

# POPULAR MECHANICS

## MAGAZINE

WRITTEN SO YOU CAN UNDERSTAND IT

REG. TRADE MARK, GREAT BRITAIN, NO. 40328

REG. U.S. PAT. OFF.



*Daredevil Photogs  
of the Navy  
--page 74*

**PONTIAC—1959's SURPRISE  
SELLER . . . Owners Tell Why  
The "Brain" That Talks to Tools  
STEREO UPSTAIRS and DOWN**

**Build the Kids a Sidewalk Car**

**NEW!** MIRACLE FORMULA—IDEAL  
FOR ALL CAR FINISHES!



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cleans and waxes... quick and easy!



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This One



414H-TXS-2HFY

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A LAND THAT'S BEEN INVADED BY A WONDERFUL NEW CIGAR

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*Slick on the draw  
and big as your trigger finger!*



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Volume 111

JUNE 1959

Number 6

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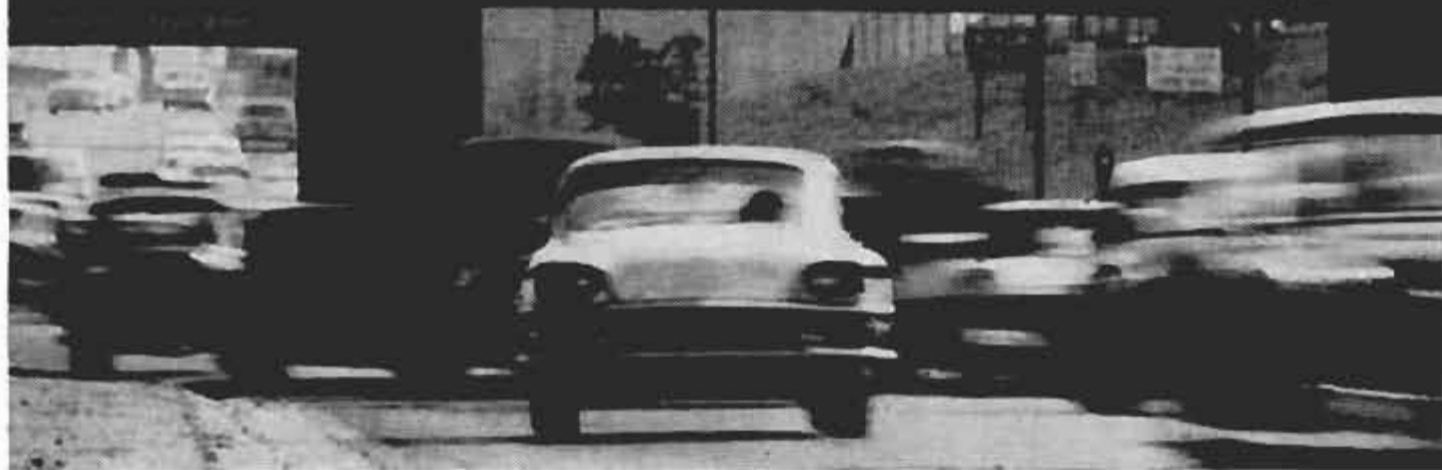
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## Next Month...

FLY THE WORLD'S RECORD model plane, a prop job that zips along at 172 miles per hour. You'll find full-size plans for this amazing model in the July issue. . . . Also, "Why Not Take to the Wilderness?"—a camping story with a unique twist. . . . The secret of erasing crab grass from your lawn. . . . The Owners Report on Mercury



*Firestone speedway research pays off here in safer tires for turnpike driving*

## **FIRESTONE: ALWAYS A CHAMPION ON THE TURNPIKE—**



*Firestone safety research in action at Daytona's record 100-mile race*

## ***Firestone Rubber-X\* again proves why in world's fastest race!***

***Firestone is FIRST in competitive tests that prove performance for you!***

In the fastest race ever run on wheels, nobody slowed down for the corners. They didn't have to at Daytona's new International Speedway, because highly pitched turns launched speeding cars into whip-cracking straightaways. Early in April, they circled this deep-dish course forty times in racing's hottest 100-mile test of men, motors and tires. Jim Rathmann covered it at a 170.261 mile-an-hour average—on Firestones. Professional drivers like Jim Rathmann know only Firestones are good enough to pass these supreme tests of tire safety and endurance. They know, too, that Firestone's proof of performance on the speedway means safer driving for you at highway and turnpike speeds. The next time you buy tires, be sure you get the proved performance of Firestone Rubber-X, the longest wearing rubber ever used in Firestone tires. Buy now, on convenient terms if you wish, at your nearby Firestone Dealer or Store.

*\*Firestone Rubber-X is compounded specifically for each type of car, truck, farm implement and construction equipment tire.*



Jim Rathmann says:  
"On the throughway,  
as well as on the speed-  
way, I want the safest,  
longest wearing tires  
that money can buy—  
Firestones!"

# **Firestone**

**BETTER RUBBER FROM START TO FINISH**  
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## PAINT NEWS



### **New Paint Covers Porous Walls in 1 Coat!**

For that drab basement or garage interior! New DuPont One-Coat Basement Wall Paint comes ready to use in 8 pastel colors and white. Thick as jelly, it covers rough, porous surfaces smoothly with one coat. Excellent, too, for all interior smooth plaster walls. Ceiling painting is especially easy. Clean brushes and equipment with soap and water. Now at your DuPont Dealer's. His name is in the Yellow Pages.

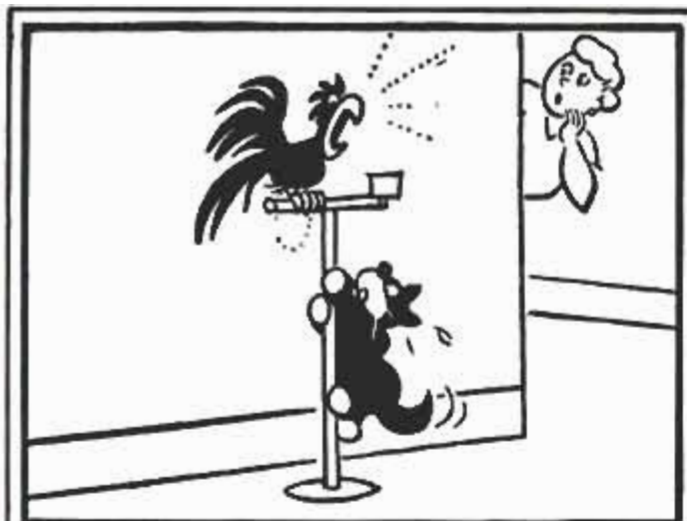
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## ACROSS THE DESK



### To the Editor:

Our pet, a Black Labrador—like any dog—dearly loves:

(1) Auto rides, which he always concludes with a game he invented (by pushing with his cold, wet nose on our necks when two or three blocks from home): He jumps out and races us home.

(2) Nightly reconnaissance tours.

Having lost one cherished pet on the highway because he couldn't be seen, we



tried to think of ways to "illuminate" him. My husband came up with a collar trimmed with squares of the same red bumper tape used on cars. Now we laugh with delight as we follow the bobbing, brilliant-red collar ahead of our car lights as he races home ahead of us on dark nights (a quiet, dirt side road), and we feel that the rare times we let him out to "reconnoiter" we've given him more of a break in case a car comes by.

Mrs. Joseph Krenmayr,  
Seattle, Wash.



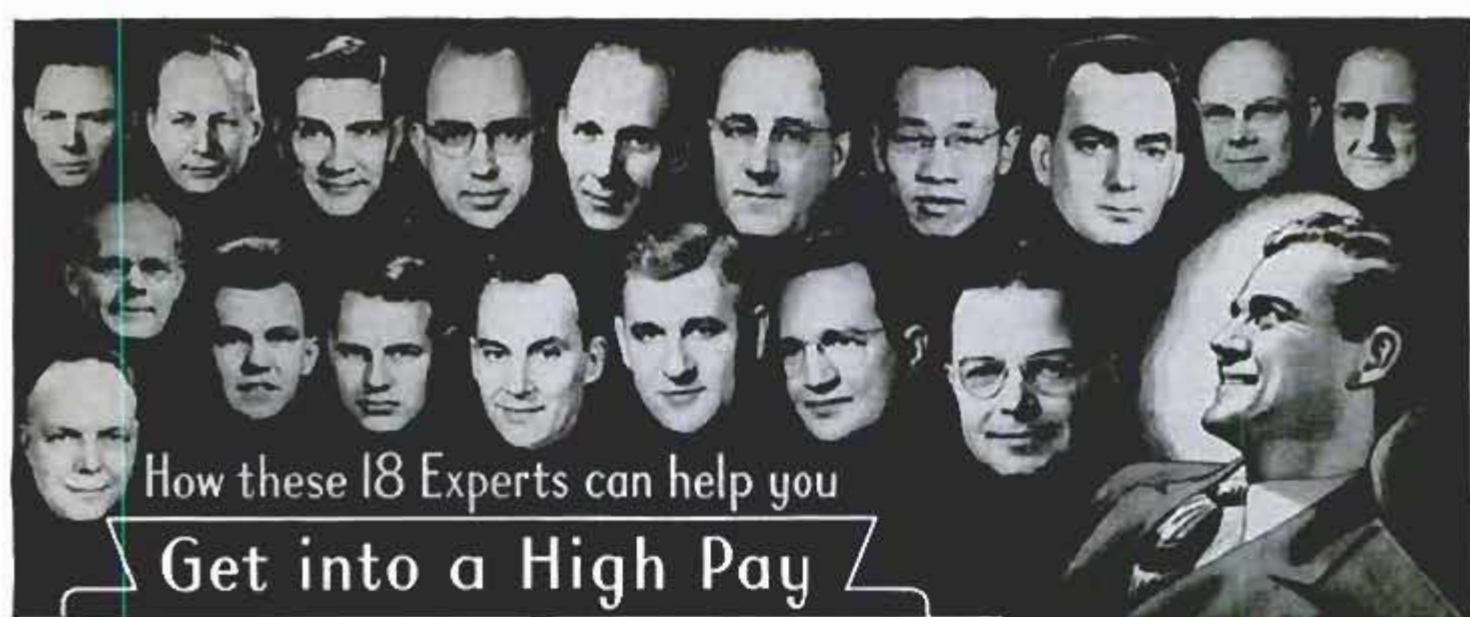
### To the Editor:

As an industrial designer I was very impressed with your PM House of 1957 [October]; so much in fact that we moved



(Continued to page 8)





How these 18 Experts can help you  
**Get into a High Pay**

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(Continued from page 6)

into the home just before Christmas. I modified the layout to our exact needs and to suit the climate.

I added a glass family room, enlarged the length of the patio, screening it in, and will have an enclosed swimming pool off the sliding glass doors of the family room.

The kitchen is our real pride and joy. It is as completely automatic as possible with all counters, fixtures and appliances in stainless steel, with natural black-ash paneling. We have added built-in zone control hi-fi and zone control complete year-round air conditioning.

W. J. Kraus  
Libertyville, Ill.

☆ ☆ ☆

### To the Editor:

It is my pleasure to inform you that your organization has been voted the National Safety Council's Public Interest Award for 1958.

We here at the Council know all you have been doing for safety, and we are delighted that the judges agreed.

The award is not competitive. It is designed to allow us to express our appreciation for exceptional service to safety. I am sure you feel, as we do, that there is an-

other dividend as a result of your safety efforts — the knowledge that you have helped prevent many accidents.

Howard Pyle, President,  
National Safety Council,  
Chicago, Ill.

☆ ☆ ☆

### To the Editor:

Enclosed you will find a photo of my boat. I am 16 and during this last year filled in my spare time (amidst study for my



School Certificate Exam.) building it from the design *Crusette* in your magazine of May 1954.

I have changed it slightly by putting a narrow decking around the sides together

(Continued to page 10)

## SPEND THE REST OF YOUR LIFE ON Velvet



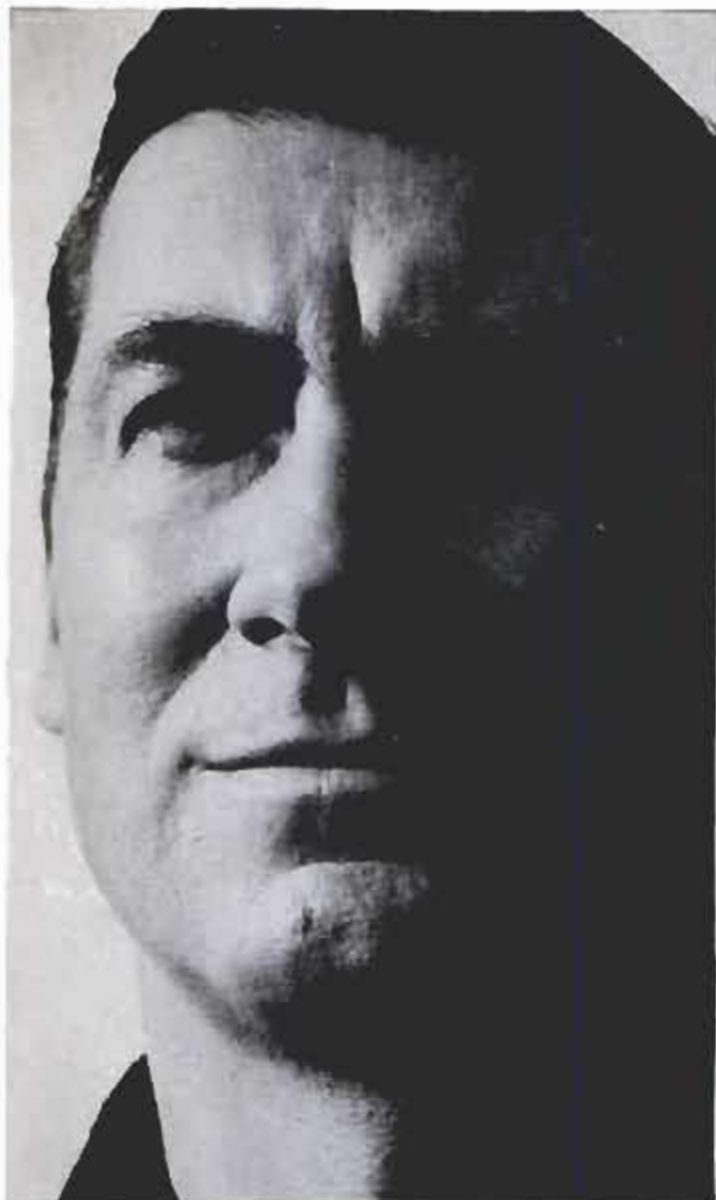
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Occupation \_\_\_\_\_

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(Continued from page 8)

with other minor changes. I had difficulty obtaining plywood and eventually bought vertical-grained plywood in rolls. I have named the boat *Cresta* after the Vauxhall. It cost about 40 pounds.

Over the holiday season we pulled it 1500 miles around the southern lakes and it has proved a seaworthy, safe and stable craft. We powered it by a three-horsepower 1929-model Evinrude motor and I took our family of six across one of the lakes. We usually "putted" around the edges. With two in the boat I clocked 8 m.p.h.!

Thank you for an enjoyable hobby and a good boat design.

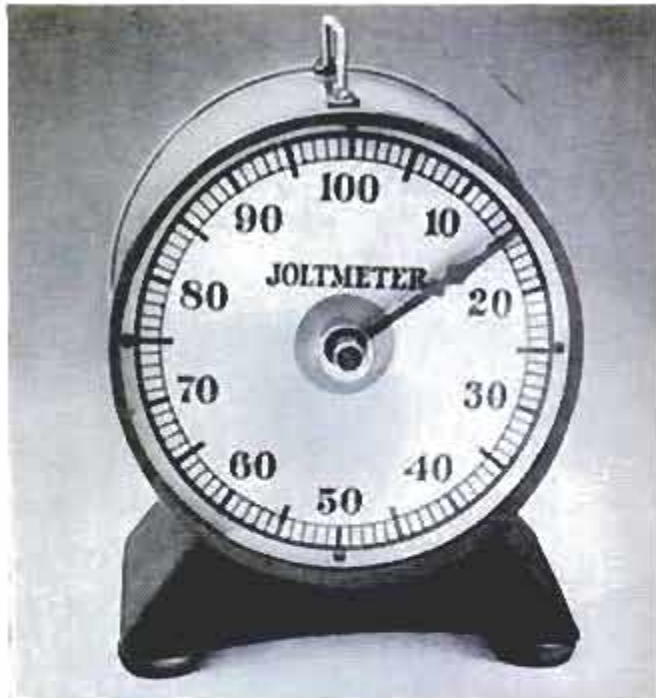
A. R. Polson,  
Waimate, N. Z.



### How Bumpy Is a Bump?

If you'd like to have the scientific low-down on how smoothly your car rides, or how poorly the builders laid the pavement in front of your home—what you need is a joltmeter.

H. E. Anderson, an engineer of Pomona, Calif., found one in a junk shop in the California Sierras and was fascinated by watching the needle jump as he drove along the freeway with the joltmeter on



the floor of his car. It really leaped as he crossed a railroad track.

Mr. Anderson thinks the instrument was made around 1920, but writes that it "carries no manufacturer's name or identification of any kind," and he'd like to know something about its origin. Any reader who recognizes the instrument may write Mr. Anderson at 2370 ~~S. Antonio~~, Pomona, Calif.  
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"I am doing very well in spare time TV and Radio. Sometimes have three TV jobs waiting and also fix car Radios for garages. I paid for instruments out of earnings." G. F. SEAMAN, New York, N. Y.



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650x14	7.82	760x15	5.42	640x15	5.32	700x16(6)	9.72
750x14	7.82	800x14	7.82	1100x20	19.52	1100x22	20.32
700x15(8)	\$9.92	700x20	\$10.02	750x17	\$13.72	825x20	\$16.62
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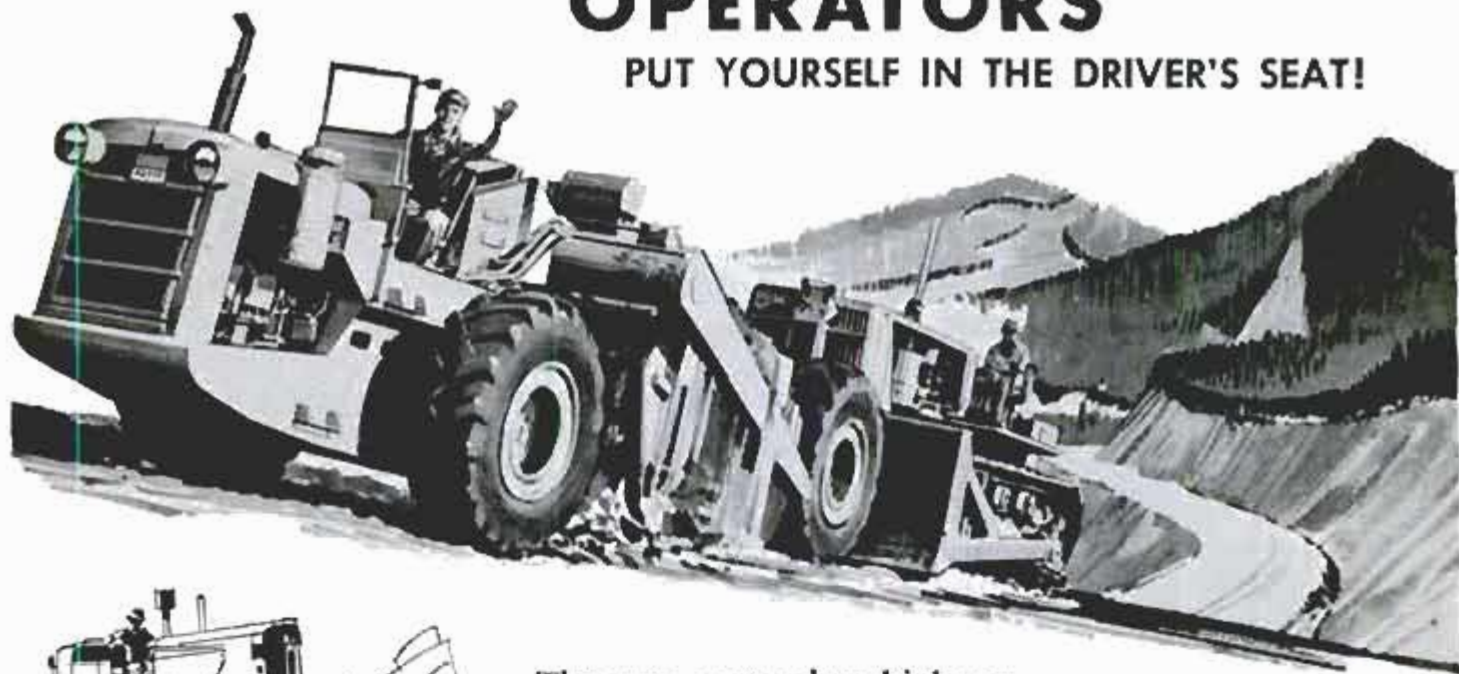
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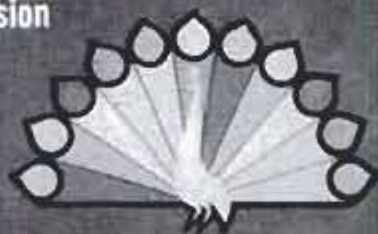
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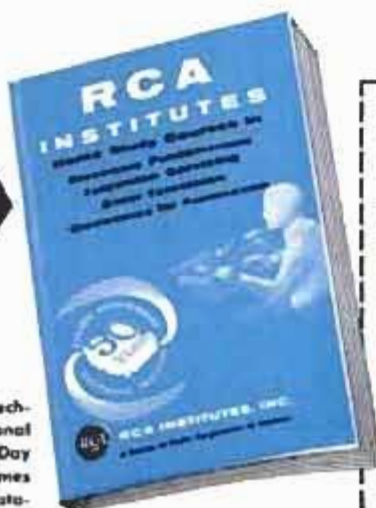
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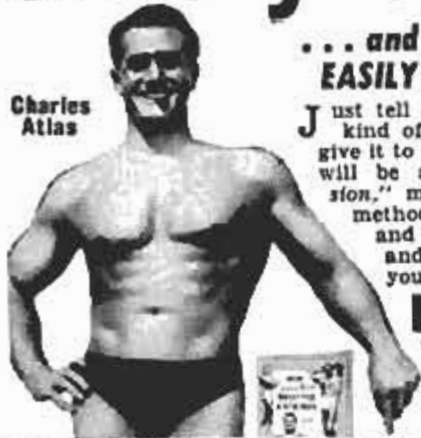
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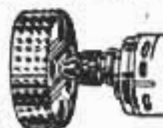
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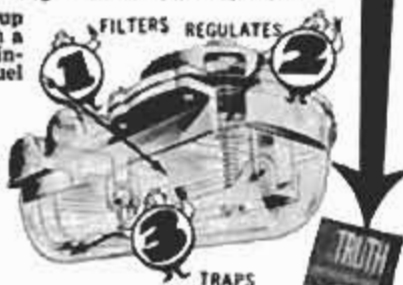
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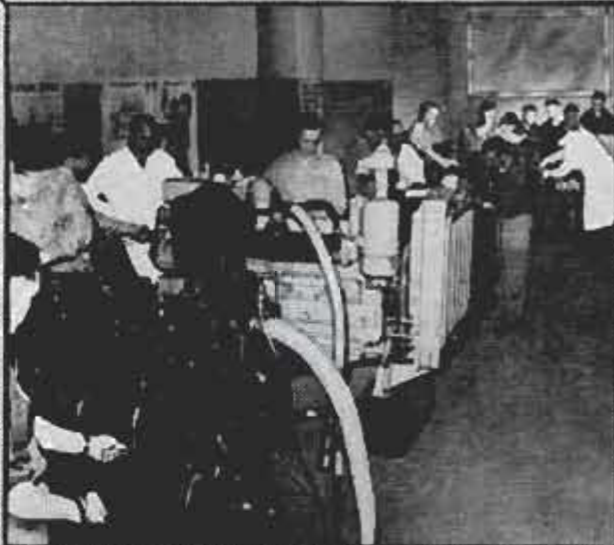
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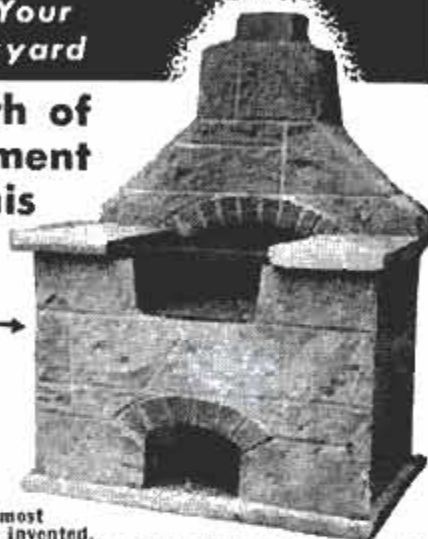
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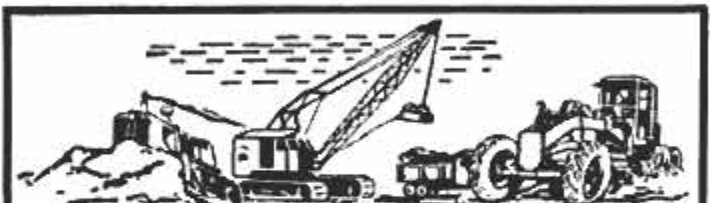
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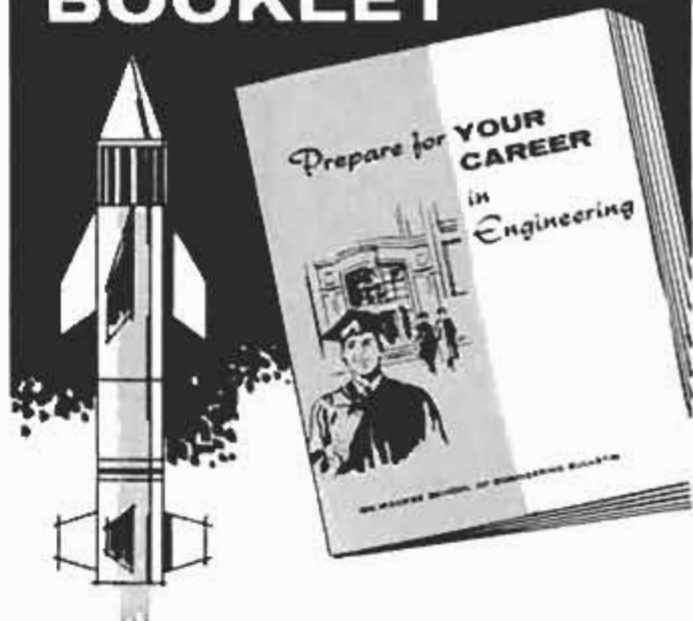
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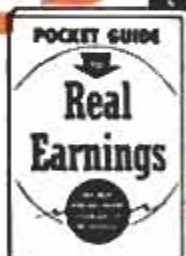
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# Sun May Create Comets From Interstellar Dust

The wispy, high-speed comets that blaze across the night skies may be created and set on their rounds by our own solar system plunging through clouds of cosmic dust on its rocketing trip through space.

Astronomers have known for years that the bright balls of matter with fiery tails are not solid, but consist of thinly dispersed bits and pieces, orbiting through millions of light years of space. But how they got that way is something else. Now, Dr. R. A. Lyttleton of St. Johns College in England has come up with the theory that as the sun moves through the interstellar dust known to exist in our Milky Way, it causes the dust to sweep around it and to converge in a thin stream behind it. The particles gravitate toward each other, form clusters, and fall toward the sun but are bent into orbits by passing planets and other celestial bodies, according to Lyttleton, and so become budding comets. Such a formation might be pulled apart by coming close to big planets, accounting for meteor streams; when close to the sun, the particles above the comets' orbital planes would move through the mass, colliding with other particles, pulverizing each other, then dispersing to form the comets' tails.

## Earth's Core Still Sizzling But Not as Hot as Once Thought

It's not "real cool" at the earth's center, 4000 miles straight down. But it isn't as hot as scientists once thought, according to Dr. Herbert M. Strong of General Electric Research Laboratory in Schenectady, N. Y.

Previous calculations had put the heat, where molten metal of the core meets solid metal, at 5400 to 7200 degrees Fahrenheit. Using G-E's diamond-making machinery, Dr. Strong has calculated that temperature at the boundary is a mere 4700 degrees. At the core, it's 6300 degrees.

Dr. Strong's figures are based on the theory that iron's melting point rises as pressure increases. Previous investigators have started with the sea-level melting point of iron—2786 degrees. In the diamond-making machine, which builds pressures to 150,000 atmospheres, Strong discovered that the melting point rose to 3132 degrees. By projecting his figures to 4,000,000 atmospheres, thought to exist at Earth's core. Strong got the new figures, which indicate that Earth's core may be solid, surrounded by liquid, iron.

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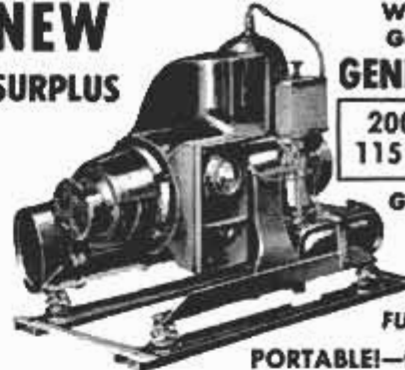
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**STARTER Collections.** 20 different Indian cents. \$2.50. 13 different liberty nickels \$2.50. 20 different Barbour dimes in folders, postpaid \$5.00. Prager, 470 27th Avenue, San Francisco, Calif.

**COMPLETE U.S. coin list, 10¢ (refundable).** Bonus offer included! Economy Sales, 156-C Dean, Mansfield, Mass.

**12 GENUINE Foreign coins, bills, 25¢.** Interesting lists. Manor Coins, Dunbar, West Virginia.

**10 INDIAN Cents, album, 20 page bargain list of coins, supplies.** Hobby Sales, Box 4054, St. Paul, Minn.

**10 DIFFERENT Coins \$1.00.** Illustrated coin catalog 50¢. Frank Herget, 2884 Bailey, Buffalo 15, N. Y.

**CONFEDERATE Currency,** paying 20¢ each. Lt. Hock, PGEU, Eglin AFB, Fla.

**LINCOLNS, 1910S, 1911D, 1912D, 1913S, 1913D, 1921S, 1922D, 1923S, 1924S, 1926S, 1931D, 65¢ each, complete lot \$6.00 postpaid.** United, 101 Cranston, Providence 7, R. I.

**FREE List! U. S. coins.** Lowest prices. Hugh's, Box 361-PR, Hickory, N. C.

**COINS From Formosa, Vatican, etc., plus foreign banknote.** 10¢ with coin approvals. Littleton Coin Company, Littleton 51, New Hampshire.

**\$4,000.00 FOR 1913 Liberty head nickel.** Uncirculated dollars 1804-1839, 1893-S, 1895-P, 1903-O pay \$100.00-\$5,000.00. Certain dates Lincoln cents before 1932, \$125.00; flying eagle cents, \$500.00; Indian cents, \$175.00; dimes before 1943, \$2,000.00; quarters before 1924, \$1,500.00; half dollars before 1929, \$3,000.00; 2¢ pieces, \$125.00; 3¢ pieces, \$150.00; halfdimes, \$1,500.00. Hundreds of others worth \$10.00, \$1,000.00. Canadian coins, 1921, 5¢ silver, \$100.00, 1875 quarters, \$100.00. 1921, 50¢, \$750.00. Wanted: 20¢ pieces, gold coins, paper money, etc. Our large illustrated guarantee buying-selling catalogue, giving complete alloy information, send \$1.00. Purchase catalogue before sending coins. Worthycoin Corporation (K-288-C), Boston 8, Massachusetts.

**VATICAN Set 4 new coins in holder,** \$1.00; 1957 U. S. proof set, \$3.00; large lists, curious coin, 10¢ Elliott, 235 Juniper, Coropolis, Penna.

**9 DIFFERENT, Genuine, foreign coins-bills 25¢; Jolie, Roslyn Heights, N. Y.**

**LINCOLN Cents: 1923-S, 1924-S, 1921-S, 1928-S, 1927-S, 1925-S, 1918-S, 1917-S, 1920-S, 1938-S, 1916-S, 1919-S.** Complete lot only \$3.00. Berry, Box 306, Westminster, Calif.

**44 DIFFERENT Coins, \$1.00.** 44 different bills, \$1.00. Oddehon, Box 482, St. Louis, Mo.

**JOIN Unique coin club.** Free periodical. Nationwide, 1274 East 93, Brooklyn 36, New York.

**ROOSEVELT Dime set uncirculated (in album) \$15.95.** 1959 proof set \$2.75. World's greatest bargain catalogue \$1.00. (Deductible first \$10.00 order.) Retail guidebook \$1.75; World coin book \$4.00. Bebe's, 4514 North 30th, Omaha 11, Nebraska.

**LOWEST Prices, reliable dealer.** Catalog 10¢. Grayson's, 2073 Dauphin, Mobile, Alabama.

**U.S. Gold, Uncirculated, \$5.00 pieces.** \$13.75; \$10.00 pieces, \$24.25; \$20.00 pieces, \$45.00. Zaid's, 733 Kerper St., Philadelphia 11, Penna.

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**300 DIFFERENT Given free with approvals.** Particulars. Windsor Stamps, 8834 Cornell Avenue, Chicago 17.

**CASH For stamps and coins.** Illustrated buying lists, 50¢ each. Plaza Stamps, 2884 Bailey, Buffalo 15, N. Y.

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**FREE! 3 Mint sets.** Foreign approvals. Seaside Stamps, Box 3102, Hayward, California.

**COLOMBIA—25 Different 5¢ Approvals.** Dopko, 3482 Laura Lane, Riverside, California.

**6000 SQUARE Inches cellulose acetate.** Make mounts stamps, covers, documents. Kit includes adhesive and instructions. \$2.00. Arbetter, 5319 Bernard, Chicago 25, Ill.

**105 DIFFERENT U.S. stamps 25¢,** approvals included. Shelton, Box 907-M, New York 8, N. Y.

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**1000 WORLD Mixture, \$1.00.** Leader, 6615 South Ashland Ave., Chicago 36, Ill.

**508 DIFFERENT Worldwide from Madagascar, Macao, Guinea, etc., cataloguing over \$15 only 35¢ Approvals.** Littleton Stamp Company, Littleton Q1, New Hampshire.

**100 EXCITING Flags, all nations, correct colors, 10¢ with approvals.** Belmont Stamps, Washington 15, D. C.

**MONACO Nudes 5¢ Approvals.** Barricks, 1600 Seward #320, Detroit 6, Mich.

**1000 DIFFERENT Worldwide \$1.00 with approvals only.** Jacobsen, Crompond, N. Y.

**BONANZA Lots—1/2¢ a stamp.** McQueston, 13544 Woodward, Detroit 3, Mich.

**TRADE Your duplicates toward our approvals!** (Foreign only.) Complete information, 10¢. Variety Stamps, Box 98-P, Newton Highlands 61, Mass.

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FREE—Your choice any volume Scott's international albums. 1959 Scott's complete catalogues, even Master Global albums free when you buy our sensational foreign approvals. Bargain Stamps, Redlands, Calif.

50 CHINA 10¢. Approvals, gifts. Coast, P.O. 2187A, Santa Ana, California.

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GIANT Approvals, thousands different, 1¢ and 2¢ each. Wahl's Stamp Exchange, 7008P Farragut, Chicago 31, Ill.

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1000 DIFFERENT, \$1.00 With approvals. Louis Golden, 6721 Eastwood, Philadelphia 49, Pennsylvania.

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UNITED States price list, 116 pages, price 25¢. Mark Hanna, 335 Fifth Ave., Pittsburgh 22, Penna.

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

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U. S. Mint flag set, complete, \$1.00. Free list. Brooks, 2323 Avenue X, Brooklyn 35, New York.

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103 DIVERSIFIED British colony stamps only 10¢. Approvals. Niagastamp, St. Catharines 671-A, Ontario.

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102 DIVERSIFIED Worldwide stamps 10¢. Approvals. Linstamp, St. Catharines 618, Ontario.

110 INCLUDING Airmails, triangles. U. S., 10¢. Approvals. Stamparee, Box 68, Sierra Madre, Calif.

U. S. Approvals. Low prices. Eagle Stamps, Romine Ave., Pittsburgh 26, Penna.

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

25 DIFFERENT Commemoratives 1893 up 10¢. U. S. approvals. K&B, Box 70, Brooklyn 23, N. Y.

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250 STAMP Hinges and 20 different Canada free with approvals. Jaydee, 218 Dickinson S.W., Grand Rapids 7, Mich.

UNITED States approvals. Select copies, used—mint. Kingsbury, Groton, Vermont.

FREE—Your choice 100 different Canada, 100 different Philippines, 100 different countries, each collection over \$5.00 catalogue value, plus many other terrific offers free when you buy our sensational foreign approvals. Topval, Box 486(b), Redlands, Calif.

25 ATTRACTIVE Pictorials worldwide different 10¢. Approvals. Linstamp, St. Catharines 618-B, Ontario.

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U. S. stamps. Giant bargain catalog. 15¢. Raymax, 35-VZ Maiden Lane, New York City 38.

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PIPEX, Newfoundland, Israel, animals, birds, sports. 10¢ with approvals. Tropicana, Box 449M, Hollywood, Florida.

U.S. #1047 \$5.00 Hamilton, good used copy only 39¢. approvals included. Shelton Co., P.O. Box 907-M, New York 8, N. Y.

AMAZING U. S. bargain. 101 different. 25¢. with U. S. approvals. Stamps, Kennebunk, Maine.

UNITED States bicentennials free. Dolinco, 31 Park Row, New York City, 38.

100 DIFFERENT 10¢ Approvals. Wilson, 201F N. Center, Orange, N. J.

U.N. Mint. 100 different foreign \$1.00. Berg's, 4724 Kelso, Chicago 30.

100 DIFFERENT Belgium free. UPU, Brussels fair, railroad stamps free. Approval applicants only. Trylon, Box 179-P, Forest Hills 75, N. Y.

77 DIFFERENT U. S.—25¢ Approvals. Utecht, 1143D North Keeler, Chicago 51.

QUEEN Elizabeth on stamps. A beautiful collection of 50 different stamps from 22 countries, all bearing the portrait of the Queen of England. Absolutely free with approvals. Capital Stamp Co., Ferrysburg 2A, Michigan.

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WOW! 110 All different Germany 10¢. Zeppelins, semi-postals, airmails, high values, etc. Giant catalog, bargain lists included with beautiful approvals. Jamestown Stamp, Dept. A69PM, Jamestown N. Y.

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HAWAII Statehood stamp. Official cachet. Mailed from Honolulu, first day of issue. Exclusively created, pictorial envelope. A must for collectors. Excellent gift. Send name, address, \$1.00 for each cachet. Clubs, send 25¢ for sample, and quantity prices. Time and quantity limited. No checks please. Dresco, Box 3356, Van Nuys, California.

PAYING High retail prices? Save up to 20% on United States stamps, foreign packets, albums, catalogs, and accessories. Lists 10¢. 130 page catalog 50¢. Stamp Discounts, Box 1867, Columbia, South Carolina.

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25 MEXICO 10¢. Approvals, packets, lists. Salsman, Box 702, Berkeley, Calif.

SUMMER Offer—1100 worldwide stamps \$1.00. Harrison's Stamps, 1435 First Ave., Oakland 6, Calif.

50 LARGE U. S. commemoratives 10¢ with approvals. Jack Clancy, Box 2187, Portland 14, Ore.

FREE United States illustrated list, 10¢ off on first order, H. and S., 45-PM Bromfield, Boston, Massachusetts.

EXCHANGE Scott basis. Want list circulation. Stamp Exchange Service, Box 494, West Lafayette, Indiana.

SURPRISE! 45 Different with general foreign approvals. Bert Collier, Chamblee, Ga.

EIGHT Old U. S. covers \$1.00. Mathewson, 636 Ocean, Ocean City, New Jersey.

APPROVALS—1¢ To 10¢ each. Richard Powell, 516 Cypress Ave., Lindenwald, New Jersey.

FREE Berlin bears with approvals. Heitmuller, Box 322, Asbury-Park, N. J.

MONACO Nudes, Israel ships 10¢. Approvals. Jewells Stamps, Tamaqua, Penna.

SEE Our display advertisement on page 24. Bailey Stamp Service.

CIRCULATION Promotion special, 3 year subscription to "The Stamp World" 50¢. Stoka, 1051C South Peoria, Chicago 43, Illinois.

50 DIFFERENT Canada, including old Victorias, 25¢ to approval applicants. Fundy Stamps, Box 414, Saint John N.B. Canada.

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GODS Of Ancient Greece: Russia sputnik; U.S. aeronautics; odd bisected stamp on piece; U.N.; Israel; world wide grab bag; etc. Free when buying approvals. Stamp Farm, M2-16, Oxford, Wis.

COLLECT Stamps without cash. Details 10¢. Frazer, 1093 "D", Springfield 4, Oregon.

1958 LAOS Unesco unused complete. 10¢ to approval applicants. Mark II Stamps Shop 1517, 6671 Sunset Blvd., Hollywood, Calif.

FREE! Giant bargain catalog—New edition listing thousands of bargains including U. S. and B. N. A. stamps, packets, mixtures, albums, accessories and supplies; sent with beautiful approvals. Jamestown Stamp, Dept. E69PM, Jamestown, N. Y.

ANTIQUES, RELICS, INDIAN GOODS, CURIOS

ANCIENT Grooved stone tomahawk \$3.00. Indian relic list free. Lear's, Glenwood, Arkansas.

7 ARROWHEADS \$2.00. List. Smith, 841 N. Tacoma, Indianapolis 7, Indiana.

SCALPING Knife, spearhead, thunderbird \$4.00. Catalog 10¢. Arrowhead, Glenwood, Arkansas.

JUNE 1959

## PRECIOUS STONES, MINERALS

**SAPPHIRE** And four more uncut gems. \$1.00. Ten polished gems, baroque-shaped, \$1.00. Free gem list. Lapidary catalogue, 25¢. O'Brien's, 1116M Wilcox, Hollywood 38, Calif.

**SEMI-Precious uncut gems.** Ten different for \$1.00. Request list 26. Prospectors Shop, 201 San Francisco, Santa Fe, New Mexico.

**EARTH Science,** the rockhounds national magazine. Subscription \$2.00. Sample 35¢. Box 1357-PM, Chicago 90, Ill.

**CUT Gems,** make jewelry—For profit or fun. 100 page magazine tells how: where to get supplies. Sample 25¢ or request free literature. Lapidary Journal, Del Mar 2, Calif.

**"GEMS & Minerals Magazine,"** largest rock hobby monthly. Field trips, "how" articles, pictures, ads. \$3.00 year. Sample 25¢. Box 687A, Mentone, California.

**GEMSTONES,** Thirty, uncut, \$4.00. Minerals. Lists. Reed's, 4930B Palo Alto, S.E., Albuquerque, New Mexico.

**ILLINOIS—Rockhounds.** Visit rockhound paradise. Come early. Saussurite \$1.00, venonaite \$1.00. Heike's Gemstones Shop, Wenona, Illinois.

**POLISHED Gem stones** sent on approval to collectors, students, schools and hobbyists. New England Gem Co., Dover 1, Mass.

**20 ROCK** And mineral specimens. Boxed and labeled. \$1.00. Deiberts', Box 213, Bath, Penna.

**AQUARIUM Rocks,** beautifully colored. Average over one inch, \$1.00 doz. postpaid. Write needs. Rock Shop, Box 902, San Jose, Calif.

**GET Free catalog** no serious rockhound, gem cutter, jewelry maker, hobbyist or craftsman can be without. Full of bargains, exclusive items, low prices from largest suppliers and authorities in the field. Free, new catalog just off the press, yours for the asking! Write Grieger's, Dept. C-11, 1633 E. Walnut, Pasadena, California.

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**EXOTIC Jungle butterflies,** suitable for laminating, decorative, educational purposes. Twelve for \$1.00. Guaranteed. Herbert Guttman Co., 257 So. Spring St., Los Angeles 12, Calif.

**HOBBYISTS—Exchange information,** buy, sell, trade, through Hobby Club. \$2.00 per year. Box 902, San Jose, Calif.

**COLLECTORS Matchbook covers,** 100 different unused, \$1.00. Catalog 25¢. Album \$3.00. Charles Edelman, 1311-C East 84, Cleveland 3, Ohio.

**CASTRO'S Officers armband \$1.00;** Cuban Revolutionary emblem 50¢; German Iron Cross \$1.50; medal catalog 25¢. Hobbies, Box 71B, Rockaway Park 94, N. Y.

**INVENTING** Can be an interesting and profitable hobby. Write for complete particulars. Institute of American Inventors, Dept. 40-E 635-F St., N.W., Washington 4 D. C.

**12 BIG Jungle butterflies \$1.00.** Houser, Box 514, Westwood, New Jersey.

**MATCH Book album** loose leaf pages, expandable, 144 spaces \$1.00 ppd., sample 10¢. Match Album, 5056 Armitage, Chicago 39, Ill.

**NAZI Insignia book,** 600 illustrations, \$1.00. 12 Nazi insignia, \$1.00. Hobbyland, Calgary, Canada.

**20 RARE Tropical seashells \$4.50.** With names, location, price list. Edward Dunav, 229 S. 9th, Philadelphia 7, Penna.

**NAZI Swastika armbands \$1.00;** Nazi medal with ribbon 50¢; embroidered swastika emblem 25¢; medal catalog 25¢. Insignia Club, Box 71B, Rockaway Park 94, N. Y.

**GEM Tumbling.** Profitable hobby. 54 pages detailed instructions. Nationally recognized. \$2.00 postpaid. Victor Agate Shop, South 1709 Cedar, Spokane 41, Washington.

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**FAMOUS German,** Japanese cameras. Direct imports save you 30-50%! Gieralt, 859 N. Paulina, Chicago 22.

**FREE! 72 Page photographic bargain catalog,** Dept. 1-A6, Central Camera Company, 230 So. Wabash Ave., Chicago, Ill.

**NEW 35MM. Aretic P2.8 German precision camera.** Built-in Gossen meter. Free literature. Herald Camera Sales, P.O. Box 454, Lyndhurst, N. J.

**FREE Wholesale catalogue,** camera equipment. Allen Studios, 105 King Court, Elmont, New York.

**FRESH Kodak Kodachrome film.** 8mm roll \$2.10, mag. \$3.20; 16mm roll \$5.75, mag. \$5.10; 135 24-\$1.50; 36-\$2.10. B & M Film Service, P.O. Box 74, Belleville, N. J.

## PHOTO FINISHING

**HAND Colored.** Two 5x7's or one 8x10 \$1.98. Mention colors. Boyle Photo, Print Shop, Box 534, Newport, Oregon.

**KODACOLOR Trial offer:** Enlarged color prints from your Kodacolor negatives, 15¢ each with this advertisement. Bell Color, Dept. PM, Englewood, New Jersey.

**ANSCOCHROME,** Ektachrome film processing \$1.00. 20 exposure roll mounted. Free mailers. Price list. U. S. Color Mart, Box 191, Hartford 1, Connecticut.

**KODACHROME Processing** by Kodak. 8mm. roll or 35mm., 20 exp., \$1.40. Prompt service. Write for mailers and prices. Color Pix, Dept. P, CPO Box 30, Kingston, N. Y.

**TWELVE Exposure rolls 49¢.** Wallets 20 for \$1.00. Lincoln Studios, Dept. K, Box 13, Lincoln, Nebr.

**ENLARGEMENTS,** Heavyweight, six 5x7's or three 8x10's \$1.00. Jack Koons, Huntington Mills, Penna.

**KODACOLOR Special,** 8 exposure, jumbos \$2.25; 12, \$1.25. Black and white, 8 or 12 exposure roll. Jumbos 50¢. Thrifty Photo, Dept. PM59, Box 275, San Francisco 1.

**QUALITY Photofinishing,** reasonable prices built our reputation. 19 years experience. Jumbo prints 5¢. Other prices equally low. We pay postage both ways. Free enlargement! Save on color, too. Write for free mailers. Mailbox Photo, Box 99A, Hamilton, Ohio.

**FREE 5x7 High gloss enlargement,** when ordering 25 wallet photos for \$1.25. Silk finish. Send photo snapshot or negative, returned unharmed. Perfect Photo, Box 1744, Church Street Station, New York 8, N. Y.

**FAST Film service.** Kodacolor processing only 75¢. Prints only 25¢. Black and white: 8 exposure 40¢; 12 exposure 60¢; 20 exposure \$1.00. Reprints 5¢. Kodachrome, Ansochrome, Ektachrome. Mounted \$1.35. Finest quality. Mail Order Photo Service, Box 297, Watertown, Wisconsin.

**35 PRINTS Made,** send negative and \$1.10. Film developed \$1.20. Perlise, 5 Raymond Court, Garden City, New York.

**ENLARGEMENTS,** Professional, five 5x7 or three 8x10 \$1.00. Elgee Photo, P.O. Box 4506, Pittsburgh 5, Penna.

**HEAVYWEIGHT Enlargements!** Three 5x7's or 12 wallets, 50¢. Photo Specialties, 1921-B Arctic, San Leandro, California.

**SPECIAL! 8 or 12-exposure rolls,** jumbos, 25¢. Premium offers. Top Photo, Wellsville, New York.

**INTRODUCTORY Special.** Processing Kodachrome 8mm movie or 35mm 20 exp. \$1.00. Kodacolor 8 exp. complete \$2.00; 12 exp. \$3.00. Black and white 8 jumbos 40¢. Jumbo reprints 5¢. Quality guaranteed. Prompt service. Write for free mailers. Fast-X-Photo, Box 7A, Jersey City, N. J.

**TWO Beautiful prints** from each picture on roll 8 exposures 45¢; 12 exposures 55¢. Thirty-eight years of satisfied customers. Quick service. Lens Photos, Dept. J-4, Janesville, Wis.

**KING Size prints,** flexigloss finish, 8 or 12 exposure, 1 roll trial 45¢, satisfaction or refund. M & S Photo Service, Box 192, Union City, Penna.

## MOTION PICTURES AND SOUND EQUIPMENT

**8MM.-16MM. sound shorts.** Also tremendous assortment full length features as low as \$15.00. Used 16mm. sound projectors our specialty, \$79.50 up. Send for 1959 catalog. Abbe Films & Equipment Co., Dept. PM659, 417 West 44th Street, New York 36. PLaza 7-2219.

**8-16-35MM Bought,** sold, exchanged. Joseph Macrie, 249 Bellevue, Hammonton, New Jersey.

**10¢ BRINGS** Big new cine manual for the 8mm.-16mm. movie maker. Save money on fresh b&w and color movie film, all home processing equipment. Superior, 448 N. Wells, Chicago 10.

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

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

**16MM. And 35mm. sound film,** projectors. Savarese, Woodcliff Lake, N. J.

**16MM. Sound films.** Bargain bulletin. Duquette, 97-T Snow, Fitchburg, Mass.

**FREE! Blackhawk's big sale catalog** 8mm., 16mm. movies, 2"x2" color slides. Biggest selection anywhere! Projectors, cameras, supplies. Big discounts! Get free, every three weeks, 12-page newspaper size bargain list! Blackhawk Films, Davenport 14, Iowa.

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

## COLOR SLIDES

**SOUTHSEAS—2x2 Colorslides.** Catalogue, sample, 30¢. Avery Colorslides, 4818A Placidia, North Hollywood, Calif.

**FLORIDA—10 Slides \$1.50.** Philly-Photos, Box 6221 F, Philadelphia 36, Penna.

## MUSIC & MUSICAL INSTRUMENTS

**VIOLIN Makers supplies.** Free catalog. 309 W. Fourth, Los Angeles 13.

**SONGWRITERS,** With publisher contacts, want song ideas. Share royalties. No fees. Send poems. Songwriters' Associates, 1650 Broadway, New York City 19-G.

**1959 ACCORDIONS Wholesale—10 day trial.** Free catalog. American Accordion Center, 5329 PM-69, Belmont, Chicago.

**VIOLIN Making supplies.** Free catalog. Fred Artindale, Box 71992, Los Angeles 1, Calif.

**RECORDS Made** from discs, tape, wire. All speeds! \$3.00 each. Quick, reliable service. Rapid Records, 185 N. Wabash, Chicago 1.

**ACCORDIONS—Below wholesale.** Lifetime guarantee. Free catalog. Dallas Music Co., 804 Main St., Evansville 8, Indiana.

**GUITAR Making books,** plans, imported woods, tools. List 10¢. Store, 510 East 11th Street, New York 9, N. Y.

**SONGPOEMS** And lyrics wanted. Mail to: TinPan Alley, Inc., 1650 Broadway, New York 19, N. Y.

**POEMS Wanted** for new songs and recording. Immediate consideration. Send poems. Songcrafters, Box 6145, Acklen Station, Nashville, Tenn.

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

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

**ACCORDIONS—1959 Models.** Lowest wholesale prices. Save up to 75%. Free home trial. Trades accepted. Big color catalog free. Accordion Manufacturers, Box R, 2003 Chicago, Chicago 22.

**ELECTRIC Guitars,** amplifiers, wholesale. Free catalog. Carvin P.M.M., Covina, California.

**ACCORDIONS,** Wholesale to everyone. Save up to 60%. All national known brands. Free catalogue. Del Principe, 29 South Cicero, Chicago 44.

**SONGS Into dollars.** Share \$33 million dollars yearly for new songwriters, song poets. Any subject, songs composed, published, promoted by largest firm. Information, appraisal free. Send Nordyke Music Publishers, 6000 Sunset, Hollywood 28 PM, California.

**SWISS Musical movements,** \$1.90. Helax, 218 W. 72nd St., New York City 23.

**SONG Request magazine** publishes new songs. Subscription two dollars per year. Olenik Records, Mount Morris, Mich.



**RADIO** And TV tubes at manufacturers' prices! 100% guaranteed! Brand new! No re-brands or pulls! United Radio, Box 1000, Newark, N. J.

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**ELECTRIC** Guitars, amplifiers, wholesale. Free catalog. Carvin, PMR, Covina, California.

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**"THE** Awl for all." Nationally advertised. Sews leather, canvas, etc. Retail \$1.98. Sells on sight. Free details. Manufacturers Agent, 4155 Armitage, Chicago 39.

**OUT** Of pawn, Bulova, Benrus watches. \$4.95 up. Illustrated folder. Cosmos, New York City 35, Dept. 300.

**SENSATIONAL** Patented device. Eliminates messy painting. Easily installed in paint can. Indestructible plastic. Gallon and quart size with attachments, \$1.00 set complete. Cash or money order. Money back guarantee. Write for details. Cobon Plastics Corp., P42 Lafayette St., Newark, N. J.

**BIG** Profits. Stamp social security plates, key protectors. Sample 50¢. Catalog free. General Products, 188-PM State, Albany 10, N. Y.

**FREE** Sample! Beautiful feather pictures. Send 14¢ stamps mailing. Sylviak, Apartado 9036, Mexico 1, D. F.

**SALON** Reducing tables, rollers, belts, cushions, slant boards. Coin timers factory. Mary-Mac, 1012 Powhattan St., Dallas 2, Tex.

**EASY** Handwork makes fast-selling useful articles. Sample free. Sunmade Company, Brockton 64, Massachusetts.

**EARN** \$12,000 Yearly—Only two sales daily. World's best seller, The Holy Bible. Illustrated. Protestant or Catholic. Margaret's, P.O. Box 92, Hazleton 7, Penna.

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

**GOLD** Or silver letters, numbers. Windows, doors, trucks, 1" to 6". 500% profits. Free samples. Atlas-T, 544 West 79th, Chicago 20.

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

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

**YOUR** Own business—Used suits \$1.50, overcoats 65¢, mackinaws 35¢, shoes 12 1/2¢, ladies coats 30¢, dresses 15¢. Enormous profits. Catalog free. Nathan Portnoy Associates, 2109-AA Roosevelt Road, Chicago 8.

**SELL** Champion, AC, Autolite spark plugs. Reconditioned, electroplated, guaranteed 10,000 miles. 100% profit. Free sample. Lee Plugs, 1608-E Roberts, Houston 3, Texas.

**AGENTS**—Make big profit on combination tool sets. Write: Gamco, Box 1546, Lancaster, Penna.

**SENSATIONAL!** Make \$50.00 day. Write for details. National Distributing, Dept. PM, 1751 W. Flagler Street, Miami 35, Fla.

**MAKE** Extra money fast—Show friends, others big value \$1.00-\$1.25 Christmas, year round greeting card assortments, gift wrappings, exciting gifts, household items, costume jewelry, stationery, toys. Profits to 100%. Bonus to 7%. Write for newest assortments on approval, free album name imprinted Christmas cards, free gift offer, details. Hedenkamp, 361 Broadway, Dept. PM-57, New York City.

**SELL** Plastic pocket stamps. Reliable outlet. 50¢ brings details and your own name, address pocket printer postpaid. Little, P.O. Box 215, Melbourne, Florida.

**SELL** Portraits painted in oils. Write Portraits, 402-A Hazlett, Baltimore 29.

**K-1** ADDED To paint kills insects for years! New product! Terrific potential! Kilpane-Ivers, Western Union Bldg., Houston 2, Texas.

**DAMASCENE** Earrings! Exotic Orientalism. Huge profit. Ohga, PM149, Sigakenkusatu, Japan.

**SELL** Imported wireless electric clocks. Crown Importing Co., 78 Glenridge Ave., Montclair, New Jersey.

**MAKE** Big easy profits selling Royal jelly vitamins. Details and sample supply \$2.00. Brannan's, 221 West 43rd Street, Anniston, Alabama.

**FEATHER** Picture and artistic catalog 25¢. Frontier, 1104, Calexico, Calif.

**BE** The Popular Mechanics representative in your neighborhood and earn big profits in your spare time. Write Popular Mechanics, Room 6A, 250 West 55th St., New York 19, N. Y.

**1959 HOTTSPARK**: Starting, pep, mileage, \$4.50; 1954 Kaisers, Varitypers, IBM's, mimeographs, multiliths, Barbells, Elmsford, New York.

**BUY IT WHOLESALE**

**WAREHOUSE** Clearance sale. Hundreds of household items less than wholesale. Illustrated catalog. 25¢ handling charge. Forsons, Box 1027, Sunnyvale, Calif.

**TERRIFIC** Discounts. Catalog 25¢ (refundable). Gille's, 1228 Main, Green Bay, Wis.

**FREE** Wholesale catalogs. My source of over fifty, \$1.00. Ozco, Canaan, Conn.

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

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

**LARGEST** Wholesale supply source in U.S.! Furniture, clothing, appliances, housewares, automobiles and accessories, tools, sporting goods, hobby supplies, farm equipment, imports, new products, bargain merchandise. Free details. Associated Wholesale, Box 2068-DD, Sioux City 4, Iowa.

**BUY** Wholesale: 100,000 nationally advertised products. Appliances, cameras, sporting goods, housewares, watches, typewriters, tools, clothing, etc. Discounts to 80%. Buy-Rite, Box 258, Hawthorne 104, New Jersey.

**30% BELOW** Wholesale. National appliances. Write. Buyers, B-5811-B, Oklahoma City 10.

**WHOLESALE** Merchandise. Free catalog. Alart, 1840 W. Camelback, Phoenix, Ariz.

**NEW** Multicolor wholesale catalog! Housewares, appliances, clothing, silverware, cookware, luggage, binoculars, shavers, radios, phonographs, cameras, projectors, recorders, typewriters, sewing machines, furniture, power tools, toys, sporting goods, watches, diamonds, jewelry, automobiles, etc. Name brands. Huge discounts. Postcard: Selbyco, Decatur 157, Illinois.

**BULOVA**, Benrus watches, men, ladies', like new. \$4.95 up. Folder, 200 illustrations, free. Cosmos, 81 E. 125th St., New York City, Dept. 251.

**FREE** Catalog! Hundreds of items below wholesale! Sparta Specialty, Sparta, Tenn.

**WHOLESALE!** 10,000 Products! Get free catalogs! Free details! United Wholesalers, 1265-M Broadway, New York 1, N. Y.

**HANDMADE** Wellington and cowboy boots. Free catalog. Ysleta Boots, Box 815, Ysleta, Texas.

**SEND** 50¢ For catalog. Leaming Co., Box 735, Mansfield, Louisiana.

**AMAZING** Savings. Big wholesale catalog \$1.00 refundable. Coleman's Personal Shopping Service, Wayland, New York.

**WE** Get it for you wholesale! America's newest wholesale service making available all types of merchandise to everyone at wholesale prices. Write today! Frank's, Dept. PM, Box 547, Paducah, Kentucky.

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

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**WILL** You test new items in your home? Surprisingly big pay. Latest conveniences for home, car. Send no money. Just your name. Kristee 33, Akron, Ohio.

**AD Match** sales! Your own business, without investment! Sell for world's largest direct selling manufacturer of advertising matchbooks. Big spot cash commission. Start without experience. Our tested sales kit tells you where and how to get orders. Men, women, part or fulltime. Match Corporation of America, Dept. PM-69, Chicago 32.

**ANYONE** Can sell famous Hoover uniforms for beauty shops, waitresses, nurses, doctors, others. All popular miracle fabrics; Nylon, dacron. Exclusive styles, top quality. Big cash income now, real future. Equipment free. Hoover, Dept. A-100, New York 11, N. Y.

**MAKE** Extra money—Big cash commissions plus premiums for you and your customers. Sell advertising book matches. Sensational new tenor, glamour girls, hillbillies; dozens others. All sizes. Quick daily sales; big repeat business. Free master kit makes selling easy. No experience necessary. Superior Match, Dept. M-659, 7530 Greenwood, Chicago 19.

**OUR** Products used everyday in automotive and marine trade. Write Mechanics Research, Madison, Indiana.

**EARN** Big commission full or part time. Build profitable business of your own selling America's largest line low priced business printing. 360 page catalog samples hundreds of items used daily by business people. Advertising specialty line features imprinted ball pens low as \$9.95 for 100. Calendars low as \$5.95 for 100. Free sales kit. National Press, Dept. 8, North Chicago, Ill.

**NEW** Mysterious life of the party. Peggie puzzles. Sample with advertisements \$1.50. Shenfelt, 227 E. 33rd St., Tucson, Arizona. Best you have ever seen or money refunded.

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**NYLONS**—Imperfects, sample dozen \$3.50. Closeouts! Bargains! Essential Products, 210 Fifth Ave., New York City 10.

**FACTORY** Representative. Now miracle invention, Car-Bo-Ti for car radios. Sells for \$2.50, costs you as low as 90¢. Reardon Company, Peoria, Illinois.

**EMPLOYMENT INFORMATION**

**FLORIDA**—Wide employment advertising service. Free details. Louis Mlecka, Box 918, Brooksville, Florida.

**INFORMATION** Alaskan employment, homesteading 25¢. Opportunities, 5 Owen Drive, Madison 5, Wisconsin.

**CALIFORNIA** Report—Just issued covers job demands, climate, salaries, colleges, newspapers, various information. Send \$2 to Pacific Research and Information Co., P.O. Box 66277, Los Angeles 66, California.

**ALASKA**—16 Pages information. Employment, living conditions, homesteading. \$1.00. Alaska Unlimited, Box 197, Ketchikan, Alaska.

**JOBS** On ships and yachts traveling foreign countries. Davenport's, 1354-K, G.P.O. New York 1, N. Y.

**TEXAS** 10 Largest cities Sunday classified ads listing jobs, housing, etc. One city \$1, each additional 75¢; all 10 \$6.95. Robert Clark, 1508 Milford Street, Houston, Texas.

**JOBS** On ships. Write for free information. World Wide Seamens Service, Box 1445-PM, New York 1, N. Y.

**JOBS** Overseas! Write Jancek Development Co., 109 Hub Station, New York 55, N. Y.

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**JOBS**—High pay; U.S.A., So. America, the Islands. All trades. Many companies pay fare. Write Dept. 71J, National Employment Information, 1020 Broad, Newark, N. J.

**JOIN** The Merchant Marine. Big pay. Box 4092, Jacksonville, Fla.

**EARN** High pay, aboard ships. Travel foreign countries. Write Dept. 76G, Universal, 1020 Broad, Newark, N. J.

**AMERICAN** Overseas jobs. High pay, men, women. Transportation paid. Free information. Write Transworld, Dept. 14D, 200 West 34th St., New York City.

**FOREIGN** Employment information. Make big money in Europe, Africa, South America, Canada, Alaska, Far East. Transportation paid. Construction workers, clerks, truck drivers, etc. Travel, adventure. Complete information application blanks, sent by return mail. Send \$2.00 to Foreign Bureau, P.O. Box 512, New Orleans, Louisiana.

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**LATEST** Overseas U.S.A. jobs. Men, women. All trades. New certified lists. Only \$2. Universal Research, Box 4912, Baltimore 20, Maryland.

**ALASKA** Hourly scale: Laborers \$4.16; truck drivers \$4.45; carpenters \$4.38; plumbers \$5.00; electricians \$5.00. Construction projects over \$335,000,000.00. Names and addresses of companies hiring; total contract awarded; location; wage scale; also information regarding homesteading. Send \$1.00 (\$1.25 airmail) to Alaska Employment Opportunities, Box 1032, Anchorage, Alaska.

**VENEZUELA** Latest job opportunities. Oil and construction companies employing. \$2.00. Ramesar, Box 10, Anaco, Edo. Anzoategui, Venezuela.

**FREE** Information—U.S.A., overseas jobs. High pay transportation. Futures, Dept. M, 215 West 34th Street, New York City 1.

**VOCATIONAL** Guidance, \$1.00. Walter Kazaks, 234 East 58th Street, New York City 22.

**CALIFORNIA!** Employment, opportunities. Free details. Chesley Distributors, 2339-PM University Avenue, San Diego 4, California.

**LAS** Vegas is booming, unique jobs, housing information. Fascinating classifieds. \$1. A. Berlin, Box 3664, North Las Vegas, Nevada.

**WANT** An overseas job? Information free. Employment Information Headquarters, 79 Wall Street, Dept. 6-A, New York City 5.

**JAPAN!** Far East! Many hi-paying jobs available. All fields. Complete, detailed coverage. \$2.00. Watts, Box 903, C.P.O. Tokyo.

**SPECIAL SERVICES**

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**MANY** Make \$1500.00 per month operating collection office. Free details. Franklin Credit, Roanoke, Virginia.

**USED** Correspondence courses and books sold and rented. Money back guarantee. Catalog free. Courses bought. Lee Mountain, Pisgah, Alabama.

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**WELDERS** Earn big money. Easy to learn arc, gas, automatic welding. Non-profit school, low tuition, GI approved. Free booklet. Hobart Welding School, Box M-692, Troy, Ohio.

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**HIGH** School at home in spare time with 62-year-old school. No classes. Standard high school texts supplied. Single subjects if desired. Credit for subjects already completed. Progress at own speed. Diploma awarded. Information booklet free. Write today! American School, Dept. XA45, Drexel at 58th, Chicago 37.

**MASTER** Watchmaking at home. Free sample lesson. Chicago School, 2328-YS Milwaukee, Chicago 47.

**HIGH** School diploma at home. Licensed teachers. Approved materials. Southern States Academy, Station E-16, Atlanta, Ga.

**SECRET** Investigations. Experience unnecessary. Investigators particulars free. George Wagner, M125 West 86th, New York City 24.

**BE** An investigator. Write for free details. State age. National Detective Academy, Dept. P. P.O. Box 1082, Scottsdale, Arizona.

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**STUDY** For Doctor's degree of psychology, metaphysics and divinity. Correspondence courses only. College of Divine Metaphysics, Dept. P-M, 2811 North Illinois, Indianapolis 8, Indiana.

**WANT** A diesel job? New opportunities to increase income. Higher pay. More money. We can help you qualify. Tools. Shop method home training. Write today! Diesel, Tractor, Heavy Equipment Division, Interstate Training Service, Dept. B-2, Portland 13, Oregon.

**BOOKKEEPERS!** Increase your earnings! Operate your own simplified "Dollar-A-Week" bookkeeping and tax service. Full or spare time. Details free. No obligation. Ellis, Box 200, Cedar Grove, North Carolina.

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**EARN** While you learn. Auto and diesel mechanics master this top paying trade. Many graduates earn \$100 a week and up. Approved for Korean veterans. For free information write Dept. No. 256, Nashville Auto-Diesel College, Nashville 3, Tenn.

**PHYSICAL** Therapy and massage. Home training. Practice privately or work with doctors and hospitals. Free catalogue. National Institute, Desk 4, 159 E. Ontario, Chicago, Ill.

**INVESTIGATOR** Training. Phillips Secret Service System, 1917-B North Kenneh, Chicago 39.

**PIANO** Tuning pays. Learned easily at home. GI approved. 59th year. Free booklet. Niles Bryant School, Dept. P, 3731 Stockton, Sacramento 20, Calif.

**COLLEGE** Correspondence courses, for Doctor of Psychology, Metaphysics, Divinity, Catalogue. Dr. Dorothy B. Arnheiter, Forest Park, Greenwood Lake, New York.

**FINGERPRINTING** Course \$12.00. Diploma awarded. School of Fingerprinting, Box 185, Fairfield, Ala.

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**MEMORIZE** Names, faces, most anything instantly. New, simple method. You'll be amazed. Free details. Campbell, 1977 E. 116th St., Cleveland 6, Ohio.

**VOICE** Secrets revealed! Free! Studio. 14356FF South Jersey, Norwalk, California.

**LEARN** Piano tuning at home! Only \$32.95 including tools. Write Tune Craft, Box 5074-M, St. Paul, Minnesota.

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**LEARN** To sell newspaper advertising. Details free. Box 371, Ravenna, Ohio.

**EARN** Diploma in Audiometry. Good pay. Home training in fitting and dispensing hearing aids. National School of Audiometry, Box 3611, Oklahoma City 6, Okla.

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**QUALITY** Mailing lists. Farmers, housewives, tourists, H.S. graduates, specialty shops, salesmen, children. Trial 250, \$5.00. Art Publishing Co., Box 1924, McAllen, Texas.

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**PRODUCTIVE** Mailing lists on labels. Many categories! C. Dickman Company, Willow Springs, Missouri.

**SUCCESSFUL** Advertising! Free lists. Magazines, newspapers. Proven sales letters. Lowest rates. Adservice, 516 Cornelia, Chicago 13.

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**NOW** Ready! New, amazing Classified Advertising Record Book—prepared especially for classified advertisers. Here is a book that tells you instantly whether or not your advertising in any publication is paying you real results. You can tell immediately how many inquiries each publication produced—how much cash received from every ad. Spaces are provided for the name and address of the publication, date of issue, space used, rate, cost of ad, key number, etc. You have a complete record of each publication right before your eyes. Plenty of space to keep accurate record of 28 separate publications. You can have a copy by sending only 10¢ to cover postage and handling. Send for your copy now. W. F. Johnson, Classified Adv. Mgr., Popular Mechanics Magazine, 204 E. Ontario Street, Chicago 11, Illinois.

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**LEARN** Sign painting by correspondence. Expert instruction. Bolger, 148 Concord, River Edge, New Jersey.

**LEARN** Profitable, fascinating tattooing. Illustrated information \$1. Zeis, 728-C Leslie, Rockford, Illinois.

**LEARN** Sign painting with fascinating system. Straley, 410 S. Western, Springfield, Ohio.

**MAKE** \$5.00 Hourly lettering trucks. Learn fast at home. Martin, Box 37, Woodstock, Ontario, Canada.

**YOU** Can entertain with chalk talks. Catalog 10¢. Balda The Cartoonist, Oshkosh, Wis.

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**POCKET,** 3 Lines \$1.00. Guaranteed. W. J. Specialty, 8464 Manhattan, Detroit 11, Michigan.

**FREE!** Rubber stamp catalog. Many items. Campfeld, Box 798, Springfield 1, Mass.

**MADE-To-order** rubber stamp. Literature free. Arlington Rubber Stamp Co., 918-A Minnesota Ave., Knoxville 21, Tenn.

**3 LINES.** Rubber stamp \$1.00, 25 cents each additional lines. Whitney's Rubber Stamp Shop, 18 Washington Ave., Chatham, N. Y.

**FREE—**Rubber stamp catalog. Martin, 1425 Major Dr., Jefferson City, Missouri.

**DESIGNS,** Silhouettes, brands, quantities, oversize. Fastamp, 420 E. Chestnut, Springfield, Mo.

## TYPEWRITERS, DUPLICATORS, OFFICE DEVICES

RECONDITIONED Typewriters, duplicating, printing devices. \$25.00 up. Supplies. Appliances. DixieGraph, King, N. C.

NEW. Check protectors \$29.50. Berlin Enterprises, West Berlin, New Jersey.

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MIMEOGRAPHING—Letters, pricellists, formulas, instructions. Lowest prices. Lem's Letter Shop, 5710 Stanton, Detroit 8.

FREE Catalog postpaid printing, rubber stamps. DM Press, Sebastopol, Calif.

POPULAR Priced printing, Indigo Press, 5800 Indigo Road, Richmond 30, Va.

BUSINESS Cards with glamour. Reasonable. Samples. Mention business. Heaven's, Colmar, Penna.

ADS Running under this heading sell printing. Ask me for proof. I'll gladly send you amazing facts. Ask for Folder "P." F. W. Johnson, 200 E. Ontario St., Chicago 11, Ill.

QUALITY Business printing, regular and embossed. Samples, catalog. Business Records Service, Box 1595, New Orleans 11, La.

500 ENVELOPES Printed, #6 $\frac{1}{2}$ —\$3.50, postpaid. Statements same. Stanley Press, Lake Katrine, New York.

100 BUSINESS Cards, envelopes, letterheads all \$3.50. Wilcox, 2659 Sunnyside, Berkeley, Michigan.

PHOTOENGRAVING. Quality cuts, lowest prices. Sheehan, Box 2931, Baltimore 29, Md.

QUALITY Printing, offset, photo-engraving, color. Lowest prices. Herrion, 119 Lafayette, New York 13, N. Y.

1,000 BUSINESS Cards. Raised letters, \$3.95. Samples. Pioneer, PM-6, Island Park, N. Y.

WRITER. Sales letter specialist. Poesing's Mimeo, 6522 West Center, Milwaukee 10, Wisconsin.

100 8 $\frac{1}{2}$ x11 BOND Letterheads, 1000 envelopes, \$2.00. Tull, 1920 W. Camelback, Phoenix, Ariz.

BUSINESS Cards 1000—\$2.95, plus postage. Other quality printing, low prices. Tribune, Green Forest, Arkansas.

OFFSET Printing: 1000 8 $\frac{1}{2}$ x11, \$5.75; 1000 business cards \$4.25. No c.o.d.s. Mateer Press, North Main St., Whitinsville, Mass.

100 EACH Printed, 6 $\frac{3}{4}$  envelopes, 5 $\frac{1}{2}$ x8 $\frac{1}{2}$  letterheads, \$2.35 postpaid. M. Fortney, R3, Dillsburg, Penna.

OFFSET Printing: 1,000 8 $\frac{1}{2}$ x11—\$5.50; 5,000, \$17. Fast! Art, varityping. Promotion, M6, 385 Broadway, New York City 13.

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In most cases, once he had made this all-important decision, he found that the sacrifices were small compared to the rewards. Indeed, most of these successful men found that there were no real sacrifices, that work toward their goal became

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2. Once you've made this decision, only one thing remains to be done: *You must take action.*

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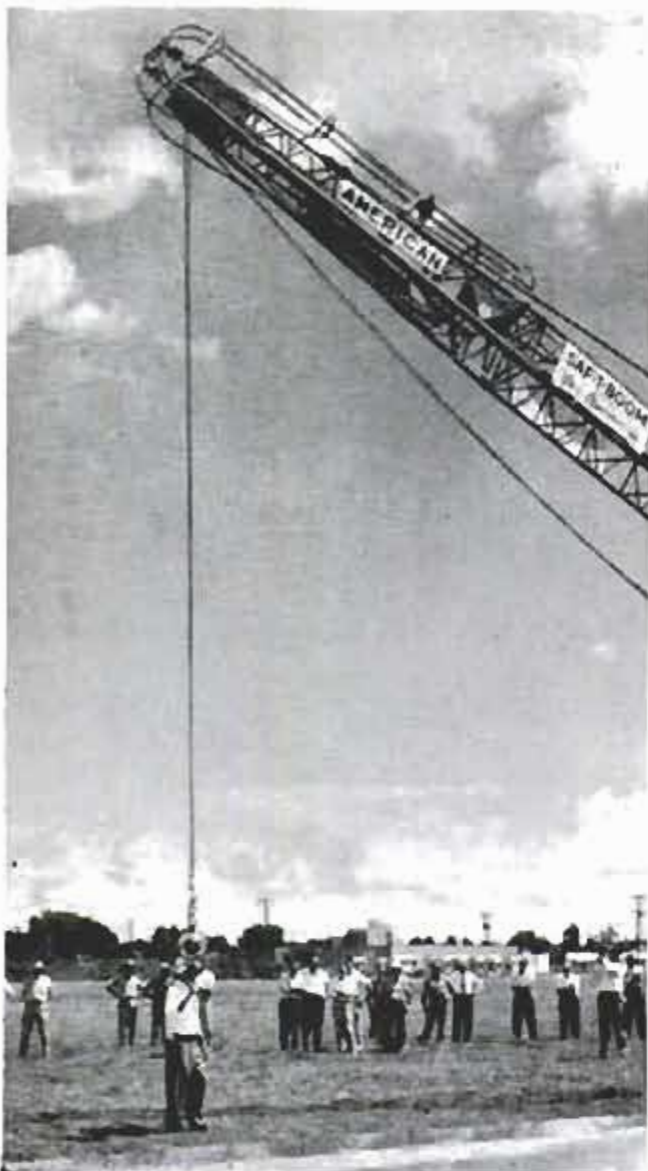
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## Insulated Crane Saves Lives of Construction Workers



Electric shocks that burn and sometimes kill construction workers when a crane boom brushes a high-tension line are licked by a new protective shield invented by an Arkansas safety engineer. The device, constructed of steel tubing mounted on 15 insulators over the boom end, will take 30,000 volts without leakage.

## Tunnel Aerial Keeps Radios Going

Car radios don't fade out as drivers whisk through the Pacific Coast Highway tunnel in Santa Monica, Calif. The reason is a single strand of wire attached by insulators to the roof of the 400-foot tunnel. It's an aerial, with 1400 feet of wire extending on poles beyond each end of the tunnel, thus providing strong signals on all necessary wavelengths through the tunnel's entire length. Installed primarily to provide continuous reception for police cars and other two-way radio-equipped vehicles, the aerial kicks in a bonus to motorists, who won't miss a second of their favorite program in the underpass.

## "Vaccine" for Sick Trees?

Scientists are seeking a tree "vaccine" that will be toxic to the parasitic dwarf-mistletoe, but not to its victim, the ponderosa pine. The parasite literally drains the life from these valuable pine trees.

## Trailer Takes Boats or Baggage

Does your hauling job call for a box trailer, flat trailer, or are you trucking a boat to the shore? Matthew W. Farmer, a Minnesota businessman, decided people shouldn't have to have a garage full of different trailers for different jobs, so he dreamed up a convertible trailer that can do them all. The basic trailer, on a four-foot by six-foot standard chassis with shock absorbers, winch and rollers, carries a plywood box body 22 inches high, sides held by hasps, snap locks and chains. Remove

the snap locks, pull a "Kwick-Loc" lever, and off come sides and tailgate; fold the front gate forward and—presto!—it's a flat-bed trailer. An arm-and-bracket arrangement sets rollers at various angles to conform to different boat-hull shapes. A tent can be carried in the bottom of the box-trailer configuration to make a camping trailer.



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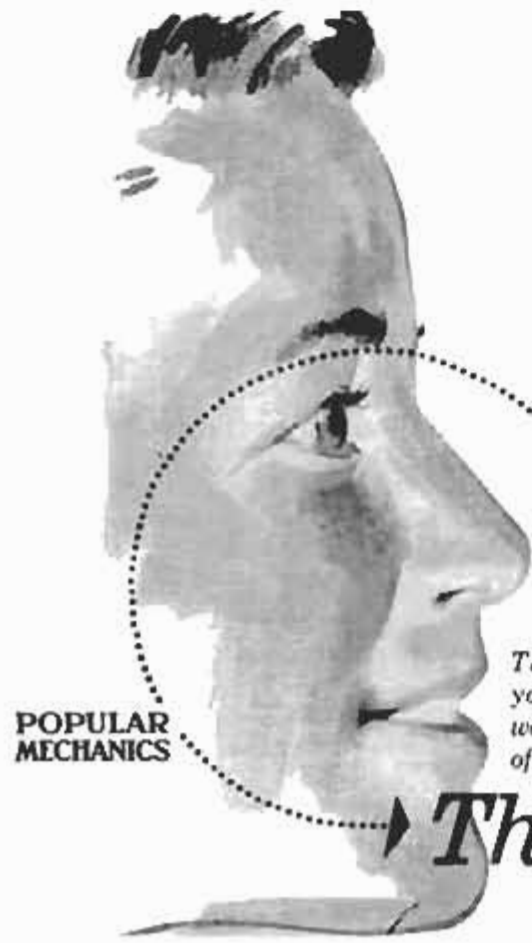
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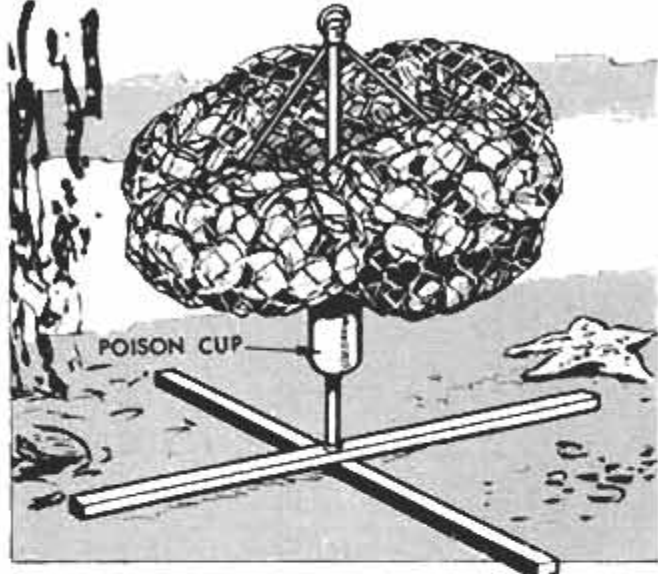
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## Poison Nest Protects Oysters

Land farmers have scarecrows and poison sprays to fend off parasites that dine on their crops, but for years sea farmers who tend oyster beds have been frustrated by predatory snails and starfish that riddle their crops before they can be harvested. Joseph B. Glancy, an oyster farmer on Great South Bay, Long Island, N. Y., has found a way to frustrate marine predators.

Glancy has patented a trick oyster nest that rests on the sea bottom, tied to a marker buoy. It is a simple circular shelf halfway up a vertical rod that sits on metal crossbar legs. On the shelf, the oyster farmer ties a chicken-wire bag full of shells, where young oyster seedlings can attach themselves and grow to appetizer size. Sea snails, called "drills," which invade oyster beds and bore holes in the young oyster shells to get at the meat, can climb the bottom half of the mast but are stopped en route by an inverted cuplike baffle containing poison that does them in.

To eliminate starfish that pry open oyster shells and eat the meat, the oysterman tours his farm periodically, pulls each nest from the bottom and dips it in a lime solution. Starfish drop off, and the nest is lowered to the bottom again.

## Vanguard Satellite Orbit Shows Earth Pear-Shaped

Studies of the orbits of Vanguard I indicate the earth is somewhat pear-shaped. Scientists had expected that the satellite's orbit at perigee (nearest the earth) would be the same over both the Northern and Southern Hemispheres. But studies of Vanguard's orbital flight show the earth's sea level is 50 feet higher than expected in the north polar regions and 50 feet lower than expected in the south polar regions.

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



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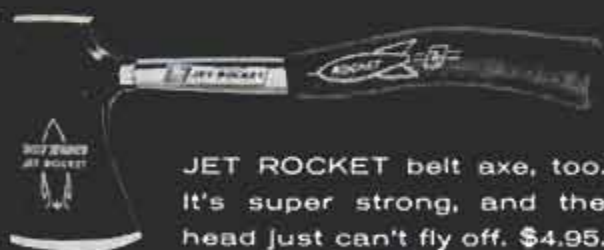
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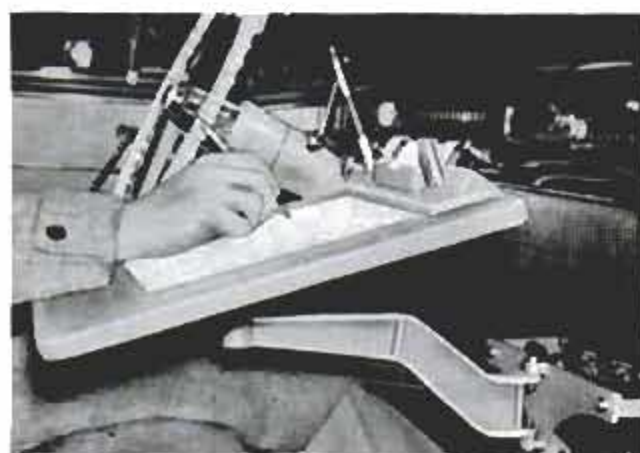
Note the forged-steel head permanently locked to the tubular-steel handle. And it has a cushion grip that won't slip - even when wet. Here, for certain, is a great hammer buy. See the JET ROCKET at your hardware store now. True Temper, 1623 Euclid Avenue, Cleveland 15, Ohio.



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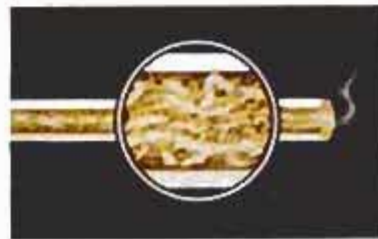
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*The folks of Morris, Ill., are all set to welcome a historic first—*

# The Telephone That Remembers

By Richard F. Dempewolff

**N**EXT YEAR, in Morris, Ill., a revolution in telephone switching will go into service. If it works as expected, a busy mother may some day pick up her telephone to call the grocer, dad at the office, or grandma, or any of the dozens of numbers she calls frequently, but instead of spinning out the usual combination of letters and numbers, she may dial just a single or double code such as "4," or "2-8" and—presto! the proper telephone will ring.

Any company president subscribing to a similar service may be able to dial a one or two-digit code and instantly telephones in all the branch offices will ring simultaneously, by means of circuits automatically set up for cross-country telephone conferences. Office PBX switchboards may vanish, their jobs being taken over by electronic gremlins.

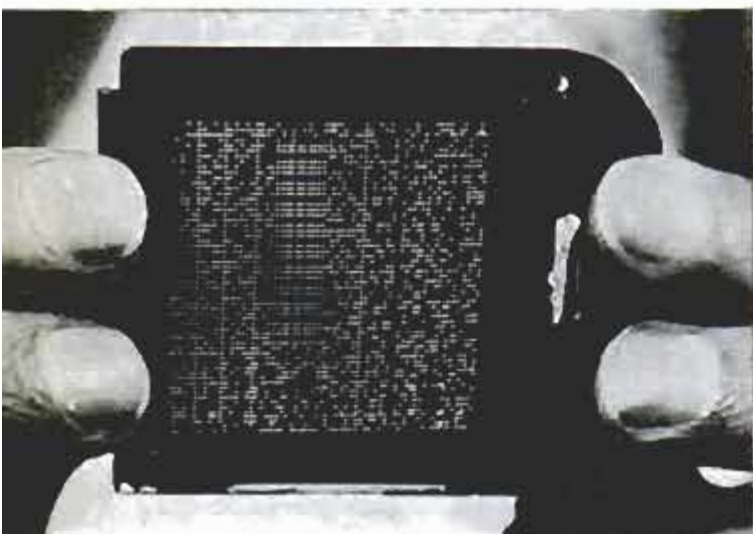
Many tricky special services gradually will become possible not only in Morris,



Eventually dial telephones will be replaced by phones with pushbutton system. Number is punched out on buttons in fraction of time it takes to spin dial and let it run back



"Flying Spot Store" prototype for electronic telephone exchange is vertically mounted unit shown here



"Memory" plate contains more than 66,000 information dots



Bell engineers lift rack of newly coded plates from developing tank. Plates are for Flying Spot Store

but all over the country. Couples going out for their regular Thursday night bridge at the neighbors, for instance, may dial a digit or two, and automatically every incoming call will be transferred to the neighbor's telephone number—until the order is canceled by the simple process of dialing another digit or two when the folks get home. Inhabitants of the town may even be spared the frustration of busy signals. When the number they call is tied up, they'll just hang up and forget about it. A few minutes later, when the line is clear, their own telephone will automatically ring them back.

"Ring" won't be the right word, for eventually, all telephones (probably with push-buttons instead of dials) on this unique network will summon subscribers with a repeating, mellow electronic tone reminiscent of a wood-wind instrument sounding an "A."

The secret behind all this magic is America's first completely electronic telephone exchange—a complex of transistors, gas tubes, cathode-ray tubes and fantastic memory devices—now under construction at Bell Laboratories' Whippany, N.J., plant.

The automatic exchange, known around Whippany as "The ESS" (for Electronic Switching System), has been in the experimental hardware stage since 1954, when a team of experts under A. J. Busch, Clarence Lovell and Ray W. Ketchledge set out to build the prototype. Morris, Ill., a town of some 8000 inhabitants, was chosen as test bed for the new baby because of its handy size, and the cross section of its telephone-customer requirements. Only 600 lines will be tied into the system at first, and chances are those customers won't know it. Eventually, if it works out, most people will know it—and have it.

Few people will ever look inside an ESS exchange. Those who do will be met by a



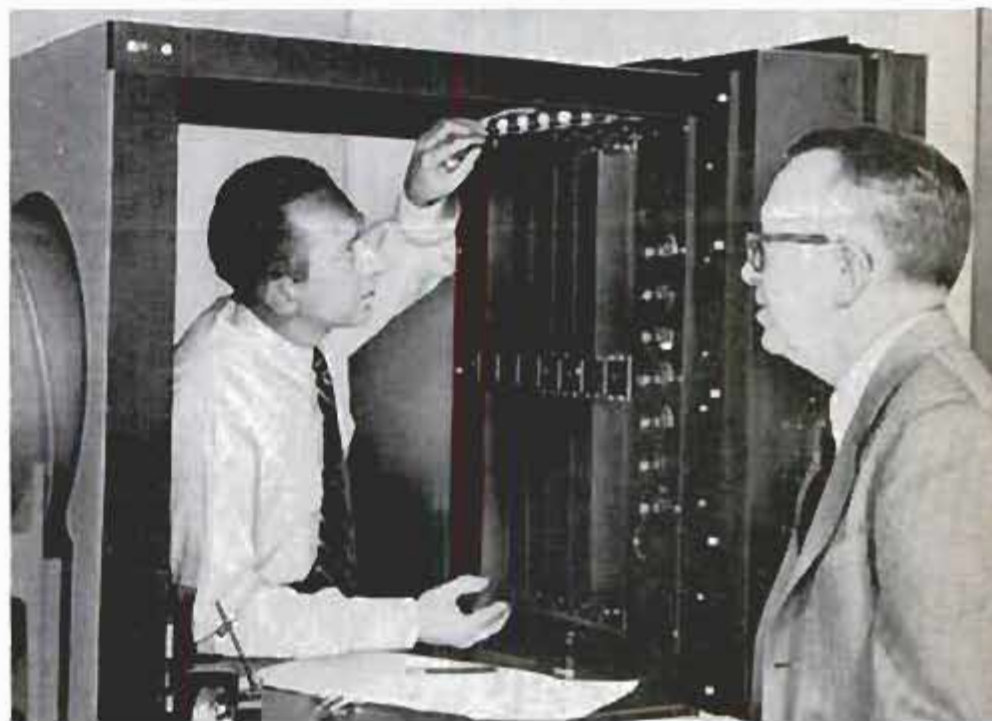
New electronic switching system is demonstrated on panel. Lights show how call progresses through maze

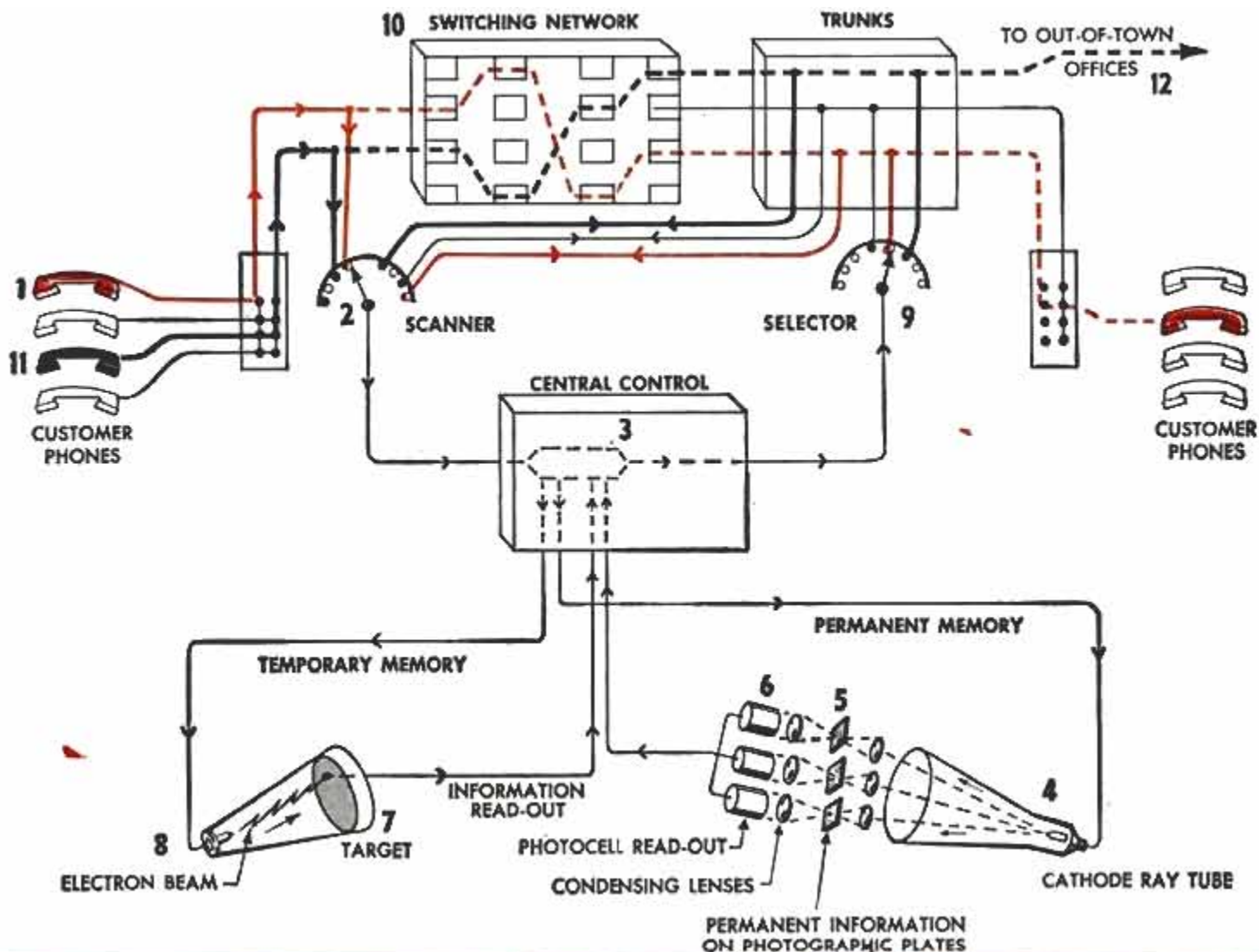
disappointing view of row on row of metal cabinets, with all the glamor of the men's locker room in a gymnasium. Today, if you wander through the basement rooms of the Whippany Labs with Ray Ketchledge, systems engineer who wheel-horsed the development of the first ESS, you can see the system "with its cabinets off." Endless banks of transistors march off across the rooms, followed by more banks of peanut-

size gas tubes, silently flashing as electronically ordered connections flick through their circuits. "The entire system," Ketchledge explains, "is specialized in the mathematical functions of memory and logic. It is really a big digital computer."

Complex as it seems, ESS requires a fraction of the circuitry and space used by present automatic-switching systems. The famous number 5 crossbar exchange that

Inside view of Flying Spot Store shows battery of lenses being installed. This is experimental model used in developing permanent memory for new electronic exchange. Lens frame being examined here has since been completed and is studded with lenses covering every inch of its surface. Lenses permit single cathode beam to read all 68 plates of memory at once





**HOW CALLS FLICK THROUGH ELECTRONIC EXCHANGE:** Caller lifts phone (1). Scanner (2) spots open line, alerts central control (3). Dial tone goes to caller, while permanent memory (4) supplies caller's number and services. Flying spot scans memory plates (5) and flashes information back to central control via photocells (6). Dialed number is stored

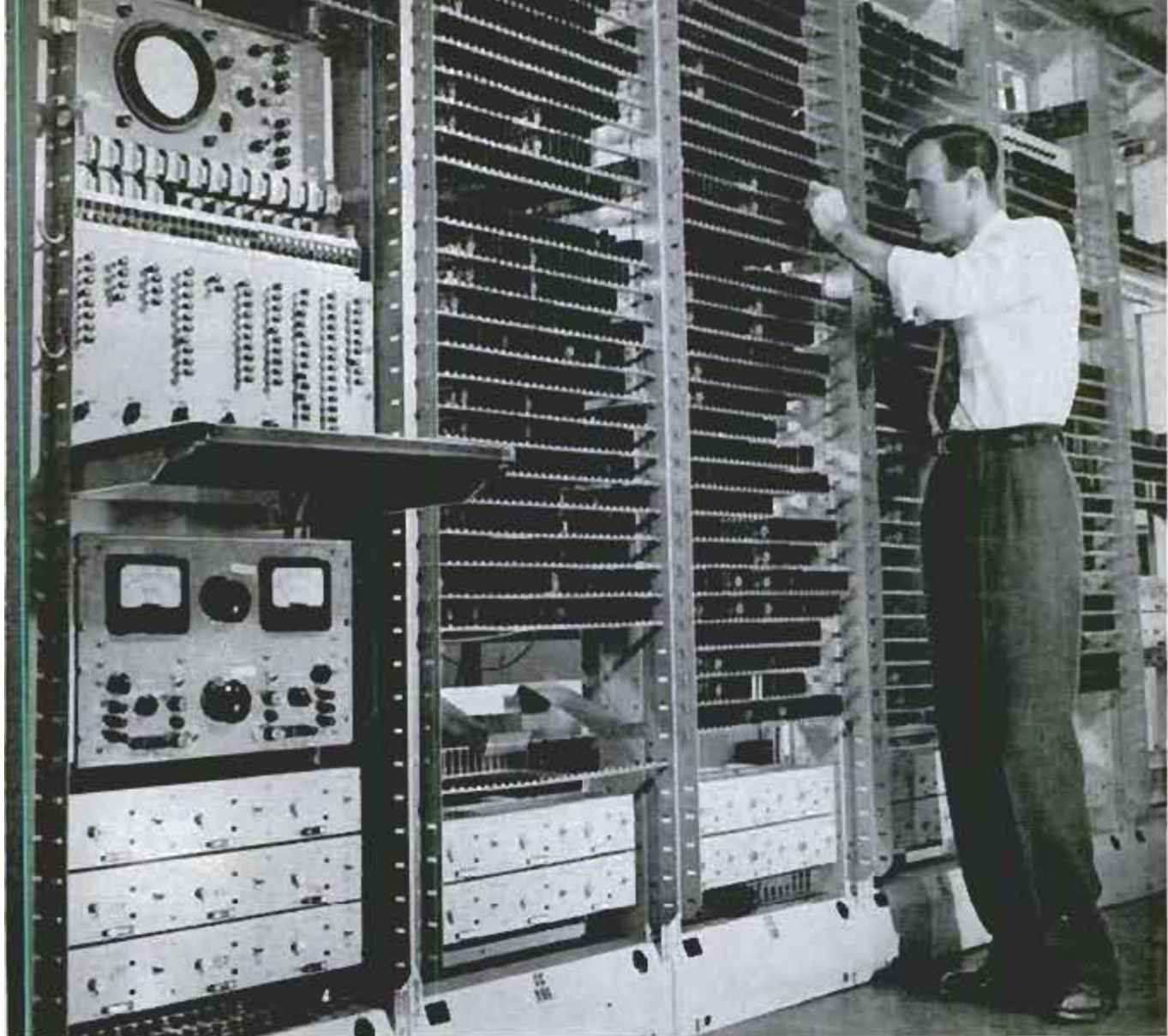
Photographic trace of flying spot shows how cathode beam progresses through cycle when ordered to provide specific information about people making calls



on target (7) by temporary memory's electron beam (8). Called number is flashed to central control, which sends orders to switching network and trunk lines to hook up connection. Selector (9) scans trunks for open circuit, alerts scanner (2), and connection is made through network's gas tubes (10). Long-distance calls (11) connect through trunks (12)

puts through your calls automatically today is one of the most intricate mechanisms ever devised by man. Clucking away inside its "maw" are tens of thousands of actual switches, and a nightmarish "nervous system" of circuitry that grows more nightmarish as the tentacles of long-distance dialing spread further across the nation. A crossbar exchange for a town of 20,000 customers takes a "central control" of ten duplicate sets of equipment. And, right now, Ketchledge explains, of the 54 million Bell telephone subscribers in this country, all but five percent dial through such automatic exchanges. Already more than eight million of these people can dial directly to about 48 million other phones in some 2500 cities across the land, without going through an operator—and millions more are being added to the long-distance dialing network each year (*Popular Mechanics*, Nov. 1951). Automatic timing and billing further complicate things. Plans are





This is system's logic section. It has 15,000 diodes and 1500 transistors that do exchange's "thinking"

afoot for automatic handling of things like person-to-person, credit-card and pay-station calls. What's more, worldwide long-distance dialing may be in the cards for the future. To handle the staggering load, present systems would soon become a spaghetti maze of circuitry and cables.

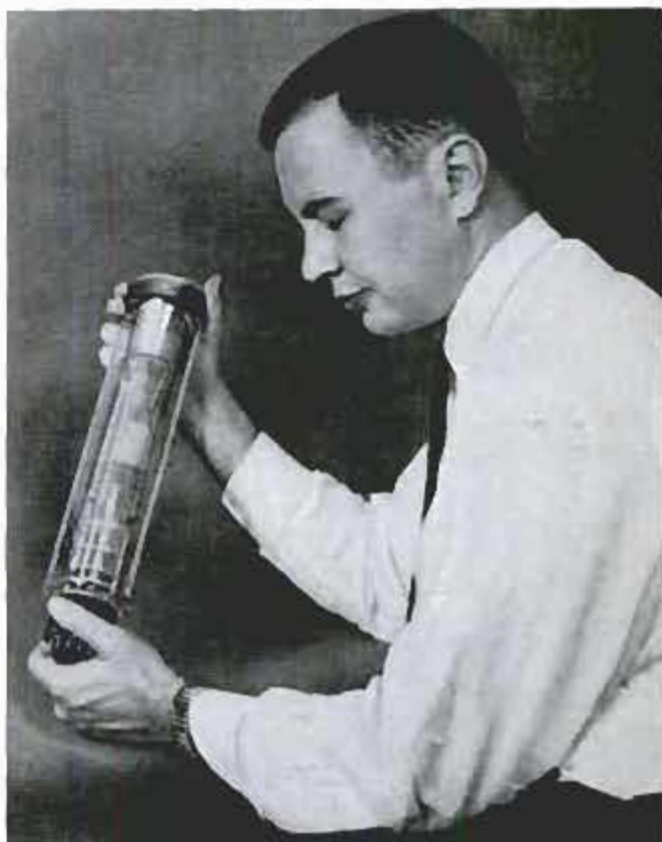
"The lab's development of the tiny transistor and other long-life devices," says Ketchledge, "allowed us to do tremendous jobs in less space and with greatly simplified circuitry. They made ESS feasible."

#### System of Memory and Logic Needed

Transistors were only the beginning, however. To make an electronic telephone exchange work, a complex system of memory and logic—essential to any brain—had to be conceived and built. An exchange serving 10,000 people, says Ketchledge, must have a memory that can store, and pull out as needed, a million or more "bits"

(Continued to page 238)

"Temporary memory" device shoots electron beam at series of grid "targets" on opposite end of tube





## Italian-Styled Midget Has More Glass, Flatter Roof

Bringing Italy to England, Pinin Farina has restyled the MG Midget, increasing its glass area and squaring up its body lines. A wrap-around back window increases rear

vision. Enough MG character is retained to make it easily identifiable. The four-cylinder 1489-cubic-centimeter engine gives a remarkable 25 miles per gallon over-all.



## Power-Mower Blade Recoils on Impact

Hinged in two places, the rotary blade of a new power mower is designed to absorb shock when it hits a solid object, protecting the engine from damage. The ends of the blade are free-floating and do not transmit the impact to the shaft. Centrifugal force keeps the blade straight for normal usage. A control lever at each wheel permits simple and fast height adjustment of the cutting blade. The recoil-starter grip is mounted high on the operating handle where all other controls are located.



## 'Covered Wagon' Will Seat Six

Suitable for use as an open-bed pickup or with a canvas cover like a pioneer wagon, the new Volkswagen double-cabin truck seats six inside its cab. There are two full-width bench seats. The rear seat is easily removed if extra cargo space is needed. The standard Volkswagen engine powers the truck.



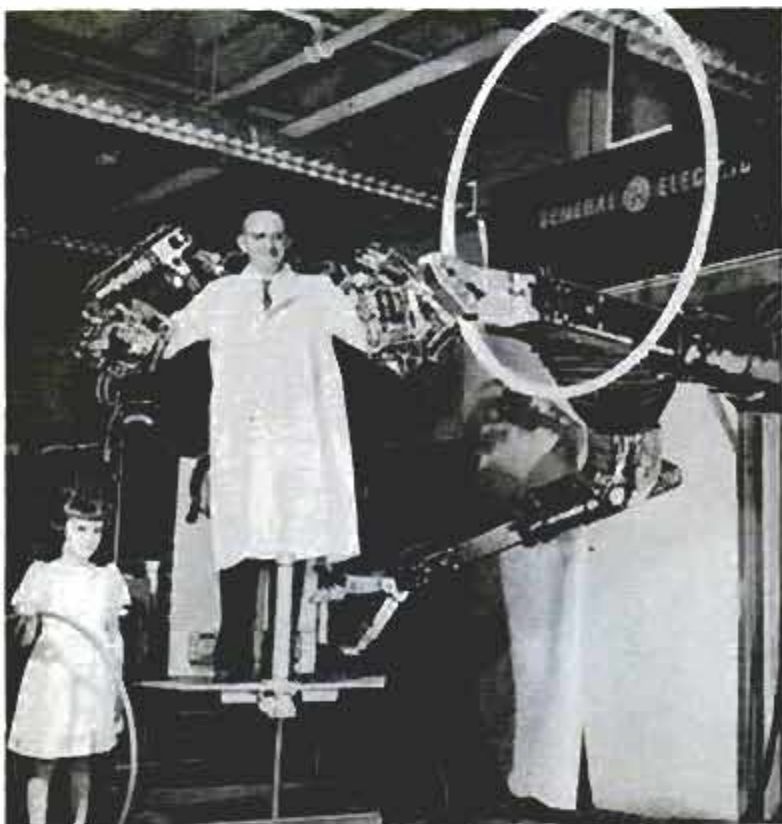
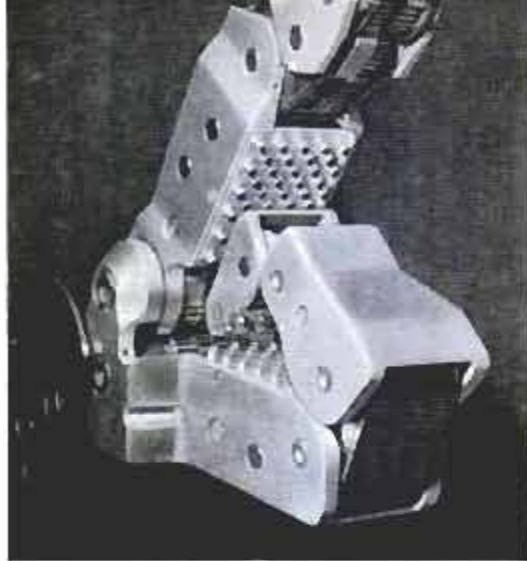
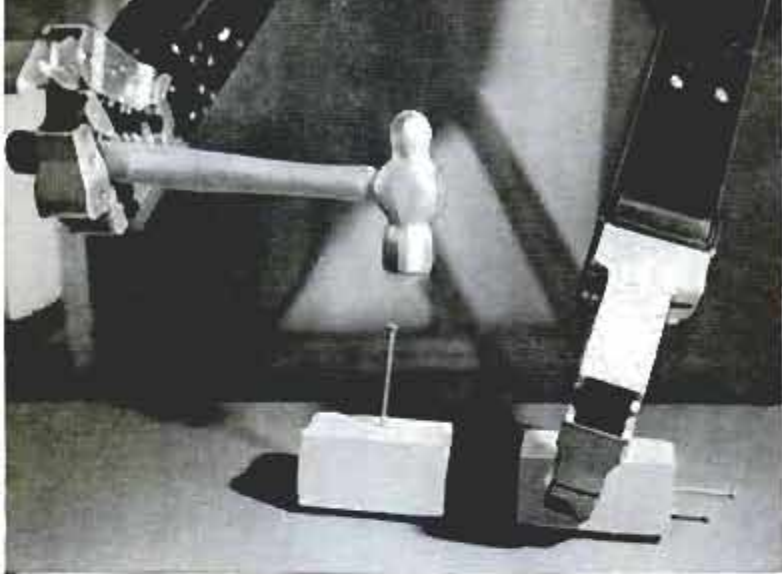
## Sprayers on Boom Defrost Plane

In Britain, ground crews are speedily defrosting aircraft from a "crow's nest" on a maneuverable boom. The 40-foot boom is mounted on a truck. From a platform on the end of the boom, workers manipulate six-foot sprayers called lances, which spray the defrosting liquid, preheated to 70 degrees, across the wing and tail surfaces of the aircraft.

## Cafe Sits Atop A Water Tank

Having dinner on a water tank may sound strange, but visitors to Rome in 1960 may actually eat in a restaurant atop a water tank. The massive structure looks like a giant birdbath. The restaurant will occupy the bowl. Located near the outskirts of Rome, it will be ready for feeding visitors at the 1960 Olympics.





## Strongarm Robot To Service Atom Plane

Scientists needed a robotlike machine to serve as a "master mechanic" on an atomic-aircraft power plant developing radioactivity that man could not endure. General Electric developed such a machine, the first of its kind that can simulate the clutching motion of the human hand. Ten basic motions were engineered into each of the machine's two "arms" and "hands." Using jointed "thumbs" and "forefingers," it can do such things as hammer a nail into a board, place one object beside another, unscrew a bolt or twirl a hula hoop. Its strength is far greater than that of the most powerful human hand, yet its touch can be so deft that it can pluck the petals from a daisy.



## Disposable Paper Camping Gear

For under \$60 a family of four can outfit itself with a paper tent and sleeping bags durable enough to last a season, but cheap enough to discard if so desired. The paper is waterproof, fire resistant and lightweight. It has the feel and much of the strength of cloth. Total cost is about one fifth that of the more permanent canvas goods. A two-man tent sells for \$13, a larger "family" tent for \$19. It is available through Ford dealers.

# AN EYE ON SPACE

By Dr. Dan Q. Posin

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



SOMETIMES A MAN wants to be alone, to have some quiet thoughts about his life—or his wife. Or maybe he's sick of the jangle of civilization.

Well, the first space travelers will escape that jangle. They'll be up there in a big fat *silence*. And, surprisingly, our space head-shrinkers (psychologists and psychiatrists) are already warning that one of the chief hazards to our astronauts will be silence. They say we'll have to send some chit-chat up to our spacemen so they'll feel right at home.

Obviously it is important that we develop good means of communication across the vast reaches of space. Several experiments are under way with radio, radar and TV transmission to way, way out there beyond the blue horizon.

It's easy to communicate with a satellite. Remember the orbiting Atlas and the two-way radio exchanges, including the satellite's beaming of the President's message to earthlings below? Signals also have been sent to the moon on a number of occasions, the first in 1946. The signals traveled to the moon at the speed of light (186,000 miles per second) and returned in 2.4 seconds, thus permitting us to calculate the distance to the moon:  $1.2 \times 186,000$ , or about 223,000 miles. According to the psychologists, when spacemen first arrive on the moon, *messages*—not just signals—must follow them, telling of Junior's cute escapades with the truant officer. Home sweet home, wheresoever space may lead.

Can we communicate with our astronauts if they wander beyond the moon? Well, radar signals have also been sent to the planet Venus, and have come back in five minutes, or 300 seconds. That means, clearly, that the trip one way took 150 seconds, and that at that moment Venus was 27 million miles away. Of course Earth and Venus are both orbiting around the sun, and when Venus is on one side of the sun and Earth on the other, Venus is 159 million miles away. This is the greatest distance that can exist between Venus and Earth. How long would it take for a radio message to travel one way? In a radio conversation between Earth and Venus would there be a time delay between the sending of the message and the receiving of a reply, and would this ball up a conversation? Well, if you ring up a man on Venus when it is 159 million miles away and ask him a question, the soonest you can expect a reply will be about 14 minutes later. This may present a problem when the operator says, "Your three minutes are up."

The radio signals sent to Venus, which bounced off and came back, were not true messages, and could not be easily recognized for a couple of reasons. In the first place, Venus has an atmosphere, complete with electrical disturbances (lightning). Lightning generates electrical and radiolike waves, and these travel through space and reach Earth along with our bounced waves. Furthermore, a great many other bodies and regions in space generate and radiate electrical waves. These, too, reach Earth, so more radio "noise" clutters up our bounced signal from Venus.

The secret of better communications to Venus and beyond is more power and more distinctive coding. Once we have developed these, we will be able to reach future earthlings on Venus with pacifying news of the routine mayhem on the home front.



# Cameramen at Twenty Fathoms

By James Joseph

**Y**ESTERDAY they handed you a "routine" assignment: Ride a submarine's deck to 10 fathoms, filming the dive in 35-millimeter color.

Now, alone on the sub's seaswept bow, you're poised for the plunge — your face mask set, your breath timed to conserve the bottled air strapped to your back, your hands tense on the camera's controls.

Suddenly from the conning tower booms the warning: "Ready to dive!"

"Take 'er down!" you signal, as wet-handed you trigger the camera to action.

There's a roar in your ears as the sub sinks from under you, the combers pounding your Neoprene diving suit, a tidal wave of brine tearing at the hemp harness that tethers you there to the deck. You change the lens' aperture, compensating for dwindling light as the sub plunges from daylight into darkness.

Pain sears your shoulders where the har-

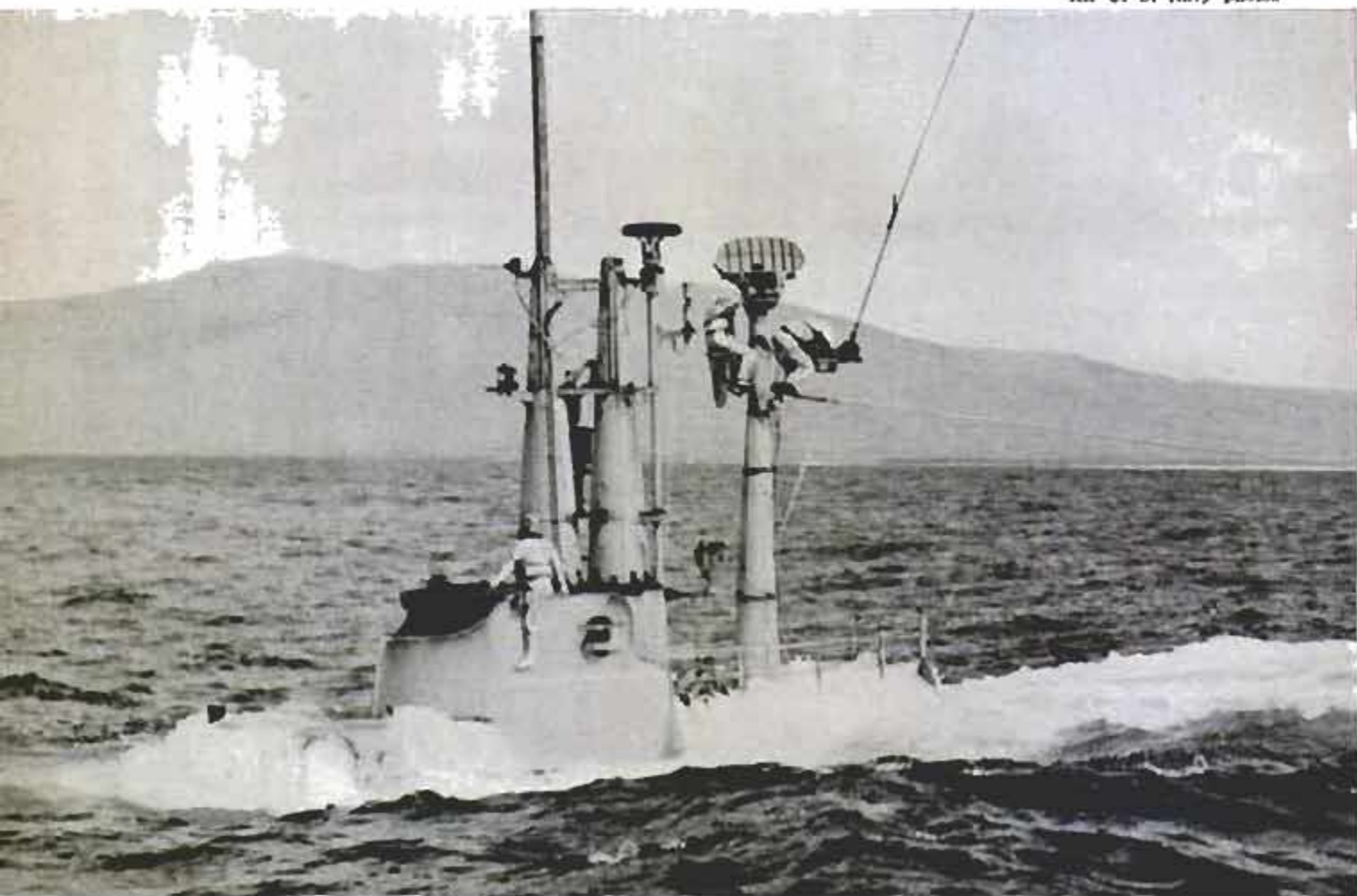
ness binds like wire rope. You wince as the pressure crushes in — a strangling 30 pounds of it to every square inch. You brace as crosscurrents, like fists, jab at your stomach. With every blow the cold works deeper, but you hold fast, a numb hand on the camera's controls and a finned foot wedged against the heavy steel tripod that's bolted to the deck.

All the way down you keep changing the lens setting, each move preplanned and calculated, to record the sub's every vibration, its every heave and wrench. A record destined for marine engineers, or maybe for the nation's TV and motion-picture screens.

You're a "fathom fotog," a practitioner of the most daring brand of photography. Yet, for the Navy's Combat Camera Group, an elite corps 100 strong which roams the seven seas both above water and below, it's strictly routine.

Strapped to radar mast of USS *Queenfish*, two daring Navy photographers get cameras ready for the big dive

All U. S. Navy photos



Up from the depths, Comdr. C. R. Eaton watches while Chief Charles H. Richards prepares to reload his pressureproof motion-picture camera for another trip

"That plunge?" shrugs Navy Chief Charles H. Richards, who six times has ridden a sub's deck to the deep, "It was SOP—the usual."

The Navy, however, doesn't shrug off the will-o'-the-wisp exploits of its deep-diving cameramen. Says a Navy spokesman, "Photographically, they are our best eyes underseas."

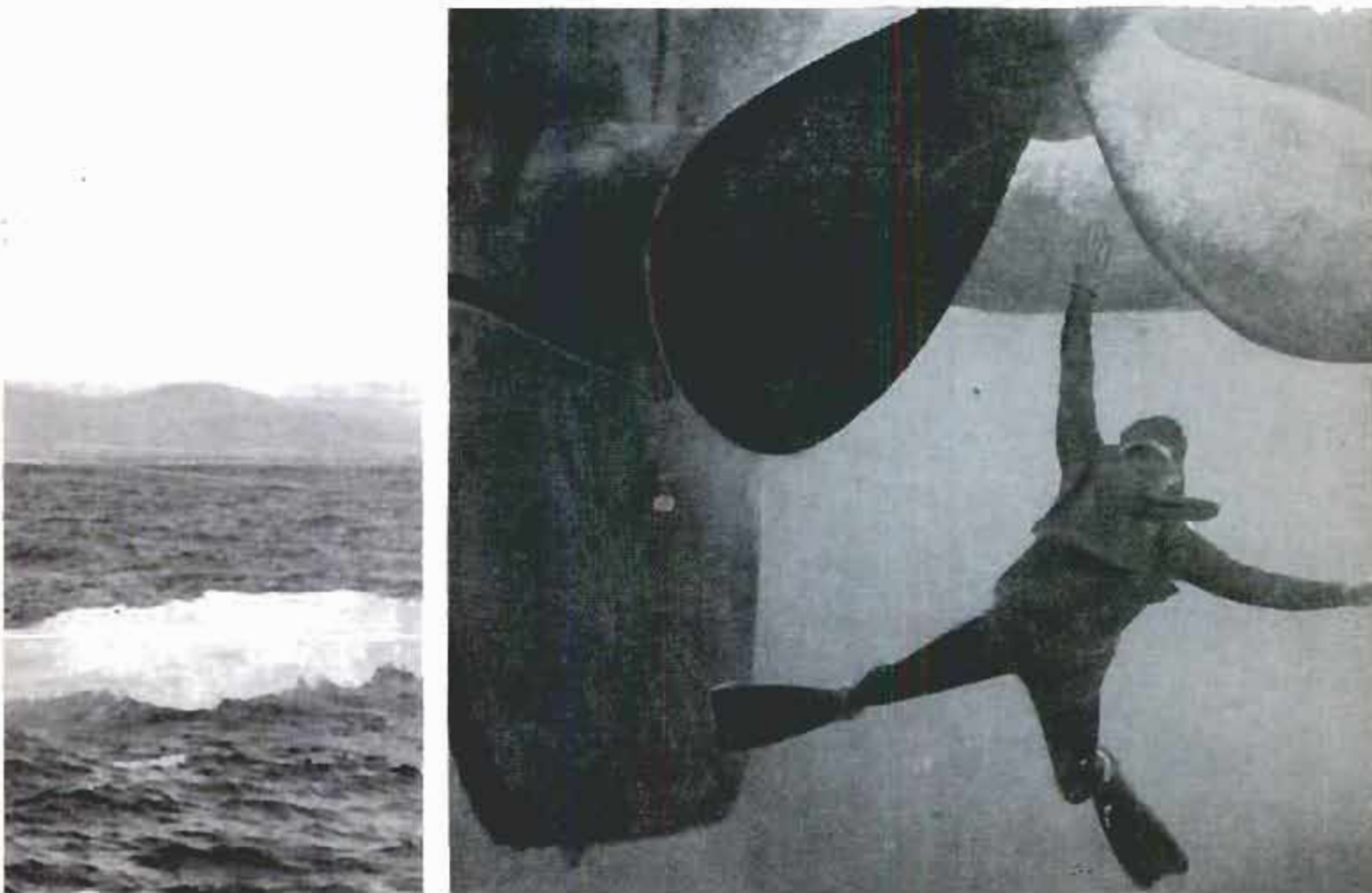
Riding a specially designed "depth sled," fathom fotogs recently filmed a torpedo's trajectory as the finned killer slammed from its tube. Ordered to the ocean floor, cameramen have made film studies of ships' screws (for Navy hull designers), documented the explosive impact of underwater demolition charges (which nearly took a fotog's life) and teamed with engineers seeking to eliminate hull vibration.

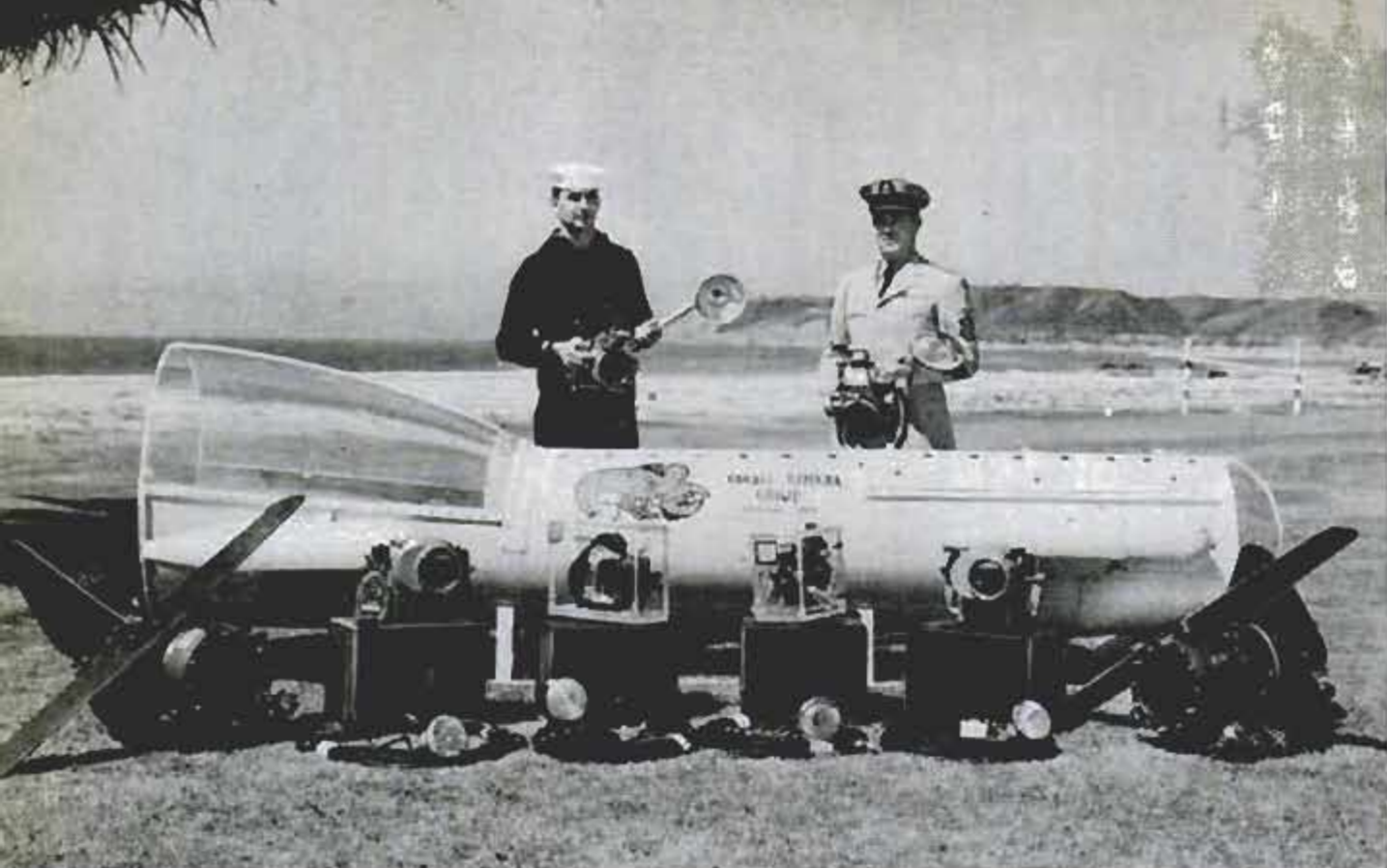
Working in 119 feet of water, aqua-



lunged shutterbugs filmed a radically new submarine escape method. In the process they devised a simple, yet low-cost, deep-water lighting system (which any skin-diving photographer, whether amateur or

Alongside submarine's stabilizer, "fathom fotog" signals buddy that everything is all set for a color shot





Arranged in front of two-man "depth sled" are costly underwater cameras. Both flash and floodlights are used

professional, can use to good advantage).

Right now, fathom fotogs, girding to record the undersea firing of the Navy's highly touted Polaris missile, are taking time out to test a top-secret diving rig (destined, insiders say, to relieve frogmen of the backbreaking burden of heavyweight compressed-air bottles).

Just as routinely, skin-diving shuttermen are assigned by Navy public relations to shoot deep-water sequences—the kind that find their way into such TV dramas as *Silent Service* and into movies like *Run Silent, Run Deep*.

Less routine was the still-classified mis-

sion which took fathom fotogs to the ocean floor—near Hawaii—to photograph a minesweeper's wake.

Chief Richards and his Neoprene-suited crew checked out a couple of \$5000 Aquaflex underwater movie cameras, strapped on "twin 70" aqualungs (each bottle holding 70 cubic feet of air) and pulling on swim fins, headed for mid-Pacific. Off Maui, in 45 feet of water, they worked for a week building a submerged 27-foot high platform — on which to mount cameras. Weighting the massive steel structure with almost a ton of iron, they strapped themselves atop the platform—some 12 feet

Sequence across these pages was made for a Navy training film and shows man leaving sub's escape hatch





From the transparent plastic nose of a depth sled, Navy Chief Charles H. Richards operates a battery-powered 35-millimeter Camerette motion-picture camera housed in a pressure-equalizing aquaflex case. Both case and camera are made in France. Chief Richards is wearing an aqualung which permits him to stay down for long periods of time. The depth sled is towed by a surface vessel and has been used to photograph a torpedo's trajectory and impact of underwater charges



underwater — and signaled the mine sweeper to make its run.

But the sweeper's skipper — ordered to veer within six feet of the cameramen — misjudged. Nor did he make allowance for the heavy-running swell.

Full speed the sweeper roared directly over the tower [see cover illustration], its flailing props knifing so close that Richards and his men had to hit the deck, sprawling there until the sweeper, with but 30 inches to spare, passed overhead.

Sighs a fathom-man, remembering, "That's the closest I ever came to losing my head—underwater."

Concedes Richards, who at 38 is "old" by Combat Group standards, "It takes a special breed of guy to work down there."

Recently, to put a torpedo's underwater flight on film, a couple of fathom-men, cameras in hand, were lowered from a Navy sub tender. Riding a steel platform, they were dropped 30 feet below tender's keel.

Seaward—1500 yards—poised a sub, its torpedoes set to travel at platform level, their course set to miss the stage by a slim 15 feet.

"In a spot like that, you trust to luck," says photographer first class Jay Skidmore. "Those 'fish' aren't loaded, of course. Still,

100 feet underwater and using new exhaling method for ascending to surface. He wears no breathing lung





Navy photographer making movie of a submerged submarine to be used in the television series *Navy Log*

they're traveling fast, maybe 40-45 miles per hour. Get hit by a ton of steel at that speed . . ."

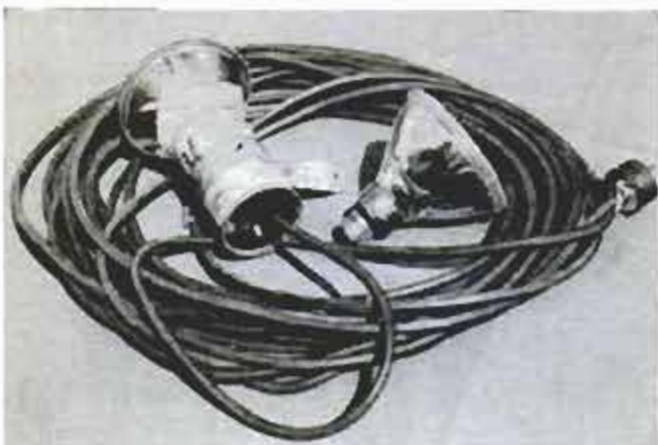
Skidmore's luck held. Precisely as planned, the torpedoes slammed past to be recorded on some of the most nerve-jangling footage ever exposed underwater.

Viewed on TV, it looks easy—but behind every deep-down foot of color lurk suspense and science.

Bottom-photography in color is an infant art. First to admit it is Lt. Comdr. Donald G. Miller, who bosses fathom fotogs working out of Pacific Fleet headquarters in San Diego (others are stationed in the Far East and in Washington at the Naval Photographic Center).

"Underwater color photography was born with the aqualung," says Miller, "and

**Shockproof underwater floodlight was made of tin can filled with tar, cable, and a Fur 38 spotlight**



has come of age only since World War II. The Combat Camera Group, in fact, wasn't even reactivated until the Korean War. And we've been shooting successful color for only a few years."

In those few years, fathom-men have girded a fabulous array of photo gear (nearly \$250,000 worth) in pressureproof plastic, now scan the depths with light meters (the reflected-light type), nonchalantly fire flash bulbs at 20 fathoms and have perfected range finders which compensate both for refraction and magnification (objects 12 feet from the camera must be focused as though at 9 feet).

Nor are fathom-men ever unmindful of underwater's fourth dimension—pressure. Flash bulbs *implode*—but even this inward "explosion" can shatter an ungloved hand (cameramen use only strong-walled No. 5s, and then only after the bulbs have been sacked and dropped to depth—to test for "leakers"). Below 100 feet, cameras must be self-pressurized, their internal pressure maintained at 1½ pounds higher than the crush of water around them.

Flimsy tripods — good enough above water—buckle at 60 feet. Navy fotogs fabricate heavyweight tripods from 3-inch angle iron.

Pressure burdens a man, fatigues him. To conserve strength, fathom fotogs ride as they work—shoot from a creature of their own invention: a surface-towed "depth sled." Carrying two men in its "wet

(Continued to page 230)

## Rear Screen on Wagon Protects, Ventilates

Fine enough to keep out insects on camping trips, an aluminum screen that fits into the rear-window opening of Chrysler Corporation wagons is backed with a heavy mesh to serve as a safety barrier for obstreperous children. The tailgate can be opened without removing the screen. The heavy mesh is sturdy enough to discourage petty thieves in parking lots.



## Yard-Light "Vacuum" Traps Insects

Bugs don't have a chance when you equip your yard with an ingenious trap that lures the insects with a bright light and then literally sucks them into the trap. The device works in a manner very similar to that of a vacuum sweeper. The fan motor operates quietly and runs all night on about two cents' worth of electricity. A large disk over the 100-watt lamp serves as a reflector to spread the light over the yard and also as a shield to keep rain off the trap. More than half of the insects are ground into chaff by the fan blades, the others are trapped live inside the bag. All parts, except the motor and bag, are aluminum.



## Auto-Current Inverter Makes TV Portable

By attaching a portable current inverter to the cigarette-lighter socket you can take your television set with you to the picnic site. Even radios and record players can be used with the assistance of this electronic device that converts 6 or 12-volt direct current from the battery into 120-volt alternating current. One inverter is specifically designed to be used with the small-screen portable television sets such as the one shown in the illustration. Larger portables are not recommended for use with these inverters. Other electrical appliances are suitable for use in the field with the inverter, providing their current demands are not too great. Small models are available for powering standard electric razors. Tape recorders can be used with a heavy-duty inverter.





## Self-Inflating Shirt Becomes Lifejacket

For nonswimmers there's a new shirt that automatically inflates into a lifejacket when it strikes the water. Made in adults' as well as children's sizes, the garment has the appearance and styling of a conventional sports shirt. A zippered inner pocket holds a small packet filled with a nontoxic chemical. Contact with water causes an immediate chemical reaction which inflates the shirt into a lifejacket. The garment also can be inflated by mouth, through a tube.

## Electricity Straight From Heart of a Reactor

There's been another major breakthrough in nuclear physics. The Los Alamos Scientific Laboratory has produced electricity directly from nuclear energy *inside a reactor*.

This is not the first time electricity has been produced directly from the atom. Perhaps the best-publicized device for achieving this goal was the instrument displayed on President Eisenhower's desk a few months ago, which may be used to power instrument packages in satellites.

The recent breakthrough at Los Alamos has greater significance. On the surface, the event itself seems puny. The scientists succeeded in drawing enough electricity directly from the reactor to light a 100-watt bulb for 12 hours. But locked inside the reactor was a tremendous amount of energy.

If enough of it could be tapped to light one electric bulb (without first being run through a turbine), might it not be possible to tap all the rest of the energy? This would make available a tremendous amount of electricity directly from a reactor. It could be a means of achieving a nuclear-powered rocket or spaceship.

In the Los Alamos experiment, a plasma thermocouple was placed in the core of the reactor. A thermocouple is a means of producing electricity by bringing two different materials (two metals, or a metal and a gas) into contact, then maintaining them at different temperatures. The temperature differential causes electricity to flow between them. The reactor was used to provide the heat in the form of charged particles.



# The Man Who Built a Towboat



Built of used steel and salvaged parts by owner Lloyd Mason (inset), towboat *Robert L.* plies the Kentucky

By George Laycock

**O**LD-TIMERS along the narrow, twisting Kentucky River will tell you that the *Robert L.* is one of the best towboats on the river. They'll also tell you that Lloyd Mason, who owns the *Robert L.*, built her himself; that he hadn't built even a rowboat before, and that he'd never worked on the river until he decided to build his own towboat and embark on his new career.

For more than a year now Mason and his new towboat have been making two 114-mile round trips a week pushing two sand barges up the river to Frankfort. This is an entirely new life for Mason. "I wouldn't trade it," he says, "for any job I can think of."

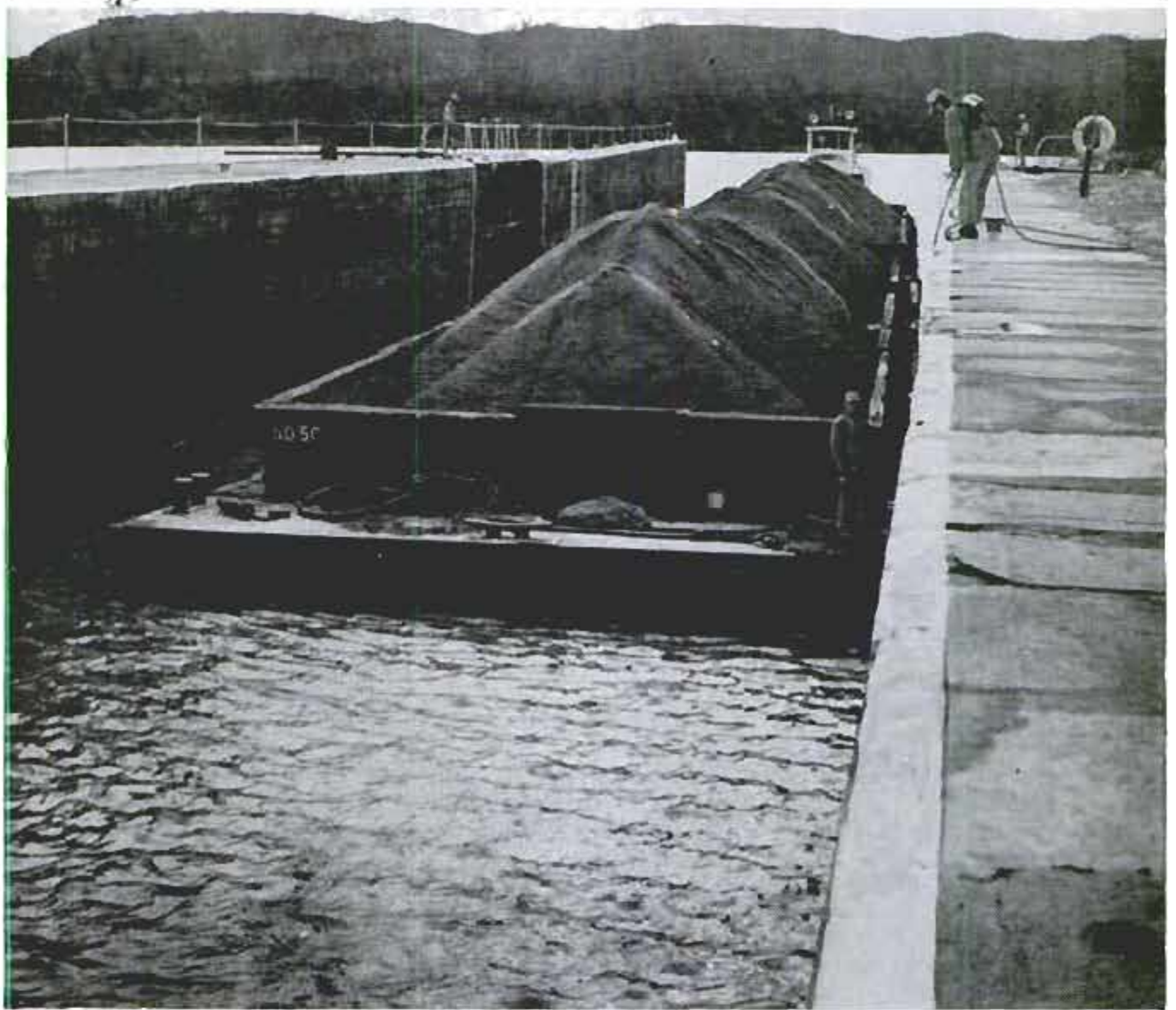
Mason is a medium-size, soft-spoken man who grew up on a farm in southern Indiana.

At 38 he has been a farmer, contractor, soldier and finally a diesel-powered Huck Finn. When he returned from World War II he went into the contracting business on what he describes as "a shoestring," and after several years built up his collection of construction equipment. He quickly noticed the frequent shortages of building sand in Frankfort, where much of his business took him, and began to eye the old towboats that chugged it upriver 57 miles from the Ohio. There was, he reasoned, room for a good new towboat on the Kentucky. A river towboat, however, is a large, costly piece of equipment, normally constructed by marine engineers in well-equipped shipyards.



Boatmen on the Kentucky go ashore to open valves in the river locks, above, and turn big gears themselves to shut miter gates





Skimpy locks make a tight squeak for towboat and barges on a journey of 44 hours upstream, 16 down

Mason looked at several used boats but there was always something wrong. Usually the engines were old. He wanted a sound boat that wouldn't tie up valuable time in repairs when it should be pushing a pay load up the river. It was logical that he finally decided to build his own.

Biggest shortcoming in this plan was Mason's lack of experience. He had a fair idea of what was required in his boat. The engines would be important and one of the biggest costs, so he went to the Caterpillar Company for help in drawing up plans—from steel hull to pilot house.

With plans finished, Mason went to work. Winter had set in, but instead of waiting for spring, he put up a large tent on the banks of the Ohio—right beside the pit from which he hoped to haul sand. Then he sold some of his contracting machinery

and bought steel. With stoves in the tent, and two welders to help him, he began a backbreaking production schedule of ten hours a day, six days a week. Steel plate was cut for the boat, the pieces numbered and welded in place like chunks of a big jigsaw puzzle. "We used 43 tons of steel to build her," he recalls, "and I don't think there's a piece of steel in her that I didn't wrestle with personally."

Meanwhile, small groups of curious people gathered around the tent. They had never seen a man build his own towboat. "Some walked away shaking their heads," Mason recalls. "Said it'd never float."

Mason found places where an ingenious man could cut costs. He needed two large wheel winches to hold the tow cable for hauling the barges, but the price tag was \$820 each. So Mason rounded up gears



Sharp corners in the narrow river keep crewmen busy adjusting tow slack. Adjustment is made by slackening or tightening a ratchet coupling on chain between the boat and the barge

from old farm tractors and built winches at a cost of \$217 each. Instead of spending \$535 for a fancy set of pilot-house controls, he put them together personally from old automobile parts at a total cost of \$25.

The boat took shape slowly. First the steel hull was finished, then the cabins and galley, and finally the pilot house stood up over the whole boat. Mason had sold all his contracting machinery, run out of money and mortgaged his boat as well. But the \$70,000 she cost was still well below the \$96,000 price quoted by one shipyard.

With the final coat of paint on her, Mason was ready to see if she'd float. At the first high water in the Ohio, he laid planks from the boat to the water's edge and brought in a couple of bulldozers. The "Cats" eased up against the steel hull of the 150-ton *Robert L.* and dug into the sandy river-bank. The boat began to slide down the planks. Mason still gets pleasure out of recalling that moment, "She slid out into the river and settled perfectly," he says, "with exactly the draft we figured."

By the time his boat was floating Mason already had a contract for all the sand he could haul. He rented a couple of leaky old barges and was ready for his first run on July 11, 1957. His pilot was Bruno Richardson, who had come out of the mountains to work most of his adult life on Kentucky River boats. "I didn't know enough to pilot my own boat," Mason said. A couple of deck hands completed the four-man crew.

A berth on the *Robert L.* is not the softest one on the inland waters. Recently I went aboard Mason's towboat for the three-day run from the sand pits up to Frankfort. "It's the only way you'll really get to know this boat and what it's like to work on her," Mason said.

You can see the engines from the catwalks along either side of the boat. The twin 230-horsepower diesels drive the boat at about six miles per hour downstream and perhaps two miles per hour against the current. The big engines pound steadily

for 80 hours a week, and Lloyd expects them to keep this up for eight years. In front of the engine room are two small cabins, with sleeping space for two men in each. Behind the engine room is the galley, where the crew eats and spends whatever spare time the river allows.

This trip was also an excellent chance to see the Kentucky River, one of the first streams in the country equipped with dams and navigation locks.

Pioneers who brought horses, hound dogs and kinfolk west to Kentucky's mountains wanted a way to ship out cattle, coal and timber, so the river became their highway. The dams on it are more than a century old, and navigation locks beside them were hand-built of large stones taken from surrounding hills.

The locks measure only 38 feet wide by 150 feet long—skimpy enough for the 35-foot by 135-foot barges that use them. Most are still hand-operated. So crews must climb off their boats and up the walls to help the lockmasters open and close valves. Within the past year, however, the heavy gates were equipped with electric motors.

When we weren't locking the boat through one of the dams I spent considerable time in the pilot house with Bruno or Mason. River boaters live from one river bend to the next. They know where the underwater rocks are and how many work scows are tied to the shore around the next bend. "You gotta stay awake," Bruno said, "or maybe you'll drown someday." Meanwhile he was cutting the inside of the next bend so sharply with the front of the lead barge that he pushed willows aside. "Gotta cut her sharp," he said, "to keep the back end from swinging around too far and wrecking on the other bank." The biggest damage to the *Robert L.* so far was caused by a sunken log. Mason had to put her in dry dock for five days while they installed new screws and shafts.

It was late at night when we came up to Dam Number 3. Lights burned dimly along





Winches made of old tractor parts take up slack in the *Robert L.*'s towing cables



Locks won't accommodate boat plus barge, so crewmen help lockmaster haul the winch cable that pulls each barge through

the lock walls. "Wonder if I can put her in there without touching," Bruno said. He knew he could. He touched the levers gently and slid the lead barge in between the high stone walls without scraping or bumping. "Just like driving a car," he said.

The 57-mile upriver trip to Frankfort took 2½ days. The river was high, and this cut speed. We locked through dams, sometimes in the middle of the night in a pelting rain. But for Mason and his crew the schedule calls for two round trips each week, with time off from Saturday noon until five o'clock Monday morning.

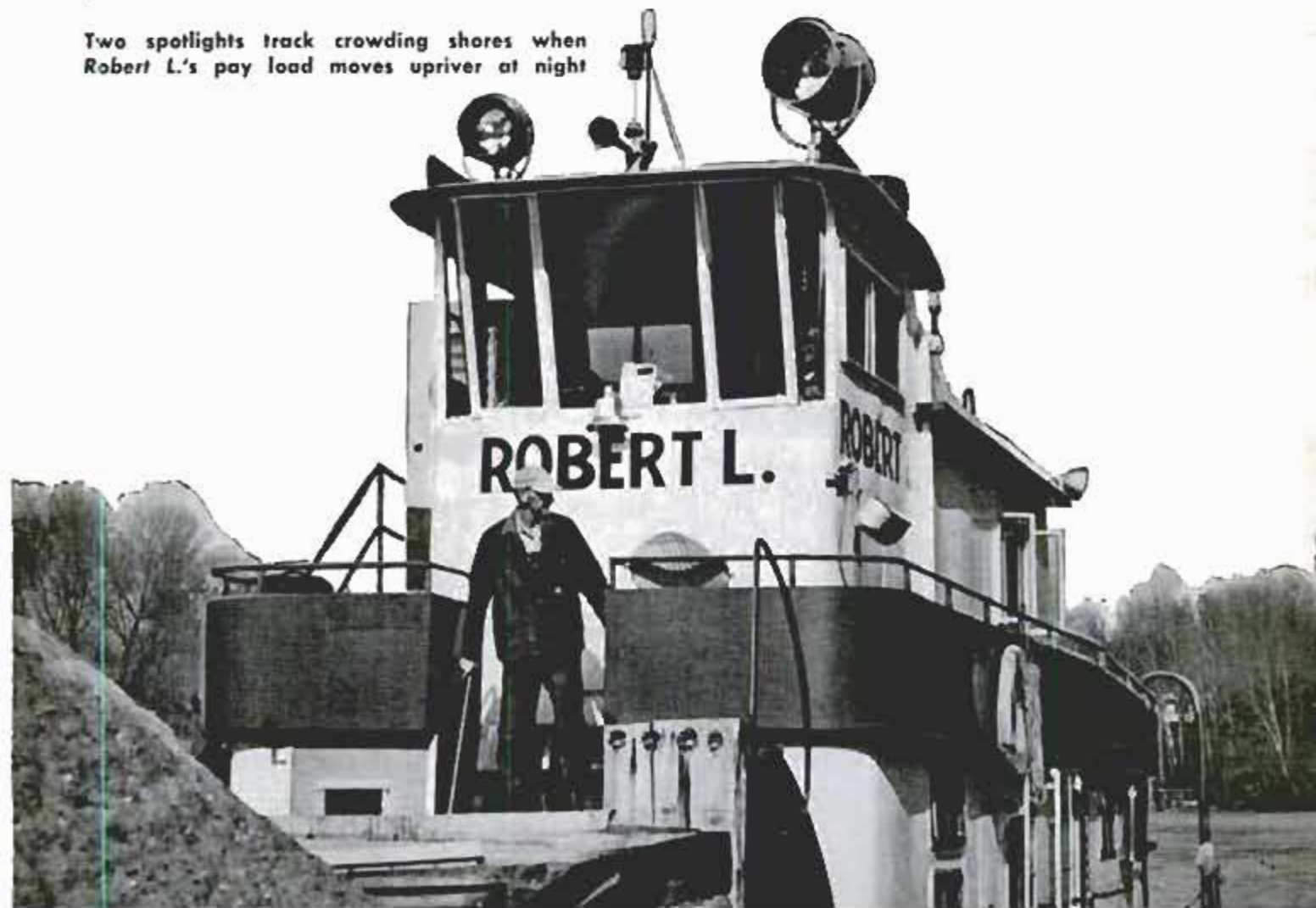
Shortly after noon on Wednesday we pushed the two barges into Frankfort, and

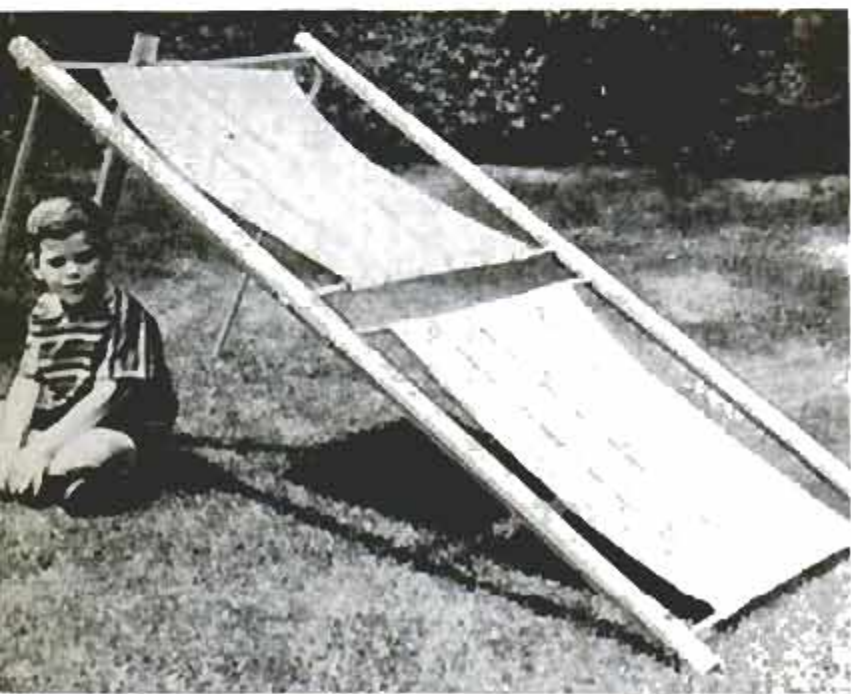
shovels began to unload the sand. At 60 cents a ton, the 1000 tons of sand brought \$600. Weekly income for the *Robert L.* runs about \$1200. Out of this Mason pays his help, buys fuel, food, insurance and other necessities, and still manages to pay off his marine mortgage at the rate of \$600 a week.

"I really like this boat," he says. "Her lines may not be as clean or the inside as fancy as some, but she's a workhorse and as smooth running as any boat on the river.

"I've never had more fun," he adds, "and who knows—maybe some day I'll know enough about this business to pilot my own boat." ★ ★ ★

Two spotlights track crowding shores when *Robert L.*'s pay load moves upriver at night





## Plastic Set Challenges Kids To Use Imagination

With a versatile plastic construction set, your children can make many of their daydreams come true—right in the back yard. They can build tunnels, lean-tos, houses, tents, radar towers, rocket launchers, windmills and other things. The set weighs about five pounds and, disassembled, fits a box with a cross-section of 2½ by 7 inches.

## Oil-Drilling Rig Moved to New Location on Pair of pontoons



On Venezuela's Lake Maracaibo, an oil-drilling rig was moved intact on a hydraulically controlled "rig-mover." The device consists of two pontoons linked at the rear by a steel superstructure. Hydraulic rams lift the rig. Main power is supplied by Caterpillar diesels.

## Light of Atomic Particles Recorded on Photographs

University of Michigan scientists have found a way to photograph the light from the path of a single atomic particle speeding through a crystal. The flash, which lasts only a millionth of a second, is recorded in a device called a luminescent chamber. The light must be intensified 100,000 times through a series of electron "image" tubes before it can be recorded by the most sensitive photographic film.

## Mailbox on Motor Scooter Is Student's "Carryall"

Those rural mailboxes are good for more than holding letters and parcel-post packages. A naval-reserve trainee and engineering student at the University of Illinois carries books, drawing supplies, lunch, raincoat and a tarpaulin in a mailbox he mounted on the carrier section of his motor scooter. He attached the box by using the mounting holes vacated when he removed the scooter's rear seat and spare tire.



## Rocking Seat Gives Air Traveler Extra Protection During Crash

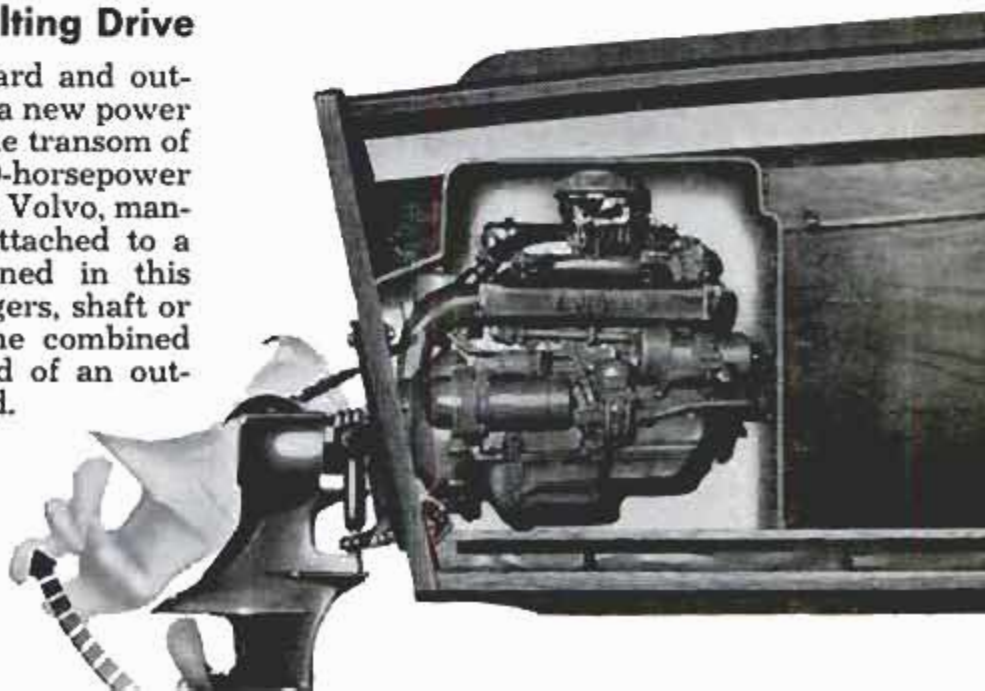
Designed for added safety in an air crash, a rocking seat automatically rocks its occupant into a position in which he is believed to be better protected against impact. Like conventional seats, it can be tilted back to various positions, including full horizontal for sleeping. But in an emergency the new seat tips the occupant back to where the spine is nearly horizontal and thighs are vertical. The seat has been adopted by Sabena, Belgian World Airlines, for its Boeing 707 jets.



## Inboard-Outboard Has Tilting Drive

Several advantages of inboard and outboard motors are combined in a new power unit that can be mounted on the transom of any outboard-type hull. The 80-horsepower four-cycle engine is the famous Volvo, manufactured in Sweden. It is attached to a tilting outboard drive designed in this country. No engine bed, stringers, shaft or stuffing box are required. The combined unit is said to have the speed of an outboard, economy of an inboard.

Outboard drive unit tilts up for beaching and trailer hauling. Tilt feature also protects unit if it should hit an underwater object. Transom is between the flanges





Monkey business is always part of the show. George, a woolly variety, likes to cavort on the trailer's awning bar—and take peeks at his admiring audience



"And this is a red-legged tortoise." Like all others in traveling zoo, tortoise wins strict attention

# THE ZOO

There's also a singing parrot in the troupe. Her name is Grandmaw and she requires little coaxing to perch on your shoulder and sing "Let Me Call You Sweetheart"—a bit off key



Zoologist Bob Truett, who introduces the animals to the children, and vice versa, shows how an opossum hangs by its tail



**By Dorothy Reed**

PHOTOS BY THE AUTHOR



"Almost big enough for me to ride," muses lad on meeting a tortoise for first time



To youngsters playing in Chicago's neighborhood parks, the most welcome sight in summer is the traveling zoo, bringing its monkeys, an alligator, tortoise, python, bobcat, kinkajou, opossum and coati-mundi

## COMES TO THE KIDS

**T**HERE ARE TWO very big zoos in the Chicago area, but believe it or not, many of the city's kids never see them. They're like the native of the Bronx who grew to manhood without seeing the Statue of Liberty—except in the movies.

So as long as all these children aren't getting to the zoo, Chicago is taking the zoo to them. In summer a zoo-on-wheels visits each of the city's 60 parks. It's chock

Sweet Pea is the agouti's name, but one day she wasn't so sweet—when she bit the microphone in half

full of animals from the famed Lincoln Park Zoo.

For many kids at the park centers and day camps, this is their first encounter with animals other than dogs and cats. And they show it—with question after question. A zoologist begins the visit by telling the kids all about each of the animals. Then the questions flow. The patient zoologist tries to answer them all. ★ ★ ★

Staring right back at his visitors is a coati-mundi, a raccoonlike fellow with a terribly long nose





## HERE'S AN ALUMINUM PREFAB

**F**OR THE FIRST TIME, a big prefab manufacturer is making available to do-it-yourselfers a home you can finish yourself. The house is a Colonial-styled low-priced aluminum prefab, and additional designs will soon be available.

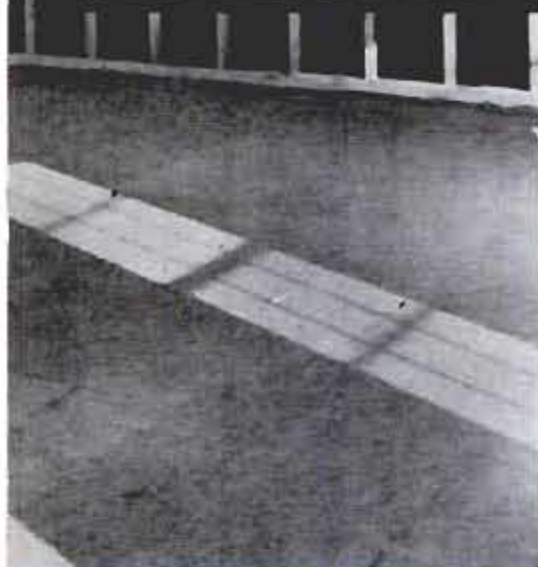
Here's how the plan works: Let's say you're accumulating rent receipts right now and you want a place of your own. You buy a suitable lot—one large enough for at least a 24 by 32-foot house. Then, either you or the subcontractor you hire builds a foundation for the particular house you select from the aluminum-prefab line. A simple drawing of the foundation is provided by the manufacturer, Kahler-Craft Homes, a division of National Homes Corporation, Lafayette, Ind.

As soon as you have the lot and foundation, the manufacturer's dealer erects the

unfinished house without a down payment, provided you have an employment record that can carry the low monthly payments.

There are seven designs to choose from, plus two garages or utility buildings. The houses range in price from \$3626 to \$4802, plus a modest erection cost. They have bake-finished, lifetime aluminum siding, either clapboard or shingle. Aluminum roof shingles are optional. They have aluminum soffits and gutter boards. Specifications include: Conventional wooden-floor system; roof and ceiling trusses 24 inches on center; wall studs, 2 by 4 inches and 16 inches on center, and a double 2 by 4-inch top plate.

Sold with each house are a kitchen sink-cabinet unit and plumbing and electrical "packages." The kitchen unit includes two wall cabinets measuring 30 by 30 by 12



## YOU CAN FINISH YOURSELF

Above is exterior of 28 by 32-foot, maintenance-free aluminum prefab, with floor plan of 896 square feet. At left is unfinished interior ready for the do-it-yourselfer to go ahead and finish the job at great saving

First step in finishing is to install ½-inch rock lath. Sheets are run to perimeter of rooms, where outer edges are supported by sidewall lath sheets. Lath is nailed at approximately six-inch intervals with special ring nails





Partitions are built as panels on floor, using group of studs cut to identical lengths in cutoff jig



Here, sheets of rock lath are being installed on inside of external walls. The sheets are pushed tightly against the ceiling lath

Left, materials should be handy but not in way. Right, insulation is tacked between exterior and wiring



inches, and a double sink and fittings mounted into a 60-inch base. The base contains a double-door cupboard and a tier of molded plastic drawers. In the plumbing package are tub, lavatory, water closet, valve and trim, copper waterlines, hose bib and all above-ground sewage-disposal lines, plus roof vent and flashing. The water and sewage lines are preassembled into a "plumbing wall" for easy installation. Wall switches and switch plates, outlets, boxes, fixtures for doors, bathroom and hall, and a six-circuit distribution panel are included in the electrical package. An optional "finish package" includes furnace, water heater, wall partitions, doors, window trim, and practically everything to complete the job. ★ ★ ★





**DON'T HOLD** your breath, waiting for the electric car. The well-publicized millennium of a troublefree, cheap, quiet, smogless runabout for Suburbia exists only in the minds of a few enthusiasts.

The hardheaded fact is that the electric car is neither practical nor feasible today. Its limitations are so overwhelming, its costs so high, that only a guy allergic to gasoline would put up with one.

There has been no revolutionary battery development (and this is what is needed), no revolutionary motor development, no revolutionary anything except in publicity stories. The whole project is premature, experts say. There may be a future in electric cars, but not by putting an electric motor in a gas buggy. The electric car must be engineered from the ground up and nobody is doing that yet.

Twelve hopefuls say they plan to build electric cars for sale. Only one is even close. That is the Charles car in California.

The body and chassis of the Charles prototype are those of the Volkswagen Karmann-Ghia. Production models are said to be plastic-bodied with aluminum frames.

The "revolutionary" batteries that were said to power the prototype failed in less than a year. The batteries that are expected to be used in production have not even been settled on yet. They will be conventional lead-acid batteries, but there is uncertainty as to whether to use an automotive type (diesel starter battery) or an industrial type. Battery people say that what is needed is a battery somewhere between these two, but none is being made today.

With industrial batteries, replacement cost will be \$700 every three to five years. With the automotive type, replacement will cost \$300 every one to three years.

That is the real hurdle: batteries. It was the electric car's trouble years ago and remains so today.

The car, when built, will sell for \$2900. With the cheaper batteries, this includes a charger. The more expensive (and better) batteries are expected to require a \$250 charger which will be extra-cost and, too big, too heavy to build into the car, must be installed in the garage. Like an electric range, it will have a 220-volt circuit with a 35-ampere fuse. Despite claims of visionaries, you won't be able to plug into a friend's porchlight to get a charge.

In winter, the car will need a gas-fired heater. Obviously, you can't heat with electricity from batteries.

At 40 miles per hour, the batteries will last about one hour, which means it can go 20 miles in one direction and then 20 miles home for a new charge, which will take about 10 hours. Stop-and-go driving is bet-



## **DETROIT LISTENING POST**

**By Art Railton**

ter. It will go all day (up to 50 miles) under these conditions, far more than the housewife would drive in a day.

The batteries weigh about 650 pounds. Replacement cost is about three cents a mile. Cost of the electric fuel is low, less than one cent a mile, total cost is higher than for operating a small gasoline car which has no range limitation.

American Motors and Sonotone say they are working on an electric car that has a small constant-speed gasoline engine in it to generate electricity, charging the batteries as the car runs. This is the ideal theoretical solution. The battery never runs down.

But in this car the weight and cost of the gasoline engine and generator will be added to the weight and cost of the batteries. It would be cheaper and simpler to hook the gasoline engine up to the wheels.

American Motors will not disclose how much money or how many engineers are working on the project. Obviously, both are too small to talk about.

De Soto claims it will use fuel cells to generate electricity that will directly power the wheels, eliminating batteries. This is real Jules-Vernish talk — far, far from contemporary reality.

The electric car is a lovely reverie, a beautiful dream. That's what makes it irresistible. It's the newest version of the everlasting match, of the 200-miles-per-gallon carburetor, the perpetual-motion machine.

The fact is that petroleum is still the most convenient, most available, most economical way to package energy for a motor vehicle. Only in very limited applications (like in-town stop-and-go delivery trucks) does electricity pay off.

After a few days at the New York imported-car show this reporter was impressed with how fast Europe has gone American at the same time America has gone European. The new British cars, especially, look like something out of Detroit. Gone is the neat, tucked-in look. Now it's tailfins for the world, alas.



1. Designer conceives the required part

2. Draftsman makes detailed drawing of the part

## Revolution by Robot: THE "BRAIN" THAT TALKS TO TOOLS

WITH LITTLE FANFARE, a team of scientists at Cambridge, Mass., recently touched off the second Industrial Revolution. They came up with an electronic brain that not only understands humans, but translates human ideas into detailed instructions for machines.

The development implies a new kind of

factory. Inside that factory, here's what will happen: A designer will conceive a part. He will simply describe the part, in a special language, to a computer. The computer will "think about" the design, and calculate every step in the production process. It then will issue the necessary "orders" to machine tools. The tools will

5. Computer makes the necessary calculations, then punches tape

6. Tape is fed to director, which instructs milling machine





**3.** *Drawing is described in APT "language"*

turn out the parts automatically, parts identical to the designer's concept.

The implications of such a fully automatic factory are obvious. Engineers will become designers, skilled machine-tool operators will find much of their work usurped by their machines, and work of almost every type will be upgraded. Optimists see an age of plenty, a shorter work week, more leisure. Pessimists see problems that will plague sociologists, politicians and labor leaders for decades.

Since the first Industrial Revolution, man has operated power machines. In the past decade or so, machines started operating other machines, but the "boss" machine had to be fed detailed instructions. Now, thanks to the development at Massachusetts Institute of Technology, "boss" machines will originate and send their own orders to "worker" machines.

**7.** *Milling machine follows sequence of instructions*



**4.** *This description is punched on cards for the computer to read*

The conversation between designer and computer, between computer and slave machines, required a new language.

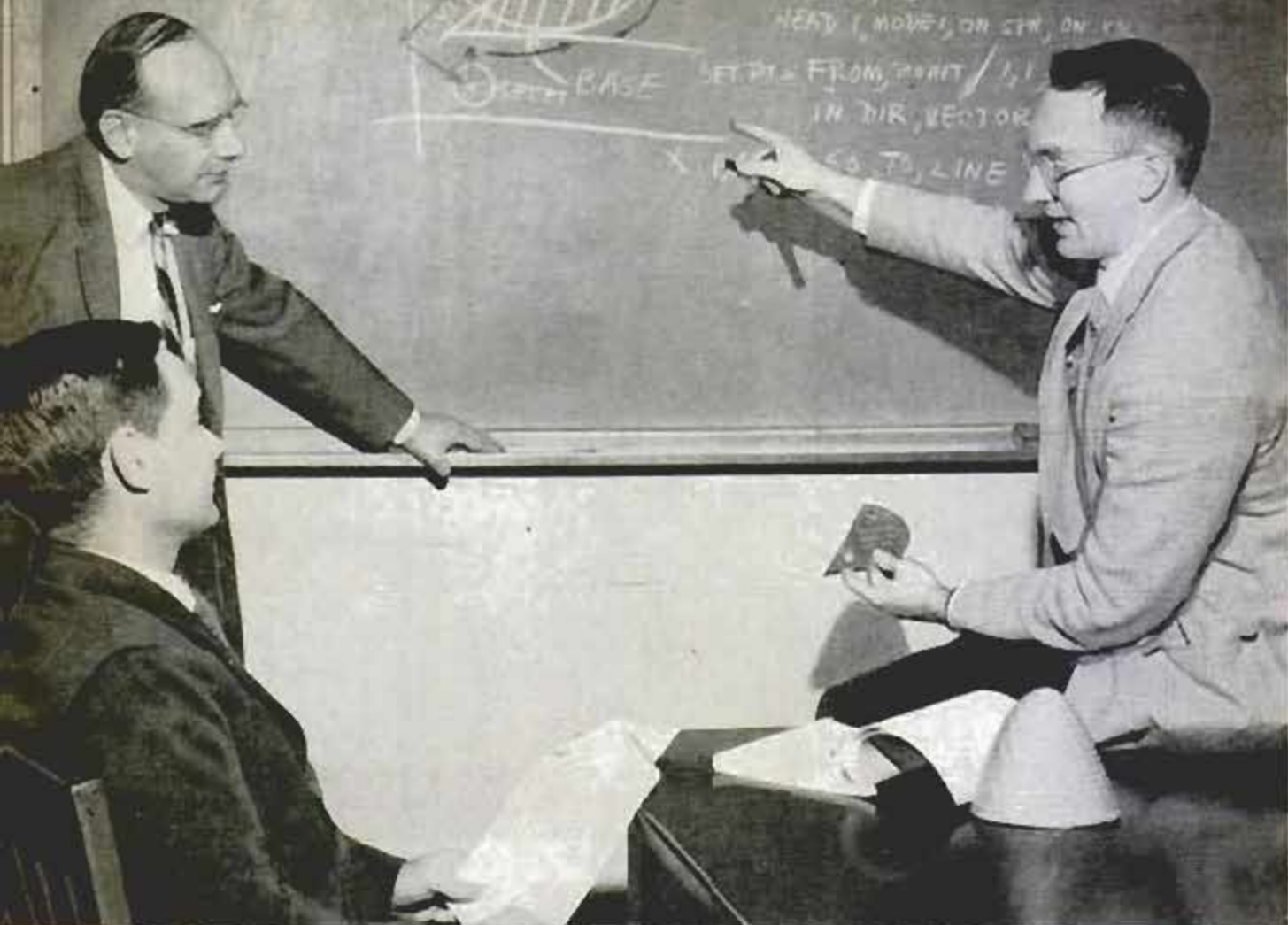
Massachusetts Institute of Technology experts devised such a language, which computers can be taught quickly. The language is called APT, short for "Automatically Programming Tools."

If you tell a computer in APT lingo what you want made, the computer can punch out instructions on a tape which will make a machine tool produce it automatically.

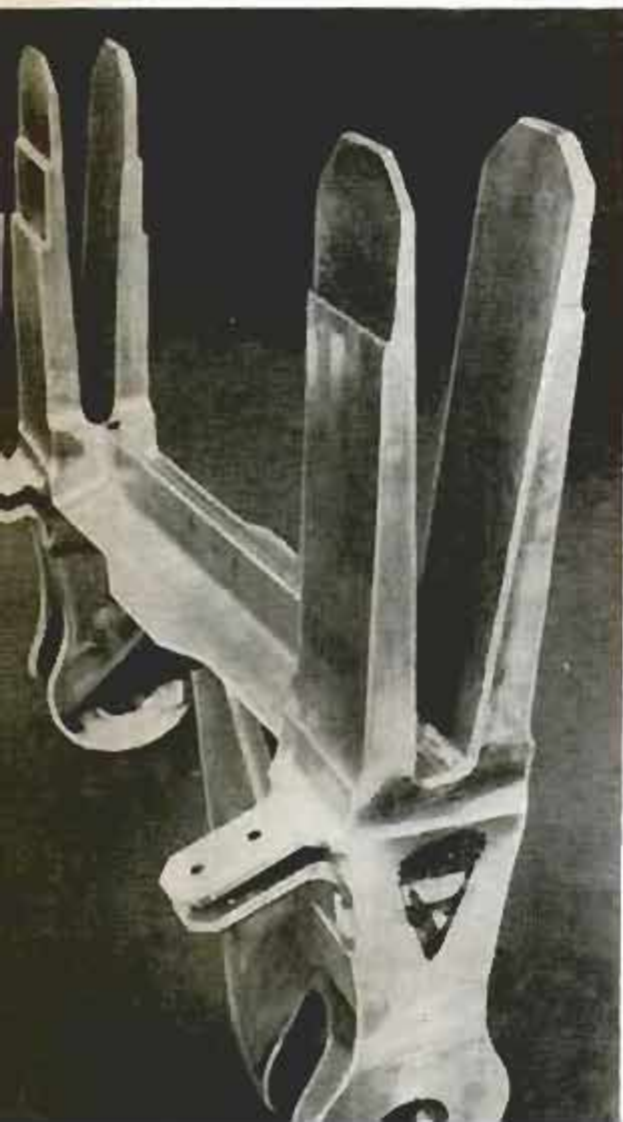
Soon, when a space vehicle's designer wants a new part made, a draftsman will first make a detailed drawing of it. Then he will describe that drawing in APT language. This description will be punched on cards which will be slipped into a computer. The computer then will punch a tape that will tell the machine tool what the designer wants and how to cut it out.

**8.** *Part identical to design is produced automatically*





Scientists who developed APT, the new language, discuss "vocabulary" to use in describing a machined part



Under the APT system, the operator of a tool will simply place a piece of metal in the proper position, then start the tape. His job will be as simple as running a player piano.

It isn't quite that simple yet. The system is still under development; certain orders have to be fed into the computer, orders that go somewhat beyond the design concept itself. But the APT language clearly implies the fully automated factory.

#### Easy-to-Learn Language

The language resembles English, so it is easy for a man to learn. Although the vocabulary is expected to grow, it consists now of only about 100 words, none of which contains more than six letters. That's enough to automatize the production of more things than you would care to count.

Suppose that you were writing APT. If you wanted the coolant turned on and the spindle of a power tool started, you would write "ON KUL, ON SPN." Then, if you wanted the tool guided to the right, you would add "GO RGT." To make its cutting edge

(Continued to page 228)

At left and below are typical intricate parts that can be produced by the new "Automatically Programming Tools" system





## ***The Bank That Broke The Mailman's Back***

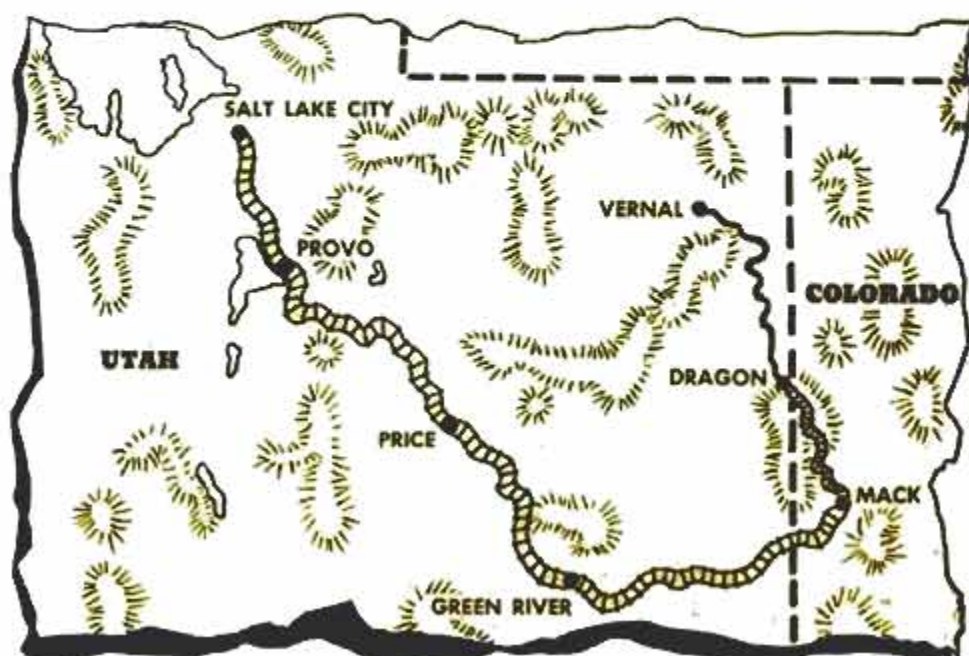
EVER HEAR of anyone ordering bricks by mail? The town of Vernal, Utah, did. In fact, that's how Vernal built its bank—with bricks delivered by mail. Every one of the 50,000 bricks that went into this two-story, 97 by 70-foot building was carefully shipped by Uncle Sam.

In 1916, directors of the Bank of Vernal decided that the community ought to have a modern fireproof bank. But the nearest brick kilns were at Salt Lake City, and because of treacherous roads freight haulers asked \$3.00 per hundredweight to haul the bricks. This meant that the cost of hauling each brick by truck would be 15 cents. The total cost would come to \$7500. This dimmed hopes for the new brick building until a bank employee, N. J. Meagher, now its president, started thumbing through postal regulations. He discovered that the bricks could be mailed in for less than half the quoted truck price.

Since regulations limited the weight of a package to 50 pounds, bank officials figured about 10 bricks to a parcel and ordered 5000 parcels. It wasn't long before a postal investigator was on the way to Vernal to find out why parcel-post deliveries were falling behind and what the Star Route carrier's strange complaint was all about: "I've got mounds of bricks for the Vernal bank and they're still accumulating." Then postal officials decided that it wasn't up to the post office to deliver brick banks by mail, and quickly ruled that a shipper could not send more than 200 pounds a day to one consignee. Meagher countered by getting local farmers, ranchers and townspeople to become consignees for the bricks. The volunteers carted them from the post office to the bank site.

It took many months, but eventually there were enough bricks to build Vernal's first brick building.—Irving Wallace.

Distance by crow from Salt Lake City to Vernal was less than 150 miles. Via mail route, however, it was 407 miles. The route included a standard-gauge railroad from Salt Lake City to Mack, Colo., then a narrow-gauge railway to Dragon, Utah. The 63 miles from Dragon to Vernal were covered by mail wagon



# Owners Praise Pontiac's Handling But They Don't Like Its Economy

**WHAT IS MAKING** Pontiac the success story of the middle-price field? It alone has sharply boosted its sales in a field that is the industry's most competitive. Mercury, too, shows gains, but they are only slight compared with Pontiac's (next month, *PM* surveys Mercury owners).

What is Pontiac's secret? To find out, *PM* asked 1000 Pontiac owners from 40 states to tell you about their cars. Here is their report.

One surprising statistic (see page 101 for the percentage table) is the large number of Pontiac buyers who traded in some General Motors car other than Pontiac. Only 44.3 percent of those in the survey traded in Pontiacs, while 25.6 percent traded in some other GM make. Compare this, for example, with the more normal ratio in the recent Buick survey when 67.9 percent traded Buicks and only 14.6 percent traded another GM make. Apparently, Pontiac is making sales at the expense of some of its other family divisions.

What do the Pontiac buyers like most? The best-liked features are similar, perhaps understandably so, to those of Buick and Chevrolet owners: First, handling ease; second, riding comfort; and third, exterior styling. Power and performance come fourth, followed by roadability.

What don't they like? Heading the complaint list is poor gasoline economy. Pontiac has placed a great deal of emphasis in its advertising on the economy V8 engine. Apparently, the buyers expected more economy than they are getting because 21.9 percent complain about the car using too much gas.

Second on the list is the difficulty of getting in and out; third is poor workmanship; fourth is the lowness of the seats; fifth, the car is too close to the ground.

Here are quotations from the owners describing the things they like best about their new Pontiacs, arranged in order of frequency of mention:

"Handles very nicely. After driving 825 miles in one day I was not a bit stiff or weary."—North Dakota service-station owner.

"Enjoy every minute of driving."—Kansas technician.

"Wonderful ride. We took a trip to California and hardly

## MARGINAL COMMENTS

BY ART RAILTON  
PM'S AUTO EDITOR

← *Is this what's happening to Buick? Strangely enough Pontiac looks bigger, more ponderous than Buick. In fact, all Pontiacs except the Catalina are longer than all Buicks except the Electra 225. Strange business!*

← *This year, Pontiac's power steering is precise, a pleasure to operate. It renews confidence in the advantages of power assists.*



## Here's What They Like:

"Handles wonderfully on curves."—North Dakota grain-elevator manager.

"Terrific stability. Feeling of control. Drives like a sports car should."—Montana trailer salesman.

"Smoothest riding car I have ridden in."—Alabama owner.

"Most stylish car this year."—Washington clerk.



knew we were on a trip. More like sitting on our own davenport."—Nebraska farmer.

"I practically live in my car from early morning to late at night. I have had an injured back from childhood and appreciate the smooth ride of this car."—Colorado teacher-therapist.

"I like the styling, the low, rakish appearance."—Virginia Naval officer.

"Modern styling, but not extreme."—Florida owner.

"Excellent acceleration. Doesn't know a hill exists. Never have been able to 'floor board' it since flying is illegal with a car."—Colorado fire chief.

"I like the engine performance very much. Good acceleration. No lag or drag."—Texas USAF pilot.

"Power is more than plentiful, but no tendency to swerve if excessive power is applied."—Tennessee sales manager.

"Roadability is best I have ever had."—Arkansas highway engineer.

"Takes curves well, regardless of sharpness or banking."—Mississippi attorney.

← **Ride is soft and relaxed. If anything, too soft. There is a tendency to oscillate on certain types of city boulevards, especially for rear-seat riders.**

← **It's not a fair comment, but this observer still expects to see a Pontiac come down the street with a ring through its nose—it's so nostril-like.**

← **No argument here. It's as tractable in the pleasurable act of cornering as any GM car.**

## Here's What They Don't Like:

"I have the economy V8 and am getting 10 to 12 miles per gallon."—North Carolina teacher.

"Low in-town mileage."—Kansas designer.

"My wife complains it is too low and too difficult to enter and leave, but I say you can't have your cake and eat it."—New York cashier.

"Give more attention to assembly in factory."—Texas pharmacist.





Pontiac instruments are very hard to read in daylight, okay at night



With the wraparound rear glass of the four-door hardtop, visibility to the rear is certainly unlimited. The flat roof helps headroom, too

No economy car. See Kelly's data on the economy engine on page 102. In a stop-and-go city test of 20 miles and 54 stops, I averaged 11.1 miles per gallon with the noneconomy engine. On the highway, the average was 13.9 m.p.g. Not the sort of record oil companies will complain about.

When women get out of the back seat, it is most revealing.

Workmanship on the car I drove was excellent. Every detail was well done.

Pontiac can't drop its front floor until it goes to a full-unit body. The X-frame cuts under the front floor as it is now.

### And Now the Complaints

Pontiac owners are not all satisfied, although 24 percent of them make no complaints at all. Most frequent complaint of the owners is the poor gasoline economy. The following quotations describe complaints in order of frequency of mention:

"Gas mileage is bad. I can't afford this car with its present mileage. I get 9 or 10 miles per gallon."—North Dakota superintendent of schools.

"Poor gasoline mileage even with the economy engine. Not up to advertised standards. Some detonation with regular gas. I get 12 miles per gallon."—Colorado Air Force major.

"Low gas mileage with economy V8 engine. Has been checked once, but does no better. I get 11 miles per gallon in city, 15 on trips."—North Dakota landowner.

"Back seat is too deep. Difficult to get in and out."—New York purchasing agent.

"Too hard getting in and out [projection of wraparound]; windshield provides two good kneebusters."—Missouri housewife.

"Rear doors are too small for elderly people to get in and out easily."—Wisconsin foreman.

"Body seems to have been put together haphazardly."—Kentucky State Trooper.

"Interior workmanship very poor, especially the fit of frames around windows, the panels and dash upholstery."—Colorado homemaker.

"I am a dentist and am alert for details. My first 1959 Pontiac was a 'piece of junk.' In the first 1000 miles, 65 separate items were noted for correction. Obviously factory inspection was sloppy. I made an 'even exchange' on another Pontiac. This one is satisfactory although not up to my expectations."—Maine dentist.

"Don't like sitting on the floor. Floor pan in front compartment should be dished down as in the rear."—Oklahoma television service manager.

"Seats too low. While seated, trouser cuffs get soiled from floor mat."—Minnesota railroader.

"I had the front seat raised two inches in back and one in front which helped some. Now I have about one inch of headroom."—Wyoming sales representative.

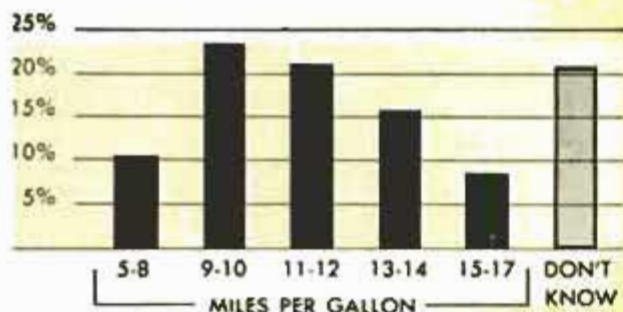
"Built too close to the ground for country driving. Scrape bottom when crossing a gutter or ditch."—Arizona security guard.

"Hits bottom of rear bumper on normal curbing or when loaded with rear-seat riders on slight ramp."—Colorado manufacturer's representative.

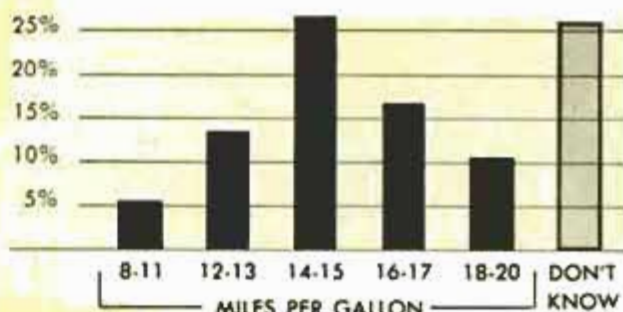
Each month *PM* asks owners to make one suggestion for



**CITY DRIVING**



**LONG TRIPS**



Pontiac owners say they use too much gas. Most get under 12 miles per gallon in city, about 15 on trips

the entire auto industry. Pontiac owners make the following interesting comments:

"I believe the industry has mistaken the public's taste as regards extreme lowness, lack of headroom and excessive length."—Maryland newspaperman.

"The industry is sacrificing comfort for lowness and style."—Iowa farmer.

"Make cars higher by two or three inches and restore good comfortable seats."—Maryland priest.

"Make cars you can enter and leave without being a contortionist."—New York salesman.

"Service has turned from bad to worse. The public has lost confidence in dealer service."—Minnesota insurance man.

"I hate the thought of buying a new car. It takes six months to a year to get all the bugs out."—Rhode Island salesman.

"Give us more legroom in the back seat instead of a big long trunk that you use once a year on vacation."—Illinois foreman.

(Continued to page 224)

← *This whole trend is due to the unexpected success that Chrysler had in 1957 with its low, finny Exner cars. The public bought them, so GM responded.*

← *What a sad commentary on the nation's biggest and most competent industry. It's the result of trying to change too much in too short a time.*

## SUMMARY OF PONTIAC OWNERS' OPINIONS:

**OVER-ALL RATING**

<b>PONTIAC</b>	<b>Excellent 75.4%</b>	<b>Poor 3.8%</b>	<b>Average 20.8%</b>
----------------	------------------------	------------------	----------------------

**Best-liked features**

Handling ease	48.8%
Riding comfort	42.0%
Exterior styling	32.9%
Power, performance	25.8%
Loadability	23.3%
Wide track wheels	13.9%

**Most-frequent complaints**

None at all	24.1%
Poor gas mileage	21.9%
Hard to get in, out	18.5%
Poor workmanship	9.4%
Seats too low	8.8%
Car too low	8.5%
Driveshaft hump	6.8%

**Had trouble with engine?**

No trouble at all	84.8%
Some trouble	11.2%
Considerable trouble	4.0%

**What was engine trouble?**

Carburetor	4.0%
Automatic choke	1.7%
Ignition	0.9%

**Best-liked styling feature**

Smooth, simple lines	10.3%
Low, long look	9.4%
Front-end design	8.8%

**Least-liked styling feature**

V-trough rear fenders	4.0%
Front grille	4.0%
Parking lights	2.6%

**Do have Economy V8 engine?**

Yes, have it	31.0%
No, do not	63.9%
No answer	5.1%

**Of those with Economy V8:**

Satisfied with economy	44.0%
Not satisfied with economy	48.6%
No answer	7.4%

**How is dealer service?**

Excellent	57.2%
Average	31.8%
Poor	11.0%

**Would buy from him again?**

Yes, would	80.7%
No, would not	12.2%
No answer, don't know	7.1%

**What make was traded?**

Pontiac	44.3%
Another GM make	25.6%
Ford Motor make	9.6%
Chrysler Corp. make	7.7%
Other makes	1.7%
No trade, no answer	11.1%

**What make will buy next time?**

Another Pontiac	61.4%
Other GM make	5.7%
Ford Motor make	4.3%
Chrysler Corp. make	2.6%
Foreign make	2.0%
All others	1.6%
No answer, don't know	22.4%

**One suggestion for industry?**

Better gas economy	22.7%
Reduce horsepower	9.7%
Better workmanship	8.8%
Make cars higher	7.7%
Make cars smaller	5.1%
Eliminate floor hump	4.0%
Make easier to get in, out	3.7%



# AN ENGINEER'S ANALYSIS

By **DALE KELLY, SAE**  
Registered Professional Engineer

## 1959 Pontiac Catalina Economy V8

**MODEL TESTED:** Four-door hardtop with economy (420E) engine, two-barrel carburetor, single exhaust, Hydramatic transmission and power brakes.

Rear-axle ratio: 2.87 to 1. Wheelbase: 122 inches. Tires: 8.00 by 14. Weight: 4375 pounds with gas tank half full (53 percent on front wheels, 47 percent on rear).

Mileage on car at time of test: 1200 miles. Barometer: 29.24 inches. Temperature: 55 deg. F. Payload: 200 lb.

### ACCELERATION TIME FROM STANDING START (in seconds)



Ignition timed for:	0 to 20	0 to 40	0 to 60	0 to 80	1/4 mile
Regular gasoline .....	2.5	6.5	12.0	22.6	19.1
Premium gasoline .....	2.5	6.4	11.8	22.1	18.9
Super-premium gasoline .....	No improvement noted				

(Gasoline used had following octane ratings by Research method: Regular 90; Premium 99; Super-premium 105.)

### FUEL ECONOMY (miles per gallon)



Ignition timed for:	Steady 30 m.p.h.	Steady 50 m.p.h.	Steady 70 m.p.h.	Traffic Route
Regular gasoline .....	19.7	16.6	12.9	9.8
Premium gasoline .....	19.1	16.2	13.0	9.4
Super-premium gasoline .....	Not tested			

(In traffic test, car makes 10 full stops per mile and is driven fast enough to average 15 miles per hour.)

### ESTIMATED AVERAGE ANNUAL GASOLINE BILL: \$216 for 10,000 miles

(Assuming that half of the owners will use regular gasoline at 30.5 cents a gallon and half premium at 33 cents a gallon.)

### SPEEDOMETER ERROR (miles per hour)



Speedometer reading .....	20	30	40	50	60	70	80
True speed .....	19	28	37	46	56	65	75

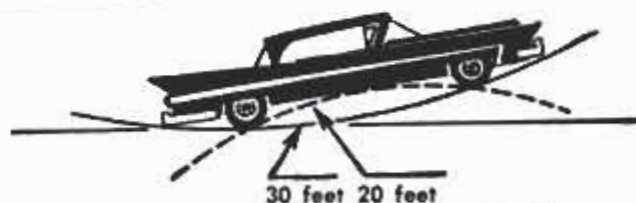
### ODOMETER ERROR (miles traveled)

Odometer registered 103 miles for an actual distance of 100 miles.



### DRIVER'S VISION

Driver could see part of road 18 feet in front of car, full width of road 25 feet in front of car.



### GROUND CLEARANCE (unloaded car)

Worst dip that could be crossed.....30-ft. radius  
Worst hump that could be crossed.....20-ft. radius  
Deepest rut that could be negotiated.....7.0 in.  
Curb clearance for door opening.....13.5 in.

### STEERING

Steering-wheel turns for 50-ft. circle.....2.3 turns  
Curb-to-curb turn-circle diameter.....42.5 feet  
Wall-to-wall turn-circle diameter.....45.0 feet  
Steering-wheel turns, lock-to-lock.....5.5 turns

**CENTER OF GRAVITY:** 22.2 inches high

### TRUNK CAPACITY

17 cartons (one cubic foot each)

### WATER RESISTANCE: Poor

Splash-pan test: Brakes badly affected  
High-pressure test: Slight leaks around doors, windows

### OBSERVATIONS

Speedometer has a relatively legible round scale. Both speedometer and odometer have the usual optimistic calibrations. There is a needle-type ammeter (without numerals however), but the temperature and oil-pressure gauges have been replaced by warning lights. The water-temperature light gives no warning unless the water stays below 115 degrees or rises above 230 degrees. The gasoline gauge needle hit "bottom" when the tank still held almost three gallons.

Ground clearance is poor, a characteristic of many 1959 cars, incidentally. Steering on the test car was without power assistance and was very slow.

Center of gravity of the lower-roofed 1959 car was the same as on the 1958 Pontiac.

After the standard splash-pan test, the brakes were so uneven that the car was almost unmanageable, it swerved so sharply.

Maximum width is at the front bumper and is one inch greater than the width listed in the manufacturer's specifications.

The center passenger in the back seat has a very hard cushion under him and very little room for his feet.

DALE KELLY, SAE



## Two-Ounce Resuscitator Is Small Enough to Fit Into Beach Bag

Weighing just two ounces, a plastic resuscitator developed for emergency service avoids actual mouth-to-mouth contact. It consists of a tube containing a valve, exhaust vent and attached mask. The valve within the tube passes the rescuer's ex-

haled breath into the victim's mouth, nose, throat and lungs. (Ed. NOTE: *The inventor of the resuscitator tube, Dr. Allen S. Cross of Washington, writes: "The Venti-Breather . . . was developed by an avid reader and subscriber to Popular Mechanics."*)

## Sun's Energy Harnessed To Run Fence Charger

Energy from the sun is harnessed to operate a new electric-fence charger. In the frame atop the conventional fence charger used by farmers, silicon solar cells collect radiant energy from the sun and convert it to electricity. The cells also charge a set of nickel-cadmium storage cells inside the fence charger to operate it on cloudy days. This enables the sun-operated charger to function in remote areas without the need to replace conventional batteries or connect to power lines.



## Portable Air Compressor Mounts on Storage Rack

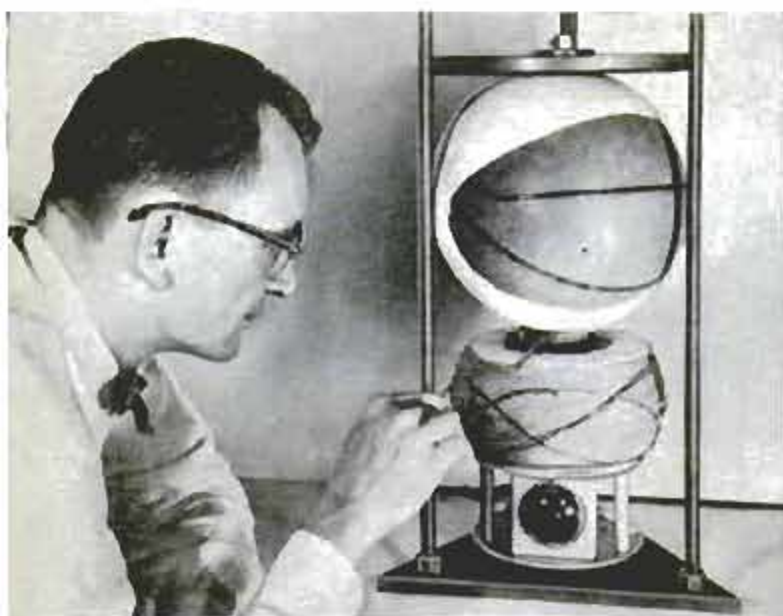
Mounted on its own air-storage tank, a miniature portable compressor makes a handy source of compressed air for darkroom technicians, retouchers and air-brush artists. In the photograph, the compressed air is being used to blow dust from a negative holder. The compressor operates on house current and automatically maintains 90 to 125 pounds of pressure per square inch in the storage tank. The unit weighs 9 pounds. It is available also for trucks and cars to power air horns.





## Guests Carve Initials On Coffee Table

Now you can smile when guests carve their initials in your new coffee table. The furniture market is offering a redwood table that comes in a "package" including a carving knife, a tube of wood putty, a putty knife and assorted sheets of sandpaper. The table is 36 inches long, 21 inches wide and 18 inches high. Its top is 1¼ inch thick. Popular as a "guest register" for graduation, housewarming and anniversary parties, the table comes with predrilled screw holes, beveled braces and wrought-iron legs with plastic tips.



## Basketball Helps Bend Fragile Salt Crystals

In the laboratories of Standard Oil Company, Whiting, Ind., a basketball is part of a scientific device for bending rock-salt crystals. When forced down, the basketball distributes exactly the right amount of pressure to bend the fragile crystal without breaking it. The bending is done over a heated mold. The curved crystal separates X rays into a radiation pattern that reveals the kinds and amounts of chemical elements present in complex petroleum products. The technique is used as a check on product quality.



## Electrostatic Spray Gun Is Hand-Operated

Electrostatic paint spraying originally was adapted to automatic operations on a production line. Now an electrostatic hand gun is being introduced, permitting more flexible use of the method by small operators. In electrostatic spraying, the atomized paint is attracted to the object so that there is virtually no loss of paint. A special voltage pack is connected with a flexible cable to the gun, creating an electrostatic field between the gun's atomizing bell and the article. Paint is supplied to the atomizer by pump or pressure tank. Atomization under the influence of the electrostatic field produces a spray of charged particles.

**A**PACHELAND, in the White Mountains of east-central Arizona, is the scene of a revolutionary experiment by modern Indians. What is occurring here may well take place at other reservations, if this plan is a success.

Apacheland is the two-million-acre reservation of the White Mountain Apaches—some 4500 of them. From a sort of "lost world" area, it has become America's largest and newest privately owned vacationland.

How it became that is a fascinating story. It began in 1954, when a pow-wow was held to determine what could be done about a serious economic lag. Cattle and lumber sales, once adequate to sustain the tribe, no longer made the grade. The young members of the tribal council saw only one solution: Open the reservation to tourists and sportsmen and make a nominal charge for fishing and hunting.

The decision was made. The tribe abandoned its tradition of seclusion, laid aside old grudges and invited the paleface in to help build a better life.

The plan was viewed with misgivings by so-called Indian "authorities" who felt the red man was not constituted to cope with whimsical tourist demands. Moreover, records showed the Indian in a poor light as a businessman. Still, it was no skin off the white man's nose; the Apaches were footing the bill, asking no outside help.

They set up the White Mountain Recreation Enterprise, staffed it with both whites and Indians, and opened offices at Whiteriver, seat of tribal government. They raised enough cash to begin development of wildlife and recreational resources, promote fishing and hunting, and launch a building program.

They ran a survey and drew up a blueprint of things to come. Some tribesmen took special training as tractor and bulldozer operators; others became game wardens. They patrol the entire area in Jeeps equipped with first aid for human casualties, and tools for making minor repairs to automobiles. When asked, they will show a novice how to cast a fly, or shoot an elk.

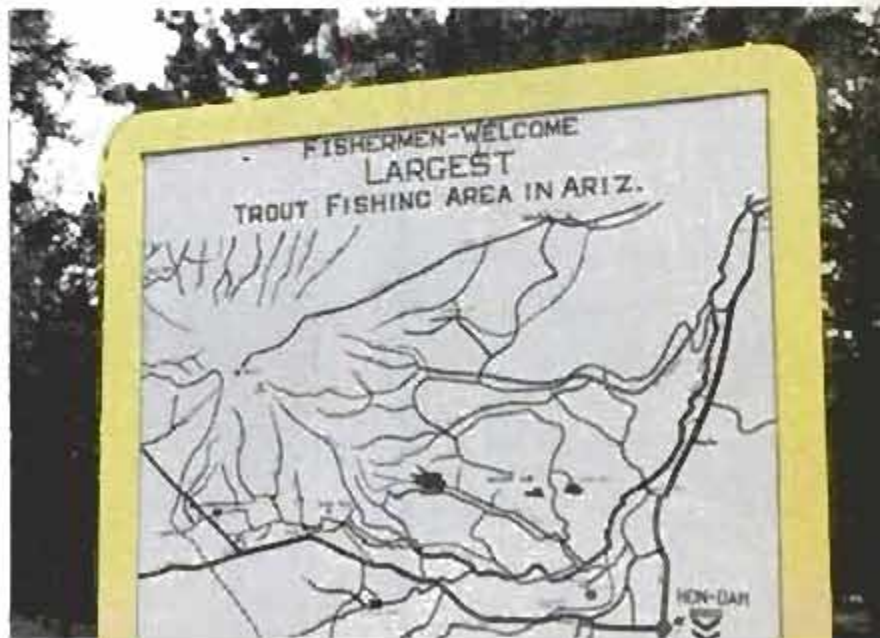


Two Apaches are at your service at the Hon-Dah filling station which the Indians built as a gasoline stop and supply center

# Your Hosts, The Apaches

By Robert M. Hyatt

Once their reservation was the private home of the Apaches. Sign now welcomes tourists and boasts of good trout streams





Within the reservation is a fish hatchery which regularly restocks all the waterways with trout and bass



Apaches maintain roads with their own machinery. Tribal cattle auction, below, often brings in \$500,000



Changing their reservation into a tourist-sports playground required no altering of Nature; she had been bountiful here. The forests of Apacheland include the nation's largest stands of ponderosa. Some 300 miles of rivers and streams, and two dozen lakes, total more than half of Arizona's finest trout waters. A large concentration of elk and other big game is here.

The Enterprise began the building campaign with a super filling station, supply center, and handsome motel at Indian Pine, northern gateway to Apacheland and junction of Highways 73 and 173.

### Stores Spring Up

Stores, cafes and trading posts went up near Whiteriver. At strategic points along the waterways, the Indians built some 400 excellent campsites, with plank tables and benches, fireplaces, sanitary facilities, even free wood. Along several creeks and lakes the Apaches erected log cabins for rental to sportsmen.

Miles of new roads and trails went in, and hundreds of direction signs pointing to good fishing and scenic attractions. On all roads into the reservation, the tribe set up signs reading "Hon-Dah"—meaning "Be my guest." It is the only Indian reservation with such invitational signs.

### Tribe Builds a Lake

The biggest project, calling for an expenditure of a half million, is Hawley Lake, which the tribe built two years ago. Here, in dense forests of spruce, fir and aspen, at an altitude of 8500 feet, there is to be a handsome lodge with restaurant and cocktail lounge, shops, cabins and boats, campgrounds and picnic areas. In the making is a golf course and ski run—the first such installations attempted by Indian workers.

Around the lake, some 500 summer homesites have been laid out which will have electricity, sewage system and water.



Four hundred beautiful campsites are scattered over Apacheland and Indians make certain they are kept neat

These lots—the smallest is a half-acre—are not for sale, but can be leased for 25 years. Prices start at \$40 a year and go up to \$175, for larger lots nearer the lake shore.

Hunting and fishing are superb in Apacheland, and fees from permits go to pay workers' wages and expand the ever-growing building program. Fishing permits are 60 cents the first day, 30 cents a day thereafter, or \$15 a year. A state fishing license is required. There is no closed season here, and no bag limit except on trout, bass and catfish—10 each per day.

#### **Elk or Bear License: \$10**

Hunting by nonresidents of the reservation is limited to elk, bear, javelina, dove and wildfowl. An elk-bear combination permit costs \$10, the others \$1 each. A state hunting license is necessary.

But whether you hunt, fish or just loaf here, you will be impressed by the beauty of the region, the hospitality of the people, and the magnitude of this vast project.

There is much material here for the camera fan and the historian. Highway 73, from Indian Pine to Whiteriver, is a 20-mile drive with history unreeling the entire distance. On both sides of the road are

small rancherias where Indians live in cottages which the government built years ago. Some sprout TV antennas. Near the cottage there is always a crude brush house, or "squaw cooler," as it is called, and a pole wickiup or tepee.

These are the three phases of Apache lodging: The brush house was the ancient village abode; the wickiup was portable and could be hauled by horse travois on hunts and forays against enemies; the cottage is the so-called "modern" Indian's home. However, more smoke curls from tepees than from cottages in Apacheland.

#### **Wild Turkeys Are Common**

A common sight here is a flock of wild turkeys blocking any road, or a herd of elk holding up traffic. But the strangest sight is a shiny diesel locomotive nosing out of the trees deep in the forest, followed by a string of cars piled with logs. This is the Apache Railroad, a privately owned line that snakes through the woods over 60 miles of track, touching at logging centers and ending at McNary, the sawmill town within the reservation.

The Apache vacationland is starting to pay off. ★★★



What better way to spend a summer afternoon? Movable bars held by setscrew locks make for variety



Above, with a crossbar seat under the canvas, it becomes reclining seat. Below, no ordinary teeter-totter gives such thrills—and it won't roll over



Dad's original idea was for a restful hammock—but whoops, you can raise the back and make a delightful slide all the way down the canvas strip

## A Back Yard "Piped" for Fun

HERE'S A PRESCRIPTION for back-yard fun at low cost: Take two 12-foot lengths of one-inch pipe; bend to semicircles 7 feet in diameter. Make crossbars of 1 1/4-inch pipe that can be moved anywhere along the semicircles and held in place with setscrew locks. Handy, but not essential, are two wheels from an old lawn mower attached to one end of the joined pipes. Dwight Kindschy of Moscow, Idaho, had a movable hammock in mind when he built the original model. His youngsters quickly took over the hammock as a fascinating piece of gymnastic equipment. He built another for adults—but seldom gets near it.







## Giant "A" Crane Flips 20-Ton Cargo Aboard Ship

TRUCK TRAILERS and ocean ships make a quick exchange of cargo these days with the help of a huge A-shaped crane running on rails along an Alameda, Calif., dock. Flatbed trailers are loaded at factory or warehouse with aluminum containers 8 by 24 feet and 8½ feet high, capable of carrying more than 40,000 pounds of cargo. At the dock, the trailer is driven under the

crane and at the flick of a switch the containers are hoisted up to deck level and transferred to the ship. The decks of six Matson Navigation Company steamers have been strengthened and fitted for locking down as many as 75 of these containers, stacked two high, on the deck. Future plans call for Matson freighters that will carry the containers below deck as well.

# Wood Chips Build Better Soil



On a commercial truck farm, wood chips are used as a mulch. Eventually they decompose to form fine humus

By Bob Whittier

Chipper powered by a 92-horsepower diesel engine gobbles up hardwood branches and spews out chips



FOR AGES THOSE who harvest the forests have taken it for granted that much of the wood in the trees they fell must be wasted in the form of trimmings, slabs and sawdust. Contractors burn huge piles of underbrush. Sawmills in the Pacific Northwest produce about half a million tons of sawdust annually. Piles of shavings grow higher and higher near hundreds of planing mills. In only a few locations where lumbering activity is concentrated has it been economically feasible to build plants for converting this huge amount of waste into useful by-products.

Soon, however—thanks to new chipping machines—the use of wood chips will be common and highly beneficial.

For some time crews have been clearing underbrush along highways with the aid of chipping machines. Trimmings are fed into the snarling machines, which turn bulky branches and even small trees into piles of chips.

The truck which tows a trailer-mounted chipper can hold the results of many hours of clearing work.

The truth is that wood chips no longer are regarded as waste but as such valuable material that underbrush is chopped up, not to get rid of it, but simply to produce chips in large quantities.

So deeply entrenched was the popular notion that sawdust and wood chips "sour the soil," or make it acid, that until quite recently nobody realized the true value of wood waste to the soil. Now every pile of chips, shavings and sawdust has become valuable.

Actually, wood technologists long have known that the end product of wood decomposition is alkaline. They are making a determined effort to eradicate the old "sour soil" idea which hinders wider utilization of chips. As soon as sawdust or wood chips are tilled into the soil, they begin to rot. The bacteria which cause wood to rot absorb large amounts of nitrogen from the soil, and this often results in sickly, yellowed plants. Casual observers jump to the conclusion that "the soil has been soured" when actually the trouble is a simple nitrogen deficiency. Merely by applying a fertilizer high in nitrogen content the soil can be made productive during the rotting period.

Sometimes wood chips are spread on the surface as a mulch; sometimes they are plowed into the soil. The results, in either case, can be spectacular. Grape growers in New York State were getting scarcely a ton of grapes per acre from vines growing in soil worn out by long use, subject to erosion by rain and to drying by wind. As soon as wood chips were introduced as a mulch, some of the growers coaxed as much as seven tons of grapes out of each acre.

During normal cultivation to control weeds, wood-chip mulch is worked into the soil of a run-down vineyard

Not only did they do themselves a service, but they solved a problem for a local woodworking mill. The mill manufactured bowling pins from hardwood, and had accumulated a pile of waste 60 feet high, 200 feet in diameter and weighing an estimated 10,000 tons. The cost of trucking it away would have put the mill out of business; yet the pile was growing so large that it had to be removed. Farmers, encouraged to undertake the mulching experiment by soil-conservation men, trucked the pile away at their own expense, saved the mill and boosted grape output tremendously.

As chipping machines have become more widely used in the last dozen years, experiments have turned up a variety of uses for wood chips. An abandoned farm was chosen for a wood-chip experiment in which 30 tons of chips per acre were tilled into the worn-out soil. That same summer the farm produced some of the finest crops in the region. A New York dairy farmer thinned out his wood lot, had the trees converted into chips, and saved \$5000 on his bedding costs in one winter. A Maine apple farmer mulched some of his trees with chips and found that 65 percent of the apples measured over 2½ inches in diameter, as opposed to 30 percent for the unmulched trees.

#### Wood Chips on the Lawn

The owner of a new home in a Pennsylvania subdivision had a "lawn" that was mostly clay; it baked as hard as concrete





Power tiller works wood chips into the soil of a new lawn. Chips are especially valuable in improving heavy clay soils



New chipping machines will turn out chips of any size. Operator can make adjustments to the machine, or select different blades



Wood-lot cuttings are chipped onto a pea patch as inexpensive mulch

in the summer, and grass was practically nonexistent. Instead of buying several tons of expensive topsoil, he tilled a four-inch layer of wood chips into the clay, along with appropriate fertilizers, and now has the most luxuriant lawn in the subdivision. Nurserymen in Montana improved their soil by tilling into it 25 tons of chips per acre. Everywhere, farmers, conservationists and homeowners are finding that wood chips save on costs, help increase production, solve problems and save extra work.

Experts of the U. S. Soil Conservation Service, concerned not only with preventing the erosion of valuable topsoil but with building up worn-out soils, have investigated the use of wood chips thoroughly and have accumulated a vast amount of experimental data. The Service's foremost wood-chip exponent is Arthur C. McIntyre, chief of the Northeast Region Forestry Division of the Service. He and his men are experts on what can be done with the lowly wood chip, and have been enthusiastically disseminating information about chips.

When tilled into the earth, wood chips provide the cheapest, most effective method known for increasing the soil's humus content. The traditional method has been to use barnyard manure, which is





Front-end loader digs into a huge pile of chips and drops them into a spreader to mulch a grape plot

scarce in many localities, contains very little actual humus after its cellulose-based straw content has disintegrated, and actually has rather low value in providing essential plant foods such as nitrogen, potassium and phosphorus.

#### Wood Produces Humus

Wood, however, leaves a rather high lignin content after its cellulose has rotted, and will produce more humus than almost any other vegetable matter. Wood chips have been called "organic matter in its cheapest form." They can be manufactured on the site from trees of sizes and species having no commercial value, at any time of the year. They cost less than five dollars a ton, on the average, and sometimes as little as two dollars a ton, which is far cheaper than manure, straw or hay.

Incorporating wood chips into the soil improves tillage and aeration, makes heavy soils porous, increases the water-holding ability of light soils as much as four times, stabilizes temperature and tends to reduce both wind and water erosion. The usual application runs from 10 to 20 tons per acre.

Chips have great advantages as a mulch. A mulch of hay or straw lasts one season, blows away, presents a grave fire hazard in dry weather, offers relatively poor insulation value, and harbors insect and vermin pests. Chips, by contrast, retain moisture in the soil far better both because they absorb and hold water themselves, and because they form a denser insulating blanket. Orchardists have scraped away several inches of chips during prolonged dry spells and found that the soil under-

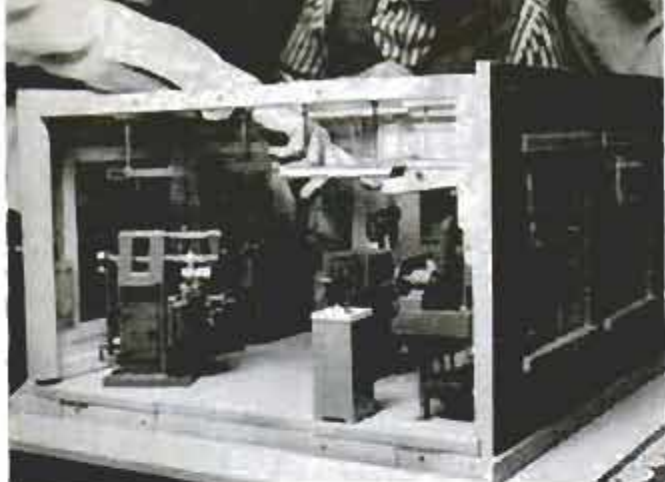
neath was nearly as damp as after a heavy rain.

Wood-chip mulches do not blow away. The fire hazard is negligible because only the uppermost layer of chips is really dry, and even that ignites with difficulty and burns slowly. A wood-chip mulch is so dense and keeps weeds down so well that often it pays for itself in labor saved on weeding. It is so resilient that it reduces

(Continued to page 216)

In dairy barns, chips make fine cattle bedding. They are highly absorbent, and don't cling to animals' coats





## Miniature Machine Shop Has Power Tools That Run

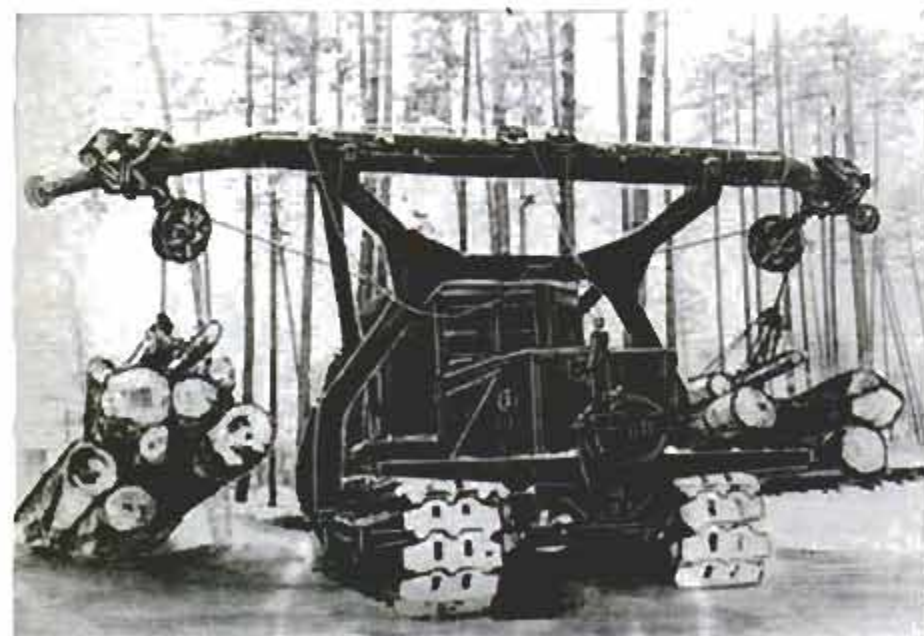
Anybody have a toothpick or paper clip that requires turning or milling? The place for it is the miniature machine shop of Richard Kirmss in Brooklyn, N. Y. The equipment includes a milling machine, woodturning and bench lathes, hardening

furnace and tool grinder. The machinery is complete down to fine details, and some of it actually runs. Partitioned off from the tiny shop is an office with secretary, desk, telephone and files. Shown at the right are some small tools.



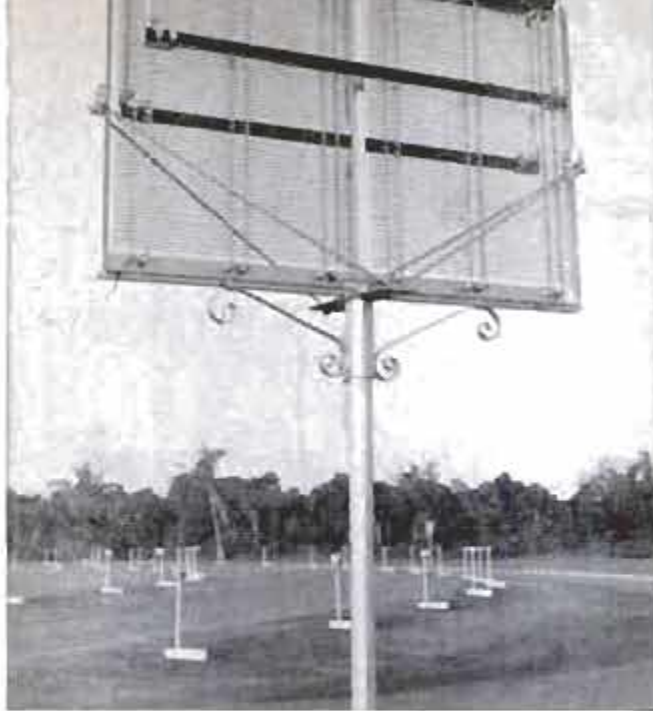
## Raft Rakes Weeds On Shallow Lakes

With a hayrake on the front and outboard motor on the rear, a home-built raft scoops cut weeds from New Jersey resort lakes. It can pick up 40 loads an hour. The raft is preceded by a water-weed mower, which clips subsurface vegetation. The 12-foot raking raft is constructed of spot-welded 12-gauge iron plate. Two pontoons run the length of the raft.



## Russian Log Hauler Has Overhead Rig

Working the vast forests of Russia, a logging tractor uses an overhead outrigger with rolling pulleys to drag clusters of heavy logs from the cutting area. Then the tractor skids the logs to the sawmill. The huge log hauler can tote up to 50 cubic yards of timber at one time. Both the cable winch and crawler drive of the tractor are operated by a 140-horsepower diesel engine.



### Electronic Flycatchers Kill Pests at Drive-ins

It's death for flying insects attracted to bars of "black light" around outdoor movies in Florida. The lights are mounted on a grid of electrodes, and when the insects come near the lights they are electrocuted by current flowing between the electrodes. Each of the electronic flycatchers is powered by 3500 volts. About 10 units are needed at each drive-in.



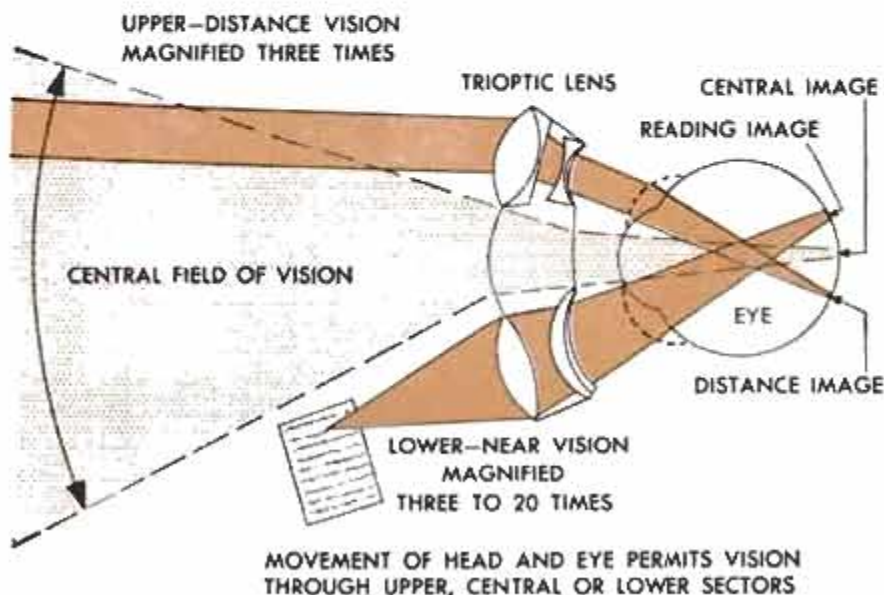
### Chair Built for Giants Weighs 4600 Pounds

What is undoubtedly the largest wooden chair in the world was built for display at a furniture store in Washington, D. C. It stands 19½ feet high and weighs 4600 pounds. More than 900 man-hours went into its construction. The chair is made of solid African-Congo mahogany. For the sake of contrast, a chair of normal size was placed on the seat of the oddity.

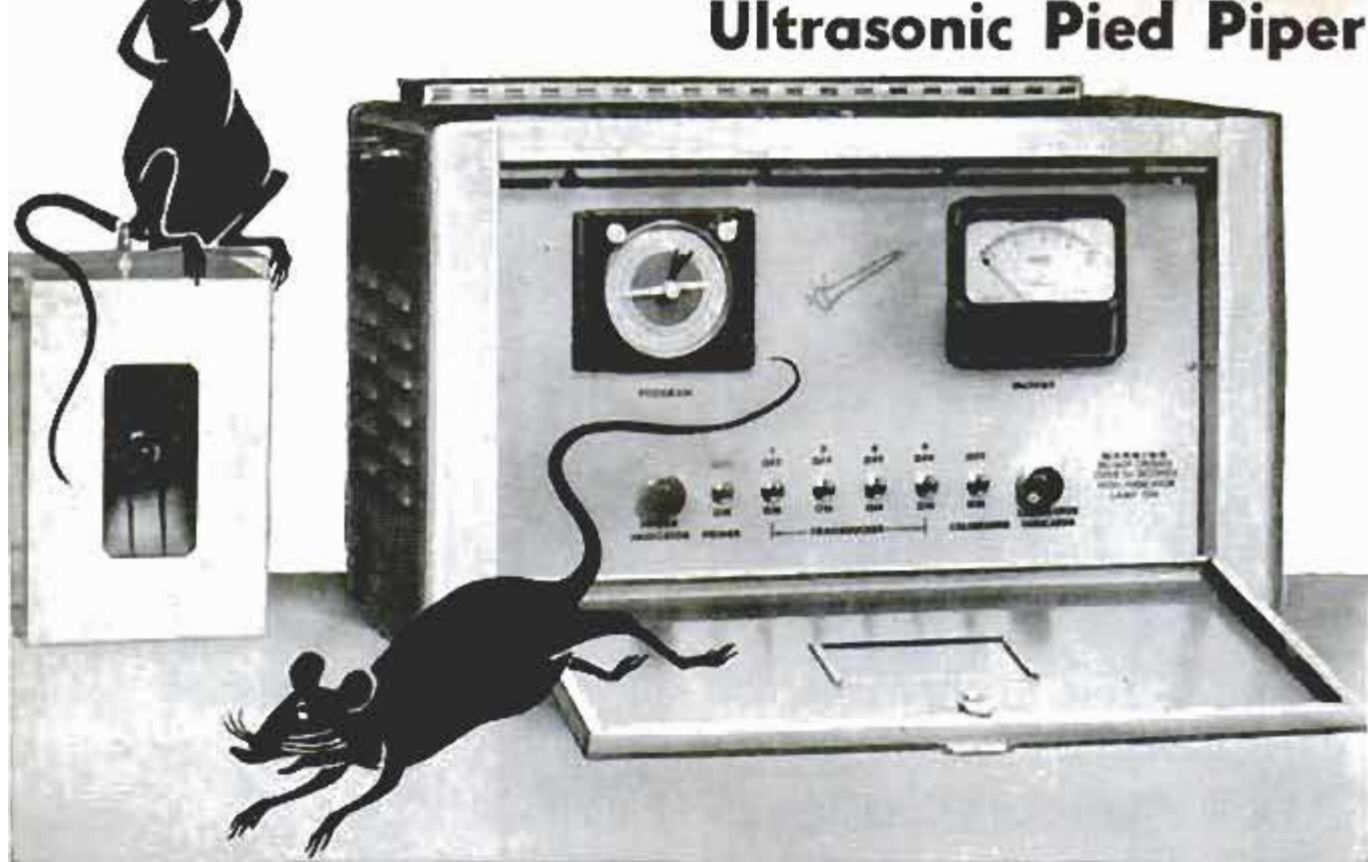
### Lens Patterned After Lighthouse Beacon Helps Near-Blind to See

Unique eyeglasses with lenses similar to the ones found in lighthouse beacons may bring vision to some of the nation's 500,000 partially blind persons. The new triple-duty, trioptic lens has a magnification range of 300 to 2000 percent. The upper

sector, for recognition of distant objects, generates magnification up to 300 percent. The center sector provides a full 120-degree field of vision. The lower sector is for reading and close work and produces up to 2000-percent magnification.

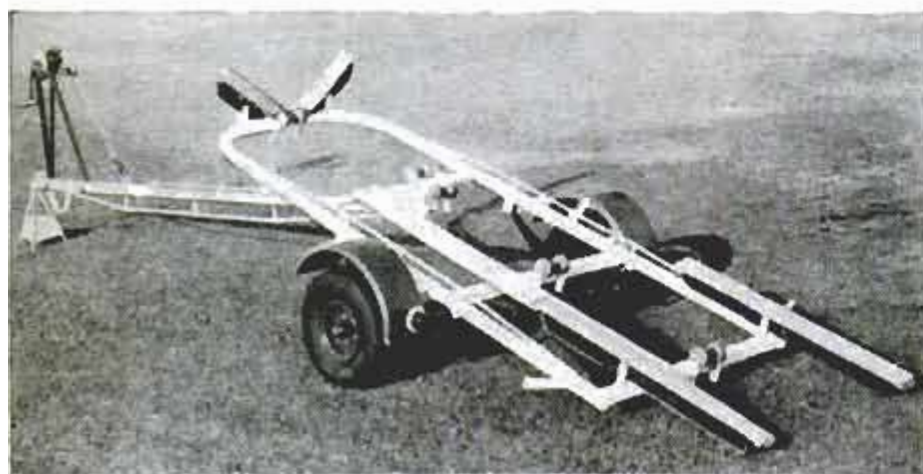


# Ultrasonic Pied Piper



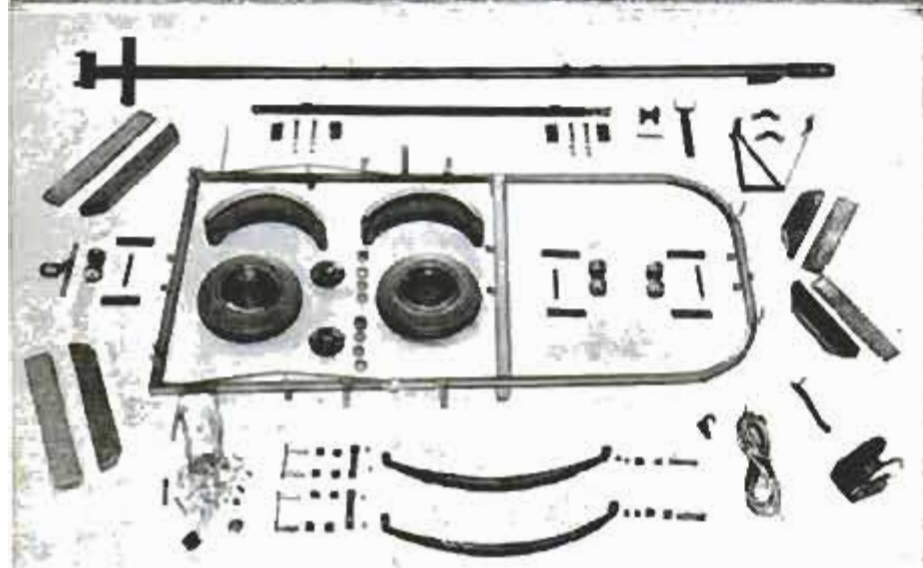
You can drive a rat simply mad with a noise you can't hear. A Cleveland firm found that out in experiments that led to development of an ultrasonic device that drives rats away—yet is pitched so that it

bothers neither humans nor pets. A unit placed in an airport office overrun with rats from a nearby dump rid the building of the pests. First annoyed, then highly agitated, the rats were gone in 72 hours.



## Boat Trailer Is Built From Kit

Sportsmen can acquire a trailer for small boats in an economical way by building their own from a kit of parts that is now available. A Florida firm is marketing a full set of components, completely fabricated and painted, the package including the winch rope and bow hook. Six different models are offered, sized to accommodate boats ranging from 12 feet and 300 pounds to a cruiser 18 feet long weighing 1700 pounds. Four of the models are equipped with a tilting arrangement which facilitates launching the boat and loading it on the trailer. Full instructions and diagrams are provided by the manufacturer for assembling the kit of parts, lower left, into the ready-to-travel trailer above.







Electric motor belted to the flywheel of an old sewing machine winds up a line to pull locomotive up the track



Paint, scraps and ingenuity converted box into locomotive. Below, "station" is convenient height

## "Locomotive" Chugs up Wire To Deliver Mail

Mail is delivered to Morton Murphy's front door by private locomotive. Murphy's home, in Brown County, Ind., is 200 feet from the road, and a trip to the mailbox takes him across some rugged terrain. Murphy redesigned his mailbox into a miniature locomotive, complete with cab, cowcatcher and headlight (a Christmas tree bulb). The "track" is a wire strung at waist level between the house and the road. The mailbox hangs from it on pulleys. A small electric motor attached to the flywheel of an old sewing machine provides its power, winding up a line attached to the locomotive. Murphy flips a switch, and the mail chugs up to the house.



## Blade Unit Slips Off to Convert Mower Into Tractor

Without any tools, the rotary blade assembly of a new riding mower can be removed. This converts the mower into a small tractor which can be used to push or pull other attachments. The control can be padlocked for safety.

## Plenty of Magnesium in the Sea

There's virtually no end to the worldwide supply of magnesium. The metal, which is being used more and more because of its light weight, can be "mined" from the ocean. In one cubic mile of sea water there are about *six million tons* of magnesium



*This is probably the world's noisiest school. Water drips from the ceiling, dynamite blasts smite your ears and noxious fumes drift through the aisles. But even tourists love this*

# **UNDERGROUND CLASSROOM**



Students at the Colorado School of Mines get practical working experience in a real mine, under realistic conditions. Here collegiate miners operate a long-hole drifter, used in drilling deep holes for dynamite blasting



**O**NE CLASSROOM at the Colorado School of Mines would have difficulty meeting an educator's standards for lighting, heating, ventilation and humidity. The floor is muddy, water drips from the ceiling, and noxious powder fumes sometimes pervade the air. When it is in use, the classroom is one of the noisiest places imaginable; yet it has not been condemned, despite its apparent shortcomings. It's the Colorado School of Mines' experimental mine at Idaho Springs, Colo.

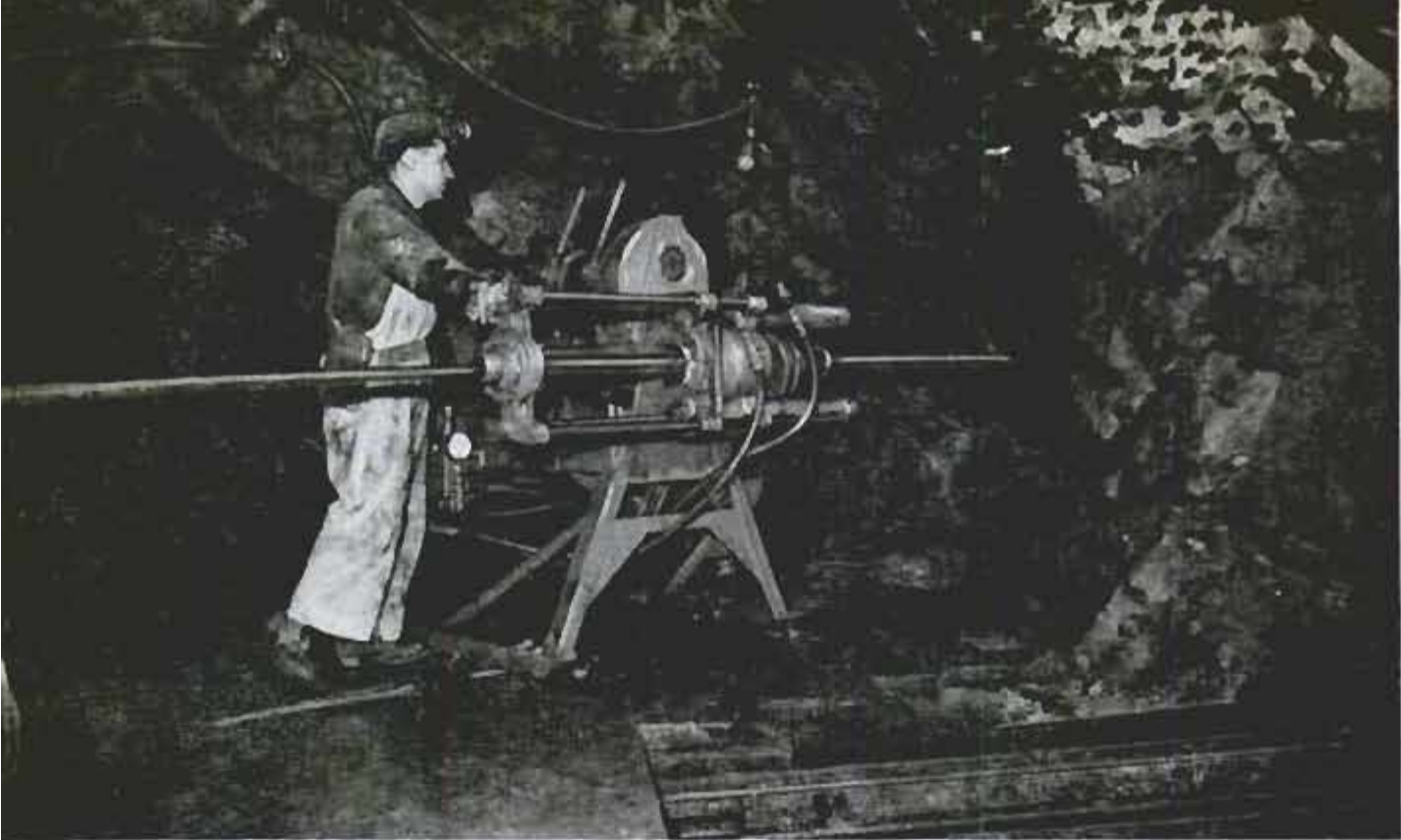
In 1921 the school acquired the Edgar Mine on long-term lease and converted its upper workings into an experimental mine and underground classroom. While most of the other mines in the Clear Creek district have declined and died, the Edgar still echoes to the thunder of compressed-

air drills and the shock of blasting. Whether it meets other classroom standards or not, the Edgar more than meets the requirement for giving student miners a very practical insight into the operations of a mine. By the time they have graduated and gone out to take jobs with mining companies, either in the United States or in foreign countries, they have become thoroughly familiar with most of the underground problems that a mining engineer is likely to meet in his career.

The mine is not a "play mine" or miniature one in any sense of the word. It has a full complement of compressed-air equipment, air lines, electrical circuits, haulage system and all the machinery needed for the operation of a producing mine. It contains the standard mine structures, such as

This student is running a mucking machine, an air-operated piece of equipment that scoops up blasted rock and tosses it into the ore car behind it. Much of the equipment has been donated by manufacturing firms





Operating a diamond drill, this student-miner is cutting drill cores that can be recovered and examined

The jack-leg air drill is used to form blasting holes at odd angles. Bottom, dynamite is rammed into holes with tamping stick. Instructor marks future holes with yellow paint



adits, crosscuts, drifts, raises, winzes and stopes. Items of heavy equipment, such as haulage locomotives, air drills, diamond drills and ore cars have been supplied by manufacturing companies interested in the development of new mining techniques or the expansion of proved ones.

In addition to becoming familiar with the most modern mining machinery and techniques, the students are given practical instruction in hand methods of mining. Many of the students have come from countries less well advanced in technology than the United States. Many others will take jobs in smaller mines or in mines outside the United States where the very latest equipment is not available. They must know techniques that can be used with the older types of equipment. For example, the students are taught to handle and use dynamite with fuses and primers as well as with electrical blasting caps. By actually doing the work themselves they learn to drill holes, load the rounds and blast rock. Then they muck out the drift or draw ore from the stope and haul it outside. They do their own timbering and extension of the haulage system. Every attempt has been made to set up the mine as an actual working property, giving the students complete training in all the various phases of underground mining techniques. In only one respect is the property different from a working mine: The ore is not shipped to a mill or smelter.

During the summer months, when students use the mine for surveying classes, it becomes a mecca for tourists, many of whom have never been farther underground than in a subway or basement. Guides are provided, and the visitors are shown all the operations of the mine. Last



Students also learn hand-mining techniques. Here, ore shoveled by hand in mine is being dumped by hand

summer, in the three-month tourist season, nearly 4000 people visited the experimental mine. It gives the average visitor a composite picture of the workings of a hard-

Student is surveying in one of the crosscuts, or horizontal tunnels, between veins in the mine

rock mine, a picture that he most likely would never get if he had to wait to arrange a visit to a commercially operating property. ★ ★ ★

Stoppers such as the one used here are employed in drilling holes upward so rock can be blasted down





Sitting in front, driver uses steering system hydraulically controlled with dozer blade and push beam

## Lightweight Army Tractor Has Detachable Sections

Army engineers have developed a lightweight tractor with front and rear sections that can be detached, so a cargo or dirt-loading body, equipment carrier, shop unit, crane or earth auger can be inserted. The

rear-engine, ballastable tractor has fewer parts, increased mobility, reduced operator needs and requires fewer maintenance skills. It can be used as a dozer, prime mover, scraper and supply carrier.

## Heatproof Electric Motor Operates in Oven

You may soon be able to buy an electric motor that can operate for long periods in intense heat. Westinghouse has developed a new system of insulation that enabled a motor to run continuously more than 100 hours while sealed inside an oven at 950 degrees Fahrenheit. The motor is shown below doing a grinding job while enveloped in jets of burning gas.

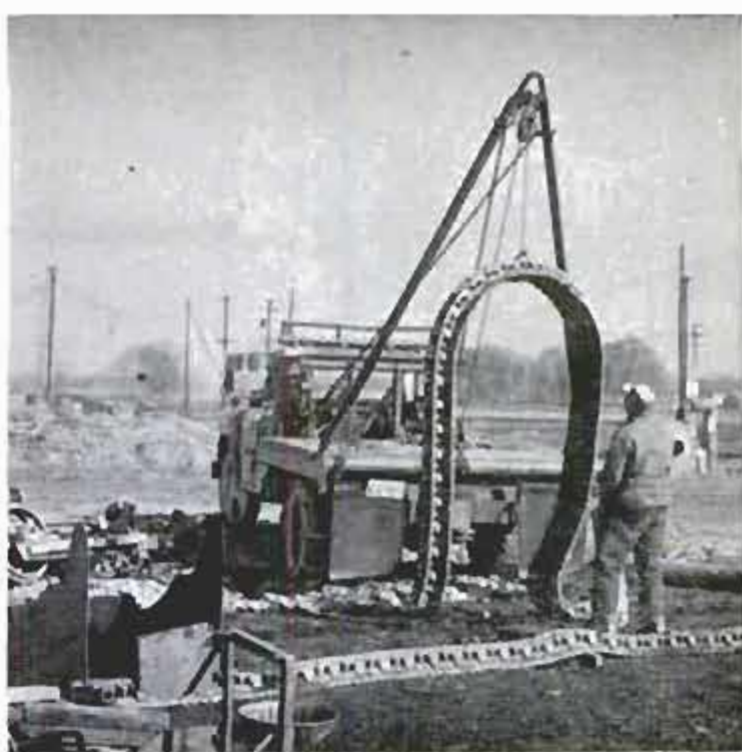
## Plastic Bags for Drinks Retain Carbonation

Hermetically sealed, flexible plastic bags have been designed for packaging and dispensing carbonated beverages. One of the bags, placed inside a tank, enables the drinks to retain their original carbonation, regardless of temperature changes. The beverage enters the bag through a stainless steel tube and is dispensed by pressing a button or pulling a faucet handle.





Part of a 3½-ton tractor starts trip through 42-inch-wide shaft to deep gas-storage cave

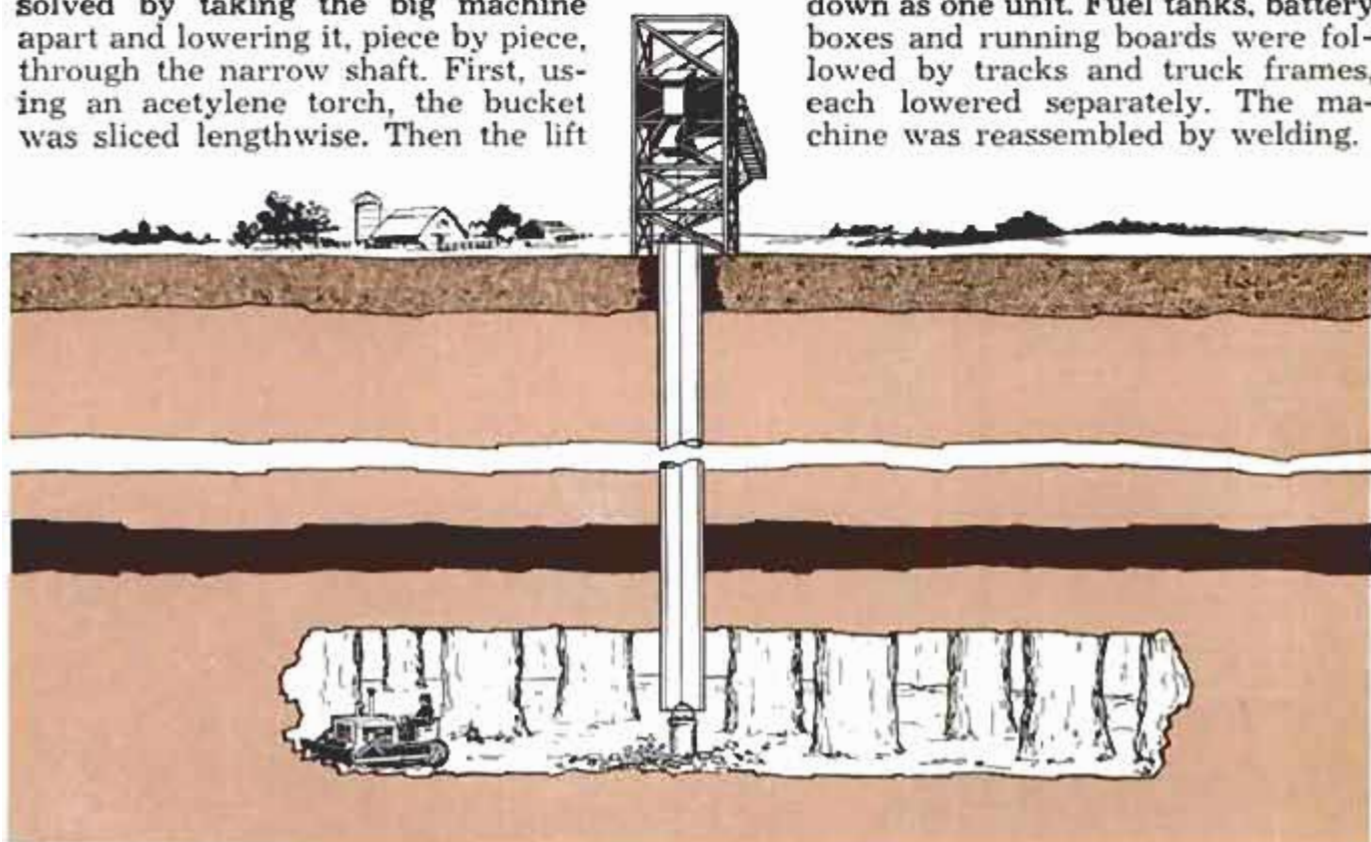


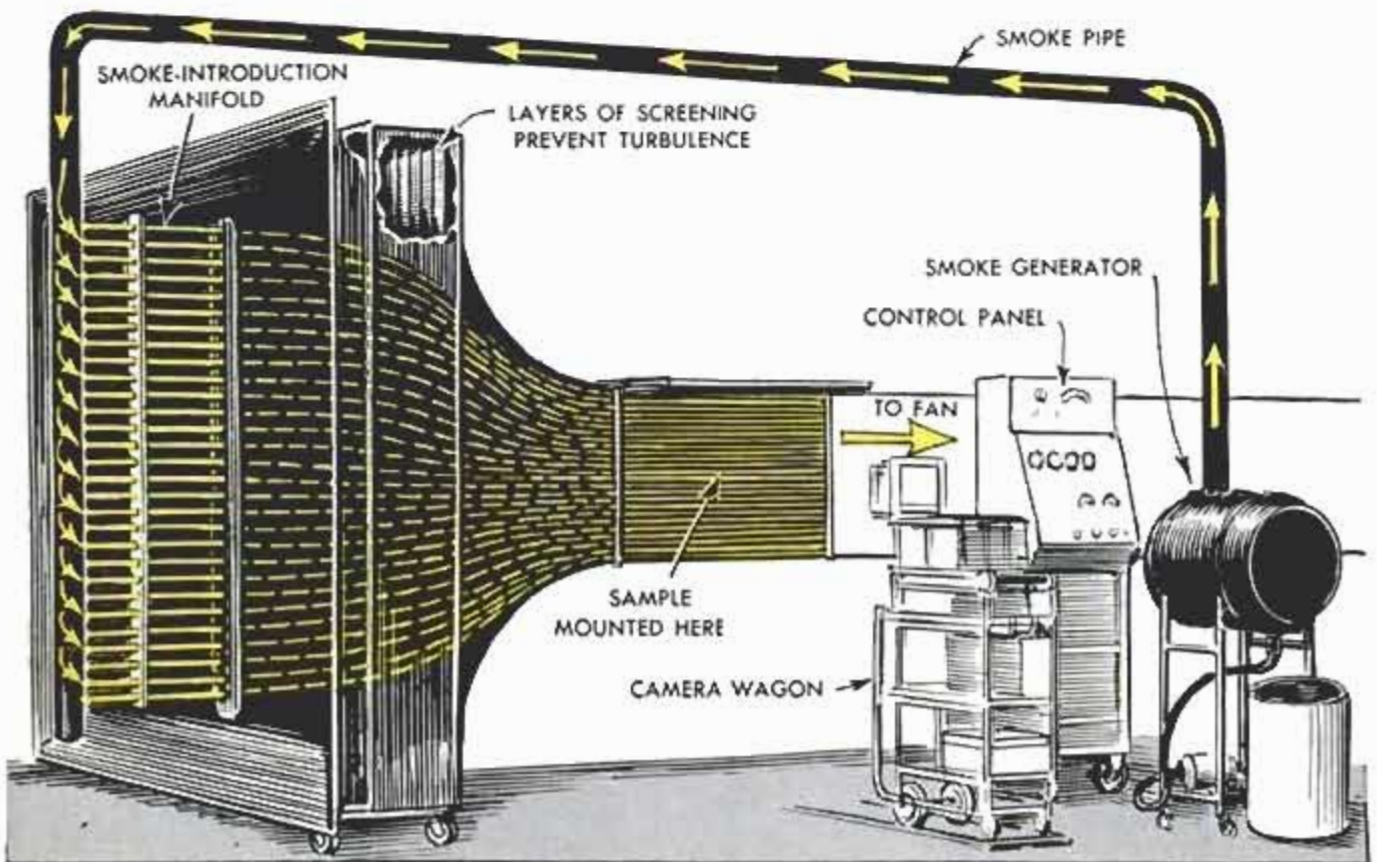
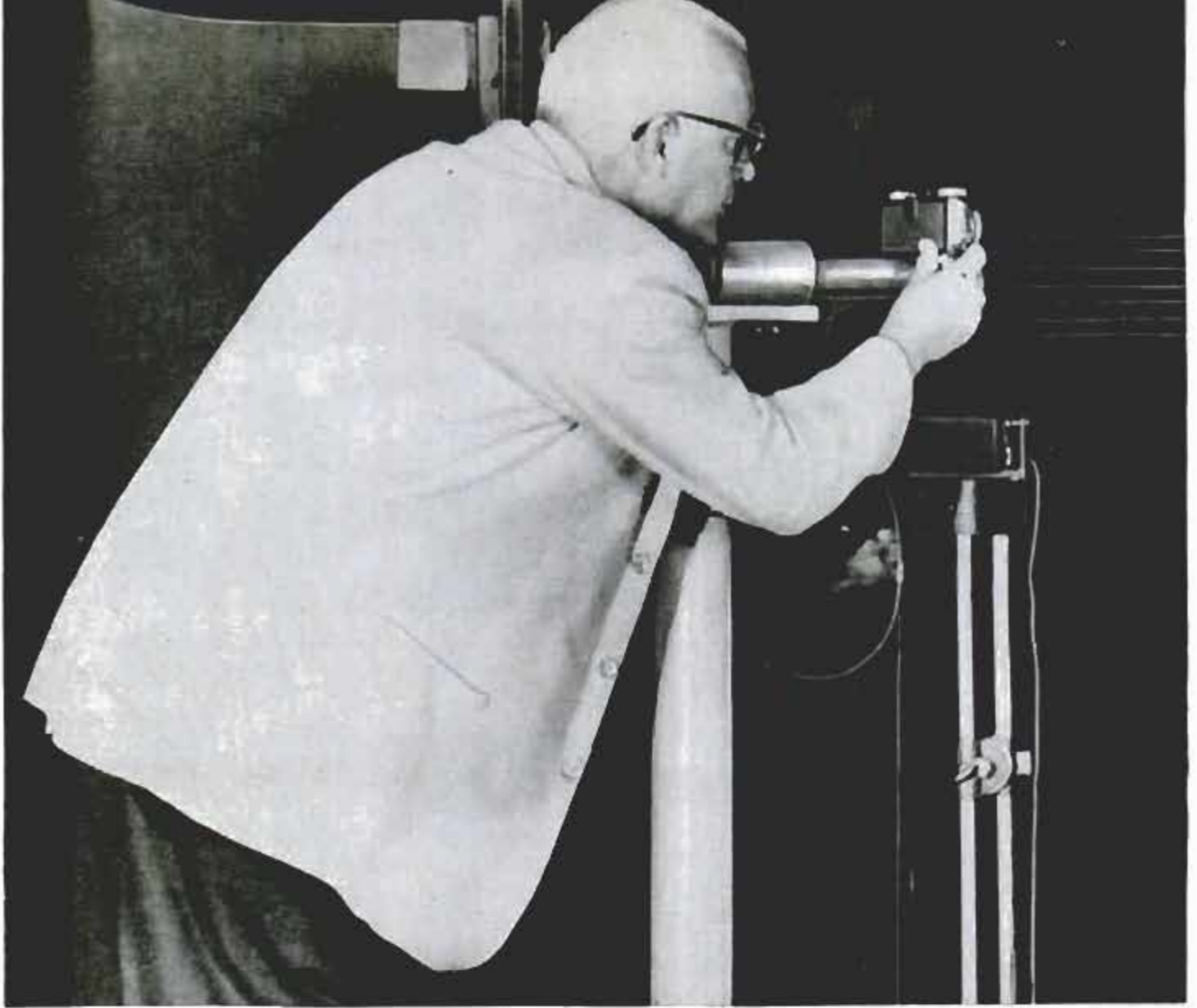
Tracks were easy to remove and lower into cave 350 feet below. Some parts had to be cut up with acetylene torch

## Tractor Goes Underground

HOW DO YOU squeeze a 7000-pound tractor-shovel through a 42-inch-wide shaft? That was the problem faced by the Cincinnati Gas and Electric Company when it started to construct a 40-room underground gas-storage cave near Middletown, Ohio. The giant cave is 350 feet beneath the surface of the ground. The problem was solved by taking the big machine apart and lowering it, piece by piece, through the narrow shaft. First, using an acetylene torch, the bucket was sliced lengthwise. Then the lift

beams were cut in half. The next steps were to take off the radiator and wrap-around, remove the transmission and the cylinder head from the engine and lower them through the 350-foot-deep shaft. The main frame was separated from the steering-clutch compartment. The engine, main frame, master clutch and rock guard went down as one unit. Fuel tanks, battery boxes and running boards were followed by tracks and truck frames, each lowered separately. The machine was reassembled by welding.







*Memo to baseball pitchers: If you could throw a ball without any spin, you could throw a curve that would break 3½ feet. A Notre Dame professor is learning such things from high-speed ribbons of smoke*

# THE STRANGE FORCES OF THE AIR

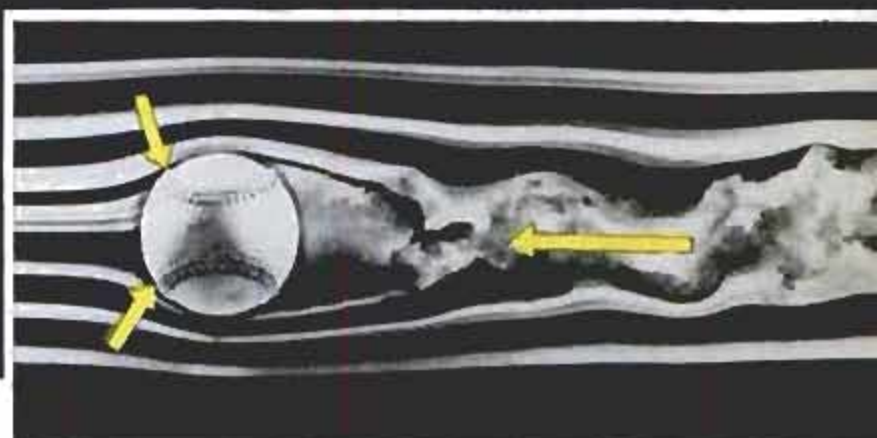
*By Clifford B. Hicks*

**WHAT MAKES** a pitcher's curve ball curve, and his slider slide?

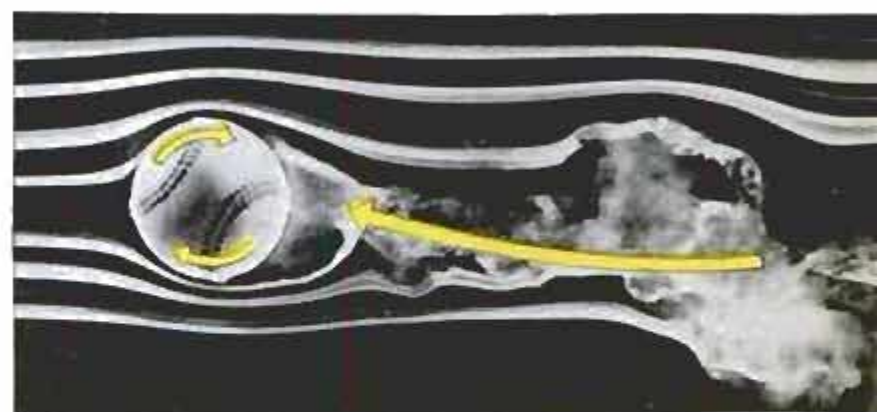
If a major-league pitcher took the time to visit a small laboratory at the University of Notre Dame, he'd come away with precise knowledge of what causes his pitches to behave the way they do. He'd discover, for the first time, the strange forces that go to work on the ball the instant it leaves his calloused fingers.

He'd learn these facts — facts vital to his profession — from a man who has virtually no interest in baseball. In fact, Prof. F.N.M. Brown hasn't seen a baseball game in years!

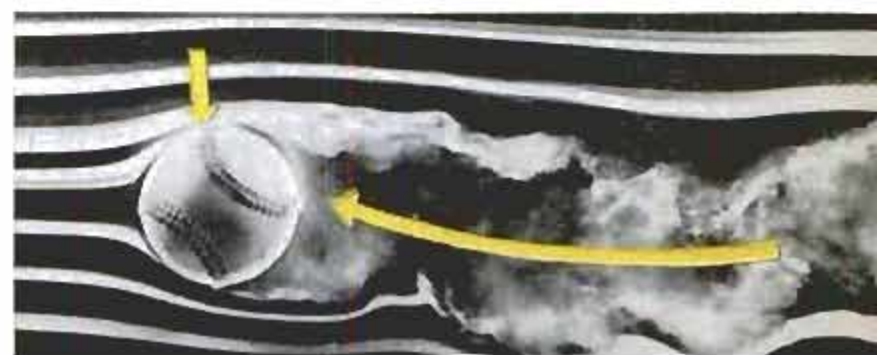
Though the national sport holds no fascination for Professor Brown, he has a deep, almost passionate interest in the forces that act on any object moving through the air, from a baseball to a huge missile. Because his research is of

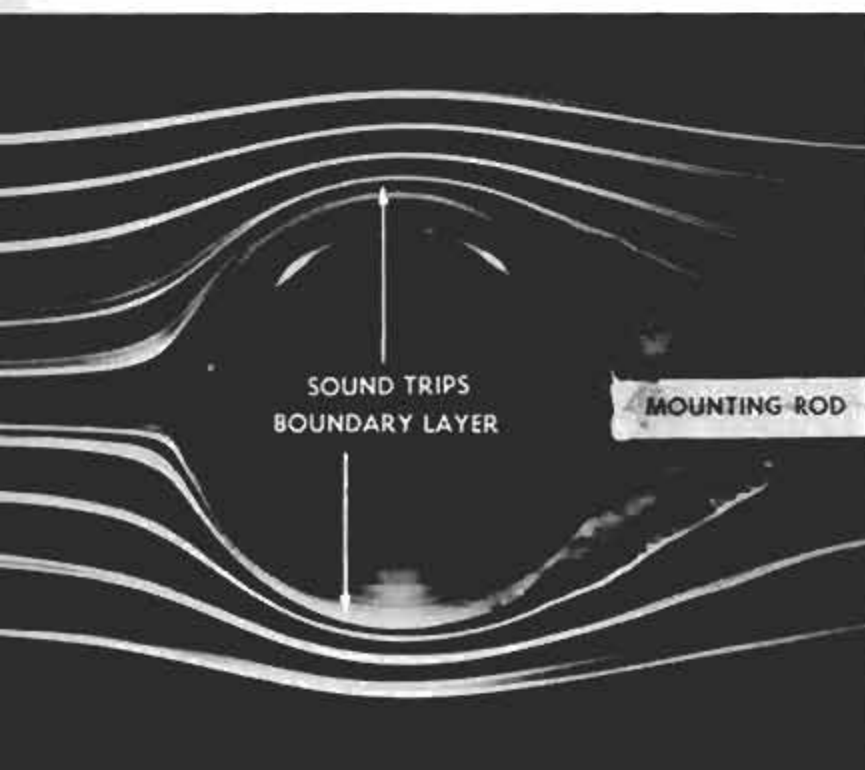


Nonrotating ball has seams in same position relative to smoke stream. Turbulence directly behind ball shows it would not curve



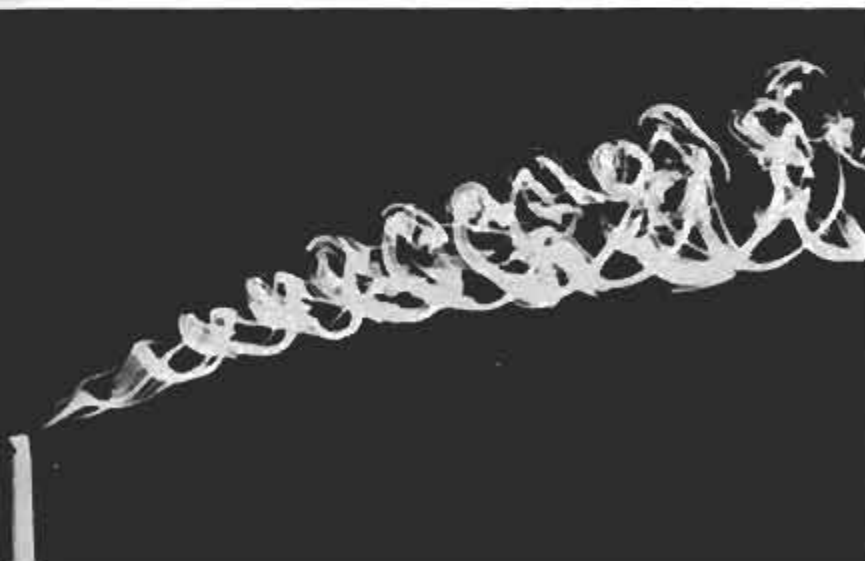
Turbulence shows that rotating ball would curve to the right. ↓ Nonrotating ball with seam as indicated would curve strongly





Top, smoke-stream pattern behind smooth cylinder indicates partial vacuum, high drag. Above, when sound is piped into wind tunnel it trips boundary layer, reduces drag significantly

Brown's research shows the amazing precision of air patterns. When the air speed is low and constant, even the smoke from a cigarette forms an intricate and regular pattern



great significance in missile design, much of his work is classified by the government. But he still finds time to poke his white-topped head into a smoke tunnel and come out with facts that upset long-held opinions.

For example, baseball fans are dogmatic in their belief that a curve ball curves because it is spinning; the greater the spin, they say, the greater the curve. Not necessarily so, says Brown. He then proceeds to demonstrate scientifically that a baseball hurled at 125 feet per second (well within the ability of a big-league pitcher) and *with no spin whatever* will curve 3½ feet between the mound and home plate — a somewhat greater curve than a ball spinning at 1100 revolutions per minute!

Brown's research reveals that a high-speed pitch will not curve as much as a slower pitch, provided the balls spin at the same rate. Consider two pitches, both spinning at 630 revolutions per minute. The first, traveling at a speed of 76.7 feet per second, will curve about 2.2 feet between the mound and home plate. The second, traveling at 117 feet per second, will curve about 1.9 feet.

### Magnus Effect Causes Curve

More than one force acts on a baseball to alter its course between the mound and home plate. Wind, of course, can be a factor. But the principal force is known as the Magnus effect. It can cause profound deviations in the trajectories of baseballs and bullets, of rockets and missiles. Here's what happens as a result of the Magnus effect:

As a body moves through the air, certain factors (spin, for example) cause the air to move faster across one side of the body than the other. On the "faster" side, the air pressure is lower. The object will invariably veer off in the direction of this lower air pressure.

This Magnus effect leads to a surprising conclusion, confirmed by Brown's research: *If the wind is blowing directly against a pitch, the ball will curve much more than if the wind is blowing cross-wise.* This is because a head wind has a tendency to increase the Magnus effect.

But what about Professor Brown's "perfect" pitch, the theoretical pitch that doesn't spin but curves almost three feet in the 60½ feet between the mound and the plate? Here another factor is involved — the boundary layer. As air moves around an object, eddies begin to form. At the point where these eddies form, a surface irregularity can, surprisingly, "smooth out" the air flow and minimize the drag effect of this turbulence. This is known as tripping the boundary layer. In the theoretically "perfect" pitch, the ball is oriented to the air stream so that its seam trips the boundary layer on one side but not the other. As a result, there is a significant drag on one side, and the ball veers off into a striking curve — striking in more ways than one! Or, if a pitcher could throw the ball so it turned only 90 degrees during its flight, it would curve first one way and then the other! It's all theoretical, of course. But if a pitcher had such superhuman control, there's no doubt he'd go down in baseball's Hall of Fame.

#### Sound Trips Boundary Layer

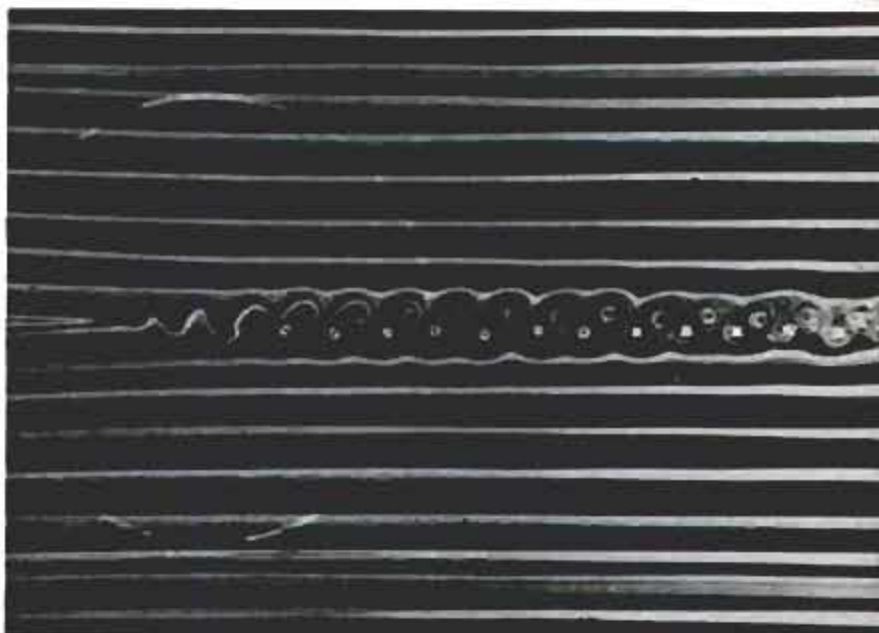
Professor Brown has discovered that a sound at a frequency of 1280 cycles per second can trip the boundary layer, whether or not the ball is spinning. This leads him to a fascinating speculation (which he admits he doesn't really believe himself): A particularly tight ball game could be decided by the sudden roar of the crowd as the crucial pitch leaves the mound. The sudden sound trips the boundary layer on one side of the ball, the pitch veers to one side, the batter swings futilely—and the ball game is over.

Brown's study of baseballs, of course, is a sideline of his real work. He has been studying the Magnus effect on spheres and cylinders, and a baseball happens to be a sphere with irregularities (the seams) that can provide some interesting data. For the most part, his work is classified because the aerodynamic shapes he is studying may be shown on the front page of tomorrow's newspaper. A satellite is simply an overgrown baseball, and the mighty rocket that hurls it through

(Continued to page 222)

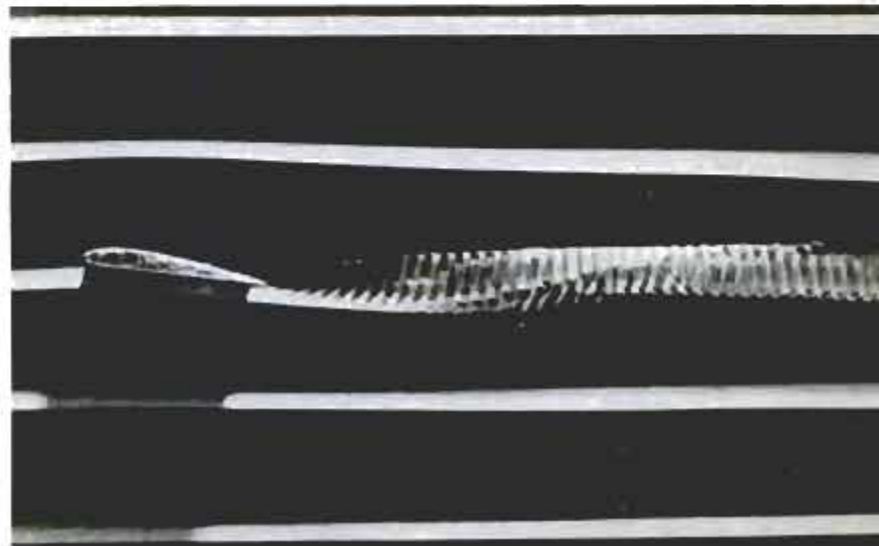


Here a model of a plane propeller is turning at 4080 revolutions per minute. The smoke shows a highly organized pattern, proving that distinct whorls are formed, and pattern is endlessly and precisely repeated as propeller moves through the air



At left is trailing edge of an airfoil. Air is moving over it at 33 feet per second, and 300 pairs of whorls are formed each second. Wake shows that airfoil has no lift under these conditions

Here a model wing has been mounted so its tip protrudes into the smoke. The undulation of the smoke stream behind the wing tip represents the drag, and can be measured quite accurately





## Fish From an Easy Chair on Plastic Pontoon Boat

Three foam-plastic pontoons form the "hull" of a strange new boat. Mounted atop the pontoons is a flat deck of heavy marine plywood. Tubular lawn chairs are placed on the deck for the comfort of fishermen or pleasure boaters. The smaller of two

models weighs 150 pounds and has 20 square feet of deck area. The larger weighs 275 pounds and has a deck measuring 30 square feet. Running lights, handrails and a wheel-controlled steering system are standard equipment on the larger model.

## Rubber Rolls Crush Hay in Field



Time required for curing hay is reduced by as much as 50 percent by a technique of crushing the plant stems during harvest. The tractor-pulled farm implement squeezes the hay between fabric-impregnated rubber rolls. When the plant cells are crushed, moisture evaporates faster, thus reducing the drying time. The process also reduces leaf loss and increases the palatability and feeding value. The rolls crush the hay in the swath or windrow. Spiral grooves in the rolls permit the hay to be taken directly from the windrow without the need for a separate pickup.



## Versatile German Toy Can Rock or Roll

Here's one kind of toy that should keep a toddler from becoming bored. When he's tired of using the piece of kindergarten equipment as a make-believe car, he can

turn it upside down and use it as a rocking chair. With some additional parts, it becomes a seesaw or a push toy. The idea was developed by a refugee from East Germany.

## Machine Reads Numbers Written in Magnetic Ink

Automatic banking equipment now includes a "character sensing" machine that can read Arabic numbers when they are written on checks with magnetic ink. The checks used in the electronic equipment are preprinted with account numbers and other routing information. When they arrive at a proof-inscriber unit, the dollar amounts are written in magnetic ink. The figures can be read by humans as well as by machine. A sorter-reader reads the magnetic-ink data from the checks. The data can be fed into several types of electronic computers or accounting machines. The magnetic ink is imprinted by the machine in the foreground. The large unit in the background is a sorter-reader.

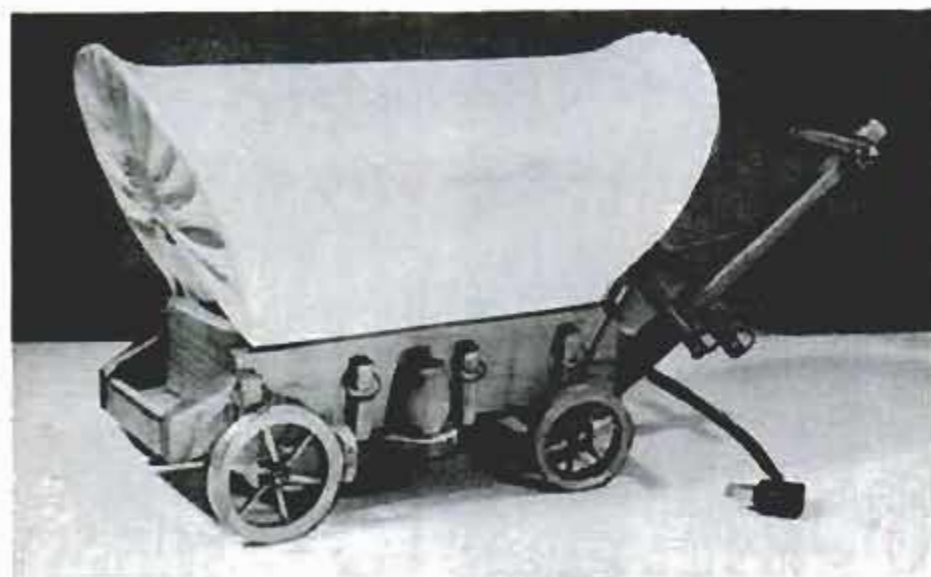


## WHAT'S NEW FOR



**AUTOMATIC INJECTOR** regulates flow of liquid-chlorine bleach into wash water. Attached to washer's lid recess, timed injector dilutes bleach, then adds it gradually to water. This protects fabrics from possible damage caused by misuse of bleach. Bleach is poured from measuring cup into injector's screened opening, from which it flows into dilution reservoir

The Maytag Company, Newton, Iowa



**TELEVISION LAMP** in form of covered wagon provides fitting decoration for top of TV set—especially at time when "Westerns" are stampeding networks. It is also suitable as night light in children's room. Wagon is 18 inches long, 12 inches high and 6 inches wide. Lamp is turned on by pushing wagon's tongue

Black Hills Enterprises, Box 72,  
Keystone, S. D.



**METAL COVES** for dry-wall construction are nailed into place. No miter cuts are required, since corners are already mitered for quick installation. Joints can be covered with dry-wall tape. Coves take all finishes, including textured and stippled paints

United Dry Wall Products, Inc.,  
6573 Pearl Rd., Cleveland 30, Ohio



**UTILITY HOLDERS** enable you to peel potatoes without danger of cutting your fingers. Consisting of three stainless-metal prongs molded into polyethylene plastic handles, the holders come in handy when you're scaling fish, too. They pin down fish at each end and thus keep it from slipping away. Holder also is used to make pouring holes in tin cans. Forreast A. Jackson & Associates, P.O. Box 7907, Portland 12, Ore.



**SQUEEZE-BOTTLE FEEDERS**, under development by the Air Force for dining under weightless conditions, already are available for ground-level use by babies. A feeder designed for tots has a baby spoon attached to its turn-on cover. After filling the container with heated food, mother squeezes out enough of the contents to fill the spoon, then feeds the infant. Bonley Products Co., 331 S. Peoria St., Chicago 7.

**ORNAMENTAL-DESSERT FORMER** produces frozen delicacies in shapes of hearts, clubs, diamonds and spades. After the gelatin or other mix is poured into the 20 compartments of the tray, the tray is refrigerated until the mix becomes solid. Made of odorless and tasteless plastic, the tray comes in pink or white. A simple twist of the tray loosens desserts. Como Plastics, Inc., 2455 National Rd., Columbus, Ind.

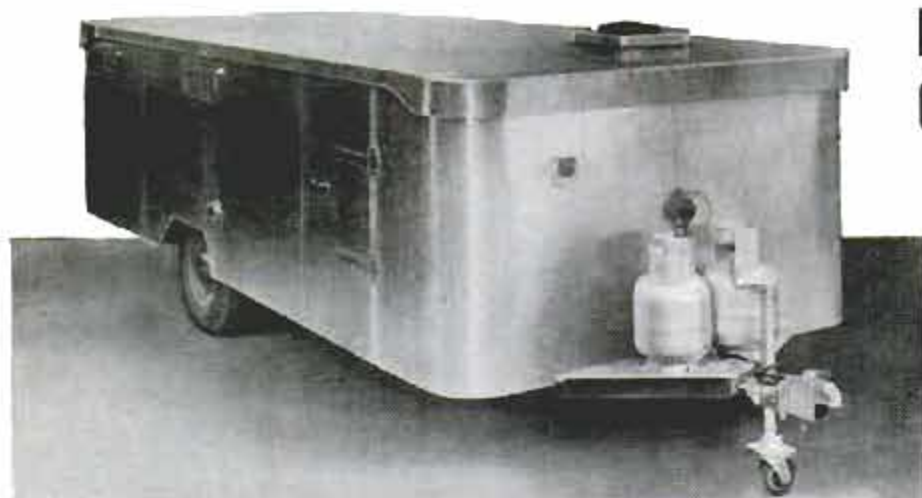


**HOOK CHAIN** can be suspended from the clothes rod to provide hanging space for purses, belts, umbrellas, children's clothing and other items that find their way into the closet. Each link in the chain is a chrome-plated, rounded hook. There are eight hooks in all, each three inches high. Use of the chain can relieve crowding and clutter in dresser drawers. Downa & Co., 816 University, Evanston, Ill.





Upper-wall sections fold against the roof, which then is lowered to form the compact road unit shown below



## Deluxe Camp Trailer Collapses for the Road

AFTER countless fishing and hunting trips, Nick Sustana of Cleveland, Ohio, grew weary of pitching tents. The result: He built a collapsible trailer for deluxe camping. Sixteen feet long, the trailer has running water, a heating system, two single bunks and a double bunk. There are compartments under the bunks for storing guns, tackle and other gear. For highway travel, the roof can be lowered by folding the upper sides against it. Trench jacks raise or lower the roof in minutes. The aluminum trailer has both a front and rear door. Even with the roof down, it is possible to sneak in the rear door for a quick nap.



Jacks raise and lower roof. Trailer has two single bunks, table that forms double bunk



## Tractor Shovel Transplants Tree

Full-grown trees can be dug out of the ground and transplanted in new sites in about 20 minutes by a big four-wheel tractor shovel. The blade of the shovel makes a series of cuts in the ground near the tree. Then it pries out a huge cone of earth containing the earth-packed roots and topped by the tree. The total weight is several thousand pounds. The tree may be reset within minutes.



## Vibrating Shoes Tamp Loose Road Beds

Operating at speeds up to 28 miles per hour, a new kind of roadbuilding machine compacts road-base materials with a powerful tamping action. The machine has six big "shoes" suspended between the front and rear axles. Each shoe weighs 420 pounds. They vibrate about one fourth inch, firmly tamping macadam, gravel or soil-cement bases. The shoes do not shove loose material ahead, as some rollers do.



## House "Overcoat" Protects Workmen

In England, construction men set up a rain-proof polyethylene tent before starting work on a new house. It saved more than 70 working hours that would have been lost because of rain or frost.

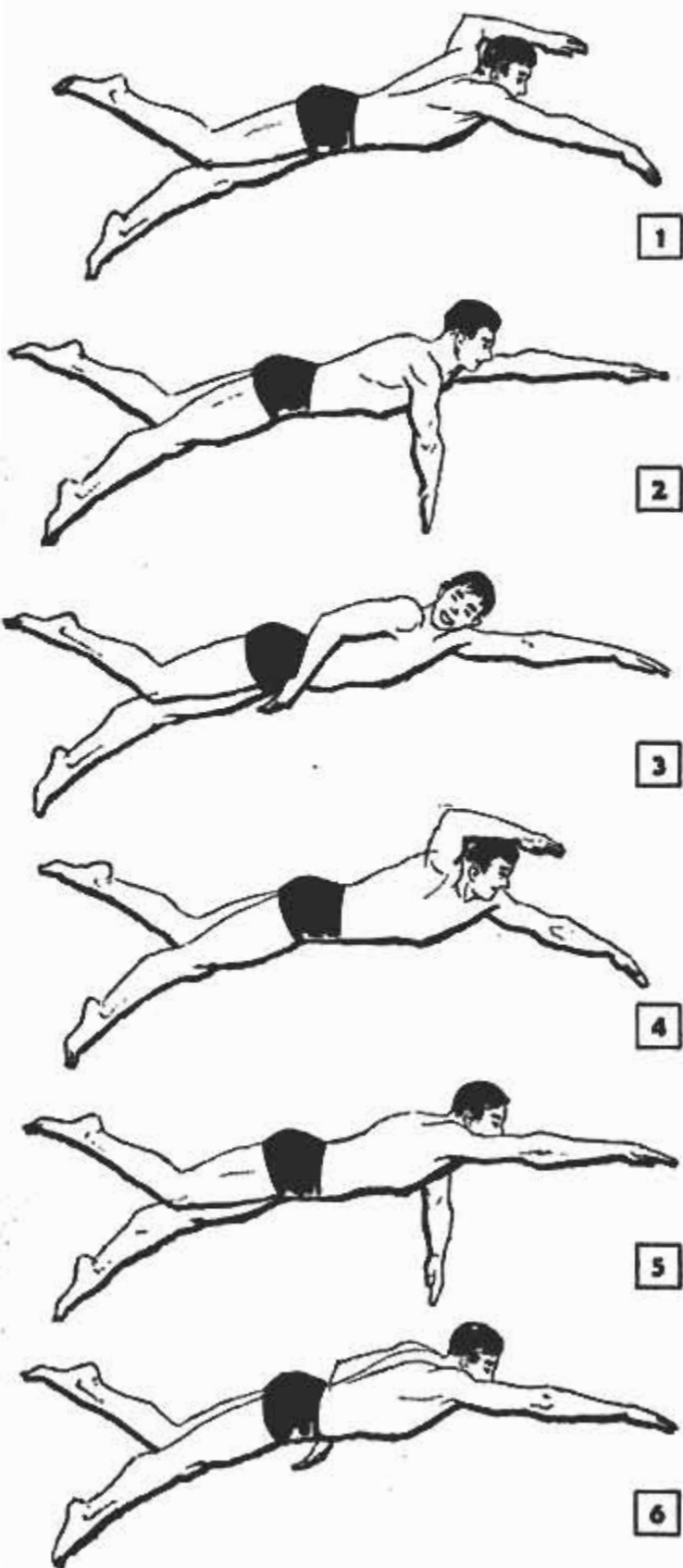
## Glow of Firefly Made in Lab

Biologists in Japan and the United States have produced the luminescent effect of fireflies and glowworms by mixing chemicals extracted from fish and other animals. One of the chemicals is called luciferin. The other is an enzyme, luciferase.





**CRAWL:** Most common rhythm is six leg beats to each revolution of arm, as shown below. Inhale while head is turned to side. Exhale under water



# *A Former Olympic Star Tells* **HOW TO SWIM LIKE A CHAMP**

*By Adolph Kiefer*

SWIMMING INSTRUCTOR AND FORMER OLYMPICS CHAMPION AND BACKSTROKE RECORD-HOLDER

**L**EARNING TO SWIM well is much like learning to be a good bridge player, golfer or trombonist: It takes practice. But swimming has an advantage over the other three: It's simple.

I'll illustrate briefly. When I was teaching sailors to swim during World War II, the wife of a Navy captain came to me one day and asked if I could teach her to swim. She was past 60 years of age, but she had a deep desire to learn.

Believe it or not, within two weeks she  
Beginner gets used to water by bobbing up and down



POPULAR MECHANICS



Beside family pool, Adolph Kiefer gives arm-stroke pointers to daughter Gail, 7. Watching are Mrs. Kiefer, a specialist in ballet swimming, and other Kiefers: Jack, 13, behind Kathy, 10, and Dale, 15

was doing 500 yards — and doing them in good style. Her success is one of the best testimonials to swimming's simplicity that I know of.

I have yet to see the person who can't be taught to swim. And I'm not excluding those who don't want to learn. In one of my Navy classes there was a veteran major-league ball player, a tall, big-limbed fellow, who hated water. He had to learn how to swim if he was ever to be graduated from boot training, and it was my job to teach him. In his case, as in that of many other nonswimmers, the hardest thing was to conquer his fear of water. Once that was done, however, the rest was comparatively

easy. The process took 12 weeks, but he finally learned to swim.

I also remember a Navy judo instructor, a Eurasian, who had had a towering fear of water since childhood. It took four weeks to teach him to swim, but once he learned, he took such a liking to water that he became an instructor—a good one, too, because he knew exactly what nonswimmers were going through.

Fear of water—usually an illogical fear — is most often the biggest obstacle between a nonswimmer and his learning to swim. The first step in conquering this fear is to get the pupil used to the feel of the water. This can be done in several ways.

Dale Kiefer, who already has won many medals and trophies in swimming, demonstrates breaststroke form





Get into the shallow end of the pool and invite the fearful pupil to "come in, the water's fine." Show him, by swimming a few widths of the pool, that the water is not too cold.

Once he gets into the water, have him walk the width of the pool several times. He'll get used to the water's temperature this way, and then he'll be ready for his next step: Squatting down and getting his face wet.

### How to Gain Confidence

Walk with him to deeper water and ask him to bob up and down for several minutes. This is great for giving confidence to a fearful nonswimmer. Then tell him to open his eyes underwater. After this, he's ready to learn how to work his arms and legs for the crawl, the commonest of all strokes. At this time you can introduce such aids as kick boards and inner tubes. These will eliminate his fear of drowning and enable him to concentrate on the arm and leg movements.

When you're dealing with someone who fears water, it's important that you never leave him in the water alone—at least not until he has overcome his fear and is interested enough in swimming to practice by himself.

At what age should children take swimming lessons? The best time is from six to eight years of age. This gives them several years to develop a technique before the time when the ability to swim well becomes an asset in their social lives—in their teens.

And now for the business of swimming. This article will show you, in words and pictures, the proper way to do the four basic strokes—crawl, breast, back and butterfly. To be excellent in all these strokes is a king-size order, but a person who wants to be more than a run-of-the-mine swimmer should work for proficiency in one or two of them.

**The crawl.** When this stroke is done right, it's the most efficient of all. The key to the stroke is in coordination of the arm movement, kick and breathing; these three actions must be synchronized. Get into a floating position, face down. Now pull down with one arm while the other is at rest in front of your head. You get your power mostly at the point immediately below the head. It's important that you get the feel of "taking hold" of water. Don't try to pull your arm through the water too fast.

Your kick should be mainly underwater and should assume not more than a 15-to-

**BREASTSTROKE:** Top, knees are raised at same moment hands are in front of chest. Center, legs kick back as arms reach out. This is glide position. Bottom, arms are pulled down to point below shoulders



**BUTTERFLY:** Arms drive downward at side and make a complete revolution. Legs propel body like fishtail

18-inch spread. It should extend a leg's length, with the hip serving as a pivoting point. Power comes from the feet more than from any other part of the leg, so the ankle must be relaxed and flexible to avoid tenseness. On recovery, the knee should be bent slightly, affording relaxation for the muscles.

#### **Turn Head for Breathing**

So that you can take a breath, your head should be turned regularly either to the left or right. Breathe smoothly, inhaling through the mouth. Exhale underwater

through the mouth, as your head is faced downward.

Gain rhythm by counting one-two-three every time you put your hand into water. Each count represents a leg kick. So for each complete revolution of the arm, six kicks are made—three with each leg.

There's also a four-beat kick—four beats to each arm cycle—that's becoming more and more popular.

Your arm gets a rest during the forward glide, after the hand has entered water. The hand's entry into water should be directly in line with the shoulder, while the

Through pool window, photographer catches faces of swimmers who demonstrated strokes underwater

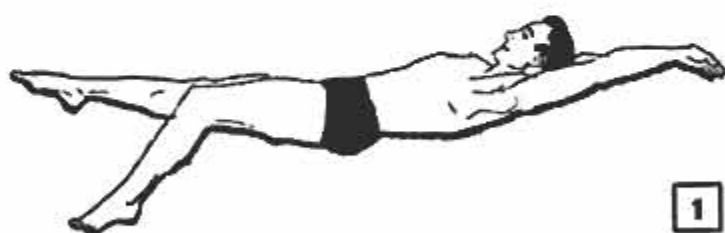




**BACKSTROKE:** Underwater shot of Adolph Kiefer shows correct position of body. Six-beat count, below, is same as in crawl



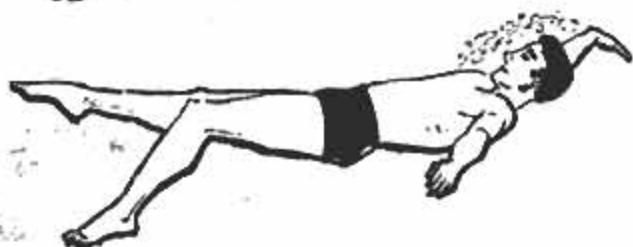
Grasping flutter board, Kathy Kiefer can swim pool length on kicking power alone



1



2



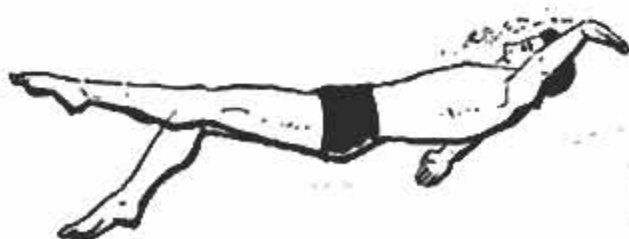
3



4



5



6

*Wedge*

elbow is still bent. The arm straightens then. As one arm glides in front, the other pulls back and recovers. The gliding arm stays in position until the other hand leaves the water. This is the secret of effective long-distance use of this stroke.

Water is a support for the gliding arm. It permits muscles of the shoulder and upper arm to relax. These are muscles that have a heavy role in the pull. The gliding period is reduced when this stroke is used for speed swimming. There must be a short period of gliding in every stroke.

Here are two ways to practice the crawl: First, use a flutter board to develop leg strength and a relaxed kick. You can assume you have a pretty good kick if you can propel yourself on the board for a distance of 200 yards without any real discomfort. Also practice by swimming long distances — from a quarter of a mile to a mile — without halting. This strengthens legs and muscles. Besides, it will help you to acquire relaxation and coordination naturally. Don't try to swim fast at first. Put your emphasis on form.

#### Common Faults in Crawl

These are the most common faults of those learning the crawl: 1. Moving the arms too fast; 2. Slapping water with the arms instead of placing the hands in water; 3. Pulling the arms back so rapidly that they slip through water in a zigzag motion; 4. Carrying the arms too high in recovery; 5. Crossing the arms over in front of the face in recovery; 6. Not relaxing sufficiently; 7. Failing to

(Continued to page 208)

## Soil Fumigator Lays Plastic Tarp

Among the new mechanical aids for agriculture is an implement that lays a sheet of plastic film on the soil. The implement also has a set of disks that seal the edges of the film with soil. As the polyethylene tarp is laid, fumes are injected under the plastic from tanks behind the tractor. The fumes kill nematodes and other soil pests. Not shown is an attachment that rewinds the plastic so it can be used again.

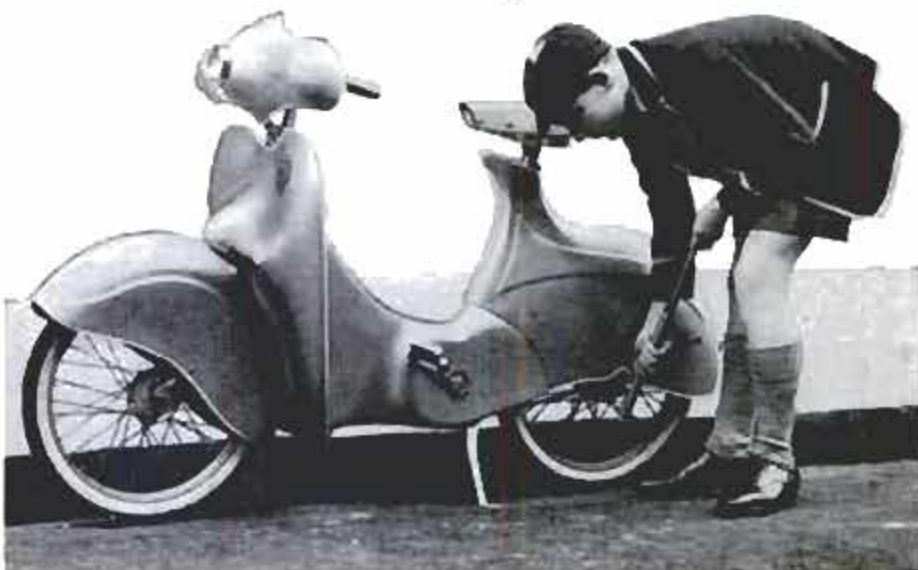


## British-Made Bike Cuts Down on Junior's Cleaning Bills

Frame, wheels and chain of a British bicycle are enclosed by a glass-fiber body, protecting the rider from oil and dirt. Leg-shields and a handlebar cowling keep off wind and road spatter.

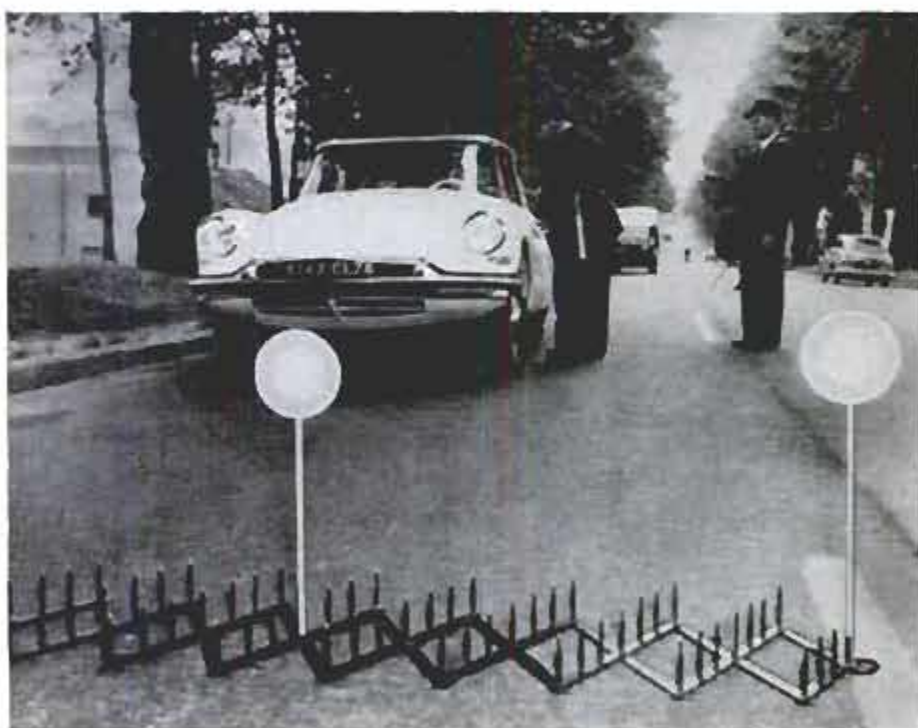
### Fountain Fluoridates Water

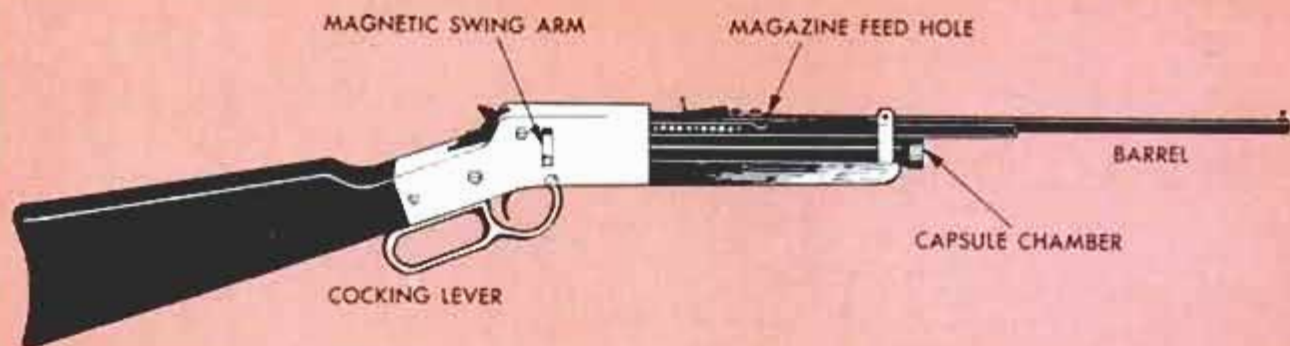
Fluoridated drinking water is provided by a new fountain attachment designed for areas where the water supply is non-fluoridated.



## No Choice Here— STOP!

In France, police use a new type of roadblock that the motorist doesn't dare ignore. It's a row of steel spikes, set into an expanding frame, that the police stretch across the highway. Any motorist foolhardy enough to drive across the roadblock will find his tires ripped to shreds. Bright reflectors are set up on the roadblock to give drivers ample warning. The driver can negotiate around the roadblock, but only at very low speed.





## Repeating Air Rifle Uses CO<sub>2</sub> Gas Capsule

Up to 100 BBs can be fired by power from a single capsule of carbon dioxide in a new repeating air rifle. The young marksman simply inserts the capsule in a chamber beneath the rifle barrel and screws on a cap which pushes the capsule against a pin. The pin releases the gas into a valved firing chamber. A spring-fed magazine holds 30 BBs. The gun is cocked for each shot by a fast finger-tip lever action behind the trigger guard. The BB is held in a magnetic socket for firing.

## Medics' Tourniquet Uses Compressed Air

From a strip of flexible metal fireplace screen and a blood-pressure arm cuff, similar to an auto inner tube, doctors at Walter Reed Army Medical Center have fashioned a tourniquet for use in operating rooms. The edges of the tube were sealed with tire patches and a tire-valve stem was added.

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# Radio Television Electronics



## UPSTAIRS STEREO DOWNSTAIRS

By Lothar Stern

**I**F YOU'RE GOING IN for hi-fi, why not go all the way?

Right now, stereophonic hi-fi represents the ultimate in the reproduction of sound, with nothing better even remotely visible on the musical horizon. Perhaps you already have it in your living room. Perhaps you're just planning it for your basement recreation room.

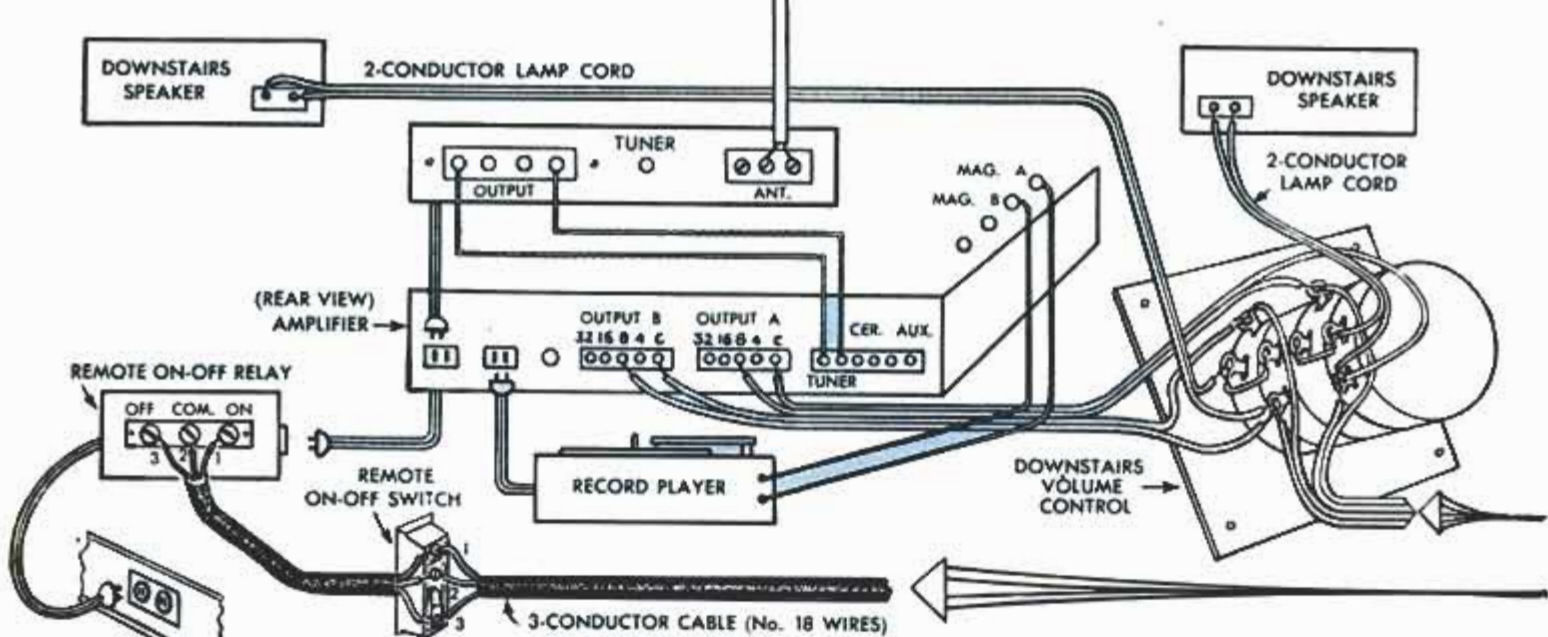
Why not put the two together? Stereo upstairs and down—with convenient controls to bring music where you want it, when you want it. This article tells you how it can be done, pointed up by the case history of a Park Ridge, Ill., family. They knew what they wanted and then put two and two together and came out with one—a single system that serves upstairs and downstairs to the satisfaction of all.

The Kaspers had just purchased a stereo system and they were eager to try it out. But an hour after the components had been unloaded from the family station wagon, they still stood unopened in the vestibule. In an adjoining room, the proud, new owners were settling their last remaining difference of opinion — upstairs or down?

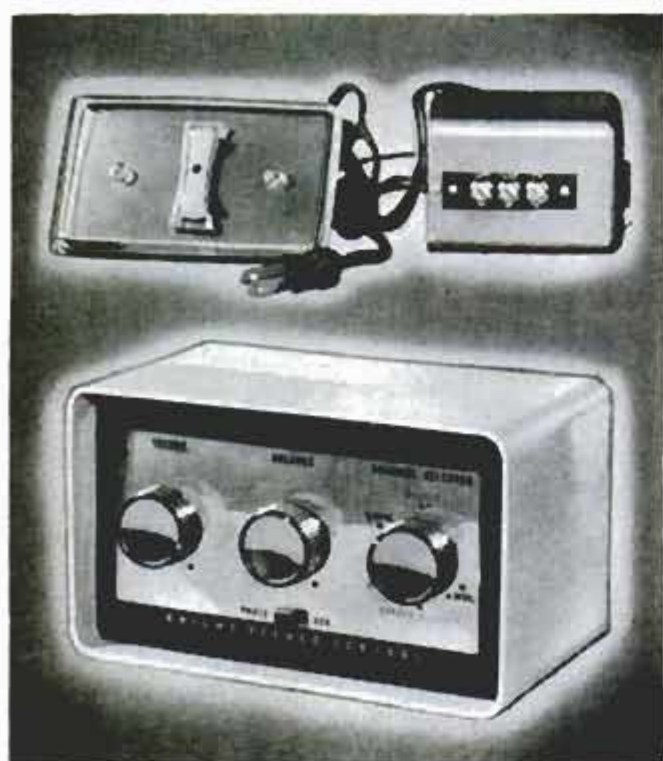
Like so many of today's homes, the Kasper domicile boasts a comfortably furnished basement recreation room. Here, Ed spends most of his leisure hours, and here, it seemed to him, would be the ideal place for the stereo installation. But Vivienne had other plans. Most of her day was spent upstairs, and why shouldn't the system be installed where it would get the most use? The living room, she insisted, was the best place for it.

With the components waiting to be installed, the dispute demanded an immediate settlement and when a decision was reached, Ed had won his point. But not without a major concession.

The system was to be installed downstairs, in a built-in bookcase which Ed had



Wiring diagram of Ed Kasper's complete upstairs-and-down stereo installation. Components in blue comprise initial stereo system. Parts in white were added later to permit remote stereo control from . . .



Principal additions to main stereo system are tiny Remcon relay (complete with wall switches), top, and Allied Radio's Knight stereo-remote-control kit

previously cleared specifically for this purpose. But provision would also be made for adequate reproduction upstairs, so that Vivienne could enjoy the new system while going about her daily tasks.

This promised to be a simple job. While two extra speakers would strain the budget a bit, the amplifier of the original system was deemed powerful enough to drive even two sets of speakers to better-than-normal listening levels. To meet Vivienne's stipulations, Ed would merely run cables from the upstairs speakers to the amplifier,

in order to obtain the sound in both places at once. And so the installation began . . .

Installing the components proved to be a simple matter. The thoughtful dealer had provided special color-coded interconnecting cables which removed all doubt as to what plugs were to go to which jacks. A couple of hours after the cartons were first unpacked, the system was turned on.

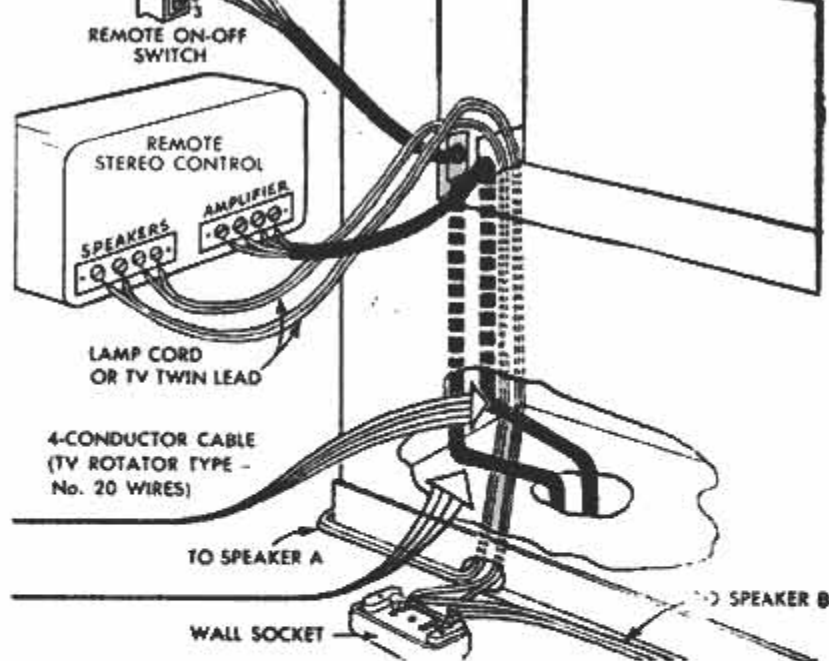
It worked perfectly. The unfamiliar controls took some getting used to, but, with the aid of the instructions, their mysteries were soon unraveled. By the end of the evening, the Kaspers were enjoying excellent results.

The extension speakers were ordered the following day.

**Impedance matching.** Adding extension speakers to a stereo system is simple.

When two speakers are connected to a single amplifier output, and both speakers have the same voice-coil resistance, the total speaker impedance is exactly one half that of the individual units. To match the amplifier properly, two 16-ohm speakers, for example, would be connected to the 8-ohm amplifier terminals, while two 8-ohm speakers would be attached to the 4-ohm terminals. Each speaker would then receive half of the total power delivered by the amplifier. So far as Ed was concerned, the most difficult part of the job was to locate a point in the basement ceiling where the wires could be passed to a suitable place in the living room.

After much deliberation, a single 4-conductor cable (two wires for each speaker) was run from the amplifier, along the ceiling molding, to the furnace room. From there, it passed through a hole in the ceiling to a recessed "planter" wall in the liv-



components mounted in living-room wall. Remote-control unit adjusts volume and balance of upstairs speakers only

Hiding wires between baseboard and carpet is hard on fingers but adds professional touch

ing room. Entrance to this room was gained through a hole in the baseboard where the four wires of the cable were split into two pairs, each running in a different direction to the two living-room speakers.

It was a job for the whole family. Even son Randy participated by pushing the cables out of sight between the baseboard and the wall-to-wall carpeting. When the set was turned on and the living room filled with music, everyone was elated.

But the elation was short-lived as the deficiencies of the installation became apparent. Not only was it impossible to balance both sets of speakers for optimum stereo perception in both places at once, but Vivienne soon tired of running downstairs before and after each telephone call to readjust the volume. There was much room for improvement.

**Stereo remote control.** It was not surprising, therefore, when, the following Saturday, Ed returned from a shopping trip and immediately disappeared into his workshop. Less than an hour later he reappeared, triumphantly exhibiting a stereo control unit he had just assembled from a kit of parts which, he announced, would solve the problem.

The Knight Stereo Control Kit seemed to have been designed specifically with Ed in mind. Not only did it permit the control of extension-speaker volume, it also provided a balance control for the extensions which was independent of the control on the main amplifier. In addition, there was a switch for reversing the connections to one extension speaker so that the pair could be properly phased, and another for choosing either stereo or monophonic operation. In short, the remote-control unit did every-

thing but turn the system on and off.

But even this last desirable function had been anticipated, for Ed had also bought a Remcon Remote Switch Kit which would permit him to do just that.

The switch kit consists of a small relay box containing a voltage step-down transformer and a low-voltage relay. The relay is momentarily energized at the touch of a remotely placed wall switch. Press the lower part of the switch and the relay contacts close to apply power to any device plugged into a receptacle on one end of the box. Press the top of the switch and the relay contacts open to shut off the power. Since all switching is done at low voltage, one or more remote switches may be connected to the relay box with ordinary cable, with no shock or fire hazard.

Again, the planter was removed from its shelf and two openings, one for the control kit and one for a remote on-off switch, were cut in the side wall just above the shelf. The previously installed speaker cable was cut at the point where it entered the living room and the four wires leading to the amplifier were connected to the "amplifier" terminals of the control box. The two 2-conductor lines leading to the extension speakers were fastened to the "speaker" terminals of the box.

Downstairs, a second on-off switch was fastened to the side of the bookcase and connected, with 3-wire cable, to the color-coded terminals of the relay box. A much longer 3-wire cable from this switch followed the route of the remote-speaker cable to the remote on-off switch upstairs.

Finally, the amplifier line cord was plugged into the socket of the relay box

(Continued to page 220)



## MAKE YOUR OWN UHF YAGI ANTENNA

By Rudolf F. Graf

**P**OOR RECEPTION from UHF TV stations in your area? Don't be too quick to blame your television receiver. Chances are that reception can be improved through the installation of a good antenna.

Antennas are the eyes and ears of television. Without one, the best receiver will leave you "snowbound" in the middle of summer. On the other hand, an adequate antenna can often bring in a "fringe area" signal even on an inexpensive set.

Indoor antennas, the built-in and TV-top variety, are normally satisfactory up to 10 or 15 miles from a station. But for greater distances you'll need something better. In some cases even a roof-mounted, all-channel antenna fails to provide the necessary signal strength and directivity for a snowfree, ghostfree picture on all channels. In such instances, a properly designed Yagi antenna may be the solution.

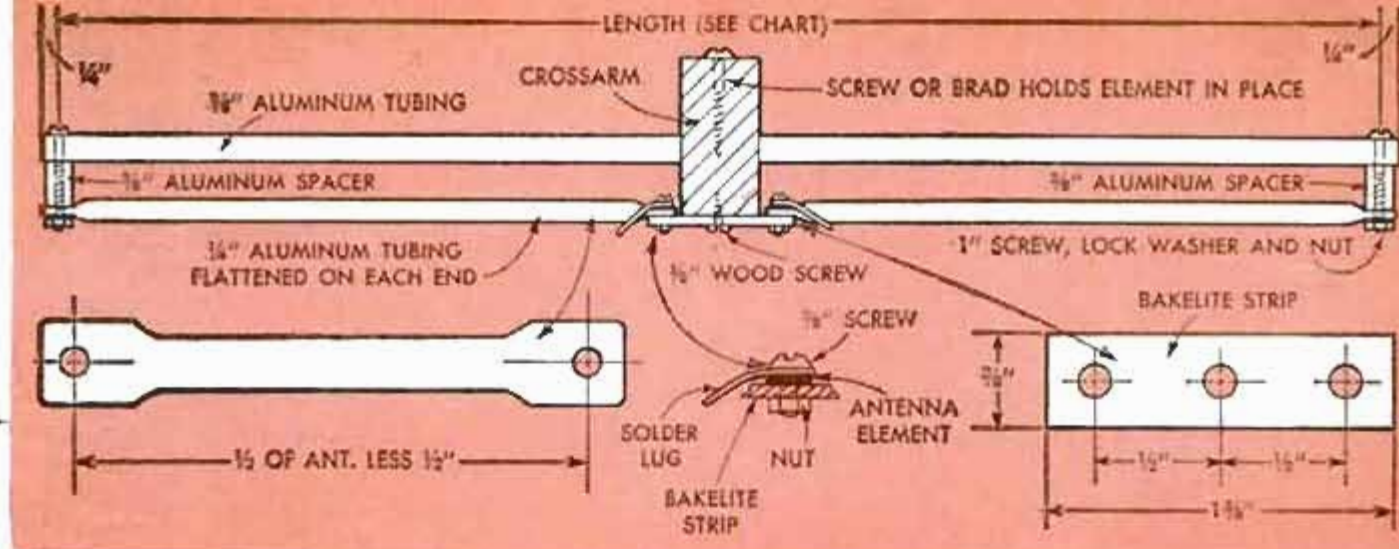
For the UHF region, channels 14 through

83, Yagi antennas are inexpensive and easy to make in your basement or home workshop. All you need is some aluminum tubing, a small piece of lumber to hold the antenna elements, and a few items of easy-to-get hardware. Dimensions and construction details are given in the table and illustrations on the opposite page.

The entire UHF TV band is covered by eight separate Yagis, each designed to cover a specific group of channels. In most areas only one or possibly two of these will be needed to bring in the available UHF stations. These may be mounted on separate masts or on the same mast with an all-channel VHF antenna. Separate lead-ins, connected to the receiver through an antenna selector switch, should be employed.

### Making the Antenna

The antenna crossarm may be of 1 x 1/2-in. Canadian spruce, Douglas fir, redwood or



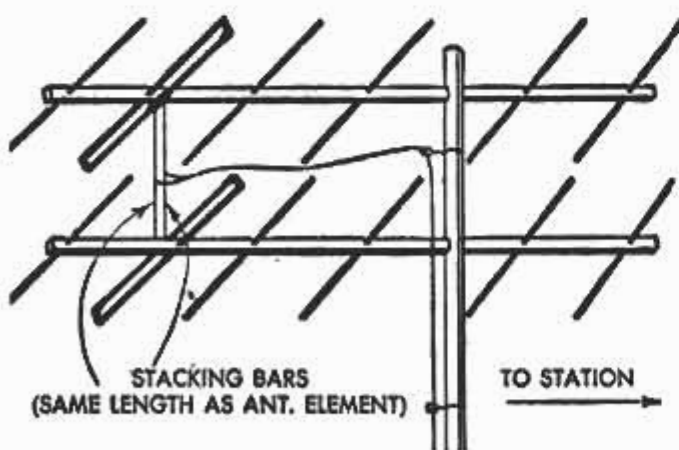
Assembly detail of driven antenna element. Length of tubing for various channels is given in table below

any other nonwarping wood. It should be given a coat of clear varnish or linseed oil and permitted to dry for about 24 hours.

The reflector and directors are made of 3/8-in. aluminum tubing and are held firmly in place with screws or brads through the top of the crossarm. The driven element, a folded dipole, is made of 3/8 and 1/4-in. tubing for proper impedance match. All elements must be in the same plane and should be exactly centered in the crossarm. The completed antenna is fastened to the mast with a U-bolt and bracket located between directors D2 and D3.

In extreme fringe areas, two identical

For greater gain, two identical Yagis are "stacked"



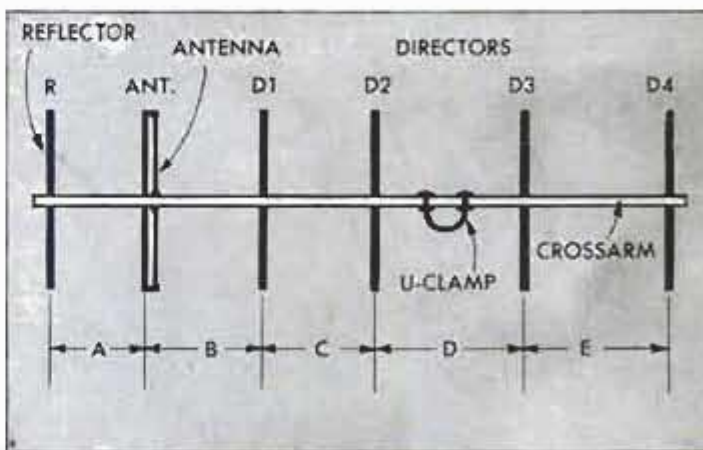
Yagis may be "stacked," one above the other, for even greater gain. The stacking bars which connect the two should be of the same length as the antenna elements; the transmission-line lead-in connects to the center of the stacking bars.

### Antenna Installation

Like a telescope, a Yagi antenna must be pointed directly at the point of origin of the signal it is to receive. A few degrees variation can often spell the difference between a good picture and no picture at all. There are, however, a few exceptions.

(Continued to page 214)

Use table to determine dimensions of Yagi you need



### LENGTH OF ANTENNA PARTS

### SPACING BETWEEN ANTENNA ELEMENTS

All Dimensions in Inches

Channel Number	Length of Antenna Parts		Length of Directors				Crossarm*	Spacing Between Antenna Elements					
	Reflector R	Antenna Ant	D1	D2	D3	D4		Channel Number	Spacing A	Spacing B	Spacing C	Spacing D	Spacing E
14-20	11 3/4	10 1/2	10 1/8	9 1/8	9 1/8	9 1/8	31 1/2	14-20	5 1/8	5 3/4	4 1/8	7	6 1/8
21-27	10 7/8	9 1/8	9 3/8	8 3/8	8 3/8	8 3/8	29 3/8	21-27	4 3/4	5 1/8	4 7/8	6 7/8	6 1/4
28-36	10	8 7/8	8 3/8	7 3/8	7 3/8	7 3/8	26 1/8	28-36	4 7/8	4 7/8	4 1/8	5 1/8	5 3/4
37-45	9	8 1/8	7 3/8	7 3/8	7 3/8	7 3/8	24 1/8	37-45	3 1/8	4 1/2	3 1/8	5 1/8	5 1/4
46-54	8 3/8	7 1/8	7 1/8	7 1/8	7	7	23 1/8	46-54	3 1/8	4 1/8	3 7/8	5	4 3/8
55-63	7 1/8	6 1/8	6 3/8	6 3/8	6 1/2	6 1/2	21 1/8	55-63	3 3/8	3 3/8	3 3/8	4 3/8	4 1/2
64-73	7 3/8	6 7/8	6 1/4	6 1/4	6	6	20	64-73	3 1/8	3 1/2	2 1/8	4 7/8	4 1/8
74-83	6 3/4	6	5 1/8	5 1/8	5 3/8	5 3/8	18 7/8	74-83	2 1/8	3 1/8	2 3/4	4	3 7/8

\* Length includes 1" spacing on both ends of crossarm, for proper fastening of R and D4.

# SCREENED FOR COOL RELAXATION

By Hi Sibley

**PORCHES AND OTHER** screened-in areas have in the past had a "cluttered" appearance because of the need for many narrow screen panels. This was necessary because screening was available only in fairly narrow widths. Aluminum screening now can be obtained in 72-in. widths, which means that an opening to be screened can be just 1 in. less than 6 ft. in height. The length of any such opening is limited only by the restrictions of safe, strong construction. For example, the opening in the screened addition in Fig. 2 is almost 19 ft. long. Because the ends of the structure are more than 6 ft. high, due to the required slant of the roof, the screening on them is positioned vertically. The width of these panels, however, can be up to 6 ft., to maintain the "picture window" effect.

Fig. 1 illustrates a screened-in addition that was built over a flagstone patio which had been laid some years earlier. Concrete blocks were mortared to the flagstones, then filled with concrete in which several anchor bolts were positioned. A 2 x 6 sill plate then was drilled to fit over the bolts. Instead of concrete blocks, a concrete footing could be poured, with forms above ground, to provide a low wall. Or a footing flush with the ground could have a brick or concrete wall built on it. It is not advisable to have lumber directly on the ground because of the moisture problem. Although the details in Fig. 2 show the 4 x 6 corner posts to be toe-nailed to the sill plate, it actually would be easier to build the end walls complete on the ground,

then have a friend help you raise them into position. Nails could be driven up through the sill plate into the columns. The frame member next to the house is drilled for lag or anchor bolts. Their locations are marked through the frame member, and the wall is moved aside while the holes are drilled and the anchors inserted. The wall framing then is fitted on the foundation and against the house wall, and bolted in place. Note in the detail in Fig. 2 that the 4 x 6 end members of the frames are half-lapped to accept the 4 x 12 timber that spans the length of the room addition.

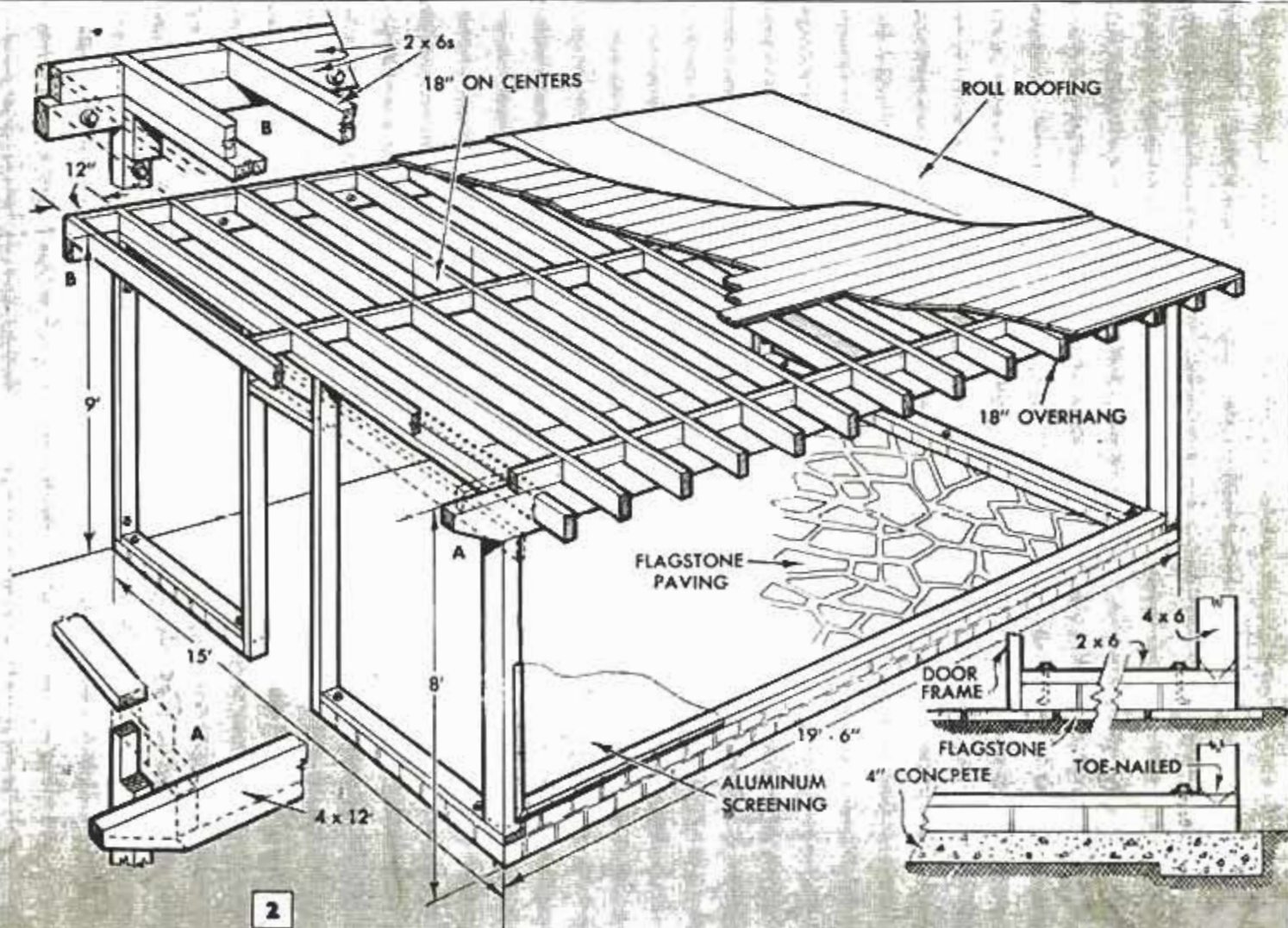
The end walls now are plumbed and the 4 x 12 is spiked to them. A 2 x 6 is fastened to the house wall to support the inner ends of the roof rafters that are fitted next. The outer ends of the rafters, of course, rest on the 4 x 12. Spacers, or bridging, between the rafters could be offset so that it would be possible to nail through the rafters into them, instead of being aligned as shown in Fig. 2. A roof overhang of 18 in. is indicated, but this could be decreased or increased somewhat to suit. Before installing the screening, all wood should be stained or painted. The framing should be allowed to settle before the screen is attached permanently, so staple or tack the material just enough to hold it in place, if the room is to be used immediately. Half-round molding is used to cover the edge of the screening, but this also should be fastened temporarily, so it can be removed easily. After the framing has settled thoroughly (the screening will sag and bulge

Wide-open view on all sides of this room addition is result of using 72-in.-wide aluminum screening





Detailed below is a suggested design for a screened-in room addition that utilizes aluminum screening available in 72-in. widths. Shown in Fig. 1 is an actual structure using this design. Whether the scene is mountains, as above, or just an attractive back yard, the view is unobstructed by any framing members





Wide aluminum screening permits use of large screen panels that can be removed, replaced with windows

as this happens) the molding is removed and the screening loosened. It then is stretched tightly and tacked or stapled at close intervals. Replacing the half-round molding completes the job.

In Fig. 5 is illustrated another room addition where the wide screening has been used, but the openings have been reduced by the use of vertical and horizontal framing. The use of this framing was for appearance, to keep the room architecturally compatible with the house. Note also that the foundation wall is both block and poured concrete, to match the house. Figs. 3 and 4 show freestanding structures that have been screened. Taking advantage of the wide screening, the panels are large, but still are removable. This setup also could be used on such structures as screened-in porches that are closed in with storm windows for the winter. Because aluminum is rustproof, the screens could be left in place all winter, with the windows

fitted inside them, or even outside if necessary or desirable. This would eliminate the storage problem presented by the large screens.

Although the screened room addition in Figs. 1 and 2 has a flat roof, it must be kept in mind that this would not be practical in an area of very heavy snowfall. In these areas more pitch is required in the roof to reduce the effect of a snow load. Also, the corner posts, as well as the long beam between them that supports the outer ends of the rafters, might have to be heavier to accommodate the greater weight of the snow. Roll roofing would be adequate in most instances, but shingles could not be used unless the roof had at least a moderate pitch. In all cases it is advisable to have a room addition designed to be compatible with the architecture of the house. What looks well beside your neighbor's house might be an eyesore next to your home. ★ ★ ★

Another structure that takes advantage of the wide screening to provide open view, improve appearance

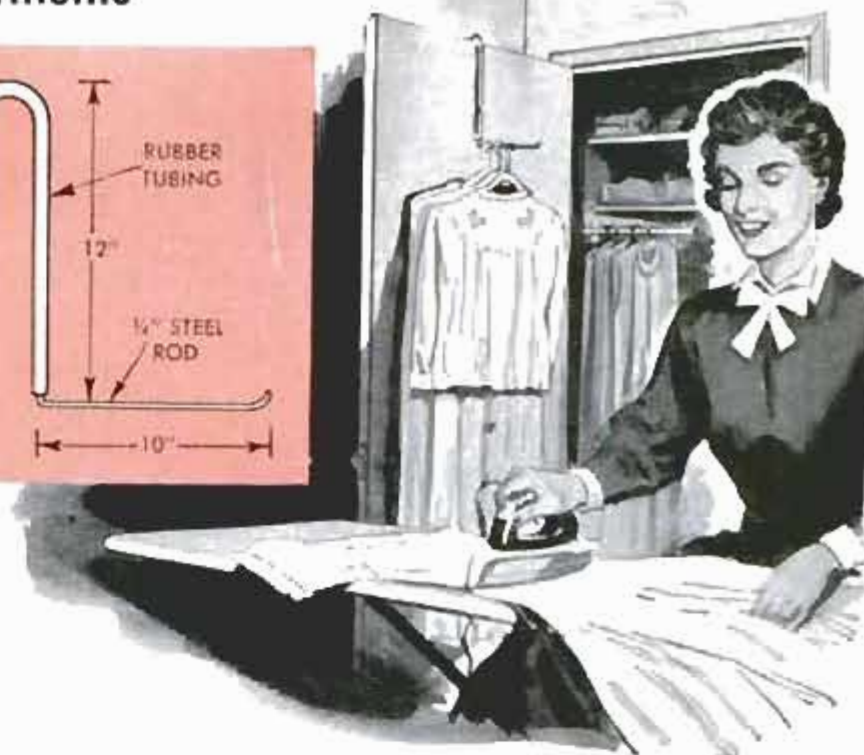
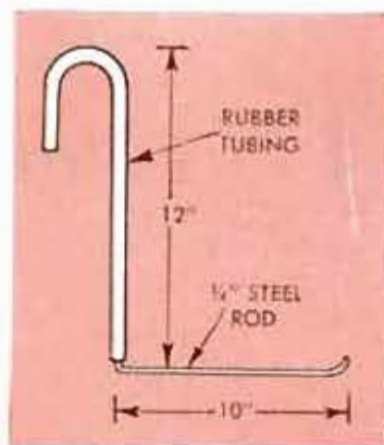
Made unnecessary by wide screening, cross members in these screened walls are for appearance only





## Support for Ironed Garments

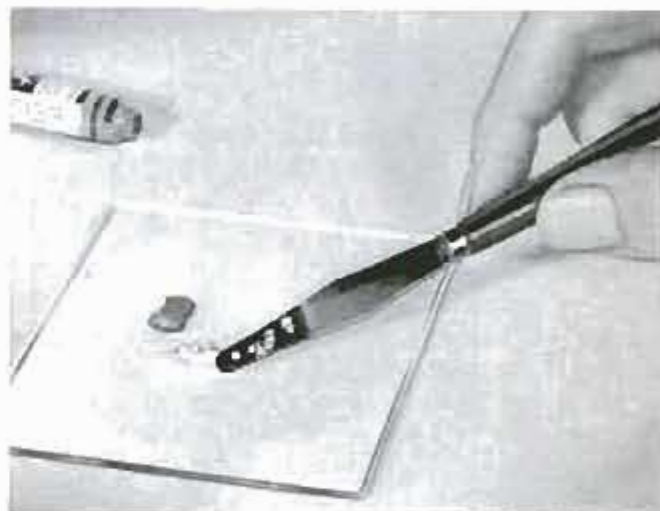
Slipped over a door near the ironing board, this temporary support eliminates the need for placing freshly ironed garments over chairs and tables, or making numerous trips to a closet. It takes only a moment to hang it in place, or to remove it and store it in a drawer. Extending 10 in. from the door, the support will accommodate quite a number of garments after they are slipped over ordinary clothes hangers. Bent from  $\frac{1}{4}$ -in. rod, the support is partly covered with rubber tubing to protect the door finish.



## Holes Improve Palette Knife

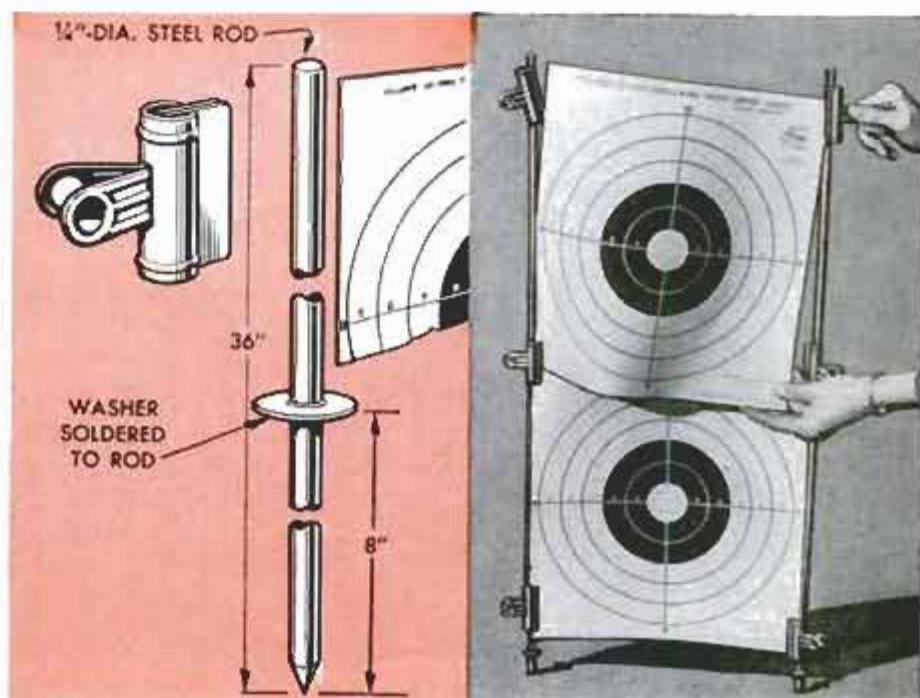
Faster mixing of artists' oil paints with a palette knife is assured if several small holes are drilled in the blade of the knife. These holes permit the paints to be mixed thoroughly as they are forced through the small openings instead of just being scraped over the surface of the palette in the usual manner.

☐ For easy painting of clay flowerpots, suspend each one upside down from a clothesline by means of a length of heavy cord knotted at one end and pulled through the hole in the bottom of the pot.



## Portable Frames For Pistol Targets

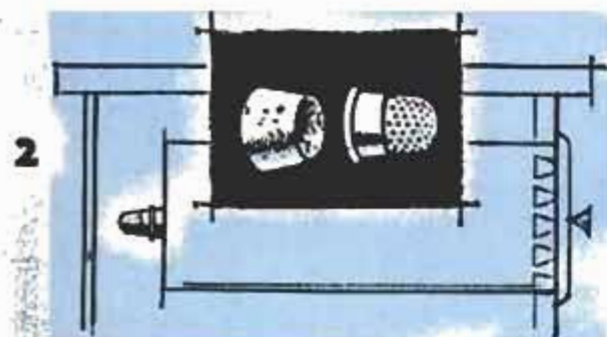
This handy portable frame for holding regulation pistol targets consists of two 3-ft. lengths of  $\frac{1}{4}$ -in. steel rod. One end of each rod is ground to a point and a washer is soldered to the rod about 8 in. from the point. Six paper clips are used to hold two targets when the rods are forced into the ground. The washers prevent the lower paper clips from sliding down. For safety, the target frame must be located with a suitable backstop.



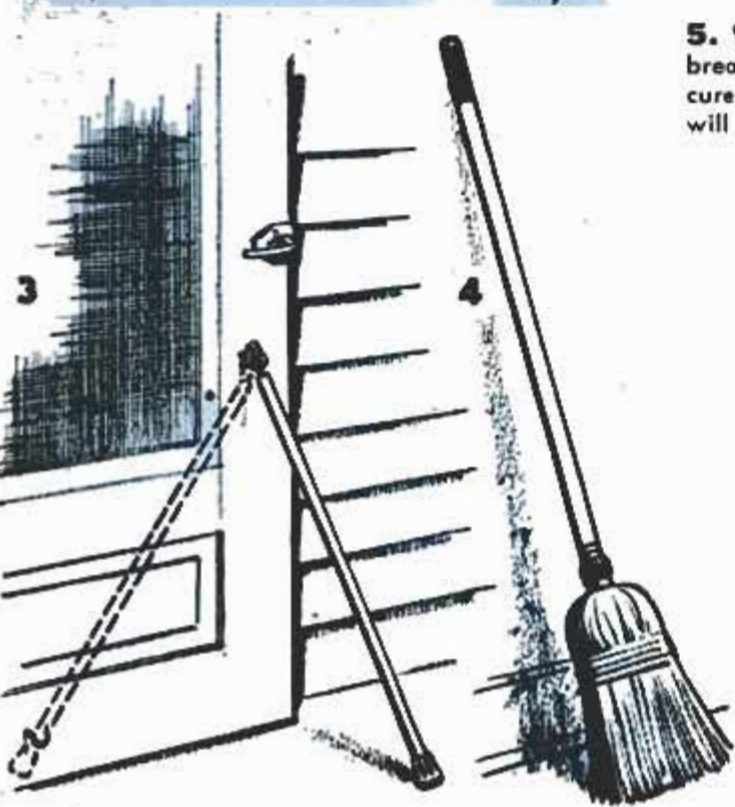
# Home Problems



**1. WALLPAPER PATCHES** placed over damaged areas are made less noticeable when the patches are torn out rather than cut out, and the edges are feathered before applying. Feathering, or tapering, is done by sanding the edges of the patch on the back



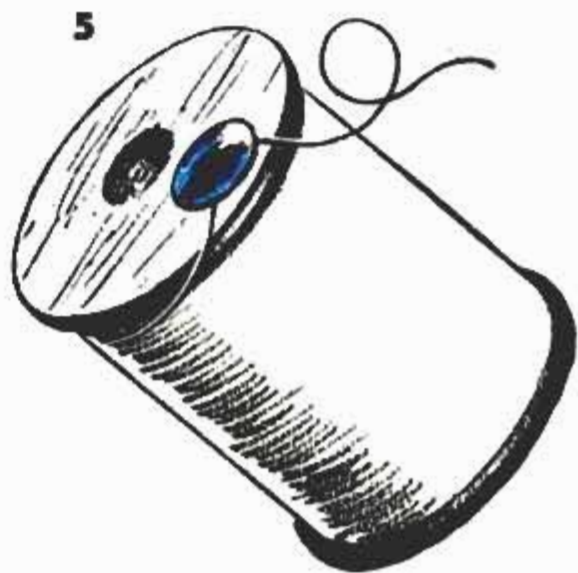
**2. GOOD WAY** to keep children from walking off with your one and only thimble is to keep it out of sight. One place they are not likely to look is at the back of a drawer where it can be stored on a cork. The cork, glued to the drawer, gives friction fit



**3. PROP IS ALWAYS AT HAND** for holding a screen door open when a crutch-tipped dowel is attached to the inside with two screw eyes. A screw hook cradles the prop against the door when not in use. One screw eye must be opened to hook it in the eye of the other

**4. BROOMS AND MOPS** leaned against a wall will not leave their mark if a finger is cut from a discarded rubber glove and slipped over the handle end

**5. WHEN THE THREAD SLIT** in the rim of a spool breaks out, press a thumbtack in the spool to secure the thread. A turn or two around the thumbtack will hold the end and keep the thread from tangling





**6. AS A RULE,** ink spots are not easy to remove from deep-pile carpeting but here is a blotter-and-salt method that works nearly every time on fresh spots. Blotters are used immediately to soak up the wet ink on the surface. The spot is blotted repeatedly with clean blotters and then common table salt is used to absorb and bleach the stain. The salt is applied generously to the spots as often as necessary, letting it stand a while and then brushing it up. When no more stain is absorbed by the salt, scrub the spot, first with milk and then with warm soapy water. The spot is dried by rubbing briskly with a clean cloth

**7. HANDY AT HOME** or on a picnic, an old cast-iron skillet will pinch-hit as an efficient barbecue grill. All that is required is to drill a row of holes around the skillet near the bottom to provide draft. The hole in the handle will support a fork or sapling a safe distance above the coals when roasting wieners

**8. POURING LIQUIDS** in small amounts from a screw-top container is difficult, particularly when the can is fairly full. It is made easy by fashioning a spout from a piece of aluminum foil and pressing it around the neck of the opening. A couple of turns of a rubber band will hold the spout securely



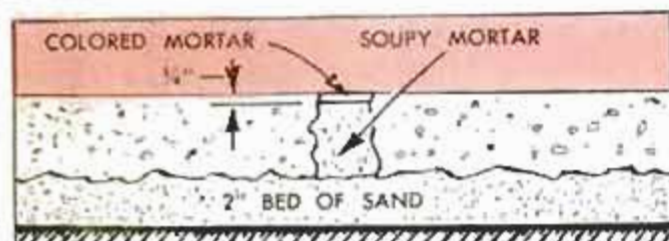


## Try This One

THE NEXT TIME you are waiting for service at a filling station try this trick on your friends. A blowgun, such as is used to clear gas lines, etc., attached to an air hose is needed to do the trick. Usually, it can be mastered on the first attempt. Here is how you do it. Hold a small, lightweight screwdriver (one with a wooden handle works best) in one hand and grasp the blowgun in the other as shown in the photo above. Then open the air valve slowly, directing the air stream to strike the curved part of the handle just above the ferrule. At the same time open your hand gradual-

ly. When the screwdriver begins to spin and bob up and down, move your hand away quickly and the tool will appear to float for as long as the air stream is directed at it in sufficient volume. To keep the screwdriver spinning, direct the main force of the air stream to favor slightly the side of handle in which direction it is rotating. To retrieve the screwdriver, and still exercise your "supernatural control" over it, simply reach out and grasp the handle just before stopping the air stream. If pressure is low, allow it to build up before trying again.

C. C. Springfield, Huntsville, Tex.



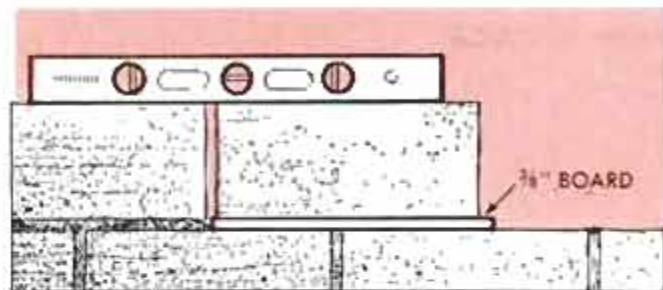
## Patio Made From Broken Pieces Of Old Sidewalk

Broken pieces of sidewalk make a colorful patio or garden walk when they are arranged in an interesting pattern and the spaces between pieces are filled with regular mortar topped off with colored mortar. When doing this, the sidewalk pieces are placed on a 2-in. bed of sand that serves as a cushion and makes it easier to level them. Then the joints are filled with soupy mortar to within  $\frac{1}{4}$  in. of the top as in the detail. Immediately after the latter is poured, colored mortar is added on top to fill the joints flush with the sidewalk pieces.

Robert L. Sargisson, Berwyn, Ill.

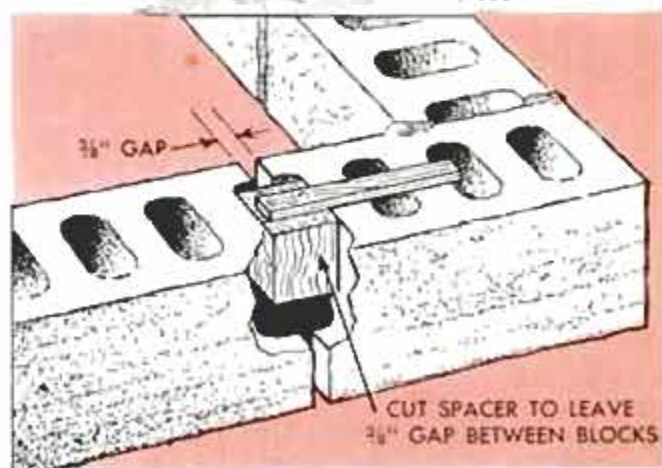
☐ Shower walls can be attractively waterproofed by first painting them with flat paint, after which two coats of marine varnish are applied for a durable surface that is easy to clean.

# Gauges Assure Uniform Joints in Block Wall



You don't have to be a master mason to do a good job of laying a concrete-block wall, when the two spacers illustrated are used to obtain uniform mortar joints. Spacing of horizontal joints is done by cutting a  $\frac{3}{8}$ -in.-thick board to the same dimensions as the block, and using it in the manner shown in the drawing above. Beginning with the second course of blocks, a corner block is laid in heavy mortar and the  $\frac{3}{8}$ -in. board with a block on top is placed next to it. Next the corner block is tapped into position level with the one with the board under it, using a level as a check. The extruded mortar is then removed from the sides of the joint and the next block is laid, following the same procedure as for the first.

Spacing the vertical joints is even easier than the horizontal ones. A wooden block is cut to a dimension that will leave a  $\frac{3}{8}$ -in. gap between blocks when placed in the position shown in the drawing at the right. The short handle that is nailed to the upper end of the block should be heavy



enough to counterbalance it. In use, the vertical spacer is simply placed in position on the last block laid and left there until the next block in the course is buttered and laid. Spacing is automatic.

Knuth Larsen, Chicago.

## Tank From Gasoline-Delivery Truck Converted to Hay Feeder

Desiring an inexpensive yet durable hay and grain feeder, one farmer cut the bottom off a tank discarded from a gasoline-

delivery truck and mounted it on a skid. Jagged edges left by the cutting torch must be ground off to prevent injury to cattle.





Photo courtesy Rocco Products, Inc., Minneapolis, Minn.

# DRIVE 'EM SAFELY

By Tom Riley

**S**AFETY IS THE PRIME FACTOR to be considered in the construction and use of any vehicle that is to be operated by youngsters. Manufacturers of powered vehicles, Figs. 1 and 3, stress safety in the design and construction of the cars and in their recommended methods of operating the miniature automobiles. Adult supervision, whether a single car is involved, or a group in competition, is a must. An off-the-street area for operation of the cars also is an absolute necessity. This may be a vacant road, or a track in a vacant lot, someone's back yard, or perhaps a course marked out on a supermarket parking lot, vacant on certain days. This keeps the cars off the streets where they are in danger of collision with automobiles, and off sidewalks where there is a chance that they could injure a pedestrian. If these limitations and restrictions are kept in mind any parent can be sure that the element of danger has been minimized. The youngster actually will have less chance of being injured than if he were climbing a tree.

Although it is recommended that a manufactured car be purchased, because of the safety factors mentioned, a father can build his youngsters a safe vehicle if he has a design in which the safety factors are built in. Such a vehicle is described in Fig. 2, and especially for read-

ers of *Popular Mechanics*, this miniature sports car shields the driver on four sides with a wall  $\frac{1}{2}$  in. thick and almost shoulder high. Thus there is no chance of the driver scraping his leg against a fence or other obstruction, or being struck by another of the little cars, if there are more than one in operation on a track. This protection is provided if the car is left in its "space frame" form, Fig. 7, or if it is fitted with a body, Fig. 2. In the latter case the body gives added protection as its strength and shielding are added to the inner frame members. The engine and drive members of the car are shielded and positioned so the driver cannot get his hands near them. This safety feature often is neglected in home-built cars.

Because most home workshops have woodworking tools, wood rather than metal is used for most of the car. Welding is required only for the front-axle assembly. To start construction, first obtain the wheels and engine. Any rugged small wheels can be used, from 8-in. coaster-wagon wheels to 14-in. aircraft-surplus wheels. Those shown are in good scale, and are a commonly available 10-in. (10 x 2.75) wheel with a semi-pneumatic tire and ball-bearing hub. If the wheels used are a different diameter, enlarge or reduce the wheel openings in the car frame



accordingly. Any 1 to 3-hp. air-cooled gasoline engine of the popular vertical type will provide ample power for the car. Any used engine should be overhauled to assure easy starting and reliability. At the same time, lead a wire into the engine magneto for the engine cutout on the instrument panel. The cutout is a grounding type auto-starter switch. It is necessary to lead a wire from the body of the switch back to the engine casting for a complete ground circuit, as the wooden frame of the car is nonconductive.

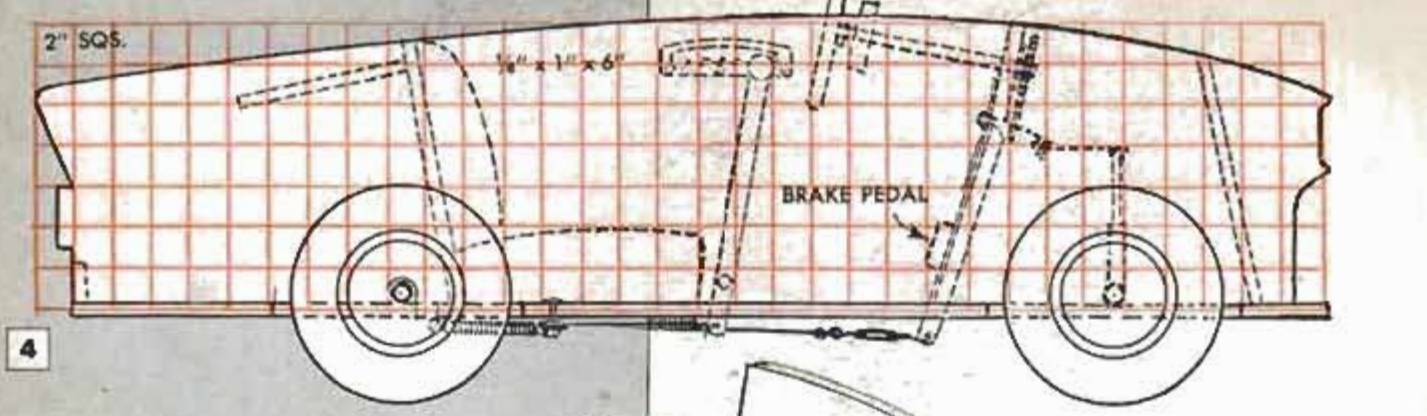
The "platform" portion of the car frame is cut from 1/2-in. exterior-grade plywood, as are all members. Fig. 8 gives the shape and dimensions of the frame. Vertical mem-

bers are made by using a pattern drawn from the squared outline in Fig. 4. Steering-column support and "radiator" are shown in Fig. 5 at the right, as is the instrument panel. The bulkhead behind the seat is a rectangle of plywood, cut to fit at the angle chosen for the seat. Note that the shapes of the "radiator" and steering-column support provide for "fender shapes" in the finished body, Fig. 2. If you wish a different body design, these members should be shaped to suit. This also holds true for the vertical side members. You might, for example, wish a "fin" effect on the rear fenders. Before cutting out the platform frame, place your particular engine in approximate position to determine

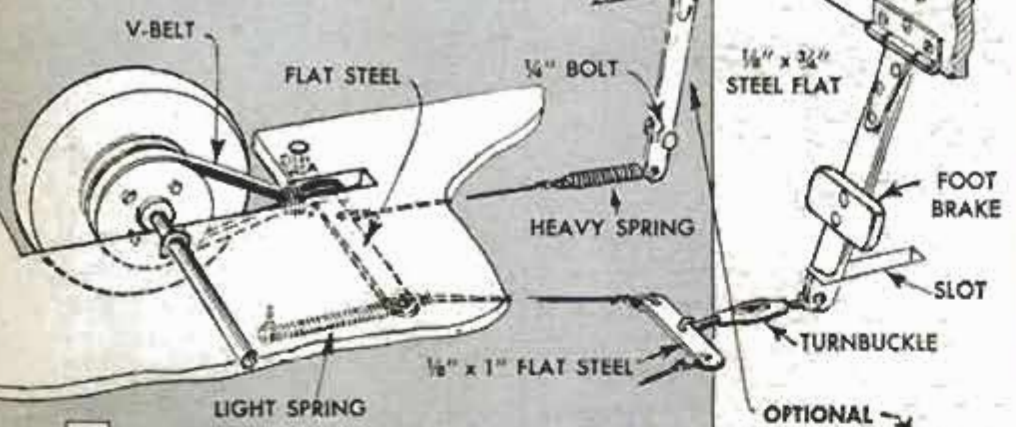
**Manufactured car has strong tubular-steel frame, tire for rear "bumper," shield over drive mechanism**

Photo courtesy Rocco Products, Inc., Minneapolis, Minn.

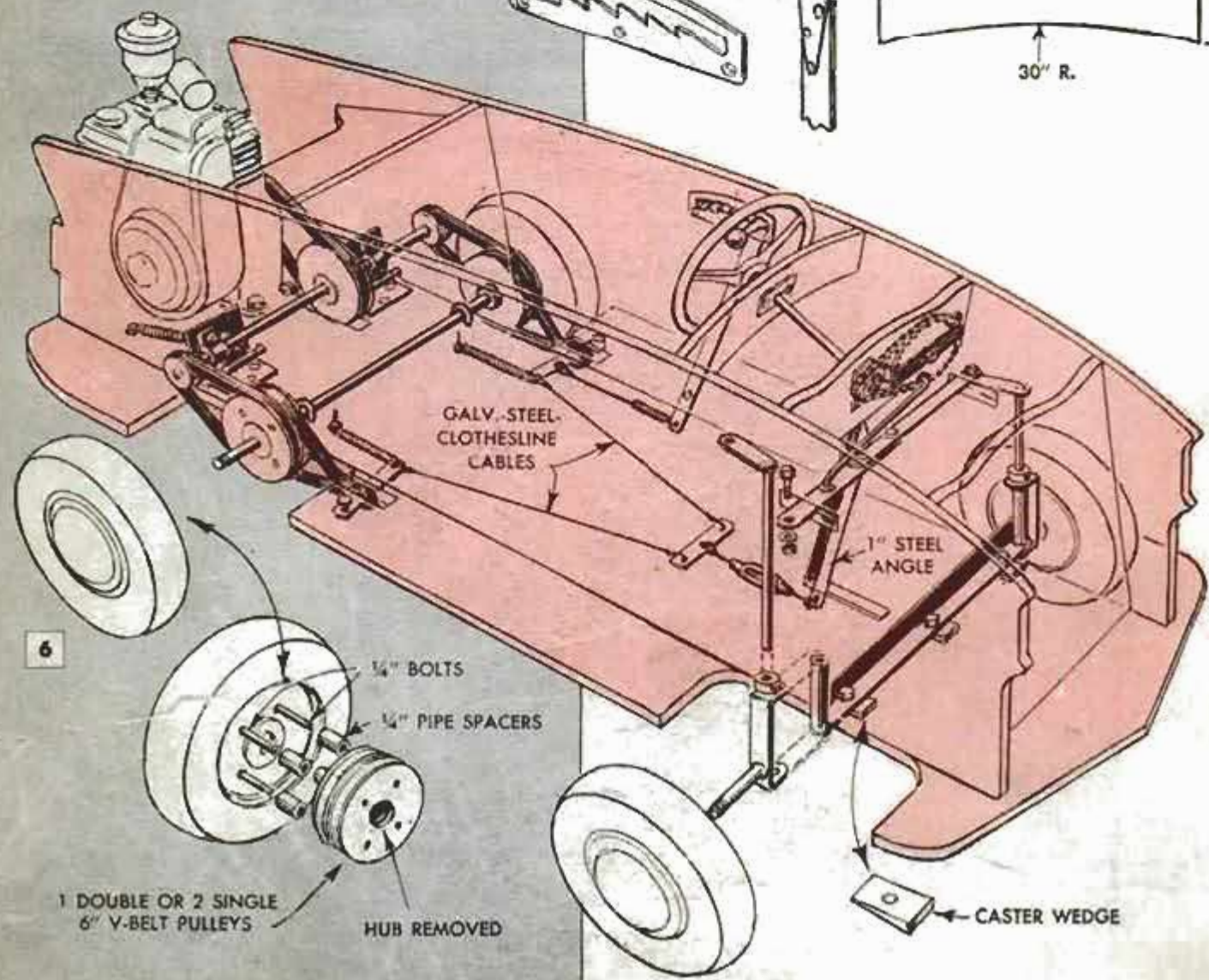
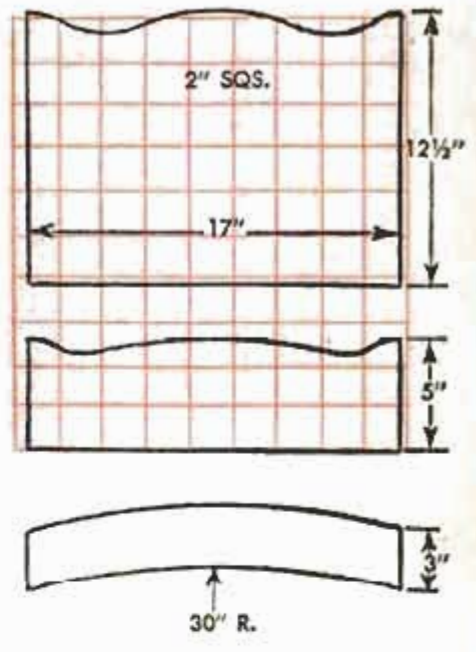
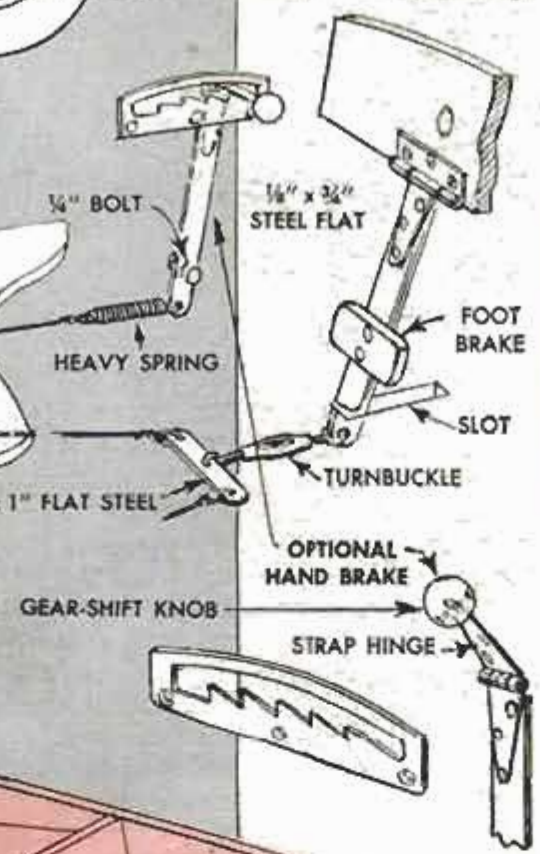




4



5



6

1 DOUBLE OR 2 SINGLE 6" V-BELT PULLEYS

HUB REMOVED

CASTER WEDGE





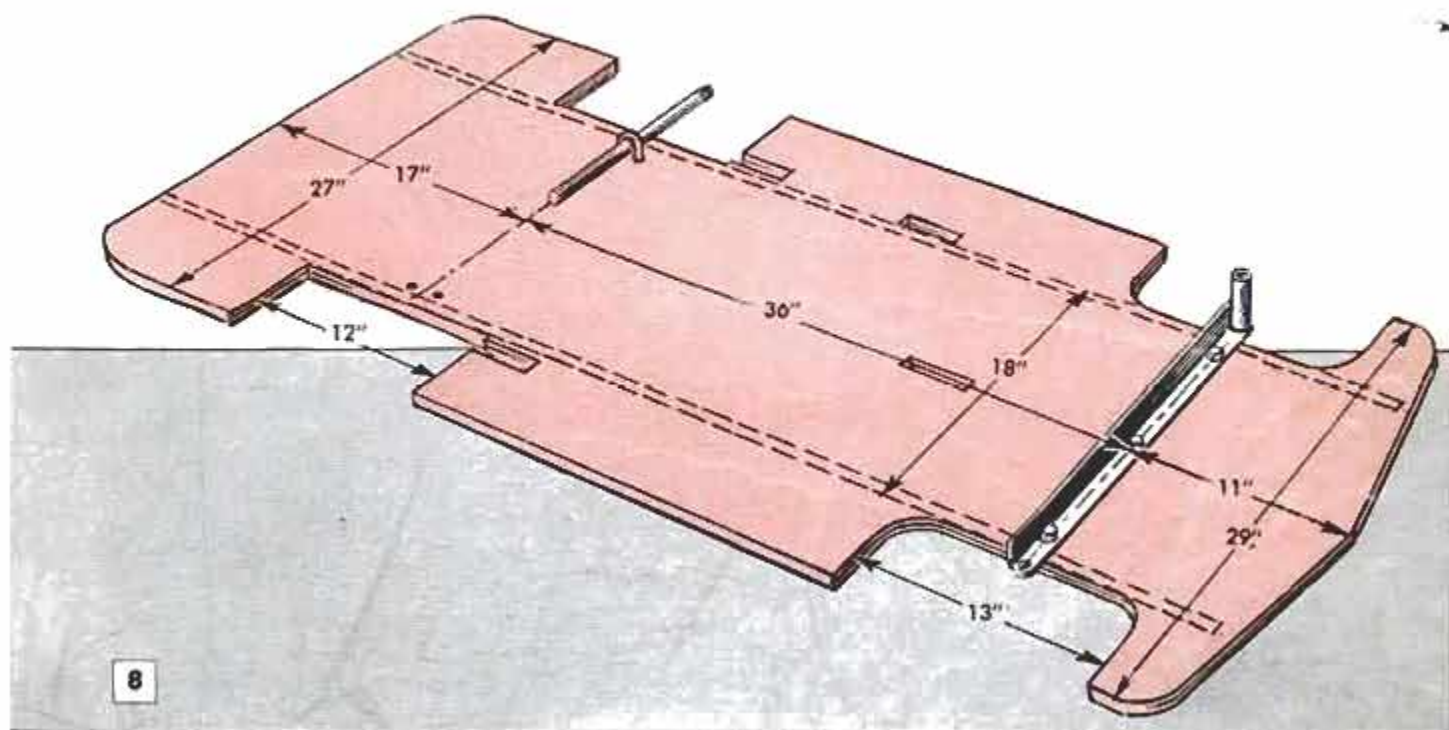
Your anxious youngster can drive the car before the body is constructed, or body simply can be omitted

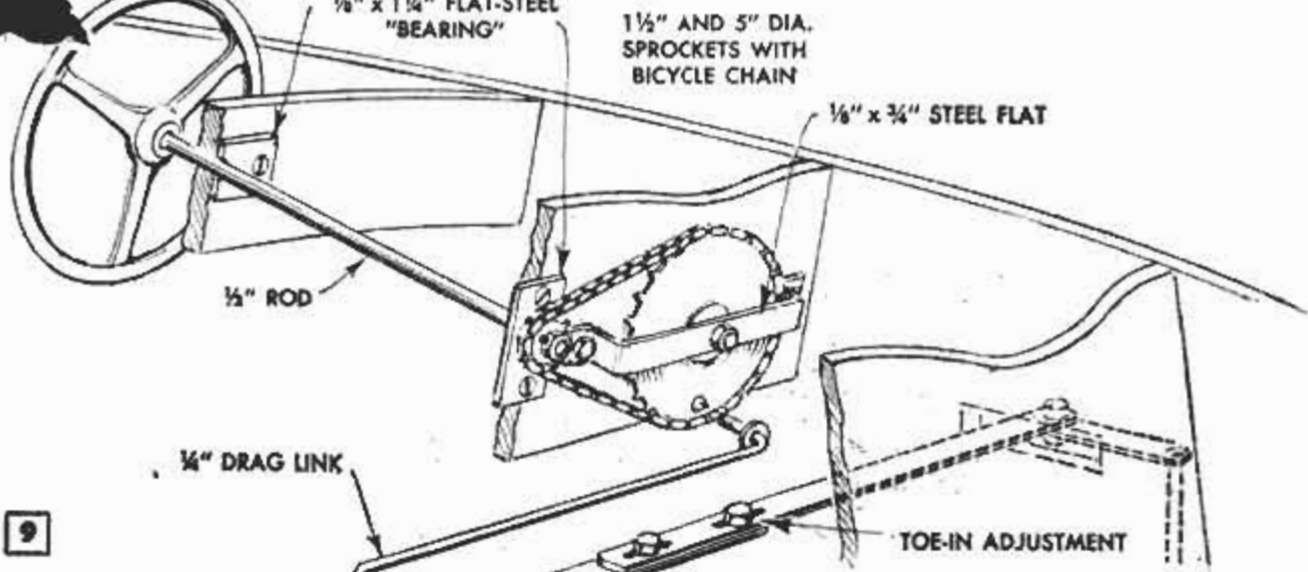
if any modification in the engine compartment is required.

The drive assembly, Figs. 10, 11 and 12, is installed on the frame before the plywood sides are attached, which permits locating the position of the slots for the steering arms and drive shaft. Fig. 10 shows a recommended gearing with V-belts that will provide both a fair speed and hill-climbing ability. This is based on the use of 10-in. wheels and the average (3000 r.p.m.) 4-cycle engine speed. With other wheels, and especially with high-r.p.m. 2-cycle engines, somewhat different pulley ratios will be required. Size "A" pulleys and V-belts are strong enough for both drives and brakes. For a clutch, the engine shown in Figs. 10 and 13 uses a split-

V pulley. Another type of clutch is shown in Fig. 11. Here an idler pulley takes up the slack in the V-belt to "engage" the clutch. Either of these two types of clutch is positive in action, and is preferred to an automatic, centrifugal-type clutch pulley. The problem with the latter is that it will engage when the engine is started, presenting the danger of the car running away from the operator. It also disengages when the engine is slowed to idling, as when making a sharp turn, cutting off the power when it is needed most. If your engine has an automatic clutch, or no clutch, use the type shown in Fig. 11.

The rear axle is a straight shaft of  $\frac{1}{2}$  or  $\frac{5}{8}$ -in. dia., to fit your wheels, and is secured to the frame with U-bolts. Springs



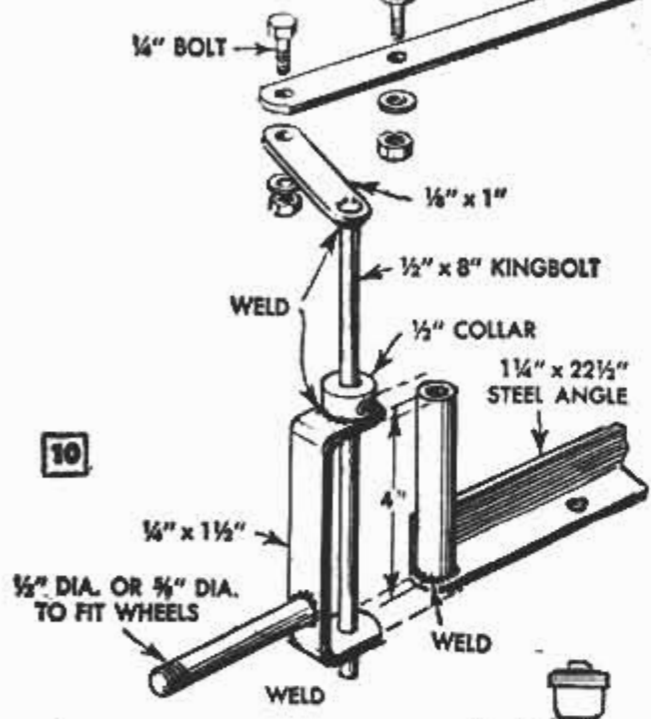


9

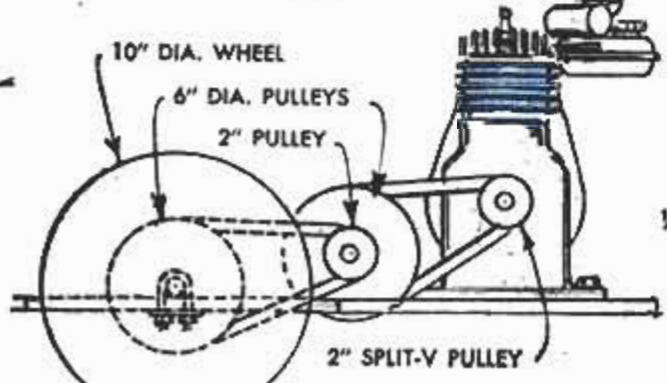
Steering mechanism has gear reduction to assure easy operation. Adjustments for toe-in permit various settings to determine the ideal steering setup

are eliminated to simplify construction, and because children prefer the rougher ride with its sensation of speed. Pillow-block bearings used for the  $\frac{1}{2}$ -in. drive shaft (Fig. 12) can be brass, babbitt or ball bearing. They are bolted to plywood plates, which in turn are bolted to butt hinges, Figs. 12 and 13. The hinges and their springs assure alignment of the drive shaft and prevent the V-belts from slipping.

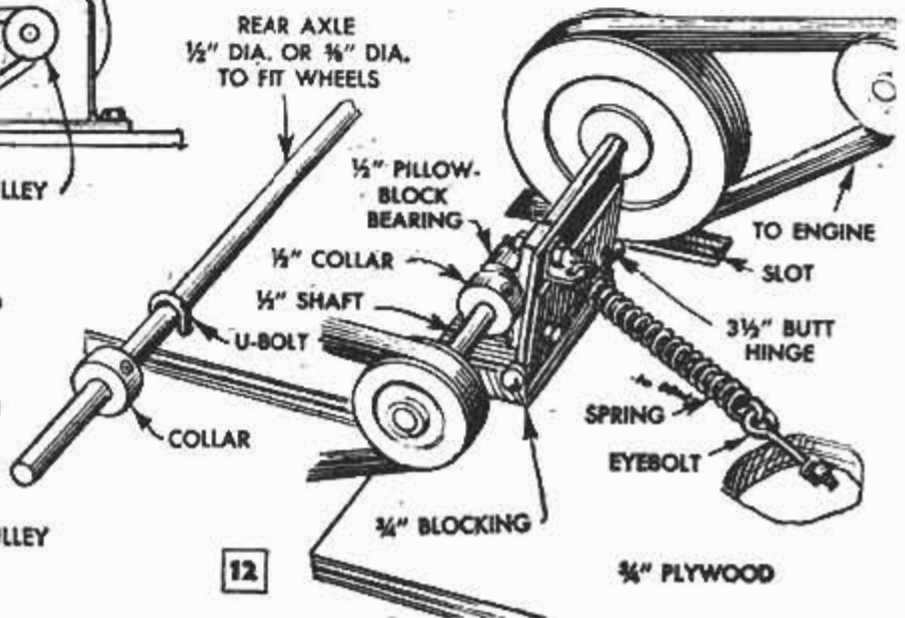
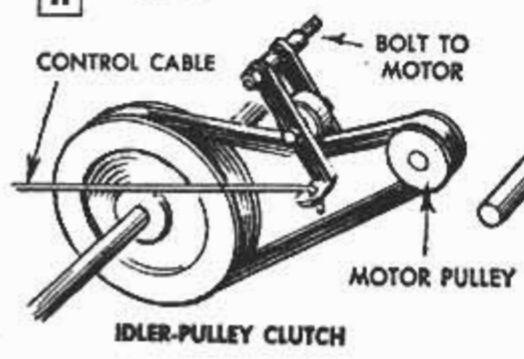
For the front axle, two pieces of  $\frac{1}{2}$ -in. pipe or heavy tubing are welded to a piece of angle steel as shown in Fig. 10. Axle spindles are whatever diameter is required to fit your wheels. Collars in which setscrews are turned are welded to both the tops and bottoms of the spindle supports. The setscrews clamp the spindle assemblies to the kingpins so they turn when acted on by the steering assembly. To assure a "self returning" steering action, the front wheels return to the straight-



10



11



12

ahead position when the steering wheel is released — more caster and toe-in are required than with a full-size automobile. For caster the kingpins are inclined approximately 3 deg. back at the tops by placing thin wooden wedges between the angle-steel axle and the plywood frame, Fig. 6. Toe-in will vary with the amount of slack in a particular steering assembly, so adjustment has been made easy, Fig. 9.

Gear reduction from the steering wheel to the front wheels is provided by two bicycle sprockets and a chain. The sprockets and drag link to the tie rod are kept high so the driver's feet fit under them. Almost any 8-in. wheel can be used for a steering wheel. The most realistic is obtained by removing the wire spokes from a tricycle wheel and welding in two or three flat-steel spokes to simulate the steering wheel of a modern automobile. Next step in assembly of the car is attaching the side members with glue and screws, after they have been notched to clear the axles and steering mechanism. The instrument panel and front and rear bulkheads also are attached. The steering wheel and brake pedal are centered in the car so the driver's legs straddle them. The foot brake is built as shown in Figs. 5 and 6. Brake cables lead back under the frame, suspended by screw eyes. Equal pressure on both brakes is assured by using a 3-in. length of  $\frac{1}{2}$  x 1-in. flat steel as an equalizer between the brake-pedal turnbuckle and the brake cables, Fig. 5. Added brake leverage is provided by pivoting 6-in. lengths of  $\frac{1}{8}$  x 1-in. steel flat ahead of each rear wheel. The optional handbrake—Dad can use this too, when he drives, as he probably will not be able to reach the pedal—is assembled as shown in Fig. 5. A gear-shift knob is screwed onto a bolt welded to a strap hinge. This assembly is fitted through a "ratchet" cut from heavy sheet metal. A heavy spring on the emer-

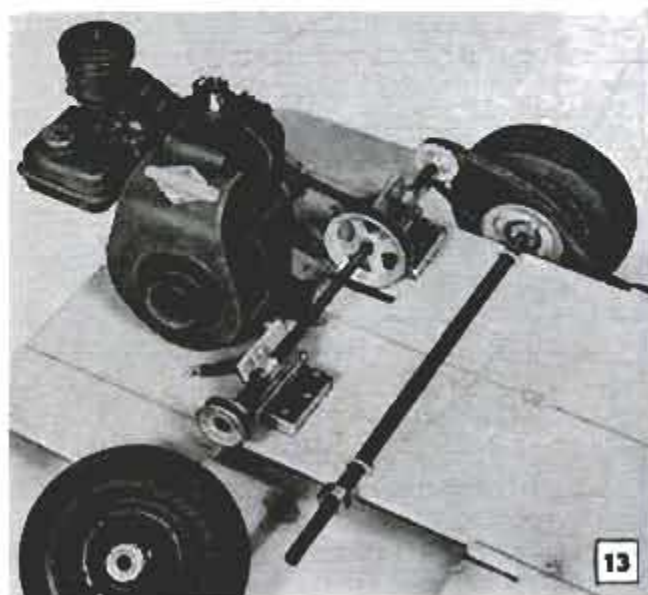
gency-brake cable helps to keep the brake handle firmly in the notches of the ratchet.

The lower detail in Fig. 6 shows how the brake and drive pulleys are bolted to the wheels. One double or two single pulleys, their hubs removed, are bolted to each rear wheel. The pulley adjacent to the wheel receives the V-belt from the drive shaft, the other pulley accommodates the V-belt from the brake mechanism.

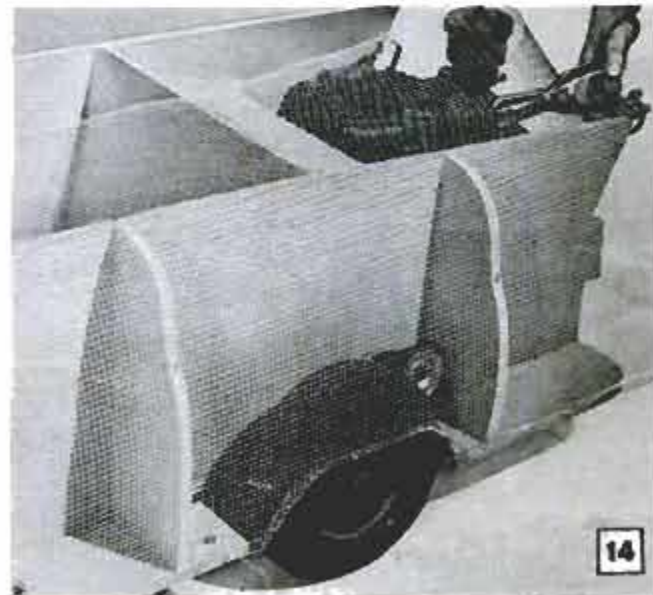
In the original car, the throttle and clutch controls were located on the left side of the cockpit. A quadrant-type marine throttle lever was used to differentiate from the clutch lever, and to provide more "throw," so the handle would move quite far in relation to engine speed. Choke cables can be used to assure a positive control. For your own car you may choose to have a foot pedal for the throttle. It should be spring-loaded to assure slowing the engine when the pedal is released. The rear deck now can be installed. It is a piece of plywood fitted between the side members of the frame, and cut so it fits around the engine, enclosing the rotating pulleys and drive members.

If your youngster cannot wait for you to build a body, the car can be driven in the frame stage, Fig. 7. A body can be added later on those long winter evenings. Wooden forming members are added outside the side members of the frame to provide contours, and sheet steel or aluminum can be nailed or screwed to the frame. Another method is to nail hardware cloth to the frame, Fig. 14, shaping it to a body design, then covering it with glass-fiber cloth that is painted with resin. The resulting body is sanded smooth and any imperfections filled with glass-fiber "putty."

White and red truck reflectors are used as headlights and taillights. They are attached to the frame, then the sheet metal or glass-fiber cloth is formed around them. ★ ★ ★



JUNE 1959





### Tape "Skidproofs" Claw Hammer

Several layers of rubber tape wrapped around the shank of the head of a claw hammer will prevent it from sliding off a slanting surface such as a roof. The tape is wrapped so that it projects beyond the surface of the hammer head, presenting a "skidproof" area. There is no interference with normal use of the hammer, and the tape can be removed quickly, should that be necessary for any reason.

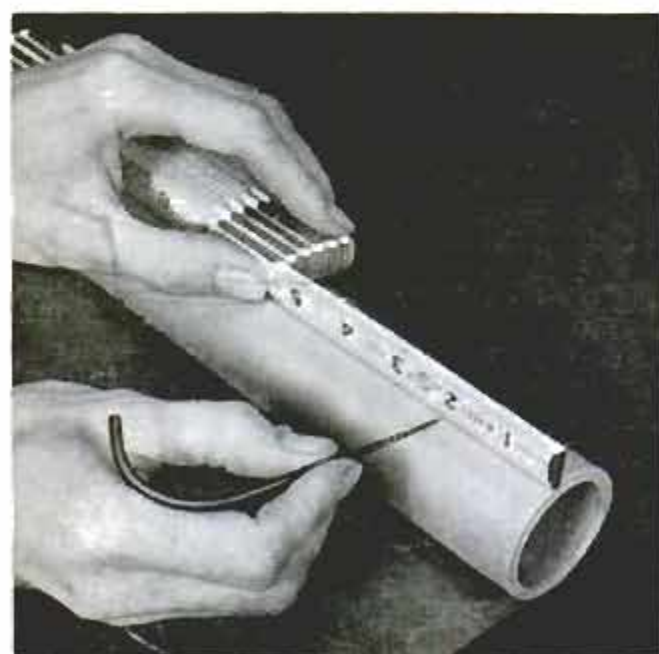
Oilstones that have become so glazed or greasy that they no longer do a good job can be restored to like-new condition with cigarette-lighter fluid. A few strokes of a cloth moistened with the lighter fluid will remove the surface grease or glaze that causes the trouble.

### Improved Stepladder Extension

When a stepladder does not reach quite high enough to do a certain job, try this stunt with two C-clamps and a couple of 30-in. lengths of 1 x 3 lumber. Clamp the 1 x 3s to the outside of the ladder rails, positioning them so that they rest under the projecting ends of the top step of the ladder, as shown. This method of extending the ladder also holds it away from the surface against which it is placed, making it easier to work on that surface.

Robert L. Sargisson, Berwyn, Ill.

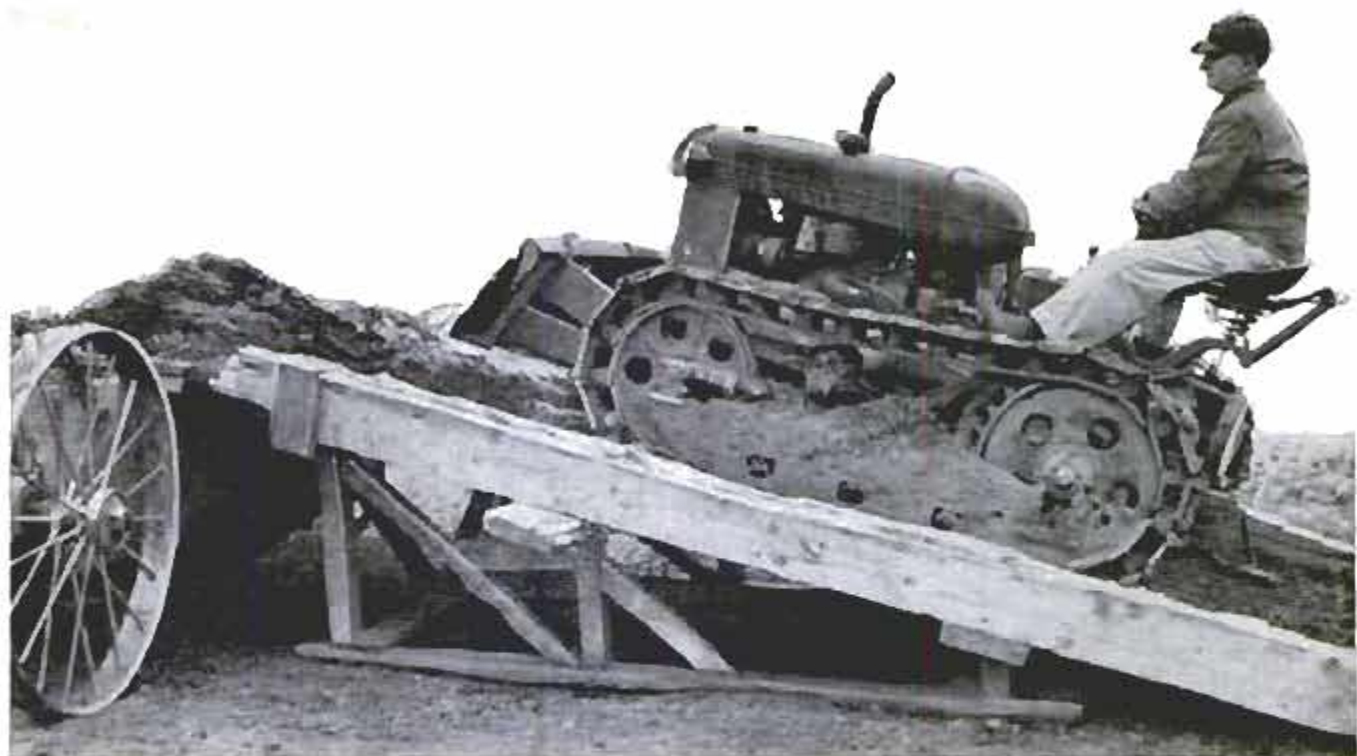
Prevent nuts from rusting on bolts by dipping the ends of the bolts in clear shellac before turning on the nuts. The shellac seals out moisture to prevent rust, yet breaks loose easily when a wrench is applied to remove the nut at a later date.



### Holes "Mark" Rolled Material

Marking rolled material for cutting into strips is done quite accurately by punching holes through the layers at the desired widths as indicated. When the material is unrolled you will have lines of holes that are spaced a distance equal to the circumference of the roll. They may be used as guides for scribing cutting lines or, if spaced closely enough, as on a roll of small diameter, can be followed in making free-hand cuts with a knife or scissors.

For quick removal of paint or varnish from carvings and curved surfaces on furniture, first moisten the finish with paint remover, then wrap steel wool around a wooden pencil or small steel rod and "scrub" away the old finish.



## Ramp Simplifies Removal of Waste From Dairy Barn

Simplicity and low-cost operation are the key features of this ramp rigged up by one farmer for loading manure with a small bulldozer. A wooden framework supports a heavy ramp up which the dozer pushes the

waste and spills it into a manure spreader. To aid in preventing the waste from being pushed off the sides of the ramp, an 8-in. timber is used along each edge.

O. V. Gordon, Des Moines, Iowa.

## Screen Cone Speeds Filtering

Faster filtering of liquids in a laboratory or photo darkroom is possible by fitting a cone of plastic window screening between the funnel and the filter paper. The screen holds the paper away from the funnel so that the entire surface of the filter is utilized to pass liquid into the openings in the screening and down the side of the funnel.



JUNE 1959

## Block for Edge-Sanding Lumber

Keeping the edge of a board square and true while hand-sanding it is much less of a problem when this sanding block is used. One leg of the L-shaped block acts as a "rubbing shoe," sliding along on the face of the wood, keeping the sanding face of the block at right angles to it. Dimension of the block will vary with individual preferences and uses.



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# X267

## FENCE IT RIGHT

By William B. Eagan

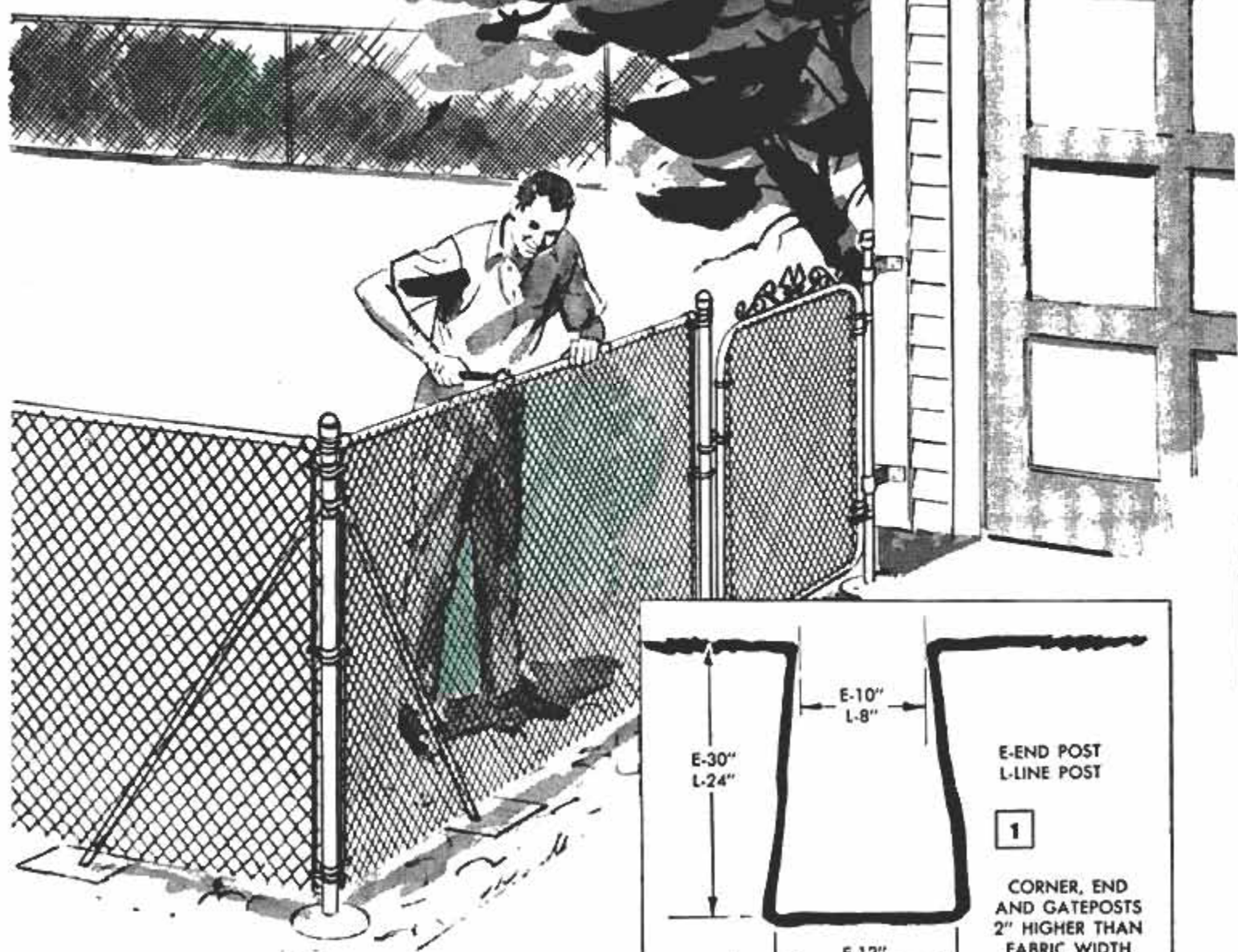
**O**NE OF THE LEAST EXPENSIVE ways of keeping stray animals off your property and insuring that toddlers will not "escape" to the street is to enclose your land with a woven-wire fence. Of the many materials available, chain-link type fencing will do the job the best and last the longest. To help you do a good job of installing such a fence, clip this article and file it for handy reference when starting the work.

Before buying material for your fence, make an accurate layout of the area to be enclosed, as shown in Fig. 6. Be sure to include all gates and locate them exactly as they are to be placed in the completed fence. If changes are made after ordering the material, some of it is likely to be wasted. Make certain that the desired location of the fence lines fall inside your property lines.

The first step of the layout procedure is to locate the terminal posts, which consist of end, corner and gate posts. Drive offset stakes and stretch lines between them as in Figs. 3 and 6. Next measure the over-

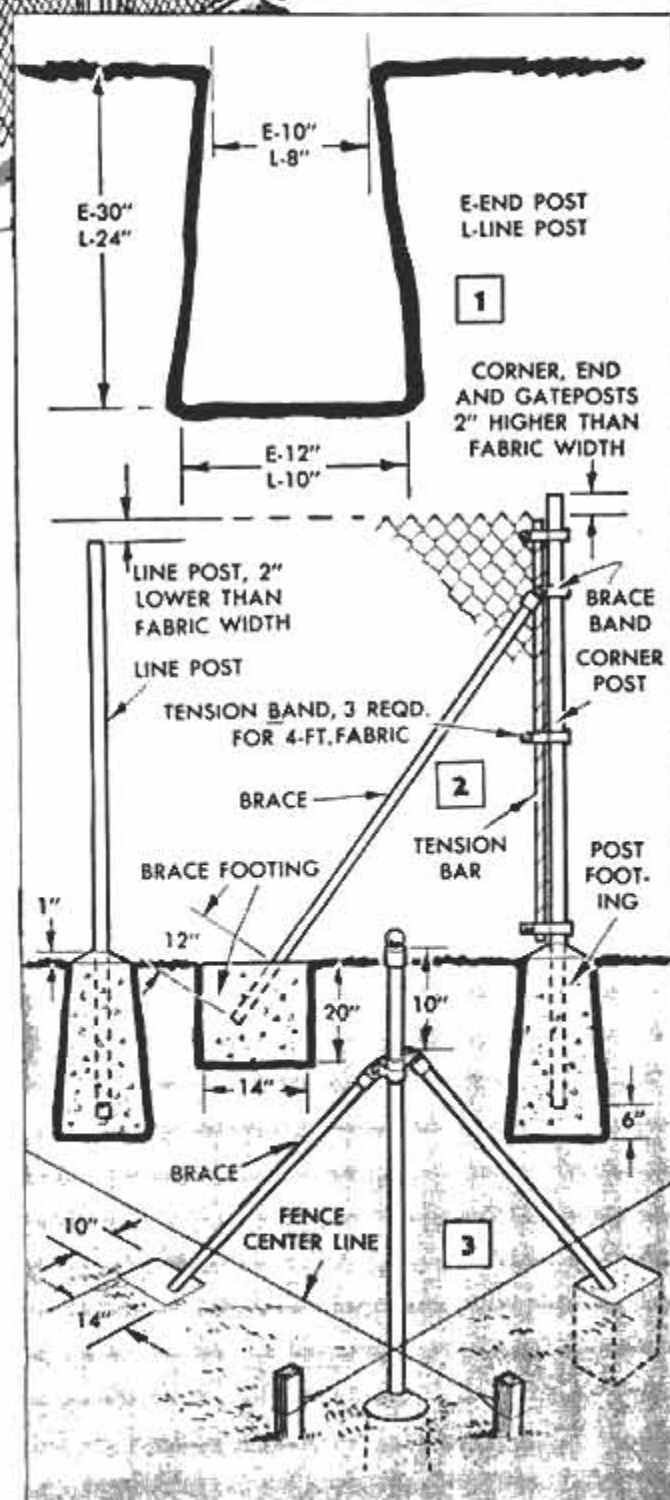
all distances between terminal-post locations and divide these distances into equal spaces of less than 10 ft. as shown in the sample layout, Fig. 6. Then drive marking stakes exactly where each post is to be placed. The distances indicated by A-B and C-D, are controlled by the gate sizes used. Be sure the gateposts are set accurately for the actual opening. This is the distance measured from the inside face to the inside face of the posts on each side of a gate. All posts should be set approximately 2 in. inside your property line to be sure the fittings do not overhang the neighbors' property. To locate the fence positions, simply stretch lines on the exact boundary of the property lines and then set the posts 2 in. inside of them.

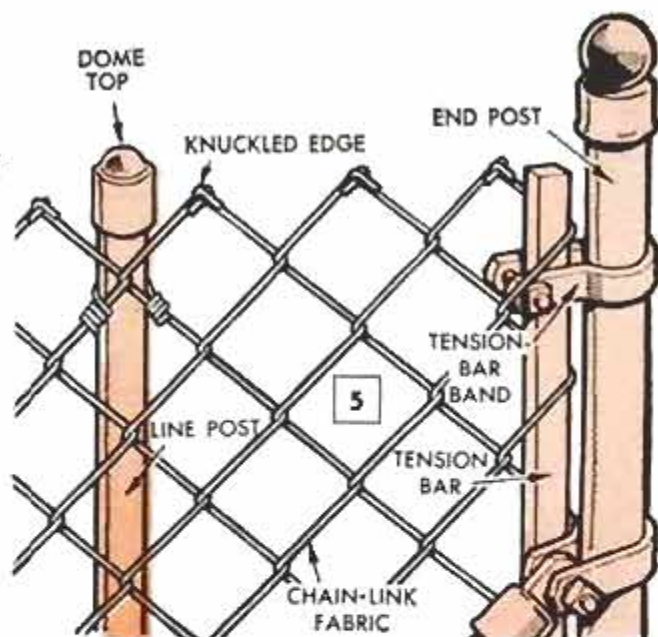
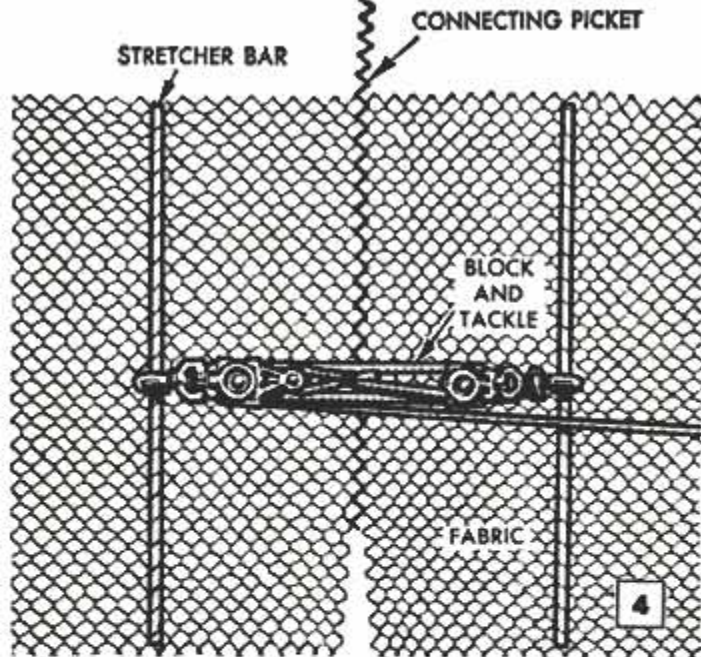
Heights for residential fences vary from 3½ to 4 ft.—the width of the fabric (woven-wire fencing). The fabric usually is finished with one edge knuckled, Fig. 5, and the other edge barbed, Fig. 8. The latter edge should be placed at the bottom of the fence. The standard gauge for such fence heights is No. 9 wire. For terminal posts, use 2-in.



galvanized steel pipe, 1¼-in. for line posts and braces, and 1-in. pipe for toprails. These can be purchased ready-made from a chain-link supplier, or galvanized steel pipe of the required diameters can be obtained and cut to the lengths needed at a considerable saving. Clamps for securing the fabric to the posts, etc., Fig. 7, must be ordered in sizes to fit the pipe members.

When all the materials are at hand, start digging the postholes, keeping in mind that the stake lines must bisect all the holes. The correct shapes and sizes of holes for terminal and line posts are given in Fig. 1. Corner, end and gate posts are set 2 in. higher than the width of the fabric, Fig. 2. Line posts are set 2 in. lower than the fabric width when a toprail is used, 1 in. lower than terminal posts when the toprail is omitted. A toprail should be used, however, as it improves the appearance of the fence and strengthens it. Usually, several lengths of pipe are used when installing a toprail of a long run, in which case they are joined together by means of expansion sleeves, Fig. 7. Try to have these joints occur at line



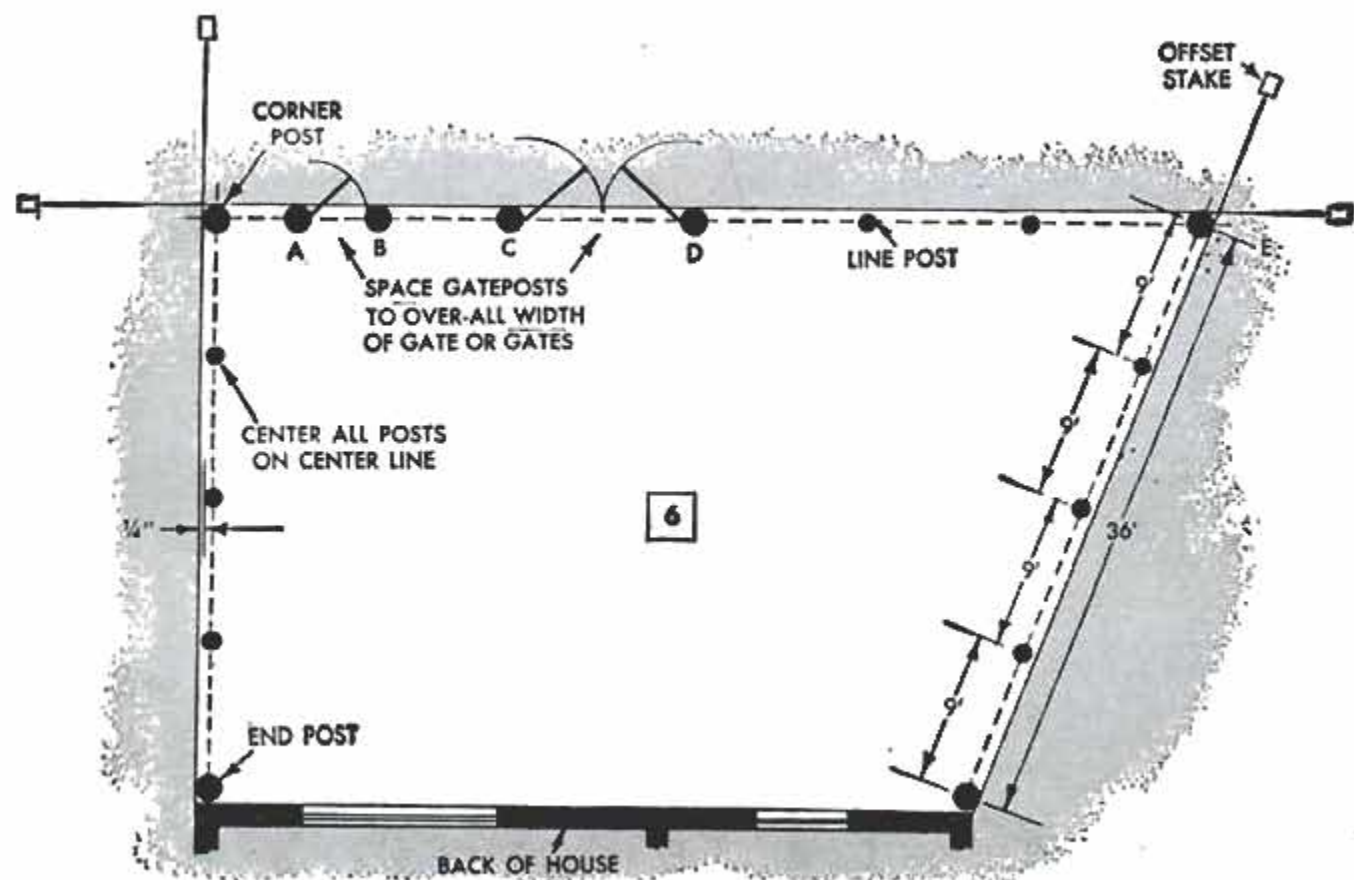


posts to avoid sagging. Corner braces are not necessary when a top rail is used. Both are shown in the pictorial drawing at the beginning of this article, but for purposes of illustration only. If no top rail is to be used, corner posts must be braced as shown in Fig. 3, end and gate posts as in Fig. 2.

Before pouring concrete for the post footings, mark each post to indicate that portion which is to extend above grade to avoid errors. A good concrete mix for post and brace footings is: Cement, 1 part; sand, 2 parts; gravel, 4 parts. After setting the posts in their footings, allow the concrete

to cure from 2 days to a week. Then pour the footings to take the braces, and after a similar waiting period, install top rails, most of the fittings and the fabric, in that order. All post footings should include a 1-in. crown above grade as shown in Fig. 2, to permit water to drain away from them.

There are two methods of attaching chain-link fabric to the posts. One involves securing a length of fabric to the post at each end of a run (distance between any two terminal posts) and splicing the two lengths together at or near the center of the run as shown in the pictorial illustra-

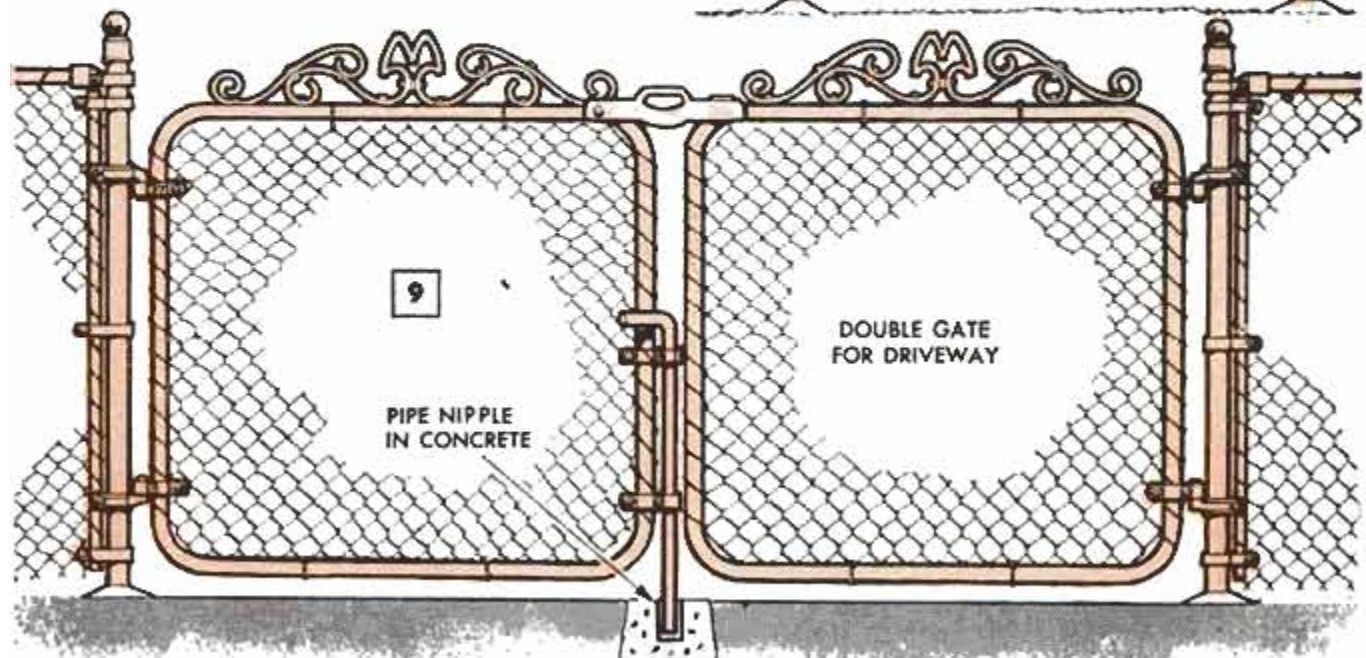
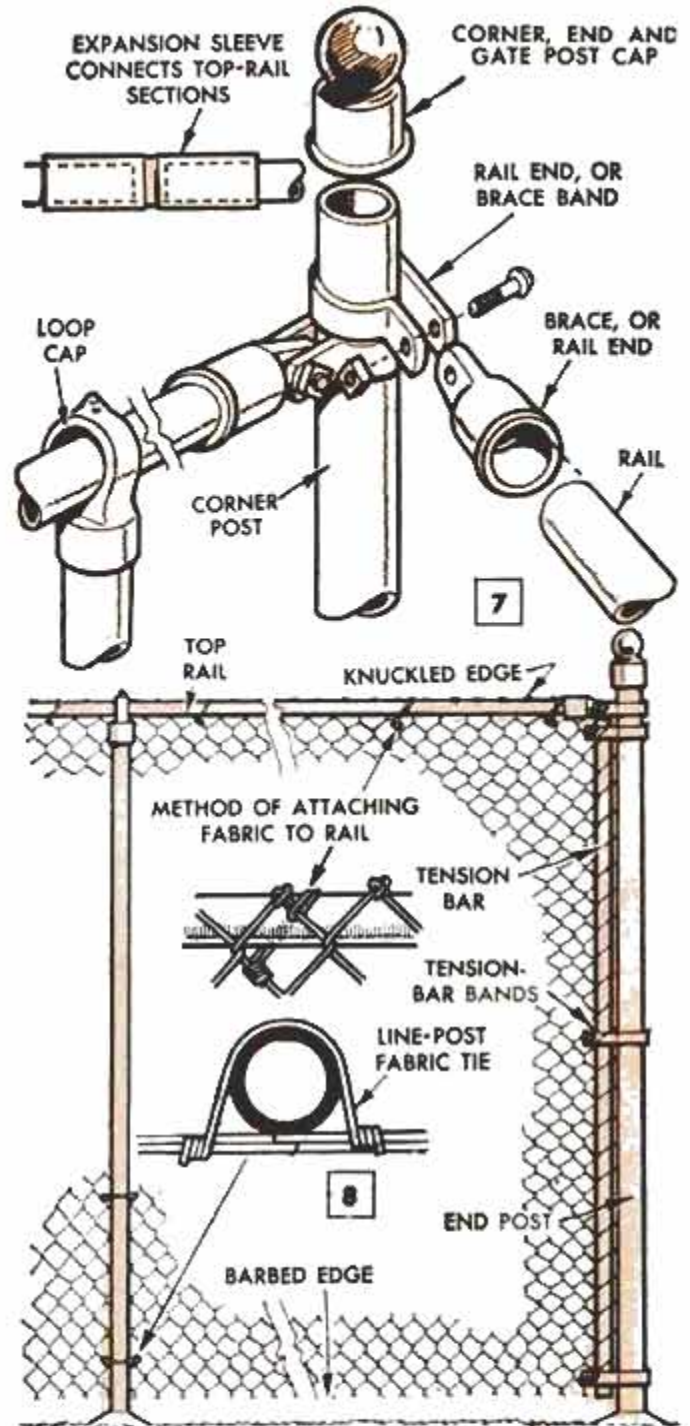


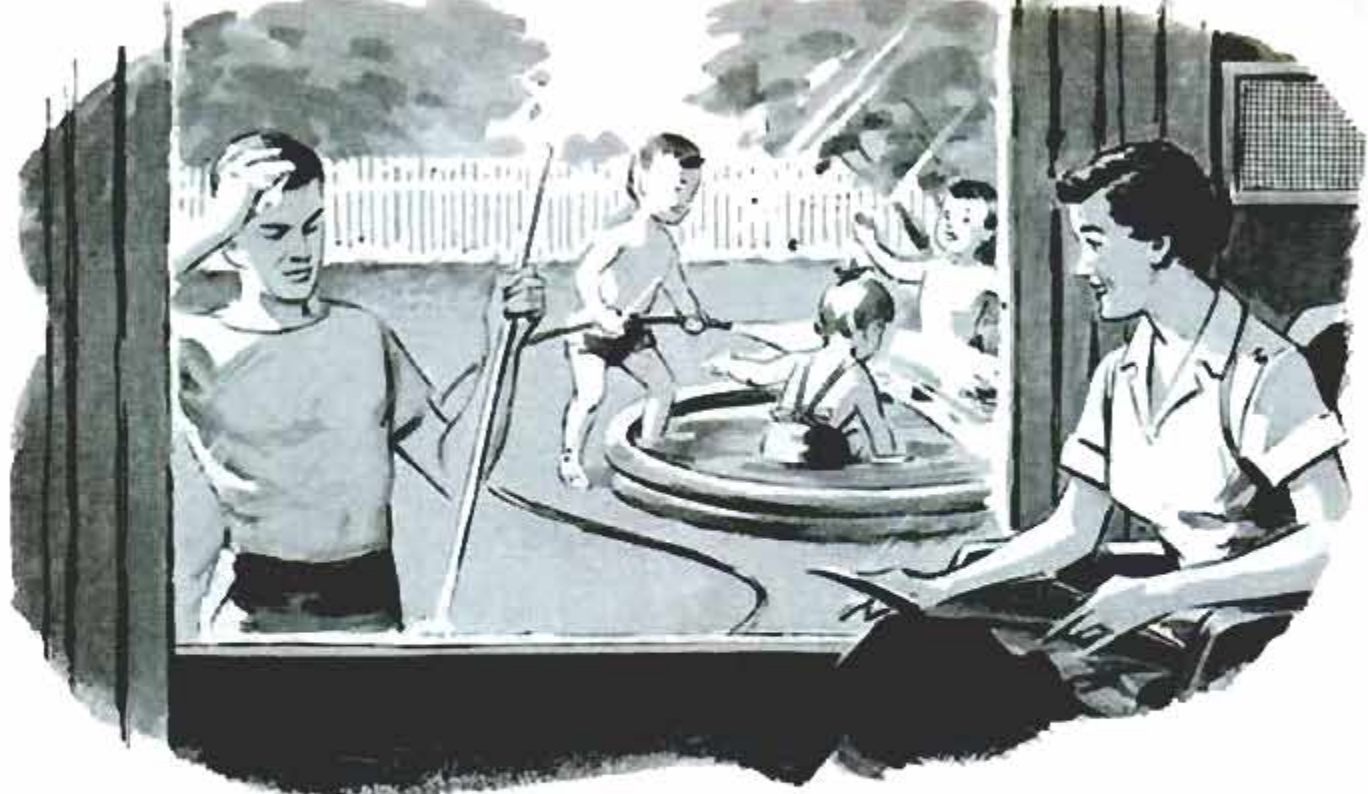


tion and in Fig. 4. To make such a splice, "cut" the overlapping lengths of fabric at the point selected for the joint by untwisting a wire spiral from each length. Then pull the fabric ends together and unite them by weaving one of the wire spirals into the mesh as in Fig. 4. The second method involves attaching the fabric to a terminal post at the beginning of a run and securing a block-and tackle to the terminal post at the other end so that the fabric can be pulled tight. Proper tension is with the fabric pulled just tight enough to take up the slack. A wire spiral is then untwisted from the fabric at the point it is to take the tension bar, Fig. 5, and used for connecting it to the post.

The first method of attaching the fabric to the posts usually is used for runs of 50 ft. and longer, when it is difficult to stretch the fabric properly. The second method is easiest and should be used on all runs of less than 50 ft. Both methods require the same fittings—a tension bar and three bands at each end of a run. The bands should be spaced as shown in Fig. 8. The fabric is fastened to the toprail and line posts with short lengths of wire as detailed in Fig. 8. Each run of fence fabric is applied in the same manner, regardless of length of run.

To complete the fence, hinges and latches are attached to the gateposts and the gates are hung in place. When doing this, place the top hinge in an upside-down position, fastening it to the gatepost while engaged in the gate fitting. This prevents the gate from being lifted off the hinges. Double-gate installations require a concrete pad in which a pipe nipple is submerged flush with the top to take the latching device, Fig. 9. Be sure all hinge bolts are tightened securely so that the gates do not sag. ★ ★ ★

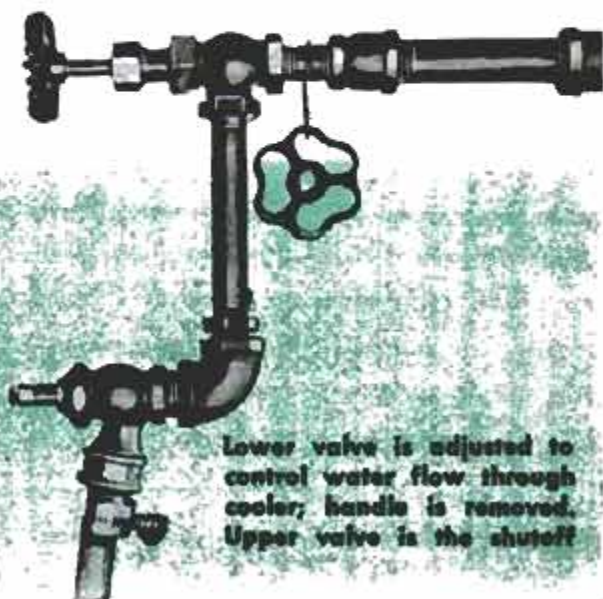
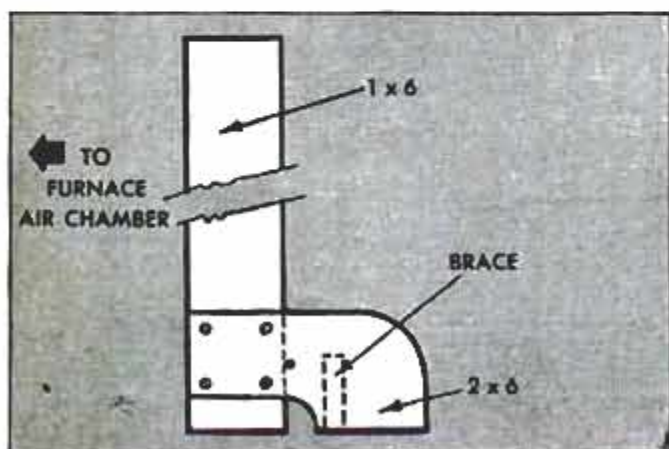
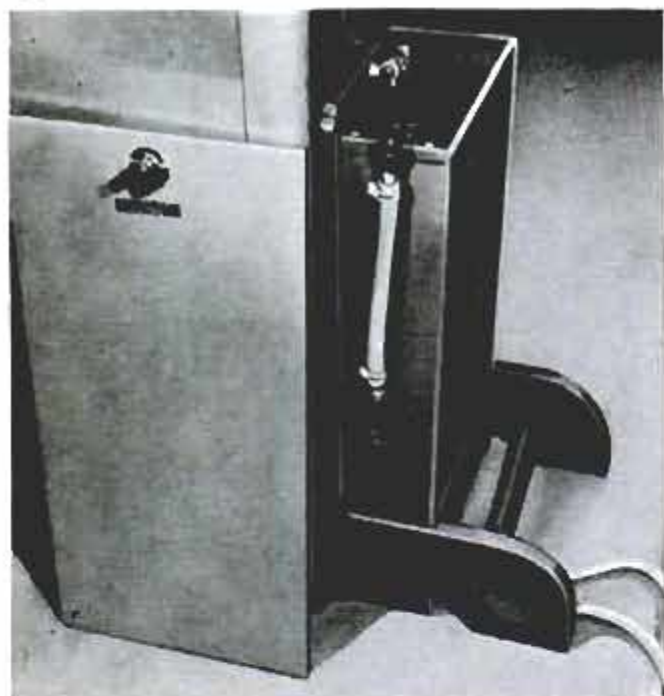




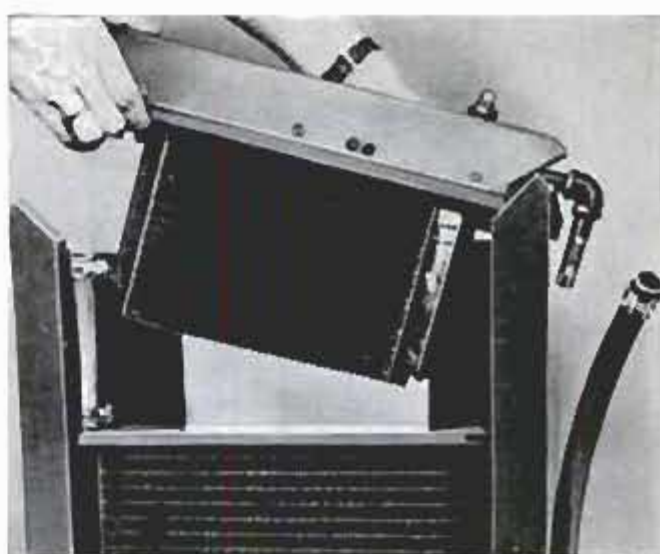
# ~~\$10 AIR COOLER~~ BEATS HEAT

By Don Walker

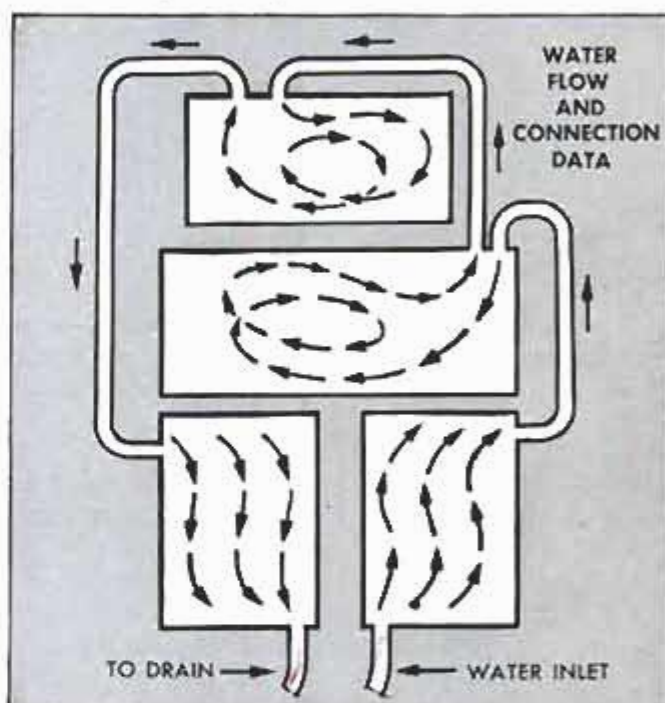
**I**F YOUR HOME is heated by a forced-air furnace, and if you live in a locality where water is plentiful, and is cool enough—not over 55 deg. F.—this air cooler will assure comfortable temperatures in your home this summer. The cost of the original unit was under ten dollars, but this figure will vary with the cost of the components in a particular area. The basic components of the cooler are four auto-heater cores, available at auto graveyards for about two dollars apiece. A regular auto radiator could be used, but would cost more. The heater radiators are assembled in a frame built of 1 x 6 lumber, dimensioned to fit



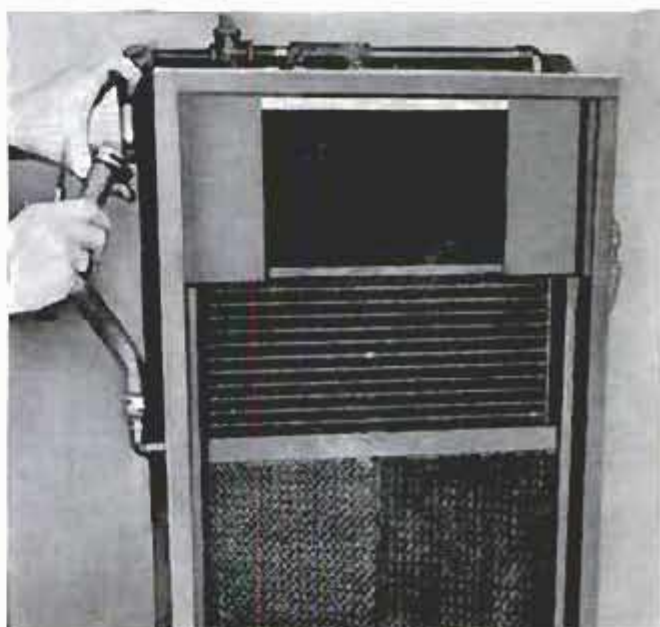
the access door in the furnace. The center left-hand photo on page 166 shows the completed unit fitted against the opening in a furnace; the frame is detailed below it. If your particular furnace has the plenum on the bottom—which is common in ranch-type homes without a basement, where the air ducts are located under the floor—the access door that permits removal of the filters will be at the top of the furnace, and it will be necessary to build the cooler frame with legs long enough to position it against the furnace opening. Because various types of auto heaters have connections at different points on the cores, the water-flow diagram shown at the right is only representative. The main factor is to arrange the radiators so water flows through each one, then is discharged into the next and on to the drain. Garden hose and ½-in. copper tubing are used to connect the cores together, ⅜-in. pipe being used where necessary to connect to a water supply. The cores are held in the frame by wooden cleats and separated horizontally by a shelf. If a core does not completely fill the space, as the top one shown does not, wooden spacers are used to seal the area. Two valves are used on the water-supply line, as in the lower, right-hand photo on page 166. The valve nearest the cooler is adjusted so the correct supply of water runs into the cooler, and the handle is removed. The valve behind the first is used as a shut-off valve in case of emergency. The filters are cleaned and replaced in the furnace, the furnace control is switched from "automatic" to "manual" and the fan is started. Air pulled through the cooler is reduced in temperature and sent through the house. ★ ★ ★



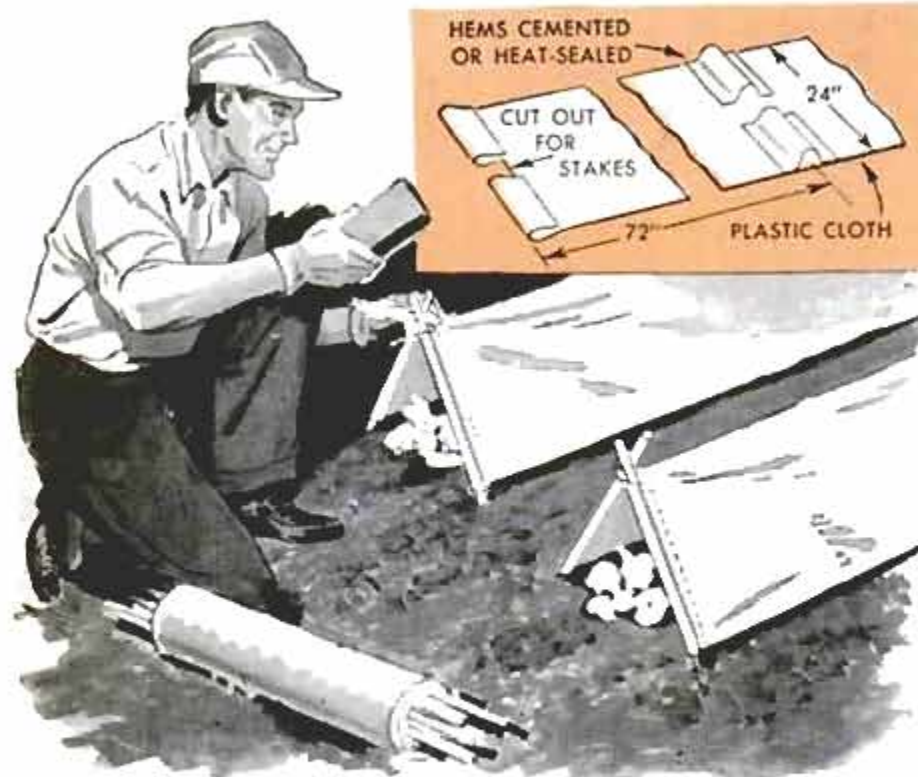
Above, radiators are fastened to side members of frame, except for top unit, installed last as shown



Below, connections are made between radiators with garden hose, copper tubing, and pipe where necessary. Components shown at left, before assembly

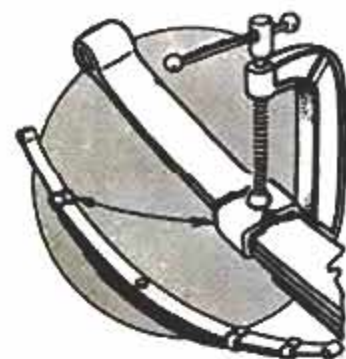


## Plastic "Tents" Protect Young Plants From Frost and Sun



To protect seedlings from extreme temperature changes, one gardener covers them with lengths of plastic cloth propped up tent fashion as shown. The "tents" are made by cutting strips of the fabric to the desired lengths and forming a pair of loops at each end and at intervals of 6 ft. to take short stakes as indicated in the detail. The hems of the loops may be cemented in place, or heat-sealed to the material, depending upon the type of plastic used. When not in use, the covers are rolled into one or more bundles for compact storage, leaving the stakes in place.

## Stop Spring-Clip Rattle

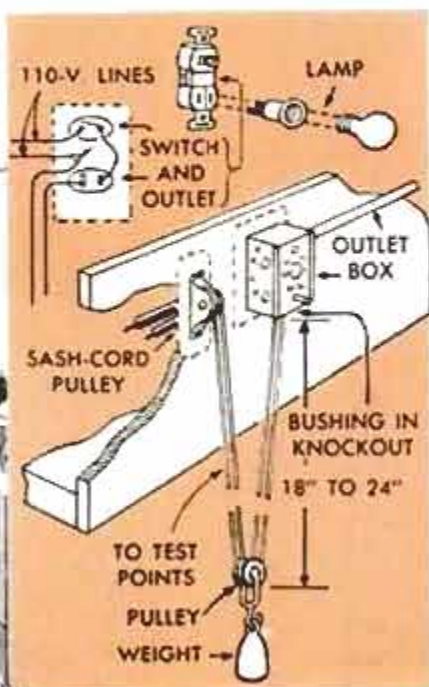


When a clip on a leaf-type car spring loosens enough to rattle, tighten it with a C-clamp as shown. Then coat clip and adjacent area with rubber cement.—H. Zave, Grand Rapids, Mich.

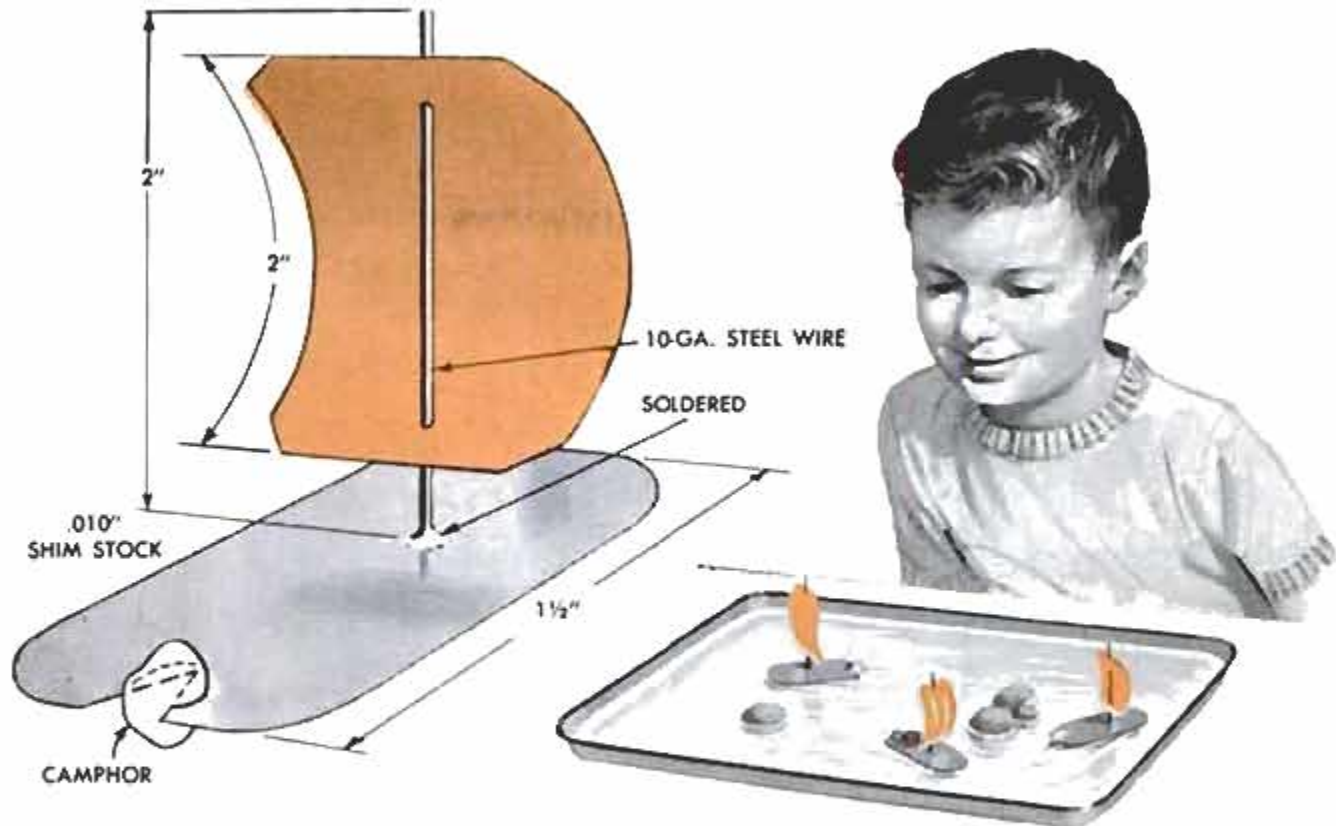
## Space Ignition Points Correctly

For proper functioning of a high-compression engine, ignition points must be spaced according to the manufacturer's specifications, says the Champion Spark Plug Co. If the points are set to open too wide on the firing cycle, the engine may "miss" at high speeds due to lack of coil build-up. If they are set too close, the coil may overheat and the point will pit and oxidize rapidly. Proper tension on the breaker arm must be maintained also.

## Retractable Circuit-Testing Lines Ideal for Benchwork



Test lines for checking electrical circuits are kept within easy reach on the workbench of one part-time repairman in the manner shown. When not in use, the lines are withdrawn from the work area by a pulley and counterweight arrangement. This is installed on a panel, which is attached to the back edge of the bench top as in the detail. To reduce strain on the test-wire connections in the outlet box, the wires are taped where they pass through the knockout hole, and held in place by a bushing for nonmetallic-sheathed cable.



## CAMPBOR PROPELS TOY SAILBOAT

By W. A. Davis and Gordon Copple

Here is a Lilliputian sailboat that moves mysteriously across a pan of water without a visible means of propulsion. Actually, a pea-size piece of camphor wedged in a notch at the stern of the boat reacts with the water to drive it forward. When two or more of the boats are placed in the water, they avoid one another and veer away from the sides of the pan as though by remote control. They also exhibit the same "magical" tendency to steer clear of other objects, such as stones that may be placed in the pan to represent islands.

A whole fleet of such boats can be made in less than an hour. Begin by cutting the hull for each from a length of .010-in. shim stock as indicated in the detail. Such material can be obtained from most auto-parts stores. Solder a 2-in. length of 10-ga.

steel wire to the deck of each boat to serve as a mast. The paper sails are then cut to shape and glued to the masts in the position shown. Use a different color paper for each sail for variety.

Before launching the boats, draw one end of a clean sheet of newspaper across the surface of the pan of water to be used, to remove any traces of oil. The slightest film of oil will prevent the camphor from reacting with the water. Do this three or four times, using a dry piece of paper each time. Then place each boat on the surface of the water. This must be done very gently since the boat relies upon surface tension to keep it afloat. Be careful not to touch the water as this would again deposit a film of oil to stop the propelling action of the camphor.

### Glass Ports Installed on Seeder Show Grain Level in Hopper

To be able to keep an eye on the grain level in the hopper of a grain drill, one farmer installed several glass tops from fruit jars on the forward side of the metal hopper as shown. The cutouts for the tops are made to take only the raised portion, leaving the flanged part on the inside. Short tabs formed at the circumference of the holes hold the tops in place.

C. F. Marley, Nokomis, Ill.



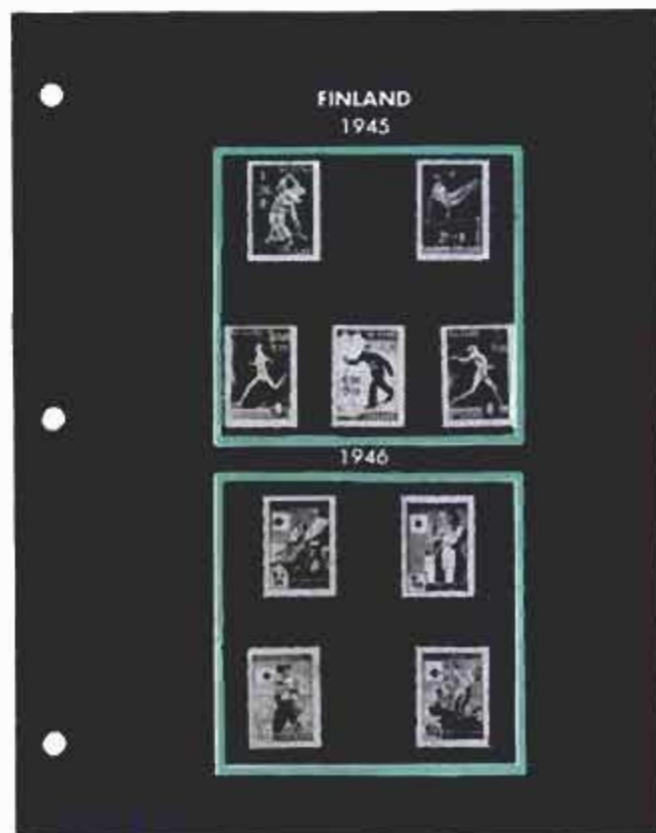
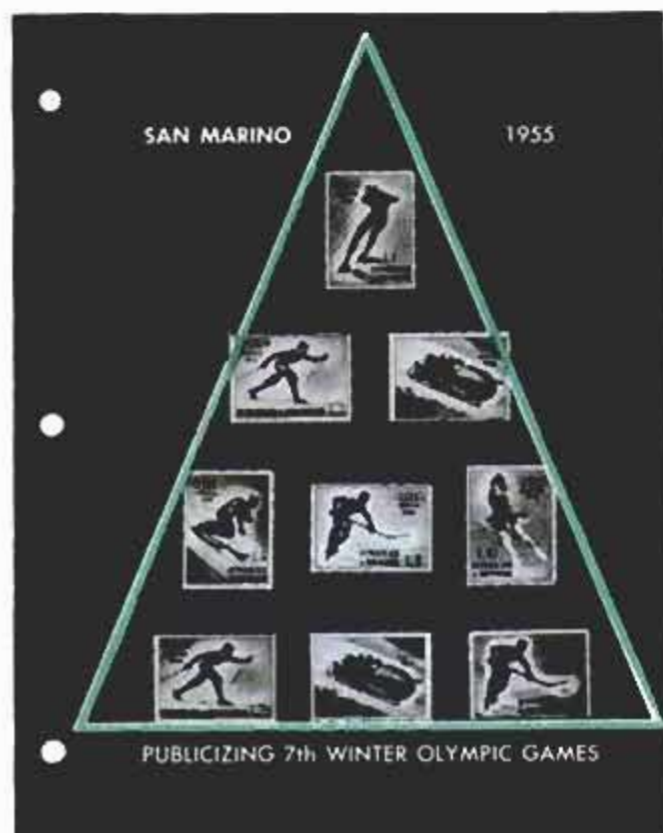
# MECHANICS OF STAMP COLLECTING

**S**TAMP COLLECTING, like any other hobby, has its professional-minded adherents who go beyond the run-of-mill status to produce a product that is good enough to win awards at regional and national exhibitions. For the beginning philatelist who wishes to garner a prize or two at such exhibitions, here are some tips on what materials to use and how to mount stamps to achieve an effective presentation—one that will catch the judges' eyes.

The first consideration is choosing a type of album in which to mount the stamps collected in each series of a country. Loose-leaf albums having plain black pages are best for this purpose. Do not use pages that have spaces outlined on them to take individual stamps issued by a country, as is the case with bound albums. No mechanics or creative effort is involved in mounting stamps in such a manner, which is very similar to filling a book with grocery-store trading stamps. Formerly, most exhibitors of stamp collections have used white loose-leaf pages. Now there is a trend toward use of jet-black pages without rulings or other art work, because it is difficult to get clear definition between the white margins on the stamps



By  
**Dr. Russel R. Voorhees**

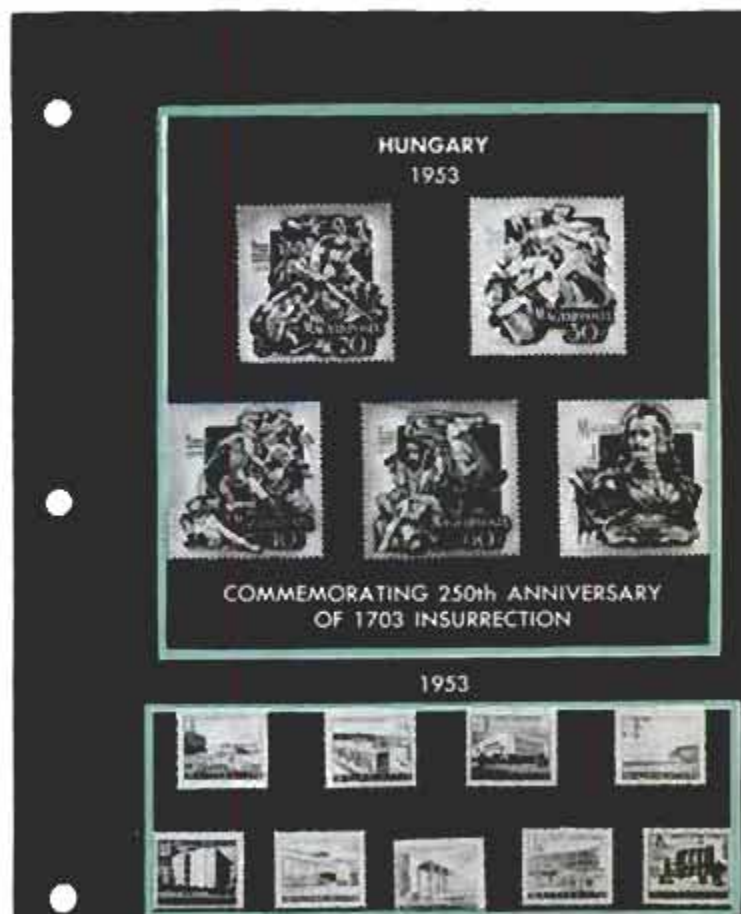
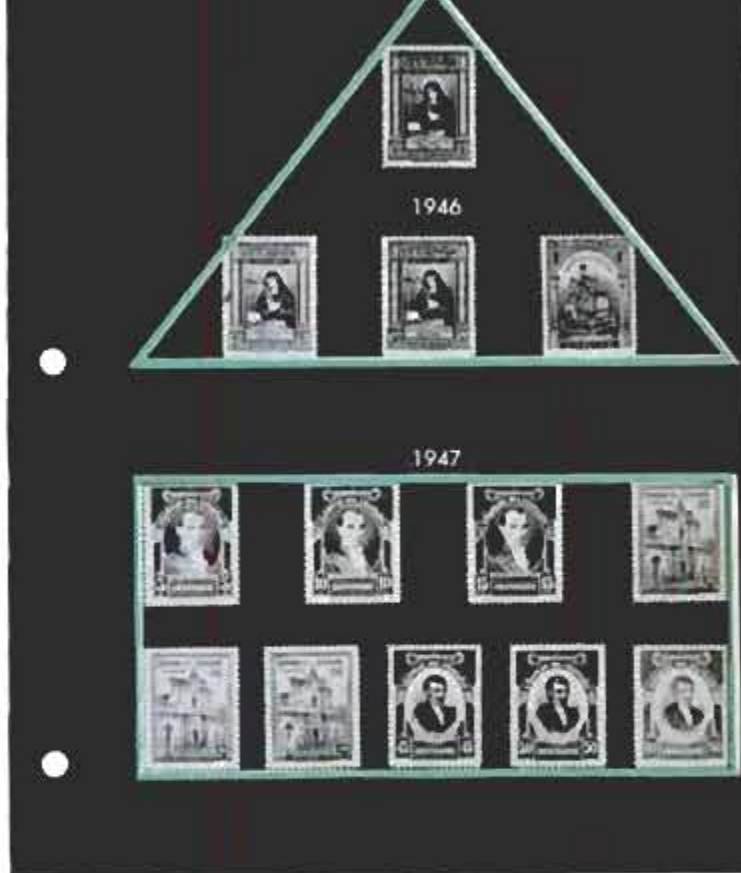


and the white paper to which they are affixed. The black background harmonizes with all colors of stamps and clearly defines the outline of a stamp so that the perforated edges can be inspected easily.

Mounting stamps on a plain black page without benefit of ruled lines is not difficult. Using a T-square with the head placed against the left side of the loose sheet, a row of stamps may be laid out across the page, spacing them as desired along the blade. Other rows of stamps may be laid out and mounted in the same way, starting from the center of the page and working in both directions vertically. There is more to mounting stamps than simply arranging them in neat rows to fill a page. The border at the top of the page (space between the stamps and page edge) should be wider than the one at the bottom. The rows of stamps should be centered horizontally on the page. The amount of black space remaining on all sides may vary from page to page.

The next step is to lay out the stamps according to the series in which they are issued. In doing this, try to fit them into some type of geometric form, such as a pyramid, square or rectangle, as shown in the photos of album pages illustrating this article. The colored lines that outline the geometric shapes shown are for purposes of illustration only. Some of the pages show a combination of geometric forms, such as the stamps from Ecuador on this page which are arranged in the form of a pyramid combined with a rectangle. The form or combination of forms to be used for mounting stamps on any particular page depends upon the quantity and shapes of the stamps in a series. All stamps forming a series should be mounted together, unless the series is too long to permit mounting it on one page, in which case it can be continued to the following page; however, this rarely happens. There are also instances of stamps in a single series having different forms. Some may be square, some rectangular and others triangular. In such cases the various forms of the stamps must be considered, to get a balanced layout.

Another factor to be considered when mounting stamps is the positioning of captions or write-ups explaining why a series of stamps was issued. The San Marino stamps on page 170, publicizing the Olympic Games, is an example of a good use of a caption. Whether captions are to be used or not, and the information they will give, is a philatelic matter and will not be discussed in this article. Such captions may be hand-lettered directly on the album page in white ink or white pencil, or they may be typed on perforated labels having one



1943



1943



1953



1953

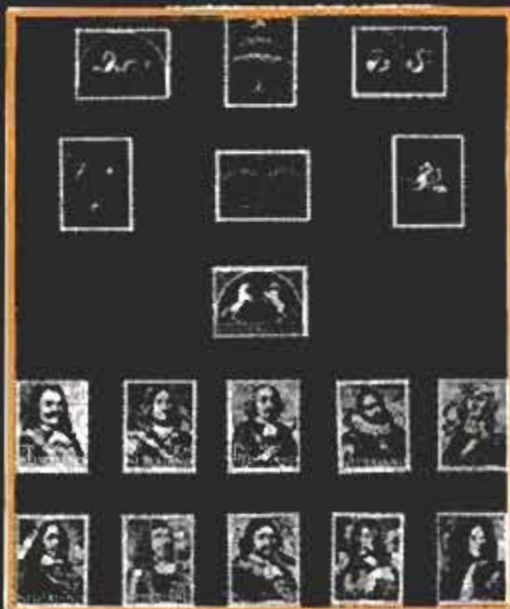


side gummed. Of the three mediums, the last one is the neatest and easiest to apply. White ink produces lines of irregular widths or weights, while captions that are written with a white pencil are too faint for good readability. An attempt should be made to have the caption run the same width as the stamp series it is to explain and it should be mounted directly under the bottom row of the series. Be sure to allow sufficient clearance for captions when determining border widths.

Stamps should always be mounted on special hinges, of which there are two main types—removable and nonremovable. The former can easily be peeled off the stamp and the album page without damaging either, while the latter type cannot be removed without damaging the stamp in some way. The removable type of hinge should almost always be used since there may be a need to remove some of the stamps at some future date; as when stamps are exchanged, additional stamps of a series are acquired and a new layout must be made. The cost is about the same for both types. There are also various kinds of cellophane pockets available into which the stamps are inserted before mounting. But these should not be used for the following reasons: They add an unnecessary cost to the hobby; the stamps often shift out of position to spoil the appearance of a layout; some stamp exhibitions bar exhibits having stamps that are mounted in cellophane pockets, since it is difficult for the judges to appraise the condition of such stamps.

Most stamp collectors who have been active in the hobby for even a short time have learned not to mix mint (unused) stamps with used ones in the same collection. If the number of used stamps on hand is not large, they can be kept in small envelopes according to required classifications. Then at a later date, they can be mounted in a duplicate collection containing only used stamps. Duplicate stamps in either mint or used condition are always kept to be offered in exchange for desired stamps other collectors might have. ★ ★ ★

NETHERLANDS  
1943-1944





## Screw Driven Into Sawhorse Provides Planing Stop

Driven into a sawhorse near one end of the top, a large, flatheaded wood screw will serve as a "retractable" planing stop for holding small pieces of stock. The head of the screw is countersunk so that the screw can be turned down flush with the surface of the sawhorse when it is not being used. This stunt is especially appreciated when you have to work away from the shop, and it would be necessary to walk back to the workbench to find a stop.

G. E. Hendrickson, Argyle, Wis.



☐ Cleaning cobwebs from ceilings and walls without making marks is done most easily by using a feather attached to a long, lightweight pole, such as a bamboo fishing rod, that permits reaching the ceiling.

## "Extending" C-Clamp Jaw Size

When only C-clamps are available for a job that requires bar clamps, the latter can be improvised from two C-clamps and a strip of fairly heavy plywood. Holes are bored or cut near the ends of the plywood strip to accommodate the clamp pads, after which the clamps are used as indicated in the photo. In some cases only one C-clamp is required. A block of wood is nailed to one end of a plywood strip to act as a clamp pad to be hooked over one edge of the work. A single C-clamp is fitted in a hole cut near the opposite end of the strip.



## Cardboard Strips Under Books Prevent Sagging Pages

Because of their weight, the pages in heavy books tend to sag away from their bindings and tear loose from the covers when the books are stored in the usual upright position. This condition can be prevented by fitting a strip of corrugated cardboard under the pages between the covers as indicated. It may be necessary to use more than one thickness of cardboard for some books. The cardboard does not show.

Robert Hertzberg, Douglaston, N. Y.

**Before welding or soldering** the fuel tank of an outboard motor, drain all the gasoline and flush the tank with a little carbon tetrachloride (fire-extinguisher fluid). The carbon-tet fumes will prevent a fire or explosion from a flame or the heat of soldering. Do not breathe the fumes of the carbon tet, as they are poisonous. Rinse the tank with gasoline before putting it back in service.



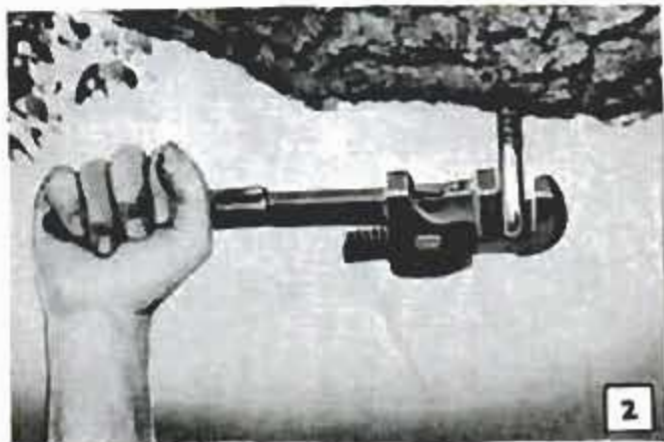
# HITCH YOUR SWING TO A TREE

By  
Enno R.  
Haan



**F**EW CHILDHOOD THRILLS equal the experience of soaring high above the ground on a big rope swing hung from a sturdy tree limb. Such a swing can be installed easily on a limb of any large tree without damaging it. For a safe installation, select a large, nearly horizontal limb and suspend the swing ropes from heavy lag hooks driven into the underside of it. Do not tie the rope ends around the limb as this would likely damage the tree and re-

Fig. 1, pilot hole is drilled to take lag hooks on which swing is hung. Fig. 2, using wrench to gain leverage, lag hook is screwed into the pilot hole

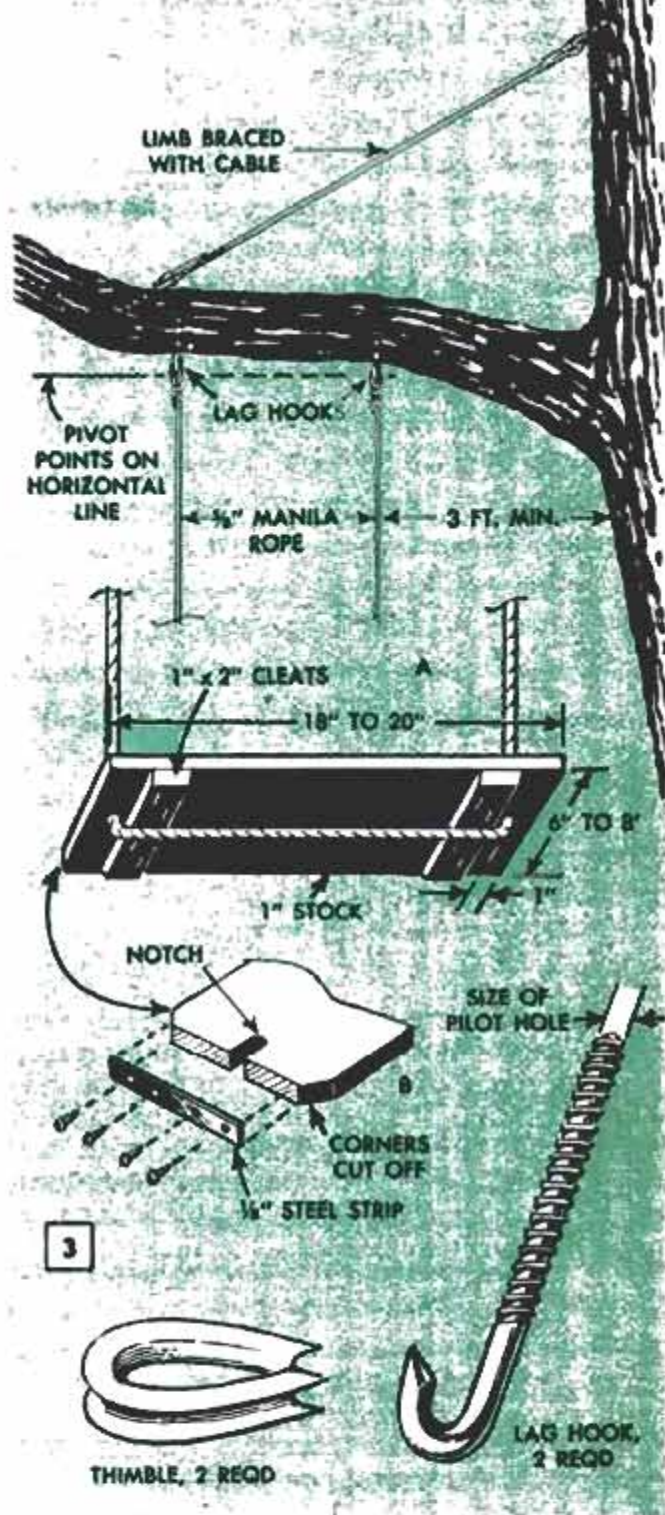


most swings are exposed continually to the weather, use manila rope that is treated to resist mildew.

Begin construction of the swing with the seat, which can be made of  $\frac{3}{4}$ -in. exterior plywood, or of 1-in. pine as shown in detail A, Fig. 3. If pine is to be used for the seat, nail 1 x 2-in. cleats across the bottom to prevent splitting. Rope holes or notches may be used to keep the seat in place. If notches are used, they should be closed with a steel strip as indicated in detail B. The latter arrangement makes it easier to remove the seat when desired.

The part of the limb to which the swing is to be attached should be not more than 1 in. out of horizontal and a minimum of 3 in. in diameter, preferably larger. A limb that appears to be of doubtful strength should be supported by a cable as in Fig. 3. Also, the swing should clear the tree trunk by at least 3 ft. Pilot holes must be drilled in the limb to take the lag hooks for the swing, Fig. 1. Space the holes to slightly exceed the distance between the rope parts at the seat. Using a wrench to obtain leverage, screw the hooks into the holes as in Fig. 2. Before turning the hook points tight against the limb, slip a thimble, Fig. 3, on each of them so that the thimbles can be secured on the ends of the swing rope later. Thimbles protect the rope from wear at the pivot points.

Now you are ready to hang the swing on the tree. Pass the rope through the seat holes and then bend the rope ends around the thimbles. The latter are held in place by binding the doubled parts of the rope with 2 layers of friction tape and 1 of rubber tape, Fig. 5. The thimbles shown in the photos are disconnected from the lag hooks for purposes of illustration. Finally, center the seat on the swing and take a test ride before turning it over to the youngsters. ★ ★ ★



Below, after bending end of rope around thimble, several turns of copper wire are drawn up tight around doubled part of rope at points shown in photo

Below, to complete the job of securing thimble on end of rope, doubled part is wrapped with two layers of friction tape followed by two of rubber tape



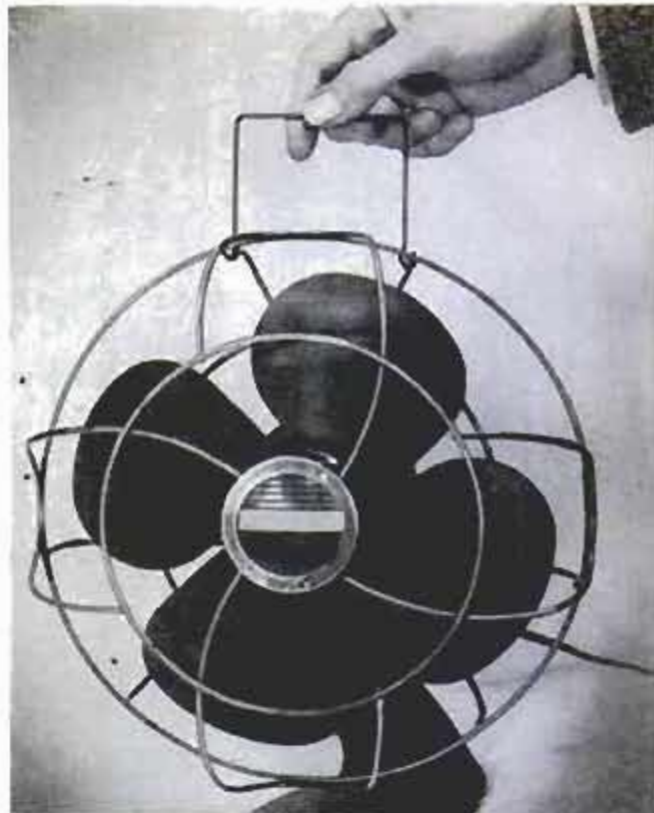


### Caterpillar Tree Nests Burned With Oil Torch on Pole

Cleaning caterpillar nests from fruit or nut trees can be done safely from the ground with a "pole torch." The torch consists of a food tin fastened to a metal or wooden pole of suitable length. An oil-soaked cloth is stuffed in the tin and ignited to provide the flame. Use care with the torch, holding it near a nest just long enough to destroy it, so that damage to leaves and limbs is kept at a minimum.

G. E. Hendrickson, Argyle, Wis.

☐ When in need of additional work space in the kitchen, cover your ironing board with a sheet of plastic or oilcloth and elevate it flush with the counter tops or to any comfortable working position.



### Wire Handle for Portable Fan Protects Fingers From Blade

Lifting a portable fan by the guard to move it while it is running can be hazardous. Avoid the chance of cut fingers by bending a handle of heavy wire and fitting it on the guard as shown, by wrapping the ends of the wire around the guard. Clamp the wrappings tightly so the handle will remain upright and can be gripped easily. When the fan is to be stored, the handle can be pushed down against the guard.

H. Hanscom, Elmhurst, Ill.

☐ Carry a pair of sleeves cut from an old coat in the glove compartment or trunk to slip over the arms of your good clothes when changing a tire or working on the engine. The sleeves will save cleaning bills.

### Spare Fuses Stored in Lamp Base Screwed to Wall



Whenever a fuse blows in your home do you have the sometimes time-consuming job of finding a replacement? Then do as one homeowner did, who knew he had fuses somewhere in the house, but could never find them quickly. He salvaged the bases from several light bulbs, drilled holes in the bottoms and screwed them to the wall near the fuse box. A fuse will turn into a lamp base readily. When a fuse blows, the person replacing it merely has to reach up to one of the bases on the wall. Another advantage is that a glance at the sockets will tell the homeowner when he needs to purchase a few more fuses to keep them on hand.—Frank A. Javor, Newark, N. J.

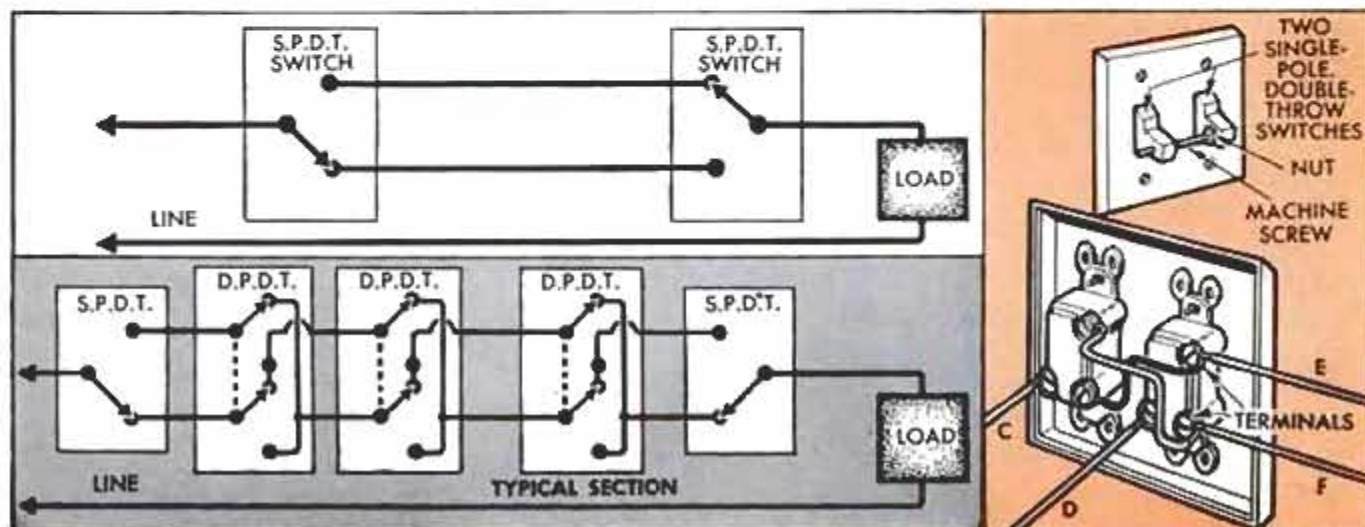


## MULTISTATION LIGHT CONTROL

By H. Alan Schwan

COMMONLY CALLED 3-way switches, single-pole, double-throw (s.p.d.t.) switches often are used at the upper and lower ends of a stairway leading to a second floor or to a basement, to permit turning a light on and off from two different locations. The method of wiring such switches is shown in the upper detail below. Should it be necessary or desirable to control a light, motor or appliance from three or more locations, two 3-way switches can be used, plus one or more 4-way switches—used as double-pole, double-throw switches (d.p.d.t.) in this wiring hookup—wired between them as indicated in the lower detail. Where small electrical loads are involved, such as lamps of 500 watts or less, or motors of  $\frac{1}{4}$  hp. or less, heavy-duty, radio-type 4-way toggle switches can be used. The example shown

in the illustration at the top of the page—controlling an outdoor light from three locations—could utilize this type of switch. Where electrical loads are heavier, regular house-type 3-way switches can be coupled together to provide a 4-way switch. The switch toggles are drilled and a small machine bolt and nut are used to lock the toggles together. The switches then are wired as shown in the lower right-hand detail. Wires C and D run to one of the 3-way switches, while wires E and F go either to another 4-way switch, or to a 3-way switch, as shown in the wiring diagram in the "typical section." These switches can, of course, be located wherever necessary. Three 4-way switches in the diagram shown produce a total of five locations. More or fewer switches may be used.



# SHOWCASE OF TOOLS

Tools shown in this article are intended only to give readers some idea of the types and sizes available.

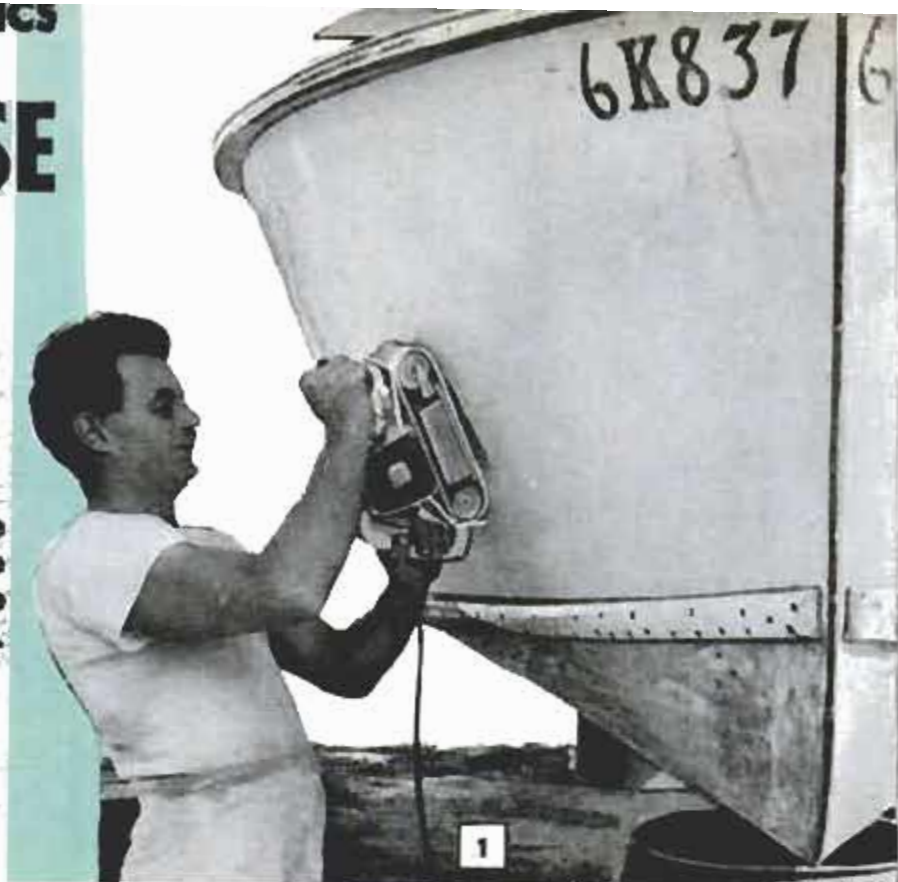


Photo courtesy Stanley Electric Tools, Div. of The Stanley Works

Portable belt sanders are ideal for use on work such as boats and similar projects having large areas

## Portable Belt, Pad and Disk

Photo courtesy Stanley Electric Tools, Div. of The Stanley Works

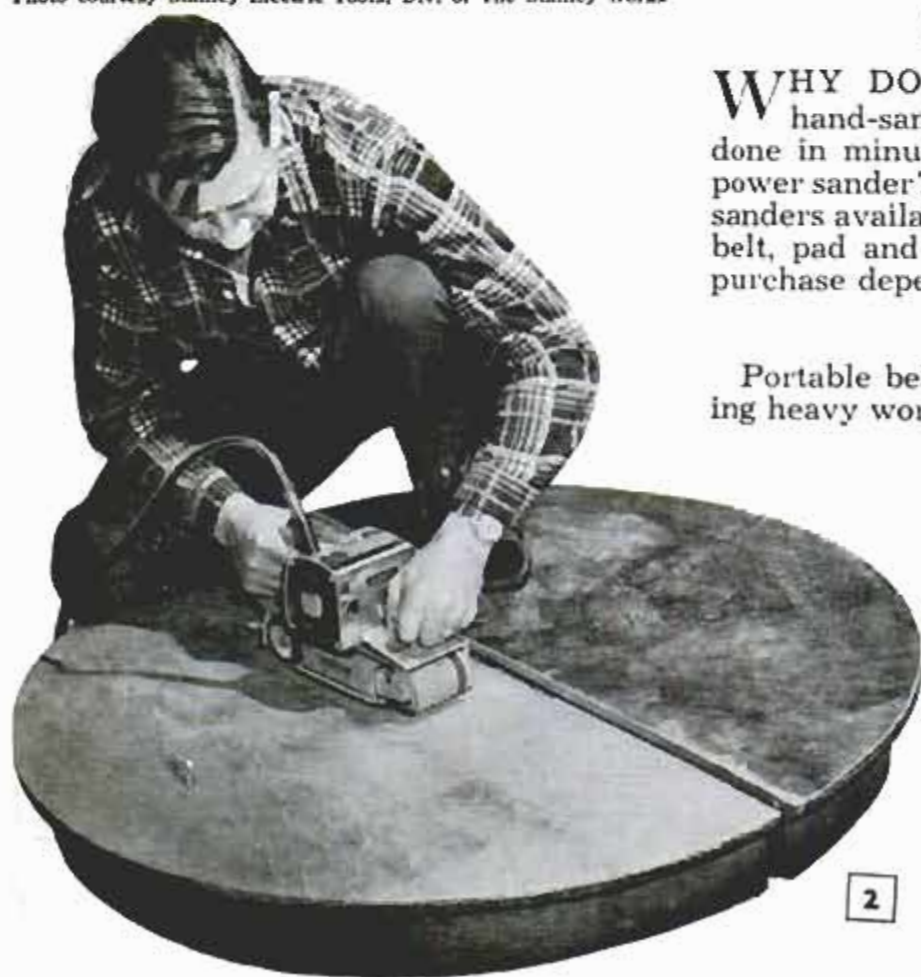
By E. R. Haan

**WHY DO "HORSE-AND-BUGGY"** hand-sanding when the job can be done in minutes with a modern, portable power sander? There are a number of these sanders available in three different types—belt, pad and disk, Fig. 3. Which type to purchase depends on the work to be done.

### Belt Sanders

Portable belt sanders are capable of doing heavy work with coarse-grit belts, Fig. 1. They also do finish sanding with medium and fine-grit belts. Weighing from 8 to 15 lb., these sanders come in belt widths from 2 to 4 in. Usually cloth-backed for strength, the belts are mounted on two drums or pulleys, one a drive pulley and the other an idler.

Belt sanders fitted with open-coat abrasive belts make quick work of removing old paint and varnish





BELT

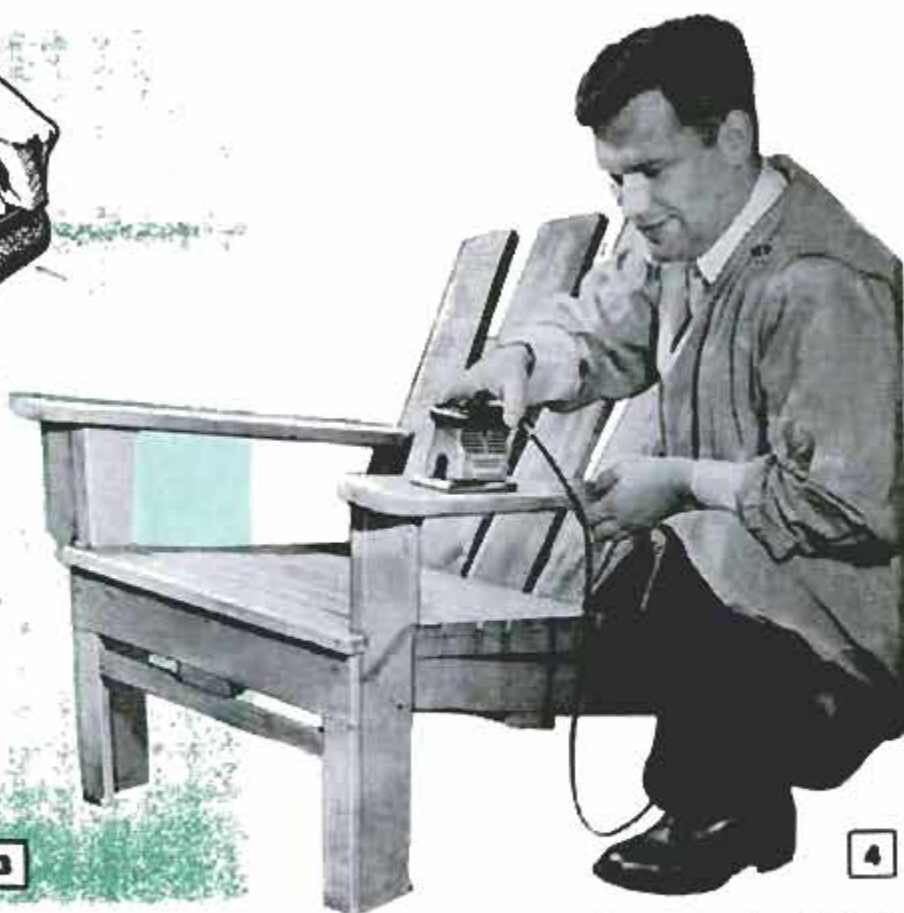


PAD



DISK

3



4

Pad sanders are hard to beat when finish-sanding furniture and other work to be painted or varnished

Photo courtesy Dremel Mfg. Co.

# Sanders

## Pad Sanders

Used mostly for finishing operations on wood as in Fig. 4, pad sanders weigh from about 2½ to 6½ lb. They also are ideal for rubbing and polishing on wood, plaster, glass, plastics and metal. In respect to their movement, these sanders are of two types—orbital and reciprocating. Some sanders have an adjustment to change quickly from one type of action to another. The pad, or shoe, of an orbital sander moves in a circular or oblong path, having a stroke of about ⅜ to ¼ in. This motion sands with, across and against the grain of wood, resulting in a very smooth surface.

Some reciprocating types are activated by a magnetic-coil drive instead of an electric motor, and have a much faster speed than the motor-driven units. The magnetic types are designed for very light work, and are lighter in weight than those driven by motors in the conventional manner.

## Disk Sanders

Portable disk sanders have many uses around the home and shop. Removing loose and blistered paint from house siding as in Fig. 12, is a good example. These sanders usually consist of a portable electric drill on which sanding disks are mounted, the

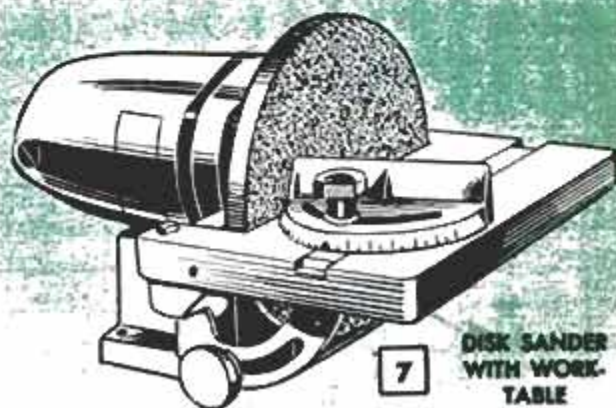


HOLD AT SLIGHT ANGLE FOR SMOOTH CUT

5



6



7

DISK SANDER WITH WORK-TABLE

STANLEY ELEC. TOOLS,  
DIV. OF STANLEY WORKS



SEARS, ROEBUCK & CO.



BURGESS VIBROCRAFTERS, INC.



PORTER-CABLE  
MACHINE CO.

SPEEDWAY MFG. CO.,  
DIV. OF THOR POWER  
TOOL CO.



SUNBEAM CORP.

### BELT SANDERS

TRADE NAME, MAKER AND NUMBER	BELT WIDTH (in.)	BELT LENGTH (in.)	BELT SPEED (f.p.m.)	DIMENSIONS (in.)	NET WEIGHT (lb.)	TYPE OF BEARINGS
Black & Decker Mfg. Co. 654	3			5-3/8 W., 13-1/2 L., 7-1/16 H.	14	Sealed ball
Burgess Vibrocrafters PS-2300	2	17-3/8				Self-lubricating bronze
"Craftsman," Sears, Roebuck & Co. 2556	3	27	1200	8 H.		Self-lubricating bronze
"Mall," Remington Arms Co. 31	3	24	1350	13-7/8 L.	10-1/4	Sealed ball
Porter-Cable Machine Co. 136	3	21	1425	6-5/32 W., 11-3/4 L., 7 H.	10	Ball, needle
"Power-Kraft," Montgomery Ward & Co. 8560M	3	24	1650			Sealed ball
Skil Corp. 405	4		2-speed, 800 & 1100	12-1/2 L.	12-3/4	Ball & sleeve
Stanley Electric Tools H31	3	24	1600	13-1/2 L., 6 W.	15	Sealed ball

### PAD SANDERS

TRADE NAME, MAKER AND NUMBER	TYPE OF ACTION	STROKE LENGTH (in.)	SHEET SIZE (in.)	PAD SPEED (cycles per min.)	OVER-ALL DIMENSIONS (in.)	NET WEIGHT (lbs.)	POWER	TYPE OF BEARINGS
Black & Decker Mfg. Co. 44	Orbital	3/16	3-5/8 x 9	4250	3-11/16 W., 9-3/8 L., 6-7/16 H.	5-1/2	Motor	
Clark Sanding Machine Co. OS-A			4-1/2 x 11	3000	4-1/2 W., 10-1/2 L., 6 H.	8	Motor	Sealed ball
"Craftsman," Sears, Roebuck & Co. 760	Double-arc		3-5/8 x 9	14,400	3-1/8 W., 10 L., 6-1/2 H.	5 lbs., 2 oz.		Magnetic vibrator
"Cummins," John Oster Mfg. Co. 476	Orbital & straight-line	3/16	3-5/8 x 9	3500	3-5/8 W., 7-7/8 L., 6-1/8 H.	5-1/2	Motor	Ball
Dormeyer Corp. S-4100	Orbital		3-5/8 x 9	4000	3-5/8 W., 7-1/4 L.		Motor	
Dremel Mfg. Co. 53	Straight-line	1/4	3-5/8 x 9	6900	3-2/3 x 7 (pad)	5-1/4	Motor	Sealed ball
"Mall," Remington Arms Co. 25	Orbital	1/4	3-5/8 x 9	4500	10 L.	5	Motor	Ball & needle
"Manning Bowman," McGraw-Edison Co. 1253	Orbital & straight-line		3-5/8 x 9	4500		5	Motor	Ball
Millers Falls Co. 580	Orbital	5/32	3-5/8 x 9	4500		5	Motor	
Porter-Cable Machine Co. 145	Orbital	3/16	3 x 8	3500	3-1/2 W., 8-1/8 L., 6-3/8 H.	5 lbs., 6 oz.	Motor	Ball & self-lubricating bronze
"Power-Kraft," Montgomery Ward & Co. 8556	Orbital		3-5/8 x 9	4500	11-3/8 L.		Motor	Sealed ball
"Sioux," Alberston & Co. RC-1850	Orbital		3-5/8 x 9	4000	3-5/8 W., 7-1/4 L., 7-1/8 H.	6	Motor	Ball & bronze
Skil Corp. 592	Orbital	3/16	3-5/8 x 9	5500	3-5/8 W., 9-5/8 L., 6-1/2 H.	5-1/2	Motor	3 ball & 1 sleeve
Stanley Electric Tools H-36	Orbital	3/16	3-5/8 x 9	4500	3-3/4 W., 11-3/8 L., 6-3/8 H.	6-1/2	Motor	Sealed ball
Sunbeam Corp. 74	Orbital	3/16	3-5/8 x 9	4000	3-5/8 W., 8-3/4 L., 7 H.	4-1/2	Motor	
Thor Power Tool Co. 15R	Orbital	3/16	4-1/2 x 6-1/2	3450	8 L.	5	Motor	Ball
Weller Electric Corp. 700	Straight-line		25 sq. in.	14,400	2-15/16 H.			Magnetic vibrator
Won Products Inc. 202	Straight-line			14,400		2-1/2		Magnetic vibrator





McGraw-Edison Co.



Dremel Mfg. Co.

Wen Products, Inc.



Dormeyer Corp.



Millers Falls Co.



Cummins Mfg. Co.  
Div. of John Oster Mfg. Co.



Albertson & Co.



Black & Decker Mfg. Co.

Stanley Elec. Tools,  
Div. of Stanley Works



Skil Corp.



Mall Tool Co.,  
Div. of Remington  
Arms Co., Inc.



Weller Electric Corp.



MILWAUKEE ELEC. TOOL CORP.

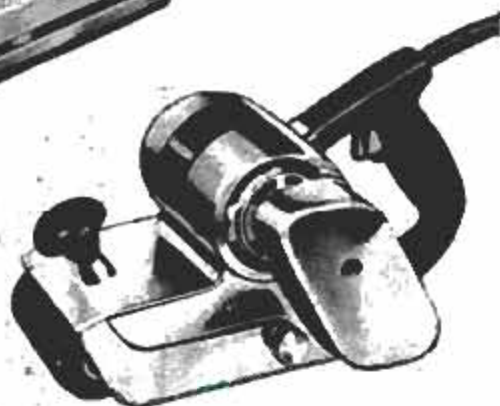
SEARS, ROEBUCK & CO.



CLARK FLOOR SANDING MACHINE CO.



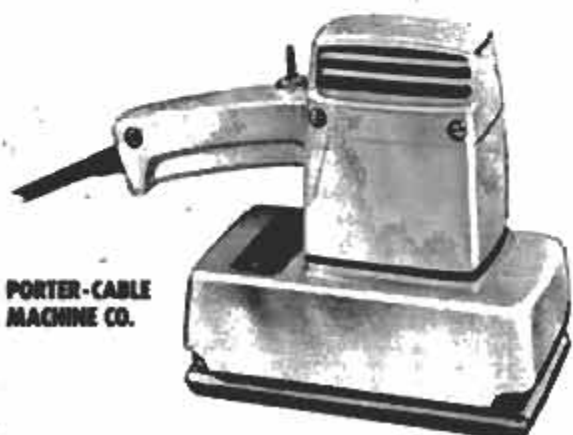
SKIL CORP.



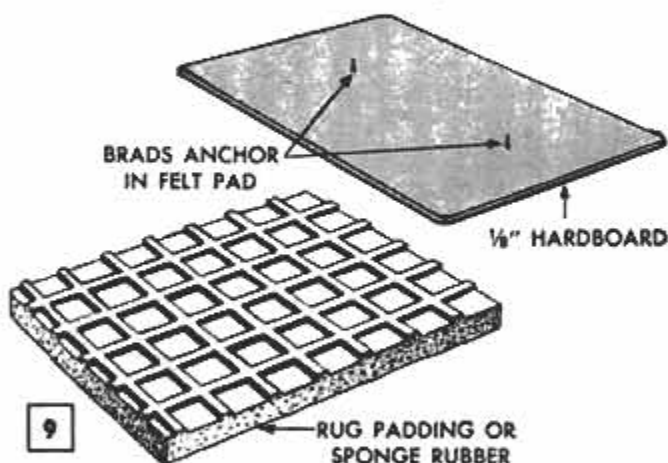
STANLEY ELEC. TOOLS DIV. OF STANLEY WORKS



PORTER-CABLE MACHINE CO.



SHEETS FOR PAD SANDER CUT FROM 9" x 11" ABRASIVE SHEET



disks being backed by a flexible rubber disk. Or they may be used on other types of hand-held motors, such as indicated in Figs. 3 and 12.

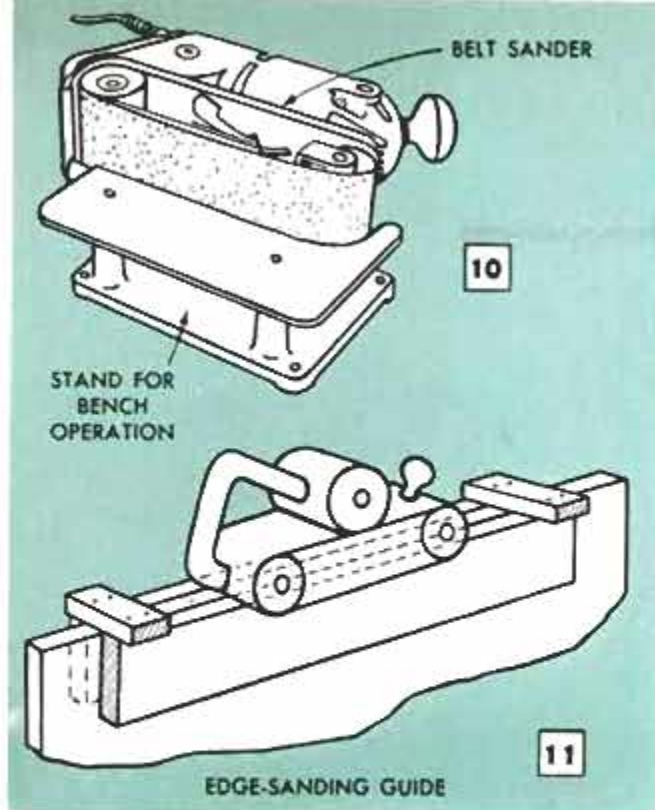
### Sander Accessories

When using a belt or pad sander on the edges of work, a true 90-deg. angle to the sides may be assured by using an edge guide as shown in Fig. 11. The wood used to make it should be of the same type as that to be sanded so that the cutting action on both guide and work will be about equal.

A flexible pad that fastens to the regular pad of a belt sander is a handy accessory for sanding concave and convex surfaces. Another accessory is a bench stand, Fig. 10, which converts the sander into a stationary belt sander. Concave surfaces often can be sanded by holding them against the belt directly over the front pulley.

On pad sanders the shoe generally is faced with felt, which gives the desired flexibility. However, a hard shoe may be preferred for some sanding jobs, such as wood having a pronounced grain of alternate hard and soft layers. A hard shoe can be made of 1/8-in. hardboard as shown in Fig. 9. Where a very soft shoe is desired for fine finishing, one can be cut from a piece of rug padding or from sponge rubber as in Fig. 9.

Adaptors such as shown in Fig. 6 can be obtained to hold the disk of a disk sander almost parallel to the drill axis, which greatly increases ease of handling. It also is possible to obtain stands, Fig. 7, to convert portable disk sanders into stationary sanders.



### General Sanding Procedures

With all types of portable sanders, the pressure on the work should be fairly light—not more than that produced by the uniformly distributed weight of the machine when resting on a horizontal surface. To smooth a rough surface, the machine first is fitted with a coarse abrasive to do the bulk of the work, after which a medium, and often a fine-grit abrasive, is used for finishing. A sander should be kept in constant motion while in contact with the work, and is moved over it in relatively slow sweeps that overlap each other slightly to assure full coverage.

Starting a belt sander before bringing it into contact with the work avoids gouging the latter. Also the sander should be lifted off the work before stopping it. In use, a sanding disk is held at a slight angle to the surface of the work as in Fig. 5, so that only one side of the disk touches the work. However too great an angle will cause gouges and make control difficult. On most sanding operations you stroke the sander back and forth in the same direction as the grain of the wood, working sideways a little to cover the entire area.

To remove a thick coat of paint or varnish, Fig. 2, use a coarse-grit, open-coat belt and change to a medium-grit belt of the same kind as you get close to the bare wood. An open-coat belt resists clogging more than a close-coat belt.

A sheet of abrasive  $3\frac{5}{8}$  by 9 in. fits most pad sanders. Three such pieces can be cut from a single sheet of standard 9 by 11-in. abrasive paper as indicated in Fig. 8. For

wood finishing, the usual range of abrasives used on pad sanders is from 2/0 to 6/0. The coarsest abrasive that can be used to advantage on them is No. 1 for comparatively rough surfaces on both soft and hard wood. Pad sanders are not intended for heavy work that can be done faster with belt sanders. When thick, old finishes are encountered, it is best to remove them with a good chemical remover, after which the pad sander is used on the bare wood. It is important to draw the abrasive sheet over the shoe of a pad sander tightly. A little play between the two will greatly reduce cutting efficiency. ★ ★ ★



## Box Cover Aligns Return-Address Rubber Stamp on Envelope

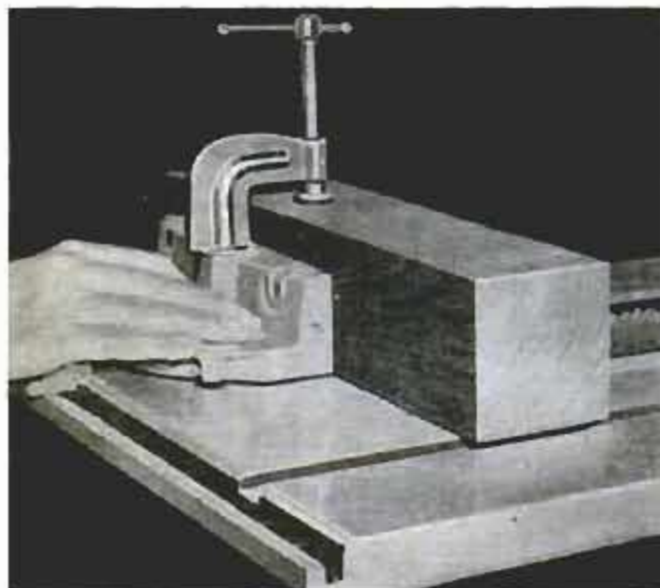


To do a fast and neat job of stamping a return address on envelopes, place them one at a time against the inside corner of a cardboard-box cover as in the drawing. The sides of the cover serve as a guide for the rubber stamp so that the address lines applied are parallel to the top of the envelope. To permit the envelopes to be slipped out of the cover after stamping them, two of the sides are cut off as shown.

G. E. Hendrickson, Argyle, Wis.

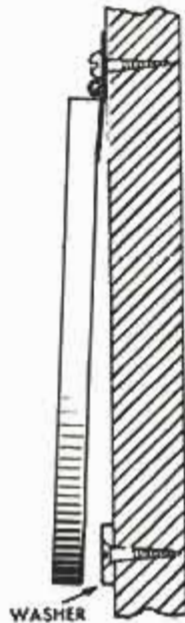
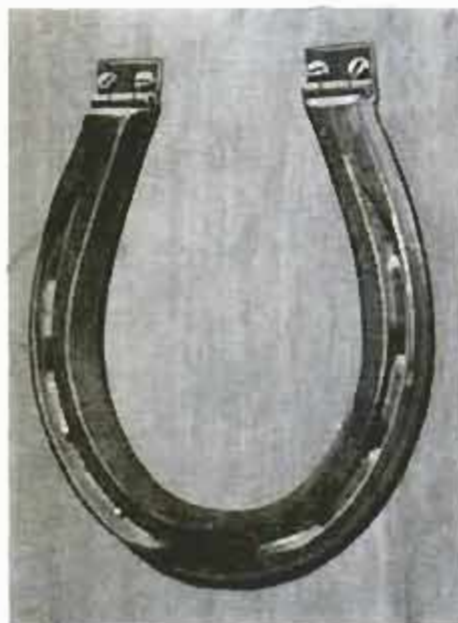
When a roller is unavailable for pressing down the edges of floor tiles that are being laid, "borrow" a caster from a bed or other piece of furniture so equipped and use it for this purpose.

## Clamping Jig Added to Miter Gauge Holds Stock in Place



For a positive way of preventing stock from slipping out of position when making a miter cut on a table saw, cut a 3-in. C-clamp in half transversely and attach the end having the screw to the miter gauge as shown. In use, the material to be cut is placed in the desired position against the face of the miter gauge and clamped in place. The clamp used for this purpose must be of a type that is fabricated from sheet metal so that the hole formed longitudinally at the center can be threaded with a  $\frac{3}{8}$ -in. tap. A  $1\frac{1}{2}$ -in. stud screwed into the hole at the top of the gauge and the C-clamp holds the two units together. For gauges that do not already have such a tapped hole, drill and tap one in it as required.—E. McCafferty, Naches, Wash.

## Rustic Door Knocker From Small Horseshoe and Pair of Hinges



If your taste tends toward the rustic, here is an idea for making a door knocker from a horseshoe. Weld one leaf of a small hinge to each leg at the open end of a small horseshoe and screw the other leaves to the door. The shoe strikes against a small washer screwed to the door at a point in line with the toe end as shown in the detail.—Hi Sibley, Nuevo, Calif.

Here is a tip for growers of African violets. In a 4-in. disk cut from  $\frac{1}{8}$ -in. cork, punch 6 or more holes to take the violet stems. Then place the disk in a bowl of water so that it floats free. The disk keeps the stems below the surface of the water, yet prevents the leaves from falling into it and decaying.

Mrs. Ada Demque, Quesnel, B. C., Can.

# UNUSUAL JOBS FOR SCISSORS

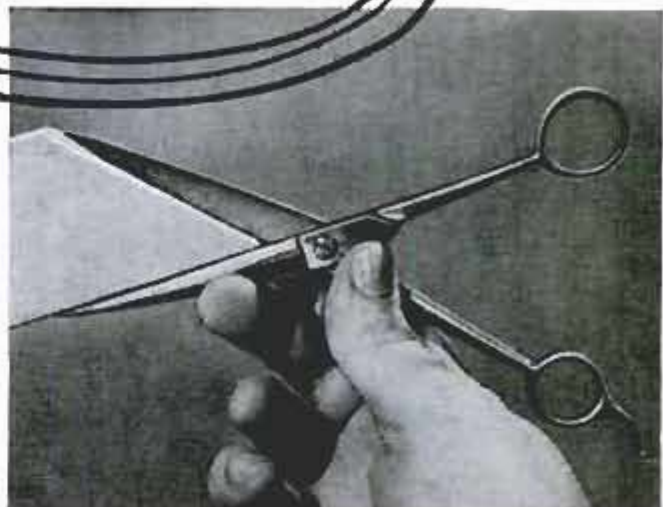
By *Kenneth Murray*

When a compass is needed for scribing circles and none is available, fasten a pencil to one blade of a pair of scissors and use it as shown. To prevent the blades from pivoting when doing this, tighten the pivot screw to jam them lightly

Right, a pair of scissors having blades with straight edges may be used as an emergency T-bevel to lay out duplicate angles, or to transfer an angle from one piece of work to another as when making miter joints

Below right, household scissors can be used as a temporary wood scraper to smooth the edge on a soft-wood board. Open the blades wide and draw the cutting edge of one of them over the stock as shown

Below, you can determine the inside diameter of a cylindrical object quite closely by spreading the blades of a small pair of sharp-pointed scissors to contact the cylinder walls. The distance across blade points can then be measured to get the diameter





1. Sending switch for Stewart-Warner tachometer fits between distributor and cap, wire leads to head

By Jon Wirth

**T**ACHOMETERS now are available from the manufacturers as optional equipment for some passenger cars, and as standard equipment for others. Why are these meters, that measure the r.p.m. of an engine, now used in passenger cars when they once were installed only in trucks and racing cars? The main reason is that many motorists are interested in keeping their complex, high-powered engines in top condition. Because modern V8 engines have so much power, it is difficult to tell when they are not functioning properly. However if the engine usually runs at 2000

r.p.m. for a road speed of 40 m.p.h., then suddenly, or gradually, requires 2200 or more r.p.m. to maintain 40 m.p.h., the motorist knows something is wrong. If there is an ignition miss, the tachometer needle will fluctuate wildly each time the miss occurs. If the miss is in a mechanical component, the needle merely will jump. (Electrical tachometers only are being considered, as they are more reliable and easier to install than mechanical types.) Every engine has a specific idling speed (r.p.m.) that can be adjusted with the aid of a tachometer. A slow idle allows the engine



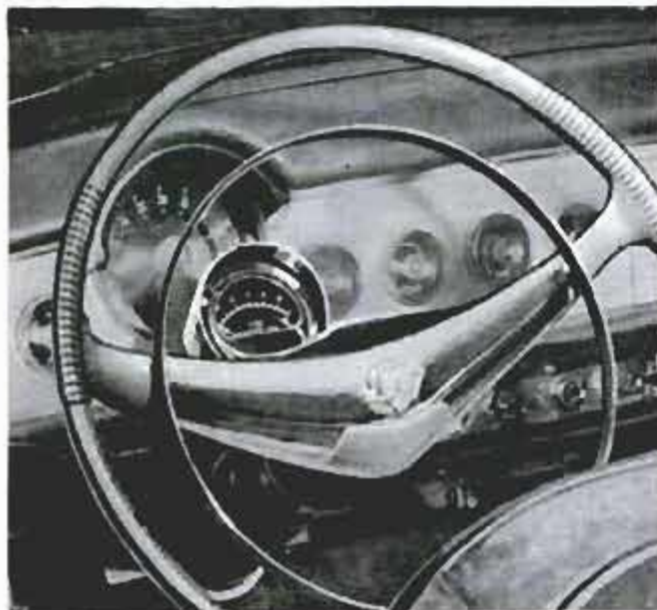
2. "Voltack" tachometer has voltmeter included in head with ignition-impulse detector. Flipping switch one way shows engine r.p.m., flipping it other way shows voltage output of battery to check its condition



to die easily or be stalled by an automatic transmission. Fast idling wastes fuel and, with an automatic transmission, will cause a car to "creep" excessively. The shift points in an automatic transmission usually are a direct function of engine r.p.m. Oil pumps driven by the engine build up pressure that opens or closes valves to actuate the transmission. A sluggish engine will not allow a transmission to shift properly. As stated in the example of more r.p.m. being required for a specific road speed, engine r.p.m. and road speed are not necessarily in direct ratio. Inefficient combustion will not produce enough horsepower at a particular r.p.m. to drive the car at the correct speed. A tachometer will tell you if the engine is not operating efficiently, and if a transmission is shifting at the specified r.p.m.

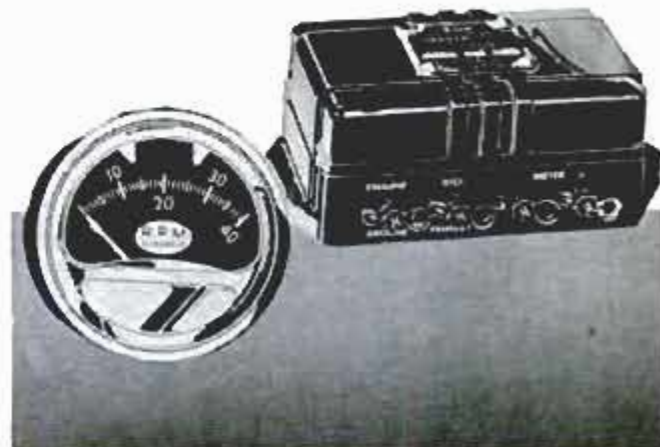
New on the market is the "Electro-Tac," a tachometer that can be used on an engine of any number of cylinders and for any ignition voltage. It uses a sending unit connected in series with the wire between the coil and ignition switch, Fig. 6. Its head, or dial, like most tachometers, can be installed in a special housing and clamped to the steering column, Fig. 5, or fitted in an opening in the instrument panel. It is calibrated with a vibrating metal "reed" held on the steering wheel with the engine running, Fig. 3. The Stewart-Warner tachometer, Fig. 1, has a switch that is fitted between the distributor and the distributor cap. The tachometer dial shown in the inset also has a small vacuum gauge. Ignition voltage and number of cylinders are specified when ordering most tachometers. The Voltack unit includes a switch that permits checking battery voltage, Fig. 2. The Sun Electric tachometer has a sending unit, Fig. 4, that translates ignition pulses to engine r.p.m. on a dial.

5. Like most tachometers, head for Electro-Tac can be fitted in housing that clamps to steering column

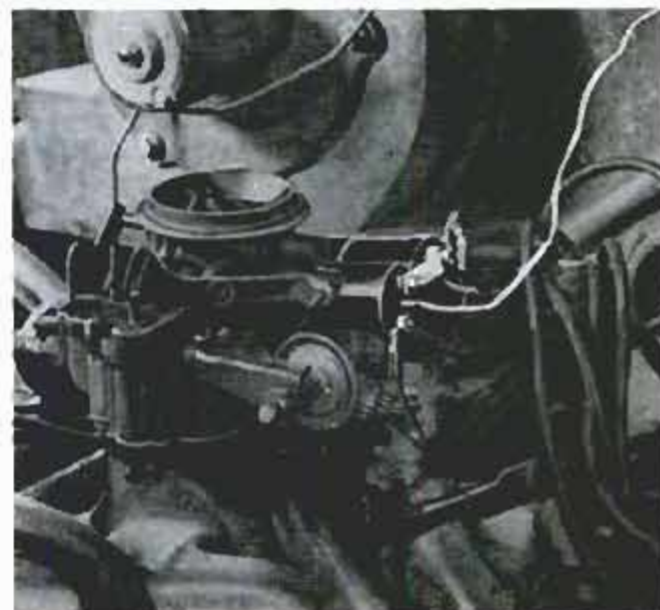


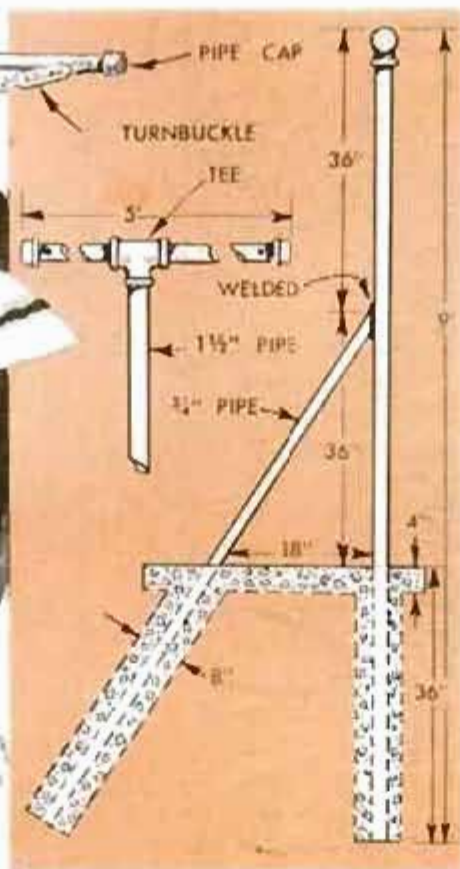
3. Above, Electro-Tac is calibrated with vibrating "reed" held on steering wheel while engine is running

4. Below, Sun unit uses separate transmitter requiring ground connection as well as hookup to distributor



6. Sending unit for Electro-Tac is connected in series between coil and wire leading to ignition switch





## Clothesline Post That Stays Erect

Here is a sturdy clothesline post that will stay in the installed position for the life of the post. Made of steel pipe and fittings as detailed at left, it is easy to install. The upright is a 9-ft. length of 1½-in. pipe threaded on one end to take a pipe tee. The crossarm consists of two lengths of pipe that give an over-all length of 5 ft. when fitted with caps and screwed into place. A ¾-in. pipe brace welded on the upright at a point 3 ft. from the top holds it rigidly in position when the unit is set in concrete footings as shown. The lines are kept tight by turnbuckles. — C. Neal, Carbondale, Ill.

☐ One coat of water-soluble paint will cover most porous surfaces if the paint is applied by means of a sprayer. A primer coat of oil-base paint is necessary for brush applications.

☐ Wooden tongue depressors are kept in the shop of one home craftsman for mixing small batches of glue, paint and other materials. They can also be used for applying grease and similar compounds.

## Knob Extension on Steel Tape Makes It Easier to Crank

For easier turning of the handle on a 50 to 100-ft. steel tape, slip a rubber fuller ball on the crank knob for a better grip as shown in the photo below. Such rubber balls are used as washers on old-style, full-er-type faucets and can be obtained from most plumbing-supply stores and some hardware stores.

R. Hanscom, Elmhurst, Ill.



## Use Toothbrush Assembly For Cleaning Chuck Threads

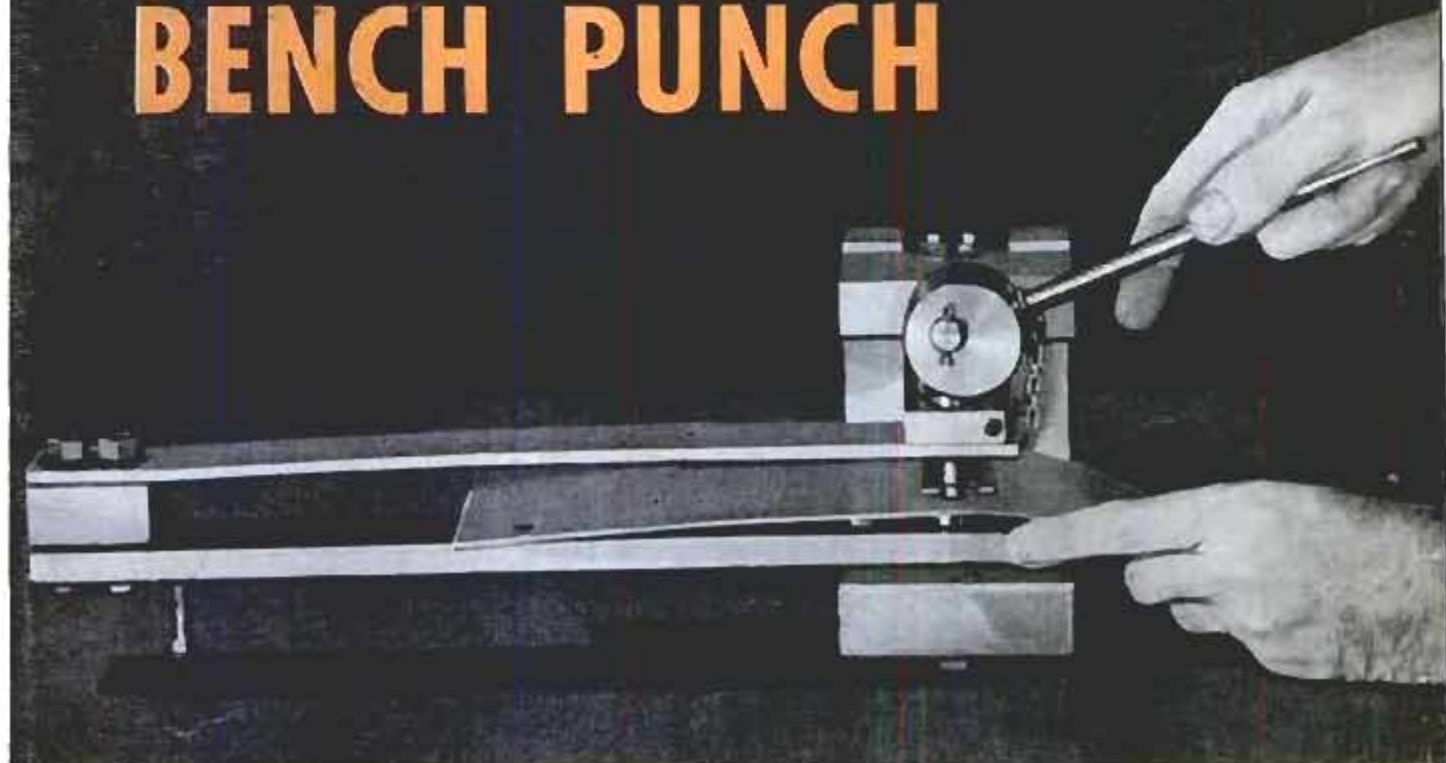
Removing chips and dirt from the inside threads on the hub of a chuck back plate, before assembling the chuck on the lathe, is easy when you have a brush such as the one shown to do the job. To make one like it, simply tape two toothbrushes back-to-back on a wooden block so that the bristles bear against the threads as shown.

H. J. Gerber, Stillwater, Okla.





# MAKING A BENCH PUNCH



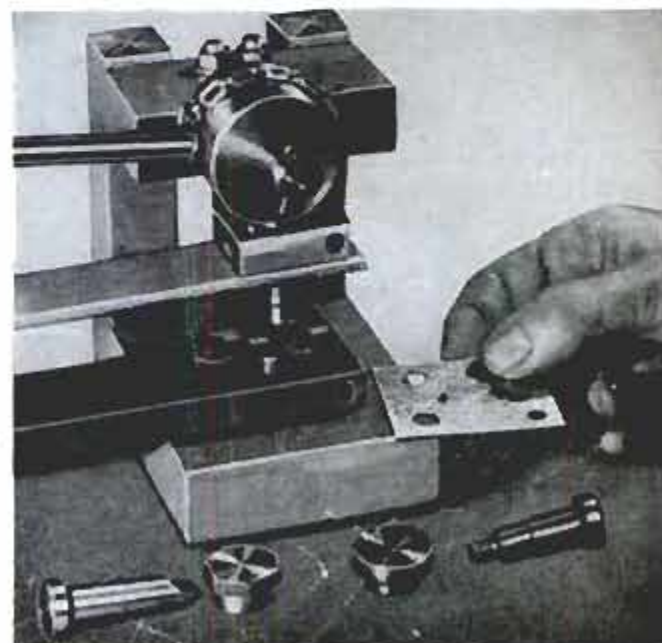
By Walter E. Burton

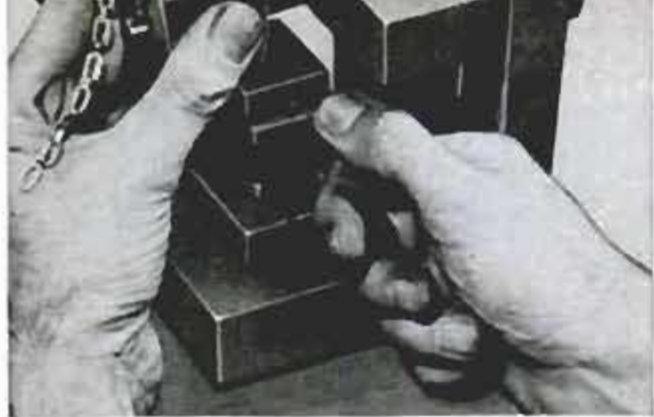
ONE STROKE of this lever-operated punch makes a clean, true hole in sheet metals up to about 22 ga., the maximum hole size being  $\frac{3}{8}$  in. By substituting a chisel and an anvil of soft metal for the punch and die, light cutting and shearing operations can be carried out on sheet metals, also cutting of wire and small rods to length. The maximum reach of the punch is about  $2\frac{1}{2}$  in. from the edge of the material to the center of the hole. The swing, or distance inside the arms, is about 12 in. This means that the punch will work in from the edge of the material  $2\frac{1}{2}$  in. and will punch a row of holes for a distance of 12 in. Of course, the material can be worked at an angle with the arms to increase the capacity somewhat.

The base should be made first as it is then somewhat easier to work out the relationship of the various parts. Note in the assembly view and also in the photo on page 191, that the arms can be placed on the base in two positions. This is made possible by two pairs of tapped holes, details C and D in the assembly view. The location of the holes is shown on the detail

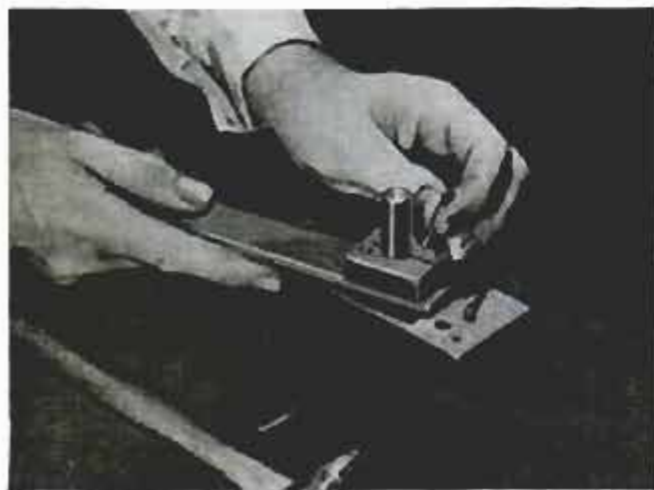
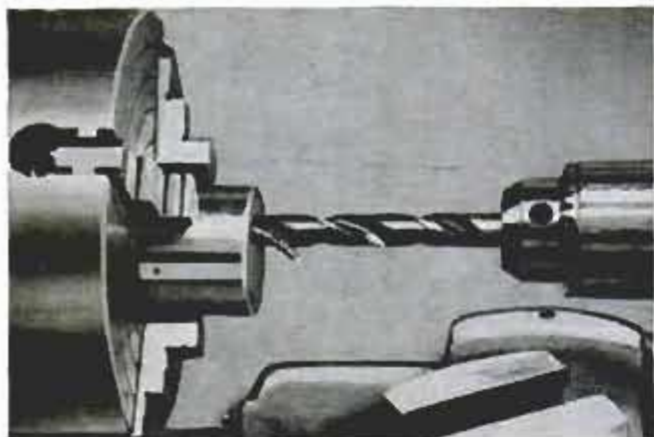
of the base. After the base has been finished, cut the cam-support posts, detail B, to length from 1-in. square stock and center-drill and tap one end of each for the  $\frac{1}{2}$ -in. capscrews which attach these parts to the base. Locate and drill  $\frac{1}{2}$ -in. through

Punch has a capacity of  $\frac{3}{8}$ -in. in metals up to 22 ga. Can also be used with chisels for cutting off

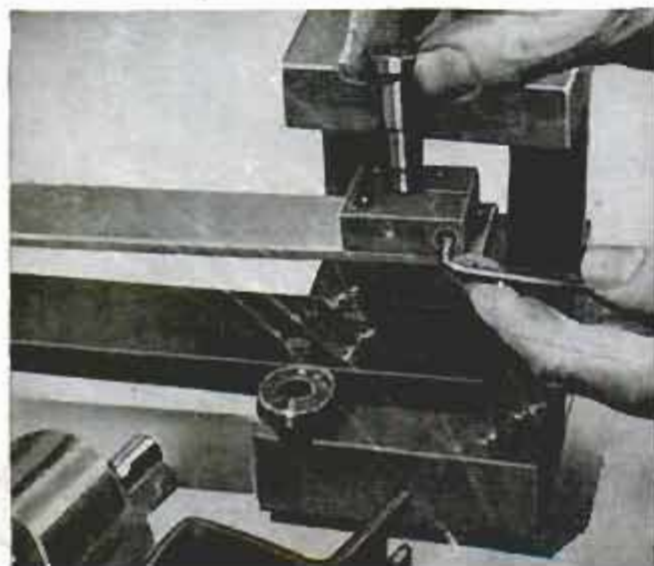




Above, fitting cam which operates punch. Cam has 5/16-in. throw and is lever operated. Below, boring offset hole in cam for spindle. Cam, punch and die are only parts which require use of a metal lathe



Above, punch holder is located with a 1/2-in. aligning pin before riveting in position on upper arm. Below, punch holder is slotted so it serves as a pinch clamp to hold punch in place. Note position of arms

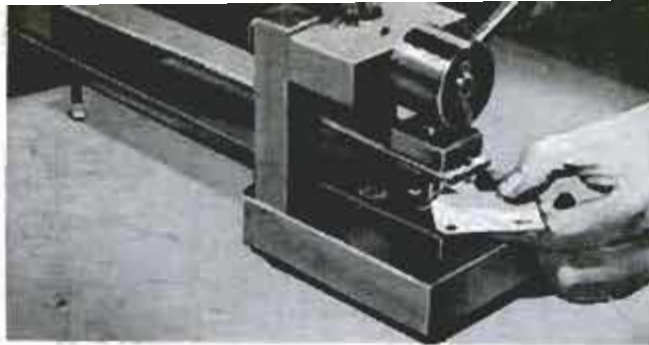


the base and tighten the capscrews holding them in position. Then locate the two blind holes near the ends. Place these parts on tap holes in one edge of the cam-support block, part A, using the posts as locators. Drill and tap these holes for 1/2-in. capscrews. Precise depth of the holes is not important. Drill the hole in the opposite edge of the support for the cam spindle and then drill a tap hole into it from the top face. Tap this hole for a 1/4-in. setscrew. Locate and drill the through holes for bolts holding the stripper.

Next, make the cam, punch and die. These parts are turned in the lathe and hardened. Several sizes of punches and dies will be needed to cover a range of work. When drilling holes through the upper arm, spacer and lower arm for the bolts holding these parts in position, care must be taken to see that the holes for the punch and die are in alignment concentrically. Note also that while the end of the lower arm is drilled and slotted to form the die holder, the punch holder is a separate part riveted in place on the top face of the upper arm. Both the die holder and the block forming the punch holder are slotted through the hole and provided with clamp screws. The slotted members serve as pinch clamps to hold the punch and die in position.

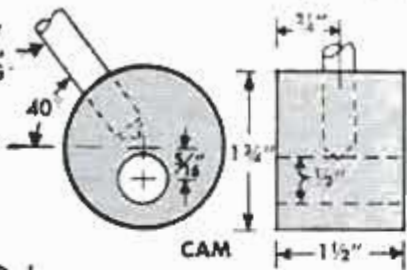
The stripper is not an essential part, although it does speed up the punching of a line of holes by stripping the stock from the punch automatically on each upstroke. Due to the short stroke of the punch the resiliency, or spring, of the upper arm cannot be relied upon to return the punch to the up position, especially when the punch must be stripped from the heavier gauges of sheet metal. Positive return of the punch to the up position is accomplished by a retracting chain, pictured in the upper left-hand photo and in detail E on the opposite page. One end of the chain is attached to the end of the upper arm as in the detail. The opposite end is looped around the cam handle, or lever, as in the photos on the preceding page. The chain is adjusted to the correct length by trial.

As designed and detailed the unit is portable. It is not attached to the bench or a stand. The base, as will be noted from the details, is supported at three points by heads of the two capscrews holding the cam-support uprights, or posts, and by a third capscrew turned into a tapped hole in the base. The outer end of the arm assembly is supported on a single adjustable leg. This is made by running the threads down on a carriage bolt and turning it into a tapped hole in the lower arm. The bolt is adjusted to support the arm at the required height and is held in position with a jam nut. ★★★



Arm assembly of punch can be placed in two positions. Compare with detail below and with photos on page 189 and lower left-hand photo, opposite page

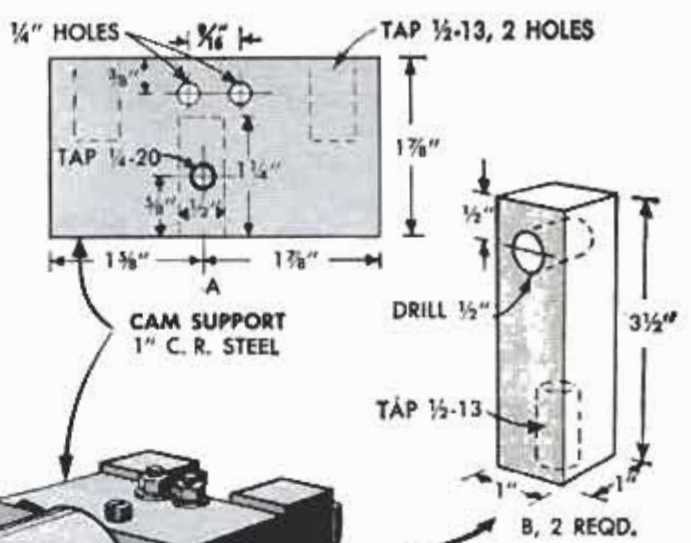
HANDLE,  
3/8" DIA.,  
8" LONG



CAM

COTTER  
PIN

CAM SUPPORT  
1" C. R. STEEL



STRIPPER

PUNCH

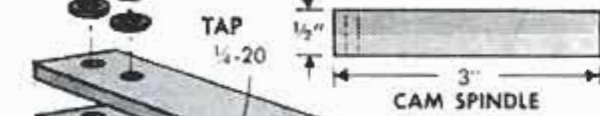
RIVETS

HOLDER

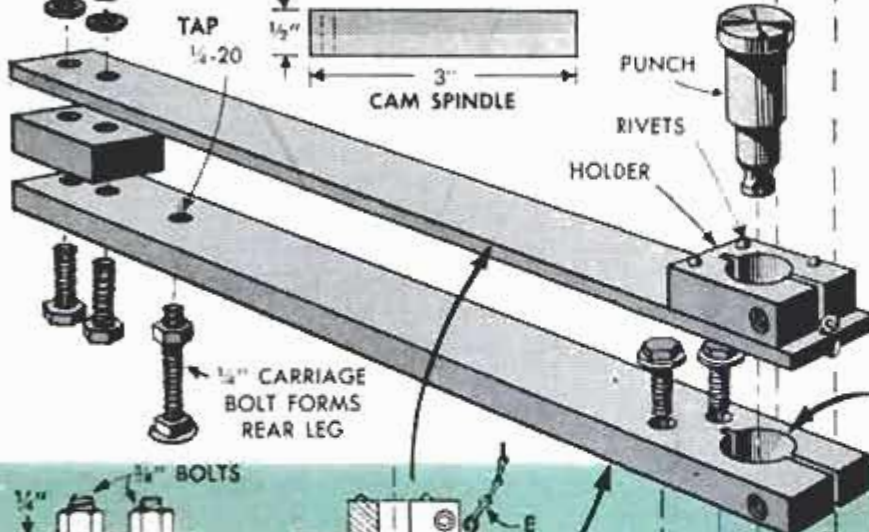
BASE

DIE

1/2" CAPSCREW SERVES AS FOOT

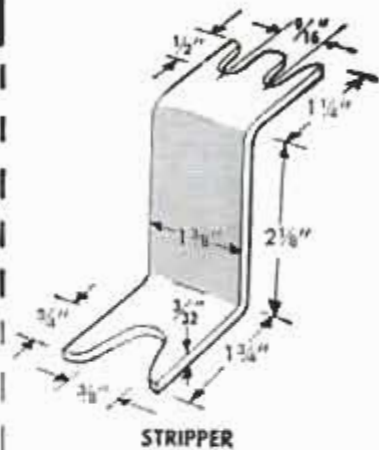


CAM SPINDLE



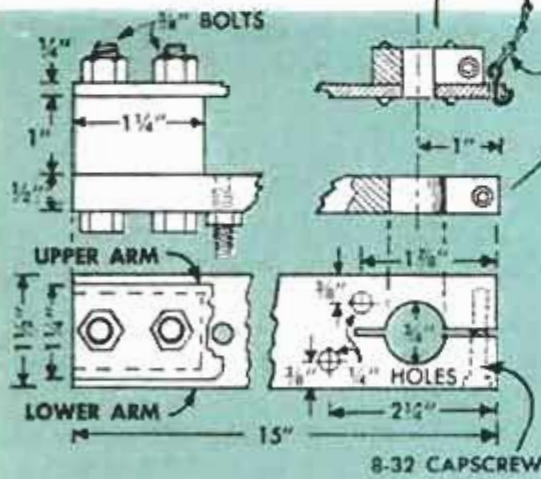
TAP  
1/2-20

1/2" CARRIAGE  
BOLT FORMS  
REAR LEG



STRIPPER

PUNCH HAS MAXIMUM  
CAPACITY OF 1/8" IN  
THIN SHEET METALS

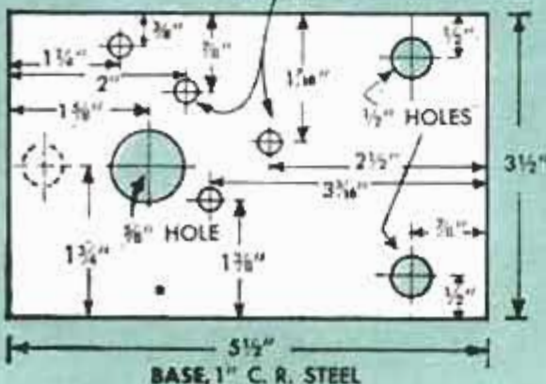


UPPER ARM

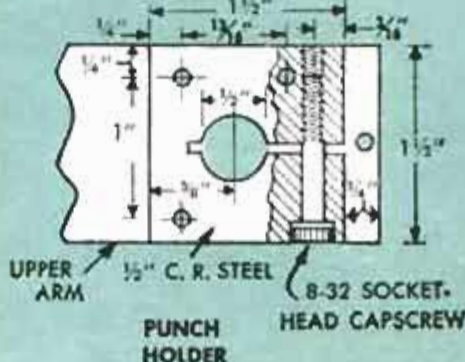
LOWER ARM

TAP 1/4-20,  
4 HOLES

8-32 CAPSCREW



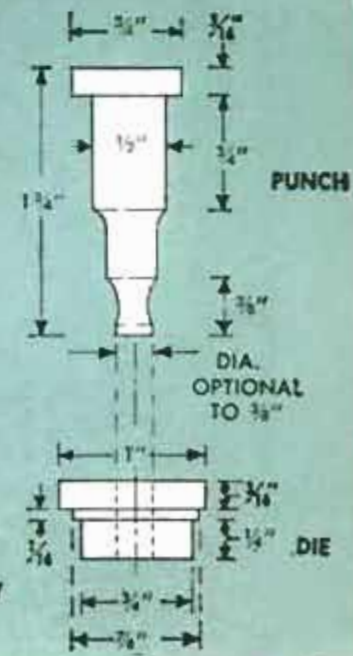
BASE, 1" C. R. STEEL



UPPER ARM  
1/2" C. R. STEEL

PUNCH  
HOLDER

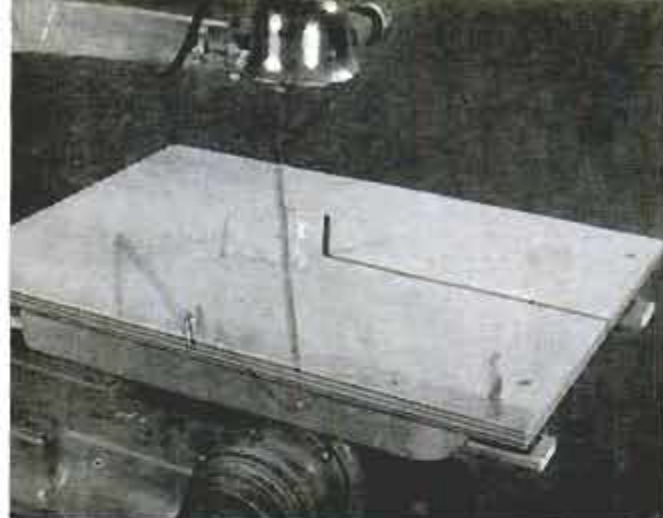
8-32 SOCKET-  
HEAD CAPSCREW



PUNCH

DIA.  
OPTIONAL  
TO 3/8"

DIE



### Auxiliary Jigsaw Table

For some types of work an auxiliary table on the jigsaw is an advantage. For example, in fine fretsawing the work may require support closer to the blade than the standard table slot will permit. Cut a piece of plywood roughly to the table size, pencil a guide line to the center of the piece and run a cut in from the edge to the center with the fret blade you are using. Clamp the plywood table in place. Do the same when you are doing heavy saber sawing and the saber blade needs extra support.

### Lathe Doubles as Paint Mixer

If you've ever tried mixing paint left-overs in which the pigment has settled to the bottom of the can, you know it takes a lot of shaking, and a lot of work with a paddle or putty knife to get the paint in condition to use again. One craftsman uses his metal lathe as a shaker. Add thinner as required, press the friction cover on tightly and mount the can in the 4-jaw chuck as shown. Then run the lathe at slow speed for a minute or so. Just make sure the lid is on tightly, otherwise you're in trouble.



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## IT TRIMS THE TREETOPS

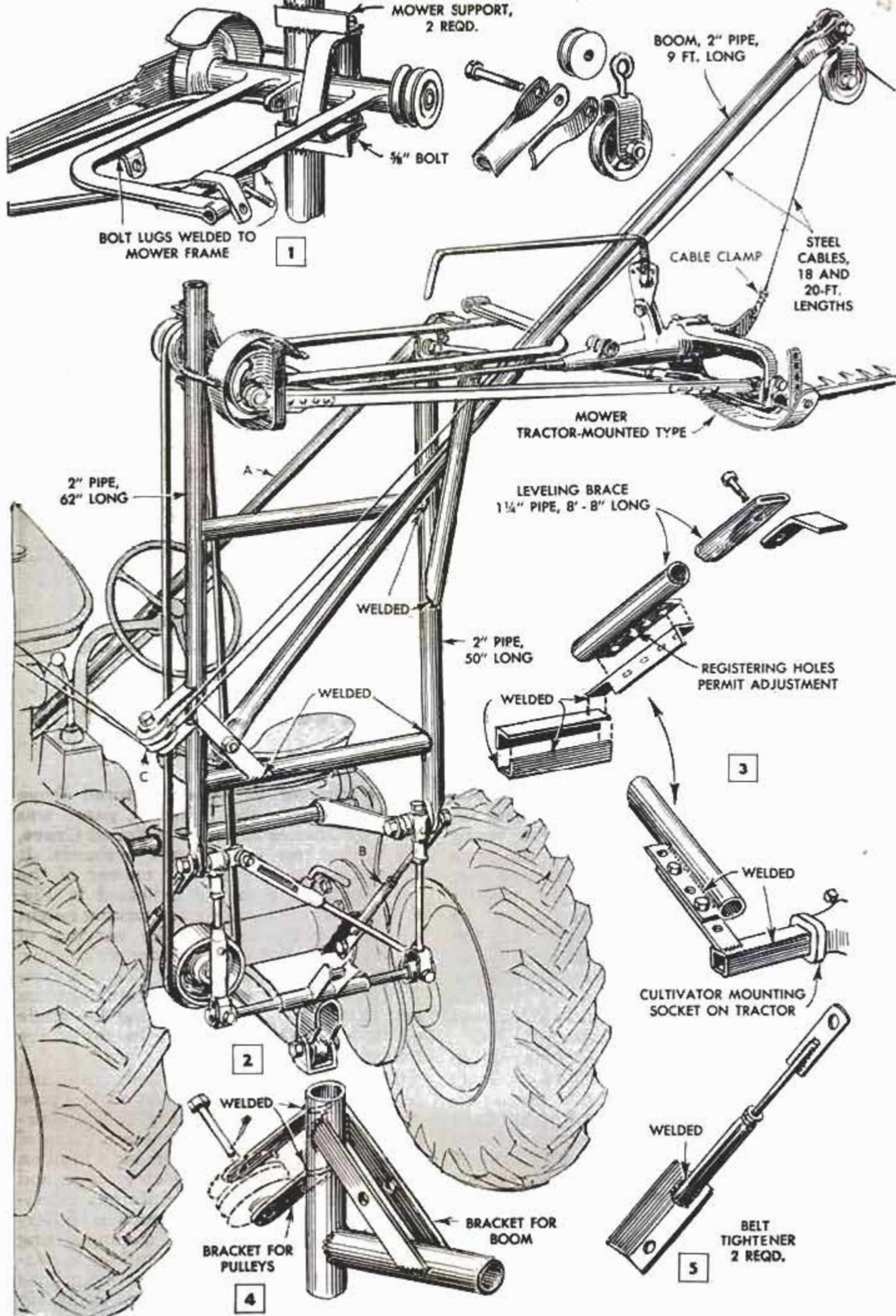
By Dirk C. Bloemendaal

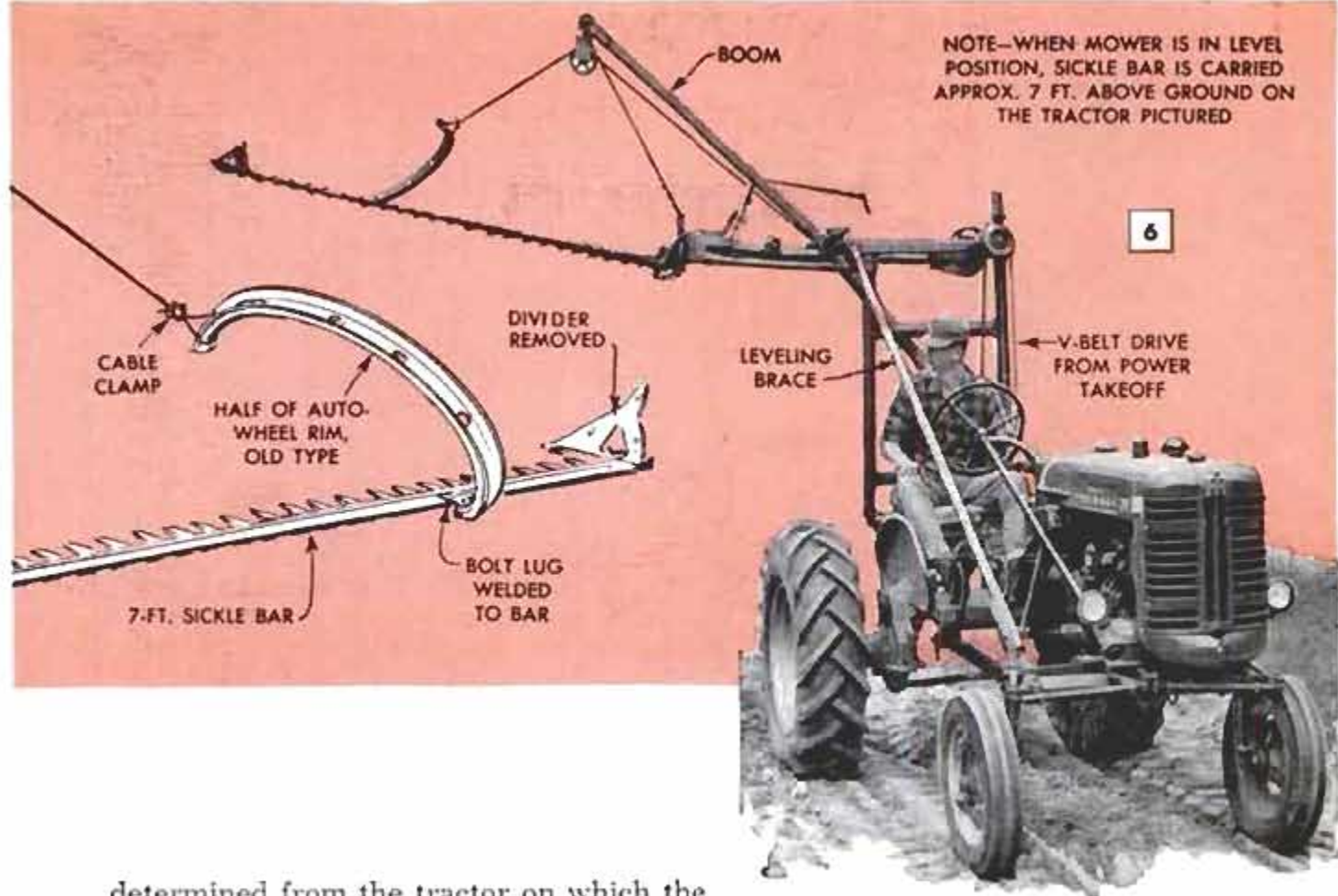
**A**FTER CONSIDERABLE experimentation in peach-growing sections, orchardists have found that healthy young peach trees will produce about the same amount of quality fruit from year to year when the tops are trimmed just slightly above standing height, thus placing the highest fruits within easy reach from the ground. This practice eliminates the use of high ladders to reach fruit on the topmost branches at picking time, reduces unavoidable ladder damage to the individual trees and cuts time and labor costs.

Usually trimming, or topping, is not advisable in older orchards where the trees have been trained to a greater height, although in some instances larger trees have been topped at an angle from both sides of the row with favorable results. Although topping has been done experimentally during the growing season, as pictured above, it is not a generally recommended practice. Topping usually is carried out when the trees are dormant, the precise timing varying with the locality and the seasonal changes.

The trimmer, or topper, pictured above and detailed on the following pages was built by Charles Klynstra of Forest Grove, Mich., for use in his own orchards. It utilizes a standard tractor mower of the rear-mounted type. As indicated in Fig. 6, the mower is carried at a working height of about 7 ft., the distance varying, of course, with the angle of the sickle bar. The working height of the sickle is controlled with the tractor's hydraulic system and two cables, one controlling the angle of the sickle, the other the height of the mower.

The frame which carries the mower and boom is made up from lengths of steel pipe welded at all joints as in Fig. 2. The overall dimensions of these parts are those of the original frame which was built to fit on the tractor pictured. Any other type and size of tractor will require different dimensions and in some cases a somewhat different assembly of the parts of the supporting frame. For this reason the builder is cautioned not to cut material until dimensions of required parts have been definitely





determined from the tractor on which the trimmer is to be used. Different mowers also will require somewhat different methods of mounting. The mower is driven by a single V-belt from the tractor power take-off as in Fig. 2. To provide a means of tightening the belt, the tighteners, or jacks, Fig. 5, are made up from steel rounds, flats and angles. The tighteners are shown in position in Fig. 2, detail B.

The leveling brace shown in position in Fig. 2, detail A, has a provision for adjustment as shown in the pulled-apart view and the assembled view in Fig. 3. Registering holes are drilled through the lug welded at the lower end of the brace and through a short length of angle. The latter is then cut away at one end as indicated and welded to a short length of square tubing made by welding two lengths of steel angle web-to-web. The square tube must be of a size to fit into the socket on the tractor frame which normally takes the square tube supporting the cultivator gang.

The lower end of the boom and the twin idler sleeves which carry the steel cables are mounted on brackets formed by welding flat steel to one upright and the lower cross member of the frame which supports the mower. The relative positions of these parts are shown in Fig. 4 and in detail C, Fig. 2. Note especially that there are two cables and that they pass over separate sheaves at the upper and lower ends of the boom. On the original unit the boom simply rests in the vee formed by the upright

and brace as in Fig. 2. However, if changes must be made in the supporting frame due to use of a different mower or tractor, or both, then it may be necessary to support the boom on a separate member. The relative positions of the parts in the original unit can be seen in Figs. 2 and 6.

The sickle is carried at the desired angle and height by the longer cable, the outer end of which is clamped to one half of an older-type auto-wheel rim. The curve of the wheel rim permits the clippings to clear the sickle bar without clogging. A divider at the outer end of the sickle is not necessary. It should be noted that for average use a sickle with serrated sections gives the most satisfactory performance. The serrated sections tend to grip the twigs and sever them cleanly, whereas the smooth sections may permit the twigs to slip forward along the cutting edge before they are completely cut off. This can result in a rather rough, uneven cut and a tendency to strip the bark on the uncut portion of the twigs. Of course, the serrated sections should be ground frequently to obtain the best results. All parts of the sickle bar should be in good condition. Worn wear plates and knife clips should be replaced, as any undue play in the sickle will permit the sections to ride above the ledger plates on each cutting stroke. This will result in a rough cut and a tendency of the severed twigs to follow the sickle, rather than falling clear. ★ ★ ★



## Spindle-Nose Collet Holds Round Rods

When it is necessary to work close to the headstock on small parts that are to be finished or semifinished, a conventional chuck is sometimes a definite handicap. This is especially true when the work is done on round stock passed through the hollow spindle. That's why machinists often resort to an improvised spindle-nose collet like that detailed. Use of the collet clears the area around the spindle nose, relieves the operator of the necessity of keeping a close watch to prevent nicking the rotating chuck jaws with the cutting tool when the nature of the work makes it necessary to manipulate the carriage by hand. The collet is counterbored to take the work and is machined and tapered to fit the spindle nose. One or two socket set-screws, preferably of brass, hold the work for machining.

## Mandrel Aids in Chucking Precision Washer for Final Facing Cut



When machining a precision thrust washer or a narrow bushing, one of the problems is chucking the work for the final facing cut. There are several methods, of course, but this one gives a high degree of accuracy and it's fast. First, chuck the rough stock, turn to the required finish diameter, and face off one side. Center-drill the work before removing from the chuck. Saw off, leaving stock for the final facing cut. Then mount the work on a mandrel, chuck it as pictured, and make the final facing cut.



## Swinging Guard in Dustpan Retains Metal Parts

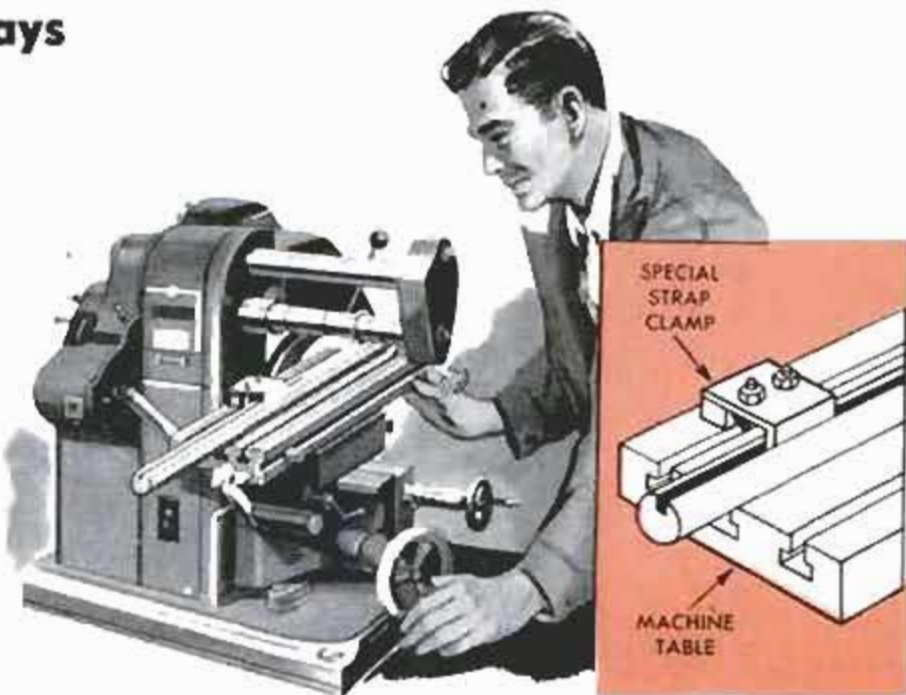
A simple wire swing guard in the dustpan can aid you in locating small parts accidentally dropped on the shop floor. Bend the guard from heavy wire to a U-shape that will fit inside the pan as illustrated. Then drill two small holes in the sides of the pan, bend the ends of the wire at right angles and insert in the holes. Sweep chips and shavings, everything on the floor, into the pan. Then brush the lighter material into the waste can and there's your lost part, still in the dustpan.

Ultrasonic vibrations can be combined with ordinary welding techniques to form stronger welded joints, according to scientists at Battelle Memorial Institute of Columbus, Ohio. The high-frequency vibrations reduce the surface tension of molten metals, permit more intimate metal-to-metal contact. Vibrations also drive out gas bubbles.



## Full-Length Keyways Milled in Rounds

By strap-clamping the work in the table T-slot and using a special guide you can cut a full-length keyway. The guide is milled with a lug which fits the keyway with .001-in. clearance. Clamp the work and mill the keyway as far as possible from the left end of the table. Then locate the guide and clamp in place with two spacers, the lug engaging the keyway. It is now possible to shift the work without changing the center line.

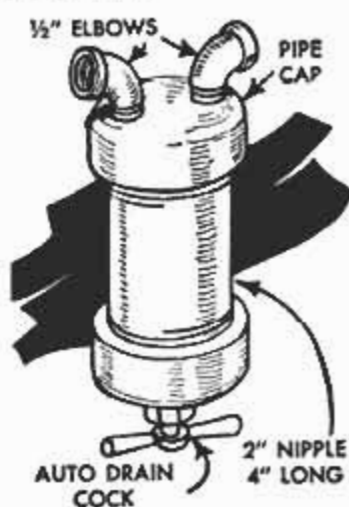


## Cut Wide Stock With Hacksaw

Here's an emergency method of cutting through sheet metal which is wider than the maximum swing of the hacksaw frame, and too wide to permit running a cut in from opposite edges. Score the dimension line across the stock, then measure  $\frac{1}{2}$  in. from the first line and score a second line in the waste. Saw down both lines as far as the saw frame will permit and then bend the waste strip down. This will give the necessary clearance for the saw frame. Continue sawing alternately on both lines, bending the strip down as you go. As a rule it will be found that a fine-toothed blade works best when making the alternate cuts.

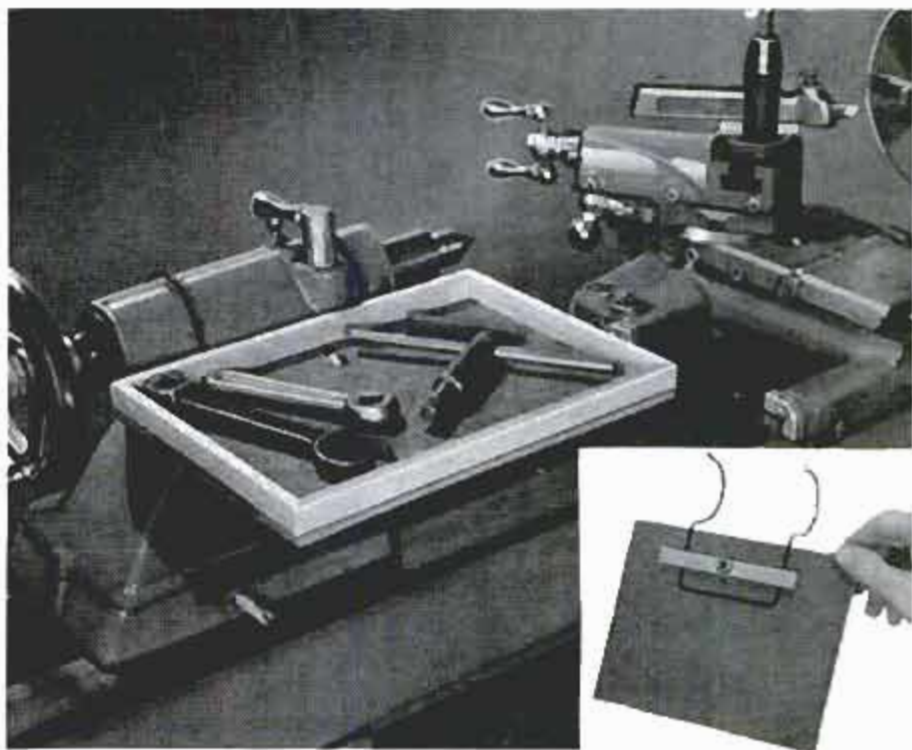
## Moisture Trap in Airline

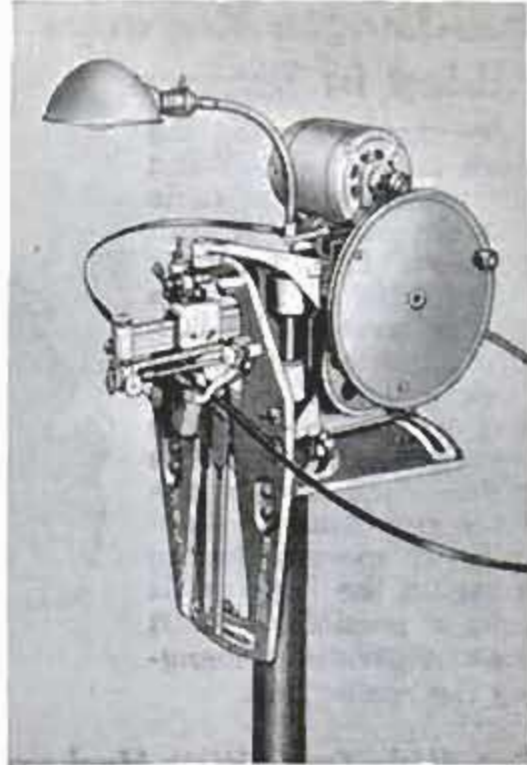
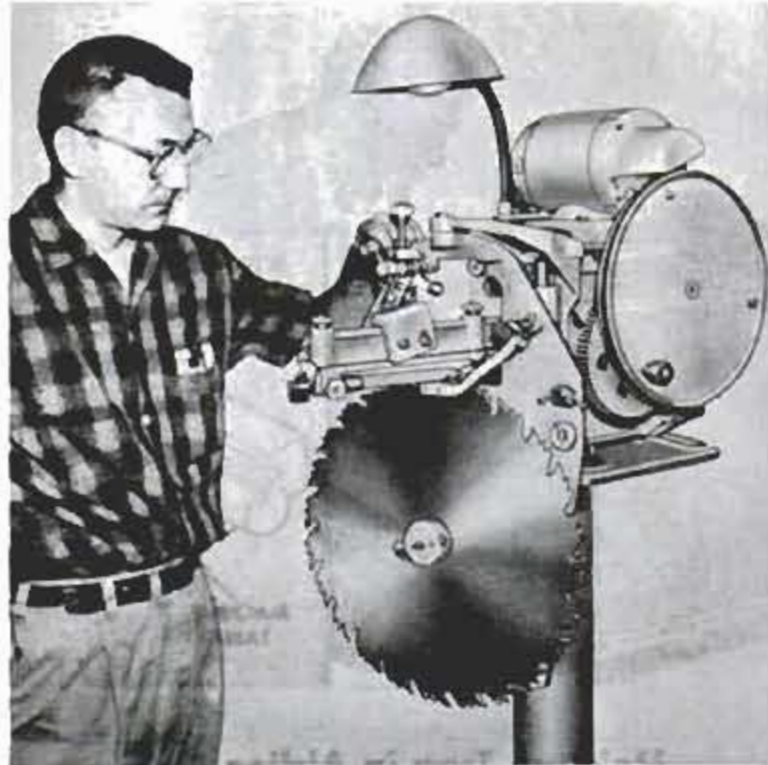
Under some conditions moisture in the airlines powering pneumatic tools can cause trouble. A simple and effective trap can be made by assembling a pipe nipple, two caps, two  $\frac{1}{2}$ -in. elbows and an auto-type drain cock.—Henry Josephs, Gardenville, Pa.



## Lathe Tool Tray Fits on Tailstock

A small tool tray with-in easy reach can save a lot of time when working on a lathe project requiring frequent set-up changes. This tray measures 6 x 8 in., with a hardboard bottom and  $\frac{1}{2}$ -in. sides and ends. A length of heavy wire is bent as in the inset photo, and attached to the bottom with a hardwood cleat and a single screw. The hooks formed at each end of the bent wire fit tightly over the tailstock barrel. Tray holds cutting tools, chuck and tool-post wrenches and collets.—R. Hanscom, Elmhurst, Ill.





# SHOPPING FOR TOOLS

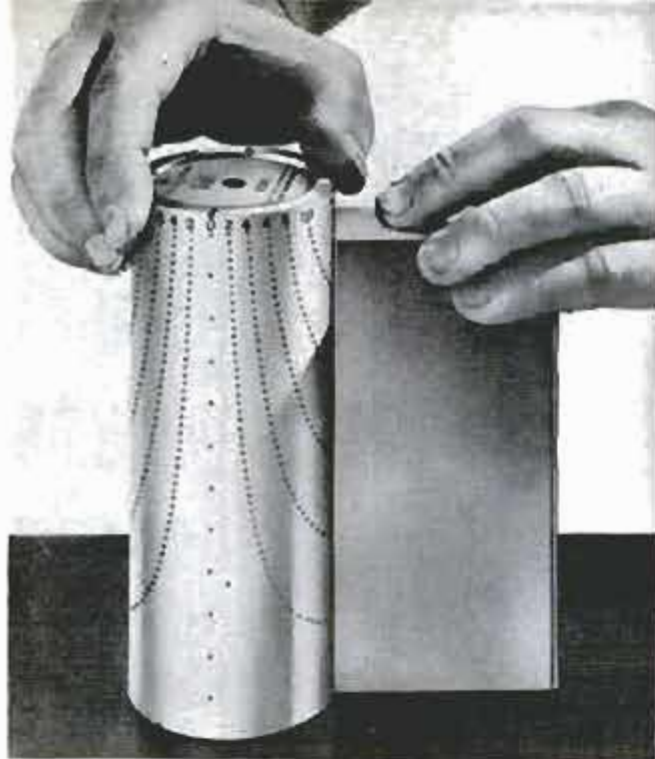


**AUTOMATIC SAW FILER**, above left, is said to be the first machine which will file circular-saw blades having combination teeth. On the combination blade, now widely used, teeth are arranged in segments separated by deep gullets. Each segment has two or more teeth which can be sharpened with a standard three-cornered file. On the new automatic filer, feeding mechanism is so designed that it feeds an entire segment at a single stroke. In this way only the first tooth of each segment is filed all the way around circumference of blade. Feed then picks up second tooth and repeats. Machine also can be used for filing bandsaw blades and all handsaws, above right  
 Foley Mfg. Co., Dept. 200, Minneapolis 18, Minn.



**PAD SANDER**, center left, has a housing designed to permit the operator a clear, unobstructed view of the front edge of the pad for feathering operations and working closely in corners. Movement of the pad is  $3/16$  in. which makes it possible to use coarse, medium and fine-grade abrasives on wood, metal, plastic. Speed of pad is approximately 3500 orbits per min.  
 Portable Electric Tools, Inc., 320 W. 83rd St., Chicago 20

**CARBIDE-EDGED SAW BLADE**, left, has no conventional teeth separated by gullets. Teeth, which are grains of carbide, are inserted at uniformly spaced intervals along edge of disk. Result is exceptionally smooth cut on wood and nonferrous metals, particularly small parts which can be cut off, mitered or ripped without burring, splintering or chipping  
 Lemmon & Snoop, 2618 Thornwood St., S.W., Grand Rapids 9, Mich.



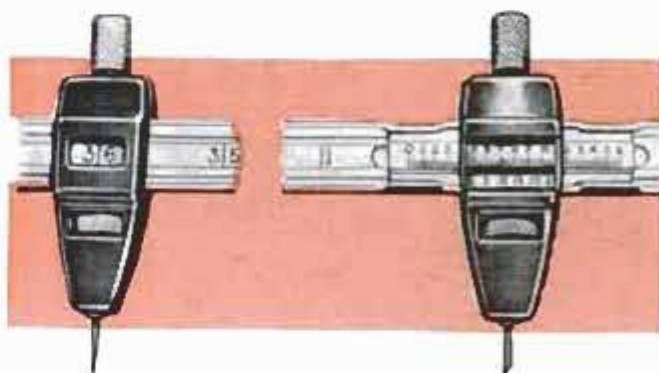
**CYLINDRICAL SQUARE**, above, is direct reading, shows variations from square in units of .0002 in cylinder. Eliminates need for transfer instruments. One end of unit is precisely ground and lapped out of square so that when rotated, angle with base surface will, at some point, match the angle of the workpiece  
Brown & Sharpe Mfg. Co., Indust. Prod. Div., Providence 1, R.I.



**DUSTLESS PAD SANDER**, upper right, comes with a special dust-collecting attachment which makes it possible to hook up sander with ordinary household vacuum cleaner for dustfree sanding in home shop. Regular package includes sander with 5-ft. flexible hose and universal fitting for attachment to cleaner  
Black & Decker Mfg. Co., Towson 4, Md.



**REVERSIBLE HEAD**, upper view, center, fits any 1/2-in. drive handle, extension, or torque wrench, has self-contained mechanism that provides "free wheeling" action in either direction. To reverse direction, head is simply pressed down and released. Head is compact, only 1-1/16 in. in dia. for use in restricted space  
Proto Tool Co., 2209 S. Santa Fe Ave., Los Angeles, Calif.

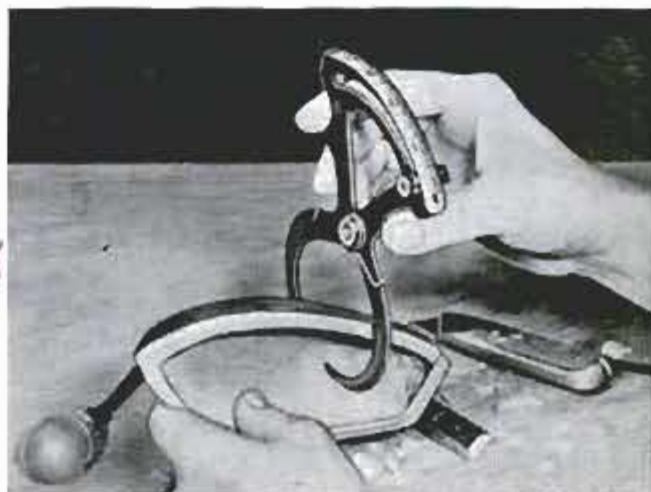


**BEAM COMPASS, OR TRAMMEL**, lower view, center, is four tools in one as it may be used as a caliper, beam compass, scale and divider. It is available in lengths ranging from 5 to 36 in. in increments of 1 in. Scales are easily read through windows in the cursors. Can be accurately set to transfer or lay out dimensions  
Ferance Construction Co., Penfield, N.Y.

*28 WOODSIDE DRIVE  
PENFIELD, New York*

**DIRECT-READING CALIPER**, right, enables the user to caliper thicknesses at a distance from edge of work equal to maximum reach of legs. Curved legs permit measurements to be taken over flanges or other obstructions of greater sectional thickness than the work at the point of measurement. Eliminates transferring  
The Drumcliff Co., Dept. 300, Towson 4, Md.

(Continued on next page)



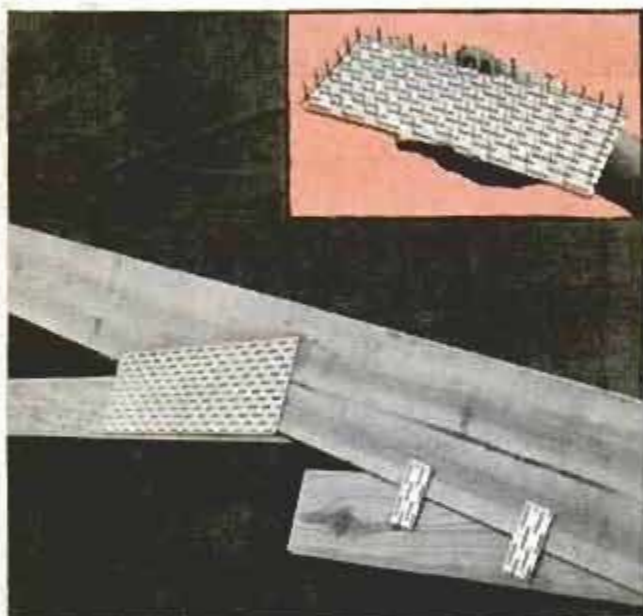
# SHOPPING FOR TOOLS

(Continued)



**FACEPLATE LATHE**, left, is designed for faceplate turning of wooden bowls, lazy Susans, trays, circular picture frames and small table tops. Both faces of work can be turned without removing it from faceplate. Weighs 40 lb., takes 18 x 21-in. bench space.  
The Bowlathe Co., 125 Bruce Rd., Walpole, Mass.

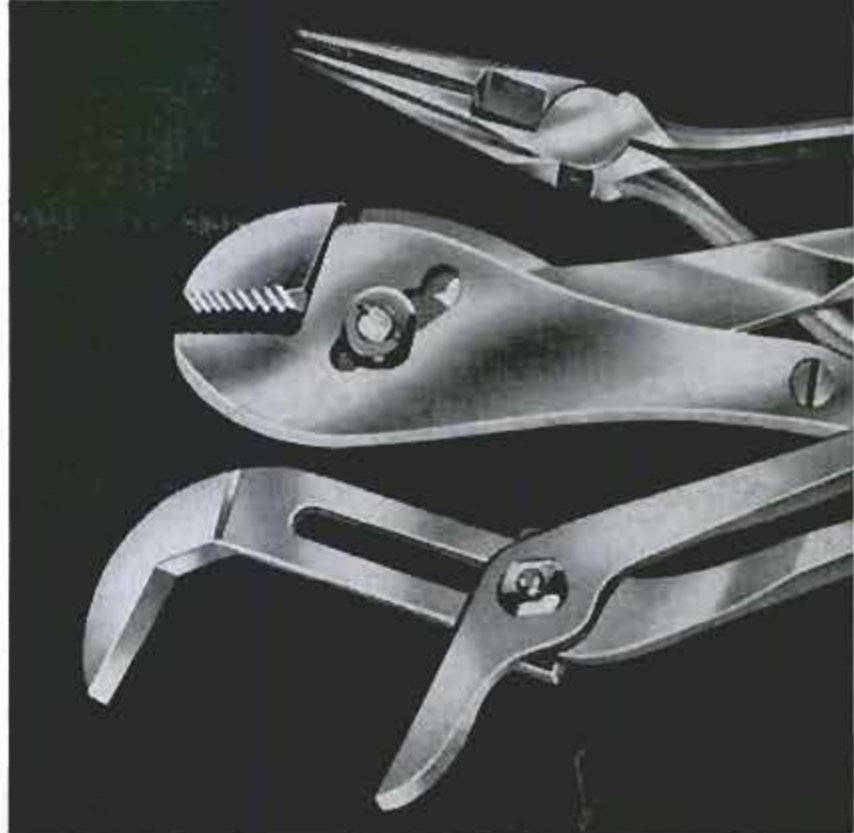
**CONNECTOR PLATES**, or gussets, center, are made from 14-ga. galv. steel and are perforated to form nail-like projections. They provide a fast and effective means of machine-nailing roof trusses and other pre-fab wooden structural units. Available in 55 sizes.  
Gang Nails, Inc., P.O. Box 7066, Miami 55, Fla.



**PORTABLE FURNACE**, lower left, comes in handy in the small shop for heat-treating, brazing and melting nonferrous metals. Heat chamber is 4½ in. in dia. and 6 in. deep. Blowtorch or a gas torch can be used as heat source. Withstands temperatures to 2000 deg. F.  
Production Engineering Co., Garnet Lake, Johnsbury, N.Y.

**ALUMINUM EXTENSION LADDER**, below, is fitted with dielectric inserts which prevent current from grounding through legs of the lower section. Even though legs of upper section extend below lower rung of bottom section there still is no electrical contact.  
Kenworth Mfg. Co., 12500 W. Lisbon St., Milwaukee 16, Wis.





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Pliers in the top photo are, from top to bottom: #226, #234, #248-S.

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- Ultra-sensitive photo-cell meter automatically sets the lens for *any* 35mm film . . . 10 to 160 ASA. Manual override for flash.
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# Camera sets the lens for you!

*Built-in electric eye measures the light... governs the lens for proper exposure... automatically!*



**IN SUN**—the lens closes down for the precise exposure you need. Automatic settings for films 10 to 160 ASA.



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# How WEEDONE

helps you have a better lawn



Broad-leaved and other lawn weeds mar the appearance of your lawn, crowd out desirable lawn grasses, rob good grass plants of needed nutrients.



**WEEDONE** penetrates the weed, kills it roots and all. Dandelion and other lawn weeds die from leaf top to root tip, yet **WEEDONE** will not injure fine lawn grass.



By killing unsightly weeds, roots and all, you give desirable lawn grasses room to grow, preserve valuable plant nutrients which weeds rob from the soil.



You'll have a healthier, more beautiful lawn if you control lawn weeds the **WEEDONE** way. It's the original 2,4-D weed killer, now with 2,4,5-T added.

**WEEDONE** is easy and economical to use—liquid for sprayer, dry for spreader application. Harmless to children and pets. Sold wherever fine garden products are available . . . still at the same low price: 8-oz. can \$1.00, 5-lb. bag \$2.25. Larger sizes available. (Dry form slightly higher west of the Rockies.)



## WEEDONE



kills weeds, roots and all!

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# Clinic for Homemakers



As a service to our readers in solving the hundreds of problems pertaining to a home—inside or out—the editors of *Popular Mechanics* invite you to present your problems to the Clinic Editor for help and advice. Address your questions to The Clinic Editor, *Popular Mechanics Magazine*, 200 East Ontario Street, Chicago 11, Ill.



### Grass Clippings

**Q**—I have a large lawn and follow a regular feeding schedule. I also remove the clippings for the sake of appearance. I mow regularly, cutting the grass to a height of about 1 in., and my mower is equipped with a grass catcher. But now I'm told that removal of the clippings reduces the effectiveness of the feeding schedule by as much as 50 percent. Right?—F.D., Va.

**A**—Yes, but the loss is greatly reduced if you utilize the clippings as a mulch for shrubs or the vegetable and flower plots. The clippings are valuable as a mulch for any growing plants and also the lawn. They reduce moisture loss from the soil, increase its humus content and reduce erosion on slopes and terraces. We note you are mowing regularly to a height of 1 in. We would suggest that you raise the mower to cut 1½ in. minimum and arrange the mowing schedule so that the grass is cut regularly when growth reaches an average height of 2 to 2½ in. Leave the grass catcher in the garage. The only time its use is really justified is when the grass is allowed to grow to a height of 3 to 5 in. during vacation time or for some other reason. Then it is advisable to raise the mower to cut a minimum height of 2 or 2½ in., and remove the clippings. Save the clippings and return them to the lawn later on.



### New Stucco Over Old

**Q**—My home is about 30 years old and is finished in a gray stucco. I'm thinking of remodeling in order to change the outward appearance of the house and update the property. No major structural changes or additions are planned. What to do about the stucco is my problem. Should I have it replaced by wood siding, or can new stucco be applied over the old?

I. S., Ind.

(Continued to page 206)





## NEW BLACK & DECKER ROUTER-PLANE GIVES YOU COMPLETE CONTROL IN THE WOOD!

It's a  $\frac{3}{4}$  HP Router and a Power Plane combined!

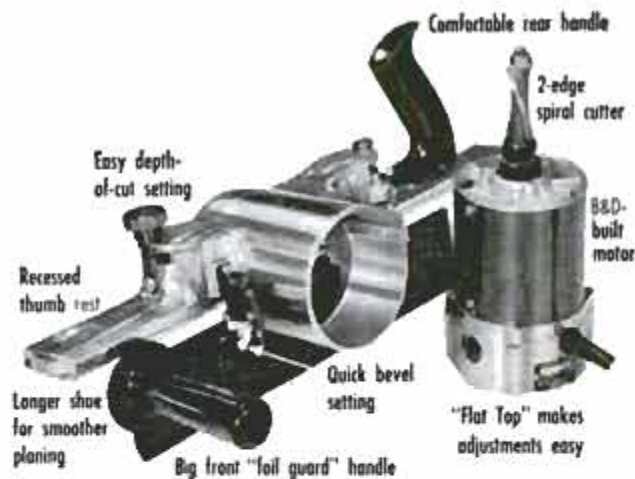
As a plane it gives you perfect balance, fast and accurate cutting, easy-to-use depth and bevel adjustments. Notice how that extra-length front shoe gives you greater accuracy in starting cuts. Notice how the motor is balanced midway between the hands for level operation. Notice how the longer front handle and thumb rest put you in control of the job at all times. Quickly adapted to  $\frac{3}{4}$  HP Router. (See below).

The powerful B&D-built Router motor handles continuous-duty operations on the toughest routing and planing jobs. Complete Kit includes router motor, plane attachment and router base in sturdy metal carrying case. Ask your B&D dealer about it.



### BLACK & DECKER $\frac{3}{4}$ HP HEAVY-DUTY ROUTER

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Dept. PM-5                      Emporia, Kansas

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(Continued from page 204)

A—You can suit yourself. As a rule it will cost more to remove the stucco and apply wood siding. Just what you do to get the most in improvement for the money expended depends to some extent on the size and general lines of the structure. If the original stucco is applied over wood lath then it will not be especially difficult to remove. But if it is applied over metal lath, then removal can be a rather time-consuming procedure. If the old stucco is still in good condition we would be inclined to suggest that you consider coating it with a suitable masonry paint or, if you wish to change the texture, applying new stucco over the old. Either step would produce a marked improvement in appearance at a reasonable cost. However, we also would carefully consider what is to be gained in modernization through the use of wood siding. If the structure is to be more completely modernized through the use of materials above and without major structural changes, as you say, then it is possible that wood siding will prove the best choice.



### Drainage Problem

Q—The back of my two-car garage is about 3 ft. from the lot line. The adjoining lot slopes toward the building and during heavy rains water runs under the sill and onto my garage floor. I am thinking of building a concrete curb back of the building to direct the water away from it. How deep should the curbing be below ground?—A.K., N. J.

A—We would hesitate to recommend installation of a concrete curbing as you suggest. It also could be that your local codes would not permit it. You could possibly consider installation of a concrete-surfaced waterway, but such an installation is exposed to frost damage and is otherwise difficult to maintain. In addition it may prove to be rather unsightly. What we would suggest is development of a grassed waterway. If this is carefully planned it usually proves the best solution to problems such as yours. The one difficulty is getting grass started, of course. Normally this should be done in the early fall when the weather is more or less settled and there is the least possibility of heavy rainstorms. First check the levels to determine the minimum slope, or fall, to carry the water away. This can be done with a carpenter's or mason's level attached to a length of 1 x 4-in. stock. Then remove soil to form a shallow depression not more than 2 or 3 in. deep and at least 2½ ft. wide along the back of the building. The fall from the high point of the waterway at one corner of the building need not exceed an inch or so. Then seed the depression and cover with muslin or burlap to prevent loosened soil and the seed from washing away. Keep the area well watered until the grass catches. Continue to water as necessary and apply plant food to encourage a vigorous growth.

### Time to Plant Dahlias

Q—Would you give a few pointers on growing dahlias, what time to plant, where to plant and how deep, what kind of soil?—H. L., Mo.

A—In general, dahlias should be planted in your locality during the last week in May or the first week in June. This is not a hard and fast rule, but in an average season the plants should do very well when planted during this period. The hole for the tubers should be at least 6 in. deep in rich soil and the tuber should be laid in the hole horizontally. Drive a stake close to the tuber so that it is ready to support the plant when the latter reaches a height of 2 ft. or so. After planting, refill the hole to about two thirds its depth. Dahlias will require additional plant food after reaching a height of 1 ft. or so. Work the fertilizer into the top inch of soil but keep it 6 or 8 in. away from the stem of the plant.

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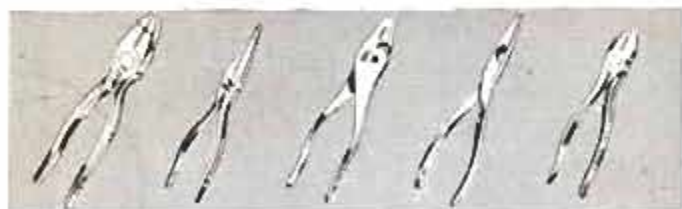
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MEADVILLE, PENNSYLVANIA

**A Former Olympic Star Tells  
How to Swim Like a Champ**

(Continued from page 138)

glide long enough with the arms before the pull is started.

**The breaststroke:** This is the slowest of all strokes but first-rate for distance swimming. There are two things that make the breaststroke basically different from the other strokes. One is the frog kick; the other, the arm-leg coordination.

Practice the following exercise before entering the water. Sit down on the floor, rest your hands on the floor in back of your body and stretch out your legs. Draw up the knees and spread them as far to the side as they will go. Your feet should be close together. Now point your toes out to the side, and thrust the legs far apart. Then bring them together again. The sweep of the legs as they come together provides the power. Count one-two before starting the next kick. Repeat this 20 times. Find a bench and try the same movements on your stomach.

Now for the arm stroke. Stand up and reach for the sky with both arms. Pull them down and back on a 45-degree angle until they're below the shoulders. On the recovery, spread your elbows until your hands are in front of your chest, then reach for the sky again.

Next step is to coordinate the arm and leg strokes. From a standing position, try it with one leg. The knee should be fully raised at the same moment your hands are in front of your chest. You kick at the same time you thrust your arms in front of the head. When your arms and leg are fully extended, you are in the glide position, the resting point of the breast stroke. Hold this position about two counts between strokes.

**First on Land Then in Water**

After repeating this exercise about 20 times, you're ready to try it in the water. Start in chest-high water with a strong push from the bottom. When the momentum of the glide is nearly spent, pull down your arms and bring up your knees. Follow through the stroke as you practiced it. The position of your head is important. To attain maximum speed, your face should be submerged during the glide.

Some common faults of the breaststroke pupil: 1. Using the scissors kick rather than the frog kick; 2. Bad timing of legs and arms; 3. Allowing the legs to sink too deeply in water; 4. Failure to relax; 5. Pulling the arms back too far; 6. Bringing the knees up too far; 7. Floating, instead of sweeping,

(Continued to page 210)

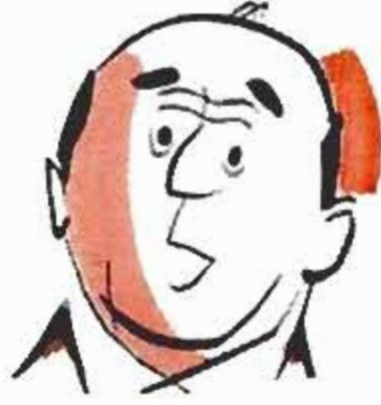
How often have you heard these sad good-byes?



"I'M SORRY, BUT WE'RE ONLY CONSIDERING HIGH SCHOOL GRADUATES FOR THIS JOB."



"SEEMS LIKE YOU MIGHT HAVE WHAT IT TAKES— BUT WE'RE NOT HIRING— INEXPERIENCED MEN."



"YOU'D NEED PLENTY OF TECHNICAL TRAINING FOR THIS JOB. WE CAN'T TAKE TIME TO TRAIN YOU."

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**2. EARN COLLEGE CREDITS...** Through USAFI and cooperating universities throughout America and overseas, you can earn college credits without worrying about expensive tuition bills. You can take your choice of more than 60 college correspondence courses from USAFI—and take

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CRESCENT TOOL COMPANY, JAMESTOWN, N. Y.

the legs back; 8. Holding the breath; 9. Breathing jerkily rather than rhythmically.

**The backstroke:** Though the timing is the same as in the crawl, the breathing is different, since the head is kept out of water. The position of the body is straight. The chin should rest on the water's surface. There are several techniques of swimming backstroke. I am credited with the development of the straight-arm recovery. The popularization of the bent-arm recovery can probably be traced to Eleanor Holm. There is not much advantage of one technique over the other, except that in the bent-arm recovery there is a tendency to reach back too far—and this wastes energy. Your arms should fall back to a position just beyond a 45-degree angle. Never pull back strenuously. Rather, the arm should be placed in water and anchored there, as the body passes by. Visualize a rowboat oar in action. The oar is dipped into the water and the boat is pulled past.

Your legs employ the same six-beat flutter kick used in the crawl, but here it's inverted. Your power comes mainly in the up kick.

Common faults of backstroke beginners:  
1. Extending the arm too far back; 2. Pulling the arm too deep; 3. Pulling the arm too fast, causing it to zigzag and slip; 4. Bending knees too much; 5. Bending at the hips, causing the body to sink too low in the water; 6. Poor leg-arm coordination.

**The butterfly:** In the butterfly, the arms enter the water at a point just inside the line of the shoulders, with the arms naturally extended. The hands should be six to ten inches apart and bent down slightly at the wrist. The arms drive downward at the side of the body and make a complete revolution.

### Feet Kick Like a Mighty Whip

The kick dominates this stroke. The legs work in double action, and the power is in the downward thrust of the legs working together. The knees are bent until almost the end of the downbeat. Then they straighten quickly, giving a mighty whip to the feet. The upstroke is started with legs straight. When they reach the central axis of the body, the knees again bend, providing the propulsive action of a fishtail. The legs weave up and down, pressing backward against the water at an angle. This gives the kick its propulsive power.

Timing for the butterfly begins from the bent-leg position, with arms extended in a sliding position. The best count for this stroke is two beats of the legs to one cycle of the arms.

Some of the common faults of swimmers

(Continued to page 212)



## Do them all easier with Bostitch staplers

Do these around-the-home jobs the way professional builders do. Use Bostitch staplers and staples. You'll save time *and* work. And get better results, too.



**1. T5 TACKER** Most versatile of fastening tools. Use it for screening, upholstering, tiling ceilings, scores of jobs. A squeeze drives staple accurately.

**2. H5 HAMMER** Fastest way to do light tacking jobs. Excellent for installing foil insulation, vapor barriers, many other jobs. Takes three sizes of staples interchangeably.

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Corrosion is a muffler's biggest enemy. So ask about the muffler's internal construction. In Silentone, hot exhaust gases are evenly diffused throughout the muffler to eliminate cold chambers and cut down heavily on the condensation that causes corrosion.

Next, ask for a coated steel muffler. Virtually all Silentone mufflers have zinc-coated steel. Such a coating can add as much as 25% to shell life. Don't believe anything else. There are no fancy "alloys" that double a muffler's life.

But even with these points checked, you must still face the fact that the muffler will slowly rust away. So, in addition, *to be sure of longer muffler life, you have to buy a muffler made of heavier steel.*

Silentone's double outer shell is up to 33% heavier than those found on other mufflers. Outer heads and inner parts are heavier, too. When thinner steel has been eaten away, Silentone's rust-resistant construction is still delivering top performance—giving up to a 33% *bonus* service life.

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# SILENTONE MUFFLERS

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Dept. 2F, Toledo 1, Ohio

learning the butterfly are these: 1. Not giving the kick enough downward thrust; 2. Timing between arms and legs not coordinated, causing lost energy; 3. Sweeping arms outward instead of inward.

Once a person has learned the proper way to do one or more of the strokes, he should be stimulated to practice and develop his swimming skills. This does not pertain only to would-be champions. I know many excellent swimmers who have never cared about swimming competitively. But they learned long ago that the only way truly to enjoy swimming is to swim well—just as bridge players, golfers and musicians have to know their games and instruments to get satisfaction out of them.

I've come across many teen-agers and people in their early twenties who've said they know how to swim but don't particularly enjoy the sport. I discovered in most cases they had never progressed beyond elementary competence. They learned once upon a time how to keep afloat and propel themselves a length or two of a pool. A little practice would have led them to the pleasures of swimming.

A high school senior who lives near me has broken four national swimming records—but as a freshman he was unable to make the team. Practice has made him. True, he has a fine body, watches his diet, is well-coached and gets a good deal of sleep and exercise, but I'm convinced that the principal reason behind his success is that he spends so much time in the water. On school days he's in the pool about four hours daily. He increases this to as much as six hours on Saturdays and Sundays.

I'm not suggesting that you practice swimming four hours a day—not unless you want to be champion. But if you're really serious about wanting to become a better swimmer, get into the water at least two hours a week. ★ ★ ★

### Do You Know This Old-Timer?

(answer to quiz, page 14)



4-cylinder 1919 or 1920 Dort





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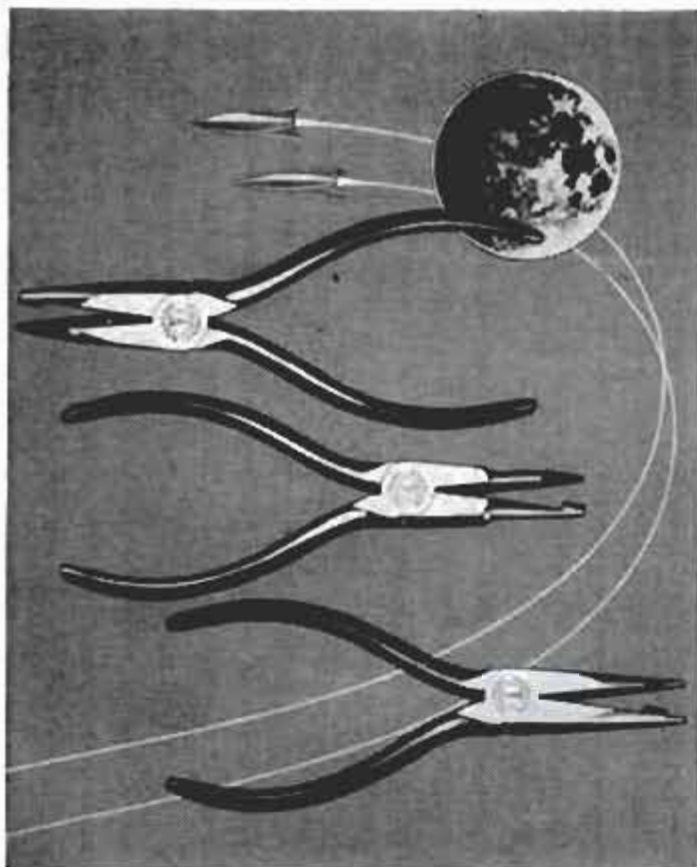
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Length, 6 $\frac{3}{8}$ "

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## Make Your Own UHF Yagi Antenna

(Continued from page 145)

Television signals differ from ordinary radio signals in two major respects. They are easily absorbed and weakened by intervening terrain between the transmitter and the receiver, and they can be deflected by high buildings, water tanks and similar obstructions. A reflected signal striking the receiving antenna along with the signal directly from the transmitter gives rise to those familiar but annoying double images called ghosts. With ordinary antennas, the reflected signal is often difficult and sometimes impossible to eliminate.

The telescopic effect of the highly directional Yagis usually permits separation of the two signals to the point where the ghost can be completely eliminated.

In some instances a reflected signal will actually provide a stronger image than the direct signal. For this reason, antenna installation is usually a two-man operation: One man to rotate the antenna—the other to watch the TV screen and indicate, in some manner, when the best picture is obtained. A two-way telephone or intercom provides a handy means of communication between the two.

In difficult reception areas it is advisable to try various locations for the receiving antenna. Where one location proves futile, another, only a few feet away, may bring in an excellent picture. The same applies to antenna height, and raising or lowering the antenna a few feet may make a great deal of difference. Finally, in hilly terrain, a slight upward tilt to the antenna may result in considerable improvement.

In deep fringe areas, where every last microvolt of energy is required for good reception, the transmission-line lead-in plays an important role. Ordinary 300-ohm line has excessive loss at ultrahigh frequencies and wastes a good portion of the signal picked up by the antenna. Tubular twin line with air-core spacing, specially designed for UHF, gives better results. Though somewhat more expensive than ordinary lead-in, UHF twin lead is strongly recommended—particularly if a long line must be employed.

Despite their low cost and extreme simplicity, properly installed Yagis outperform most other television antennas. The small investment in material and construction time will often pay large dividends in extra television enjoyment.

EDITOR'S NOTE: Construction information for VHF Yagis was published in the August 1952 issue of *Popular Mechanics*. ★★

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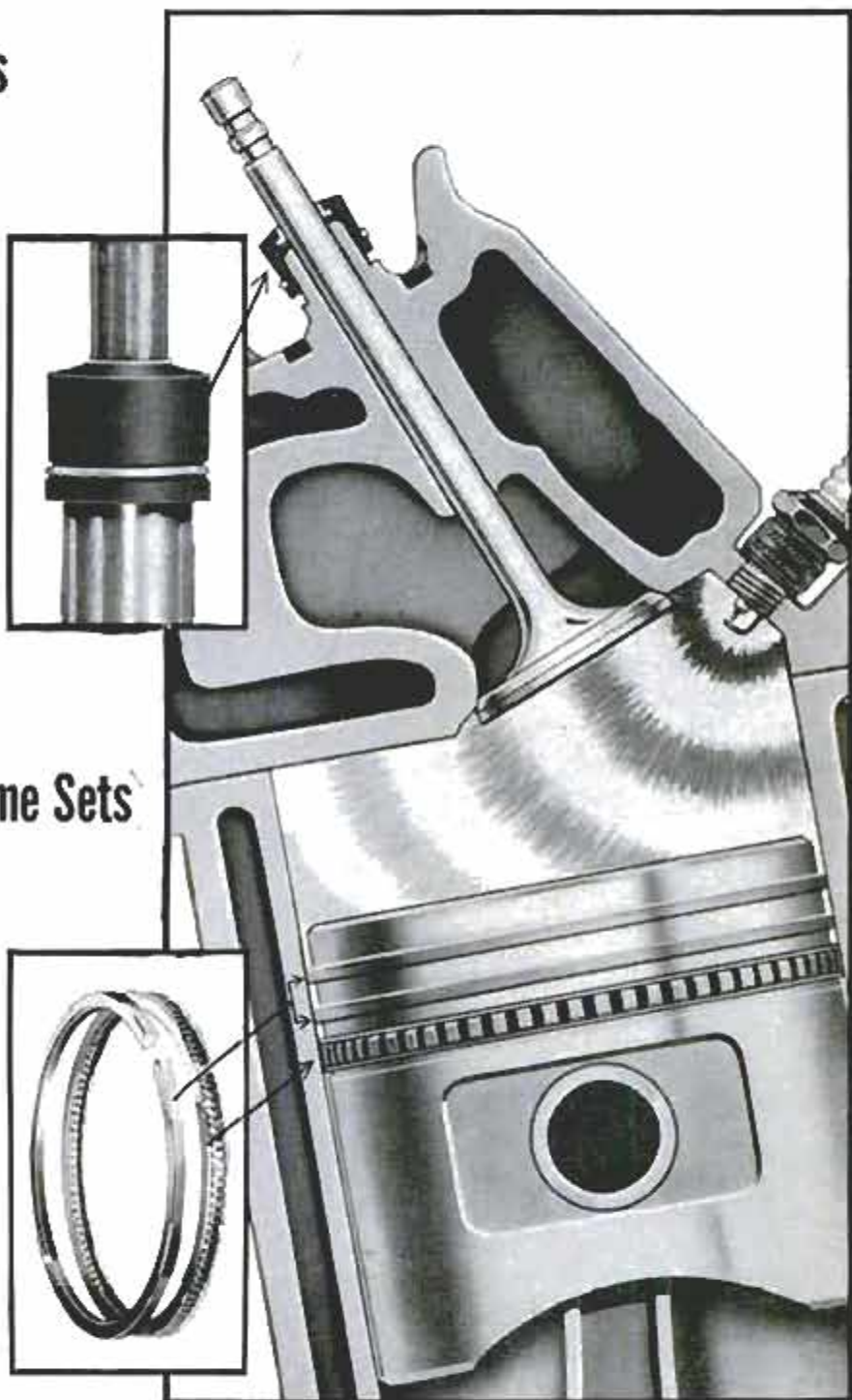
**For best performance**, valve or ring jobs should include installation of Perfect Circle Valve Seals. The cost is surprisingly low.

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2-in-1 Chrome sets provide the finest piston rings obtainable! Top rings and oil rings are plated with thick, solid chrome that doubles life of cylinders, rings, pistons. No tedious break-in is necessary, rings are pre-seated at factory.

**For best performance** install 2-in-1 Chrome sets for thousands of extra miles of power protection and positive oil control!



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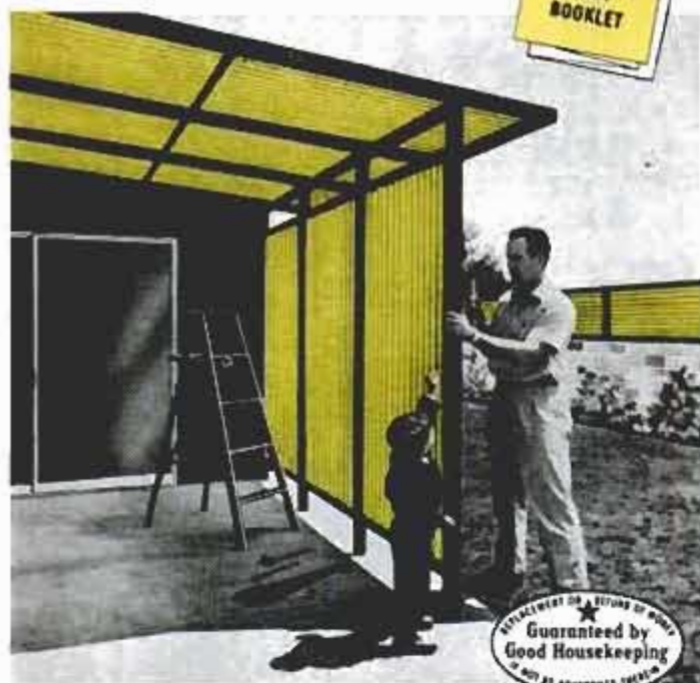
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# Wood Chips Build Better Soil

(Continued from page 113)

damage to falling fruit and makes it easier to see and salvage. It provides a clean, comfortable surface on which to kneel to harvest low crops, and even keeps them from becoming spattered with mud, thereby reducing processing costs.

More uses are being found each year. A layer of chips on a hillside provides very good erosion control. Dirt roads have been covered with chips to reduce mud and dust. Temporary parking lots and parade grounds have been paved with chips, and have given good service for a year or more. The Air Force finds this use so valuable in isolated or temporary installations that it has prepared chip-paving instructions for its maintenance personnel. Zoos use chips for bedding. Playgrounds use them for safe surfacing under swings. Foresters thin out stands and leave the chips from felled trees on the ground to improve the soil and increase the rate of growth of the remaining trees by reducing the evaporation of rainwater.

## Chips for Litter

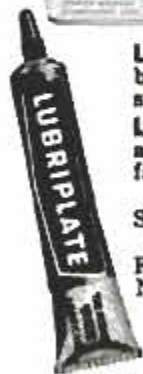
More and more farmers have been using wood chips for litter. They cost less than straw. They don't mat down and cake. They absorb large quantities of moisture. They minimize the fire hazard. They form a soft, springy surface which animals appear to like. They don't cling to animals' coats, as do shavings and straw. There is no dust, and muddy surfaces in stock pens become a thing of the past. Chips don't contain weed seeds to sprout and create a problem. When they have served their original purpose, they can be spread on fields to be tilled into the soil, thus giving the farmer double his money's worth.

As the realization of the usefulness of fragmented wood has spread, piles of sawdust and shavings near mills have become scarcer. This has added impetus to the use of chipping machines, which are now manufactured by a score of firms. Several models are available, some designed for installation on farm tractors and driving from the tractor's power takeoff, others installed on two and four-wheel trailers with their own four or six-cylinder gasoline engines.

Feeding a six-inch tree trunk into a set of whirling blades creates considerable resistance. Thus from 40 to 70 or more horsepower are needed. In addition, the chippers are of heavy construction. A heavy steel cylinder is fitted with four or more removable blades and runs in large

(Continued to page 218)

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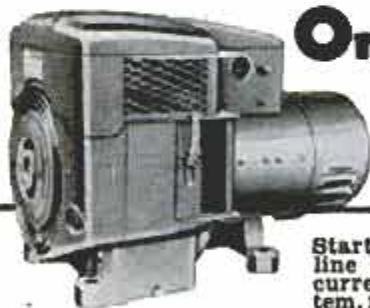
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bearings mounted in a sturdy casting. The cylinder revolves at around 2000 revolutions per minute. Blades are removable for sharpening, and can be adjusted to produce chips of any size.

So useful is a chipper that more and more city governments now consider it good business to invest in one or more units.

A Connecticut city uses chippers after the holidays to chop up thousands of Christmas trees arriving at the city incinerator, thereby avoiding trouble with the tree trunks jamming incinerator equipment. Banana stalks, which proved incombustible in the incinerator, are chipped and then go through it easily at the rate of two to four tons weekly. Ownership of a chipper offers a community assurance of rapid highway cleanup after windstorms.

Similarly, farmers have been buying chippers on a cooperative or district basis so that the cost is spread out, yet everyone has the opportunity to take advantage of the financial and practical advantages of wood chips. In many states, second-growth woodlands are not receiving proper management simply because the return from the meager amount of lumber, pulpwood and fuel does not make the big investment in labor worthwhile. As the demand for chips increases, marginal woodlands can be thinned out to harvest chipping wood on a sound financial basis, with the result that the trees which are left will increase in commercial value.

### **Extra Money From Chips**

Already a sizable number of men have gone into the business of custom wood-chipping. Farmers buy chippers for their own use in clearing woodlands and making low-cost litter, and during the off season make extra money doing chipping for other farmers in their areas.

The idea is practical because chippers mounted on tractors and trailers can quickly go right to the site of the cutting operations. Discharge spouts on chippers make it possible to spread chips on the ground exactly where wanted when mulching, or to load them into trucks and manure spreaders for application to nearby fields.

With world attention focused on feeding a burgeoning population, some scientists are already predicting that within a hundred years every available acre of tillable land will be under cultivation. The time-honored method of building up worn fields by rotating crops may well become out of the question. If we can't eat wood, at least we can utilize endless quantities of otherwise worthless scraps and unmarketable trees in maintaining the earth's thin layer of topsoil. ★ ★ ★

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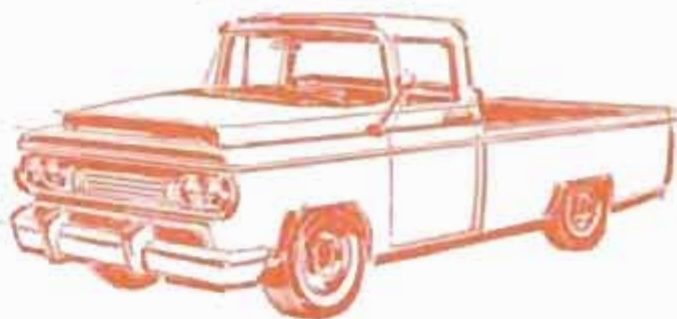
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Worn engine bearings are easy to diagnose. Among other things, they cause oil burning, engine misfiring and knocking, poor gas mileage, sluggishness and loss of power. Spot the symptoms in your own car? You need an overhaul, and new Federal-Mogul engine bearings.

### WHAT TO REPLACE?

An "overhaul" without new engine bearings is no bargain—you can tell after a few miles. Then you put up with it, or pay to do the job over. So make it right the first time! It costs just a few dollars more, and it's worth every cent of it.

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## Upstairs Stereo Downstairs

(Continued from page 143)

and that of the latter was plugged into the a.c. wall outlet. (The line cords of the radio tuner and record changer had been plugged into switched receptacles on the back of the amplifier during the initial installation.) When the on-off switches of the tuner and amplifier were turned on—nothing happened.

Then, Vivienne touched the newly installed on-off switch upstairs and—success. The pilot lights inside the remote switches glowed red; the tuner and amplifier pilot

### Equipment Used in Ed's Stereo System

#### Initial System

Knight KN-734 Stereo Amplifier  
Knight KN-120 Stereo FM-AM Tuner  
Knight KN-2000 Speaker System (2)  
Garrard RC88-4 Record Changer  
G-E GC-7 Stereo Cartridge

#### Extension Speakers and R/C Equipment

Stephens 816/80FR Speaker System (2)  
Knight Stereo Control Kit\*  
Remcon Remote Control Switch Kit with pilot-light switches and wall plates  
Mosley 343-PK wall sockets with matching plugs (3)  
Allied Radio No. 420005 Dual Volume Control  
\*Rated for stereo amplifiers furnishing up to 20 watts of power per channel.

lights lit up and, a few moments later, a previously tuned-in FM station came in loud and clear on both sets of speakers.

The remote-control unit worked like a charm. Upstairs the speakers could be balanced independently and the volume could be adjusted from maximum to a mere whisper. In the eyes of his family, Ed had gained the stature of an electronics genius.

Contentment reigned in the Kasper household until the following week end when trouble once more reared its ugly head. No sooner had Ed tuned in his favorite TV Western in the recreation room than Vivienne turned on the hi-fi upstairs.

Now anyone knows that two different programs in the same room just don't mix. Yet, when Ed turned down the hi-fi volume on the main amplifier, a squeal of dismay from upstairs told him that he had again incurred his wife's displeasure. Now, even with the upstairs volume control at maximum, the extension speakers were ominously silent. TV or hi-fi—that was the question.

Another trip to the radio store—this time for a dual-speaker volume control for the downstairs speakers, so that these could be operated at a level independent of the amplifier volume-control setting.

The control, Allied Radiopart No. 420005, was mounted on a metal plate and installed next to the remote on-off switch on the

side of the bookcase. The two downstairs-speaker cables were disconnected from the amplifier and soldered to the speaker terminals of the control. A short, 4-conductor cable was wired from the other control terminals to the amplifier lugs from which the speaker leads had been removed. Now, even with the amplifier volume control set for a much higher-than-normal listening level, the levels of both sets of speakers could be reduced independently by means of their separate controls. The installation was finally complete—well, almost.

Upstairs, the extension speakers had been placed for best stereo perception in the preferred listening area—the living room. In the L-shaped dining room and the enclosed porch beyond, the stereo effect was conspicuous by its absence. Only by moving one of the speakers to an opposite wall could this area be reached.

Fortunately there was enough extra wire on the speaker so that its location could be changed when the occasion demanded. But this practice soon produced a feminine veto. Not only did the wire, stretched across the carpet, present an unsightly appearance, it was downright dangerous to Randy who was wont to use the living-dining area as his personal speedway. Something had to be done.

Evaluating the situation, Ed found that the speaker location which would provide satisfactory stereo coverage for the dining area was near the point where the two speaker cables entered the living room through the planter wall. This made the solution simple and convenient.

At the preferred speaker location, Ed disconnected the wires from the speaker and fastened them instead to a Mosley type 343-PK transmission-line wall socket which, subsequently, was screwed to the baseboard. At the point where the cable entered the room it was cut and both ends connected to another socket. The latter was fastened to the baseboard directly over the entrance hole.

To the speaker terminals, Ed fastened a 4-ft. length of line cord terminated in a plug to match the previously installed sockets. It was now possible to move the speaker to either location and simply plug it into the nearby socket without resorting to long speaker leads. Even Vivienne conceded that this lent the finishing touch.

The system is not perfect. A change of radio stations, and a switch from radio to record changer still must be made from downstairs. But within these limitations, the remote installation offers all the advantages of two complete hi-fi systems—a low-cost means for obtaining stereo both upstairs and down. ★ ★ ★





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## Why outboarding actually "feels" different with the Sea-Horse "V"!

It will happen a hundred times this very weekend. There will be a small crowd gathered at dockside where a boat with a sleek, white motor is tied up. Someone's about to try a V-50 Sea-Horse for the first time.

He steps aboard, slips behind the wheel and kicks her over with just a twist of the ignition key. Then, with all lines free, he shifts into forward gear and eases open the throttle.

Right about now you'll see a smile break out on his face—a smile that widens into a man-sized grin as he opens her up out on the water. After this ride, no other outboard will ever feel the same again!

What is there about this new Sea-Horse V-50 that makes it so excitingly different, so much fun to handle?

Let's start at the starting. Here's the first difference you feel. It's Johnson's new electric starting motor that makes the V-50 spring to life so eagerly. This is a more powerful motor

than ever before, yet it actually uses less battery current than older types.

And that velvety-smooth idling. That's Johnson's thermostat-controlled cooling at work. It quickly brings engine head temperature to a perfect 140°—and holds it there automatically, regardless of outside water temperature.

That wonderful surge of power responding to the throttle is something you'll feel only in a "V". Firing impulses come every 90°, feeding a beautifully balanced flow of power through the short, rigid crankshaft. You get full thrust instantly . . . full horsepower at just 4500 r.p.m. And this is real, load-lugging power. There's a mighty 70.7 cubic inch displacement at the heart of the V-50.

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## The Strange Forces of the Air

(Continued from page 127)

the thin reaches of the atmosphere is a huge cylinder. Research on spheres and cylinders thus becomes highly important.

In his studies, Brown uses a smoke tunnel of his own design. For some types of research, a smoke tunnel has obvious advantages over a wind tunnel. In a wind tunnel, you mount an object in the air stream and keep it stationary while the air moves past it at the desired speed. Then you "feel" around the object with probes.

Trouble is, the probes themselves may cause turbulence, thus making their measurements inaccurate. The instruments, in effect, get in their own way. One way to overcome this difficulty is to introduce smoke into the air stream and then observe what happens to the smoke. This was attempted as early as 1901, but was relatively unsuccessful until Brown developed his smoke tunnel.

### Ordinary Straw Smoke

Over a period of years he tried a variety of smoke sources — chemicals, tobacco, rotten wood, excelsior—with no success. Finally he hit upon a source so common it had been overlooked: Ordinary straw.

A high-speed exhaust fan pulls the straw smoke from the smoke generator through the tunnel. At the mouth of the tunnel the smoke is split into ribbons. Brown can use as many as 30 ribbons, but most of his studies are made with only seven or eight. The ribbons of smoke flow down the tunnel at speeds up to 220 feet per second. In the center of the tunnel is a glass window. At this point, the opposite wall of the tunnel is lined with black velvet. When light is thrown into this area, you see what appear to be stationary white ribbons.

The object to be studied is mounted behind the window. The ribbons of smoke, as they move around the object, show clear patterns of turbulence. It is these patterns which reveal to Brown precisely what will happen to the object as it moves through the air at any given speed. The object may be mounted on a revolving shaft, permitting the Magnus effect to be plotted.

The tunnel is the most fascinating of all research tools at Notre Dame's department of aeronautical engineering, which Brown heads. Working on a campus where interest in sports runs high, Brown makes no apologies for his lack of interest in baseball.

"It makes no difference to me whether Warren Spahn wins one or 20 games this year," he says, "but I'm very much interested in what happens to that ball every time it leaves his hands." ★ ★ ★



TIPS FROM TEXACO

## How to tune up your car without tools

**1** Use some clean rags and a bottle of non-flammable household cleaning fluid to remove every speck of dirt and grease from exposed ignition wiring, spark coil, condenser, distributor, battery top and spark plugs. This will cut down electrical "leakage" and give you a more potent spark for increased pep and gas mileage.

**2** Clean out carbon and combustion deposits from engine's upper cylinder area with a series of full-throttle accelerations. Do it this way: Find a stretch of lightly traveled road and brake to a stop with your engine idling. Now put 'er in gear and accelerate to the legal speed limit as fast as you can — with the gas pedal pushed down to the floorboard. Gently brake to a stop and repeat six times.

**3** Take a 100-mile round-trip drive on open roads where you can drive at legal speed without constant stop-and-go. This will "boil away" liquid contaminants that get into your motor oil between 1,000-mile changes — and improve your engine's lively "feel."

**4** Make it a habit to use the *only* gasolines specially blended for *your* climate and altitude *wherever* you drive . . . Texaco Sky Chief Supreme with Petrox, or regular-price Fire Chief. You get superior performance with these gasolines because their formulas are changed every month of the year in every one of 26 climate areas in the United States. Yet, they cost no more than other "premium-grade" and "regular" gasolines!



# Owners Report on the Pontiac

(Continued from page 101)

## More Best-Liked Features

→ **This wide-track business is mostly mental. Pontiac's front tread is 63.7 inches, Buick's is 62.4 inches, Dodge's is 61.4 inches. Blindfolded, who could tell the difference? There are many factors here other than tread.**

Pontiac's campaign about the advantages of its wide-track wheels struck a responsive chord among owners. This feature rates sixth among the best-liked features and is mentioned often as something the rest of the industry should copy.

Here in order of frequency of mention are the additional best-liked features beginning with the sixth on the list, wide-track wheels:

"The wide track makes it go around curves with ease while all other cars have to slow down."—Arizona steamfitter.

"Power steering is much easier than on the 1958 model."—Maine nosologist.

"Large windshield and rear glass. Can see in every direction without obstruction."—South Carolina laundry superintendent.

"Excellent brakes. Have a good feel to them."—Minnesota tool and die maker.

"I like its roominess—crosswise."—Indiana florist.

"Ample space in trunk for luggage and sporting goods such as outboard motor and golf clubs."—Virginia Army man.

"Hydra-Matic transmission shifts smoother than before."—Kentucky salesman.

→ **See Kelly's report on the brakes when they are wet.**

## And the Other Complaints

Here, also in order of frequency of mention, are the other complaints of Pontiac owners beginning with the one that ranked sixth, uncomfortable floor hump:

"They made the car longer and wider but have cut the passengers to four. The middle of the back seat is hard, the middle of the front seat has no place to put your feet because of hump."—Iowa dentist.

"The most uncomfortable car I ever owned. I'm six feet tall and my head hits the hardtop ceiling and my legs suffer on long hauls trying to reach the accelerator. I drive about 1000 miles a month and don't care about mileage or upkeep, but I do care about comfort."—New Hampshire salesman.

"I have had no luck getting the car de-rattled. Doors and rear end rattle."—Colorado atomic-plant worker.

"Straight transmission is incorrect in every detail. Hangs in gear. Cannot put it into low or reverse during a freeze."—Georgia barber.

"Hydra-Matic does not operate smoothly until at least five minutes' operation with temperatures below 50 degrees."—Minnesota foreman.

"We have two new Pontiacs and both have a few bare spots or blemishes in paint jobs."—South Dakota farmer.

"Tie-rod end goes over the stop whenever you make a hard turn in either direction. It makes a cracking noise and sounds terrible."—Pennsylvania owner.

"Lots of rattles in dash."—Georgia salesman.

"Too long, too hard to park."—North Dakota farmer.

"Dash reflections in windshield."—Nebraska plumber.

"Visors do not sufficiently cover the windshield. There is about a foot of unshielded area that is very annoying."—Arizona artist.

"Heater gets too hot in front without warming the back seat."—North Dakota salesman.

"Hardest to read of any instrument panel I ever saw. You can hardly read it at all with sunglasses on."—Michigan hotel owner.

→ **This is progress!**

→ **Doesn't the barber know that the industry can't afford to engineer handshift linkage? There are not enough sold to warrant perfecting it.**

→ **Pontiac's dashboard is virtually unreadable in daylight, clearly visible at night. It has metallic numerals on a dark black background. Reflections on the glass lower the contrast to a point where you aren't even sure how fast you're going at times. It must have been designed by the night crew.**

(Continued to page 226)

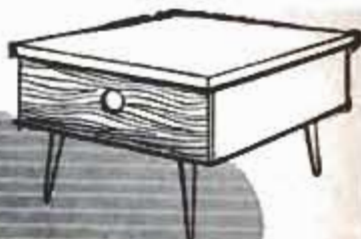
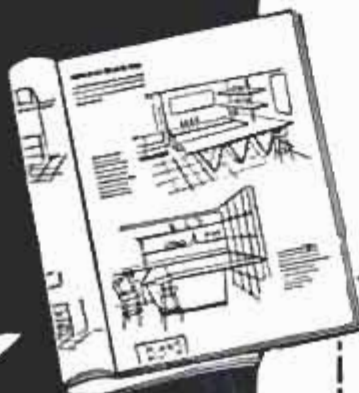
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FIRST SEAL  
WOOD WITH . . . . .



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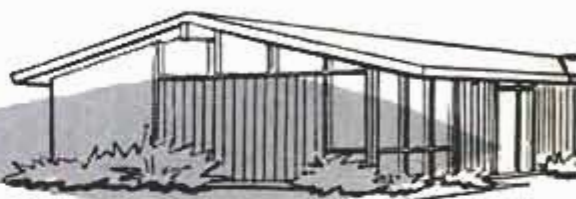
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## 13 REZ COLOR-TONES

*for modern and beautiful color finishes on exterior and interior wood.*

REZ Color-Toned sealers are the easiest, most economical, most richly beautiful finishes for siding, garages, carports, fences, garden furniture, etc. Just one coat for interiors or two coats for exteriors seal and color, and the wood is protected against weather, sunlight, changing humidity, rain, sleet, snow! REZ Color-Toned sealed wood retains natural grain pattern.

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**MISCELLANEOUS:**

*It would seem that we've reached a point of diminishing returns on car width. Some cars feel narrower than they are, this one feels wider and therefore "senses" bigger than it is. Actually it drives and handles easily in traffic situations despite its size, once adjusted to it. Driver's posture is good with excellent support for accelerator leg. Left leg is somewhat neglected and dimmer switch is awkward. Excellent rebound control, despite long overhang. Front end makes considerable fuss on chuckholes, but little shock is transmitted to riders. Feet of rear-seat riders in footwells may bother front-seat passengers, up through cushions. Over-all it's a good car, but far from the economy car that some claim it to be.*

"There is a little danger in the wide front wheels. You can very quickly run the right front wheel too close to the shoulder and lose control."—Missouri postal worker.

"Too much slush flies up into the working parts and freezes. This is dangerous when the accelerator freezes going at a fast speed."—Maine banker.

"It is so wide I can't reach over to open the opposite door." Missouri owner.

"Dimmer switch is too far from the brake pedal, making night driving a strain."—Illinois salesman.

"I don't like to have to roll down the back window of this wagon every time I want to open the tailgate."—Wyoming rancher.

"They have hidden the position of the front wheels so I don't know within one foot the space I occupy in my lane. Also car can't be pushed to start it."—Kansas civil engineer.

"Advertising booklet on the Pontiac says that the air conditioner cools and heats as a unit. Yet I had to pay \$430 for the air conditioner and another \$101 for a heater."—Maryland retired Army colonel.

"Water in the heater makes a lot of noise."—New Mexico missile mechanic.

"Pontiac should have gauges instead of lights for water and oil. When sun is shining you can't see the lights."—Minnesota sales manager.

"Can't keep the rear window of this wagon clean. Any moisture on the road and it gets dirty."—Ohio farmer.

"Bumpers are not made for bumping, just for looks."—North Dakota farmer.

There it is, the story of the 1959 Pontiac as told by the owners themselves, the people who know the car best. For an engineer's analysis, turn to page 102.

Stop at the sign of the Smiling Tire



Tire meets chuckhole—that's when you need Smileage

**Real punishment**—but you can relax on B.F. Goodrich Silvertowns. We do the worrying for you in torture tests more brutal than any chuckhole. Forget tire worries. Make driving fun again on the quality tires automakers put on new cars. Get Smileage! 4 tires, \$4 down.

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Easy! No skill required. Won't chip or crack! Nothing like it to resist water, weather!



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Handles like putty—hardens into wood!



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15 1/4" bed with 4 1/2" swing.

7" between centers.

Satisfaction Guaranteed

FREE FOLDER

Write for it today!

Rosemoor Manufacturing Co.  
Box 147J, Lansing, Ill.

## Ashes Found Under Sea Hint at Comet Collision

From the tossing deck of the *Vema*, research sailing vessel of Columbia University's Lamont Geological Observatory, Dr. J. Lamar Worzel has pulled a plum from the bottom of the Pacific Ocean—possible evidence of a cataclysmic collision of the earth and a comet.

Worzel, assistant director of the laboratory, had been taking bottom samples with a huge, finned coring device resembling an upside-down rocket. A few hundred miles off the coasts of Central and South America, the snakelike cores contained a layer of fine white ash and glassy particles unlike anything that should have been there.

In his report, Worzel estimated that the "recent" deposit was laid down within 100,000 years, during a period of one year. Sub-bottom seismic reflections indicate the ash layer stretches 750 miles north of the equator and 825 miles south of it. Whether or not the ashes came from some celestial collision is still speculative, but Lamont scientists have stated that they "must record a notable event in history."

JUNE 1959

# Cut it with WISS



Wiss "Grass Master" Shears, No. 701, are the easiest cutting, fastest cutting grass shears you've ever used, with molded vinyl handle grips and special closing latch. \$2.75 at hardware, garden supply, and department stores. Others \$1.39 to \$4.95.

### OTHER FINE WISS CUTTING TOOLS

#### PRUNERS

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\$3.25



Wiss Hy-Power Pruners, with new vinyl grips, cut toughest limbs, protect your hands. 7-inch pocket size. \$3.25 wherever garden tools are sold.

#### TIN SNIPS

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Only seven inches long, these "mighty midget" snips cut metal, vinyl, rubber, leather. Others 10" to 17" in aviation, combination and solid steel styles.

### J. WISS & SONS CO., NEWARK 7, N. J.

World's Largest Manufacturer of Shears, Scissors, Pinking Shears, Skalloping Shears, Metal Cutting Snips and Garden Shears



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## STAR Hack Saw Blades and Frames


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★  automatically position and tension blade. ★  high-strength tempered steel back. ★

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 ★ Send 10¢ in coin for information-filled ★  
 ★ booklet on metal cutting. ★

★ **CLEMSON BROS., INC.** Middletown, N.Y., U.S.A. ★

## The "Brain" That Talks to Tools

(Continued from page 96)

proceed along the left side of a circle—the center of which was two units to the right and three units above a certain point on your drawing, and the radius of which was five units—you would write: "TL LFT, CIRCLE/CTR AT, PLUS 2, PLUS 3, RADIUS 5."

### Will Hasten Automation

A man using the APT system can give as many instructions to a computer—to be passed on to a tool—in five hours as he previously could in 200 hours. That's why the invention of this language has been hailed as a tremendous technological breakthrough. It will hasten automation, increase defense production, and probably bring about changes in countless industrial operations.

Space-age developments, says Dr. C. S. Draper, head of the M.I.T. Department of Aeronautics and Astronautics, "involve the manufacture of relatively few highly complex items rather than tens of thousands of such comparatively simple devices as the aircraft of the past." This accounts for the interest of the Air Force and the Aircraft Industries Association in the work done in the M.I.T. Servomechanisms Laboratory to devise the APT system. This system will accelerate the production of the tapes necessary to make automatic tools produce the new parts needed for new missiles and vehicles.

### Long-Needed Development

Years of work have gone into the development of the APT language and system. It has been needed ever since a computer first ran a milling machine at M.I.T. in 1952. Now, says William D. Beeby of the Boeing Airplane Company, "numerical control has proven it can reduce costs, reduce lead time, improve quality, reduce tooling and increase productivity."

The APT system simplifies scaling parts up or down. It provides a means of bringing about industry-wide compatibility. It increases the work load that can be turned over to the giant manmade brains.

Defense experts are convinced, consequently, that it represents a long leap forward in America's technological race with Russia. ★ ★ ★

### TV for Jetliner Passengers

Television will be provided for passengers aboard jetliners of Continental Airlines when its Boeing 707s start Chicago-Los Angeles service in June.



# sprinkling is with a NELSON DIAL-A-RAIN®

Just select the sprinkling pattern and set the finger-tip dial control. A powerful water motor does the rest, driving the smoothly oscillating sprinkler bar dependably—even on low water pressure! Rifled jet nozzles propel the water in a steady positive stream—in high winds, too!

The beautiful rainlike spray covers a rectangular area up to 2400 square feet. Sturdily-built with Nelson quality throughout. Fully guaranteed!

Only \$13.95

The Dial-a-Rain, Capri and other Nelson lawn sprinklers are available at leading hardware, garden supply and department stores or you may write direct to...



**L. R. NELSON MFG. CO., INC.**  
PEORIA, ILLINOIS




Try a Nelson **CAPRI**... and you'll agree the Capri with rifled jet nozzles can cover areas up to 2000 sq. ft. with a gentle, soaking spray. Modern in design, colorful and dependable in operation. Fully guaranteed. Just \$9.95.

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More than ever—you need a  
**HULL  
AUTO COMPASS**  
The Famous Make Used by  
Most Car and Boat Owners  
\$5.50 and \$6.95  
At your dealer, write for folder  
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Use 1/4 HP motor or larger... 1 HP for up to 7,500  
GPH; 1,000 GPH 60" high; or 3,000 GPH from 25" well.  
1 1/4" inlet; 1" outlet. Stainless shaft.  
TYPE X—2 oil-less bronze bearings. Won't rust... **\$10.95**  
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Tough, elastic rubber in paste form. Seals windshield leaks, repairs convertible tops, awnings, tarps, boots, raincoats, swimming pools, hoses. Dries quickly—permanent, waterproof.

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The Amazing Metal Mender with 1001 Uses  
Solders, seals, repairs all metal. No heat or tools needed. It's real metal in paste form that can be drilled, filed, tapped, threaded when dry. Waterproof, gasolineproof, heatproof to 600°. For Home, Auto, Boat, Plumbing.

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on the job...**

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B-Line sprays on underground systems take the work and trouble out of watering for a lifetime. Permanently installed below turf level, pop-ups rise up when the valve is turned on... watering lawns thoroughly, and without effort.

\$1.85 per head at many leading hardware stores; ask to see the B-Line Guarantee.

**BUCKNER SALES CO.**

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## Camermen at Twenty Fathoms

(Continued from page 78)

cockpit" (riders wear aqualungs), the 13-foot-long, 24-inch-diameter, 244-pound aluminum and Plexiglas projectile, rigged with plywood fins, can maneuver as though self-propelled.

But underwater, there are problems other than pressure. Few know them better than Lt. Comdr. Miller.

"The problem," says Miller, "is light—or the lack of it. Sure, you can set up floodlights or pop a flash bulb and get good results. But in our work, generally, we depend on natural light, a pretty unstable commodity, even at relatively shallow depths."

How shallow? Well, even in clear, calm coastal water with the noontime sun directly overhead (the "ideal" setup for fathom photography), fully 50 percent of the sun's light is lost—at only 15 feet below the surface.

### Squanderers of Light

The light-squandering culprits are (1) *reflection*—the rays bounced back into the atmosphere; (2) *surface loss*—which occurs at the air-water juncture to a depth of about three feet; (3) *scattering*—diffusion, both horizontally and vertically, by water, mineral and plant particles; (4) *absorption*—light energy changed to heat energy, especially when the water is turbid.

Reflection alone may squander two percent of the light. At 4 p.m., when the sun's at 45 degrees, reflective loss may exceed four percent. Thus, when shooting color movies by natural light, fathom fotogs abide by the "10 a.m. to 3 p.m." rule. Surface loss as sunlight passes through the air-water barrier may reach 30 percent. At 15 feet, horizontal scattering by minute particles sometimes saps 20 percent of what light intensity remains. Vertical scattering at the same depth takes another one to six percent. The absorptive loss may range to 30 percent. And this when the sun is directly overhead. The loss increases slowly as the sun moves to lower angles.

But fathomwise, intensity of light is less than half the story.

The rest of the story concerns *color absorption*, water's penchant for filtering out the most desirable colors in the visible spectrum (reds and yellows), while passing the less desirable blues, greens and violet. Nonvisible wavelengths—infrarreds—are literally stopped dead at the surface.

Thirty feet below the ocean's surface, the sun's red waves have been absorbed nearly to extinction. Orange is squeezed

(Continued to page 232)



## WHAT DOES THIS GRILLE SIGNIFY?

➤ This grille performs a vital function by admitting an unrestricted flow of air to the radiator. It's an attractive grille by virtue of its entirely functional shape and it signifies what other grilles do not . . . that this is an honest car dealing in fundamentals.

➤ The Lark has an unusually high brake lining to weight ratio, and employs an advanced suspension system using variable rate coil springs and hydraulic shocks. Only 14½ feet long, it seats six comfortably and is extremely maneuverable, very easy to park and agile in traffic.

➤ Like to work on your own car? The Lark's engine ("6" or V-8) is easily accessible. ➤ Like economy? The Lark V-8 outclassed all V-8's in the Mobilgas Economy Run: 22.28 miles per gallon with automatic transmission. And the "6" does better. ➤ Like performance? Try The Lark V-8 with 4-barrel carburetor and dual exhausts. ➤ Like to drive? Get into a Lark. ➤ See your Studebaker Dealer.

THE **LARK** BY STUDEBAKER

# MODEL CHANGEOVER SALE! 1958 MODEL—BELOW COST!

## 8" TILT ARBOR SAW

**BLADE TILTS—TABLE  
REMAINS LEVEL**

Heavy duty all cast iron and steel construction. Precision ground cast iron table. Price includes massive cast iron mitre gauge and patented motor drive that fits any motor.

Cross cuts, rips, bevels, mitres, dadoes, cuts compound angles — everything expected of saws costing four times as much. Depth of cut adjustable; 0" to 2 1/4" — table always level. Send check or M.O. \$2.00 deposits on C.O.D.'s.

**SPECIAL BARGAIN** — This saw is our 1958 model. Each saw is brand new — sent to you in factory sealed cartons. Sold and guaranteed direct from the factory to you at a fantastic bargain.

### FREE 10 DAY TRIAL — MONEY BACK GUARANTEE

Try this famous saw 10 days. If you are not satisfied that it does the work of any tilt arbor saw, regardless of price, return for immediate money back refund.

*Sent Express Collect.*

*We reserve right to refund money if stock is exhausted*

**AMERICAN MACHINE & TOOL CO.**

ROYERSFORD 16, PA.



Shipped  
Complete as  
shown Less Blade

NOW  
**\$9.95**  
Was \$24.95

from the fathom-spectrum (depending on the kind of water and its relative calmness) at about 80 feet; yellow at 200 feet; and blue at the 250-foot level; some greenish light is believed to penetrate to depths of 5000 feet.

"Water is a blue filter," emphasizes Miller, "a filter in front of your lens and it gets bluer the deeper you go. Down to 25-30 feet you can color-correct to approximate surface colors using a CC-R series (Kodak) filter. Below that, the reds are lost and no amount of correction restores color that simply isn't there. If you're after anything like true color below 30 feet, you'll need artificial light."

That was the problem — shedding light on the subject—when recently fathom fogs were ordered into Hawaii's 119-foot-deep 280,000-gallon fresh-water tank where submariners learn the Navy's new free-ascent technique for escaping from their crafts. Successfully tested to 300 feet, the system involves the continuous exhaling of breath, to avoid deadly air embolism. The big problem was to light the tank for a training film as gobs rose the 119 feet.

"We dropped four 5000-watt diving lamps powered from the surface," recalls Chief Richards, "but we were still in the dark—photographically speaking."

Turning inventive, Richards devised from roofing tar and beer cans a pressure-proof light mount which has become an underwater stand-by.

He strung 96 reflective floodlights (Par 38s) along 100 feet of pressureproof electrical cable, soldering the connections directly to the bulbs' terminals. Then, collecting 96 beer cans, he snipped off tops and bottoms, filled them with hot roofing tar . . . and in each, planted a photobulb.

"They worked" says Richards, "and they're still working, though we've used them at depths of 150 feet."

Like flash bulbs, floodlights are used unprotected and unencased underwater. Usually they're weighted, so they won't pop to the surface (if a lighted bulb surfaces, it will explode).

Consider for example, the easiest of surface assignments: illuminating a subject close up (say at 10 feet) with a No. 5 flash bulb.

Undersea, so seemingly simple a chore is anything but simple. Not only must the bottom-dwelling still photographer shackle his flash bulbs to keep them from bobbing to the surface (bulbs are usually strung six inches apart with the cord tied to the diver's waist), but he's got to recompute their surface ratings. This is because water is a two-way barrier. Light intensity is

(Continued to page 234)

the fiber glass body you've been waiting for!

**KELLISON**

J-4 Gran Turismo (base price \$365)



Send \$1.00 refundable with purchase for color brochure with information about Kellison fiber glass sport car bodies and accessories.

**KELLISON ENGINEERING AND MANUFACTURING CO.**

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# BALKY



# MOWER?

**QUICK!** Speed it up fast with a few drops of 3-IN-ONE. Penetrates hard-to-get-at places. Doesn't gum up.

**3-IN-ONE OIL**  
REGULAR · OIL SPRAY · ELECTRIC MOTOR



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**CARBURETORS • FUEL PUMPS • FUEL FILTERS**

Keep swift, sure power for years . . . have your car serviced regularly at the Sign of the Carter-Trained Expert. Look for the Carter sign or check the yellow pages of the phone book.



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lost lamp-to-subject and is lost again returning subject-to-camera.

"In clear water," says fathom-man Skidmore, "we begin by cutting the guide number in half. If the water's murky, as off the West Coast, we cut it to one quarter."

Suppose, like Skidmore, you're on "still" assignment—ordered to snap a ship's propeller (for corrosion evaluation) at a depth of 20 feet. Back-packing a couple of "twin 38" air bottles (enough to keep you breathing about 50 minutes at working depth) you head for the hull. Tethered to your wrist is a plastic-encased light meter (the plastic  $\frac{7}{16}$  inch thick and weighted for "negative buoyancy"—so the meter won't float from your grasp). For this job you've loaded daylight Ektachrome into your Rolleimarin (a Rolleiflex sealed in a cast-aluminum housing, its controls and synchronous flash operated from outside the watertight case). You also lug a heavy-weight tripod (even so, you'll shoot at  $\frac{1}{50}$  second to thwart any vibration from currents). And you'll fire clear No. 5 bulbs, not the blue-tinted variety usually used with daylight color film. Excessive reds will be absorbed long before the light reaches the camera.

On the surface, Ektachrome's guide number would be 80 (using a tinted No. 5 bulb at  $\frac{1}{50}$ -second shutter speed). But here, in 20 feet of murky water, things have changed considerably.

First off, combining the clear No. 5 with a highly directional reflector, Ektachrome's effective guide number jumps to 150. This apparent windfall, however, gives little cause for elation. For, right off, you cut your guide number to one fourth—to 37—compensating both for the murk and, more importantly, for the fact that the bulb's light must fight every foot of the way—going and returning.

Suppose you're working 10 feet from your underwater subject. To find the correct lens opening you hew to convention: Divide the new guide number—37—by the distance (lamp-to-subject)—10 feet. Result? A "recommended" setting of f:3.7.

Will you get a picture? Probably not—because the Rolleimarin's lens has a maximum f:3.5 aperture. And underwater (as above), you've got to bracket your shots, shoot a half stop either side of the recommended setting.

But even under ideal, clear-water conditions, you'd likely have flubbed your color. Why? Because farther than about eight feet from your subject, guide numbers—and all your careful calculations—break down.

Shrugs a fotog, "You shoot close in,

(Continued to page 235)

closer the better. Or you gamble. Even from 10 feet, it becomes a kind of guessing game."

How then do the Navy's fathom fotogs shoot color movies at depths of 60 feet and more using only natural light?

"Mostly," says Comdr. Miller, "it's a matter of judicious timing—picking the place, the time and the ideal light conditions."

They tell about the time when Richards and Skidmore climbed aboard a depth sled towed by a surface craft and headed seaward to rendezvous with a sub. The site was 100 miles off Maui, a stretch of crystal-clear Pacific. It was noon, the sun hanging high over calm seas, when the sled—Richards working prone at the controls, Skidmore haunched aft over this camera—made its first pass along the sub's hull.

Recalls Richards wryly, "I'd engineered every safety feature I could think of into that sled, but I never figured we'd ever need them."

### Sled Can be Released

Tethered from the surface craft by a 400-foot cable, the sled could be released instantly with a simple safety device operated by Richards. Moreover, once released, the sled would surface—buoyed by four air tanks. Escape had been made easy for both fathom-men: Richards would exit through a hatch in his forward compartment, Skidmore through the sled's open rear where, riding backwards, he had a clear, head-on view of the sub.

Up above, something went wrong. The tow boat missed its bearings. Instead of hauling the sled parallel with the sub (for a six-knot close-up), it veered, dragging the sled across the sub's submerged decks.

"First thing I knew, the conning tower was all but in my lap," grins Richards.

Skidmore, camera trained on the submarine, suddenly found himself but a hand's reach above its deck.

In the next instant, Richards, popping from his escape hatch, was fending off the sub with a finned foot. Skidmore, pushing the camera aside, left by the stern. Sled and sub scraped briefly, then parted. Clinging to their sled, the fotogs rode the 30 feet to the surface.

Months later Richards was in a theater when the sequence—spliced into a deep-sea thriller—flashed on the screen.

Next to him, a popcorn crunching teenager turned excitedly to his girl friend.

"Gosh," the youngster whispered, "whoever took that one musta been hangin' from the periscope." ★ ★ ★

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with just one tool**

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**This Month's  
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(Page 20)



**Gottlieb Daimler (1834-1900)**



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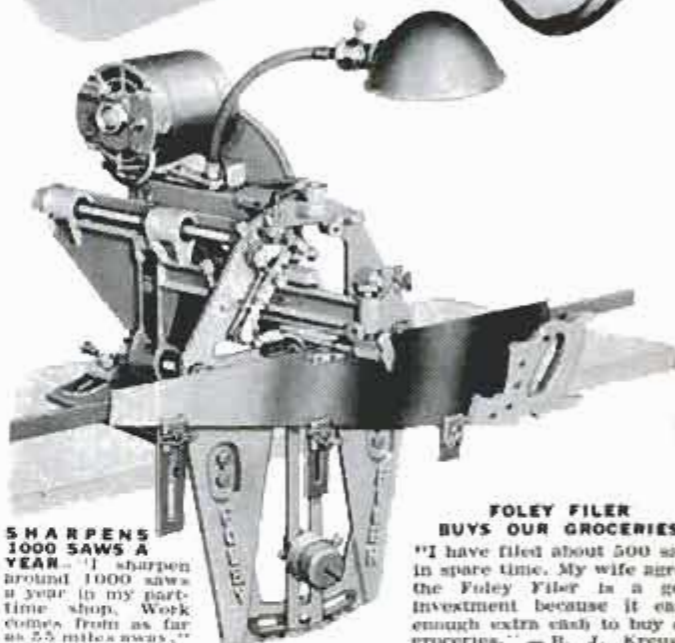
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comes from as far  
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BUYS OUR GROCERIES**  
"I have filed about 500 saws  
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the Foley Filer is a good  
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enough extra cash to buy our  
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Here is a steady repeat CASH business that pays from \$3 to \$6 an hour, and you can start in your own basement or garage in your spare time. Every saw you sharpen with the machine accuracy of the Foley Saw Filer is an ad that brings more customers. J. C. Deibert wrote us: "Since I got my Foley Filer five years ago, I have averaged 4 1/4 saws each day over all this time." Howard Kuhns says: "We operate 2 Foley Filers, and our business averages about 500 saws per month. The count last year was 5,798 saws."

The new model 200 Foley Saw Filer (shown above) is the first and only machine that automatically sharpens combination (rip and cross cut) circular saws—also all hand saws, band saws and crosscut circular saws. The adjustments are simple—there is no eyestrain—and you can start right away to turn out perfect cutting saws. Exclusive jointing action evens up irregular teeth — old saws cut like new!

"MONEY MAKING FACTS" explains how you can get business from hardware stores, home owners, farmers, carpenters, schools, mills, factories, etc. Just think, with a modest investment, no overhead, no stock of goods to carry, you can start right in on a cash business that will help pay the rent, buy groceries, or a new car. Time Payments available; send coupon today for this practical money making plan. No salesman will call.



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**The Telephone That Remembers**

(Continued from page 69)

of information. And it must be able to check each one of those bits every fraction of a second. It has to be, in fact, what Ketchledge calls "a megabit memory with microsecond access."

Actually, ESS has two memories. One, called the Flying Spot Store, is the warehouse for more or less permanent intelligence needed to process a telephone call. This includes data such as the number of each customer, any special service he gets, codes for long-distance dialing and so on. A temporary memory, known as the "Barrier Grid Store," receives a constant stream of information from an electronic scanner that checks the line of every customer 10 to 100 times a second! As the scanner picks up open lines and dial pulses, it passes the "dope" on to the temporary memory, which remembers things such as whose phone is off the hook and what numbers are being dialed from instant to instant. Then it clears itself as calls are completed.

"It is really an electrostatic storage tube," Ketchledge explains, "with a screen, or target, about 1½ inches in diameter. An electronic beam hitting the target makes notes on it by piling up electrons in a series of infinitesimal 'charges' and 'no charges,' which can be read off in code on succeeding sweeps of the beam, then swept clean electronically when they're no longer needed." In short, this tricky memory is forever writing notes to itself, then wiping them out. "It's an electronic scratch pad," says Ketchledge.

Since every good brain needs logic as well as memory, ESS logic is performed by central control—a vast bank of circuits using 20,000 semiconductor diodes and 3000 transistors. This electronic wizard gathers information from both memories and the exchange's switching network, and "decides" what to do. It also tells the memories and the network, in pulse codes, what it wants them to do next—delivering orders at the dizzy rate of 400,000 per second.

"The really big breakthrough, though," says Ketchledge, "was the use of an old idea—a photographic scanning process—in the big permanent memory, or Flying Spot Store."

Today, in one of the rooms of the Whippany Laboratories, you can see the complex insides of this fantastic memory that forms the core of ESS. All necessary "permanent" information, such as each customer's number, special services that go with that number, codes for long-distance dialing, is stored on photographic plates 1½ inches

(Continued to page 240)

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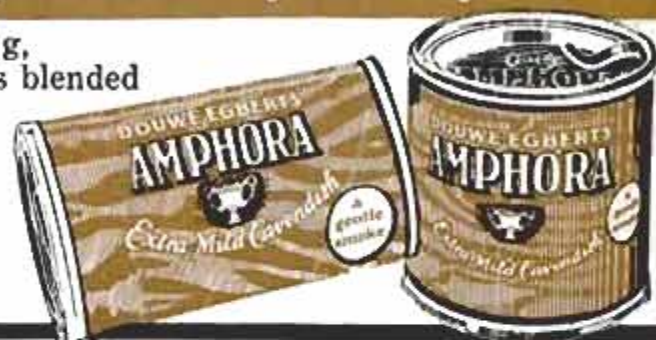
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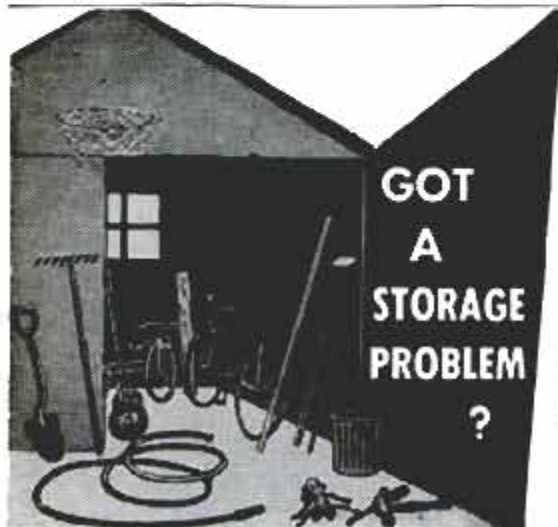
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--	---

square. The data on each plate is in the form of infinitesimal dots and spaces, like a shorthand version of the Morse code. Each dot or space is an information "bit"—and there are some 66,000 such bits on every little plate! The permanent memory for the Morris exchange has 68 plates, capable of storing a whopping five million "bits" in a flat frame only two feet square.

To monitor that massive "directory," and allow the brain to reach inside itself and snatch out a given piece of information when a customer dials a number, Bell engineers used a cute trick. They devised a multiple optical system, with lenses like a bug's eye, so that a single flying cathode ray scans all 68 plates simultaneously each fraction of a second.

"The flying spot," Ketchledge explains, "doesn't fly steadily around the plates like the flying spot on a TV screen. It jumps around as directed by central control, to read out special information that might be needed for a particular call. In other words, it may be skimming along the lines of dots, and central control will tell it: 'Stop what you're doing and go to switching information on line 65, and tell me what to do for such-and-such a customer who just dialed 4-5. When you're done, go on back to your skimming.'"

In a microsecond flash, the beam has flicked across the proper series of dots and flashed the coded information through a bank of photomultiplier tubes (see diagram, page 68), which relays the data back to central control. Then the call is switched through banks of transistors and gas tubes to its destination.

"In 50 milliseconds," adds Ketchledge, "the flying spot may perform 20,000 separate jobs."

### No Hardware Is Needed

"The beauty of the system," he points out, "is that it involves no hardware—just spots on photographic plates. If a new customer signs up, or if someone wants a new or special service, we simply go to the darkroom and make up a new plate with the proper dots in the proper places."

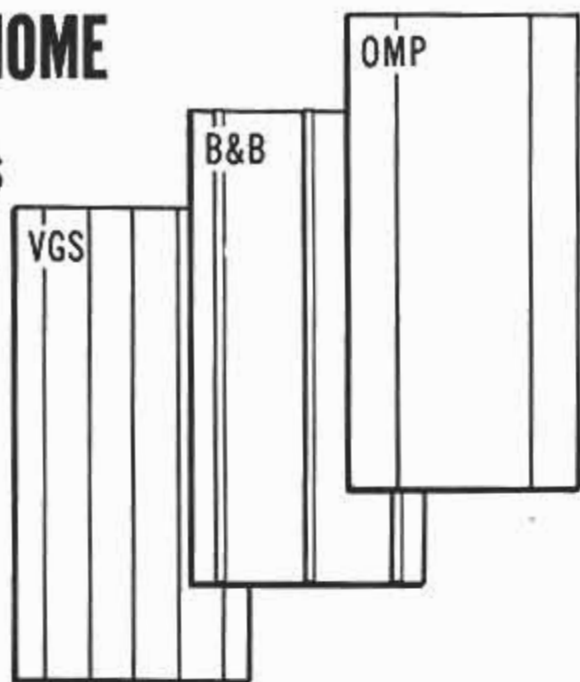
How a call goes flickering through this electronic maze sounds like a description of how a thought whisks through someone's head:

A customer picks up his telephone. For an instant, nothing happens. In the ESS office, the scanner, sweeping past the newly opened line, detects it. It searches the temporary memory, which tells it that on the last sweep, a tenth of a second ago, that line wasn't drawing current. So the scanner knows a change has occurred that requires action. But it doesn't know yet if

(Continued to page 242)

# TO SAVE MONEY ON YOUR NEW HOME

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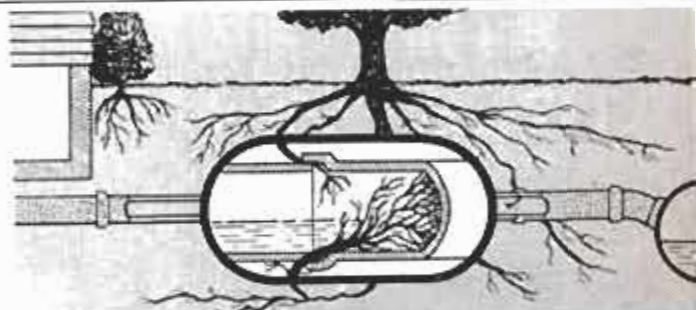
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the customer is placing or receiving a call, so it searches the temporary memory again, finds no record of a call. Now it knows it's a new call, so it does two things:

1. Flashes a command to the switching network to send a dial tone to the customer. ("This isn't necessary," adds Ketchledge, "but it tells the customer we are ready for his call.")

2. It goes into the temporary memory to reserve space for the upcoming call. "We call this reserved space a 'register,'" Ketchledge explains. "Meantime, the permanent memory has already informed central control that this is a working number, at such and such an 'address,' and gets the regular service."

"Since the scanner can't do anything more on that call until the customer has started dialing," says Ketchledge, "it goes looking for other calls." However, each 1/100 second it goes back to this customer's line and picks up 'bits' of the number he's dialing, and passes them along to the temporary memory until the whole number has been 'written' on the target. When the temporary memory informs central control that the complete number is in, a command is sent to the switching 'yard' to set up a 'ringing loop' with a connection to the called party. This automatically sets up an audio frequency, which can be converted into a ring or—some day—a mellow tone in the called party's transistorized telephone base.

"It also sets up a connection to the caller," says Ketchledge, "and feeds him the same tone in his earpiece—just to tell him: 'Hang on, mister, we're working for you.'"

When the called party lifts his telephone, the scanner immediately notices on its next sweep that the circuit is drawing power. Now it's a priority call. The scanner stops its rounds long enough (perhaps a few microseconds) to send another command to the switching network, telling it to take down the ring and ring-back connects, and set up a direct talking circuit. Now the parties can talk.

In serious overloads, Ketchledge admits, the system might wind up without a clear circuit. "But," he points out, "the brain takes care of that, too. If the system keeps failing to find a 'connect' on successive sweeps past that line, it tells the switching 'yard' to put through the call on the ringing connection."

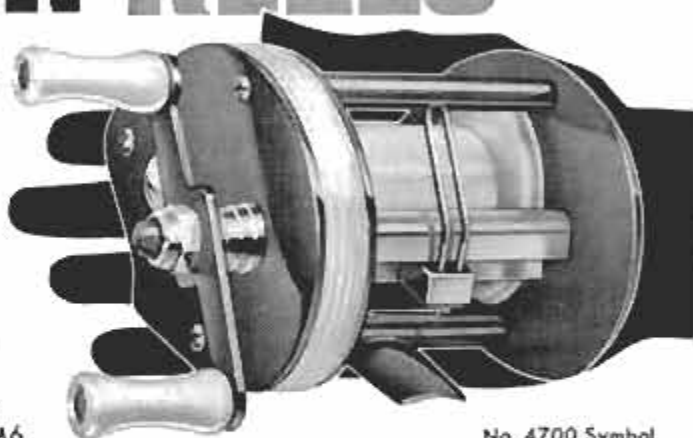
When the customer hangs up, the scanner, on its next pass, observes that that line is no longer drawing current. It makes a note of this in the temporary memory, but doesn't do anything yet. On the next pass, a tenth of a second later, it finds the same situation and makes another note in

(Continued to page 244)

reach for the reel fishermen trust!

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**FIELD-TESTED SINCE 1922**

the temporary memory. After three passes, the machine knows this is a real disconnect and orders switching to take down the connection. "This is equivalent to a slow-release relay," explains Ketchledge. "If it turns out that four or five passes are safer, we will simply put the order in the permanent memory by switching a photographic plate—instead of replacing thousands of relays as we'd have to in an electromechanical exchange."

#### Tiny Photographic Plates Are the Key

Those tiny photographic plates, with their myriad dots, are the real key to all the new conveniences for subscribers, once ESS "goes national." Just by adding or rearranging the specks for any given subscriber, electronic geni in the exchange can be automatically directed to perform a wide variety of stunts.

"You may be able one day to dial '1-1' on your telephone in Philadelphia or Chicago, and get Aunt Hattie in San Francisco every time you do it," Ketchledge says. Dial another simple double-digit number when you go out, and if anyone calls while you're gone, the system can automatically route the caller to a recorder that will take messages for you and play them back for you when you come home. It's all in the dots, easily changed to conform with your wishes. "We call this double-digit system 'dialing the one-x,'" Ketchledge explains. "Actually, if you only wanted a few special services, you could get them by dialing a single digit. But the double numbers will permit more than a hundred special-call orders for any telephone on any exchange."

Putting ESS in shape hasn't been easy. For two years, no outside supplier could produce a cathode-ray tube for the permanent memory that was precise enough to scan the minute lines of dots accurately. "We put out that fire by building our own in six weeks," Ketchledge recalls. "Then, we couldn't get the beam to scan properly. It worked on test patterns in the lab, but in the field it jumped wildly, deflected and did everything wrong. It looked as though we were licked. Then we suddenly discovered it wasn't the cathode at all. The photomultiplier tubes that were supposed to be picking up the signals from the beam were defective."

When will your house have a pushbutton phone with all the electronic fixings? If things go well at Morris, Ill., next year, and the customers like it, a gradual change-over to electronic switching could begin. But it will take years before all the millions of telephones are tied in to the miracles. Crossbar switching still is going into many communities after nearly a half century of constant installation. ★ ★ ★

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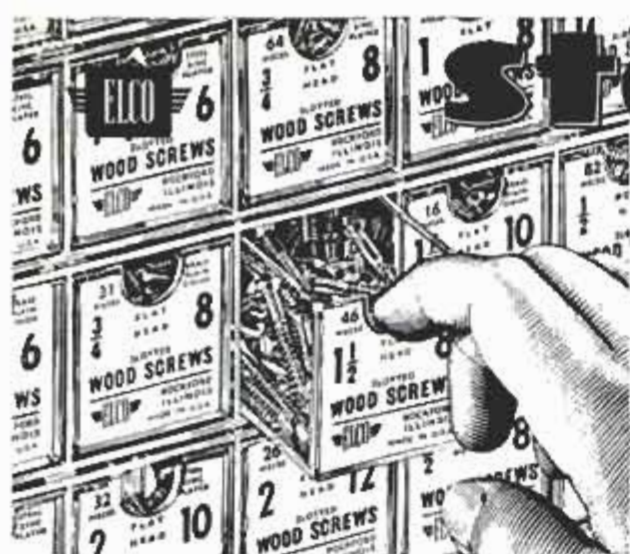
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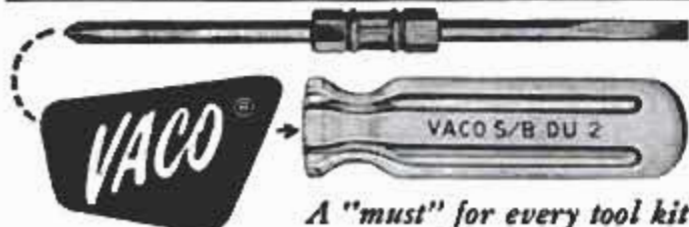
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## Atomic Chemicals Coming Up

Radioactivity in the cores of special reactors soon may be turning out industrial chemicals. According to Dr. Willard Libby, Atomic Energy Commissioner, studies have begun on an air-cooled reactor in which the fissioning particles would act as a catalyst on certain chemicals, producing nitrogen oxide—a primary step in the production of nitric acid. The possibility of catalyzing this and other chemicals profitably with intense radiation "looks bright and encouraging," Libby says.

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## You May Take Your Own Census For 1960's National Roll Call

Slide-rule wizards in the Census Bureau, analyzing what they call "response error" between census takers and citizens, have a hunch that people might make their own best census interviewers.

Ever since the last big census of population and housing, in 1950, 300 special interviewers have been making "spot checks" in selected areas, asking people the same questions previously put to them, but getting different answers. Worse, they discovered by checking outside sources that many folks don't like to tell a stranger the truth about income and age. The surveyors unearthed evidence of the public's tendency to understate income by 10 percent and, oddly, in several areas people over 60 boosted their ages four to five years. Many errors occurred because mother—who usually was the only one home when the census taker stopped by—had forgotten things such things as dad's age, or how far Uncle George had gone in school.

As a result of the findings, census officials are trying out a "do it yourself" questionnaire in two North Carolina counties. People, they have found, don't mind filling in their own questionnaires (only five per-

cent failed to return quizzes in one early test). And the experts believe that if everyone in the home has a chance to study the questions and talk them over, more accurate census data will result.

If the North Carolina tests prove them right, you may be counting yourself in next year's big roll call.

### How Uncomfortable Are You?

It's not the heat, it's the humidity, etc. But if you'd really like to know just how uncomfortable you are, here's how. Earl C. Thom, meteorologist of the U. S. Weather Bureau at Washington, gives this rule for figuring out your discomfort index:

Add the temperature reading on your ordinary Fahrenheit thermometer to the wet-bulb temperature, which you can determine by putting a bit of wet muslin around a thermometer bulb and then whirling it around. The wet-bulb reading is, of course, lower.

Multiply the sum of wet and dry-bulb temperatures by four tenths (.4) and add 15.

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 G.E. 200 amp, 30V, perfect. . . . . \$13.50  
 R-1 300 amp, J&H or G.E. Good Cond. \$15.50  
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**COMPLETE PACKAGE ACCESSORIES** for welding and battery charging as listed in kit above including reactor coil arc stabilizer. All 12 items like new. Incl. instructions. \$29.50

**AC-DC WELDER KIT** #311 G.E. Generator. Makes 1250 Watts AC light plant and 200 amp. DC welder and battery charger. Includes all items listed in accessories kit. AC-DC generator & inverter. \$38.50

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Now 4 way open center c. valve with adj. relief & metering. #10000 \$12.95. #4811 4 way for 1 cyl \$3.95 (+ 15% postage)

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Delco	1/5	6.5	7/32x2"	5.95 2/10.75
Bendix	1/4	8	5/16x1"	6.75 2/12.00
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MFG.	TYPE	R.P.M.	G.P.H.	Price
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Pasco	Gear	1500	198	\$ 8.95
7 Pasco	Gear	4500	270	\$14.50
Stratopower	P Disp.	450 cu/in rev	375 gph	\$15.50
Bendix	Vac. Air	15 cu. ft. M.	4500 RPM, 10" suction, 24" Hg press.	New \$21.50 used \$14.50

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## War "Vet" Returns as Flying Polio Hospital

RECENTLY an old war plane took off from Pacoima, Calif., bound for a new life in Buenos Aires as a flying hospital. The plane, a modified C-47B, is now on a unique mission. The origin of that mission was the polio epidemic of 1956 in Argentina.

With much of its population thinly scattered over its million-plus square miles, Argentina was faced with a heart-breaking problem during the polio epidemic. The small agricultural communities lacked medical facilities. Good medical treatment and respirators were available only in a few large cities. Since polio strikes in relatively concentrated locations, rural hospitals were overwhelmed with patients for whom little could be done.

### Plane Evacuates Victims

Authorities called on the Argentine Navy for help in evacuating the victims to Buenos Aires by plane. The Navy supplied a DC 3, which airlifted 149 patients from rural areas to the city. All but four of these patients lived to reach modern hospital facilities. On one occasion all the residents of a village turned out to build a runway 4000 feet long three hours after a woman was stricken with polio. The sky became the highway of life for many Argentines.

The success of the makeshift aerial ambulance prompted authorities to order a special plane for this purpose. The Navy was given the job of purchasing the plane in the United States.

The plane which was destined to fill the role was a C-47B which had started its career in World War II. Manufactured in 1943, it was delivered to the British Commonwealth Forces in Africa and saw hard service during the rest of the war. Eventually it was cannibalized for parts and sold as surplus. However, the airframe was sound, and was purchased by an American company, Calair International, to be reconditioned for use as the flying hospital.

### Stretchers and Respirators

Today the plane is equipped with racks of stretchers and respirators. The old war veteran is not just an ambulance, but a flying hospital. There's a sterilizer, operating table and overhead operating lamp. An auxiliary power unit supplies electrical power for the medical equipment and respirators. Full-size and chest respirators are carried.

Is such an elaborate flying hospital, designed specifically for the treatment of polio, needed, now that the Salk vaccine is available? Even in America, three years after introduction of the vaccine, countless people still have not been inoculated. Further outbreaks are expected in the next few years until widespread use of the Salk vaccine and other vaccines stamps out the virus.

Meanwhile the people of the Argentine pampas will have the benefit of a modern polio hospital that reaches them from the sky.

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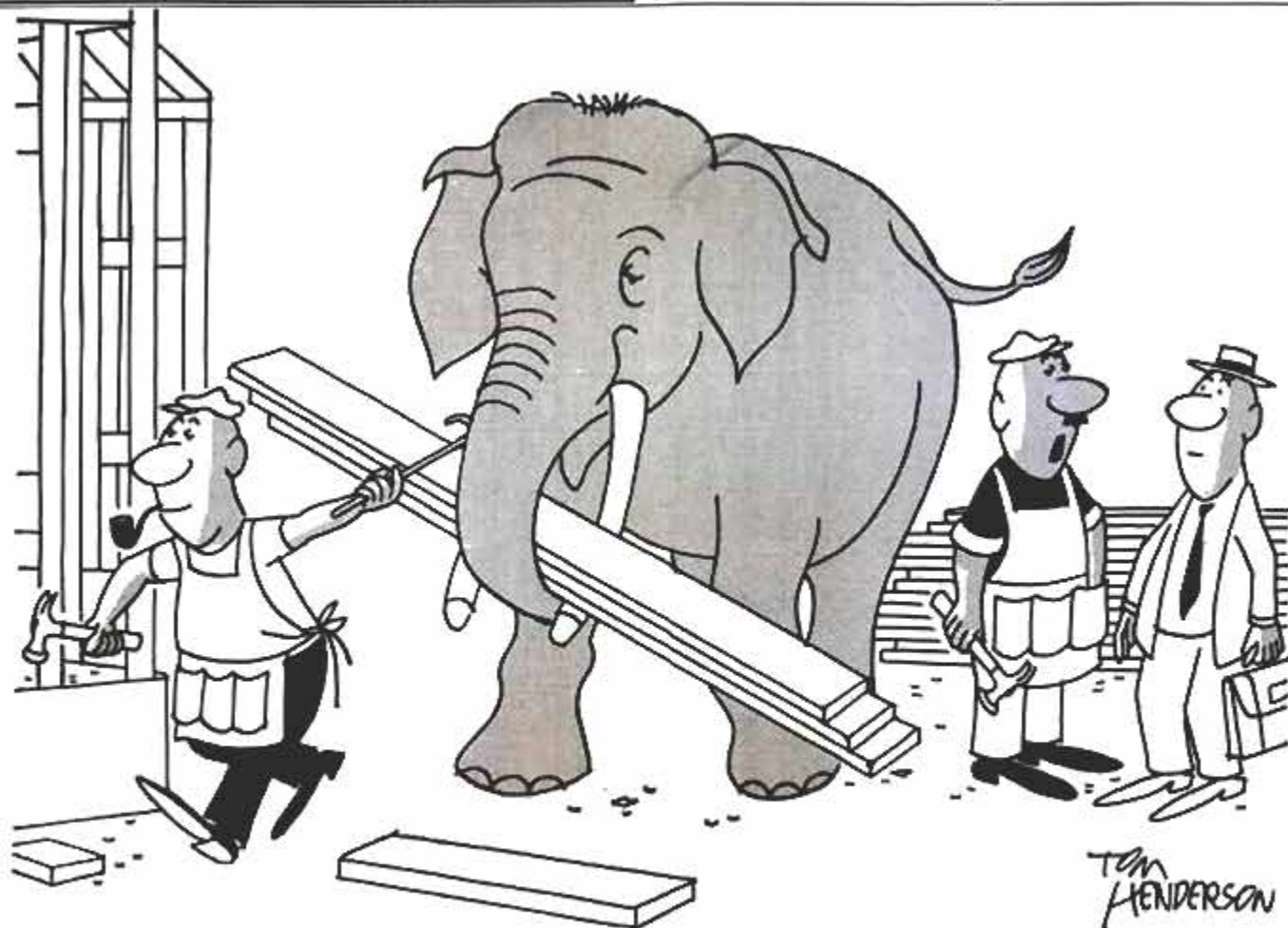
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JUNE 1959

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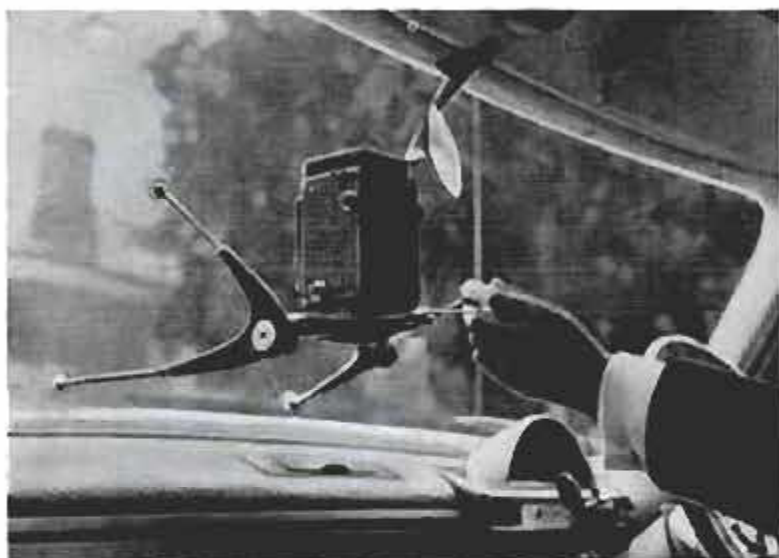
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## Camera Mount on Windshield Permits Driver to Take Pictures



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## Airborne Gravity Meter Will Help Remap Earth

Development of an instrument that measures gravity from an airplane will permit scientists to remap the earth. The unique instrument was tested recently aboard a KC-135 jet Stratotanker with results that varied only 10 parts per million from gravity measurements made on the surface of the earth. Further work on the airborne gravity meter is being conducted at the Air Force Cambridge Research Cen-

ter. Eventually it can be used to find the exact center of the earth and the true shape of the planet. It also will enable mapmakers to make precise locations of islands, measure exact distances between continents and determine other information about the face of the world. Previously, scientists were limited in their studies of the earth by "areas you cannot walk in, drive in, sail in or survive in."

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With Deluxe accessories consisting of one 200 AMP. Gen., adjustable helmet, electrode holder, 30' welding cable, rheostat, giant toggle switch, voltmeter, voltage reg., 1 pr. heavy-duty welder's gloves. All units guaranteed pre-tested. Approx. GOVT. COST — \$500. Most items new — all perfect. \$26.00.



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With Deluxe Accessories consisting of one R1 300 Amp Gen., 30' welding cable, welder's adjustable helmet electrode holder, 300 AMP ammeter, 300 AMP shunt, Rheostat, Giant Toggle Switch, 300 AMP reactor coil arc Stabilizer, Voltage Reg., Reverse Current relay, 1 pr. heavy duty welder's gloves. All units guaranteed pre-tested. Approx. GOVT. COST \$750. Most items new — all perfect. \$49.50. \*400 AMP Gen. with above accessories — \$44.50.



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