

# POPULAR MECHANICS MAGAZINE

WRITTEN SO YOU CAN UNDERSTAND IT

REG. TRADE MARK, GREAT BRITAIN, No. 410426

REG. U.S. PAT. OFF.



*Johnson*

**Report on the Foreign Cars**  
*Page 126*

*In This Issue*  
**HERE COME THE LEATHERNECKS!**  
*For the Craftsman*  
**WHEN SHOULD YOU CHANGE OIL?**  
**Build Your Own**



# Here's the MONTA MOWER Story



**TRIMS  
AS IT CUTS**

The MontaMower story is about the thousands upon thousands of people who are mowing their lawns in less time than they ever did before . . . with scarcely half the effort.

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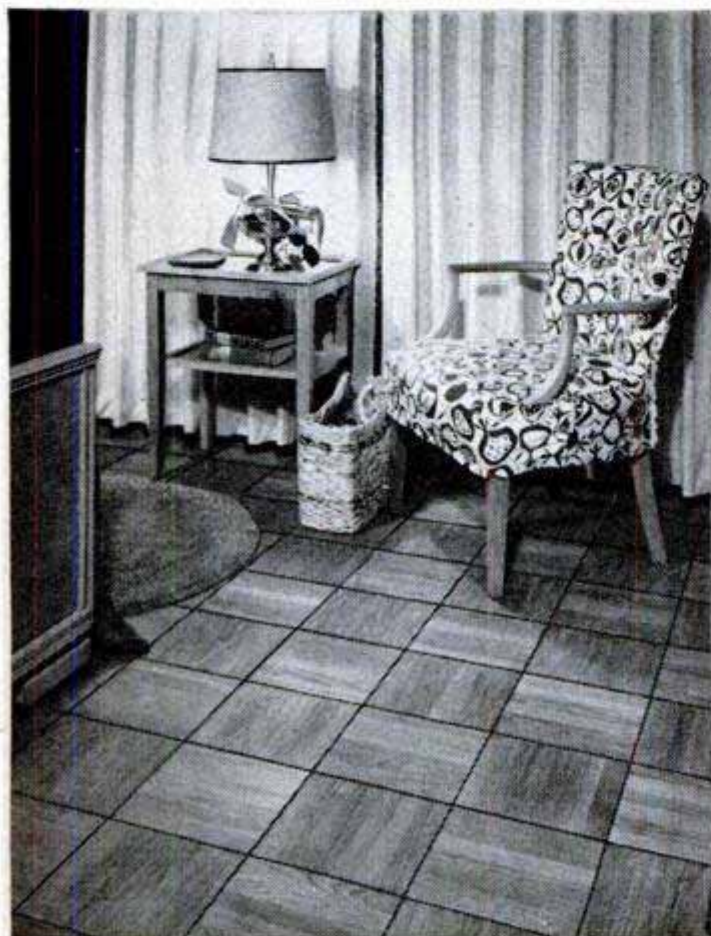
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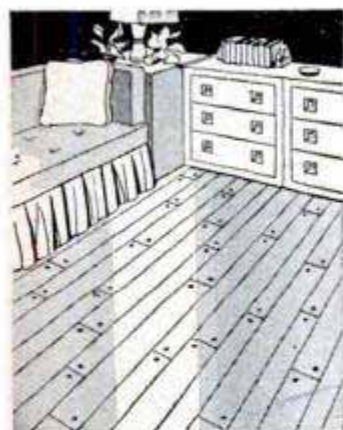


# Beautify your home

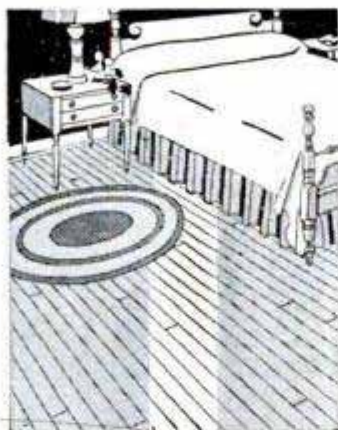
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**MODERN BLOCK**, in solid oak, will give your home rich style and lasting beauty. This distinctive parquet-type floor can be laid over concrete or wood.



**RANCH PLANK** with walnut pegs gives the effect of a random-width floor at one-third less cost. The 2 1/4" and 3 1/4" oak strips are pegged and finished at the factory.



**STRIP DESIGN** is always in good taste . . . has been more widely used than any other hardwood floor. A Bruce Strip Floor gives your home lifetime charm at minimum cost.

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**"Scratch-Test" Finish** — This test (left) proves that the factory-applied Bruce finish does not scratch, chip or mar like a surface finish. It's baked into the pores of the wood . . . outwears ordinary finishes 3 to 1.



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That's a pretty strong statement to make about a motor oil, isn't it?

Yet, because it's a true statement you may rightly feel that it's worth the 1 minute and 30 seconds it will take you to read the rest of this page.

Since automotive engineers tell us that 50% of your gasoline is burned up overcoming engine friction (at 40 miles an hour on a level highway), any reduction of that friction gives you more mileage from the same amount of gasoline.

Now, anything that reduces this friction naturally can make your car go faster or farther or climb a steeper hill on the same amount of gas. That's because less of your tankful is needed to overcome friction and more of it can make your car go.

That makes sense, doesn't it? All right. Now there is a testing machine called a Dynamometer—accepted by the automobile industry as a way to measure power.

Hundreds and hundreds of cars like yours were scientifically tested on a Dynamometer. The results showed that the motorist got an average of 8% more power from the same amount of gasoline after he had changed from whatever brand of oil he had been using to Macmillan Ring-Free Motor Oil.

Maybe 8% doesn't seem very much to you until you stop to think that at 25¢ a gallon it means 2¢. Over a normal oil drain period that means \$2.00—enough to pay for your Macmillan Ring-Free Motor Oil refill.

Now read the headline again, please. It's clear now, isn't it?

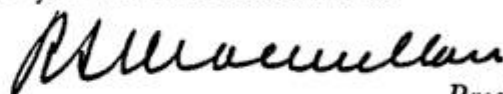
But that isn't all.

That 8%, if you *are* getting average mileage, means an *extra* 20 miles from every tankful.

And while Macmillan Ring-Free Motor Oil is reducing friction it also reduces deposits of carbon and gum in the combustion chamber, in rings, valves and valve stems. It means higher compression from better piston seal, smoother running and less likelihood of ping.

And when you cut down friction you cut down repair bills. With less friction, your motor is a healthier motor, runs sweeter, uses less oil and stays new longer.

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President

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## SPECIAL NOTICE

**P.S.** There's an easy way to find out which dealers near you can service your car with Macmillan Ring-Free Oil. Just pick up your 'phone and call Western Union (by number). Then ask for Operator 25. Give her your name, address, and telephone number. Your inquiry will receive my prompt attention. Don't put it off. Start taking better care of your motor right now. R.S.M.



# Popular Mechanics Magazine

Registered in U. S. Patent Office and Canada

H. H. WINDSOR, Founder

H. H. WINDSOR, JR., Editor and Publisher



*this month's cover*

NOT MANY YEARS AGO the sight of a foreign-made automobile started heads spinning and tongues wagging. The driver of an alien car found himself continually leading a parade of curious motorists. Not so today. European-made autos appear in towns and cities everywhere, and names like Austin, MG and Jaguar no longer have a strange old-world flavor. But that sleek, low car framed by an arch of Roman ruins on our cover would cause heads to spin almost anywhere. It's an Italian Ferrari. Only 10 racing cars and 150 sports cars are built by Ferrari each year, and they sell for upwards of \$12,000 apiece. Floyd Clymer visited the Ferrari factory to acquire material for his extensive survey of European cars, which began in last month's issue. The second part of his report starts on page 126. The painting reproduced above is by Bill Johnson, one of the youngest and best cover artists in the world of magazine art

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Empire State Bldg., Room 2906, New York 1, N. Y.

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302 23rd St., Santa Monica, Calif.

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77 Baker St., London W. 1, England

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# Have You Taken This Opportunity for

**COLONEL, RESEARCH AND DEVELOPMENT DIVISION, DEPARTMENT OF THE ARMY:** "Full support should be given any sound measure designed to encourage inventors and facilitate consideration and further development of their ideas or inventions. It is difficult to conceive of any action that would accomplish more in this direction than that called for in the Sinclair Plan."

**CABINET MEMBER:** "It should bring to light some valuable ideas which might otherwise not have been known."

**AN INVESTMENT COUNSELOR:** "I can imagine the great surge of hope now going through the breasts of the young men specializing in this field. 'Here,' they will say, 'is a corporation willing to give us a break.' . . . Its fundamental unselfishness cannot fail to strengthen the faith of those without property. . . . This is opportunity!"

**AN AIR FORCE GENERAL:** "I have read of your plan for encouraging invention and offering a testing ground for ideas. Such a project seems to me both practical and inspirational!"

**A CABINET MEMBER:** "The provisions regarding patents are unique . . . the compensation for your investment of money, time, and facilities would be limited to nonexclusive, royalty-free shop rights for your company."

## Men Who Know the Importance of Independent Invention Encourage You to Use the Sinclair Plan

**A MEMBER OF THE JOINT CHIEFS OF STAFF:** "The Sinclair Oil Corporation is performing another fine public service in opening its research laboratories to the American inventor. I am confident that the nation will derive many benefits from this selfless service."

**PRESIDENT OF LARGE MANUFACTURING CORPORATION:** "We all think the plan, which opens wide the doors of your great research laboratories, should indeed encourage individual inventors."

**AN AIR FORCE GENERAL:** "I wholeheartedly agree that there is a need to help the independent inventor because of the complexity of modern technology and the prohibitive cost of these facilities. Your farsighted plan is a great stride in relieving this situation."

**PRESIDENT OF A LARGE MANUFACTURING COMPANY:** "You have recognized a great need, and have done something objective to overcome it . . . another idea which puts to beneficial use the resources and capacity of a large group."

**PRESIDENT OF A BROADCASTING NETWORK:** "To make the magnificent facilities of the Sinclair Research Laboratories available to inventive Americans under what would seem to be a very fair arrangement is a constructive and forward-looking step."



# Advantage of Independent Inventors?

*If you have an idea for a new petroleum product—  
but do not have the facilities needed to develop it—  
the Sinclair Plan offers you laboratory help.*

**E**IGHT months ago, Sinclair opened up a part of its great research laboratories to independent inventors who had ideas for new or improved petroleum products but who did not have the facilities needed to develop and profit by their ideas.

To date nearly 5,000 inventive people have submitted ideas to the laboratories; and the Sinclair Plan has become recognized as a service to inventors, the oil industry and the public. As a result we have made the Plan part and parcel of the long-range operation of our company.

If you have an idea for a new or improved petroleum product or application, you are invited to submit it to the Sinclair Research Laboratories. In your own interest, each idea must first be protected by a patent application or a patent. If the laboratories select your idea for develop-

ment, they will make a very simple arrangement with you: In return for the laboratories' work, Sinclair will receive the privilege of using the idea for its own companies, free from royalties. This in no way hinders the inventor from selling his idea to any of the hundreds of other oil companies for whatever he can get. Sinclair has *no control* over the inventor's sale of his idea to others, and has *no participation* in any of the inventor's profits through such dealings.

**HOW TO PARTICIPATE:** Instructions are contained in an Inventor's Booklet. Write to W. M. Flowers, Executive Vice-President, Sinclair Research Laboratories, Inc., 600 Fifth Avenue, New York 20, N. Y.

**IMPORTANT:** *Please do not send in any ideas until you have sent for and received the instructions.*



*Nine buildings of the Sinclair Research Laboratories at Harvey, Ill.*

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## in this corner..... THE EDITORS



### Mexican Road Race

Each year, racing drivers converge on Mexico for the road race, a classic that always provides supercharged thrills. Latest winner is Piero Taruffi, who roared along the 2000-mile course in a Ferrari, the



Italian-built car shown on this month's cover. But a special thrill in the race was provided by Tony Bettenhausen, one of the best-known drivers in the business, who teamed up with a small plane to navigate the tricky course.

Bettenhausen, driving a stock-model Chrysler tuned up for the race by Kiekhaefer Engineering, followed the visual signals of a light plane which scouted the course just ahead of the car. A flapping tail indicated rough terrain to Bettenhausen, a sharp bank gave advance warning of a turn and an up-and-down motion indicated hilly roads ahead.

After bad luck at the beginning of the race, Bettenhausen averaged 114.33 miles per hour on the final 230-mile lap to set a new world's record.

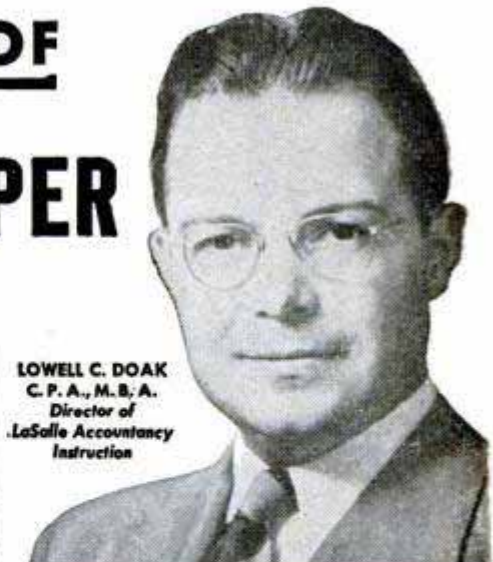
### Tip for the Craftsman

Not long after the 500-page Golden Anniversary issue appeared on the newsstands, we received a letter from Harold Trombly of Oildale, Calif., a letter which aroused some curiosity because a short piece of twine had been carefully taped above the message. Mr. Trombly pointed out that the piece of cord could be of some value to our craftsmen readers. Here's his suggestion: "Drill or punch two holes about four inches apart in the binding of *Popular Mechanics*,

(Continued to page 8)



# Let Us Send You **FREE PROOF** that you can become an expert **ACCOUNTANT... BOOKKEEPER** **OR C.P.A.**



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"There is need for accountants. There is ample compensation for accountants. There is no prospect that the supply will overtake the demand within the lifetime of even the youngest of us."

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# MEN OF THE HOUR

are moving UP!



Thousands of Embry-Riddle trained engineers, mechanics, specialists and pilots are making rapid strides in today's booming aviation industry.

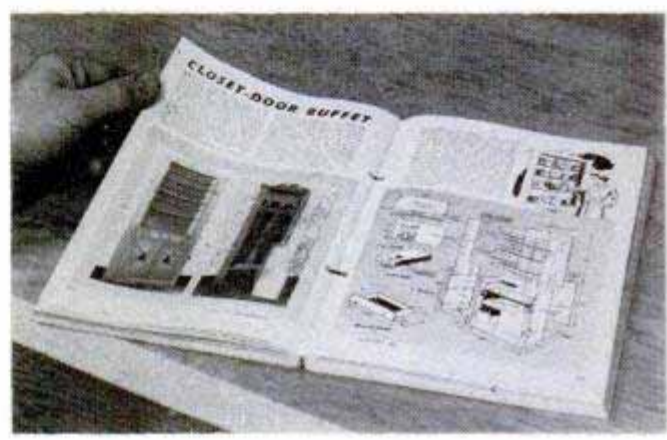
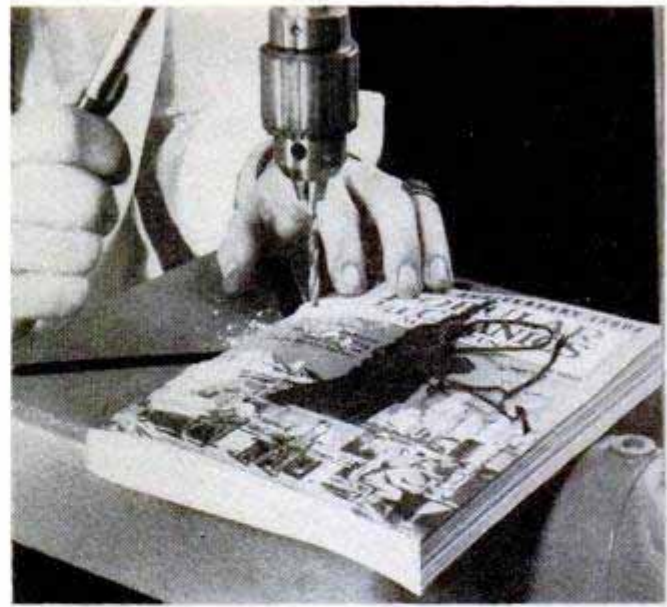
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TRAIN IN MIAMI--AIR CAPITAL OF THE WORLD

(Continued from page 6)

near the staples, and pass this cord through them. Tie a square knot on the other side and remove the metal staples. Open the magazine to any page, and it will lie on a workbench perfectly flat." We tried it with the Anniversary issue. The happy result, as Mr. Trombly predicted, is a magazine that opens flat for ready reference.

### Here Comes the Circus!

Lloyd Morgan is a busy man. It's his job, as lot superintendent, to see that the "Greatest Show on Earth" (Ringling Bros. and Barnum & Bailey Circus) rolls smoothly to the lot, is erected for a performance, then vanishes aboard the three circus trains—all within a few hours. Morgan directs the activities of 1400 people in unpacking, setting up and repacking 72,000 (count them) 72,000 tons of circus. The big top itself ("Largest Canvas Roof in the World") covers an area more than twice that of a football field. The circus will make a one-night stand in the May issue, complete with its 73 miles of rope, its cookhouse that serves 4200 top-notch meals a day, its mechanical stake drivers that have largely replaced the flashing sledges of yesteryear.

(Continued to page 10)





**This man will get ahead . . . This one won't . . .**

### CAN YOU TELL WHY?

They went to the same school, live on the same street, both have bacon and eggs and coffee for breakfast, both twirl a ball at Martin's Bowling Alley Monday nights.

### WHAT MAKES THEM DIFFERENT?

One thing—what they're doing about the future. The man who hasn't got any future isn't doing *anything* about it. That's why.

The man who *has* a future is doing something about it right this minute. He's building it with an I. C. S. course that will prepare him for a job he knows he'll be able to fill when it comes.

The dreamy man expects breaks—somehow they never come. The wide-awake man is letting I. C. S. show him how to *manufacture* breaks. They'll be his because he's ready for them.

Which man are YOU going to be like? If you're made for something more than a dead-end job that pays little and holds you back . . . if you feel the urge to climb and grow . . . check off, below, the field you want to get ahead in and send the coupon. Do it while you feel like it—don't let the urge die.

How about it, fellow?

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##### Art Courses

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- Structural Drafting
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- Internal Combustion Engines

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- Foundry Work
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- Industrial Instrumentation
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- Machine Shop Inspection
- Mechanical Drafting
- Mechanical Engineering
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- Mold-Loft Work
- Patternmaking—Wood, Metal
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(Continued from page 8)

The big show will go up and come down in the full-color drawing of art director Frank Beatty. Don't miss it next month!

### Letter to the Editor

In the January issue you state in the article "Underwater Camera" (page 209) that "... camera even has an oxygen bottle..." This statement is incorrect since not oxygen but only compressed air at pressures of 2000 to 3000 pounds is used. Use of the air bottle is to pressurize the camera case automatically to three pounds above the pressure at which it is used. This system is capable of balancing pressures so that the camera is never under any stress. If anything, air leaks out, but water never leaks in. . . . Air volume in the bottle is capable of pressurizing the case for depths under 300 feet. On ascending to the surface, a relief valve set to maintain the three pounds plus depth constantly releases air from the main camera case. Otherwise pressure trapped at greater depths would burst the camera case when it is lifted. The camera case thus "exhales" coming to the surface. This basic principle is very ingenious and revolutionizes the general approach to design of deep-diving equipment which, in the past, has consisted of true pressure vessels taking the strain through the design and strength of the shell, such as the bathyspheres of William Beebe and Otis Barton. . . .

Richard Crosby, Uniondale, N. Y.

### Letter to the Editor

In your Golden Anniversary issue you show 50 outstanding men whose work contributed to the welfare and happiness of all the people.

I would like to place the name of Thomas A. Edison at the top of the list. He did more than any other man to make the people of the world happy and prosperous.

T. Clarence Marshall, Yorklyn, Del.

The name of Thomas A. Edison was the first suggested when Popular Mechanics editors began compiling the Hall of Fame. However, the group selected represented only those who had made their major contributions in the last 50 years, which were the first 50 years of this magazine. Mr. Edison's most creative work was done prior to 1902, and the educational leaders and scientists with whom we consulted in compiling the Hall of Fame agreed on this point. Certainly the name of Edison would appear high on any list of scientists not chosen from a limited period of years.

The Editors



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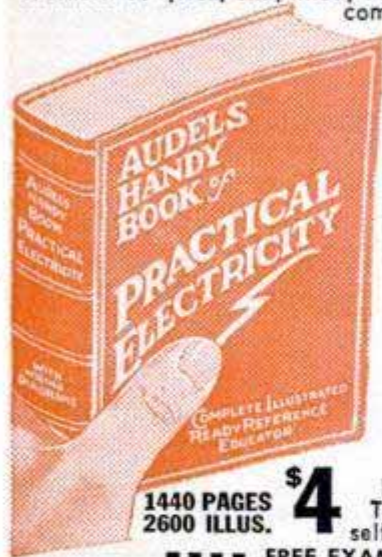
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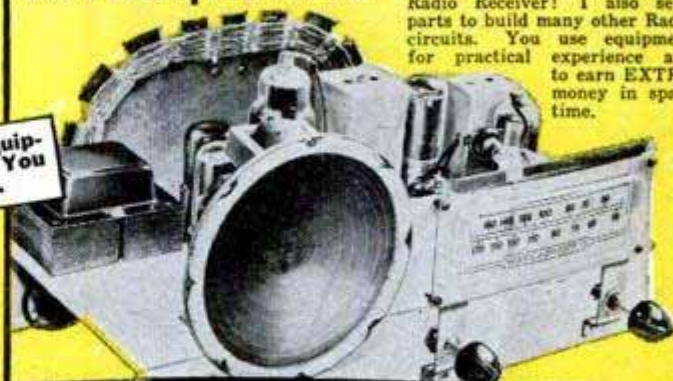


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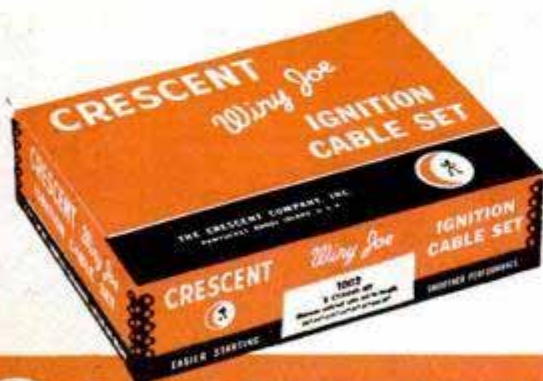


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## Mass Killer

Last February, the automobile outpaced war as a mass killer of Americans when its fatality toll exceeded for the first time in history the total of the nation's military dead since 1775. According to the Association of Casualty and Surety Companies, the automobile killed its millionth victim December 22 last year. At the 18-month mark of Korean hostilities, traffic fatalities were occurring seven times faster than those of war, claiming in one day as many American lives as the total lost in one week's fighting in Korea.

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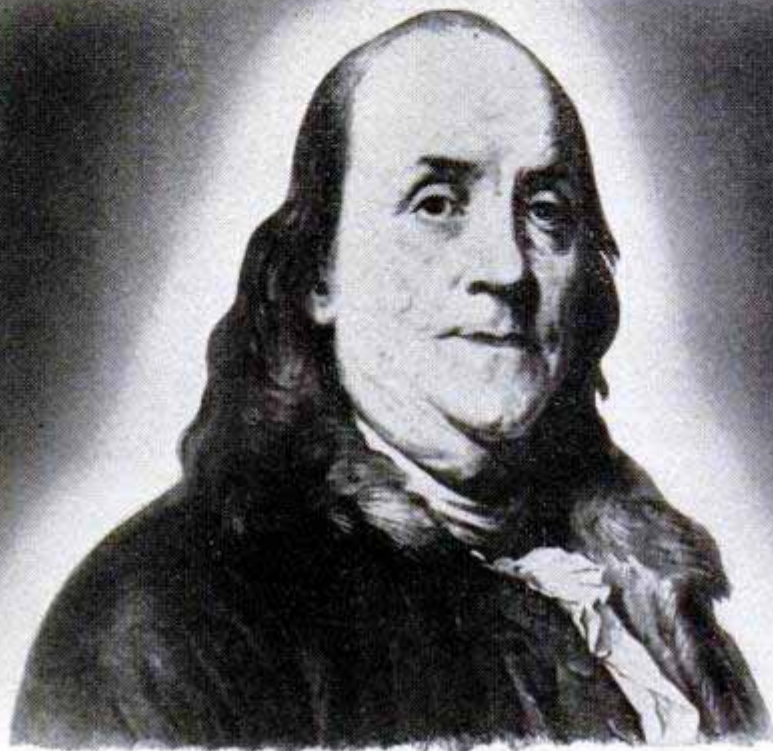
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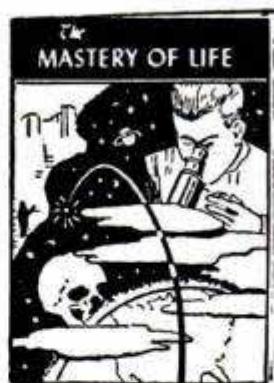
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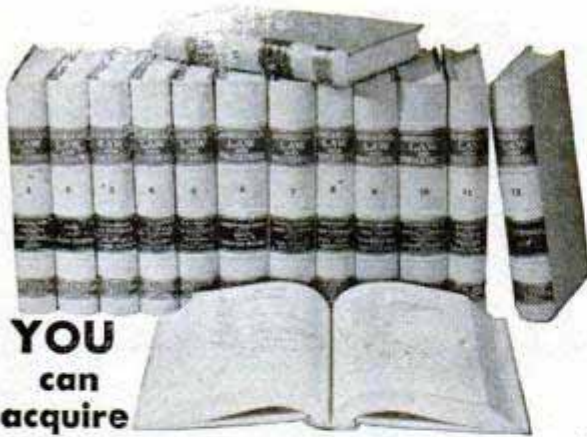
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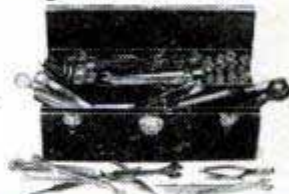
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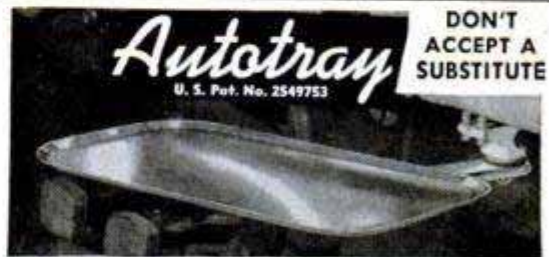


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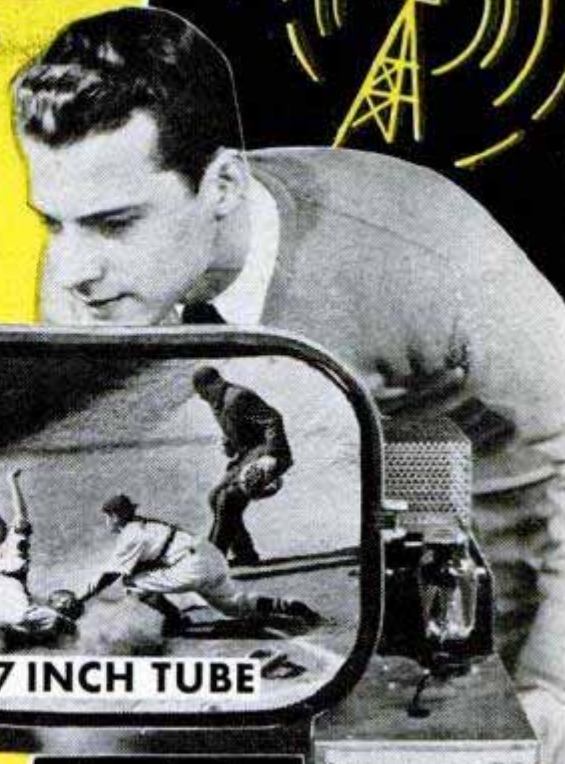
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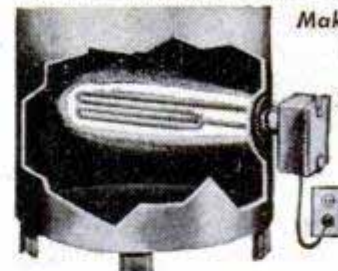
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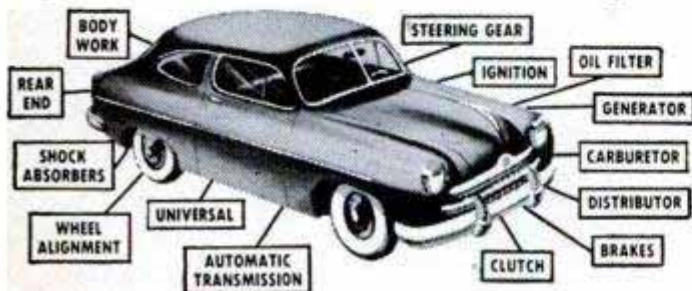
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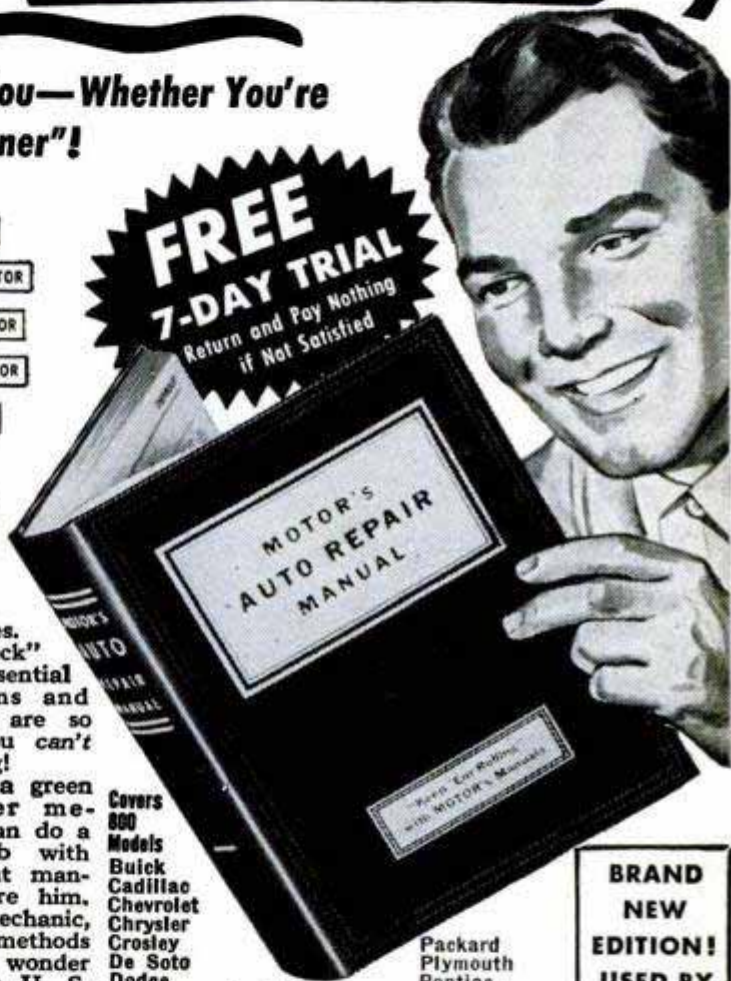
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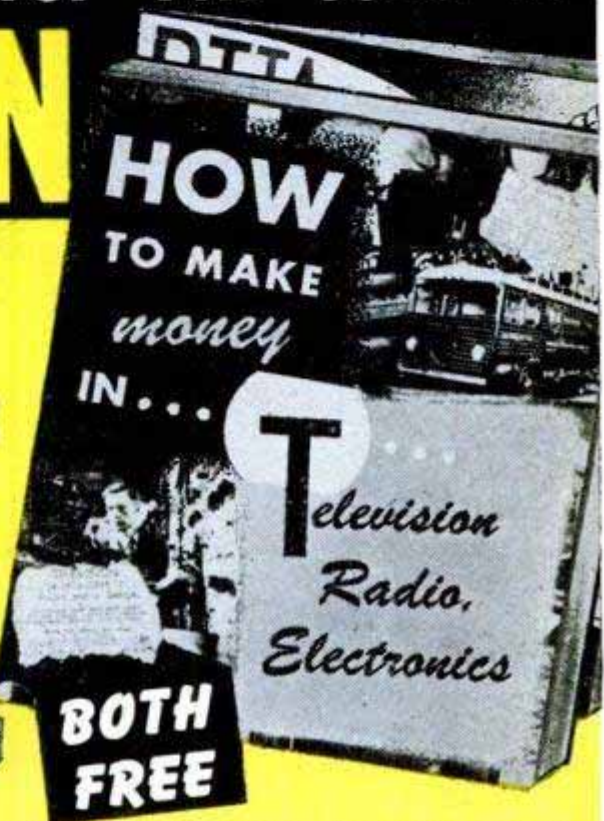
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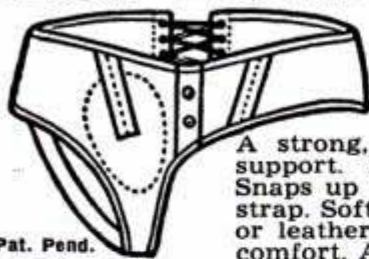
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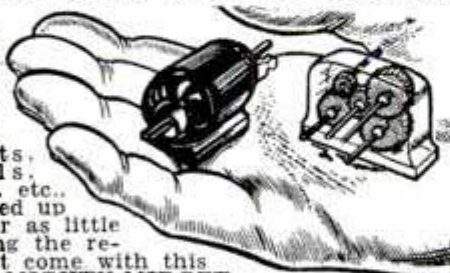
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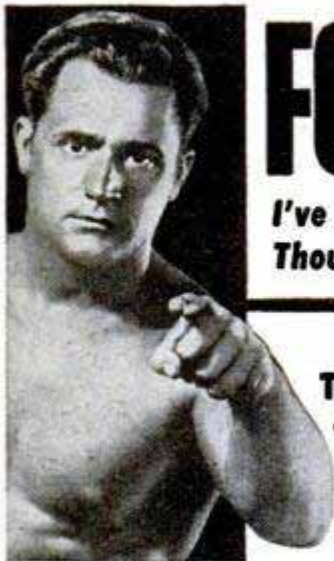
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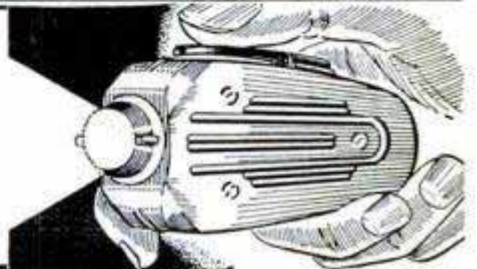
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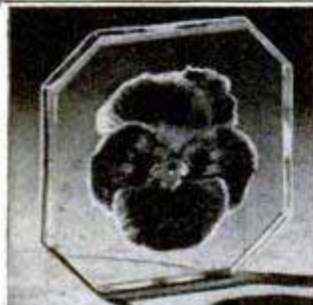
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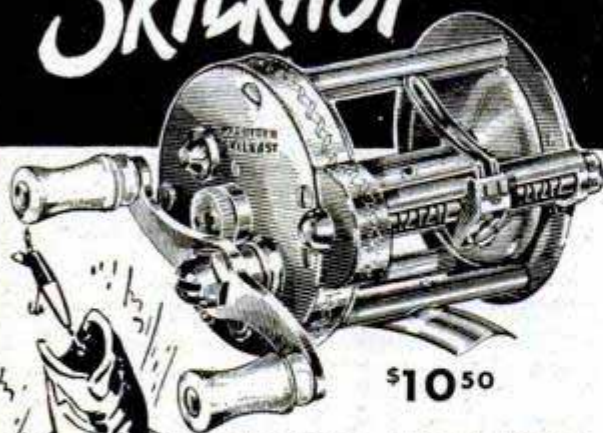
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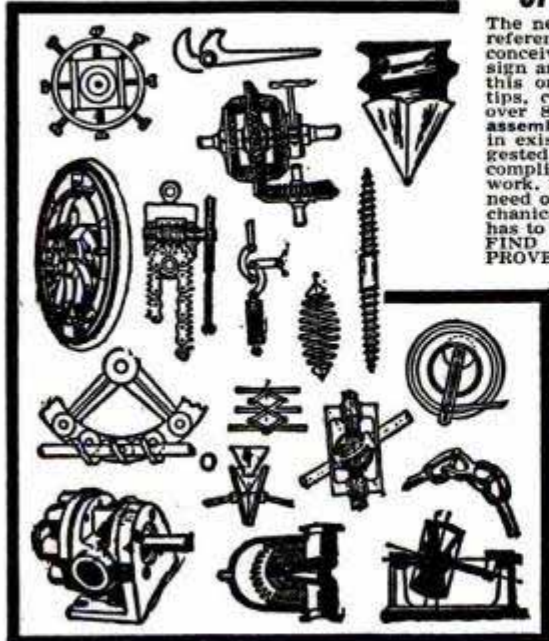
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650x16	4.54	670x15	4.74	32x6(10)	10.84	900x20	13.34	650x15	4.34	650x20	7.84
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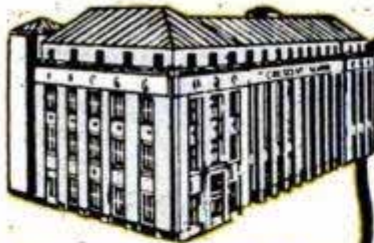
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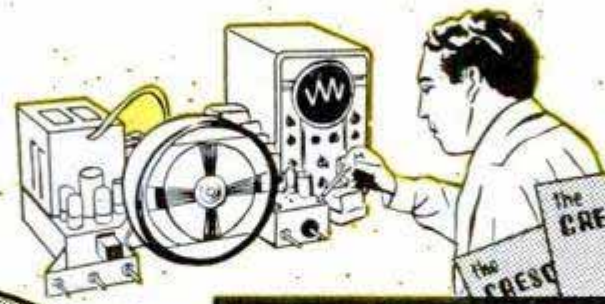
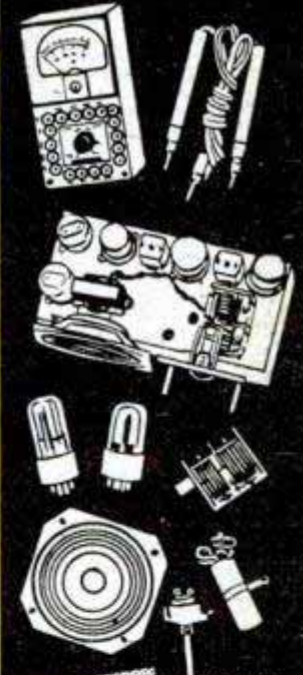
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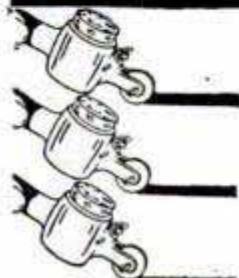


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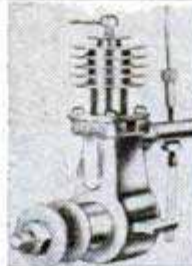
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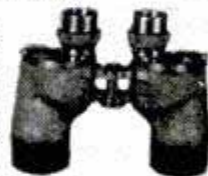
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**EXTRA-Money**—No selling, operate vendors. Amazing profits, details free. Silver King, Suite 220, 622 Diversey, Chicago 14.

**BUY IT wholesale!** Manufacturers, distributors offer 850,000 items. Literature free. Olsen, 1231-A East Third St., Duluth 5, Minn.

**\$25 WEEKLY** Working two hours daily. No canvassing. No manufacturing. Lycke, Box 2471-A, Cleveland 12, Ohio.

**HOW** And where to obtain capital, details free. Star Service, Wapakoneta, Ohio.

**EARTHWORM** Breeding? First, get unusual story. "An Earthworm Turned His Life." Free. Earthmaster, Dept. 14, El Monte, Calif.

**MONEY** In new greaseless doughnuts. Start in kitchen. No smoke. Sell stores. Free recipes. M. Ray Company, 3605 South 15 Ave., Minneapolis 7, Minnesota.

**INCOME** From local information. No selling. Write Neherco, La Verne, Calif.

**UNPAINTED** Bookends, plaques, statues, figurines. List. Haverty Products, 822-17th St., Altoona, Penna.

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

**DOLLARS** In personalized baby record books. Sell by mail. Use same literature we do. No-Co-Ro, Oakland 6, Calif.

**FABULOUS** Earnings—Fascinating pastime. Growing genuine, living-miniature (ming) tree. New sensational business or hobby. Astounding information free. Dwarf Gardens, Box 355B, Briggs Station, Los Angeles 48, Calif.

**MADE** \$24,500 Using money making plans from Schemer Magazine, world's oldest mailorder publication. Box 275M, Canfield, Ohio. Year \$2.00. Sample 20c.

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

**COPUBLISH** Leading m.o. paper. Latest copy Mail Sale Advertiser, details, dime. Vanroy Shirk, Lebanon, Penna.

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

### MONEYMAKING OPPORTUNITIES

**MAIL** Order opportunities. Send 25c for magazines, "Progressive Mail Trade" and "Tip Top Salesman," plus our latest wholesale catalog of toys, novelties, etc. Gerlach, Box 245, Sheboygan, Wisc.

**PROMOTE** Dances, parties, shows, contests, etc., in small towns. Get "Promoters' Package." Contains: Actual samples over 90 different tickets, over 40 different posters, big 100-idea lists, plus detailed plan. Everything postpaid \$2.50. Tikco, 3456 S. State, Dept. 204-1, Chicago 16.

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

**"HOW To Make Money With Hobbies."** Free folder. Campbell, Bealeton 1, Virginia.

**UNFINISHED** Plaques, bookends, novelties. Stamp brings list. Umlauf, 239 So. Luther, Detroit 25, Mich.

**FREE!** Moneymaking opportunities galore including magazines. Wilbur Erickson, Englishtown, New Jersey.

**1000% PROFIT.** Can't fail system. Free particulars, or, for quick start invest \$1.00. Money back guaranteed. Honest Deal, Box 6421, Philadelphia.

**CASH** For your handmades! "The Shopping Guide" tells how. Sample 10c. Ida O'Malley, Route 1, Phoenixville, Penna.

**WIN** Contest money. General Contest Bulletin gives hundreds of tips. Lists current contests and rules. Sample 25c. General Contests, 1609½ East 5th, Duluth, Minn.

**MAILORDER** Selling pays off, when you know how. Several profitable opportunities available. Variety, 57-H Circuit Avenue, Newton Highlands 61, Massachusetts.

**580 MONEY** Making secrets. Send stamp for particulars. Book Service, P.O. Box 453, Port Chester, New York.

**MAKE** Big money. Sharpen lawn mowers. Full or part time. Season just starting. Complete sharpening machine \$59.00. Bridges Industries, 270 East Park, Mansfield, Ohio.

**TIE-Breaker** picture puzzles exposed, \$1.00. Wenograd, Box 1495, Philadelphia 5, Penna.

**FREE** Nationwide advertising, publicity! Advertise your products to 51 million readers thru 77 national magazines, free of charge! Broadcast on 400 radio stations without risking a penny! Send 25c (refundable) for details today! Treasury, 149 Stor-er, New Rochelle 5-L, New York.

**HIGH School men**—Splendid opportunity to earn money this vacation. Write Box 154, Oakland City, Indiana.

**\$15,000 YEARLY** Possible with surplus comic books. New, fascinating. Particulars and sample 25c. Kenneth C. Fleck, Columbia City, Indiana.

**RAISE** Fishworms. Outstanding opportunities! Detailed 15-page booklet explaining raising, feeding, packing, marketing. 25c. Ozark Worm Farm-J, Willow Springs, Mo.

**SELL** Nationally advertised merchandise, start own mail order business, we supply everything, catalogue, details, \$1. Refundable on first order. Daurio Enterprises, Teaneck 5, New Jersey.

**OLD** Phonograph records wanted. Paying up to \$300. Complete price lists of over 1,500 records and details. Send \$1.00. International Mart, 1264M North Harper, Los Angeles 46, California.

**OPERATE** Profitable mail order business. Mail order manual, \$1.00. Free circular. Sheldon Mail Order, Sheldon 1, Iowa.

**EARN** While learning to hand-paint textiles. No canvassing. Screen-Art Service, Stillwater 7, Minnesota.

**50,000 ARTICLES** Wholesale. Source directory, dime. Nelko, Box 3462-DR, Chicago 54.

**FREE** Book "505 Odd, Successful Businesses." Work home. Expect something odd! Pacific, Oceanside, Calif.

**BE** Appointed State Notary Public now! Details: Stationers, Helotes, Texas.

**PUBLISH** Your own magazine. Hand-some 52 page format, well edited, illustrated. Cost low as \$1.00 month. Brings you prestige, profits. 25c brings sample, details. National, Ord, Nebr.

**READ** Progressive Mailtrade, the magazine that tells how to make money by mail. Dime brings sample and special offer. Progressive Mailtrade, Box 357, Sheboygan, Wisconsin.

### FORMULAS, PLANS, ETC.

**HOW** Make cosmetics, book \$1.00. Avery, 112-S Elizabeth, Wichita 12, Kansas.

**REAL** Manufacturing formulas. Lists free. Cummings, Chemist, Gordon Ave., Syracuse 4, N. Y.

**ANY** Formula \$2.00. Satisfaction guaranteed. Jack, Chemist, 4292 Parkside, Philadelphia 4.

**FORMULAS;** All kinds. Latest, best. Literature free. Kemixal, Park Ridge, Ill.

**TESTED** Formulas. Interesting descriptive booklet free. Pont, Box 635-PM, Terre Haute, Indiana.

**HOT** Tamale making for profit. Particulars. Write F. E. Skinner, 419 W. Live Oak, Altus, Okla.

**FREE** Formula catalog. Anything analyzed \$25.00. Western Chemical, Salem, Oregon.

**10,000 FORMULAS,** Trade secrets, etc. 900 pages, \$3.98 postpaid. Free literature. K. Paulin, Loudonville, Ohio.

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**OH Boy!** New book of science. Experiments, formulas, secret processes, together with catalogue of laboratory supplies, only 25c. National Scientific Company, Dept. 16, 2204 W. North Avenue, Chicago 47, Ill.

**CHEMICAL** Supplies catalog 15c. refundable. Laboratory Sales, Box 161-A, Brighton, Mass.

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

**SPECTROSCOPE** For quick chemical analysis \$3.00. Book 200 electric stunts \$1.00. Kutting Sons, Los Altos, Calif.

**NEW** Idea chemical and apparatus outfits for home experimenting. Photo-scales, microscopes, chemicals, biological and laboratory supplies in small quantities. Catalog 25c. Established 1931. John H. Winn, 124A West 23rd Street, New York, N. Y.

**ILLUSTRATED** Catalog: Chemistry, mineralogy, biology, 10c. Tracey Laboratories, Evanston, Illinois.

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**PLASTICS** Catalog—10c. Sheets, rods, tubes, molding, casting plastics. Information, bargains galore. Sample low price: 1/16" clear Lucite, full sheets, 98c square foot. (36"x48"). Gem-O-Lite, Box 686G, North Hollywood, Calif.

**LUCITE** Plexiglas. Any size sheets, masked. Square foot (12 x 12) cost, 1/16", \$1.20; 1/8", \$1.40; 3/16", \$1.75; 1/4", \$2.08. Include 10% postage. Almac Plastics, 230 Fifth Ave., New York 1, N. Y.

**PLASTIC** Sheets, rods, tubes, etc. Free list. Plastic Supply Co., 2901 N. Grand Blvd., St. Louis 7, Mo.

**MANUFACTURERS** of a complete line of internal carvings. Crystal Floral Company, Bound Brook, New Jersey.

**NEW** Liquid casting plastic. Clear, colors. Embed flowers, insects, coins. Saw, drill, carve. Send 25c for wholesale catalog and new sales manual showing how to make money at home. Castolite, Dept. D-101, Woodstock, Illinois.

### HELP WANTED

**AMBITIOUS** Married man travel U. S. with wife, training for fascinating career in radio advertising. Executive position, non-travel available after 18 months. Salary plus commission start. Highly profitable. No experience necessary. We will train friendly outstanding, young, career man with good car. Wife must type, drive and assist first 18 months. Lifetime opportunity with successful firm. Write immediately. National Radio, West Hempstead, New York.

**TIRED** Of no money, second rate jobs? Like to start a real career with a lifetime of high salaries? Write me about two growing fields that really need men. Ed. Howes, Chief, 456 W. Santa Barbara Avenue, Los Angeles 37.

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**NEED** Money? \$50-\$100 and more is yours—easily, pleasantly, quickly. In spare time just show friends irresistible Elmira assortments of all-occasion greeting cards, wrappings, personalized stationery, napkins, matches, many other exclusive, profitable specialties. No investment. No experience. Success assured. Bonus. Special prizes. Promptest service. Write today. Free samples, assortments on approval. Elmira Greeting Card Co., Elmira 112, N. Y.

**AT** Last! Something new and sensational in everyday cards, 21 for \$1. Make extra money fast! Show satin, velour, metallic cards. Get orders easy. Big line \$1 assortments, scented stationery, personal matches, kiddie books. Imprints free. Two \$1 boxes on approval. Puro Co., 2801 Locust, Dept. 240-D, St. Louis 3, Mo.

**MAKE** Money fast—Sell big value greeting cards. Four new 21 card \$1.00 all-occasion assortments, birthday, Easter, novelty cards. Gift wrappings, stationery, notes. Unusual gift items. Over 100 fast-sellers. Amazing profits. Write for samples on approval and "get-started" plan. Hedenkamp, 361 Broadway, Dept. PM-20, New York.

**HOUSE** Paint—Wholesale price \$2.85 gallon. Private label. Big profits. Certified Products, Louisville, Ky.

**PART** Time salespeople—Men and women. Daily cash returns showing Artmoore Products, three "in demand" items. No investment in stock. Liberal no risk starting offer. Write Dept. P-4, Artmoore, 1319 North Third, Milwaukee, Wisconsin.

**MAKE** Money selling ties. Free catalog. Write to Phillip's Neckwear, Dept. 917, 20 West 22 St., New York.

**FREE** Samples, and amazing plan, giving you gorgeous dress without penny cost. Rush name today with dress size. Harford, Dept. G-535, Cincinnati 25, Ohio.

**NEW** Plastic mending tape. Just press on! Repairs clothing instantly. Lightning seller. Samples sent on trial. Kristee 146, Akron, Ohio.

**WHOLESALE** Catalog appliances, toys, watches, etc. 25c (refund first order). Cam Company, 1717-58th, Brooklyn 4, N. Y.

**MEXICAN** Feather pictures. Sell on sight; 200% profit! Free details; sample 10c stamps. Sylvia-PW, Apartado 9036, Mexico City.

**MAKE** Wedding profits. Sell invitations, napkins, matches. Samples free. Dunbar's, Middlebush 3, N. J.



**DISH WASHER.** Amazing invention. Portable. Fits kitchen drain board. Washes, rinses, air dries in minutes. No installation. Low priced. Guaranteed. Housewives wild about it. Great money maker. Literature free. Bessen Co., 522 Main, Evanston, Ill.

**LARGE Earnings** selling flush valve. Every toilet needs one. Details. Excell, 3281 N. 46 St., Milwaukee, Wis.

**PRINCESS Garters.** Comfort, beauty. Hose last longer. Sell \$1.00 pair, cost 50c pair. Excelsior Pro. Co., Box 4644, Detroit 34, Mich.

**BUY Wholesale** — 25,000 items. Catalogue 25c. Matthews, 1472-B9 Broadway, New York City.

**MAGIC Words** give you daily cash! "Kendex nylons are free unless satisfactory." New style 300 only 98c including your commission, bonus and postage. If these wonderful sheer DuPont nylon stockings run, snag or are not satisfactory within 1½ months of receipt, we refund the full 98c so they will cost nothing! What woman will hesitate to wear fine nylons at our risk? Just write orders. We deliver and collect. Advance cash plus huge bonus. Spare or full time. No experience necessary. Postcard brings you sample stocking and money-making outfit free and prepaid. No obligation. Kendex Corporation, Babylon 73, N. Y.

**GREETING Card agents!** Add 50c profit to each sale. Show customers how to emboss own names on any greeting cards, stationery, etc. Free samples. Write Bauer-Lee, Sierra Madre 5, California.

**MEXICAN Feather pictures.** High profit! Fast sellers! Adelphi, Box 57-B, Bellerose 6, N. Y.

**CHOCOLATES** Sell easy—12 boxes earn \$6.00. Steady repeater. Belanger Confectioneries, 5122 Talcott, Rockville, Conn.

**READY** To pay you biggest cutlery profits ever known. Exclusive line made for the masses. Rush inquiry. James Industries, 25 Municipal Bldg., Skaneateles, N. Y.

**BIG Daily profits**—Selling uniforms, shirts, caps, ties, wallets, initialed buckles, belts, badges. Choice 3000 emblems. Free sales kit. Hook-Fast, Box 480PM, Roanoke, Virginia.

**FAST Profits**—No investment. Plastic aprons, tablecloths, etc., 300 sure-fire items. We guarantee sales. Free information. Halliday Co., Dept. PM, 15 Pennington Ave., Passaic, N. J.

**BUY Nylons** direct from mill. Make good profits on fast selling nylons. Quick delivery on any quantity. Write for confidential wholesale pricelist. Joy Hosiery Mills, Delawanna 13, N. J.

**BIG Profits** selling ties (\$2.00 values.), \$6.50 dozen. Free catalog. Empire Cravats, 648 Broadway, New York 12.

**MEXICAN Feather pictures.** Unusual novelty. \$1.00 (stamps) brings \$2.00 worth samples, refunded if unsatisfied. Aztec Art, Apartado 762, Mexico City.

**START A buying service,** buy wholesale thousands nationally advertised products. Make big profits selling at sizable discounts. Send postcard for details. American Buyers Service, 627-PM Linden, Buffalo, New York.

**BUY Wholesale** thousands nationally advertised products at big discount. Sent free "The Wholesale Plan." American Buyers' Service, 629-PM Linden, Buffalo, N. Y.

**BIG Money making opportunity.** Exclusive line work uniforms. Jackets, pants, shirts, coveralls. Advertising embroidered. Every business prospect. Outfit free. Master Corp., 217 Water, Ligonier, Ind.

**BIG Profits.** Power mowers, prepaid. Wholesale—With county agency. Rotacut-RP, Excelsior Springs, Mo.

**GOLD Lacquered** and silver sign letters. Windows, doors, trucks. Standard sizes. Penny and up samples. Atlas-P, 544 West 79th, Chicago 20.

**DELAYED Action** light switch. New! Automatically shuts light off a minute after switch has been turned off. No tripping, falling, groping in dark. Lightning seller—Be first! Samples sent on trial. Durever, 62, Brooklyn 7, New York.

**YOUR Own business**—Used suits \$1.50; topcoats 50c; shoes 12½c; ladies' coats 30c; dresses 10c. Enormous profits. Catalog free. Moro, 558-AA Roosevelt, Chicago 7.

**BIG Profits,** fast sales with 7 sensational new items! Free samples! Durever, 2781-D Atlantic Ave., Brooklyn, N. Y.

**MAKE Tremendous profits** with fast-selling costume jewelry! Buy direct! Sell your friends, neighbors and customers at big savings to them! Write for our free catalog! Penn Jewelry, Dept. P, 826 W. Lacka., Scranton, Penna.

**HOTTEST 39c Item** on the market. National Sales & Service, Greenville, Penna.

**CALIFORNIA Sweet smelling beads.** Sensational sellers. Free particulars. Mission, 2328PM West Pico, Los Angeles 6, Calif.

**LOOK**—Big profits, free samples. Greeting cards, personalized napkins, personalized stationery and gift items. G. M. Dunn Co., 484 Broadway, Newark, N. J.

**PRINTING**—Salesbooks, envelopes, tags. Free illustrated catalog. Ersco, Bronx 72, N. Y.

**BARGAINS**—Terrific savings, job lots, close-outs! Also save up to 50% on complete lines of drygoods, clothing, hosiery, notions, drug sundries, toiletries, novelties, gifts, jewelry, television, etc. 2000 items. Send 25c for illustrated wholesale bargain catalog, closeout flyers, and special "get acquainted" offer. Valuable merchandise certificate (worth many times 25c) included free. Reliable Jobbers, 311-B N. Desplaines, Chicago 6.

**BE A money maker.** Use your home as magazine headquarters. Liberal commissions. No experience—No capital needed. Everything furnished. Write for free catalog. McGregor Magazine Agency, Dept. 500A, Mount Morris, Ill.

**\$50 WEEKLY** Selling finest razor blades, other items. Free details. Edisons, Box 274, Far Rockaway, N. Y.

**GUARANTEED 200,000 Mile ring, valve job!** Restores compression! Stops oil pumping! Send \$3.00 for \$6.00 package and sales offer! Nerlino, Box 7, Inglewood 5, Calif.

**NEED Extra cash?** Take orders for personal initialed belts and buckles, cap badges, tie holders, etc. Choice of 3000 emblems. Free sales kit. Hook-Fast, Box 1425PM, Providence, R. I.

**SCHOOL Seniors**—Earn sensational profits selling classmates America's most beautiful graduation name cards. Largest selection. Outsells all others. Free sample kit. Printcraft, Dept. M, 1425 E. Elm St., Scranton 5, Penna.

**EXCELLENT Sideline** for printing and advertising salesmen. Decalcomania name plates in small quantities. Great demand. Also, make money with our line of automobile initials and sign letters. Free samples. "Ralco" XL-Roxbury, Boston 19, Mass.

**AGENTS:** Stamping names on key protectors. Sample 25c. Stamping outfits, checks, social security and name plates. Hart Mfg. Co., 303 Degraw St., Brooklyn, N. Y.

**AGENTS**—300% Profit selling genuine gold window letters; stores and offices. Free samples. Metallic Letter Co., 438-B North Clark, Chicago.

**SELL Big money-maker** to men and women. Easy handwork makes fast-selling useful articles. Sunmade Company, Brockton 64, Mass.

**SALESMEN, Distributors,** fast selling costume jewelry direct from factory. Big picture catalog, free. Pickcraft, M19 Bank, Attleboro, Massachusetts.

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**SELL Degreasing solvents** to automobile dealers, garages, repair shops. Nice income, steady repeater, exclusive territory. Donn Chemical, 1417 East Sixty-First, PM, Chicago 37.

**ADVERTISING Book matches**—Cash in on big demand; sell union label matches. Cuts for all businesses and political parties. Free powerhouse selling kit, low prices, protection guaranteed on repeat orders. Cash commissions. Superior Match Co., Dept. M-452, 7530 Greenwood, Chicago.

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**IS \$210 A week worth a postcard to you?** Then rush card with name and address for special free trial plan that sells amazing new automatic refrigerator defroster "like hot cakes!" Write to Mr. Lewis, D-Frost-O-Matic Corp., Dept. G-102, 173 W. Madison, Chicago 2, Ill.

**DISTRICT Mgr. calendars, specialties.** Klingstedt's, 425-509 Schroyer, Canton, O.

**WANT To make real money?** Sell fast repeating chemical detergents to restaurants, bakeries, etc. High 30% commission. No investment. No collections. P.O. Box 1437, Milwaukee 1, Wisconsin.

**WANT To make real money?** You can positively make \$50.00 a day and up selling a brand new item going to every type of food and beverage store, factories, laboratories, hospitals, etc. First time advertised. Samples furnished. Utility Dura-wear, 53 West Jackson Blvd., Dept. PM-04, Chicago, Illinois.

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**BECKER Will pay you twenty five dollars a day** to act as part time salesman. Becker Paint & Varnish Co., P.O. Box 54, Bay City, Mich.

**MAKE \$3000 Next 60 days** selling 1953 calendars, advertising specialties and executive gift line. Season on. Big commissions advanced. Outfit free. Meyerson Calendar, 605-PM Washington, Chicago 6.

**\$45.50 IDEAL Wheel balancer** leads all! Makes persuasive demonstration. Three sales daily easy. Earn \$22.15 to \$26.37 each sale. Gas stations, tire dealers, garages. Sample free if qualified. Price Sales Company, Dept. P.M.-3, Sylvania, Ohio.

**SUCCESS Opportunity**—Sell famous Spring-Step shoes. Earn up to \$25 daily plus cash and shoe bonus. Write PM-4, Ortho-Vent Shoe Co., Salem, Va.

**AD Matches!** Sell amazing designs—20, 30, 40 and 240-light book matches. Bigger spot cash commissions; every business a prospect. Low prices for high quality. Repeats. Start without experience; men, women; full, part time. Buy nothing! Sales kit furnished. Match Corp., Dept. PM-28, Chicago 22, Illinois.

**PAINTS, Varnishes, roof coatings, flooring, automobile undercoating.** Sell ready-made accounts. Earn up to 30% commissions—Time, territory your own. Big season ahead. Scott Paint Co., 2948 E. 81, Cleveland, Ohio.

**"SURE-Fire" sideline** for salesmen calling on retail stores. Different, unusually clever all-occasion comic greeting cards. Pocket sales kit brings fast first orders, year-round sales, steady repeat business. Liberal commissions. Protected territory if qualified. Novo Products, 1166-PM Milwaukee Ave., Chicago 22.

**DEALERS And distributors** wanted for laboratory approved portable dishwasher that sits on kitchen drainboard. No installation expense. Washes, rinses and air dries dishes for average family in 10 minutes. Low retail price. Fully guaranteed. For descriptive literature and discounts write Bessen Company, 520 Main St., Evanston, Illinois.

**REPRESENT America's largest factory** selling advertising pencils. High commissions. Attractive line. Send \$1.00 for pencil kit (refundable). Union Pencil Company, 389 Broadway, New York City.

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**MAKE Money** with fast-selling Bostonian shirts, blouses too. Spare time, full time. Sales kit free. Bostonian, 89 Bickford, Dept. M-10, Boston 30, Mass.

**NEW Jobs open in selling!** Send name, address for five free issues of Opportunity Magazine's money-making guide, listing hundreds of companies who'll pay you well, full or part-time. No experience needed. Opportunity, 28 E. Jackson, Dept. 17, Chicago 4, Ill.



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**OWN A collection agency.** Big money. Franklin Credit, Roanoke 7, Virginia.

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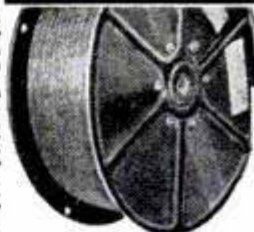


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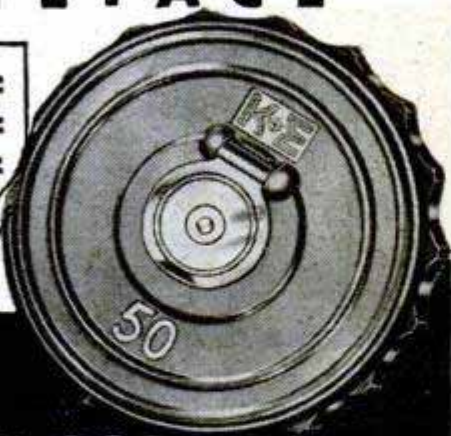
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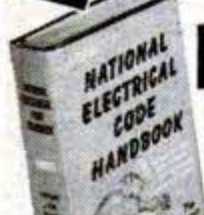
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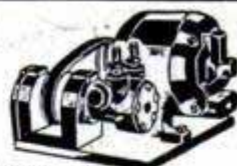
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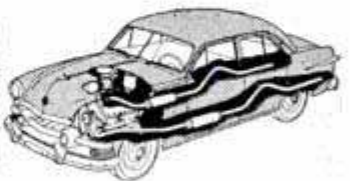


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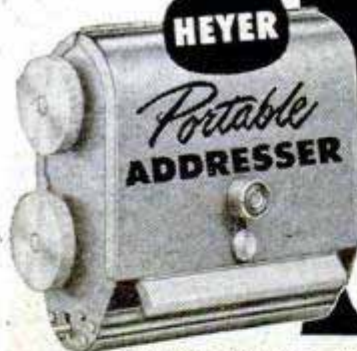
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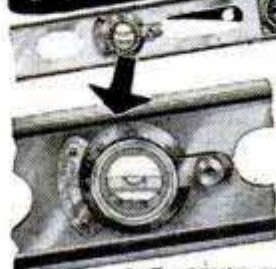
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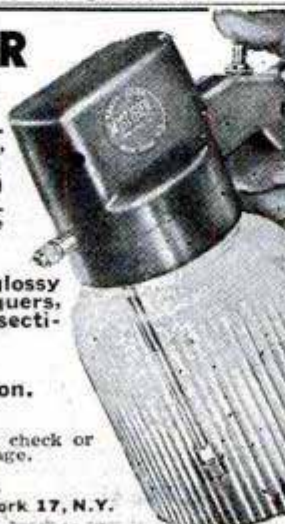
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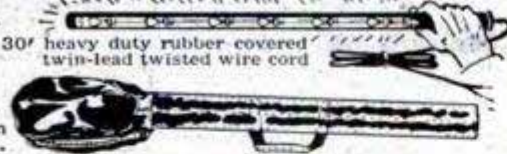


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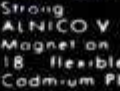
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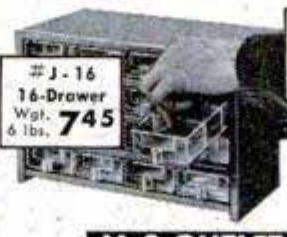
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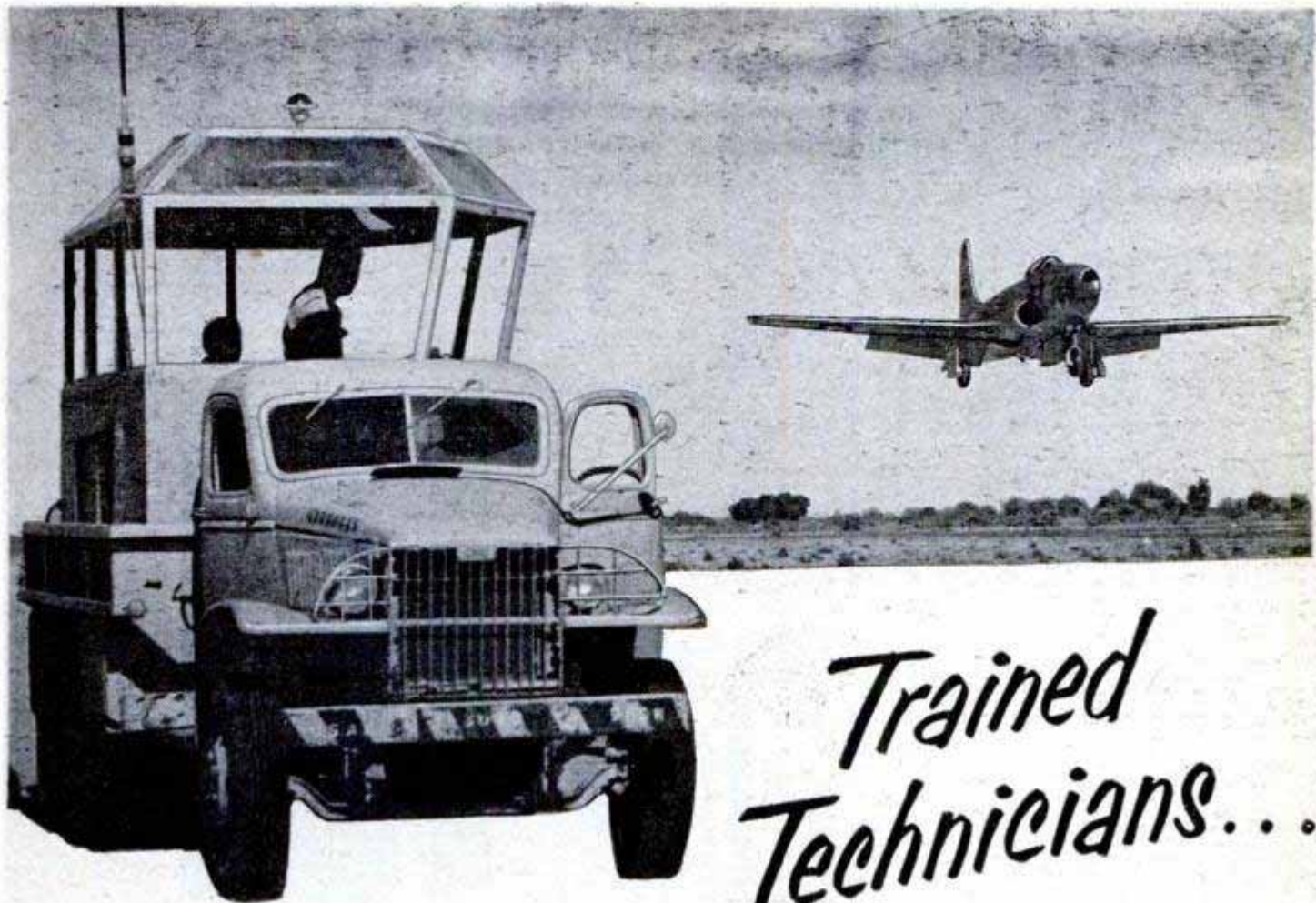
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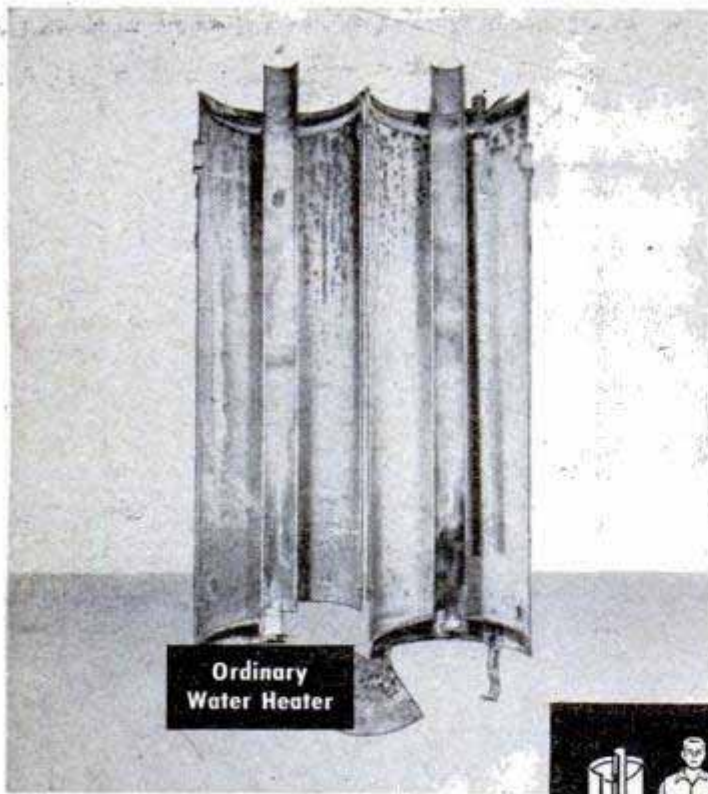
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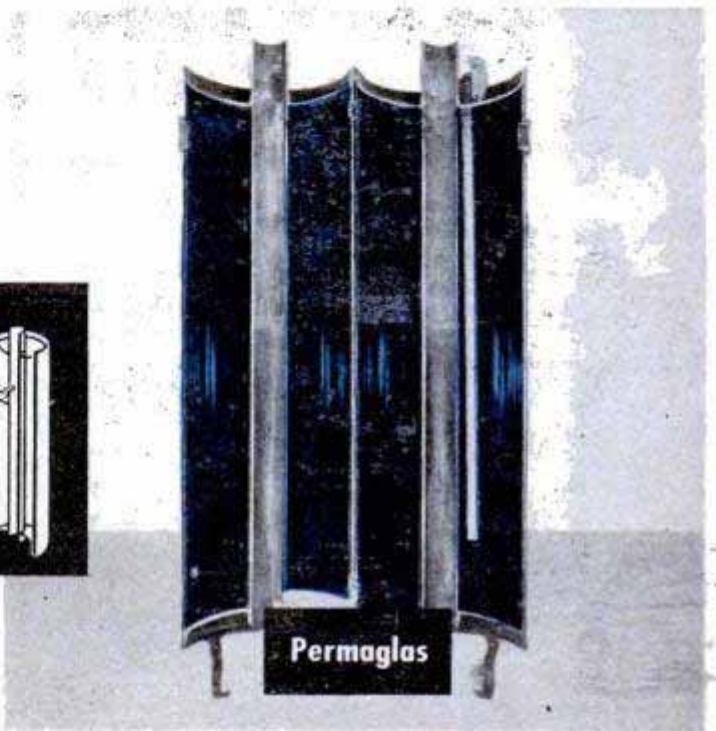
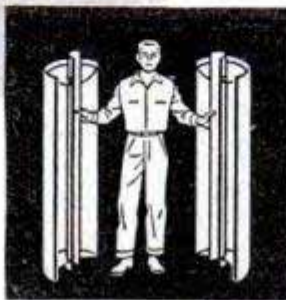




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# SEARCHERS OF SPACE

*By Thomas E. Stimson, Jr.*

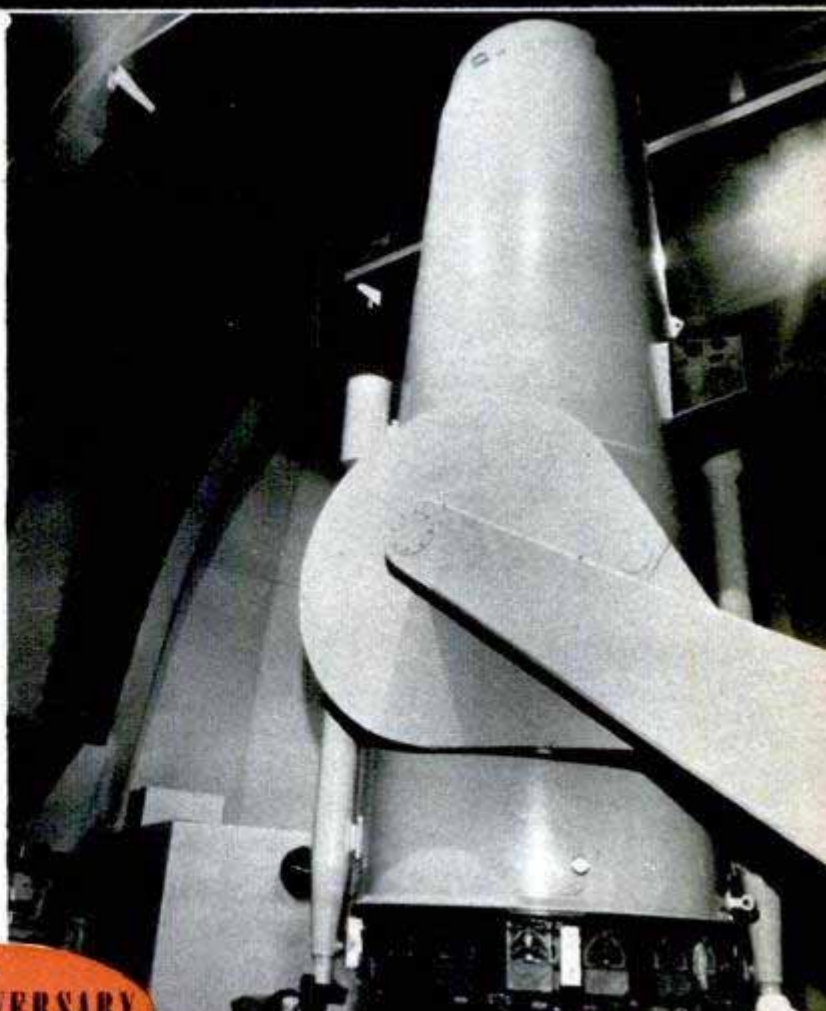
The picture above of a spiral nebula in outer space was made with 200-inch telescope. Rim is mostly gas

**A**STRONOMERS are pretty sure that within the next few decades they will have telescopes that are far more efficient than the best ones in use today.

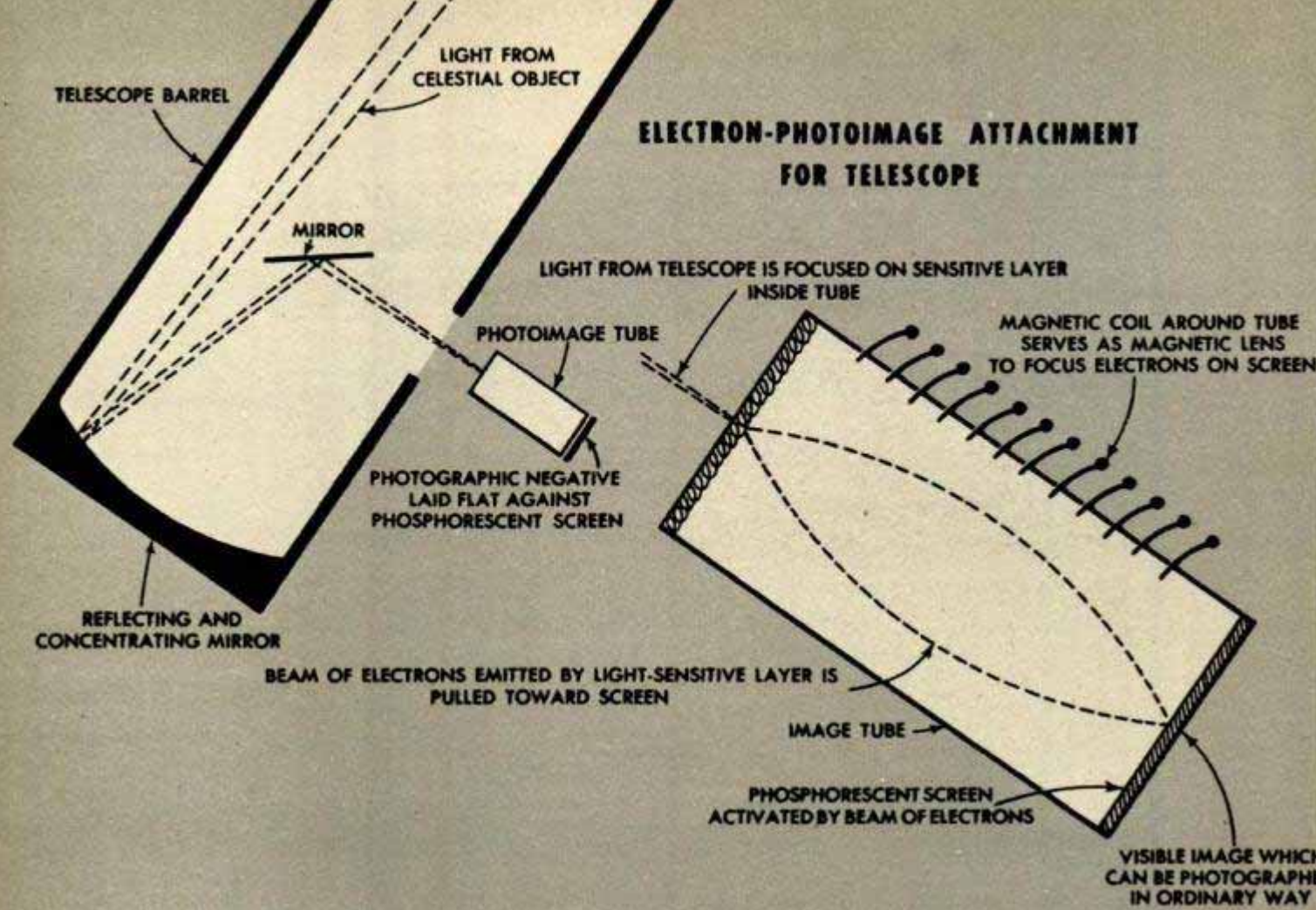
No new giants that would outrank the 200-inch Hale telescope at Palomar Mountain are contemplated (the shimmering of the atmosphere would restrict the usefulness of a much larger mirror); rather, increased efficiency will come from new or improved attachments for the telescopes we already have.

One possibility is an electronic image tube something like a television pickup tube that could be placed at the focus of a telescope. The image of a celestial object that is focused by the telescope on a sensitive layer inside the tube would kick off a stream of electrons that in turn could be focused electrically on a phosphorescent screen, producing a bright image that could

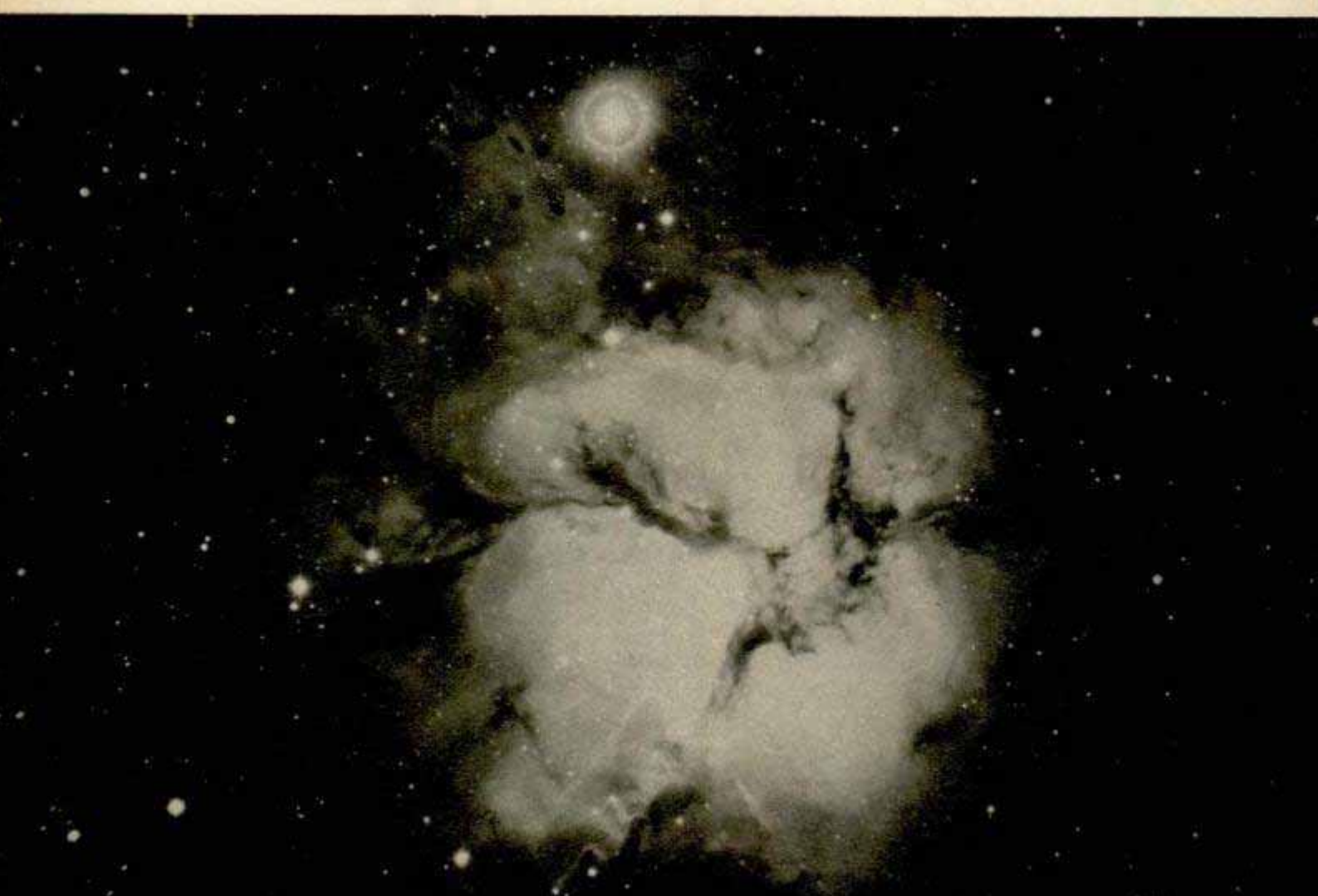
The 48-inch Schmidt camera at Palomar makes 14 by 14-inch photos







If the tube above were attached to the 200-inch telescope, it would have the capacity of a unit with a mirror 26 feet in diameter. Below, nebula in Milky Way photographed by the 200-inch telescope is of dust and gas





This gas and dust cloud in the Milky Way is called the North American Nebula due to shape

be recorded by a camera.

The sensitive surface of an image tube can utilize about 50 percent of the light that strikes it, while the photoemulsions that are used for direct star photography are sensitive to only 10 percent of the light they receive. Thus the image tube at present is five times more sensitive to light than is film. If a tube of this efficiency should be attached to the 200-inch telescope, the combination would be roughly equal in light-gathering capacity to a telescope having a mirror more than 26 feet in diameter. The combination would permit the photographing of objects that are much too dim to be recorded by today's means.

There is also a possibility of enormously amplifying the electron beams to form images that are much brighter than the original images at the focus of the telescope. In no sense, however, would the resolving power of the telescope be increased.

Some image tubes already have been tested with telescopes and the results suggest that when additional improvements to the tubes can be made, they will become an important astronomical tool for exploring behind the dark curtain of space.

If and when a tube of the necessary high quality is designed, it doubtless will be used to help the 200-inch telescope in the big job that has been assigned to that instrument. Briefly, this job consists of measuring and mapping the universe, at least that part of the universe which is visible to our astronomers from the earth.

Portions of the universe have been measured before, to be sure, but even the measurements made with the 100-inch Hooker at Mount Wilson were perhaps 50 percent inaccurate. Today the big Hale, its 48-inch-wide-angle Schmidt companion, and new ultrasensitive photoelectric cells provide a much more accurate celestial yardstick.

With these instruments it is hoped that in some cases measurements will be obtained that are accurate to within plus or minus a few trillion miles. This would be a remarkable degree of precision, considering that the standard cosmic unit of meas-



National Geographic Society-Palomar Sky Survey photo

ure is the light-year, the distance that light travels in a year's time zipping through space at a rate of 186,000 miles per second.

The new measurements will help confirm or disprove many of the present theories about the size and intricate structure of the universe.

The Palomar telescope has a calculated range of one billion light-years and already has photographed objects that are at or near the limit of its range. The objects are visible in photographs only as faint points of light. Yet each apparently is an extragalactic nebula or island universe similar to our own Milky Way.

There are more than 100 million such nebulae in observable space, each containing upwards of 100 million separate stars. Many of the nebulae that are close enough to us to have a visible shape are rather flat and have a spiral pattern. It is assumed that if our own galaxy could be viewed from a distance, it too would be observed to have a spiral pattern. In actuality, the sun is a somewhat average star well out toward the edge.

Measuring the universe and the distances to faraway nebulae is done by using one group of facts to solve an unknown, and then using the answer to help solve the next unknown.

To start with, distances to many stars in





Photo at left of earth's galaxy of stars was made with 48-inch telescope and the one at right with the big 200-inch. The picture at right is a "close up" of the Cone Nebula, which is shown at left in white square

our own galaxy have been carefully measured by triangulation, using opposite points on earth's orbit around the sun to obtain a pair of angles. By this means a certain star may be found to be five light-years away, another may prove to be 325 light-years distant. The nearest stars are not necessarily the brightest. Stars of certain classes have the same real brightness and so their apparent dimness in the sky is a measure of their distance from us, according to the astronomers.

The brightest stars in some of the nearest extragalactic nebulae appear to be dim, but

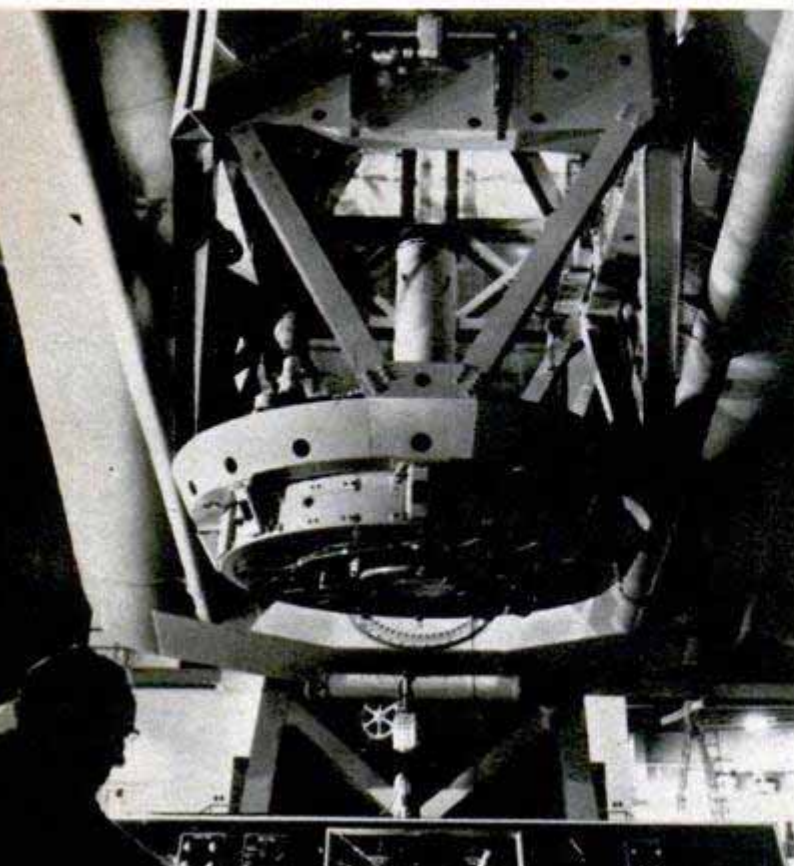
actually they are comparable in brightness to stars in our own galaxy. Their relative dimness helps indicate their distance, hence the distance to galaxies where they occur.

The relative brightness of these nebulae is used in turn as an indication of the distances to other "key" nebulae that may be fainter still.

Today the brightness of some of the stars in near-by nebulae is being measured very precisely with sensitive photoelectric cells attached to the focus of the 200-inch telescope. After the distances to these star systems have been determined, the studies

Supervisor at control panel of 200-inch telescope can open observatory shutter and then aim at star

When the Schmidt camera is pointed toward the zenith, the observer can work from an easy chair





Some of the millions of stars appear as points of light in the spiral nebula at right. It is about three million light-years away and resembles Milky Way

will be extended to the more distant star systems.

Another project on which the 200-inch telescope is being employed has to do with the question of whether the universe is expanding, as suggested by the "red shift" in the spectra of distant nebulae.

The shift occurs in the spectral lines of the elements that make up the nebulae and is always toward the red, or long, wavelength end of the spectrum. The phenomenon can be compared to the lowered tone of a train's whistle after it has passed a listener and is speeding away. Many astronomers interpret the red shift as an indication that the nebulae are moving away from us. The greater the distance to a nebula, in fact, the greater its recessional speed appears to be.

This was borne out in recent observations with the 200-inch telescope by Dr. Milton Humason, in which measurements were made of the shift to the red in clusters of nebulae as far as 360 million light-years away. In some cases it was found that the shift of a given spectral line amounted to more than 800 angstrom units, equal to a velocity of some 38,000 miles per second. This is about one fifth of light's velocity.

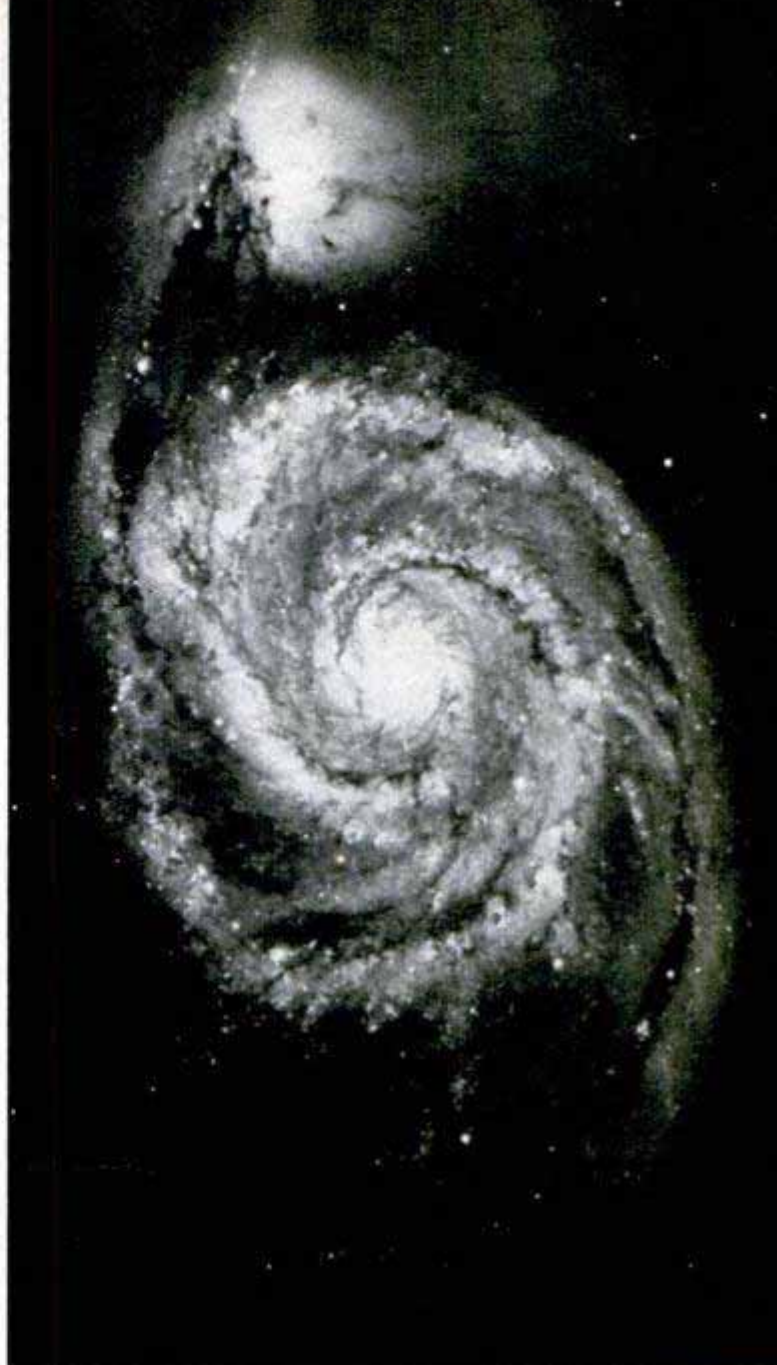
Some astronomers suggest a different interpretation for the red shift. They think that light may get tired during its journey through space and lose some energy, thus accounting for a shift in the wavelength. Others wonder if the light that we see today from a distant star system is not actually "fossil light" that is quite different from modern light. Calcium atoms, for instance, that now produce a blue light may have emitted the longer wavelength of green light in the distant past, according to this recent speculation.

Ten years from now astronomers will be much more positive about the meaning of the red shift. If it is finally agreed that the universe actually is expanding, the next questions will be: What caused the explosion, and where in cosmic space did the blowup begin?

In all this research the big Palomar telescope is playing a major, but by no means the only, part. The instruments and facilities of both the Palomar and Mount Wilson observatories have been joined in the same program. These two important West Coast observatories now are being operated as a single unit by the Carnegie Institution of

(Continued to page 252)

New in design is this model of a 120-inch telescope being built at Lick Observatory by the University of California. It will be second largest in the world





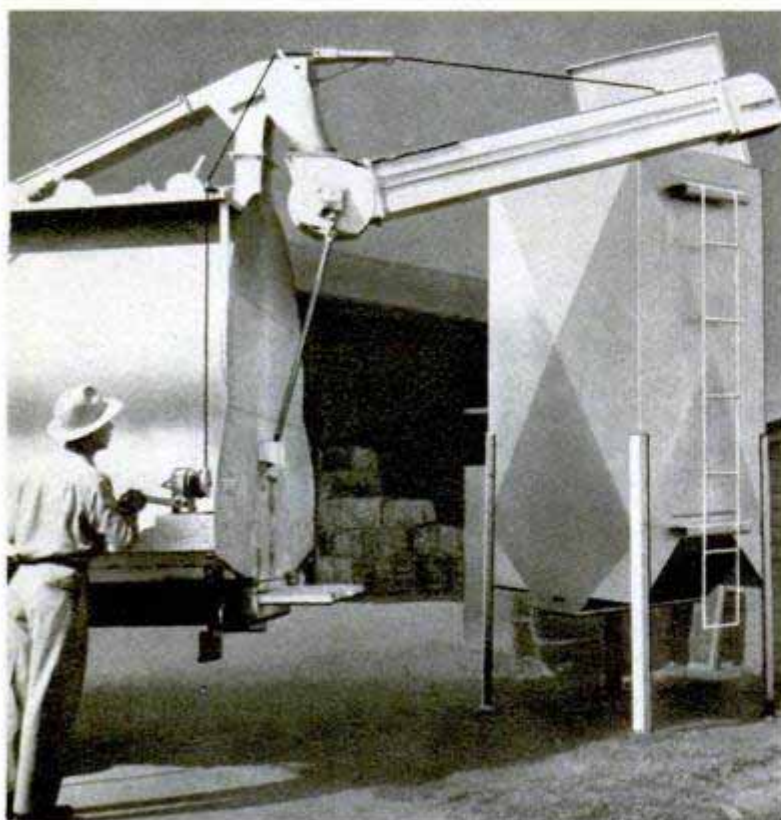


## Tiny German Auto Has \$27 Engine

Scooting down German highways is a new car, so small the average pedestrian stands head and shoulders above it. The car, powered by a two-horsepower engine, has a top speed of 50 miles an hour. It sells for about \$850. The car is economical to operate and repair costs are low. When the engine wears out, you can buy a brand-new one for \$27 from the manufacturer in Bremen.

## Color-Exposure Meter

One half the size of a standard meter, a photoelectric exposure meter is designed primarily for color photography. Easy to read, the meter is aimed at the subject and the exposure data read directly from the calibrated rotating scale—the pointer reading being the camera setting. No calculations are necessary. All popular film speeds and lens openings are covered and the meter can also be used for black-and-white work. Sensitivity of the meter ranges from nine candles per square foot to the brightest sunlight. The selenium-barrier photovoltaic light cell, sealed in plastic and preaged at 75 degrees C., is said by the manufacturer to be “the most stable cell manufactured.”



## “Tank Car” Grain Delivery

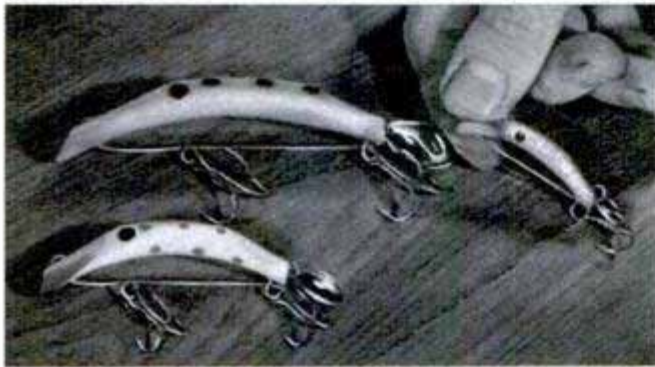
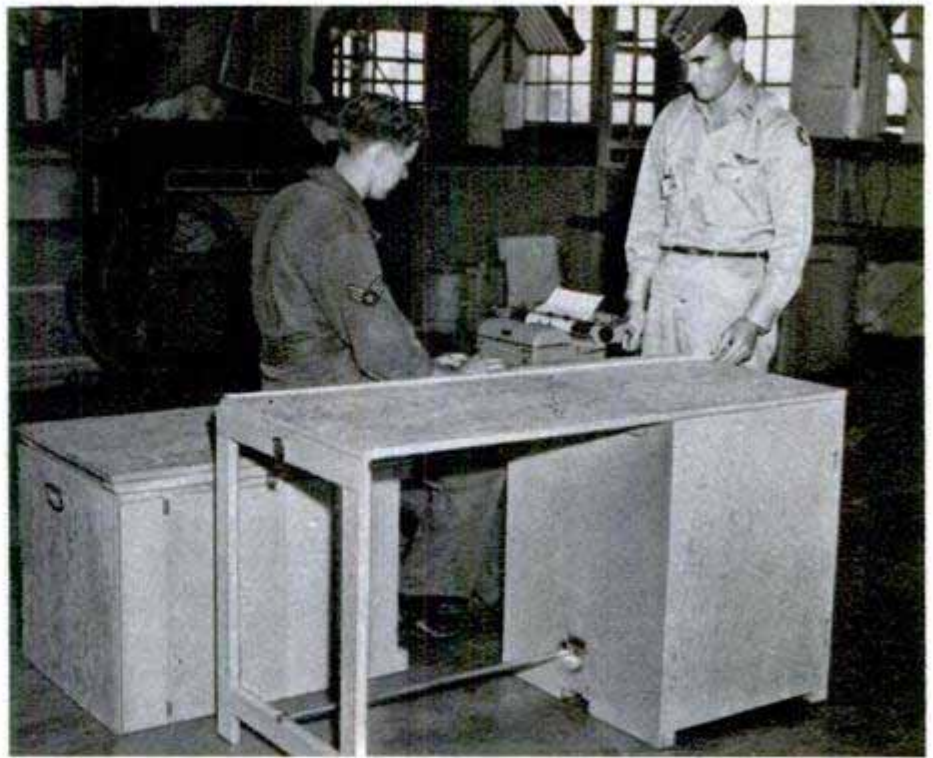
Farmers now buy their feed by the “tank car” and save themselves money and effort. Specially designed multiple-compartment truck bodies transport the feed to metal storage tanks on the farm. Chain draglines lift the feed 15 or 20 feet through a hinged “nozzle.” Not only is grain bought more cheaply this way, but the farmer eliminates the rodent problem by storing grain in sealed metal tanks.

Sources of supply for available products described in this issue are listed in the index which starts on page 12. Sources of further information on other articles in the magazine are listed in the WHERE-TO-FIND-IT LIST which is available without charge from the Bureau of Information, *Popular Mechanics Magazine*, 200 E. Ontario St., Chicago 11, Ill.



## Air Force Typing Desk

Military operations today require plenty of paper work. That means typewriters, so one officer at the Bergstrom Air Force Base in Austin, Tex., has designed a portable typing desk to take office efficiency right into the field. When collapsed for shipment, the desk serves as its own packing crate, and has the typewriter and supplies stored inside it. When opened for use, it provides nine square feet of working space. The desk weighs 90 pounds and costs only \$12.



## Reversible Lure

Reversible fishing lures made of plastic are fitted with an exceptionally strong hook assembly. The hooks and metal spinner are attached to a wire that runs from one end of the body to the other. When the line is attached to the head of the lure, it travels deep; when attached to the rear loop, it travels near the surface. Sinkers make the lure operate at any other depth desired.

## Aluminum Sailboat

With ordinary woodworking tools John F. Clark of Port Lavaca, Tex., has completed what he believes to be the first all-aluminum sailboat. The craft is made of the light metal from the tip of its 22-foot mast to the bottom of its centerboard. Weighing about 250 pounds, the boat is made of .064-inch sheets of sea-resistant aluminum alloy. The mast and boom are aluminum pipe. The craft measures almost 16 feet long and five feet across the beam. Clark spent 800 hours working on the boat.

## Chemical Kills All Plants

Keeping the ground free from vegetation, a new chemical wipes out all living plants when 20 to 100 pounds are scattered over an acre. Known by its short name of CMU, the chemical will be used along railroad tracks, storage areas and other places where combustible materials must be removed.

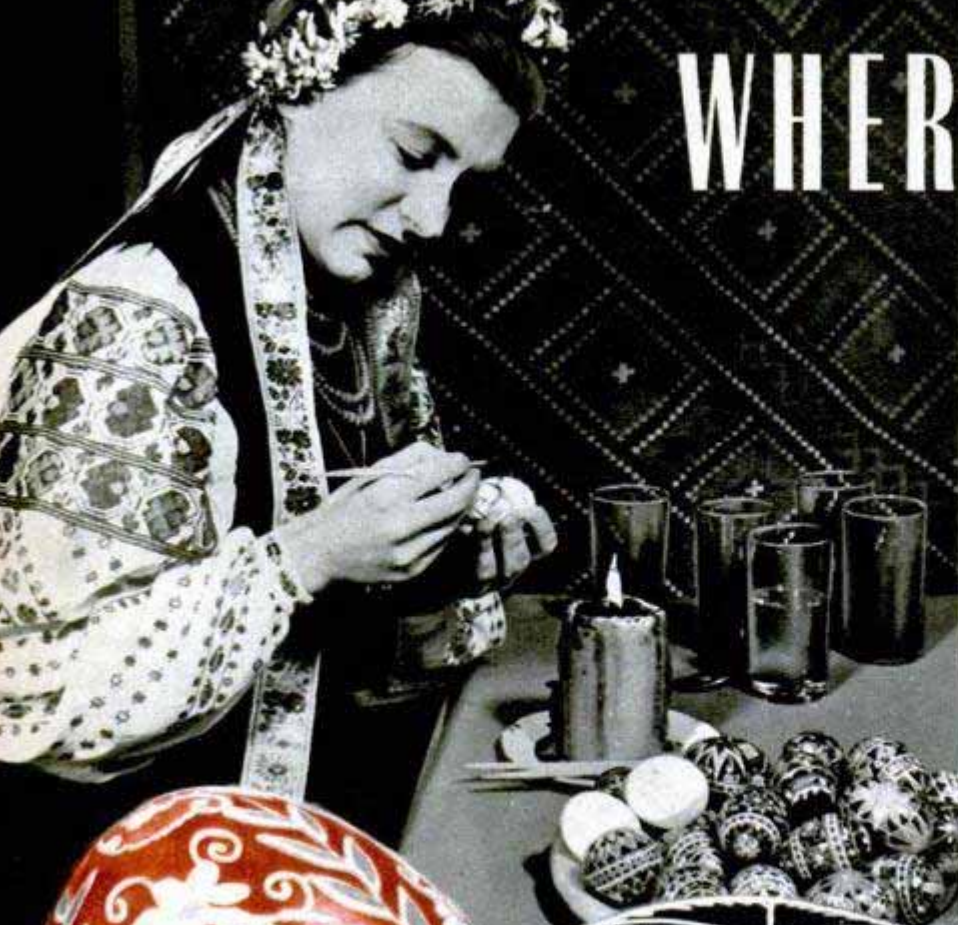




# WHERE EASTER

In fashioning the intricate designs and color schemes on their Easter eggs, Ukrainians first put melted wax on parts that are to be kept white

*Graphic House photos*



It took four hours to color each of these fancy designs. Flowers on the eggs above stand for love and charity



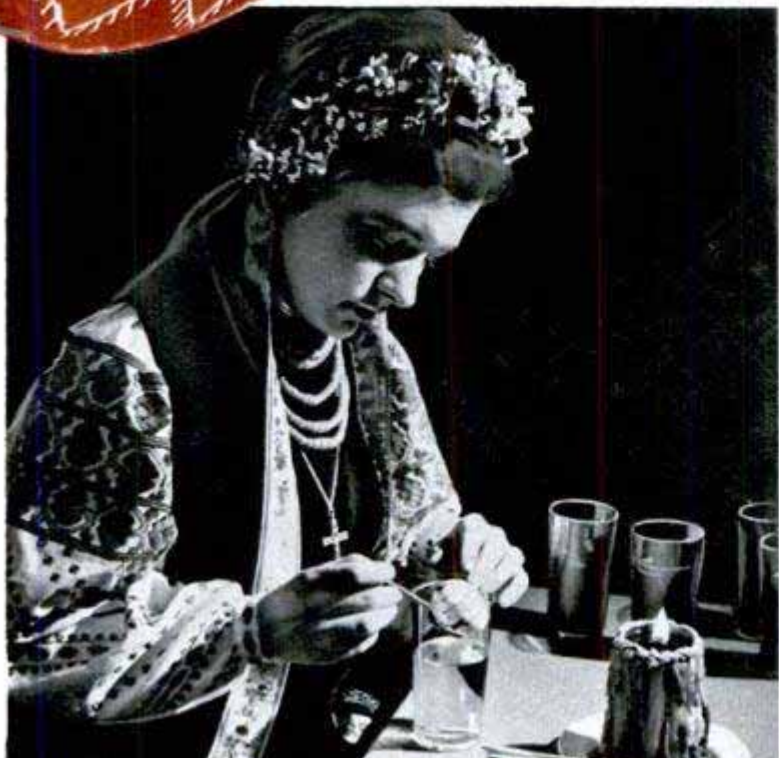
# EGGS RIVAL THE RAINBOW

**P**EOPLE have been coloring Easter eggs for centuries, but no one has been able to match the intricate patterns and color schemes of the Ukrainians. They work about four hours on each egg. Using only fresh, uncooked eggs, they first apply melted beeswax to the parts that are to remain white. The eggs are then dipped in a series of color baths, with wax applied after each dipping. When the final color has set, all the wax is rubbed off and a hard glaze applied to protect the eggs from damage.



Many of the egg designs are symbolic. The eight-pointed star, above center, represents a tribute to sun god, Atar. Chicken at right stands for the fulfillment of wishes

After each color bath, lower left, the egg is again waxed. When the final dye has set, the egg is dipped in hot water, right, and the wax is rubbed off

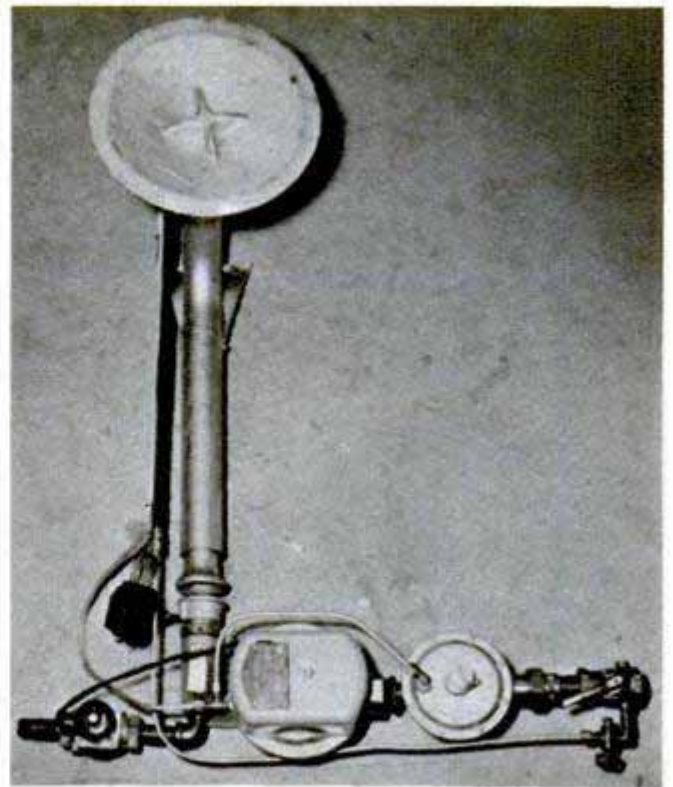






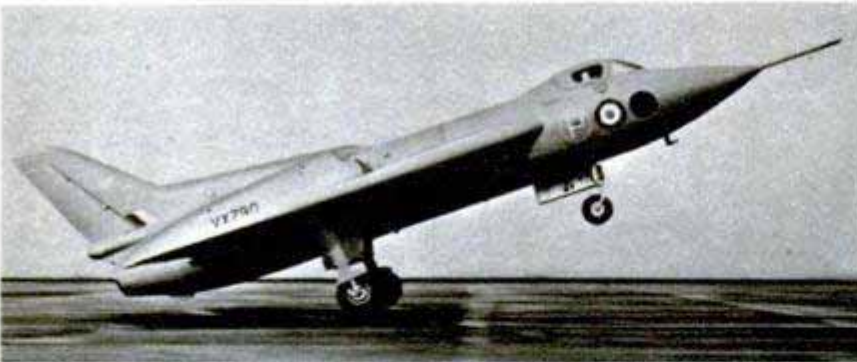
## Dual-Fuel Gas Burner

Heating units which burn either natural gas or LP gas (liquefied petroleum gas) are being used in areas subject to sudden, unpredictable cold snaps. The dual-fuel burner switches automatically from natural to LP gas during cold weather. When the thermometer drops, the local utility some-



times is unable to fill the demand for natural gas. In such areas the utility frequently will not grant natural gas for heating unless the householder supplies an auxiliary source of fuel. An outside thermostat is set for the temperature at which the overload may occur. The thermostat cuts off the natural-gas supply and cuts in the LP gas, which is stored in a stand-by tank.

## British Test Delta Wing in Flights With High-Speed Jet

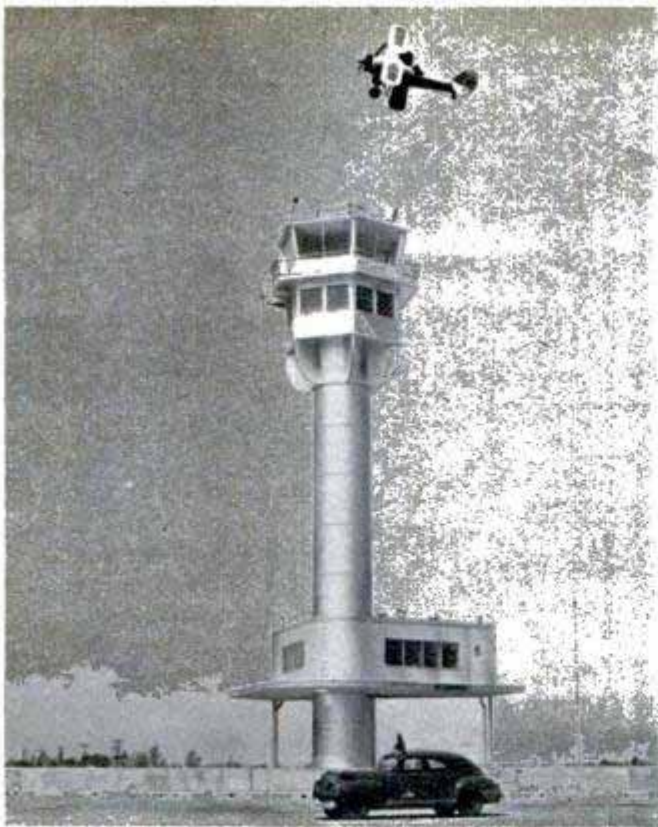


Built to investigate the problems of delta-wing flight, the Avro 707B has already demonstrated exceptional control at very high and very low speeds. At a British air show it was flown at low altitude past the gallery at an estimated 150 miles an hour. The delta shape, much like that of the paper planes made by school children, was

dictated to designers by the modern demand that aircraft must be capable of carrying heavy loads at high altitudes. An antispin parachute housed in a cigar-shaped cylinder above the jet tailpipe can be released to shorten the craft's landing run.

Information not listed on articles in the index frequently is listed in the WHERE-TO-FIND-IT LIST, which is available to readers without charge from the Bureau of Information, *Popular Mechanics Magazine*, 200 E. Ontario St., Chicago 11, Ill.

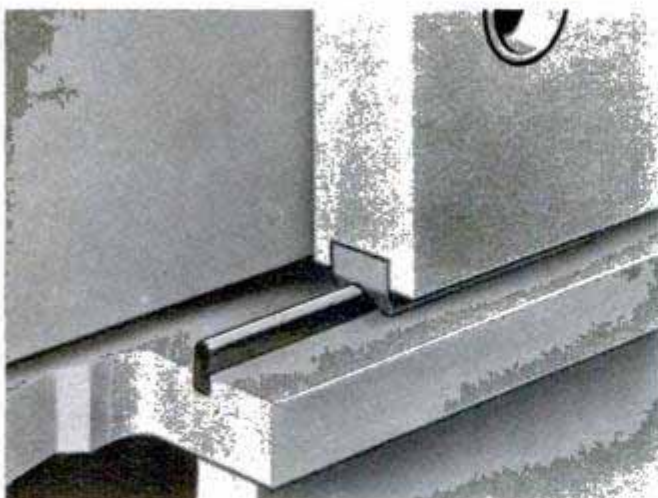




U. S. Steel photo

## Futuristic Control Tower

Towering above Sky Harbor Airport at Phoenix, Ariz., is a unique "building of the future." It's an aircraft control tower set atop a shining steel shaft. Operators of the tower climb 139 spiral steps inside the shaft to arrive at the working level of the 100-foot structure. Above the ground, but nearer the bottom of the shaft, is the chief controller's office. In the future, other buildings will be built around the tower. The controller's office then will be above the roof level of the proposed administration building and airline ticket offices.



## Track for Sliding Doors

Easy to install, a fiber track and shoe assembly makes sliding doors, drawers and sash smooth and quiet in operation. There are no moving parts. Both track and shoe are cut to fit the job, making installation a simple matter.



## Mobile Air-Traffic Unit

All the equipment needed for air-traffic control is housed in a mobile unit built by the Civil Aeronautics Administration. It is mounted on an Army truck and carries an auxiliary power unit in case of outside power failure or lack of power. The tower is intended for use at small fields where air shows or other special events may attract an unusually heavy volume of traffic. Radio and weather gear is located in the truck.

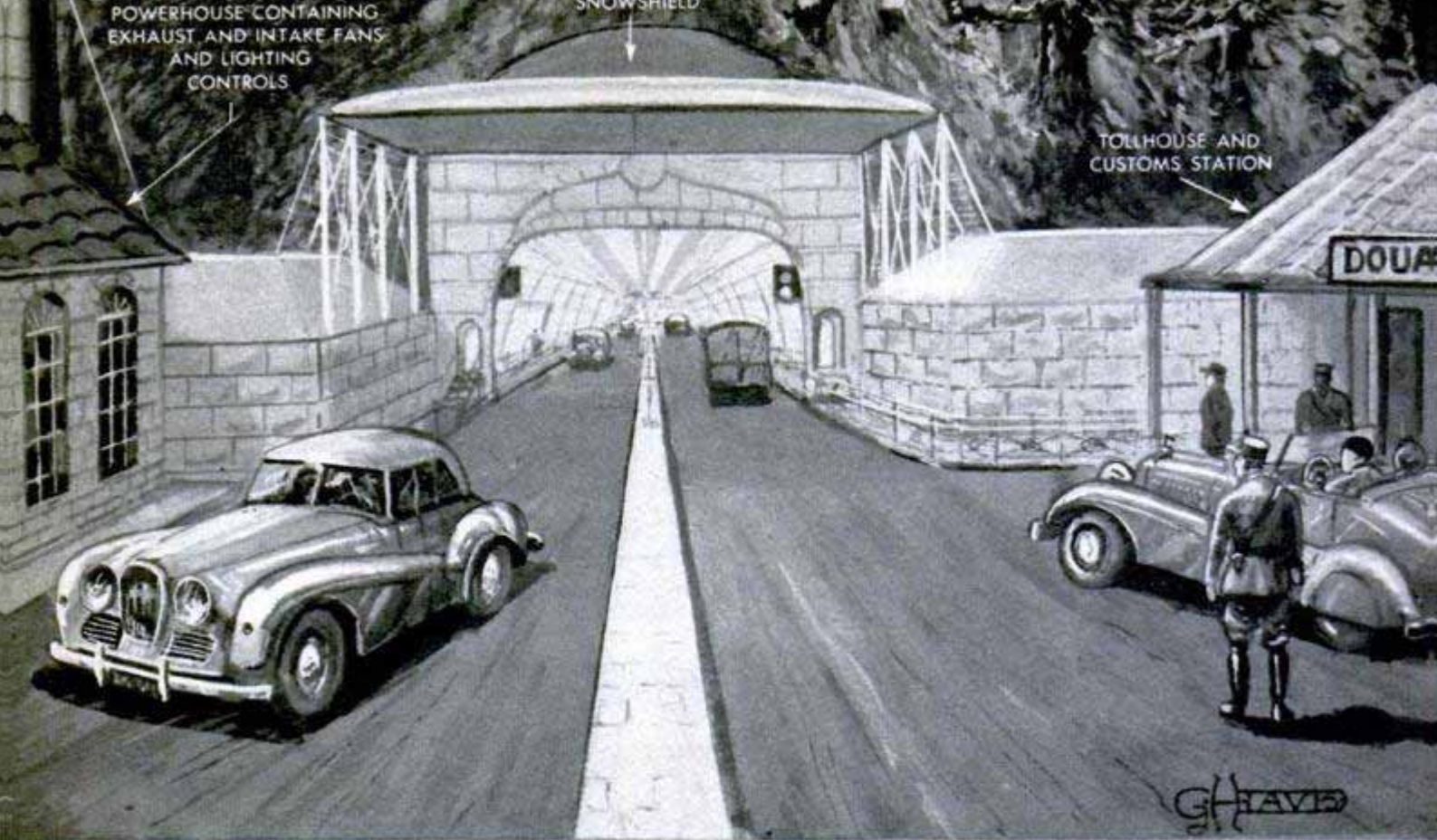
## Fire Alarm

Hung on a nail anywhere in the house, a self-contained warning device whistles loudly should fire break out. It may even give warning before a fire actually starts because it is designed to operate when the temperature reaches 130 degrees. If placed near the furnace or at the head of a stairway where heat accumulates, the whistle will warn you of an overheating furnace even before fire breaks out. It is powered by compressed gas, and its shrill whistle sounds for 60 seconds.



Neutral mesons, subatomic particles produced by cosmic rays, are the shortest-lived of any particles yet discovered, existing for only 100 million-millionths of a second.



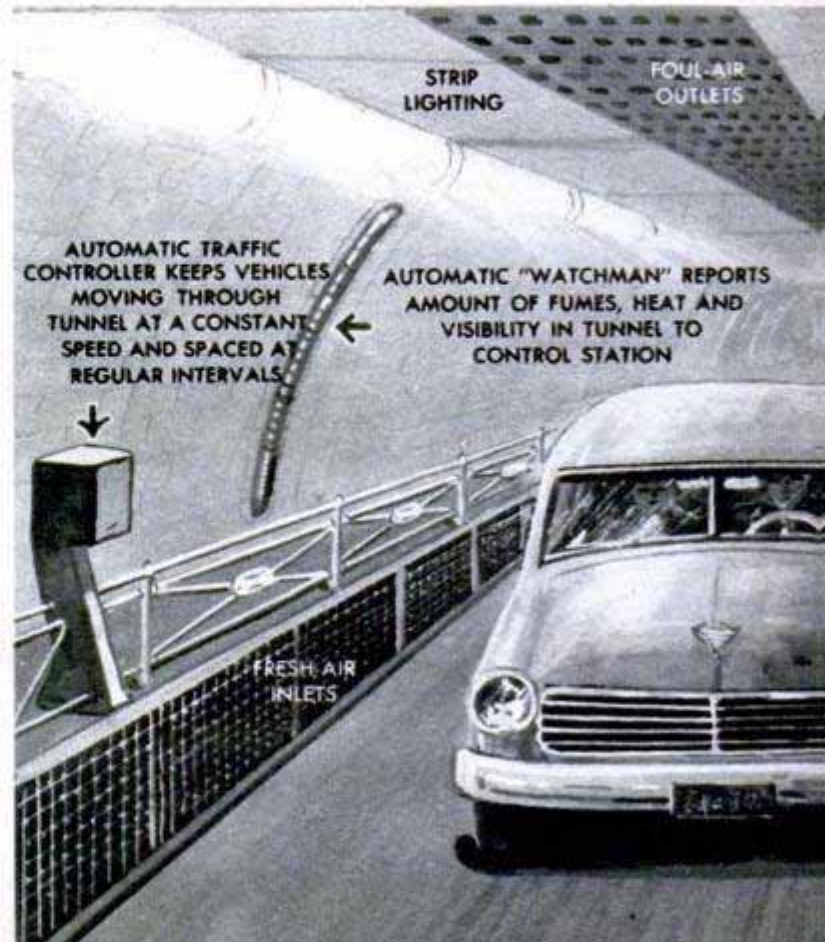
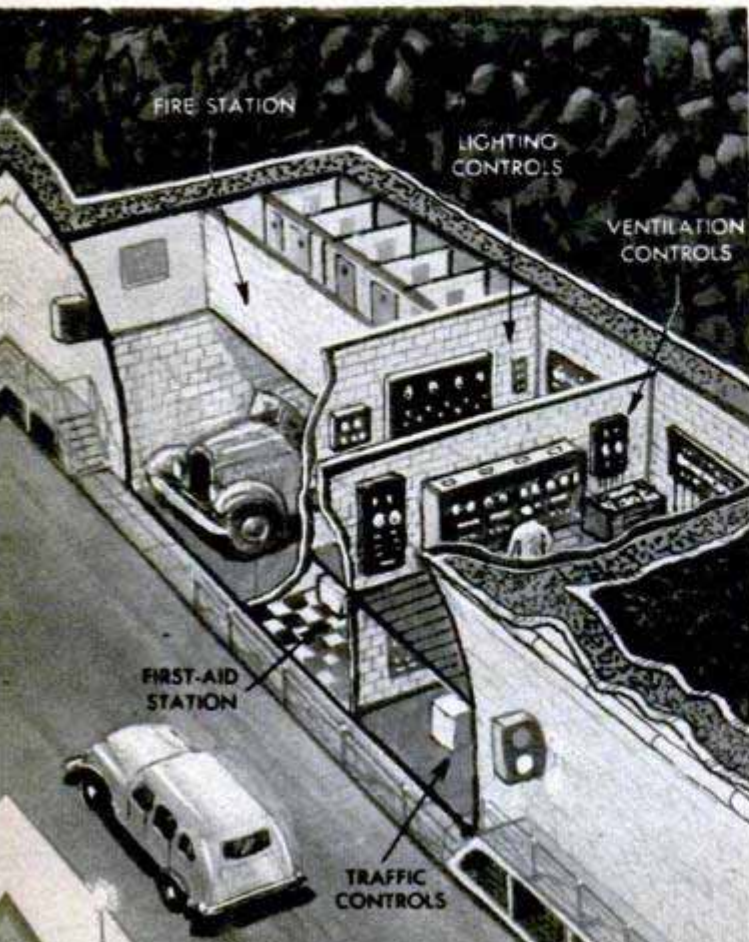


Vehicles would enter tunnel at 100-foot intervals. Shield over entrance will prevent blockage by snowslides

By  
G. H. Davis

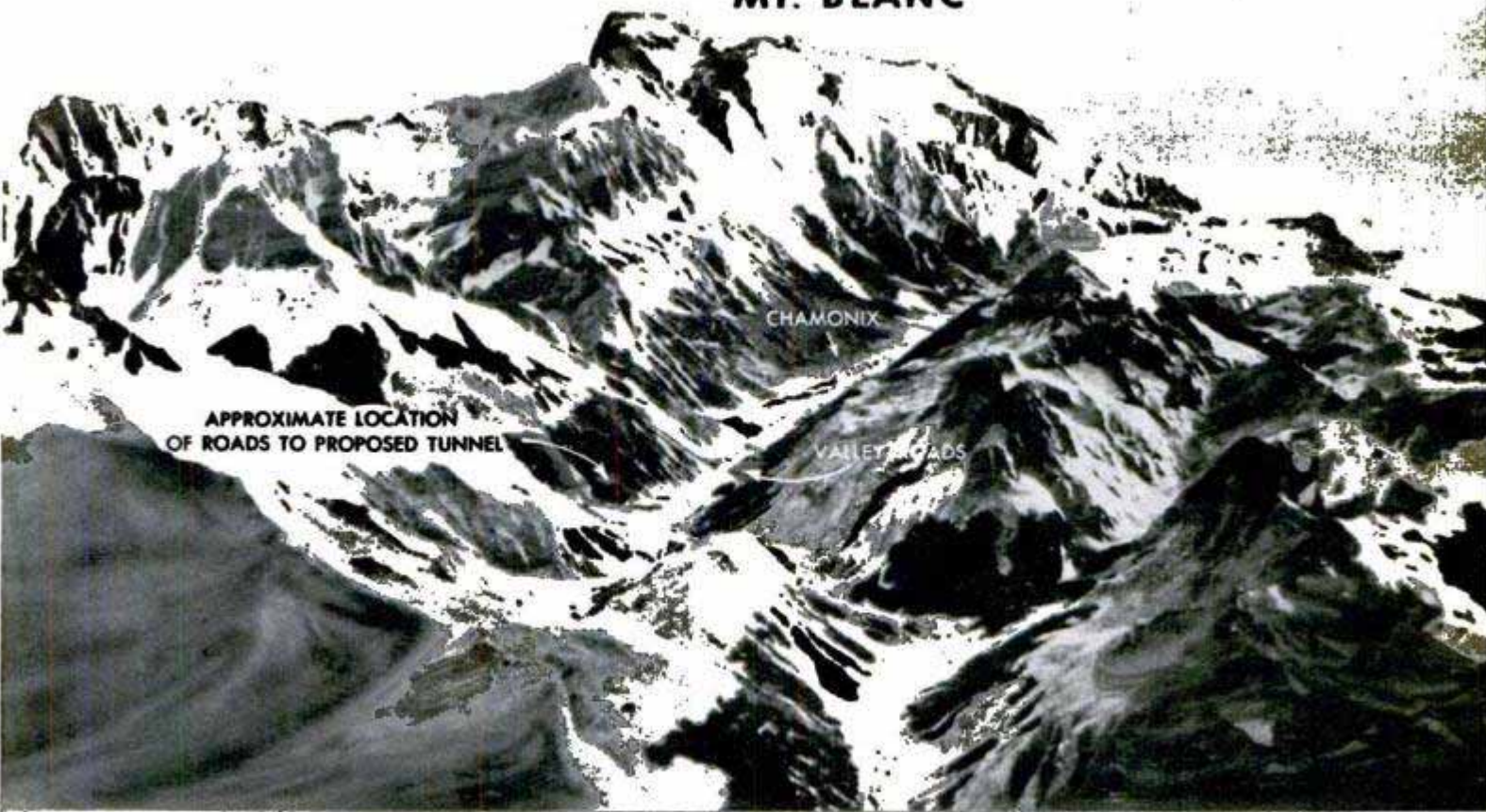
# TRAFFIC TUNNEL

Below left, cutaway drawing of control station midway in the 7½-mile tunnel. Right, signal-light system will regulate flow of traffic throughout tunnel. The automatic "watchman" will continuously check air conditions





# MT. BLANC



Model of Mont Blanc shows the proposed location of French entrance to the tunnel near the town of Chamonix

## to PIERCE MONT BLANC

**D**RIVING through the Alps in a tunnel may not be scenic, but it is practical—so practical, in fact, that thousands of cars before long may be doing it every week.

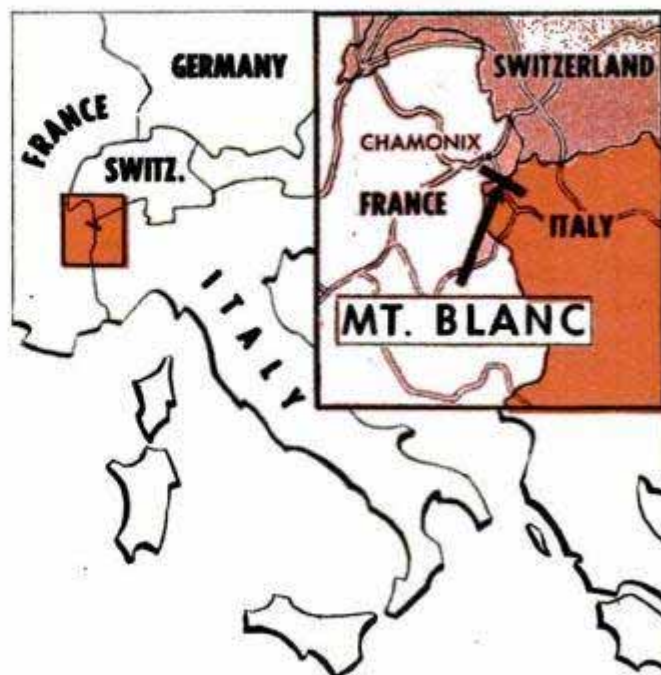
After years of planning, the three governments involved, France, Italy and the Canton of Geneva, Switzerland, have agreed on the details. The tunnel, about  $7\frac{1}{2}$  miles long, will burrow under the Alps' highest peak, Mont Blanc, and will reduce the summer road route from Geneva to Milan by 75 miles. The shortest year-round road route will be cut 200 miles.

But miles are not a true measure of the tremendous value of the tunnel. Time saved is the real test. The passes, open only from May to November, involve long, arduous climbs. In every case they rise to heights well over 3000 feet, and the St. Bernard pass, most famed of all, requires a climb of 8094 feet—an auto trip that may be spectacular, but certainly not speedy.

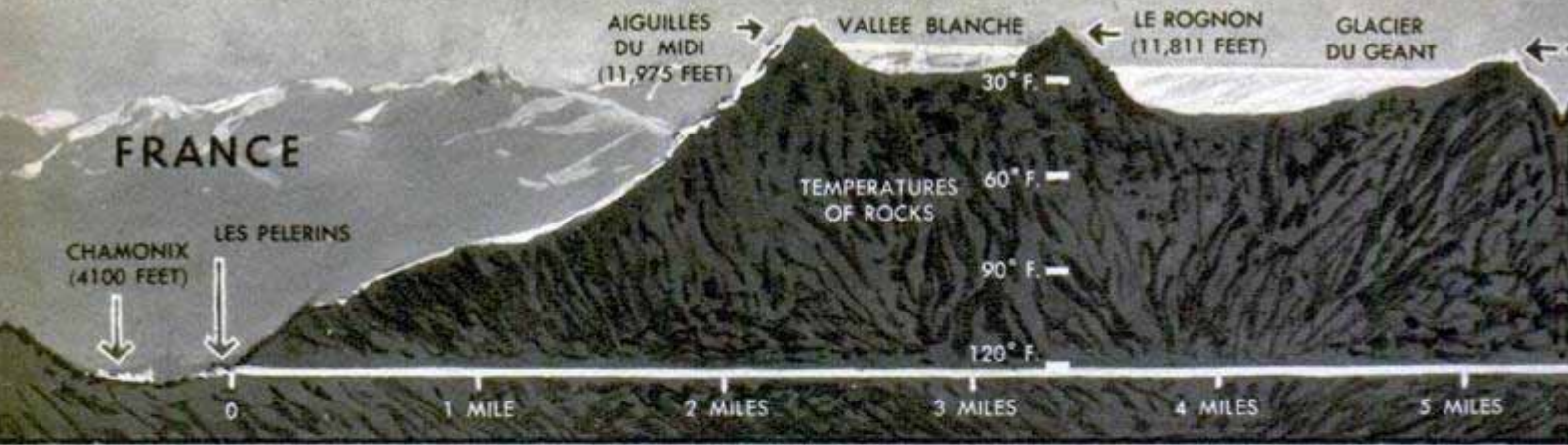
It takes about 90 minutes for a first-class car to cross the average pass—the tunnel will shorten the trip to about 12 minutes, with much less strain on driver and vehicle.

Providing a short, all-weather route across the Alps, the tunnel will serve France, Italy and Switzerland

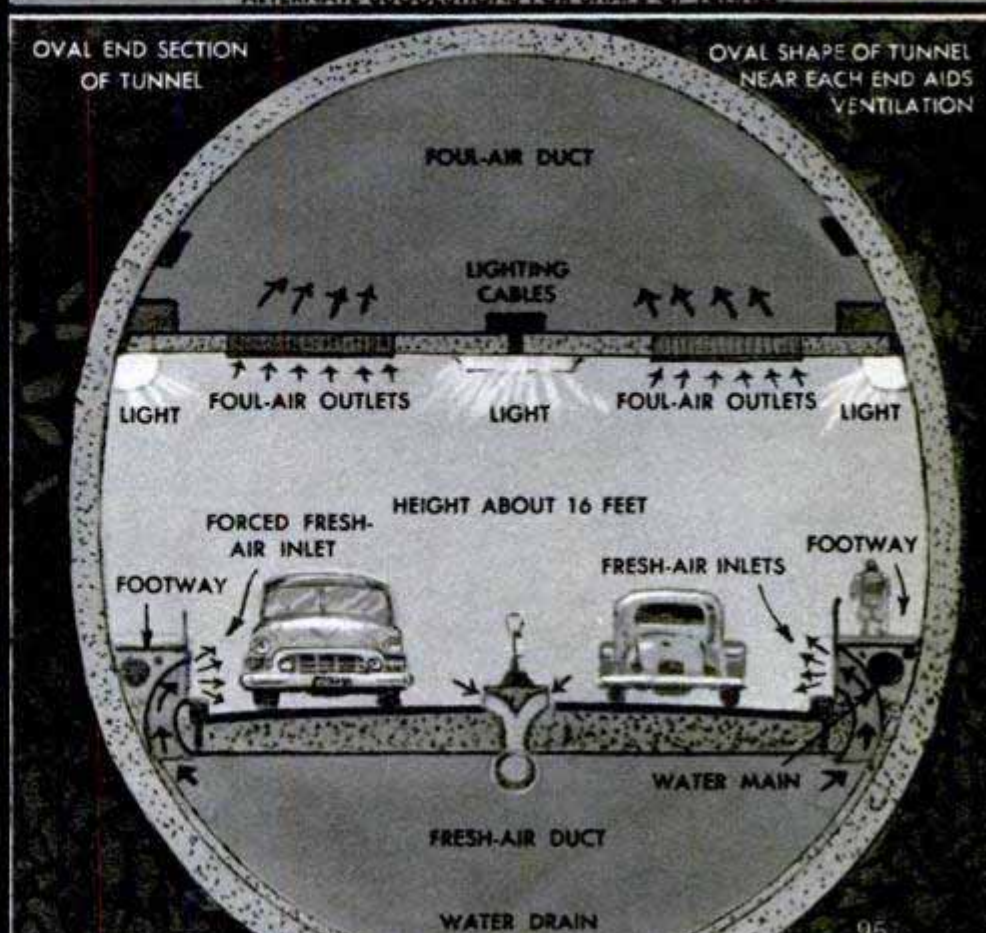
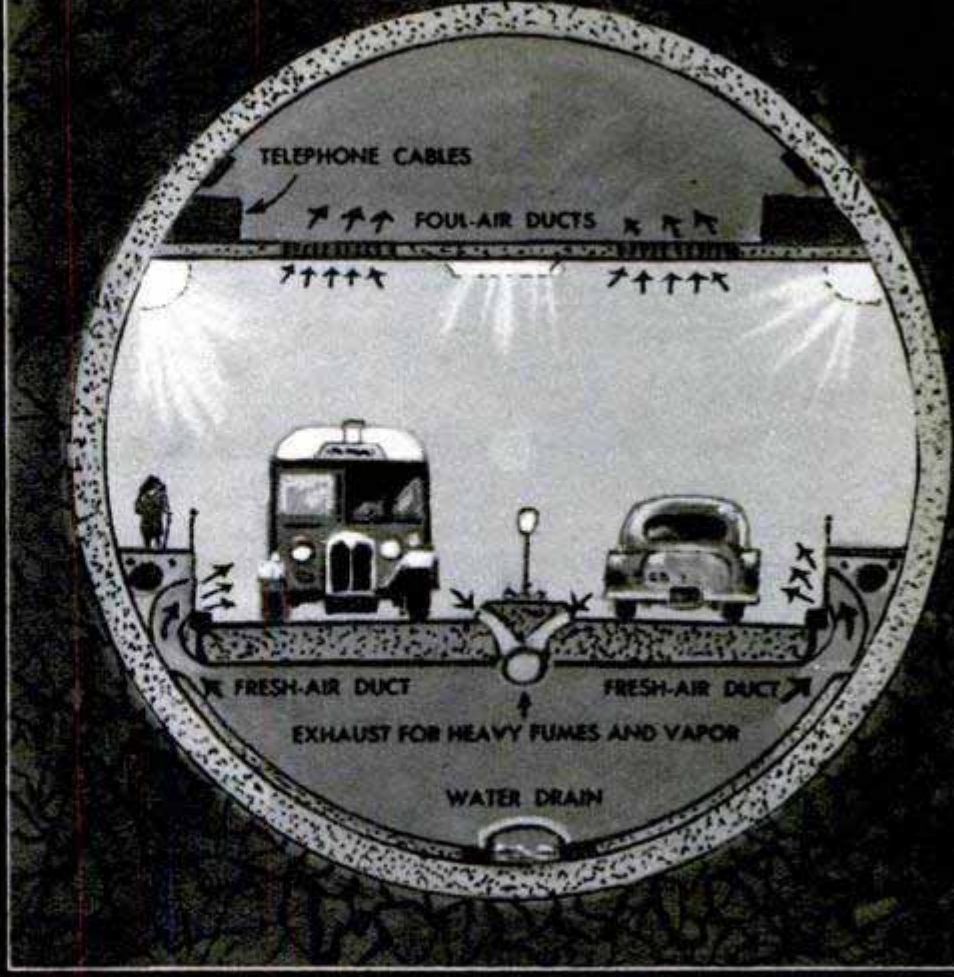
There is expected to be little difficulty boring the  $7\frac{1}{2}$ -mile hole through rocks which are described by geologists as easy to work with the exception of a 1000-foot section. Water infiltration and rock temperatures are not unusually high. The slope of the tunnel will be not more than



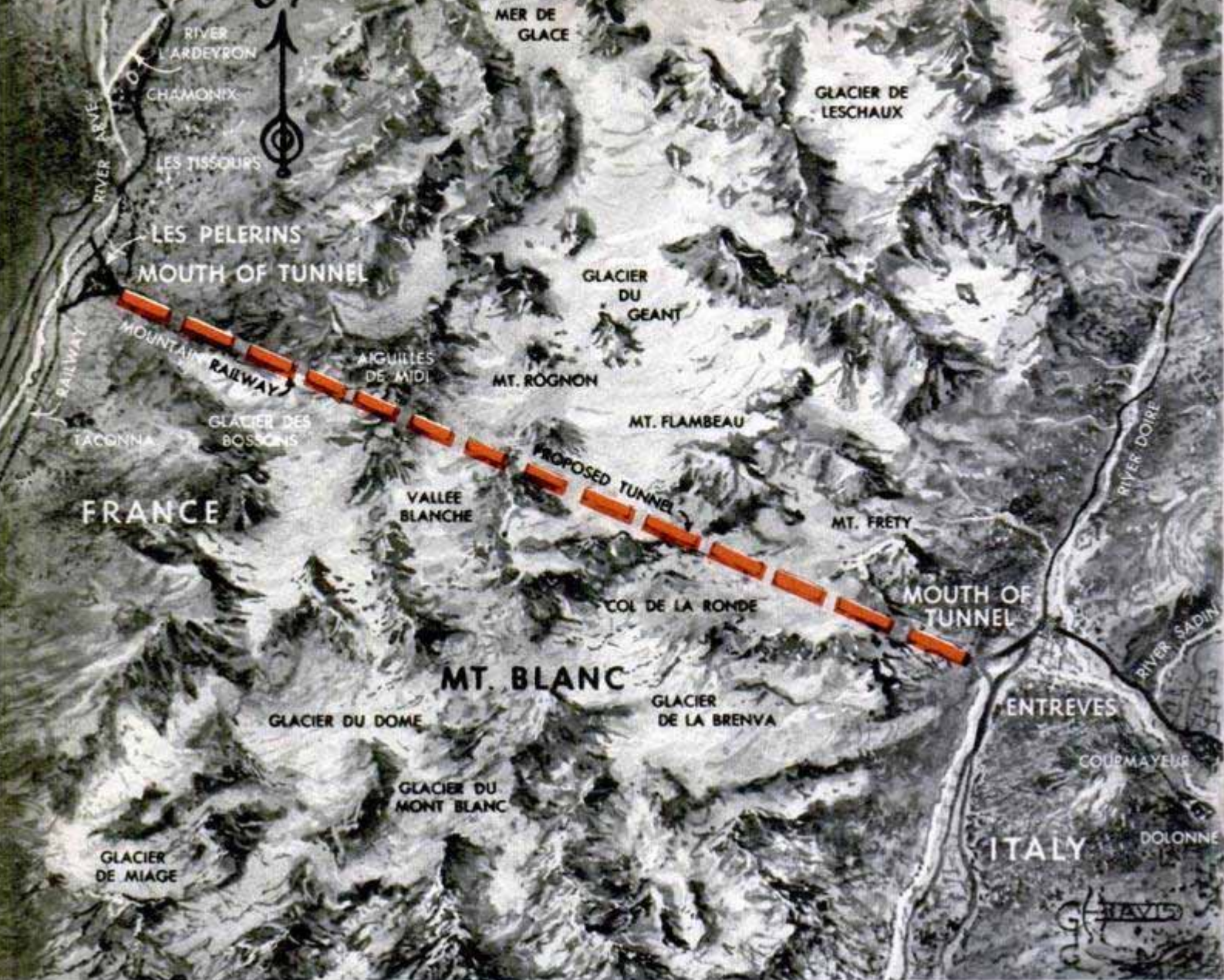












Tunnel (see dotted line) will bore beneath the massive mountain range that separates France and Italy

four percent, allowing drainage through the tube and also assisting in ventilation.

Six ventilating stations in the tunnel will collect the exhaust air. It will be drawn to the tunnel ends by large fans. Another set of fans will force fresh air through ducts below the roadway. Temperature and air-pollution gauges will keep the control stations informed of atmospheric conditions prevailing inside the tunnel.

Traffic will be regulated by a novel signal-light system that will keep cars a stated distance apart at all times. Emergency havens will be located along the tube to allow disabled vehicles to pull out of the way. Mechanics will be on duty continually for such emergencies.

Conservative estimates set the annual traffic at a minimum of 200,000 vehicles. A toll charge, about \$1.50 for a small car with four passengers, is to be made by the private company that will operate the tunnel for profit. This company, incidentally, will invest about 35 percent of the total cost of construction. Traffic is expected to increase

greatly as tourists learn of the ease with which they can drive across a mountain range that had previously been a discouraging barrier. Plans call for opening the tunnel to passenger cars during the day and to trucks at night. More than 500,000 tons of freight will be hauled annually through the tube.

Although the tunnel site is beneath the highest portion of the Alps, it is also at the narrowest, reducing the length and cost of the tube to a minimum. Year-round entrance roads at each end are already in existence, except for the last mile or so. However, considerable work will be done on the Italian side to straighten and widen some of the valley roads leading to the tunnel from the south.

No total-cost figures have been made public. Whatever the cost, though, it is expected to be a profitable investment because it will open an all-year transport route between two extremely populous and industrialized regions. In addition, its appeal to the motoring tourist is expected to be tremendous.





U. S. Marine Corps photo

Marines storm out of one of their big new "eggbeaters," ready for action after leapfrogging behind "enemy" lines

## HERE COME THE LEATHERNECKS!

*By Richard F. Dempewolf*

**A**CROSS a battered North Korean ridge one day last fall, the sky suddenly came alive with a dozen buzzing giant helicopters. They hovered over the rugged 3800-foot peak like a swarm of monstrous mosquitoes. Then, from yawning doors in their sides, knotted ropes unfurled to the ground. Down shinnied hordes of battle-ready U. S.

Marines. Quickly, the first troops cleared 25-foot-square landing areas in the scrub brush. Into these postage-stamp landing fields, more of the new copters dropped to deposit their passengers right on the surface. Each craft sat down, unloaded and took off again in about 20 seconds.

Wave after wave of big 10-man Sikorsky

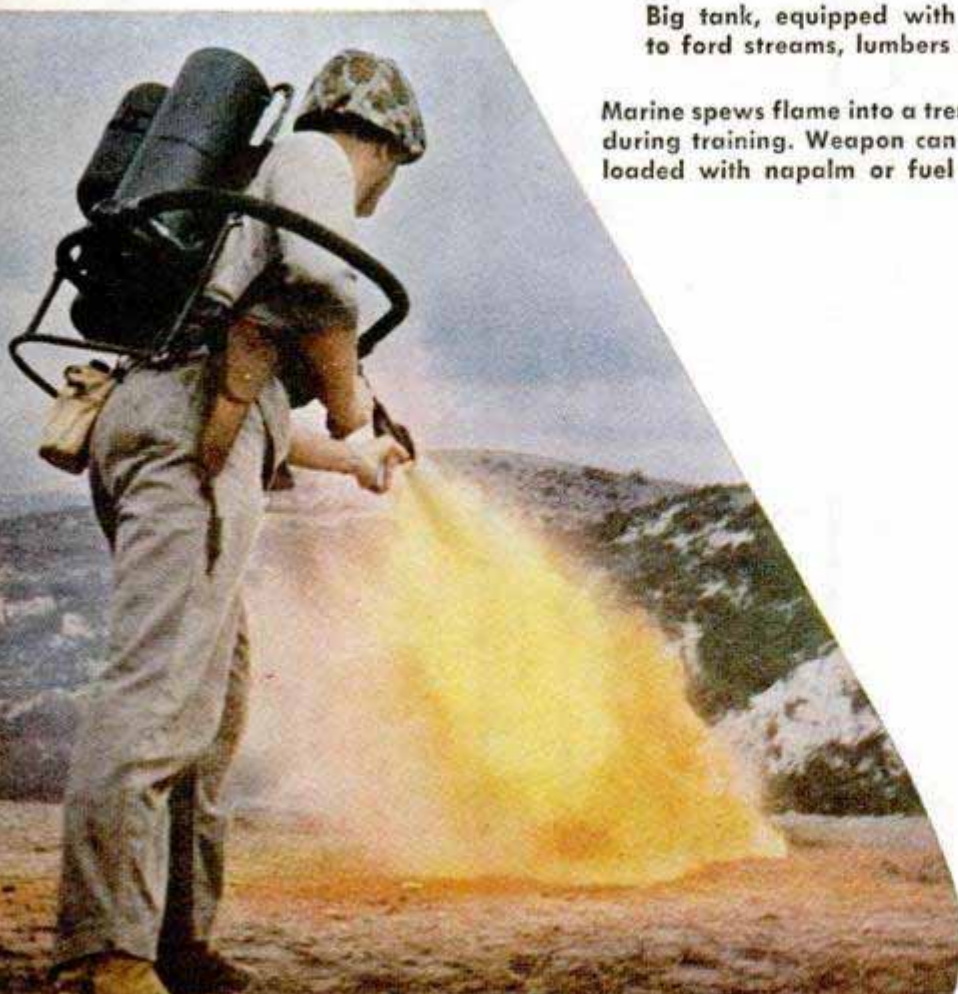
In air-support practice, three planes lay down smoke while two others drop napalm smack on their targets







Big tank, equipped with "breathing" apparatus which enables it to ford streams, lumbers across beach supported by ground troops



Marine spews flame into a trench during training. Weapon can be loaded with napalm or fuel oil

"eggbeaters" followed the first until an entire company of 250 leathernecks had been deposited on the inaccessible mountaintop.

Still more helicopters came — some with big field guns dangling on pallets under their bellies; others stuffed with ammunition and supplies. Meanwhile, smaller one-man helicopters with bubblelike plastic noses and skeletal tails, whirred around the area stringing wire to establish telephone communication between these newly planted forward troops on their remote mountaintop and Marine headquarters miles in the rear.

In a total of four hours, a huge force of 1000 men was battling the enemy from a place that would have taken 175 trucks and two days to



reach by the shortest overland route. "That mountain alone would have taken seven hours to climb," one officer observed, "and, carrying full packs, the men would have been in no condition to fight when they arrived. In jungle and mountain warfare, helicopters are the answer to a prayer."

Man-carrying "whirlybirds" are just one innovation in a stepped-up program of training and fighting designed to streamline America's most rugged corps of two-fisted battlers. They storm invasion beaches in newer and faster "water buffaloes" — amphibious, tractor-driven monsters with armored sides. They fight from armored tanks that roar across water or clamber over rough terrain with equal ease. Queerly rigged DUKWs stream up from the sea and lay landing mats down in front of them as they go across a boggy beach. Marine pilots streak across the sky in jets. Down in the foxholes, radios crackle as air observers flash fixes to fighter planes in a smooth-working air-support system.

But all these things are in addition to the fundamental business of being a Marine. At Parris Island, S. C., and San Diego, Calif., the Marine boot still steps from the recruit train with 74 other victims in his platoon to face crushing defeat at the hands of a merciless staff-sergeant drill instructor and his two assistants.

For eight weeks, the DI attacks his blundering confusion with rigid discipline and a blistering barrage of vocal abuse until the

boot is bullied and battered into a Marine. He's a "meathead," "goon," "skinhead," "idiot," "yardbird," or "numb." Head shaven bare, he is deloused and shoved in a shower. As he shuffles out, nude and damp, corpsmen flip needles into his tender arms. Disdainful supply sergeants, without ever looking at his miserable face, drape him with a knapsack, blankets, poncho, rifle, belt, boots, bayonet and other gear until he looks like a walking Army-Navy store. Finally his shorn head is clutched like a basketball by rough fingers, turned this way and that, and a fatigue cap of approximate size is yanked down over his ears.

Outside, the DI is waiting to whack his stomach in, shove him into line, yank his chin down and deflate his ego. Slightest mistakes are greeted with tirades. To a sheepish boot who blinks at him during a chewing out, the DI roars. "Eyes front! Why do you stare at me? Do I fascinate you, meathead?" Meathead's hat is yanked down and twisted askew "so you'll look like the goon you are."

To the thundering cadence of "... Awn, hupp, reep . . . reep, faw, y'layuft . . ." he and his chagrined brother goons are marched off to barracks, Quonset huts or pyramid tents, and the strenuous ordeal begins.

"We try to knock out of every 18-year-old's head the idea that he can get something for nothing," says one DI. "America wasn't built that way, and the Marines

Clanking amphib carries Marines ashore, then up across beach. Sign designates craft's wave and position  
U. S. Marine Corps photo







**Leatherneck and his mate scramble through a rugged indoctrination course toting a light machine gun**

weren't either. Besides, we can't afford weaklings when the chips are down."

Twelve to 18 hours a day, six days a week, the boot is on the drill field, stumbling over obstacle courses, hiking with full pack on infantry maneuvers until he staggers for his sack each night. Day after day on the range his sore right shoulder toughens as he learns to use an M-1 and a BAR. Every Marine is an expert rifleman—or else. A man who can't learn to squint his left eye will find his fatigue cap pulled down over it as a reminder. The man who carelessly drops his rifle in the mud sleeps on a dozen of them that night.

In between scorplings, the browbeaten boot works out incessantly with machine guns, hand grenades, .45-caliber automatics, bazookas and recoilless weapons. He becomes an expert at hand-to-hand combat. In battles with his buddies he practices judo, fighting with knives, and bayonet combat. He clammers down landing nets hung from a 40-foot tower, and charges from a landing barge at the bottom.

On the drill field, the pace is relentless and laden with planned abuse. A boot who can't learn to pivot on the proper foot may get the foot stamped on: "Now turn on the one that hurts," growls the DI.

Everyplace the yardbird goes, he goes on the double. During vicious upbraidings, he's continually reminded that he should have joined the Army instead of the Marine Corps.

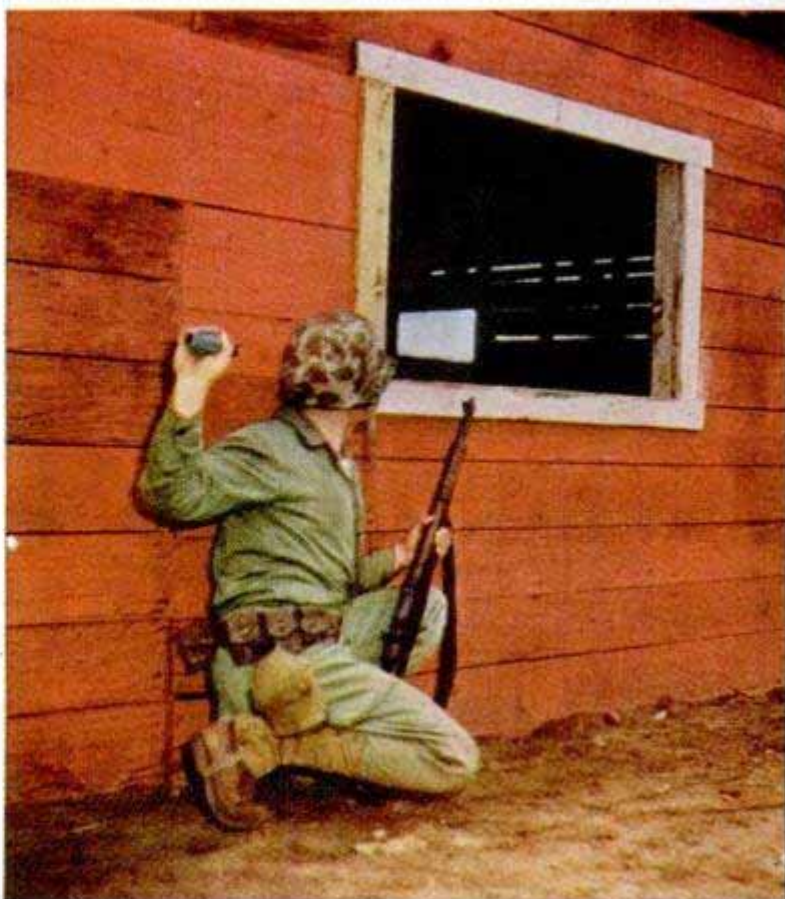
**Charging through a "combat village," Marine pauses to hurl a smoke grenade through window of "house"**



U. S. Marine Corps photo

**In sea-survival training, Marine recruits learn to float casualties on waterwings made of knotted trousers**

There's never a letup. A man caught eating a chocolate bar had to hold it in his chubby fist all day, through obstacle courses and all, until it ran down his sleeve and smeared him from head to foot. Shoes, belts and other bits of apparel found under bunks are held in the mouth through a day of training as a pointed reminder that there's a foot locker for them.







Ramp of a landing craft slams down with a splash and men charge across the beach in a landing exercise

Finally comes the "day at the beach," when the boot rigs himself in battle dress at the crack of dawn, marches several miles to a combat area and, in full gear, spends the day scouting through jungles, crawling through brush and wriggling through barbed wire and obstacle courses. At dusk, he picks up his sore, mud-begrimed body and, looking considerably more like a Marine than when he first arrived, double-times those several miles back to the bar-

racks. Let the DI catch anyone sneaking a drink and all canteens are emptied on the spot. Some men pass out, but most make the grade. In every group of 75 men, some 60 will graduate. The rest will be held over to try again. This time they are old hands, toughened by now and much more likely to make the grade.

Despite relentless discipline, constant harping and agonizing physical punishment, someplace in that boot-camp process

"Flying banana," older-type helicopter, discharges its load in seconds while another hovers, awaiting its turn







Helicopters by the wave hover overhead, ready to squat down with supplies for Marines storming across beach

the cowed and shuffling goon is miraculously transformed into a proud, vital cog in the Marine Corps. Incredible *esprit de corps* is tattooed on his rugged soul. And he's learned to use his head to save his hide. Pay-off on that heart-rending eight weeks comes on the battlefield, where they win wars and may save the life of the boot who complained loudest. These eight weeks can be the toughest of a Marine's life.

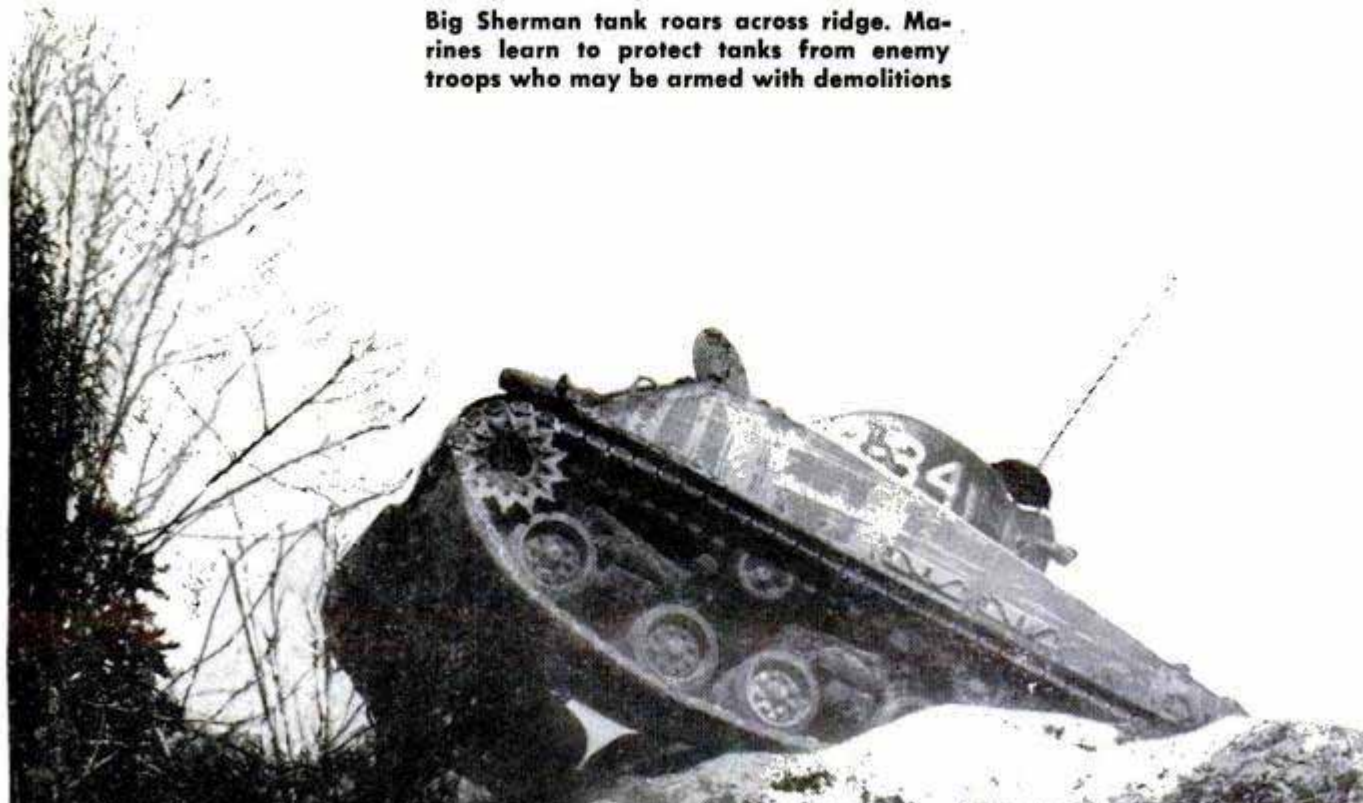
But boot camp is only the beginning. Many Marines will go on to advanced training at Camp LeJeune or Cherry Point in

North Carolina, Quantico, Va., Camp Pendleton or El Toro in California, to become indoctrinated in the use of a host of formidable weapons. No longer are they goons or meatheads, however. They're United States Marines, and they are proud of the distinguished title.

Over the beaches and "boondocks" of Cherry Point and Camp LeJeune they rehearse daily with two new squadrons of those 10-man Sikorsky HRS-1 helicopters.

Though not so big or cumbersome as the old "flying bananas," the new ships carry

Big Sherman tank roars across ridge. Marines learn to protect tanks from enemy troops who may be armed with demolitions





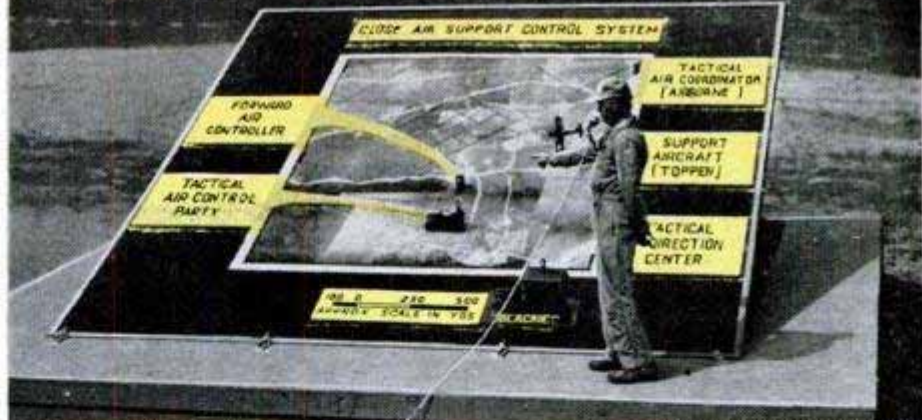
more and are not hampered by a critical center of gravity. Men can move around in them. One windmill instead of two carries them aloft and whips them along at 100 knots. They're constantly off on raiding parties, supplying troops to high ground, removing patrols and "wounded" from mock-battle areas, or carrying a 2000-pound cargo of supplies to isolated units.

"We can put them down almost anywhere," says Maj. M. Ober, "exec" of the group. "I've even set one down on the side of a hill, with only the wheels on the uphill side touching, and held it there in a half hover. Troops jumped out the low side, and we were off."

Just to prove they could do it, Ober and his pilots moved their squadron of eggbeaters laden with troops behind the "aggressor" lines during a recent maneuver, and landed them in a clearing with only three feet of leeway on each side of the helicopter blades. "We sat down one after another, emptied the machines in four seconds each, and were out of there before anyone knew what happened," he recalls. "A few minutes later the surprised enemy was wiped out."

Speed is essential in landing and removing troops, as any helicopter is vulnerable to small-arms fire. To hustle the men out, the pilot blows a horn when he's ready for them to debark. The men pour out in a rush. "We used to use an intercom," Ober explains, "and the squad leader in back got the signal via headset. But it wasn't too hot. One leader got so excited that when we gave him the signal, he rushed out of the helicopter still wearing the earphones and forgot to tell anyone else to go with him. I took off with half the men still aboard."

Under the belly of the big transport helicopters are four little eyes, from which cables can be rigged to hook a pallet. You can see the eggbeaters wearing this harness, hovering over a field problem with a Jeep or a big fieldpiece dangling in the



U. S. Marine Corps photo

**Air-control board, with Jeep and plane models, teaches Marines how to transmit target fixes to planes for close air support of ground troops**



**Men wait for burst of phosphorus shell near pillbox. Split second later they'll dash forward in this rehearsal for assault on fortified position**

breeze, ready to be let down where it's needed. In test runs, the copters have hovered low over a fieldpiece while men rushed underneath to hook up the gun, lifted the whole works into the sky, carried it for a mile and set it down ready to fire, all in two minutes.

"And," says Ober, "we can do this kind of thing day or night, under lowest weather minimums. We can land on the gun turrets of LSTs to get supplies, if necessary, and hike back behind enemy lines in a hurry so the infantry can suddenly commence shooting at an unsuspecting enemy."

Even a baby aircraft carrier has room to stow a big HRS, once its blades are folded fore and aft along its backbone. Pilots continually practice setting the big helicopters down on a painted CVE flight deck on the runway at Cherry Point.

Farther south on the Carolina coast, across Camp LeJeune's 200 square miles of

(Continued to page 236)





# Detroit Listening Post

*By Siler Freeman*

**T**HE SECOND QUARTER of passenger-car production looks a lot more hopeful than it did a month ago. While factory officials are silent, they have a more optimistic attitude as they examine schedules for the next three months.

With the best selling season of the year coming up, the chances of raising the original estimates for the second quarter look good. The agitation the industry put up in Washington when it was cut to 800,000 units on metals has paid off.

Materials appear more plentiful than they did earlier. The production pace has picked up at the plants and the bugs have been ironed out on the assembly lines.

Among outstanding innovations on 1952 cars is Oldsmobile's "Autronic Eye," an electronically operated unit which automatically dims bright headlights when another car approaches. The Eye is located at the left of the instrument cluster and aimed through the windshield at the road ahead. It operates by means of a prismatic condensing lens, which acts as an electric eye in catching the light of an oncoming vehicle. The device returns the headlights to full beam when the oncoming car has passed and if no other approaching car is within range. An over-ride foot control takes the dimming device off automatic.



Now the manufacturers' eyes are turned to 1953 models. And there the picture is brighter, too. V-8 engines, which had to be held back by the government restrictions on machine tools, are once again in the picture. It seems almost certain that Dodge and Buick will have them ready for their next models. Pontiac may join the group.

The race to tool for V-8 engines has been one of the most interesting developments in the auto industry. While other features such as power braking and power steering have been almost as sensational, the engine feud has been spotlighted. Those who al-

ready had V-8 engines feuded for the most horsepower. Those who didn't moved to get into step with competitors.

But the machine-tool ban appeared for a while to have halted the race. The car manufacturers were given a February 1 deadline to complete whatever tooling they had under way, and then clear the decks for military projects.

The timetable on armaments, especially the aircraft program, was changed. Space opened in the tool shops and the deadline was extended first to February 15 and then to March 15 in some cases. Additional extensions are probable.

But don't think the industry has shot its bolt in the engine field. Some serious work is going on to bring out something newer, lighter and more economical.

Some doubt has been cast on the power race. The question has been raised as to where engine builders are going with this mania for getting more and more horsepower out of their power plants. Fears have been expressed that with traffic conditions being what they are, and speed being one of the main contributing factors to the high accident rate on the highways, legislation may come to limit horsepower in auto engines.

The engineers, however, point out that stepped-up horsepower is not intended for high rates of speed which are possible but to "fatten up" the curve at the most-used speeds—between 50 and 70.

The power-steering competition isn't at an end either. The hydraulic device, now in the hands of Chrysler and General Motors exclusively, will be extended to others. Lincoln and Packard are eying it enviously. Even the truck companies are intrigued.

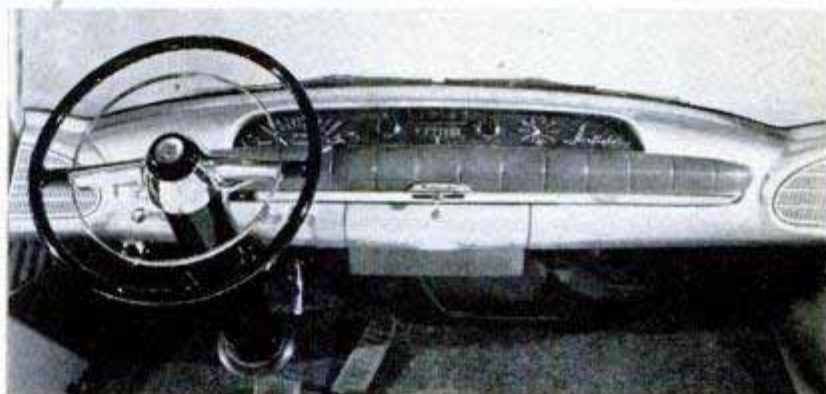
Cadillac, of course, is getting the bulk of G.M.'s power-steering device. Buick and Oldsmobile are dividing the balance.

Chrysler has extended its use to DeSoto, to go with the latter's new V-8 160-horsepower engine. The two steering devices are identical, except that G.M. has not changed its steering mechanism, while Chrysler's steering ratio has been reduced to 16:1 to make the wheel respond instantly and without pressure from the driver.





Continental styling is featured in the 1952 Nash Ambassador above. Below, hidden fuel-tank cap and panel



## '52 Nash

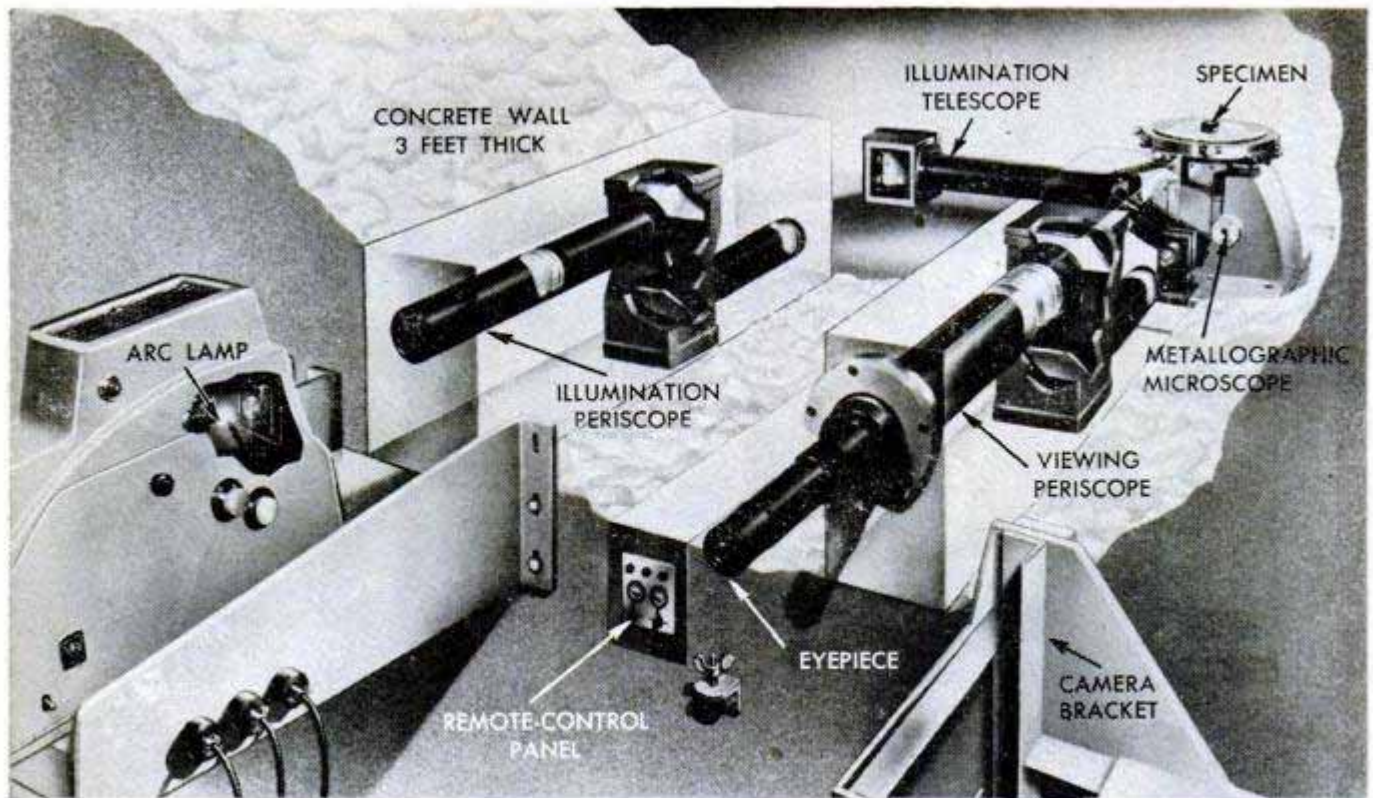
Styled by Pinin Farina, noted European designer, the 1952 golden-anniversary models of the Nash present a sleek Continental appearance. Horsepower of the Am-

bassador's six-cylinder overhead-valve engine has been increased from 115 to 120, and the Statesman's six-cylinder L-head engine from 85 to 88. Glass area has been increased, and a vinyl safety crash pad has been added to the dash.

Production model of the Nash-Healey sports car which has 125-horsepower six-cylinder Ambassador engine







## Offset Microscope

With the aid of a new optical instrument, radioactive materials can be examined by microscope and photographed through a thick concrete wall. Without the special microscope assembly, radiations could penetrate straight to the observer. Light for illuminating the specimen comes from an arc lamp mounted outside the three-foot

concrete wall. It passes through a periscope which eliminates a straight-line opening in the concrete. The light is reflected from the specimen and returns through another series of lenses to form a magnified image which can be studied or photographed. The instrument, developed by the American Optical Company, will be used in the Knolls Atomic Power Laboratory operated by General Electric in Schenectady, N. Y.

## Medicine That Synthesizes Phosphocreatine May Aid Heart-Disease Victims

New hope for sufferers of various heart diseases is contained in preliminary reports of a medicine consisting of betaine and glycocyamine, two substances related to the amino acids.

Some bedridden patients were able to resume active lives one to five months after treatment began, although a number showed no improvement. In all cases, however, patients reported a new feeling of cheerfulness and well-being.

Drs. M. E. and Henry Borsook of Los

Angeles selected betaine and glycocyamine for investigation because these substances appear to synthesize into phosphocreatine, the main reservoir of immediately available energy in muscle and nerve. The doctors reasoned that larger than normal amounts of that material might be beneficial in cases of muscular weakness or degeneration, including cardiac failure.

Typical examples of beneficial results include a 57-year-old woman who previously suffered considerable anginal pain. Five weeks after treatment began, she was able to do all her daily housework. A 46-year-old male patient, who had been unable to work because of severe chest pains and shortness of breath, improved so much that five months after treatment he drove a car 4000 miles in 10 days without fatigue, then took up active life as a farmer.

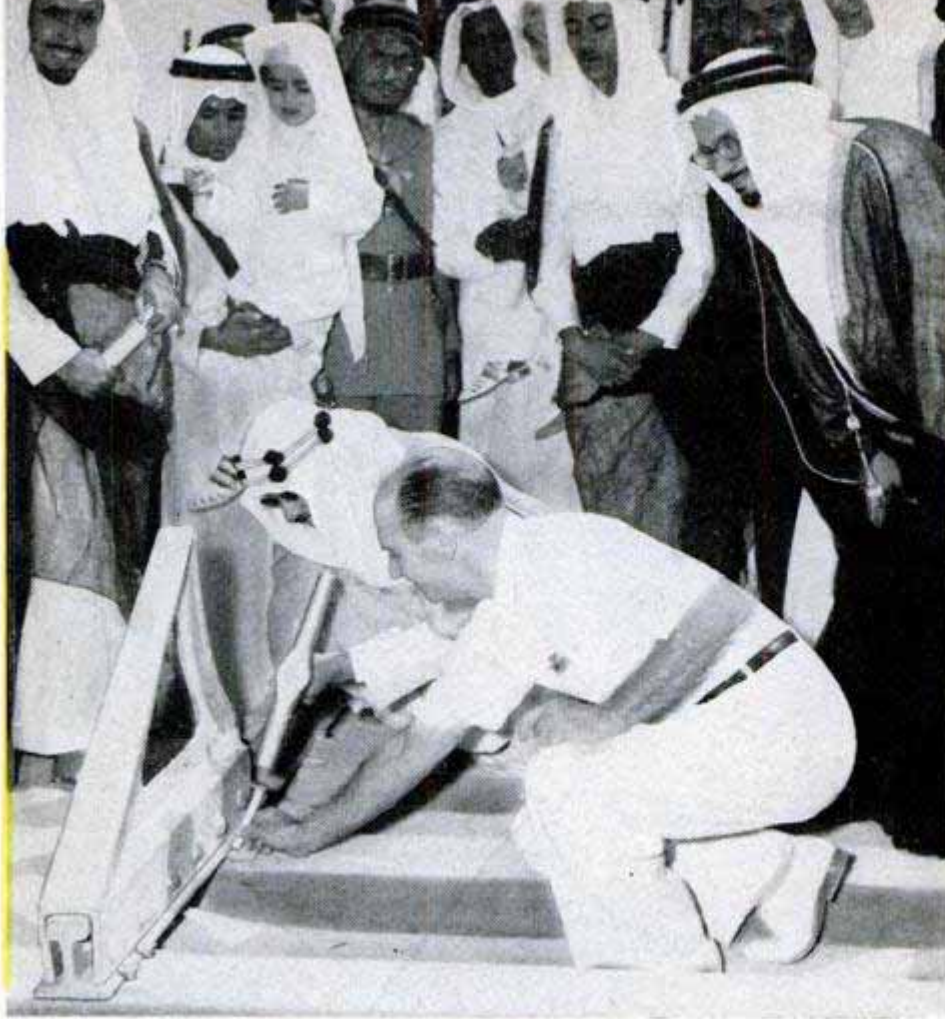
At present, the combination of betaine and glycocyamine is available only for experimental use, but if tests prove its efficiency it will become generally available. The medication is taken by mouth and appears to have no toxic effects, reports the Los Angeles County Medical Association.

### HOW TO KEEP FIT AT 50

You take good health for granted when you're young. But when you're 50—every creaking joint, every pain in the neck adds a new wrinkle of worry.

But you can keep yourself in top physical condition in your 50s if you follow the rules of Dr. Thomas K. Cureton, director of the Physical Fitness Laboratory of the University of Illinois. Over 50 himself, he takes his own advice and keeps in rugged condition, and still is able to beat most young recruits through a military obstacle course. Read his story, "How to Keep Fit at 50," in next month's *Popular Mechanics*.





A golden spike, marking the completion of desert railroad, is held by J. H. Gildea, American engineer, while Crown Prince Saud drives it into tie at city of Riyadh

# American Railroad on the Arabian Desert

By John C. Henry

**T**HREE HUNDRED AND FORTY miles of modern American railroad are threading the Arabian desert today from the Persian Gulf to the ancient capital city of Riyadh.

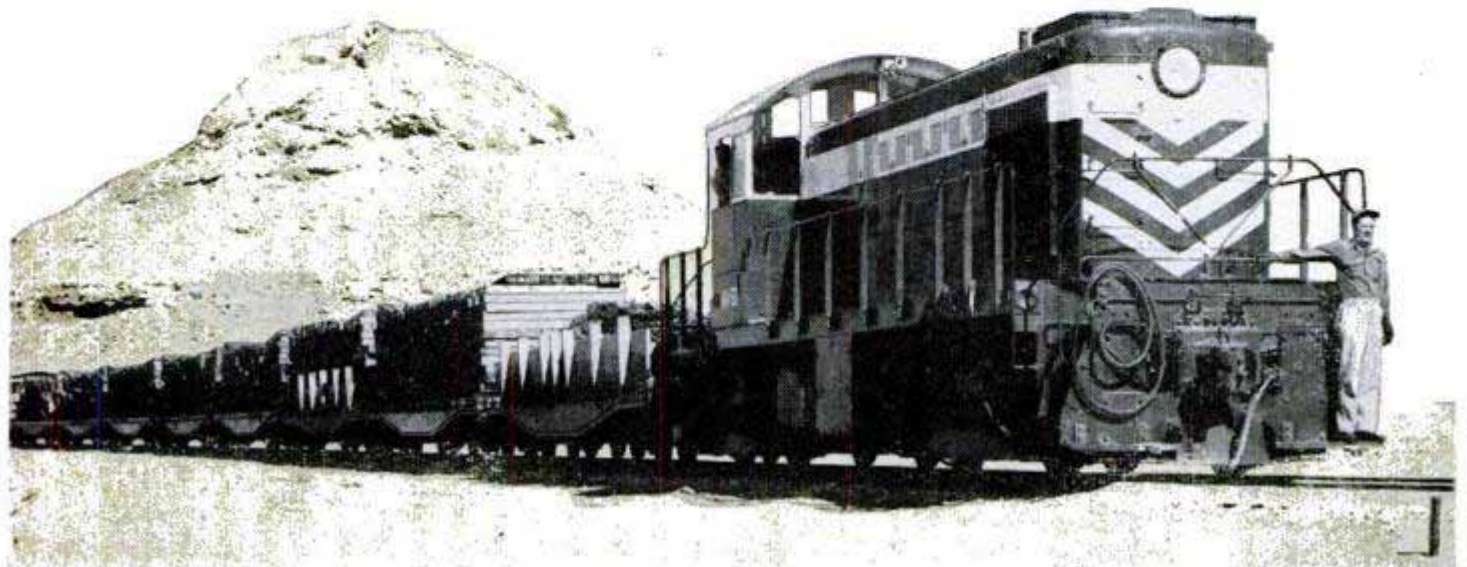
To the American mind, a steel highway of this extent is hardly an awesome accomplishment, but in the shifting sands of a country that is compressing industrial and economic development that might normally take centuries into a very few decades it is a mark of startling progress. Indeed, its actual construction not only is a unique exercise in engineering, it is likewise a dramatic manifestation of America's Point Four philosophy of technical assistance to underdeveloped countries. Only in this case

it was conceived and applied by private initiative long before it ever became a segment of our foreign policy.

Genesis of the Arabian railway project is found first of all in the discovery some 20 years ago that the great peninsula is a storehouse for one of the world's richest oil deposits. By concession, exploitation of this natural wealth was vested in the hands of American interests, represented today by the Arabian-American Oil Company, wholly owned subsidiary of Standard Oil of California, Standard Oil of New Jersey, Socony-Vacuum and the Texas Company.

Expanding shipments of both crude and refined oil products by the end of World War II made clear the desirability of a

A trainload of ties is hauled to end of the line over Saudi government railroad in eastern Saudi Arabia





Arabian track crew uses U. S. pneumatic hammers to spike rails along the desert line. The temperature climbed to 130 degrees, but crews worked on a 24-hour basis



deep-water port on the Persian Gulf coast of Saudi Arabia—the eastern belt along which most of the oil reserves so far have been proved. At the same time the over-all development and economic progress of the country made it equally desirable to improve transportation facilities, both for personnel and freight, to interior points—in particular, to the capital city of Riyadh.

In 1947, agreement was reached between King Abdul Aziz Ibn Saud and Aramco that the twin project should be undertaken, its cost to be financed primarily by the Saudi government out of oil royalties, with the engineering and construction to be arranged under guidance of Aramco and the Bechtel Construction Company. In the spring of 1948, recruitment of experienced American railroad men of all technical categories began with James H. Gildea, formerly of the Union Pacific, chosen as the

operating boss. Gildea had acquired Middle East experience during World War II when he was one of the operating chiefs for the Iranian railroad. This road carried supplies from the head of the Persian Gulf to the Russian take-over points on the Caspian Sea.

The port site was established at Dammam, about midway between Dhahran, headquarters town for Aramco, and Ras Tanura, where a large new refinery had been completed only a year or two earlier. Work on both the port and the railroad began in the summer of 1948, each project presenting huge engineering problems.

To get beyond the treacherous shallows of the Persian Gulf, engineers established that the main pier must be built nearly seven miles out from the shore. To reach this point it was decided to build a rock causeway about five miles long, with a steel trestle extending for 1½ miles. A substan-

Hospital car converted from a Pullman was trucked across desert in Saudi Arabia to the new railroad







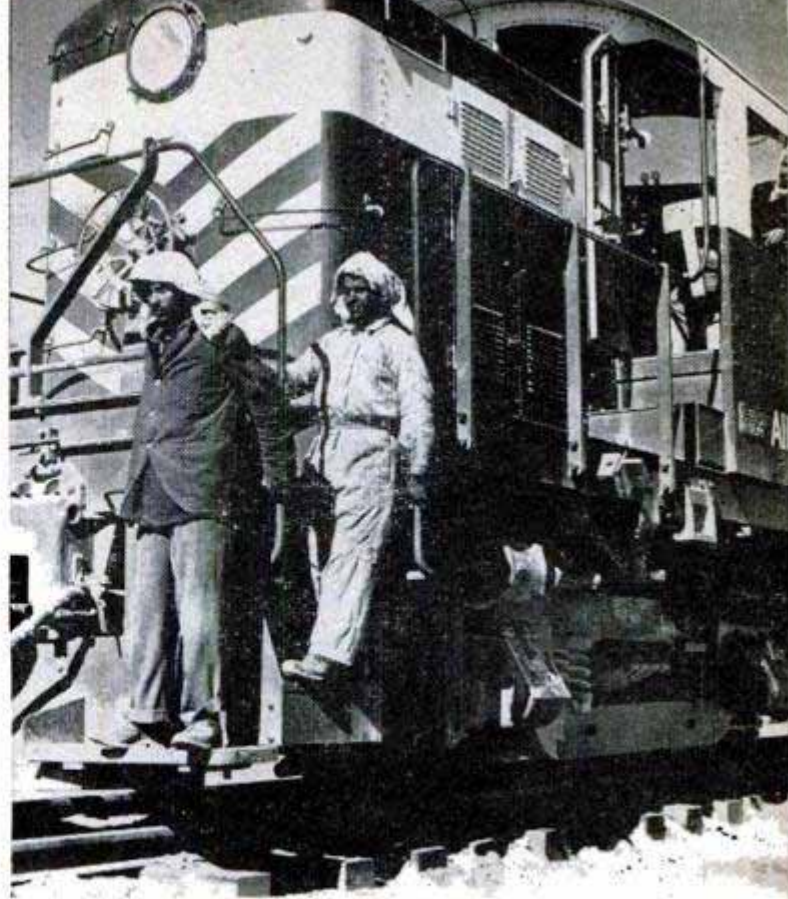
Map shows 340-mile route of the desert railroad which links Persian Gulf with oil-rich interior

tial rock deposit was uncovered scarcely two miles from the land end of the causeway. In succeeding months thousands of tons of good limestone were quarried and transported on heavy-duty trucks with special sand tires in a creeping extension of the causeway. At almost the five-mile mark, the causeway was five feet above high-water mark and 13 feet above the low-water level. The restless tides of the Gulf made it inadvisable to continue it further, and the steel-trestle construction was joined at that point.

With Arab workmen trained on the job and employed in all phases of the operation, work was pushed on a 24-hour seven-day basis. Steel supports for the pier were driven 40 feet through the muck of the Gulf to reach solid foundation in a spot where the water itself was another 40 feet deep. In dimension, the pier is 744 feet long and 90 feet wide, large enough to accommodate two ocean-going tankers and a railroad freight yard with main line and five sidings.

In early 1950, the 422-foot Liberty ship *SS Lissekerk*, flying the Netherlands flag, tied up at the new pier with a load of rails, locomotives and other cargo consigned to Saudi Arabia.

Meanwhile, work on the railroad proper was moving even faster despite the two major problems of getting material ashore without benefit of a proper port and of combating the engineering obstacles of locating track on sands that drift constantly like snow. It was, in fact, this similarity to snow that provided an important key to solving



Arabian railroad workers, shown riding a diesel locomotive, adopted Western-style clothes for the job

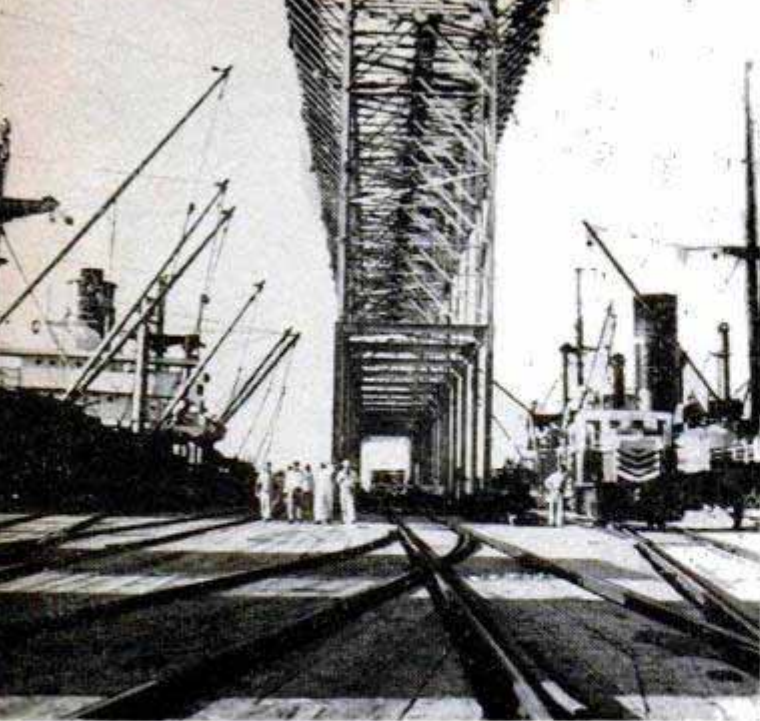
the difficulty. As strong prevailing north-west winds, known in Arabia as *chamals*, kept the sand in continual movement, engineers employed plows and spreaders, successful in snow operations here, to level and clear the wavelike dunes. Fences comparable to snow fences were erected along the right of way. Heavy coatings of crude oil were applied and the heavy crust thus created not only held the sand firm beneath it but provided a surface over which the blowing sand would not hold.

The first stretch of completed track, as early as 1949, was between Dhahran and Abqaiq, location of one of Aramco's first and biggest fields. The second was from Dhahran to Dammam.

As the line extended, a railway-camp train was put into operation in order to cut down on time lost in traveling to and from the job. Improvised and assembled on the spot, the work train had four bunk cars with wardrobe closets, sleeping accommodations, reading rooms and sanitary facilities built on wood-decked flatcars. A former U. S. Army hospital car was converted into a diner, a tank car was utilized for water storage and a refrigerator car was put together for food storage. A freight car was made into a machine shop. In consideration of desert temperatures which often reach 130 degrees, it was necessary to air condition the whole train.

The months that followed compounded the ingenuity required but produced no obstacle too great for the capacity at improvisation developed by Americans and





**Loading facilities and cargo tower are located at the end of Dammam causeway and pier on Persian Gulf**

Arabs alike. Today the line is finished from Dammam to Riyadh.

The road, a single-track standard-gauge line, has numerous sidings and passing tracks with terminal facilities at Hofuf, Al Kharj and several other intermediate points along the 340-mile route. All equipment and materials are in accordance with American specifications. It is the only railroad in Europe or Africa that operates with automatic couplings on all its rolling stock and locomotives. Locomotion is provided by diesels fueled with oil that is surfaced virtually along the right of way. Its equipment already includes virtually every type of car known to American railroading (except the luxury Pullmans), and its operation is on a schedule basis accommodated to

both passenger and freight traffic. To a degree increasing monthly, Arabs trained only during the past three years are taking over operation and maintenance. As this trend continues, the Aramco and Bechtel supervision has been gradually withdrawing in favor of the Saudi Government Railroad Administration, led by Mr. Gildea.

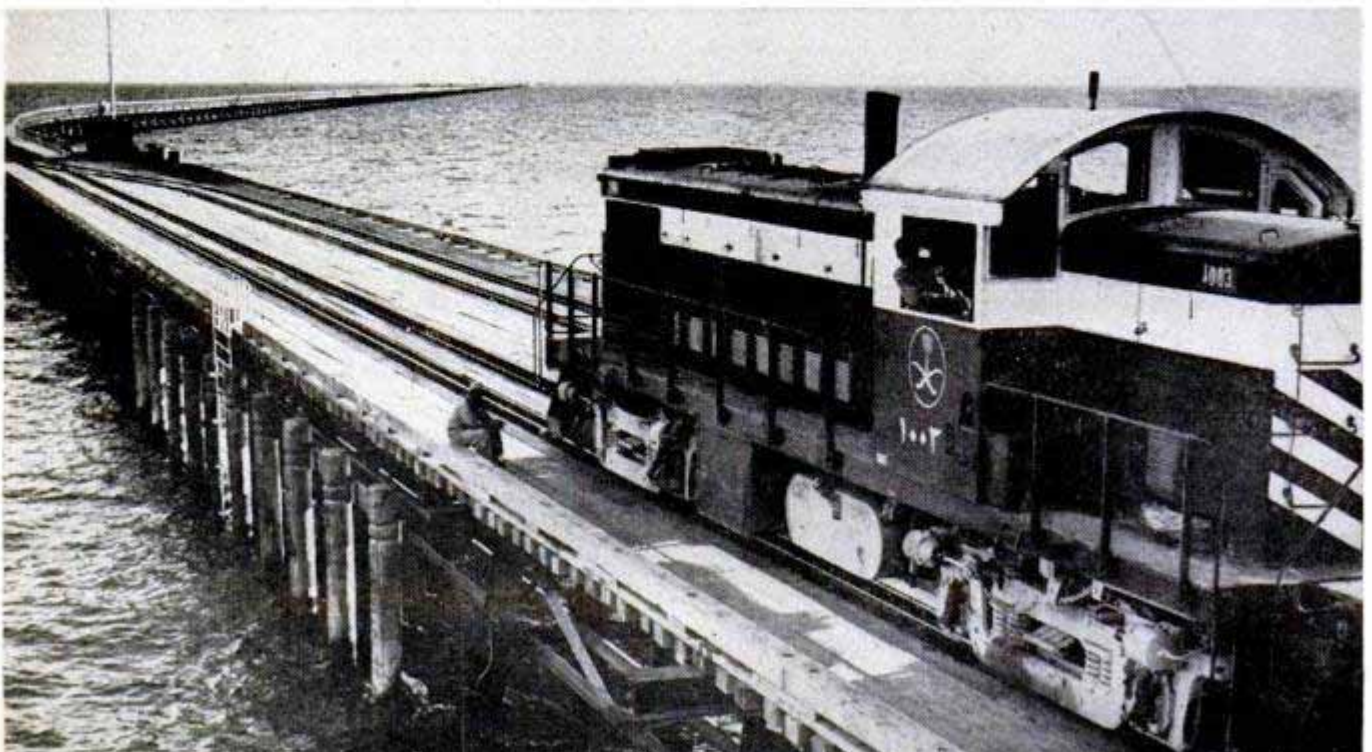
From the beginning, the King and his oldest son, Crown Prince Saud, have taken a keen personal interest in the project. The Crown Prince has traveled over most (if not all) of the route and has experienced the thrill of riding in the cab of one of the 1000-horsepower diesel locomotives.

Plans already are being charted for extending the line across the entire peninsula, connecting the Persian Gulf with the Red Sea. Tentatively it is proposed that the road would by-pass the sacred city of Mecca but would reach Medina, second holiest city of Islam, after turning north from the Red Sea terminal at Jidda.

Eventually the line may go on to Ma'an in Jordan, probably using what remains of the roadbed of the pre-World War I railroad between Ma'an and Medina. Built in 1908, this old narrow-gauge line brought thousands of pilgrims—it was known as the pilgrims' railway—from Damascus and other Islamic centers of the north to the shrines of the Hejaz.

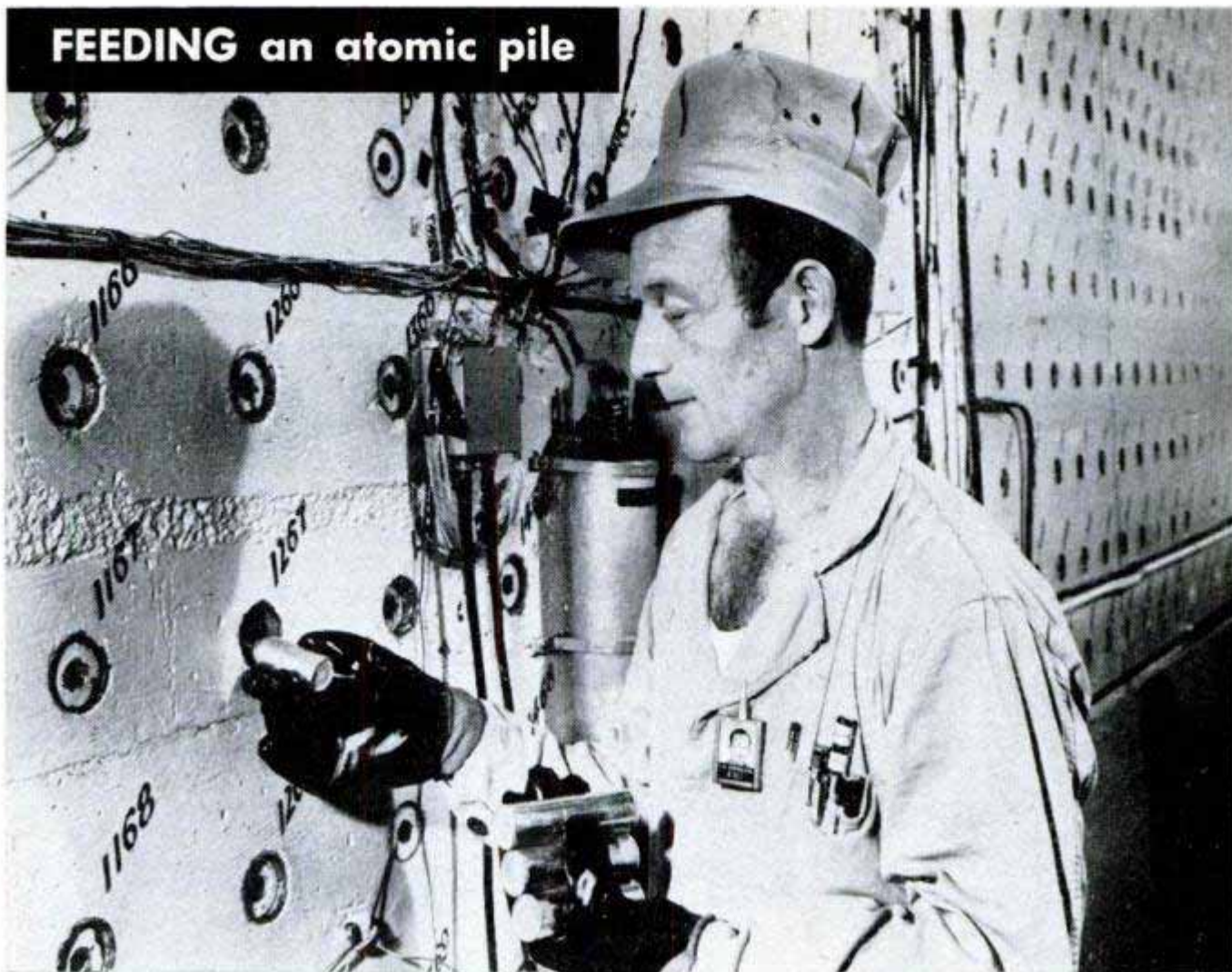
During World War I it was Lawrence of Arabia who turned his desert raiders upon what was then a Turkish Empire property and had them tear up the rails between Medina and Ma'an. It is nearly 40 years later now, and it may be more before today's highway of steel starts crawling northward again from this Arabian desert, but it has a solid and inspiring beginning.

**Pier at Dammam extends for several miles out into Persian Gulf because of treacherous shallows nearer shore**





## FEEDING an atomic pile

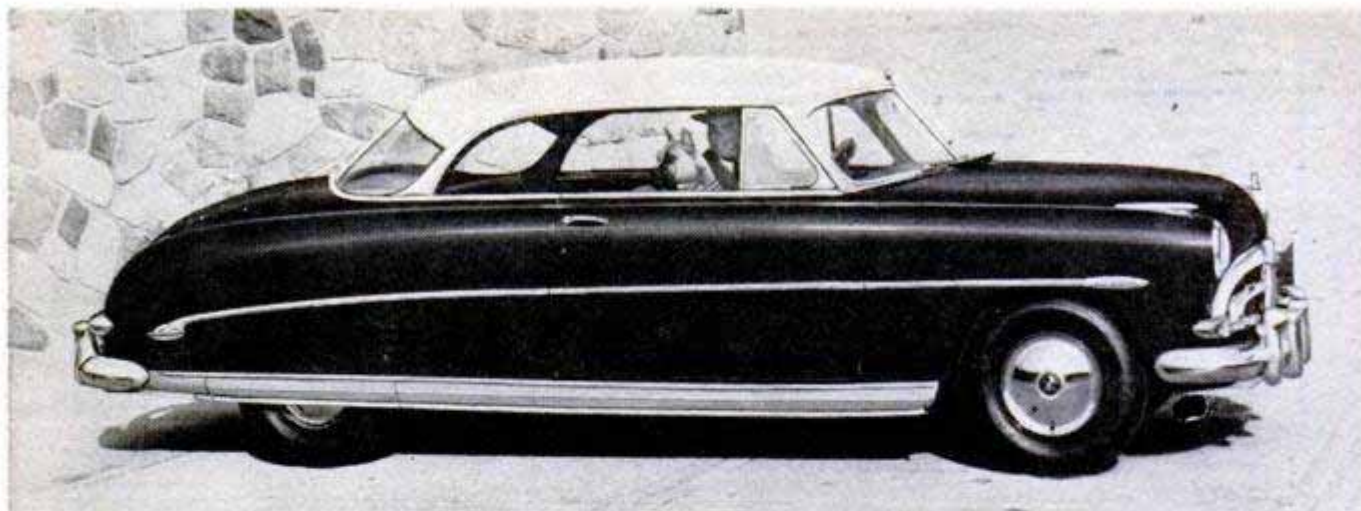


TO FEED the atomic pile at Oak Ridge, Tenn., workman shoves uranium slugs into fuel channel in loading face. Each slug weighs 2.57 pounds, measures four inches long. Below, after the chain reaction has started, operator in control room can stop it by throwing a switch which drives control rods into heart of reactor

## STOPPING an atomic pile







## '52 Hudson

Hudson has added a running-mate to its Hornet line for 1952 in the Wasp. This line has a 119-inch wheelbase, a 127-horsepower engine and hardtop styling. The engine has

a compression ratio of 7.2 to 1 with an optional aluminum head and 6.7 to 1 with the standard iron-alloy head. Hudson retains the Hornet, Commodore and Pacemaker in its line. Hydra-Matic is offered on all models as optional equipment.

## '52 DeSoto

Coincident to changing the power plant for its 1952 models, DeSoto has made a few distinctive modifications in its outside appearance. One was apparently dictated by the new V-8 engine of 160-horsepower. DeSoto calls it the air-vent hood. The air vent is built into the hood ornament to supply air to the carburetor. The new engine is made on the same principle as Chrysler's V-8 and has a similar name — FireDome. It has a compression ratio of 7.1 to 1 and operates on regular grades of fuel. Power steering and electric window lifts are optional equipment. Significant with the new engine is the speedometer dial which now goes all the way to 120. Before it went only to 100. DeSoto will continue to make a six as well as the new eight in the Custom and DeLuxe lines.



## Bubbles Combat Water Pollution

Waste and sewage are removed from water through a new bubble process costing less than one third the present methods. The process is similar to the one used in production of carbonated beverages. Air is trapped in the waste water under pressure, producing millions of tiny bubbles which rush to the surface. These bubbles carry with them virtually all the chemically treated waste material suspended in the water, which becomes crystal clear and is returned to the lake or stream. The process was developed at the Engineering Experiment Station of Michigan State College.

☐ Milk bottles are on their way out, according to C. F. Merriam, chairman of the British Xylonite Co., who predicts the future milk container probably will be a disposable thin plastic bag so tough it can be tossed over the front fence.

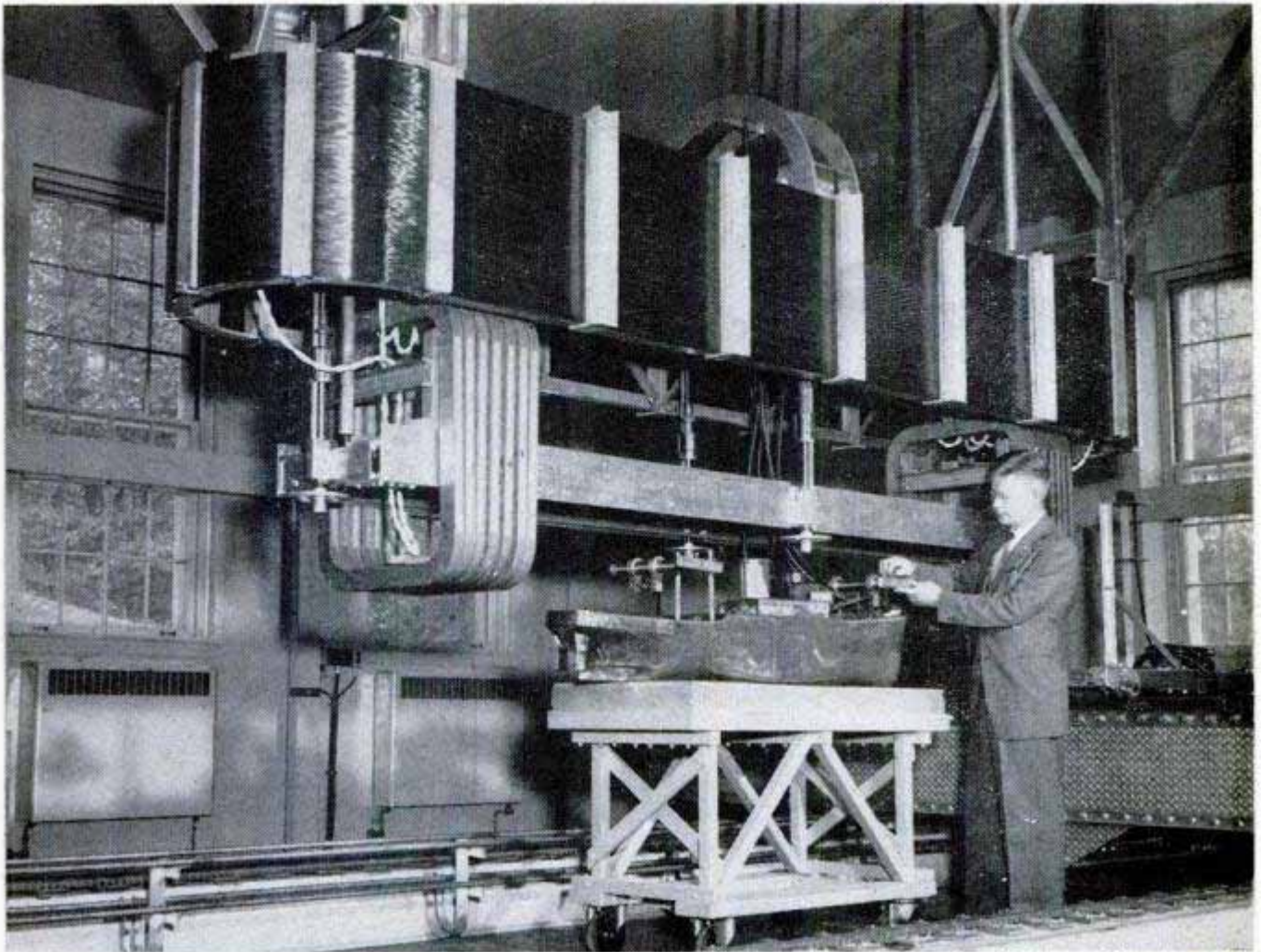
### *Coming Next Month . . . — Some Tall Tales!*

Have you heard the one about the Marine pilot who used the tail hook of his carrier plane to rip up telephone wires in North Korea?

Did you know that the first American aircraft knocked down in the Korean war was a helicopter — hit by a land mine?

Tall tales, but they're true. Don't miss this exciting roundup of "Tall Tales From Korean Skies," by Lt. Comdr. Arthur L. Schoeni, coming in your May issue of *Popular Mechanics*.





Naval Ordnance Laboratory photo

## Magnetic Waves in Dry Sea Test Model Ships Against Mine Threat

Navy scientists sail model ships in an arid sea where the only waves are magnetic as they seek methods of protecting our warships against magnetic mines and torpedoes. All ferrous objects pick up magnetism while in the earth's magnetic field and in warships the amount is increased by violent vibrations such as result from gun firing. Even the tossing of ships on a rough sea increases the pickup. At the Naval Ord-

nance Laboratory, White Oak, Md., scientists control the magnetic field by a giant coil assembly housed in a building made entirely of nonferrous materials. Magnetic fields can be simulated to duplicate any which would be encountered by the ship. Or, by using the coils to compensate for the earth's magnetic field, the scientists can study the models in an area absolutely free of all magnetic influences.

## Fog and High Altitude No Problem for One-Ton Electronic Bombsight

Detecting targets in bad weather and through overcast from eight miles up, a new United States bombsight "thinks" faster than the human mind. The pilot guides the plane to the nearest terrain feature that can be identified by radar, such as a river bend,

and the sight's complicated electronic system does the rest. In contrast to the Norden's 50-pound weight and \$8000 cost, the new K-1 bombsighting system weighs a ton and costs \$250,000, according to the Defense Department.

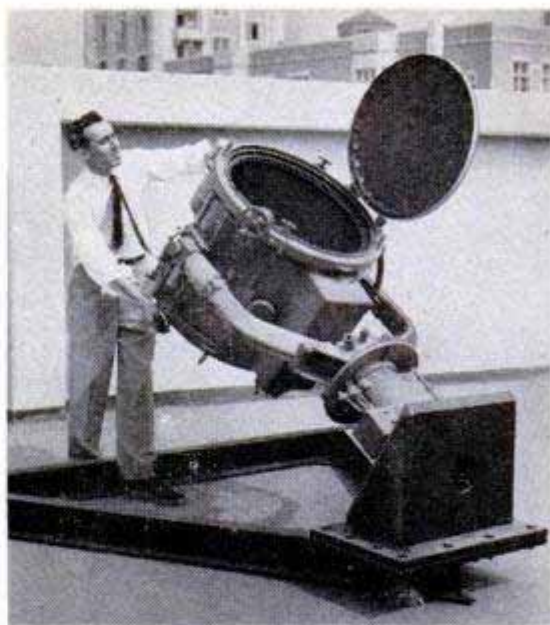
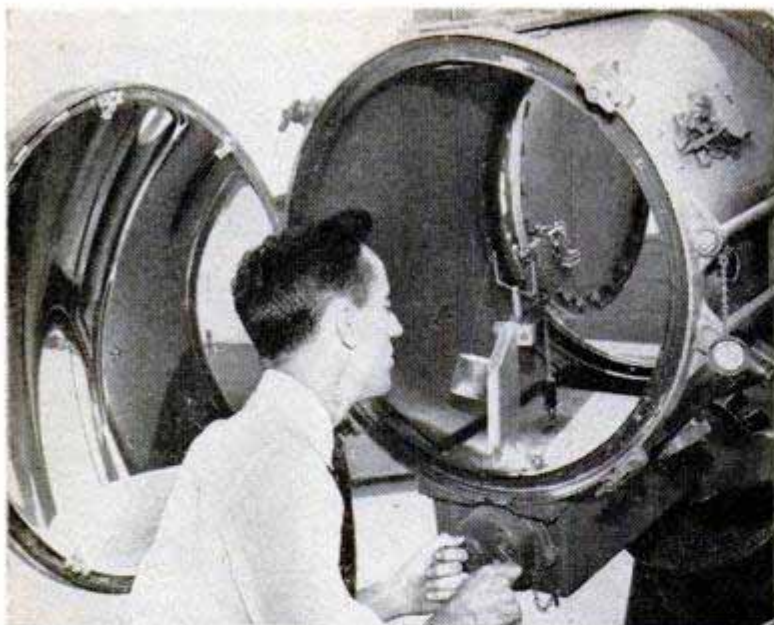
## Insecticide in Floor Wax Is Deadly to Crawling Bugs

Floors are shined and crawling insects are killed by a new self-polishing wax. Known as lindane, the insecticide in the product is odorless, and harmless to human beings and pets, reports the manufacturer. In a test in 100,000 Florida homes, it proved deadly to roaches, ants, water bugs, silver fish and other household insects. The wax

can be applied with a paintbrush or cloth to linoleum, asphalt or rubber tile, cement, and varnished and painted wood floors.

☐ Over 900,000 species of living animals are recognized by zoologists, in addition to many which are now extinct but are known through their fossil remains.





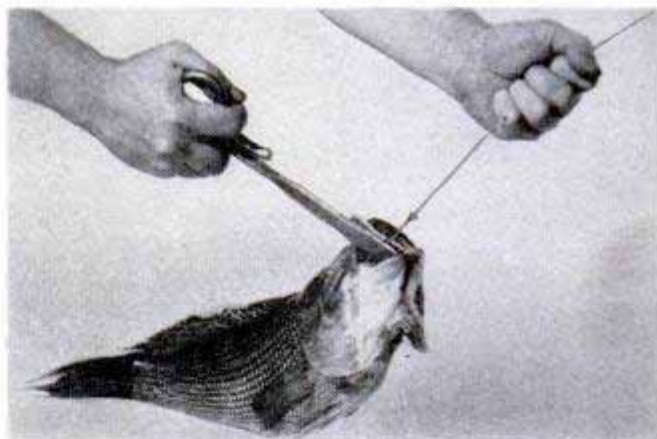
## Solar Furnace From Searchlight

Engineering students at the University of California in Los Angeles are using a surplus Navy searchlight as a simple but effective solar furnace. The chrome reflector at the rear of the light gathers and focuses the sun's rays, producing heat of more than 6000 degrees F. The only change

required was to reverse the carbon-feed mechanism so the material to be heated can be placed at the focal point. The solar furnace is being used to test the melting point and heat resistance of alloys and ceramics that might be of value in jet engines. The searchlight-furnace will be provided with a motor drive to keep it pointed directly at the sun at all times.

## Fishhook Remover

Weighing only nine ounces, a stainless-steel fishhook disgorger takes the danger out of removing tight-set hooks from fish after they have been landed. It is used by simply sliding the eyelet end of the tool down the leader until it goes over the hook shank, then twisting to free the barb. Only 10 inches long, the tool can be carried in any tackle box. It also is useful for releasing plugs and hooks which may have become snagged underwater.



## Human Flies

With only plywood wings to keep them aloft, European flying enthusiasts have introduced a new kind of endurance competition. They drop from a helicopter at altitudes close to 10,000 feet and vie to see who can stay in the air longest. As an added precaution the motorless birdmen wear parachutes.

☐ To equal the wetness of a one-inch rainfall, 27,154 gallons of water would have to be poured on an acre of land.





Engineers use a scale model of Niagara Falls to learn how to make better use of its thundering waters

## NIAGARA'S POWER GOES UNDERGROUND

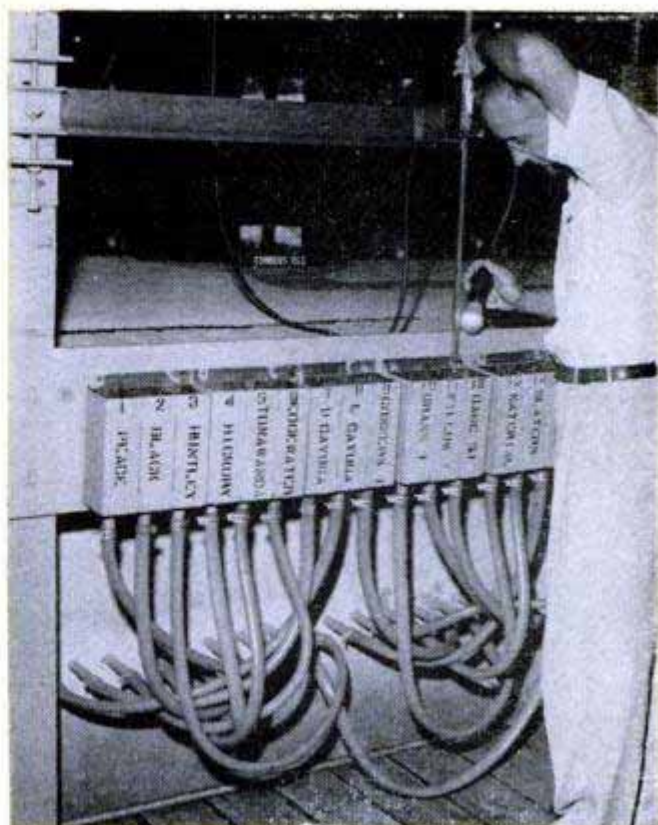
**M**ILLIONS OF TOURISTS visit Niagara Falls each year to see and hear one of the world's most expensive luxuries. The honeymooners' mecca is an expensive luxury because every cubic foot of falling water and every decibel of thundering sound represents wasted power in a power-thirsty area.

To convert more of Niagara's potential into actual power without spoiling the beauty of the Falls, engineers are devising methods of making less water do more work. A United States-Canada treaty signed in 1950 permits increased diversion of water for power during the night when tourists have gone to bed, as well as during the winter when fewer tourists are around and when electricity demands are greater.

In a project now under construction, the Hydroelectric Power Commission of Ontario will divert more upstream water for power, but it will get almost double the power from it. No miracle is involved. The water is piped five miles downstream in a huge tunnel to a point in the gorge where the drop to the river bed is almost double the drop at the Falls. The longer fall means more energy to drive the generators.

Through the five-mile concrete tunnel,

Water levels are shown by these water boxes, which are connected by hoses to various points along the scale model of the 23-mile stretch of Niagara River







Seven holes near top of cliff will be penstock intakes of new power plant. Existing plant is seen at right

the water to supply the 700,000-horsepower generating station will roar unheard beneath the city of Niagara Falls, Ont. Leaving the river above the Falls, the water will drop 250 feet below ground level. From this low point, the tunnel will climb until, in a final sharp rise at the outlet, it comes back to ground level only a few feet below its starting elevation. Pouring from the mouth of the tunnel, 20,000 cubic feet of water per second will flow along a two-mile canal to the brink of the cliff above the power station. Through penstocks, the water will plunge with a fury the remaining 295 feet to the river bed—almost twice the 180-foot drop at the Falls. On its way down, it will spin turbines and generators to produce 525,000 kilowatts of much-needed power. The total project, including tunnel, canal and power plant—all cut from solid rock—will cost \$182,000,000.

If, as is expected, power demands in the future continue to soar, the project will not be unprepared. Its design permits the addition of a second tunnel, five generators and an extra 375,000 kilowatts.

The new treaty between the two nations requires that a minimum of 100,000 cubic feet of water per second flow over the Falls during daylight in the tourist season and not less than 50,000 cubic feet at all other times. U. S. Army engineers are studying ways to get maximum scenic use of this

water in hope of permitting additional diversion later without jeopardizing the beauty of the Falls.

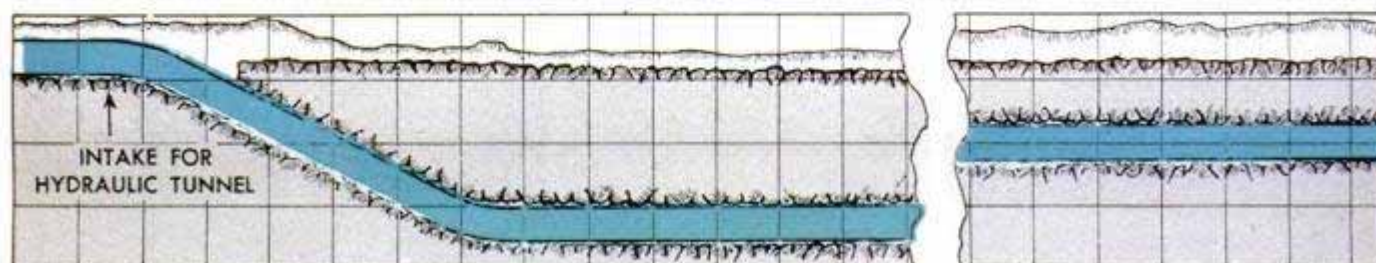
Studies are being conducted at the Waterways Experiment Station near Vicksburg, Miss. There, near the quiet-flowing Mississippi, engineers have built their own Niagara Falls. It is a 7000-square-foot model of the Falls.

Built to a horizontal scale of 1 to 360 and a vertical scale of 1 to 60, the model makes one cubic foot of water do the work of 167,000 cubic feet for the engineers' tests. One minute of flow on the model equals 46 minutes on the river.

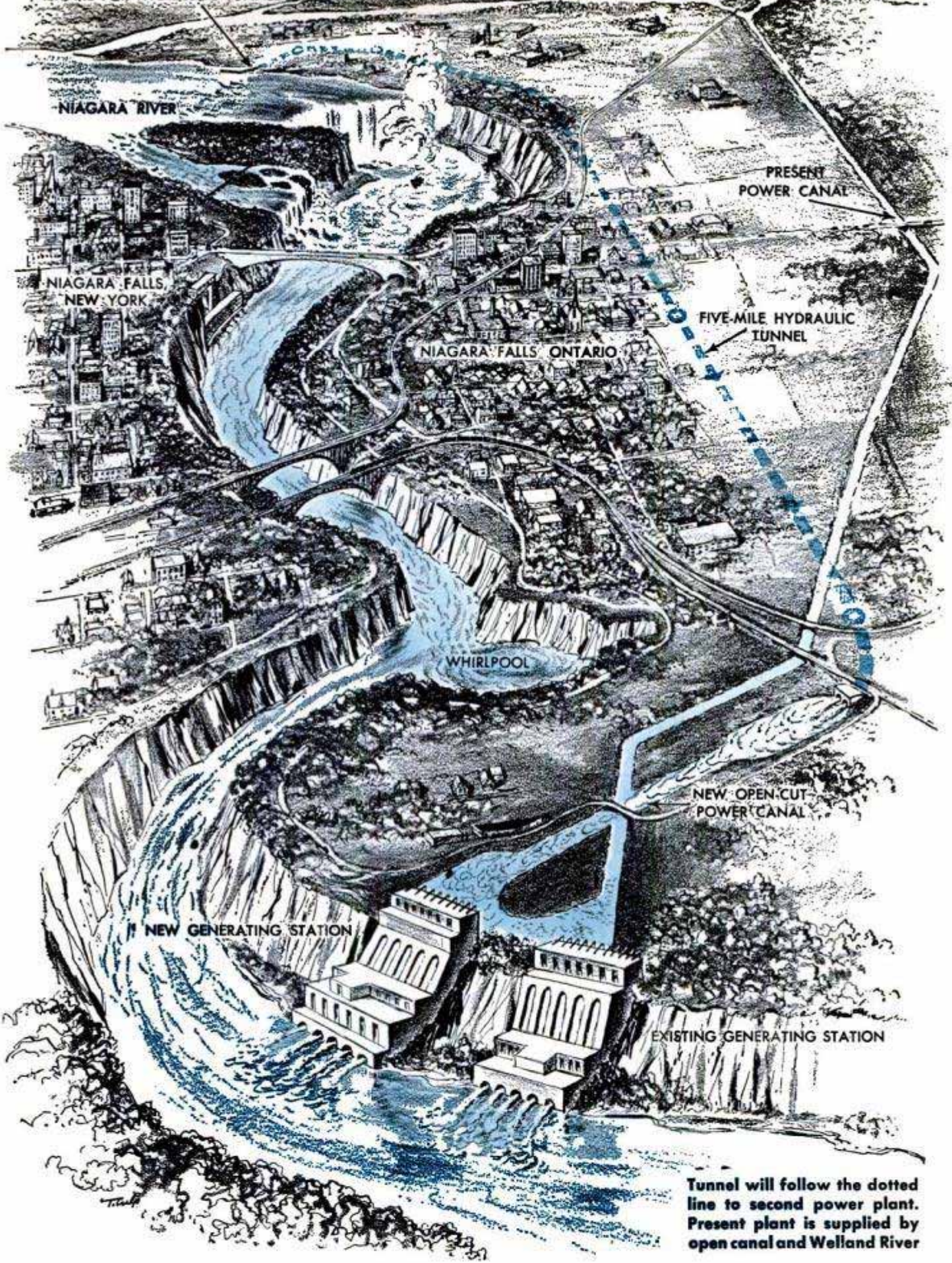
Engineers learn what effect each upstream diversion (like that of the new Canadian tunnel) will have on the appearance of the Falls. They also are studying designs for an upstream weir, or submerged dam, to fan out the water as it approaches the brink, causing it to flow over the edge in wide sheets. This would make maximum scenic use of the flow and, it is hoped, make possible additional diversion for power.

Electricity from the new tunnel system will be available in 1954. The honeymooners of that year won't notice any difference in Niagara Falls, engineers say, but Canadian industry will—the extra 700,000 horsepower will help meet pyramiding demands for power in the highly industrialized areas of southern Ontario.

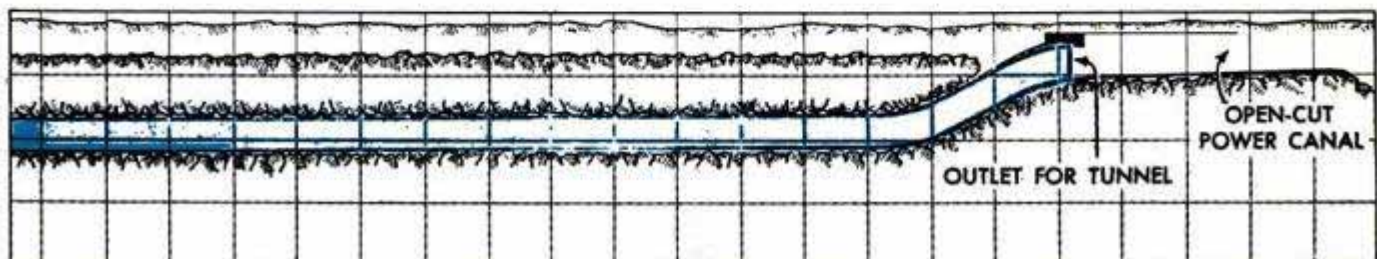
Concrete tunnel, 51 feet in diameter, drops 250 feet at intake end, then climbs to surface at open-cut canal







Tunnel will follow the dotted line to second power plant. Present plant is supplied by open canal and Welland River







## Supermarket Merry-Go-Round

Customers in an Oregon supermarket ride a merry-go-round while waiting for the cashier to check their purchases. Beside each check-out point is a nine-foot circular platform mounted on a revolving pivot.

Each merry-go-round is divided into three "booths." Included in the booths are space for the cart, a counter for the checker and a bench for the customer. The counter has storage shelves for paper sacks, string and other items. The supermarket is located at Eugene, Ore.



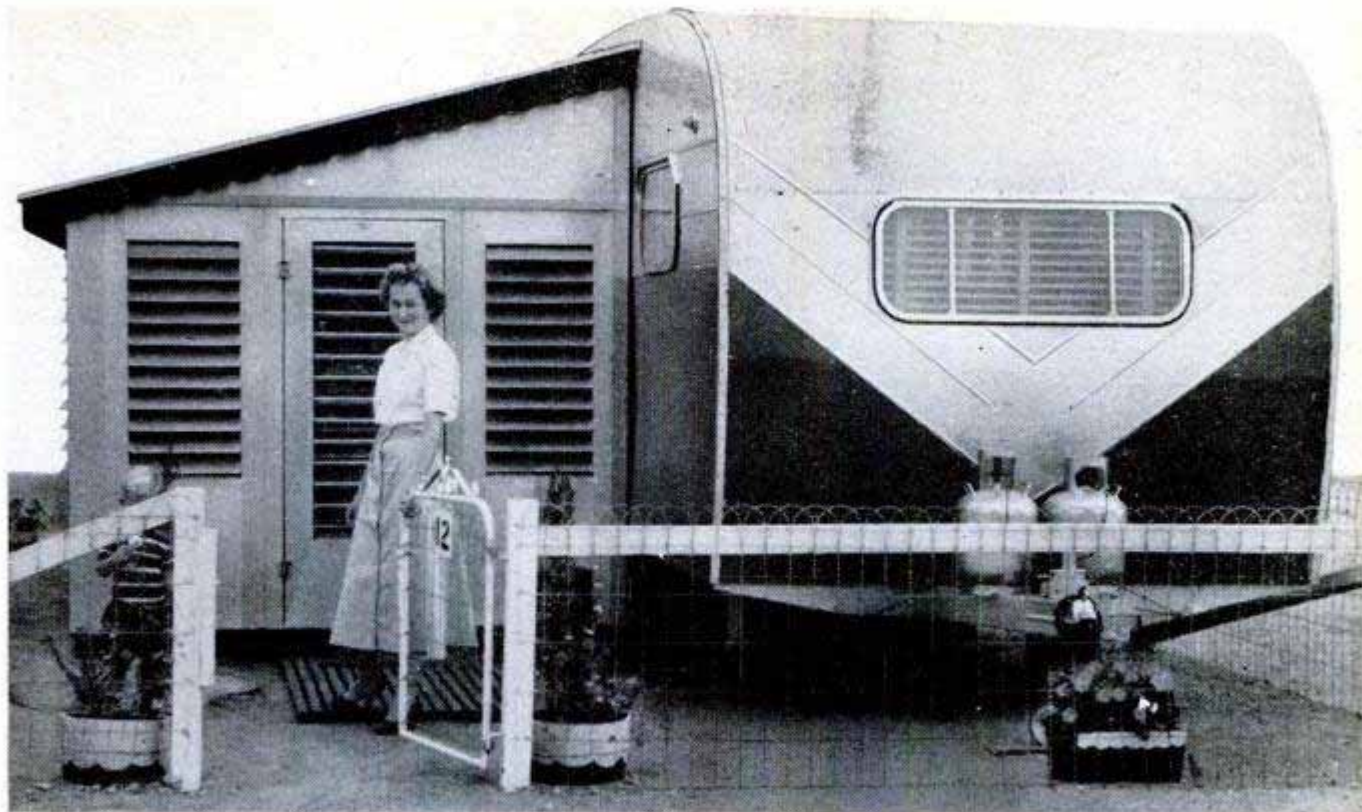
## Fast-Action Shotgun

Three shots can be fired in less than two seconds by a shotgun that features a short lever action. Almost no manual effort is required to operate the lever. Three fingers of the trigger hand fit into the lever, which is an extension of the trigger guard. Merely by spreading the fingers downward, the hunter cocks the gun for the next shot. The throw distance is only one third that of the conventional lever-cocking rifle. This is, incidentally, the first time lever action has been adapted to a shotgun. The gun has a one-piece barrel and chamber for easy take-down.



☐ Total electrical-generating capacity in the United States has been increased 40 percent since the end of World War II and should rise another 50 percent in the next four years.





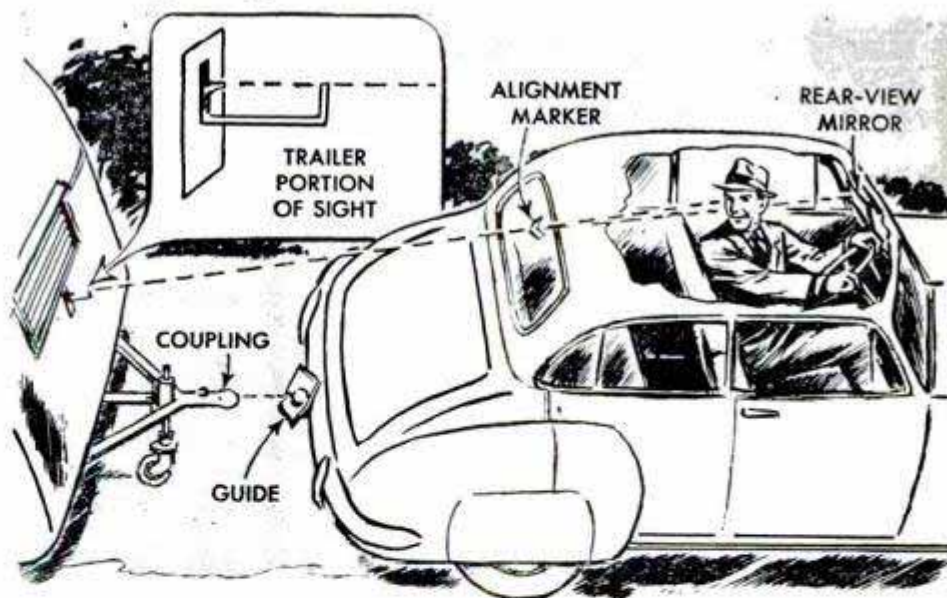
## Trailer "Bustle"

Servicemen and transient workers who dwell in trailers can add any amount of space to their living accommodations with a collapsible room. The room is made of aluminum sections fastened together with

bolts. Any number of sections can be erected to make a room of the desired size. When the trailer owner moves, the sections are simply dismantled and slipped inside the trailer, or may be shipped to the new site in special cartons. The "bustle" can be insulated in areas of extreme cold.

## Trailer-Hitch Guide Offers Easy Alignment

Designed for 12 to 60-foot trailers equipped with front dolly wheels, a combination hitch guide and alignment sight permits even inexperienced drivers to back into a trailer hitch with little effort. While backing, the driver steers by looking into the rear-view mirror or over his right shoulder to align sights located on the car's back window and front of the trailer. Although the car may be as much as three or four inches to one side of the trailer tongue, smooth inner surfaces of the V-shaped guide slide the cup section of the hitch directly over the ball. A dual-purpose

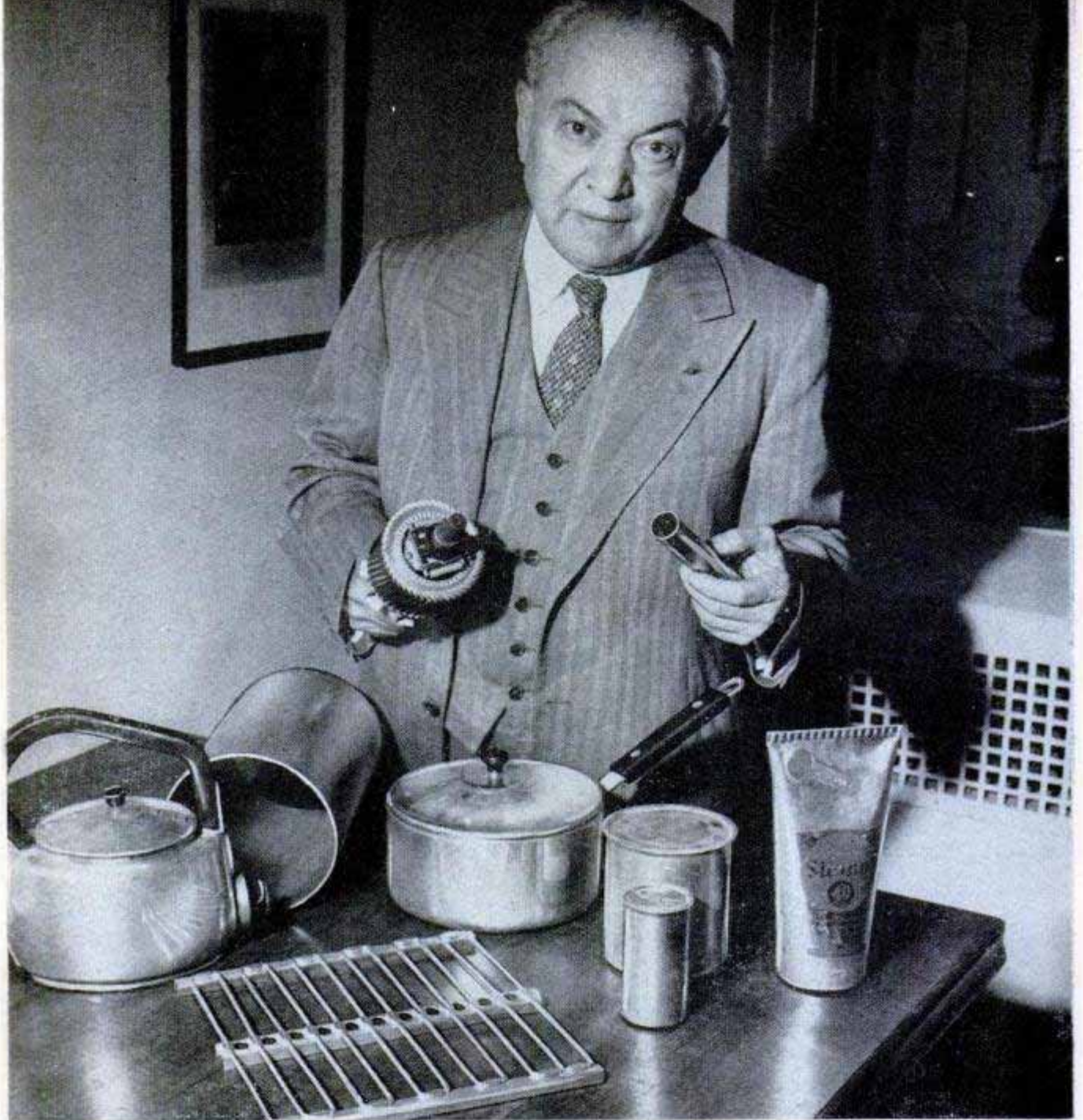


accessory, the guide also forms a durable bumper guard as it is reversed simply by loosening two wing nuts.

If you do not find the information you need in the index on pages 12, 14 and 16, sources of further information are available without charge from *Popular Mechanics*. Write to the Bureau of Information, 200 East Ontario Street, Chicago 11, Illinois

Although the rate is slow, the Hawaiian Islands are sinking into the Pacific and probably will be completely submerged in about 60 million years, say Navy scientists, after their oceanographic survey of the mid-Pacific.





Dubilier, codeveloper of process, exhibits pans, trays, tubes and cans made simply by squeezing seams together

***A Royal Air Force pilot stumbled quite by chance on a cold-welding method that is too simple to believe. He's***

## **PUTTING THE SQUEEZE ON METALS**

**By Clifford B. Hicks**

**I**N A PINT-SIZED office high above the streets of Manhattan, a rotund little man is performing miracles in metal. With the flick of a hammer he's welding — actually welding — handles and knobs on kitchen utensils, splicing heavy wire with the mere squeeze of a hand tool. He can, with the turn of a hand crank, convert long strips of aluminum into seamless tubing, then join two pieces of tubing end to end merely by pressing them together. And here's the

real miracle: You can't break any of these astonishingly simple welds—the metal itself tears before the joints give way.

William Dubilier's story is the tale of a freakish fact of science, a phenomenon so simple it's difficult to believe. Like the lost umbrella, this fact has been lying in plain sight, unnoticed, its existence crying for recognition while science has stumbled all over it. Millions of metalworkers have kicked it about without bothering to pick



it up, even though they may have seen it.

Despite its simplicity, this scientific fact may be of extreme value. For centuries, metallurgists have sought an easy way to join metals, especially nonferrous metals.

At last it's been discovered.

Here's the plain fact. The easiest way to weld two pieces of nonferrous metal is merely to squeeze them together. You need no intense heat, no flux. The process requires little pressure—a tool resembling a pair of pliers will make most welds. Yet the bond is stronger than the metal itself. Moreover, two different kinds of metal can be joined—for example, a squeeze of a hand tool will weld copper to aluminum, aluminum to nickel.

Even a trade-school freshman can see how this discovery may affect the manufacture of countless items from pots and pans to superbombers. Cold-welding, as the process is called, may bring about a radical change in the electrician's trade; already under development is a simple hand tool that will enable the electrician or even the housewife to make virtually any kind of a splice in electrical wire with a mere squeeze of the fingers. Cold-welding can convert a flat aluminum strip into a sealed tube, turn out cans without benefit of rivets, solder or anything else. Moreover, it can make such "impossible" welds as aluminum to zinc, or aluminum to lead.

Who discovered the cold weld? Back in 1939, a Royal Air Force pilot named Anthony B. Sowter, his flying career cut short by crash injuries, went to work in the laboratories of General Electric Company, Ltd.

**With a light squeeze, hand tool splices wires by actually welding them, and joins wires to terminal lugs**



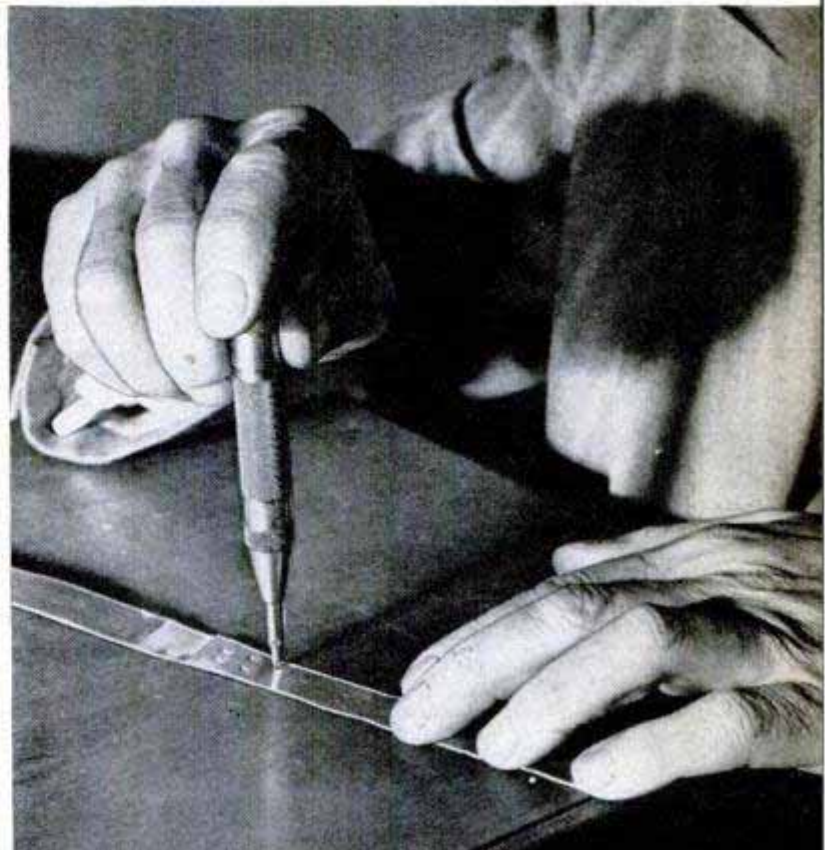
(no kin of G.E. in the United States). Sowter, in his research, frequently had to do a small amount of metalwork. One day he became aware of a strange phenomenon—whenever he accidentally used a pair of dull snips to cut overlapping sheets of copper, the sheets would stick together. Sharp shears made a clean cut and the pieces fell apart, but not the dull shears. And when the sheets stuck together, they were joined so permanently that the sheets themselves would tear before the joint gave way.

Sowter had little opportunity to investigate this curiosity until the end of the war when, with approval of G.E.C., Ltd., he started experimenting. To his surprise he discovered that a rap with a hammer against a hand punch would cold-weld aluminum as well as copper. Since then, he has found that virtually all nonferrous metals can be cold-welded, though some are more difficult to weld than others, and some of the harder magnesium and aluminum alloys can't be cold-welded unless the metal is first annealed.

Though cold-welding is as easy as squeezing or striking two pieces of metal, Sowter soon learned he couldn't make a weld with ordinary pliers or a hammer. The pressure had to be applied in a narrow area, so he needed a pair of pliers with special jaws, or a punch to use with the hammer.

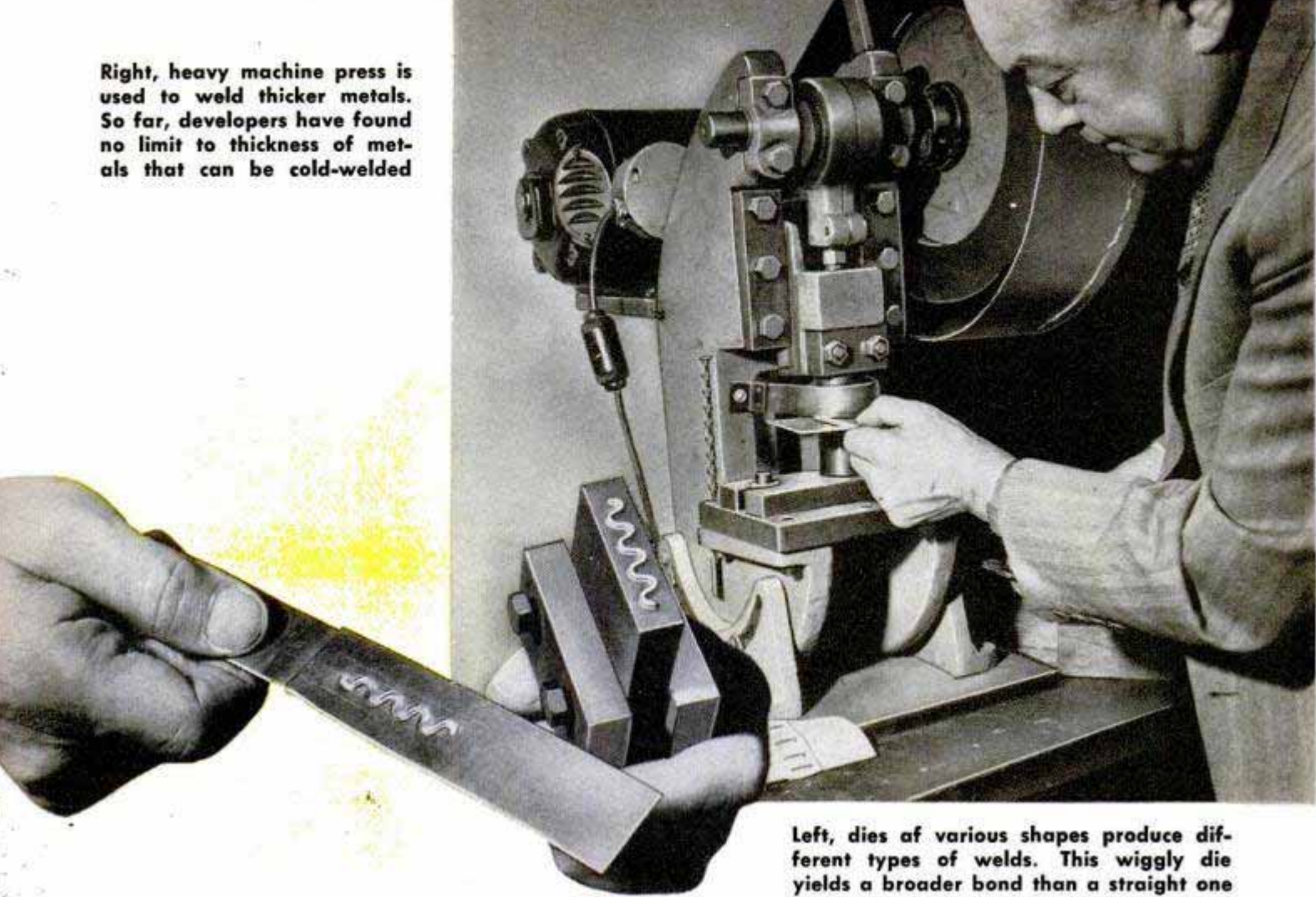
In 1949 G.E.C., Ltd., asked William Dubilier, an American, to take a look at cold-welding. Dubilier is a prolific inventor in the old tradition, a man who helped Marconi experiment with wireless telegraphy and has invented such oddly diverse

**Simplest weld is made in light aluminum by spring-actuated punch. Metal tears before weld pulls apart**





Right, heavy machine press is used to weld thicker metals. So far, developers have found no limit to thickness of metals that can be cold-welded

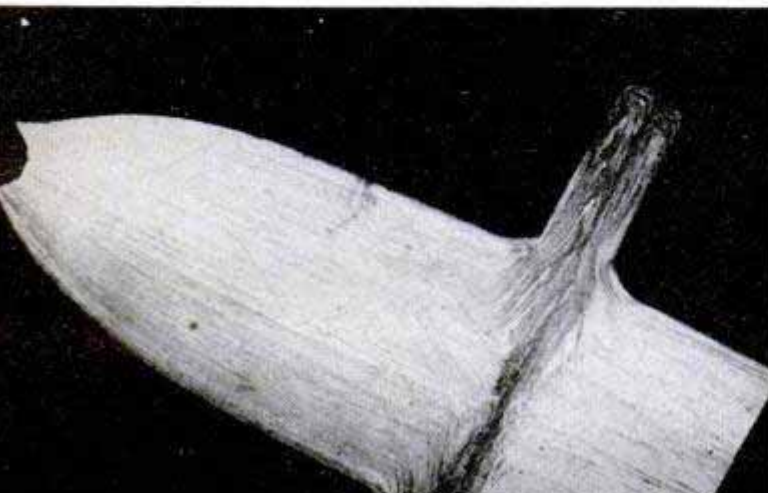


Left, dies of various shapes produce different types of welds. This wiggly die yields a broader bond than a straight one

items as the mica capacitor (essential to modern radio), the portable X-ray machine and a flexible track for miniature trains. He immediately saw the potentialities of cold-welding and eventually formed the Koldweld Corporation in this country for marketing the development.

Koldweld sells patent rights in the United States, but Dubilier is convinced that his job is to make the process available to virtually every manufacturer who can use it, no matter how small he may be—"to set the license rights so low it would be cheaper to buy than to steal them." Therefore, the Koldweld Corporation is basically a consulting agency; manufacturers bring their

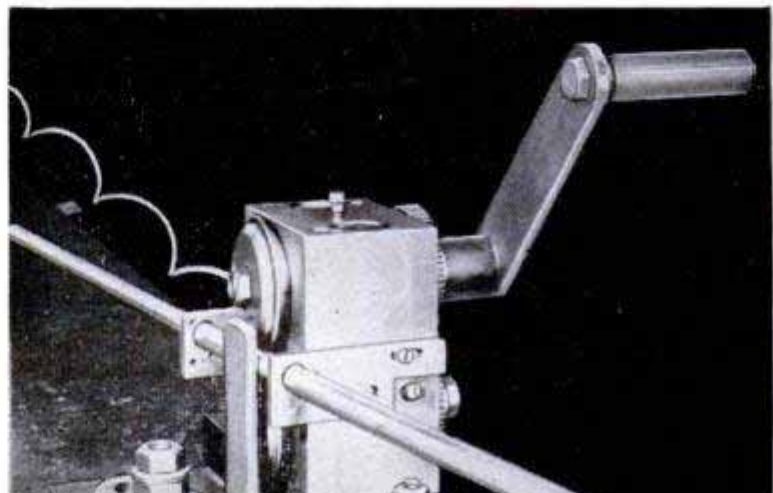
Photomicrograph of rods welded end to end shows how metal flows under pressure to yield a true weld



metal-welding problems to Dubilier who, for a fee, provides the detailed information on the shape of the stamping die and the exact amount of pressure required to make the strongest weld. Though anyone can make an elementary cold weld, exact information based on experimentation is required to make the strongest possible weld. The corporation sells this information.

Still, the fantastic thing about a cold weld is its simplicity. Dubilier demonstrates it by overlapping the ends of a couple of thin pieces of aluminum, then pressing down on them with a small, spring-actuated prick punch. After three or four pings of the punch, he'll ask his visitor to tear the two

Hand-cranked machine with a wheel die makes a continuous weld in preformed tubing, then trims seam





pieces apart. The visitor does it easily enough because the metal is so thin, but he immediately notices that he's torn the metal around the weld, *and the weld itself is still intact*. Dubilier goes on to demonstrate with heavy presses that so far they've found no limit to the thickness of metal that can be cold-welded.

The only preparation necessary for a weld is to remove any oxidation from the two surfaces to be joined. This is done simply by scratching it off with a wire brush. Because the surfaces immediately begin to oxidize again, cold-welding is done as soon as possible after they have been scratched, though parts can be cold-welded as long as 24 hours afterward.

Apparently the rate at which the pressure is applied has little to do with the resulting weld. You can make identical welds by slowly squeezing two pieces of metal together with a hand tool, or by stamping them with a sharp rap of a hammer against a punch.

Metallurgists have been surprised to discover that a cold-weld is a true weld in every sense of the word. Two welded pieces actually "flow" into one, a fact revealed by photomicrographs of the weld's cross section. Even Sowter and Dubilier can't explain the "why" of the odd process. Some experimenters suspect even though pressures are relatively low, the heat generated by the pressure melts the metal, causing the molecules from the two surfaces to mingle. But this is only a theory.

The main thing is that cold-welding works. There have been a good many improvements in the process since Sowter went to work with his hammer and hand stamp. Early in his experiments he evolved four basic die shapes to make various types of welds. The simplest was a small rectangle for spot welds. Next came a long narrow die for seams, a circular die for sealing cans and joining pipes and a wheel die for continuous-seam welding.

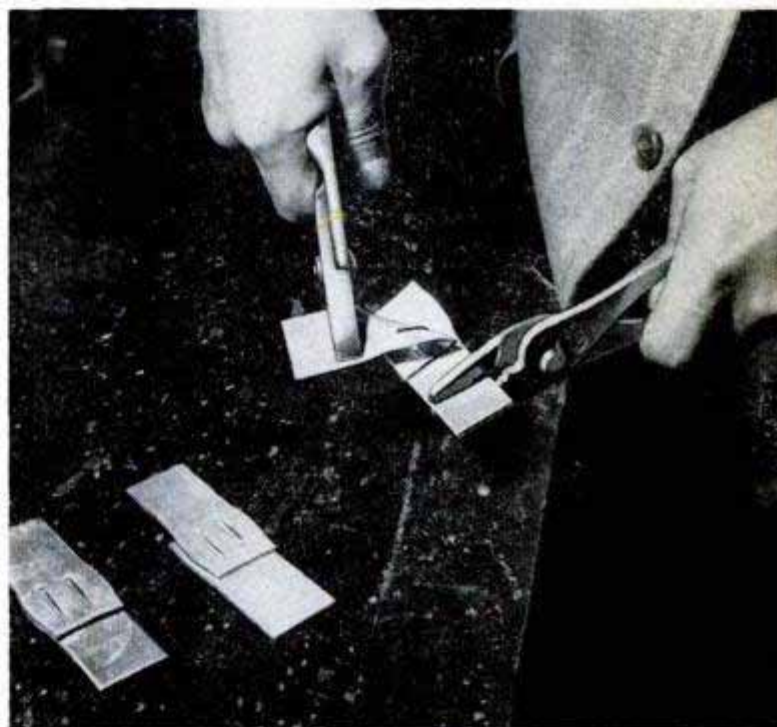
To these early welds there was one big objection. The die, when it punched down into the metal, left a definite depression. This was undesirable not only from the standpoint of appearance, but because it made the metal thinner around the rim of the depression, thus weaker and more likely to tear. Sowter and Dubilier worked together to overcome this problem and eventually came up with two new techniques—the sandwich weld and the projection weld.

In the sandwich weld, a third piece of metal, a cylindrical one, is inserted between the two pieces to be joined. The third piece becomes a substitute for the die. All that's required is enough pressure to flatten the

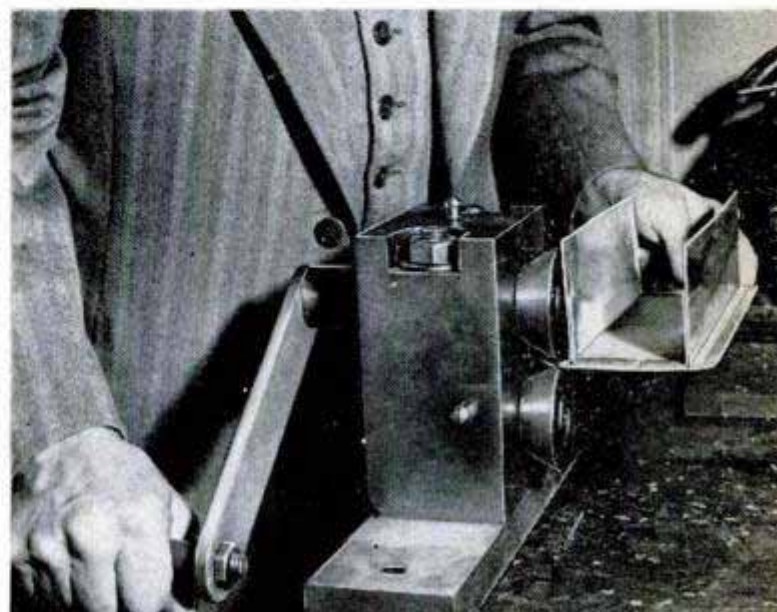
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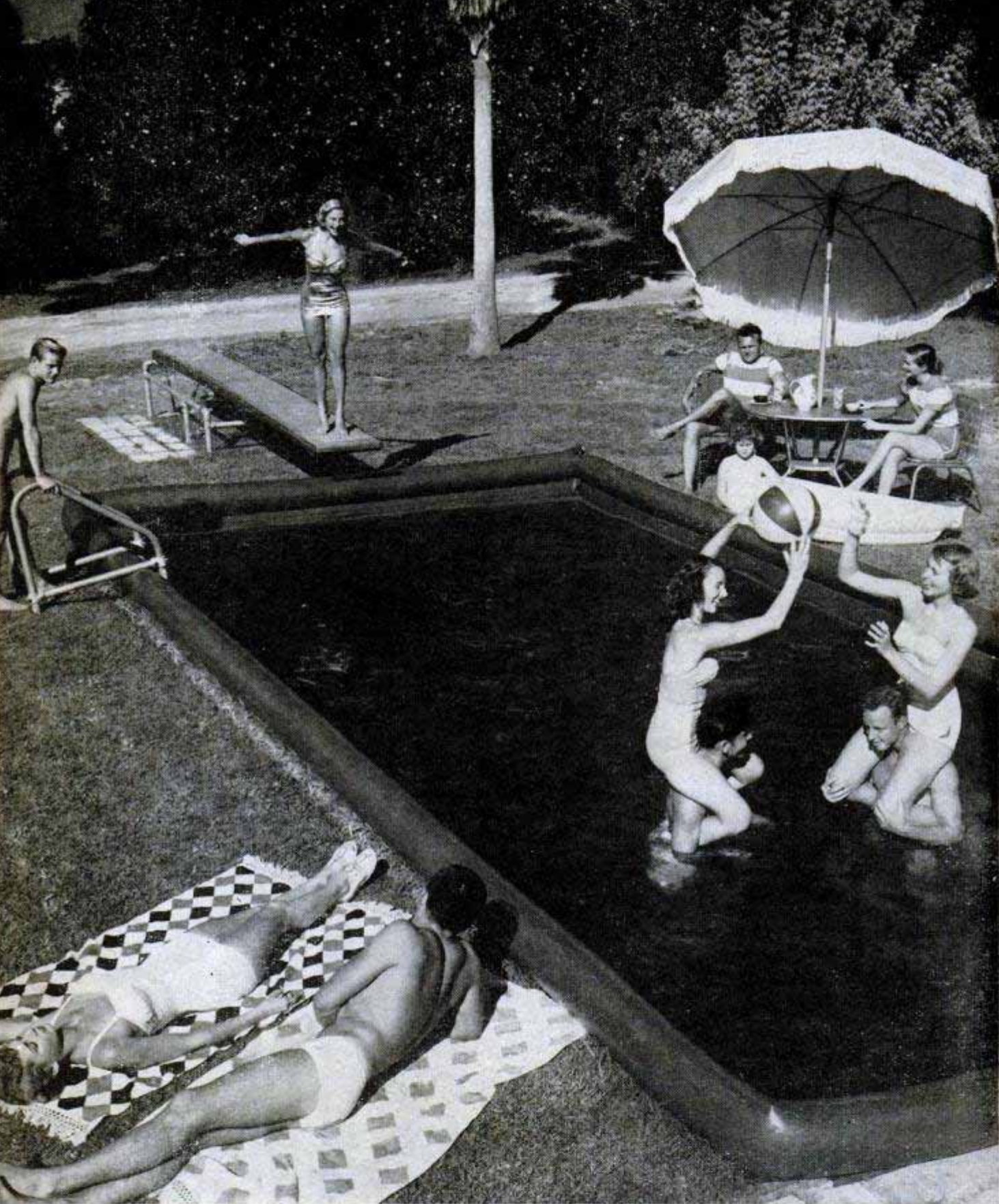
Dies are interchangeable in hand tools, too. These permit metalworker to make various on-the-spot welds



In simplest welds, metal can be twisted apart with pliers, but note that it's the metal around the weld that tears. Weld itself is still intact. Below, a roller press with die wheels makes continuous welds







## PLASTIC POOL

ADULTS can swim and dive in a big plastic pool similar to the smaller wading pools made for children. The standard pool, measuring 27 feet long and 13 feet wide, is made of heavy Vinylite sheeting. It fits tightly into an excavation graduated in depth from three to five feet below ground level. In sandy or loamy soils, the manufacturer recommends that the excavation be lined

with roofing boards, sheathing or plywood. The pool is anchored in the depression with two by four corner posts. It can be emptied with a built-in drain and pipe outlet, or with a sump pump. Accessories include an inflatable bumper to prevent water from splashing beyond the pool area and a plastic pool cover. The cover is intended to keep pets, leaves and debris out of the pool when it is not in use, but it also prevents children from falling into or entering the unguarded pool.

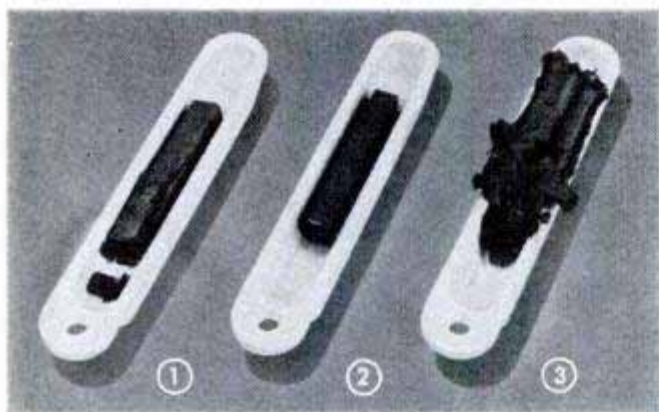


## Sports Car

Parts from a good many conventional autos have been combined in a low-slung sports car built by Bill Houk of Wichita, Kans. It took Houk two years of spare-time work to build the vehicle, which has a top speed of 110 miles per hour and covers  $\frac{1}{4}$  mile, from a standing start, in 17 seconds. The car has a Chevrolet gas tank, a Mercury motor, wire wheels from a 1935 Ford, a Lincoln transmission, a surplus aircraft-instrument panel and a body Houk made from sheet metal. Houk reports that his creation gets about 26 miles to a gallon of



gas at speeds of 60 to 70 miles per hour. He attributes the good mileage to the car's light weight.



Though all were originally identical in shape and size, after exposure in air at 1850 degrees for 24 hours only the chrome-carbide sample, 2, remains unchanged. Sample 1, used in oxidation-resistance test, is 18-8 stainless and 3 is tungsten carbide

## Cobalt-Free Carbide Tougher Than Tungsten

Made without cobalt and virtually no tungsten—both strategic materials—a tough chrome carbide near production is lighter than tungsten carbide (the nearest comparable metal) and has much greater resistance to abrasion, corrosion and erosion. It is also nonmagnetic and resists oxidation or burning at temperatures above 1800 degrees F., where steel and other carbides are distorted or consumed. Fifteen percent nickel and 85 percent chrome and carbon by weight, the new metal is expected to have special advantages for the petroleum, food, dairy, chemical, aviation, marine, ceramics and electrical industries.

## Seaplane Dolly

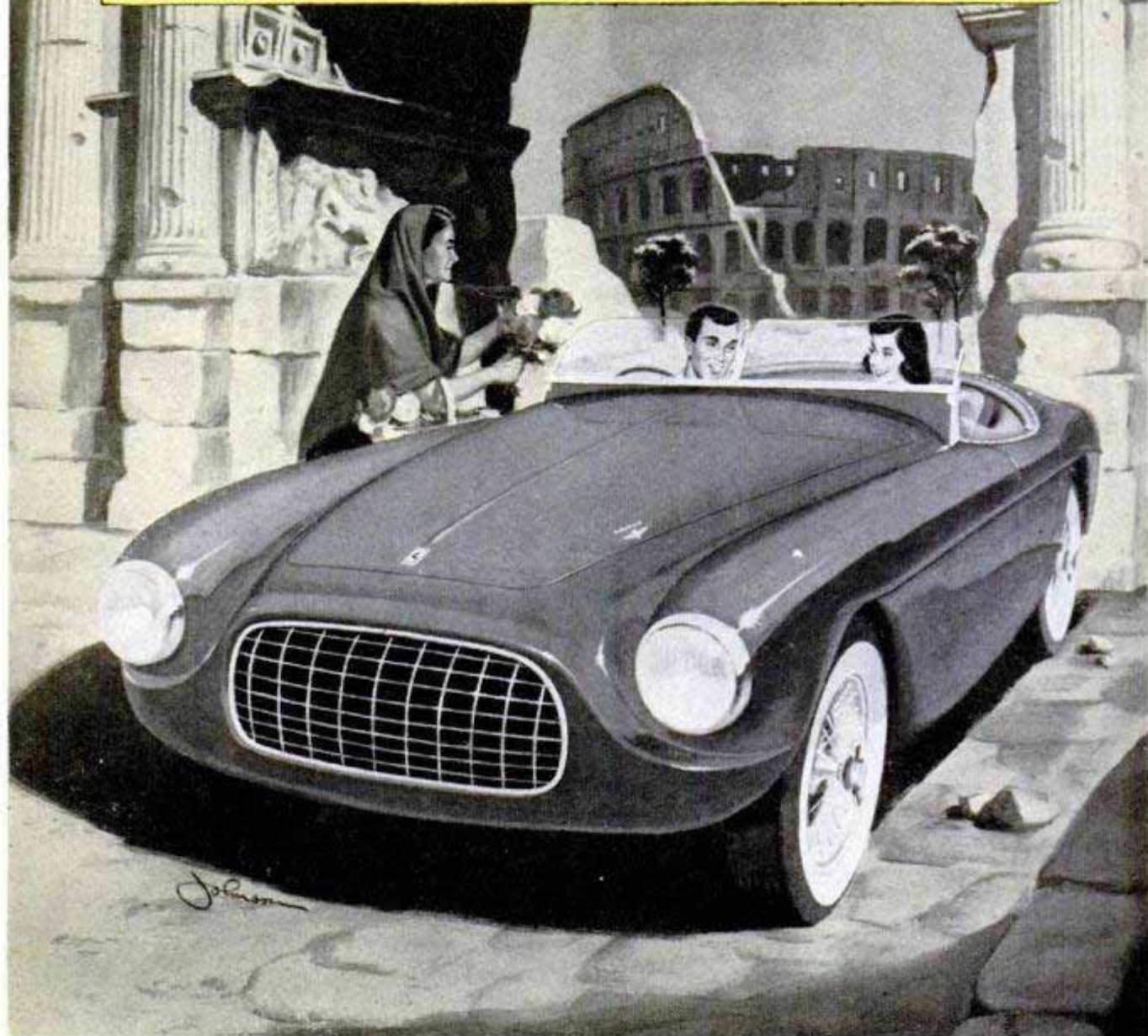
One man can dock a seaplane using the dolly Art Schoepflin designed and built to handle his Luscombe in Brooklyn, N. Y. The dolly is placed under the float crossbars after the pilot has taxied a few feet up out of the water and the plane is jacked up on it. A handle on the dolly is slung and tied between the floats in a straight-ahead position. The pilot then returns to the cockpit, starts the engine and taxis the craft up on the ramp. The handle is untied and used to pull and guide the dolly in the final positioning. Built of welded channel iron and weighing approxi-



mately 300 pounds, the dolly has four 12-inch rubber-tired wheels. Its lifting bars are tipped with rubber.



# Report on the Foreign Cars



The Italian Ferrari (also featured on cover) is one of Europe's smartest sports cars, costs \$12,000 and up

*By Floyd Clymer*

## *Part II*

**A**FTER VISITING the Volkswagen plant, I went to the Daimler-Benz plant at Unterturkheim, near Stuttgart, where the Mercedes-Benz, Germany's finest car—also one of the world's finest—is built. More than 32,000 employees work at four plants, building more cars per month than ever before in their history. Average monthly production is 4000 passenger cars, 1200

trucks, 150 busses and (built in Berlin) 100 to 200 stationary gas engines.

Mercedes-Benz exports 10 to 40 percent of its production. Best export market is Sweden, followed by Switzerland, Belgium, Holland, Argentina and Brazil. Some diesel models go to Australia. Comprising 50 percent of production is the factory's smallest four-cylinder model 170V, which sells for about 7800 deutsche marks (\$1950). The new 300 O.H. camshaft model is outstand-



ing, one of the fine cars of the world, selling about 18,500 marks (\$4625) for the sedan. I drove this car a few miles. It is an excellent car in every respect and its roadability is outstanding. A device operated from the driver's seat adjusts the shock-absorber springing for a soft or hard ride, depending on the road.

The popular 300 sports convertible is a fast and sporty car. Thirty percent of the production is devoted to the diesel passenger car, and this jumps to 40 percent when war rumors are heard. The diesel job is seven percent slower than the small gas-powered car (same chassis). A governor holds the diesel's speed to 67 miles per hour. The diesel is a practical car for economy-minded Europeans, but it is noisy, especially when cold. Mercedes-Benz' sales rank first in Germany in value, third in unit production. The factory, almost totally destroyed in the war, was completely rebuilt with new machinery.

In Stuttgart, I next visited the Porsche



Clymer (center) inspects a Maserati sports car built in Modena, Italy. The company also builds a few racing cars—two of which have won the Indianapolis 500-mile race. Below, German Ford, called Ford Taunus, is four-cylinder car with 38-horsepower engine; runs 30 miles on gallon of gas



American-style proving ground at Opel plant (General Motors) in Germany gives new cars a rugged testing







At the Paris Auto Show, Clymer was intrigued with a Jeeplike all-purpose car made by Fiat, Italian builder

factory. The son of Dr. Ferdinand Porsche, who first designed the Volkswagen, carries on in a small way, producing nothing but sports cars. Actually, it is a specialized factory; the chassis and bodies are constructed about 90 percent by hand and not on line production. Body and chassis are all one unit (similar to our own Nash construction). Approximately 150 employees build 100 cars a month. These sell quickly to sports-car fans in almost every country.

The engine is a Volkswagen rebuilt for high performance by use of two carburetors, high-compression heads of special design and aluminum-alloy chrome-plated cylinders. The engine is air-cooled and a small radiator cools the oil.

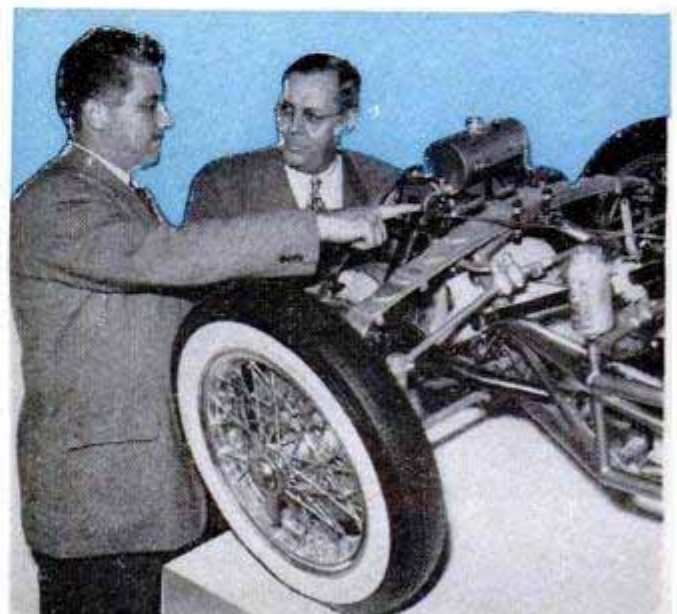
Price for a fully equipped coupe is 10,500 marks (\$2625). The convertible sells for 12,500 marks (\$3125). One gas-tank filling is good for 440 miles. Each engine is run for four hours to break it in. Three models are produced—the 1100 c.c., the 1300 c.c. and the 1500 c.c. The largest engine model will do an honest 100 miles per hour, quite fast for a 91-cubic-inch engine (about half the size of a Willys, Henry J or Nash Rambler).

Next I went to Opel, the German General Motors' plant, at Russelsheim, near Frankfurt. Modern in every respect, this plant builds two models, the six-cylinder Kapitän at 9600 marks (\$2400) and the four-cylinder Olympia at 6400 marks (\$1600). It also produces a sliding-roof model at 6600 marks (\$1650) and a delivery van at 6200 marks (\$1550). Under direction of an American manager, 20,000 employees

(including 630 women) build an average of 197 Olympias, 95 Kapitans and twenty-six 1½-ton trucks a day. Refrigerators are also built in the same plant. Employees work 40 hours a week and average about 48 cents an hour. There are two shifts, 5:45 a.m. to 2:15 p.m. and 2:15 p.m. to 10:45 p.m., with a 30-minute rest period in each (not on company time). Eight men assemble a car while conveyors deliver units as needed to given points.

Coal and steel shortages are slowing production. Ninety percent of the machinery is German, the rest is from Switzerland and the U.S.A. The plant was 47 percent destroyed by bombing, but was reconstructed

Italian Nardi engineer explains to Floyd Clymer the unique front suspension of the two-cylinder sports car





in 4½ years. There is a winding two-mile chain assembly line where parts receive 700 different inspections. Opel claims no break-in period is necessary and that its cars can be driven at top speed immediately, something I was glad to hear as I have contended in recent years that the break-in period for most modern cars is unnecessary.

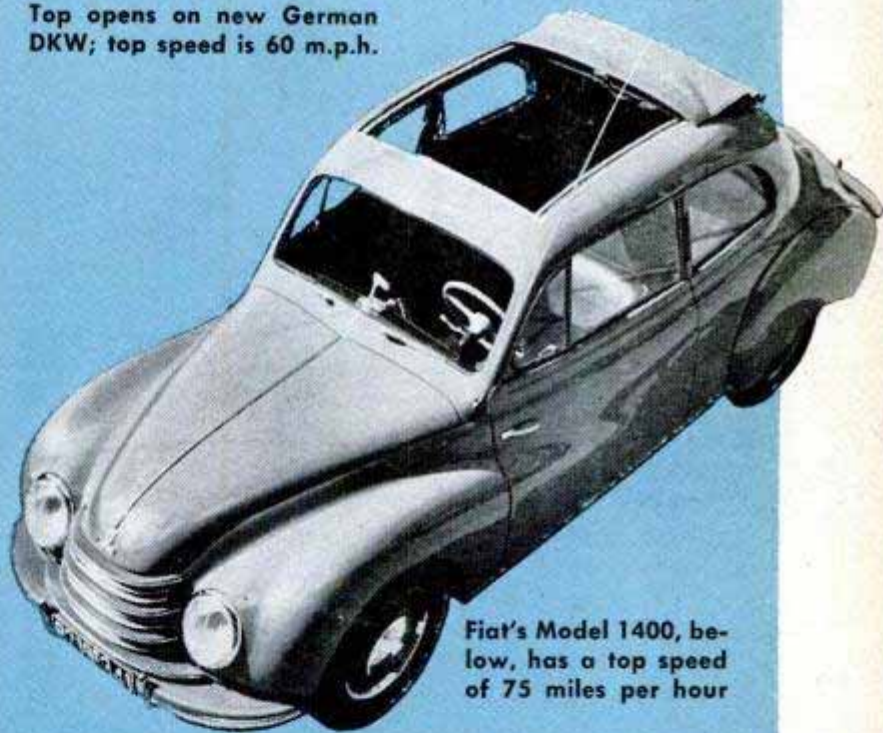
Opel has a very fine proving ground and converted a wartime bomb shelter into a warehouse. During the war the factory built airplane engines and parts under orders from the Nazi regime. It has its own port on the river Main, as well as its own railroad station and hospital. Fifty percent of the production is exported. Belgium is the best export market, followed by Holland, Switzerland, Denmark, Sweden and South Africa.

Next, to Italy and the Alfa-Romeo factory, builder of Italy's finest production car. In Milan, 6000 employees build 25 cars daily, as well as 90 busses and trucks each month; also some chassis to be used on trolley cars. Three unions operate in Alfa-Romeo. One large new building now is being built. An Alfa, driven by Juan Fangio of Argentina, had just won the Grand Prix race at Barcelona, Spain, and as a result the employees were celebrating by going home at 3 p.m. the day I was there. Quality cars long have been built by Alfa-Romeo though the method of



Three-wheel German motorcycle-auto has plastic top

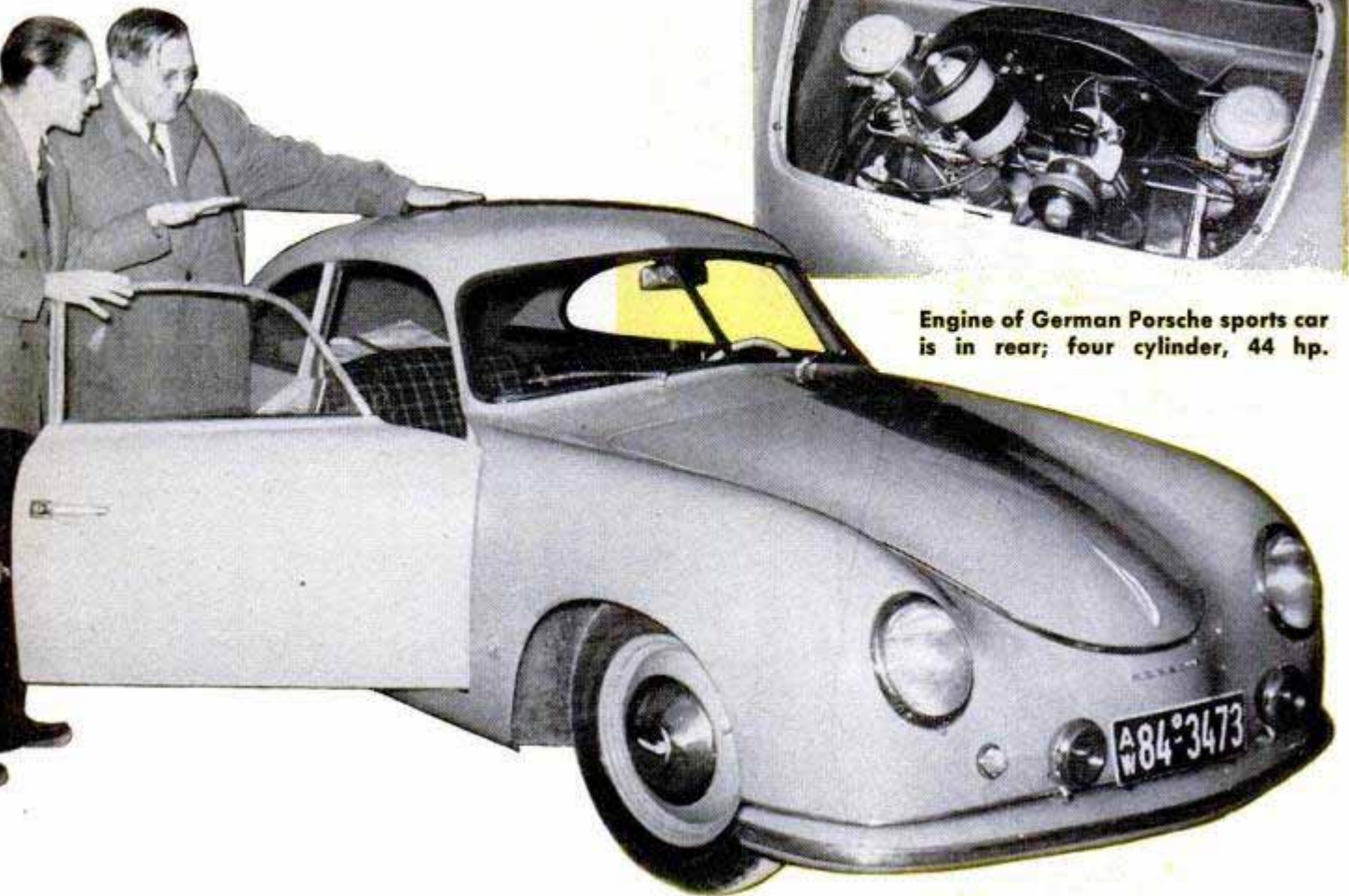
Top opens on new German DKW; top speed is 60 m.p.h.



Fiat's Model 1400, below, has a top speed of 75 miles per hour







Engine of German Porsche sports car is in rear; four cylinder, 44 hp.

Above, Porsche sports car is extremely low and is built almost entirely by hand in Stuttgart factory — \$2625

assembly was not as modern as in some other factories I visited.

From Milan I drove to Modena in a Fiat 1400 with Piero Taruffi, famed Italian engineer and race-car driver (he won first place in the Mexican Road Race last November, driving a Ferrari at an average speed of 87 miles per hour for 1933 miles).

At Marenello, near Modena, we visited the Ferrari factory. This small, compact plant is a precision factory headed by former Alfa-Romeo engineer and race-driver Enzo Ferrari. Here 270 neatly uniformed employees build only 10 racing and 150 sports cars per year at prices of \$12,000 each and up, depending on model, type and equipment.

From the Ferrari office we went to the Maserati factory, also in Modena. Here is the home of famed Maserati race cars (twice

(Continued to page 260)



Above, Russian Moskvitch four-door sedan was tested by Clymer in Vienna—a copy of G.M. Opel of prewar vintage

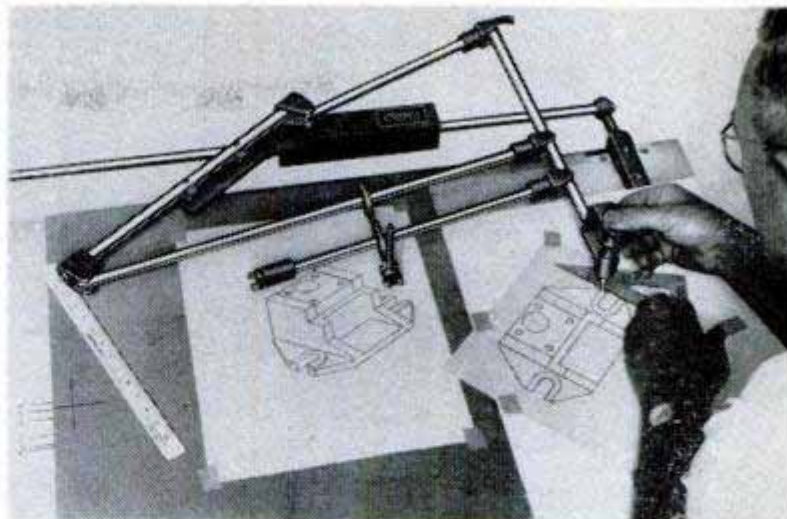
Clymer calls the Alfa-Romeo Italy's finest production car; has high-compression engine of 105 hp.





## Instrument Changes Flat Drawings to Angular Views

With a new instrument attached to his drawing board, the draftsman can quickly convert a flat, or orthographic, drawing into a three-dimensional, or isometric view. The instrument is simple to use; when the draftsman traces the lines of standard flat drawings, a pencil or pen draws the isometric view on another sheet of paper. He moves the original drawing occasionally to various positions corresponding to the height of parts of the drawing. The resulting view will be at the correct angle and with perfect ellipses. It will be drawn to the same scale as the original flat rendition. Through simple adjustments, the instrument also will draw dimetric views, similar to isometric draw-



ings except that the angle of sight is slightly different. Special linkage holds objectionable friction to a minimum.

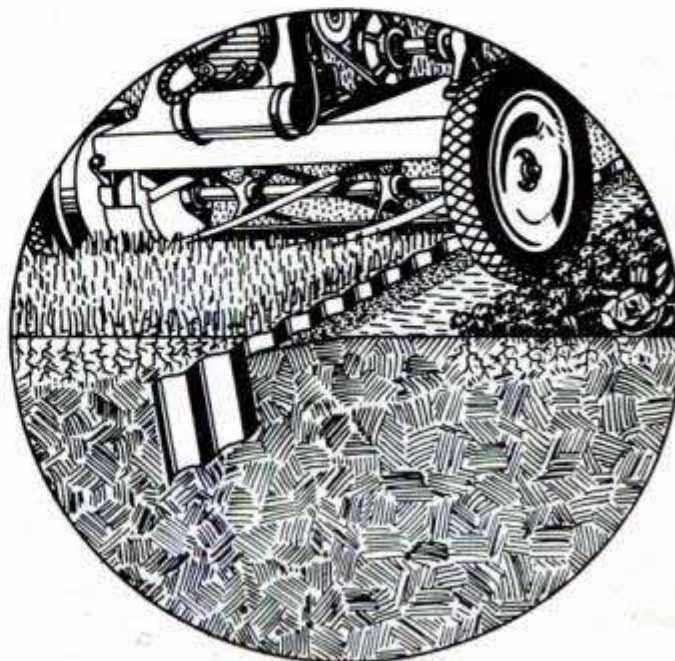


## Folding Flash Gun Fits in Pocket

Small enough when folded to be carried conveniently in a coat pocket, a lightweight flash gun of Italian manufacture is now available in this country. Battery case and reflector are hinged together so the case swings into the hollow of the reflector. The mounting bracket also folds up compactly. The whole unit weighs only seven ounces including battery. The reflector can be turned in any direction. The connecting cable fits most imported cameras, and an adapter is available for domestic models.

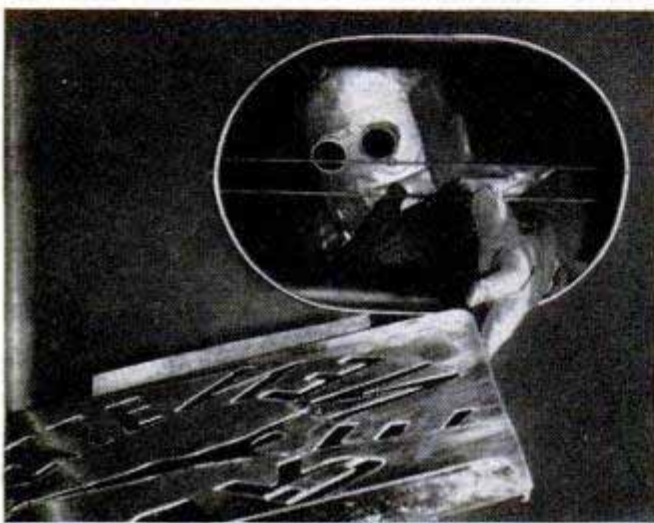
## Steel Strips Offer Neat Lawn Edges Without Trimming

Installed flush with the top of the soil, corrugated, galvanized-steel strips make it possible to have clean edges on your lawn and flower beds, around trees and along fences without trimming. The four-inch strip is set by marking a line with a spade, placing the metal on edge and tapping it down to the soil line. Special steel fasteners lock the pieces together to form a continuous strip. By keeping one wheel of the mower on the edge of a mulched area and the other on the grass, you trim the edge while you mow. The metal is easily bent to form graceful curves around flower beds, but will not buckle when stepped on. The edging comes in 26-inch lengths.



☐ In 1951 the U. S. set a new power-generating record, and now averages over a billion kilowatt-hours per day.





Fantastic weapon of the future? Actually it's a superspotlight, a 2½-ton projector, 36 feet long

Attendant wears metal suit and heavy asbestos gloves for protection from heat when he changes the slides

Powerful light passes through advertising slide to a mirror, which casts resulting image on night clouds

## "Cannon Light" Paints Ads in Sky

Mysterious advertisements are appearing nightly in the sky over northern Germany. They are beamed against cloud formations by a superspotlight, a cannonlike projector which weighs 2½ tons. The spotlight is 36 feet long and has an electric arc of 4,500,000 candlepower. Advertising slides are placed in the beam, and a mirror casts the message upward. At an altitude of 3300 feet the advertisement covers an area of 225,000 square feet and can be seen eight miles away. The attendant who changes the slides must be dressed in a protective suit and wear thick asbestos gloves, so intense is the heat. A heavy generator supplies 100-volt, 300-ampere current.

## "Superadrenalin" for Fighting Shock

Twice as powerful as adrenalin, a new blood chemical called serotonin has been produced synthetically and may prove of great value in fighting shock. The chemical restricts small blood vessels and therefore is believed to have the effect of raising the blood pressure. Developed by the Upjohn Company, it has been tested on laboratory animals and shows a marked ability to reduce blood loss from wounds. It may be useful in treating the bleeding disease, hemophilia, and in some kinds of surgery, such as brain operations where it is essential to prevent the bleeding of tiny blood vessels.

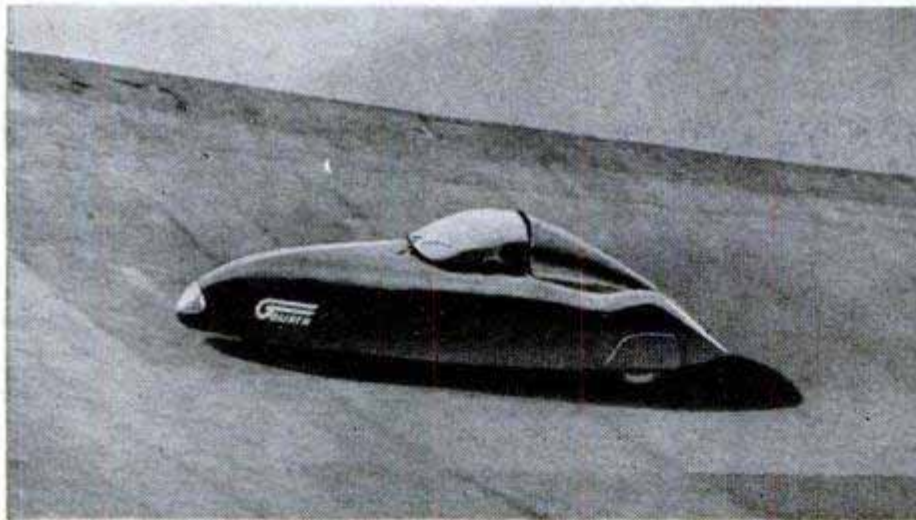


## Exposure Suit For Navy Flyers

Flyers downed in icy waters can survive long periods of immersion when wearing the Navy's new survival suit, the Mk 3. Designed to provide more than adequate protection from cold water, the suit is especially fashioned for comfort. Key feature of the suit is its ability to "breathe." The rubber-coated cotton cloth that forms the body of the suit has a high vapor-transmitting factor although it is, strangely enough, completely water-tight. This allows the water vapor given off by the body to pass through the outer skin of the suit instead of collecting as condensation within the garment, as was the case with previous models. Natural-rubber cuffs



at the neck and wrist effectively seal out water without discomfort. An insulating liner fashioned like a one-piece coverall is worn beneath the suit for warmth.

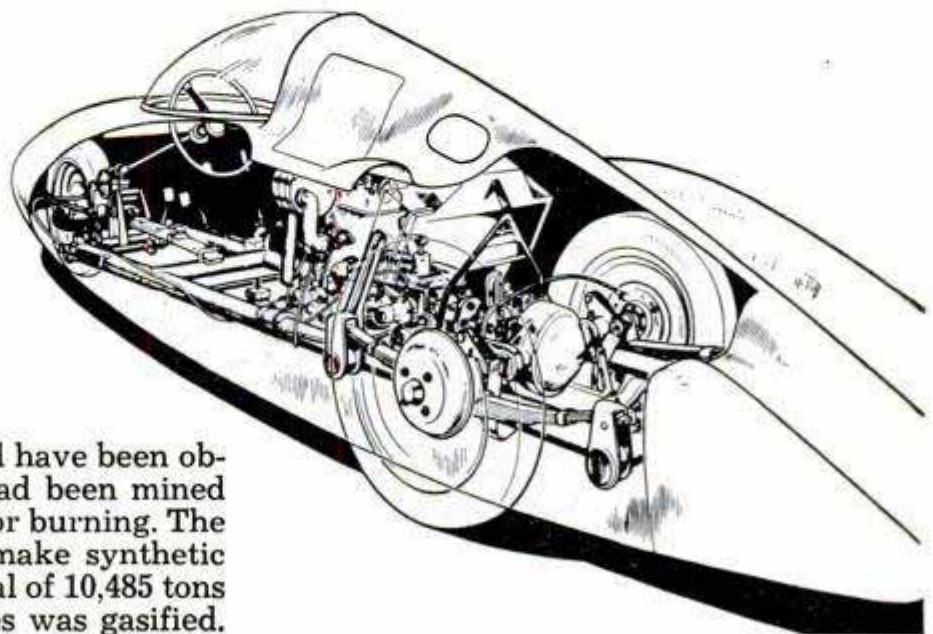


## Tricycle Speedster

Parts from a three-wheel delivery van and an automobile were pooled in the building of a new streamlined German motor-tricycle. The body for the vehicle, which averaged nearly 100 miles an hour during a 4350-mile test run, was constructed of lightweight metal. Cut-away diagram below shows component parts.

## Underground Coal Produces Fuel

After four years of tests, the Bureau of Mines has announced that unmined coal can be burned underground to release gases that will operate turbine engines or provide fuel for steam generation. During one four-month period of tests, the energy yield was greater than could have been obtained from the coal if it had been mined and brought to the surface for burning. The gases can also be used to make synthetic gasoline and fuel oils. A total of 10,485 tons of coal underlying two acres was gasified.

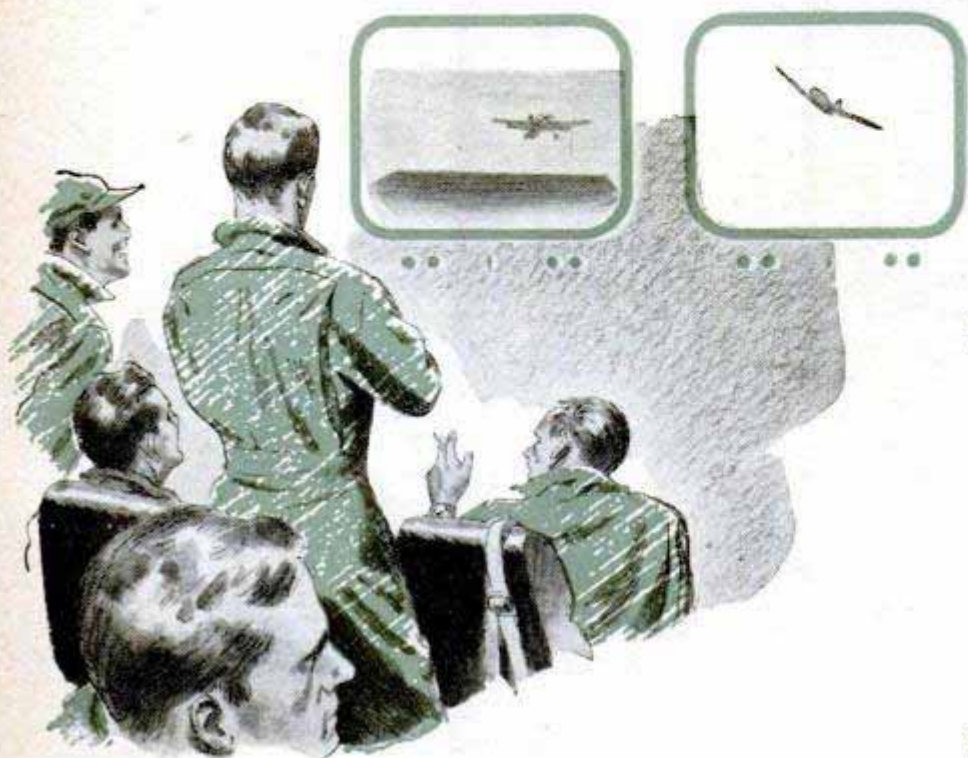




# TV Joins



Television screen on the bridge of an aircraft carrier gives officer view of deck operations. Below, in ready room pilots watch a take-off



**By Theodore L. Taylor**



# a Flattop Crew

**T**V—OUR MID-CENTURY marvel that conducts Faye Emerson and the Brooklyn Dodgers into the living room—may face a stern task in several years if the Navy calls on it to help operate the world's largest aircraft carrier.

Designers of the 59,900-ton USS *Forrestal*, scheduled for completion sometime in 1955, propose TV for deck observation during flight operations, conning and docking. While shipboard television is still in planning stages, with first trials booked as experimental, the "entertainment medium" has a great seagoing potential.

Within the next two years, the Navy will conduct TV tests aboard ships at sea. If successful, the \$218,000,000 supercarrier will have extra eyes in mothering its brood of warbirds. Installation of TV equipment on other vessels will also hinge on the outcome of the trials.

In examining television for the *Forrestal*, designers hope to lick a visibility problem. Flattops aren't the easiest ships to handle, and CVB 59 will have additional bugaboos in that regard. A retractable bridge, operating like an elevator, and a widely flared flight deck on the beams make for impaired vision during flight operations and docking. Measuring 128 feet at the beam water line, the big ship will flare out to 252 feet at the

widest extreme of the broad flight deck.

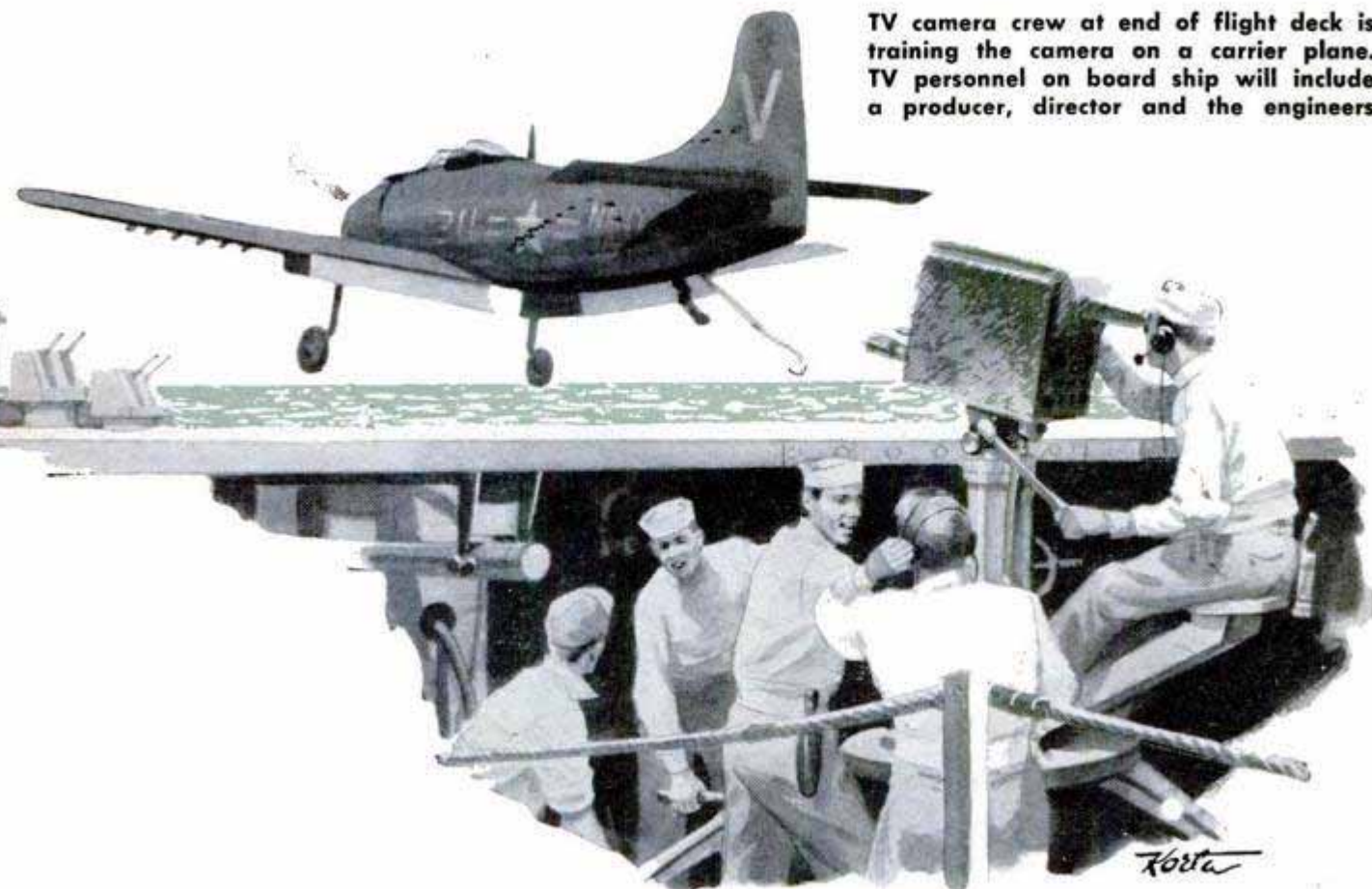
A radically new development for carriers, the retractable bridge will make the *Forrestal's* flight deck resemble a pancake while planes are launched and landed. No doubt pilots will be happier, but the man at the conn might grow a few gray hairs when the bridge is lowered.

Here's where designers begin to speculate on TV's role—cameras to be trained on aircraft and ships or targets in the dead-vision areas for transmission of pictures to receivers mounted on the bridge. The skipper, officer of the deck and other parties concerned can then visually monitor air operations and maneuverings of other vessels. These same scenes will also be viewed on screens mounted in other vital centers throughout the ship. Pilots relaxing in ready rooms will be able to watch all of the proceedings.

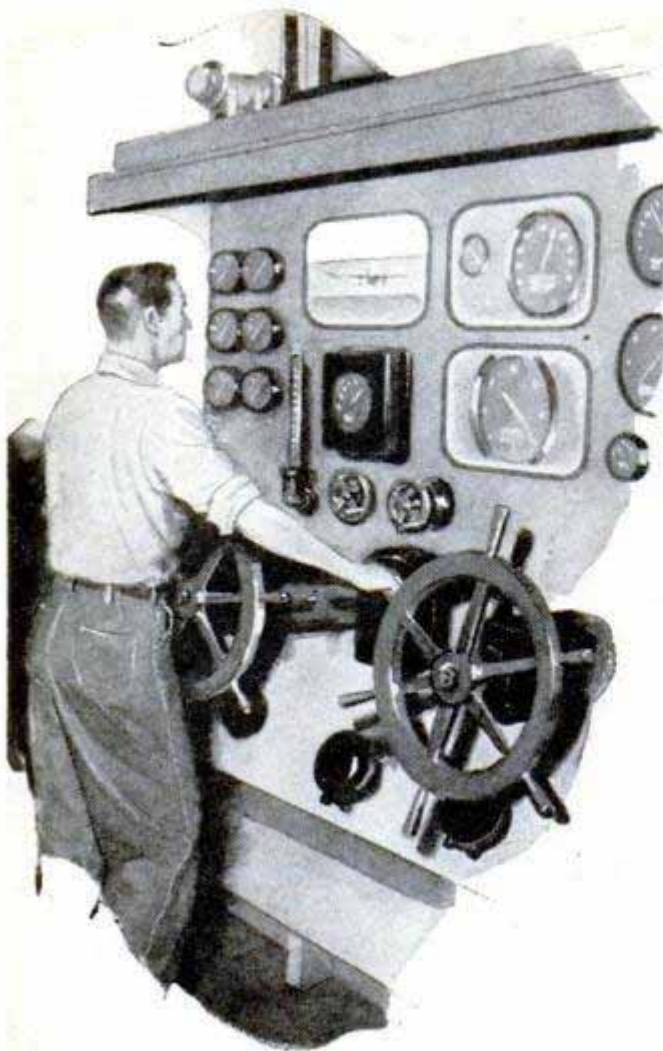
At present, camera placement is a topic for engineering discussion. The TV cameras might be located aft near the landing-signal-officer stations. Then again, the camera eye could be set in retractable masts. The latter would enable quick clearance if a plane strayed too close. Experimentation will provide the answer.

To scan the maneuverings of task-group ships astern and on the quarters, cameras

TV camera crew at end of flight deck is training the camera on a carrier plane. TV personnel on board ship will include a producer, director and the engineers







In the engine rooms away below deck, TV screens may assist ship's engineers in scanning scattered gauges at central location or watching a landing

Wide overhangs of flight decks present a docking problem which the TV cameras may assist in solving by transmitting picture of blind area to bridge

would be spotted on the fantail of the *Forrestal* and at vantage points on the beams.

Another possible role in ship-handling may occur in elimination of the dead-vision areas while bringing the 1040-foot ship alongside her berth. To widen the skipper's field of view, cameras will focus on the dock areas directly beneath the wide overhangs of the flight deck. For this and similar situations, the planners don't discount use of a mobile camera unit.

Below deck uses are also being explored. In engine rooms, TV may assist by watching boiler gauges and other vital machinery. In this variation, engineers would scan all gauges by viewing a centrally located screen instead of checking each gauge.

For programing — picture selection and the like—the Navy may copy some of the techniques already developed by commercial television. TV units aboard ship are likely to include personnel corresponding to a producer, director and engineer. There won't be need for a sound-effects man or property custodian with the Navy's type of drama.

In the forthcoming experiments, TV cameras will be placed at various vantage points on carriers and other combat vessels. Experts in electronics and ship characteristics will observe the tests with two main items in mind: Advantages offered by TV and wearability of equipment. Nautical television gear will have to be very rugged.

Should tests prove the equipment too costly to maintain in dollars or number of personnel, the scheme is likely to be shelved for a few years. The Navy has different hopes, though.







## Cab Leaves the Ground as Truck Loads Itself

Loading itself by means of a winch located behind the driver's cab, a new British truck called the "Mighty Antar" is capable of carrying 25 tons of assorted machinery. When the load is about to be lowered onto the platform, its weight raises the cab and

front wheels off the ground. Both loading and unloading operations are handled by the driver and his helper. The truck was designed and built to transport heavy machinery and parts over sandy soil in South America and the Middle East.



## Army Inventor

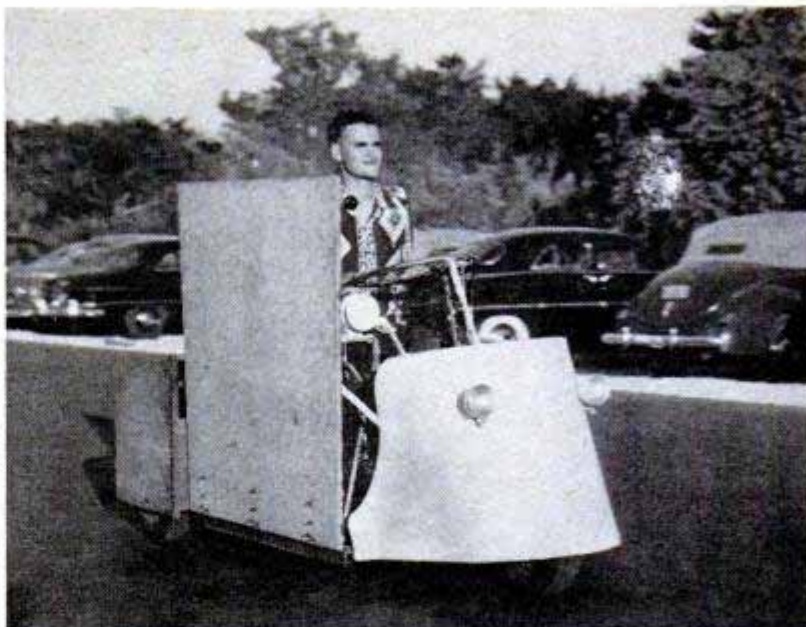
Wounded soldiers of the 24th Infantry Division in Korea benefit from the inventive nature of Lieut. Nathan E. Morrell of Lisbon, N. H. An officer in the 24th Medical Battalion, Morrell developed a blanket rack and plasma-bottle support of inexpensive materials. The blanket rack holds the weight of the covers away from the wounded area without sacrificing warmth. The bottle support holds the plasma at the correct height. Both devices fold up for storage.

## Rod-Guide Tape

Loose guides on fishing rods can be repaired by wrapping them with thin plastic tape. The 1/4-inch flexible adhesive is waterproof and comes in a variety of colors, or in transparent rolls. The tape also can be used for making temporary repairs to rubber waders and raincoats.

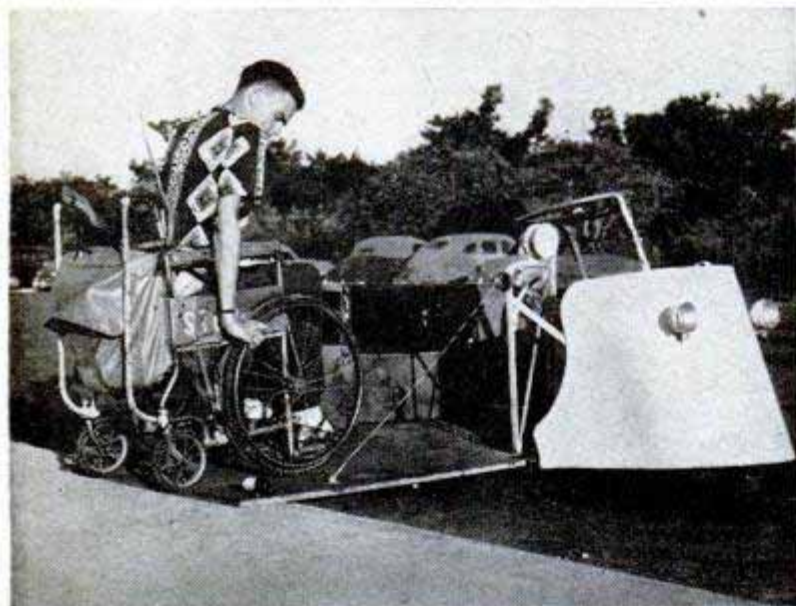






His chair rolled onto the scooter, Jerry Chapin cranks up his built-in runway. Below, with the runway resting on the curb the handicapped veteran can move on or off without assistance

With all its controls hand operated, the converted motor scooter can move through Miami traffic at a top speed of 40 m.p.h.



## Wheel-Chair Scooter

Starting with an old motor scooter, Jerry Chapin of Miami, Fla., has licked the problem of being dependent on others for getting around in his wheel chair. Ornamental-iron workers, friends of his, helped him convert the scooter's starter, brake and accelerator to hand operations. A specially made hand winch lets down a platform that serves as a runway for the handicapped Navy veteran's chair to be rolled on and off the scooter. Chapin can make speeds of up to 40 miles an hour going to classes at the University of Miami.

## Minute X-Rays Given GIs

One minute is all the time it takes the Army's newest field X-ray unit to turn out a finished picture. The 500-pound machine is described as the fastest and most versatile ever built.

If you do not find all the information you need in the WHERE - TO - BUY - IT INDEX, starting on page 12, sources of further information are available to readers without charge from the Bureau of Information, *Popular Mechanics Magazine*, 200 East Ontario Street, Chicago 11, Ill.

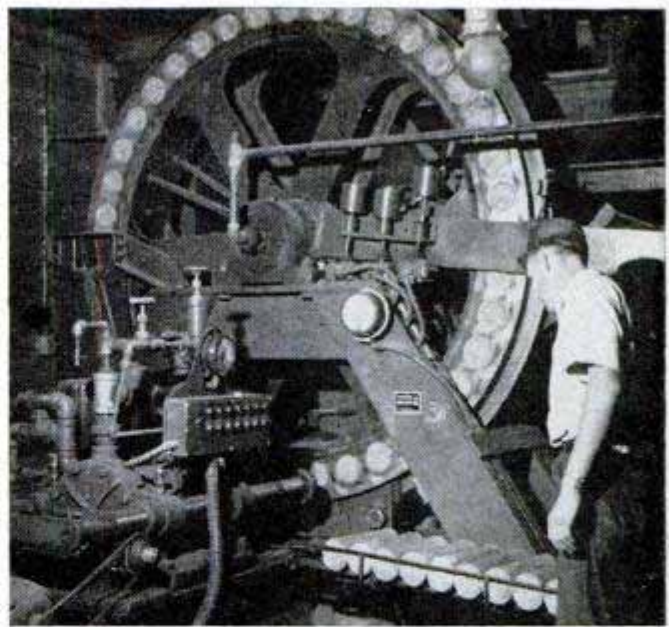






## Sunflower Logs

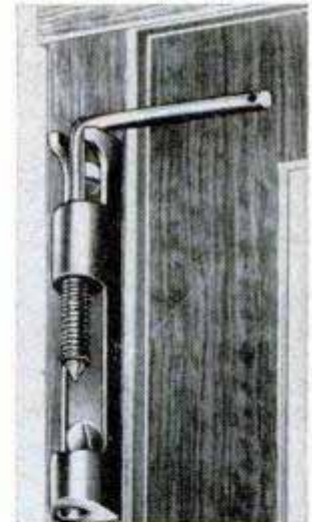
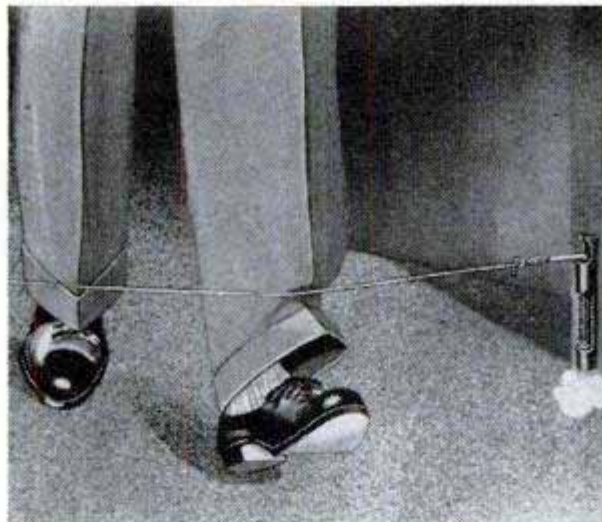
Ever burn a sunflower log? The logs, ideal as a fireplace fuel, roll from an Altona, Man., plant by the hundreds of thousands. For years the plant has extracted vegetable oil from sunflower seeds, but until recently the hulls were a liability. Now the hulls are fed into the sleeves of a circular



briquetting machine. Under a pressure of 165,000 pounds per square inch, no binder is required to produce a log two to three times as dense as wood. Each log weighs  $7\frac{1}{4}$  pounds and measures 12 inches long by 4 inches in diameter. It yields about the same heat as low-grade coal but leaves only one quarter the ash. Each pound of the fuel yields about 8100 B.T.U.s.

## Burglar Alarm Fires Cartridge

Thieves are in for a surprise if they try to enter a door or window equipped with a new burglar alarm. The alarm fires a .32-caliber blank cartridge. A spring-actuated lever is released by movement of a thread, door or window, and its pointed end strikes the primer of the cartridge. Tear-gas cartridges can also be used.

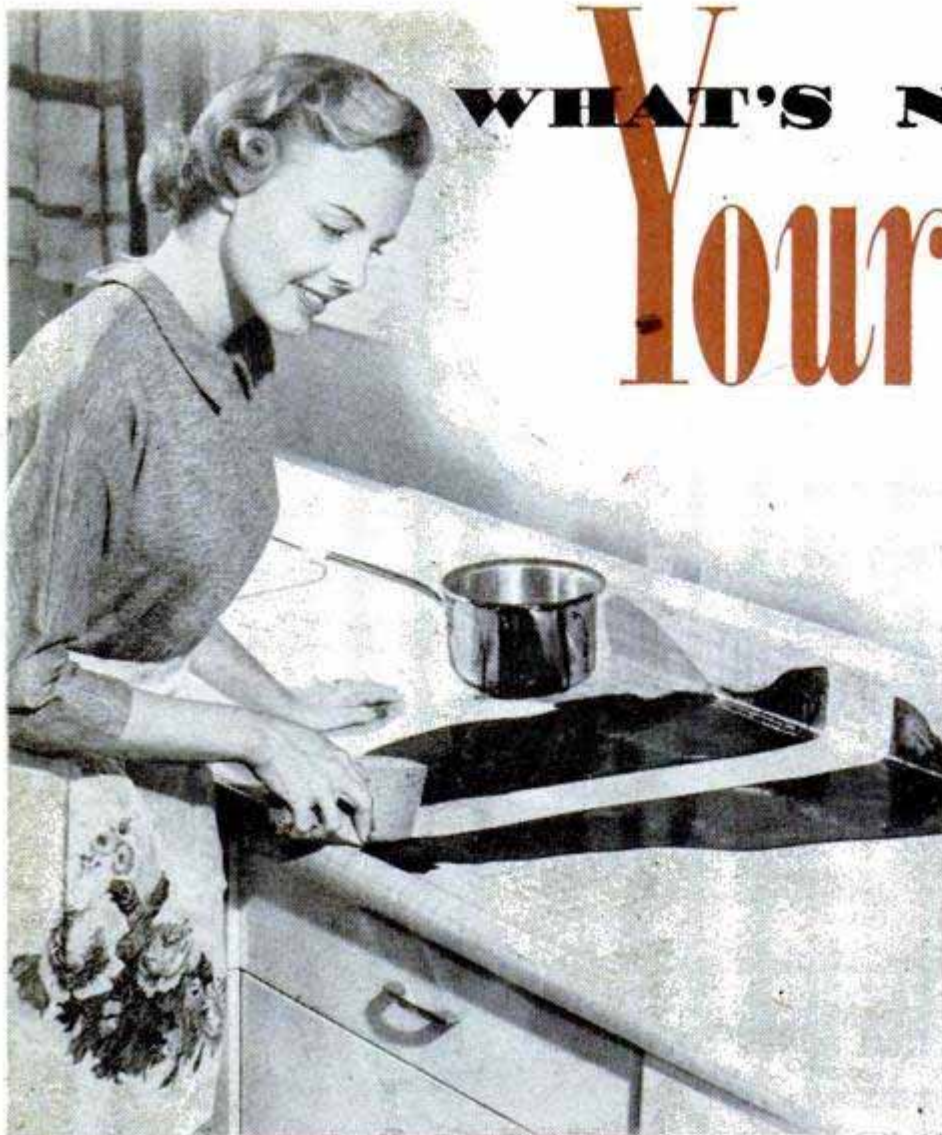


## Card Holders

Playing cards are held upright in front of the player by a plastic "hand" which rests on the table. The card holders are of special value to paraplegics or to those who temporarily lose the use of one hand as the result of an accident. Spring-loaded balls, or "fingers," hold the cards, which can be inserted in the holder, fanned out and played with three fingers. Plastics in two colors are available.



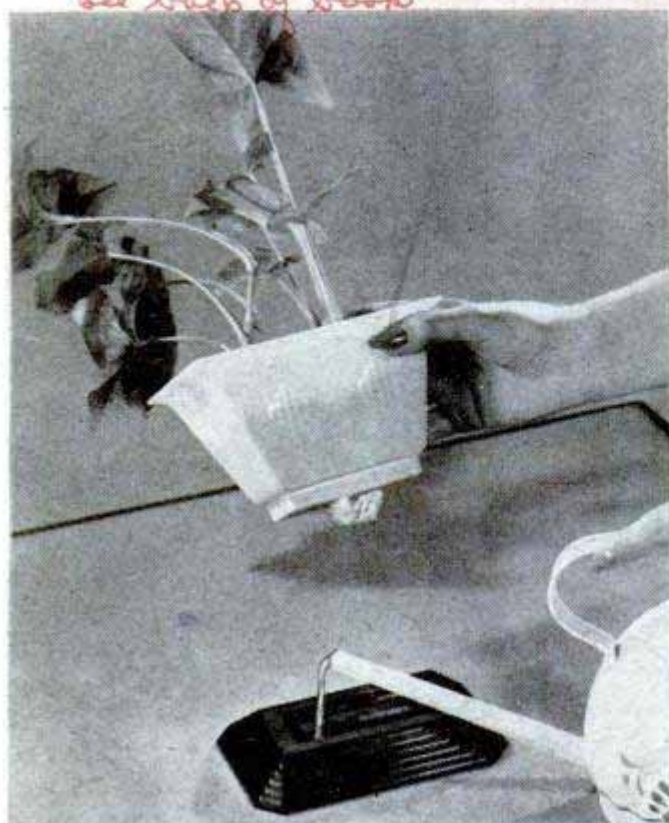
# WHAT'S NEW FOR Your Home



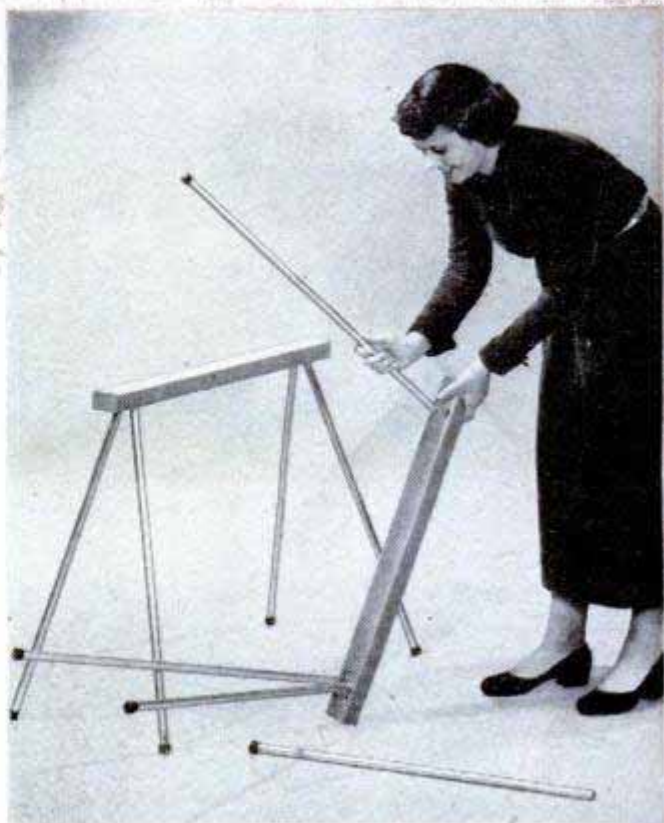
**PLASTIC COUNTER TOP** wipes clean at a stroke. Cast in one piece, it has no seams to trap spilled food. The backsplash and front edge are molded with top, eliminating metal trim

**SELF-WATERING FLOWERPOT** has a pedestal base which holds about a week's supply of water. A wick made of synthetic fiber carries water by capillary action through bottom of plastic pot to plant roots

*See back of book*



**COLLAPSIBLE SAWHORSE** is erected simply by inserting four steel rods in holes drilled in a hardwood block. Rubber-tipped legs prevent floor marks. Horses can be used for carpentry, scaffolding or tables





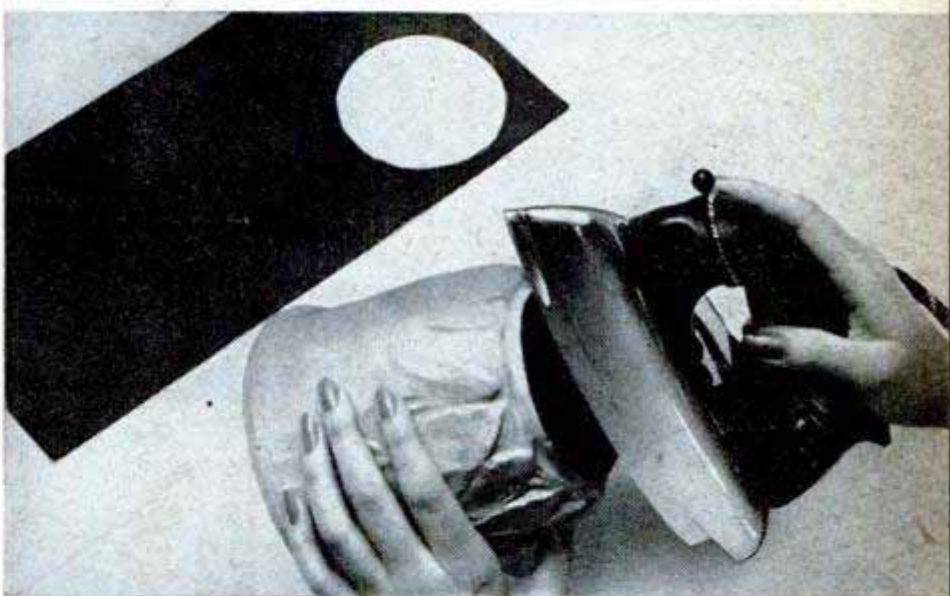
**JAR WRENCH**, built in two units, gives housewife a good grip on a hot jar while she tightens the lid. Holder can be adjusted to fit pint, quart and ½-gallon jars. Twin units also remove tight lids



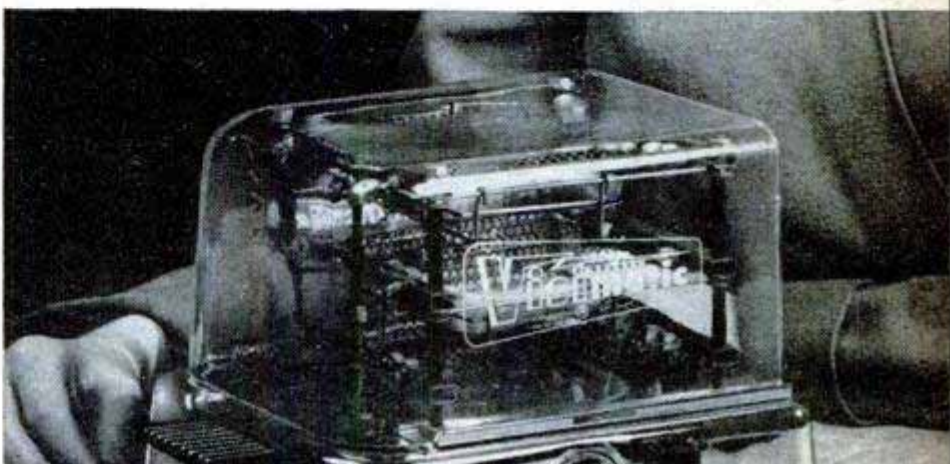
**TILLING TOOL** takes the blisters out of hand gardening. An armrest, padded with sponge rubber, absorbs most of the pressure. Tool can be used to dig out weeds, roots or crab grass, and mix fertilizer



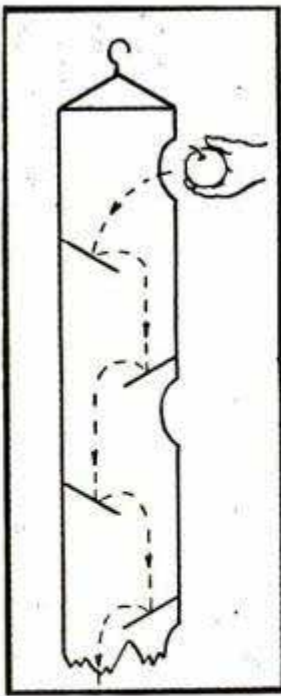
**FELT CUSHION** for ash trays, lamps and knickknacks can be attached to metal, glass or wood by ironing it in place. Adhesive backing takes hold when heat is applied. Felt is available in 7 by 14-inch sheets, is easily cut to shape



**LOOK-SEE TOASTER** lets you examine the bread while it's toasting. Glass cover is mounted on a chromium base. Bread is placed on horizontal holders and slipped into the appliance. It is automatically ejected onto a plate or the built-in crumb tray, or can be removed by hand





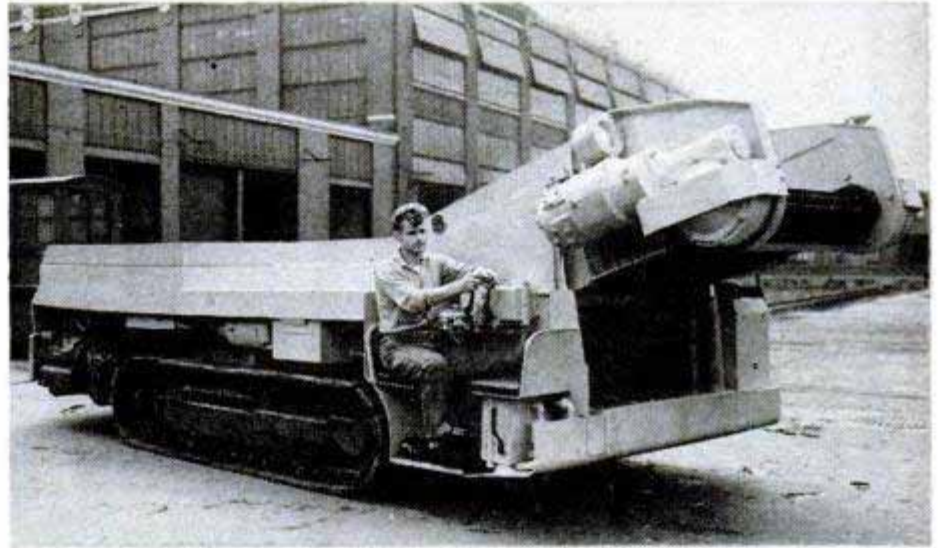


## Fruit-Picking Chute

Faster picking with fewer bruises to fruit results when a canvas tube is used to carry the fruit from the tree to the ground. Instead of climbing down the ladder at frequent intervals, to empty his basket, the picker simply drops the fruit into the canvas chute. Inside the tube, which comes in lengths from 3 to 12 feet, are sloping canvas baffles, 9 inches apart on each side. No drop is more than 4½ inches. Side openings along the tube permit more than one worker to feed fruit into it. By connecting several lengths together, workers can make tubes long enough for any size tree. A 40-foot tube has been used on a tall avocado tree.

## Tanklike Carrier Shuttles Coal

With treads like an Army tank, a new "shuttle car" pivots and turns through underground tunnels to carry coal from veins to railroad cars. The machine's power cable simply is plugged into an outlet and the 600 feet of cable are automatically reeled in or out as the car moves. Coal is loaded into the carrier by miners deep in the veins. The car then shuttles the load to the waiting rail cars in the main tunnel. Through an adjustable "snout" it discharges the coal, which is moved off the



vehicle by a continuous conveyor belt. The shuttle car can carry 10 tons of coal in a single load.



## Sidecar Auto

Made in Germany, a midget runabout has only three wheels and resembles a motorcycle sidecar. The little vehicle sells for about \$330. It has a top speed of 40 miles an hour and will travel 85 miles on a gallon of gas. The dwarf vehicle is manufactured by Wagner and Kratisch.

☐ A new roller-skate wheel made of a thermo-setting plastic will wear 50 percent longer than wood and 25 percent longer than fiber, its manufacturer claims.

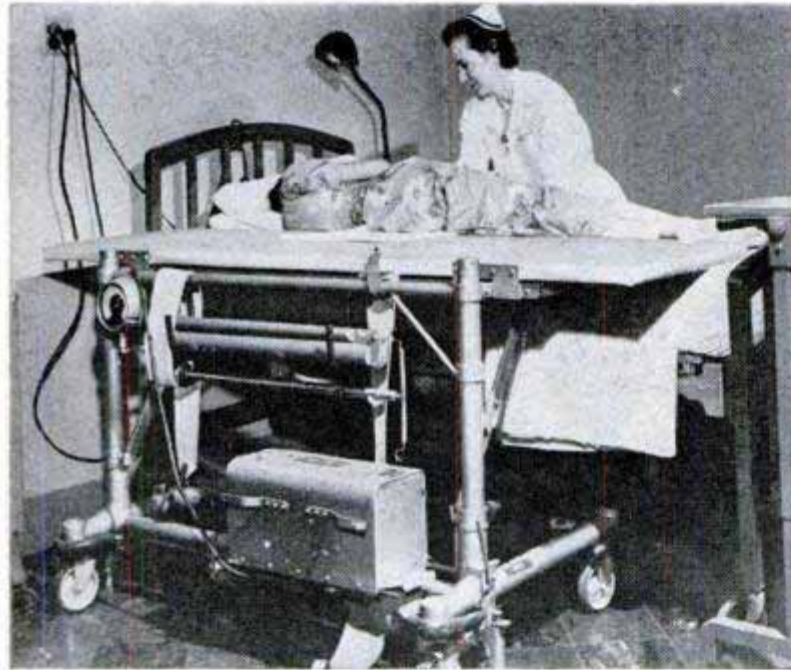


## Foil Protects Tanks in Shipment

Uncle Sam is now wrapping his Army vehicles like candy bars for overseas shipment. All trucks, tanks and similar equipment are being sealed with aluminum foil to protect them from the elements during long hauls. Field tests have proved the foil to be considerably more effective than the shellac, nonhydroscopic tape and tape-sealing compound previously used. A final coating of paint covers the foil.



U. S. Army photo



## Rolling Shelf Eases Movement of Bed Patients

With a newly developed rolling shelf, seriously ill or injured patients can be moved from a bed with minimum disturbance. The patient can lift himself onto the shelf, or be eased onto it after hydraulic power raises it to bed level. A safety device holds the shelf at the desired height. When the shelf is being moved, the front wheels can be locked in a rigid straight-away position to prevent rolling from side to side while it is being steered from the rear. The unit can be used as an emergency operating table. It also has a scale that weighs patients.

## Jeep Loads Planes

Mounted on the back end of a Willys Jeep, a belt conveyor speeds the loading of mail and freight on United Air Lines planes. The conveyor belt is driven by the power take-off on the Jeep. It will lift packages 10½ feet and has a capacity of 2500 pounds. The airline has ordered 22 of the mobile loading machines.

☛ There are about 450 active volcanoes in the world, all of them potentially capable of eruption and destruction.

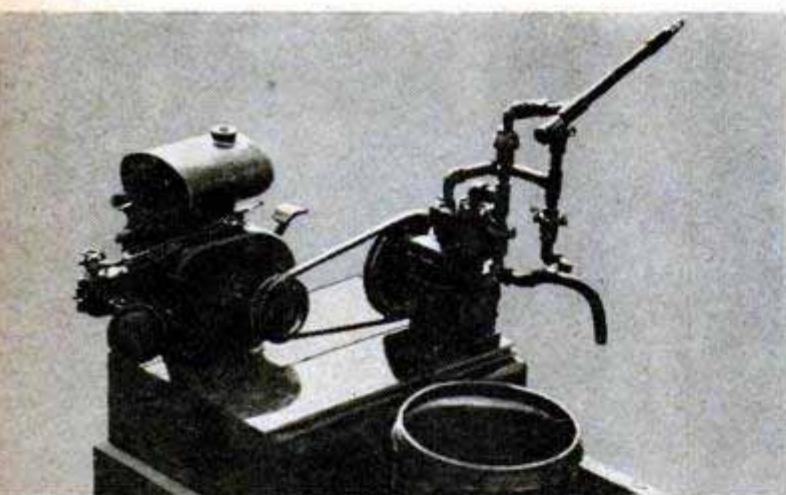






Beneath the Flying Boxcar is the junk pile that supplies GI mechanics with materials for their inventions

## Yanks in Korea Put Scrap to Work



Above, parts from damaged air compressors were used in a water pump that provides pressure for washing mud-coated vehicles. Below, outperforming brand-new models, a junk-heap air compressor was GI-built by members of a truck outfit at a Korean airfield

Beside a busy airfield in Korea is a pile of battle-torn equipment that is "raw material" for some GI inventors. A heavy-duty grease rack, an air compressor, a water pump for washing vehicles and other mechanical aids were built with salvaged material by mechanics in a truck outfit led by Lieut. Lugino Dalessandro of Altoona, Pa. Into the compressor went parts from a worn-out water purifier, an engine from a disabled lighting plant and a renovated tire gauge. The grease rack was once the frames of two trucks. Angle steel from bombed Quonset huts forms a ramp for unloading patients from flying ambulances. Not all the improvisations are complex: The best center punch in the outfit's tool kit is an armor-piercing bullet!

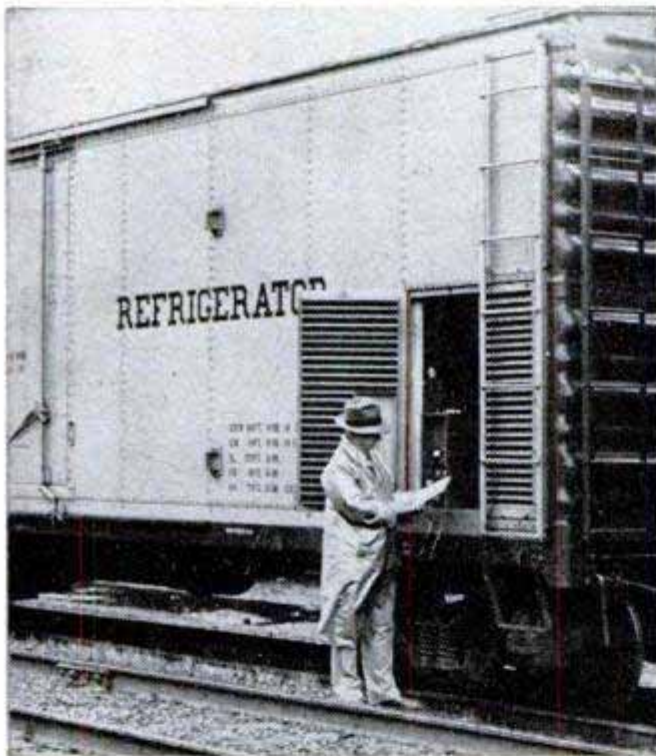
Below, an 11-ton anti-aircraft half-track is serviced on a rack built with the frames of wrecked trucks





## Unsinkable Tackle Box

Fitted with a rubber gasket to make it airtight, this durable tackle box easily supports a man in the water in case an emergency occurs while fishing. It has two cork-lined trays divided into 24 compartments to accommodate an assortment of baits and hooks. Exterior surface of the box, constructed of 1/2-inch kiln-dried pine, is mahogany stain, finished with marine varnish. Lock, handle, hinges and other hardware are rustproof.



## Refrigerator Replaces Ice On Railroad Cars

Refrigeration units now installed on railroad cars are capable of maintaining a temperature of zero for weeks at a time. The refrigerators replace the former ice-and-brine system of cooling the railroad cars carrying frozen food and juices. With the old system, the initial cooling of the car required about 10,000 pounds of ice and 3000 pounds of salt. The car then had to be re-iced during the journey. The new system cuts refrigerating costs about 90 percent, and adds an estimated 10 to 12 years to the life of the car, as brine corrodes the car's metal parts. The refrigeration unit uses only 0.8 gallon of fuel oil per hour. It can be stopped or started without entering the car.



Untreated milk in sealed bag at left has thoroughly soured after three weeks at 77 degrees, but atomic-radiated sample, right, shows no sign of spoilage

## Atomic Energy "Cans" Foods

Atomic radiation may make it possible to store foods such as milk and meat at room temperatures for days without spoilage. Experiments at the University of Michigan show that atomic bombardment, while not making the food radioactive, does sterilize it by the lethal effect of radiation on the bacteria. Heavily irradiated samples of milk and beefsteak, sealed in plastic bags to prevent contamination by atmospheric bacteria, have been kept at 77 degrees for over three weeks without any signs of spoilage. Thus far, the experiments have not determined the effect of radiation upon flavor or nutritional values. Prof. Lloyd E. Brownell is supervisor of the project.

Opid's Camp, Calif., holds the world's record for the greatest amount of recorded rain in one minute—.65 inch.



# Hollywood "Prefabs" a Pioneer Boat

By Tom McHugh

**C**OULD a 63-foot boat be taken apart and trucked a thousand miles from Hollywood for use on Wyoming's Snake River?

That was the question that producer-director Howard Hawks put to his crew of RKO-Radio technicians. But it was more than a question. The boat had to be built in pieces so it could be used both in Hollywood and in Wyoming in Winchester Pictures' movie dramatization of the historical novel, *The Big Sky*.

And that wasn't all. This 14-ton boat could draw no more than a foot of water. Otherwise, it would run aground in shallow stretches of the river. Its propellers had to be powerful enough to push the boat upstream, yet they could not extend more

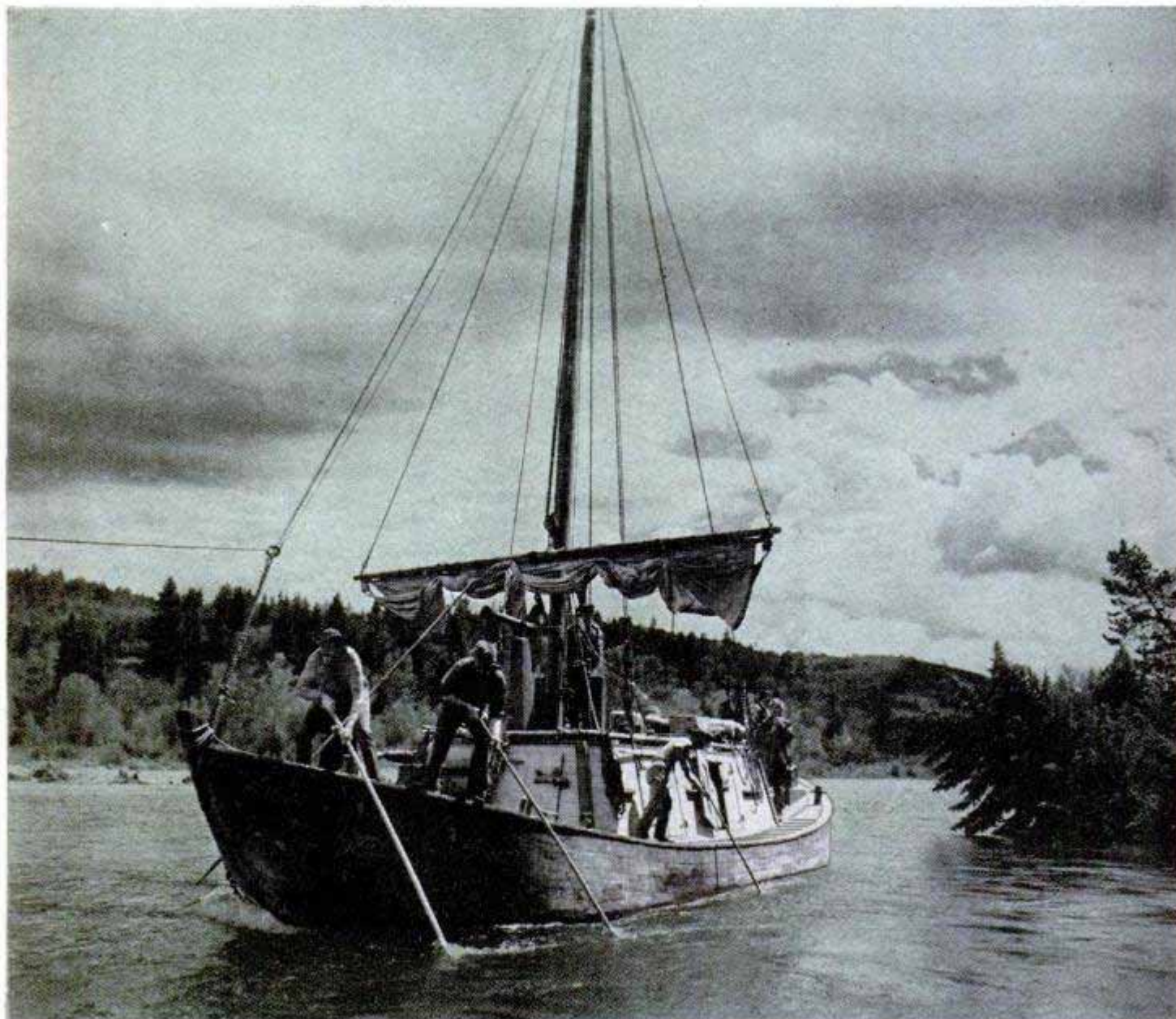
than one foot below the boat's water line.

Dubious special-effects men set to work to test their designs. Six weeks later, a crew of 25 men produced the first full-size keelboat in existence since the middle 1800s.

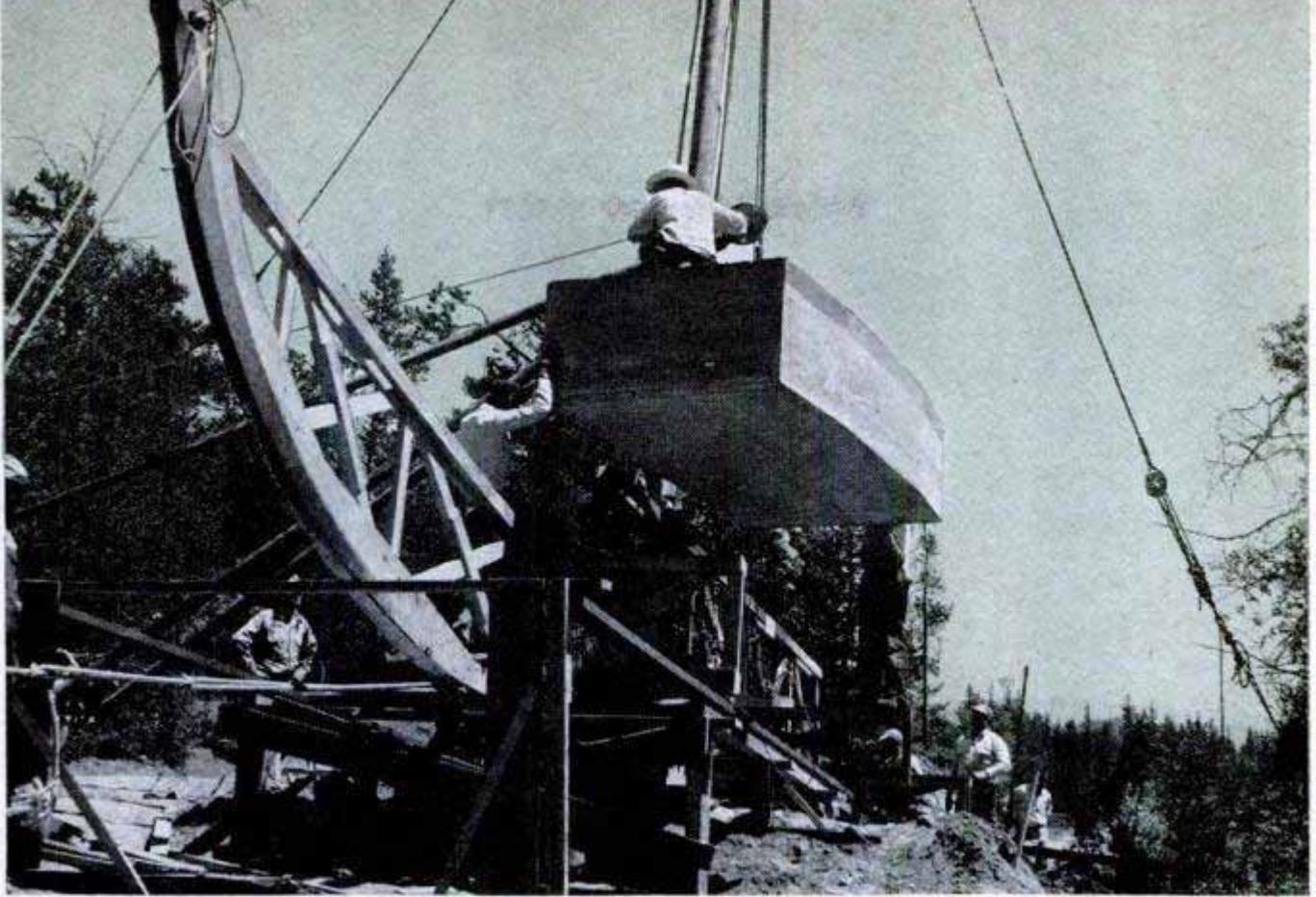
Now a keelboat is no ordinary craft. It is a peculiar vessel which was used mainly for river exploration before the steamboat had its heyday. A crew of 26 frontiersmen used every possible means of locomotion to fight their way up the Mississippi and Missouri Rivers.

They attached a 1000-foot line to the top of the mast and pulled the boat upstream with a crew on the shore. Where the shore was too marshy for this method, the crew poled the boat. And, if the water was too

**Skeleton crew keeps a 63-foot Hollywood keelboat off riverbank while main crew pulls it upstream by tow rope**







In constructing the old river-exploration craft for a movie, five pairs of pontoons were bolted into the framework

deep for poling, they used oars or a 20 by 25-foot sail.

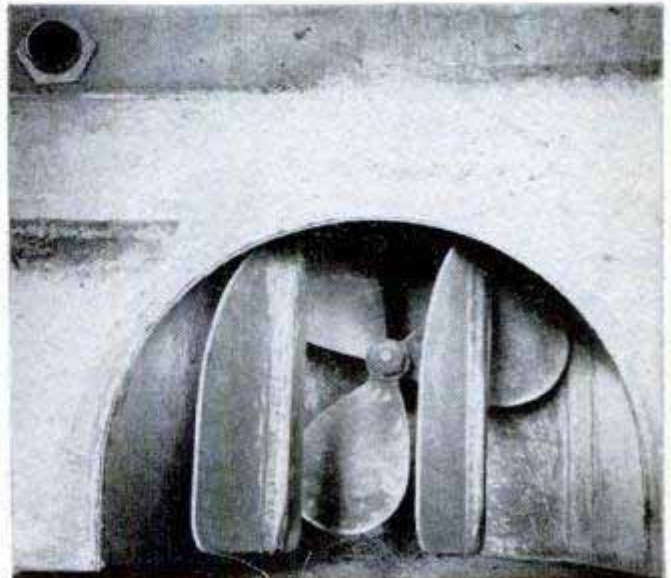
In "The Big Sky," the keelboat pushes up the treacherous Missouri River from the frontier town of St. Louis in 1830. With a crew led by Kirk Douglas and Dewey Martin, the boat heads for the wild Blackfoot Indian country 1200 perilous miles to the northwest. They plan to establish a trading post in this fur-rich area where no white man has ever penetrated. Rough stretches of rapids, a near scalping by bloodthirsty Sioux savages, an attempt to fire the boat by a rival fur trader, and a raid by Crow Indians almost stop the expedition.

Large rudder is synchronized with four rudders in propeller tunnels. Exhaust vents are at water level

The keelboat survives all this rough treatment in spite of the fact that it was put together like a jigsaw puzzle. The construction crew started with a truss along the centerline built from preconstructed units bolted together. Four cross trusses were inserted in the framework and the pontoons were then slipped between these.

The pontoons support the boat in the water. To make them, boxlike plywood frames were coated with resin and then a layer of glass cloth was applied. After two hours of drying in the sun, the mixture hardened into a tough and absolutely waterproof covering. Sixteen-gauge sheet

Two motor pontoons, located at the stern, have built-in tunnels for the 26-inch propellers and rudders

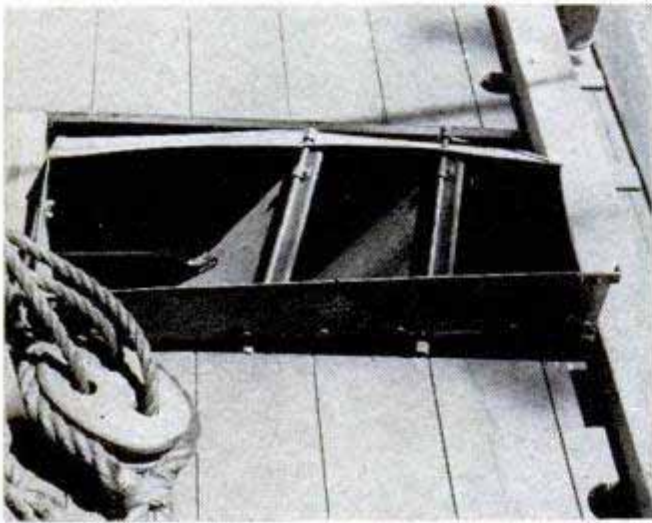




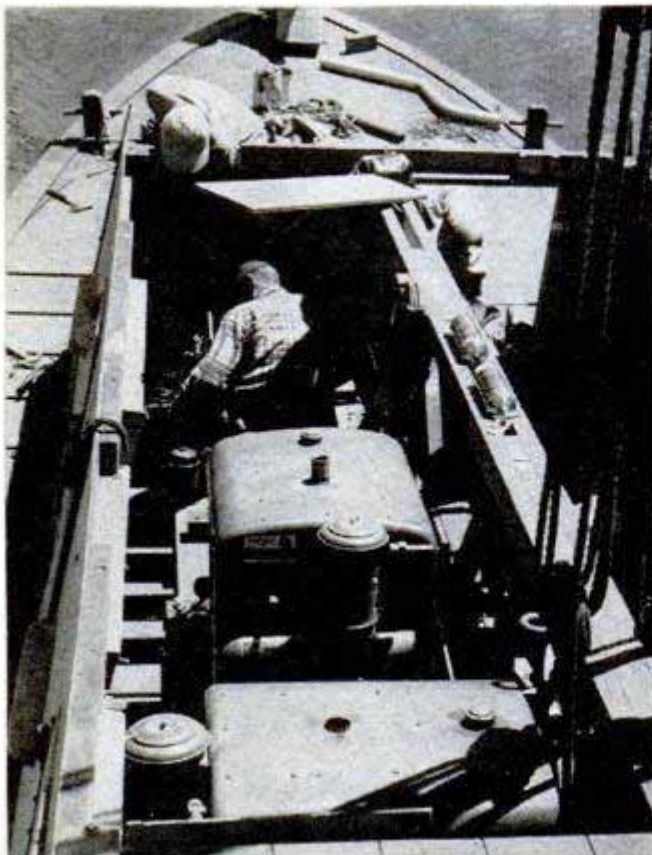


TKO-Radio Pictures photo

While filming action shots for "The Big Sky," cameraman operates from platform attached to stern of boat



Top-deck vent, above, directs air from large blower into the sail to fill it out when no wind is blowing. View into cargo box, below, shows air-cooled gas engines that operate the sail blower and power winch



iron attached to the bottom of each pontoon protects it from rock damage.

The power unit was another problem for the technicians. The keelboat had to have motors to enable it to move quickly from one location on the river to another, yet the propellers could operate in but a foot of water. To solve the problem, the technicians modified the old idea of tunnel-stern boats. Under the keelboat they built two elongated tunnels 30 inches high, enough room to give clearance for the 26-inch propellers. Then they used a high-suction pump to draw all air out of the top of the tunnel. From then on, the water stayed in the tunnel like a glass of water held upside down in the bathtub.

A 115-horsepower Chrysler engine, geared 3.71 to 1, powered each of the two propellers.

After finding that one rudder was not sufficient to divert the stream of water from the propellers, the technicians mounted two rudders behind each propeller. If these four rudders plus the big rudder on the stern do not turn the boat, the crew can rely on an extra 25-horsepower outboard motor. Mounted on one side of the boat, it can be used to swing the craft in an emergency.

For sailing on deep, open water, the keelboat has a retractable four by eight-foot centerboard.

Reconstructing this historic boat cost \$28,000, a rather small sum when you consider that a yacht the same size would cost twice as much. One hundred and fifty years ago, when keelboats were in active use, they cost but \$3000.

In addition to the two 115-horsepower engines for the propellers, there is a 25-horsepower, air-cooled gas engine for the winch. A  $\frac{3}{8}$ -inch steel cable is run from the winch drum down to the keel and from there underwater to some firm anchorage on shore or in midstream. If the rivermen have difficulty poling the boat upstream, the winch becomes their invisible servant.



# MOLECULES

## TAILORED TO ORDER

By Ewart Thomas

**A**TOMIC CHEMISTS soon may be drawing up specifications for new kinds of molecules that would unite with disease organisms and make them harmless.

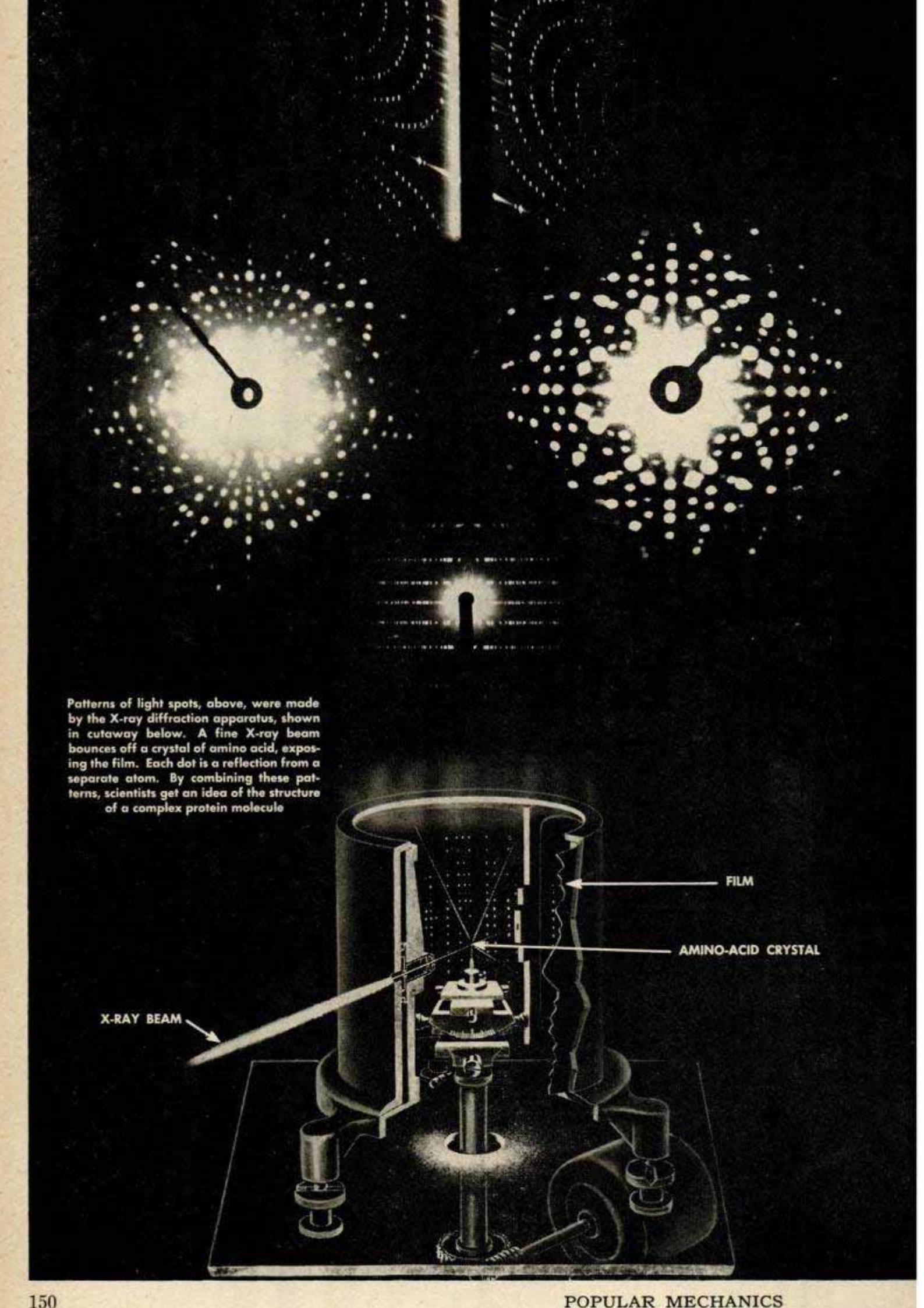
That's one of the hopes expressed by Profs. Linus Pauling and Robert B. Corey after their recent discovery of how atoms of nitrogen, carbon and other elements fit together to form protein molecules.

The new information has been called one of the greatest scientific discoveries of our time. It not only makes possible a new direct approach to the conquest of many diseases, but partially solves the baffling secret of life itself. Proteins are the principal building blocks of living things. By themselves they are on the border line between living and nonliving substances. They are so complicated that all previous attempts

Scientists built this model showing how a protein molecule in muscle fiber is made in spiral forms







The image is a composite illustration. At the top, two circular patterns of light spots are shown against a dark background, representing X-ray diffraction patterns. Below these is a smaller, central cutaway view of the X-ray diffraction apparatus. At the bottom, a larger, detailed cutaway diagram of the apparatus is shown. An X-ray beam enters from the left, passes through a crystal, and hits a film. Labels with arrows point to the 'X-RAY BEAM', 'FILM', and 'AMINO-ACID CRYSTAL'. The apparatus is mounted on a base with various mechanical components like gears and rollers.

Patterns of light spots, above, were made by the X-ray diffraction apparatus, shown in cutaway below. A fine X-ray beam bounces off a crystal of amino acid, exposing the film. Each dot is a reflection from a separate atom. By combining these patterns, scientists get an idea of the structure of a complex protein molecule

X-RAY BEAM

FILM

AMINO-ACID CRYSTAL



to learn the proteins' structure had failed.

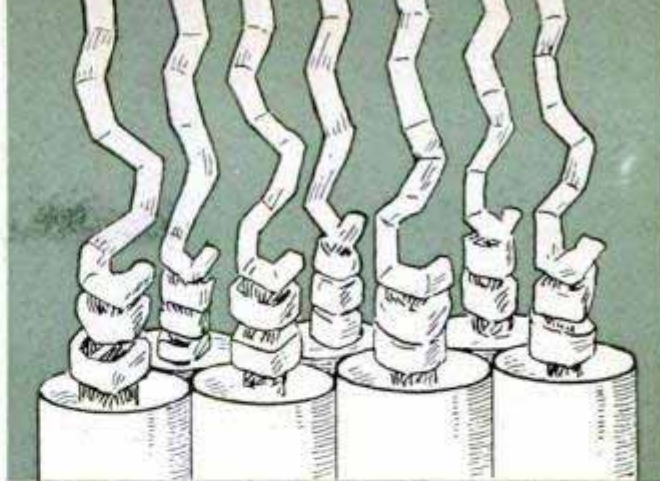
Proteins occur either as separate molecules or as the molecular framework of cells, and may contain 5000 or more atoms each. There are some 50,000 different kinds of proteins in the human body. They are a principal constituent of muscle, bone and hair. The red hemoglobin of blood is a protein. Other proteins travel about in the bloodstream as special messengers. Still others serve as catalysts for many body processes.

Hormones, enzymes and chromosomes are all among the specialized and complicated groups of atoms called proteins.

Plants that contain large amounts of protein are valuable sources of food for humans and other members of the animal kingdom. In the body these proteins are broken down into simpler substances that are then used to manufacture new proteins of the types the body requires. Still other proteins, relative giants, cause the so-called virus diseases—including poliomyelitis.

On the basis of their research, the Cal-Tech chemists have learned that the atoms which make up hair, wool, muscle, fingernails and several other fibrous substances are arranged in the form of spirals, or helices, similar to springs. Each turn of the spiral is about 5.65 angstrom units in length, or about  $\frac{1}{23}$  billionth of an inch. The red hemoglobin protein of blood also seems to have a helical structure.

Collagen, the protein that makes up tendons and is also present in skin and



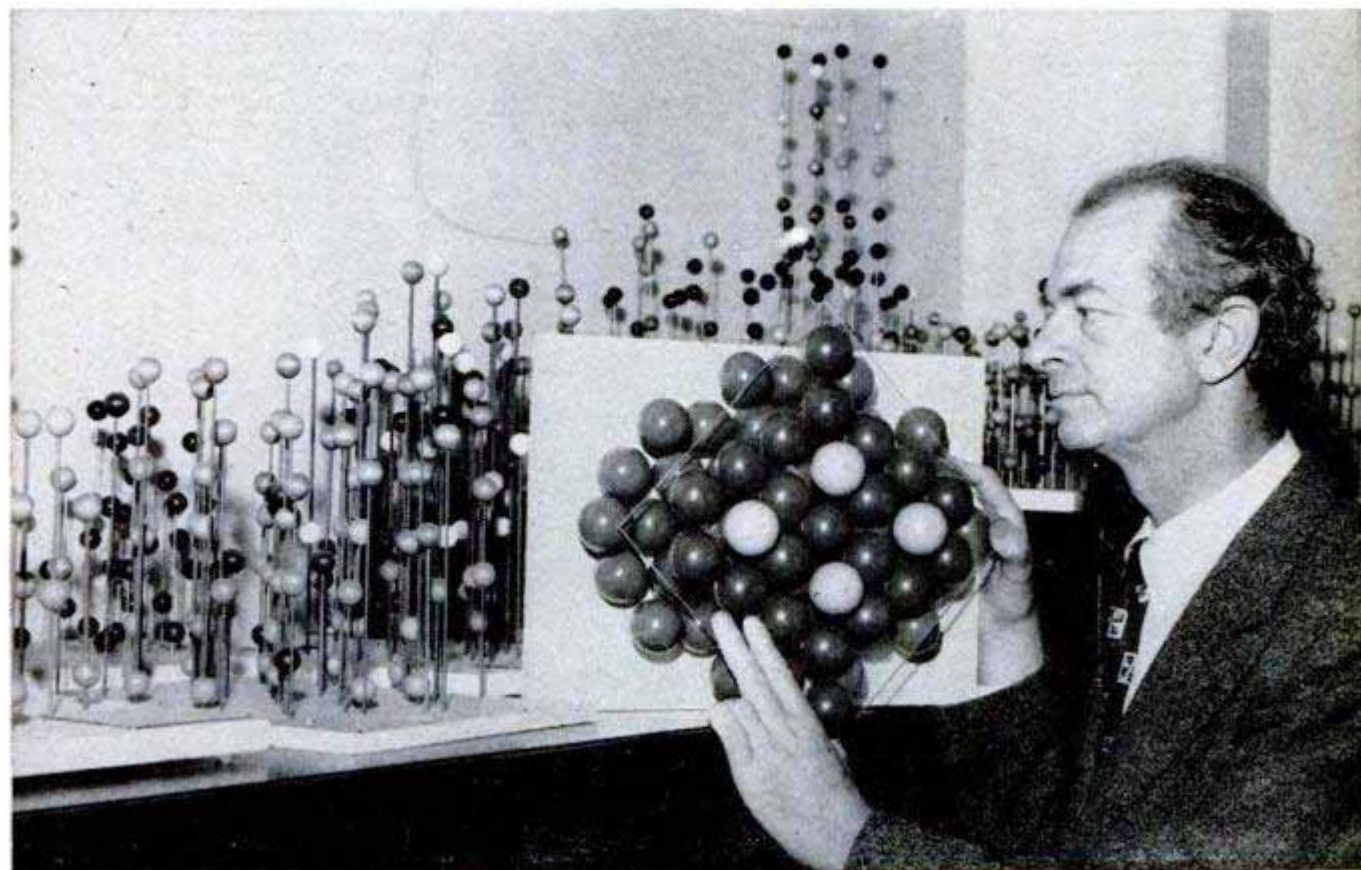
Protein molecules in muscles are coiled and drawing shows their position when muscle is stretched

bones, has a structure comparable to a three-strand cable. The molecules of gelatin also have this twisted shape. It was found that in all cases the molecules are attached to their neighboring molecules by electrostatic attraction, provided by hydrogen atoms that seem to be present only for that purpose.

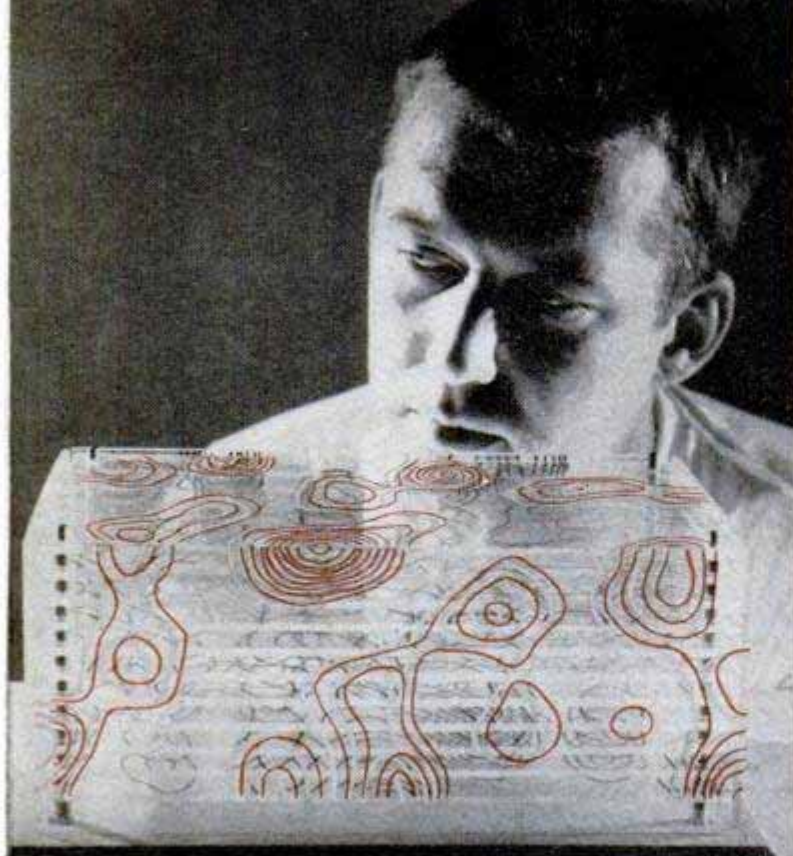
These hydrogen bonds have an elastic quality that permits hair to be stretched, or allows muscle protein to become stretched or compacted. When a muscle is stretched, it appears that its rows of coiled, or helical, protein molecules become extended and bonded together at the same time like a pleated sheet.

To date the structures of some 20 different proteins have been learned, and the architecture of additional protein molecules is slowly being discovered.

Professor Pauling shows atomic arrangement of metallic alloys, technique which aided in study of proteins



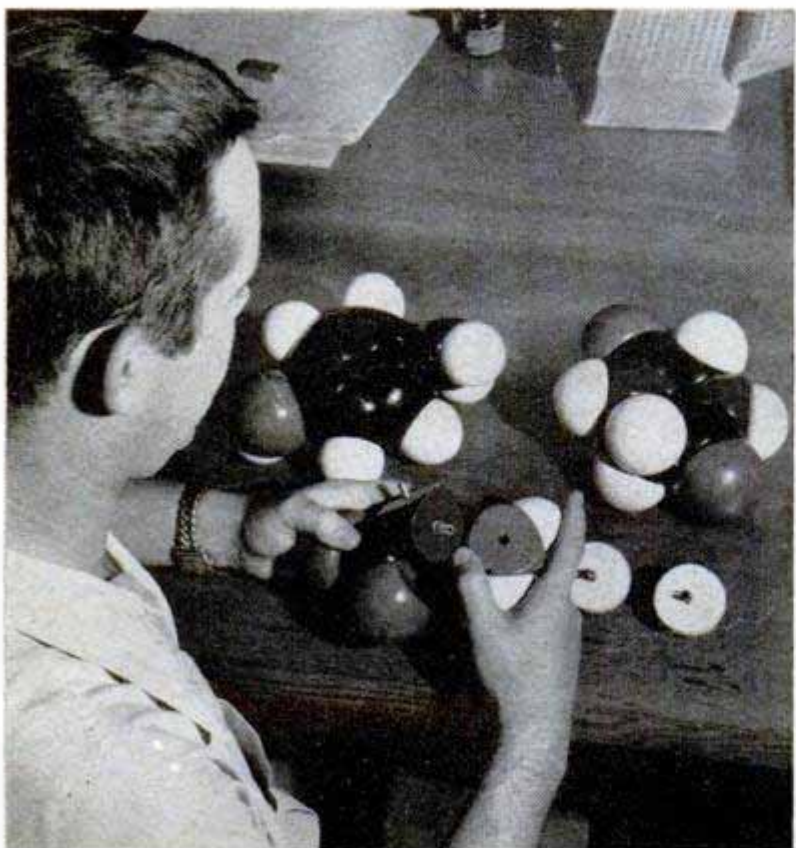




Parallel sheets of plastic provide a three-dimensional diagram of atoms in amino acid. Line concentrations locate atoms

The exploration of proteins is only one of many contributions that Professor Pauling has made to chemical knowledge. He is the principal author of the famed and useful resonance theory of chemical bonds, which was recently attacked as "vicious" and "hostile" by Russia because some of her chemists have other ideas. Professor Pauling is one of the outstanding American scientists selected by *Popu-*

Laboratory technician assembles colorful models of protein atoms that are several million times larger than their actual size



*lar Mechanics Magazine* for its Golden Anniversary Hall of Fame. He is head of the chemistry and chemical-engineering division of the California Institute of Technology, with which Professor Corey also is associated.

Information on the structure of proteins has been one of the goals of science for 30 years or more. In recent years the exterior shapes of some of the large virus proteins have been photographed with the aid of electron microscopes, but not even these instruments can begin to resolve the separate atoms of a protein.

A different approach was attempted with the aid of X-ray diffraction photography, a technique that in an indirect way can resolve the separate atoms of a molecule. In this method, a fine beam of X rays is directed through the window of a cylindrical chamber and against a crystal in the center of the chamber. Reflections of the X rays from the planes of the atoms in the crystal are recorded by photographic film placed in the chamber. The positions and intensities of the reflections are indications of the relative positions of the crystal's atoms.

This technique failed because proteins are too complicated. The patterns of dots on the X-ray films couldn't be interpreted.

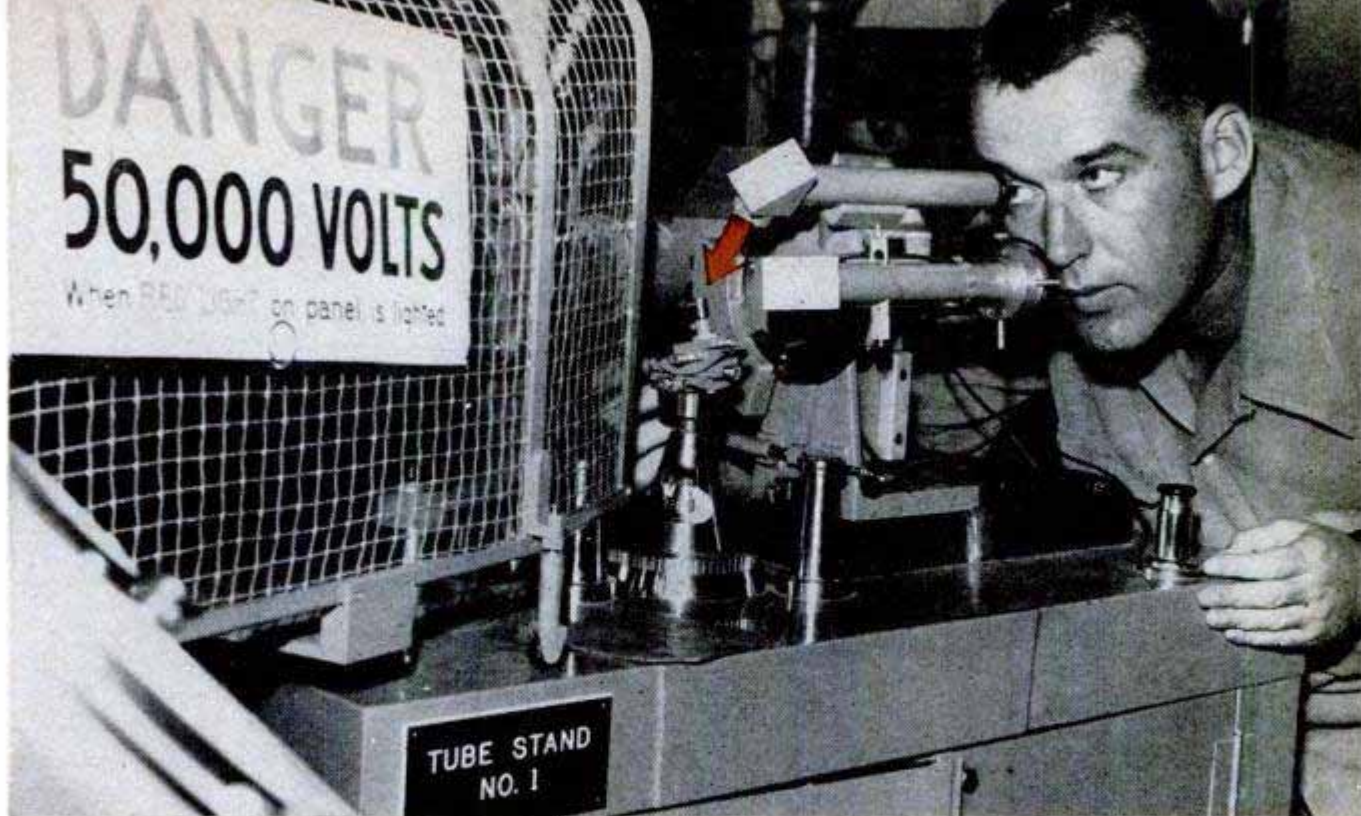
Professors Pauling and Corey went a step farther. They knew that a protein consists of polypeptide chains, long chains of amino-acid residues. The amino acids are relatively simple substances that result when protein is broken down by boiling with hydrochloric acid, or by digestion with enzymes in the stomach.

The CalTech chemists decided to try to learn the atomic structures of some of the amino acids, then try to assemble these structures into shapes or combinations that might fit the requirements for a protein. This was done by means of X-ray diffraction photography and associated techniques with the assistance of a dozen younger men as collaborators.

"The work is extremely difficult and the X-ray data must be interpreted with the aid of electronic calculating machines," Professor Pauling explains.

"It is somewhat comparable to





Crystal of amino acid is mounted on short rod (arrow) and lined up by microscopes for X-ray diffraction photos

standing on a beach in a dense fog and determining the locations of ships that are moored offshore by studying the interruptions and changes in pattern that occur to the incoming waves."

With the X-ray data, the team slowly assembled three-dimensional diagrams of amino-acid crystal structures. Their diagrams consisted of a number of parallel sheets of transparent plastic, on each of which a cross-sectional shape was drawn. The group of plates provides a drawing in three dimensions.

From these diagrams, and with additional calculations, it was possible to build up structures that might represent proteins themselves. Other data and tests showed that the structures did indeed exist in some proteins.

To aid in visualizing the atomic structure of a protein, the group next manufactured models of several proteins, using rounded and brightly colored wood and plastic shapes to represent the atoms themselves. Hydrogen atoms are shown as white or yellow, depending on their job, nitrogen atoms are blue, carbon atoms are black and oxygen atoms are red. These colors, of course, were selected simply as guides.

The models of the atoms represent a lineal magnification of several million times. On the same scale a grain of rice would extend from New York to the Hawaiian Islands, or from London to the heart of Texas.

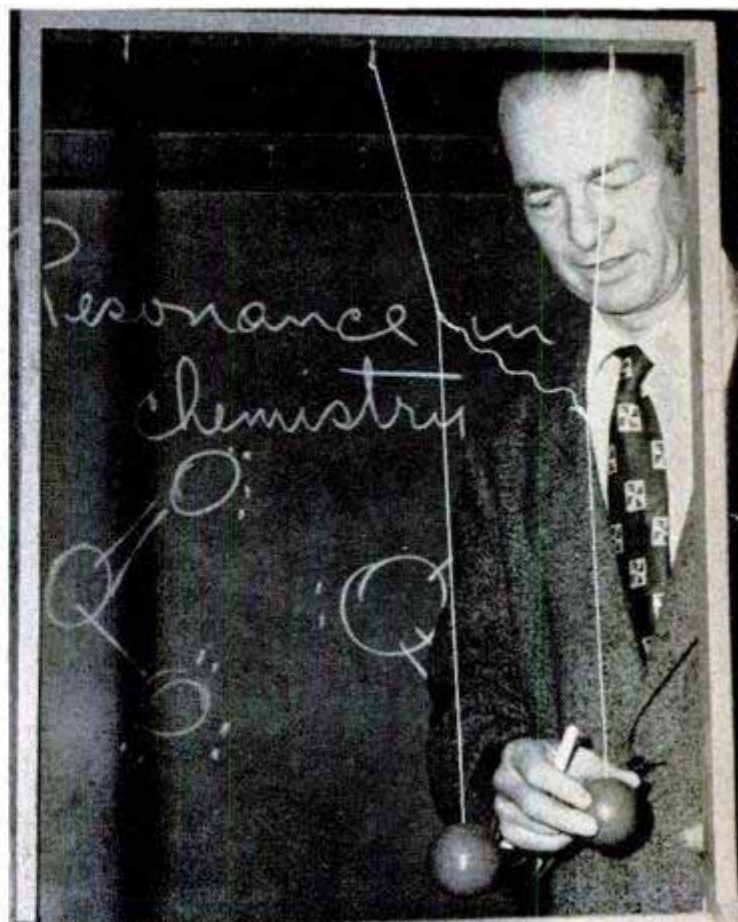
The atomic models can be joined together only in the same sequences and attitudes in which the atoms of a protein might be assembled. Now that the protein models

themselves have been put together they are proving to be an important research tool. Almost by trial and error the atomic components can be fitted together to confirm or disprove ideas about a protein that is being studied for the first time.

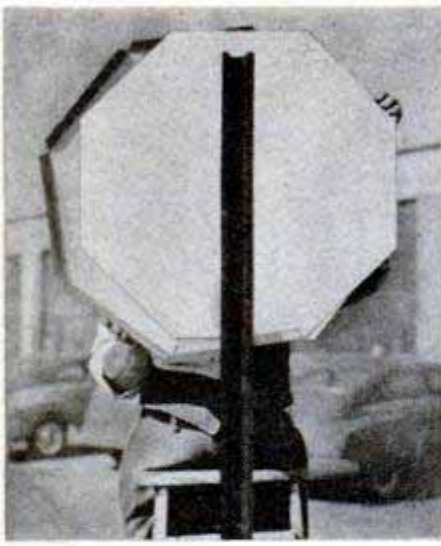
Understanding of the structure of protein molecules opens up several new fields of

(Continued to page 250)

Professor Pauling employs rubber balls on strings connected by coiled wire to explain chemical bonds



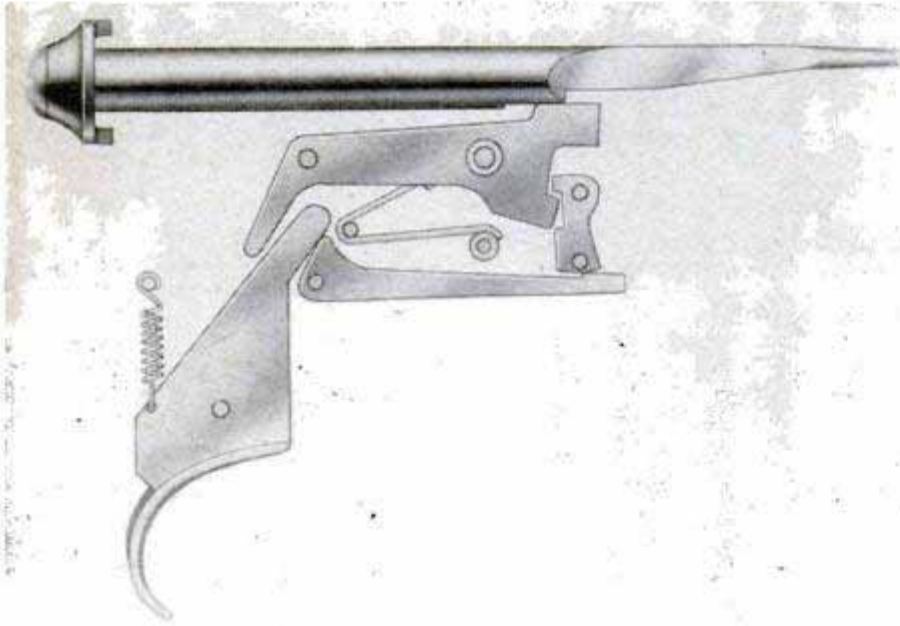




## Replacement Faces For Traffic Signs

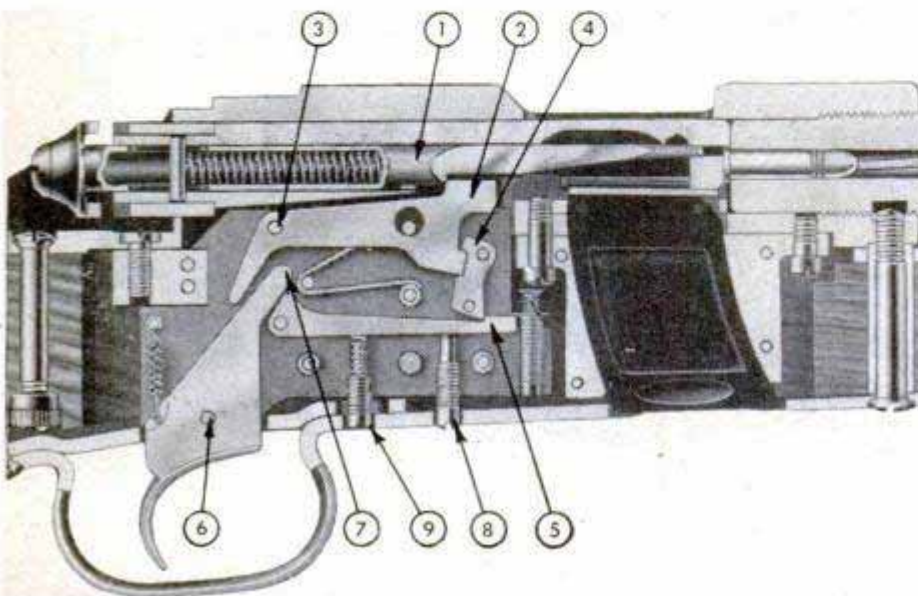
Battered traffic signs are made to look like new in five minutes by means of light-weight steel faces that slip over the original

signs. Available in standard sizes, shapes and legends, the slip-on faces have flanged edges that are quickly crimped to attach them firmly. They can also be used to change sign legends either permanently or temporarily as traffic conditions require.



## "Micro" Trigger Has Little Motion

Through a system of interlocking levers, a new rifle trigger requires very little movement, producing virtually no vibration to affect the shooter's aim. The trigger is a feature of the new Model 52 Winchester .22-caliber rifle for match shooting. The trigger moves only .003 to .005 of an inch, but the movement is increased almost 500 percent by the lever system. The firing pin (1) is held in the cocked position by the sear (2). Pivoted on pin (3), the sear tends to move downward but is blocked by the rocker (4). The rocker, in turn, is held in place by the long trigger lever (5). The trigger is pivoted on pin (6). When it is pulled, it engages the rear end of the lever at point (7) to release the other parts and permit the firing pin to move forward. Two screws (8 and 9) permit the shooter to make adjustments affecting the movement and pull of the trigger.







## Back-Yard Butterflies

Giant butterflies, one with a wingspread measuring more than four feet, decorate the lawn of Jesse Douthat's residence in Nescopeck, Pa. The huge insects perch on

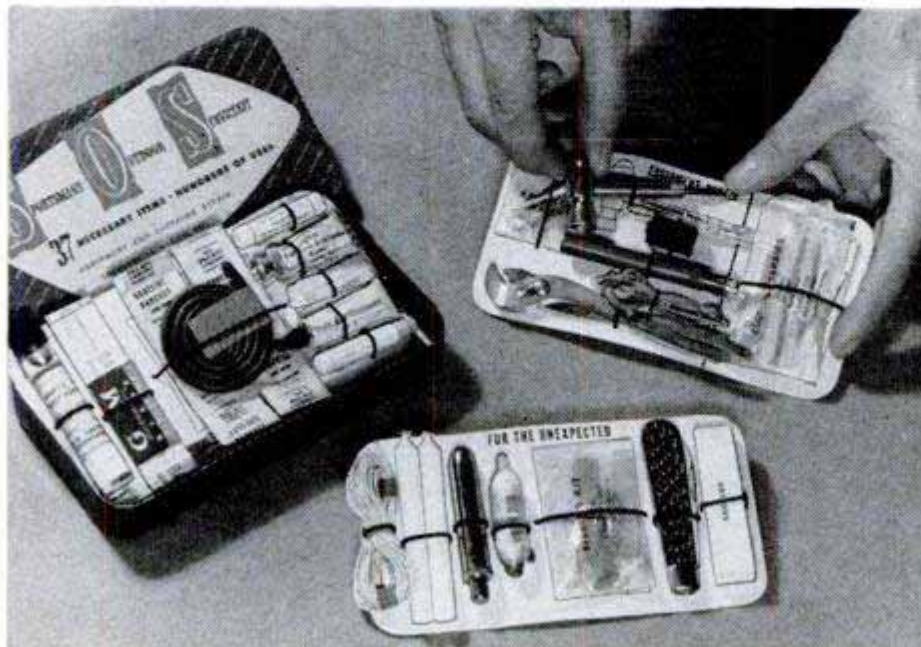
equally large sunflowers and oak leaves. Douthat, a retired cabinetmaker, fashioned the lawn decorations from wood. The giant insects are painted orange and black with markings that are patterned after monarch butterflies.

## Button Clipped to Ear Warns of Oxygen Loss

Clipped to the pilot's ear, a tiny button sets off a signal that indicates the oxygen supply is leaking or the hose is disconnected. It causes a red light to flash on the instrument panel. The device operates on an electric-eye principle, using the ear lobe as a light filter. It detects the blood's change to dark red when oxygen is lacking and causes the light to flash, warning the pilot of the possibility of passing out. Dr. Kurt Kramer, physiologist at the U. S. Air School of Aviation Medicine at Randolph Field, Texas, developed the safety device for airmen.



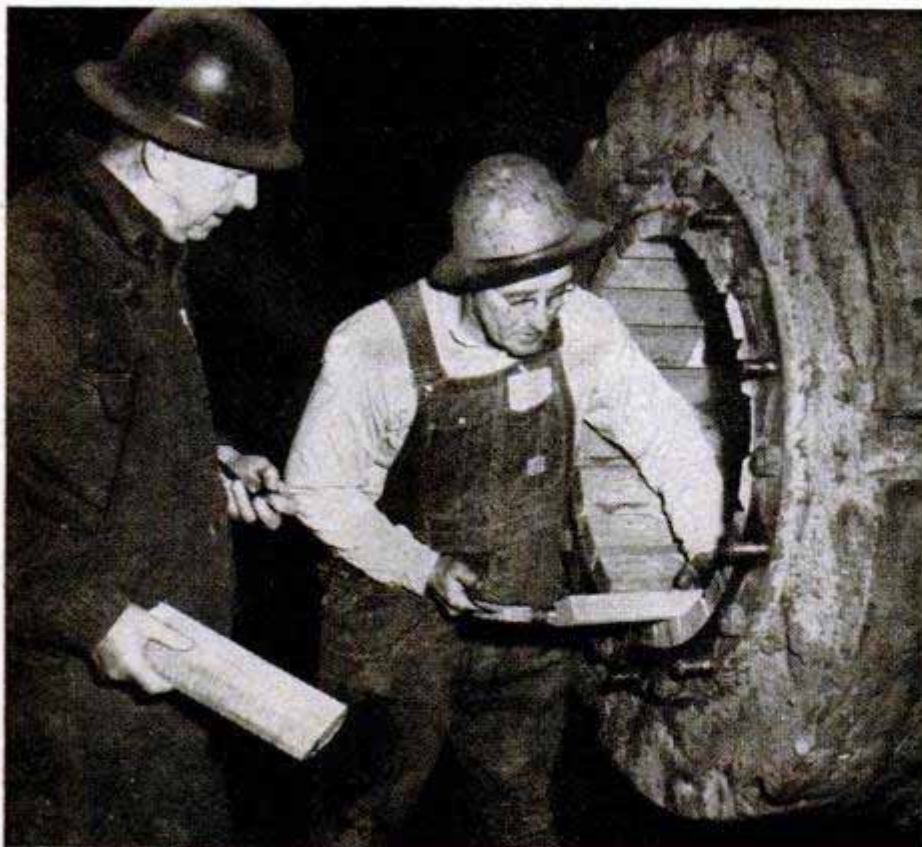
U. S. Air Force photo



## Emergency Kit

Almost anything the sportsman might need can be found in a new emergency kit small enough to fit into a jacket pocket. The little metal box, filled with medical supplies, tools and other items, weighs only 10 ounces. The 37 items include a hammer, screwdriver, pliers, fishhooks, fish-line, flashlight, needle and thread, candles, matches, lighter fluid, razor blade, insect repellent, tweezers, adhesive tape, ointment and iodine.

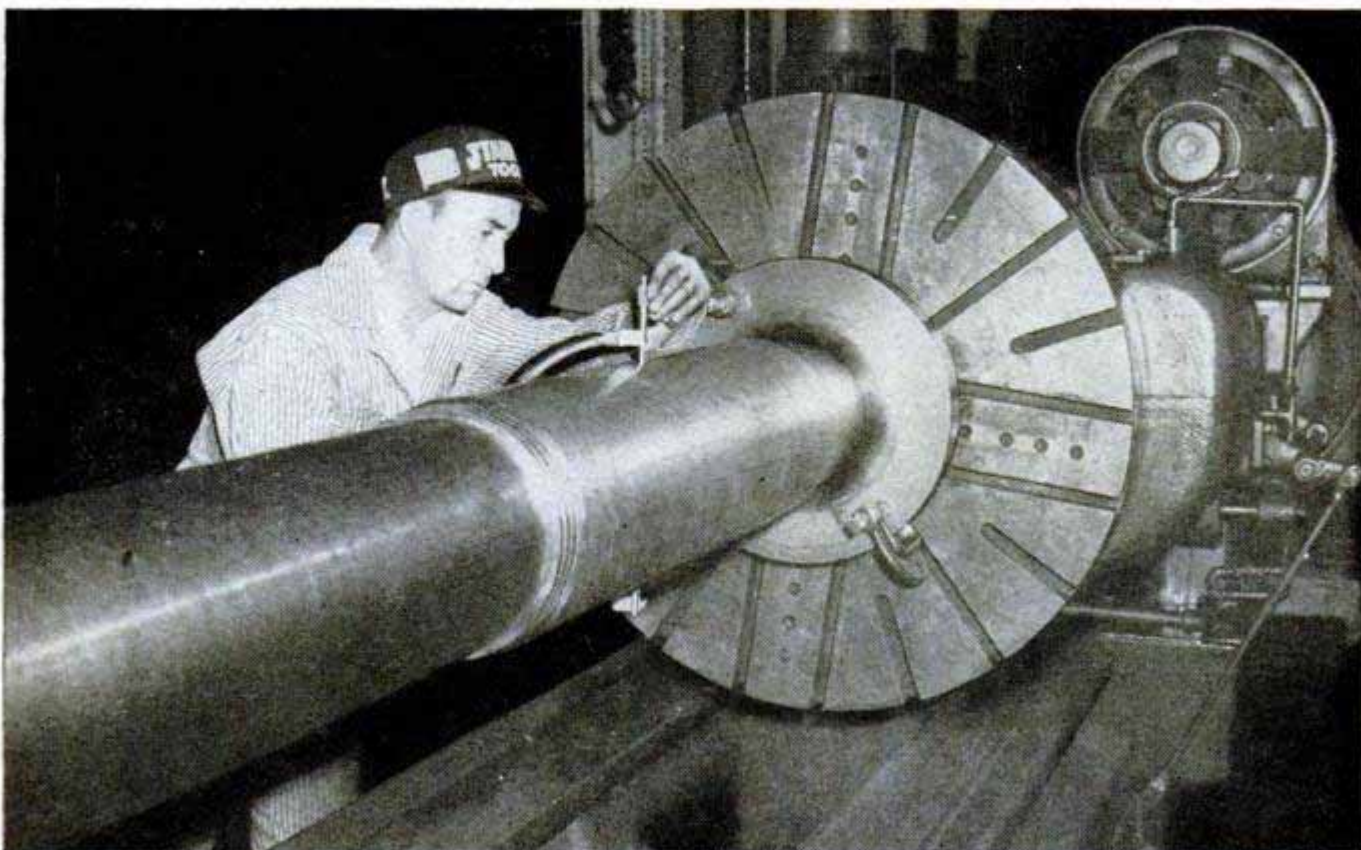




Shipyard worker drives lignum-vitae block into propeller-shaft bearing

## FITTING SHIPS with WOODEN BEARINGS

Wooden bearings will encircle this propeller shaft which is being planed and calibrated for a Liberty ship



By Gene D. Legler

**S**HIPS ARE miracles in metals, but it seems that shipbuilders can't do without the primitive tree.

While wood has nearly lost its foothold in the mechanical field now absorbed by metals and plastics, it still is vital to the economical, trouble-free operation of ships weighing from a few tons to over 83,000 gross tons.

The huge steel shaft that spins a ship's giant propeller operates in bearings made of a special kind of wood called lignum vitae (wood of life). It is an oily, rock-hard wood so heavy it won't even float. Lignum vitae is sent to shipyards in log form cut from trees growing mostly in Central America. The average price of the precious wood in the United States is about 10 cents a pound. A completed tail-shaft bearing for a large ship weighs about 1500 pounds.

When a vessel is dry-docked and bearings for



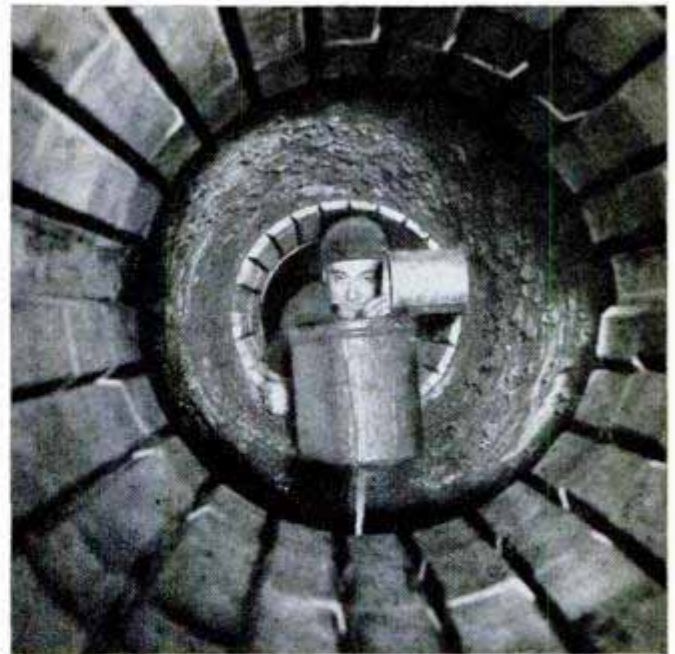


**Rock-hard lignum-vitae logs, from which blocks will be cut to form a vital tail-shaft bearing on ship**

the big "screws" need replacing, as they do about once every three or four years, shipyard carpenters cut lignum-vitae logs into blocks about three inches wide, two inches thick and 10 to 12 inches long. It takes two bearings, inboard and outboard, to make a completed bearing. About 150 blocks make up an outboard bearing approximately seven feet long and 24 inches in diameter; about 75 blocks make an inboard bearing nearly three feet long.

The blocks are trimmed along each side

**Electric boring mill, equipped with chisel-like blades, trims the wooden bearings to exact thickness**



**Workman deep inside shaft tube bails out salt water trapped between the inboard and outboard bearings**

at the base and cut at an angle on each side at the top. When installed around the propeller-shaft tube, the blocks fit tightly at the base and hold each other in place. A series of Vs around the inside of the bearing allows salt water to lubricate this part of the shaft.

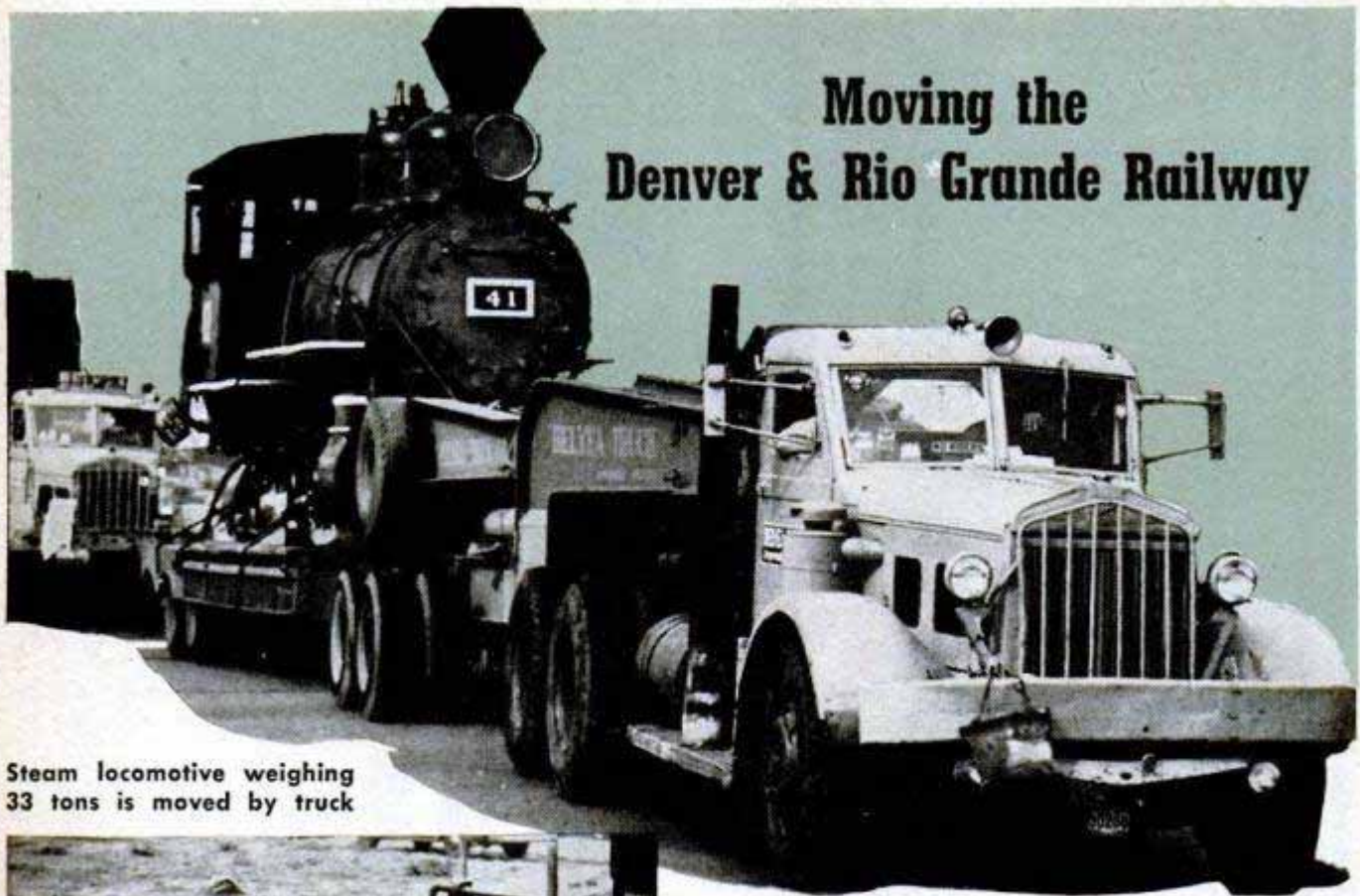
Once installed, a boring bar is firmly set through the center of the propeller-shaft tube around which a boring mill with chisel-like blades spins to trim the wooden bearings to specified thickness.

**Bandsaw cuts edges of bearing pieces so they will form Vs for salt-water circulation around the tube**





## Moving the Denver & Rio Grande Railway



Steam locomotive weighing 33 tons is moved by truck



IT WAS quite a problem—moving a railroad from Colorado to a ranch in southern California. Walter Knott recently purchased the historic Denver & Rio Grande Railway. He built a narrow-gauge track, then set about moving the rolling stock. Locomotives and cars were moved to a spur line on railroad flatcars, then hoisted onto trucks and hauled to the ranch. The trucks were backed into a trench and the stock eased off onto its own new track.

Left, hand jack is used to align wheels of caboose with the track. Below left, with truck backed into a trench, locomotive is eased onto the narrow-gauge rails. Below, locomotive moves off, ready for a run







Fishery scientists help make possible hauls like this. Below, at the school are students from Siam, India, Iceland and other nations

# FISH ON THE RESEARCH MENU

By **George Phillips**

**H**OW OLD would you say those rainbow trout are?"

The question was put by Dr. Lauren Donaldson, director of the Applied Fisheries Laboratory in the nation's only professional school of fisheries at the University of Washington in Seattle. He was pointing at some 13 and 14-inch colorfully freckled beauties cavorting in a tank of the school's new million dollar building.

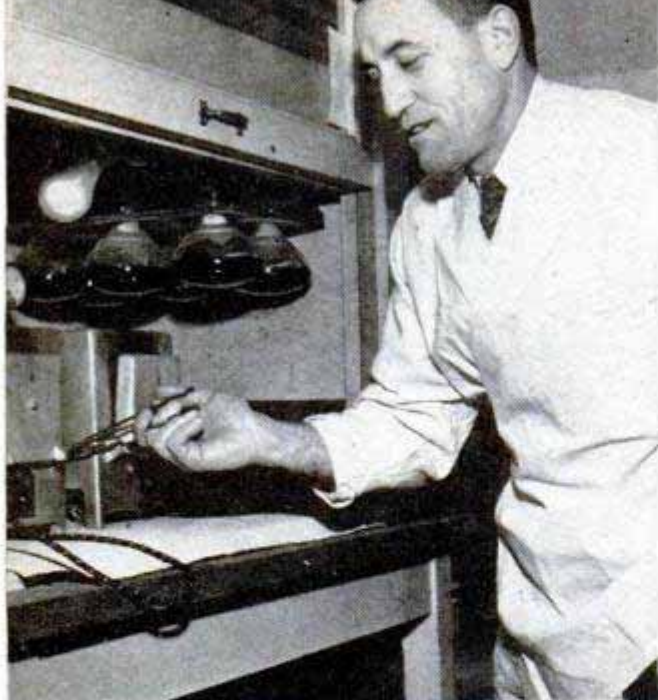
We hazarded a guess. "Three or four years old."

"One year," replied Doctor Donaldson. "Trout more than ready for the frying pan in a year—just goes to show what you can do with selective breeding."

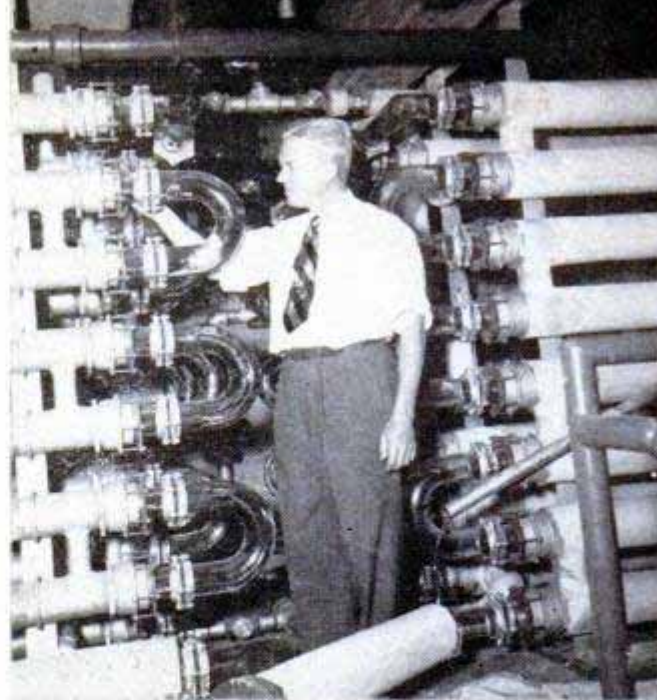
Normally, trout are only 4 or 5 inches long at one year. The "educated" fish at the University of Washington have other qualities, too. They reproduce in two years. The wild strain from which they sprang required four years. Also, more eggs are laid.







**Fish caught at the Bikini atom-bomb area are tested for radioactivity by Dr. Lauren Donaldson at the lab**



**Doctor Van Cleve, head of the School of Fisheries, inspects the laboratory's complex plumbing system**

Various game-department officials are now queueing up to get starts of the superstrain for their hatcheries.

But selective breeding is only one of many scientific enterprises performed in the amazing school building, which has up to 3600 gallons of water flowing through it per minute—enough for a good-sized city.

The two-story brick building is located on the brink of one of the nation's most important fishing areas. Many fishermen setting out to sea with their nets get a

glimpse of the structure at water's edge of Portage Bay, near the entrance to Lake Washington Canal. In the building are classrooms, laboratories, offices and a library with fish information going back to pre-Biblical days. The school harbors a good share of the world's 20,000 known species of fish—alive, stuffed or pickled.

Basically, the University of Washington's School of Fisheries is concerned with fisheries biology and conservation. It wasn't always thus.

**Any of three kinds of water can be turned into an outdoor tank to duplicate fish habitats anywhere in world**





In 1913, Hugh M. Smith, then U. S. Commissioner of Fisheries, suggested to University of Washington officials the establishment of a school "to train fisher-folk" in more efficient methods of fishing, as well as in the handling and processing of the catch.

At that time, fish in the Northeast Pacific were abundant. Washington fishermen were not only harvesting the salmon runs that spawned in the rivers of Oregon, Washington and British Columbia, but were also plying the deep waters offshore and in the fisheries of Alaska. The need then was not for more fish, but for more fishermen.

After delays due to World War I, the University of Washington established its School of Fisheries in 1919—to produce more fishermen. Now the need has changed and so has the school. It is out to help the fish—and in the long run the fishermen.

Most expensive feature of the new building is its plumbing — \$500,000 worth. Turn on a faucet and one of five different kinds of water will gush out. Running through the building are lake water, warm and cold salt water, and chlorinated and dechlorinated water from city mains.

Special pipes lined with glass or rubber had to be installed for the salt water, as the salt is rough on ordinary steel pipes. An elaborate filtering device had to be constructed to take the chlorine out of city water. It operates as a sort of aquatic "gas mask."

Not only must the supply of water to various tanks be maintained continually, but the temperature must be kept at the required degree for a particular experiment. Scientists can duplicate in the building the water of any ocean, lake or river in the world. One tank may have simulated in it the icy waters of the North Pacific, another the tepid, plant-spawning waters of a tropical lagoon.

Just as in a large hospital, there are special rooms for special cases. Diseased piscatorial patients are kept in one laboratory;



Fish are not just something to catch and cook at the lab, they are subjects for careful experimentation as science tries to solve their secrets

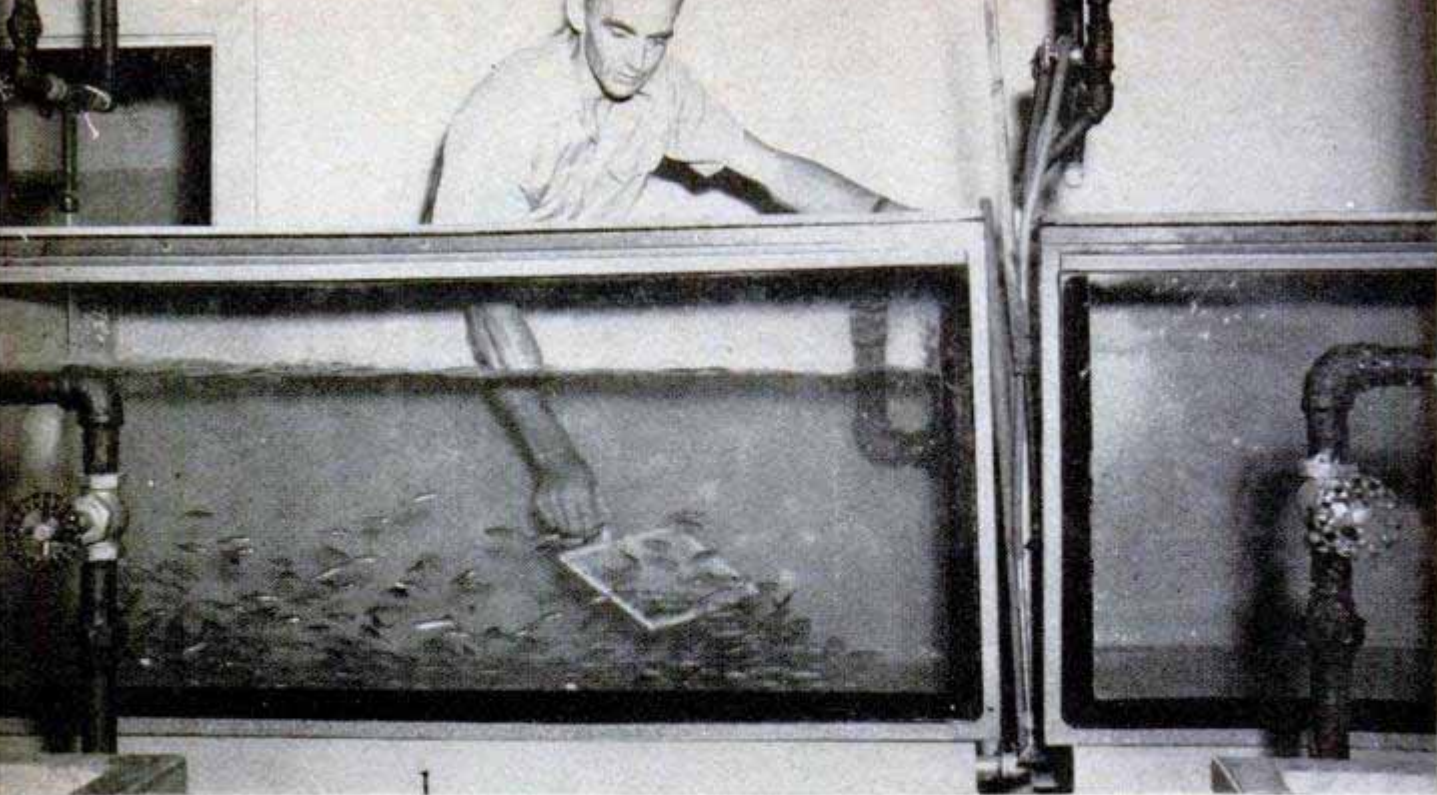
those on special diets are kept in another.

Currently, extensive experiments are being conducted with thousands of specimens of fish and plant life from the waters of the Bikini area where the atom bombs were set off. The Applied Fisheries Laboratory was established by the federal government at the school under Doctor Donaldson's direction for the primary purpose of studying radioactivity in aquatic organisms.

"Most of the equipment in the building had to be specially built," said Doctor Donaldson. "We even had to design our own tanks, and figure out ways of heating and cooling the water."

There are hundreds of power saws on the market, for instance, but not one suited the special need of the School of Fisheries. That need was for sawing small fish bones without tearing them or leaving rough edges. A specially designed saw with a fine-toothed, circular blade is now doing the job.





Fish in these tanks are fed special diets. They are removed regularly so their growth can be measured

The bones are cut and studied to determine the age of a fish. Fish bones show structures like the rings in a tree. Because of seasonal differences in mineral deposits, bone development in the winter has a different shading from that in the summer.

Now under construction at the school is a new type of glass observation tank. It is designed somewhat in the manner of an angel-food cake pan, and a researcher can observe the fish from either the center of the tank or the outside. The tank is particularly adapted for studying the reactions of fish to various lures.

An experiment with potent possibilities is being conducted at the University of Washington by a scientist from the University of Wisconsin. Although a fish's sense of smell is feeble, the researcher is checking on what odors attract fish, what odors repel them. The fishing kit of the future

may well contain an atomizer and scents.

A major project is the study of the productive capacity of the Puget Sound area.

"We are evaluating the fertility of areas," explained Dr. Richard van Cleve, director of the school, "and then determining what can be done to improve them."

Studying of a new postwar problem in the fishing industry is now causing the school again to deviate somewhat from biological aspects.

"While the prices of the raw product and of labor were low, fresh fish and manufactured fish products could compete on the open market with other foods by selling at lower prices," said the school's director. "Good profits could be made so there was little inducement to improve the handling or processing of fish.

"It was easier still to sell fish at high prices during the war and the increased cost of the raw products caused little concern. Profits rose still higher. Now the inevitable readjustment is taking place. With general inflation still holding, the fishing industry finds that its past neglect of the search for better methods of handling fresh fish, of canning and the development of new and more desirable products has caught up with it."

The school, consequently, is trying to do its part in helping the industry to get in stride with the changed conditions. Meanwhile, attention is also being given the sportsman.

"The sport-fishing pressure is so great in  
(Continued to page 246)



Fish bones are sliced carefully on a circular saw and age determined by a study of the growth rings



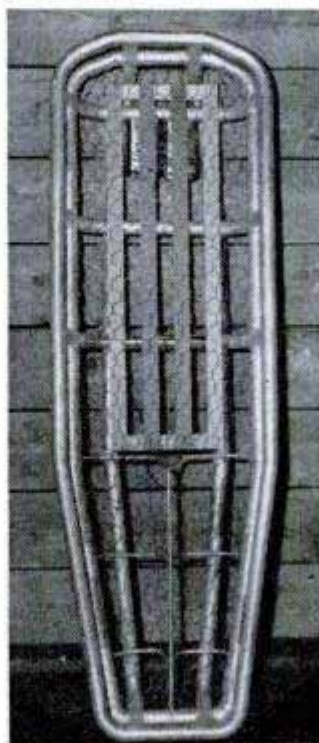
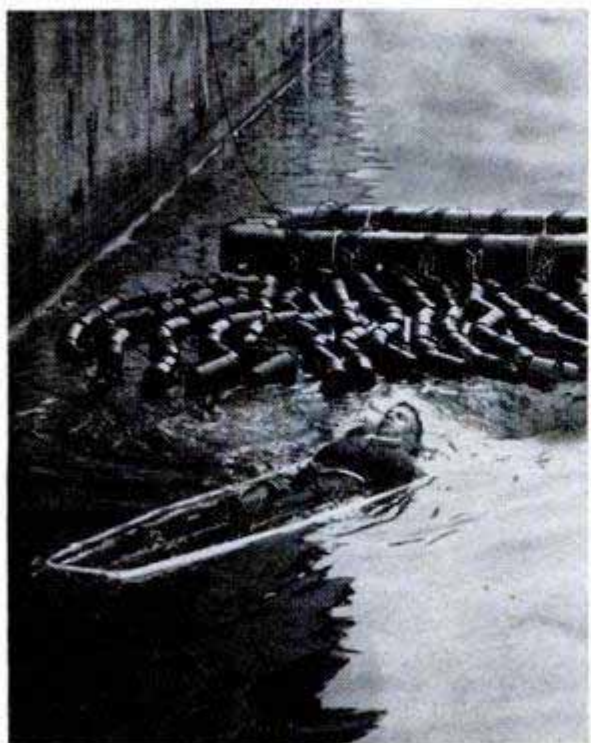
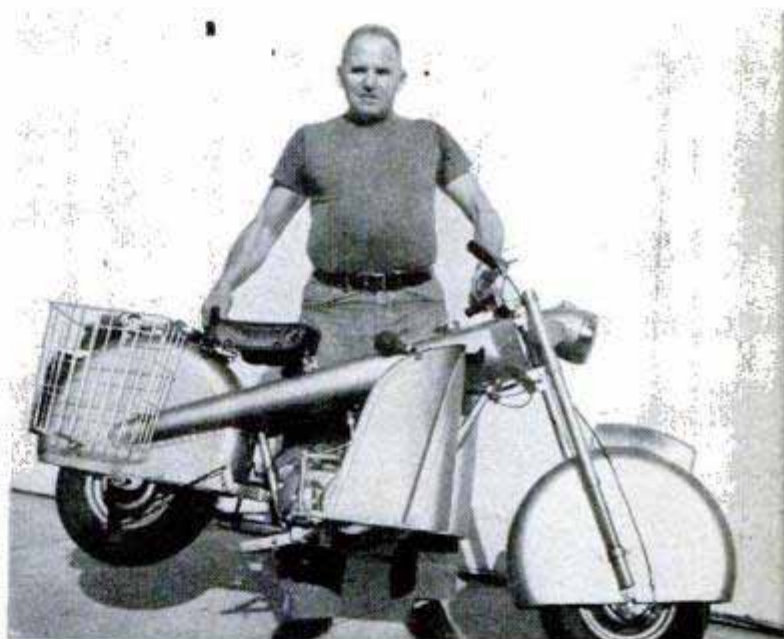
## Swinging Mailbox

Snowplows can't knock over a swinging mailbox—all they can do is push it aside. It is the invention of Earl W. Dotten of Cromwell, Minn., and it promises to end the farmer's chore of replacing R.F.D. boxes knocked down by snowplows. The mailbox is mounted on a four-foot extension arm. A heavy spring returns the arm to the correct position if it is pushed in either direction. Dotten is not yet decided if he will market his invention.



## Aluminum Scooter

Made mostly of aircraft aluminum, a new motor-driven scooter manufactured in England weighs only 117 pounds. A roll of aluminum replaces the usual tubular framework. The roll contains the gas tank and supports the engine, which has a two-speed transmission and weighs only 35 pounds. The little vehicle has a top speed of about 50 miles per hour and will travel 130 miles on a gallon of gas, according to the manufacturer. Aluminum fenders and leg shields give the scooter a bright, streamlined appearance. A de luxe model with a three-speed transmission and larger engine is also available.



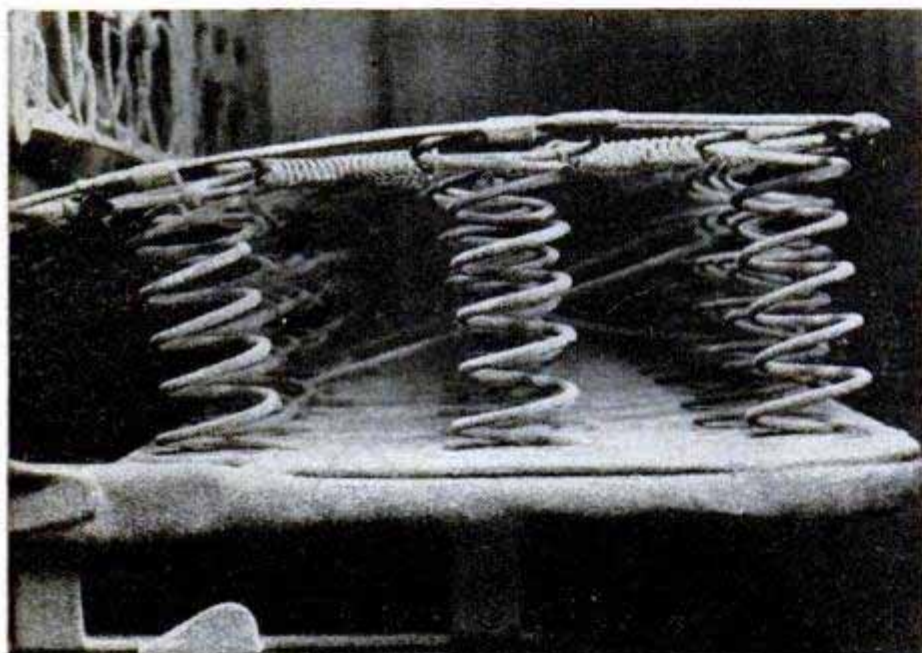
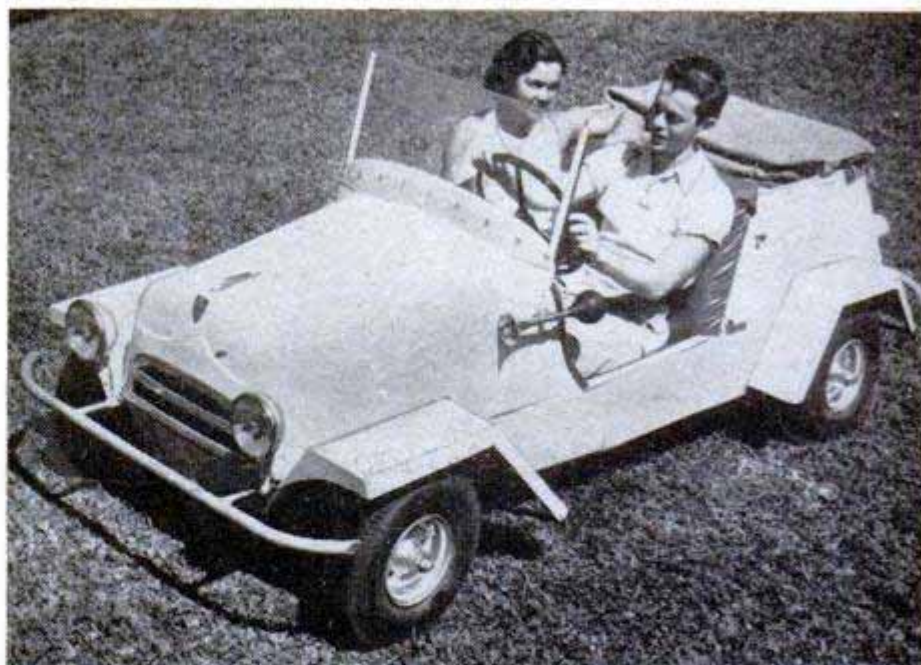
## Floating Stretcher

The danger of accidentally losing a patient overboard during ship-to-ship transfer is lessened by a newly perfected floating stretcher. Made of 1½-inch aluminum tubing, it has slots at the head end where a sling can be attached for hoisting. Two ½-gallon airtight tin containers fastened beneath the head hold it high enough so that small waves will not lap over the patient's head and choke him. A patient can right an upside-down stretcher by rolling over as he would in bed.



## Assemble Your Own Automobile

You can assemble your own car from a new kit of parts supplied by the manufacturer. It is powered by a one-cylinder engine rated at  $7\frac{1}{2}$  horsepower. The car comes in small sections which can be assembled by the owner with a few hand tools, or may be purchased ready to drive. Measuring 4 by  $8\frac{1}{2}$  feet, the car costs \$500. On a pound-for-pound basis, the manufacturer points out, the car is cheaper than steak!



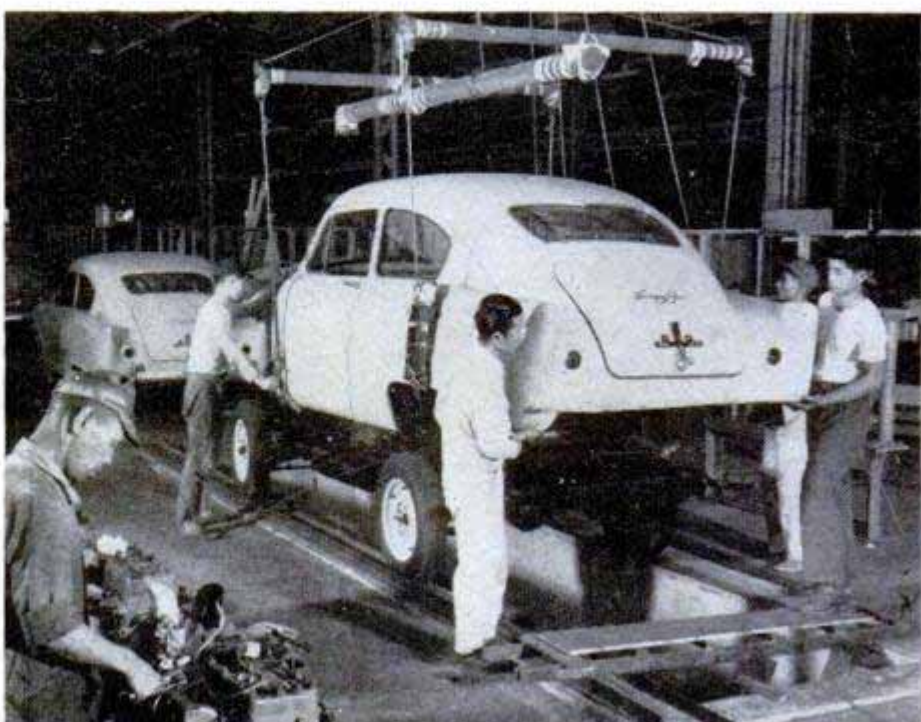
## Rayon Stops Spring Squeaks

Annoying squeaks in springs now are silenced with a coating of rayon flock. The rayon fiber, so finely shredded it takes 250,000 particles to cover a square inch, is applied to the springs over a layer of adhesive. Some automobile seat cushions are already being treated in this way, and the rayon flock may soon be used on bed and chair springs, reports the American Viscose Corp., producers of the rayon flock.

## U. S. Cars Roll Off Tokyo Assembly Line

Just outside Tokyo, late-model U. S. cars are rolling off an American-made assembly line. Parts for the Kaiser-Frazer automobiles are made in this country and shipped to the foreign capital for assembly by Japanese laborers as a means of reducing the cost of cars distributed throughout the Orient. Production rate at the Tokyo plant is 400 cars a year.

U. S. warships are being equipped with tripod masts made of aluminum.





# the **POPULAR MECHANICS** CRAFTSMAN



## DECORATE WITH PLASTIC FABRIC

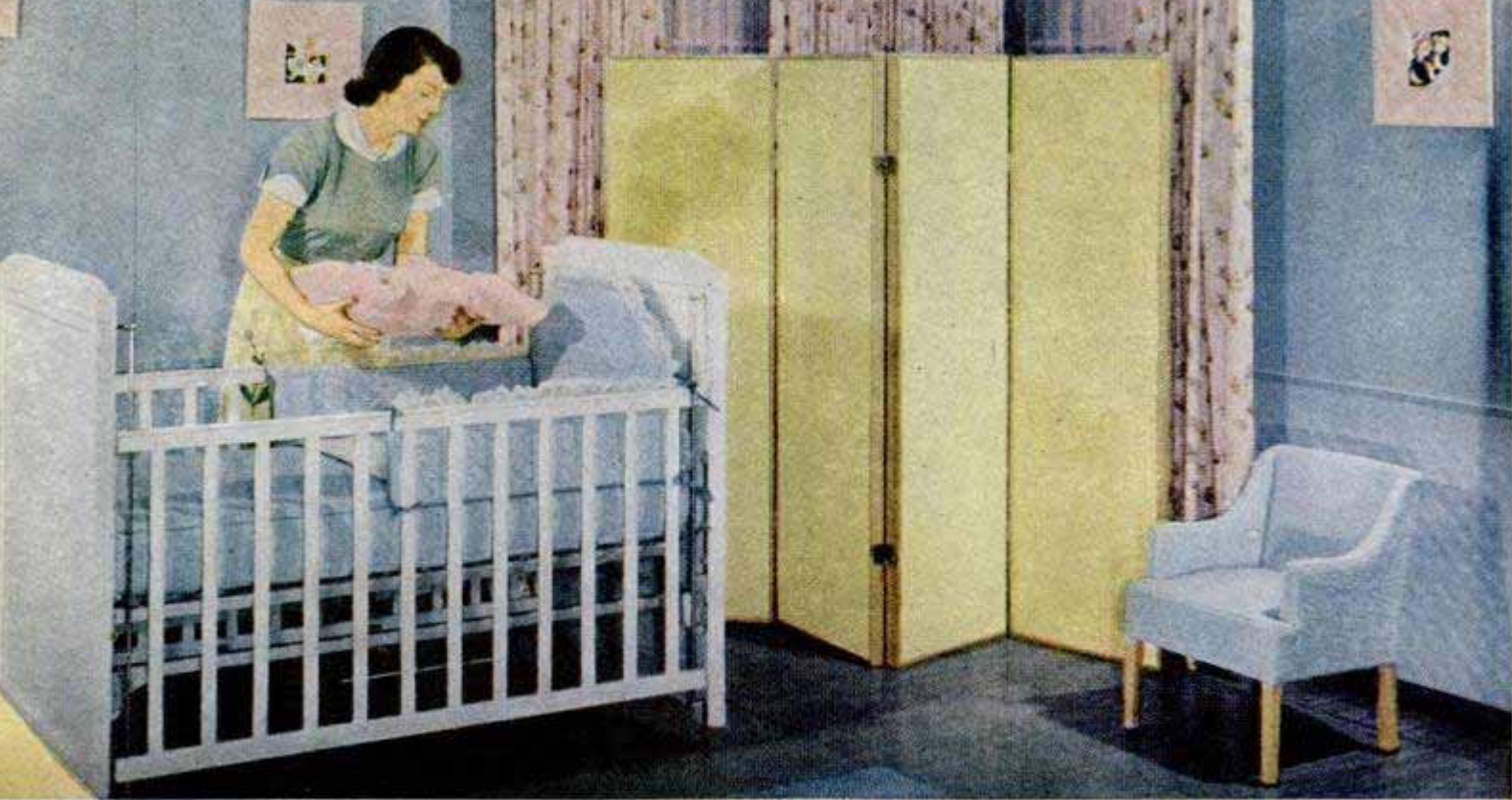
*By Frank N. Stephany*

**H**AVE YOU SEEN what they've done to plastic? It's been quilted and embossed to look like fine upholstery fabric, and yet it retains a texture and sheen all its own. Refreshingly different, these easily handled materials provide a new "finishing" media for the home craftsman as well as a wealth of beautiful "fabrics," the very sight of which will give the housewife dozens of decorating ideas. A glance at the pictures on these pages will show you some of the many applications of plastic fabric. In the photo above, for example; the drawer fronts on the chest and the night stands, the

Attractive desk at right demonstrates how quilted plastic is effectively applied to modern furniture







Ease of cleaning makes plastic fabric excellent for use in the nursery. The picture above shows bed and screen panels, chair, wainscoting, mattress and even the picture frames covered with quilted plastic

bed headboard and the lampshades are all covered with quilted plastic—even the bedspread is made of the same material.

The plastic is suitable for almost any decorating purpose that allows it to be stitched or tacked in place. Waterproof, colorfast and wear-resistant, the material is cleaned in a jiffy with soap and water or simply by wiping with a damp cloth, and it will not scuff, chip or crack. It is the ideal covering for furniture to be used in a child's room, as it will withstand normal wear and tear amazingly well. Remember, however, that

Applied to drawer fronts, quilted plastic adds distinctive touch to chest at left. Illustration below suggests unique twin-bed setup, utilizing quilted or embossed plastic on headboards and drawer fronts







Eye-catching lamp, above, consists of simple wooden base covered with plastic and shade covered with same material. Plastic is lapped and tacked at rear of base, and shade is covered in much the same way as when cloth is used, trim being added if desired

although the finish is unaffected by ordinary dirt and grime and is resistant to most chemicals, it is best to play safe and wash off lipstick, ink and other stains of this type as soon as possible.

The quilted plastic consists of a filler of fire-retardant cellulose padding sandwiched between two sheets of plastic. The sheets are dielectrically welded together, an operation that not only holds the padding in place but produces a wide variety of designs and results in a product that has the workability of cloth. It can be cut, punched, tacked, sewed and decorated and, under normal usage, will not come apart, stretch or flatten out.

The quilted material is available in several different designs in both smooth and fabric-textured finishes. The embossed plastic, which is a single sheet having a raised design, can be had in a number of floral and geometric patterns. Leather, wood-grain and marbled finishes may be obtained in plain sheet plastic. Light and heavy-gauge material, as well as a variety of colors are available in the quilted, embossed and plain types of plastic fabric.

The embossed plastic is handled in much

Durable and waterproof, plastic fabric is just the thing for covering a baby carriage. Heavy-gauge material is recommended for bottom and side panels



Sample swatches of quilted, embossed and marbled plastic, pictured above, will give you some idea of the range of patterns, textures and colors available







This modern bathroom is practical as well as attractive. The sides and front of the lavatory cabinet and the wainscoting are covered with quilted plastic which is quickly wiped clean with a damp cloth

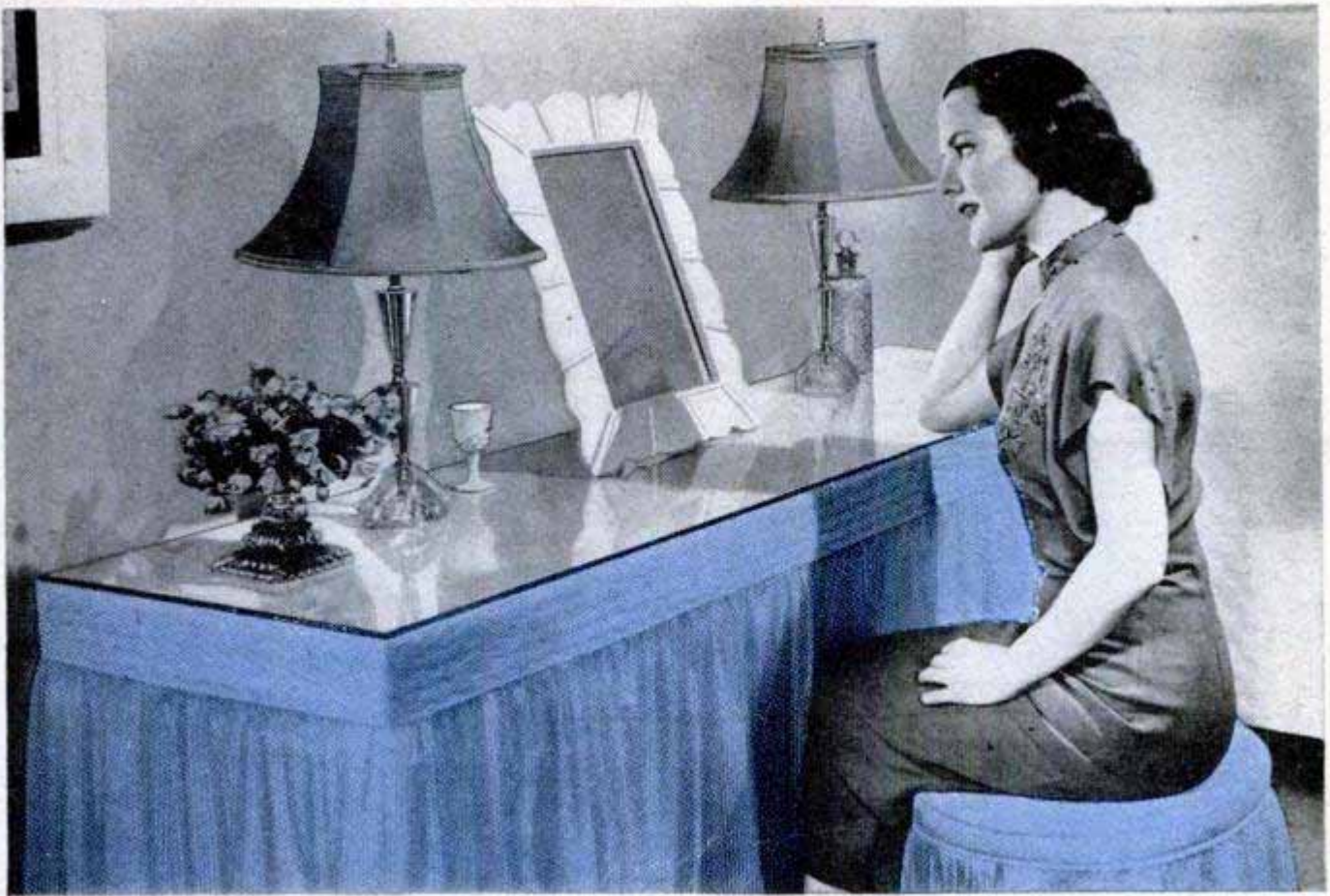
Re-covering the seats and backs of dinette furniture with plastic may be no novelty, but you will be amazed by the striking effects now obtainable with new textured finishes and decorator colors



the same way as the quilted material. There are a few simple rules to remember for best results when using this fabric. Before applying the plastic, sand down or pad all sharp corners and edges. Use plenty of the material so that you do not have to stretch it, and cut it for tailoring the corners as shown in Fig. 1. The column of diagrams labeled "right" shows the proper way to cut into the plastic in order to make folds. Sharp angles, as shown under the heading "wrong," are likely to cause the material to tear under usage. Where possible, cut all notches U-shape, but if a V-shaped notch must be cut, round the point of the notch with a punch or scissors to a keyhole shape as shown. An ordinary sewing machine will do a satisfactory job of stitching the material. Space the stitches 5 or 6 to the inch and do not run one row of stitches over another.

Fig. 2 illustrates how simple it is to reupholster a chair seat or back with the plastic material, whether it is of the quilted, embossed or plain type. After removing the seat from the chair frame, take off the original fabric, pulling out all tacks. Then, using the original covering as a pattern, cut out the plastic. Be sure to cut all the notches U-shape. Spread the plastic face down on a table or bench top and then place the seat, bottom side up, on the plastic. Bring the edge of the plastic around each side of the seat in turn, fastening it with two or three tacks at the center. Then work from the center tacks toward the corners of the seat, spacing the tacks about 1 in. apart. Do not tack too close to the corners at this time, but leave sufficient material free to enable you to make the corner folds. Draw the plastic evenly and tautly enough to assure a smooth covering, but do not stretch it out of shape. Note in the lower detail of Fig. 2 how



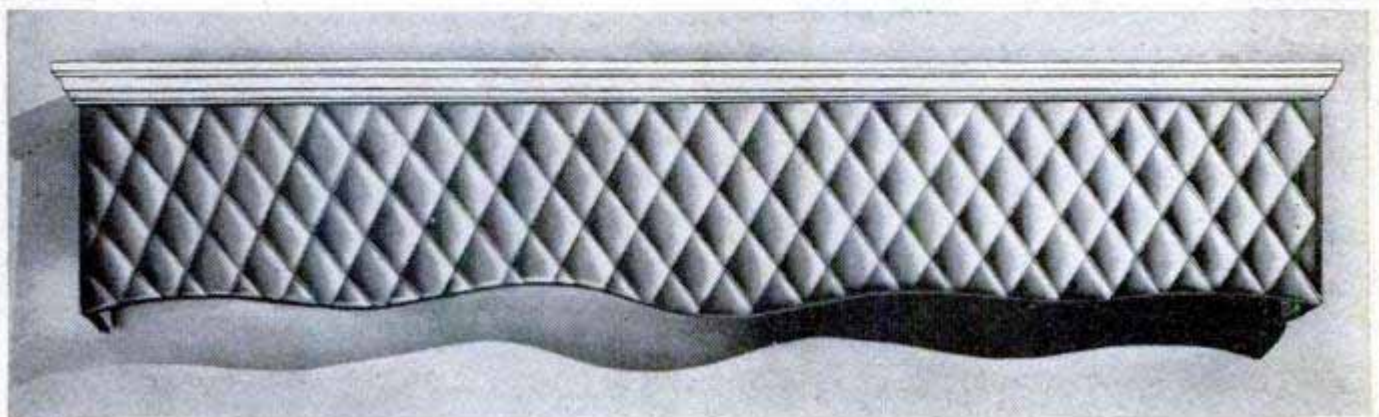
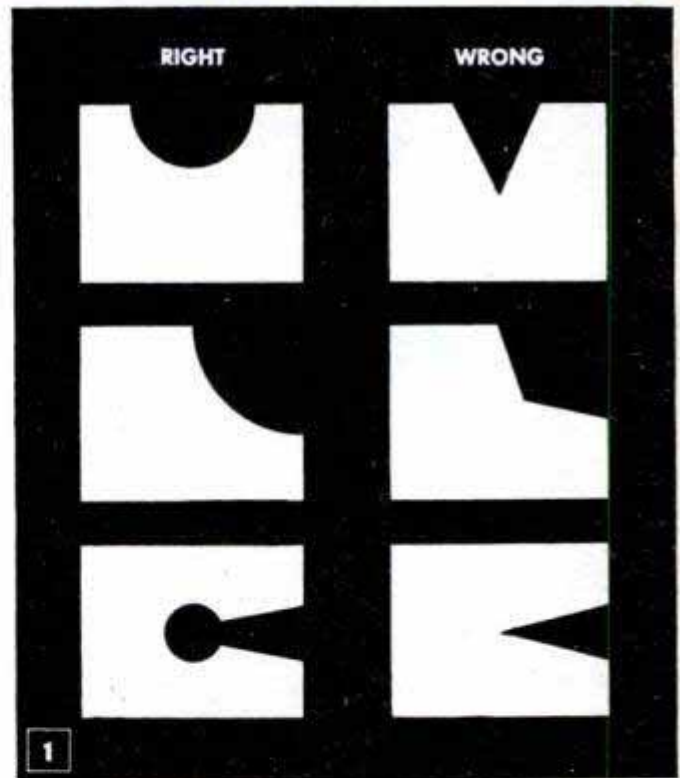


Build rough wooden frame, cover plywood or hard-board top with glass and add a quilted-plastic edging plus a plastic skirt to make the attractive vanity above. Seat also is covered with quilted plastic

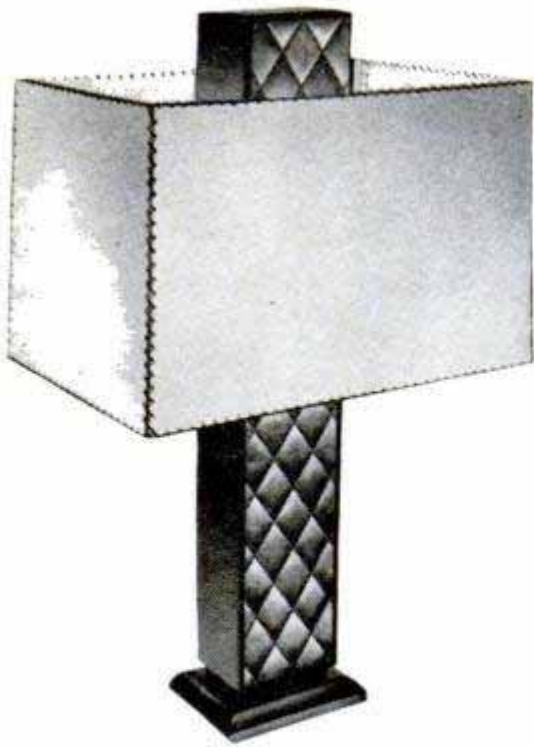
the corners are overlapped and tacked. If necessary, cut the excess material from the corner folds so that the seat will fit snugly on the chair frame. For best results, use tacks with large heads and round shanks, driving them straight. The heads of the tacks should be in firm contact with the material, but they should not be embedded in the frame. Where maximum strength is desired, fold the edge of the material and drive tacks through the double thickness.

To add a professional touch to your upholstery jobs with plastic, you can add welting and tufting as shown in Fig. 3. To make

With colorful plastic fabric, it's easy to transform a plain board or a cardboard-covered frame into a handsome window valance. The plastic is brought around the edges and tacked to inside of the valance







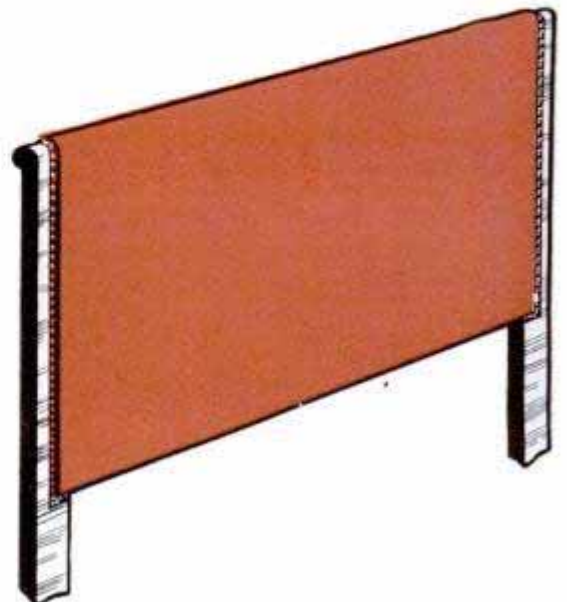
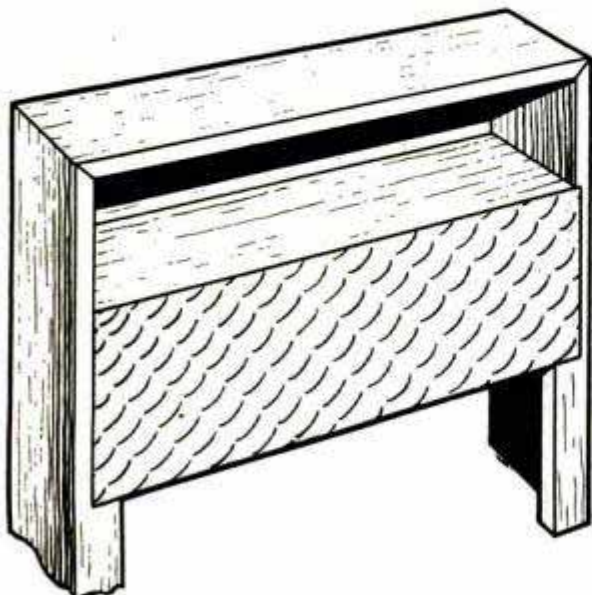
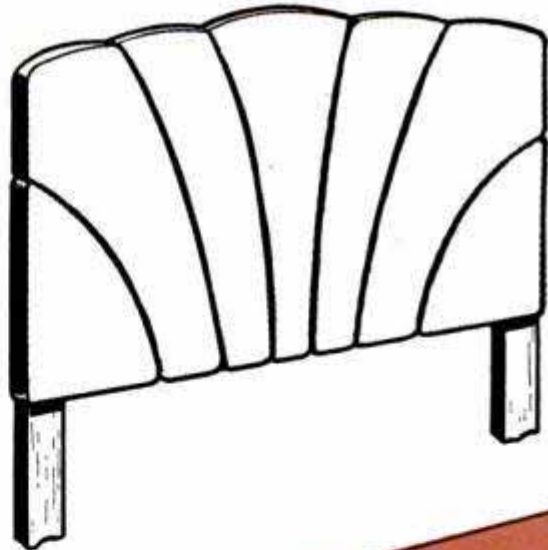
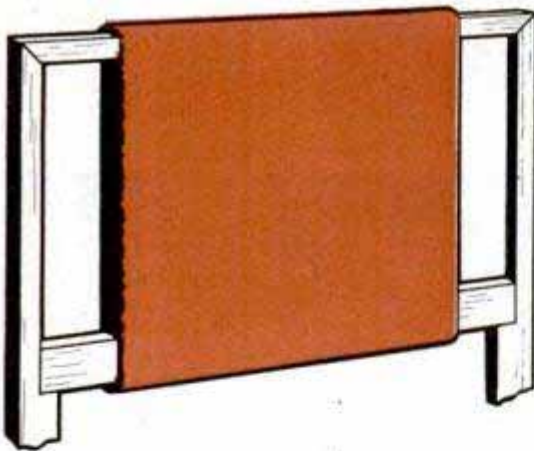
Quilted plastic adds the finishing touch to the base of this extremely modern table lamp. Ply-wood panels can be covered with the plastic and mounted on the base assembly with glue blocks. Color of plastic is selected to suit finish of wood

the welting, plastic strips are wrapped around the welt cord and stitched between the panels, as in the upper details. When tufting a cushion, as in the lower detail, a button having a cloth tab should be used, and this is tied to the cushion springs. It is best to reinforce the plastic directly under the button with a special supporting tape sold for use with this material.

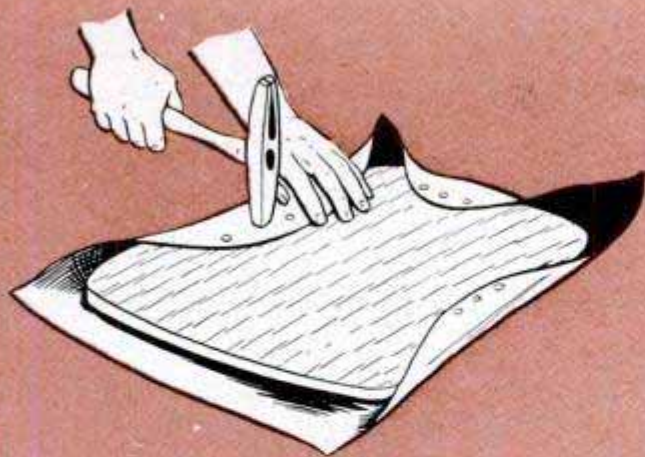
The quilted plastic is especially suitable for protecting and decorating the interior of your car. Scuff pads, of course, can be made quite easily but, if you desire, entire door panels may be removed and covered in this material with little difficulty. Both slip-on and tailored seat covers also can be made.

Window valances and decorative screens are two common uses of plastic fabric, as these require only simple tacking with a minimum of cutting. Furniture nails having colored or ornamental metal heads may be used to fasten the plastic in place and also add interesting decoration. The plastic also provides an excellent material for the hobbyist, as it is an attractive covering for a variety of projects. It has been used with pleasing results for covering of picture frames, wastebaskets, lamp-bases, as trim on desk-blotter holders and for decorating similar items. Both the quilted and

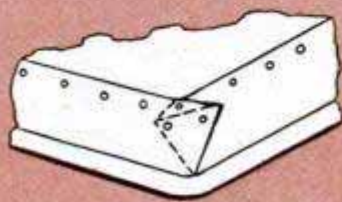
The four headboards pictured below lend themselves to upholstering with plastic fabric. Padded with cotton, the plastic is tacked to the backs of the headboards or fastened to the fronts with decorative furniture nails







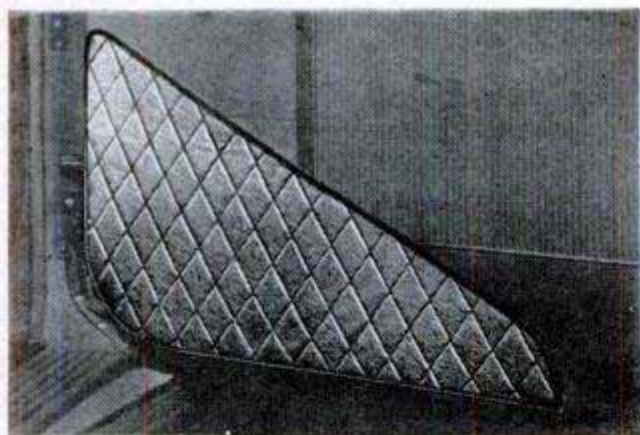
BEGIN TACKING AT THE CENTER OF EACH SIDE AND WORK TOWARD CORNERS



FOLD CORNERS LIKE THIS, CUTTING AWAY EXCESS MATERIAL



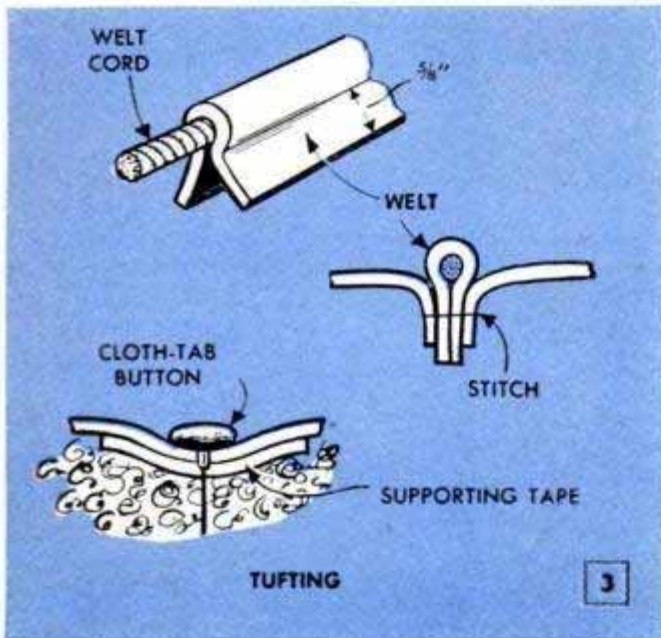
2



Sturdy plastic scuff pads protect upholstery of family car, above. The crib, right, boasts quilted-plastic headboard panels, while plastic-covered toy chest, below, speeds mother's house cleaning





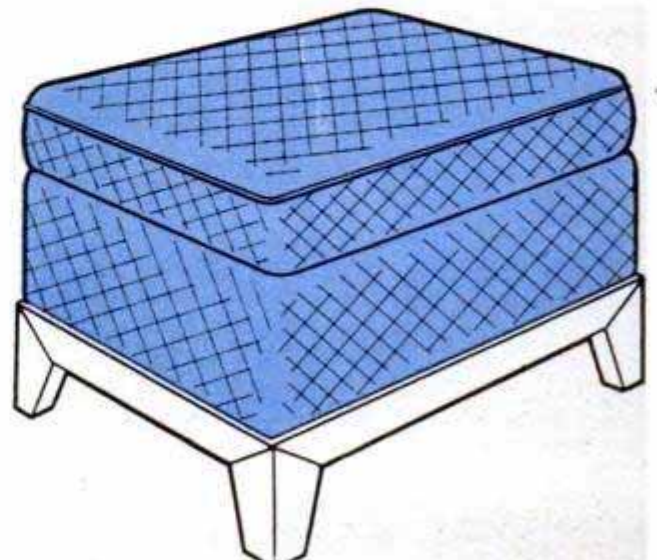


Quilted plastic is used extensively on the juvenile furniture pictured above. Note how material is employed on cabinet side panels and all around the bed

embossed plastics also can be used to make attractive handbags, crib padding, beach and knitting bags and for covering such items as hatboxes and vanity cases. In other words, whether you are most interested in an attractive pattern, a harmonious color or merely in durability, you will find that plastic fabrics offer a combination of all three. Just remember the few simple rules for applying the material and you can be sure of a satisfactory covering that will give you the maximum in service and retain its original color for years.

Photos and certain information courtesy Bolta Products Sales, Inc. and The Jason Corp.

The child's rocker, lower left, is completely upholstered with quilted plastic. Plastic-covered footstool, shown below, is a useful home-workshop project

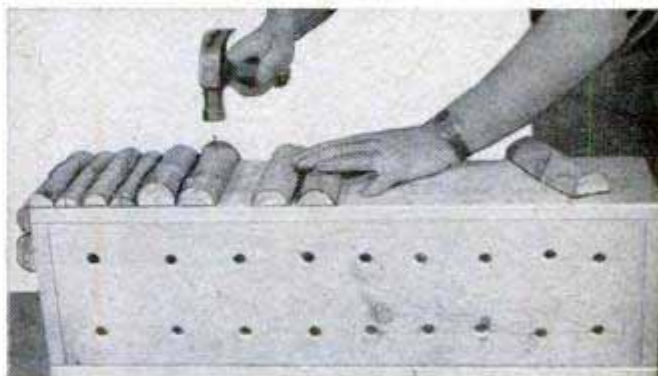
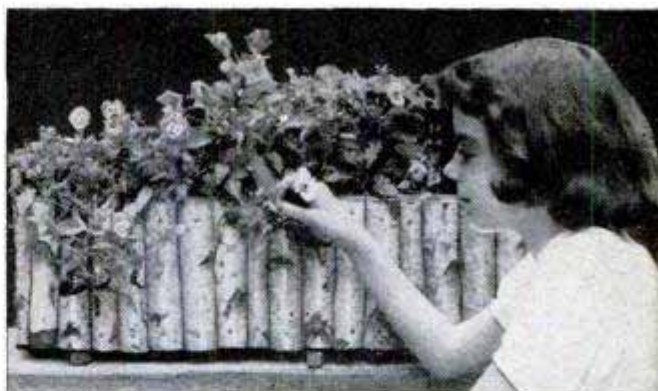




## Rustic-Appearing Window Box Is Trimmed With Birch Limbs

Requiring no finish of any kind, this rustic window box is trimmed with split lengths of birch limbs, which improve in appearance with weathering. The box itself may be made from low-grade stock, but should be assembled with screws to check warpage. Note that a number of holes are drilled in the bottom to provide for drainage. Saw the birch limbs into suitable lengths, then split them on a bandsaw, or clamp each length in a vise and rip it by hand. Then drill the halved lengths for nailing to the box.

Harrison Neustadt, New York City.



## Repairing Lawn-Mower Roller

Short lengths of pipe inserted in the worn ends of a wooden lawn-mower roller provide metal bearings which make the roller operate like new. Sections of 1/2-in. pipe are cut to fit flush with the ends of the roller and are held in the holes with wood putty. If 1/2-in. pipe is too large for your particular roller, sections of brass or copper tubing of the correct inside diameter may be used in the same manner as the pipe.

W. F. Schaphorst, Newark, N. J.

## Cellulose Mop Used to Paint Floors

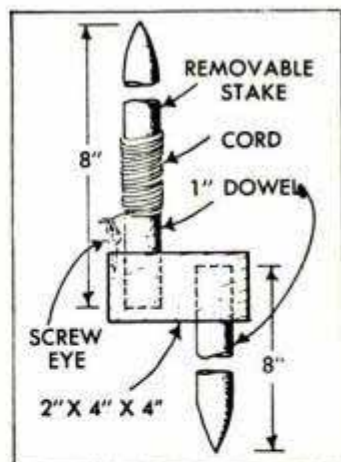
A cellulose mop that can be obtained at any hardware store saves both time and labor in painting concrete floors. The mop first should be soaked in the same solvent as is used in the paint to soften the mop. Then squeeze out the excess solvent, pour paint on the floor and use the mop in the regular manner.

Walter Haase, Hartford, Conn.



## Reel Aids in Laying Out Straight Garden Rows

Straight, uniformly spaced rows of vegetables not only are a source of pride to every home gardener, but also are more efficiently cultivated with hand tools or a wheel hoe. This garden reel makes it easy to lay out straight, spaced rows on large and small seedbeds. It consists of two pointed stakes made from 1-in. dowel stock and inserted in holes drilled near the ends of a short block. One of the stakes is fastened in the block, while the square end of the other is sanded for easy removal from the hole in the block. In use, the line is wound on the loose stake and the end tied to a screw eye located near one end of the block. The fixed stake is driven into the ground at one end of the seedbed, the loose stake is removed and the line unreeled to the desired length. Then the loose stake is driven into the ground at the opposite end of the bed to hold the line taut while a trench is opened along the line with a hoe or furrower.

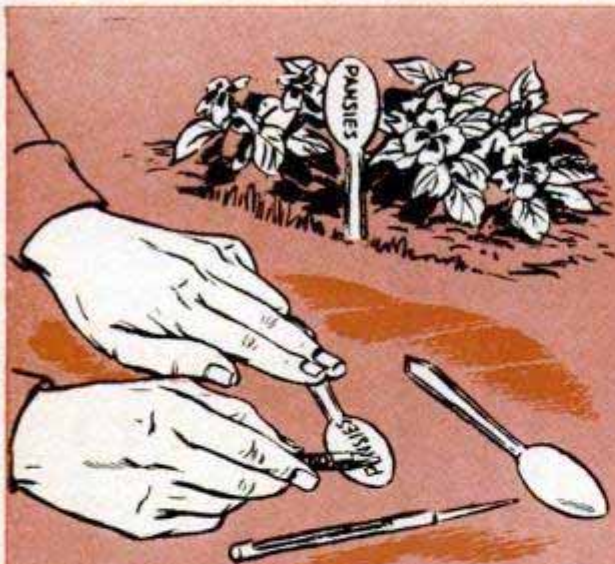


The fixed stake is driven into the ground at one end of the seedbed, the loose stake is removed and the line unreeled to the desired length. Then the loose stake is driven into the ground at the opposite end of the bed to hold the line taut while a trench is opened along the line with a hoe or furrower.

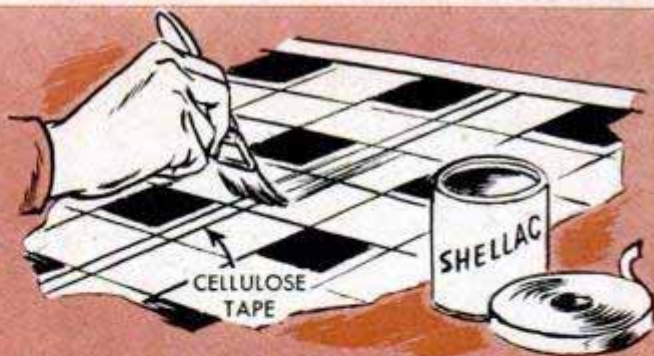
Homer E. Lee, Bedford, Ind.

☐ If you scratch or mar furniture with your mop handle, wrap the handle with velvet ribbon and stitch it to make a neat sheath.





**WEATHERPROOF GARDEN MARKERS** are improvised quickly from plastic picnic spoons. Labels are scratched on backs of spoons and lettering filled with crayon of contrasting color

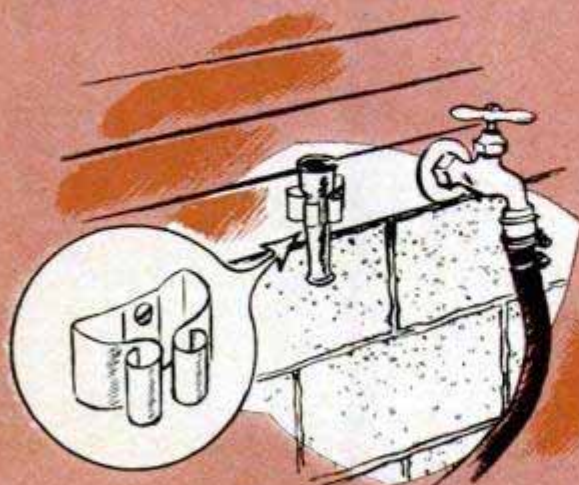


**CELLULOSE TAPE** seals and smooths the seams of linoleum floors. The tape is stretched the full length of the joint, pressed down evenly and then covered with a coat or two of clear shellac

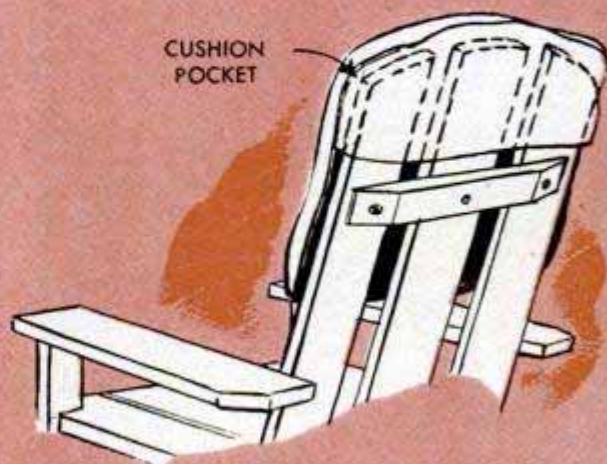
## Solving HOME



**PAIR OF BRACKETS** fitted with dowels provides convenient skirt hanger. Loops are added to skirts

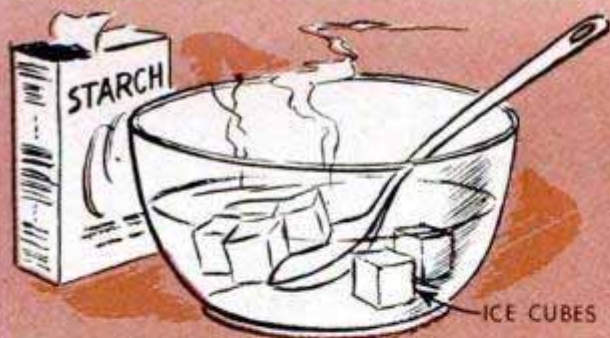


**GARDEN-HOSE NOZZLE** won't be mislaid when not in use if set in holder near sill cock. Broom clamp fastened to the house provides a suitable holder

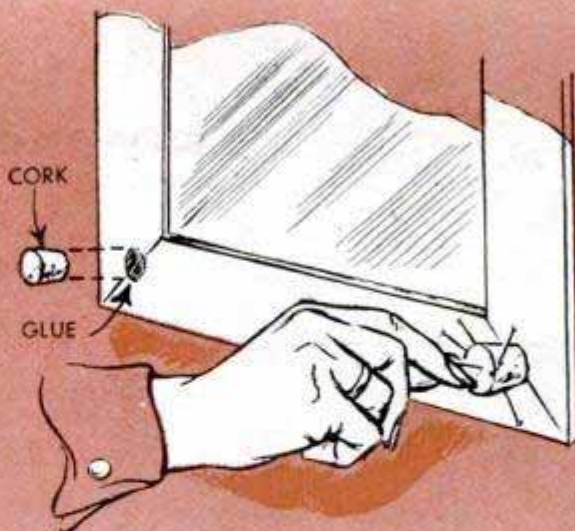


**LAWN-CHAIR CUSHION** fitted with pocket is hung on back of chair so it will not slip down when in use. Make pocket of same material as cushion



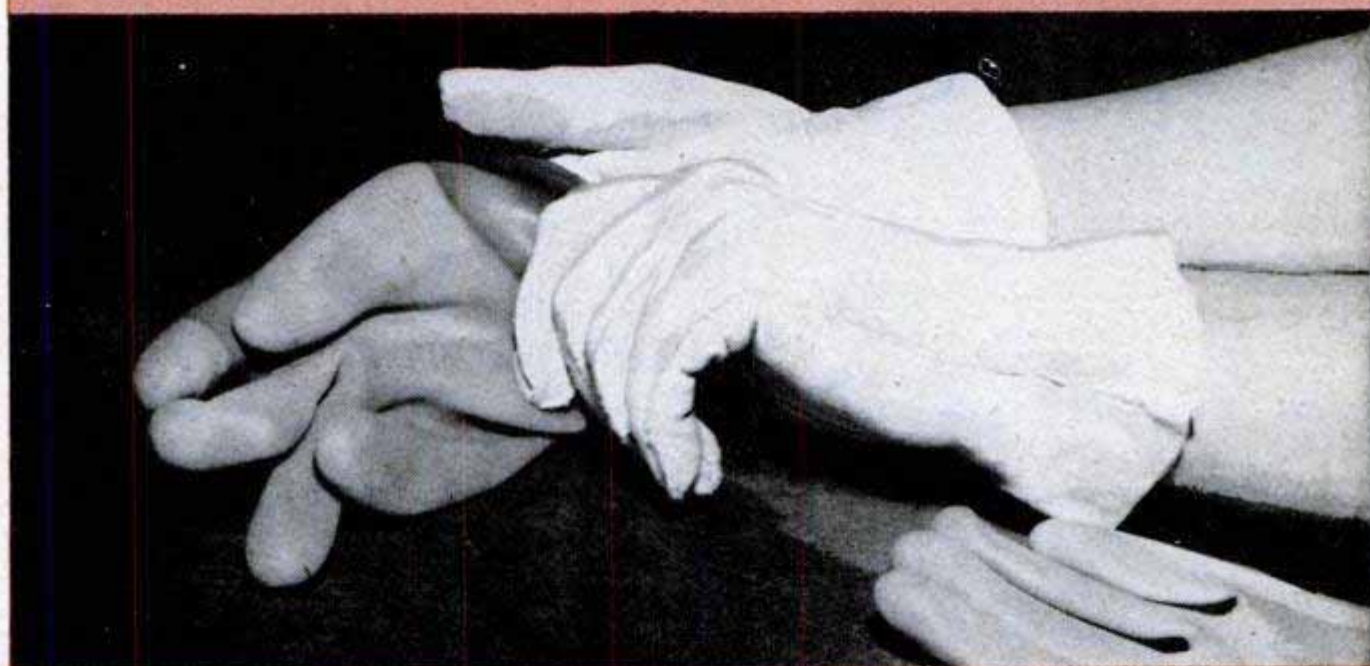


**ICE CUBES** placed in hot laundry starch not only cool the starch to prevent burning hands, but dilute it to the proper consistency. Stir three or four cubes in starch and add more as necessary

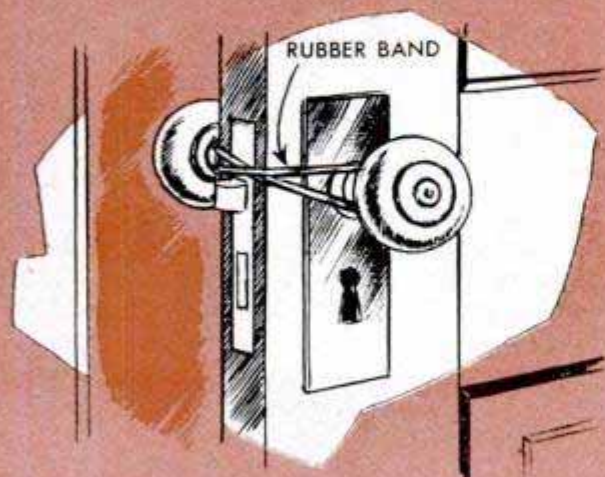


**HANDY PINCUSHIONS** for dressing-table mirror are had by mounting two corks on mirror frame. The corks are glued to surface of frame, or the latter is drilled and the corks embedded flush

# PROBLEMS



**IF RUBBER GLOVES** make your hands perspire, be more comfortable by putting on fabric gloves first



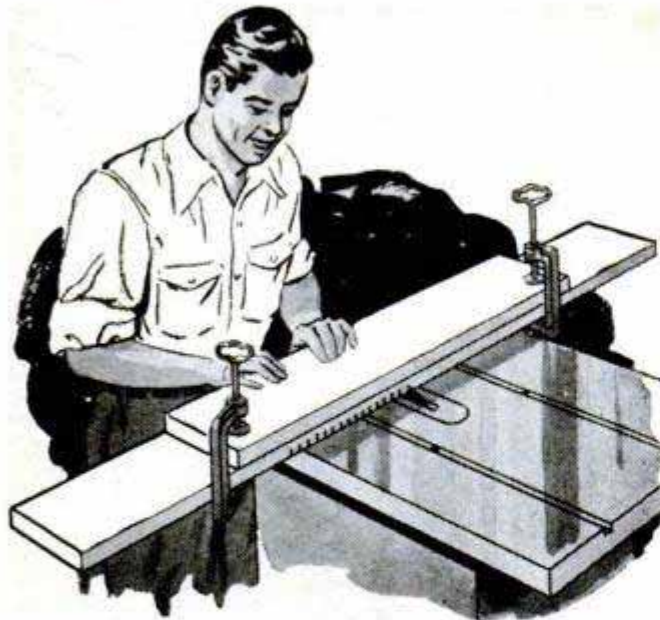
**RATTLING OF AN INSIDE DOOR** often can be stopped by stretching a rubber band across the edge of the door, looping the ends over the knobs



**TIGHT-FITTING BOTTLE CORKS** are lifted out readily if safety pins are used for handles. Insert the pins at a slight upward angle if necessary



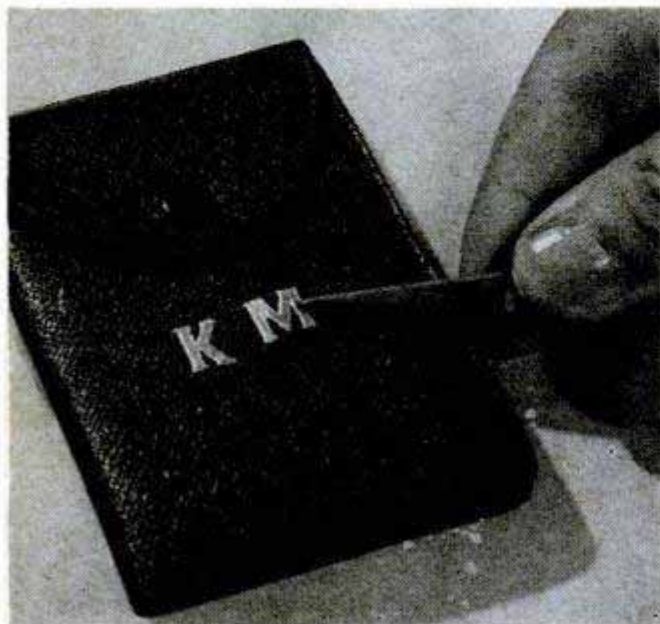
## Effective Support for Long Work Kerfed on Circular Saw



When using a circular saw to cut kerfs across the width of a long board, clamp a shorter one over the part to be kerfed. This will reinforce this portion of the work and prevent any possibility of breakage caused by the weight of the ends overhanging the saw table. The same method can be used when cutting half laps near the center of a long board.—Dick Randle, Valparaiso, Ind.

## Luggage and Billfold Initials Cut From Cellulose Tape

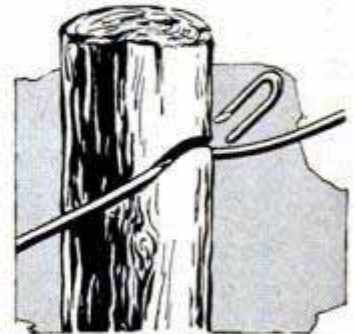
Attractive initials for luggage and billfolds are made from cellulose tape that is available in an assortment of colors, as well as a gold or silver finish. A strip of the tape is attached to clear cellophane and the letters cut out with a small scissors. The cutting may be done either freehand or with the aid of letters snipped from a magazine or newspaper serving as a pattern.



The tape letters are then carefully stripped from the cellophane backing and pressed onto the surface to be initialed. Carefully mounted on the wallet, the letters will have the appearance and durability of a professional job.

## Grape-Arbor Posts Notched To Support Heavy Wires

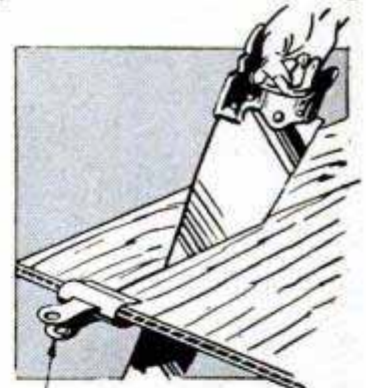
Wires supporting grapevines heavy with fruit are often pulled from the arbor posts when held by ordinary staples. To prevent this, one gardener sawed deep, diagonal notches in each post and placed the wires in them. This done, staples were driven in over the notches to keep the wires in place.



G. E. Hendrickson, Argyle, Wis.

## Small Clamp Prevents Saw Chatter

In handsawing a strip from thin, wide work, such as a wide board or sheet of plywood, you can keep the saw from binding and chattering by using a spring-type paper clip or other small clamp. Place it over the edge of the work at the starting point of the saw cut when deep enough to permit free movement of the saw.—William B. Eagan, Louisville, Ky.

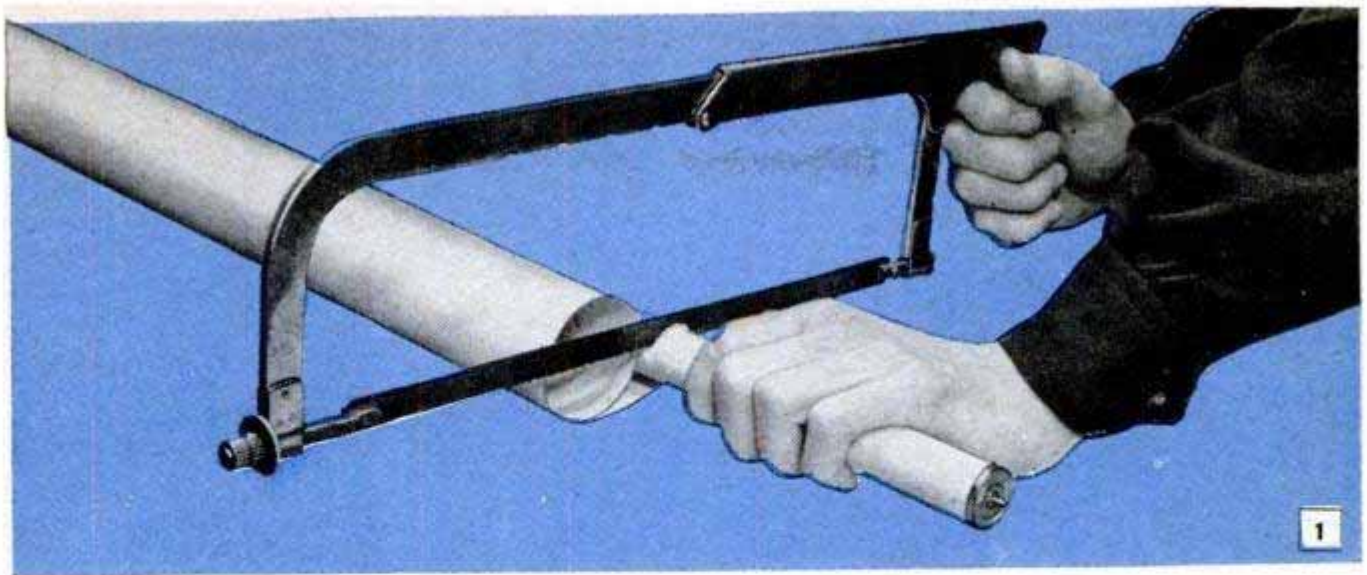


PAPER CLIP

## Preserving Bait Minnows

With this simple wet-pack method of preserving minnows, the bait will remain firm and lifelike without becoming stiff or losing its natural color. The formula is prepared beforehand so the minnows can be packed on the bank of the stream or pond from which they are seined. A season's supply of bait may be seined and packed on a single trip. The minnows are tightly packed in a solution of water, 40 oz., Formalin, 1 oz., and pure glycerin, 6 oz., using glass containers which have tight-fitting caps, such as pint fruit jars. Before capping the jars, add 10 drops of rhodium oil to each pint jar. The rhodium oil is an attractor for some kinds of fish and also kills the odor of the Formalin. The glycerin keeps the minnows from becoming stiff.

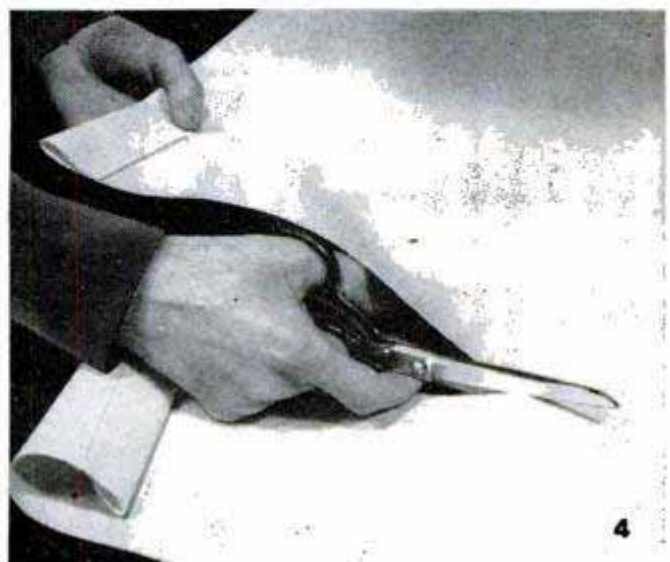
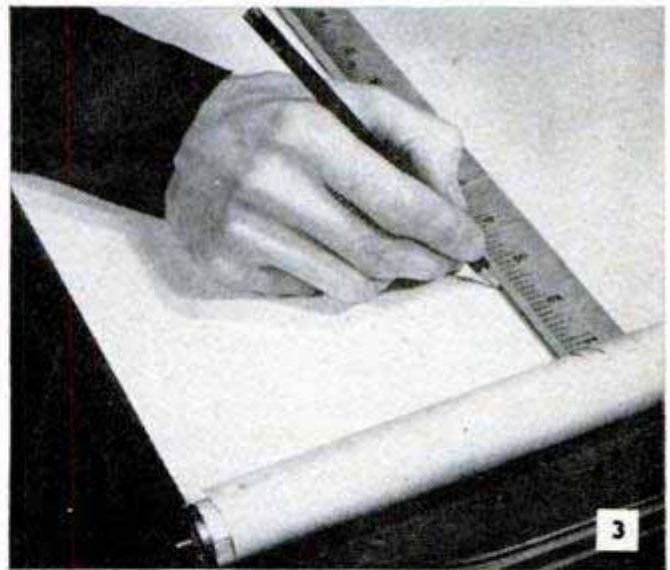




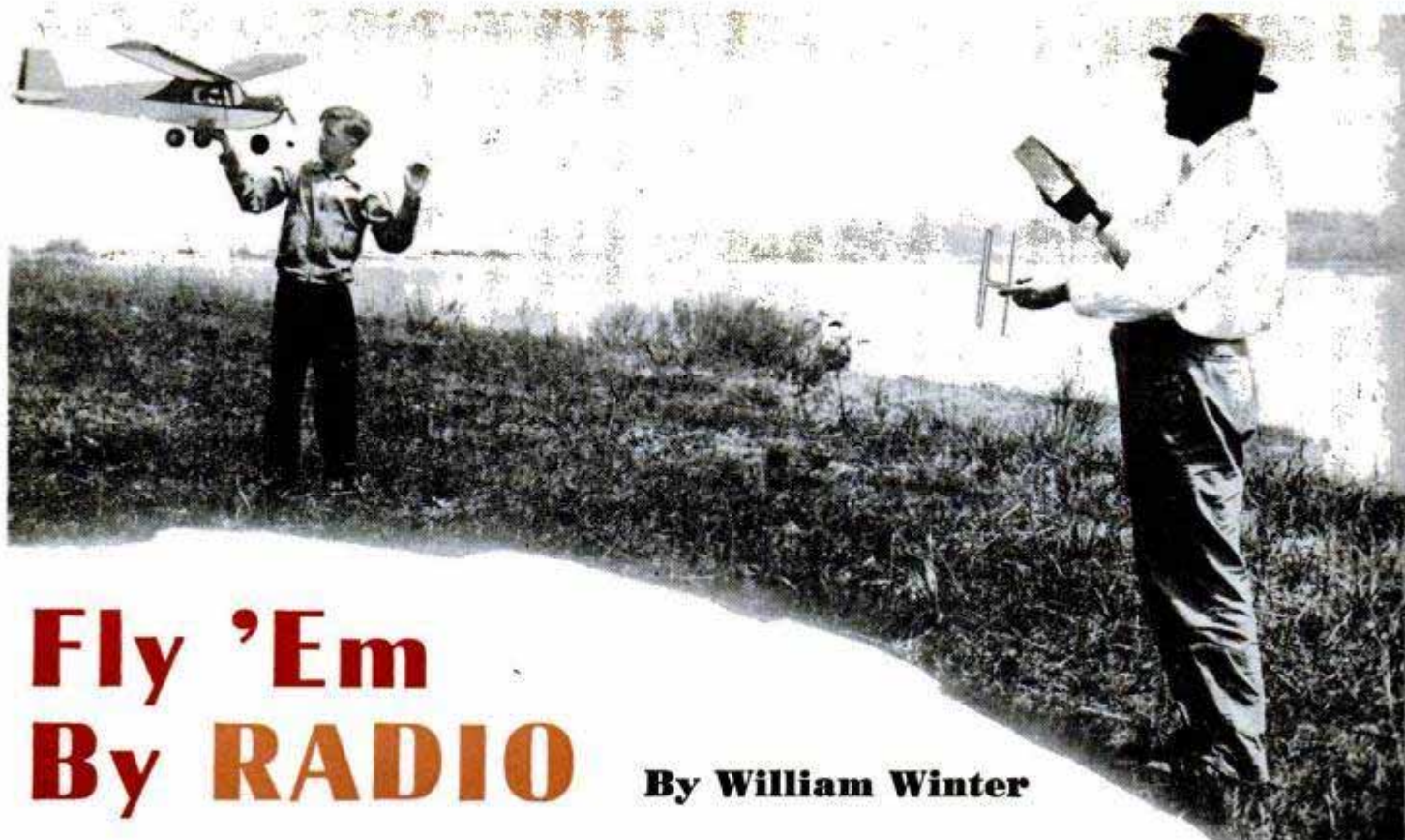
## Cutting Down a WINDOW SHADE

*By Richard Hanscom*

IF YOU FIND, when remodeling a room in your home, that the window shades no longer fit windows that have been made smaller, try cutting them down yourself before you buy new ones. First, take measurements of the cut-down window casings. If a shade is to be installed inside the casing, measure exactly the distance across the opening where the brackets are to be placed and subtract  $\frac{1}{8}$  in. to allow for bracket clearance. If installing the shade outside the casing, add 3 in. to overlap at the sides. The length of the larger shade may be retained, as it will provide extra material should the shade tear at the roller at any time. Now, unroll one of the shades on the floor or, preferably, across the top of a large table, measure off the desired width with a yardstick and make a pencil mark. Make similar marks to enable you to draw a straight line connecting them, pictured in Fig. 3. Be sure to measure the shade so that you cut off the end fitted with a metal cap and pin rather than the end containing the spring mechanism. After removing the stick from the end of the shade, cut along the line, as demonstrated in Fig. 4, using scissors or a razor blade and metal straight-edge. This done, use a hacksaw to cut the roller and stick to the proper length, as in Fig. 1. Now, remove the pin and cap from the cutoff end of the roller, using pliers to extract the pin. Fit the cap over the newly cut end of the cut-down roller and drive in the pin with a hammer. Replace the stick and attach a pull cord to the end of the shade. In replacing a worn shade, place the old shade alongside a newer, larger one and use it for measuring, as shown in Fig. 2.







# Fly 'Em By RADIO

By William Winter

*Build and fly "Electron" with a single-channel radio receiver approved for operation without a license*

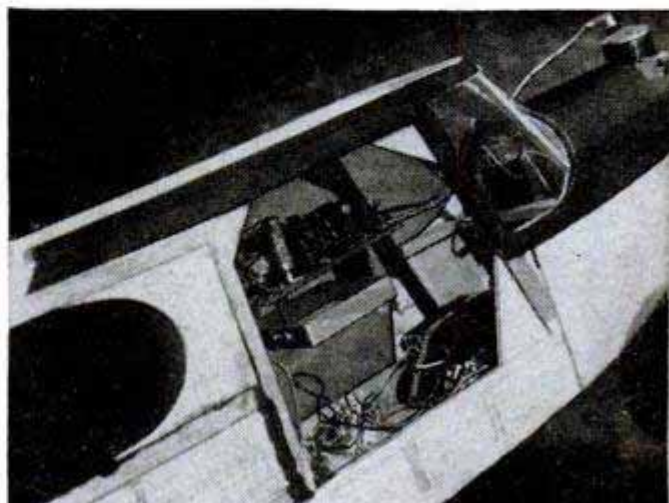
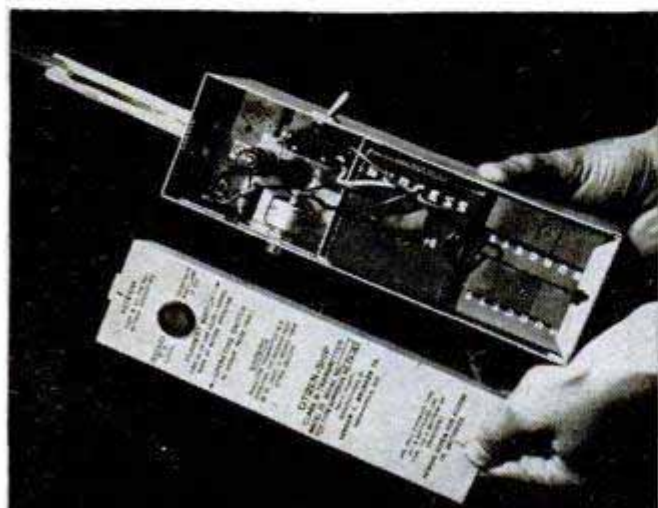
**E**LECTRON" is one of several experimental models designed especially to utilize all the structural and design features necessary for reliable radio control of a model plane having a wing loading of about 13 oz. per sq. ft. of wing area when fitted with radio and batteries. High air speeds have been sacrificed deliberately in order to obtain stability and versatility in flight, characteristics which are essential to successful radio control of a model plane. Rudder-only control gives satisfactory maneuverability in flight as the plane can be fast-dived, zoomed, stalled and even looped

Transmitter requires no operator's license. Button at left is keyed to transmit impulses to receiver in plane. B-batteries in bottom of case, A-battery in center

if the speed build-up is sufficient. Of course, accurate approaches and landings, take-offs, lazy eight, Immelmans and other more intricate flight maneuvers require skill and experience on the part of the operator.

The radio-control unit employs a single-channel receiver with a sensitive relay that closes a circuit to operate an escapement which is rubber-strand driven and is connected to the rudder by a music-wire linkage. This arrangement permits use of left and right rudder positions and neutral position for straight flight. Of course, it is

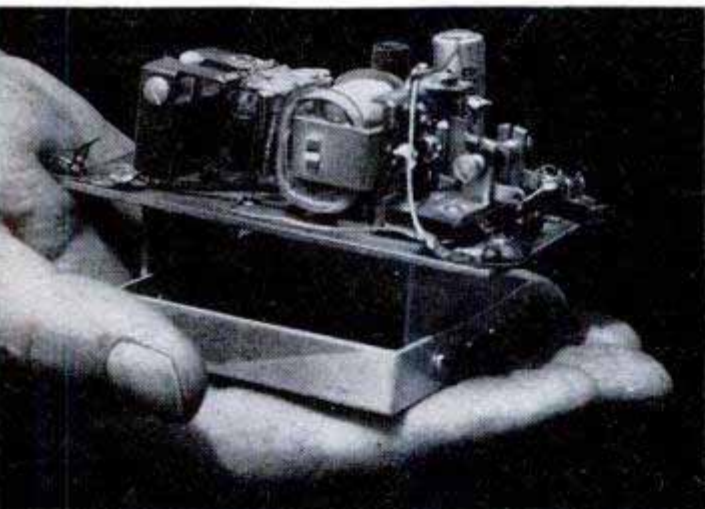
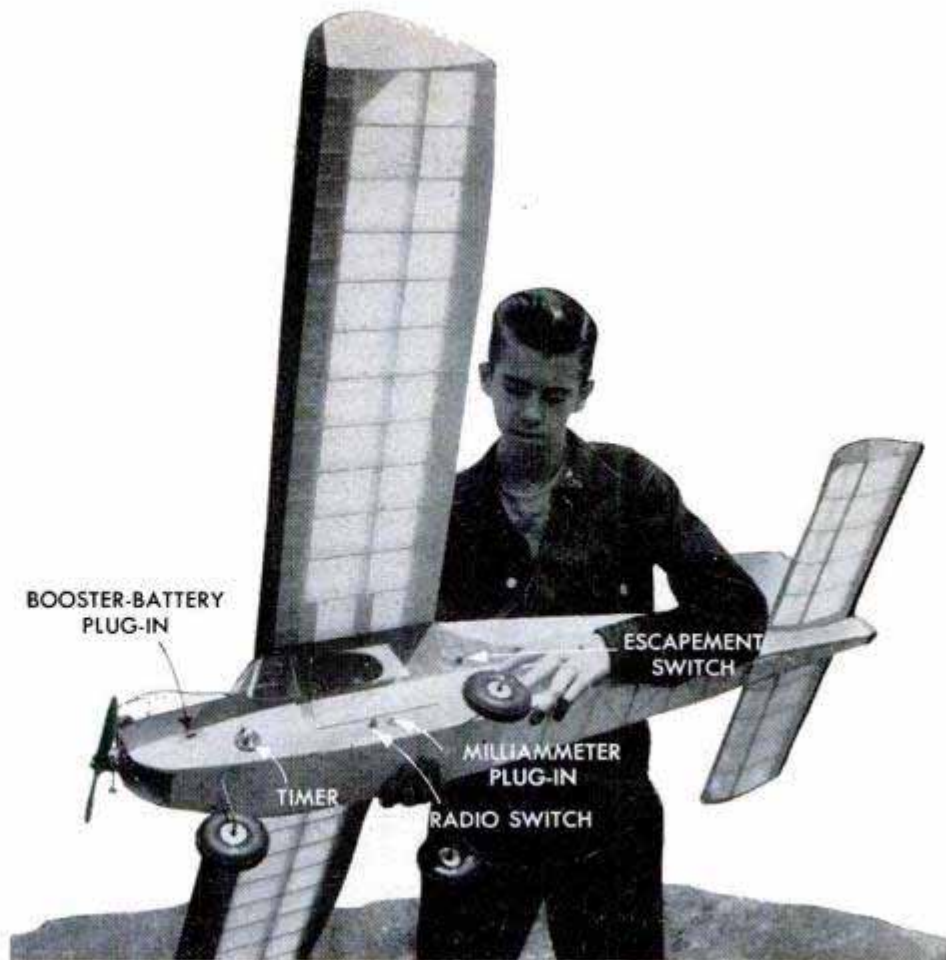
Looking into cabin through right-hand door, showing batteries in place and receiving set in position on its rubber mounting suspended from cabin corner posts



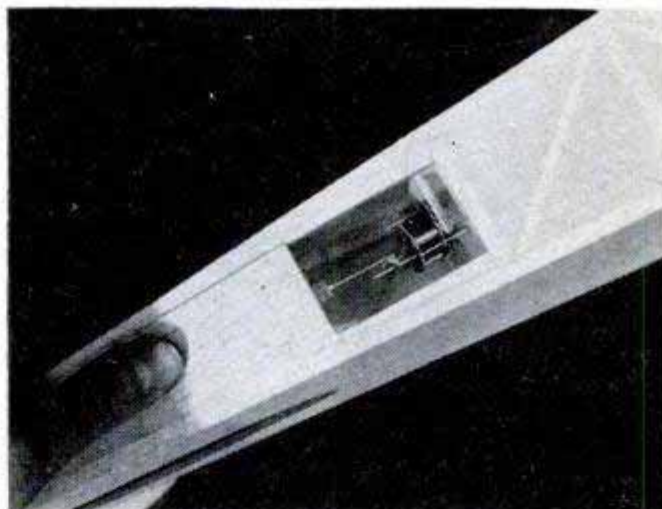


possible to develop radio control from the single-channel receiver to include as many as six positions for rudder and elevator, as well as throttle and wheel-brake control, but in this case these details have been left to the builder. As pictured, Electron is powered with a spark-ignition engine of .24-cu.-in. displacement, but experiment has shown that the plane flies well when fitted with engines ranging from .19 to .29-cu.-in. displacement. If other engines are used, some experimentation with the throttle setting will be necessary.

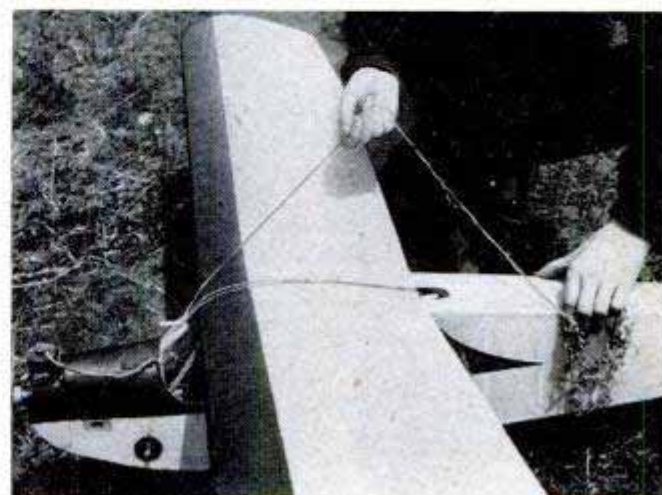
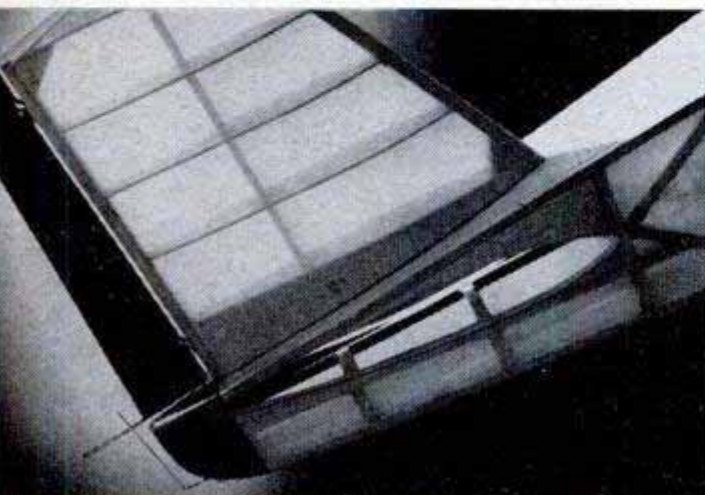
**Fuselage:** The fuselage is of the familiar box construction. The side frames are built first, then joined by top and bottom crosspieces.



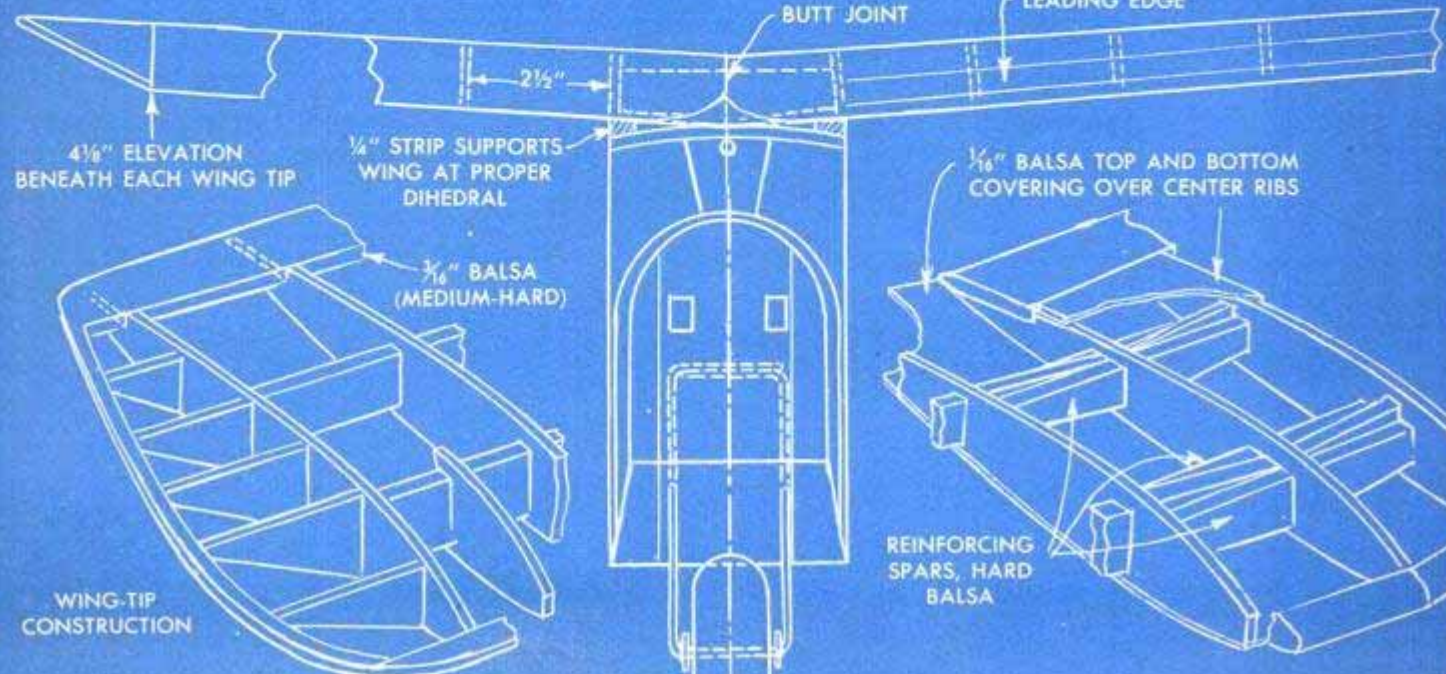
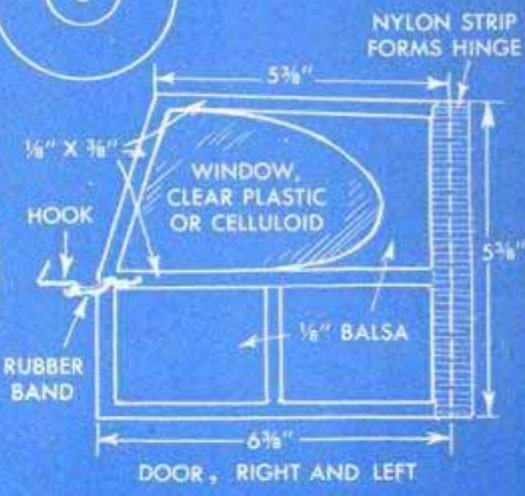
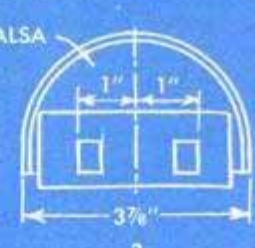
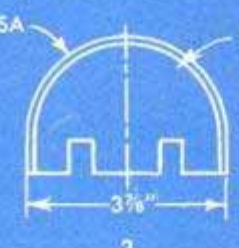
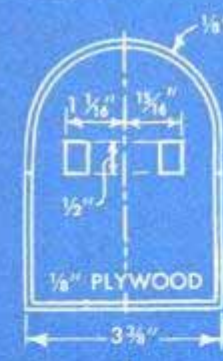
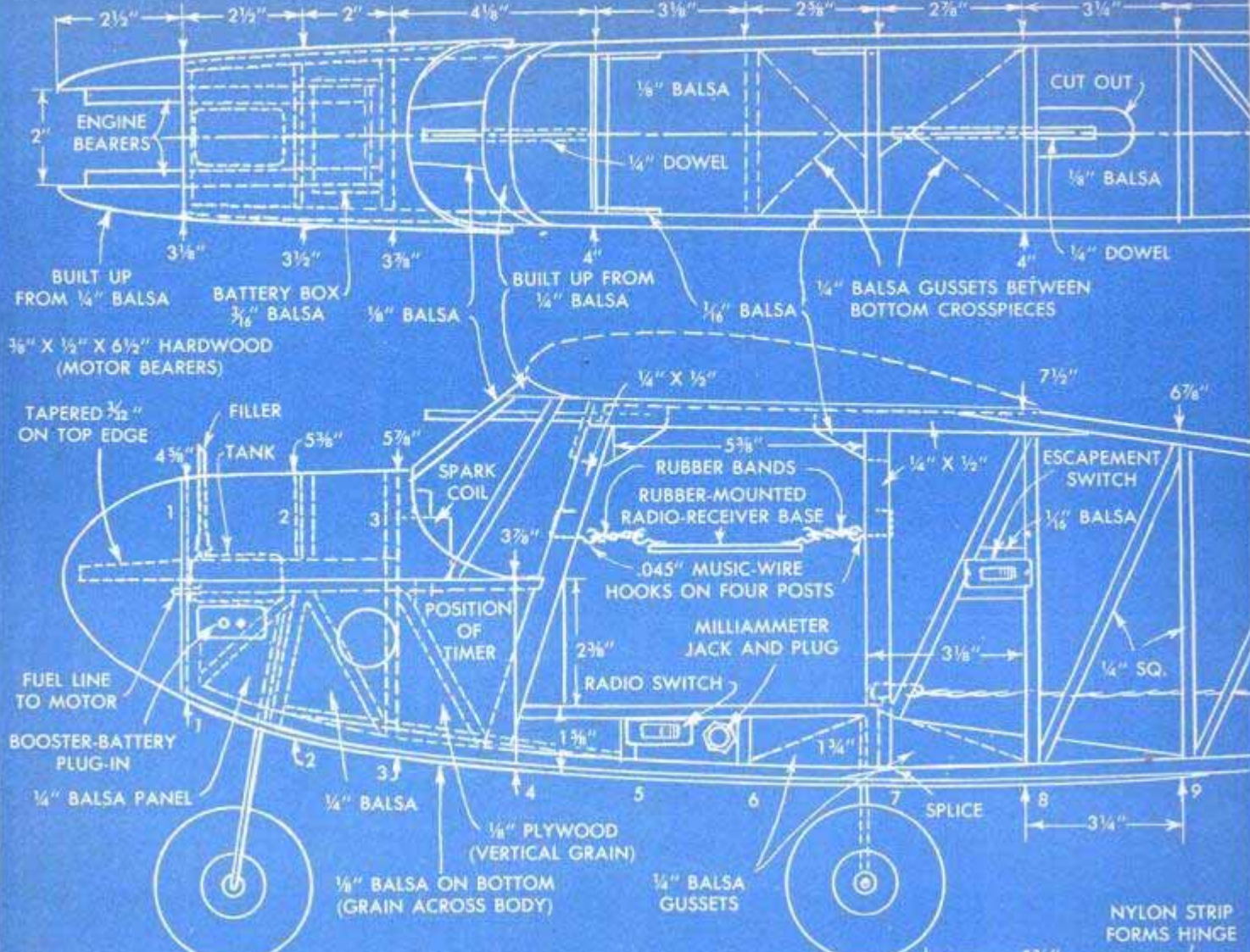
Above, close-up of receiver assembled ready for mounting in plane. Metal frame beneath is antenna. Below, close-up of wire yoke which actuates rudder



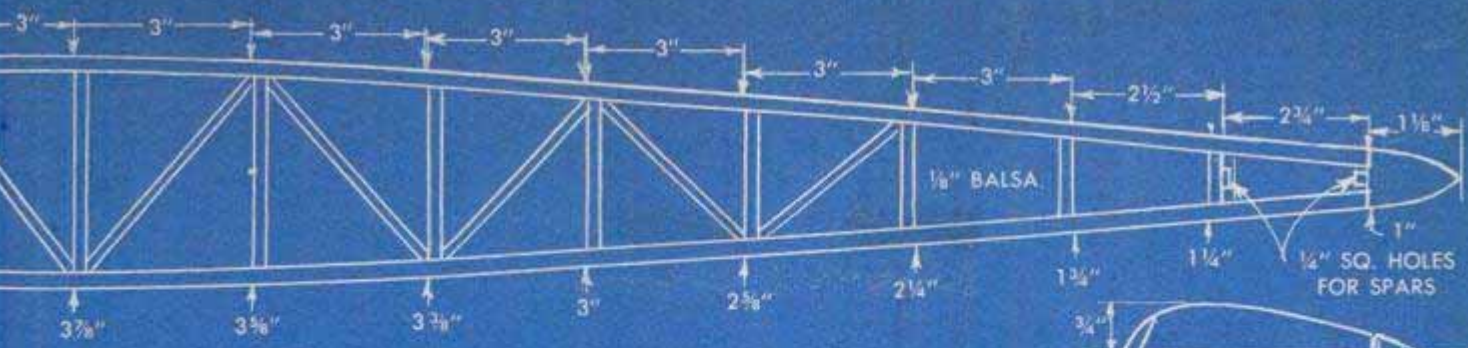
Above, looking through escapement access door showing actuating linkage. Below, wing is attached with rubber bands looped over dowel installed in cabin top







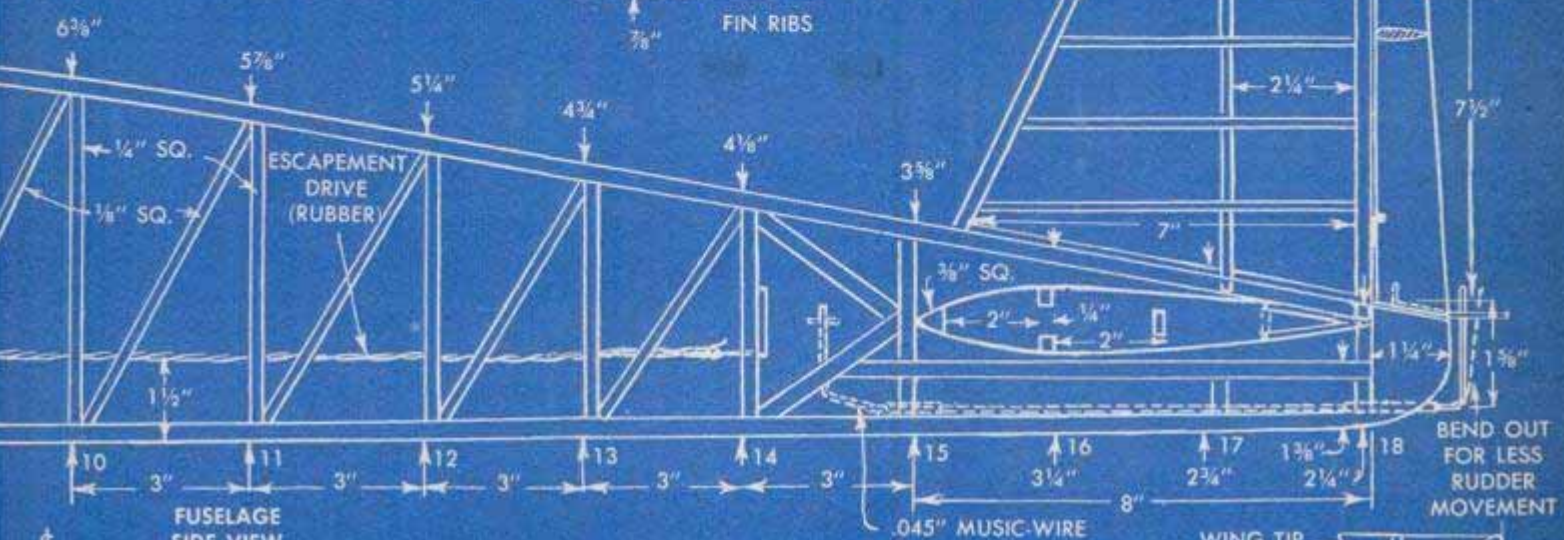




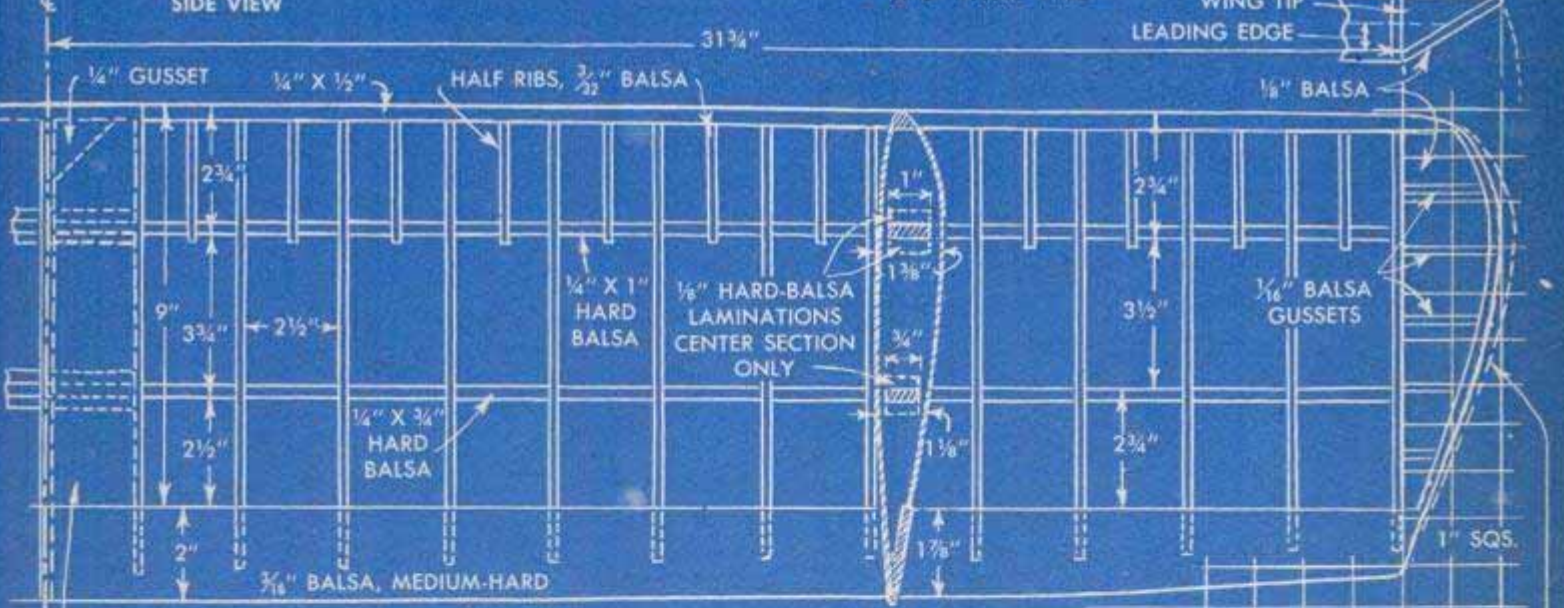
FUSELAGE, TOP VIEW



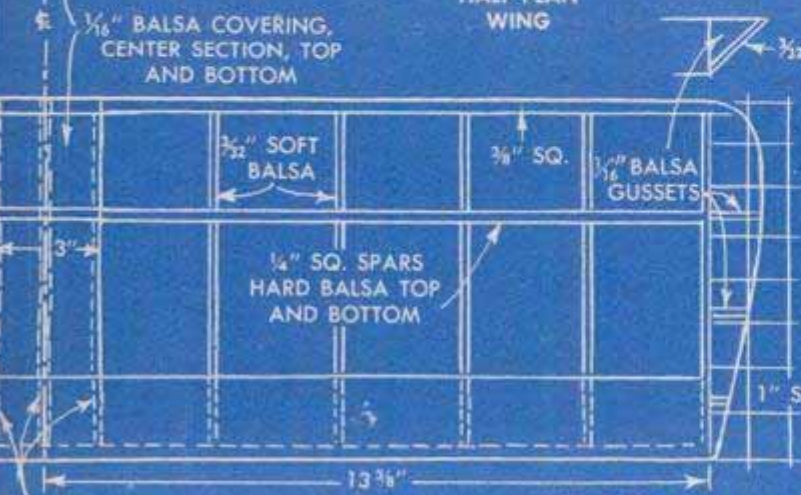
FIN RIBS



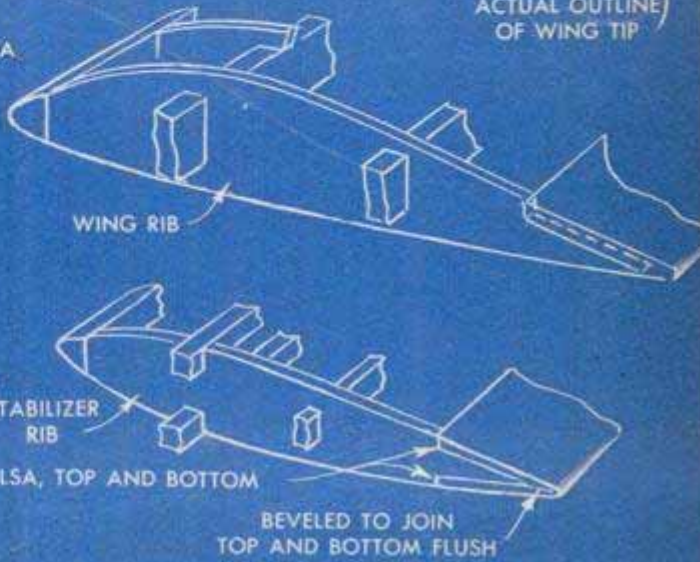
FUSELAGE SIDE VIEW



HALF PLAN WING



HALF PLAN STABILIZER

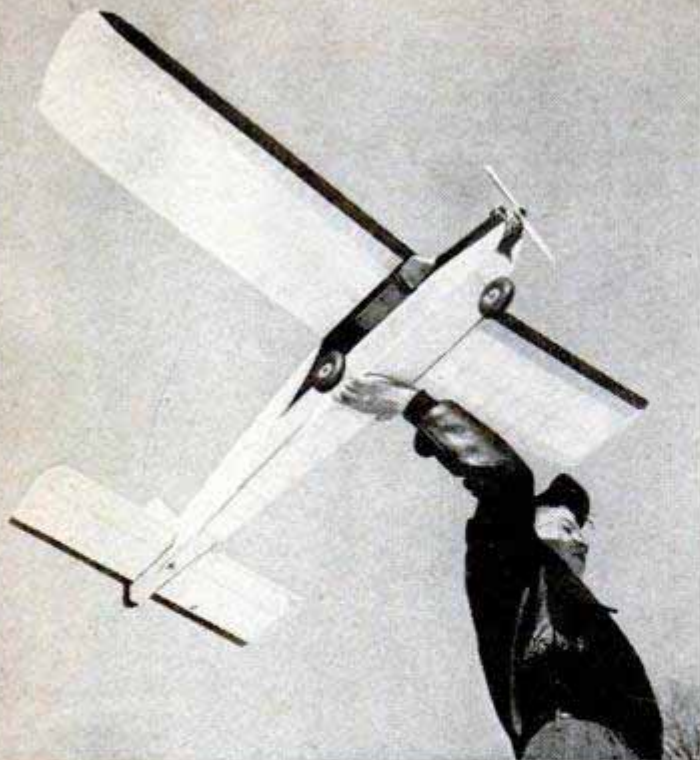


ACTUAL OUTLINE OF WING TIP

3 RIBS AT CENTER 1/16" LESS IN WIDTH (TOP AND BOTTOM) TO ALLOW FOR Balsa COVERING

BEVELED TO JOIN TOP AND BOTTOM FLUSH





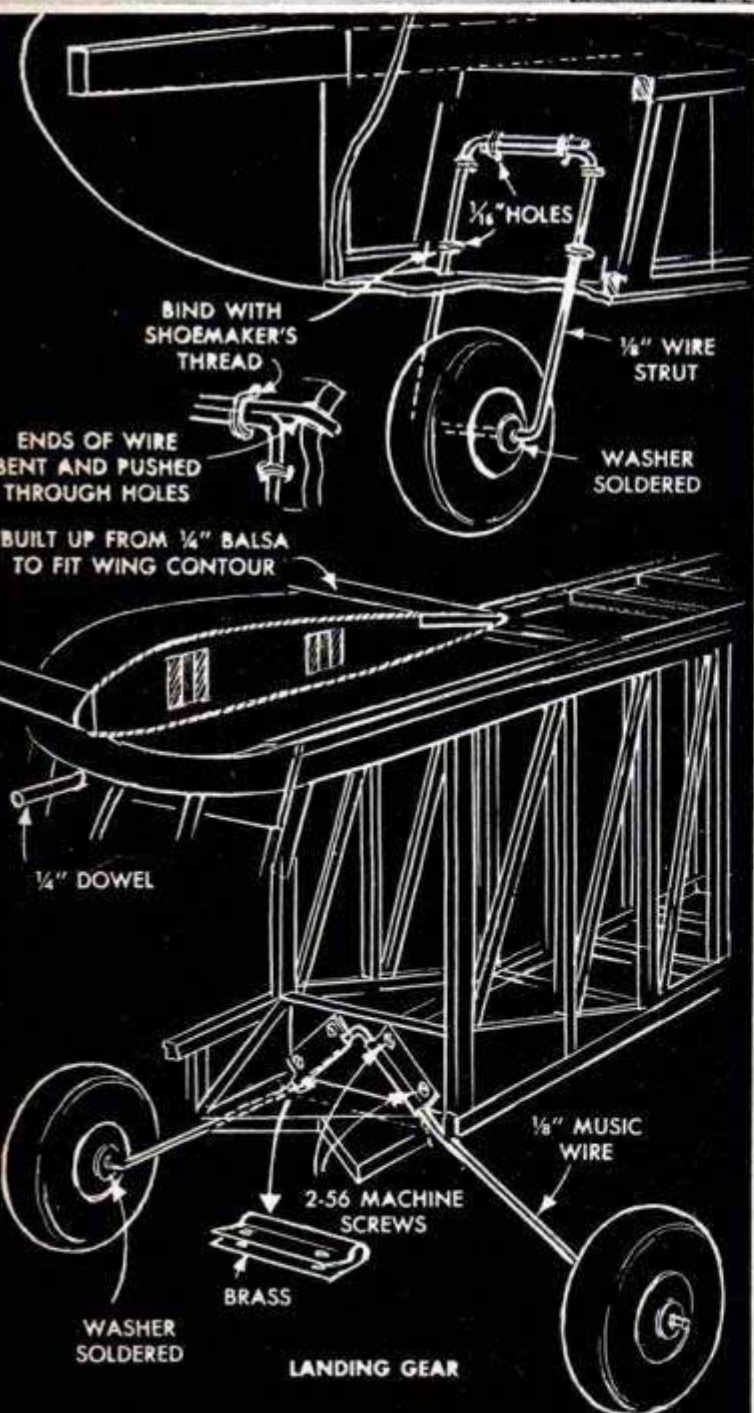
For this reason the simplest procedure is to make full-size drawings of the side frames from the side view of the fuselage and thumbtack these to a piece of plywood or to the top of the bench. Then build the open frames right over the working drawings. If you wish to preserve the drawings, cover them with wax paper to prevent cement from adhering. Use straight-grained balsa wood for the longerons, and select matched pieces by flexing them to determine uniformity of tension under stress. Hold the longerons in place over the plan drawing with pins. Hand fitting of the vertical members at the various stations is always necessary in an assembly of this type.

Be sure that all joining surfaces are well coated with cement before placing the parts in position. After the units are assembled, allow the cement to dry overnight. Then remove pins, trim away the wax paper and trim excess cement from the joints. Cut eight top and bottom crosspieces to give the width required at stations 4 to 8, inclusive. Insert pins through the side frames to engage the ends of the crosspieces at stations 4 and 8 only. Now spread cement on one end of each of the four crosspieces at stations 4 and 8, place the pieces in position on one frame and force the pins into the ends.

Proceed in the same way with the second side frame. Invert the fuselage and place a heavy weight inside the cabin to hold the fuselage in place on the bench. Now check the assembly for squareness, making sure that the four crosspieces are at right angles to the side frames and are in line with each other, and that the side frames are perpendicular to the bench. If necessary, force the parts into the correct position and hold with clamps or weights until the cement is dry. From stations 8 to 18, the remainder of the fuselage construction can be carried out from the blueprint details.

The nose section, stations 1, 2 and 3, is shaped by means of forms shown in separate details on the blueprint and numbered 1, 2 and 3. Note that forms 1 and 3 have squared through holes to take the engine bearers, but that form 2 is notched to fit over the bearers. Also, note that the notches are off-center. This position of the engine bearers neutralizes torque.

The spark coil, fuel tank, timer, battery plug-in and battery box must be installed before the forward part of the fuselage is finished. The wiring is installed in accordance with the instructions that come with the spark coil. Also, the tricycle-type landing gear, detailed at the left, is installed before the balsa side and bottom panels are cemented in place. Make and fit the right and left cabin door-frames and then install the plastic windows and windshield. Fill in





the spaces between vertical members of the side frames from station 4 to station 9 with  $\frac{1}{4}$ -in. balsa. Filler panels from station 4 to the nose can be  $\frac{1}{8}$ -in. balsa, instead of the  $\frac{1}{4}$ -in. balsa and plywood specified on the blueprint. The top of the nose section is covered with  $\frac{1}{8}$ -in. balsa and the sides forward of station 4 are covered with  $\frac{1}{8}$ -in. sheet balsa with the grain running vertically. The bottom of the fuselage is covered with  $\frac{1}{8}$ -in. balsa from the nose to station 9. From station 8 to station 9 the covering is sanded to a featheredge. When completed to this stage the fuselage is carefully sanded to smooth all parts flush and rounded to receive the nylon covering.

**Fin and rudder:** Cut the fin ribs, and drill and square a hole through each one to take the  $\frac{1}{8} \times \frac{1}{4}$ -in. balsa spar. Apply the  $\frac{1}{4}$ -in. rear spar with pins and cement and the front slanting spar in the same manner. After the cement is dry, remove the pins and fair the spars into the rib curves by sandpapering. The space between the two lower ribs is enclosed with  $\frac{1}{16}$ -in. balsa, allowance being made on each rib so that the panels fit flush. The top edge of the fin is a separate piece cemented in place and faired into the curves in the same manner as the leading and trailing edges. The rudder is profiled from  $\frac{1}{4}$ -in. balsa as shown in the section. It is not fitted until after the fuselage covering is in place.

**Stabilizer:** The first step in making the horizontal stabilizer, as in the half plan, is to cut 13 ribs from  $\frac{3}{32}$ -in. balsa. Pin the ribs together and sand to a common outline, then notch the top and bottom edges for the  $\frac{1}{4}$ -in.-sq. spars. After the parts have been fitted and cemented together, cut an opening in the sides of the fuselage beneath the rudder as in the side view, and trim the opening so that the stabilizer will fit in place. Careful handwork is necessary to assure a close fit. The stabilizer is not cemented in place until the plane has been tested.

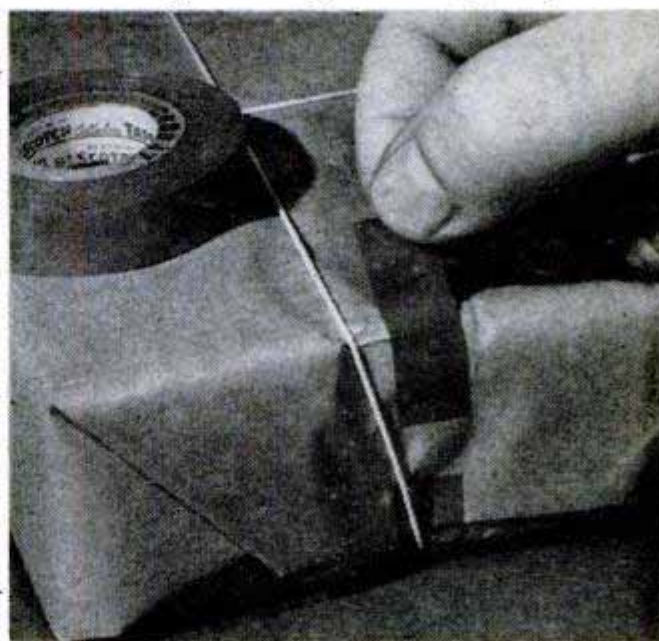
**Wing construction:** Construction methods for the wings and stabilizer are quite similar except that false ribs are used in the wings for added strength. The wings are joined at the center at an angle to give the proper dihedral. To assure this, the ends of the front spars are slanted  $\frac{5}{32}$  in. and the rear spars  $\frac{1}{8}$  in. Then reinforcing spars are fitted across three ribs as shown in one of the perspective views on the blueprint. This angle gives the required  $4\frac{1}{8}$ -in. elevation at each wing tip. The wing is attached to the fuselage by means of rubber bands looped over the projecting ends of a dowel which is installed in the top of the cabin. Nylon is the preferred covering for the fuselage, wings, stabilizer and fin, but pure silk is a good second choice.

## Hatchet Serves as Vertical Guide For Driving Form Stakes



When driving stakes to hold concrete-form boards, the stakes can be kept from twisting or entering the ground at an angle by using a hatchet as a guide. Each stake is held flat against the form board and the point started into the ground. Then hold hatchet flat against the stake and embed in the ground, as illustrated, after which the stake is driven the rest of the way.

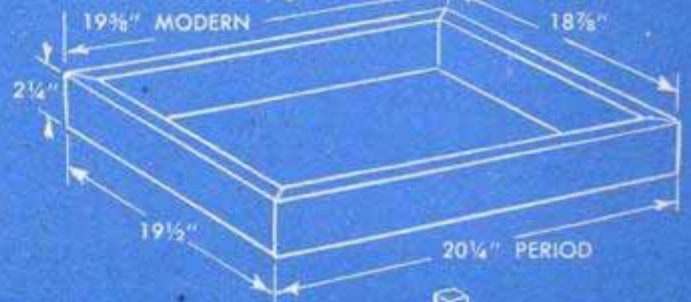
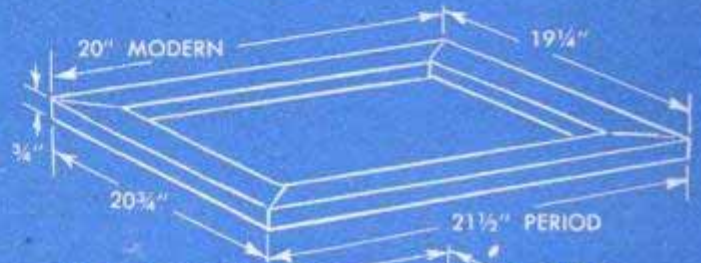
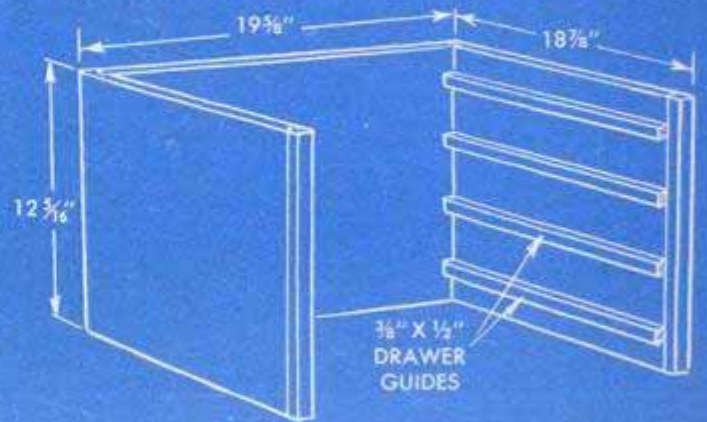
## Tape Under Cord Protects Wrapper On Heavy Package During Shipment



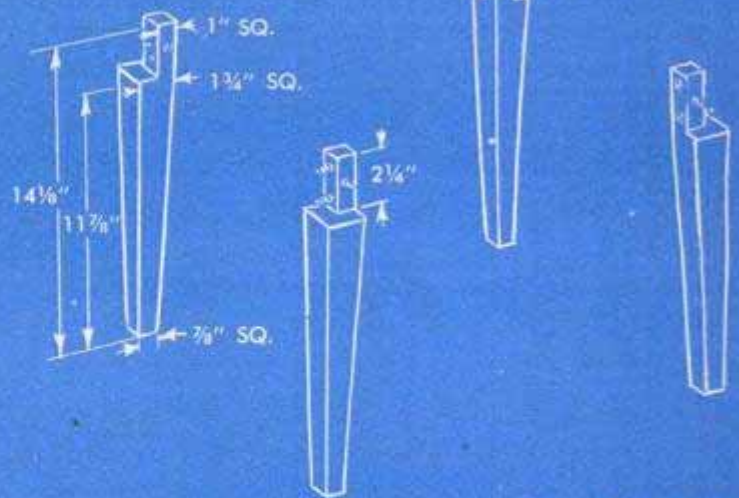
The wrapper on a heavy package is less likely to become cut and torn by a tightly drawn cord if all edges that come in contact with the cord are protected by short lengths of cellulose tape as shown.



# PLAN of the MONTH...



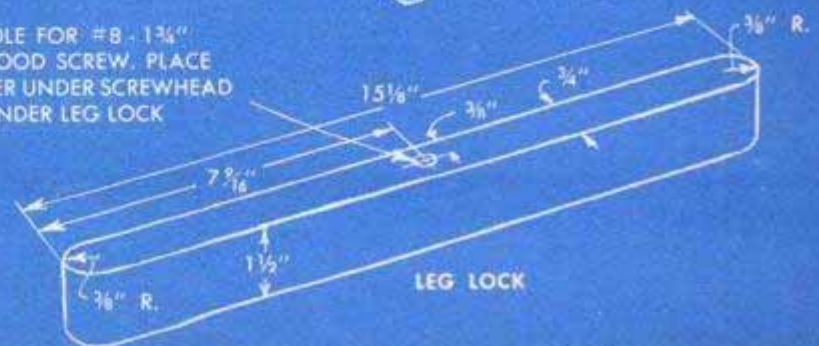
HOW DRAWER BECOMES TABLE



PLAN A-A

BEAD AROUND DRAWER FRONT, 1/4" X 3/16"

3/16" HOLE FOR #8 - 1 3/4" R. H. WOOD SCREW. PLACE WASHER UNDER SCREWHEAD AND UNDER LEG LOCK

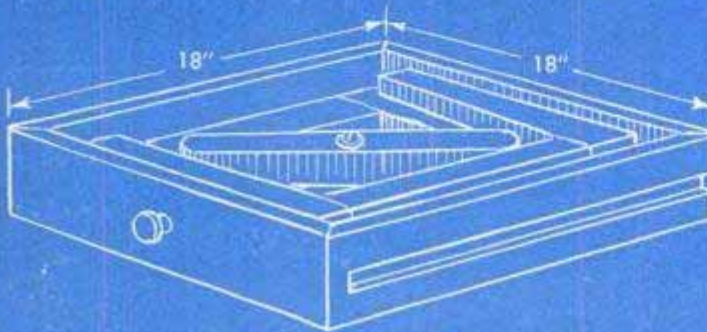


LEG LOCK

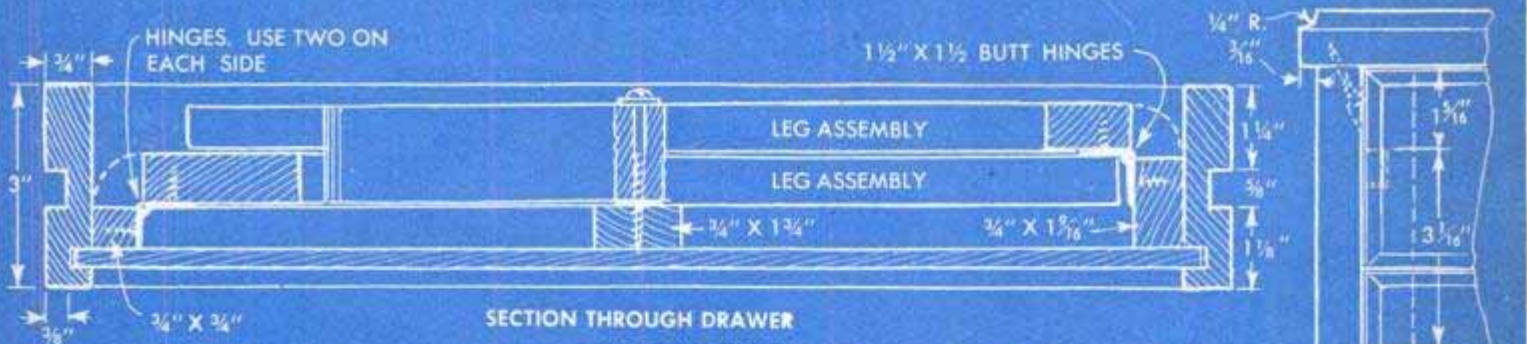


# Nested Tables in a Chest

Deception with a novel flair is the keynote of this latest creation from the drawing board of John Bergen, noted furniture designer. The "drawers" are not drawers at all but clever little tables designed for individual serving. The tables fold flat for storing upside down in a simple four-drawer chest. A choice is made between modern and period design by selection of appropriate wood, hardware and decorative treatment. If your furnishings are modern, select white oak, if period, choose either walnut or mahogany. Period styling is made by running a cove molding around the top, adding a bead around the drawer fronts and shaping the edge of the base. Wooden turn button in each table locks legs rigidly when set up



FOLDED POSITION



SECTION THROUGH DRAWER

## MATERIAL LIST

### Cabinet plywood

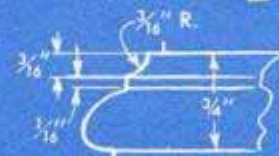
- 1 pc. —  $13\frac{1}{16}'' \times 19\frac{1}{4}'' \times 20''$  — Top
- 2 pcs. —  $\frac{3}{4}'' \times 18\frac{1}{8}'' \times 12\text{-}5\frac{1}{16}''$  — Sides
- 1 pc. —  $\frac{3}{4}'' \times 18\frac{3}{8}'' \times 12\text{-}5\frac{1}{16}''$  — Back
- 4 pcs. —  $\frac{1}{4}'' \times 17'' \times 17''$  — Table tops

### Lumber

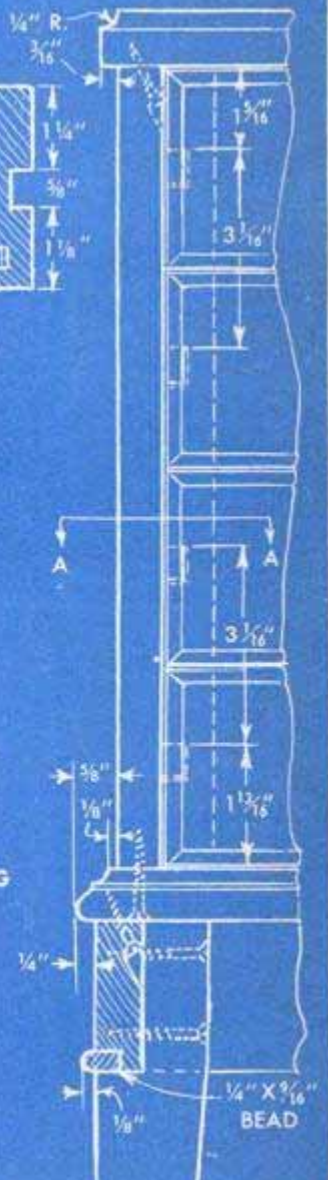
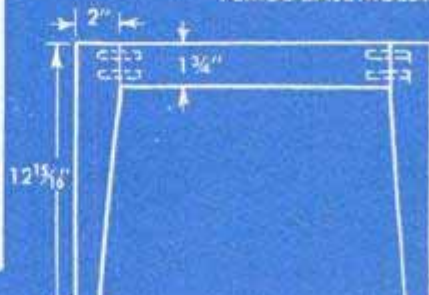
- 4 pcs. —  $\frac{3}{4}'' \times \frac{3}{4}'' \times 16\frac{1}{2}''$  — Leg strips
- 4 pcs. —  $\frac{3}{4}'' \times 1\text{-}9\frac{1}{16}'' \times 16\frac{1}{2}''$  — Leg strips
- 4 pcs. —  $\frac{3}{4}'' \times 1\frac{3}{4}'' \times 16\frac{1}{2}''$  — Lock brace
- 4 pcs. —  $\frac{3}{4}'' \times 1\frac{1}{2}'' \times 15\frac{1}{8}''$  — Lock
- 8 pcs. —  $\frac{3}{8}'' \times \frac{1}{2}'' \times 17\text{-}5\frac{1}{16}''$  — Drawer guides

### Cabinet lumber

- 16 pcs. —  $\frac{3}{4}'' \times 3'' \times 18''$  — Drawer material
- 4 pcs. —  $1\frac{3}{4}'' \times 1\frac{3}{4}'' \times 14\frac{1}{8}''$  — Legs
- 8 pcs. —  $\frac{3}{4}'' \times 2'' \times 12\text{-}15\frac{1}{16}''$  — Table legs
- 8 pcs. —  $\frac{3}{4}'' \times 2'' \times 13\frac{3}{4}''$  — Table legs
- 4 pcs. —  $\frac{3}{4}'' \times 1\frac{3}{4}'' \times 12\frac{1}{4}''$  — Stretchers
- 4 pcs. —  $\frac{3}{4}'' \times 2\text{-}9\frac{1}{16}'' \times 12\frac{1}{4}''$  — Stretchers



PERIOD BASE MOLDING



BEAD

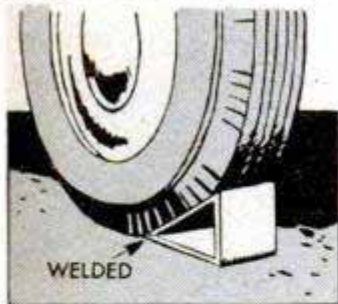


## Handy Screen Salvages Small Parts By Sifting Bench Sweepings



A screen that slides out from under his workbench enables one craftsman to salvage small parts from shavings and sawdust sweepings. The screen is mounted on a frame which slides back and forth on wooden guides fastened to the underside of the workbench. Hardware cloth, having  $\frac{1}{4}$ -in. mesh, or larger, can be used for screening.

## Steel Chocks for Car Wheels



Just the thing to keep the car from rolling when it is jacked, these lightweight wheel chocks are easy to handle and take up little room in the trunk. The chocks are made by bending  $\frac{1}{8}$  or  $\frac{3}{16}$ -in. steel plate to a triangular shape. The ends of the plate may be welded together. The portion of the chock to be inserted under the tire should have an angle of about 30 deg. in order to prevent it from slipping when the tire bears against it.

John Krill, North Lima, Ohio.

## Humid Nights Can Foul Ignition

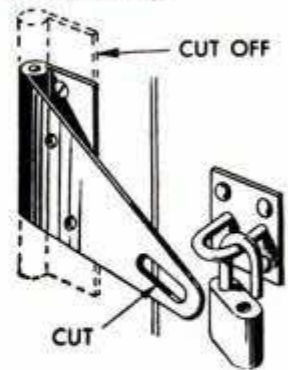
If you find that your car will not start some morning, the reason may be that the spark plugs are wet even though there has been no rain. This is most likely to happen when a car is left outside and the night is unusually humid. Also, any dust and grime

on the plugs will tend to absorb and hold the moisture. To correct the trouble, just wipe the plugs with a dry cloth.

Ed Packer, Chicago.

## T-Hinge Doubles as Lock Hasp

With a little alteration, a T-hinge will provide a suitable hasp for a padlocked door. The hole at the end of the tapered hinge leaf is elongated to fit over the staple, and the barrel as well as the other hinge



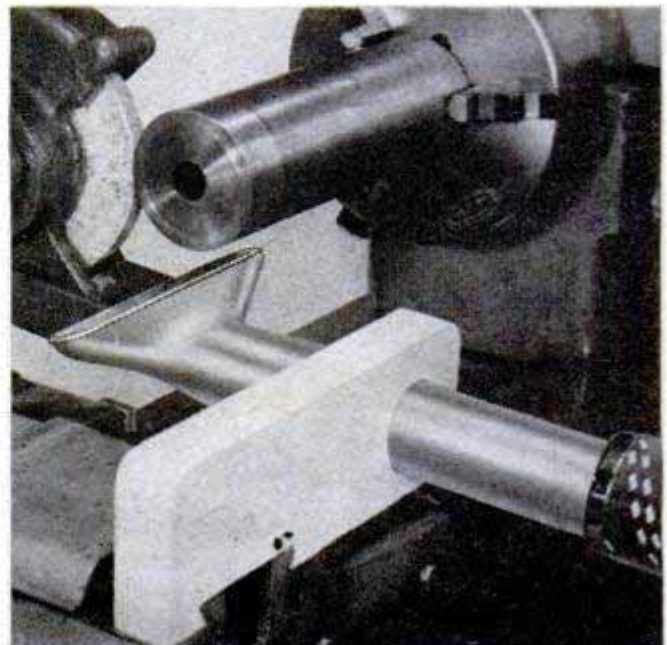
leaf are cut off as shown by the dotted lines. The hinge is mounted so that the tapered leaf covers the screws which fasten the other leaf to the door or casing. This, of course, keeps the hasp from being removed when the door is locked.

Victor H. Lamoy, Upper Jay, N. Y.

## Vacuum Cleaner Collects Metal Dust From Lathe Grinding Work

Following the grinding wheel as it moves along the work, an ordinary vacuum-cleaner attachment will collect most of the abrasive metal dust resulting from surface-grinding work on a metal-turning lathe. A wooden bracket for holding the vacuum-hose nozzle is cut from a block of wood, one edge of which has been cut to slip over the dovetail section of the lathe crossfeed. A hole is bored in one end to accommodate the barrel of the hose nozzle. The use of the flat type of nozzle will provide greater pickup area.

Henry Hanscom, Elmhurst, Ill.



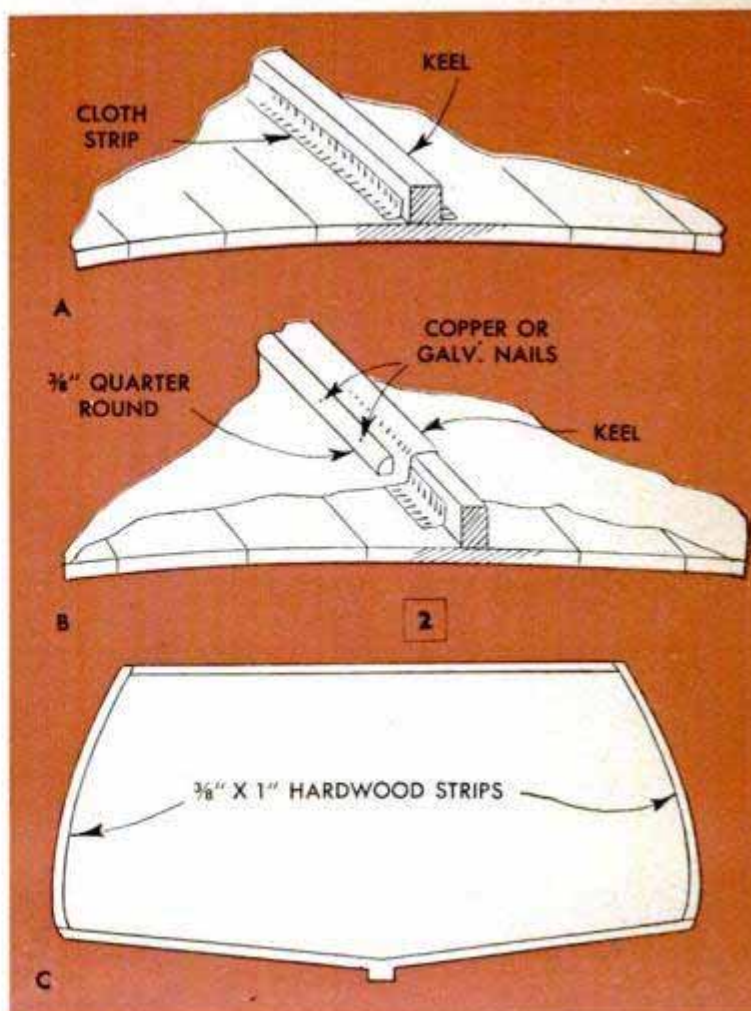


# PLASTIC "PLANKING" renews YOUR BOAT

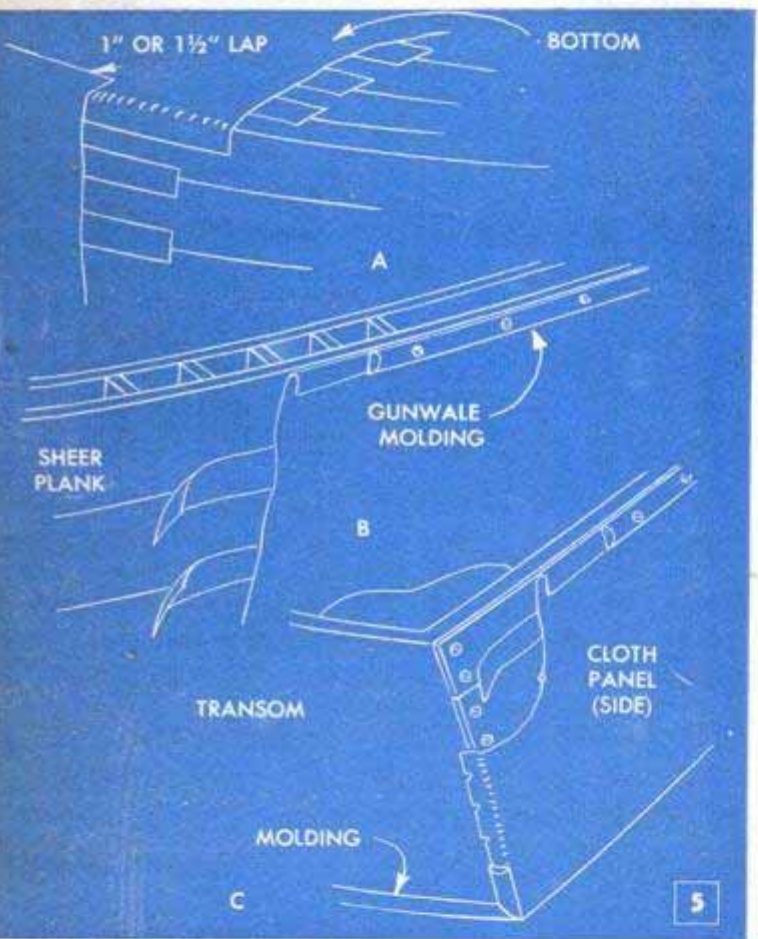
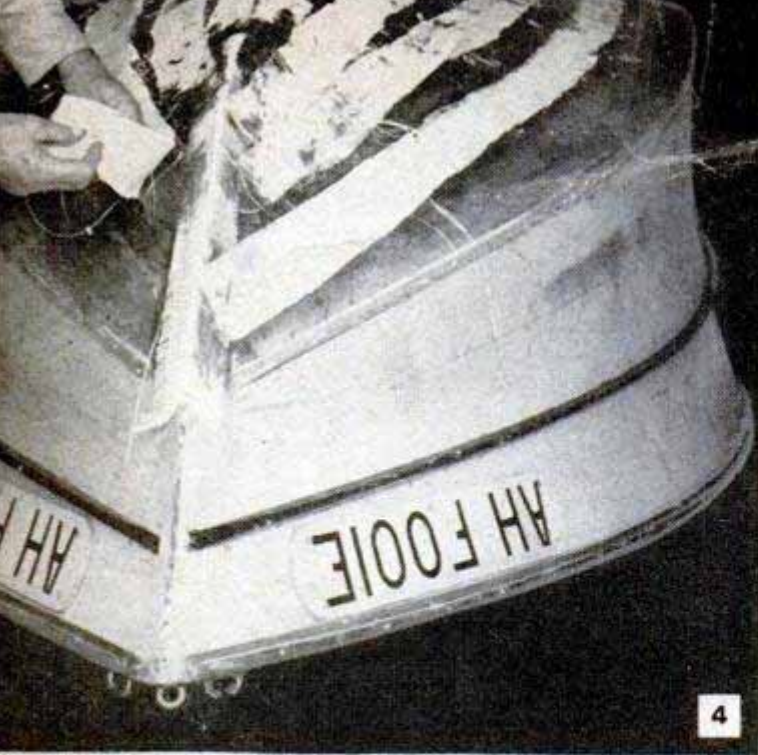
By Clinton R. Hull

**P**LANKED ROWBOATS, outboard runabouts and other small craft that are stored during the winter months, often develop serious leaks below the waterline. This makes it necessary to recalk and pre-soak the planking each season before the boat can be considered safe and usable. In some cases, the individual planks or the plywood covering will be found so badly weather-checked that complete renewal is necessary. Owners of small boats can avoid seasonal labor and upkeep cost by covering the hull with glass cloth (Fiberglas) or muslin impregnated with liquid plastic, which can be applied with a brush. Properly handled, this treatment waterproofs old boats at a reasonable cost and provides a durable coating that resists scuffing and cracking, and adds considerably to the structural strength of a sound hull.

Since liquid plastic acts as a paint solvent, the first step is to remove all moldings, rub rails and other trim from the boat, and then remove the paint down to the bare wood either by scraping or by use of a paint remover. Then fill all cracks, checks and other surface defects with marine putty. After this has hardened, the hull should be sanded to remove all traces of paint and expose new wood at all points on the planking. Now, lay the glass-cloth seam strips on all the bottom seams, Fig. 1, and cut to approximate length. On some boats it will be necessary to lay strips on each side of the keel as in Fig. 2, A, and finish, after applying the cloth covering, with a  $\frac{3}{8}$ -in. quarter round as in Fig. 2, B. Mix plastic with the recommended reducer, or catalyst, until the plastic is thinned to a brushing consistency. Then lift the strip of cloth over the garboard seam and apply the plastic in a uniform coating over the seam. Press the cloth into contact with the plastic coating as in Fig. 4. Proceed in the same manner with all seams on both sides of the keel, starting at the garboard seam and working outward. Roll or carry the boat into the sun and





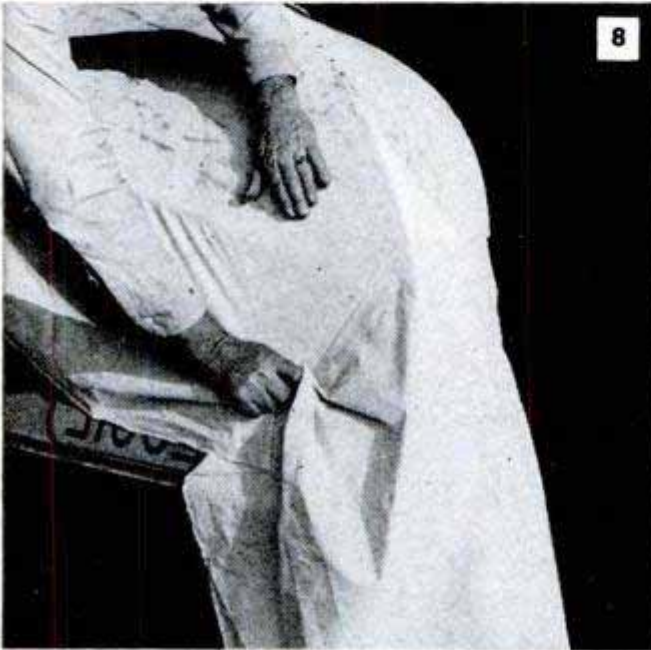


allow the plastic to set for about one hour.

While the plastic is setting, cut the cloth covering to the rough size, using either glass cloth or unbleached muslin. Then roll the boat back into the shade and apply a second coat of plastic, taking special pains to coat the strips over the seams thoroughly so that there are no dry spots, Fig. 3. Lower the cloth over the wet surface, pull it uniformly tight and press into contact with the plastic as in Fig. 6. An ordinary squeegee can be used for working the plastic into close contact, but avoid excessive pressure as otherwise you may remove too much of the plastic coating. At the bow, the covering is fastened to the keel with copper tacks, Fig. 6. Be especially careful to work out all wrinkles that may develop over the bow, Figs. 7 and 8. Trim off excess cloth about 1½ in. above the gunwale, or spray rail.

Now, without curing the previous coat, apply a second coat of plastic to the cloth surface, Figs. 9 and 10. If you are using muslin as a covering, reduce this coat about 25 percent. Use the plastic unthinned on glass cloth. Soak the surface thoroughly and make sure that there are no blisters before curing in the sunlight. This time allow the plastic to cure so that it is sufficiently hardened to permit a light sanding with fine-grit paper. Some boatmen sand the first coat lightly, but as a rule this is not essential. This final step completes the bottom. In some cases, it will be necessary to cover only the bottom from the keel to the chines as was done on the boat pictured, but if the side planking shows signs of checking and other minor deterioration, it is best to cover the sides of the boat as well. Use the same procedure, except that in most instances a somewhat lighter cloth may be used. Details A, B and C in Fig. 5, also detail C in Fig. 2, show recommended methods of lapping the cloth covering at the chines, gunwales and transom. Special care must be taken to get a smooth lap of the cloth at the chine, detail A in Fig. 5. On some hulls it may be necessary to notch the overlapping edge of the cloth from a point near midships forward to the bow to prevent wrin-





pling of the side covering. Some boatmen will want to cover the transom and this is perhaps desirable on a rowboat, but on hulls designed for outboard motors it is neither necessary nor advisable. The cloth covering is brought around the corner formed by the transom and side planking, notched if necessary to prevent wrinkling,

and covered with flat hardwood strips as in Fig. 2, or with half-round molding as in Fig. 5. The job is finished with a light sanding, reinstallation of the moldings, spray rails and rub rails, and keel shoe. After the plastic is thoroughly cured, the hull may be painted any color desired. Paint must be removed in order to renew the plastic.

### Foil Helps Preserve Model Engine After "Pickling" for Storage

A model-airplane engine can be protected effectively when stored by oiling and greasing it and wrapping in aluminum foil. First, cover the entire outer surface of the engine with a light grease. Then remove the spark plug and fill the engine with a light break-in oil, or any oil of the type recom-

mended for use as model-engine fuel. Now, after replacing the spark plug, wrap the engine in the foil, using a sheet large enough to completely enclose the engine. No rubber bands or string are needed to hold the foil in place, since it can be pressed into any shape desired.

### Cork Helps to Remove Skin From Surface of Paint

The skin that usually forms on the surface of paint after some has been used from the can, may be removed easily with the help of a large cork. Before storing a partly used can of paint, immerse the cork in the paint and leave it in the can. If a skin forms

over the surface of the paint before it is used again, simply separate the skin from the sides of the can and lift the cork. When sufficiently thick and hardened, the entire skin will be lifted free of the paint.

George Kapitan, New York City.



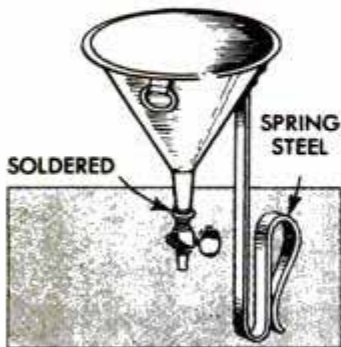
## Marble in Tip Helps Balance Balloon To Create Exciting Parlor Stunt



Balancing a long toy balloon on the tip of your finger for an extended period of time is sure to provide a child with a delightful parlor stunt. This seemingly difficult feat may be performed easily with the aid of a marble slipped into the balloon and pushed down into the tip of the lower end.

## Funnel Fitted With Pet Cock Dispenses Liquid by Drops

If you have occasion to apply liquid drop by drop to any mixture or solution, a dispenser for this purpose can be made inexpensively from a tin funnel and a small pet cock. The latter is soldered into the neck of the funnel, which is fitted with a spring-steel clip for supporting the funnel in a vertical position.



Such a dispenser is also handy for the amateur lapidarist, or anyone else using abrasive wheels where water must be applied to them. — R. E. Hancock, Portsmouth, Va.

## Warmed Roofing Lies Flat

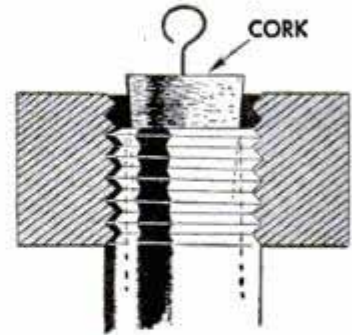
Wrinkles and bumps will not develop in asphalt roll roofing if the material is applied on a very warm day. If the roofing must be done during cool weather, the rolls

should be stored at room temperature until ready for use. Applying the warm roofing assures that it will not expand additionally after it is on the roof.

Carter Robertson, Chicago.

## Pipe Plugged While Threading

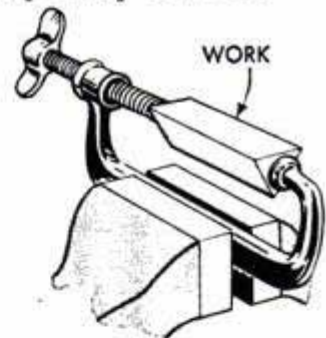
Threading vertical lengths of conduit or water pipe after they have been installed sometimes causes chips to be dropped into the pipe. In the electrical system, this may result in



shorts or grounds, and in the water system the chips are liable to damage the faucets. To guard against this possibility, plug the pipe with a cork before cutting the threads. Select a cork to suit the size of the pipe, and cut away the upper portion of the cork so that the die will fit over it. Press a short length of stiff wire through the cork, bending it to form right angles at the bottom and a loop-shaped handle at the top.—Anthony J. Mazure, Jr., Crown Point, Ind.

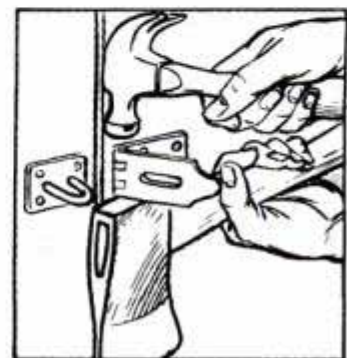
## Clamp Enlarges Capacity of Vise

If you have an irregularly shaped piece of work that won't fit endwise in a vise, try holding the piece in a C-clamp and mounting the frame of the clamp in the vise jaws.



## Tightened Garage-Door Hasp Pin Prevents Accidental Locking

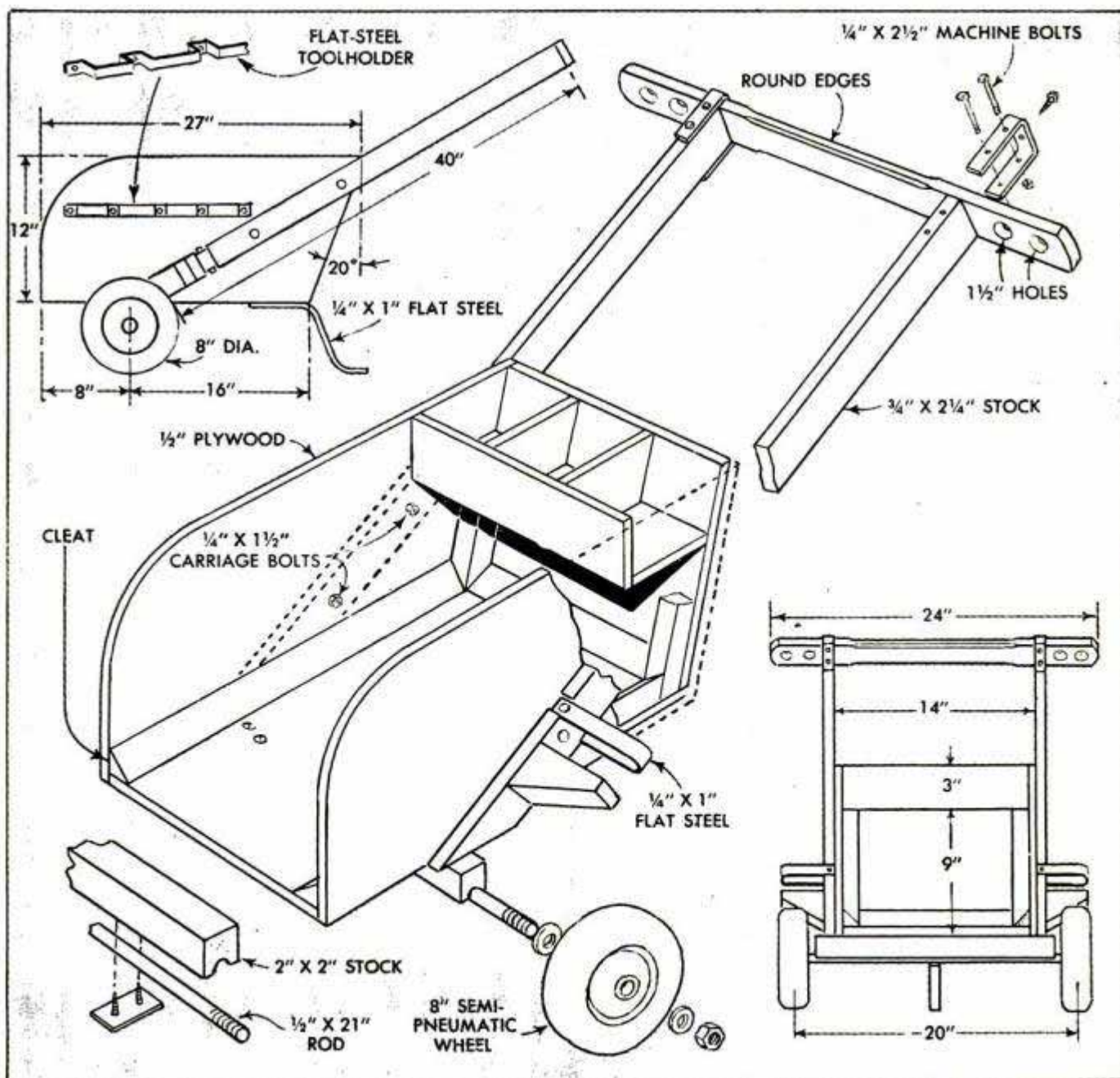
If you ever have been in a garage or barn when the only door was blown shut, causing the hasp to swing over the staple so that you were unable to open the door from inside the building, you may find it helpful to try this preventive measure. Hold the head of an ax or other heavy tool under the hasp pin and pound the top of the pin until it fits snugly. This will prevent the hasp from swinging around whenever the door is slammed shut.





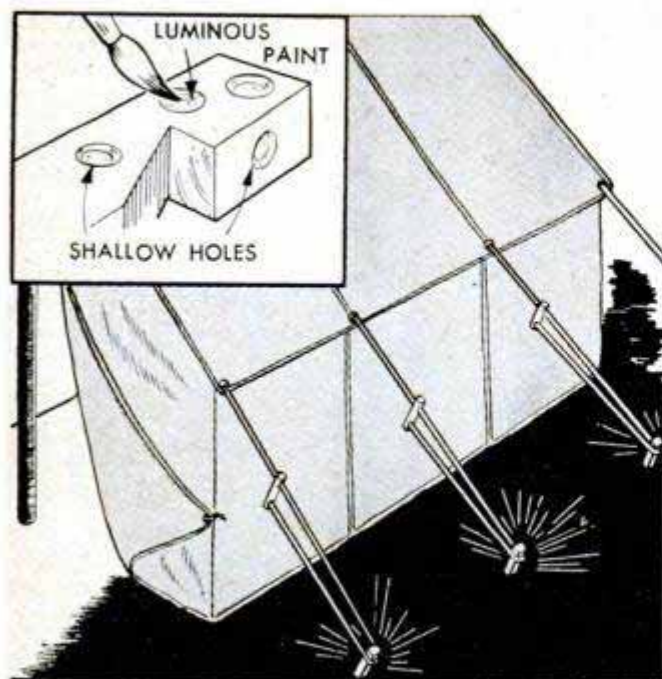
# ALL-PURPOSE GARDEN BARROW

THIS handy garden barrow will help eliminate the necessity of numerous trips back and forth from the garden to the garage to fetch various garden tools as the need for them arises. Wheeled along easily on two 8-in. semi-pneumatic tires, the barrow accommodates several long-handled tools, such as rakes and hoes, and has a convenient rack for carrying a number of small garden tools. The body, which contains compartments for seeds and bulbs, has plenty of room for carrying bags of fertilizer or grass seed, humus, plant clippings or hose. The body is constructed from  $\frac{1}{2}$ -in. waterproof plywood. The axle is held in a groove cut in a 2 x 2-in. block attached to the underside of the barrow.—Hi Sibley, Nuevo, Calif.



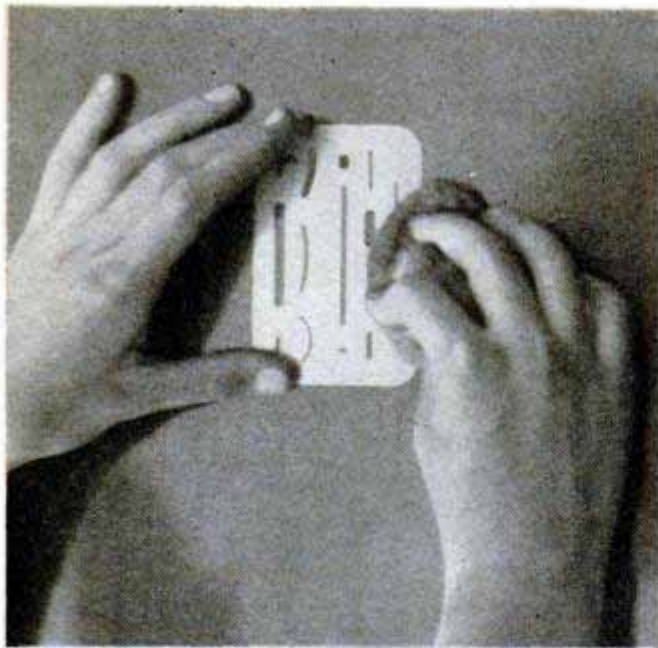


## Shallow Holes in Tent Stakes Preserve Luminous Paint



When using luminous paint on tent stakes, drill shallow holes in them and apply paint to the holes. In this way, the paint is less likely to be chipped off when driving the stakes, or worn off from exposure to soil and water. Also, the holes permit a thicker coating of paint to be applied.

## Furniture Spots Refinished With Aid of Eraser Guide



When sanding small spots on furniture or a car to refinish them, an eraser guide of the kind used by typists will prevent marring the finish surrounding the damaged spot. Just place one of the openings in the guide over the spot to be sanded and then use the sandpaper or steel wool in much the same manner that you would use an eraser.

# Wooden AWNINGS and CANOPIES

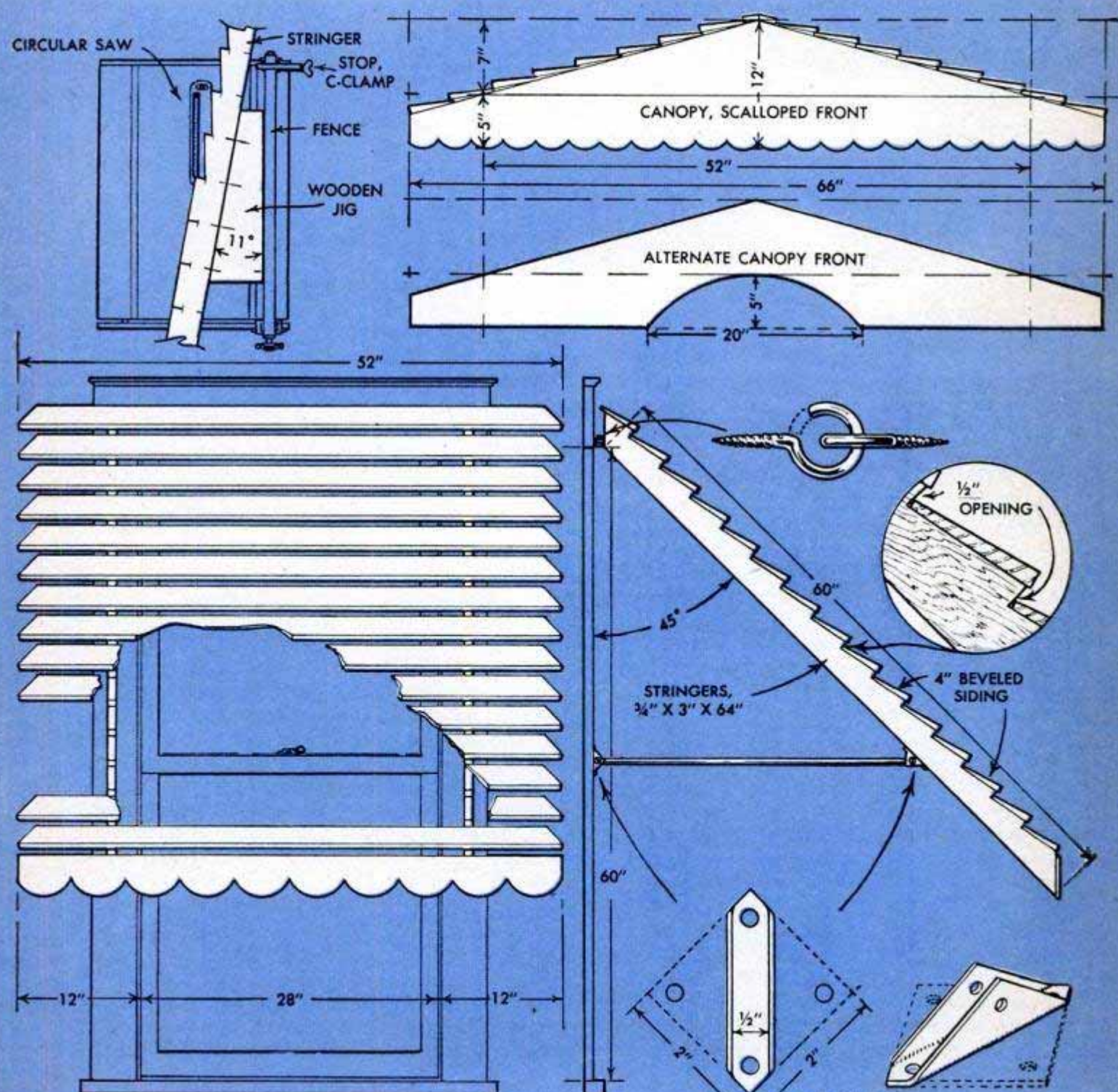
By Julius W. Marsh

**F**AR SUPERIOR to the common variety of cloth window awnings, these wooden ones will last indefinitely. Even though they cover two thirds of the window to provide maximum protection against sun and rain, your view is not obstructed because you still can look through them as you would a Venetian blind. Designed for free passage of air, strong winds will not damage them. They also are designed to drop flat against the window, a desirable protective feature in the case of a summer home which is closed for the winter season. The most important feature, of course, is the fact that they can be made easily and inexpensively by any homeowner with little more than a saw and hammer. Using lengths of standard 4-in. beveled siding for the slats, the work requires merely nailing the slats to "saw tooth" stringers, adding simple standoff curtain-rod braces and hanging them with screw eyes. Width of the awning for any particular window is determined by the width of the sash, plus 24 in. The dimensions given in the drawing are for a 28 x 60-in. sash, 15 slats being cut 52 in. long. Where a span of several windows is to be fitted, the complete awning can be made in several sections with false stringers added for additional support. If you have a table saw, a wooden jig may be used to cut the saw-tooth member uniformly. Here, of course, the depth of the notches is cut in the edge of the pieces first. The stringers are laid out for 4-in. notches, the lines being extended across the full width of the piece. These serve later as index marks in positioning the work on the jig. As shown, the jig is tapered 11 deg. and correspondingly spaced index marks are made along the tapered edge. After all notch cuts are made, a chisel is used to break out the waste blocks quickly. Canopies are made similarly and supported with the same kind of standoff braces. A choice of two styles of canopy front is given. Likewise it is optional whether the scalloped edging is to be added to the awnings. The standoff braces are of 1/4-in. cold-rolled rod, the ends being flattened.

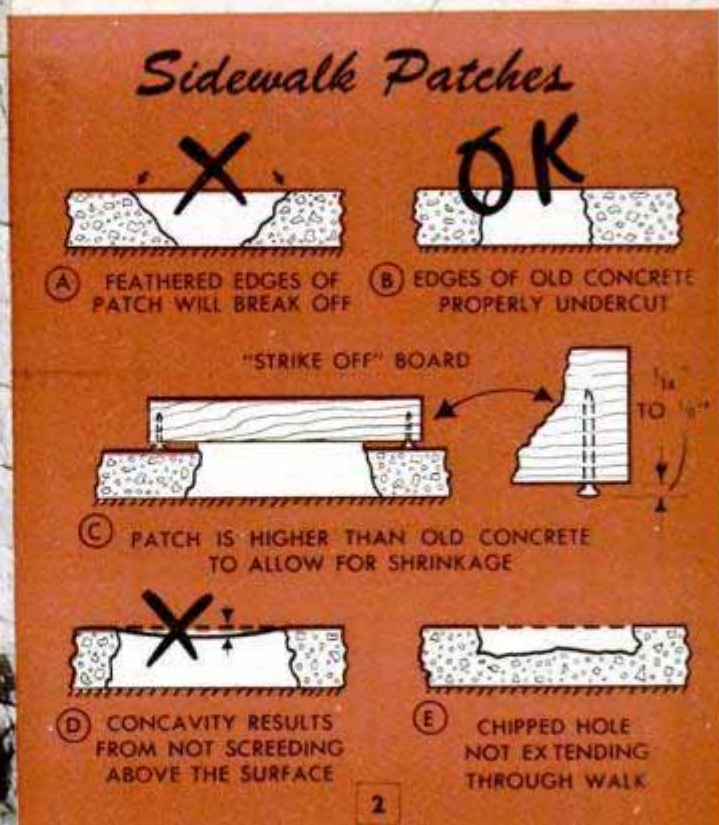




In addition to their usefulness as awnings, these two before and after shots show what a decorative touch these smart slatted awnings lend to a plain-looking house, especially when painted a complementary bright color







## CONCRETE REPAIRS around

By E. R. Haan

**I**T'S EASY to repair cracked and broken concrete walks, driveways, steps, floors and walls, or make other permanent repairs and improvements around your home with concrete.

**Patching sidewalks:** To patch broken and crumbled portions of walks, driveways and floors, first chip away all old and crumbly concrete and undercut the edges as in detail B, Fig. 2 and Fig. 4. Always avoid featheredge joints when joining new concrete to old, detail A, Fig. 2, as such edges will break off. Use a cold chisel and hammer for chipping concrete, and protect your eyes from flying chips by wearing goggles. If the broken portion does not extend entirely through the walk, roughen the bottom and have the sides straight or undercut as in detail E, Fig. 2. Brush away all chips and dirt, and soak the edges thoroughly, Fig. 5. Then apply a coat of grout, Fig. 6. This is simply a mixture of portland cement and water, of pastelike consistency, which penetrates small voids and irregularities. Use mortar for small patches, concrete for large ones.

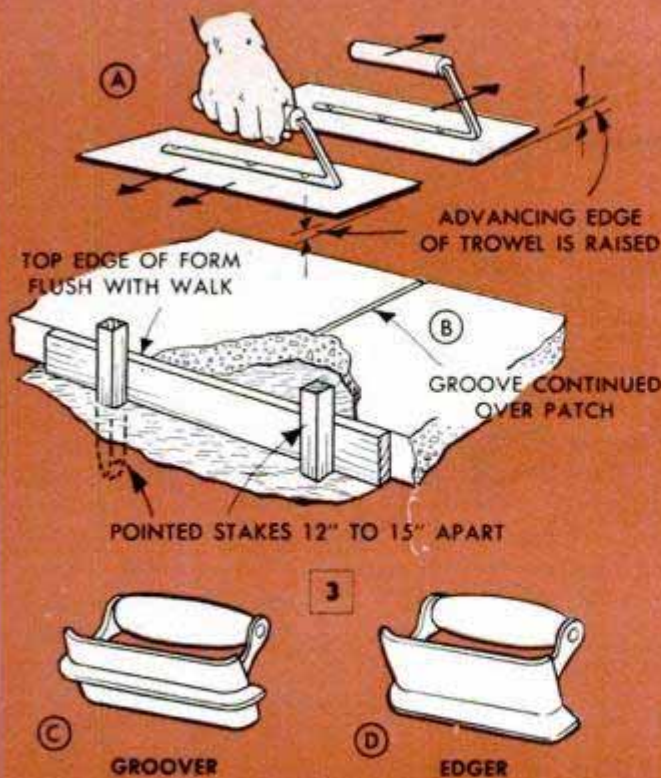
You can purchase prepared mortar mixes requiring only the addition of water. Concrete is made by adding gravel or crushed stone. If you mix your own mortar, use

portland cement, 1 part, and clean sharp sand, 3 parts. Mix these dry until gray color is uniform, then add just enough water to make a rather stiff mix. Small amounts can be mixed in an old pail. For concrete patches a 1:2:3 mix of portland cement, sand, and gravel, or crushed stone is recommended. Details on mixing large quantities are given in the paragraph entitled "Mixing by hand." When placing concrete in a large hole you can add washed stones.

Let the patch come about  $\frac{1}{4}$  in. above adjoining surfaces. Then scrape the surface even with a strike-off board, detail C, Fig. 2. Note that this has nails projecting slightly from the underside at both ends to ride on adjoining surfaces so the patch will be slightly higher to compensate for shrinkage. For large patches, the height should be slightly more than for small patches. This method of surfacing or screeding prevents the patch becoming slightly concave after it sets and dries. See detail D, Fig. 2.

After an hour or two, during which time the mortar or concrete attains its initial shrinkage, you can use a steel trowel or a float to get a smooth or a rough finish respectively. Move the trowel or float sideways with slight downward pressure and with the advancing edge raised a little as





## the Home

in detail A, Fig. 3. To hold concrete at the edge of a walk, use a flat board and stakes, detail B. When a patch crosses a joint, use a groover, detail C, to continue the groove. Use an edger, detail D, to round the outside edge next to the form. After a few hours, when the surface has set hard enough to resist marring, lay a piece of tar paper over the patch and cover this with sand or dirt as in Fig. 7. Or, cover the patch with a layer of grass clippings about a foot thick, and soak them with water. Such coverings retard evaporation and permit concrete to cure slowly, which is necessary to obtain its greatest strength. Keep the patch covered for a week.

**Filling walk-to-wall cracks:** Where walks join exterior masonry walls, keep the crack tightly sealed to prevent entrance of water and also the removal of soil from under the walk by ants. Ants can remove considerable soil as shown in Fig. 8. This, together with water, often causes the walk to settle and tilt as shown in detail A, Fig. 9. Cracks  $\frac{1}{8}$  or  $\frac{3}{16}$  in. wide can be sealed with asphalt roofing cement or calking compound forced in deeply with a calking gun, detail C. Such calking will adhere firmly to masonry surfaces if applied when the surfaces are dry. If not dry, you must first dry the sides of the crack with a blowtorch as in detail B. If properly applied to small cracks, roofing



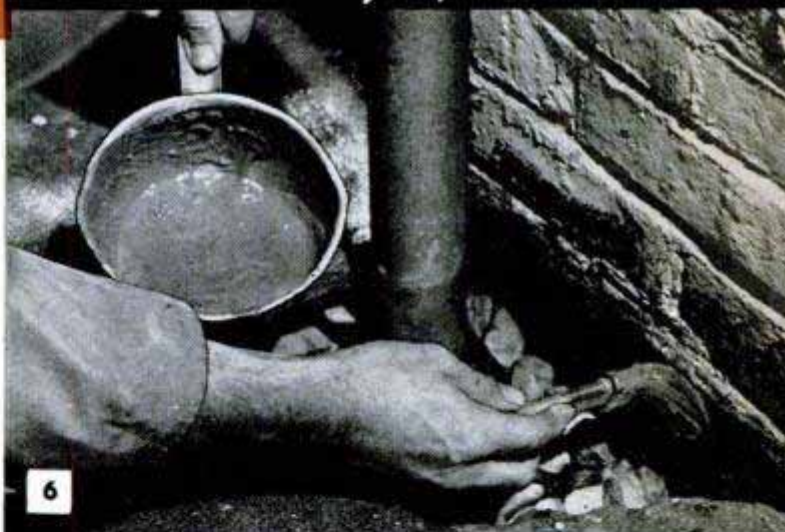
4

*Undercut the Sides*



5

*Soak Thoroughly With Water*



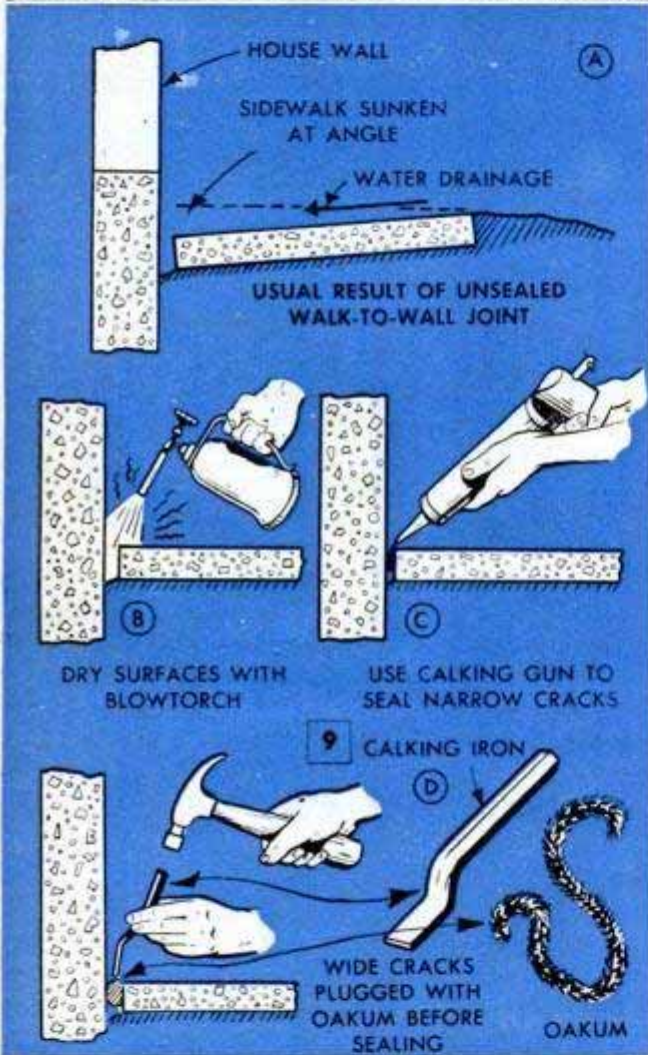
6

*Apply Grout Coat*



7





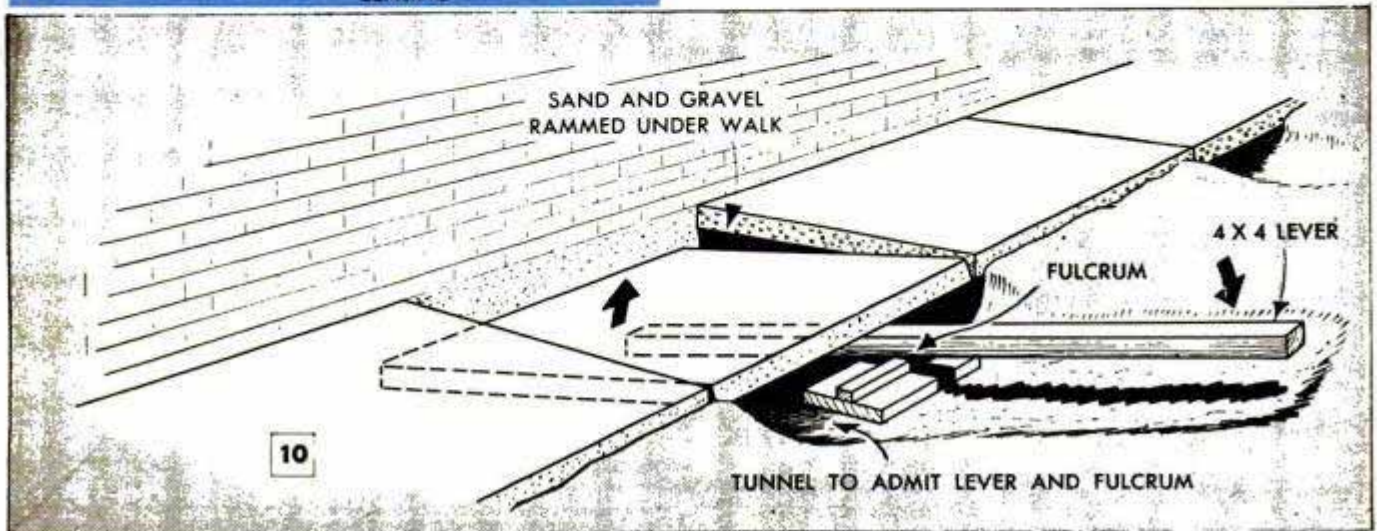
cement and calking compound remain slightly flexible and will not loosen from slight expansion and contraction of the walk.

For sealing wider cracks, first brush out loose particles and dirt, dry the surfaces, and then smear oakum or jute with roofing cement or calking compound before tamping in place. Use a calking iron and hammer as in detail D. Leave just enough space above the tamped fill for a layer of seal. If only roofing cement or calking compound is used for wide cracks, the seal may loosen from shrinkage.

**Leveling tilted walks:** Badly tilted walks that are still in good condition sometimes can be pried up level as in Fig. 10. While a helper holds up a walk section with a heavy wooden lever, gravel or crushed stone and sand are tamped firmly under it. After leveling the walk, seal the crack along the house wall as explained in the preceding paragraph.

**New walk sections:** When replacing one or more sections of a walk—or laying a new walk—break up the old concrete with a heavy sledge and remove it. You can use the pieces as in detail A, Fig. 12, to help save concrete. Soak the chunks to prevent rapid absorption of moisture from the new concrete. Leave enough space between the pieces for the concrete to anchor securely.

Whether or not pieces of old concrete are used as fill, the first step in laying a walk is to excavate to proper depth and erect forms, Fig. 11, to hold the concrete. Use 1-in. boards as wide as the thickness of the walk or driveway, 4 or 5 in. being recommended for walks and 6 in. for driveways. Hold the forms in place with pointed stakes driven firmly into the ground on the outside of the form and at 12 or 15-in. intervals as in detail B, Fig. 12. The stakes should not extend above the forms. Nail the forms to the stakes with 4d nails with heads driven down flush. One side of the form should be slightly lower than the other, about  $\frac{1}{4}$  in. per ft. of width of the walk,



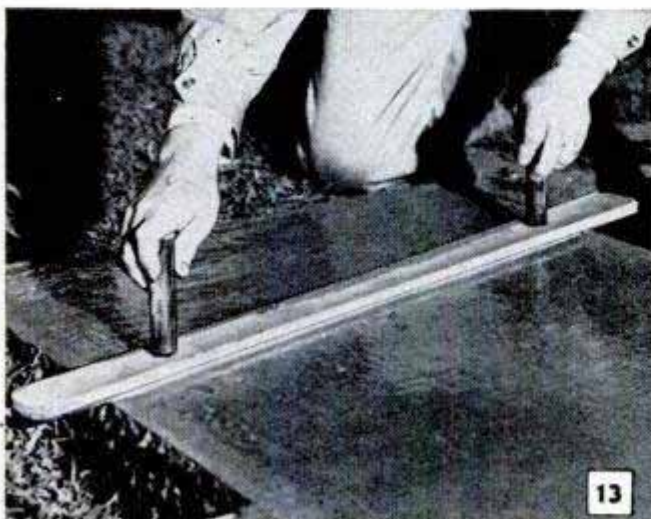
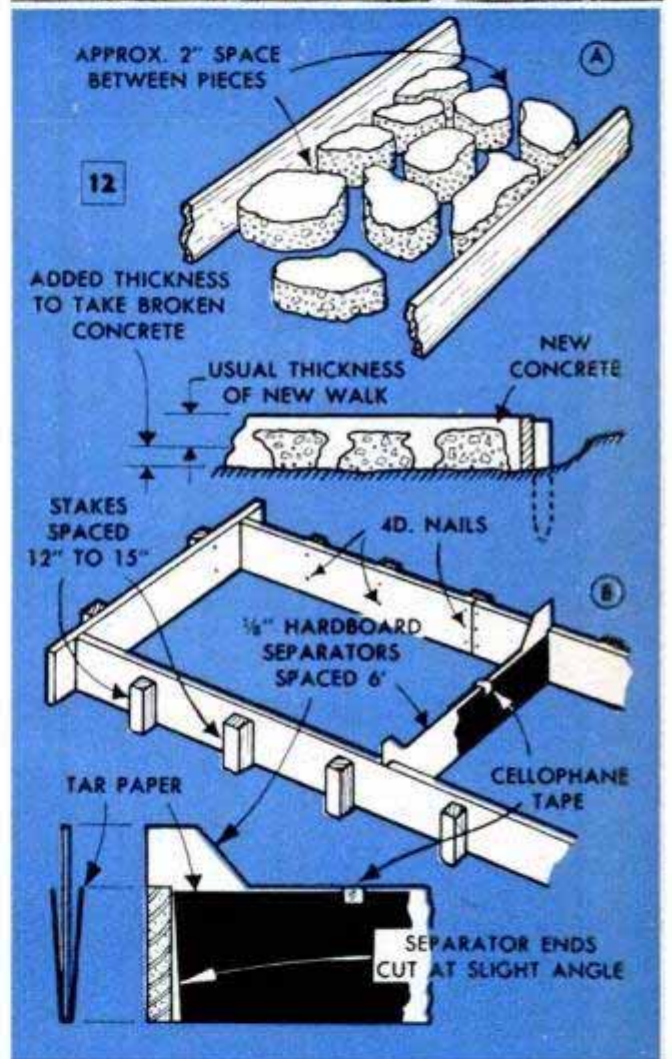
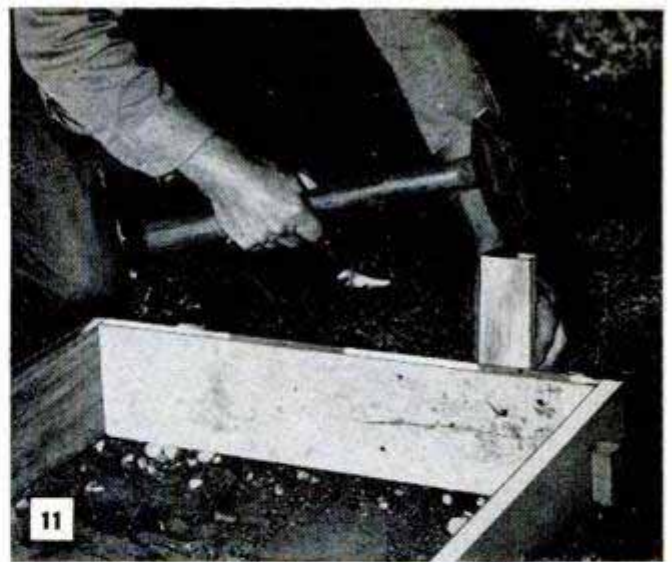


to provide a slight slope for drainage. Use a level across the forms to adjust for height. Wide walks and driveways are crowned sometimes instead of being sloped toward one side.

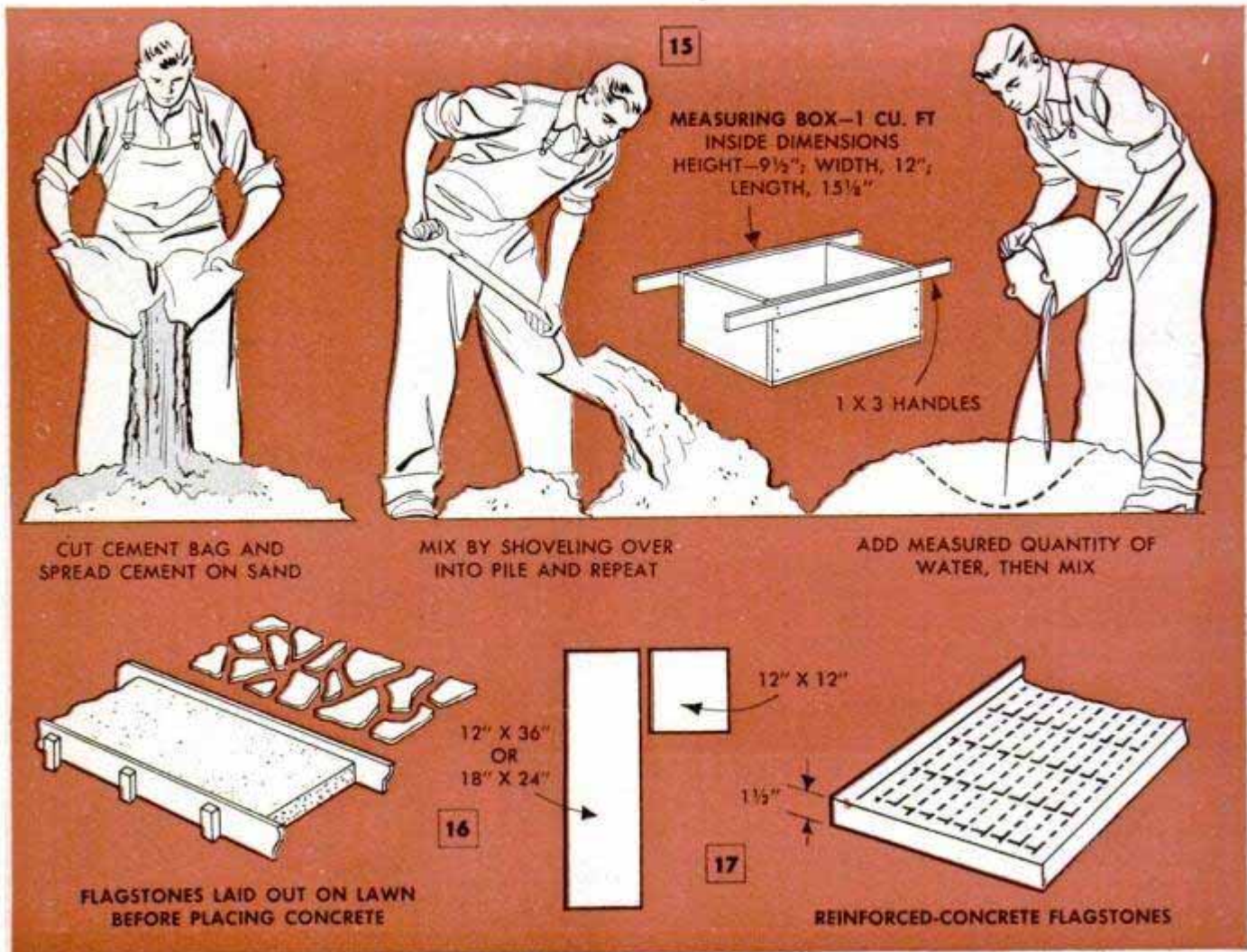
Concrete walks and driveways can be laid directly on well-drained and well-compacted soil. When laid on poorly drained soil that cannot be tiled, a 5-in. subbase of gravel or cinders is first laid and a drain is placed to carry off water that collects under the walk. If no drain is provided, the porous subbase merely serves as a reservoir for water to collect and thus defeats its own purpose.

When laying a new walk, use separators  $\frac{1}{8}$  to  $\frac{3}{16}$  in. thick and as wide as the thickness of the walk, to form joints for expansion and contraction. You may be able to rent steel separators from a concrete contractor. Otherwise, make them from  $\frac{1}{8}$ -in. hardboard, detail B, Fig. 12. Place them at right angles across the forms and at intervals of about 6 ft. By inserting them in a folded piece of tar paper they are easily removed. Place the concrete on both sides of the separators at the same time to keep them straight. Then remove them when you finish the surface, leaving the tar paper in the joint.

Walks and driveways can be laid in one course. The mix for this is 1:2:3 of portland cement, sand, and crushed stone, or pebbles no larger than 1-in. dia., with water not exceeding  $6\frac{1}{4}$  gal. per sack of cement. Immediately after pouring the concrete, level it with a strike-off board resting on the side forms, Fig. 14. Use a sawing motion as you advance. For crowning a wide walk or driveway, the underside of the strike-off board is cut slightly concave—and in this case the side forms are of equal height. While striking off, press interfering stones below the surface. In an hour or two finish the surface with a long float that extends over the side forms, Fig. 13. A strike-off board provided with handles will serve as a float. If a smooth finish is desired, use







a steel trowel in sweeping arcs. After removing separators, round the cross joints with a groover and the edges along the forms with an edger.

The two-course method of laying a walk is sometimes preferred as there is no interference from stones when surface finishing. The first layer is a 1:2¼:4 mix and is tamped down ¾ in. below the top edge of the forms. Then a mortar top course (1:2 mix of cement and sand with just enough water for workability) is laid on within 45 min. after laying the first course. Finishing is the same as already explained.

**Ready-made concrete:** The hard work of mixing large quantities of concrete by hand can be avoided in localities where you can purchase ready-made concrete. This is poured from the truck on which it is mixed directly into forms, or into wheelbarrows used to distribute it.

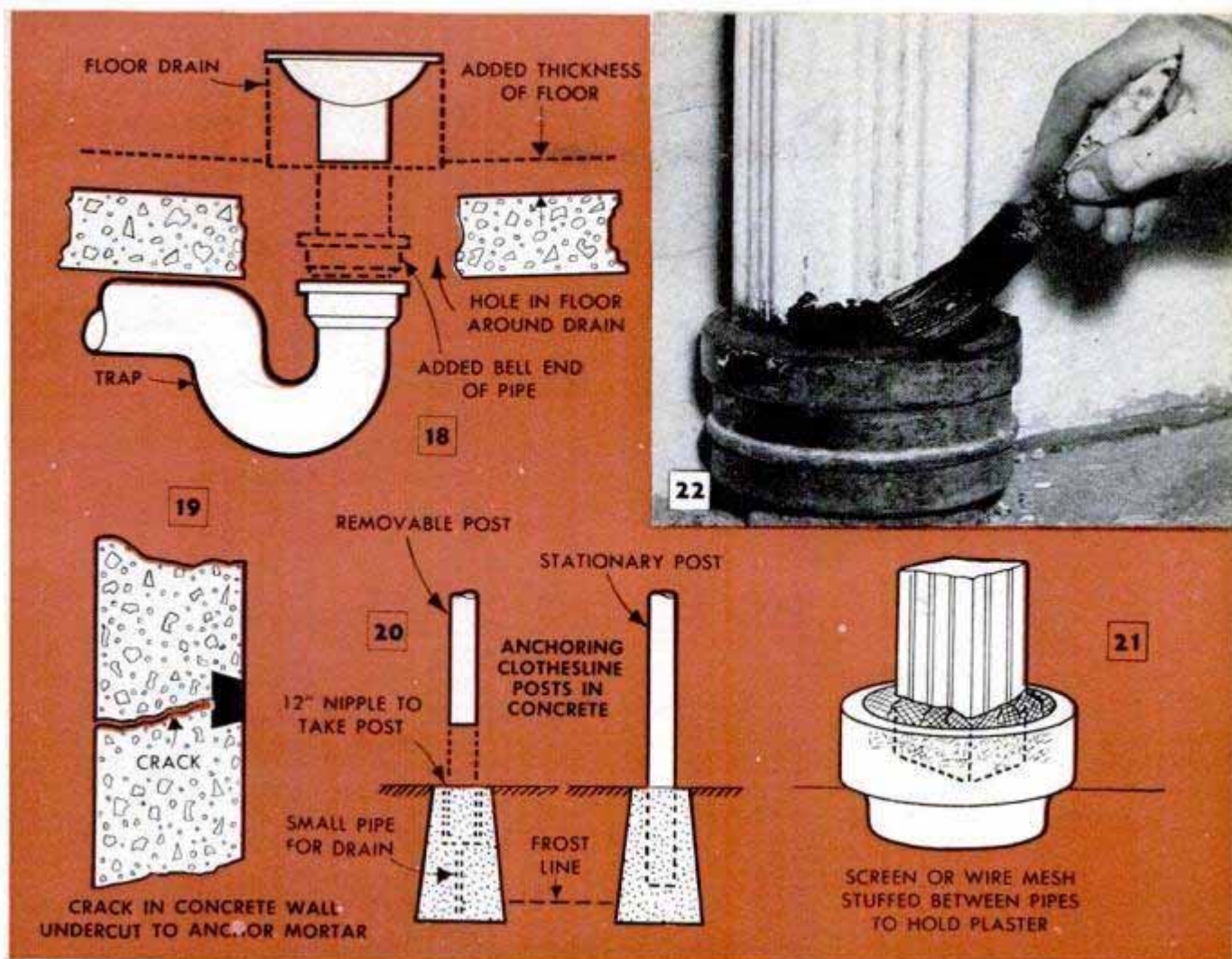
**Mixing by hand:** If you have to mix a large amount of concrete by hand, do it on a flat surface such as a driveway, Fig. 15. Be sure to remove all traces of each mix with a hose and old broom to prevent an accumulation of cement. Concrete aggregates are measured by volume. A sack of cement equals 1 cu. ft. To measure sand and gravel, use a box as detailed in Fig. 15. Spread a measured quantity of sand in a

layer on the mixing surface and distribute the required amount of cement over it. Then turn over the pile to mix thoroughly. Add the required quantity of crushed stone or gravel and repeat the mixing until you have a uniform distribution. At least three turnings are necessary to do this. Make a depression in the center of the pile to hold water, which should be clean enough for drinking, adding it as needed. Never use more than 6¼ gals. of water per sack of cement; less if the sand is very moist. Mix until all stones are covered with wet cement and sand. Use only clean sharp sand and clean gravel, properly graded.

**Brick and flagstone walks:** Where earth is well-drained and not subject to heaving frosts, brick and flagstone walks can be laid directly on it. Usually the excavation is made deep enough for a 2-in. layer of sand under the bricks or stones. By standing on flagstones already laid, instead of on the sand, the walk will remain level. Butt the bricks together or space them about ¼ in., filling the spaces later with sand. You can lay the bricks in any of several attractive patterns. Use a lawn roller to press them down to uniform height. If you desire, use mortar instead of sand to fill spaces between bricks.

Brick and flagstone walks will remain





level longer if they are laid on a 4-in. concrete base, Fig. 16. After tamping the concrete level, spread on a ½-in. layer of mortar just before placing the bricks or stones. If you are laying flagstones, arrange them on the ground as they are to be placed permanently, as shown, before laying the concrete and mortar, to avoid setting of the latter while experimenting with design and arrangement of stones. Fill joints with mortar. To prevent it from sticking to the exposed sides of the stones (or bricks) coat these sides with linseed oil. You can make concrete flagstones as in Fig. 17. Reinforce them with fence wire, preferably the kind that is welded together. Several such castings can be made in a large, partitioned form, which is greased to minimize sticking of the concrete. Use gravel up to ½ in. in diameter.

**Resurfacing broken floors:** Old, broken basement floors of concrete can be resurfaced with a 2 or 3-in. layer of concrete. Chip out embedded floor traps and install longer sections of soil pipe as in Fig. 18 to compensate for the added thickness of the concrete floor. If the soil pipe is cast iron, it is best to have a plumber add a new section as the joints are leaded. Joints of vitrified-clay pipe are sealed by tamping with oakum or jute, and filling with cement mor-

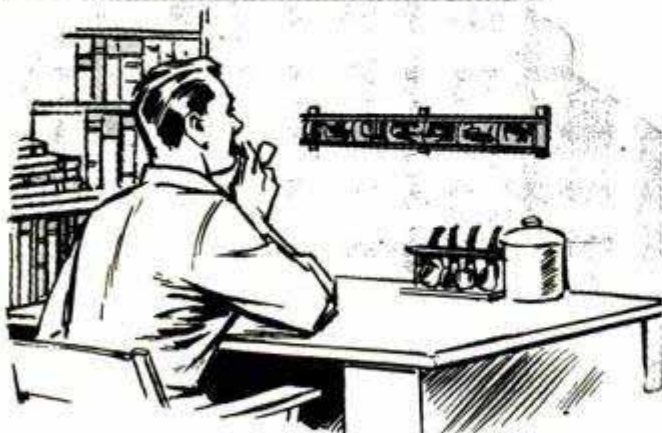
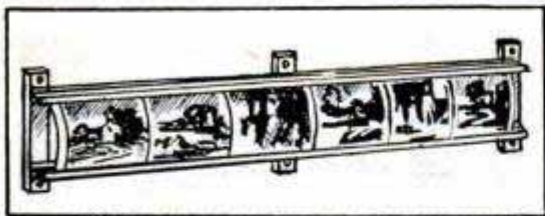
tar. Brush away all loose dirt from the old floor, soak it thoroughly and coat with grout. Do this in sections about 3 ft. wide so you can work the concrete to uniform thickness and finish the surface before laying the next section. Be sure to maintain the drainage slope.

**Sealed wall cracks:** To seal cracks in concrete walls with mortar, undercut both sides of the crack, Fig. 19, brush away all dirt and loose particles, soak the surfaces, apply grout and then the mortar. Do this at a time when water is not seeping through the wall. Large structural cracks should be examined by a contractor as they may indicate other and more extensive trouble.

**Other concrete jobs:** Steel clothesline posts are anchored securely in concrete as in Fig. 20. The concrete should extend below the frost line. For circular clotheslines, embed a short length of pipe in the concrete, in which to slip the post, permitting easy removal. Often it is desired to seal downspouts to iron or clay pipe leading to the house drainage system. Stuff some screen or fine wire mesh into the joint, Fig. 21. Then seal with plaster of paris rather than cement mortar; the plaster can be broken out without damaging the clay pipe. Waterproof the plaster with a coat of roofing cement, Fig. 22, to complete the job.



## Hobbyist Mounts Model-Train Photos on Miniature-Track Sections



Using sections of miniature twin-rail track in place of frames, one hobbyist devised a unique method of mounting and displaying snapshots of his model railroad. The photos are trimmed and mounted on a strip of mounting board, which then is covered with cellophane and curved to fit between the track rails as shown. Screws are inserted through holes in the ends of track ties to fasten the sections to the wall.

## Spectacles Kept Tight With Nail Polish



If a small screw in your spectacles loosens and you cannot keep it tight, apply a drop of nail polish to the head. This will cement the screw in place until you can have the spectacles repaired permanently. This same

idea may be used for other small screws that have a tendency to loosen from vibra-

tion. Be sure the screwhead and the surrounding metal surface of the frame are completely free of grease and oil to make it possible for the nail polish to adhere to them. Replace the bottle cap tightly to prevent the liquid from evaporating.

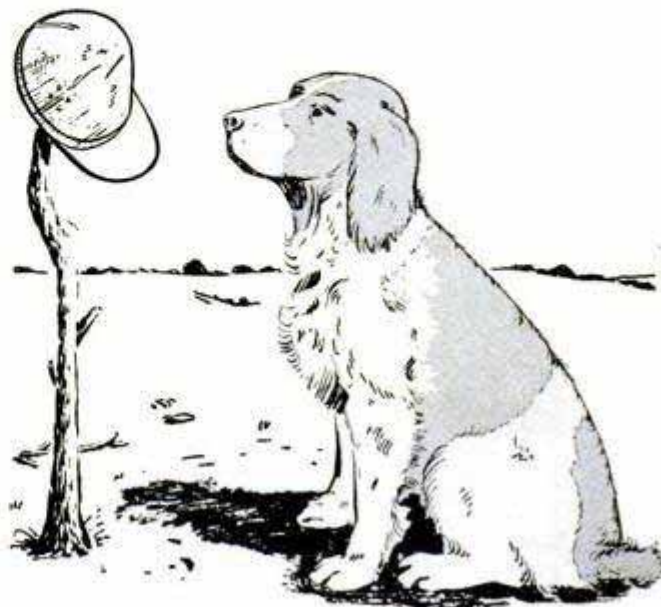
## Dust-Tight Bottom for Door Mat

To prevent the floor under a door mat from being continuously covered with dust and debris which work down through the mat, fit it with a dust-tight bottom. This can be done by covering the underside of the mat with a piece of oilcloth or closely woven cloth which is stitched to one end of the mat only. This permits the bottom to be dropped so that the dust collected there can be shaken into a container for easy disposal.



## Lost Hound Returns to Master's Cap Located in Vicinity of Separation

One hunter has found that when his hunting dog becomes lost after a long chase or because he followed another hunting party, he eventually returns to the place where he became separated from his master. Here the hunter drives a stake into the ground on which he hangs his hat or glove at the height of the dog's head. Returning the next day, the hunter nearly always finds the dog guarding the article of clothing that bears his master's scent. A near-by tree or fence post may serve in place of the stake.

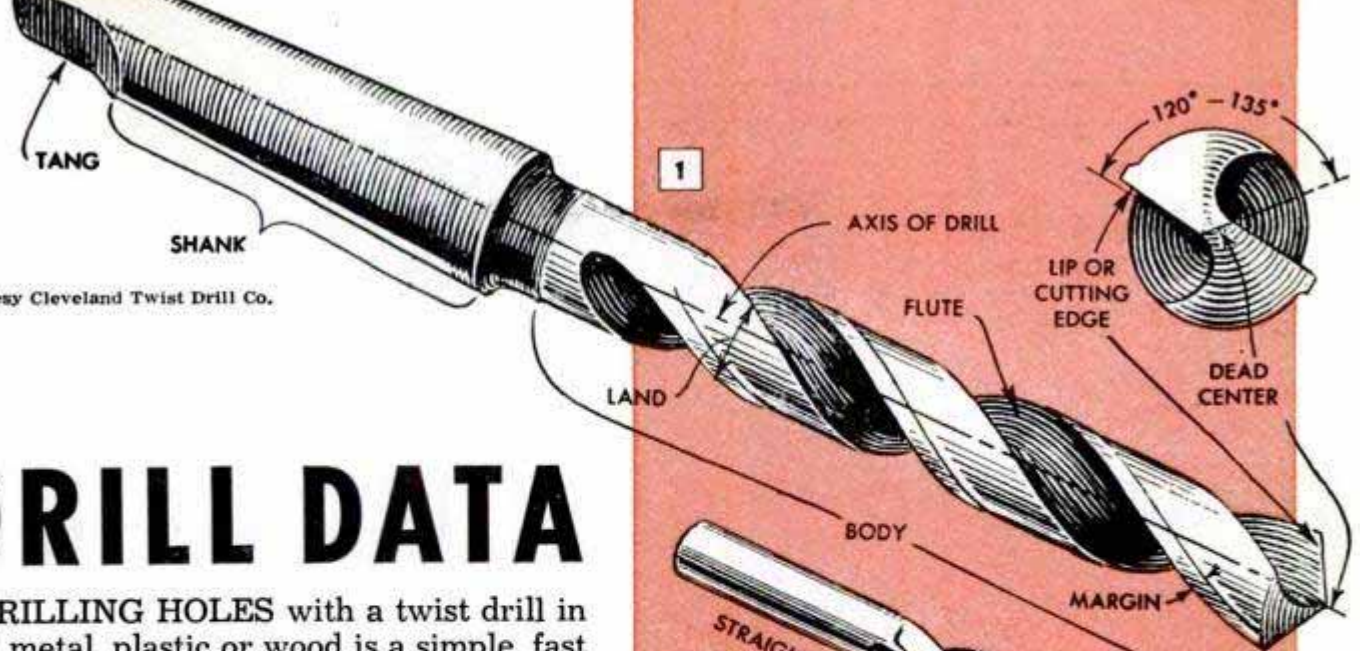


## Your Next Home Project... A Modern Dinette

Next month, in full color, we present a gay, modern dinette ensemble of plywood that you can build with little more than a saw and hammer. It is a seven-piece set offering you the choice of a conventional corner-type china cabinet or the popular functional china-buffet. The chairs feature colorful plastic upholstery. Don't miss this article in the May Craftsman Section.



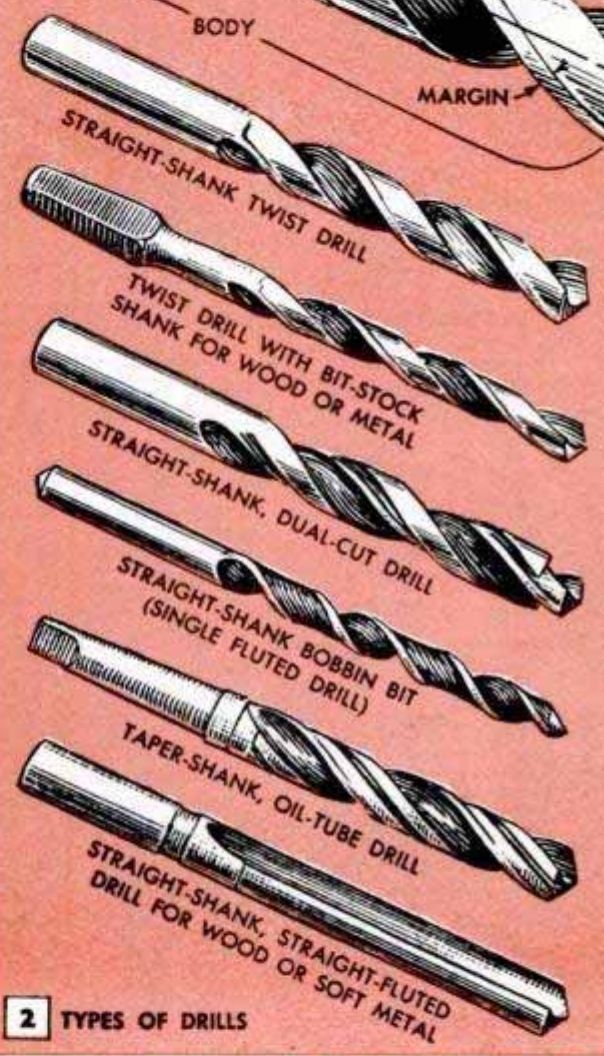
Courtesy Cleveland Twist Drill Co.



# DRILL DATA

**D**RILLING HOLES with a twist drill in metal, plastic or wood is a simple, fast operation if the drill bit has been properly ground for the job so that its cutting edges remove chips of a regular size and form. In order that the drill may produce accurate work, it is essential that the dead center of the cutting edges, or lips, be set precisely on the center line of the drill body, and the cutting lips be equal both in length and clearance angle. These important points are shown in Figs. 1 and 4. Drills are made in a wide range of sizes and flute types, Fig. 2, and also are available with straight shanks for use in a drill chuck, with squared shanks for use in an ordinary hand brace and with tapered shanks for use in heavy-duty drill presses having tapered spindle sockets. The tang, formed by milling a flat on opposite sides of the tapered shank, engages a slot in the small end of the socket and provides a positive drive. Drills are available in four general classifications. The number sizes range from No. 80, the smallest, to No. 1 (.0135 in. to .228 in.). In the letter sizes, A to Z, inclusive, the drills range from .234 in. to .413 in. in

**2** TYPES OF DRILLS



**3** CAUSES AND CURES FOR COMMON DRILL TROUBLES

**BREAKING OF CUTTING EDGES AT CORNERS**

**CAUSE**

- 1—Too much lip clearance
- 2—Material has hard spots, sand inclusions or scale
- 3—Drill running too fast
- 4—Wrong cutting compound or lubricant
- 5—Feed too rapid

**CURE**

- 1—Regrind and reduce lip clearance to between 12 and 15 degrees
- 2—Reduce speed
- 3—Reduce speed
- 4—Use proper lubricant or compound
- 5—Reduce feed

**OVERSIZED HOLE**

**CAUSE**

- 1—Length and angle of lips not equal

**CURE**

- 1—Regrind drill and equalize lip angles and lip lengths

**BROKEN TANG**

**CAUSE**

- 1—Poor fit of tang in socket caused by nicks, burrs, dirt or wear
- 2—Mutilated tang

**CURE**

- 1—Ream old socket or replace with new one. Cleaning sockets before use lengthens their life
- 2—Dress or replace

**CHIP FORM CHANGES**

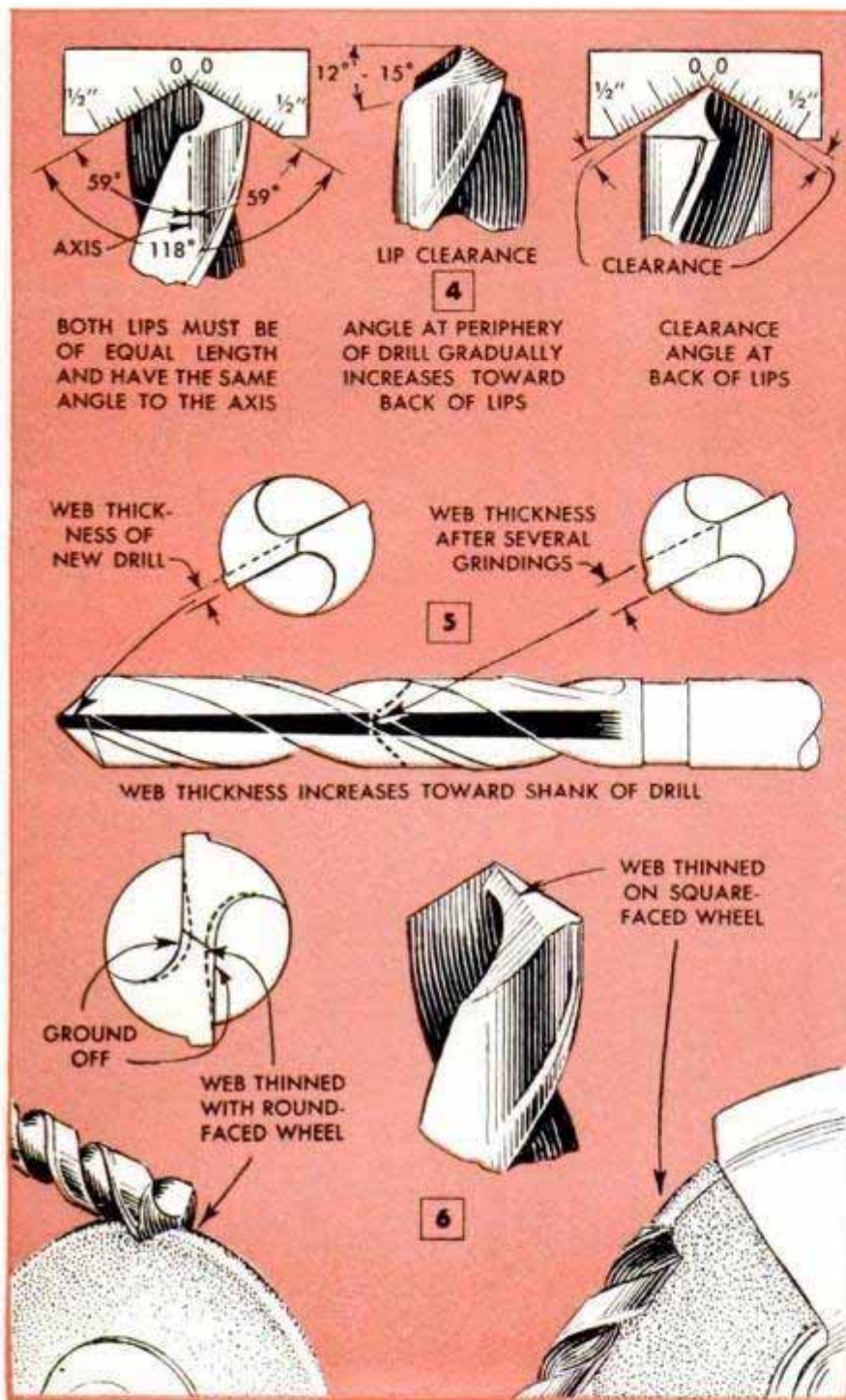
**CAUSE**

- 1—Lubricant not reaching proper location

**CURE**

- 1—Drill chipped, dulled or damaged—Inspect and regrind
- 2—Remove drill and check lubricant





lips, or increased web thickness after the drill has been ground a number of times. Increased web thickness is corrected by grinding away the flutes as in Fig. 6. For ordinary work in common metals, such as gray iron and cold-rolled steel, the lips are ground to an included angle of 118 deg., or 59 deg. from the center line as in Fig. 4. The correctness of this angle and the width of the web at the dead center are extremely important to the satisfactory operation of the drill. When grinding, use a drill gauge and check the angle of the lips frequently. Dip the drill point in warm water at intervals while grinding it to prevent overheating. When drilling brass and certain other soft metals, many machinists increase the included angle across the lips to about 125 deg. and grind a narrow flat on each lip, reducing the clearance angle at the cutting edge to very nearly zero. This causes the drill to cut more slowly, prevents any tendency to dig in and helps to eliminate chipping when the drill breaks through.

The details in Fig. 3 show the more common drill troubles, and the causes and cures. When a drill bit which appears to be in good condition fails to perform satisfactorily, the cause sometimes can be traced to a defect in the

drill press. In automatic machines, backlash in a gear train or driving mechanism may be the cause of broken or chipped drills. Note also the first cause of a broken tang, Fig. 3. In nearly all operations on the various metals with the exception of gray iron, which usually is drilled dry, use of the proper lubricant is important. In industry, lubricant specifications are made for all types of metals and degrees of hardness. But, in ordinary work with common metals, kerosene and lard oil or kerosene and soluble-oil mixtures will serve for a wide range of work. Kerosene is commonly used in drilling aluminum, while lard oil will serve when drilling any of the mild steels, forgings, tool steel, cast steel and wrought iron. In ordinary work where production speed is not a factor, brass, bronze and gray iron usually are drilled dry.

dia. Fractional drills begin with the smallest,  $\frac{1}{64}$  in. in dia., and range upward by 64ths. Metric sizes range from .5 mm. to 10 mm. by .1-mm. gradations. Sizes larger than 10 mm. rise by .5 mm.

The cutting lips of a new drill wear away quite uniformly in normal use, but the rate of wear depends on the type of material being drilled, the amount of heat generated in the drilling operation and on other variable factors. A dull drill develops excessive friction at the cutting lips, the chip form changes in certain materials and breakage of the drill and damage to the work eventually result. Trouble with the drill, other than that which usually develops because of normal wear of the cutting lips, generally is caused by faulty grinding, which results in too much or too little lip clearance, unequal length and angle of the



# POPULAR MECHANICS

## TAP-DRILL SIZES FOR THREADS OF AMERICAN STANDARD FORM

## SIZES OF TAP DRILLS MACHINE SCREWS

SCREW THREAD				COMMERCIAL TAP DRILLS*				SCREW THREAD				COMMERCIAL TAP DRILLS*			
Outside Diam. Pitch	Root Diam. Inches	Size or No.	Decimal Equiv. Inches	Outside Diam. Pitch	Root Diam. Inches	Size or No.	Decimal Equiv. Inches	Outside Diam. Pitch	Root Diam. Inches	Size or No.	Decimal Equiv. Inches	Outside Diam. Pitch	Root Diam. Inches	Size or No.	Decimal Equiv. Inches
1/16-64	0.0422	3/64	0.0469	24	0.3834	X	0.3970	24	0.3834	X	0.3970	24	0.3834	X	0.3970
72	0.0445	3/64	0.0469	27	0.3894	Y	0.4040	27	0.3894	Y	0.4040	27	0.3894	Y	0.4040
5/64-60	0.0563	1/16	0.0625	1/2-12	0.3918	27/64	0.4219	1/2-12	0.3918	27/64	0.4219	1/2-12	0.3918	27/64	0.4219
72	0.0601	52	0.0635	13	0.4001	27/64	0.4219	13	0.4001	27/64	0.4219	13	0.4001	27/64	0.4219
3/32-48	0.0667	49	0.0730	20	0.4351	29/64	0.4531	20	0.4351	29/64	0.4531	20	0.4351	29/64	0.4531
50	0.0678	49	0.0730	24	0.4459	29/64	0.4531	24	0.4459	29/64	0.4531	24	0.4459	29/64	0.4531
				27	0.4519	15/32	0.4687	27	0.4519	15/32	0.4687	27	0.4519	15/32	0.4687
7/64-48	0.0823	43	0.0890	1/16-12	0.4542	31/64	0.4844	1/16-12	0.4542	31/64	0.4844	1/16-12	0.4542	31/64	0.4844
				18	0.4903	33/64	0.5156	18	0.4903	33/64	0.5156	18	0.4903	33/64	0.5156
1/8-32	0.0844	33/32	0.0937	27	0.5144	17/32	0.5312	27	0.5144	17/32	0.5312	27	0.5144	17/32	0.5312
40	0.0925	38	0.1015												
5/64-40	0.1081	32	0.1160	5/8-11	0.5069	17/32	0.5312	5/8-11	0.5069	17/32	0.5312	5/8-11	0.5069	17/32	0.5312
				12	0.5168	35/64	0.5469	12	0.5168	35/64	0.5469	12	0.5168	35/64	0.5469
5/32-32	0.1157	1/8	0.1250	18	0.5528	37/64	0.5781	18	0.5528	37/64	0.5781	18	0.5528	37/64	0.5781
36	0.1202	30	0.1285	27	0.5769	19/32	0.5937	27	0.5769	19/32	0.5937	27	0.5769	19/32	0.5937
11/64-32	0.1313	9/64	0.1406	11/16-11	0.5694	19/32	0.5937	11/16-11	0.5694	19/32	0.5937	11/16-11	0.5694	19/32	0.5937
				16	0.6063	5/8	0.6250	16	0.6063	5/8	0.6250	16	0.6063	5/8	0.6250
3/16-24	0.1334	26	0.1470												
32	0.1469	22	0.1570	3/4-10	0.6201	21/32	0.6562	3/4-10	0.6201	21/32	0.6562	3/4-10	0.6201	21/32	0.6562
13/64-24	0.1490	20	0.1610	12	0.6418	43/64	0.6719	12	0.6418	43/64	0.6719	12	0.6418	43/64	0.6719
				16	0.6688	11/16	0.6875	16	0.6688	11/16	0.6875	16	0.6688	11/16	0.6875
7/32-24	0.1646	16	0.1770	27	0.7019	23/32	0.7187	27	0.7019	23/32	0.7187	27	0.7019	23/32	0.7187
32	0.1782	12	0.1890												
15/64-24	0.1806	10	0.1935	13/16-10	0.6826	23/32	0.7187	13/16-10	0.6826	23/32	0.7187	13/16-10	0.6826	23/32	0.7187
1/4-20	0.1850	7	0.2010	7/8-9	0.7307	49/64	0.7656	7/8-9	0.7307	49/64	0.7656	7/8-9	0.7307	49/64	0.7656
24	0.1959	4	0.2090	12	0.7668	51/64	0.7969	12	0.7668	51/64	0.7969	12	0.7668	51/64	0.7969
27	0.2019	3	0.2130	14	0.7822	13/16	0.8125	14	0.7822	13/16	0.8125	14	0.7822	13/16	0.8125
28	0.2036	3	0.2130	18	0.8028	53/64	0.8281	18	0.8028	53/64	0.8281	18	0.8028	53/64	0.8281
32	0.2094	7/32	0.2187	27	0.8269	27/32	0.8437	27	0.8269	27/32	0.8437	27	0.8269	27/32	0.8437
5/16-18	0.2403	F	0.2570												
20	0.2476	17/64	0.2656	15/16-9	0.7932	53/64	0.8281	15/16-9	0.7932	53/64	0.8281	15/16-9	0.7932	53/64	0.8281
24	0.2584	I	0.2720												
27	0.2644	J	0.2770	1 - 8	0.8376	7/8	0.8750	1 - 8	0.8376	7/8	0.8750	1 - 8	0.8376	7/8	0.8750
32	0.2719	9/32	0.2812												
3/8-16	0.2938	5/16	0.3125	12	0.8918	59/64	0.9219	12	0.8918	59/64	0.9219	12	0.8918	59/64	0.9219
20	0.3100	21/64	0.3281	14	0.9072	15/16	0.9375	14	0.9072	15/16	0.9375	14	0.9072	15/16	0.9375
24	0.3209	Q	0.3320	27	0.9519	31/32	0.9687	27	0.9519	31/32	0.9687	27	0.9519	31/32	0.9687
27	0.3269	R	0.3390												
7/16-14	0.3447	U	0.3680	1 1/8-7	0.9394	63/64	0.9844	1 1/8-7	0.9394	63/64	0.9844	1 1/8-7	0.9394	63/64	0.9844
20	0.3726	25/64	0.3906	12	1.0168	13/64	1.0469	12	1.0168	13/64	1.0469	12	1.0168	13/64	1.0469
				1 1/4-7	1.0644	17/64	1.1094	1 1/4-7	1.0644	17/64	1.1094	1 1/4-7	1.0644	17/64	1.1094
				12	1.1418	111/64	1.1719	12	1.1418	111/64	1.1719	12	1.1418	111/64	1.1719
				1 3/8-6	1.1585	17/32	1.2187	1 3/8-6	1.1585	17/32	1.2187	1 3/8-6	1.1585	17/32	1.2187

SCREW SIZE		TAP DRILLS*		
No. and Pitch	Outside Diam. Inches	Size or No.	Decimal Equiv. Inches	No. and Pitch
0-80	0.0600	3/64	0.0469	10-
1-56	0.0730	54	0.0550	
64	0.0730	53	0.0595	
72	0.0730	53	0.0595	12-
2-56	0.0860	50	0.0700	
64	0.0860	50	0.0700	
3-48	0.0990	47	0.0785	14-
56	0.0990	45	0.0820	
4-32	0.1120	45	0.0820	16-
36	0.1120	44	0.0860	
40	0.1120	43	0.0890	
48	0.1120	42	0.0935	18-
5-36	0.1250	40	0.0980	
40	0.1250	38	0.1015	
44	0.1250	37	0.1040	20-
6-32	0.1380	36	0.1065	
36	0.1380	34	0.1110	
40	0.1380	33	0.1130	22-
7-30	0.1510	31	0.1200	
32	0.1510	31	0.1200	24-
36	0.1510	1/8	0.1250	
8-30	0.1640	30	0.1285	26-
32	0.1640	29	0.1360	
36	0.1640	29	0.1360	28-
40	0.1640	28	0.1405	
9-24	0.1770	29	0.1360	
30	0.1770	27	0.1440	30-
32	0.1770	26	0.1470	

\*Commercial drill sizes that allow at

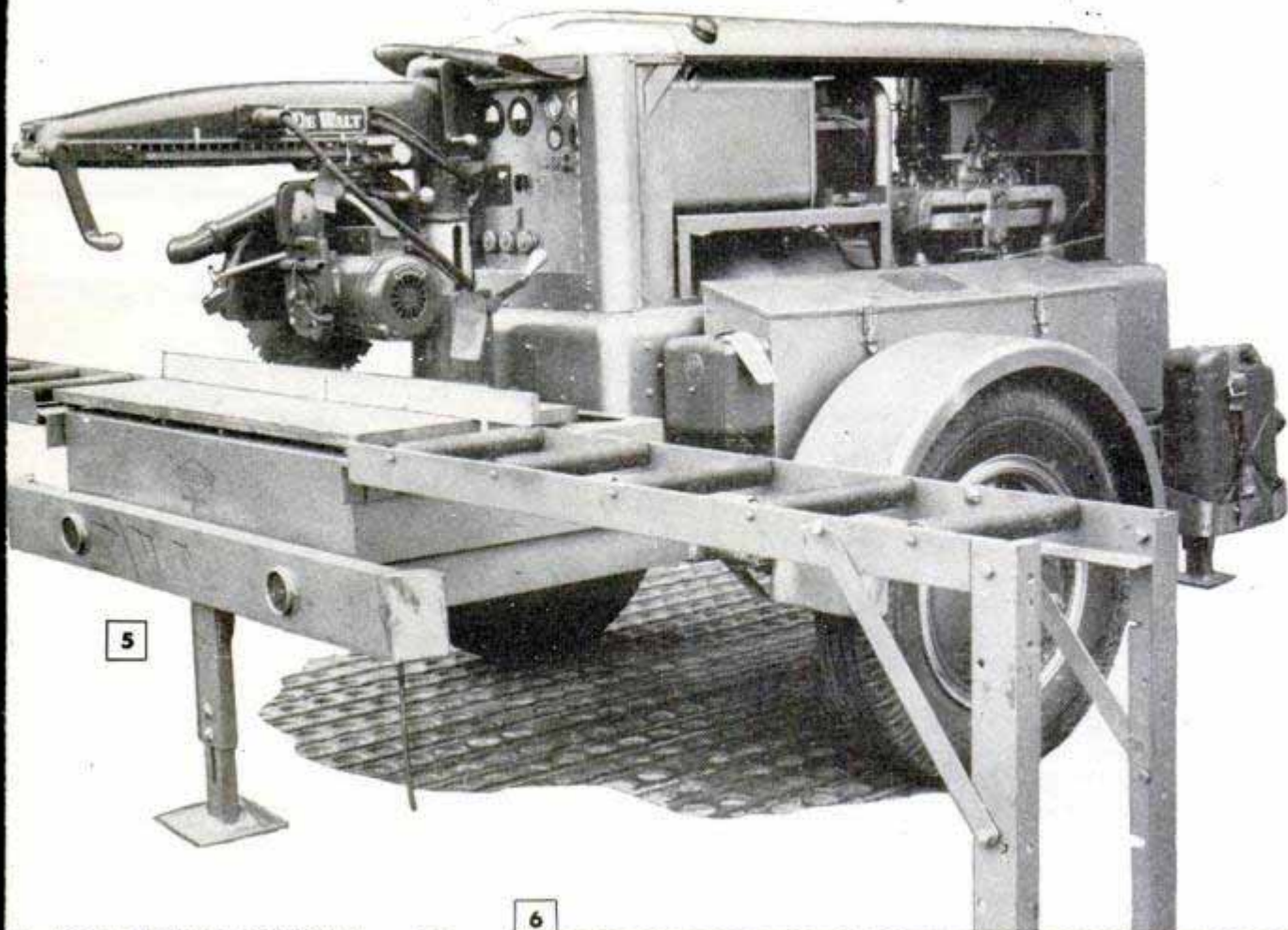
### TAP-DRILL SIZES FOR PIPE

Size of Tap In.	Drills for Briggs Pipe Taps In.	Drills for Whitworth Pipe Taps In.	Size of Tap In.	Drills for Briggs Pipe Taps In.	W
1/8	11/32	5/16	1/4	1 1/2	
1/4	7/16	27/64	1 1/2	1 23/32	
3/8	19/32	9/16	1 3/4	.....	
1/2	23/32	1 1/16	2	2 3/16	
5/8	.....	2 5/8	2 1/4	.....	
3/4	1 5/16	2 9/8	2 1/2	2 5/8	
7/8	.....	1 1/8	2 3/4	.....	
1	1 5/8	1 1/8	3	3 1/4	

\*Before tapping, hole should be reamed taper of 3/4 in. per

\*Tap-drill diameters allow approximately 75% of a full thread





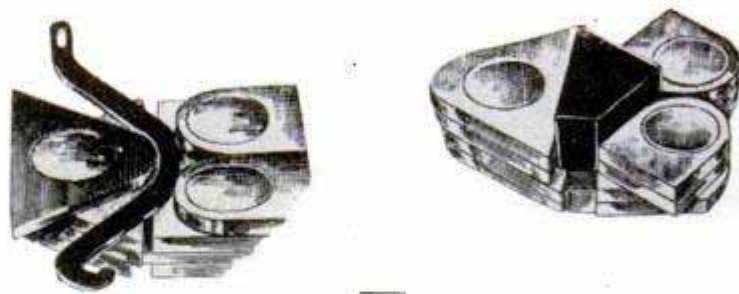
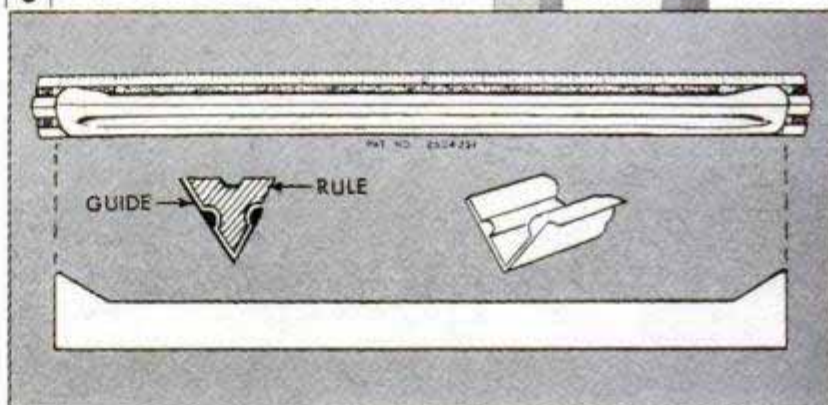
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**5. MOBILE POWER-TOOL UNIT** consisting of radial saw and built-in generator has been built for use by builders and others for cutting wood, metal and tile in areas where suitable electric power is not available. Unit is completely self-contained, mounted on a trailer and fitted with folding roller conveyors which are locked in place at the right and left-hand ends of the saw table. With this type of setup, long, heavy pieces of stock can be handled on the saw easily by one man

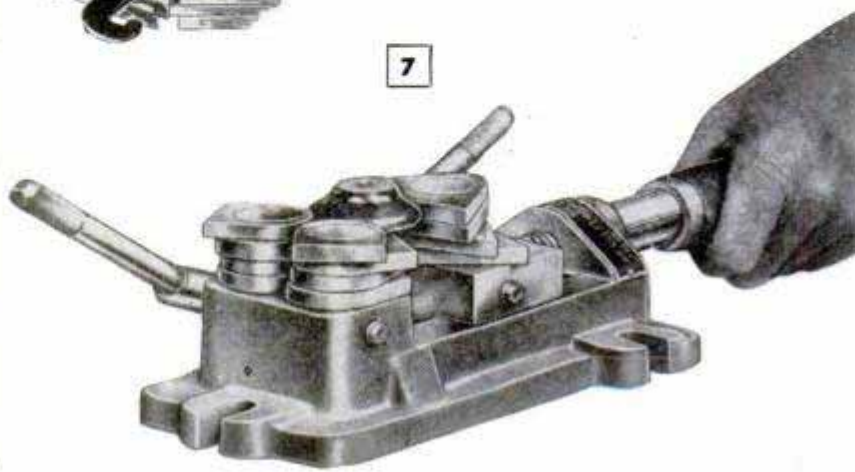
**6. SCALE SELECTOR** snaps onto an ordinary draftsman's triangular scale and overcomes the principal objection to the triangular scale by covering all scales except the one being used. Saves time and prevents costly errors on drawings. Made of thin sheet metal and formed to fit all 12-in. triangular scales, the selector is easily adjusted or removed and replaced in position to expose a different scale to view. Any selected scale is made a single scale by positioning selector

**7. UNIVERSAL BENCH VISE** is fitted with several machined flat plates, or jaws, which swivel in any desired direction, enabling the vise to grip and hold securely irregularly shaped parts without damaging any of the exposed surfaces. The jaws are also designed that they can be moved individually, or in relation to each other, and the locking jaw positions itself automatically when vise screw is tightened. The vise is available in two sizes with jaw openings of 2½ to 5 in. to cover a range of bench work on tools and dies

6

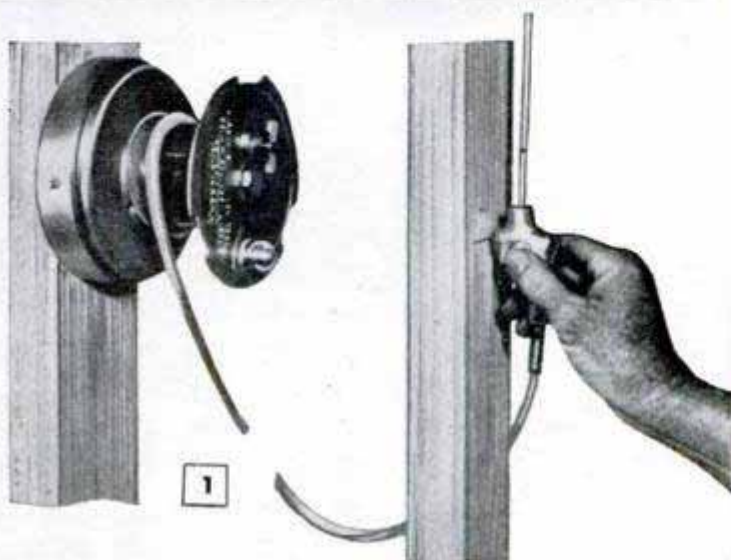


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# SHOPPING FOR TOOLS



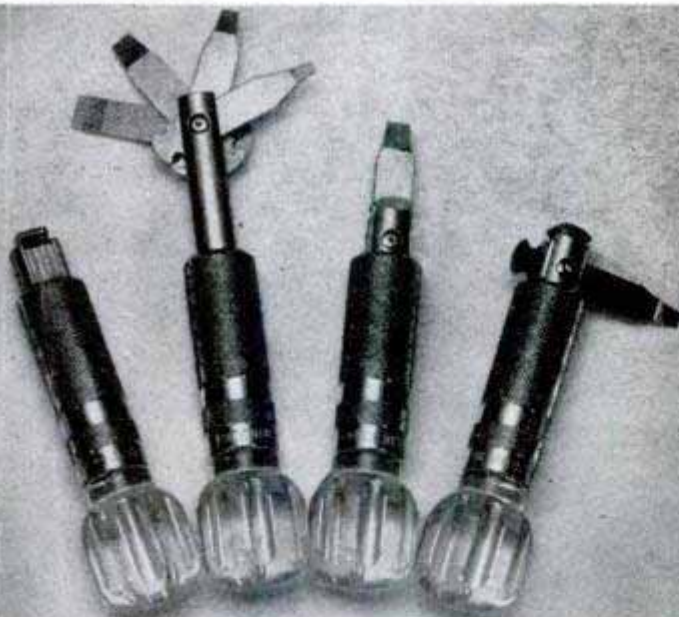
1



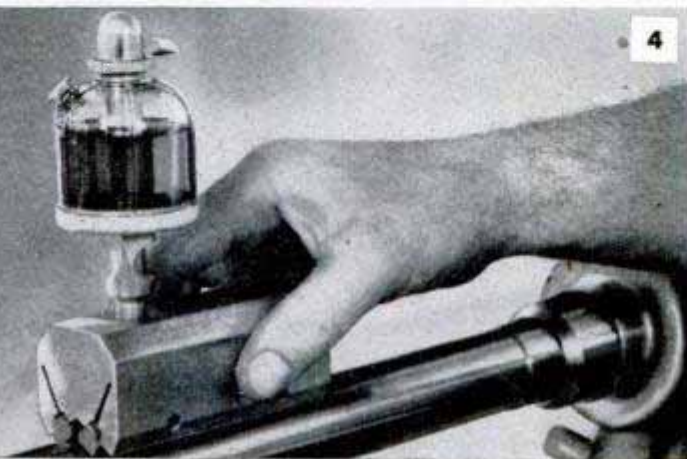
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3



4



**1. HYDROSTATIC LEVEL** for carpenters, masons and plumbers permits extending a level line over and around obstructions. Consists of a reel and reservoir to which is attached a 40-ft. plastic tube, scribe valve and level sight. To use, place reel at desired point, unreel tube, pull it over or under obstructions, then raise scribe valve until liquid appears in glass tube

**2. HIGH-SPEED DRILL BIT** is surface-hardened by a new process which makes it last two to three times longer than ordinary drills. Bits are double-edge ground as pictured in circular inset so that in effect there are four cutting edges instead of two. This feature reduces friction to a minimum and at the same time permits bit to penetrate hard materials readily

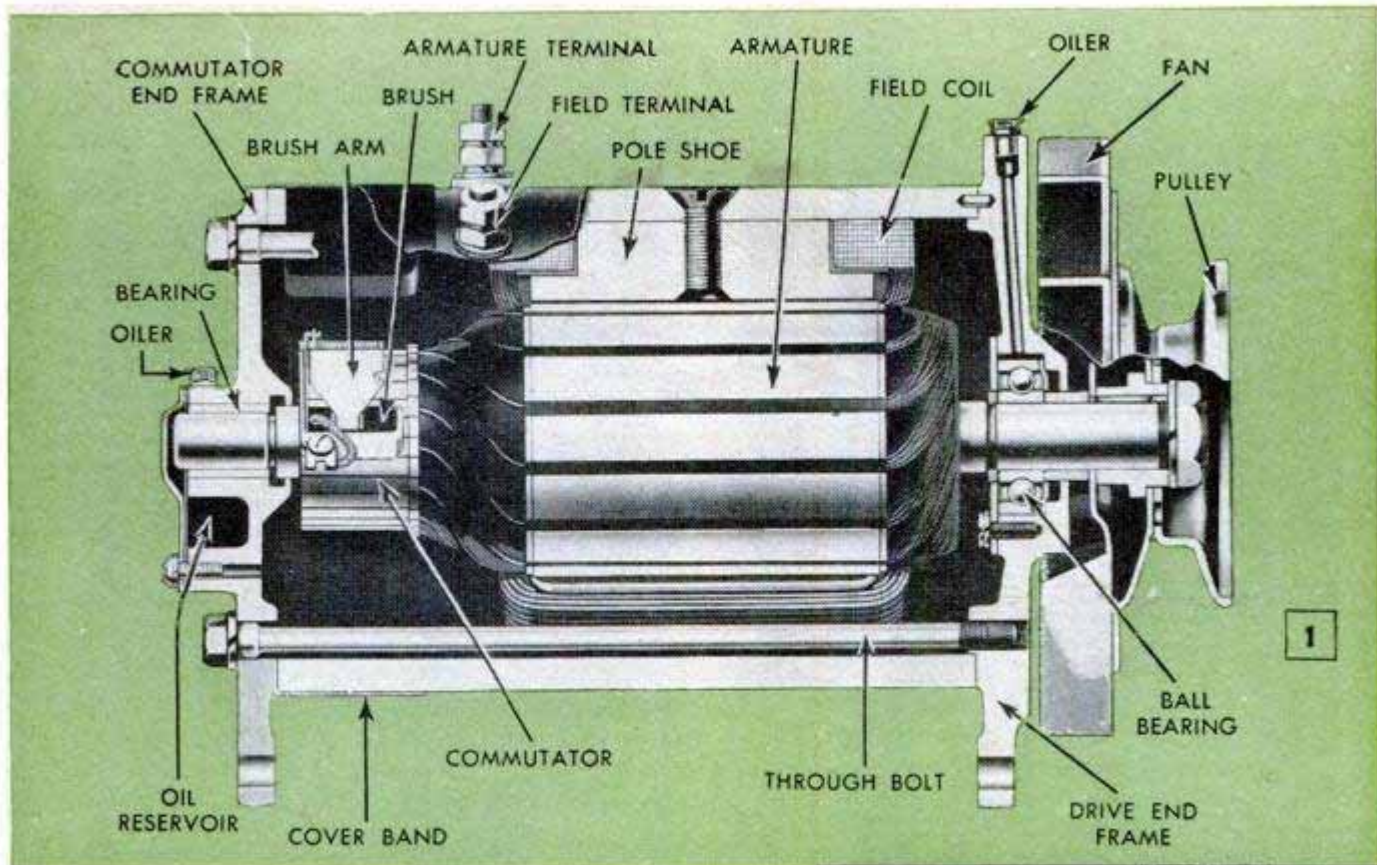
**3. FOUR-IN-ONE-SCREWDRIVER** has four pivoted blades in sizes which will drive wood screws from No. 1 to No. 14. Blades pivot in a slotted holder which is retractable into the knurled handle as pictured at extreme left. Each of the blades can be extended straight and used as a conventional screwdriver, or the blade can be turned at right angles to the handle

**4. CYLINDRICAL SURFACE HONE** produces smoother surface on round work in either straight or tapered form. Unit uses special abrasive sticks in a wide range of grits, and is furnished with a finger-controlled container for coolants. Hones round work chucked in lathe or drill press from  $\frac{1}{4}$  to 3 in. in dia., effectively removing cross pattern and chatter marks









# KNOW YOUR CAR'S NERVOUS SYSTEM

## The Generator

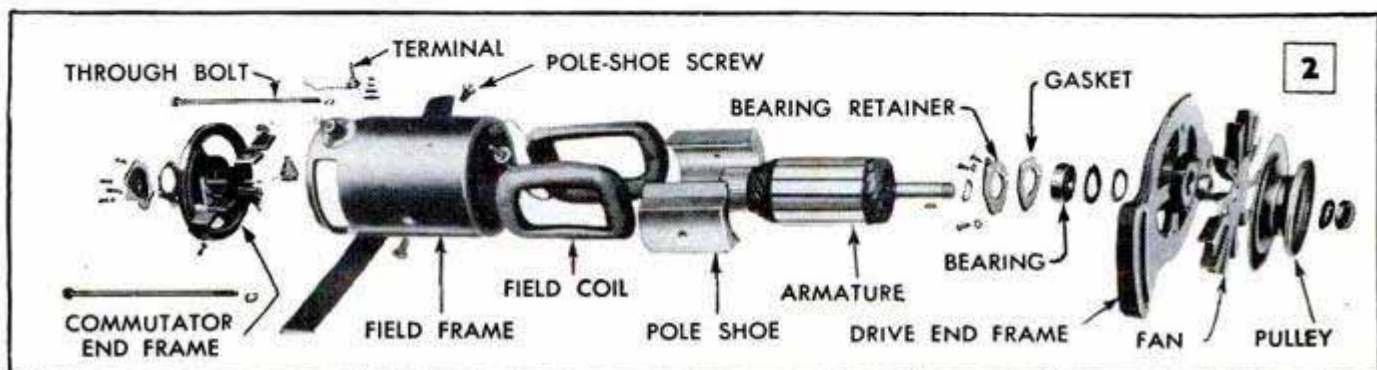
By W. K. Mitchell  
and Howard B. Birt

**P**OWERHOUSE of your car's electrical system, the generator supplies current for two important purposes. First, it keeps the battery charged, and second, the generator provides sufficient current to meet the electrical requirements of the vehicle. As the generator is belt-driven from the car engine, its armature rotates with a speed in proportion to that of the car. When you are driving at 50 m.p.h., the generator armature spins at about 5000 r.p.m., making it one of the hardest-working units of the electrical system. For this reason, the generator requires regular checking and maintenance to keep it operating efficiently.

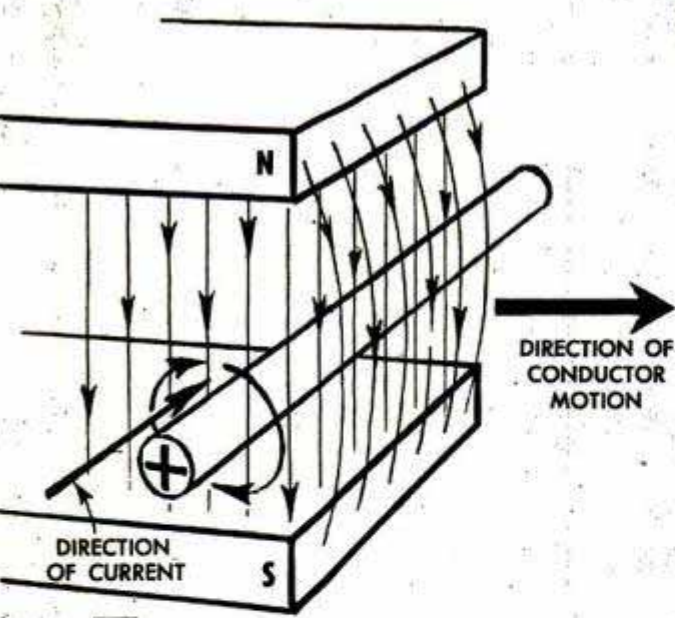
Figs. 1 and 2 show cutaway and pull-apart views of a typical passenger-car generator. This is a shunt-type generator having two

magnetic poles and two brushes. Most cars are equipped with either a shunt or third-brush type of generator. Although late-model cars ordinarily use the shunt type, many older models are equipped with the third-brush version. Of the two, the shunt generator is more adaptable to automatic control and produces a steadier output. The other is generally a lower-output unit.

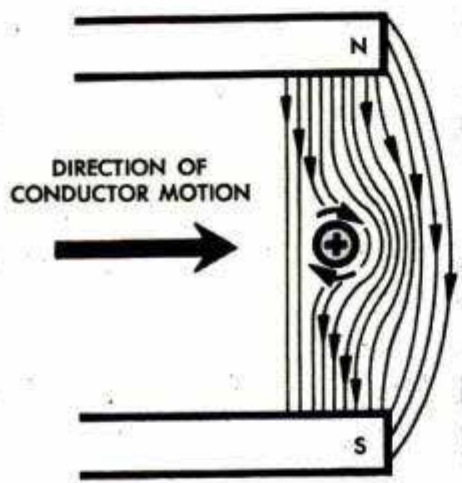
The generator operates on the principle that current is induced in a moving conductor which cuts through a magnetic field. This principle is illustrated in Fig. 3, the vertical arrows representing the magnetic field between the two poles. The lines of force are "wrapped" around the conductor as it is moved, Fig. 4. This wrapping tendency causes the induced current



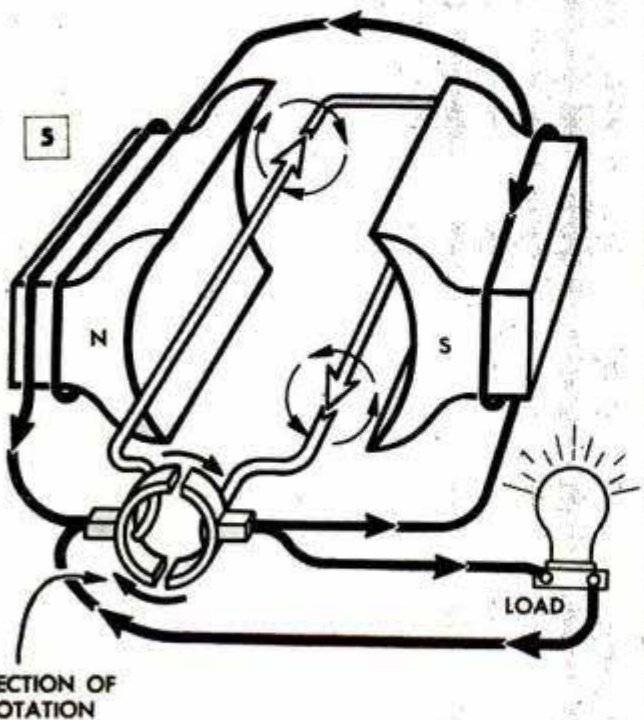




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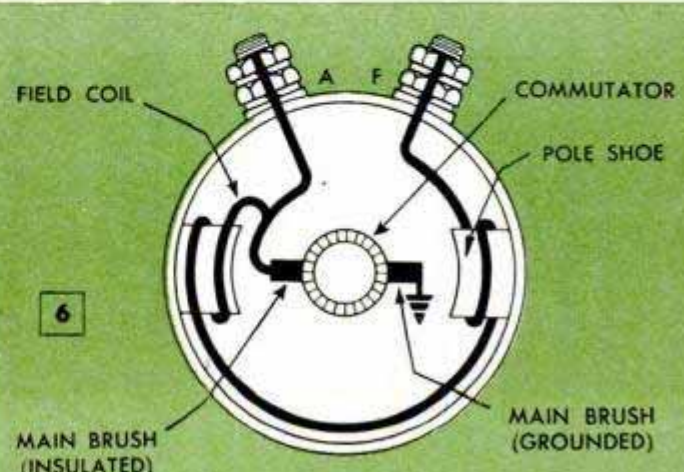


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and also determines the direction of its flow. The amount of current induced depends upon the strength of the magnetic field and on the speed with which the conductor is moved across the field. This provides a positive means of controlling a generator, as this permits output of the generator to be increased or decreased simply by varying the strength of the magnetic field. Fig. 5 pictures a simple generator having a wire-loop armature in which current is induced when the loop revolves between the two magnetic poles. Note that part of the current is routed through field coils wound around the pole shoes to reinforce the magnetic field. This generator is of the shunt type because the field is connected directly across the generator armature.

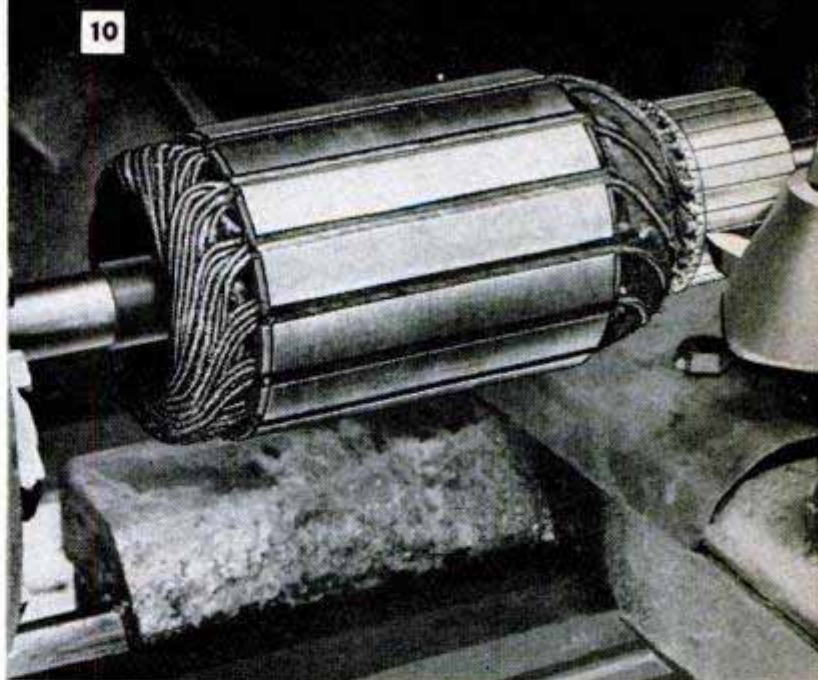
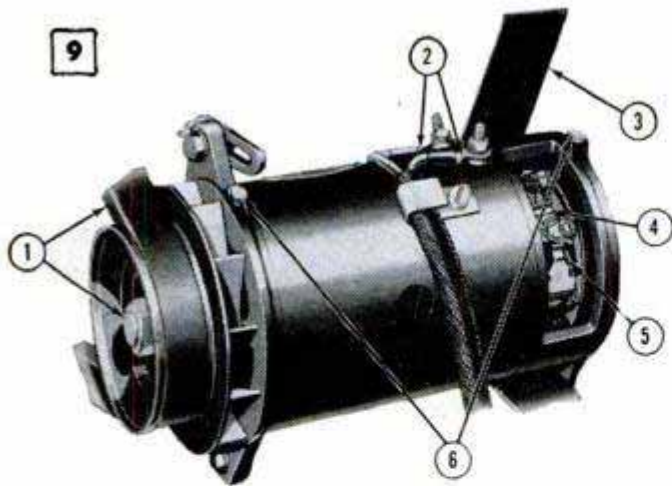
The difference between the shunt generator, which is controlled by a separate unit called a generator regulator, and the third-brush type is illustrated by the schematic wiring diagrams in Figs. 6 and 7. By moving the third brush closer to the insulated main brush, Fig. 7, a higher voltage can be impressed on the field coils. Conversely, increasing the distance between these two brushes decreases the voltage. As repeated moving of the third brush to meet varying current demands is impractical, a resistance is added to the field circuit when reduced generator output is desired. Fig. 8 shows the resistor in position. When the generator temperature increases due to high output, the thermostat inside the generator opens a set of contact points, thus connecting the resistor into the generator field.

Generators should be given a six-point inspection and lubrication, Fig. 9, every 5000 miles. Step 1—Check the belt for tension and the mounting and pulley nut for tightness. 2—Be sure that the connections at the terminals are tight and the leads in good condition. 3—Check the cover band for thrown solder. This is evidence that the generator has been overloaded, and if detected before the armature is too badly damaged, the leads simply can be resoldered to the riser bars. Of course, the trou-



6



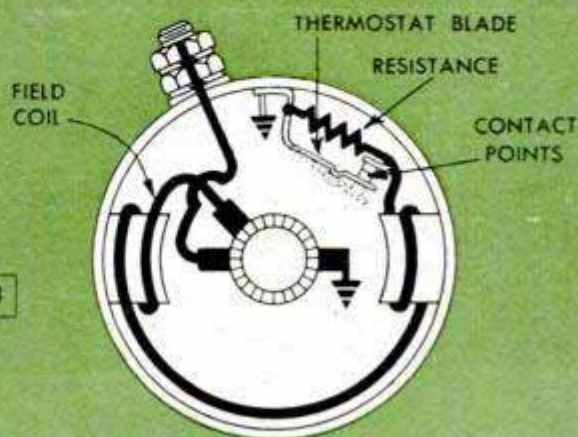
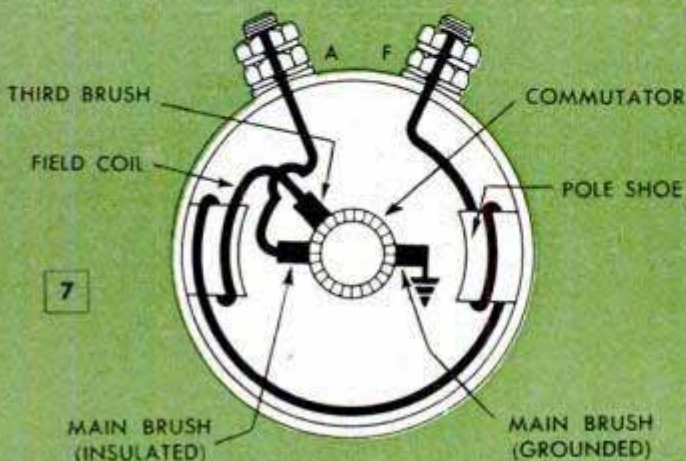
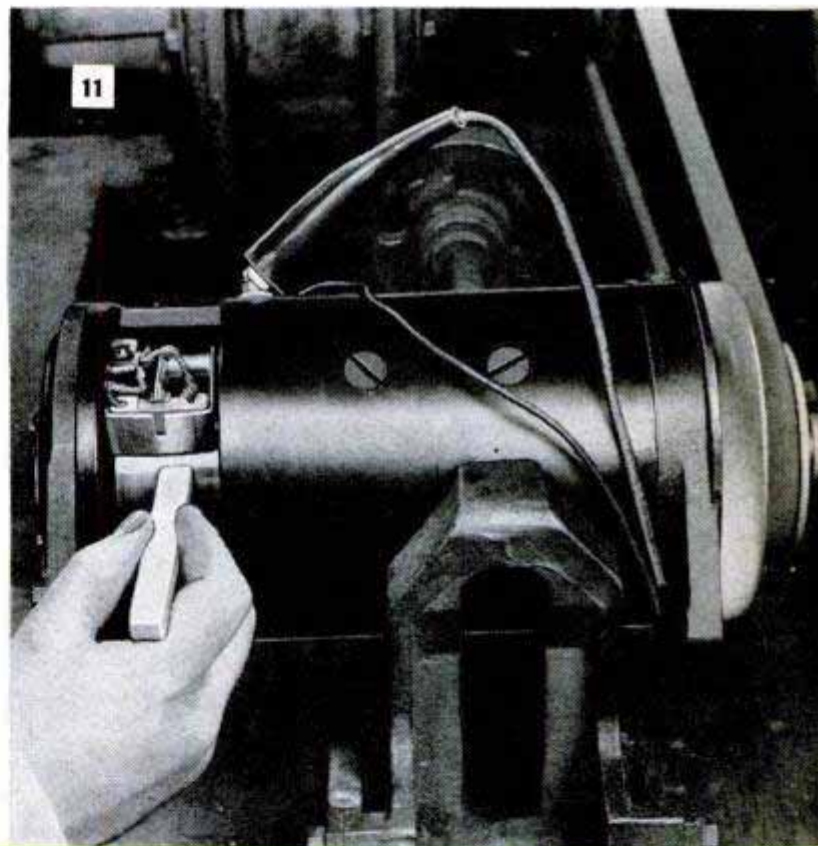


Armature is mounted in lathe, as above, for turning down commutator. Below, brush-seating stone of mildly abrasive material is held against revolving commutator. Wears brushes to contour in few seconds

ble which caused the overloading must be located and repaired. 4—Clean the commutator. A slight coating of gum or dirt can be removed by holding a strip of 0/0 sandpaper against it with a small stick while the commutator rotates in the generator. Do not use a degreasing or cleaning compound. If the commutator is worn, especially dirty, out of round or has high mica, it should be trued on the lathe as in Fig. 10. Then, the mica is cut from the slots to a depth of  $\frac{1}{32}$  in. with a hacksaw blade, and the slots carefully cleaned. 5—Inspect the brushes to make sure they are free in the brush holders and rest against the commutator with sufficient pressure to insure good contact. Replace them if worn to half their original length. Seat new brushes, as in Fig. 11. 6—Apply 8 to 10 drops of medium engine oil to the oilers. Avoid excessive lubrication and be sure that only clean oil is used. Don't lubricate the generator while it is running.

After a generator has been dismantled and repaired it must be repolarized to be sure that it has correct polarity with respect to the battery it is to charge. Failure to do this may result in burned relay contact points, a run-down battery or serious damage to the generator itself. The method of repolarizing depends upon the generator-regulator wiring circuits, which vary with different manufacturers, so the manufacturer's specifications must be followed.

Photos and information courtesy Delco-Remy Division, General Motors Corp.





## Quarter-Round Molding on Shelves Keeps Toilet Articles in Place



If you are continually bothered by various toilet articles that slide or fall from the shelves of your medicine cabinet, try installing strips of quarter-round molding along the shelf edges. These may be cut to wedge against the sides of the cabinet to keep articles in place.

H. Drouyn, Longueuil Annex, Que., Can.

## Hardened Shoe Paste Softened With Infrared Lamp



Shoe paste that has become old and hardened need not be thrown away. By placing it under an infrared lamp it can be restored to its original condition. Set the opened can on a heat-resistant surface, and then

place the lamp a few inches above it. When the paste melts and runs together, turn off the lamp.

## Saving Paintbrush Cleaner

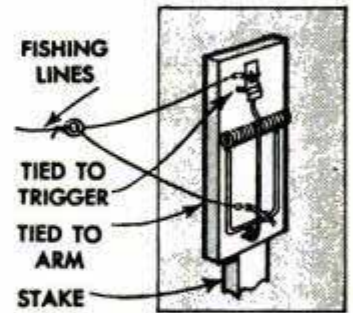
After cleaning paintbrushes, save the turpentine by pouring it in a large jar and capping the jar tightly. Stored in this way, the thinner can be used over and over again by carefully draining off the top. Before storing the brushes, wash them with soap

and water and rinse thoroughly so the bristles will dry soft and clean.

Sid Corlin, Chicago.

## Mousetraps Help Catch Fish

You don't need a "better mousetrap" to catch a fish. Just use an ordinary one. Drill a hole in the wood base below the trigger and run one end of a short piece of line through the hole and tie it to the trigger. Drill a second hole near the other end of the trap, run the other end of the line through this hole



and tie it to the trigger arm. A ring suspended on this line is tied to the end of your fishing line. Fasten the trap to a stake and drive it near the bank. A good strike at the bait by a fish will spring the trap and cause the jaw to jerk the line, thus setting the hook in the fish's mouth. A stronger jerk on the fishline can be provided by using a rat-trap in the same manner.

Willard Benner, Souderton, Pa.

## Birdhouse Easily Removed For Winter Storage

Here's the way to make a birdhouse easily removable for cleaning and storing during winter months. Keyhole slots are cut in the house to line up with nail or screw heads projecting from a support or building. The narrow top portion of the slot is cut deep enough to secure the house against dislodgement by a strong wind. One need only raise the house slightly to free it from the hangers.





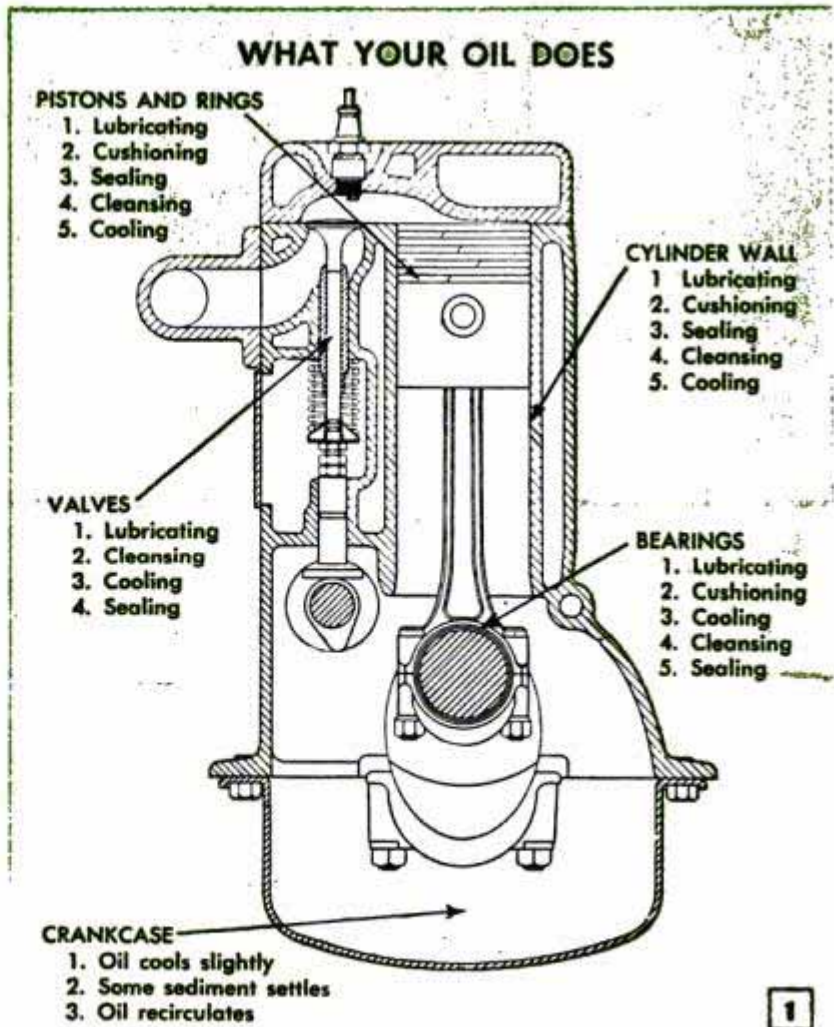
# When to Change Oil?

EVERY MOTORIST is faced with this question which becomes more and more perplexing as he hears many recommendations. Some tell him to change oil every 1000 miles, others recommend 2000 miles, and still others advocate changing oil every 3000 to 5000 miles, most recommendations being dependent on favorable or unfavorable driving conditions.

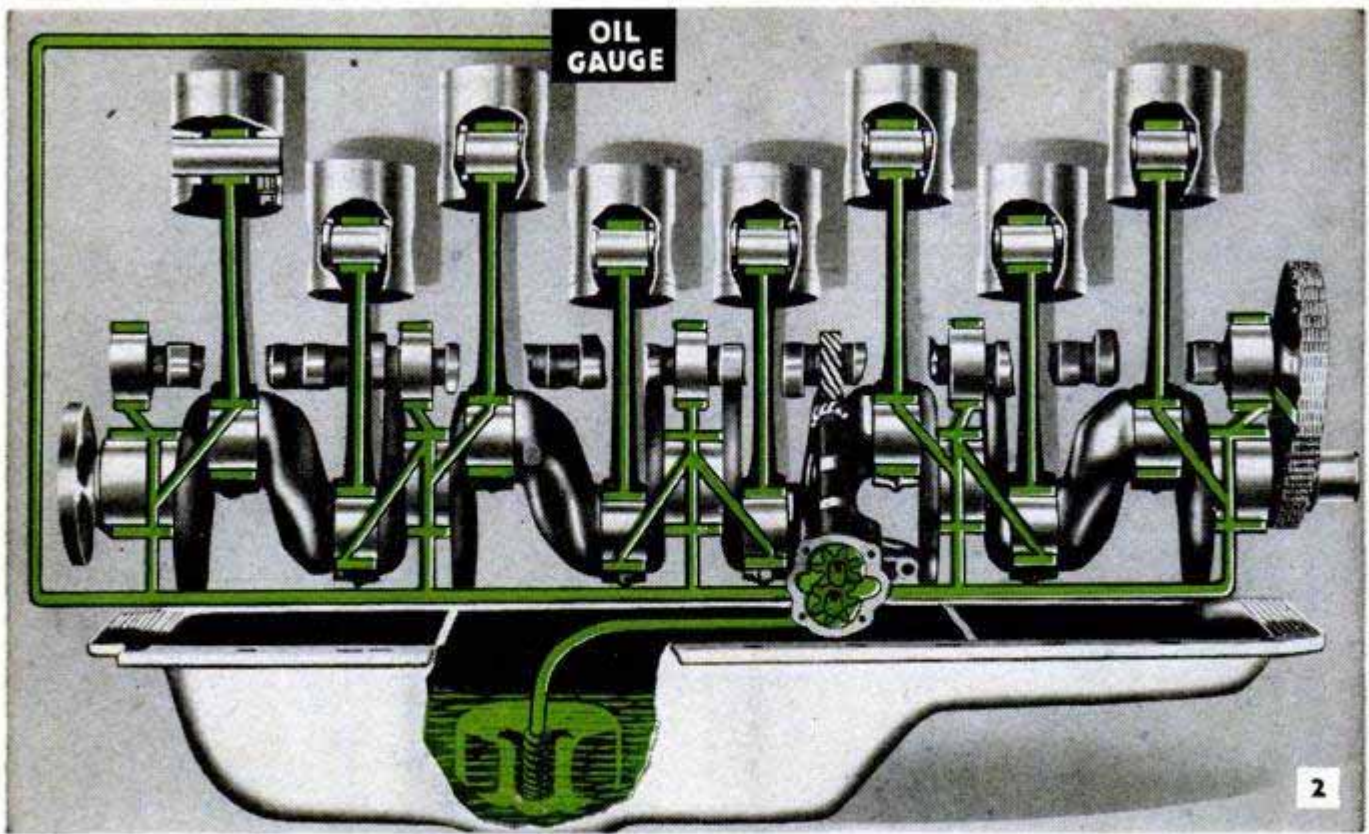
In order for a motorist to determine which of these many recommendations is best suited to his particular car, it is necessary that he understand just what oil does for his engine and how driving conditions affect it. Reference to Fig. 1 will give some idea of what oil does for the engine, and Fig. 2 shows the maze of passages through which oil must travel to correctly lubricate an engine. From these two views, you can readily understand the importance of correct lubrication.

In order to determine when oil should be changed to be reasonably sure of correct lubrication, it is necessary to know how driving conditions affect it, as the way a car is driven has more to do with frequency of oil change than any other one factor. As an example, many long-haul truck fleets operate with oil drains at intervals from 3000 to as high as 7500 miles with completely satisfactory results in spite of the fact that such vehicles travel at high speeds with heavy loads. On the other hand, passenger cars, which are operated with a great deal of starting, stopping and idling, require oil drains more often to avoid excessive oil deterioration, sludge deposits, etc.

Contrary to the popular impression that high-speed engine operation under heavy loads in hot weather imposes the severest conditions on motor oil, this type of operation is the







most favorable when oils of good quality are used. The worst driving conditions on oil are those involving short periods of running, and frequent stopping, starting and idling, under which the majority of passenger cars are used.

Only two things can cause deterioration of motor oil to the point where it becomes unsatisfactory as an engine lubricant. These are oxidation, caused by extended use at very high temperatures within the engine, and contamination.

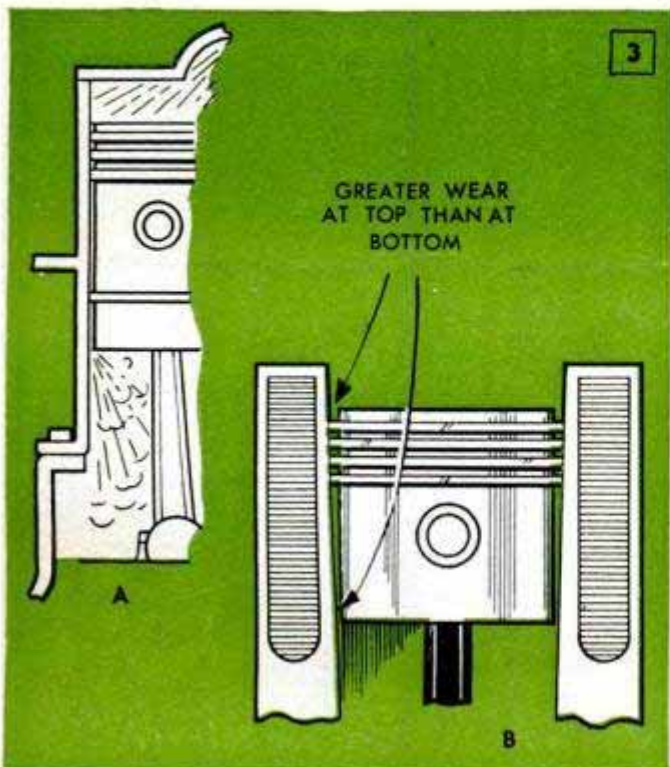
When motor oils are subjected to very high temperatures for extended periods

Diagram above graphically shows the path oil follows in reaching such vital engine parts as pistons, rings, cylinder walls, bearings and valves

they tend to oxidize. Unstable oils of poor quality, on exposure to such conditions, will form sludges, varnishes and corrosive acids, which may cause stuck valves or rings, plugged oil lines and screens, and burned or corroded bearings.

The most important and most frequently encountered cause of oil deterioration is contamination. When engines are used in light service, engine-jacket and crankcase temperatures do not get high enough to maintain good lubrication. Contrary to popular opinion, a hot-running engine is more efficient, is subject to less wear and is easier to lubricate than a cold-running engine used in light intermittent service. In the latter engine, cool cylinder walls act as condensers of fuel vapors and combustion products, such as combustion soot, moisture and lead compounds from burning antiknock-treated gasoline. These impurities then wash past or blow by the pistons into the crankcase, detail A, Fig. 3, instead of being blown out of the exhaust pipe. In the crankcase these combustion products mix with the oil and cause contamination. When these contaminants reach excessive concentrations they tend to emulsify, coagulate and settle as sludge deposits, Fig. 7.

Experienced lubrication engineers have said frequently, "Good oils don't wear out, but they can be contaminated to death." Frequent oil drains are necessary not because oil wears out, but to flush blowby contaminants from the crankcase before





they build up to dangerous concentrations.

In order to minimize as far as possible excessive blowby contamination of the crankcase oil, engine cooling systems should warm up quickly and maintain coolant temperatures of at least 140 deg. F., and preferably 160 to 180 deg. F. This applies especially to cylinder-jacket temperatures which, when below 140 deg. F., are the starting point of oil contamination.

An important fact is that the dashboard temperature gauges do not give an accurate indication of cylinder-jacket temperatures. These gauges show cylinder-head temperatures, which always are the hottest point of a cooling system, with the result that in cool or cold weather the cylinder and jacket may be much too cool. The best insurance against cold cylinder walls is to be sure the cooling-system thermostat is in good working order, and it is advisable to use a thermostat having a setting of 160 or 170 deg. F.

Adequate crankcase ventilation also is essential to provide purging of volatile blowby products from the crankcase before they condense and mix with the oil.

Rich fuel-air mixtures mean poor combustion, which in turn, means excessive soot formation and raw gasoline dilution in the oil. If your oil thins out badly and turns black in color, you can be pretty sure the carburetor is set too rich, or that the choke is used too much, or that the engine is idled too much. Idling involves the richest mixtures and poorest combustion, and the worst conditions of oil contamination with raw gasoline, moisture, road dust and soot.

**Actual, unretouched photos of good and bad road-test pistons. Scored and fouled piston at left is result of badly contaminated oil due to infrequent changing**



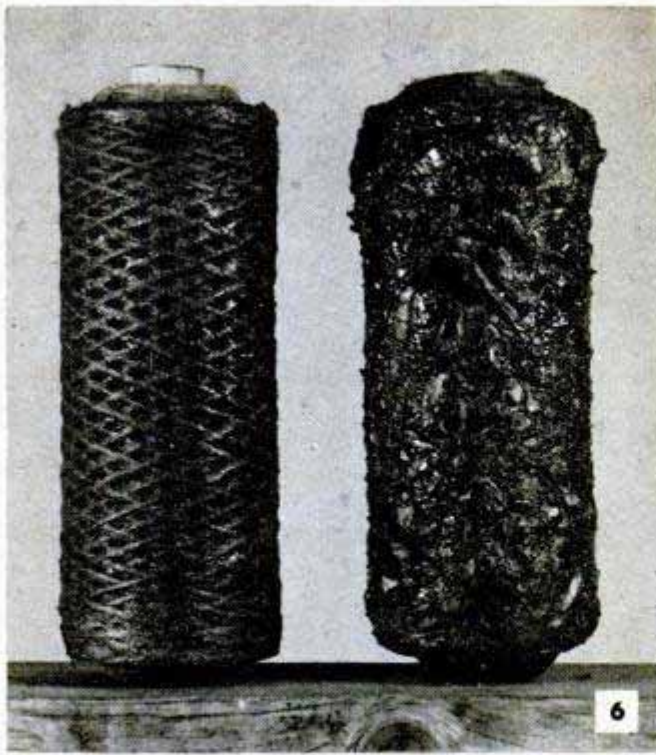
The deposit-free valve at left shows how clean the valves remain when oil is changed regularly. Dirty, fouled valves at right clearly show the difference

Oil filters are of great help in prolonging oil life as well as engine life. Filters remove dirt, insoluble blowby contaminants (not acids) and dust from the oil as it circulates through the engine. However, oil-filter cartridges, just like the crankcase oil itself, must be changed at proper intervals if the filter is to perform its intended function. Cartridges should be checked at each oil change and should be replaced as soon as signs of heavy solid deposits appear on their external surfaces.

The effects of driving conditions on oil contamination and on oil-filter life are illustrated by the photo of two filter cartridges, Fig. 6. The cartridge containing a moderate





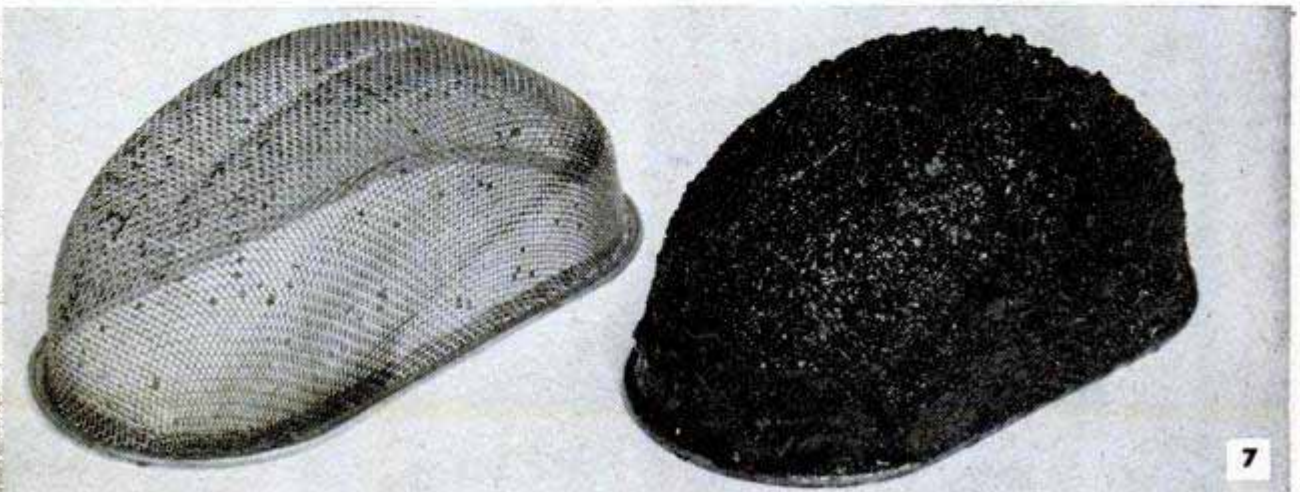


Clean oil-filter cartridge pictured at left shows results of 6000 miles under favorable conditions, as compared to sludge-filled one which was driven only 1800 miles under adverse driving conditions

amount of oil sludge was used for 6000 miles on an engine driven under favorable conditions; in this case, high-speed country driving in hot weather. The heavily sludged cartridge was used for only 1800 miles on an engine of the same make, but driven under adverse conditions; entirely stop-and-go city driving in winter and with the engine in poor condition as to carburetion and cooling-system temperature control.

Although a properly maintained oil filter is a wise addition to any engine, filters are not a cure-all and cannot correct the basic problem of oil contamination or the need for periodic oil changes at reasonable mileage. New or rebuilt engines with tight rings and unworn piston, ring and cylinder surfaces develop relatively little

Two similar examples, below, show a clean and a sludge-filled oil-pump screen. Heavily choked one at right has been made completely ineffective by deposit



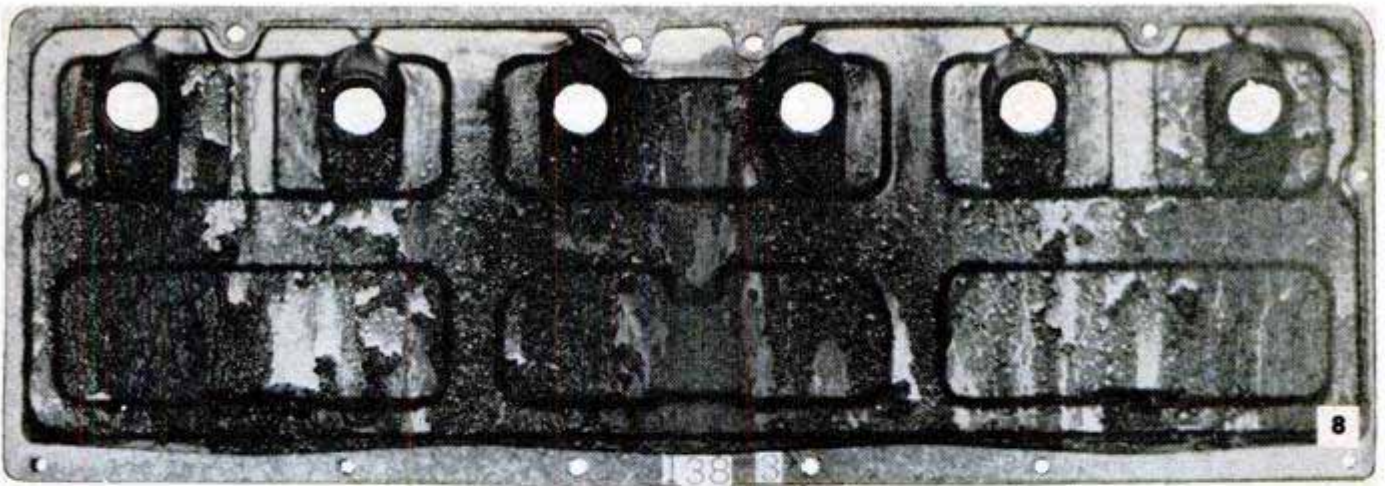
blowby and oil contamination. As engines become older and more worn, the amount of blowby and the rate of oil contamination increase rapidly due to looser fits and larger clearances, as indicated in detail B, Fig. 3. As an engine wears, the cylinders become tapered. This means that as the pistons move up and down, the rings must expand and contract to follow the tapered surface of the wall. At extreme speeds, and when the pistons are fouled with carbon, the rings may not be able to adjust themselves. As a consequence, blowby is greater along with its destructive effect on engine oil. By comparison, therefore, newer engines require less-frequent oil drains than older engines.

Some very interesting practical information has recently been released by a well-known research laboratory. A large-scale field test was conducted to study the relation of oil contamination to oil change periods. Vehicles in this field-test program were divided into three groups: Group 1 adhering to an oil-change interval of 1000 miles; group 2 changing oil at 2500 miles, and group 3 changing oil only every 5000 miles.

Analyses of the used oils drained from the engines in each of these groups showed that the oil drains from the group-2 cars, running with 2500-mile changes, contained from 55 to 65 percent more contaminants than those from the group-1 cars, running with 1000-mile oil changes. The drains from the group-3 vehicles, running with 5000-mile drains, contained from 114 to 174 percent more contaminants than the group-1 cars. When it is considered that these contaminants consist of carbon, soot, oxidized matter, metal particles and compounds, dust, dirt and abrasive matter, there is good reason for not using oil too long. Figs. 4, 5 and 9 give an indication of what can happen inside an engine when oil of a high contamination is used. Valves carbon up and burn, and pistons and bearings score. Fig. 8 shows a valve side cover coated with sludge, and Fig. 10 shows a cover when clean oil is used.

Although many factors govern the mile-





Compared with clean side cover plate below, this sludge-covered one shows what contaminated engine oil will do

age or time interval at which oil should be changed, it is possible to classify passenger-car driving conditions in three basic types, and to consider oil-change intervals that will constitute a safe and sound practice with a minimum of expenditure.

**Favorable driving conditions:**

- Country driving at high temperatures.
- Newer cars in warm-weather use.
- Oil drains at intervals up to 2000 miles.*

**Unfavorable driving conditions:**

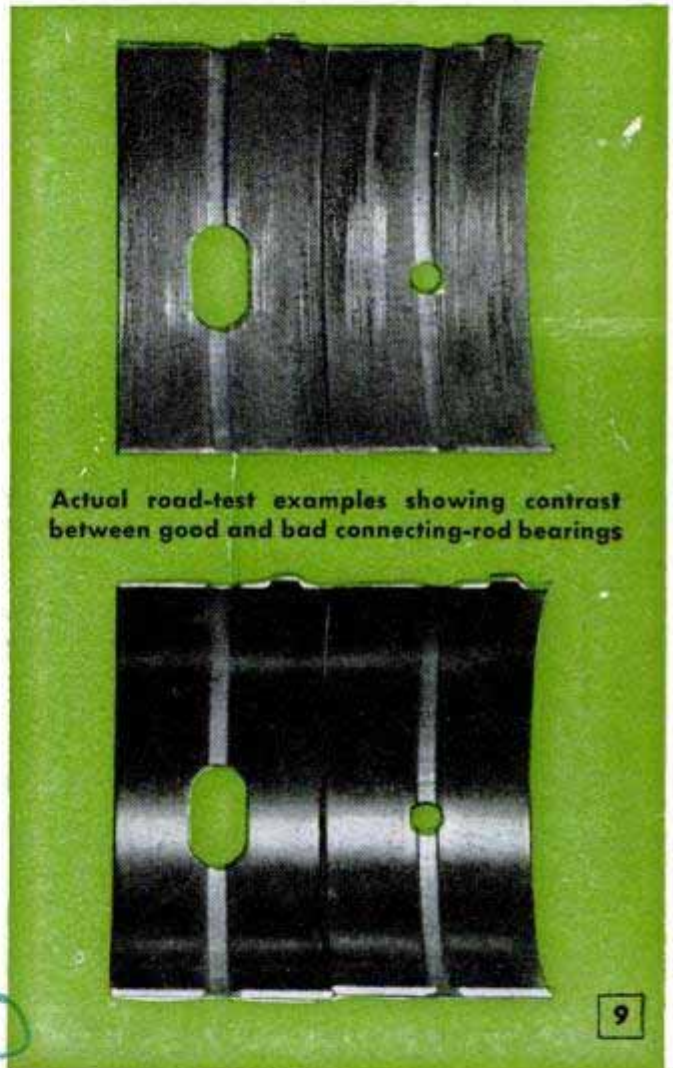
- Operation involving an excessive amount of engine idling, stopping and starting and no long runs.
- Operation in severe winter months.
- Oil drains as frequent as every 500 miles may be necessary.*

**Average driving conditions:**

- Oil drains at 1000-mile intervals.*

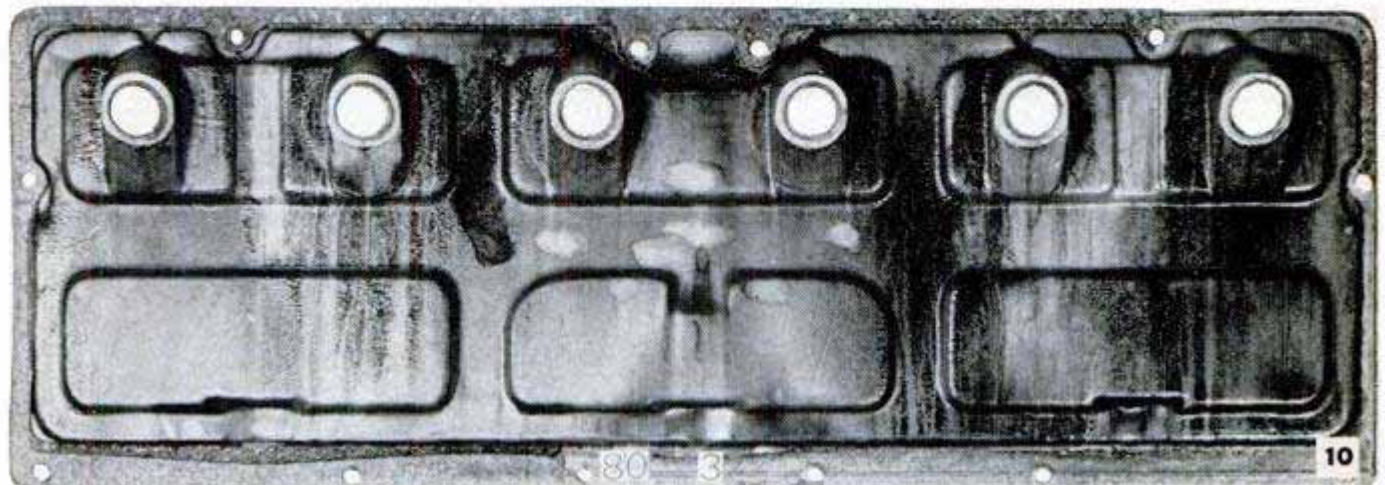
Although motor oil may be used longer than the above mileages, possibly with no ill effect, very little monetary saving is gained in relation to the risk which may be involved. Motor oil is a comparatively inexpensive commodity considering the highly important job it has to do, and one engine-repair job can readily cost considerably more than all of the oil required for a year's safe lubrication.

Information furnished by the Technical Advisory Committee, Pennsylvania Grade Crude Oil Assn.



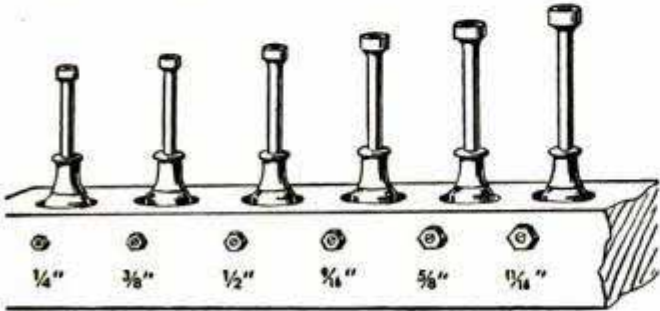
Actual road-test examples showing contrast between good and bad connecting-rod bearings

This clean side cover plate indicates that oil was changed and filters cleaned regularly at recommended intervals





## Rack Holds Spinner Wrenches For Quick Identification

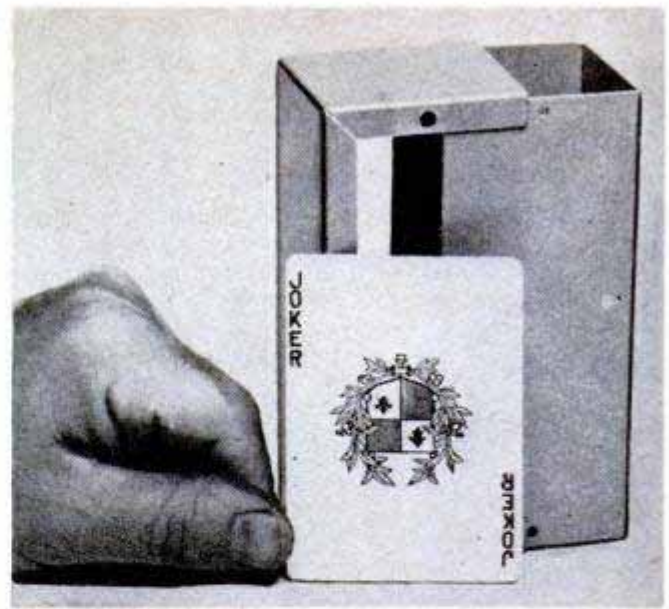
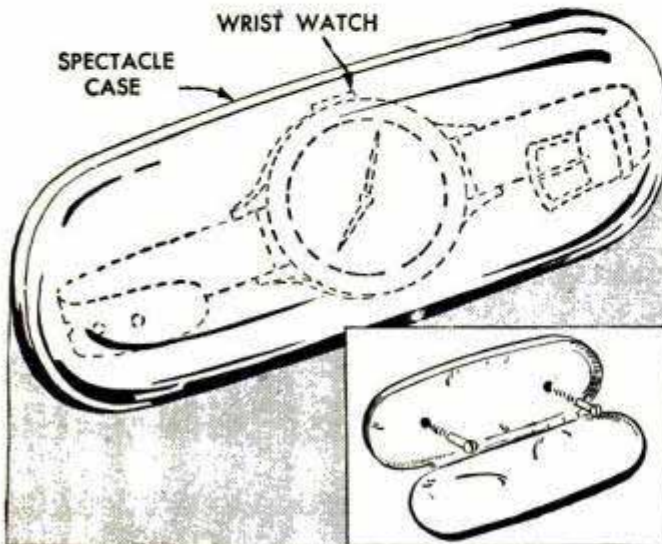


This rack for holding and storing spinner wrenches makes it an easy matter to identify quickly each wrench. A nut of corresponding size is displayed beneath each wrench, as well as the size itself. The holder may be made from a block of wood in which holes have been bored to receive the various wrench-handle sizes.

W. H. McClay, Pasadena, Calif.

## Watch Stored in Spectacle Case Is Guarded From Shop Damage

If you remove your wrist watch when working in your shop, place it in a spectacle case of the type shown. Such a case is ideal for the purpose as it is fully lined and is kept closed by a spring. For convenience, the case may be screwed to the wall of the shop or inside a cabinet.



## Playing Card Aids in Focusing

When an object to be photographed has plain flat surfaces, focusing on the ground glass or through a range finder is usually somewhat uncertain. A very effective "target" for use in such cases is the joker from a deck of playing cards. Placed in front of the object, the word "joker" appears reversed at top and bottom and is easily seen on the ground glass even though the image is inverted.

## Film Processed in Developer Recorded on Bottle Label

The handiest place to keep a record of the number of film rolls developed in a given amount of developing solution is right on the bottle where it can never be misplaced. To preserve the record, make the label from a strip of water-repellent masking tape and, using a soft pencil, make a mark every time a roll is developed.



## Film Clip Safeguards Thermometer

To prevent accidental breakage of a dial-type thermometer, attach a film clip to the stem of the instrument. This will keep it from rolling off a table or bench, and also will provide a means of hanging it on a nail.—Ken Murray, Colon, Mich.

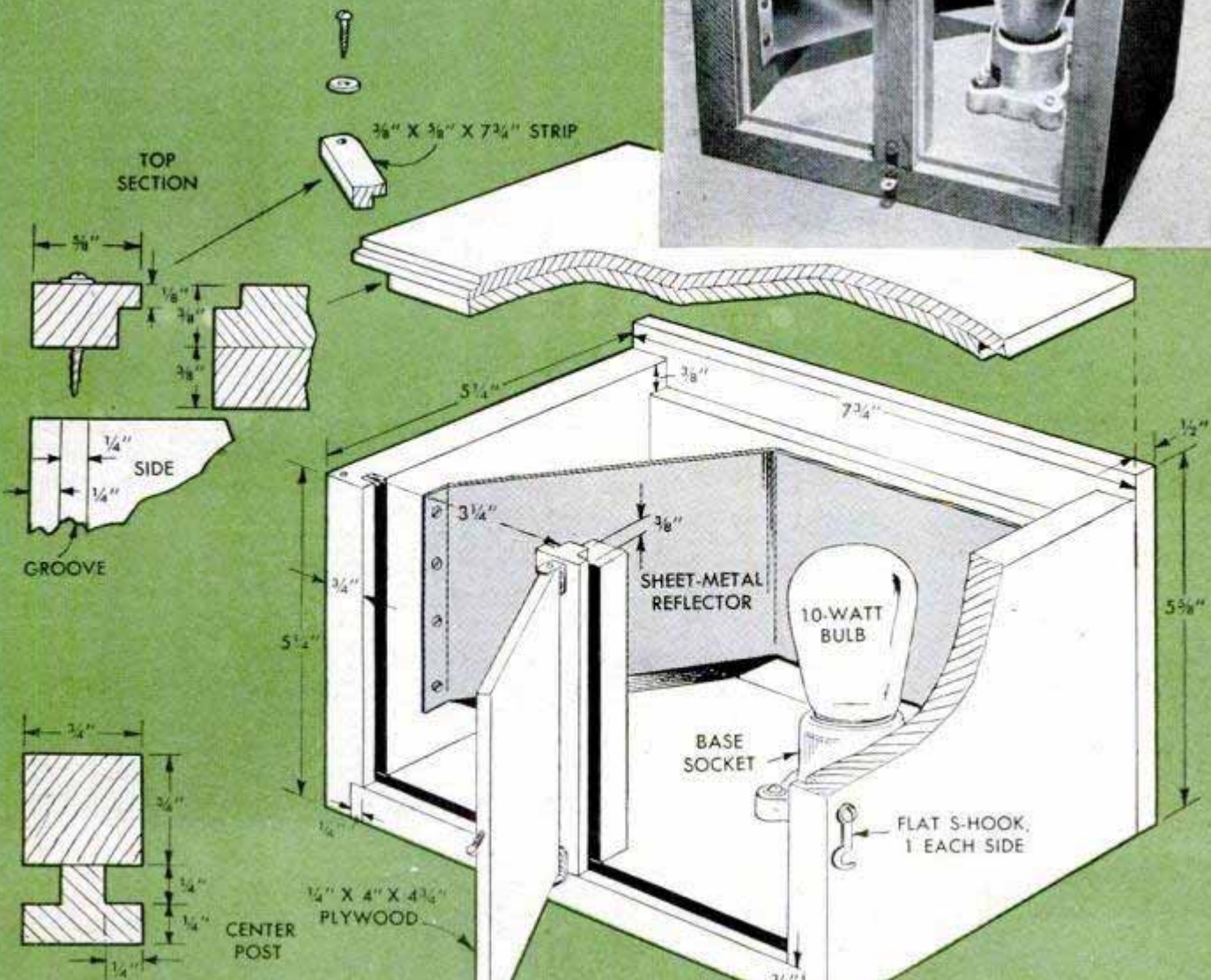
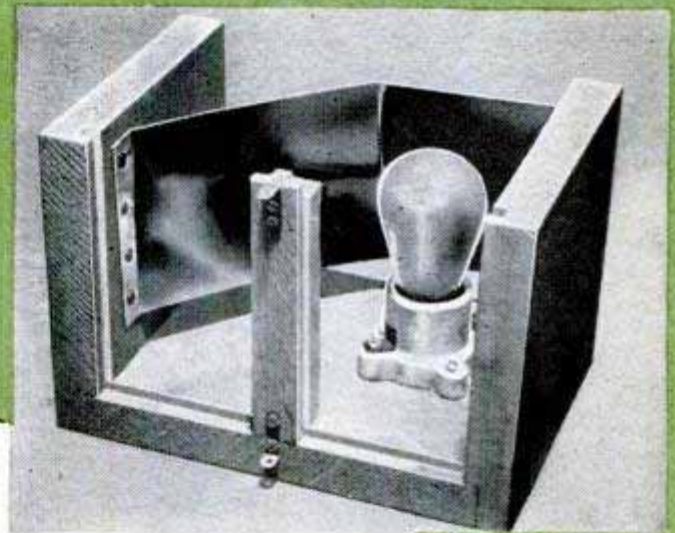
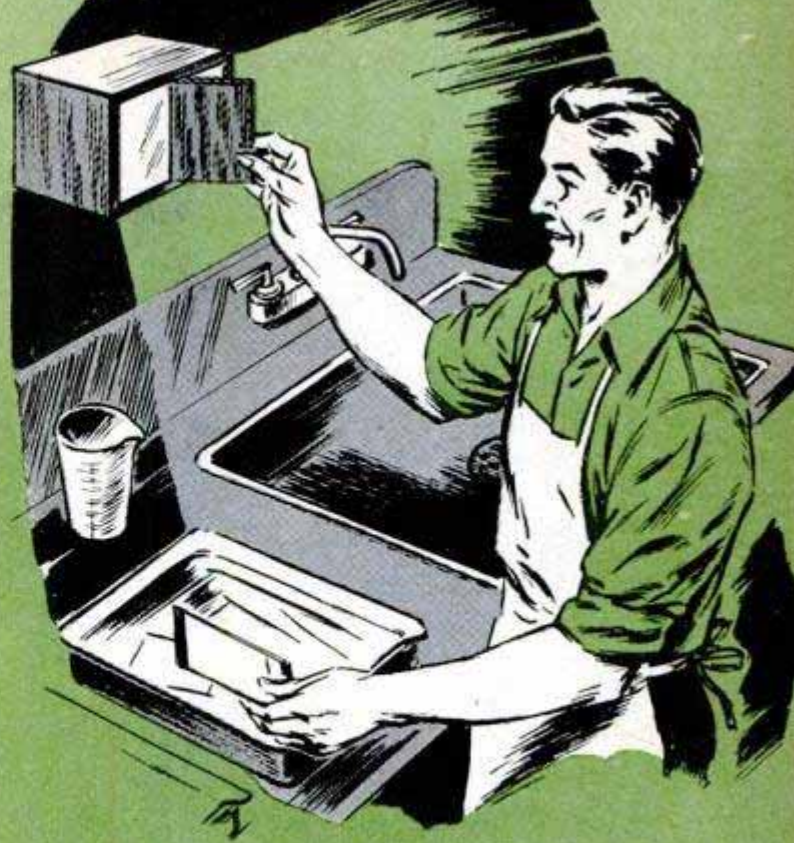




# TWO-WAY SAFELIGHT

PHOTOGRAPHERS who frequently switch from one type of safelight filter to another will find this two-way safelight a real timesaver. The front of the lamp housing, which holds two standard filters, is fitted with a swinging door to cover one of the filters while the other is in use. A small S-hook on each side of the housing locks the door in the closed position. The front of the housing is grooved to receive the filters, and a pivoted strip is swung in place to form a lightproof cover for the tops of the filters. This strip is rabbeted to fit snugly against the front edge of the housing top and is held closed with a peg or nail, the latter being inserted through a hole in the strip to engage a blind hole in the side of the housing. Note that all joints are rabbeted to provide a light-tight fit. If you do not have power tools, you can build up the sides by gluing together pieces of  $\frac{1}{2}$  and  $\frac{1}{4}$ -in. stock in the same manner as the top is constructed.

Louis Hochman, Sherman Oaks, Calif.





*Season's Greetings*



# TRICK PHOTOS *are* FUN

By Robert G. Hall

This unusual and welcome Christmas greeting card is made by double printing a family group portrait on a shot of a TV receiver. Appropriate background is selected and arranged



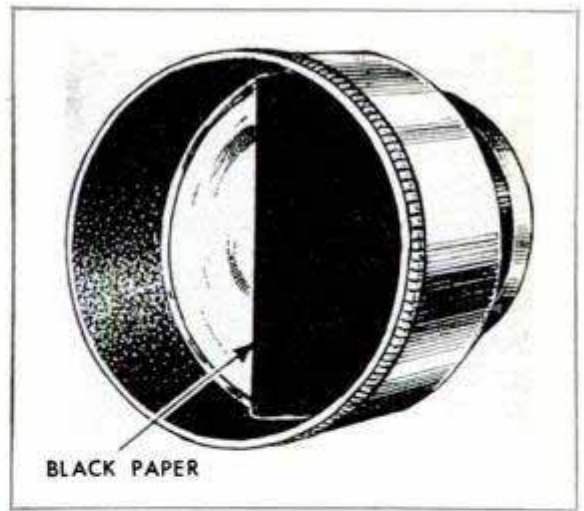
Amusing print above is a typical double exposure that displays originality in posing of the subject. Photo below is another example of same type, but somewhat more difficult



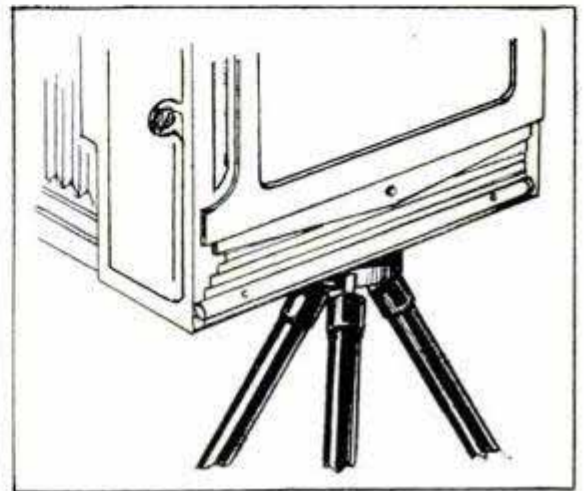
**TAKING TRICK** pictures is an amusing photographic diversion, either for fun or profit. The possibilities for unusual presentations are limited only by the photographer's imagination and initiative in arranging the subject and props. Occasionally a good trick picture will turn up accidentally as a result of the photographer forgetting to wind the film or reverse the holder after making an exposure. But only planned multiple exposures and carefully arranged double-printing can be made to produce positive results. Practical applications of the multiple exposure include greeting cards of various types which convey a message, such as the Christmas greeting card shown above at the left, and also personalized business cards or those devoted to some novel or individualized form of product promotion. Probably the most popular are the trick photos which portray the purely comic, the obviously impossible, or plain characterizations which are typical of the individual. Note the two photos at the left and the trick shot at the top of the opposite page.

In most trick photos involving multiple exposures, the background should be very dark, or black, and the subject should be well lighted. When shooting trick shots under difficult conditions, especially when the background poses a problem in composition, some photographers either shoot





Masking lens eliminates lines on print



Camera should be mounted on a tripod

the subject against a black backdrop as in the sketch at the right, or mask the lens with opaque masking paper as in the upper-right-hand detail. Cut a circular disk from the paper to a diameter that will cover the lens, then cut off one third of the disk and place the larger piece in the filter holder. The important thing is to make sure that the straight edge of the mask is vertical when placed in the holder. Also, experimental shots may show that some variation in the size of the mask is necessary to avoid a dark, unexposed line in the center of the print. On the other hand, if the mask is cut too small there will be a double-exposed light line in the center of the print. With the mask in the first position, make the first exposure. Then have the subject move to a point on the opposite side of the picture field and assume whatever pose the composition requires. Be sure that the second pose is well inside the picture limits. Then make the second exposure. Triple exposures are handled in much the same way, but more care is required in posing the subject and exposure timing must be more exact. Of course, in some cases, two or more negatives must be made and superimposed in enlarging or in contact printing. The popular "ghost" picture is made as in the lower detail at the right. The first shot of the subject reading is fully exposed but the second exposure of the ghost, a second subject wearing a white sheet, is underexposed and is made without winding the film or moving the camera.

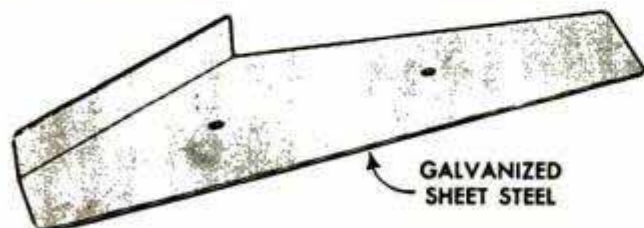
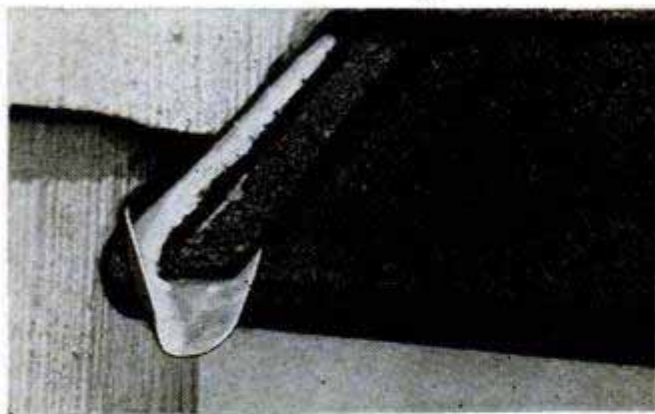


Above, whenever possible shoot the subject against a dark background. Below, a typical setup for making the popular "ghost" shot





## Metal Drain for Porch Roof Prevents Stained Siding

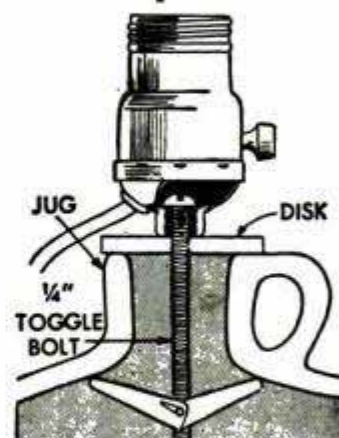


On houses that have small entranceway roofs not equipped with eaves troughs, staining of the siding, caused by water running down from the roof on it, may be avoided by installing a drain similar to the one pictured. This is placed about 2 in. away from the siding and can be made from thin

galvanized sheet metal, or even tin. Before installing the drain, it should be given a coat of red lead followed by a good paint job.—Robert H. Hawkins, Morton, Ill.

## Converting Jugs Into Lamp Bases

A jug, bottle or other narrow-necked container need not be drilled in order to convert it into a base for a table lamp. Instead, use a toggle bolt and a wooden or metal disk, and assemble them as detailed. To do this, remove the base from the light



socket and drill a hole in one side to admit the lamp cord. Then pass the bolt through the original outlet and through the disk, and screw the end of the bolt into the toggle. Push the toggle through the opening of the jug and tighten the bolt until the assembly is held snugly. When rewiring the socket, a rubber grommet should be inserted in the cord outlet.

Art Trauffer, McClelland, Iowa.

## Popular Mechanics Bookshop



### Build-It-Yourself Ranch-Type House

Spring is bustin' out again, and about this time of the year thoughts of that dream home you'd like to build start cropping out. A lot of those dreams are coming true this year—and they might as well be yours! Last year *Popular Mechanics* published plans for a plywood ranch house, with detailed instructions for those who want to build it themselves. Well over 5000 copies of the book were sold in the first three months after publication, and over 1000 readers have bought the blueprints. Make this your home-building year, too. Write to Popular Mechanics Book Dept., 204 East Ontario Street, Chicago 11, for *Build-It-Yourself Ranch-Type House* (\$3.50). Blueprints for the ranch house are \$13.50, or order book and plans together for \$15.00. They can save you \$7000 to \$10,000!

### Popular Mechanics Auto Album

We haven't had so much fun in years as

we had putting together for you the *Popular Mechanics Auto Album*. It's the story, fascinating in pictures and historical text, of the American gas buggy from the moment some saucer-eyed Huckleberry Finn first heard that roar down Main Street and yelled, "Hey, fellers! Look, a horseless carriage!" to the exciting finish of our own "Race of the Relics" in '51 when shiny Cadillacs and Chryslers paced an ancient Stanley Steamer as it outraced a Stoddard Dayton from Chicago to New York. Grandpa or youngster, this is a book you must see. The pictures of the interesting old-time automobiles alone are worth the price of admission—\$2.50.

### All About Television

*All About Television* in one book? A professional TV repairman has done that for you. A new *Popular Mechanics* book under that title gives you both theory and practice in television: How to save money in buying a set, how to install an antenna, how to make your own replacements and repairs safely. This \$3.00 book can save you many times its cost. Address the Popular Mechanics Book Dept., 204 East Ontario Street, Chicago 11, for *All About Television*.

**All books available from Popular Mechanics Book Dept., 204 East Ontario Street, Chicago 11**



## New Handles for your garden tools

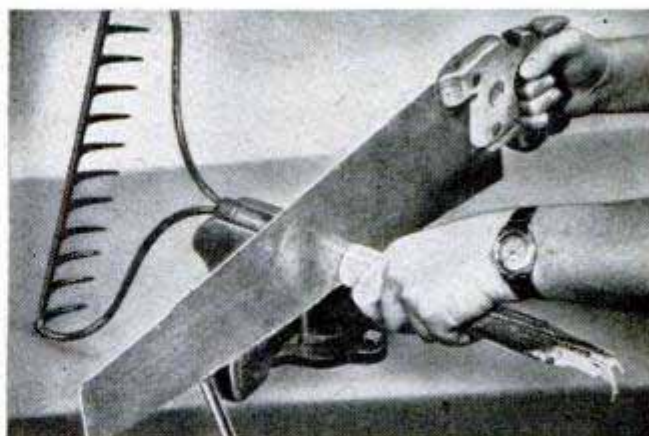
By Elma Waltner

**D**O YOU HAVE a favorite old rake out in the garage from which the handle is missing? Or a spading fork with a taped handle that splits a little more each time you use it? If you've been planning to replace these or other garden tools this year but haven't bought the new ones yet, why not pause to look around? See how many good tools you could have just by fitting the old broken ones with new handles.

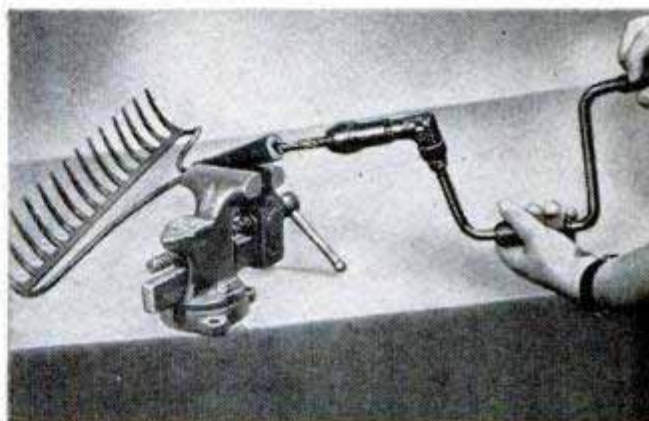
Fitting tool handles can be done easily with ordinary hand tools. The photos on these pages take you through the basic steps of applying new handles to a rake, spade, spading fork or ax. You will note that the rake tang is pinned to the handle, so care must be taken to drive the handle all the way onto the rake to align the holes in the handle and tang. As shovel handles are made in a variety of shapes, it is best to take the blade with you when buying a new handle for your shovel.

A hammer handle is fitted in much the same way as the ax handle pictured in the photo sequence, except for shaping the handle to fit the eye. Most hammer heads have an eye which tapers both ways from the center of the head. Therefore, cut down the end of the handle so its fits through the eye and projects approximately  $\frac{1}{2}$  in. beyond the head. Taper the handle to suit the eye on the handle side of the head. When the head is mounted on the handle, the latter is spread to fit the outer section of the eye by driving a wedge into the wood. End of the handle is cut flush with the head.

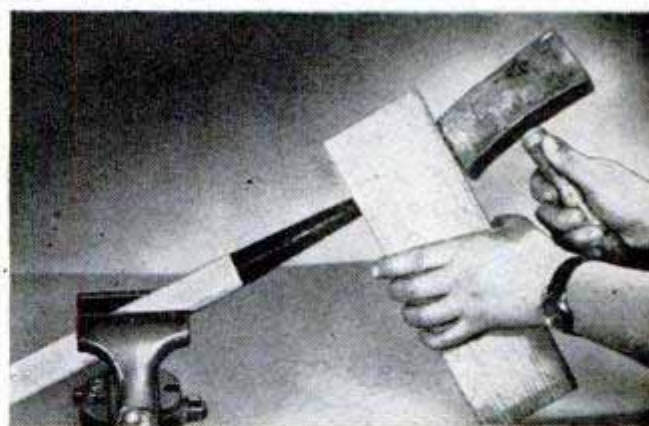
To attach handle, drive tang into hole by tapping on handle. Drill through hole in ferrule until bit strikes tang and drive pin in hole to engage tang. Joining tang and ferrule properly aligns the holes



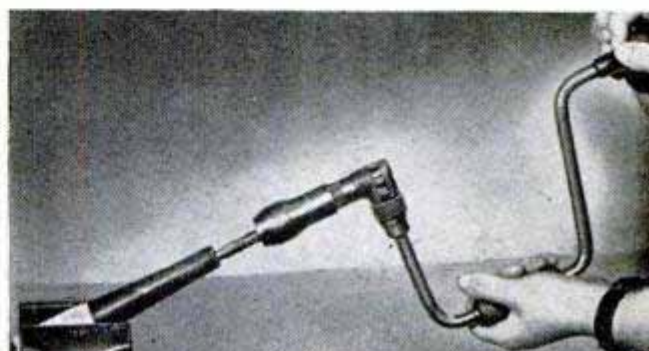
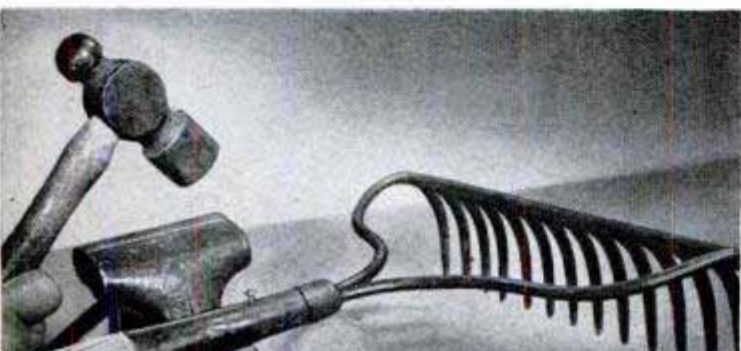
If rake handle cannot be removed after prying out pin, saw off handle as close to ferrule as possible



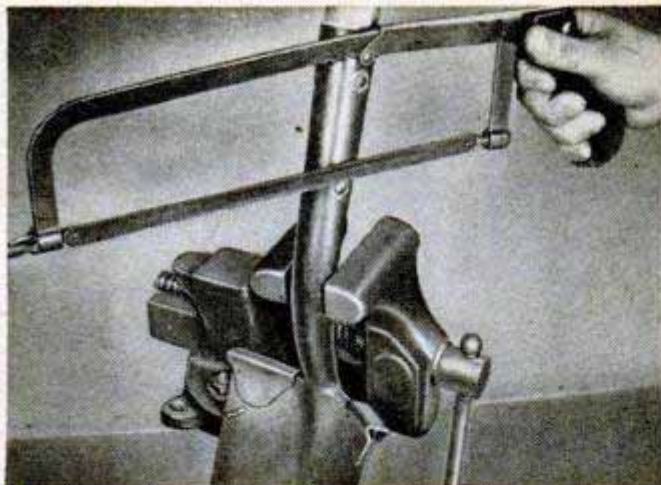
Using metal drill, remove wood to loosen the tang, and with a punch, drive the tang from the ferrule



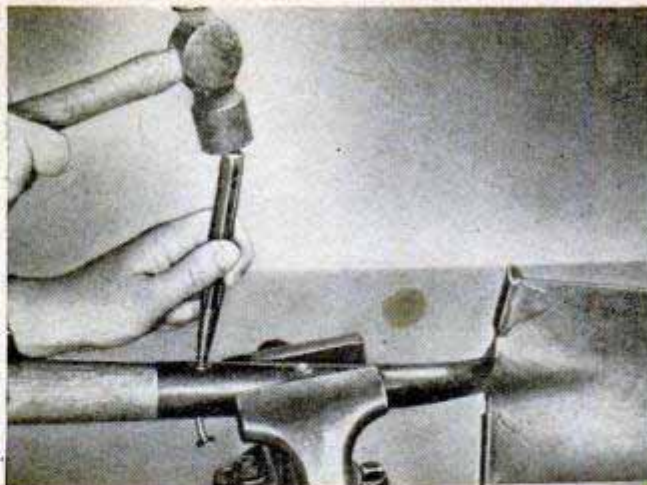
After shaping new handle to fit ferrule, drive ferrule on end of handle as above. If necessary to enlarge hole in handle to take rake tang, drill as below, using bit about  $\frac{1}{16}$  in. smaller than tang







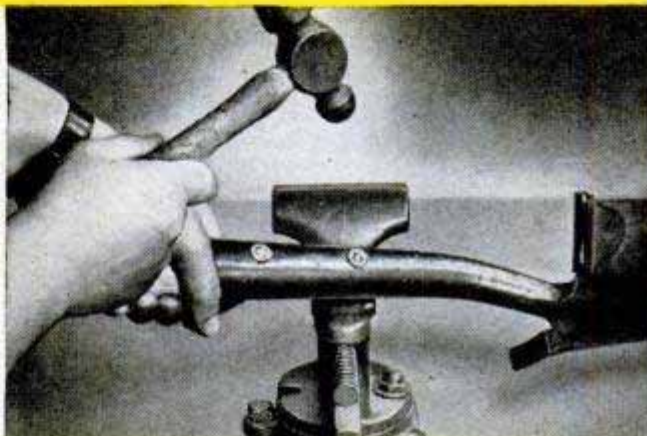
To remove handle from spade, cut off rivet heads with hacksaw or center punch and drill them out



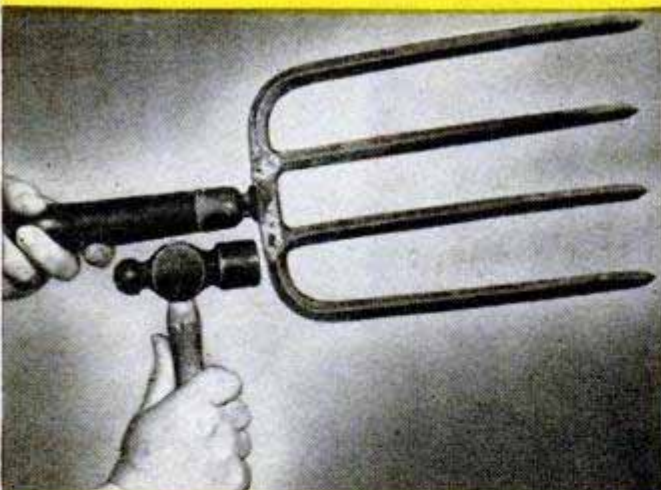
Then clamp ferrule of spade firmly in vise and drive cutoff rivets from handle with a punch



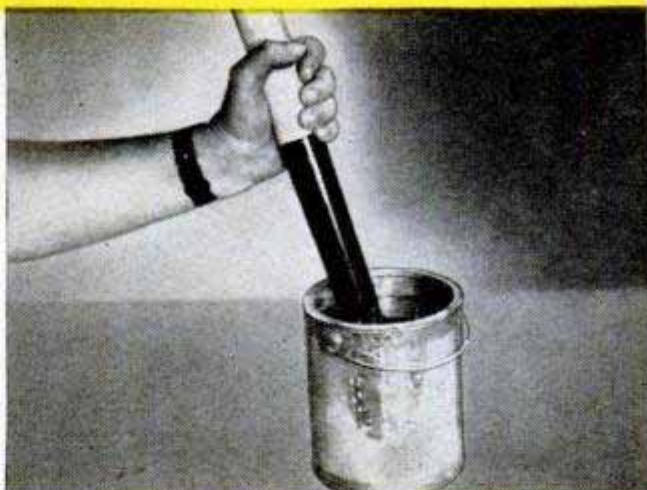
Shape end of the handle with a rasp so it can be driven fully into ferrule for maximum strength



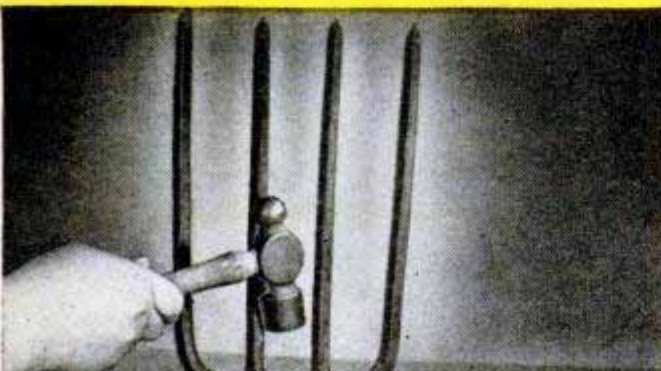
After driving handle in ferrule, drill for rivets. Latter should extend about  $\frac{1}{8}$  in. before peening



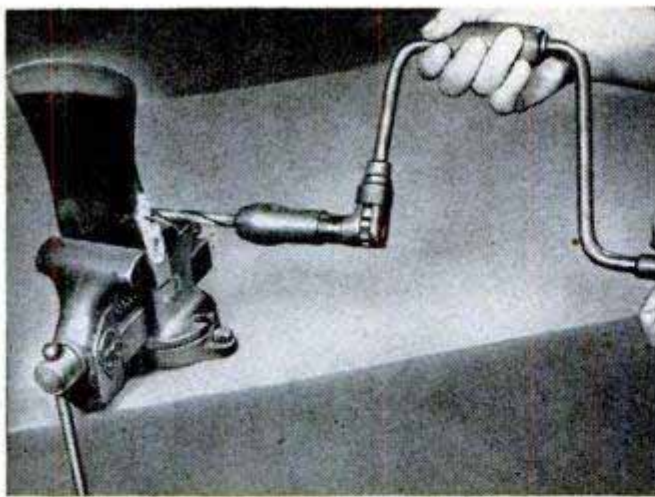
Remove spading fork from handle by tapping close to handle, as above. To replace, insert tang in new handle and tap fork between tines, as below



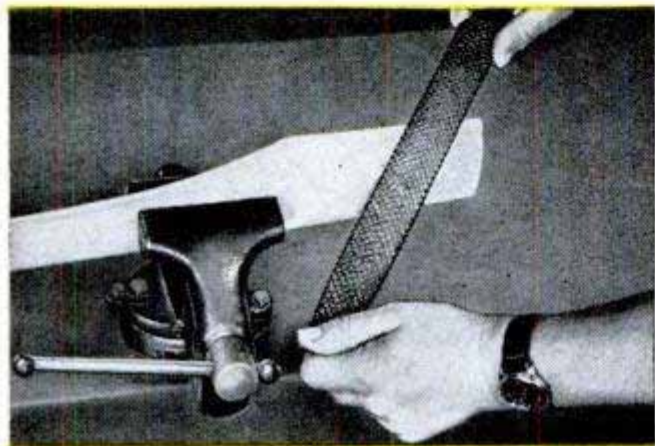
Above, soak fork handle in hot water for a half hour before fitting. Shovel handles, below, sometimes must be shaped or cut away to fit ferrule



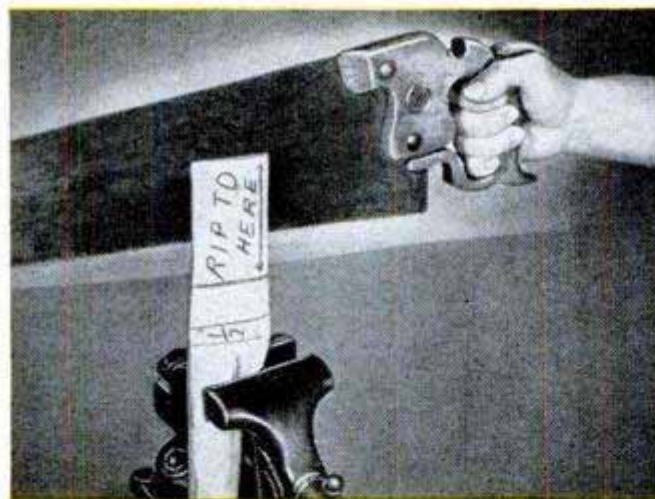




Saw off broken ax handle at head and drill wood in eye with metal bit. Remove wood with a punch



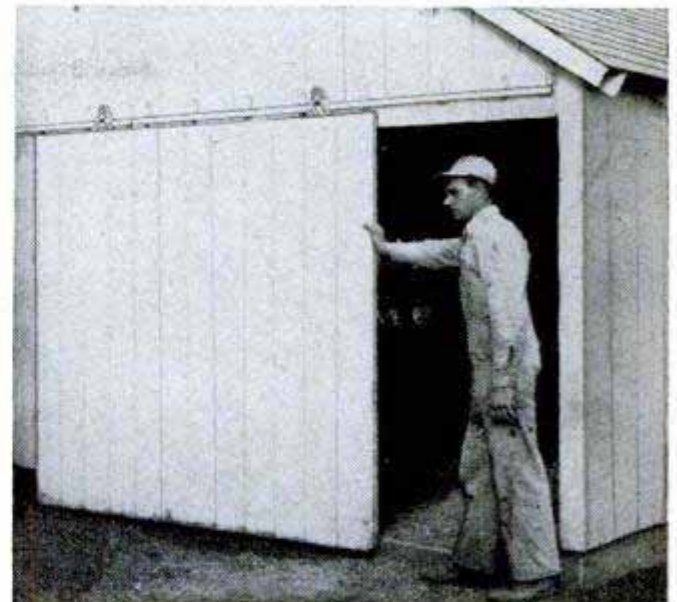
Clamp new handle in vise and rasp to fit eye, checking fit with ax head as shaping proceeds



Slot handle for softwood wedge, above. Check fit, below, with ax on edge. End of handle and blade edge  $\frac{3}{8}$  from front should touch bench top

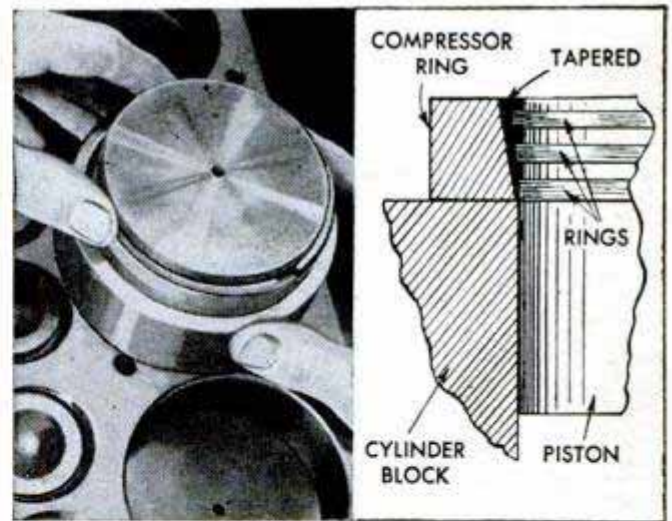


## Sliding Door on Poultry House Makes Cleaning Easier



One farmer has minimized the work involved in cleaning his poultry house by installing a sliding door over an entrance large enough to permit driving in a small tractor and manure spreader. Droppings and litter are shoveled directly into the spreader, thus eliminating the necessity of further handling.

## One-Piece Ring Compressor Speeds Inserting Piston

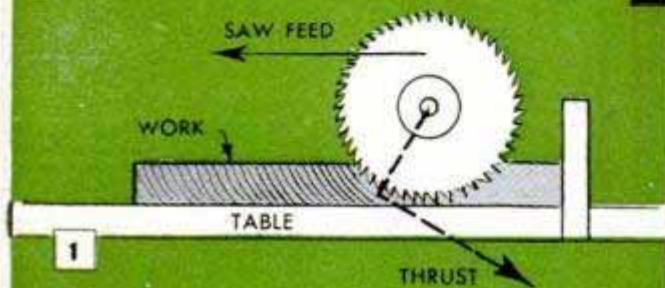
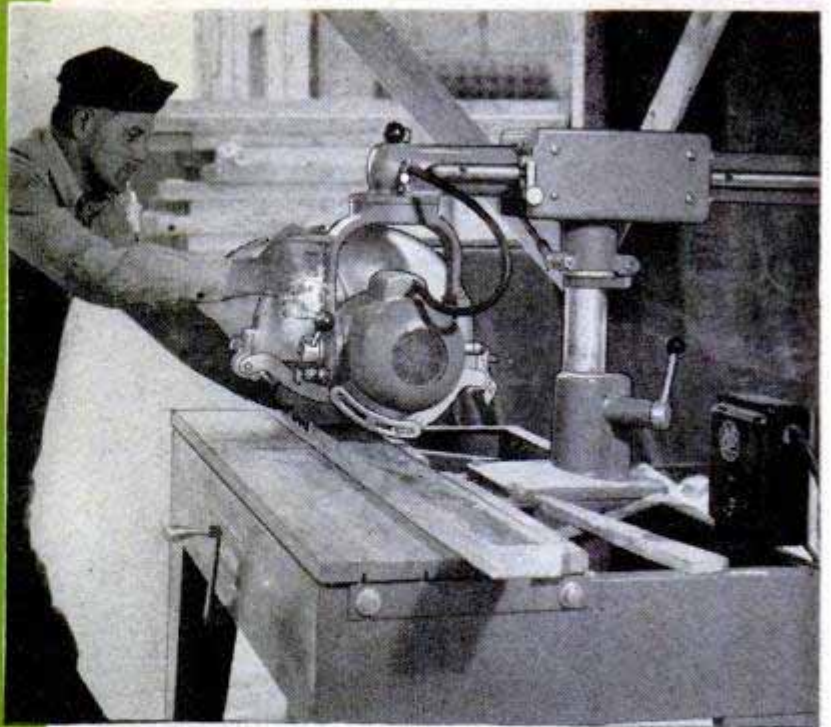


Especially useful to mechanics who specialize on a particular engine, this one-piece ring compressor is made for use on a specific sized cylinder and requires no manipulation when used. Each compressor is a steel ring 1 in. wide, the inside surface of which tapers from a diameter equal to that of the cylinder to a diameter  $\frac{1}{4}$  in. larger. In use, the small end of the compressor is placed over the cylinder and the piston passed through it, the rings being compressed by the tapered surface as the piston is inserted.—Ed Packer, Chicago.

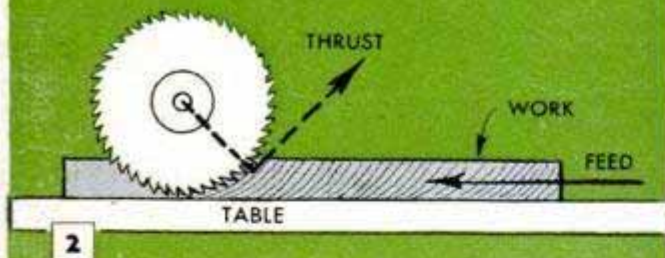


# THE RADIAL SAW

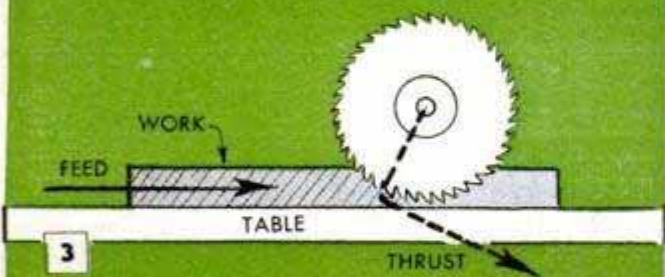
By Sam Brown



**1**  
**CROSSCUT**—Action of blade pushes work down on table and back to fence. Dull saw tends to climb



**2**  
**RIP**—Feed is against rotation of blade. Dull saw has tendency to lift the work from the table



**3**  
**NEVER** rip in same direction as saw rotation. This is same action as crosscut but lack of back-stop causes saw to hog the work without control

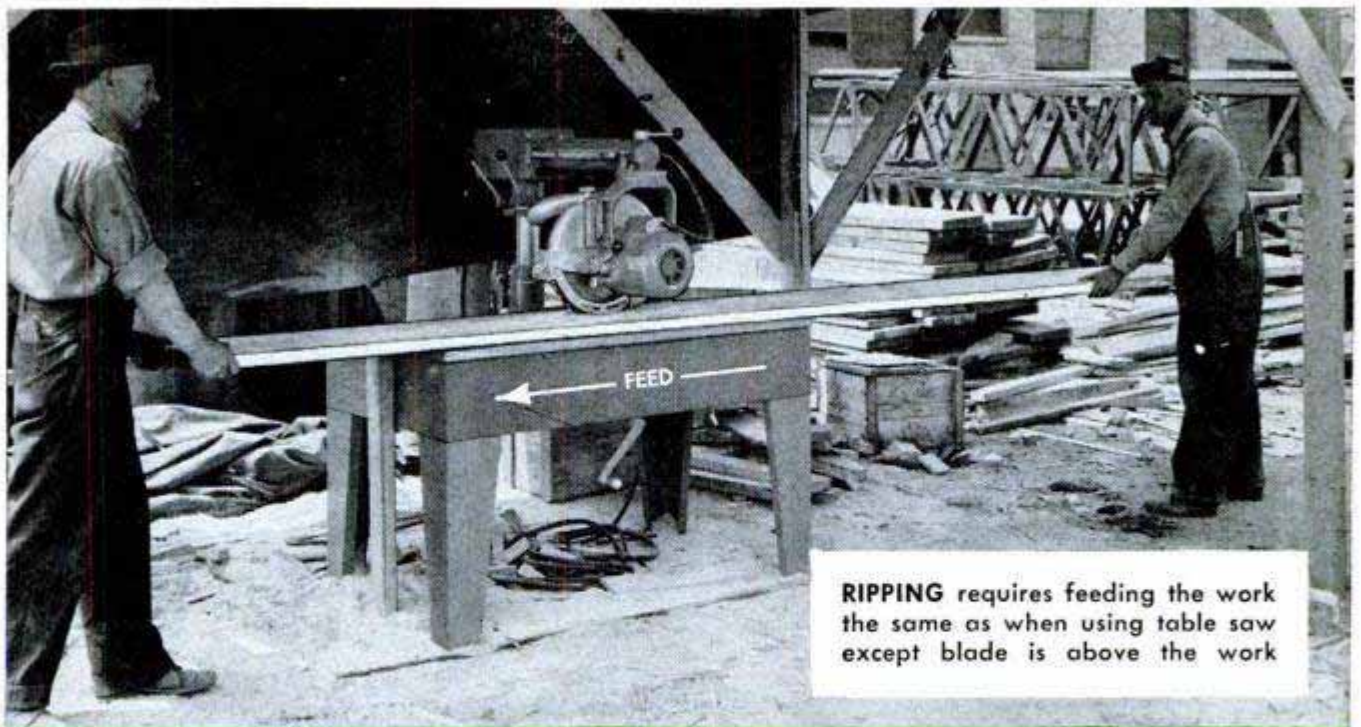
**CROSSCUTTING** is job radial saw does best. Work remains stationary and saw is pulled through to cut

**THE RADIAL SAW** slides along an overhead arm, and the saw itself can be rotated in a full circle. These adjustments permit a wide variety of operations, although the one job the radial does best is plain crosscutting, either square or at an angle. In this operation the work remains stationary while the saw is pulled through it. Radial saws are available in a range of sizes from  $\frac{1}{2}$  to 10 hp., the smaller sizes of  $1\frac{1}{2}$  hp. or less being most popular. Motors are commonly 3450 r.p.m. which gives a constantly increasing rim speed with larger size saws; a 12-in. blade will have a rim speed of about 11,000 f.p.m.

**Saw action:** The radial saw is a pull-through saw and uses climb feed for crosscutting. In this action, the saw is moved in the same direction as its rotation, as shown in Fig. 1. The action in ripping is the same as that of a table saw except the saw is above the work, Fig. 2. The saw has a slight lifting action which is negligible with a sharp blade but increases as the blade becomes dull. It is common practice to swing the infeed side of the guard nearly in contact with the work to prevent lifting. Ripping must never be done in the same direction as saw rotation, Fig. 3. This is climb feed and, without the backstop as in crosscutting, the hogging of work is violent and uncontrolled, especially with a dull blade.

**Choice of method:** Your first cut with the saw will pose the question of right-hand feed, Fig. 4, or left-hand feed, Fig. 5. You will probably use left-hand feed because it puts the holding (right) hand on the side away from the saw and is obviously safer. However, the right-hand feed is more





**RIPPING** requires feeding the work the same as when using table saw except blade is above the work



4

**RIGHT-HAND FEED** is the natural and practical position for crosscutting most types of work



5

**LEFT-HAND FEED** offers extra safety and is often the best feed for use on all awkward work



6

**LONG END TO LEFT** permits the left hand to hold solid portion of work safely and securely



7

**LONG END TO RIGHT** is a poor way to operate saw when left hand must hold short cutoff



8

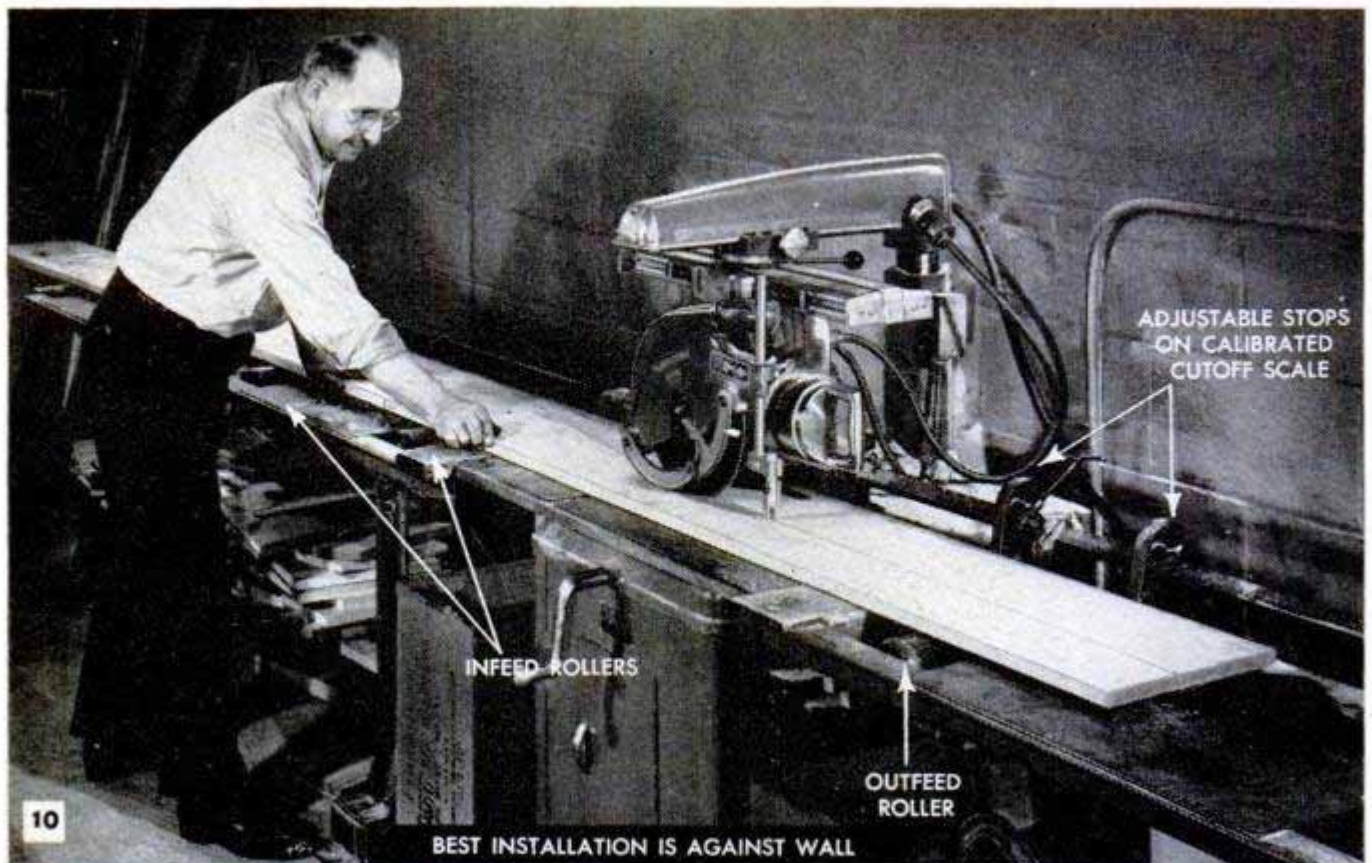
**LEFT-HAND MITER** is the most comfortable to use on all angle cuts up to approx. 60 deg.



9

**RIGHT-HAND MITER** is an awkward position although it is useful in cutting angles over 60 deg.





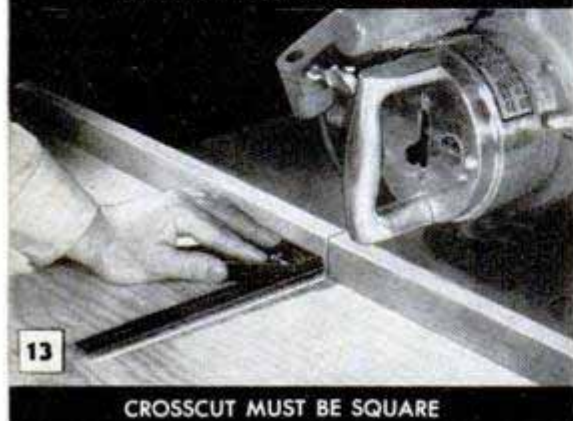
BEST INSTALLATION IS AGAINST WALL



"WEAR" TABLE IS NAILED IN PLACE



FENCE IS SECURED BY WEDGES



CROSSCUT MUST BE SQUARE

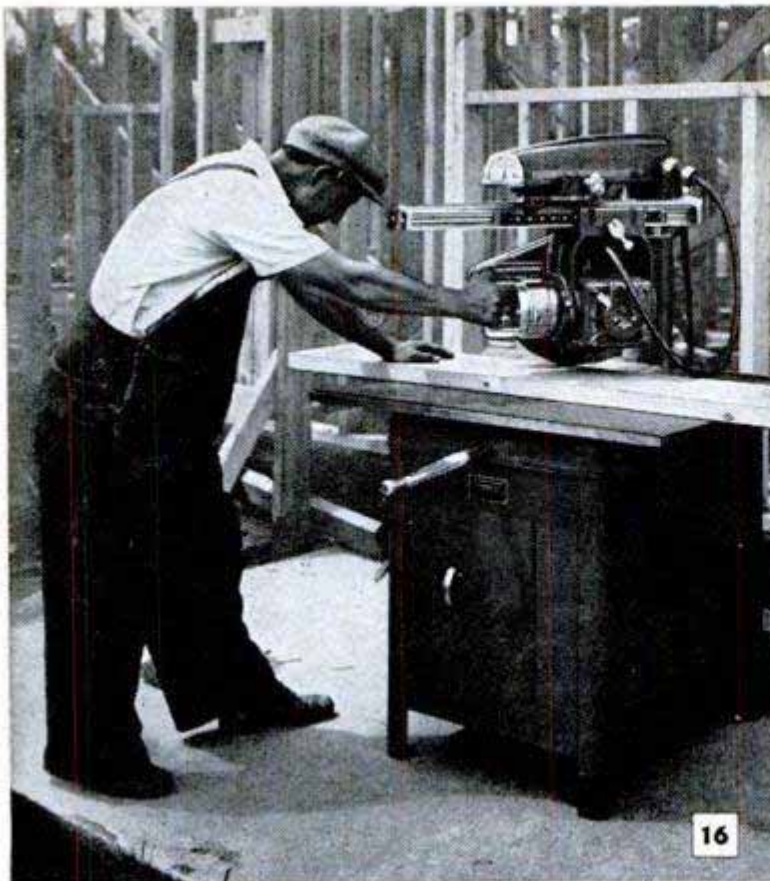
practical, more comfortable, and you will quickly adopt this system.

A choice that should be obvious is to hold onto the long part of work when making a cutoff as shown in Figs. 6 and 7. When it comes to miter cuts, you will find the left-hand swing more comfortable for most work, Fig. 8, although the right-hand miter, Fig. 9, is often the best choice when cutting at an extreme angle. In ripping, you have a choice of inside rip or outside rip, these terms indicating whether the saw is toward the column or away from it. Fig. 10 shows outside rip and the top photo on the preceding page shows an inside rip. Most workers prefer outside rip although it is a wrong hand operation when compared with a rip cut made on a table saw.

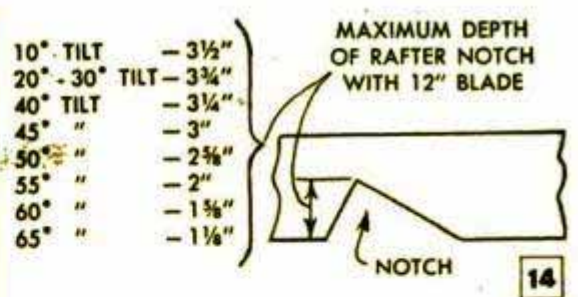
**Installation:** For shop work, the radial saw is best installed along a wall. You can do what you like in the way of extension tables and extra fixtures, Fig. 10. In all cases, a "wear" table of plywood or hardboard should be nailed over the permanent front table as in Fig. 11. This takes the saw cuts and keeps the permanent table from being chewed up. The fence is any straight stick of wood held in place with a wedge at either end as in Fig. 12. A new saw should be carefully adjusted when set up, including leveling of table, squaring of crosscut, Fig. 13, etc.

**Cutting rafters:** The radial saw is "tops" for building construction where most of the lumber is dimension stock that needs only cutting to length. Roof framing is typical of this work. Table on page 221 shows required rafter angles. For example, suppose you are framing a roof of  $\frac{1}{3}$  pitch. Any plumb (vertical) cut is made with the saw set at  $33\frac{3}{4}$  deg. on the miter scale, while any level cut is made with a miter swing of  $56\frac{1}{4}$

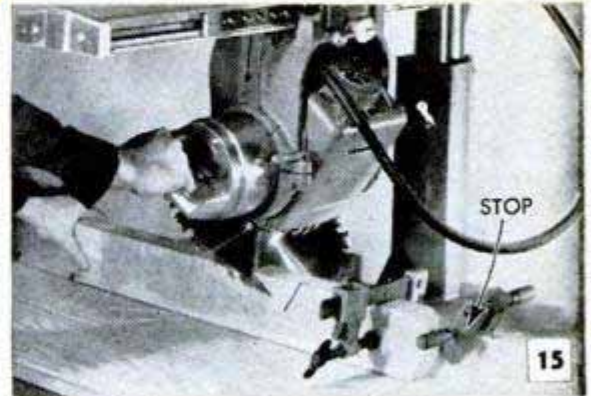




16



14



15

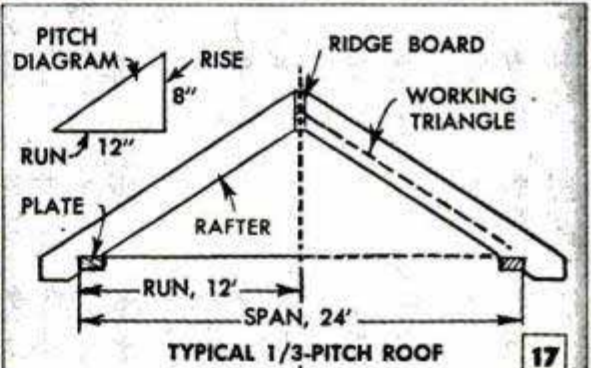
SAW IS TILTED to same angles for rafter notching but note that work is cut on edge

BUILDING CONSTRUCTION is field for radial saw. Saw is swung to desired miter to make both plumb and level cuts

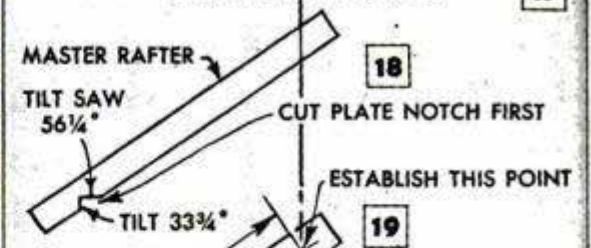
**TABLE OF COMMON RAFTERS**

RISE PER FT. OF RUN	PITCH	SAW SETTING*		LENGTH PER FT. OF RUN
		PLUMB CUT	LEVEL CUT	
1"	1/24	4 3/4°	85 1/4°	12.042"
2"	1/12	9 1/2°	80 1/2°	12.166"
3"	1/8	14°	76°	12.369"
4"	1/6	18 1/2°	71 1/2°	12.649"
5"	5/24	22 3/4°	67 1/4°	13"
6"	1/4	26 1/2°	63 1/2°	13.416"
7"	7/24	30 1/4°	59 3/4°	13.892"
8"	1/3	33 3/4°	56 1/4°	14.422"
9"	9/24	37°	53°	15"
10"	5/12	39 3/4°	50 1/4°	15.621"
11"	11/24	42 1/2°	47 1/2°	16.279"
12"	1/2	45°	45°	16.971"
13"	13/24	47 1/4°	42 3/4°	17.692"
14"	7/12	49 1/2°	40 1/2°	18.439"
15"	15/24	51 1/4°	38 3/4°	19.209"
16"	2/3	53°	37°	20"
18"	3/4	56 1/4°	33 3/4°	21.633"
20"	5/6	59°	31°	23.324"
24"	FULL	63 1/2°	26 1/2°	26.833"

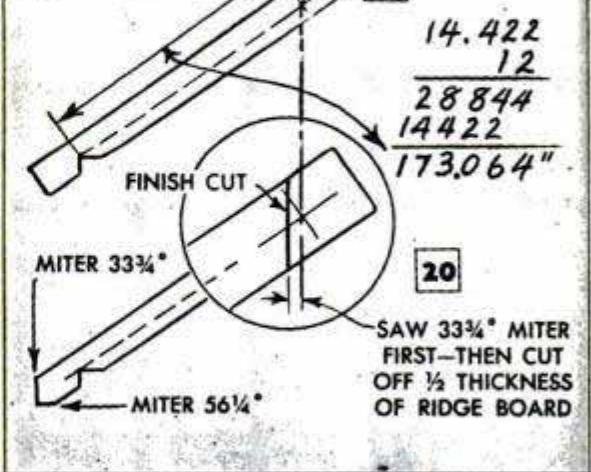
\*DIRECT SETTING TO TILT AND MITER SCALES WHEN 0° IS NORMAL SQUARE CROSSCUT. OTHERWISE, TRANSPOSE COLUMNS



17



18

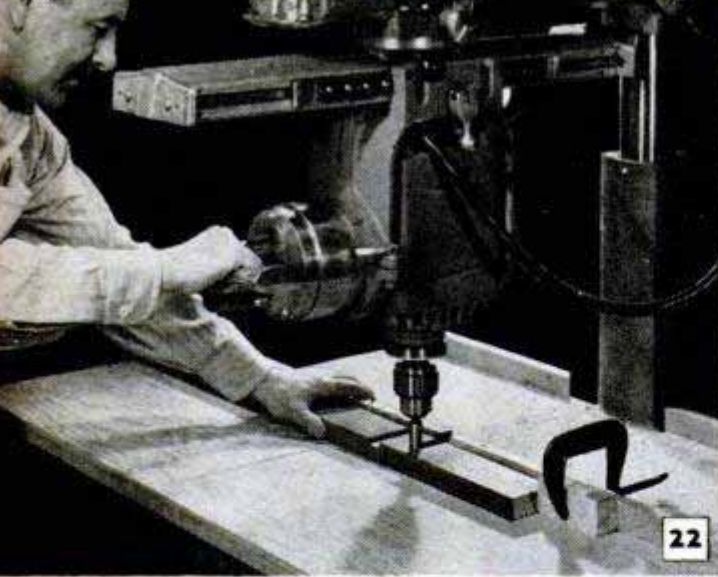


14.422  
12  
28844  
14422  
173.064''

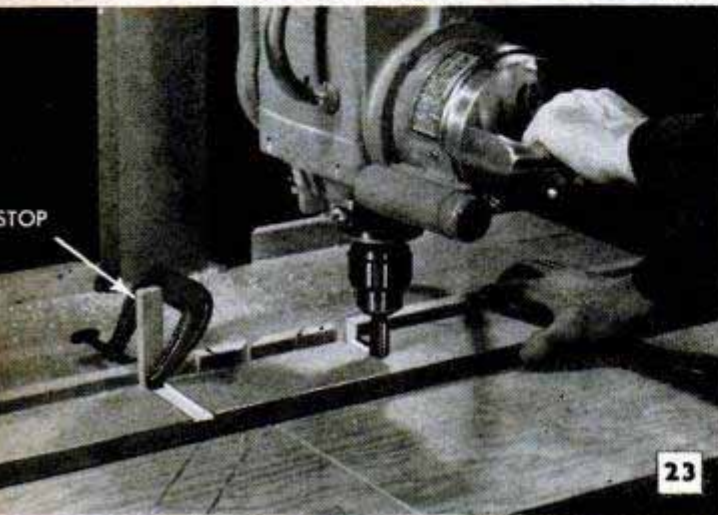
20

PITCH OF ROOF AND RUN OF RAFTERS ARE ONLY INFORMATION REQUIRED TO DETERMINE ANGLES OF CUTS AND RAFTER LENGTH FROM TABLE AT LEFT. TABLE COVERS FROM 1/24 TO FULL PITCH

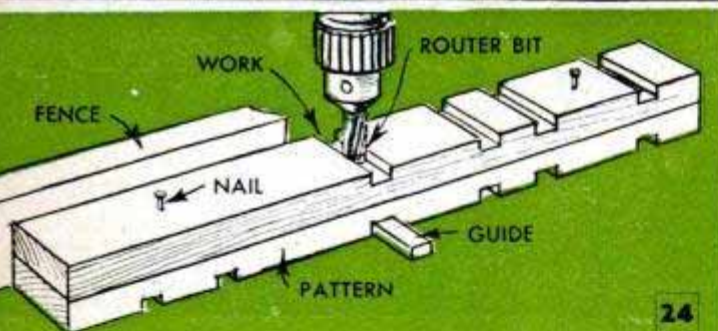




22



23

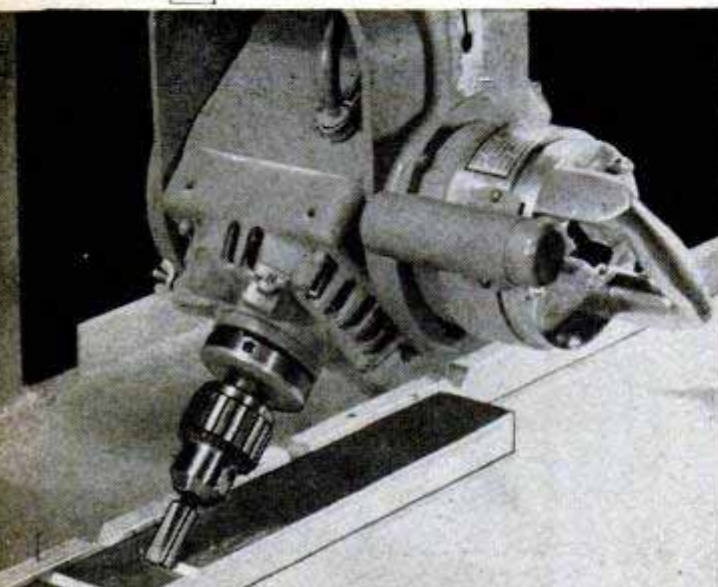


24

FIRST PIECE is used as template for routing similar piece, guide strip being located below bit

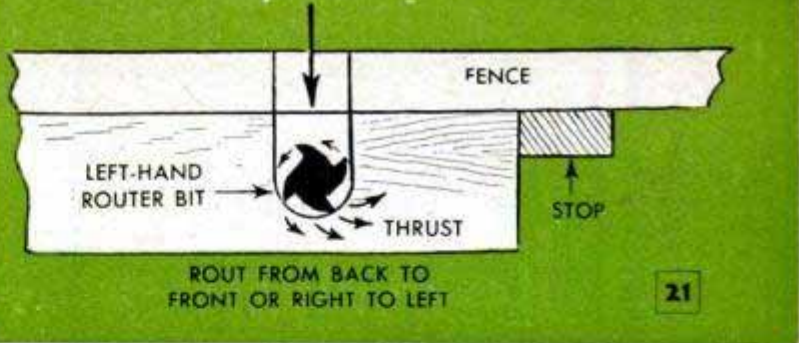
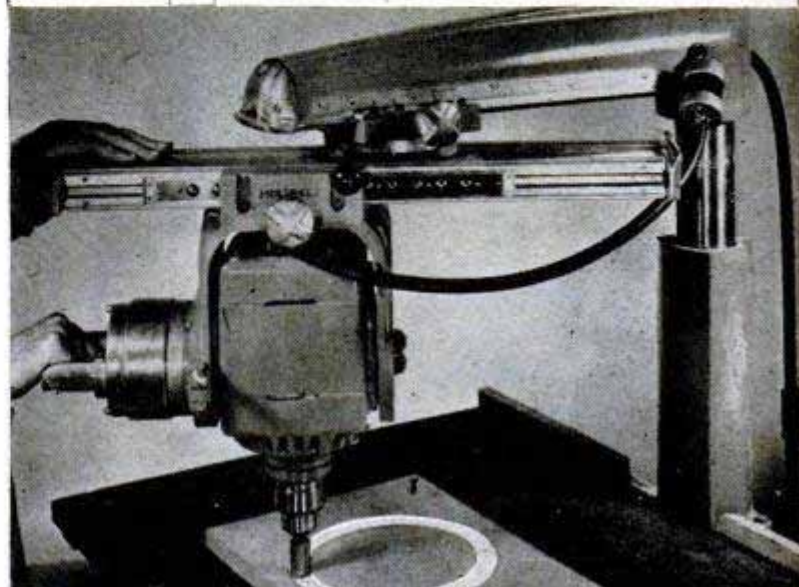
25

V-GROOVING



26

CIRCLE ROUTING



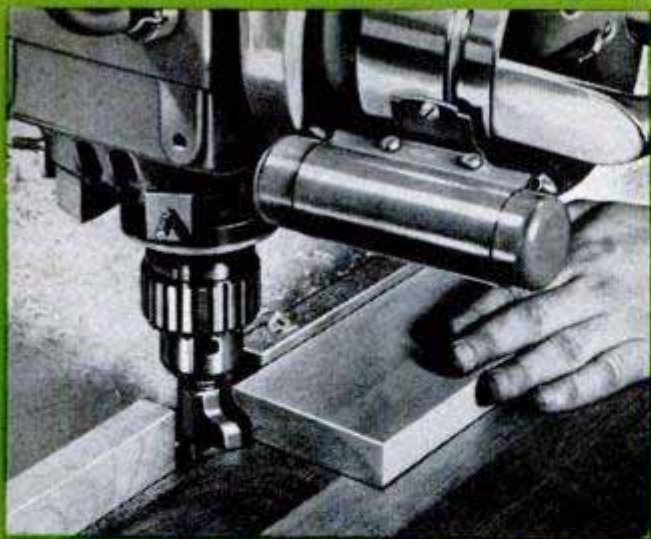
**ROUTING** is second only to crosscut sawing in radial-saw operations. Stop prevents work creeping

deg. If you have to do notching for the plate, the angles are the same except the work stands on edge while the saw is tilted, Fig. 15. This operation has depth limitation, Fig. 14, but can be used for a large number of jobs involving pitches from  $\frac{1}{3}$  to  $\frac{3}{4}$ . It is usually necessary to remove the saw guard when making these angle cuts. While the cut itself is no more dangerous than a plain crosscut, it is sensible practice to clamp the work to the fence, Fig. 15, for this "bare blade" cut.

The table also gives a multiplying factor which enables you to find the length of any rafter for any pitch. For a  $\frac{1}{3}$ -pitch roof, the factor is 14.422 in. When this figure is multiplied by the run of the rafter, it gives the rafter length between two specific points, as shown in Fig. 19. The working triangle, Fig. 17, which uses the run as a base, can be located at any convenient point, that is, to inside of plate or outside of plate or some intermediate point. The run measurement is commonly made to outside of plate since this usually is an even figure and simplifies the job of multiplying. Follow the example from Figs. 17 to 20, inclusive, and you will see how this works.

A master rafter is always made first, starting with the plate notch. Once this is cut to required length, it is used as a guide for setting stops. The plate notch is cut last since the end cuts must butt against the stop, Fig. 15. When a rafter notch is too

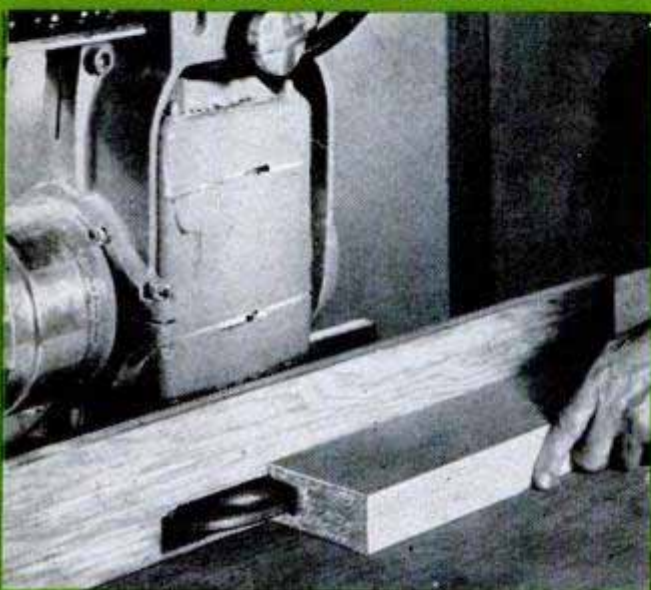




SIMPLE SHAPING IS DONE EASILY



WIDE RABBETS CUT WITH SAW HORIZONTAL



CUTOUT FENCE IS USED FOR GROOVING



DADO HEAD MAKES VARIETY OF CUTS

deep for edge-cutting, it is often practical to make the cut as far as possible in the miter position, Fig. 16. This will leave a small uncut section of wood which is easily completed with a handsaw.

**Routing:** Other than crosscut sawing, routing is the handiest job done on the radial. The mounting is rigid, the motor husky; you can swing bits up to 1½-in. dia. at ⅛-in. depth per pass. Cross-routing can be done from back to front or front to back. Routing from the back, Fig. 21, is the most practical since the fence gives support for the starting cut which, with front to back routing, tends to tear the wood on entry. When you cross-rout from the back, a stop should be used at the right end of work, Fig. 22, to eliminate creeping of the work. If you rout from the front, the stop should be at the left end.

Cross-routing of equally spaced grooves is done easily by using a stop clamped to the fence at the required distance from the bit, Fig. 23. This not only spaces the cuts but also prevents creep. When two similar pieces of odd-spaced work are required, as

for a shelf, the second piece is accurately routed by using the first piece as a pattern which fits over a guide strip located directly below the bit, as shown in Fig. 24. Routing is excellent for V-grooves, Fig. 25. The action here is more side than end cutting, making the preferable feed from front to back, as shown. Radial saws of the center-pivot type can be adjusted to rout circles, as shown in Fig. 26. Note that left-hand bits are needed for all routing operations. When routing with hand feed, that is, feeding the work along the fence, the feed is always from right to left, just the reverse of the drill press, which uses right-hand bits. Like the drill press, the idea is to have the bit rotation force the work against the fence.

**Other jobs:** Once you start using a radial saw you will find it capable of doing a hundred and one different jobs. The photos above picture four examples. A speed of 3450 r.p.m. is a practical working speed for an 8-in. sanding disk or a 6-in. grinding wheel. The tilt adjustment is especially useful for precision grinding jobs, such as saw sharpening.



## Steel Angle Serves as Guide For Cutting Torch

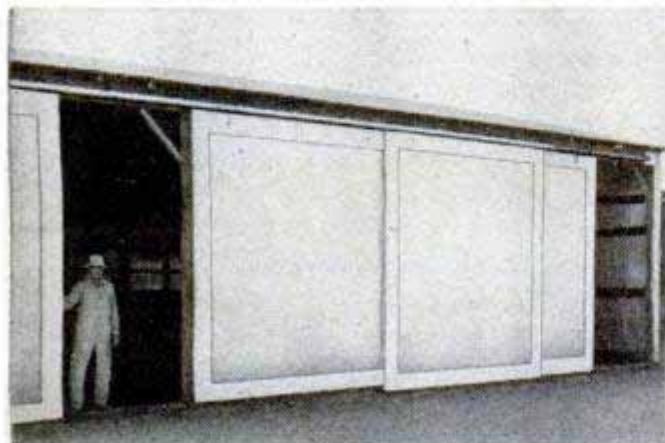


Straight cuts with an acetylene torch are easy to make when you use a length of steel angle as a guide. Select a piece of 1½-in. angle of sufficient length to span the work and clamp it in position with its corner about ½ in. from the cutting line. Then rest the end of the torch against the vertical web of the angle and play the flame straight downward as the torch is moved along the angle. The cut which results requires very little grinding to finish.

T. F. Watts, Charlotte, N. C.

## Farm Shed Has Telescoping Doors To Facilitate Implement Storage

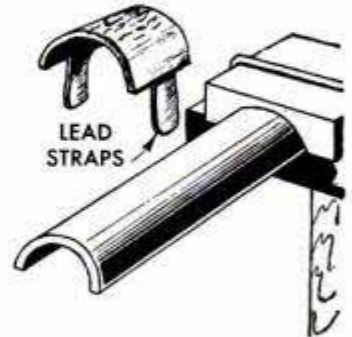
By hanging specially made sliding doors on adjacent tracks all the way across the front of a 60-ft. machine shed, one farmer simplified the storage of his implements. With this arrangement any one of the machines could be removed or replaced without the necessity of moving the other units. The doors are made in various widths and consist of rigid frames of 1-in. stock covered with corrugated aluminum roofing. When



fully closed, the doors overlap about 4 in. to keep out rain and snow. The doors are hung alternately on inner and outer tracks, which makes it possible for each door to slide past the adjacent one in either direction.

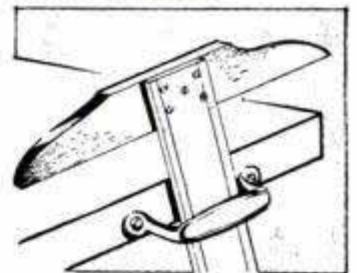
## Lead Straps Hold Punch Plate On Tinner's Stake

Metalworkers who have frequent use for a lead punch plate often experience trouble in keeping the plate in position on the rounded surface of the stake. To prevent the plate from slipping off, one tinsmith soldered two short lead straps, or tabs, to the lower edges of the plate. When the plate is in use, the straps are bent around the lower edges of the stake to hold the plate securely in position.



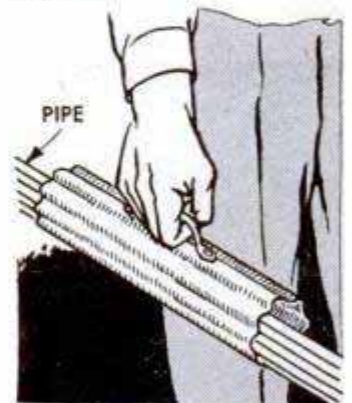
## Door Handle Holds T-Square

Attached to one end of a drawing board, a brass or chrome-plated cabinet-door handle makes a practical holder for your T-square. When attaching the handle, be sure that it is positioned so that no part of it projects above the surface of the drawing board, otherwise the holder may interfere with the use of the T-square, especially on small boards.



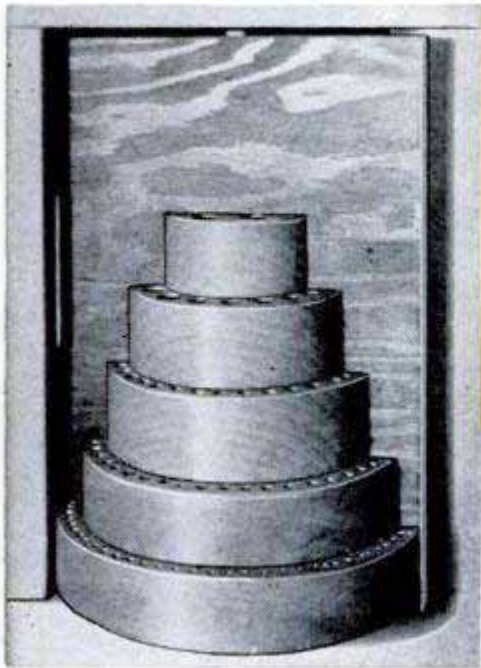
## Improvised Pipe Carrier

To save time and labor when moving a quantity of pipe by hand, plumbers and steamfitters often use a simple carrier made from a short length of downspout, which has a fitted screen-door handle attached at the center. The carrier is slipped over one end of the pipe locating it at the center when carrying short lengths. The handling of long lengths will require two men with separate carriers, each supporting one end of the burden.





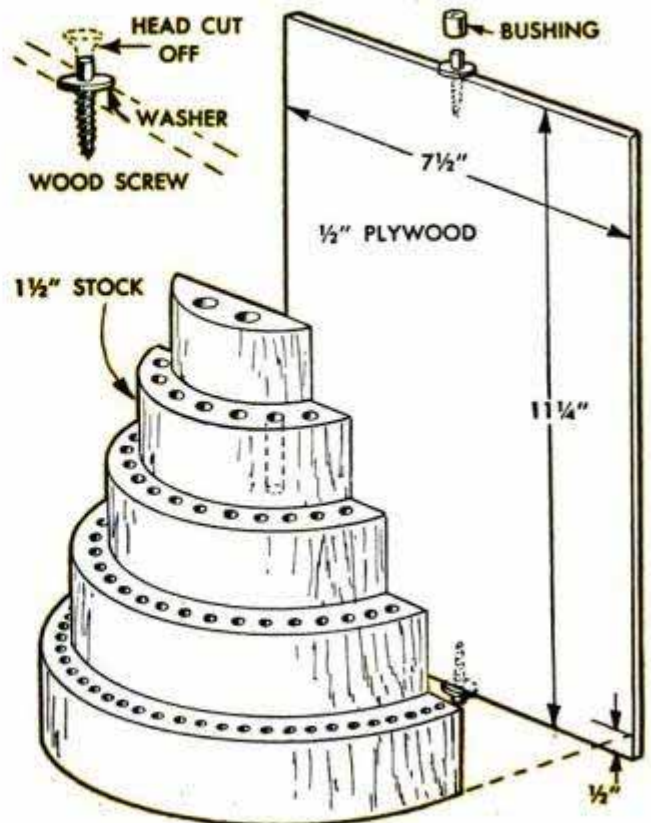
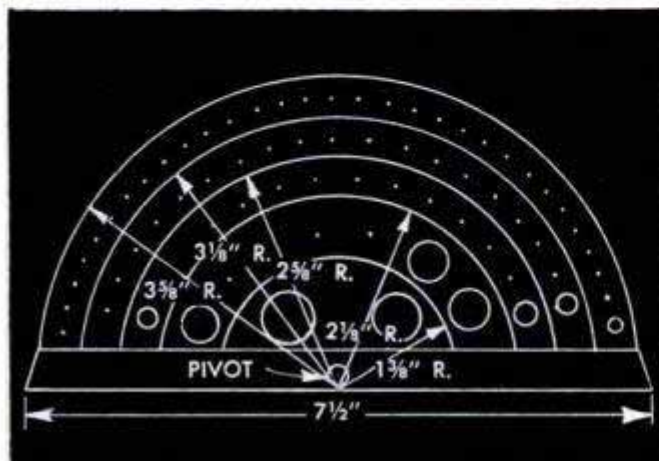
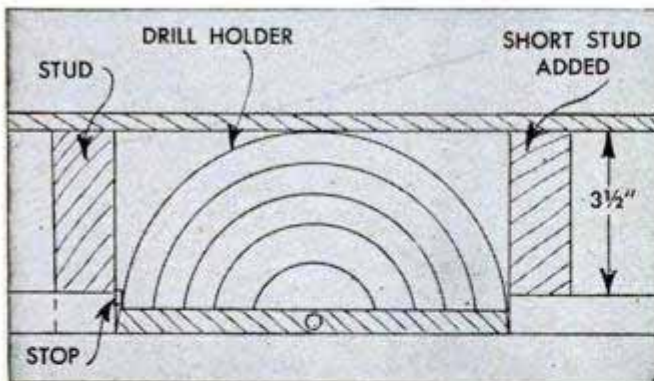
# Hideaway DRILL HOLDER



By Dick Hutchinson

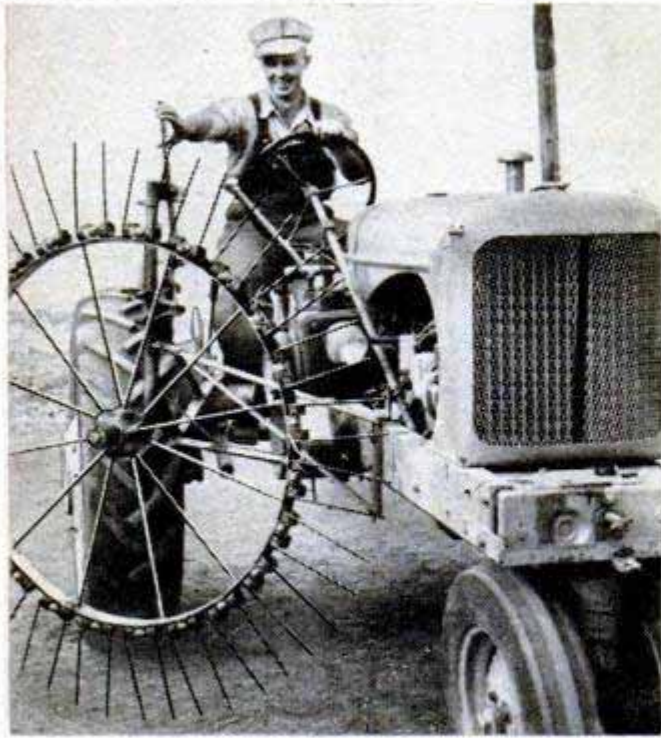
MADE TO PIVOT in an opening cut in the wall above a workbench, this drill holder will enable you to utilize waste space between the studs for storing a set of twist drills. Five pieces of 1½-in. stock are cut in semicircular shapes of varying sizes as shown. A protractor is used in laying out the pieces for drilling of holes. Each hole is drilled 1¼ in. deep and made one size

larger than the bit for which it is intended. After this is done, the pieces are smoothed with sandpaper and assembled with glue and finishing nails. The holder is then attached with glue and nails to a piece of ½-in. plywood that has been cut to form the back, or door, of the unit. The door is supported by two wood screws—with their heads removed—which pivot in bushings set in 2x4s, the latter being fitted horizontally above and below the wall opening.





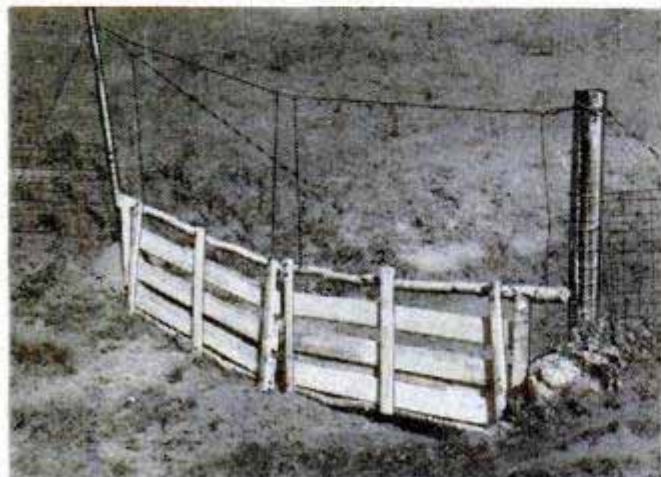
## Farm-Tractor Windrow Turner



Farmers like this windrow turner especially well because it can be operated at high tractor speeds without shattering leaves or seed from the crop being cured. The wheel is mounted on a short spindle and rotates at an angle to the direction of travel. Spring teeth attached to the rim of the wheel lift the windrow and roll it completely over without tearing or scattering. The unit is mounted on the tractor frame and the height and raking angle are controlled by a lever within easy reach of the driver's seat.

## Inexpensive Flood Gap Is Made From Scrap Material

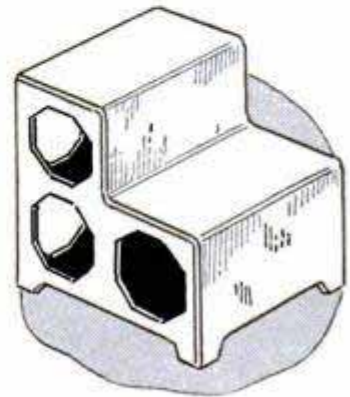
A flood gap like the one pictured can be made at practically no cost from material found on the average farm. It consists of two gatelike sections, which are suspended from a wire cable stretched between two supporting posts on opposite sides of the stream or waterway. Each section is sus-



ended from the cable by means of twist wires, the lower half of each gate being covered with sheet-metal roofing to make it hog and lamb-tight. For a permanent installation, it's a good idea to set the supporting posts in concrete. During flood waters, the gates will swing outward as the water rises and resume their original position when the water recedes, thus closing the opening in the fence.

## Handy "Stepladder" for Mechanic Simplifies Truck Maintenance

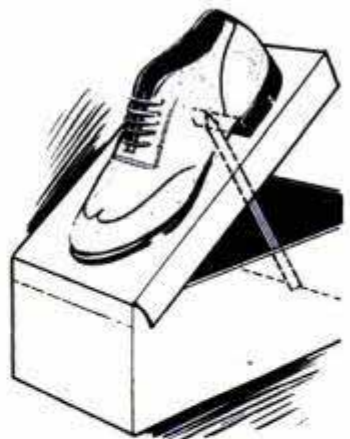
Two-step units, made by bending and welding  $\frac{1}{8}$ -in. flat steel, save time and lessen fatigue for mechanics in a large garage specializing in truck maintenance and repair. The treads and risers are standard depths and heights, but the units are only 16 in. wide. Openings are cut in the sides and back to lessen the weight and make the units easier to handle. Treads and risers are cut and bent from one piece of steel, but the back and sides can be made by welding together three separate pieces, if desired.



L. H. Houck, Jefferson City, Mo.

## Dowel Holds Shoe on Box Cover In Window Display

While working out an unusual window display, one shoe-store clerk originated the display shown in the detail. First, he slit the corners of the shoe-box cover at one end to prevent the cover from sliding off the box when tilted.



Then he pointed a small dowel and forced the point through the cover near the raised end. A sample shoe from the box was then placed with its heel hooked over the projecting point of the dowel. The latter holds both the shoe and the tilted cover securely in place.

☐ To prevent a jigsaw blade from squeaking, rub it with a piece of paraffin to serve as a lubricant. The paraffin will not discolor the work.



# RADIO *Television* ELECTRONICS

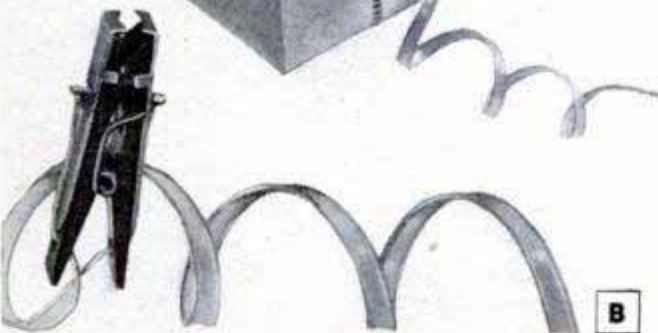
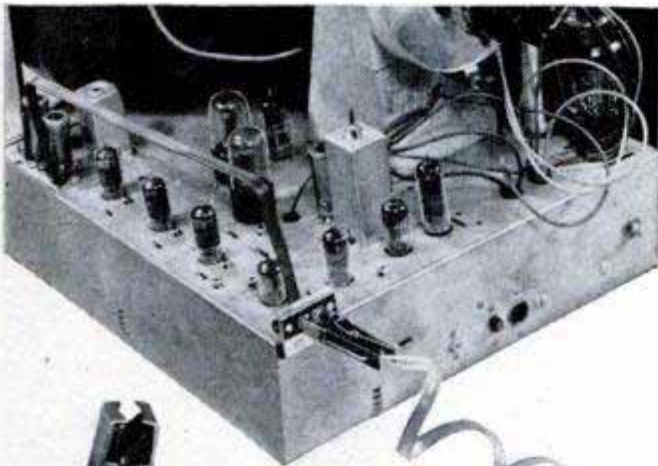


## TODAY AND TOMORROW

TODAY you can purchase a TV receiver with a front glass door that may be unlocked and swung out of the way for washing and cleaning the face of the picture tube, as illustrated in photo A. What looks like a clip-type clothespin in photo B is now providing a quick means of solving the TV-antenna connection problem for showrooms and service departments.

If the F.C.C. licenses an additional 1400 ultra-high-frequency TV stations as predicted, rooftops all over the country will be sprouting new types of TV antennas similar to the experimental bow-tie model placed atop the RCA receiving truck shown in photo C. A new lightweight long-range walkie-talkie, photo D, now in production for the armed forces, is designed especially for air-sea rescue operations.

At a recent meeting of the American Institute of Physics, Dr. Earle Kent displayed his new electronic "music box" invention, photo E, which is claimed to produce sounds of any musical instrument.





# HOW TO INSTALL YOUR OWN THREE-SPEED

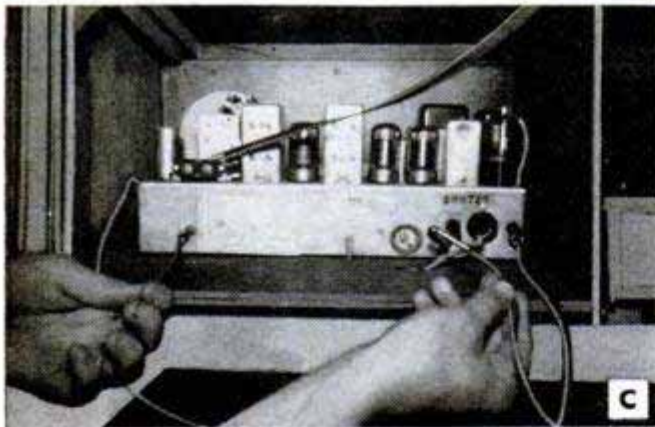
By M. Francis



A



B

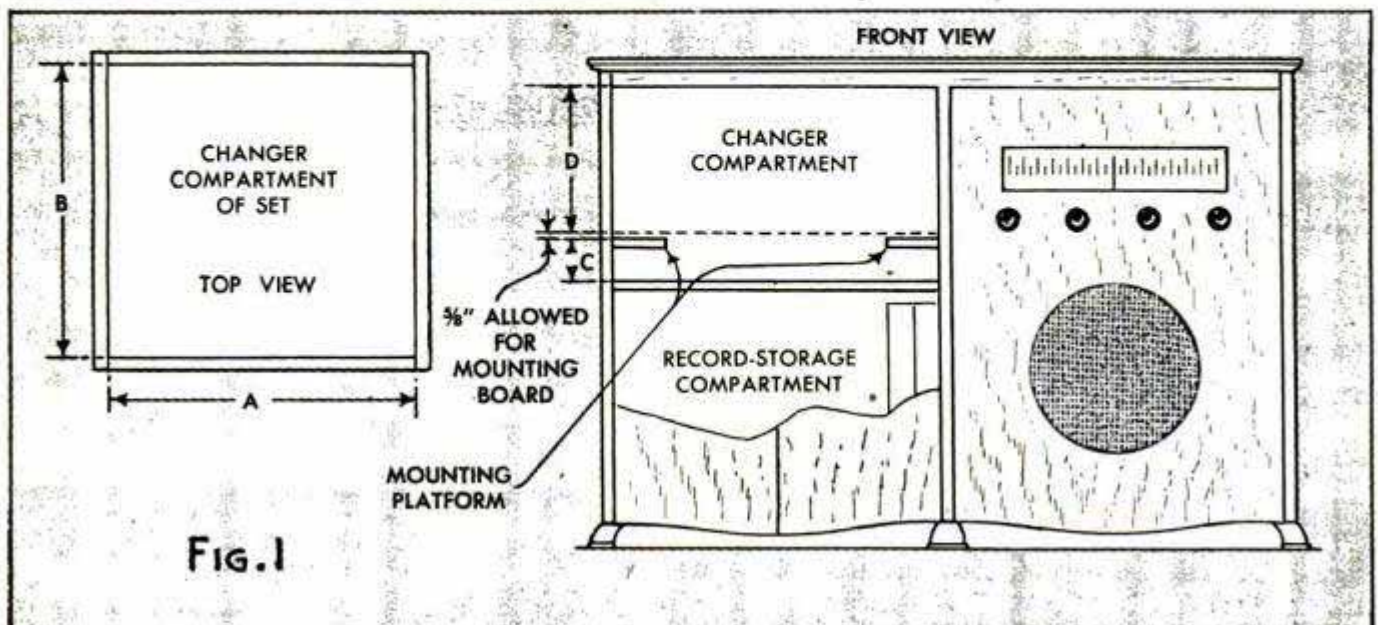


C

NOBODY wants to discard a good phono-radio console because it has a single-speed record player. Especially not when you can easily modernize it yourself so that it will play all speeds and record sizes automatically. Along with standard 78-r.p.m. records, 45 and 33 $\frac{1}{3}$ -r.p.m. speeds have taken such a firm hold on music lovers that single-speed record changers are now seldom found in the new consoles.

With a few common tools and a modern three-speed mechanism, you can equip your set to play any speed or size of record available.

Owing to the wide variety of older phono-radio consoles, the installation of a new three-speed changer replacement should be planned carefully with three considerations in mind: Selecting the right changer, mounting the changer, and making the electrical connections. With rare exceptions, single-speed changers in phono-radio combinations employ crystal pickups, and the amplifier circuits are built to conform to their requirements. Therefore, it is necessary to replace a crystal-pickup single-speed changer with a three-speed changer also equipped with a crystal pickup. An exception to this general rule, the variable-reluctance pickup, Fig. 2, will be discussed later. Photo G shows a typical crystal pickup mounted in the tone arm of a single-speed changer. If your pickup is a crystal type it will look very much like this one. A typical three-speed record changer is shown in photo B; this is the Webster-Chicago Model 101 replacement, or conversion type which is available from practically any radio-parts house.





# RECORD CHANGER

It is obvious that the size of any changer you select for installation is of extreme importance. Carefully measure the dimensions of the changer compartment in your console, noting the inside length and width of the space available, and also the height above and below the mounting platform. In measuring the height above, subtract  $\frac{5}{8}$ -in. for the thickness of the mounting board. Make a copy of Fig. 1, inserting inside dimensions A, B, C and D; measure the dimensions to at least  $\frac{1}{8}$ -in. accuracy.

Space measurements must be made with accuracy regardless of the way in which the old changer is installed. Some are mounted to expose the changer when the top of the cabinet is opened, as in photo D. Others are built into a slide-drawer assembly which pulls out with one of the front doors, or panels. Still others are mounted on a hinged bracket so that the changer comes forward when the door is opened. In this last case it is often desirable to remove the entire changer with its special bracket and, with the aid of slide-drawer hardware, to install the new changer as a drawer assembly. Some manufacturers of replacement units supply a slide-drawer hardware assembly to be used with a mounting board.

Be sure to discuss with your dealer the important subject of 12-in.-record overlap. Most three-speed changers either are less than 12-in. across, or the record spindle is not geometrically centered. This means that while 7 and 10-in. records do not extend beyond the changer edge, there is often an overlap with a 12-in. record. This overlap must be taken into consideration in your particular compartment measurements.

To remove your old changer, first disconnect the set from the power-line wall receptacle. Locate the bolts holding the changer

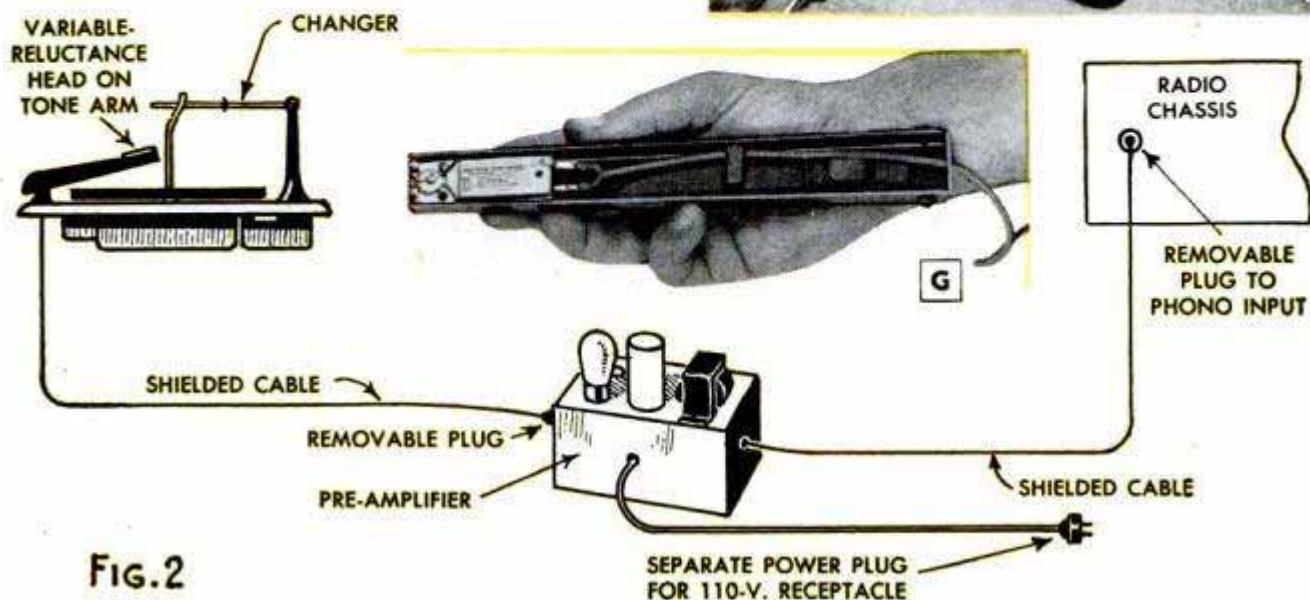
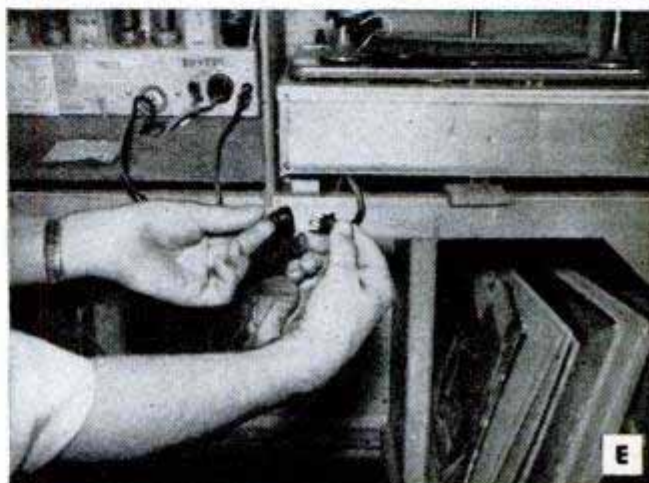
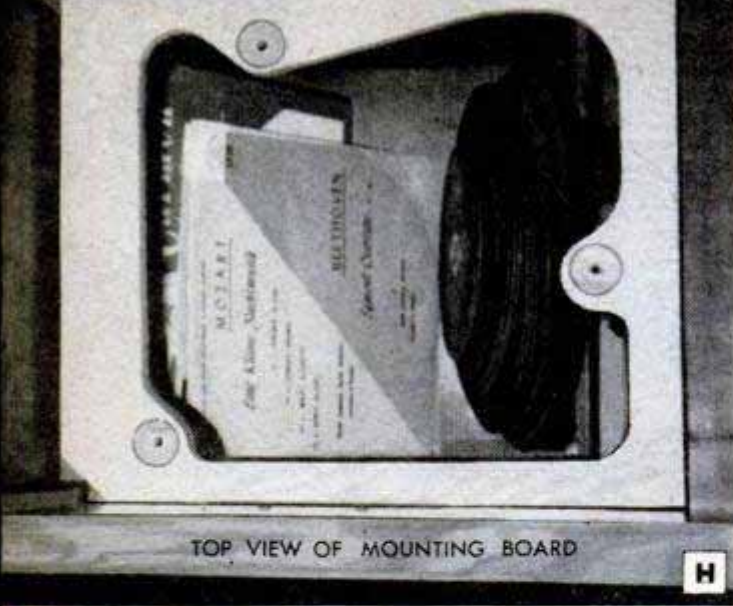


FIG. 2





TOP VIEW OF MOUNTING BOARD

H

on the mounting platform; in a drawer-assembly mounting, the drawer must be unlocked from the rear so that you can pull it far enough forward to work with. This generally can be done by removing one or two wood screws which fasten the retaining clamp to the inside of the cabinet. The nuts in most cases can be reached from the record-storage compartment. Do not lift out the changer until the electrical connections have been disengaged as indicated in photos C and E. There are two sets of these electrical leads which must be disconnected. One is the 110-volt a.c. pair shown at "X" in Fig. 3; the other looks like a single conductor but is really a pair with an outside shielded metal cable enclosing an inner conductor. The shielding is often covered by black or brown cotton fabric. This terminates in the removable phono pin plug shown in the inset photo I in the schematic diagram of the circuits involved in a three-speed-changer installation (Fig. 5). This

(Continued to page 254)

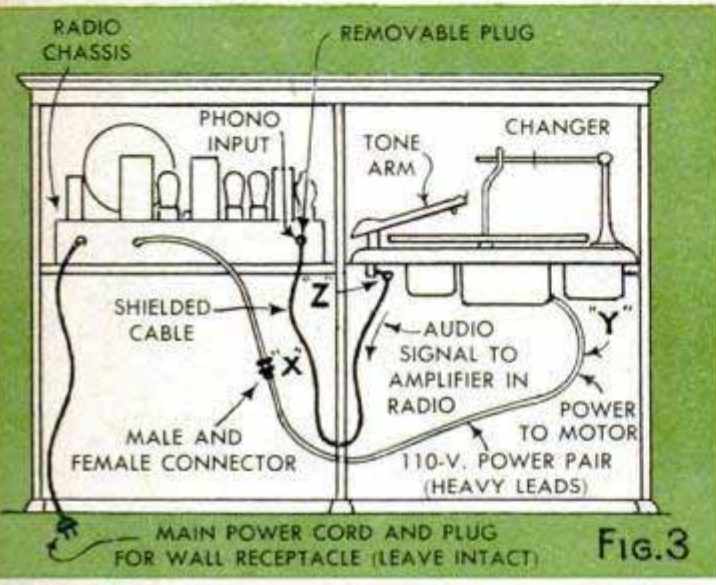


FIG. 3

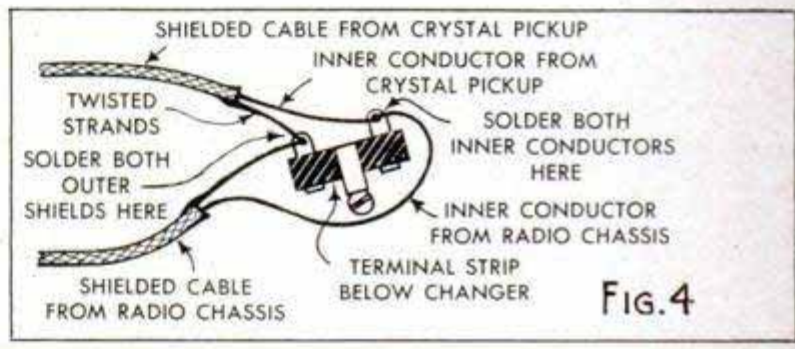


FIG. 4

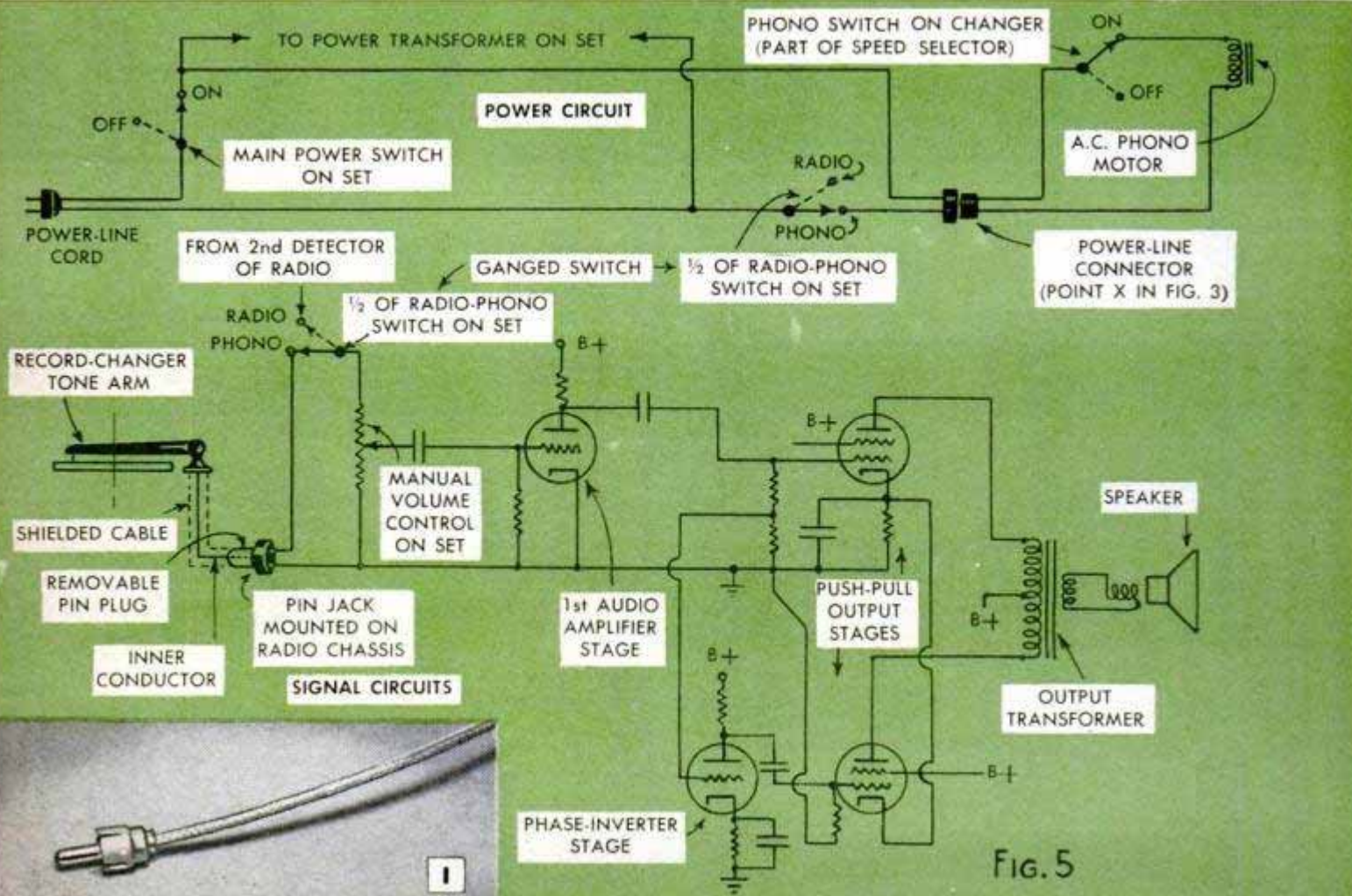


FIG. 5

I

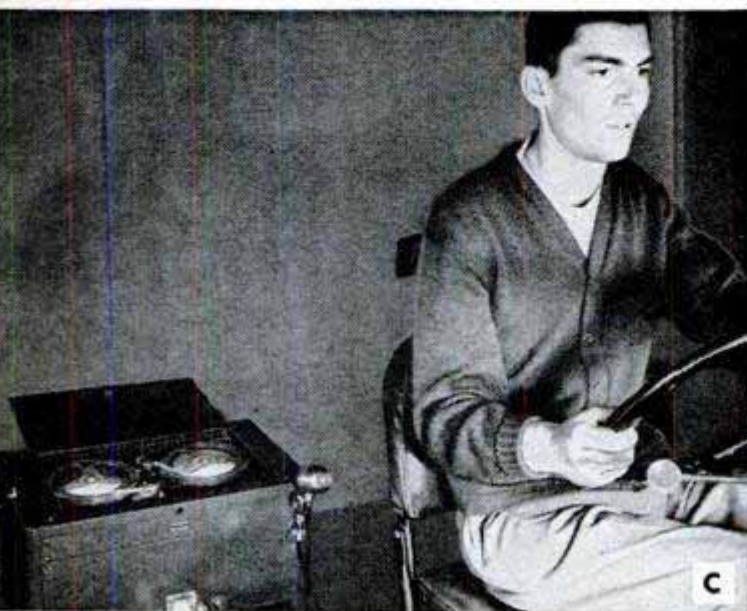
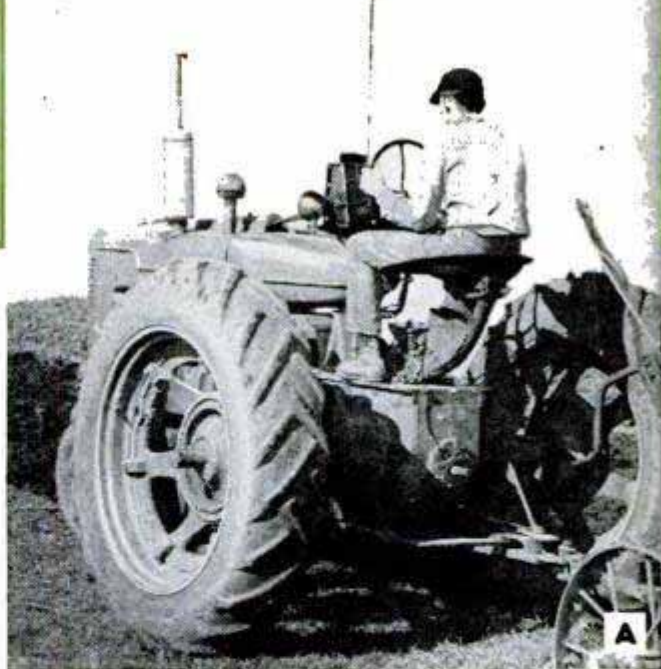


# UNUSUAL MOBILE RADIO AND SOUND INSTALLATIONS

YOU NEED NOT miss the ball game or your favorite broadcast programs just because you drive a farm tractor all day. Carl Schmidt of Marshall, Mo., solved this problem by bolting an auto-radio receiver in a convenient position near the steering wheel as indicated in photos A and B. Some types are better adapted for the purpose than others, but most auto sets are quite rugged and easily mounted on a board like the one shown. Two standoff insulators, mounted on the board at the right, support the telescoping antenna.

The entire assembly is mounted on the tractor in an upright position by means of a single bolt. The battery cable is provided with a detachable connector so that the entire installation can be completed in about two minutes in the morning, and quickly removed at night.

An unusual mobile PA system, operated by a Minneapolis automobile dealer in a "billboard on wheels," employs a tape recorder to provide both music and commercials. The equipment shown in photos C and D was custom-built by the Ecklen Radio Company, which is a local distributor of sound equipment. Music and talking advertisements are recorded in advance on 1200-ft. reels of magnetic sound-recording tape. Each reel provides music and commercials for an hour's operation as the sound truck is driven through the streets. The builders claim that the use of long-playing sound-recording tape for mobile PA installations has many advantages over conventional disk recordings. The tape can be erased easily and spliced for quick changes.





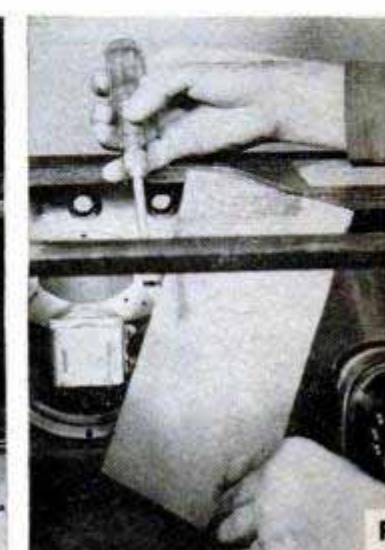
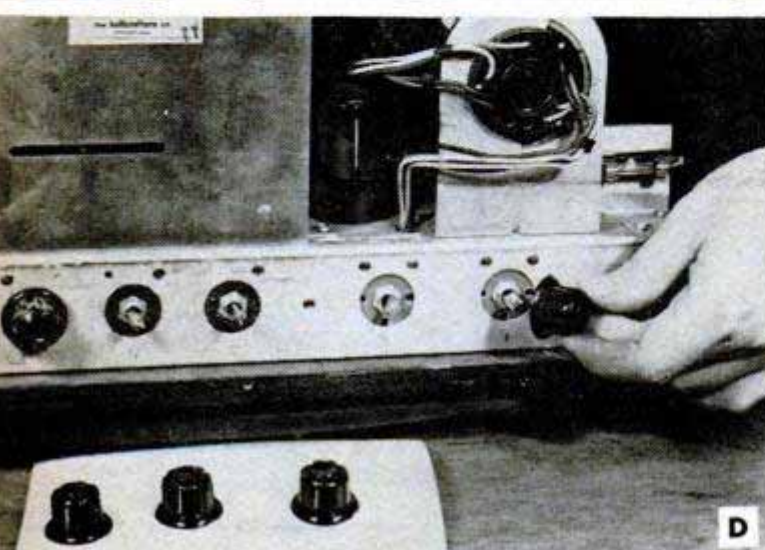
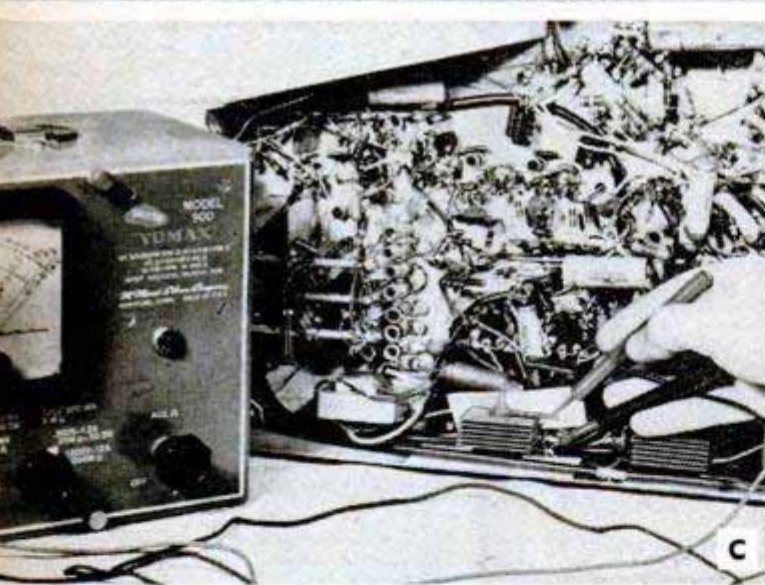
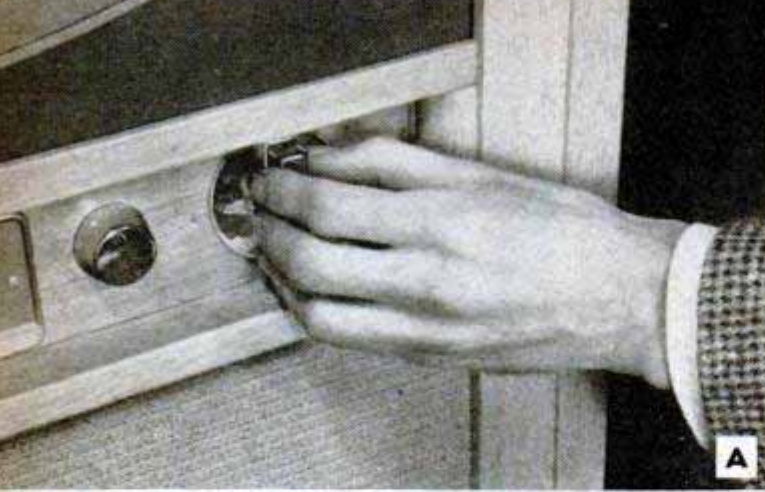
# SERVICE HINTS

## For TV-SET OWNERS

ROUGH usage of the channel selector can damage the delicate mechanism of the tuner unit in your television receiver. Do not spin the selector knob from channel to channel; click it a step at a time, as indicated in photo A, so that positive contact is made without undue jarring.

When it is necessary to place a TV picture tube on the bench, make certain that it does not roll, and also support the delicate neck of the tube. Rubber doorstops serve as wedges, as shown in photo B, and a small block of wood may be cut out to support the neck of the tube against excessive weight. Another method for protecting the tube is to place it face down on a soft pad or folded blanket. Selenium rectifiers commonly used in TV receivers may become open, or short circuited. A high-resistance ohmmeter will reveal defects as the resistance in one direction should be higher than in the other. Comparison of readings taken across a suspected unit, as in photo C, with those taken across a new rectifier may be of assistance in borderline cases that are very difficult to trace.

Experienced set owners often make adjustments on the back of the set without bothering to replace the insulated knobs that are provided with some types of TV receivers. Where knobs are provided, as illustrated in photo D, it is always best to use them. When removing the picture-tube socket, as shown in photo E, or other parts soon after disconnecting the line plug, it is a good idea to always keep one hand in a trouser pocket to avoid possible harmful shock. When it is necessary to work around TV tubes with tools, keep a piece of heavy cardboard between the tube and the work being done, as indicated in photo F, or put a light blanket over the tube.







Take *the word of the man who knows paint*

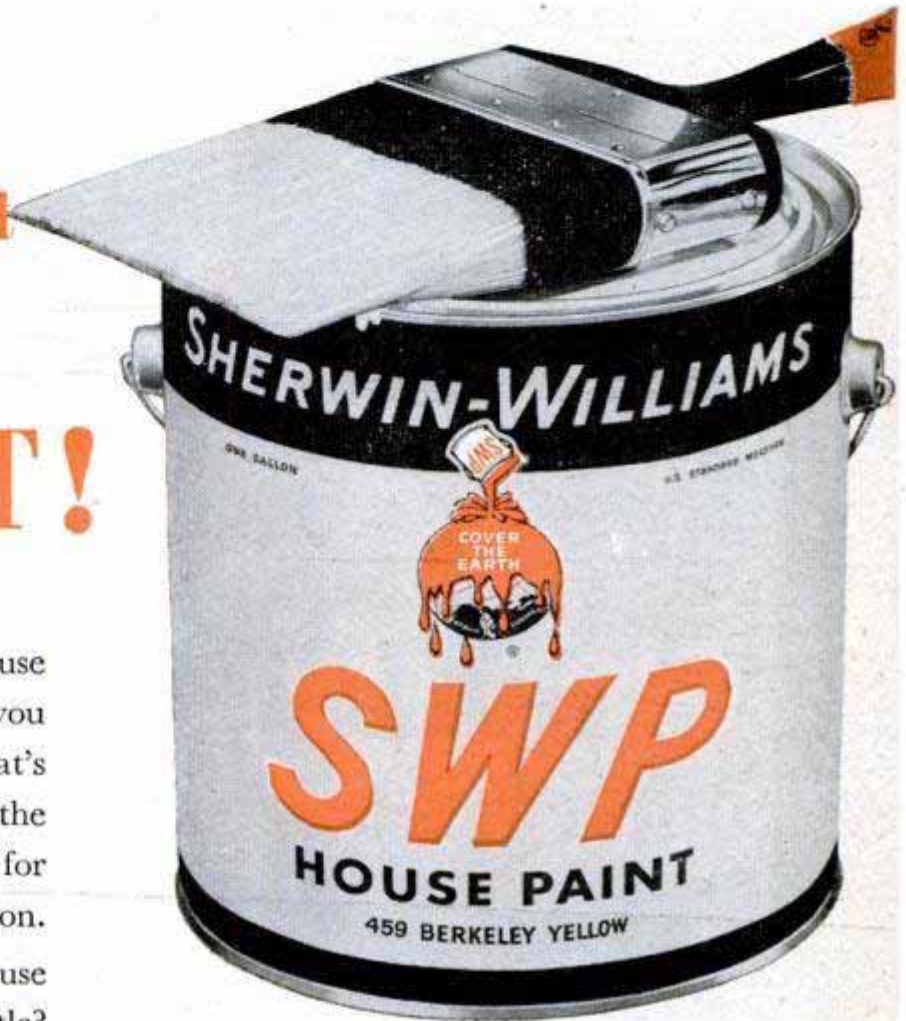
**In house paint  
it pays to buy**

**THE BEST!**

There's a big difference in house paints. It pays to use the best so you won't have to paint so often. That's why it pays to insist on SWP, the house paint that is *Weatherated* for long lasting beauty and protection.

Why gamble with ordinary house paint when the best costs so little? Enough SWP House Paint for the average six-room home costs less than \$45.

Ask your Sherwin-Williams dealer to show you how SWP House Paint is *Weatherated* to clean itself and wear longer.



*IT'S WEATHERATED*  
That means SWP is tested rigorously for its ability to resist chalking, checking, cracking, fading and dirt collection.

*Go outside and look at your house...  
isn't it time for SWP?*

**FREE . . . For Decorating Ideas** let your Sherwin-Williams dealer show you or lend you the big Paint and Color Style Guide. Scores of large color photographs of beautiful rooms and homes. Hundreds of authentic color styling suggestions.



IT PAYS TO SEE THE  
DEALER WHO SELLS

**SHERWIN-WILLIAMS PAINTS**

©1952, The Sherwin-Williams Co.

SHERWIN-WILLIAMS AND ITS ALLIED COMPANIES LEAD THE WORLD IN PAINT RESEARCH

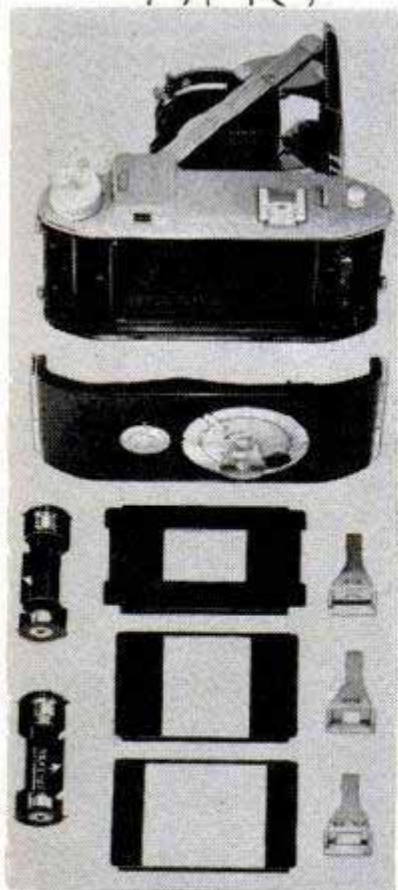




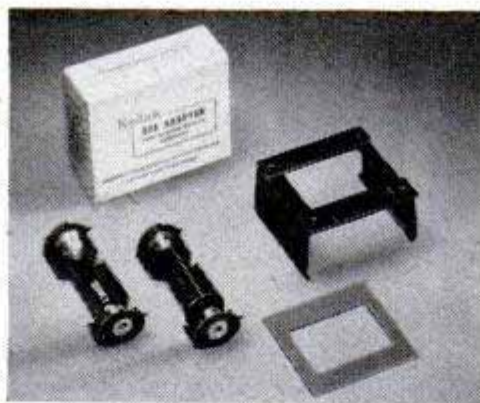
**Leather carrying cases—**There's no better way to protect your camera than with a sturdy leather Kodak carrying case. Gives it a smart appearance, too. At left is top-grain Kodak Field Case for Kodak Pony 828 Camera, \$6.50. Other cases from \$3.95 to \$10.50 (simulated leather case for Kodak Duaflex Cameras, \$2.50). Your Kodak dealer can fit *your* camera with a Kodak carrying case.



# Spring Round-up of



**Get 4 picture sizes—**Kodak Tourist Adapter Kit for de luxe "Tourist" Cameras permits color shots on 828 film, economical half and square pictures on 620 films. \$13.25.



**Equip your Kodak Reflex Camera for Kodachrome Film—**The 828 Adapter for Kodak Reflex Cameras permits you to use economical Bantam-size films—both color and black-and-white. Kit consists of back-frame mask, view-finder mask, and special pool baskets. Price complete: \$4.59.

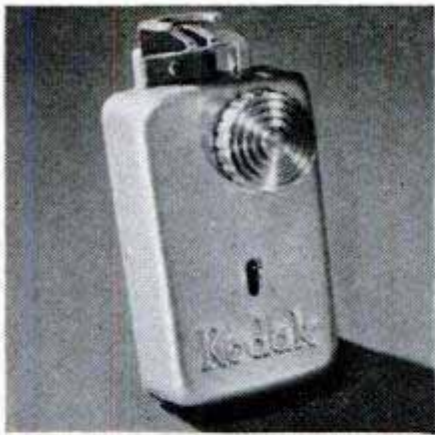


**Safe way to clean your lens—**Kodak Lens Cleaning Paper and Kodak Lens Cleaner are made to remove dirt and dust from optical surfaces without scratching. Paper comes in booklets of 25 4x6-inch sheets. \$.90 for 12 booklets—\$.40 for 1-ounce bottle of cleaner.

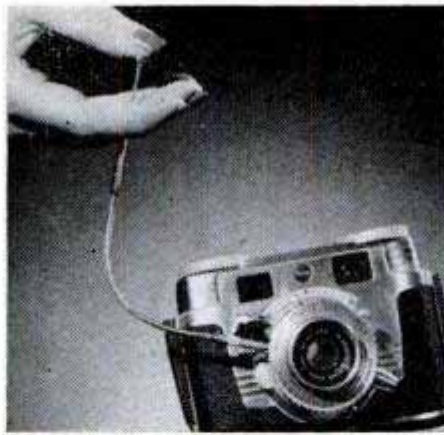


**Keep negatives safe and handy—**Kodak Negative Files (left) provide a convenient way to keep negatives in order and easily identified. Transparent, numbered envelopes hold the individual negatives or negative strips. Index pages give quick reference. Sizes from 35mm. to 5 x 7 inches. From \$2.37.

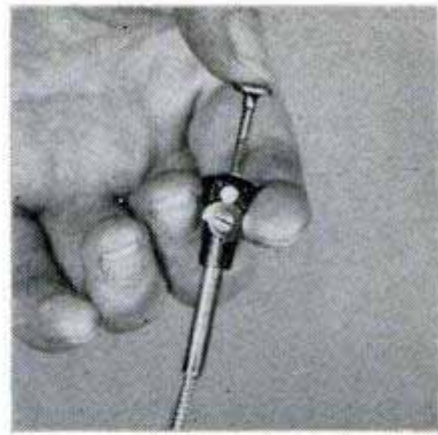




**Get in the picture yourself—** Attach a Kodak Auto-Release to any camera which has a cable release socket. Set it . . . you have 10 seconds before the shutter clicks. For flash shots, too. \$3.86 (does not include cable release).

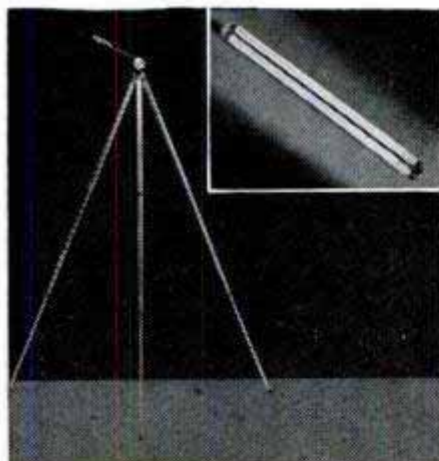


**Prevents jarring of camera—**The Kodak Metal Cable Release, No. 5, can be used for "T", "B", or instantaneous exposures. The non-stretching braided metal won't kink or twist. 7-inch size is \$1.05; 12-inch size, \$1.35.



**Lets you take time exposures—**Kodak T.B.I. Metal Cable Release, No. 2, is made particularly for cameras with "B" but with no "T" setting. The release can be used for "T", "B", or instantaneous exposures. Price: \$3.43.

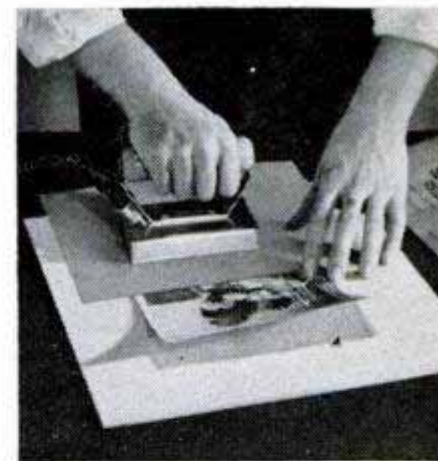
# Useful Photo Specialties



**Sure way to steady your camera—**Kodak Eye-Level Tripod (for still or movie cameras) adjusts for heights from 2 to 5 feet. Folds to 22 1/2 inches. Made of aluminum, it weighs only 2 lbs. \$20. (Tripod Head not included.)



**For effortless "panning"—**The Kodak Turn-Tilt Tripod Head permits you to swing camera while photographing a moving object—without jarring the camera. Multiple-disk, felt-friction clutches insure smooth action. \$13.25.



**Mount pictures securely—**Kodak Thermount Tissue and Kodak Thermount Iron provide a secure method for mounting both black-and-white and color pictures. Iron, \$9.85. Tissue (in variety of sizes), from \$.20 per package.

You're sure to find all these useful photo specialties (and many other items) at your Kodak dealer's. Make use of his professional knowledge and experience. He'll always be glad to help you choose the right photographic equipment for your needs.

*Prices subject to change without notice*

**EASTMAN KODAK COMPANY, ROCHESTER 4, N. Y.**

**Kodak**





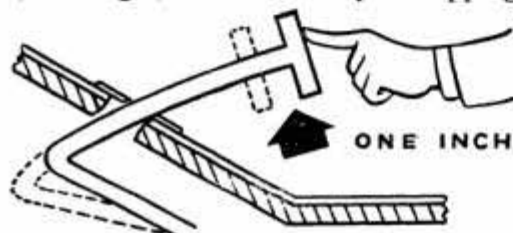
# Care and Feeding of Engines

BY S. P. CORP

## HOW'S YOUR CLUTCH?

Clutch trouble used to be common. Now clutches have been improved to a point where they are almost trouble-free. Lack of attention and improper driving habits, however, can still cause difficulty.

Check your clutch this spring. It should have an inch of free play in the pedal before it starts to disengage. Press the pedal with your index finger. If there is little or no pedal movement under the pressure of your finger, the clutch may be slipping.



## CLUTCH PEDAL FREE PLAY

This can be corrected by adjusting the clutch pedal linkage at the bottom of the pedal. The one inch of free play is to compensate for normal wear.

To avoid excessive clutch wear: (1) Never "ride the clutch." Keep your foot off the pedal except when you are using the clutch. (2) Never slip the clutch to hold your car on a slight grade. (3) Always start your car in low gear, not in second.

## SUMMER OIL MUST DO 5 JOBS!

Good oil is cheaper than new parts. Always follow car manufacturer's recommendations as to the viscosity of oil to be used. Remember—it must (1) Reduce friction to prevent wear between moving parts; (2) It must help keep moving parts cool; (3) It must seal piston and rings against loss of compression; (4) It must penetrate into tight places like rings, valve stems and guides; (5) And it must, like a good Navy man, "keep the place clean," picking up foreign particles and depositing them in the oil pan or oil filter.

## SPECIAL RINGS FOR LATE-MODEL CARS

New Sealed Power KromeX Ring Sets are the latest answer to the tough punishment of modern engines. They fight heat, friction, corrosion, abrasion! MD-50 Steel Oil Ring controls oil even in badly tapered and out-of-round bores! Write Dept. G-4, Sealed Power Corp., Muskegon, Michigan, for valuable free booklet, "More Power, Less Gas, Less Oil."



## Here Come the Leathernecks

(Continued from page 103)

swampland and sand dunes, Marines of the Second Division pound through their paces in a variety of modern behemoths operated by the newly reactivated Second Amphibian Tractor Battalion. On Courthouse Bay, men in green thunder out of the jungle, up over rocky ridges and flounder into the water in a phalanx of steel monsters you're sure could never float. But they do!

In the first wave come ponderous armored amphibians—tanks that swim. They weigh 16 tons, mount a big howitzer on their forward turret and bristle with three .30-caliber machine guns. These mammoths precede the personnel carriers and form the assault wave. Their clanking tracks carry them bounding overland at a 35-mile-an-hour clip. The same tracks, made up of row on row of cup-shaped steel grousers, also propel them—like big paddle wheels—through water at five miles an hour.

Once across the Bay, they heave themselves up on the beach and plow their way into aggressor forces, making room for the Marine infantrymen who'll be along in a minute.

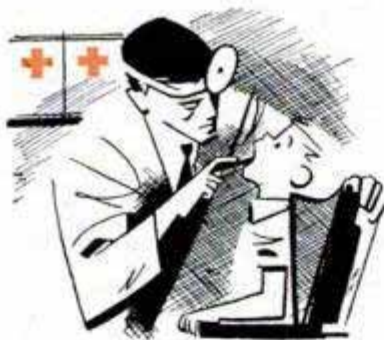
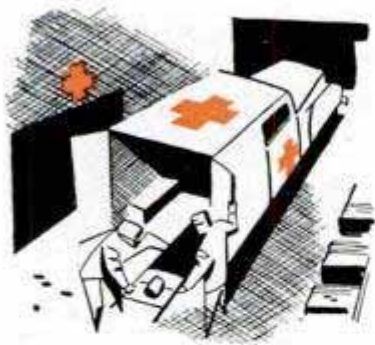
Close on the heels of these monsters come the new LVTs (landing vehicle—tracked), mounting a .50-caliber machine gun on their forward turret and two .30s on each side. Inside these tracked, self-propelled steel pillboxes crouches a score of men, sheltered from rifle and machine-gun bullets and shrapnel. A seven-cylinder Continental radial engine, delivering 250 horses, propels the tanklike carriers in the same manner as the armored Amtraks. Once ashore, they can carry their fighting men to sheltered areas behind the vulnerable beachhead. Their rear ends drop open and the assaulting forces come out on the gallop, hunching low until they reach cover.

These amphibious goliaths can land whole divisions. And they double in brass for hauling cargo, moving stalled trucks, bulldozing trees to make fire lanes in battle areas, or lining up bow to stern to bridge a river. The men of the Second Amtraks who run these babies are proud of their iron horses. On maneuvers, as in combat, they eat, sleep and live in their charges. You see them roaring in from a problem, haggard, tired and caked with mud from the storm of dust and water kicked up by the spinning tracks of the roaring vehicle in front as it thunders over land and sea. But each skipper will pat the hard steel side of his clumsy monster affectionately and brag about its performance.

If large forces and heavy equipment are

(Continued to page 242)





# what to do before accidents or illness strike your home

With hospital and doctor bills so high, illness and accidents so expensive—get White Cross Plan care and protection for pennies a day.

**1 out of every 9 persons in the U. S. A. will be hospitalized during the year 1952.**

**Up to \$15 per day** for 100 days for each accident or illness for each and every member of your family.

**\$5 to \$250** for your surgeon.

**Assured income!** Up to \$300 a month while you're in the hospital; up to \$200 a month while you're at home recuperating.

**Plus cash** for many other hospital expenses . . . cash for medical care at home or doctor's office.

**ALL PAID BY  
BANKERS LIFE & CASUALTY COMPANY**

**WE PAY YOUR HOSPITAL, YOUR DOCTOR, OR YOU . . .** in addition to Workmen's Compensation or any other insurance you may have.

**RATES NEVER RAISED.** White Cross has never found it necessary to make a single adjustment in general rates.



Offices in principal cities

*Every 8 seconds an injury—every 19 minutes a death—from "home accidents" in the United States.*



• White Cross Plan, Dept. PM42  
• Bankers Life & Casualty Co.  
• Chicago 30, Illinois

• Send me all the facts about the great WHITE CROSS PLAN issued by  
• the BANKERS LIFE & CASUALTY CO. This does not obligate me.

• NAME.....

• ADDRESS.....

• CITY..... COUNTY  
• OR  
• ZONE..... STATE

• The WHITE CROSS PLAN is issued by  
• BANKERS LIFE & CASUALTY COMPANY  
• HOME OFFICE: Chicago, Illinois



# Here's how for home painters



**A quick, neat trick for painting window frames.** Simply cut newspapers to exact size of window pane, soak in water for a few seconds—and then smooth onto the glass. You'll have perfect protection for the pane . . . can paint the wood

trim in no time. You'll get best results with beautiful Devoe Trim & Shutter Colors.

**A play place for children—out of a pot of paint.** On basement floor or discarded table, help kids paint roads, lakes, rivers. Make houses, boats, bridges from painted pieces of cardboard; trees from small bits of painted rubber sponge. Keeps the youngsters happy and occupied on rainy days.



**Easy way to keep tabs on garden tools**—paint them in bright colors. Makes them easier to find lying in the grass . . . easier to identify if Junior drags them over to the neighbor's. Use Devoe Mirrolac Enamel for bright lasting colors.



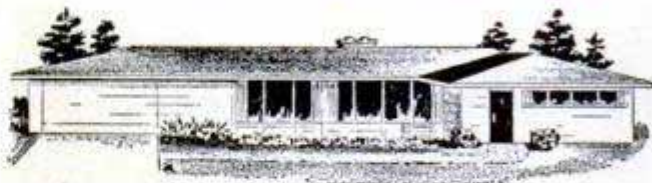
**No strain to get rid of hard lumps in old paint.** Mix paint . . . then cut piece of wire screen to size of can. Put screen into can and away it goes to the bottom—carrying lumps with it, leaving smooth strained paint above.



**You can get all the painting accessories that you need—and many more helpful tips—at the sign of the Devoe Diamond. Why not stop in and see your Devoe Dealer very soon? You'll find his name listed in the Classified Phone Book.**



## 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.



### "Walking" Rocker

**Q**—Recently I purchased an old Boston rocker at an auction. After refinishing it and putting it into use I find that it moves across the floor in a sidewise direction when one sits in it and rocks slightly. It will move several inches in a lateral direction in a few minutes' time, always in the same direction. What causes this unusual performance and how does one remedy it?—T.A., Me.

**A**—One or the other of the curved rockers is out of line. This can be due to warping of one of the rockers, but more probably the misalignment is due to loosening of the glue joints where the turned stretchers join the legs on one side or the other. Unfortunately this condition in a rocker of all-wood construction generally has no simple remedy. Often it is necessary to practically rebuild the rocker in order to eliminate the trouble permanently. However, it is suggested that you examine the joints where the stretchers join the legs. You may find that one or more of the joints are loose. If so, pry them apart so that you can insert a small quantity of glue. Then reassemble and draw the joints tight with bar clamps. The chances are good that this will correct the tendency of the chair to "walk" across the floor. While you have the chair partially disassembled, it's a good idea to plane the bottom edges of the rockers to a uniform curvature.

### Repairing a Table Leaf

**Q**—How do I repair a split, or check, in one end of a table drop leaf? The edge of the leaf is molded and the check is approximately 8 in. long and has opened about  $\frac{1}{8}$  in. at the end. I think the wood is genuine walnut, at least it is finished in a dark color and shows some grain. Is there any suitable filler that will dry smooth and stay in place?—C.R., N. Mex.

**A**—There are several materials which can be used as fillers, and probably would be successful in closing the crack, or check, but they are sometimes difficult to conceal in refinishing. If the table leaf is of genuine walnut, as you believe, then we would suggest that you try regluing the break. Remove the leaf from the table, clean the crack thoroughly to remove all loose material and then carefully wedge it open as far as possible without extending the crack. Use a small hardwood wedge for this purpose. Then mix a water-resistant glue (dry-powder form) to a consistency slightly thinner than that normally used. Brush the glue into

(Continued to page 240)

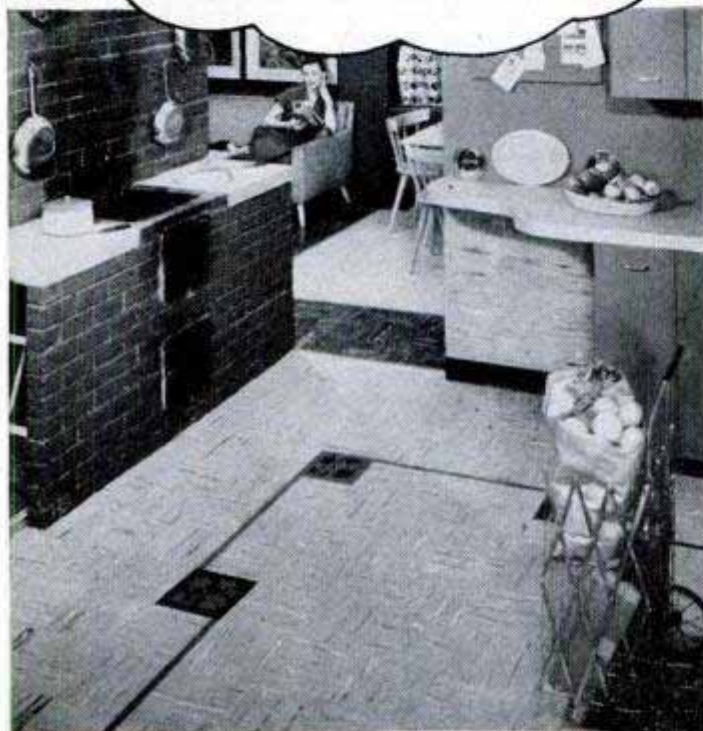


# YOU DON'T HAVE TO BE A MECHANIC TO INSTALL YOUR OWN COLORFUL

# KENTILE FLOOR



anyone can do it in  
his spare time and  
save real money!



You can have a floor like this in your kitchen  
for only \$19<sup>75</sup>\*

ANYONE can install their own Kentile Floor! The tough, durable squares go down one at a time... for just a small section or whole rooms at once... and colorful Kentile is ready for years of hard wear as soon as it's down. It's quick, easy, fun!

26 wonderful Kentile colors mean that you can create any design you want... match any plan. Kentile's ready-to-install decorative inserts

Your Kentile dealer's low price includes adhesive, instruction booklet and this handy Ken-Kit that contains all of the simple tools needed to do a neat, long-lasting job.



Or one like this in your living room  
for only \$36<sup>25</sup>\*



Write for your FREE copy of the  
Kentile Color Booklet showing all  
of the sparkling, modern colors in  
low-cost Kentile Floors.

make your own floor the only one of its kind.

And, when you've finished, you'll have an attractive floor that will give almost unbelievable service... modern colors that can't wear off because they go clear through to the back of each tile... simple and inexpensive to clean with just mild soap and water. And the fresh Kentile beauty needs only an occasional no-rub waxing to always look new.

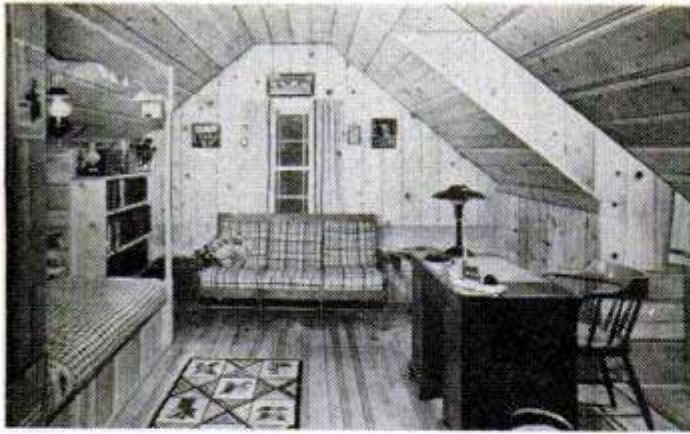
\*Price based on a 8' x 9' kitchen and on a 12' x 15' living room

## KENTILE.

The Asphalt Tile of  
Enduring Beauty

KENTILE, INC., 58 2nd AVE., Dept. G-6, BROOKLYN 15, N.Y.





## FOUND! more living-space . . .



## in attic and basement . . . thanks to WESTERN PINES\*

Reclaim that idle attic space—turn it into a bunk bedroom for the youngsters, or a sewing-room for mother. Make your wife proud of her modern, efficient kitchen lined with decorative, useful cabinets. Panel the cellar for a rumpus room. Easy to do, with the Western Pines\*.

Smooth texture and straight, even grain make the woods of the Western Pines\* ideal for a variety of remodeling jobs or workshop projects. Easy-to-handle, they cut clean and accurately, grip paint, stain or enamel—or look beautiful left natural.

**How-to-do-it instruction sheets** to show you how, colorful booklet, "Enchanting Homes of Western Pines," with 71 pages of ways others have used the radiant Western Pines\* are in Idea Packet No. 537, yours FREE for the asking. Write to WESTERN PINE ASSOCIATION, Dept. 537-N, Yeon Bldg., Portland 4, Oregon.

**These are the Western Pines**

- \* IDAHO WHITE PINE
- \* PONDEROSA PINE
- \* SUGAR PINE

(Continued from page 238)

the crack in sufficient quantity to assure that all surfaces are coated. Then place a bar clamp across the leaf over the crack and draw the clamp tight to close the break. Protect the edges of the leaf with blocks of softwood, such as pine, as otherwise they may be crushed or marred by the clamp jaws. Wipe off all excess glue with a dampened cloth and allow to dry overnight. However, if the crack is wide or splintered this procedure will not produce a satisfactory repair. It then will be necessary to make two ripping cuts, one on each side of the crack, and remove a waste strip. Then rip a replacement strip from matching wood and glue in place to build out the leaf to the original width. Use bar clamps to draw the glue joints uniformly tight. After the glue has dried, remove the old finish, sand the surface smooth and refinish to match the original color of the wood.

### Sanding Moldings

**Q** — I have several concave moldings recently obtained from a local lumberyard. The concave surfaces are rather rough in spots and the wood is discolored with dust and grime. Moldings are about 4 in. wide and are of the type that fit in a corner. I want to use these for making picture frames. How can I clean them up and smooth the concave surfaces?—R.O., Calif.



**A**—Unless the wood has been discolored by blue stain or other fungus growths that attack the wood, preparing the surfaces should be quite simple although it may require considerable time and hand labor to achieve a first-class job. Although you did not say, we are assuming that the moldings are of pine. One method that works quite effectively is to rub the surfaces with medium and fine steel wool to remove the discoloration. Dip the wool in turpentine occasionally and as you rub, wipe the surface with a clean cloth to pick up the loosened dirt. However, steel wool is not effective in smoothing a rough surface. This will require sanding. One good method is to wrap a small piece of sandpaper around a synthetic sponge (a spun-glass sanding block also is available) to form a "contour" sanding block that will readily shape itself to the molding.

### Linoleum Bulges

**Q**—My dining-room floor is covered with wall-to-wall linoleum laid like an over-all rug or carpet. This floor covering is bulged in several places near the baseboards, and the bulges, or wrinkles, extend diagonally outward from the baseboard into the room a foot or so. Raised portions do not flatten during temperature changes and are wearing through rapidly. What can I do to correct this condition?—J.B., Ohio.



**A**—If we judge correctly from your description the linoleum was laid with its edges under the shoe molds, which have been nailed down tightly. This prevents the normal expansion and contraction of the floor covering and causes it to wrinkle or bulge as you describe. This sometimes takes place even when the covering is cemented in place. We suggest that you loosen the shoe molds all the way around the room and then see if it is not possible to force the edges of the floor covering farther under the molds so that it will flatten. If this does not work satisfactorily, then it will be necessary to remove the molds and trim the edges of the linoleum so that it will lie flat. When replacing the shoe mold, nail it to the baseboards only; do not nail it to the floor.



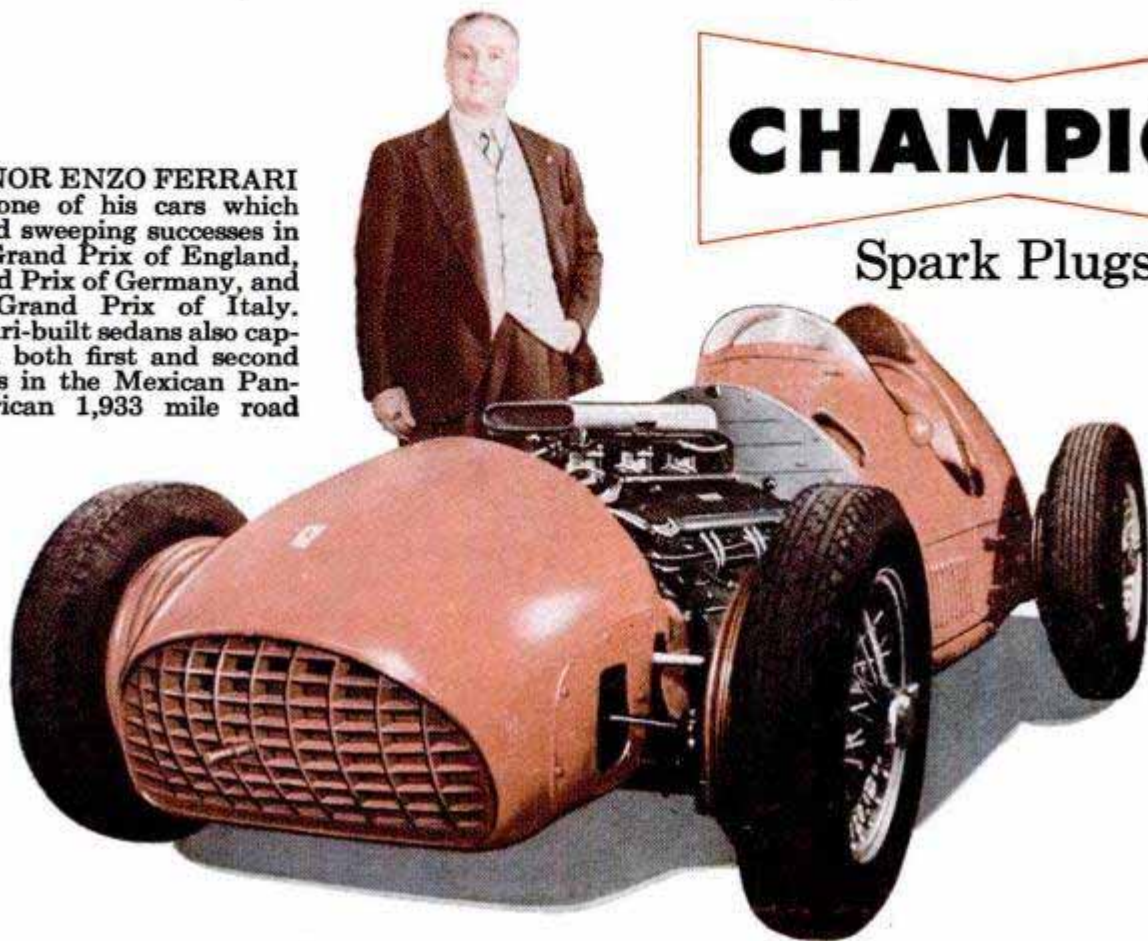
# Brilliant Italian Race Car Manufacturer

## Pays Tribute to Dependable

# CHAMPION

## Spark Plugs

**SIGNOR ENZO FERRARI** and one of his cars which scored sweeping successes in the Grand Prix of England, Grand Prix of Germany, and the Grand Prix of Italy. Ferrari-built sedans also captured both first and second places in the Mexican Pan-American 1,933 mile road race.

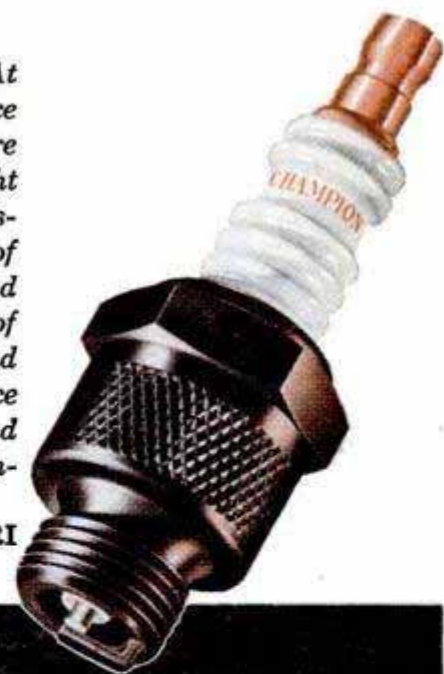


*"The victory of Alberto Ascari in one of our Ferrari cars in the 22nd Grand Prix of Italy at 115.547 miles per hour average, established new all-time records for the Monza track, and also established the highest speed attained in European circuits. This 4½ litre 12-cylinder Grand Prix Ferrari was equipped with 24 Champion Spark Plugs which withstood perfectly the uninterrupted strain of instantaneous acceleration and equally instantaneous deceleration demanded by Euro-*

*pean type of racing tracks. At Monza, as on most European race courses, sharp turns and severe braking alternate with straight stretches where flat out speed is possible. We attribute a great deal of the merit of our success in the Grand Prix of England, Grand Prix of Germany, Grand Prix of Italy and the Mexican Pan-American Race to the magnificent performance and unflinching dependability of Champion Spark Plugs."*

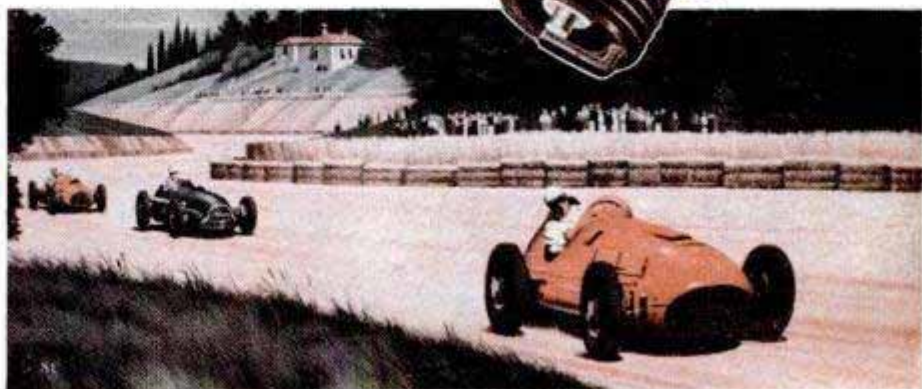
**ENZO FERRARI**

Alberto Ascari in front with the winning Ferrari, in the Grand Prix of Germany.



**FOLLOW THE EXPERTS  
DEMAND DEPENDABLE  
CHAMPIONS FOR YOUR CAR**

**CHAMPION SPARK PLUG COMPANY  
TOLEDO 1, OHIO**





# How to take the guess out of picture-taking



**GRAFLEX**

*Ciro-flex*

One look at the brilliant focusing ground glass and you know the picture is the way you want it . . . no cut off heads, no tilting. A twist of a knob and you're in focus . . . no more fuzzy, blurred results. *Ciro-flex* is ideal for all-round picture-taking . . . indoors or out . . . comes in five models (three with built-in flash). Each has fast, coated f/3.2 or f/3.5 lens and a host of features to take the guesswork out of picture-taking. Yet most *Ciro-flex* models cost under \$100! No wonder it's America's most popular twin-lens camera.

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*Prize-Winning Cameras*



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State \_\_\_\_\_

being landed on a soggy beach during a maneuver, you may see a little amphibious DUKW with yards of accordion-pleated wire mesh stowed in its stern, waddling ashore and laying down a continuous stream of landing mat over its bow as it goes. Thus, it paves the way for other vehicles coming ashore from the maws of landing craft.

With such machines, Marines need not go ashore in navigable harbors where beaches are heavily defended by enemy forces. The tracked amphibs can put them ashore, fresh and dry, on almost any rugged coastline and carry them inland where it's tougher for an enemy to get at them.

All over Camp LeJeune, mock battles are fought continually. Up the coast, airplanes trailing smoke screens streak across the skies while Marine forward air-observer crews on the ground give the pilots position fixes for close air-support fire. Now and then the ruddy glow from a well-placed napalm bomb blooms on the wasteland out beyond the troops. "You hear a lot of pro and con about close air support from the armchair strategists," says one of the Marine airmen. "but somehow, ours always works like a charm."

Out in the boondocks, or swamps, where realistic field problems are in progress, big Sherman tanks, looking like vampire bats with the huge breather stacks that allow them to ford streams and lakes, roll over men crouched in foxholes. Live TNT and phosphorus shells send smoke and dust cascading around the crawling men who snip their way through barbed-wire obstacles. In the "assault on fortified positions" area, you can watch hordes of creeping attackers work into a hornet's nest of pillboxes. First into position is the weapons company, with its flame throwers, rocket launchers and demolition men. Fire sears the landscape. Live charges explode in the pillbox slits while the men creep steadily forward. Behind them, dashing low from cover to cover and creeping crab-like over the ground, comes a rifle company with its platoons of men armed with M-1s, BARS, machine guns, 60-mm. mortars and big bazookas. Fireworks continue until every pillbox is taken.

Nighttime at Camp LeJeune affords little respite. Besides being top-notch fighting men, Marines are often chosen for rugged reconnaissance missions — best performed under cover of darkness. On black, moonless nights 121 men of the Second Division's "recon" company may be out prowling on grueling night problems. In actual combat, these men might be sent out 30 to 60 days ahead of a big landing to infiltrate enemy

(Continued to page 244)



**GOOD-BYE TO THIS COST!..GOOD-BYE TO THIS WORRY!..GOOD-BYE TO THIS DANGER!**



**1** Paying Out \$10 to \$30 A Month for "little" engine repairs? Burning up dollars — in gas and oil? Then you're paying for a WIZARD-IZED Engine.

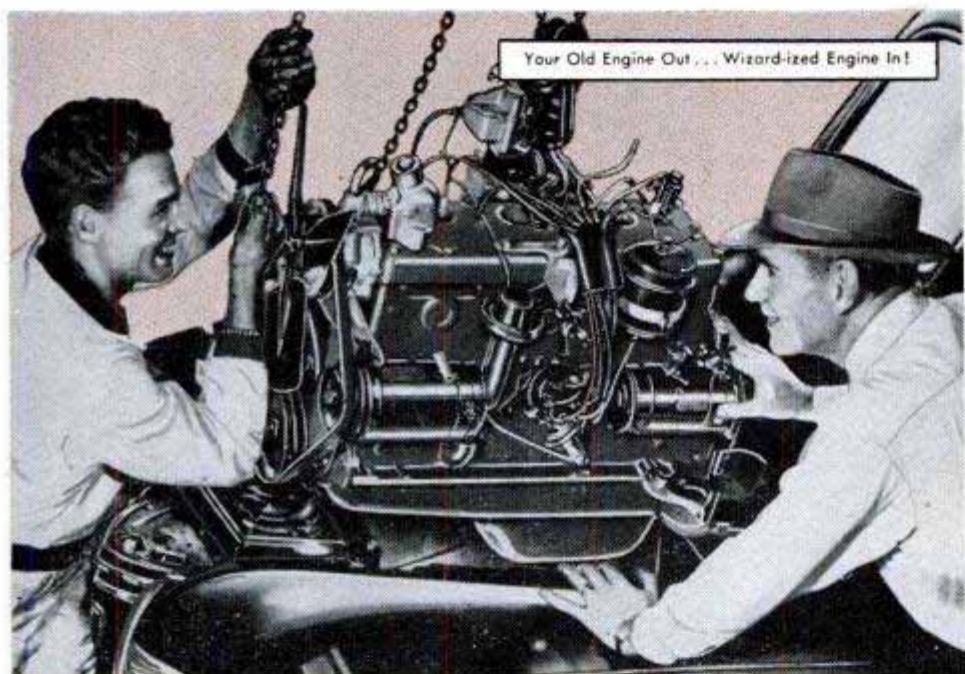


**2** Afraid To Take Your Car out for fear the engine will "conk-out"? Put your money in a WIZARD-IZED Engine — not in towing and repair bills!



**3** Engine Too Sluggish And "Old" to provide the power to pass other cars safely? Your repair money could pay for your WIZARD-IZED Engine!

# Now You Can **"NEW-ENGINE"** Your Car For About The Price Of An Overhaul!



Instead of merely overhauling, "new-engine" your car this easy WIZARD-IZED way — for about what you'd pay for an overhaul. Expert installation by trained

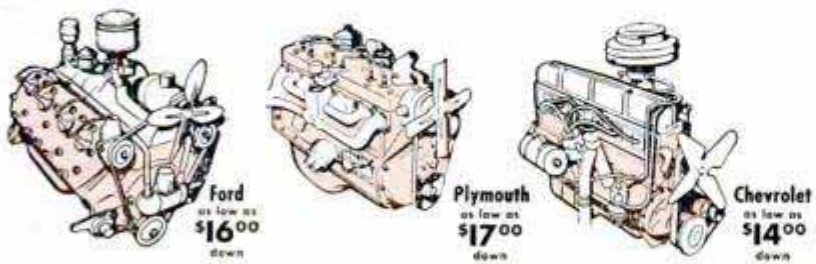
mechanics in fully-equipped garages. And your old engine is worth a generous guaranteed trade-in allowance. See your Western Auto man — now!

And A Factory Remanufactured **Wizard-ized Engine** Has A New Engine Guarantee!

That's right! Why pay \$150 to \$180 for a bearing-ring-and-rebore overhaul, and have all the other "tired" old parts left in your engine? — when the same money can buy you a completely remanufactured Wizardized Engine? Why take 10,000 to 15,000 engine miles for your money — when you can get up to 50,000 miles or more?

Here's what we mean by remanufactured: It is **not** just your old engine, overhauled and put into your car! Your Wizardized Engine is precision remanufactured, using original factory block, in one of five large factories that handle no other work. Every part meets new-engine tolerances.

Every moving part is brand new or fully remanufactured to function like original equipment.



**GUARANTEED**  
New Car Engine Performance for  
Chevrolet, Ford, Plymouth, Chrysler, Pontiac, Mercury, Dodge, Studebaker, DeSoto, Olds and other popular makes.

New car engine guarantee—backed by Western Auto, the most trusted name in auto parts—plus free 500-mile inspection!

So before you buy any overhaul, see how much more you get in a Wizardized Engine!

(Terms vary by area, make, and model of car)

For location of your nearest Western Auto Store, write WESTERN AUTO SUPPLY CO., 2107 Grand, Kansas City, Mo. © 1962

# Wizard-ized Engines

FACTORY REMANUFACTURED

The Engine You Can Buy with New Car Confidence!



NOTE: Western Auto Associate Dealers own their own stores and set their own prices, terms and conditions. Prices may vary due to differences in local conditions. (PM42)



# Specially Priced

for Hardware Week, April 17-26



3½" Long  
1" Solid Tool  
Steel Cutter



Every home owner, farmer, hobbyist, modelmaker and professional craftsman will find hundreds of time-saving uses for this sturdy, well-built little Model and Patternmakers Plane.

It's part of the world's finest line of bench and block planes — with solid tool steel cutter skillfully hardened and tempered to take and hold a razor-keen edge. It comes to you honed and ready to use.

Ideal for close quarters — it cuts clean and fast, with or across the grain. You'll find it perfect for planing sticky doors and windows, for edging boards, shaping curved surfaces and many other jobs. Cuts soft and hard woods.

Look for it in the bright red and black display carton at your hardware dealer's. Get one and save money while this little plane of endless uses is being offered at a special low price during Hardware Week, April 17-26.

Millers Falls Company • Greenfield, Mass.



*The Mark of Superiority*

positions. Expert swimmers, wearing rubber frog feet, spend hours diving to study currents and underwater terrain off the landing beach. Creeping around in camouflaged uniforms, other squads get beach conditions, study slopes, sand, rocks and pebbles, and note hazards. Working stealthily, they move inland to sound out the enemy's force, fire power, gun positions, roads and defenses.

At LeJeune, under one of their officers like Maj. Fred Harbin, the recon men work out incessantly. Out in a bivouac on a night problem, you'll find them holding briefings on the sand. The men smear their faces with camouflage paint and don green jungle suits, spotted with brown.

Helmets are left behind, but over their heads, pirate fashion, are tied bandannas of camouflage cloth. Even rifles are wrapped in this material. A floodlight directed right on a man dressed this way often won't reveal him. To each leg a knife is strapped, and rifles are slung over shoulders.

Generally the problem is to "con" an aggressor force across a body of water. To do the job, an 8 by 12-foot black inflatable rubber boat weighing 350 pounds is broken out. Ten men, painted like demons and dressed like leprechauns, climb aboard and paddle softly across to the objective, coasting quietly toward the beach. Some 3000 yards offshore, the boat stops and into the water slip two scouts, each holding his knife in his teeth so it's ready in case of sharks. These men swim ashore, letting wavelets ripple over and hide them, and signal the others to come in if the coast is clear.

In drifts the nearly invisible black boat, every man inside hugging the bottom so there will be no silhouette. In heavy surf the coxswain is busy keeping the bobbing craft from broaching-to.

The boat is deflated and hidden. A CO<sub>2</sub> cylinder will make it seaworthy again in a matter of seconds, or it can be pumped up and launched by its crew in minutes. Carefully the men fan out. Aggressor sentries, marked from friendly forces by the peaked helmets they wear on such problems, are stalked down and pounced upon. In actual combat, a knife would be drawn across the sentry's throat before he could utter a cry.

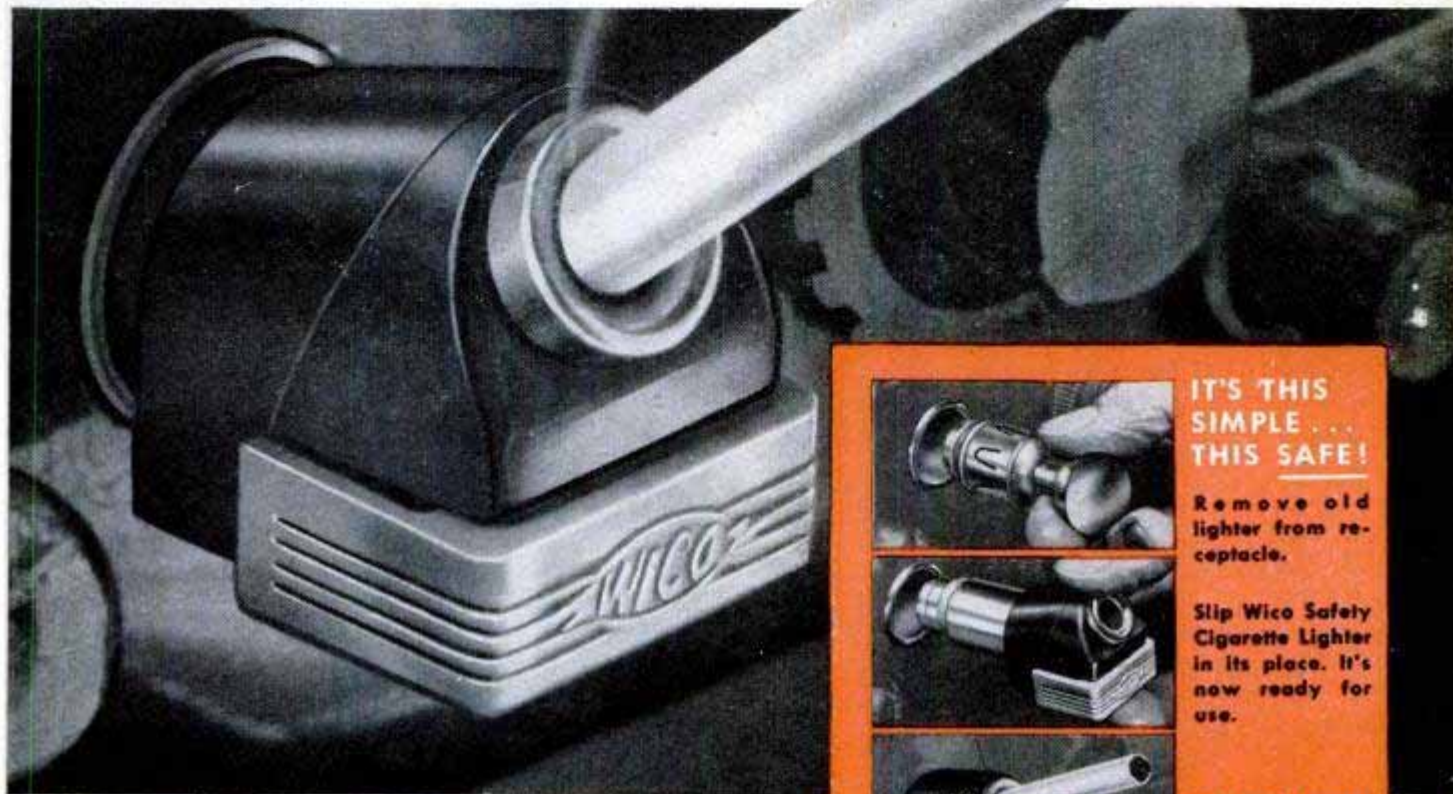
"These 10-man units," Major Harbin points out, "can also be sent out from submarines, from assault personnel destroyers (APDs), or PBM aircraft. Subs are best for silent approach."

Though seemingly melodramatic, the success or failure of an amphibious assault frequently depends on just such a mission. Even in big maneuvers you can see the effectiveness of these creeping pirates who

(Continued to page 246)



# This automobile lighter could save your life!



**T**AKE your eyes off the road for a split second and *anything* can happen!

Yes, tragedy can take the wheel in *the four seconds it requires to light a cigarette*. Play it safe with the new Wico Safety Cigarette Lighter!

No need to take your eyes off the road ever! It lights your cigarette and takes the first few puffs.

The Wico fits into the present lighter receptacle of your car. No installation or new wiring needed.

**ONLY \$2.95** at auto dealers, accessory stores, gift shops, department stores, and gas stations. Or you can use the coupon to order direct from the factory. Get yours *today!*



**ELECTRIC COMPANY**  
WEST SPRINGFIELD, MASS.  
*Producers of specialized fine ignition equipment for more than 50 years.*

**IT'S THIS SIMPLE... THIS SAFE!**



Remove old lighter from receptacle.



Slip Wico Safety Cigarette Lighter in its place. It's now ready for use.



Place cigarette firmly in the lighter.



Push plunger in for a moment... pump once or twice.



Remove lighted cigarette and enjoy your smoke in safety!

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PM401

Enclosed is my check (or money order) for \$2.95. Please ship immediately Wico Automobile Safety Lighter for car \_\_\_\_\_ (Make)

\_\_\_\_\_ (Year)

Name \_\_\_\_\_

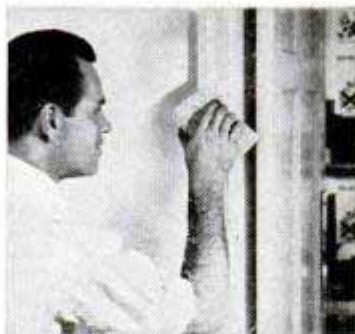
Address \_\_\_\_\_

City \_\_\_\_\_ Zone \_\_\_\_\_ State \_\_\_\_\_



# Pointers for **Woodwork:** home painters

Before painting woodwork, remove all grease and oils so fresh coat will stick better. Use one cup of baking soda to one quart of water. Rinse with fresh water.



If painting over previously stained surface, first sandpaper, dust, then apply prime coat of aluminum paint. Use a nylon-bristled brush for best results.



For neatest work remove doorknobs and hardware before painting. Cut paint odors by placing ammonia in pan of water on floor.



When storing brushes for long periods, clean thoroughly and wrap securely in heavy paper as shown here. Brushes stay in better condition when they're kept in shape.

**JOB AFTER JOB** you'll get best results with a well-tipped nylon paint brush. Durable Du Pont nylon bristles paint smoother . . . are clean and sanitary . . . never get brittle . . . don't break off even under the roughest treatment. And nylon bristles last from 3 to 5 times longer than ordinary bristles. Leading manufacturers make nylon paint brushes in all types and sizes. Look for the name **NYLON** on the handle. Be sure to pick the size brush designed for the job . . . and demand Du Pont nylon bristles.

**150th Anniversary**



Better Things for Better Living  
... through Chemistry

The best brushes have  
**DU PONT NYLON  
BRISTLES**

practice under all conditions they may encounter.

One group, on board the submarine *Perch* off Oahu during Operation Miki two years ago, spent 17 days in conditions so crowded they had to eat in their bunks. One bath was their limit, and they were submerged three days. Finally, on the crucial night, advance patrols stripped to shorts, donned rubber frog feet and swam over a mile to shore, where they spent 28 hours spying out the situation. Some were captured, but most came back with valuable data, documents and an Army aggressor prisoner. The soldier was towed 2000 yards back to the sub because he couldn't swim. The Marines gave him quite a time. He was moved by rubber raft from submarine to submarine and finally transferred to a destroyer with a breeches buoy so the general could look him over. "Something he'll never forget, I'll bet," says one of the men. "We scared him half to death."

Whether patrolling, policing, fighting, flying in helicopters or riding in amphibious goliaths, Marines are proud they're Marines. And the chances are that the little band of men with flintlock popguns and tricornered hats who first formed the Corps at Tun's Tavern in Philadelphia 175 years ago, would be mighty proud if they could see the results of what they started.

## Fish on the Research Menu

(Continued from page 162)

some areas," Van Cleve pointed out, "that game can be provided only by planting artificially reared fish of catchable size, and the entire plant may be caught within a few days of releasing the fish in the stream. Problems in hatchery operation, planting programs, nutrition and feeding are basic ones that may involve savings of thousands of dollars."

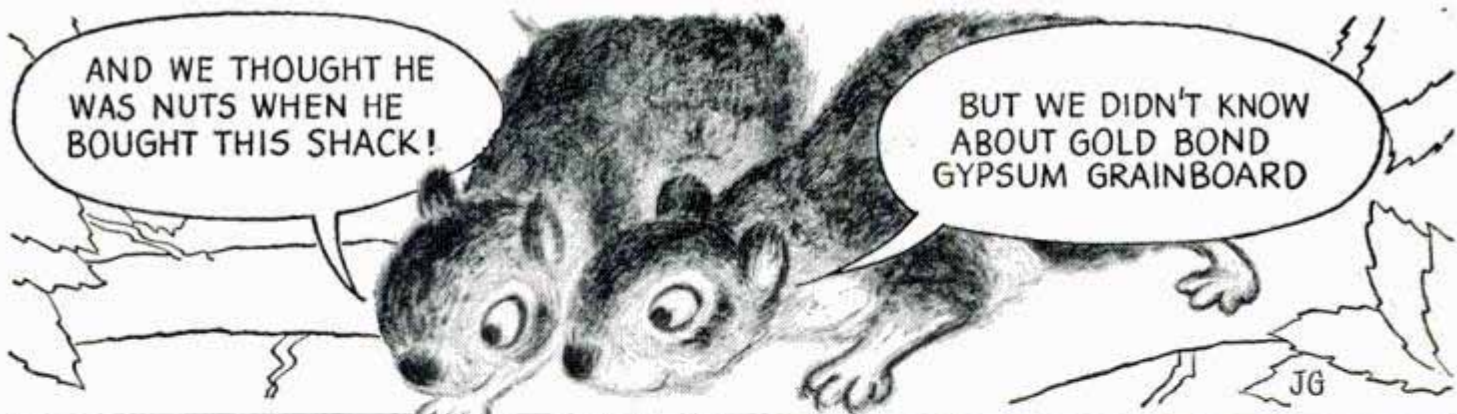
Fishermen who know what the school is doing are highly cooperative. They report catches of marked fish. They also supply many specimens for the school.

Crates arriving at the school are likely to contain almost anything in the way of fish. In a recent one were the huge jaws of a 14-foot, 1800-pound shark caught in a salmon gill net off Willapa Harbor on the Washington coast.

The school has become a center for cooperating agencies which share equipment and experience. Working in the School of Fisheries building, besides the scientists of the Applied Fisheries Laboratory, are biologists of the Washington State Department of Fisheries, the U. S. Fisheries and Wildlife Service and State Department of

(Continued to page 250)





AND WE THOUGHT HE WAS NUTS WHEN HE BOUGHT THIS SHACK!

BUT WE DIDN'T KNOW ABOUT GOLD BOND GYPSUM GRAINBOARD

JG



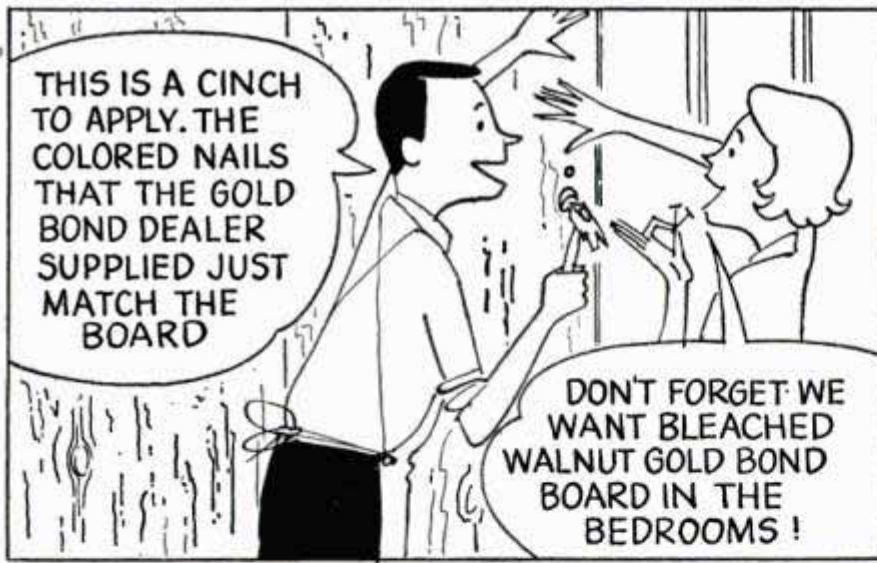
ALL I DID WAS TELL OUR GOLD BOND LUMBER AND BUILDING MATERIAL DEALER THE SIZE OF EACH ROOM

I CAN'T TELL THAT GOLD BOND GYPSUM GRAINBOARD FROM REAL KNOTTY PINE!



CUTS AND SAWS EASILY AS WOOD - JUST LIKE THE DEALER TOLD US!

JUST AS STRONG AS WOOD-AND BETTER STILL-IT'S FIREPROOF



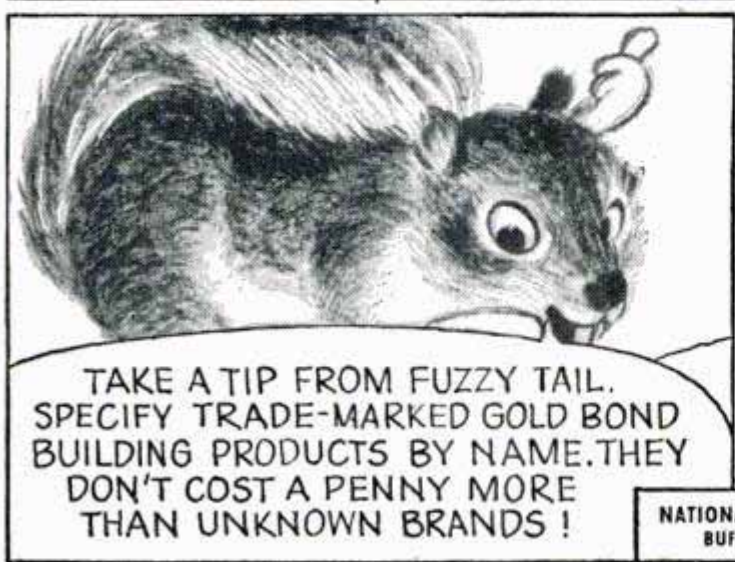
THIS IS A CINCH TO APPLY. THE COLORED NAILS THAT THE GOLD BOND DEALER SUPPLIED JUST MATCH THE BOARD

DON'T FORGET WE WANT BLEACHED WALNUT GOLD BOND BOARD IN THE BEDROOMS!



WHEN WE GET BACK TO TOWN LET'S BUILD A RECREATION ROOM IN THE BASEMENT

OK, IF YOU'LL PROMISE TO DO A ROOM WITH GOLD BOND IN OUR UNFINISHED UPSTAIRS!



TAKE A TIP FROM FUZZY TAIL. SPECIFY TRADE-MARKED GOLD BOND BUILDING PRODUCTS BY NAME. THEY DON'T COST A PENNY MORE THAN UNKNOWN BRANDS!



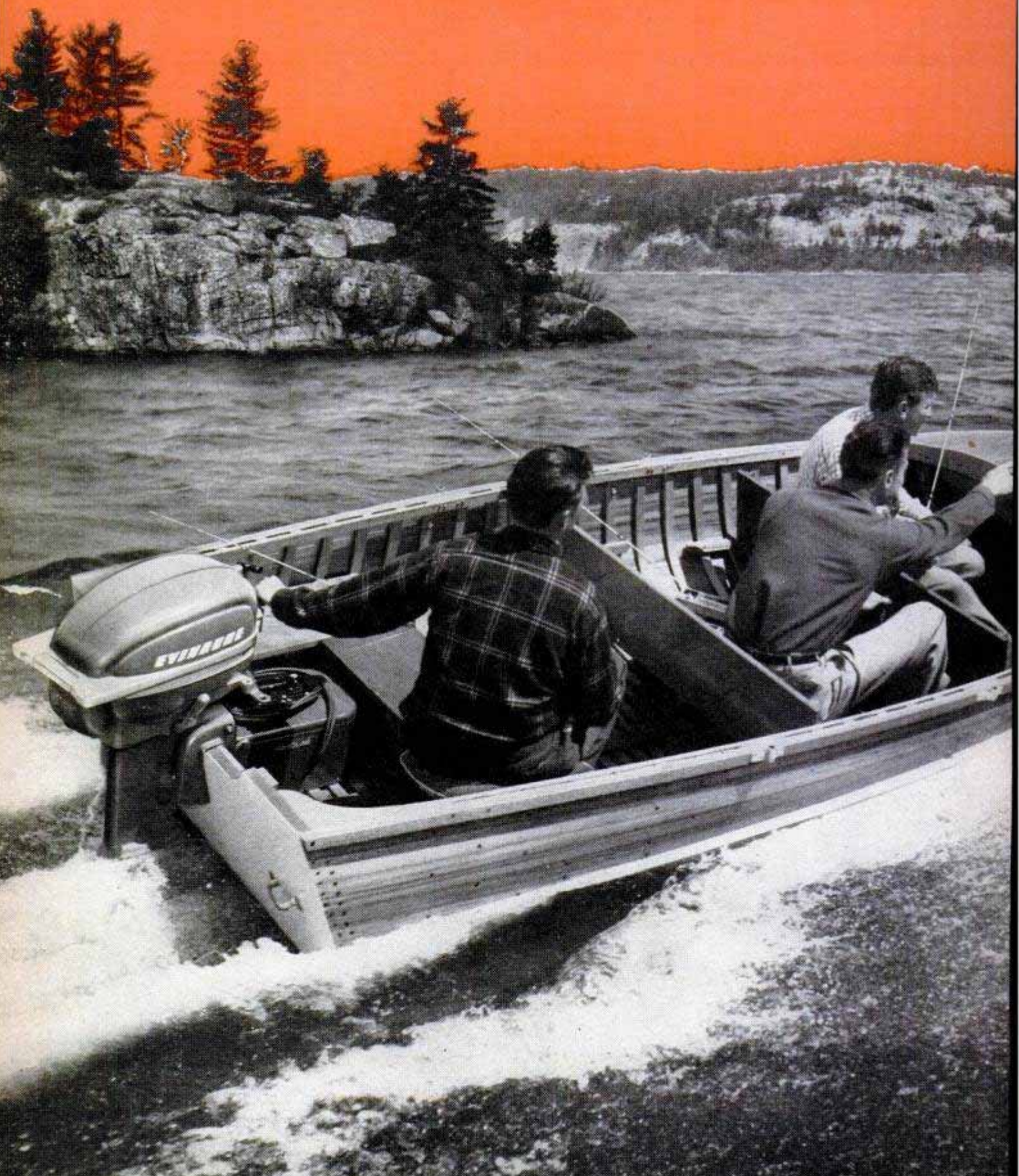
LOOK FOR GOLD BOND'S ORANGE AND TAN STRIPED LABEL-YOUR ASSURANCE OF TOP QUALITY BUILDING MATERIALS.

**ADD-A-ROOM NOW!**  
with **Gold Bond**

NATIONAL GYPSUM COMPANY  
BUFFALO 2, NEW YORK



# one run - and





you

**Know!**

It's easy to settle on the outboard you want... it's easy... it's fast... and it's *Fun!* Take a look at the Evinrude that's hustling this "fisherman's express"... *take a run with Big Twin!* Try it!... and you'll never settle for less!

Take over the controls and see for yourself! Start in Neutral and back away... Big Twin's gearshift makes dockside maneuvering simple as handling your car! Shift to Forward—flick the Roto-Matic Control—Big Twin's blazing power smacks your boat to top speed in breathless seconds! You're streaking along at a 30-mile clip—smooth, quiet and steady! Far-off fishing spots are only minutes away... with Big Twin, the run is the biggest part of the fun!

**Like trolling?** Close your throttle 'way down... you whisper along with bare steerage way... for Big Twin is the 30-miler that trolls like a small motor. On every count... for those who want the last word in fine outboard performance... Big Twin is the motor. *One run—and you know!*

**SEE YOUR EVINRUDE DEALER**—and get the good news on price... the 25 horsepower\* Big Twin is yours at lowest price per horsepower of any outboard motor. If you'd like Big Twin's kind of performance for smaller boats, it's yours in two companion models—the 14 H.P. Fastwin and the Fleetwin, 7.5 H.P.

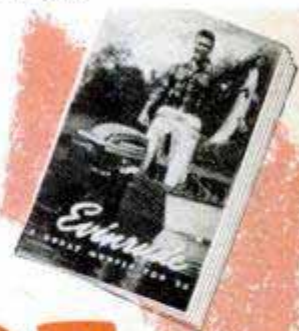
**CATALOG FREE!** Write today for big, full-color catalog of the complete Evinrude line!

### **EVINRUDE MOTORS**

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*In Canada: Manufactured by Evinrude Motors, Peterborough, Ont.*

*\*Power ratings are O.B.C. certified brake H.P. at 4000 R.P.M.*



# **EVINRUDE**

**FIRST IN OUTBOARDS... 43rd YEAR**



**RUGGED WORK IN ALASKA!** This boat is one of a fleet of more than a thousand gill netters fishing the stormy waters of Bristol Bay, Alaska. Formerly restricted to the use of sail only, the fleet is now being rapidly converted to power. The Evinrude 25 H.P. Big Twin mounted in the stern provides reliable power in toughest going—saves space—



of Game. Also established on the campus in other buildings are the Fisheries Research Institute and the International Fisheries Commission Laboratory.

"Successful work of the International Fisheries Commission in building up halibut fisheries has done much to spotlight the value of sound biological research," said Doctor Van Cleve.

In 1915, the halibut catch in the North Pacific reached an all-time high of 70 million pounds. Then it began to drop alarmingly — down to 43 million pounds. The United States and Canadian governments got together and formed the commission to study causes and apply necessary regulations. Through knowledge gained by the commission of breeding and tightening of laws, to assure adequate propagation, the catch went up to 56 million pounds last year and will go still higher this year.

The University of Washington is not the only institution in the nation where fisheries research is being conducted, but it is the only one where you can take a four-year course in the subject and go on to get master's and doctor's degrees.

Alumni are scattered around the world. That is also true of fish "alumni."

In about three years, some fish alumni may begin to give their "alma mater" trouble. On July 1, 1951, Doctor Donaldson

opened the gates of the school's outdoor tanks and sent to sea 40,000 baby Chinook salmon.

Donaldson is counting on about one percent—400—to return to the tanks where they were spawned. When the fish went out, they weighed about  $\frac{1}{70}$  pound each. When they return, they will weigh about 20 pounds each.

"Question is," said Donaldson, "where are we going to put them?"

## Molecules Tailored To Order

(Continued from page 153)

research, including the possible manufacture of synthetic proteins in the laboratory. This would be a scientific triumph and would permit the manufacture of protein foods directly from the elements of which they are composed. Economically, the process could hardly compete with present ways of raising foodstuffs.

More important, the possibility now exists of designing and creating molecules that would attach themselves to virus proteins and then destroy the potency of the viruses by forcing a rearrangement of their atomic structure. Part of the cost of the present research program, in fact, was borne by the National Foundation for In-

(Continued to page 254)

# STOP THAT OIL EATER!

Now - Get New Car

Performance with

## PISTON SEAL WITHOUT COSTLY OVERHAULING

● Piston Seal — the amazing compound that forms a self expanding, pliable lubricating seal around pistons that compensates for wear. Eliminates oil burning, restores power and compression. Can be applied in a few minutes without dismantling the engine. Guaranteed in writing not to harm the finest engine.

GOOD FOR  
10,000 MILES



### READ WHAT SATISFIED USERS SAY ABOUT PISTON SEAL!

I installed a tube of Piston Seal in my 1940 Packard convertible which prior to the use of Piston Seal was using a quart of oil to every 65 to 75 miles. Now the same car is using oil at the rate of less than one quart every 800 miles.

Thanking you for saving us a great amount of time, effort and money.

N. E. P. — LYNN, MASSACHUSETTS

On October 22, 1950, I had a tube of Piston Seal installed in my 1941 Hudson. Prior to the installation of Piston Seal, my car was using a quart of oil every 100 miles. Now, after having driven 225 miles, my oil checks full.

H. G. J. — LYNN, MASSACHUSETTS

Have received one tube and it is doing a good job. Enclosed find check for another tube of Piston Seal.

S. C. S. — LAFAYETTE, RHODE ISLAND



SIMPLY REMOVE  
SPARK PLUG AND SQUEEZE

Write Now for  
Complete Free Details

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ATTENTION CANADIANS!  
Write TREGLOWN CO., INC.  
1269 Greene Avenue  
Montreal, Canada



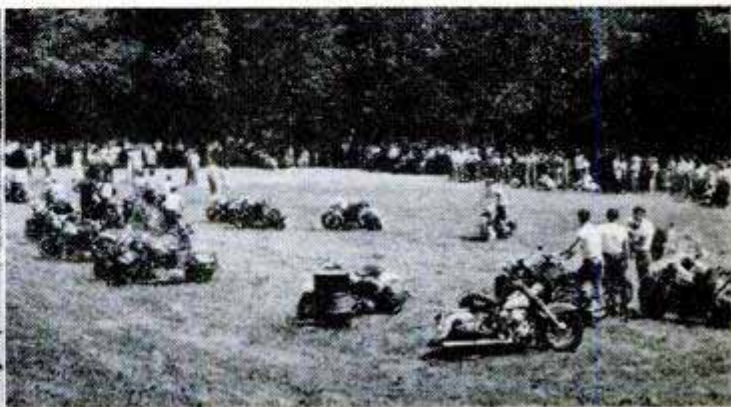
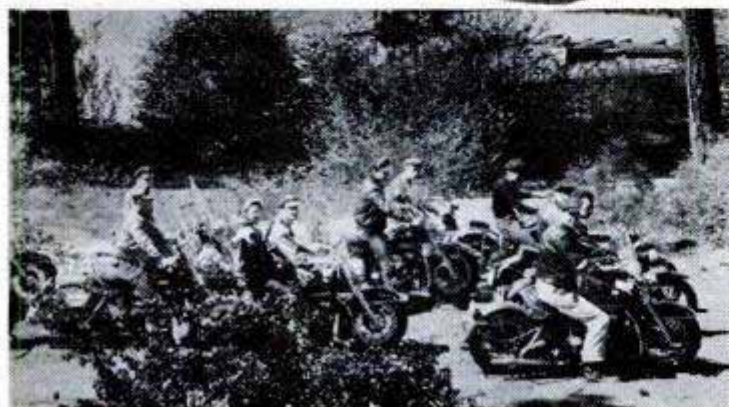
*No sport like motorcycling..  
No satisfaction like owning a*

# HARLEY-DAVIDSON **HYDRA-GLIDE®**

That's right, Mister . . . for all-out sport, you can't beat the thrill of owning a smooth, powerful Harley-Davidson. Invigorating travel . . . exhilarating good times . . . congenial comrades . . . exciting gypsy tours, race meets, club runs — are all yours to enjoy right from the minute you swing into the saddle of this smooth-riding "streamliner."

See your dealer today. Learn first-hand about the world-famous, power-packed O.H.V. motor with hemispherical combustion chambers; the super-fast foot shift with hand clutch for greater riding pleasure and convenience; the exclusive Hydra-Glide fork that "irons out" bumps and ruts for floating-on-air comfort; the big internal expanding brakes front and rear that assure smooth, positive stopping and other features that put Harley-Davidson in a class by itself as the world's finest motorcycle. Send us 25 cents for literature on the 1952 models, and a copy of the ENTHUSIAST Magazine filled with motorcycle action pictures and stories.

HARLEY-DAVIDSON MOTOR Co.,  
Dept. PM, Milwaukee 1, Wis.







The 200-inch telescope reveals what remains of a star that exploded in A.D. 1054. Gases still swirl



Photograph of the Ring Nebula was made at Mount Palomar. Nebulae in outer space have various forms

## Searchers of Space

(Continued from page 85)

Washington and the California Institute of Technology.

Now that the big "eye" on Palomar is at work it has proved every bit as perfect as its designers had planned. Actually it is even better because recent improvements in film emulsions are permitting shorter and steadier exposures. The telescope is solely an instrument for photography as are all large astronomical telescopes. As an indication of the work involved, it is interesting to know that some 100,000 photographs of objects and spectra have been made with the 100-inch telescope on Mount Wilson in the last 34 years, nearly every one of which received hours or days of study by many different observers. It is from the study of photographs, usually the least spectacular ones, that most knowledge about the universe is gained.

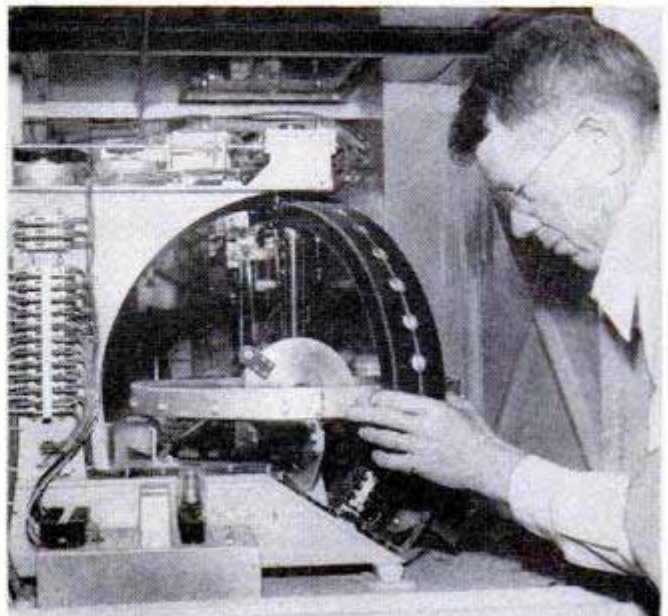
Astronomers are watching an associated field with a great deal of interest—that of the new "radio telescopes." They are picking up high-frequency radio waves from the direction of the sun and some portions of the Milky Way. These waves seem to be a by-product of the conversion of hydrogen into helium, the process by which the sun maintains its energy. It may be that more information on the way that this fusion process occurs will come from studies of the radio waves.

Astronomers see no hope of ever answering one of the most intriguing questions of all, whether or not there are other races of beings comparable to the human race elsewhere in the universe. The mathematical

chances are that the human race is not unique. There may even be thousands of populated earths right in our own galaxy. There is evidence that other stars aside from the sun have planetary systems.

Three or four such planetary systems have been detected recently by studies with the sensitive photoelectric cells. Periodically the light from a certain star grows slightly dimmer and then bright again. The best explanation is that the black body of a planet is circling the star and regularly passes in front of it, obscuring its light in the order of a few hundredths of a magnitude. If the planets exist, who can say that some of them are not populated by intelligent beings like ourselves?

"Phantom telescope" automatically rotates the dome of 200-inch telescope to keep open shutter in the right position regardless of where scope is aimed





Compare this

# AMAZING LOW PRICE

## For an 8-inch

## TILTING ARBOR Bench Saw



# \$46<sup>95</sup>

Cash

Complete with blade, miter gauge, rip fence, machine pulley, and V-belt. ONLY \$5.00 DOWN

**COMPLETE OUTFIT AS SHOWN**

# \$110<sup>00</sup>

Cash

Complete Bench Saw with motor, motor pulley, two side table extensions, power tool bench, tool light, and Power Panl.

ONLY \$11.00 DOWN ON EASY TERMS

These Accessories make your saw much more useful



**A CRAFTSMAN 6-inch Dado Set.** Dados, rabbets, grooves, etc. with  $\frac{1}{2}$  or  $\frac{3}{8}$ -inch-arbor bench saws. \$9.50 per set.

**B CRAFTSMAN Molding Cutter Head.** Fits most bench saws with  $\frac{1}{2}$  or  $\frac{3}{8}$ -inch arbors. 4-inch diam. With Allen wrench. \$4.50. Cutter bits for above head. 1-in. wide bits cut styles as shown. Styles \$2.95 per set, and up.

**C CRAFTSMAN Carbide-tipped Saws.** New! Safer—8-tooth design eliminates kickback. Teeth project only .020 in. above non-cutting edge. Rips, crosscuts, miters—lasts 20 times longer than ordinary blades. 5 $\frac{7}{8}$  to 10-in. diameters, all arbor sizes. \$10.85 and up.



Table stays level, work lies flat at any angle of cut. Blade and guard tilt up to 45°



Double-row ball bearings form unit with arbor, prevent misalignment; need no oil



Floating motor mount makes tilting easier, keeps proper belt tension. Motor dismounts

### DUNLAP 8-inch Tilting Arbor Bench Saw

Compare the features! . . . compare price! You'll agree it's one of our best power tool values . . . ever! We know of no other saw of this same type and price that even begins to compare with it. And best of all, you can have this in your shop for only \$5.00 down.

**Tilting arbor** lets you cut to any angle up to 45° while the work itself stays level. You work faster, easier, and more accurately.

**Floating drive motor mount** supports motor behind saw . . . smothers vibration . . . makes tilting easier . . . permits removal of motor for other use.

**Super-lubricated precision ball bearings** NEVER need further lubrication. NEVER get out of line. (They form integral unit with arbor shaft.)

**Improved fence design** accurately squares fence directly against front of table. Can be used on either side of blade. Easily removed.

**17x14-in. table** of cast semi-steel; top and sides machined. 8-in. combination blade ( $\frac{1}{2}$ -in. bore) gives up to 2 $\frac{1}{4}$ -in. depth of cut. (Use at least  $\frac{1}{2}$ -H.P. motor; 3450 R.P.M., 2 $\frac{1}{2}$ -in. pulley, 40-in. belt; or 1750 R.P.M., 5-in. pulley, 44-inch belt.)

**Complete outfit** (as shown) includes CRAFTSMAN  $\frac{1}{2}$ -H.P. 3450 R.P.M. ball-bearing capacitor motor (110-120 volt, 60-cycle AC), 2 $\frac{1}{2}$ -inch motor pulley, 2 side table extensions, 40-inch belt, adjustable steel power tool bench, tool light, and Power Panl (remote control for light, motor, etc.).

Choose this great DUNLAP saw value NOW! Available only at your nearest Sears retail store.

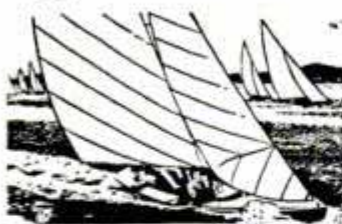
The Sears Retail Store nearest you will furnish you with exact selling prices which will not exceed O.P.S. ceiling prices.

# CRAFTSMAN and DUNLAP Tools by SEARS, ROEBUCK and CO.

## Famous for fine quality . . . precision performance . . . low price!



# Thinking of Building a Boat?



Plan 21—20' Sloop



Plan 25—13 1/2' Runabout



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## Choose One of These Easy-to-Build Designs

**PLANS AND INSTRUCTIONS ONLY 10¢ EACH**

PLAN NOW to log a season full of boating pleasure by building one of these sturdy Exterior plywood boats. Each is designed by a top naval architect. Each is planned with plywood to make it easy to build, light, strong and durable. Big sheets speed work . . . add strength and rigidity . . . eliminate caulking and open seam troubles. Exterior plywood (identified by EXT-DFPA® on panel edge) is bonded with 100% waterproof marine adhesives. Your lumber dealer now sells it at new low prices. See him soon.

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Plan 21     Plan 23     Plan 24     Plan 25

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fantile Paralysis with this in mind. Other contributors have been the Rockefeller Foundation and the U. S. Public Health Service.

Professor Pauling points out that many of the new drugs such as the sulfas and penicillin are believed to be potent because they combine with proteins and other organisms. But, he adds, these drugs and other valuable ones were mere accidental discoveries. It now seems possible, when additional information has been accumulated, to sit down in the laboratory and write out the specifications for whatever kind of molecule is needed for vanquishing a particular disease. Then the antibody could be manufactured at once. There is even a suggestion that molecules might be fashioned which would act on the wild growth of protoplasm in cancer, reducing or eliminating the malignancy.

Some time in the future, too, chemists may be able to manufacture virus proteins. This would be a tremendous scientific achievement because a virus has some of the properties of a living organism. A virus has no metabolic reactions; on the other hand, it can reproduce itself. Plant viruses, for instance, make use of food from a plant to produce replicas of themselves and these offspring in turn can reproduce.

When atomic chemists finally create synthetic virus proteins they will have come close to manufacturing life itself.

## How to Install Your Own Three-Speed Record Changer

(Continued from page 230)

cable carries the audio signal from the changer to the amplifier circuits in the receiver chassis. If your old set previously used a single-speed changer with crystal pickup, no circuit changes need be made under the radio chassis. If your new changer is not equipped with a power cord, do not pull connector "X" apart, but instead clip both power leads at point "Y" about 2 in. below their connections to the old changer. The long leads will later be used to deliver power to the new changer.

If your new changer is already equipped with a shielded cable and pin plug, pull the old pin plug from the pin jack on the radio chassis and use the new shielded cable. If the new changer has no shielded cable installed, unsolder the shielded cable from the old changer at point "Z" shown in Fig. 3. This same cable will be used later to bring the audio signal from the new changer to the radio-set chassis. Now you can lift out the old changer. If no mounting

(Continued to page 256)



**Light Weight**—only 73 pounds. The gas tank's built in, no extras to carry.

**Proved Full Jeweled\* Power Head**—the same basic "Super 10" Hurricane powerhead that set the whole outboard industry on its ear . . . that outperforms engines of two and three times its rated horsepower.

**Reverse Gear and Neutral**—engineered right for outboard use. The shift lever's up front where it should be.

**Twist Grip Synchronized Spark and Throttle** with new longer steering handle for ease of control.

**New "Power-Thrust" Lower Unit**—for more efficiency with heavy loads. Unicast one piece gear housing keeps lubricant in—water out.

**Plus**—all the famous features that make every Mercury the leader in its class by a nautical mile. See your Mercury dealer for a demonstration.



The outboard that has everything—does everything!

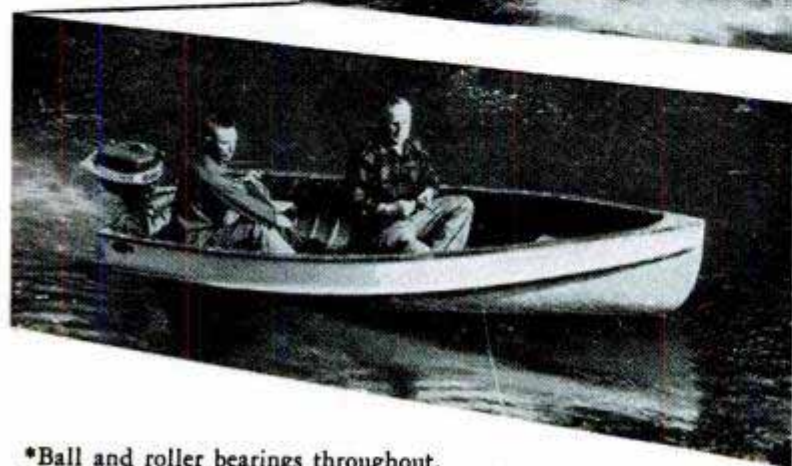
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to the new  
KIEKHAEFER  
**MERCURY  
CRUISER**



**performance!** Now — take the whole family in a big boat at runabout speeds. Plenty of muscle to power cruisers and work boats but light enough for one man to handle.

**water skiing** — Power to spare — actually pulls two skiers up out of the water and over ski jump!

**fishing** — throttles down to a sweet slow troll but wings your party and gear home in a hurry.



\*Ball and roller bearings throughout. Features of Mercury Motors are protected by issued or pending patents.



Write for free illustrated catalogue "Move Up To A Mercury". Kiekhaefer Corporation, Fond du Lac, Wisconsin.



board comes with the new changer, the manufacturer supplies a template with full directions for cutting and drilling the 5/8-in.-plywood mounting board to conform to the shape of the new changer. A top view of a typical mounting board, in position in the changer compartment, appears in photo H.

Sand, stain and varnish the mounting board before fastening it down permanently. Your new changer will be shock-mounted on springs or rubber bushings. The method of rewiring the electrical leads to the new changer will be determined by whether or not it is already provided with cords and plugs attached. If it is, drop these leads through the large opening in the mounting board as you set the changer in position. If the new changer is not provided with attached leads and plugs, use the old leads and connectors as previously stated. The shielded cable from the radio chassis to the pickup arm will be connected to a terminal strip that the manufacturer provides underneath the main plate of the changer. This terminal strip and the necessary connections are clearly shown in Fig. 4. Note that the metal shields are connected together on one lug and the inner conductors on the other. On the initial test, if a loud hum is present, it may be eliminated by reversing the power leads to the changer only. You should never plug an a.c. record

changer into a receptacle wired for d.c.

If a variable-reluctance pickup is desired, instead of a crystal, the changer will be installed as described but a preamplifier must be added as indicated in Fig. 2. A self-powered G.E. preamplifier designed for this purpose is shown in photo F. These are available from all radio-parts houses, and they are easily installed in the audio lead between the changer and the radio-set chassis. In most cases the preamplifier can be mounted with wood screws on the inside of the cabinet.

## Putting the Squeeze on Metals

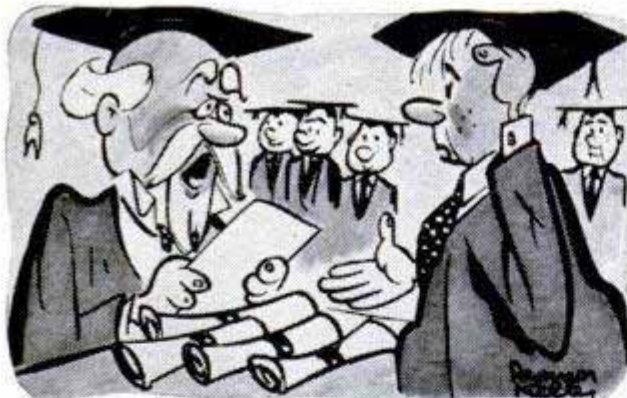
(Continued from page 123)

extra piece between the other two to give a double weld. Most important, there are no tool marks or weak spots.

A refinement of the sandwich is the projection weld. A product—for example, an aluminum handle—is cast with rounded projections on its flat base. When the handle is driven hard against an aluminum plate, the projections flow out to form a strong, hidden weld.

Now they've developed not only hand tools for many basic welds, but a simple machine that converts aluminum strip into continuous tubing. All the operator does is

(Continued to page 258)



"Sorry James, we haven't got one for you. You flunked your Finger-Nail Test!"



"It's easy to see which one of these guys uses Wildroot Cream-Oil!"



"Well... Claude has *one* good habit... he uses *non-alcoholic* Wildroot Cream-Oil!"

**YOUR HAIR'S  
BEST FRIEND**

America's  
Favorite  
Hair Tonic!



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**CORALOX**  
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**ALSO CHOSEN FOR NEARLY AS MANY NEW CARS  
AS ALL OTHER MAKES OF SPARK PLUGS COMBINED**

AC's patented *CORALOX* Insulator is the greatest spark plug advancement in 40 years. It contributes definite performance advantages that owners of any make of car can recognize and enjoy.

Easier starting. Better idling. No misfiring and loss of power at high speed or under heavy load.

*CORALOX* accomplishes these benefits because it is far superior to any previous

insulator. High temperatures don't crack it nor cause it to lose its insulating properties. It heats up quicker in a cold engine, burning away oil and wet carbon deposits. It doesn't attract oxide coating.

Chevrolet and other leading manufacturers have specified ACs as standard equipment because of these *CORALOX* superiorities. You can have them, too. Just have your service man install a set.

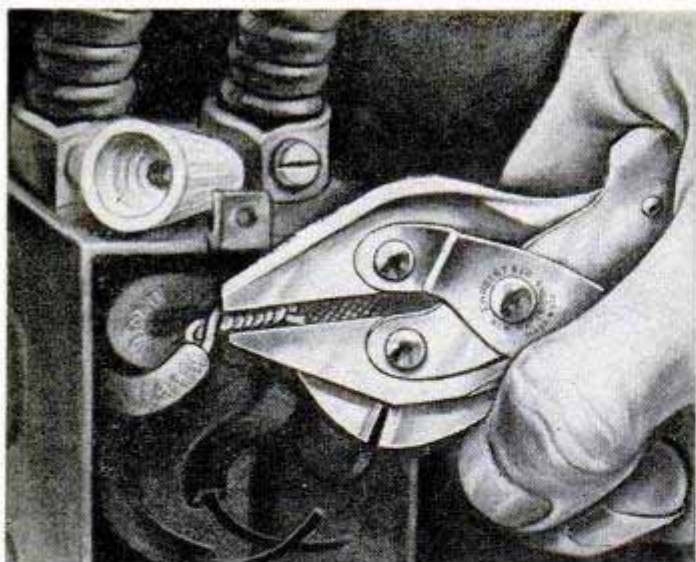
AC SPARK PLUG DIVISION



GENERAL MOTORS CORPORATION







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- **A CUTTER**
- **A WRENCH**



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- **Open Throat** allows wire to run between jaws from either end... to straighten or pull wire.

Available in 4½", 5½", 6½" and 8" lengths.

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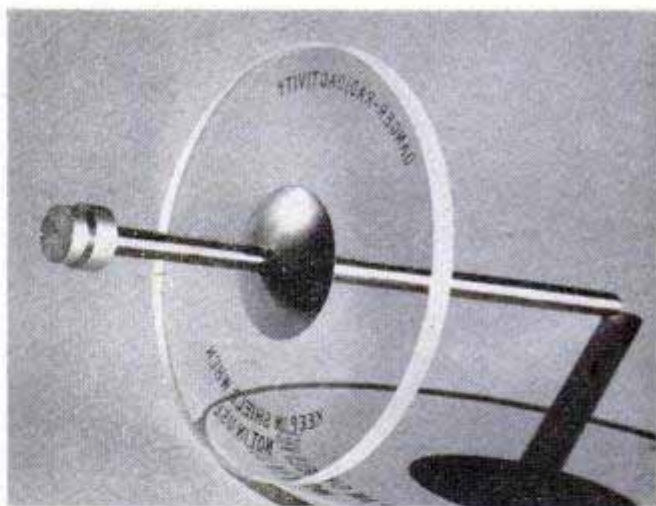
The Tops in Tools  
The Latest in Locks

Builders Hardware and Fine Tools since 1864

turn a crank. The machine curls the strip into a tube, cold-welds the seam and trims it. Aluminum conduit for power transmission can be produced merely by enclosing the electrical cable as the tube is formed and welded. Dubilier calculates that if the heavy lead sheaths on telephone lines were replaced with cold-welded aluminum sheaths, telephone poles could be placed three times as far apart.

Some manufacturers who have been offered the cold-welding process have been hard to convince. It's the same old reason—cold-welding is so simple, it's almost unbelievable. They won't utilize it until they've run extensive tests themselves. But pots and pans, motor armatures, refrigerator shelves, aluminum cans, tubes and electrical parts have recently been turned out with cold-welded seams, and Dubilier is certain the process soon will be widely used by industry. Because the process shows promise of substantial savings in money and time, the Air Force has awarded Republic Aviation a contract to experiment with cold welds in the manufacture of parts for airplanes.

Dubilier even hints that someday cold-welding will open up still another field. Can iron and steel be welded without heat or flux? Already, a few experimental welds have been made in some stainless steel and between stainless steel and aluminum.



## Beta Rays From Applicator Aid in Eye Treatments

Beta rays from strontium-90, a radioactive isotope, and a new applicator are aiding in the treatment of corneal ulcers and other eye conditions. Because of their relatively slight, even penetration, the rays permit effective therapy without danger to the delicate inner structure of the eye. Compared to previous beta-ray sources which lost their strength in a few days, strontium-90 has a half life of about 25 years.



# Tough hobby jobs

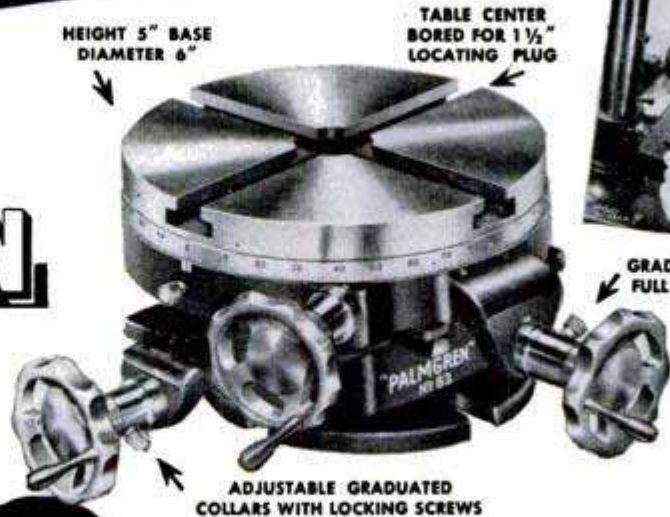
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**\$54<sup>50</sup>**



## The Only Table Having ROTARY FEED Combined With DUAL CROSS FEEDS!

It's sensational—in price, in construction, in performance. Makes your drill press a vertical milling machine. You can rout, straight or curved-rabbit-drill-sand or mortise. Also hundreds of other jobs such as milling slots, grooves, keyways, squares, hexagons, curves, flats, dovetails, indexing and laying out work.

Designed for use on Drill Press or Milling Machine, it will handle large tough jobs or small model parts on all types of metal and woodworking projects.

### Built by Specialists for LIFETIME SERVICE

Precision built. Permits close tolerances. Rotary feed is calibrated in degrees-cross feeds in thousandths. Cross slides and feeds are 2 1/8" each side of center—4 1/4" overall. Adjustable gibs on cross slides—40 to 1 worm and gear ratio in rotary feed. 4 Bolt slots—2 lock screws.



### OTHER "HOBB-E" TOOLS



**"Hobb-E" ANGLE VISES**  
for quick accurate set-ups and any angle. Save hours of time. XI-VISE 1 1/2" Jaws \$4.95. No. 000-2 1/2" Jaws Only \$8.75



**"HOBB-E" MILLING ATTACHMENTS**  
Mill on your lathe. Make T-Slots-Dovetails-Keyways, Etc. Fits any lathe. Graduated for rotary or vertical feeds. Attaches to tool post in 10 Seconds. No. 150-1 1/2" Jaws \$20.65. No. 250-2 1/2" Jaws \$27.25. No. 400-4 Jaws \$43.75



**"Hobb-E" BENCH-DRILL PRESS VISES**  
A handy combination. Use on bench for hand work—slide vise off adaptor to use on drill press. Swivel bench Base—2 1/2" Jaws. V grooved for holding round pieces. Only \$12.95



**"Hobb-E" DRILL PRESS VISES**  
Designed especially for Hobbyists, to make operations on small article more convenient. No. 6—1 1/2" Jaws \$3.30. No. 30—2 1/2" Jaws \$5.50



**"Hobb-E" HAND VISE**  
A handy device with unlimited uses in finishing operations. Grips smallest pieces for buffing or grinding without damage and safeguards hands and fingers. No. 15—1 1/2" Jaws Wt. 7 oz. Only \$2.15

No.	Base Keyway	T-Slots	Table Dia.	Base Dia.	Ht.	Wt.	Price
83	5/8"	3/8"	8"	6 1/4"	5"	28 lbs.	\$54.50
82	As above without ROTARY FEED					26 1/2 lbs.	43.75

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Model 413D

Your

# "OUTING PALS"

for Good Food  
Good Light

Wherever You Go!

You always have good food with a Coleman Camp Stove along. You're sure of plenty of light in camp at night with a Coleman Lantern. Unsurpassed for emergency uses in floods, disasters, power failures.



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## CAMP STOVE • LANTERN

**Easy Meals**—The Coleman Camp Stove cooks like a city gas range. Instant lighting. Two and three-burner models. Make and burn their own gas from gasoline. Safe—help prevent forest fires. Fold up and carry like a suitcase.

**More Fun** with the powerful Coleman All-Purpose Lantern. Floodlights 100-ft. area. Compact; light weight; sturdier built. 8 to 10 hours lighting service from one filling. Safe; can't spill fuel. Stormproof. Coleman REFLECTOR makes it a high-power spotlight. See it lighted—ask your dealer.



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## Report on Foreign Cars

(Continued from page 130)

winners of the Indianapolis 500-mile race). This factory is small and builds only a few race cars. The firm builds a few small trucks, but its principal business is precision machine tools, batteries and electrical devices. As a car maker, the factory is indeed a small one.

Now back to Milan, Zurich and a quick flight to Vienna, where I landed in a British plane in the Russian zone. The next day I took a sight-seeing tour and a 40-mile test run in a new Russian car, the Moskitch. It's a small Russian copy of the prewar (1939-40) German Opel Kadette. When the war ended, the Russians acquired tools, dies and other necessary equipment from the Opel plant at Russelsheim as part of their reparations. They reproduced the original German model as closely as possible, therefore there is no evidence of any original Russian engineering.

The car is equipped with a four-cylinder water-cooled engine of 66-cubic-inch displacement, with a low 5.8 to 1 compression ratio (probably because of low-octane fuel). It has three speeds and reverse with a conventional gearbox which has an old-style shift lever coming through the floor board. Wheelbase is 102 inches. Brakes are hydraulic and 5.00 x 16 tires are used.

The car was quiet, throttled down well, had fair acceleration for its size and would do about 60 miles per hour top speed. Hard brake-pedal pressure and some vibration were evident. Safety glass was used only in the windshield. The paint was fairly good and the upholstery and inside hardware average. The car as a whole showed evidence of crude assembly in some places. However, it was better than I had expected, although not so good as produced by the German Opel plant in 1939.

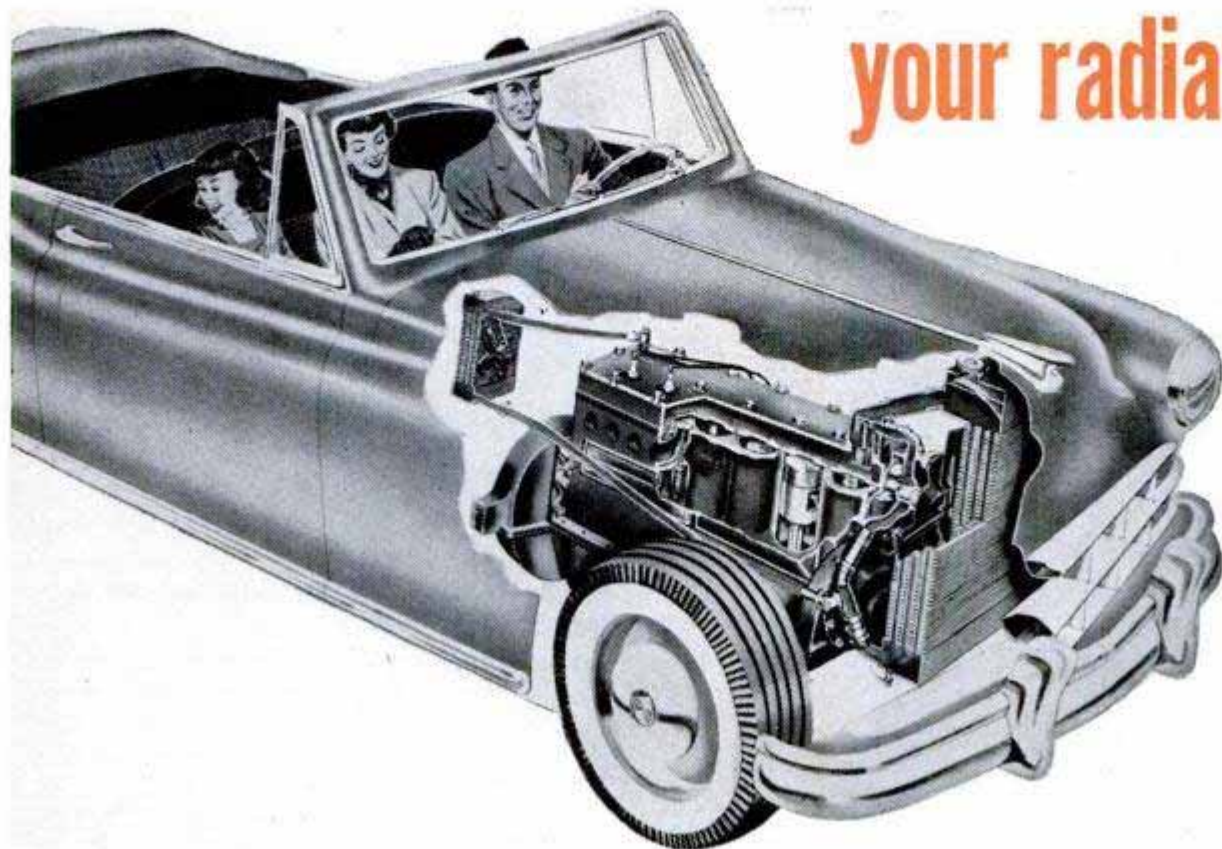
The sedan I drove sells in Europe for about \$990 unequipped. The car is built near Moscow in limited numbers and only a very few have been seen on this side of the Iron Curtain—mostly in Belgium. Belgian tires (Englebert), battery and some other parts are attached in Belgium. I could secure no authentic production figures for the Moskitch.

I also saw a few large Russian Zis cars being driven by military officials in the Russian sector of Vienna. Four were parked around the Grande and Imperial, two of Vienna's largest hotels which the Russians of the occupation forces use. This car is almost a copy of the prewar Packard in design and construction with some Russian equipment. I also noticed several

(Continued to page 262)



# It's time to DRAIN OUT and CLEAN OUT your radiator



Enjoy trouble-free summer driving...  
remove rust and avoid overheating with



## DU PONT *Cooling System* CLEANSER

Hot weather makes auto cooling systems work twice as hard... makes overheating more likely. But you can guard against this annoying problem *right now*, when you drain out anti-freeze—by removing rust with Du Pont Cleanser. Du Pont Cleanser makes the job safe, thorough, and simple. It will even do its work while you're driving. And neutralizer is included in the can for a complete job. There's no fuss, *no reverse flushing necessary!* Ask for a can at your auto supply store or service station today, or ask your service station about Du Pont's "Drain Out" service.



### After cleaning keep rust out for good with DU PONT ACID and RUST INHIBITOR

When your cooling system has been cleaned out, it's wise to guard against rust formation in the future. You can keep your radiator free from rust all season long simply by pouring in a can of Du Pont Acid and Rust Inhibitor. It's harmless to hose and metal parts... retards rust formation and neutralizes acids.



BETTER THINGS FOR BETTER LIVING... THROUGH CHEMISTRY



"Well, blow me down!..."



Look at these  
**LOW PRICES** for  
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**RIP • CUT-OFF • EASY-CUT**  
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6" .. \$1.75	9" .. \$2.65
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Supplied with round or special-shape center hole for portable electric hand-saw machines.

Simonds, sawmaker for woodworkers since 1832, now offers this complete new line of high quality saws at new popular prices . . . 13 types of blades up to 12" diameter (including Dado Heads and Carbide-Tipped metal-cutting saws) . . . all made of Simonds Steel and fully guaranteed. Get them at your hardware dealer or local saw shop.



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Factory Branches in Boston, Chicago, San Francisco, and Portland, Ore. Canadian Factory in Montreal, Que.

prewar Austrian-built Steyrs. This concern now is assembling Italian Fiat cars for sale in Austria under Fiat license.

From Vienna we drove by bus through the Russian zone to the Pan-American airport, where I left for Berlin. Along the route I saw many buildings boarded up. While some stores had skimpy food and clothing displays in the windows, others were completely closed. Some houses appeared abandoned and very few people were on the streets. Almost no cars appeared on the road to the airport.

In Berlin, two days later, I showed films of U. S. automotive events, including Indianapolis races, to our GIs in the Service Club at McNair Barracks. I saw very few Russian cars in Berlin.

And now overnight to New York City and home after a 30-day flying jaunt. Interesting and educational as it was, I was glad to set foot again on U. S. soil, where we can still say what we wish, and where in 90 days Chevrolet, Ford and Plymouth build more cars than all of the factories I visited in Europe do in a year, combined—and more than Stalin builds in five years.



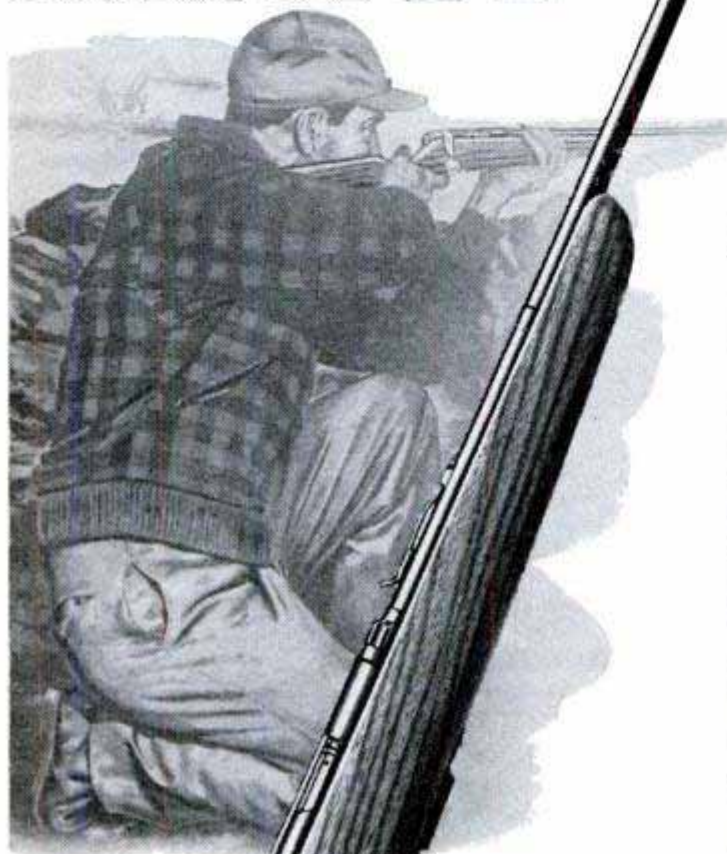
### Bike Radio

German cyclists can talk to each other as they ride even though they may be several miles apart. They use two-way ultra-shortwave-radio sets no larger than a lunch box. This latest fad of German radio hams is popular in West Berlin.

☐ Believed to be the largest motion-picture camera now in use, a new 70-mm. X-ray camera is serving as a new medical tool for diagnosis and research.



# SAVAGE *"22"* Hornet *gets the pests*



**Model 342 . . . only \$48.75**

Get more spring shooting sport with a Savage Model 342 5-shot bolt action repeating rifle . . . especially designed to give you all the *extremely accurate, flat-shooting efficiency* for which the .22 Hornet center-fire cartridge is famous. It's a fine, modern rifle in design, appearance, performance and dependability. And . . . Savage specialized manufacturing methods make its high quality available to you at only \$48.75.

Available in Model 342 Standard (shown) and Model 342-S (Deluxe) with special sights . . . receiver tapped for Weaver 'scope sight . . . sling screw eyes for a carrying strap . . . checkered stock and fore-end.

See these "First in the Field" rifle values at your dealer's. Write for *free* catalog of Savage-Stevens-Fox rifles and shotguns.

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### .22 Hornet Cartridge

Both Savage Models 342 and 342-S were especially designed to handle this extremely accurate, flat-shooting, center-fire cartridge. It's one of the most popular and effective "varminters" ever developed and is widely available.



### Fast, Smooth Action

Round knob bolt handle is in direct line with trigger for fast, smooth operation. Shield protects bolt from dirt. Bolt head and chamber enclosed in solid housing. Convenient, thumb-operated safety. Newly designed stock and fore-end of selected walnut.



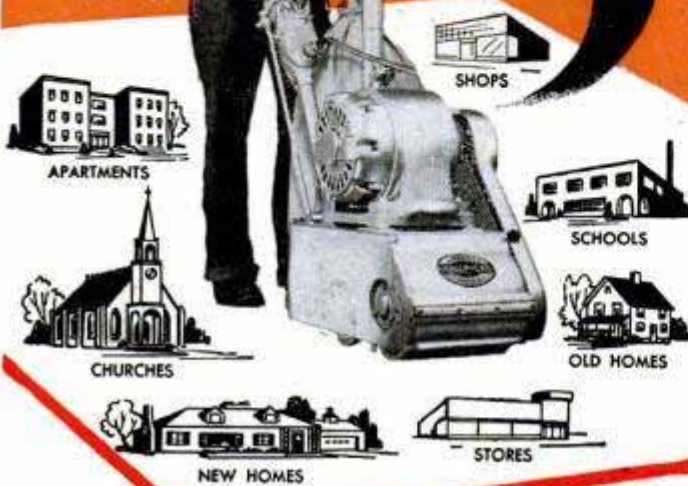
### Modern Sight Equipment

Model 342 Standard (shown) has square topped ramp front sight with gold bead insert and disc elevator rear sight with click adjustments. 342-S Deluxe is fitted with Hooded front sight and Savage 175 Micro Peep Sight.



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## ALL AROUND YOU!



**BE YOUR OWN BOSS!** Big Money waiting for you today in floor surfacing! Hundreds of prospects near you! The floor next door may be your first job—and business mushrooms as folks tell others. Earn as high as \$50 and more a day sanding floors with an easy-to-run American Machine. Pleasant indoor work—steady the year round. A sound opportunity to get in something for yourself and be *your own boss!* No schooling—no experience needed. Only small investment in sander gets you started to success! Send coupon for “money-making booklet” entitled “Opportunities in Floor Surfacing”—enclose 25c in coin or stamps to cover handling.



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Enclosed find 25c in stamps or coin for booklet “Opportunities in Floor Surfacing”, telling me how I can start my own floor sanding business.

Name.....

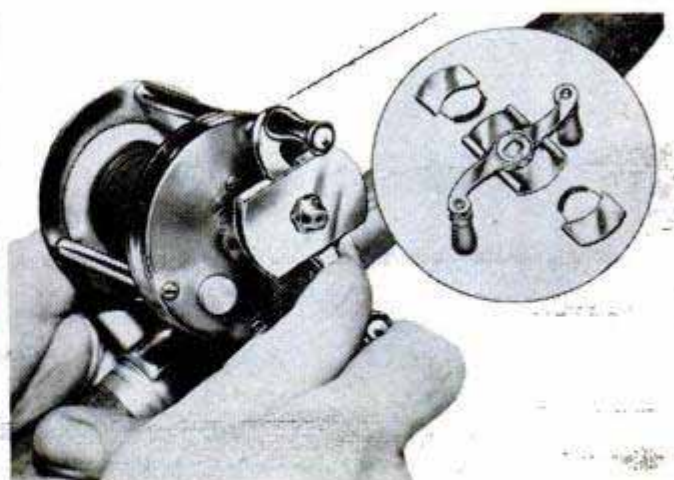
Street.....

City..... State.....



### Extra Leg Steadies Typewriter Shelf

Typewriter shelves on office desks are given added support and rigidity by an adjustable leg that locks to any height in seconds. The leg is attached permanently to the typewriter platform and swings out of the way when the desk is closed. It extends from 15 to 17 inches and has a rubber foot to prevent slipping and also to absorb typing vibrations.

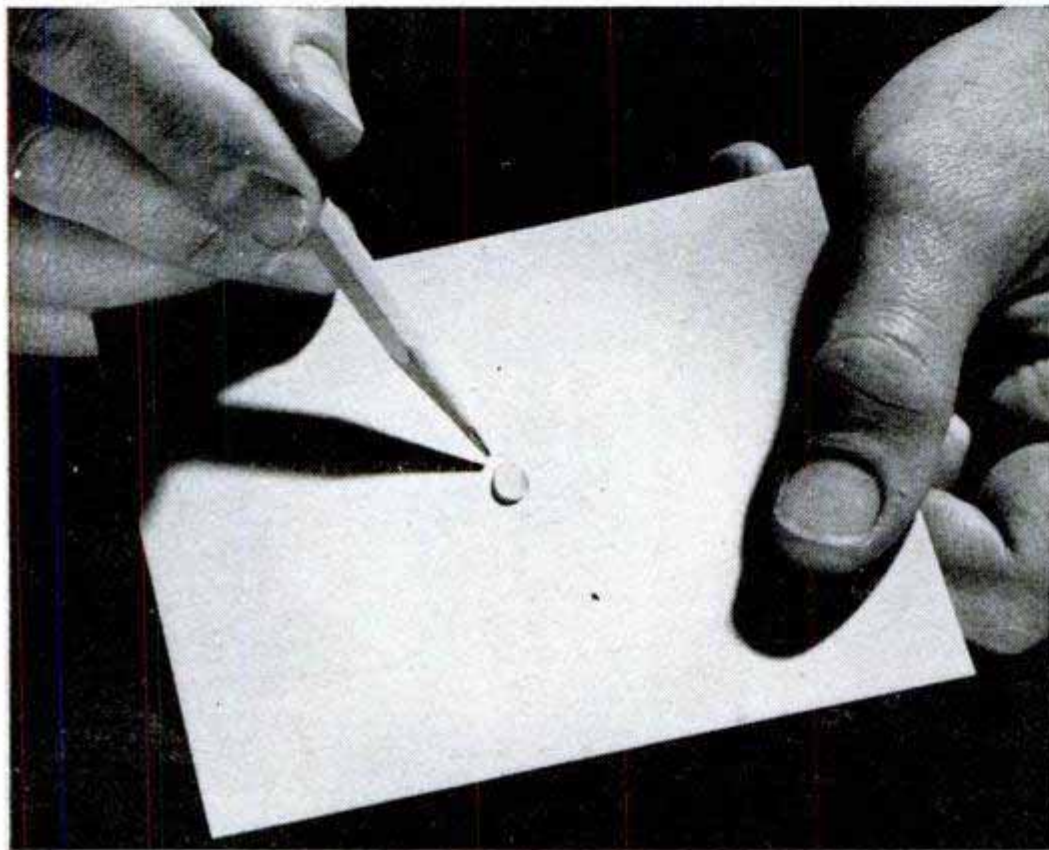


### Backlash Stopper

Designed to fit most detachable-type reels, a governor prevents backlash without the help of any braking device. The governor permits the spool to spin free while the plug is in flight, offering greater distance and accuracy in casting.



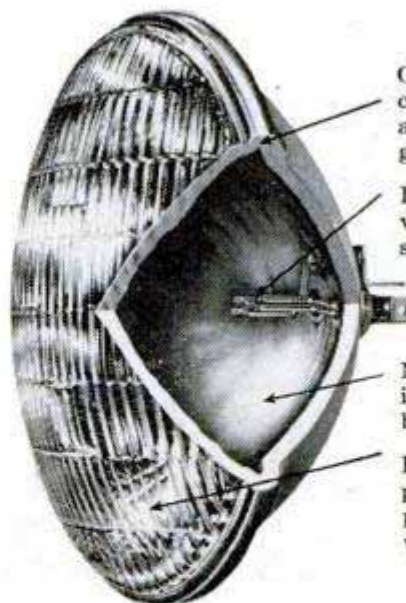
There is a difference in sealed-beam headlamps



...and this is it

## All-Glass sealed-beam headlamps do not grow dim

When moisture collects inside a headlamp and deteriorates the reflector, it cuts light output. Unless your headlamps are All-Glass, you may be able actually to see traces of moisture inside. But there's one way to be *sure* your headlamps are not growing dim. Replace them with G-E All-Glass headlamps. Because they're *All-Glass*, all one big bulb, there's no way for water to get in. Tests show that General Electric sealed-beam headlamps average 99% as much light after years of service as when new. Be sure to specify G-E All-Glass headlamps.



One-piece All-Glass construction. Dirt and moisture can't get in.

Filaments held in vise-like grip. Can't shake loose.

Mirror-like, built-in reflector. Stays bright.

Rugged, hard-glass precision lens to put light where you want it.

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SHOWING STEEL FIBRE STRUCTURE  
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Build your own quality mower with our LOW COST KITS. Parts, Engines. Free Plans guide you. 3 and 4 Wheel Kits, complete. Parts precision finished, ready to use. Write TODAY for Free Plans, Low Prices, Parts List and Guarantee.

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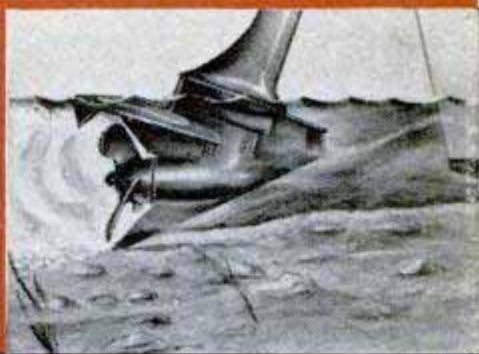




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SLIDES RIGHT THRU WEEDS**



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**AND KEEPS ON DRIVING—  
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HORSEPOWER**

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NOW, a fishing motor that will take your boat wherever it will float. No more fishin' the fringes. *Go right in!* The all-new Sea-Horse 3, featuring a new kind of propulsion unit, takes you through weeds, over rocks and stumps, in shallows, *where others dare not venture.* Keeps right on driving in *inches* of water. And compact? Here is an Alternate Firing Twin—with traditional Johnson ruggedness—developing 3 hp—*that weighs less than 30 lbs.!*

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SEA-HORSE 3**



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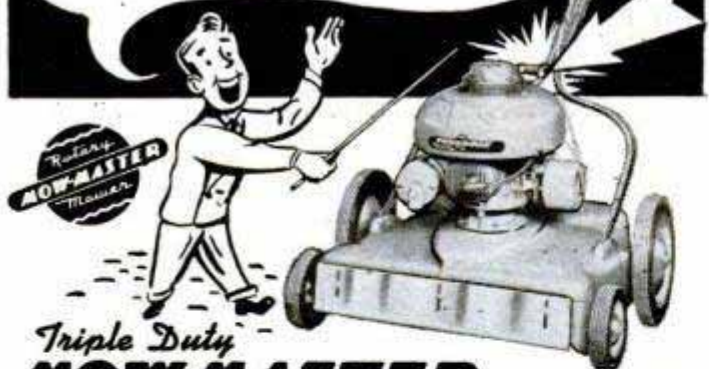


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Brings Added Mowing Ease!



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**MOW-MASTER** now mows  
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Mows lawn grass smoothly and evenly. Pulverizes clippings. — Cuts tall grass and weeds easily. — Instant adjustable cutting height. — Pulverizes fallen leaves. Keeps yard clean all through the autumn season. — 2 H.P. Motor — Direct Drive — Rugged, All Metal Machine — Light Weight — Easy to Handle

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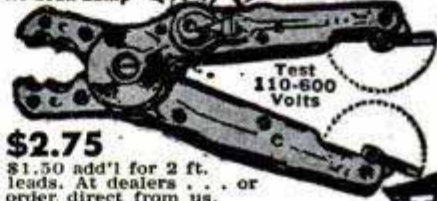
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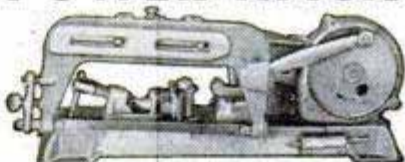
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New Model 353 — Dual Range  
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Welds Anything From Auto Fenders To Tractor Frames

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FOR SUMMER POWER SUPPLY

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• COTTAGES • CAMPS • HOUSE TRAILERS • CONSTRUCTION • ROAD BUILDING, etc.  
Plenty of emergency stand-by or general utility power from 350 watts to 25 KVA.

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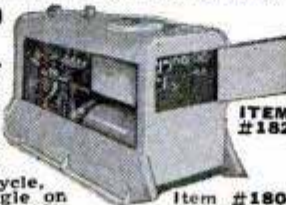
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ITEM #199



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Write for free information on other generators—350 watts to 25 KVA.



ITEM #180

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# HYDRAULIC EQUIPMENT

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Large supply of new labor-saving, economical hydraulic equipment in many types and sizes. Use these positive, highly efficient smooth pressure hydraulics on presses, arbors, lifts, loaders, power control, positioning, brakes, plastic dies, auto frame alignment, etc., etc.

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An outstanding Buy! F.O.B. Chicago.

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(Item #42)

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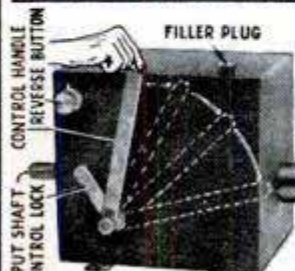
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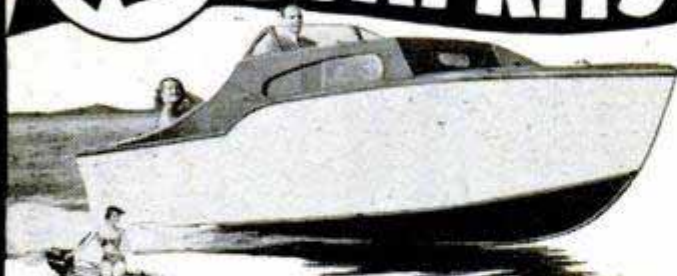
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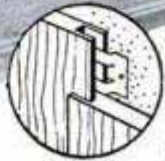
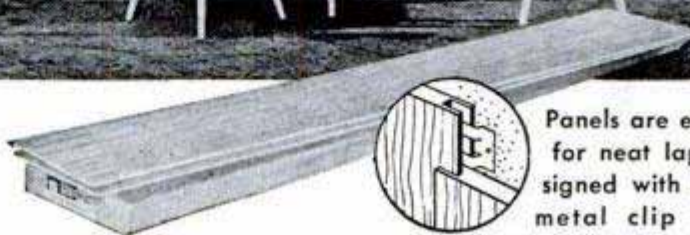
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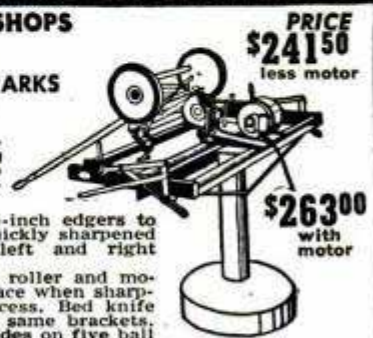
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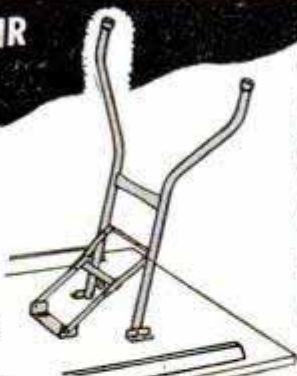
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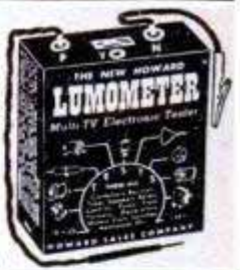


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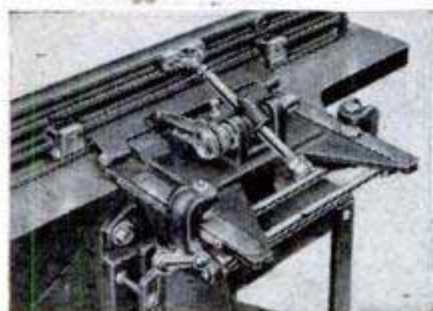
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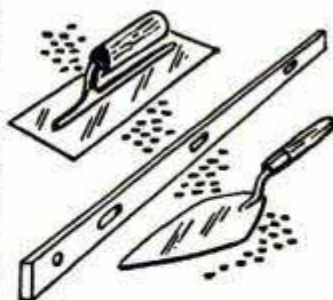
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Brand New. Guarantees equal flow and equal pressure for Two cylinders or Two systems. Capacity 360 G.P.H. 1500 P.S.I. Data & instructions incl. A \$75.00 value. **\$14.50** post-paid Stock I-D-397 only



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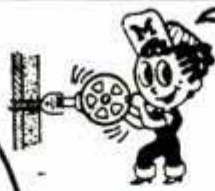
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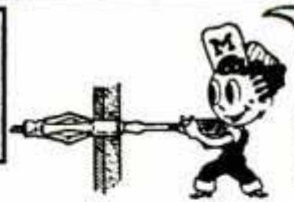


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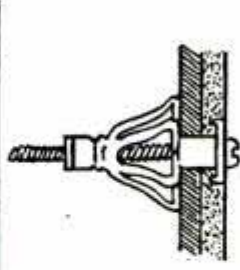
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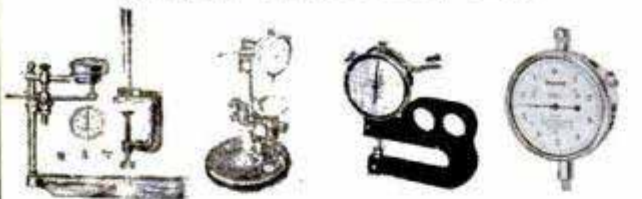
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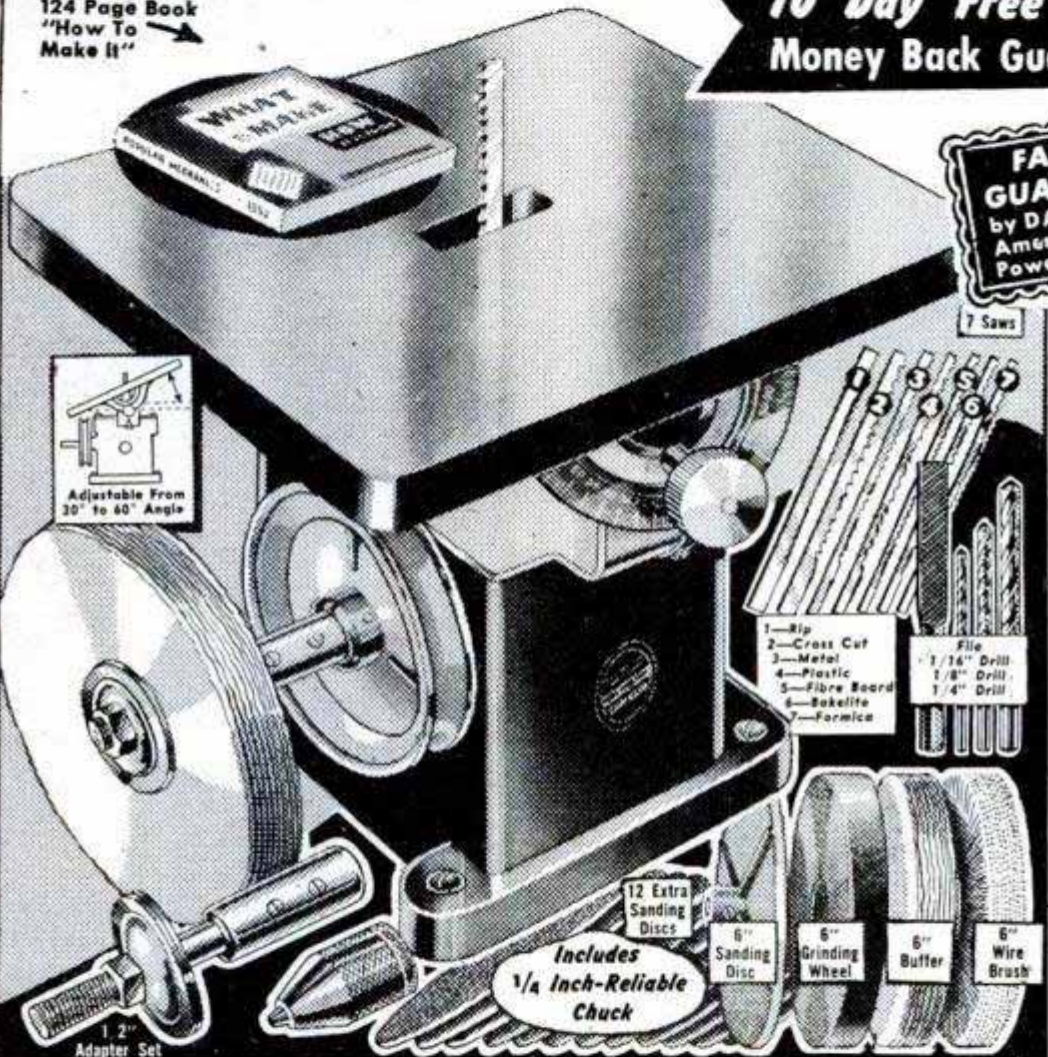
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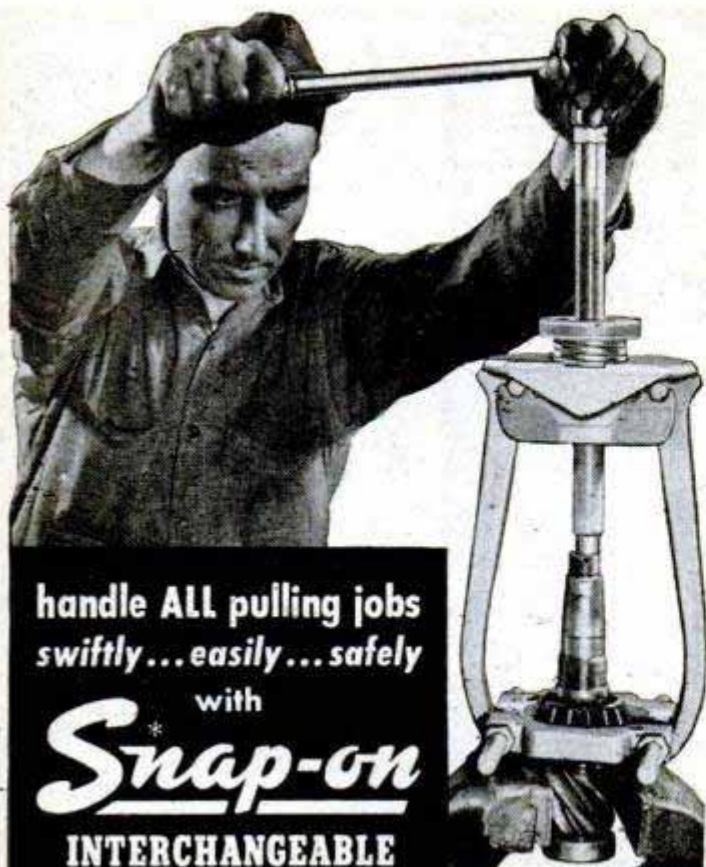
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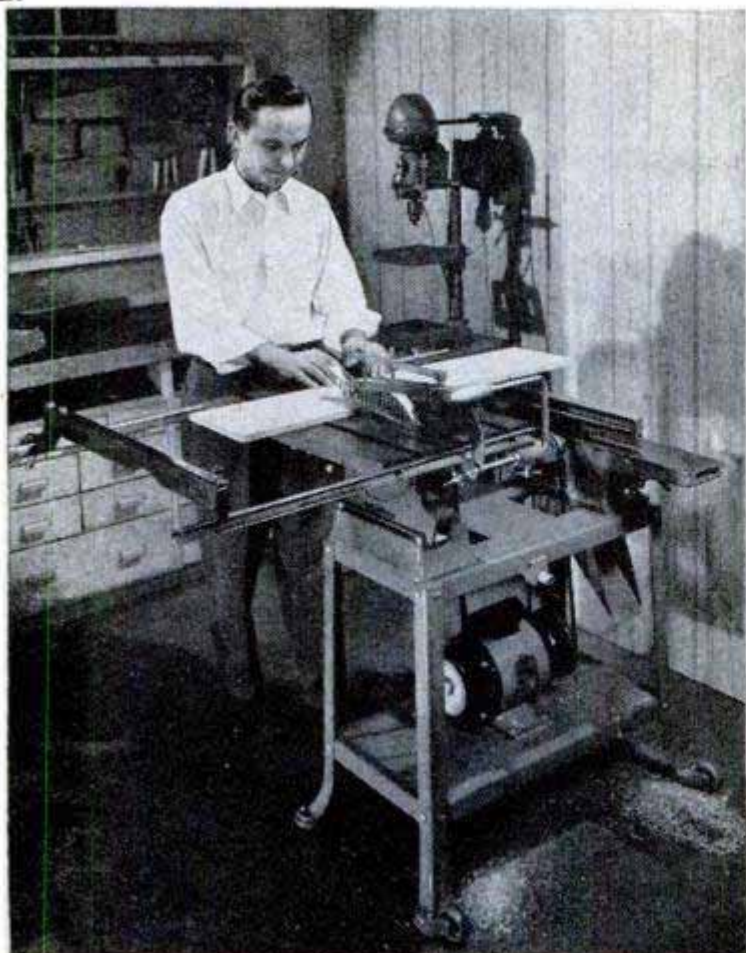
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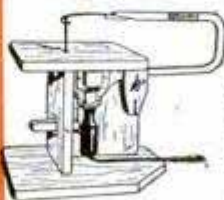
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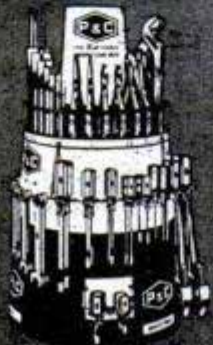
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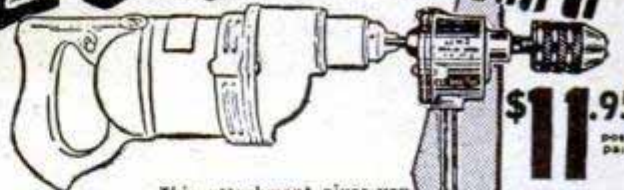
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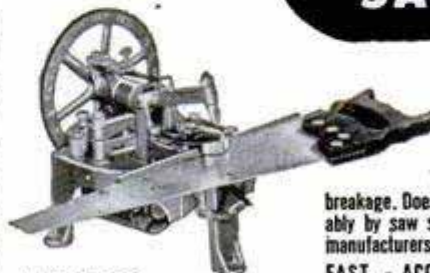
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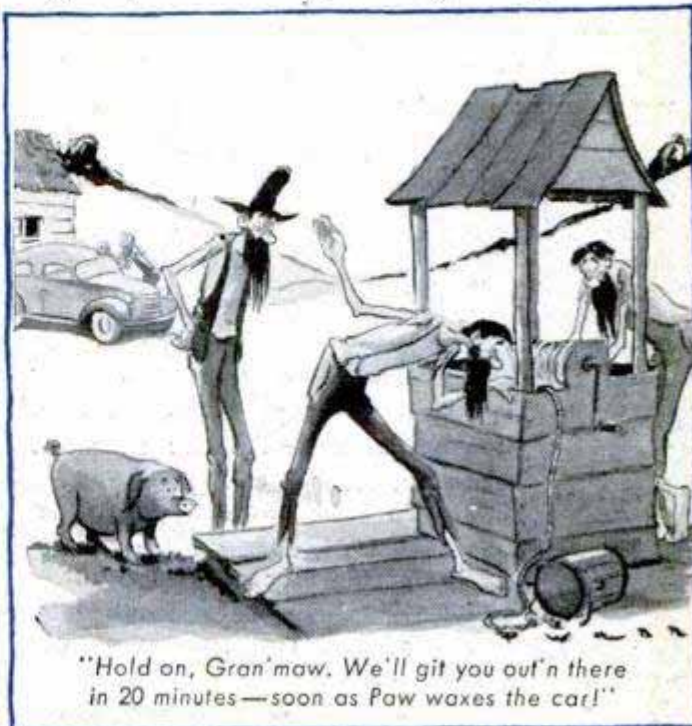


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MODERNIZE YOUR WALLS... ONCE AND FOR ALL!

# CONGOWALL

TRADE-MARK ®

LOOKS...  
FEELS...  
CLEANS..

like  
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never needs  
refinishing!

Put up Gold Seal Congowall—and your work's done for good! No refinishing, no repairing, no repainting... ever!

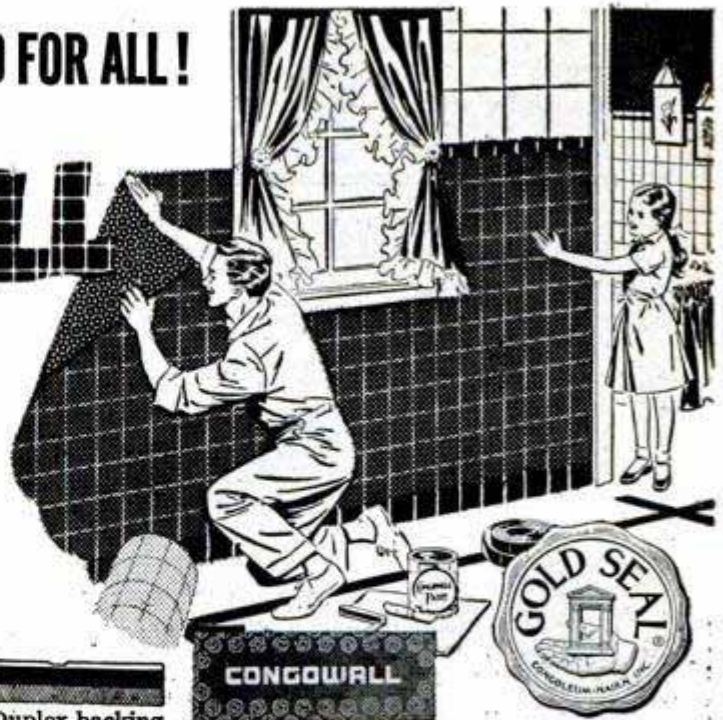
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Cost? Only about 15¢ a square foot!

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**MAIL COUPON**



Duplex backing absorbs paste... locks Congowall to wall!

Patented duplex backing identifies genuine Gold Seal Congowall.

The Gold Seal guarantees satisfaction or your money back!

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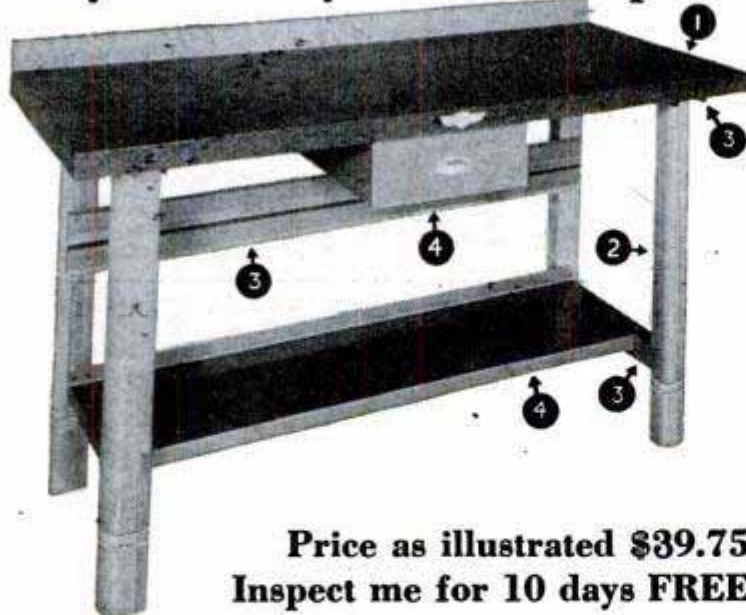
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Staze is fluid-resistant . . . contains "aquatrol," which *holds back moisture penetration.* Thus, it holds false teeth *tighter, longer.* With Staze, thousands now bite into corn and steak—enjoy all the hot coffee they want.

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● \$650,000.00 INVENTORY SALE

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● G. E. Sealed Beam air force long-life extra hi-intensity parabolic precision reflector units. 24-v, 250-w, 8" size. Equivalent 2500-w ordinary light. Use 5 in series on 110-v. for 800,000 candle-power illumination effect. Light building fronts, parking lots, ball parks, constr. jobs. Original cost, 5 units, \$39.00. SALE, 1-unit, \$1.95. 5-units, \$7.49.



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● Heil Power Winch, 15,000 lbs. with 150' 1/2" cable. Cost \$290 ..... **\$179.00**

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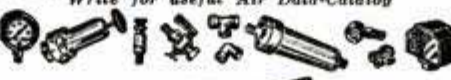
Paint, blow up tires, control termite, use in shop, etc. Build your own unit.

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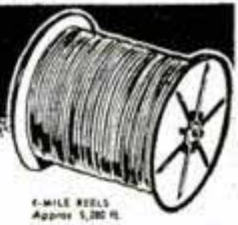


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12 inch blade. .... Only **\$1.50**

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Blowers for forced drafts, heating boosters, exhausters, coolers, dryers and dust collectors. 110 volt A.C., 50/60 cycle motors.

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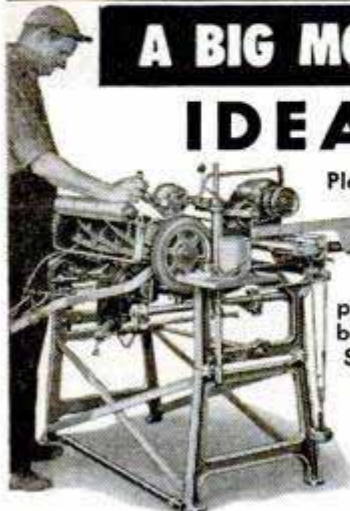
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Double drum model WINCHES, 1,000 lb. cap. Hand oper. \$ 12.95  
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**CABLE** 1/4" preformed stainless steel aircraft, 100 ft. or less.....17c/ft.  
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**SAVE OVER 50% ON THESE BRAND NEW WAR SURPLUS POWER UNITS**

**BE PREPARED for any emergency!**

**300 WATT 110-220 volt AC, 60 cycle light plant** powered by 1 HP gas engine, direct drive, mounted base, wgt. 40 lbs. Ideal for campers, P. A. systems, house trailers, etc. Equipped with handle for easy carrying \$99.00

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**2000-2500 WATT 110 volt AC, 60 cycle, slow speed generator, 5.10 HP Briggs & Stratton gas engine, NEW.....\$294.50**  
 To make 110-220 add \$40. for transformer.

**2500-3000 WATT 110 volt AC, 60 cycle, Leland generator—runs at slow speed (1800 r.p.m.) for longer life, 8.25 HP Briggs & Stratton gas engine. You can rely on this plant for all average home needs—freezer, stoker, pump, hot plate, radio, etc.—and overloads from starting motors. Reconditioned and fully guaranteed. \$295.00, NEW. \$345.00**  
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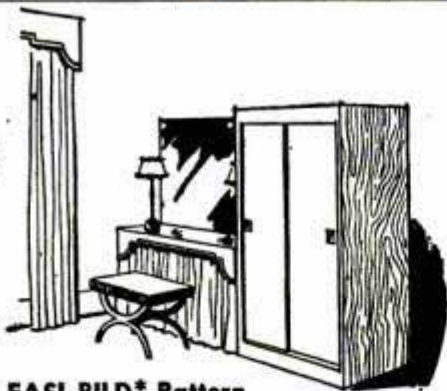
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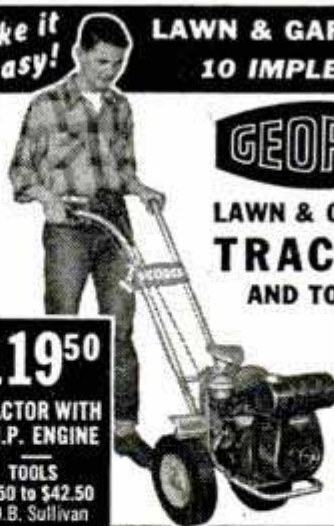
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 $\frac{1}{4}$ " to  $\frac{1}{2}$ " with  $\frac{1}{4}$ " Shanks  
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Set 35Z and 36Z will fit any  $\frac{1}{4}$ " drill.

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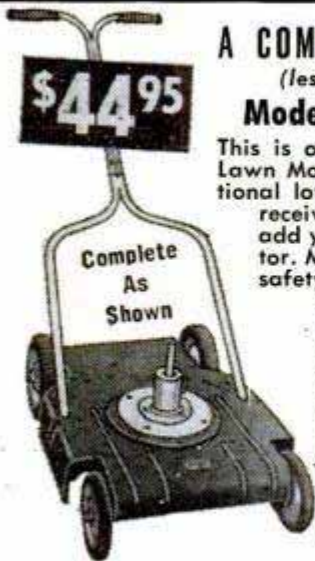
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**FOR REPAIRING ALL ELECTRICAL APPLIANCES-MOTORS**  
*an all-around electrical trouble shooter*



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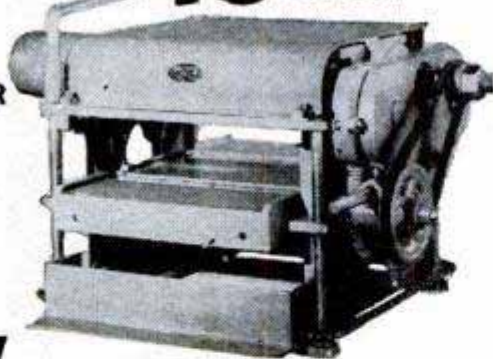
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Chemically treated, this unusually efficient shine cloth absorbs dust, leaves no oily film to catch more dust... and... makes your polish and cleaning job last over a long period of time.



**BOWES** Save time and labor with this unusually effective shine cloth.

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**10 FORWARD  
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ALL AT  
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with new **SELECT-O-SPEED** Transmission

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**DOUBLE ARC MOTION  
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For an easier, faster job of sanding, polishing around home this spring—get new "504" Synco! Its exclusive Double Arc Motion **DOUBLES** sanding action—combines best of features of orbital, straight-line sanding. Powerful yet light for easy vertical or overhead work. Gives satin-smooth, high-gloss finish. Sanding area approx. 14 sq. in. COMPLETE with new Built-In direct drive Electric Motor, 10 sand-papers, lamb's wool and fabric polishing pads. Low cost. At dealers or write for **FREE CIRCULAR**. (Dealers, Jobbers—write!)

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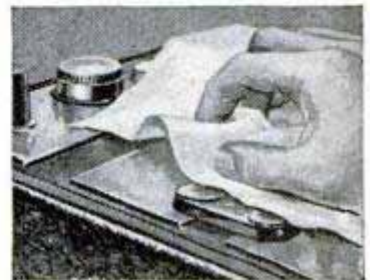
A LIGHT FOOT'S BEST

**Keep a light foot on the accelerator.**

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**PurOlator**  
(ENGINEERED FOR EVERY MAKE OF CAR)  
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**NOW! YOU CAN SAW 8 TIMES FASTER** with **ARCO SAW** OVER 100,000 SOLD

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with  
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Toss away your old handsaw!  
Convert your drill in 1 minute to a rugged PORTABLE SAW. Whiz through wood, wallboard, plastic, etc. You'll be amazed how accurately "ARCO-SAW" rips, crosscuts, bevels, dados.

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Portable 2-Cyl. Piston Type  
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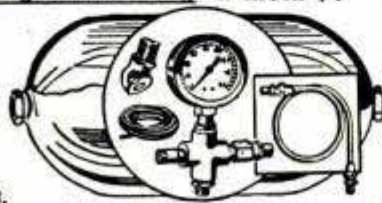
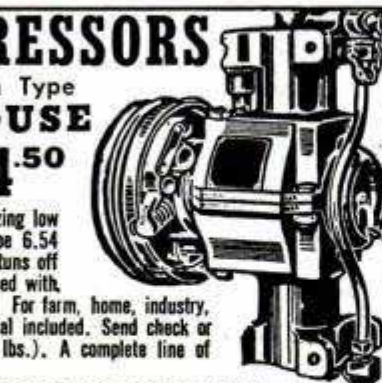
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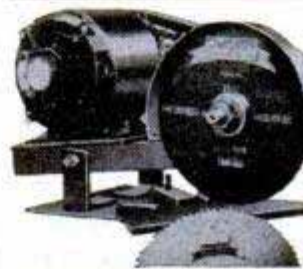
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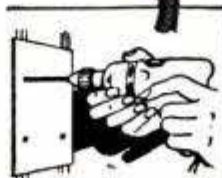
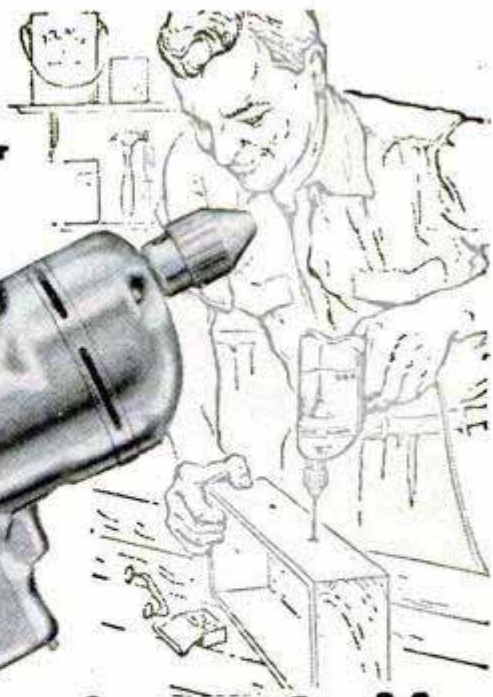
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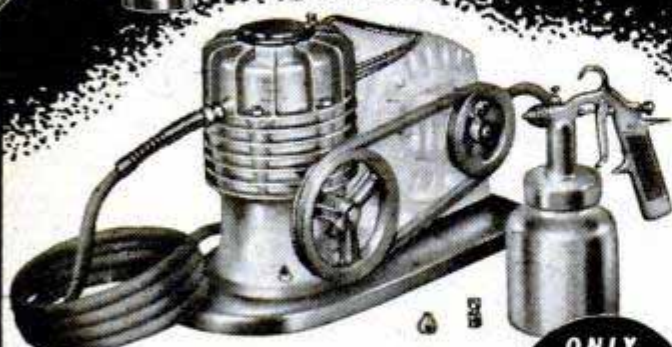
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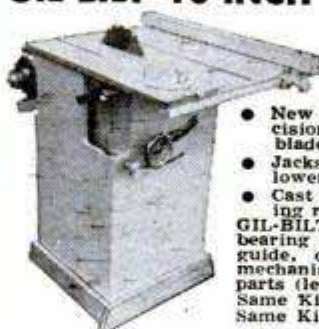
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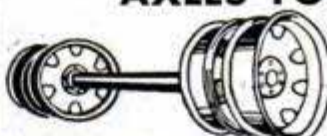
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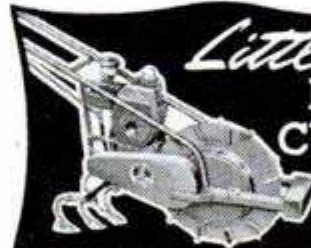
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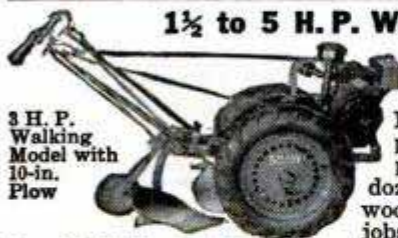


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1½ to 5 H. P. Walking Models



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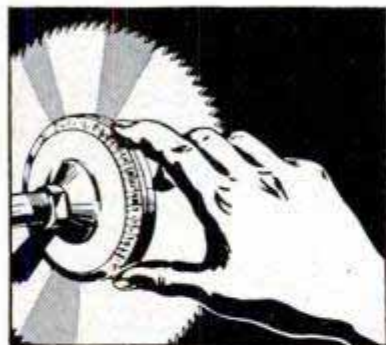
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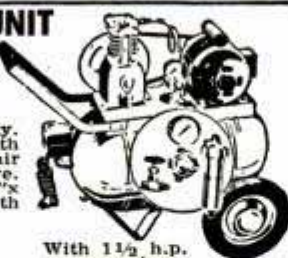
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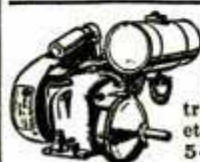
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1/4" Air Regulator. Gauge and filter. Wt. 5 lbs.

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6"x24" tank, air gauge and chuck, 30 ft. hose, pop-off valve, copper tubing with 4 brass flared fittings, 4 way cross, 3 nipples

PRICE **\$12.45**

TANK ONLY **\$6.25**

Same outfit as above with 12" x 24" stainless steel tank. 400 P.S.I. **\$19.75**

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Takes starting load off engines or motors. When speed is reached, a flip of handle shifts clutch from idling to driving position. Handles "A" belts, 2.35" pitch diameter, 5/8" bore. Ideal for use with lawn mowers, garden tractors, home workshop motors, etc. 3 1/4" long. Safe, easy to mount, sealed bronze bearings, positive action. Shpg. wt. 3 lbs. **\$7.50**

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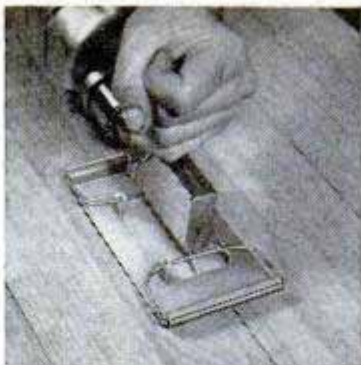


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Fits any 1/4" electric drill

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**B-T HACKSAW** fits any 1/4" drill. Takes full 5/8" stroke. Full chip clearance on any wood, metal or plastic stock. Powerful, portable — weighs 11 oz. Hacksaw only, \$4.95.

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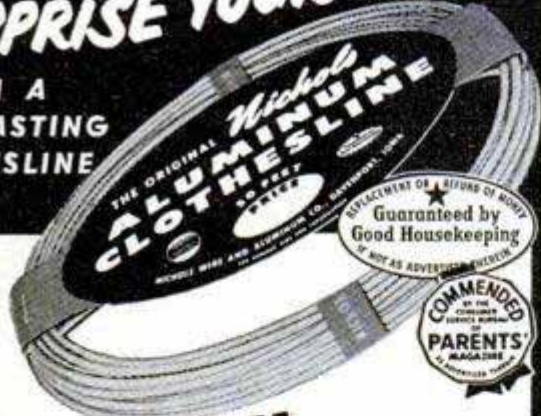
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With built-in variable flow control valve in head. Positive displacement piston type. Displaces .450 cu. in. per revolution. 2 gal. per min. cap. at 1500 RPM at 1250 PSI. Pressure limit, 1250 PSI continuous, 1400 PSI for 15 sec. Operates at 3750 RPM, intermittent maximum 4500 RPM. Rotates either direction without adjustment.

**1950**

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Will deliver maximum volume at any pressure setting between 600 & 900 PSI. Desired pressure settings obtained with adjusting screw. Pump housing serves as reservoir for system. Has built-in compressed air supercharger which makes system independent of outside atmospheric pressure. Rotation is left hand only. Maximum speed for continuous duty is 3750 RPM. Displacement is .484 cu. in. per revolution or approx. 4 GPM at 1750 RPM.

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Rust resistant, alloyed steel. Extra flexible. Pre-formed, 7 x 19 strand. On reels.

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3/32" - 5 1/2 ft.	9/32" - 15 ft.
1/8" - 7 ft.	5/16" - 16 1/2 ft.
5/32" - 7 1/2 ft.	3/8" - 18 ft.
3/16" - 9 1/2 ft.	1/2" - 20 ft.

SPECIAL 3/16" cable, 18 feet long, with turnbuckle ends. . . . 99¢

Stainless Steel Cable - Pre-Formed

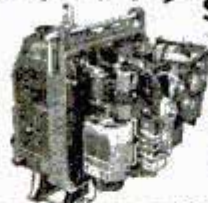
1/16" - 6 ft.	5/32" - 20 ft.
3/32" - 14 ft.	1/4" - 26 ft.

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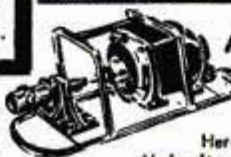
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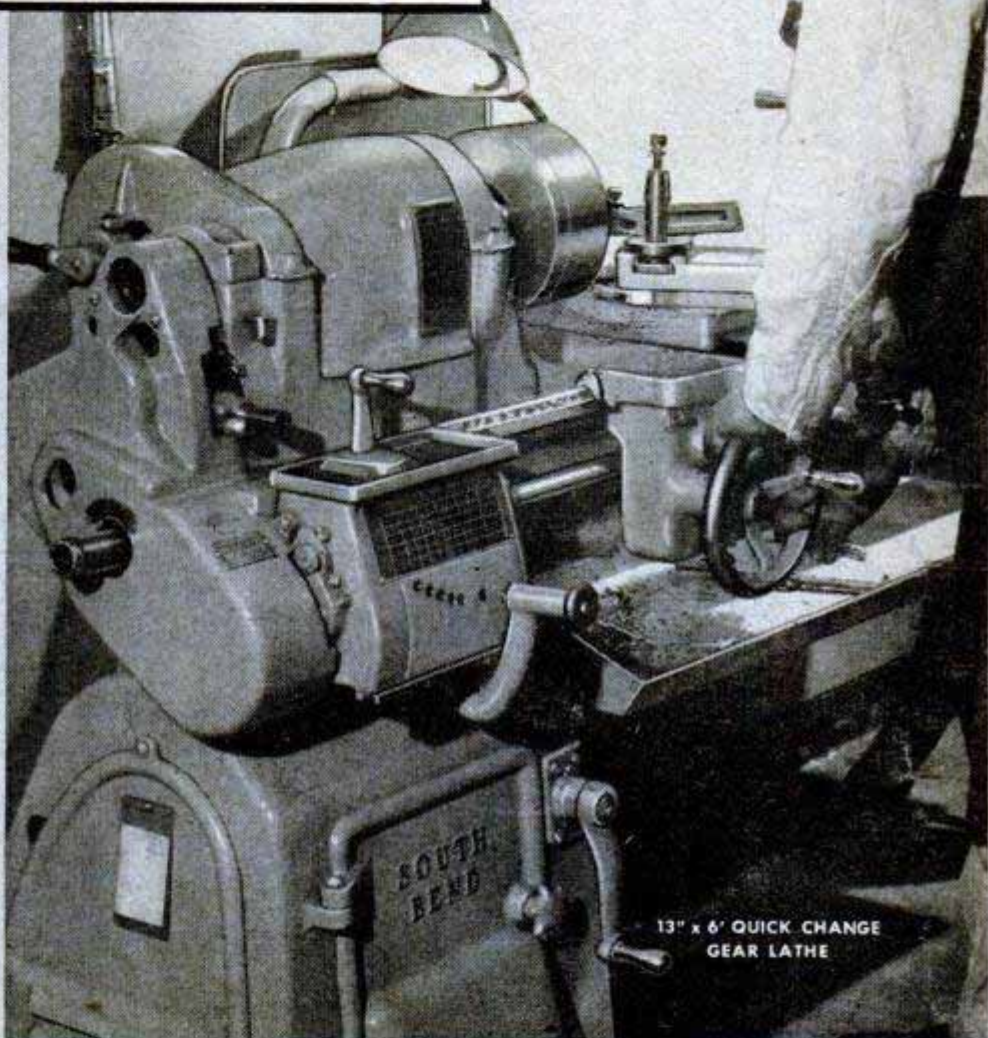
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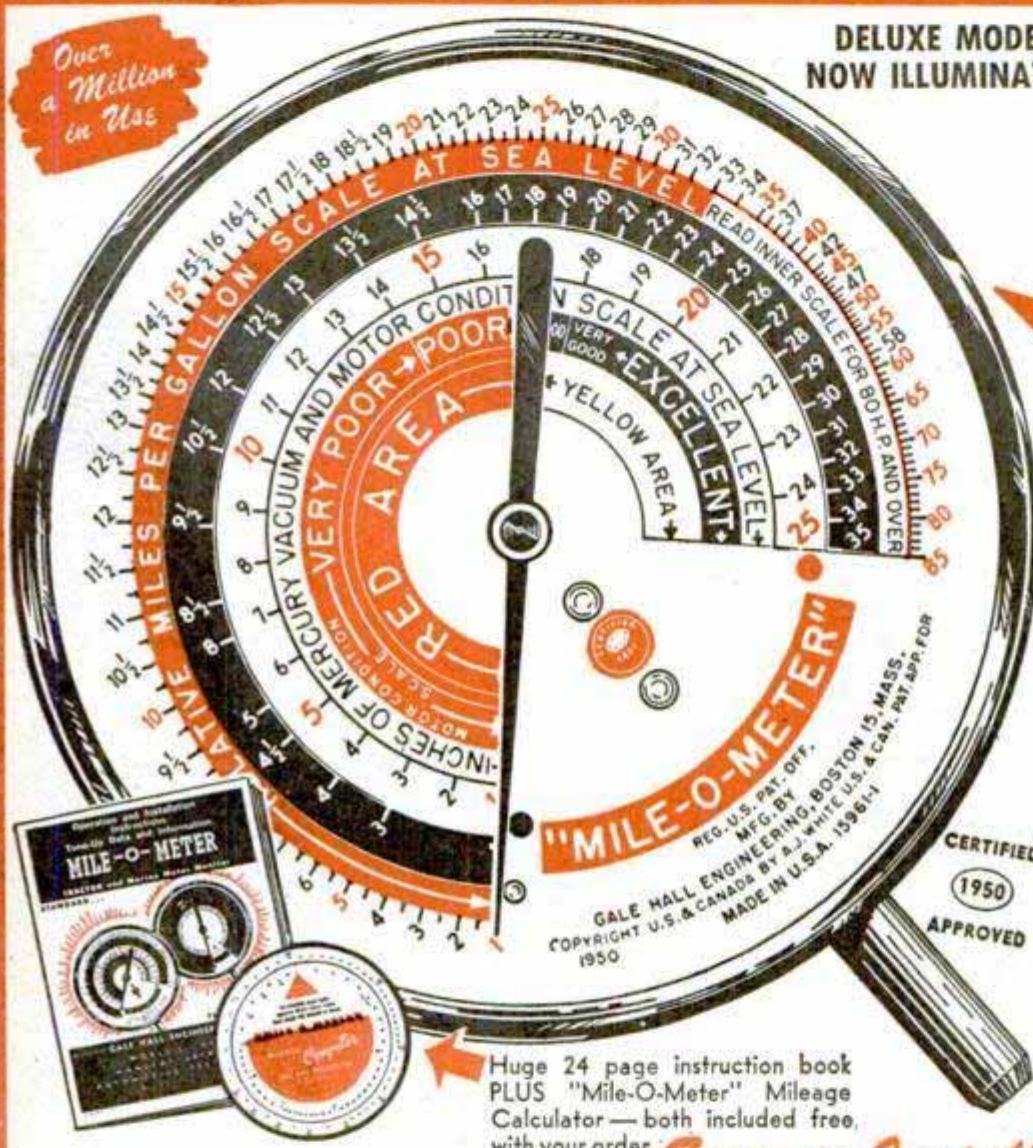
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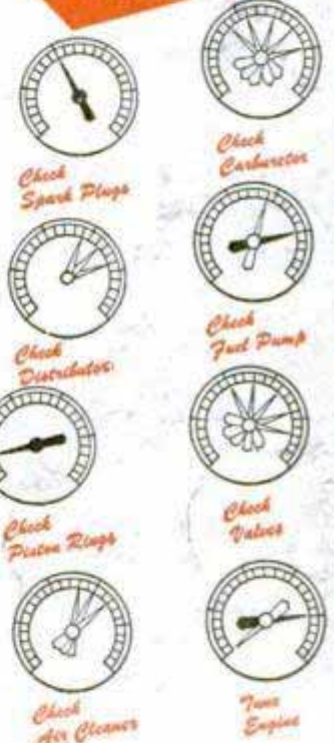
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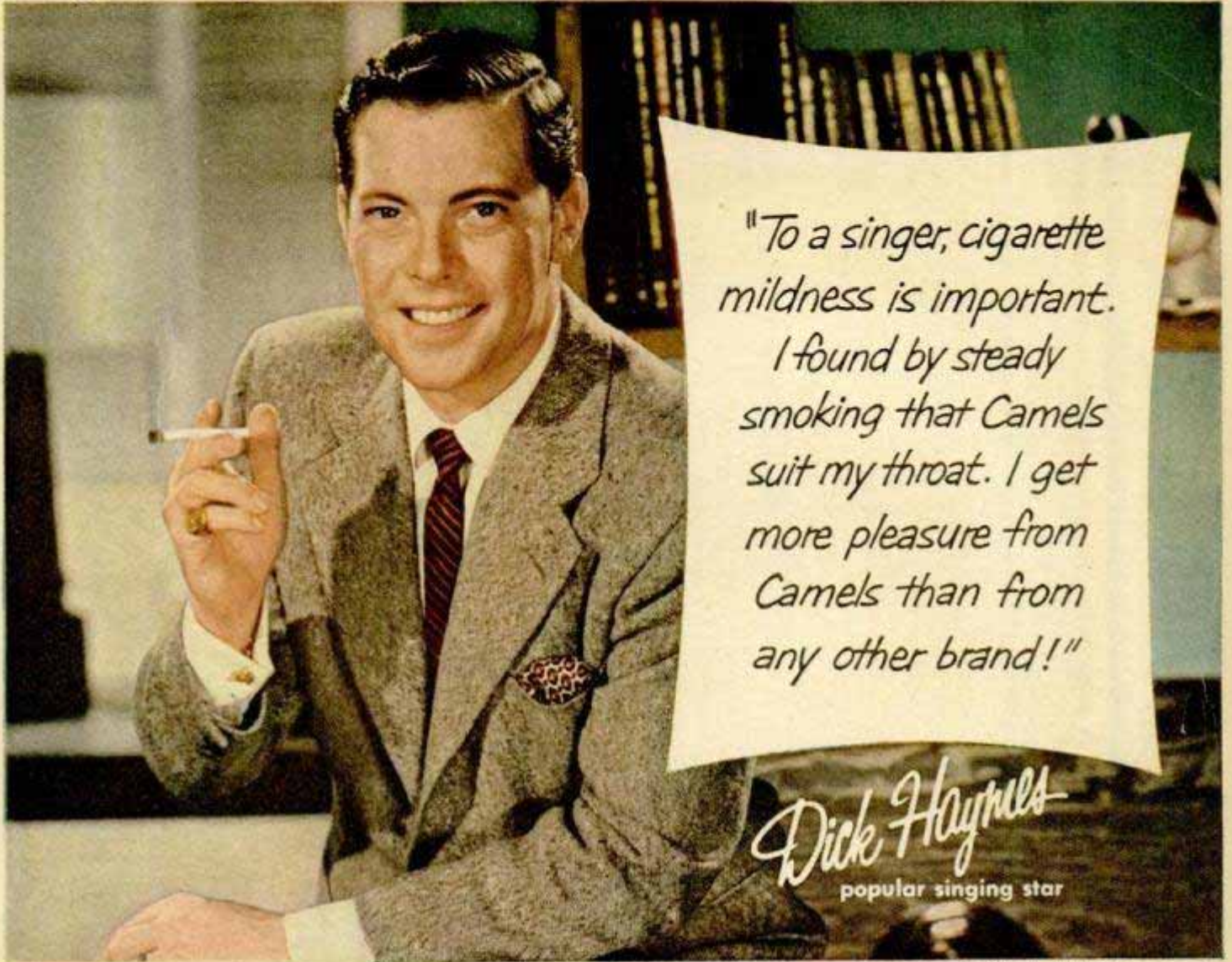
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