers. A horn was blaring in the pilot's ready room. Fighter jockeys were piling into cockpits. In a minute or so they'd be off the ground—heading our way. In about 10 minutes, at 1500-m.p.h.-plus, they'd be sidling up to us—fingers on triggers.

"They should have a pretty good track on us by now," said Art in an unconcerned way. In pilot talk, he was telling me that they now knew our speed, course and altitude, and were figuring out the best intercept course for the fighters. "So let's see what we can do. Hang on."

It took me about one second to find out why he said that. The 57 flipped on its end—nose down—and headed straight for the nearest planet—Earth. The altimeter in front of me began to unwind like a windmill in a hurricane. My body, which didn't know any better, tried to obey the laws of physics and keep going forward. The seat straps cut into my shoulders as I strained to fly through the canopy.

A few moments later and more than 34,000 feet lower—just before we were about to scream into the ocean, it seemed to me—Art pulled the nose up and pointed it toward the horizon again. The G-force—I learned later that it had been a moderate 4—jammed me into the seat.

This mid-air spasm, I learned, is called evasive action. The earphones in my helmet came to life again as Art explained his strategy. "They've got a track on us now and are sending interceptors to where they calculate we'll be a few minutes from now. But we'll stay down here on the deck where we may be able to lose the radar temporarily, and change course. By the time we get in close enough for them to

FRIENDLY BOMBER glides through sky, high above Atlantic, en route to friendly bombing mission on New York. That's Capt. Jepson in forward cockpit



pick us up again, the fighters will be off somewhere else looking for us.”

It worked. We flew another 10 minutes before ground radar found us again. Art tried jamming, but it didn't work for long. Coastal radars overlap. At least three cover any given spot. They can all switch frequencies as often as they like. You might be able to jam one, but you can't keep them all jammed.

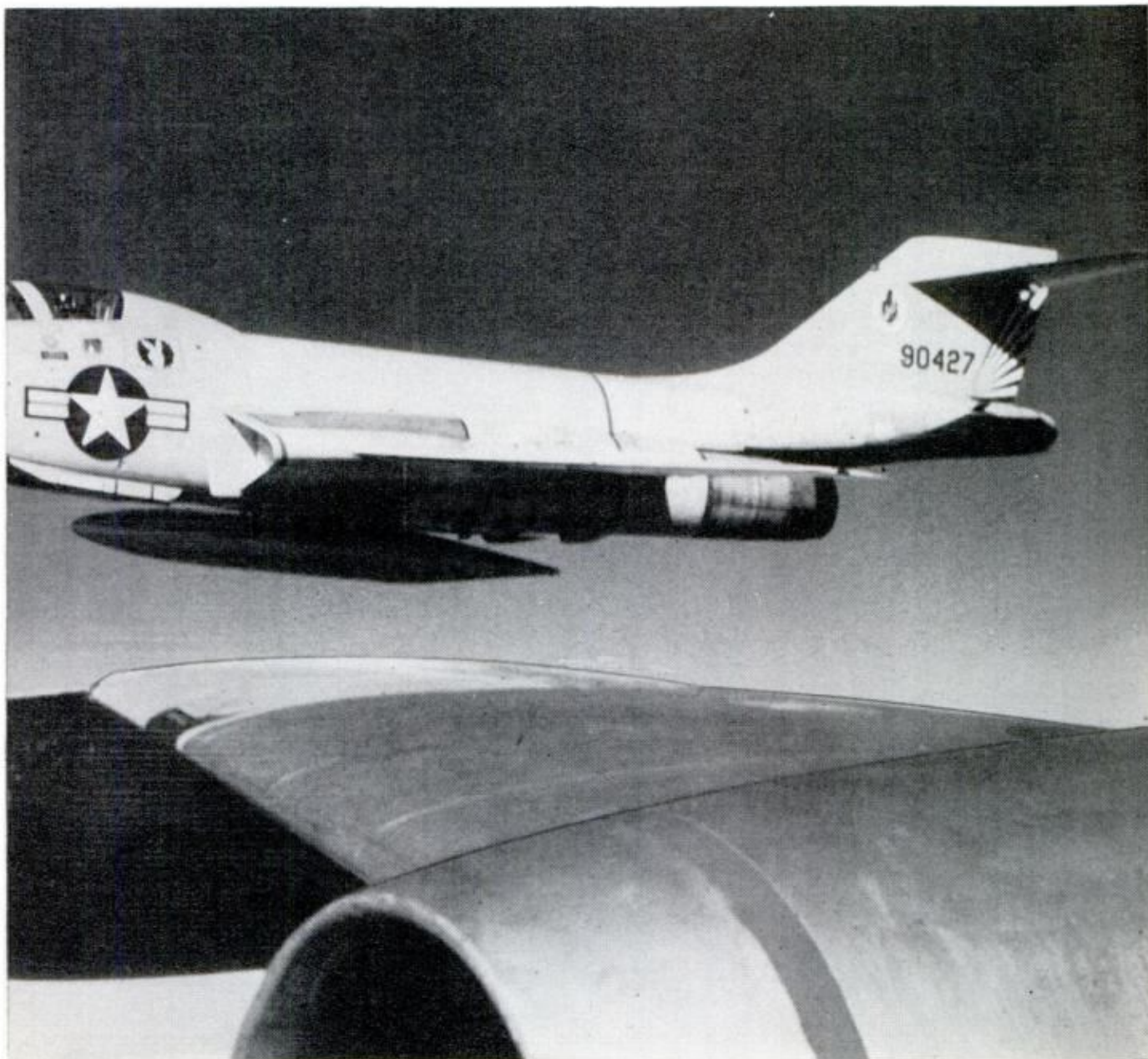
Back on top at 35,000 feet, we were fighting for time. If we could keep the interceptors off our back for a few minutes, we'd be within striking range of the target. We were too close to jam coastal radar effectively, but maybe we could still confuse the fighters.

Knowing how the interceptors attack helped us plan our defenses. They scramble in groups of two, then come in at the target—us—about five miles apart. One makes a run to identify the unknown and shoot it down if hostile. The wingman, meanwhile, hangs back. If anything happens to the leader, the backup man attacks.

All we had to do was keep the first man from locking his radar on us. Art tried all the tricks. He asked me to switch the radio in the rear cockpit to ground frequency. The ground controller directing the fighters came through. “Black Leader,” the voice crackled, “go nine zero. Climb gate. Angels at 35.” Head due east, he was tell-

[\(Please turn to page 218\)](#)

FRIENDLY FIGHTER pulls alongside bomber after shooting it down—in a friendly way. Electronically, it had done its job—found the bomber, got it in its sights, and shot it out of the sky, miles from intended target



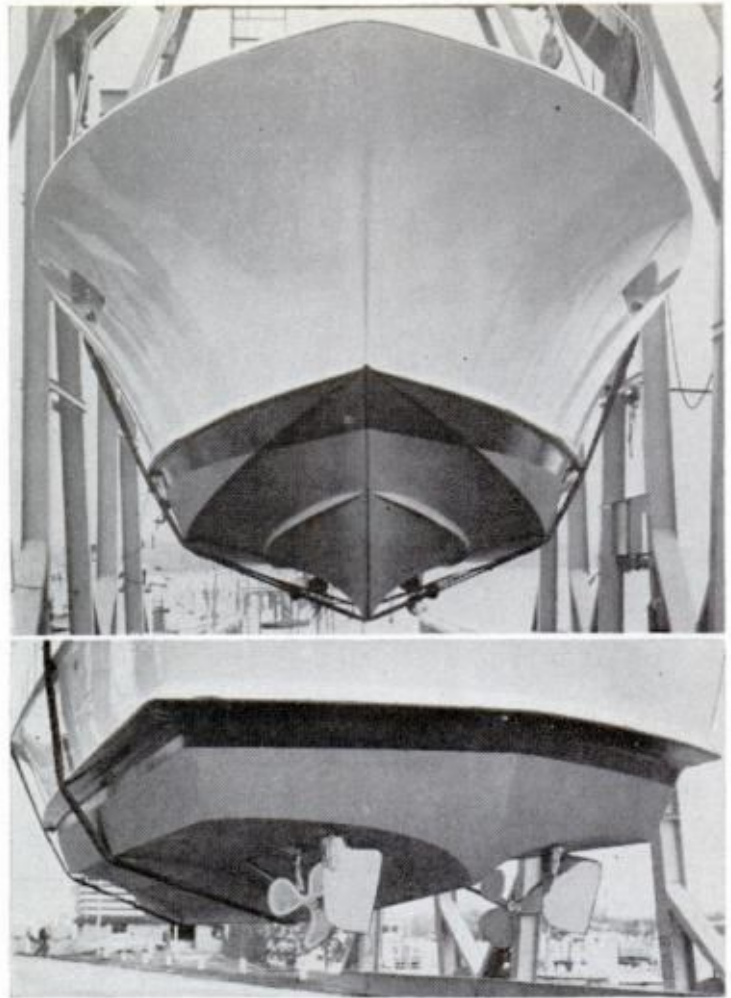
New Transom Takes a Bow

A new 38-foot all-fiberglass cruiser includes a design feature borrowed from World War II landing craft.

To minimize the effects of a following sea, the transom of Chris-Craft's Commander Thirty-Eight has a moderate vee shape which breaks the waves. A more extreme vee transom used on the 13,000 landing craft built by Chris-Craft during the war was designed to minimize broaching during an assault and hold the craft on a steady track.

The Commander's bottom has a deep keel and full-length longitudinal steps. Although the entry is deep, sharp and salty, the keel flares out into a planing surface as it moves aft, assuring a fast ride.

A foil running about a foot above the waterline gathers width as it moves aft and goes completely around the transom, projecting about six inches. Hull fittings, including the exhaust outlets, are neatly tucked out of sight under this foil. Locating the exhaust outlets here automatically deflects fumes downward into the hullside wake where they won't be blown back over the transom by a following wind.



Car Heater Warms Plane Engine

On frigid days, an aircraft owner uses a homebuilt tubing system to pipe air from his automobile heater to warm up the airplane engine before starting it. He uses two flexible tubes so the air will circulate, without wasting any of it.



Inside Look at the Eye

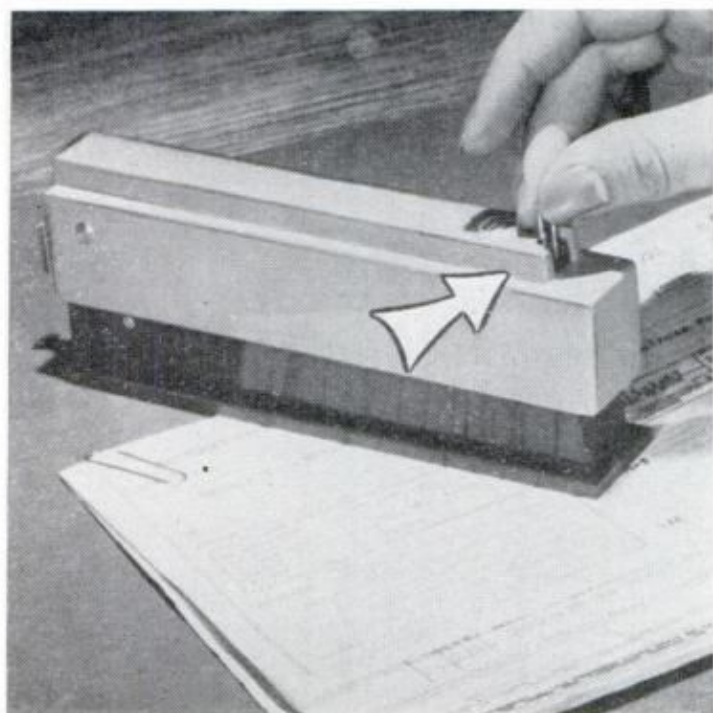
An intra-ocular telescope fitted to a camera with an endoscopic reflex housing can now take pictures of the inside of the eye. Developed by an Australian, the 'scope is inserted into the interior of the eye through an incision in the eyeball.





Clip Dispenser

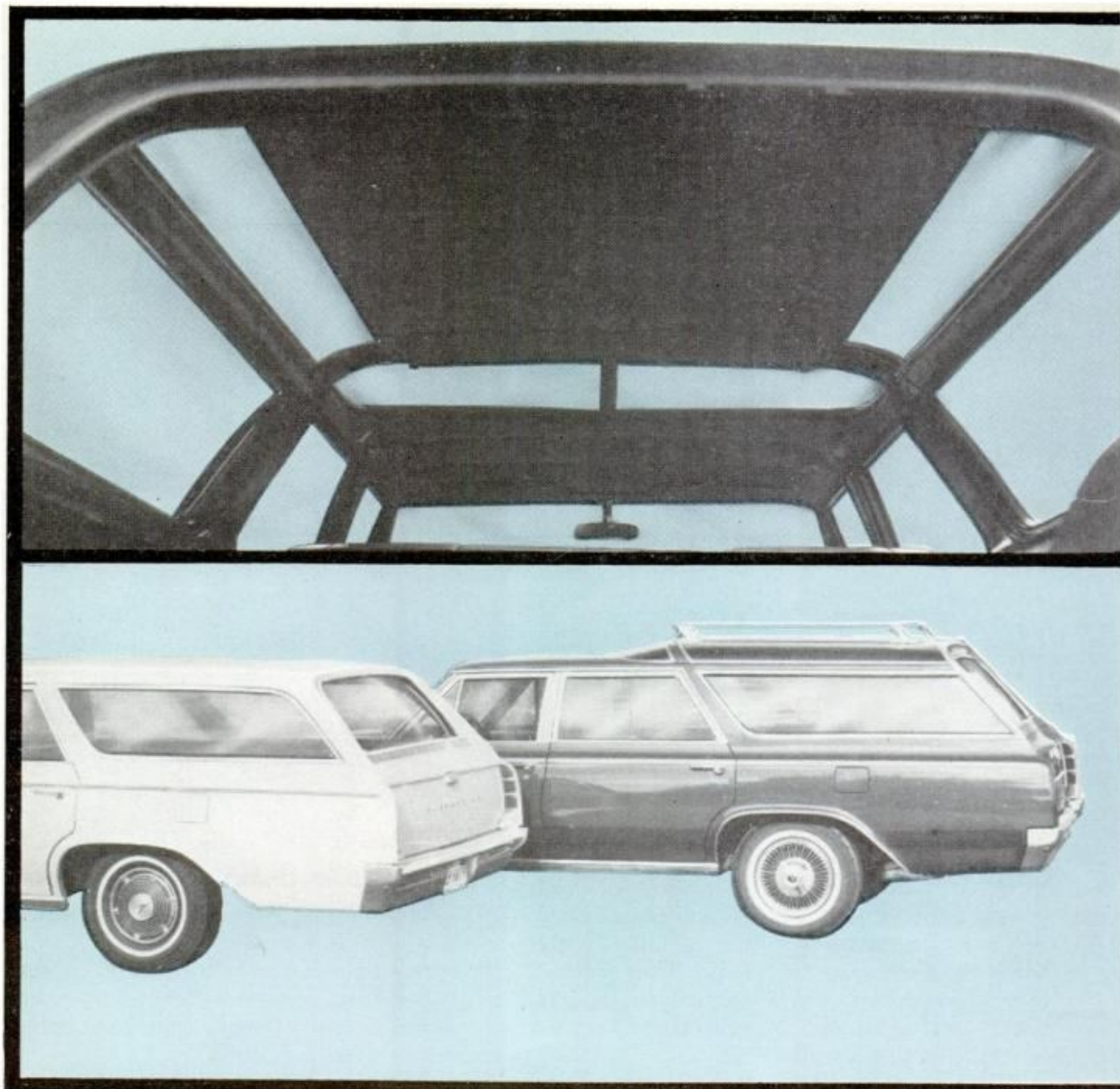
You get one neatly dispensed paper clip, instead of a tangled bunch of clips, with the new desk clip dispenser. The seven-inch plastic unit holds cartridges of 100 clips and is made by Burgess Vibrocrafters, Inc., Grayslake, Ill.



Fashionable Scooters

Carting dresses from salesroom to fitting room is a lark for salesgirls in a Vienna department store who whiz around on specially designed scooters. Besides speeding up service, the unique method keeps dresses in good condition.





TINTED GLASS side panels and miniature windshield surround the raised section of roof on Olds F-85 and Buick Special's new sky-view wagons, top. Comparison of standard and "Vista" F-85 shows higher roof, longer wheelbase

New Station Wagons

BECAUSE of their sleek silhouettes and low over-all heights, building a three-seat, eight-passenger station wagon on the 1964 Buick Special and Olds F-85 raised some problems.

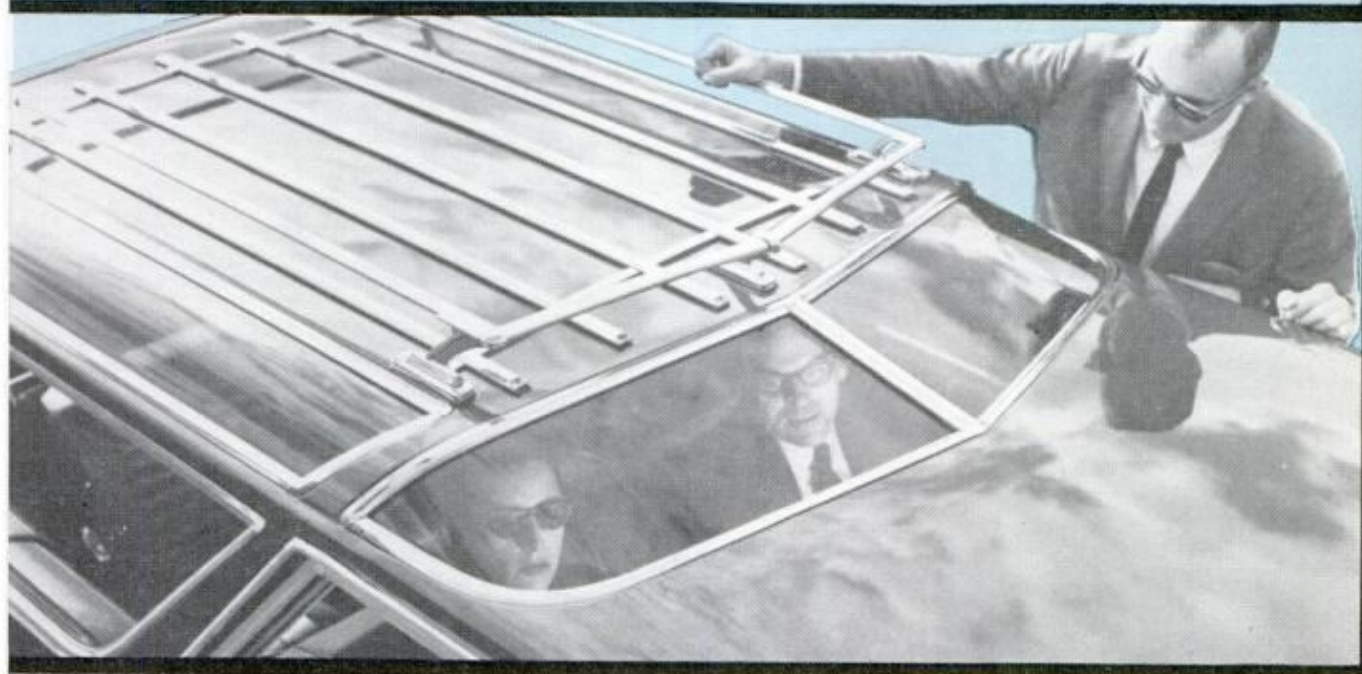
GM body engineers took a direct and simple approach to the problem of third-seat headroom—they raised the roof.

The new wagon, which Oldsmobile calls the "Vista-Cruiser" and Buick the "Sky-lark," has a rear roof panel nearly four inches higher than the standard wagon's.

To bring additional light to the second and third-seat areas as well as provide for scenic viewing by second-seat passengers, a second windshield (complete with sun visors), plus curved side windows, is built into the raised section of the roof.

Entrance to the third seat on the new wagons is via the rear side doors, as the seat faces forward. The righthand section of the middle seat double-folds for easier entry to the third seat.

To provide easier entry, the rear doors



BUICK'S SKY VIEW wagon is in the luxury "Skylark" series, although it may be had in Deluxe and Custom trim, at top. Right-hand third of middle seat folds for easier access to the third seat when the wagons are so equipped

Raise the Roof

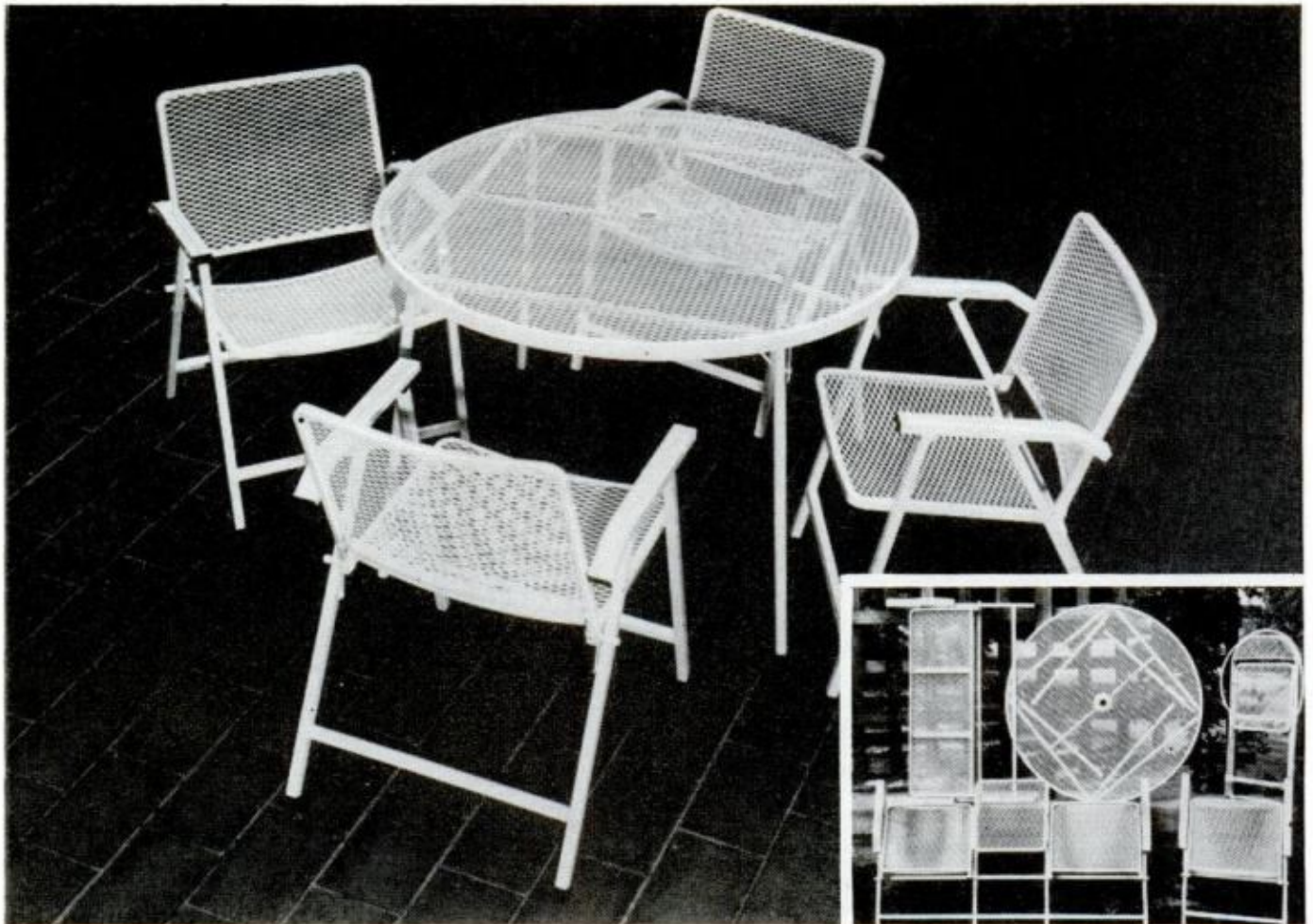
have been made five inches wider, and to make space for legs of third-seat passengers the rear axle has been moved five inches further back increasing the wheelbase from 115 to 120 inches.

This increase in wheelbase required a special frame and a longer driveshaft.

Bumper-to-bumper length remains as on the standard wagons at 208 inches. Both Special and F-85 wagons can be ordered without the third seat. Both wagons also have a special storage compartment be-

neath the floor at the rear of the wagon's cargo compartment which adds 6.4 feet of lockable cargo space to the wagon's 87 cubic feet available when second (and third) seats are folded into the load floor.

Buick offers its Skylark glass-roofed wagon with either 215-cubic-inch V6 or 300-cubic-inch V8 engines, while Olds F-85's Vista-Cruiser offers buyers a choice of 230 and 290 horsepower versions of its 330-cubic-inch V8. Prices were not available at presstime.



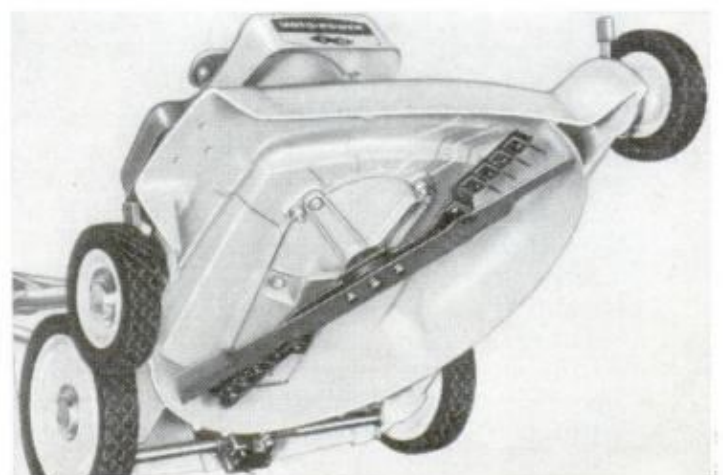
FOLDING UMBRELLA SET of 5 pieces folds down to 14 inches flat, is a cinch to store. Made of expanded steel mesh on square tubular frames, the furniture serves indoors or outdoors, year-round. Units are finished in white enamel—rust resistant and maintenance-free. Hampden Specialty Products, 295 Fifth Ave., New York 16, N.Y.

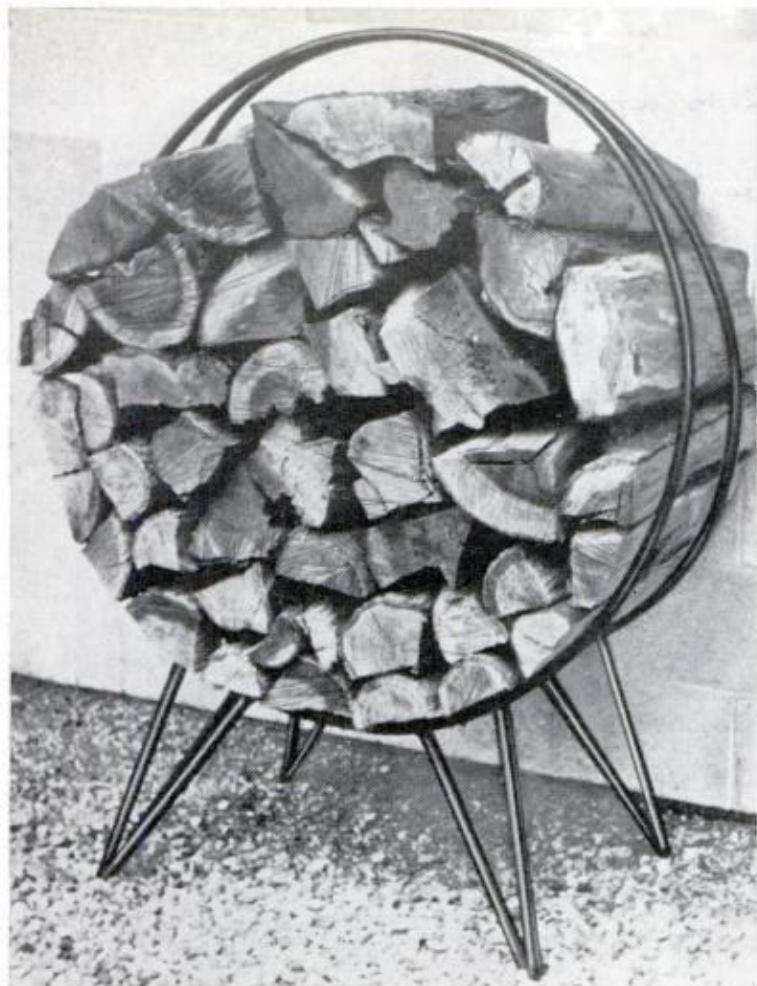
New for Your Home

GOURMET RANGE with walnut cutting board operates electrically as you cook, serve and keep food warm at buffet table. Features: backguard, 1100-W. burner and cool bottom design. \$19.97: Trak, 3250 Riverside Dr., Columbus, Ohio.



SAFETY BLADE for rotary mowers attaches in front of cutting blade of mower, lifting cutting blade over stones and glass. 21-inch blade, guard and flexible hub cost \$14.95. By Klingbiel, Box 174, 113 W. Sixth St., Port Clinton, Ohio.

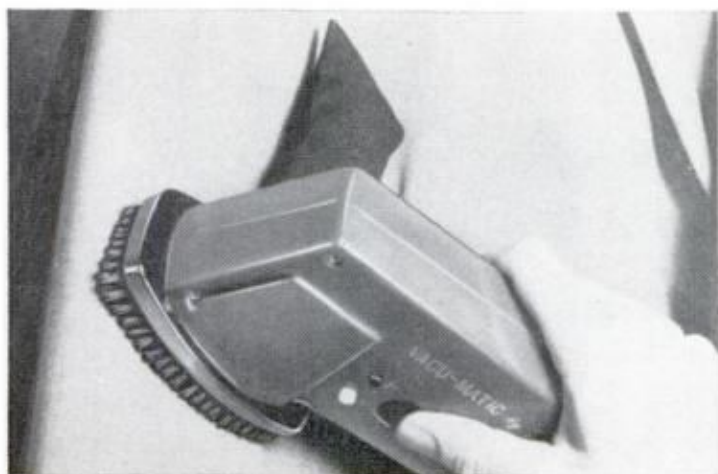




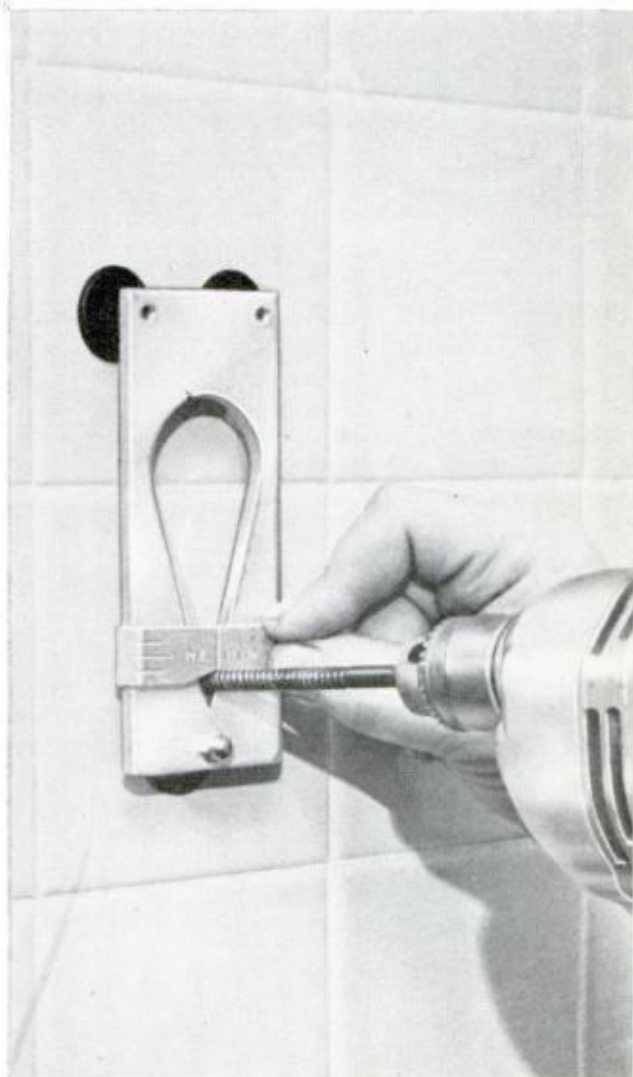
LOG HOLDER of steel finished in satin black provides convenient storage of firewood on porch, patio or inside. It stands 48 inches high, 39 inches wide. Easy-to-clean unit costs \$15.95. NRC Products, Box 221, New Fairfield, Conn.

MASONRY DRILL GUIDES prevent drill walking, offer precise, adjustable drilling without hammer or chisel. Pocket-sized \$7.50 model handles difficult angle holes. Morey Products, 1101 Vermont Ave., N.W., Washington, D.C.

MIDGET VACUUM CLEANER works off four batteries stored in handle. Electric motor powers plastic wheel which provides suction: it vacuums as it cleans. Dust and grit collect in side bag. \$5.95 from Shields, 401 5th Ave., N.Y.C.



TRANSISTOR METRONOME operates in any position, anywhere. Easily set selector knob for speed and loudness of clicks, plus sealed movement eliminate service problems. The unit is 7 by 5 by 3 inches, and costs \$24.95. Seth Thomas Div., General Time Corp.





PRACTICALLY MOTIONLESS above the neck of his galloping mount, the jouster must pick all three rings from the standards with his seven-foot steel lance and cover the 90-yard course in just 10 seconds



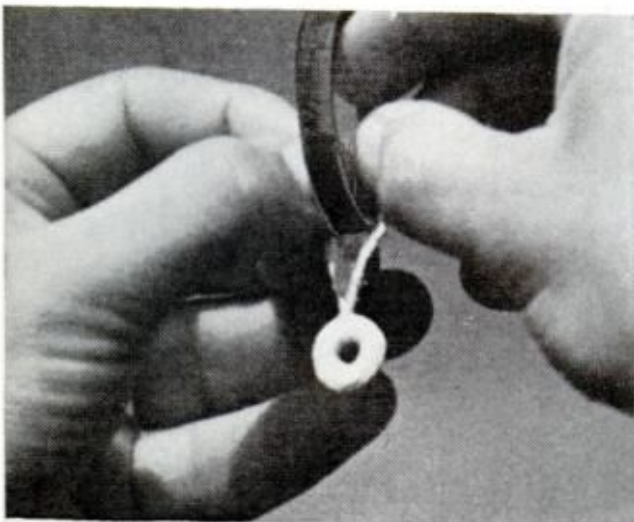
HORSE AND RIDER must always be superbly coordinated, the horse charging a perfectly straight line through the arches. The slightest deviation and the concentrating lancer will miss one of the rings



Charge, Sir Knight!

Ever try to spear a quarter-inch doughnut from a galloping horse? In Maryland they make it look easy

EACH RIDER covers the course three times, attempting to take a total of nine one-inch rings. In a ride-off, the jousters cover the course three more times, but the rings (photo) then are the size of candy Lifesavers

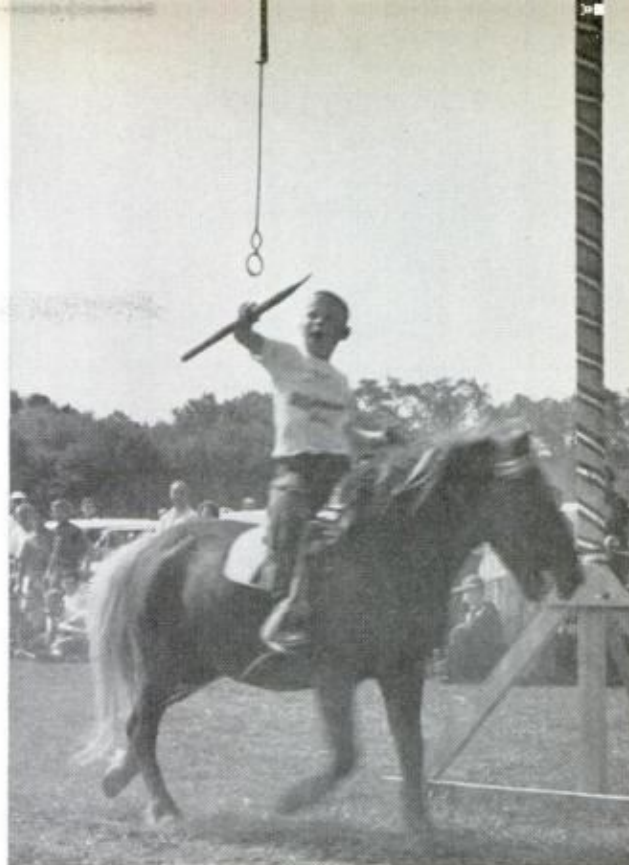


PAGEANTRY harking back to the age of heraldry is part of the procession opening the jousting. Although it has been practiced since 1634, jousting became the official state sport of Maryland in 1962





TEENAGERS, boys and girls, compete in the amateur division, displaying amazing skill. The State Jousting Association fosters a training program for youngsters, encouraging tournament participation by them



PINT-SIZED KNIGHT scores a miss in the class for children under 10 years. The youngest joustier this year was four years old. Riding ponies, youngsters learn the thrill of competing before a live crowd

EXCEPT FOR the hot dog stand, the modern horse trailers, the band playing "Dixie," and the heavy southern drawl of the announcer saying, "Okay, Sair knight, let 'er rip," it could be a scene from the days of King Arthur.

Against a backdrop of lush rolling hills at Owings Mill, Md., skilled riders—men and women of all ages—compete for honors in the Maryland State Jousting Tournament, a colorful sport surviving in this

COSTUMES are part of the procession, but comfortable boots and jodphurs are worn for the jousting. Under a hot sun, the youngster in armor said, "Boy, I don't know how those old knights breathed."



state since the year 1634.

Three arches holding suspended rings are set every 30 yards along a 90-yard course. Riding at full gallop, the joustier must spear each ring and cover the course in 10 seconds. As competition narrows, the size of the rings is reduced from one inch to the size of a candy Lifesaver.

Climaxing a season of local jousting, the state tourney is the World Series of southern horsemanship.—*Stuart James*

RIDING TO THE LINE, knights hold lances aloft, guiding their special mounts. Highly trained, these horses must have the speed of the quarter horse and the steady, perfect gait of the thoroughbred



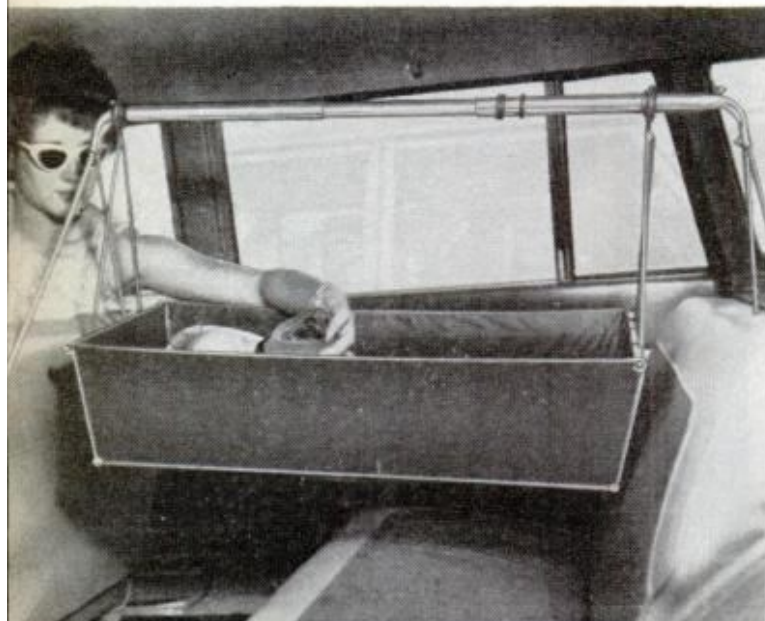


Better Vision for Divers

Skin divers who wear glasses can now have optical prescriptions bonded into the face plate of their masks, eliminating cumbersome inserts. The process was developed by A. S. Newton, O.D., 575 West Sixth St., San Pedro, Calif.

For Toting Tiny Tots

Built on the principle of the old porch swing, Tot-Cot is a canvas bassinet hung from a metal frame that extends between front and rear seats of the family car. It is made by Benton Designs, Inc., Decatur, Ill. Price is \$4.95.



New Racing Cat

Capable of carrying 186 square feet of sail, "Mirage" is a new 15½-foot fibreglas racing catamaran. Designed by MacLear & Harris, who produced *Beverley* (*Hopped-Up Sailboats*, Feb. PM), it's built by Synthetic Laminate Industries, Wash., D.C.

Catamaran House Trailer

Combining house trailer and houseboat, "Caracat" rides on a four-wheel trailer for land living, but is easily launched for cruising. Powered by twin outboards, it sleeps four. It is made by Bryan Jackson Ltd., Mt. Wellington, New Zealand.





Watch the Watch Change Its Appearance—35 Ways

The case and leather strap of a new Swiss watch can be changed to match the outfit that a woman is wearing. Each case fits over the watch face, and the strap is changed by slipping a new one through metal loops on the back of the case. Five

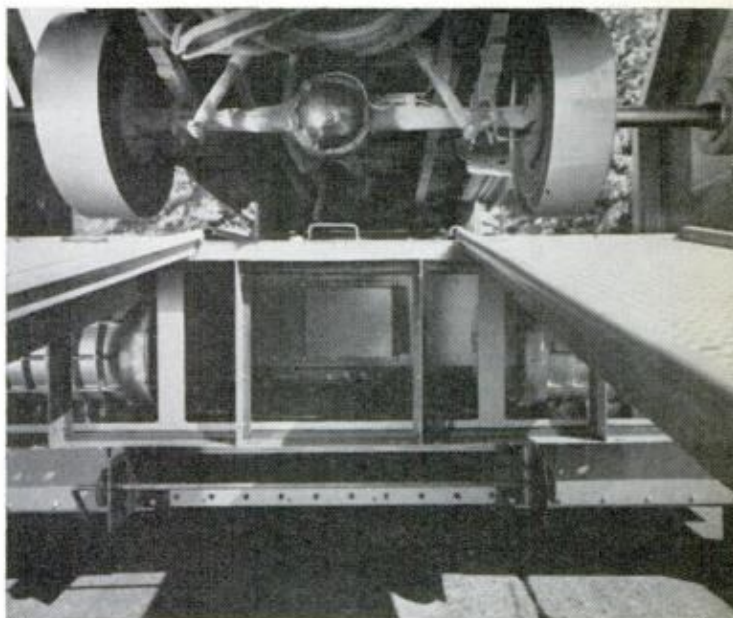
cases and seven straps offer 35 variations.

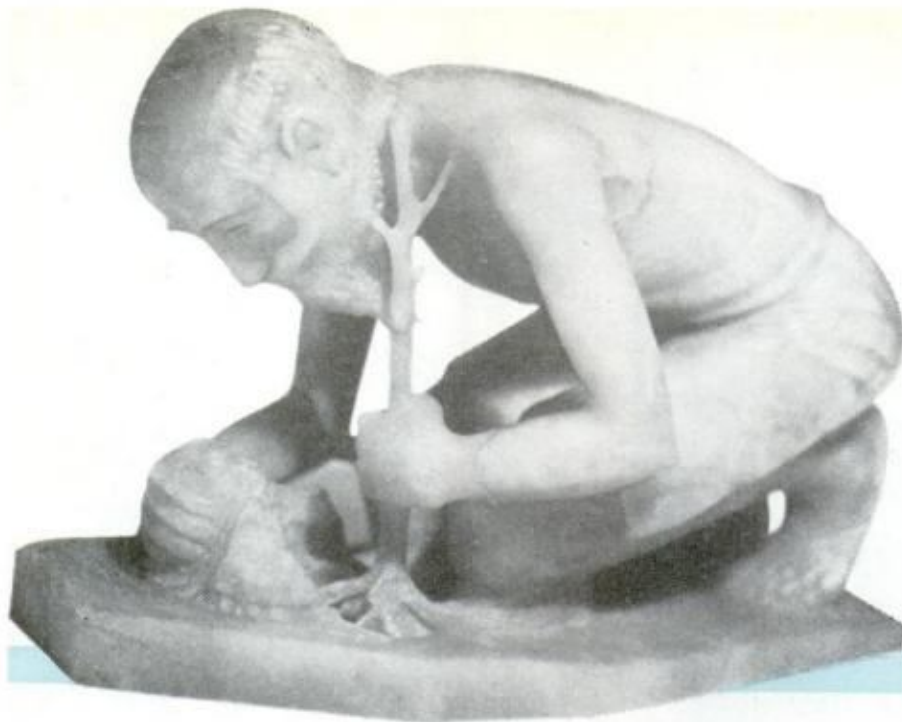
Five of the cases and five straps are shown at left. At right, a watch is being inserted into the case. The Nivada Colorama watch set is sold by Andrew & Co., Ltd., 102 Hatton Garden, London, England.

Proving Ground Rolls to Test Site

There's no need to move vehicles to the site of an ordinary chassis dynamometer when the new M-P-G (Mobile Proving Ground) is available. The new testing unit can be towed where it's needed to check vehicle performance.

Available M-P-G models range from stationary units that merely absorb and record power output to tape-controlled, fully mobile rigs that can duplicate operation on any highway or proving ground. Manufacturer is Labeco, Mooresville, Ind.





PINK JADE was used to carve figure of old man planting tree. Valued at \$8000, it took 1100 hours. Detail includes tree roots cut to thickness of sewing thread

Lore from a **Gemstone Carving Genius**

He uses dentist's drills and infinite patience to shape raw ruby and jade into things of beauty

By **Dennis J. Cipnic**

ONE OF THE MOST REMARKABLE artists around is a South Texas oilfield welder named Robert S. Harvill. During the day he works in the construction of multi-ton brush clearing equipment. In spare time he carves some of the world's finest gemstones.

Harvill, 60 years old, has won state and national honors for gem carving, and major gem shows invite him every year, expenses paid, to be a special exhibitor. Among his admirers are sculptor Lincoln Borglum, oriental jade experts and the Smithsonian Institution, which wants to add two of his works to its permanent collection.

His pieces range from tiny jade pendants worth about \$50 to a giant ruby weighing 4500 karats and valued, in his words, at "anywhere from \$50,000 to \$250,000." They were all made in his drafty, litter-strewn welder's shop at Sinton, Texas, using simple tools, a lot of patience and an instinctive artist's touch.

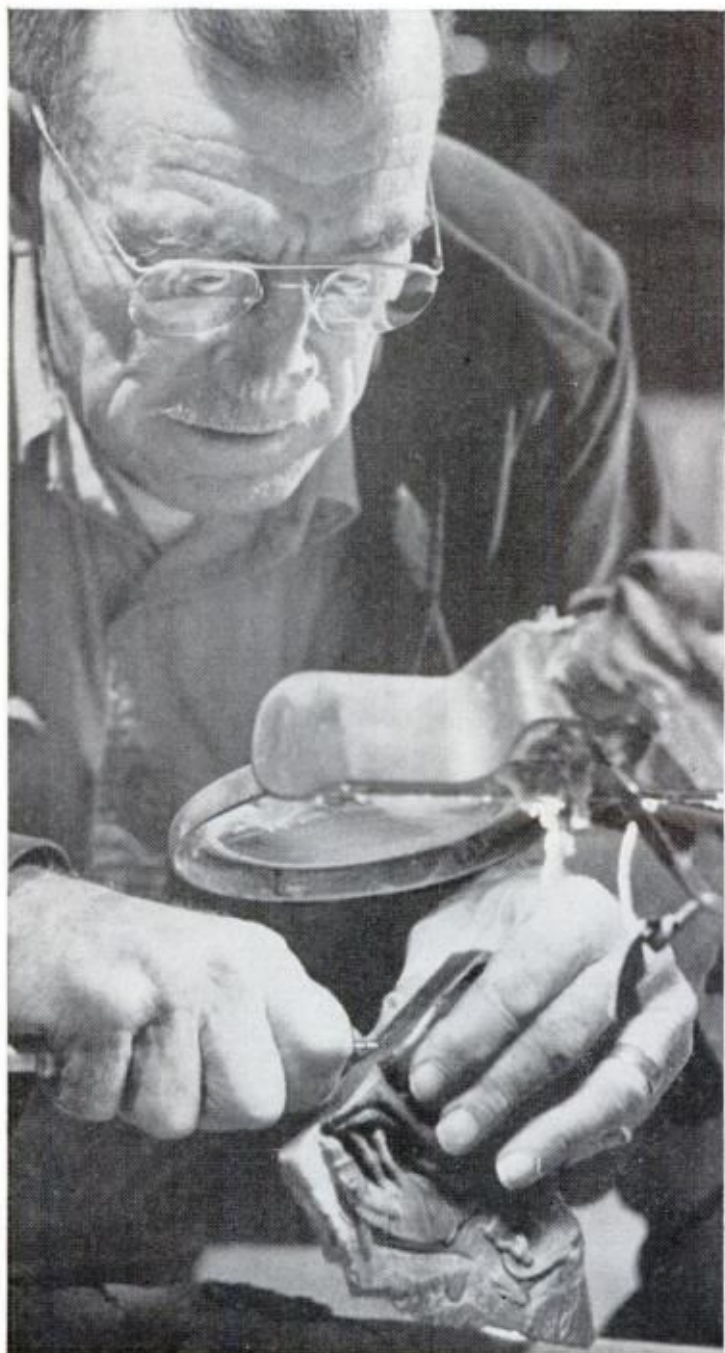
Some, like a finely detailed old man planting a tree, in pink jade, and appraised at \$8000, are marvelous for their detail and workmanship. Others, such as a full-sized working



GOOD SAMARITAN, photographed here against light, shows translucence of gemstone. Stone is 1½-in. thick, but note glow around Samaritan's head. Also note retreating figures in rear



ROBERT S. HARVILL at work on giant 4500-karat ruby. He peers through magnifier while carving, but removes work frequently for inspection. Harvill keeps fingers close in for control



EXTREME CLOSEUP shows needlelike drill used on detail work. Harvill makes his own drill tips; larger tips eventually wear down to smaller tips

DENTIST'S DRILL is held close to work by Harvill's fingers. When doing close-in detail work, Harvill does not use water spray. It would obscure work



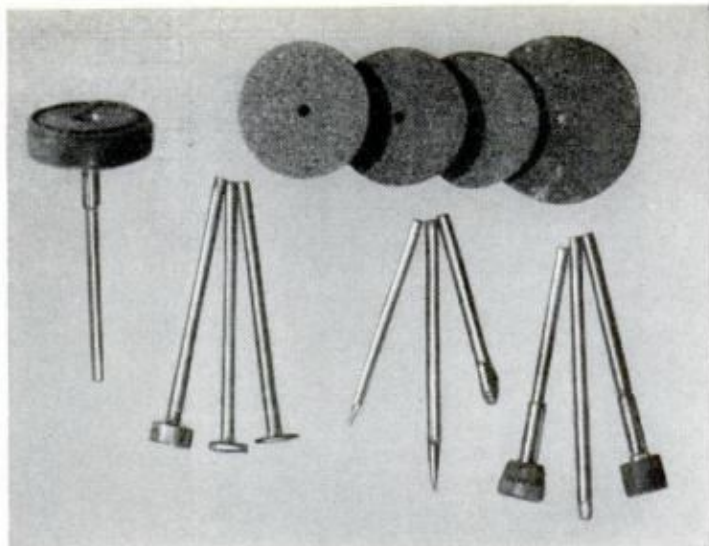


FIRST TOOLS were modest. They included metal rod with sapphire and ruby tips, pocket whetstone and small sand cloth. First carvings are also shown

teapot and pitcher, carved out of flawless black jade, and costing another \$8000, are remarkable for their very existence.

According to Mr. Harvill, anybody can do what he does with gemstones. He got started only eight years ago, "and I had no idea I could do it," he says. He was 52 at the time, and had been an auto repairman, welder and heavy equipment builder for 25 years. That year his oldest son gave him a small piece of green jade for Father's Day to add to his modest collection of rocks, almost all from local creek and river beds.

"I had seen commercially carved pieces of jade jewelry," Harvill says, "and the minute I got that piece of jade I decided to try to carve it. I figured I could do as



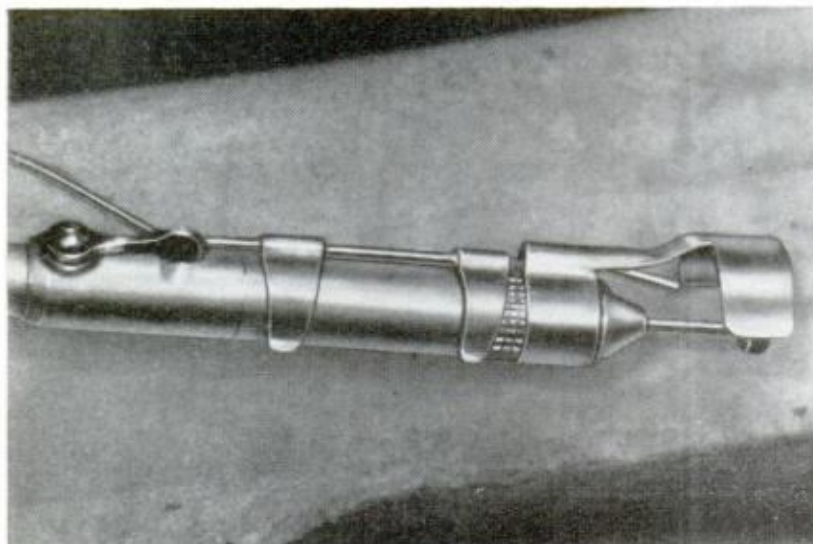
NEW TOOLS include variety of diamond and bronze-tipped steel drills and carborundum wheels. Three needle bits in center are worn-down diamond tips

well as some of the junk I saw in stores."

Harvill's first tools were extremely simple—a metal rod with a chip of ruby embedded in one end and a similar piece of sapphire in the other, a pocket whetstone and a piece of sand cloth. He used an ordinary small diamond-bladed trim saw to rough out the shape of his first effort, a fish. The jeweled stick was used to cut the features, the whetstone to rub away jade to the final contours, and the sand cloth to finish it off.

"All it took," says Harvill, "was lots of time. But that's the beauty of jade. It's just hard enough to require patience and many hours to work. But if done properly, it will hold an infinite amount of detail and last forever."

DENTIST'S DRILL is equipped with tube that carries water spray to tip. Picture at right shows drill in position for early rough work. Water spray was not on, however, in order to get clear a close-up photo of the drill head





ANOTHER EXAMPLE of fine detail in carved gemstone. Antelope head has full set of antlers. Done in green jade, piece is worth about \$500, Harvill says

His next 13 pieces were carved in exactly the same way, and they were good enough to begin winning lapidary (stone cutting) awards almost at once. His animals and simple shapes ("I had to start with easy things," he says) won him the Texas state award the second year he tried for it. The third year he was Texas champion and tied for U.S. honors. The fourth year he copped the state, national and special "highest single achievement" prizes.

By this time the jeweled stick and sand-cloth technique had proved too tedious for major pieces, so Harvill turned to the technique he now uses.

"First," says the laconic Texan, "you [\(Please turn to page 200\)](#)

BLACK-JADE Genii rises from spout of green-jade lamp. Valued at \$3500, it stands eight inches tall and is the favorite of Lincoln Borglum, who carved heads of presidents on Mount Rushmore. Harvill has other pieces wanted by the Smithsonian Institution





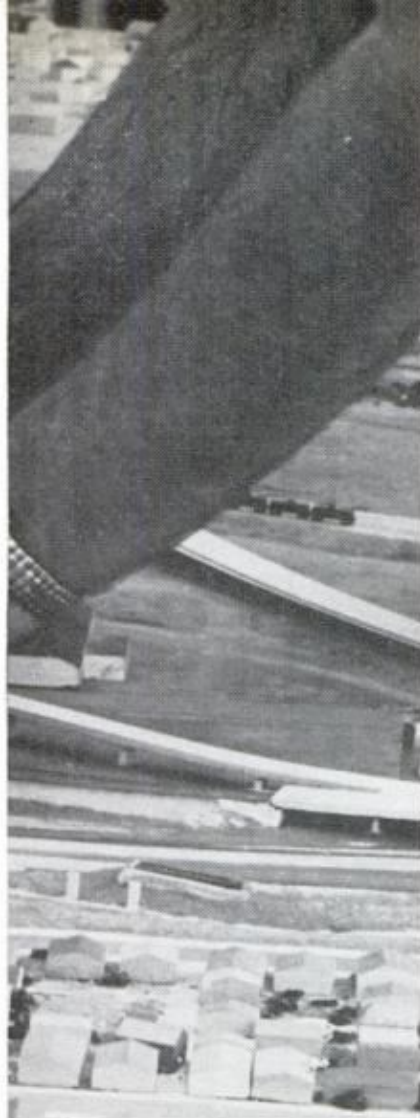
Pint-Sized *Super Highways*

What keeps those twisting, curling cloverleaves from becoming a great can of worms? It's planning—in miniature—the kind which would delight the heart of any amateur model builder

AMONG highway construction engineers, it is said, there is a recurrent nightmare. In this bad dream they are attending the official dedication of their latest design—a multiple interchange that is a maze of swooping, curving bridges, approaches and exits. On hand to witness the operation of this engineering marvel are the President of the United States, the Governor of the state, assorted senators and congressmen. A signal is given by the President and 12 new automobiles of various make approach the intersection at top speed from different directions. When they reach the center they all crash.

To make certain that this will never happen in California, a group of road builders are plying their craft in a warehouse studio in Sacramento—building the state's highway system in miniature.

Working from topographical maps and elaborately detailed aerial photos, California Highway Department's model makers



CUT TO THE CONTOURS of a topographical map, layers of plastic foam are built up, then sanded off to reproduce California's hills in detail

LIKE GULLIVER in the land of the Lilliputians, a model maker constructs a highway overpass in a residential area that has been scaled down to 1/600th of actual size



CRUCIAL MOMENT comes when sections of a model—built separately—are pieced together. To insure a perfect fit, there must be strict adherence to minute details

construct detailed reproductions of areas (1/600th scale) where new highways or interchanges are to be built, then faithfully build a miniature version of the proposed construction.

These models are invaluable for a variety of reasons. They present a three-dimensional picture for analysis of engineering design, and studies of landscaping problems and esthetics. They are also used for public relations exhibits, studies of right of way, and exploration of complex legal problems.

In a legal hassle between the state and a contractor who had turned in an overtime statement for \$200,000 over the original contract agreement, the model shop turned out a special take-apart model of the job. The lawyers for the Highway Department went into court with the model and were able to show that the overtime costs were a result of the contractor's not following correct procedure. This saved the state \$175,000.

When a property owner asked one million dollars in damages because a large cut made through his property for a metropolitan freeway allegedly ruined the value of his property, the model shop turned out before-and-after reproductions of the terrain and won the case for the state. In another case, a businessman contended that a cut for a freeway would take traffic below his property level and eliminate the visibility of his business sign. A scale model demonstrating the flow of traffic showed his allegations to be unfounded in fact.

Under the direction of Louis Baker, a former bridge architect, who has been in charge of the model shop for six years, a four to six-man staff applies considerable ingenuity in the construction of the models. The terrain is first built up with sections of styrofoam cut to the specifications of a contour map. This is sanded and covered with putty. Then it is painted, covered with glue, and covered with ground wool (flocking) shaken from a tea strainer. Result: "grass-covered slopes, unmistakably the rolling hills of California." Important buildings are copied from aerial and ground photos. Lesser buildings are not faithfully reproduced, but are stock plastic houses planned as closely as possible to a neighborhood.

Wooden blocks, cut to the hundredths of the inch, are used in the preliminary building to achieve the exact grades of

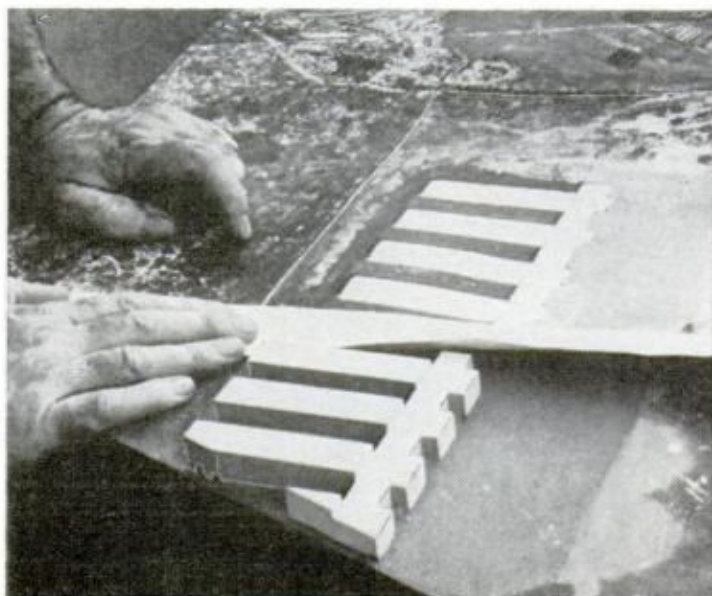
all roadways. The adherence to scale is so detailed that the eighth-inch plywood represents seven feet of concrete, and the two coats of finishing paint represent another foot.

Finding the right materials for trees took considerable time and research, and resulted in some strange choices. Reindeer moss is used for sycamores, oaks and poplars. Fine rubber sponge, tapered and painted, makes excellent evergreens. Japanese seaweed is used for a special kind of evergreen. For palms, which are prevalent in California, the bristles from deer hide are attached to wire "trunks" with a fisherman's fly-tying device. Ground up

WIND-RUFFLED SURFACE of a river is created by working the thick surface coating of polyester resin with a stiff brush just before the resin becomes hard



AERIAL PHOTOS are used to authenticate sites. Here, a model maker compares the aerial picture of a large factory building with the miniature reproduction



sponge and lichen are used for shrub masses.

Bodies of water are created with a base coat of colored casein, which shows a blue tint through a thick coating of polyester resin. A wind-ruffled surface is made by working the resin with a stiff brush just before hardening.

Roadways and bridges are cut from 1/8-inch pressboard, with wooden blocks duplicating prestressed concrete supports. All construction is closely scaled to engineer's drawings.

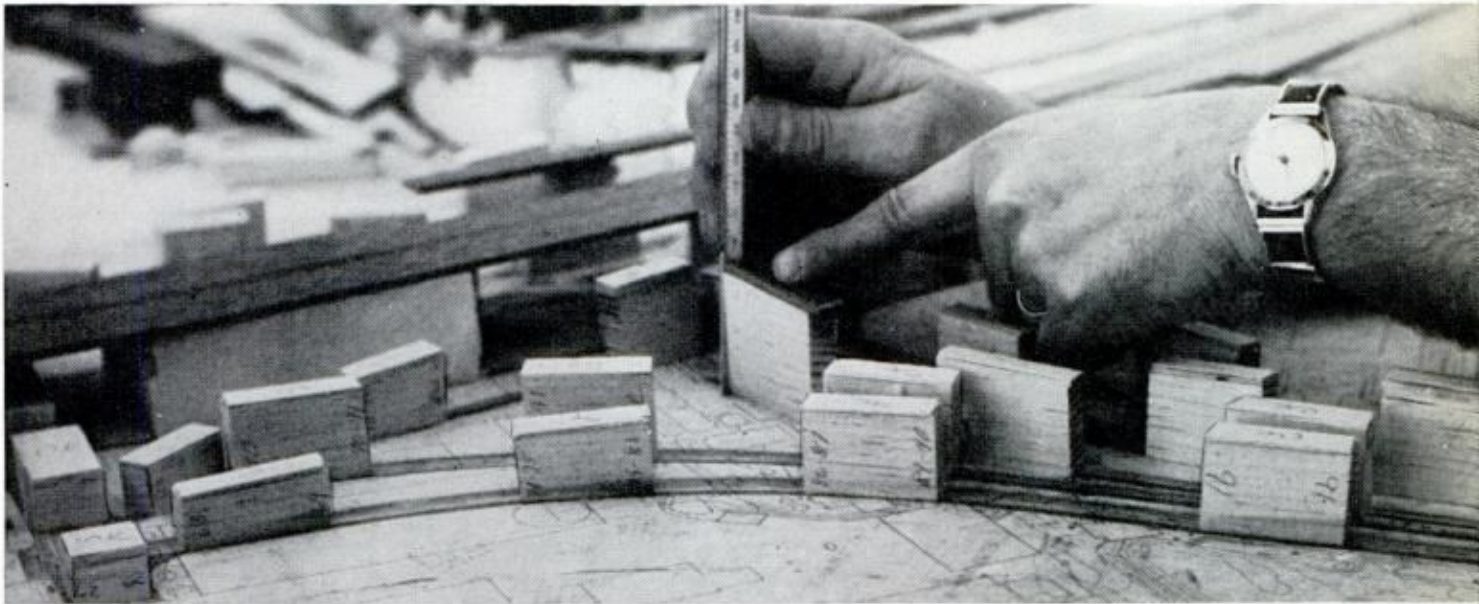
Used as public education displays, the models have had a vital influence on the quelling of adverse public opinion regarding freeways and complex interchanges.

There has only been one instance where such a plan backfired.

When an interchange was planned for Monterey, Calif., a town famous for resistance to any progress, the local taxpayers started a rumble that echoed straight to the legislative chambers. When a model was presented to combat the opposition, the local newspaper quickly dubbed it, "The Can of Worms," and the public outcry only increased. The plan was then quietly withdrawn.

But even the newspaper had to make the admission: "We didn't want any part of that interchange, but it *was* a beautiful model." ★★★

HUNDREDS OF WOODEN BLOCKS are used to establish grades of a complex roadway. Work is so accurate that in establishing the scale for the model, its two coats of finishing paint account for 12 inches in the actual landscape



FISHERMAN'S fly-tying vise is used to hold wire "trunk" of miniature palm tree. Deer hide bristles to simulate palm leaves are attached to the wire

ROCK LICHEN is trimmed into the shape of oak, maple and elm trees. With a pin inserted in the hollow stem they look remarkably like the real thing



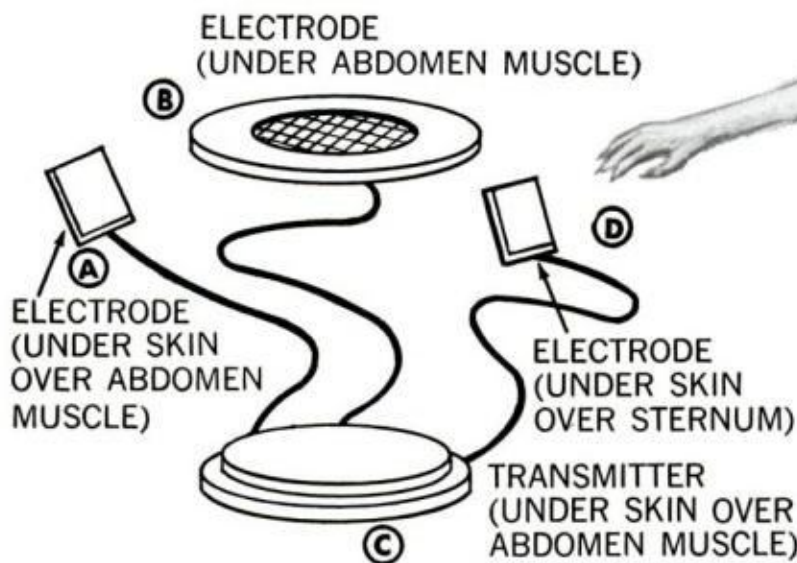
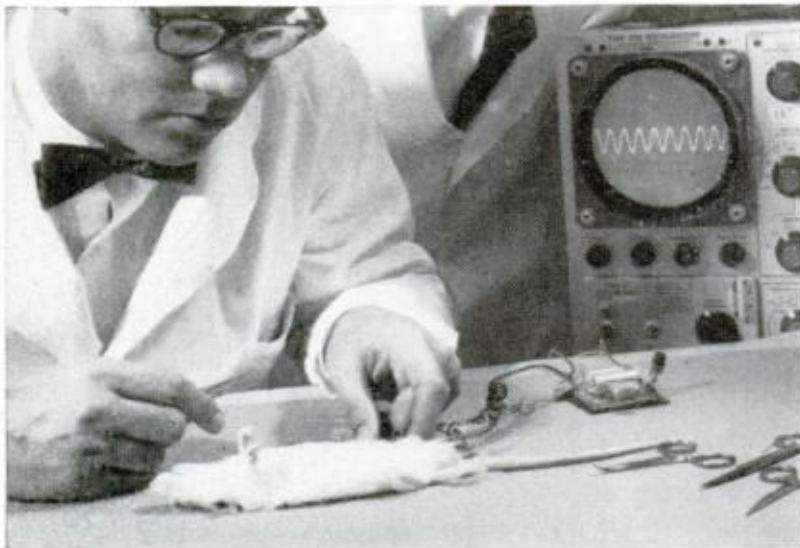
Yep, You're A Human Dynamo

ONE OF THESE DAYS somebody may call you a human dynamo and mean it literally, thanks to General Electric's Space Science Lab. GE recently powered a tiny radio transmitter with electricity from a rat's body.

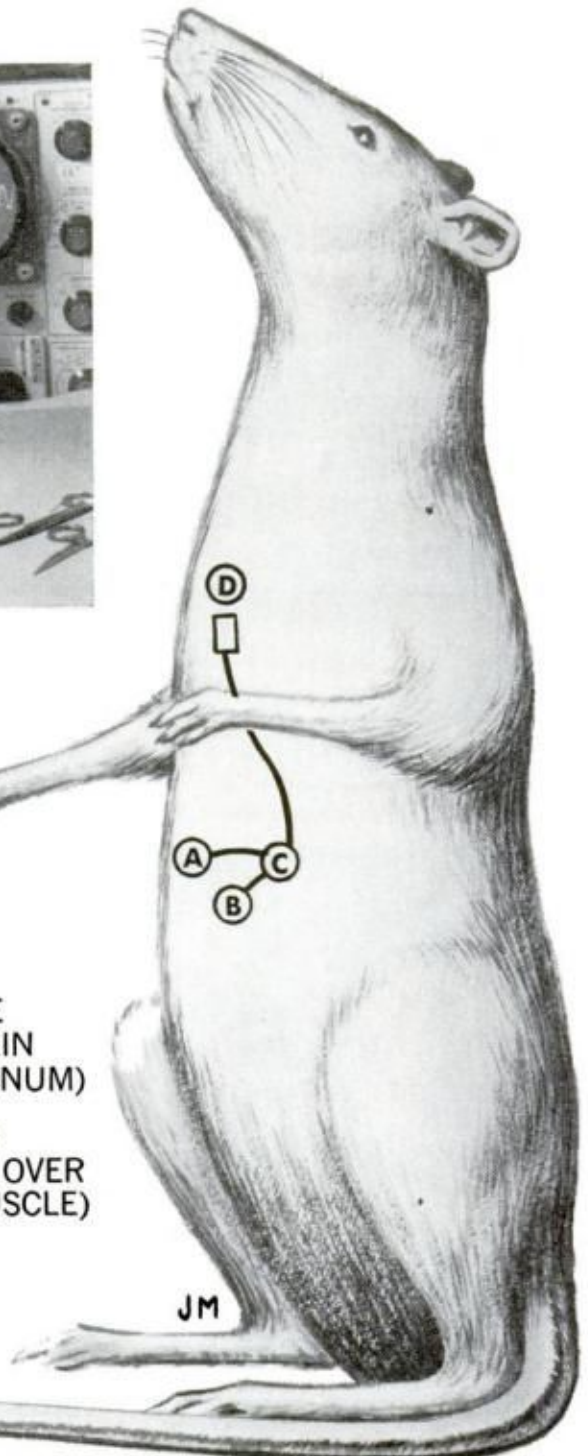
That living organisms generate electricity is not new in itself. But it has never before been possible to harness this energy to perform useful work. If GE succeeds, heart patients who depend on battery-powered pacemakers could forget the batteries. And astronauts could be equipped

with sensors and transmitters to monitor body functions and not be tied down by bulky connecting cables.

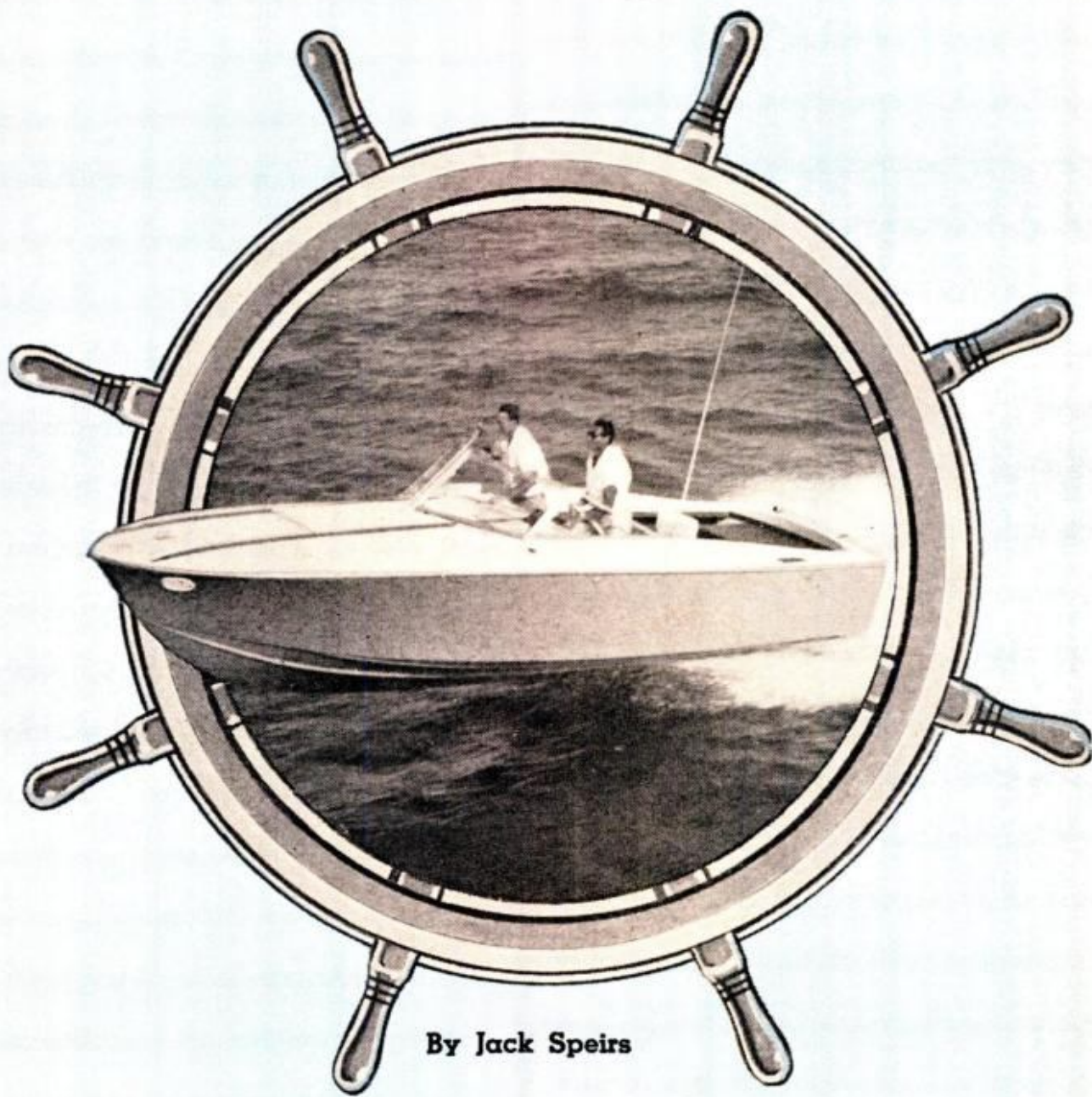
GE uses a stainless-steel electrode implanted just under the skin and a platinum electrode in the abdominal cavity. The result: 155 microwatts of power. Next, electrodes will be placed in larger animals for extended periods of time while constant measurement will show whether the power remains constant. If it works, one day you may have flashlights at your fingertips.—Art Zuckerman



ELECTRODES implanted in body of anesthetized rat draw off enough electric power to operate the tiny 500-kc. radio oscillator alongside it on the table. Oscilloscope shows radio signal being generated.



Boating '64



By Jack Speirs

Shoe-box shapes, flight-deck design, schizophrenic bows and wild new bottoms are the big newsmakers this year

IF YOU'RE THINKING of trading up this season, be sure to allow plenty of shopping-around time.

Almost everybody in the boating business has something new. Lines have been refined, expanded, redesigned, renamed, upholstered, painted and, above all, propagandized. And the results are not just new, they're exciting.

It's a year when you can buy a boat with one bow, two bows or three bows—either round, square or half-octagonal. You'll even find a few design "firsts" like

Custom Craft's Sting Ray, which bleeds air through slots in the bottom to cut friction and increase speed.

Whether your taste in power runs to two-cycle, four-cycle or diesel, you're almost certain to find exactly what you want on the '64 market. And when you do, there's a better-than-even chance that your choice is either new for '64 or an honest improvement over last year's model.

Propulsion isn't lagging either. There are more stern drivers; outboard lines stretch from one horsepower all the way

'64 BOATING TRENDS . . . Less graceful, but they make more sense

up to 100 hp. with no real gaps; and you'll discover that there are more jet boats around. Even CrisCraft, the granddaddy of the "speedboat" field, includes a squirt gun in its line.

At first glance, the net result of all this frantic activity may seem to be confusion. A closer look, however, shows that 1964 marks a big step toward that pie-in-the-sky goal mentioned in all the ads—maximum performance, minimum maintenance and more boating value for your dollar.

THE BOATS. There was once a time when a boat was called "she," and if it wasn't as graceful as a ballet dancer, it was a failure. That time is long gone.

Then, much later, came the day when boat manufacturers decided it might be pretty shrewd to take lessons from their car-making brethren. They added fins to the stern, chrome to the gunwales and "New!" to the ads. That time, too, is gone.

So what's left? Well, to get an idea of today's trend in boats, let's take a look at the line put together for '64 by that General Motors of the outboard business, Outboard Marine Corporation.

Two years ago, after decades of being the big-daddy of the outboard field, OMC decided that the grass looked pretty green on the other side of the fence, so it knocked down the fence and brought out a boat-

motor package, a 17-foot "three-point" hull with fat, boxy lines powered by OMC's 88-hp. two-cycle stern-drive combination. Later, an outboard version was added.

This year, the experiment has consolidated into a full-fledged trend, and there are *two* separate packages. A quick change of nameplate turned the OMC boat into the Johnson boat, and Evinrude, the other ace in OMC's hand, has an entirely new line all to itself.

Obviously, OMC wants to sell as many boats as possible, and with years of experience in the outboard field, this company knows as much about the mass boating market as anyone, so these boats tell a great deal about things to come.

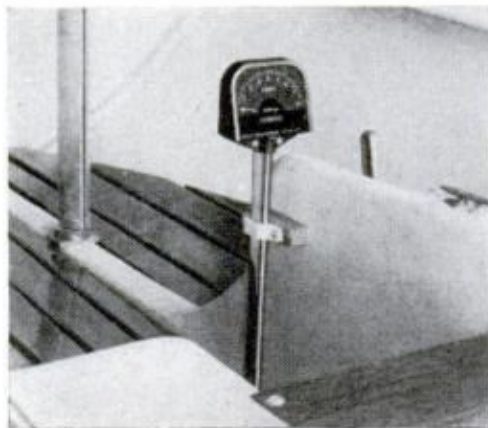
The new Johnsons and Evinrudes aren't graceful in the old Cape Cod sense of the term. But they're not gaudy. They're something like a Youngstown kitchen—square main lines and rounded, easy-to-clean corners. In a word, they're *efficient*.

But the biggest news is below the waterline. Although the Johnson and Evinrude hulls are actually quite different, they both aim in the same direction: achieving the stability of the catamaran and the speed of a hot planer or three-pointer while avoiding the drawbacks of each.

There's no doubt that both boats go a long way toward accomplishing what they

'64 NEW EQUIPMENT

ROPE WHIPS cut from special plastic tubing shrink to 50 percent original diameter within seven seconds after being heated to 257 degrees. Available in three diameters, they're made by the Alpha Wire Corp., 180 Varick St., New York 14, N.Y.



SAILBOAT SPEEDOMETER for racing one-design boats has jeweled bearings for sensitivity, responds quickly to changes of sail trim. Kenyon Marine Instruments, Guilford, Conn., is the manufacturer

and are more fun to live with . . .

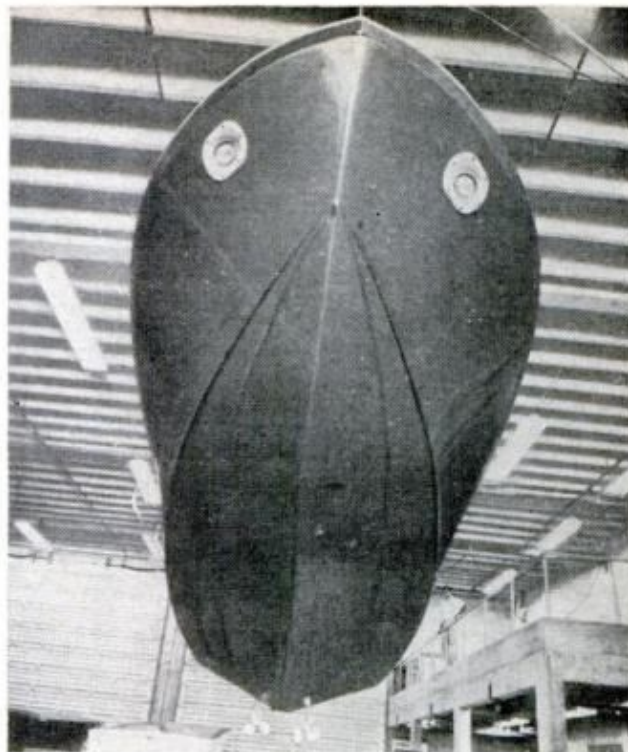
set out to do. Johnson does it with three bows forward and one hull aft (sounds like a square dance call, doesn't it?).

The two outboard bows are stepped, veed and short-lived; they break off about halfway to the transom. From there on, the center bow flattens out and widens to form a more-or-less standard planing area. When on plane, the boat rides on the trailing edges of each short "sponson" and the aft section of the hull—a conservative three-point attitude.

Evinrude applies a somewhat similar principle, though it's basically a simple planing hull. The bow rises, flares outward and arches down to form a gull-wing shape with the "wingtips" acting as spray-deflectors and sponsons. The troughs formed by these wings carry aft, parallel to the keel, and fade smoothly into a conventional shallow-V planing area.

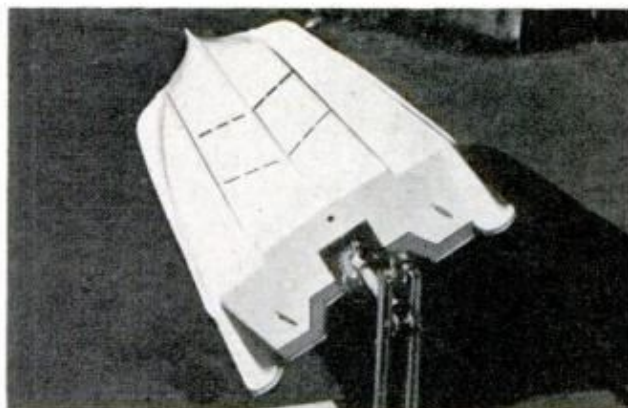
From many points of view, the Evinrude is a very pretty boat indeed, probably because of the graceful rake of all three cutwaters. But since both boats touch on the outrigger principle, the topside configuration is just about inevitable. Looking down from a dock, you see two boxy boats.

Now, the shoe-box shape isn't limited to "advanced concept" hulls. In fact, it's practically epidemic this year. In otherwise conventional boats, it's achieved by way



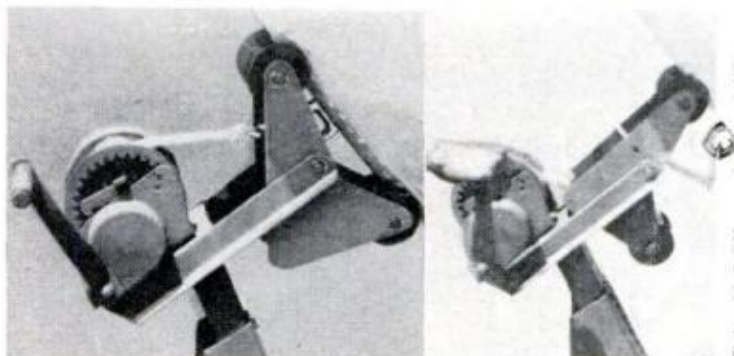
HOT FORMULA on p. 133 skims along on this bottom

AIR-BLEEDING BOTTOM is a "first" for Custom Craft



SAFETY HARNESS of nylon line keeps wearer's head above water when line is pulled. It's priced at \$3.35 a kit, \$7.50 made-to-measure by West Products Corp., Box 707, Newark, N.J.

BUILT-IN LAUNCHING AID called Power Launch enables you to winch your boat onto bolster rollers. It's standard equipment on the Roadmaster 1100, 1300 and 1700 trailers which are manufactured by the Lone Star Boat Co., Dallas, Tex.



BOATING TRENDS . . . *There are flight decks for everyone and*

of an exaggerated bow flare that's squared off into what is called, somewhat defensively, "flight-deck design."

Actually, the idea has a great deal of practical value, as anybody knows who has ever perched on the narrow tip of a conventional bow and tried to make a mooring.

Companies like Glasspar, Arrow Glass, Glastron and Traveler handle this approach more or less successfully. Somewhat more conservative, but not to the point of numbness, is a company like Thompson, which this year uses a modified, well-bred version of the flight deck.

But way over on the far-out side are a few boats with overhang that's so wildly exaggerated that it loses its chief justification; there's so much unsupported deck out there that a well-fed yachtsman standing on the starboard edge could almost tilt the port transom right out of the water.

Even more important, that bad balance could have dangerous results in a hard-heeling turn, when the overhang is perfectly capable of digging in and dumping the whole works. Boats like these can be as squirrely as a hundred acres of hickory trees.

Many companies don't go along with the flight-deck approach, mainly those that deal mostly in aluminum and those that make conventional inboards (maybe be-

cause their basic big-cruiser orientation leads them to believe that if they built a flight deck, somebody might land on it).

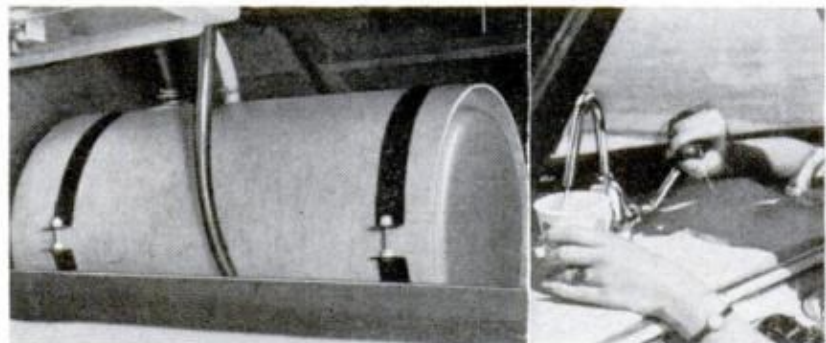
Then there are the traditionalists, those who calculate that if flight decks are such a good idea, how come the Vikings didn't use them. And besides, a blue double-breasted suit is always in good taste.

But builders of catamarans, cathedral hulls and all the other multi-maran variations have the advantage here. When they go to cover the hull(s), they automatically arrive at what flares and flight decks are aiming for—a full-length, full-width top-side area. And with supports under it on

FLIGHT DECK gets tasteful treatment by Traveler



NEW EQUIPMENT



WATER SYSTEM for small boats uses lightweight fiberglass tank mounted in the bow connected to a pump located in the cockpit. Available in sizes from 10 to 30 gallons, both tanks and hardware are sold by Tempo Products Co., 6200 Cochran Rd., Cleveland, Ohio

FLEXIBLE DOCK FENDER of high-impact plastic tubing absorbs shock without marring boat. The 2 $\frac{3}{8}$ -in.-diameter tubing comes in lengths up to 15 ft. and is mounted with rubber shear assemblies. It's made by S. K. Fulton, 1341 S.W. 21st. Terrace, Ft. Lauderdale, Fla.

more hydro-jet squirt guns and stern drives aft . . .

both sides, this deck is not only as big as Pier Nine, but just about as stable.

In fact, the boats with sponsons, multi-keels, twin hulls or what-have you are fantastically stable, whether you're walking on them or running them. This is especially true of such boats as the Boston Whaler, an early entry in the triple-bow derby; Custom Craft's many patented multi-hull designs (among them, a "five-point catamaran"); most catamarans; and of course, the new OMC contenders.

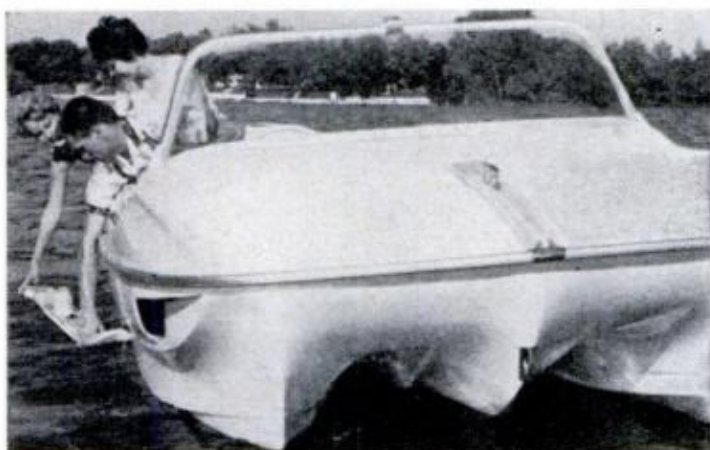
In these boats, there is no listing, no slipping, and almost no heeling on turns. In fact, most of the unique sensations of

boating—many of them inconvenient, we'll allow—have been designed right out of them. The ride is fast and flat; running one of them is not unlike driving a T-Bird down a six-lane highway at six a.m. on a Sunday morning.

If these boats turn out to be what the public has always wanted (and from all appearances, there's a good chance that they will), it will mean that the whole purpose of pleasure boating is about to be redefined: You won't go somewhere to do some boating; you'll do some boating to go somewhere.

THE POWER. It's an economic fact that

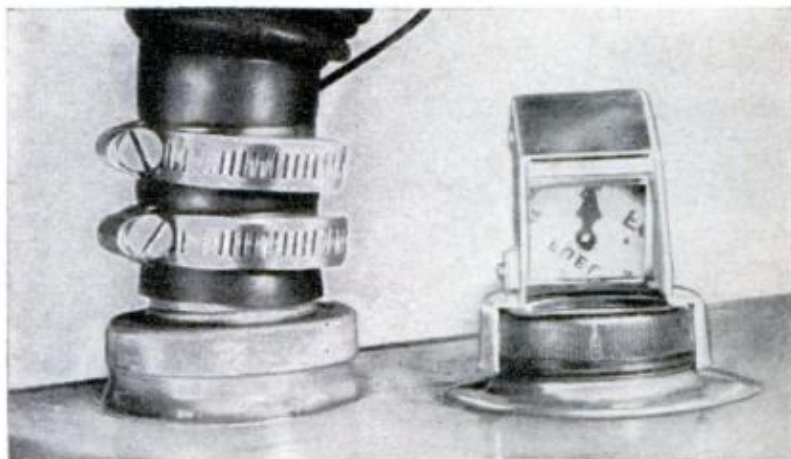
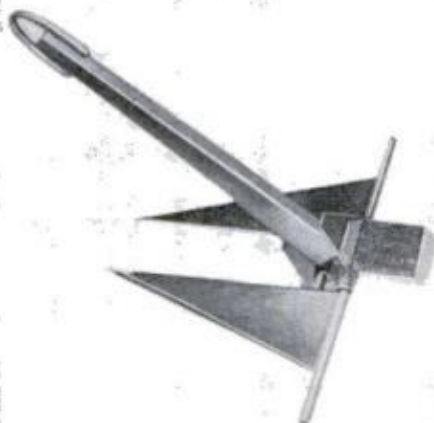
TRIPLE-THREAT BOW on Johnson boat is all curves



SQUARE APPROACH of Evinrude hull looks more sleek



DESIGNED TO SET immediately with minimum dragging, new big-fluke anchor uses lever and fulcrum action to break out. It's from Chandler-Warner Marine Co., Box 211, Cherry Hill, N.J.



FUEL-GAUGE MIRROR is a simple solution to the problem of finding out how much fuel you have when the tank is tucked away under the transom or in some other inaccessible spot. The double-mirror unit fits snugly over the top of the gauge. Retailing for \$3.95, it's made by Tempo Products Co., 6400 Cochran Rd., Cleveland, Ohio

BOATING TRENDS . . . Versatile stern drives keep steadily

abundance is the *father* of invention, especially in merchandising. Look what happened with corn during the year of the Big Crop. Someone invented sour mash whiskey and hominy grits.

Well, this is the year of the Big Crop in the field of marine power.

Outboards blanket the market below 100 hp., leaving everything above this century mark to the stern drives. Perhaps the best example of one-thing-leads-to-another continuity is Kiekhaefer's Mercury line.

Mercury covers the waterfront with both

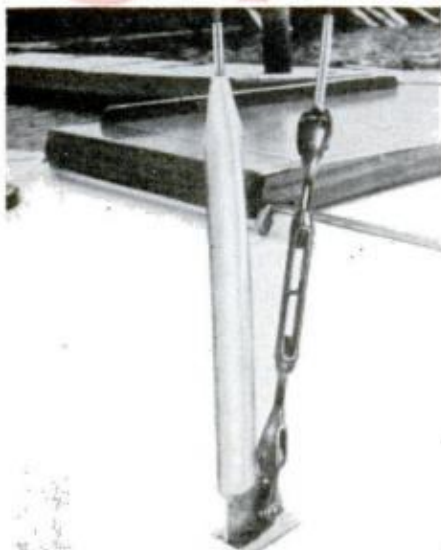
two- and four-cycle power. The outboards run from 3.9 hp. to 100 hp. in nine well-spaced models. From there, seven four-cycle MerCruiser stern-drive packages pick up with 110 hp. and go clear to 310 hp. And though the big MerCruiser III is paired with a 310-hp. engine, it can take anything up to 400 hp. Whether you own a six-foot dinghy or a 40-foot yacht, you can find a suitable engine for it somewhere in that wide array of power options.

The stern drive's takeover of this traditional inboard territory is by no means a

MERC LINE-UP stretches from 3.9 hp. to 100 hp., includes something for everybody



NEW EQUIPMENT



HOLLOW MUSHROOM anchor molded of high-density polyethylene weighs only 15 ounces empty, but turns into a 15-pound heavyweight when filled with sand or any other dense material at hand. It can also be used as a sea anchor when partially emptied. All metal parts are treated to resist corrosion. Available in your choice of bright colors, the Magic Mushroom is a product of World Marine Inc., Chillicothe, Ohio, and carries a retail price tag of \$3.95

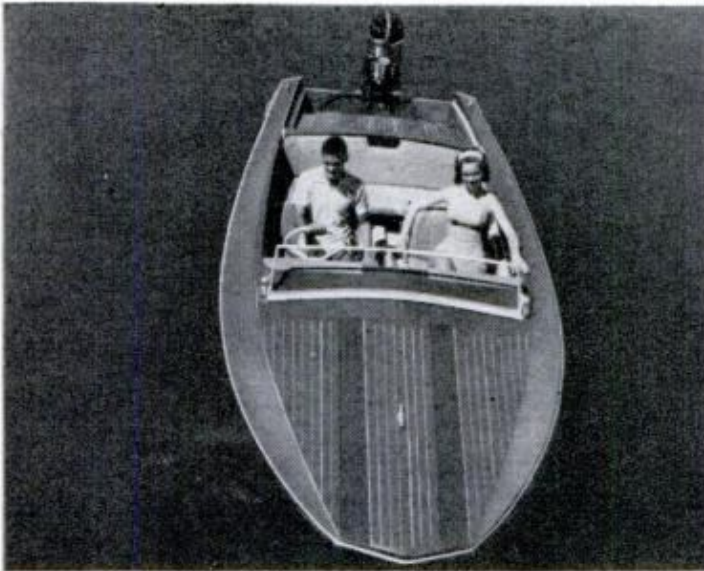


ZIP-ON CHAFING BOOT ends the necessity of taping turnbuckles to protect sails and passengers from rough edges. Made of a special white vinyl, the boot can be raised on the shroud or stay whenever you wish to inspect the turnbuckle. Zippertubing chafing boots come in sizes to fit turnbuckles from $\frac{1}{4}$ in. to $\frac{3}{8}$ in.; lengths range from 16 in. to 36 in. Custom sizes are available on request. Manufactured by the Zippertubing Co., 13000 S. Broadway, Los Angeles, 61, Calif., prices on standard sizes range from \$2.75 to \$7.95

nibbling away at the higher end of the engine horsepower line . . .

one-man invasion. Volvo-Penta, the pioneer in this field, is still a front-runner, with the Eaton PowerNaut and Muncie Flexidrive trailing not too far behind. West Bend's Shark-O-Matic 800, an in-board-outdrive version of the Tiger Shark 80-hp. outboard introduced in 1961, is still popular. OMC, with a new transom-mounting system for the engine (sounds like a wayward outboard, doesn't it?), is matching its outdrive with two new in-board four-cycle engines and the 88-hp. two-cycle for '64.

LUSH SKIBOAT, Glasspar's Super-G, follows SK lines



All in all, the stern drives practically gang-plow the field between 80 hp. and 400-hp.

Like Mercury, OMC's approach shows a little evidence of field-covering. Via Johnson and Evinrude, Outboard Marine dropped a new 90-hp. outboard on the market this year—just two horses more than their smallest stern-drive package.

This probably isn't bet-hedging, since you can't simply clamp a stern-drive combination on your transom. But the choice of nearly identical power in two different packages could be a form of market research: Which will the public buy?

It's plain that the stern-mounted drive unit is eating into the conventional in-board market, especially in the relatively low 100 to 200-hp. range. And even the die-hard inboard sailor will admit that it has its advantages.

It allows a sleeker bottom; it eliminates the need for a rudder and still steers better; it kicks up over obstructions; and it makes a boat easier to beach and a lot more portable. In short, the stern drive is here to stay.

Just the same, you don't notice any of the outboard manufacturers cutting down on their lines. This year, Johnson and Evinrude each have nine models, ranging from 3 hp. to 90 hp.; McCulloch offers six



ROTARY HAND PUMP empties bilge at the rate of 10 gallons per minute, is completely self-priming. It draws water up four feet to the pump and can push it 10 feet above. The five-pound pump comes complete with mounting brackets and six feet of one-inch neoprene hose. It sells for \$14.95 from Airborne Sales Co., 8501 Stellar Dr., Dept. P, Culver City, Calif.



LIGHTWEIGHT TRAILERS made of heat-treated, tempered aluminum alloy are stronger than conventional steel trailers, according to the manufacturer. Featuring a rust-proof anodized surface that never requires painting, they're made by Trailex Inc., Canfield, Ohio

BOATING TRENDS . . . *New oil-gas ratios will save money . . .*

standard motors running from 3½ hp. to 75 hp., plus two work motors and two special-order high-speed competition models. And West Bend makes it from 3½ to 80 in seven steps. Homelite and Perkins, apparently happy with the status quo, are sticking with last year's lines.

Obviously, the stern drive's success isn't having much effect on outboards, certainly not in the lower horsepower brackets where stern drives fear to tread.

Fuel economy in all power categories, has for years been a sore point with outboarders, a fact which has no doubt been the cause of the manufacturer's annual claims of "improved fuel economy." This year, however, these claims seem to have a little more substance than usual.

If there aren't actually more knots-per-gallon involved, at least the fuel will cost you less, because the recommended oil-gas ratios are being lowered substantially.

Money-Saving Fuel Mixes

McCulloch pioneered this oil-reducing movement, and today its outboards whiz along on oil mixed at just one part per 100—not too far from pure gasoline. For '64, Evinrude and Johnson have a 50:1 gasoline-oil mixture to replace their previous 24:1 prescription. This alone makes a tidy and tangible saving of 10 to 12 cents

per six-gallon tank of fuel. And when you're running a high-horsepower outboard over a long season, this saving adds up quickly.

Actually, though, the real benefits are less in dollar savings at the fuel dock than in the area of function. The new ratios mean better carburetion, with less likelihood of trouble-making gum deposits; better ignition, since spark plugs are less likely to foul; and less combustion-chamber carbon from careless fuel mixing. Also, because the gasoline isn't as diluted by oil, combustion is more complete and efficient.

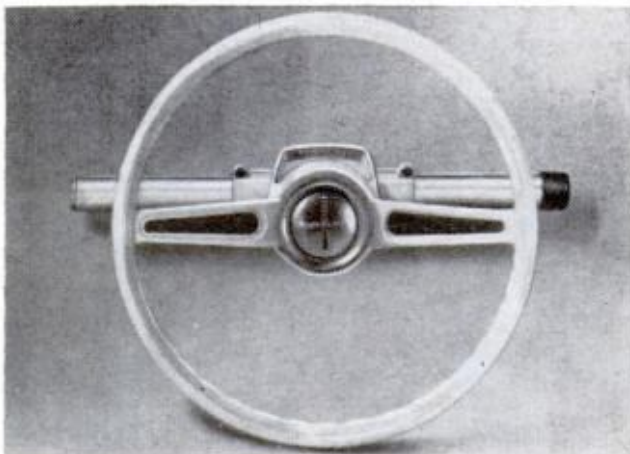
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JET 5K does 69 m.p.h., reaches 55 in seven seconds



NEW EQUIPMENT

PRECUT WIRE TIES made of corrosion-resistant Monel metal can withstand a pull of 150 pounds. Loop at top of the 6½-in. tie makes it easy to secure shackles, oarlocks, etc. Called Bosun's Ties, they retail for 69 cents per package and are manufactured by the St. Regis Paper Co., 150 E. 42nd St., New York, N.Y.



RED ARROW on the steering-wheel hub of all Mercury Ride-Guide remote-steering systems indicates direction bow will take when boat gets under way. Though designed for use with MerCruiser stern drives, this feature will work equally well with any outboard

Those Silly Shingles

Take a featherweight hull, add one or two kart engines and you have a hydro-kart—a pin-money package of exciting, splashy fun

By Bob Grant and John E. Boykin



EITHER OF THE PINT-SIZED BUZZ BOMBS shown in the photo above can run all day on just a dollar's worth of regular gas.

A direct outgrowth of the karting craze that swept the nation a few years ago, these wetback midgets are taking over where their land-based cousins left off. And the reasons for their growing popularity are obvious.

Hydro-karts spell water fun for the entire family at a price that most families can afford. They're small and

light, easily stored in the average basement or garage. Two 12-year-olds can lift one out of a station wagon, carry it into the water and have it running within minutes. No trailer or launching ramp is required for a hydro-kart.

While hydro-karts come in a variety of designs, most are about eight feet long, between 40 and 50 inches wide and tip the scales at slightly over 100 pounds complete with engine and a tankful of gas.

Until recently, the majority were powered by stock inboard installations. Lately, however, many manufacturers have begun to realize the potential market this field presents.

Berkley, for example, makes a jet drive which is proving extremely popular with family karters. All the moving parts of the jet pump are completely enclosed, so even in the event of a spill, there is no chance of being cut by a churning prop.

In addition, a special inboard-outdrive was recently introduced by Dolphin Marine, and McCulloch Corp. has an air-cooled 28-pound kart outboard with your choice of powerheads.

Since the kart outboard reduces mounting problems to a minimum and is invariably faster than an inboard of the same size, there is little doubt that it's destined to take over a larger share of the market. And McCulloch's top-of-the-line "Hydro-Mac 70," a racing motor, sells for less than \$300, so it's well within the reach of almost any enthusiast.

While a few small outboard power heads have been adapted for use on hydro-karts, the majority are powered by McCulloch or West Bend kart engines. These tiny two-cycles generally put out about 7½ hp. at 10,000 r.p.m., but when altered and highly tuned they often deliver up to 15 hp. and turn 18,000 r.p.m.

And don't be fooled by their small size. Any of the standard karting engines provide ample oomph to kick a little 100-pound boat out of the hole and send it cutting through the waves at from 20 to 40 m.p.h. Most can even pull a full-grown man on a single water ski.

In fact, one reason for the rapid rise of hydro-karts is the fact that about 3,500,000 of these engines have already been sold to the landlubber karting crowd. Thus, all a karting enthusiast has to do to go to sea is to buy a hull and drop in his engine.

One of the most attractive things about hydro-karts is their low cost. In kit form



JET-POWERED KART kicks up a frothy wake as it digs out. These midget squirt guns can hit 20 m.p.h. and will skim along nicely in only a few inches of water



LAST-MINUTE TUNING continues right up to race time. Note the high-mounted outboard on HK-43, second from left. It's McCulloch's Hydro-Mac racing model

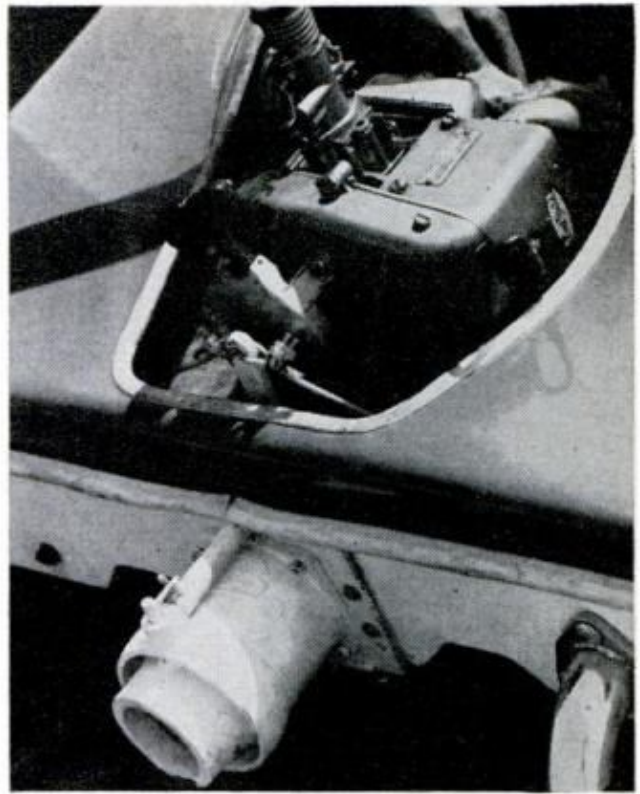
with no engine, prices start at about \$165. A completed boat minus engine sells for around \$300, and a boat-and-engine package will cost slightly over \$500.

If you're looking for a prestige-class hydro-kart, however, you can go into a twin-engine job with electric starting and lots of fancy chrome and hardware, thereby running the price up to nearly \$1000.

Though still in its infancy, hydro-karting already has two national associations and a number of smaller local or regional



TWO-SEATER KART designed by Dolphin mounts passenger on an elevated piggyback seat behind driver. It's powered by a front-mounted McCulloch inboard



SMALL-BUT-POTENT propulsion package links a West Bend inboard to Berkley's 5J5 jet pump. This one is especially popular for recreational hydro-karting



LE MANS START begins on the beach. Drivers sprint across the sand, into the water and hop on their karts. Variations such as this are combined with a number of different course layouts to spice up a day's hydro-kart racing

organizations. Races are held regularly in many parts of the country with the boats running in different classes (singles, twins, children's, etc.)

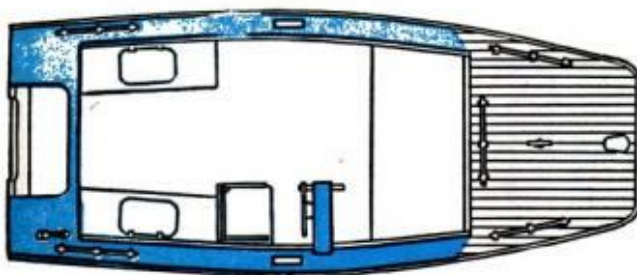
To add variety, several different types of races are scheduled. Among the most popular are drag racing, circular or oval "track" racing, and slalom racing. In a slalom race, the boats run a zigzag course, and since the highly maneuverable little hydro-karts are especially adaptable to this type of obstacle racing, slalom racing

may prove the most successful.

Karting took the nation by storm, but hydro-karting seems to be an even faster growing sport. Any small piece of water can become a hydro-kart "track", and the little boats have already turned up in such unlikely places as swimming pools and golf course ponds.

In fact, if the present trend continues, there won't be a birdbath in the country safe from the angry buzzing of these tiny sea-going karts. ★★★

SHOP AND CRAFTS



SPORTS SLED

Drop 50 sq. ft. of open cockpit into a rugged inverted-V hull and the result is this speedy versatile sportsman's dreamboat

By Arthur Mikesell

DESIGNER: William D. Jackson

TYPE OF HULL: Inverted-V

LENGTH: 16 ft. Over-all

BEAM: 7 ft. Over-all

WEIGHT: 600 lbs.

SEATING CAPACITY: 6 Passengers

COST TO CONSTRUCT: \$200

TIME TO CONSTRUCT: 125 hrs.

MAXIMUM HP.: 100 (OBC's
New Standards)

SPEED: 33 M.P.H. (Johnson
RD-25D 40-hp. Motor,
10³/₈ x 13¹/₄-in. Prop,
325-lb. Passenger Weight)

CONSTRUCTION DRAWINGS:
George Blow, PM Art Dept.

DON'T BE FOOLED by the sleek, racy lines. In spite of its high-style appearance, this soft-riding inverted-V is a rugged, do-anything sports boat that's fine for fishing, sensational for skiing and roomy enough to hold all your scuba gear with plenty of space to spare. And it can take anything you're likely to dish out.

To build it, follow the same general rules that apply to all PM project boats:

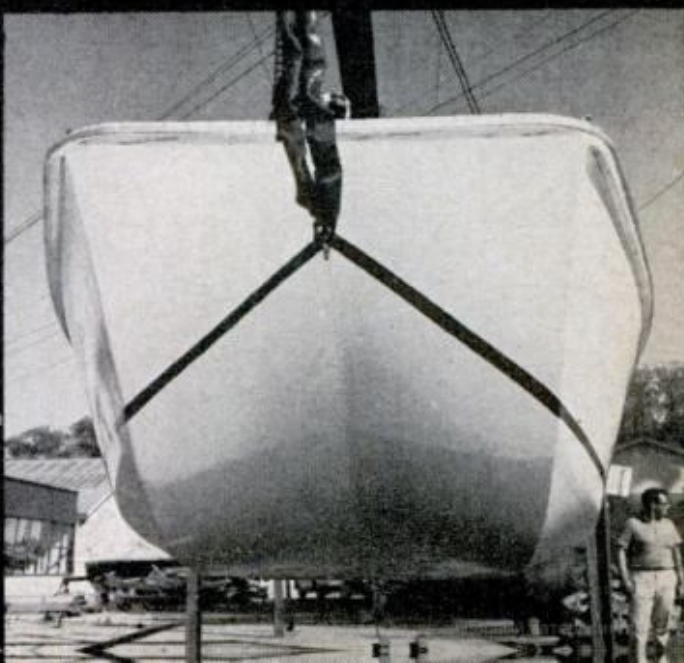
- Frame with the best stock lumber locally available. Douglas fir, Philippine Mahogany, Yellow Pine or even the better grades of Hemlock will suffice, so long as the wood is reasonably free of knots. Lumber dimensions denote stock sizes, i.e., a 1 x 4 actually measures 13/16 x 3⁵/₈ in.

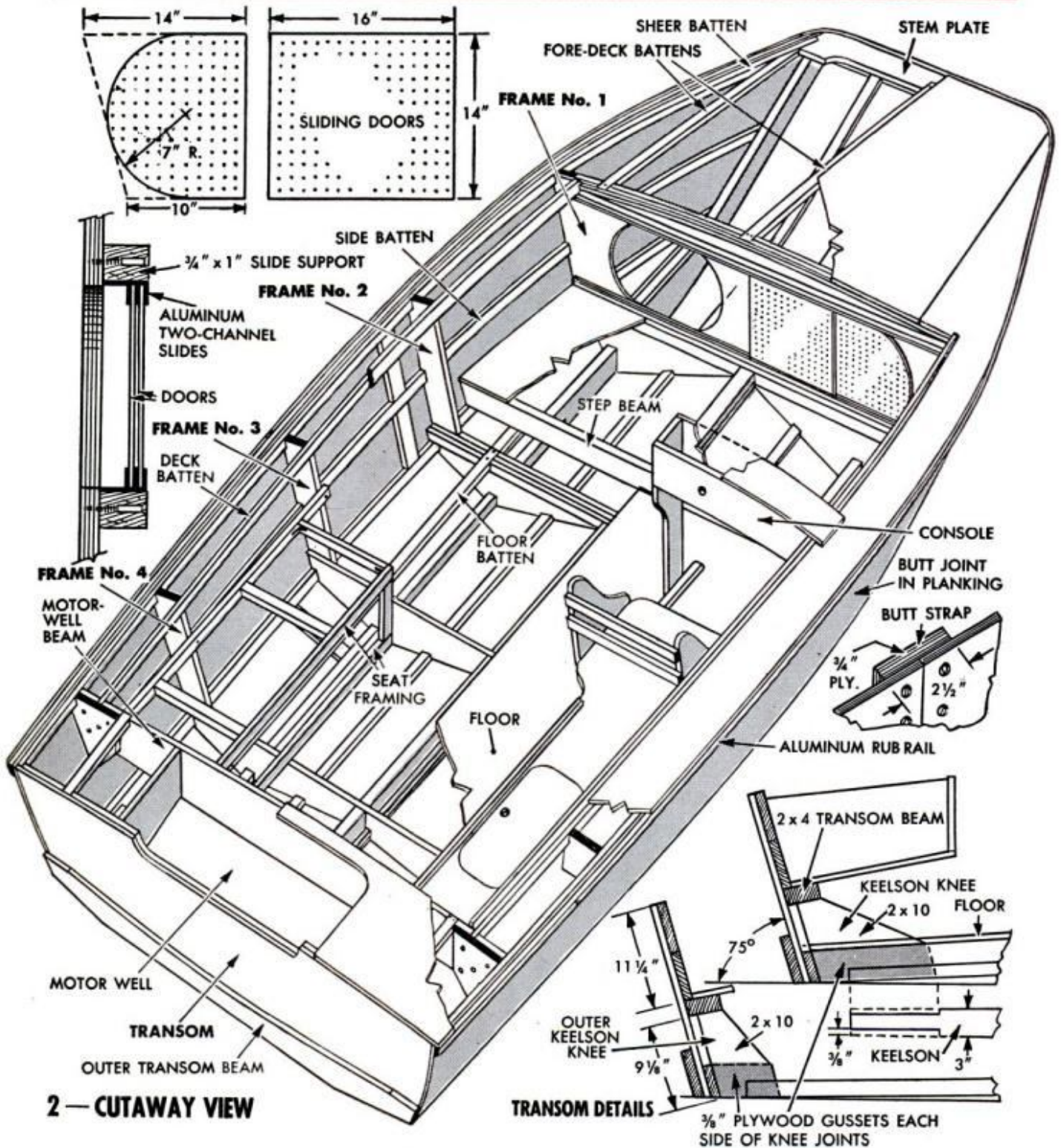
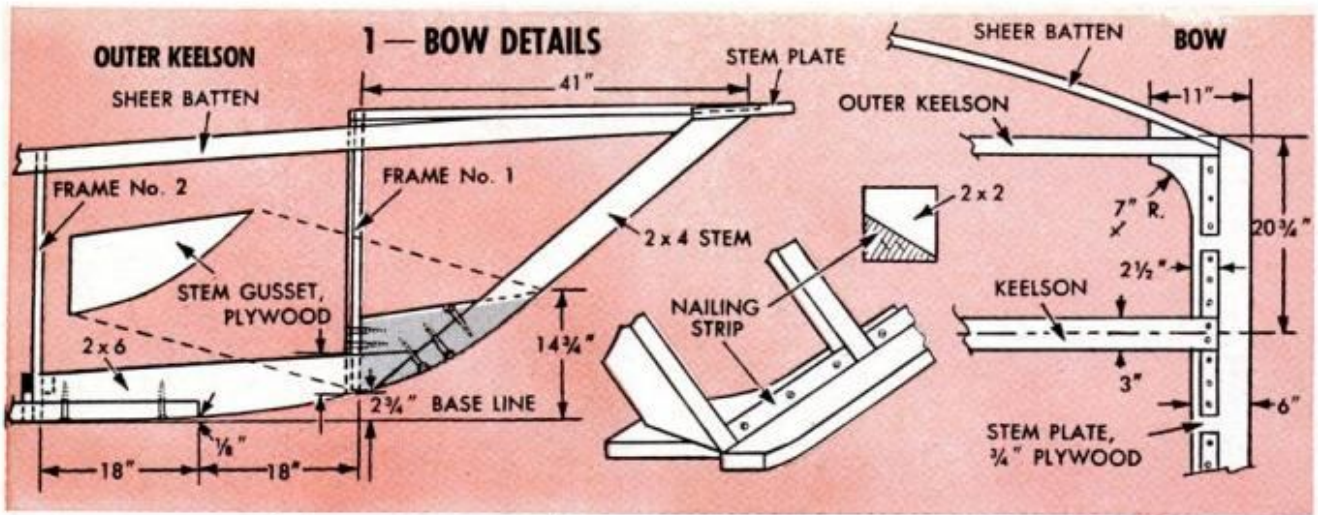
- Use annular-ring boat nails (Stronghold, Anchorfast or similar) and waterproof glue to secure the 3/8-in. plywood planking to the frame. Galvanized nails and screws are suitable if you plan to use the boat only in fresh water, but substitute silicon bronze if it will receive salt-water exposure.

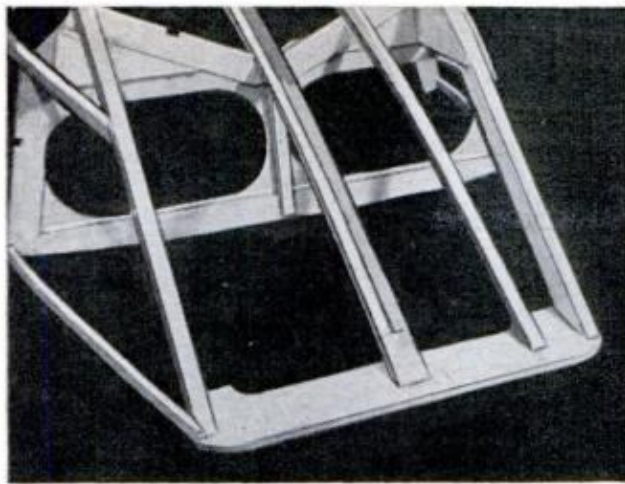
- Where necessary, make full-size paper patterns by using the grid system to enlarge the plan drawings. Transfer these patterns to the lumber or plywood with a dressmaker's toothed wheel. (You can make a suitable substitute by salvaging a gear from a discarded alarm clock and mounting it on a nail between the legs of a wooden clothespin.) Cut slightly over-size to allow for the final fitting.

- Countersink all exterior fastenings slightly and plug holes with wood putty.

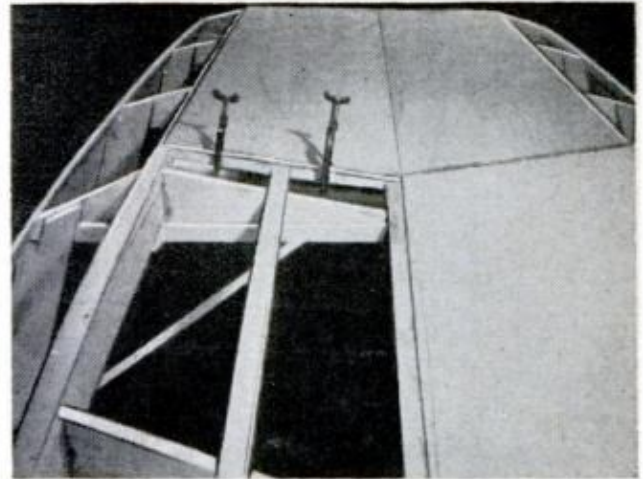
- Fiberglassing is a matter of personal taste, but on this particular hull it is strongly recommended that you seal the below-waterline seams with fibreglas tape.







FILLER PIECES mounted on the keelson are decreasing-angle wedges which give inverted-V configuration to this member. The final trial-and-error shaping of these pieces to receive planking is part of fairing



START PLANKING at the transom and work forward. The 2½-in. plywood butt straps at the planking joints must be cut to fit between the framing members. Be sure to seal all of these joints with fiberglass tape

The first step is to cut and assemble all frames, Fig. 7. Fasten the side members to the bottom crosspieces with glue and 1½-in. No. 8 f.h. screws, three per joint. Use the same size screws to mount the inner transom framing on the ¾-in. plywood transom, spacing them about 3 in. apart. (The outer transom beam isn't installed until after the frame is planked.) Secure the 2 x 4 transom beam by driving 2-in. No. 10 screws from outside the plywood. And remember to coat all contacting surfaces with glue.

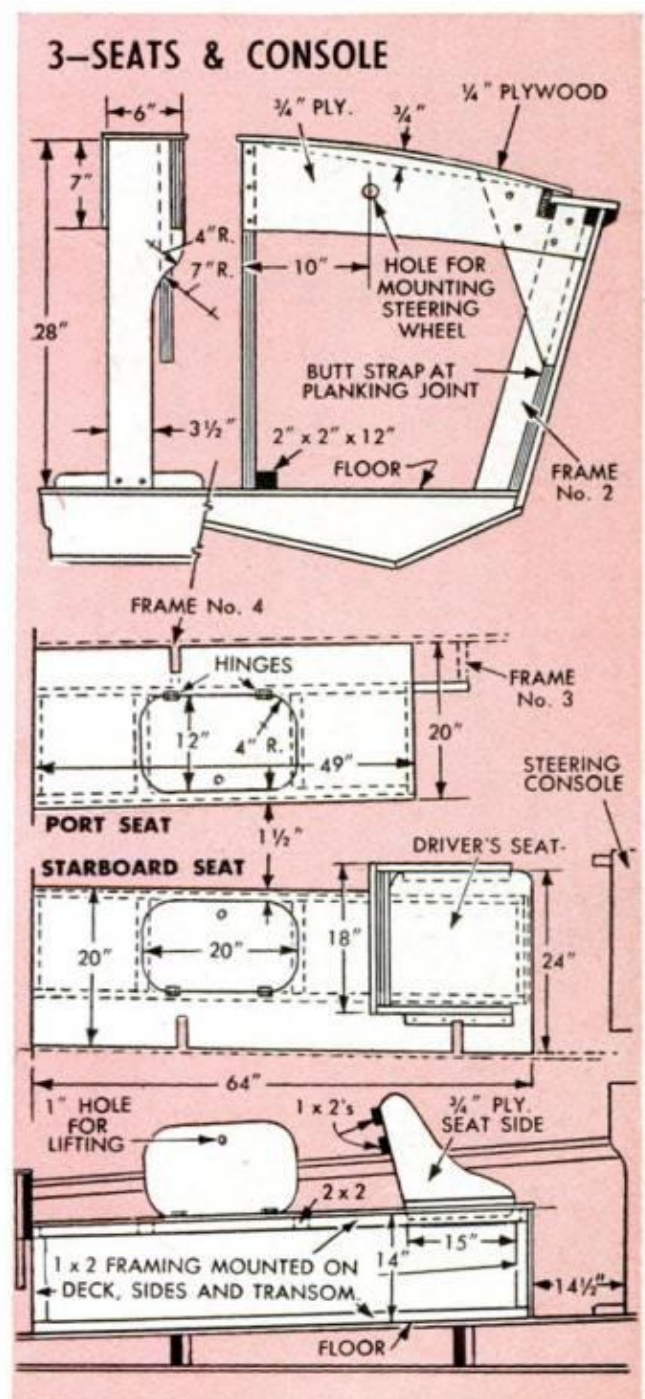
When you have finished frames 2, 3 and 4, brace them with 1 x 1 tie bars as shown in the photos on page 151 to prevent distortion during the rest of the building process. Note that frame 2 is braced with 1 x 2 doubling pieces on each side of the bottom crosspiece. Mount these with glue and 1½-in. No. 8 screws. Don't forget to notch the upper beam in frame 1 to hold the fore-deck battens.

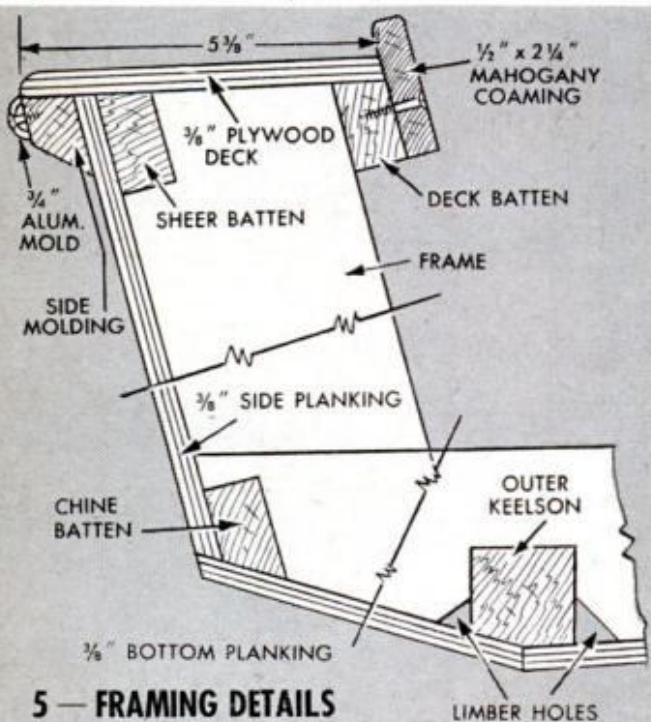
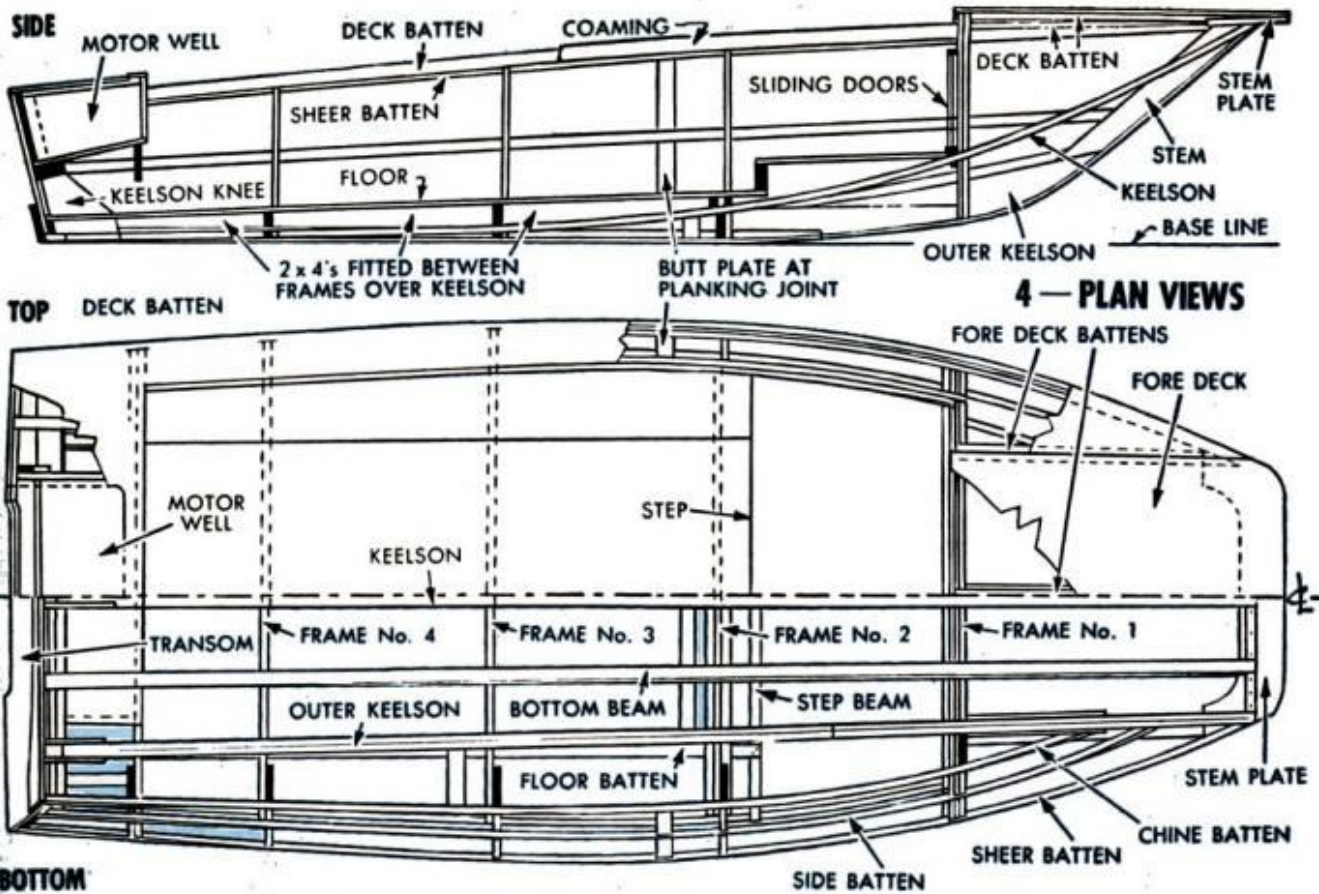
While the glue in the frames is hardening, turn your attention to the longitudinal framing pieces, Fig. 7. Saw all the keelsons, battens and molds first, then set blade at 30-deg. and rip the chines.

Because this boat actually has three stems—one on each side of the vee, plus a third running down the center of the tunnel—the framing may look somewhat complicated when you first go over the plans. Once you get into it, however, you'll find that it's actually quite simple.

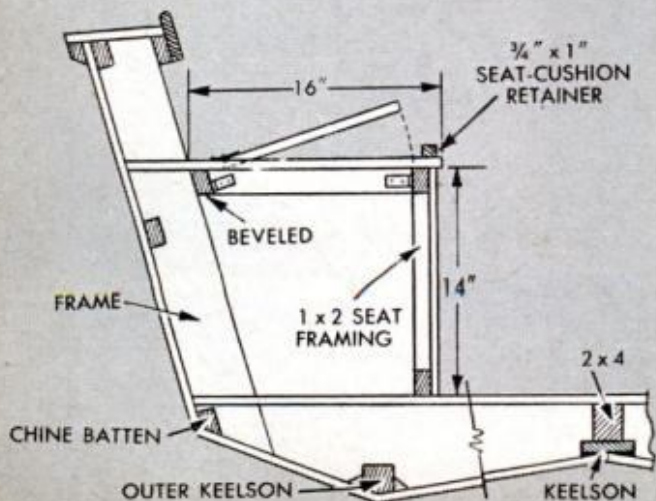
Begin with the stem assembly, which includes frames 1 and 2. These frames and the two outer keelson/stem members should be assembled right side up, clamping short legs to the stems to elevate them the proper distance above the base line, Fig. 6. First, cut the stem plate from ¾-in. plywood.

The next step is to cut and assemble





5 — FRAMING DETAILS

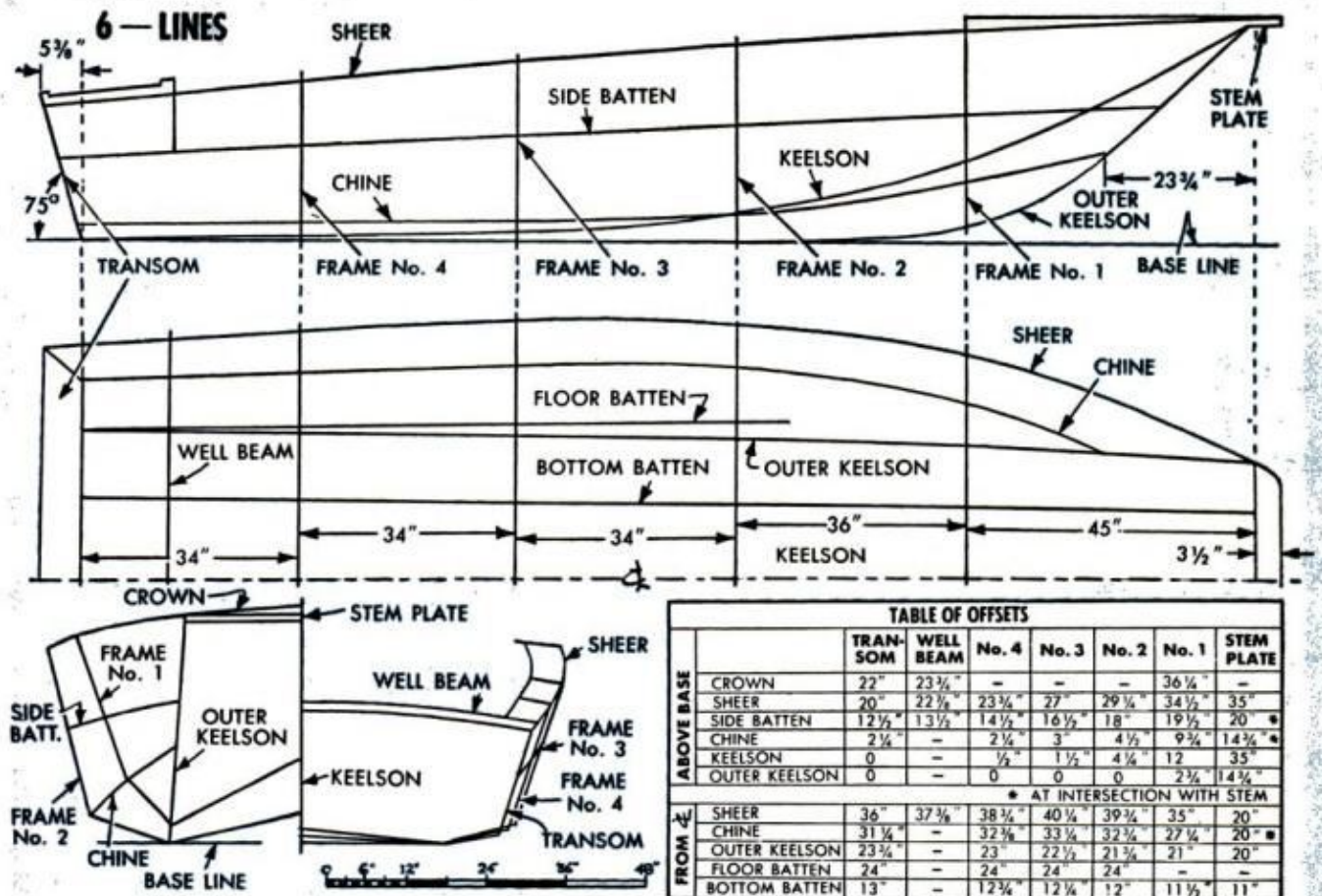


the two outer stem/keelson members, Fig. 1. After coating all mating surfaces with glue, secure the two $\frac{3}{8}$ -in. plywood gussets (per stem) with $1\frac{1}{4}$ in. No. 8 nails, then drive three 3-in. No. 12 screws into the fore end as shown, one from above and two from below. These should be countersunk slightly to allow for fairing.

When the glue has hardened, join the 2 x 2 outer keelson to the stem assembly with glue and two 3-in. No. 12 screws. Now notch frame 1 to fit the bottom stem member, and with legs clamped to the two outer stems, slip frame 1 over them and check the fit. Next, position the stem plate on these two stems and mark their location on it. Then, if everything fits to your satisfaction, remove frame 1 and the stem plate, coat all adjoining surfaces with glue and return these parts to position, fastening frame 1 to the outer stems with two 2-in. No. 10 screws per joint, Fig. 1, and the stem plate to the ends of the outer stems with two of the same size screws per joint.

Before securing frame 2 to the outer keelsons, turn the assembly upside down. Coat all mating surfaces, with glue and drive one 2-in. No. 10 screw through the frame into the after end of each stem assembly.

Next, add frames 3 and 4 using glue and one 3-in. No. 12 screw per joint. Finally, secure the transom to the outer keelsons with two knees, Fig. 2. Coat adjoining

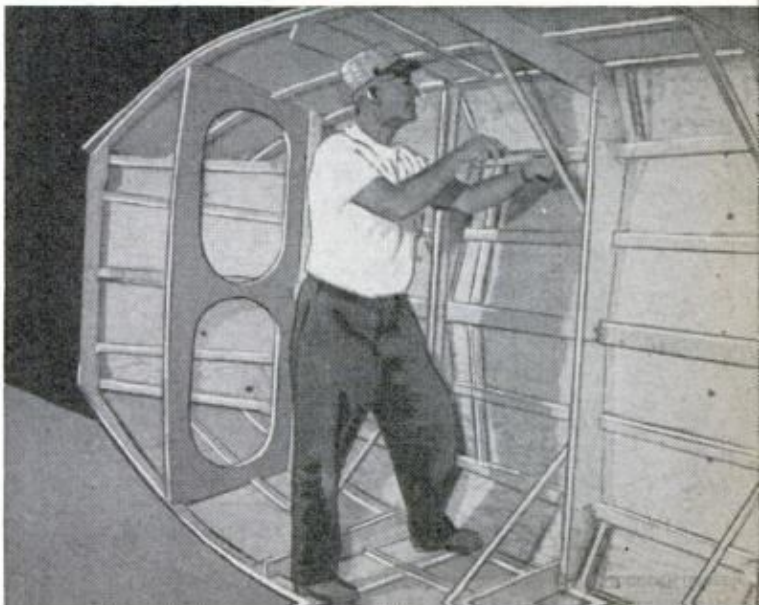
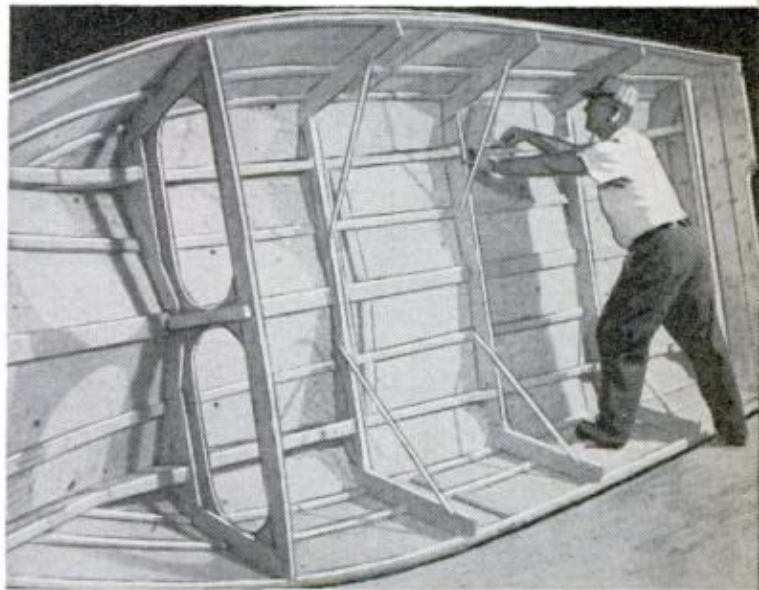


surfaces with glue and attach with three 3-in. No. 12 screws—one through the transom beam, one through the rear of the transom and one through the outer keelson. Then secure the plywood gussets with glue and nails, clamp 1 x 2 legs to the transom and toenail these to the floor.

The next framing member to be added is the center keelson. At the transom, this is attached in the same way as the outer keelsons, Fig. 2. Secure it to each frame with glue and one 2-in. No. 10 screw. Bevel the end to fit flush against the stem plate, then coat mating surfaces with glue and fasten with two 1 1/2-in. No. 8 screws.

The pre-cut chines go on next. Cut a 1-in. piece off the end to use as a pattern for the chine notches in the frames and saw these square to each frame; then, with chines in position, run a hand saw between chine and frame notch to insure perfect seating of the chine in the notch. Attach with glue and one 2-in. No. 10 screw per joint. Don't secure the chines to the stems yet, however, because the stems must be bevelled first. After completing this part of the fairing operation, bevel the ends to fit against the stems and fasten with glue and one 2-in. No. 10 screw.

Like the chines, the bottom battens are notched all the way through the transom and fastened with one 2-in. No. 10 screw per joint. Position them midway between the center keelson and outer keelsons. To simplify bending, slit about 6 ft. of the



forward end by running it through a table saw on edge. Then, after bevelling this split end to fit against the stem plate, apply glue to the slit portion and fasten with one 2-in. No. 10 screw.

Follow the same general procedure for mounting the sheer and side battens, but remember that the sheer battens, like the chine battens, shouldn't be secured to the stem until this member is bevelled.

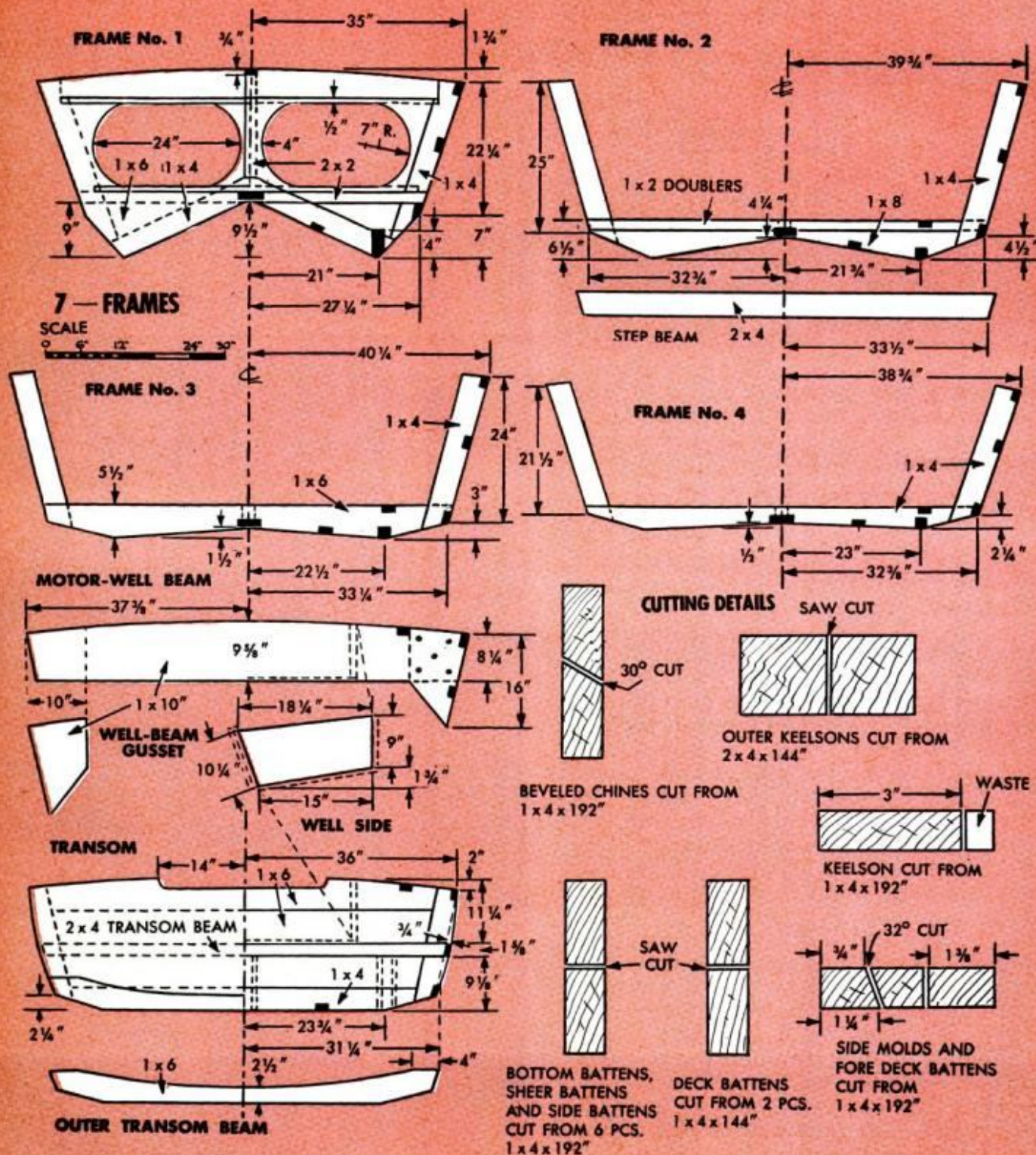
Fairing the frame is undoubtedly one of the most difficult steps in the construction of this boat, but if you exercise rea-

sonable care and don't attempt to hurry through this operation, you shouldn't run into any real difficulty. Properly shaping the frame surfaces to insure perfect contact between the plywood planking and the frame members will require the use of a coarse wood rasp and a jack plane.

If one is available, a Stanley Surform wood file will speed up the job.

For those who aren't familiar with this operation, fairing involves laying a 1 x 1 batten across the framing surfaces and

(Please turn to page 220)



NO-SLIP FLOOR

For Your Boat

Why take a chance on a tumble? This low-cost safety finish is 100% slip-proof, even when wet

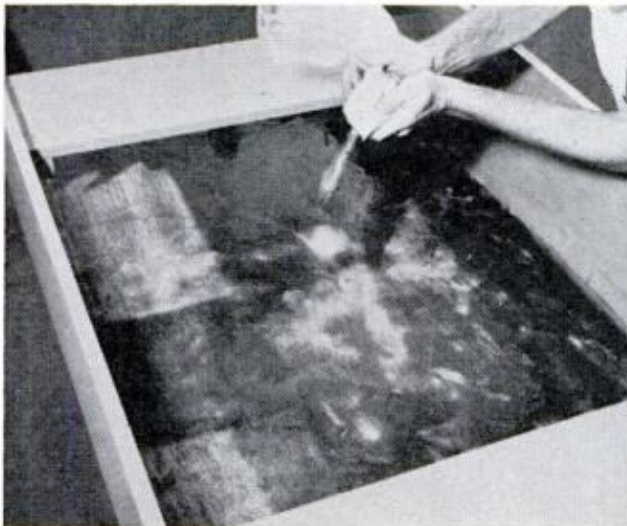
ANY FISHERMAN or duck hunter knows that it's almost impossible to keep the floor of a small open boat dry. And a slippery floor in a small boat is like an accident waiting to happen.

Commercial non-skid finishes do a fine job of taking the slip out of a wet floor, but few sportsmen would want to use these relatively expensive products on a knock-around fishing boat which may double as a duck blind. However, here's a low-cost non-skid finish that you won't hesitate to use anywhere, even on small floats or docks.

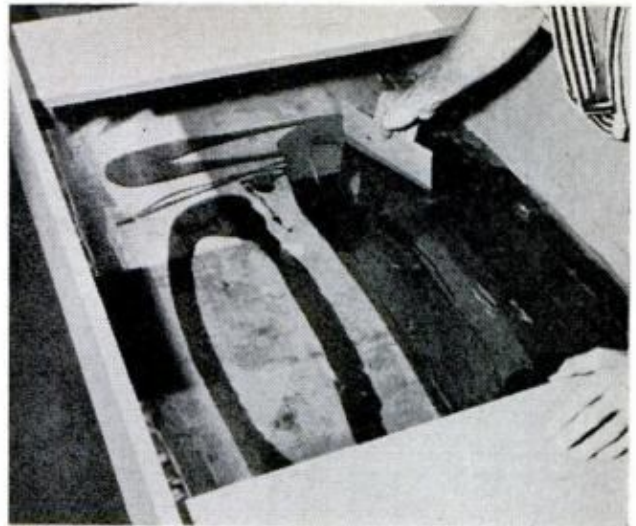
Made by sprinkling screened sand over tacky polyester resin, it provides a rough surface texture that won't become slippery when wet. And in addition, it protects the floor from wear.

For the best surface use #30 crystal sand, which may be obtained at any building supply house. If this isn't available, any common fine-screened sand may be substituted. Before applying it, make sure that the resin is tacky, for otherwise the sand will simply settle down into the resin instead of remaining on the surface.—V. Lee Oertle

3. WHEN RESIN SETS to a tacky surface, scatter the sand evenly over the entire floor. You can either make a shaker-type dispenser from a tin can or punch tiny holes in the bottom of a plastic bag

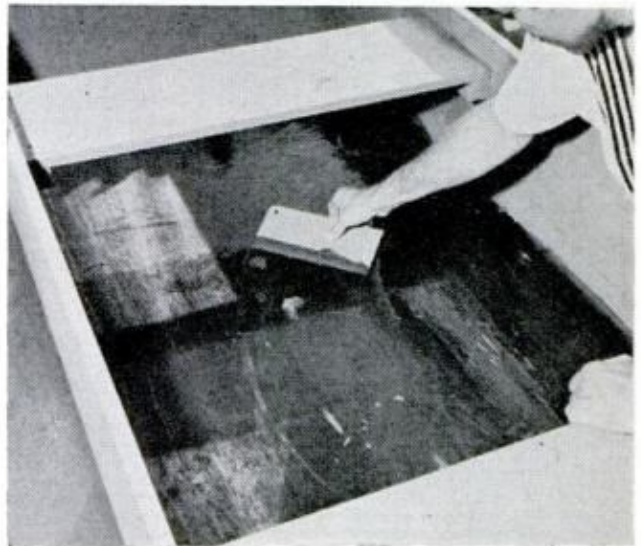


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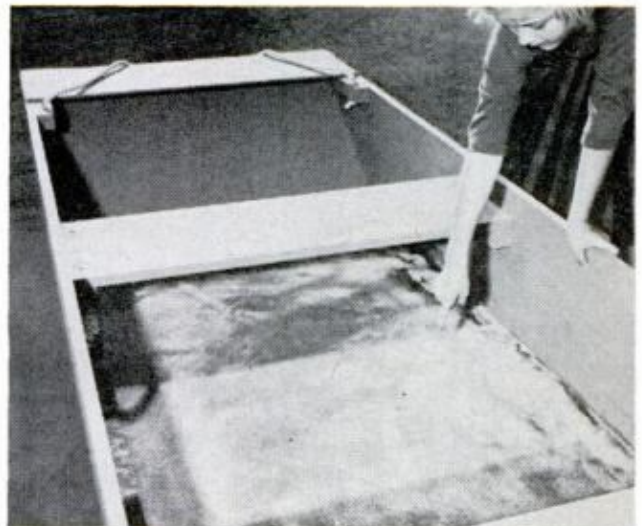


1. CLEAN FLOOR thoroughly, removing dirt and grease spots. Use sandpaper where necessary. Then catalyze the polyester resin and pour it evenly over floor. A pint of resin will cover most small-boat floors

2. SPREAD RESIN carefully with a piece of cardboard, filling all cracks in floor and pushing it into all corners. Work quickly, since resin will begin to set and become more difficult to distribute evenly

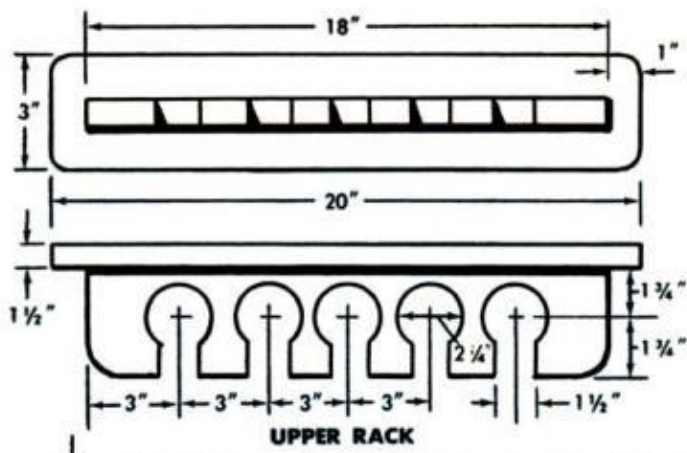


4. AFTER RESIN CURES, go over the floor with a whisk broom to remove any loose sand which failed to adhere to the resin. The boat is ready for use again as soon as polyester resin has cured thoroughly

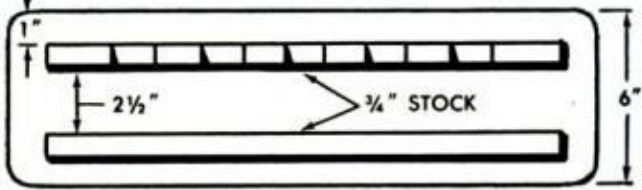


151

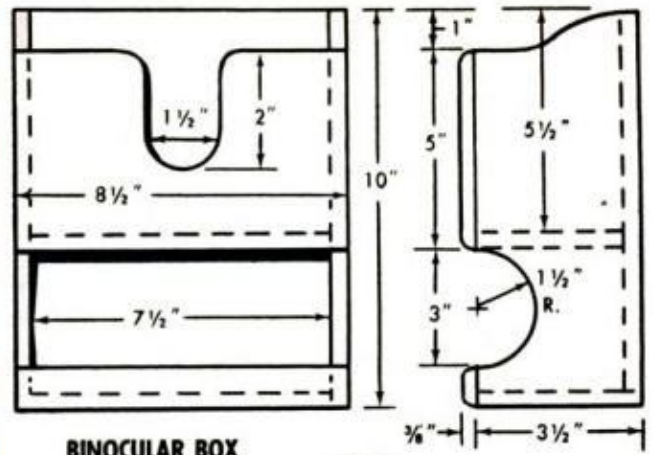
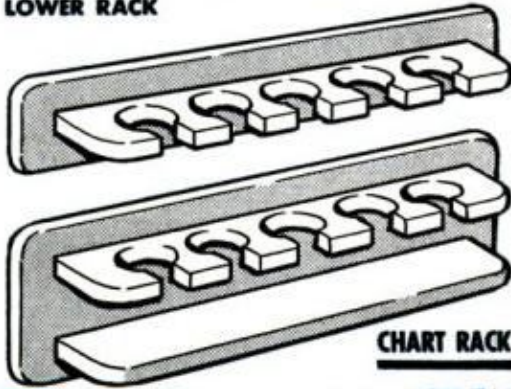
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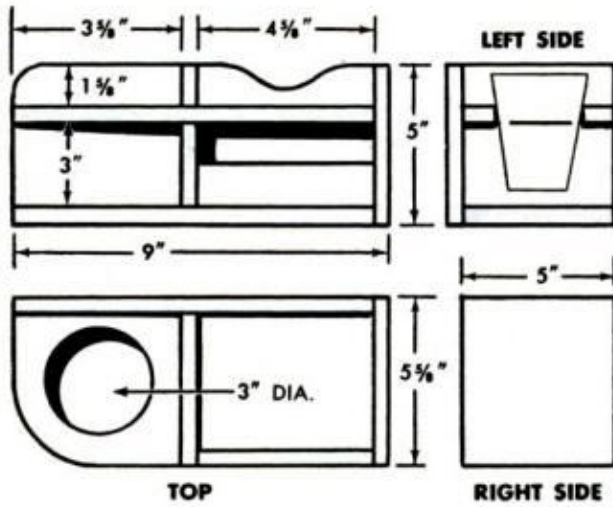
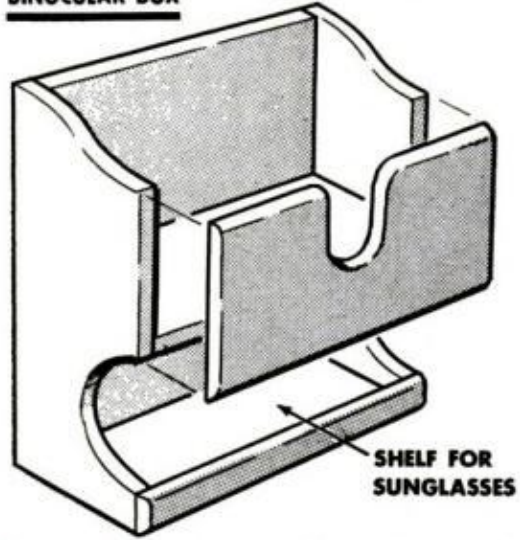
UPPER RACK



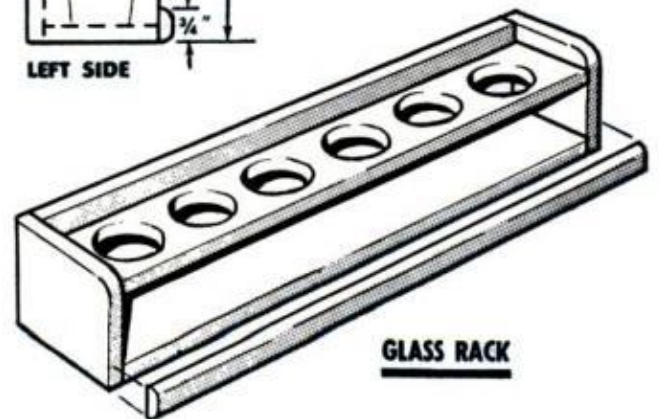
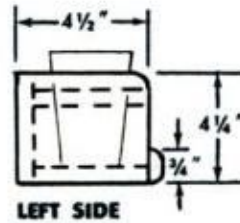
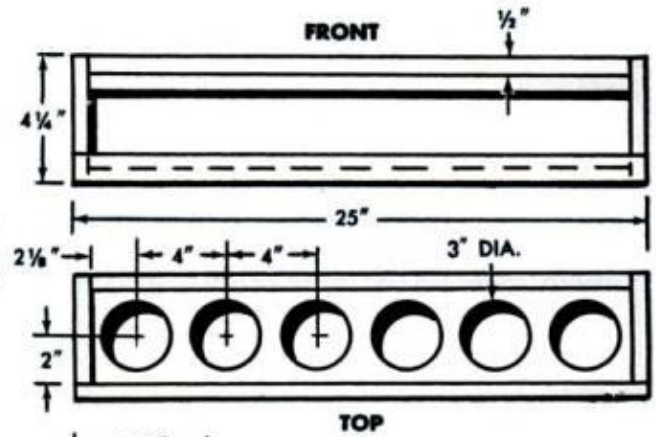
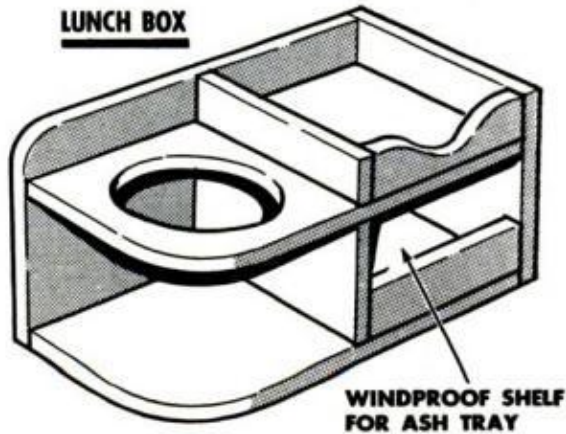
LOWER RACK



BINOCULAR BOX



LUNCH BOX



SIX BITS OF LUXURY

For Your Boat

By Patrick K. Snook

ANY SKIPPER worth his salt knows that there's nothing quite so annoying as loose or sloppily stowed gear, particularly when a chop starts kicking up.

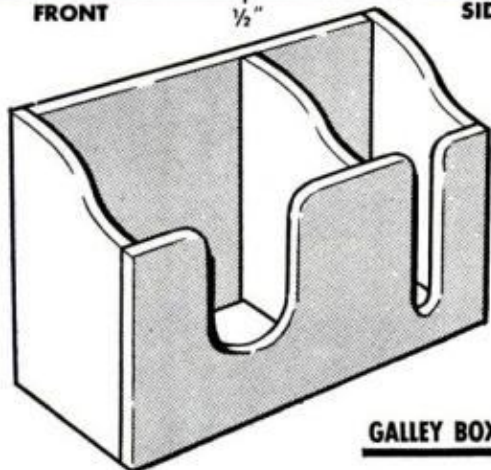
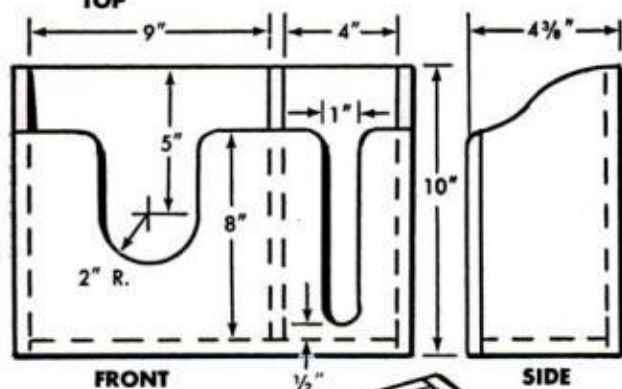
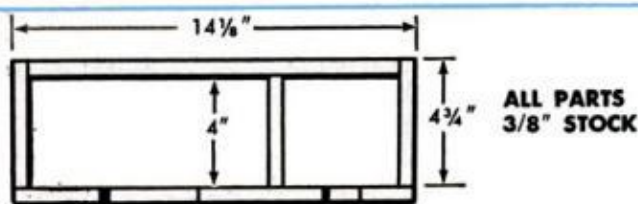
These six simple built-ins will provide tailor-made storage space for some of the more awkward-to-stow articles commonly found aboard a large runabout or small cruiser. All six can be built with hand tools, and they represent a total investment of less than \$10 for lumber. The pilot models were made from solid Honduras mahogany and finished with a dark mahogany stain followed by several coats of spar varnish. However, other materials and finishes may be substituted if desired.

All units should be constructed to fit your particular needs, so be sure to check the dimensions given in the drawings against those of your equipment. They can

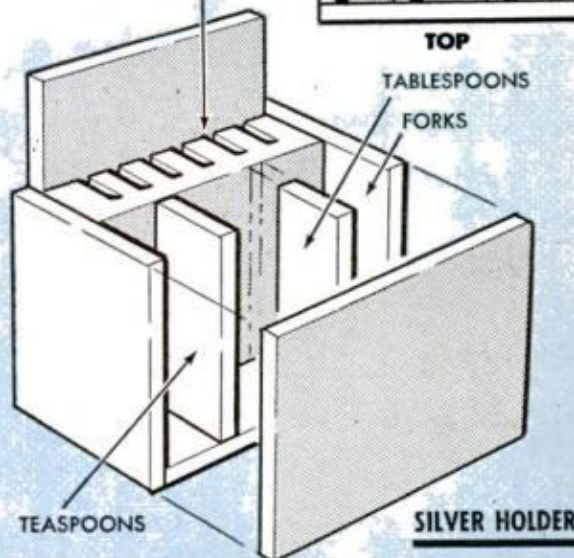
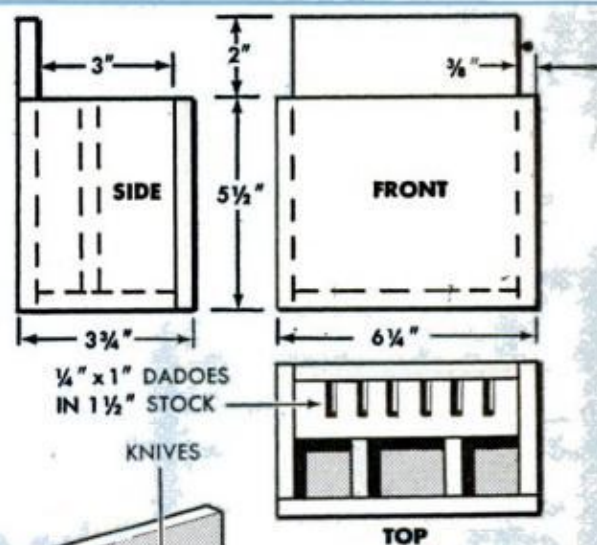
easily be altered if necessary. By the same token, you may wish to enlarge the capacity of a unit, making a rack for six charts or eight glasses. Such modifications can easily be made.

All parts should be cut, checked for fit and sanded before final assembly. Use liberal amounts of *waterproof* glue on all joints. When the glue is dry, give the piece a careful final sanding and apply the desired finish.

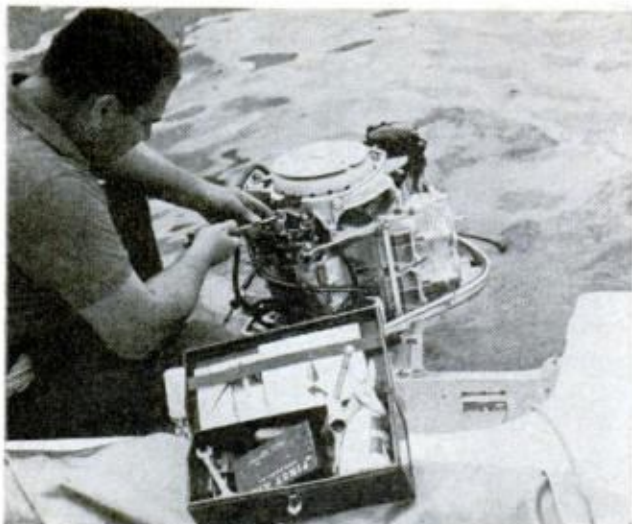
Line the bottom of the binocular box with a square of $\frac{1}{4}$ -in. foam rubber to protect the glasses. For easy cleaning, use a loose piece of vinyl tile in the bottom of the sandwich shelf of the lunch box. Other liners (for the glass rack, galley box and sunglasses shelf of the binocular box) can be cut from a sheet of automotive gasket cork after making a paper pattern.



GALLEY BOX



SILVER HOLDER



CRISIS KIT

For Your Boat

Don't risk being stranded with a dead motor. Assemble a repair kit for use in such emergencies and you'll always make it home

EVERY BOAT should carry a repair kit. While you don't have to load yourself down with enough tools and spare parts to stock a marine supply store, your equipment should be complete enough to make simple on-the-spot repairs.

For instance, suppose you shear a pin and find that the broken stub is jammed in place. If you have a ten-cent ice pick handy, you can pop the stub out in sec-

onds. But if you don't . . . well, then the fun starts. And the same thing holds true for other tools and replacement parts.

Most of the equipment listed below can be packed into a small tool box. Wrap the spare prop in a small piece of canvas and tuck it away under a seat. Special trailer tools and parts can be assembled in a separate kit and stored in the trunk of your car.—Pat Snook & Marc Michaelson

TOOLS

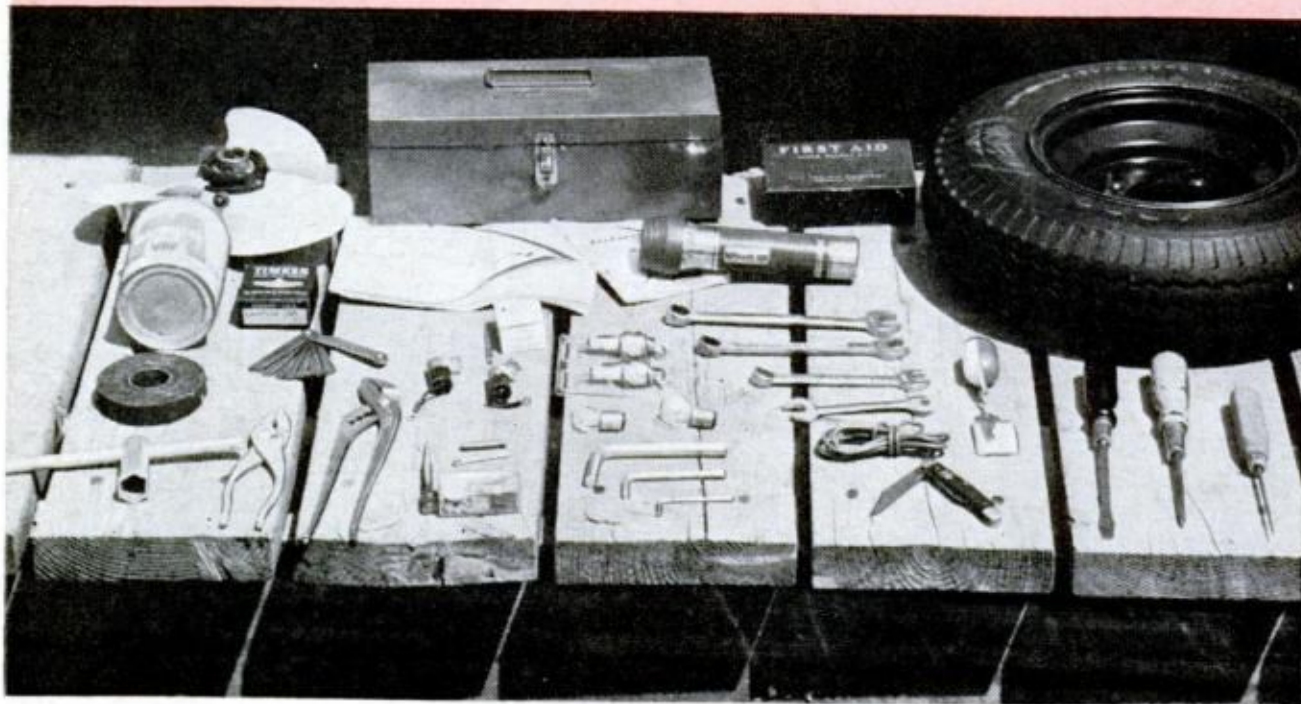
Pliers (water pump & slip joint)
Screw Drivers (large & small blades, No. 1 Phillips)
Ice Pick
Spark-Plug Wrench
File (for plugs & points)
Gap Gauges (wire for plugs, feeler for points)
Knife
Allen Wrench Set
Assorted End Wrenches (optional)
Flashlight

PARTS

Shear Pins
Cotter Pins (prop hub & trailer wheel)
Spark Plugs (in waterproof package)

Points
Condensers
Gasket Kit
Insulated Wire (for running lights or trailer tail lights)
Plastic Electrical Tape
Light Bulbs (running lights & trailer tail lights)
Wheel Bearing for Trailer
Spare Wheel & Tire for Trailer
Spare Propeller
Wheel-Bearing Grease (also used on trailer-hitch ball)
Spare Ignition Keys

First Aid Kit
Factory Motor Manual
Service Depot Manual



NO-SNAG ANCHOR

For Your Boat

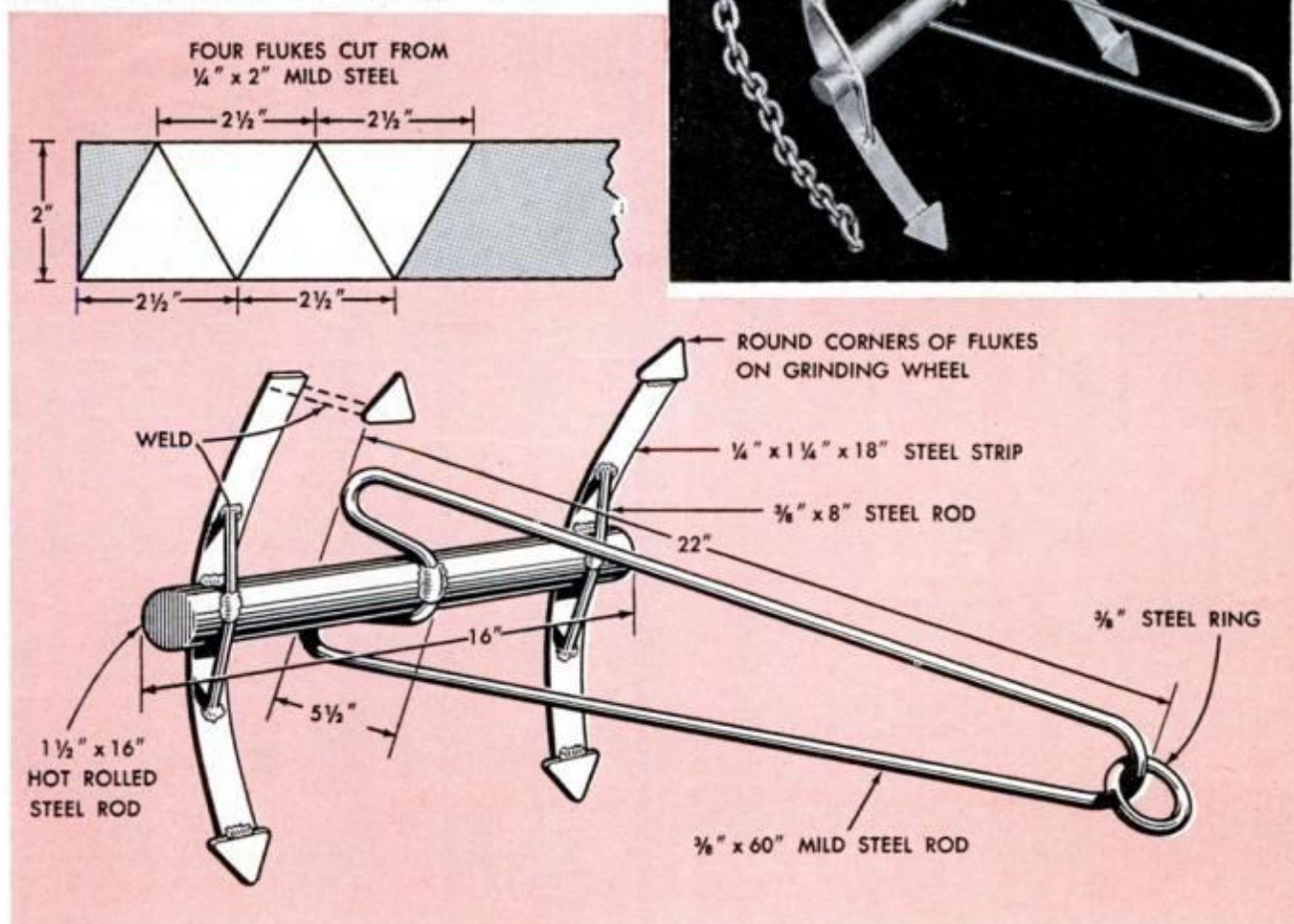
Easy to free from the trickiest snags, this shop-made anchor is a simple one-evening welding job

USE-TESTED in Oregon's fast-water fishing streams, this shop-made anchor is a perfect hook for rocky bottoms. Though hung up on snags dozens of times, the owner has never failed to free it by running back over the anchor and slightly beyond so that the slip ring slides down the shank. Since the bottom of the shank is behind the flukes, a quick tug pulls them out the same way they went in.

Cut the pieces from mild steel stock and weld them together as indicated. In bending the shank, first make the bend on each end by heating the rod red hot and forging it over the stock itself. Next, make the two bottom bends by heating the rod again and bending it in a vise. Finally, make the upper bend in the center of the rod, bring the ends together over the 1½-in.-dia. stock and weld them.—*Manly Banister*



UNLIKE OTHER snag-proof anchors, this shop-made hook is equipped with four arms instead of just two





Anyone for Skittles?

By Clifford B. Hicks

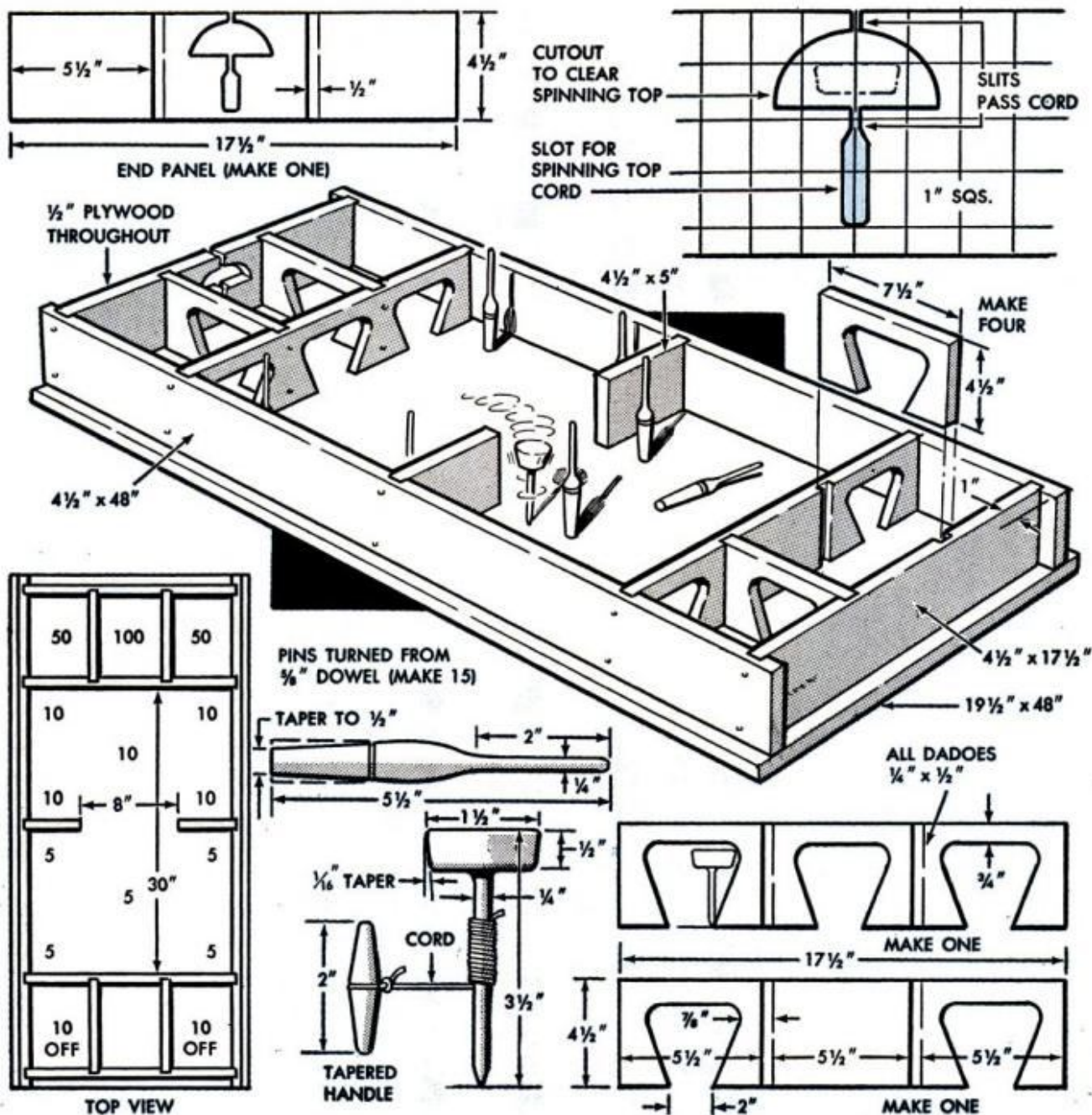
FOR CENTURIES, Englishmen have gathered in pubs to play skittles—a miniature sort of bowling game. The object is to send the top spinning through the “rooms,” knocking down skittles (pins) as it goes. Point values in the “rooms” can shave ten points off your score or boost it by 100. The game may be played for a predetermined number of turns or simply with each player taking a turn to see who gets the highest score. You needn’t go to England to try it—it’s easy to make your own board.

A 4 x 4-ft. sheet of ½-in. plywood will

provide adequate material. After cutting the base and walls, mark and cut the dados; if your shop lacks a power saw, simple butt joints may be used.

An optional step is to cement a scrap of plastic laminate or tempered hardboard to the inner face of the end wall, where the hole for the top will be cut. Without this protection, the top will eventually wear away a cradle to brake its spin.

After cutting all doorways—a job you can speed by careful stacking of the blanks—sand edges smooth. A coat of shellac thinned 50-50 with alcohol, fol-

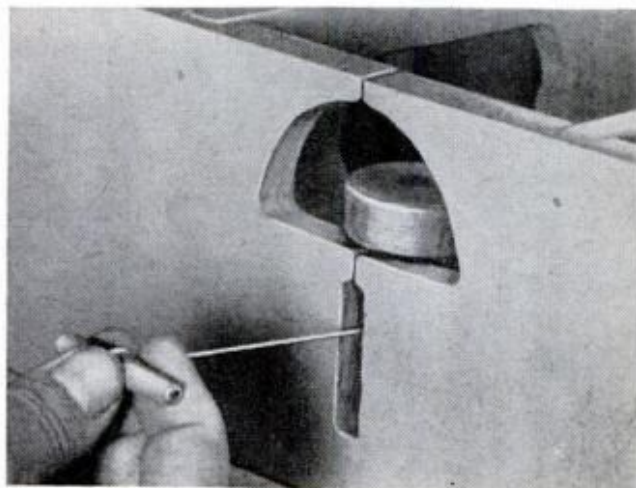


lowed with two coats of enamel makes a durable finish. Brushing is easier if you prefinish the parts before you glue and nail them together.

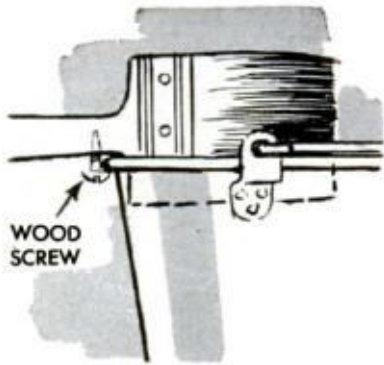
If you have a lathe, turning the skittles will present no problem. The alternative is to use straight sections of dowel. These have a greater tendency to block doorways than do the turned pins, but they are usable. So are toy bowling pins.

If you don't have a lathe but do have a portable drill, you can make a true-spinning top by driving a 1/4-in. dowel in a tight-fitting hole in a hardwood disk and then chucking it in the drill to true the disk with a sharp wood chisel. It's important that the top be made of hardwood since it takes quite a battering as it bounces off the walls. Strong black thread makes a good cord and should be about 12 in. long with a pull handle tied at the end. Happy skittling! ★ ★ ★

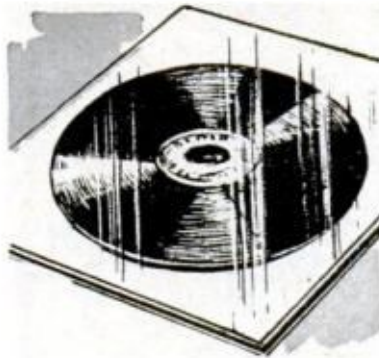
TO SPIN THE TOP, wind the cord around its stem, then feed the free end down through the slits as you lower the top into the position shown below. Hold the top snugly against the end wall with the left hand, releasing it at the same moment you give a sharp, smooth tug to pull cord out through slot



TAKE A HINT FROM READERS



A **WOOD SCREW** driven into the handle of a paint brush at a point near the ferrule makes it possible to hang the brush over the inside edge of a paint pail. You'll find this a helpful tip when moving ladder or scaffold



A **PHONOGRAPH RECORD** that has been heat warped can be flattened by sandwiching it between two pieces of glass and placing it in the sun. When record has cooled off in the evening air it will be perfectly flat



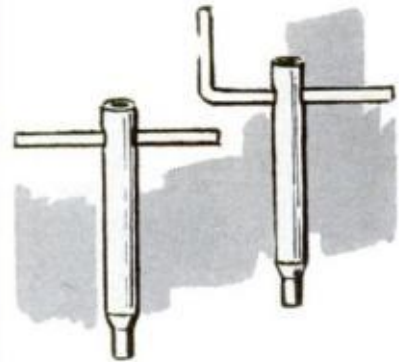
QUICK FILLING of small-mouthed bottles, such as the ones used for darkroom chemicals, is a snap if you provide an air vent. Simply tape a nail to the funnel spout to prevent the funnel from sealing the mouth of bottle



A **CARPENTER'S PENCIL** must be kept sharpened to a chisel edge. You will find that this may be done conveniently on a strip of emery paper glued to the saw handle. Use water-soluble glue for ease in paper changing

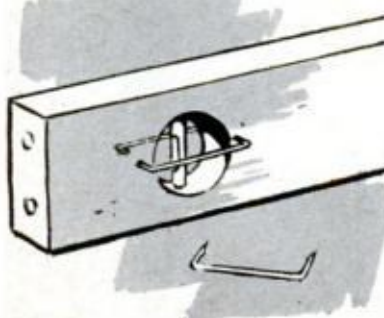


IF YOU INTEND to store your tennis racket for a long period, you can keep the strings from snapping by coating them with petroleum jelly. When you take the racket out of storage, the jelly can be removed by wiping

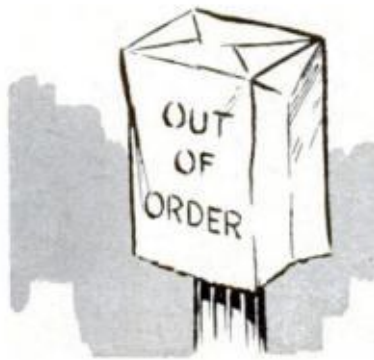


SAVE TIME when adjusting lathe-chuck jaws by removing the straight bar handle from the chuck wrench and substituting a longer bar bent into an L-shape. The resultant crank action speeds up adjustment

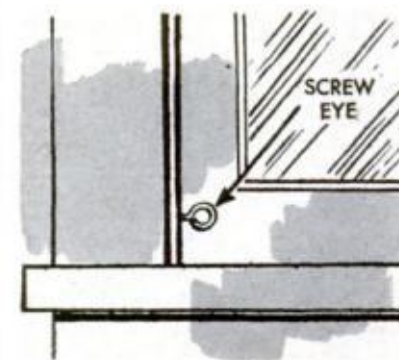
PROTECT THE VIAL on your wood level from breakage by driving a wire staple into the level on each side of the glass. If staples are positioned so that they cross the exact center of the vial, they will aid reading



A **PAPER BAG** with the words "Out of Order" printed on both sides should be kept in your car. When you park and find that the meter does not work, slip bag over it so that you won't be ticketed. Check local ordinances first



WINDOW SASH that rattle in the wind may be quieted by inserting a screw eye in the window frame as indicated. When finger-tightened so that it bears against the sash, the screw eye will prevent annoying rattles



Direct-Drive Table Saw Has Built-in Brake



WAITING for the blade to coast to a stop is something you don't have to put up with when using DeWalt's new tilting-arbor bench saw. For even though this direct-drive workhorse has no belts or pulleys to help slow down the blade when you flick off the switch, its motor has a built-in electro-mechanical brake which takes over and stops the blade completely within seconds.

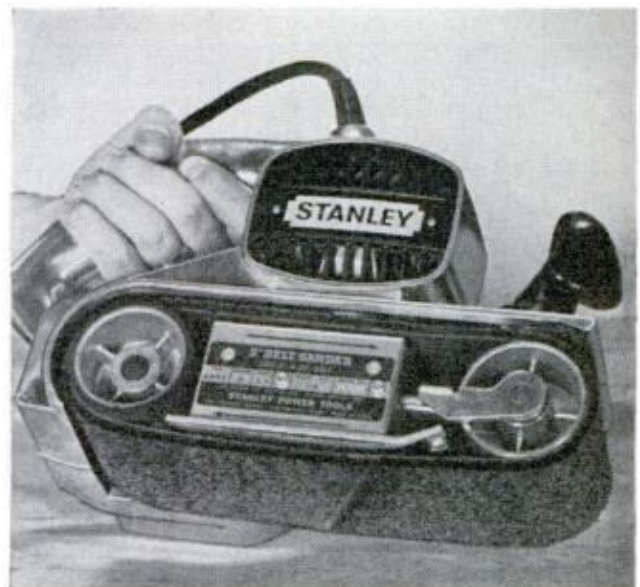
This positive-stopping feature makes this husky 10-in. saw extra safe to operate, and, of course, without belts and pulleys, there's no wear and slippage as with conventional belt-driven table saws. The motor, rated at 1.8 hp. and turning at 3450 r.p.m. is totally enclosed to protect it from sawdust, and is centered under the table to keep vibration to a minimum. The basic saw, as pictured above, sells for \$260.00. Extra extensions give you a kingsize table, measuring 28 $\frac{1}{4}$ x 71 in. Made by The Black and Decker Mfg. Co., Towson, Md.

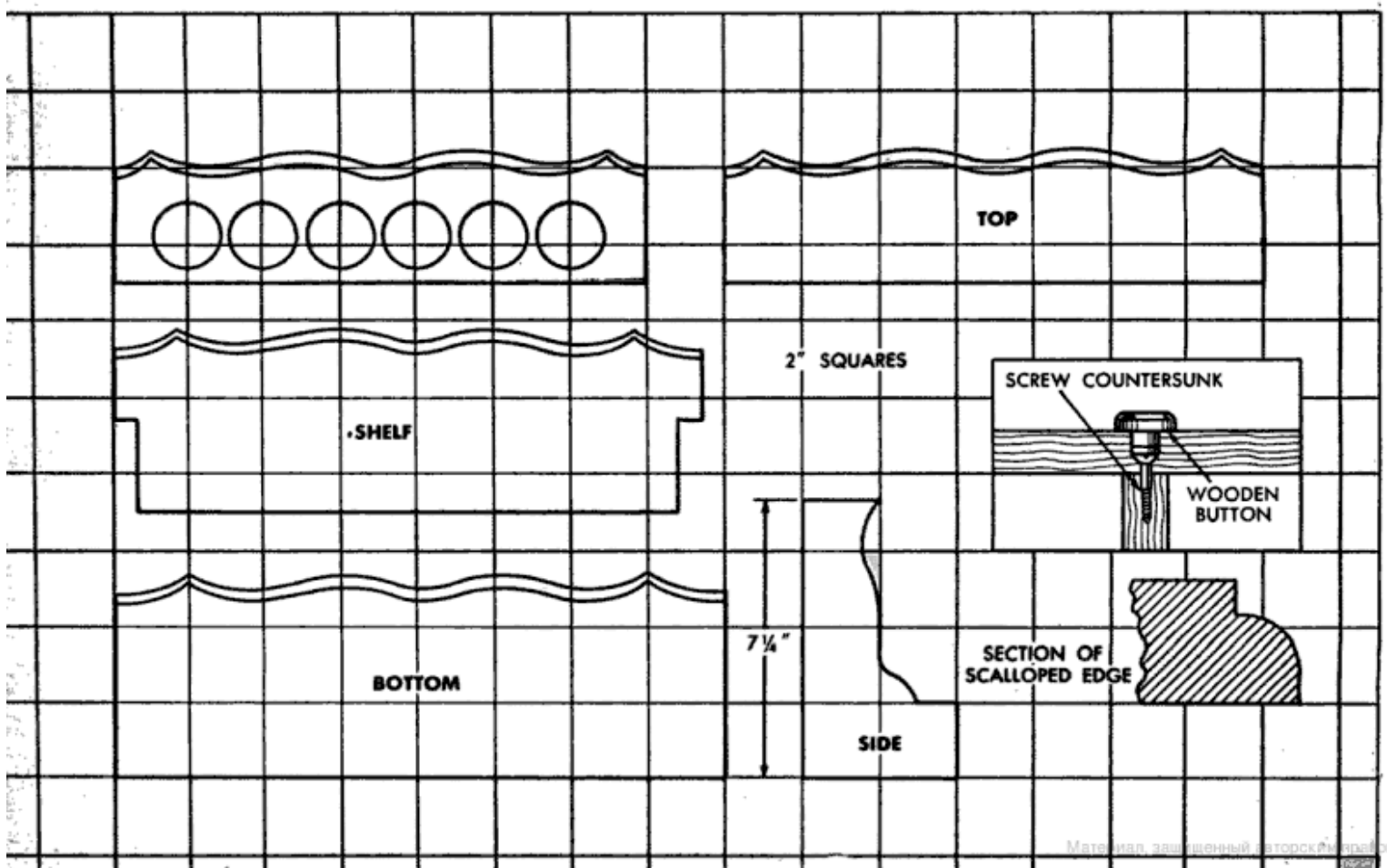
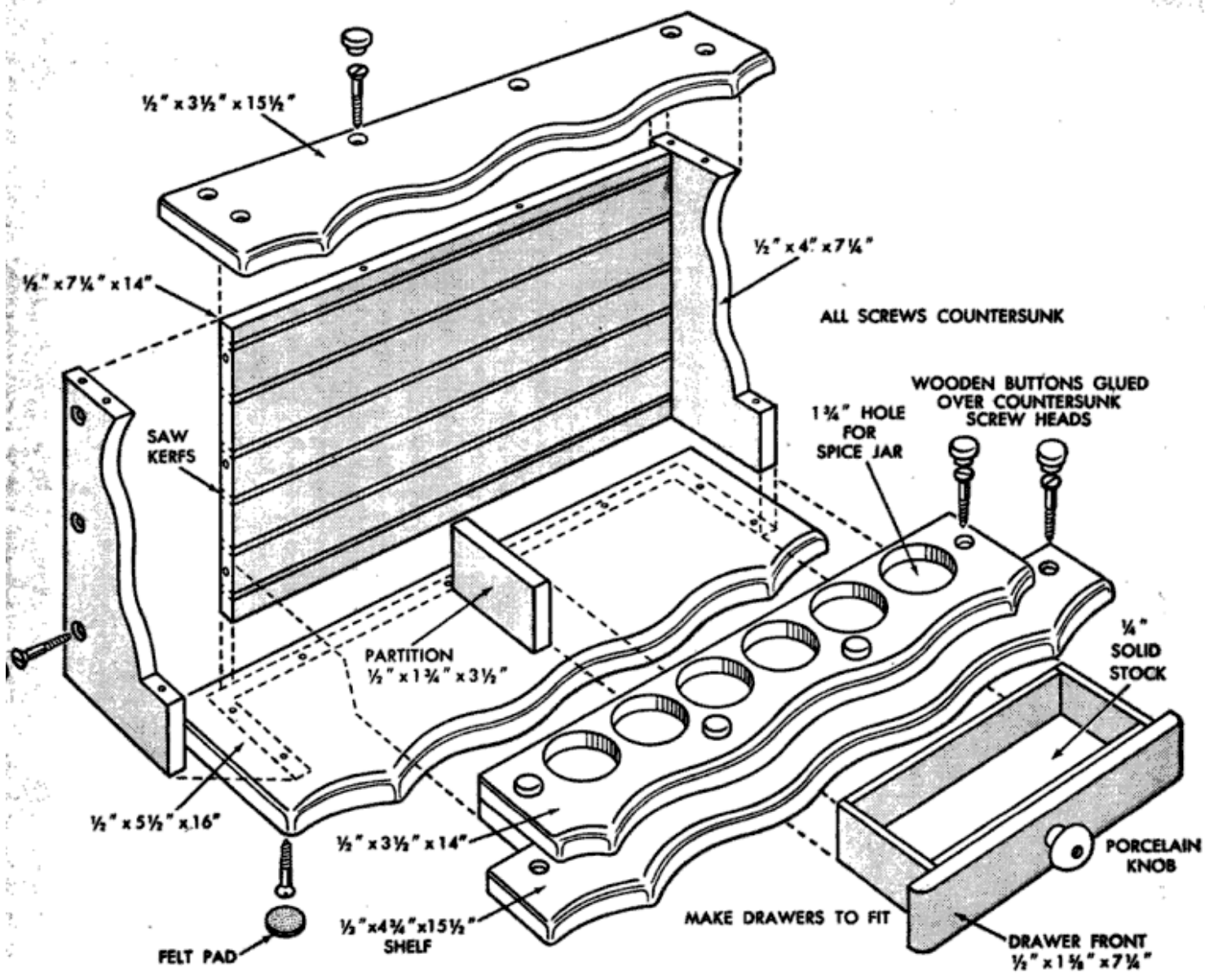
Specifications

Arbor diameter	5/8"	Max. cut at 45°	12 $\frac{1}{32}$ "
Blade diameter	10"	Table size	28 $\frac{1}{4}$ " x 50 $\frac{1}{2}$ "
Motor	1.8 hp.	Cap. right of blade	27 $\frac{1}{2}$ "
Speed	3450 r.p.m.	Cap. left of blade	13 $\frac{3}{4}$ "
Max. cut at 90°	2 $\frac{1}{16}$ "	Cap. front of blade	13 $\frac{1}{2}$ "

Extra Duty for Belt Sanders

There was a time when portable belt sanders were good for only one job: sanding—but not any more. Now owners of Stanley open-end machines can buy special finishing belts to slip on in place of the sandpaper ones, for converting their sanders to power polishers. Made from a new pliable nylon abrasive, these new, thick, web-type belts, when charged with grease stick lubricants, are perfect for finishing stainless steel, brass, copper and aluminum, and for the final finishing of wood and plastic. Belts are available in three grades, coarse (150) grit, medium (280) grit and fine (500) grit, and in both 3 x 21 and 4 x 24-in. sizes. The belts sell for \$2.40 and \$3.50 respectively at dealers.







Early American Spice Rack

By A. J. Canada

IN MOST CASES, making a piece of Early American furniture is just a matter of copying an original piece. But when my wife asked me for a Colonial spice rack, I had to become my own designer, as our forefathers had no such accessory in their kitchens. They didn't have pretty apothecary bottles with nice, neat labels, so they kept their spices in little drawers built into the kitchen cabinet.

Fortunately, however, the project turned out a lot simpler than I expected.

I began by cutting the main pieces out of ½-in. pine, after first enlarging the patterns shown at left. I used a jig saw on the scalloped edges, but a saber saw, band-saw or even a hand coping saw would do the job quite handily. Next step was shaping the scalloped edges with a router, after which I cut the jar holes with a hole saw in an electric drill.

I then cut the back piece out of ¼-in. solid pine (if you can't find any, use plywood), and decorated it with six double saw kerfs as shown.

Assembly was simple and straightfor-

ward, using white glue and ¾-in. No. 6 F.H. screws. I countersunk the screws half way into the wood and covered them with wood buttons to simulate pegs. The drawers I assembled with brads and glue.

An important step in making "antique" furniture is treating the wood to simulate a hundred years or so of use. I solved this problem by sanding all edges—rubbing a little harder at the corners—then as an optional treatment, you can distress the surfaces by knocking them with a chisel, gouge or other sharp instrument.

Final step, of course, was finishing. Merely applying a good Colonial pine stain would have given a perfectly satisfactory appearance, and I recommend that method if you want convenience and speed. However, I achieved what I consider a somewhat more realistic effect with a mixture of charcoal and boiled linseed oil, which I rubbed in vigorously with a soft cloth. The advantage of this technique is that the charcoal tends to accumulate in corners and surface knicks, thus enhancing the desired antique effect.



YOU CAN IMPROVE the posture of potted plants with weak stems by providing supports to hold them upright. One of the simplest ways of doing this is to push the handle of a small plastic fork into the dirt and slip the stems down between the tines



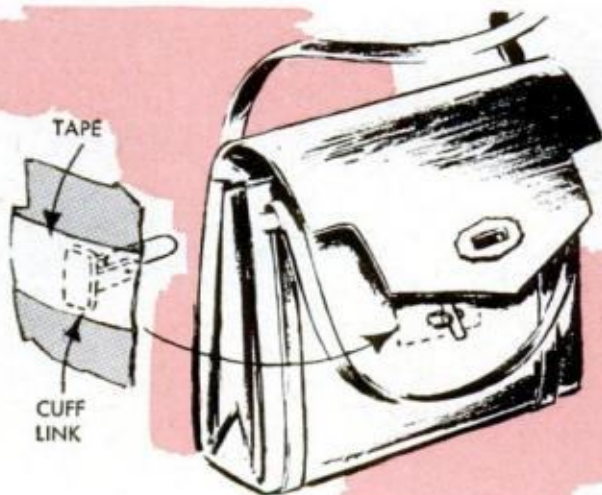
HANDY HOLDERS for workshop materials packaged in tubes can be made by mounting spring-type clothes pins on the inside of the door to your shop cabinet. You can either glue them in place or drive a small nail at an angle through one leg of each clothespin



Solving

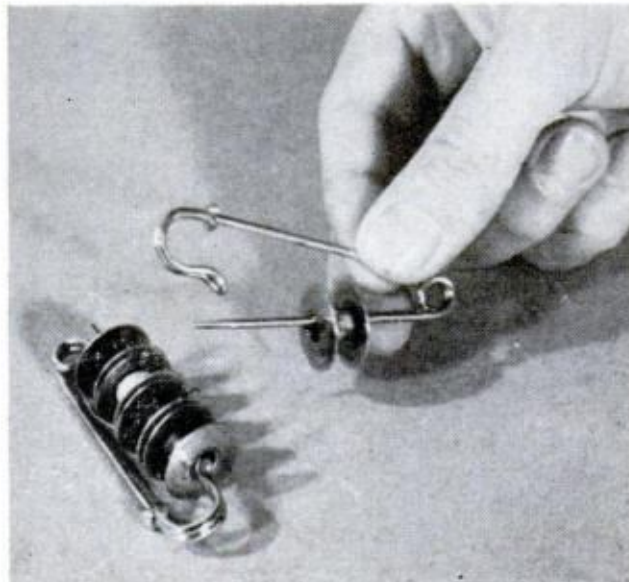
HOME PROBLEMS

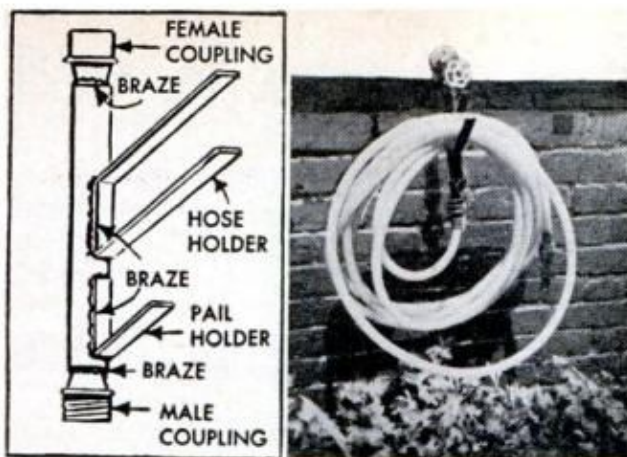
HINT NO. 137,684 for using discarded plastic bleach jug: Cut a square opening in the front and turn it into a bird feeder. After washing the jug to remove any traces of bleach, mount it on a tree by running wire around trunk and through the handle



IF MILADY LOSES the turnbutton on her favorite handbag, you can make a temporary replacement from a cuff link. Simply remove the old fastener, punch a hole large enough for the cuff-link stem and mount link from inside with a strip of adhesive tape

HERE'S A TIP to pass along to your wife. One of the neatest ways of storing sewing-machine bobbins is to slip them on a large safety pin. Fishermen have used this tacklebox trick for years, storing everything from hooks to small sinkers on safety pins





COMBINATION hose holder and faucet extension requires no mounting holes since it screws directly to your outside faucet. Made from $\frac{1}{2}$ -in. pipe and $\frac{1}{8}$ x 1-in. strap iron, the screw-on unit also includes a hanger for holding pails while filling them

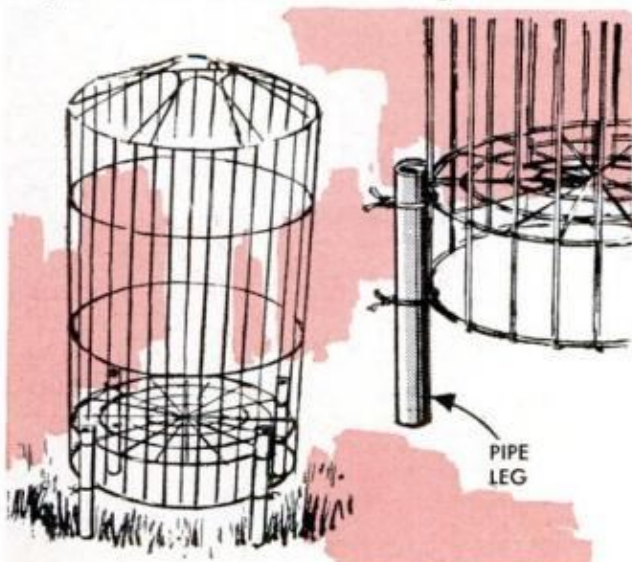


WHAT'S THE QUICKEST way of drying inside of a pair of hunting boots? Use a hair dryer, of course. After disconnecting the plastic hood, push the flexible hose all the way down into the toe and switch on the dryer. Allow about 15 min. to dry each boot

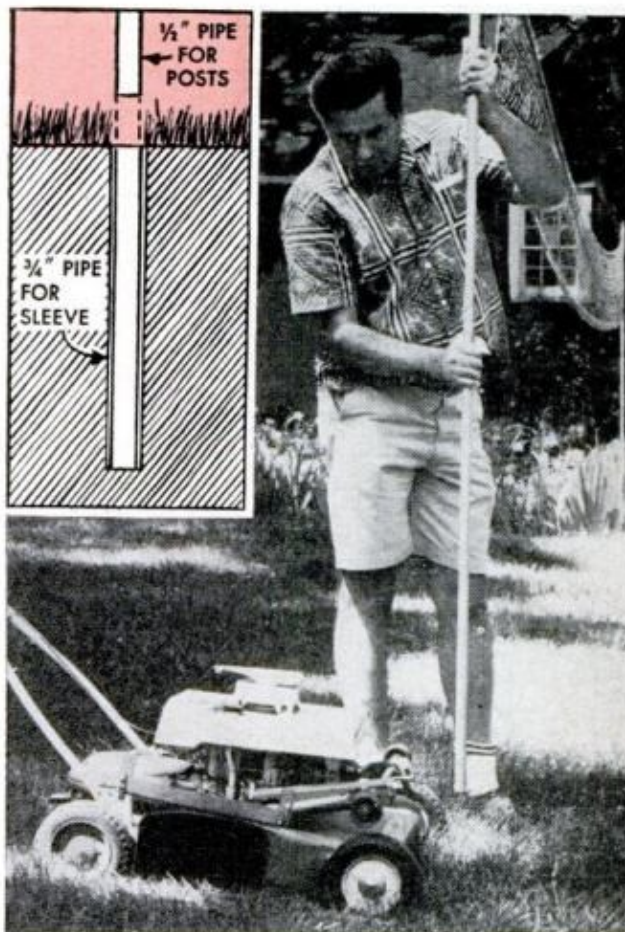


TIRED OF LICKING all those envelope flaps, postage stamps and trading stamps? You probably have the perfect tool for these jobs right in your medicine chest. Simply fill an empty roll-on deodorant bottle with water and roll ball over surface to be moistened

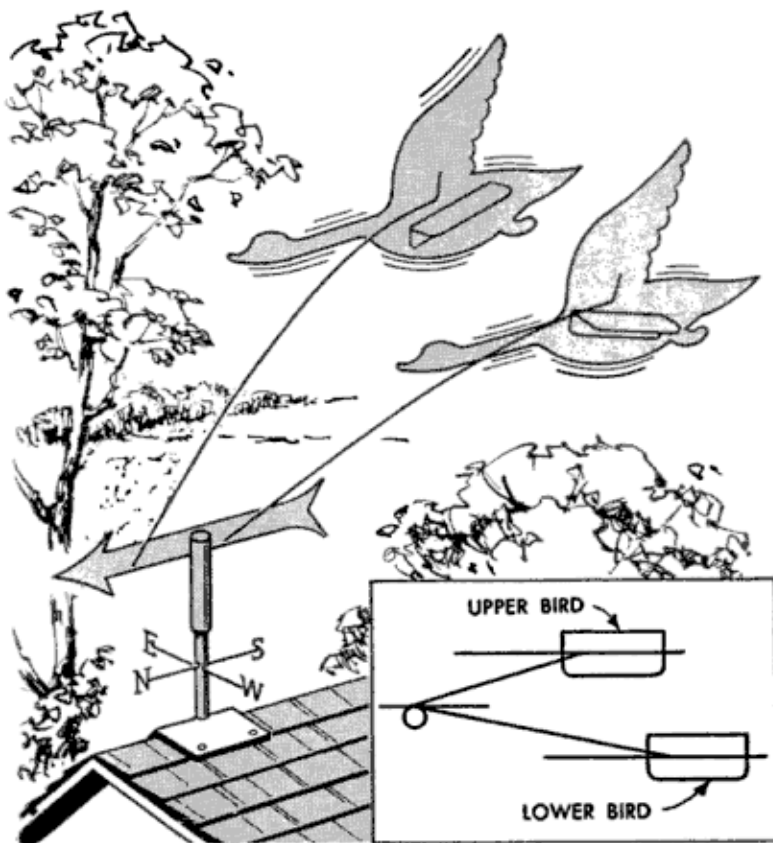
TO LENGTHEN LIFE of a wire rubbish burner, support it a few inches off the ground by means of four metal pipe legs. A clearance of from 4 to 6 in. is ample. When supported in this way, the bottom of your burner doesn't touch the ground and rust



PERMANENT POLES for your badminton net require no guy ropes and can be lifted out for easy mowing. Make them from two sizes of galvanized pipe: $\frac{3}{4}$ -in. for the permanent sleeves in the ground and $\frac{1}{2}$ -in. for the poles. Sleeves should be about 2 ft. long

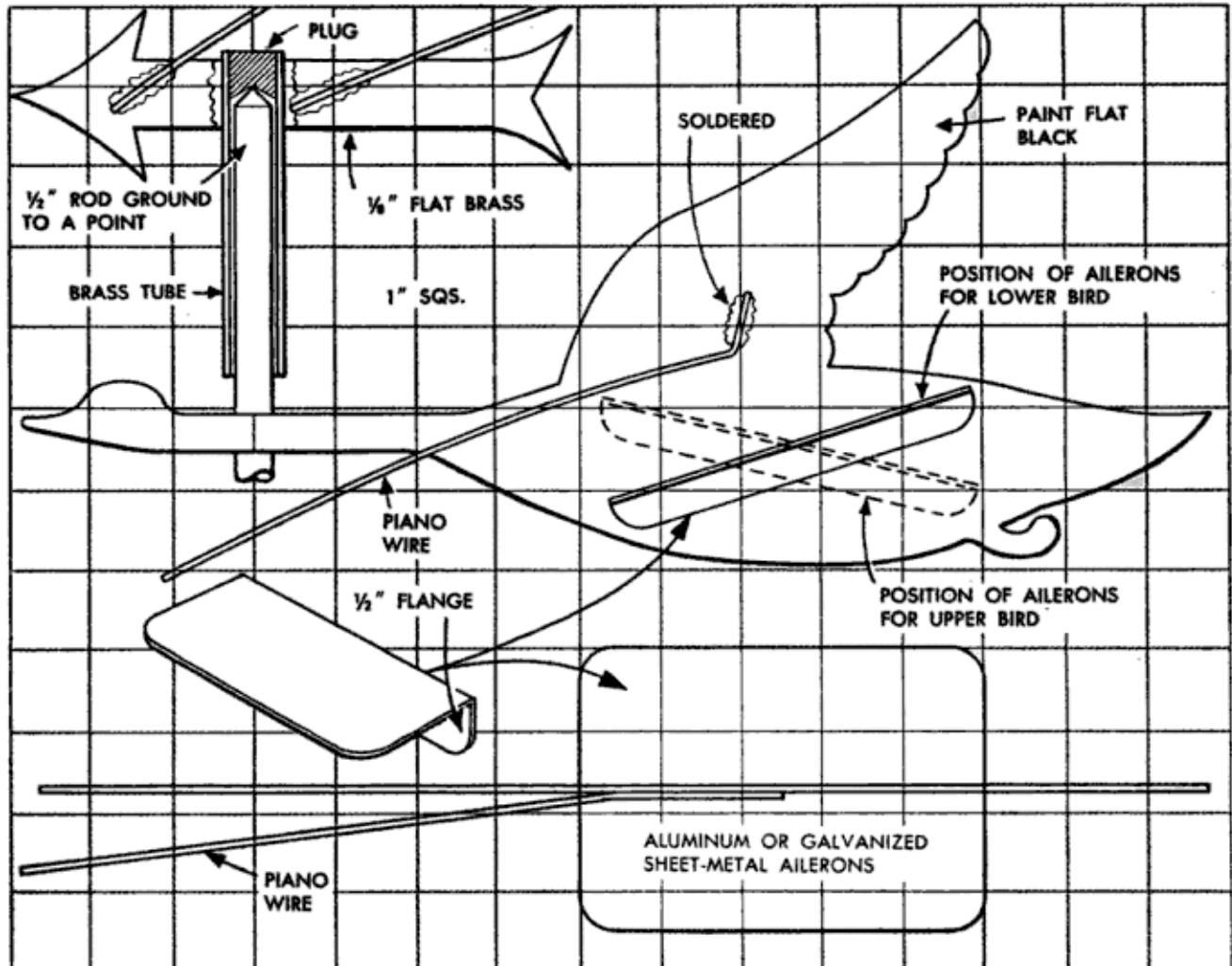


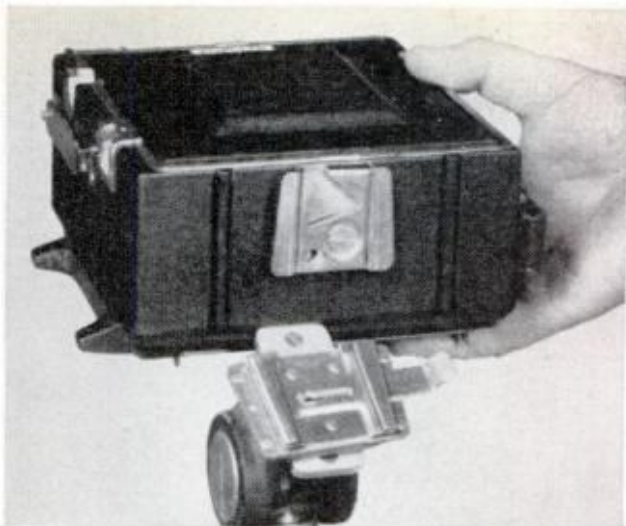
Wild Geese Head into the Wind



THE GENTLEST breeze sends these geese soaring realistically while they faithfully indicate the wind direction. Their unique movement is produced by ailerons slanted in opposing directions, causing one bird to be forced down, the other up.

The geese are cut from aluminum or galvanized sheet metal, as are the ailerons, which may be either riveted or soldered to the birds. A length of piano wire soldered or brazed to the arrow and the bird serves as a support. Make certain that the wires are bent apart enough so that the geese do not interfere with each other when they move. An attractive finish is flat black enamel for the geese and aluminum for the arrow. Smoothness is important in the pivot which is made from a pointed rod and a metal plug drilled, countersunk and forced in the end of the pipe support.—Hi Sibley





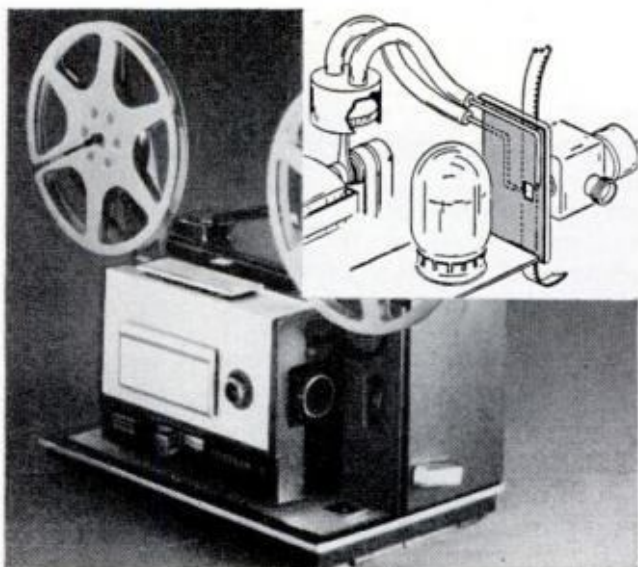
By Arthur J. Maher

IF YOU SHOOT FROM A TRIPOD, the Kliklok can save you a lot of time in mounting the camera. A channel piece screws to the tripod, and a slide goes on the camera. To mount the camera, you just push the slide into the channel. Costs \$3.95. Extra slides, for switching cameras in a hurry, cost \$1.80. Master Photo, 7908 West Grand Avenue, Elmwood Park 35, Ill.

SHOOT AND SHOW KITS include handy pocket-sized cameras that give up to 72 slides from a roll of 35-mm film. You also get a special wide-angle projector that blows the small slides up to full screen, flash gun, a roll of Agfachrome film and a camera case. Sells for \$89.95 with standard camera, \$119.95 with electric eye. Agfa Incorporated, Rockleigh, N.J.



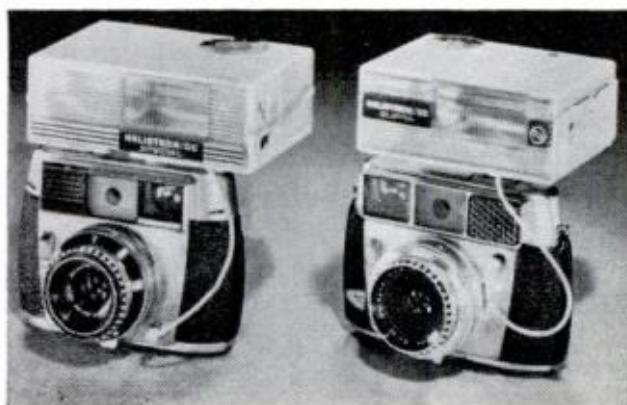
CHEVRON 8, Model 10, a self-threading 8-mm projector, is said to give single frame projection as bright as motion pictures. The usual heat-resistant glass shield, which absorbs light, is replaced by a mechanism that cools the film with jets of air. Sells for \$189.50 and up. Eastman Kodak Co., Rochester 4, N.Y.

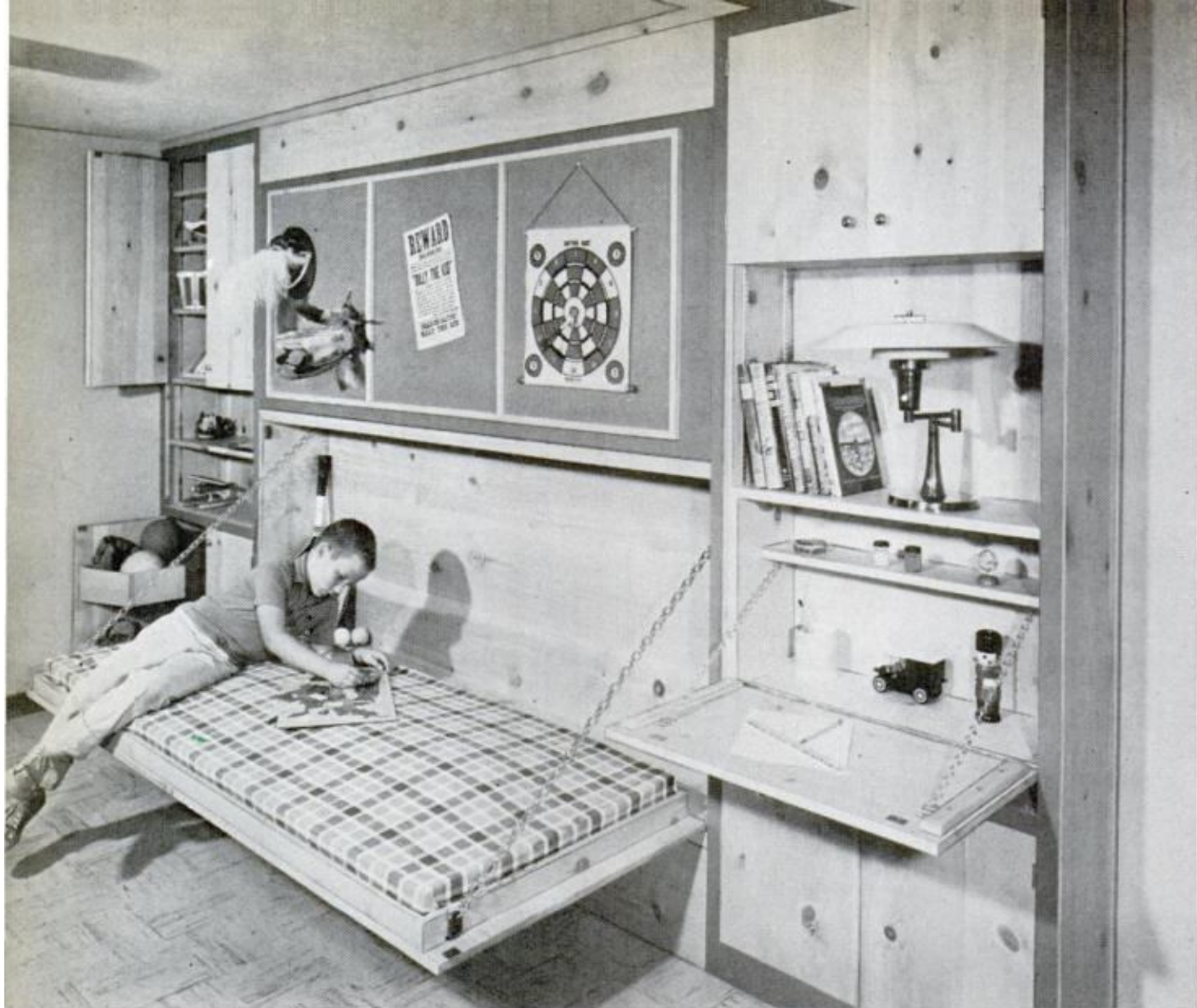


A BLAST OF DRY GAS from this aerosol can cleans dust from your camera, lenses, negatives, enlarger, etc. Equipped with a flexible plastic nozzle for reaching into difficult places. Trade named Omit, it sells for \$2.00 a can, prepaid. Century Laboratories, Merchandise Mart, Post Office Box 3314, Chicago, Illinois.

POLAROID COLOR FILM is now available in 4x5 sheets for use with press and view-type cameras equipped with Graphic, Graflock or similar backs. Like Polacolor roll film, it has an ASA rating of 75 at 60-90 deg. F., and is balanced for daylight. Sold by industrial photo dealers only, for about \$13 to \$14 a box of 10 sheets. Polaroid Corp., Cambridge, Mass.

HELIOTRON CC ELECTRONIC FLASH GUNS are balanced for all daylight color films. To shoot slides, use a gun as is. For Kodacolor film, you merely slide a retractable filter into place on the gun. Supra model costs under \$80, Special model, under \$40. Kling, 257 Park Avenue South, New York, N.Y.





FOLD-AWAY BEDROOM

Double-deck bunks, a desk, bookshelves, five cupboards and two roll-out toy chests—all packed into a foot-deep built-in that solves your kids' room problem in one fell swoop

PUT A GROWING FAMILY into one of today's small homes and *something's* gotta give! When the youngsters pass the crib stage and need their own rooms, space has a way of shrinking. That "extra" room you press into service is apt to be the smallest in the house. If *two* children must share it, you'll probably have to resort to double-deck bunks—and nothing crowds a small room more. Even if the room's to be used by only one child, he or she will want an extra bed so a chum can be invited to stay over sometimes.

And the sleeping problem is only the start. School-age children need a study desk and a place for books—plus lots of storage space for games and hobby equipment. And if the room wasn't originally a

bedroom, it probably won't even have a closet for extra sheets and blankets.

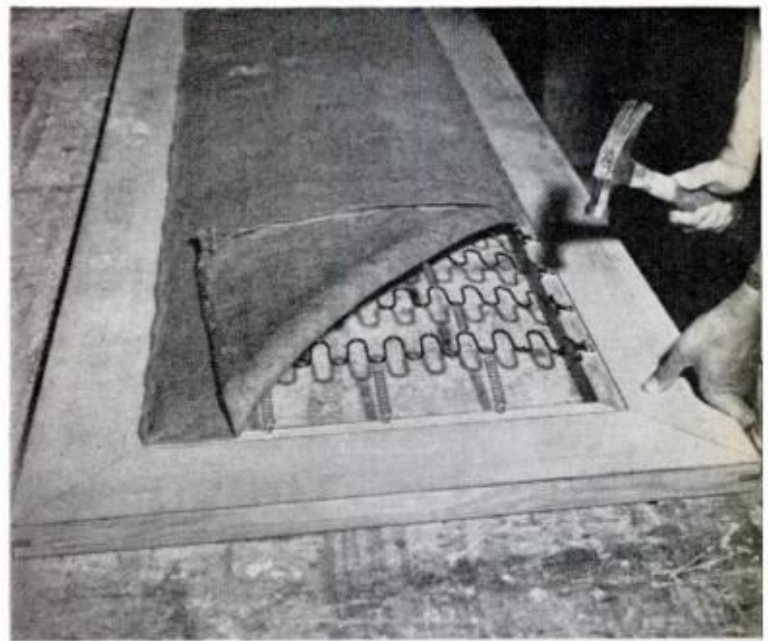
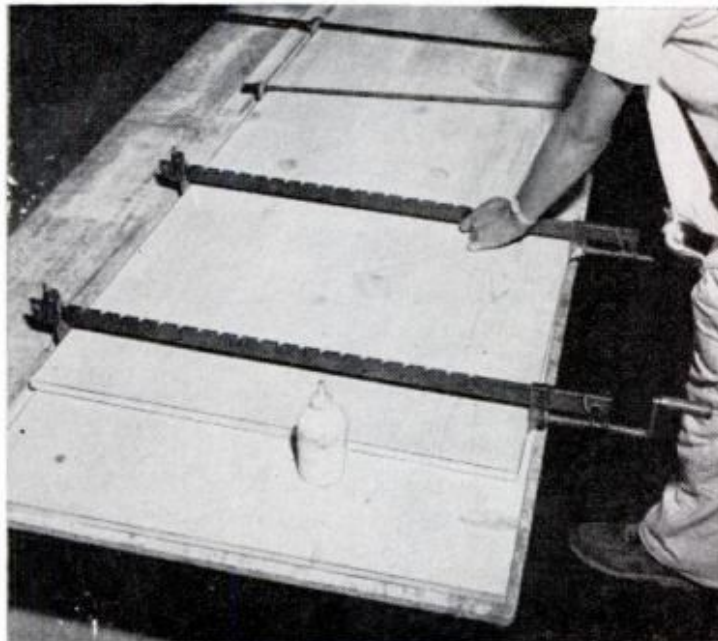
Imagine the full solution to so knotty a problem being tucked neatly behind a knotty-pine wall! The ingenious design shown on these pages can be adapted to any problem room. As presented, it requires a 12-ft. wall, but it can easily be expanded or contracted to fit the length of the wall you have in mind. Simply alter the widths of the end cabinets.

The unit stands about 7½ ft. tall, to fit today's low ceilings, but its height, too, is readily adjustable. The one thing you won't want to adjust is the remarkable slimness that lets you pack a roomful of furniture into one foot of floor space!

Since the design was worked out for *PM*



BUNK SECTION is made first, by nailing 1x12 frame to glued-up back panel. This panel is then anchored to the wall by driving 2½-in. screws into the studs. Because of great weight panel must support, 18 screws were used. Secret storage compartment is formed at top by gap in fascia under nailed-on cornice (right)

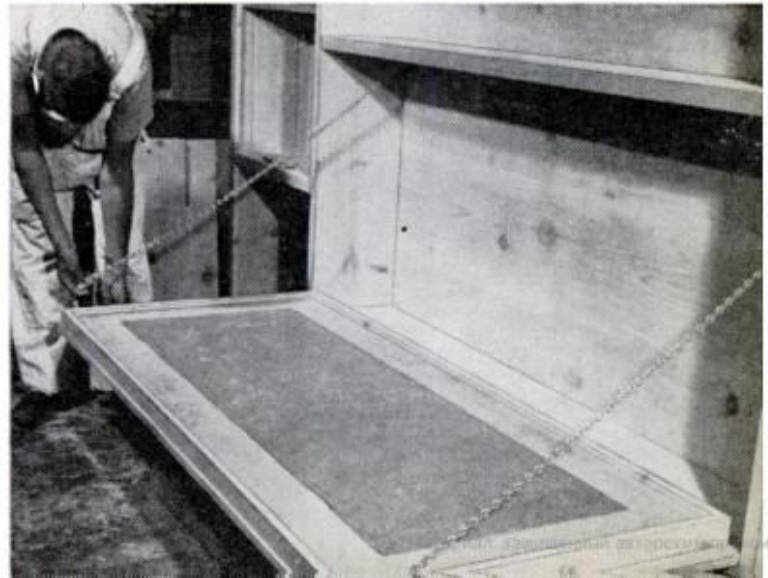
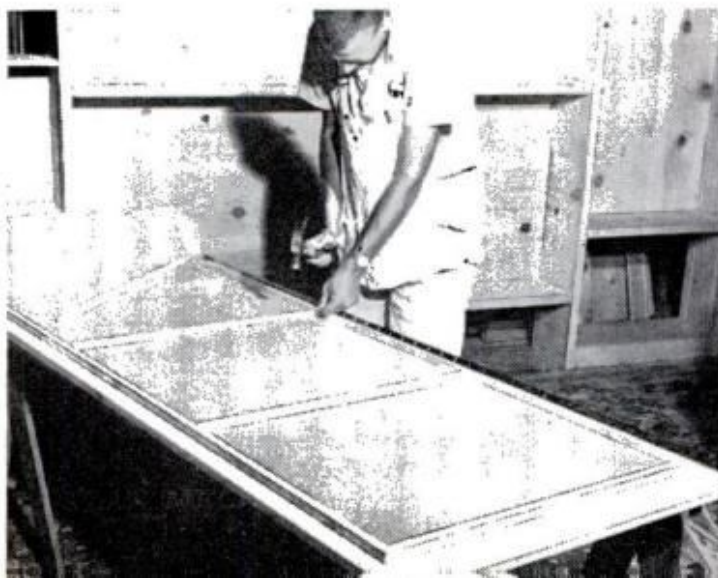


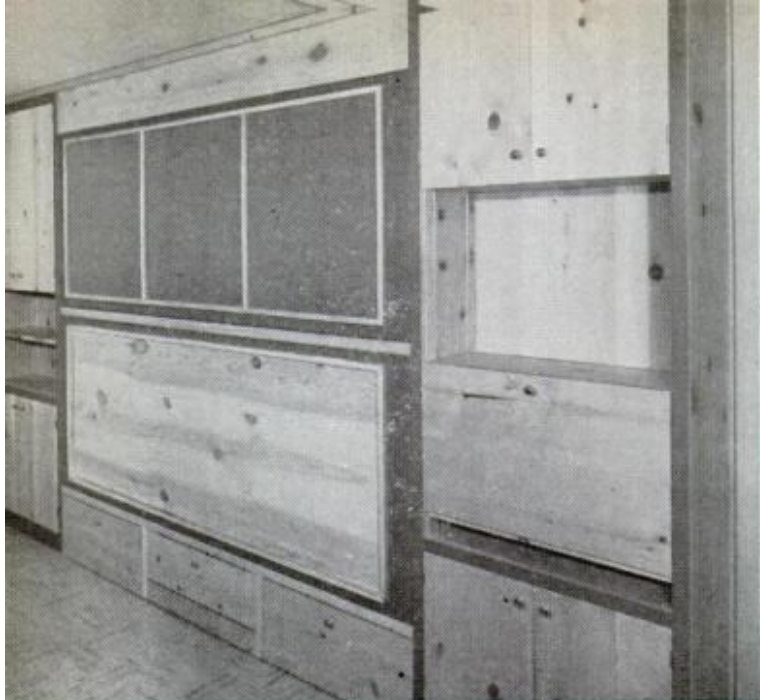
BAR CLAMPS—or a substitute wedging system—are essential when gluing up drop panels for bunks. With white glue, two hours' clamping is enough

INNER EDGE of mitered 2x6 frame (note corner splines) is rabbeted to provide nailing recess for No-sag springs. Burlap is stapled to frame to cover springs

CORK PANEL is glued to underside of top bunk panel, then framed with rabbeted molding. Two center strips are for appearance and to prevent cork's warping

SUPPORT CHAINS are installed after spring frame is fastened to bunk panel and edge of latter is attached to bottom of bunk section with piano hinge

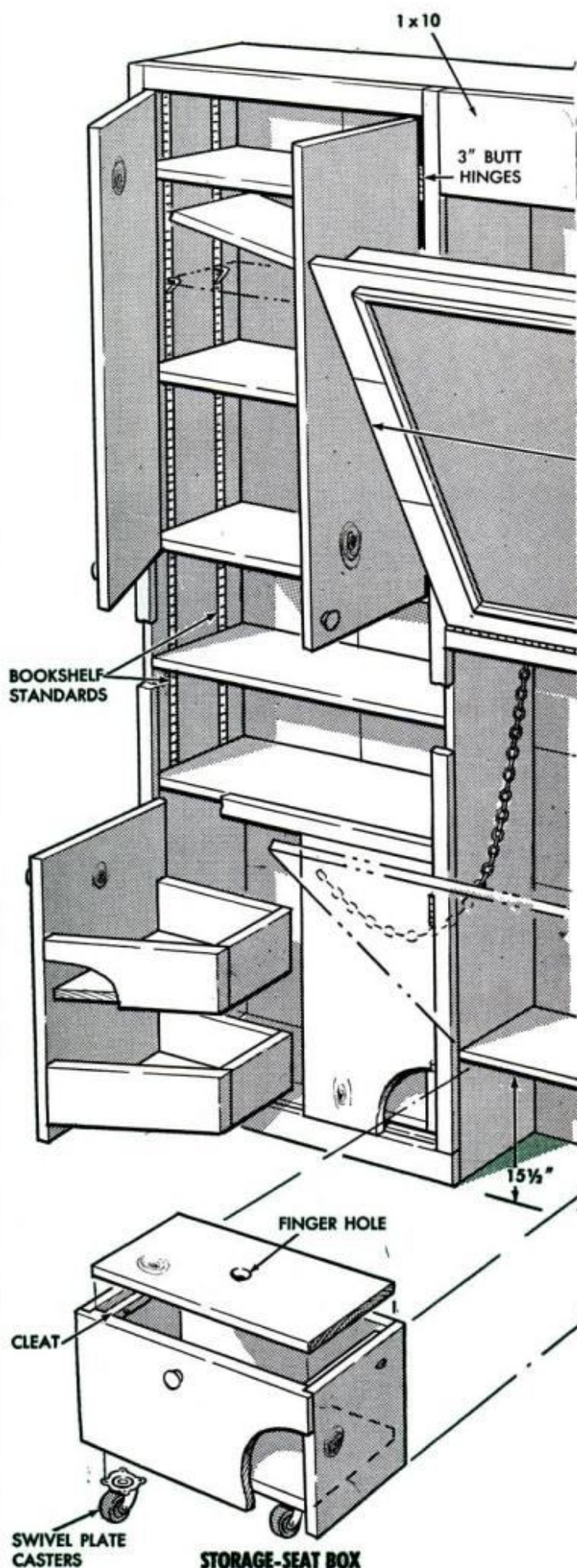
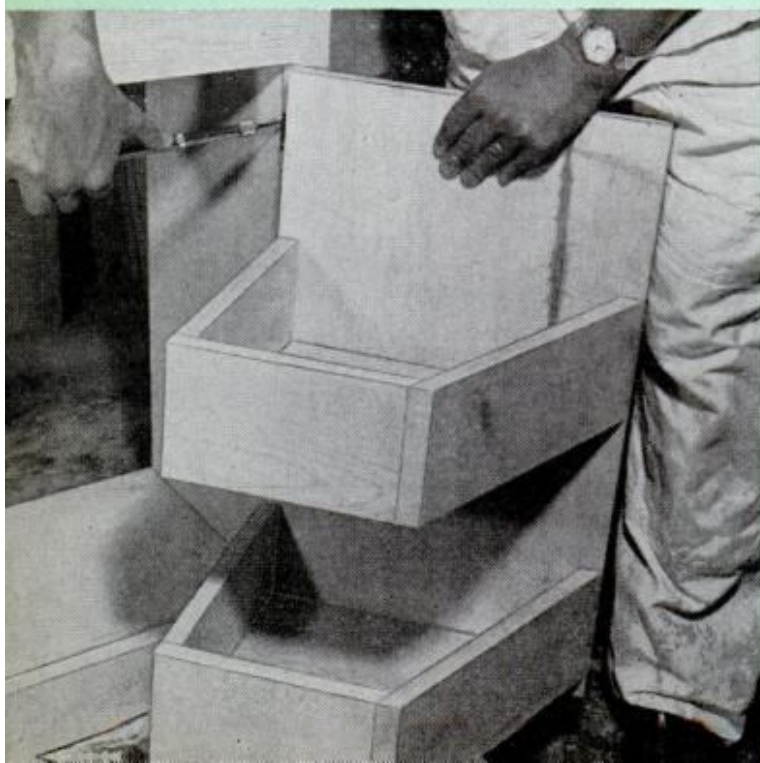


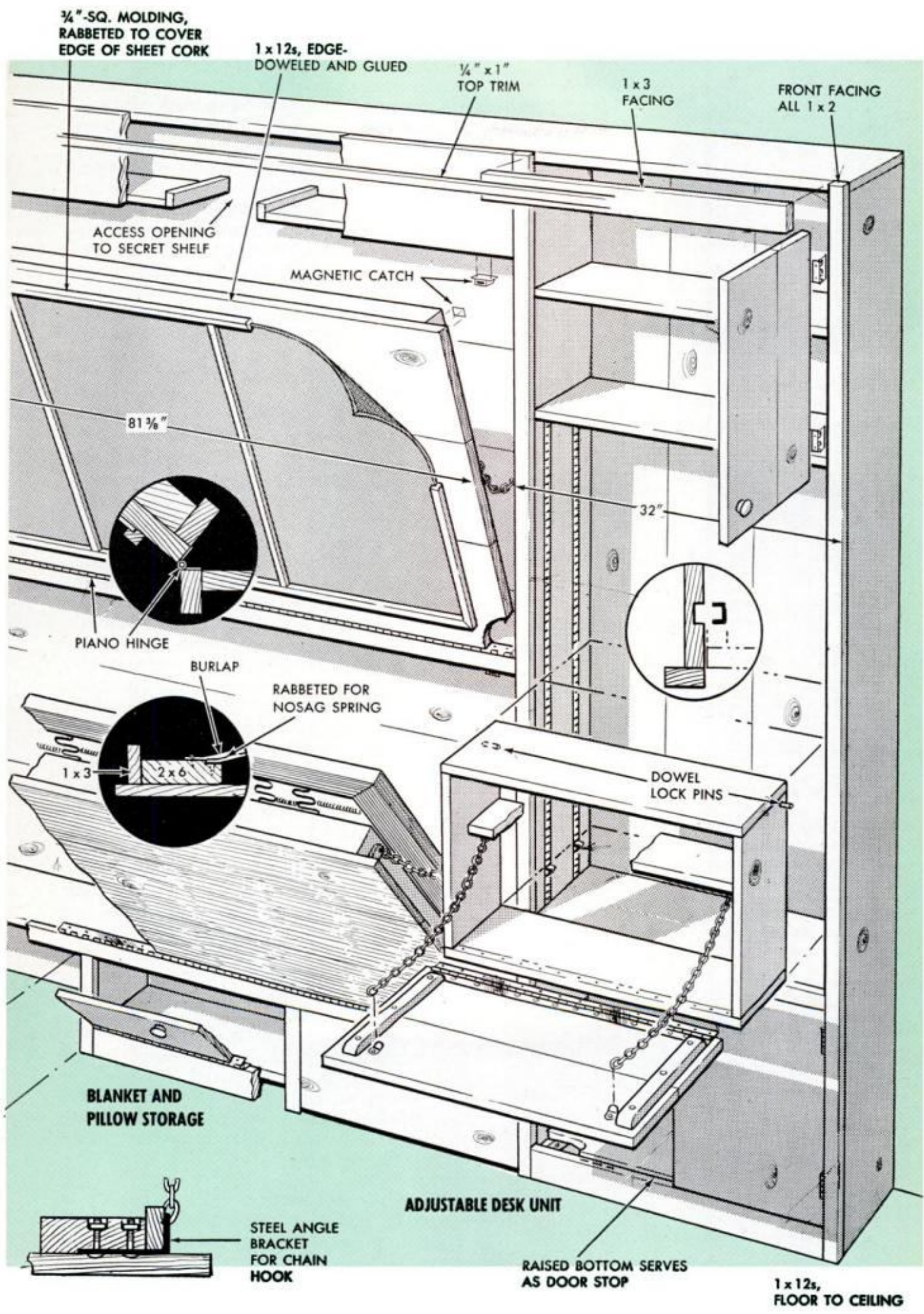


WHO'D SUSPECT an entire sleep-study-play room was waiting behind this attractive wall? Note that underside of bottom bunk has trim of mitered molding to match bulletin-board frame above it. Borders outside these frames are painted bright color for accent, as are forward edges of flanking cabinets

TO PREVENT TUMBLES, note two points not detailed at right. Top end of bed chains must be anchored to U-bolts passed through back panel and steel plate mortised into rear face so nuts will clear wall. Desk's lock pins are slip-fit dowels which you push into mating holes in frame after desk is inserted

DOOR BIN UNIT is treated like other doors, hung after assembly. One leaf of both hinges is secured to door first, then door is held in place while positions of other leaves' holes are marked for drilling. Note that only front of bin is angled for swing-out clearance. Other corners are square





3/4" SQ. MOLDING,
RABBETED TO COVER
EDGE OF SHEET CORK

1 x 12s, EDGE-
DOWELED AND GLUED

3/4" x 1"
TOP TRIM

1 x 3
FACING

FRONT FACING
ALL 1 x 2

ACCESS OPENING
TO SECRET SHELF

MAGNETIC CATCH

81 3/8"

32"

PIANO HINGE

BURLAP

RABBETED FOR
NOSAG SPRING

1 x 3

2 x 6

DOWEL
LOCK PINS

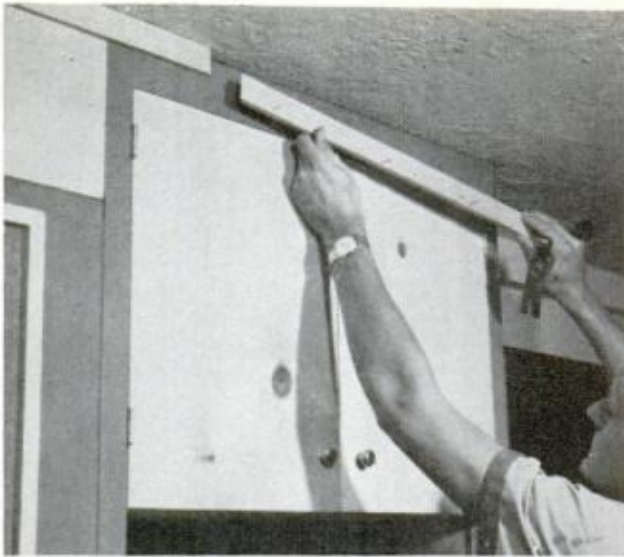
BLANKET AND
PILLOW STORAGE

ADJUSTABLE DESK UNIT

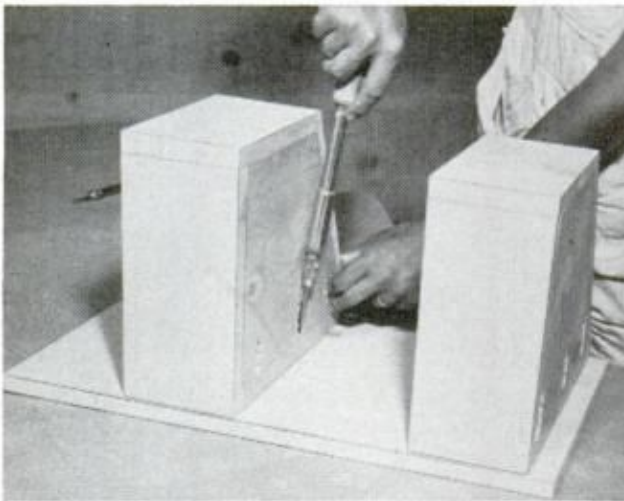
STEEL ANGLE
BRACKET
FOR CHAIN
HOOK

RAISED BOTTOM SERVES
AS DOOR STOP

1 x 12s,
FLOOR TO CEILING

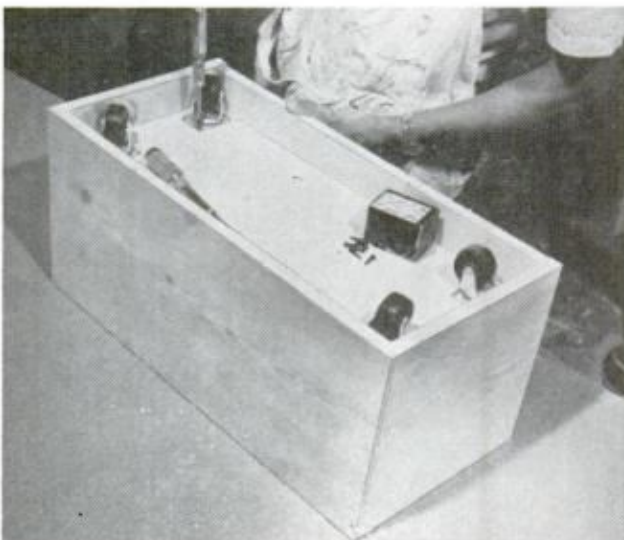


FLAT MOLDING hides crack between top of built-in units and ceiling. If splice is necessary, as here, bevel ends 45 degrees to avoid any shrinkage gaps



OPTIONAL BINS replace shelves in lefthand cabinet for swing-out storage of bulky sports gear. To avoid visible screw heads, drive from rear of door

BOTTOM OF BIN is recessed $\frac{1}{4}$ in. less than height of plate casters so, when bin is flipped over, casters keep sides from touching floor. Bin doubles as seat



by the Western Pine Association, it's not surprising that solid Ponderosa pine is used throughout. Actually, the extra effort involved in gluing up large panels from 1x12 lumber pays off in rugged good looks, with no need to "treat" exposed edges.

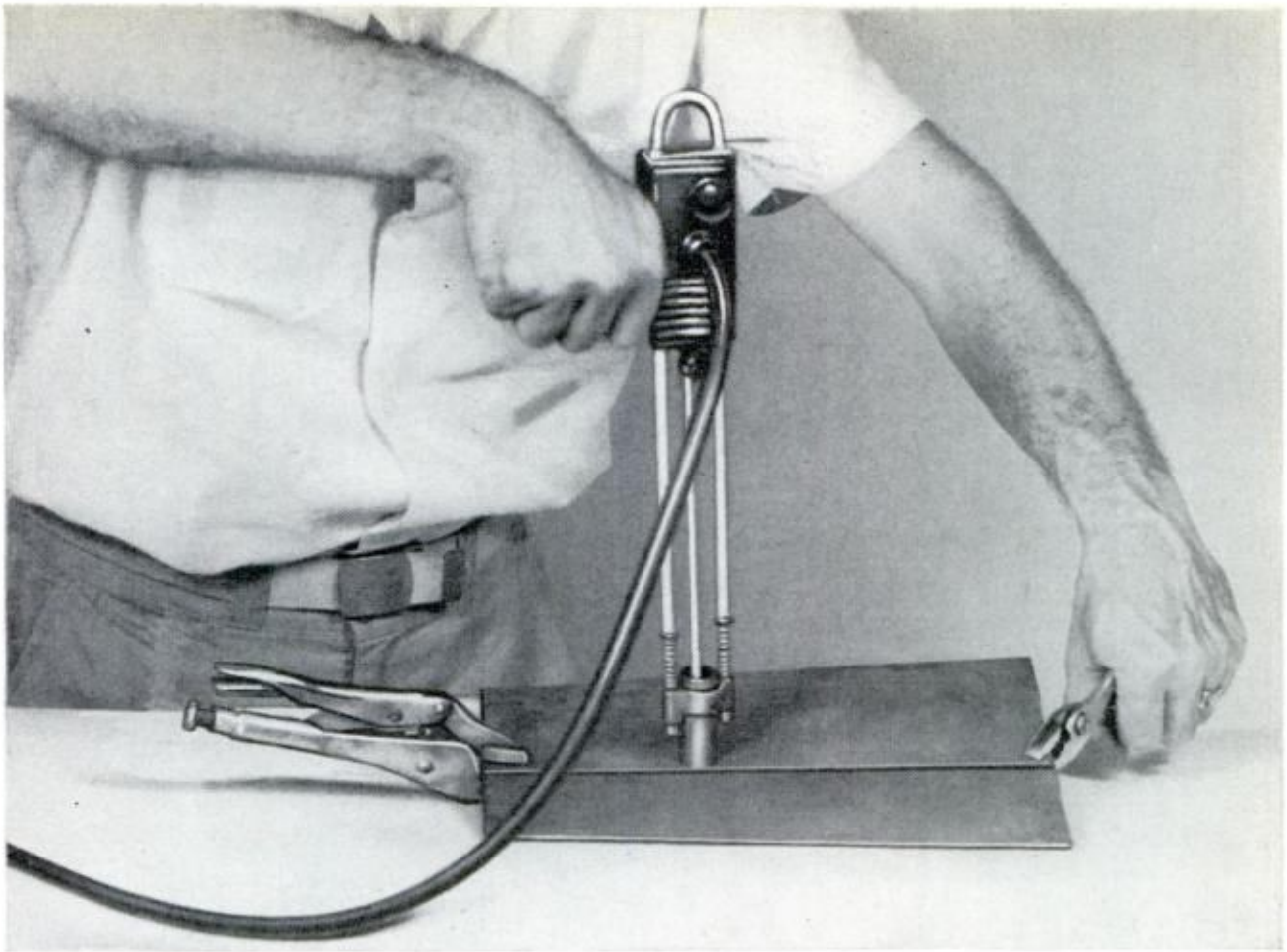
Finish the pine natural for a boy's room, or tint it with a pastel wiping stain for a girl's. Or, if you build the unit of a wood that lacks knotty Ponderosa's character, you may prefer to coat it with enamel. The unit shown has some painted accents.

Even if you don't copy this design exactly, you'll find it boasts a number of novel features you'll want to incorporate into your own version. Starting at the top: Behind that center cornice is a secret storage area for those private treasures that mean so much to kids. What a spot to stow the gang's code messages—or hide that Mother's Day gift—or stash a private supply of after-hours candy.

The built-in desk really *isn't* built in. The drop leaf—hung on sturdy chains to match the bunk supports—is merely the lid of a tipped-up box; it's attached (by means of a piano hinge) to the edge of the bottom side of this box, and the whole unit nests inside the larger cabinet, resting on clips inserted in shelf brackets that are recessed into the inner face of the cabinet's side walls. This arrangement makes the height of the drop-leaf fully adjustable. You can mount it low for a child's chair, to start, then keep raising it as the child grows and graduates to an adult chair.

The base cabinet on the left side gives up its shelves in favor of swing-out bins for easy access to bulky equipment. These bins are screwed directly to the back of the doors, and since the doors were to have a natural finish that precluded counter-sinking and plugging the screw heads, the screws were "toenailed" in from the back as shown, left, by sinking them in screw pockets. Note that these bins taper toward the rear so they'll clear the opposite door—and each other—as they swing out.

The three storage sections under the bottom bunk are novel, too. The stationary one, at the center, has a drop-down door (again attached with a piano hinge) that gives access to a cupboard designed to store extra bedding. This is flanked by two berthed-but-unattached toy chests. A tug on the drawer pull rolls each chest completely free of the wall unit. The chests are simple boxes (butt-joined except for the rabbeted front) with a bottom set in to recess four plate casters, as shown at left. A cleat across the inner face of each end provides a lip to support a loose lid that turns the chest into a mobile bench and scooter. The lid has a finger hole at the center for easy removal. ★★★



ARC WELDING GUN

By Phillip M. Wilson

IT'S BEEN MORE than a year since I built this arc-spot welder and though I use it almost every day, I'm still finding new jobs it can do. I've spot welded sheet metal without a back up, tack welded, and burned holes in sheet metal faster than I could have drilled them.

The "secret" of its operation is the copper nozzle that acts as a shield and heat sink for the arc. The tremendous heat is concentrated on a small area for a short length of time, and with the springs tending to push the gun back at the same time the rod is burning off, a spot, plug, or tack can be made in less than a second.

You have a lot of leeway when rounding up the materials, in fact, your scrap box probably contains some parts that can be used. Just as an example, the handle on my welder was originally part of a toy machine gun. Incidentally, if you can manage to wangle your son's tommy gun, the handle will probably need some beefing up. The best bet is to fill it with epoxy after adding hardener. If you prefer, pieces of plywood can be sandwiched together with epoxy to form the handle like the one de-

tailed. When the cement has hardened, the block can be sawed to shape and sanded smooth.

A saw slot cut in the rear of the handle allows the clutch knob to tighten the hair-pin-shape slide rod. The knob should be tightened just enough so that the electrode can be fed with an easy downward push. An electronic supply house or radio repair shop can supply a knob of this type or you can improvise one from a 1-in.-diameter plastic medicine-bottle cap, filled with epoxy. Before the cement hardens, embed a 1/4-20 bolt, head down, to serve as a stud. The knob on the conductor screw that holds the electrode can be made in the same way. Keep in mind that both the knob and the stud are part of the electrical circuit and therefore must be made of some insulative material.

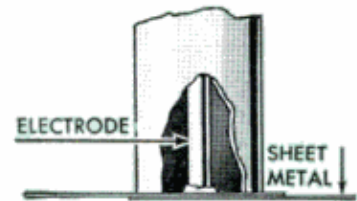
A 3/4 in. hole drilled in the side of the handle accepts the fiber or plastic sleeve that provides insulation for the welding cable. Drill a 3/8 in. hole in the side of the sleeve to take the conductor screw, then drill and tap the front of the handle for the threaded brass rod that holds the elec-

press fitted to a depth of $\frac{3}{8}$ in. inside each nozzle. This keeps the rod centered and prevents arcing against the side of the nozzle.

The slide rod is $\frac{1}{4}$ in. o.d. and is made of brass, bronze, stainless steel or other non-corrosive metal. If you use bronze, heat it at the bending point and quench it in water for easy workability. Two holes are drilled in each rod for the cotter pins that hold the springs in place. The distance between holes should be $\frac{1}{16}$ in. less than the length of the spring so that there is a slight compression.

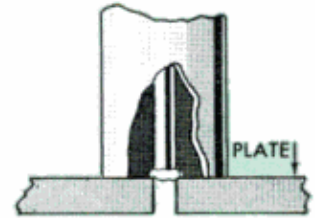
After assembling all the parts, clip the cable lug onto your electrode holder. Use the ground of the welder in the usual way. Slip a match tip, self-starting arc-welding rod (available from Sears Roebuck or Montgomery Ward) into the conductor tube and adjust the clutch knob for $\frac{1}{8}$ to $\frac{1}{4}$ -in. space between rod end and nozzle tip. Then set the heat at 75 amps. and press the nozzle down against two pieces of sheet metal that are to be tacked. There will be a slight hiss and a little smoke. Release the pressure to stop arcing and inspect the joint. If penetration is insufficient, increase the heat and the pressure time. For burning holes it's best to use high heat and a short pressure time. The nozzle makes it unnecessary to wear a welding mask but safety glasses are a must. ★ ★ ★

WHEN WELDING together two pieces of sheet metal remember that timing of dwell determines the type of weld. Momentary contact will produce a spot weld, longer contact a plug weld



STRAIGHT NOZZLE

TACKING two pieces of plate before making a conventional weld can be accomplished without the use of a welding mask because the nozzle acts as a guard. For safety wear flash goggles



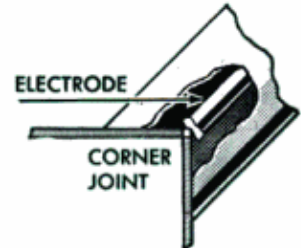
STRAIGHT NOZZLE

SPOT OR PLUG welding inside corner calls for the use of a special purpose nozzle



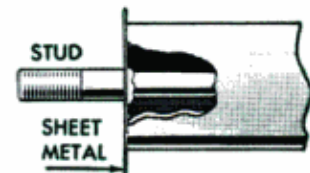
45° INSIDE NOZZLE

THIS NOZZLE holds the welding electrode at a 45-degree angle for tacking or spot welding of outside corner



45° OUTSIDE NOZZLE

WELDING A STUD to a sheet or light plate stock is possible by completely penetrating through to the stud from the work's reverse side



STRAIGHT NOZZLE

THE WELDING GUN, shown here with its four quick-changeable nozzles, can handle a multitude of jobs



LIFTING THE LID ON POWER BRAKES

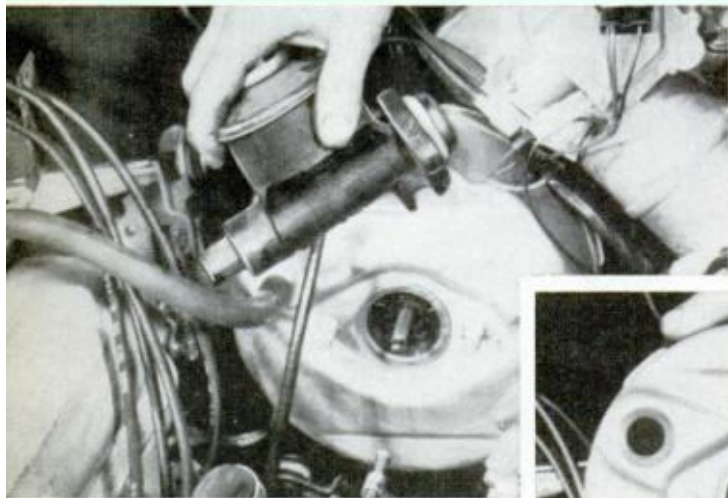
CONCLUSION:

Tearing Down the Power Assist

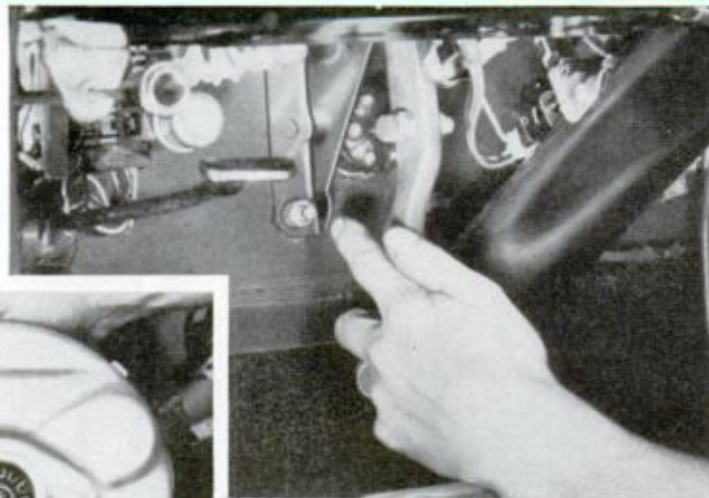
By Morton J. Schultz

Last month we showed how power brakes work and how you can troubleshoot the system. But if the power assist unit must be removed for rebuild, here are the facts you'll need to decide whether to tackle this job yourself

REMOVING THE UNIT FROM YOUR CAR



MASTER CYLINDER comes out first on this Delco-Moraine diaphragm-type unit used on '63 Pontiacs. Just unbolt the hydraulic line and lift it out so you can get at power assist unit



FOUR BOLTS above the brake pedal hold the unit to the fire-wall. Unscrew these from inside, remove pedal linkage crevice pin and lift unit off front of wall as shown in inset, left

REBUILD KITS are available for every type of power assist unit made. These kits run about \$10 to \$15. If you have a mechanic do the job, it'll set you back the price of the rebuild kit plus \$10 to \$24 for labor. If you bought a rebuilt unit, it would cost from \$30 to \$50, depending on the car, plus your old unit.

But with sixteen variations of power brake systems on American cars, it's impossible to recommend whether you should attempt the disassembly of your particular unit. Some types are more difficult to rebuild than others, and the sample disassembly shown at the right is not necessarily typical.

You should contact the manufacturer of your particular unit (or your car) for detailed information about rebuild. You might, instead, get this data from one of the many auto repair manuals you'll find at your local garage or library—or from the dealer handling your make car.

So you'll know what to look for, we've compiled a list of all power assist units made from 1955 to the present and the cars on which they were used (see next page). Just run your finger down the right hand column until you find your car, then note which type of power assist is listed to the left.

You'll see that, in any one year, some make cars use more than one type. The reason for this is usually a production change—or a difference between models. If your car is one of these that's listed more than once, you won't be able to identify which type of unit you have until you compare it against the rebuild instructions.

To assure all-around, continuous, and long-lasting performance from your power braking system, there are several service tips with which you should be familiar. These are as follows:

1 All units are equipped with a filter that cleans the air entering the unit. Some are external filters and can be removed without tearing the unit down. Others are internal, and the unit has to be ripped open to reach them, as shown on page 177.

External filters should be cleansed twice a year to guard against dirt entering the unit. Remove the filter and wash it in a non-oil-base cleaning solvent. Allow it to dry before reinstalling it.

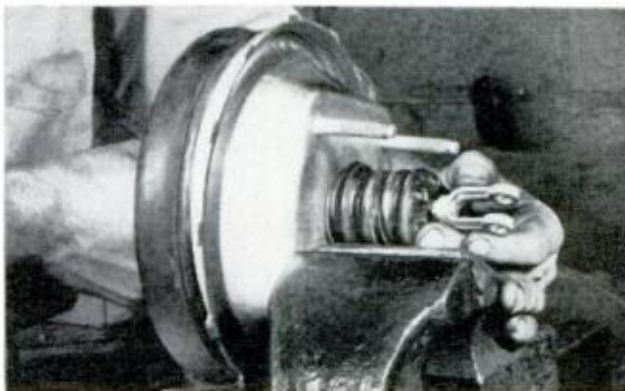
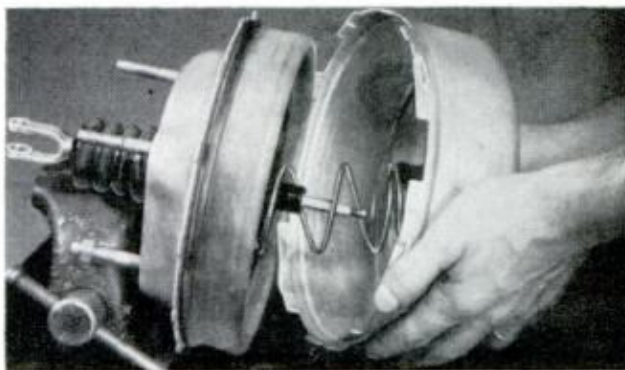
Internal filters usually stay in good condition for the life of the unit, and needn't be cleaned or replaced unless you're tearing down the unit for overhaul.

2 Flush out the entire braking system of hydraulic fluid once a year and refill with new, heavy-duty fluid. Use only top quality fluid. This guards against dirt in

TAKING THE UNIT APART



FILE REGISTER MARK across unit's end plate and vacuum cylinder to aid in reassembly. Hold unit in vise by running a nut up one of the retaining bolts to take pressure of jaws. Self-locking units require strap wrench (photo far left). Watch that tensioned piston return spring doesn't fly out (below)



UNSCREW CLEVIS from rear of cylinder (above) and piston assembly slips out (below). It's in two parts, held together by bolts. Disassembly of other type units will differ. Generally the newer units are easier to work on than the ones on older cars. For subsequent steps, see the photos on page 177



THIS MODEL POWER ASSIST IS FOUND ON THESE CARS

Bendix Hydro-Vac

Cadillac, 1955 & 1957
Chevrolet, 1957
Studebaker, 1955-60

Bendix Treadle-Vac: Poppet-Valve Type

Cadillac, 1956 & 1958
Chevrolet, 1955-56
Lincoln, 1956-58
Mercury, 1956
Pontiac, 1955-56
Rambler, 1956

Bendix Treadle-Vac: Hydraulic-Reaction Type

Buick, 1957-59
Chevrolet, 1957-58
Edsel V8, 1958-60
Lincoln, 1959-60
Mercury, 1956-58
Oldsmobile, 1955-59
Pontiac, 1957-58
Rambler, 1957-59

Bendix Diaphragm Type

Cadillac, 1962-64
Chevrolet, 1962-64
Rambler, 1962-64
Studebaker, 1962-64

Bendix Power-Vac

Chrysler, 1955-61
DeSoto, 1955-61
Dodge, 1957-61
Plymouth, 1957-58

Bendix Master-Vac

Cadillac, 1959-61
Chevrolet, 1959-61
Ford, 1960-61
Lancer, 1961-62
Lincoln, 1961-64
Mercury, 1959-61
Oldsmobile, 1960-64
Pontiac, 1959-64
Studebaker, 1961-62
Thunderbird, 1960-61
Valiant, 1960-64

Kelsey-Hayes Piston Type

Buick, 1955-56
Plymouth, 1956

Kelsey-Hayes Diaphragm Type

Chrysler, 1955
DeSoto, 1955
Dodge, 1955
Plymouth, 1955-56

Kelsey-Hayes Bellows Type Variation No. 1

Chrysler, 1956-61
DeSoto, 1956
Dodge, 1956
Edsel 6, 1959-60
Ford, 1957-60
Imperial, 1956-61
Plymouth, 1957-61
Thunderbird, 1958-60

Kelsey-Hayes Bellows Type Variation No. 2

Buick Special, 1962-64
Oldsmobile, 1964

Midland-Ross Hy-Power

Ford, 1955-56
Thunderbird, 1955-57

Midland-Ross Diaphragm Type

Chrysler, 1963-64
Dodge, 1962*-64
Ford, 1961-64
Mercury, 1961-64
Meteor, 1962-64
Plymouth, 1962*-64
Thunderbird, 1961-64

Delco-Moraine Piston Type

Buick, 1957-59
Cadillac, 1956-58
Chevrolet, 1958
Oldsmobile, 1955-59
Pontiac, 1955-58

Delco-Moraine Diaphragm Type Variation No. 1

Buick, 1960-64
Cadillac, 1959-61
Chevrolet, 1959-61
Oldsmobile, 1960-62
Pontiac, 1959-64
Rambler, 1960-61

Delco-Moraine Diaphragm Type Variation No. 2

Cadillac, 1962-64
Chevrolet, 1962-64
Oldsmobile, 1962-64

Chrysler Tandem Diaphragm Type

Chrysler, 1962
Dodge, 1962 (early)
Imperial, 1962-64
Plymouth, 1962 (early)
* See Chrysler Tandem
Diaphragm list, also

the fluid entering the power assist unit and damaging parts.

3 Check hydraulic fluid level in the master cylinder once every 2000 miles. Keep the cylinder full.

4 Bleed the power assist unit as well as the brake system periodically, and certainly if a spongy brake is encountered. A spongy brake usually means that there's air in the system.

Some power assist units are equipped with bleeder valves. Always start the bleeding operation at the power assist unit—then proceed to the wheel cylinders. If your power assist unit has more than one bleeder valve, bleed the highest one first, followed by the next highest, and so forth. If your power assist unit has no bleeder valve, remove the hydraulic line fitting protruding from the power assist unit. In many cases, this fitting is attached to the master cylinder. (This was pictured in Part I, February issue.)

Bleed through the fitting or bleed valve by stroking the brake pedal several times to force air from the unit.

5 Adjust shoes to their proper clearances frequently—say, everytime the car is greased. This limits the travel of power assist unit and wheel cylinder parts, cutting down on the amount of wear these parts receive.

6 Check all vacuum hoses, tubings and connections every 10,000 miles. If hoses and tubings are deteriorated, replace with new ones to insure correct vacuum on the power assist unit. Make sure all connections are tight.

7 Tune up your engine every 10,000 miles and check the vacuum output at the intake manifold. Make whatever engine repairs and adjustments that are necessary to obtain 17 to 21 points of vacuum at the intake manifold.

8 Make sure power brake mounting bolts are tight and the brake pedal push rod is properly adjusted. On all cars equipped with power brakes, adjustment is from 3/4 to 1 inch of pedal free play.

9 If you replace the power assist unit with a rebuilt one, know whom you are buying it from, and make sure it has been completely overhauled and tested.

10 If your car is equipped with power brakes, never "ride" your brake pedal (a good tip to follow even with conventional brakes). Never even rest your foot on the pedal of a power system or tap the pedal while accelerating. Too much of this will damage the power assist unit.

A final word: Even if you decide to tear down your unit and it goes back together without mishap, don't list yourself as a power brake expert. The next type of unit you tackle may be less cooperative. ★ ★ ★

INSIDE THE UNIT



LEVERS AND SPRINGS inside piston assembly should act freely. Vapors can rust and gum them. Check by pressing with finger. If spring-back is sluggish, give these parts a good cleaning in solvent



INTERNAL FILTER on this particular power-assist unit consists of fiber washer placed over end of piston assembly, covering wad of cotton. Though this type is usually good for the life of the unit, it's best to clean or replace it when overhauling unit

DIAPHRAGM RING comes loose when two parts of assembly are pulled apart. Replace it and all seals with new parts from rebuild kit, lubricate unit with special lubricant provided and begin reassembly



● Next time you replace the hose to your windshield wipers, make the new one several inches longer than the old. As the ends wear out or deteriorate, that bonus length lets you cut them back for several more remountings.

● Tubeless tires are no blessing when it comes to finding small leaks in them. But if you spray a little white sidewall cleaner on the tire, bubbles will show where the leaks are.

● One more cold-start tip for those last wintery days: Transfer the battery ground lead from the chassis to the starting motor. When the battery is grounded to the chassis, a high voltage drop can occur. This trick works with both positive- and negative-grounds.

● Always wet the windshield before you adjust the position of wiper arms. The blade won't carry as far on dry glass, so the adjustment will be off.

● Plastic covers on dome lights have a way of shrinking loose, or even falling out. When this happens, hold the cover near an electric heater or iron, then stretch it a bit all around when the plastic becomes pliable. Dip the cover in cold water to set the shape.

● Tire spreaders often disappear just when you need to hold a tire casing open. As a substitute, prop a big double-headed open end wrench between the casing beads.

● When mohair upholstery gets matted, place a damp cloth over the affected area and run a hot iron over it. When you brush the moistened nap upright, it looks good as new.

● Freshen the faded interior of an aging car by spraying it with fabric dye dissolved in hot water. Use a deeper shade of the original color, and saturate the material. You needn't mask off other areas, since the dye wipes off metal, glass and paint.

● If you've a ring job to do on an older six- or eight-cylinder Chevy—say a '56—be sure you seat the valve seals right or the valves will suck oil. As a fast check, inflate a small balloon and slip its neck over the valve stem. If the air rushes out, you've got a seal that needs replacing.

AUTO CLINIC

How can I prevent moisture from gathering inside both turn-signal lenses of my 1963 Pontiac Grand Prix?—W. E. F., W. Va.

This is a problem that Pontiac says it's eliminated in 1964 models. The only thing you can do now is try to make a firmer seal between the lenses and their mounts. Many Pontiac service departments are using a plastic sealer called dum-dum to prevent moisture seepage into the lenses. You can buy it or something comparable at auto supply stores.

My 1961 6-cylinder Ford sends out a clacking noise at about 20 m.p.h. which disappears when I accelerate. Could it be the water pump?—C. G. H., Md.

Doubt it. If it were, the noise wouldn't occur only at one speed, but all the time. I believe the source of your problem is a bad universal joint, which would set up the clacking noise at low speed but not at high. Drop the drive shaft and pull the U-joint. Check it to make sure it's smooth and hasn't developed score marks. If it has, replace it immediately.

The Torqueflite transmission on my 1959 Plymouth is giving me problems. It seems to have trouble upshifting past second gear. I've had a conditioner put in the transmission oil . . . I've had the bands adjusted . . . I've even had one of the forward gear valves removed and reversed. No help. It's now in your hands.—H. L., Minn.

Torqueflite governors have been notorious for causing the searching-shift problem you're talking about. It should have been the first thing you checked. If you let it continue, that governor will get so bad as to prevent the transmission from shifting at all. Take the governor off and clean it. If this doesn't help, replace it—and to prevent this from happening again, clean the governor whenever you do a major tune-up.

I'm troubled by a rattle coming from the manifold heat-control valve of my 1961 Buick LeSabre; it's been there since I bought the car new. I've tried hanging a light coil spring on the end of the shaft, but engine heat caused it to lose

its temper, and it didn't work at all. I'm willing to buy a new unit, which'll cost me \$20, but no one will guarantee that the problems won't reoccur. Any suggestions?—P. L. M., Pa.

The trouble you're having is one experienced by many Buick owners. The only thing you can do is replace the unit although, as you said, you won't find anyone who'll guarantee the results. It's just one of those inherent problems. One way to at least deaden the noise is to lubricate the heat valve shaft every 1000 miles with Buick Heat Trap Lubricant. It may not eliminate the rattle, but it will reduce the noise to a tolerable level.

We recently bought a used car that has a light scratch on the windshield where the wipers were apparently operated without a blade. Can anything be done to get rid of this?—A. M. B., Ark.

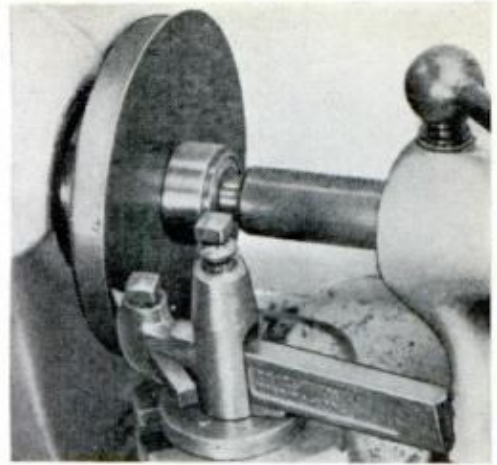
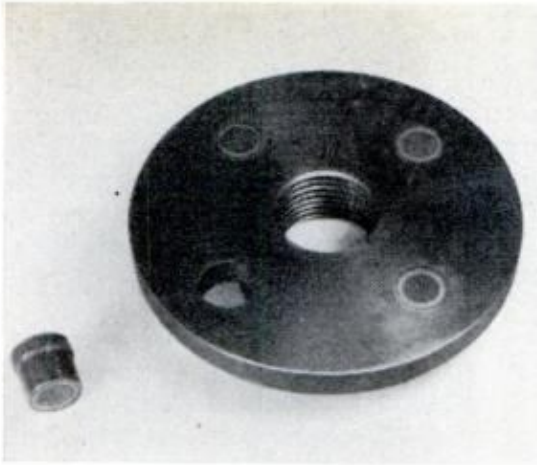
As long as the scratch is light, you can try rubbing it out with jeweler's rouge. If this doesn't work, it means the damage has gone too deep. The only other alternative is to replace the windshield.

The rubber bushings around the shock absorbers and front suspension of my 1962 Chevrolet are squeaking like crazy. Can I oil them?—D. T. S., Ill.

By no means! Never oil rubber parts of any sort, since this lubricant will hasten deterioration. You can try to soak the bushings with a strong detergent and water. If they're not too far gone, this will loosen them up to a point where the squeak will disappear. Failing this, you'll have to replace the bushings.

MONTHLY SERVICE TIP

★ We've recently received several letters concerning discoloration of plastic rear windows of convertibles. It's really a "sun tan" resulting from prolonged exposure of oil that's added to the windows at the factory to make them pliable enough to fold over when the top is lowered. The sun causes the oil to come to the surface of the window in a brown stain. Oldsmobile has a product called GM Dry Cleaner (Part No. 982006) for cleaning dirt off car bodies. Research proves this material equally effective for removing stains and scratches from convertible windows. It's a fine abrasive that can be applied by hand or with a buffing pad in a 1/4-in. drill.



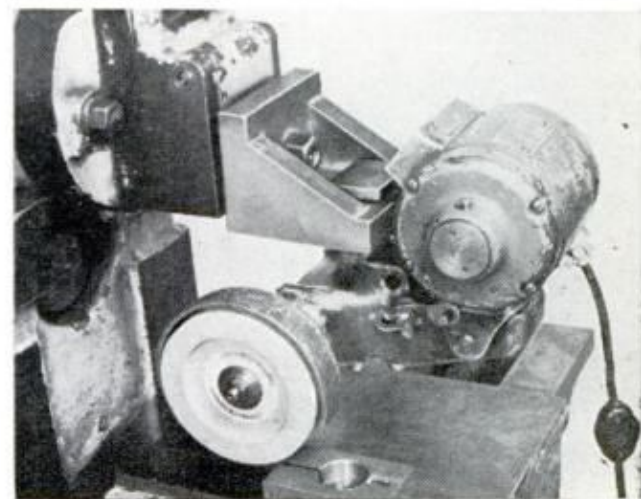
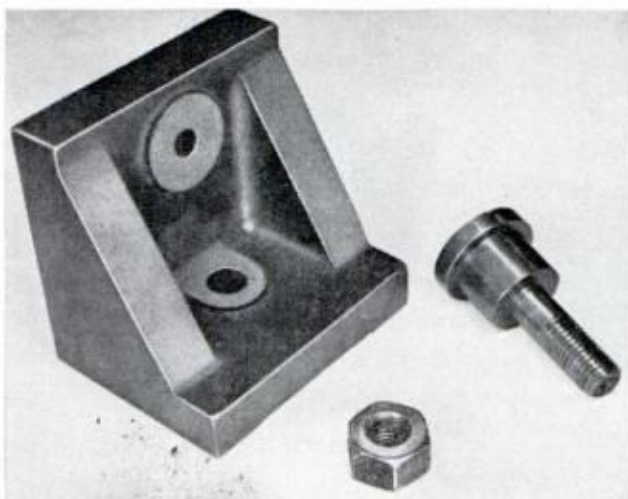
How do you hold thin plate or sheet stock in the lathe for turning and boring jobs? It's no problem if you make a magnetic faceplate. A conventional faceplate may be used—or one may be machined from cast iron or a piece of solid steel. In the latter case, the blank is bored out and threaded to fit the lathe spindle, then screwed on so it can be turned to the desired diameter and faced. The small button magnets that are used to hold the work have a soft steel shell which should be turned in the lathe for a press fit in

holes bored through the faceplate. Those shown in the photograph measure .751 in. and fit in a 3/4-in. hole; they're stock items with firms that make alnico or ceramic magnets. At least four magnets should be used, though six or eight assures a better grip on the work. After drilling and reaming, the faceplate holes are counter-bored from the rear so the magnets will shoulder up to fit flush with the front face. For additional support on heavy cuts, it's best to run a ball bearing pad center tightly against the work, as at the right, above.

Adapter Coupling Eliminates Toolpost to Clapper

When used in conjunction with a metal lathe, the toolpost grinder produces an almost microscopically fine finish with such great accuracy that many machinists fail to explore the possibilities of using the grinder with other tools. It can, for example, be teamed up with a shaper for surface grinding operations on hardened metals. An adapter is needed in such a case to attach the grinder to the shaper's ram. This is simply an angle plate made of cast iron which is machined square on its two seating surfaces. It is drilled and

spot-faced at the two points where it is bolted to the shaper's clapper block and the mounting stud of the grinder. The bolt with the stepped shank, shown below with the adapter, is a simple machining job. It replaces the toolpost on the clapper block. When the unit is being used, the clapper block must be locked in place so that it can't raise on the return stroke as it does in normal shaping operations. The lowest ram speed is usually the most suitable for grinding work though there may be exceptions in special jobs.—H. J. Gerber



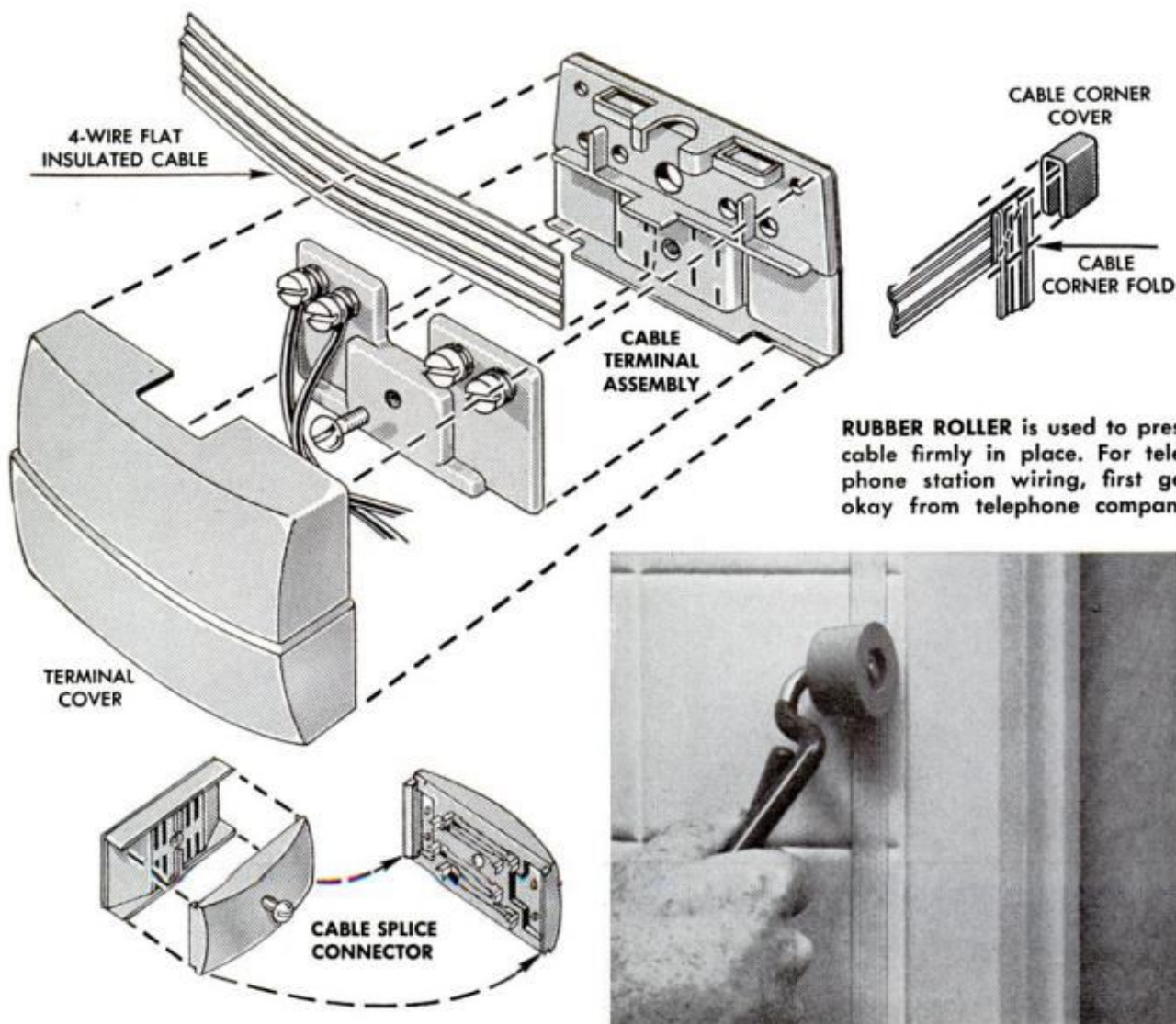
New 4-Wire Cable System Sticks in Place

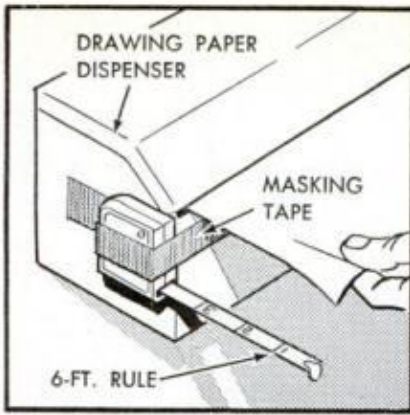


PROTECTIVE PAPER on cable's adhesive backing is removed before pressing cable in place. Available in gray or ivory, can also be painted to match wall

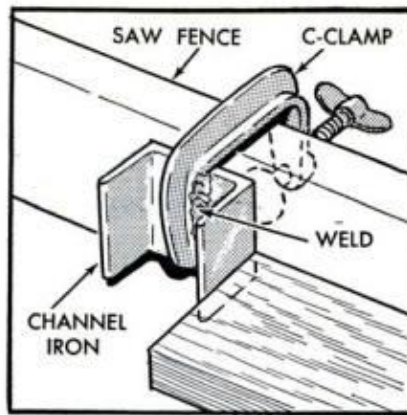
NO HOLES TO DRILL—no nails or staples to drive—no surface defacing, just press firmly and the pressure sensitive backing on all components of a new 4-wire flat cable system will adhere to virtually any surface. Called Scotchflex, the smooth-looking installation is designed particularly for use with low-voltage hookups such as hi-fi systems, home intercoms, model-train layouts and telephone station extensions in the home.

No insulation removal is required. Sharp prongs in the plastic terminal blocks pierce the insulation and establish contact with each of the cable's four wires and its respective terminal binding screw when the U-shaped connector plate is screwed onto the baseplate. The cord from a hi-fi, intercom or other unit is then connected to the binding screws, as shown in drawing. Splicing terminals enables the cable to be extended where necessary. For corners, the tape is folded over itself and a cover is slipped over the fold. The cable system is produced by Minnesota Mining & Mfg. Co., St. Paul 19, Minn.

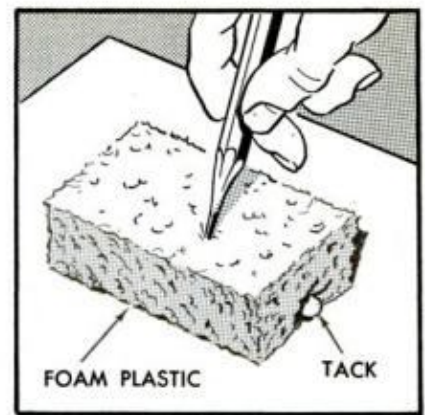




ELIMINATE WASTE when using roll size drawing paper by taping a 6-ft. tape to the end of the dispenser. Then there will be no need to guess about how much paper should be drawn from the roll.



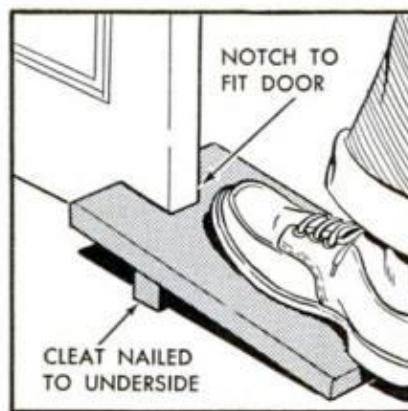
AN ADJUSTABLE STOP for cutting boards to identical length with a radial arm saw can be made from a C-clamp. Weld a piece of channel iron to the clamp to act as a stop for the piece being cut



AFTER SHARPENING your drafting pencil, remove the graphite dust by poking the pencil point into a small block of polyurethane. This makes a wiping cloth unnecessary and assures clean work



NO NEED to run the risk of pinching your fingers in the teeth of a check key. Just enlarge the hole in a washer and slip it over the shank of the key to serve as a protective bearing plate



A NOTCHED BOARD held in place by your foot will keep a door from swinging when you are boring a hole for the latch. A cleat nailed to the bottom of the board raises it for a solid hold on the door



A SHOWER CURTAIN HOOK can be made into a tool hanger that will let you carry a hammer on your belt. Expand the hook by straightening the two bends so that the handle can pass through

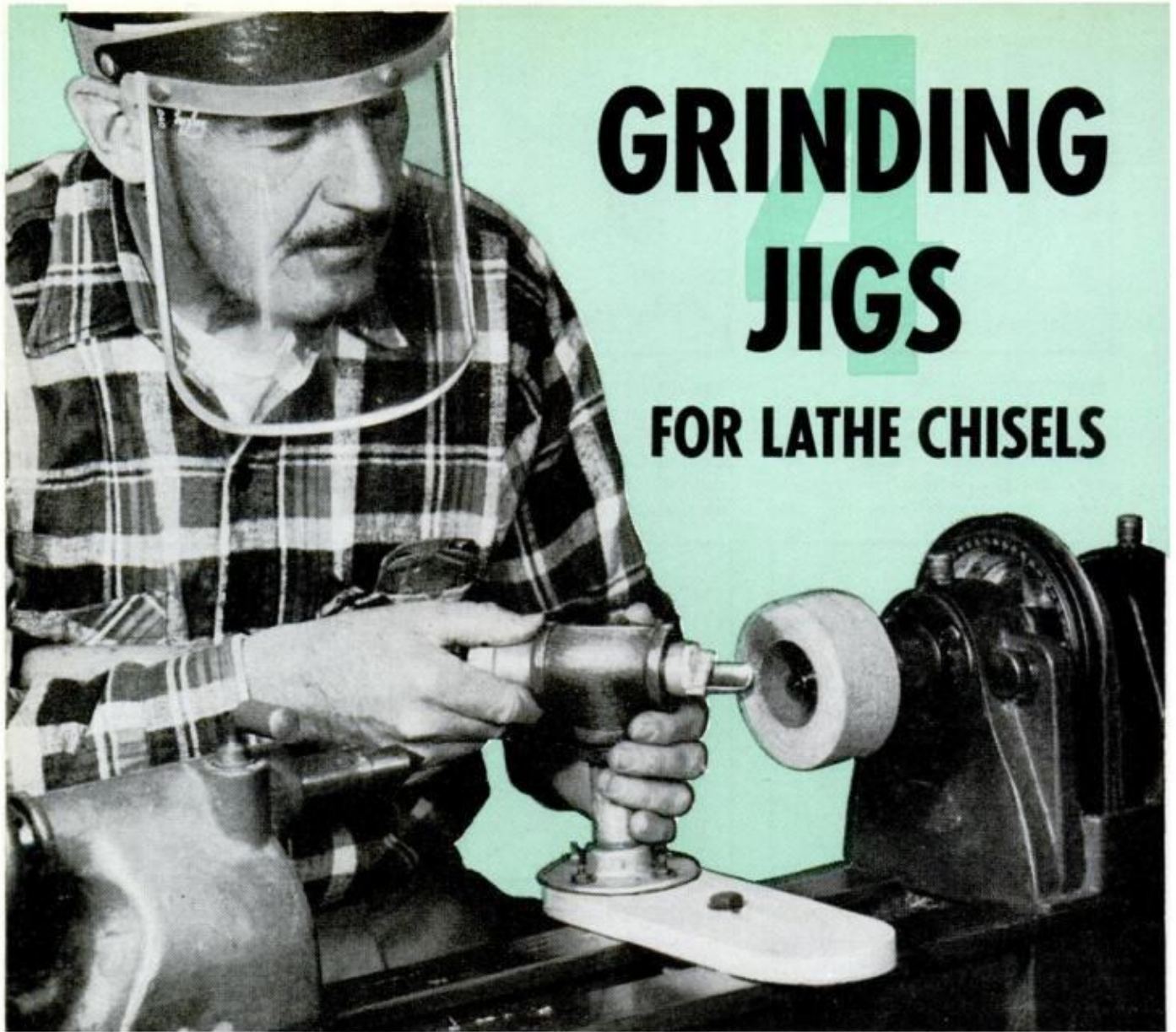
NEXT MONTH IN SHOP AND CRAFTS

SPRING REMODELING IDEAS. In next month's plan-packed issue you'll find complete instructions for installing a slate floor in your entryway, building a catch-all hobby wall and a dozen other eye-catching projects to add extra livability to your home. Some can be completed in a week end; others may require a few extra evenings, but the results are more than worth the effort. If you're looking for new ideas, don't miss this issue

FOILING THE LOCK ARTIST. Any reasonably talented burglar can open a door locked with a spring latch by using a strip of celluloid to push back the latch. However, you can foil the sharpest "loid" artist if you follow the instructions in the April issue. Don't miss these tips for making your doors secure against this trick "key"

HOW TO MAKE A BOOMERANG. One of the strangest weapons ever developed, this novel homing throwing stick is also a terrific toy that intrigues youngsters and grownups alike. Next month's PM will include easy-to-follow plans for making both left-handed and right-handed boomerangs, so if you want to be the first boomer on your block, don't miss it

FOLDING MOTOR SCOOTER. You'd have to look a long time to find a more compact transportation package than this 77-lb. midget, yet it can carry a 225-lb. man at 15 m.p.h. Powered by a 3/4-hp. two-cycle engine, it folds for easy toting in car or boat. The April PM will include Part I of a two-part article telling you how to build this jewel



GRINDING JIGS

FOR LATHE CHISELS

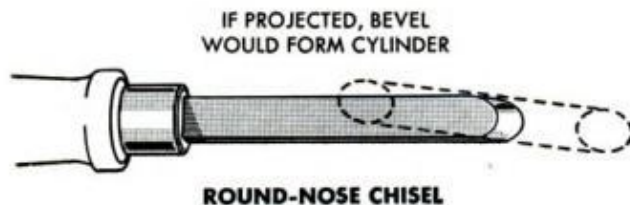
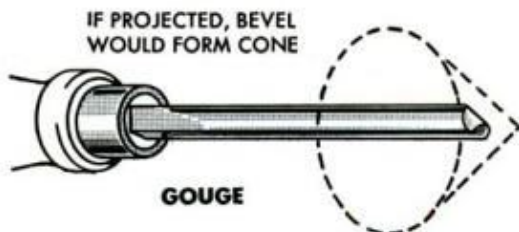
By Art Youngquist

SHARPENING wood-turning gouges and round-nose, skew or spear-point chisels is a chore many lathe owners turn over to a professional tool-grinder. But the four easily-made jigs shown on the next three pages take the place of years of experience and turn you into a pro on your first try. In fact, you're likely to get a better edge than pros who use the freehand method!

Curved-edge cutting tools must be ground to different shapes, as indicated below. The tube-in-a-tee jig on the next page is designed to produce a *parabolic*

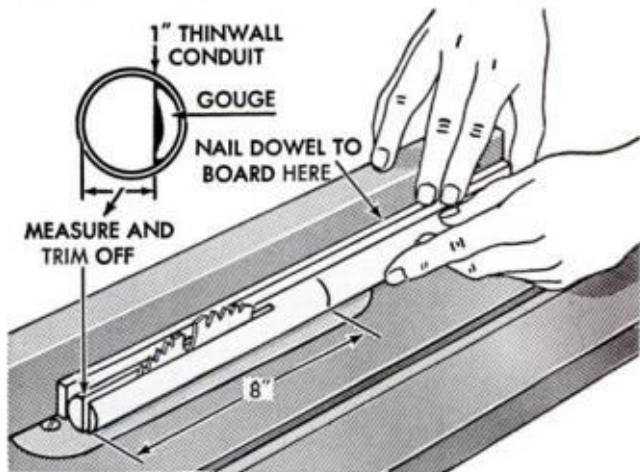
cutting edge on gouges of various sizes. Examine the edge on a new factory-ground gouge—or watch the movement of the tool in the hands of a skilled freehand grinder, and you'll realize that the bevel is actually a fragment of a *cone*. Round-nose chisels, on the other hand, cut best when the bevel is *elliptical* in shape, forming part of the surface of a *cylinder*. It's virtually impossible to grind an edge this shape without a jig of some sort. Freehand grinding of round-nose chisels usually results in a cutting edge somewhere

WHY ONE JIG CAN'T DO BOTH JOBS

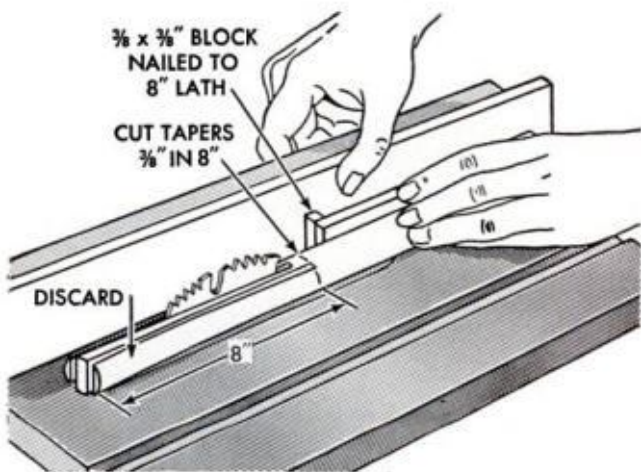




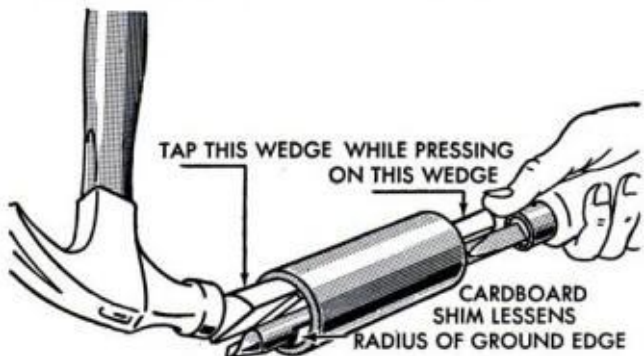
TRIANGULAR TEMPLATE speeds adjustment of jig for grinding 30-degree bevel as in title photo at left



DOWEL WEDGES clamp gouge tight against inside of conduit. To make pair, measure space to be filled, trim 1-in. dowel to match (above); then make angled cut by shimming out one end of fence-guide (below)

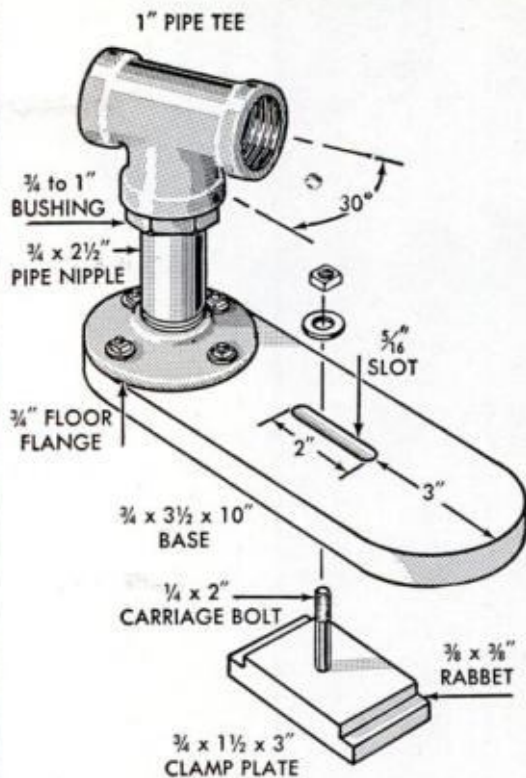


TAP OPPOSING WEDGES in atop gouge and you're ready for grinding. Shim under gouge is optional



MARCH 1964

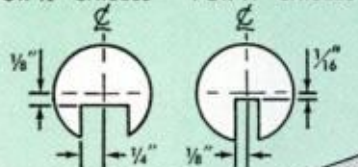
GOUGE GRINDING JIG



TO HOLD SMALL GOUGES

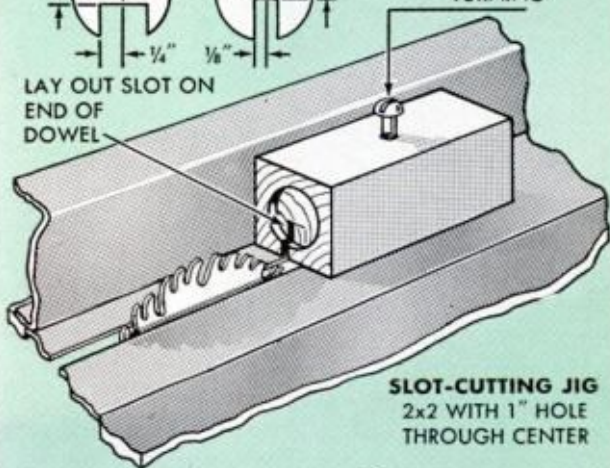
DOWEL INSERTS

FOR 1/2" CHISELS FOR 1/4" CHISELS

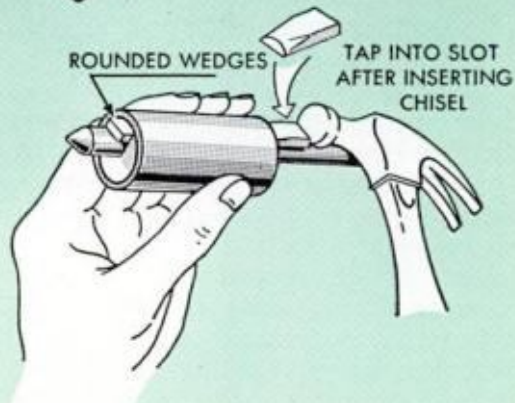


POINT OF WOOD SCREW KEEPS DOWEL FROM TURNING

LAY OUT SLOT ON END OF DOWEL

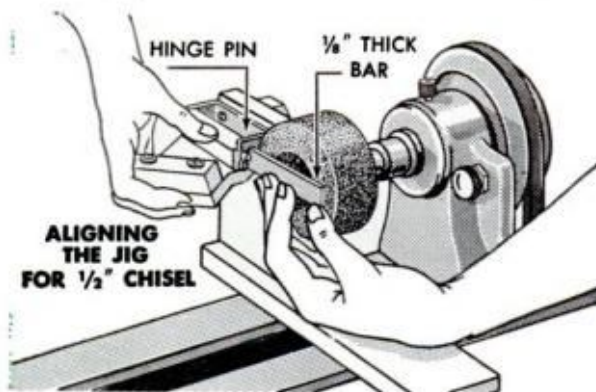
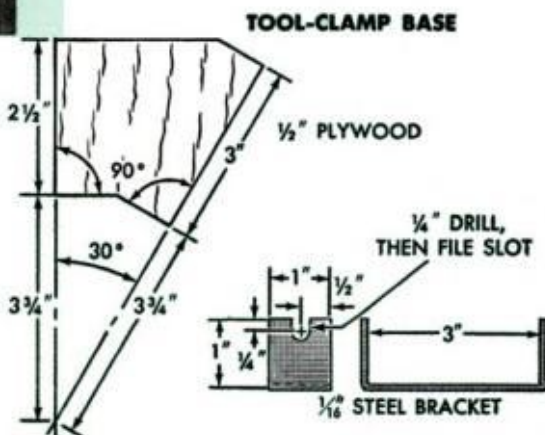
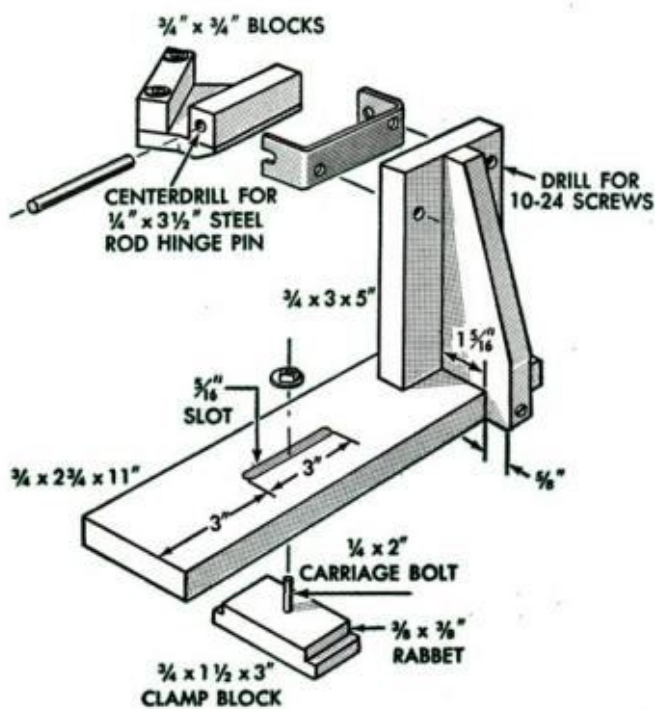
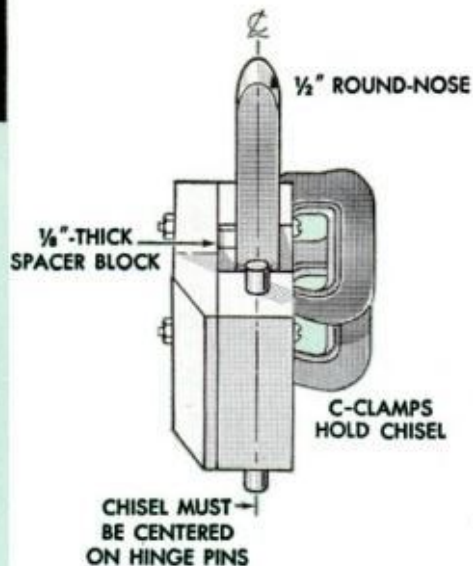


SLOT-CUTTING JIG
2x2 WITH 1" HOLE THROUGH CENTER





JIG FOR ROUND-NOSE CHISELS



between parabolic and elliptical in shape.

Don't worry about the geometry if this isn't entirely clear. The point we're making is just that grinding a round bevel is tricky—unless you have special jigs.

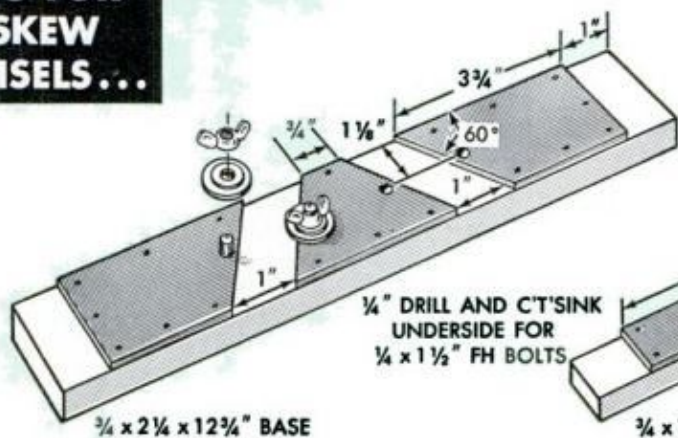
When assembling the gouge jig from standard pipe fittings, adjust the nipple to bring the center of the tee in line with the center of the wheel arbor. An 80-grit, silicon carbide wheel mounted on a lathe head stock is an ideal setup, but this jig could also be used with any bench grinder. When grinding in a lathe that has taper-shank centers, you can slide up the tailstock to engage the work arbor to avoid all chance of vibration-loosening.

After assembly, file down the tee's

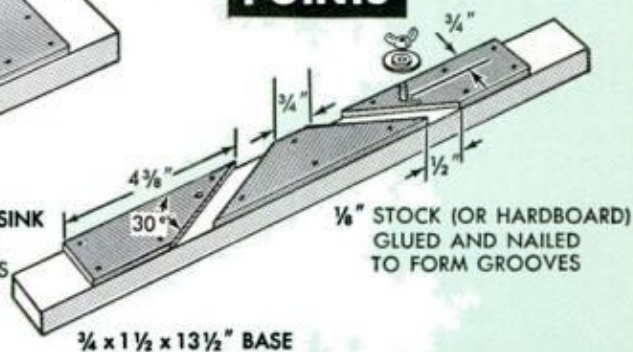
threads until a 4-in. length of 1-in. conduit (pick up a scrap at an electrical shop) can be inserted and rotated with the least amount of play. This "clamp tube" handles all sizes of gouges in home workshop sets—including the top 3/4-in. size. The 1/4 and 1/2-in. sizes require dowel inserts for accurate centering in the tube. The cutting edge should project about an inch, while the clamp tube should protrude far enough from the back of the tee to provide a grip. Let your thumb or index finger bear against the rim of the tee to serve as a depth gauge as you slowly rotate the tube to grind across the entire undersurface of the gouge. Take light cuts to avoid overheating, and remove the tube occasionally



**JIG FOR
SKEW
CHISELS...**



**... AND
SPEAR-
POINTS**

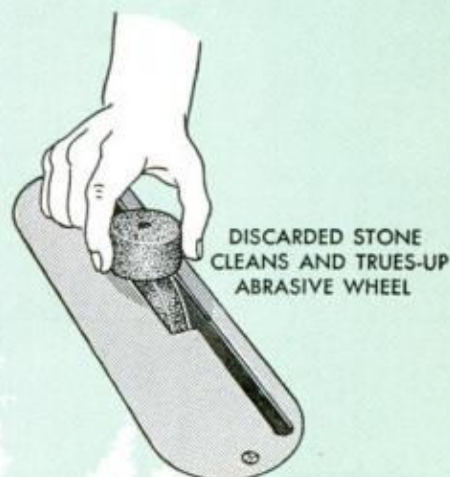
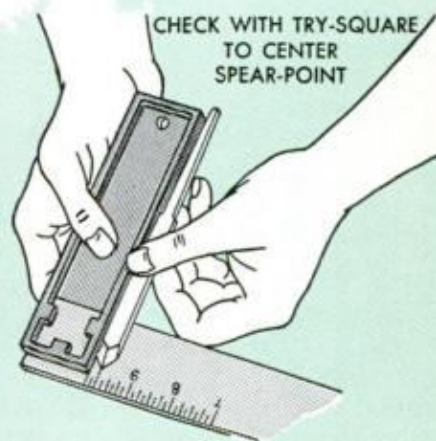


to dip it in a can of water and to inspect the edge.

The first time you grind your gouges by this method, you'll probably be establishing a new shape on the cutting edge, so it may take longer than future regrindings that will require only touchup. If you wish to make the radius of the cutting edge smaller, shim the gouge, as shown on page 183. The nearer you move the gouge toward the tube's center, the smaller the radius of the cutting edge will be. After grinding, hone the edge with a slip stone.

2 The jig on the opposite page puts a perfect edge on $\frac{1}{2}$ -in. round-nose turning tools. The pivoting clamp block merely nests in the steel bracket, to facilitate removal and replacement of the chisel during grinding. When clamping the jig to the lathe bed, butt the pin against a $\frac{1}{8}$ -in.-thick spacer as shown in the aligning sketch. This moves the axis of the pivot exactly $\frac{1}{4}$ in. in front of the wheel—half the width of the chisel. The chisel is centered and clamped in the block's groove with two small C-clamps. The cutting edge should touch the wheel just before the forward hinge pin seats in the bracket slot. (The pins are simply the projecting ends of a rod driven through the block.) About $\frac{1}{64}$ -in. clearance between the rod and the bottom of the slot allows enough grinding for a starter. Hold the chisel lightly against the wheel

(Please turn to page 199)

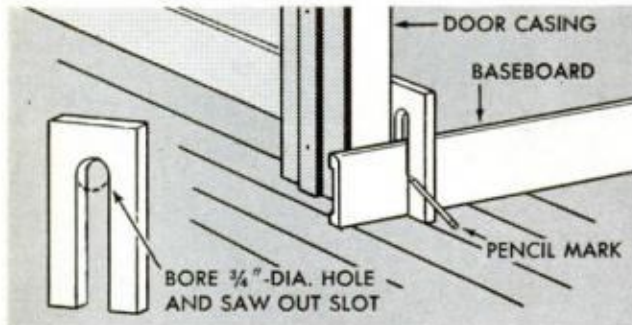
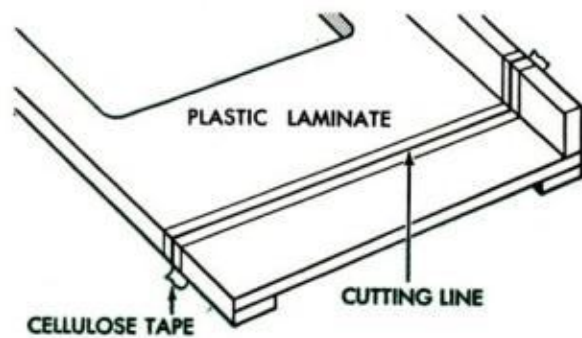


HANDY SHORTCUTS



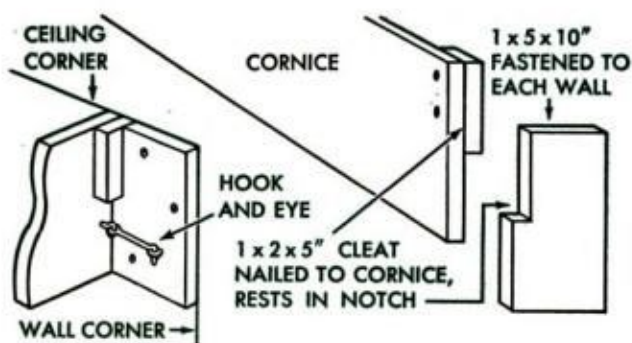
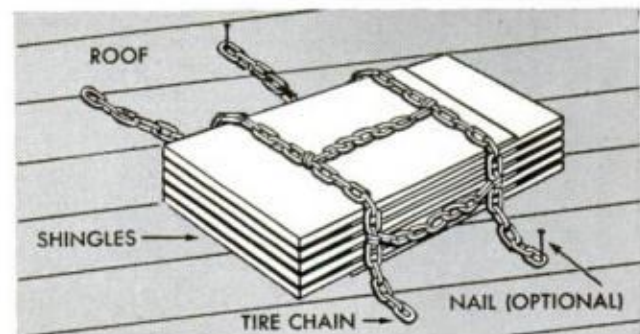
Holes for cabinet hardware and drawer pulls must be spaced precisely and bored in identical positions on matching members. To avoid the chore of laying out these holes individually, just nail together a self-positioning boring jig like the one shown at left. This type is ideal for already-hung cabinet doors: You just swing the panel out, nest the corner in the jig and drill through holes spaced to match those in the pull.—*Michael Ligocki*

If you're installing a new sink cabinet, chances are you'll buy a plastic-laminate-covered top panel that will need trimming to fit against an end wall. To prevent chipping the laminate, press a length of transparent tape over the pencil mark and saw through it.—*Victor Lamoy*



Since door casings are seldom perfectly plumb, a square cut at the end of the baseboard may leave a gap. The jig shown at the left lets you mark for an accurate trim cut. Simply slot a piece of scrap to fit over the baseboard, hold the inner leg tight against the edge of the casing and mark along the front face of the jig. That inner leg shouldn't be wider than the casing is thick, for a snug fit.

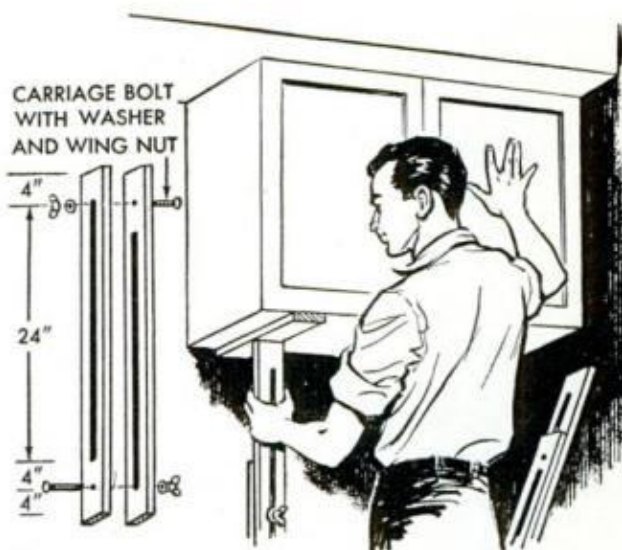
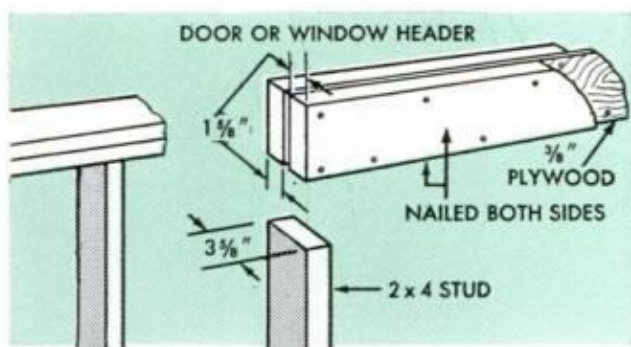
Ever try to shingle a roof on a windy day? Once you've opened the bundle, the shingles lift off one by one and sail away. They won't if you sling a tire chain across the pile to weight them. The chain still lets you pull shingles out as they're needed. If the roof is steep, you may have to anchor the chain with nails tapped into roof boards.—*J. Carpenter*



When my wife wanted a cornice board stretching from wall to wall and I found she intended to upholster it, I knew I'd have to put it up and take it down many times before she was satisfied—and whenever she wished to recover it. So I devised the installation shown at left. The board can be put up without help and removed without tools, yet looks permanent once it's in place.—*Stephen N. Stresnic*

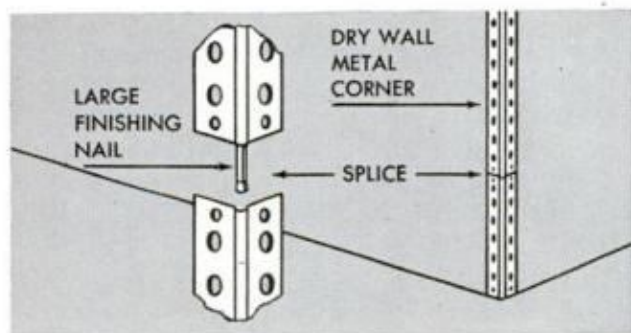
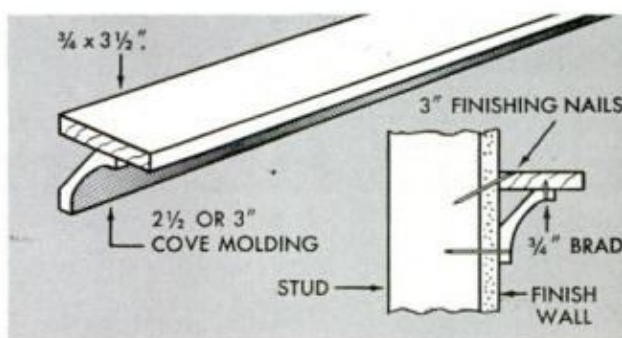
for HOME REMODELERS

6 Even if you can draft a helper, keeping a wall cabinet suspended while you anchor it is a grim job. But with a pair of these adjustable prop stilts, it's a cinch for *one* man. The two halves of each stilt are identical, except positions are reversed end for end to allow an extension of about two feet, letting you bring the prop tightly against a scrap block underneath the cabinet, once it's lifted in place. To cut slots, bore holes at ends, saw out between.



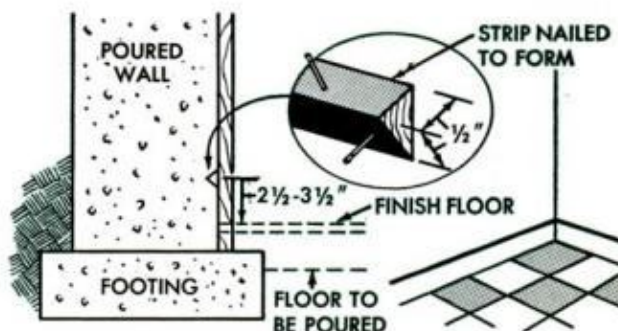
7 Window and door headers built up of 1 5/8-in. stock, on edge, are usually spaced apart with scraps of lath to match the 3 5/8-in. width of standard framing. Such headers will be considerably stronger if you sandwich 3/8-in. plywood between the two members, instead, as at left.

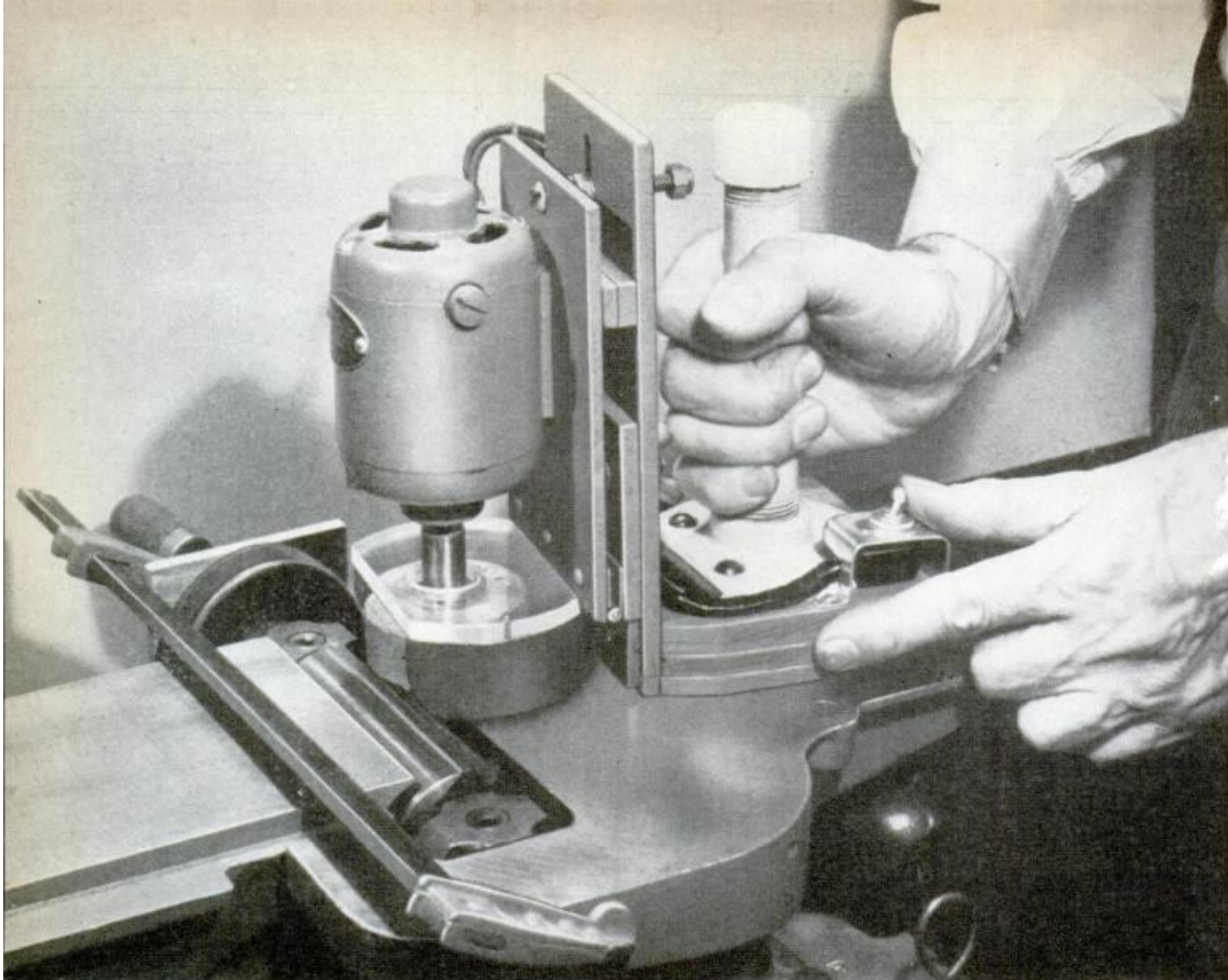
8 Mounting a narrow shelf for knick-knacks, bathroom bottles or spices? Most brackets are a bother to install and have too heavy an appearance for so small a project. If the wall is of standard frame construction, you can mount your shelf with a strip of cove molding, the same length as the shelf. Brad it to the underside first, then nail this assembly into the studs as shown, right.—*Archibald Black*



9 Metal outside corners used in dry-wall application usually come in 8-ft. lengths. In older homes with higher ceilings, you must splice on a short piece. After securing the full-length section, slip a large finishing nail into the bead, as shown, before nailing the short piece in place. This keeps the sections properly aligned and stiffens the joint.

10 A baseboard effect perks up a barren poured-concrete wall and gives it an interior touch. If you're planning to pour such a wall, you can achieve the effect simply by nailing a beveled strip on the inside face of the form before it's erected. Rip 1/2 x 1/2-in. strips diagonally and position them by estimating how high the finished floor will come. The groove creates a shadow effect.—*John J. Bahr*





Grind Anything Anywhere

Jointer knives would get sharpened more often if you could grind them right on the machine. And that's only one job this homemade rig does

By **Walter E. Burton**

ONCE YOU'VE MADE this portable rig, you'll wonder why they ever tied grinders down. This one goes right to the job—whether it's smoothing castings, grinding off projecting nail-heads and screw points, or—laid on its side—putting an edge on tools just like a standard vertical grinder.

Perhaps its best feature is that it lets you sharpen jointer knives without removing them, as demonstrated above. You just lock the jointer head in a position that brings the knife bevel parallel to the table surface. You do this by tightening a clamp so it bears on the V-belt sheave through a ¼-in. scrap of plywood. Position the wheel slightly above the grinder base (the rig has a height adjustment)

and control the depth of cut by adjusting the jointer's back table, on which the grinder rests. As you finish each knife, make sure the next one is brought into the same position.

The grinder consists of a small motor mounted vertically on a hinged panel attached to a flat, smooth-faced base. The hinge lets you tilt the arbor so only a limited arc of the wheel will touch the work. The clamping bolt at the top of the tilt panel provides a sort of micrometer control for depth of cut.

Ideally, the motor speed should be matched to the size of grinding wheel used, but this isn't critical. The motor shown is a ½-h.p. universal type rated at 5000 r.p.m.—well below the 14,500 speed



DRESSING BOLTS to uniform length is easy with tilt panel adjusted forward. Bolts are inserted through holes in a board, their heads underneath



LAI D ON ITS SIDE with a corner of the base clamped in a vise, unit becomes a horizontal tool grinder which puts a quick sharp edge on a knife or chisel

recommended for wheels up to 2½-in. diameter—which is the maximum size the grinder accommodates. The motor performs well, and is of a practical size, with a diameter of just over 3 in. and a length of 4½ in., exclusive of shaft. Any similar universal motor—such as one from an old vacuum cleaner or sewing machine—should work as well. If it's more powerful, and operates at double the speed (or more, all the better). Dimensions can be altered if the motor is of a very different size. It's a good idea to have both the motor and at least one wheel on hand before you begin construction.

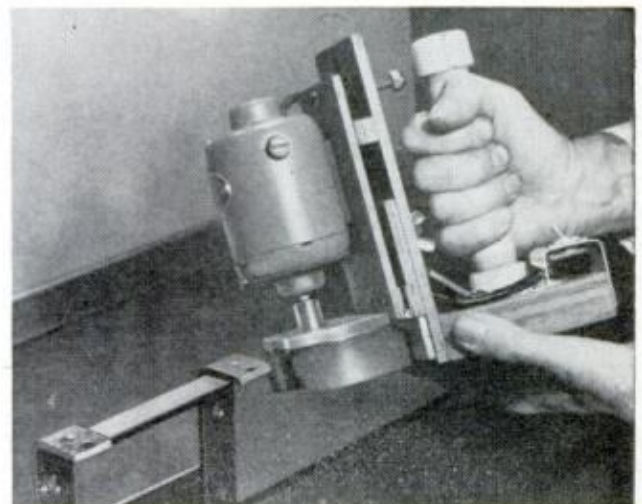
The grinder uses either a cup-type or a conventional straight-faced, disk wheel (Type No. 1). The cup wheel shown in the photos is a straight No. 6, but a flaring No. 11 works as well. Cup wheels are preferable for such jobs as jointer-blade grinding, where the work is done by the wheel rim. For grinding jobs where the face does the cutting, use a No. 1 wheel.

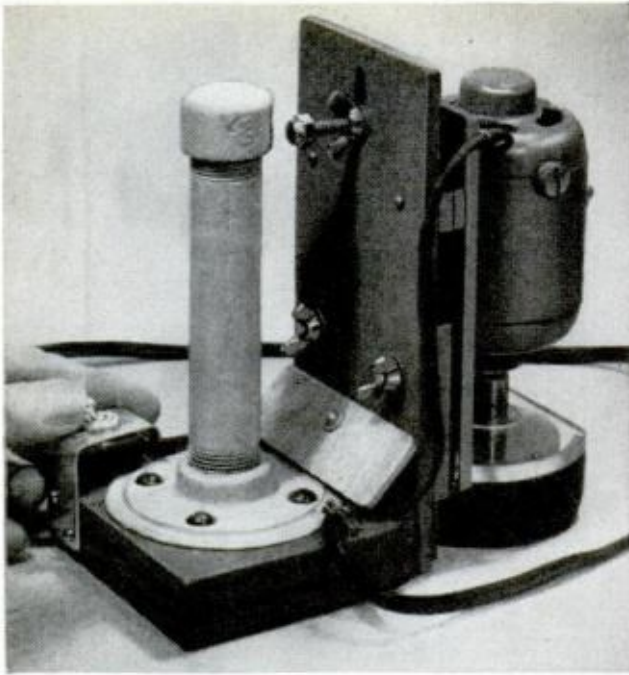
With the dimensions shown, the grinder will take wheels up to 2½ in. in diameter and ¾ in. thick. They're mounted on the motor shaft by means of arbors. Sometimes suitable ones can be purchased. Two types you can make are detailed in the two bottom sketches on page 191. The one at the left is for cup wheels and was made from cold-rolled steel. It measures about 1¾ in. over-all, though this may vary with the motor used. Two 8-32 setscrews lock the arbor on the motor shaft. The arbor on the right is for threaded-hole wheels,

a type that's particularly suitable for this grinder since there's no nut to project below. It's made much like the first arbor, but the threaded portion must match the wheel you want to use. Install the wheel with its paper label next to the arbor. The motor should run in the direction that tends to tighten the wheel or nut on the arbor.

The base (Part A) is ¾-in. plywood, faced on the bottom with tempered hardboard to provide a smooth, wear-resistant bearing plate. This facing projects ¼ in. at the front to form a rabbet for an upright (E), cut from the same hardboard (as are parts F, G and H).

HAND-HELD PORTABLE grinder is handy for knocking sharp edges off steel or for smoothing castings. Wheel, here, is straight-faced disk, Type No. 1

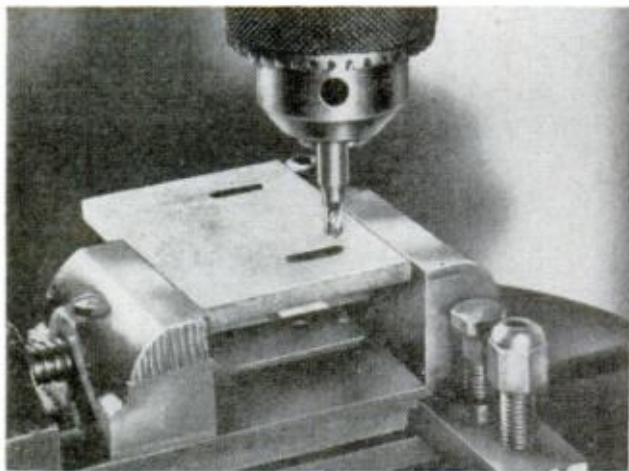




CANOPY SWITCH can be mounted anywhere within convenient reach. Wiring connections are masked by hardboard strip bridging the corner behind flange



WORM'S-EYE VIEW of grinder shows how No. 6 cup wheel fits within guard. Its face is higher than the base edge of the guard, which is flush with hardboard



SLOTS IN PIECE F can be cut with $\frac{1}{4}$ -in. end mill or router bit while work is held in sliding drill-press vise. Or drill overlapping holes with regular bit. Slots must take shoulders of carriage bolts

To the top of the base, screw a standard floor flange to take the handle; this is merely a section of $\frac{3}{4}$ -in. iron pipe, with a cap at the top. To help counterbalance the motor, a 6-in. length of steel rod can be slipped inside the pipe before it's screwed in place.

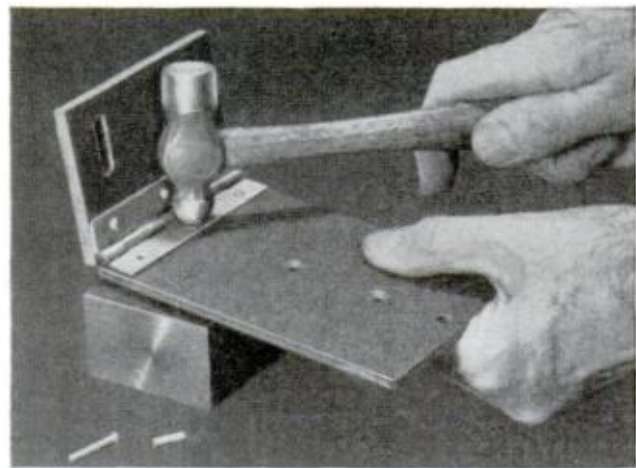
After hinging parts F and G, make stop-strip H to a thickness that will hold the tilt panel (G) parallel with the upright (E) when the panel rests against the strip.

Insert the tilt-control bolt through the top hole in panel G, and run the first hex nut up snug against the back face. The position of panel E on the bolt is determined by the second hex nut and the wing nut, which clamp the panel between them. The slot in panel E permits the bolt to move as the tilt panel swings outward.

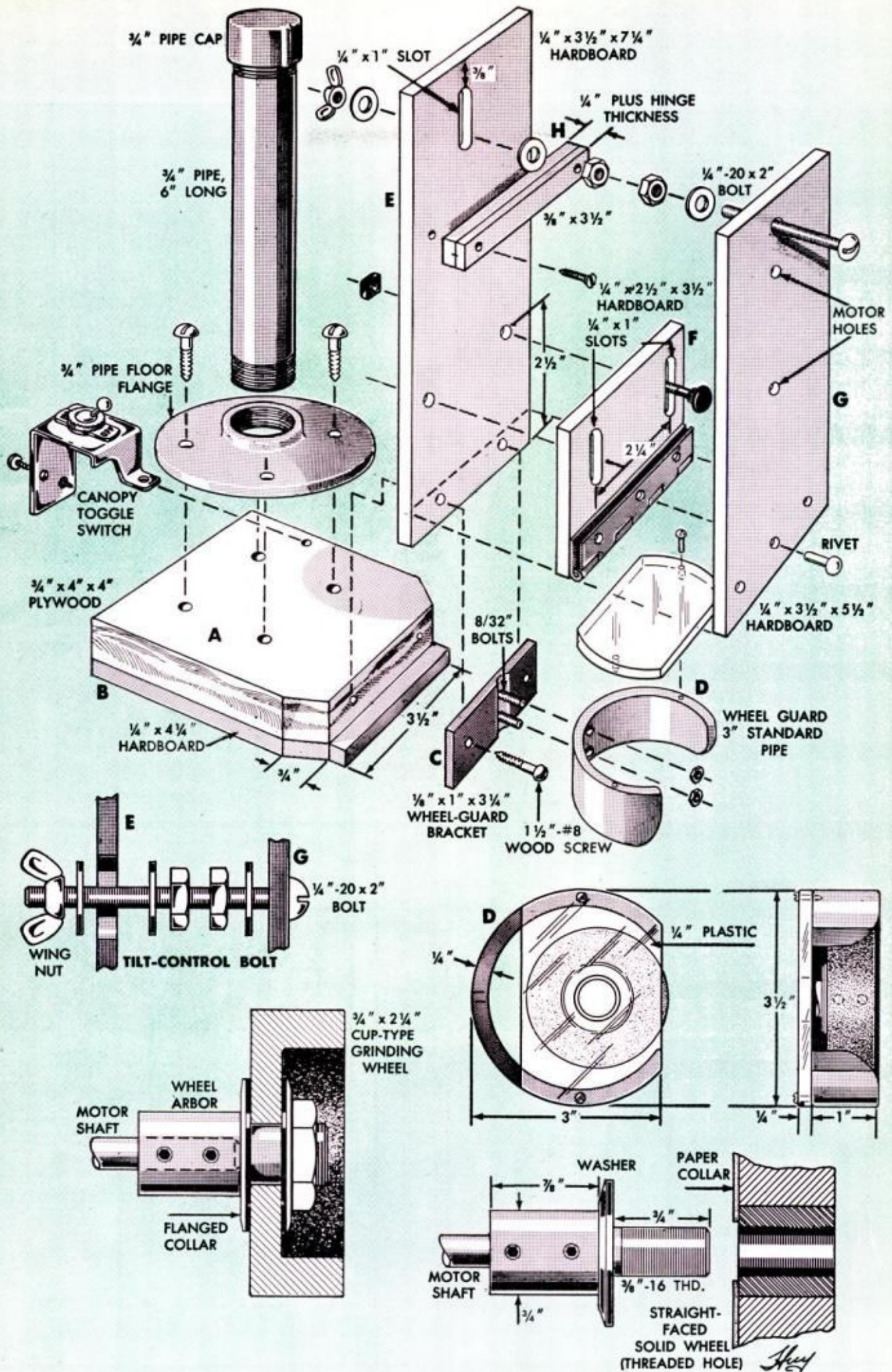
The wheel-guard assembly includes three parts. The bracket mount (C) is steel, with two studs projecting at its center to hold the C-shaped guard. These studs should be centered on the motor shaft, to hold the guard concentric with the wheel. Countersink the holes on the back face so the flathead bolts used as studs will set flush. File or mill a flute or notch squarely across the mount, $\frac{3}{8}$ in. wide, to help hold the guard in alignment. When the bolt-heads are soldered in place, the studs should project about $\frac{1}{2}$ in.

The guard was made from a 1-in.-long section of standard 3-in. steel pipe, cut away to provide working clearance for the wheel. The bottom edge of the guard sets flush with the bottom face of piece B. When attaching the plastic to the top edge (with 2-56 machine screws), allow clearance along the inner edge for movement of the tilt panel. And make the motor-shaft hole large enough to permit tilt, too.

Safety goggles or a face shield are always advisable when grinding. ★ ★ ★

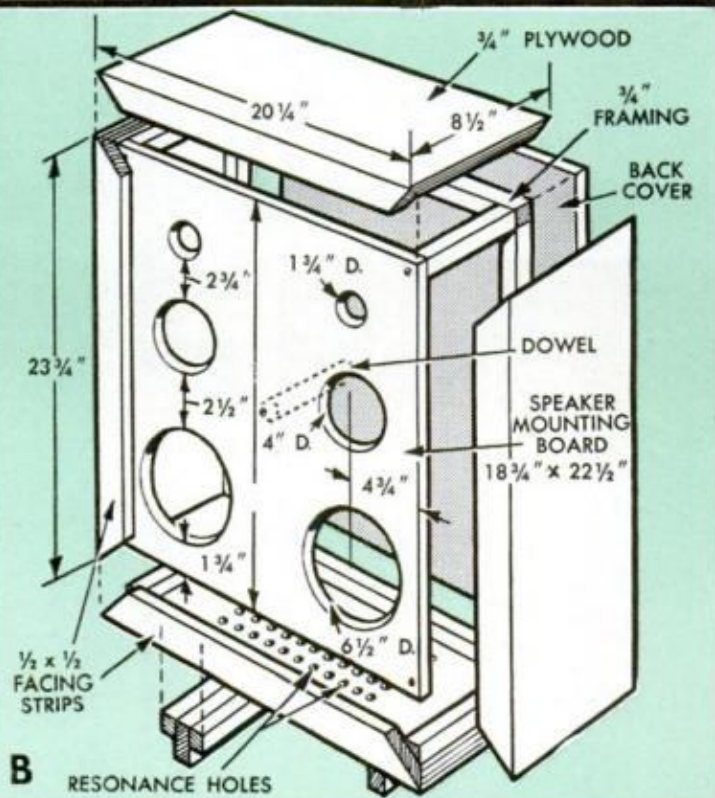
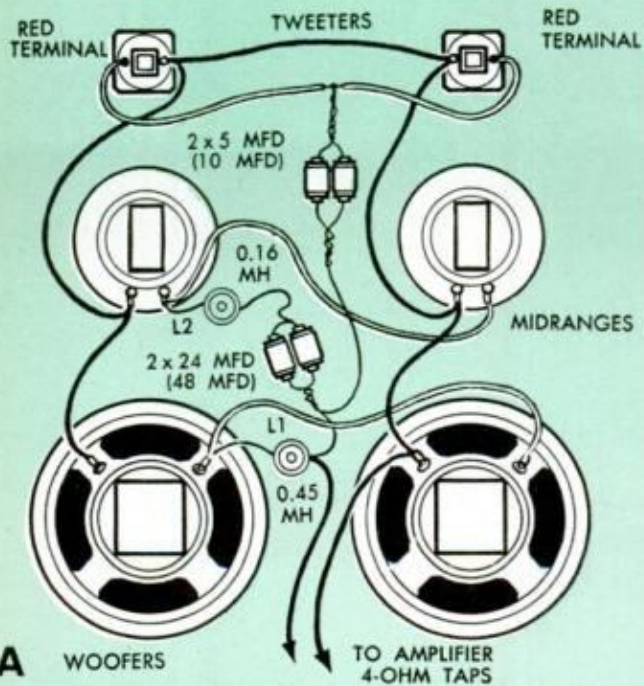


PIANO HINGE is fastened along bottom edges of height-adjustment panel F and tilt panel G, using $\frac{1}{8}$ -in. rivets. Choose sturdy, tight hinge with no play around pin, as it must support the motor





Six Speakers for Higher Fi



Multiple speakers combine with three-way crossover for a low-cost high-quality speaker system

By Ernest Wayland

THERE'S BEEN a lot of controversy among hi-fi fans about multiple-speaker systems. The advocates of the lots-of-little-speakers-in-one-enclosure idea claim that all sorts of benefits result from distributing the amplifier signal among 10 or more speakers. Theory aside, however, I've heard several multi-speaker systems, and to my ears, they just aren't worth the time, effort, and cash it takes to build them.

The problem is not the concept, but rather the type of speakers used. If you use good quality speakers (not the \$1.50 specials specified for most such projects) and a three-way crossover, you can get excellent results at a modest cost.

In the PM Multiflex described here, six speakers are used. Two high-quality 8-inch low resonance woofers deliver the low frequencies crossing over to a pair of sealed-back 5-inch midrange speakers at about 750 cycles. These handle frequencies up to about 4000 cycles where another crossover takes place. From 4000 cycles up to the limits of audibility a pair of 2-inch cone-type tweeters are at work. The three-way crossover network eliminates intermodula-

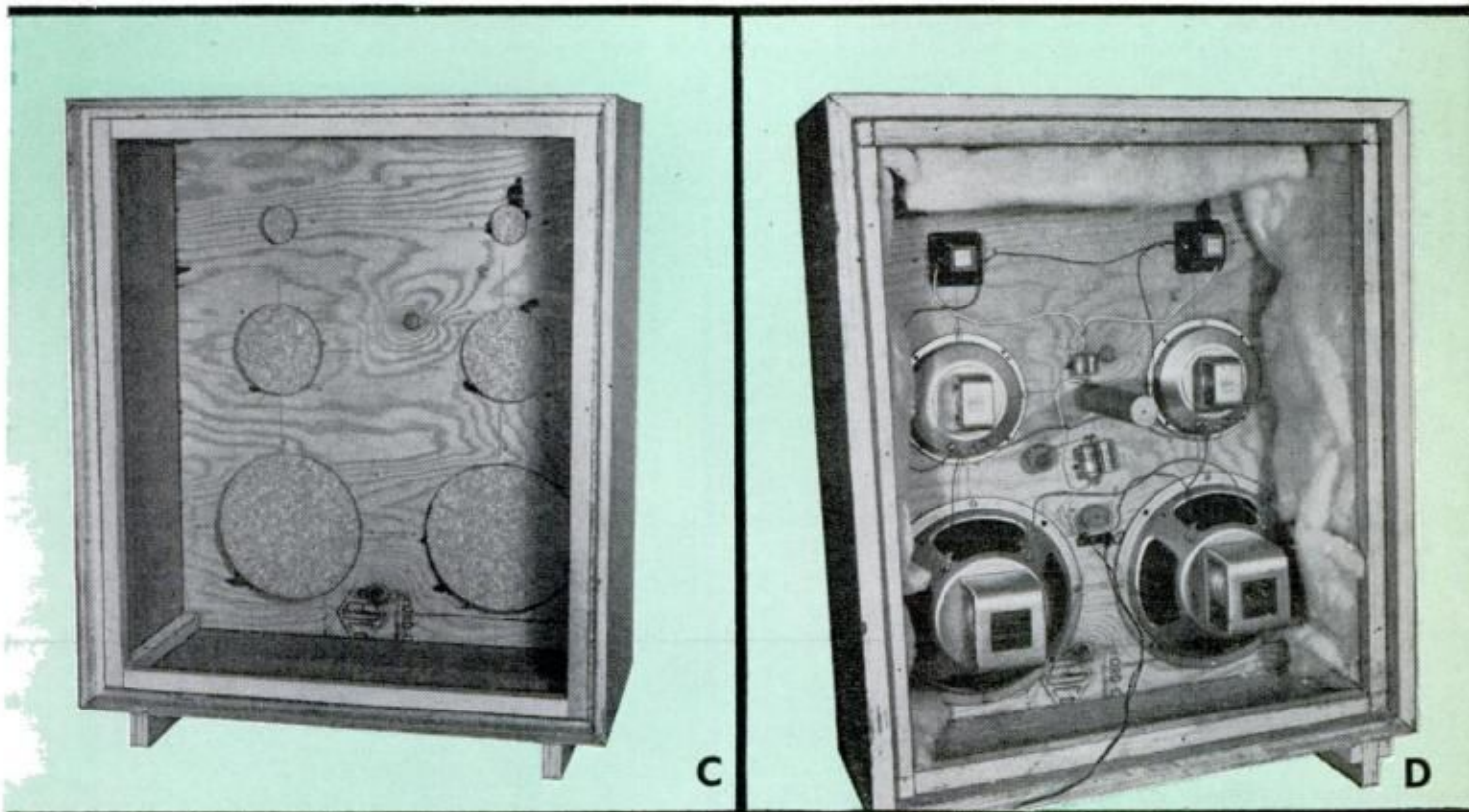
tion distortion, and using a pair of speakers for each frequency range minimizes harmonic distortion.

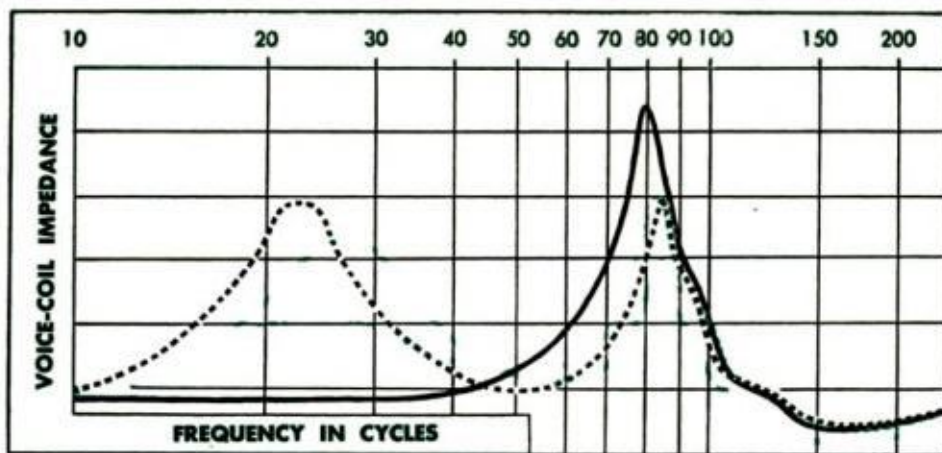
The Multiflex's frequency range is from 35 to 18,000 cycles and its sound is full and clean and equal to systems priced two and three times its low \$38 component cost. The very high efficiency of the system enables it to be driven by almost any size amplifier. In fact, anything from a transistor radio to a 60-watt amplifier can be used with excellent results.

Cabinet Construction

There are no special tools or tricks required to build the cabinet. Use 3/4-inch Novoply or plywood and carefully follow the dimensions given. Miter or butt joints may be used, but the cabinet must be air tight (except for the 44 3/8-inch holes drilled in the bottom) to preserve the acoustic design. A 1-inch diameter dowel is fixed to the inside of the front panel with a 2-inch wood screw and glue. The dowel should be just long enough to touch the back panel. It's a good idea to install the dowel before mounting the speakers. You

PICTORIAL DIAGRAM (A) details wiring of the crossover components. (B) Exploded view shows how cabinet goes together. (C) Completed enclosure ready for speaker mounting. (D) Your speaker system should look like this with all the parts in place just before you fasten the back cover into place





— SEALED BOX
 TUNED—21 HOLES
 1 LAYER OF BURLAP OVER 21 HOLES
 44 HOLES WITH 1 LAYER OF BURLAP
LOW-END frequency response is varied by adjusting number of porting holes in the bottom of enclosure

can then judge its fit and locate the proper position for the pilot hole in the rear panel by reaching through the woofer holes. The dowel prevents the front and back panels from vibrating and coloring or blurring on loud passages.

Staple a 2-inch layer of fibreglas insulating material loosely to the inside top and sides of the cabinet. If after a trial listening period you decide you want a more resonant sound, remove some of the glass wool. To "tighten" the sound add more.

Cover the front panel with an open-weave grille cloth. If you use anything else, much of the treble response will be lost. For a better looking cabinet, paint the front panel with a fast-drying flat black paint before installing the grille cloth. This will keep the speaker openings from appearing as black circles behind the cloth. Staple the grille cloth into place (stretch it tightly to prevent flapping on loud passages). Conceal the stapled edges with strips of moulding.

Center the speakers over their respective cutouts and mount them. You can use a router and attach the speakers with the supplied clamps (as shown in the instructions that come with the speakers) or with roundhead wood screws.

Speakers and crossover components must be carefully wired as shown or there will be a loss of bass or treble or both. In the two speaker kits you'll find four capacitors and two coils. The two large 24-MFD capacitors are placed side by side and their leads twisted together as shown. Follow the same procedure for the smaller 5-MFD capacitors.

Two crossover coils come with the speakers. The one designated L1 is used as is; L2 is modified by removing 75 turns (about 17 feet) of wire. This lowers its inductance to adjust it for feeding the midrange speakers. (Note that the crossover network has been completely redesigned and the manufacturer's original diagram and instructions no longer apply.)

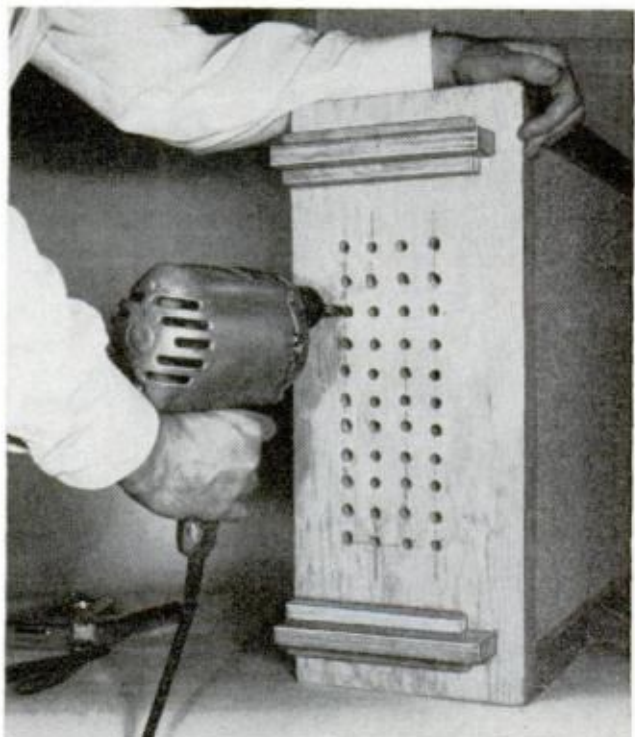
Staple a 2-inch layer of fibreglas to the rear panel (avoiding the dowel pilot hole)

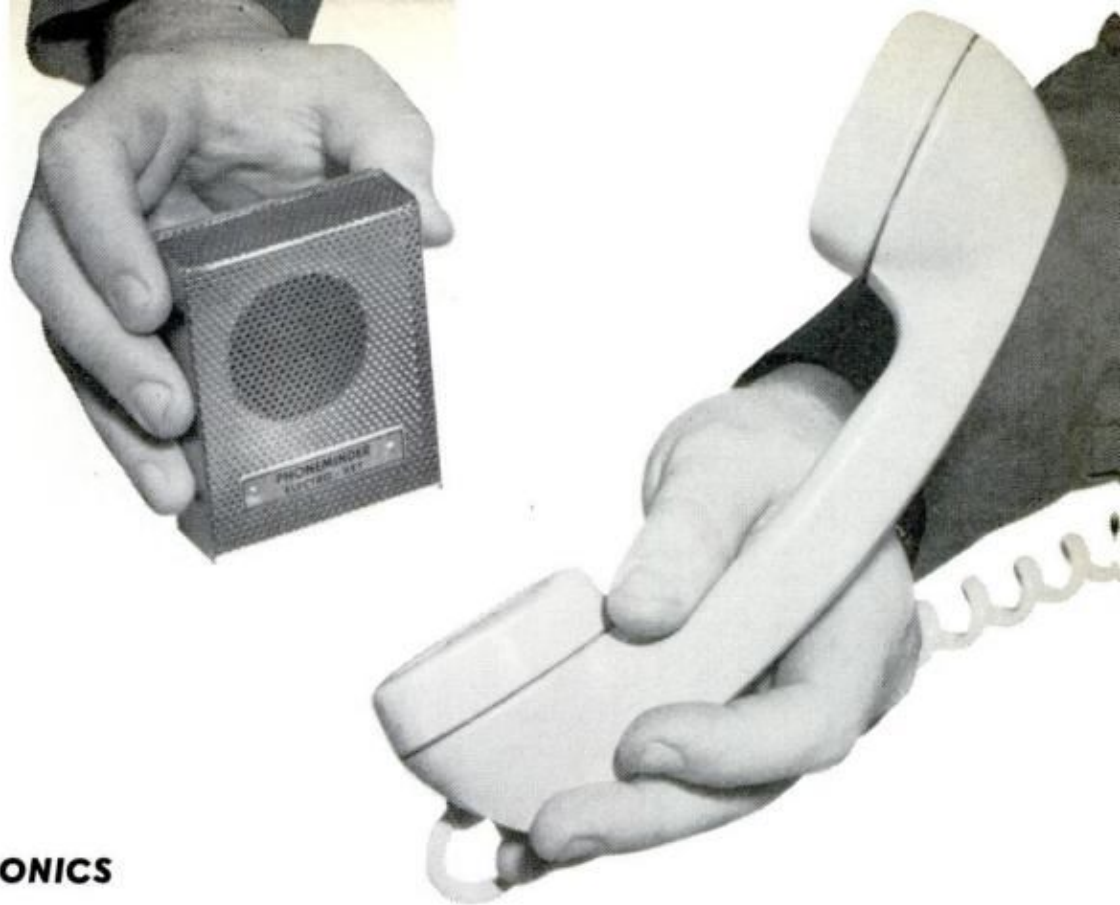
and use flathead wood screws (1½-inch, No. 8) spaced about 4 inches apart to fasten the panel in place.

This speaker system is carefully designed around and tuned to a particular set of speakers. Possibly, other speakers could be used, but the system would have to be redesigned to accommodate them. The sets of speakers are available for \$38 plus shipping from either Radio Shack (730 Commonwealth Ave., Boston 17, Mass.), stock number 40T1025E, or Lafayette Radio (111 Jericho Turnpike, Syosset, L.I., N. Y.), stock number (TS-271).

As far as speaker location goes, your best bet is try different placements in the particular room. In general a corner location will give the best bass, but not necessarily the best stereo. But no matter where you place the enclosure, you can be sure that for the money you spent you couldn't buy better sound. ★★★

WE FOUND that 44 holes made with a ⅜-inch bit, spaced out over the bottom of the cabinet, gave the best bass response. Try four rows of 11 holes





NEW IN ELECTRONICS

Electronic Girl Friday

TIED TO YOUR DESK by the telephone? You can be free and still receive your calls at the nearest phone for less than you spend on coffee and cigarettes.

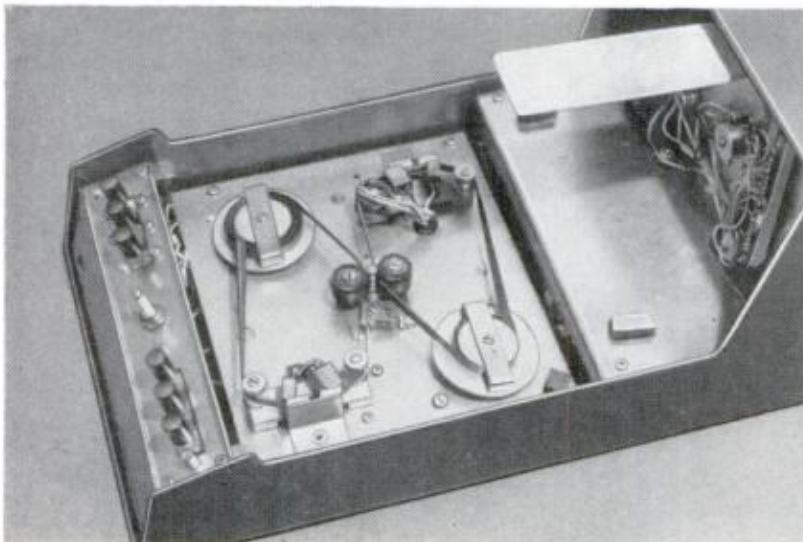
When you're out, the Phoneminder answers at the first ring. Callers hear your voice tell them you're out and to leave their name and phone number.

When you call, from any telephone, you put the Electro-Key against the mouth-

piece (photo, above) and push a small button. The "key" sends a special coded signal over the phone lines to your Phoneminder. This unlocks it and the recorder plays back all messages it has received.

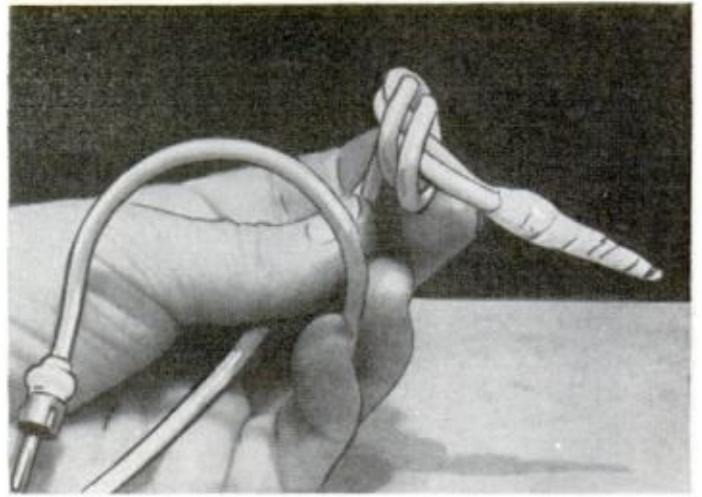
The device is completely portable and a salesman can take it with him on a trip from hotel to hotel. It's distributed by Phoneminder, 241-21C Braddock Ave., Bellerose, New York.

WITH THE COVER REMOVED (bottom left) you can see the two tape recorders that form the working heart of the Phoneminder. One plays back your message, the other records incoming calls. (Right) This unit is all ready to run

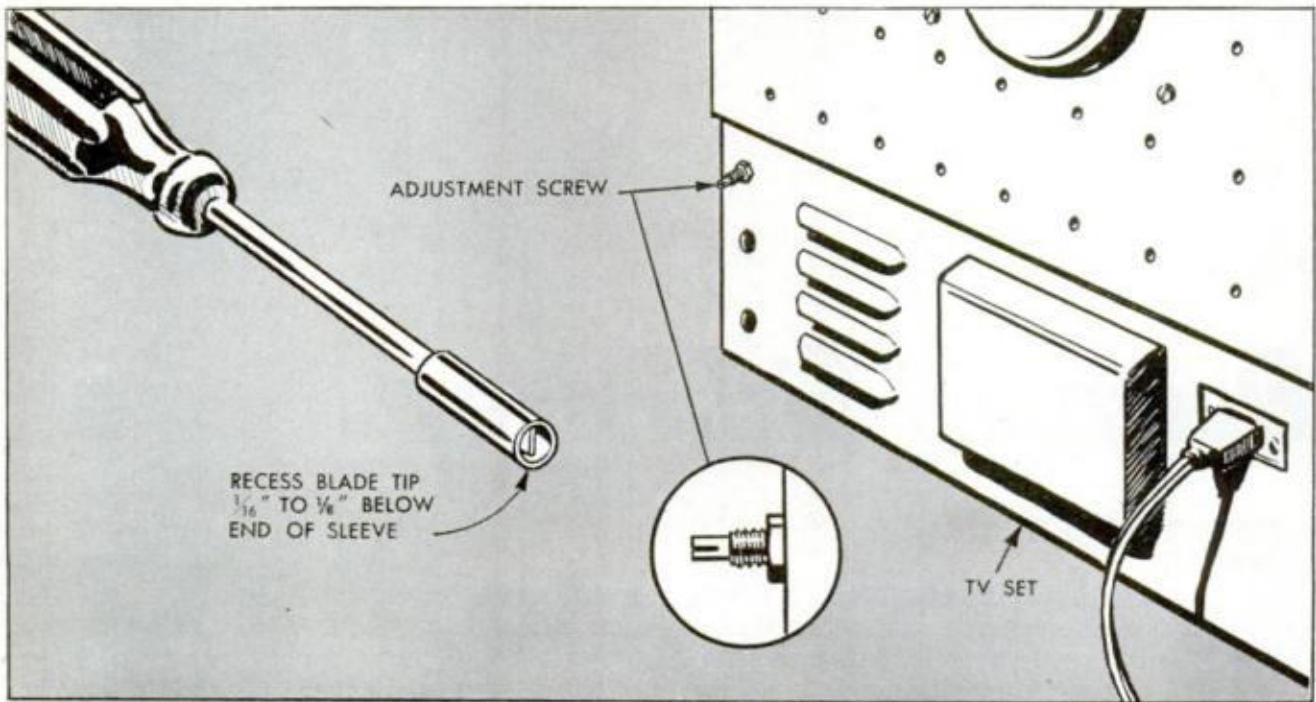


Electronic

KINKS

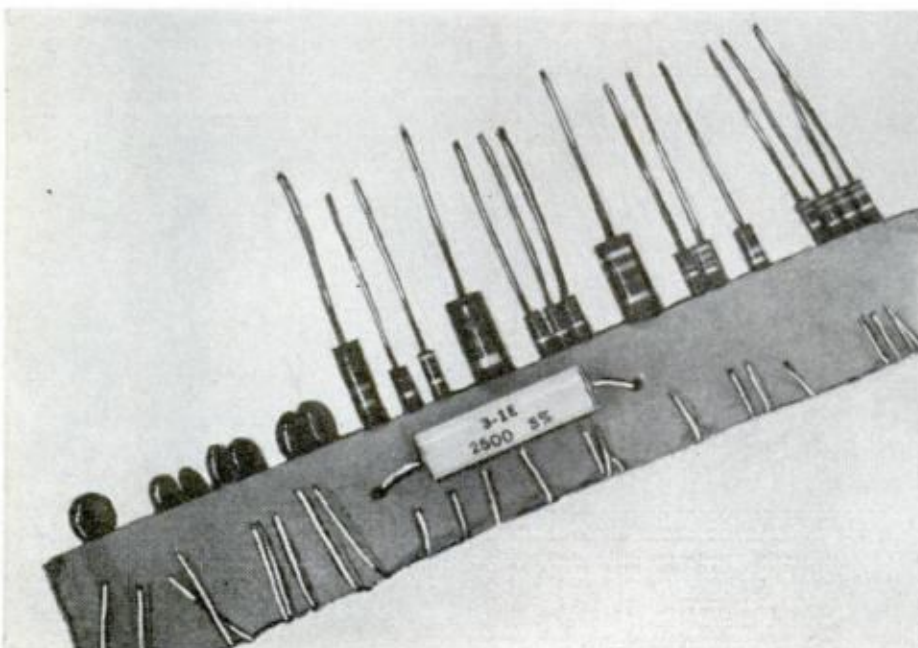


WIRING BREAKS AT SPLICES can be easily prevented if a bulky, rather unsightly joint is not objectionable. Just knot the wire an inch or two from the joint. Once this is done, pulling on either end of the wire will have no effect on the joint.—Glen F. Stillwell



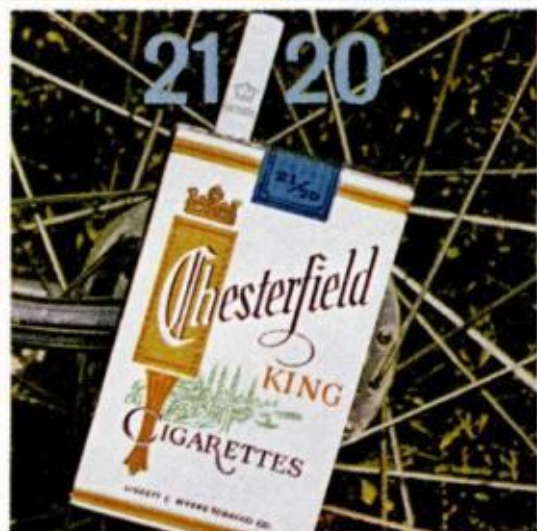
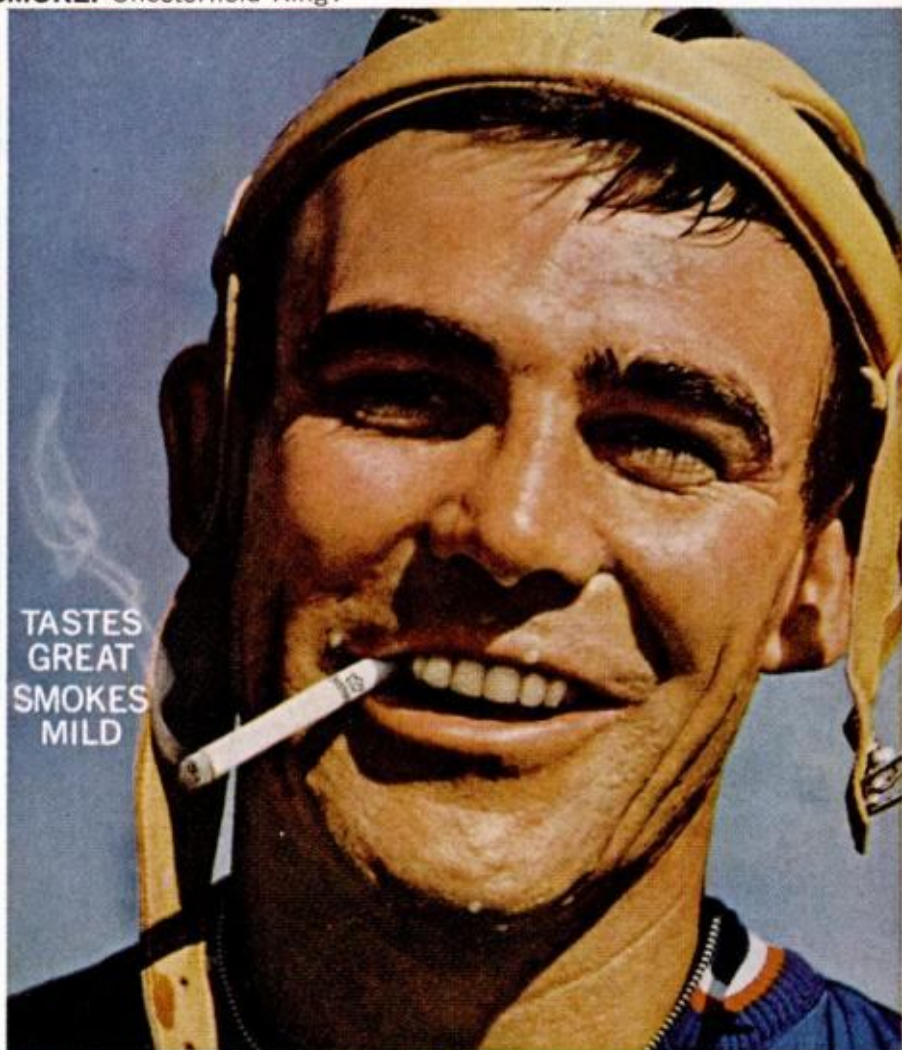
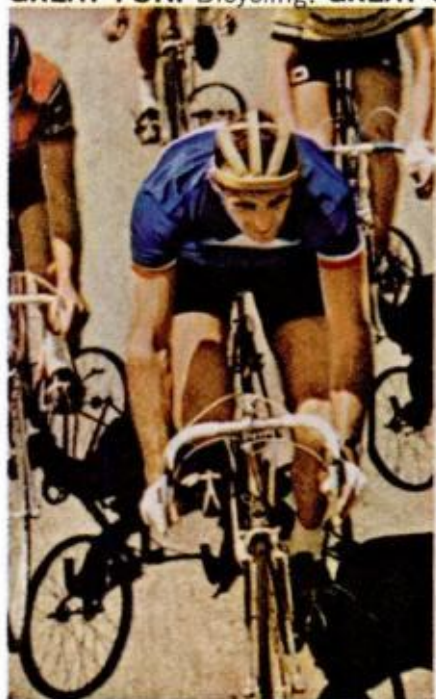
TURNING ADJUSTMENT SCREWS behind a TV receiver while watching the screen in a mirror can present quite a problem. That screwdriver just keeps dropping out of the adjustment screw notch. To

prevent this, try fitting a plastic sleeve over the blade of the screwdriver. It should keep it from slipping off the adjustment screw. The sleeve should extend at least $\frac{1}{8}$ to $\frac{1}{16}$ inch.—David Simpson



TAME KIT PARTS and keep them right where you need them with a small piece of corrugated cardboard. Use a strip $\frac{3}{4}$ -inch wide. Insert resistor and capacitor leads through the cardboard and bend them over slightly to secure them in place. Then you can pull a part free when ready for it.—Elmer Carlson

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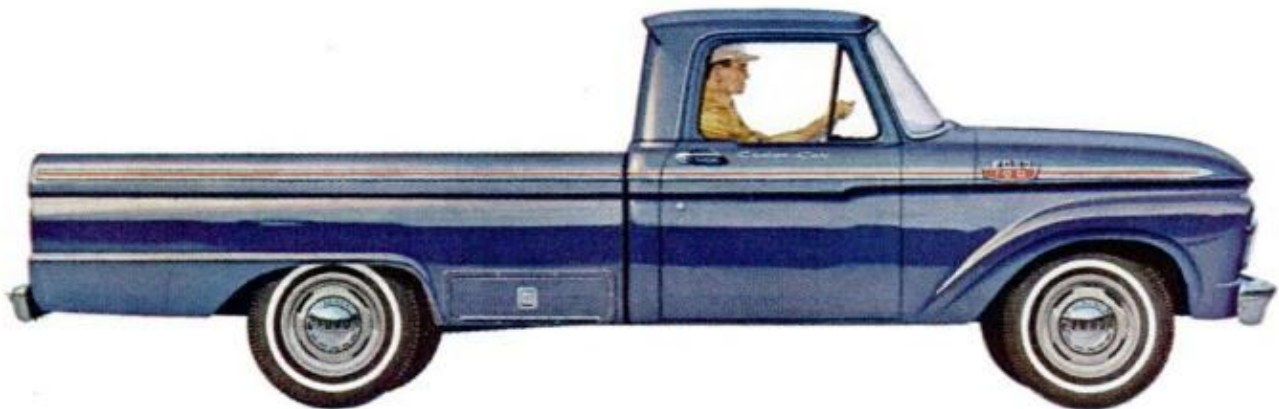


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'64 FORD PICKUPS

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Grinding Lathe Chisels

(Continued from page 185)

while pivoting the block.

Skew and spear-point chisels with compound-angle edges are best sharpened on the table saw because the arbor can be accurately tilted to the required angle. Replace the blade with a 6-in.-dia., 1/2-in.-thick 80-grit abrasive wheel, and true up the edge with a coarser piece of stone, as shown in the sketch on page 185.

3 To use the skew-chisel jig, slip the tool in either of the channels formed by the facing stock, and turn the wing-nuts tight. Tilt the abrasive wheel to a 15-degree angle and place the jig on the saw table parallel to the wheel with the bevel directly over it. Raise or lower the wheel until it just touches the chisel. Now clamp a straight-edge along the outer edge of the jig as shown in the photos. To grind, slide the jig back and forth across the face of the wheel. When it no longer makes contact, raise the wheel slightly and resume grinding. Be sure to cool the chisel occasionally by dipping it in water, or by applying water from a plastic squirt bottle. When you're satisfied with the first bevel, flip the chisel to the jig's other channel and repeat the process. Lower the wheel slightly before you start grinding this side. To determine when you've ground each side equally, measure the width of the bevels.

Setting the wheel at 15 degrees will give you an included double-bevel angle of 30 degrees; this is a compromise angle that handles both hard and soft wood. Some wood turners, however, prefer a 25-degree included angle for softwood, and 35 for hardwood. For these, adjust the tilt of the wheel to *half* the included angle desired. The 60-degree cant of the edge is automatically set by the jig.

4 The jig for spear-point chisels is used much the same way, except here you set the abrasive wheel at 30 degrees. And you don't, of course, flip the chisel over when you shift it to the second channel. Use a try square, as shown on page 185, to determine how much you must grind off each side to bring the point to the center of the blade. Centering the point can be quite a chore when you're grinding freehand, but you'll be surprised how this jig simplifies the job. And the beauty of all four of these jigs is that whenever you remove the tool to check the edge, you know that when you replace it for further grinding, it will position itself precisely as it was before.

When you've finished grinding, hone with an oilstone to remove the "feathering" for a razor-sharp edge. ★ ★ ★

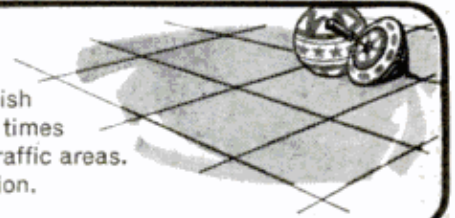
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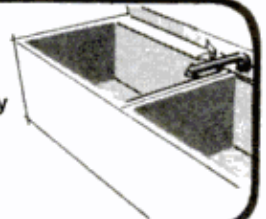
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Gemstone Carving Lore

(Continued from page 127)

have to get the stone."

This can be anything from free to very expensive. Jade can cost from 30 cents per pound to more than \$500 per karat. It also occurs in Wyoming and Alaska, and can be picked up for the finding in particular canyons and river beds.

"The important things are color and quality," Harvill points out. "Jade comes in innumerable colors, from black to white, including pastel shades of green, pink, grey, brown, yellow, blue and lavender. Special shades of green are the most costly, mainly because people like green."

Harvill is given a few of his stones by friends, but buys most of his raw material. He looks at jade of many price ranges in gem and mineral dealers' shops all over the country. Surprisingly, most of his best buys come from the less expensive grades. He looks for purity and intensity of color, and especially for uniformity of stone grain.

Large Rocks Not Needed

"You don't need large rocks for carving," he points out. "Buried in a big chunk of jade full of apparent color shifts and defects may be an area just perfect for a small piece."

That chunk might weigh as much as a small sack of potatoes and cost only a dollar per pound; the carving may weigh 10 ounces and be worth \$1000. Good surface indications, such as deep colors and compact grain structures, combined with a low price, sometimes make it worthwhile to buy a stone on speculation. Almost always there is an area of the stone which will make an excellent basis for a valuable carving.

"In the final analysis," Harvill points out, "you can go with a less expensive grade of jade if you have a suitable use for it. A well-done carving, in a stone of color and grain suited to the subject, is what makes the value. I always try to fit a stone to a subject, or, if I have a subject in mind, will wait for the right stone to come along."

When the stone does come along Harvill first makes a sketch of his subject. Then he rough cuts the stone to a broad outline with the diamond saw. This eliminates as much excess material as possible. Harvill says that the saw is the fastest and, consequently, the most dangerous tool to use. What it takes off cannot be replaced.

He does his actual carving with a dentist's drill salvaged from a junkyard. It is

operated by a foot-pedal control. His first cuts are made under a stream of water forced over the whirring bit from a tiny copper tube fastened over the hand-piece of the drill.

"You can cut faster, longer and safer under water," Harvill advises. "The spray keeps the stone from overheating and cracking or the work area from filling up with dust and debris."

Water Obscures Details

But from the rough outline stage onward, water is out. It obscures details, and the speed advantage no longer counts. Detail work must be done slowly. As the shape of the piece approaches completion, Harvill begins working with smaller and smaller bits, until finally he may be down to one as small as a needle point.

Most of the drill bits are home-made. They consist of a $\frac{3}{16}$ -in. stainless-steel shank, upon which is silver-soldered a bronze and diamond-dust compound cutting head. Making these heads is one of the trade's secrets. Harvill uses an oxy-acetylene torch; he squeezes the dust and bronze into a cake in a mold, then sinters (fuses) it together with the torch. There is no formula for the heat or time required to get best results.

"You have to make tests with each new mix of dust," Harvill says. "If you use too much heat you'll coke the diamond and turn it into useless powder. Too little, and there's no bonding for the cutting head. Keep the dust clean and as pure as possible, and the torch set as a reducing flame (low oxygen) at low temperature. Otherwise you'll turn the diamond dust to carbon dioxide."

Harvill makes his bits about $\frac{1}{4}$ -in. in diameter by $\frac{3}{16}$ -in. thick. Then he lets them wear down as the work progresses, so gradually he acquires the tiny bits needed for fine work without having to make them. Diamond bits are the only ones he works with, but both diamond and silicon-carbide bits are commercially available. The diamond models cost about \$23 each and last for approximately 200 carving hours.

Always Uses Magnifier

All the carving is done under a magnifier. It is necessary to use one to see what you're doing, but, warns the Texan, "It is also deceptive. Magnifier distortion can be misleading. I take my work out frequently to check on how it looks in normal perspective."

Harvill also offers these trade hints to would-be gem carvers: "It helps to have done some woodworking. The same prin-

(Please turn to page 202)



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Gemstone Carving Lore

(Continued from page 200)

ciples apply. Don't cut or carve up against the grain of the stone. Reverse the direction of the work or the drill so you're cutting downwards. Otherwise the work will begin to chip unevenly.

"Guard against overheating. Use slow drill speeds, light pressure and sharp tools.

"Start working on the surface forms. Don't undercut any features, such as bringing the head of a figure into full relief, until your work begins to stabilize and you're sure no imperfections are showing up to mar the piece. Once you undercut the feature it is stuck right there. If it's only in shallow relief you can shift it a bit.

"Leave details for the end; keep your progress as 'fluid' as possible, so it can be moved if necessary. For example, if you're doing a face, cut the nose wide. Narrow it down later, when you're sure the facial position is where you want it to be.

"Haste can lead to tremendous waste in gem carving. I'll never use a saw when a carborundum grinding wheel will do as well. They cost about 30 cents each, for a 1-in. diameter wheel, and I've used as many as eight dozen on a single piece. Sometimes they take hours to get to the same point that a saw could reach in minutes, but the time spent is cheaper than a ruinous overcut with a saw."

Time of Little Account

Time is of little account to Harvill in turning out his masterpieces. He spent 1100 working hours on the jade statue of the old man planting a tree. After half again that much time, he is still putting finishing touches on a 4500-karat ruby figure.

When he gets down to ultimate detailing, he still resorts to hand techniques: the sand cloth for smoothing, or loose grit and a bamboo splinter to rub in and finish the really tight corners.

"You can never have too many tools," he concluded. "I use up nearly \$500 worth on the big pieces. But given enough time you can do any piece with the simplest tools in the world."

Harvill hasn't attempted to "hard sell" his work. He has carved most of his gems in his spare time; the welding business provides his income. But now, he feels, he has to make up his mind to change.

"It isn't enough just to carve these pieces. People have to see them. I guess I'm about to become a professional artist."

It's a good guess that he already is exactly that. ★★★

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Q Late last fall I moved into my new home which is built throughout with aluminum windows. With every change from cold to warm and warm to cold these windows pop and crack most annoyingly, due, I suppose, to contraction and expansion of the metal. The sashes also sweat, the water running down the frames onto the sills and dripping to the floor. Is there any way to overcome the noise and the sweating?—G.B., Pa.

A You do not say whether the windows are fitted with storm inserts. If not, then of course condensate tends to form on the metal sash frames (and possibly the panes) due to the metal being much colder than the air with which it is in contact on the room side. Installation of storm inserts will tend to minimize this, also may help to reduce noise due to expansion and contraction of the metal during wide variations in temperature. There is no immediate simple and practical solution to this latter problem, although in time it usually tends to correct itself.

Q I have a 6 x 9-ft. woven fiber rug, one side of which is painted with a design. Although worn some and quite old, the rug appears to be still in useable condition. I'd thought of painting the reverse (bottom) side but I'm told that when the paint dries the fibers will shrink and cause the rug to wrinkle and pull out of shape. Would this be true?—L.F., Ga.

A If the weaving is still intact, that is, none of the fibers broken or otherwise damaged we see no reason why the rug cannot be painted as you suggest. But we would forewarn you that it's going to take a thorough cleaning and a lot of paint to attain a satisfactory result. Go over the bottom surface first with a scrubbing brush, working with the lay of the fiber to loosen the dirt. Then vacuum the surface to pick up all the loosened material. In both procedures be careful not to tear or wear down the fibers unduly. Then wash the surface with a mild soapy solution and allow to dry for several days, or until the fibers are thoroughly dry. This is important as otherwise you may have trouble with the paint not adhering properly. Although you can use any semi-

gloss enamel in the color desired (you should use one of the darker colors) you probably will get the longest service from a porch or deck enamel. Apply the enamel with a full brush and keep the coating brushed out to a uniform thickness. The job will require at least two coats.

Q What can I do to clean natural patio flagstones? My patio is floored with natural flat stones and they are discolored with ground-in dirt and something that looks like moss, the latter apparently impossible to remove by any ordinary means.—H.L., Mich.

A If, as you say, the discoloration is several seasons old, then it's going to take some doing to get the stones bright and clean again. Perhaps the best way is to hose the whole area thoroughly, preferably in the evening, and then sprinkle the whole area uniformly with dry soda concentrate. Allow to stand overnight then go over the stones with a broom or better, a stiff-bristle scrubbing brush. Hose off the area and repeat as necessary. If grass grows at the edges of the patio area then it will be necessary to mop up the wet sludge after scrubbing. Don't hose it off into the grass. Wear rubber gloves when cleaning up the sludge. Protect your eyes from spatters.

Q Somehow water is leaking into my steam-heating system making it necessary to withdraw two pails of excess every 48 hrs., or so. My plumber has checked the inlet valve, says it is in good condition. He thinks water is leaking slowly into the boiler through the hot-water coil and recommends that a new coil be installed. Is he right in this assumption, or is there some other possibility?—J.P., Minn.

A It would be difficult for us to say at such long range whether your plumber is correct in his assumption of the cause of the trouble. But we would be inclined to agree with him that a leak through the coil is a possibility. If yours is an older installation, and your description indicates that it is, then we think the coil should be investigated and probably replaced. In this we are assuming that the inlet valve does not leak. We still wonder about the valve, as sometimes a valve can appear to be in good condition and still permit a slow, "drop-by-drop" leak, enough to cause the trouble you describe. Before you replace the coil it might be a good idea to have the valve repacked or replaced and then check results.

MARCH 1964

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Why Lasers Don't—Yet

(Continued from page 106)

pletely outclassed by time of publication. Ruby lasers are expected before long to reach a power range of a billion watts.

Three general classes of lasers are recognized, although this could easily change due to new developments:

- **Solid-state lasers** (light-pumped) were the first to be developed. Usually of ruby, the most recent ones have been made of glass and plastics. The first laser, made by Theodore H. Maiman, then with the Hughes Aircraft Company, consisted of a synthetic ruby rod about a half-inch in diameter and several inches long. The energy source was a helical electronic flash tube. The pulsed beam of the solid-state laser is now used in industry for micro-welding chores. One of its most promising future applications lies in the field of radar for range-finding—both on earth and in space.

- **Gas lasers** of neon-helium, which emit a continuous beam, are used by the National Bureau of Standards to determine standards of length, replacing the Krypton tube and the platinum bar. Tested over a 610-foot course, a helium-neon laser provided measurements accurate to one part in 200 million. The bureau also plans to use this laser to calibrate surveying tapes.

- **Injection lasers**, simultaneously developed by General Electric and International Business Machines, show most promise as a data-transmitting or communications medium. The active material in these diode lasers is a crystal of gallium arsenide phosphide almost too small to be seen. One region of the material contains impurities that create an *n* (negative) zone, containing an excess of electrons; the other region, a *p* zone (positive), shows a deficiency of electrons.

Direct current is applied across the junction between the two regions causing electrons from the *n* zone to move across to the *p* zone, releasing photons of energy in the process. The device "lases" along the junction toward the polished ends of the laser.

One of the newest applications of laser techniques, photography without the use of a lens, was recently announced by two engineers at the University of Michigan, Emmett N. Leith and Juris Upatnieks. While the concept sounds simple (all that is needed apparently is a mirror, photographic film and a holder, plus a gas laser), it's not likely to become part of the average amateur's darkroom for years to come—if ever. At present, it can be used only in a laboratory.

The new technique has two steps. First, the laser light is trained through a transparent object, such as a photographic negative, a color slide or a microscopic slide; a portion of the laser beam is directed around the object with mirrors. All of this laser light is trained on a lensless camerallike device which contains ordinary film. The resulting exposed film (negative) is an unrecognizable blur.

Second, the negative is then placed in a lensless projector and a laser beam trained on it. A screen or a piece of light-sensitive paper placed at a precise distance from the projector picks up the laser beam and reproduces a sharp, clear, magnified picture of the object.

The lensless photography technique may eventually result in sharp, well-defined X rays or better enlargements of ordinary photos; it will be used in such instruments as microscopes, both light and electron, for studies of individual molecules.

Bullet Photography

Lasers have also been successfully used in conventional photographic techniques. Three physicists at the University of Tokyo, for instance, make multiple photos of bullets in flight with laser light bursts. The technique is simple and they use ordinary cameras ([see drawing, page 104](#)).

Open aluminum-foil "sandwiches" are placed in the bullet's path to act as switches; a bullet tip hitting a foil pair closes the circuit which triggers a flash lamp. This stimulates the ruby to fire. Any number of exposures of the speeding bullet can be obtained by increasing the number of foil switches used.

Such scientists as Dr. Schawlow see communications as possibly the richest potential field for laser application. For one thing, it will be filling a need that will soon be imperative. Present communications facilities are rapidly approaching saturation point, due in part to the increasing use of telephone lines to transmit electronic computer data; satellite communications will also increase the pressure.

Experts expect message loads to double within a decade. Radio and TV frequencies are already crowded. The best transatlantic cable can handle only 100 simultaneous calls. Theoretically, it's possible for one single laser beam to carry 100 billion telephone calls at one time.

But theory is far from application. The laser beam won't take over the communications load overnight. Low-energy laser beams are limited by such things as fog, rain and clouds; and, they won't bend, meaning that relay stations will have to dot every horizon. The most talked-of

(Please turn to page 208)

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Why Lasers Don't—Yet

(Continued from page 206)

solution is to develop special vacuum pipes for underground transmission, using mirrors to bend the beams.

Modulation—or the hookup of data with the laser beam—is another problem. In radio circuitry, this is easily done with the vacuum-tube transmitter, which is electrically modulated to vary either the power or frequency of the carrier wave. At the receiver end, the data is converted back into usable form with a superheterodyne circuit.

Modulating a light beam will be difficult but scores of laboratories are concentrating on a solution. A semiconductor laser can be electrically modulated by changing the direct current which activates it, but this laser is still too low-powered to be efficient. Other plans call for modulating the beam as it leaves the laser by passing it through certain crystals. A special magnetic field can also be used to modulate crystal lasers.

How Efficient Are Lasers?

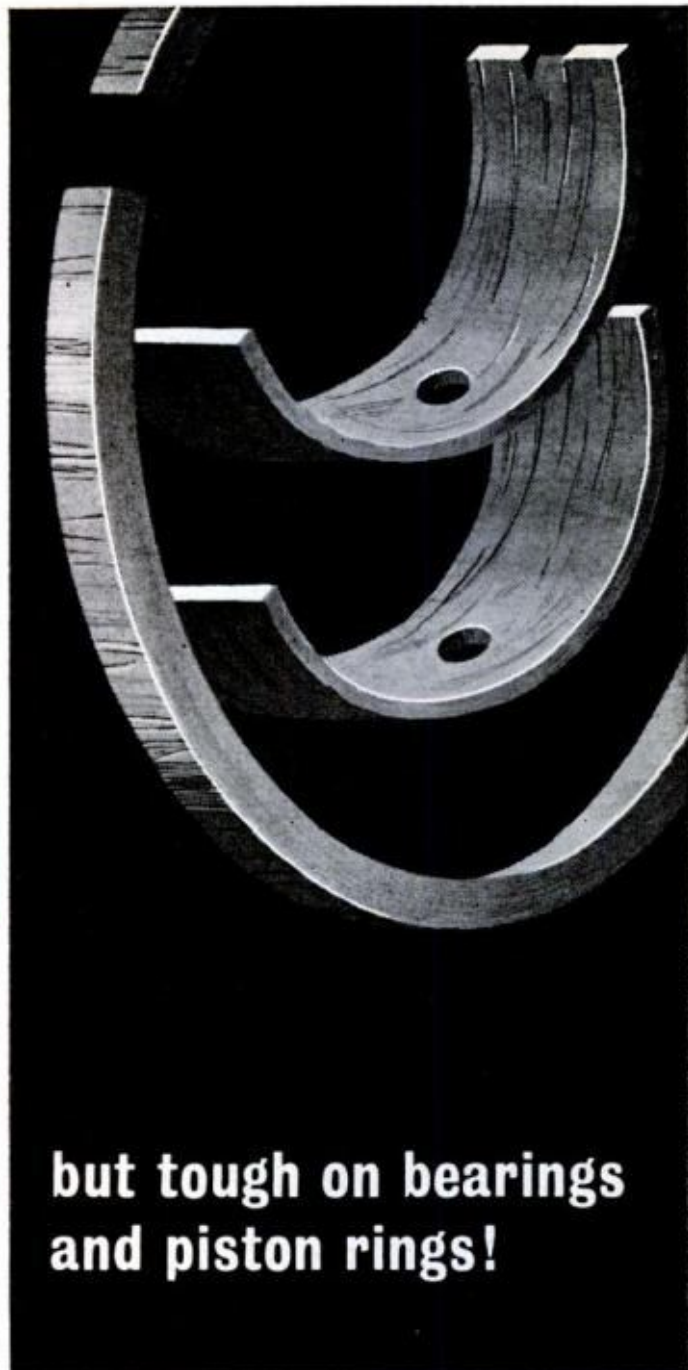
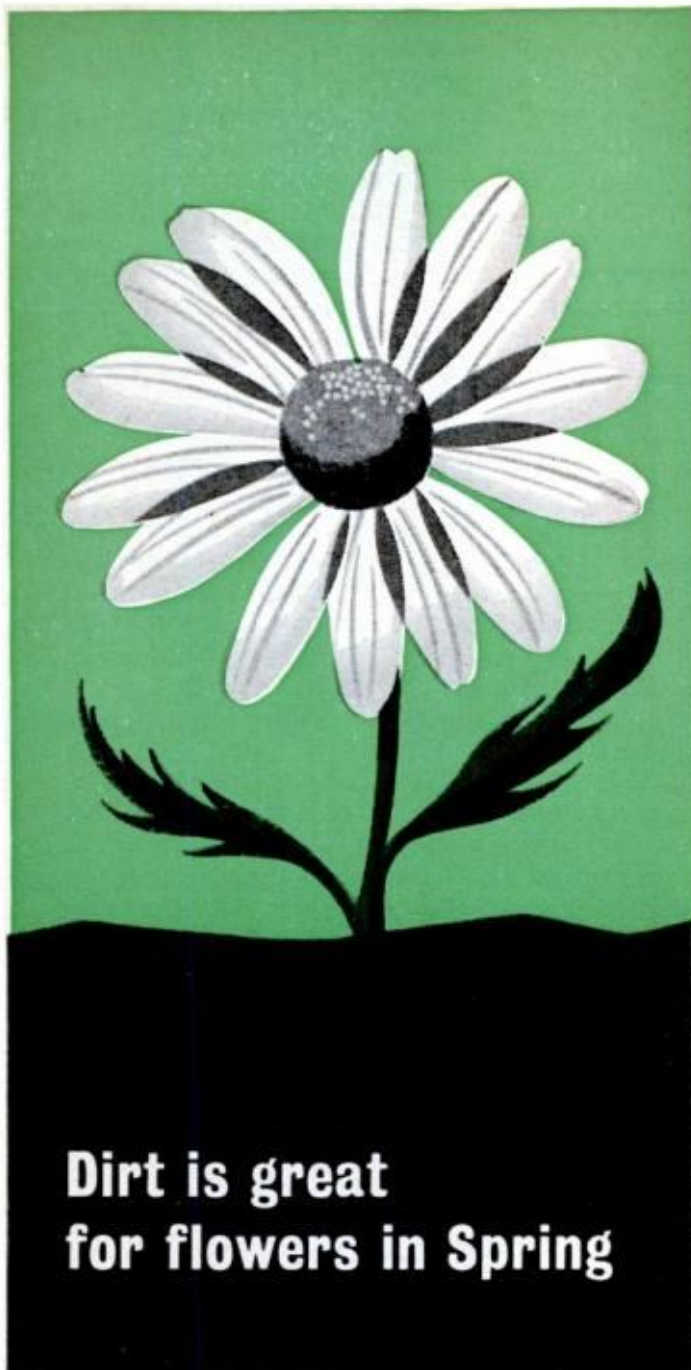
Laser efficiency, or the full transformation of the power source into coherent output, has been a major problem. Gas and crystal lasers heretofore have achieved about one percent efficiency. But gallium arsenide lasers have been boosted to 30 percent use of their electrical input, and scientists at Sperry Gyroscope have reached nearly 50 percent efficiency. They say that 85 percent efficiencies "are very close to reality."

The first radar to use light waves instead of radio waves was built at Hughes Aircraft Company. The seven-mile-range laser-radar beams its red light in pulses which are reflected into a telescope-linked photo-tube. As in conventional radar, distance is measured as time from transmission to bounce and back.


This early model led directly to other devices, including a portable laser-range finder and to artillery range finders. The most dramatic stunt performed by laser-radar came when M.I.T. engineers sent a needle of red light shooting at the moon. The thin beam covered an area only two miles wide; the narrowest microwave beam would spread over an area several hundred miles wide. Precise mapping of the moon from earth by laser-radar may yet become feasible.

This ability is due to the minuteness of light wavelengths; radio waves are tenths of a mile long while light waves are measured in millionths of an inch. Radio frequencies come in millionths of a second,

(Please turn to page 210)



AC filters will help keep the dirt out of your engine

Even a little dirt in your engine can chew into precision parts and lead to costly repair bills. After a winter's driving, there is certain to be dirt in your engine—especially if the oil filter hasn't been changed. Since fall your crankcase has likely digested 6½ gallons of gasoline, 2 gallons of water, a pound of lead salts and organic sludge and 4 grams of wear debris. The only way to clean up after winter is by changing the oil and filter, too. While you are at it, make sure you give your engine complete AC protection . . . install new AC Air and Gas Filters, as well. AC's complete filtration will make your engine run clean all season. AC SPARK PLUG  THE ELECTRONICS DIVISION OF GENERAL MOTORS


**OIL-AIR-
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Why Lasers Don't—Yet

(Continued from page 208)

light frequencies trillionths of a second.

A laser radar using Doppler principles (that is, frequencies vary according to whether an object is coming or going) has been built by Sperry which measures motion or speed 10,000 times more accurately than the best conventional Doppler-radar. It measures changes in speed from miles per second to thousandths of an inch per second and is the forerunner of devices that will be used in missile guidance and satellite rendezvous.

Sperry engineers have also built a "ring" laser which shows promise as an automatic guidance device in spacecraft. Its developers say it is "simpler, cheaper to produce, more stable and sensitive than present navigation systems which rely on the 'inertial' sense of a gyro."

The ring laser consists of four gas lasers arranged in a square. Two thin light beams travel around the ring in opposite directions. Photo-detectors constantly compare the frequencies of the beams. If the device is rotated, it produces the Doppler effect in the frequencies of the beams; that is, beams traveling in the direction of rotation crowd together and beams going in

the opposite direction stretch out. Detectors would record the difference and call for corrective action on the part of a spacecraft or submarine.

The ring laser has an accuracy of a fifteen-thousandth of a degree on the compass. This is the closest man has come yet to the perfect guidance device. If left undisturbed, the ring laser registers a frequency difference of 40 cycles per second, caused by the earth's rotation of about a sixth of a degree per minute!

An optical radar using a laser is being installed at Cape Kennedy and at the Goddard Space Flight Center. At the cape it will be used for precision missile tracking at ranges up to 50,000 feet, too close for conventional radar. At Goddard the laser system will be used, in clear weather, to optically track satellites. Pulses from a ruby laser will bounce off the satellite and be picked up by a photomultiplier.

But perhaps we'll have to wait until men get into space to see the laser really come into its own. It'll not only be used as a long-range (millions of miles) communications channel, but may also be put to work to carry power directly from earth to manned stations on other planets. In the vacuum of space, at least, there are no horizons to get around. ★★★

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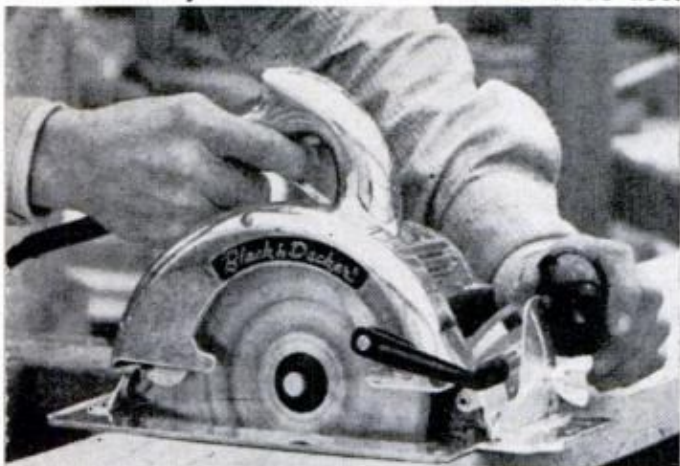
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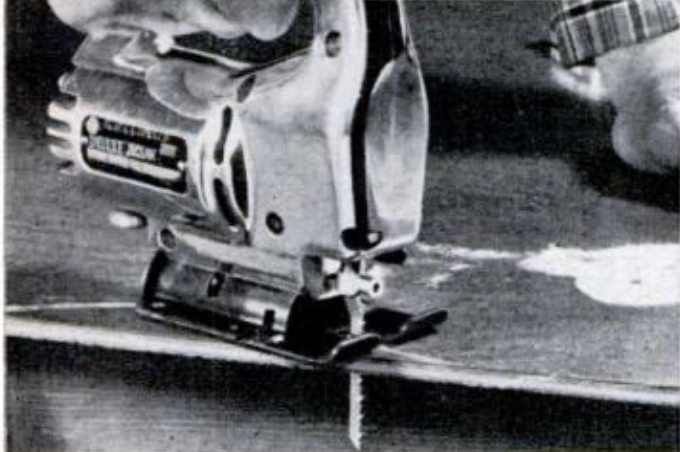


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Boating '64

(Continued from page 140)

There hasn't really been enough time to see how this will affect the pre-mix market. Any mixing, no matter what the proportions, is an inconvenience. Also, pre-mixes have a quality edge over mix-it-yourself fuel, since the gas and oil are homogenized into a stable, nonseparating mixture. Thus, it's doubtful whether the new ratios will have much effect on the pre-mix people, except for requiring them to add a couple of extra pumps for mixes to these new proportions.

Most of the inboard-outdrive units are powered by four-cycle engines, and their fuel is pumped from a gasoline tank; their lubrication from a crankcase sump. But there are exceptions.

West Bend's Shark-O-Matic is a standard two-cycle which burns an oil-gas mixture. OMC's 488 is a two-cycle, too, but it stores the oil and gasoline in separate tanks, and by means of a metering system, mixes them as they flow to the powerhead. This is a step in the right direction. Ideally, of course, outboards would end up with a direct oiling, or perhaps with some variation of the four-cycle principle.

But meanwhile, over at the pump factory, a bunch of guys are all primed and ready to knock the props out from under the whole shebang—inboards, outboards, outdrives and all. "We're living in the jet age," they say, "and you'd better get to know it. Hydro-jets, that is."

As everybody knows, marine jet propulsion has been around for quite a while now, so the jet itself isn't really news any more. What is new is the wildfire spread of this system throughout the industry.

A number of well-established companies are building jet-drives—Berkeley, Starfire, Parsons and Jacuzzi, for example—and some of these also build jet boats. In '64, however, many major boat companies are getting into the act. Dorsett, Lone Star, Glastron, Gaspar, Valco, Fleetcraft, Grafton and Chris-Craft all have jets.

In the specialty boats, you can get jet drive on Stevens, for instance, and on all-out water-rattlers like Raysoncraft. You can even jet-it-yourself with a frame kit or plans from Glen L. Marine Designs, and plans are still available for that dandy modified-Garvy hull designed for jet propulsion that *PM* brought out in 1962.

But even with all these winds of change blowing up a storm in pleasure boating, there are still a few islands of stability.

Small boats, 15 feet and under, continue to command 60 percent of the total market. Most of these have one sharp bow in front

(Please turn to page 214)



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Boating '64

(Continued from page 212)

and one square transom in back, and some of them even have oarlocks. As long as several million Americans go fishing, these boats are not likely to change a great deal.

In the same vein, outboards under 20 hp. still hold over 40 percent of the market, and this slice remains fairly consistent though the big motors grow bigger.

Specialty Craft

Specialty boats, like the ski boats, won't change until someone finds a good reason for it, so the SK shape stays basically the same, with a needle-nosed shallow-vee forward section and a big flat planing area aft. Only the horsepower changes. It keeps going up—sometimes to 900, via hop-up alterations plus nitro-methane.

Float boats, open-deck boats and houseboats are growing in number, but in spite of the presence of a few relatively hot planers in this category, most of them hew closely to tradition. They're big, slow, always stable, always fun.

So what's ahead? Well, in outboards, the little ones will probably get even more compact and lighter without losing power. And the big ones may pack in even more horsepower.

Carl Kiekhaefer, who makes the most powerful transom-hanger in the business, isn't about to concede that 100 hp. is necessarily the top figure for outboards. As long as boaters continue to buy pairs of 100's to mount on a single transom, he points out reasonably, why stop?

As for boats, here's the opinion of naval architect David Beach, one of the nation's foremost specialists in small-boat design:

"Trends are things of the imagination—we see them today, and they're gone tomorrow. But a design for a 16-footer that's on my drawing board right now may indicate one that's real: that a single hull may be the basis for many models, just as with cars. This one will make two distinct boats—one with a stripped, stark deck, the other with a really jazzed-up deck and interior.

"And maybe that's another trend: that good boats will get lusher, and utility boats will get simpler."

Johnson and Evinrude, among others, have already committed themselves to this variations-on-a-theme trend. Each uses only one basic hull for open sports models, and both lush and stripped runabouts.

Today it's the tricky bottoms and way-out styling that seem to sell boats, just as it's the infinite options and combinations that seem to sell power. ★★★

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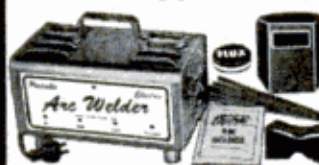
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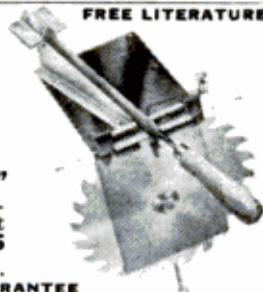
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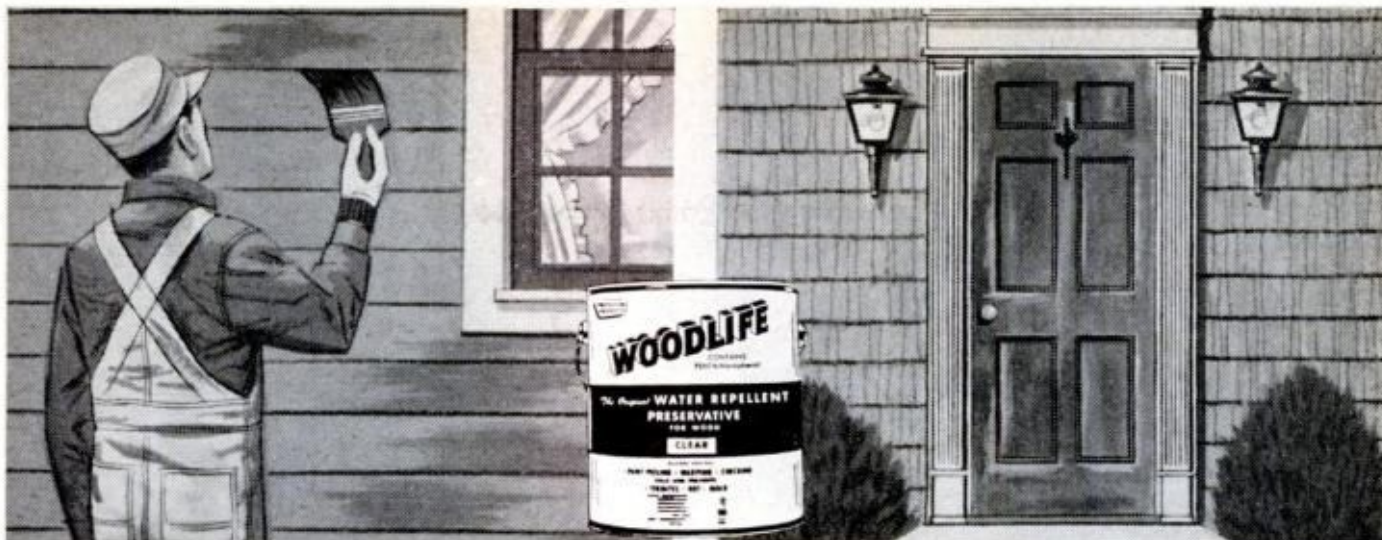
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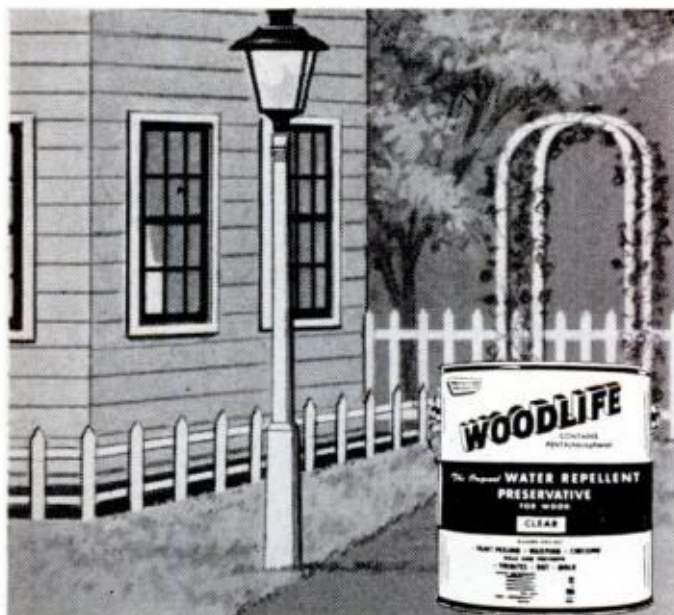
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Protect wood in or near the ground. Here, the problem is not only moisture, but also fungi and insects. Woodlife contains chlorinated phenols which do a superior job of protecting against fungi which cause rot and stain and against termites and other insects. Dip ends of lawn lamp posts or fence posts in Woodlife for 2 or 3 hours. Dip garden stakes or ends of trellises 15 to 30 minutes. Treat any outdoor wood that touches the ground.

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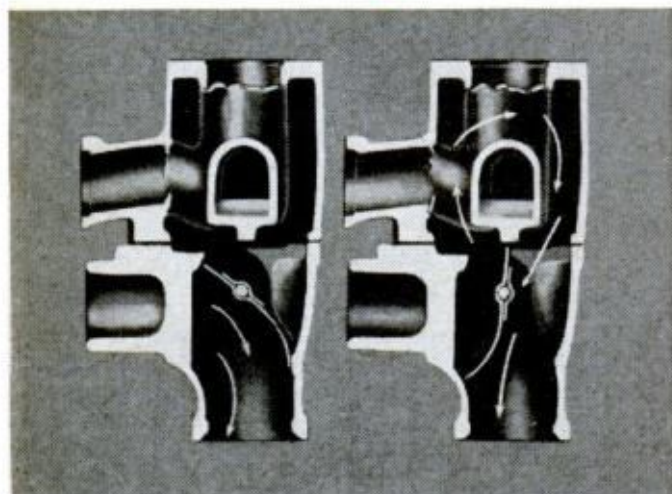
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QUAKER STATE OIL REFINING CORP., OIL CITY, PA.

Shot Down by an American Jet

(Continued from page 113)

ing the fighter, climb at full power to 35,000 feet.

Art waited almost a minute, then opened his mike. "Black Leader," he said, imitating the ground controller, "go port to zero seven five." The fighter would discover soon that he had been had. Meantime, though, we'd gain more precious time.

Soon, an indicator in front of Art signalled that the fighter radar was on us. Then came my big moment. "Throw out some chaff," said Art. My performance was flawless. I turned on the two switches he had shown me earlier. Two yellow lights above them started to blink. Each flash meant another package ejected. At the same time, Art was working the jamming equipment.

Our electronics barrage and aluminum smoke screen must have done some good. Nothing happened for a couple of minutes. But then the interceptor got close enough to "burn through" our defense. The indicator panel showed he was locked in again. We couldn't shake him. "I hope that guy on the ground has told him we're friends," I thought.

A minute or so later, we knew the word has been passed. First, we were still flying. And second, an F-101 pulled in just over our right wing, about a hundred feet away. We didn't know exactly when it had happened, but we knew then for sure we had been shot down. The fighter that had done the job was pulling alongside to show that there were no hard feelings.

I learned later that the other planes in our squadron had all been blasted out of the sky, too. The closest one got about a hundred miles from his target.

After we were shot down, Art turned the ship north, flew up the coast, over Rhode Island, then east over Connecticut to Stewart. It was still a beautiful day. From about 40,000 feet, we thought we could make out the hazy outlines of New York City and Boston at the same time.

For an hour or more, I had been so caught up in our battle with the United States that I could almost believe it was real. Now, flying above the countryside again, the whole thing began to take on the familiar dreamlike quality.

I leaned back and enjoyed the ride. Art seemed contented, too. As he greased the wheels onto the runway just after five o'clock, it occurred to me that the men of the friendly enemies must take a great satisfaction in their almost daily defeats. What would really upset them would be victory. Because if they could get through, so could others. ★ ★ ★

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PM's Sports Sled

(Continued from page 152)

removing enough wood from each member so that the batten contacts each one fully. Basically, it's a trial-and-error process—put the batten in place, shave away a little wood from the surface and check the fit.

It may be necessary to remove screws from some members to make possible adequate fairing. In such cases, simply re-drill and refasten after fairing. Filler pieces must be attached along the center keelson and on the stem plate between the ends of the bottom framing members. Mount these with glue and 1-in. wire nails when you are satisfied with the fairing; however, during the actual fairing operation they will be easier to shape if you simply clamp them in place.

Planking the hull is simplicity itself. The butt joints shown in the photos on p. 151 and in Fig. 2 should be backed with $\frac{3}{4}$ x 2½-in. plywood butt straps; fasten these to the planking with glue and 1¼-in. No. 8 screws spaced 1½ in. apart. Use glue and 1¼-in. No. 13 ring nails to secure the planking to the frame, spacing them 2½ in. apart along the transom.

To avoid error, make a corrugated cardboard pattern of the planking sheets on

either side of the center keelson in the forward tunnel portion. Then transfer the outline to the plywood.

Once the bottom and side planking has been installed, you can mount the outer transom beam. Then, before turning the hull right side up, seal all seams (including planking butt joints) with 3-in. fiberglass tape and resin. When the resin has cured, you may sand and paint the bottom. However, for an extra rugged hull which will be easier to maintain, it's recommended that you fiberglass the entire hull.

On the pilot model, we stretched a cotton mason's cord down the center of the tunnel over the glass cloth and impregnated it heavily with resin to protect this joint. As you have probably guessed, the tunnel joint takes the most stress on this type of hull.

With the hull turned right side up, you are ready to install the interior framing.

Note that the center keelson is braced with short lengths of 2 x 4 cut to fit snugly between the frames, Fig. 4. After installing these, coat the contacting surface of the side molding and hull with glue, clamp these in place and secure them with 1½-in. No. 8 screws spaced 6 in. apart.

The motor well is next, Figs. 2 and 4.

(Please turn to page 222)

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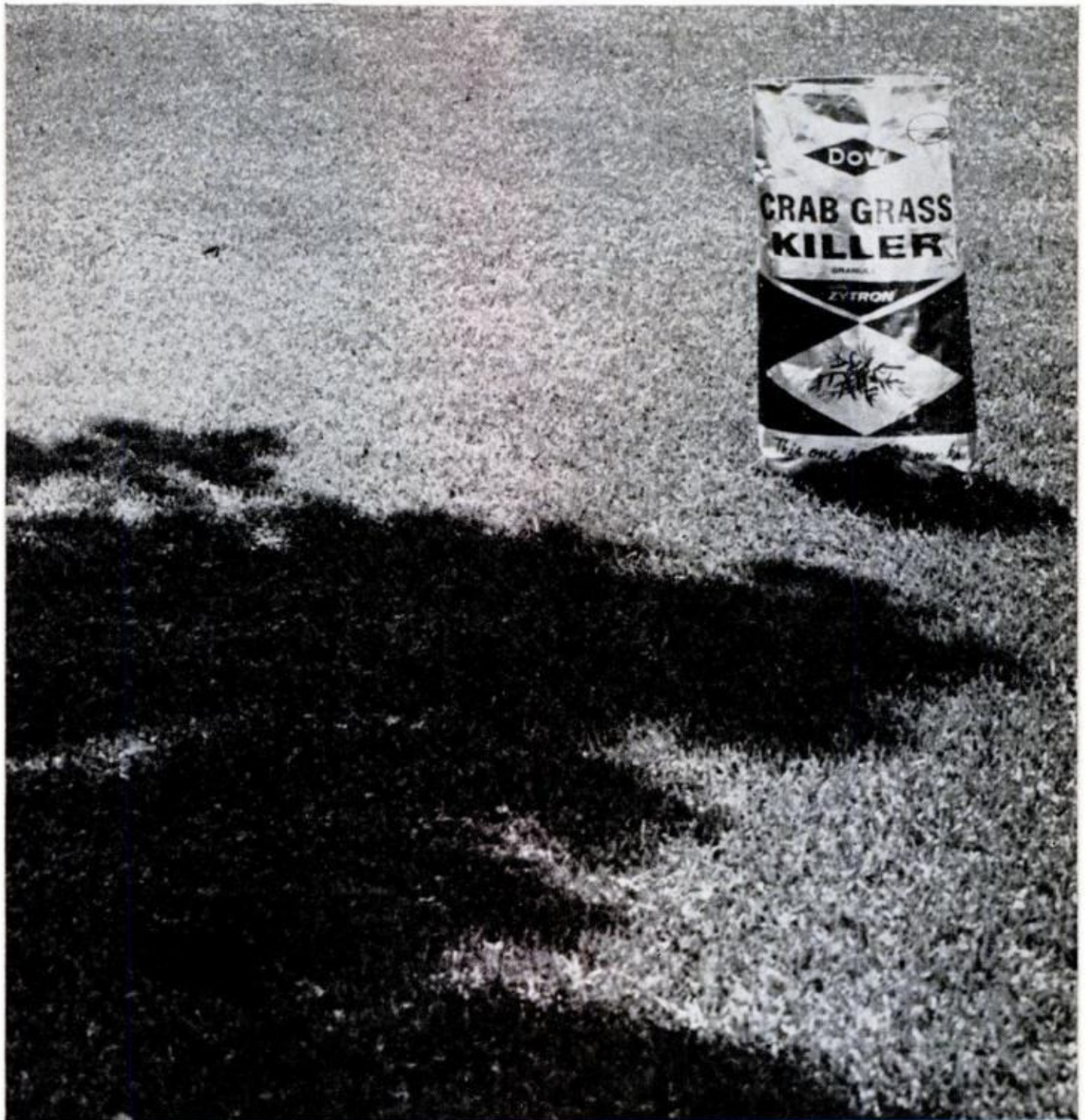
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With not a sign of crabgrass.

Beautiful.

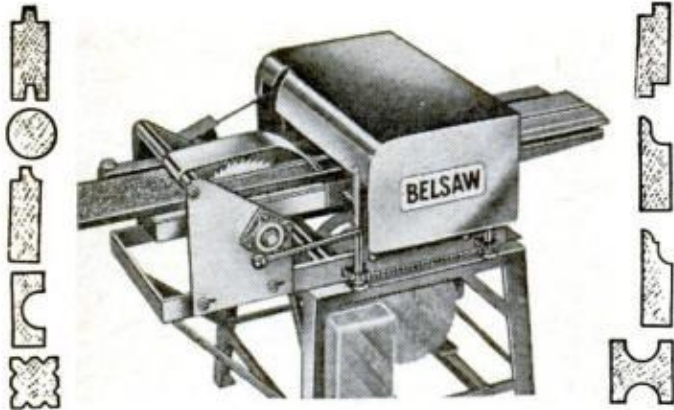
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PM's Sports Sled

(Continued from page 220)

After notching the well beam for the deck battens, attach the gussets with glue and five 1½-in. No. 8 screws per gusset, then secure this assembly inside the hull by driving three of the same size screws from the outside of the hull into the gussets on each side. Cut the two well sides from a 4-ft. length of 1 x 12 and mount these between the beam and the transom with 2-in. No. 10 screws. To complete the well, cut out the ¾-in. plywood bottom and fasten it to the transom beam, sides and well beam with 1¼-in. nails and glue. Avoid leaks by sealing all well seams with fiberglass tape and resin.

The deck battens extend from the well beam to frame 1 and outline the cockpit. Attach them with one 2-in. No. 10 screw per joint. The fore-deck battens are notched into the upper beam of frame 1 and bevelled to fit against the stem plate and sheer battens. Use 1½-in. No. 8 screws to secure them.

Fair the deck framing as you did the bottom, and follow the same procedure for applying the planking. The plywood floor panels, notched to fit around the side frames so as to reach all the way out to the inner surface of the side planking, must be supported by two floor battens mounted over the two outer keelsons. These run between the transom and frame 2.

Since the center keelson rises above the level of the main floor between frames 1 and 2, this part of the floor is elevated slightly to form a step, Figs. 2 and 4. To secure the 2 x 4 step beam, drive two 3-in. No. 12 screws through the side planking and into the end grain of this beam. The fore end of the step flooring rests on the 1 x 2 doubler mounted on frame 2.

While it wasn't absolutely necessary, we added 12 cu. ft. of foam-in-place urethane foam flotation under the floor and ahead of frame 1 to provide additional structural strength. This increases the rigidity of the hull and its ability to withstand the tremendous pounding experienced in extremely rough water.

Once you have put down the cockpit floor, the basic hull is complete and ready for finishing. The box-construction seats and console may be installed and finished later. As you can see from the photo on the cover, we used a red-and-white color scheme and covered the fore deck with a white marine vinyl (Nautolex, Du Pont or similar). For safety, we used a non-skid paint on the cockpit floor.

The "trim" aspects of the boat are best

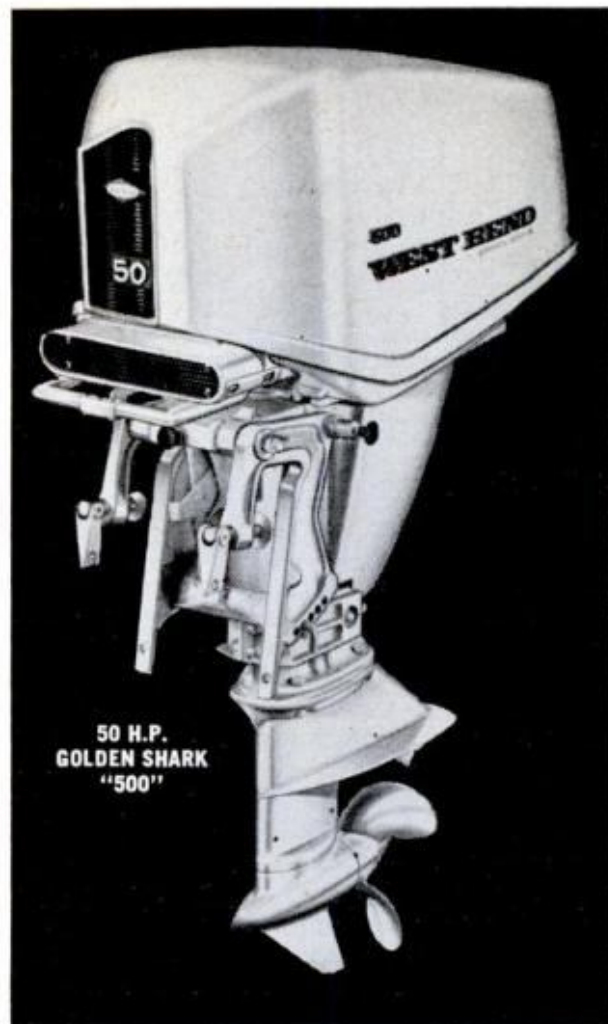
(Please turn to page 224)

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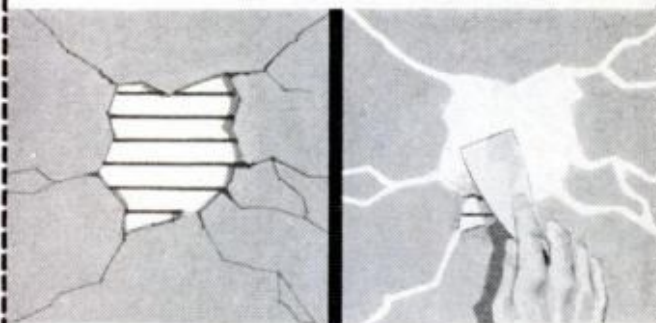


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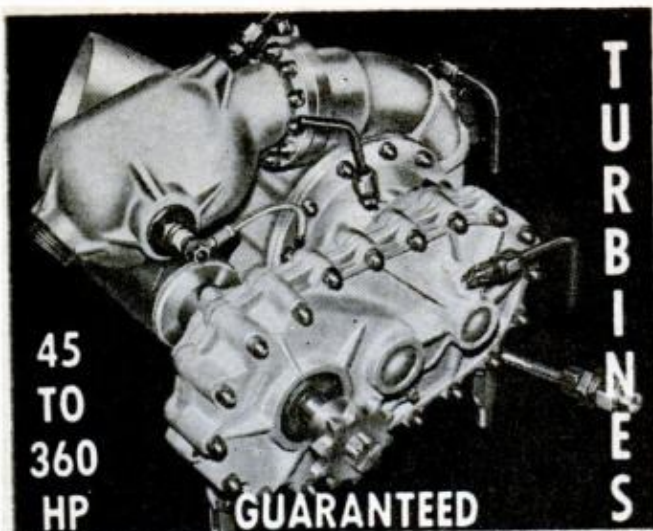


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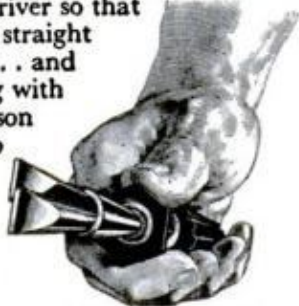
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ASK YOUR DEALER OR WRITE



KEDMAN COMPANY, 233 So. 5th West, Salt Lake City, Utah

PM's Sports Sled

(Continued from page 222)

left to the taste of each builder. While you may wish to duplicate the original and add mahogany coaming, 1/8-in. mahogany plywood cockpit lining, etc., you can also substitute less expensive coaming and line the cockpit with perforated hardboard, or even skip the cockpit lining. However, if you do line the cockpit, first install the seats and console, then make paper patterns of the lining to fit around these.

The seats and console, Figs. 2 and 3, are simply boxes mounted inside the cockpit. Use corner irons to assemble the 1 x 2 seat framing. The 14 1/2-in. space between console and seat is an average measurement. Test this before securing the console in place, and if more leg room is required, move it forward.

When you have completed the cockpit, install the motor-well drains, hardware, motor and controls you're ready for a season of water sports like you've never enjoyed before. ★ ★ ★

MATERIALS LIST

LUMBER

- Frame 1—1 x 4 x 5'; 1 x 4 x 6'; 1 x 4 x 5'; 1 x 6 x 2';
2 x 2 x 8'
- Frame 2—1 x 4 x 5'; 1 x 8 x 6'
- Frame 3—1 x 4 x 5'; 1 x 6 x 6'
- Frame 4—1 x 4 x 4'; 1 x 6 x 6'
- Transom—1 x 4 x 6'; 2 x 4 x 6'; 1 x 6 x 6' (2); 1 x 4 x 3'
- Chines—1 x 4 x 16'
- Keelson—1 x 4 x 16'
- Outer Keelsons—2 x 4 x 10'
- Bottom Battens—1 x 4 x 16'
- Sheer Battens—1 x 4 x 16'
- Deck Battens—1 x 4 x 12'
- Side Battens—1 x 4 x 16'
- Side Moldings—1 x 4 x 16'
- Stems—2 x 6 x 8'; 2 x 4 x 8'
- Keelson Fillers—2 x 4 x 8'
- Transom Knees—2 x 10 x 4'
- Step Beam—2 x 4 x 6'
- Well Sides—1 x 12 x 4'
- Well Beam & Gussets—1 x 10 x 8'
- Seat Framing—1 x 4 x 8' (4 cut lengthwise to make 8 pcs.)
- Floor Battens—1 x 4 x 8' (cut lengthwise to make 2 pcs.)
- Coaming—1/2" x 2 1/4" x 12' mahogany (2)

PLYWOOD

- 10 Panels—3/8" x 4' x 8'
- 1 Panel—3/8" x 32" x 6'
- 1 Panel—3/4" x 4' x 8'

FASTENINGS

- 3 Lbs.—1 1/4" No. 13 ga. annular ringed nails, silicon bronze or galvanized steel
- 1 Gross—1 1/4" x No. 8 flat-headed screws
- 2 Gross—1 1/2" x No. 8 flat-headed screws
- 1 Gross—2" No. 10 flat-headed screws
- 3 Dozen—3" No. 12 flat-headed screws

MISCELLANEOUS

- Paint—White and high-visibility scarlet (Baltimore Copper Paint Co. Baltimore, Md.)
- Foam, Fiberglass & Resin—Glass Plastics Corp., Linden, N.J.
- Deck Vinyl—General Tire & Rubber Co. Textileleather Div., Toledo 1, O.
- Deck Fittings—Nautalloy Products, Inc. Auburn, N.Y.
- Well Drains (2)—Aqua Mate Sterrett Industries Montpelier, O.
- Seat Cushions—Atlantic-Pacific Mfg. Corp. 124 Atlantic Ave. Brooklyn 1, N.Y.

PLANS AVAILABLE

If you have decided to build the PM Sports Sled, you may obtain an enlarged version of the plans appearing in this article by sending \$3.00 to Popular Mechanics Blueprint Dept., 740 N. Rush St., Chicago 11, Ill.



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 only \$3.95 a pair 

The Gates Rubber Company 999 South Broadway Denver 17, Colorado

Owners Report—Pontiac

(Continued from page 94)

spots painted over dirt. The general body work has more ripples and dimples than my 1961 Bonneville."—Colorado installer.

"I do not like the low gear in my automatic transmission. There's too much slippage, it's too sluggish, and the shift point (13 m.p.h.) is too high"—Georgia civil servant.

"The transmission is jerky from low into second; it feels as if there is a drag."—Michigan salesman.

Pontiac (and other GM divisions) are going through a transmission transition. The old-style fluid coupling Hydra-Matic will soon be replaced by smoother torque-converter type boxes.

"The transmission has more slippage on light acceleration than my Ford. This is particularly true in slow moving traffic. I reported this to the dealer but the situation was not improved."—Ohio engineer.

"This car cost \$5000 and for that price the workmanship is very poor. The doors squeak and they don't fit tightly. In fact, you can sit in the car and look out the cracks."—North Dakota painter.

It's always those tremendous trifles; \$50 worth of neglect in assembly can sour a \$5000 investment.

Back on the bright side, here are examples of the sixth through tenth affirmative comments by owners reporting:

"Excellent interior design and quality materials used."—Wisconsin data processor.

"The beautiful interior wears well under all conditions with two small children and it is completely washable."—New Jersey electrician.

"I like its quiet operation."—South Carolina banker.

"I like the stability with the wide track wheels."—South Carolina machinist.

Wide track is a prime example of common sense engineering—it costs you no more yet does a real job in boosting stability, smoothing ride.

"Those wide track wheels provide a smoother riding car and a lot less sway on turns."—Ohio salesman.

"It does not nickel and dime me to death. The oil is at the same level as when I bought it 1900 miles ago."—Virginia guard.

He'll probably be able to go without adding oil between changes even after 40-50,000 miles. Detroit has oil consumption just about licked.

"It is a work horse and it's so depend-

able."—Georgia sales representative.

"I like the utter reliability."—Wisconsin physician.

There's a "con" for every "pro". Here are numbers six through ten of the points owners complained about:

"The back seat is uncomfortable to sit in even in four-door sedans. I feel that the car would sell better if the body style were changed to provide better comfort."—Maryland realtor.

This is a valid criticism, Pontiac is roomier from side to side than from end to end in spite of great over-all length.

"There's too much trunk and not enough back seat room in the Grand Prix."—Wisconsin storekeeper.

"I found various minor complaints: the oil filter cap was missing, there were defects in the paint job, light bulbs were missing, screws were missing from the window moldings and the glass in the back up light was cracked."—Michigan detective.

This guy could hire on as an inspector at Pontiac if he tires of sleuthing.

"There were too many small repairs not checked at the factory."—Michigan Army recruiter.

"The rear end seems to be sprung too softly. With a moderate load in the trunk, I found it necessary to install overload springs."—Arizona technician.

"When the no-draft vent windows are open, the wind makes excessive noise."—Ohio retiree.

No automaker has been able to lick this problem.

"I've had mechanical trouble with a seal in the transmission. It has been replaced."—Wisconsin insurance agent.

Wrapping up owners' praises, here are numbers 11 through 16 of the points that pleased Pontiac buyers:

"For its price range, I feel I have a large, roomy, powerful automobile under me."—New Jersey supervisor.

"It has ample space in both seats as well as in the trunk."—West Virginia minister.

"I like the large areas of visibility."—New Jersey toolmaker.

"It handles well; we are enjoying the power steering very much."—Michigan foreman.

Pontiac's power steering is a nice compromise between underpower and overcontrol; it's a good thing, too, because you need it to turn those wide wheels.

"There's plenty of heat in the winter."—North Carolina executive.

"Wagon has a large storage area under the rear deck."—New Jersey electrician.

(Please turn to page 228)



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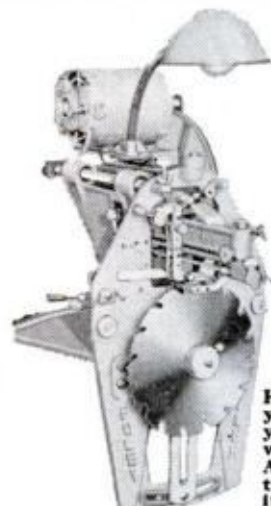
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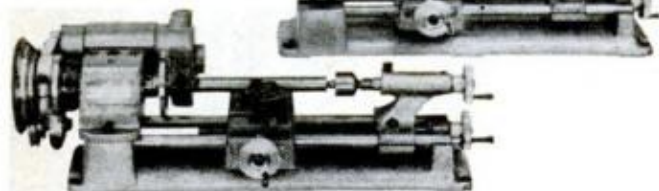
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**WRITE: AMERICAN EDELSTAAL INC., Dept. GC
350 Broadway, N.Y. 13, N.Y.**

Owners Report—Pontiac

(Continued from page 226)

"Pontiac is built like a good bridge—to last almost indefinitely if proper care is given. It is solid and reliable."—Ohio retiree.

Let's hope he's right. At any rate, Pontiac seems to have made a good start.

To finish up, here are numbers 11 through 16—with the most frequently mentioned items first—of the complaints by the PM owners' panel.

"Let's all pull together and see if we can get rid of those idiot lights and put back the gauges that we can see at all times."—North Dakota oil refinery worker.

We'll always second this motion!

"I've had trouble with a starter motor short circuit. It was replaced."—Michigan dentist.

"The main wiring plug shorted out."—Michigan toolmaker.

"The doors don't fit tightly enough."—Ohio machinist.

Adjustment of latch strike by dealer will often work wonders.

"This is my fourth Pontiac. The quality of workmanship has quite obviously deteriorated."—South Dakota clergyman.

"The windshield wipers are not designed to take snow far enough to the left of the driver's vision."—Michigan teacher.

"The glove compartment should be a drawer that pulls out, and not just a door."—Wisconsin sales manager.

Well, that wraps up the pros and cons of the '64 Pontiac as reported by a group of owners who've rolled up an average of 3514 miles on their new cars. ★★★

Biggest Bang

An exploding galaxy, blown apart by the most gigantic bang ever known in the universe, was recently photographed on the 200-inch Hale telescope at Mt. Palomar, Calif. Light from this vast explosion has taken more than five million years to reach the earth, since the galaxy is some 5.2 million light years away.

Known to astronomers as M-82, the detonation spewed material out of the heart of the galaxy at velocities up to 20 million miles per hour. Photos show tremendous jets of matter 60 million billion miles long (or 10,000 light years) streaming from M-82's nucleus. Matter equal to five million suns is involved in the cataclysm. Such galactic explosions may be the prime source of cosmic rays; they may also shower the earth with neutrinos, a subatomic particle.

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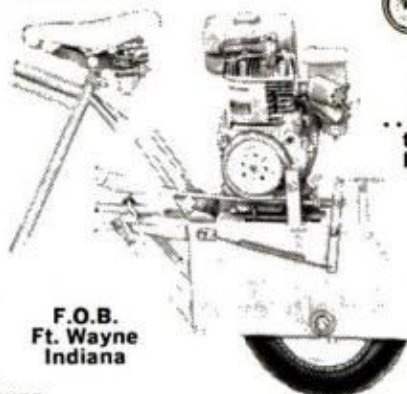
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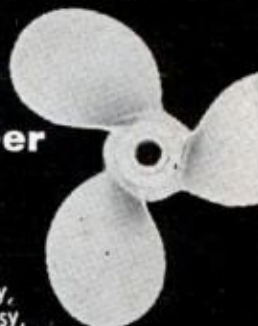
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		10 3/4 x 14	PJ-40	11.00
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Aerosols Can Be Dangerous

(Continued from page 89)

ing cream, bug juice, perfume and paint in all directions. One split a seam and took off like a free-flying Fourth of July pinwheel, screaming as it went. It threw open the heavy incinerator lid and went howling through the air for 50 feet. The photographer was too busy moving out of range to catch a picture of it in flight. Other cans blossomed into multi-bladed sheet metal knives which, had they not been contained, could easily have wreaked havoc with any human flesh encountered.

Interstate Commerce Commission regulations require that pressurized cans must be able to contain more than twice the pressure they exert at a temperature of 70°F. Virtually all home product aerosol spray cans are packed to generate 40 pounds per square inch, or less, at 70° and will, unless faulty, stand temperatures ranging from 155° to 180°. That is a healthy safety margin for all practical purposes. To assure it, most reputable packers run charged cans through a hot water bath exceeding 130°. Hence, "leakers" quickly eliminate themselves.

Carelessness Is Hazard

The truth is that much of the hazard of aerosols lies in the people who use them. "Aerosols are so common," points out an underwriter's safety engineer, "that people use them without much thought or safety consciousness. If Mom is washing windows and the phone rings, she leaves her dispenser on a radiator, or the stove, where pressure in the can will quickly build to the failure point."

Typical was the lady who put her aerosol hair spray on the gas-fired radiant heater in her bathroom. The bursting container killed her.

What about those glass containers? Most are used by the cosmetics industry for their more aesthetic appeal. While packed at relatively low pressures (13 to 15 pounds per square inch, or "p.s.i.") they often contain volatile formulations that may rise to 25 p.s.i. in a warm bathroom. Warnings on their labels are often minimal, since there isn't room on the tiny bottles. Yet, in laboratory tests, tiny 1½-ounce containers of this type, when dropped on a tile floor, burst and propelled pieces of glass violently to all parts of the room. Recently, many packagers have turned to coating their bottles with plastic, which reduces the barrage of glass, when the container is dropped, by about 80 percent. Even so, they should not be stored in a warm place.

Actually, it doesn't take much apparent heat to build pressure in an aerosol con-

tainer to the critical point. Plenty of automobile interiors have been ruined by exploding dispensers left in a closed car under a hot sun, where temperatures readily soar above 150°. Especially susceptible are some of the new highly volatile ether engine starting sprays which, besides heating up to high pressures quickly in the can, have been classified by the New York City Fire Department as "Extremely Flammable." The designation is defined as a "product which flashes below 20° F."

The ignition characteristics of many pressurized products such as paints, lacquers and lubricants, as well as many gas propellants, is presently giving a severe case of the collywobblers to fire departments everywhere.

New York City Fire Commissioner Edward J. Thompson isn't bashful about stating emphatically that "aerosols have contributed to the extension of fire in many cases." Edward P. McNiff, Chief in charge of Department, is even more emphatic. "Make no mistake about it," he told this magazine, "many of our warehouses are full of bombs—aerosol bombs."

Firemen Needed Shields

In the next office, Chief Thomas J. Harnett pulls from his files a report on a Brooklyn warehouse fire telling how firemen had to advance "under shield" when a large store of aerosols in glass containers went off in "continuous explosions, throwing glass at great velocity" in all directions. Last year, in the cellar of a Manhattan hardware store, firemen descending with hose through dense black smoke created by burning aerosol, were met by a barrage of containers exploding all around them. Several men were struck and, according to the chief's report, the aerosols did intensify the fire.

The National Fire Protection Association has a growing list of major blazes in which aerosols contributed to spread of the fire. In one, half a million aerosol containers of military insecticide exploded, sending the fire out of control to the tune of \$420,000. Last May in a warehouse, "various flammable liquids in aerosol containers" contributed to the spread of a \$2,340,000 fire. And following a recent food store blaze, firemen reported that when flames reached the aerosol container section, control was lost. "Falling ceilings and exploding containers hampered firemen," reads the report.

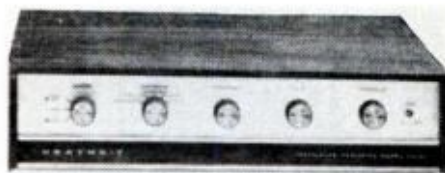
Upshot of it all is that last fall, New York City's Fire Department put into effect restrictive regulations on a number of "Extremely Flammable," "Flammable" and "Combustible" aerosols—designations

(Please turn to page 234)



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Aerosols Can Be Dangerous

(Continued from page 230)

depending on things such as flash point and "flame extension" from the container orifice. De-icers for refrigerators and freezers, in these categories, were outlawed in the city, as were oven cleaners. Rigid rules for licensing other ignitable spray products were established along with restrictions on container sizes for them, label information, storage limitations and the like. Ether engine starters were limited to four-ounce, one-shot containers.

Can Be Flame-Throwers

Though most combustible aerosols carry labels warning against use near open flame, or while smoking, people fail to realize the spectacular things some seemingly innocent pressure spray products can do under certain conditions. Last fall, Commissioner Thompson put on a dramatic show for the industry and newspapers by spraying a neat's foot oil aerosol across a burning candle. The little can became a flame-thrower, producing an extension of flame seven feet long! "People aren't aware of what these things will do," says Thompson. "Too often, label information is inadequate. In most instances, the regulations are inadequate and do not face the realities of the situation."

What all this can signify for the home user was pointed up in a recent tragedy in Newark, New Jersey. A woman used a flammable hair spray, some of which dripped on her blouse. Then she went to the kitchen and turned on a gas burner. She reported that a tongue of flame from the burner ignited the fluid in her blouse, and flashed to her hair which was still damp with spray. She went to the hospital with face and chest burns and severe injury to one eye.

The toxic effects of some aerosols are well known. By now, Rachel Carson should have made everyone aware of the caution required in the handling of many pesticides. Some of these turn up in aerosol pesticides.

Before a product is marketed, reputable aerosol manufacturers run their formulation through exhaustive tests to insure its chemical compatibility with the propellant, and to determine its effects on humans. In spite of such precautions, Safety Engineer Frank Burkett reported cases "where formulations have caused dermatitis, loss of hair, facial scars and poisoning".

Actually, many aerosol products contain at least one toxic ingredient—the propellant. In most cases it is hardly a dangerous quantity. But it's there. The Underwriters' Laboratories classify propellants in six

groups according to the quantity it takes, in a given volume of air, to produce lethal effects in a certain length of time. Worst, for example is sulphur dioxide—in Group 1. Concentrations of one-half to one percent in any volume of air can be lethal to anyone breathing it for a short five minutes. Freon-12 and Freon-114, in Group 6, have no harmful effects up to 20 percent by volume, even after two hours of whiffing it.

While some packers fail to print the chemical contents on their label (of a dozen aerosols in the author's cellar, only four had this information), the fact is that most aerosols use the relatively safe Freons and fluorinated hydrocarbons falling in Groups 4 and 5. In concentrations of two percent, Group 4 propellants can be injurious if breathed for two hours. Butane, propane and ethane, in Group 5—all frequently used—are less toxic.

Ventilation Is Essential

The significance of all this is that, with any aerosol, ventilating or exhausting fumes is essential. And unless an aerosol is designed for body contact, don't get in the way of it.

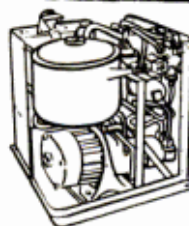
Safety Review, a Navy Department publication, summed up the whole matter of aerosols neatly, in an editorial entitled "DANGER!", in which it said: "The growing availability of these canned sprays is in many instances putting a toxic or flammable material in the hands of the untrained nonprofessional in the home and in work areas where the hazards of such sprays are not appreciated. Lacquers and paints in particular, contain thinners, solvents, pigments and other additives which may be flammable and can be toxic if enough is absorbed through the skin."

Here are the precautions they prescribe:

1. Do the job outdoors, if possible. Don't spray indoors unless you're sure of good ventilation.
2. Don't smoke while spraying. Don't use heating or other appliances that may cause a spark.
3. Keep the body well covered and wash exposed areas after spraying. This is especially important with insecticide or paint sprays which can be absorbed through the skin.
4. Stop work at the first sign of dizziness, incoordination, nausea, headache, blurred vision or skin irritation; remove clothing and wash; call a doctor if symptoms are severe or persistent. Don't drink alcohol; it magnifies effects.
5. Don't put empty cans in the incinerator; they still contain fumes which are explosive when confined. ★★

MARCH 1964

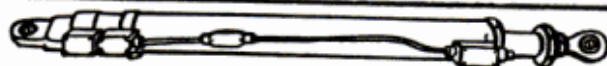
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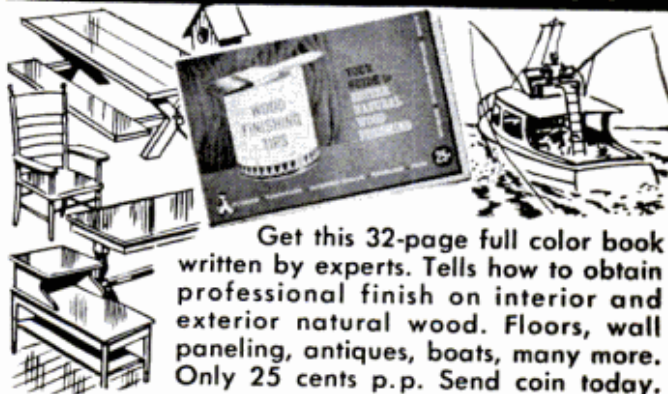
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Owners Report—Falcon

(Continued from page 100)

"It has squeaky rear springs and there is no way to lubricate them."—Colorado retiree.

His problem may not be the springs themselves but not-quite-tight U-bolts which clamp them to the axle.

"The single-speed electric windshield wiper is noisy at times and the speed is too great during light rains."—New Jersey clerk.

"Windshield wipers aren't up to snuff in a good storm."—Maine postal clerk.

These two guys need one thing, a three-speed wiper!

"The carburetor had to be replaced because of a faulty jet."—Ohio machinist.

"Carburetor icing was caused by the crankcase ventilation system."—Minnesota agricultural agent.

This is what's known as design for disaster. Who knows, someday the carburetor engineer and the ventilation man may meet in a corridor—we'd love to eavesdrop!

Now, a swing back to the bright side. Here, in order most often mentioned, are best-liked items 6 through 10:

"I'm 6 ft. 3 in. and can sit comfortably in front or back with plenty of leg and head room."—Nebraska quality controller.

"I like the roominess for carrying musical instruments (bass viola, drums, mike and amplifier). There is also room in the back for children to sleep lying down on long trips."—New Jersey radio technician.

Who can sleep with the kids pounding that darned drum?

"I like its size for easy parking and handling."—Virginia machinist.

"It pleases my wife as she dislikes having to drive and park a large car."—South Carolina U.S.A.F. sergeant.

Sarge, your wife is like millions of short-hopping suburban woman drivers who find as much relief in driving compacts as they do in kicking their shoes off in the movies.

"The new Falcon has a sports car feel for holding the road on curves and sharp turns that's very good."—Ohio salesman.

"I like most the way it holds the road at cruising speeds."—Minnesota retiree.

"Windshield area is very large, good visibility."—Ohio bus driver.

And who should be in a better position to judge a car's visibility than a bus driver who sits behind the biggest piece of glass on the highway?

Once again we join the pessimists with the complaints ranking sixth through tenth in order of most frequent mention:

"I do not like the position of the manual choke on the left side beneath the dash. It is inconvenient to get to."—South Dakota transportation director.

He's right. Not only is it hard to reach left handed, but it's easy to forget and leave "On" after engine is warmed up. But we do prefer a manual choke to the creeping maladjustments that still plague the automatics.

"It's hard to keep from weaving in a strong crosswind."—Minnesota service repairman.

"My V8 convertible needs 100 pounds more weight over the rear axle. The front end is too lightly sprung and dives too much on turns."—New Jersey manufacturing engineer.

Another approach to the problem would be that the V8 Falcon needs 100 pounds less weight over the front axle.

"My complaint is lack of headroom when seated in the rear seat."—New Jersey automobile adjuster.

"Too slow on pickup. I have the 170 Special Six engine but this is still not enough power for automatic transmissions."—Michigan engineer.

Could be that the power's adequate and the transmission's not. Valiant has same size engine which works fine coupled to a three-speed automatic.

"Will do only 90 m.p.h. I have the six-cylinder."—North Carolina dispatcher.

"There are small flaws in paint and body work."—Maryland student.

Behind every cloud looms a silver lining so here are the compliments again—items best-liked by owners in order of mention from 11th through 16th:

"The interior has an 'expensive car' feeling—styling is good."—Maryland bookkeeper.

"I like its unit body construction; it's very, very tight."—Ohio state patrolman.

After trying several '64 Falcons, we're inclined to agree.

"The heater and defroster are excellent."—Ohio accountant.

"I drove it well over 500 miles without feeling overly tired."—Colorado retiree.

"It's a well-built car. I haven't had any trouble with it."—Georgia typist.

"It's fast starting."—New Jersey serviceman.

Once more we accentuate the negative with the final group of owner complaints, numbered 11th through 16th in order most often mentioned:

"When brakes are wet, they grab."—Idaho shipping clerk.

This problem cuts across the industry. If

(Please turn to page 238)

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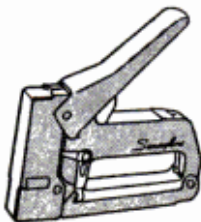


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shoots 5 staple sizes up to 9/16". Does everything a \$12.50 gun will do and more. Available at hardware, stationery and department stores. Only **\$7.95**

SWINGLINE, INC.
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Latest, most popular boat designs...

PLANS FULL SIZE PATTERNS FRAME KITS

Inboard, outboard, Jet & Sail
"Glen L's" new 80-page catalog illustrates over 40 of the newest boats . . . V-Drives, Dragsters, Cruisers, Cats, ski boats and others. Designed by a Naval Architect, all units include step-by-step instructions for amateur builders! Mail Coupon and 50c Today.



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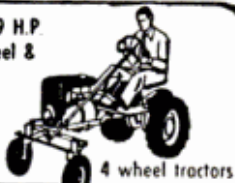
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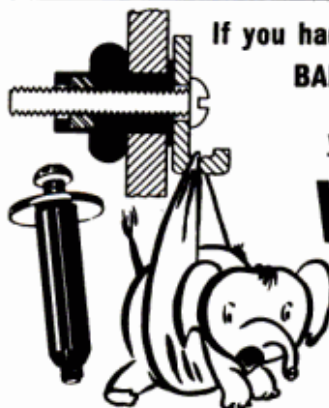


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AMERICA'S MOST POPULAR MUFFLER

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BABY ELEPHANT—

you could with the new WELL-NUT®



An All-Purpose FASTENER—
a modern Wall Anchor that holds in any wall—thick or thin. Ask your dealer or send 3 dimes for samples.

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Subsidiary of Rockwell Products Corp.

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FIX-IT PRODUCTS

"A Feller's Best Friend"

Your Choice
of these four
REGULAR \$1.00 EACH

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Baseball's "Hall
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Save money on hundreds of repair jobs with DURO-PLASTIC, the original Plastic Aluminum, Plastic Rubber, Liquid Steel and E-POX-E Glue ... available at your favorite hardware, variety, auto accessory, department or paint store!

LARGE PROFITS—SMALL INVESTMENT

Many men of all ages have proven this grinder to be the best investment they ever made. Earn up to \$40 for 1½ days work. No other grinder, regardless of cost, sharpens mowers BETTER or FASTER than the UNIVERSAL LAWN MOWER GRINDER. This precision machine will sharpen mowers better than new. Amazing Results, Accuracy, and Simplicity. ONE simple SET-UP. Mowers are ground without removing any blades. No shop—no previous experience needed. Complete LAWN MOWER GRINDER in one unit—nothing else to buy. Start a SPARE or FULL TIME business today.

FREE FACTS—ACT NOW
NEW CIRCULAR SAW GRINDING ATTACHMENT AVAILABLE. Write NOW for FREE FACTS on Big Money-Making opportunities in LAWN MOWER and SAW SHARPENING. TIME PAYMENT PLAN included.



ROGERS MANUFACTURING CO., Dept. M-34, Lindsey, Ohio

FAMOUS DOT TEENUT® FASTENERS



Can't slip, flush-mounted, strong. ONLY nut that gives steel threads in wood!

- Now available in bright NEW finish!
- NEW red and yellow, skin-pack cards!
- Look for colorful NEW display carton, too!
- Handyman need TEENUTS!
- Sold at hardware stores.

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TEENUTS is a registered trademark of United-Carr Fastener Corp.

PEEL OFF PAINT with KLEAN-STRIP

- Fast, clean, safe
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Heavy-Bodied wash type

Regular for furniture work



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THE ORIGINAL PACKAGED

BOAT KITS PLANS & PATTERNS FRAME PACS

- World's Largest Line — New Fiberglass Hulls. Over 200 styles Boats-Kits, Formed-Hulls, Semi & Custom finished. All types: Prams, Cruisers, Racers, Inboards, Outboards. Easy to build. Professional results. Dealers—Agents Inquire
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- SPECIAL OFFER. Colored CATALOG plus "Boating Handbook" . . . all for \$1.

• Over 400 Plans-Patterns, Frame Pak Kits, Prams, Kayaks, Racers, Runabouts, Catamarans, Cruisers-In-Outboards (6' to 40') Wood, Plywood and Steel. Send \$1.50 for 136 pg. Plan Catalog.

Catalog plus "Boat Building Handbook" . . . Send \$2.00

Credit Terms

Custom-Craft BUFFALO 7, N.Y.

Owners Report—Falcon

(Continued from page 236)

U.S. motorists demanded better brakes as emphatically as they demand better styling, economy or power, we'd see the best brakes in the world on our cars.

"In burning Esso regular gasoline I encounter carbon knock often in the mountains, necessitating changing gears. Higher octane gasoline eliminates this."—Colorado rancher.

"Doors latch poorly. You have to slam the doors to close."—New Jersey machinist.

Sounds like an adjustment problem; often springy new weatherstripping resists too much so latch must be eased off.

"Water runs down windows and somehow seeps into front compartment through doors."—New Jersey contractor.

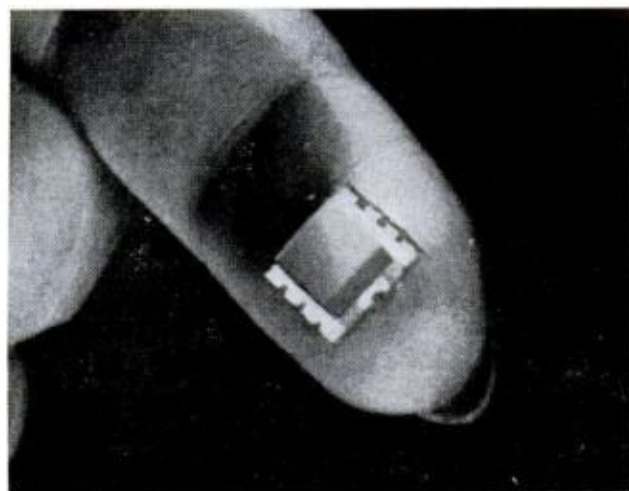
"There's too much noise from pebbles, water and such objects flying from the wheels onto the bottom of the car. It sounds like a tin box."—Michigan printer.

"After it has been standing for a half a day or overnight, it doesn't start too quickly, but it has manual choke which helps."—Rhode Island housewife.

This could be due to fuel seeping or evaporating out of the carburetor. Better check it.

Well, that wraps it up, a list of typical compliments and complaints from a group of owners who have averaged 2728 miles on their 1964 Falcons. ★ ★ ★

Tom Thumb Refrigerator



One of the world's smallest coolers, this solid state unit was made by Melpar, Inc., to chill microcircuit elements endangered by their own heat. Less than a tenth of an inch thick and three-tenths of an inch wide, it uses small elements or legs to form a thermoelectric junction. When a current passes through the junction, heat is moved from one leg to the other, causing one surface to become cool.

BUY GREAT NECK HAND TOOLS

... for long-lasting performance



GREAT NECK SAW MFRS., Inc.

MINEOLA, N. Y. — SEE YOUR LOCAL STORE

PAGE FOR TILLING PLOWING MOWING

A FULL LINE — 2 to 9 HP with complete gear drive and reverse
 FREE CATALOG • LOW PRICES • EASY TERMS
 Over 40 years experience
 OVER 60 ATTACHMENTS AVAILABLE!

PAGE Richfield 4 Wisconsin

DEALERS WANTED

BASEMENT TOILET FLUSHES UP

TO OVERHEAD SEWER OR SEPTIC TANK. NO DIGGING UP FLOORS. INSTALLS EASY. Write McPHERSON, INC. BOX 15133 TAMPA, FLA.

WILHOLD® CLEAR-EPOXY GLUE

AMAZING!

ONE DROP IS STRONG

DRIES CLEAR AS GLASS

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Learn how you can earn up to \$1000.00 per sale, showing our quality aluminum siding on your home.

ALUMINUM INDUSTRIES, DEPT. M-34 KANSAS CITY 11, MISSOURI

Shrinks Hemorrhoids New Way Without Surgery Stops Itch — Relieves Pain

For the first time science has found a new healing substance with the astonishing ability to shrink hemorrhoids and to relieve pain — without surgery.

In case after case, while gently relieving pain, actual reduction (shrinkage) took place. Most amazing of all — results were so thorough that sufferers made astonishing statements like "Piles have ceased to be a problem!"

The secret is a new healing substance (Bio-Dyne®) — discovery of a world-famous research institute.

This substance is now available in suppository or ointment form under the name Preparation H®. Ask for it at all drug counters.

NEW HYDRAULIC CYLINDERS

Bore	Stroke	D. Shaft	Long	Double Action	Hvy. Duty 2000 PSI air or oil
1 1/2"	4 1/2"	1 1/2"	10"	3 1/2 lbs.	\$ 2.75
1 1/2"	4 1/2"	3/8"	8"	3/4 for	\$ 5.00
1 3/8"	3 1/2"	3/8"	13"	5 lbs.	\$ 2.95
1 3/8"	3 1/2"	1"	13"	1 1/2 lbs.	\$ 12.95
1 1/2"	8 1/2"	3/4"	13"	8 lbs.	\$ 8.50
3 1/4"	10 3/4"	1 1/2"	17"	15 lbs.	\$ 12.95
3 1/4"	10"	2 1/4"	23"	28 lbs.	\$ 14.50
3 3/4"	16 1/2"	1 3/4"	24"	30 lbs.	\$ 18.50
4 7/8"	8"	2"	22"	30 lbs.	\$ 22.75

Under 20 lbs. add 15¢ for p.p. *good condition

New 1 1/2 H.P. Vacuum Air Compressor kit with pump, 15CFM 2250 RPM, 2 gal. tank, hose, gauge & fittings. \$135.00 value \$29.95.

New Open center Four way Hyd. Valves for 1 D.A. cyl. \$12.95. For 1 to 4 D.A. cyl. with relief \$14.95.

Welding & Battery charging kit has R-T generator, 300 amp. D.C., 30 ft. cable, helmet, holder, voltmeter, rheo., solenoid, volt. reg. or. clamp, switch & reactor Coil \$44.50.

ACDC Welder kit with 2 new motor-generator units converts to 150 Amp. 110-220V. AC-DC 60cycle welder & battery charger includes accessories & instructions. Size—2x13x12". wt. 75 lbs. \$48.50.

GENERAL SALVAGE CO Check or M.O. 2922 E. 27 St., Dept. 134, Kansas City 27, Mo.

DRAINS IRRIGATES - CIRCULATES - SPRAYS collars, cisterns, wash tubs; \$8.95

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 1,800 GPH from 25' well. 1" inlet; 3/4" outlet. Coupling included free. \$8.95.

HEAVY DUTY BALL-BEARING PUMP. Up to 5,200 GPH; or 3,000 GPH from 25' well. 1 1/4" 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

Loosens Rusted Bolts nuts, screws, "frozen" parts!

LIQUID WRENCH SUPER-PENETRANT

Cleans guns, rods, reels and sports equipment. Harmless to all metals.

3 oz. **35¢**

AT HARDWARE AND AUTOMOTIVE SERVICE STORES

OUTWORKS THEM ALL

4 action packed models with efficient chain drive that delivers equivalent of 2 extra hp! Prepare toughest soils in one operation, till to 12" deep — 12" to 48" wide. Rotors, tractor tools for all jobs and soil conditions. Send for details.

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TAPE RECORDER (liquidation stock)

\$8.99

Liquidation of our special purchase of tape recorders complete with excellent 2 1/2" speaker and microphone. A \$20 value. This production left over from giant national department store promotion where recorders were taped with a message to give to passing customers. Comes complete with standard 1/4" magnetic tape. Use for messages, rig with remote control invisible thread for detective work. Has unique endless loop feature. Hide anywhere, conceal in toy animal and let it make outrageous remarks to guests. Hundreds of uses. While they last. Send \$1 deposit for C.O.D. Satisfaction guaranteed.

MISSION LIQUIDATORS, 735 Celis Street, San Fernando 2, California



PHIL RIZZUTO
REPORTS:

**\$280 FOR THIS
HEAVY DUTY
LIFETIME ENGINEERED
POWER SAW?
HECK NO!**

DIRECT FACTORY OFFER

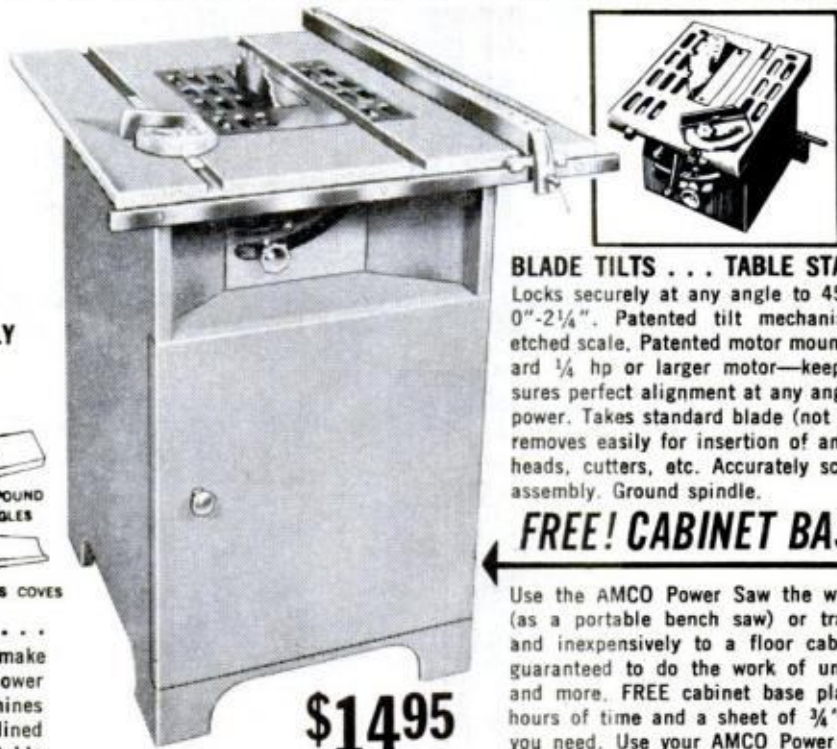
AMERICAN MACHINE & TOOL CO. DEPT. PM-34B, ROYERSFORD, PA.

- Please send 8" TILT ARBOR POWER SAW at \$14.95
 - Include Standard Rip Fence #354 at \$3.50
 - For longer Rip Fence #354C at \$4.50 (for use with cabinet base)
 - Payment in full enclosed \$_____ or \$3 deposit enclosed.
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- SEND FREE Catalog of America's Greatest Tool Values

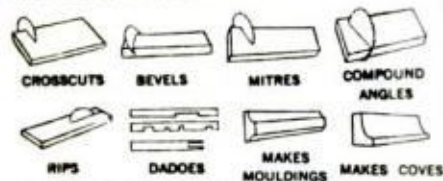
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BUYS THIS PROFESSIONAL QUALITY
Amco 8" TILT ARBOR POWER SAW!!!**



PERFORMANCE, ACCURACY AND DURABILITY EQUAL TO ANY \$75 TABLE SAW . . . CONVERTS EASILY TO EQUAL ANY \$280 FLOOR MODEL CABINET UNIT!



REVOLUTIONARY NEW PATENTS . . . NEW DESIGN are the secrets that make possible this top quality full-scale power tool . . . with speed, accuracy of machines selling for as much as \$300. Streamlined design features such as perforated table top reduce weight, material cost, polishing, grinding time. Special patents add efficiency, accuracy, savings. Nothing left out but expensive gingerbread. Parts made, assembled, tested and packed right in our own factory, shipped direct to you.

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Locks securely at any angle to 45°, raises, lowers 0"-2 1/4". Patented tilt mechanism has accurate etched scale. Patented motor mount takes any standard 1/4 hp or larger motor—keeps belt tight, assures perfect alignment at any angle, transmits full power. Takes standard blade (not incl.). Saw insert removes easily for insertion of any standard dadoe heads, cutters, etc. Accurately scaled mitre gauge assembly. Ground spindle.

FREE! CABINET BASE PLANS!

Use the AMCO Power Saw the way you receive it (as a portable bench saw) or transform it easily and inexpensively to a floor cabinet unit that is guaranteed to do the work of units costing \$280 and more. FREE cabinet base plans . . . 3 or 4 hours of time and a sheet of 3/4" plywood are all you need. Use your AMCO Power Saw for cutting. Plans provide 27" x 24" work surface, table height 33", tool storage compartment.

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Includes completely assembled cast iron and steel 8" Tilt Arbor Power Saw with precision ground cast iron table . . . less blade. If desired, Rip Fence, for easier work alignment, \$3.50 add'l for table top saw as rec'd, or \$4.50 for extra long fence for cabinet base.

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CHOICE OF PHIL RIZZUTO AND 500,000 OTHER HOBBYISTS—"I had no idea how much fun it could be to make things out of wood—nor how easy it could be. I don't know how they do it, but the remarkably low cost of the quality tools by American Machine has taken nothing away from their ability to do a professional job."

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**Now protect your paycheck again
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INCOME PROTECTION! Mutual of Omaha's famous "Paycheck Plus" plans provide from 50.00 to \$500.00 a month (according to the plan you select) while the "breadwinner" is unable to work because of illness or accident, as explained in the policy. Life-

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Starflite 90-S is a compact high-performance motor. Runs smoother, quieter. Gives your boat more power, more speed.

And saves you money on gas and oil.

Skippers with a sports car bent like the bite of its big V-4 engine. The "90" stands for 90 solid, delivered horsepower. The "S" stands for sizzle.

The 90-S develops more power on less gas than any outboard has ever developed before.

How? The answer is sealed fuel distribution. Each cylinder is fed precisely metered amounts of fuel and air through a straight-in manifold—unaffected by pressure and vacuum in adjoining cylinders. Perfect combustion climate does the rest. Thermostat control keeps engine temperature constant.

Oil costs are cut in half with a 50 to 1 gas-oil mix. The 90-S deflates 4-cycle fuel claims. Beats all comers on overall economy and performance.

What makes it so quiet and smooth?

The answer is balanced power impulses, fine tuning, close tolerances. The same thing that gives you more go on less gas and oil.

You might like to teach your old boat new tricks. Or get a new Evinrude gull-wing hull to match the most efficient outboard motor ever built.

See the Starflite 90-S at your Evinrude dealer (listed in the Yellow Pages). Catalog free. Write Evinrude Motors, 4192 N. 27th, Milwaukee, Wis. 53216.



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