

STEEL OF THE FUTURE

# POPULAR MECHANICS MAGAZINE

WRITTEN SO YOU CAN UNDERSTAND IT

REGD. TRADE MARK, GREAT BRITAIN, NO. 410426

REG. U.S. PAT. OFF.

**MAY**  
**25 CENTS**

**SEE PAGE**  
**674**





**DON'T RETARD  
THE SPARK TO  
CURE "KNOCK"**



**Get the right fuel for  
high compression**

*(Only 37 seconds to read)*



Your car cannot run without gasoline. Your engine develops power only by compressing and "firing" gas.



The more gasoline is compressed before it is "fired," the greater the power each cylinder develops.

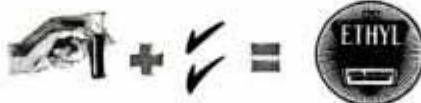


Gasoline which fails under compression causes a "pinging" sound

when you accelerate or take a grade. Called "knock," this means *loss of power and waste of gas.*



To make gasoline stand higher compression, most oil companies add anti-knock fluids (containing tetra-ethyl lead) made by Ethyl Gasoline Corporation. Special gasoline for *highest* compression is sold at pumps marked "Ethyl."



At "Ethyl" pumps you get:

- ! Enough fluid to bring out all the power of the high compression engines of modern cars—and to put new life in older cars.

✓✓ All-round quality that is doubly checked—by the oil companies and the Ethyl Gasoline Corporation—at the refinery and at the pump.



Down to 2c a gallon over regular gasoline—and 'way up above it in anti-knock value.



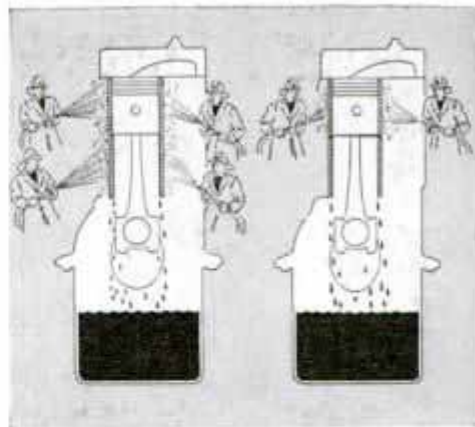
Get more power from each gallon you buy! Make the most of your car-investment!

**NEXT TIME GET ETHYL**



# Why Modern Cars "Live" so Long—

NEW DEVELOPMENTS OF RESEARCH  
PROVIDE AMAZING DEPENDABILITY IN  
CARS OF TODAY



FULL-LENGTH water jackets give sure cooling . . . reduce oil temperatures.



FROM BUMPER to bumper the 1936 Plymouth is built to stand up.

THE NEW PLYMOUTH is an impressive example of advanced automotive engineering.

Floating Power engine mountings—and a balanced four-bearing crankshaft, eliminate the usual wear of vibration.

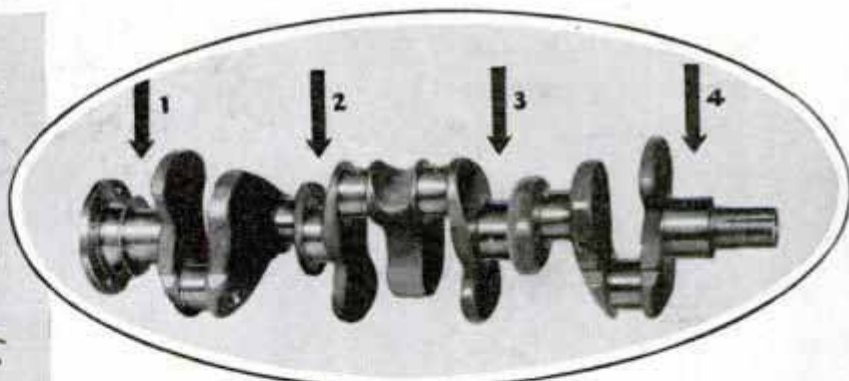
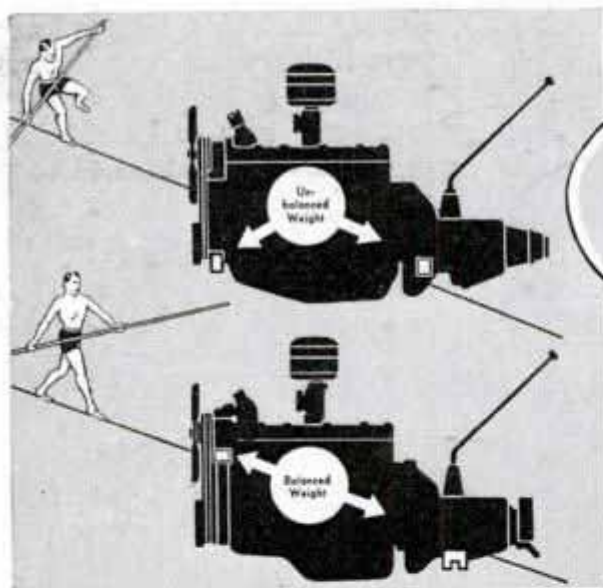
Full-length water jackets plus full-pressure lubrication saves oil . . . lengthens engine life. Air cooling prolongs clutch life . . . makes it 30% easier to operate.

Plymouth's All-Steel Body

and extra rigid frame give greater safety and durability. 100% Hydraulic Brakes are always equalized . . . save adjustment.

There are dozens of long-life features exclusive to Plymouth in its price range. Drive this big car yourself! Ask any Chrysler, Dodge or De Soto dealer. Prices are only \$510 and up (list at factory, Detroit, special equipment extra).

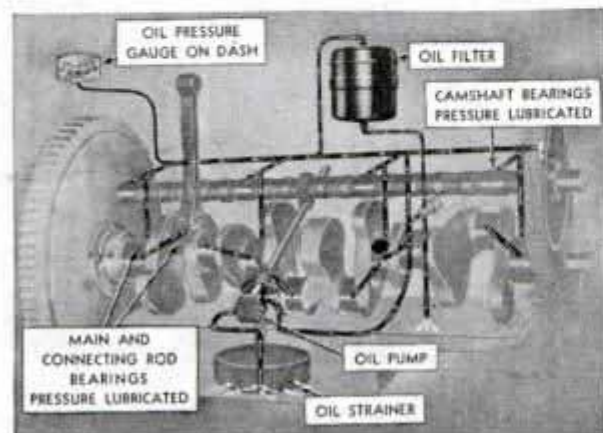
Plymouth Division of Chrysler Corp.



PLYMOUTH has four main bearings—not three as are found in many low-priced cars. These eliminate deflection and vibration.

(Left) ORDINARY ENGINE—off balance. Floating Power—in balance.

(Below, left) FULL PRESSURE lubrication protects moving parts at all times. Leaves nothing to chance.



Insist on the  
Official Chrysler Motors  
Commercial Credit Company

6% TIME PAYMENT PLAN

Available through all PLYMOUTH Dealers  
Pay \$25 a month—including everything  
You pay for credit accommodation only  $\frac{1}{2}$  of 1% per month on your original unpaid balance. To arrive at your original unpaid balance: **1.** Add cost of insurance to cost of car. \* **2.** Deduct down payment—cash or trade-in. Result is *Original Unpaid Balance*. \*(In some states a small legal documentary fee is required.)



SILENT CHAIN camshaft drive . . . more expensive—more efficient! Another example of quality.



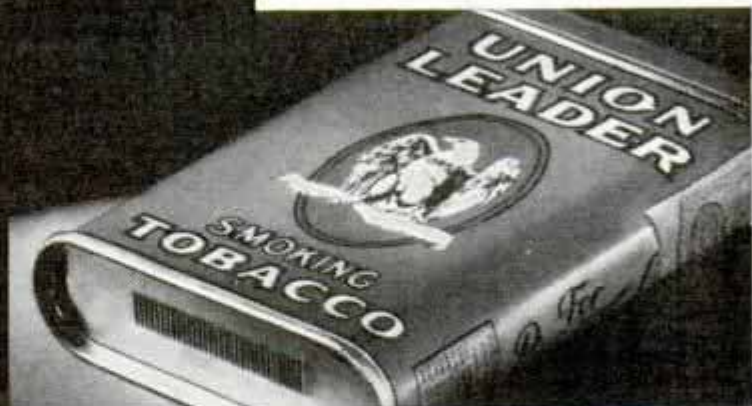


**HOW CAN A  
DIME  
BUY MORE?**

asks *HAM FISHER*.

**T**HE quick reply, Mr. Fisher—to your query is, “It can’t be done!” Don’t you know that Union Leader’s biggest boosters are men who once demanded the best regardless of cost? These experienced buyers of fine tobacco rate this mellow *old* Kentucky Burley far above its modest price. Now we ask *you*, wouldn’t it be foolish for any man not to gamble a dime to win the “best bet” any pipe smoker ever collected? (And it’s great for cigarettes, too!)

© P. Lorillard Co., Inc.



HAM FISHER, Union Leader smoker, and famous creator of “Joe Palooka”

**UNION LEADER**



**THE GREAT AMERICAN SMOKE**

*When writing to advertisers please mention Popular Mechanics*



# Popular Mechanics Magazine

H. H. WINDSOR, Founder

H. H. WINDSOR, Jr., Editor and Publisher

May, 1936

Vol. 65, No. 5

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## Modern Wonders of an Ancient Art

**M**ORE than three thousand years ago, someone heated a batch of minerals, producing a glass-like coating which he found could be fused to metal. The result was porcelain enamel, the finish which today protects your bath tub, refrigerator and gas range. Yet, despite its hundreds of uses, we are just beginning to realize the ultimate possibilities of this union of glass and metal. Homes, furniture and even trains are being constructed today of porcelain enameled metal. Read in the June issue the first of two articles describing new uses for this age-old product. Eight pages of Coloroto pictures illustrate the story.

## Next Month

**F**ISH, it seems, are finicky. That's why there are as many kinds of rods, reels, lines and lures as there are kinds of fish to be caught. Next month Bob Becker tells you how to select your fishing tackle. His article is full of tips for the beginner and some new stunts for veteran anglers.

## Tree-Climbing Tigers

**T**IGERS won't climb trees. That's what the natives of British India told Capt. John D. Craig when he went to the jungles to make moving pictures. So Capt. Craig felt secure on his perch in a tree with a very angry tiger below. Then the tiger did what the natives said was impossible. It climbed the tree, shook the captain off his limb—and the finish is just as dramatic as the end of Capt. Craig's story of hunting sunken treasure this month.

## How Safe Is Flying?

**I**F YOU are timid about flying, consider that insurance companies which make a business of estimating your chances of accident have found you are safer riding in the cabin of a modern commercial air liner than when driving your automobile. An article in the June issue describes the latest safety devices employed to minimize your chances of an accident even further.

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This One



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# ALL NEW CARS NEED SIMONIZ

Whatever make of car you have, be sure to Simoniz the finish. It keeps new cars looking new for life. Makes old cars look like new again. And no type of finish can be expected to last long and stay beautiful without the all-weather protection of Simoniz. So Simoniz your car—the sooner, the better. Get world-famous Simoniz and Simoniz Kleener today. Insist on them for your car! They're faster, safer, easier to use. Inexpensive! Dependable!



*Motorists Wise*

# SIMONIZ

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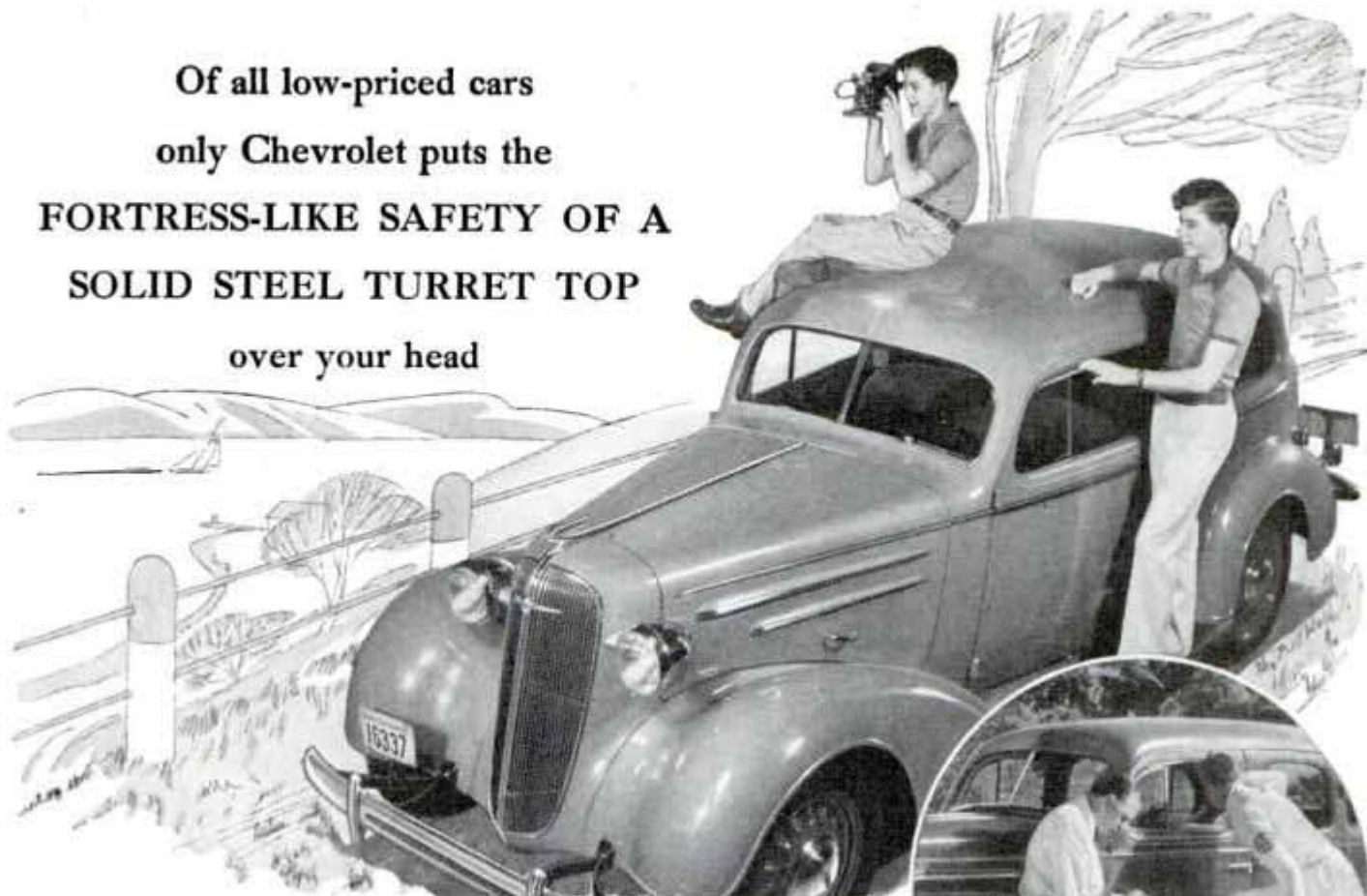
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Of all low-priced cars  
only Chevrolet puts the  
**FORTRESS-LIKE SAFETY OF A  
SOLID STEEL TURRET TOP**  
over your head



Chevrolet's Solid Steel one-piece Turret Top is reinforced by sturdy bows of heavy gauge steel. Similar reinforcing members are used at other points throughout the body.



Even the floor is formed from one piece of solid steel. You are protected overhead, on all sides and underfoot in the new Chevrolet.



Chevrolet has gone to extraordinary lengths to build *safety* into every part and feature of the beautiful new Chevrolet for 1936. The top of this car, for example, is the world-famous Turret Top—a solid sheet of seamless steel—a fortress of protection over your head. The cowl, the rear panel, the two side panels and the floor also are steel, heavily reinforced to give maximum strength and rigidity. This Turret Top construction—like New Perfected Hydraulic Brakes, Knee-Action\*, Shockproof Steering\* and many other important features—is exclusive to Chevrolet in its price range. It typifies Chevrolet's policy of giving you and your family that extra motoring safety which is so important today and which you naturally expect to find in the *only complete low-priced car*. CHEVROLET MOTOR CO., DETROIT, MICH.



Cooler in summer, too! A series of temperature readings taken under the tropical sun of Key West proved that Chevrolet's Solid Steel Turret Top gives much better protection against heat than ordinary fabric tops. Kaye Don, British sportsman, and Bill Cummings, national racing champion, assisted the A.A.A. observers who supervised the tests.

#### TEMPERATURE TEST

Take a piece of top fabric about six inches square, place it on a piece of headlining material, and put them out in the sun on a hot day—with an ordinary thermometer under them. Do the same with a piece of highly finished steel and a piece of headlining material. Then read the thermometers!

*Only Chevrolet brings you these five other famous features so important to complete motoring satisfaction*  
**NEW PERFECTED HYDRAULIC BRAKES..IMPROVED GLIDING KNEE-ACTION RIDE\*..GENUINE FISHER  
NO DRAFT VENTILATION.. HIGH-COMPRESSION VALVE-IN-HEAD ENGINE.. SHOCKPROOF STEERING\***

*\*Available in Master De Luxe models only.. Knee-Action, \$20 additional.*

*The only complete low-priced car*

# CHEVROLET

A GENERAL MOTORS VALUE

When writing to advertisers please mention *Popular Mechanics*



*Now Better than Ever*

# IMPROVED PYROIL

**Different in Color, Greater  
in Benefit and Results**

—Yet essentially the same product that was used by Sir Malcolm Campbell, by Barney Oldfield, by winners of the 1933, 1934 and 1935 Indianapolis 500-mile auto race—used by millions—tested, proved and found to markedly increase power and performance; reduce wear; increase mileage; reduce repair expense and to provide an unusual protection against common damage dangers to bearings, gears, valves, pistons and other vital engine parts.

Pyroil keeps abreast of steady improvement in automobile manufacture—the use of alloy metals—and improvement in lubricant refining processes. Not just a "graphite oil" although it contains colloidal graphite. Not just a "break-in" oil: it does not accelerate wear. Pyroil's color is now a dark wine red.

**FREE: INTERESTING AND IMPORTANT INFORMATION FOR EVERY CAR OWNER AND MACHINERY OPERATOR.** This is in chart, photomicrographic and understandably written form and will be sent free on request to any inquirer. Mail the coupon below at once!

Meanwhile, insist on Genuine Pyroil at your service station, garage or other dealer. Manufactured and Guaranteed by Pyroil Company, W. V. Kidder, Founder, 55 Pyroil Bldg., LaCrosse, Wis., U.S.A.

**Pyroil has been tested by Popular Mechanics and is used by Popular Mechanics' Presses and Equipment.**

**DISTRIBUTORS** — For an unusual business opportunity, check coupon below.

**Genuine Pyroil (patent protected) Bears This Signature on Every Can.**



*W. V. Kidder*  
Founder

PYROIL COMPANY  
55 Pyroil Bldg.,  
LaCrosse, Wis., U.S.A.

Please send Free charts, photomicrographs and reports showing Pyroil's unusual efficiency.

Please send details of the Pyroil Sales Opportunity.

Name.....

Address.....

City.....County.....State..



**Simply ADD TO GAS OIL AND GREASE**

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# TODAY... Almost Broke!



Yet tomorrow Tom Smith will be on his way toward being a really successful man . . .

SOMEWHERE there is a Tom Smith—that name is as good as any—who is practically flat broke, back on his heels and discouraged today. Perhaps he's in debt. Perhaps, as far as his job is concerned, he's in a rut. Perhaps he's just a victim of these trying times. Yet—he still has vision, imagination. And—ambition. He still believes that he's going *somewhere* . . . somehow, some way, some time. He hasn't given up hope. He still believes in success and opportunity.

Tom Smith will read this advertisement. No—there is a better way of saying it. Tom Smith *will study* this advertisement. He will read it once, then again, then yet again. It will strike a responsive chord somewhere within him. It will stir his dormant ambition, give wings to his imagination, set his vision afire. And he will *act!* As though Hope—as swift and powerful as lightning when it strikes—had suddenly taken possession of him, he will take advantage of the opportunity this advertisement offers him. And then—

Six months from now, his friends will say, "Have you heard about Tom Smith? Yes—just got a new job with an increase in salary." And two years later, the business journals in his field may report, "Thomas Smith Appointed Manager." And five years . . . or ten . . . or fifteen years hence, the sign on his office door may read "Thomas Smith, President."

All because Tom Smith had the vision, the imagination, the ambition, to recognize the significance of this advertisement. Because he had the foresight to see that here was his way to opportunity.

\* \* \*

This page advertises the training of LaSalle Extension University. It is a unique university in many respects.



It utilizes Uncle Sam's postal service in its contacts with its students. It is the university for those men and women who work by day in every type of business and profession. It is the university of the clerk ambitious for success in accountancy. It is the university of the business man with an eye upon an executive position. It is the

university of men and women, young and middle aged, who wish to become accountants, bankers, sales managers, traffic experts or specialists in some one of twenty different fields. In short, it is the university for ambitious people, determined to succeed, who recognize that only by thorough specialized training can they reach their objectives.

In the history of LaSalle Extension University, there have been more than 850,000 such men and women. They have gladly substituted night hours of study for night hours of aimless pleasure. They have sacrificed hours of minor enjoyment to reach years of major success. They have studied hard—accumulated the accurate, comprehensive and practical training LaSalle offers by its famous Problem Method—thus wresting from Life the success which long before many had thought was not for them.

The LaSalle Method is comprehensive, yes. It is accurate, up-to-the-minute and alive. It is invaluable training. But above all things, it is a Road Toward Success. It is not an easy road. It is not the road for sluggards, for those who refuse to sacrifice and work. Rather, it leads to their destination only those who have the will to *finish* what they have once *begun*.

\* \* \*

Perhaps you think that prophecy of Tom Smith's career mentioned above is pure fantasy. Perhaps you feel it is solely the product of an advertising writer's imagination. If such are your beliefs, you are wrong. For that prophecy is based upon past experience—

The past experience of thousands of discouraged Tom Smiths who read just such an advertisement as this years ago. Tom Smiths with vision and ambition and imagination who accepted LaSalle's offer of one of the booklets listed below. And—who found the booklet so intriguing, so full of hope, that they enrolled in LaSalle . . . and as the months passed, they found themselves rising out of their rut, reaching toward more attractive and better-paying jobs. Finally, achieving rich and deserved success in their chosen lines.

Tom Smith, wherever you are, whoever you are, whatever are your ambitions—here is your opportunity! Are you going to pass it by?

**LA SALLE EXTENSION UNIVERSITY, Dept. 564-R, Chicago**

I am in earnest about my success and I would like to have your special booklet—without any cost or obligation to me—about my opportunities and your success training in the business field I have checked.

- |  |  |
|--|--|
| <input type="checkbox"/> Business Management   | <input type="checkbox"/> Industrial Management   |
| <input type="checkbox"/> Higher Accountancy    | <input type="checkbox"/> Modern Foremanship      |
| <input type="checkbox"/> Traffic Management    | <input type="checkbox"/> Personnel Management    |
| <input type="checkbox"/> Modern Salesmanship   | <input type="checkbox"/> Business Correspondence |
| <input type="checkbox"/> Commercial Law        | <input type="checkbox"/> Business English        |
| <input type="checkbox"/> Law: Degree of LL. B. | <input type="checkbox"/> Effective Speaking      |
| <input type="checkbox"/> Expert Bookkeeping    | <input type="checkbox"/> Office Management       |
| <input type="checkbox"/> C. P. A. Coaching     | <input type="checkbox"/> Stenotypy               |

Name.....Age.....

Position.....Address.....

**LaSalle Extension University**

When writing to advertisers please mention Popular Mechanics

Ask for one of these booklets—or a similar one on your own field of business. They are free!







# In a Malayan Jungle I made my Strangest "Find"

by Frank Buck

Author of "Bring 'em back alive"

TRAPPING and handling ferocious animals is no joke, but I'd rather face a wild beast any day than shave with a shoddy razor blade.

That's why it was almost tragic when I ran out of Gillette blades a few months ago up in the jungle of Negri Sembelin. But I found them in a native trading post, located on a bullock-cart trail leading into a dense Malayan jungle. I didn't know then why the Gillette blade stands head and shoulders above all others—why it gives me clean, easy shaves under all conditions. That was before I visited the Gillette factory in Boston, and got the surprise of my life!

I never dreamed it took so much care to produce the Gillette blade. I saw the finest Swedish steel put through one elaborate process after another. I saw them perforated, hardened, tempered, ground, honed, stropped and cut into individual blades by machines that are almost unbelievably accurate. I met skilled technicians who supervise the ingenious scientific devices that constantly check and double-check for quality. I couldn't imagine such rigid inspection.

Yes, these blades seem to be examined as closely as a bacteriologist searches for microbes on a slide. And after the final inspection the blades are sprayed with a special antiseptic and placed in their sanitary waxed paper wrappers.

Now I know why I can shave every day, in the jungle or out, and actually enjoy it! And that goes whether I buy my Gillette blades in New York, London or Paris—Calcutta, Singapore or Shanghai. They're equally sharp and smooth-shaving. No wonder wild animals can't keep me from shaving with Gillette blades.

*Here are the facts about razor blades. Why let anyone deprive you of shaving comfort by selling you a substitute! Ask for Gillette Blades and be sure to get them.*

**GILLETTE SAFETY RAZOR COMPANY, BOSTON, MASS.**

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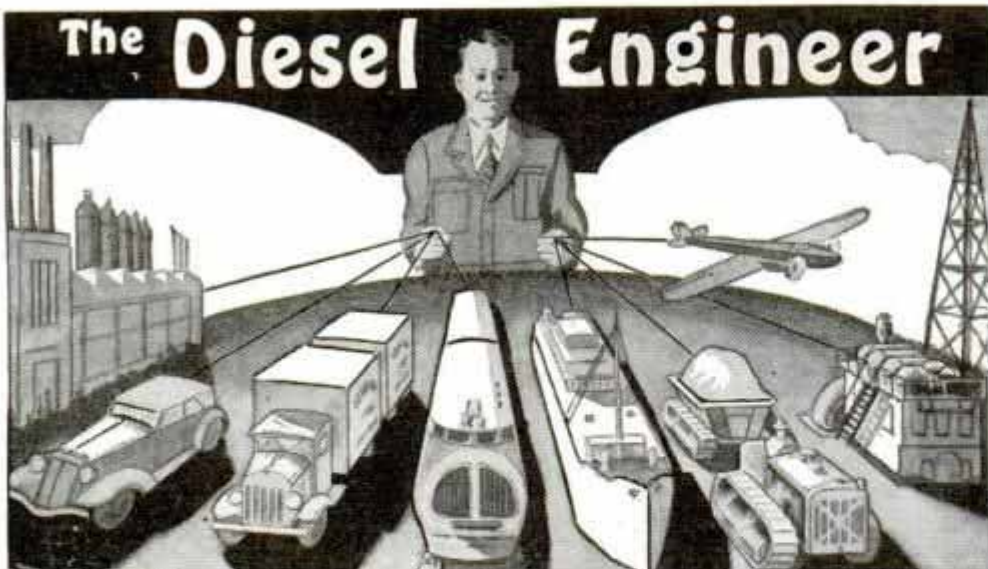
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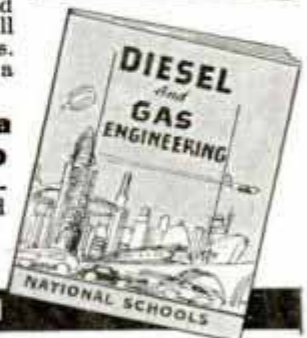
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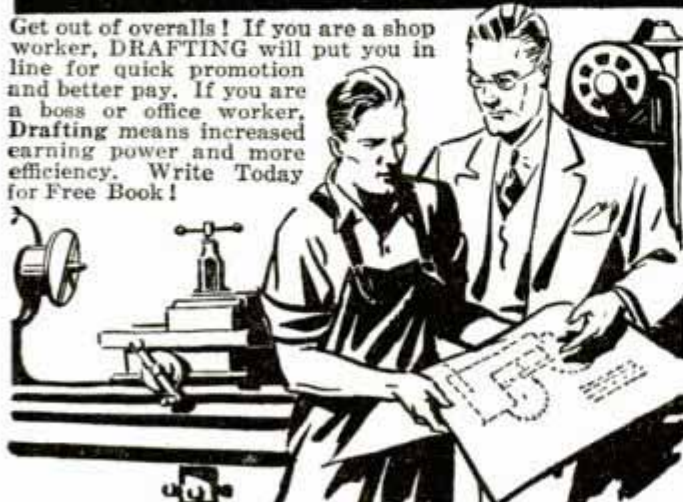
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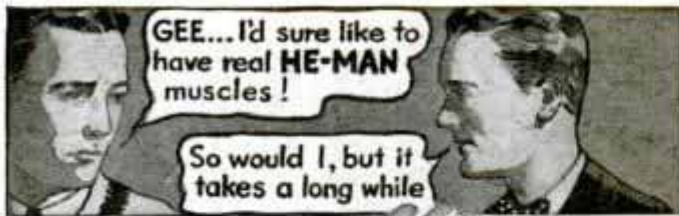
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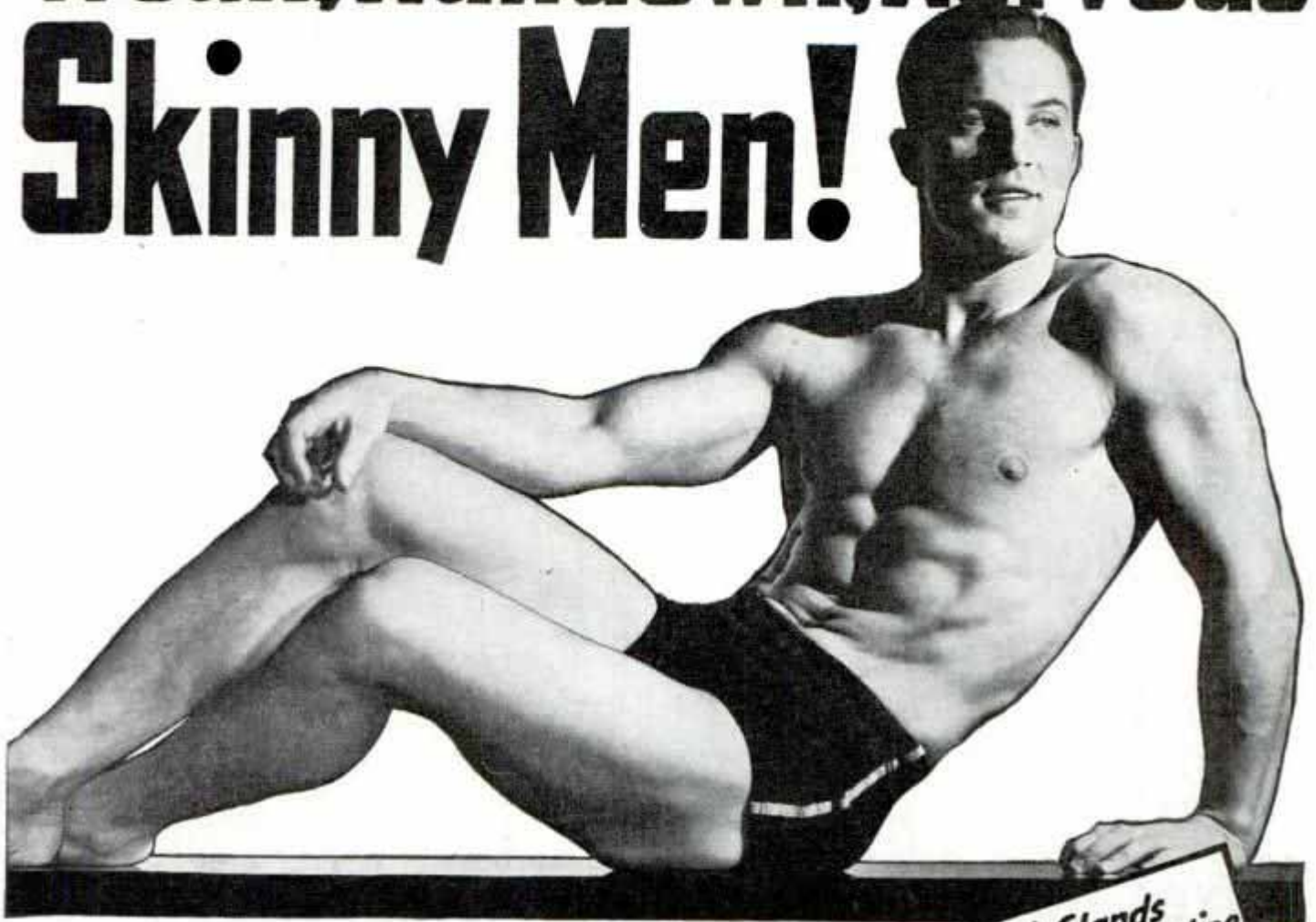
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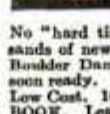
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"Show them you can dance as well as they!" my pride whispered.

But halfway across the hall my courage died. There she was, waiting expectantly—Marion Blake, an exquisite dancer. Suppose she should refuse?

## The Unexpected Happens

"I'm—I'm sorry"—I stammered. "I guess—"

"Why, of course. I'll be glad to dance!" And before I realized it we were swallowed up in the dancing throng.

What a terrible ordeal it was. And twice as bad for her. I stumbled through the steps. I trod on her toes. Suddenly she suggested that we sit out the rest of the number. "Now it's coming!" I thought. "Jim," she began softly. "I'll be frank. You're not the best dancer in the world. What you need is 'brushing up' on the latest steps. Why don't you get in touch with Arthur Murray?"

"Arthur Murray!" I exclaimed. "He teaches dancing by mail. You can't learn that way!"

"No?" smiled Marion. "That's exactly the way I learned."

If Marion could become a wonderful dancer that way it was certainly worth investigation—especially since I didn't risk a penny.

What a surprise the lessons were! In a few evenings I had learned the modern Waltz—the modern Fox Trot, and many delightful variations of the very latest steps—without music, partner or teacher.

## I Turn the Tables

A week later I attended a dance. The old crowd was there. "Here he is again!" they chorused. "Give him the cigars! He earned them!" Imagine how surprised they were when I asked Marion to dance! They stood open-mouthed as I glided around the floor like an expert!

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# INVENTIONS



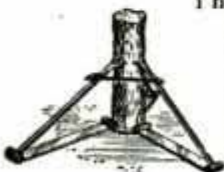
## INTERESTING INVENTIONS

The world moves on. Above is the giant Martin China Clipper Ship, designed and built by the Glenn L. Martin Company, to carry mail and passengers across the Pacific Ocean. In this luxurious super air liner are embodied many inventions. But in a few years even this magnificent bird will be obsolete.

Here you see an ingenious small invention. This little bottle decapper was exhibited at the last Bottler's Convention in Baltimore. Makes unnecessary the use of a bottle opener to remove the cap from a ginger ale or beer bottle. Simple, but think of its great commercial possibilities.



Remember last Christmas? Then you will recall the usual struggle with the Christmas Tree. This recent invention by a woman, Mary Peskulich of California, will do away with all that. Another simple gadget that should appeal to many.



**W**E HEAR a lot about the great inventors—Bell, McCormick, Pullman, Kettering, Atwater Kent, and others. But as a matter of fact, most of the articles that we see and use everyday of our lives, came to us from people that we never heard of at all. Walk through any dime store and notice the number of simple gadgets that are marked "Patented" or "Patent Pending." Someone had a bright idea—and *did something about it*. For every big startling inventive development like radio, the automobile or the aeroplane, there are thousands of simple little articles that find their way to the markets, and pay their inventors a profit.

Whether the invention be large or small—simple or complex—one thing is certain, in order to profit the **INVENTOR MUST DO SOMETHING ABOUT IT**. The world does not reward the man who keeps his ideas locked up in his brain. The old saying that: "He who hesitates is lost" is all too frequently true where inventive matters are concerned.

The question is what to do and how! The answer, fortunately, is usually simple enough. It is given fully in the two booklets shown here. In thirty-six years of experience, we have acquired a wealth of practical, helpful information which the average man with an invention, or an idea for one, can put to practical use. This information comes to you in the booklets shown on the next page.

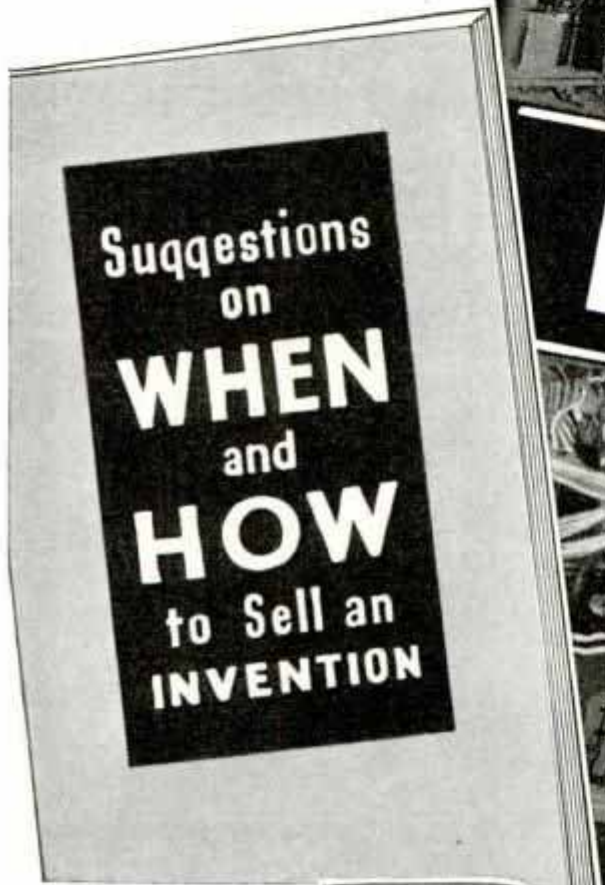
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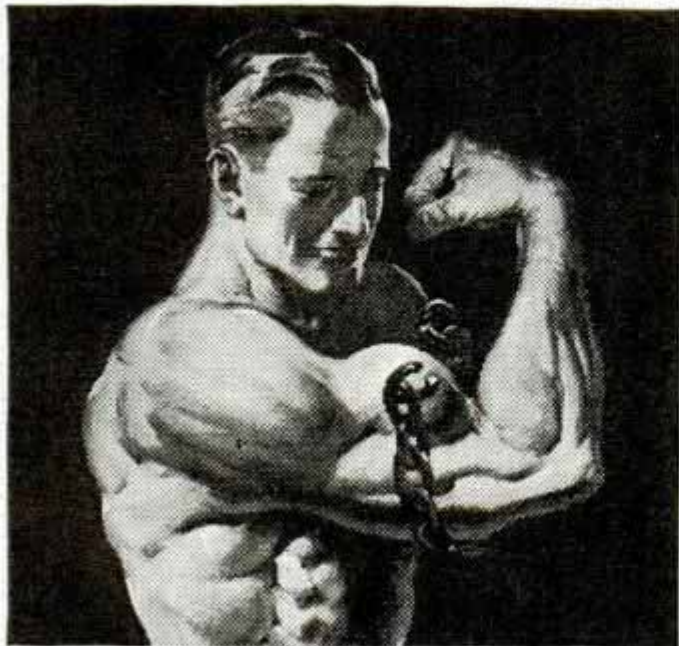
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(Continued to page 35A)

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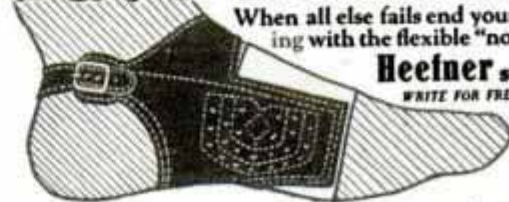
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## The Editor's MAIL BAG

(Continued from page 29A)

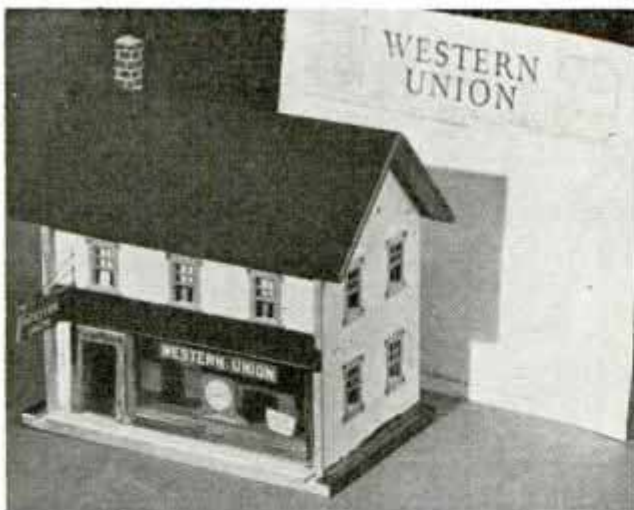
the breeze be strong enough to stretch it perfectly and absolutely unvarying in strength and direction. The flag does wave because these conditions never can be realized."—C. A. Heyser, Elkins Park, Pa.

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### "Shop Notes" Booster

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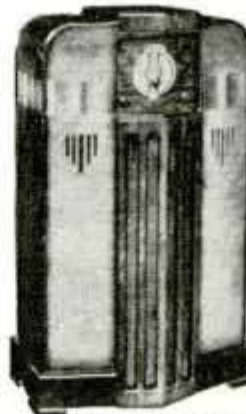
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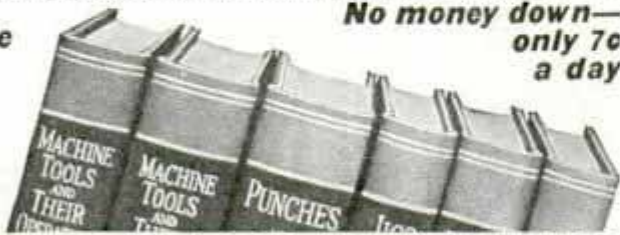
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Advertisements in this section, 35 cents per word, each insertion, minimum 10 words, payable in advance  
To be inserted under proper classification in June issue, copy should be in our office April 10th  
Popular Mechanics Magazine, 200 East Ontario Street, Chicago, Illinois

Popular Mechanics Magazine, Chicago, Ill.

Gentlemen: We are certain that it will be interesting to you to know that in going over last year's records for classified advertising, we have found Popular Mechanics to be one of our best media for inquiries and subsequent orders. Moreover, in checking our repeat orders from customers, we find that Popular Mechanics' customers are the best repeaters. This seems to prove that there is no better medium from which a substantial business can be built. We should also like to mention the large amount of foreign business we have received through original inquiries from Popular Mechanics, it is a sought after American publication in every foreign country.

Yours very truly,  
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**R & B Mfg. Co.**, Anderson, Indiana. Enclose 20 cents for 1936 catalogue. Racing equipment. Midget included.

### A. C. GENERATORS

**PRACTICAL** Changes for automobile generators. See our advertisement at bottom of page 147A. Autopower, Inc.

### AUTO SUPPLIES AND EQUIPMENT

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**TRAILER-ITES!** See advertisement of Trailer Travel Magazine on page 141A.

**TRAILER** Hitches \$1.95. Heavy duty \$2.95. Send dollar, balance C.O.D. Walraven's, Zanesville, Ohio.

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**MOTORCYCLES**—Direct to you at rock-bottom wholesale prices. Rebuilt, roadtested and guaranteed Indians, Harleys, etc. Send 10c today for "Bargain Bulletin 43." Crandall Hicks Co., 780 Commonwealth Avenue, Boston, Mass.

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GOVERNORS Control speed of any make of auto engine, regardless of load changes, when used for stationary or portable power production. Read our ad on page 136A. Candee-Smith Governor Co.

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TEN ½ Hp. GE motors, 60 cycle, 110 volts, like new, \$9.50 each. Send \$2.00, balance C.O.D. Erie Electric, 120 Church, Buffalo, N. Y.

WINDING Data, 100 AC motors, various horsepower and voltage, \$1.00. Motor Data Co., 2002 Monroe, Kansas City, Mo.

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OUTBOARD Motor Mart. New motors from \$39.50, used \$20.00 up. Parts, new and used, all makes. Motors bought and exchanged. 10c brings used motor catalogue. No. 315 Atlantic Ave., Boston, Mass.

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**MAIL** Business. Start small. Everything furnished. Free details. Metromails, P-5, Cincinnati.

**PROFITABLE** Home manufacturing business. Make and sell your own products. New ideas. No risk. Particulars free. Russell Adams, Guthrie, Okla.

**MAKE** Artificial marble, glossy tiles, no polishing, uncanny. Novelties, tabletops, statuettes, sanitary floors, whetstones. Hard, inexpensive, fireproof, enamel wood. Secret cement processes. Make beautiful thin cement pottery without moulds. Liquid rubber, rubber molds, scrap celluloid sold. Amazing samples 3c, none free. John A. Payne, 945 Grande Vista Avenue, Los Angeles, Calif.

**WE** Start you in business, furnishing outfits and instructions, operating "Specialty Candy Factory" home. Men and women, earn \$25.00 up to \$75.00 weekly, all or spare time. Booklet free. W. Hillier Ragsdale, Inc., Drawer 4, East Orange, N. J.

**CHEMICAL** Expert furnishes manufacturing formulas with complete working directions. Reliable individual services. Charges reasonable. Dr. VanHeeden, 1410 East 54th, Chicago.

**WE** Start you in business. Unlimited field! Make, sell compound for puncture-proofing tires, radiators. Big profits, repeats. Free details. Non-Leakable Mfg. Co., Haekensack, N. J.

**67** PROVEN Money making plans, 25 cents. Frank Turack, 127 Starr Bldg., Export, Pa.

**WHY** Slave for starvation wages when 25c brings 24 ways to make money? Zachorow, Jackson, Michigan.

**BUY** Wholesale—1,000,000 articles. Directory 25c. Midwest, 4854 Reading, Cincinnati.

**SELL** Dealers, automotive supplies. Profitable easy work. Hibbs, Fort Worth, Tex.

**MASTER** Business opportunity. Staebler Products, 79-20-45th, Elmhurst, N. Y.

**24** WAYS To make money 10c. Business Builders, Hanover, Mass.

**BARGAINS**—Paint spray outfit, gasoline engine drive. Terms—trial. Helmer Paint Spray Exchange, M-565, Troy, Ohio.

**LEARN** To mold statuary, pottery, kewpie dolls, toys, vases, lamps, ashtrays. Instructions 50c. Mack, Box 1278P, San Francisco.

**"SOBERINE"** Will sober an intoxicated person in quick order. Salesmen make big money selling hotels, drugists, etc. Unlimited opportunities. Send \$1.00 and start at once. Soberine Laboratories, Box 963, Allentown, Pennsylvania.

**HOW** And where to obtain capital fully explained, particulars free. Star Service, Wapakoneta, Ohio.

**"SCHEMER** Magazine." Alliance, Ohio, prints schemes, ideas, business starters, formulas—big winners; \$10,000 to \$50,000 reported. 38th year; \$1.00. Trial special: Six months only 30c.

**SUCCESSFULLY** Manufacture your own products. For any complete guaranteed formula, send \$1.00. Dept. "B." McGillivuddy Laboratories, Box 1093, Seattle, Wash.

**FOOD** Distributors—Prepared waffle flour, cake mixes, for homes, restaurants; package and bulk; repeats; protected territory; attractive discounts. "Modern Maid," 330 34th Street, Brooklyn, N. Y.

**LEARN** Marbleizing: With our snow-white cements. Imitates marble perfectly. Make your own molds with our rubber composition. No heat required. No special equipment. Anyone can do. For statues, novelties, etc. (See samples). Send dime for George Washington mold with marbleized cast. Cowell Institute, Grayling, Mich.

**HERE** Is a wonderful way to end your money worries. Start your own business at home, spare or full time, no canvassing or soliciting. Investment from \$5.00 to \$100.00. Others are making \$1000.00 to \$2500.00 yearly. Send for your free plans telling about these special opportunities. Acme, Garnerville, N. Y.

**OPERATE** Chain world's finest money making vending machines. Sells four products—same time. Instant success! Small capital—profits immediately. No curiosity seekers. Penny King, 1233 Chouteau, St. Louis.

**MAIL** Order dealers—Take a short cut to more business. Free booklet tells how. Economical Advertising Service, 3028 North Whipple, Chicago.

**KITCHEN** Range oil burners, clean, dependable. Bennett Co., Islip, N. Y.

**OPEN** A New York office in the heart of Times Square. Increase mail order sales. No room number necessary. Mail forwarded promptly. Only \$1.00 monthly. Paramount Office Service-A, 140 West 42nd, New York.

**STOP** Squealing—Start crowing! Unusual "plan." No canvassing! Work half days—home. Prepare for surprise! National Folios-A, (Metro-sta), Los Angeles.

**FREE** Plans, books, circulars. Make thousands of dollars selling by mail. Home. Spare time. Mail Order Institute, 193-H Tompkins Ave., Brooklyn, N. Y.

**\$40.00** AND Up weekly growing mushrooms for us, free spawn, 500% stronger. Patent 331583. Contract prices guaranteed for mushrooms. Illustrated booklet. North American Spawn Co., Ontario Bldg., Toronto.

**LIQUID** Marble—Anyone can make! Colorful, glazed! Moulded, brushed, sprayed. Rubberlastic moulds. Composition flooring. Big money in these! Particulars free. Marbleizing Service, Edwardsville, Illinois.

**START** A mail order business of your own. Earn big money. Send 10c for interesting mail of opportunities. Natsales, Plymouth, Indiana.

**101** WAYS To make more money. \$1. Free literature. Send birthdate. Theodore Messick, Camden, New Jersey.

**I** MAKE \$200.00 monthly from small sideline mail order business. Complete particulars 25c. Grinstead, Edwardsville, Illinois.

**PROFIT** With new products. Make, sell, repeat. Guaranteed formulas, special prices, leads. Biggest catalog free. Gibson, Chemist, BD-4702 No. Racine, Chicago.

**SPARE** Time workers send dime for latest offers. Tucker, P. O. Box 63, Indianapolis, Ind.

**GET** Big mails—Thousands—offers, samples. Name inserted 25c. Big package magazines, money hints worth \$5.00. Opportunity Directories, 319 So. Marengo, Pasadena, Calif.

**SWAP!** Sell! Anything! Anywhere!! 4 months 10c. Traders-Exchange, Brookings, S. Dak.

**START** A mail order business in your home. Write Dixie Service, King, N. Car.

**SIX** Radically original moneymaking ideas \$1. Seaboard, 114 Patchen Ave., Brooklyn, N. Y.

**REMARKABLE** Book describes mail order business. Write, Box 1165, Stockton, Calif.

**START** Your own business. Cosmetics and extracts under private label or in bulk. Necessary information free. Elliott's, 264 Shawnee Path, Akron, Ohio.

**FREE** Books mail order home work. Circular mailing. Doisen Herald, 75 Gates, Brooklyn, New York. (Stamp.)

**SUCCEED** With your products. Formulas, processes, analytical service. Information free. B. Thaxly Co., Washington, D. C.

**SPARE** Time Industries, Omaha, Nebraska. "Journal for Ambitious Folk." Copy 10c.

**ONE** Man with auto, for county franchise. Make and sell food and other products, to general and grocery stores. Good repeater. Write Budd Laboratories, 20 W. Clifton Ave., Cincinnati, Ohio.

**\$1.00** MONTHLY Opens New York office with oldest organization. Co-Operative Mail Service, 126 Lexington Avenue.

**START** Profitable business. Small investment. 300% profit. Plan, sample, 25c (coin). Heine, 3534-N. Lawndale, Chicago.

**LEARN** Account collecting. Good income, quick results. Interesting booklet free. National Collectors Assn., Newark, Ohio.

**FREE** Plans, books, circulars. Make thousands of dollars selling by mail. Home. Spare time. Mail Order Institute, 193-G Tompkins Ave., Brooklyn, N. Y.



**ARTIFICIAL** Marble sanitary flooring, instructions covering wood or cement flooring  $\frac{1}{2}$  inch thick, fireproof, all colors, low cost, ornamental casting, concrete, plaster, papier-mache, garden furniture, statuary, flexible molds, particulars free. Chris. Mahler, Elmton, N. Y.

**PLASTEX** Industries offers industrious men an opportunity to start a business of their own, manufacturing art goods, novelties, souvenirs, etc., in Plastex and marble imitation. 5c material makes \$1 articles. Rubber moulds furnished for speed production. Small investment brings big returns. You are just in time for the big 1936 business. Write for interesting booklet mailed free. Plastex Industries, Dept. A, 1085 Washington Ave., New York.

**POPCORN**, Crispette, caramels, potato chip, salted nut machines. Long Eakins, 1960 High St., Springfield, Ohio.

**FREE** Booklet describes 107 plans for making \$20-\$100 weekly, in home or office, business of your own. Elite Co., 214 Grand St., New York.

**GET** Lots of mail. Money making offers, etc. Your name in 10,000 directories, 25c. Roseco, 4627 Glenshade, Cincinnati.

**START** Little business anywhere. Everything furnished. No canvassing. Maywood, PM-923 Broadway, New York.

**I WANT** To send you proof of the wonderful pulling power of Popular Mechanics Magazine's classified pages. What's your proposition? Write me today. F. W. Johnson, Manager, Classified Advertising, 200 E. Ontario St., Chicago, Ill.

**SELL** By mail. Books, novelties. Bargains! Big profits. Particulars free. B. Elfco, 525 S. Dearborn, Chicago.

#### MONEYMAKING OPPORTUNITIES

**AMERICAN** School of Baking announces the preparation of a new home study course covering all phases of commercial baking. Baking is nearly a depression proof business. A good field for ambitious men. For information address 3601 Michigan Avenue, Chicago, U. S. A.

**PUFFING** Machines to puff wheat, rice and corn. Supply your town with fresh puffed cereals, ready to eat. Write to David Hafner, R. No. 1, Box 365A, Hynes, California.

**12 MONEYMAKING** Secrets! Successful sparetime business. Full instructions, 10c. Saleservice, 2231 McKinley, Berkeley, Calif.

**\$50.00 A WEEK** With car and camera—big profits with your inexpensive camera. Described on page 62 in new Photographic Almanac and Bargain Book of cameras and supplies. Write for free copy. Central Camera Co., 230 So. Wabash, Dept. 5355, Chicago.

**OPERATE** Sparetime business. Sample, details 10c. Klein, 2517 John R., Detroit, Michigan.

**\$25.00 WEEKLY** Possible operating profitable business. Midwest, 4854 Reading, Cincinnati.

**HOLLYWOOD** Trade News, business starters, plans, sample 25c. Western Agency, 1458 W. 25 Street, Los Angeles, Calif.

**START** Candy business at home. Information 15c. Janice Institute, Altoona, Pa.

**A HOUSEHOLD** And industry article, steady income. Blueprint, instructions \$1. Jehle, 5110 Tulip St., Philadelphia, Pa.

**PATENT** Your idea—Write immediately for two free books, "Patent Protection" and "When and How to Sell an Invention." Fully explain many interesting points to inventors and illustrate important mechanical principles. With books we also send "Evidence of Invention" form. Prompt service, reasonable fees, thirty-seven years' experience. Avoid risk of delay. Address: Victor J. Evans & Co., Registered Patent Attorneys, 803-E, Victor Building, Washington, D. C.

**EASY** Money at home. Start small, grow big. Thurston, 518 Munroe, Asbury Park, N. J.

**10c BRINGS** Copy National Mail Order News, Box 1773-PM4, Roanoke, Virginia.

**EMPLOY** Yourself profitably at home. Free information. Innes, 21 NE. Fifth St., Minneapolis, Minn.

**EXTRA** Cash in spare or full time, particulars. Cole Mail Order Department, Bryant Pond, Maine.

**HERE** Is a way for you to make easy money. New on radio. Everybody interested. Start now. Make a simple attachment to every radio and it automatically turns on the program any time you wish. Send dime and stamp for details. Eero Langen, 23 Rollstone St., Fitchburg, Mass.

**GET** Into advertising. All or part time. Big profits, practically no investment. Circular free. Medwin A. Benton, 183 Chestnut, Liberty, New York.

**OVER** Twenty profitable, sparetime, home manufacturing opportunities, 25c coin. Owens Service, Millport, N. Y.

**STEADY** Income; lettering signs. Instructions 25c. Blake, 1081 Gerard, New York City.

**FINGER** Printing a big paying business. See advertisement page 34A.

**EARN** Money in your home. Full information and plan will be sent for 25c. Particulars free. David Wachtenheim, 1265 Broadway, New York City.

**PUBLISH** Local newspaper without capital. Instructions, 10c. United Service, Redwing, Minnesota.

**BOOKLET** "More Money for Ambitious People," 10c. Publishers Syndicate, Saginaw, Mich.

**"FREE** Instructions." Write for free 10-page booklet on making beautiful, fast-selling novelties, bookends, plaques, etc. Big demand! Big profits! Stewart's Studio, 2102 West 19th, Chicago., Dept. P65.

**"HOME** Clock Repairing." For anyone. Profit or pleasure. 50c. Clarence Ross, Jeweler, Lena, Ill.

**"PRIVATE** Brands" magazine. Money with your own products. Formulas, methods, each issue. Sample free. Myers Publications, Troy, 5, N. Y.

**PROFIT** With new products. Make, sell, repeat. Guaranteed formulas, special prices, leads. Biggest catalog free. Gibson, Chemist, CS-4702 No. Racine, Chicago.

**"101** WAYS To Make Money," new book, just off the press, postage paid 25c. Sovereign's Sales, Toronto, Canada.

**STOP** Squealing—Start crowing! Drive to country or "movies"—afternoons. Work mornings—home! Unusual "plan!" National Folio-A. (Metro-sta), Los Angeles.

**RECEIVE** Big mails, magazines, samples. Your name in 5,000 directories, 10c, including directory. National, Box 335-WS, Saginaw, Mich.

**MAKE** And sell useful articles from tinkers found in ordinary ashes. Real moneymaking opportunity. Write at once for details. Adolph Ringl, 12524 Moran Ave., Detroit, Mich.

**MILLIONS** Jobless! Make money, like we do, supplying them satisfying, job-getting information (got man 76 openings). Keep dollars you receive; we fill your orders free. Stamp brings details. Co-Operative Service, 77 Swan, Buffalo.

**FREE** Booklet describes 107 plans for making \$20-\$100 weekly, in home or office, business of your own. Elite Co., 214 Grand St., New York.

**BIG** Money at home plating auto parts, reflectors, mirrors, chandeliers; by new method; experience unnecessary. Outfits furnished. Gunmetal Co., Ave. N. Decatur, Ill.

**MAKE** Money with your camera. New book tells how. 113 pages illustrated. \$1.50. Popular Mechanics Press, 200 E. Ontario St., Chicago.

#### FORMULAS, PLANS, ETC.

**2,342** FORMULAS For making adhesives, weed killers, ant destroyers, enamels, face powders, vanishing creams, lotions, rust removers, waterproofing compounds, gold plating, floor waxes, soaps, polishes, etc. Explains how to mix ingredients, clarify liquids, grind materials, where to buy supplies. Start a business of your own. This 300-page book, \$2.00. Franklin Publishing Company, 800 North Clark Street, Dept. 2402, Chicago.

**FORMULAS**, All kinds. Guaranteed. Catalog, "Special Offer Free." Kemico, 32, Park Ridge, Ill.

**ANY** Specific formula you want 25c. B. Sherlock, 6138-Trumbull, Detroit, Mich.

**FORMULAS** And plans for making and selling your own products. Details, Demsky, 463 East 45, Brooklyn, N. Y.

**PROFITS** Making brushless shaving cream. Formula and sufficient ingredients for five pounds, one dollar. Fuller & Company, Valparaiso, Indiana.

**FORMULAS** That make fortunes! Terrene, 22 Station S, Brooklyn, N. Y.

**ANY** Formula \$.50, three \$1.00. Cole Laboratories, Bryant Pond, Maine.

**500** MONEYMAKING Formulas 25c. Descriptive literature free. Harvey Teple, Decatur, Indiana.

**MAKE** Your own brushless shaving cream. All materials and directions for making two quarts of the finest cream for only \$1.00. Almont Chemical Company, Box 2670, Lakewood, Ohio.

**NEWEST** Guaranteed formulas. Biggest catalog free. Special prices, leads. Gibson, Chemist, BD-4702 No. Racine, Chicago.

**NEW** Labor saving paint and varnish remover. No scraping! Inexpensive. Non-injurious. Amazing results! Formula 25c. Becker, 22F Hale Avenue, Brooklyn, N. Y.

**ANY** Guaranteed, complete formula—\$1.00. Dept. "H," McGillicuddy Laboratories, Box 1093, Seattle.

**3,000** FORMULAS, Facts, processes, trade secrets in Dr. Brown's Book of Formulas—380 pages. Price, postpaid \$1.00. Ogilvie Publishing Co., 57 Rose Street, Dept. 25, New York.

**EXTRAORDINARY**—Wealth using formulas. Large catalogue free. Brown's Formula, 212 East Waters, Tampa, Florida.

**FORMULAS**—List free. Andco Laboratories, 225 - 7th St., Rockford, Ill.

**SUCCEED** With your products. Formulas, processes, analytical service. Information free. B. Thaxly Co., Washington, D. C.

**FORMULAS**—Guaranteed paint and varnish remover, \$1.00. Baic, 1150 Leonard Ave., St. Louis, Mo.

**TESTED** Formulas—Largest, most complete line. Catalog free. Grinstead Laboratory, Edwardsville, Illinois.

**FORMULAS**—Latest money makers. Literature free. Belfort, 4042 N. Keeler, Chicago.

**FORMULAS**—Tried, tested, proven. Real money makers! Average cost only 4c per formula! Write for interesting information. Best-Formulas-of-the-Month Club, Mayo, Florida.

**HAVE** You seen our new book catalog? It's free. Just send 3c postage. Popular Mechanics Magazine, 200 E. Ontario St., Chicago.

#### CHEMISTRY

**SEND** 25c For new illustrated chemical experiment book with over 300 formulas and tests. Also receive entry blank for \$100.00 cash prize contest. Illustrated catalog of apparatus and chemicals free. A. Winn, 124 West 23rd St., New York.

**NEWEST** Guaranteed formulas. Biggest catalog free. Special prices, leads. Gibson, Chemist, CT-4702 No. Racine, Chicago.

**COMPLETE** Chemical service. Formulas, processes, analysis, research, consultations. Estimates free. Dept. "C," McGillicuddy Laboratories, Box 1093, Seattle.

**SPECTROSCOPE** And book of 120 experiments, \$2.50. Kutting Sons, Campbell, Calif.

**HANDBOOK** For chemical experimenters, for students and amateur chemists, revised, illustrated, 50c. Chemical catalogue 5c. Booklist free. Reading Scientific Company, Reading, Pa.

**25** CHEMICALS With experiments, 50c. Kayare Chemicals, 5522P Ft. Hamilton Parkway, Brooklyn, N. Y.

**FREE** Chemistry catalogs. Supplies at 5c! Equip complete laboratory. Send 3c postage. Kemkit Corporation, 135P Johnson Street, Brooklyn, New York.

**CHEMICAL** Analysis and industrial problems. Estimates free. Essco Laboratories, 2206 Lycaste, Detroit, Michigan.

**CHEMICALS**, Laboratory glassware and apparatus. Catalog CP. Biological Supply Co., 1176 Mt. Hope Ave., Rochester, N. Y.

**PRACTICAL** Everyday chemistry—How to make what you use. 2342 practical workable formulas of widely used products. Save 4c. Start a paying business of your own. \$2.00 postpaid. Popular Mechanics Press, Room C35, 200 E. Ontario St., Chicago.

#### HELP WANTED

**STEADY** Work for responsible man. Wonderful opportunity for good steady cash income and extra money to save. Old established manufacturer will furnish you with complete stock of finest guaranteed food products, farm and household necessities on credit—you pay when sold. Premiums, dealer helps and fast-selling specials for quick sales and profits. Anderson of Utah sold \$402.70, Karel of Michigan \$347.48, McMillen of Pennsylvania \$314.15 in one week. Work very pleasant. Permanent. Write McConnon & Company, Room 66EG, Winona, Minnesota.

**EARN** More money. Write. Atkins, 4579 Garfield, St. Louis, Mo.

**BIG** Advance cash profits selling men's quality hats, made-to-measure, rain-proof caps. Bargain prices. Your own hats, caps free of extra charge. Outfit free. Taylor Hats, Dept. C-22, Cincinnati, Ohio.



**GO** Into wholesale business without investment. Call on stores with biggest line self-selling counter displays: Aspirin, razor blades, handkerchiefs, breathlets, household cement, 79 different items. Up to 125% profit for you. Experience unnecessary. Write for catalog and plans: Procopax, Dept. 36-YD, 1956 S. Troy, Chicago.

**I'LL** Give you groceries at wholesale besides splendid opportunity to make \$60 a week. Brand new Ford sedan given as bonus. Details free. Albert Mills, 2763 Monmouth, Cincinnati, Ohio.

**USE \$500?** Raise canaries for us. Guaranteed market. Free particulars. Crimmins, 3741-A 69th, Woodside, New York.

**NEED** Cash? Grow mushrooms for us—cellar, shed. Pictures free. United, 3848-A231 Lincoln Ave., Chicago.

**CASH** Paid for butterflies, insects. See Sinclair Display Advertisement on page 12A.

**10,000 MONEY-MAKING** Formulas. Tells you how to make and sell almost everything under the sun; cosmetics, mucilage, anti-freeze solutions, battery solution, beverages, cheese, chewing gum, cleaning preparations, extracts, hair preparations, inks, bluing, leather polish, mirrors, perfumes, polishes, typewriter ribbons, carbon paper, washing powders, liquid soap, and hundreds of other profitable articles. \$4 postpaid. Popular Mechanics Press, Room C35, 200 E. Ontario St., Chicago.

#### AGENTS WANTED

**FULL** Letter size stencil duplicator. Retail only \$3.00! Prints letterheads, menus, advertising, etc., in colors. Complete with ink, stencil, etc. Big demand—offices, stores, clubs, churches, restaurants, etc. Enormous profits to demonstrators. Free samples of work. Rocket Duplicator, Dept. A-870, Cincinnati, Ohio.

**100% PROFIT** In the "Self Starting Cigar Lighter." No flint or friction. What makes it light? No wind can blow it out. Retail 35c. Costs \$2.00 per dozen. Sample and sales plan 25c. New Method Company, Desk PM-41, New Method Bldg., Bradford, Pa.

**DOUBLE-EYED** Self-threading needle packages, size 3/9. Blind people thread them. Invaluable for failing sight, necessary for good sight. Five samples 25c. Twenty packages, dollar bill, 100 packages \$5.00. Particulars. Wm. Oglesby, Vandavia, Ill.

**\$2.00 INVESTMENT** Pays you over \$32.00 profit distributing America's fastest selling food specialty. Exclusive territory. Particulars free! Write today! Wyss Products Co., 999 Holloway Ave., San Francisco, Calif.

**AGENTS:** Smash go prices. Santos coffee 12c lb. 100 sticks chewing gum 12c. 150 other bargains. Carnation Co., PO, St. Louis, Mo.

**\$6.85 HOURLY!** Amazing No-Flatz fixes punctures without patching; makes tires puncture proof! Instantly—permanently seals holes made by nails, etc. Big seller. Free sample offer. No-Flatz, Dept. A-172, Cincinnati, Ohio.

**WHOLESALE** Catalog free, 500 best sellers. Paty Co., 1167 Broadway, Somerville, Mass.

**CASH** Income daily silvering mirrors at home. Plating autoparts, tableware, etc. Combination outfit. Write Sprinkle, Plater, 128, Marlon, Indiana.

**\$2.00 HOURLY** With new, scientific cream that mends all cloth easily, quickly, invisibly, without needle and thread. Stands laundering. Free sample. Sewnmore, A-744, Cincinnati, O.

**SENSATIONAL!** Onyx-like "Photo-Rings." Sample, 25c. Century, 4932 Eighth, Philadelphia.

**MAKE 212% Profit!** Metalix—amazing new "metallic liquid" instantly, permanently repairs metal, wood, glass, leather, etc., without heat, acid or tools. Holds forever! Free sample. Write, Metalix, Dept. A-313, Cincinnati.

**FREE!** Descriptions, 450 newest money making opportunities. Metromails, P-5, Cincinnati.

**450% PROFIT** In new automatic gas lighter. No flint or flame. Lights gas instantly. Retail 25c. Costs you \$1.00 a dozen or 15 dozen for \$8.00 postpaid. Sample 10c. New Method Co., Box PMG-41, Bradford, Pa.

**\$6.00 HOURLY.** Amazing Karnu refinishes auto like new without rubbing, polishing, waxing or painting. Wipes on with cloth. Lasts 8 to 12 months. Free sample. Karnu, Dept. A-8, Cincinnati, Ohio.

**NEW** Chemical discovery finds, kills moths automatically without work or mess. Free gift. Every home a prospect. Big weekly profits. Sample free. Puro, 3107 Pine, Dept. E-296, St. Louis, Mo.

**CASH** Paid for butterflies, insects. See Sinclair Display Advertisement on page 12A.

**GUARANTEED** Salary plus commissions to producers. New plans undersell stores. Hundreds fast selling necessities. Free gifts. Special deals. Rush name for catalog. National Products, 116 Berwyn, Ill.

**CONCENTRATED** Ink tablets, equal to highest advertised fountain pen ink, and only half the price. Clean. Non-corrosive. Permanent. (Not a "powder" or pellet.) Only needs addition of clean water. Big profits and splendid opportunity for live agents. Used in Canada by post office department, and large railroad systems. Sample quart tablet, 50c. Blanchard, 62 St. James Place, Winnipeg, Canada.

**GOLD** Letters for store windows. Large sizes penny each. Free samples. Modernistic Sign, B-3004 Lincoln Ave., Chicago.

**100% PROFIT!** Amazingly new table utensil. Housewives buy quickly. Sells year round. Grab this moneymaker. Hill, 2245 N. Kedzie, Chicago.

**SEND** Hose size for samples and chance to earn \$20 weekly. Show sensational guaranteed hosiery. Guaranteed against holes or replaced free. Dignified, pleasant work. Wilknit Hosiery, Desk 37-E, Greenfield, Ohio.

**STOP** Squealing—Start crowing!! Drive to country or "movies"—afternoons. Work mornings—home! Unusual "plan"!! National Folio-A, (Metro-sta), Los Angeles.

**MANUFACTURER** Offers big daily commissions, steady employment, liberal cash bonuses. Complete new spring and summer line tailored shirts, neckwear, dress and work pants, uniforms. Experience unnecessary. Part or full time. Outfit free. Write today. Packard Shirt Corp., Dept. S-314, Terre Haute, Ind.

**NEW!** Two ties with your name mailed for 25c. Legion Ties, 703-P Broadway, New York.

**PERMANENT** Income selling auto seat covers, sun glasses. Write, Rice, 135-15 227th, Laurelton, N. Y.

**MEN!** Women! Exclusive territory. Two lines. Homes, business. No investment. Murray Barron, 1222-30 Rockefeller Plaza, New York.

**PROFIT** With new products. Make, sell, repeat. Guaranteed formulas, special prices, leads. Biggest catalog free. Gibson, Chemist, RD-4702 No. Racine, Chicago.

**AUTO** Radio—\$11.95. No-cost sample. J-20th Century Co., Kansas City, Mo.

**ZIPPER** Clothesline—Sensational new invention. Instant demonstration. Free big money plan. Dunn Bros., Hempstead, N. Y.

**SELL** Men's neckwear. 100% profit. Free catalog. Artstyle Neckwear, Elmira, N. Y.

**PREPARE** For surprise! Work mornings, home. No more canvassing!! National Folio-S, (Metro-sta), Los Angeles.

**COLLECT** Big daily commissions taking orders for "Famous" shirts, ties, hose. Beautiful fast selling line. Popular prices. Free samples. Famous Shirt Company, Box 328, Milan, Tennessee.

**MEXICAN** Feather pictures. Unusual novelty. No competition. 25c (stamps) brings \$1.00 worth sample and details. Refunded if unsatisfied. Mexican Art, Apartado 1593, Mexico City.

**"1,000 WAYS** To Make \$1,000.00." You can do it—others have. This new amazing book will startle you. 475 pages only \$2.50. Popular Mechanics Press, 200 E. Ontario St., Chicago.

**TRANSPARENT** Day and night signs. 8"x14"; 4c. Retail 25c; over 1000 designs; sample free! Lowy, Department 635, 8 West Broadway, New York.

**WOULD** \$32.50 A week end your money worries? Write for free details of splendid-paying opportunity. New Ford sedan given as bonus for business and pleasure. Address: Albert Mills, 2769 Monmouth, Cincinnati, Ohio.

**SELL** Men's ties, razor blades, etc., big money for you. Hell Premium Co., M-6, Gaylord, Minn.

**ENGRAVED** Initial plates, nameplates, signs, numbers. Enamel finish, five colors, big profit. Hilton Specialty, 29 Portland, Providence, R. I.

**MAKE 100% Profit.** Write for particulars. Mailing Bureau, Lawndale, Calif.

**500% PROFIT!** Gold and colored sign letters for windows, offices, trucks, signs. Monograms. Easily applied. Neonite, Akron, Ohio.

**COIN** Money selling colored people. Give away free pictures of Joe Louis with hair preparation. Valmor, 2241-NM Indiana Ave., Chicago.

**MAKE** And sell your own products. Employ agents yourself. We supply formulas and full instructions for making toilet preparations, perfume, flavoring extracts, soap, household specialties. Valuable booklet free. National Scientific Laboratories, 1950W Broad, Richmond, Va.

**MAKE** Big money with our sterling silver initialed photo rings. Send for proposition. Gibson Photo Jewelry, 837 McDonald Ave., Brooklyn, N. Y.

**SUCCEED** With your products. Formulas, processes, analytical service. Information free. B. Thaxly Co., Washington, D. C.

**DISTRIBUTORS**—Sell table model radios. Trutone Radio Co., 1700 South Ogden, Los Angeles.

**MAKE** Good money taking orders; shirts, ties, underwear, dresses, hosiery, raincoats, pants, uniforms. Sales kit free! Nimrod Company, Department 8, 4922-28 Lincoln Avenue, Chicago.

**WANTED**—Direct purchasing agents. No experience or money required. Write Purchasing Manager, 174 N. Halsted, Chicago.

**AGENTS** Mosco corn and callous remover will build you a steady repeat business. Send today for pocket-size trial outfits. The Moss Company, 64 Searle Bldg., Rochester, N. Y.

**GOLD** Reflecting letters for store windows. Easily applied. Large sizes, penny each, free samples! Atlas Sign Works, 7941 Halsted, Chicago.

**100 PROFITABLE** Mail order and local business plans. A. Pruitt, Elburn, Ill.

**AGENTS**—Opportunity to make money; book containing 107 successful business plans; home or office; send for free introductory booklet. Elite Co., 214 Grand St., New York.

**PROFITABLE** Home business. Legitimate. No canvassing. Maywood Publishers, P-923 Broadway, New York.

**GENUINE** Gold letters for store windows. Easily applied. Free samples. Liberal offer to general agents. Metallic Letter Co., 438-B North Clark, Chicago.

**AGENTS:** Stamping names on pocket-key protectors. Sample check with your name, address, 25c. Stamping outfit. Emblem checks, check-fobs, name plates. Hart Mfg. Co., 303 Desraw St., Brooklyn, N. Y.

**BIG** Money and fast sales. Every owner buys gold initials for his auto. You charge \$1.50; make \$1.45. Ten orders daily easy. Write for particulars and free sample. American Monogram Company, Dept. 40, East Orange, N. J.

**MAN** In each town to plate auto parts, reflectors, bathroom fixtures, refinish beds, mirrors, chandeliers; by new method. No capital or experience required. Simple plan of manufacturing at home starts you in big money-making business. Outfit furnished. Free particulars and proofs. Gun Metal Co., Ave. H, Decatur, Ill.

**NEW** Cleaner! Washes clothes quickly. Cleans everything. Premium deals. Free sample. Bestco, 5007 Irving Park, Chicago.

**BIG** Money applying gold initials on automobiles. Easiest thing today. No experience needed. Free samples. "Balco," 1084 Washington, Boston, Mass.

**SELL** Townsend postcards, big demand, large dollar assortment starts you. Chariton Associates, Chicago, Ill.

**POWERNU**—Motor compression seal. This season's sensational seller. Write Powernu Laboratories, Station "A," Spokane, Wash.

**SELL** Novelty fun cards, surprise pocket novelties, etc. Samples, list 25c. National, Box 500M, Cincinnati.

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**NEW** Serial trade card sales stimulator. Side line or full time. Advance cash commissions. Big repeats. Sells all retail merchants including gas stations, restaurants, etc. Hottest, newest out. Complete ready-to-work sales kit free. Meinhardt, Dept. E5, 18 E. Kinzie, Chicago.

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**SELL** Stores factory fresh gum. Big profits. Sample outfit 50c. American Chewing, Mount Pleasant and Fourth, Newark, N. J.

**MAN** Wanted by shoe manufacturer established 32 years for sales work. Ready cash daily and extra bonuses to producers. No experience needed. Your own shoes at factory prices. Sales outfit free. Write Mason Shoe Manufacturing Co., Dept. B22, Chipewaga Falls, Wisconsin.

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**BIG** Money makers: Large line work uniforms, raincoats, pants, shirts, etc. Advertising embroidered. Low prices. Every business, individual prospect. Free outfit. Dove Garment Co., 1733 Milwaukee Ave., Dept. 116, Chicago.

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**BIG** Money in tire patches. Sell New auto tire patch to service stations, garages, etc. Tiger-Grip patches guaranteed 10,000 miles. \$75 weekly for salesmen or distributors. Protected territory. Write Economy Rubber Co., 798 Burkhardt, Dayton, Ohio.

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**GARDEN** Weeder salesmen wanted. Link Manufacturing Co., Fargo, N. Dak.

**FLASHLIGHT** Keycase combination. Tremendous seller. 25c cash or stamps brings you sample and full details. Albright, 170 Fifth Ave., New York City.

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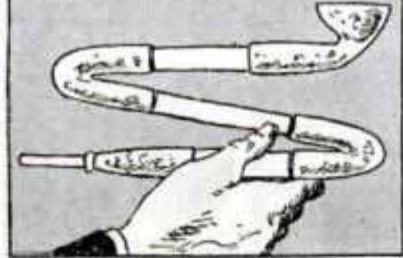
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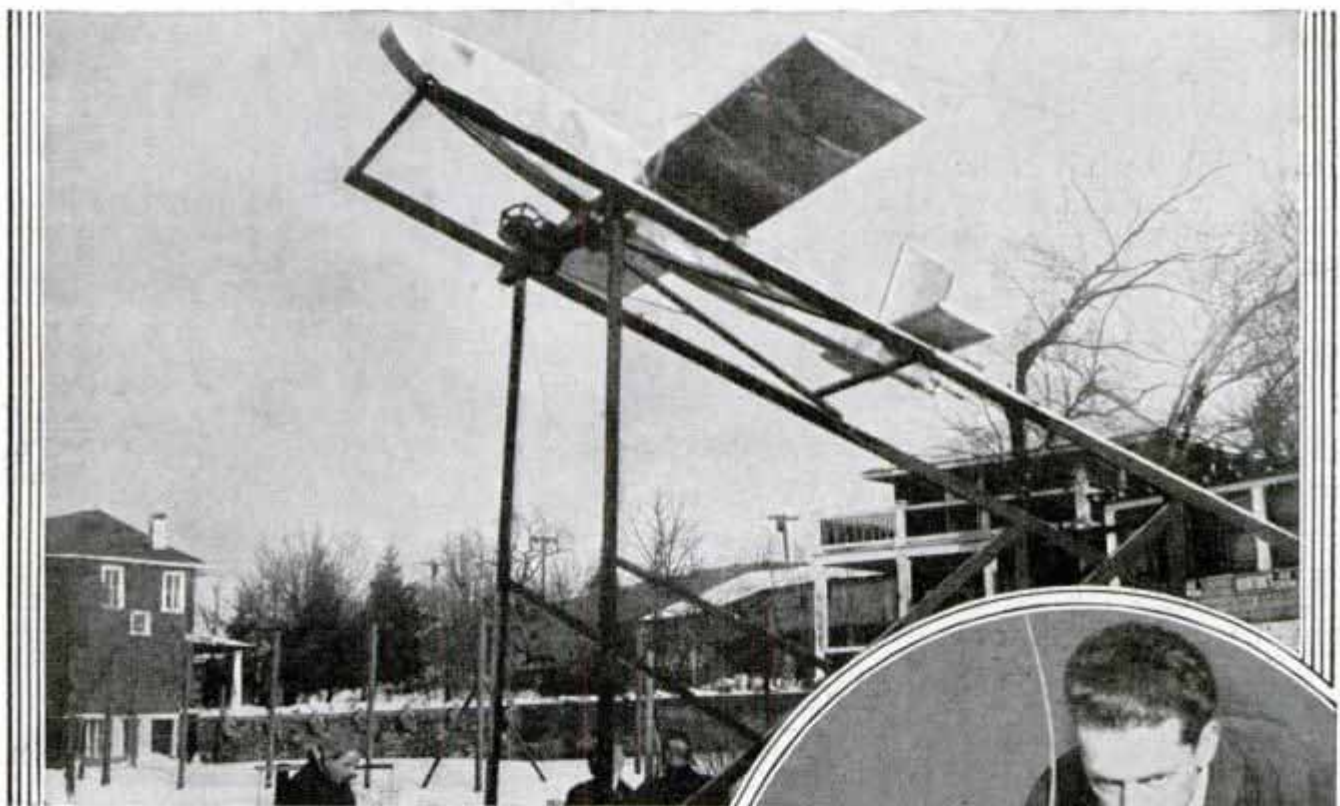
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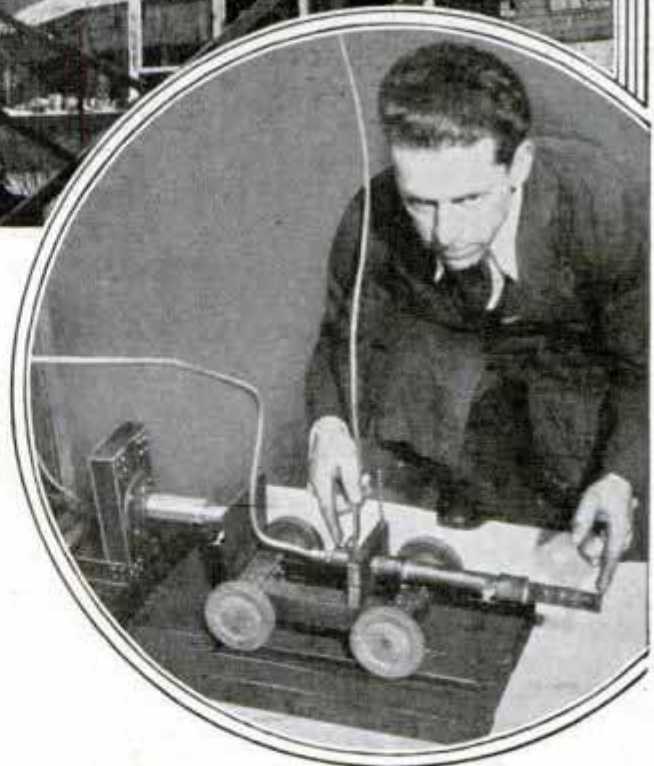
No. 5

## *The* <sup>F309</sup> **FIRST ROCKET** *AIR MAIL* **FLIGHT**



**A**LTHOUGH it covered only a few hundred feet, the recent flight of the "Gloria," America's first air mail rocket, at Greenwood lake in New Jersey, may in time be considered as significant as that first historic flight of the Wright brothers at Kitty Hawk, which covered an even shorter distance.

Despite the short distance covered, the rocket mail flight has been termed a success because it proved certain basic principles important to the world-wide research program. It proved a rocket motor can lift and propel a loaded airplane fifty times as heavy as the motor itself. It also proved a rocket airplane can maintain a



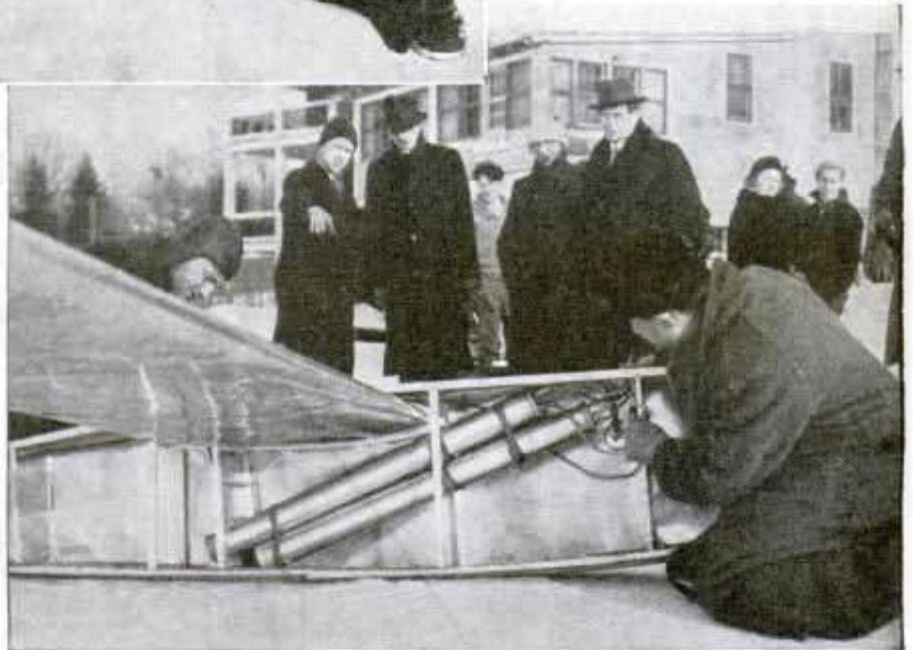
*Rocket mail plane on catapult ready for takeoff, and the tiny but powerful motor*

*Conc. Elton Slossman*





Left, powerful two-pound reaction motor of rocket mail plane. Above, rocket mail plane stamp. Below, how fuel tanks are stored in fuselage



safe stability while in the air. From the first flight, it appears the principle of the reaction motor is basically sound, although it can stand improvement.

The "Gloria" was an undertaking of the Rocket Airplane Corporation of America, while the aerodynamic design of the wings and fuselage was the contribution of the Guggenheim School for Aeronautics. Loaded with air-mail covers addressed to stamp collectors, the "Gloria" skidded to a halt on the ice about 2,000 feet from the point of takeoff. The "Gloria's" two-pound motor actually develops 300 horsepower per minute. On the test block it registered almost fifty pounds of reaction on a measuring device. Propelling a 100-pound airplane at a speed of about 4,000 feet per second, the rocket motor would develop an equivalent of 160,000 foot-pounds per second.

While the motor is simply a hollow pipe with no moving parts, its construction involved many difficulties. At present the main difficulty in building a rocket motor is in finding a metal or other substance to withstand the intense heat generated, about 2,000 degrees centigrade. All the common and many rare metals melt at lower temperatures. The "Gloria's" mo-

tor was made of monel metal. When a better heat-resistant substance is developed, there will be a great improvement in the performance records of rockets.

Another important consideration at present is fuel. After many disappointments, rocketeers have abandoned powder fuel and substituted liquid fuels. Powder rockets create detonation waves which cause dangerous explosions. Liquid fuel lends itself to easier manipulation and control, and is safer to handle. The "Gloria's" motor burned a mixture of powerful fuels blended in a combustion chamber. Fuel tank No. 1 contained liquid oxygen, temperature about -200 degrees centigrade; tank No. 2 contained a mixture of alcohol, gasoline, methane and other liquids; tank No. 3 contained com-

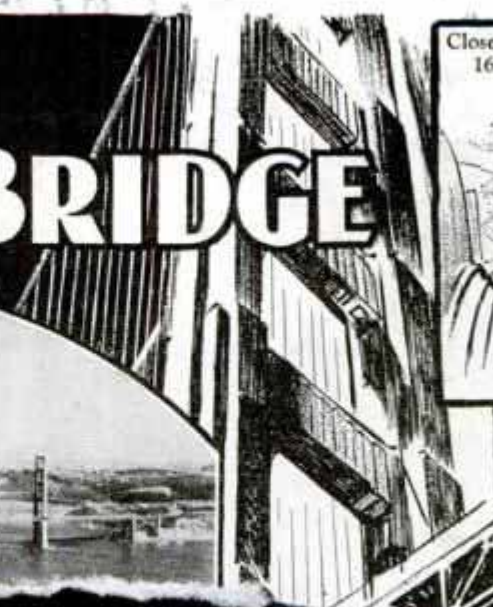
(Continued to page 152A)

Paradise, Calif

See Eng 19 1910



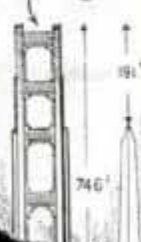
# *The World's* **WONDER BRIDGE**



Closeup of one of the four  
169-ton cable saddles



Golden Gate  
Bridge





F151.

Com. ...  
of Geneva Daily Times  
Geneva, N.Y.

# BEHIND the



boards are not the feature attraction they will have a place on the program. Back of the thrills, spills and speed of the actual race—behind the starting gun—is a high-g geared unit of committee machinery equipped with modern, scientific apparatus to handle efficiently the running of the modern boat regatta.

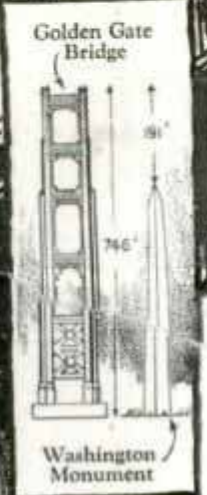


F 200. ...

# The World's WONDER BRIDGE

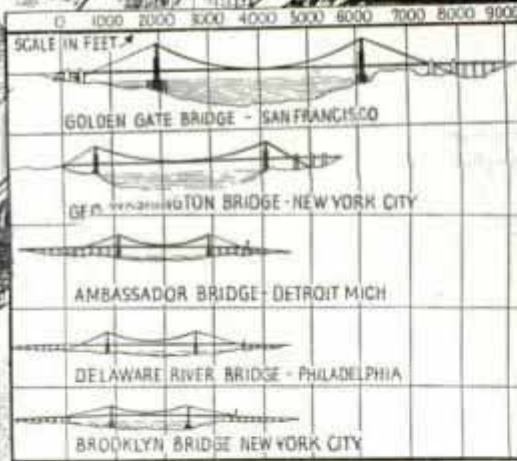


Closeup of one of the four  
169-ton cable saddles

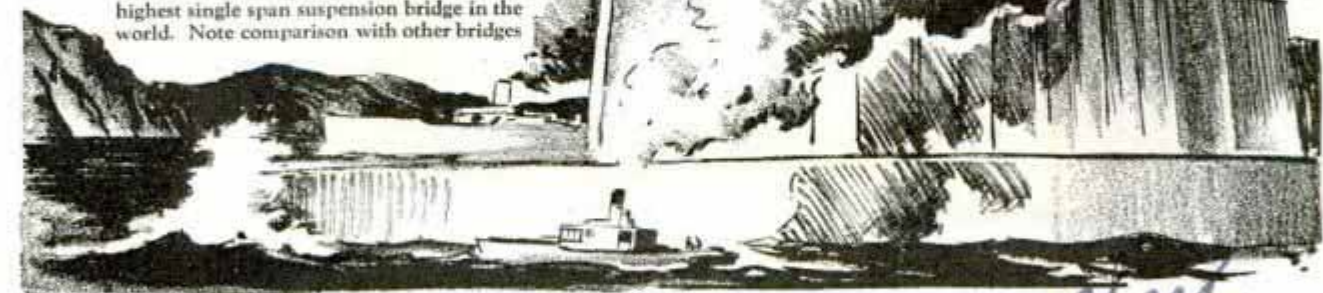


Golden Gate  
Bridge

Washington  
Monument



The Golden Gate Bridge is the longest and highest single span suspension bridge in the world. Note comparison with other bridges



Photograph and drawing, in oval, showing \$35,000,000 Golden Gate bridge with its 4,200-foot span and its 746-foot towers as it will appear when completed next year. Its 100,000 tons of steel would load a freight train twenty miles long, the concrete required would build two ten-foot sidewalks from Chicago to Omaha and the two three-foot cables contain 80,000 miles of wire, enough to erect a wire fence six feet high on both sides of the highway from Canada to the Mexican border. This triumph of engineering skill is the first bridge ever to be flung across a major harbor entrance and will form the key link in the proposed Pacific coast highway system

*San Francisco - Oakland*



F151.

Cont. Erie G. Melgrove . . .  
of Geneva Daily Times  
Geneva, N.Y.

# BEHIND *the*



boards are not the feature attraction they will have a place on the program. Back of the thrills, spills and speed of the actual race—behind the starting gun—is a high-g geared unit of committee machinery equipped with modern, scientific apparatus to handle efficiently the running of the modern motorboat regatta.

Some of the devices in use have been adapted from other scientific purposes. Others have been

**T**HE white flag is flying from the committee boat. A circling, sputtering group of flying "shingles"—outboard racing motorboats—is trying to kill the last few seconds before the gun and still hit the starting line with wide-open throttle.

One eye on the six-foot dial of the clock and the other on the spurting, zigzagging boats about them, the drivers edge forward as the single hand of the clock nears the zero figure. On the committee boat a group of officials is at work.

"Nine, eight, seven, six—," the monotonous chanting of the starter's voice calls off the last seconds,—“five, four, three, two, one—gun!” With a deafening roar of unmuffled exhausts the boats slam down the straightaway.

This is outboard motorboat racing, America's fastest-growing water sport. This year, the American Power Boat Association, governing body of motorboat racing in the United States, together with the National Outboard Association, has the heaviest racing calendar in years. And ninety-five per cent of it is outboard racing. In the few regattas where the out-



Gar Wood, Jr., ready for a race, and coast-guard patrol boat used by race committee

created solely to let young America know to the split-second just how fast his sliver of a boat is going. It is from the terrific grind of the regatta that steady improvement of the efficient little outboard is derived in a large measure.

Outboard racing exemplifies the scientific progress and advancement of this mechanical age. This is true not only of the two-cycle motors turning more than 7,000



7,51 1212

# STARTING GUN



Intercollegiate Power Boat Race  
at Lake George, N. Y., 1912

*Flying "shingles" at start of an intercollegiate race. The success of such a race is due as much to careful planning by race officials as to the work of the drivers*

revolutions per minute but is also apparent when viewed from the standpoint of the engineer and scientist, each of whom contributes to the successful handling of a race. Engineering skill steps into the picture from the very first. Laying out and directing the setting of buoys for the course requires technical knowledge. A course-measuring device has been used to some extent by an American Power Boat Association official. It consists of an apparatus designed to lay a measured wire around the buoys, but it has not come into common use.

The speed of the course may depend upon how wisely the engineer has plotted it. Long straightaways with curves held to a minimum of sharpness are usually desirable. In the event of a new record the engineer is called upon to recheck the course and certify its accuracy. A few years ago at an eastern meet, records fell in almost every event. A jubilant committee saw its hopes fade when the recheck proved the course to be short. At Lake George, N. Y., the Gold Cup race committee solved its course problem in a novel way. It started work early and laid

out the course on the ice-locked surface of the lake with fixed marks on shore from which to set the buoys in the summer.

Science and its instruments play a large part in timing a race. Up until a few years ago timing involved the use of individual stop watches in the hands of experienced men. The watches still are used but Charles F. Chapman, secretary of the Racing Commission of the American Power Boat Association, has made a simple yet highly efficient device by which two rows of watches may be started or stopped all at once or, if desired for timing finishes, they may be operated individually. All of the watches in this device are calibrated by the bureau of standards. Commodore Phelps Ingersoll of the National Outboard Association has a similar apparatus in which stem-action watches may be inserted.

The starting cannon may be anything from a yacht cannon or one-pounder on a coast-guard boat to a shotgun or even just plain Japanese bombs. These last two are considered only as emergency measures. Contrary to general belief, the cannon is not the official starting signal. The race is





*Even girls and women are interested in outboard racing as evidenced by this California contest. Outboard motorboat racing is hailed as America's fastest-growing water sport*

officially on when the white flag comes down. The two operations of firing the cannon and the downward sweep of the flag on the chronometer man's call of "fire" are usually simultaneous, however.

Manually operated starting clocks have found greater favor in some cases than electrical or spring clocks. Bad weather or strong winds are apt to play havoc with the latter type although they have been used with some success on the New Jersey circuit. Working with the clockman is the member of the committee with the chronometer from which time is taken. The flag man and gun man also work with the clock and chronometer officials. Scorers and checkers record the times and numbers of the boats for the summary sheet men.

To many spectators—although the working committee seeks to keep them out of the hectic scene—the pits are one of the most colorful parts of a regatta. Here all apparently is confusion and haste with boats, motors, drivers and mechanics scattered all over the lot. At the pits the headquarters committee has its headaches. Usually these officials see little if any of the actual racing but are confronted with the human element in the handling of keyed-up drivers. Registration, inspection of boats, weighing and launching all are pit problems. The chief inspector holds

forth at the pits and out comes his kit of delicate measuring instruments—micrometers and other fine gauging tools—when a new record is set. Under his watchful eye the driver or his mechanic tears down the record-breaking motor for measurements to see that all units comply with stock motor rules.

Spectators provide another problem for a regatta committee. Some means of keeping them informed on results as well as giving a running account of races had to be found. Radio brought the answer with a public-address system. A rubber-insulated cable from the committee boat microphone to a sound car or station on shore has proved very satisfactory. The noise of the outboards means little broadcasting, however, as the boats are going by. A short-wave transmitter on the boat with a receiver on shore also provides the committee with a private means of communication with the pits.

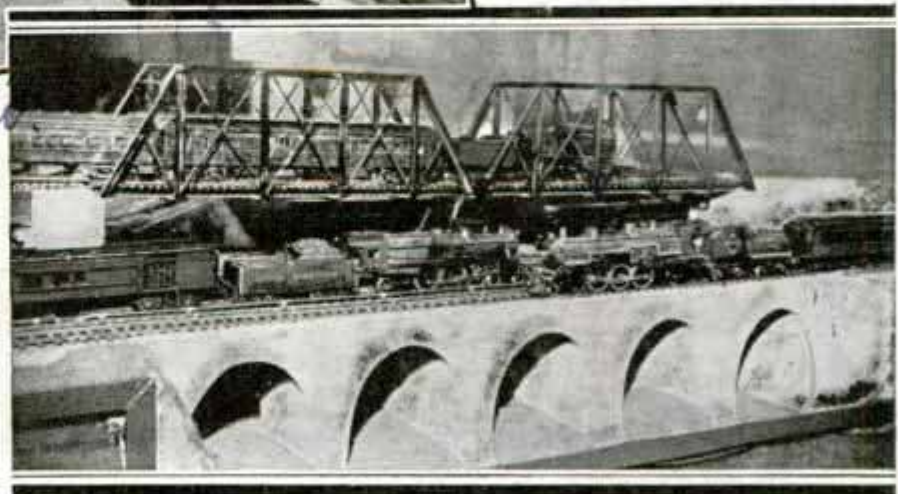
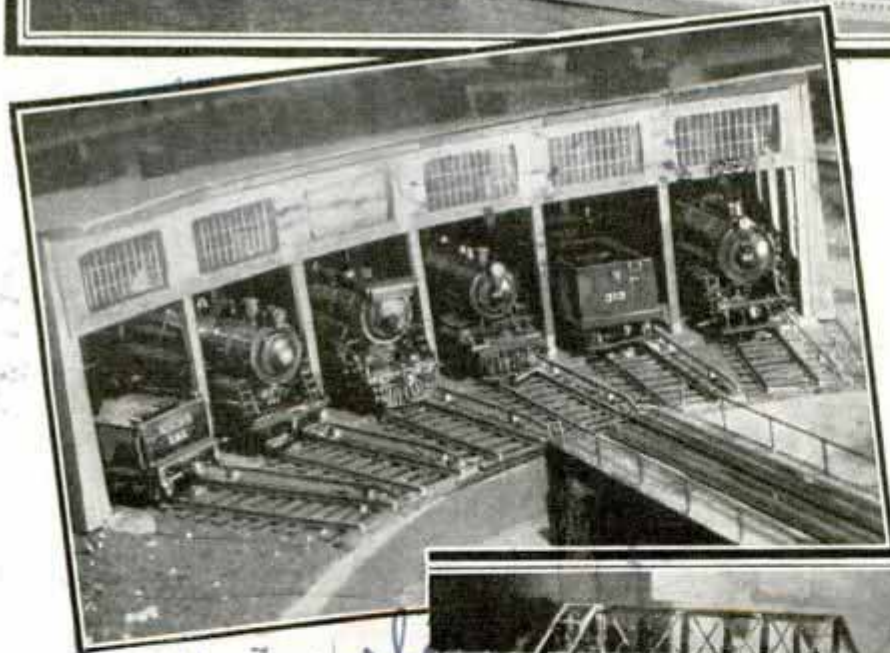
Is all this ear-shattering noise and frenzied work worth-while? The popularity of outboard racing with the public is an effective answer. Perhaps the very noise signifying action is a big factor in the appeal. But beyond all that there are very real thrills—speeds now reaching up to seventy miles per hour and thrills, spills and colorful action galore. Split-second

(Continued to page 150A)

Type built by Century Boat Co. Manufactured in U.S.A.



# Remote Control Runs Baby Railway System



General view, above, of part of the union connecting railroad system which absorbed the attention of old and young at a recent exhibit of the New York Society of Model Engineers. A real working knowledge of railroading practice is necessary to operate this complicated remote-control system, complete in every detail

Above, roundhouse of the miniature railway system with baby locomotives ready to chug out onto the main line, just one of the many realistic features of the model system. Right, a view of the main line of the miniature railway, looking toward Bridgetown, a section with heavy traffic

Number 51 G

152 W. 42nd St. New York City

Wide World

retro type

5.15



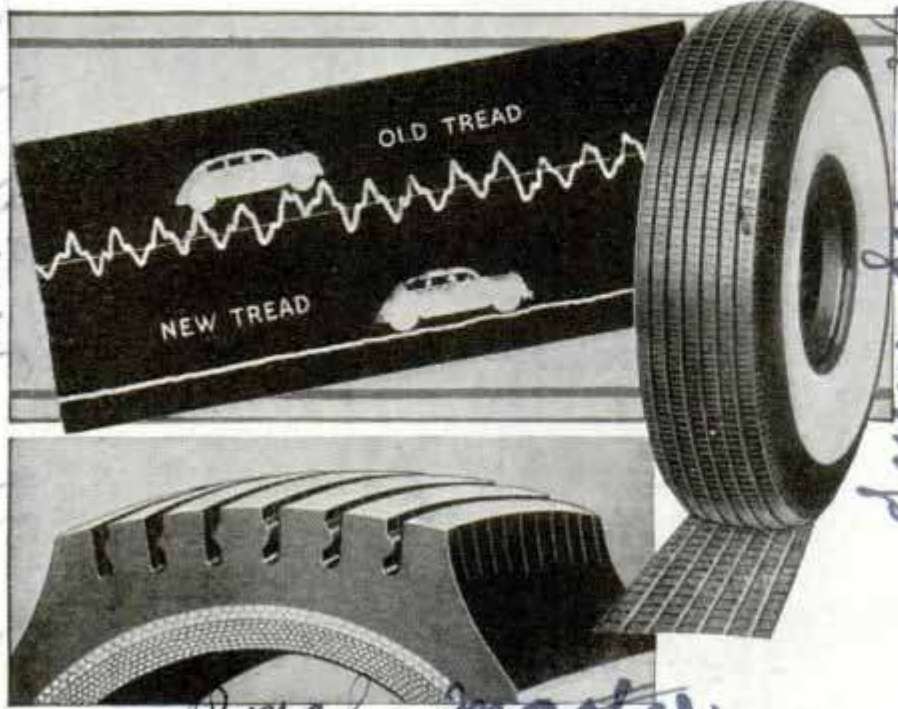
1269. Ave. 1790 Broadway  
648

POPULAR MECHANICS

New York

# Road-Gripping Tire Tread Results In Faster Stopping

Charles U. Ashberg, driver by and Earl  
of measuring your olfactory efficiency has been devised. An odorous substance is placed in a bottle having an inlet tube through which air can be forced, and an outlet tube branching to each nostril. While the person being tested holds his breath, a measured quantity of air is pumped into the bottle. Your smelling ability, then, is measured by the minimum number of cubic centimeters of air you need to inhale from the bottle before you detect the odor.



Two views of latest safety-tread tire, with chart showing how new design tends to reduce vibration and give smoother ride

Constructed with multiple ribs which are cross-grooved to give the effect of "fingers" in gripping the road, a new automobile tire is said to reduce the braking distance considerably. It will bring a car to a full stop in two-thirds the distance required by the ordinary anti-skid tire on roads of the worst type, according to the makers. In addition, the tire is long-wearing, practically silent and easy riding. The tread design squeezes out the moisture picked up from the road surface, resulting in a firmer grip. The effect is similar to that of a windshield wiper. An important feature is the protection the tire gives against swerving when brakes are applied. The tire stops the car without changing the direction of travel. Plain sidewalls give it a sleekness that fits in with the general advance in streamlining. Engineers of the U. S. Rubber Products, Inc., adopted the tread design after tests on all kinds of road surfaces.

a bicycle equipped with a gear-shift drive is being tested in California. A lever permits shifting from one gear to another. The drive gears are inclosed in a housing.

## Bike Gear Shift Gives Three Speeds

Capable of three speeds at the desire of the rider,



Housing open to show gears which are shifted by means of lever near seat

## "Smell-Meter" Tests Ability to Detect Odors

How good is your nose at detecting odors? At Columbia University a method

neurological constants, New York City

2.0/8

San Diego  
Marlborough  
4054

San Diego  
California  
2.0/8



61 / 74 American Ironing Mill Middleburg Ohio

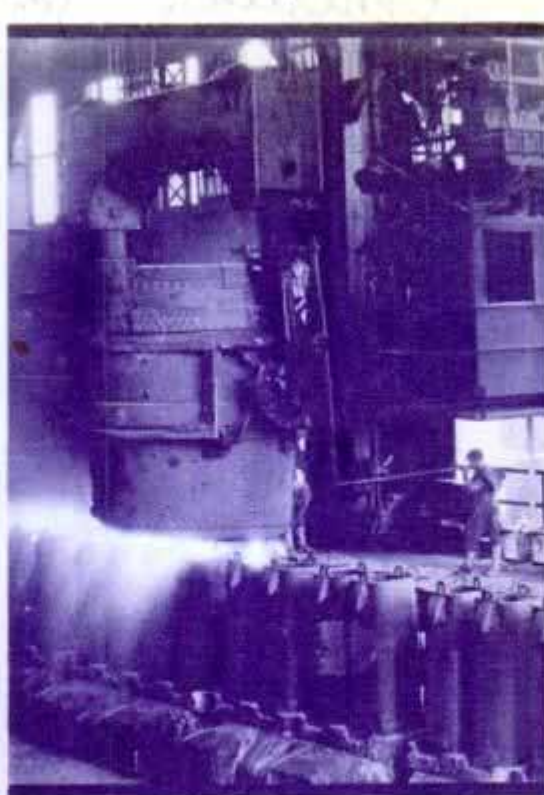


Illustration by K. Palmer

*The*  
**STEEL**  
of the **FUTURE**

**TAPPING** a blast furnace. The molten metal flows down a winding trough and into a huge ladle car which transports it to the open hearth furnaces.





**LEFT**, the melter, the sentinel of steel, watching from his platform as an open hearth furnace is tapped and 150 tons of molten iron rushes into the ladle. **Center**, filling ingot molds with molten metal from a huge ladle which moves down the long row of molds. **Right**, fingers of a giant crane lifting a cherry-red ingot from the soaking pits. From here the ingot goes to the roll train and the "blooming mill" rolls it into a long slab.

By  
H. W. Magee

**F**ROM bronze to iron, from iron to steel, and now a new era—that of steel and its alloys—such is the story of human progress.

Before the Napoleonic wars, this was a world of hard labor. Then came steam to lighten toil, and to lift loads off men's backs.

Iron supplanted bronze. Steel displaced iron because it was stronger. Certain kinds of alloys today surpass ordinary steel in physical properties—strength, toughness, hardness, resistance to oxidation, the action of chemicals, stability at high temperatures, electrical characteristics and luster.

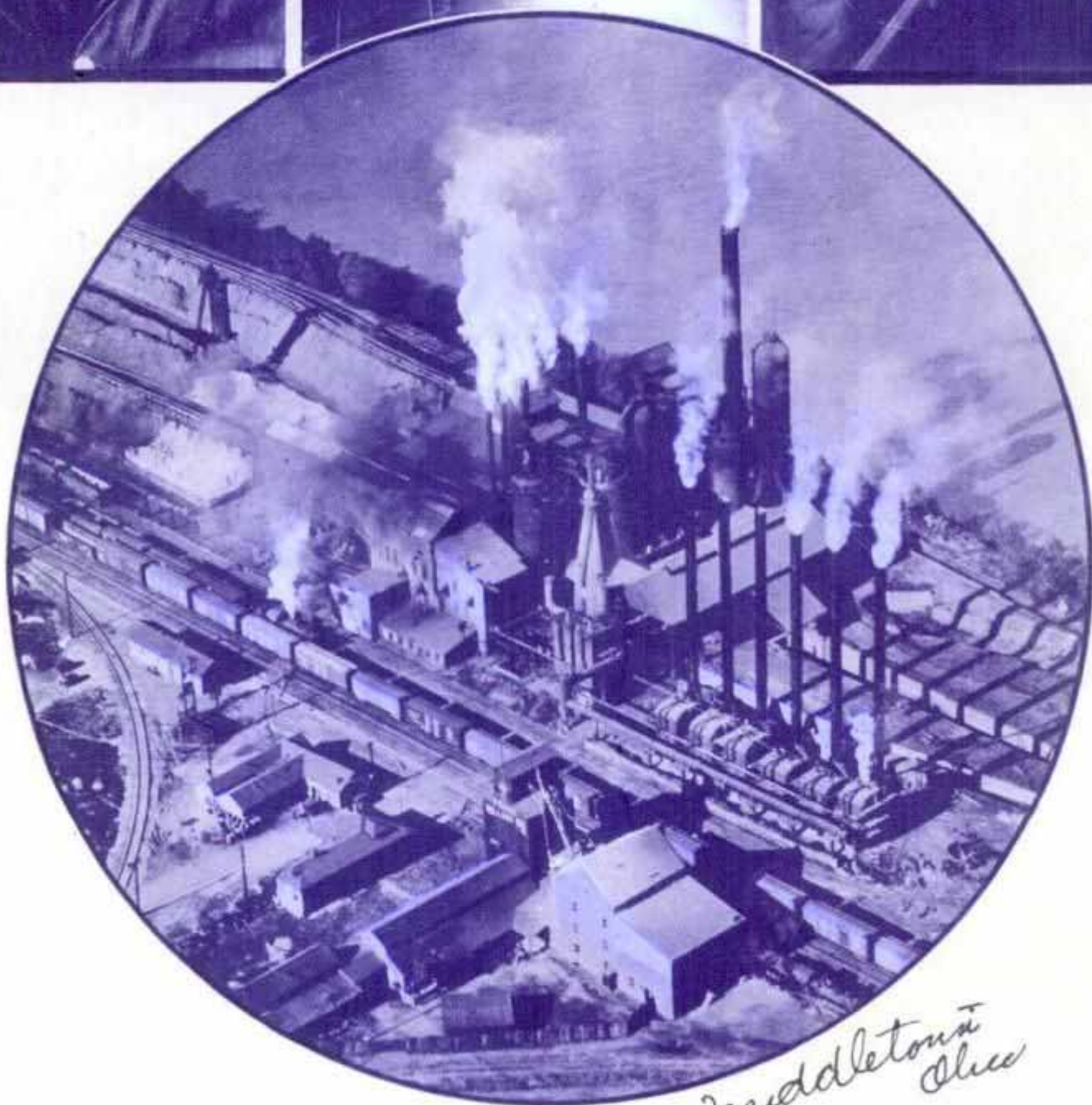
The physical properties and characteristics of steel can be changed in an

endless variety of ways not only by combining it with other metals but also by applying heat. Heat treatment gives almost as much promise for future growth in the uses of steel as do the developments of its alloys. Steel is alive. By heat alone, it is possible to change the two ends of a steel bar so that each has entirely different characteristics. The heat treatment of metals is still one of the great unexplored fields of science.

There are almost as many kinds of iron and its alloys today as there are uses for iron and steel products, and the number is constantly increasing. Your automobile, for instance, contains about forty different kinds of iron, steel and steel alloys, and those in your car may be entirely different from the metals with an iron base employed for thousands of other purposes ranging all the way from massive machinery to domestic cooking utensils.

To realize the possibilities of these new alloys, we must first know some of the properties of the mother metal, iron. While iron and iron products form the





*Middletown  
Ohio*

**BLAST** furnace of the American Rolling Mill Company. Above, steel worker peering into open hearth furnace, a white-hot slab ready to start through the continuous rolling mill, and steel worker cutting slabs into three-foot squares in preparation for rolling into sheets.





F4

base upon which our civilization has been built, no one knows when or by whom iron was discovered. But it did have to be discovered because there are no nuggets of pure iron. Perhaps some early aborigines built a roaring fire against a bank of reddish earth consisting partly of iron ore. The prevailing wind served

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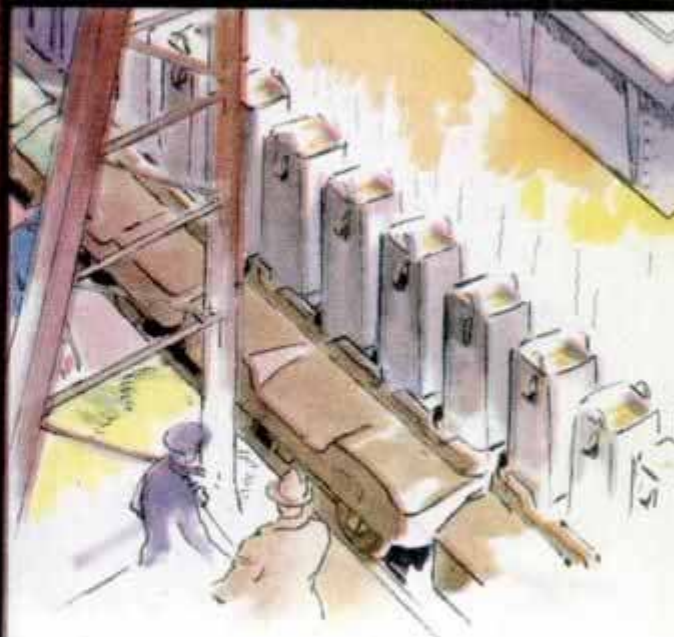
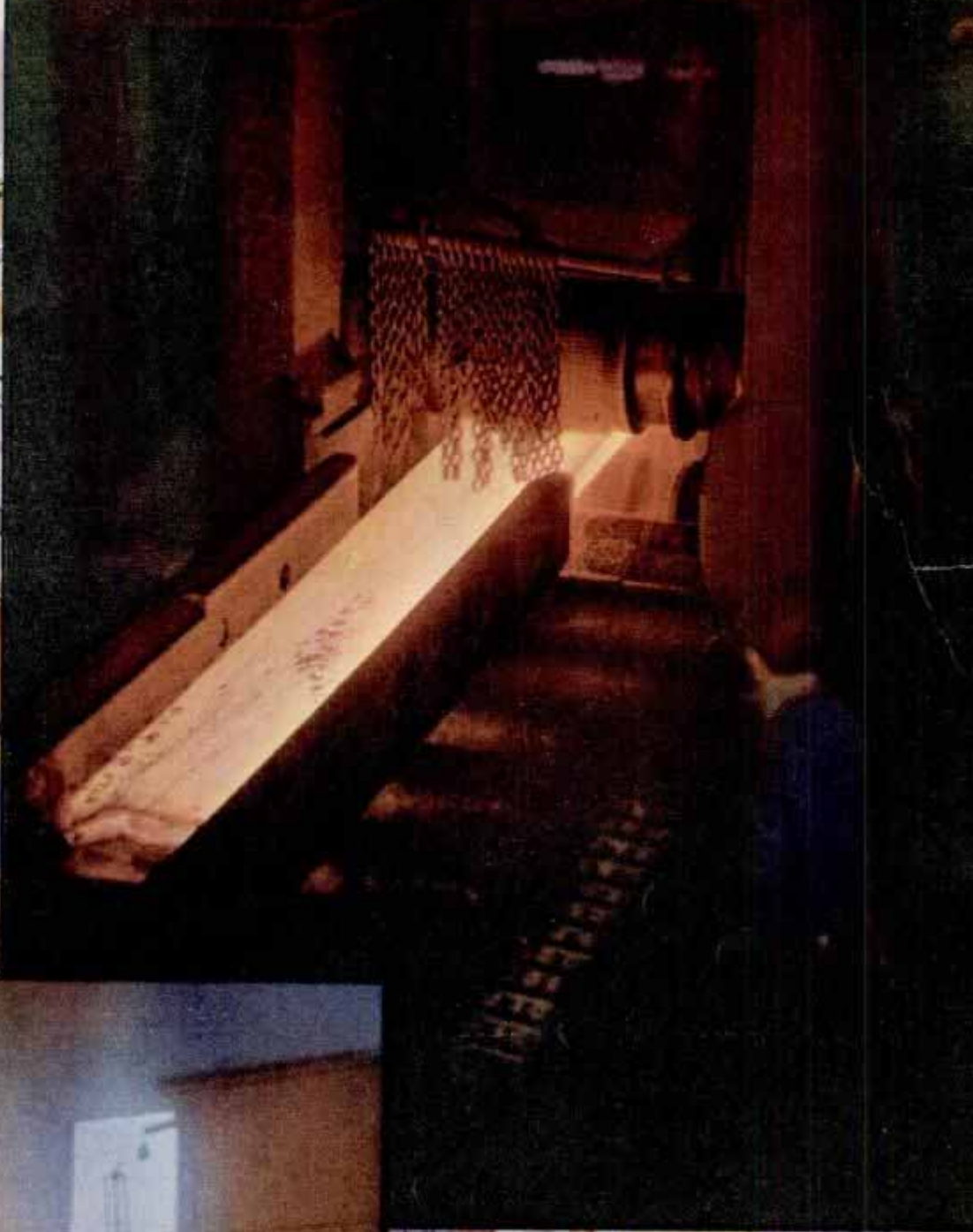
**CHARGING** an open hearth furnace. Heat is generated by hot gases forced through checker chambers under pressure and temperatures of 3,000 degrees are not uncommon.

as a bellows to blast the hot flame against the bank. When the fire died out, they poked about among the embers and found a few pellets of malleable substance which made a very superior spearhead. Some such accident must have ushered in the iron age.

At any rate, the neolithic genius who "doped out" the secret seems to have spread the news, for the remnants of ancient furnaces are scattered all over the world, and a wedge of wrought iron was buried in the great pyramid of Cheops probably as early as 3,500 B.C. The real forerunner of our modern blast furnace, however, was the Catalan forge, a very crude furnace developed in Spain some 150 years before Columbus discovered America. It burned charcoal and used a blast of hot air to smelt a malleable iron.

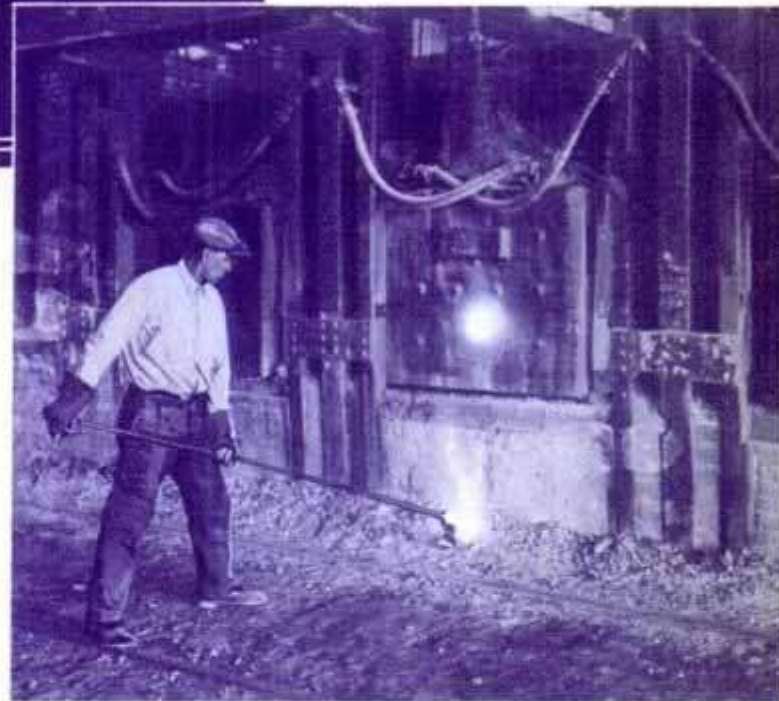
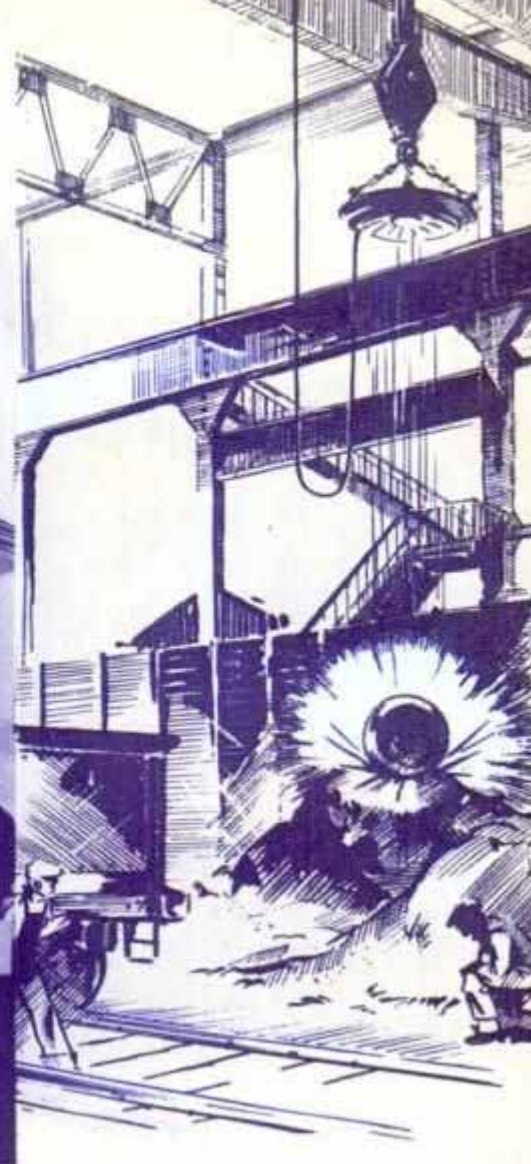
Some of the troubles of these early





**PONDEROUS** ingot, above, being passed back and forth through mighty rolls to reduce it to a twenty-foot slab. Left, stream of molten metal spilling into ladle from "hot car."





F4

654

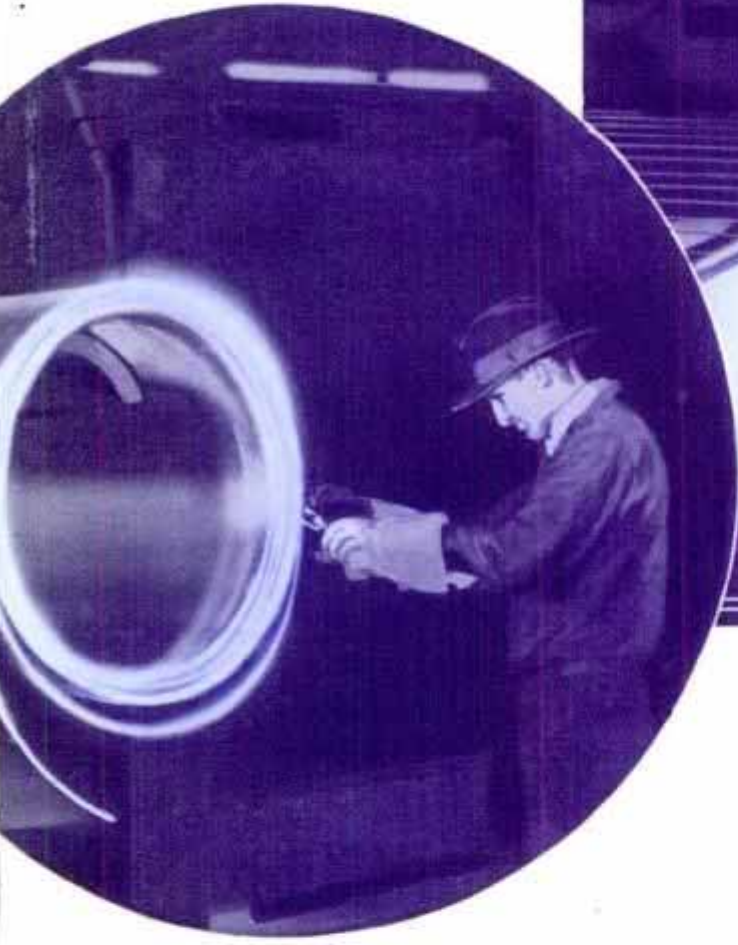
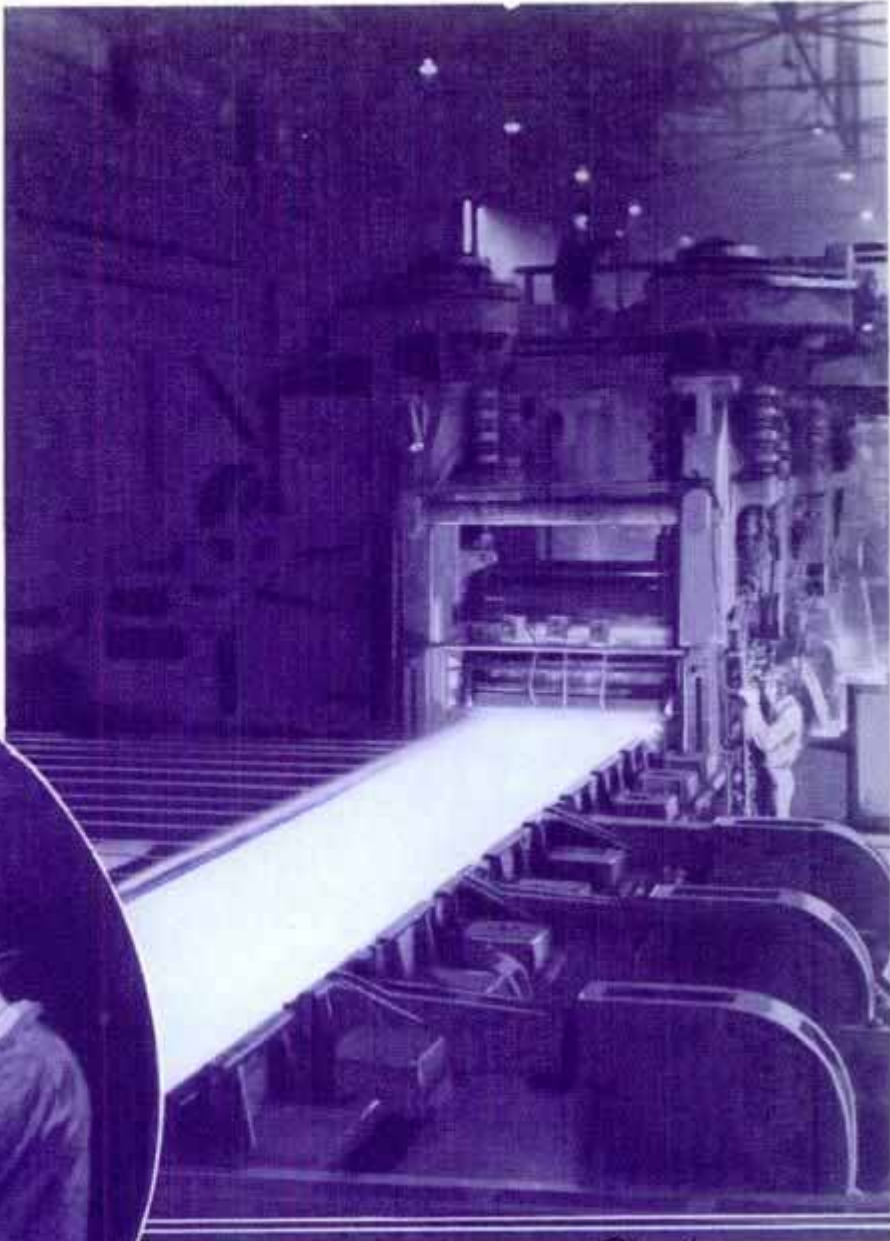
metal workers are explained by the very nature of iron. Iron ore is a natural deposit consisting of the iron held in the chemical grip of oxygen. Under the influence of high heat, oxygen's strangle hold on the metal can be broken by carbon. The first primitive furnaces produced a small ball of metal, soft and malleable, a variety of wrought iron.

Then a great discovery was made—a discovery which affected the future of civilization. It was found that when more charcoal was present in the furnace than was necessary to combine with the oxygen of the ore, the liberated iron absorbed enough of the excess carbon to change its own nature. The intense heat produced a fluid metal in the hearth of the furnace instead of the stiff, pasty ball of malleable iron. It also was found that this liquid iron could be “cast,” or poured into molds and made into shapes useful to man, so it became known as

**LIFTING** steel sheets from the roll table in the finishing mill as the morning sun streams in through the windows and, below, dipping a sample of molten metal from the open hearth furnace to be sent to the laboratory for analysis.



653



*JH 4*  
**A RIBBON** of steel as it speeds through the continuous rolling mill and, at left, the end of the journey through the mill. The man is measuring the gauge of the red-hot coil.

cast iron. That was a great stride forward in the iron age—the knowledge that a surcharge of three and one-half to five per cent of carbon gives iron a fluid quality while hot and an extreme brittleness when cold.

Next came steel, the master servant of mankind and the first alloy of iron. Steel has neither the softness of malleable iron, which is low in carbon content, nor the hard brittleness of cast iron which is high in carbon content. The early metal workers made very fine sword blades by heating rich ore in small closed crucibles,

allowing the metal to absorb about two per cent of carbon instead of the three and one-half per cent or more of cast iron. The result was carbon steel. When hardened by cooling quickly in water, a forged-out blade of this material could cleave a piece of iron without dulling its edge or cut in half a piece of silk floss tossed into the air.

The triumvirate of wrought iron, cast iron and steel formed the basis of the iron and steel industry. As civilization advanced, the world needed more and more iron and from this need there





**LADLE** pouring molten metal into ingot molds. When the valve in the bottom of the ladle refuses to close as the ladle is moved from one mold to the next, a display of fireworks worthy of the Fourth of July results as the metal strikes the edges of the molds.

evolved the blast furnace, a modern adaptation of that early Catalan forge. The blast furnace, a great hollow bell-shaped tube, operates like a glorified base-burner coal stove. Ore, coke and limestone are dumped in at the top and a mighty blast of preheated air is forced in at the bottom. Coke is the reducing agent and limestone is the fluxing agent. A pool of molten iron forms at the bottom of the furnace with a layer of molten slag floating on top. The iron and slag are drawn off separately. The molten stream of iron is sometimes guided into huge "Thermos Bottle" ladle cars where it is kept hot for delivery to the open hearth furnaces. When the molten metal is not needed for immediate use in

*(Continued to page 118A)*

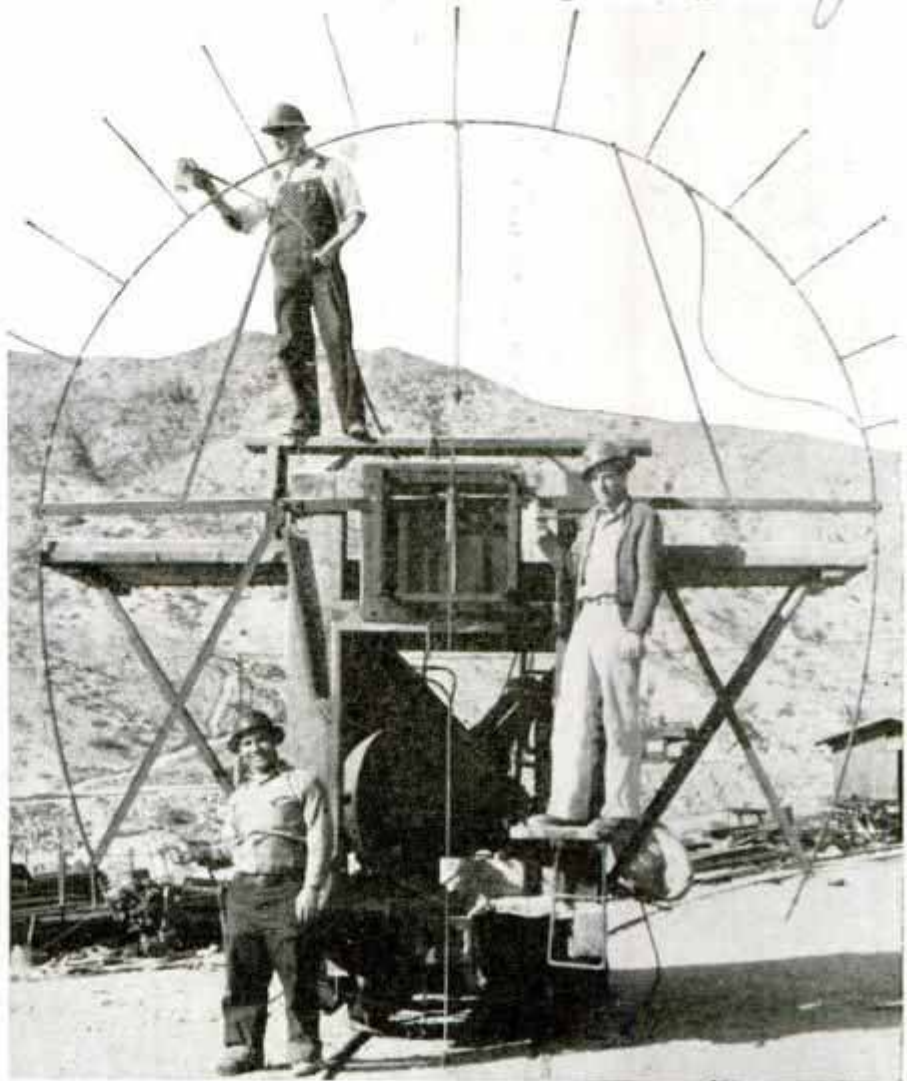


*115 S. Broadway  
Los Angeles, Calif.*

# "Feelers" Measure Tunnel for Painting Crew

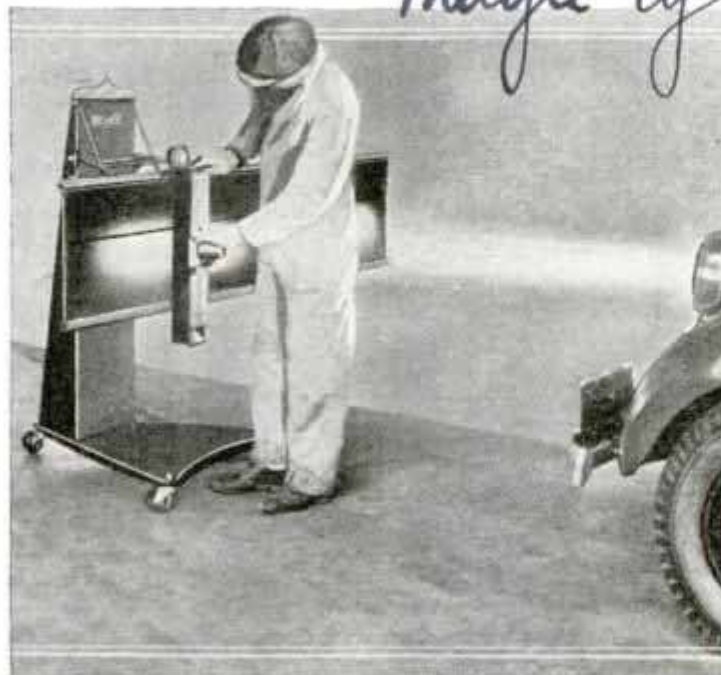
Painting the rocky walls of a mountain tunnel calls for special equipment, and when the "decorators" move into the Colorado river aqueduct tunnels in southern California they ride a platform car over which is mounted an iron collar. This horseshoe-shaped frame with its spring wire "feelers" gauges the size of the tunnels. An air receiver is connected to the air line of the tunnel, and, by way of a reducing valve, feeds the paint guns. A crew of three men paints 1,000 feet of tunnel in a day. The machine is used also as a template for scribing timber supports.

*One thousand feet a day of tunnel wall can be painted by a three-man crew riding this traveling platform. Wire "feelers" extending from the iron collar gauge the size of the tunnel. Paint is fed by air guns*



*7256*

# "Electric Eye" Tests Headlights for Focus and Intensity



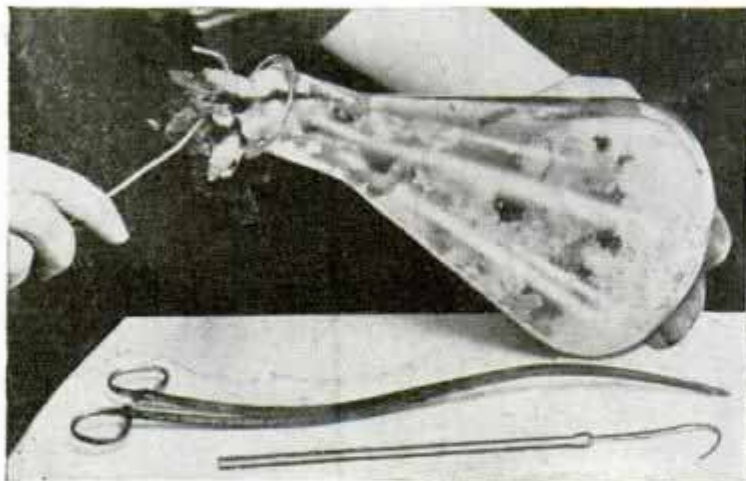
Adjusting automobile headlights to proper focus and brilliance has been simplified by the use of the "electric eye" on a portable screen. Requiring no battery or wiring, the instrument is wheeled about ten feet in front of the car and the headlights switched on. With a few simple adjustments, you can read on the photoelectric "optoscope" the candlepower of the headlight and its aim in terms of inches drop per twenty-five feet. The tester is useful to garage men, helping them "sell" headlight service.

Testing headlights for brightness and focus with "electric eye"

*Weaver Mfg. Co Springfield*



72 32  
 37.41-8 3rd fl.  
 Jackson Height 2-4  
 Bottle-Raised Plants Thrive on Synthetic Soil



Top, transplanting from outgrown bottle; right, light meter measures sunshine "dose"; below, paper cup as bottle cap

Raising plants in bottles used to be a hobby of Miss Clara Hires, schoolteacher of Millburn, N. J. Now her hobby has grown into a greenhouse "nursery" in which hundreds of plants are flourishing in sealed bottles, nourished by a jellylike, translucent artificial soil. Miss Hires and several assistants, including mechanical ones, devote full time to these bottle-raised plants, controlling normal or dwarf growth by the chemicals in the synthetic

soil. Nothing is ever added to the formula in which the seed is first placed—a mixture of agar-agar with certain chemicals, sufficient to sustain life for years. Moisture is continually replenished by mist collecting on the inside of the bottle and "raining" back on the plant. Light is necessary, but direct sunlight would burn the plants and Miss Hires tests the light frequently with a light meter and also has automatic alarm bells which ring if the light becomes too intense. In sterilized, sealed bottles plant diseases and insects are excluded, and bottle-raised plants which are transplanted to outdoor gardens are hardier than those started in natural soil. Some bottles are permanently sealed with metal caps and a special glue; others are capped with cotton wads and paper cups so that the plant, when it



has outgrown its first bottle, can be transplanted to a larger one or to a garden. From the moment the seed is planted in the transparent jelly, every stage of growth is visible for study.

F244.

### Pictures on Glass in Ballroom of Big Liner

Panels decorating the ballroom of the superliner, "Queen Mary," are glass pictures produced by a London artist. Wheels for cutting, apparatus for sandblasting and acids for burning are the tools and materials he uses. Delicate colors and tints are drawn from the sheets of glass. Sometimes color is burned on in a kiln. The panels required eight months' work.

Jan Juta, South African



Artist at work on glass panel to be used in decorating ballroom of the "Queen Mary." Note intricacy of some of the patterns

## Planes Drop Feed for Birds Threatened with Starvation



acme

Loading hundred-pound sacks of seed aboard an army plane at Newark, N. J., to be scattered over the country for hungry birds

When lack of feed in the open country threatens the bird population with starvation, "birdmen" come to the rescue. Hundreds of pounds of seed were loaded on an army plane at Newark, N. J., and taken aloft to be scattered over the countryside for the birds last winter. State game officers, sportsmen and army officers cooperated to feed the birds.

F242.

### Electric Putty Softener Aids Removal of Old Panes

Designed to speed up removal of panes from old windows, an electric device softens hardened putty without damaging the sash. It plugs into the nearest socket, either alternating or direct current, 110 volts. The softener facilitates removal of large panes of glass without the usual danger of breakage or chipping at the edges and corners.

110 v. a.c.



Fletcher, Terry Co.

Photo: (unreadable) 110 v. a.c. 110 v. a.c. 110 v. a.c.



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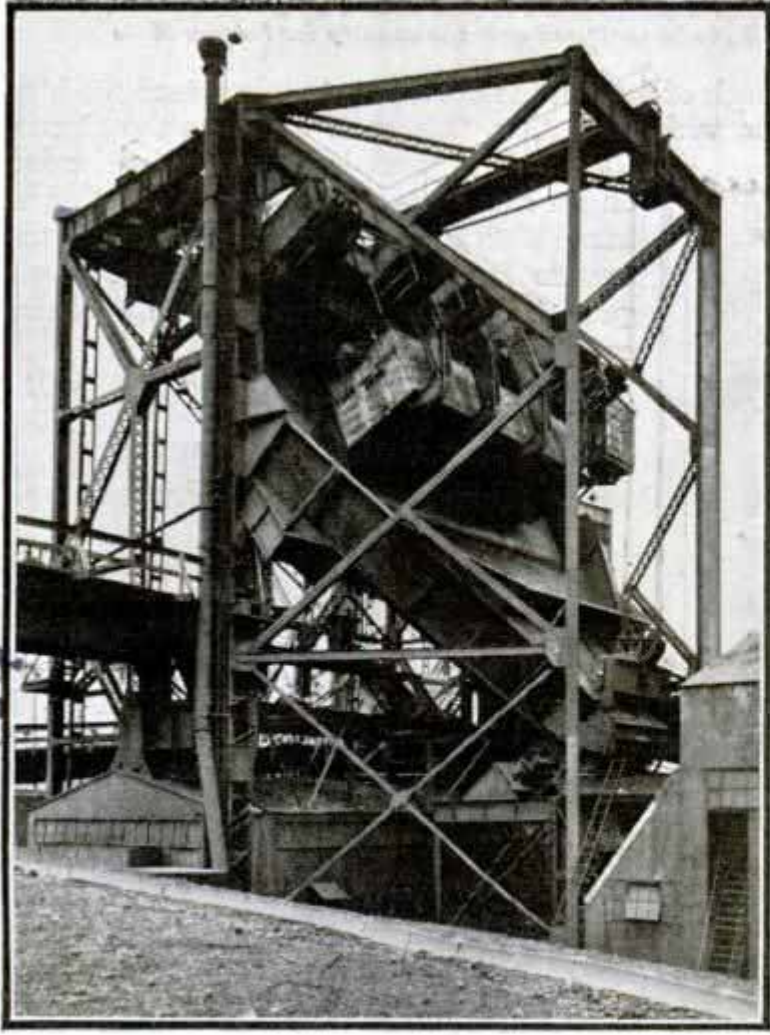
Com. George H. Cokford,  
2047 N. Park Ave.  
Philadelphia

# The FREIGHT TRAIN

Merrimac River, Concord, Md.



Curtis Bay Coal Pier, Baltimore, Md.



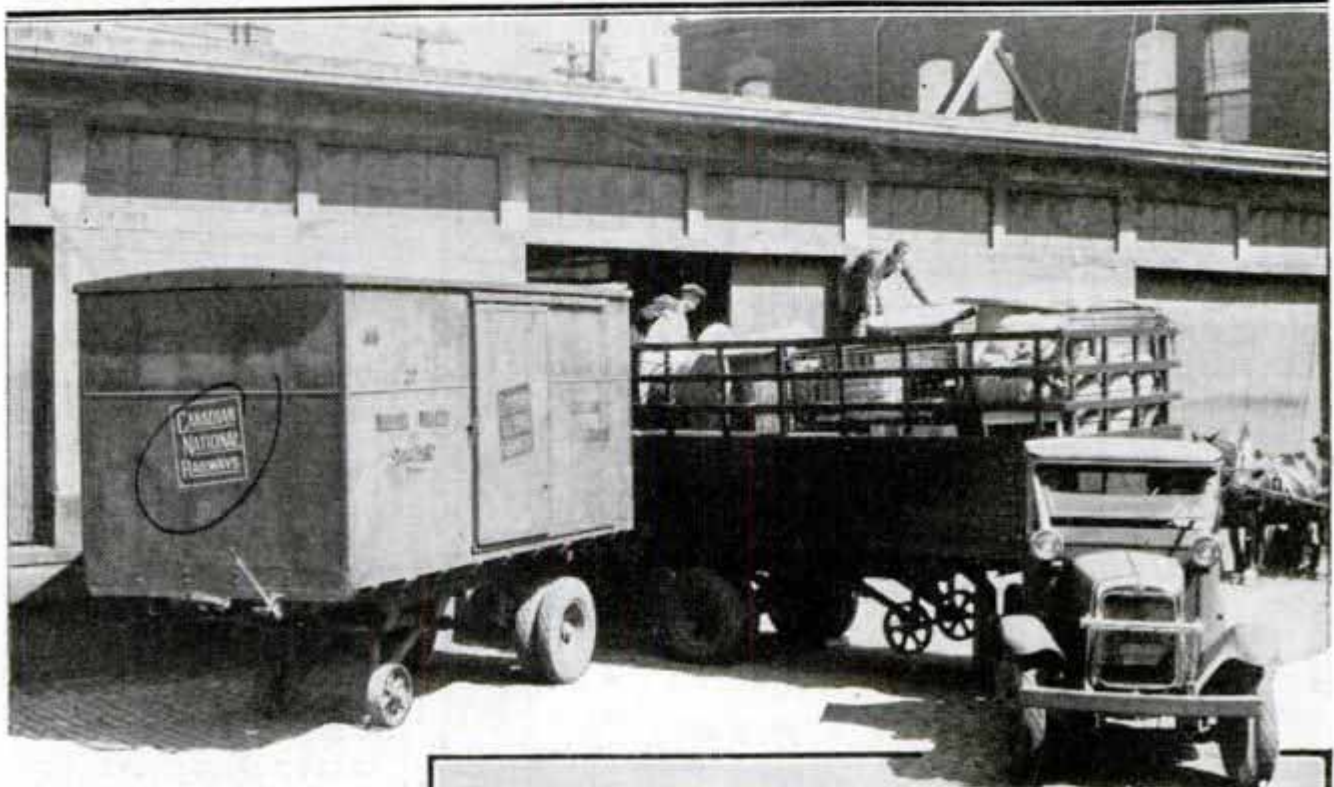
NO LONGER does the lowly freight train puff and pull from one siding to another, lingering at water towers while the crack flyer whizzes by; no longer does it wait patiently for opportunities to move between passenger trains; and no longer is it known by a number only.

Freight trains now run on regular fast schedules of their own, and—what is more—the crack freight train of today sports a name instead of a mere number. There is the "Speedwitch" between Baltimore, Philadelphia and Boston each way every night carrying merchandise; "Man o' War" carrying live stock east from Chicago; "The Greyhound" carrying its live stock burden from St. Louis east; "The Packer" from Chicago; "The Gaswagon" carrying automobiles from Detroit eastward; "The Ranchman" carrying perishables from California and the southwest; "The Derby" carrying perishables from Chicago to Louisville, and "Uncle

Top, hauling a Boston and Maine freight up a grade. Below, it's "bottoms up" at a Baltimore and Ohio coal pier as giant hands pick up a steel hopper car and dump its cargo



# Goes MODERN



Remus" carrying oranges and grapefruit from Florida to Boston. And everyone of these crack freight trains lives up to its name, following its schedule with the precision of a de luxe limited.

In the last ten years the average speed of freight trains has increased thirty-two per cent. The electric locomotive has almost revolutionized the freight train. The steam locomotive is powerful, but its power is limited, while theoretically the electric locomotive can draw almost unlimited power from its source of supply.

Few, if any, railroads are free from grades, and while a hill may be barely perceptible to the powerful steam passenger locomotive, that same slight grade will slow down the most powerful steam freight locomotive with a long string of cars behind it. But the electric freight locomotive merely draws more power from its over-

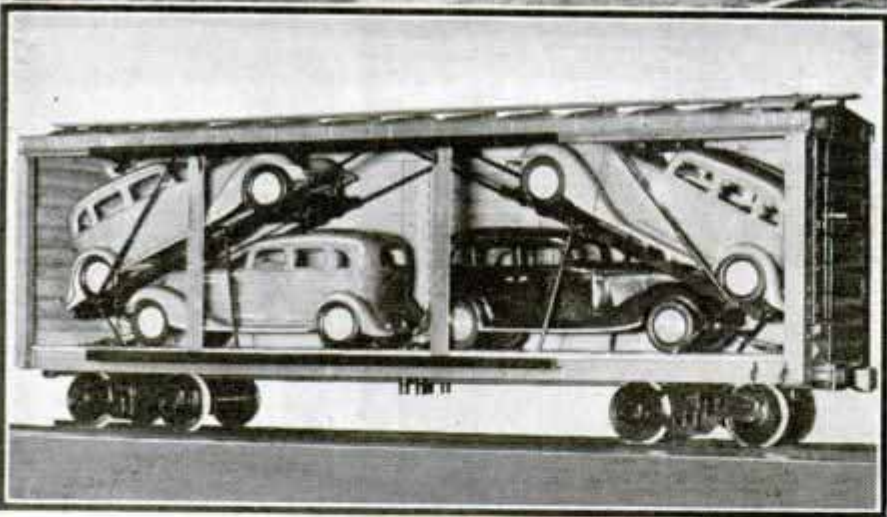
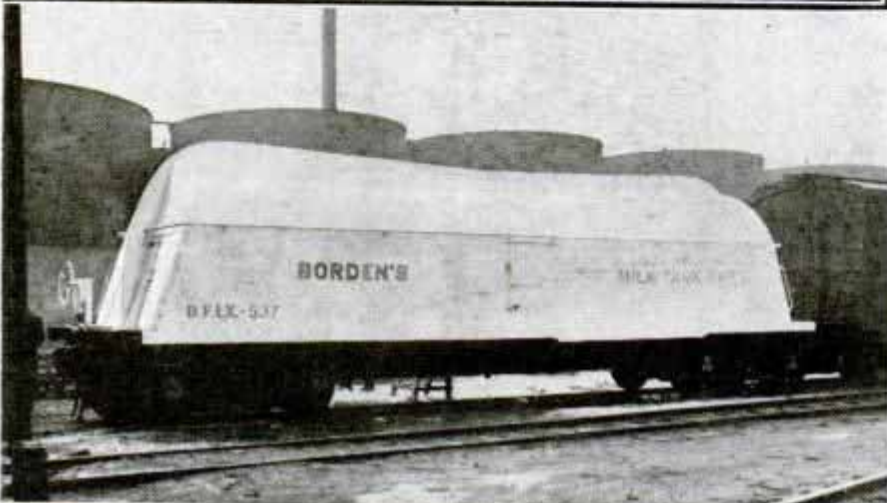
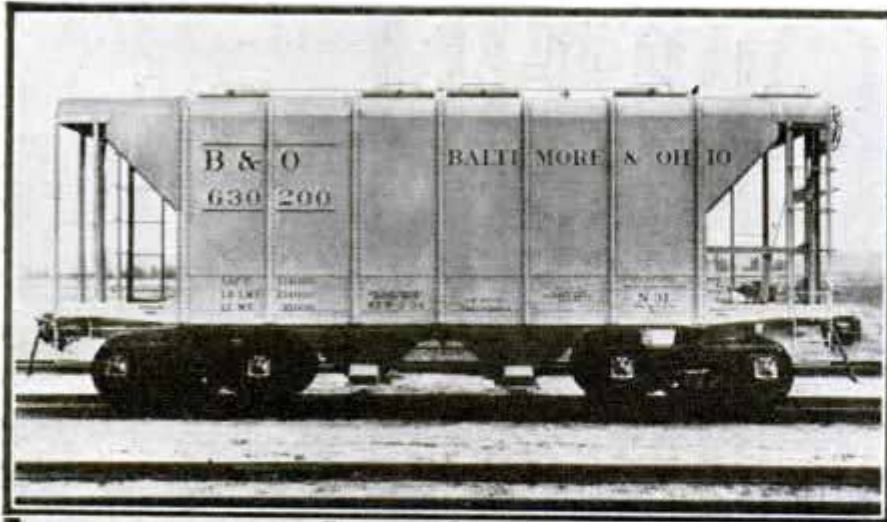


*Rubber-tired box car at top is trailer hauling less than carload freight between stations. Bottom, airplane is shipped in end-loading box car*

head line and maintains its speed. While freight trains have achieved speed and style, freight cars themselves have dressed in modern fashion and gone specialist. A streamline car that carries 6,000 gallons of milk is being tested in New York's dairy region. Milk tankers are now glass-lined for sanitary reasons. Auto-loading de-



6 14 42  
662



Top, "covered wagon" weather-tight hopper car for cement. Center, streamline milk tank car. Bottom, cutaway view of auto-loading car

balsam wool to ship Dry Ice safe from evaporation. In place of the old refrigerator cars with air-chambered wooden walls and floors a foot thick, insulated steel cars with icing arrangements or mechanical refrigerating units and vastly greater loading capacity now hurry fresh vegetables and fruit across the states to you. Hopper cars for cement, phosphates and similar "perishables" wear watertight metal covers, and seventy tons of bulk cement can be dumped into one car instead of packing in bags. Steel container cars are "specialists" in carrying less than carload freight between metropolitan centers, where the containers are lifted off and on the cars by cranes. Each car accommodates five containers of about 400 cubic feet capacity. Small lots of freight thus can be carried from one station to the next with a minimum of burden in loading. Tank cars usually are owned by the shipping company, since they are reserved for transporting one particular product. An oil company, for example, loads its tank car with top-grade lubricating oil and would not want the car filled

with a lower grade oil on another trip for fear of contamination. Acid is carried in tank cars lined with lead, rubber or nickel. One of the latest applications of the car builders' ingenuity is the convertible boxcar. Because of its limits of shape, size and loading the boxcar has not been easily adaptable to all types of freight. The Baltimore and Ohio railroad has built a fleet of light steel boxcars that can be

with a lower grade oil on another trip for fear of contamination. Acid is carried in tank cars lined with lead, rubber or nickel. One of the latest applications of the car builders' ingenuity is the convertible boxcar. Because of its limits of shape, size and loading the boxcar has not been easily adaptable to all types of freight. The Baltimore and Ohio railroad has built a fleet of light steel boxcars that can be

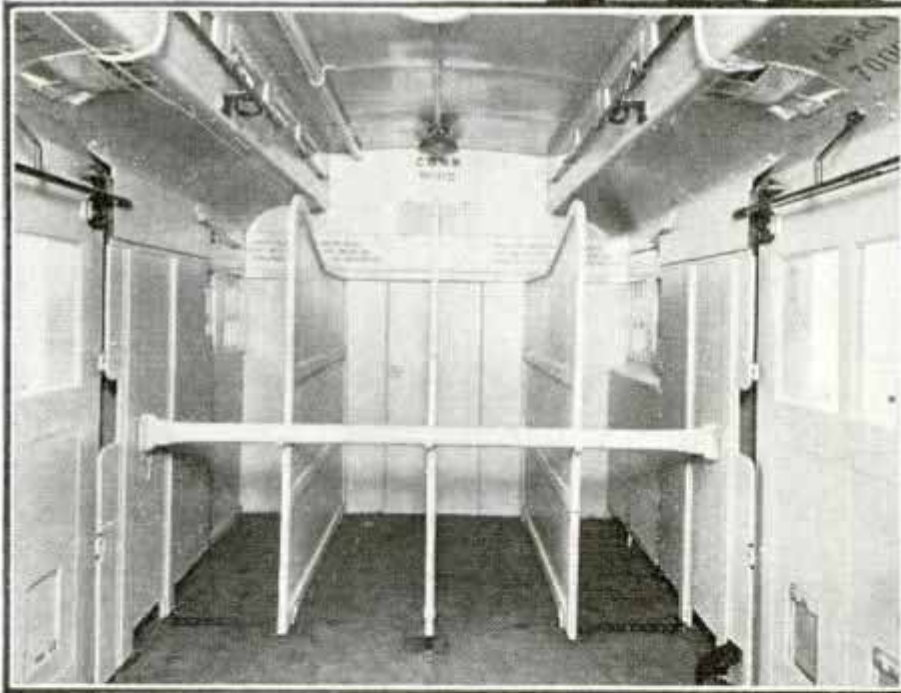
3112 S Kedzie



Liquid Carbonic  
3112 S. Kedzie  
Chicago 18 1442  
663

loaded as usual from the sliding side door; or it can be transformed into a single giant bin for wheat, corn, cement, sand or any bulk product. Lift up the floors and you find a steel hopper bottom. Trap doors in the roof open for loading. The cargo is quickly dumped from the floor hoppers and chutes at the end.

Freight trains are not dressing up in sport togs just for the sake of personal appearance. There is economy in the new metal cars. Not only do they offer greater capacity and better protection for shipments, but the light steel alloys and aluminum save considerable tonnage. One boxcar of Cor-Ten steel weighs 7,900 pounds less than the standard wooden car. Another car of welded Cor-Ten and special alloy construction



Above, loading Dry Ice aboard insulated car with sloping steel sides. Below, race horses ride in style in this Chicago and North Western car

cars, have developed a stainless, rustless steel hopper. Containing eleven per cent chromium, this abrasion-resisting car is expected to outlast by several years the former type.

Sixty miles an hour is not unusual speed for a freight train today. Truck and airplane competition is goading the old-time "slow freight" to a fast pace. The average speed of freight trains in the United States quickened from eleven and one-half miles an hour in 1924 to

weighs 10,200 pounds less than a similar heavy steel car built in 1933. Steel hopper cars look tough, but their life is actually short because of corrosion and wear, hastened by rain, atmospheric conditions, but especially by sulphur-bearing coal and ore. The average life of a coal hopper car body is only eight to twelve years. Steel "doctors" to lengthen the life of these

sixteen miles an hour in 1935; and that included the way freights that stop at every milk depot. Perishable shipments set the pace for other freight. The Baltimore and Ohio marked up a record in 1935 by hauling a trainload of bananas from Baltimore to Cleveland in fourteen and one-half hours; formerly thirty-six hours was good

(Continued to page 124A)

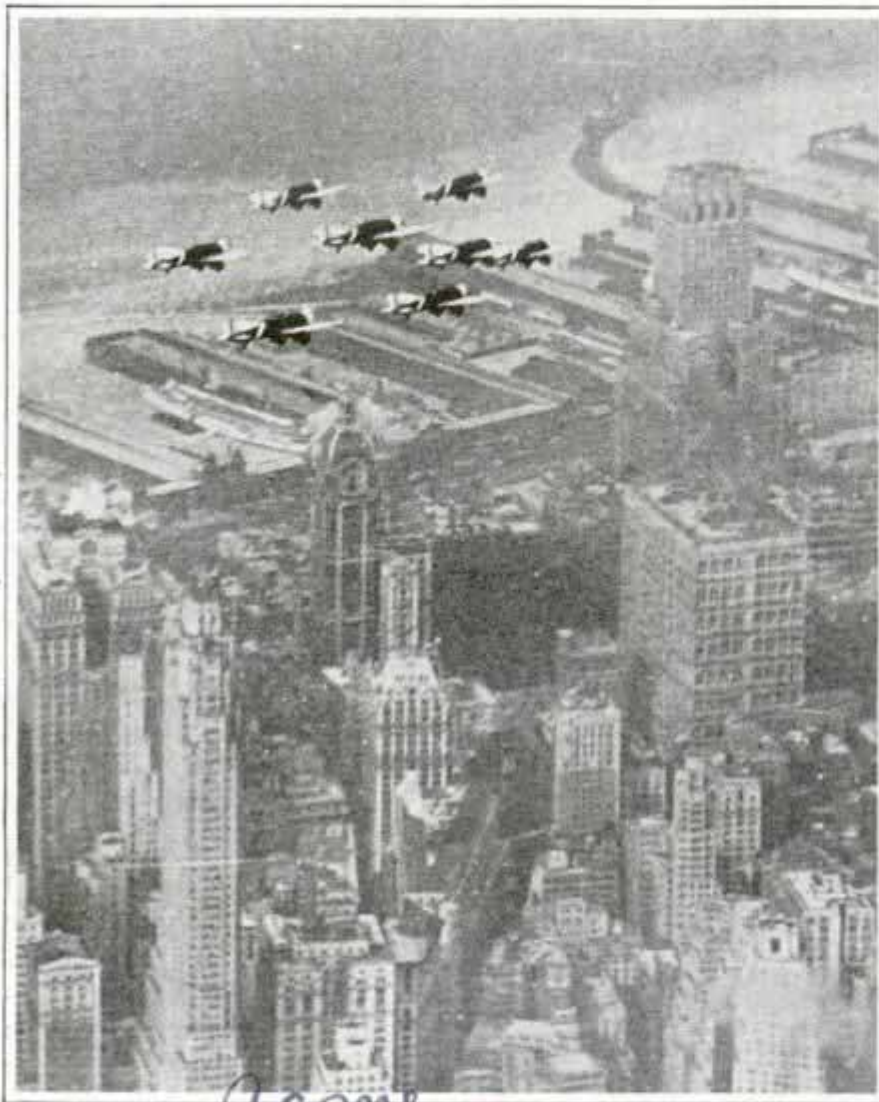
American Car and  
Chicago and North Western



F190

Charles A. ...  
Transportation Engineer,  
Westinghouse Electric

# Planes "Attack" New York in Mimic Air Raid by Army



Group of planes preparing to "attack" the city of New York in recent maneuvers. Defending forces drove off the enemy

Recent maneuvers of army air forces gave New York a taste of what might be expected if enemy flyers should attack the city. From Concord, N. H., army planes swooped down on Manhattan's skyscrapers in a mimic air raid, while from Mitchel field ascended a defending force which engaged the "enemy" off the battery and repelled them in a short battle. Cities in many foreign countries have been subjected to similar "attacks."

## Two-Miles-a-Minute Trains

Seen in Near Future

Passenger trains roaring over the rails at 100 to 120 miles an hour may be a com-

Charleyway Age

monplace in the not distant future. Powerful locomotives and sturdy streamline, light steel cars capable of this terrific speed already have been engineered, although their safety and ability to maintain high speed have yet to be proved. But public demand for fast travel and fast freight is growing, and railroad executives already are planning to step up passenger schedules and operate freight traffic at sixty to seventy miles an hour.

F267

## Two-Way Reflector at Curb Easy for Driver to See

Visible to drivers approaching from either direction, the latest curbstone reflector appears red to one and white to the other. The motorist approaching a bend sees a red reflector on his near side or a white reflector on his off side. The two-way reflector is set into a small recess in the curbstone.

Wm. G. & E. ... Pa.



Reflector in each of the V-shaped recesses serves as warning to motorists

Wide World  
on Everham - Worcester  
Road, England

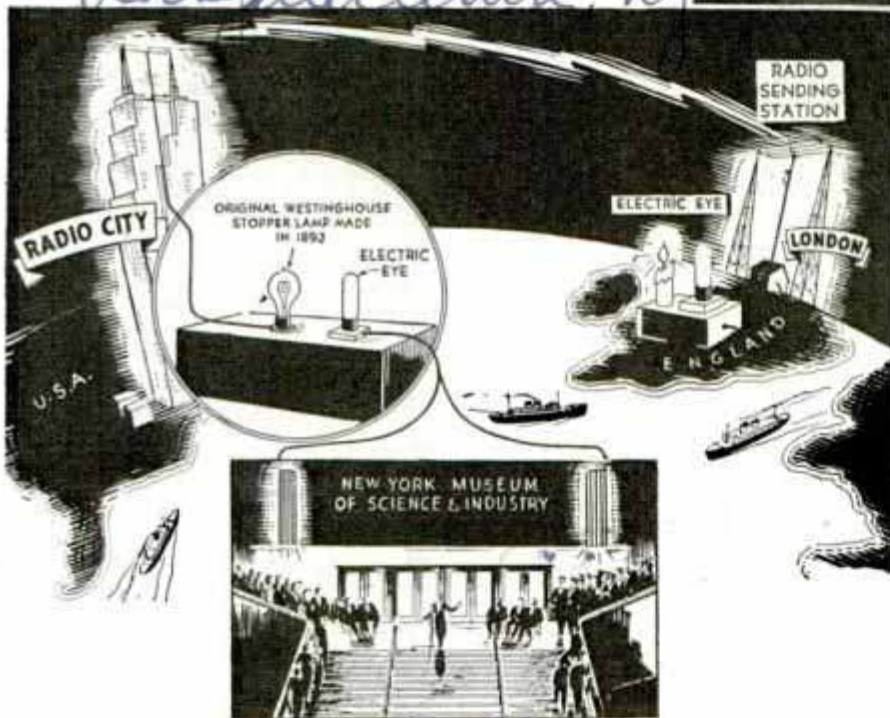


# Sound of Candle Lights Bulb across Ocean

By a feat of modern magic, the "noise" of a candle's flame in London turned on a historic electric-light bulb in New York, and its light set ablaze in the Museum of Science and Industry in Radio City a bank of high-intensity mercury vapor lamps, symbolizing the new day in illumination. This was part of the ceremony dedicating the museum. At the desk of Michael Faraday, great English scientist a century ago, a candle was lit. Sound-recording apparatus caught its imperceptible noise, carried it by short-wave radio to America, where the impulse set alight one of the original Stopper lamps such as George



Above, "Stopper" lamp beside "electric eye." Drawing traces electric impulse from candle to mercury vapor lights



Westinghouse employed to illuminate the World's Fair at Chicago in 1893. An "electric eye" picked up the glow of the Stopper lamp and actuated switches that turned on the mercury vapor lights in which electricity is sent through metallic or gaseous vapor instead of a filament.

## Elusive Spark of Life Is Electrical Says Famous Surgeon

Is electricity the basis of life? Dr. George Crile, famous surgeon and a founder of the Cleveland Clinic, in his recent book, "The Phenomena of Life," puts forward the theory that electricity is the elusive spark of life. He believes our bodies are made up of cells which are really minute but powerful electric furnaces or "radiogens." Scientists generally have not accepted Dr. Crile's theory and a test would require collaboration of investigators in many fields of science. Briefly, Dr. Crile's theory is that oxidation produces radiant energy, radiant energy generates electric

currents in protoplasm, electricity is the energy that governs the activity of protoplasm, the normal and pathological phenomena of life are manifestations of protoplasm, therefore the phenomena of life must be due to radiant and electrical energy. Dr. Crile believes the liver, brain and adrenal glands "provide the clue to the control of energy that most immediately governs life, the failure of which causes death." He defines protoplasm as "a system of generators, conductance lines, insulators and infinite numbers of infinitely thin films to hold electric charges."

F296

Cleveland Ohio

Dr. Robert G. Well Laboratories  
 Professor of Chemistry, Columbia University, N.Y.  
 Ridgecroft of Westinghouse  
 9/5/26  
 Dr. Crile



# 'Future Air Liner' in Film Aids Plane Builders



Scene from motion picture showing how producers expect the future air liner to look. Note map, which lights up as the plane travels, and the comfortable chairs

Designed for use in a motion picture, an "air liner of the future" has features which officials of air transportation companies have decided to adapt to planes now under construction. The movie ship has upholstery of blue, fashioned from a material resembling chinchilla. A red and white neon-lighted map, with chromium background, outlines the transcontinental route of the plane. As the air liner moves along the route, the map is lighted to show the position of the plane at all times. More comfortable seating is another feature of the cabin.

Popular Mechanics Magazine does not publish the name of the maker of, or dealer in, any device described in its pages, but this information is kept on file and will be furnished by our Bureau of Information upon request, accompanied by stamped, self-addressed envelope.

F265

## Concrete Bomb Trains Pilots of Army Air Squadrons

Instead of bombarding targets with costly bombs, army aviators take dummy



Dummy bomb made of concrete which is used for training army flyers

Acme  
at March Field

Paramount Pictures  
 Hollywood  
 545  
 Los Angeles  
 California  
 Paramount Pictures  
 545  
 Los Angeles  
 California

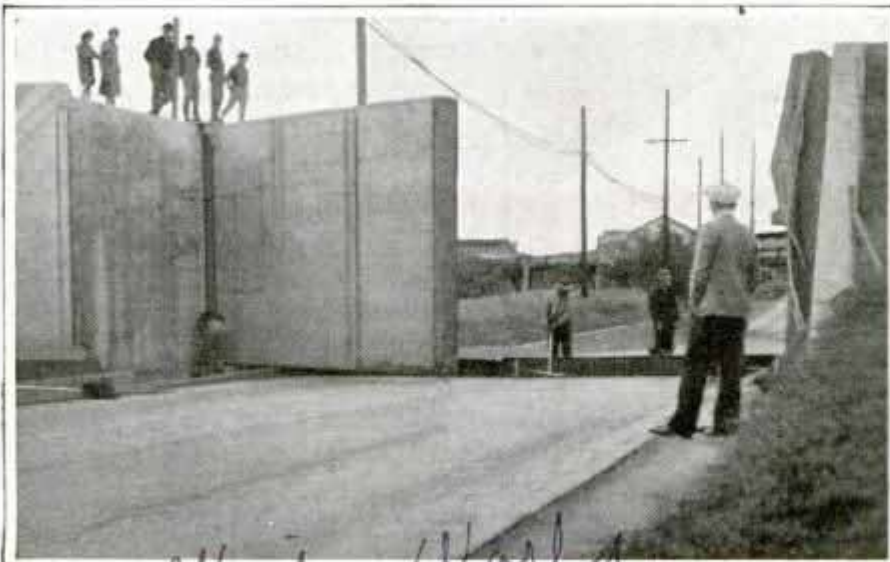


bombs of concrete aloft on training flights. These imitation bombs cost only six dollars each and weigh 1,100 pounds. Although not perfectly streamlined, they can be dropped on a target with considerable accuracy, and are being used to drill ground crews in handling bombs and to study the effect on airplane formations when they are dropped. Two of the dummies can be carried by a plane.

F253

### Floodgates Guard City When River Spills over Bank

When spring thaws in the high sierras of California send freshets down into the valleys, the people of Sacramento close their floodgates and bolster the dikes that keep the capital city dry. Steel gates are thrown across highways which might be transformed into rushing streams if the neighboring rivers spilled over their banks.



Preparing to close the floodgates across a highway leading into Sacramento, Calif., as rising river threatens to overflow into city

## Mobile Air Conditioner Services Cabins of Big Transport Planes



Photo snapped on cold day shows air conditioner supplying warm air for cabin of big transcontinental transport plane

Used for warming the cabins of airplanes in winter and for cooling them in summer, a mobile air-conditioning unit

is the latest adjunct to the modern airport. It was designed by Transcontinental and Western Air, Inc., as a means of making cabins of transport planes comfortable at the beginning of flights. After the planes are in the air, special steam heaters supply warmth in winter and the air stream at higher altitudes cools the cabins in summer. A large hose from the unit is introduced into the cabin of the air liner to conduct either heat or cooling air.

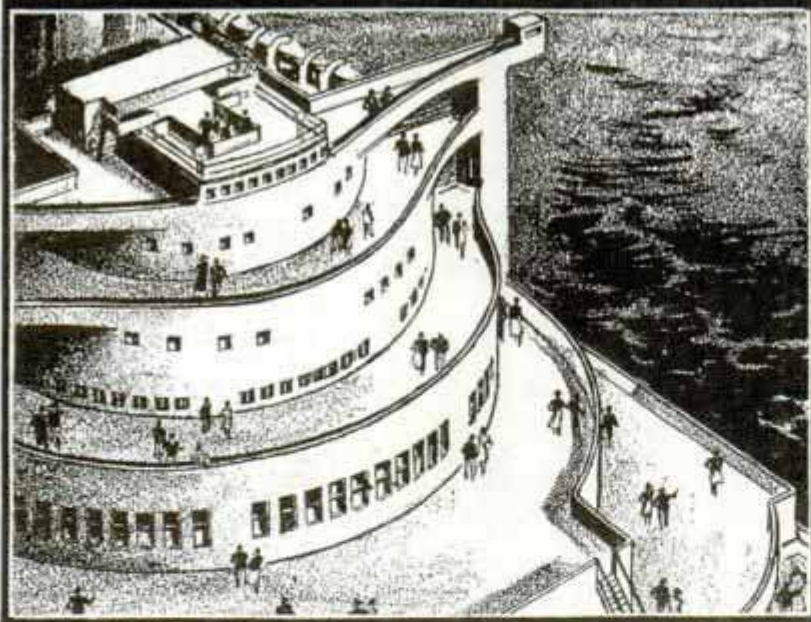
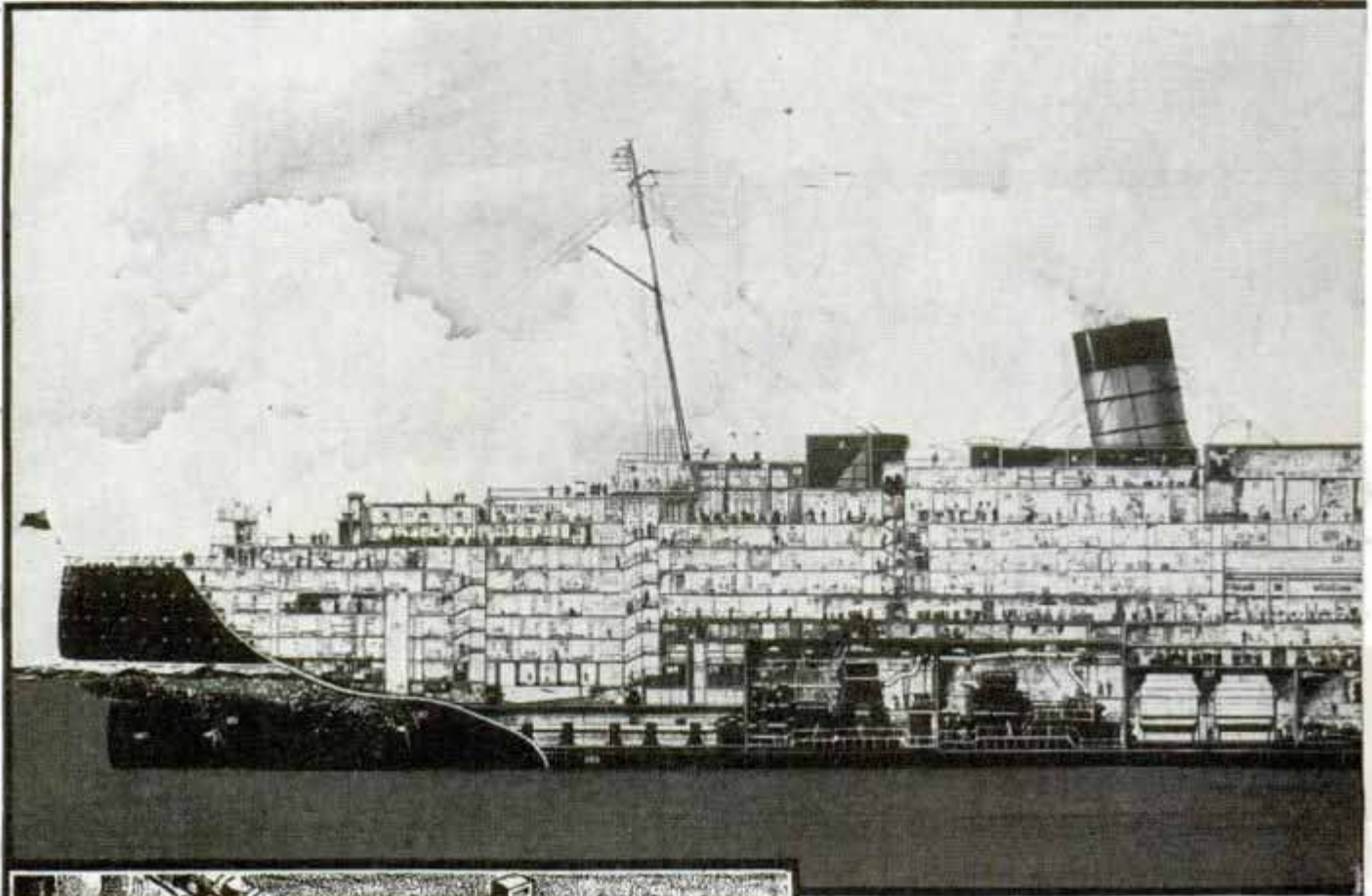
Transcontinental and Western Air, Inc. 2114 Central St. Kansas City, Mo.

Wide World



7115 Cont. John Blaiseman.  
4 W. 103rd, New York

# Thirty MILLION Dollars



*Cutaway drawing of the "Queen Mary" and artist's sketch, looking down on forward decks*

**F**IVE years in construction, England's \$30,000,000 masterpiece of shipbuilding, the "Queen Mary," represents the latest achievement of British materials and Scotch engineering, a combination that has maintained England as mistress of the seven seas.

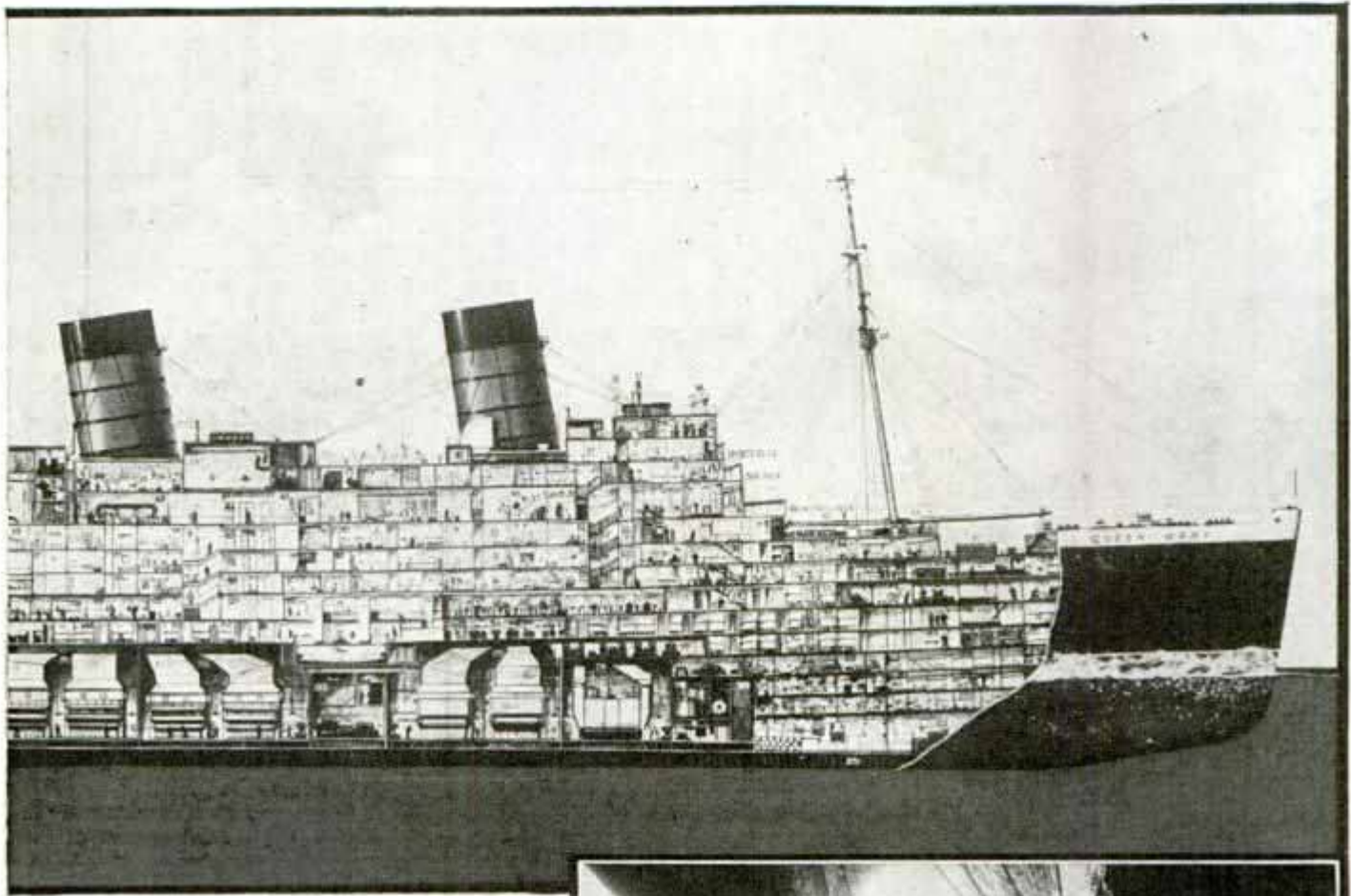
Among old salts there is a saying that

any man can run a ship, but only a Scotchman can build one. There is no gainsaying that Scotchmen around Clydebank are shipwrights worthy of their calling for the seagoing monster that for five years has stood like a towering landmark of John Brown's shipyard, fares forth with new standards, comforts, safeguards and equipment. And the British and Scotch are so proud of their work that they are rushing plans for a sister ship. The "Queen Mary" is really two ships, one inside the other. Between the outer and inner bottoms there is room everywhere for a man to walk erect, while the outer and inner sides are separated by as much as twenty feet, and this double skin runs up to a height of forty feet. The inside



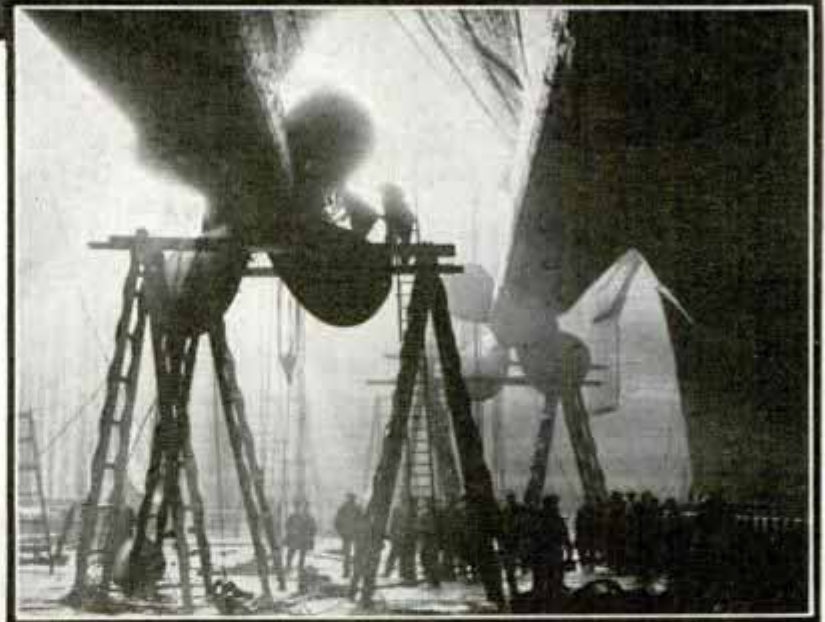
Canada ... + 1/15  
line, 25 Broadway  
Worth of SHIP *needed*

# Worth of SHIP



shell is inhabited by the crew and passengers who are protected by 160 watertight compartments in the outside shell. Within the shells are thousands of rooms, and shops, theaters, restaurants, lounges, parlors, swimming pools, promenades, gymnasia, libraries and gardens.

One promenade deck is longer than the facade of Buckingham palace. If stood on end, the "Queen Mary" would top the Eiffel tower by thirty-four feet. She smashes all records for engines in a floating bottom. These monsters can deliver 200,000 horsepower to the propeller shafts, 50,000 horsepower to each propeller. Power means speed. The "Queen Mary" is out to beat records, and she doesn't expect to strain herself to do it. An early announcement said she would sail at thirty-two knots "without pushing." This may

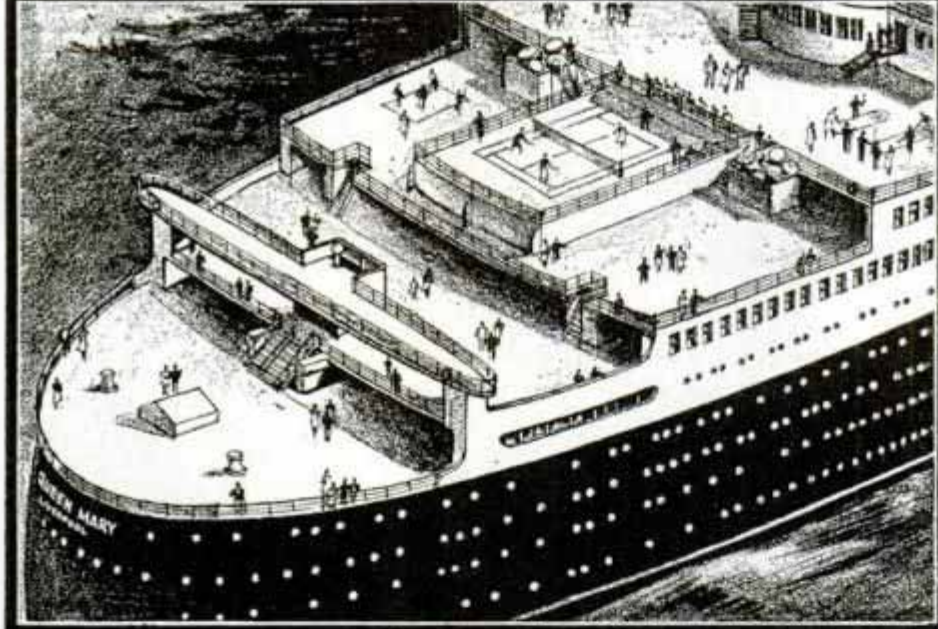


*Scraping bottom of the huge liner in graving dock during early days of construction*

be interpreted to mean she will chalk up about thirty-five knots if the skipper wants to push her a wee bit.

Commodore Sir Edgar Britten will run the "Queen Mary" from a "brain center," the ship's chart room, next to the wheelhouse. A glance around dials and indi-





*Drawing representing one of the spacious public rooms of the British liner, and, at left, sketch showing the aft decks of the "Queen Mary," only a small part of the total deck space aboard the liner available for promenading and sports*

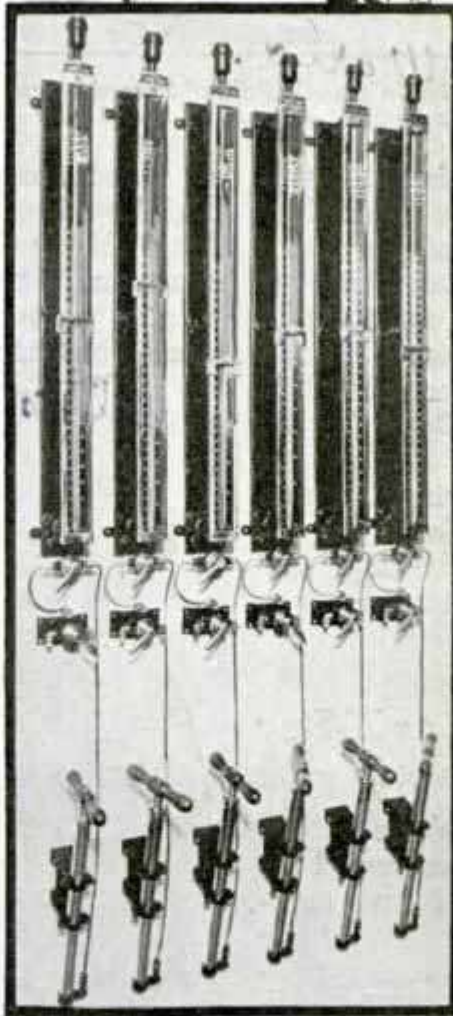
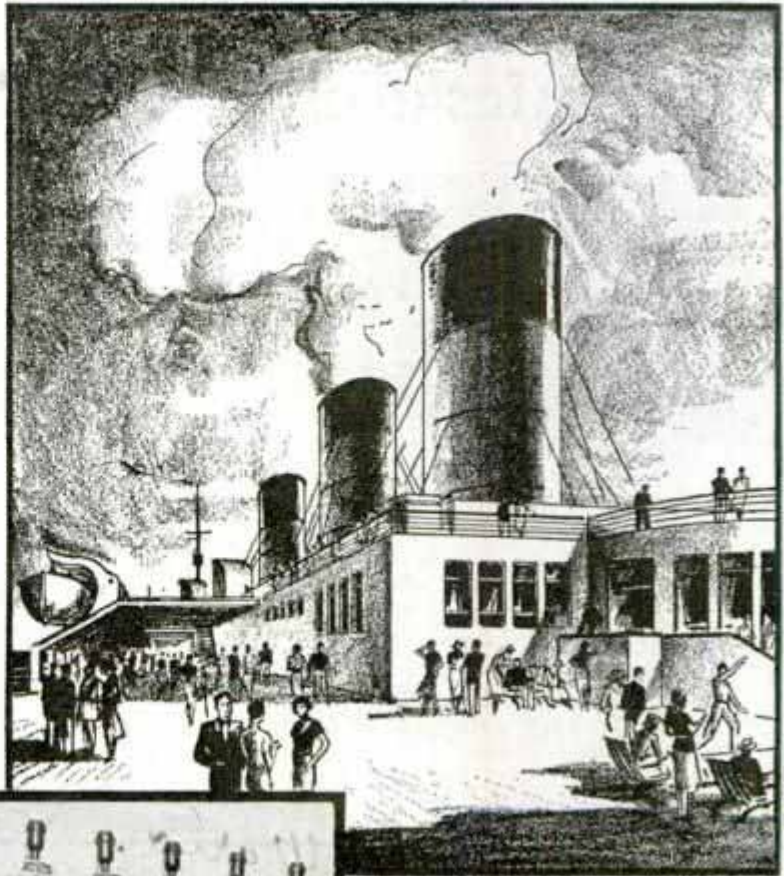
*Right, main swimming pool of the "Queen Mary." It is decorated with porcelain tile of straw color, crossed by bands of emerald green and fire-box red. The pool is equipped with an anti-splash device and an observation balcony extends around three sides*





cators in this room gives an officer more information than a regiment of foot messengers could bring in. For communication with the outside world there are thirty-two different radio bands or wave lengths divided as follows: eleven for short waves, nine for radiotelephony, seven for long waves, and five for medium waves. To broadcast wireless signals, the "Queen Mary's" operators have nine separate aerial systems. The main aerial is 600 feet long, one auxiliary aerial is 150 feet long and there are three short-wave aeri-als, three receiving aeri-als and one emergency aerial. Two ship-to-shore telephone circuits are available to passengers. She is the first ship to have worldwide telephone booths distributed around the decks, but passengers will also be able to talk direct from their staterooms. The radio system operates on a total power of seventy kilowatts. The machines for supplying this power are duplicated, in the event of power failure. In a grave emergency, the radio station can switch to power from storage batteries.

The automatic transmitters and receivers can handle up to thirty radiograms per minute. Sending a single message by the old-fashioned hand method required about a minute but the high-speed communications of the "Queen Mary" will handle press dispatches, private messages, weather reports, stock quotations, and telephone conversations simultaneously. The new model crow's-nest has electric heaters, telephones, and buzzers. The lookout station is 130 feet



Part of spacious aft section of sun deck of "Queen Mary." Below, oil gauges which tell engineers exactly how much oil is contained in each of forty-seven tanks, and rate of consumption.

above sea level, and is reached by a ladder inside the foremast.

The "Queen Mary" will run the year round, and despite weather conditions, expects to deliver passengers on train schedule. As a matter of fact, weather outdoors will mean little to the passengers because the "Queen Mary's" air-conditioning system is the most elaborate ever installed in a ship. Passengers have individual control over the amount of cold and warm air admitted to staterooms and the air in dining rooms and lounges will at all times be under complete control.

The Scotch shipbuilder has a contempt for other people's "margins of safety." What is generally considered safe is risky

(Continued to page 124A)



F26 G...

2/24/36  
6117

# Camera Sees Sun Skim Earth over Alaska on Shortest Day



*Wide World.*

Snow-covered city of Fairbanks, Alaska, in ghostly light of December sun as camera records its march across horizon on shortest day of year

Days are lengthening now in the lands of midnight sun, but back in December when the sun was working only a four-hour day up in Alaska a camera was set up as "timekeeper" to check up on "Old Sol" at intervals. Every quarter hour the shutter was snapped, from sunrise at 9:52 a.m. to sunset at 2:04 p.m. on December 22, shortest day of the year. The result was a spectacular photograph showing the sun first peeping from behind Mount Hayes, then skimming across the southern sky just above the horizon, in successive steps, until it disappeared.

## Branding Needle Used as X-Ray by Old Violin Makers

How the master violin makers of the sixteenth century found perfect wood for their instruments has always been a mystery. Now it is believed they may have tested the wood with a hot branding needle, for the marks of needles can be seen on many old violins. Studying the composition of wood in ancient violins, Prof. K. Lark-Horovitz at Purdue University discovered the branding-needle test told virtually the same story as an X-ray study

*W. Lafayette, dnd.*

of the wood. First the wood is lightly coated with wax. If the wood is homogeneous, when touched with the branding needle the melting wax forms nearly a circle around it. If not homogeneous, but possessing grain, the branding-needle test shows a long, narrow ellipse.

*F254.*

## Repeating Crossbow Is Machine Gun's Grandfather

Three hundred years before modern machine guns were invented, Chinese hunters and warriors pumped arrows from the machine gun's great grandfather—a repeating crossbow. In a Los Angeles museum one

of these ancient weapons is on exhibit. This bow is of dark wood, nearly four feet long. Along the top of the weapon is the magazine, a narrow slot which would hold twenty arrows. As fast as one shaft is fired, another arrow drops in its place.

*Atis Arms Collection*



*Wide World*

Ancient Chinese repeating crossbow with magazine that held twenty arrows for rapid firing

*F293*



F 226.

# Future 'Sea Dogs' of Air Train in Flying Boat



© Fox Photos

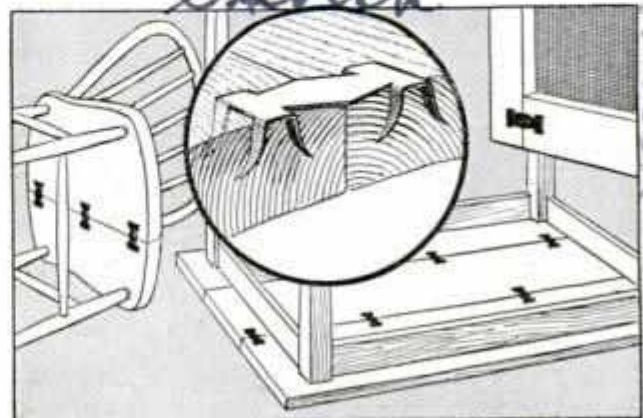
Crew aboard big seaplane prepares to cast off for training flight. These young officers are getting their "sea legs" in order that they may command transoceanic air liners some day

Great Britain is training a new type of "sea dog" to command her ships. Aboard flying boats at Hamble on the Solent, senior captains of the Imperial Airways and the newest probationary officers are qualifying, side by side, for their "sea

legs." Later they will be in command of the great air liners which will be used in transatlantic service. The officers learn an entirely new kind of flying and a new kind of seamanship aboard these classrooms of the air.

## Small Metal Fastener for Wood Joints Is Easy to Apply

Designed for making or strengthening any type of wood joint, a small metal fastener is handy for the amateur or professional carpenter and woodworker. It has curving prongs which draw the sides of a wood joint together firmly as the fastener is hammered. There is no shearing or splitting of wood fibers. The fastener is cadmium plated to prevent rusting. It may be used in stores for making display frames, counters and shelves; in the home for making and repairing screens, sash, tables, chairs, garden furniture, toys and general work, and in the maintenance departments of large corporations.



Some uses of handy wood-joint fastener. Prongs draw the two pieces of wood together

Superior Fastener Co. Philadelphia

Vertical handwritten notes on the right margin, including the word 'Sketch' and other illegible scribbles.



8/588.

# DIVING for

27 Meacham Road, West Somerville Mass



Manta ray or batfish such as attacked the diver in the incident related by the author. They weigh up to 10,000 pounds and grow to be twenty-five feet wide

By Capt. John D. Craig

19 10 69 H. H. Newford City

NEAR a group of islands off the west coast of Mexico under nine fathoms of crystal water lies a chest of gold. The gold came from California but never reached its destination because the ship was attacked by pirates, the captain and most of the crew massacred and the boat burned. This was in 1868.

In 1932 a small party of motion-picture technicians joined me on a vacation cruise. We set out over uncharted seas, camouflaged our treasure hunt under the guise of a fishing expedition. We had camera equipment aboard including two under-sea cameras of my own design, and we hoped to film many strange happenings, including the finding of the treasure.

We found the sea teeming with fish voracious beyond our fondest hope and there

followed days of fishing that would make any sportsman turn green with envy. We caught giant sea bass weighing 300 to 400 pounds; yellowtail, tuna and skipjack by the skiff load. In one place as far as the eye could see the swordfish were jumping.

Antonio, one of old Mexico's true sons of the sea, joined us at the cape. He was dark, wrinkled and full of sea lore. He had several pet superstitions at which we at first laughed. One of them concerned a porpoise. We don't laugh at that legend any more.

It was on this trip that Jim Ernst lost his life. Jim had a healthy interest in everything. If it was dangerous and provided a thrill, so much the better. We learned to dive off Cedros island. It was out-of-date, patched Japanese gear we used, but it held out the water and kept in sufficient air. That first dive was a trip into fairy-



# Sunken TREASURE

land. Jim and I at once became devotees. There were no phones so we devised a series of jerks that spoke a language all our own.

On one of my dives I saw a Garibaldi or deep-sea gold fish, and was reminded of our quest for sunken treasure. We purchased two diving gears from the Japanese and proceeded on our way. It was the day following that we ran afoul Antonio's legend.

During our years of making adventure motion pictures we have occasionally run into streaks of bad luck when



Diver enacting movie scene in forty feet of water for the picture production, "Sea Killers," and boat used on movie trip to lower Mexico

everything seemed to happen otherwise than planned. At such times we returned home with a mediocre batch of films but with memories of incidents that happened, and which we somehow missed shooting, that would curl the hair of the most hardened explorer. There is no accounting for these runs of hard luck. Sometimes broken traditions and superstitions are blamed. It is easy to scoff at such things but we have sometimes taken apart, as it were, such legends and their application to our expedition, and

(Continued to page 114A)



### "Cellophane" Sail Gains Speed for Racing Boat

F 80



"Cellophane" sails, shedding instead of absorbing water, are expected to gain speed for small boats

Waterproof sails of Cellophane are introduced to the yachting world this year. Since they are unaffected by damp air, rain or sea water and do not gain weight by absorbing spray, they retain their "flow lines" almost indefinitely without stretching or sagging. It is anticipated that small racing boats with these smooth Cellophane sails will attain greater speed. Tests have demonstrated their fitness in navigating, the only disadvantage thus far developed being the necessity for rolling Cellophane sails instead of the usual method of furling. It is likely that roller reefing gear will be used.

### Gold Production Passes Billion as High Price Spurs Mining

Gold mining became a billion dollar industry in 1935. Preliminary estimates of world production indicate more than 30,-

John J. ... Boston mining engineer, at meeting of American 000,000 ounces of the yellow metal were dug, ten per cent above the previous year and worth more than a billion at the current valuation of the dollar. Leading producer was the Union of South Africa, followed by soviet Russia, the United States and Canada. Russia showed the largest percentage increase. Gold mining began to gain after 1929, and was spurred into activity when Great Britain and the United States abandoned the gold standard and nearly doubled the value of the metal.

### Latest Winter Garb for Pilot Gives More Comfort

Increased warmth, comfort and convenience in winter flying are claimed for the new style equipment tested recently by the air corps. There are new types of helmets, jackets, trousers, mittens and boots. An individual pup tent which may be folded into a compact roll contains an eiderdown sleeping bag, blankets and a pneumatic mattress and pillow. Each member of the crew sets up the waterproof tent under the airplane wing. The latest



Pilot holding trousers used for winter flying. This garment gives real warmth

Capt. Charles J. Bauer

Cellophane Co. One W. 33rd Street New York City

2/17/35

Investigate of ... meaning of ... if ...

F 261



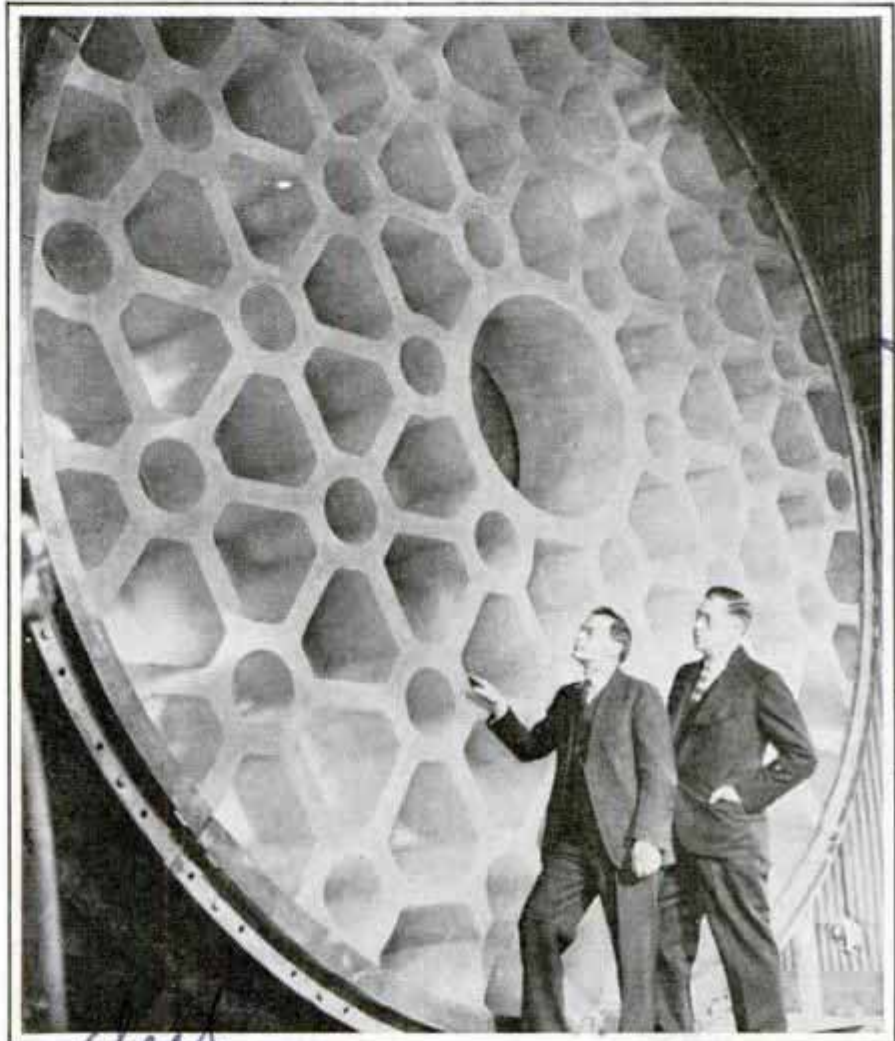
helmet is formed to the wearer's head by a series of adjusting cords, and a chamois chin fastener replaces the usual neck strap. An arctic collar that straps nearly to the eyes eliminates the need of a face mask. Lamb and sheep shearings are used as clothing lining and are so warm that electrical heating is unnecessary.

7224

### Gold Mining Truck Speeds Work in Desert

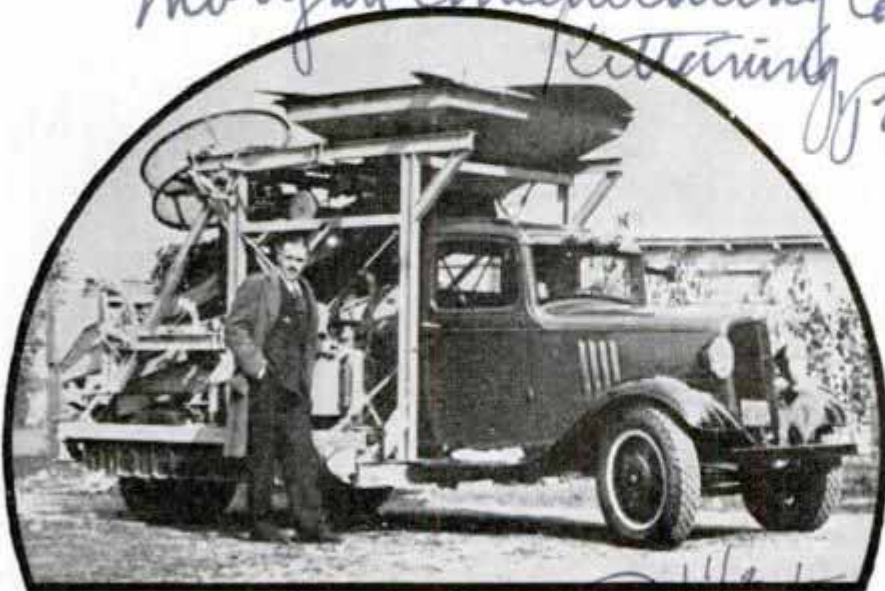
Gold concentrating at 300 feet below sea level in the southern California desert is made easier by mounting necessary machinery on trucks. The motorized prospecting and mining unit operates in an area where the temperature is 130 degrees during the day and the sand is so deep that special chains are required to keep it "afloat." One company has a large fleet of trucks in the desert to speed up its mining operations.

## Twenty-Ton Telescope Eye Sheathed in Steel for Travel



Experts inspect the honeycomb glass back of the gigantic telescopic mirror, revealed for the first time when it was lifted into vertical position and encased in a protective steel ring for shipment across the continent

Morgan Concentrating Co. Pottsville Pa.



Gold concentrating machinery loaded on Chevrolet truck, ready for a trip to mining district in hot desert

To protect its edges on the long trip from Corning, N. Y., to Pasadena, Calif., the 200-inch telescopic mirror to be installed in the Mt. Palomar observatory has been sheathed in a ring of steel. After this ring was in place the twenty-ton disk, largest piece of optical glass ever molded, was raised into vertical position, revealing its honeycomb glass back for the first time since it was poured. The mirror was made for the world's largest telescope.

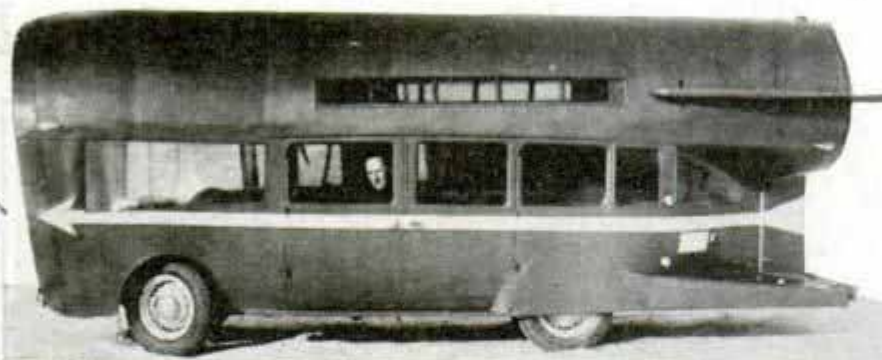
Chevrolet Motor Co. Corning Glass Works



F 220  
678

St. Louis Mo. Finley

# 'Vacuum-Rocket' Car Sets Style for Dirigible



Side and front views of "vacuum rocket" car, showing the propeller that forces air back through the tube in the upper interior of the car

Looking as though it might be as much at home in the air as on the ground, a motor truck propelled by air sucked through a wind tunnel is testing principles that may revolutionize the building of dirigibles. Air is drawn into its concave, funnel-shaped front by a small propeller and is forced out at the rear with tremendous velocity, sending the car rocketing across the earth. Testing it on the Kansas City airport, its inventor, Thomas M. Finley of St. Louis, said he attained a speed of forty-seven miles an hour from a standing start in a half mile. If this propulsion principle were applied to dirigibles, propellers would suck air into a hollow nose and thrust it back through a tunnel in the middle of the bag, creating a vacuum at the front instead of pushing against air pressure.

W. Fred K. Baxter & Co. Kansas City, Mo.  
3561 Howell Ave.

# Lights Blaze as "Queen Mary" Dresses for Maiden Trip

"Queen Mary" is ablaze with light as the night shift succeeds the daytime army of workmen hurrying the finishing touches on the ship. Already long afloat in the shipyard at Clydebank, Scotland, many months of work were required to install the engines and complete the furnishing and decorating of the vast floating hotel. The "Queen Mary" will leave Southampton May 27 on her maiden trip to New York.



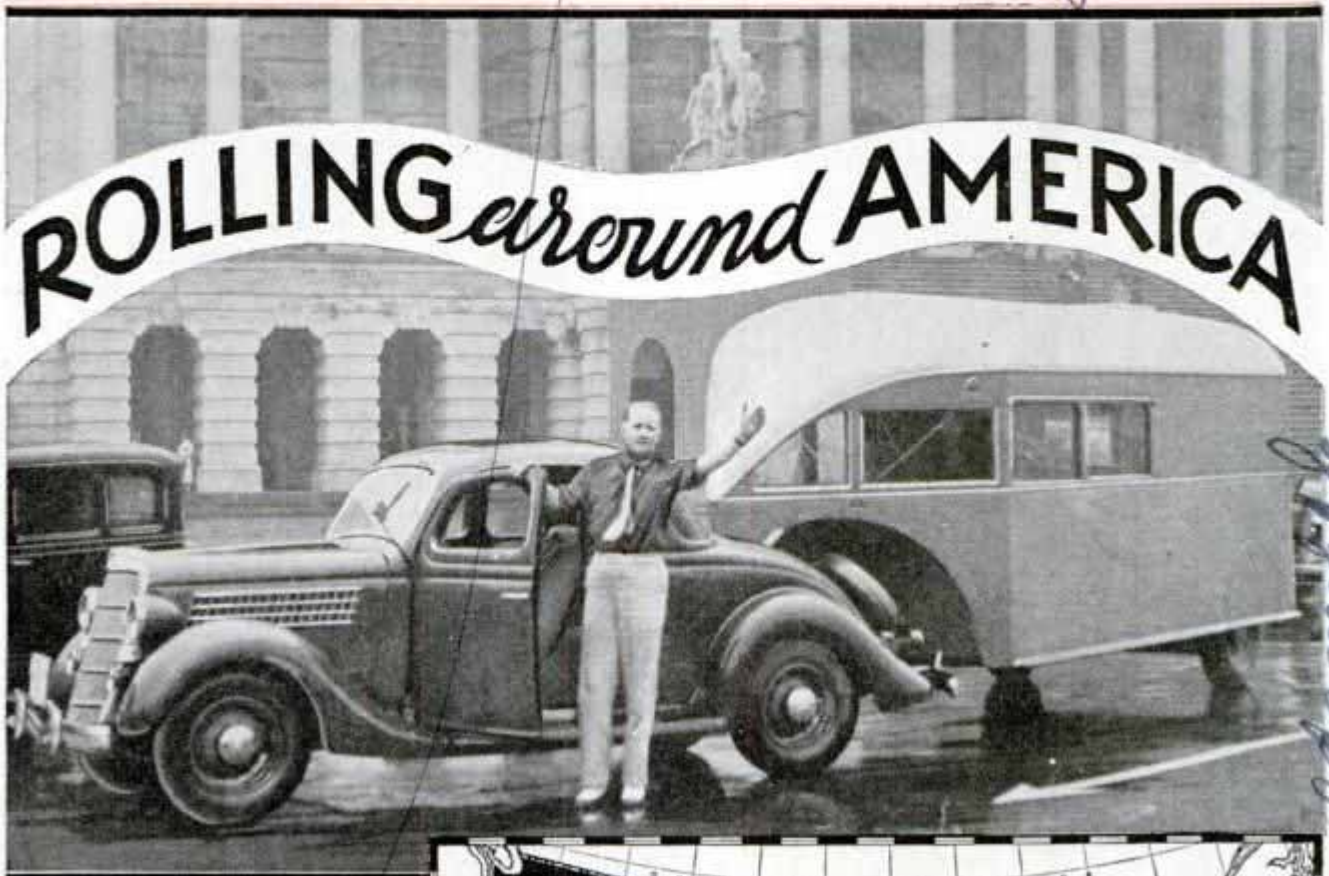
Lights shine for the night shift on "Queen Mary" in Clydebank shipyard

F 235



746

Senate Office Building  
Washington, D.C.



Edmundo

By  
**Robert R. Reynolds**  
*United States Senator  
 from North Carolina*

**T**RAVEL, with its many broadening influences, should be a major course, required in every man's education.

Travel is expensive only if you choose to make it expensive. It can be as cheap as staying at home. Our roads are good, our automobiles are relatively cheap, the cost of fuel is low, and food and lodging, if you look for them in the right places, are not high.

I nursed a pet theory for a long time before I was able to try it out. I believed it was possible to spend thirty days seeing America from coast to coast, and from Canada to Mexico, at a total cost of \$100 per person in actual travel expenses. And by seeing America I don't mean racing from dawn to dark along the highways until you're so tired driving you can't sleep and so sleepy you can't drive.



*Senator Reynolds in Washington with his coupe and trailer at the start of his tour of America, and map showing his route*

I mean visiting the beauty spots and the places rich in historical traditions, soaking in the atmosphere, letting the imagination fold back the pages of history, learning to know the places you have read about and viewing the great industrial centers and agricultural sections.

I took a thirty-day trip through America. I drove 11,500 miles—and did all the driving myself. I visited thirty-one states and the District of Columbia. I touched both coasts, drove through Ontario in Canada and took a glimpse of Juarez, Mex-





*Trailers such as these offer a home on wheels for an auto tour of America, but less pretentious ones can be built or purchased*

ico, passed through three national parks, visited fourteen state capitols, stopped briefly in some 500 American cities and towns—and I did it all for less than \$400.

If four young men followed my plan and something of my schedule, they could do the same thing for \$100 each and have enough left for an inexpensive present for the folks back home and an occasional movie en route.

Here's how I did it. I got a trailer, equipped with a combination living room and sleeping quarters for two—berths that made up something like those in a Pullman. There was a folding table, an alcove for a portable typewriter, one for a small library, a radio and reclining chairs, a

kitchenette, equipped with a small gasoline stove, a sink, hot and cold running water, a wardrobe for clothes, a compartment for shoes and linen, one for cooking utensils and dishes, one for groceries and an ice-box. There was also a shower bath and a telephone connection between the trailer and the power car in front, and electric lights.

This trailer was hitched to the back of a small coupe. I started from Washington and returned thirty days later with more sights and memories and new facts and new friends than I ever in all my life packed into thirty days. And while I did all the driving because my companion did not know how, I got back feeling better than when I started. I saw more than many people see in a lifetime. And I traveled almost as cheaply and just as comfortably as I ever traveled before.

Perhaps you say I was able to do this because I had a trailer and not many people have one.

Mine was unusually fine, but all trailers do not have to be equipped with electric lights and running water. Any ingenious boy, with the help of a mechanic, can build a good enough trailer to carry pup-tents, cooking utensils and the equipment he needs. Or they can be bought for prices starting remarkably low.

Here are some of the things we saw in thirty days. We started from Washington and drove to the Naval Academy at Annapolis, and made stops to view historical points in Baltimore, Wilmington, Philadelphia, Trenton, New York City, West Point, Plymouth, Boston, Albany, Buffalo and Niagara Falls.

At Niagara Falls, we crossed the Interna-



## Fix Cameraman Catches Waterspout in Rare Photograph

tional bridge into Canada and traveled 300 miles across Ontario to Detroit where we visited an automobile factory and saw what no American should miss—Henry Ford's Greenfield Village and Museum which brings places of interest for you to see instead of making you go thousands of miles to see them.

In Chicago we visited the packing plants, then went through Iowa and into the Black Hills and the Bad Lands of South Dakota. Then came Lead, S. D., home of the largest gold producing mine in the world, and Rushmore National Park, where Gutzon Borglum, the sculptor, is carving giant likenesses of Washington, Jefferson, Lincoln and Theodore Roosevelt from the solid granite of a mountain top.

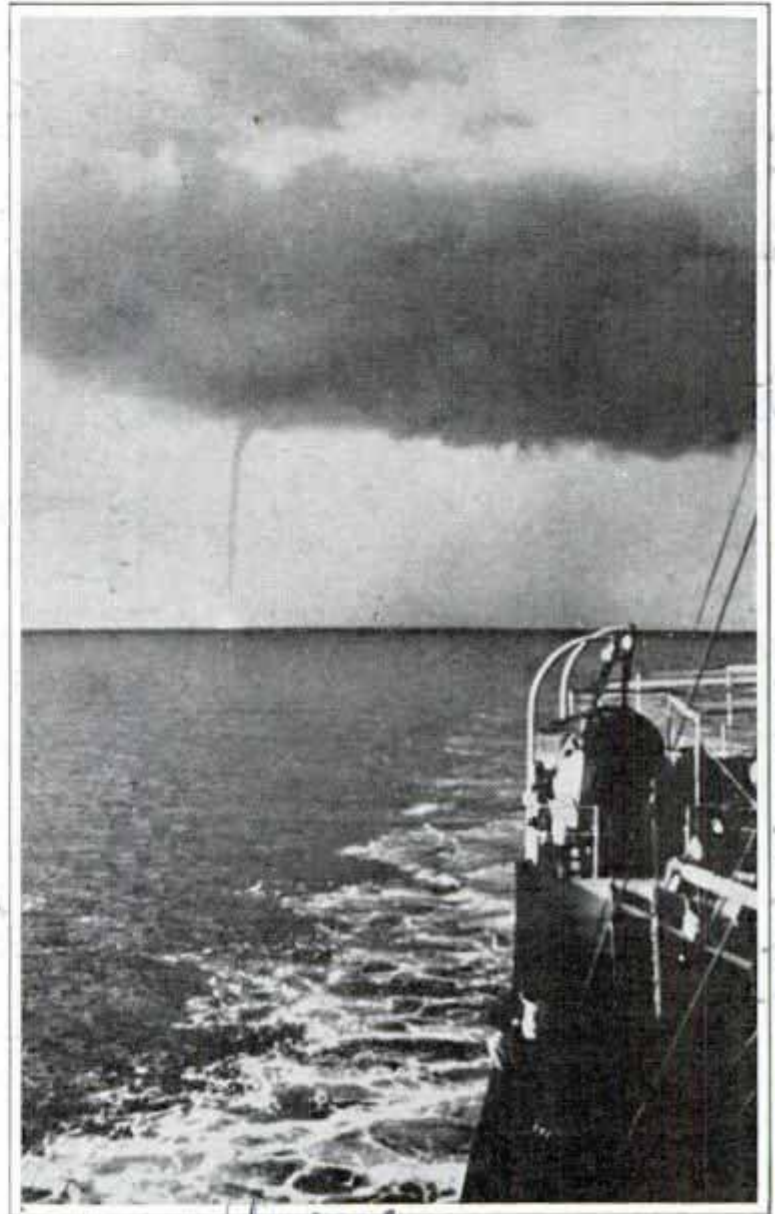
We spent an exciting night here when we encountered a steep grade without an opportunity to gain momentum. We crept almost to the top when the engine, boiling over, went dead. We were stalled on a steep mountain road at night with a precipice on one side and a towering cliff on the other. We worked for two hours trying to nurse our load up that hill, but we couldn't make more than a foot at a time between "breathing spells" of the motor. Finally we went to sleep in the woods beside the road, afraid to sleep in our comfortable bunks in the trailer. It was daylight when we awoke, with a car stopped on the road and a man standing over us. He was Mr. Borglum's son.

"Brother," I said, "your father got us into this mess. I drove thousands of miles to get here and see his work. So you have to get us out."

And he did. He hitched us on behind with a tow rope and took us clear to the top of the mountain. If you are really in trouble on the road, you'll always find a friend to help.

We visited Wyoming state park; then Cheyenne, Denver, Colorado Springs,

(Continued to page 122A)



View of waterspout passing off eastern end of Puerto Rico.  
Note white spot where twisting wind and water meet

When a waterspout swept near the eastern end of Puerto Rico, a cameraman was right on the job. The result was a photograph of the rare meteorological phenomenon, one of the few pictures ever taken of the column of water created by the force of the wind. The photograph was snapped from aboard ship as the waterspout passed not far away.

If you don't like spinach in its natural state, you can obtain it in a powdered, concentrated form or even in candy-coated tablets retaining the blood-building qualities of the green vegetable.

mental Am. med. Assoc.  
Spent all  
May + R. Dietrich  
Columbus, O.



# Nail File Driven by Motor

## Latest Aid to Beauty



Demonstrating the ease of using motorized nail file. It eliminates the "rasp"

Eliminating the unpleasant rasp incidental to manicuring the fingernails, a new file operated by an electric motor seems to slide almost magically over the edge of the nail. A small fractional horsepower motor drives the filing apparatus at high speed, which eliminates rasping. The electric nail file is the latest scientific aid employed by beauty experts.

## Magnifying Glass with Light Gives Better Vision

Giving five-power magnification in an illuminated field of vision, a new instrument appeals to professional men, police departments, bankers, purchasing agents and others requiring magnification. A spacer ring holds the double lenses in

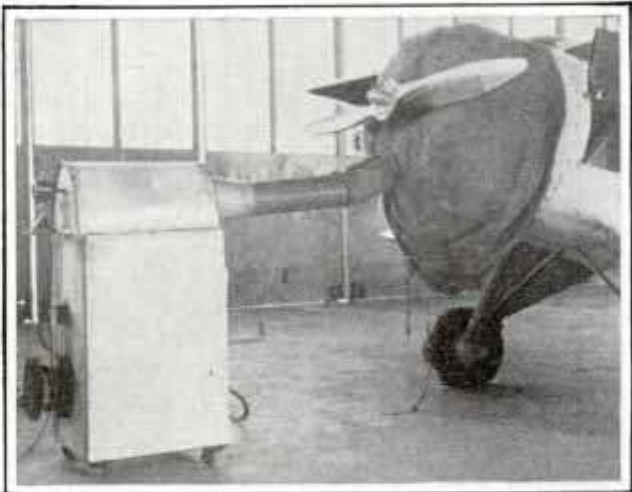


exact focus. The electric bulb is placed in the handle so that direct light does not reach the observer's eye. An opening in the frame makes it possible to use instruments or a pencil while an object is being examined.

## Animal's Ear Is More Efficient Than Best Microphone

No microphone has yet attained the perfection of the ear. Experiments made recently with guinea pigs demonstrated that the animal could hear tones over a wide range of frequencies, even very faint sounds, while mechanical microphones must sacrifice either sensitivity or range. In measuring the sensitivity of the guinea pigs, small currents arising in the cochlea of the inner ear were recorded on an oscillograph. The accuracy of this method was shown previously by amplifying the tiny currents a half million times and connecting them with a telephone receiver. In this manner the voice of a person speaking to the animal was transmitted to a distant room and not only understood but the voice recognized.

## Preheater for Plane Motors Cuts Fuel Bill in Hangar



Motor of plane is being warmed up by heater containing gas stove and blower

Making unnecessary the heating of the entire hangar and thereby saving several hundred dollars monthly on fuel, a preheater for airplane motors is used by a Cincinnati flying service during severe winter weather. The unit consists of a standard gas stove set in an asbestos-

Vertical into Clark. Wis

E. W. Pike. 38 Chambers St.

Bellevue 2/19/36

Prof. Ernest S. Wood and Prof. Charles W. Gray. Dept. of Psychology Princeton, N.J.

made for... Beauty Shops

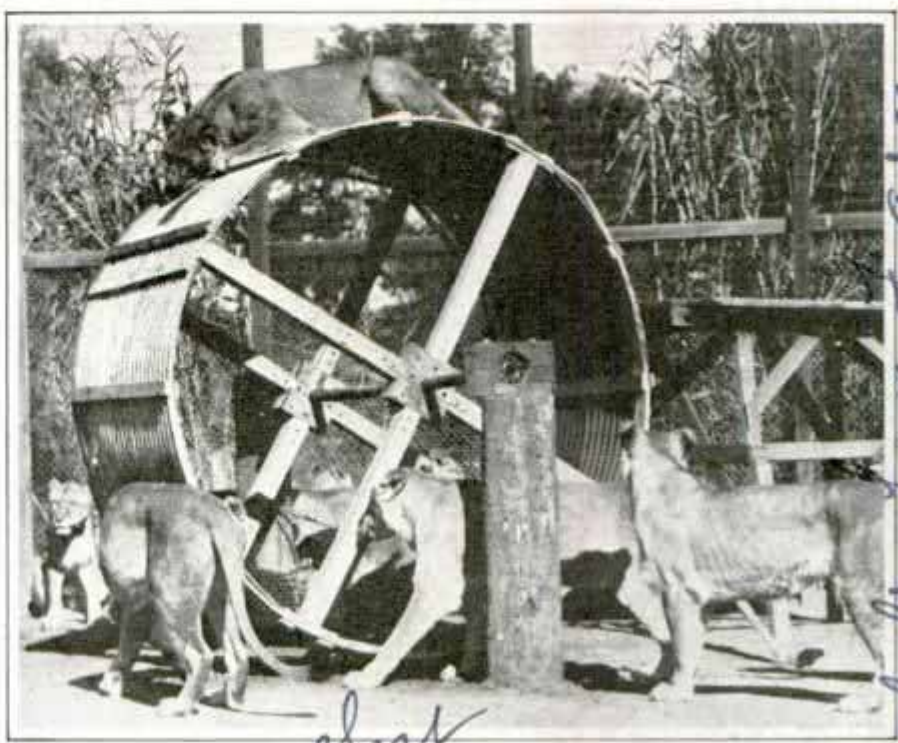
Prof. Ernest S. Wood and Prof. Charles W. Gray.



Langar Ave. Lynden 4170  
Airport, Bismarck, N.D.

covered metal enclosure, with an electric fan to blow the heated air through a stovepipe into a canvas cover over the motor. This cover holds the heat around the motor. In about thirty minutes, the motor is warm enough to operate the plane. An immersion type heater in the oil tank, which is separate from the motor, is used at the same time to warm up the oil.

# Lions Find a Barrel of Fun Riding Their Rolling Wheel



When a husky lion springs on top of this "free wheeling" barrel and starts it spinning, any jungle cats inside it have a wild ride

## "Clouds" in Movies Are Made of Cotton

Building castles in the clouds is not so far from reality, now that the motion-picture producers are manufacturing realistic clouds of fluffy cotton. Pushed, pulled and pinched into cloud formations, the masses of cotton closely



Artists making "clouds" for the movies. The white material is fluffy cotton

resemble real clouds as they are made to drift slowly in front of the camera for scenes in one of the latest movies.

Playful cats on a California lion farm get plenty of fun as well as good exercise on a rolling barrel. As soon as one of the jungle kings climbs on top, the big wheel starts spinning, and any lions that get aboard the inside are given a rough-and-tumble whirling ride.

## Latest Desk Lighting Saves Eyes of Midshipmen

Midshipmen living in Bancroft Hall at the U. S. naval academy, Annapolis, Md., are pursuing their studies nightly under better lighting conditions than did their predecessors, and navy department officials expect future graduating classes to have a lower percentage of failures due to poor eyesight. The lighting unit installed upon recommendation of General Electric company engineers delivers from twenty to thirty foot-candles of intensity of illumination within the principal work areas on the desks. In the Annapolis class of 1934, of 647 men who entered the academy, only 464 passed on to the senior year, and fifty-nine of these were found to have defective eyesight.

Isobel's from 8 am. Caly  
Thousand Oaks.

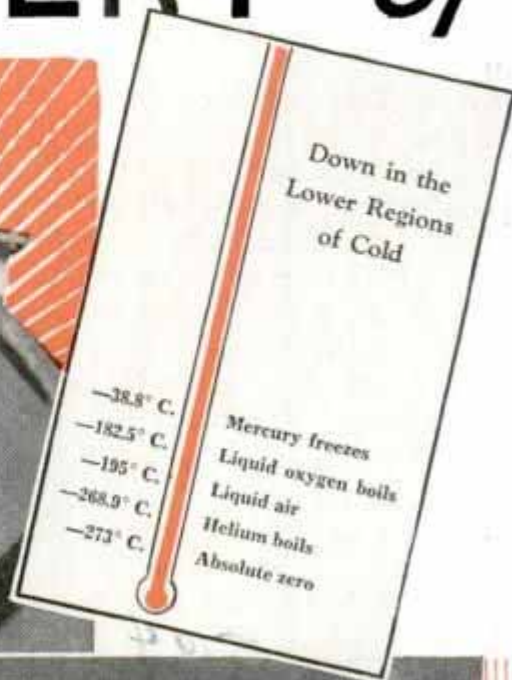
Scheneclady, N.Y.



F61

Cont. from *Classroom*  
4 W. 103rd St.  
New York

# The MYSTERY of



Lower photo courtesy Air Reduction Co.

Top, electric currents produce high temperatures.  
Below, brittle flower after bath in liquid air

**T**HE STRANGE effects of extreme heat and cold on common substances is arousing interest in what may become a field of sensational discovery.

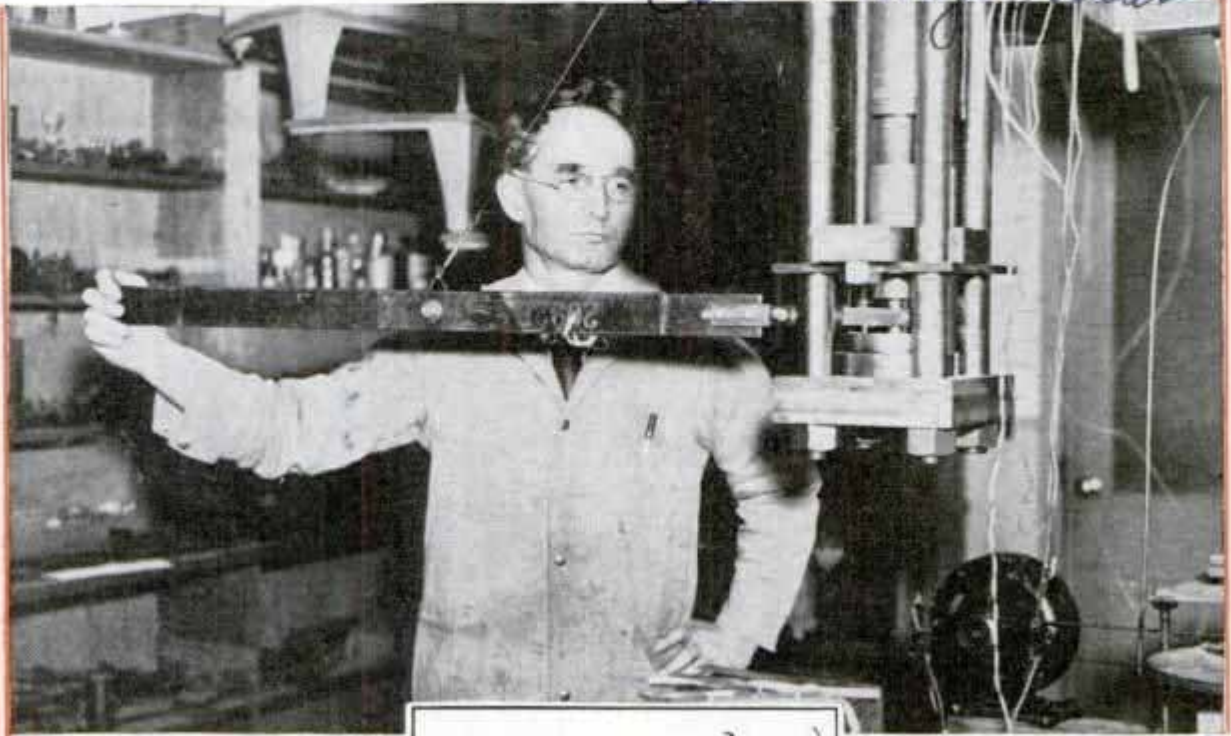
For years man has sought to extend his command of temperature and pressure, but until quite recently he was restricted to the ordinary temperatures found in nature. Today there are about ten special low-temperature laboratories scattered about the world. After twenty years, the low-temperature laboratory at Leyden, Holland, has succeeded in coming within five-thousandths of a degree of absolute zero, which is  $-273$  degrees Centigrade. This establishes a record for cold that is likely to stand for some time.

On the other extreme, astronomers have made measurements of star temperatures that go beyond 40,000,000 degrees Centigrade. In still another related field, high pressure, Prof. P. W. Bridgman, of Harvard, has succeeded in changing the struc-



*Prof. Bridgman, University of Harvard, Cambridge, Mass*

# HOTTER and COLDER

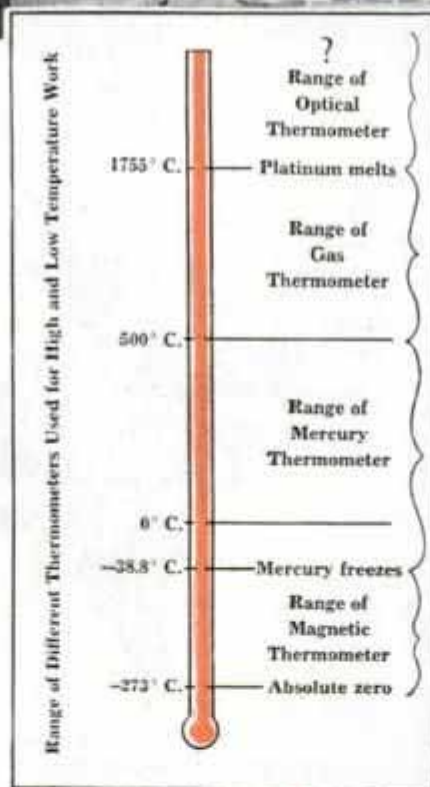


*Apparatus used to create pressures of 1,500,000 pounds to square inch*

ture of many common substances by subjecting them to pressures equal to those several hundred miles below the surface of the earth.

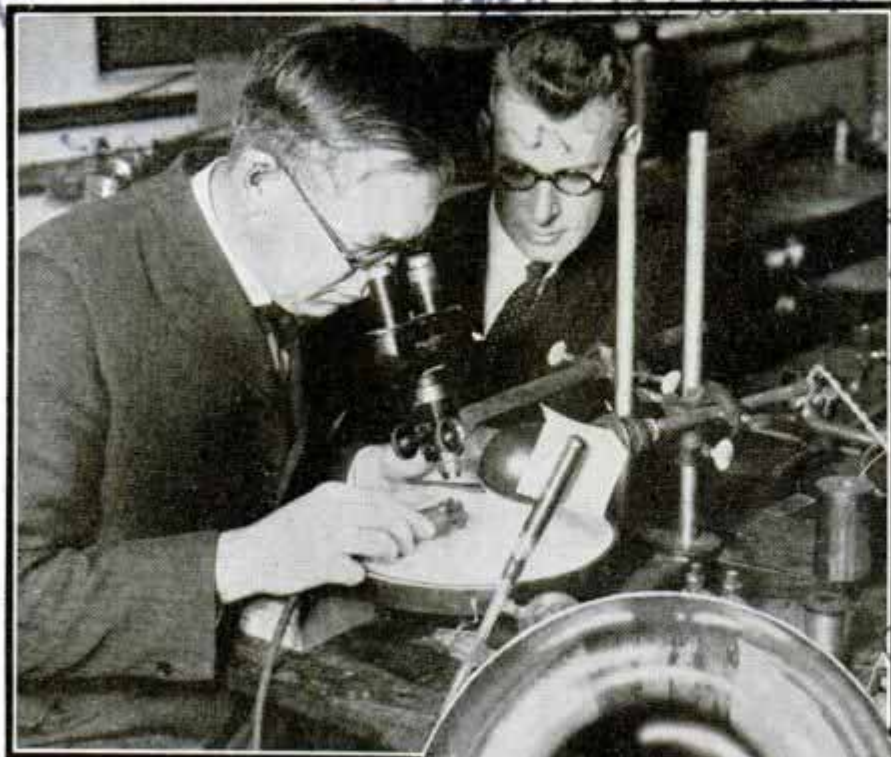
At present man is far from equaling the internal temperatures of the stars. For a brief instant it has been possible to reach 20,000 and 30,000 degrees Centigrade in the laboratory. This was accomplished by exploding wires with tremendous electrical discharges. For a longer period of time it is possible to reach 5,500 degrees Centigrade by focusing the rays of nineteen high-power lenses in a solar furnace. The atomic hydrogen torch has made it possible to develop as high as 3,800 degrees Centigrade on a small spot. Beside the internal temperatures of the stars, however, these artificial temperatures are comparatively feeble.

For general purposes, it may be said the difference between the greatest heat



*Pouring out a container of liquid air which steams like boiling water*





...tive for some indefinite period, the animal is revived by slow thawing and the application of stimulants.

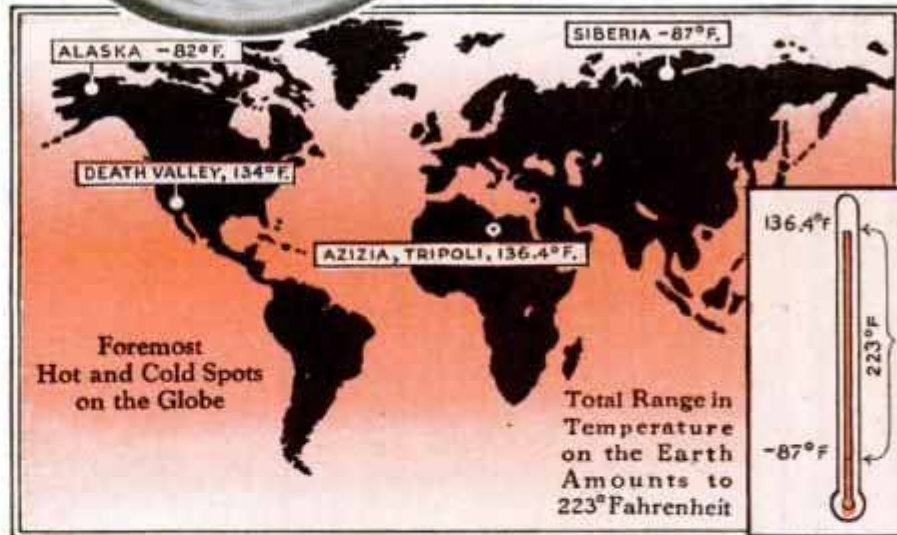
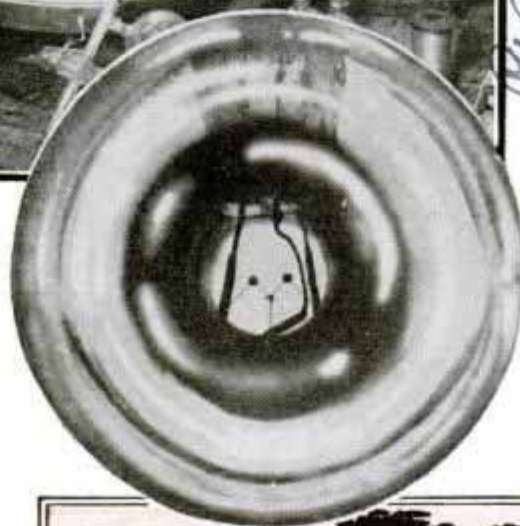
Although there is reason to doubt that men can remain in a state of "suspended animation" by being frozen into a state of inactivity, there is no doubt that microbes can do so. Immersed in liquid helium at a temperature of  $-450$  degrees Fahrenheit and kept there for weeks at a time, germs have come out alive and kicking, none the worse for their experience. This shatters many of our illusions about the frailty of microbes. There is much to say for their stamina.

Prof. Bridgman's work with high pressures has brought him into the realm of "hot

and the greatest cold thus far produced by man is  $5,773$  degrees Centigrade, although he has, for a fraction of a second, gone as high as  $30,000$  degrees Centigrade and extended the temperature range up to  $30,273$  degrees Centigrade.

It is likely that men will be able to go beyond that figure, but it is extremely unlikely they will be able to exceed the cold of absolute zero. Greater cold is not known anywhere, not even in the upper reaches of space.

Why search for very high temperatures? We have reason to believe that if we could generate and control temperatures of  $100,000$  degrees or more, it would be possible to create new substances and find new properties for old substances. In the realm of extreme cold, the present interest centers around some recent experiments tending to show it is possible to freeze animals into a state of inactivity, as if they were dead. After remaining inac-



Top, examining thermocouples used to measure the temperatures of stars, and a view through such an instrument

and cold ice." Examining many solid substances, he discovered they pass through significant crystalline changes when subjected to high pressure. So far, he has distinguished some queer varieties of ice. "Hot ice Number one" may be heated to a temperature too hot to bear with the

(Continued to page 144A)



Dearborn, Mich.

# Mobile Home Expands to Form Three Rooms

Light and compact enough to be drawn behind a motor car like a trailer, a movable type of house can be expanded to form three rooms at its destination. On the road it is supported on two wheels with drop axle and is sixteen feet long and



Top, left, the mobile home ready for the road, and, below, expanded into a three-room cottage. Above, right, the kitchen of the home on wheels

*Under world*

six and one-half feet wide. When expanded, it forms a living room twenty feet by fourteen feet, supplemented by a fully equipped kitchen. When the house is fully extended, it can be divided into twin bedrooms and a living room. The kitchen is equipped with many modern conveniences, including a refrigerator, and a gasoline tank supplies fuel for both refrigeration and cooking. The mobile home was developed by William B. Stout, automotive and aeronautical engineer.

Popular Mechanics Magazine does not publish the name of the maker of, or dealer in, any device described in its pages, but this information is kept on file and will be furnished by our Bureau of Information upon request, accompanied by stamped, self-addressed envelope.

## Angle Drill Bores Vertically in Close Quarters

Fig 6

Constructed for work in close quarters, a German-made electric tool has an angle or offset drill holder. This makes it possible to drill vertically in a corner without the motor housing coming in contact with the sides of the walls.



With the ordinary drill, work in such close places is impossible. The tool operates on 220 volts and is plugged into the nearest socket.

*Vertical, Chem, 576 420  
Electric and Refrigerator  
Camp. 1936-40  
Germany  
Schueker*



# Chart Tests Film Colors at the End of Each Scene

Emb. Andrew B. - Boone, every day, San Francisco, Calif. 1/5/31

F2 18



© Walter Wanger Productions

Photographing the color chart at end of scene, for comparison with colors in the movie before the entire film is developed

At the end of every movie scene filmed in colors, a chart containing seventeen colors is held before the camera. This tag end of the scene is developed first to determine whether the color qualities are perfect. Later the scene itself is developed. By this means constant check is kept on the camera's records, thus avoiding expensive retakes. Two-foot lengths of each of the three negatives used in the technicolor camera are developed behind a lightproof curtain. Thus, in a few minutes can be determined the color qualities of each scene of a production.

## Gold Miners Invent Simple Code for Secret Messages

F2 82

Mining prospectors in Australia have developed a simple method of sending out

secret messages. The two parties to the code use identical editions of some inexpensive pocket dictionary. Sender and receiver then agree that for example, the eighth word in the dictionary following the word written in the code message is the word meant to be conveyed. The writer jots down his real message. Then he looks up each word in his dictionary, counts back eight words and writes that word in his code letter. The receiver checks up each word in his pocket dictionary and writes down the eighth following word to translate the note.

Emb. Andrew B. Boone, every day, San Francisco, Calif. 1/5/31

## Electric "See-Saw" Rocks Tumbler to Mix Drink

For mixing malted milks and other beverages, an electric shaker that rocks and shakes the contents of a sixteen-ounce tumbler 125 to 150 times a minute is now on the market. Being completely covered, it is quite sanitary and needs no oiling after it leaves the factory. In the laboratory it can be used to shake emulsions and chemicals.

\$ 27.50 Rex - H. Mills

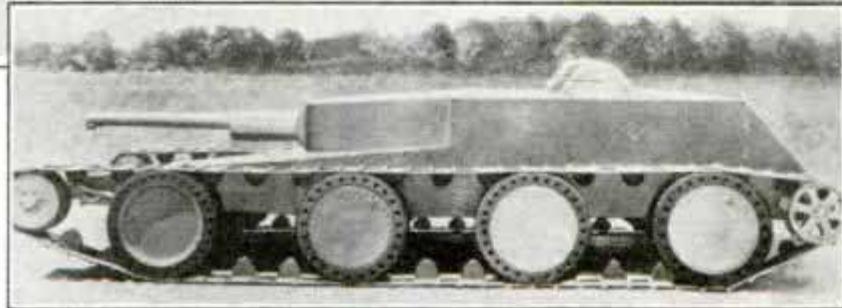
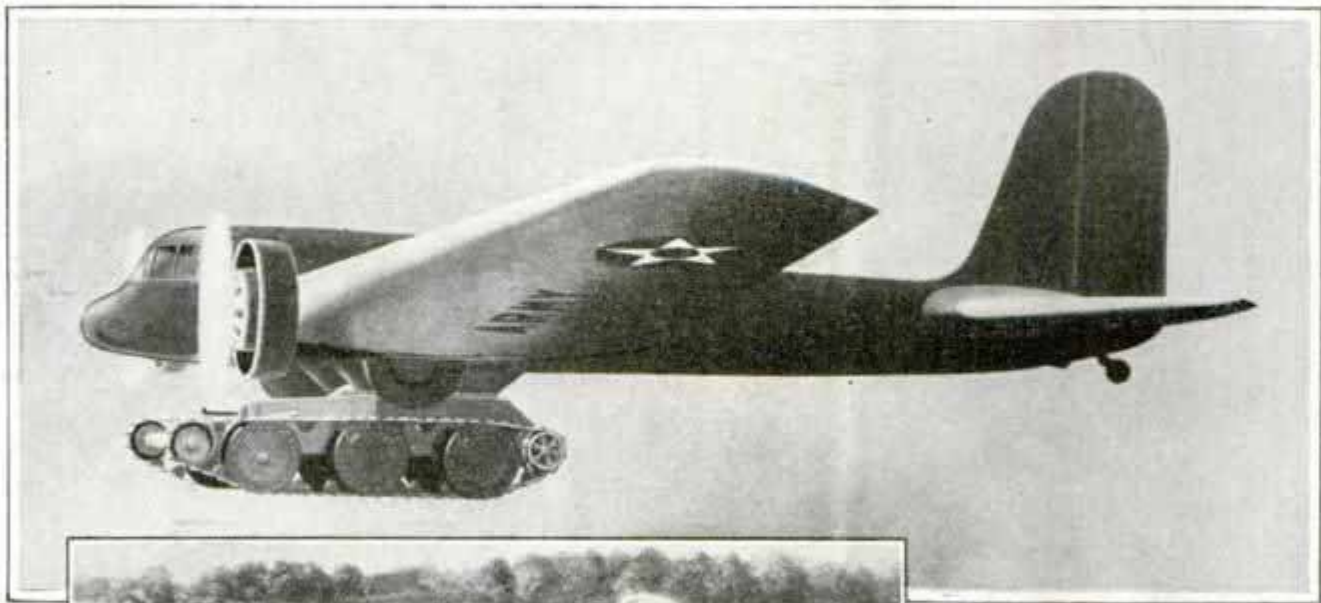


Electric see-saw mixes beverages in a hurry

H. P. Hinge Machine



# Fast Tank-and-Plane Latest War Machine



*Acme*  
Above, composite photo showing how tank-carrying plane would appear in flight. Below, latest high-speed tank which travels ninety-five miles per hour when caterpillar equipment is removed

Combination of a high-speed tank and a fast plane is the new war machine being developed by Walter J. Christie. In military service, the tank would be attached to the fuselage of the plane to be transported to any point desired. Upon landing, the tank would be detached, free to advance on enemy positions. The possibility of whole fleets of these tanks which may be moved quickly from one sector to

another is being studied by military experts. A convertible high-speed tank invented by Christie is now under construction by the U. S. war department. With the caterpillars attached for operation in rough country, the tank is capable of sixty-five miles per hour and without caterpillars, ninety-five miles per hour. The higher speed, on the open road, would facilitate movement to a new vantage point.

## F201 Office Mounted on Wheels Travels to the Customer

*C. M. Harris*  
Traveling offices are maintained by a Los Angeles public accountant for the convenience of his clients. Each of his three offices is outfitted in the rear of a truck. The equipment includes a desk, typewriter, comptometer, book-keeping machine, extensive files and other paraphernalia. Upon receiving a call, the accountant drives to the client's place of business, parks the office, collects the client's book and starts to work. Started with a single truck eleven years ago, the business now requires three complete outfits.



*Wide World*



6 1533

Carl John W. Meyer  
of Field Museum  
Chicago

# The MARVELS



museum habitat group differs from ordinary hunting because only first-class specimens in the best of condition are wanted. After obtaining the subjects needed for the group, they must be given the proper care.

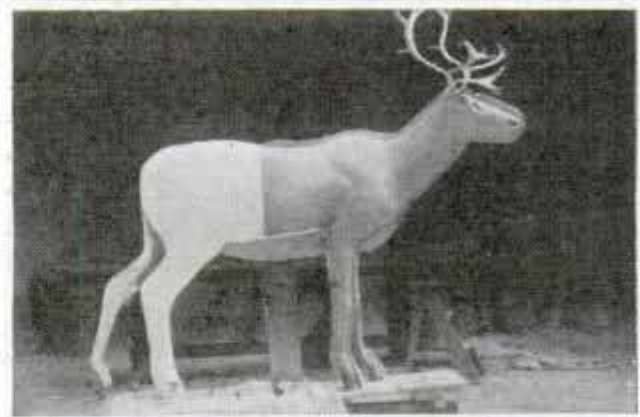
*Left, python mounted by the cellulose-acetate method, the most recent process developed*

**A**MONG all the professions, that of taxidermist, or preparator, for the natural history museum is one of the strangest. He combines many professions in one, for designing and executing a natural history group calls for a knowledge of surgery, dentistry, sculpture, painting, casting, photography, wax working and general mechanics.

From the four corners of the earth expensive expeditions bring back to the museums specimens of birds, animals, fishes and reptiles, some of them representing months of work. All are dead and all must be made to appear to live. Making the dead seem to live represents the true art of the museum preparator.

When a certain subject is decided upon for a museum group, an expedition is sent to collect the animals and all necessary data. The expedition may consist of only one man or it may contain a hundred or more, including collectors, hunters, taxidermists, artists, porters and camp helpers. All are transported, after leaving civilization, in motor cars and trucks or pack trains of horses, mules or camels. The expedition may be gone for months or even years and may involve a great amount of time, money and hard work.

The collecting of animals or birds for a



*Top, skeleton posed in position. Center, clay modeled over skeleton. Bottom, ready for the skin*



ع 1533

# of a STRANGE ART



This includes skinning and curing the hides, taking measurements, making death casts of the important anatomy of the bodies, gathering samples of trees, leaves, grasses and flowers and making casts of them and taking color notes. Photographic records and painted background studies must be made because all will be needed when the group is turned over to the taxidermist in the museum studio. For the taxidermist must become acquainted with the lives and habits of the animals he is to portray. He must study the trees, flowers and grasses, so they can be reproduced in wax and other material in their true color and form and used as accessories in making a setting true to life for the finished group. Before any group is built, a small scale model is constructed. Sometimes this is built in the field on the exact spot which is to be portrayed in the

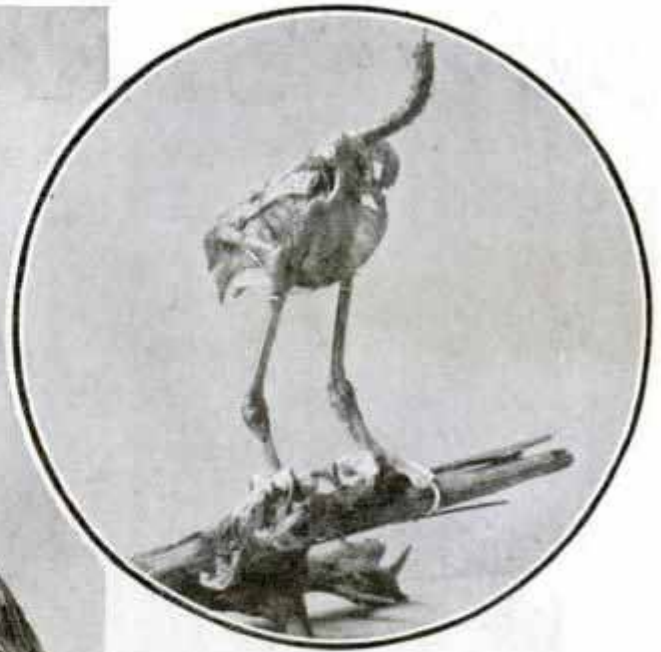


Photos courtesy Field Museum of Natural History

*Completed specimen of hippopotamus, showing strength of finished specimen. Bottom, removing plaster of paris mold from Florida manatee*

group, or later in the studio at home. The animals are modeled in miniature in wax and other materials. An armature, or framework, is next set up, using the skel-





*Above, mounted griffon vulture and bird skeleton posed in position. Below, skeleton covered with composition to take place of flesh*

eton of the animal to give the proper foundation to model over. Now the taxidermist's knowledge of sculpture is utilized, as the animal must be modeled in clay just as it was in life. Using the measurements, death casts, photographs and other information obtained in the field, it is built up little by little, every muscle in its proper place. As much care and thought are put into the modeling of a subject for a

museum group as a sculptor would give to making a bronze.

After the animal is modeled in clay, a plaster-of-paris mold is made in sections so it will come apart easily when the plaster has set. The mold is taken off the clay model and a manikin—made of burlap and composition—is constructed inside the plaster mold. The mold is joined together and the plaster broken away from the burlap manikin. He now has an exact copy in the manikin of the original clay model. The antlers, or horns, if there are any are fastened to the manikin and it is ready to receive the skin, which has been treated so it will not deteriorate by tanning, or leathering, as it now resembles leather, strong and pliable, but with the hair still on. The skin is pulled over the manikin and cemented in place. Glass eyes are used in all specimens, and these are now set in their proper positions. After all has dried thoroughly, the antlers are oiled and the skin around the eyes, nose and mouth colored with oil paints.

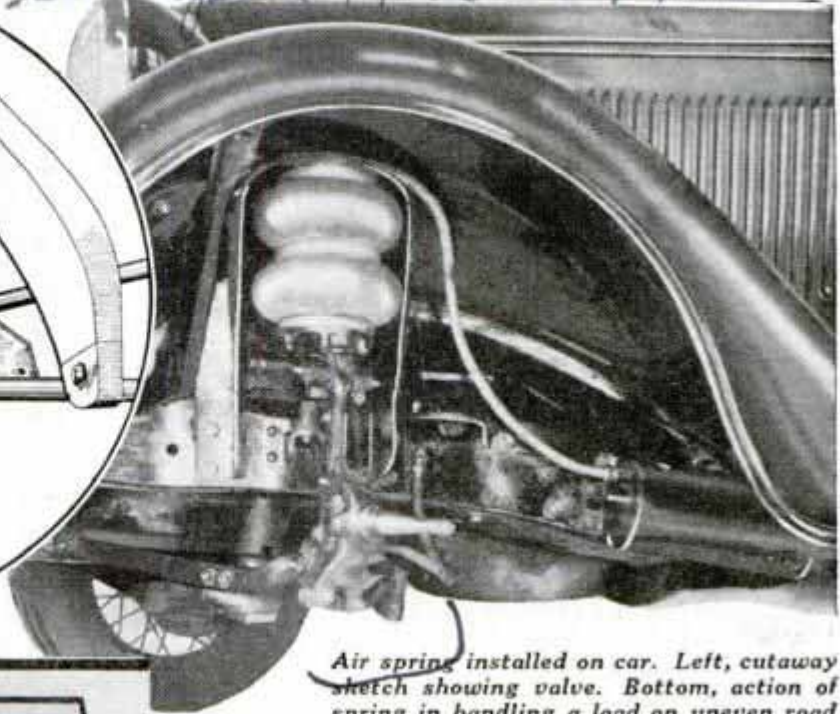
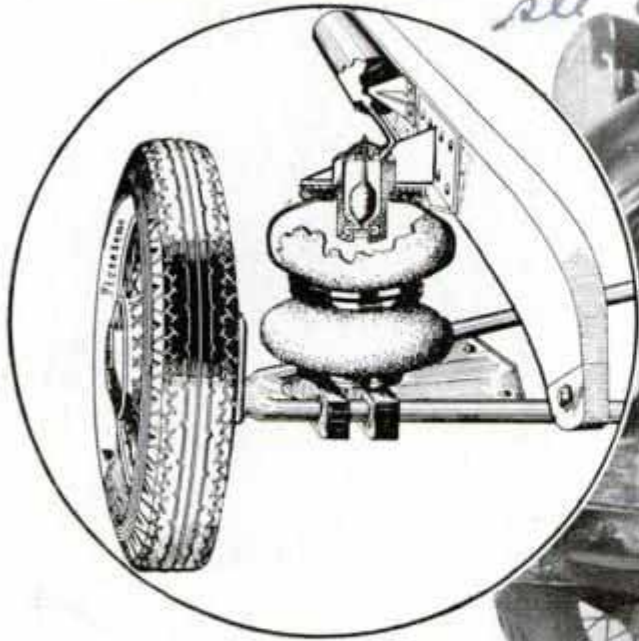
In the mounting of birds, the complete skeleton is used and left in place in the finished mount. When birds are collected in the field, they are carefully skinned and cured. The skeleton is "roughed out," that is, all meat is removed, and measurements taken. Before skinning and as soon after it is obtained as possible, color notes of the eyes, bill, feet and other fleshy parts are taken, as these change rapidly in color

(Continued to page 126A)

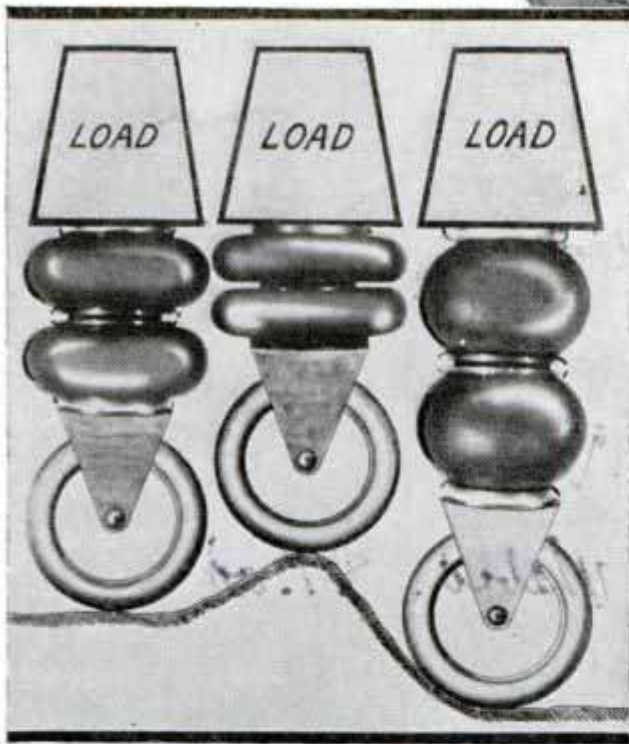


# Inflated Rubber Springs Improve Auto Ride

*see April 1936-577*



*Air spring installed on car. Left, cutaway sketch showing valve. Bottom, action of spring in handling a load on uneven road*



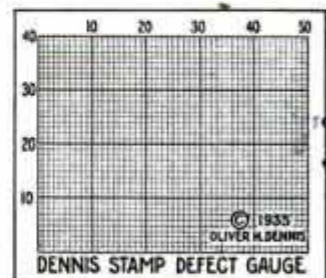
corners at high speed; erasing the effect of road irregularities and quieter car operation. The device weighs about two pounds per wheel, compared to the ten to fifty-five pounds per wheel for steel springs. It is a development of the Firestone Tire and Rubber company. In explaining the air spring, R. W. Brown of Firestone research says: "Laboratory tests over a period of months and practical tests on the road show that the new suspension principle is sound and practical and provides solution to the problems on the old type of spring systems."

*F188.*

## Defects of Postage Stamps Seen with Transparent Gauge

Designed to produce a "soft" ride, a new type of springs has been developed for the automobile. It is an inflated rubber spring which permits the car literally to ride on air. It consists of a rubberized fabric bellows which is filled with air to carry any load desired. The bellows operates automatically in conjunction with an air reservoir by means of a pendulum shock absorption valve. The reservoir and bellows are connected by metal tubes. Among advantages claimed for the air spring are: less fatigue to passengers, elimination of body roll when rounding

To aid the postage-stamp collector in measuring specimens and observing defects, a transparent gauge of celluloid has been devised. It is squared off in millimeters, forty by fifty millimeters in measurement. By placing it over the stamp, the collector can quickly spot a defect, determine how well it is centered, measure its size and its perforations.



*Oliver H. Dennis's Stamp Defect Gauge No. 1401*



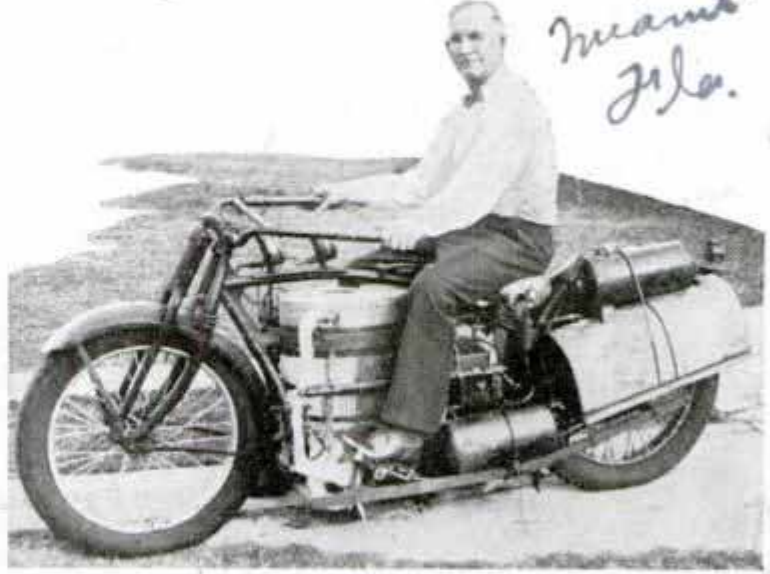




Wavel...  
 Chicago Heights  
 POPULAR MECHANICS  
 F164  
 Pearce  
 948 S. 3rd.  
 695

ings is now on the market. No matter how short the stub of chalk or crayon, once the knurled sleeves are turned the crayon will not fall out. The joints are easily adjusted and fixed in any desired position, and circles from one and one-half inches to thirty-six inches in diameter may be drawn.

**Motorcycle Driven by Steam**  
**Operates Almost Noiselessly**



Builder is shown on steam motorcycle which operates smoothly at all speeds. A faint chug when it starts is the only noise

F163  
**"Lifeboats" Stored in Rack on Flagship of the Air**

Parachutes, the "lifeboats" of the air, are packed neatly into a small rack aboard the new twin-motored Douglas which will serve as flagship of the U. S. air forces. The chutes are rolled into packages somewhat resembling basketballs in their carrying bags and stored in a small compartment that may be reached easily by the crew. The Douglas carries no armament as it will fly high above the range of anti-aircraft guns.

Silent except for a faint chug-chug at the start, a steam-driven motorcycle is in operation in Miami, Fla. It runs smoothly at one mile or fifty per hour, makes fifty miles per gallon of gasoline, kerosene or distillate and has no gears. A two-cylinder, double-action steam engine powers the cycle. It has a water tank, fuel tank, burner tank and pilot light tank. The six-gallon boiler is built to withstand a steam pressure of 500 pounds, but normal operation requires only 250 pounds. It takes only twenty minutes to get up steam when the engine is cold. A foot pedal operates the engine, stopping it automatically when the foot is removed, and a foot brake operates on the back wheel. The vehicle is built from secondhand parts.



Parachutes arranged neatly in compartment aboard the new flagship of the U. S. Air Corps

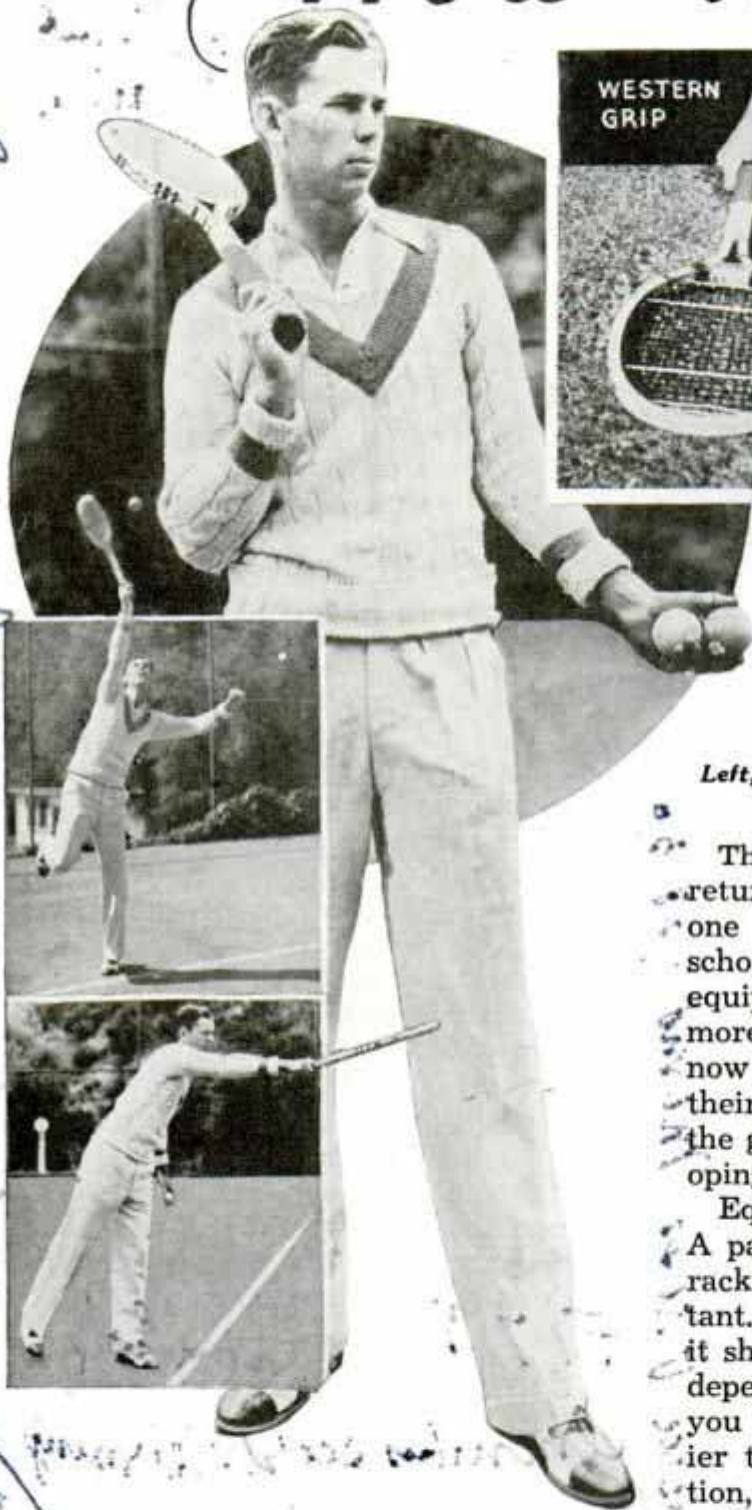
F177  
**Self-Adjusting Brakes Cut**

Costs of Servicing  
 Special mechanism built into the nose of the brake shoe may be the means of eliminating brake adjustments, thus reducing the costs of servicing automotive vehicles. An-automatic adjuster invented by a British engineer has been used on 135 busses for more than 2,000,000 miles without a brake adjustment. The mechanism operates to maintain a constant clearance. Any clearance desired can be maintained by a suitable pitch of wheel and rack.

Vertical Commerce of Mass...  
 1905...  
 I am early  
 Clayton Dewandye  
 Birmingham



# How to PLAY



Left, the correct service position, the service, and the correct follow through

There is no sport that will give greater returns in health and pleasure, and it is one of the few games people play after school days are over. Public courts, many equipped for night playing, are becoming more numerous, and many schools are now including instruction in tennis in their courses. These things are making the game increasingly popular and developing more and better players.

Equipment is simple and inexpensive. A pair of tennis shoes, some balls, and a racket are all. The racket is most important. It need not be an expensive one, but it should not be the cheapest. Its weight depends on the user. Buy one as heavy as you can swing comfortably, for the heavier the racket the heavier the construction, and consequently, its sturdiness.

There are accepted ways of gripping the racket, hitting the ball and making the various strokes, which long experience has shown to be best. Learning these fundamentals comes easier to some than to others, but the player who acquires them too easily is in more danger than the one who does not, for he is likely to loaf, and that is fatal to his game.

There are three ways of gripping the racket in general use, the western, the

By Ellsworth Vines, Jr.

(As told to John R. Marcy)

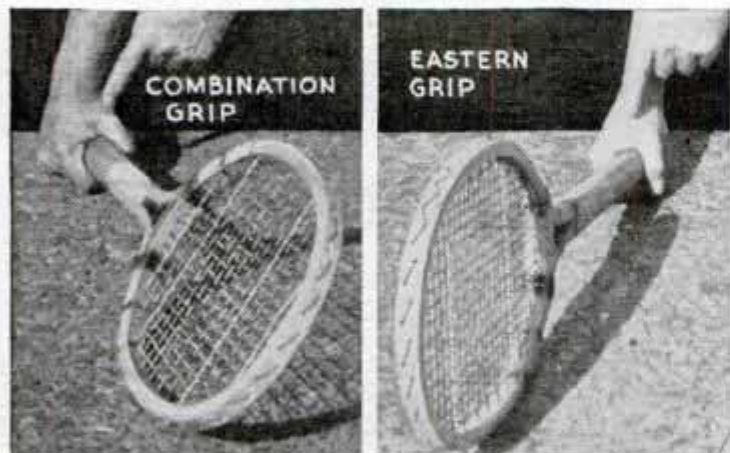
ANY normally healthy person can become a good tennis player. Not everyone can become a champion, but with plenty of application and by mastering the few comparatively simple fundamentals of the game, a player can become a formidable opponent.

6 14 38  
Hollywood, Calif  
1922



8 14380

# Winning TENNIS



- DON'T**
1. Try to knock the cover off the ball.
  2. Play until exhausted.
  3. Try fancy shots.
  4. Fool or loaf.
- DO**
1. Concentrate—Keep your eye on the ball.
  2. Always stand sidewise to the net when hitting.
  3. Always hold your racket tight.
  4. Follow through.
  5. Learn the correct strokes and stick to them.

*Left, in circle, start of forehand drive. Above, position when ball is hit. Bottom, the follow through*

eastern, and the combination grips. In the western grip, the crotch between the thumb and forefinger rests on the flat side of the handle. This grip is good for high balls but not for low ones. In the eastern grip, the narrow side of the handle is between the thumb and forefinger. This is good for low or medium balls, but not for high ones or those close to the body. The combination grip is similar to the eastern, except that the racket is held tilted to the left two or three inches. It is generally considered the best, as it is good for both high and low balls and allows greater freedom in swinging.

Hold the racket so the end does not extend beyond the hand. I hold mine right





at the end with the leather butt just on the little finger. Under no circumstances should you choke the racket. Your fingers should be slightly separated for better control. Your wrist should be straight, the hand and racket neither twisted upward nor downward.

For the service, stand with your left foot forward so it forms an angle with the base line, and your weight on your right foot. Throw the ball about six feet above your head. Swing your racket so it will meet the ball with your arm fully extended upward.

There are three kinds of service most players use—the slice, the twist, and the cannon-ball. In the slice the ball is hit sidewise and downward toward the left, so considerable spin is put on it. It is the easiest to put into the court. In the twist, the racket is swung from behind the shoulder toward the right, but the same direction of spin goes on the ball. In the cannon-ball the ball is struck with the racket almost flat toward it. It is very speedy, but it takes a lot of energy. The reverse twist, in which the racket is swung from right to left in front of you, putting the opposite spin on the ball, is hardly used these days. It is hard on the arm and its advantages are not great.

A common service fault is hitting the second ball easier than the first. Neither ball should be served harder than necessary to get it into the court. Reduce the speed of your first ball and hit your sec-

ond a little harder is good general advice. Vary your serves occasionally. To develop your service practice shooting a dozen balls for one corner of the court, then serve them to another spot. Don't hit them hard at first, but as you develop accuracy, increase the speed.



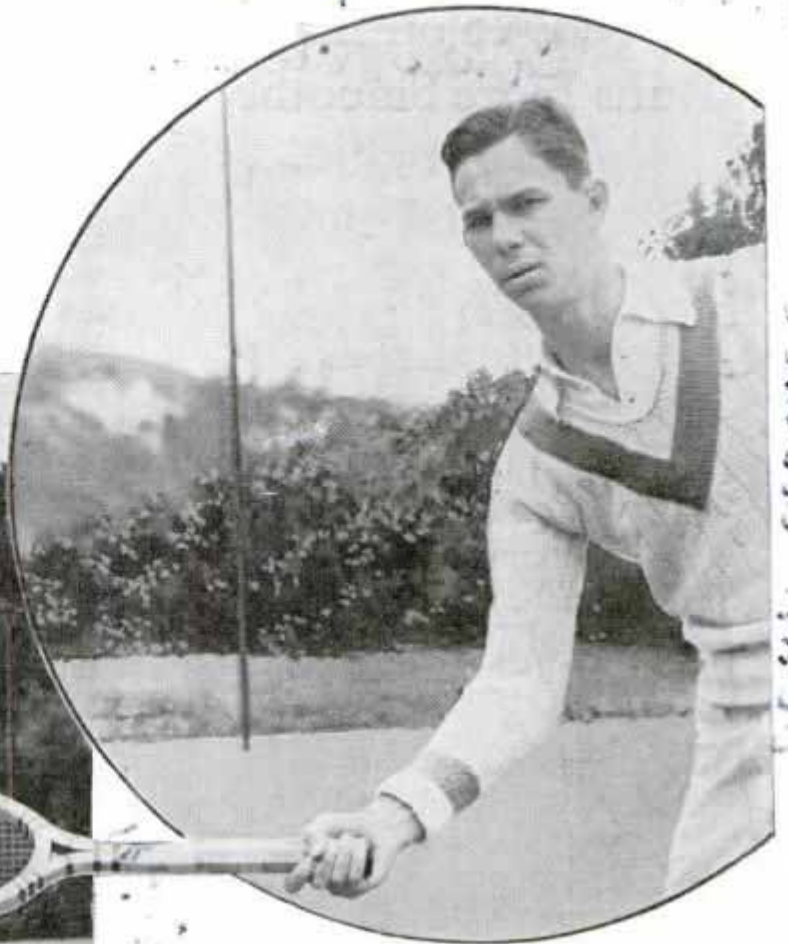
*Top, start of backhand drive. Center, position at point of contact with ball. Below, the finish*

Next come the various strokes, the forehand and backhand drive, the forehand and backhand volley, the lob, chop, and smash. There is one general principle that applies to all—the “follow through.” This means your racket should not be checked when the ball is struck, nor wind up around your neck. At the finish it should be pointing at the place you want the ball to hit. A ball stays on the racket longer than



we think and if you lift or lower your racket after the impact, you start the ball out of the court or into the net.

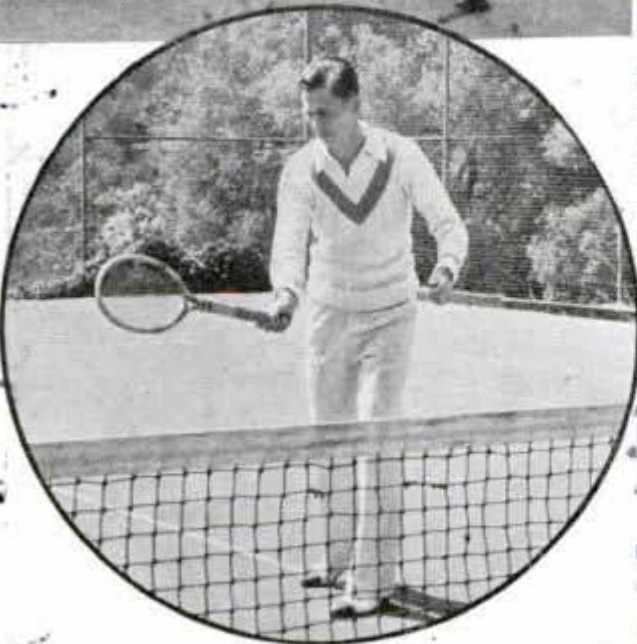
The whole foundation of tennis is built on the drive. Stand with your left side to the net. This throws your weight into the shot and automatically takes care of



your footwork. With your arm fully extended, swing forward and hit the ball just after the peak of the bounce, always remembering to follow through.

A backhand drive is made the same way, only reversed. The speed with which you return the ball should depend on your ability to get it back into the court. Don't try to knock the cover off. Remember most points are lost by knocking the ball into the net or out of the court, and the one who consistently gets the ball back safely is the one who wins in the long run.

Constant practice is the only way to become proficient in the drive, or any other feature of the game, but never practice or play until exhausted. You will go stale. Stop while you still feel like playing. A method I find helpful in developing driving accuracy is to practice with the net stretched two or three inches higher than regulation. I shoot them over as close to the top as I can. This makes the regulation height seem easy afterward. Or draw a line on a board fence or handball court at net height and shoot just above it—not hard, but merely to get used to the height. It's surprising how accurate you can be-



Top, start of the lob, and, in center, the finish of the shot. Below, same grip is used for forehand volley as for forehand drive

(Continued to page 140A)



Butler Bros

2/14/36

700 POPULAR MECHANICS  
F157 **Lawn Mower on Air Tires**  
Runs More Smoothly

Butler Bros. Randolph and Canal Chicago



Low air pressure in the pneumatic rubber tires makes the lawn mower run more smoothly

Lawn mowers are wearing rubbers this year. Low-pressure pneumatic tires make the grass cutter run more smoothly, especially on rough or wet ground, and the rubber also absorbs shock and prevents breakage of the wheel when run against concrete sidewalks. The roller and cross-bar between wheels are both of rubber.

ing screen and a source of light. The light impinges on the "window blind" screen in the tube, which takes the place of the fluorescent screen ordinarily used in the receiver. It is a six-inch square plate with forty-eight rows containing forty-eight apertures or windows each, a total of 2,304 windows. Tin foil flaps on each window act as blinds, controlling the amount of light passing through to the viewing screen. The window screen and its blinds are charged positively to about 4,000 volts, the blinds thus being repelled from the screen and letting a maximum of light pass; as the electron beam of the cathode-ray scans the blinds it discharges them in a degree varying with the intensity of the received picture signals, letting the blinds shut off a corresponding amount of light.

F179 **Golf Ball Teed Up for Drive**  
by Stepping on Plunger

Labor-saving inventiveness has now turned to the golf course and produced an automatic tee that mounts your ball for the drive at a mere touch of a foot pedal. Designed for the practice tee, it was invented by a San Francisco Chinese. Golf



Step on the pedal and a ball pops up on the practice tee at just the right level for your swing

F240 **Television Images Are Enlarged**  
by "Window Blind" Screen

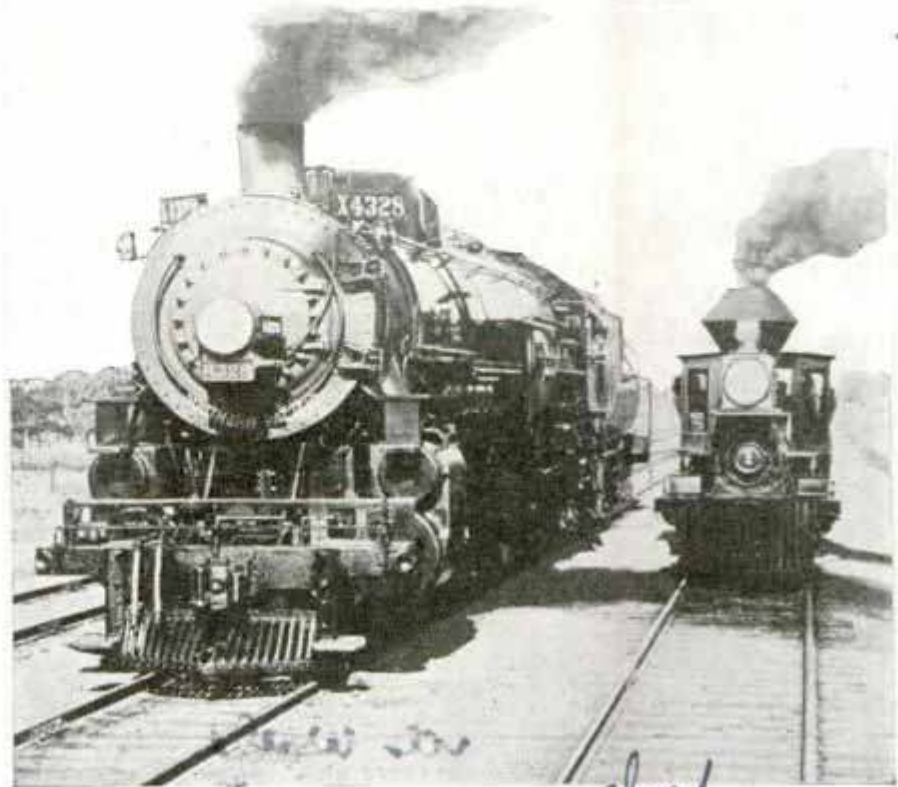
Successful projection of television images from the six-by-seven inch laboratory size to the full motion-picture screen size is claimed for a "window blind" screen in a cathode-ray tube, invented by Dr. Vladimir K. Zworykin. The cathode-ray apparatus which receives the television impulses is placed between the large view-

438 Stanley St.



balls are loaded into a metal hopper from which they roll into a pipe extending beneath the carpeted tee. When you step on the plunger, a ball is caught by a hook and lifted to a rubber tee. The tee can be adjusted to any desired height.

# Pioneer Railway Engine Dwarfed by Modern Giant

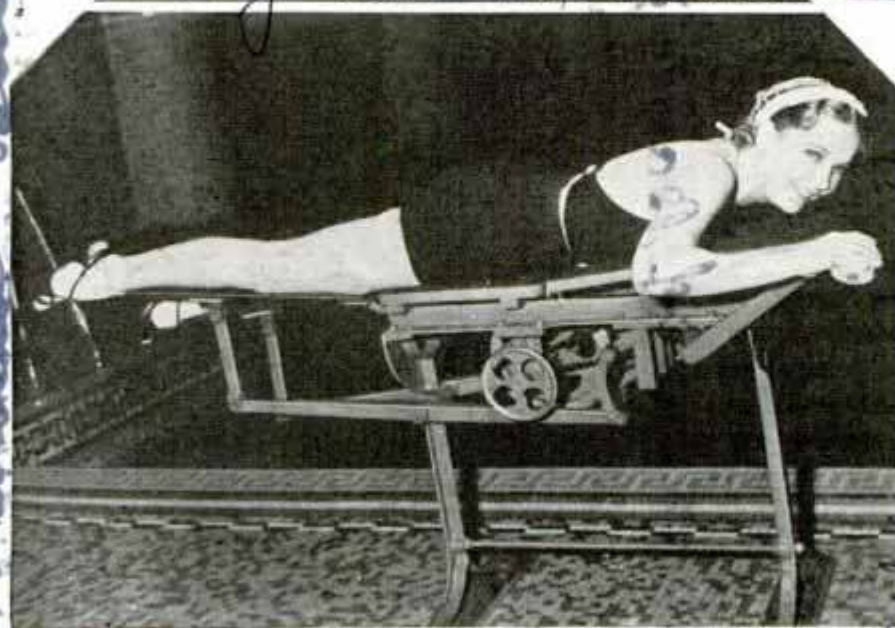


Modern locomotive and pioneer engine, showing how the "iron horse" has grown since the early days of railroading in the west

## Swimming Motions Taught by Robot on Dry Land

People who would like to swim but are afraid of the water until they have mastered the rudiments of the sport, now can learn how to kick and paddle with the aid of a robot instructor known as a swim coordinator. The student lies face down on the apparatus and turns hand cranks which cause platforms supporting the legs to move up and down, duplicating the movements of an efficient stroke which the student tries in the water after practicing on the coordinator.

Only one-thirtieth as powerful as the modern railway engine, the pioneer "C. P. Huntington" locomotive of the Southern Pacific railroad appears a midget beside the giant engine of today. The little locomotive is twenty-nine and one-half feet long and weighs 39,000 pounds, smaller than the tender of the modern giant. The "C. P. Huntington" was built in the east and carried to San Francisco in a sailing ship by way of Cape Horn, then to Sacramento by river steamer. It was placed in service by the Central Pacific, then building the western link in the first transcontinental railroad, but now a part of the Southern Pacific system. The midget engine, which bears the honorary title of Southern Pacific Number One, is on exhibition in the March of Transportation building at the California Pacific International exposition at San Diego.



Swim coordinator on which leg and arm motions of swimming can be learned without going near the water

Pool manager  
Bleeding  
Ethan

Progressive Corporation  
San Francisco, Cal.  
March 1915

no further information

Alfred M. [unclear]



F199

# Automatic Grader Sorts Eggs and Packs Them by Weights



Selectors sort eggs as they ride down conveyor at left, dropping them off according to weight in one of four channels leading to cartons

Poultry farms are being equipped with automatic machinery to save labor and speed the product to market. An egg grader and packer sorts the eggs into four different weight grades and drops them into commercial cartons at the rate of 140 dozen per hour. A conveyor with a chain drive, carries the eggs down past the weight-selectors until they reach the proper groove and roll along to the packer.

## Phonograph Record Improves Pianist's Own Playing

Phonograph records that actually improve on the playing by great pianists are now being made. The method is simple enough. Instead of recording at the usual speed, the revolving speed of the disk is cut to one-fourth of normal and the artist has four times as much time to cover difficult passages. In doing this the pitch must also be lowered. If the disk is at half normal speed, the music is played an octave below. Then, played at customary speed, the record contains passages the greatest artists would find difficult to ren-

der at the regular pace, and the richer tones of the lower pitch are retained as the tones are stepped up to the proper level.

## Pocket Vapor Bulb Operates Like Flashlight

As handy as a fountain pen, an electric vaporizer that works like a flashlight has been designed as a "pocket relief" for colds. In the head of the tiny metal case is a special bulb with two openings. A few drops of a nasal inhalant are inserted from the side. When the thumb switch is pressed, the "flashlight" batteries generate heat in the filaments of the bulb and vaporize the liquid, which is then inhaled from the top of the bulb, acting on congested nasal passages.



Inhalant in bulb is vaporized by heat of filament when button is pressed

is better at packaging N.E. Poultry Producers Exhibit

S. W. S. MFG. CO., WEST

(Eckhard) of van I vanitch Bramtudre and

75¢  
Chiba  
van I vanitch Bramtudre and

75¢  
Chiba  
van I vanitch Bramtudre and









Tractor-trailer unit loaded with 50,000 pounds of coal being lifted and swung about with ease by the huge strip shovel

all-welded, alloy-steel dipper, large enough to comfortably hold seventy-five persons. One of the great tractors can be accommodated in this dipper and easily lifted and swung about. One of the tractor-trailer units, loaded with 50,000 pounds of coal, or a total weight of 90,000 pounds, has been attached by cables to the bottom of the dipper and lifted and swung about with the greatest of ease by the "behemoth" shovel.

The huge stripper has a maximum cutting or digging radius from center of shovel rotation of over 115 feet, with a maximum digging height of almost 100 feet. The radius of the floor which the machine can clear for itself is seventy-five feet. The material can be dumped a distance of 215 feet from the point where

under engines developing 140 horsepower. A tractor-trailer unit weighs 40,000 pounds; is forty feet from bumper to bumper, 104 inches wide, and 101 inches high. The trailer holds about thirty-three cubic yards. The roads are muddy, full of bumps and holes, and wind over steep grades, but the giant trucks make the two-mile round trip from loading shovel to tipple, including loading and unloading, in fifteen minutes. The trucks are not driven on highways but only to haul the coal from the loading shovel to the tipple.

The electrically operated strip shovel is so big it had to be shipped to the mine a piece at a time and assembled there, a job which took nearly three months. The shovel, which strips dirt from the top of the vein of coal, weighs more than 2,000,000 pounds, is fourteen stories high, and can move from 2,000 to 3,000 cubic yards of earth per hour. It moves under its own power and looks like some mammoth prehistoric monster as it slowly crawls into digging position.

This giant carries a thirty-cubic yard,

it is dug—almost a city block—and, to allow plenty of room for piling high, a maximum dumping height of seventy feet is provided. This is comparable to the height of a six-story office building.

The pull applied to the dipper may be compared to the lift required to raise a railroad locomotive weighing 150 tons. This lifting force of 300,000 pounds is applied by the large hoist motors plus the movable counterweight. The principle applied—comparable with that of a modern elevator—consists of substituting for part of the machine's stationary counterweight, a live counterweight that moves up and down as the dipper moves and thus greatly increases both the digging force and speed of operation.

Thirty motors, capable of developing a total of 2,500 horsepower, supply the power for all the operations of the stripping shovel. It is driven and controlled by two men and crawls on four independently driven endless-track mountings and steers by means of hydraulic controls. Coal loading to the trailers is handled by a heavy-

Western Road & Equipment Co. - Denver, Ill.  
 Motor - La. E. Co. -  
 Chevrolet -  
 1930

Greatly improved efficiency of stripping shovel

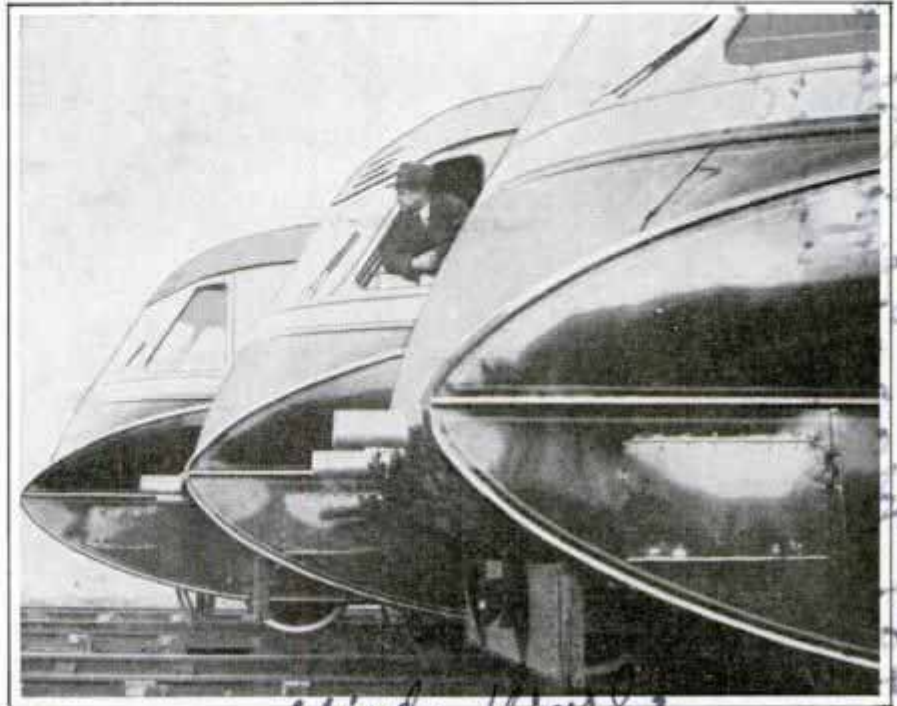
1930



duty dipper, also electrically powered. Handling the big dipper with its tremendous load is even simpler than handling the coal scoop of your furnace at home.

The 300-ton-per-hour capacity tipple is of all-steel construction, loading on five tracks, with picking tables and loading booms over four tracks. The shaking screens are in two separate operating sections. A scraper type mixing conveyor is used to cross the ends of all the loading booms for selective mixing of any or all sizes and in the slack track end of this conveyor a crusher is interposed. Selective crushing of any size of coal is possible.

## Fleet of Streamline Rail Cars Speeds Travel on British Line



Streamline power cars, three of a kind, are lined up on adjoining tracks of the Great Western Railway in England

F-202

### Cardboard Bull on Motorcycle Advertises Merchant's Wares

Lifting a page from American advertising methods, a Spanish merchant is capitalizing on the popularity of bull fighting in that country. He has rigged up a full-size cardboard bull on his motorcycle and



advertises his wares on the sides of the animal as he goes through the streets making deliveries.

Streamline equipment is making fast strides on British railroads. The three power cars pictured above are part of a fleet being built for the Great Western Railway in England, which already has eleven of this type in regular service and has ordered ten more.

### Vacuum Grip on Fishing Rod Fits Handle Tightly

F-160

For producing a tight fit between rod and handle, the modern fishing rod has a vacuum forward grip. A tapered cowl on the rod houses an air chamber which forms vacuum contact when the rod is inserted into the handle.



Removing the rod from the handle is accomplished by twisting the tapered grip slightly to break the vacuum. This eliminates the practice of removing the tip by means of the guides.

Joseph & Co. Inc.



F1483

Emb. Thomas & O'Connell Jr  
10555 Holman Ave  
Los Angeles, Calif

# Master CRAFTSMEN

Reference - Teete Carle. Publicity Dept  
5451 Marathon Blvd  
Los Angeles, Calif



SUPPOSE you had to build a steam engine and half a dozen palm trees by tomorrow night. An order like that is easy for the property-making department of the Paramount studio in Hollywood.

No matter what a director needs, from cobwebs to battle-ships, the craftsmen are ready to build it. The experts spin cobwebs in a special machine. For the fourteen-inch guns of a warship, they bend thin sheets of plywood around skeleton tubes and spray the wood with grey metallic paint. Swords usually are cast in rubber since that material can do less harm than wood or metal and the gilded weapons appear as dangerous as the real article.

In the movies appearance is the thing that counts and the artisans create mira-

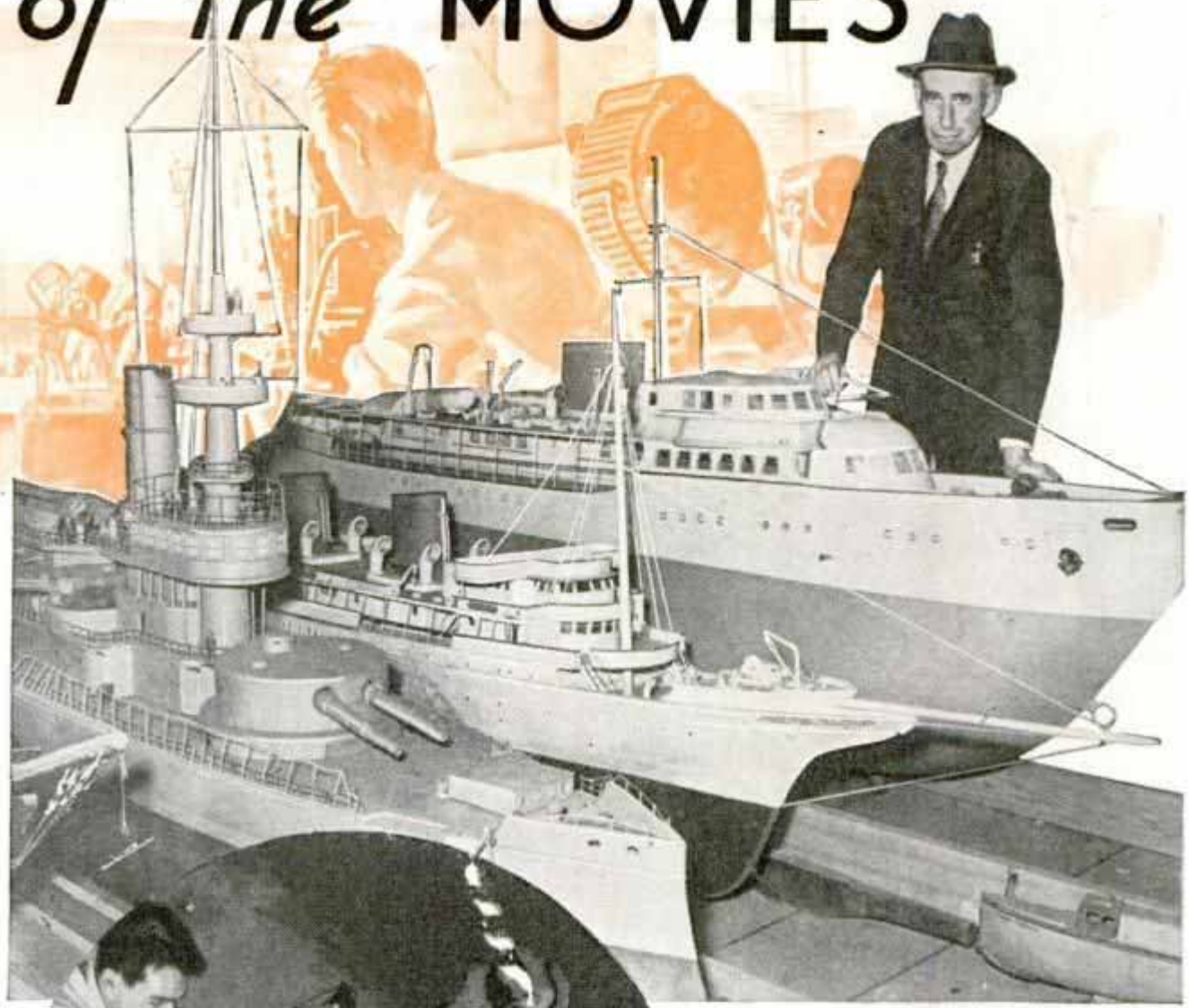
*Tin helmets for movies, wrought-iron workers in studio foundry, and making statues for Paramount's "The Scarlet Express"*

cles for the camera with a few simple substances. A poured concrete wall may be part of a real building or merely a painted fiberboard partition with the concrete form marks applied with plaster. Kick at a granite boulder and it may go bounding across the stage, a featherweight rock built



6 74 3 3

# of the MOVIES



*Part of Paramount's fleet of model boats, and studio sculptor at work*

masquerade as the steel plates of a ship with painted wooden buttons glued in rows for rivet heads. The gold throne you see in a picture is probably plaster. The craftsmen select materials with an eye to looks, speed and costs. Eighteen hundred skilled workers in the carpenter shop, machine shop, foundry, plaster shop, electrical shop, and tin shop turn out \$2,000,000 worth of construction work, including sets and properties, in the Paramount shops each

of burlap and wire. Rest your arm on a table and if it collapses it's a "breakaway" piece of furniture that looks genuine but does no damage in a fight.

Wood, fiberboard, plaster and paint are the chief materials used. Fiberboard may

year. Nearly every skilled trade is represented on the payroll from ships' carpenters and cabinetmakers to jewelers and explosives engineers. One painter is a specialist at giving plaster timbers an aged appearance while another specializes in





spinning propeller of special design, some underwater vanes, and an electric motor was the secret.

Once when a full-size ship was needed the Paramount crews constructed the center section of a large liner right on the lot. The superstructure and masts towered over the stage buildings. It was used in thirty-seven different pictures. In one picture it served as a freighter, for the next it was filmed as a tramp steamer. In other pictures it was a crack passenger carrier of the Atlantic. The construction department finished the ship in two months and it was complete to a full-size bridge, cabins, deck ma-

painting Chinese signs and characters. Not everyone can make a tree. The tree experts build lath framework trunks and wrap them with rope and burlap, surmounted with real branches. Other tree trunks may be fashioned of plaster and given a lifelike appearance by artistic scraping with a wire brush. Real branches and leaves are usually used because they can be obtained easily. If Spanish moss is called for, the tree manufacturers get their effect with handfuls of hemp fiber. Rocks, boulders, and banks of dirt are ordinarily built up of lath framework, covered with chicken wire and a layer of burlap, coated with plaster and paint.

The plot of one story called for a whirlpool and before a week had passed Supt. Ed Davis led the director to a large pool of water on one set and snapped a switch. The water began to churn and then swirl like a natural whirlpool in a treacherous river. The next time a whirlpool is needed Davis knows a good one costs \$450. A



*Sculptor working on plaster sea horse, and scale model of ocean liner used in movies*

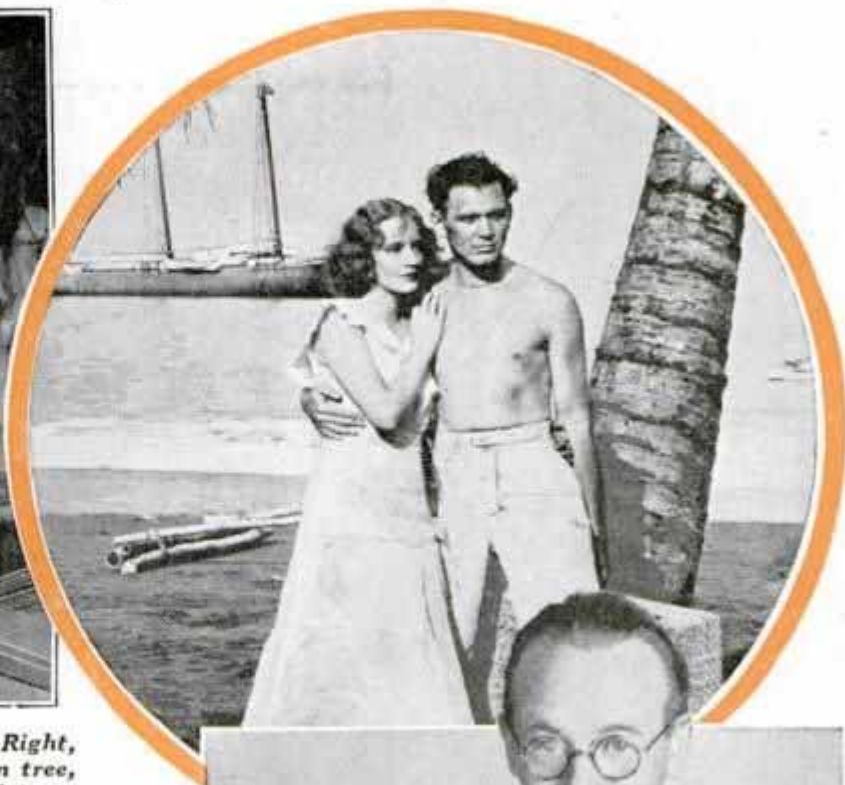
chinery, lifeboats with davits, and funnels.

One ship the craftsmen are proud of is a six-foot model of "Old Ironsides" built in the shops. The running rigging actually works and the guns can be pointed and fired by compressed air. Hidden machinery in the hull causes the guns to move forward, fire, and recoil to loading position. The shops can turn out tiny airplanes, automobiles, war tanks, or trains and one model of a railroad engine built





Early harp carved by hand for movies. Right, actor and actress beside imitation palm tree, and stage jewelry made on movie lot



by Harry Reynolds, master model builder, cost \$5,000 to complete and special patterns and castings were made for it. Real steam from the boiler moves the pistons.

Motion pictures must be authentic so the research department may spend months tracing details of articles to be made. For one picture exact copies of the jewelry worn in the time of the Crusaders were required and the studio jewelers created colored glass gems set in gold and silver plated rings and bracelets. Most medals worn by actors are cast in lead.

The artists duplicate intricate wood carvings and rough tree stumps with plaster. "Throwing mud" artistically takes long training, and real skill is needed to mold plaster into the shape of heavy timbers or to create realistic tree roots. The studio employs sculptors who design statuary and ornaments and who have duplicated many of the world's masterpieces in plaster for movie scenes. Garden furniture, decorative columns, scrollwork, and gargoyles all come out of the plaster shop. Replicas of rare vases and antiques, and interior furnishings like candlesticks and fireplaces are also cast in plaster.

The plaster shop keeps on hand stock items such as brick walls and cobblestone pavements. In making brick, a large plaster cast of the surface of a brick wall is made. From this master cast copy after



copy of the brick facing is made in thin plaster veneer and stacked away. When a brick wall is needed the carpenters saw the sheets of plaster brick to the right di-

(Continued to page 133A)



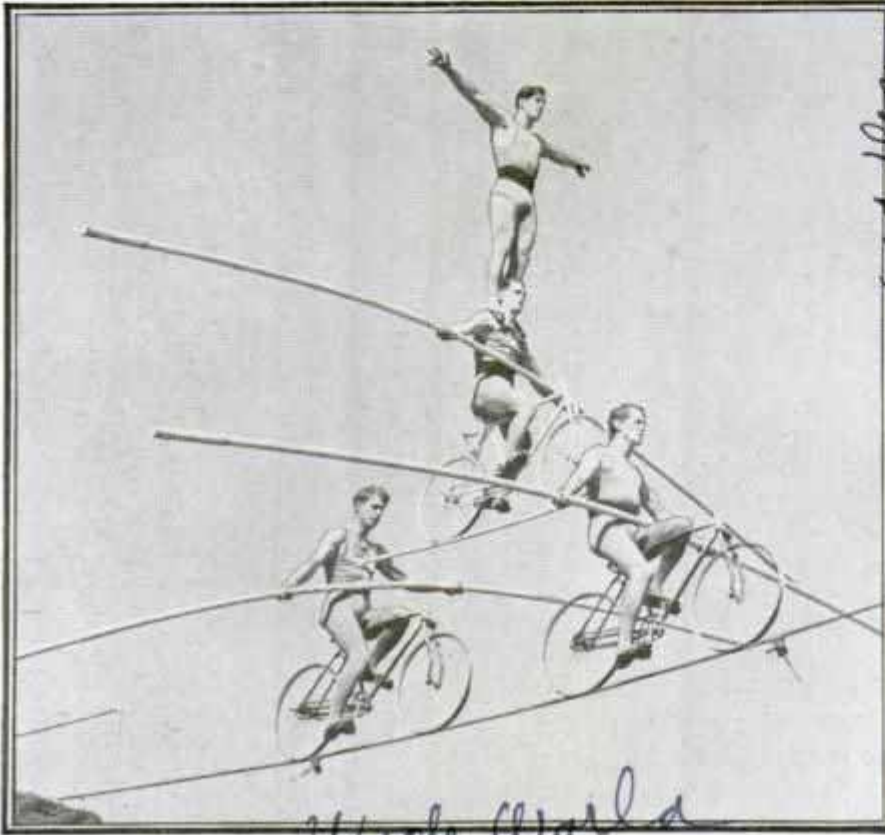
F 208  
710

(Director) Aeronautical  
Research Patent

# Cyclists Defy Death on Wire Ninety Feet over Circus Ring

wing and tail surfaces to prevent cold weather accidents, improved cowling to increase the safety factor and to increase speed, and an altimeter for low flying. To qualify for rewards, devices must be capable of use in government aviation and receive approval of the national advisory committee for aeronautics.

and was...  
F221



Four brothers from Hamburg, Germany, performing their breath-taking act of riding a pyramid of bicycles ninety feet above the circus ring

Flirting with death every second of their act, the four Hustrei brothers of Hamburg, Germany, thrill circus fans in the United States as they perform on bicycles balanced on a wire ninety feet above the earth. Their three bicycles form a pyramid, and a fourth brother poises on the shoulders of the topmost cyclist. Weighted poles help them keep balance.

## Super-Photos of Eye May Help Add to Life Span

New possibilities in the study of blood pressure and arteries are opened by a super-camera for photographing the capillaries of the eye. These photographs of the fine, threadlike blood vessels help to reveal hemorrhages and ruptures which are not visible otherwise. Changes in these tiny blood vessels may indicate high blood pressure, which may be

## Rewards Offered to Inventors F257 for Aviation Aids

Producing approved devices which may be used in government aviation will bring rewards up to \$75,000 to inventors. One development now sought is a high-lift device which will enable planes to land at a lower speed without slowing their air speed. Other needs include: new bombing sight for faster modern planes, improved superchargers to increase engine power, improved methods for braking planes in landing, lighter and more efficient propellers, improved sights for airplane machine guns, devices for de-icing propellers and



Photographing inner eye to help physician determine susceptibility to high blood pressure

Chicago Tribune 2/17/36



*Cleveland Ohio* *at McAlister* *F182*

# Off to Prison Convicts Ride in Rumble Seat "Jail" Cage

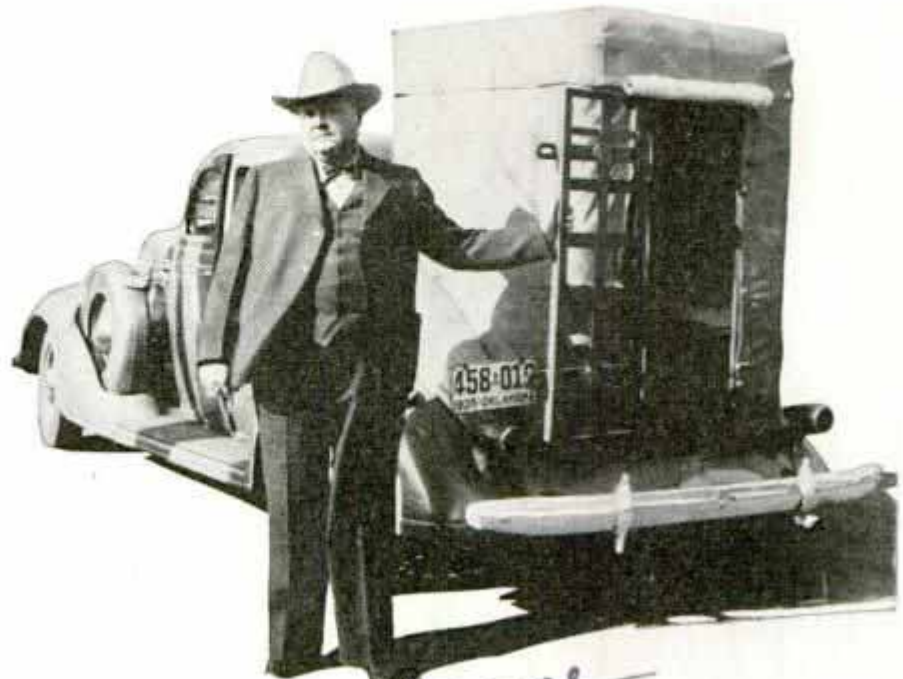
treated before a fatal break occurs in the vessels feeding the brain, according to Dr. A. D. Reudemann of the Cleveland Clinic. In designing the camera, Dr. Reudemann found that one of the chief problems was to focus a light sufficiently strong on the eye so that it could be photographed distinctly after magnification eighty times. Two auto headlamps are used, the light of one being focused into the center of the other.

*F175*

## Captive Baseball Helps Train Batters

Teaching the batter how to swing at high or low balls is made easier by use of captive baseballs. One baseball is suspended shoulder high and the other knee high from a cable strung between two poles. The balls are attached to the cable by wires with loops to permit them to whirl freely around the cable when hit. This simple training device may be used in the gymnasium or on the open field.

*Mr. Pearce*



Oklahoma's "prison-wagon," a steel cage mounted behind a coupe, opens its barred door to admit convicts bound for the penitentiary

Oklahoma has a jail on wheels to take its convicts to prison. Instead of a rumble seat, the prison transfer car has a barred steel cage mounted behind the coupe body. Alex Watson, in charge of the transfer of prisoners, can watch his wards in the cage by a mirror from the driver's seat. The traveling jail accommodates four convicts, having a padded seat on each side. The floor is carpeted and the back door is covered by a drop curtain of heavy duck for protection from the weather.

*Operated by Leslie Mann's and Max Carey*



Left, player preparing to swing at captive baseball. Above, ball appears at upper left of photo after batter has swung



*Installed at Miami*

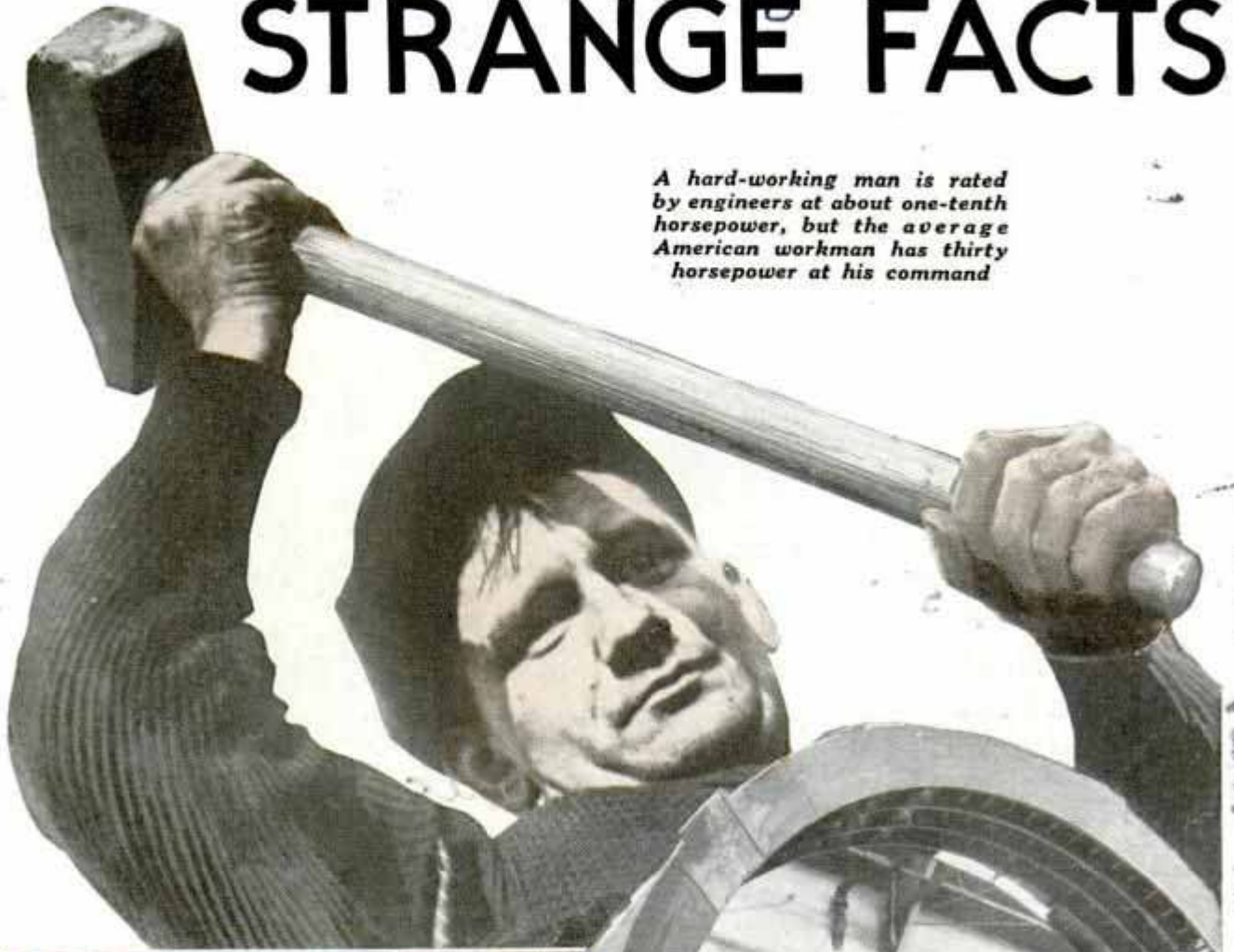


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# STRANGE FACTS

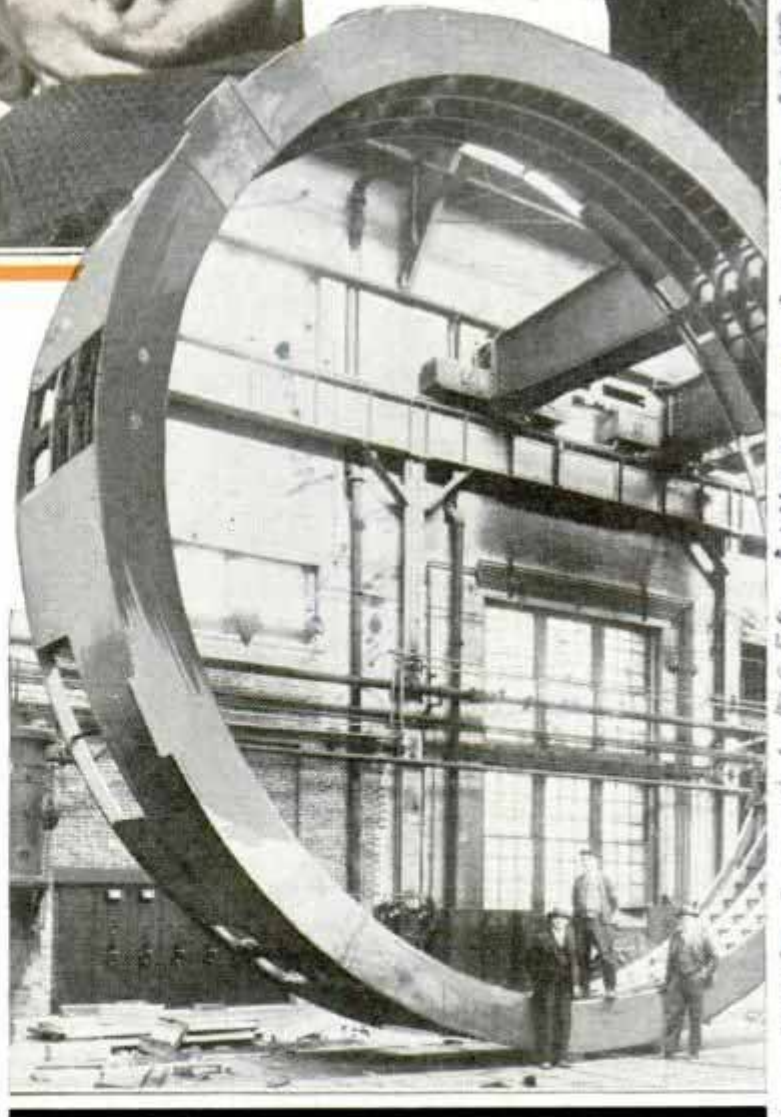
*A hard-working man is rated by engineers at about one-tenth horsepower, but the average American workman has thirty horsepower at his command*



**W**HAT has the power age done for America?

Experts now give the United States credit for performing half the useful work of the world. This means that Americans, with the help of science and invention, accomplish as much work as 1,875,000,000 people in other parts of the world, or that one-sixteenth of the world's population now performs as much work as the other fifteen-sixteenths. This is not a chance guess, but is based on a recent world survey by Prof. T. T. Read, of Columbia University.

America's rise as chief worker is due largely to an abundance of power. Without power there could be no machine age. Now we are looking for still more power and for a better distribution of power. What promises to be a decisive factor in distribution is a new system of "constant current di-



*This is not a Ferris wheel, but the frame for a water-wheel electric generator of 57,000 horsepower, one of the many developments of the power age.*



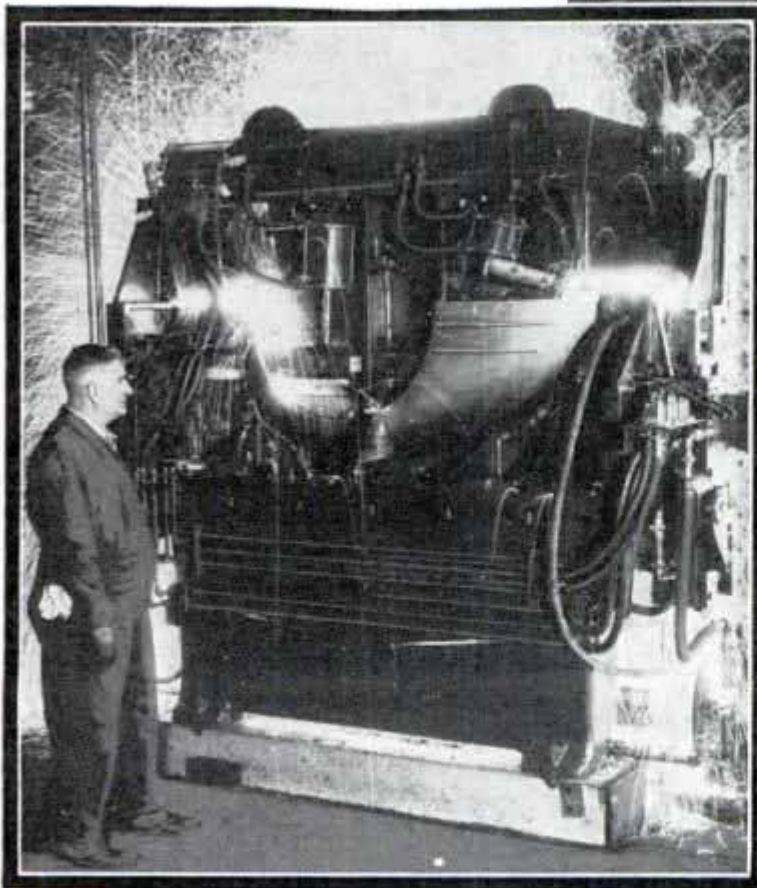
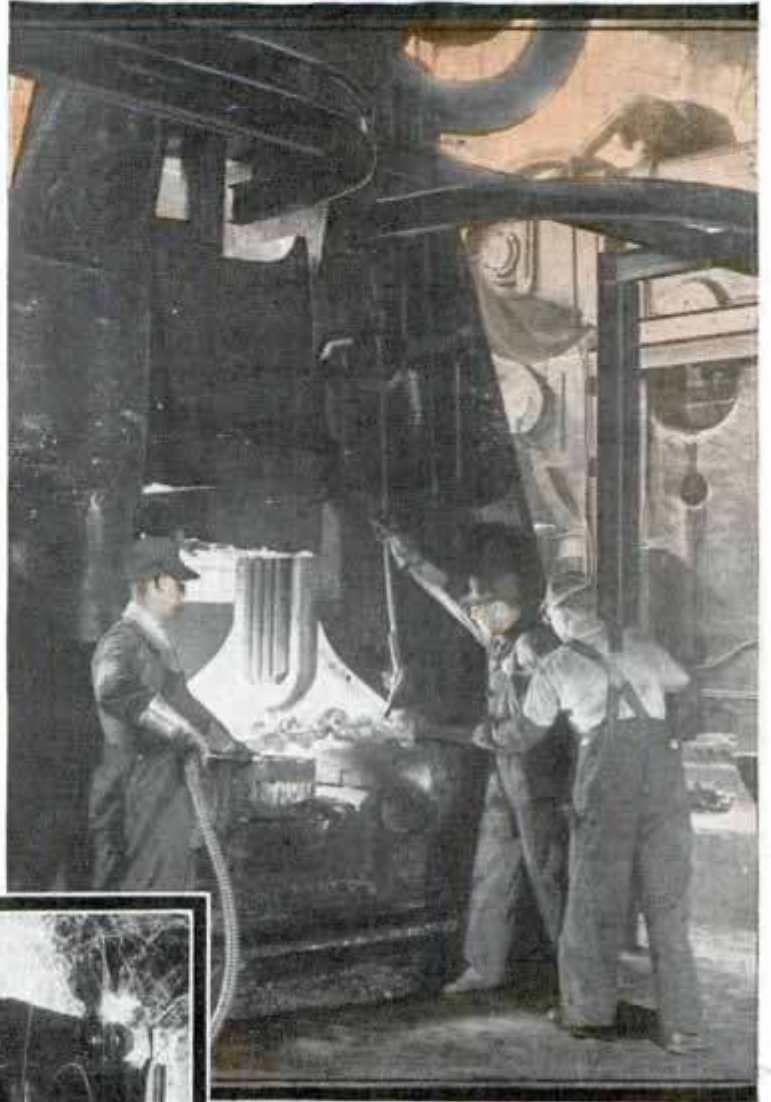
# *about* POWER AGE

rect-current" transmission, developed in General Electric's laboratories by Dr. C. H. Willis, B. D. Bedford, and Dr. F. R. Elder.

Electric engineers hail the system as revolutionary. For the layman it means simply that direct-current power may now be transmitted any distance from a power-generating plant; ultimately it may displace the present system of transmitting alternating current. In one of his last interviews, Edison made this prediction:

"In a few years everything will be direct current. Then everything will be changed. We will be able to send current over distances of thousands of miles."

The fulfillment of Edison's dream has awaited the development of the "thyatron" and

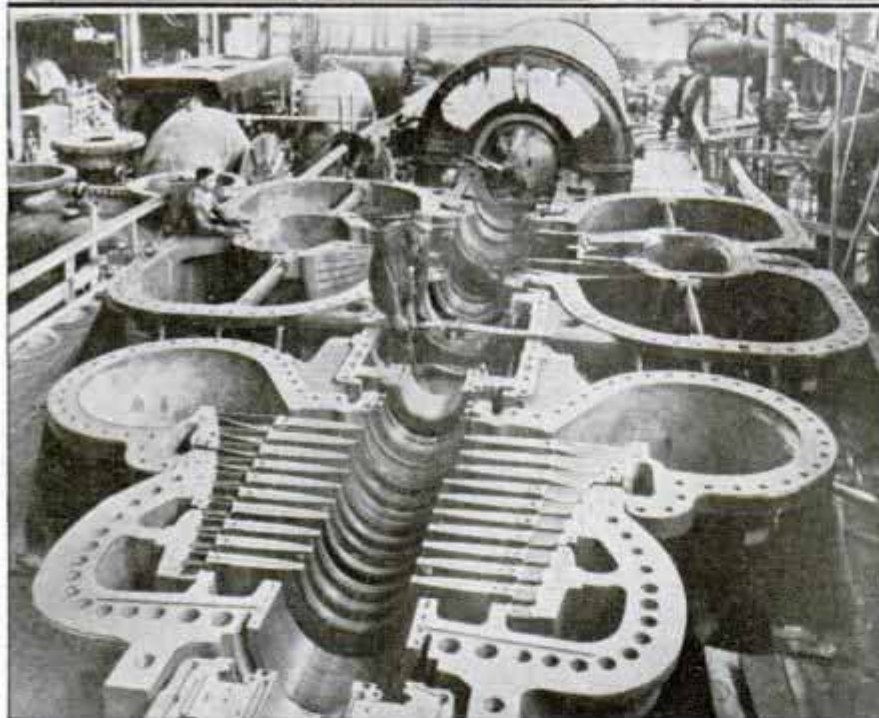
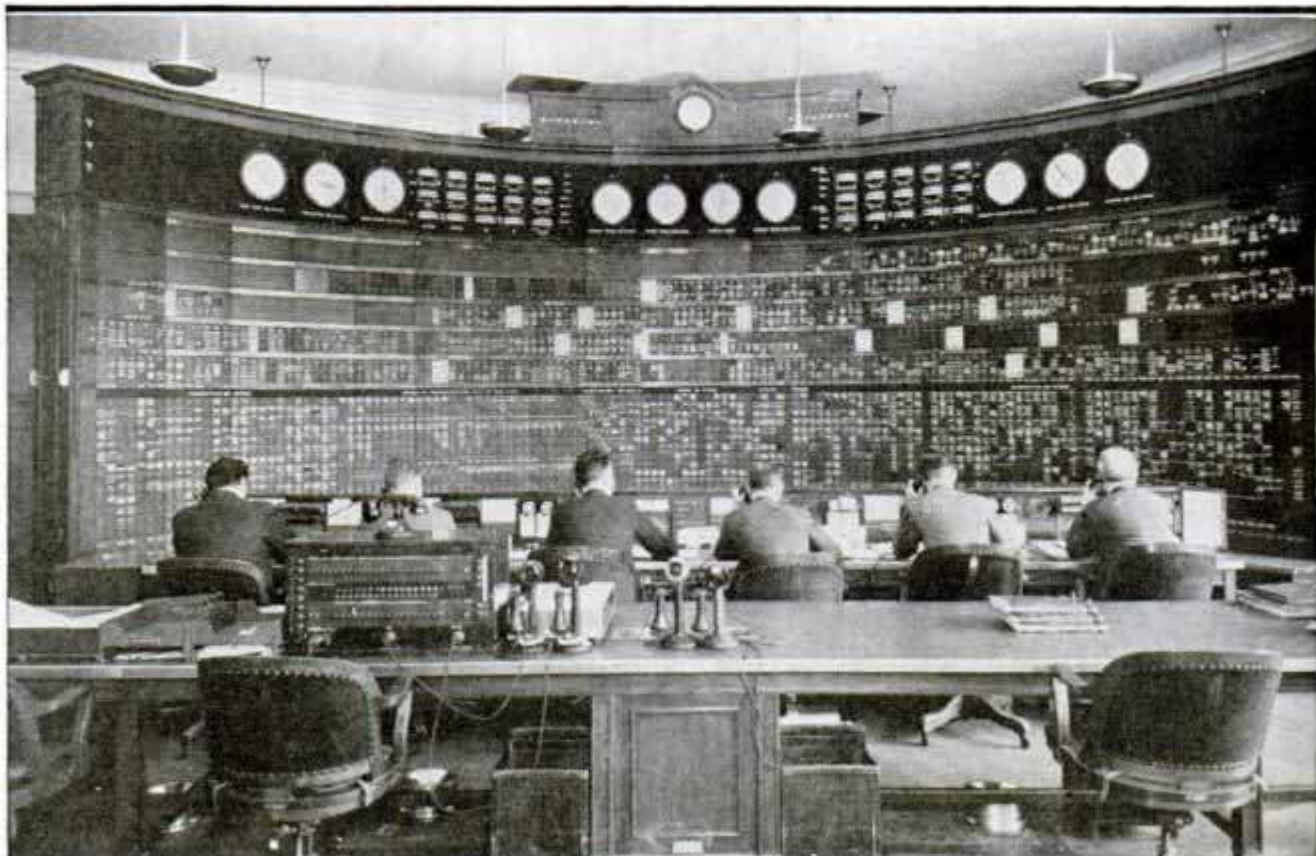


*Power forge in auto plant, above, and below, an electric welder doing the work as workman stands by with nothing to do except supervise the machine*

"phanatron," members of the ever-growing tube family. These have given engineers the means of overcoming many difficulties which heretofore prevented direct-current power transmission on a commercial scale.

"Alternating current is at present almost universally used for power transmission, in spite of many difficulties," said Dr. Willis. "Control of power flow is largely determined by the demands of the system, and the operators have little control except by means of circuit breakers, which may be opened or closed, automatically or manually, usually resulting in interruption of service. This means that in case of faults in the system, a large concentration of





Top photo courtesy New York Edison Co.

Top, pilot board controlling 1,330,000 horsepower of electrical energy. Below, half of casing enclosing revolving disks of giant steam turbine

out of synchronism; and faults, such as short circuits, cause a drop in power flow rather than an increase."

If direct-current power transmission is adopted generally, the whole country will be united into one giant power pool. The nature of the direct-current power circuit is such that systems of like or unlike frequencies can be operated together to feed any other system of like or unlike frequencies. Power lines which at present do not go beyond 250 miles, can be extended indefinitely. To transmit alternating current even for 250 miles

power results, which may be sufficient to shake the system apart and cause considerable damage.

"The new system, however, places in the hands of the operator full control. He can at all times control not only the amount of power flow but its direction. The system cannot get out of phase or

necessitates high cost and high voltages. Modern direct-current power transmission may be compared to a Mississippi river of power—a mighty stream of direct current fed by tributaries with either alternating or direct current.

Briefly, the new system comprises the conversion of alternating to direct current



F13

F 156

for transmission, and the reconversion to alternating current for consumption.

Electricity is an invisible force. Even in a power plant you see little evidence of the immense power generated. And although we can produce it and harness it, electricity is still one of the greatest riddles known to man. A cheap abundance of power gives America many advantages. Each person in the United States represents a daily consumption of about thirteen horsepower. The average for England is only 6.6 horsepower, and for India and China, it is less than one-half horsepower per person. There is still a general misconception concerning the amount of useful work performed by domestic animals. All of them do not perform more than five per cent of the useful work. When you consider how many people are employed in feeding and caring for these animals, their contribution to the world's work is negligible.

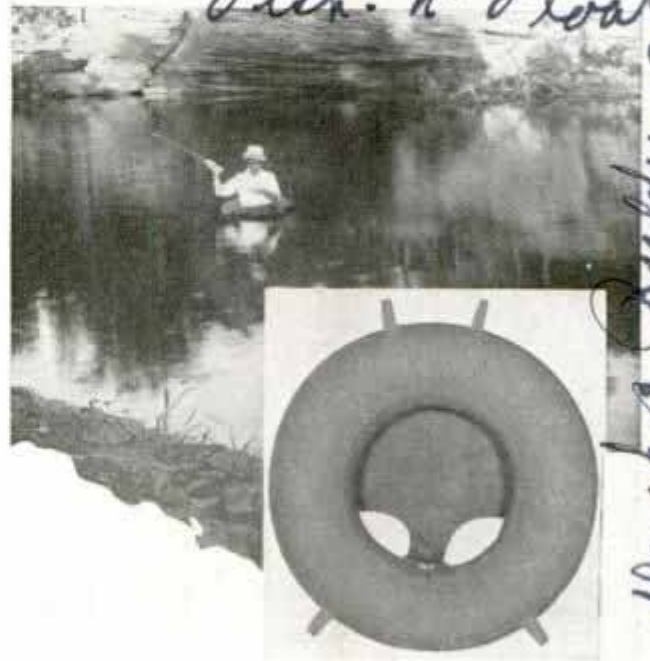
Considering how many millions of people are still engaged in muscular labor, you would expect their contribution to the world's work would bulk large. But human muscles do not perform more than one-eighth of the world's work. What can one man do? The engineer rates an ordinary laborer at one-tenth horsepower. That is not much; yet in some backward countries, the percentage of man power against machine power still bulks large. But in the United States, the work done by mechanical means is forty times the work done by muscles. In a progressive country, it becomes more and more expensive to buy muscle power. It costs but a few cents a day to run a one-tenth horsepower motor and a barrel of crude oil yields an average of 183 horsepower of energy, corresponding to the work output for a day of 1,500 average men.

The power age has brought about queer situations in the distribution of the world's work. Although one-twentieth of the world's population lives south of the equator, it performs only one-fortieth of the total work. The average American family employs the equivalent of eleven able-bodied men fifty-six hours per week, at a total cost of about \$75 per year. This is far cheaper than owning slaves. Power machinery gives the average American

(Continued to page 138A)

### Zipper Float for Fisherman Uses Auto Inner Tube

Such. n. Float



Fisherman supported by float, shown inset. A standard inner tube may be used

Whether fly or bait casting, the fisherman may venture into deep water safely by using a new float equipped with a standard 6.00 by 16 inner tube. The float has a zipper for easy removal of the tube. Straps on the canvas cover are used for carrying the four-pound float when the fisherman leaves the water.

### F166 Table Model Humidifier Costs Little to Operate

Electrical consumption equivalent to that of a twenty-five watt bulb will operate a table model humidifier which evaporates one and one-half pints of water an hour.



The capacity of the humidifier is two gallons of water. The alternating current, sixty-cycle 115-volt electric motor plugs into the nearest outlet. Container and dome are of heavy gauge copper finished in statuary bronze. Proper relative humidity is recommended for health and for preserving furnishings and interior woodwork of the home in winter.

American Electric Co. Elizabeth

Such. n. Float  
J. A. Tucker  
J. A. Tucker  
J. A. Tucker



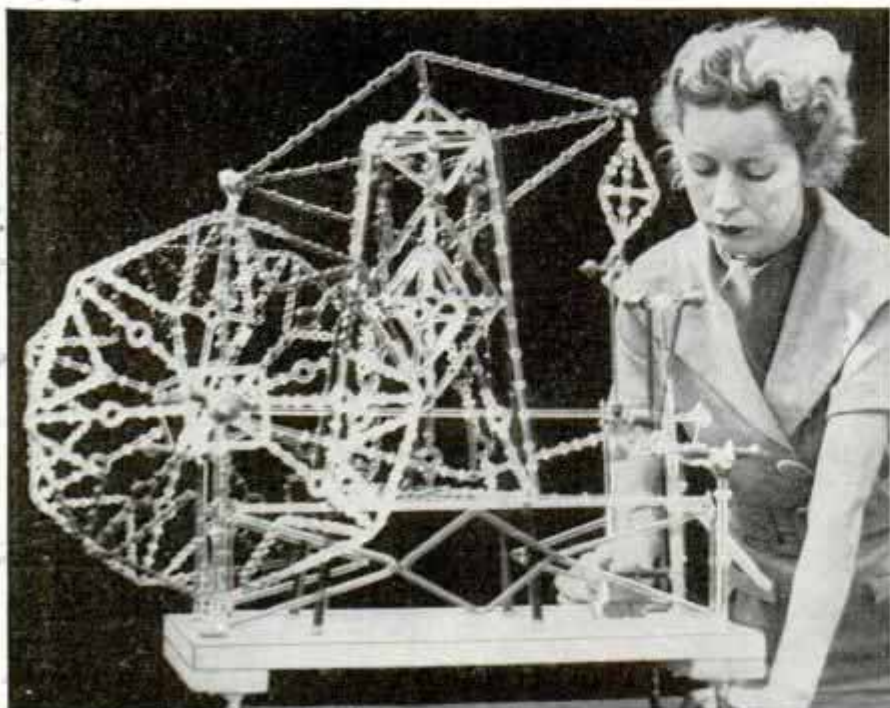
City Editor, St. Petersburg  
 James St. Petersburg, Fla

716

POPULAR MECHANICS

F250

**Working Model Steam Engine  
 Built Entirely of Blown Glass**



*Peggy Lorow with the working model steam engine she built entirely of glass, even to spun-glass piston packing*

Peggy Lorow, glass blower of Tampa, Fla., spent her vacation building a working model steam engine entirely of glass. At the Chicago world's fair in 1893 a similar engine was exhibited by her grandmother, also a glass blower, but this original has since been lost and Miss Lorow constructed her engine on the same lines from memory. A glass whistle pipes like a peanut stand as the engine gathers speed. It took thirty full days to blow the glass and put the engine together, and only one part had to be reblown. The flywheel was a hairbreadth out of balance.

**Inflated Collar for Horse  
 Handles Load Easier**



Comfort for the horse is offered in an inflated collar which eliminates much of the scuffing of the animal's neck in pulling heavy loads. So elastic is the collar that the driver

may slip his hand between the collar and the horse's shoulder without discomfort while a full load is being handled. The collar consists of a special rubber tube fitted into an ordinary collar and inflated with five pounds of air pressure. A valve at the lower end of the collar permits it to be inflated.

**Midget Town Hall  
 Houses Tank and  
 Postoffice**

On the Mojave desert, about fifty miles north-east of the Salton Sea is a fifteen-foot building which houses the city hall, water tank and postoffice of the town of 29 Palms, Calif. The tank is on top of the building,

with the city hall and postoffice occupying the quarters beneath. The town has a population of less than 100.



*This small building serves desert town as city hall, postoffice and water tower*

Vardell, Curcio, Mo.

C. M. L. L.

Bellendale Calif  
 29 Palms, Calif  
 C. M. Paul Blaney, 1-2-30

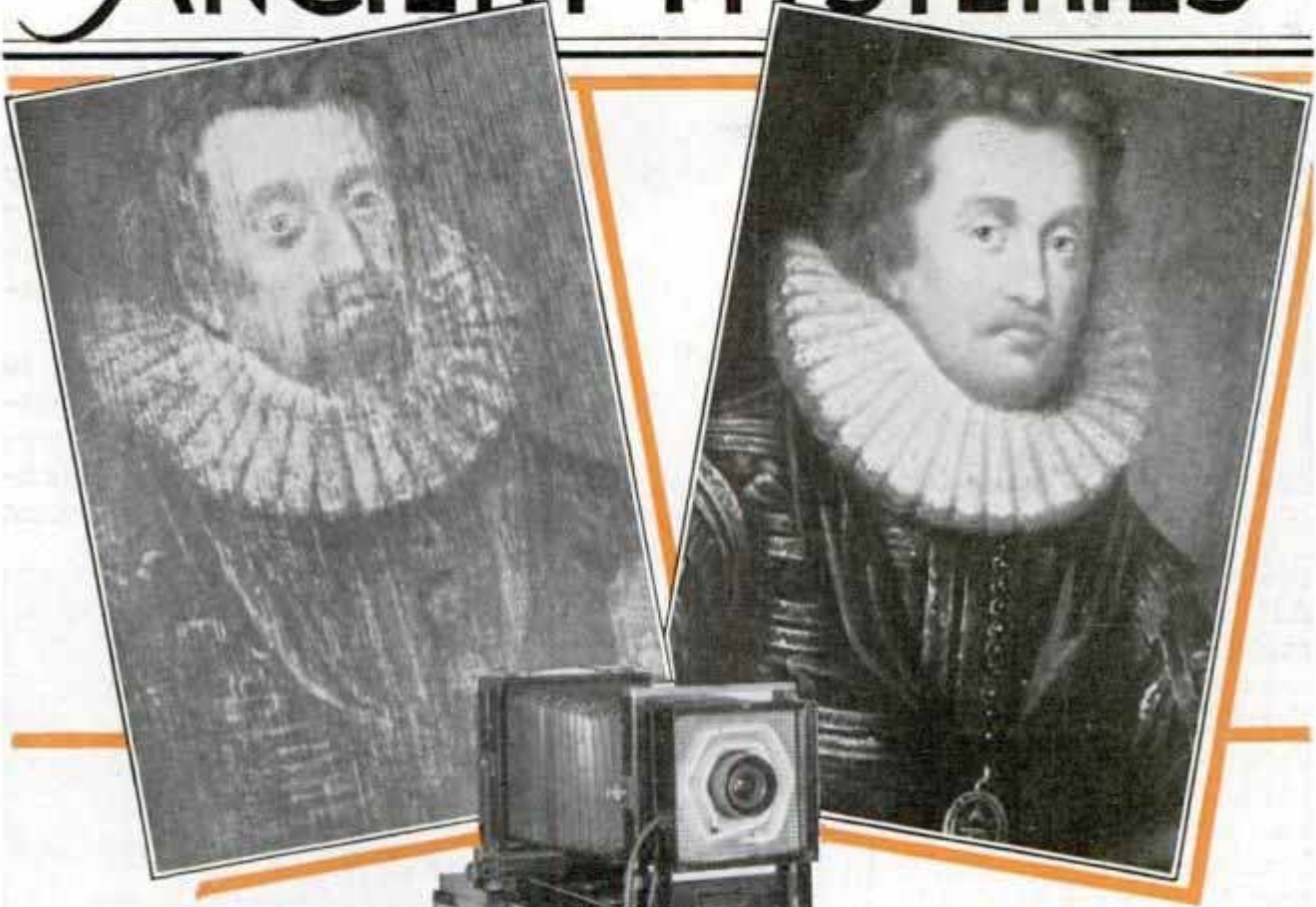
C. M. L. L. Vardell



1306

Star News  
Pasadena, Calif

# INVISIBLE RAYS solve ANCIENT MYSTERIES



**M**YSTERIES of art, literature and history locked for centuries in rare old paintings, tomes and letters are being revealed today by science's twin agents of illumination, X-rays and ultraviolet radiation. The same invisible rays which have been used in the diagnosis and treatment of disease now promise greatly to increase the sum total of human knowledge. A pioneer and leader in this scientific research work is Dr. Lodewyk Bendikson, head of the photo-technical laboratory of the world-renowned Huntington library and art gallery, near Los Angeles, where are priceless treasures of art and literature gleaned from all over the world. In the face of repeated discouragements, he has achieved

*Top, left, original Van Somer painting revealed by X-ray. Right "restored" painting of King James I. Below, ultraviolet ray lamp attached to camera*

results that intrinsically are noteworthy and potentially have almost unlimited possibilities.

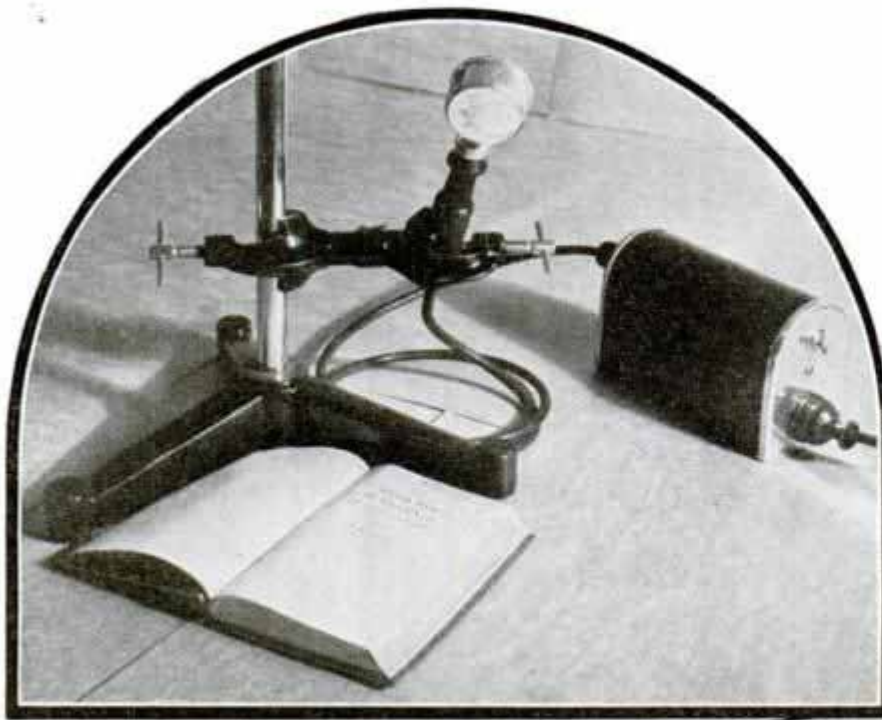
His most spectacular accomplishment concerns the use of X-rays in solving the mystery of a seventeenth century portrait, originally thought to be that of Francis, Lord Bacon. First, Dr. Bendikson proved that the portrait was not of Bacon but of

James I. Still more startling, X-ray detection proved that the James I portrait was but a "restoration" of a much earlier study of an unidentified gentleman.

A clue to the original artist's possible identity, as well as to that of the restorer's subject, was gleaned from an almost invisible inscription on the back of the oak panel, only eight inches high, upon which



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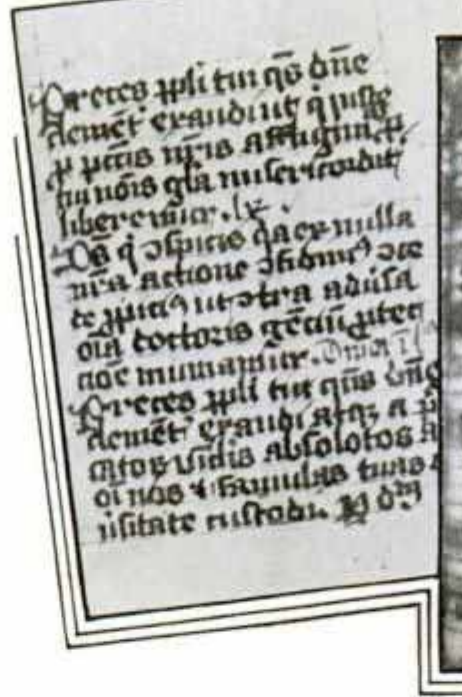
with the back of the panel toward the X-ray tube. To Dr. Bendikson's delight a painting underneath was revealed, a portrait of the unknown man in a similar pose to the "restored" James I. The scientist guessed the original painting to have been that of a wealthy merchant, whom Van Somer might have painted in Antwerp or Amsterdam.

Even more stirring to the imagination of Americans and of great promise in the field of historical research, is recent

the portrait was painted. All that Dr. Bendikson could discover, at first, was the name "Van Somer," with a word underneath it that appeared to be "Bakin." At first, it was assumed that Van Somer, a Dutch painter born in Antwerp in 1576, had small knowledge of English and had misspelled Bacon's name.

But Dr. Bendikson had to be sure. He compared the portrait with established likenesses of Lord Bacon. Many points of dissimilarity were found. Then the scientist submitted the inscription to ultraviolet rays. Thus, was revealed writing inserted between the two lines already partly deciphered. Finally, the three lines read: "Van Somer, see print in Rapin."

Then Dr. Bendikson recalled there was a history of England, translated from the French by Rapin de Thoyras, in the Huntington library. Checking the history, he found among the engravings one of Bacon, quite unlike the portrait in question and one of King James, of which the picture under examination was undoubtedly a copy. Now, the X-rays were turned on,



Top, ultraviolet ray desk lamp. Below, left, page of breviary in ordinary light, and, right, as it appears under ultraviolet light

work by Dr. Bendikson with ultraviolet rays in deciphering secret messages sent from France in the Revolutionary war period to John Jay, president of the Continental congress and chief justice of the United States. The letters were written to Jay by Silas Deane, American diplomatic agent who under an assumed name and in the disguise of a merchant, was sent to France in 1775 by the Continental congress to keep it informed secretly on conditions in Europe and to buy supplies for the Revolutionary army. In some of



the letters to Jay, Deane signed himself "Thomas Johnson" and Jay was addressed as "Mr. Thomas Smith." The messages were sent in a roundabout way and Deane wrote a harmless, chatty letter on the top half of the paper and on the bottom part inscribed, in invisible ink, the important message. The American patriot, of course had the counterpart of the ink to bring out the hidden message.

Jay neglected to use fixative to preserve the secret message after it had been made visible. As a result everything but a faint trace disappeared. Dr. Bendikson, with the aid of ultraviolet light, was able to decipher the secret message, devising a new type of ultraviolet light source for his research of the letters.

In other fields ultraviolet radiation also is being employed increasingly. Forged documents and counterfeit money have been exposed and forged wills have been discovered, especially where the original writing had been removed with ink eradicating fluid and a typewritten statement superimposed. In ultraviolet light the handwritten note as well as the marks of the eradicator are visible. In detecting fake money, corresponding sections of a genuine and a spurious bill are exposed simultaneously to ultraviolet radiation of small wave length and the results recorded with a quartz lens, without the use of light filters. The appearance of the authentic note remains unaltered in this light, whereas the counterfeit note assumes a blurred aspect.

A new type of ultraviolet lamp to be used as desk equipment to examine old books and documents was developed by Dr. Bendikson after a collector submitted for examination an old vellum breviary of some 400 pages, in manuscript.

He examined the breviary under ultraviolet light and found that earlier writing had been erased and new material inscribed. In some cases, he found, more than a century had elapsed between the two writings. Due to the obvious difficulty of photographing each of the 400 pages, Dr. Bendikson devised a portable desk lamp set, not unlike a flashlight, which emanates ultraviolet rays, using ordinary house current, through a transformer. This "Palimpsest" enables the examination of documents with the naked eye.

## Roots Grown at Top of Plant by Special Treatment



Observe new roots sprouting near top of this plant, doctored with a special root-growing agent

Topsy-turvy plants with roots that sprout from the upper stem are among the wonders produced by experts at the Boyce Thompson Institute for plant research. Sturdy vegetation can be grown entirely without sunlight, and some plants have been produced without soil. A "kalanchoe" plant, treated with a newly developed root-growing agent, shot out roots from the stem just below its topmost leaves.

## Fishing Reel Is Adjustable to Weight of Lure



Speed of the line is adjusted to the weight of the lure when the fisherman sets an indicator at the proper point on a new type of fishing reel. The adjustment feature automatically thumbs the line with the proper pressure, reducing the number of snarls and backlashes.

Westinghouse Lamp, Co

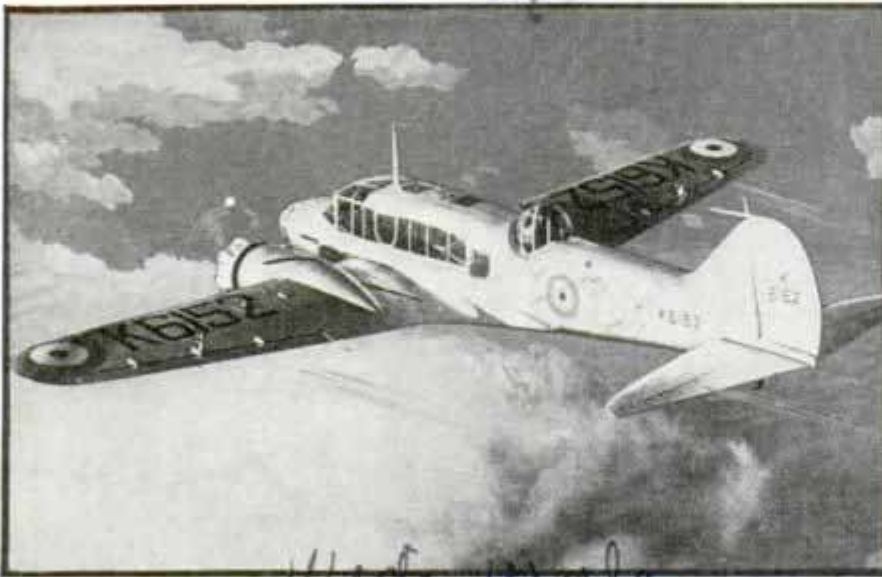
W. J. Jarmann California Chicago



F 236

Schenectady NY

# Fleet of Twin-Motored Ships to Guard British Coast Line



One of the fleet of monoplanes being organized by the British Royal Air Force for coast reconnaissance duty. Notice the glassed-in turret

Britain's Royal Air Force is organizing a fleet of fast twin-motored monoplanes for reconnaissance duty over the long English coast line. The design chosen for this fleet was adapted from civil aircraft, and represents the first use of retractable landing gear by British military ships. A glassed-in observation turret is mounted in the top of the fuselage at the rear of the cabin.

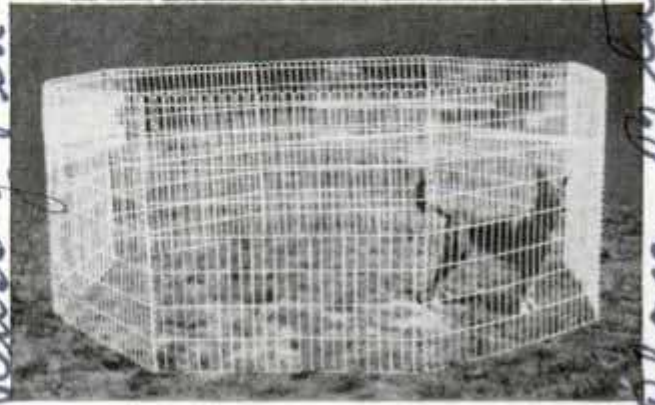
## Long-Wearing Silent Switch Is Mercury-Operated

No larger than a marble, a new mercury electric switch works silently because it has no moving parts. For the same reason,



it is long wearing. One of these switches has been turned on and off 65,000,000 times in two years without failure or apparent wear. The switch consists of two shallow cups, sealed with a strip of lead glass inside of which is a small amount of mercury. Separating the two cups is a small hole. When the mercury is all in one cup, the switch is off. When

have spiral hinges permitting them to be folded flat and easily carried or stored away. The end panel can be opened and closed like a gate.



Wire fence play yard can be carried under the arm when folded flat. Below, it is shown set up on lawn

Write Wade  
Auto Union

## F165 Folding Play Yard for Child or Pup Easy to Carry

Wire play pens that take up only a small amount of space when folded, but provide a safe yard for the youngster or the puppy to enjoy on sunny days, are now being offered. Available in various sizes, the pens

Porto Pen

1509 Western Ave Chicago

Dussey Pen Products Co

Blair Island, Ill  
Blair

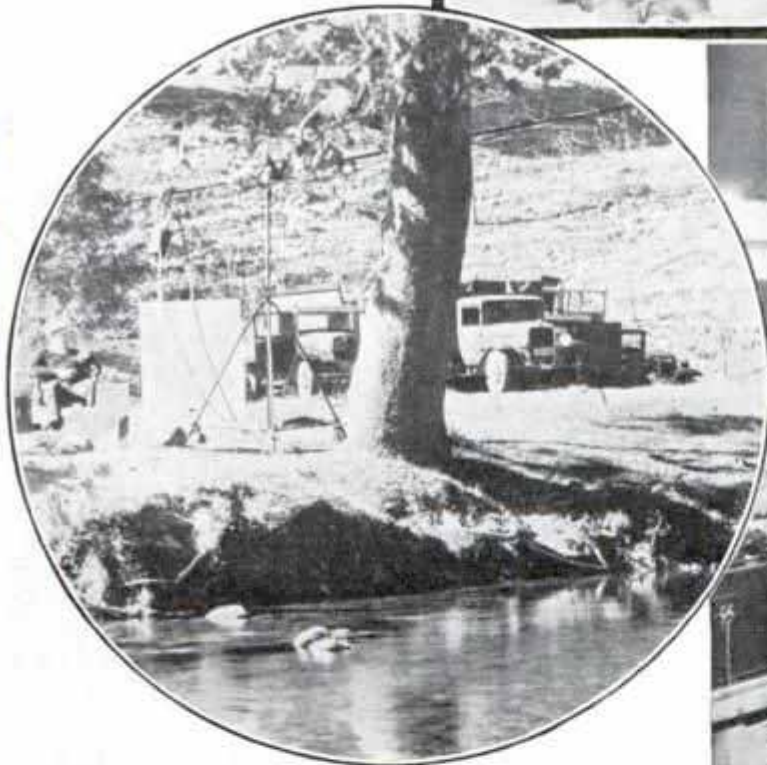
Dussey Pen Products Co



# Canned Sounds Add Realism to Stage Shows

Producers of amateur theatricals who have labored with wind machines, thunder sheets, electric fans, sandpaper and drums trying to manufacture realistic off-stage sound effects now can obtain almost any sound required on a phonograph record at low cost and reproduce it with nothing more complicat-

Right, scene from "Dead End" which used recorded sound effects. Below, picking up ripple of brook, and sound effect control room



ed than a phonograph or electrical pick-up and amplifier. Some of the records obtainable from sound libraries contain as many as eight different effects, each separated from the others by visible blank spaces and labeled for easy selection. Some of the effects include dogs barking, babies crying, trains and automobiles starting, stopping and running, crowd noises, airplanes, thunder storms, sea effects, running brooks and orchestras tuning up. Special sounds are now recorded for professional dramas and it is anticipated that amateurs reproducing plays of

the day may soon be able to obtain sound-effect records with the script. Sound trucks are sent to the scene of the particular sounds desired, to pick them up with microphones and record them on film. Later the sounds are re-recorded on disk records for distribution. Many records for amateur use have identical sounds on both sides, permitting one side to be used for rehearsals and the other reserved for performances. For reproducing the sounds, many amateur organizations use combination phonograph-radio sets or even ordinary phonographs.

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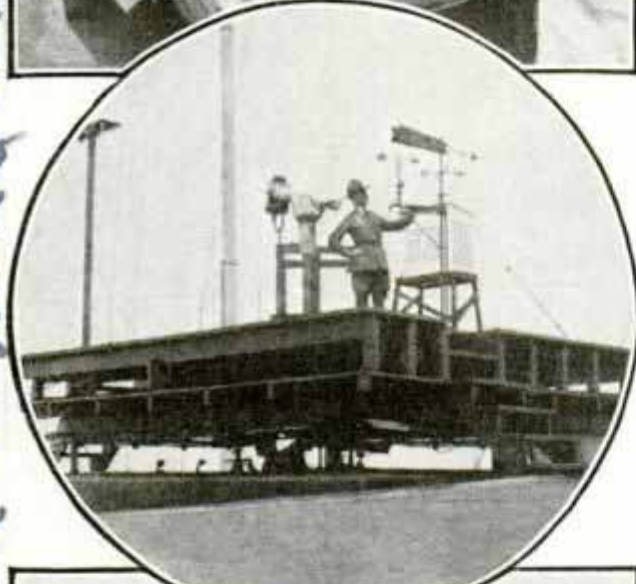
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Pictogram Co Box 682  
Washington, DC

# MODERN WAR

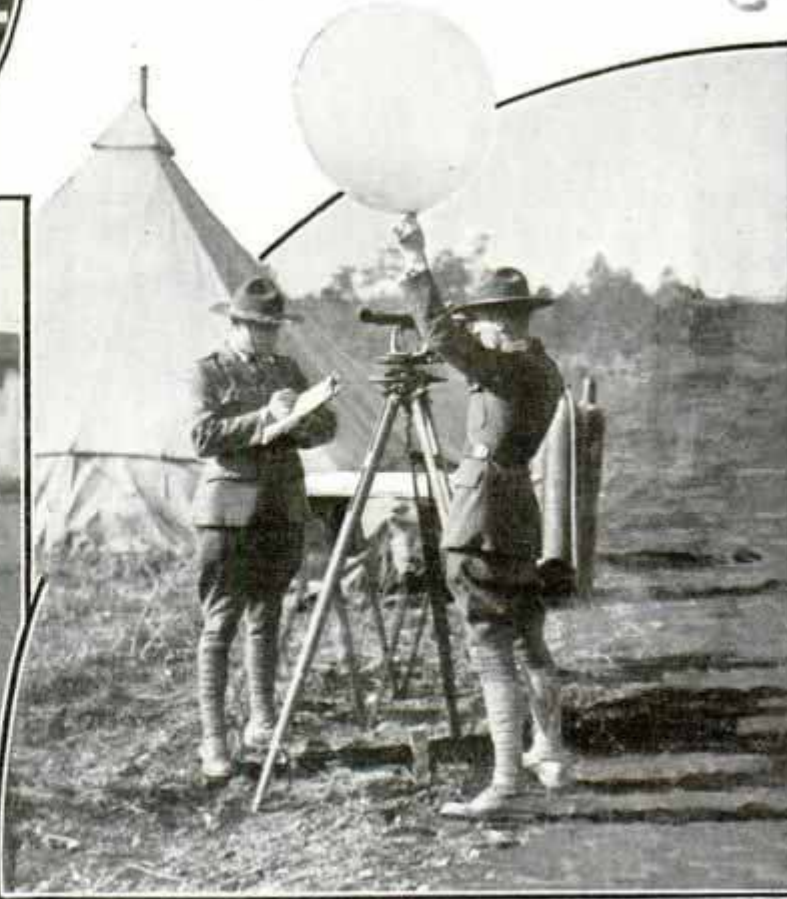


**W**EATHER has always played a part in war, and often a decisive one. Long ago battles were lost or won because rain made roads impassable, or the breaking up of ice prevented the crossing of a river, or a dense fog permitted troops to make a surprise attack. In the world war atmospheric factors assumed greater importance because of their effects on various new weapons and methods employed. The same conflict, however, placed at the disposal of commanders a new art—military meteorology—the function of which is to overcome weather handicaps and to utilize meteorological information in conducting campaigns.

The development of this art did not cease with the Armistice. It has become a permanent part of the art of war, and is destined to figure prominently in future struggles. But meteorological units such as were attached to armies and navies two



*Top, teaching navy men to measure cloud movements. In circle, artillery weather station in Canal Zone*



*Left, instrument for measuring air current to show how gas will drift. Right, signal corps weathermen*

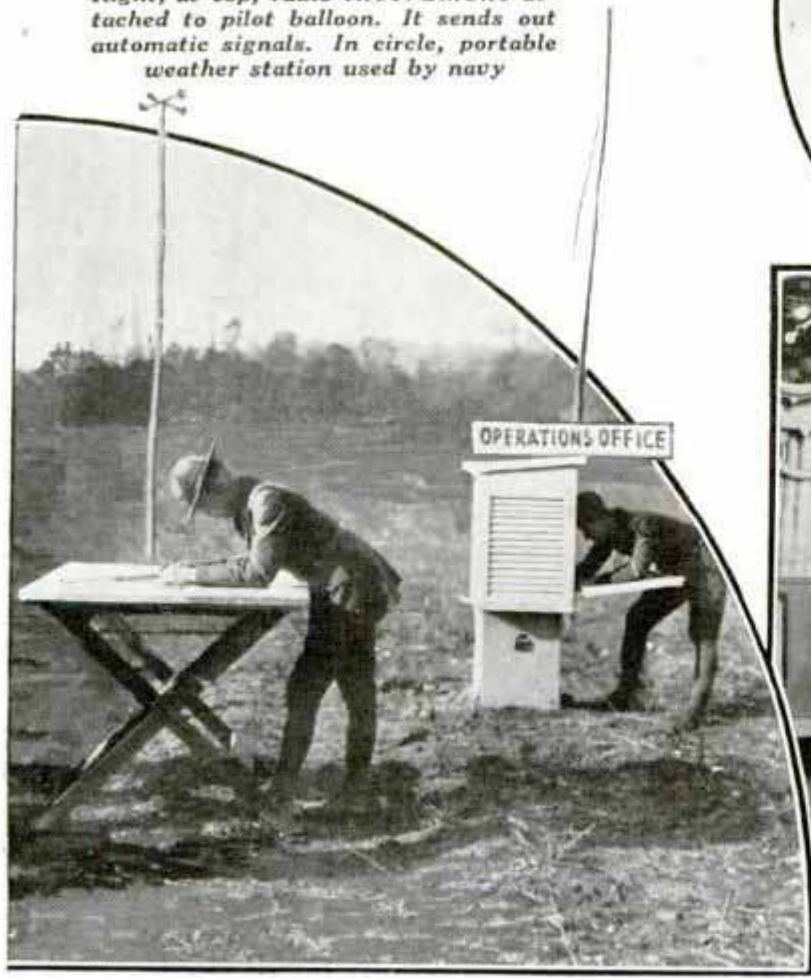
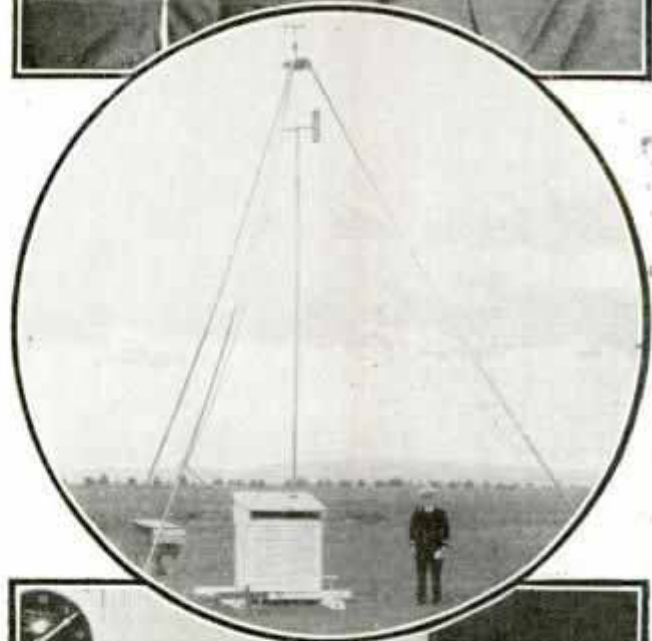
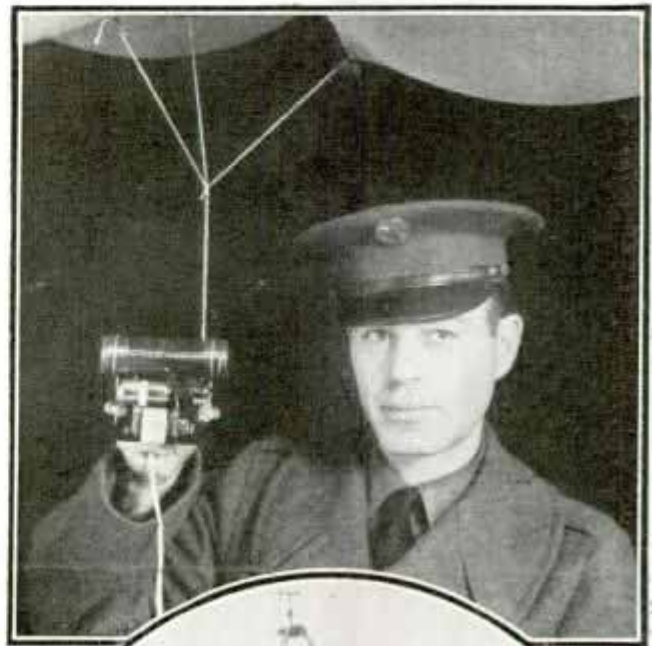


# Depends on WEATHER

decades ago, cannot be organized and trained overnight. Hence in many countries, including our own, they are now a part of peacetime military establishments. In the United States, entirely distinct from the civilian weather bureau, there is a meteorological service under the war department and another under the navy department. The former is a branch of the signal corps and the latter is attached to the bureau of aeronautics. The naval service is known as the aerological section.

The army and navy weathermen perform a variety of tasks. The aiming of long-range guns would be a haphazard performance without their aid. Chemical warfare depends upon the accurate data they supply. Sound ranging calls for special observations of atmospheric conditions. The dependence of aviation upon meteorological information is even greater in war than in peace. Strategic and tacti-

*Right, at top, radio instrument attached to pilot balloon. It sends out automatic signals. In circle, portable weather station used by navy*



*Preparing the weather map for use on a man-of-war, one of the important duties of the navy meteorologists*





*Left, signal corps weathermen in France. Below, preparing weather forecast for army in France, army observer measuring humidity, and charting weather for navy flyers*

cal movements, on both land and sea, tend to be governed by weather maps and weather forecasts.

Experience in the world war showed that old-fashioned methods of correcting the aim of artillery for the effects of wind and other atmospheric factors were entirely inadequate for modern guns, the projectiles of which rise to altitudes of from 10,000 to 20,000 feet and encounter conditions quite different from those prevailing on the ground. Some modern projectiles remain in the air as long as seventy seconds. In such a case the wind may easily deflect one half a mile or more from its course. The temperature and the density of the air affect the range, and both vary with height.

The practice was introduced, therefore, of measuring air currents at different heights by means of pilot balloons and computing from these observations the "ballistic wind," a fictitious wind which, if affecting the projectile throughout its flight, would produce the same total deflection and effect on range as do the various winds that the projectile actually encounters. The "ballistic density" of the air along the path of the projectile was computed from measurements of the barometric pressure, air temperature and humidity near the ground. In future wars it is likely that this factor will be obtained more accurately with the aid of upper-air soundings, probably through the use of radio sounding balloons send-





ing out automatic signals. Meteorological observations were required in connection with the various new sound-ranging and listening devices used to locate enemy guns and aircraft, since the speed and direction of sound waves are affected by winds and temperature. The use of poison gas demanded detailed wind measurements, as local air currents often differ from the prevailing wind. A wind may be too weak or too strong for the use of gas. Gas clouds have been known to sweep back upon the troops employing this weapon.

A highly specialized and localized weather forecasting service was carried on in the world war. The late Major W. G. Reed, who served as a meteorologist with the American expeditionary force in France, wrote of this work:

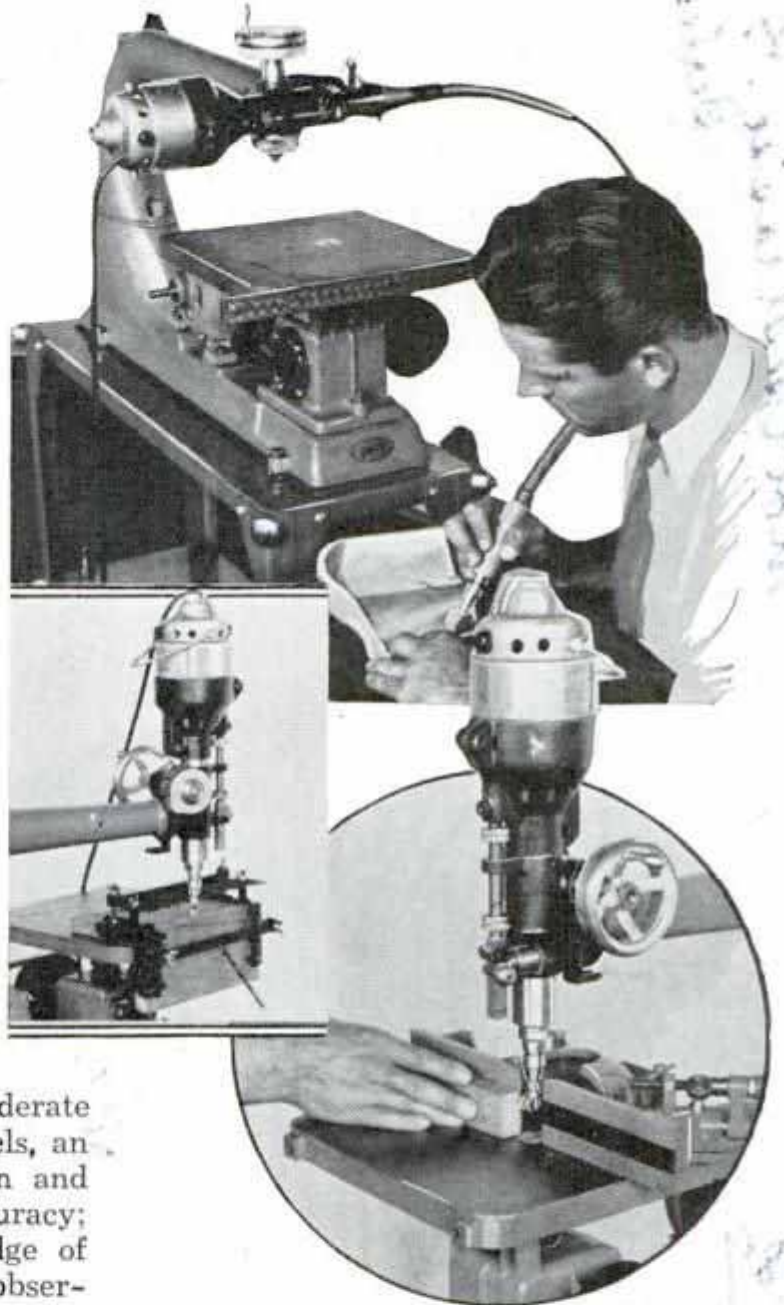
"Forecasts of the character of the night, whether clear, cloudy or with broken clouds, are particularly important in planning offensive bombing operations by aircraft or in arranging for defense against possible enemy raids. For instance, if the conditions on the Lorraine front in the fall of 1918 indicated a moonlight night with broken clouds and a moderate west wind at reasonable flying levels, an enemy raid was practically certain and could be forecast with great accuracy; furthermore, with a little knowledge of the enemy's habits, together with observations of his aerial activity during the preceding day, the point of the raid could generally be forecast."

At Fort Monmouth, N. J., where the signal corps maintains experimental laboratories, much attention has been given to developing new apparatus for army meteorologists. In the next war the corps will have mobile meteorological stations that will travel swiftly by truck and by airplane to any point where current weather observations are desired.

The signal corps has also devised a method of measuring upper-air currents in cloudy and foggy weather and during

(Continued to page 137A)

## Router Motor and Flexible Shaft Used with Jig Saw



*How router and flexible shaft may be used in connection with jig saw*

Increasing the usefulness of the latest jig saw, new router equipment can be attached to the arm. A flexible shaft, which is turned by the electric motor of the router is used for grinding and carving. Attaching the router assembly converts the jig saw to routing, dovetailing, shaping, carving and grinding.

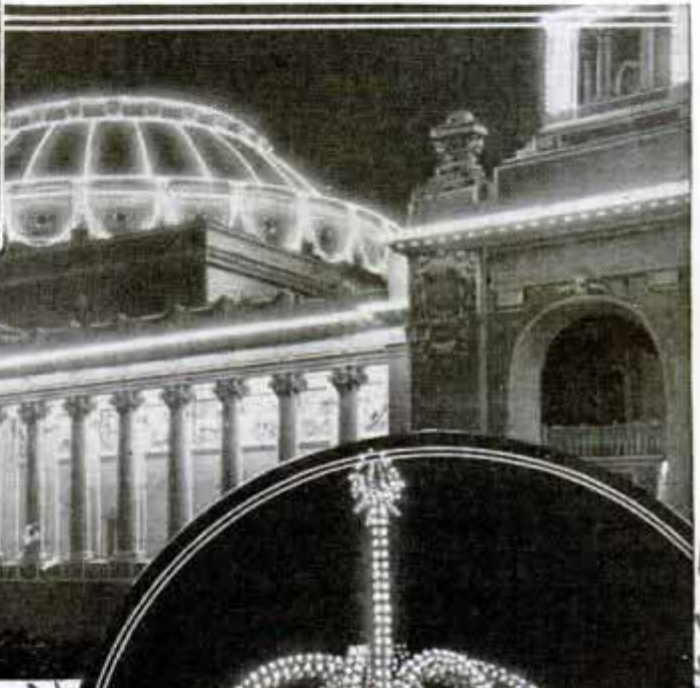
☐ Whenever you find that you wish to know more about any article in this magazine, write our Bureau of Information, inclosing return postage.



*Berlin, Germany*

# Waterless Fountain "Flows" As Lamps Flash

Containing not a single drop of water, an illuminated fountain is among the features of Rio de Janeiro's festivals. It is built like a fountain, but colored electric lamps flash in sequence to present a spectacle closely resembling the flow of sparkling water. Another night feature is the illumination of trees in the Avenida Rio Branco with colored bulbs. The banquet hall is adorned by a crown of flashing lights which are visible for long distances.



Brilliantly illuminated buildings, trees and waterless fountain at Rio de Janeiro

## Rubber Cap for Tobacco Bag Is Handy for Smoker

Eliminating the necessity of tightening and loosening the strings of tobacco bags, a small rubber cap was designed to fit into the top of the bag. It has a slot through which may be poured the mixture in any quantity desired, simply by squeezing the

cap between the thumb and forefinger. The cap is inserted into the top of the bag and the strings pulled tight and knotted around it, holding it firmly in place. Excess lengths of string are cut off.



## Sandy Soil Made Solid as Rock by Injecting Chemicals

Loose, sandy soil is being transformed into solid rock resembling sandstone by a chemical injection process developed in Europe. The method finds valuable application in reinforcing building foundations in dangerously soft soil, strengthening un-

*Emb. Hans J. Kutzgebach, mult. the use of Berlin*

*F 189*

*my house is very strong*

*re - 1810 428*

*Dan-Dee & specially Gooster*

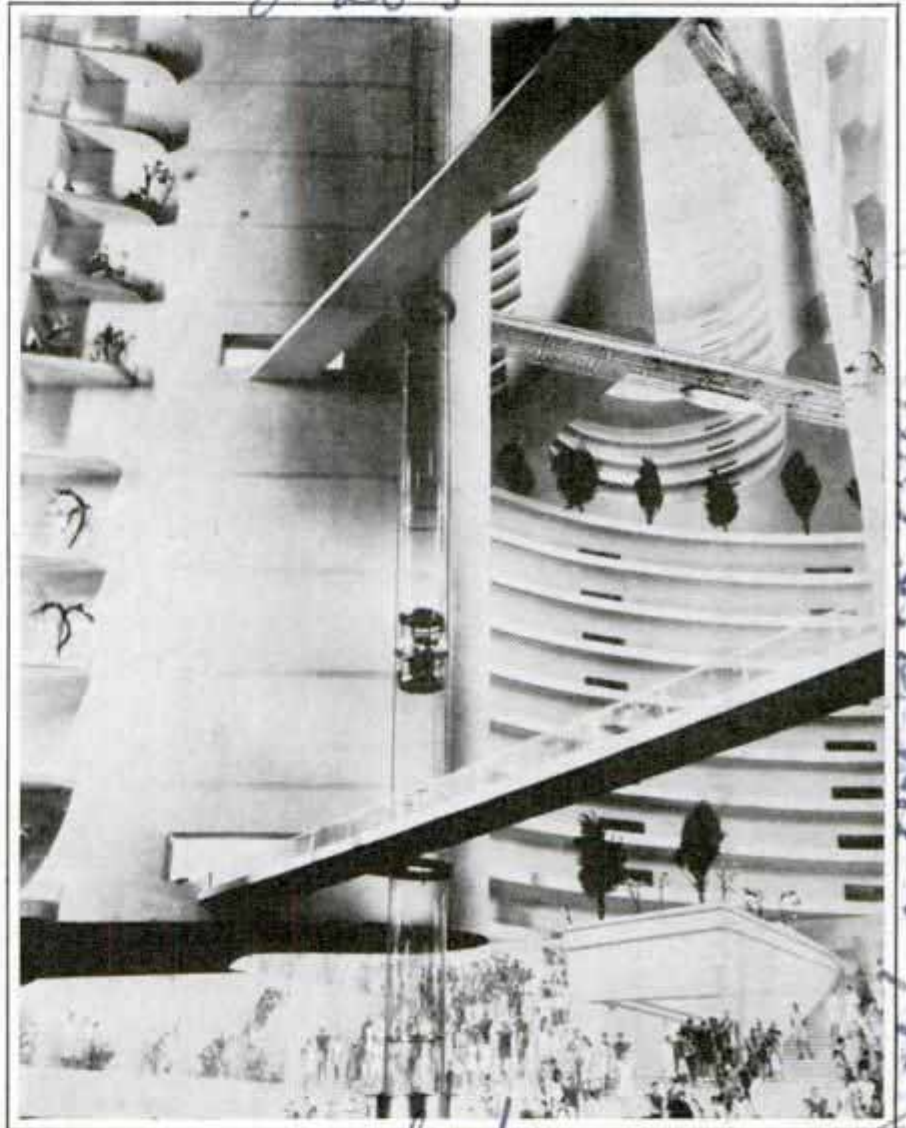


Works, Berlin - Siemensstadt  
Germany

derground tunnels, plugging leaks in streams where valuable mineral springs exist and restoring underwater dams. Two chemical solutions, when forced into the soil, react to form an insoluble gel with high surface tension which draws the sand grains firmly together. The roof of London's subway was reinforced by this process, and a cathedral in Jutland was saved from probable destruction by solidifying the sand underlying its foundations. The chemicals are sent through injection pipes.

## Glimpse of World of Future Is Presented in Movie Scene

21205



City of future as portrayed in movie scene. Note the glass-enclosed elevators and overhead tracks for streamline street cars

### Streamline Tricycle Serves Ice Cream in the Streets

F203

Ice cream is dispensed in the streets of London from tricycles equipped with streamline bodies which extend over the tops and sides of the vehicles. The top of the body forms a "counter" to hold the dispensing equipment.



Streamline tricycle which dispenses ice cream in the streets of London

What will cities be like ten centuries from now? One conception of the future metropolis is presented in H. G. Wells' motion picture of the next war and a rebuilt world.

The future city is portrayed as built in tiers like the homes of the Pueblo Indians. Glass-enclosed, compressed-air elevators, overhead streets and overhead tracks for cigar-shaped "street cars" supply the means of transportation, and the people of the future are depicted as obtaining the news of the day by television.

Names and addresses of manufacturers and dealers in articles described in this magazine will be furnished by our Bureau of Information upon request accompanied by stamped, self-addressed envelope.

at National Ice Cream  
and Dairy Ex. Station

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81538

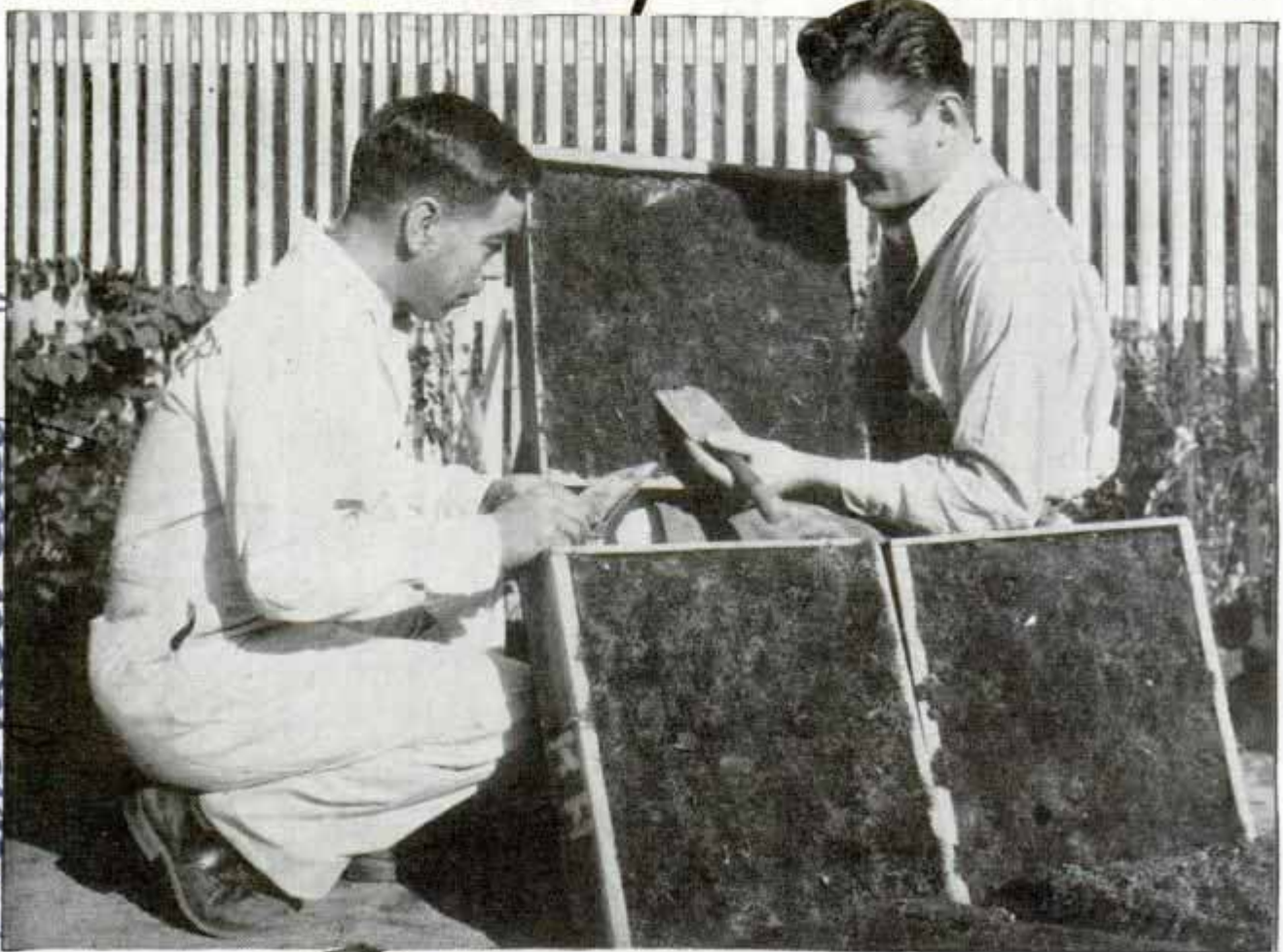
Carl Thomas 6. 8. 1915

10565

Holman's as  
Los Angeles

# SECRETS of MAKING

Creeping bent of Muller + Easton 62.5.3 Hollywood  
All names & dates  
Los Angeles, Calif.



Inspecting boxes of grass grown under experimental conditions. Below, testing soil for acidity, one step in making a good lawn

ONLY three things, good soil, good seed, and proper care are needed to create a lawn that will last for years. One of the chief causes of a poor lawn is poor soil not properly prepared.

First, learn the nature of your soil to determine the materials you need to add. In the east most soils are acid while in the west alkali soils prevail. Take a dozen teaspoonful samples from various parts of the plot, an inch or so down, and mail the earth to your state university for analysis. Or consult your county farm agent who probably knows the nature of the soil in your locality and how much neutralizing matter it needs.

The best soil for a lawn is neutral or slightly acid. One test you can make is to pulverize a handful of earth, mix enough distilled water to form a thick paste, lay a strip of blue and a strip of red litmus paper in individual saucers, and cover each strip with some of the moist earth. If the red litmus paper turns blue the soil is al-



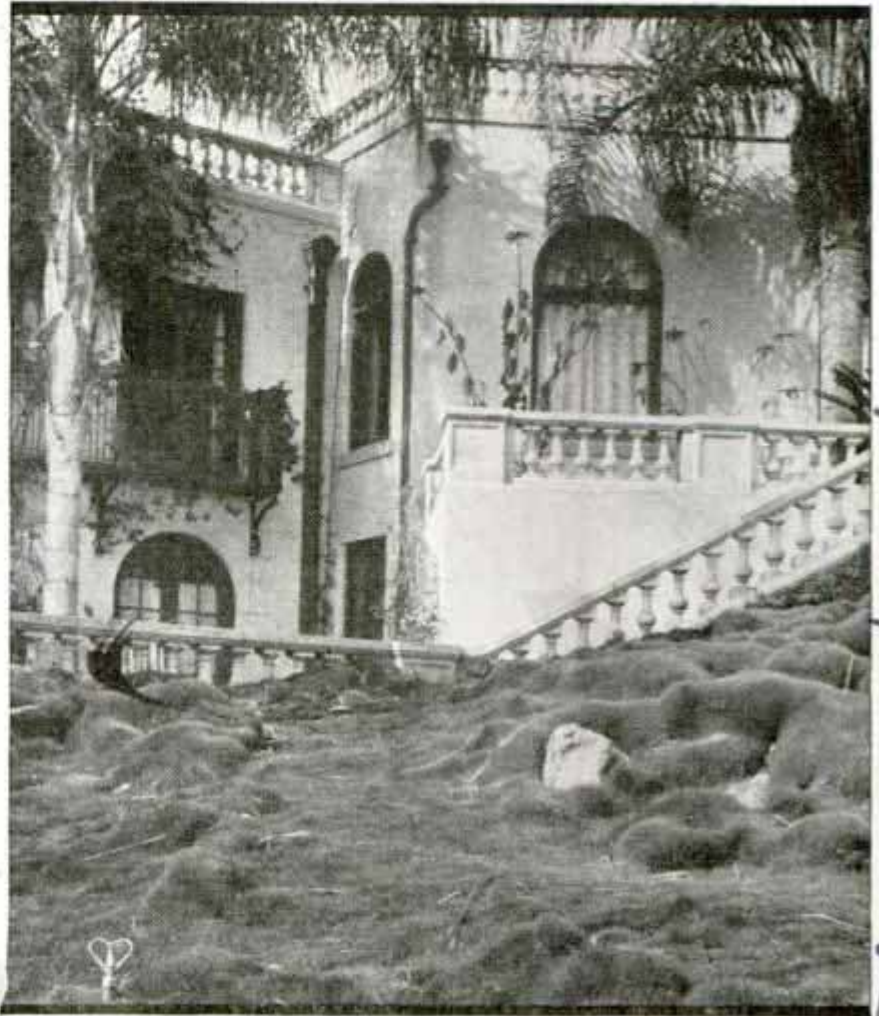
8/15-38

750 d  
L. B. Buey  
Los Angeles

# a GOOD LAWN

kali, but if the blue strip turns red the soil is acid. If neither strip, or both, change color, the soil is in a neutral condition. The litmus paper does not reveal the degree of acidity or alkalinity and gives no indication of how much neutralizing matter is needed, however.

If the soil is acid, a sprinkling of about three pounds of powdered lime to each 100 square feet of ground will not be too much. Spade it in well. For an alkali condition sprinkle ammonium sulphate sparingly over the surface and dig it in. Your seed store probably can recommend the right



Top, Korean carpet grass which grows in hummocks and bunches. Below, mature creeping bent turf which forms a thick carpet

amount for your locality. It is best to use not enough rather than too much.

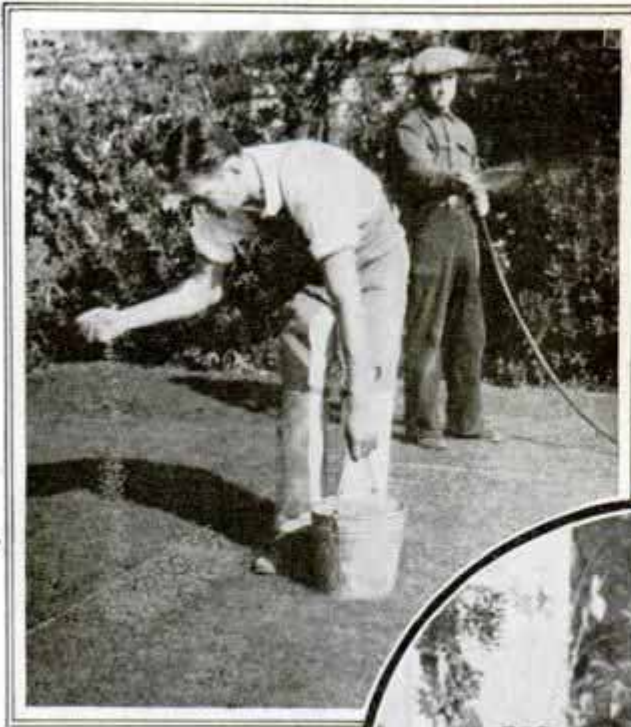
Next, decide whether your soil is too heavy or too light. Ground planted heavily, year after year, aside from being acid, usually needs to be lightened to provide oxygen and drainage for the grass roots. Good loam, ideal for a lawn, contains about equal proportions of sand and clay together with considerable humus from old manure or decayed vegetation. Heavy or sticky soil should be lightened by working in an inch of sharp sand. It also needs horticultural peat moss, old composted barn manure, or vegetative matter to provide a spongy quality. Half an inch or more of one of these materials sprinkled over the surface will do. Peat moss contains no weed seeds and does not increase acidity, but manure provides more food. Green manure should never be used since it "burns" the grass seed.

If your soil is light and sandy, stiffen

several lawn fertilizers -  
P. Able & Co. -  
Toward Nursery.  
Los Angeles

see Letter





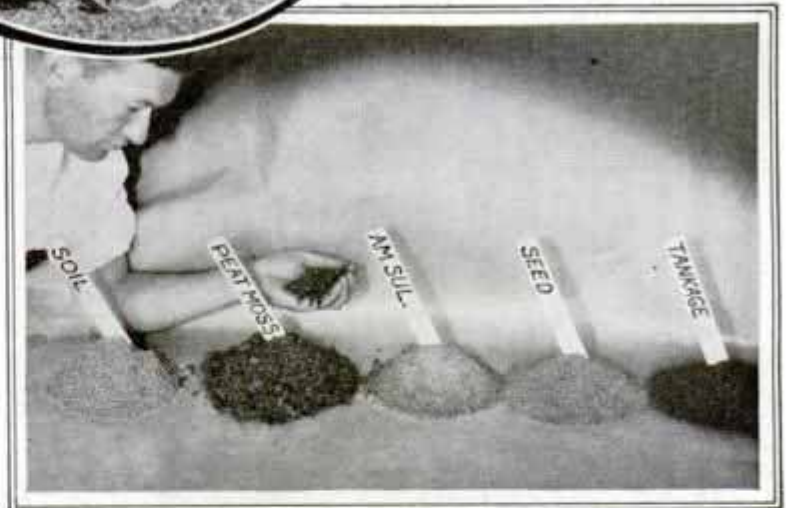
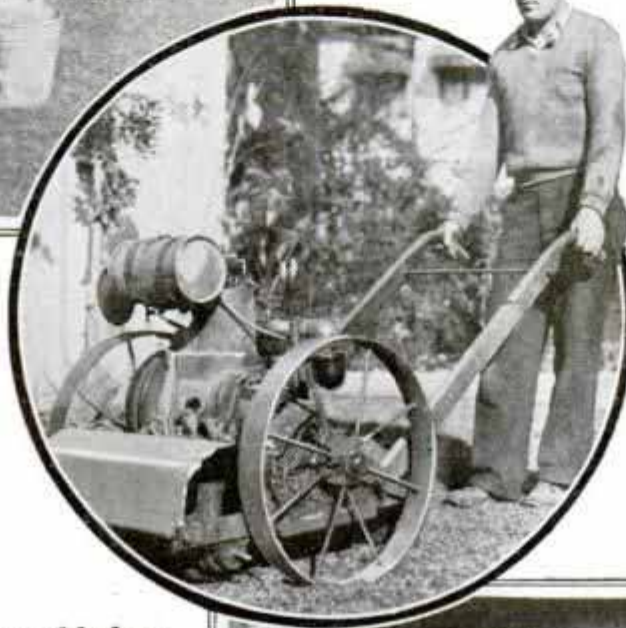
with an inch of heavy clay soil spread over the ground and thoroughly mixed in. Your farm agent or seedsman should be consulted for the right amount. Half an inch of peat moss or barn manure may be added at the same time to provide material for holding moisture. One way to insure a lawn in poor soil is to haul good loam or silt-loam and spread it six inches deep.

Take it for granted that the soil also needs some sort of plant food. More than a dozen chemicals are required by growing plants but nitrogen, phosphorus, and potash are most important. If you use barn manure to tone the soil no other fertilizer is needed before seeding. You may use ammonium sulphate or any of the blended plant food formulas. These may consist of cottonseed meal, fish scraps, bone meal, or tankage. Follow the directions on the container and sprinkle sparingly so you will be able to use more as a top dressing later. One pound per 100 square feet is plenty.

April is a good month to start a lawn in most parts of the country. Digging may

be done as soon as the frost is out of the ground. This is the time to decide whether the lawn is to be level or have contours. It is best to install drain tile leading away from any depressed area. To obtain drainage to one side, slope the ground seven inches to every sixty feet. This is enough to provide natural drainage yet hardly enough to be apparent as a slope.

When you have scattered the sand, peat moss, manure and whatever ingredients the soil needs, spade the plot from six to eight inches deep. Mixing the right ingredients thoroughly with the soil is most important since if this is not done properly the entire lawn must be torn out and replaced. Experienced gardeners say it is impossible to make soil too rich for a lawn.



Top, applying fertilizer top dressing. Center, renovator which prepares for reseeding. Below, ingredients for alkali soil

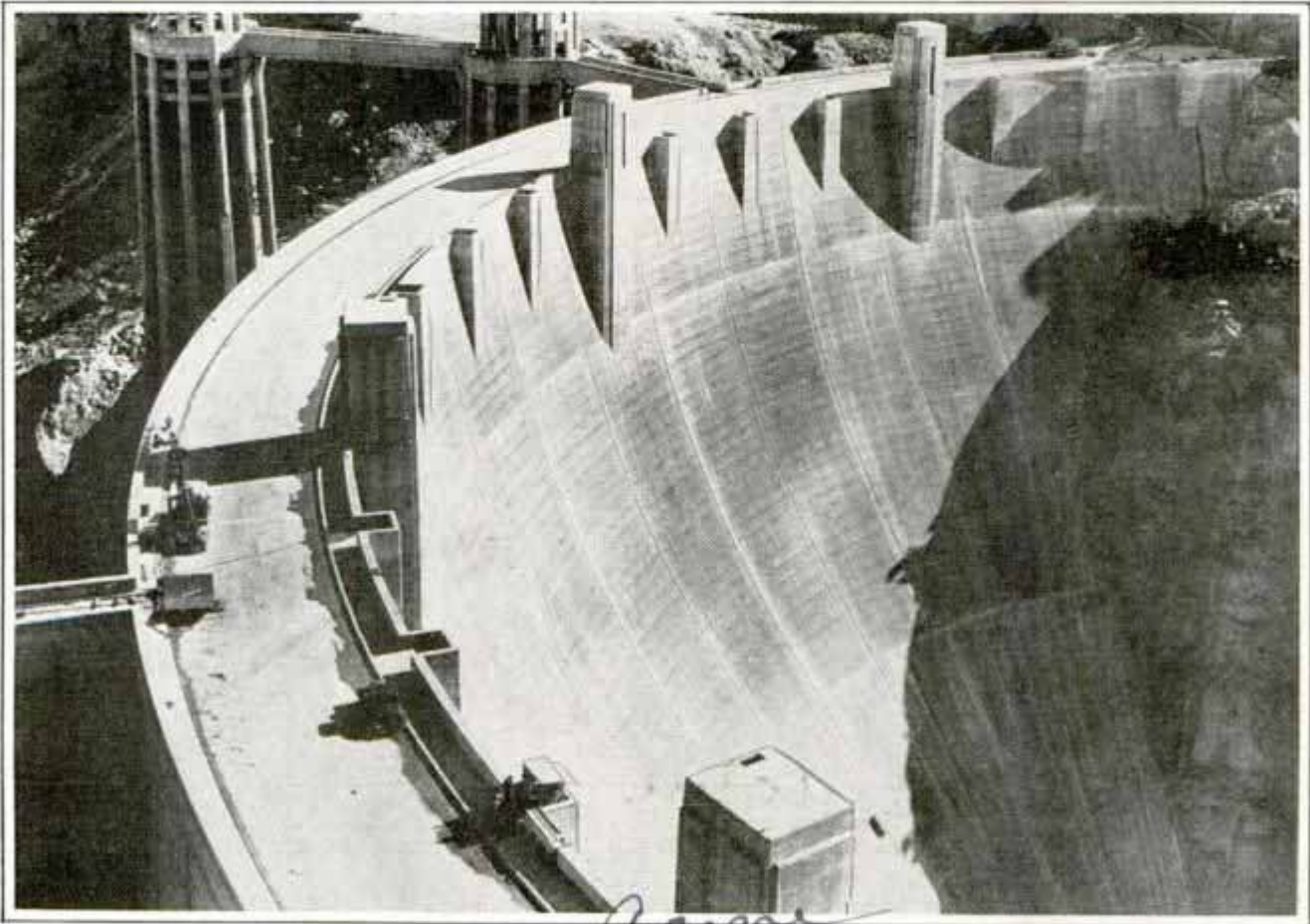
After spading, allow the rough ground to stand two or three days before planting. In case of a heavy rain or if the turned ground stands for a long time, spade it over to aerate it. When ready to plant, break up the clods and rake the top three inches back and forth until the earth is pulverized. Remove rocks and

(Continued to page 128A)



718

# Roadway on Boulder Dam Links Two States



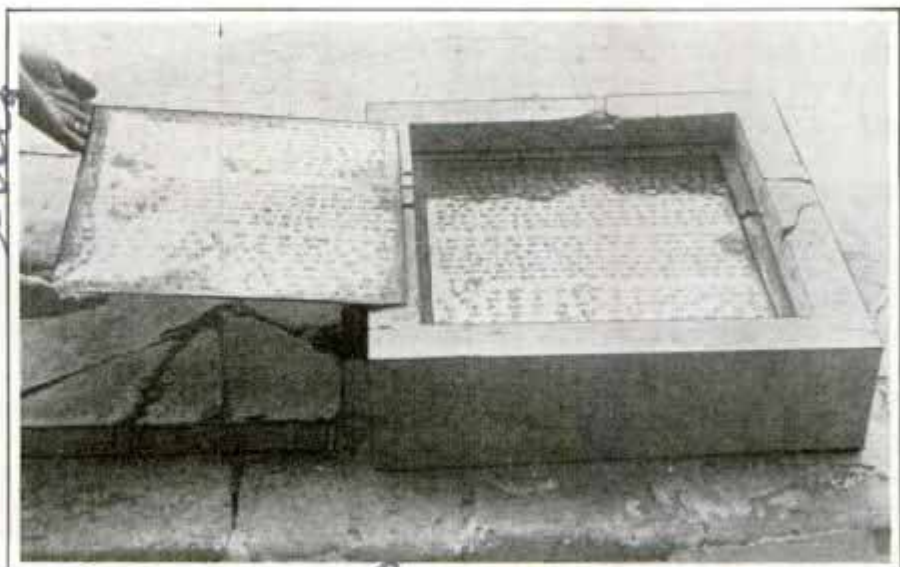
*acme*  
 This wide roadway running on top of curving Boulder Dam connects two towns in different states. It provides for pedestrian, as well as vehicular traffic between Las Vegas, Nev., and Kingman, Ariz.

Connecting Las Vegas, Nev., and Kingman, Ariz., a four-lane highway has been constructed on the crest of Boulder Dam, now rapidly nearing completion. The

highway is flanked on either side by a sidewalk. The scenic road affords motorists and pedestrians an excellent view of the great Boulder Dam power project.

*F200*  
**Gold and Silver Tablets Tell History of Persian Empire**

In beautifully cut limestone boxes apparently deposited in cornerstones of an ancient palace at Persepolis, scientists from the Oriental Institute of the University of Chicago have found engraved plaques of solid gold and silver. In three languages—Old Persian, Elamite and Babylonian—was written an account of the extent of the empire of Darius the Great, at the time these tablets were cut, about 515 B. C.

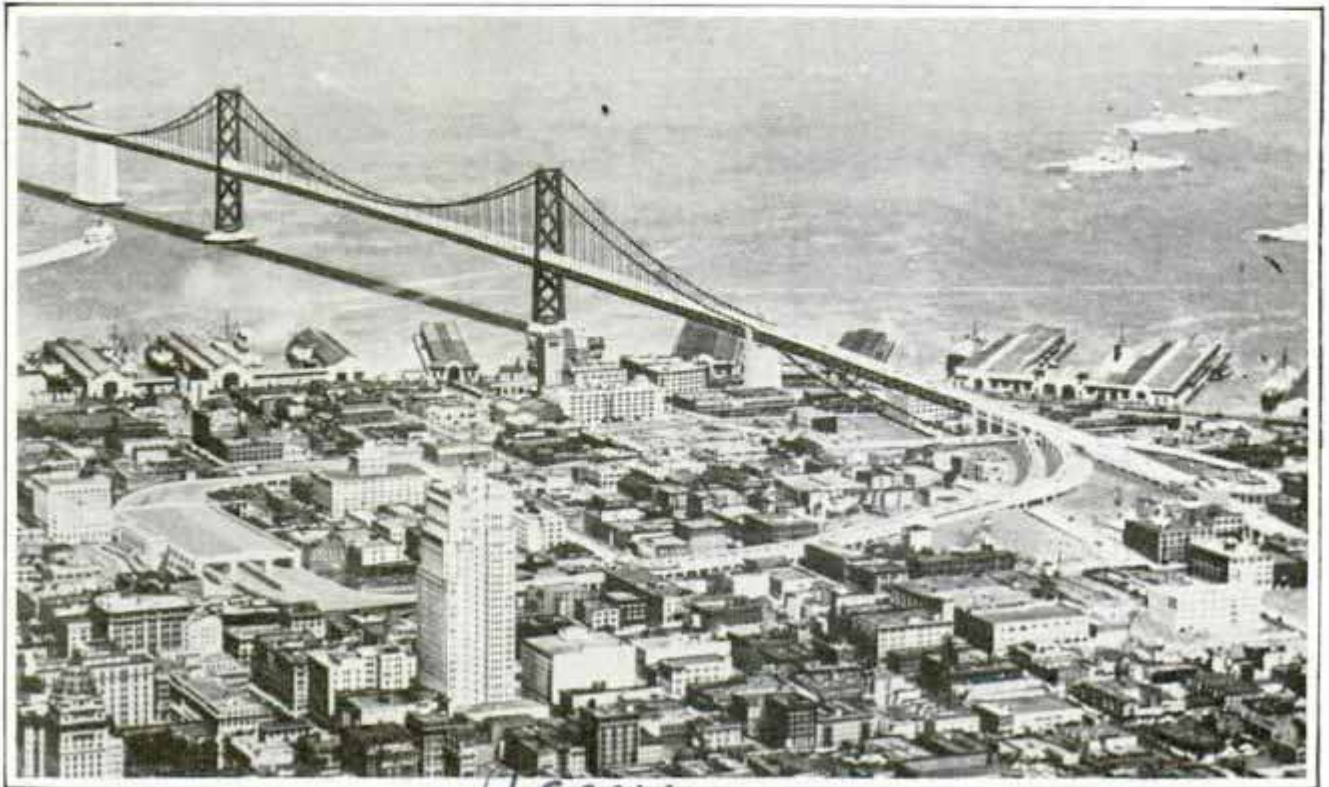


*Persia*  
*acme*  
 Engraved plaques shown with limestone box in which they were found

*Isreal Palae Terrace*



# Elevated Ramps Will Untangle Bridge Traffic



*Photo-drawing shows how San Francisco end of bridge will appear when finished, with ramps leading vehicular traffic to twin-decked span. At left is rail terminal where commuters will change to city cars*

Not the least of the engineering problems imposed by the bridging of San Francisco bay was the disposition of automobile, truck, train and interurban traffic that will flow across the new span. On the photograph above, taken from the air over San Francisco, has been superimposed a drawing of the bridge as it will appear when completed and the series of elevated ramps that will lead traffic to and from the two decks of the suspension bridge. At the left may be seen the terminal where transbay trains will discharge commuters, who for many years have crossed the bay on ferries docking at San Francisco's famous landmark, the Ferry building. Special elevated ramps will be built to speed street-car traffic between the terminal and San Francisco's business center. The bridge will carry traffic between Oakland and San Francisco.

☐ Popular Mechanics Magazine does not publish the name of the maker of, or dealer in, any device described in its pages, but this information is kept on file and will be furnished by our Bureau of Information upon request, accompanied by stamped, self-addressed envelope.

## Remote Pick-Up Transmitter Smaller Than Your Hand

So tiny it fits into the palm of the announcer's hand, a micro-wave radio transmitter has been developed to facilitate



*Midget transmitter in man's hand is designed for "covering" events in field*

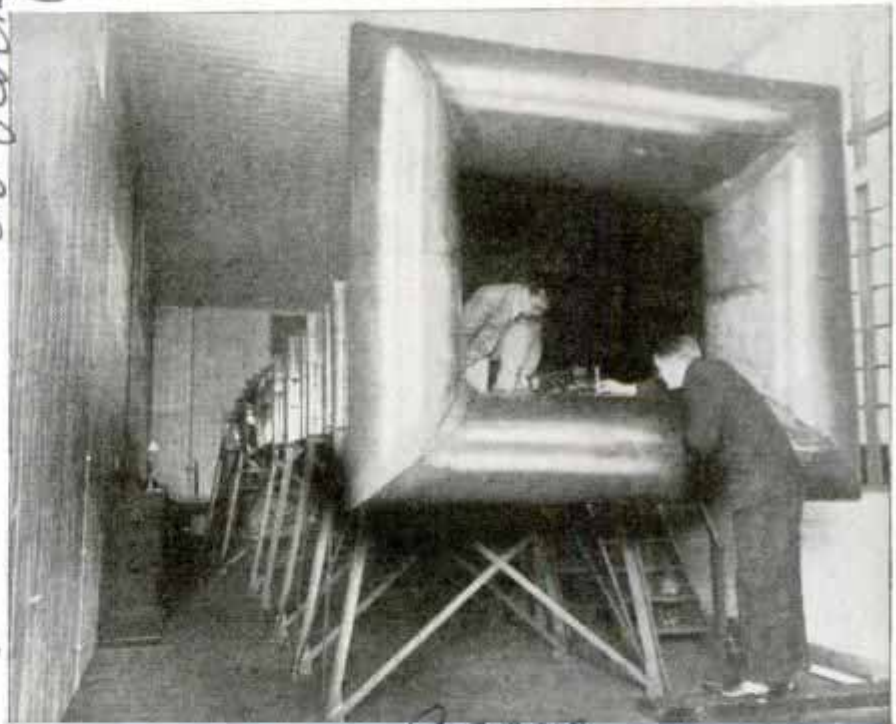
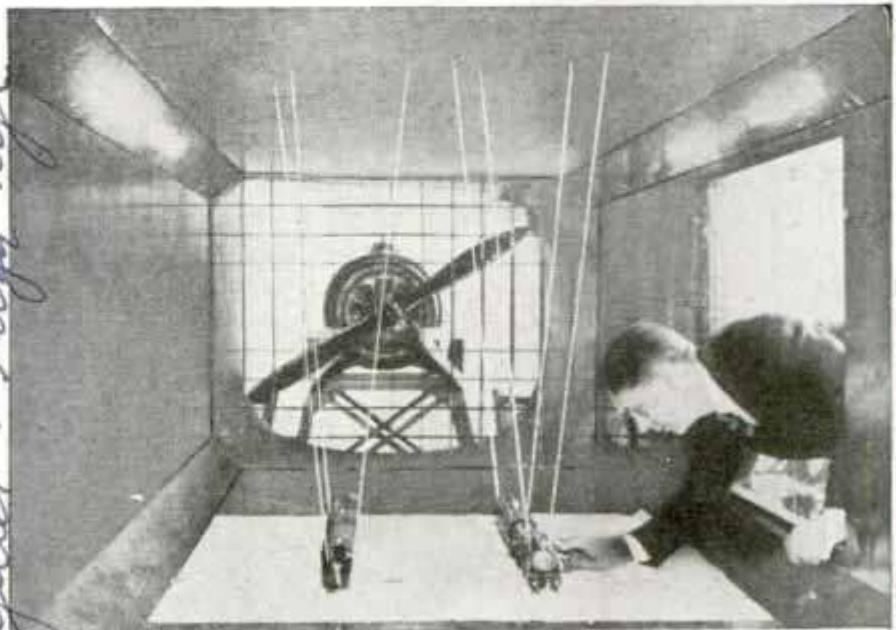


## Tiny Engines in Wind Tunnel Show Effect of Streamlining

"covering" events in the field. It is designed not for direct broadcasts to receiving sets but to pick up programs within a few miles of the main sending station, which would receive and re-broadcast. Thus it extends the scope and mobility of radio coverage. The transmitter uses very low power from a battery, sending on a wave length of about one meter.

### Facsimile Messages by Radio Speed Air Line's Work

Experimental transmission of messages by the facsimile method is speeding up communications between two radio ground stations of the Transcontinental and Western Air, Inc. The experiments are being made in cooperation with the Radio Corporation of America. The air line's headquarters station at Kansas City and its station at Chicago are transmitting and receiving the facsimile messages. A message is typed on a high-speed typewriter and as the tape with the printing thereon emerges, it is fed into a transmitter. A beam of white light, one one-hundredth of an inch wide, passes rapidly up and down the tape as it moves through this unit. The light is reflected to a photoelectric cell when it strikes white paper, but when interrupted by the black of letters on the tape, the cell emits an impulse which keys a standard radio transmitter. At the receiving station, the impulses are picked up and converted into a facsimile of the message. In reality, each letter in the message is a series of tiny black dots.



Placing model locomotive in wind tunnel to determine effects of streamlining in designing and constructing British trains

Wind tunnels, long used in testing designs for airplanes in model form and even in testing full-size ships, now are being employed to test models of railway equipment. Research engineers are testing locomotive models in a thirty-five-foot wind tunnel in England to determine the effect of streamlining. The results of such tests will be used as a basis for designing and constructing streamline trains.

London, Midland and Great Northern

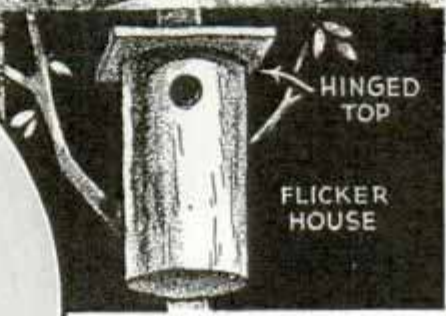
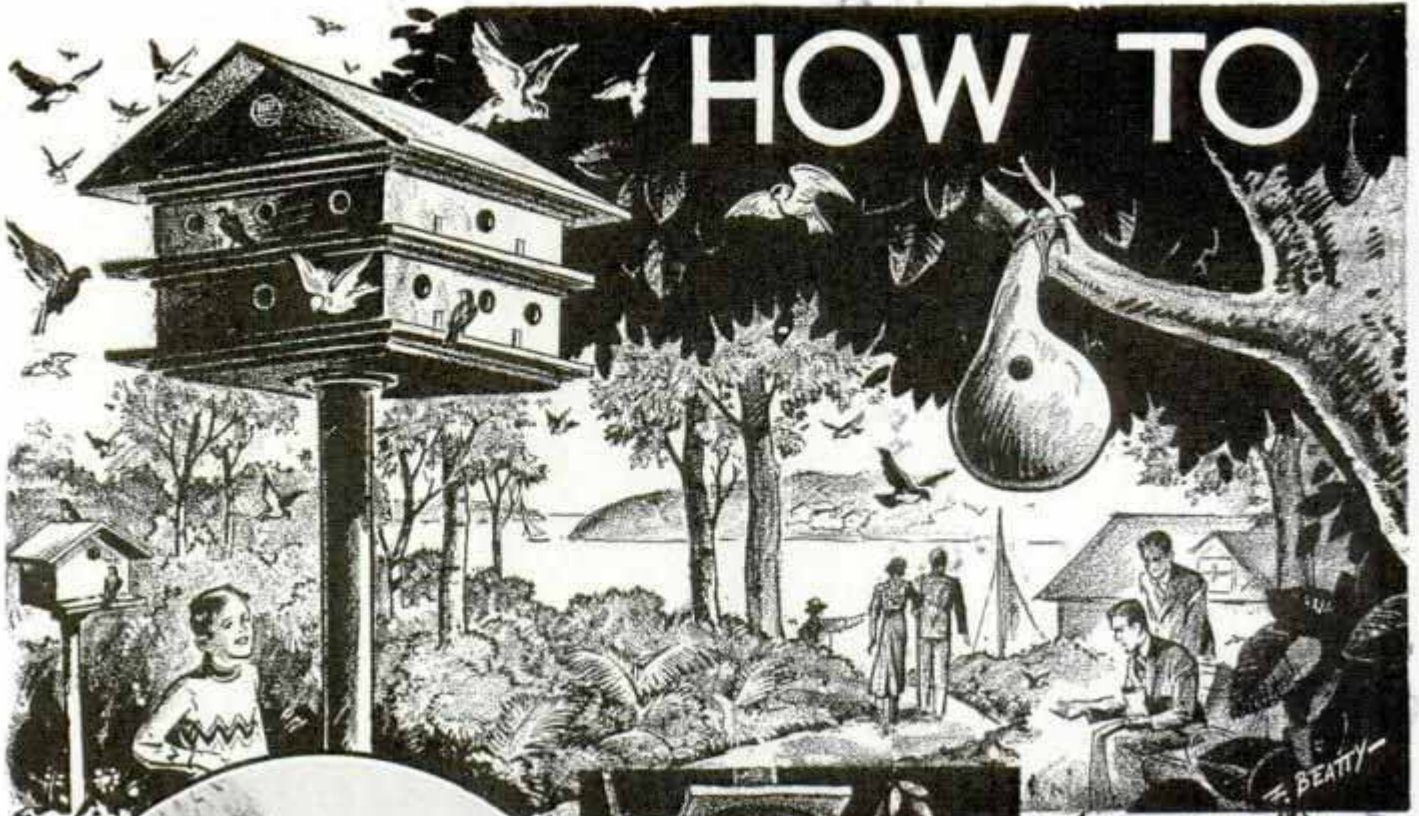
Kansas City, Mo

30 Rockefeller Plaza New York



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# HOW TO

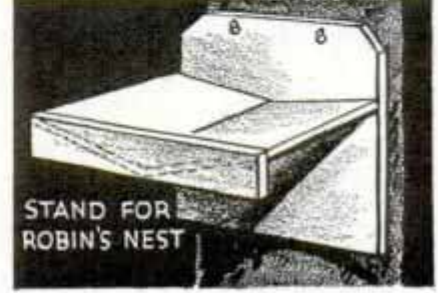


Here are some simple homes suitable for various species of birds. The screech owl, at left, likes a hole in a tree but can be induced to make its home in a box.

By Bob Becker  
*Chicago Tribune Sports Dept.*

EVER since the early colonists and some Indian tribes started hanging gourds on trees as nests for purple martins, the hobby of attracting songbirds around homes has been growing in popularity. Today, boy and girl scouts, owners of farms and estates, and countless residents of towns and city suburbs either make or buy various kinds of nesting boxes to induce birds to make their homes close to human habitations.

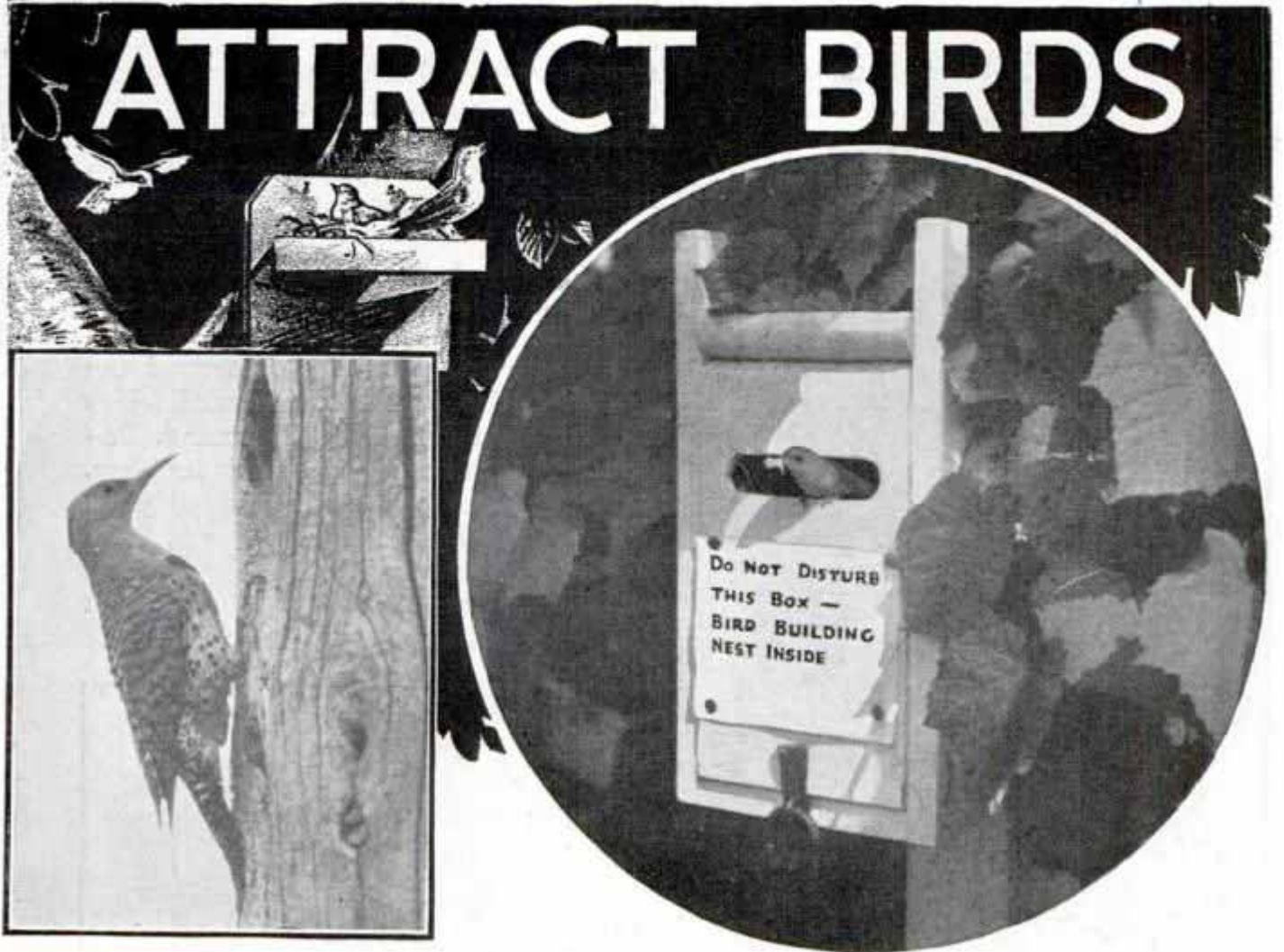
To attract birds to a piece of land is not only fun but also has a definite economic value. Many songbirds eat insects and weed seeds. Some communities have recorded a definite reduction in the number of mosquitoes after residents put out numerous nesting boxes for purple martins which catch these insects on the wing. So the home owner who induces songsters to stay around a garden really is signing up bird neigh-





E 15 340 212

# ATTRACT BIRDS



*The flicker, left, a desirable bird neighbor, likes a nesting box. The wren, at right, had trouble locating a home until it found this mailbox with an ideal opening*

neighbors that more than earn their keep. More than forty kinds of interesting birds are known to take either boxes or shelters provided for them. The list, which contains many songsters, includes the western bluebird, song sparrow, eastern bluebird, English sparrow, robin, house finch, mountain chickadee, purple grackle, Carolina chickadee, starling, black-capped chickadee, phoebe, titmouse, crested flycatcher, tufted titmouse, red-shafted flicker, red-breasted nuthatch, yellow-shafted flicker, brown creeper, red-headed woodpecker, house wren, downy woodpecker, brown thrasher, hairy woodpecker, tree swallow, screech owl, barn swallow, saw-whet owl, cliff swallow, barn owl, purple martin and mourning dove.

Boxes for the more desirable and common species of songbirds can be constructed in the workshop at very little expense and, with the simpler types, not much time is needed with saw, hammer, nails, and paintbrush. First, determine from the

accompanying table the size of box necessary for the birds you want to attract. Obviously, it is foolish to build a home for a house wren with an entrance hole two inches in diameter when an entrance the size of a quarter will suit the wrens and at the same time keep sparrows out.

You do not need expensive materials for houses for wrens, bluebirds, woodpeckers and other desirable bird neighbors. Although metal can be used, it is not recommended because it is such a conductor of heat. Cypress, pine, or poplar woods are excellent. Tar paper is not recommended because it has no advantages over wood.

Rough slabs of kindling wood known as "sawmill waste," which have the bark on them, are cheap and make beautiful, rustic birdhouses. A saw, hammer, nails, and an auger are all the tools needed unless you want very smooth finished boards which will be planed and sandpapered. For finishing, brown or green paint can be used. White is usually applied to martin

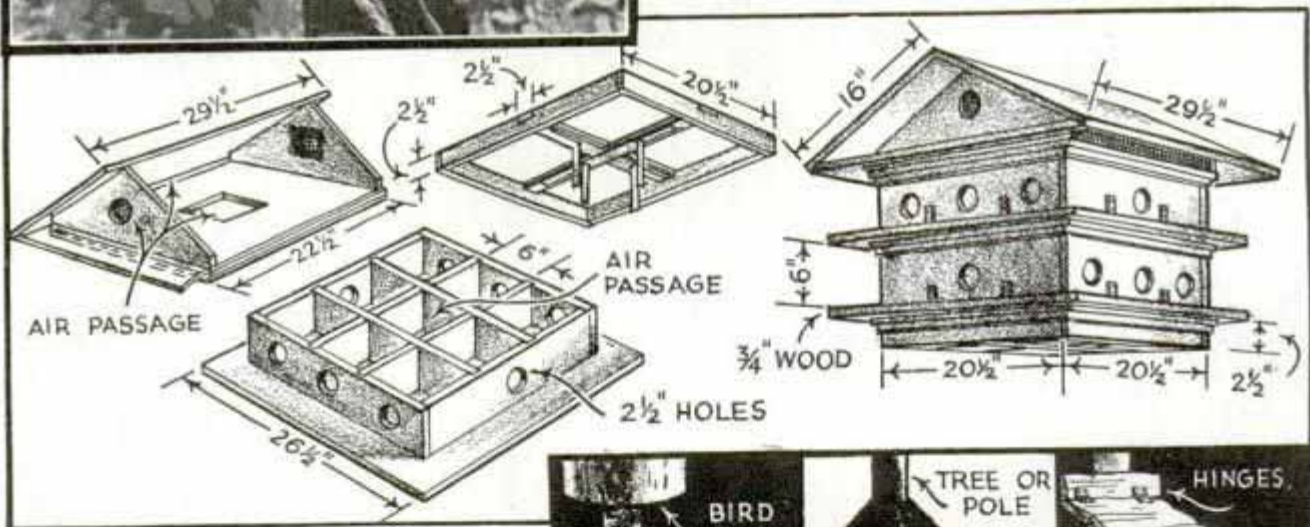




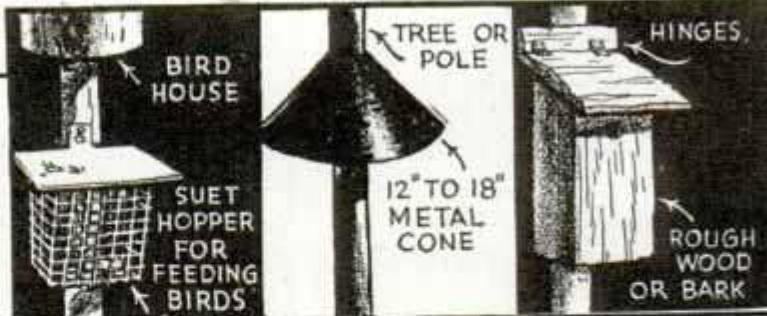
removable top, bottom or side is desirable. A panel which can be removed with screws or one which is hinged can be used. One common mistake in making wren, bluebird or other nesting boxes is to forget to provide for adequate protection against the elements. Bore two or three small holes in the bottom of the box for drainage. Also, a top that projects over the entrance hole keeps a driving rain out.

You can put a wren box in most any shady or partly sunlit spot around the garage, garden, kennel or dooryard. Place it six or eight feet above the ground. Designs for wren houses are almost limitless. Almost square ones made out of plain pieces of wood painted dark brown, those with steep pitched roofs, and those in the shape of log cabins are popular. If you

(Continued to page 146A)



houses. The house wren is one of America's favorite birds and they are not at all fastidious. They will take houses made of smooth material or the rustic type. The size doesn't make much difference because they will fill the cavity with sticks and other materials. However, boxes of small size are more desirable. A horizontal slot makes the best entrance. The circular hole for wrens is about the size of a quarter. When you cut a slot in the nesting box make it seven-eighths of an inch high and four inches wide. The birds can get their twigs through this easier.



DIMENSIONS FOR BIRD HOUSES THAT ATTRACT FEATHERED FRIENDS					
SPECIES	Floor of cavity inches	Depth of cavity inches	Entrance above floor inches	Diameter of entrance inches	Height above ground feet
Bluebird . . . . .	5 by 5	8	5	1 1/2	5 to 10
Chickadee . . . . .	4 by 4	8 to 10	6 to 8	1 1/8	6 to 15
Flicker . . . . .	7 by 7	16 to 18	14 to 16	2 1/2	6 to 20
House Wren . . . . .	4 by 4	6 to 8	1 to 6	7/8	6 to 10
Martin . . . . .	6 by 6	6	1	2 1/2	15 to 20
Red-headed Woodpecker	6 by 6	12 to 15	9 to 12	2	12 to 20
Starling . . . . .	6 by 6	16 to 18	14 to 16	2	10 to 25

You must clean wren and other nesting boxes each winter, so a

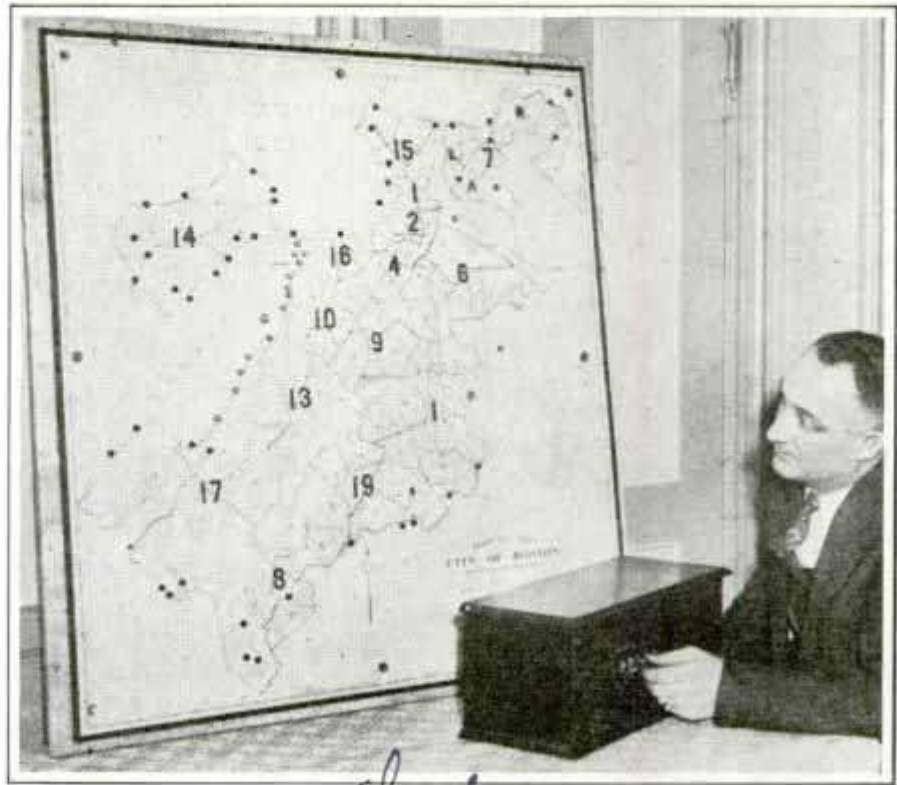
Top, robins in elaborate nesting shelter. Center, sectional purple martin house held together with hooks and screw eyes. Above, in center, cone keeps cats away



*F15*  
*Ely, Telephone Operator*  
*Police Dept., Boston, Mass*

# Radio Map Flashes Positions of Squad Cars

In the office of the Boston police radio operator is a huge map serving as an "electric dispatcher" for the cruising squad cars. The city is divided into seventy-odd districts for police supervision, and 400 lights represent the squad cars on the map. While a car is cruising, the light is white. When it is dispatched on a mission, its letters flash red, and when the car reports arriving at the point to which it was sent, the red light is thrown at that point. The electric dispatcher thus shows at a glance whether squads have received their orders and reached their destination.

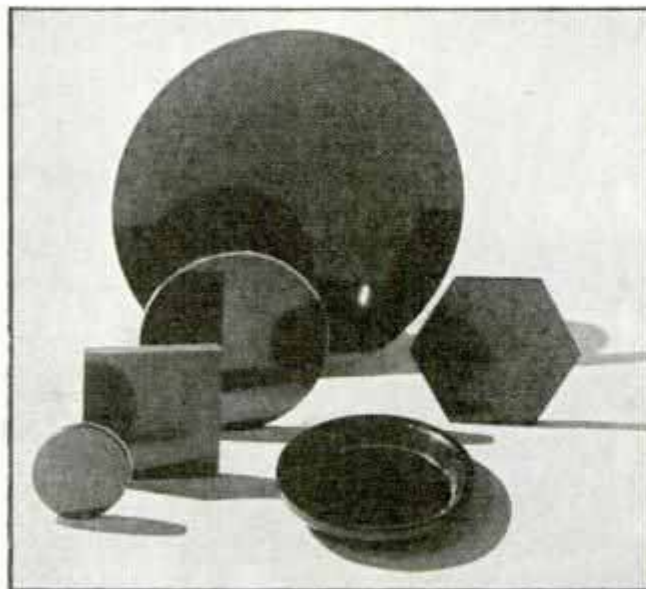


*dr*  
 Radio operator of Boston police charts position of cruising squad cars with red and white lights on map of city

# Plastics Molded from Sawdust May Utilize Waste Wood

Development of a method of converting sawdust, shavings and waste wood slabs into durable plastic material may open a profitable field for the lumber industry. Great quantities of sawdust are now burned as worthless and represent an actual loss to the woodworker. At the U. S.

Forest Products Laboratory in Madison, Wis., efforts are being made experimentally to convert waste wood by a simple chemical process into a plastic molding powder. This is pressed into sheets, disks and useful shapes having high density, good body and glossy surface. While the process has not been developed to a point of commercial usefulness yet, the prospects are regarded as encouraging.



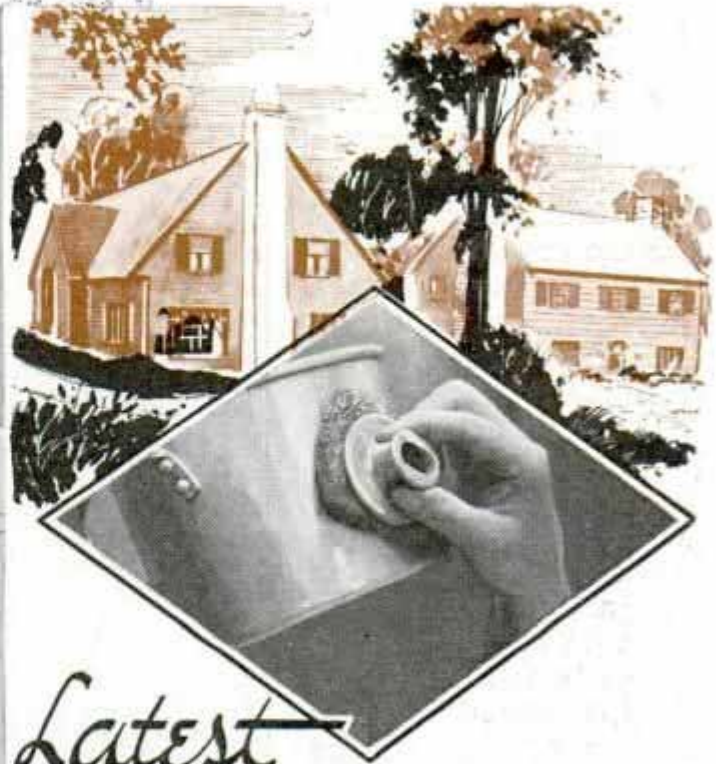
These disks were pressed from a molding powder into which waste sawdust was converted chemically

# Turbine Cooled by Hydrogen Develops Less Friction

By cooling with hydrogen, the General Electric company has designed a huge turbine-generator with only one-tenth the air friction and rotational losses incurred by the air-cooled generator. Use of hydrogen for cooling is justifiable only for large units, such as the 40,000-kilowatt unit under construction. It will employ steam at 1,250 pounds pressure and 925 degrees Fahrenheit, turning at 3,600 revolutions per minute. Hydrogen cooling enhances efficiency by 0.6 to 1.1 per cent.

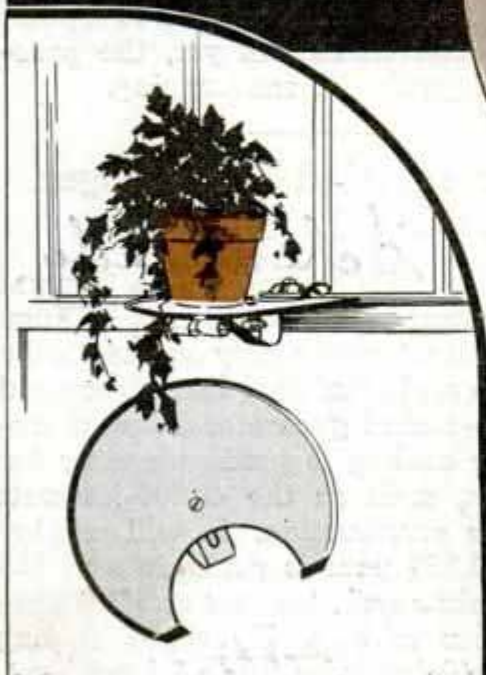
*F199*  
*Schenectady, NY*  
*Gen. E. C. Holahan for App. Glacian Electric*





*Latest*  
**HOME**

*Electric range with control which keeps food at "simmer" heat. The stove has two lighted ovens and lighted platform lights. Right, steel wool holder made of rubber*



*Table which can't tip over and, at left, enameled metal window shell for potted plants which can be attached by tightening one wing nut*



*Handy hanger for  
pots and pans and,  
below, knife sharpener  
which imparts  
a bevel to the  
blade. The stones  
can be removed  
and changed end  
for end*



# ACCESSORIES



*Streamline baby carriage  
with curtained windows.  
Right, living room of  
home of future exhibited  
recently in New York.  
Note built-in lights, and  
sofa which divides into  
four parts*



### Electric Horse with Five Gaits Used for Indoor Exercise

F132



Electro-mechanical horse with five gaits ranging from a trot to a running gallop

Some of the benefits of horseback riding as a form of exercise can be obtained indoors with the aid of an electro-mechanical horse which not only provides fun for the children but sport for grown-ups as well. At a touch on the reins, the horse can be induced to break into any one of five gaits ranging from a trot to a gallop.

### Spoon Lure Wags in Water Like Wounded Minnow

F161



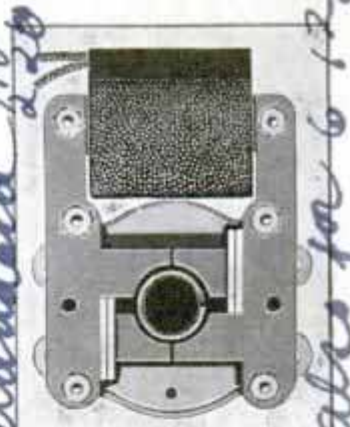
Designed to produce a waggling action resembling a wounded minnow, the latest spoon lure is said to prove unusually attractive to fish when drawn through the water. Its upturned end causes the lure to rock, giving it a wag-

ging action which is accentuated by the turned-down rear end. A pork strip forms a tail piece. The hook is mounted to get short strikers and is so placed that it pierces the upper bony structure of the fish's jaws. It is almost impossible for the fish to throw the hook because the jointed spoon offers no leverage to work against. No swivel is necessary for the spoon does not make a complete turnover. The lure can be used at any depth, the action being as pronounced at twenty feet as at ten or twelve inches.

F176

### Self-Starting Clock Motor Comes in Kit Form

An unusual development of a new powerful self-starting synchronous motor has made its appearance in the electric field. Its operation is based upon a novel scientific principle that distinguishes it in a marked degree from other synchronous motor mechanisms. The rotor turns at 3,600 revolutions per minute on a frequency of sixty cycles. Rotor speed is then reduced through a unique movement to one revolution per minute. The enclosed gears run in oil. After years of research to develop this motor, a perfect helix formed from a special steel, treated to the correct hardness, was forced over a non-magnetic rotor, mounted in a two-shaded pole laminated field, careful consideration being given to proper air gaps and tolerance in the rotating field. By applying proper coil it will operate on voltages from six to 220 alternating current. With structural changes in the inner movement, true time is available for twenty-five and fifty cycles. It consumes three and one-half watts. The cost is low as it is obtainable in kit form.



Inquiries as to makers of articles described in Popular Mechanics, will be answered by our Bureau of Information upon receipt of return postage.

W. J. Jamison Co  
739 California  
Chicago

2306 Lindenwood Drive, East St. Louis, Mo.

100 N. La Salle  
Chicago



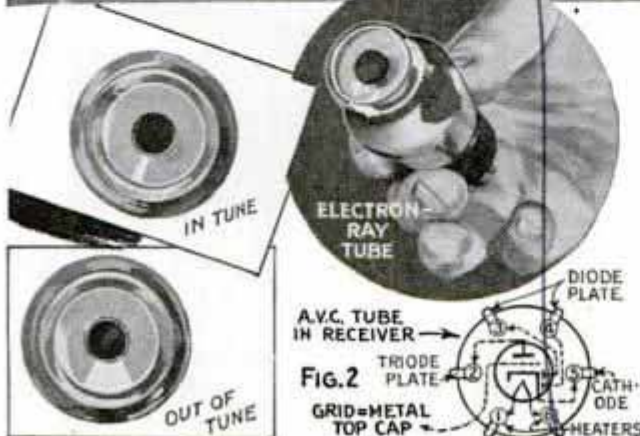
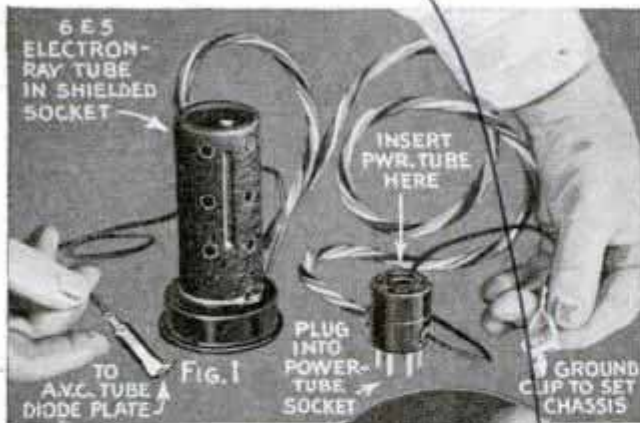
# Radio



## ELECTRON-RAY TUNING Tube Adapter

F 3509

**A**CCURATE visual tuning by means of the type 6E5 electron-ray tube is now within the reach of a large number of set owners. If your receiver includes automatic volume control (a.v.c.) and a suitable power-output tube, "magic eye" tuning may be added quickly by means of a simple adapter arrangement without making any changes in the circuit. The visible effect is observed on a fluorescent target in the dome of the bulb. For dif-



ferent controlling voltages of the received signal, the pattern on the target varies through a shaded angle from about 90 degrees to approximately zero for sharp tuning, as can be seen in the photos shown at lower left.

Electron-ray tuning tube adapters are available in three types for a.v.c. sets with the following power-output tubes: 6A4 or LA; 41 or 42 and 6F6. The adapter plug is placed between any of these power-output tubes and its socket; a red lead with a metal connector strip slips over the diode plate prong of the a.v.c. tube and a black lead terminating with a clip for a ground connection on the metal chassis of the set completes the hook-up. You will not find it difficult to locate the a.v.c. tube in your receiver as it will be one of the following types: 75, 85, 6B7, 6B6, 6Q7 or 6R7. Fig. 1 shows the complete adapter unit. A bottom view of the socket connections for a type 75 or 85 a.v.c. tube is given in Fig. 2.

*Brooklyn, Mass.*

*Alden Manufacturing Co.*





# Build Your PORTABLE

By Frank M. Lund

THIS easily portable vacation receiver is simple to build and has a number of new features that insure excellent results. It is not only handy for beach and picnic use, but also makes a fine battery set for homes not equipped with electricity.

Although only four tubes are used, it is equivalent to a five-tube receiver. With full superheterodyne circuit using the new 1A6 tube as a combined mixer and oscillator, and a type-34 tube to eliminate cross talk, the result is a very sensitive, selective and economical low-drain battery set. Power detection, pentode audio, absolute control of volume, excellent tone and distance with police calls included, leave little to be desired.

The A-battery voltage adjuster, shown in Figs. 1 and 1-A, is merely a tapped resistor and switch mounted on heavy card-

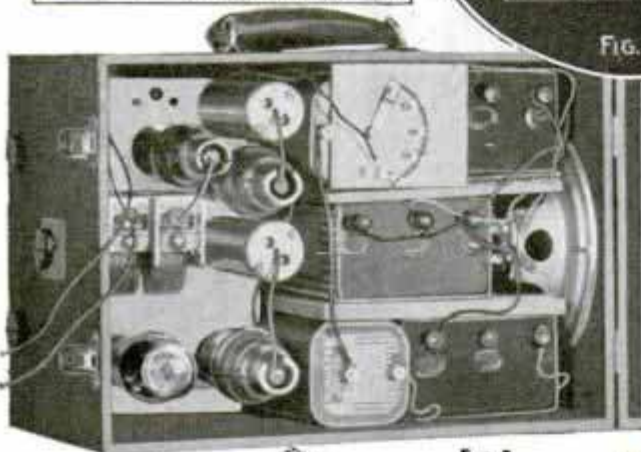
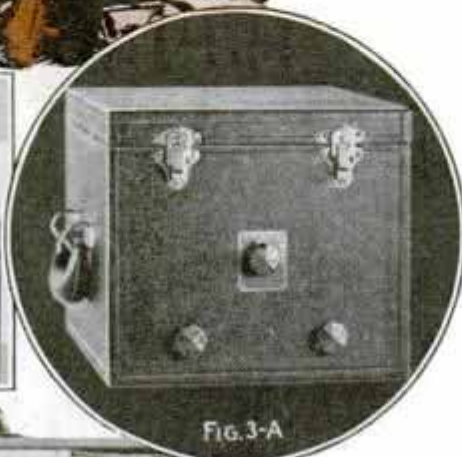


FIG. 3

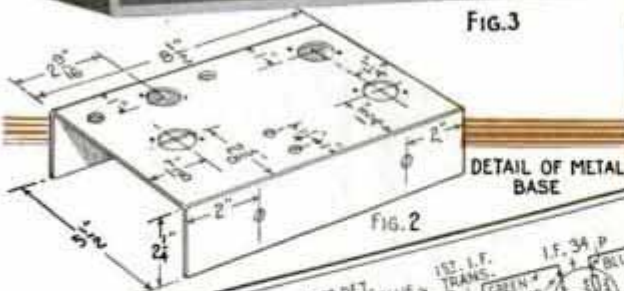


FIG. 2

DETAIL OF METAL BASE

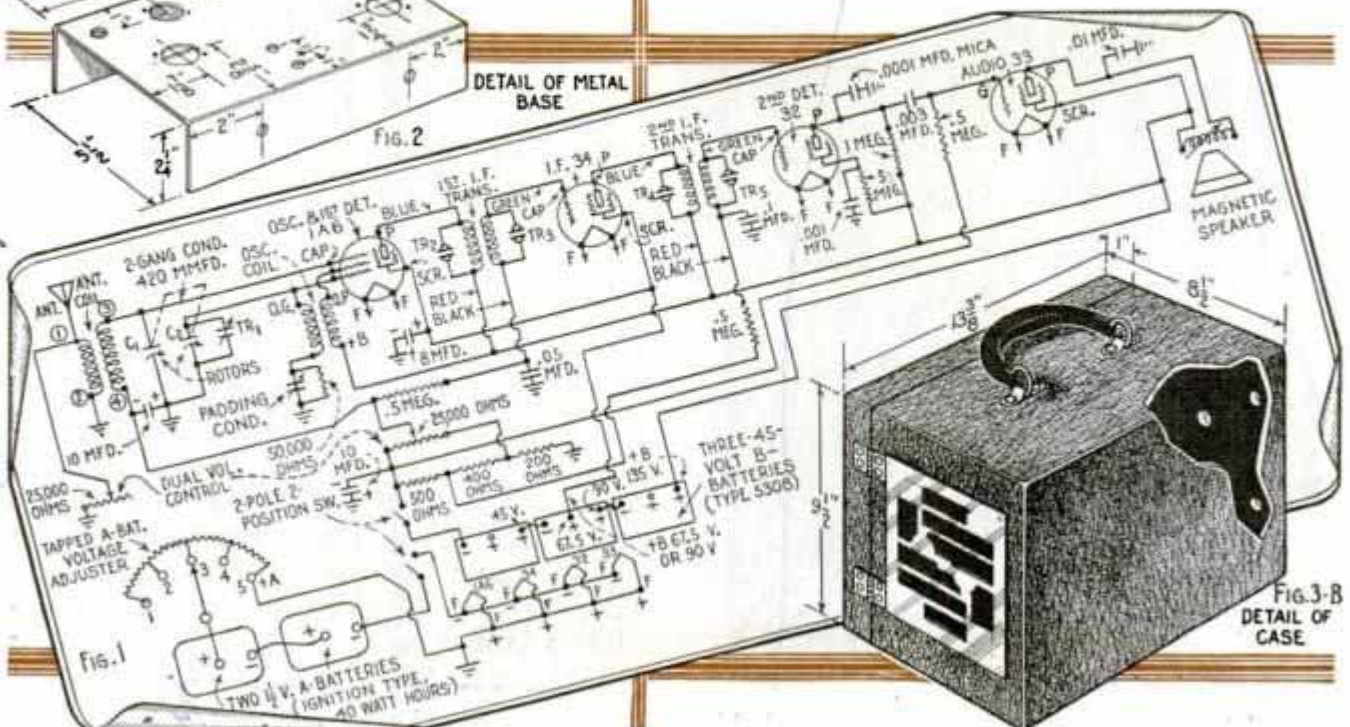


FIG. 3-B  
DETAIL OF CASE

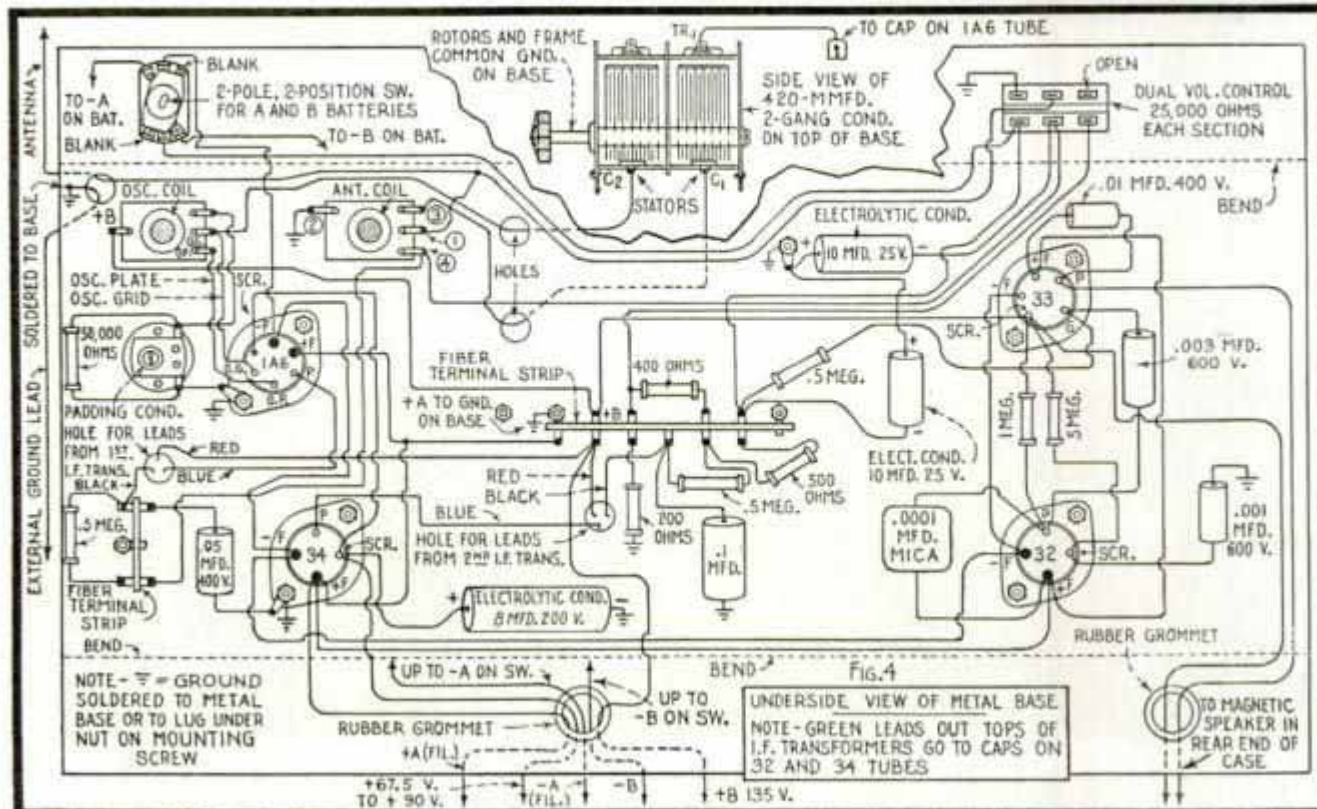
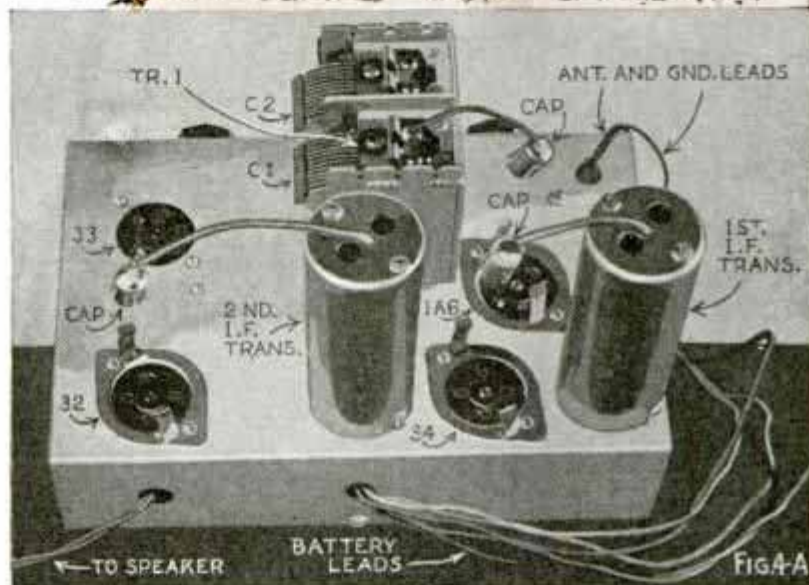


# Own . . . BATTERY RECEIVER



board. It is supplied by the battery manufacturer to reduce the A-battery voltage to a safe value for 2-volt tubes. Fig. 2 shows the sheet-metal base that may be purchased drilled as shown, or it can be made easily; the socket holes are  $1\frac{1}{8}$  in. in diameter. A simplified wiring diagram is given in Fig. 4; this shows a flattened-out, underside view of the base. The cutaway section reveals the ganged tuning condenser which is mounted on top of the base as shown in Fig. 4-A. Note that the 2-pole, 2-position battery switch is shown in the "off" position. This switch opens both the A

(Continued to page 134A)









Alden Mfg. Co., 715 Center, Rochester, N.Y.

Wright  
Inc. St. Paul  
Minn

# Hints for Radio Experimenters

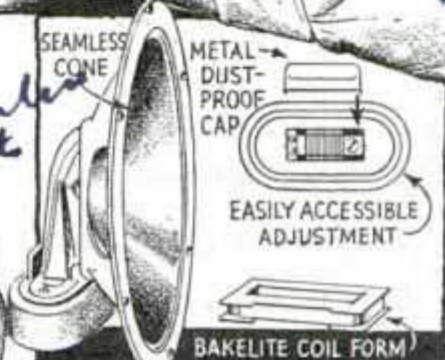
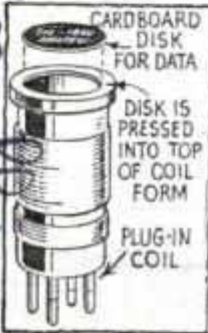


Right, magnetic speaker of advanced design mounted in metal cabinet for battery receivers, auto radios, experimental hook-ups and extension use in home or school. Has wide frequency range and is available in two standard impedances to accommodate most output tubes, single or push-pull

ε 3708

Below, small button-type porcelain insulators for continuing high voltage leads through metal bases. Wires are soldered to lugs placed under mounting screw

Impromented product



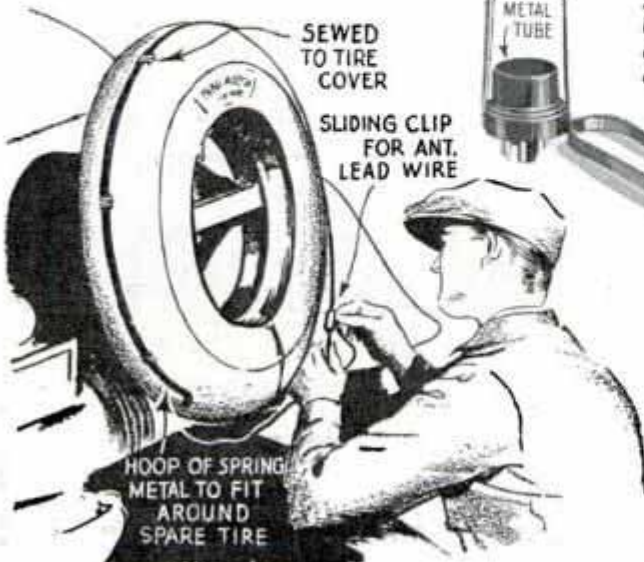
Above, wave-length label for plug-in coils; right, extractor for removing metal tubes from tight sockets; below, 5-meter antenna on spare tire; although not as efficient as the "fish-pole" type, it works well over a 1 or 2-mile range

ε 3711



Above, auxiliary terminals on tube base provide means for connecting a short-wave adapter, or beat oscillator, tube to the receiver power supply. The same idea may be used for phonograph pick-up to audio stages

Transparent index for accurate dial reading; a fine line should be inked on pointer

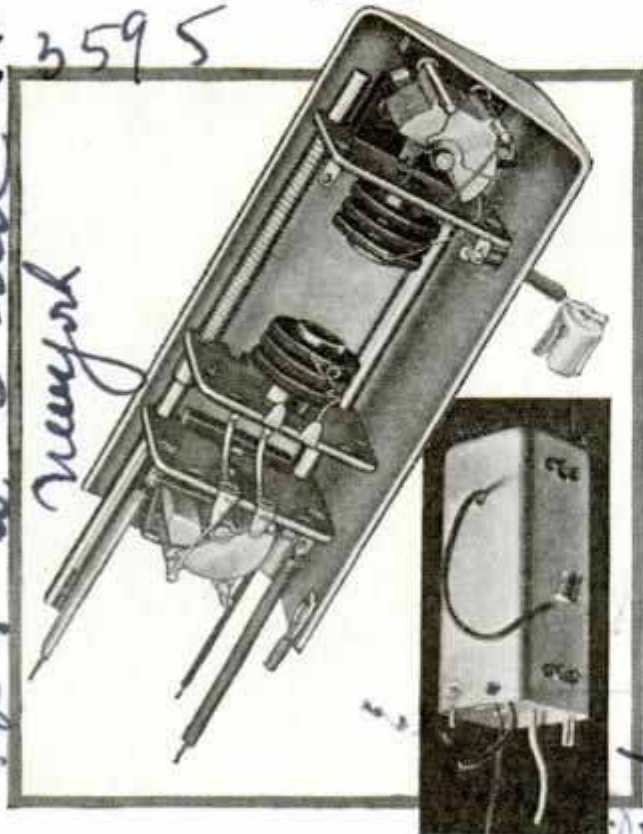


ε 3709

Band-changing switches with insulated shafts, positive contacts and high-voltage spacing. The switch at right is a double-pole, 6-point rotary type; flexible copper leads run from blades to terminals. This variety may be ganged for quick band changing in amateur radio apparatus



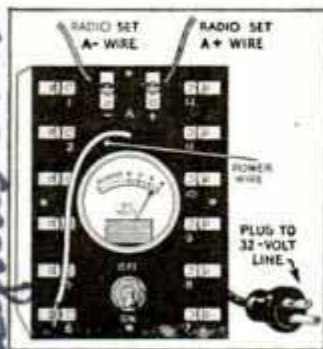
### Variable Coupling I.F. Unit



Sectional view shows threaded coupling shaft

This variable coupling air-tuned intermediate-frequency transformer provides a continuous range of variation from one-third critical coupling for high fidelity reception, to over three times critical coupling for sharp tuning. Coupling is controllable from the receiver panel by means of a mechanical arrangement not shown in the photos, or it may be locked to any desired value.

### A-Eliminator for Farm Sets

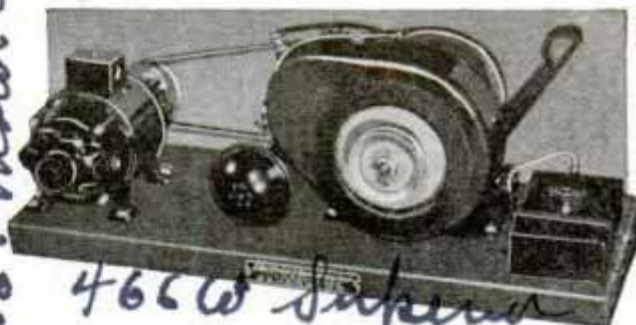


Owners of battery receivers living on farms equipped with a 32-volt light plant can use an inexpensive A-battery eliminator to operate a set using from one to eight

201-A tubes, and a 171-A or 112-A tube. This does away with the heavy and messy 6-volt storage battery that must be recharged at frequent intervals. The unit may be located in the radio console at any point where it will receive good ventilation. Correct A-voltage for the set is obtained by plugging the device into the 32-volt line and connecting the power wire to one of the numbered clips that will give a reading of 5 volts on the meter with set turned to full volume.

### Gas-Engine-Driven Generator

Providing both 110 volts of alternating current for the operation of a.c. radio receivers, amplifiers or other electric devices, and 7½ volts of direct current to charge 6-volt storage batteries, this generator offers an economical type of power supply for a mobile public-address system or a compact power plant for use in isolated localities. The engine is a 4-cycle



General-purpose generator is driven with gas engine

variety that will run about four hours on a quart of gasoline. A built-in mechanical governor assures a constant frequency of 60 cycles; an efficient muffler is employed to reduce noise to minimum. The generator is self-excited and will produce 110 volts a.c., sufficient for a 300-watt load; d.c. charging rate is 5 amps.

Blueprints covering radio construction articles in past issues can be obtained for 25 cents each; material lists are available without charge on receipt of postage.

**NEXT MONTH—How to Build a Three-Tube All-Wave Battery-Operated Receiver.** A simple and inexpensive layout that any beginner can build with few tools. New tubes are used in an efficient circuit tuning from 17 to 550 meters. Magnetic speaker is built into front panel; there are no coils to wind.

The Muter Co. 1255 S Michigan Street  
 F3501  
 Hammerlund Mfg Co  
 424 W 33rd  
 New York  
 F3595

Pioneer Gen. & Motor Corp.

4660 Superior  
 Chicago



# The CRAFTSMAN



## MODERN MIRROR *of pleasing simplicity*



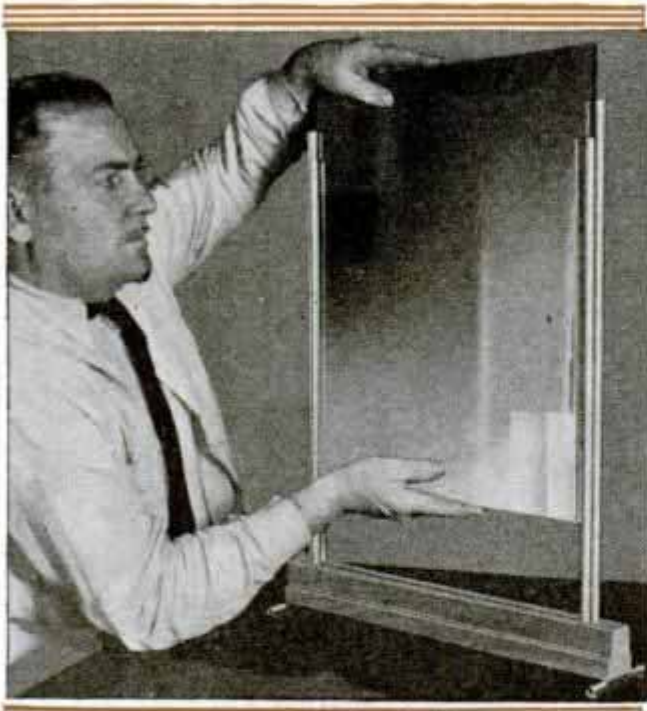
FOR either the hall table or the dressing room, this wood and metal mirror stand "takes the eye" mainly because of its plain and simple modern lines, and its construction also makes it suitable for even the beginner in craftwork. The wood base may be mahogany and the side members are merely  $\frac{3}{8}$ -in. brass tubes or rods. Or, to cut cost to a minimum, you can substitute brass-plated iron tubes or rods.

The molding work on the base can be done by hand with a saw or combination plane, or may be quickly accomplished with power tools. Cut a groove lengthwise in the top of the base to take the mirror. Fit the latter in the groove carefully so that it is equidistant from each end, mark off the part of the groove not needed, glue in strips of wood to come flush with the surface and sand to a smooth finish.

The brass tubes or rods are then cut to

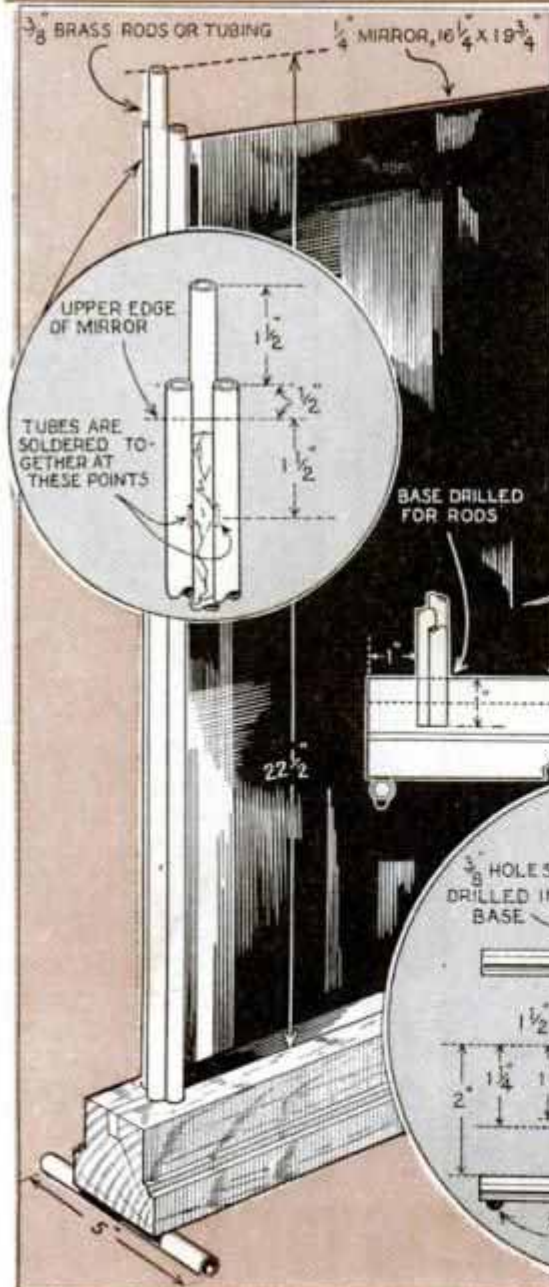
the lengths specified, allowing 1 in. extra for the rods to extend into holes, which are now drilled into the top of the base, noticing their exact position carefully. The center rod projects above the two on each side, a cluster of three rods forming each side frame. Holes for the rods must be drilled in the base with great exactness and strictly plumb to hold the rods perfectly vertical. The two feet under the base are 5-in. lengths of the same size rod or tubing and are attached at right angles as shown. To prevent them from marring the finished surfaces upon which the mirror is to be set, you can cement small disks of felt or rubber to the underside of the feet. If the feet are tubing, you can use two rubber-head wood screws, first drilling a hole into which the screw can be driven, then cutting the screw so that it will come just above the inside surface of





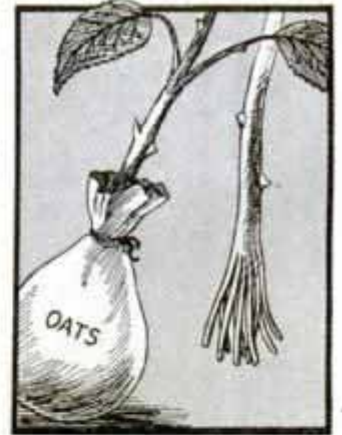
the tubing and probably running some solder inside to hold the screw in place. Such soldering can be done neatly with a small alcohol lamp and blowpipe to direct the flame inside. The feet are drilled and countersunk for flat-head wood screws with which they are attached to the underside of the base.

The holes, which are to receive the side uprights, are filled with glue and the rods then driven home, all surplus glue being wiped off and out of the mirror groove. Next, the mirror is slid in place and the tops of the rods tied together with strings to hold them in position while the glue dries. The following day the mirror is removed, and small drops of solder are flowed between the rods at the points indicated. Sand the wood carefully, avoiding rounded edges and then apply a good paste floor wax.



### Slips from Rose Bushes Take Root in Grain Bag

If you have had difficulty in "starting" slips from rose bushes, try the following method: After the slip is cut from the parent bush, split the butt end into fine slivers about 1 in. long. Then fill a small muslin bag with oats or other small grain, insert the slivered end of the slip and tie the sack



around the stalk. Place the sack in a pan of water allowing the grain to soak thoroughly for a week or ten days. The sprouting grain will become so entangled with the slivered wood that the sack may then be removed and the slip planted with the grain adhering. The success of the method lies in the fact that the sprouting grain feeds the plant through the slivered ends and root formation soon takes place. Then the grain decays and supplies food for the new roots.



### "Musical" Roller Skates

Put this noise maker on your skates and you will start a fad that will be copied soon by all your friends in the neighborhood.

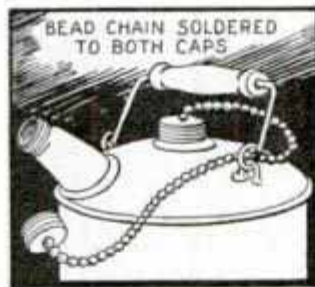


The noise is produced by a piece of spring steel soldered to the skate axle housing so that it strikes against drops of solder evenly spaced on the inner surface of one wheel. The edge of the steel piece should be rounded and it should be set at a slight angle to the surface of the wheel to avoid scraping off the solder.

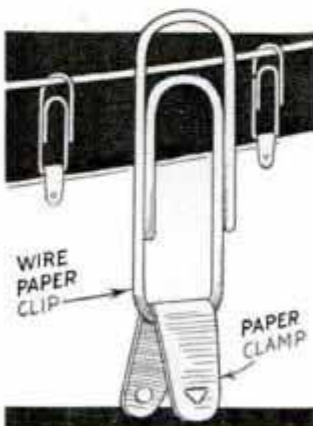
rounded and it should be set at a slight angle to the surface of the wheel to avoid scraping off the solder.

### Chained Caps on Kerosene Cans Are Never Lost

If you solder a short length of small chain to the screw caps on a kerosene can as shown, there will be no possibility of misplacing one of them when they are removed to fill other containers. Small beaded chain such as used on lamp sockets is ideal for the purpose.



### Light Stage Curtains Suspended on Paper Clips



When a curtain of light material is hung temporarily for amateur stage shows, you can suspend it quickly with paper clips as shown. It will slide easily over a wire and little time is required to put it up or take it down.

The same idea can also be used on cloth backgrounds in photographic studios.

### Making Erasures on Duplicates without Smudging



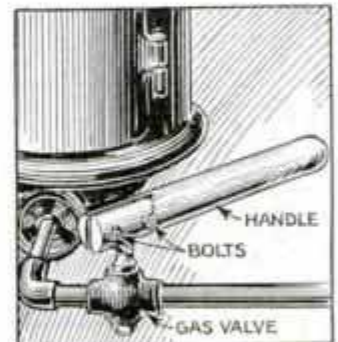
Type-cleaning "dough" removes excess carbon from lettering of typewritten copy to make neat erasures

Before an erasure is made on a carbon or duplicate sheet in a typewriter, press a ball of type-cleaning "dough" against the lettering to be erased. Any excess carbon will adhere to the ball and the erasure can be made without smearing the copy.

### Gas Valve Has Extension Handle to Open Easily

If the large gas valve on a hot-water heater is tight and is rather hard to turn with the fingers, a short piece of hardwood slotted at one end to straddle the finger grip on the valve and bolted in place will solve the problem.

However, such a handle is not recommended if the valve is so tight that there is danger of twisting it off with the added leverage. Valves that are too tight should be adjusted by your local gas-service man.—Norman H. Belcher, Winthrop, Mass.



Valves that are too tight should be adjusted by your local gas-service man.—Norman H. Belcher, Winthrop, Mass.

Pewter can be polished by rubbing it on an old kid glove sprinkled with whiting.

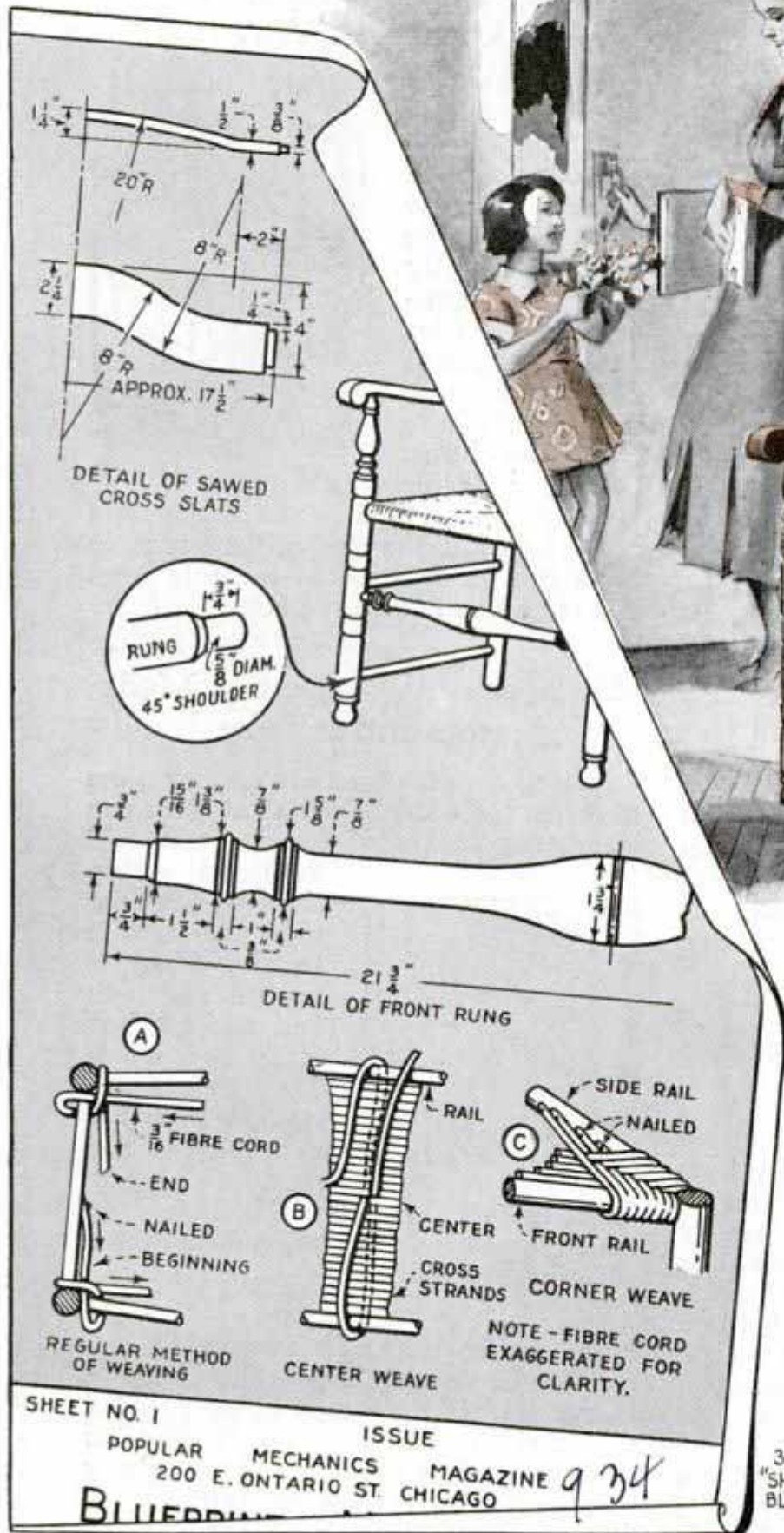
*Charles J. Fisher  
47 Conklin St. N.J.*



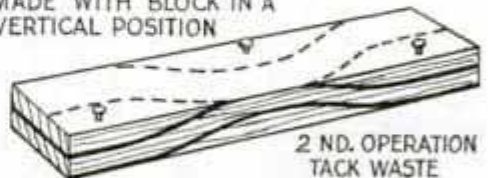




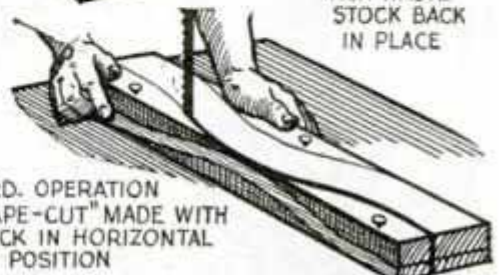
# CHAIR of Colonial Days



1 ST. OPERATION "BOW-CUT" MADE WITH BLOCK IN A VERTICAL POSITION



2 ND. OPERATION TACK WASTE STOCK BACK IN PLACE



3 RD. OPERATION "SHAPE-CUT" MADE WITH BLOCK IN HORIZONTAL POSITION

SHEET NO. 1

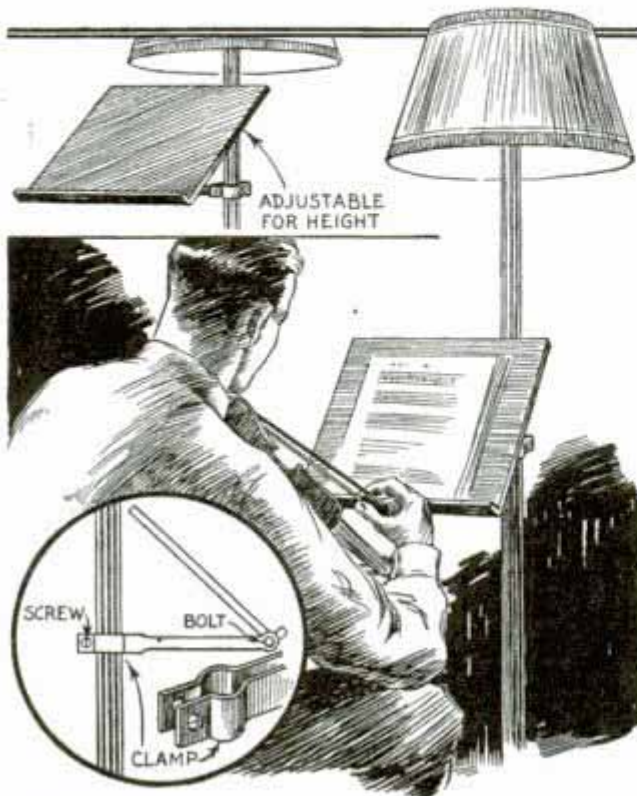
POPULAR MECHANICS MAGAZINE  
200 E. ONTARIO ST. CHICAGO

BLUEPRINT

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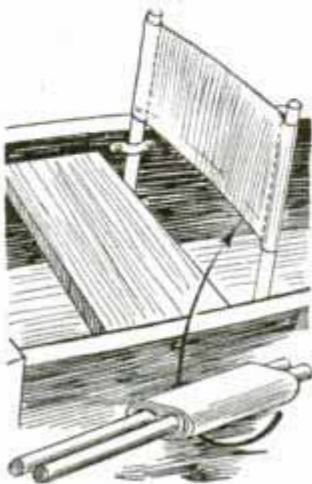
## Music Rack Clamped to Lamp Assures Good Lighting



Besides being adjustable, a music rack clamped to a lamp is always well illuminated

This music rack attached to a floor lamp gives you good lighting plus the convenience of an adjustable stand. Almost any rack can be fastened to the lamp with a clamp made from two pieces of flat iron as shown. If you have no rack, one can be made of light plywood. Felt or pieces of inner tube cemented to the inside surfaces of the clamp will prevent marring the lamp standard.

## Canvas "Lazy Back" Eases Strain on Fisherman's Back

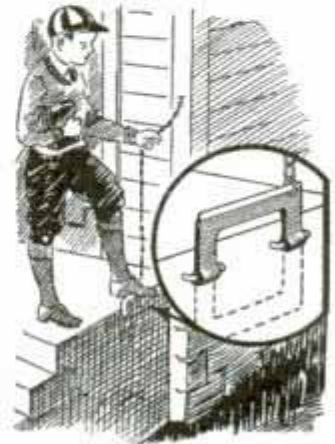


Tiresome strain on your back from sitting upright in a boat is greatly relieved with this "lazy back," which can be rolled into a compact bundle for carrying. Consisting of a wide strip of canvas hemmed at the ends to take lengths of bam-

boo, the lazy back is held vertically behind the seat with blocks or U-shaped pieces of flat iron screwed to the sides of the boat as shown.

## Hinged Shoe Scraper Folds Out of the Way

Accidents caused by falling over a foot scraper fastened to a porch, step or sidewalk, are eliminated by hinging the scraper so that it folds down when not in use. A chain, wire or cord raises it to clean the shoes.



Large staples or U-bolts are used to hinge the scraper, and are driven into the side of the porch, or holes can be drilled into concrete steps and sidewalks to take the bolts.

## Emergency Weatherstrip Made from Inner Tube

Instead of placing an old coat or piece of carpet along the bottom of a door as an emergency means of keeping out cold drafts, cut a strip from an old inner tube and tack it to the door as shown. You will find the rubber strip more effective than the cloth, which has to be moved when the door is opened.



Three or four tacks are sufficient to hold the rubber, which can be removed easily when not needed.

Personal checks and other valuable papers can be protected against alteration of the writing if the paper has been sponged with a weak solution of blue writing ink in alcohol before the writing is done; any attempts to change the writing with chemicals will then show very plainly.

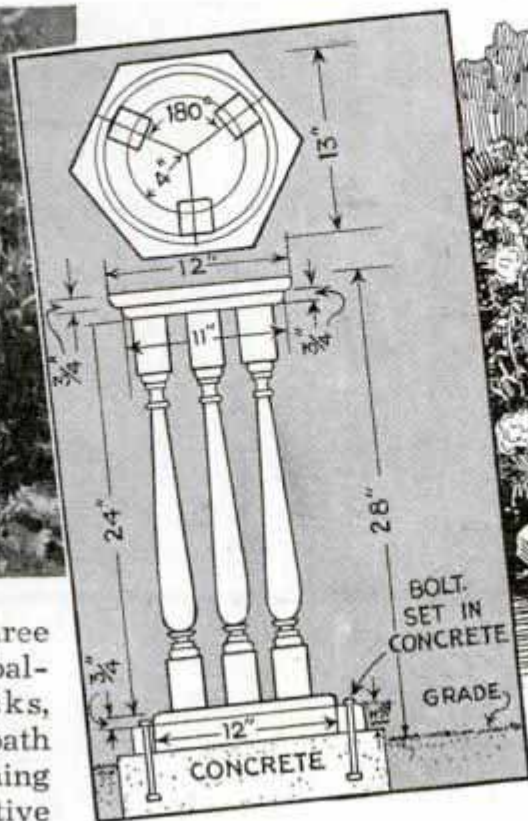


## Attractive Sundial Pedestal from Balusters



Assembled from three 24-in. turned porch balusters and wood disks, this sundial or bird-bath pedestal is just the thing to set off an unattractive corner of the garden.

Balusters can be purchased at any lumber yard, and the wood disks may be cut on a band saw or with a keyhole saw. Wood screws are used to assemble the pedestal, two being used at each joint to prevent



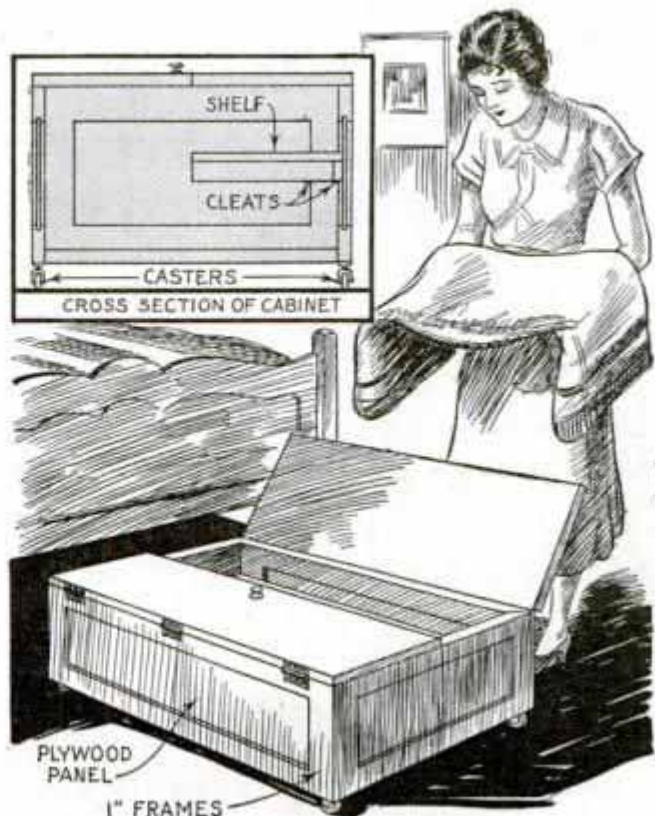
Long bolts set in a concrete base, which is sunk in the ground, support the pedestal rigidly

the balusters from turning. The top disk and the hexagonal base are both screwed into place from the underside. A block of concrete 12 in. thick and just large enough to carry the base, supports the pedestal.

## Blanket Chest Rolled under the Bed Utilizes Waste Space

Where space is limited in a bedroom, the problem of storing blankets, sheets, towels, etc., is solved with this chest, which rolls out of the way under the bed. The chest is merely a box 24 by 36 in. in size and high enough to just clear the underside of the bed when the casters are in place. A single shelf, one half the width of the chest, running from end to end is the only interior fitting. Frames of white pine and panels of fir plywood will be satisfactory if the chest is to be painted, but if a natural finish is desired, it is best to use gum, walnut or oak for the frames and similar plywood for the panels. The bottom is  $\frac{5}{8}$ -in. fir plywood. The top is two pieces of solid stock to match the sides.

(Besides making good mixing and rolling boards in a kitchen, old ferrotype boards make ideal vibrating boards, magnetic diaphragms, etc., for experimenters.





supplies. see for more



By  
W. Clyde Lammey

# Building Your

## The Real Starting Line!

Going at a job haphazardly wastes time and material besides putting one at a great disadvantage with the fellow who thinks and plans before building. Avoid the handicap of doing things proved wrong by experience and by underlying principles governing such vital factors as friction, weight, gravity, etc. Know how problems can be solved or conditions improved, which gives you "the edge" on the fellow who builds without planning. Armed with this knowledge, design a car that incorporates the ideas you think will make it most efficient. Work out every detail carefully on paper. You may want to alter the designs given here, perhaps using ideas of one in combination with those of another, considering the advantages and disadvantages of each. Do not start actual building until you have read the 1936 official Soap Box Derby rules. Suggested dimensions for the designs presented here will be given in the next issue of Popular Mechanics, with official rules, which cannot be released at present, to come later.

## FRAMES, AXLES AND SPRINGING

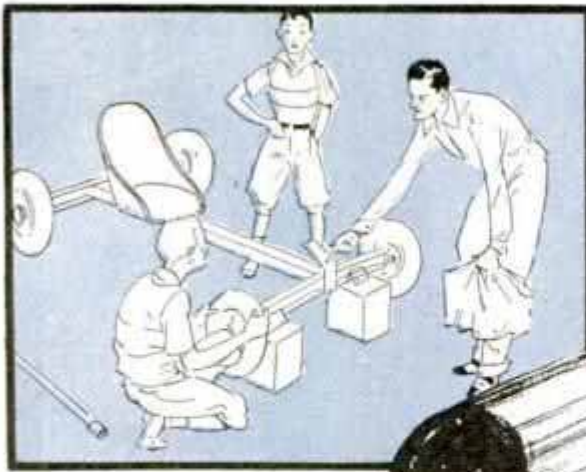
**R**OLLING downhill into a four-year college scholarship—without motor, leg power or even a friendly shove—that's all you have to do in the All-American Soap Box Derby. Out of the thousands of entries, one small gravity-powered car will reach the finish line first—and win the big prize. Wheel alignment, bearing adjustment to minimize friction, springing, skillful driving, and other factors, will all play an important part. However, there is no car so superior, no record so high, no driver so good, that the combination cannot be beaten.

With this in view, the designs for Soap

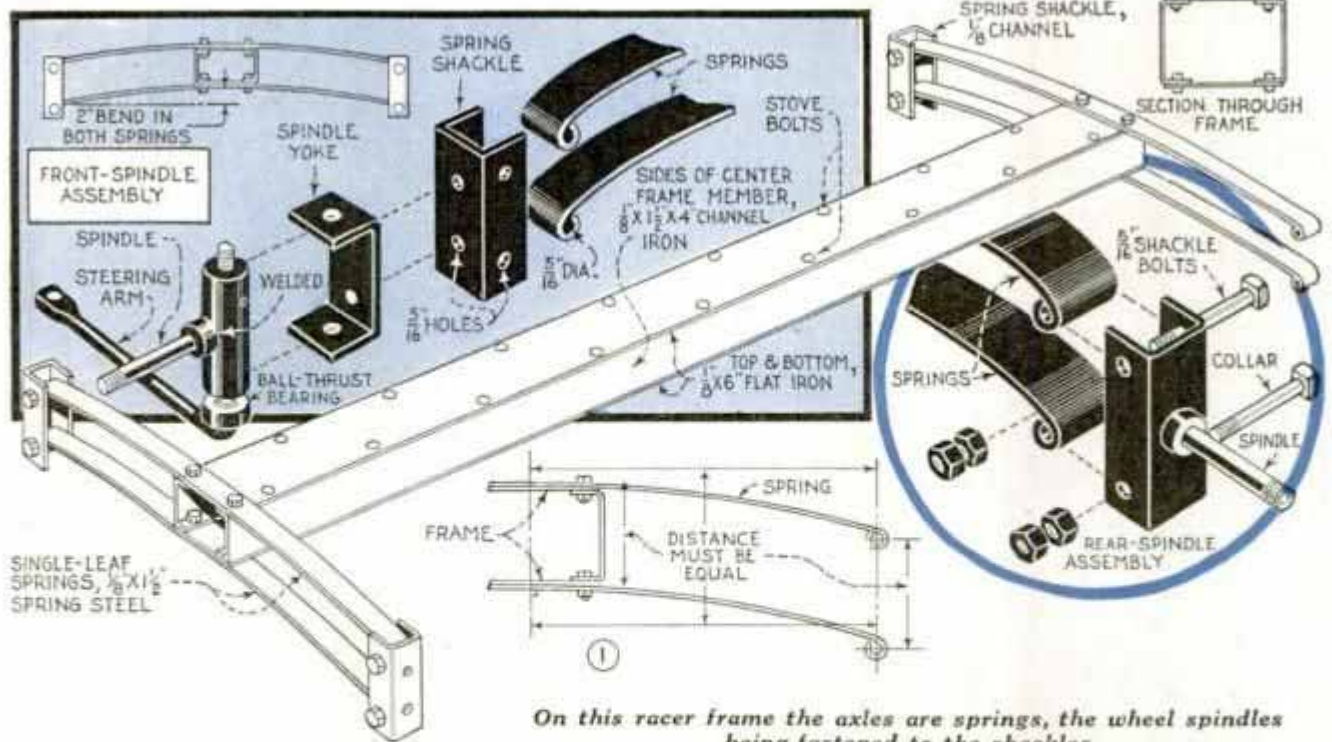
Box racers that you see here, are merely suggestive of what you can do in the way of approved design, using stock materials that you can get almost anywhere. For example, take the type shown in Fig. 1. The axles are really flat spring leaves, and the wheel spindles are carried on the shackles, which are short lengths of channel iron. The center member, or frame, consists of two pieces of channel iron and two lengths of flat iron. Fig. 8 shows the assembly, which can be fastened together with stove bolts or rivets. The springs are bolted to the frame, exactly at right angles to it. In this design you will have to

Build - Mr. Leon Stegess Co Sept 26, 1936  
52 37 W. Lake Chicago according to rules  
C.F.





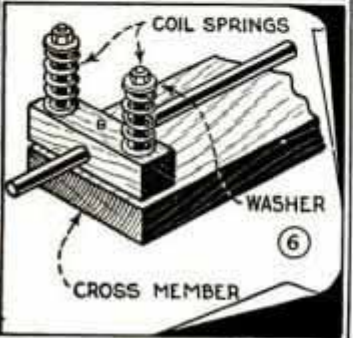
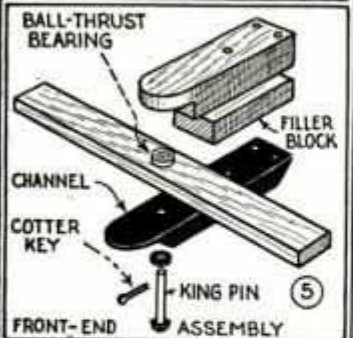
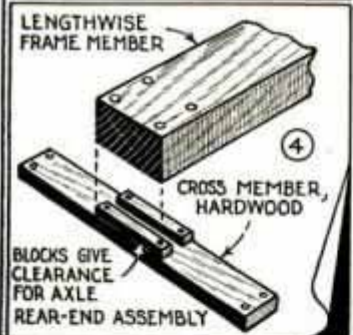
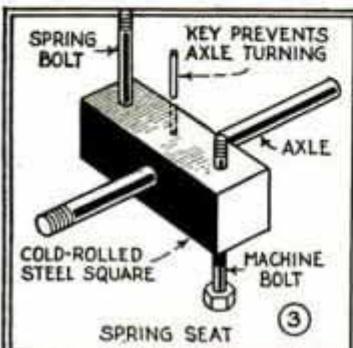
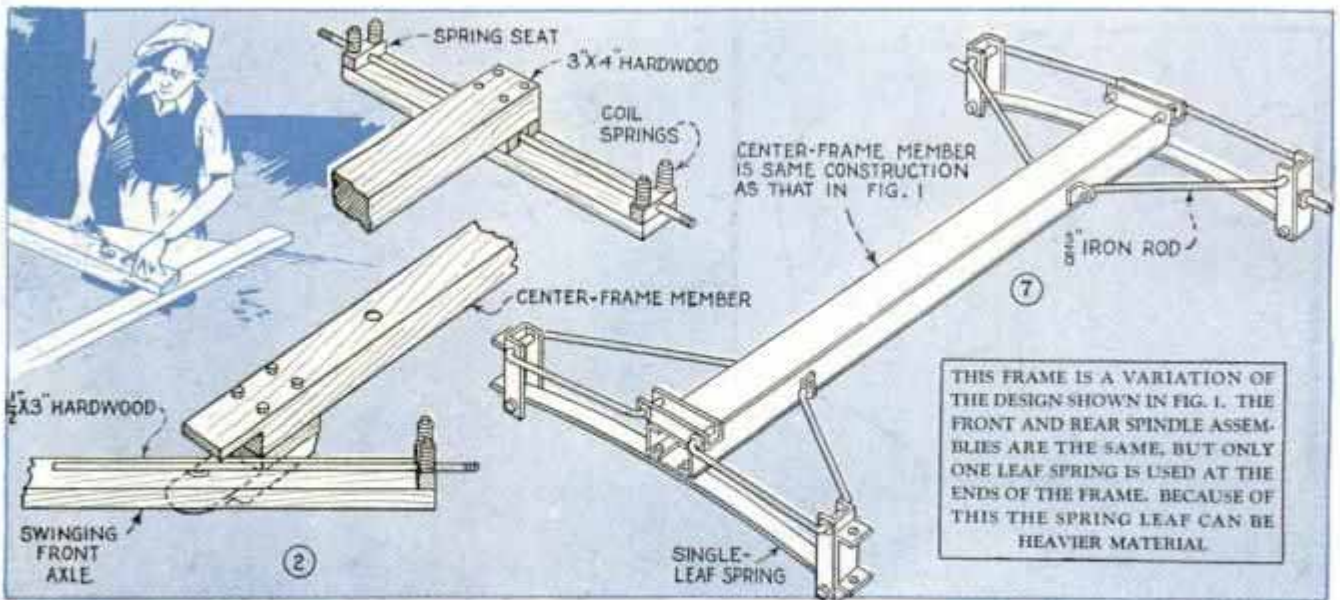
# RACER *for the* SOAP BOX DERBY



have the springs made. The two pairs of leaves must be the same length, have an equal bend, and the eyes at the end of each leaf must be exact size so that there is no play in the assembly. This gives you an individual spring action on all four

wheels. As this chassis has been designed for use with wheels fitted with solid rubber tires, this feature is a decided advantage. Though the solid tire flexes somewhat when striking an obstruction, its resiliency is not enough to absorb the shock,

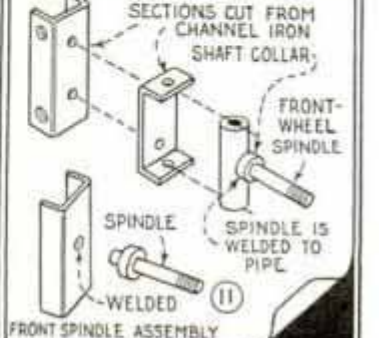
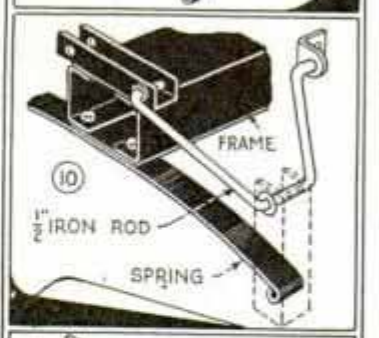
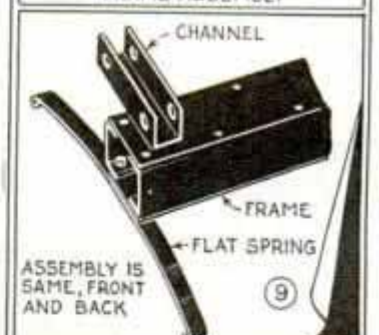
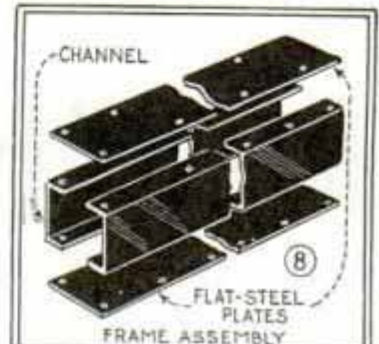




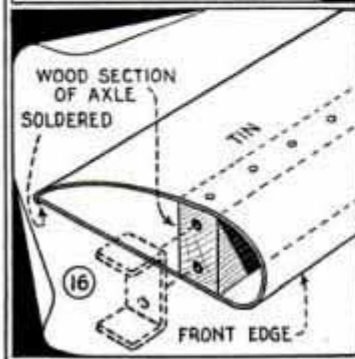
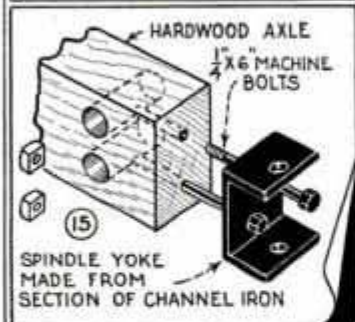
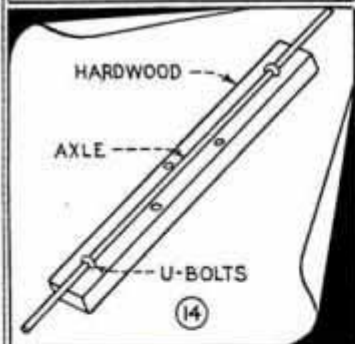
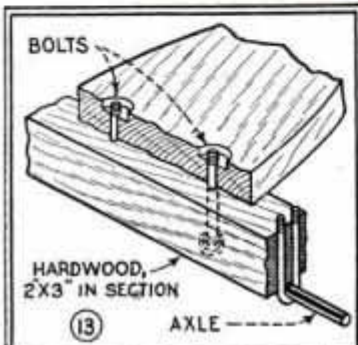
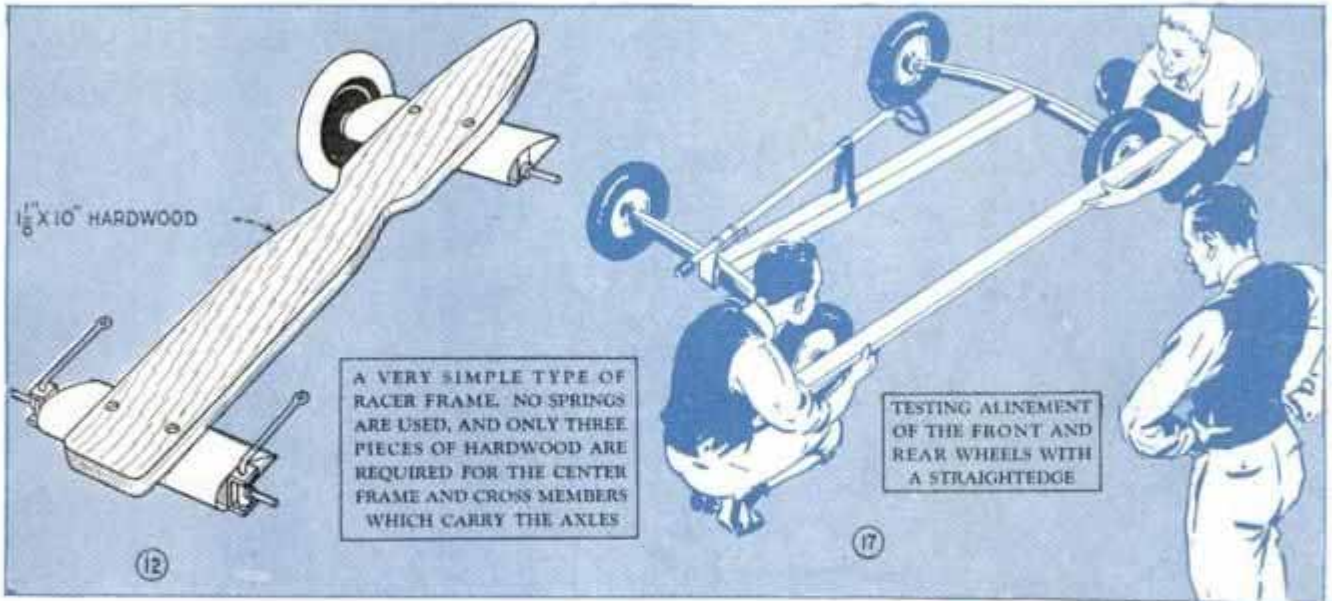
which then passes through the wheel to the frame, setting up vibrations which tend to retard the forward motion of the car and cause it to sway. On the other hand, Fig. 20 shows how the springs flex and absorb the shock.

Notice in Figs. 1 and 7 how the front-wheel spindle is supported by a yoke while the rear-wheel spindle is fastened directly to the spring shackle. This means that the two rear spring leaves must be slightly longer to equalize the tread. If the front and rear springs do not equalize under your weight, you can stiffen the rear springs with a short leaf.

Fig. 7 shows the same type of frame as Fig. 1 except that only one spring leaf is used instead of two. The shackles are held in the vertical position by rods bent and fastened to the frame as in Fig. 10. The rods are held in place with washers and cotter keys inserted in holes drilled through the rods. See also Fig. 27, which shows how a rod of the same shape is keyed in place. Figs. 8 to 11 give the constructional details of the frame in Fig. 7. Front and rear spindles, Figs. 1 and 11, are simply steel rods threaded at one end and cut to the proper length. They should be a true fit in the wheel-bearing sleeves so that the wheel runs true when mounted. The knuckle is best made from a



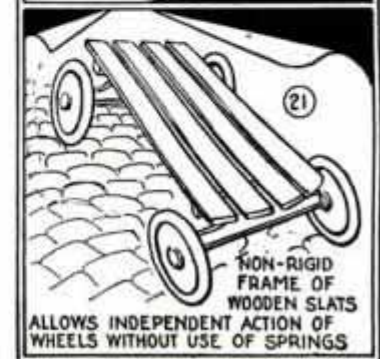
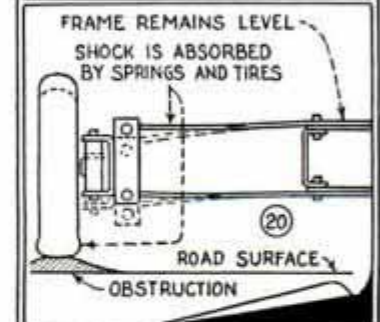
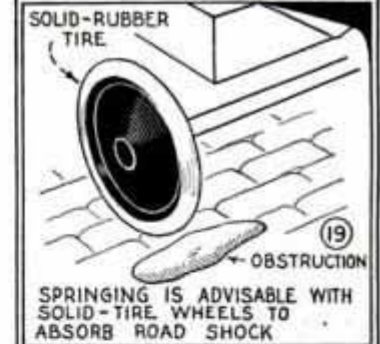
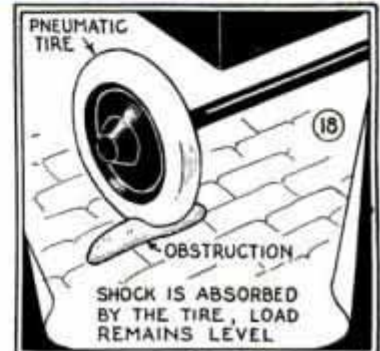




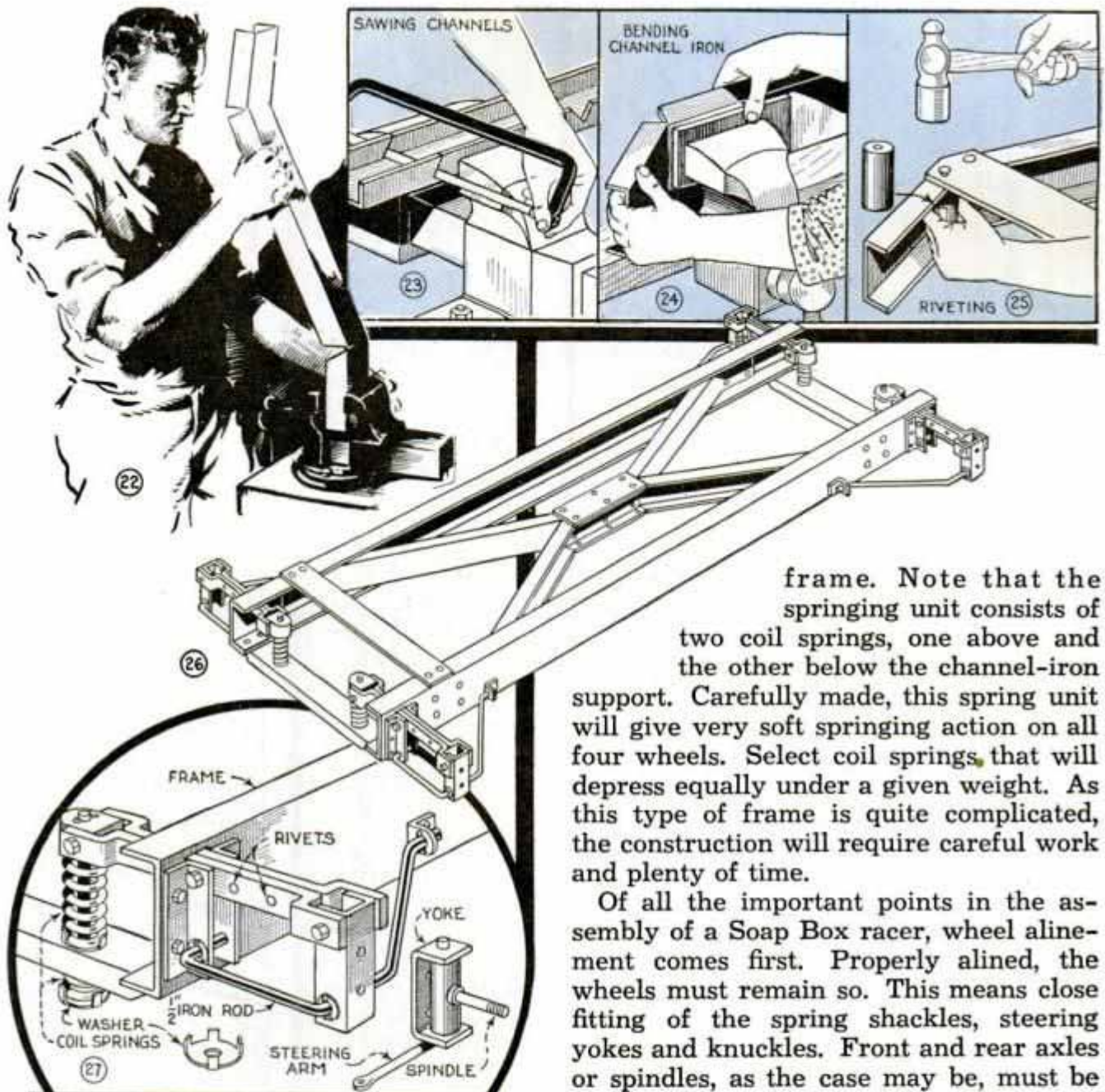
short length of steel shafting, drilled lengthwise to take the steering arm, and at right angles for the spindle. Your local garageman can weld these parts together in a few minutes. Both front and rear spindles are fitted with collars, which are necessary to keep the wheel clear and provide a shoulder against which the bearing sleeves can be tightened. The rear spindles are simply welded to the shackles.

Coil-spring suspension and a swinging front axle are features of the frame shown in Fig. 2 and detailed in Figs. 3 to 6. Each one of the eight springs must depress an equal distance under a given weight. Valve springs from certain types of auto engines will serve very well in the spring assembly shown in Figs. 3 and 6.

Fig. 12 pictures a frame you can build in a hurry, while Figs. 13 to 16 give you the details of its construction. The center member is simply a hardwood plank, sawed to the form shown and bolted to hardwood cross members. With exception of the spindle-yoke fastening, detailed in Fig. 15, the front-spindle assembly is the same as that in Figs. 1 and 11, that is, the automobile type. Though not necessary, you can streamline the axles as in Figs. 12 and 16. No springs are used as the frame is to be fitted with pneu-







*This X-braced frame is fitted with "knees," giving a soft, uniform springing action on each of the four wheels*

matic-tired disk wheels. The pneumatic tire has the property of absorbing road shocks without rebound, as in Fig. 18, making springs unnecessary. Being made of one piece, the frame will spring or twist so that the car will ride over road irregularities as in Fig. 21.

Figs. 22 to 29 give some ideas on bending and riveting channel iron which is necessary to build a frame like the one shown in Figs. 26 and 27. The feature of this frame is the X-brace to give it rigidity. Spring suspension consists of an individual unit made as in Fig. 27, the unit being the same at all four corners of the

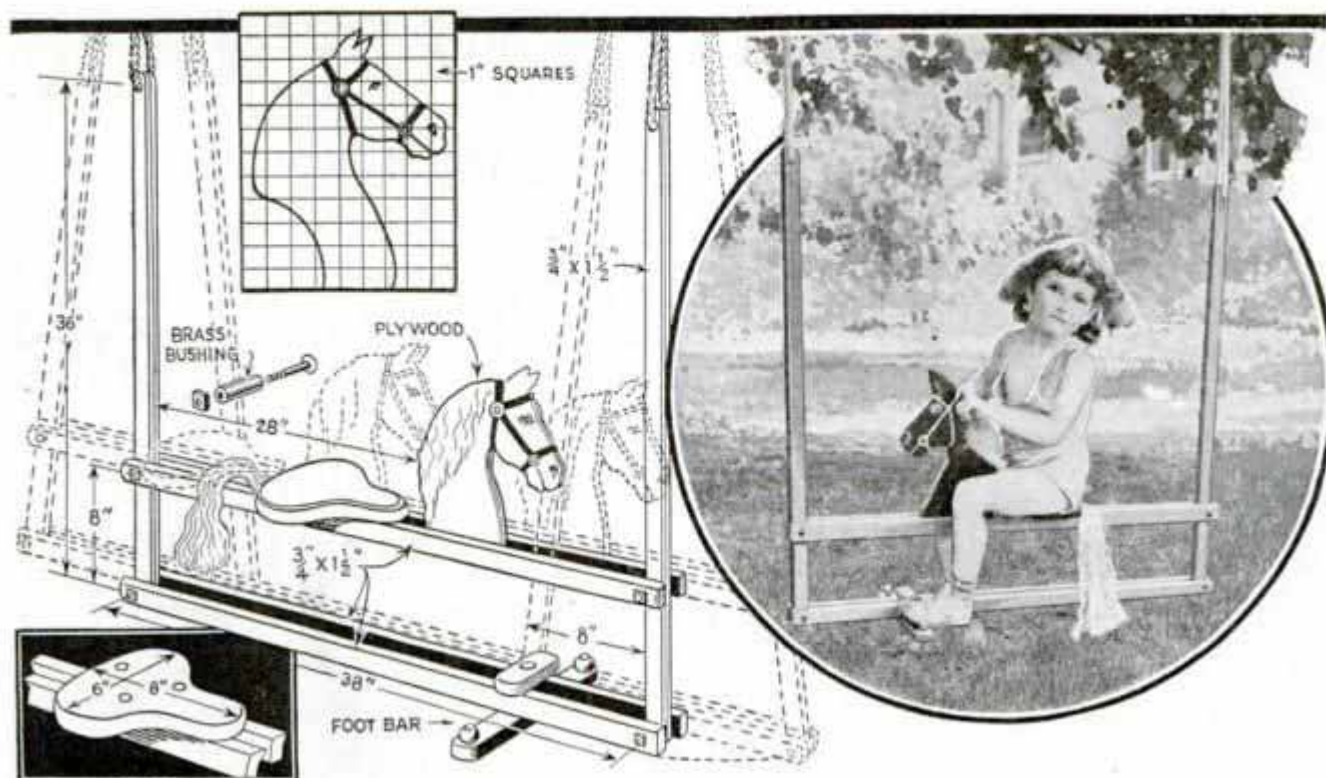
frame. Note that the springing unit consists of two coil springs, one above and the other below the channel-iron support. Carefully made, this spring unit will give very soft springing action on all four wheels. Select coil springs that will depress equally under a given weight. As this type of frame is quite complicated, the construction will require careful work and plenty of time.

Of all the important points in the assembly of a Soap Box racer, wheel alignment comes first. Properly aligned, the wheels must remain so. This means close fitting of the spring shackles, steering yokes and knuckles. Front and rear axles or spindles, as the case may be, must be exactly parallel and at right angles to the frame. There is no caster, camber or toe-in on the front wheels. You can test the front and rear alignment of the wheels by simply using a straightedge as in Fig. 17. This is merely to check assembly; the wheels cannot be aligned permanently until the steering gear is fitted. Of course, pneumatic-tired wheels can be used on any of the frame types shown, but they will run up the total cost, unless fitted to a simple frame like that in Fig. 12 where expense on the frame alone is negligible.

*General dimensions on the designs shown in this article, together with some suggestions on cost, and also various types of steering equipment and brakes, will be given in next month's issue*



## Hobby-Horse Swing Gives a Thrilling Ride



*This unusual swing will appeal to children, is perfectly safe for them to use and is a means of wholesome exercise*

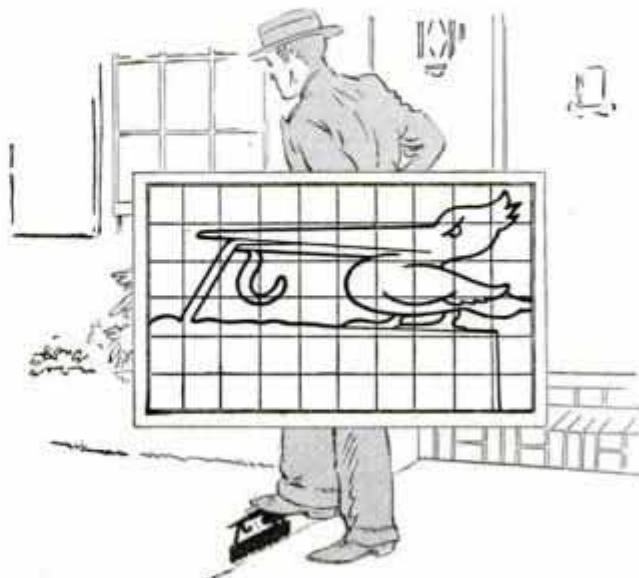
Suspended from a large tree limb or a special framework, this unusual swing, with its brightly colored horse's head, flowing mane and tail, will give small children a thrilling ride. Any light wood will do for the framework, which is pivoted at all joints, bushings of brass tubing or pipe being used to avoid squeaks and assure

long wear. The horse's head is  $\frac{1}{2}$  or  $\frac{3}{4}$ -in. plywood while the mane and tail are unraveled hemp rope. A short length of dowel through the head serves as a handhold. A pleasing color scheme can be had by painting the frame red, green or other bright color and the head brown, black, cream or dappled gray.

## Pelican Shoe Scraper Adds Touch of Novelty to the Lawn

Tugging away at a large earthworm, this pelican is an appropriate lawn ornament located just outside your door, where it also serves its real purpose as a shoe scraper. It is cut out of flat iron, using a metal-cutting scroll saw. For the straight cuts, a hack saw will be of service. Smooth all the edges with a file and paint the pelican white, its beak yellow and the earthworm red. The pelican sets on a small concrete block sunk into the ground.

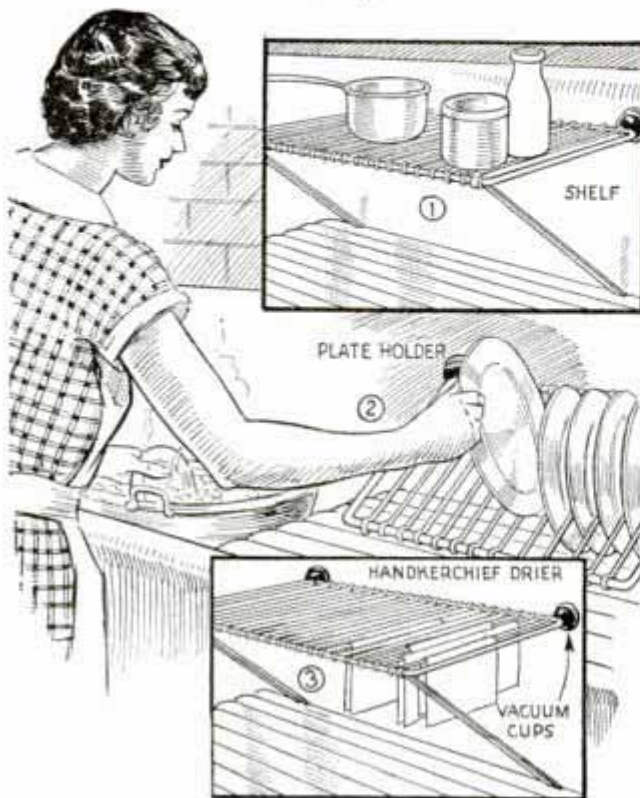
☐ Ordinary photographer's hypo, 1 lb., dissolved in water, 1 gal., makes an excellent solution to remove iodine and mercurochrome stains from cloth. After dissolving the stain, the garment should be washed thoroughly to remove the hypo.



*A pelican-shaped shoe scraper that you can cut out of heavy metal with a scroll saw*



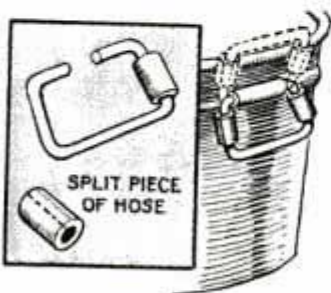
## Adjustable Shelf Above Sink Has Many Uses



The shelf can be folded against the wall and held with a hook when not in use

Hinged to the back of a sink by means of two large vacuum cups, a wire shelf from an icebox will serve many purposes. Held in a horizontal position by two heavy wire braces, as in Fig. 1, the shelf is handy for pans, bottles and other articles. Or, it makes a dandy drying rack for towels, handkerchiefs and wash cloths, as in Fig. 3. When the shelf is dropped down on the sink, it will provide an excellent support for draining plates as in Fig. 2.

## Bumpers on Wash-Tub Handles Protect Your Knuckles



Wash tubs may be carried without squeezing your knuckles if the handles are fitted with short pieces of garden hose as indicated. Spread the handles

apart and remove them from the tub so that the hose can be slipped over the ends. Or, if more convenient, cut the pieces of hose lengthwise and slip them

over the handles, wrapping with friction tape to keep them in place. When the tub is carried, the hose comes against the rim, keeping the handles out far enough so that the load can be carried comfortably.

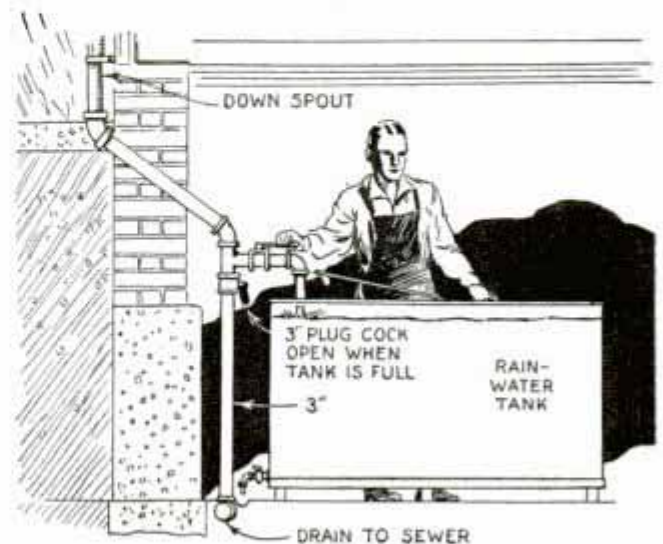
## Pipe Knocked Against Cork to Remove Ashes

Glued in an ash tray as indicated, a large cork forms a resilient knocker for emptying ashes from smoking pipes with minimum danger of breaking them. Use any all-purpose cement for the glue job, making sure that the surface of the tray is clean. The cork can be stained to match the tray.



## Supply of Rain Water in Home at Little Cost

If the eave downspouts on your home lead into the basement, you can have a supply of soft water for the cost of a small storage tank and a few pipe fittings. Install a tee and a shut-off valve in the pipe leading from the downspouts and connect another valve in the tee with a short nipple. From this, run a pipe to your tank. To fill the tank, close the valve in the downspout line and open the other one.

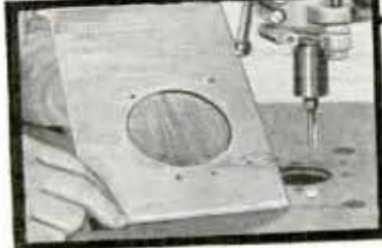
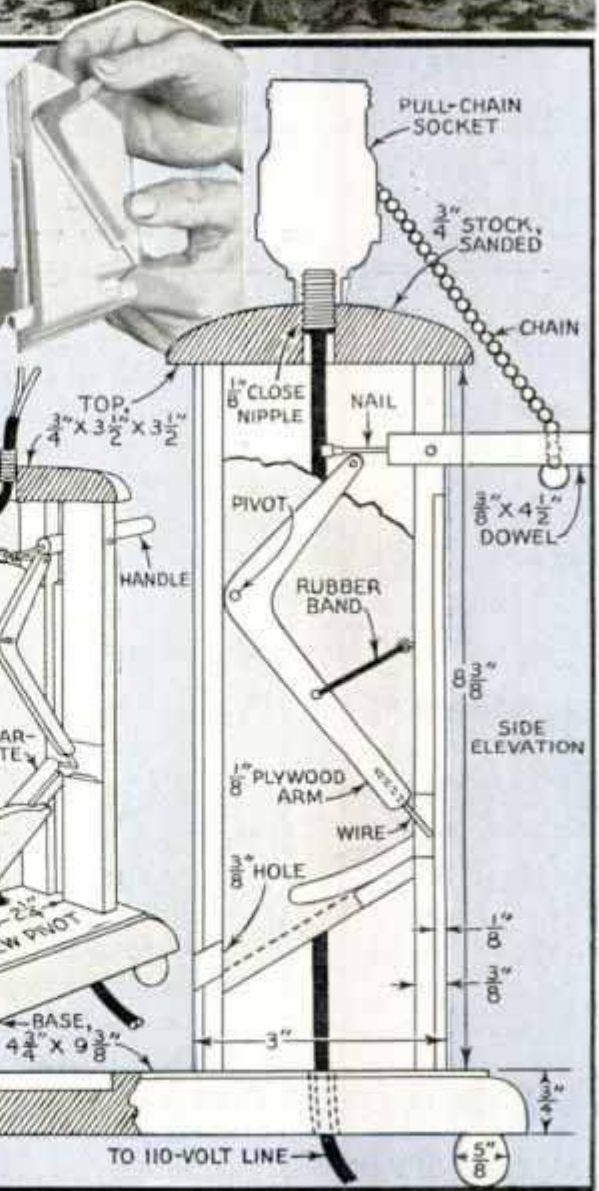
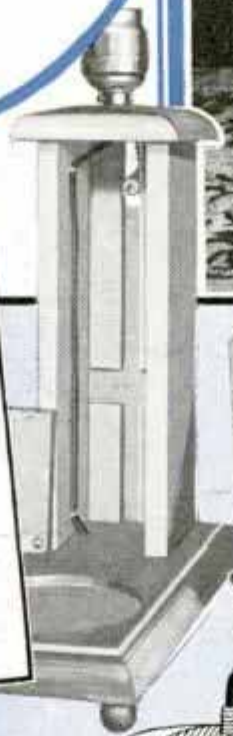


Storage tank in basement for rain water is filled from eave downspouts



# Old Town-Pump LAMP and CIGARETTE DISPENSER

With a base resembling an old wooden water pump, this lamp is not only turned on and off by pushing down the pump handle, but the surprise comes when you lift the handle, which pushes a cigarette out near the bottom, just over an ash tray held on the base. The plywood lever arrangement and cigarette-dispensing slide are concealed inside the pump as shown in the photo and cut-away drawings. Note how the back is grooved to allow as much travel of moving parts as possible so that the dimensions of the pump may be kept small. The recess for the ash tray is routed, which can be done on a drill press as shown in the lower photos. Ten cigarettes can be placed inside by opening the pivoted front panel.





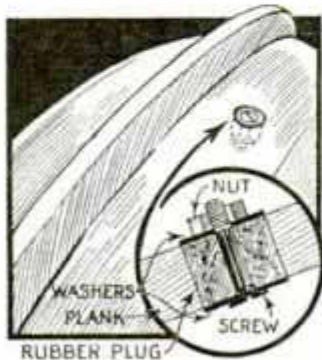
## Skis Locked to Building Studs Hold Their Shape



*Adjustable crosspiece slips behind skis, springing them to shape to prevent warping*

When storing my skis for the summer, I always fasten them between two studs as shown in the drawing, so that they retain their shape. Any building that is weatherproof and has the studs exposed will do. Two crosspieces are nailed to the studs about 6 ft. apart, after which the skis are put in place, face out, and a third crosspiece is nailed under the curved ends. The center crosspiece is then slipped in place behind the skis. This does not have to be nailed as pressure will hold it.—Paul Beckman, Omaha, Nebr.

## Expanding Plug for Boat Drain



If your small boat has a drain hole in the bottom, substitute a rubber plug for the wooden one and there will be no danger of damaging the planking when removing or putting in the plug. A large rubber bottle stopper is just the thing for this purpose. Select one that will fit the hole snugly, drill it through the center to take a small brass

machine screw and insert the assembly in the hole, using brass washers on both ends of the plug. These should be smaller than the diameter of the hole in the boat, so that when the nut is drawn up tightly the rubber will be expanded to a tight fit.

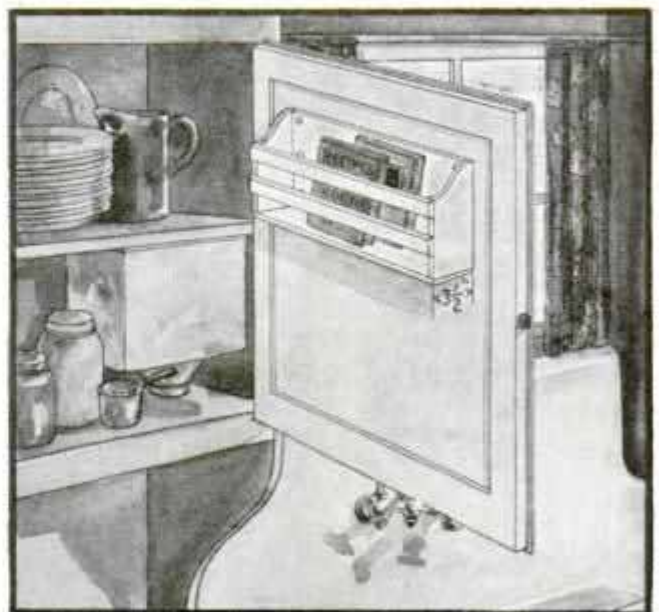
## Food Cans Are Safely Gripped While Opening Them

Made from a piece of heavy spring wire, this clamp will hold a can rigidly while removing the top with a can opener so that there is no possibility of cutting the hands on the rough edges of the tin. A piece of rubber hose slipped over the clamp provides plenty of friction.



## Cookbooks Stored in Rack on Cabinet Door

Instead of storing your cookbooks and recipe files on a shelf or in a drawer where it is often inconvenient to reach them, use this simple rack, which is screwed to the inside of one of the cabinet doors. Being only 3½ in. deep, the rack does not interfere with articles on the shelves.



*Your cookbooks are always at hand for instant reference when kept on this narrow rack*

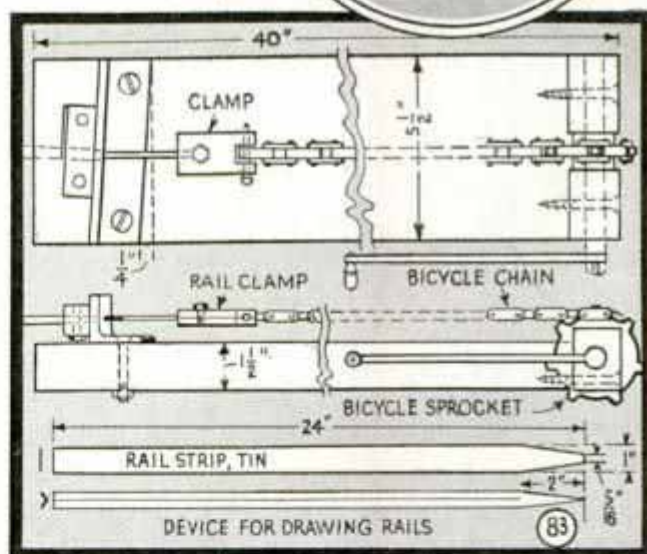


# Shortcuts for MODEL RAILWAY BUILDERS

## PART V—TRACK CONSTRUCTION

**B**EGINNING with Fig. 81, you have a solution to the problem of building suitable track for your model. With the fixture shown a hundred feet of rails can be drawn in a very short time and each section of rail will be exactly the same size as the preceding one. The secret of this precision is the steel forming die shown in Fig. 82. It's quite a trick to make the die, but once you have it you are equipped to turn out model trackage on a production basis.

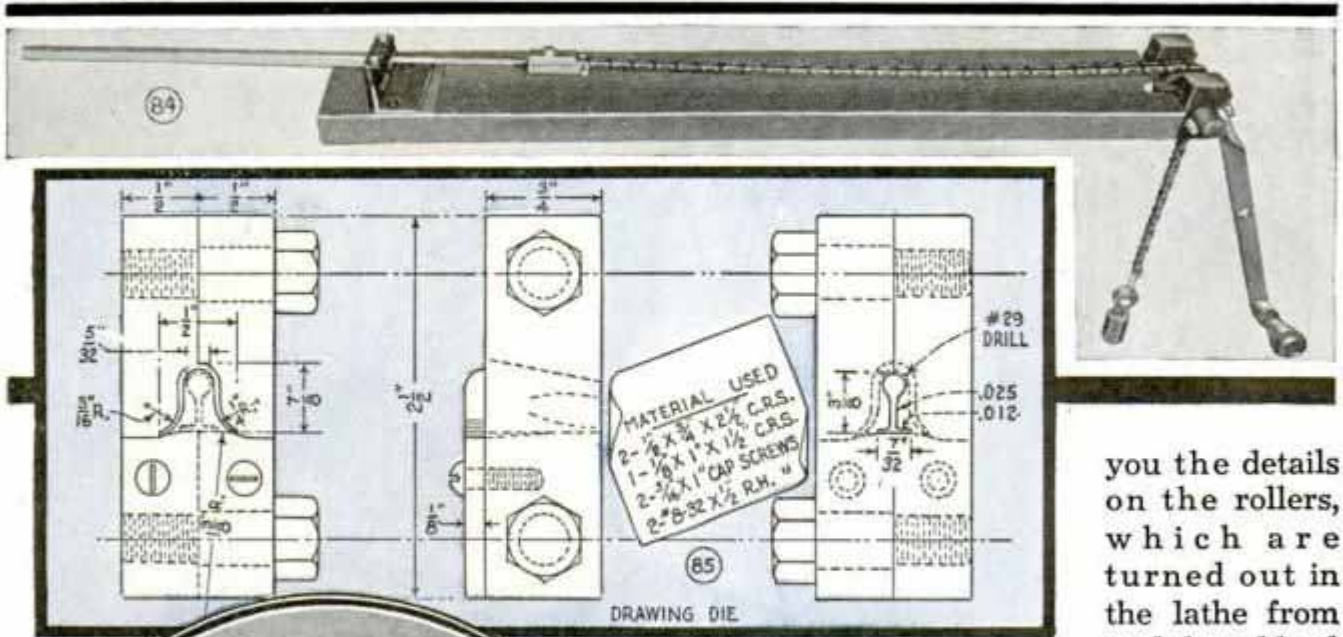
Figs. 83 to 87 inclusive show the die in detail. After the necessary holes have been drilled and tapped, the rest of the job is simply a matter of very careful work with a file. Note especially that the rail-forming section of the die is tapered, that is, the opening tapers from the rough form to the finished form of the rail. Remember that the size of the die determines the size of the rail. Usually the pressed or rolled rail is formed from ordinary tin of the thickness known to the trade as "95-lb. plate," so you will have to make this allowance when bringing the die to the finished size. A sample piece of ready-made rail will help in determining the exact size required. When you finish filing, polish the die with fine emery cloth, to remove all file marks. This is very important, for if the inner surface of the die is rough it will give trouble. When the die is finished you go back to Fig. 83 for the details on the construction of the fixture for drawing the rail strip through the die. As will be seen from Figs. 83 and 84, this calls for a length of bicycle chain, a bicycle sprocket, a base of hardwood and a clamp made from two pieces of cold-rolled steel, each  $\frac{1}{4}$  by 1 by 2 in., bolted together with a  $\frac{3}{8}$  by  $\frac{3}{4}$ -in. capscrew. A



slot slightly wider than the bicycle chain is cut in one end and a  $\frac{3}{16}$ -in. hole drilled transversely takes a pin which holds the clamp to the chain. A small weight is attached to the opposite end of the chain to hold it on the sprocket.

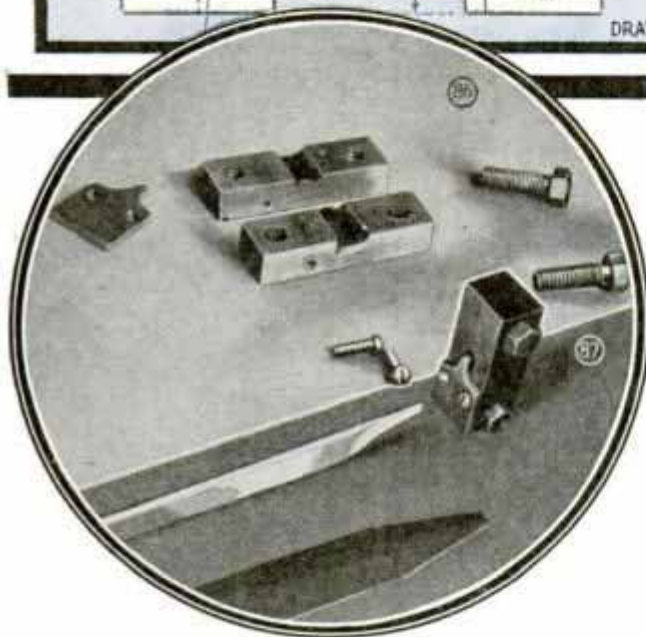
Now note especially the position of the angle-iron bolster plate in the upper detail in Fig. 83. When you mount this on the hardwood base, bore the holes in the wood slightly oversize so that the position of the bolster can be changed readily. This change may be necessary to make the rail draw straight. Lastly you provide bear-





you the details on the rollers, which are turned out in the lathe from cold-rolled

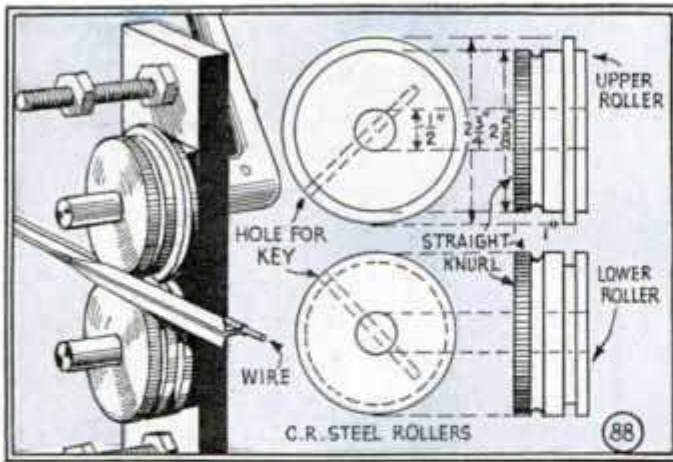
steel. The one essential thing in the construction is that the rolling unit be assembled accurately and that it be rigid. This means accurate work in the assembly of the mill. The die, Fig. 89, should be filed to shape and to the exact size required and then lapped to a glass-smooth surface with progressively finer grades of emery cloth. Fig. 89 shows the assembly of a frame of cold-rolled steel, which is designed to keep the rollers exactly in line. A positive adjustment is provided by two threaded machine bolts, each fitted with three nuts. The rollers are keyed to short lengths of 1/2-in. steel shafting as in Fig. 88. When turning the rollers, it should be noted that the concave groove turned in each is an exact semicircle. The size of this groove is determined by the size of the wire around which the tread or ball is rolled. Also, allowance must be made for the thickness of the tin used. The rollers form the web and tread of the rail and the base is formed in a die as the strip passes through the rollers. The wire over which the tread is rolled may be pulled out after rolling the rail or it may be left in place and used to join sections of the track together. Before starting the strip through the rollers it is bent around the wire and the end beveled and flared slightly so that the strip will start easily through the die. The knurled sections of the roller press the web to shape and at the same time tightly grip the tin and pull it through as the crank is turned. Clearances between the rollers therefore have to be calculated with care. For example,



ings and a shaft for the sprocket, a crank of about 10-in. throw and the fixture is ready for work as you see it in Fig. 84. Figs. 83 and 87 show you how to cut the end of the rail strip and how to bend it for entrance into the die. In drawing rail in this fashion the strip of tin must be lubricated, otherwise it will stick and buckle in the die. Experiment has shown that a solution of soapy water applied to the rail strip with a sponge is just the thing. However, in using this solution as a lubricant, it is necessary to be careful that the die does not rust. Each time you finish using it the die should be taken apart, wiped dry, and thoroughly oiled.

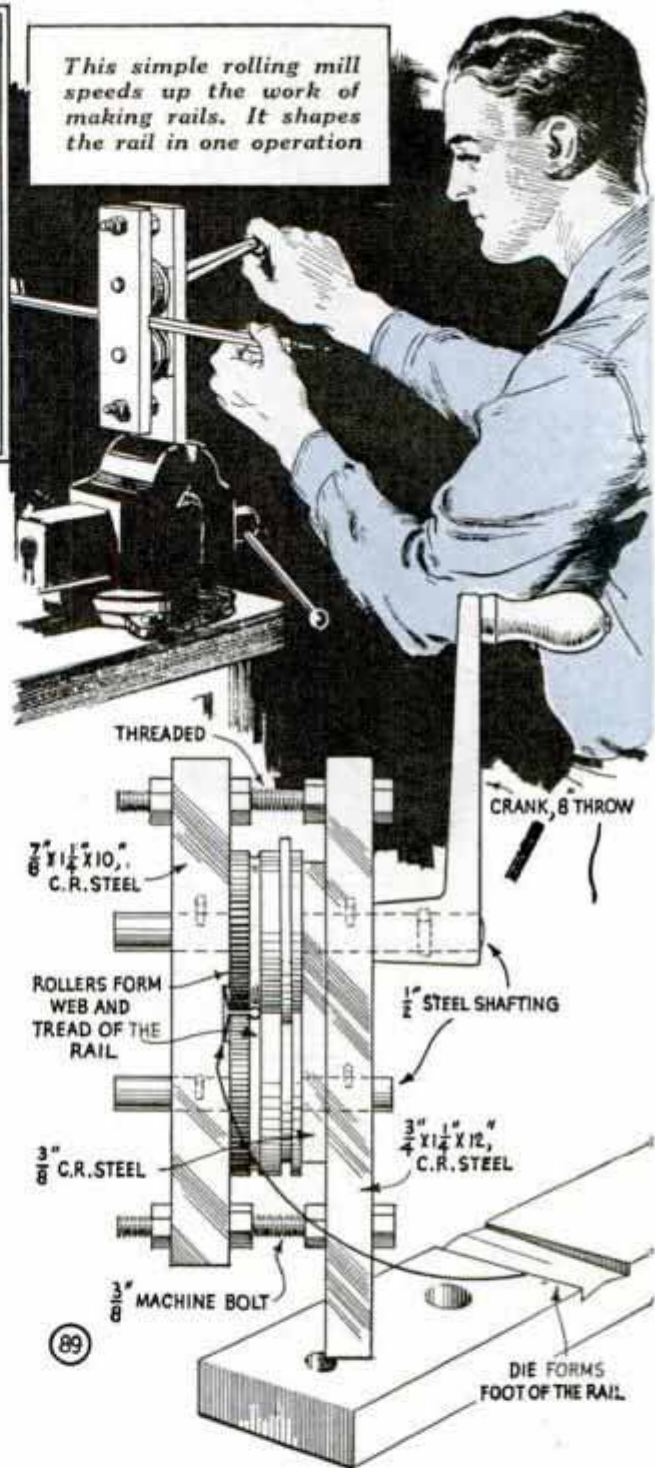
Figs. 88 and 89 turn up another device for making rails. Here the strip is rolled instead of being drawn to shape. To build this rolling mill you will have to have some machine work done. Fig. 88 gives





the space between the knurled sections should be slightly less than twice the thickness of the rail strip. Also, you have to see to it that the flange on the upper roller is a close fit in the groove cut in the lower roller. Holes for the shafting carrying the rollers are drilled slightly under-size and are then reamed to exact fit. Notice, too, that you have to run back the threads on the two bolts used in assembling the frame, this being necessary to space the nuts as indicated in Fig. 89.

Both the rail-making devices just described form a rail with a round tread similar to the commercial product. Now, the details in Fig. 90 to 93 inclusive give you still another type of precision die which forms a rail with a square tread like that in Fig. 91. Though this arrangement is a somewhat more complicated affair, it forms a rail which is an exact miniature of the prototype. There are really two separate dies as you will see from Figs. 92 and 93. The first forms the rail into a U-shaped section, Fig. 92. The second fixture completes the rail in three separate operations as in Fig. 91. Fig. 90 shows the fixture assembled for the second operation shown in Fig. 91, that of forming the square tread. A length of cold-rolled steel  $\frac{1}{8}$  in. square is bent at one end to form an eye as in Fig. 93. This is shown in place in the jig in Fig. 90 and is for the purpose of forming the square tread. When the rail section has been completed through the four operations shown in Fig. 91 this rod is removed from the rail. You will notice that the dimensions given in Figs. 91 and 93 are for rails in the  $\frac{1}{2}$ -in. scale, but by changing the size of the die to suit you can make rails in  $\frac{1}{4}$ -in. scale just as easily. In either case you use cold-rolled steel for all parts



of the die. Faces of the die should be polished bright and should be greased while in use. Fig. 92 shows the first operation, that of forming the rail strip into a U-shape. The die is set to give a width of  $\frac{1}{8}$  in. plus the thickness of the tin used. Then a strip of flat cold-rolled steel is filed down until it will slip into the die with a thickness of rail tin on each side. This done, you're ready to begin work by bending the strips of rail tin to a V-shape, the bend being in the center line. The strip is then set into the die with the steel strip edgewise on top. Light taps with a hammer force the whole into the die as in



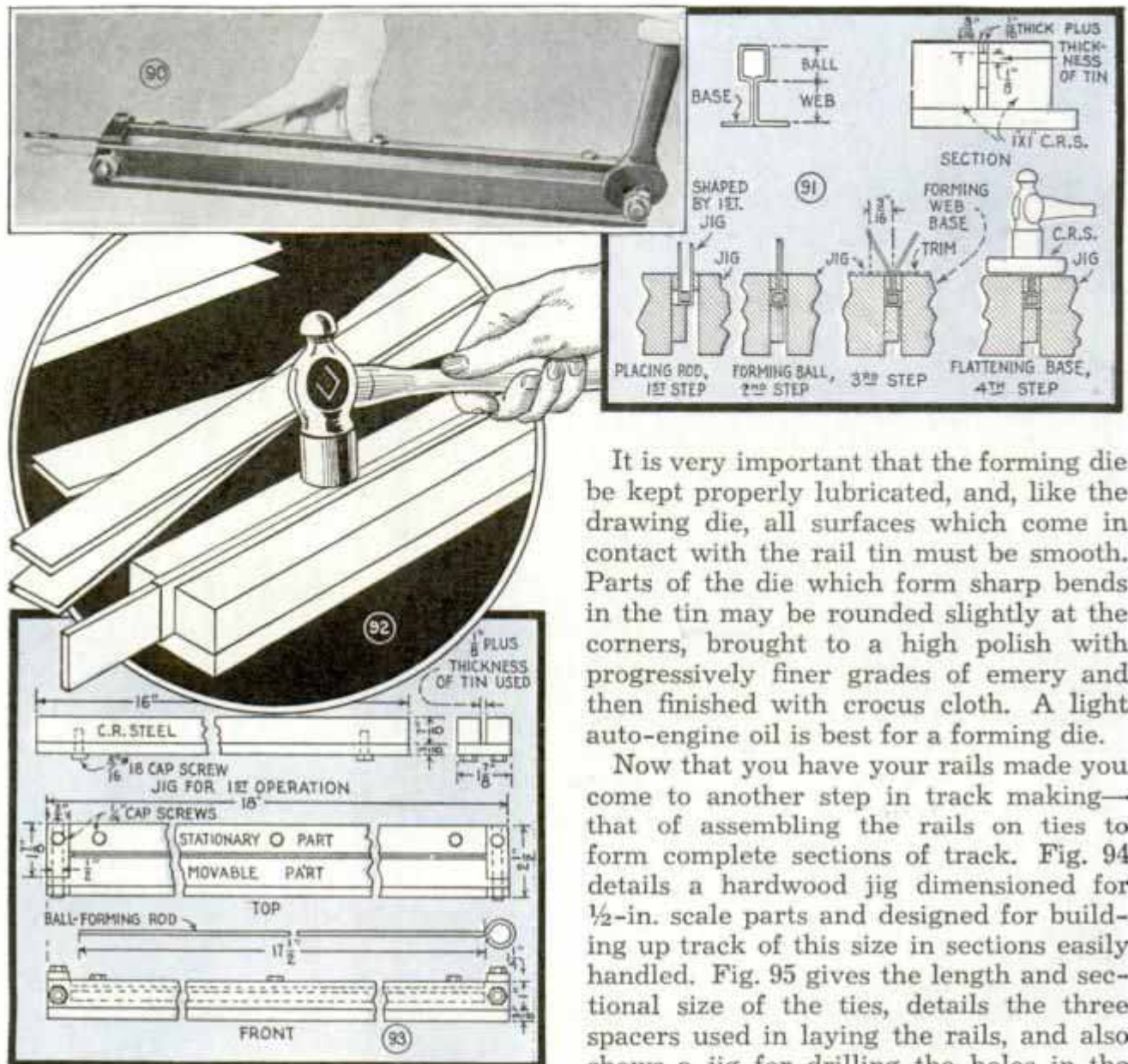


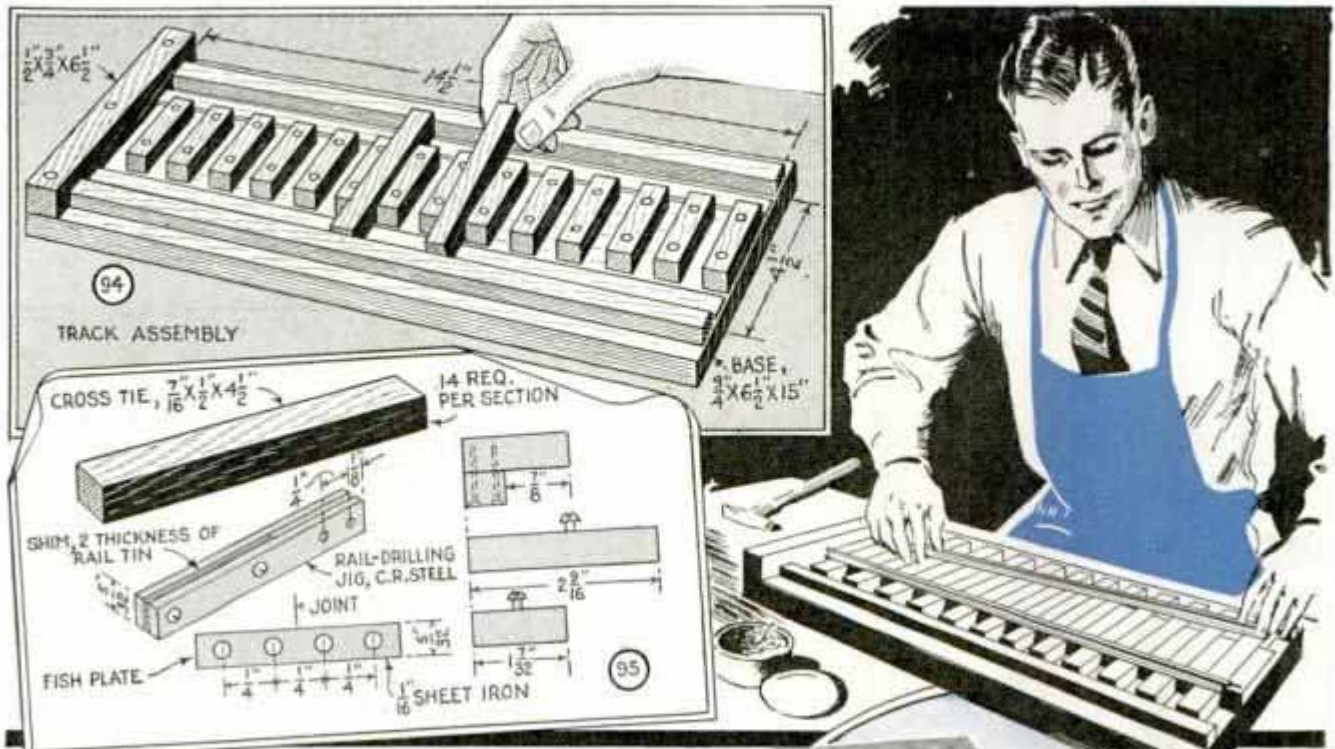
Fig. 92. You will make time by completing this operation on whatever number of rails you are going to form. Then comes the first step in forming the rail. The  $\frac{1}{8}$ -in. rod around which the tread is formed is placed at the bottom of the U-shaped rail strip. The strip is held in the position shown with a strip of cold-rolled stock pinned to the stationary part of the die with  $\frac{1}{16}$ -in. steel pins. Then the two strips which form the web are also pinned in position shown in Fig. 91. With all these parts in place as shown the die is closed by tightening the bolts at the ends as in Fig. 90. After tightening the die, the projecting sides of the rail strip are spread as in the third step in Fig. 91. Then a strip of flat steel placed on top and tapped lightly with a hammer forms the base of the rail as in the fourth step.

It is very important that the forming die be kept properly lubricated, and, like the drawing die, all surfaces which come in contact with the rail tin must be smooth. Parts of the die which form sharp bends in the tin may be rounded slightly at the corners, brought to a high polish with progressively finer grades of emery and then finished with crocus cloth. A light auto-engine oil is best for a forming die.

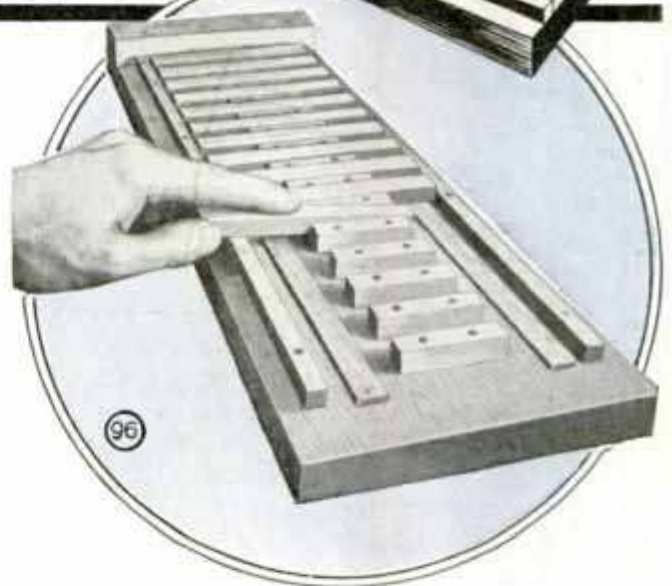
Now that you have your rails made you come to another step in track making—that of assembling the rails on ties to form complete sections of track. Fig. 94 details a hardwood jig dimensioned for  $\frac{1}{2}$ -in. scale parts and designed for building up track of this size in sections easily handled. Fig. 95 gives the length and sectional size of the ties, details the three spacers used in laying the rails, and also shows a jig for drilling the holes in the ends of the rails to take the screws holding the fishplates. First, you cut the ties to exact size and place them in the jig as in Fig. 96. Then the rails are placed on the ties and positioned with the spacers. For rail spikes you can use brass escutcheon pins. Fasten the ends of the rails first, then spike both sides of one rail using the spacer on each tie to insure that the ends of the ties all project the same distance from the base of the rail. Then fasten the second rail, using the spacer between to get the width exact throughout the length of the section.

True reproduction of the full-size track requires that you use fishplates for joining the track sections. Fishplates can be made of tin slightly heavier than that used for the rails. With the ends of the rails jig-drilled you simply fasten the plates to the rails with small bolts. Though all the

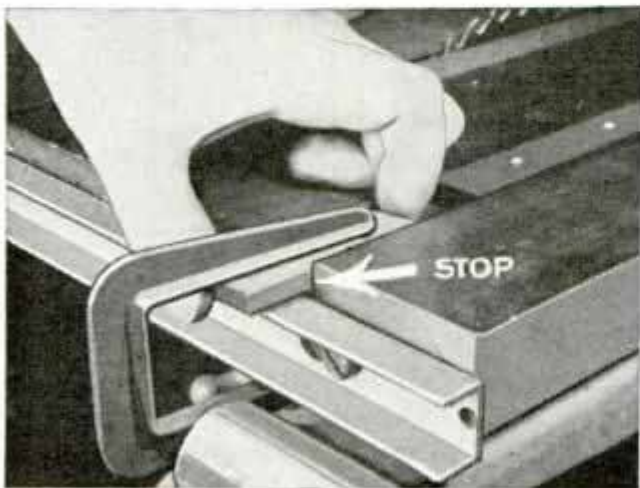




track-laying fixtures shown in Fig. 95 are dimensioned for  $\frac{1}{2}$ -in. scale track you can easily reduce the size for the  $\frac{1}{4}$ -in. scale. When using the rails made with a round tread, some model makers join the track sections with dowel pins made of wire. This saves the time of making the fish-plates and also the drilling of each end of the rail. The wire dowels are of such size that they can be pressed easily into the open end of the round tread. Rails made of tin can be blackened by heating to a dull red and then allowing to cool slowly. Ties can be made more realistic by dipping in a dark shingle stain.



## Miter-Gauge Stop to Cut Duplicate Work on Circular Saw



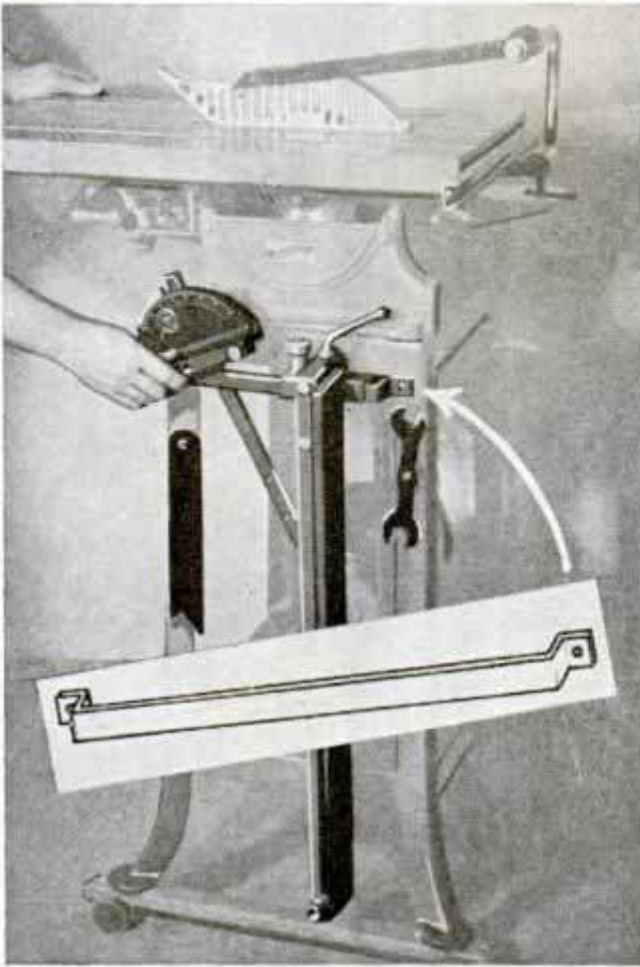
When several pieces are to be cut the same depth, this miter-gauge stop assures a uniform job

When a number of duplicate pieces are to be cut on a circular saw, and it is desired to cut into the wood a predetermined distance, a stop can be placed at the back of the table to control the distance which the gauge can travel. As shown in the photo, this consists of a strip of wood held in the gauge slot with a C-clamp, and adjusted so that it will stop the end of the gauge slide at the required distance.

☞ To remove coffee stains from a tablecloth or napkin, lay it over a hot electric iron and apply glycerin to the stains with a sponge or brush; then the stain can be washed out easily.



## Handy Rack on Circular Saw Holds Accessories



*If your saw sets on a workbench the rack can be screwed to it within convenient reach*

The problem of where to store the miter gauge and ripping fence of your circular saw is quickly solved with this rack. It is a piece of flat iron bent to the shape shown and bolted to the saw stand. Machine screws, tapped or bolted through the legs of the stand, provide a place for the arbor wrench and push stick so that they are within easy reach. A push block for the jointer may be hung on the opposite side.

## Hot Vegetables Drained in Pan with Cake Turner



With one side cut off rounding as shown, a perforated cake turner makes a good strainer for draining hot vegetables, the long handle enabling

the user to keep the hands away from steam. The rounded side helps to remove the vegetables from the pan after they have been drained.

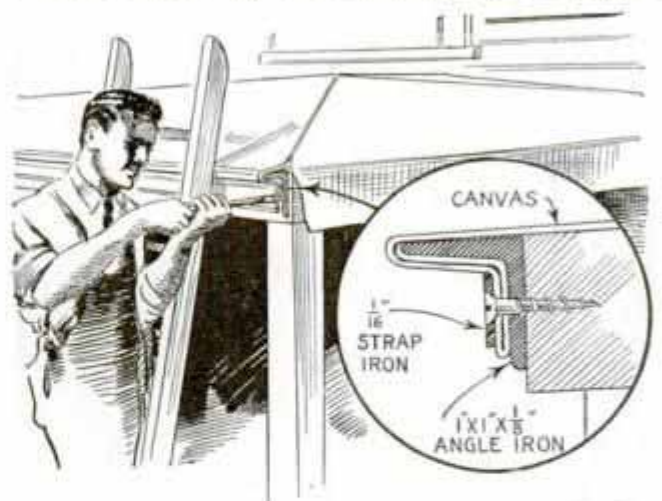
## Heat Shield for Toasting Fork Keeps Hands Cool

The next time you are toasting frankfurters or marshmallows on a picnic or hike, and find that the fire is too hot to hold your toasting fork near it, slip a paper plate over the handle for a shield. Use the largest plate available so that it will protect both your hand and arm from the heat.



## Porch-Deck Covering Fastened Securely at Edges

Instead of lapping a canvas deck over the edge of a porch roof and tacking it with large-head nails, from which the canvas soon pulls loose, screw a length of angle iron to the edge of the roof as shown, bring the canvas down over this and then bind it in place with a strip of strap iron. Before fastening the canvas in place, give



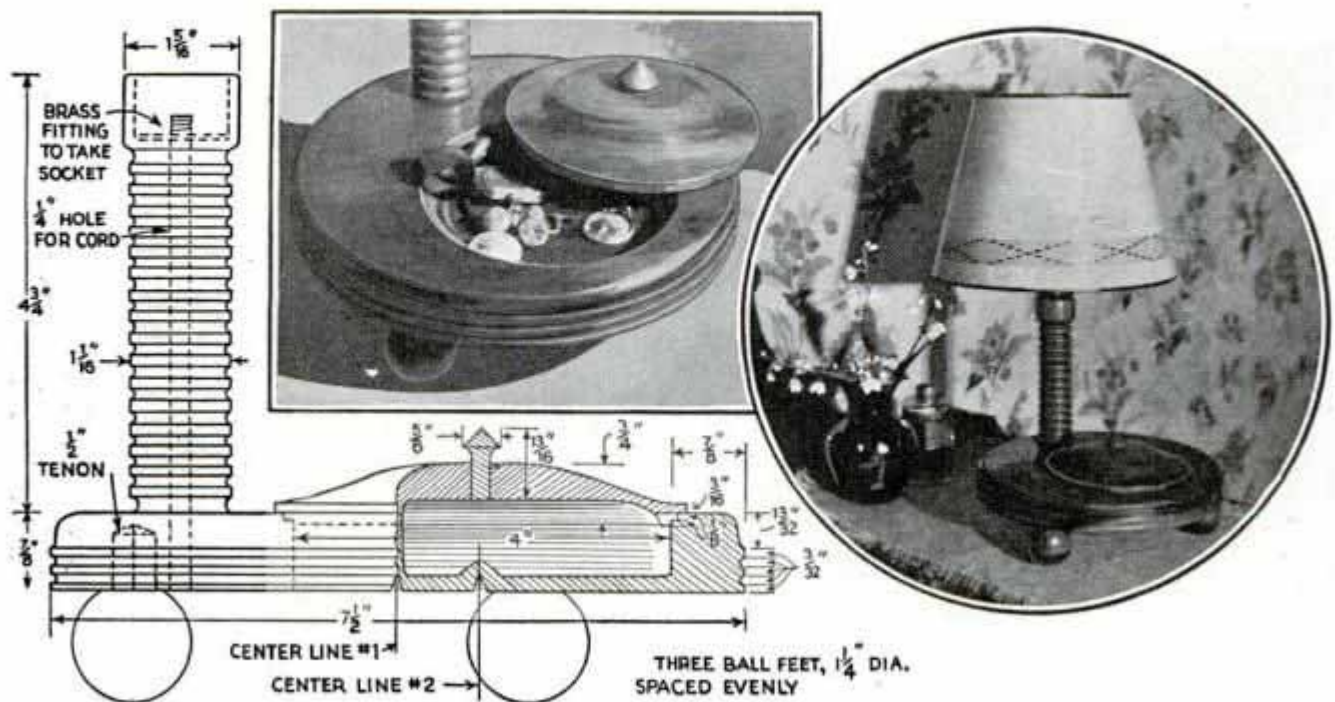
*Canvas deck fastened to edge of porch roof with angle iron will not pull away*

both it and the angle iron a liberal coating of paint, completing the job while the paint is still wet.

☛ For even rinsing of dishes, insert an aluminum clothes sprinkler into the faucet.



# Dressing-Table Lamp Has Jewel Box in Base



*Used in pairs on your dressing table, this lamp adds a pleasing touch to the bedroom, and the jewel box with its hollowed cover holds many articles*

For the boudoir, this small lamp, turned from rare wood, and fitted with a simple shade in keeping with the base, has the added advantage of serving as a jewel box. The base is turned on two different centers, one being used to turn the base proper and the other to form the depression for the box. This is covered with a neat lid, while at the back rises a short spindle, which is capped with a socket and light. Three round balls, each with tenons,

form the feet. They are equally spaced with one lined up at the back with the spindle. This is turned to shape with a tenon on the lower end to fit in a hole bored in the base midway between the edge of the box depression and the back edge of the base. An interesting variation of the spindle is to carry the idea a little farther and provide a short horizontal arm at the upper end to bring the socket directly over the center of the base.

## Loose Soil in Trench Settled Quickly by Running Water

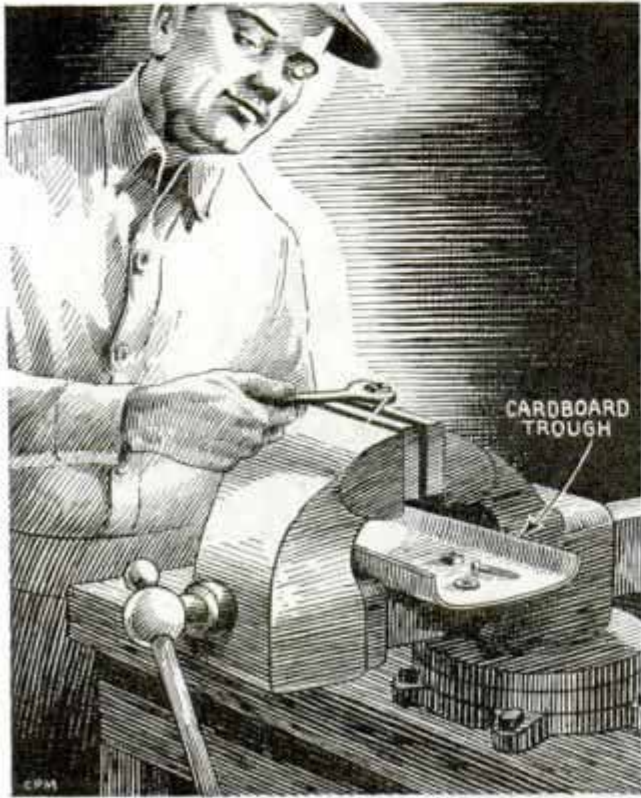
Injected deeply into a filled trench dug in your lawn, water under pressure will settle the loose soil in a few hours so that the sod, taken up in squares when starting the trench, can be reset before it dies. To wet the soil, slip a length of pipe into the end of your garden hose, turn on the water and insert it into the trench as shown. Let the water run a few minutes and then raise the pipe a foot or two and repeat to thoroughly saturate the soil. Make the injections at intervals of three or four feet the entire length of the trench.

By adding a small quantity of aniline red to dark ink, the writing will have a changeable bronze color when dry.





## Trough Catches Small Parts Dropped from Vise



*Small parts handled in a vise are caught in this trough if they happen to drop*

When screws and other small parts are held in a vise for filing, sawing or similar work, you won't lose any of them when the vise is released if you slip a piece of cardboard between the jaws as shown. The cardboard should be cut wide enough so that the edges curl upward to form a trough when it is slipped into place.

## Candle Holder from Jackknife for Campers' Use



Every camper who carries a jackknife has a means of quickly improvising a "candlestick" for use around the camp site. Just open a blade at each end of the knife as shown, stick one into the bottom of the candle and the other one into a near-by tree or one of the tent poles, first impaling a

chip or piece of bark over the blade holding the candle to serve as a drip pan.—G. E. Hendrickson, Argyle, Wis.

## Butter Patties Cut Uniformly with Old Table Fork

It's no trick to cut butter into uniform patties if you use an old table fork with two of the tines removed. Grind or file one side of the remaining tines to provide cutting edges. One tine serves as a guide as the other one cuts the butter.



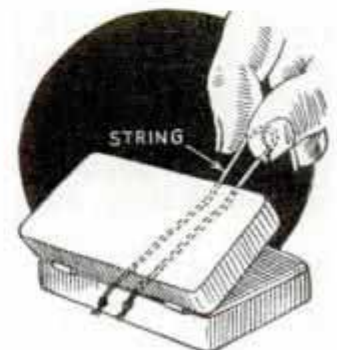
## Guard on Carving Knife

It is a good idea to solder guards on large knives used about the kitchen to prevent the fingers from slipping down over the sharp edges. It takes only a few minutes to bend a small piece of metal at right angles and solder it to the knife blade near the handle.



## Pull String Opens Stamp Pad

When the lid on a stamp pad becomes bent or dented around the edges so that it is hard to open, knot the ends of a strong cord and slip it under the lid as shown, pulling the knotted ends close against the back. The looped end of the string projecting from under the lid provides a good grip for opening it, and does not interfere with closing.













## Imitation Microphone for Plays

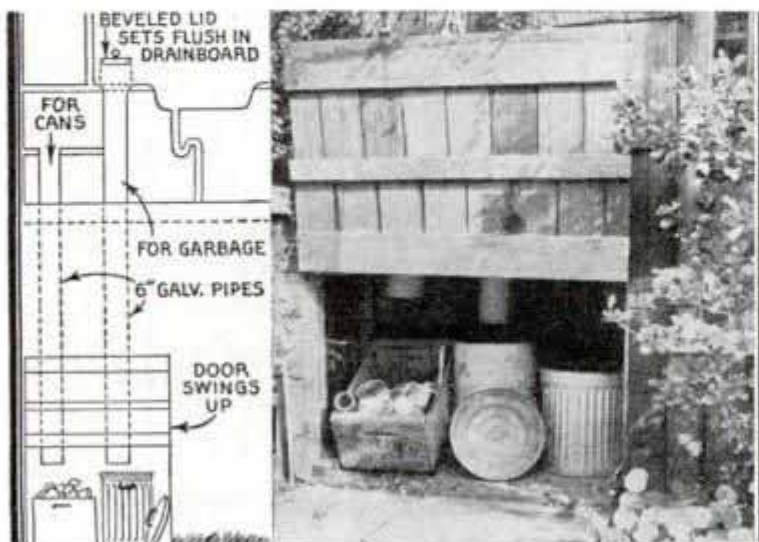
When an imitation microphone is needed for amateur stage plays, one is easily made from a set of radio headphones and a music stand. Remove one of the phones from the headset and insert the holder into the end of the music stand as shown in the circular detail. If the "mike" is not high enough, an extra piece of tubing can be put in the stand. The job will be more



realistic if a couple of wires are run down the stand from the phone to disappear under the stage wings or behind the footlights.—Edward Drake, Chicago.

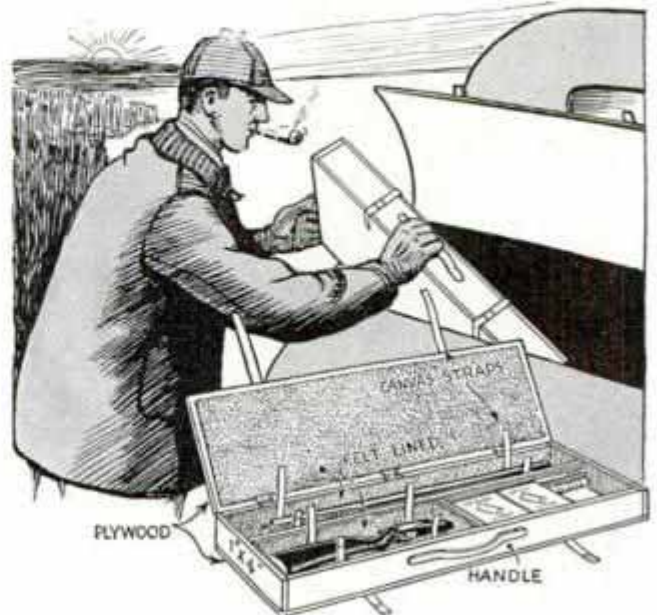
## Garbage from Second Floor Goes Down Chutes

Where living quarters are on the second floor, two large sheet-metal pipes leading from the kitchen or porch to containers set below will save many steps when disposing of cans and garbage. With this system it is necessary to wrap and tie the garbage in sacks or paper to avoid getting it on the inside surface of the pipes which would be unsanitary.



Garbage and refuse from upper floor dropped into cans below, through sheet-metal pipes

## Gun Carrying Case of Plywood Is Inexpensive



This carrying case provides ample space for one or two guns, ammunition and cleaning equipment

Here is a carrying case that will afford protection for your guns when you go on your next hunting trip. Use plywood for the top and bottom of the case and 1 by 4-in. stock for the sides and partitions. The case should be about 1 in. longer on the inside than the longest gun barrel, and about 18 in. wide. This will afford room for a narrow barrel compartment, while the remaining space, when partitioned off as shown, can be used for gunstocks, ammunition and cleaning equipment. The entire inside surfaces of the case are lined with felt tacked or glued in place. Two small leather straps tacked to the bottom

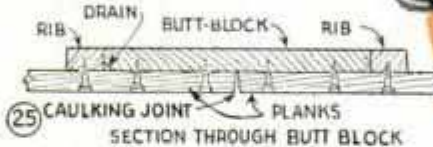
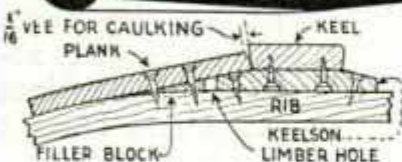
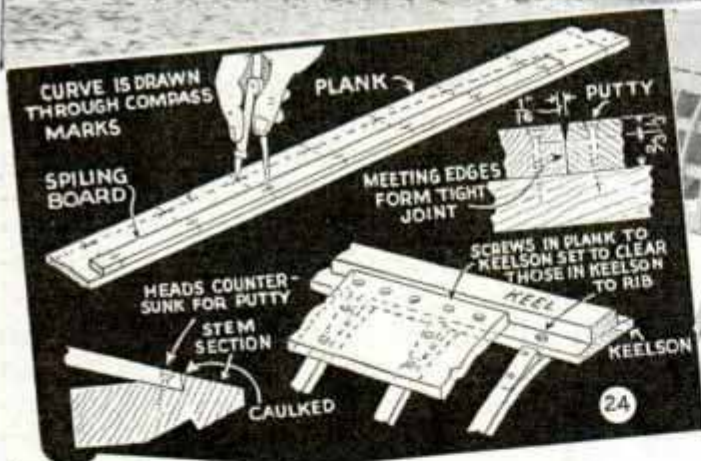
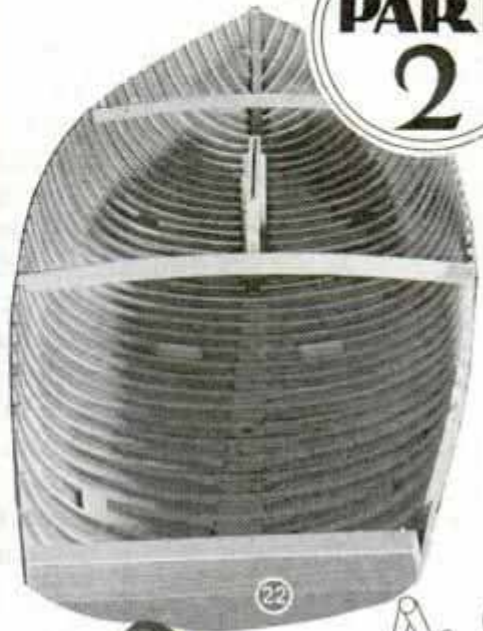
near the ends of the two compartments, will enable you to fasten the barrels and stocks down snugly. The plywood cover is attached with two or three cabinet hinges, and stout canvas straps are fastened to the cover and bottom of the case so that it can be strapped shut. A strip of felt, tacked around the upper edge of the case and soaked with oil, will make the cover weatherproof for general purposes. A heavy strap, consisting of two or three thicknesses of leather, tacked or screwed to the upper side of the case serves as a carrying handle.

—G. E. Van Horn, Lincoln, Nebr.



# "ARROWHEAD" A 21-FT. SLOOP

## PART 2



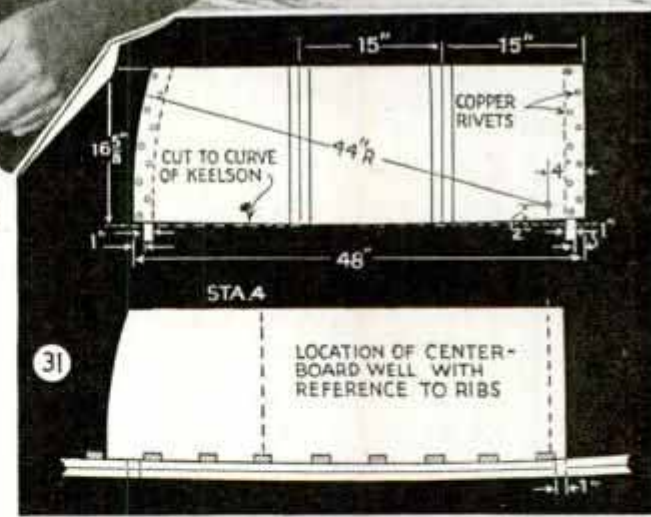
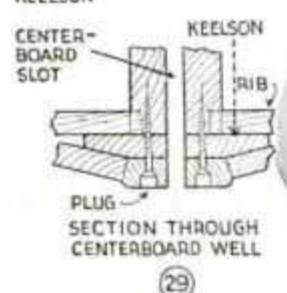
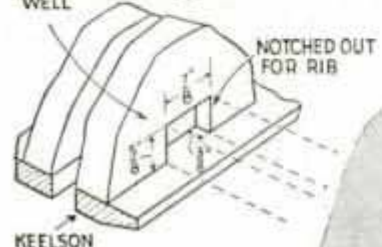
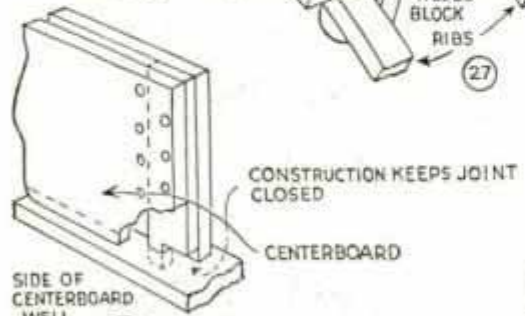
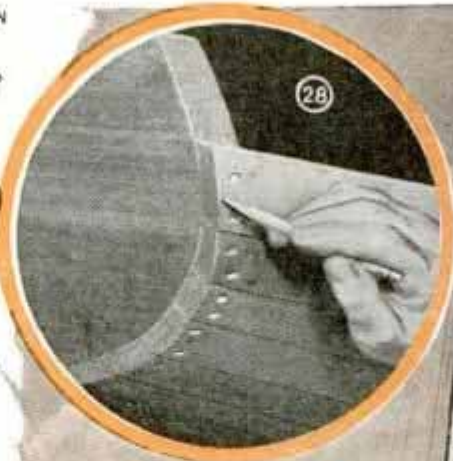
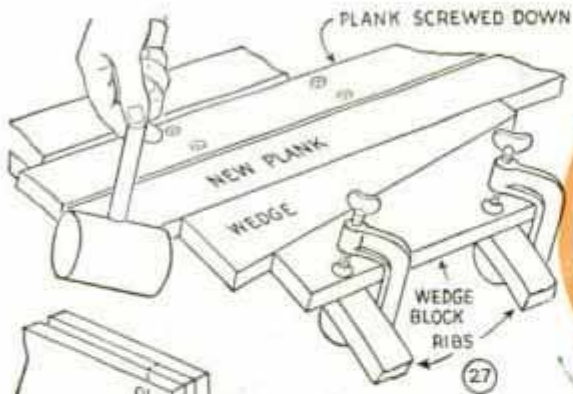
### Hull Planking, Deck Framing, and Mast Step

NOW that the frame is complete, the planking is done while the frame is still on the form. First, provide a "spiling board" on which measurements are made to determine the curve on the edge of each plank, Figs. 23 and 24. This spiling board should be about  $\frac{1}{4}$  in. thick and 3 in. wide, preferably of spruce, which will permit it

to lie flat over the curves of the hull. Nail it temporarily to three or four ribs and mark off distances with a pair of dividers as in Fig. 23. The spiling board is laid on an uncut plank and the required curve plotted as in Fig. 24.

The first plank, next the keel, comes well forward on the stem, Fig. 26. The



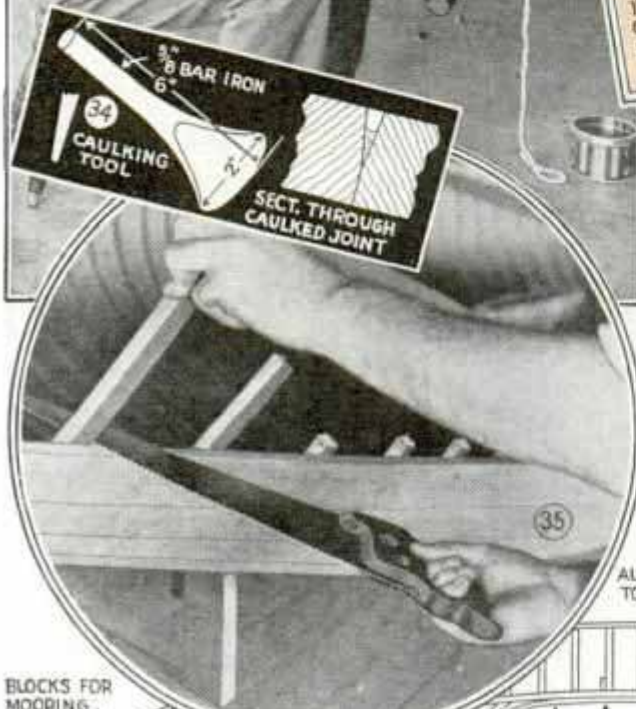
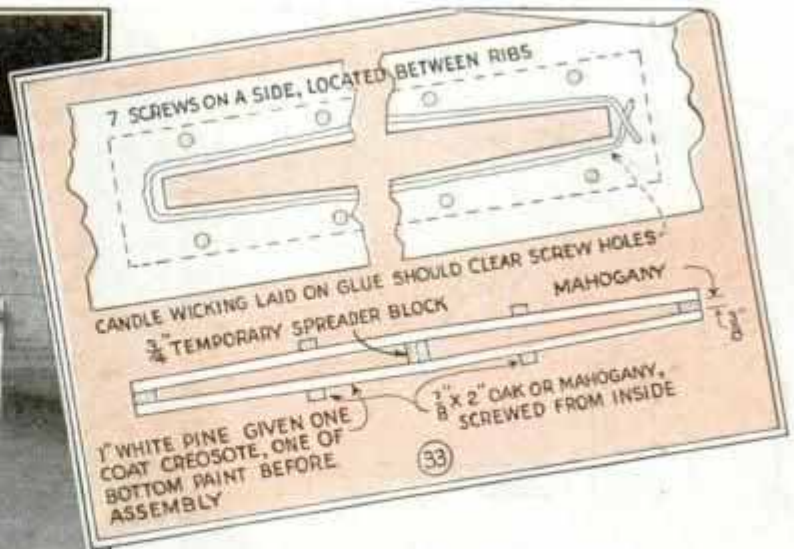


joint at the rabbet line should be about  $\frac{1}{16}$  in. wide to admit caulking. This should be carried the full length of the plank along the keel as in the sectional view, Fig. 25. Incidentally, the plank should be screwed down only temporarily until you are sure that it fits snugly against the keel. There are three screws into the keelson between each frame, so located that they will not strike those through the keelson into the ribs, Fig. 24. Planks are in three widths, 6 in., 7 in. and 8 in. The wider planks are installed near the keel and sheer line with the narrower planks between, where the greatest curve occurs. Each plank should fit snugly against its neighbor for two-thirds of the width of the edge, the remaining third forming a V-groove for the caulking, Fig. 24. To

*Novel construction of the centerboard well allows the wood to swell without opening the joint. All seams between planking are waterproofed with caulking cotton*

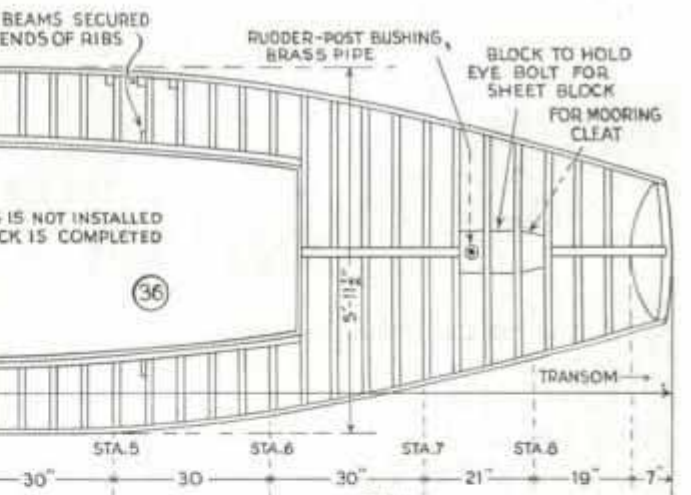
bring the planks tightly together use a wedge arranged as in Fig. 27. Although the planking comes from the mill long enough to run from stem to transom, it will be necessary here and there to make an end joint backed with a butt block, as in Fig. 25, the butt block being the same width as the plank. At the corners be-





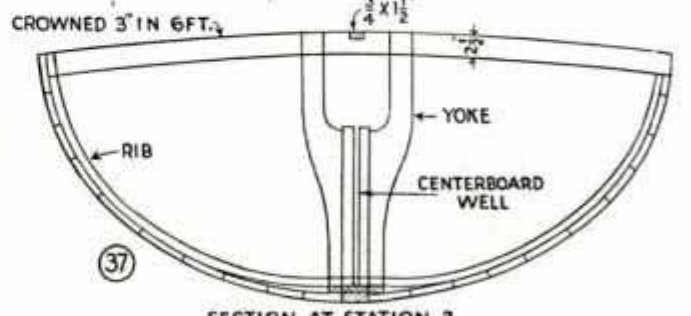
the planks at the transom, except about 1½ in. where the stern molding is to be fitted, Fig. 28.

While still on the form, all seams are caulked. Make or buy a caulking tool similar to that in Fig. 34. Divide the caulking cotton into three strands as in Fig. 30, and roll it into a fairly tight cord. This is worked into the seam and driven home with the caulking tool, Fig. 32. The tool is frequently dipped in oil. The blade should be smooth, as any burrs tend to pull the

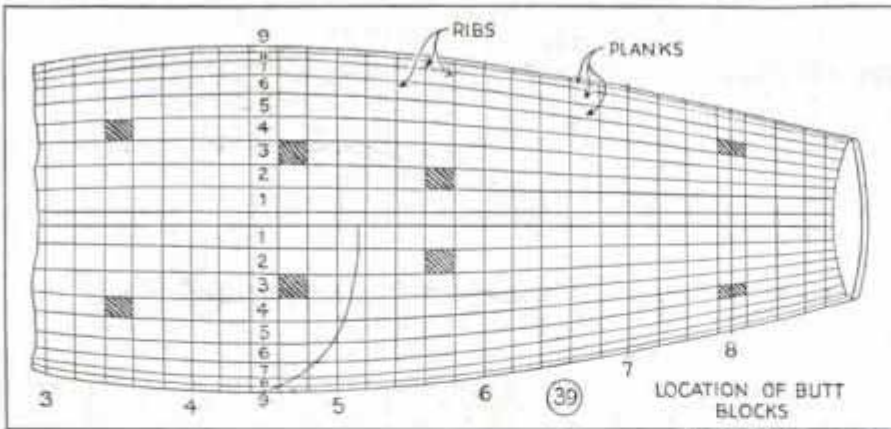


After planking, the hull is lifted off the form and placed on sawhorses for installation of the deck

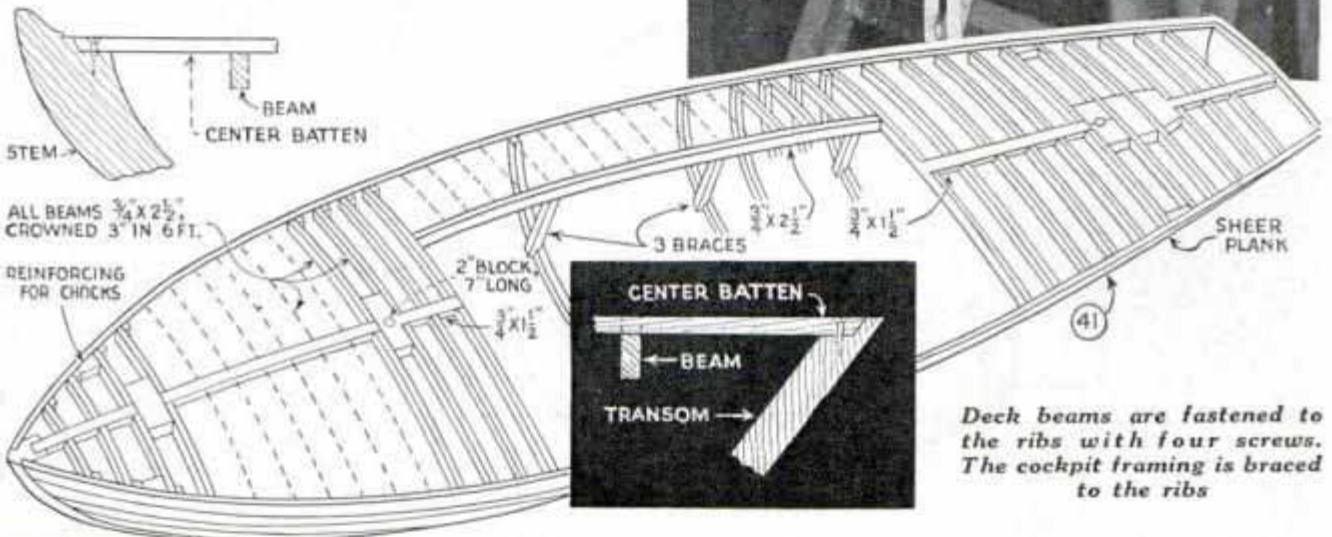
tween rib and plank, a triangular opening should be left for a drain. There should also be a space between the plank ends for caulking. In the original hull the butt blocks were located as indicated in Fig. 39. The sheer-line marks on the ribs, mentioned in the preceding installment, will indicate the gunwale edge of the top plank. When all have been permanently installed, the joints should be planed smooth. Also round over the corners of



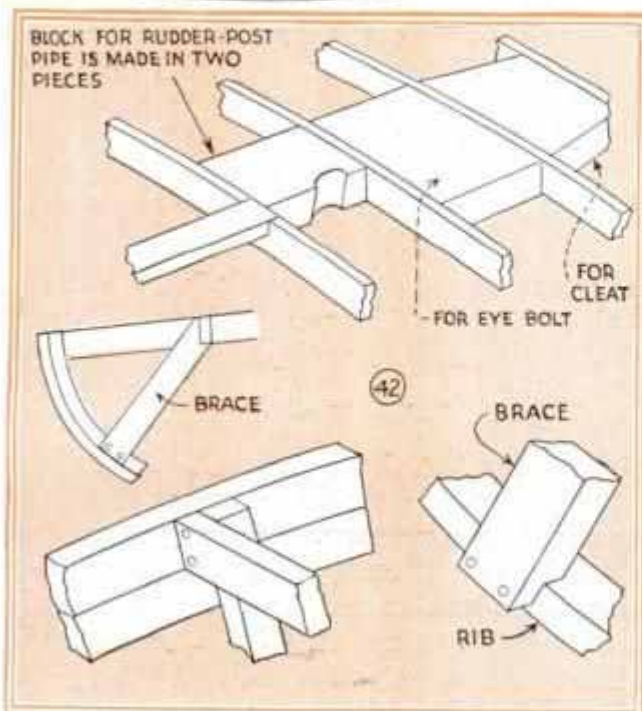




cotton out each time the tool is withdrawn. It is assumed that before caulking or planing the hull, the two ribs have been installed just forward of the transom. These are bent oak ribs and are installed by screwing first to the keelson on the inside, then to the planks from the outside. With



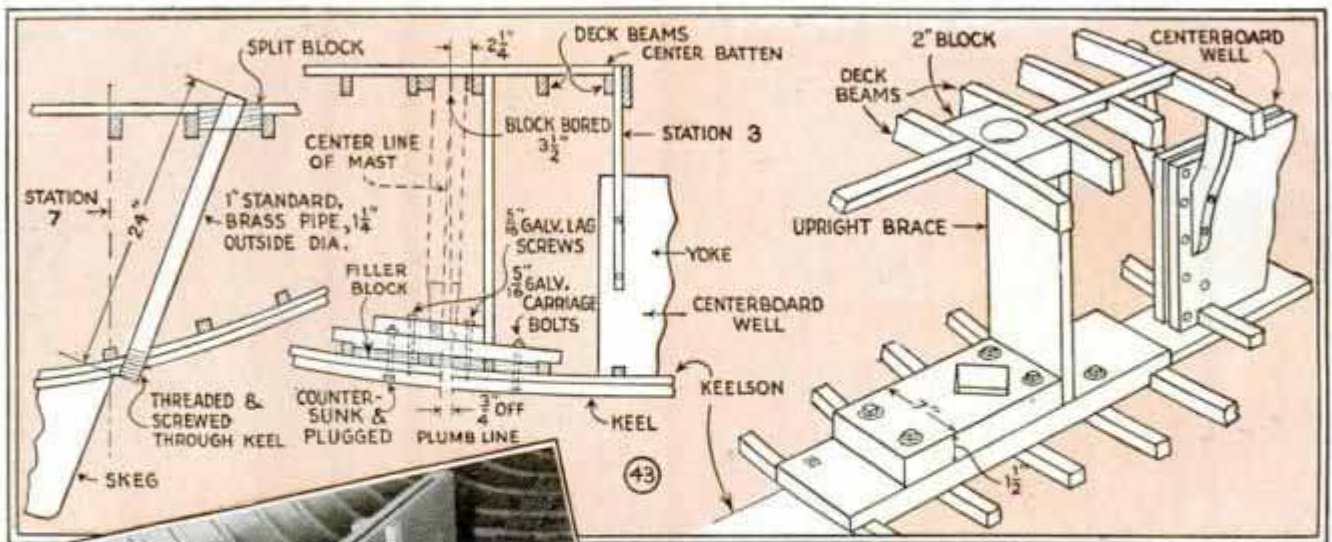
Deck beams are fastened to the ribs with four screws. The cockpit framing is braced to the ribs



the hull complete, sanded and caulked, it can be removed from the form and turned over. This is accomplished by sawing the ribs at the sheer line, as in Fig. 35. Three or four men can easily turn it over as it weighs approximately 400 lbs. at this stage of construction. Set the hull level on sawhorses and brace it as in Fig. 45.

Now to build the centerboard well, Fig. 31: This is 16<sup>5</sup>/<sub>8</sub> in. high at the greatest width, the bottom edge being cut to conform to the curve of the keelson. The sides are of white pine with mahogany bulkheads or spacers at the ends. These are slightly beveled to take care of the greater width of the opening at the center, and a 3/4-in. piece is inserted here to keep it spread apart until screwed down on the keelson, Figs. 33, 40, and 44. The reason being that a centerboard well al-





Two yokes and an upright brace at the forward end of the cockpit give rigid support to the mast step and the centerboard well. Position of step gives the mast a rake of  $\frac{3}{4}$  in. aft. Before the deck beams go on apply two coats of marine paint to the interior of the hull as in Fig. 46. Paint should be worked into corners at ribs and keelson

ways has a tendency to bow in, owing to the swelling of the wood. An ingenious lock joint is also incorporated in this well, Fig. 29. This allows the wood to swell at

right angles to the grain without opening the joint. Before assembly, the inside of the well is painted with one coat of creosote and one of bottom paint, and the mahogany cleats are screwed on. The location of the well will be determined by the slot already cut in the keel member. Notches are cut only  $\frac{3}{8}$  in. deep for the ribs, as in Fig. 29, the ribs being cut to length accordingly. When fitted in place, lift the well and

drill holes for No. 14 screws in the keel member as in Fig. 33. Then with a punch, mark corresponding locations in the edges of the well, and drill holes for the 3-in. screws, which are to hold it in place. The joint is first treated with marine glue and a strand of candle wicking laid along it as in Fig. 33. The wicking should be kept clear of the screw holes. The screws are countersunk  $\frac{3}{8}$  in. and the holes closed with wood plugs. Fig. 22 shows the hull completed to this stage. Paint the interior with two coats of marine paint as in Fig. 46.

Now for the deck framing. To get the crown equal on all forty beams it is best to make up a pattern. All beams are pine, except those at ends of the cockpit, which should be oak or mahogany. The ends of the beams are nailed to the tops of the ribs with galvanized nails, and pilot holes should first be drilled to prevent splitting



the ribs. A center batten runs along forward and after decks and sets flush with the tops of the beams. This construction is shown in the cross section, Fig. 37, and also in Fig. 41, which shows how the center batten joins the stem and transom, and gives the location of diagonal struts or braces under the deck at the sides of the cockpit. A number of blocks are installed for various fittings, that for the upper end of the brass rudder-post tube being made in two pieces as in Figs. 36 and 42. The tube itself is 1-in. standard brass pipe, Fig. 43, the inside diameter being slightly

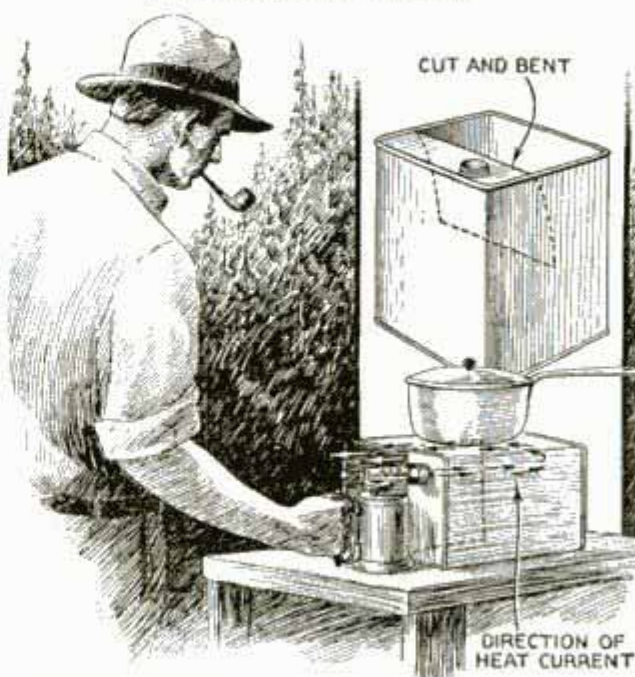
### Material List

- 200 board ft. cedar or cypress, 9/16-in. stock, in 6, 7 and 8-in. widths for planking
- 2 pcs. white pine, 1 by 17 by 48 in., for centerboard well
- 4 pcs. oak or mahogany, 7/8 by 2 by 17 in., for centerboard well
- 2 pcs. oak or mahogany, 1/2 by 2 by 18 in., for centerboard well
- 1 pc. mahogany, 5/8 by 8 by 24 in., for yoke
- 2 pine boards, 3/4 by 12 in. by 16 ft., for deck beams
- 16 No. 14 bronze screws, 3 in. long, for fastening centerboard well to keel
- 1 1-in. brass pipe, 24 in. long, for rudder post
- 14 doz. 1 1/4-in. No. 8 bronze screws to fasten planking
- 150 ft. cotton caulking
- Marine lead paint, inside two coats.

over 1 in., which permits free movement of a 1-in. rudder post. The lower end is threaded to screw directly into the wood keel unit. It is not installed permanently until canvas is put on the deck. Locating the mast step is important, as it must give the proper rake to the mast. The center line should be 3/4 in. farther forward at the keel than at the deck line, as in Fig. 43, which also shows the relative position of the mast step and the centerboard well. When you install the blocks supporting the foot of the mast, it is well to see that holes for the bolts and lagscrews do not come in line. An upright and a yoke reinforce the deck at the forward end of the cockpit. A profile of the yoke is given in the squared detail, Fig. 38. These parts are cut from 3/4-in. oak or mahogany.

(To be continued)

## Small Camp Stove from Oil Can and Blowtorch



*This improvised camp stove is easy to carry and just as efficient as most one-burner stoves*

For the camper, hiker or fisherman who wants a light stove, this one is just the thing. One end of a 1-gal. oil can is cut and bent as shown, after which the flame of a small blowtorch is directed into the can through the filler hole. The intense heat of the torch follows the path indicated by the arrows.

## Old Razor Blades Kept in Cork Avoid Injuring Hands

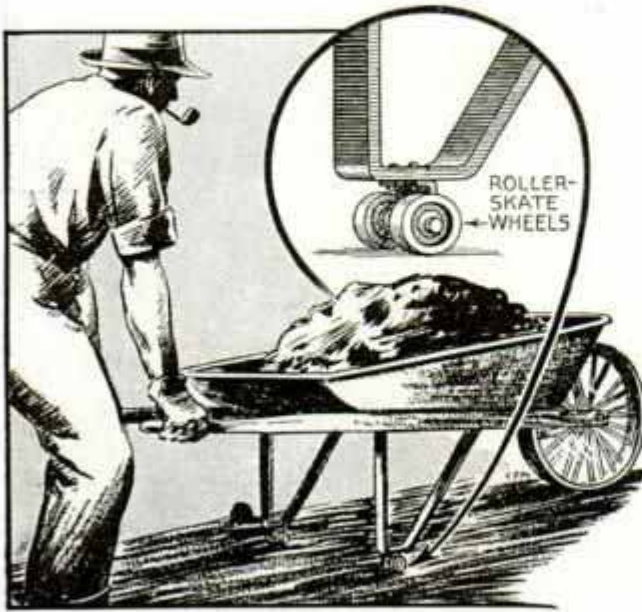
When old single-edge safety-razor blades are kept around the house for various purposes, they should be inserted in a cork as shown so that there will be no possibility of accidentally cutting the hands on them. The idea also applies to awls, ice picks and other sharp-pointed instruments, which are often kept in drawers with other articles.



☞ A few whole cloves added to scrapbook paste will keep it from souring.



## Wheelbarrow Has Roller Skates to Move Heavy Loads



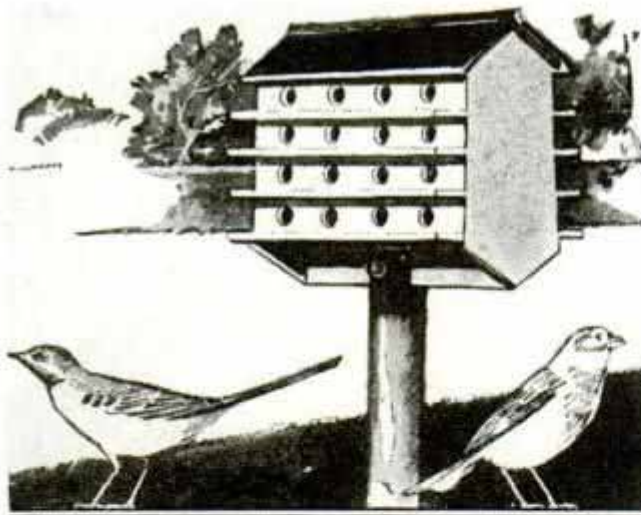
Wheels on legs of wheelbarrow give three-point contact to save strain on back and arms

For the man who occasionally uses a wheelbarrow around his home two pairs of roller-skate wheels attached to the legs will save back and arm strain when moving heavy loads. The wheelbarrow is pushed over soft ground in the regular way and then lowered to a horizontal position and pushed along on sidewalks or drives as shown.

## Cement Putty Is Durable and Does Not Crumble

I have found that portland cement mixed with linseed oil and kneaded to the consistency of regular putty, is in many ways superior to the latter for glazing windows, and for filling small cracks and nail holes in surfaces to be painted. The mixture remains flexible after it sets, and it does not crumble and fall off after long exposure.—H. H. Siegele, Emporia, Kan.

## It's Easy to Build Bird Houses



that will attract peppery little wrens, martins, bluebirds and others. Our plans include a wide variety of nesting boxes that not only look good to the songsters, but also add a delightful touch to the garden.

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**"ZIP," MODEL RACING YACHT**—880 to 884: 50 in. long. Plans include full-size lift templates. Four prints \$1.00.

Any six of these blueprints will be sent postpaid upon receipt of \$1.00. Address Blueprint Dept.

POPULAR MECHANICS MAGAZINE, 200 East Ontario Street, CHICAGO





# Photo ENLARGER

*has uniform illumination*

By Arthur Trauffer

WITH this snapshot enlarger your camera does double duty—takes the picture and then enlarges the negative. The barrel or drum of the enlarger is a simple affair built of large cans with friction lids. The sizes indicated are merely general dimensions suitable for cameras with removable backs, which take pictures  $3\frac{1}{4}$  by  $4\frac{1}{4}$  in. and smaller. You may find it necessary to make some alterations to suit the camera you have.

Fig. 2 shows a cutaway view of the negative holder completely assembled. The whole thing acts as the negative holder and also as a bellows extension for the camera. For the complete assembly, negative holder, center section and the light housing you need two flour cans, or boxes as they are called, each 7 in. in diameter



*There's no need to buy an extra lens for this enlarger. Instead, you simply use the camera with which you took the picture*

and 7 in. deep, and one cake box, 10 in. in diameter and 4 in. deep. Only a  $2\frac{1}{4}$ -in. section of the flour box is used for the negative holder. The balance is cut away with tin snips. Now, in the bottom of this section you cut a rectangular opening slightly larger than the film used in the camera. For example, if the picture size is  $2\frac{1}{4}$  by  $3\frac{1}{4}$  in., the opening should be  $2\frac{3}{8}$  by  $3\frac{3}{8}$  in. A disk of  $\frac{1}{4}$ -in. plywood is



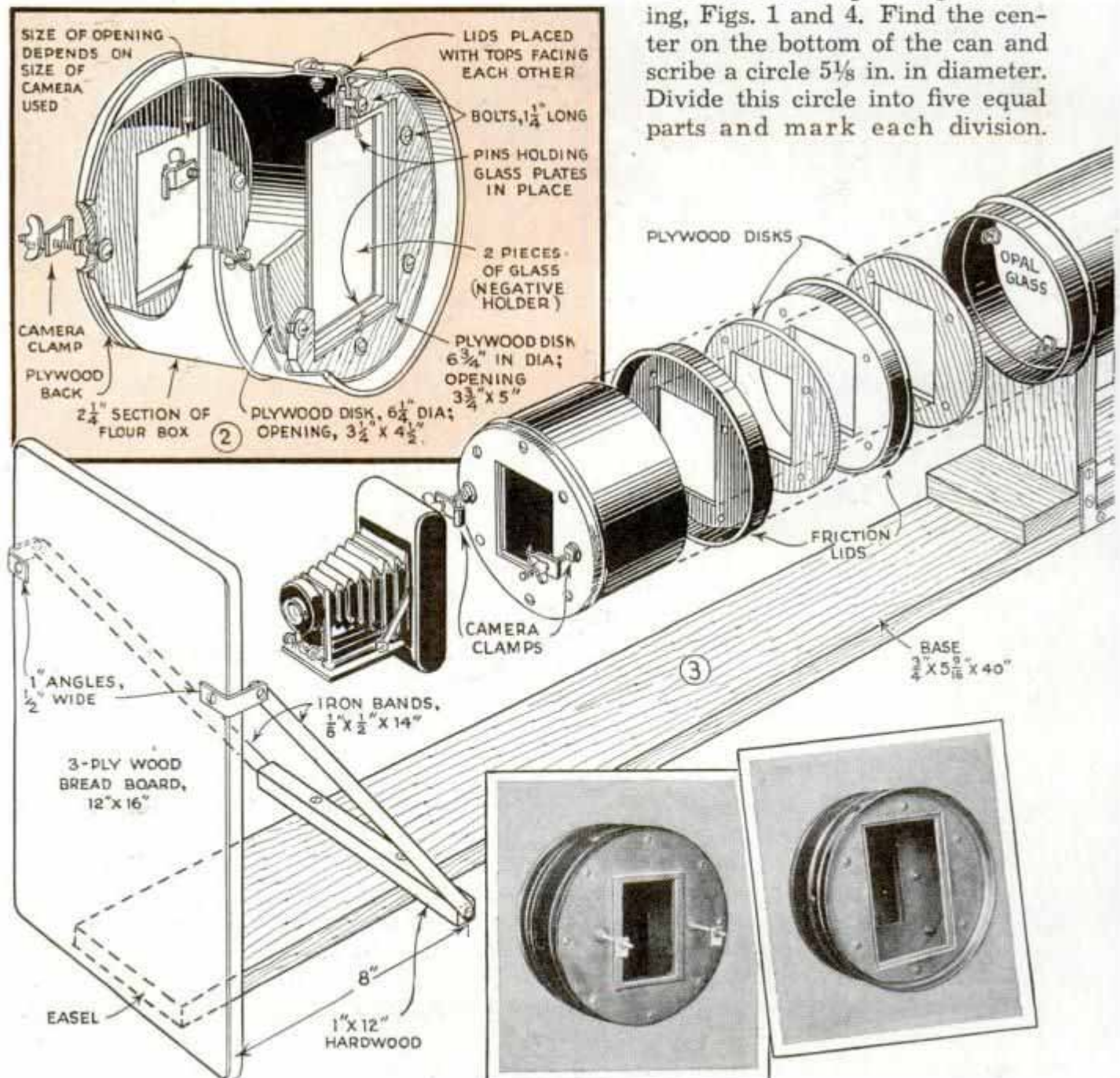
cut to fit inside the box. An opening  $2\frac{3}{8}$  by  $3\frac{3}{8}$  in. is also cut in the plywood disk. Two simple clamps are provided to hold the camera securely in position.

A second can, the same diameter as the negative holder, forms the center section which is supported by the sliding base. Note that in Fig. 2 the negative holder proper is formed by the two friction lids placed with the tops facing and bolted together with a disk of plywood between. First, you cut rectangular openings, each  $3\frac{1}{4}$  by  $4\frac{1}{2}$  in., in both lids. Then two disks are cut from  $\frac{1}{4}$ -in. plywood, one  $6\frac{1}{4}$  in. in diameter, the other  $6\frac{3}{4}$  in. in diameter. In the first you cut an opening  $3\frac{1}{4}$  by  $4\frac{1}{2}$  in., and in the second  $3\frac{3}{4}$  by 5 in. All four

parts are bolted together with small stove bolts, the smaller disk being located between the lids. Assembled in this way, the parts provide a rigid support for the two pieces of plate glass between which the negative is placed.

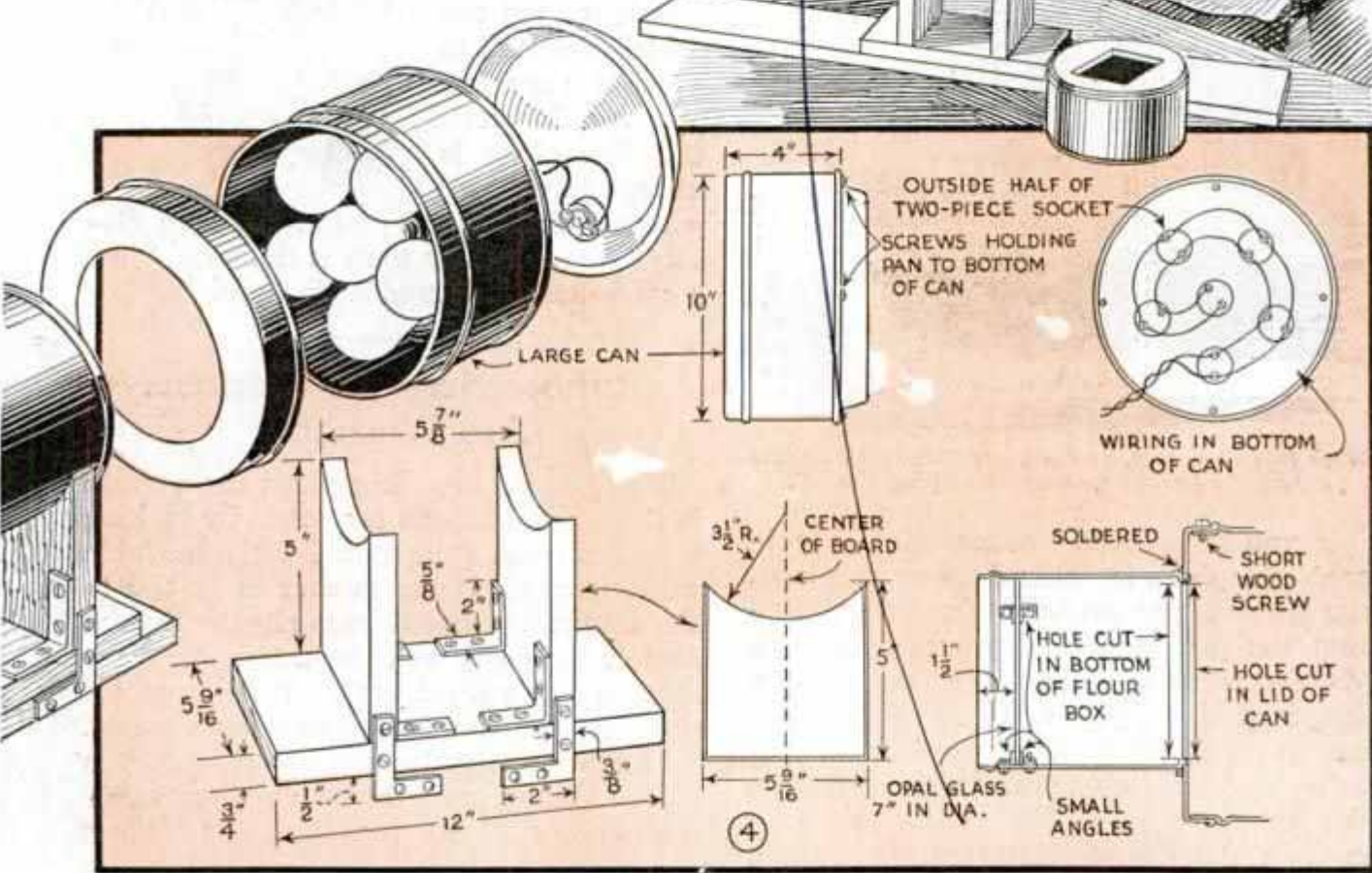
Now to return to the center section. First, you cut the bottom out of the can with a can opener. Then a circle of corresponding size is cut in the lid of the third can which forms the light housing. This lid is now soldered to the bottom of the center section, as in Figs. 3 and 4. A disk of opal glass is placed in the upper, or forward end of the center section,  $1\frac{1}{2}$  in. from the top and is fastened with six  $\frac{1}{4}$ -in. angles cut from tin.

Now to make up the light housing, Figs. 1 and 4. Find the center on the bottom of the can and scribe a circle  $5\frac{1}{8}$  in. in diameter. Divide this circle into five equal parts and mark each division.





Then scribe six circles the same diameter as the sockets to be inserted and have the openings punched at a tinshop. Six two-piece sockets with "pig-tail" connections are screwed in place in the openings and wired in parallel as in Fig. 4. All connections should be soldered. To cover the wiring, a baking pan, 9 in. in diameter and about 1½ in. deep, is bolted to the bottom of the light housing and a connector plug is fitted in the bottom of the pan, the wires from the plug being led to the nearest socket in the



Large cans are used to build up this enlarger. The white-pine base is cut to exact width to allow free movement of the sliding member. Six 40-watt light bulbs provide illumination

group of six in the light housing. Provide a cord with switch and six 40-watt bulbs for illumination. Figs. 3 and 4 show clearly how the base is made.

The sliding member which supports the enlarger is made of three pieces of stock cut to exactly the same width as the base. The latter is simply a pine board planed to exact width throughout the length. The easel is screwed to the end and braced at right angles as shown. The sliding member, Fig. 4, consists of three parts cut from ¾-in. stock. Ends of the two upright members are cut to the same radius as the center section of the enlarger and fas-

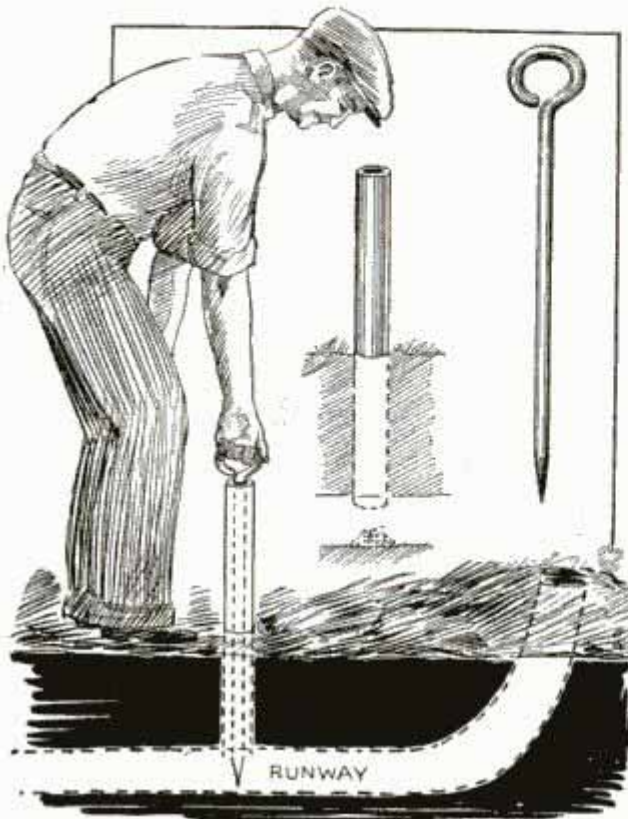
tened in place as shown with small iron angles and screws. Flat angles in the position shown act as guides. Meeting faces of the base and the sliding member may be coated with hot paraffin.

The easel must be braced exactly at right angles to the base. The center section of the enlarger drum may be fastened to the sliding member with small screws. Paint the interior of the negative holder and center section with flat black paint.

Articles made of sheet tin will take on the appearance of polished steel if they are rubbed with fine steel wool.



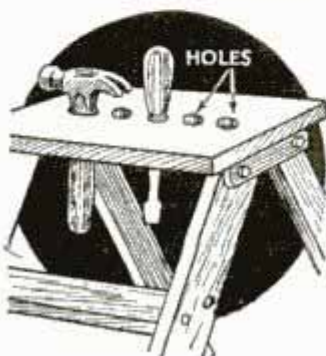
## Sure-Shot Method of Poisoning Gophers in Their Dens



*With this little tool, you can get poisoned bait into gophers' runways without disturbing the soil*

If you have been unsuccessful in poisoning gophers in their dens or runways, the trouble was probably due to not getting the poisoned bait properly located. With this tool, which is made from a length of  $\frac{1}{2}$ -in. pipe and an iron rod, you can get the bait into the runway without disturbing the latter and without covering the bait with dirt. The rod is just long enough for the pointed end to project from the lower end of the pipe. In use, the assembly is pushed into the ground until the lower end breaks through the roof of the runway. The rod is removed and the bait poured through the pipe.

## Holding Tools on Stepladder

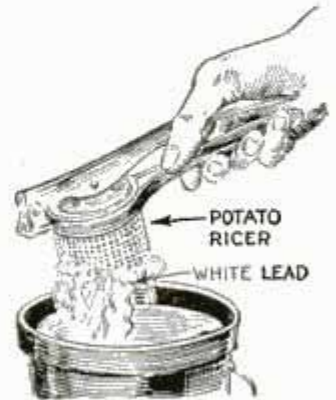


The problem of keeping a number of small tools at hand when working on a stepladder, is solved by inserting them into holes drilled through the top step of the ladder,

as shown. The tools are easy to remove, and they will not fall out when the ladder is tipped or carried about.

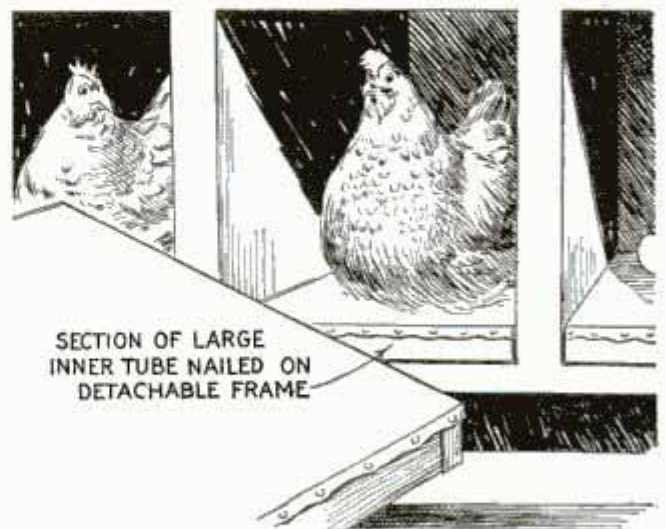
## White Lead Run Through Ricer Saves Time in Mixing Paint

If you make up your own paint, squeezing the lead through a potato ricer of the type shown will do much toward reducing the lead to a consistency to mix readily with oil. The ricer is inexpensive and you will find that it makes the lead dissolve more quickly than is the case when a solid mass is stirred with a paddle.



## Rubber Nests for Chickens Are Washable

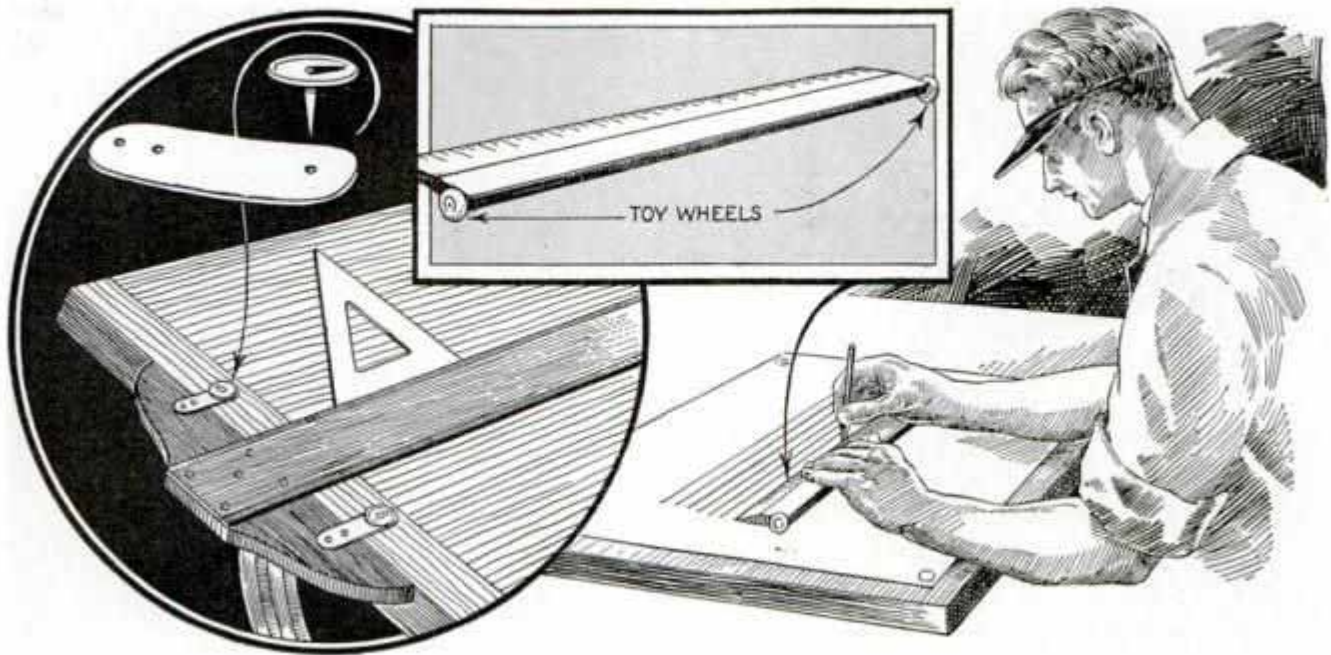
There is no breeding place for vermin in these nests, which are made by tacking pieces of inner tube over light, removable wood frames. If the rubber is tacked to the frames so that it sags slightly in the center, the nests will be just as comfortable as those lined with straw or excelsior, and they can be removed and washed. As further protection against vermin, it is a good idea to paint the frames thoroughly with creosote before applying the rubber.



*These sanitary nests can be removed for washing at regular intervals*



## Two Simple Ideas That Help the Draftsman



*Above, evenly spaced lines are made easily when ruler is fitted with small rubber-tired wheels from toy. Left, T-square held rigidly in position on drawing board by means of thumbtacks and brass strips*

When a T-square is used to support a triangle, as shown in the circular detail, a couple of brass strips screwed to the head and drilled to take thumbtacks, will help hold the instrument rigidly on the drawing board. When the T-square has been placed in the desired position, the thumbtacks are pushed through the strips into

the board. Another idea that saves time and helps produce good work, is to fit toy rubber-tired wheels to the ends of your ruler. The wheels aid in spacing parallel ruled lines uniformly as the friction between the ruler and the paper is greatly minimized, so that movement of the ruler will be the same at both ends.

## Formulas Quickly Filled by Using Proportional Weights

By substituting small muslin bags filled with shot for weights on his balance scales, a western photographer quickly

weighs chemicals to compound solutions needed in his work without referring to a book or tediously following a written formula. A bag is made up to exactly balance the weight of the required amount of each chemical used, after which a tag carrying the name of the chemical is attached to the string binding the top of the bag together. The bags for each solution are kept together in a small container labeled with the name or number of the formula. —Birt Oberlies, Jr., Hastings, Nebr.



**MUSLIN BAG FILLED WITH SHOT AND LABELED**

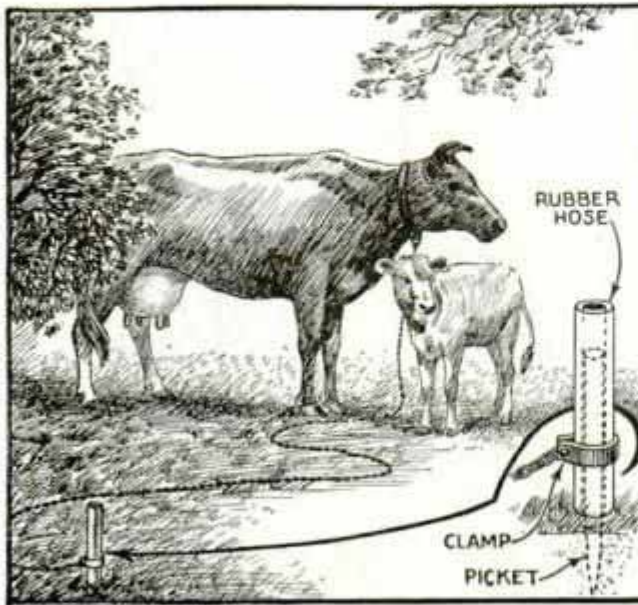
*Possibility of errors in solutions is greatly reduced with this method of weighing chemicals*

## Finishing Wood End Grain

The end grain of coarse woods, such as pine and redwood, can be finished smoothly for painting or enameling by giving it a heavy coat of thick casein glue; this is rubbed into the wood thoroughly with the fingers, allowed to dry and then sanded down to a smooth, hard surface.



## Steel Tether Stake Is Shielded to Protect Animal's Feet



*Hose slipped over tether stake shields rough edges and prevents rope from tangling*

Owners of milch cows who tether them on unfenced property will find that a piece of hose slipped over the tether stake will help prevent them from injuring their legs on the stake. If the hose is a loose fit, it will turn and help keep the tether from becoming wound around the stake.

## Moles Killed in Their Runways with Motor Exhaust Gas

If moles are "working" in your lawn or garden, slip a length of hose or flexible tubing over the exhaust pipe of your car or tractor and insert the free end into the runways so that they will be filled with carbon-monoxide gas. When pushing the hose into the runway, be careful not to



*Carbon-monoxide gas forced into the runways of moles will kill every rodent in a few minutes*

press down the dirt and close the hole. A 5-min. "shot" for each runway is usually sufficient. Run the motor at a fair idling speed, preferably on a rich mixture, which can be obtained by slight choking.

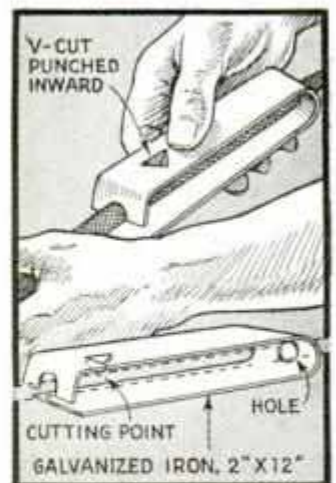
## Glue Spreader from Pipe Cleaner

With one end twisted into a flat coil, a pipe cleaner makes a good emergency glue spreader. And when used in their original shape, the cleaners are very handy for applying glue in corners, grooves, narrow joints and other constricted places. As the cleaners are inexpensive, the spreader can be discarded when the work is finished, and a new one used for the next job.



## Insulation Stripped from Wire in a Jiffy

Electricians will find this wire stripper a timesaver as it slits and removes the insulation in one operation. When the end of the wire is threaded into the tool and the jaws squeezed together, a twist of the rest in opposite directions causes the slot in the open end to sever the insulation, which is then slit by the cutting point and peeled off as the wire is pulled out. The edges of the slot and cutting point, of course, are sharpened.—T. L. Moore, Detroit, Mich.



Acetone is useful for cleaning the hands after using a paintbrush, as it will remove paint, varnish, shellac, enamel and lacquer stains.







*E. H. Sargent.  
155 E. Superior  
Chicago*

# ELECTROPLATING

*Brass.  
Bronze and  
Cadmium-  
Silver  
Alloys*

*by C.A. Crowley*



*do not  
maintain*

**E**LECTROPLATING with alloys offers many possibilities including the making of ornamental designs by using alloy plates of contrasting color. After the metal to be plated has been polished with emery powder and jewelers' rouge as in Fig. 2, to remove surface faults and develop a good luster, it is subjected to a careful cleaning procedure as success in electroplating is largely controlled by the thoroughness of cleaning.

**Cleaning:** If the object to be plated is coated with heavy rust or scale, it should be rinsed in a pickling solution, Fig. 3. This is made by carefully adding sulphuric acid, 2 lbs., and hydrochloric acid, 1 lb., to water, 7 pts. (caution—do not add water to acid). The work should not be left in this pickling solution any longer than is required to remove scale and corrosion, as it will attack the metal and cause pitting. When rust or scale is only slight, the work should be pickled in a mild solution, Fig. 4, which is made by adding hydrochloric acid, 1 lb., to water, 3 pts. For best results, this solution is used while heated to about 120° F. These solutions should be used in glass containers or stone crocks. When the work is removed from the pickling solution, it must be rinsed thoroughly first in hot and then in cold water.

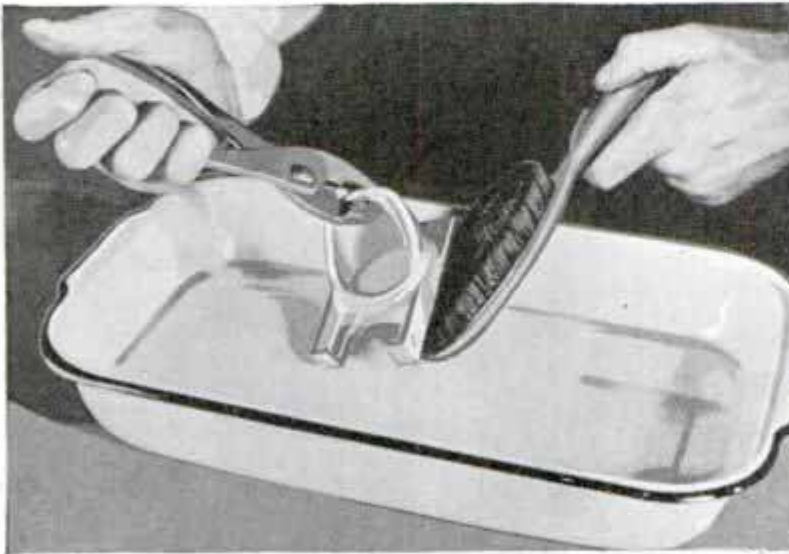
After pickling, the work is freed from grease by washing in carbon tetrachloride or in trichlorethylene. These solvents are noninflammable. It is a good plan to solder a connecting wire to the work to be plated before cleaning in the solvent as in Fig. 11, in order to make possible handling without contact by the hands. Otherwise use rubber gloves or a pair of pliers as in Fig. 1. Grease and oil from the skin will form a thin coating on the metal and prevent proper plating. After the work has been cleaned it is kept immersed in clean water until ready for plating to prevent the formation of a thin film of corrosion which would make plating difficult.

**Silver-Cadmium Alloy Plating:** Silver-cadmium alloy plate is considerably more resistant to corrosion than pure silver. Before attempting to coat the work with silver-cadmium alloy, the surface should be given preliminary plates with the following strike solutions, depending upon the metal. If steel or iron, it should be immersed for a few seconds in a first strike solution made by dissolving in the order listed, potassium cyanide (96%), 9 oz. (deadly poison), copper carbonate, 2 oz., and silver cyanide, 0.2 troy oz., in water, 1 gal. See Fig. 7. The silver cyanide and copper carbonate are dissolved by stirring

*Cadmium Stubs Co. 159 W. Kenzie  
Chicago  
W. M. Welch 1515 N. Sedgwick  
Chicago*



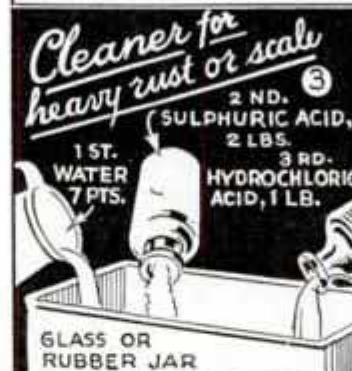
# with ALLOYS



After polishing to remove surface faults, the work must be carried through a thorough cleaning routine to assure success in plating. To avoid touching the work with hands, which leaves a slight oily deposit, wear rubber gloves or hold work with wire soldered to it and if this is impossible, use a pair of pliers

the solution with a wooden stick. In all cases where cyanides are used, the work should be done close to an open window where the draft will carry fumes away from you. In addition, care should be taken to prevent acids or chemicals of any type from getting into these solutions as this would bring about the formation of hydrocyanic-acid gas which is a deadly poison. If these solutions are used as directed, if care is taken to keep them away from acid, and if the solutions are washed away through a sink with copious quantities of water after use, there should be no danger.

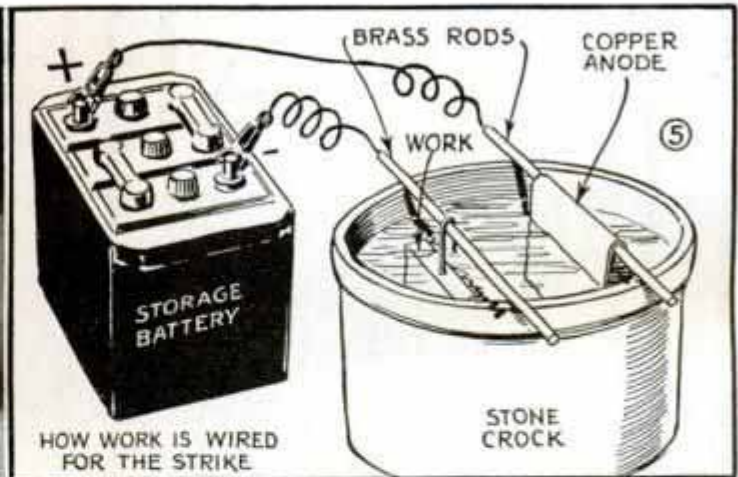
Fig. 5 shows how the work is connected for the strike. Simply attach the wire soldered to the work, to the negative pole of the battery and suspend it into the solution for a few seconds to insure a complete surface coating of silver-copper alloy on its surface. By inspecting the work, you can easily tell when the entire



surface has become coated. Next, immerse the work for a few seconds in a second strike, Fig. 8, made by dissolving potassium cyanide (96%), 9 oz. (deadly poison), and silver cyanide, .8 troy oz., in water, 1 gal. This solution is used in the same manner as the first strike. After the second strike, steel objects should be rinsed in hot water and immediately transferred to the silver-cadmium plating solution shown in Fig. 6. If this is not ready, the work should be kept immersed under clean water to protect its surface from corrosion.

If the work is made of brass, copper, or Britannia metal, the cleaned work should be immersed for a few seconds in a blue-dip solution made by dissolving mercuric





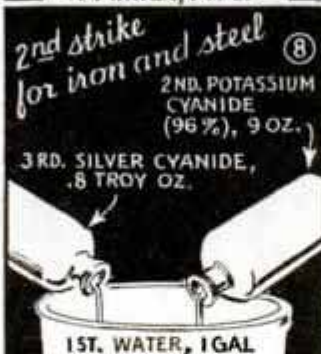
HOW WORK IS WIRED FOR THE STRIKE



Before attempting to plate iron and steel objects with silver-cadmium alloy, the work should be given a preliminary plate with strike solutions. For brass and copper work, first immerse in a blue dip and then use second strike

chloride, 1 oz. (poison), and ammonium chloride,  $\frac{1}{2}$  oz., in water, 1 gal. See Fig. 9. Dipping the work into this mercury solution will cause the deposition of a thin coating of mercury on the surface. The work should only be left in this solution 3 or 4 seconds. After immersion in the blue dip, the work is rinsed quickly in warm water and placed in the second strike as previously explained for a few seconds, after which it is ready for plating with the silver-cadmium alloy.

If the object to be plated is made from nickel silver or other nickel alloys, it is only necessary to give it the second strike and place it in the silver-cadmium plating bath. The silver-cadmium plating solution is made up by dissolving in the order listed, potassium cyanide,  $4\frac{1}{2}$  oz. (deadly poison), silver cyanide, 4.4 troy oz., cadmium cyanide, 3 oz., and potassium carbonate, 5 oz., in water, 1 gal. The plating of bright, lustrous corrosion resist-



ant silver-cadmium alloys is quite difficult if the following working instructions are not carried out carefully. Fig. 13 shows the method of connecting. Strips of cadmium and silver are suspended on the anode rod in the plating tank. The rod used to support these strips should be wood or hard rubber. If ammeters are not available, simply omit them from the circuit and use the rheostats to control the current, until the appearance of the alloy is satisfactory. Once a suitable adjustment has been found by experiment, it is a simple matter to produce uniform plate. If ammeters are used, the ammeter connected to the cadmium strips should read approximately  $2\frac{1}{2}$  times the value shown by the ammeter connected to the silver strip. This will produce a plate which is a little less than 50% silver. The voltmeter should read between 3 and 4 volts. A suitable plate thick enough for ordinary purposes will be produced in anywhere from 5 to 15 minutes. If a brighter plate is desired, a drop or two of carbon disulphide is added to the plating solution.

When the silver-cadmium alloy





IN CADMIUM-SILVER PLATING, TWO RHEOSTATS AND AMMETERS ARE CONNECTED IN THE CIRCUIT TO CONTROL AMOUNT OF CADMIUM AND SILVER DEPOSITED ON THE WORK ⑫



The diagram below shows the connections for plating with silver-cadmium alloy. Although ammeters are not absolutely necessary, it is preferable to use them—the one connected to the cadmium anode should read about two and one-half the reading of the one connected to the silver anode, which will result in a plate consisting of about 50 per cent silver and the balance cadmium

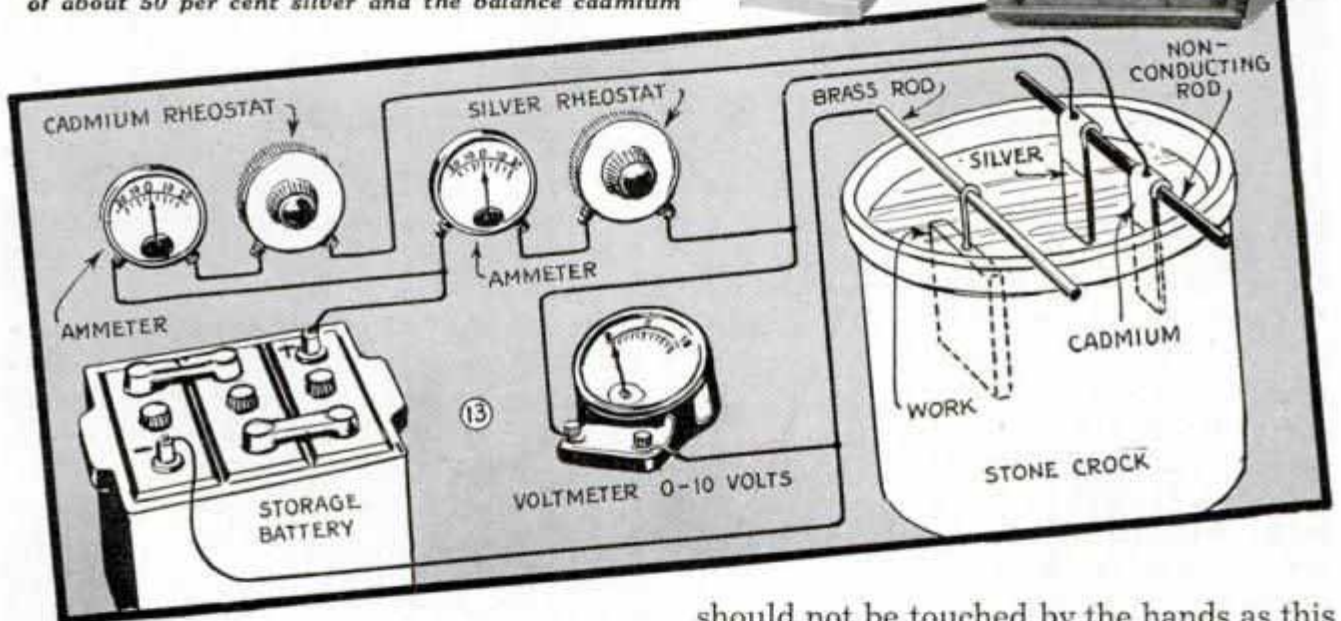
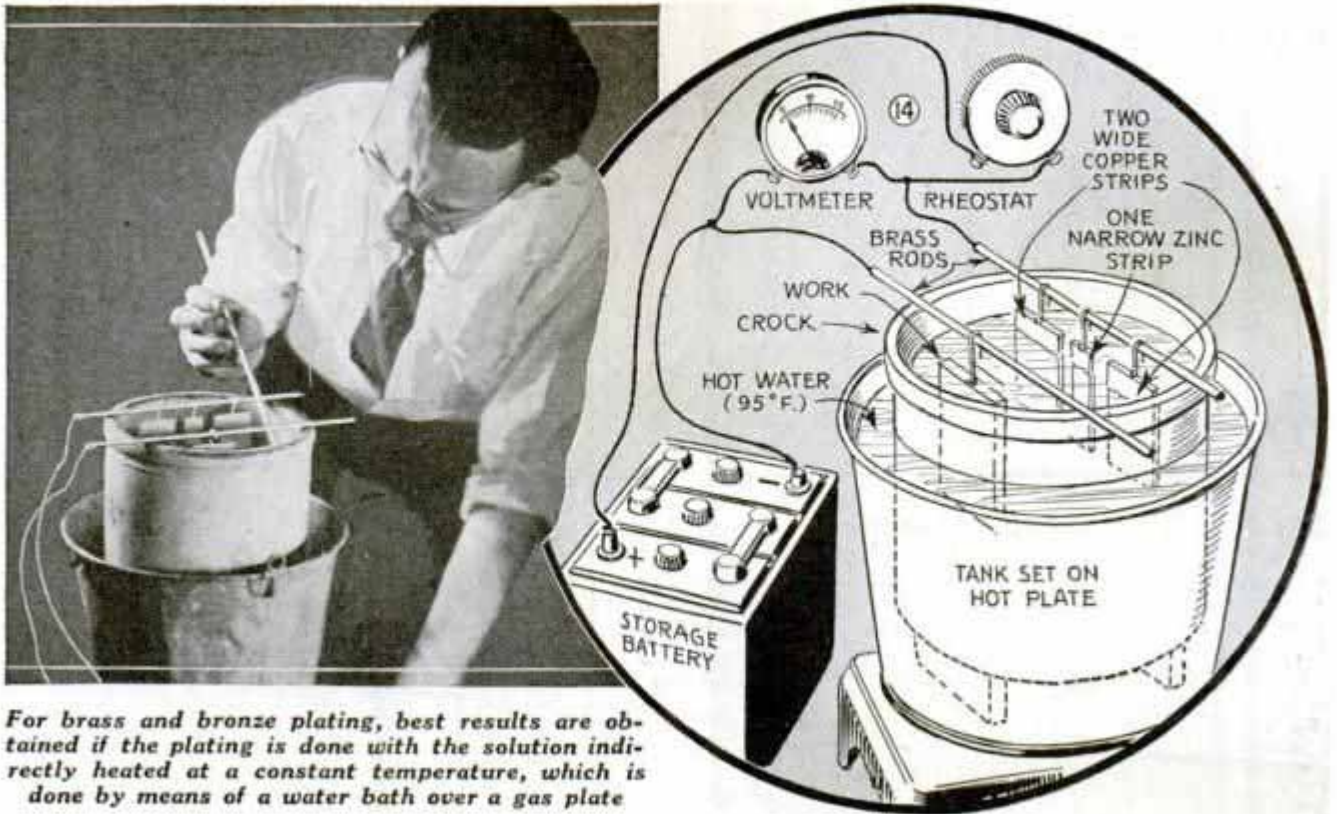


plate has been completed the work is removed from the tank and immediately rinsed in hot and then in cold water. If a design is to be plated over the silver-cadmium alloy with bronze or brass as described later, dry the work in sawdust and coat the parts not to receive the bronze or brass with stop-off varnish. This can be made by mixing copal varnish and yellow ocher to the consistency of paint, rubbing the ocher into the varnish with a mortar and pestle. Apply the varnish with a fine camel's-hair brush. Allow to dry without forcing until thoroughly hard, which may require 24 hours. Electrotypers' varnish may be used in place of the stop-off varnish. In using varnish, prevent getting it onto the parts to be plated with bronze or brass. Also, the parts to be plated

should not be touched by the hands as this would produce a thin film of oil which would interfere with the adhesion of other plate. If care is taken in varnishing, a simple rinse in water or an immersion in the second pickling solution, already described, followed by a rinse in clean water will be all that is required after the varnish has dried, to prepare the work for the second plate.

**Bronze Plating:** The so-called "bronze plate" is actually not a bronze but a high copper brass. The reason is that tin, which is a component of true bronze, does not plate as an alloy with copper. The high copper brass closely resembles bronze. An excellent solution for producing this imitation bronze is made by dissolving in the order listed, sodium cyanide (96%), 5 oz., copper cyanide, 4 oz., zinc cyanide,  $\frac{1}{2}$  oz., sodium carbonate, 2 oz., and rochelle salts,





For brass and bronze plating, best results are obtained if the plating is done with the solution indirectly heated at a constant temperature, which is done by means of a water bath over a gas plate

2 oz., in water, 1 gal. The solution is placed in the tank and connected as shown in Fig. 14. The anodes are brass containing approximately 10% zinc. If anodes of this composition are not available, then alternating strips of copper and zinc may be suspended on the anode bar. In this case, about 10% of the anode surface should be made up of zinc and the rest of copper. This solution will plate onto any common metal after cleaning, without the use of strike solutions. When the work is suspended in this solution, the voltage should first be adjusted to about 5 volts and allowed to remain there for 3 or 4 seconds after which it should be reduced to between  $2\frac{1}{2}$  and 3 volts. Leave the work in this bronze-plating solution for a period of time sufficient to produce the desired contrast of color. From 5 to 10 min. is usually sufficient. If the plate becomes too yellow, there is too much zinc surface; if the plate becomes too red, there is too much copper.

**Brass Plating Solution:** To produce a brass plate, a solution is made by dissolving sodium cyanide (96%),  $5\frac{1}{2}$  oz., copper cyanide, 4 oz., zinc cyanide, 1 oz., and sodium carbonate, 2 oz., in water, 1 gal. This solution is placed in the tank, connected exactly as shown in Fig. 14 and heated to between 80 and 95° F. It will plate onto most common metals after cleaning, with-

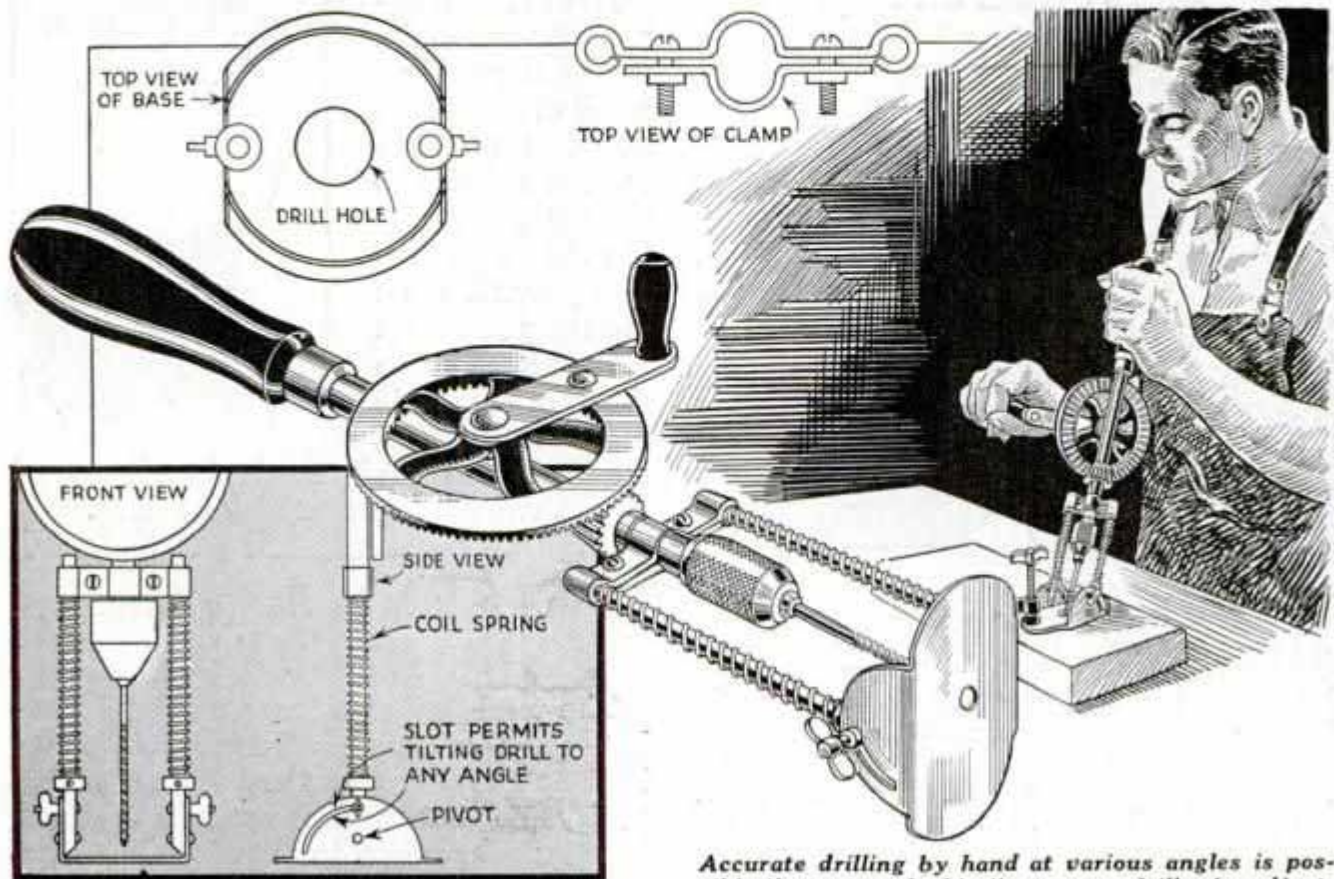
out using a strike bath. For yellow brass, the anodes should be made up of strips of copper and zinc so distributed that there is about 8 times as much copper area as there is zinc. To plate with this solution, the rheostat is adjusted so that the voltmeter reads about 5 volts. This adjustment is left for about 5 sec. after which the rheostat is adjusted so that the voltage reads around  $3\frac{1}{2}$  volts. In some cases, the brass plate produced by this procedure is not sufficiently yellow. Then add ammonium chloride,  $\frac{1}{2}$  oz., to each gallon of the plating solution. If sheets of a good grade of yellow brass are available, these may be used as the anode in place of the combination of the zinc and copper strips.

In electroplating with alloys, it is important to pay close attention to details and observe carefully the color of the deposit produced so that you will acquire as much information as possible about the way the various solutions work. After a little practice, it will be found that some extremely interesting results can be produced by varying the voltage and the distance between the anodes and work in the tank. Work carefully and experiment until you get the exact results desired.

☞ By placing a fiber washer between the tripod and the camera, the latter can be "panorammed" easily in any direction.



# Adjustable Jig Holds Drill at Accurate Angle



*Accurate drilling by hand at various angles is possible if you attach this jig to your drill. An adjustment permits it to be set rigidly*

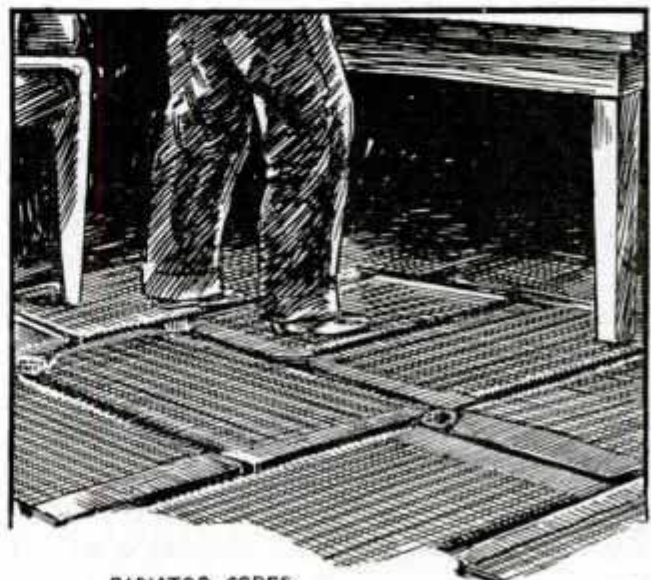
Taking the guesswork out of hand drilling, this simple jig can be made in a few minutes from flat iron, two small rods and a couple of coil springs. Two pieces of flat iron bent as shown, form a clamp, which fits over the frame of the drill just above the chuck. Guide rods pass through the clamp and are pivoted to a heavy sheet-metal base bent to the shape indicated.

Compression coil springs fit over the guide rods and bear against collars as shown, while pins through the guides above the clamp prevent the jig from slipping off the clamp when the drill is lifted. Sides of the base have slots to permit tilting the drill at any angle up to  $45^{\circ}$ , bolts and wing nuts holding the adjustment.

## Non-Slip Covering for Wet Floors from Radiator Cores

Laid side by side on wet or greasy floors in shops and factories, old auto-radiator cores provide a non-slip covering that will keep the workers' feet dry. As the cores are made of copper, they are not affected by moisture, and will last a long time. If cores of approximately the same thickness are selected, they can be laid carefully on a floor so that a fairly uniform surface results.

☐ When vases or other vessels containing water are placed on painted or varnished surfaces, the finish should be protected by placing an asbestos mat or piece of tin foil under the vessel.



RADIATOR CORES



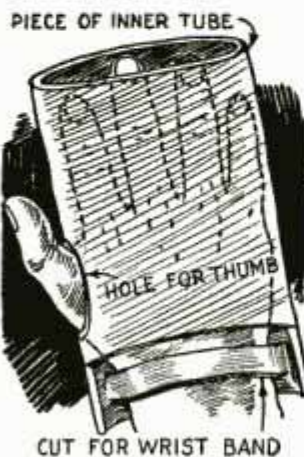
## Wire Holder for Your Milk Pail Eases Strain on Legs



*Fitting comfortably on the legs, this holder makes it unnecessary to keep pressure against the pail*

This holder fits comfortably over the legs and holds the pail snugly between the knees, thus easing leg strain and greatly reducing the possibility of the pail being tipped over. The holder is made from a piece of heavy wire, which is bent around the pail near the top and large loops twisted on the ends as shown. The loops are curved to the contour of the legs so that pressure is evenly distributed.

## Rubber Mittens for Rough Work Made from Inner Tube

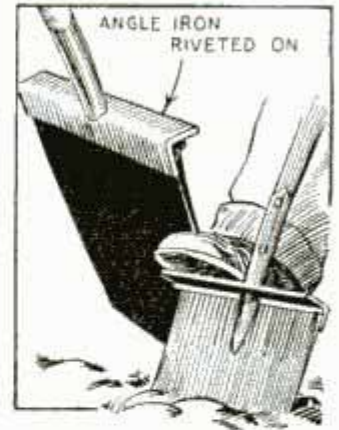


When handling stones, timber and other rough work, a pair of mittens simply made from a piece of inner tube will come in handy. Where work gloves are worn regularly, the rubber mittens can be worn over the gloves to protect them

against wear.—Edward J. Hartel, Jamaica Plain, Mass.

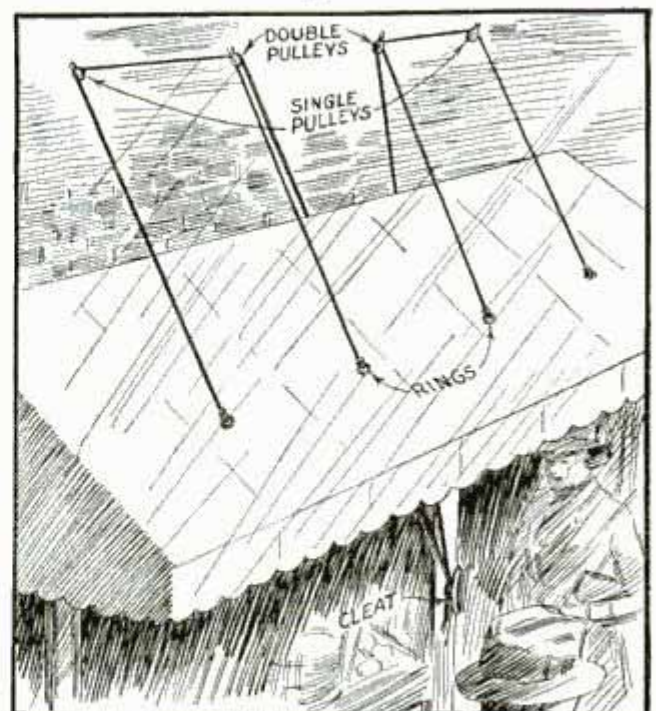
## Angle-Iron Footrest on Spade

Riveted horizontally across the top of a spade, a piece of angle iron affords a wide surface for the shoe when pushing the spade into the ground, thus reducing strain on the foot. If the shape of the spade handle permits, the angle iron can be notched to fit around it. Or, two short pieces may be used.



## Rain Pockets in Large Awnings Removed by Ropes

The tendency of a large awning to sag between the braces and hold rain water led one storekeeper to arrange ropes and pulleys so that the low spots in the canvas could be raised to allow water to run off. As shown in the drawing, rings were sewed to the awning, after which light ropes tied to them were run over small pulleys and down behind the awning to a cleat near the door. Reinforcing disks of heavy canvas or leather are advisable at the points where the rings are attached.



*Arrangement of ropes and pulleys used by California storekeeper to prevent water pockets in awning*

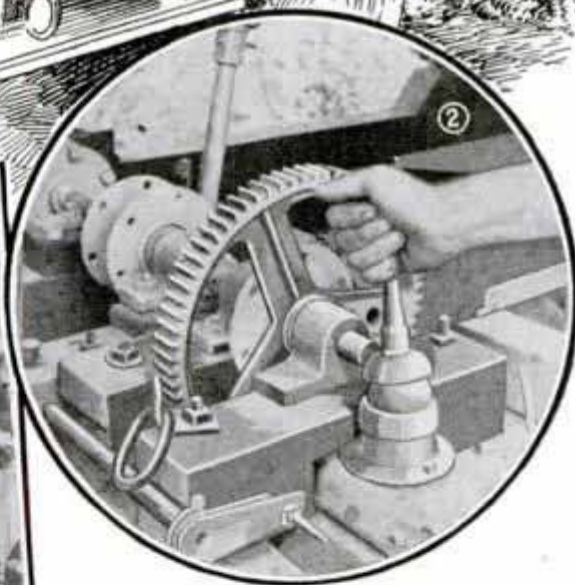
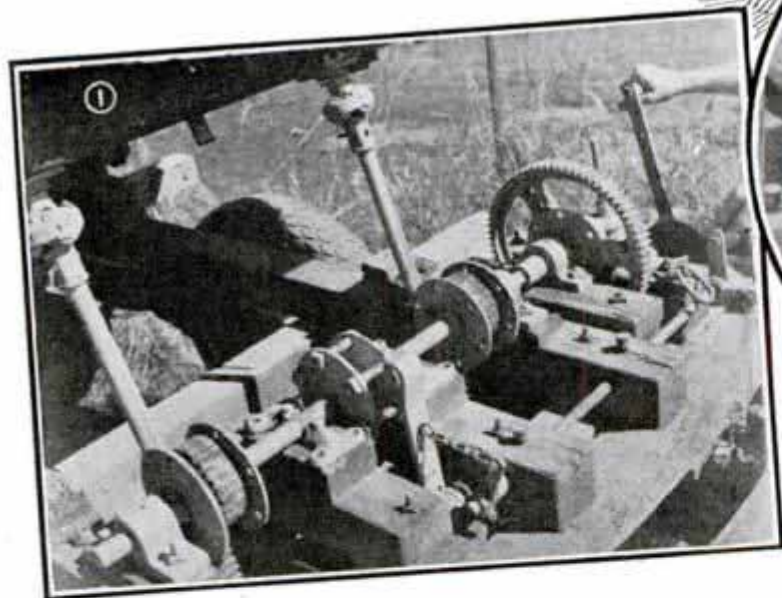


# Three-Speed TRUCK LIFT

*is hand operated*

**T**HIS three-speed lift installed on a light truck enables you to dump any load quickly and easily. With the exception of a reduction gear, the entire lifting unit is made from discarded auto parts. A standard transmission gives the three lifting speeds and the reduction gear makes it possible to raise the heaviest loads with a hand crank.

Figs. 1 and 2 show how the lifting mechanism is mounted on the truck chassis at the rear of the cab. Any variations in the chassis design may make it necessary to alter the mounting of the lift to

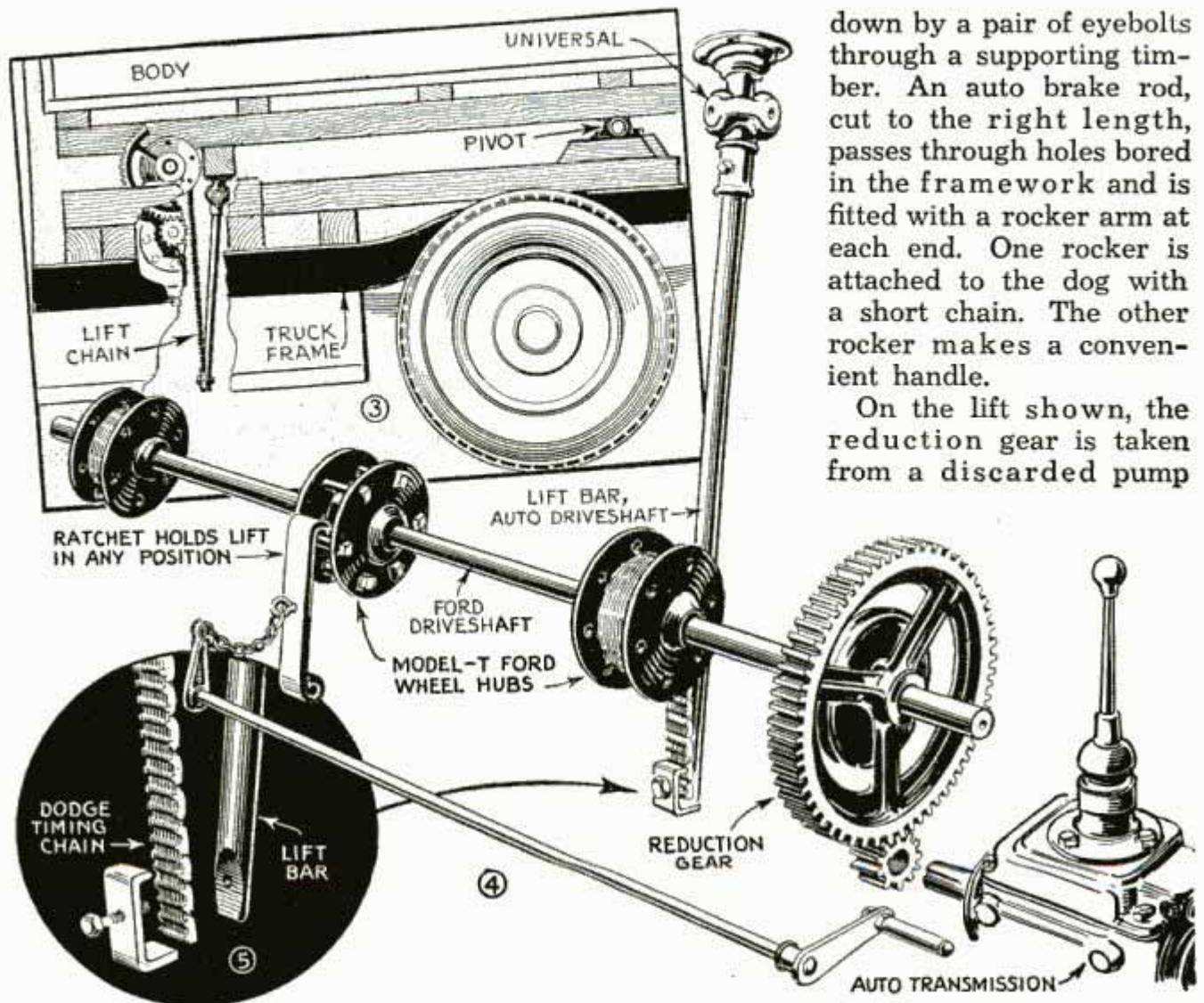


*An old auto transmission operating through reduction gears, taken from a pump jack, permits quick selection of a speed most suitable to easily lift the load to be dumped*

suit. Fig. 1 gives you a general idea of the mounting, which supports the main shaft carrying the lifting drums and the ratchet. Pine stock, 4 by 4 in., will serve this purpose. The whole assembly is bolted to the truck frame, while the body is pivoted as in Fig. 3. The forward end of the body should rest on a crossbeam when it is level so that the weight of the load is not carried on the lift. A heavy hook or latch should be provided to hold the body se-

curely in the level position. Figs. 4 and 5 show the assembly of the lift mechanism. The main lifting shaft is a Ford drive shaft, turning in four  $1\frac{1}{8}$ -in. pillow blocks. Three Ford rear hubs are bored out in the lathe to fit the shaft and are welded to it. Two Ford motor-support saddles mounted one each side of the center hub give additional support to the shaft. The two outer hubs or drums carry the lifting belts, which are made up from four Dodge





down by a pair of eyebolts through a supporting timber. An auto brake rod, cut to the right length, passes through holes bored in the framework and is fitted with a rocker arm at each end. One rocker is attached to the dog with a short chain. The other rocker makes a convenient handle.

On the lift shown, the reduction gear is taken from a discarded pump

timing chains joined end to end in pairs. This forms two double-length chains, the inner ends of which are welded to the lifting drums. The lift bars are made by cutting auto drive shafts to the desired length, flattening and drilling the lower end and bolting to the chain through a metal clip as in Fig. 5. The lift bars are joined to the lower side of the body with rocker joints made from four automobile universal joints, only the half of each joint having the hollow sleeve being used. A bolt up through each sleeve joins the upper half to the body. The upper ends of the lift bars fit into the joints as in the usual drive-shaft assembly.

The six holes in the flanges of the center hub on the lifting shaft are drilled out to take  $\frac{1}{2}$ -in. bolts. These, as will be seen from Fig. 4, are engaged by a dog, which is simply a short length of heavy flat iron with one end bent to form a hook. The other end is formed into an eye to fit a  $\frac{1}{2}$ -in. bolt or rod, the latter being fastened

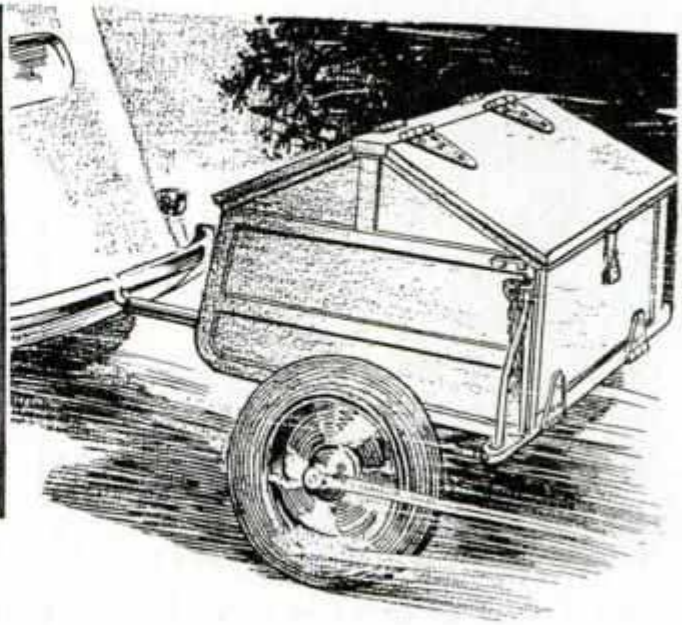
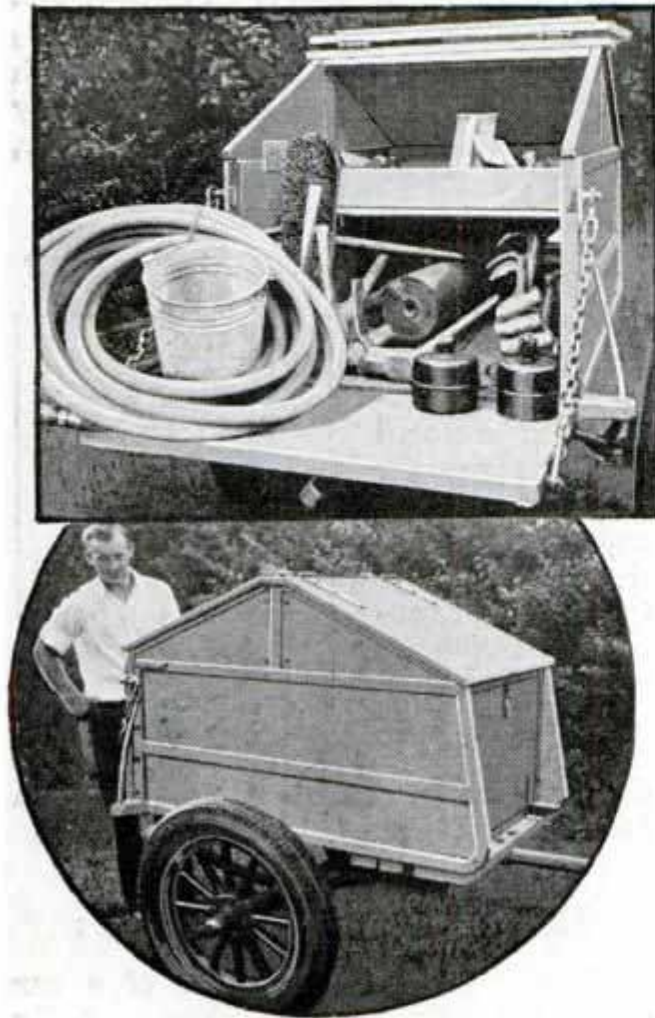
jack, the pinion being keyed to the transmission shaft and the large gear keyed or welded to the lifting shaft. All that remains is to fit the projecting end of the shaft on the opposite end of the transmission with a suitable hand crank and to mount the assembly on the frame with the reduction gears meshing and in line. This generally can be worked out by supporting the outer end of the gear box on a piece of channel iron bolted to the wooden cross members. Other mountings can be worked out to suit the individual requirements of the user.

### Wick Oilers in Rocker Arms

If a wick oiler is damaged or missing in one of the rocker arms of a valve-in-head motor, a new one should be put in immediately. Unless this is done, the oil, which is pumped under pressure to the rocker arms, will leak out and prevent the other arms from getting oil.



## Contractor's Tool Box Is Towed Behind Car



Built on the rear-wheel assembly of an old car, including the spring, this portable tool box is a lesson in compactness. Each tool has its particular place. Trowels and finishing tools are carried on a shelf or in a drawer, which moves on slides near the top of the box, while shovels, mauls, brooms, picks, etc., are stored in the compartment underneath the shelf, the pick heads projecting through holes in the bottom. Saws and similar tools rest in slots on the underside of the lids. The hinged ends and lids provide easy access to any tool in the box.

## Garden Cart with Four Pivoted Wheels Handles Easily

For the gardener or home owner who does considerable transplanting of flowers and shrubs, this cart is just the thing for hauling dirt, boxes and flowerpots about the premises. As all four wheels are pivoted it is handled easily in constricted places around shrubs and flower beds, and it also comes in handy for the housewife in moving loads that are too heavy to carry with ease. The cart consists of a strong box 6 or 8 in. deep, which has bicycle forks fastened at the four corners with U-bolts. Any wheels may be used, such as those from a baby carriage, coaster wagon or even some old bicycle wheels.

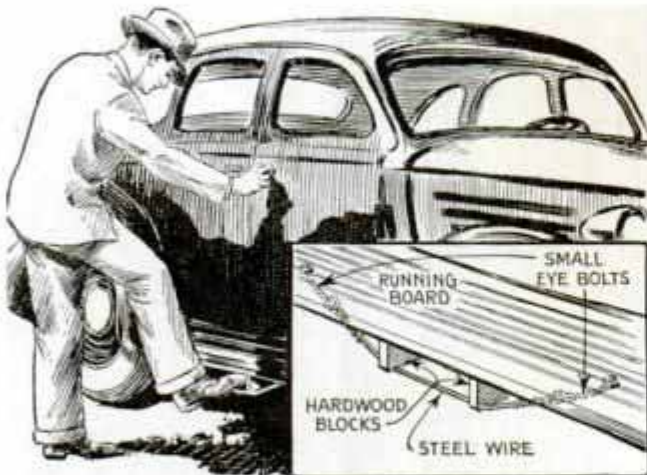
Thin photo negatives may be converted into positives suitable for framing by soaking them in a solution of mercury bichloride (poison), after which they are washed, dried, and the emulsion side painted black.



This cart is easily pushed over crooked paths and through constricted places around your flower beds. The wheels may be taken from an old baby carriage or coaster wagon.



## Shoe Scraper on Running Board Keeps the Car Clean



*Taking a few seconds to clean your shoes on this scraper will prevent tracking mud into the car*

Stretched tightly over two blocks on the underside of the running board as shown, a wire provides a hidden scraper for removing mud from the shoes before entering your car. The ends of the wire can be fastened to the running-board supports. Another method of fastening is to drill holes through the running board and insert eyebolts to hold the wire. If this is done, the bolts should be located close to the ends of the running board so that the nuts on the upper side will be out of the way.

## Installing a Tight Fan Belt with a Cloth

When installing a new fan belt on a car when the adjustment is so limited that there is not enough slack to slip it over the water-pump pulley, try running the belt on the pulley with a piece of cloth as



*There's no injured hand or broken pulley when a fan belt is "run on" with a cloth*

shown. This is much safer than prying it in place with a screwdriver, which may result in an injured hand or a broken pulley flange. The cloth is folded around the belt just ahead of the pulley, after which it is pulled outward and toward the pulley as the motor is cranked.—C. E. Packer, Chicago.

## File Is Waxed to Smooth Solder

When solder is used to fill irregularities in damaged fenders and other parts of car bodies, the trouble experienced with the file "hogging" is easy to overcome if the file is rubbed with a piece of beeswax before starting the work. Rub the wax down the center of the file to fill the teeth for a width of about  $\frac{1}{4}$  in.



## Relining Hydraulic Brakes

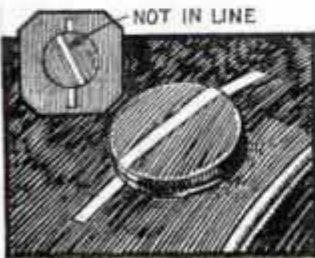
When relining brake shoes of a car equipped with hydraulic brakes, carefully avoid losing any of the fluid for, if this is lost it must be replaced and then the cylinders at each wheel must be "bled." If this is not done, it may prove not only costly, but dangerous. After the wheel, hub and shoes have been removed, bend a piece of heavy wire around the cylinder so that the plungers cannot fall out. Then, after replacing the shoes and adjusting them, test the pressure of the brake pedal by pushing it down as far as possible and holding it there for at least a minute. If the pedal goes all the way to the floor board, there is air in the lines which will have to be removed. To do this, get an 18-in. length of small hose and a pint can of hydraulic brake fluid. Some cars have the hose as stock equipment in the tool kit. If not, one taken from an old tire pump will serve the purpose. At the top of each brake flange you will find a small bolt, which is removed to install the hose. Insert the free end of the hose in the fluid. Loosen the check valve one half turn and then push the brake pedal all the way



down several times. Now tighten the check valve, replace the bolt and proceed to the next wheel. All four brake cylinders must be bled and the master cylinder must be kept filled with fluid at all times or the brakes will be ineffective.

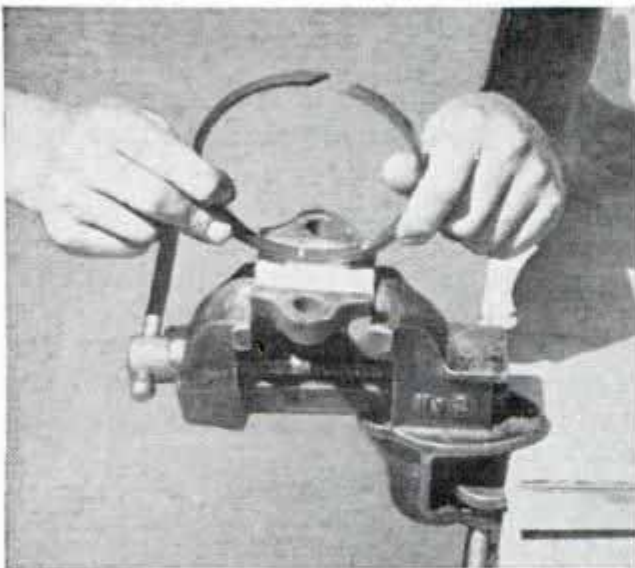
### Position of Gas-Tank Cap Shown by Line

Painted across the cap of your gas tank as shown, a line not only shows at a glance whether or not the cap is screwed on tightly, but it also serves as a reminder for a station attendant to replace the cap firmly after refilling the tank. Such a line, if painted carefully in a color contrasting to that of the car, will not mar the appearance of the body.



### Bearings Scraped to Perfect Fit with Old Piston Ring

The next time you have to fit a bearing try an old piston ring for the scraping job. Piston rings are honed to a razorlike edge, yet, having a square cross section, they



If you wish, friction tape can be wrapped around part of the ring to protect the hands

do not dig in. They are easy to grasp, and as one edge becomes dulled with long service there is always another to use.

### Riders on Rear End of Truck Kept Off with Barbed Wire

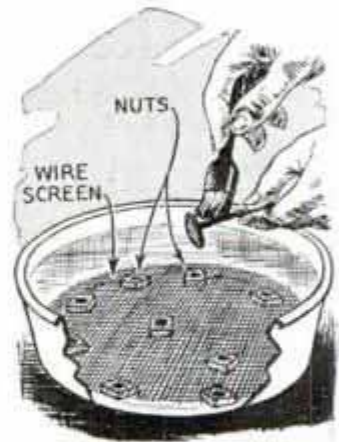


Truck owner uses board wrapped with barbed wire to keep riders off rear end of truck

The owner of a large truck fleet who had experienced several accidents resulting from boys riding on the rear ends of the trucks, used the method shown to discourage this practice. Boards were wrapped with barbed wire and fastened to the tailboards of the trucks with spring-steel clamps so that they could be removed easily when loading or unloading. Signs on the tailboards gave warning of the wire to anybody trying to steal a ride.

### Washing Pan Has False Bottom of Screen Wire

Cut to fit snugly inside of a pan in which small parts are washed, a disk of screen wire keeps the gasoline clean for long use by preventing sediment, accumulated on the bottom, from being stirred up. The disk is spaced about  $\frac{1}{2}$  in. from the bottom of the pan with large nuts, which are tied to the underside of the screen with fine wire.



☛ Lacquer or shellac which has been allowed to dry in brushes can be softened by soaking the bristles in acetone.



## Scarecrow with Spring Joints Sways in a Breeze



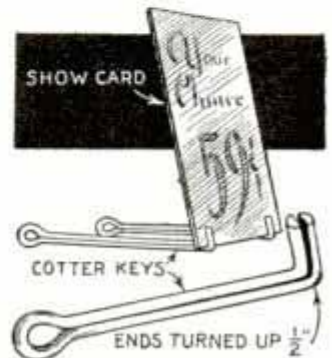
*Located prominently in your garden, this realistic scarecrow will keep birds and chickens away*

Swayed easily by the slightest breeze, the head, arms and legs of this scarecrow

move so realistically that even the boldest of birds is fooled. The skeleton of the scarecrow is light wood, the body members being attached with coils from an old bed spring. After dressing the scarecrow, it is best to pad it with straw or excelsior to give it shape, being careful not to pad the joints too heavily.

## Price Tags Held in Cotter Keys

Bent upward at the split ends as shown, cotter keys make ideal supports for price tags and announcement cards. The keys can be bent easily with a pair of pliers.



Poor results in making photo enlargements can often be traced to a dirty lens, particularly when using vertical enlargers.

# The Next Issue

## COLORED PLASTICS TO ENHANCE YOUR CRAFTWORK

To produce things of unusual elegance in gorgeous colors and shades, this durable, grainless material combines many qualities of both wood and metal. Just the thing for smart lamp bases, exquisite candlesticks, fine chess boards and sets, desk pen sets and clock cases, jewel cases, cigarette boxes, etc. This material comes in sheets, rods and tubes of almost any size to suit your needs, and it can be turned, sawed, drilled, threaded, ground and polished either by wood or metal-working tools.

### SPARE-TIME PROFITS FROM SILVERING MIRRORS

Done easily in your home workshop. Success depends on thorough cleaning of the glass and correct preparation of tested silvering solutions.

### LEAKY BASEMENTS AND HOW TO CURE THEM

Are you one of the thousands troubled with leaky basements? Getting at the cause and applying effective remedies is really a simple matter.

### PICTURESQUE GARDEN FURNITURE

Set in a colorful garden, a quaint, wheeled, "sunbonnet" chair gives shaded seclusion, while a picturesque "carreta" makes outdoor luncheons a pleasure.

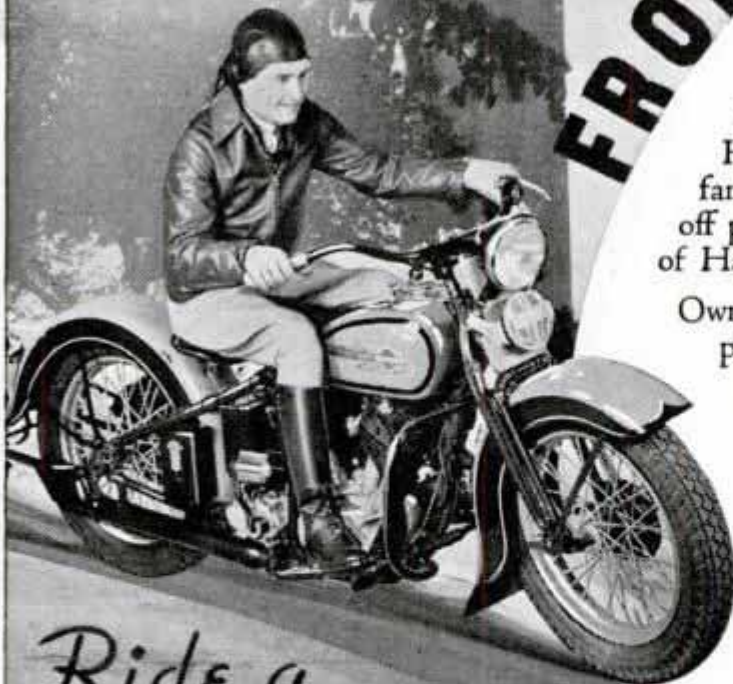
### BATHROOM "HAMPER-SEAT"

Disguised by modern design and a padded seat, the lowly clothes hamper now ranks as a piece of furniture appropriate for bathroom or bedroom.



# SCENIC AMERICA

Thousands of Harley-Davidson riders have seen the great Washington Monument from this very spot in the Nation's Capital.



FROM THE SADDLE  
of a

## HARLEY-DAVIDSON

From coast to coast green horizons are beckoning to lovers of the great outdoors. Let your Harley-Davidson take you to the beauty spots and famous historical places in your own state and to the far off places you've always wanted to see. Make the most of Harley-Davidson's wide range of economical riding.

Own a new 1936 Harley-Davidson! Thrill to its surging power and fast get-away. Enjoy its gliding ride—zooming speed—flashing style—low-cost mileage—and other advantages of latest streamline design and up-to-the minute motor improvements. Don't wait—ask your Harley-Davidson dealer for a FREE ride—he'll gladly explain his Easy Pay Plans. And send in the coupon—NOW!

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HARLEY-DAVIDSON MOTOR CO., Dept. P, Milwaukee, Wis.  
Interested in motorcycling. Send illustrated literature. Postage stamp is enclosed to cover mailing cost.

Name .....

Address .....

My age is ( ) 16-19 years, ( ) 20-30 years, ( ) 31 years and up, ( ) under 16 years. Check your age group.

Ride a

# HARLEY-DAVIDSON



# Diving for Sunken Treasure

(Continued from page 675)

6/5/88  
 we have found cause to stop and wonder if such things could be serious. Probably the most uncanny experience we ever had occurred during this treasure hunt.

We were a day out of Cedros when one of the landlubbers harpooned a porpoise. Superstitious seafaring men declare a curse settles upon the crew of any vessel guilty of taking the life of a porpoise and the curse will not be lifted until a human life is forfeited. Antonio, when he learned what had happened, crossed himself and asked to be taken back home. We scoffed at his predictions, but were unable to change his mood. According to Antonio there was nothing but tragedy ahead.

A few days later, when filming some pearl-diving material, one of the skiffs became fouled with a manta ray. That huge sea bat dragged skiff, divers and all undersea and it was only by sheer luck we were able to cut free one man who was headed for certain doom. We did kill the manta, however. Antonio blamed the porpoise but we had little time to dwell on ill omens. That evening the pearl divers gave us accurate information as to the location of the islands we sought.

In our work there are naturally many hazards to face, but we have learned there is little real danger when we understand and can plot the type of hazard and where we are likely to meet it. In all my experience, I am happy to say there has never been a serious accident that could be traced to the failure of equipment or the negligence of the boys. Our one and only fatal accident occurred while we were diving during the filming of the undersea sequences of the treasure-hunt picture. It was unavoidable.

We located a wreck under fifty feet of water and had been diving there for some days seeking the portion that might contain the reputed chest of gold. It was hard work and I had been doing most of the diving, blasting away dangerous projections and preparing the location for some scenes we would shoot whether we found gold or not.

One day I had trouble with the air line. Three or four times it clogged and although the boys cleared it repeatedly, I was still having trouble getting sufficient

air. Several times huge sharks cruised about the area and Antonio, now handling my life lines, insisted I come up until he harpooned them or drove them away. I determined to continue and strode off to inspect a huge wooden bow-section which I had previously neglected. The cameras were lowered and I shot many feet of the strange flora and fauna I saw. A dark shadow loomed ahead. As I approached it evolved into a barnacle-covered skeleton of a wooden vessel. Was it possible that I had found the right wreck?

It was a rugged, dangerous hulk with bared ribs and sections of twisted steel bolts projecting from the rotting beams. I avoided these sharp points for fear of tearing my dress or fouling my lines. Suddenly I was conscious of a pain in my head. I recalled the monotonous "punk-punk-punk" of the air compressor had ceased. I signaled for more air. None came.

There were warning jerks on the line. Were they fouled? Were sharks coming? Breathing became increasingly difficult. There was an unusual stillness about me. I grew fainter and fainter and barely recall dropping to my knees as I slid off the wreck. I blew my valve and sank slowly into another world. Then came the far away "punk-punk" of the engine and the refreshing hiss of cool air. The boys dragged me to the surface semi-conscious. Antonio mentioned the porpoise.

While the compressor engine was being repaired, Jim asked to dive next. My safety time for diving was expired for that day, so we dressed Jim and he was soon over the side. He had long wished for this opportunity and, if he located the right portion of the wreck, had every chance to be the one to recover the treasure.

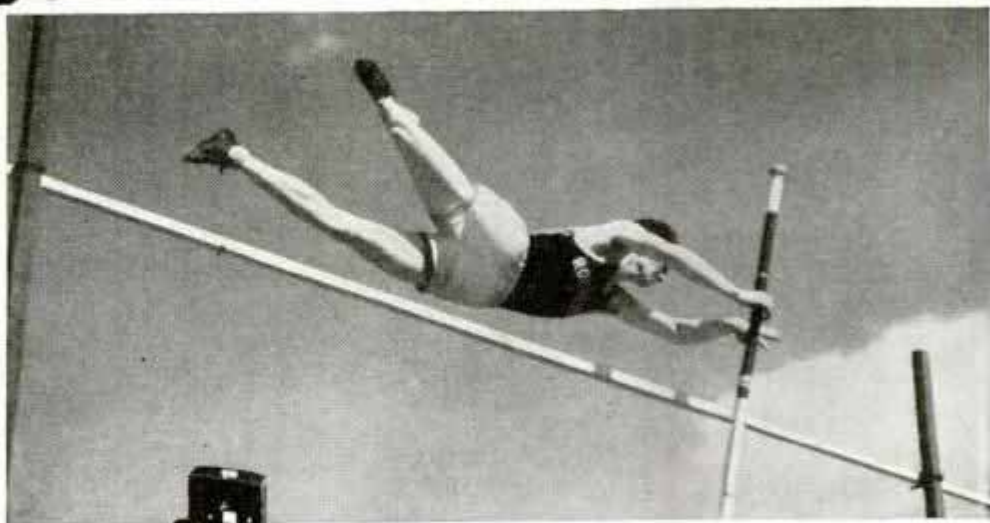
As the sea closed over his helmet, Antonio shot me a look that sobered my excitement. I tried to forget the porpoise, the legend, the sharks. Here we were over the wreck that had every mark of being the one we sought. We couldn't fail. Jim jingled the line. He wanted the cameras. He and I had planned to film the actual finding of the treasure—we had agreed not to touch it but to set up the cameras and walk into the scene with all

(Continued to page 116A)



# For Action!!!

## KODAK VOLLENDAA a precision miniature



### 2 MODELS TO CHOOSE FROM

**K**ODAK VOLLEENDA fits in the palm of your hand, pops open for instant use at the touch of a button... Precise—it yields needle-sharp negatives. Sixteen 1-3/16 x 1-9/16-inch pictures each loading.

Available in two lens-and-shutter combinations. With 1/500-second Compur-Rapid shutter and *f*.3.5 lens—\$44.50... with 1/100-second Pronto shutter and *f*.4.5 lens—\$25.



### KODAK MINIATURE ENLARGER

to supplement your tiny camera. Makes big prints from little negatives. Cabinet base optional. Price for enlarger, paper holder, Anastigmat *f*.4.5 lens—\$67.50. Paper cabinet base, \$10 extra.

### KODAK PANATOMIC FILM

extremely fine-grained, fully color-sensitive. Especially designed for miniature camera use—an ideal film for Kodak Volleenda and other small cameras. Makes striking enlargements possible with a minimum of grain.



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Every picture maker should have this book—"How to Make Good Pictures." Its 224 pages are packed with useful photo knowledge. Tells new ways to use your camera... how to make trick pictures. Get your copy today.



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PM-5-38



(Continued from page 114A)

6/15/48  
the accompanying dramatics. What a picture!

The minutes passed rapidly. Most of the crew were at the side watching Jim's progress by following his path of bubbles as they broke the surface. That long delay would be when he was setting up the cameras and checking the angles. He made a wide detour and stopped for a moment, then started walking into the scene. He was turning—probably the treasure was in sight. Then there was a sudden jerk on the line—two more—and then the frantic danger signal.

"Pull up," I ordered, and Antonio hauled away on the lines. He had hardly taken up on the slack when a terrific tug on the air line nearly pulled him from his feet. He released his hold and eased off slack. Then slowly he pulled it in. I signaled to Jim. There was no answer. The signal line had fouled something solid.

Antonio looked worried. Had Jim fallen off the wreck? The line was taut again. With the caution born of years as a diver's tender, Antonio braced himself. The strong hose quivered. The strain was much greater than the weight of any diver. Suddenly the line parted and the broken end came shooting to the surface like some writhing serpent. At the same instant the life line eased away. I reefed it through my eager hands. The end was shredded—broken.

Eight minutes to live! That was the amount of life-sustaining air in Jim's suit. Frantically the boys tied lines to scraps of iron, wrenches, anything heavy and threw them overboard. We hoped Jim might see one of these and seize it. We could then pull him to safety.

Antonio hastily dressed me in another gear. My hope of finding Jim alive dwindled as the moments passed. My face plate was barely shut as I slipped over the side. The water was disturbed and silt-laden patches, like clouds, hampered my vision. I searched for hours, but Jim had disappeared. Darkness finally drove us in. For several days we continued our search but as time passed all hope of finding his body vanished. The only evidence I found was one of Jim's heavy lead shoes. The boys agreed we should abandon the trip.

Weeks later when the gear was being cleaned in Hollywood, one of the boys

found some rolls of film in the undersea cameras. They had been exposed! We recalled Jim had been the last to use the cameras. We rushed the film to the laboratory for development.

In the quiet of the screening room our little band of silent adventurers watched the film that had been automatically ground off by Jim's motor-driven cameras. It was like a message from the beyond—a message Jim had sent back to us. The screen revealed a tragedy that left us all dumb with horror.

The film clearly showed the side of the wreck with Jim approaching out of the hazy distance. He walked alongside until within fifteen feet of the cameras, then paused as he saw the treasure chests weed-covered and half buried in the foreground. He grinned toward the cameras, approached and knelt beside the chest.

Suddenly a shadow darkened the scene. Jim looked up and saw something disturbing out of camera range. He quickly tried to rise. At that moment there swept into the picture a huge manta ray, fully twenty feet across. It paused just over Jim, turned, and a few feet away deliberately seized his air and life lines with its spiral flippers.

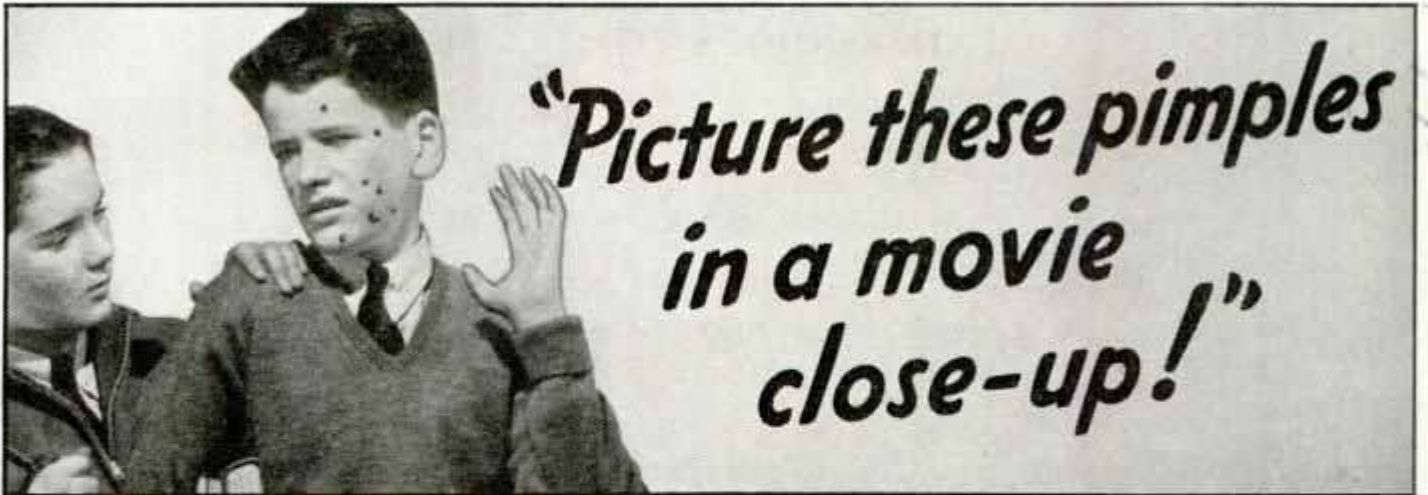
For an instant the bat fish seemed to hesitate—then made away from the cameras and Jim. The diver braced himself against the jerk that lifted him off his feet. At this moment the life line fouled a rib of the wreck and parted. The powerful manta, momentarily stopped, seemed excited. It wheeled and with a rush drove into Jim, entangling his helmet and lifting him from the bottom. Straight for the cameras they came until—crash! They were overturned. That ended the scene. It was the answer to Jim's disappearance.

Jim was a real adventurer at heart—he set the stage and filmed his own departure on that greatest adventure of all, the exploration of the great beyond.

The wreck is still there, and so is the treasure. Maybe the curse of a pirate-massacred crew rests over the spot. Perhaps some mysterious, destructive force guards the treasure. Or is it the sea protecting her own? It is beyond the ken of adventurous spirits and courageous hearts. Probably Jim knows.

(Another article by Capt. Craig next month)





*"Picture these pimples in a movie close-up!"*

**Little sister Florrie helps Dave to star in the high school movie . . .**



GREAT NEWS, FELLAS! MY UNCLE WALT WILL HELP OUR CLASS MAKE A **MOVIE!** AND HE'LL LOAN HIS CAMERA ~ PROJECTOR ~ **EVERYTHING!**

GEE WHIZ!

OH BOY!



UNCLE WALT'S GOT A SPECIAL CLOSE-UP LENS ~ NOW YOU, DAVE, I EXPECT WILL BE THE **HERO!**

NO CLOSE-UPS OF **ME** ~ NOT WITH ALL THESE **PIMPLES!**



GRANNIE ~ THEY WANT DAVE FOR THE HERO IN HIS SCHOOL MOVIE ~ HIS GIRL IS TO BE HEROINE! BUT DAVE'S GOT **TERRIBLE PIMPLES!**

LAND SAKES, CHILD FLEISCHMANN'S YEAST IS THE THING FOR **PIMPLES!** I'LL GET YOU SOME FOR HIM TO START ON



**SCRAM, FLORRIE!** I'M BUSY!

JUST A MINUTE, PLEASE! GRAN SAYS THIS FRESH YEAST TAKES PIMPLES AWAY. IT MIGHT, EVEN IN TIME FOR THAT MOVIE. OH, DAVE, **DO TRY IT!**



**LATER** I TOLD FLORRIE SHE COULD COME SEE THE MOVIE SHOTS MADE THIS AFTERNOON. YOU KNOW, SHE ~ GOT YOU STARTED ON FLEISCHMANN'S YEAST FOR THOSE PIMPLES. GOOD WORK, FLORRIE!

IT WAS REALLY GRANNIE

**Don't let Adolescent Pimples keep YOU out of the limelight**

After the beginning of adolescence—from about 13 to 25, or even longer, important glands develop and final growth takes place. This causes disturbance throughout the body. The skin gets oversensitive. Waste poisons in the blood irritate this sen-

sitive skin. Pimples appear. Eat Fleischmann's Yeast to clear these skin irritants out of the blood. Then, pimples vanish. Start eating 3 cakes a day, before meals—plain, or in a little water—until your skin clears!



*—clears the skin*  
**by clearing skin irritants out of the blood**

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# The Steel of the Future

(Continued from Coloroto)

I 4  
the furnace, a casting device known as a pig machine forms it into "pigs" for use in foundry work, hence the name pig iron.

Cold pig iron is very brittle, high in carbon and other impurities and of low tensile strength but it can be converted into soft but tough wrought iron by "puddling." The iron is heated, iron oxide and certain slag-forming materials are added and the molten mass is stirred, causing the iron oxide to react with the carbon to form iron while the slag removes other impurities. As the carbon is removed the melting point rises and the metal becomes a pasty mass like bread dough which is pressed between big rollers to squeeze out the slag.

Steel first was made commercially by the crucible process from wrought iron produced by "puddling." The iron was packed in carbon and heated, causing it to absorb some of the carbon. The resulting product was melted in crucibles to obtain homogeneity, a slow and costly process.

The Bessemer converter ushered in the real age of steel and made possible our early railroads, battleships and skyscrapers. By this process, molten pig iron is placed in a giant egg-shaped vessel, the converter, and a blast of hot air is blown through it. The oxygen of the air burns up most of the carbon and non-ferrous impurities, the other impurities forming a slag. To keep the liquid steel from dissolving oxygen, a small amount of manganese is added.

The Bessemer converter, whose spectacular blowing lights the country for miles, lowered the cost of steel through quantity production but Bessemers today have been replaced to a large extent by open hearth furnaces which produce a better and more uniform product. Open hearth furnaces provide the great dramatic spectacle today on the stage of steel. Into a battery of these brick-lined furnaces, each holding 100 tons or more, go molten iron from the blast furnace, limestone, metal scrap and any alloys needed to impart special properties. Here the metal seethes and bubbles for hours. Temperatures as high as 3,000 degrees are produced by burning intensely preheated gas and oil forced through checker cham-

bers under pressure. Because of the terrific temperatures produced, furnaces must be entirely rebuilt at intervals.

When laboratory analysis of samples shows the metal has been refined and is of the required specifications, a big clay plug is rammed out and, with a mighty roar and a shower of sparks, the molten steel rushes into a great ladle which is lifted by a giant crane to pour the white-hot metal into molds, each holding 10,000 to 12,000 pounds. A mold train carries the steel into the yard to cool. Cranes release the red-hot metal ingots from the molds and carry them to huge gas-fired soaking pits where they are soaked with heat to bring them to uniform temperature. Then giant pincers lift them out and lay them on roll tables leading to the "blooming mill."

No better illustration of the ability of the machine to shoulder the back-breaking tasks of man can be found than the modern process of rolling metal. Brawny steel workers wielding heavy tongs used to pass slabs of red-hot metal back and forth through the rolls of the mill, something like a huge clothes wringer, until a slab was reduced to a sheet of metal. Only the strongest men could stand the labor and the heat.

To the American Rolling Mill company at Middletown, Ohio, several years ago came a young paper-mill engineer, John B. Tytus. Tytus had an idea—a dream of straight-line production of steel, stand after stand of rolls, conveyors and reheating furnaces half a mile long with a three-foot slab of metal going in one end and coming out the other as a strip 200 feet long and as thin as a coin.

Iron and steel engineers ridiculed the plan as visionary and impracticable but the company was interested. For fourteen years Tytus labored with blueprints and designs under the supervision of Charles R. Hook, now president of the company. Thousands of dollars were spent on experimental work but the only way to find whether such a machine would work was to build one. So the company bet several million dollars that Tytus was right and ordered construction of a continuous rolling mill. And Tytus was right.

(Continued to page 120A)



# CHANGE NOW **GET RID OF THINNED-OUT WINTER OIL**

Fill up with Fresh  
Summer  
Mobiloil



**H**ARD WINTER WEAR dirties oil. Winter "choking" dilutes it. Have your crankcase drained today and refilled with the correct grade of summer Mobiloil!

Car owners report Mobiloil gives up to 50% more mileage—reduces repairs. For Mobiloil, made by Socony-Vacuum's

Clearsol Process, is free of gum and carbon forming elements. No matter what type of bearing—or how high the engine temperature—it gives 100% protection.

Get set for summer at the Mobiloil sign—or the Sign of the Flying Red Horse. SOCONY-VACUUM OIL COMPANY, INC.



See the 1936 Mobiloil chart  
for correct grade for your car



(Continued from page 118A)

Today, starting in the blooming mill, ponderous 12,000-pound ingots are mauled through mighty rollers until they have been reduced into slabs eighteen or twenty feet long, five or six inches thick and three feet wide. Each is sheared into slabs ranging from 1,200 to 2,600 pounds, according to ordered size, and these are reduced to ribbons of metal 200 feet long at the rate of a ton every thirty-two seconds. All the labor required is the energy necessary to press push buttons. The continuous mill does the work.

During the journey through the rollers, the metal becomes strained, so annealing is necessary to allow rearrangement of the grains that make up its structure and control its temper. The sheets are allowed to soak up heat and "relax" for several days in great furnaces, then follow cleaning, cold-rolling, coating with lead or zinc, trimming, polishing and other operations, depending on the purpose for which the metal is intended.

Different processes are followed in the foundry and in the fabrication plant in order to shape the metal for its intended use, but the initial preparation is the same.

While man has used iron and steel for centuries, he is only now beginning to understand some of its hidden properties. The X-ray is helping to reveal this in metallurgical laboratories. Chemically pure iron has never been prepared in usable quantities and thus research to determine the actual properties of pure iron may disclose something entirely new about this age-old metal.

Nickel, chromium, manganese, cobalt, molybdenum, vanadium, titanium and tungsten are among the metals alloyed with steel today but it is likely we have hardly scratched the surface of the possibilities in alloy steel. Nickel makes steel hard without detracting from its toughness so we use it in gun barrels and armor plate. We know, too, that chromium has much the same effect as nickel and in addition those metals give steel a high resistance to corrosion, thus making possible our stainless steels. Manganese makes steel so tough it cannot be cut or bored, so we use it for vaults and safes.

The high-speed steels are alloyed with tungsten or molybdenum which enable the metal to hold its temper even when

heated to incandescence, making such steel suitable for cutting very hard substances. And without iron we would be without electrical energy because the electrical industry is based on the magnetic properties of iron. Electrical steel has silicon added.

By proper treatment, iron and its alloys may be modified in an endless number of ways. For example, it may be prepared in such active form that it bursts into flame on contact with air, or it may be made resistant enough to withstand the action of boiling acids. This adaptability is constantly increasing the uses for the metal. The total ingot capacity of the American iron and steel industry is about 60,000,000 gross tons a year, or sixty per cent of world production. Who can predict the forms this material will take in a few years? Perhaps the best answer comes from George M. Verity, chairman of the board of the American Rolling Mill company. "Ninety per cent of Armco products today," he said, "were not even produced twenty years ago. Two more decades may see an even greater change. The growth and expansion of iron and steel is an index to progress and as civilization advances, iron and steel must continue to perform greater and greater services."

There are three pivots on which civilization turns—food, clothing and shelter. Once all three were scarce. Weapons and plowshares made of iron then made food abundant. The cotton gin, the loom and mechanical weaving have supplied us with plenty of clothing. But we still live in houses of wood and brick and stone—the identical materials which have been used for hundreds of years.

One of the next great tasks of iron and steel is to make shelter for mankind as easy to obtain as food and clothing. It should be as easy for an American family to own a home as to own a car. Iron and steel have made it possible for the average family to own a car and iron and its alloys can make it possible for the same family to possess a home with more comfort and conveniences than the modern home today, and at a fraction of the cost.

Our Bureau of Information will answer questions regarding articles in this magazine, if accompanied by return postage.



# Cooler shaves

## EVERY DAY

### because Ingram's does these three things

When you start using Ingram's, you stop getting hot shaves. For three special ingredients in this rich-lather cream do these three things to make all shaves quick, clean and stingless—

1st, they wilt whiskers softer at the skin-line, where your razor works. 2nd, smooth your skin so the blade can't skip and scuff. 3rd, cool your face while you shave, keep it cool when you've finished.

You'll never need a lotion after a shave with Ingram's. There's no burn—no smarting—no rawness. That's why "bluebeards," twice-a-day shavers, find Ingram's a special friend. With it they can shave as often as they have to, yet pay no penalty.

And all shavers find Ingram's economical. Because it's concentrated, it goes further. Three months of cooler, happier shaves in every tube or jar! At your druggist's.



#### TRY THE WORLD'S COOLEST SHAVE *free*

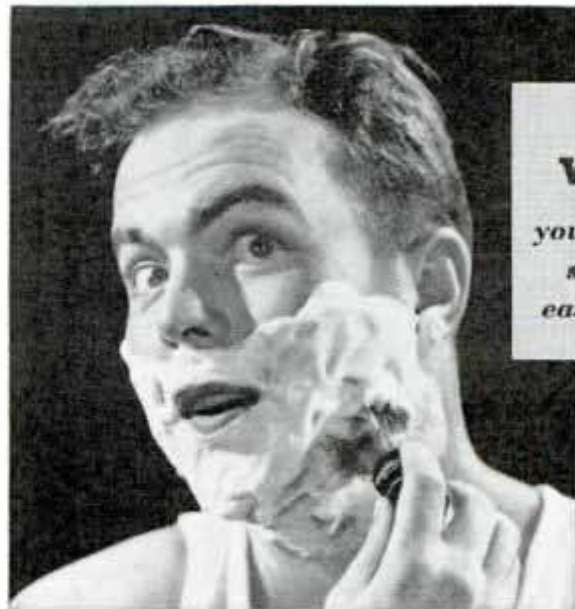
BRISTOL-MYERS CO., Dept. E-56,  
636 Fifth Ave., New York, N. Y.

*I'm ready for cool shaves. Send me a free 10-shave tube of Ingram's!*

Name.....

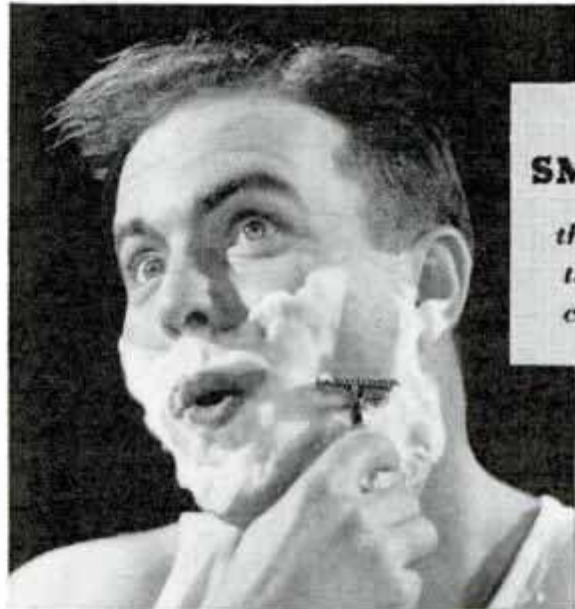
Street.....

City..... State.....



### 1 WILTS

*your whiskers  
softer for  
easy shaving*



### 2 SMOOTHS

*the skin so  
the razor  
cuts close*



### 3 COOLS

*your face  
and banishes  
after-sting*

# INGRAM'S SHAVING CREAM

*When writing to advertisers please mention Popular Mechanics*



# Rolling Around America

(Continued from page 681)

7220  
Pikes Peak, the Garden of the Gods, and Cody, Wyo., home of the Buffalo Bill Museum, then crossed the Yellowstone National Park, and turned southward through Montana and down to Salt Lake City. We visited Reno and the capitol at Carson City. We drove through the Yosemite National Park—then continued westward to San Francisco. We spent several days in southern California, took a peek at the movie industry, then drove eastward to the petrified forest of Arizona, stopped at the famous Carlsbad Caverns, then dropped into Texas and across into old Mexico at El Paso. Then to San Antonio and the Alamo Mission. From Houston and Beaumont, we drove to Baton Rouge, then to New Orleans, then across Alabama and Florida to St. Augustine, and up to Atlanta. Tennessee followed with stops at Chattanooga and Knoxville and then toward North Carolina and Tennessee's Great Smoky Mountain National Park. Then came historic King's Mountain, Charlotte, and on into Virginia, over the Natural Bridge, through the Shenandoah valley and its hundreds of crystal caverns to Charlottesville, and the famous homes and shrines of Jefferson, Monroe and Madison. From these historic places we drove to Fredericksburg, then back to Washington.

During this trip of thirty days we slept in the trailer at night and parked it wherever we wished, cooked our supper which usually consisted of a big steak, light bread and milk, and got to sleep early. Breakfast consisted of nothing but fruit and a steaming cup of black coffee. Then we started driving just about dawn. I found the best time for driving was between dawn and ten o'clock in the morning. Sometimes, we drove at night. We covered an average of about 375 miles daily, depending on where we wanted to stop and what we wanted to see.

I found many people had never seen a United States senator and they usually expressed surprise at seeing one dressed in overalls and unshaven. At Sioux Falls, S. D., I parked the car and was walking along the street when a nice looking fellow came along. I accosted him, intending to ask where the telegraph office was.

Without pausing he said: "Sorry, I haven't got a dime" and increased his pace.

There were days at a time when we enjoyed the "luxury" of not shaving, bathing or changing clothes. We had a few breakdowns, but someone always happened along and gave us a hand. The roads were good everywhere. However, those in South Dakota and Wyoming could stand a lot of improvement. In the Yellowstone and Yosemite parks many stretches were rough and dangerous.

Now, about expenses. I used about 850 gallons of gasoline and spent approximately \$250 for gas and oil. We didn't cook all our own meals as people along the route entertained us frequently at noon and supper. Food purchased along the roadside can be bought from twenty-five to thirty per cent cheaper than in the city markets or stores. With \$350 going for food and fuel, the only other additional expenses were tunnel and bridge tolls and the fees to museums and national parks.

Anyone taking such a trip will need a red lantern, rope or chain for towing, flashlights, a tent, provided the trailer does not have sleeping accommodations, first-aid kit, water bucket and a small gasoline or kerosene stove if you do not want to gather wood for fuel. The trip should be carefully planned. One wise method is to procure literature describing the country you intend to visit.

Don't tie yourself down to a too definite daily schedule. Stop at the places which appeal to you, have a good time and don't work yourself to death merely trying to cover ground. In every state there are comfortable and cheap tourist camps and the national parks have fine camp sites.

Don't let someone tell you, "It can't be done." I had that said to me many times. Well, I did it. And if I can do it, you can. But you can't do any loafing and you can't waste any money if you try to cover the United States and take a glimpse of Canada and Mexico all within thirty days and for \$100 each for four persons.

But here's luck if you do undertake it and I'll venture the assertion that when you get back you will feel healthier and stronger and be more enthusiastic about your country than ever before.



# OUT OF LUCK!



## THE ONLY TIRE THAT GIVES YOU GOLDEN PLY BLOW-OUT PROTECTION

**Child; pointing:** "Look, mamma, the front is all smashed up."  
**Mother:** "Yes, it was a blow-out. They're lucky they didn't go through the railing."

\* \* \*

Here's how the amazing Goodrich invention—the Golden Ply—saves lives. At speeds of 40, 50, 60 miles an hour terrific heat is generated *inside* the tire. Rubber and fabric begin to separate. A tiny blister forms. You don't know it—you can't see it—you drive on. Bigger and BIGGER it grows until—sooner or later—BANG! A blow-out! By resisting internal tire heat the Golden Ply—found *only* in

Goodrich Silvertowns—keeps rubber and fabric from separating. Blisters don't form inside the tire, and when you prevent the blister you prevent the high-speed blow-out.

When the tires on your car can easily mean the difference between life and death, don't you want this real blow-out protection and the months of extra mileage and greater riding comfort that Silvertowns will give you? And when you stop to think that Silvertowns cost not a penny more than other standard tires, isn't it foolish to gamble on tires? See your Goodrich dealer now.

HEAT CAUSES BLOW-OUTS.  
PREVENT THOSE  
BLOW-OUTS WITH THIS  
HEAT-RESISTING  
GOLDEN PLY



**FREE!** Join the Silvertown Safety League. Sign the Safe Driving Pledge and your Goodrich dealer will get for you absolutely free a tail-light emblem with red crystal reflector. No obligation to buy.



# The *new* Goodrich **SAFETY** Silvertown

With Life-Saver Golden Ply Blow-Out Protection



## Thirty Million Dollar Ship

(Continued from page 671)

for him. That accounts for the unusual strength and thickness of the "Queen Mary's" plates and their solidly riveted overlaps. It accounts too for the extraordinary precision and accuracy of her moving parts, especially for her four 320-ton gear wheels, cut to mesh within one-thousandth of an inch. It accounts also for her foolproof system of fire prevention. On the ship's bridge, an officer notes on an automatic recorder that a man in the baggage room hundreds of feet away has put a match to his pipe. With slight effort the officer can throw a fireproof wall around the baggage room and isolate it from the rest of the ship. Every passageway on the "Queen Mary" can be isolated from the rest by fireproof bulkheads and fire walls, controlled from the bridge. High-pressure water mains traverse every deck. The system is said to be sufficient to protect a cargo of wild gasoline and explosives.

The "Queen Mary" also carries the greatest lifeboat fleet ever installed on a ship. Each lifeboat can carry more people than the entire passenger capacity of the first Cunard steamship, the "Britannia" of 1840. The fleet comprises twenty-four steel boats, all equipped with Diesel engines capable of six knots. These boats range from thirty to thirty-six feet in length and each can carry 145 passengers. Each carries emergency rations, water, flares, axes, compass and ropes, and two carry radio transmitters.

For passenger recreation the "Queen Mary" provides deck play spaces equal to the area of the famous Yale Bowl. In addition to two swimming pools, there are three gymnasias, squash courts, Turkish and electric baths, a "frigidarium" and a "tepidarium." One lap around the main promenade equals one-third of a mile.

Fifty-nine varieties of rare wood are used in the decorative schemes alone. The entire wall over the dining salon staircase is devoted to a map of the North Atlantic, with a moving model of the "Queen Mary," showing her exact position day by day.

And the lighting control in the main ballroom and veranda grill is "geared" to the particular selection of music being played so that the color of the illumination is affected by the pitch of the notes.

## The Freight Train Goes Modern

(Continued from page 663)

time. But dispatchers can't always do so well. They must allow extra hours for blizzards, for heavy loads; must know the grades on surrounding divisions, the power of the engines, the weight of the train. Seven thousand tons is a heavy load under any conditions. The heaviest single carload ever hauled, an electric machine sent from Schenectady, N. Y., to Wilkes-Barre, Pa., over the Delaware and Hudson line, weighed 367,000 pounds; 473,900 pounds including the car, and cleared some bridges by only one inch.

Romances have been woven about the wanderings of freight cars. Like nomads they travel from railroad to railroad, but they are never forgotten. Hounded like a criminal, each car eventually finds its way back to the home line—for the owner can collect rental for the car so long as it is held by another railroad. As soon as a Chicago and North Western railway box-car reaches the Nickel Plate tracks, the latter railway must report its movements until the car is passed on to another road or returned to the North Western. Naturally this rental charge is an incentive to return the car to its owner as soon as possible. One of the important jobs on the railway is that of the car distributor, who must know business conditions on his line and have grain cars on hand when harvest movements begin, merchandise cars ready when factories are producing, and so on.

Keeping the vast produce of a nation moving in orderly fashion is a gigantic task, and with the recent steady growth of freight cargo the railways are requiring new rolling stock and ever faster schedules. The Pennsylvania system alone owns more than a quarter of a million freight cars, and has ordered 10,000 new cars for this year. It is estimated that there are \$200,000,000 worth of freight cars in this country owned by companies other than railroads. The amazing variety of cars needed can be seen in the report of one transportation company that it found 110 different commodities carried in tank cars alone during one year, and it furnished sixty-five distinct types of cars to shippers.

Our Bureau of Information will answer questions regarding articles in this magazine, if accompanied by return postage.



# Insulating Spark Plugs Against Electrical, Mechanical and Heat Shock

No spark plug is better than its insulator, and incidentally no engine is better than its spark plugs. The function of the insulator is to prevent the high tension current from flowing in any direction except across the gap, formed by the two electrode wires. At this point, the current, in the form of a spark, ignites the combustible gas in the cylinder at the instant of highest compression.

Except for Sillimanite, discovered by Champion engineers, various types of porcelain insulators are most generally used. Synthetic Sillimanite, developed by research, proved that if the material could be discovered in its natural state it would make the finest insulator known to ceramic science.

Years of search finally uncovered a huge deposit of this rare mineral, on the southwest slope of White Mountains, in the Inyo Range, California. Located at 10,000 feet elevation, this non-metallic mineral is mined, shipped East, and processed into Champion Spark Plug insulators or cores. Champion owns broad basic patents covering the exclusive use of Sillimanite in spark plugs and many other fields.

Such laborious effort would scarcely be warranted unless Sillimanite really made Champion the better spark plug. That Champion with Sillimanite insulation is the better spark plug, is established beyond a shadow of a doubt by Champion's 12 years of supremacy in racing the world over.

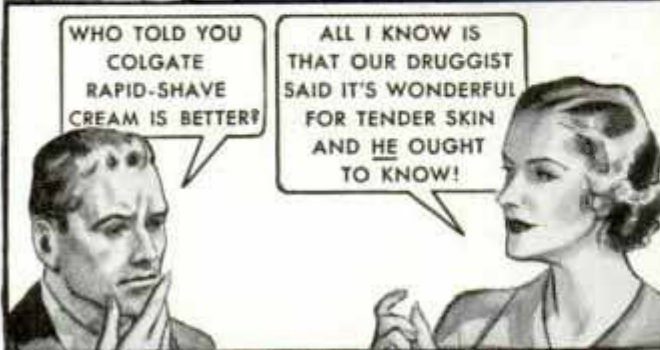
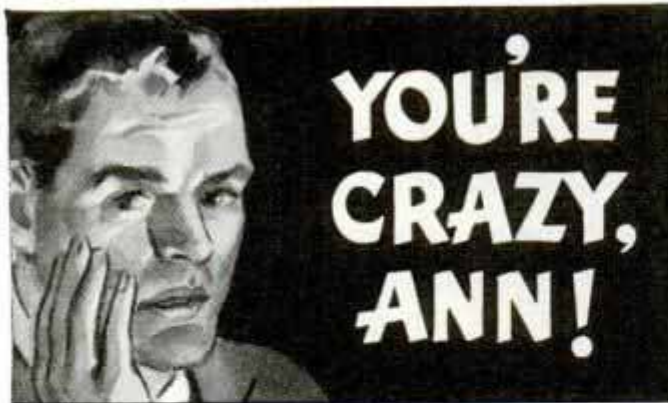
Remember when you buy Champions you buy the only spark plugs which have had 25 years of unswerving attention in research and experiment, and advanced manufacturing technique applied to the only product made by Champion.

**USE THE SPARK PLUGS  
CHAMPIONS USE**

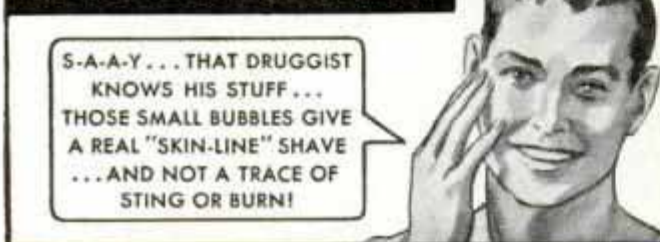


# CHAMPION EXTRA-RANGE SPARK PLUGS





**SO JUST TO PLEASE HER**



**BUBBLE PICTURES SHOW WHY**



**MOST LATHERS** are made of bubbles too big to get to the *base* of the beard! Air pockets keep the soap film from reaching the whiskers. So the beard is only *half-wilted*.

**COLGATE RAPID-SHAVE CREAM** makes tiny bubbles that get clear down to the skin-line. Its rich soap film soaks your beard soft at the base. Makes your shaves last longer.

**DINNER THAT NIGHT**



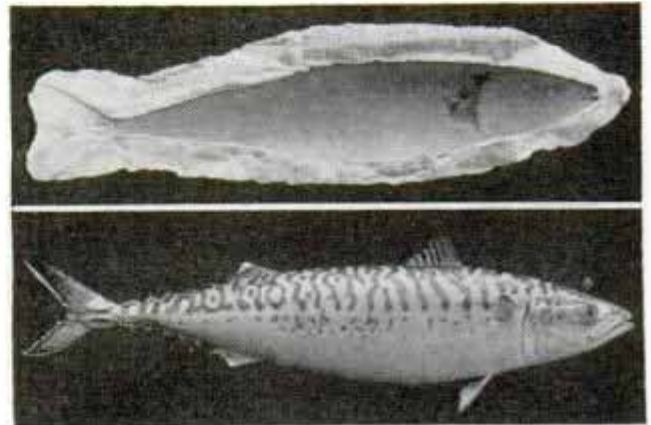
COLGATE "SKIN-LINE" SHAVES LAST HOURS LONGER



**The Marvels of a Strange Art**

(Continued from page 692)

after death. In the studio, the skeleton is posed in the position on the rock or base it will eventually stand upon. Papier-mache is modeled over the skeleton, reproducing the body of the bird in all its exact detail. When the composition has set, the skin of the bird, which has been relaxed and tanned, is pulled over this sculptured body and adjusted. Now comes the most important and trying part in bird taxidermy—feather handling, or arranging the feathers and feather patterns of the bird into a natural position. This is no easy task, especially if the bird has been



Above, plaster-of-paris mold of mackerel with fins cut away. Below, finished cast

handled carelessly in skinning. After the specimen has been dried, the colored glass eyes are set in place and the bill, feet and all fleshy parts are painted.

Fishes and reptiles present the most difficult work in taxidermy, as you have not only form and anatomy to consider, but color as well. Both are cast in several different mediums and these casts, or reproductions, are put on exhibition. While an angler probably would never be satisfied with a reproduction of his catch, he would never know if the taxidermist did use the casting method in mounting his fish, and in the end he would have a more lifelike job. Because of the varying nature of the skin and the body formation in fish and reptiles, they are prepared for museum exhibition by reproducing them in several different ways. The finished work, in each case, represents an exact copy of the original and one that will not deteriorate.

Color notes are made of the fish or reptile as soon after death as possible or even while it is alive if this can be done. In



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 casting fish, the fins and tail are cut away, spread out and dried into shape. The fish is laid in the position wanted in the finished mount and plaster of paris is poured over it. After this has set, the fish is removed and you have a mold of the specimen. A separator is painted in this mold and more plaster poured. When this has set, the mold is broken away and you have a plaster of paris cast of the fish as it was in life, minus fins and tail. The fins and tail are fastened to the cast, it is "pointed up" in places, colored glass eyes are set and the whole is painted in color. Sometimes as many as fifteen or twenty colors are used, some of them only tints, and several different applications may be used in coloring one small fish.

The reproduction of reptiles is accomplished by a complicated method, known and used by few on account of the difficulties. Due to its translucent color, it is impossible to paint the cast of a reptile as is done in mounting fish. Therefore the different colors must be painted into the mold. The reptile is posed and a plaster-of-paris mold is made of it, sometimes in several sections if the reptile is large and posed in a difficult position. Each color is mixed separately, using color notes taken from the original specimen. The medium used is cellulose-acetate. Oil colors are mixed with this clear liquid celluloid, each color to itself and kept separate until applied to the mold.

The colors are next painted into the mold, those that showed on top being painted in first and being graded down to the background or body color. After all the colors have been painted in and built up in thickness to represent the skin, it is allowed to harden slowly. A framework, in large specimens, is built inside the mold to strengthen it. Then the plaster mold is broken away from the reproduction. You now have the reptile reproduced in a medium that will last indefinitely, and one that shows the correct form and, most important, the translucency of color.

Making the dead appear to live is indeed a strange profession. It never grows monotonous and every day brings something new from strange corners of the earth.

Our Bureau of Information will answer questions regarding articles in this magazine, if accompanied by return postage.

*Who can equal  
this record?*

**G**UARANTEES and money-back offers are not "news." More than thirty years ago we said:

We desire to call your attention to Edgeworth Tobacco. Every box of it is guaranteed not to burn the tongue, and to give satisfaction. We will cheerfully refund money to any dissatisfied purchaser.

That guarantee is still in effect—not merely for thirty days, or a year, but any time! Every tin of Edgeworth or Edgeworth Junior shows "Satisfaction Guaranteed."

Smoke as much or as little Edgeworth as you please. If the tobacco does not satisfy, return it and you will get your money back. In all these thirty-odd years, the claims made under this guarantee could be counted on the fingers of your two hands. There,

we believe, is a record of satisfied customers few can equal. Larus & Bro. Co., Richmond, Va., Tobacconists since 1877.

"CELLOPHANE" WRAPPED



**CORN COB PIPE CLUB**

Crossroads' fun, music, Wednesday evenings at 9:00 (E. D. S. T.) over NBC Blue Network, direct from Richmond, Va. (Pacific Coast, KOMO, KFI, KPO, KGW, KHQ.)



# Secrets of Making a Good Lawn

(Continued from page 730)

debris and roll the surface until it hardly shows the indentations of footprints. A firm seed bed is necessary for a good lawn.

The seed depends on your soil and climate. Most lawns contain a mixture of grasses, so consult your seed store for the mixture suited to your locality. Your seedsman may recommend a mixture containing Kentucky bluegrass and a small amount of clover. The clover springs up in a week and dies by the end of the season. It is added partly because everyone likes to see a lawn turn green quickly but it also acts as a "nurse," protecting the bluegrass that requires about seventeen days to make an appearance. The bluegrass forms the permanent sod. English rye grass, like clover, is sometimes added to the mixture for quick results. Canada bluegrass is hardy on poor or clay soils, and the bent grasses make good permanent sod on sandy soils. Red fescue is another grass that flourishes in poor soil and dry places, but it springs up in bunchy growths.

If part of your lawn will be shaded most of the time, obtain a special shady lawn mixture for that area. The mixture may contain shade bluegrass, red top, and Australian rye. If part of the lawn is to receive hard wear, a mixture consisting in part of Australian rye or Pacey's rye will probably be best. These grasses are coarser than the bluegrasses and bents.

Sow the seed on a calm day to obtain even distribution. Use about one pound of seed to every 150 square feet of lawn. Broadcast a handful of seed in front of you with a sweeping motion at every step. Use half the amount on the first round and sow the balance at right angles to cover the plot evenly. After seeding, rake the surface lightly so the seeds are barely covered and roll once lightly, or cover the seeds with a thin top dressing of sprinkled dirt.

Then sprinkle with a fine spray of water and repeat as often as necessary to keep the surface moist for ten days but don't let the soil become soggy. Sprinkle at least twice a day for the first three weeks, then once a day in dry weather. Mow when the grass is two inches high. Set the mower to cut about one inch high and al-

low clippings from the first mowings to remain. In mid-summer, especially with a new lawn, it is best to keep the grass two or three inches high. Once a month, give a light top dressing of some commercial fertilizer, and water afterward. These meals will keep the grass healthy and green. To create a compact turf the lawn may be rolled after the grass is cut.

In some sections, fine lawns are grown of creeping bent, one of the popular grasses used on the putting greens of golf courses. The lawn is sown by broadcasting chopped-up grass roots instead of seed. The chopped pieces send out underground runners that sprout leaves at close intervals, forming a solid mat. The chopped bent "stolons" cost about one-third more than seed and the stolons from one square foot of nursery sod will plant about ten square feet of new lawn. Creeping bent lawns may be planted at any time except when the ground is frozen and are well established after three months. During the first month progress seems slow since most of the early growing occurs underground. Creeping bent is tolerant of acid soils and is often planted with bluegrass, forming a solid turf that resists weeds. Such a lawn automatically repairs itself since the runners fill in worn or injured areas. After stolons are broadcast and covered with a very thin coating of peat moss or manure they should receive the same kind of care as grass seed.

No matter what kind of fertilizer is used as top dressing, the grass should be dry before the plant food is applied and should be well sprinkled immediately after or the fertilizer may burn the grass tips. Well kept grounds are said to add twenty per cent to the value of a house. Some nurseries sell sod at from five to ten cents per square foot. Overnight a nurseryman can transform a bare yard into a green lawn that may be walked upon, needs watering at night, and a cutting at the end of the week.

If you have room for a grass plot in a back-yard corner you can raise turf from seed for replacing worn areas. Cut the turf in strips a foot wide and separate it from the ground two inches below the

(Continued to page 130A)



# One Crude Fact

## ANSWERS THE QUESTION

### "WHICH IS THE WORLD'S FINEST MOTOR OIL?"

**Crude Prices at Wells**  
(Cents per barrel)

Bradford, Allegheny (Tide Water Pipe Co.)	\$2.80
Penns. crude oil, In S.W. Pa. National Transit Lines	2.75
Penns. crude oil in Bureau Pipe Line Co. Lines	1.80
Penns. crude oil in Buckeye Pipe Line Co. Lines	1.80
Coming	
Luna	
Hibon	

**The costliest crude oil**  
IN THE WORLD IS THE ONLY CRUDE  
THAT GOES INTO VEEDOL MOTOR OIL

*Yet Veedol costs you no more than ordinary oil*

**T**UCKED away in one corner of the great financial dailies, is a little column of figures that tells you more about motor oils than all the ads ever written. It is called "Crude Prices at Wells."

Daily, that list is topped by Bradford and Allegheny crude oils... the costliest crude oils in all the world... and Bradford is the only crude that goes into Veedol Motor Oil. This crude surpasses all others in rich oiliness, in obstinate heat-resistance, in friction-fighting stamina... qualities which are vital in creating Veedol's famous "Film of Protection." The oil film that is thin-as-tissue,

smooth-as-silk, tough-as-steel. The oil film that millions of car owners regard as the soundest insurance policy against motor wear and tear.

When "the world's costliest crude"... is refined by the world's largest refiners of Pennsylvania lubricants... to give you a motor oil with the fighting "Film of Protection"... how can it help being the world's finest motor oil?

Doesn't that make "Veedol" the answer to the question at the top of the page?

TIDE WATER OIL COMPANY  
17 Battery Place, New York City

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**INDESTRUCTIBLE VEEDOL MOTOR OIL**

THE FILM OF PROTECTION

MADE 100% FROM PENNSYLVANIA'S COSTLIEST CRUDE

THIN AS TISSUE  
SMOOTH AS SILK  
TOUGH AS STEEL

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WHAT? NO WHEY

YOU HEARD ME  
CORNED BEEF AND  
CABBAGE!**LITTLE MISS MUFFET**

SITS ON A TUFFET . . .  
AND SAYS "I WANT NO WHEY!"  
I'VE GOT MY TUMS  
IF SOUR STOMACH COMES . . .  
I'LL EAT MY FILL, TODAY!"

**"YOU NEVER KNOW WHEN"  
SO...CARRY...TUMS**

PEOPLE everywhere are surprising their friends by eating foods they have long avoided by carrying a roll of Tums right in their pocket. Millions have learned this quick, safe way to eliminate heartburn, sour stomach, gas, acid indigestion in this pleasant way. TUMS represent a real scientific advancement. They contain no harsh alkalis. Instead a remarkable antacid that never does more than neutralize stomach acid. No danger of over-alkalizing the stomach or blood. A roll of TUMS in your pocket will save many a day for you. They're so economical—only 10c a roll—ask any druggist.



TUMS ARE  
ANTACID . . .  
NOT A LAXATIVE

FOR THE TUMMY

HANDY TO CARRY

**FREE:** Beautiful five-color 1936 Calenda-Thermometer. Also samples of Tums and MR. Send stamp for packing and postage to A.H. Lewis Co., Dept. 15E-53, St. Louis, Mo.



**GIVE YOUR .22 RIFLE  
60% More POWER!**

GET more out of your shooting holidays, without more cost. Shoot Winchester Super Speed Staynless .22 rim fire cartridges. Speed—100 yds. to regular .22's 80 yds. Power—away out at 150 yds. your .22 Long Rifle bullet hits with the same 90 ft. lbs. shock that the regular .22 L.R. delivers at only 50 yds. Accuracy—plenty, with flatter line of flight. Clean, from no-rust Staynless priming. Hollow-point (for hunting) or solid lead bullets, Kopperklad or lead greased. Used extensively by farmers, ranchmen, government exterminators, shooting small predators and farm pests. Priced no higher than regular .22s. Get them at your dealer's. For folder and 64-page Gun and Ammunition Catalog—FREE—write Dept. 46-C, Winchester Repeating Arms Co., New Haven, Conn., U. S. A.

**WINCHESTER**  
TRADE MARK

(Continued from page 128A)

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roots with a flat sharp spade, rolling it backward like a jelly roll so it can be handled easily. Remove enough dirt from the area you wish to repair so the new turf will fit snugly and be the same height as surrounding grass. After one watering, the new turf can be treated like the rest of the lawn. Cover banks and terraces with mature turf since much of the seed planted on a slope is washed away.

If you have no turf, re-seed the thin patches. Rake the area deeply, work manure into the surface, broadcast the new seed, and cover with a thin top dressing of soil; after that, roll the area before each sprinkling. Never roll a lawn after a watering as that leaves a hard surface. Once every month, scatter half a cupful of seed over the whole lawn and follow with a sprinkling to wash the seed to the ground. That is the secret of having new growth appearing all the time. Even if a lawn appears in good condition, it should receive one major renovation each fall or spring. Cut the grass close, remove large weeds, and scratch the whole plot deeply with a rake. Work peat moss or manure into the surface, sow seed liberally, add a top dressing, and roll and water.

Until your lawn becomes a thick solid turf, exterminate weeds as soon as they appear. If you allow them to go to seed they will multiply next season. Devil grass, witch grass, or crab grass should be raked out or pulled up. Docks, dandelions, and plantains can be removed by placing one drop of sulphuric acid on the crown of each plant during a dry spell so the acid will be absorbed before rain washes it over the grass. One part of sulphate of iron to three parts of sand sprinkled over weeds after a rain or following a sprinkling burns down the broad-leaved weeds and has little effect on the grass.

Worm casts indicate an improperly drained topsoil or a soil that is quite heavy. Soapy water, or lime water made by dissolving lime in water and decanting the clear liquid after the lime has settled, attracts the worms to the surface when sprinkled over the lawn. Then they may be raked off. Casts should be brushed off before rolling the lawn.

Our Bureau of Information will answer questions regarding articles in this magazine, if accompanied by return postage.



**1** Rich red blood necessary to properly nourish and build up every part of the body, is especially promoted by this new discovery where iron is needed.

**2** A healthy digestion which gets ALL the good out of your food requires an adequate supply of Vitamin B. This new discovery supplies this precious element.

**3** Normal, regular elimination to remove poisonous waste and thereby promote health and growth calls for adequate Vitamin B. This is the third purpose.

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Scientists recently discovered that thousands of people are thin and rundown for the single reason that they do not get enough digestion-strengthening Vitamin B and blood-enriching iron in their daily food. Now the richest known source of body-building Vitamin B is cultured ale yeast. By a new process the finest imported cultured ale yeast is now concentrated 7 times, making it 7 times more powerful. Then it is combined with 3 kinds of blood-building iron in pleasant little tablets known as Ironized Yeast tablets.

If you, too, need these vital elements to build you up, get these new triple-acting Ironized Yeast tablets from your druggist today. Then, day after day

as you take them, watch flat chest develop and skinny limbs round out to natural attractiveness. Constipation and indigestion from the same cause vanish, skin clears to normal beauty, new health comes — you're a new person.

### Try it—guaranteed

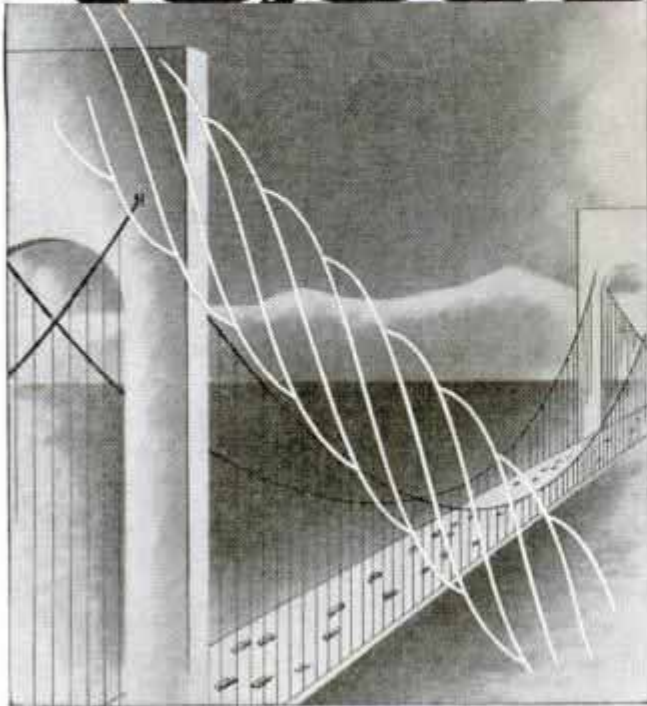
No matter how skinny and rundown you may be from lack of sufficient Vitamin B and iron, these new 3-way Ironized Yeast tablets should build you up in just a few weeks, as they have thousands of others. If you are not delighted with the benefits of the very first package, your money will be instantly refunded.

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## Master Craftsmen of the Movies

(Continued from page 709)

mensions and nail them in place. Slate roofs, stone walls and chimneys are also duplicated from plaster casts.

The finishing touches to wood and plaster objects are added by the "gay deceivers," the painters who give the objects a lifelike appearance. With a few strokes of his brush a painter transforms a plaster cast into a genuine-looking marble statue or adds a weather-beaten appearance to some wharf timbers. Brick veneer and tile roofs are given their final coats with spray guns. Everything used on a set is painted in its natural colors even though the camera reduces all to black and white tones. This is because of the psychological effect on the actors.

Most breakaway furniture is made of light balsa wood that can be worked into any shape and that splinters like pine when used as a club. Sometimes real furniture is used but the article is broken apart ahead of time, then glued together and painted over. Breakaway milk bottles are made of thin plaster, a painter adding a band of darker paint at the necks to simulate cream. Chinaware and vases to be broken in pictures are also made of plaster. If an actor is required to break a glass window, clear rock candy poured to the right shape is substituted for the glass. The candy shatters realistically but no one is cut. An automobile fender of thin lead folds and crumples realistically in a collision with another car.

One of the largest breakaway articles Paramount builders ever erected was a full-size house supposed to collapse at a hand's touch in a comedy picture. Engineers had to figure out ahead of time where each part would fall. The house was put together on the principle of a falling box used to trap small game and collapsed at the touch of an electric trip.

The closest the "back of the lot" boys have come to being stumped was in another comedy picture. The director wanted to show what happened when a young bride placed too much yeast in some bread dough. When the pan of dough was placed in the oven it was supposed to overflow and force its way out. First, wet plaster was tried, then a glue preparation. Finally, in desperation, someone made up a big batch of real dough. It worked perfectly!

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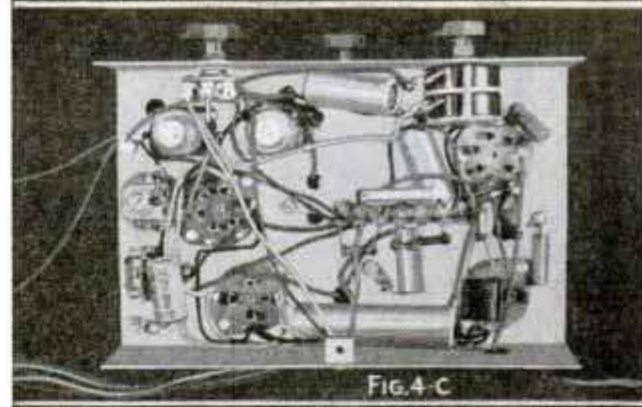
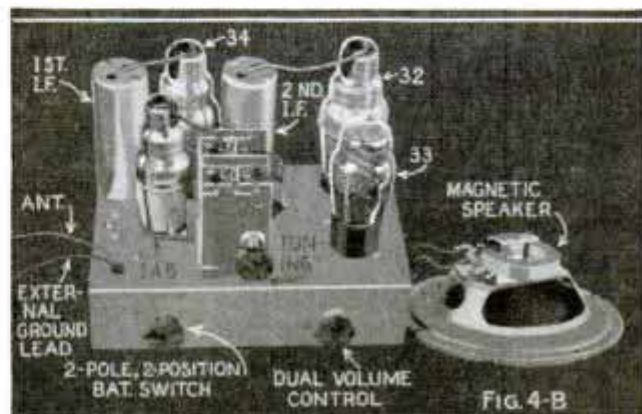
City..... State.....

## Portable Battery Receiver

(Continued from page 743)

and B-battery circuits when the set is turned off. Top and underside photos of the completed chassis are shown in Figs. 4-B and 4-C. The series-wound Hi-Q, I.F. transformers and the oscillator coil are 456-kc. types.

Fig. 3 shows a photo of the final assembly in the carrying case, details of which are given in Fig. 3-B. A 6-in. magnetic speaker is mounted in the rear end of the case behind a neat metal grill. Although



the assembly is compact there is no crowding of parts. An original list of all materials can be obtained from Popular Mechanics radio department without charge. The blueprint number is R-223.

To balance the set, connect it up outside the case and tune in a weak station, then with a small screwdriver adjust trimmer screws Tr. 2, 3, 4 and 5 inside the tops of the I.F. transformers. Turn each screw back and forth, not more than one complete turn in each direction, until maximum volume is obtained. Then adjust trimmer Tr. 1 for loudest signal; next turn the unmarked trimmer on top of the front section for clearest signal. Finally turn ganged-condenser plates in about seven-eighths closed and adjust padding condenser for maximum volume.



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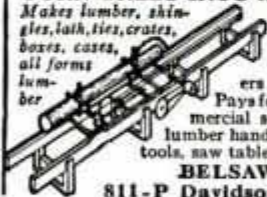
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## War Depends on Weather

(Continued from page 725)

the night. A pilot balloon carries a featherweight radio set, which emits signals at regular intervals. The balloon is traced by means of radio direction finders on the ground. The laboratory also has been experimenting with portable wind gauges for making rapid measurements of air currents from point to point over an area in which a gas attack is contemplated. The army weathermen are interested also in



*Army weather station on wheels. Radio-equipped truck carries meteorological instruments*

designing a trustworthy instrument for measuring visibility. The signal corps conducts at Fort Monmouth a school for training weather observers and a course in meteorology is now given at the post-graduate school of the naval academy.

Military meteorologists will be called upon in future wars for climatic data in planning various undertakings. Such data will give, for example, information concerning the probability of the ground being snow-covered at a specified season, the dates when leaves will change color which must be considered in planning camouflage, and the periods when rivers are likely to be frozen, a matter of importance in connection with navigation and water-supply as well as with the possibility of transportation on the ice. An invasion will often be timed, as recently happened in Ethiopia, by records of the average dates of dry and rainy seasons.

Marshal Joffre in the early days of the world war, excused setbacks experienced by his army on account of muddy roads, by saying, "I command soldiers, but not the barometer." But at the very time this remark was made the first steps had been taken, on European battlefields, toward making commanders independent of the weather in conducting campaigns.

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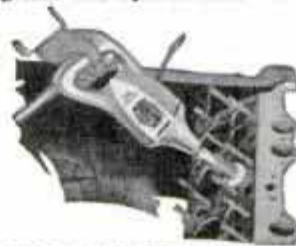
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**Strange Facts About Power Age**

(Continued from page 715)

**F13**  
workman about thirty horsepower at his command. This means a 300-fold increase of a man's muscular energy.

The power age is largely dependent upon fuel, since less than ten per cent of the world's power comes from falling water. Coal performs about two-thirds of the world's work today and about one-third of all the work done by water power is performed in the United States. Since 1859, about 800,000 oil wells have been drilled in the United States, and about 300,000 are still producing. If we depended upon fuels alone, the end of the power age might be in sight. Such an expert as Dr. Gustav Egloff predicted recently that if we depended solely on coal, we could run our machinery for another 6,000 years, assuming we did not increase horsepower enormously. Dr. Egloff's presumption is that 7,000 billion tons of coal are still available. But if we extend the limit of mining operations below 3,000 feet, we shall have much more coal. As for oil resources, added Dr. Egloff, about 2,000,000 out of a possible 1,110,000,000 acres have been exploited in the United States.

Since oil first was struck in Pennsylvania, about twenty-six billion barrels of crude have been taken out of the earth. "This," Dr. Egloff said, "would not fill a hole in the earth a mile deep and a mile wide. But even so, the petroleum resources of the United States won't last us much longer than a century."

After the richest concentrations of oil have been used, there is another source of crude largely untapped. Experts have recently surveyed vast deposits of coal and oil shale in Utah and Colorado. The shales cover thousands of square miles. One series averages twenty-five feet in thickness and yields about forty gallons of oil per ton; another fifty feet thick averages thirty-two gallons per ton. Government engineers estimate this oil can be extracted for about fifty to seventy-five cents per barrel.

Another possible source of common fuel is plant life. When present gasoline supplies get low, it may be possible to manufacture alcohol cheaply from the abundant vegetation in the tropic regions. According to present beliefs, alcohol will become more and more important as a fuel.



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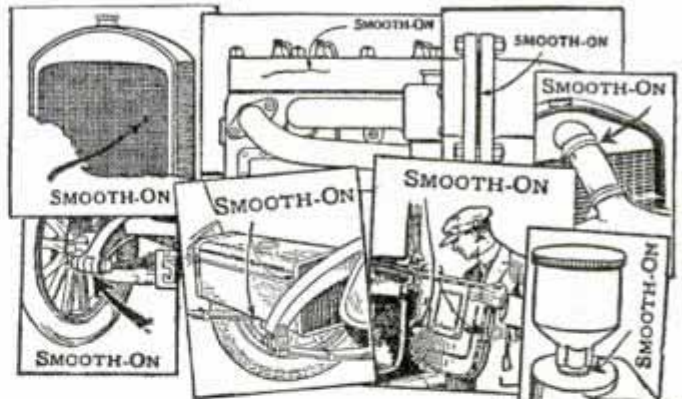


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## How to Play Winning Tennis

(Continued from page 699)

come in a short while. The volley is made before the ball bounces. Ordinarily it is made from close to the net, but good players today are volleying from the center of the court, the "no-man's land" of tennis. Hit down and under in a chopping fashion on a slow ball, holding the racket as for a drive. On a fast ball, simply hold your racket still and block the ball. This is easier, and safer until a player is adept.

The lob is one of the easiest strokes, but one that must be mastered. It is a defensive shot, made when you are in awkward position, or receiving a difficult ball. Knock the ball high in the air. This gives you time to prepare for the return. It probably will be returned, for it is usually easy to get. Lob only when in difficulty. If you do it consistently, a good player will run forward and cut off your lob with a smash.

The smash is made like a serve, except that the ball is coming down from a lob. It is a difficult shot, and should not be played hard until you are proficient. A good player, though, will play a smash as hard as a serve. Here, as in other shots, gauge your speed by your ability to return the ball into the court.

The chop describes itself. Hit the ball as though you were chopping a tree. This puts a reverse spin on the ball which causes an erratic bounce. This and such strokes as the half-volley and drop shot, should not be attempted until the other fundamental strokes are mastered. No two players do them exactly the same way. They take on the individuality of the player, and each develops special shots he does better than others.

After you have become proficient, you can consider strategy, placing the ball where it is most difficult for your opponent to return it. With about ninety per cent of players this means their backhand. Strategy also involves drawing your opponent out of position or throwing him off balance. For the average player, however, these are not as important as getting the ball back into the court.

For your position in the court during play, there are a few simple rules. When you are playing back, be in the center behind the base line until drawn out. When

(Continued to page 142A)





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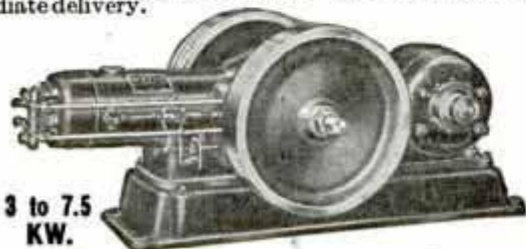


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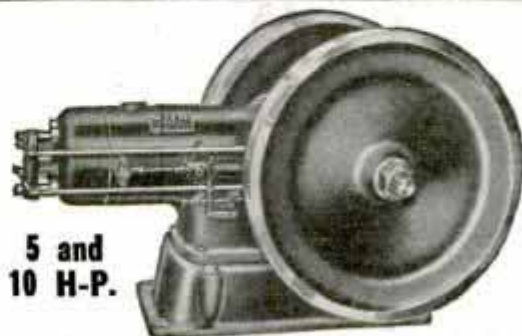
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(Continued from page 140A)

you go up, stay six or eight feet from the net to avoid hitting it. In doubles, except during the service, both players should, as far as possible, keep alongside, going up and dropping back together.

As a rule, it is best to play your ball into the center of your opponent's court, because this gives him less degree of angle for the return. Stay in the center of your own court also—that is, back of the center of the net. Timing is knowing just when to hit the ball. It makes for ease and speed, and explains why a little man can hit as fast a ball as a big one, and why an old man can still play tennis well. It's largely a matter of instinct, but it can be developed by practice.

There are few new developments in the game. In general, it is becoming faster, more balls are being volleyed, but only once in a long while is anything radically different developed. It is being proposed now that the serve be limited to one ball, and that fouling on the serve by stepping over the line be eliminated by putting another line six inches back, behind which the player must stand.

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# The Mystery of Hotter and Colder

(Continued from page 686)

hand if enough pressure is applied to prevent it from melting.

To produce "hot ice Number one," Prof. Bridgman applies a pressure of 90,000 pounds. To convert this product into "hot ice Number two," he applies a pressure of 375,000 pounds. "Hot ice Number two" is hotter than boiling water when it melts, and it can be made to melt at a much higher temperature merely by raising the pressure. Besides the hot ices, Prof. Bridgman has produced a new form of cold ice.

High pressure on other substances effects profound changes. Rubber loses its elasticity and becomes a translucent horny material; paper is similarly affected. Having achieved this much in the application of high pressures, man's present efforts are directed toward raising the temperature limits.

For the present, the method of raising a temperature of 5,500 degrees Centigrade in a hotspot sun furnace might bear improvement by some more efficient method of focusing the sun's rays. However, the general belief is that if we are really to pass into the realm of high temperatures, we must first learn how to handle the slippery and mysterious atom.

It may be that the intense sustained heat and light of the stars is due only to high temperatures and pressures. The youngest stars radiate the most energy. One youngster, called Plaskett's star, is held to have a central temperature of 500,000,000 degrees Centigrade. According to Sir James Jeans, "all processes which are affected by temperatures of less than 7,500,000,000,000 degrees leave the total number of electrons and protons in a star unimpaired." This is a little more heat than we are prepared to handle on our planet, and indeed, it is more than is ordinarily discussed by astronomers.

The thermocouple device on the Mount Wilson telescope has already measured the surface temperatures of many heavenly bodies. Star surface temperatures range from 6,000 degrees Centigrade to 23,000 degrees but the interior temperatures are much higher. That of our sun, for instance, is estimated at 40,000,000 degrees Centigrade.

The absolute zero of temperature is

—273.15 degrees Centigrade. Beyond this no one has ever gone. The boiling point of helium lies about four degrees above this. By reducing pressure on the liquid, it has been possible to reach within one degree of absolute zero. In the low-temperature laboratory at Leyden, Prof. W. J. DeHaas has reached the all-time low of only five-thousandths of one degree above absolute zero. Thus man has achieved a temperature which has not, so far as is known, been reached by nature herself. Interstellar space is held to be three degrees above absolute zero.

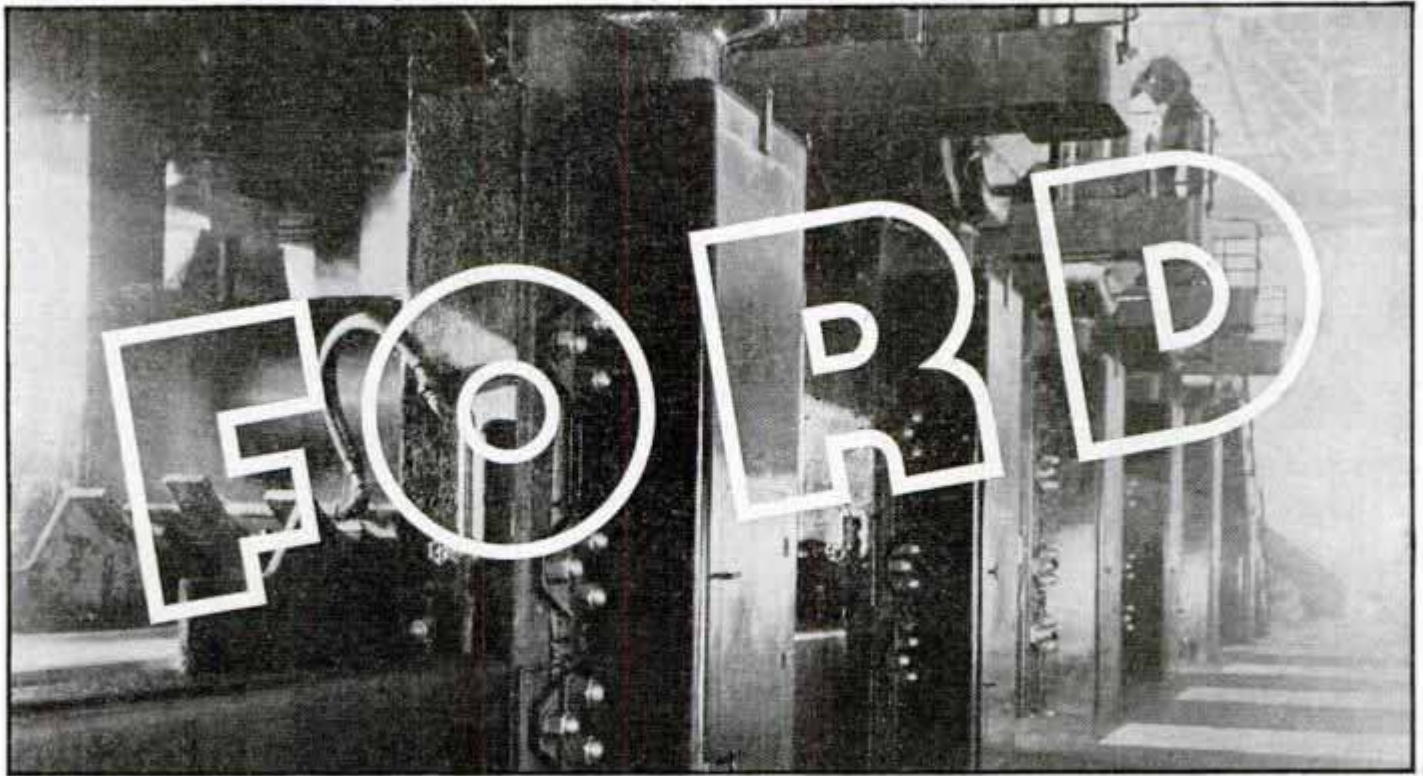
On the earth's surface, the highest recorded difference between the hottest spot and the coldest spot is only 124 degrees Centigrade or 223 degrees Fahrenheit. The coldest spots where readings have been made are Alaska, —82 degrees Fahrenheit, and Siberia, —87 degrees Fahrenheit. The hottest spots are Death Valley, Calif., 134.1 degrees Fahrenheit, and Azizia, Tripoli, 136.4 degrees Fahrenheit.

Tungsten and graphite are among the substances with the highest known melting points. The highest temperature recorded with burning fuel is 2,000 degrees Centigrade, while an oxyacetylene torch flame may reach a temperature of 3,500 degrees Centigrade. The atomic hydrogen flame, 3,800 degrees Centigrade, is sufficient to melt or vaporize every known substance with the possible exception of carbon and the grinding material, tantalum carbide.

For the extremes of temperature, the ordinary mercury thermometer will not work. To measure the cold around absolute zero, it is necessary to employ a magnetic thermometer. This method increases in sensitivity as the temperature is lowered. Above 500 degrees Centigrade, the mercury thermometer must be discarded. It is necessary to use gas thermometers up to the melting point of platinum, 1,755 degrees Centigrade. For reading above the melting point of platinum, a form of optical thermometer is used. This works on the assumption that flame colors vary according to the temperature. But near the maximum temperatures obtainable by man, it is quite difficult to get accurate readings.



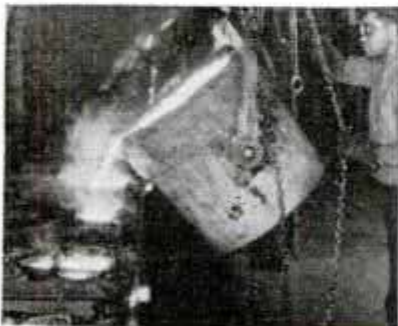
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## How to Attract Birds

(Continued from page 736)

have any gourds by all means use them to try to get a wren family.

The bluebird is an ideal neighbor. It doesn't eat fruits in orchards, or destroy garden truck. Being an insect eater, it is a desirable bird neighbor in any orchard, back yard or garden. A box eight inches high, with a base five inches square, and an entrance one and one-half inches in diameter that is six inches above the floor cavity is excellent for bluebirds. They will take boxes of smooth or rough lumber. Put your bluebird houses in the orchard or in the yard near a fence. Boxes on the trees five to eight feet above the ground or on fence posts will attract them if there are no cats around. A rectangular, cylindrical or any other shape will be attractive.

The robin doesn't want a box such as the wren or woodpecker likes. This bird will use just a simple nesting platform, open on three sides. If you do not have enough robins around your home, the reason may be that there are no natural places in the trees or under the eaves. In such cases a platform will attract the birds. A plain wood platform six by eight inches or eight by eight inches, preferably made of weathered boards, can be placed in a tree along the main branches, or in the shelter of a shed or house roof. The birds will gather their own nesting material. In dry weather they will provide no end of entertainment if you moisten a patch of ground where they can gather mud for their house foundation.

The purple martin is friendly, useful and a treat to watch because it is such a graceful flyer. Getting a colony to take a house is not easy, however. Here are points to keep in mind in building a martin house. Don't make it too large. A house with twenty-four compartments is ample. Locate your house near a stream, pond or lake if it is available. Make the house so each story can be taken down easily and cleaned. This is a recommendation for a martin house put together with hooks and eyes. Don't forget to provide ventilation and be prepared to war on sparrows or the sparrows or starlings will take over the house.

The martin house illustrated was designed by the Biological Survey and has

(Continued to page 148A)



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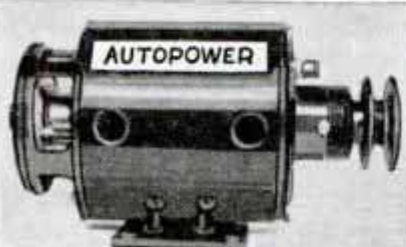
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**IT'S A JOHNSON**

NOW—a genuine Johnson Sea-Horse TWIN . . . an improved version of the famous Johnson power head known 'round the world for DEPENDABILITY and that sold in other years for as much as \$145 . . . with the highest official certified power rating in its class . . . for only \$79.50! Try it—and get the thrill of your life!

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OUTBOARD MOTORS

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The Eskimo word for this light, one-man boat is "Kayak." The woodworker of average ability can build it easily and economically. And it's lots of fun!

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**NOW**  
*Combined*  
*in*  
**ONE**



**PULVEX** *Combination*  
WORM CAPSULES

61539 (Continued from page 146A)

a central air chamber down the middle. Each section is held to the others by hooks and screw eyes. You can start with one floor of eight rooms and a roof and add to it. Some bird fans have tried putting tiny mirrors on the roof of a martin house because they believe this decoration lures the birds. The martin house should be in the open and about fifteen or twenty feet above the ground. Walls and floors should be about three-quarter inch thick. The roof and interior partitions should be of half-inch material with compartments six by six by six inches in size. Instead of boards you can use roofing paper on the roof. Usually three-inch porches are recommended, but some prefer them four inches wide to prevent young birds being pushed off. When the house is not in use, block the entrances, or take it down, so sparrows and starlings will not occupy it.

The "yellow hammer" or yellow-shafted woodpecker is partial to nesting boxes. It is a real decoration to any yard, and a useful one too. Deep boxes for these birds should be of material rough on the inside, because it permits the young to climb up to the entrance as they grow. Put about two inches of sawdust, ground cork, or small chips and sawdust in the bottom because the birds will want to make a depression in this material for the eggs. If you don't provide this material, the flickers may hammer away on the box to get it. A deep, rectangular box of rough slabs with the bark on the inside is suitable. The box should be sixteen or eighteen inches deep and the entrance hole two and one-half inches in diameter. Put the entrance close to the top. Place the box twelve to twenty feet above the ground and above heavy foliage.

Remember that songsters must be given protection against house cats. A birdhouse in a tree or on a pole can be made cat-proof by attaching galvanized tin or other metal to the tree in the form of a cone a foot or more long. Many birds can be secured as neighbors by planting desirable shrubs and bushes to furnish protection from their enemies and sources of food. Lilac bushes, honeysuckle, elderberry, wild grapevine, gooseberry and other shrubs are liked. Sunflowers which furnish food will bring species that ordinarily would not be seen.



# Raise Giant Frogs

## We Buy What You Raise



"Nufond Giant"  
weigh up to  
3 pounds

### Good Profits—No Competition

Each pair of "Nufond Giant" breeders lay 10,000 eggs every year. With modern methods, up to 90% turn into frogs.

We pay you up to \$5.00 per dozen for "Nufond Giants". Think of the profit possibilities! Competition is unknown because the wild supply is diminishing.



10,000 Eggs from Each Pair

### Start In Your Backyard

A small backyard pond 20x25 feet with a little bank space is all you need to start. The pond is very shallow; little water is needed. Expand with the off-spring.

Any kind of drinking water is suitable. Running water is not required. Flowers, lilies and plants make the pond very attractive.



A model backyard frog pond

### Any Climate Suitable

"Nufond Giants" are a hardy breed of "North American" bull-frogs. You can raise them in the North or South, even in Canada.

### Costs Little to Start

A frog pond is easy to make. There is nothing to buy except fence! You even raise the food right in the pond with the frogs! What other livestock offers you such advantages?

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Send complete information on SUPER-X and the entire line of World's Champion Ammunition.

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for yourself at home, building vehicles with 10 by 2 3/4 inch Musselman Doenut Cord Tires and Ball Bearing Cadmium Plated Disc Wheels. Tire requires only 12 to 15 lbs. air to carry loads up to 200 lbs. per wheel. Patent No. 2015459. Doenut Tires take less power to propel, literally float over road bumps and are winners in coasting contests. We show you how to build all of these vehicles. They sell readily everywhere at a good profit. Blue print drawings for any vehicle mentioned or shown, 15c each for limited time only. Wheel and parts catalog FREE.

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6247-E. St. Clair Ave., Cleveland, Ohio

with MUSSELMAN DOENUT CORDS



## 715 Behind the Starting Gun

(Continued from page 646)

finishes are common. Spills sometimes are too numerous but the wise rule, rigidly enforced, that all contestants must wear an approved life jacket has provided the necessary margin of safety.

In addition to the development of faster race boats, recent months have seen great strides in the production of lightweight and compact outboard motors and small lightweight boats. Much progress has been made in the design and construction of small boats with a view to providing a maximum of strength and durability with a minimum of weight. A boat which will carry several hundred pounds and yet can be lifted with one hand is a far cry from the old heavy rowboat. Moreover, light weight combined with scientific streamline proportions gives the sportsman more miles per gallon with his motor and thus reduces the amount of spare gasoline which he must carry. Some of these boats are so constructed that they fit on the roof of the average car and hence eliminate the need for trailers.

Canvas-covered hulls are favored because they do not develop leaks in drying out through a winter or when transported for long distances in hot sun, and hence require no soaking when launched.

The popularity of such portable, lightweight motors and boats has enabled manufacturers to turn them out in quantities at low prices. The boats also are available in knock-down kits ready for assembly at home, enabling the purchaser to save still further.

## F297 Three Rare Minerals Found

Three new minerals, rare and hitherto unknown constituents of the earth's surface, have been discovered recently by scientists of the Smithsonian Institution. The first is steigerite, a combination of vanadium, aluminum oxides and water, found in Colorado. The other two were found in New Jersey. One is a variety of the rare mineral known as ganophyllite, a mixture of silicon, aluminum, iron, calcium, magnesium and other oxides, with bound water. The third is a form of the mineral known as amphibole but contains unusual amounts of zinc and manganese.

Science Service. 2/25/34

Edward J. Deardorff

William F. Foshay





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A sensation! Assemble "OK-2"—Mead's new 50 lb. tough, durable, seaworthy, portable Outboard Ki-Yak—in 2 days at home *without any experience!* Then it's always ready to go anywhere by hand or car. Safe, leakproof. Takes any outboard 4 h.p. or less. More speed per horsepower. More miles per gallon! **IDEAL** for auto tourists, anglers, campers, hunters, yachtsmen.

Mead's exclusive, perfected aluminum-ribbed, Cut-To-Fit Construction Kit (all parts numbered) **GUARANTEES** successful assembly, easily, quickly, economically—and profitably if you build to sell to others! Amazing low Introductory Prices, and if you wish, you can even Pay as You Build. Also available **Factory-Assembled**. **RUSH** dime and Coupon below for details.

**CK-2 PADDLE BOAT Converted to Speedy Sailboat in 10 Minutes!**

Assemble Mead's "CK" Sportsman's Ki-Yak (paddle and sailboat!) in  $\frac{1}{2}$  less time with new, exclusive construction principle. "Home Assembly" saves you nearly **half** the factory-built cost! Most **sensational** boat development in years! CK-2 weighs only 30 lbs. Portable by hand or car. **Thousands** in use. (Available **Factory-Assembled** if you don't want to build!) **RUSH** dime (covering handling, postage) and **Coupon** for giant new Colored Circular, Low Introductory Prices, and Special \$6.00 Gift Paddle Offer! **Hurry!**



**9 HOURS  
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**\$6 PADDLE GIVEN**  
with your Ki-YAK  
**—IF YOU HURRY!**



**MEAD  
KI-YAKS  
are STRONG  
as a GIANT!**



Entirely new exclusive small-boat construction principle gives astonishing strength to "OK" and "CK" boats. Ribs can't split, break, rot, warp. Truly, they are strong as a giant, yet

**LIGHT AS A  
FEATHER!**



**Jeeps**—CK-1 weighs 20 lbs., CK-2 only 30 lbs., CK-3 only 45! "OK-2" weighs only 50 lbs. **NOTHING** else like them. In a class by themselves! Strong as a giant... light as a feather—and extremely

**PORTABLE!**

Easily carried by hand or car. A 5½-year-old can carry CK-1... a 10-year-old carries CK-2! Just the ticket for autoists, fishermen, hunters, campers, yachtsmen. Feather-light, seaworthy, strong, roomy, easily handled, **INEXPENSIVE!** The best for you.

**Easily Assembled**

Ribs pre-shaped ready to attach, wooden parts accurately cut-to-shape, all parts numbered. A child can assemble!

**WARNING!**

Beware of imitations—there is only one genuine **KI-YAK**... originated, manufactured, sold by Mead Gliders only! "Mead" has meant "QUALITY" for nearly 50 years!

**ENDORSED  
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"My Mead Ki-Yak was the **Best Buy** I ever made **through the mail!**"—writes A. L. Rice (Pa.) "Friends think my Mead Ki-Yak is one of the **greatest fishing boats**—wind doesn't bother it like it does a canoe!" says N. Bealite (Ill.) And R. E. Jacobson (Minn.) writes: "**Finest craft** I ever used. Sturdy, light, rides waves beautifully!" Geo. Arents 2nd (Ill.) writes: "My Mead Ki-Yak easy to **construct**. Drawings remarkably clear, easy to follow!"

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Don't deny yourself the pleasure of learning all about these remarkable new, portable, low-priced Mead Ki-Yaks for motoring, paddling or sailing! Mail the Coupon, and 10c, now for full details and illustrated Circular! **MEAD GLIDERS**  
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Gentlemen: I am enclosing 10c postage, handling charge. Please rush me your New OK and CK Ki-Yak Circulars, Low Introductory Prices and marvelous \$6.00 Gift Paddle Offer!

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Only \$10 DOWN  
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You can do what hundreds of others are doing.

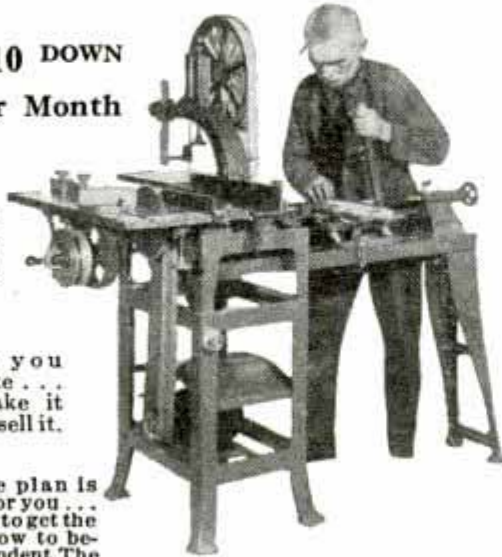
We show you what to make . . . how to make it . . . how to sell it.

A complete plan is worked out for you . . . it shows how to get the work and how to become independent. The Electric Carpenter runs from any light socket. Performs every woodworking operation with speed and accuracy . . . mortising, shaping, mitering, tenoning, paneling, rabbeting, boring, sanding, etc. Any handyman can operate it in a small room. Guaranteed for 10 years.

Right NOW is time to get ready for Spring Business

**AGENTS WANTED** Handymen are making money selling The Electric Carpenter in their communities . . . in spare time or full time. Get your machine for nothing by acting as our agent. Write at once for illustrated folder.

**CARPENTERS MACHINERY CO.**  
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## The First Rocket Air Mail Flight

(Continued from page 642)

pressed nitrogen gas. The nitrogen gave the necessary pressure to the other tanks.

As the liquids from tanks one and two are sprayed into the combustion chamber, they explode with a terrific impact. The sudden combustion generates a hot gas having a volume many thousands of times the original volume of the fuels. The pressure of the escaping gas lifts the rocket against gravity. Theoretically, the "Gloria" was supposed to build up her speed until she reached a maximum of 500 miles per hour. This is a long way from the speed required to escape the earth's gravitation—25,200 miles an hour.

Rocketeering experimenters are not especially interested now in exploring outer space. They want, first, to build a rocket that will be useful for high-speed communication in comparatively low altitudes. Such rockets would be useful in sending mail to remote and inaccessible places. Military tacticians see still other possibilities. A rocket might be made into a flying projectile with its own power-generating plant. It would fly faster than the fastest airplanes and escape anti-aircraft attacks. For obvious reasons, both the airplane and the balloon are inefficient above 40,000 feet, but the rocket motor operates better in a vacuum than at low altitudes.

With the rocket motor, there is no waste of energy in the transmission of power through shafts, gears, or drives. For the first time, man has found a means of getting power direct from the heat of combustion. That is the principle of the reaction motor, and it is likely to find many useful applications in the future. Theoretically, at least, the rocketeers have gone far. One has already designed a rocket airplane with a propeller. The combustion chambers are contained within the propeller blades. They have also studied the possibilities of man-carrying rocket airplanes. A 150-pound man in a 250-pound ship would require fifty pounds of rocket fuel for an eight-mile flight.

A vista of what air travel by rockets may be like fifty years hence has been opened by the patent of Prof. Robert H. Goddard, Clark University scientist, who

(Continued to page 154A)

**GEP ACTIONIZED ROD**

Reg. U.S. Pat. Off.

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**GREAT News for Fishermen!**

Remarkable invention "actionizes" steel fishing rods—action attained only by new and exclusive Gephart Process of "Actionizing."

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Specialists in Steel Fishing Rods

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**1/3 size of real planes**

**5 ft. Monocoupe (Illustrated)**

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**USERS REPORT**  
**3 to 7 MILES MORE PER GALLON**  
**MOTORIST SAVES \$180.00 a YEAR**

"On my V-8 Ford it works miracles. Its added power, acceleration and top speed has sold me. The results are unbelievable."—Ralph Fields, Mass.

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"I have twelve VACU-MATICS on cars now, and they all show an increase in mileage. The car owners are very well pleased."—Fred Taylor, Ohio.

"I have been pushing VACU-MATICS on expert mechanics' cars. All are well pleased."—J. W. Decker, W. Va.

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 VACU-MATIC proves itself on every car. It is guaranteed to give worthwhile gas savings, quicker pick-up, and more power or it costs you nothing. You can instantly tell the difference in added power and motor performance — you quickly notice the cash savings on gasoline.

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 VACU-MATIC is constructed of six parts, assembled and fused into one unit, correctly adjusted and sealed at the factory. Nothing to regulate. Any motorist can attach VACU-MATIC in ten minutes. Once in, its only reminder is the surge of instant power and speed it gives to the motor and the savings it affords your pocketbook.

**Free Details**  
 You owe it to yourself to know all about this remarkable discovery. Mail the coupon below. Start saving gas with VACU-MATIC and enjoy a new driving thrill! There's no obligation—so get the facts now! Write today!

**AT LAST!** Automotive engineers have smashed down the barriers to perfected combustion! The new VACU-MATIC solves the secret of greater power! With almost magical action, this amazing invention instantly puts new life and pep in any motor. It adds mileage to every gallon of gasoline . . . produces split-second pick-up, sensitive accelerator response, quicker starting, greater speed and smoother running.

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 The self-starter — four wheel brakes — knee action — streamlining . . . and now VACU-MATIC! The sensational money saving invention! With it, engineers have achieved a practical means of balancing air and gasoline automatically for all speeds. VACU-MATIC is *entirely different!* It operates on the supercharge principle by automatically adding a charge of extra oxygen, drawn free from the outer air, into the heart of the gas mixture. It is entirely **AUTOMATIC** and allows the motor to "breathe" at the correct time, opening and closing automatically as required. No idling troubles—no carburetor adjustments necessary. It is so simple it will amaze you — so practical it will save you many dollars on gas costs.

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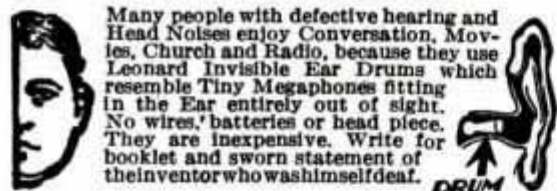
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Streamlined Trailer at little cost. Send dollar for plans, blueprints, details, instructions, pictures of the Standard and the DeLuxe Model as shown. Mail a dollar to **D. VAN OOSTVELDT, 111 Marston, Detroit, Mich.**

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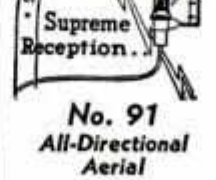
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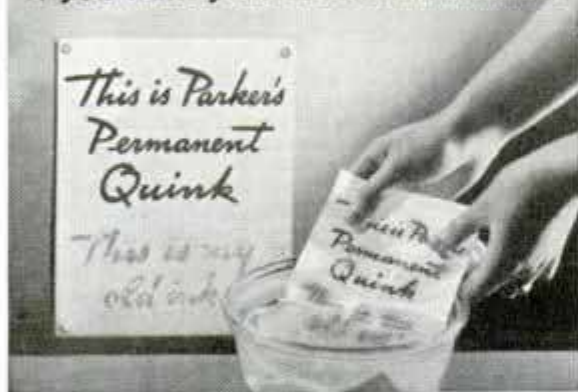
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**KNOX PORCELAIN CORP. KNOXVILLE, TENN.**



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And You'll Throw Away  
Your Ordinary Ink

If you want your records PERMANENT!



**1—Write on a sheet of paper with Parker's PERMANENT Quink and any other ink, and leave it outdoors exposed to the sun a few days.**

**2—Write on another sheet the same way, and let it soak in water for a day or two, then dry.**

Anyone can make these simple tests and see how Parker PERMANENT Quink—the new creation in writing ink—does what no other ink can do:

**I—PERMANENT Quink** lasts as long as the paper. (This does not apply to WASHABLE Quink for home and school. That washes out without trace.)

**II—Quink** cleanses a pen as it writes—a Parker or any other pen. For one harmless ingredient in Quink dissolves sediment left by pen-clogging inks. Thus Quink makes your pen start instantly—every time.

**III—Quink** dries ON PAPER by penetration—so fast you'll throw your blotters away. Yet Quink resists evaporation—hence does NOT dry in a pen.

Get Quink today for 15c and test it yourself. See what new distinction it gives your writing, because it is not a watery ink, but rich, full-bodied, brilliant. The Parker Pen Co., Janesville, Wis.

## Parker Quink



Made by the Makers of the Celebrated Parker Pens

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AMERICA'S FINEST  
ELECTRIC LANTERN



● 2 lights on a double acting switch. 80 ft. spot light from front reflector; broad floodlight from top,  
**80 to 100 Hours Light from One 6-Volt Dry Battery**

The most powerful, serviceable electric lantern for all needs—fishing, camping, touring or home. Stands 6½ in. high. Unbreakable lens. At sport, hardware, electrical dealers, or write

DELTA ELECTRIC CO., Marion, Ind., Dept. 308

**\$3<sup>35</sup>**

A GENUINE DELTA

(LESS BATTERY)

(Continued from page 152A)

has been experimenting for years at Roswell, N. M., with funds supplied jointly by the Carnegie Institution of Washington and the Daniel and Florence Guggenheim Foundation.

The Jekyll-Hyde aircraft, as described in the patent, would change its shape from a conventional airplane at lower altitudes to a streamlined rocket ship when the rarefied stratosphere is reached. In the troposphere—the layer of air immediately surrounding the earth—the rocket airplane has wings, propellers, a tail skid, landing wheels, rudder and other conventional parts. In the stratosphere and above, all projecting parts disappear into the body and only stubby wings are left.

Instead of being driven by propellers at these high altitudes, the rocket ship is hurled along by jets of gases streaming at high speed from nozzles in the tail. Passengers would be protected from changes in temperature and pressure by the peculiar air-tight and insulated construction of the craft's body. The craft would carry a supply of oxygen for the passengers.

When flying as an airplane, the propellers would not be driven by supercharged gasoline motors, but by hot gases resulting from the combustion of hydrogen and oxygen. Shot against the blades of turbines to which the propellers are connected, these gases would whirl them at tremendous speeds, much as steam shot against the myriads of blades on turboelectric generators spins the generators to produce electricity.

From Dr. Goddard's aircraft may spring the rocket-propelled air liner which will solve tomorrow's transportation problems. The versatility of Dr. Goddard's craft may solve several difficulties now surrounding rocket flight. At low speeds a rocket is inefficient. While flying several thousands of miles per hour, it does not require any wings, yet in taking off and landing the opposite is true. Dr. Goddard's rocket plane takes both these factors into consideration. On entering the upper heights where the propeller fails to "bite" efficiently into the rare atmosphere, the pilot would operate levers to retract and fold up the propellers, telescope the wing tips and pull in the landing gear.

Simultaneously the "rocket motor" goes

(Continued to page 158A)

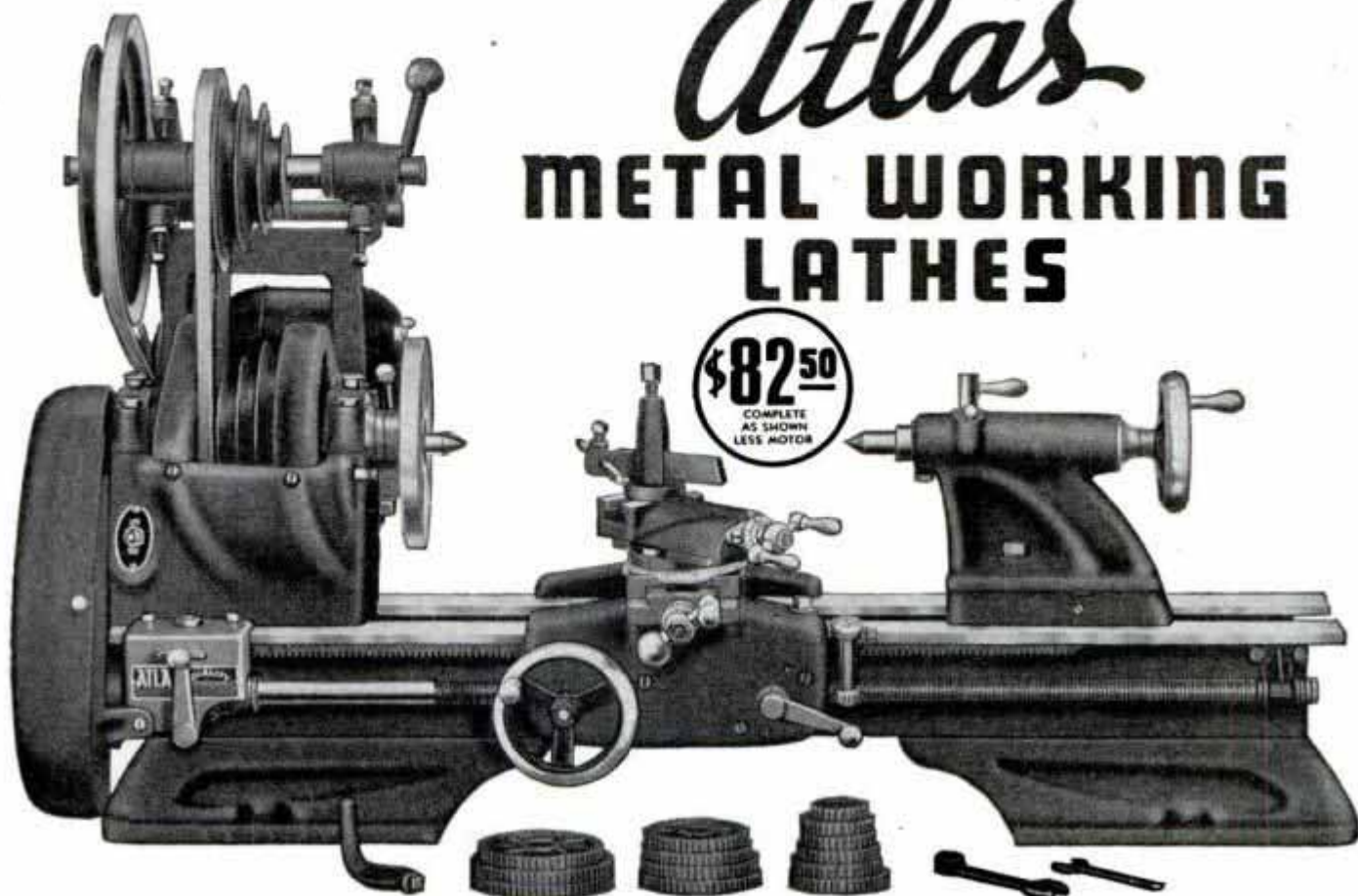
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# NEW! MODERN!

# Atlas

## METAL WORKING LATHES



**\$82<sup>50</sup>**  
COMPLETE  
AS SHOWN  
LESS MOTOR

### Modern Design—Modern Construction

The new Atlas lathes were designed and built to give more value—accuracy—efficiency and satisfaction than ever before during the 25 years Atlas has been building precision shop equipment. The new Atlas is not like other metal lathes. It is the first truly modern lathe, of its size and price. Bed is 36 inches long. Has 10 $\frac{1}{4}$ -inch swing, takes 18 inches between centers. After comparing every feature, specification, appearance and price, you too, will agree Atlas is today's biggest lathe value.

Other new Atlas metal lathes priced from \$35.50 up. Sold on small monthly payments extending over 2 years. 2 weeks trial. Money back guarantee. Send coupon TODAY for FREE catalog of metal and wood lathes, drill presses, tools and attachments.

**Atlas Press Co., 552 No. Pitcher St.,  
Kalamazoo, Michigan**

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New York—130 W. 42nd St.  
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**ATLAS QUALITY**  
Shop Equipment Since 1911

### GET THESE FEATURES AT NO EXTRA COST

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Please send your free catalog of new models.

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Address.....

City.....State.....



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WHILE FLOWERS SCENT THE BREEZE  
AND SANI-FLUSH IS JUST THE THING  
TO CLEAN OUT ANTI-FREEZE!



WINTER'S rust and sediment are choking your radiator. Sludge and lime deposits are interfering with the cooling system of your car . . . spoiling performance. You can clean out the radiator of your car in a few minutes, for ten cents, with Sani-Flush.

Pour Sani-Flush in the radiator (directions on the can). Run the motor. Drain, flush and refill. The delicate veins of the radiator are cleaned and opened. Anti-freeze is thoroughly removed. The motor will run cooler, and better. Sani-Flush is safe. Cannot harm aluminum head, block or fittings. You'll find Sani-Flush in most bathrooms for cleaning toilet bowls. Or you can buy a can from grocery, drug, hardware, or five-and-ten-cent stores—25c and 10c sizes. The Hygienic Products Co., Canton, Ohio.

**Sani-Flush** *Safe* NOT CAUSTIC  
KEEPS RADIATORS CLEAN

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No scraping, no steel wool, non-explosive. Simply apply. Then wash off with water. Sample 25c plus 10c postage. District Representatives write for proposition.

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Chicago, Ill.

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SIX SHOTS

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## END OF THE MAN ON THE FLYING TRAPEZE



**H**E fell from the bar with the greatest of ease when the fumes from that gooey briar got him. Won't some usher please rush out for a pack of pipe cleaners and a tin of Sir Walter Raleigh's peaceful blend—and let the show go on? Sir Walter burns slower, cooler. The air stays cleaner, your tongue stays calmer, and its delightful aroma wins applause from any crowd. Sales go up and up as smoker after smoker finds Sir Walter Raleigh the answer to a pipe-lover's prayer for mildness and fragrance. Sold everywhere. Ever tried it?

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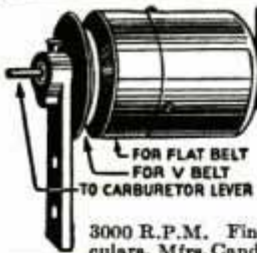




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**D**ELIGHTFULLY rids your scalp of every speck of dandruff. A single application stops that miserable itching... A single bottle corrects annoying scalp irritations; lends softness and beauty to dull, lifeless hair, but positively does not discolor either hair or scalp. Use Lucky Tiger Hair Tonic and dandruff remover now and enjoy the tingle of new life and cleanliness. *At Druggists and Barbers.*



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**TRAILER SUPPLY CO.**  
Box 438-A Wausau, Wis.

F 309 (Continued from page 154A)  
into action, shooting from nozzles the gases which hurl the rocket through space. When the rocket plane has reached its destination, and reenters the lower air levels, rocket motors are shut off, propellers, wing tips, rudders and landing gear all unfold.

Among the immediate difficulties of constructing such a rocket plane is the need for a suitable metal to withstand the enormous forces of erosion where the jets of gases strike the turbines whose job it is to turn the propellers at low altitudes. In present-day rocket tests, much less pretentious than the patented rocket plane, difficulty is already found because it seems impossible to make an orifice which will withstand the escaping gas jets. The openings will work for a short while but the high temperatures plus the velocity of impact of the gas against the metal soon wears them out.

### SOIL STERILIZED BY ELECTRICITY TO KILL PLANT ENEMIES

F 341  
Clean dirt, not an anomaly but a necessity for florists and specialty growers, can be obtained electrically with the aid of equipment developed by the General Electric company. The sterilization process, similar to that employed in the pasteurization of milk, has been performed with steam, hot water and chemicals, all more costly and less dependable than the electrical method. In sterilization, the temperature of the soil is increased enough to kill weed seeds, insect life and fungi. The electrical equipment consists of several heating units, each inclosed in a brass vane and with mounting straps, studs, nuts and washers. The grower builds this equipment into a wooden vat or container. A thermostat can be supplied to hold the temperature constant at 160 to 180 degrees. Growers have found the saving from not needing to weed small plants alone offsets the cost of sterilization.

Popular Mechanics Magazine does not publish the name of the maker of, or dealer in, any device described in its pages, but this information is kept on file and will be furnished by our Bureau of Information upon request, accompanied by stamped, self-addressed envelope.



# NEW 10-Inch CIRCULAR SAW

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**DELTA MANUFACTURING COMPANY**

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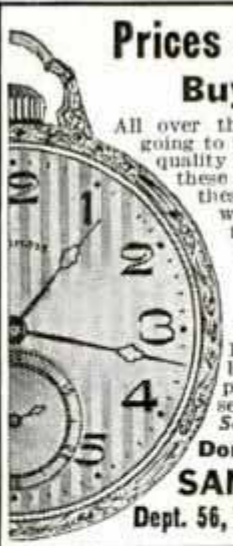
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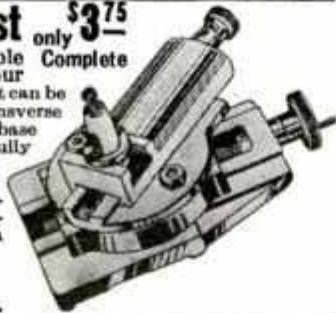
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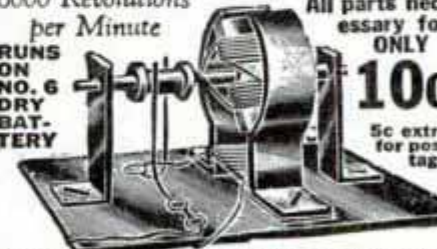
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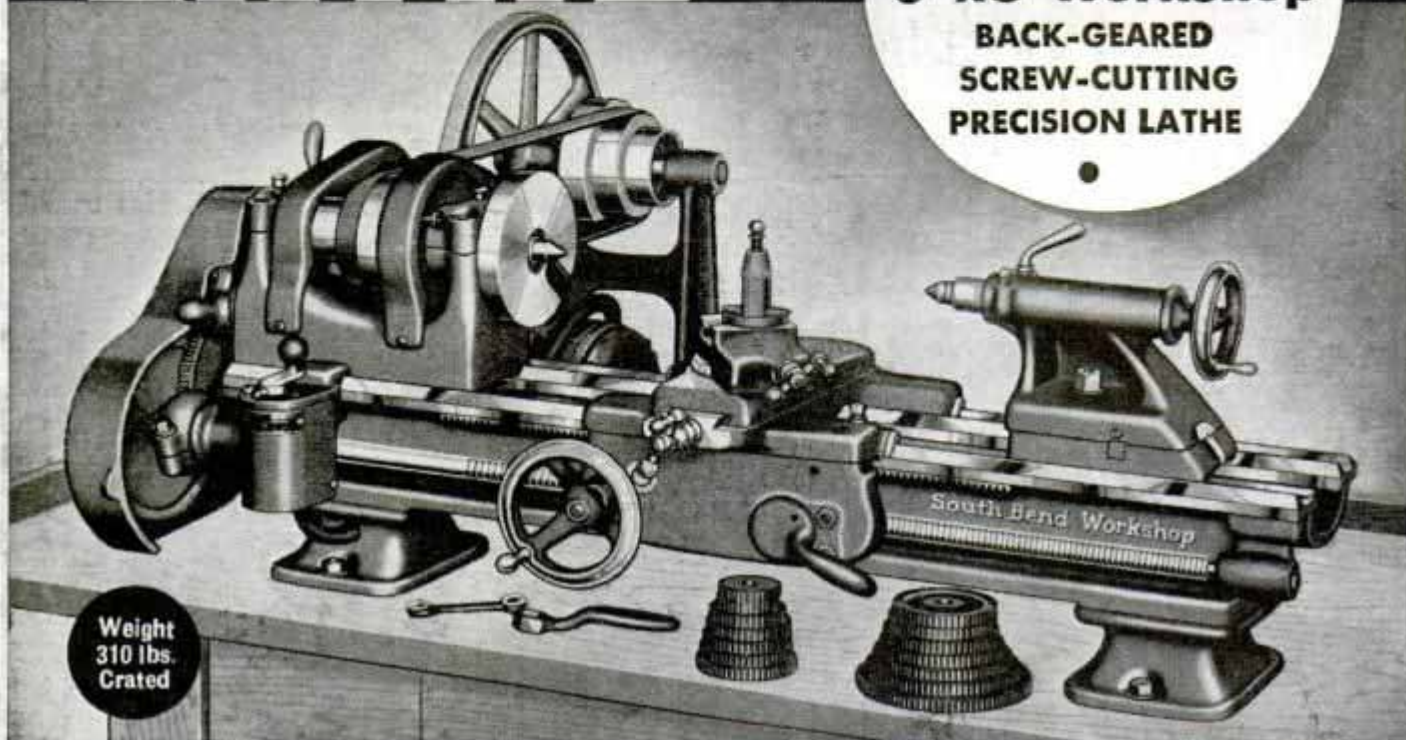
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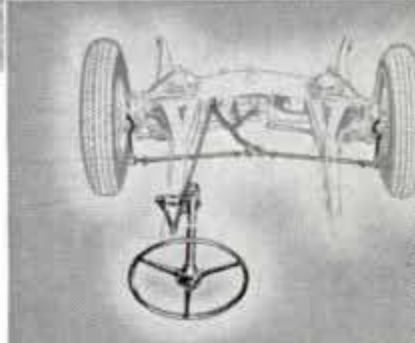
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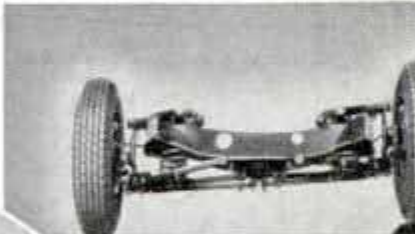
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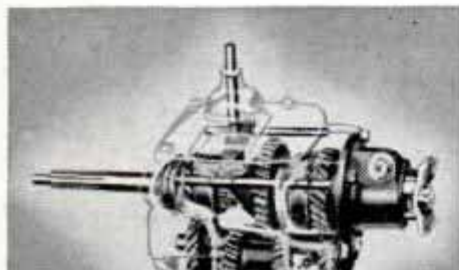
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