NEW WAR OF THE SPEED KINGS

POPULAR MECHANICS MAGAZINE

WRITTEN SO YOU CAN UNDERSTAND IT

REG'D. TRADE MARK, GREAT BRITAIN, No. 410426

JULY
25 CENTS

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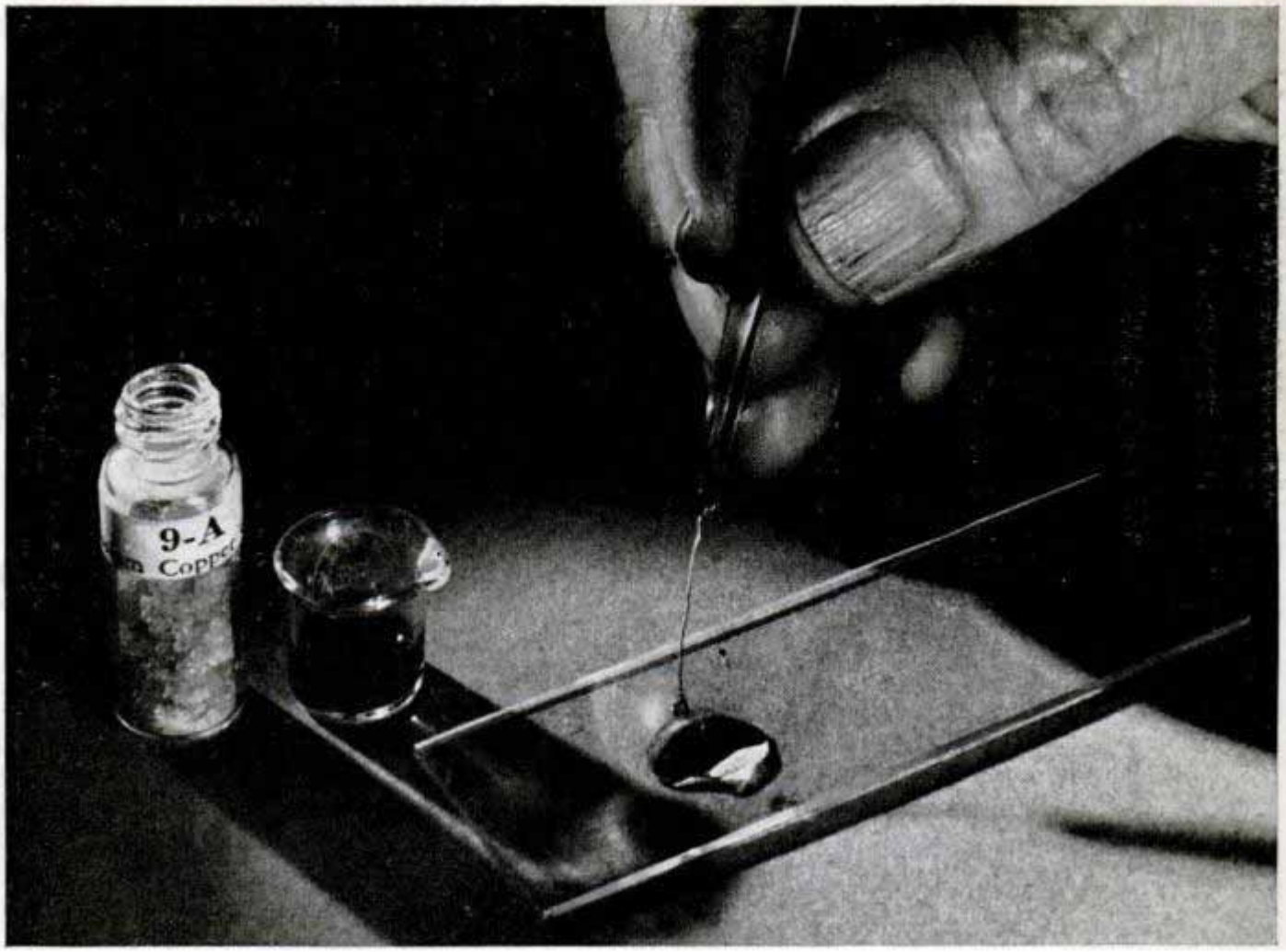


50,000 GAMMAS

DIVIDE this drop into 50,000 parts. Each part is a gamma—1/28,329,000 of an ounce. Yet in such tiny units research chemists find the secrets of long life and efficient operation of electric machinery —of refrigerators and electric clocks, of lamps as small as a grain of wheat, and great turbines that supply electric power to a whole city.

A smear of oil, a chip of metal, a scarcely visible film on a polished surface—these are clues to improved designs. Working with drops on a microscope slide, General Electric scientists are able to detect even as little as 1/1,000,000,000 ounce of impurity. And so, in the Research Laboratory, in Schenectady, they check and examine, contributing of their skill and experience to the final perfection of the finished machine.

Scientific research requires attention to a thousand details, patience to carry out innumerable experiments, clear understanding of the fundamental principles of nature. And the results of this painstaking research in the world of the very small are longer life and lower cost of operation in the manufactured products that you use.

G-E research has saved the public from ten to one hundred dollars for every dollar it has earned for General Electric

GENERAL ELECTRIC

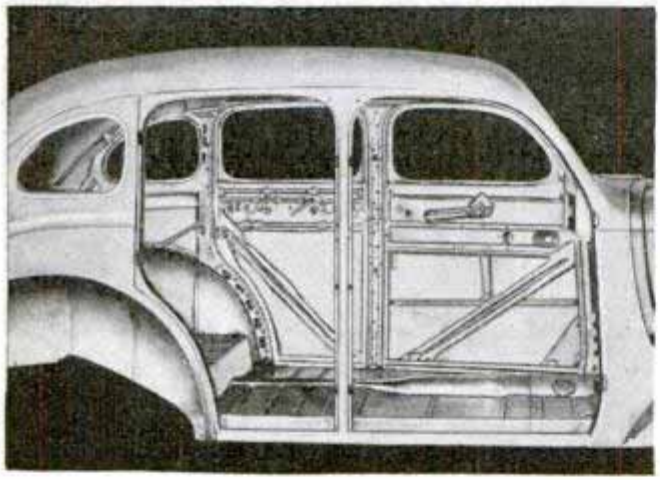
WAR ON WASTE ENGINEERS FIND NEW WAYS TO CUT CAR OPERATING COSTS

FEWER STOPS HERE—Two big ways Plymouth saves you money: (1) Plymouth owners report 18 to 24 miles per gallon of gas. (2) Full-length water jackets, directional cooling, *four* rings per piston and an oil filter keep Plymouth oil bills *down!*

Amazing Gas, Oil and Tire Mileage... with Minimum Upkeep Costs

DOLLARS saved in operating costs...dollars saved in upkeep! Plymouth engineers have *cut down* all phases of motoring expense.

New engineering developments now give Plymouth long life and economy that are sensational in the low-price field. Read why Plymouth is the car that *stands up* best. PLYMOUTH DIVISION OF CHRYSLER CORPORATION, Detroit, Michigan.



THIS BODY IS ONE SOLID STEEL UNIT

Steel pillars, panels, floor ...one-piece steel top... sides and rear...are all welded into a single, rigid unit. The entire body is pillowed on rubber, and sound-proofed with five different kinds of insulating material. It's the safest, quietest, longest-lasting construction you'll find on any low-priced car built today.

•

SAVINGS IN BRAKES—Plymouth's double-action hydraulics (left) distribute equal pressure to the entire braking surface...give smooth, even stops with a minimum of effort. This self-equalizing action means *surer control:* there's no grab or jerk..."diving stops" are eliminated. This also adds to the life of your tires.

TUNE IN MAJOR BOWES' Amateur hour—Columbia network, Thursdays, 9 to 10 p.m., E.D.S.T.

"CALIBRATED IGNITION"

Vacuum is "free power." It runs windshield wipers, and, in Plymouth, gives you Calibrated Ignition.

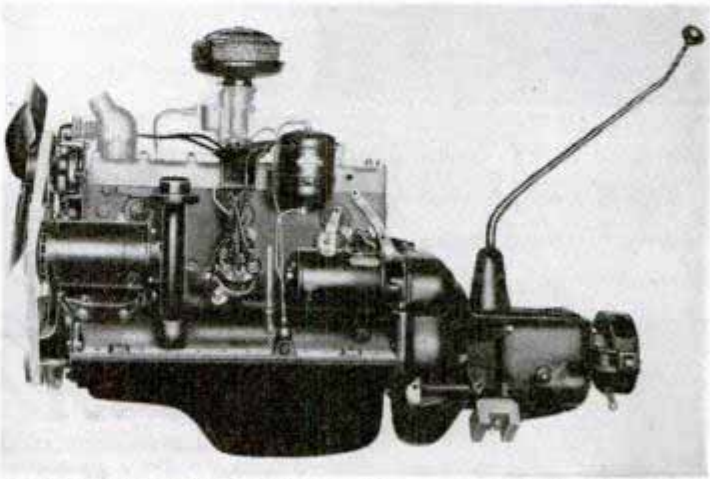
Calibrated Ignition is simple. Vacuum from the manifold increases or decreases with engine load. In Plymouth, this vacuum is made to control the spark adjustment by direct connection. Thus, the engine actually "feeds itself" proper spark.

Result—at all times...under all conditions... the spark is at maximum efficiency! That's why Plymouth's 6-cylinder, "L-head" engine delivers compression of 6.7 to 1 without needing a premium gasoline! And also why you save money!

PLYMOUTH HAS THE HIGHEST RESALE VALUE OF "ALL THREE" LOW-PRICED CARS

A check-up on used-car ads in city after city shows that used Plymouths are bringing as much as seventy-five dollars more than competitive used cars. Here is direct dollars-and-cents evidence of the public's discovery that Plymouth is the car that stands up best.

EASY TO BUY—Plymouth is priced with the lowest...and offers convenient payment terms. The Commercial Credit Company has made available—through Chrysler, De Soto and Dodge dealers—terms which make it easy to buy a new Plymouth *today*.



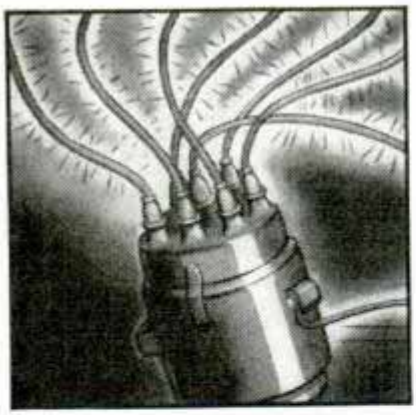
FAMED FLOATING POWER mountings support the big, 6-cylinder "L-head" engine in perfect balance. Cushioned on rubber, the weight of the engine itself acts to counteract the forces of vibration.

WHAT IS CORONA?

He thinks it's a cigar. She thinks it's a typewriter. He *knows* it is one of cable insulation's deadliest enemies!

An electrical engineer will tell you that *corona* is an "electrical field" which surrounds any wire carrying high-tension current — that corona breaks down the air into rubber-destroying ozone.

Corona is just one of the enemies of spark plug wires— others are oil, age, heat, cold, moisture and abrasion. These deteriorating agencies attack the insulation of spark plug wires, allowing electricity to escape, and causing weakened sparks, lost power and increased gas consumption. The ordinary rubber, cotton-braid, lacquer type of cable —of organic vegetable materials—is naturally an easy prey to the spark plug wires' enemies.



Packard, the pioneer and world's largest maker of automotive wiring, has discovered a new and better ignition cable—Packard FOUR-FORTY. This cable employs a secret-formula inorganic sheath—a man-made "rubber" compound of coal, salt and water—which provides unequaled resistance to heat, cold, oil, moisture, abrasion, age and corona.

Packard FOUR-FORTY Ignition Cable Sets for any car are available at most service stations. Install a set *now* and enjoy trouble-free new-car performance this summer. The cost is low ($1.80 to $5.00 per set in the United States, less installation) and you'll benefit by faster pick-up, more power and lower gasoline bills. Packard Electric Division, General Motors Corporation, Warren, Ohio.

Packard
REG. U.S. PAT. OFF.
TRADE MARK

THE STANDARD WIRING EQUIPMENT OF THE AUTOMOTIVE INDUSTRY

Popular Mechanics Magazine

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

July, 1937 Vol. 68, No. 1

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At Home Afloat

HUNDREDS of American families have found a new way to live. They are closing up homes and deserting city apartments during the summer for life aboard that model of comfort, compactness and seaworthiness—a modern small cruising motorboat. Nowhere is mechanical progress better exemplified than in the motorboat of today. There are comfortable berths, complete galleys, electric lights, shower baths, running water and power plants ready to take you out on the water for a week end or an entire season. And they are priced to fit almost any purse. Read the first of two articles next month about these modern power cruisers and you'll want to try living "At Home Afloat." The story is illustrated with eight pages of Coloroto pictures.

Next Month

POINT your camera straight ahead, push the button and you get just another picture. Take the same scene, but play the angles, and you may have a prize-winning shot. There are interesting pictures in commonplace objects if you get the right angles. An article in August tells how.

Danger Ahead!

TRAFFIC accidents will kill or injure more than 20,000,000 persons in this country within the next fifteen years unless we do more to promote highway safety than we have done. This means that you, as a driver, have better than an even chance of killing or injuring yourself or someone else within the next few years unless you make your own driving "accident proof." An article in the August issue points out the common mistakes which land most drivers in hospitals and morgues.

Down to the Sea

TUMBLING a big plane around in the sky is fun for naval test pilots, but taking a flying boat down for rough water landings isn't. They pick a day when the waves are high and they smack her down with a crash that will break your ankles if you take it standing up. Then, if the ship survives, comes the take-off. If you like action, read "Thrills of the Naval Test Pilots" next month.

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This One

DO THIS

and GET BETTER CAR OPERATION, AVOID REPAIRS

Your car can be new or old, but it needs Pyroil to safeguard its vital parts. In the modern engine, even normal conditions of combustion set up a dryness and acid corrosion. This causes early wear on pistons, cylinder walls, valves and bearings. Your engine loses compression and power. But when you add a small amount of Pyroil to the gasoline tank and to the crankcase, these harmful conditions are overcome.

Pyroil prevents hard carbon, gums and sludges from hurting your engine and from stealing its power. It clears them out where such have already formed.

Insist on Pyroil every time you buy gas and oil. Sold the world over. Manufactured and guaranteed by Pyroil Company, W. V. Kidder, Founder, 57 Pyroil Bldg , LaCrosse, Wisconsin, U. S. A.

PYROIL HAS BEEN TESTED BY POPULAR MECHANICS AND IS USED BY POPULAR MECHANICS' PRESSES AND EQUIPMENT.

DISTRIBUTORS:

Check and mail coupon for facts of our unusual Sales Opportunity for you. Big season starting now.

SIMPLY ADD TO GAS & OIL

This 12-ounce can treats 7 Quarts of Lubricating Oil.

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

☐ Please send Free facts on Pyroil's money saving and protection features.
☐ Send details of Premium Plan and Business Opportunity for me.

Name.....

Address.....

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

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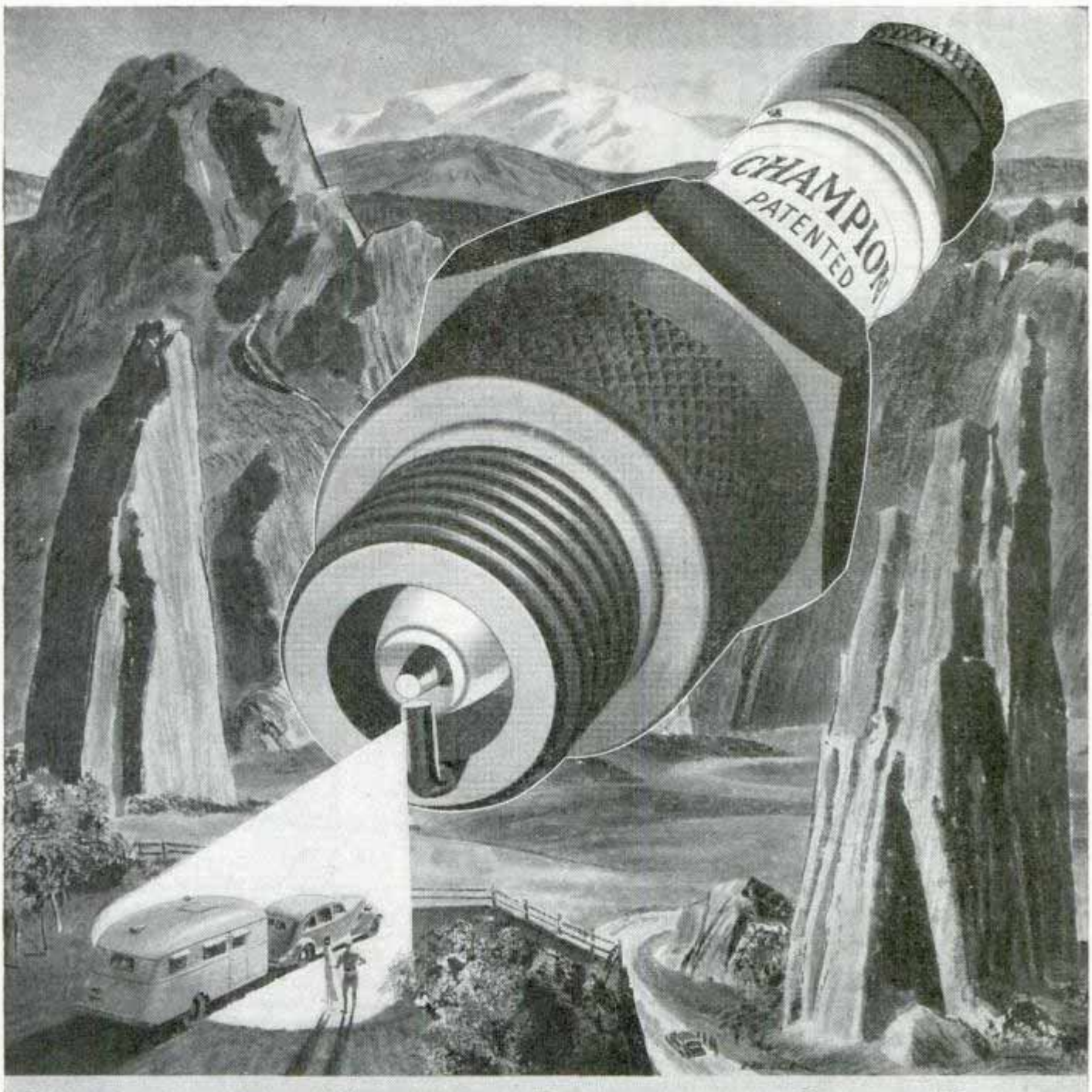

TROUBLE-FREE MOTORING DEPENDS ON SPARK PLUGS

The amount of pleasure you may get from your car during vacation touring depends upon the trouble-free performance of the engine. Engine performance depends to an extraordinary degree on spark plugs.

That is why you find Champion Spark Plugs installed in so many engines. That is also why so many vacation-bound motorists have their spark plugs thoroughly checked and tested before leaving. Remember, it is a money-saving economy to install new spark plugs every 10,000 miles.

New Champion Spark Plugs will speed your car on its way, with renewed acceleration, power, speed and dependability, and above all, with increased gasoline mileage, which will quickly save their cost. **Demand Champion Spark Plugs because you can depend on them.**

YOU CAN DEPEND ON

CHAMPIONS

THE SPARK PLUG CHAMPIONS USE

CHECK AND CLEAN SPARK PLUGS WHEN YOU CHANGE OIL

WE'RE THROUGH USING MISFIT BLADES

—say men everywhere

Unsolicited letters tell why it pays to use only Gillette Blades in the Gillette Razor

RIGHT BLADE FOR THE GILLETTE RAZOR

After using other make blades I went back to Gillette and got such wonderful shaves, I am going to keep on using them. It makes a big difference when you use the right blade for your Gillette Razor.

R. D. Bellinger,
166 East 96th St., N. Y. C.

FACE SORE FROM MISFIT BLADES

At times I tried other brands of blades, but they do not shave anywhere as well as the Gillette Blade in my Gillette Razor. I have found my face raw and sore from these misfit blades—but Gillette Blade shaves are always comfortable.

George F. Lyman
51 Moseley St. Dorchester, Mass.

★ The Gillette Blade is especially designed to FIT the Gillette Razor. That's why you get such cool, comfortable shaves, when you use them together. No worry about too much shaving edge to scuff your skin; nor too little shaving edge to leave patches of stubble behind. Slip a Gillette Blade into your Gillette Razor tomorrow and enjoy shaving comfort at its best.

Gillette Blades

Precision-made for the Gillette Razor

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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. 764-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.

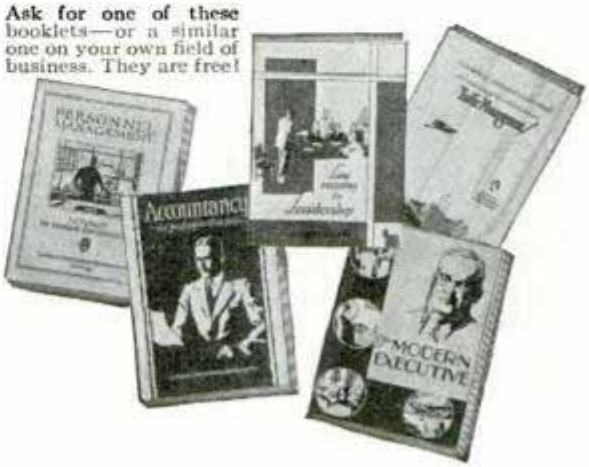
- ☐ Business Management
- ☐ Higher Accountancy
- ☐ Traffic Management
- ☐ Modern Salesmanship
- ☐ Commercial Law
- ☐ Law: Degree of LL. B.
- ☐ Expert Bookkeeping
- ☐ C. P. A. Coaching
- ☐ Industrial Management
- ☐ Modern Foremanship
- ☐ Personnel Management
- ☐ Business Correspondence
- ☐ Business English
- ☐ Effective Speaking
- ☐ Office Management
- ☐ Stenotypy

*Name*_____ *Age*_____

*Position*_____ *Address*_____

La Salle Extension University

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



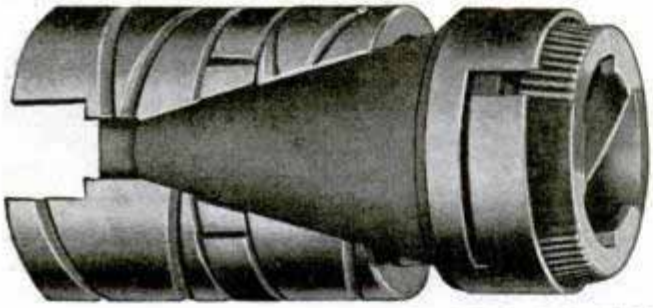
WIN $200 CASH

PART OF

Simply write an advertising slogan for

MUSSELMAN COASTER BRAKE

It will be easy for you to write a slogan about the greatest coaster brake the world has ever known. Write in 10 words or less, a slogan that can be used for advertising this marvelous brake that makes all older coaster brakes obsolete and behind the times. Here's a sample slogan: "The coaster brake that's years ahead." See your dealer and examine this different, spectacular coaster brake. Study the features and you'll be so enthusiastic you'll write a good slogan.



THE AZ CARTRIDGE UNIT

With this cartridge unit, the Musselman 1937 Coaster Brake can be reconditioned as easily as changing a safety razor blade. Don't buy an obsolete coaster brake—demand Musselman. You can get it on any bicycle without extra charge. Then you'll have quick braking, easier pedaling and win every coasting contest. Slogan contest prizes are: 1st, $100.00; 2nd, $35.00; 3rd, $15.00, and 25 prizes of $2.00 each. See your department store, hardware or bicycle dealer now and send your slogan today. Contest closes July 15th. Awards made July 25th.

COSTS NO MORE THAN THE ORDINARY COASTER BRAKE

ENTER THIS BIG CONTEST TODAY

THE MUSSELMAN HUB BRAKE CO.
6220 St. Clair Avenue Cleveland, Ohio

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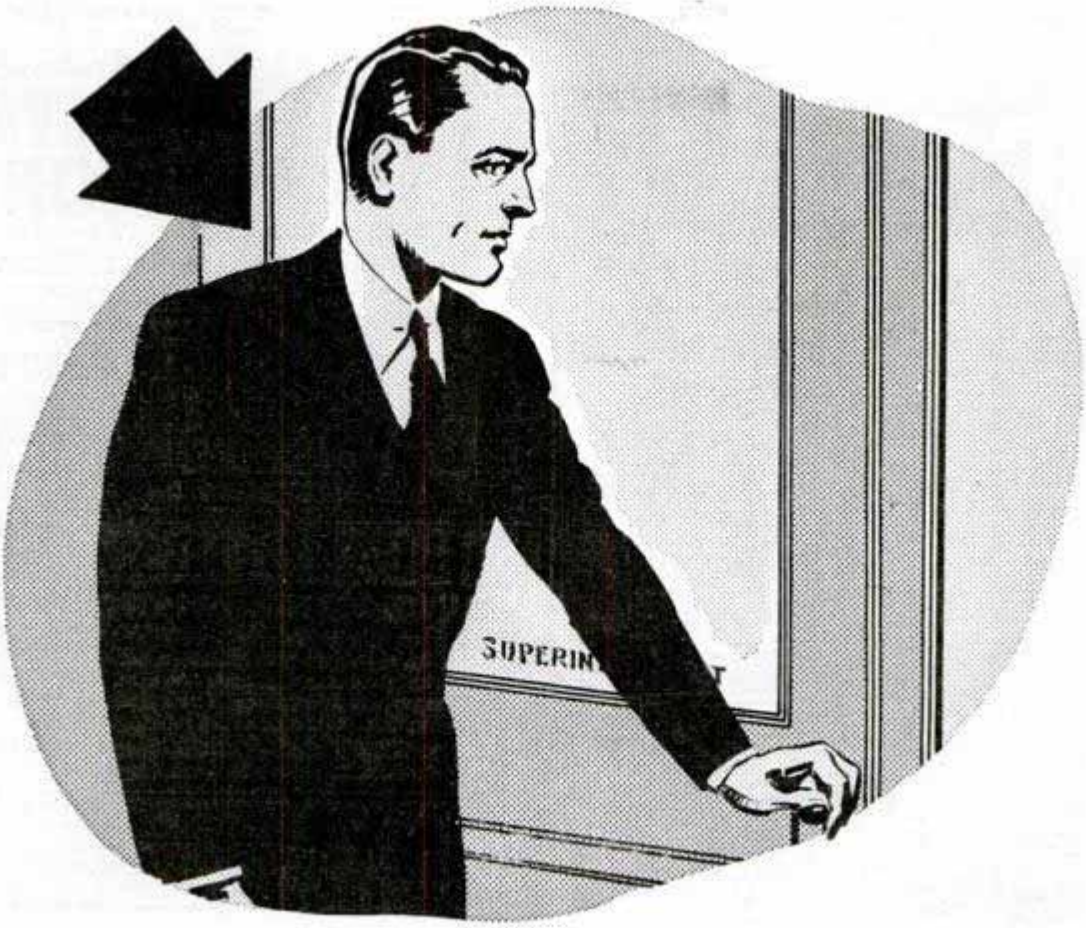

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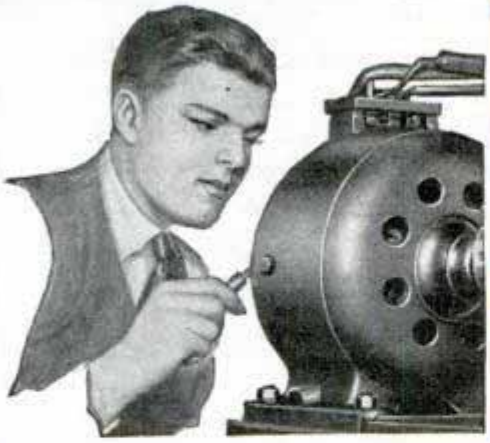

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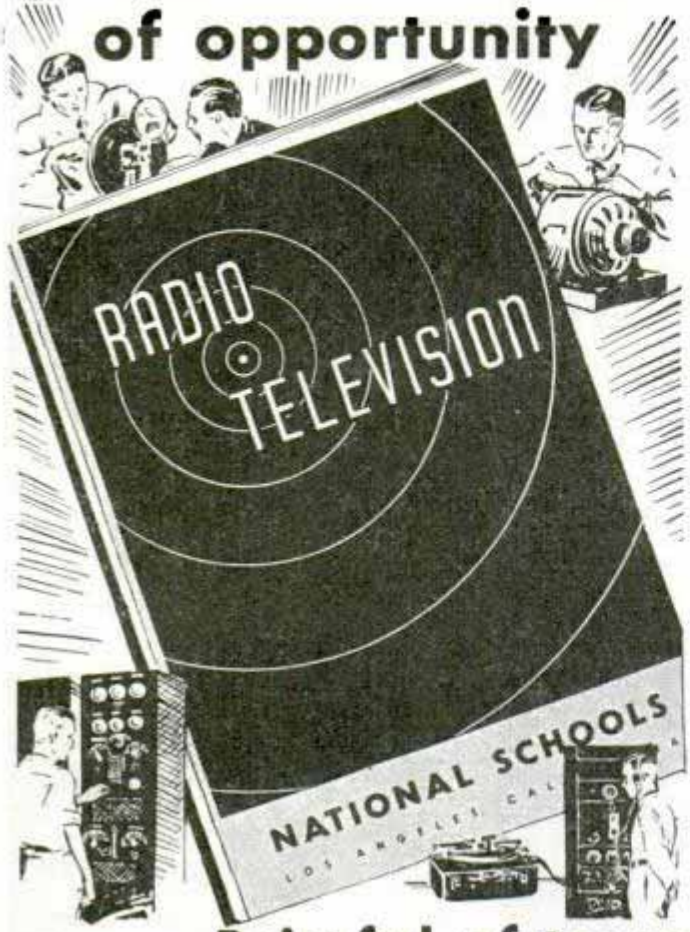

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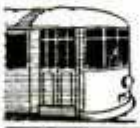

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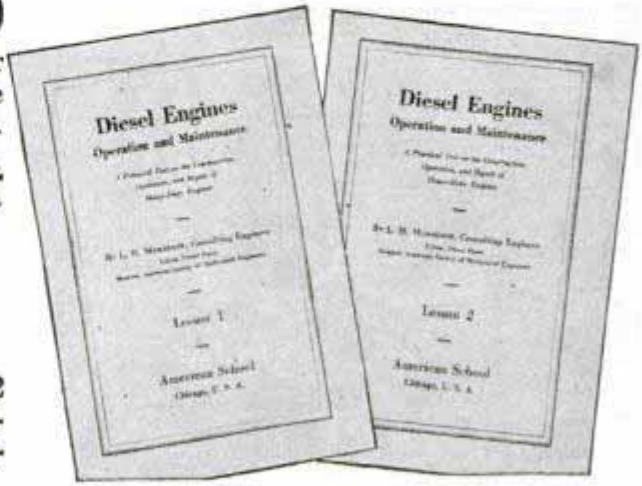

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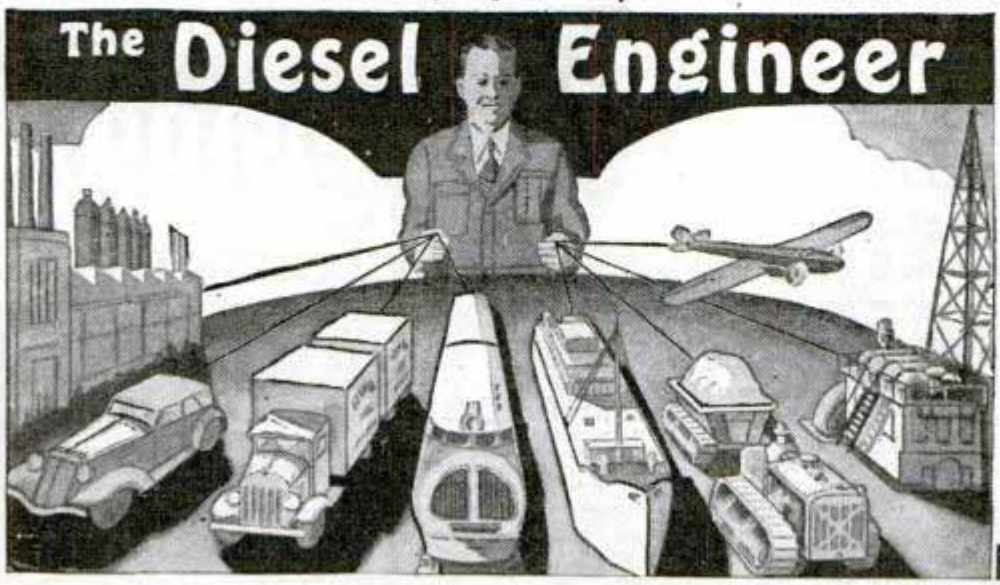

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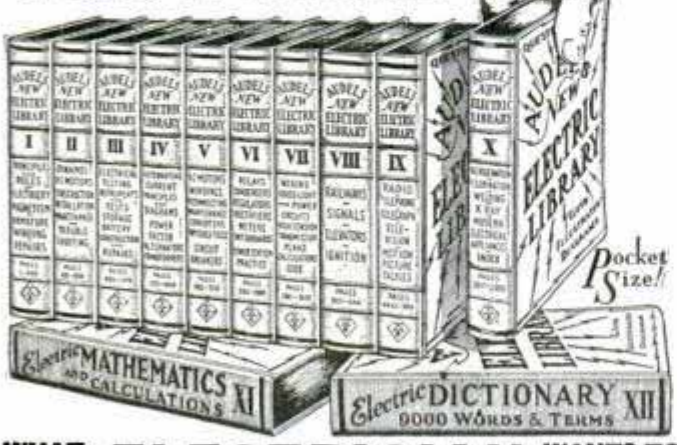

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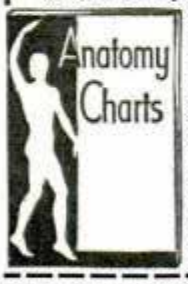

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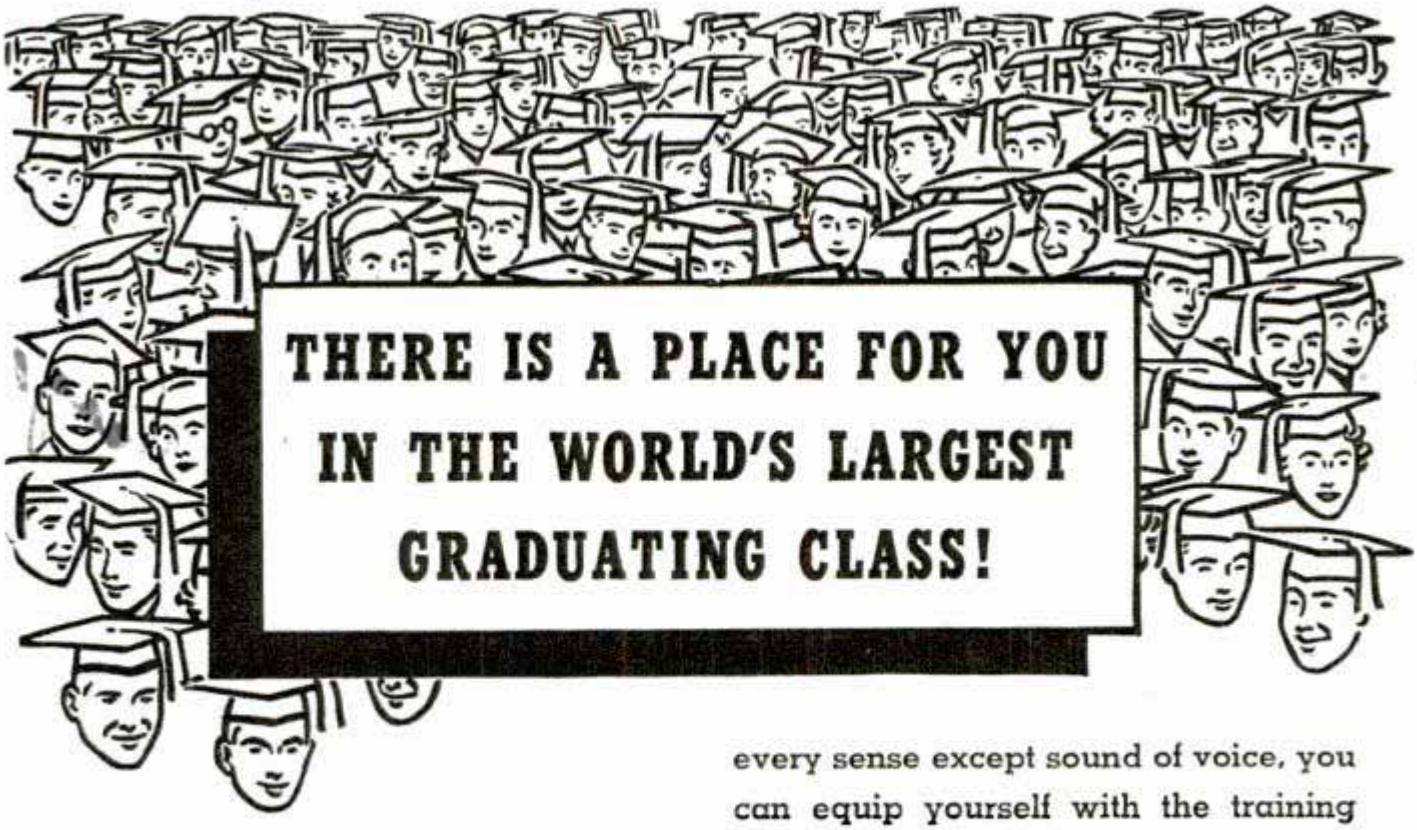

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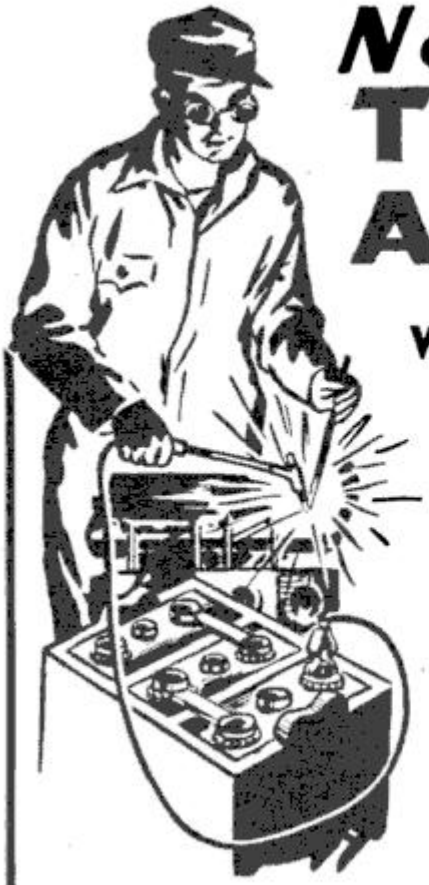
(Continued to page 25A)



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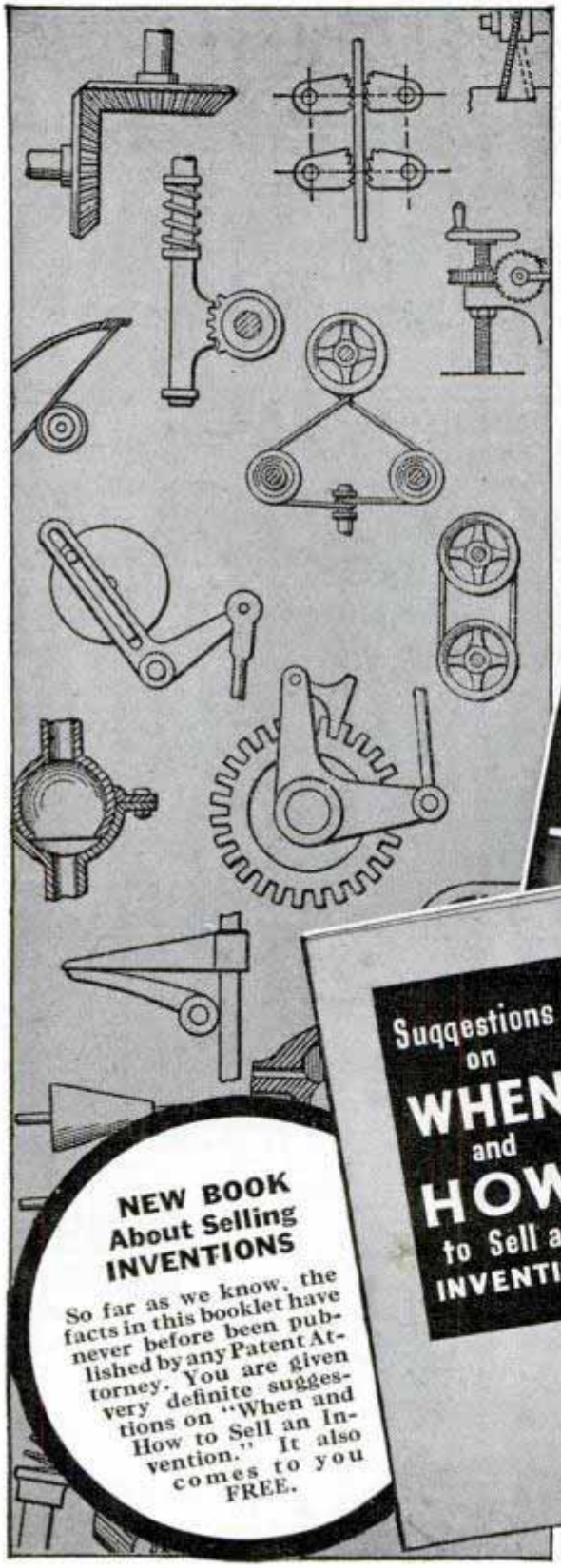

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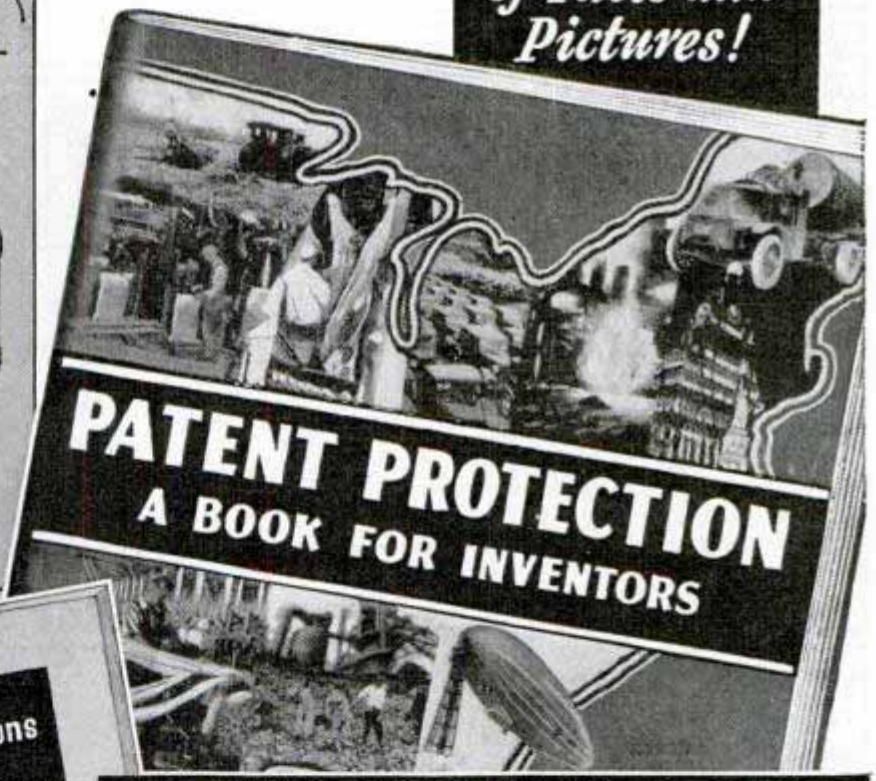

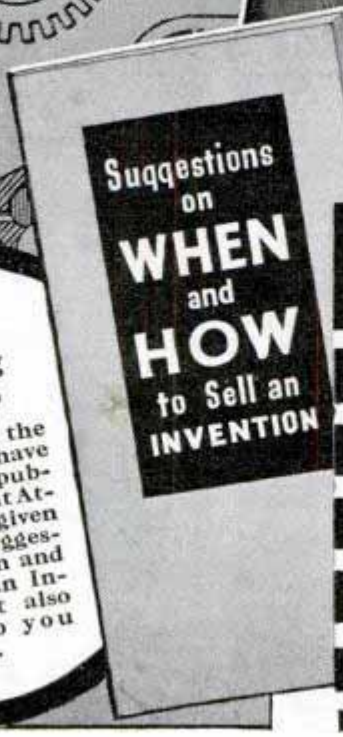

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(Continued from page 20A)

comes "taxa de plata," in Cuba "tasa por cobrar," in Brazil "taxa devida," and in the Dominican Republic and Ethiopia, the letter "T" alone, the latter being surcharged on ordinary stamps. "Te betelen" shows on the stamps of Netherlands and colonies and as one of the bilingual inscriptions on the stamps of Belgium, the other being "a payer." The stamps of Denmark, Austria and Jugoslavia show the word "porto," Norway, "portomaerke," Portugal, "porteado a receber." Those of Costa Rica are inscribed "multa," and those of Ecuador, "multas." "Deficit" or "franqueo deficiente," is used in Peru, "deficiencia de franqueo," in Salvador and Nicaragua, and "complementario" in Mexico. Danzig requires the words "vom empfanger einzuziehen," Sweden, "losen," and Italy and colonies, "segnetasse." In Czechoslovakia the word is "doplatit," or "doplatne," and in Poland, Central Lithuania, and Russia, "doplata," the latter being in Cyrillic characters.

The due stamps of Switzerland and Hungary are distinctive in that they show nothing to indicate their use, but depend upon the large central numerals of value which in so many countries have become associated with postage due stamps. An interesting use of these stamps is found in the semi-postal postage due stamps of Portugal. In 1925, the use of semi-postal stamps was obligatory on certain days to aid the soldiers who fought in the world war. When this rule was not observed the semi-postal due stamps were used to collect double the surtax which had been avoided by failure to use the right stamps.

Of all the various due stamps, those of Hong Kong stand out alone as having a design in character with the use and meaning of the stamps. This shows a balance with a letter in one pan and a weight in the other. The position of the balance and pans indicates that the letter is much overweight.

Stamp Notes

The current point for discussion at stamp clubs is whether gum should be removed from unused stamps. Collectors who have had experience with early stamps with full gum know that the gum shrinks with the passage of time and causes the stamps to

(Continued to page 31A)

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(Continued from page 25A)

curl and crack. In some cases it discolors the stamp with brownish stains. The current United States stamps in themselves are a great argument for removal of the gum, for they are printed on a rather cheap pulp paper which is brittle when the gum is allowed to remain, but quite strong when the gum is removed. Those who have trouble keeping their blocks from separating along the perforations will welcome the time when gum is taboo.

—o—

A small souvenir sheet is promised by Postmaster General Farley in connection with the convention of the Society of Philatelic Americans to be held in Asheville, N. C., in August. No stamp has been selected for this miniature sheet, but it probably will include one or more designs from the Army-Navy series.

—o—

Many countries have adopted photogravure printing for their postal issues. This process produces beautiful stamps, but they are of a very fragile nature. The process is identical with the rotogravure of the magazines and Sunday supplements. The ink is mixed with a volatile fluid such as benzine is order that it may dry quickly, and any of the watermark detectors will cause it to wash off or smear badly.

The ink is applied almost as lightly as if an airbrush had been used with the result that the stamps rub badly, even though mounted in the better-grade albums with tissue-backed pages. This rubbing is augmented by the benzine-mixed ink which adheres only slightly to the paper as compared to the slow drying, varnish-mixed engraving inks used for the early line-engraved stamps.

New Stamp Issues

The Philippine islands are providing many new stamps for collectors since they have become a more or less independent state. Recent emissions include the remainders of the 1935 pictorial set overprinted with the single word "Commonwealth." Three samples are shown in the illustration. At the top, center, is a black, green and yellow stamp issued by Brazil for the recent Eucharistic Congress in that country. At the left is a new French stamp to advertise the 1937 International Expo-

(Continued to page 33A)

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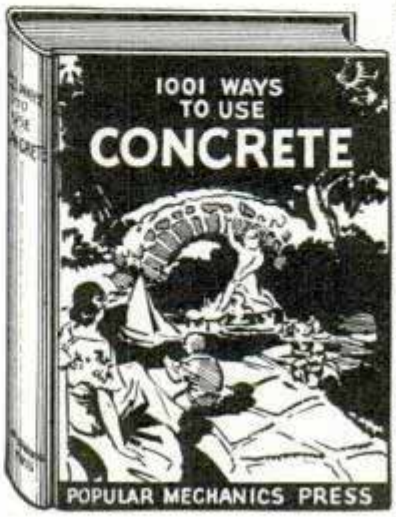

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(Continued from page 31A)

sition at Paris. This is printed in greenish blue and is much superior to other stamps which were issued a few months ago to advertise the Fair. At the right is an example of the air-mail stamps of Libia, issued along with regular postage stamps to commemorate the opening on March 15 of the new military road to the Egyptian frontier. In the center of the illustration are two new Czechoslovakian triangular stamps. These mark a new phase of postal service, for when they are used on letters the postman may not deliver the letter to anyone except the addressee.

At the bottom center are three stamps issued by Netherlands to advertise the coming World Jamboree of Boy Scouts in that country. The first example shows the fleur-de-lis, insignia of the scouts, the second shows a drum being played in front of a line of massed flags, and the third bears the head and shoulders of Hermes, or Mercury, messenger of the gods, from the statue by Praxiteles. The remaining stamps show examples of various issues surcharged by Guatemala for a philatelic exposition in that land.

Nickel Three-Cent Pieces

The minting of nickel three-cent pieces was commenced in 1865 and ended in 1889. All are of the same design and all were minted at Philadelphia. This coin is larger than the silver three-cent piece, being about the size of the silver dime, and shows a liberty head on the face with the date below, and the Roman numeral "III" in a wreath on the reverse. All dates between 1865 and 1889 are known, but the coins of 1877 and 1878 are only found in proof state as there was no regular issue in those years in spite of the fact that the dies were made regularly. The proofs of 1877 are quite scarce, while those of 1878 are only moderately so, for 2,350 were made in the latter year. One of the most interesting of the series is that showing the date 1887 over the original date of 1886. None of the dates between 1883 and 1888 are common as less than 8,000 coins were minted each year. Three years ago an attempt was made to renew the coinage of this piece, but many objections were voiced, among them being the fact that no unit of United States money would divide evenly into three-cent pieces.

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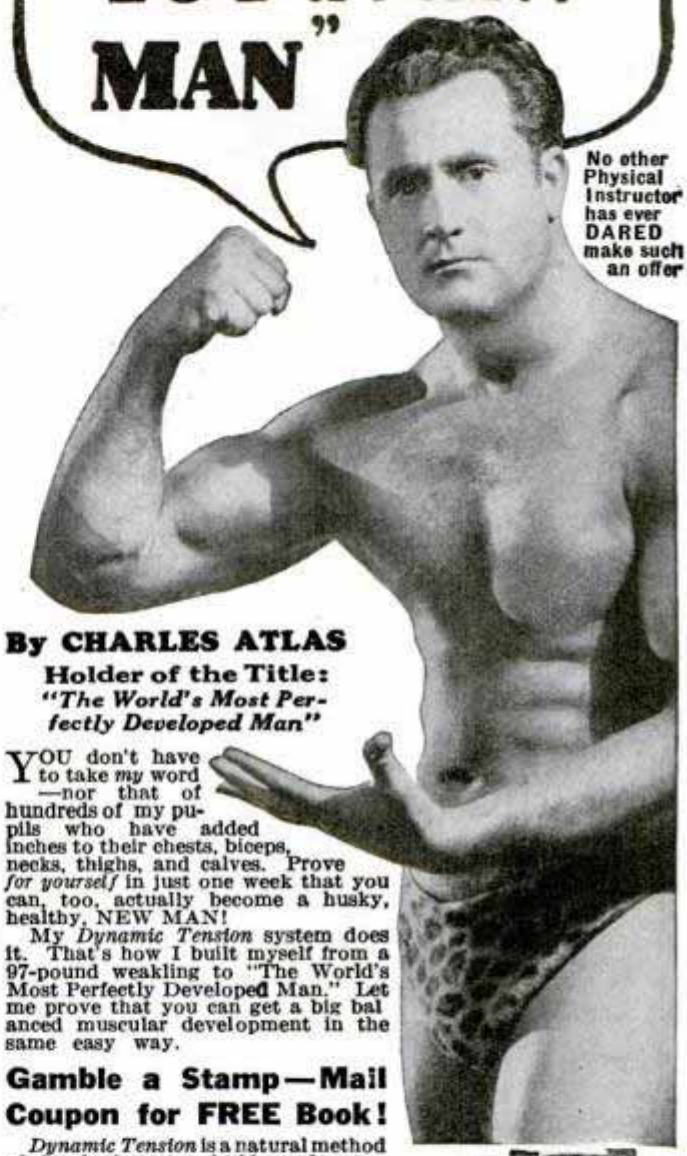

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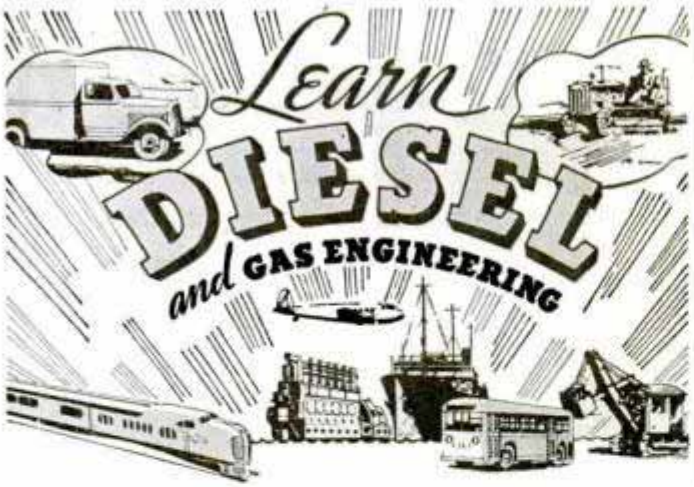

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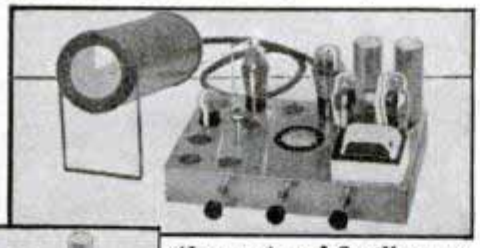

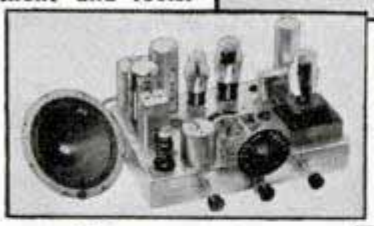

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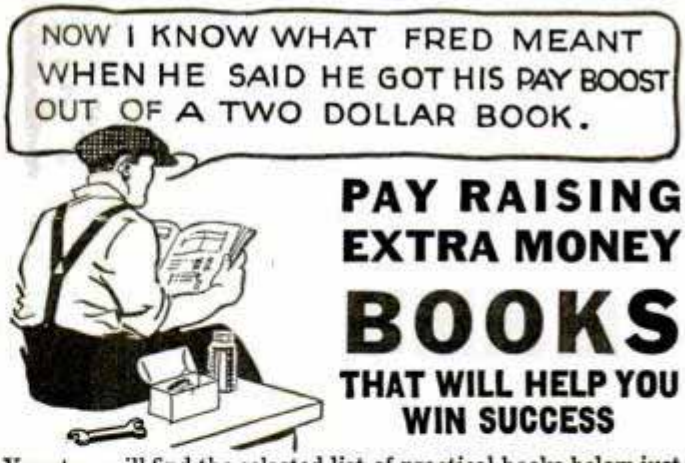

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BUSINESS By mail. Big profits. Write Steininger, 706 West North, Pittsburgh, Pa.

BED Bug and roach formulas. Guaranteed. Big money selling products. Instructions and formulas $1.00. Stewart, 18 E. St. George Ave., Linden, N. J.

"FOOD Concentrates" offer quick mail success. Vegetable powders, tablets, vitamins (millions vitamin E already sold). Your brands labels. Samples, dime. Gardena, 128B, Station "S," Los Angeles, California.

START Mailorder! Home businesses! Steady income. Write. Service Mails, Grand Marais, Mich.

RAISE Needed business capital. We show you how. Write fully. Enterprise Bureau, Syracuse, N. Y.

MAKE Artificial marble, glossy tiles, uncanny. Tabletops, plaques, floors, whetstones, novelties. Inexpensive, hard, fireproof, cement secrets. Brilliant tile and liquid rubber samples 3c. John A. Payn, 945 Grande Vista Avenue, Los Angeles, Calif.

FREE Booklet—Sparetime, full time, opportunities. Graham, 151 Fifth Ave., New York City.

MONEY Making chances offered in the Key to Business Opportunities. Free. F. Spindler, 4628 McPherson, St. Louis, Mo.

DELAWARE Charters: Complete service $35. Submitted forms. Chas. G. Guyer, Inc., Wilmington, Delaware.

CORRESPOND For newspapers: Profitable, interesting, easily learned. Write Publishers' Service Bureau, 4515-F Cottage Grove, Chicago.

CONDUCT A paying mail order business from home or office. Particulars free. Thomasson's Service, Minneapolis, Minn.

DELMACO Mail opportunities, silvering mirrors. Instructions—free. Stamp appreciated. Box 1123A, Wilmington, Del.

MANY Money making ideas, one dollar. Free literature. Ancasco, Box 271, Rochester, New York.

$12,184. PROOF How was made nine months. Legitimate. "Extra Money" Magazine, dime. Long Industries, Elkhart, Ind.

ADVERTISING Business. Operated by telephone. Paid me $30 to $100 weekly. No personal canvassing. Start at home. Booklet. Nameyer, Utica, N. Y.

HONEST. Legitimate information concerning mail order business, home industries and direct selling. Wholesale sources and unique memory calendar. Dollar value for 25 cents. Coin. Business Service, Box 337, Muskogee, Okla.

START Little business anywhere. Everything furnished. No canvassing. Dunn, Box 74, Ionia, Michigan.

MAKE Big money, this new way! Learn how free. Complete details. Write Midwest Club, 308 Helen, Sioux City, Iowa.

100 PROFITABLE Mail order and local plans. Gilbert Supply, 1107 Broadway, New York.

BIG Mail offering wonderful opportunities. Stamp appreciated. Joseph Castell, 1663 Madison St., Brooklyn, N. Y.

WE Start you in business, furnishing outfits and instructions, operating "Specialty Candy Factory" home. Men and women, earn $25.00 up to $60.00 weekly, all or spare time. Booklet free. W. Hillyer Ragsdale, Inc., Drawer 4, East Orange, N. J.

MONEY By mail. Big opportunity packet 3c. Wilko, Box 521, Middlesboro, Ky.

"RAISE Capital!"—Finance big or little business or—"idea" quickly! Carlyle System, 739 So. Berendo, Los Angeles, Calif.

MAKE $21 Per 100 stamping names on keychecks. Samples and instructions 25c. Either sex. Keytagsmm, 689 E. 48th St., Brooklyn, N. Y.

MAKE Good money addressing postals. Write Springer Printery, Miami, Oklahoma.

START Your own business. Manufacture household necessities. Formulas free. Boxes with your own name. Buy materials in your town and save freight. Send for free samples. Box 269-B, Calumet City, Illinois.

WHERE To buy at lowest wholesale prices. Information free. Yorena, Box P-312, Bayonne, N. J.

PROFIT With new products. Make, sell, repeat. Analysis. Research. Guaranteed formulas. Biggest catalog free. Special prices, leads. Gibson Laboratory, Chemists, BD-1142 Sunnyside, Chicago.

WE Buy from you. Product easily obtained everywhere. Write Superior Supply Service, Springfield, Illinois.

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

$5.00 HOURLY! Own amazing new electric saving invention. Business. Big money opportunity. Propell-O-Lite Company, Mt. Washington, Ohio.

SELL Zerpid, new plant fertilizer. 25c. Sanquist Co., Pomeroy, Iowa.

RAISE Giant mushrooms! We buy! Start cellar, shed. Book, pictures free. United, 3848 Lincoln Ave., Dept. 67, Chicago.

OPPORTUNITIES For money making. Summit Press, Box 123, Jackson, Michigan.

OPPORTUNITIES. Literature free. Silvester & Co., Old Bridge, N. J.

SELL By mail—Perfumes, beauty aids, tremendous profits, investigate. Duby, Box 337, Glen Cove, N. Y.

MEN, Women, Regular income, no canvassing. Unique; world-wide. McArthur, Drawer 339-5, Butte, Montana.

UNUSUAL Opportunities for business of your own. Stamp appreciated. Rocke, 34 Connecticut, Somerville, Mass.

CASH Every week clipping and preparing news items for publishers. Simple, fascinating work. Experience unnecessary. Stamp brings information. Division 55, National Press, 3923 West Sixth, Los Angeles, California.

BURGLAR Proof window lock. Locks windows open any height. Sample $1.00. Big discount, exclusive territory. Burglalock, Box 1, Edmonton, Canada.

NU-SHINE Startling new polish. Formula, 10c. Box 319, Canton, Kansas.

REAL Money, steady business, manufacturing modern raise sign letters. Sells 1c and up. J-H-M Company, 12844 Omaha St., Detroit, Mich.

MARBLEIZING; Porcelain enamel finish. Cement prepared, mix with water, applied to wood, wall-board, concrete, etc. Flintlike hardness, brilliant. See our 85c liquid rubber for mold making. Sets solid in four hours. Any thickness. Send dime for assorted samples, both rubber and porcelain. Cowell Institute, Grayling, Mich.

"SCHEMER," Monthly Magazine, Alliance, Ohio, prints schemes, tips, ideas, formulas—big winners—$10,000 to $25,000 reported. 39th year; $1.00. Special: Trial six months only 30c.

MANUFACTURE Newest profit-making specialties from guaranteed formulas, trade secrets, analyses. Complete chemical service. Charges most reasonable. Interesting literature free! Miller, Manufacturers' Chemist, Tampa, Florida.

INVENTION Finance Magazine, 80-G Wall Street, New York. Year subscription 60c entered upon promise to pay on receipt of first copy.

START Your own circulating library. We furnish and exchange your books. Fireside Rental Library, 210 Crosby Bldg., Buffalo, N. Y.

SUCCEED With your products. Make-sell them. Formulas. Processes. Accurate analyses. Catalog free. B. Thaxly Company, Washington, D. C.

PLASTEX Industries offer industrious men an opportunity to start a business of their own, manufacturing art goods, novelties and utility products in Plastex and marble imitation. ½c material makes regular 10c store sellers. Rubber moulds furnished for speed production. Small investment brings big returns. Since the crash, low priced goods are needed and this line meets the demand. Interesting booklet mailed free. Plastex Industries, Dept. A, 1085 Washington Avenue, New York.

SELL By mail. Books, novelties. Bargains! Big profits! Particulars free. B. Elfco, 438 North Wells, Chicago.

CHARTERS: Delaware; best, cheapest; free forms. Colonial Charter Co., Wilmington, Del.

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

ARTIFICIAL Marble sanitary flooring, instructions covering wood or cement flooring ½ inch thick, fireproof, all colors, low cost, ornamental casting, concrete, plaster, papier-mache, garden furniture, statuary, flexible molds, particulars free. Chris Mahler, Elmont, N. Y.

MAKE Money at home in your spare time. Operate your own legitimate business. Free circular. Hunt Publishing Service, 516 Federal St., Pittsburgh, Pa.

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.

MAIL Order business is your opportunity. Many began small, now earn thousands yearly. No personal contact. Boundless opportunities. Have had over 30 years experience; will help you succeed. Send 25c for valuable booklets, none free. B. Breniser, 257 South 21st, Philadelphia.

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.

MONEYMAKING OPPORTUNITIES

TENNIS Players: Earn money, string rackets. Perfect results with inexpensive tool. Write for particulars. Whiteside String Tensioner, 1534 South Avenue, Syracuse, N. Y.

AMATEUR Cartoonists—Win $25.00. No drawing ability necessary to win. 26 prizes in all. Rush name on postcard for valuable tips on "How to Make Money With Simple Cartoons," cash prize entry blank and rules. Send no money. Cartoonists' Exchange, Dept. C-97-B, Pleasant Hill, Ohio.

BOOKS, Chock full of money-making ideas, plans. Particulars for dime. Strom, 302 Boyden Ave., Maplewood, New Jersey.

START Own business. Stamp brings big envelope of latest money making opportunities. A. Bittin, 1719 St. Charles, New Orleans, La.

VALUABLE Moneymaking opportunities, book 25c. Literature free. Harvey Teeple, Decatur, Ind.

67 PROVEN Moneymaking plans, 25 cents. Frank Turack, 127 Starr Building, Export, Pa.

AFTERNOONS Free! Work mornings home—drive to country—"movies"—afternoons! Unusual "plans." No canvassing! Prepare for surprise! National Folio-B, Station "D," Los Angeles.

PRIZES, $1 To $15,000, listed; new world contests, 10c. 6551 Jones, Seattle.

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WANT A real, big profit paying, little business? Here's one worth investigating. Seneca Specialties, Geneva, N. Y.

IF You like to draw, you can earn up to $35 weekly, tracing and duplicating simple designs for advertisers. Ad-Service, Argyle, Wis.

MONEYMAKING Information. Start your own business, write. Dixie Mailers, King, N. Car.

LEARN About a new profitable industry at home. Send 10c. California Earthworm Farms, LaCanada, California.

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 (C37), 200 E. Ontario St., Chicago.

MONEY In old desks, old trunks, old attics. Information free. Laird, B1043, Erie, Penna.

$100 WEEKLY! No selling! Knockout plan! Send 25c. C. Fortunato, 528 West Rockland, Philadelphia, Penna.

MONEY Magazine, Peekskill, N. Y.—tops them all in ideas, plans, tips to make money. $1 year, sample 25c.

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START Spare time business. Mailorder or local. Write Paul Stewart Company, 189 Poplar Circle, Atlanta, Georgia.

MAKE Money at home! Starting outfit 25c. Exchange mailing, 100 circulars. Send yours. Tell Service, JPM, 1451 Broadway, New York.

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10c BRINGS Copy National Mail Order News. Box 1773PM16, Roanoke, Virginia.

$30.00 PER Week with a typewriter! Earn comfortable income at home. Information mailed for 3c stamp. Ace, TPM-2, 322 Empire Bldg., Birmingham, Ala.

NEW Brush plating outfits for auto parts, reflectors, etc., connect to a battery, no tanks used. Almost as simple as painting. Good income plating and silvering mirrors, low cost. Free proof. Gunmetal Co., Ave. N, Decatur, Ill.

NEW Mailorder and local opportunities. Merchants Sales, 617M North Second, Milwaukee, Wis.

107 PLANS For making $20-$100 weekly in home or office business of your own. Descriptive booklet free. Elite Co., 214 Grand Street, New York.

MILLIONS Jobless! Get dollars in mail daily, like we do, for amazing employment information (got man 76 jobs). Keep money; we fill your orders free. Stamp brings details. Co-Operative Service, 77 Swan, Buffalo.

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GUARANTEED Formulas—New fast sellers. None better. Lowest prices. Catalog free. Kemico, 49G, Park Ridge, Ill.

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SOILLESS Agriculture, raise tomatoes, potatoes, flowers, etc., in shallow tank of water containing 21 chemicals. Tomato vines 20 feet, bear for year, 20 pounds per vine, quality better than soil grown. Instructions, formula $1.00. Purdy's Chemicals, 1852 E. Slauson Ave., Los Angeles.

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MAKE Your own products. Employ agents yourself. Toilet articles, soap, extracts. We furnish everything. Valuable book free. National Scientific Laboratories, 1950W Broad, Richmond, Va.

ICELESS Refrigerator. Cheapest. Best. Instructions 25c. Box 1093, Bethlehem, Penna.

MOTOR Oil 2c per gallon. You can reclaim used oil, no machinery required. One cheap chemical used. Formula 25c. George, 285 E. Queen, Philadelphia, Pa.

"CRYSTALLIZED Flower Petals," sell ten dollars pound. Six formulas, one dollar moneyorder. Holt, 30 Fifth Ave., New York.

FREE Formulas and moneymaking plans. Send for free samples. Box 269-F, Calumet City, Illinois.

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TESTED Formulas; analysis, research; details. Kaplann, 13 S. Eden, Baltimore.

NO More ice bills. Ice Ola keeps food cool. Formula 25c. George, 285 East Queen, Philadelphia, Pa.

MONEY Making formulas 2c each. Send for list. Ben Buller, P. O. Box 211, Henderson, N. C.

CERTIFIED Formulas, best science can produce for making popular, biggest-selling specialties. All lines. Before buying formulas, get my valuable "Eye-Opening" literature, including free subscription to Miller's Monthly Messenger. Miller, Chemist, 1706-A, Tampa, Fla.

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MAGIC Chemical submarine, magazine, book of experiments, catalog, all for 10c. Clinton Chemical, Swedesboro, New Jersey.

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CHEMISTRY, Microscopes, telescopes, binoculars, mineralogy. Catalog free. Teeko, 1126N Elmwood, Evanston, Illinois.

CHEMICAL Units for experimental chemistry. 40 assorted units in a durable aluminum cabinet for $2.00. Send for list of contents. Fales Units, Inc., 72 Gold Street, New York City.

RUBBER Latex. Dime brings literature, twenty experiments. Eastern Latex Labs., Box 53, Canton, Mass.

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LEATHER Neckties—Big profits for salesmen. Look finer than silk. Cleaned with damp cloth. Always look new. All styles, colors. Sample tie and sales outfit 50c. Nu-Mode Ties, 1337-A North Twelfth, Milwaukee, Wis.

450% PROFIT In perfected (1937) quick action automatic gas lighter. No flint or flame. Lights gas instantly. Retails 25c. Costs you $1.00 for dozen or $8 for 12 dozen postpaid. Sample 10c. New Method Co., Box PMG-55, Bradford, Pa.

LOCAL Agents wanted to wear and demonstrate free suits to friends. No canvassing. Up to $12 in a day easy. Experience unnecessary. Valuable demonstrating equipment, actual samples free. H. J. Graves, Pres., 1300 Harrison, Dept. U-817, Chicago.

AGENTS Get cash hourly. Thrilling new kind guaranteed silk hosiery plan. Start without experience. Full or spare time. Your hosiery free as bonus. Send size. Rush name. Wilknit, Desk 7B37, Greenfield, Ohio.

$10.00 DAY And expenses easy, selling unique car washing device. Pocket sample. Sells by sight to service stations, fleet owners. No demonstration necessary. BB Chem. Co., Box 418, Gainesville, Tex.

CANVASSERS Buy household products cheaper. Your own literature, latest deals. Paty Co., Dept. B, Somerville, Mass.

CLEAN-E-ZE Metal polishing cloth sells on sight. 12x12 sample 20c, small free. Para-Sweet Co., Pleasantville, N. J..

MONEY In butterflies, moths. See Sinclair Display Advertisement on page 14A.

AGENTS: Earn $3 daily selling Herb Laxative Tablets. Sample free. Thompson Co., Idlewild, Michigan.

ABLE Man to distribute advertising circulars and handle routes. Make up to $42.50 first week. Brand new Ford sedans given producers as bonus. Details free. Albert Mills, 2369 Monmouth, Cincinnati, Ohio.

BIG Money applying gold initials on automobiles. Easiest thing today. Free samples. Also, sideline salesmen for name plates and tire cover transfers. "Ralco," 1305 Washington, Boston, Mass.

NEW Ironing invention. Pocket size. Save electricity. End scorching. No lifting. Abolishes kinks from cord. Telephones also. 135% profit. Samples furnished. Neverknot, Dept. 7-A, 4525 Ravenswood, Chicago.

EARN Extra money or a steady income selling Fine-Art all-season greeting cards; 100% profit. Descriptive folder free. Fine-Art Card Co., Inc., Dept. 121, Buffalo, N. Y.

MAKE Your own products. Employ agents yourself. Toilet articles, soap, extracts. We furnish everything. Valuable book free. National Scientific Laboratories, 1950W Broad, Richmond, Va.

300% PROFIT In new perfected (1937) quick action self-starting cigar lighter. No flint or friction. What makes it light? No wind can blow it out. Retails 50c. Costs you $2 a dozen. Sample and sales plan 25c. New Method Co., New Method Bldg., Box PM-55, Bradford, Pa.

AGENTS: Smash go prices. Santos coffee 12c lb., 4-oz. vanilla 8½c. Razor blades 10 for 8½c. 100 sticks chewing gum 12c. Christmas cards, 21 in box, 14c. 150 other bargains. Premiums. Experience unnecessary. Carnation Co., PO, St. Louis, Mo.

90c PROFIT On $1.00 sales. Cleaner for autos, metal and glass. Your name on labels. Free sample. Write. Instant Kleen Lab., Dept. E, Dayton, Ohio.

TRANSPARENT Neon-like signs, 4c—retails 25c. Celluloid pricing sets, 50% commission. Sample free! Lowy, Department 721, 8 W. Broadway, N. Y.

$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. T-172, Cincinnati, Ohio.

AGENTS Make flavors, lotions, shampoos, medicines. 68 products. Your name on labels. Materials supplied. Quality Company, E-20030 Russell, Detroit, Mich.

YOU'LL Like resilvering mirrors, auto-parts, reflectors. Making chipped glass signs. Write, Sprinkle, Plater, 128, Marion, Ind.

DISTRIBUTOR Wanted. New auto tube patch. Brose, 216 N. Clinton, Chicago.

UP To $6.00 an hour. Amazing Karnu refinishes autos like new without rubbing, polishing, waxing or painting. Inexpensive—costs little. Wipes on with cloth. Lasts 8 to 12 months. Free sample. Karnu, Dept. T-8, Cincinnati, Ohio.

ELECTRIC Razors $4.00. 32 pages of opportunities 10c. Eag, P-129 Brick, Dickson, Penna.

SENSATIONAL Seller! Millions sold, agents coining money. Send dime for sample, (none free). No stamps. Your opportunity, answer quick! M. D. Manufacturing Co., Decatur, Georgia.

NO Competition. Steady income. New sensational home manual. Box 1104, Stockton, Calif.

SENSATIONAL New Cleaner. Dissolves grease. Amazing demonstration makes sales easy. Fast repeater. Sample free. United Products, Olean, N. Y.

15,000 PROFIT Making formulas. Following and many others: Accidents and emergencies, agriculture, alloys and amalgams, artist's materials, beverages, cements, glues, pastes, mucilages, bleaching, renovating, coloring metals, dyeing glass, heat treatment of metals, household formulas, ice cream, confectionery, chewing gum, lapidary work, exterminating vermin, lubricants, paints, varnishes, photography, condiments, canning formulas, rubber, soap, candles, soldering, toilet preparations, perfumes, waterproofing, fireproofing, writing materials. $5.50 postpaid. Popular Mechanics Press, Room (C37), 200 E. Ontario St., Chicago.

REVOLUTIONARY Mystery mike. Sells on sight everywhere. 100%-200% profit. Make $25.00 daily. Write for details. Exclusive territory. Free sample offer. Standard Appliances, 528 No. LeClaire, Chicago.

CHRISTMAS Cards—50 beautiful folders, name imprinted, cost 65c, sell for $1.00. Marvelous 21-folder assortments sell for 60c and $1, pay you 100% profit. Be first with this great new 1937 line! Extra bonuses for early sales. Samples free. Start now! New England Art Publishers, North Abington, 256, Mass.

"HANDY Hack," the new all purpose hacksaw. Fastest selling tool of the year. Mechanics rave over it. Salesmen make 200%. Sample 50c postpaid. Winnebago Tool Works, Dept. 83, Winnebago, Minn.

NEW Cleaner—Amazes everybody. Cleans everything. Washes clothes snow-white quickly. Spots, stains removed like magic. Startling demonstrator. Free samples make fast sales. Quick repeater. Immense profit. Write quick for "free sample." Super-X Cleanser Co., Dept. 11, Berwyn, Illinois.

PORTRAIT Agents, including foreign countries, lowest prices, portraits frames. Catalogue free! Picture-Man Friedman, Dept. 9, 528 Cornelia, Chicago, Ill.

MAKE Money with "Leo's Hand-Made Leatherlink Adjustable Belts." Belt and proposition 35c. Leo Thomas, Hot Springs, S. D.

PROFIT With new products. Make, sell, repeat. Analysis. Research. Guaranteed formulas. Biggest catalog free. Special prices, leads. Gibson Laboratory, Chemists, BD-1142 Sunnyside, Chicago.

THYDRO-X (Extra miles). Improved! Better than ever! It's got everything! Miles—power—sales—profits. Grab a territory! Trial offer. Particulars free. Thermo-P Works, Peoria, Ill.

NINETY Best 9x11 blue signs $3.00 delivered. Koehler, 334 Goetz, St. Louis, Mo.

MEN! Women! Tremendous market untouched. Germicidal deodorant needed everywhere. Steady repeater. Surefire demonstration. Act quick! No'Der Laboratories, Kewanee, Illinois.

MAKE All the profit. Manufacture your own products. Formulas free. Boxes with your own name. Buy materials in your town saving freight. Free samples. Box 269-A, Calumet City, Illinois.

SELL Novelty fun cards, novelties, etc. Samples 10c. National, Box 500M, Cincinnati.

500% PROFIT! Gold reflecting letters for store windows. Large sizes 1c. Free samples. Modernistic Sign, B-3004 Lincoln Ave., Chicago.

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

NEW Brush plating outfits for auto parts, reflectors, etc., connect to a battery, no tanks used. Almost as simple as painting. Good income plating and silvering mirrors, low cost. Free proof. Gunmetal Co., Ave. H, Decatur, Ill.

HOW To obtain capital, fully explained, particulars free. Star Service, Wapakoneta, Ohio. Established 1934.

MONOGRAMMING Automobiles biggest money maker today. New type requiring no varnish to apply. Write for samples. International Monogram & Transfer Co., Box 9360, Philadelphia, Pa.

ENGRAVED Nameplates, signs, initial plates. Enamel finish, five colors, big profit. Hilton Specialty, 29 Portland, Providence, R. I.

SELL The Driving Master. Shows miles per gallon when driving. Analyzes motor. Described page 369 September Popular Mechanics. Driving Master Co., Sioux City, Iowa.

MAKE More money taking orders: Shirts, ties, hosiery, raincoats, uniforms, dresses. Sales kit free! Experience unnecessary. Nimrod Company, Department 8, 4922-28 Lincoln Avenue, Chicago.

GOLD Reflecting window sign letters. Penny each. Large sizes. Easily applied. New styles. Absolutely beautiful. Free samples. Atlas Sign Works, 7941 Halsted, Chicago, Ill.

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, Dunellen, N. J.

SUCCEED With your products. Make-sell them. Formulas. Processes. Accurate analyses. Catalog free. B. Thaxly Company, Washington, D. C.

ENGRAVED Name plates, numbers, signs, etc., easily sold, profits large. Brett Bros., Winthrop, Mass.

FREE Sample—Amazing cleaner; sells homes, taverns, everywhere. Big profit—fast repeater. Betco, 5007 Irving Park, Chicago.

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 outfits. Emblem checks, check-fobs, name plates. Hart Mfg. Co., 303 Degraw St., Brooklyn, N. Y.

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.

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

DO You want agents for your proposition? Your ad in this space will place your message before hundreds of men seeking fast-selling products. My folder "How to Secure Agents" is filled with proof. I'll gladly send you a copy free. F. W. Johnson, Manager Classified Advertising, Popular Mechanics Magazine, 200 E. Ontario St., Chicago.

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

HIGH-GRADE SALESMEN

STOP Slamming doors. Sell automatic air-cushioned door regulators. One size controls any door or screen indoor or out. Eliminates breakage. Low price. New adjustable, strong foolproof design creates unlimited market. H. L. Diehl, 109 Jefferson St., Muscatine, Iowa.

SALESMEN, Distributors. New deal. More profit, exclusive territory. 125 varieties brushes, mops, specialties. Neway Brush Co., Hartford, Conn.

MAN Wanted—By shoe manufacturer established 34 years, for sales work. Ready cash daily and extra bonuses to producers. No experience needed. Your own shoes at factory prices. Sales outfit sent free. Write Mason Shoe Manufacturing Company, Dept. F76, Chippewa Falls, Wisc.

NEW Punchboard assortments. Free 32 page colored catalog. Nothing to carry. Larger cash commissions daily. Season now! Addwill Sales Co., 180 Adams, Chicago.

SALESMEN, Sell harvest hats. Big commission. American Harvest Hat Co., St. Louis, Mo.

NEW Burglar proof lock. Fast seller. Salesmen, distributors wanted. Stewart Safety Window Lock, St. Clair Shores, Mich.

I'LL Start you in the products business on my capital. 200 home necessities. Big profits. Quick repeats. Bargain deals. Write today. Ho-Ro-Co, 2757-R Dodier St., St. Louis, Mo.

SELL Nothing! $95.00 weekly. $500,000 punchboard firm announces new, no investment plan. Season starting. K&S, Dept. C127, 4329 Ravenswood, Chicago.

SELL Celluloid and cardboard pricing tickets, steel shelf moulding, changeable signs, menu covers. Every store prospect. P. Pricing Press, 124 White St., New York.

MAN Wanted to supply Rawleigh's household products to consumers. We train and help you. Good profits for hustlers. No experience necessary. Pleasant, profitable, dignified work. Write today. Rawleigh's, Dept. G-53-PPM, Freeport, Ill.

BIG Earning opportunities for you. Own good paying business of your own free. Everything needed for you to start at once is supplied without cost. Hundreds of different direct selling opportunities listed for your selection. Nothing like this directory anywhere. Send 25c for big 160 page book that puts you in touch with the greatest money-making opportunities in every section of the country. Write Direct Selling Institute, Inc., 75 East Wacker Drive, Dept. A, Chicago, Ill.

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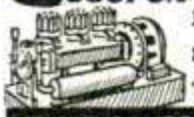

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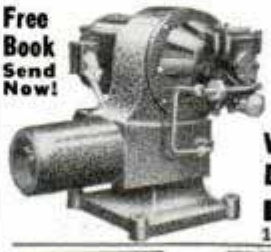

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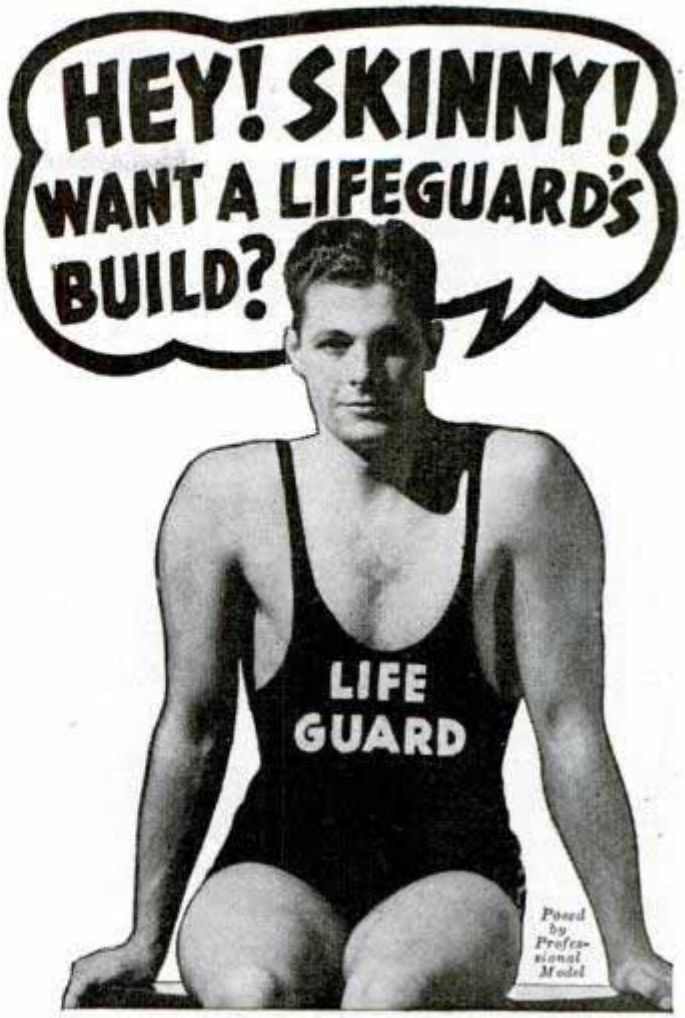

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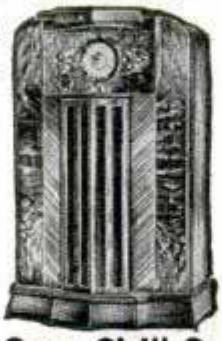

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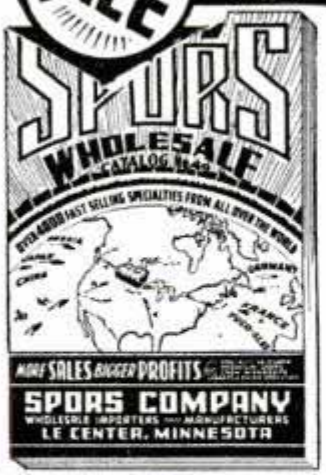

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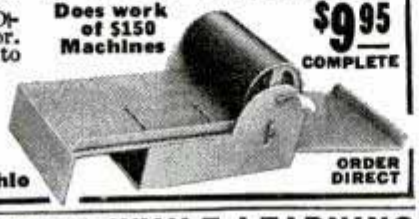

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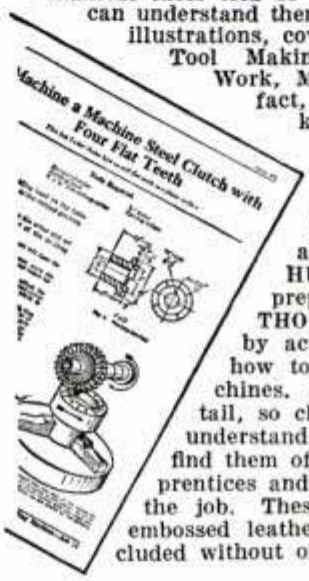

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This is a reproduction of one of three job ticket pages showing how to mill flat teeth in a plain surface. In these pages are listed the tools required and a complete description of each of the seven operations.

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With each job ticket is a set of quiz questions for self examination. These job tickets and the books offer a practical method for learning machine shop work by a study of actual jobs and thus simplify and shorten your training period. They alone should be worth more than the price of the books.

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Popular Mechanics Magazine

REGISTERED IN U. S. PATENT OFFICE AND CANADA

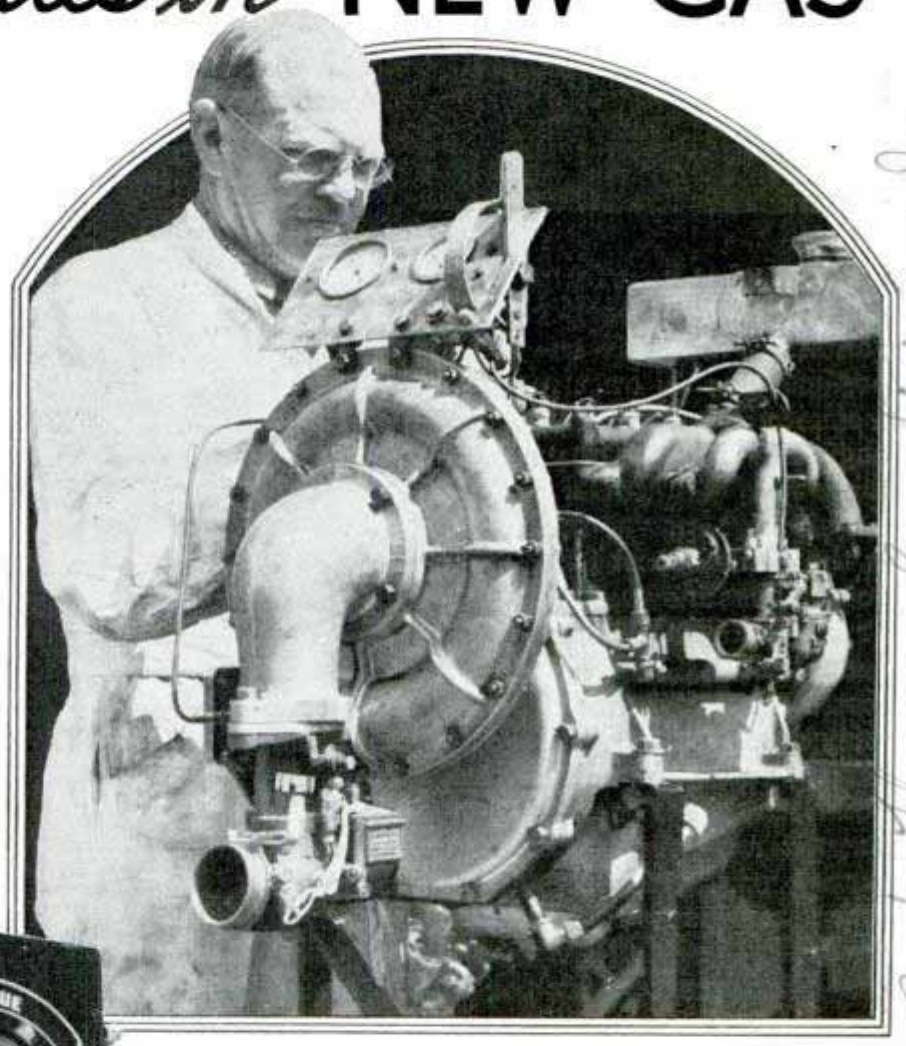
WRITTEN SO YOU CAN UNDERSTAND IT

Vol. 68 JULY, 1937 No. 1

More Miles in NEW "GAS"

SUPER-GASOLINE far more powerful than the best motor fuel you can buy today may be on the market in a few years. Two years ago this high-power fuel was a chemical curiosity and cost $25 per gallon but now it can be produced for less than fifty cents per gallon and eventually it will sell for under twenty-five cents.

"Ordinary motor cars will run with smaller engines. With this the China Clipper can carry 1,900 pounds more pay load. Airplanes can get off the ground more quickly, thus making big fields unnecessary," states

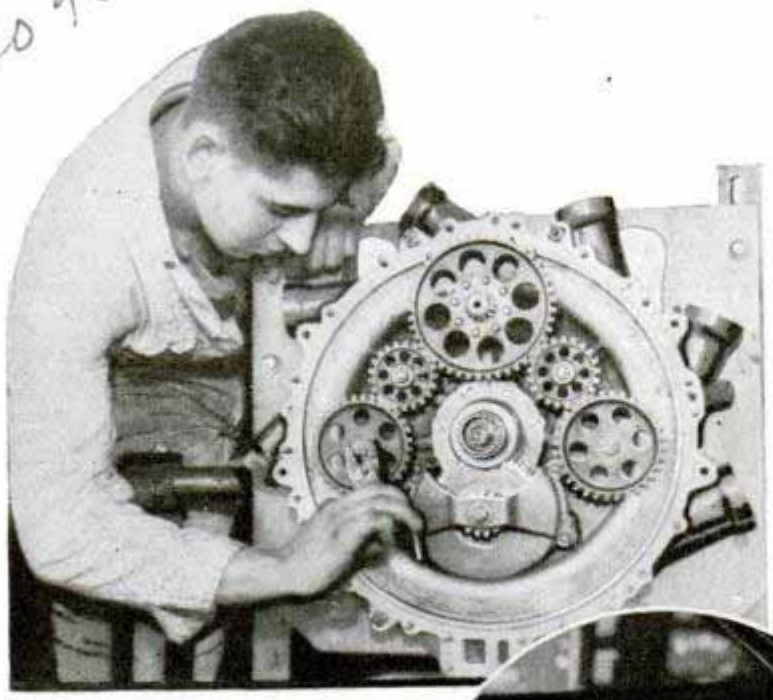


Top, supercharger driven by auxiliary engine for use in high-powered trucks. Bottom, dynamometer dials show power developed by auto engine under test

Dr. Gustav Egloff of the Universal Oil Products company of Chicago, "It will also aid in the rocket-flight experiments where the chief question is one of fuel. More power is coming."

When automobile engines are redesigned to take full advantage of the new fuel, one motor engineer estimates, the present performance of automobiles will be maintained with engines approximately half the size of present engines, and with an

20484



increase of at least forty per cent in miles per gallon. When this super-gasoline is on the market your automobile engine will be about the size of a suitcase.

This high-power fuel is the same secret 100-octane gasoline that the army and navy have been testing for two years. It is just about the same as ordinary gasoline except that it is of extremely high antiknock value. That single characteristic in the fuel permits an engine to extract and use far more of the actual power contained in gasoline. Already, army air corps engines designed for ninety-two octane gasoline are delivering one-third more power per unit of weight by using 100-octane gasoline. Engines specifically designed for the new fuel should be even more powerful. It is estimated that a transport plane, using 100-octane instead of the eighty-seven octane now used for cruising, would consume twelve gallons of fuel less per hour and would be able to fly faster as well. The estimate is that in transcontinental service a passenger transport would save $1,000 per trip with the new fuel and new engines. Engineers say that each increase of one number in octane rating is worth five cents per gallon in increased power.

Better engines and better fuels go hand in hand. In the last fifteen years research has increased automobile engine efficiency by more than thirty per cent. Of that amount, twenty-three per cent was obtained by stepping up the octane number of premium gasoline from sixty to eighty. But another twenty-point increase in antiknock value will permit an additional sixty-five per cent increase in automotive efficiency. Efficiency rises at an accelerated rate as the octane numbers go up. In one recent test a stock 1936 automobile engine developed an increase in horsepower of seventy-one per cent when a fuel seventeen-octane points higher than usual was used, together with the supercharging that was made possible with the higher octane gasoline.

High compression and supercharging are the two best ways of stepping up the efficiency of a gasoline engine. The trouble in the past has been that fuel would break down and start to knock as soon as the compression or supercharging was increased very much. This

Top, gears for stepping up speed of supercharger for aviation uses. Center, acceleration instrument measures power developed by auto. Bottom, rocket model with orifice for utilizing final push of fuel

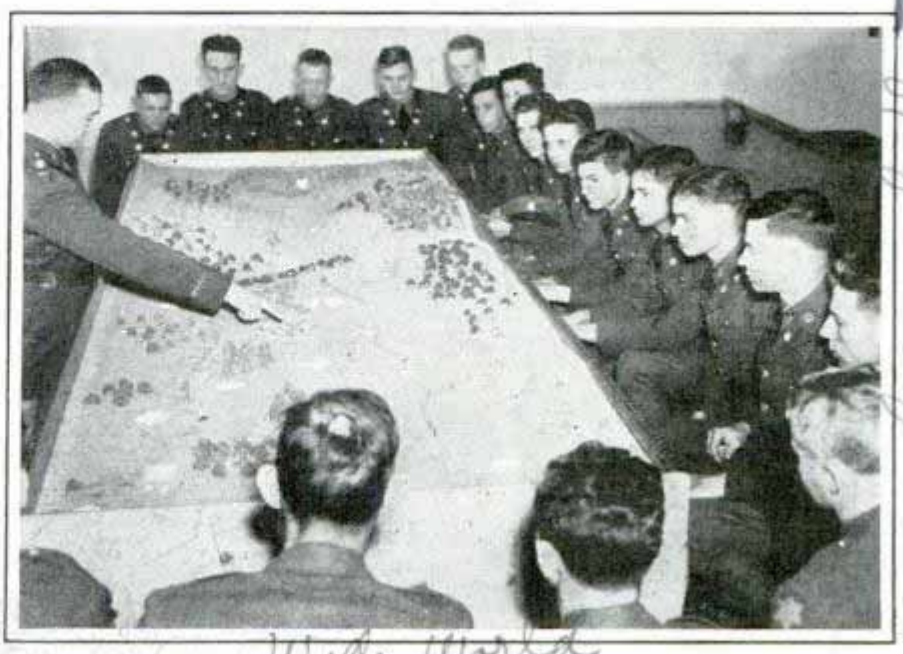
Esrover Products Co
1221 S. Hope St.

trouble with gasoline has been the main obstacle to production of more efficient engines. Some gasolines knock worse than others and this fact is still one of the mysteries of petroleum, although several explanations have been offered. An antiknock fuel burns at a steady rate in the combustion chamber and delivers a steady useful push against the head of the piston. A knocking fuel starts to burn in the same way and then suddenly explodes. Much of its potential power is wasted in the explosion. Although petroleum chemists don't yet understand completely why an untreated western gasoline is often more knock-resistant than a similar eastern fuel or why cracked gasoline knocks less than straight-run gasoline, the important thing is that they can create practically any grade of antiknock gasoline that they desire. Their scale is the octane scale, by which they compare the knocking of an unknown gasoline against the knocking of an artificial fuel that they blend in the laboratory.

This fuel is made up of proportions of heptane which knocks violently in an engine, and of iso-octane which hardly can be made to knock at all. Both are hydrocarbon compounds of the same nature as the compounds in gasoline. Pure iso-octane is rated arbitrarily at 100. The percentage of iso-octane blended with heptane in the reference fuel establishes its octane number. That means that when an unknown gasoline is placed in a test engine and is found to knock exactly the same as seventy-three parts of iso-octane mixed with twenty-three parts of heptane, for example, the octane number of the fuel being tested is seventy-three. High octane numbers mean high antiknock fuels. The modern cracking process produces gasolines that have octane values as high as seventy and seventy-

(Continued to page 151A)

War Games Played in Sand to Teach Plan of Campaign



Officer instructing infantry class in war campaign strategy, using sand map to point out plan of attack on enemy territory

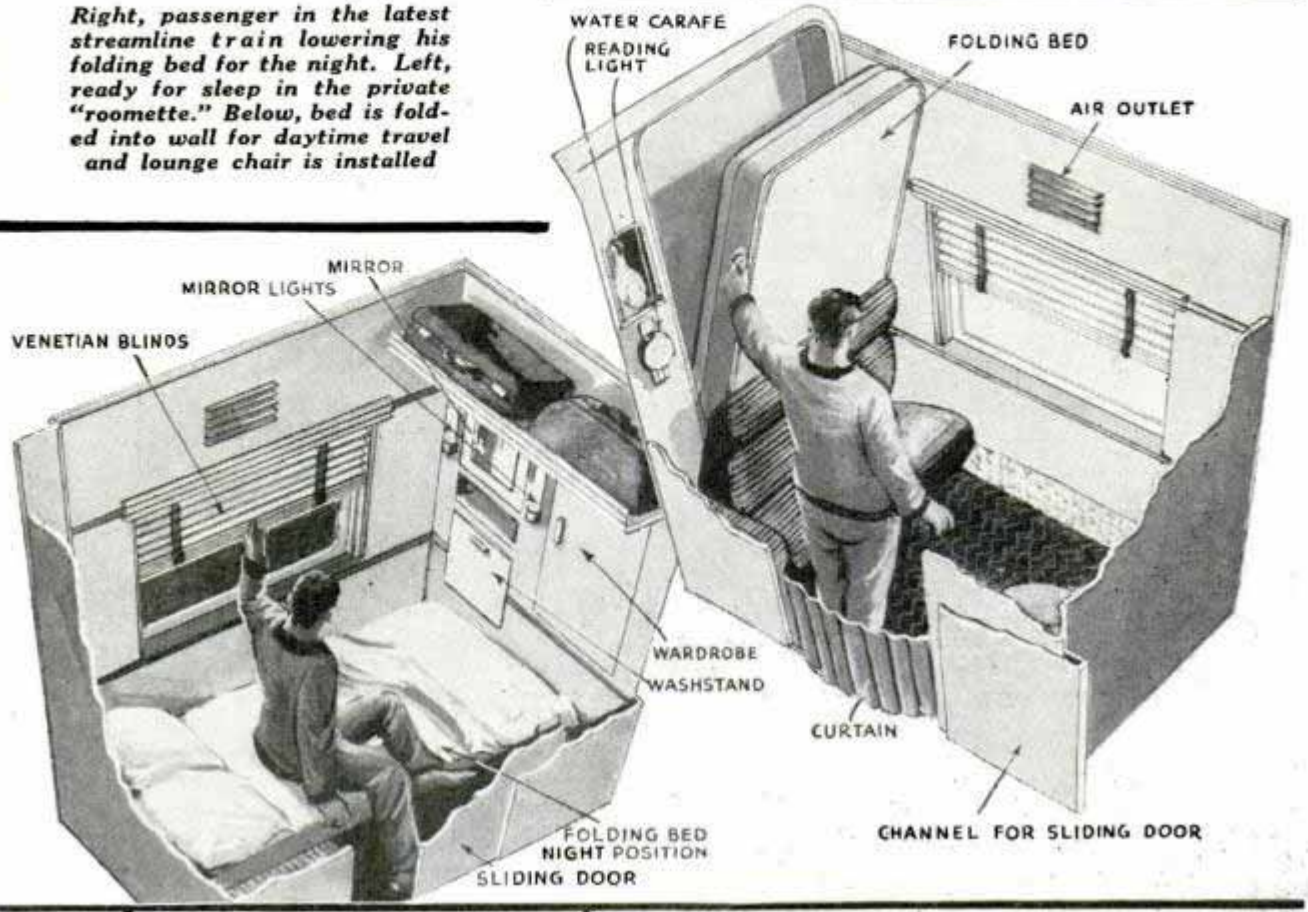
Military strategy is taught on a sand map at Jefferson Barracks, Mo. Infantrymen gather around a table on which a "contour" map of "enemy" territory is laid out in sand, and an officer uses the map to explain the plan of attack.

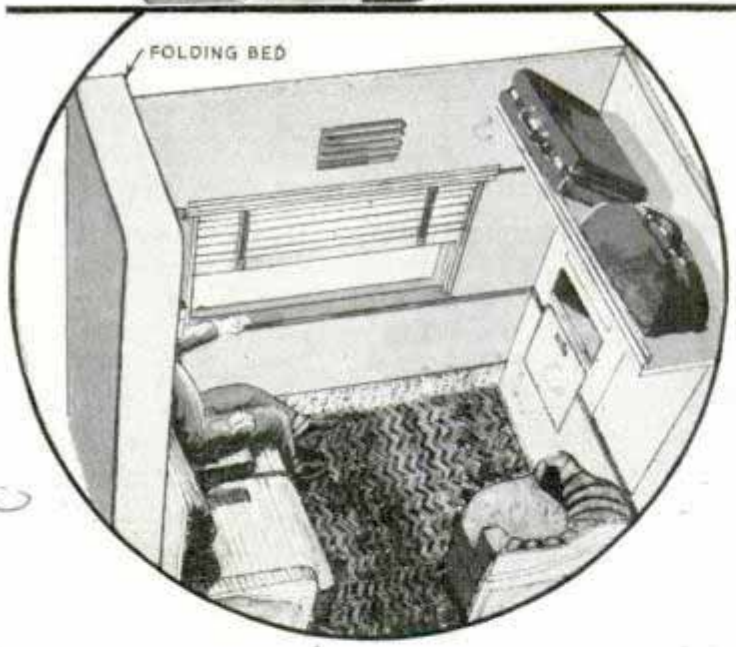
Exposure Meter for Movies Adjusts for Camera Speed

Made especially for amateur moviemakers, a midget exposure meter is now offered. Its direct reading is set for average use, with the normal camera speed of sixteen frames per second and with supersensitive film. However, a simple pre-set adjustment makes it possible to obtain a direct reading of the meter for any film including color film, and for slow motion and other settings of speed. It is governed by a photoelectric cell. Very compactly made, it can easily be carried in a vest pocket.

Folding Beds Vanish into Wall of Streamliner

Right, passenger in the latest streamline train lowering his folding bed for the night. Left, ready for sleep in the private "roomette." Below, bed is folded into wall for daytime travel and lounge chair is installed



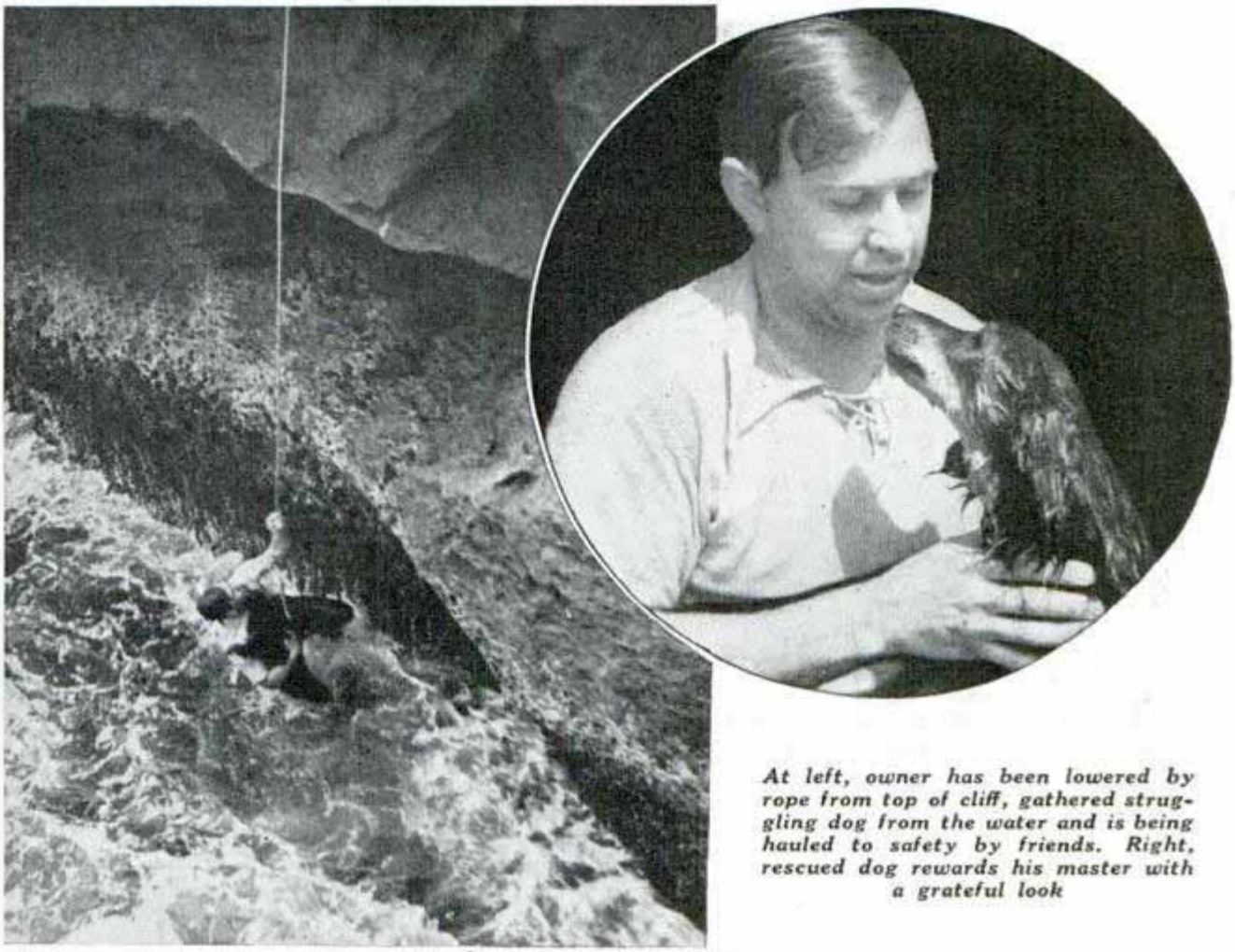


"Roomettes" with folding beds that disappear into the wall will be introduced in the two seventeen-car streamline trains being built for the Chicago-to-California run on the Union Pacific route. The bed folds behind the seat, and a lounge chair is added for daytime travel. Sliding doors are provided. From head to tail these streamline giants are 1,291 feet long—nearly a quarter of a mile; at the head are three Diesel-electric power cars each housing two 900-horsepower engines, making available a total of 5,400 horsepower. Both steam and electric heating systems are installed, arranged so that either or both may be used and controllable in each room. Every room, too, is equipped with radio outlet. One of the sleepers has upstairs and downstairs bedrooms with enough headroom in both for the passenger to stand. The train consists of articulated pairs of cars, one pair consisting of a diner and a coffee shop with kitchen between. One train will operate between Chicago and Los Angeles, the other between Chicago and San Francisco, on a thirty-nine and three-quarter hour schedule

¶The zoological station and aquarium at Naples, pictures of which were shown in the April issue, were built with funds contributed by Francis M. Balfour, of Trinity College, Cambridge, England.

Chicago and Northwestern
Northern Pacific
(Letter)

Owner Risks Life to Rescue Dog from Ocean



At left, owner has been lowered by rope from top of cliff, gathered struggling dog from the water and is being hauled to safety by friends. Right, rescued dog rewards his master with a grateful look

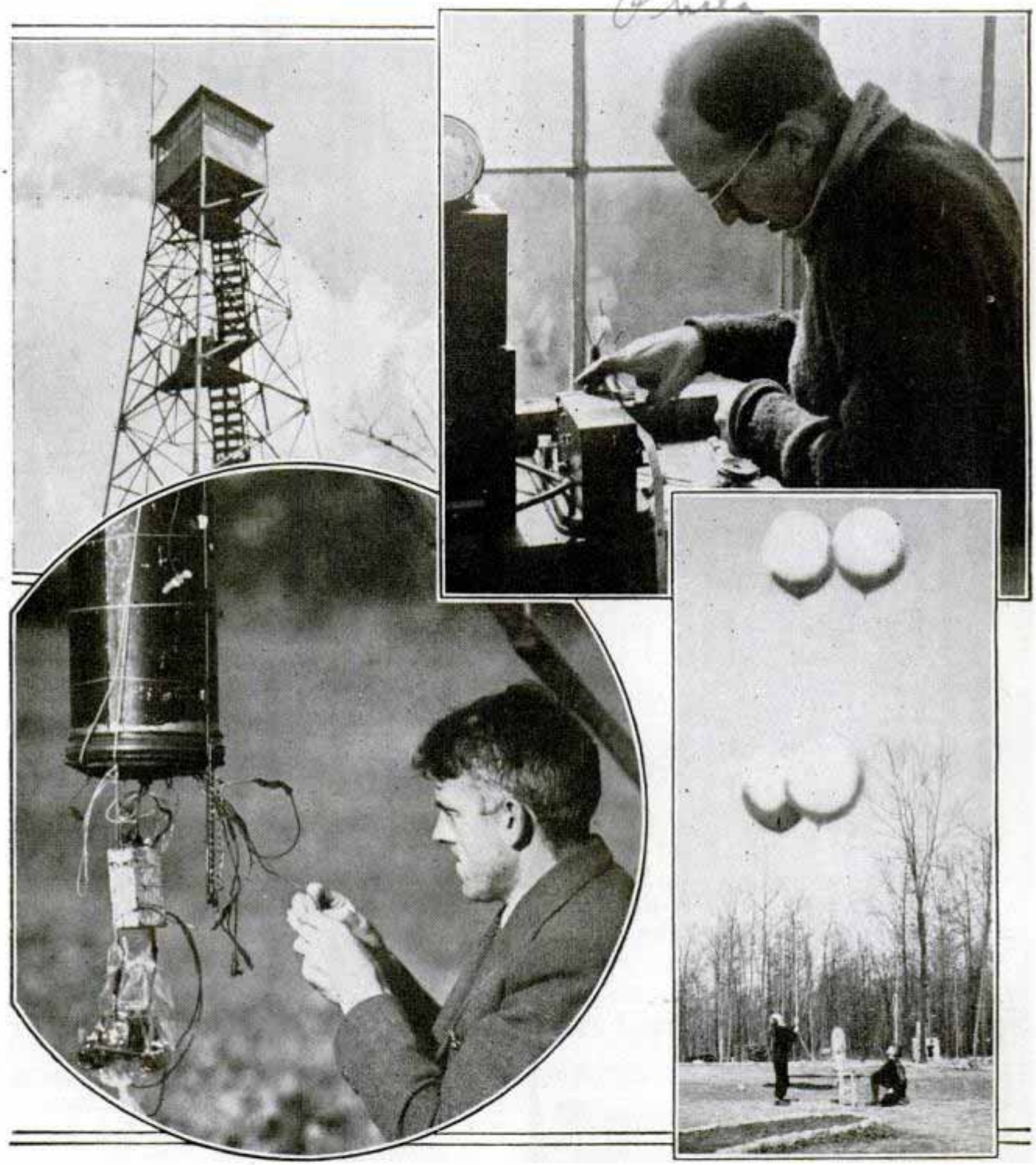
When his dog, "Snarky," was caught in the surf at the foot of a rocky California cliff, the owner went down at the risk of his life to save his pet. Just as he collared the dog, a big wave rolled in and pounded him against the rocks, but he clung to the pup and called to his friends above to "haul away." They pulled him up the face of the precipice with a rope, dog and man dripping but none the worse.

Sportsmen's Sea-Going Auto at Home on Land or Water

Vacation-bound sportsmen travel on road or river in a sea-going tractor built by two California men. Its lines are those of a motorboat, but it can climb ashore without any alteration and continue its journey on tractor treads. The "mobile boat" is nineteen feet long and weighs two tons. Its builders are now considering the construction of a "floating trailer" for the mobile boat.

Built like a motorboat, this amphibian craft ventures ashore on tractor treads that can travel on paved road or rough country

Radio Balloons Gather Secrets of Cosmic Ray



Top, left, tower in which receiving station is located. Right, radio receiver which records on tape the signals from balloon transmitter. Bottom, left, the transmitter. Right, balloons ready for flight

Helping scientists to investigate one of their greatest mysteries, small balloons carrying radio apparatus are being sent into the upper air to gather information about the cosmic ray, a form of energy known to be bombarding the earth. Dr. Thomas H. Johnson of the Bartol Research Foundation of the Franklin Institute has perfected radio apparatus, small enough to be carried aloft by four small balloons, which automatically sends by short-wave radio a count of the rays, an altitude report and barometric readings. These balloons attain an altitude of 50,000 feet easily and scientists believe a height of 90,000 feet is not impossible. The cosmic-ray counter carried by the balloons sends back radio impulses of a duration of a few

hundredths of a second, easily distinguishable from the more rapid impulses due to static and similar causes. Readings are received on a tape at a station on earth every few seconds. Barometer, ray counter and radio transmitter weigh only fourteen pounds and are sealed in a can. By means of the balloons it has been found that the cosmic ray consists of two components, one "hard" and the other "soft." At the earth's surface there are about fifty-two parts of "hard" component to twenty of the "soft," while at stratosphere height there are ninety-eight parts "soft" to 1.7 parts "hard." This, to scientists, means that the cosmic ray changes as it passes through the earth's atmosphere. No observers travel in the radio balloons, hence the safety factor is high, and the apparatus is so inexpensive that it does not matter if balloons are lost.

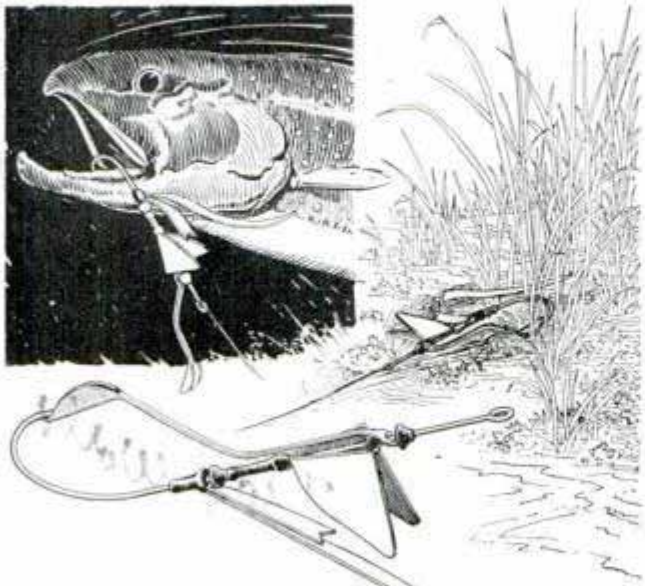
Camouflaged Guns on Guard over Mouth of Thames River

Watching over the mouth of the Thames river is this formidable cannon, one of a battery of big guns camouflaged to escape enemy eyes

Huge coast-defense guns that guard the mouth of the Thames river in England have been camouflaged to protect them from the eyes of raiding aircraft. Gunners of the coast guard are constantly being trained to man the battery at the Shoeburyness garrison. (Essex)

Weedless Rubber Bass "Bug" Has Adjustable Guard

Made with a spring guard which completely incloses the point and barb of the hook, this weedless "fly" can be worked through heavy weeds, lily pads, moss and thick grass without fouling. By sliding a tiny spool of rubber along the body of the hook, the guard can be adjusted to suit practically all conditions requiring the use of a weedless hook. Any clamping pressure, such as would be exerted by the jaws of even a small game fish in striking, instantly disengages the guard and exposes the point and barb of the hook. A most realistic simulation of live bait is attained by using colored strips and triangular-shaped pieces cut from thin, soft rubber and lashed to the hook as shown in the illustration. The triangular pieces and strips of brightly colored rubber represent the wings and body of an insect and when the lure is drawn over the surface of the water they impart a short, jerky motion, thus giving the final touch of animation that fools the lurking big ones into striking. The lure is available in a considerable variety of hook sizes and colors.

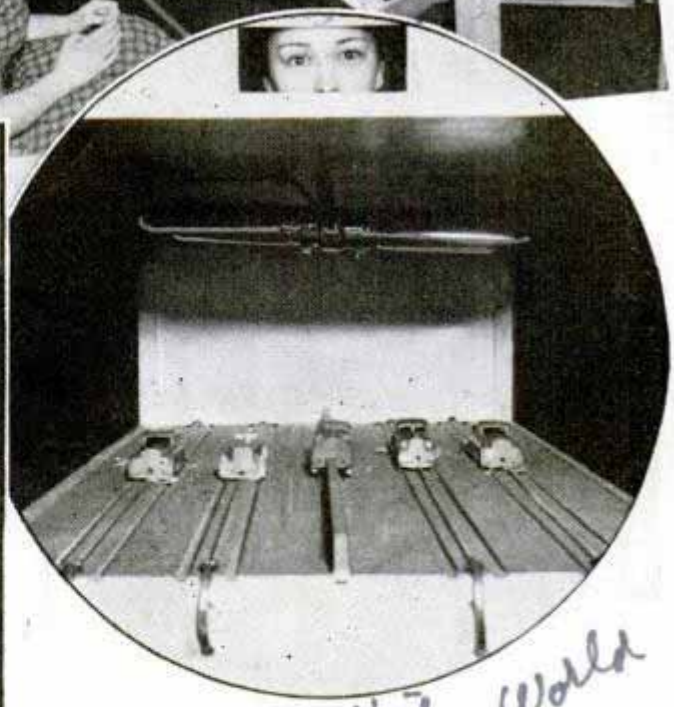


Butterfly Bait Co. Box 173, La Grange, Ill

Clinic's Toy Cars Test Traffic-Law Violators

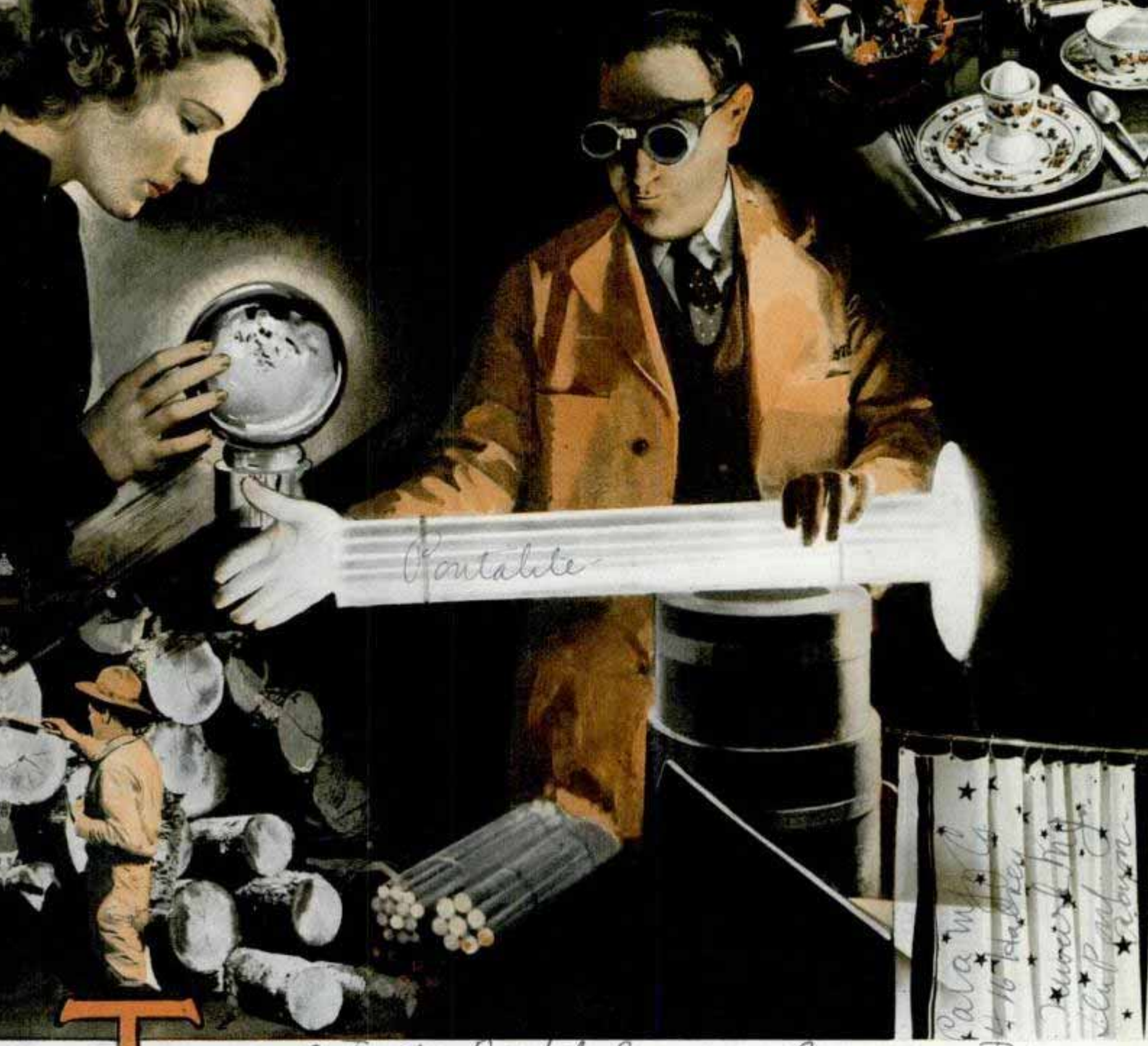
Mr. Lowell S. Selling, Director, Psychopathic Clinic, Recorder's Court

Several scenes in psychopathic clinic where violators of traffic laws at Detroit, Mich., are subjected to tests of their ability to drive and of their reactions in emergencies. Top, patient regulates speed of her car by foot switch while clinic attendant maneuvers the other toy auto to create dangerous traffic situation. Right, measuring field of vision. The patient must fix her eyes straight ahead and notice an object on rim of testing device before it has moved too far forward



Wide World

Left, traffic problems are projected on screen while machine records motions of stopping and starting and patient's emotional reactions. This is the "reactograph." Above, patient looking into mirror fifteen feet away must aline the toy cars by means of strings, thus testing her depth perception



E. I. du Pont de Nemours Co, Wilmington Del.

F1655

THINGS *are* NOT *what* THEY SEEM

9

Fabrikoid - see ads

PART 2

CELLULOSE was the beginning of both the tablecloth and the decorative tree: Below, machining "Lucite," a new crystal-clear plastic which can be sawed, cut, drilled and polished. It transmits a large portion of the sun's ultraviolet light and can be fabricated into delicate tinted shades.

By H. W. MAGEE

FLOWERS and coal—a strange pair. Two wholly different products of nature, seemingly with nothing in common. And yet, curiously enough, coal has enabled man to duplicate not only the fragrance of the flowers, but the hues of the rainbow as well.

To most of us coal means heat, light, power. But to the chemist it is also the source of coal tar—a sticky, gummy, evil-smelling compound which contains the base for beautiful dyes, rare perfumes and a host of other useful products. The blooming of a lily out of the mire is no more a miracle than the birth of a rich indigo dye or the sweet scent of lilacs from the black, unlovely substance we know as coal tar.

Once, only kings and the very wealthy could surround themselves with brilliant colors and luxurious perfumes. Today, thanks to coal tar and the wizardry of the chemist, the humblest maid can afford to wear a perfumed rainbow around her shoulders. Coal tar has brought inexpensive color and beauty into the lives of everyone. Without coal-tar products, this would be a gray, drab world.

We have seen how chemists of the E. I. du Pont de Nemours and Company pro-

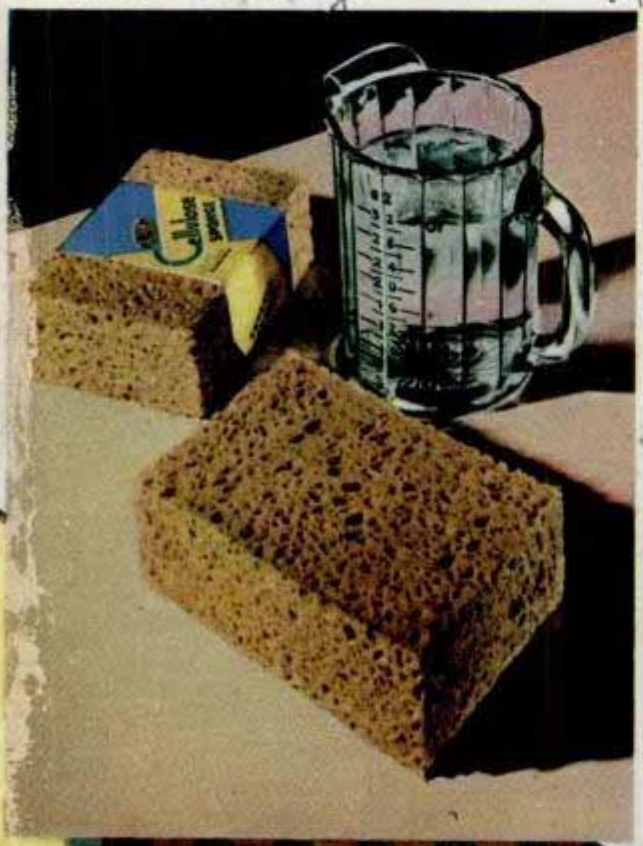
Photos courtesy E. I. du Pont de Nemours and Company

Hercules Co.
Wilmington, Del.

CELLULOSE sponge in foreground has been immersed in water. The one in background is dry. Note increase in size after immersion. Right, this gown has a permanent finish. It can be boiled and does not have to be restarched. The vat dyes used to color it are impervious to washing, sunlight and perspiration. Bottom, model sun room furnished and decorated with products of American chemical laboratories.

R.H. Macy.

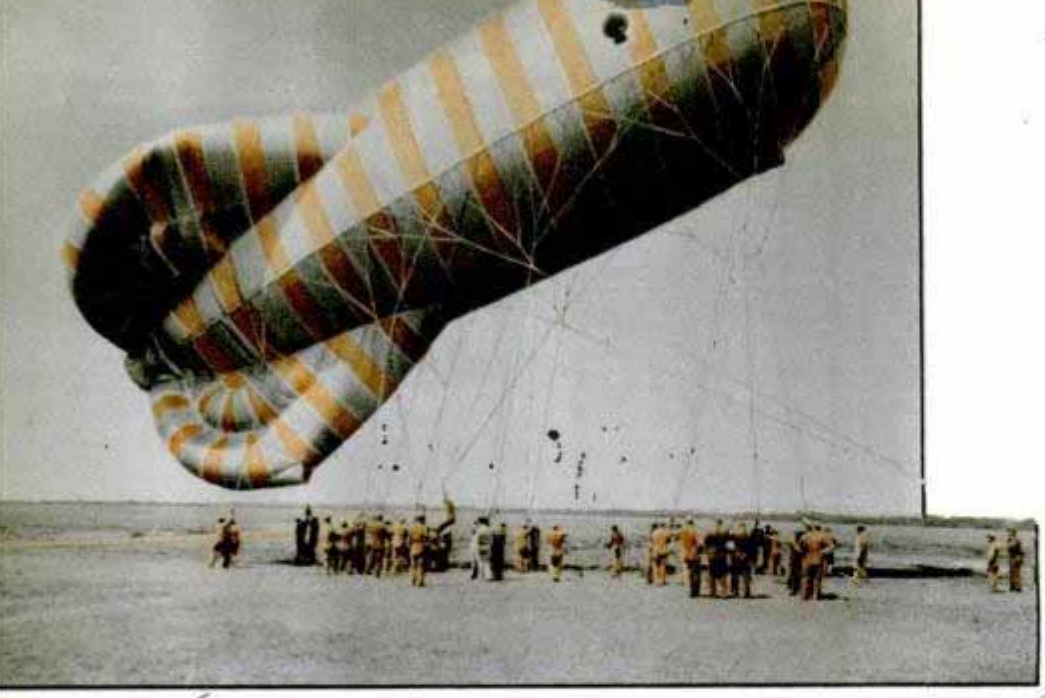
11



Best & Co. 5th Ave and 35th Newyork 19-75

F1655

du Pont Products exhibited at Chicago Century



Neoprene

BALLOON made of fabric treated with man-made rubber compound. Below, hat made of braided strips of jet-black "Cellophane." Any woman with deft fingers can fashion one like it. Bottom, ornamental enamelware decorated with gay ceramic colors made possible through the development of new chemical products.

The Lido

F1055

duce an array of man-made materials from cellulose as unlike as the finish on your car, the barrel of your fountain pen, the wrapper around your cigar and the lining of your coat. All are born of the stately spruce and the white cotton boll. Now let's observe what marvels are produced when coal and chemistry, instead of cellulose and chemistry, join forces.

When coal is heated, as in making coke, a by-product is the thick, sticky substance known as coal tar. If this gummy tar is distilled, it yields various carbon compounds at different boiling points. These are the "crudes," the intermediate compounds between black, sticky tar and the colorful substances used for dyeing. They go by such imposing names as toluene which, when treated with nitric acid becomes "TNT"; benzene, not to be confused with the petroleum product, benzine; phenol, commonly known as carbolic acid; napthalene, used for making moth-balls, and anthracene, cresol and carbazol. All of them together make up about one per cent by bulk of the original coal.

Lemon Mfg Co

Ceramic Colors
Enamelware - Volcraft Co
Dept. store

PHOTOGRAPH of girl at right was taken through a cylindrical block of "Lucite," a new crystal-clear plastic, to demonstrate its transparency. Below, packing man-made camphor as it is delivered from the flaking drum. Bottom, one of the properties of "Lucite," new plastic, is its ability to convey light through itself edgewise, concentrating the illumination at the ends or edges only, as shown in this demonstration.

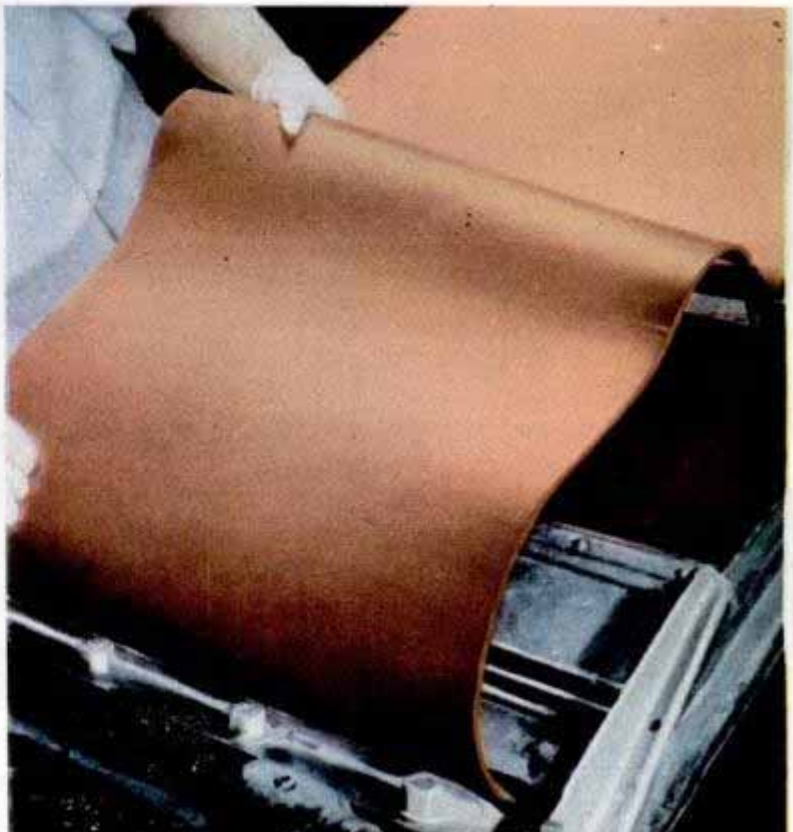
When purified, these substances are either colorless liquids or white, crystalline solids. They have a peculiar odor and so are called "aromatic compounds" but they exhibit none of the brilliant colors which appear on further treatment. When the chemist treats these liquids and crystals with nitric acid and other substances, however, they yield not only dyes but a wealth of products useful to man.

Toluene, for instance, produces not only "TNT," but a group of dyes, some intermediates for still other dyes and certain rubber chemicals. Nitrated benzene, when reduced, gives aniline and this, in turn, yields a stabilizer used in smokeless powder. And aniline might well be called the head of the family of coal-tar colors. So important is it that all such dyes are known as aniline dyes, although not all of them are actually

made from it. It does form the base, however, for indigo, one of the first synthetic dyes to gain outstanding commercial importance and still the most widely used textile color today. But don't get the idea that it is all as simple as it sounds. Indigo is one of the most difficult of all dyes to produce—and none of them is easy.

When the world war shut off the supply of foreign dyestuffs, America faced a famine of color so acute that warehouse floors were scraped to recover the spilled colors. Today American chemists make hundreds of primary colors from coal-tar derivatives and combine them to produce the several thousand hues used commercially. And if you can't find what you want

BEACH suits, above, colored with fadeless vat dyes developed through chemical research. Below, left, examples of "Lucite," the new plastic, showing how it can be molded or cast into any desired shape. Its absence of color makes it receptive to dyes and pigments of any shade wanted. Right, below, "Pyralin" coming through the "sheeter."

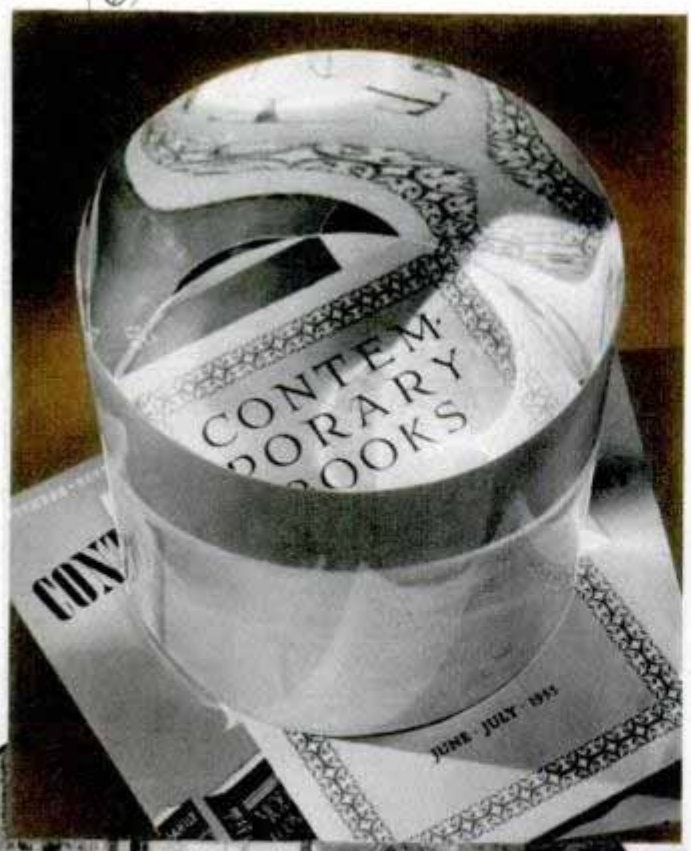


among them, they'll make up the exact shade you specify. Thus chemistry has produced a rainbow of beauty and fast color for everyone. Nowadays you need not be a king or queen to wear "the royal purple." There's a dye for every purpose—special dyes for cotton, silk, wool, rayon, leather, rubber, paper, even gasoline. A dye suitable for one fabric may not have an "affinity" for another, so today the number of dyes produced is almost as great as the number of products to which man wants to add color.

But that's only part of the story of coal tar. Each of the coal-tar derivatives yields many other products besides dyes. Benzene, for instance, is chlorinated to make chlorobenzene, a by-product of which is an effective moth repellent. Chlorobenzene, in turn, is treated to yield the base for several sulphur colors and a photographic developer, half a dozen dyes, intermediates to produce still other dyes, and picric acid which can be used as an explosive but which also forms the base for still more dyes. Other

SINGING through "Cellophane." The hood mutes the high notes of the coloratura soprano so they can be broadcast without fear of microphone vibrations. Left, "Pyralin" toiletware, beautiful, durable and inexpensive as compared with natural materials such as ebony and ivory which this man-made material has replaced for such purposes to a great extent.

F165



coal-tar compounds yield as many different substances out of which are produced such materials as accelerators to speed up the vulcanization of rubber; anti-oxidants which prolong the life of automobile tires; tetraethyl lead, the active principle in anti-knock fluid for automobiles; extreme pressure lubricant bases for increasing the strength of oil films, many pharmaceutical chemicals and perfume bases.

It is difficult for anyone but a chemist to realize that the sticky, evil-smelling stuff we know as coal tar produces the aromatic bases for most of our perfumes today, but this is a case where smelling is believing. There would be no lilac or lily-of-the-valley perfumes, for instance, if it were not for coal tar because no means has ever been found for extracting the oil from these flowers. So coal tar plus chemistry offers us perfumes never produced before but also duplicates such odors as violet and rose—and it used to take twenty-five tons of violets to make one ounce of natural oil for this perfume and a ton of roses to make ten ounces of

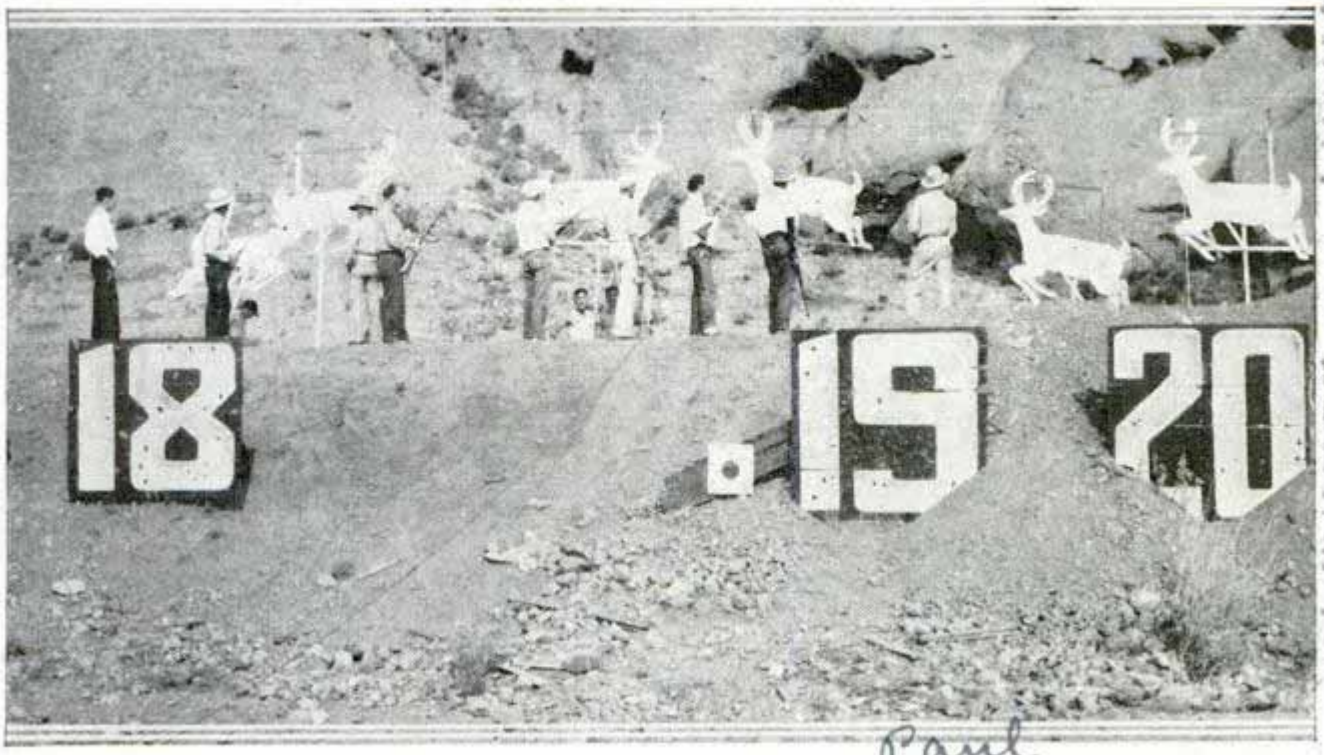
(Continued on page 128A)

DEMONSTRATING magnifying power of "Lucite," above. At left, washing window with a man-made sponge. Bottom, this kitchen has "Cellophane" drapes, "Fabrikoid" table cover, synthetic finishes on furniture and refrigerator.

Marshall Field Chicago

Drapes - Cellophane Cellulose Film.
F. Schumacher, 60 W. 40th, NYC.

Bounding Targets Test Skill of Deer Hunters



Cut-out deer targets are pushed across this rifle range by boys who run behind embankment. The targets have a bounding motion like running deer. The range is used between hunting seasons

Deer hunters in southern Arizona put in a bit of pre-hunting season practice on a rifle range that has cut-out dummy deer for targets. The dummies are pushed across the range on wheels, bounding along with the natural movement of running deer. Boys running behind a protective embankment furnish motive power.

Electric Iron Emits Steam from Base to Dampen Clothes

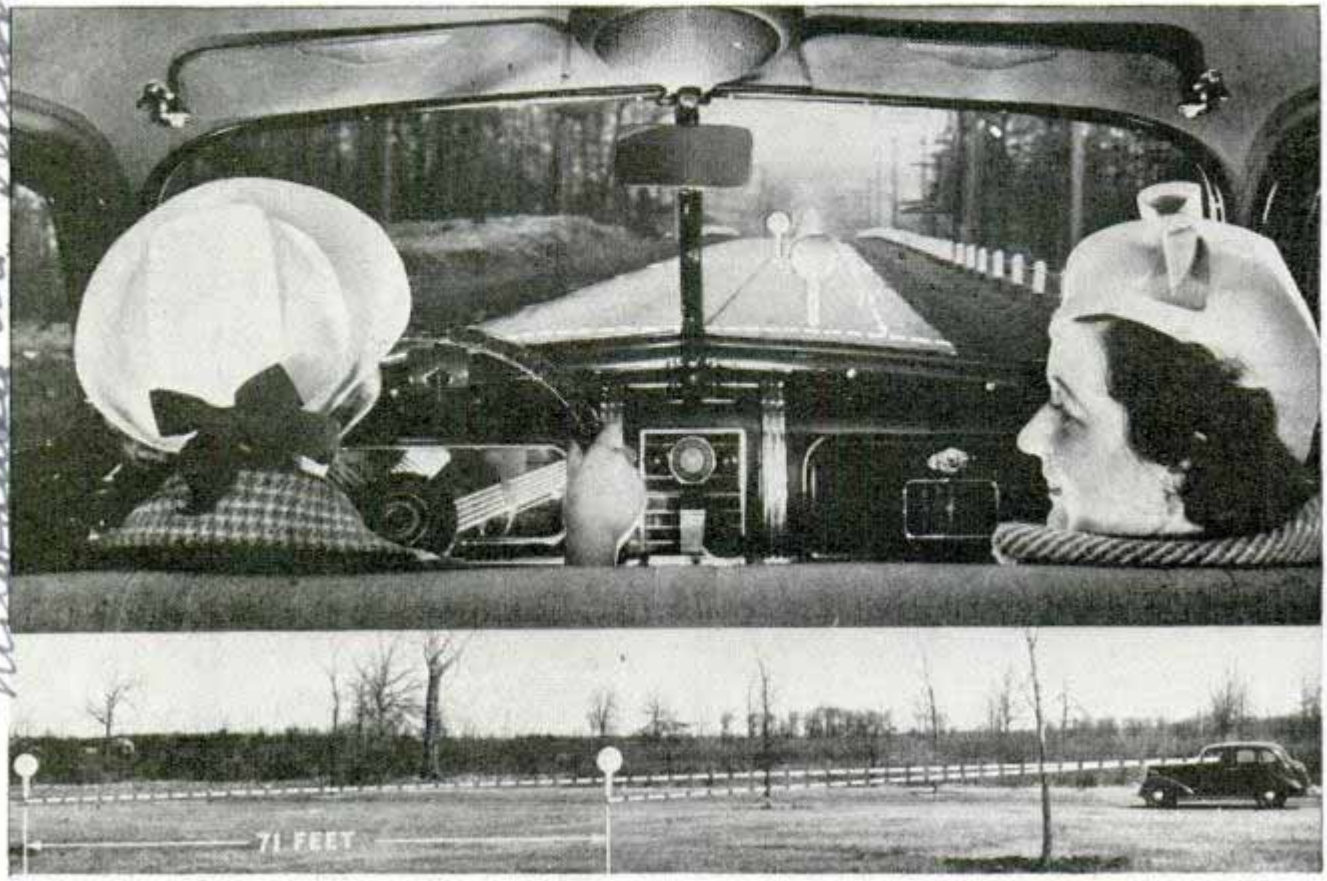
Dampening and pressing clothes is one operation with an electric iron recently offered. Water is placed in a compartment inside the iron and the electric element heats it, causing steam to flow from holes in the bottom of the iron. Water controls the temperature, preventing any scorching. The reservoir is refilled by pouring in one and one-fourth pints of water.

Large electric iron simplifies pressing work by emitting steam from ports in bottom

Rocks Given Beauty Treatment for That Weathered Look

Even the rocks in the national parks have to take beauty treatments. Where the Walnut Canyon highway cuts through solid rock near Carlsbad, N. M., the raw cut stuck out like a sore thumb against the weathered rock surrounding. So the national park officials applied copperas to give the fresh-cut rock a yellow tinge, and sprayed oil over that to make it look old.

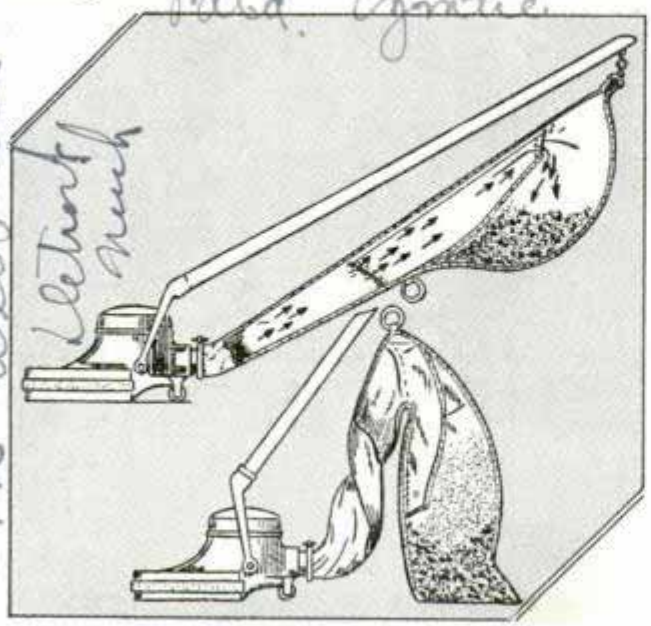
Raising Seat Gives Short Driver Wider Vision



These two photo-diagrams show the increased visibility which seat adjustment gives. Note that driver can see seventy-one feet closer to front of this Chevrolet than was possible in former models

Wider range of vision for the short driver is achieved by proper adjustment of the front seat of modern automobiles. As the seat is moved forward to its normal position for such a driver it also rises. A person five feet two inches in height can see seventy-one feet closer to the car, over the center of the hood, in one of the new low-priced cars than he could in previous models.

Rug Cleaner Traps Dirt at Top in Easily Emptied Sack



Vacuum-cleaner bag in use and, below, with dirt trap released from hook on handle for emptying

With the dust trap at the top of the bag, a vacuum cleaner can operate more efficiently because dirt does not clog its air passage and cause back pressure on the fan. A vacuum bag of this type, recently developed, can be emptied without removing it from the cleaner, simply by unhooking it from the handle and shaking it open. The bag has a large capacity and can be attached to any make cleaner.

Weather Runs Perpetual Clock as Barometer Reading Varies

For more than twenty years a clock in Sweden has been run continuously by changes in the weather. It takes about one millionth of one horsepower to operate the clock, and this power is derived

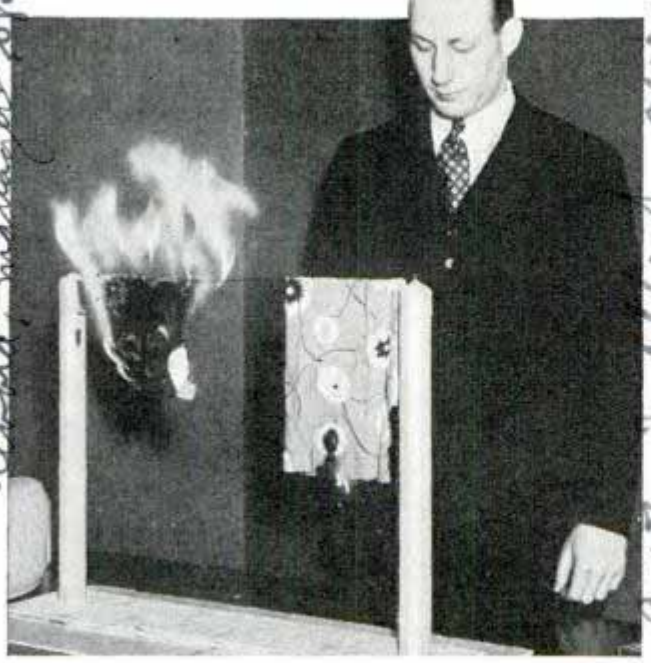
from changes in barometric pressure. Seven metal boxes in its mechanism are moved by atmospheric pressure, and their movement raises the weights that run the clock. It was started in November, 1916.

Flat Metal Strips Are Woven into Seat for a Chair

Metal strips saved from old packing boxes were woven into a practical chair seat by a Virginia man. Winding the strips carefully around the front rung to add strength, he worked them together like a woven basket.

Flameproof Treatment for Cloth Does Not Harm Its Texture

Fabrics and paper can be rendered flameproof by treatment with a chemical agent which has no harmful effect on the texture or the dyes used in the material treated. To demonstrate its effectiveness, an untreated bit of cloth lighted with a match was completely burned while another piece of the same fabric, flameproofed, was merely scorched.



Cloth at left burns readily while piece of same material at right, chemically treated, resists flame

Burglarproof Grille Door Rolls Up Like Curtain

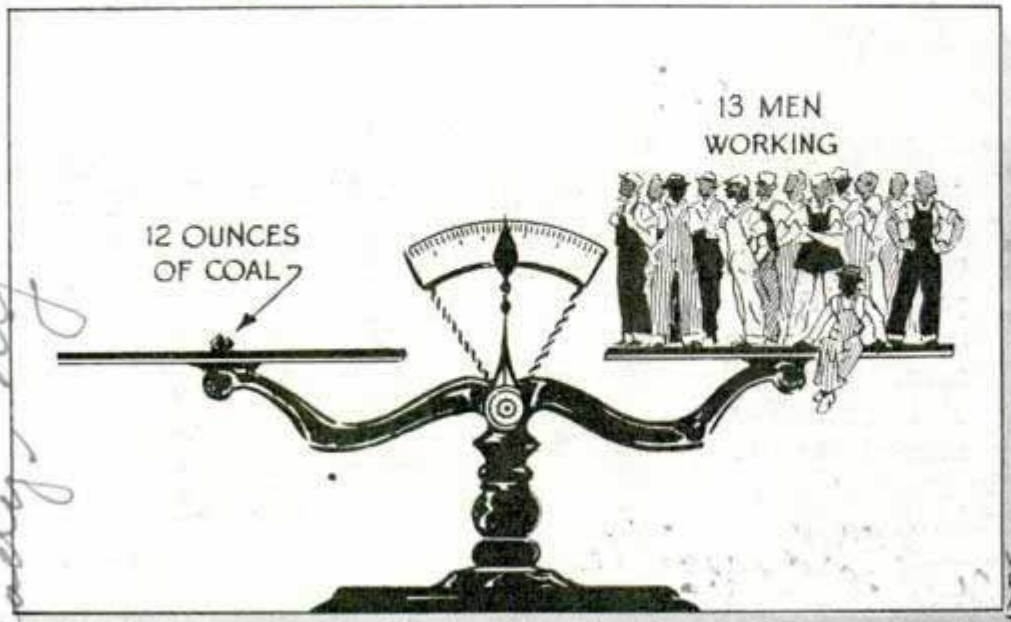
Factory storeroom guarded by steel grille rolling door which lets in light and air

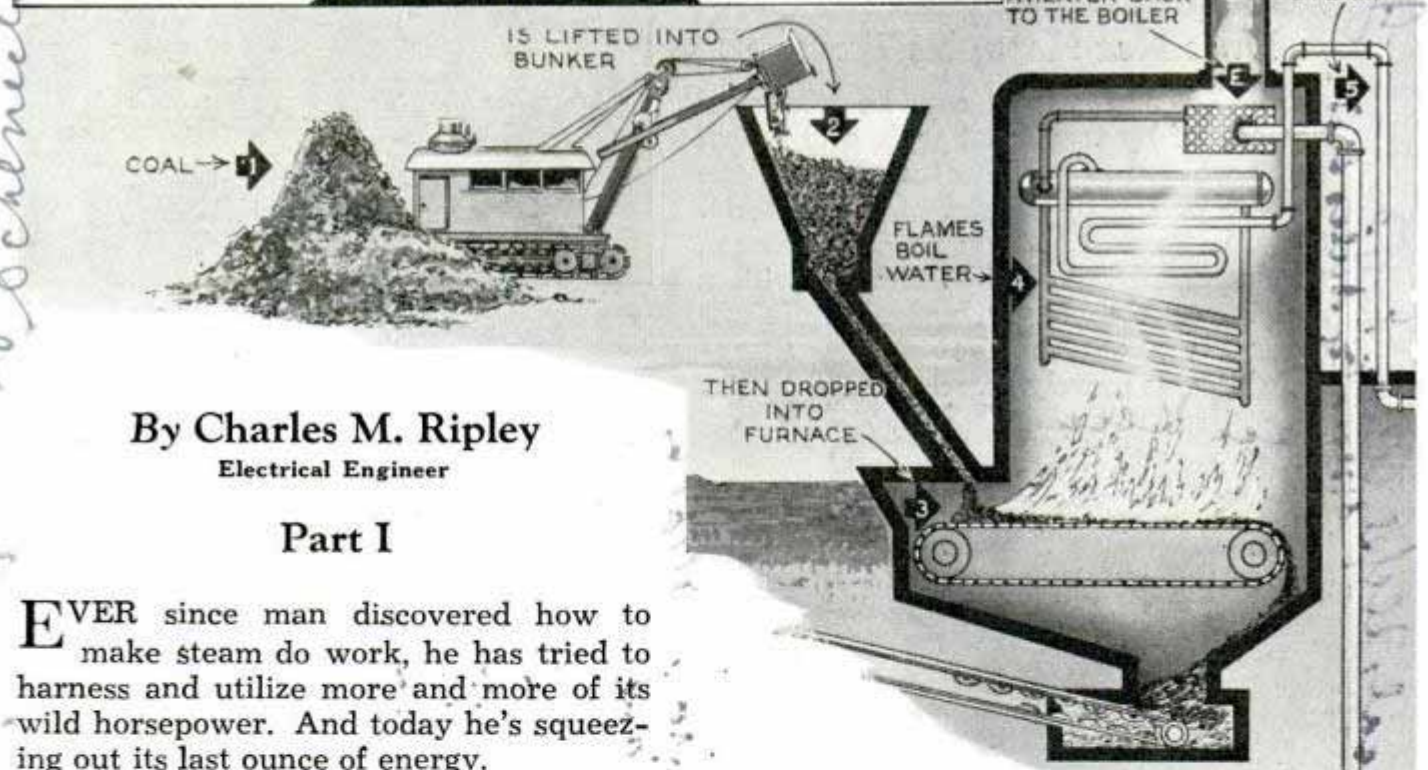
Steel grille doors that roll up like a curtain are being used to protect show windows, shops and factory rooms against intruders. Drawn down in front of windows after a store is closed, they afford protection yet permit shoppers to view the displays. Trademarks or street numbers can be worked into the grille.

Pelican Crashes into Plane and Knocks Out Pilot

Flying straight through the propeller, a big pelican crashed through the windshield and knocked the pilot of an air-corps attack plane unconscious. The bird continued toward the tail assembly, bending the elevators before falling lifeless. The pilot was cut severely about the face by glass from the windshield and his goggles were smashed. His gunner managed to keep the plane aloft until the pilot recovered consciousness.

SUPER-STEAM





Photos Courtesy General Electric Co.

Top, from twelve ounces of coal, an efficient steam turbine produces one kilowatt-hour, representing the work of thirteen men for an hour

By Charles M. Ripley
Electrical Engineer

Part I

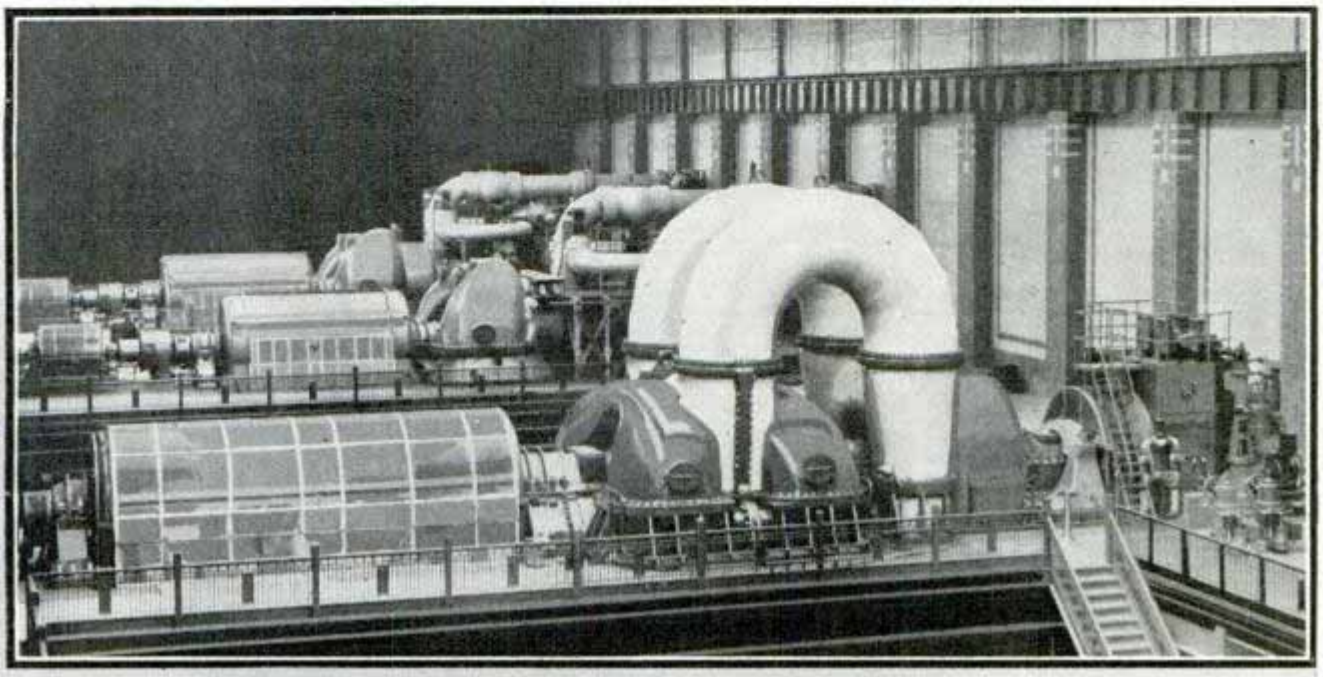
EVER since man discovered how to make steam do work, he has tried to harness and utilize more and more of its wild horsepower. And today he's squeezing out its last ounce of energy.

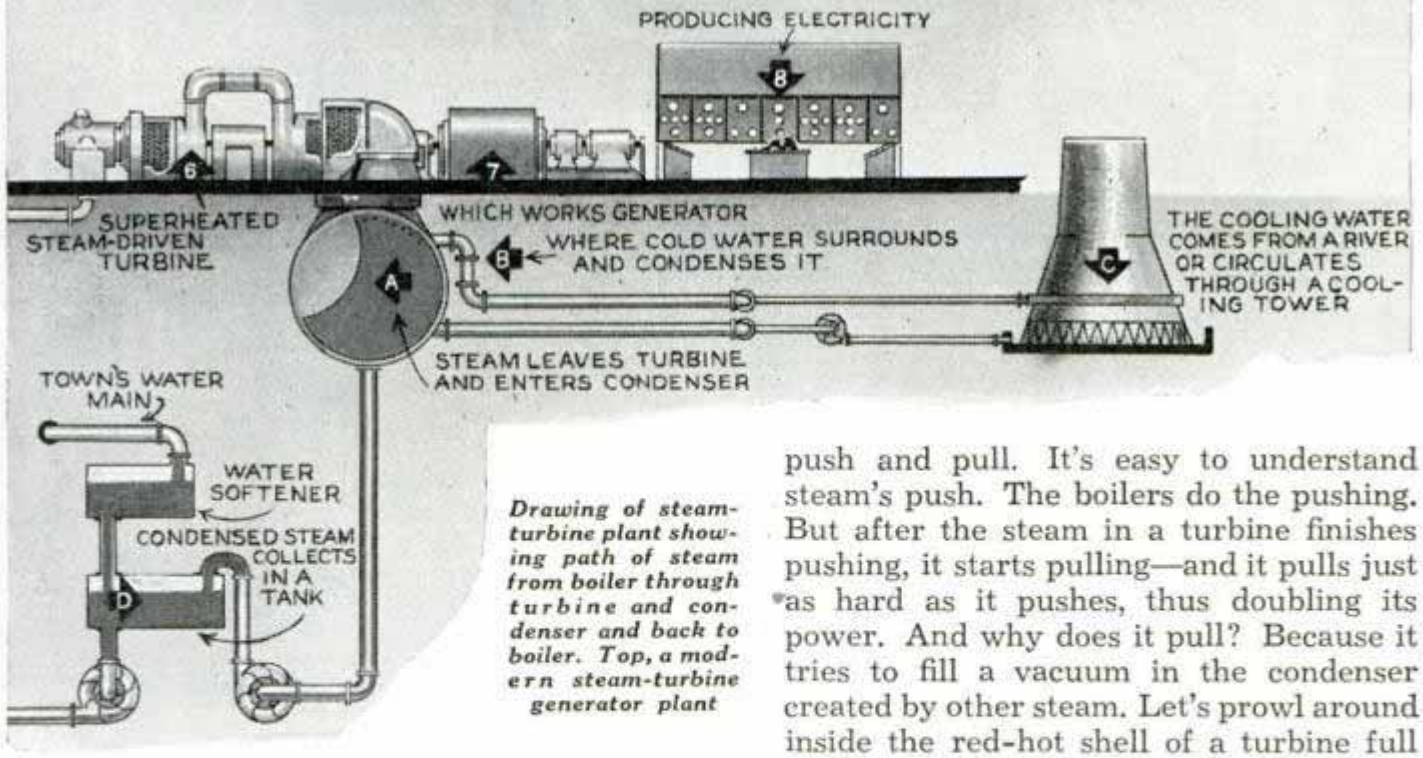
From the steam produced by burning one ounce of coal he obtains an amount of power equal to the muscle work of one strong man for one hour!

So efficient has he become in extracting work from steam that he now gets from each ton of coal double the amount of power he got fifteen years ago. As a result, about two-thirds of all the electricity used in the world today is steam-made. From twelve ounces of coal a modern steam power plant produces one kilowatt-hour, and since this represents the muscle work of thirteen men for an hour, it's about like producing one man's work for one hour with one ounce of coal.

This amazing feat has been made possible by the development of the modern steam turbine, an outstanding example of

An Amazing Story of Achievement . .

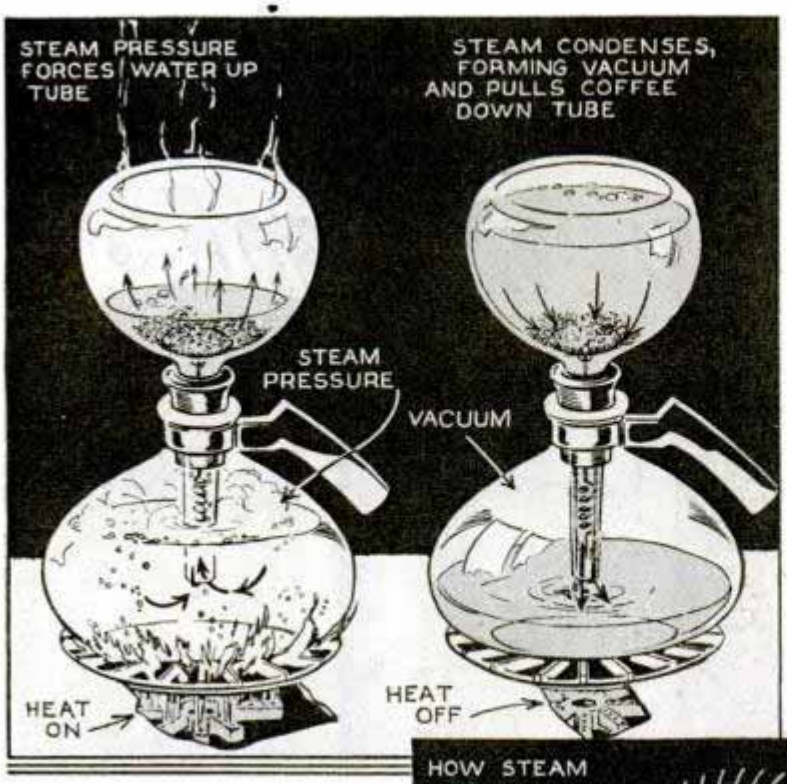


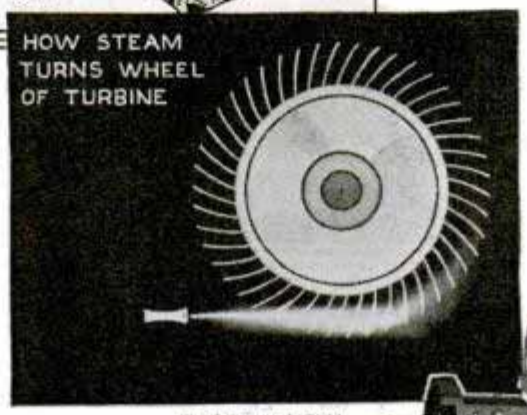


Drawing of steam-turbine plant showing path of steam from boiler through turbine and condenser and back to boiler. Top, a modern steam-turbine generator plant

human ingenuity and engineering achievement. The modern turbine produces electricity for about one-fourth as much as a good steam engine can because the turbine is designed to use super-steam and because it utilizes the "team" in steam—push and pull. It's easy to understand steam's push. The boilers do the pushing. But after the steam in a turbine finishes pushing, it starts pulling—and it pulls just as hard as it pushes, thus doubling its power. And why does it pull? Because it tries to fill a vacuum in the condenser created by other steam. Let's prowl around inside the red-hot shell of a turbine full of super-steam and see what's going on.

Someone once described a steam turbine as "a waterwheel inside a tin can." But steam expands and water doesn't and a turbine depends for its efficiency on the expansion of the steam. If you attach a bucket to the rim of an empty hose reel



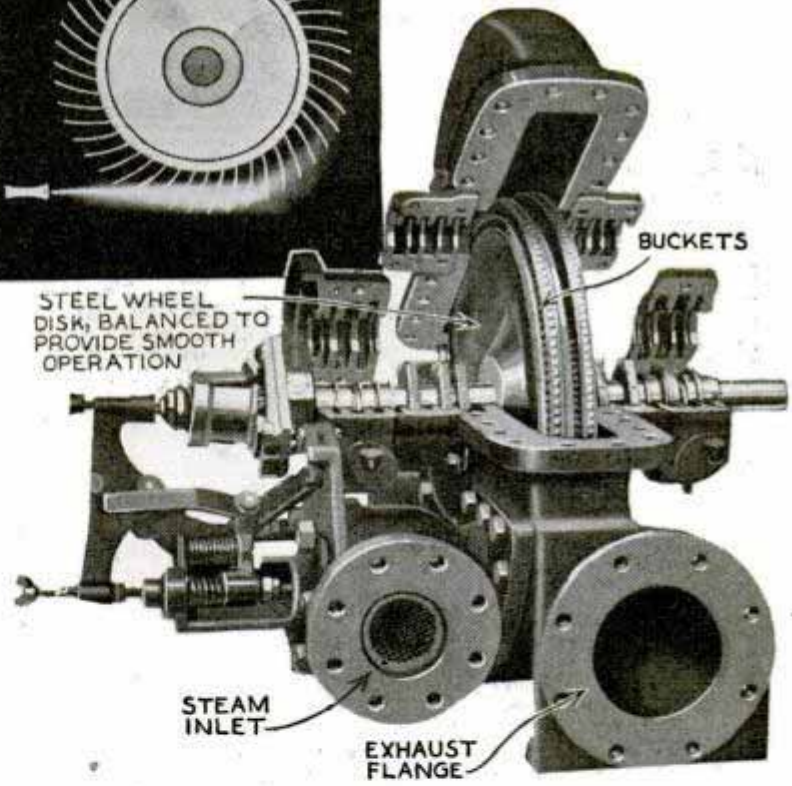


and shoot a stream of water at the bucket, the force of the water makes the wheel revolve—and you have a very simple "water turbine." If you hire fifty helpers to shoot fifty streams of water at fifty buckets around the rim of the reel, and if you inclose your reel in a huge tin can, leaving an opening at the bottom for the water to escape, you get some of the effect of a single wheel or single-stage turbine.

But the volume of water coming out of your tin can is identical with the volume going in. And after the water strikes one bucket, it is dead as far as power is concerned at that level. But if you used steam instead of water, the steam would keep on expanding. After striking the bucket of one wheel, it would expand and hit the bucket of a second wheel, then expand some more and hit a third wheel. Thus its energy can be used against twenty or more wheels arranged side by side like doughnuts firmly attached to a broomstick. In this way a considerable amount of power is created on one shaft with only rotary motion.

The turbine rotor resembles a trumpet. The small end—where you blow in—is where the steam enters. The steam expands as it rushes through the "trumpet," striking the different wheels rigged on a shaft down the center until it reaches a large bell-like opening, the exhaust passage to the condenser. The steam must strike the blades at fifty or more points on each wheel, always near the rim and always near the surface of the shell, hitting each bucket at a tangent and emerging on the other side ready to expand and strike the next wheel.

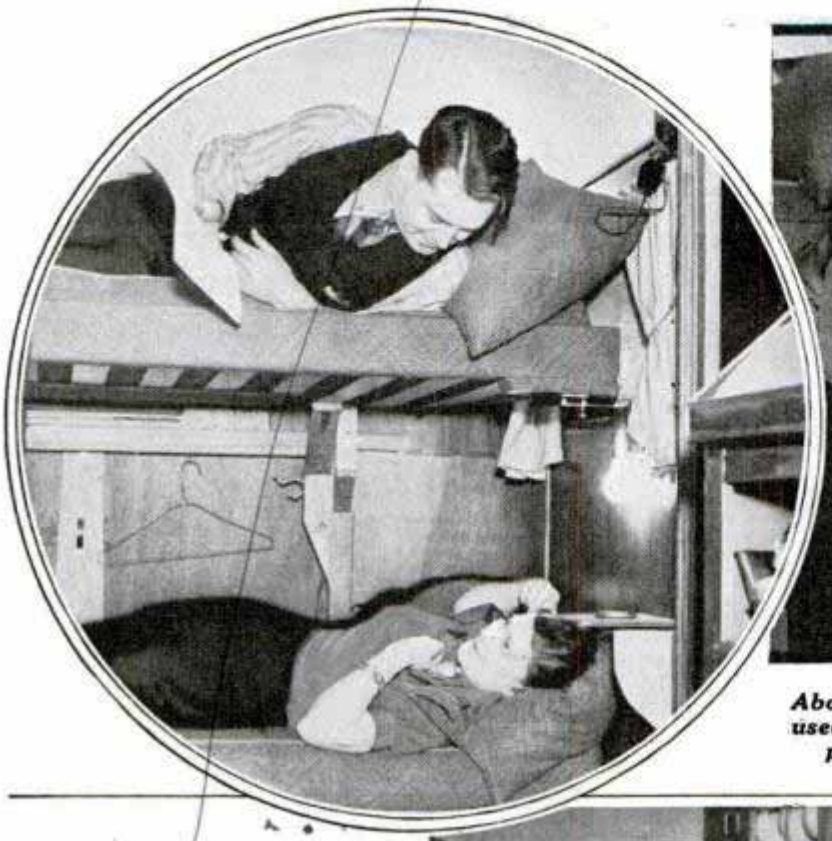
But this steam is not ordinary steam. It's super-steam—super-heated and super-dry. As long as steam is "saturated" or in contact with boiling water, there's a fixed temperature for each pressure. At atmospheric pressure, the temperature is 212 degrees Fahrenheit. At fifty pounds pressure, the temperature is 281 degrees and it increases until, at 1,200 pounds



Steam turbine with upper half of casing raised, steam turning turbine wheel and, at top, vacuum type coffee-maker which shows pull and push of steam

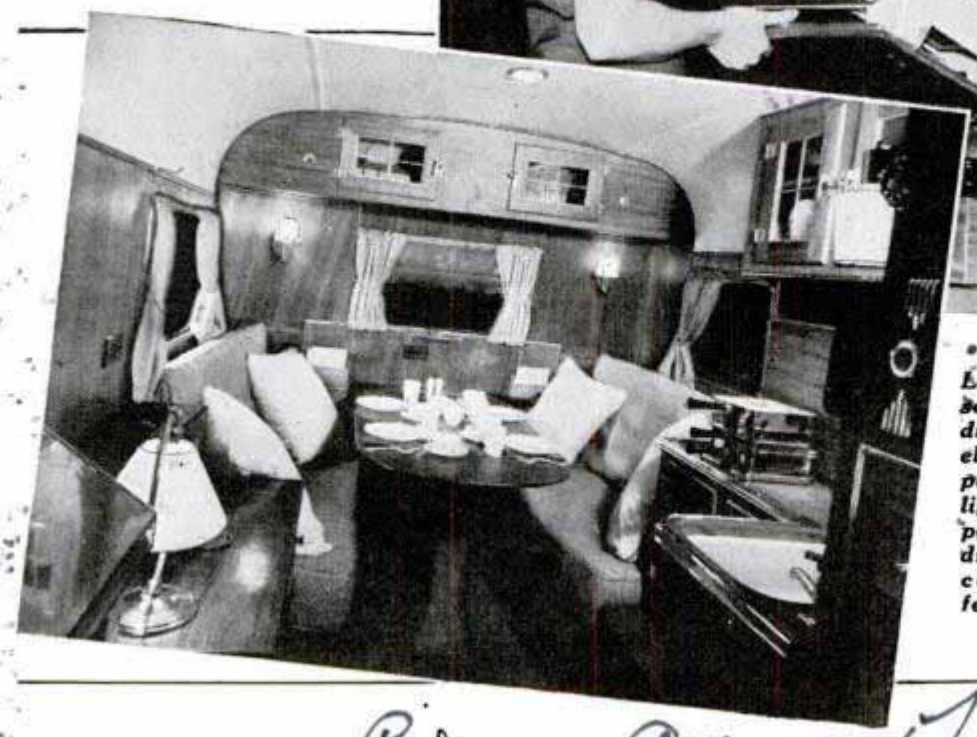
(Continued to page 137A)

Many Comforts of Home Built into Trailer



Above, open fireplace which also may be used as a grill for broiling steaks. The pipe carries away smoke and fumes

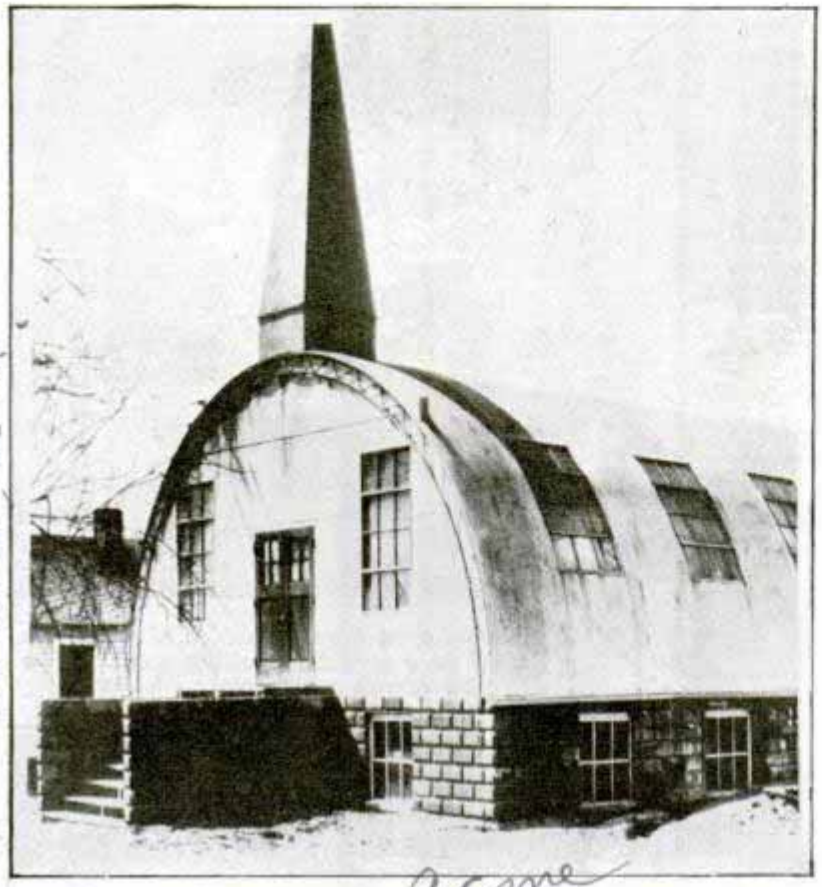
Interior views of trailer redesigned to meet requirements of the owner. Top, left, double-decker beds created by conversion of settees. Center, right, foldaway stove with its fuel tank. Also note the water cooler and the radio in same photo. Other features include disappearing clothes closet and tiled bathroom with hot and cold water and shower



Left, general view showing settees convertible into beds, dining table which folds away, electric grill, sink, white-painted dome ceiling, unusual lighting. The trailer has carpeted floor and a foldaway dressing table. Each feature contributes to the homey feeling of this house on wheels

Pierce-Arrow Travelodge

Church Built Like a Tank of Electric-Welded Plates

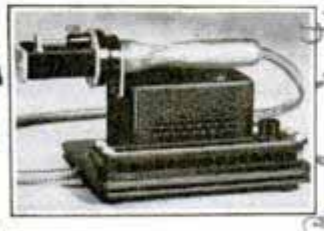


Steeple is only conventional detail of this church, constructed of semicircular plates of steel electrically welded

From a Peoria, Ill., factory comes a "prefabricated" steel church. It was built of semicircular plates of steel welded together electrically to form a tanklike roof and walls. This was laid upon a brick foundation. The building cost was low.

Wire Burned Clean of Insulation by Adjustable Glow-Loop

Instead of stripping the insulation from electric wires with knives or tools which might cut and weaken the wires themselves, an electric glow-loop burns the insulation off leaving the wire clean. Adaptable for wires of all grades and sizes, the burner has two openings through which the ends of single or double wire are inserted, and the length to be burned is governed by a sliding stop and set screw. A button on the transformer adjusts the glow-loop to the best temperature according to size and thickness of insulation. Less than a minute is required for burning off sixty wires of five-millimeter diameter.

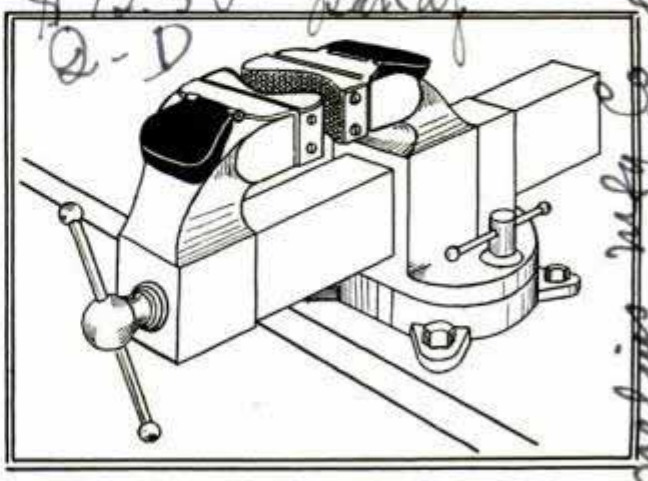


Diesel Lights in Cave Found Economical

Belted to a fifteen-kilowatt direct-current generator, a Diesel engine supplies 224 kilowatt-hours per day to illuminate a scenic cave near the Iowa-Minnesota line. Operating cost averages nine-tenths of a cent per kilowatt-hour. Figuring depreciation, the total cost over a six-month period has averaged 1.6 cents per kilowatt-hour for an output of 40,320 kilowatt-hours.

Odd-Shaped Vise Jaws Are Detachable

Detachable vise jaws that provide gripping surfaces to fit various shapes can be installed on any vise. There are concave, padded jaws designed to hold pistons, hub caps, armatures and similar curved parts; flat jaws with fabric padding to protect surfaces from scratching or denting; hinged jaws for gripping beveled parts, and jaws with vertical and horizontal grooves and slots to take hold of round and square pipes and rods.



Detachable jaws of special shapes to grip curved, beveled and other surfaces are installed on vise

Model C Radio Control

Auto Radio Operates Garage Door and Lights

Photos show how driver, pressing button on instrument panel as car passes over receiving loop imbedded in pavement, opens or closes garage door by radio. Transmitting loop built into running board of car is shown at left

Press a button on the instrument panel of your car and the garage door opens and lights are turned on. Radio does the trick. This control system, developed recently, includes a transmitter installed under the hood of the automobile, fed by the car battery and sending out waves from a coil fastened beneath the running board. When the car approaches the garage, without stopping, you press the button as you drive over a receiving coil placed in the driveway. This picks up the waves, carries them to a receiver on the garage wall and actuates the controls for door and garage lights. The same method closes doors and switches off the lights when you leave.

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Fox Exceeds Man's Best Speed When Clocked by Auto

That the fox can run faster than man was revealed recently when Clarence Cottam of the federal bureau of biological survey used his automobile speedometer to clock the speed of a fox on a South Carolina highway. The fox attained a speed of twenty-six miles per hour, covering the first 100 yards in less than eight seconds and gradually slowing to a speed of twenty-one miles per hour at the end of a half mile. Man's fastest pace for the 100-yard distance is between nine and ten seconds.

U. S. Dept. of Agriculture. Washington, D. C.

Barber Coltman Co.

Capt. C. Huntington
25 Fifth Ave. New York

It's AMERICA

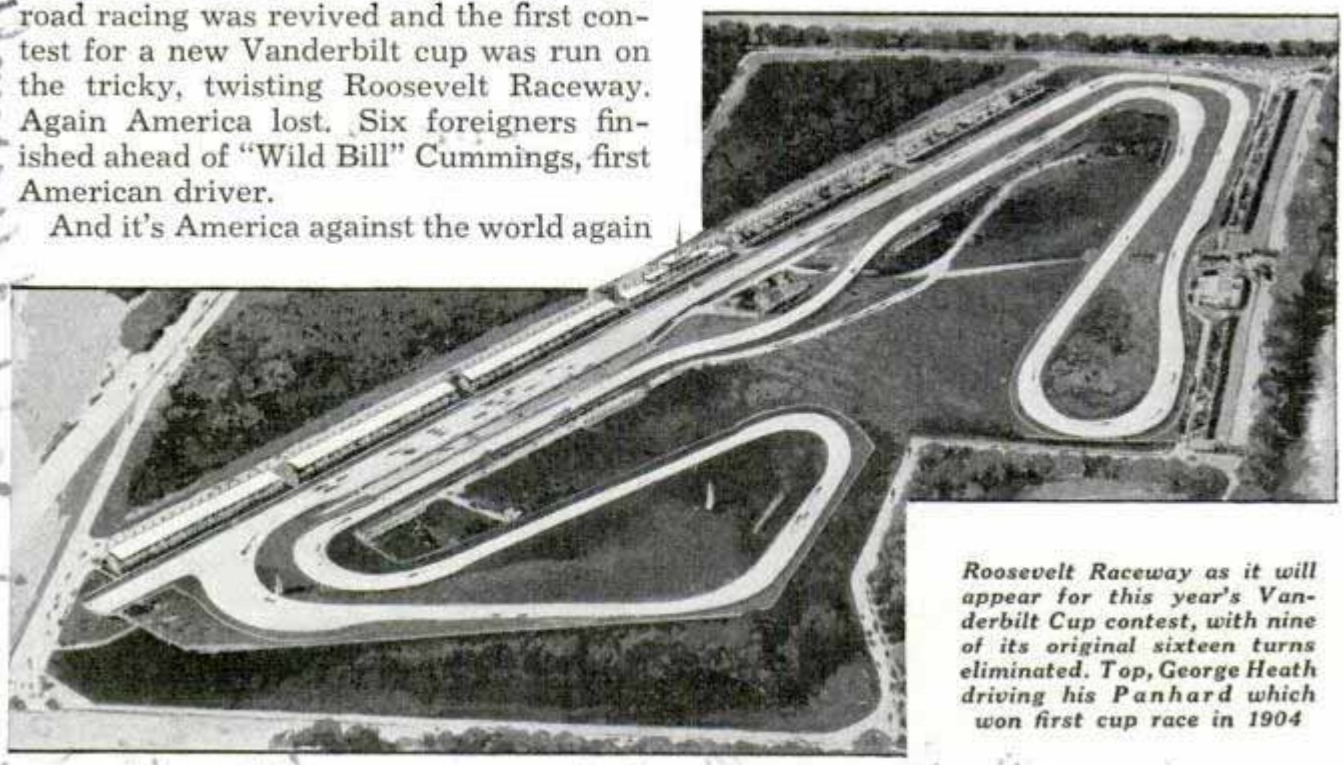
ROAD racing, which gave this country its first taste of real speed more than thirty years ago, is back with a bang after an absence of two decades and, strangely enough, history is repeating itself.

When the first race for the first Vanderbilt cup was run over the dusty country roads of Long Island in 1904, it was America against the world—the best Yankee cars and drivers pitted against the fastest cars and the greatest drivers of Europe. And America lost.

It was America against the world again last fall on the same Long Island when road racing was revived and the first contest for a new Vanderbilt cup was run on the tricky, twisting Roosevelt Raceway. Again America lost. Six foreigners finished ahead of "Wild Bill" Cummings, first American driver.

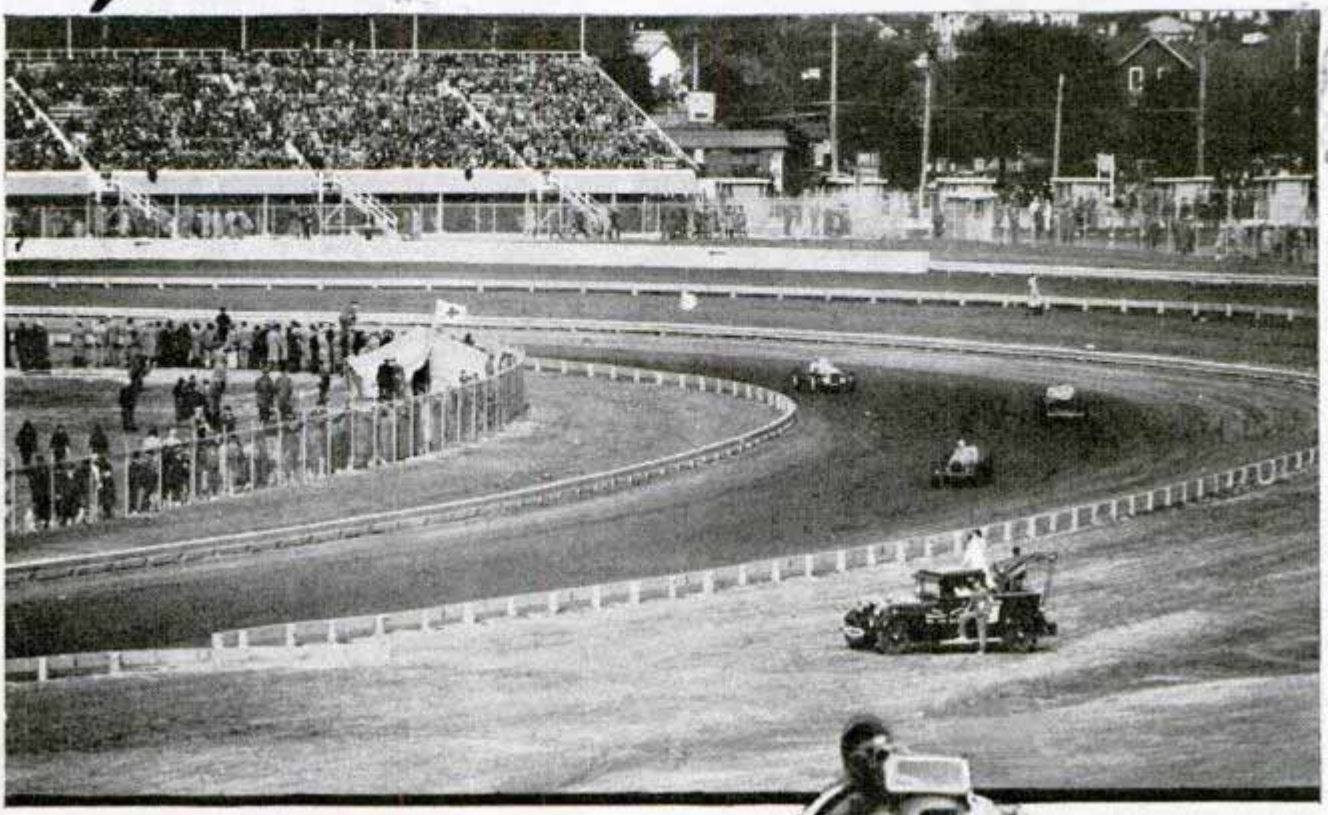
And it's America against the world again this year, for the renewal of road racing has renewed all the old rivalry between the speed kings of Europe and America. America also lost the second race for the original cup in 1905. Will history repeat itself again at Roosevelt Raceway on July 3 when the second race for the new cup and $60,000 in prizes is run?

It's quite possible, but whether they win or lose, American cars and drivers are likely to give a better account of themselves this year than last. Both labored under the same handicap last year. The

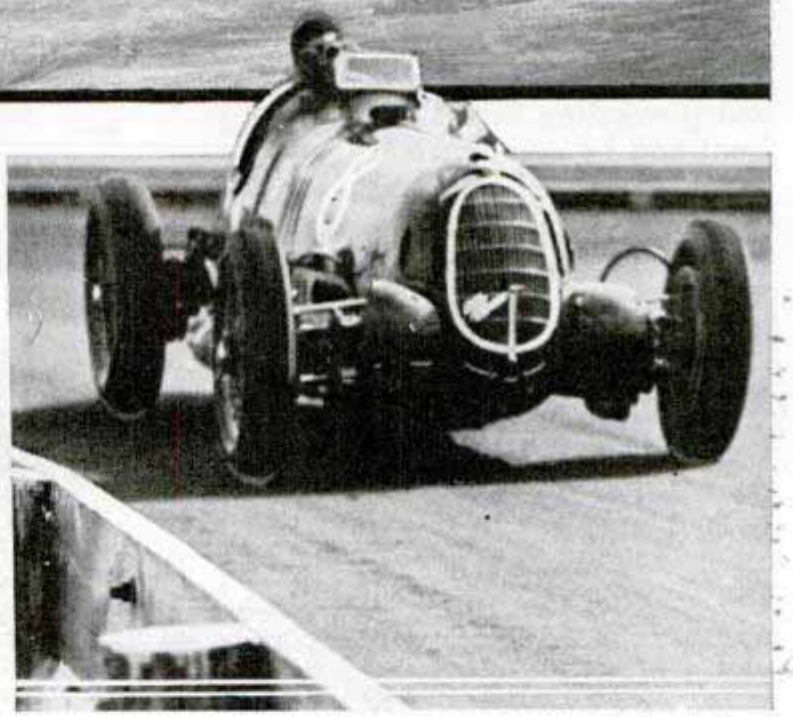


Roosevelt Raceway as it will appear for this year's Vanderbilt Cup contest, with nine of its original sixteen turns eliminated. Top, George Heath driving his Panhard which won first cup race in 1904

against THE WORLD



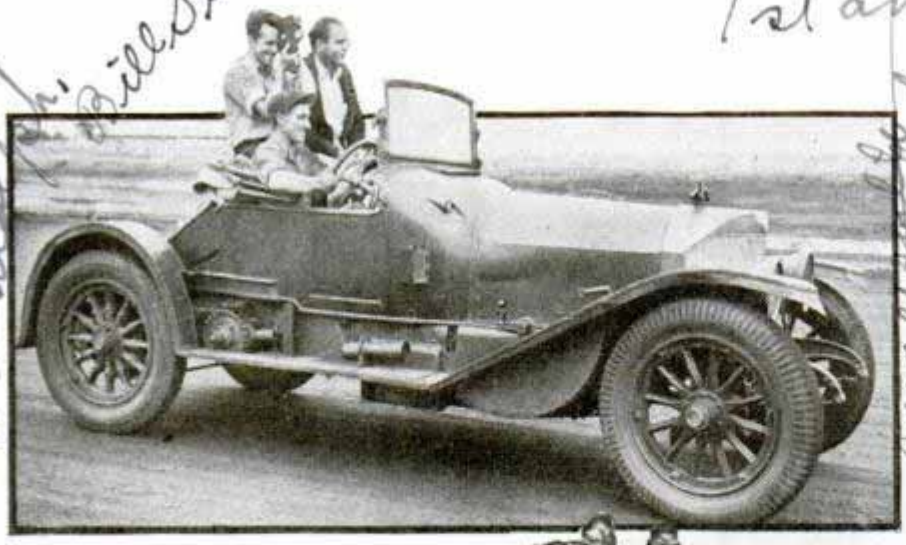
cars were built for track racing, not road racing, and the drivers had gained most of their experience in track competition. Even so, most of the Americans drove like veterans, but it took more than good driving to beat the Europeans. It required cars designed for a road course—long, low bodies; large, sturdy clutches and gear boxes to withstand rapid acceleration and deceleration; big, powerful brakes for negotiating sharp turns and curves, and supercharging to give the power for quick pick-up coming out of turns. Most European cars had these superior mechanical features. Few American entries did. This was not entirely the fault of American builders because, with no road racing in this country for twenty years, most American cars in last year's race had been designed originally for track competition. On an oval or rectangular speedway with highly banked turns, cars are run with almost wide-open throttle all the time, gear shifts are used only in starting and brakes are employed mostly for pit stops.



Cars taking hairpin turn during 1936 cup race and Tazio Nuvolari, the winner of 1936 race

But in a 300-mile road race with 1,200 turns and curves and comparatively short stretches of straightaway, the winner must depend on both gears and brakes to get through the turns at speeds and must also have a power reserve to accelerate rapidly after using his brakes or gears. And quick acceleration, possibly more than any other one factor, won the race for the foreigners last fall.

Most foreign cars last year had longer

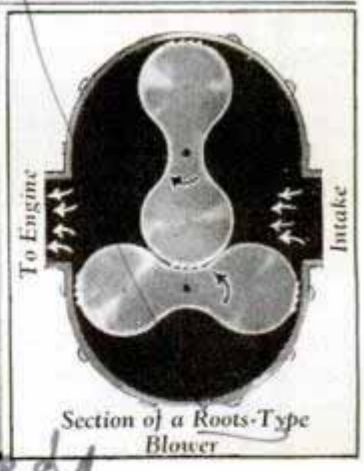


wheel bases than the American, lower slung bodies and better weight distribution, affording a low center of gravity and excellent roadability. Many European entries used a smaller diameter on front wheels, holding the nose down at high speed and preventing lift of the front end by aerodynamic action. Several also had independent wheel suspension, front and rear, enabling drivers to take the bumps without the jolts.

In general, the transmissions of the foreign cars were better than the American. Clutches mostly had very large disks, made of lightweight alloys, and gear boxes had three or four forward speeds and reverse, of the synchromesh or constant-mesh type, and showed a remarkable ease of gearing up or down at all speeds. Such a design offers rapid acceleration or deceleration, and foreign cars were singularly free from transmission trouble in the race. One little British car employed an automatic gear shift to relieve the driver of the effort of changing gears.

Foreign and American cars also varied in differentials. Most American entries had "locked differentials," with a solid rear axle forcing both wheels to turn at the same speed. This does not matter on speedways with banked curves and has a certain advantage on dirt tracks as the driver always has traction on one rear wheel in slamming around a rutted or soft-surfaced curve. But the 1,200 curves in last year's cup race placed a terrific strain on differentials of this particular type.

Centrifugal Type of Blower as Effectively Used in Graham Passenger Cars



Section of a Roots-Type Blower

Top, this Simplex, an early Vanderbilt Cup racer, still runs. Center, George Robertson, winner of 1908 race, "taking off" from a humpbacked bridge. Bottom, diagrams of centrifugal and Roots-type blowers

Many foreign road courses have sharp curves following straight stretches where cars may attain speeds of 150 miles an hour or more, so European cars need good brakes. And those in the cup race had them. They were mostly of the hydraulic type with enormous brake drums, ribbed for cooling and rigidity, and with built-in air scoops to cool the shoes. Despite their size, weight was kept down by using aluminum and alloy castings. Nearly every American racer this year will have better

brakes than last. European cars, in general, also had more efficient superchargers. American cars favored the centrifugal type blower which, to be effective, must turn at five or six times engine speed and begins to show real efficiency around 12,000 revolutions per minute or more. To reach such speeds through gearing uses engine power and that is detrimental to quick acceleration. This does not matter in a track race with a flying start and not much slowing down. But a road race is different.

Tazio Nuvolari, the little Italian who won last year's race in an Alfa Romeo Special, acknowledging the cheers of the crowds

Suppose there's a sharp curve at the end of a long straightaway. A car reaches high speed on the straight stretch with the engine turning 5,000 or 6,000 revolutions and the supercharger 25,000 or 30,000. Then the turn forces the driver to slow the engine. But slowing the centrifugal blower is like trying to slow down a gyroscope and the strain on driveshaft and gears is terrific. Rather than subject cars to such punishment, many Americans last year omitted superchargers entirely. The first three American cars to finish were without blowers.

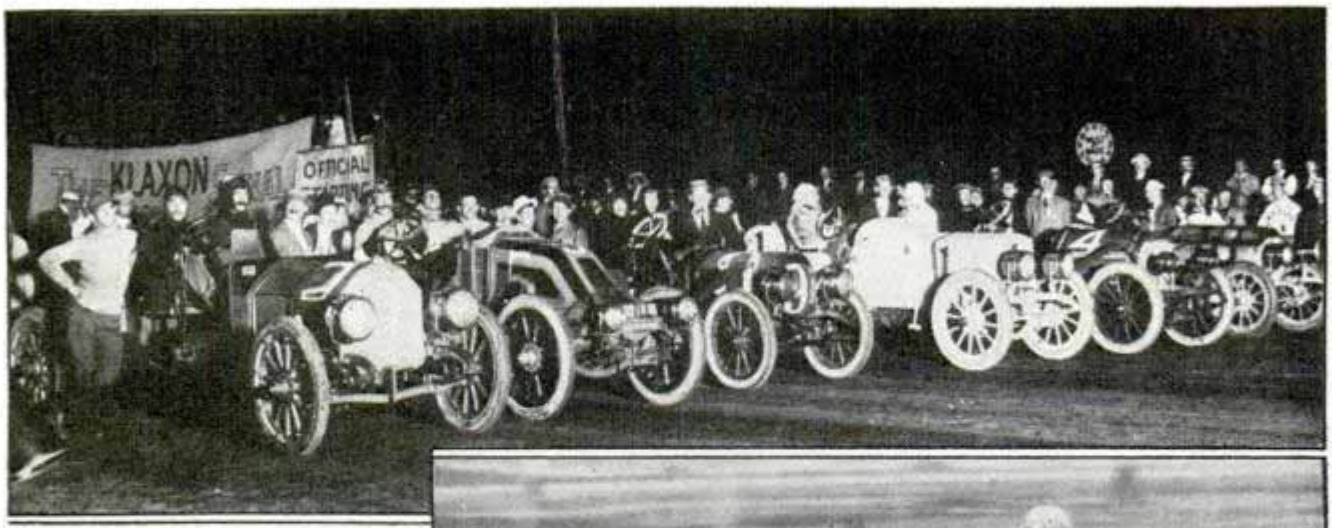
Foreign cars used Roots-type compressors which operate something like a pressure pump and are effective when turning at engine speed or slightly higher. With such a blower, there is no loss of power on acceleration, no more strain in decelerating than on the engine parts themselves, and it is effective at all engine speeds. With high-speed engines capable of turning close to 6,000 revolutions a minute, and with such effective supercharging, the European cars developed tremendous horsepower and very high speeds.

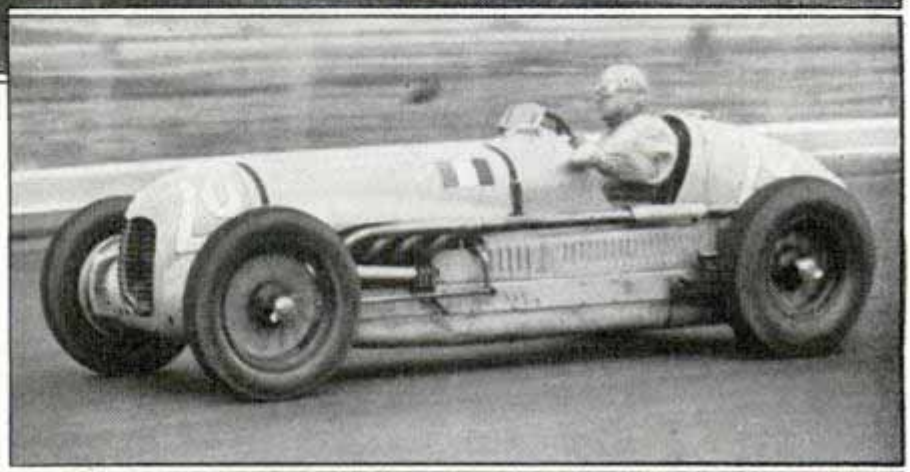
Ignition and lubrication systems on foreign and American cars were similar. Lubrication on most foreign cars followed aviation practice with separate oil tanks, high-pressure lubrication to the motor, and oil pumped back from the sump in the crankcase to the tank. In some cases, the oil, on its return, was passed through a cooler outside the body. There were no restrictions on fuels, so each driver "rolled his own." Foreign cars did not use tetraethyl lead to prevent detonation, but went in for methyl and ethyl alcohol and benzol. Some fuel mixtures were composed of about eighty per cent alcohol and the rest gasoline and benzol.

American builders and drivers learned a bitter lesson from the French, English and Italians last year. But they lived through it and they know what they're up against now. Drivers, accustomed to left turns in track races, for instance, found making right turns in a road race about like trying to write with the left hand. They found, too, that they couldn't broadside through turns and expect to keep up with a foreign driver who used his brakes and gears to get through a turn and an efficient supercharger to pick up speed again.

American designers also have profited from last year's sad experience. This year's transmissions will be built to do more than get under way, and brakes will be intended for more than pit stops. And a lot of designers are thinking about superchargers since the foreigners demonstrated their use.

Several American cars are being built exclusively for the Vanderbilt cup race.





Top and bottom photos by Lazarnick

Old timers, top, lined up for a contest, one of French entries in last year's race, and George Heath crossing finish line in 1904 race

Others were designed primarily for the Indianapolis race, but they won't be the same cars when they show up at Roosevelt Raceway. The builders have changes in transmissions, axles and other parts to convert the cars from track to road racers overnight. In addition, American interests have purchased several foreign cars intended to run under the Stars and Stripes.

Physical changes in the course may be a big advantage to American cars and drivers. When Roosevelt Raceway was opened last fall, the four-mile course contained sixteen turns of varying sharpness, banked only one per cent. For this year's race, the course has been rebuilt. There will be only seven turns, instead of sixteen, and the straightaways have been increased while the length of the course has been decreased from four to three and one-third miles. Instead of a surface composed of sand, clay, asphalt and tar, the new track consists of a rock and asphalt mixture—virtually a stone road with an asphaltic binder.

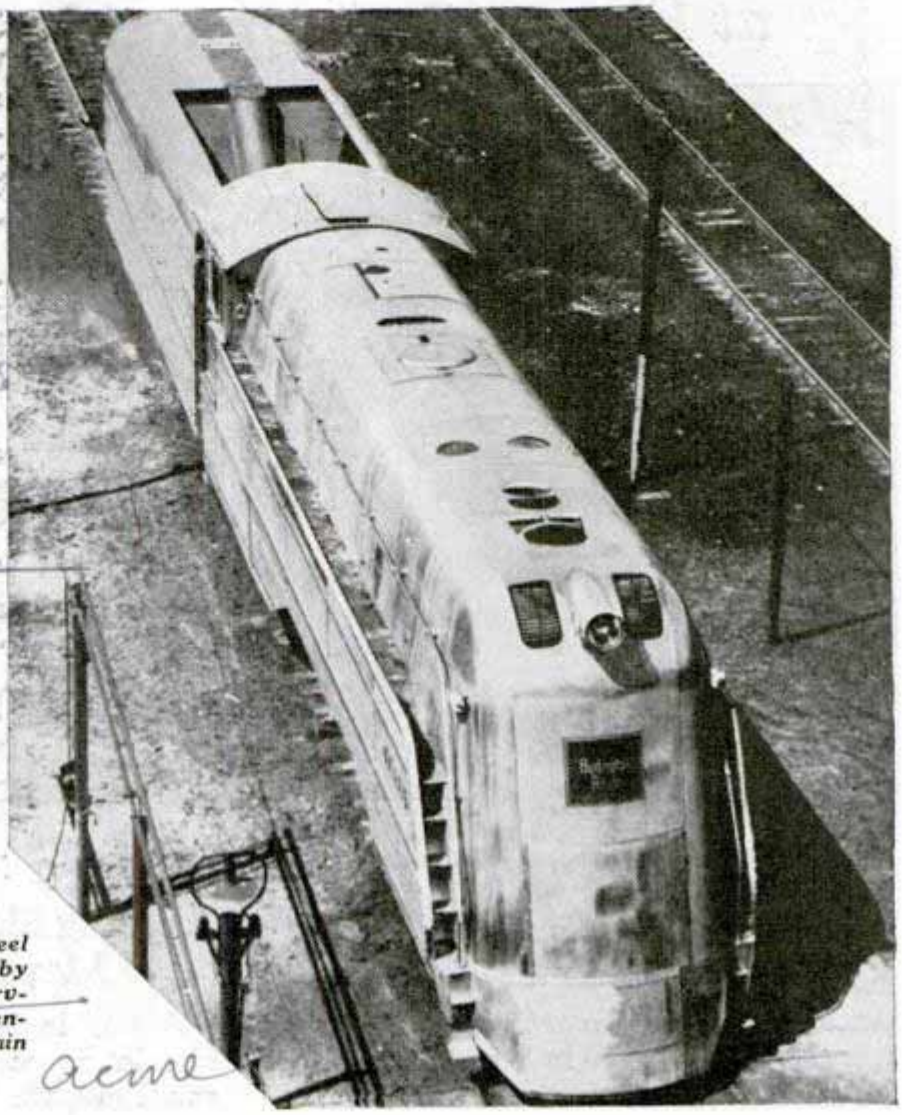
On the major straight stretch of 3,620 feet, speeds of 170 miles an hour are anticipated. A secondary straightaway measures 3,544 feet, two others are more than 2,100 and a minor one is more than 2,000 feet. One turn will have a thirteen-foot bank and others will have nominal banks of from three to five feet.

Eliminating nine turns, increasing the number and length of straightaways and banking the curves will raise the speed. Tazio Nuvolari, the little Italian who piloted an Alfa Romeo Special to victory

(Continued to page 148A)

Stainless-Steel Locomotive Is Built for Speed

Built to cruise at 125 miles per hour, a new stainless-steel steam locomotive is ready to challenge Diesel-electric streamliners now in operation. Top speed of the engine has not been revealed. Weighing 400 tons loaded, the locomotive is streamline. It can make the long run between Chicago, Ill., and Denver, Colo., with only two stops for coal and six for water. The Burlington railroad, which also operates Diesel trains on the Chicago-Denver run, is placing the stainless-steel "iron horse" in service. The Burlington's Diesels have been clocked at 122 miles per hour.

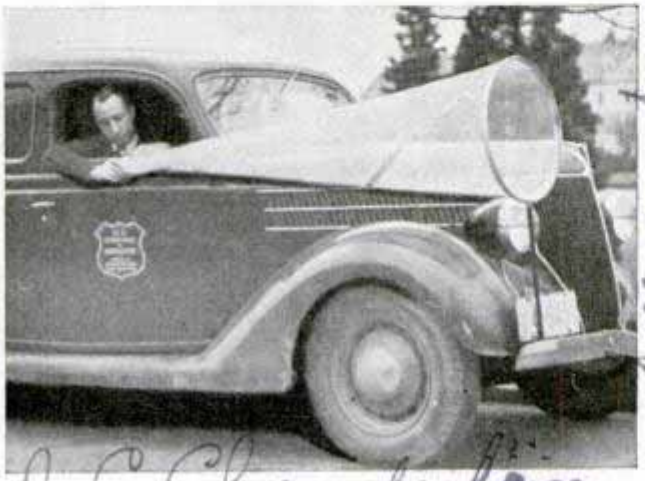


Right, one of the stainless-steel streamline locomotives built by the Burlington railroad for service between Chicago and Denver. It is expected to attain high speed

acme

Insect Trap on Front of Auto Aids Fight to Save Crops

To help control insect pests in farming areas, a federal entomologist in Oregon attaches a conical screen to the front of his automobile and drives into the country to trap a sample bag of bugs. After a short trip, examination of the collection in his cloth bag tells what kinds of insects prevail at the time, and in which proportion to each other. This makes it possible to time sprays and dusts accurately to coincide with the appearance of crop-destroying pests.



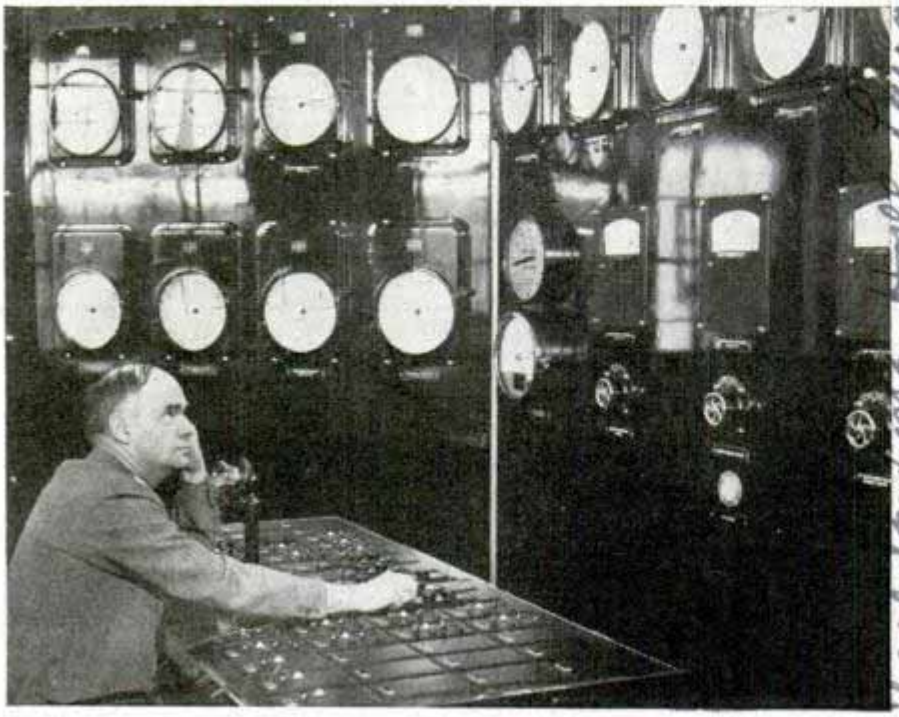
J. C. Chamberlain
Oregon State

Soybean Milk Used in Dessert

"Milk" from soybeans, made by grinding the beans, soaking the meal in water, boiling and then straining, has been used to make sherbet at Iowa State College. Made in the usual way, except for the substitution of soybean milk for cow's milk, the dessert was pronounced equivalent to the regulation article in taste. Soybean milk has long been used in China for feeding children and for producing a variety of soft cheese.

Ames, Iowa
Chemical Engineering

Controls for Vast Flow of Gas at Fingertips of Dispatcher



Gas dispatcher watching indicators which show pressure. When change in the gas flow to any point is required he flips a lever

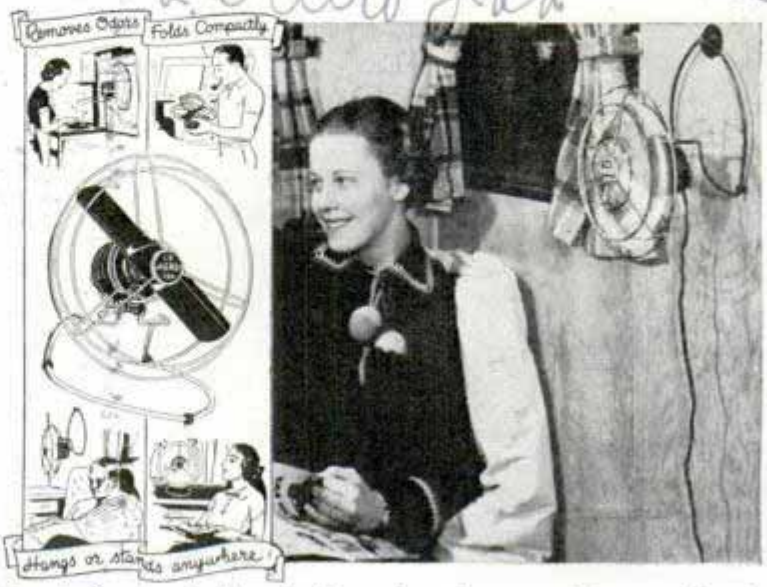
Enabling him to control the flow of more than 100 million cubic feet of gas daily a keyboard operated by the gas dispatcher at Ford's River Rouge plant contains levers by which he regulates the fuel supply to all points in the big factory. Indicators on a master board provide the dispatcher with a constant record of gas pressures and supplies throughout the plant and telephonic contact is maintained with all consumption points. The gas controlled by this board is only one of the power sources in the plant, and in other Ford factories in the Detroit area. Electric power consumption of the company during 1936 was 724,567,451 kilowatt-hours, sufficient to meet domestic power requirements of a city of about 3,500,000 population. Fuel used for power and steam required in manufacturing processes amounted to the equivalent of 747,319 tons of coal, enough to fill about 19,000 railroad cars. The company burned 53,050,938 gallons of fuel oil, enough to heat the homes of a city of 160,000 persons the year around; coke breeze equivalent to 43,245 tons of coal, and about 43,139,300,000 cubic feet of blast furnace and coke oven gases. Waste heat boilers in the plants last year produced 1,233,016,000 pounds of steam.

Invisible Marks for Laundry

Invisible in ordinary light, the latest laundry mark flashes in letters five-eighths of an inch high when placed under a special lamp. The mark does not deface the laundry and does not injure fine fabrics. Another use suggested for the mark is identifying ransom bills in kidnaping cases.

Folding Electric Fan for Trailers May Serve as Exhaust

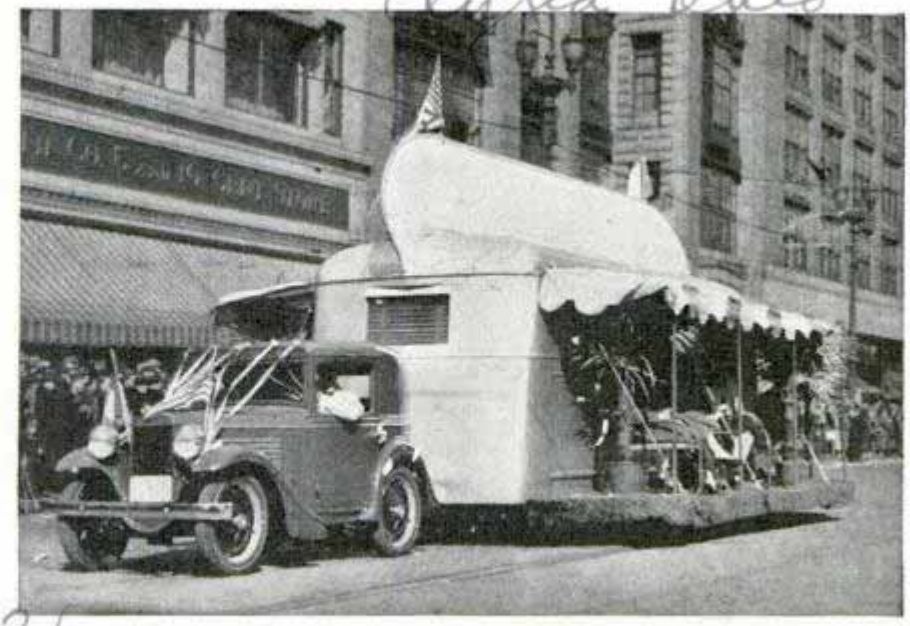
Available for exhausting air from, or circulating cool air within, the trailer, a small electric fan is now on the market. It may be attached to a cord and hung in the trailer window, or set on its wire base in the spot desired. The fan folds compactly when not in use.



Handy fan for trailers is shown hanging on wall to provide air circulation. Drawings at left show uses of fan

Tiny Car Pulls Trailer with Canopied Porches

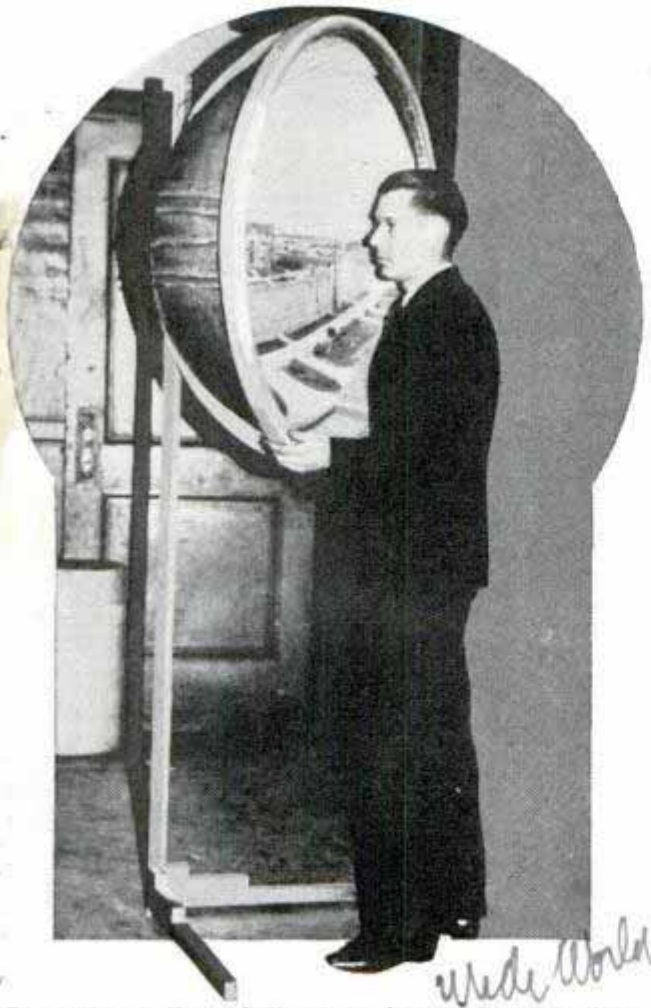
To demonstrate the ease of touring with a big trailer home, a midget automobile was "hitched up" to a heavy trailer carrying nearly an extra ton of weight. Canopied porches extended from both sides and the back of the trailer, decorated with potted plants and furnished with metal chairs seating ten persons.



Home on wheels with broad canopied porch on each side is hauled by baby automobile in a parade. Ten persons were seated on porches

Scene in Papier-Mache Shell Has Third-Dimension Effect

Painting scenes in the hollow hemisphere of a papier-mache shell, a New York artist obtains an unusual effect. Viewed from its focal point, the lines straighten out and the picture appears to have a third dimension. From any other point of view the lines seem distorted. The shell is mounted on an adjustable stand.

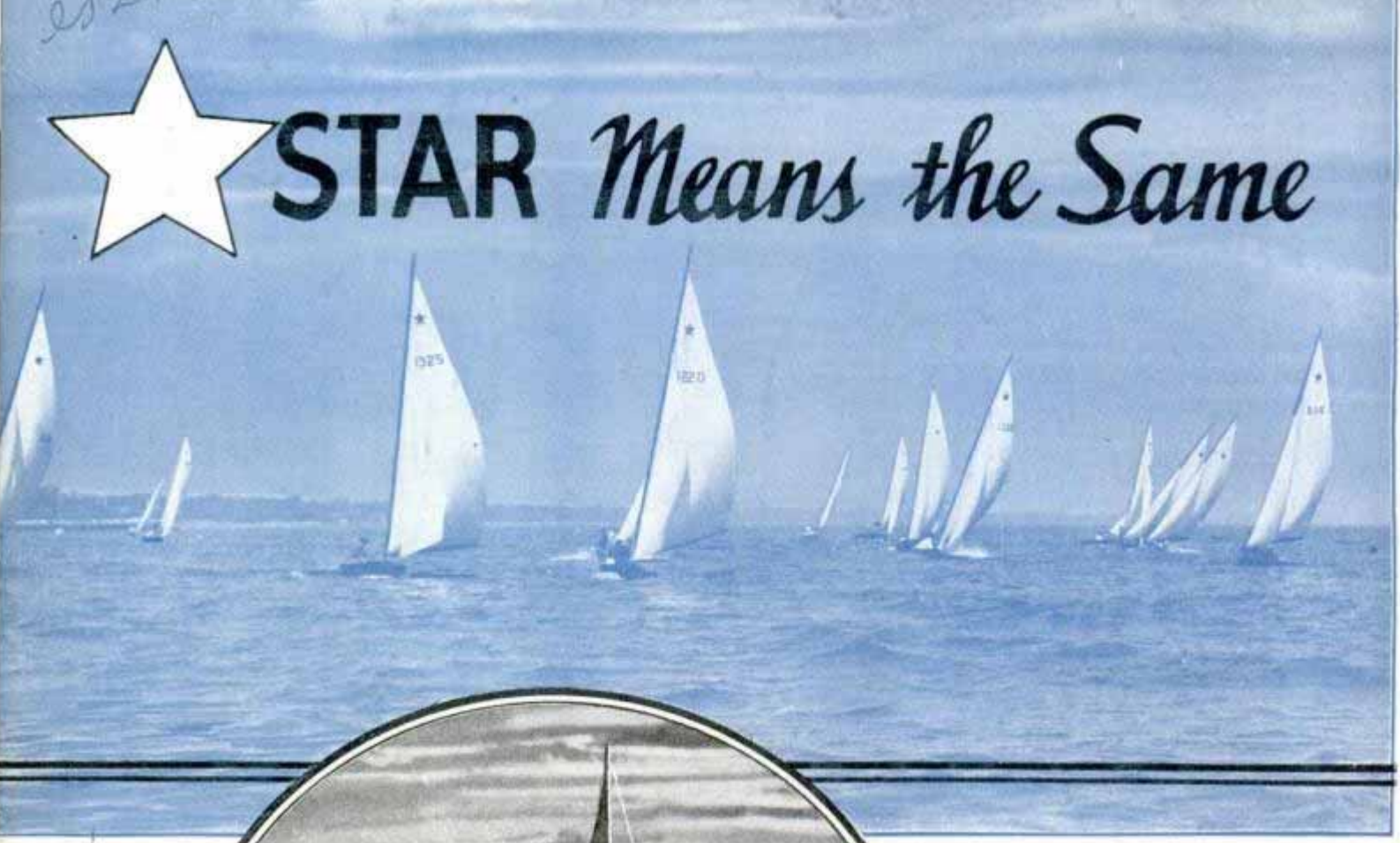


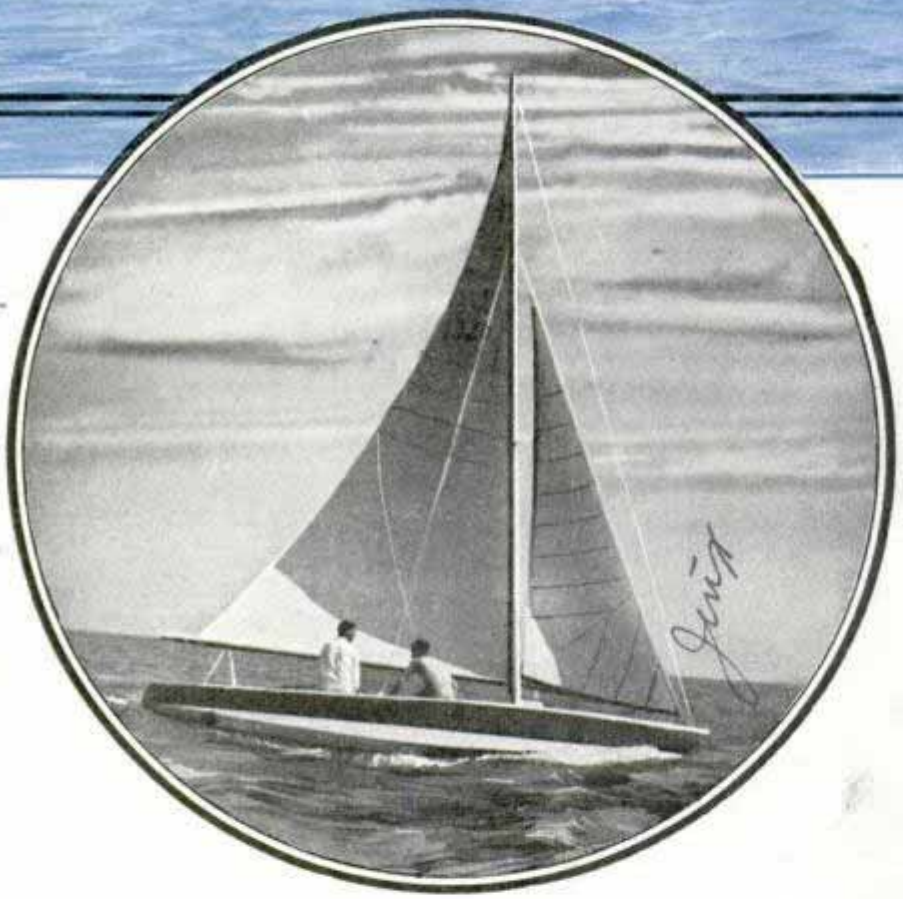
Picture in hollow shell seems distorted unless seen from proper spot, then it has three-dimension effect

Handy Gas Mileage Tester Proves Car's Economy

Designed to be removed from one car to another, a gas mileage tester is available for auto dealers and garages. The device shows in ten minutes of driving exactly how many miles per gallon of fuel the car gets. The glass test tank contains one-tenth of a gallon between two indicating marks. When the gas level falls below the bottom mark during the test ride, multiplying by ten the number of miles the car has gone gives the number of miles per gallon. Thus, auto dealer or garage operator may prove to any owner the economy of his car. The tester is installed by hooking it over the top edge of the right-hand front window of the car and connecting hose lines to fuel pump and carburetor fuel line.

STAR *Means the Same*





Above, starting a race at Sheridan Shore Yacht club on Lake Michigan. Left, "Jinx" hard on the wind. Note general conformation of the hull

RAIL down on the starboard tack, white combers hurling spray into sun-bronzed faces, a Star goes racing down to the outer buoy. Coming up astern through a smother of spray gallops the rest of the fleet.

"Trim her!" yells the skipper to his crew of one. "Trim her, you lug, and climb on the high side. We'll have to pinch her to make the mark on this tack." Bracing his feet against the combing of the cockpit, the crew hauls in the jib sheet an inch or two, and whirls around, balancing himself on the high side with his feet well to windward. "Stand by for a jib!" shouts the skipper as the boat shaves by the mark. The crew flips back into the cockpit, with a sheet in each hand ready to release the sails on one side and trim them again on the other in less time than it takes to tell it. The boat slams around the buoy and heads for home before the wind.

"Wow! We've got a whale of a lead!" and the skipper relaxes.

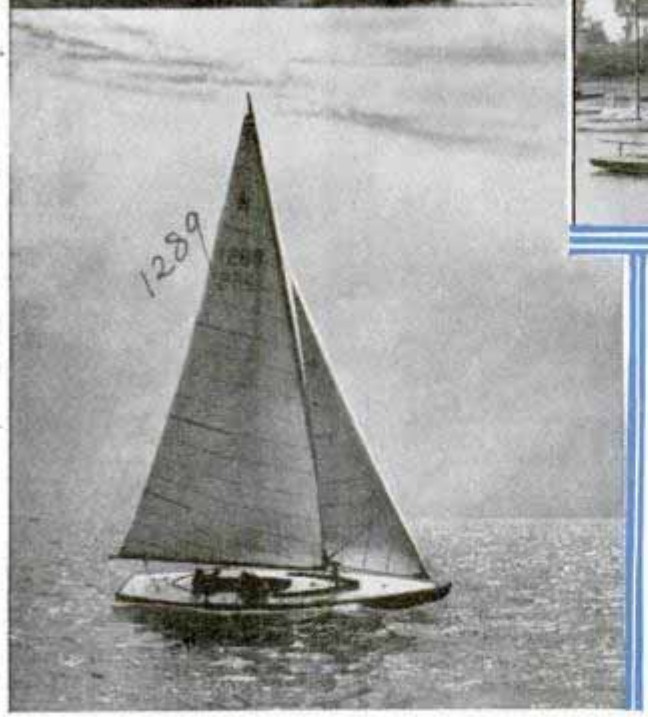
The scene may be Manila or Oslo. It may be Table Bay at Cape Town, or the Gulf of Mexico, or Lake Michigan. For Star boat means the same in any language. The fourteen hundred scattered over the globe, making up the greatest one-design international racing class in the history of yachting, are all built according to the international specifications, and sailed ac-

the WORLD AROUND

cording to international rules.

The skipper in a red fez knows as well as the skipper in a French beret that a boat on starboard tack has the right of way over a boat on port tack. The sportsman who can follow the sun with his boat and sail all winter knows as well as the copper-colored islander who built his own boat that it is a foul to hit a buoy above the water line. The skipper who hears the warning gun as he starts a race in the back-lash of a typhoon off Shanghai and the skipper who glides through the blue water of the Mediterranean both know that to hit the starting line at the gun with stop-watch precision takes something

Two Star boat yachtsmen handling their craft as it races through Lake Michigan waters. Below, Star constructed by the skipper in his spare time. Close behind is another of the same class



"Neo" showing spreaders and rigging. Bottom, general view of the "Katydid's" deck and cockpit, photographed from another boat

more than beginner's luck. There are ninety-six fleets of Star boats scattered over twenty-three countries of the world. They compete locally for the privilege of representing their fleet in the larger events, of which there are many.

Once a year an international championship series is held. In 1936 these races were sailed at Rochester, N. Y., with thirty-five fleets represented, including entries from Nassau, Paris, Hawaii, Manila Bay, Havana and Ontario, Canada. The series was won by Adrian Islen, II, of Long Island in his boat "Ace." The international races are usually held at the home port of the winner of the preceding year, although there is a rule that they cannot be held more than five consecutive years in the same half-hemisphere.

A Star is twenty-two feet seven and one-half inches long, carries a 900-pound fin keel and 265 square feet of sail—has a beam of five feet eight and one-fourth inches at the deck, and a draft of about three feet four inches. It is a swift, sensi-

Some of the Stars in large Wilmette fleet in Lake Michigan harbor

tive craft, providing the keenest of sport, yet is safe. In twenty-five years of Star boat sailing, there is no known record of any lives being lost. This element of safety, plus the fact that a new Star can be bought for approximately the price of an inexpensive car, or built at home for the cost of the materials, has brought international yacht racing to the door of the sailor of moderate means.

Unlike an automobile, which is out of date in a year or two, a Star boat today is built to exactly the same hull specifica-

tions, and with the same amount of sail area as the first Star twenty-five years ago. In fact, the first ever built, Star No. I, still skippered by Commodore Corry, age seventy-three, of the Manhasset Bay Yacht Club, continues to play an important part in all Star class events on the Sound. And the "Little Dipper," as Corry's boat is called, is just as good looking in her coat of black paint as any of her fourteen hundred younger sisters. Practically every Star boat ever built is still in active hands.

Steamship companies, recognizing the growing interest in yacht racing among sailors of modest means, have offered to transport Star boats free of charge to Bermuda and return,if their skippers wish to enter the races there. And there are many other inducements to persuade Star sailors to compete in foreign waters. In August, 1936, Star boats raced in the Olympics for the second time. The events were held in the Bay of Kiel, Germany, with twelve countries represented. It stormed the first three days of racing, but the races were sailed as scheduled without serious damage to the sturdy craft. The Olympics ended with the countries ranking in the following order: Germany, Sweden, Holland, England, U. S., Norway, France, Turkey, Italy, Portugal, Japan, Belgium. There are now thirty-four Star boats in the German navy.

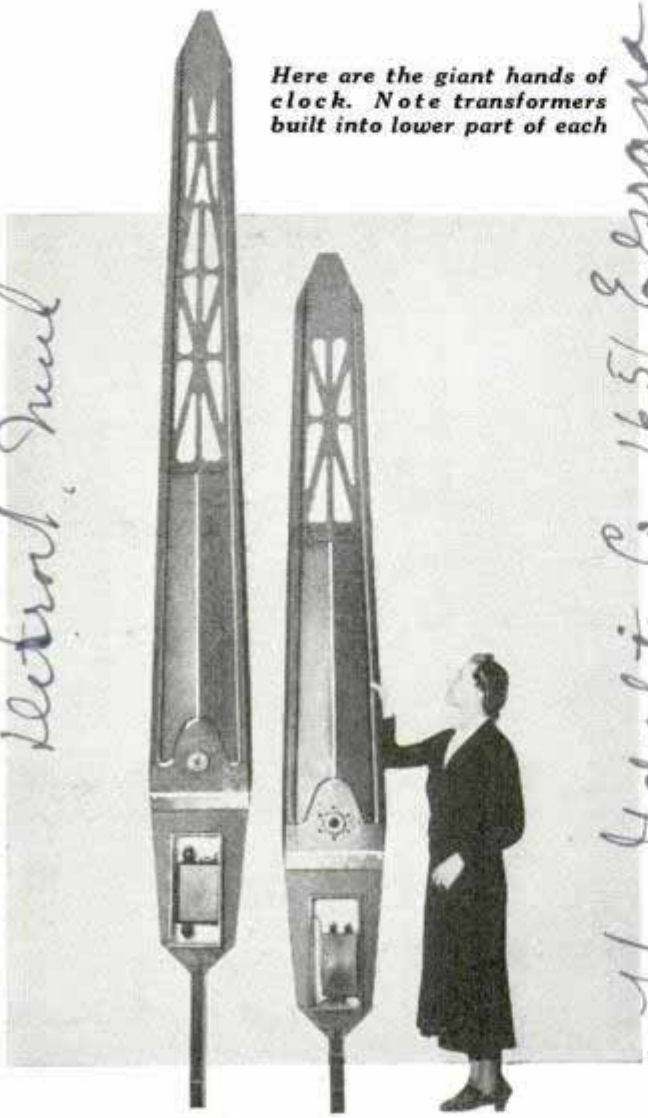
Students at Annapolis have been sailing Stars for a long time, but only within the last year these boats have been organized

(Continued to page 116A)

Another view of the Wilmette Star fleet, anchored in the harbor

Top, "Skip-It" first around the mark. Bottom, another action photo of Star boats racing in Lake Michigan events

Clock Visible Three Miles Has Eleven-Foot Hand



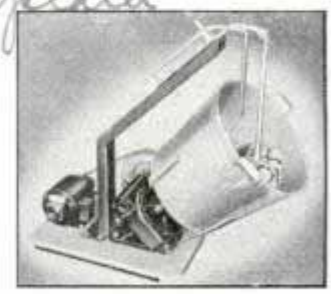
Here are the giant hands of clock. Note transformers built into lower part of each

From a distance of three miles you can tell the time by glancing at a giant clock located at Bluefield, W. Va. The clock has a minute hand eleven feet long and an hour hand 100 inches long. To provide illumination for the hands it was necessary to build transformers into the base of the hands. Though they weigh 245 pounds, the hands are so evenly balanced that they can be revolved by finger pressure a foot from the center.

Abandoned Coal Mines Sealed to Halt Metal Corrosion

In a move to reduce $10,000,000 loss each year, the government and states in the watershed of the Ohio river are sealing abandoned coal mines. These mines may have rock containing sulphur. When ground water and oxygen from the air mix with the sulphur, sulphuric acid is formed. This acid, carried by natural mine drainage into the rivers, attacks metal surfaces of boats and bridges, causing huge damage. Sealing 47,000 openings in 13,500 mines has done much to reduce formation of the acid.

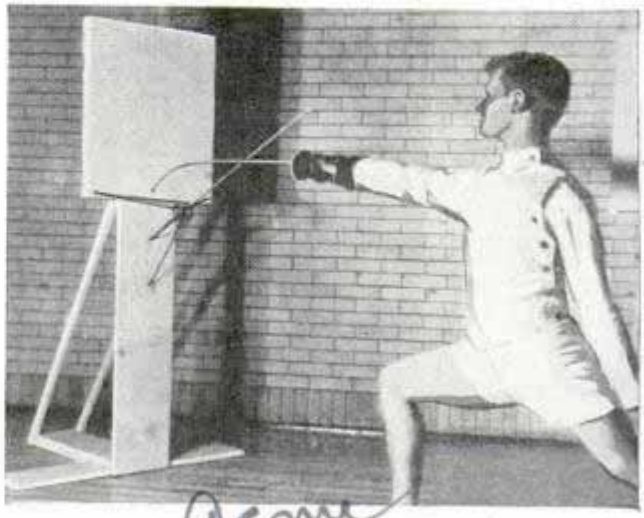
Small Self-Contained Plating Unit Is Detachable for Unloading



For the occasional plater who has a handful of small parts to be plated, a self-contained unit with a capacity of one peck has been developed. The rubber-lined cylinder can be detached for loading or unloading, and this makes it possible to use several plating solutions in one machine. A motor generator supplies low-voltage direct current.

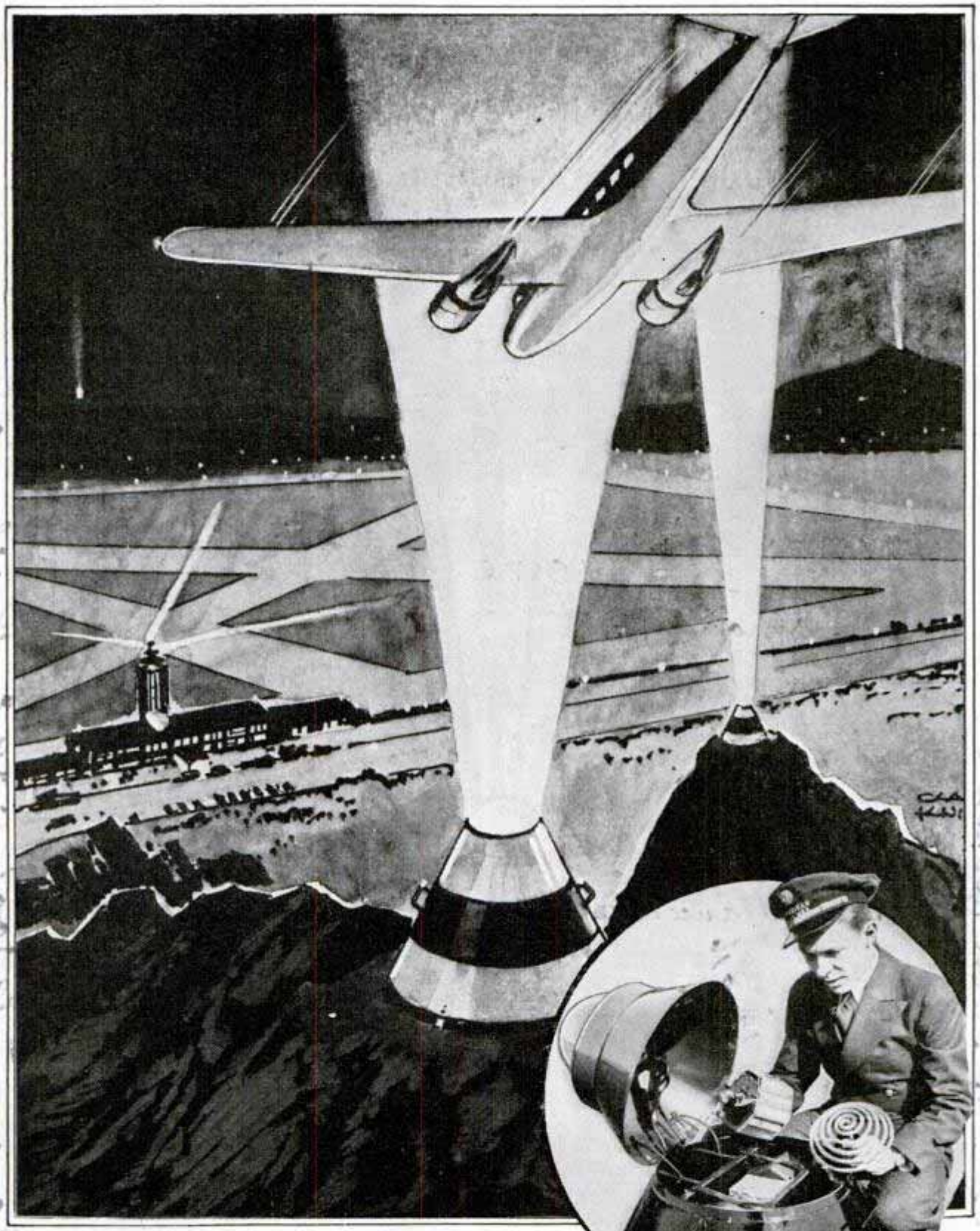
Fencing Robot Used as Target to Train College Team

Training of the Rutgers University fencing team is speeded up by the use of a mechanical target invented by Coach Hubert Pirotte. It consists of a backboard, with fixed upright on a wooden stand from which a foil is suspended by springs. Action of the springs enables the fencer to use the target as an opponent.



Student practicing fencing with aid of robot which permits use of more than 100 exercises

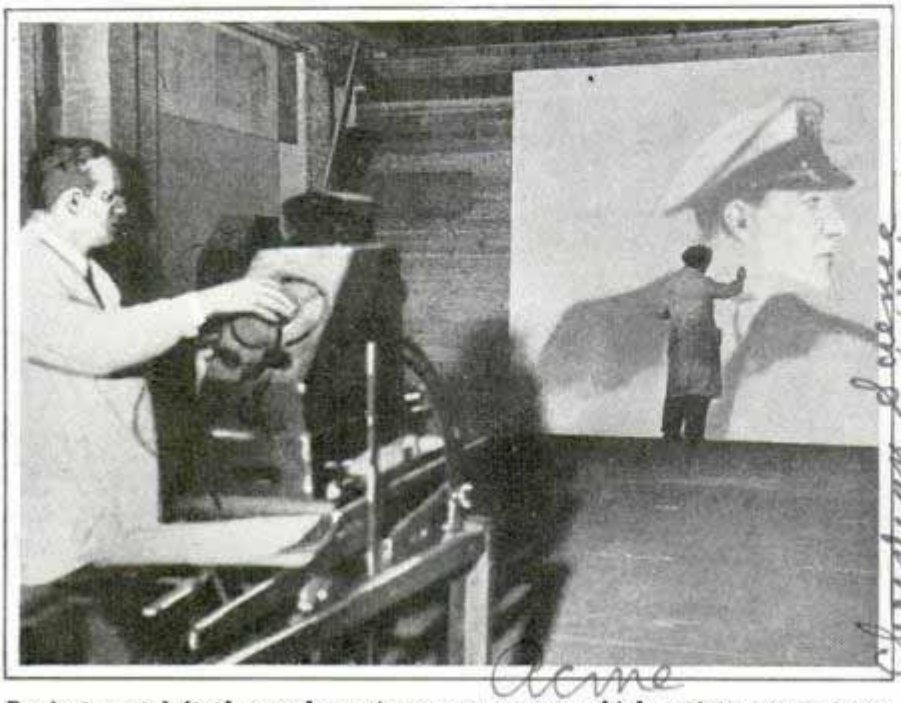
Neon-Eyed Portable Lighthouses Dot Airway



Portable lighthouses that wink neon eyes visible five miles are being built to mark air routes and airport lanes, temporary hazards and highway danger spots. Five feet of spiral neon tubing, seen at right, are fed by eighteen-cell battery flashing 120 times a minute for six months unattended, then reserve battery would go into action. Placed on mountainside as warning to fliers, self-contained lighthouse would make unnecessary installing wiring or generators at remote spots. Handles make it readily portable

Pilot Safety Light

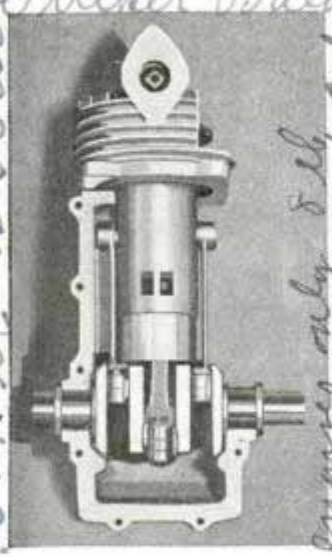
Artist Traces Projected Image in Painting Poster for Movies



Projector at left throws large image on screen which artist uses to trace outlines of figure and block in high lights and shadows for poster

To simplify the work of artists painting posters for movie displays, a projector is used to throw a huge image on a screen. The artist then traces over the image which is to be the center of interest, and blocks in high lights and shadows.

Small Double-Action Engine Drives Bike or Mower



Operating on the double-action principle, a lightweight engine developing one horsepower has been designed for propelling bicycles, lawnmowers, compressors, generators and garden and small-farm machines. The explosions of fuel take place between the piston and a piston cylinder to produce the double action, a power stroke in both directions at the same time. This is said to eliminate vibration and give balanced power. A supercharger is used instead of the two-cycle principle of placing the gasoline in the crankcase.

Buses Are Gaining on Street Cars but Still Lag Behind

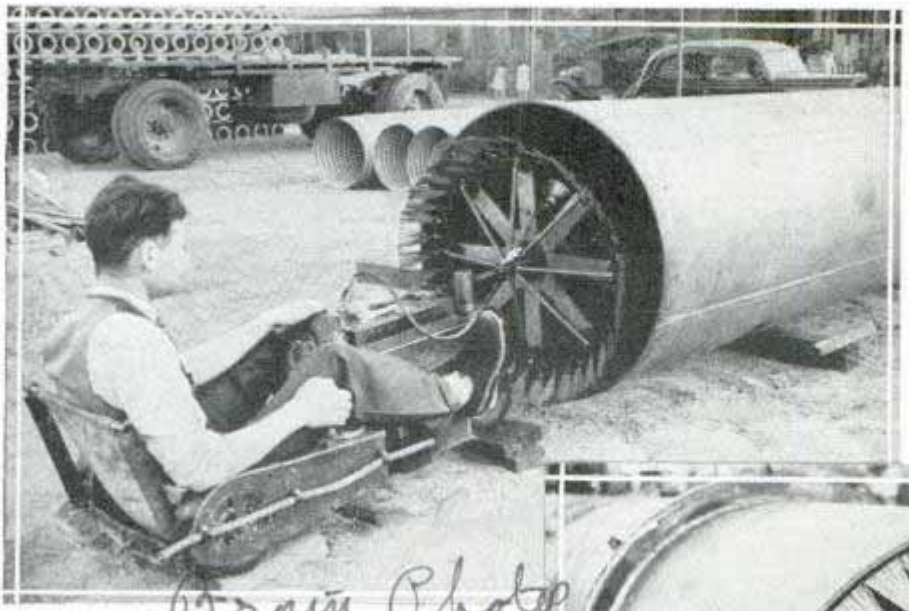
Bus lines are increasing steadily on the streets of American cities, but they have not yet caught up with street-railway systems. In 1936, the number of cities in the 10,000 or more population class which had buses exclusively increased from 393 to 434. There are about 19,000 buses on the streets of 982 cities.

Tiny Jails along City Streets Hold Prisoners for Patrol

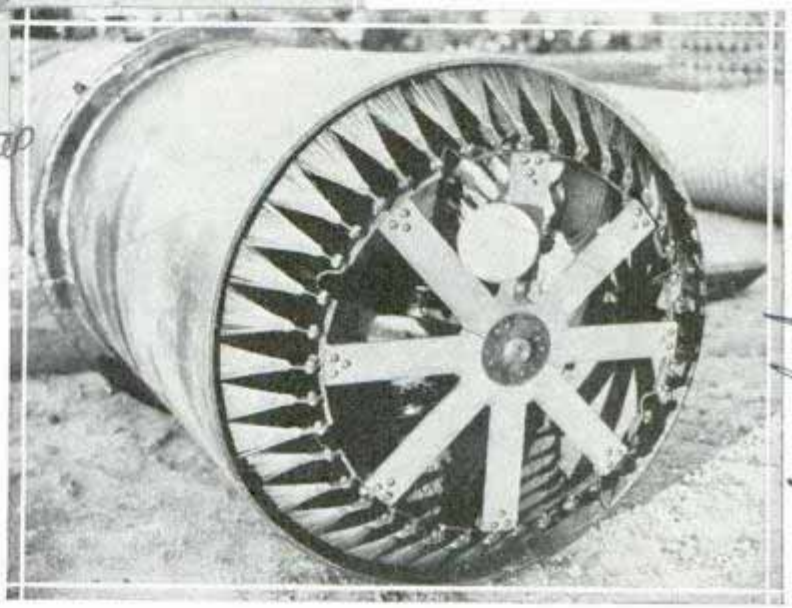
It takes no time at all to clap a lawbreaker in jail at Tombstone, Ariz. Along the streets are convenient little stone cells with barred windows, just big enough to accommodate one or two offenders while the officer calls for a patrol to haul the prisoners to the big city jail.

Officer guarding prisoner in handy sidewalk jail in Tombstone, Ariz., while waiting for patrol to arrive

Inspector's Tiny Car Runs Inside Water Mains

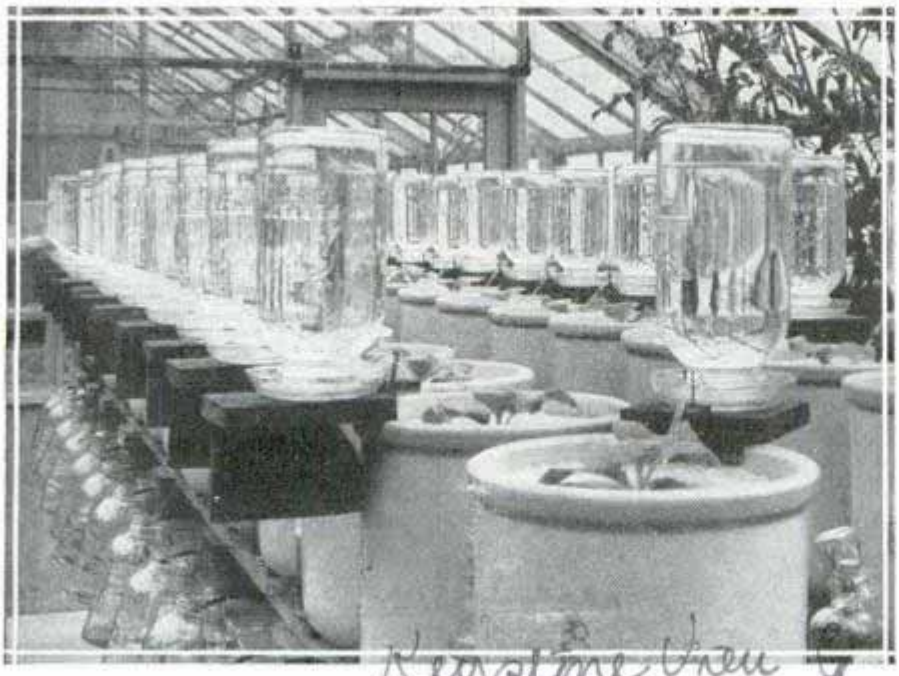


Left, inspector driving car into water pipe. Below, front of the car emerging from pipe. Note the steel brushes contacting inside of water main



So small that it can travel through a thirty-six inch water main while carrying an inspector, an electric car has been developed for locating defective enameling in the big pipes. Revolving steel brushes and a light on the front of the car enable the inspector to find faulty spots, which then are marked to be repainted. Storage batteries provide power for the car and light.

Plants Nourished by Bottle Grow Rapidly in Pure Sand



Tobacco plants growing in inert sand in greenhouse are nourished by growth-promoting solution fed into the sand from large bottles

Bottle-feeding for plants is being tried at Columbia University. Growing in pure, inert sand, the plants are nourished by a solution dripping from large bottles, thus permitting close control of growth. Plants raised in this way grow faster and the yield may be increased threefold. Tobacco and tomato plants are fed by bottle in the greenhouse shown.

¶ The center anchorage of the San Francisco-Oakland bay bridge is greater in bulk than Egypt's largest pyramid.

SHOOTING MODERN

Above, International News scene in Spanish war showing woman on the firing line with riflemen. Left, "shooting" Gandhi of India

HISTORY was being made as the rain glistened on the President's silk hat. Franklin Delano Roosevelt was about to be inaugurated for his second term, the first president to be inducted into office on January 20, instead of the traditional March 4. He turned to secret service men guarding him and said: "Give the newsreel men a break!"

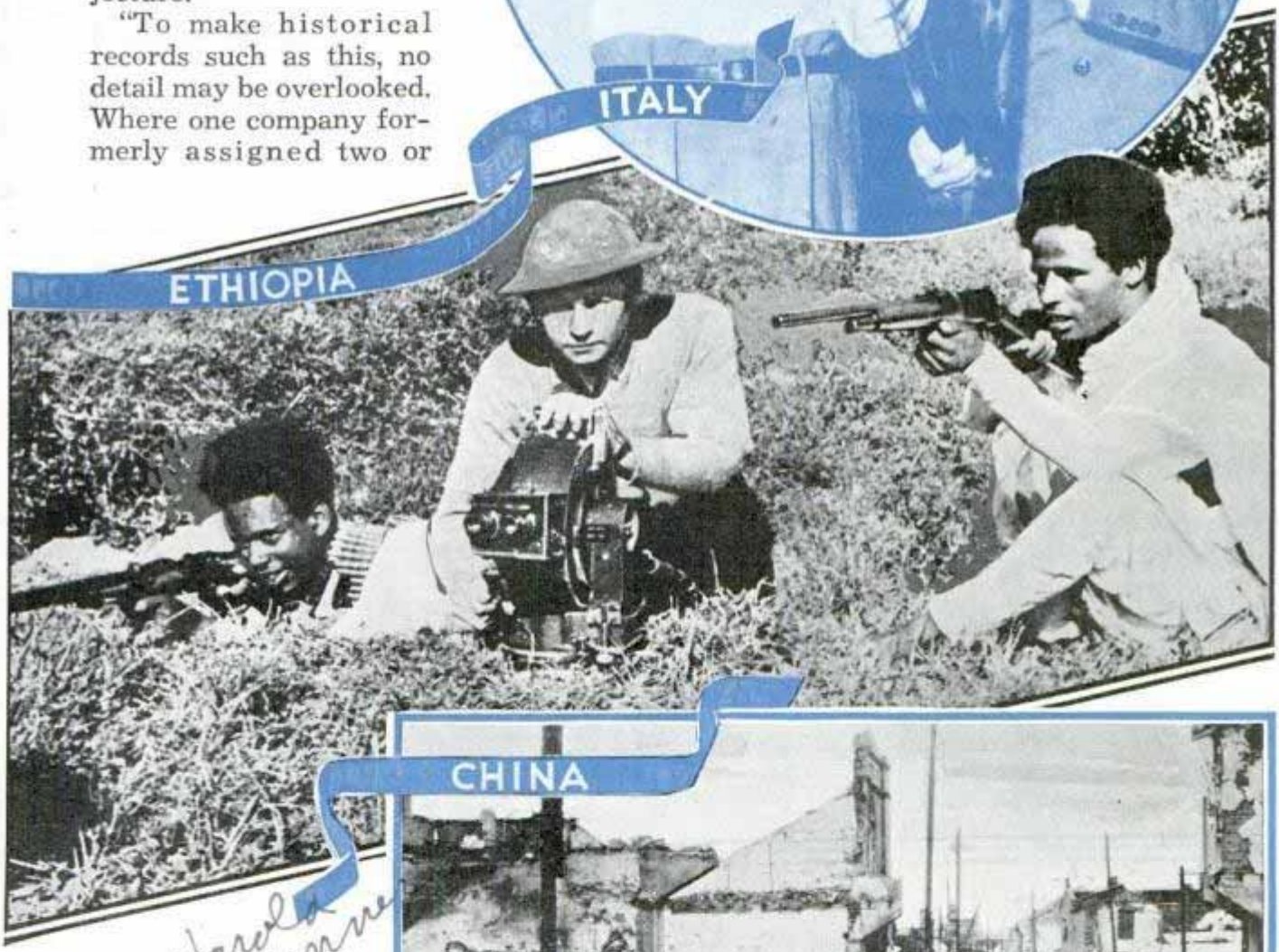
Forty-eight hours later in their favorite theaters, millions of people throughout the United States were seeing and listening to the complete story of the inauguration. In one reel of talking film was compressed a page of American history, preserved for all time. The six words spoken by the President brought out clearly the new role which the newsreel men are playing as historians.

"The motion-picture record of the recent inauguration is an excellent example of the technique which newsreel men have perfected in shooting modern history," says Claude R. Collins, assignment editor of one newsreel company. "Fifty or a hundred years hence if a schoolboy should want to know what President Roosevelt looked like, how he talked, how he acted in private as well as in public life, he can be told the complete story by means of a

HISTORY

strip of film in a motion-picture projector. Just imagine how valuable to us today would be such records of Lincoln and Washington and how real would become the heroes and statesmen of a hundred years ago whose physical appearance and other characteristics are already a matter of conjecture.

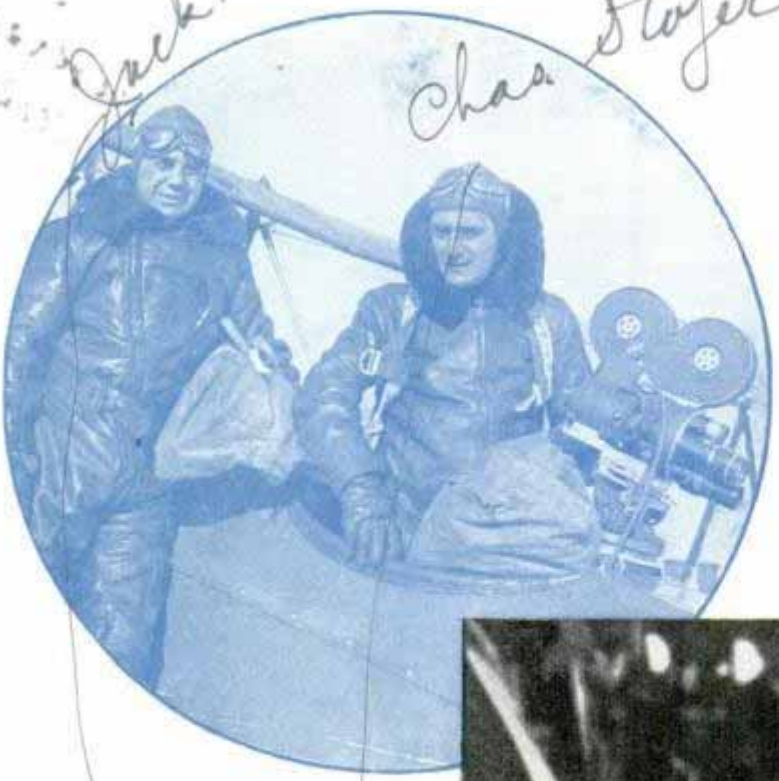
"To make historical records such as this, no detail may be overlooked. Where one company formerly assigned two or



Top, General Balbo looking at film of his flight from Italy to America. Center, riflemen protecting Universal Newsreel cameraman. Bottom, scene from Chinese war

Jack Kuhn

Chas Stoger



newsreels of a few years ago, Mr. Collins ordered a complete reel of a thousand feet shot by his crews, just as was done with such other recent outstanding news events as the funeral of King George V, the abdication of King Edward VIII and the midwest floods.

Col. Charles A. Lindbergh's landing at Le Bourget Field near Paris was directly responsible for the technique now practiced by newsreel companies on important stories. When Lindbergh landed, the unruly crowds broke through

Top, cameraman and sound man ready for flight. Center, "shot" of Italy's Mussolini. Bottom, early view of Theodore Roosevelt (Fox Movietone)

police cordons and shoved the newsreel cameramen aside in their rush to the aviator. The cameramen had great difficulty getting any usable footage. As a result wherever crowds are apt to assemble, several additional crews are assigned to "cover" on the theory that at least one will get a valuable story.

three newsreel crews to cover the inauguration, it sent twelve crews to the recent one. Seven crews were assigned to the capitol to take shots from various angles. One crew was stationed behind the President, and four more were placed in the crowds, making long shots, close-up and cut-in shots."

Because of the historical value of this subject, instead of the ordinary fifty to 100 foot shots such as were made for the

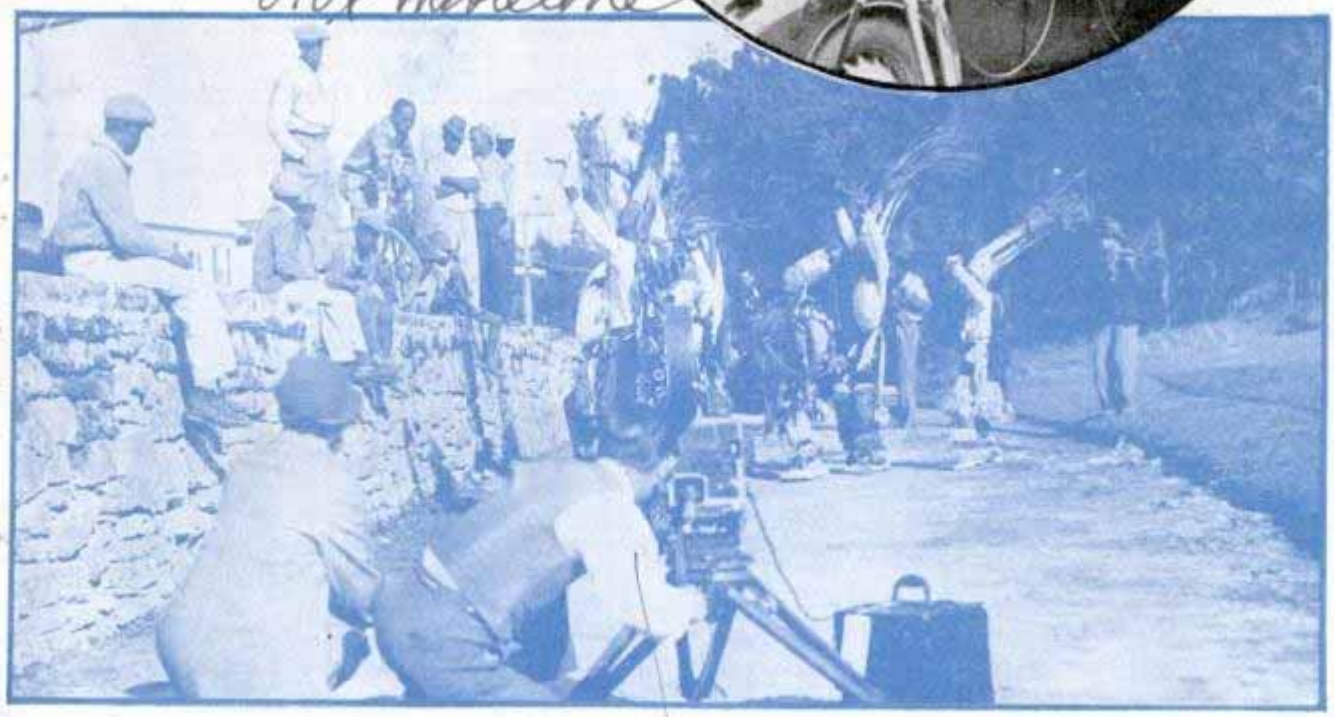
Georges Mejat, ace newsreel cameraman in France, secured one of the most dramatic historical films ever shot. He was covering the procession of King Alexander of Yugoslavia and French Minister of Foreign Affairs Barthou through Marseilles. He was working with a small hand camera whose lens, when seen by excitable police in a crowd, might be mistaken for a large revolver barrel. He had made a close-up of the King and Barthou as

Fox Movietone

they sat in an automobile when he heard shots fired. An assassin was firing at the two subjects of his own camera. In spite of the danger of being mistaken for the assassin by soldiers who immediately closed in, Mejat remained cool and got the only picture of the Croat assassin actually firing the fatal shot. His film also showed the people falling from the wild shots from the assassin's gun, the King dying on the seat of the car, the assassin being hacked and beaten to death, a gendarme carrying away the weapon.

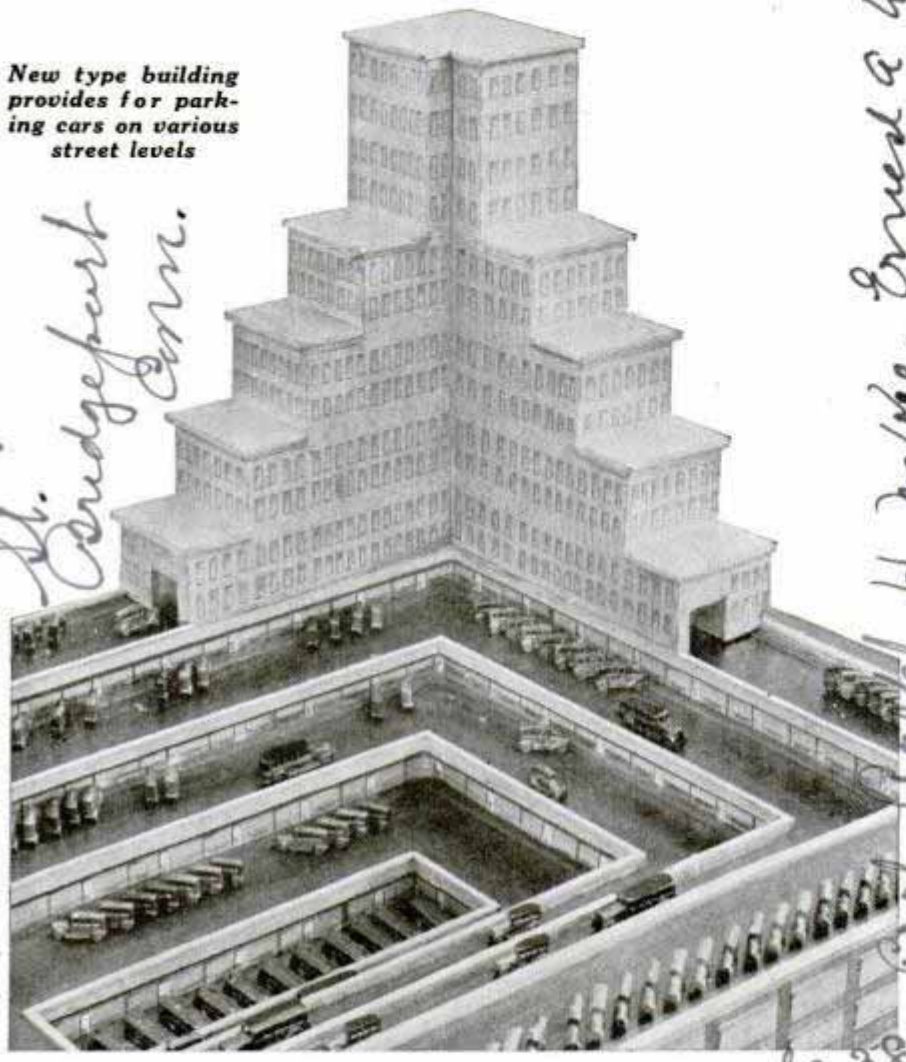
Cameramen shooting modern history don't always get by with whole skins. Joe Gibson, after passing through many dangers unscathed, was hit in the leg by a stray machine-gun bullet while covering the revolution in Havana. A. P. Alexander, another cameraman, flew 60,000 miles in obsolete planes photographing activities of China's National Government against the Communists. After returning to America, he and his sound man, Francis Tappan, were killed when the modern plane in which they were traveling crashed.

(Continued to page 114A)



Top, scene in Ethiopia. Center, Universal crew on the job. Bottom, Fox Movietone crew filming natives in Bermuda, recording folklore and customs

Tiers of Streets in Building Offer Solution for Parking



New type building provides for parking cars on various street levels

Recognizing the parking problem confronting merchants today, the designer of a new type of trading center has provided a means of parking cars on various floors in the building. With stores and offices on every floor and sidewalks for shoppers, the design permits each car on the inside of the building to be parked in front of a store or office, with the exception of those on the third-story roof. The basement is for parking, stores and bus terminal. All cars would be out in the open, not using any part of the interior of the building. Entrances to the inside of the building would be by ramps leading to the several floors and to the basement. These ramps are designed to have their entrance in the middle of the road, so that automobiles entering or leaving or driving through the entire building would not cross any lines of pedestrian traffic. Superstructures, similar to the present skyscrapers, would be erected on the same base, rising above the several levels where the cars would be parked.

Low Cost "Dry Ice" Made from Waste Chimney Gas

Waste gases pouring from the smokestacks of steam-power plants promise an inexpensive source of Dry Ice in the future. A method of recovering carbon dioxide from industrial chimneys has been developed by Columbia University scientists and is ready for commercial use. The gas is passed through towers in which carbon dioxide is absorbed, and later, converted into solid form, becomes the refrigerant, Dry Ice.

Red Arrows Flash Warning of Left or Right Turn

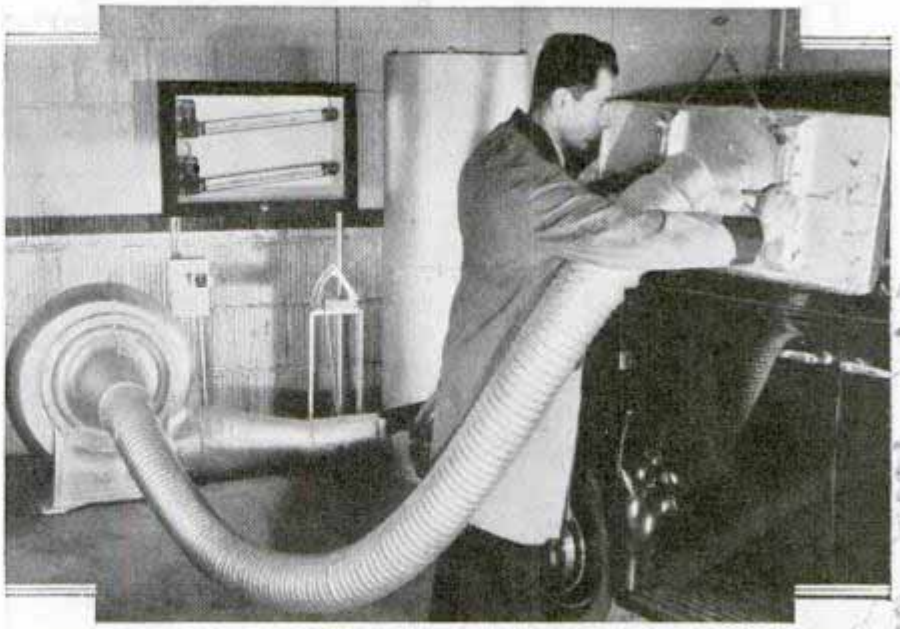
Bright red arrows flashing in the rear window of your automobile give unmistakable warning to the driver behind that you are turning left or right. A turn signal now on the market is fastened to the window, where the driver himself can see it, with vacuum cups and a touch of cement. Before turning, he presses an ivory button on the instrument panel and lights an arrow pointing either right or left. The signal should be installed where it will not interfere with vision to the rear.

Pressing button on instrument board flashes arrow in rear window indicating right or left turn

General Motors Sales Corp
420 W. Milwaukee, Chicago

"Elephant's Trunk" Tests Tightness of Auto

By sucking air out of the automobile, a device which engineers call the "elephant's trunk" tests the tightness of car bodies. The rate at which air from the outside rushes in to replace that drawn out is recorded on two instruments, thus showing how tightly doors and windows are fitted and how well insulating materials do their work. The elephant's trunk, a length of noncollapsible hose several inches in diameter, connects with one window of the car being tested. All other windows and doors are closed. A powerful suction fan at the other end of the hose draws the air out of the car's interior. Connection between the hose and the window is made through a rubber-faced wooden plate. Readings obtained by this method enable engineers to design cars which will keep out dust and dirt and cold.



Attaching "elephant's trunk" to car window. At left note housing of suction fan which draws air from the car to test body tightness

ls 414.

Copies Made in Sixteen Colors by Electric Duplicator

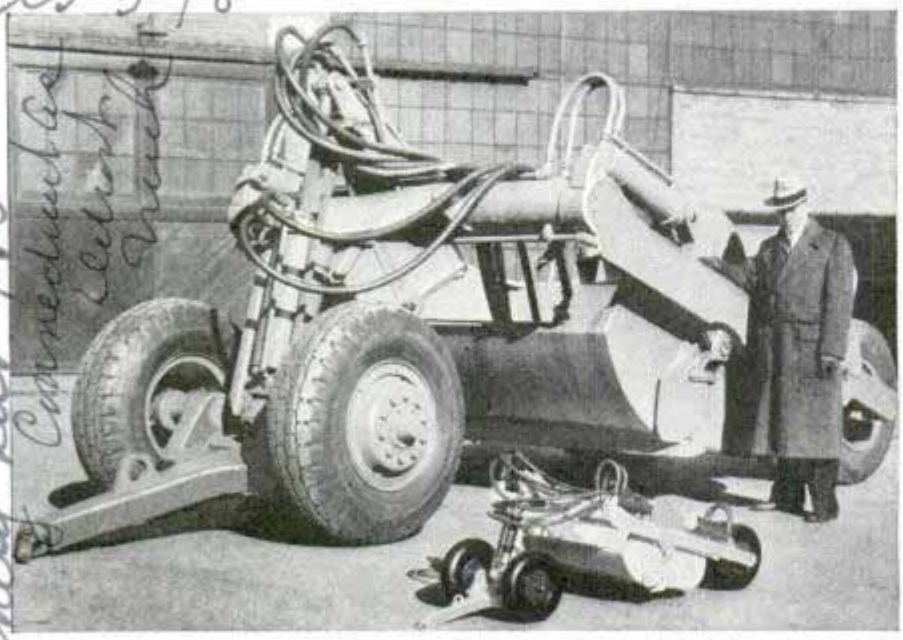
From one to sixteen colors may be reproduced on copies of writing, typing or drawing by an electric rotary duplicating machine now on the market. The original writing, typing or drawing is called the master. Employing the gelatine method, the machine does such color work as catalogue pages, broadsides, cartoons, illustrated bulletins, house organs, maps, style sketches, charts, window cards and posters. In addition it can be used for business systems—payroll, order invoice, purchase order, sales analysis—turning out as many copies as desired. In color work the master copy is laid on a gelatine roll which is locked on the cylinder of the machine. This roll removes and retains enough ink from the master to turn out copies automatically as the blank sheets are fed into the duplicator. More than 200 copies can be made before replacing the master. Any weight of paper may be used in making copies, from tissue to card stock, without special adjustments.

Operator seated at electric rotary duplicator. This machine does color copy work

¶ Inquiries as to makers of articles described in Popular Mechanics, will be answered by our Bureau of Information upon receipt of return postage.

Elec. Dupl.
Oakley

"Vest Pocket" Road Scraper Demonstrates for Big Brother



Six-ton hydraulic road-working machine beside its baby brother, a tiny model built for demonstration. It does the same work on a small scale

It was impractical to send a 12,000-pound hydraulic road scraper on a demonstration tour, so a tiny working model, true to scale in every detail, was built as a "traveling salesman" for its big brother. The giant road-working machine is nearly twenty feet long; the model five feet. The baby scraper, with its small set of hydraulic hoists, demonstrates digging and loading, lifting, hauling, dumping and spreading material.

Hot Water Supplied at Low Rate When Electric Load Is Light

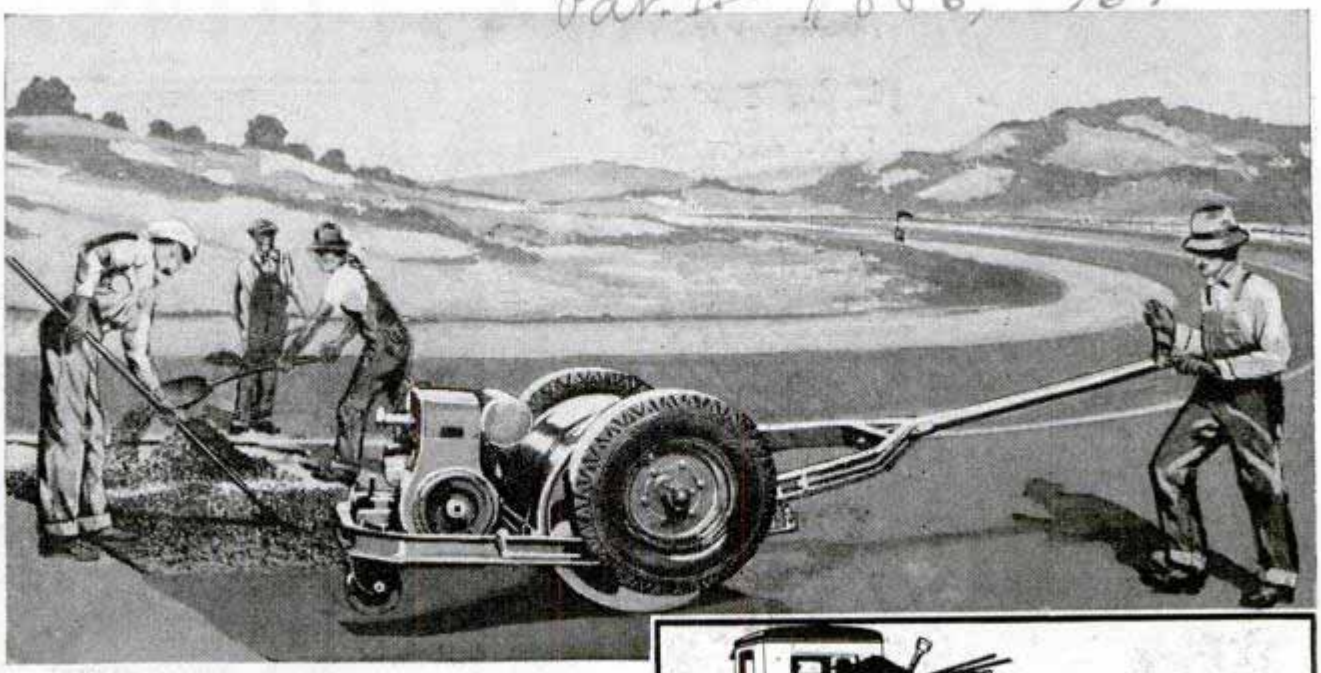
By letting the dispatcher at the power station turn on your electric water heater whenever the power load is low, you may obtain domestic hot water at the minimum electric rate. High frequency "carrier current" makes possible this remote control. It travels over the same wire that carries the heating current. At night, or at any period of the day when the central power plant is loafing, the engineer throws a small switch in the power house and the carrier current turns on every water heater along the line. When the load is heavy during the evening, or during any emergency calling for a peak load, the engineer pulls the switch and disconnects the hot-water heaters. Formerly the "off-peak" rate for electric water heating was on a fixed hourly basis, a clock mechanism turning on the heater during the late night when the load is usually down. But demand is not always uniform. Loads may be heavier on a Saturday evening than during the week, and more current is used during washing and ironing days than at other times. The carrier current permits the power station to use idle power at any time for hot-water heaters, and the householder receives the off-peak rate, about one-fifth the regular rate.

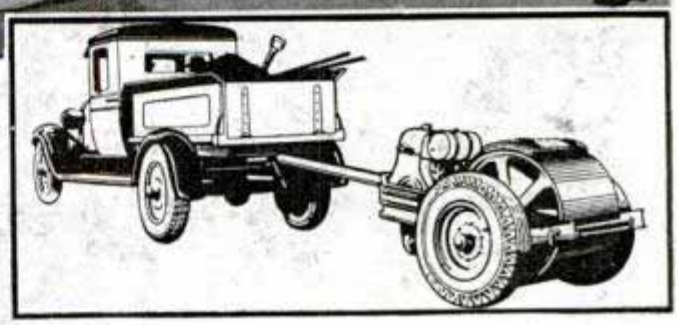
Lawn Mower Whetted at Home with Abrasive Attachment

Sharpening your lawn mower is easy with an abrasive attachment just put on the market. By stepping on the handle, you lift the wheels above the ground and then slip the sharpener over the crossbar. While one hand presses the abrasive against the blades, the other turns the wheel and the mower is sharpened in a minute.

One hand presses abrasive against blades while other hand turns wheel of lawn mower

Wheels Convert Road Roller for Fast Towing





Two sketches of motorized roller. Right, note that it may be towed easily

For quick transportation in trailer fashion, the latest motorized road roller is equipped with pneumatic-tired wheels mounted on eccentric spindles. Shifting from trailer to roller is accomplished by lifting the tongue up and over, raising the wheels off the ground and lowering the roller into working position. On the job it is self-propelled, operated by one man. Often a job can be completed and the roller returned to its base in less time than it would take for the slow oil or steam-powered roller to reach the scene.

Gas Motor Drives Wheel Chair Sixteen Miles an Hour

Wheel chair powered by gasoline motor goes sixteen miles an hour

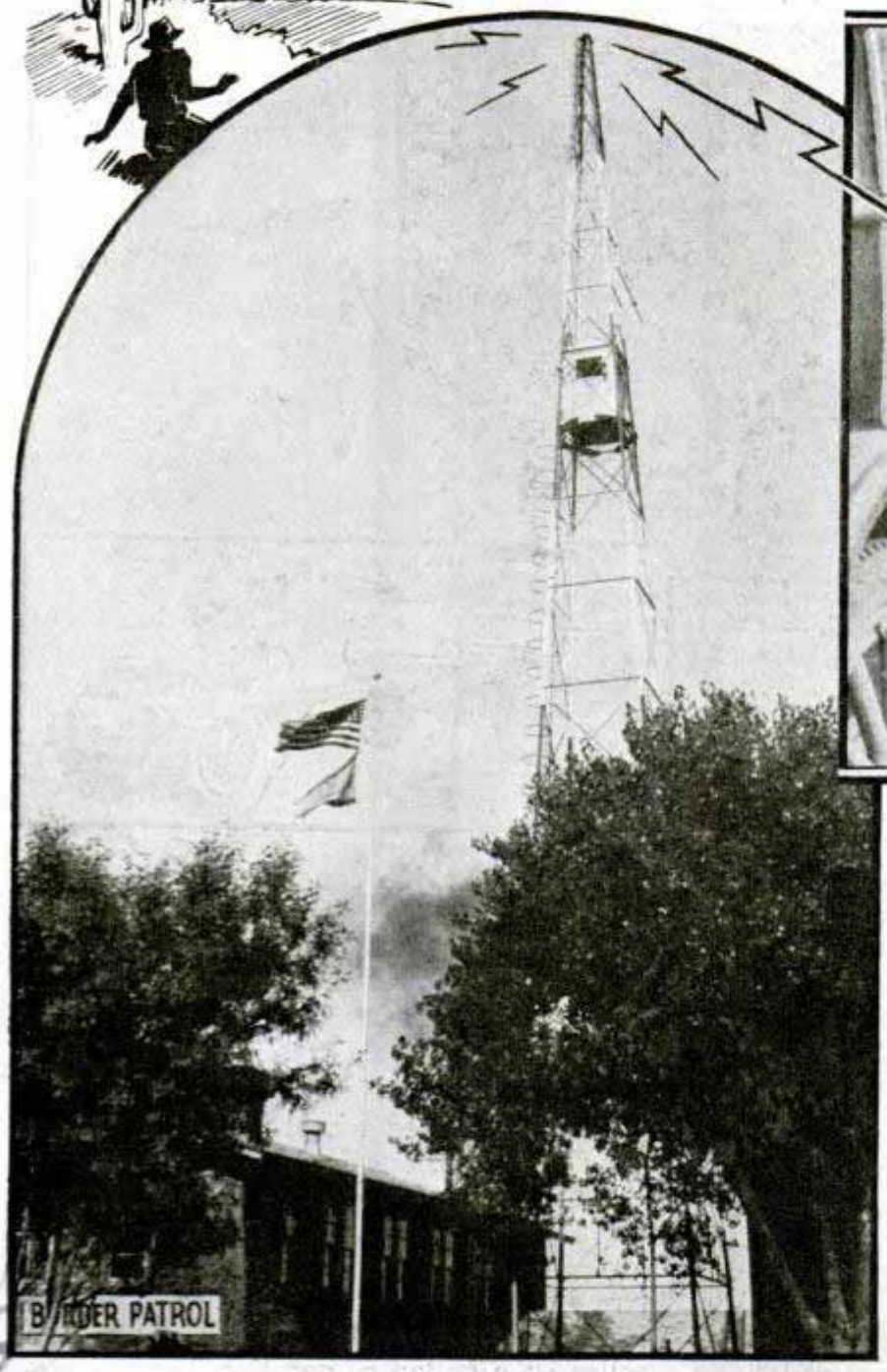
Hand-propelled wheel chairs being too slow and laborious for a Seattle man, he installed a gasoline engine and now he can drive along at top speed of sixteen miles an hour He steers with a single handlebar. The chair is equipped with lights, horn and brakes. It covers seventy-five miles on a gallon of gasoline.

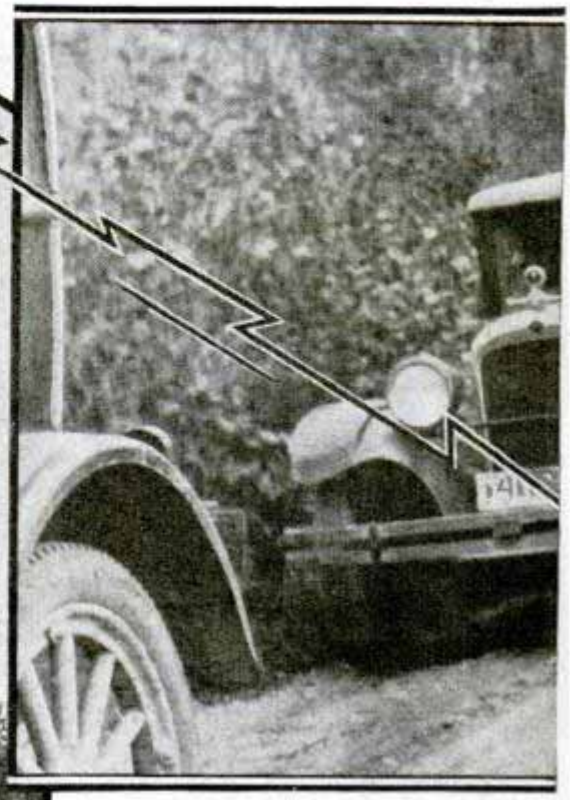
Luminous Paint Guards Bike in Night Traffic

Protection of the bicycle and its rider in night traffic is afforded by application of phosphorescent paint to mudguards or other parts. Used in Germany, the paint makes the bicycle visible in the darkness for long distances when auto headlamps strike it. Sixty stations for applying the paint have been established.

National Press Club
Washington, D.C.

CATCHING





Radio observation tower at El Paso. Note the observation booth near the top

"CALLING car 14; calling car 14! Proceed up Water street to the bed of the river. I see three aliens crossing the Rio Grande."

Car 14 proceeds cautiously down the water-front road.

The voice of the towerman of the El Paso detail of the U. S. Immigration Service is heard through the patrol car's loudspeaker.

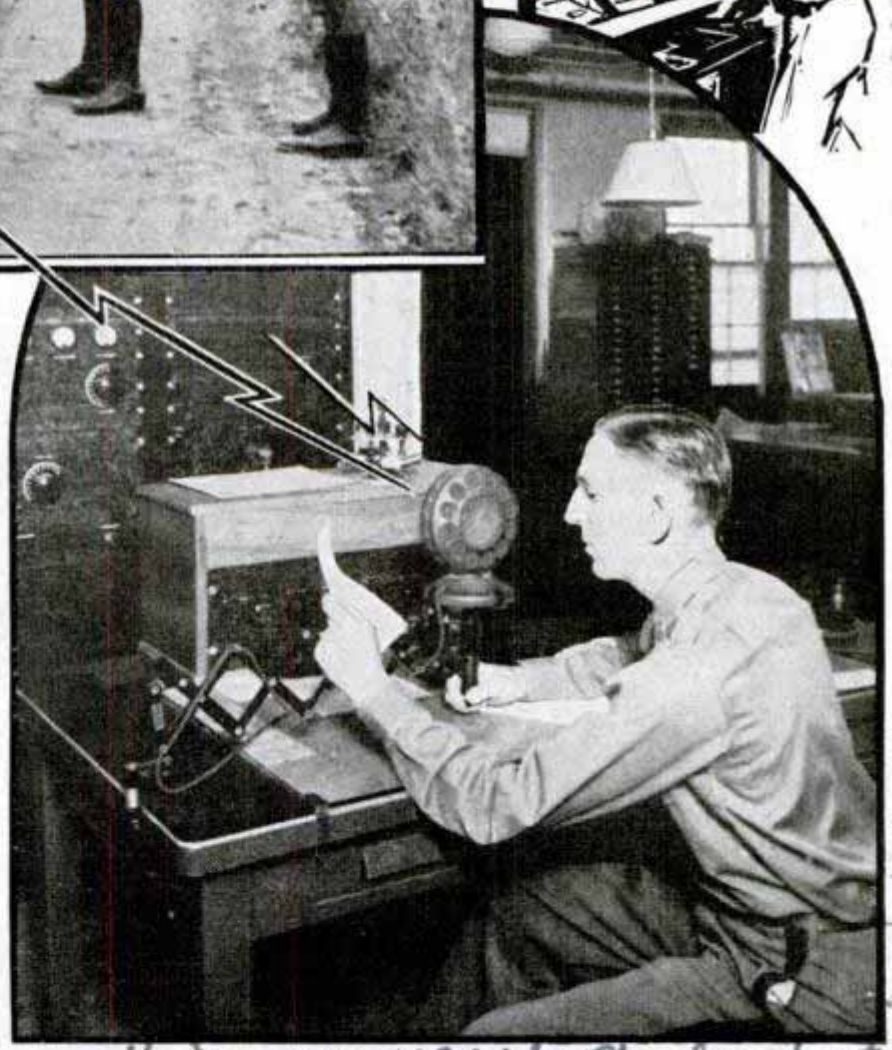
"All right, MacBride. Stop; you're directly opposite them. You and Hill hide in the underbrush. The aliens are coming directly toward you."

The two inspectors crouch in the mesquite. In a few minutes the immigrants appear, creeping through the bushes. Officers MacBride and Hill stop them with drawn revolvers, handcuff them and take them to headquarters. Another attempt at illegal entry into the United States has been thwarted.

Every conceivable method is tried by aliens who attempt to enter the United States illegally. Europeans become stowaways on ships; Chinese and Filipinos enter Mexico and endeavor to smuggle themselves across the international boundary. Sometimes they try it alone. In other instances they pay professional smugglers. Along the Canadian border, too, Uncle Sam's inspectors must be ever watchful. Something had to be done to stop this

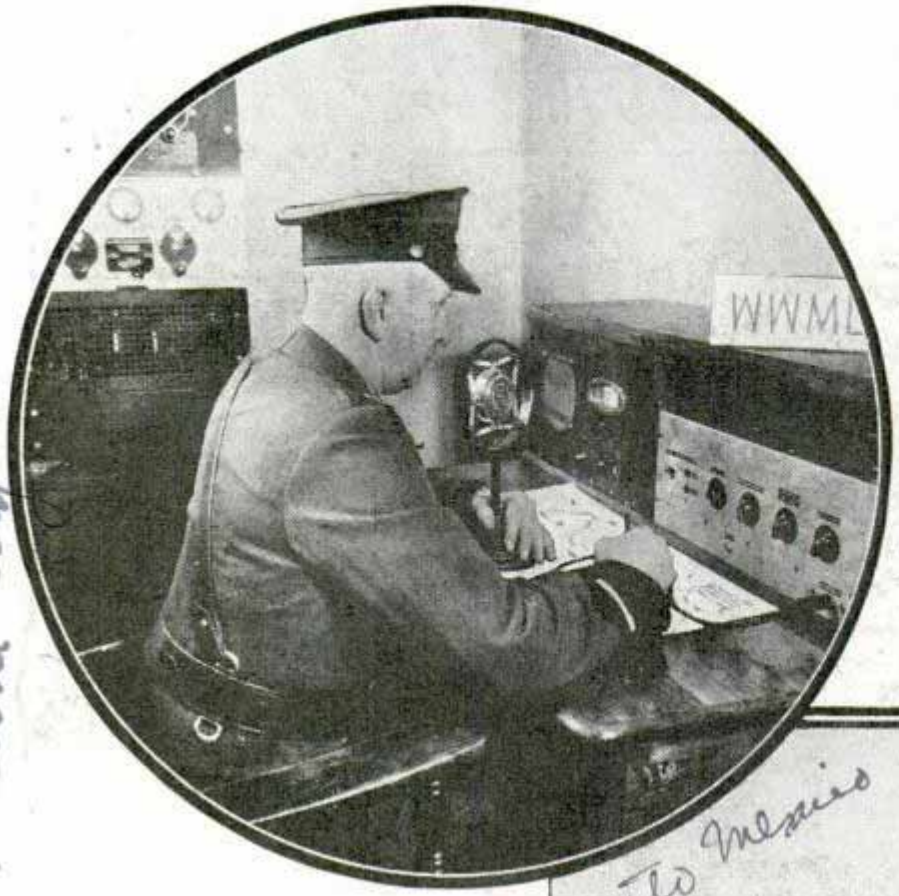
ALIENS by RADIO

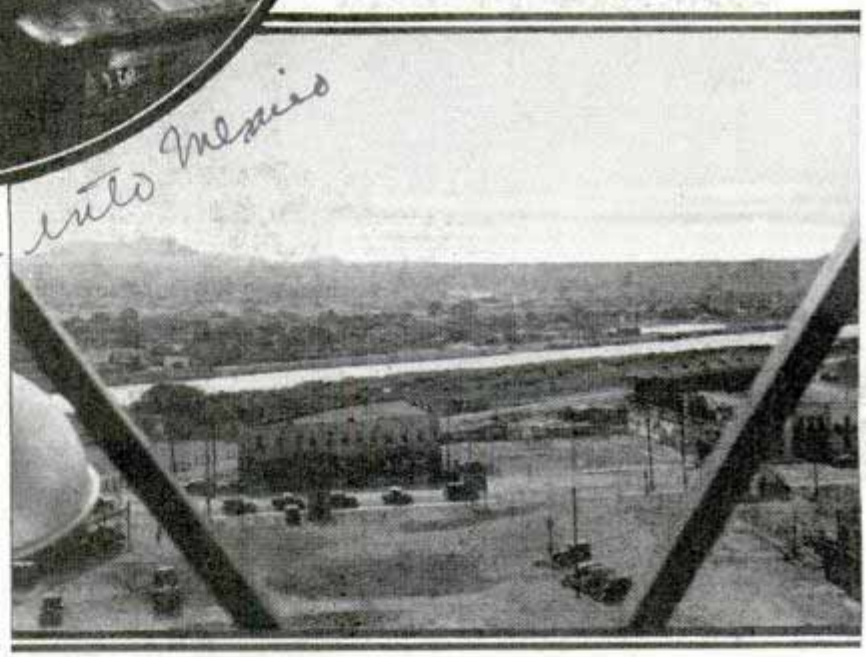
Left, questioning aliens at border. Below, directing patrol cars by radio. Scene is radio room at foot of El Paso tower



horde of aliens. The number of immigration patrol officers is slightly over 800. To their vigilance is entrusted the combined 5,000 miles of the two international borders. Obviously that comparatively small body of men, operating with patrol cars, horses and on foot, could not possibly hope to catch every foreigner. A few years ago the immigration service decided to erect observation towers with two-way radio communication with the patrol cars. The latest such radio tower has just been completed at El Paso, Tex., and its method of operation is simple, but highly effective.

Juarez, the town across the border from El Paso, is one of the greatest concentration points for aliens in Mexico. Federal officers, prior to the operation of the radio tower, had more than they could manage, trying to stop the steady stream of immigrants crossing the Rio Grande. Oftimes the river is so low that it is possible to wade across. At such periods, the peculiar topography of the region lends itself to successful smuggling. Both banks of the river support heavy growths of bushes and mesquite. A border patrolman, cruis-





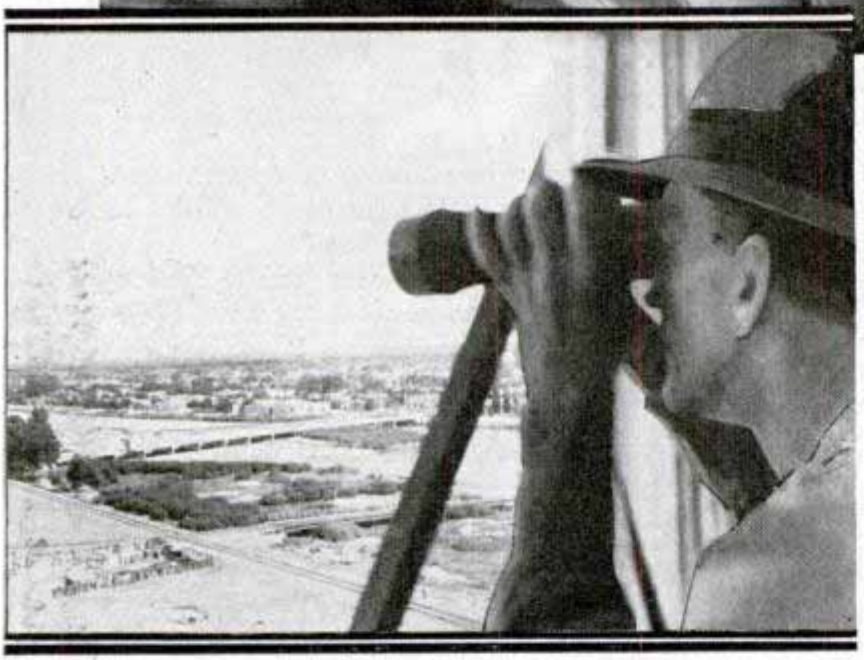
Top, officer on duty at radio station in Michigan. Bottom, looking over Rio Grande from El Paso observation tower

ing along the American side, could not see immigrants preparing to wade the Rio Grande. Once the alien crossed, he could hide in underbrush on the American shore. The best chance the federal men had of detecting the self-smugglers was to spot them in the water and wait on the bank. Often the more vicious type of professional smuggler had "spotters" on the Mexican side to fire on federal men while the aliens were dashing for the United States. More than one inspector has lost his life in such encounters. At night, detection of alien smuggling was doubly difficult.

Advent of the tower changed conditions. Immigrants began to be apprehended by the score. The steel tower, 125 feet high, gives the observer a clear view of both sides of the Rio Grande for several miles. A trained inspector sits in the tower with powerful binoculars and a microphone. When the observer speaks, his voice is heard over loudspeakers of the twenty-three patrol cars of the El Paso district. The instant an alien is spotted, the observer gives directions to the patrol car nearest the point of attempted entry. The ground inspectors, guided by instructions of the towerman, usually succeed in capturing the alien.

Effectiveness of this new system is evidenced by a paragraph in the confidential report to the Labor Department. It reads: "We (the El Paso detail) estimate that the use of the new alien detection tower has been instrumental in our officers apprehending upward of thirty aliens a month that otherwise would never be caught."

At present, part of the Canadian border is well guarded by a series of radio towers stretching from Vermont to Michigan. These mechanical alien spotters are located at Derby Line, Richford and High Gate, Vt.; Rouses Point, Chateaugay, Massena and Buffalo, N. Y., and Detroit and Marine City, Mich. Two more are under construction at Pembina, N. D., and Lynden, Wash. It is the aim of the immigration service to have both borders under constant radio supervision from coast to coast. To complete the protection of the Mexican border, stations are under con-



Top, capture of aliens being smuggled across border in car. Bottom, inspector spotting aliens attempting to cross Rio Grande

struction at Brownsville, Laredo and Alpine, Tex., and El Centro and Chula Vista (San Diego), Calif.

In the confidential files of the Labor Department is a description of the activities of the El Paso towerman and two inspectors in the act of catching four aliens. The report is from Chief Patrol Inspector H. C. Horsley of the El Paso district. It says: "Through the receiving set in my office, I heard the following conversation:

"Towerman; 'Calling Car 26; calling Car 26! Proceed cautiously to the foot of Oregon street as I see four men crossing the river—Car 26—they are hiding in the brush near the river—proceed there.'

"This brush is very thick and ten feet high. I went outside to watch the operations from the river bank. I could hear the radio instructions, as follows:

"Towerman; 'Cain—keep your head; don't get excited; I've got them all spotted. There is one directly ahead of you in that clump of brush.'

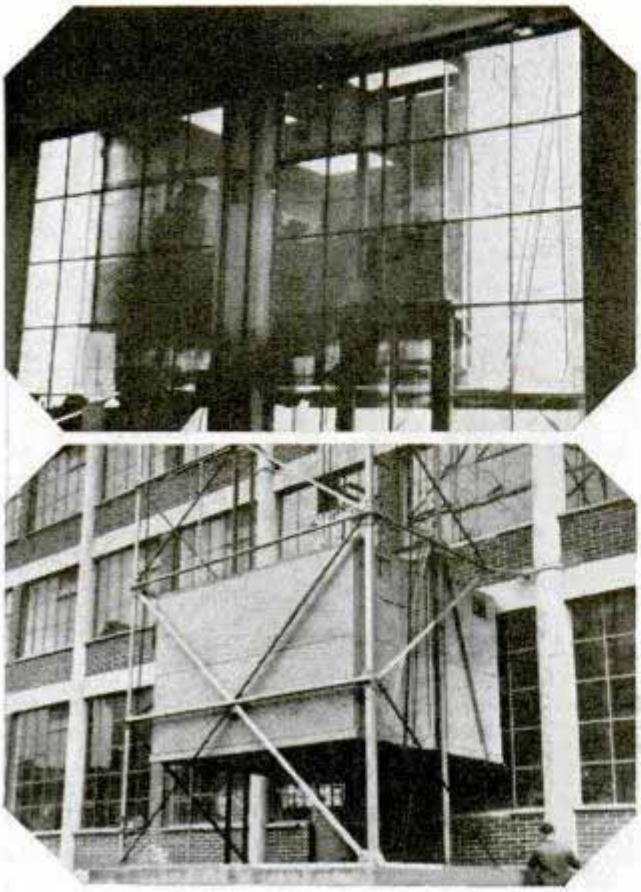
Inspector Cain dove in the bushes and came out with an alien whom he handcuffed to the car; he returned to help his brother officer round up the others.

"The voice of the towerman went on: 'One is hiding in the bridge pillars near the water's edge.' Officer MacBride dragged the immigrant out of concealment and handcuffed him to the first prisoner.

"The voice of the towerman continued with instructions: 'Now there is one away over near the Stanton street bridge in the last clump of brush.' Officer Cain hot-footed it over and made the arrest.

"The fourth alien was apprehended by Inspector MacBride with the towerman giving the following directions: 'The last one is over there on your left, hiding in the bushes—he is over there on your left —further over—that's him right there!'"

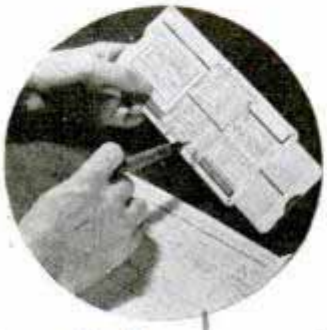
Factory Office in Elevator Travels to All Floors



Top, view of "elevator office" from inside factory, and, below, the outside appearance

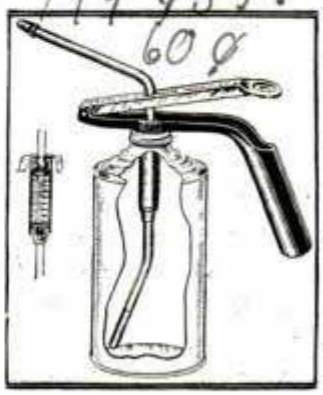
By operating a switch on his desk, the manager of a shoe factory in Czechoslovakia can move his office to any floor of the plant. His office is really an elevator, moving up and down in a shaft along the outer wall of the building. It is furnished with all necessary office equipment, including a telephone that can be used while the room is in motion; and it is insulated against heat and sound, and is lighted and heated electrically.

Handy Calculator for Trucks Shows Performance



Enabling the operator or salesman to determine quickly the performance of trucks under various conditions, a simple slide-rule calculator has been distributed to dealers by one manufacturer. The device shows at a glance the percentage of grade the truck will climb with optional tires and rear axle ratios; the speed of the truck in all transmission gears, tires and all rear axle gear ratios. A chart gives the percentage of body and payload distribution for each wheelbase.

Oil Pump to Fit Standard Can Works at Finger Touch



Developing 200 pounds pressure with light finger leverage, a handy oil pump fits standard cans. It is powerful enough to shoot a stream of oil twenty feet. The lower end of suction tube is turned to the front so that it remains submerged when the can is tipped forward, making possible the complete draining of contents. The pump has many uses around the garage, factory, farm, shop and home.

Fossil Hunters Turn Detective in Search for Oil Strike

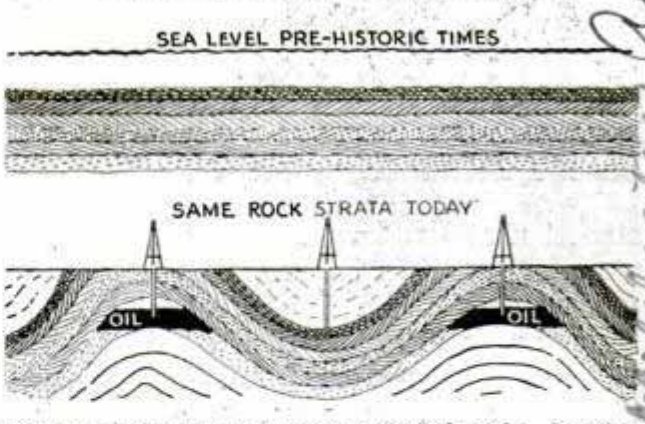


Diagram shows how pressure folded rocks, forming oil pockets. Study of rock averts drilling useless wells

Fossil hunters in laboratories far from the oil fields are searching for oil with microscopes. Once a well brings in oil, samples of the rock strata through which the drill passed are examined microscopically to identify the fossils that formed those rock layers. Once identified by the paleontologist, these fossils from successful drills are signals for the oil prospector.

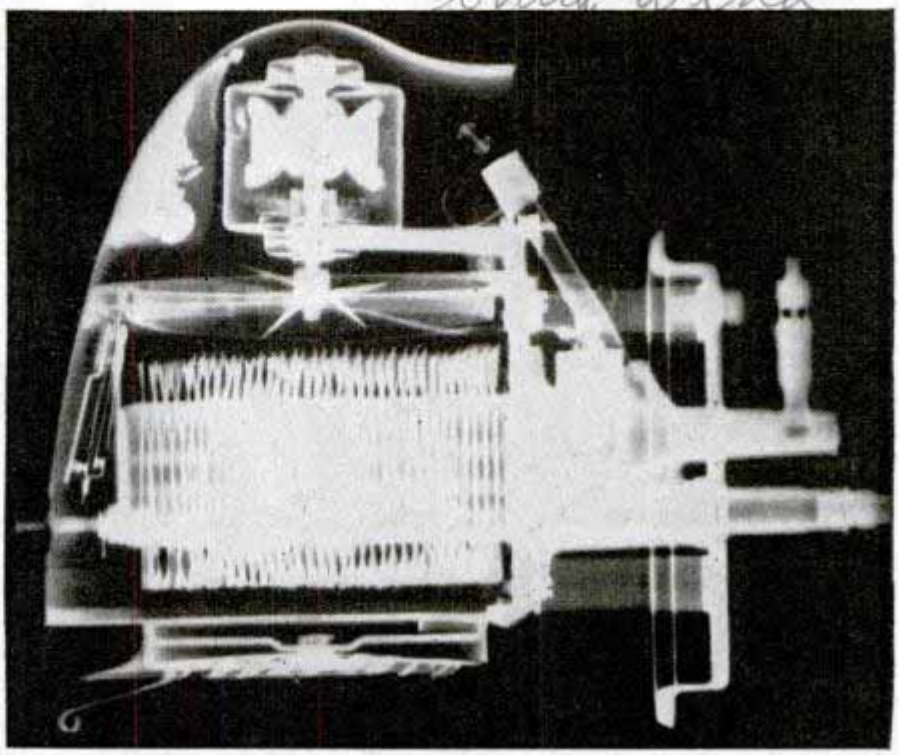
Engineers hunt a surface outcrop of similar rock, send samples to the paleontologist and if its fossils are the same, prospects are good for another paying well. By analyzing these fossil strata the probable depth of the drill can be gauged.

Air Bubble Test Finds Balance in Brake Drum

Perfect balance for brake drums is determined in one automobile factory by the bubble test. A bubble of air floating in solution on a circular dial stops at dead center when the drum has been honed to the point of exact balance. If the bubble is off center the drum is marked for further honing.

Note tiny bubble in indicator which inspector is steadying with his left hand

X-Ray Photo of Auto Heater Reveals Its Internal Design



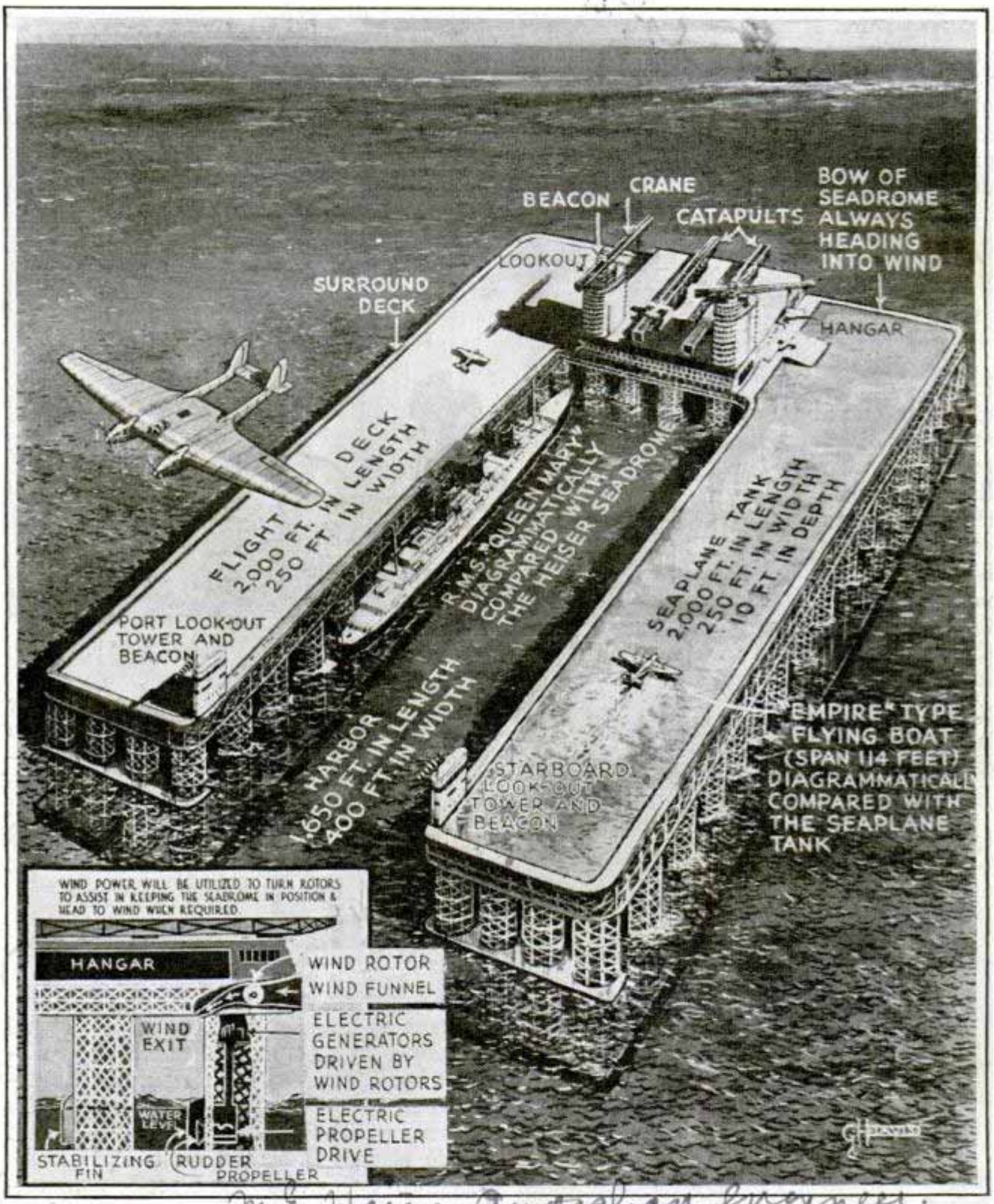
Here is how an automobile heater looks to the X-ray camera. Photo shows some parts housed in metal castings three inches thick

Regarded as opening up a new field for inspection of commercial products, an X-ray photograph of an automobile heater has been produced successfully. The photo was made through a sheet-metal wall. It shows parts housed in metal castings three inches thick, thus revealing the internal structure clearly.

Bent Radio Beam Guides Pilot to Blind Landing at Airport

Bent radio signals from underground antennas in a pit at the center of an airport hold promise for safe landing of aircraft in foggy weather. The plane glides down a path marked by equal strength of radio signals indicated on a dial in the cockpit. One wave goes directly from antenna to plane, and another goes from transmitting antenna to the ground and then is reflected to the plane. By placing the transmitter in a subterranean compartment the hazard of lofty antenna at the edge of the airport is eliminated, and only one antenna is necessary. It is mounted on a turntable and can be swung around according to wind directions.

Floating Base Proposed for Ocean Air Liners



M.L. Heiser, Australian Engineer.

This is a drawing of the Heiser seadrome, proposed as a means of permitting land or sea planes to break their flights between Europe and the United States. The seadrome is U-shaped, with a 2,000-foot tank for flying boats and a 2,000-foot deck for land planes. Inside the "U" is a ship harbor, 1,650 feet long and 400 feet wide, large enough for liners of the "Queen Mary" type. The seadrome would not be anchored. It would be constructed of steel tubes built up on girder-work columns mounted on pontoons sunk 150 feet below the action of wave currents. Air currents agitate water to a depth of sixty feet, at which point pressure increases with depth until there is enough upward force to sustain the structure in position as the centrifugal force of the earth keeps the ocean in place. To help hold the seadrome into the wind, wind rotors would drive generators to supply power for twelve giant propellers. Two large rudders would be used for steering

California Journal of Commerce & Industry 2/27/37 P. 356.

506 - 47th Ave San Francisco, Calif

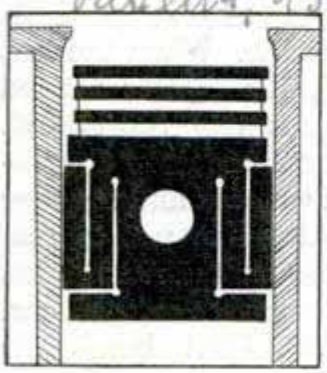
Sky Clipper Drops in on Tropic Port for Gas

At the foot of a palm-grown hillside in the harbor of tropical Pago Pago, Samoa, the Pan-American Airways clipper ship rests while "gassing up" during its first flight from America to New Zealand

At home in strange surroundings, the Pan-American Clipper came to rest in tropical waters at Pago Pago, Samoa, on its pioneering flight from California to New Zealand. The trail-blazing experimental plane was the first of its line to "gas up" in the Samoan harbor, which nestles beneath a palm-covered hillside.

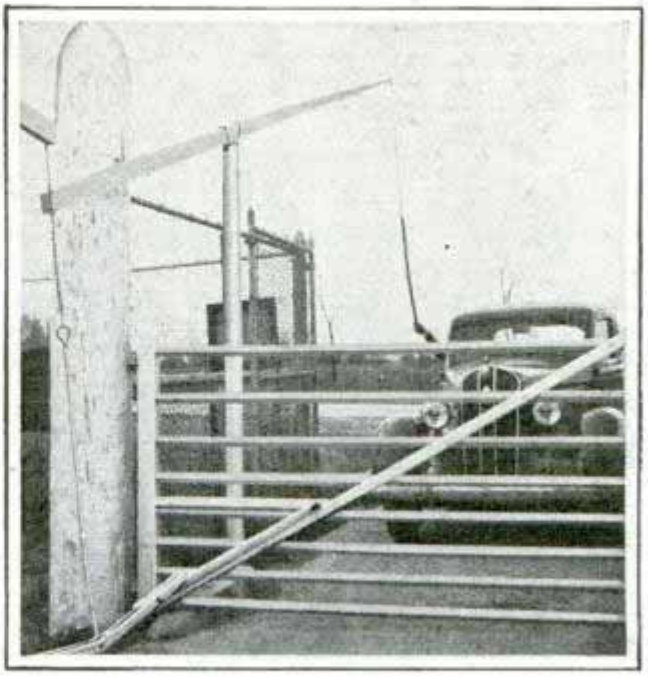
Piston "Breathes" to Conform to Cylinder Walls

Designed to produce a "breathing" action that makes it conform to the cylinder, a new resilient-type piston fits standard auto engine cylinders. It has a self-compensating bearing surface that closely follows tapered walls of the cylinder. A slotted arrangement insures adequate lubrication and heat dissipation and prolongs the life of piston rings. The flexible construction is said to reduce slap and drag and to safeguard against contraction and collapse of the piston.



Gate Is Operated from Auto by Pulling Handle

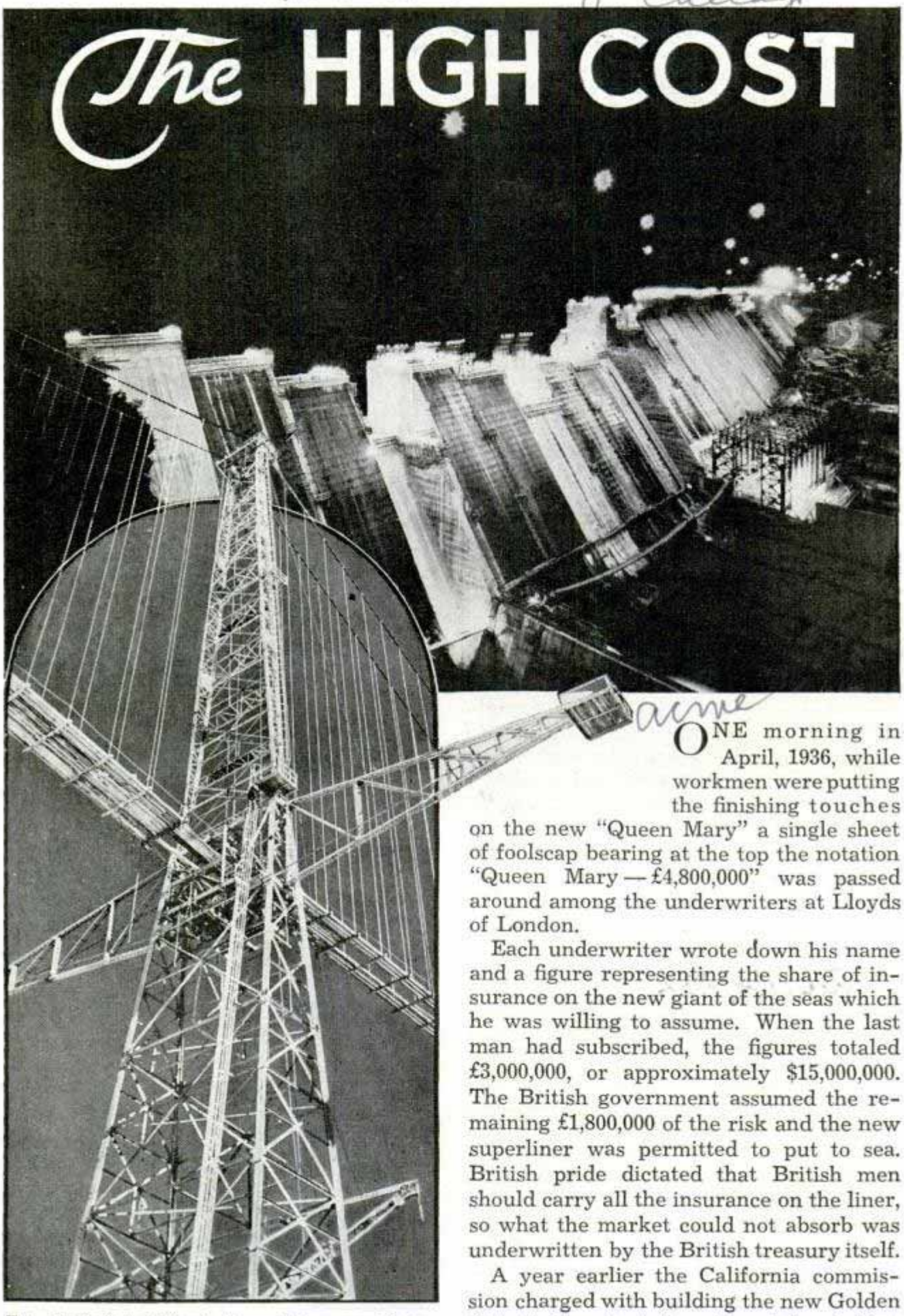
One home owner has rigged up a gate which may be opened or shut by reaching out of the automobile window and pulling a handle. Tugging at the handle opens the gate. After the car has passed through, the driver pulls another handle on the other side and closes the gate.



Driver easily opens the gate by pulling on handle. Closing gate is as simple

es 21 ? Mr. Jay Carle Miller
168 N Michigan Ave
Chicago

The HIGH COST



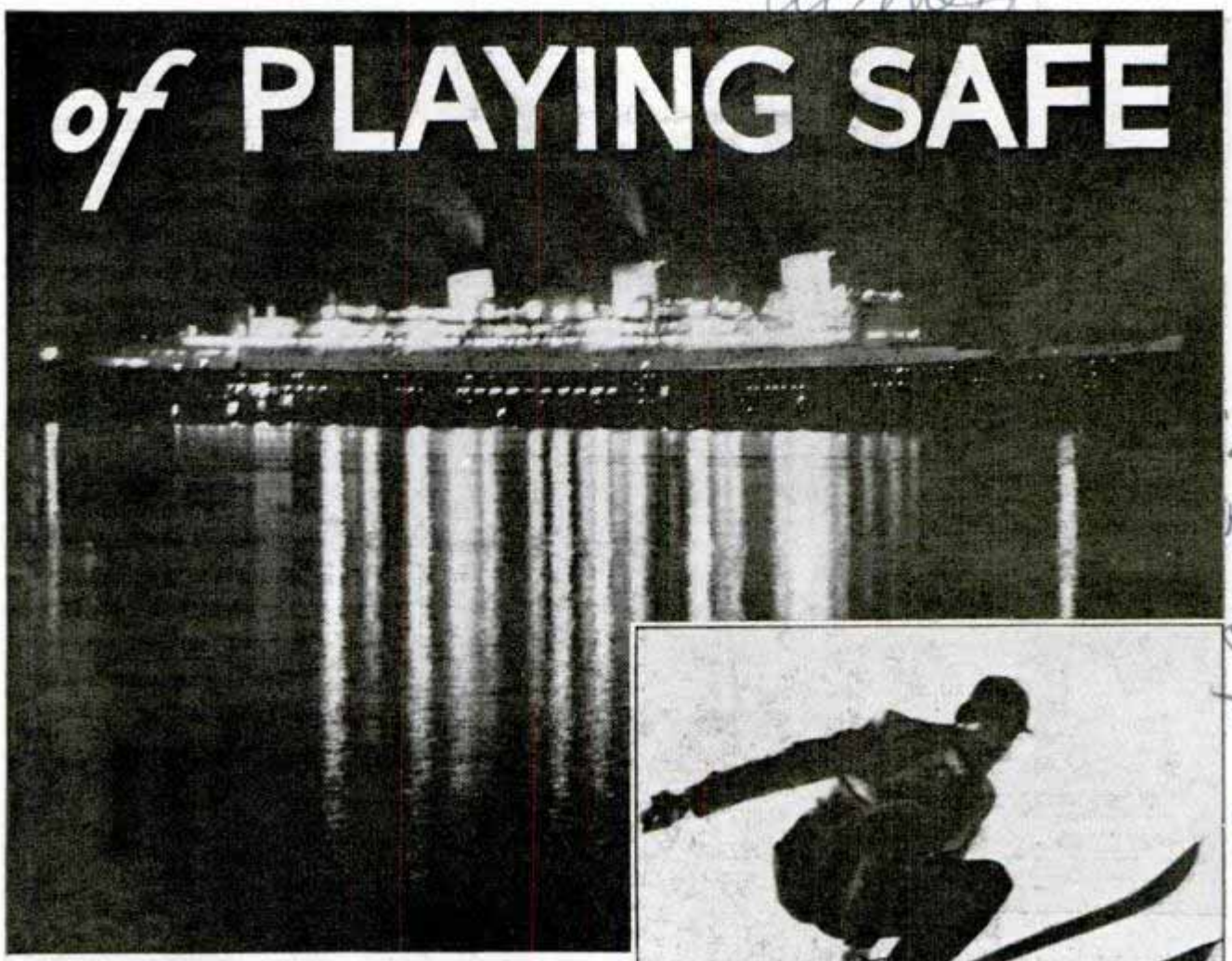
Top, night view of Norris dam. Bottom, gravel conveyor tower at Grand Coulee dam. Both projects call for vast insurance coverage

ONE morning in April, 1936, while workmen were putting the finishing touches on the new "Queen Mary" a single sheet of foolscap bearing at the top the notation "Queen Mary — £4,800,000" was passed around among the underwriters at Lloyds of London.

Each underwriter wrote down his name and a figure representing the share of insurance on the new giant of the seas which he was willing to assume. When the last man had subscribed, the figures totaled £3,000,000, or approximately $15,000,000. The British government assumed the remaining £1,800,000 of the risk and the new superliner was permitted to put to sea. British pride dictated that British men should carry all the insurance on the liner, so what the market could not absorb was underwritten by the British treasury itself.

A year earlier the California commission charged with building the new Golden Gate bridge started work, not by sinking a caisson for one of the mighty 746-foot

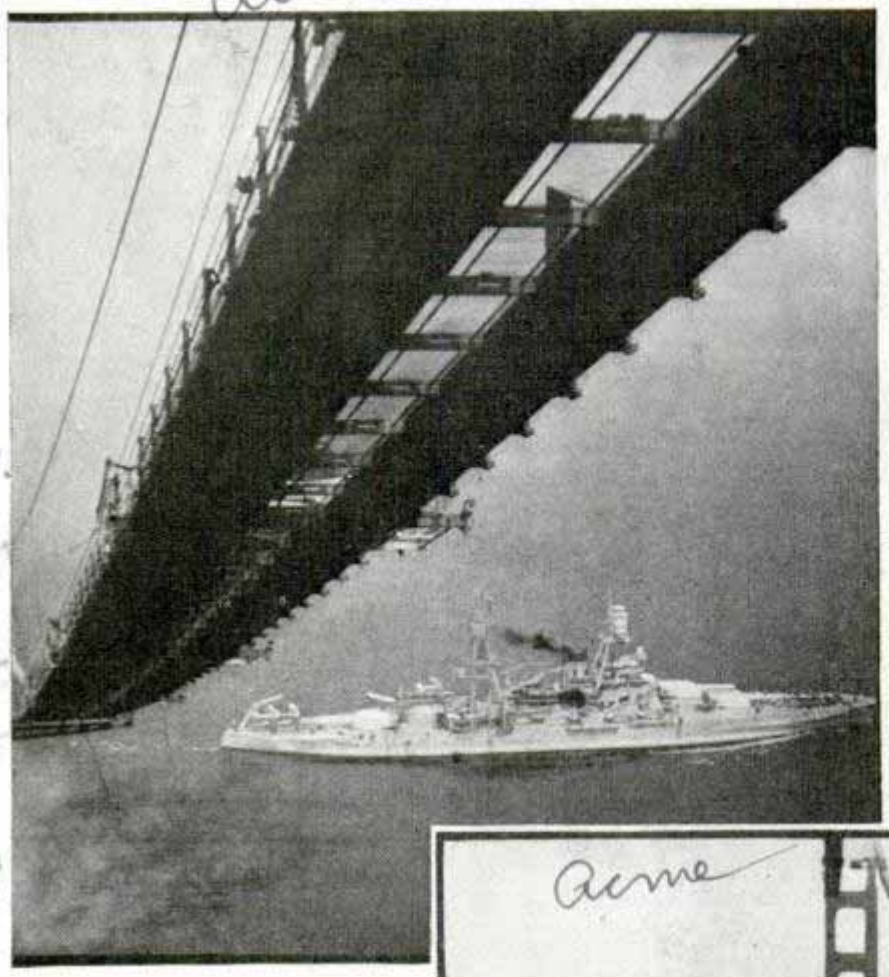
# of PLAYING SAFE



Top, the "Queen Mary" at night. Bottom, well-executed skiing maneuver. The ship and the sport are insurance risks

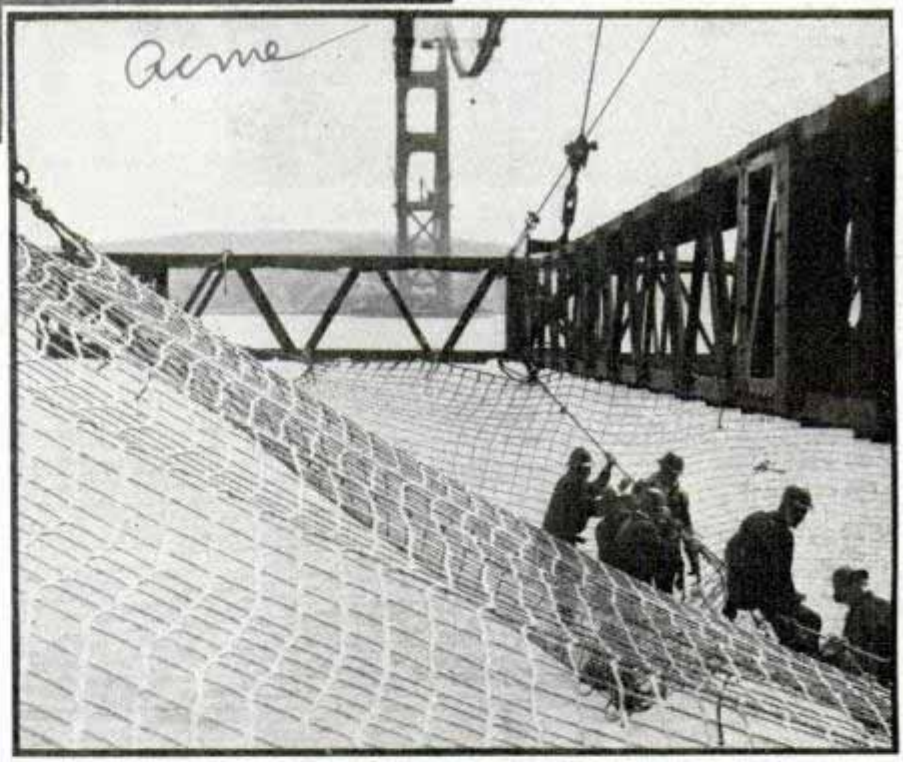
towers, but by applying for $38,000,000 insurance. Bonds sold to build the bridge were to be retired out of tolls collected from those who used the structure. Should the bridge collapse there would be no tolls and no money to retire the bonds. Insurance against that eventuality was the first step in building the bridge. Of course, no one expects a new bridge to fall, but that very thing happened twice during the building of an 1,800-foot span across the St. Lawrence a few miles above Quebec, P. Q., each time sending scores of workmen to their death.

Because of the recent accident which carried ten men to their death, the process by which the Golden Gate bridge was insured holds special interest. The $38,000,000 policy which protected the bridge commission against loss or damage from fire, lightning, flood, rising waters, ice, explosions, earthquake, tornadoes, windstorms, collisions, strikes, riots and public commotion was only a fraction of all the insurance which had to be written before the bridge could be built. Potential cov-



liability coverage. Part of the bridge was built over land, where rivets or steel beams or construction materials might fall on passers-by. There was always the possibility that the bridge or part of it might fall on a ship, killing or injuring passengers or crew, and damaging or even sinking the ship. Losses in such an accident might run as high as $50,000,000 or more.

Insurance men estimate that claims resulting from the death of the ten men last February will average from five to seven thousand dollars each, and higher if any of them had



Top, unusual view of Golden Gate bridge as battleship "Arizona" passes beneath. Bottom, safety net credited with saving eleven lives, and with avoiding compensation claims, at Golden Gate bridge

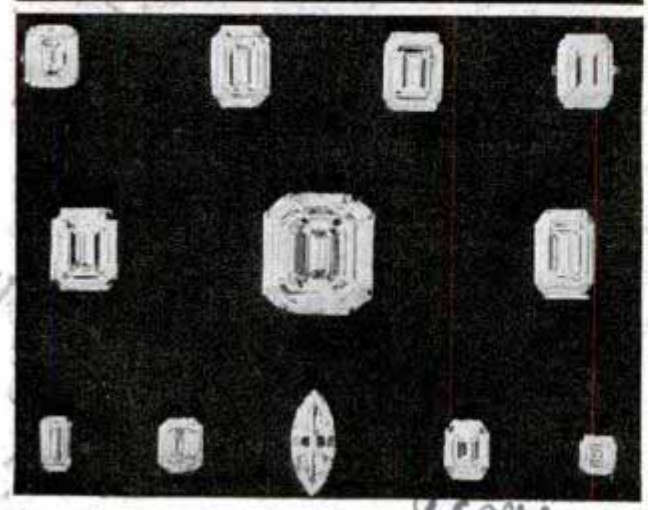
erage for this $35,000,000 bridge was in the neighborhood of 175 to 200 million dollars.

First the contractor had to file a performance bond for the full face amount of the contract. Had it been a private project this bond would have cost him $15 per $1,000, but because the government dictates a special rate on government projects he got his bond for approximately $10 per $1,000, which meant a premium of about $350,000. Next, workmen had to be protected under the state workmen's compensation law against accident or death. The California law is fairly liberal, and, because of the extra-hazardous nature of bridging the Golden Gate, the premium on this coverage was $22.51 for every $100 of payroll throughout the duration of the job. The contractor also needed public

large families of minor children. To keep down such claims the bridge engineers spent $82,000 for the biggest safety net ever woven. They announced that if the net saved even one life it would have more than paid for itself, in terms of human values. Prior to the February accident it had saved eleven lives, so it actually paid

for itself in dollars and cents of compensation claims avoided.

The huge insurance coverage required for a Golden Gate bridge, a Norris or Grand Coulee dam, an Empire State building, or one of the government office structures in Washington is divided up among several companies. On federal projects no one company may insure a portion of the risk greater than ten per cent of its combined capital and surplus, which fixes a limit of about $1,500,000 on the largest amount any one American company can carry. Casualty companies usually divide a $100,000, $500,000 or $1,000,000 contract into tenths, spreading the risk among ten companies. A $2,000,000 policy may be divided into twentieths. In this way the companies avoid the added perils due to concentration of the risk in one small territory, where a single accident might wipe out all of the men employed.



Top, factory fire. Center, Jonker diamond. Left, British imperial state crown. Bottom, stones cut from Jonker diamond

Concentration of risk is always an extra hazard to the insurance man. In 1935 the S.S. "President Roosevelt" arrived in New York harbor with a package about the size of a shoe box locked in its registered-mail strong room. Had anything happened to that package American insurance companies would have been out $2,000,000, for it contained the Jonker diamond, fourth largest stone in diamond history. The stone, despite its 726 carats of weight, could have been slipped into a vest pocket and carried away. When a two-million-dollar risk can be carried in one's vest pocket, concentration of risk has about reached its limit.

Underwriting the Jonker diamond was the largest insurance operation of that particular type ever placed in the Amer-

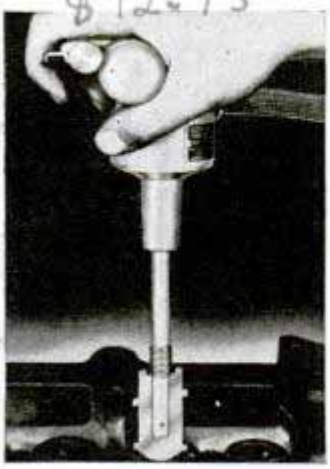
(Continued to page 118A)

Radio Built in Refrigerator Tunes in Recipe Program

Tuning in radio set built in top of electric refrigerator to listen to music or recipe broadcast

One electric refrigerator has a five-tube radio built into the top, so that housewives can tune in on recipe programs or listen to music while at work in the kitchen. Refrigerator tops equipped with radio or without it are interchangeable simply by lifting one off and installing the other.

Air-Powered Valve Grinder Has Variable Speed



Adjustable to speeds of 600 to 6,000 strokes per minute, a pneumatic valve grinder now on the market oscillates and rotates the valve to produce a compression-tight valve seat. As the valve is oscillated it is advanced automatically one-sixth of a revolution at each stroke, being turned continuously. Constructed without cam or gear the grinder has few wearing parts. At high speed its abrasive action meets requirements for grinding hard valve seats satisfactorily. The grinder is moderately priced.

Handy Foot Switch Controls Power Tools Safely

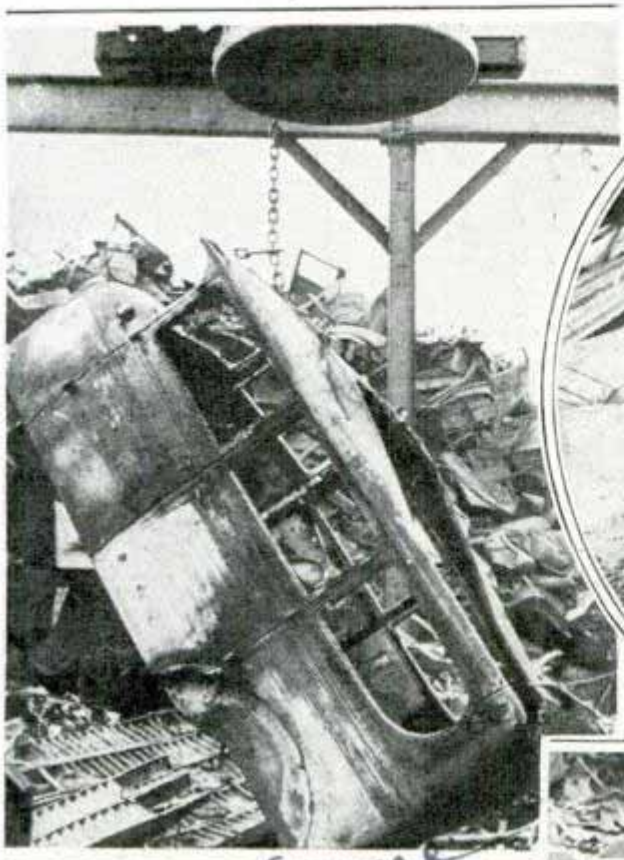
Giving positive and safe control for power tools, a handy foot-operated switch is available for starting and stopping electric motors in the workshop. Applying slight pressure on the pedal switches on the motor. When the job is completed, releasing pressure stops the motor. The control allows the craftsman to use both hands in handling his work. It is equipped with a five-foot rubber-covered cord and cap for connecting to power outlet and an outlet for plugging in the motor.

Screws Held Firm in Plaster by Rubber Plug with Fins

To attach fixtures to plaster walls, a rubber plug which provides secure anchorage for screws in the plaster is available. Fins keep the plug from turning while the screw is inserted. Being rubber, it absorbs shock and vibration without pulling loose from the wall, and it expands to accommodate screws of three different diameters.

Six-inch "pencil" of rubber is thrust into plaster wall and cut off, leaving plug as anchor for screws

Old Auto Bodies Crushed into Small Bundles



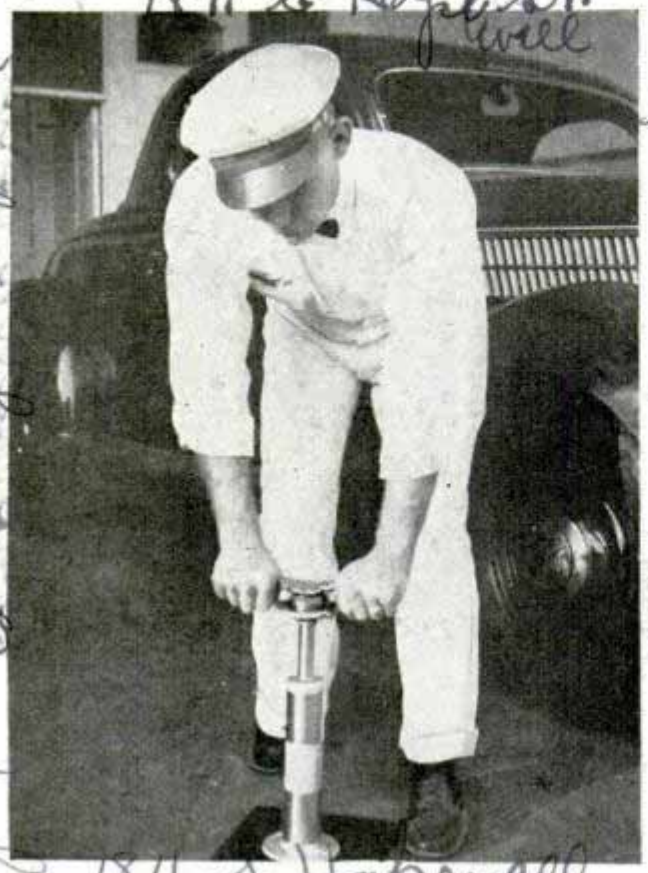
Compressing auto bodies into small bundles of metal, a large crushing machine is speeding up work at one junk yard. After broken glass and other useless materials are removed, the giant jaws of the crusher compress the car body. Then a big battering ram completes the job of smashing the metal into a package about the size of an orange crate, in which form it is delivered to smelting furnaces for remelting and further use. The crusher also converts springs, tractor parts and other steel into bundles.

Top, left, and bottom, views of old automobiles being crushed. Circle, metal bundle produced by the crushing machine

Wood Shrinkage Is Reduced by Treating with Sugar

Treating wood with sugar solutions reduces shrinkage by retaining water in the wood, according to scientists connected with the U. S. Forest Products Laboratory. When wood is treated with a twenty-five per cent invert sugar solution no shrinkage occurs unless the air with which it is in equilibrium has a relative humidity of less than sixty per cent. The shrinkage down to a humidity of twenty per cent is only one-fifth that of untreated wood. The only disadvantage is that sugar solution drips from the wood under very moist atmospheric conditions, causing loss of the sugar and subsequent normal shrinkage in the wood. The treatment is considered valuable for special uses in climates where the air is rarely saturated.

Wheel-Bearing Lubricator Speeds Servicing



Lubricating wheel bearing by pressing down on bar, forcing lubricant upward

Designed for forcing heavy lubricant into auto wheel bearings, a handy servicing device is now on the market. It consists of a cylinder that is filled with lubricant. Out of the upper end protrudes a tube flared to form a base for the wheel bearing. Placing the bearing on this surface the operator presses downward on a bar, forcing the lubricant up through the tube and into the bearing. This pressure method automatically cleans the bearing by forcing out gritty, wornout grease.

Air-Conditioned Refrigerator Needs No Defrosting

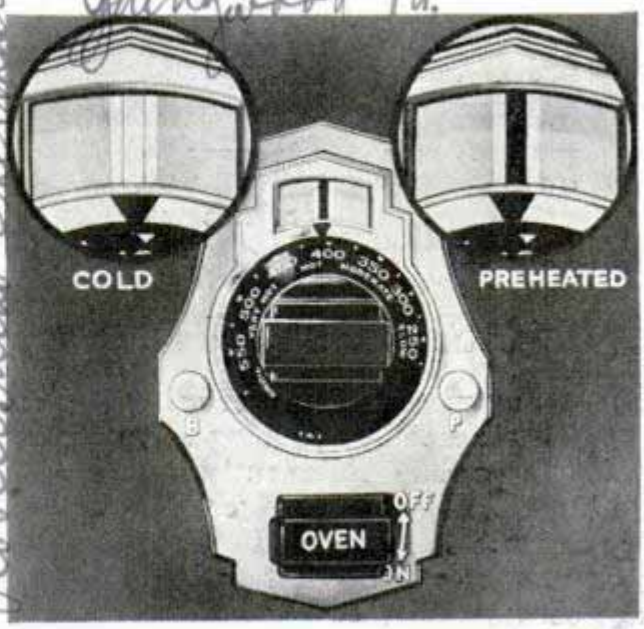
Providing air conditioning for preventing dehydration, an electric refrigerator which keeps foods fresh is on the market. It virtually eliminates odor transfer, abolishes defrosting, provides faster freezing of ice and desserts in a special compartment at zero temperatures and has a chamber for home freezing of certain foods and storage of meats, poultry, fish, vegetables and fruits. Frozen foods can be kept almost indefinitely. Completely automatic, the refrigerator has no controls.

Incline Meter Mounted in Car Shows Road Steepness

Installed in the automobile, a simple incline meter shows at a glance the correct percentage of any grade on which the car may be stopped. The meter is limited to twenty-per-cent grades because few highway grades exceed that in this country. The meter is mounted on door post or door panel adjacent to the front seat.

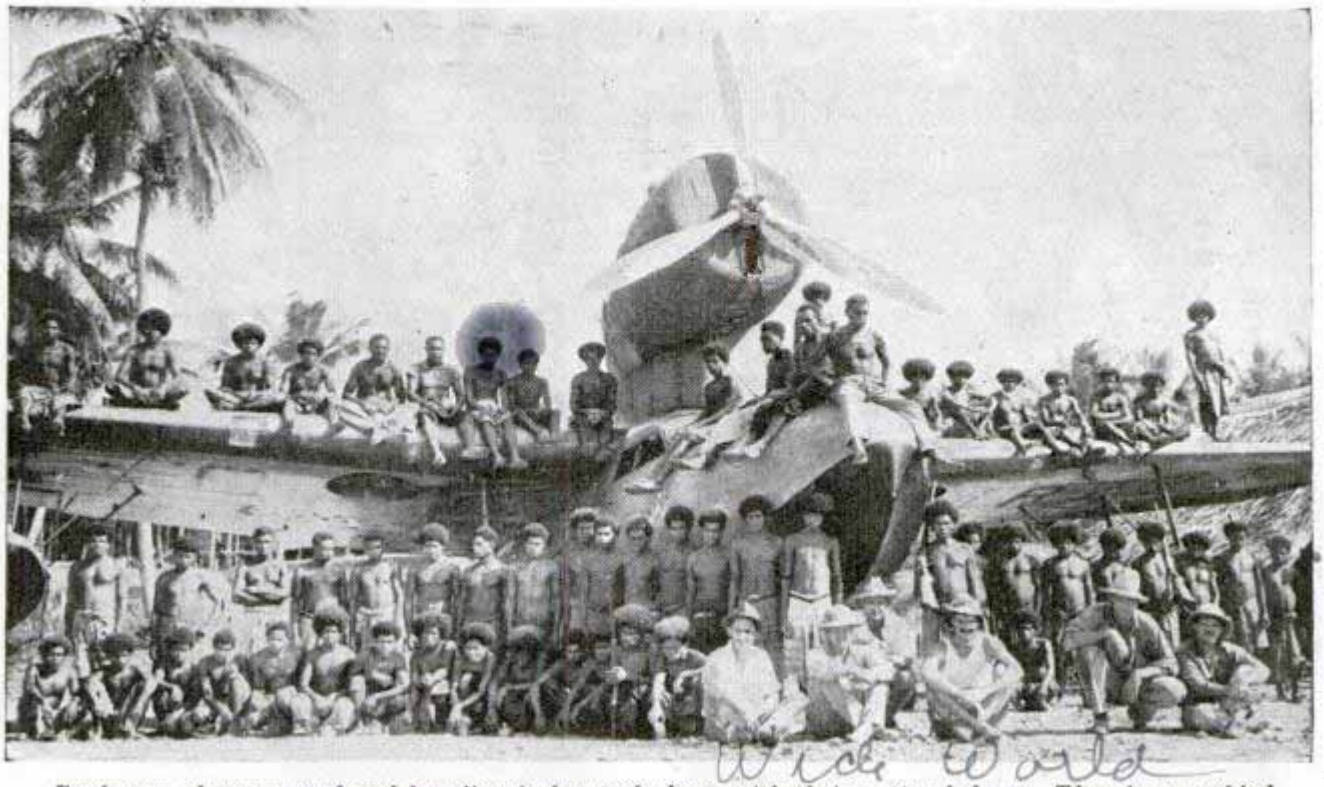
"Thermal Eye" Signals the Cook When Oven Is Ready for Food

Gas and electric ranges are now being equipped with a "Thermal Eye" which tells the cook when the oven reaches the exact temperature desired. First the cook turns a dial to the degree of heat called for, then the cake or pie is prepared. When the oven temperature is at the right degree a red indicator moves into view in a window above the dial.



When red indicator line reaches center of window, cook knows oven has reached desired temperature

Headhunters' Stronghold Explored by Plane

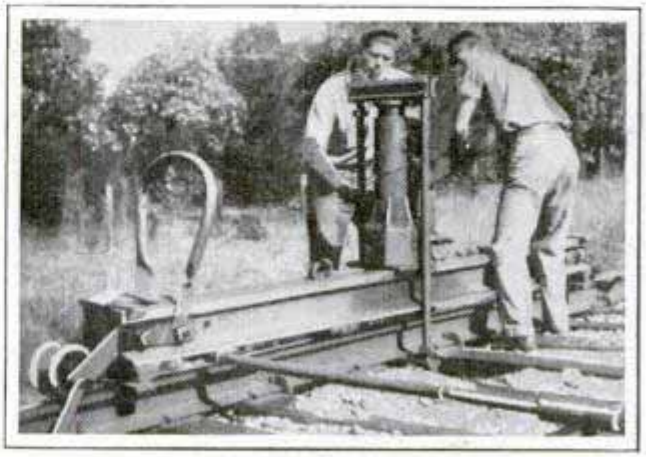


Explorers, shown seated and kneeling in front of plane, with their native helpers. The plane enabled the party to reach hitherto inaccessible parts of New Guinea where cannibal tribes live

One of the last strongholds of headhunting tribesmen was explored recently by an expedition sent out by the American Museum of Natural History. It lies in the tropical hinterland of New Guinea, a vast island north of Australia. Headed by Richard Archbold and equipped with a big airplane to maintain their line of supplies, the explorers penetrated to the sources of the Fly river, deep in the island's mountains, where the naked tribesmen never had had contact with white men. The plane enabled the party to obtain the first authoritative topographical data about areas inaccessible to explorers on foot. A storm at Port Moresby wrecked the plane, stranding the main party 800 miles from the coast, but the expedition traveled part of the way down the river on hastily constructed rafts and the rest of the way by boat and borrowed airplane. Implements and weapons, 400 species of mammal and 2,000 species of plant life were brought back by the explorers.

Rail Straightener Stops "Lurch" of High-Speed Trains

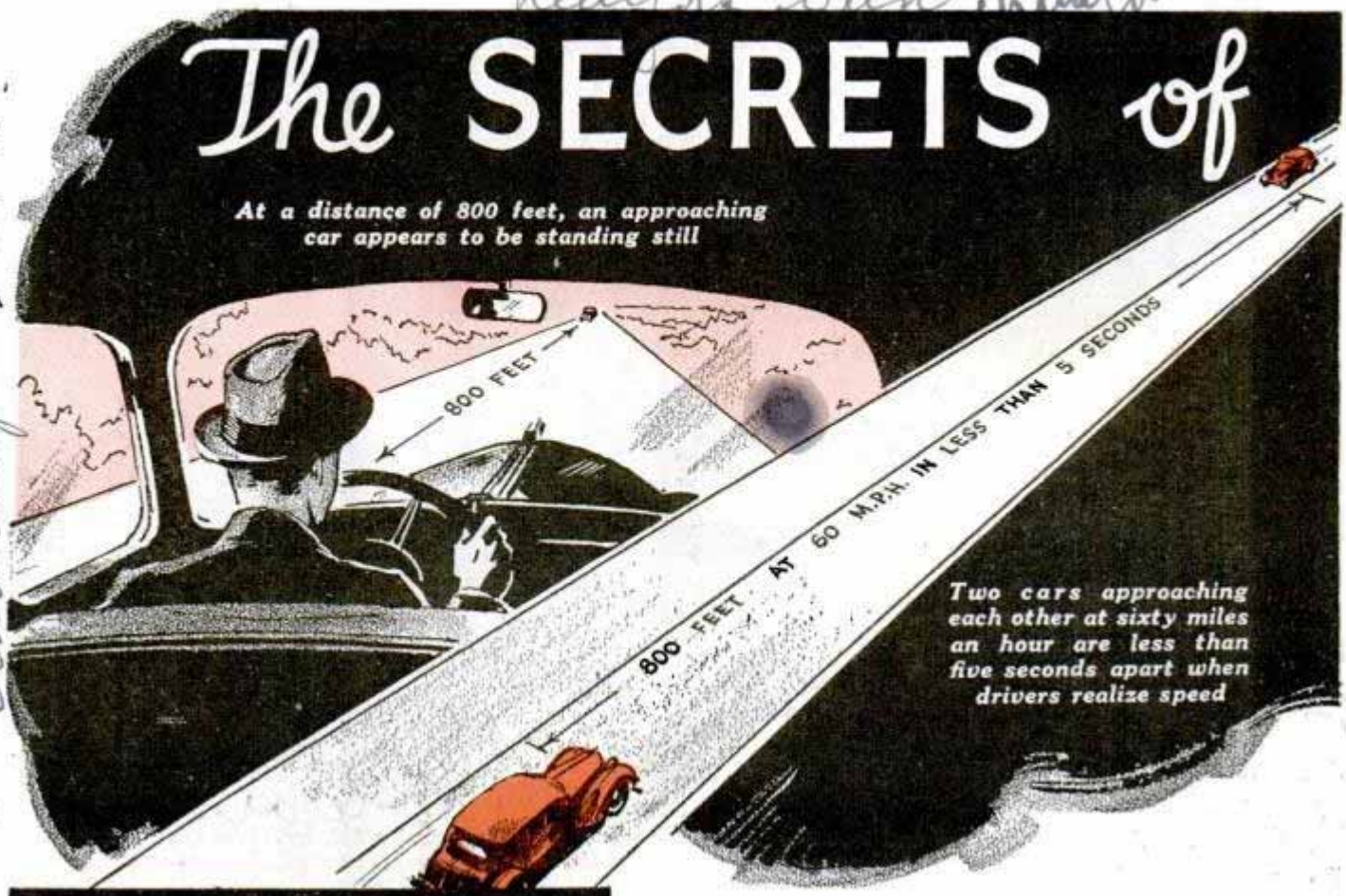
Three minutes of work with a newly devised rail straightener will take the bend out of a rail and the "lurch" out of riding on a high-speed train. It "doctors" the rail without removing it from the ties, shipping it to the mill and relaying it. A seventy-five ton jack mounted on two ten-foot steel rails furnishes the tremendous pressure necessary to correct a bent rail. It can be pushed by one man.



Putting pressure on jack to straighten out a bent rail and smooth way for fast trains

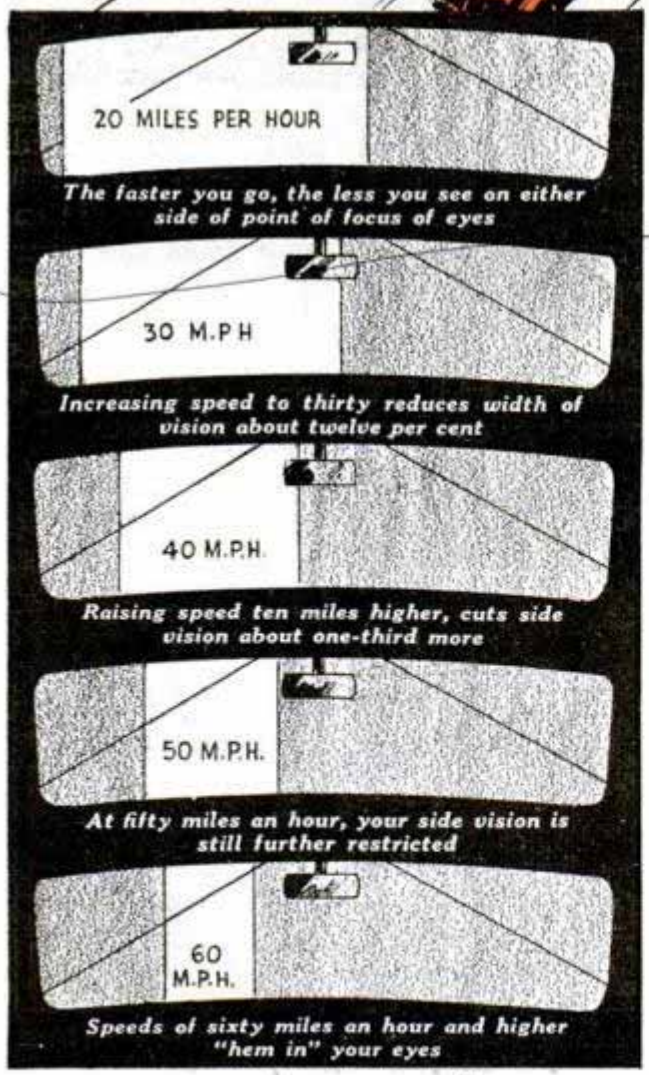
¶Our Bureau of Information will answer questions regarding articles in this magazine, if accompanied by return postage.

The SECRETS of



At a distance of 800 feet, an approaching car appears to be standing still

Two cars approaching each other at sixty miles an hour are less than five seconds apart when drivers realize speed



The faster you go, the less you see on either side of point of focus of eyes

Increasing speed to thirty reduces width of vision about twelve per cent

Raising speed ten miles higher, cuts side vision about one-third more

At fifty miles an hour, your side vision is still further restricted

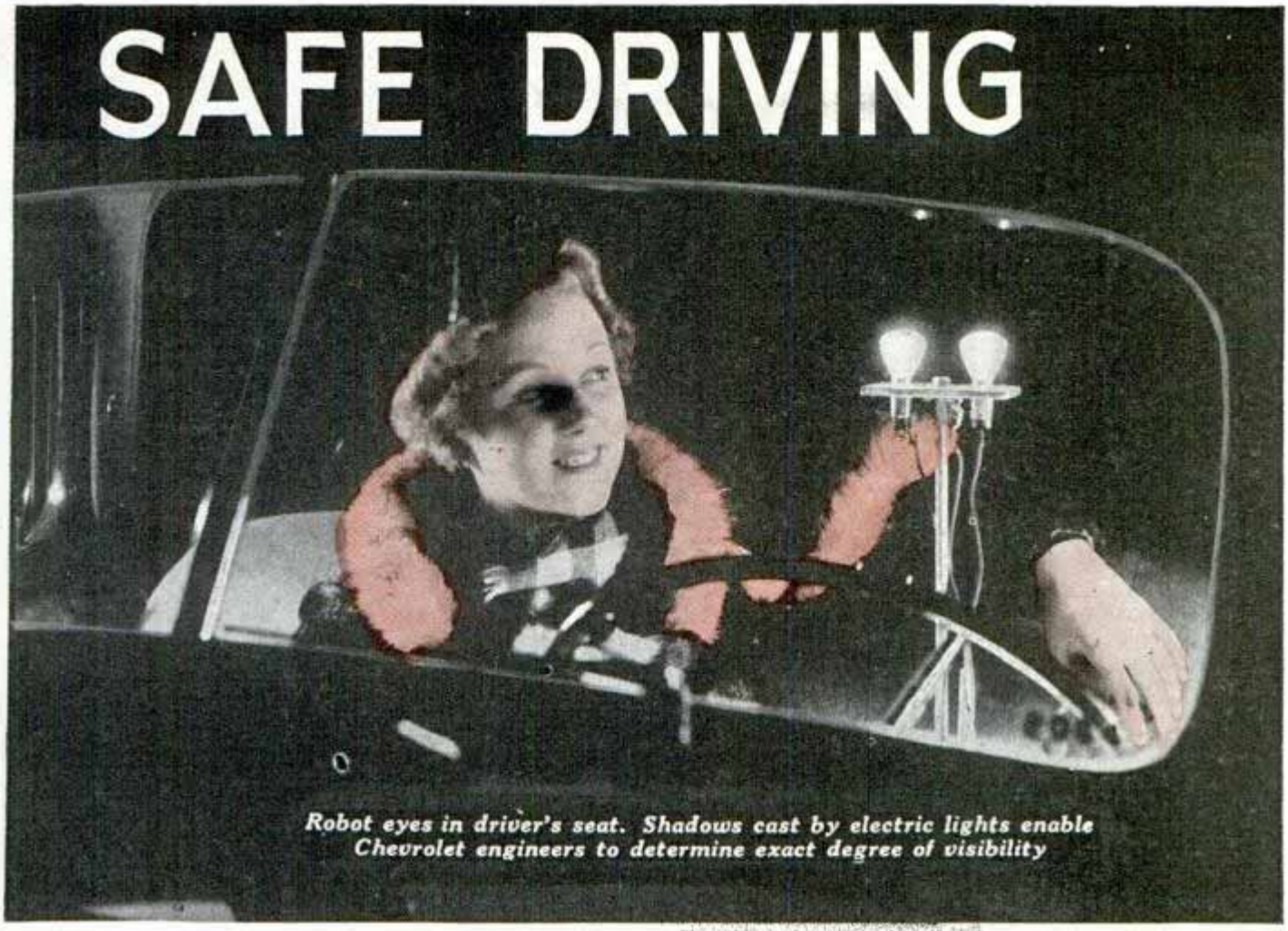
Speeds of sixty miles an hour and higher "hem in" your eyes

"THE average man's reflexes are not fast enough to handle the top speeds of today's automobiles. When the pinch comes he finds the car is driving him and not the other way around."

So says "Cannonball" Baker who has driven more than 3,000,000 record-smashing miles and averaged one broken record for each 1,000 miles he has driven. He beat the Twentieth Century Limited from New York to Chicago. He drove across the continent with no stops except for refueling. He made a trip from New York to Miami, 1,400 miles, on less than fifty gallons of gas. But the record of which he is proudest is that he has driven more than 120 times around the world and has been in but one accident—and that happened when his own car was standing still.

"The smart driver these days is not proud of how fast he can drive, but of how safely," says Baker. "That's the modern game—to keep out of trouble on the road. It's a real game, too, demanding thought, care and ability. The smart driver is really driving four cars: his own, the car behind him, the car ahead, and the car he can't see, around the corner. Any one of the four can get him into a jam, and

SAFE DRIVING



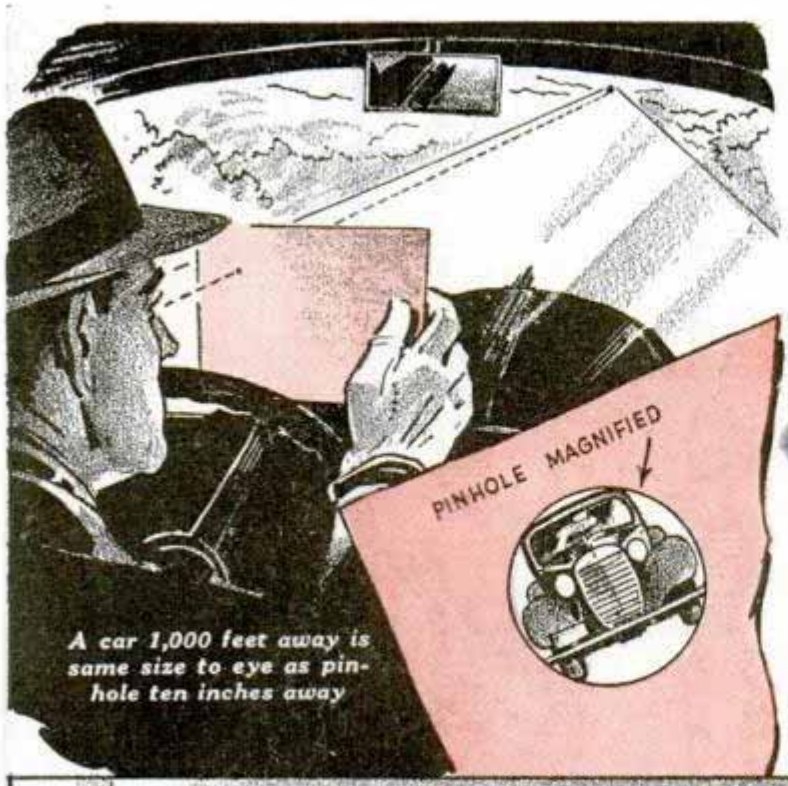
Robot eyes in driver's seat. Shadows cast by electric lights enable Chevrolet engineers to determine exact degree of visibility

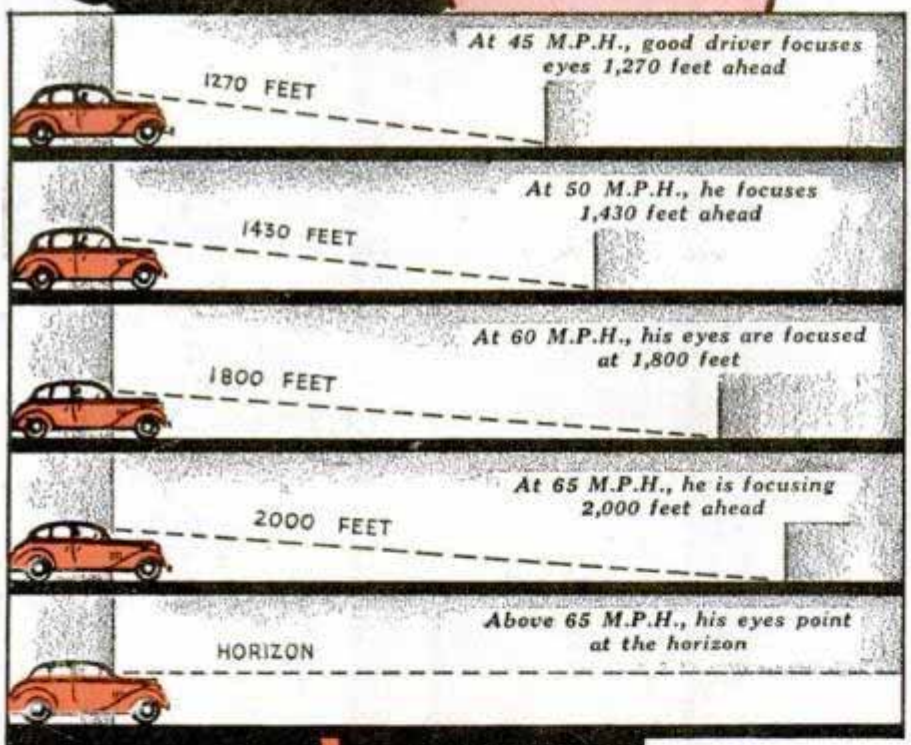
he allows for all of them.

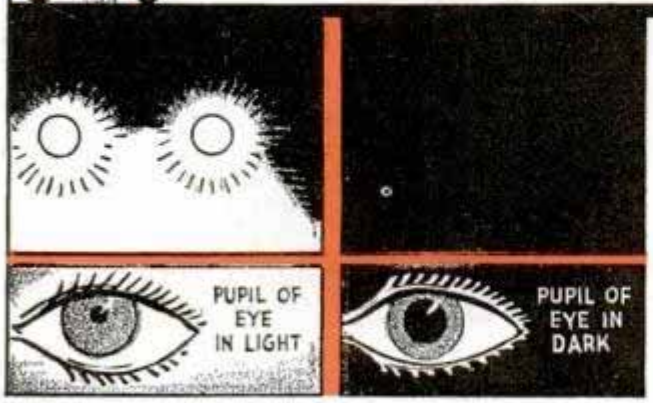
"The fellow who drives carefully and at a reasonable speed will get there about as soon as the fellow that tries to push the accelerator through the floor. Two of us left the center of Cleveland at the same time, headed for a spot five miles away. The other fellow drove as recklessly as he could, ignoring lights, cutting in and out, running on the wrong side of the road, exceeding the speed limit.

"I drove carefully, obeying all the laws. The reckless man got to the destination just thirty seconds before I did. He'd been risking his life to save thirty seconds. Seems to me that's putting up a lot for a little."

These drawings represent findings contained in book, "Safe Driving," by J. R. Hamilton and Louis L. Thurstone, published by Doubleday, Doran and Co.







Eyes adapted to bright headlights cannot penetrate darkness until they readjust themselves—and this is a slow reaction because the pupil of the eye does not enlarge quickly

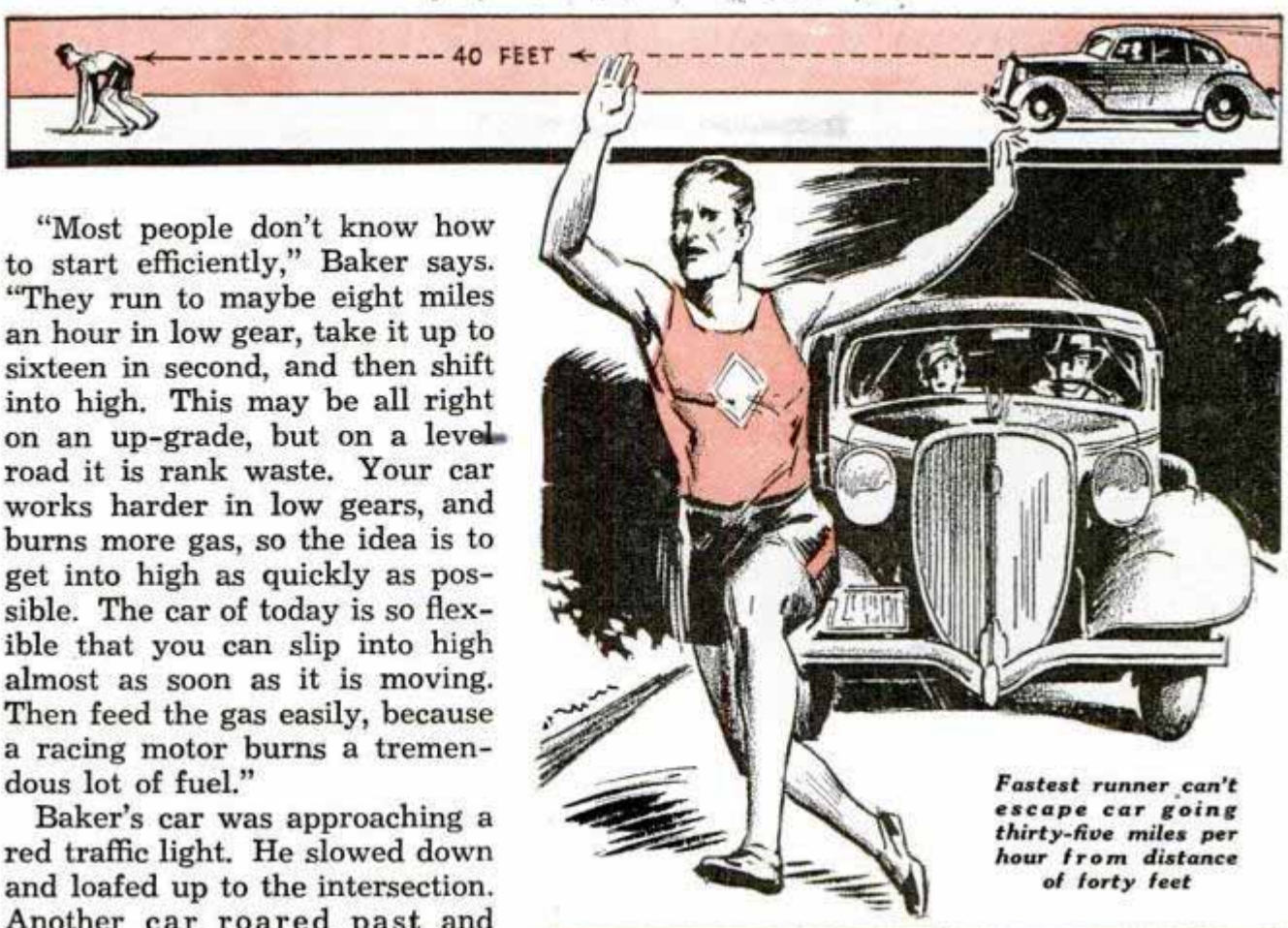
In addition to being dangerous, reckless driving is wasteful. The faster an engine turns over, the more gas goes into the cylinders, and the more oil it uses. High speed takes more out of a car than does a reasonable rate, for speed develops more friction and heat. The former is responsible for the latter, which in turn wears out moving parts of the car.

"Cannonball" also has something to say about engine temperature. On a cold morning, it is sometimes hard to start your car. And when it does catch, it sputters and performs inefficiently until it is warmed up. Every time the motor sags, every time the choke is used, gas is wasted.

"A spoonful, maybe," says Baker. "That doesn't sound like much, but it takes little time to waste a gallon. Sometimes you waste as much as one gallon out of every ten you put in the tank. A cold engine is as bad as a hot one. On a record run, I kept readjusting the radiator cover to change the engine temperature from three to five degrees every thirty miles. A check at the end of each period showed a switch of three degrees made an appreciable difference in the amount of gas burned. If you want to save gas keep your motor-meter registering as near 180 degrees as possible, for that's the point of maximum efficiency."

Baker believes in keeping his engine in perfect shape. A poor ignition system means wasted gas. A cylinder that isn't firing and imperfectly fitting piston rings both waste fuel.

But careless driving wastes even more gas. Your car burns more gas when the engine is idling than when the clutch is engaged. Therefore, when you stop the car, stop the engine. All you have to do to make it go again is step on the starter.



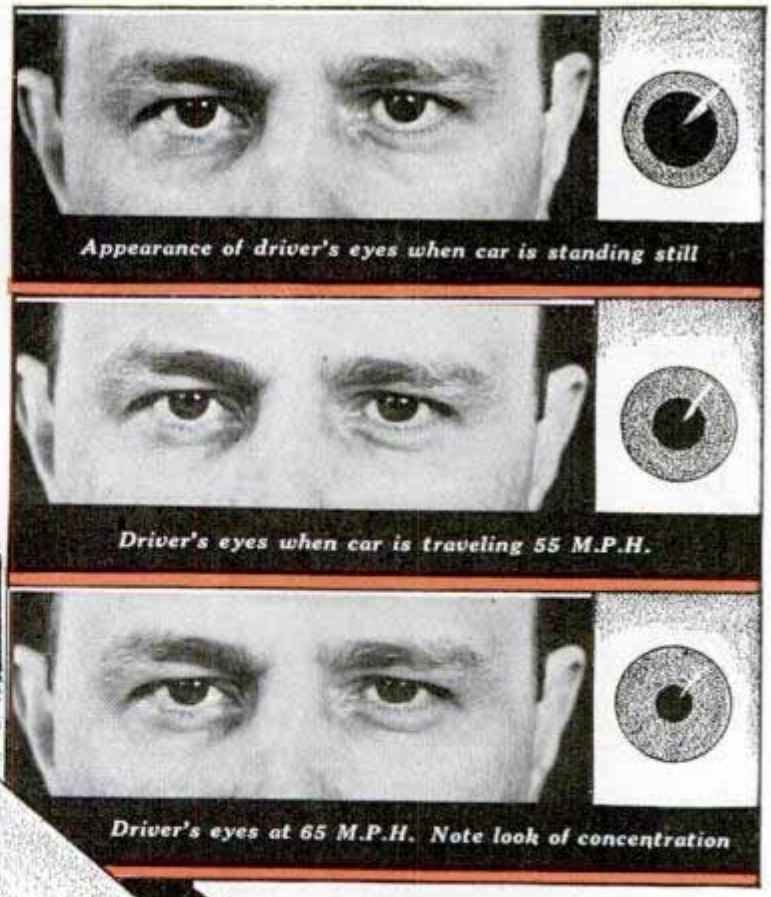
Fastest runner can't escape car going thirty-five miles per hour from distance of forty feet

"Most people don't know how to start efficiently," Baker says. "They run to maybe eight miles an hour in low gear, take it up to sixteen in second, and then shift into high. This may be all right on an up-grade, but on a level road it is rank waste. Your car works harder in low gears, and burns more gas, so the idea is to get into high as quickly as possible. The car of today is so flexible that you can slip into high almost as soon as it is moving. Then feed the gas easily, because a racing motor burns a tremendous lot of fuel."

Baker's car was approaching a red traffic light. He slowed down and loafed up to the intersection. Another car roared past and stopped with brakes screeching. It got there long before "Cannonball," but the latter didn't have to stop at all, because the light had turned green. Baker gestured toward the other car.

"What did he gain by all that

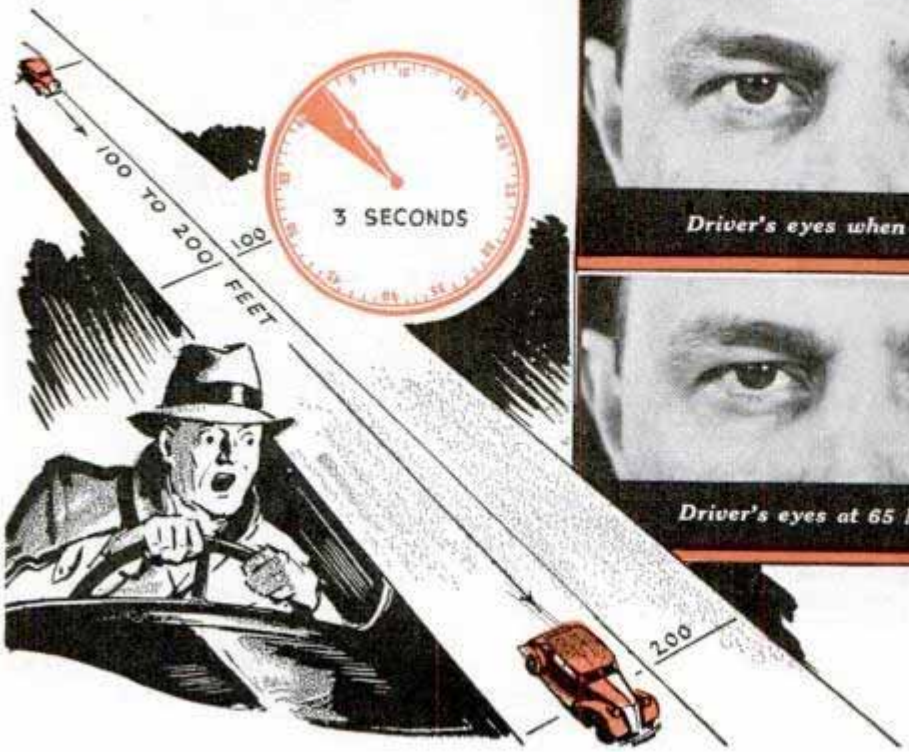
(Continued to page 122A)



Appearance of driver's eyes when car is standing still

Driver's eyes when car is traveling 55 M.P.H.

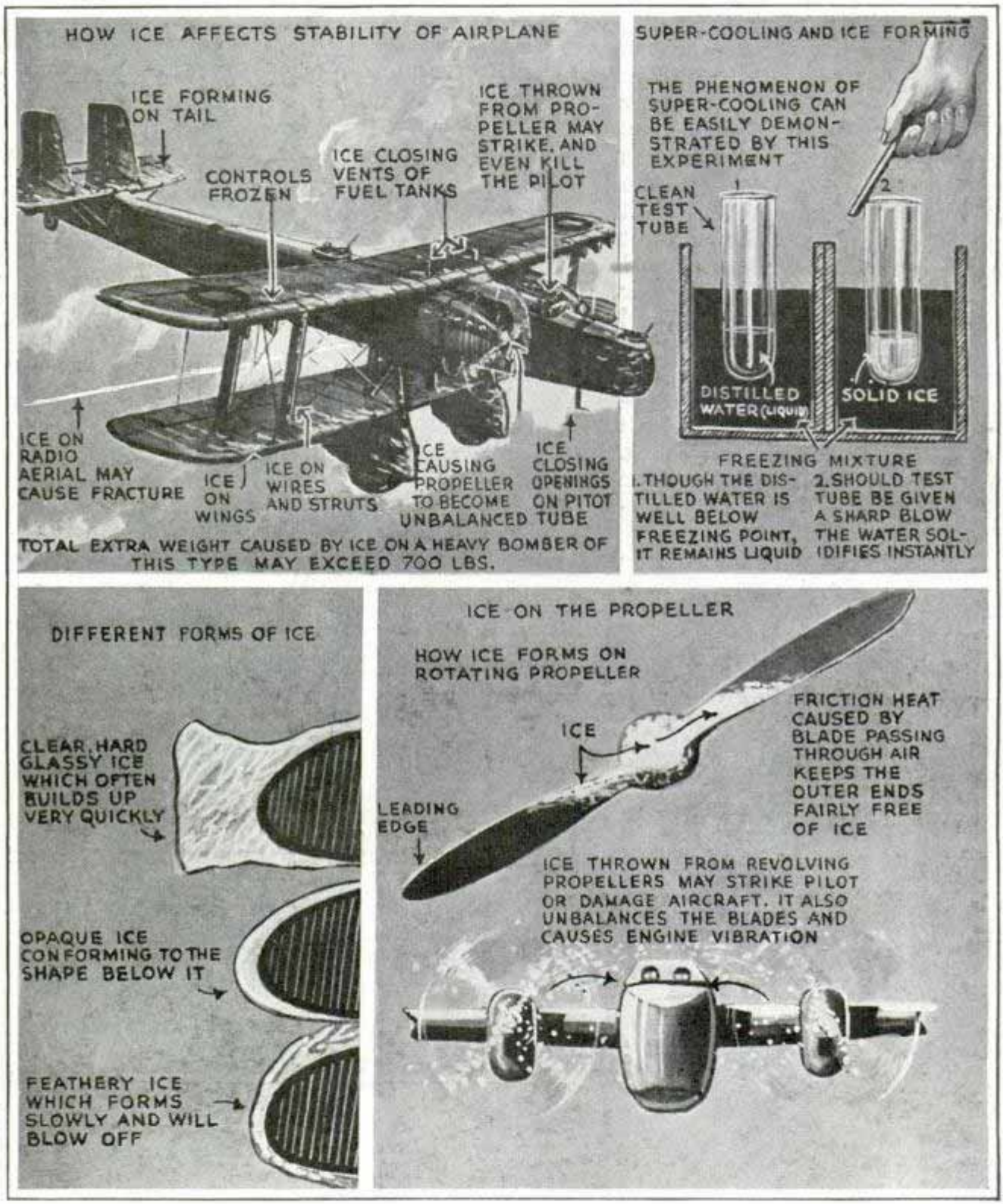
Driver's eyes at 65 M.P.H. Note look of concentration



Left, speeding car often covers from 100 to 200 feet in the one to three seconds required for completion of driver's reaction

March 13, 1937. P. 446.

Ice Formation Found Big Hazard in Aviation

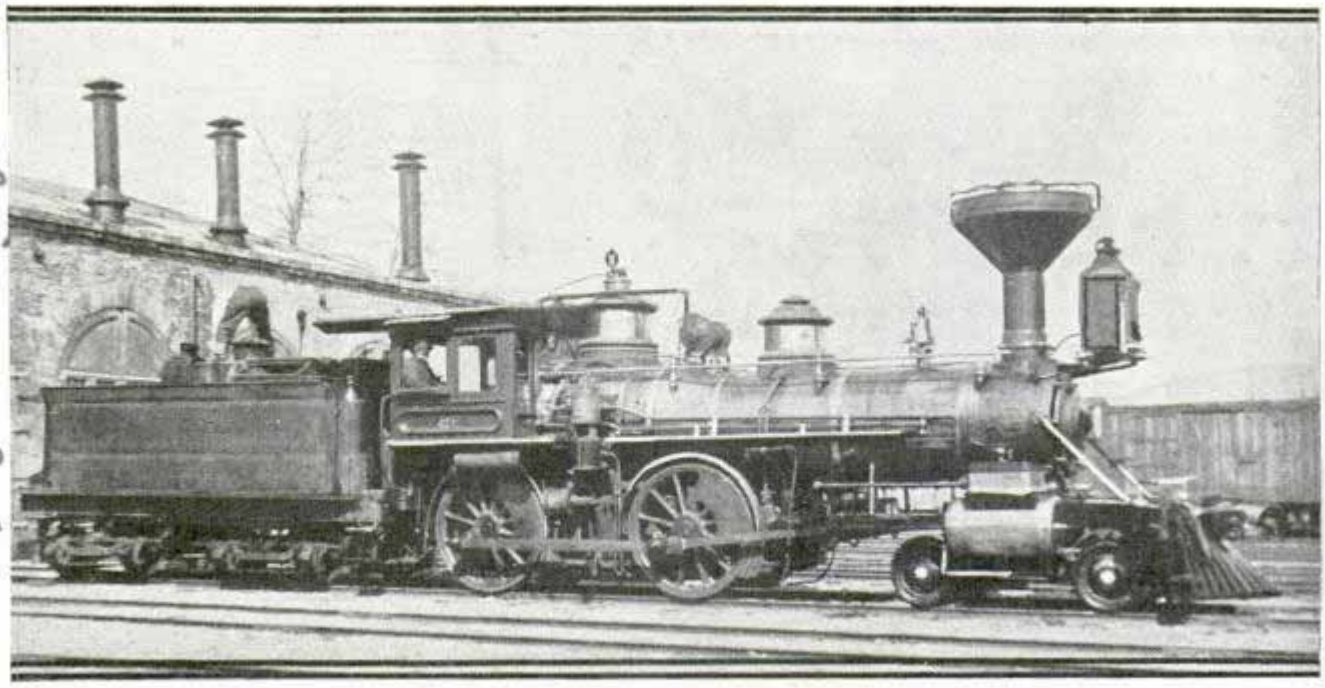


One of the biggest hazards of aviation is ice. Many planes have been wrecked as a result. Ice on the wings of any aircraft increases the drag, and unsymmetrical ice deposits on propeller blades cause dangerous vibrations of the engine. Blocking of venturi tubes and pressure-head orifices, jamming of external controls, closing of fuel-tank vents, blocking of engine air intakes, fracturing of radio aerials and other serious things can be the result of ice formations. The rapidity with which ice can form on parts of a plane increases the peril. Only recently the crash of a giant air liner in the United States was blamed on the jamming of controls by ice which formed within a few minutes while the ship flew through fog at just the temperature to accelerate freezing of moisture on the plane

Experts Fight Peril with De-Icers for Planes

Experts have been hard at work in attempts to combat the formation of ice on planes. One means of preventing formations on wings is by inflating and deflating rubber tubes placed along the leading edges. Another is by carrying the warm air of the engine exhaust into the leading edges of the wings, while a third is by covering leading edges with chemical anti-icer. Electricity has been used to heat orifices and prevent ice, and shields have been placed around control pulleys and wires. Warm gases from the exhaust have been used to prevent freezing of venturi tubes, and metal covers over working parts have solved another problem. One interesting device is an ice detector which warns the pilot of the presence of ice-forming conditions in the air by flashing a red light on the instrument panel

Old Wood-Burner Retires to Star in Movies



Old timer of a pioneer Nevada railway ready for its last run. "Brass Betsy," built in 1879 for the Virginia & Truckee line, has since quit work and left for Hollywood to star in the movies

"Brass Betsy," at fifty-eight, has retired from active service to become a movie star. The old wood-burning locomotive was built for the Virginia & Truckee railway in 1879 and hauled passengers for years between Virginia City, Carson City and Reno. At first No. 22 was a wood-burner; learned to burn coal, and then was converted into an oil-burner. Now the old-timer has reverted to wood-burning, and after its last run on the old railway has gone to Hollywood.

No-Splash Cap for Mixing Bowl Has Hole for Beater

Using electric beater through hole in cover of bowl. Cover prevents splashing

Preventing liquids from splashing out, a handy cover for the mixing bowl has a hole to permit operation of electric or hand-turned beater. The cover fits snugly around the rim and over most of the mouth of the bowl, protecting the housewife's clothing from being spattered. A similar product is the transparent zipper bag now available for keeping fruits, vegetables and salads fresh over long periods. This bag prevents dehydration and protects the food from contact with meat, fish and cheese odors in the refrigerator.

Glass Curtains for Theaters Sought in Experiments

Final tests are being made in experiments which may produce fireproof and weatherproof theater curtains made of glass yarn. Owens-Illinois Glass company engineers have been working to provide a huge curtain for the amphitheater in the

Toledo, Ohio, zoological gardens. The stage opening is sixty-five feet high by eighty-five feet wide. Developing a glass yarn strong enough when woven into cloth to support its own weight over so large an opening was the problem placed before the engineers. If such a curtain proves practical the company expects that glass curtains may replace theater curtains made of other materials. Since the curtain would be fireproof, it would eliminate use of an asbestos curtain.

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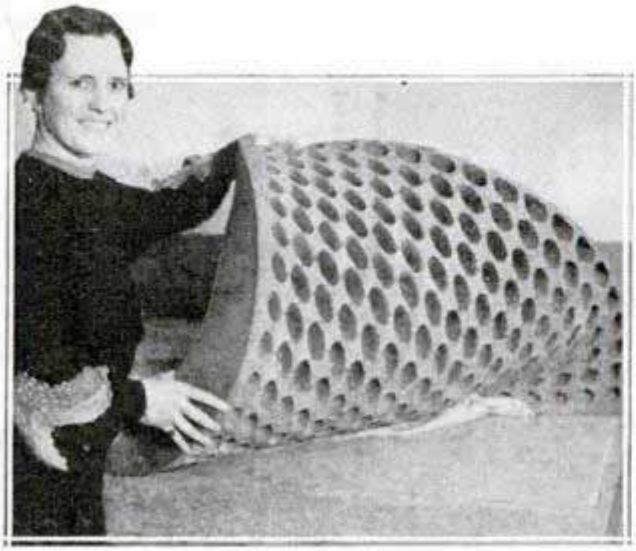
Rubber Mattress Conforms to the Body

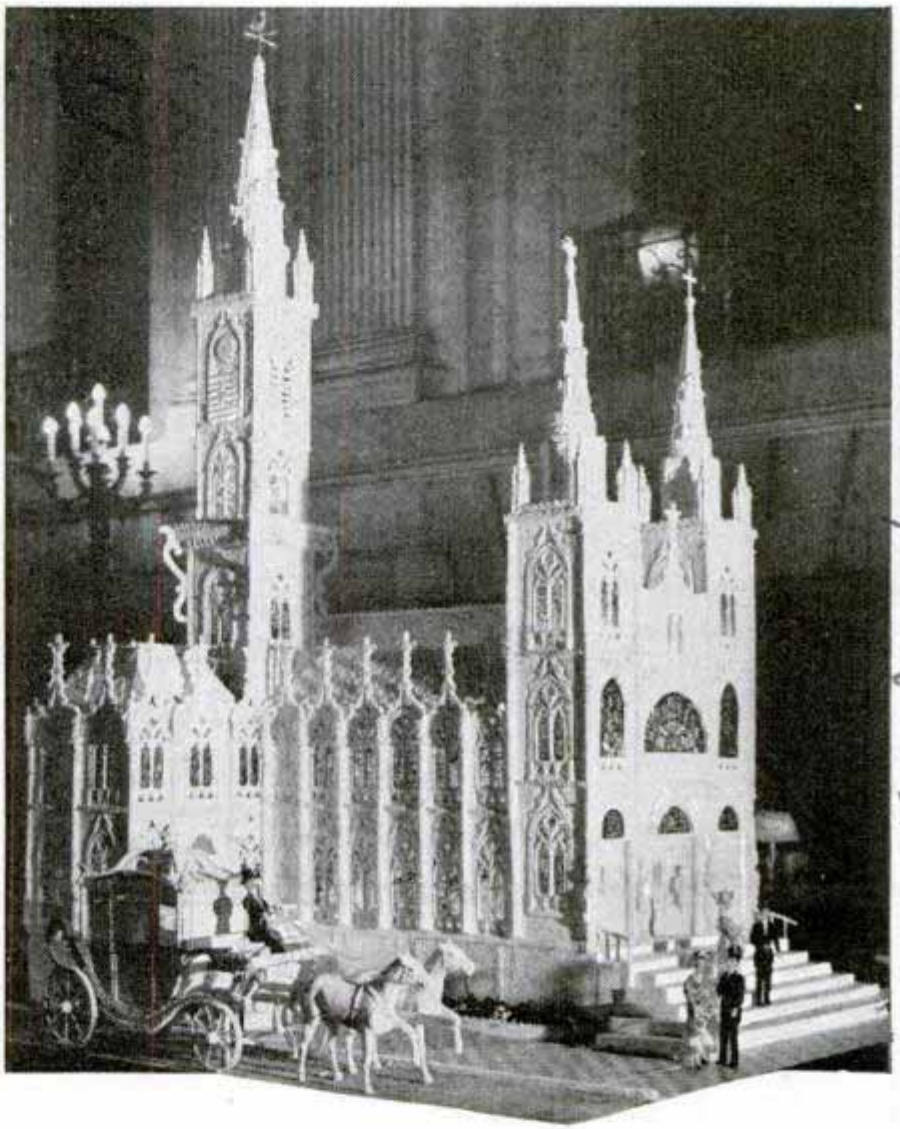
Porous, lightweight and dustless, a mattress made of rubber conforms to every movement of the sleeper's body. Air bubbles molded in the rubber give the mattress a high degree of resilience and resistance to wear. It is washable and evens itself out without being punched or shaken.



Here is the latest mattress, made of rubber. Note holes which make it resilient

Goodyear Tire + Rubber Co. Akron Ohio / not for

Seven-Foot Cake Cathedral Sculptured by Pastry Chef



This is the result when a pastry chef tries his hand at sculpture. The cake cathedral, with its seven-foot tower, contains 200 pounds of sugar

Cyrelle Lee Mugt.

Two hundred pounds of sugar went into a cake cathedral sculptured by the pastry chef of the Stevens hotel in Chicago. It was a reproduction, seven feet high, of the famed cathedral at Ghent, Belgium. The delicate tracery of the pinnacles and the windows, which were painted to resemble stained glass, required great skill. Electric lights twinkled within, and recordings of organ music added to the realistic effect. Besides the sugar, the cathedral recipe called for six pounds of gum tragacanth and six quarts of water.

¶Our Bureau of Information will answer questions regarding articles in this magazine, if accompanied by return postage.

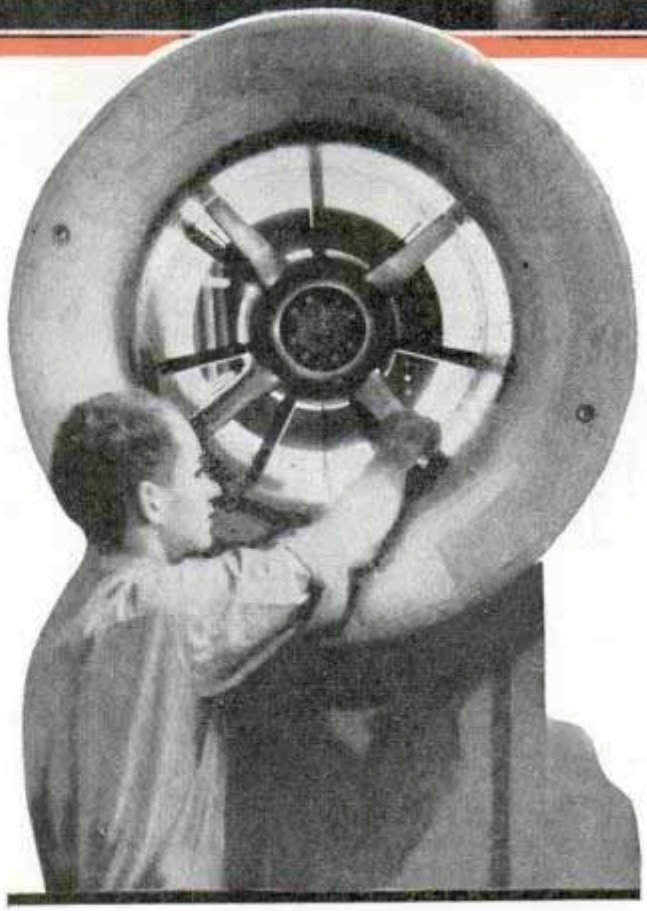
es 3/8. Mr. Chas G. Dunham, Jr.
10 555 Holmar Ave
Los Angeles, Calif

STREAMLINING

WHAT'S the price of speed? When air-line officials go out to buy some they consider $1,000 per plane a cheap price for every extra mile per hour. That seems like a lot of money, but it's worth it because the faster an airplane flies the less time it spends in the air per trip. Ten per cent more speed would save about an hour and a half on a transcontinental flight. Four flights per day means a saving of about 276 eight-hour working days per year. That's twenty extra trips free.

More power is one way to boost speed but a better investment is to do it by streamlining. Today's transports are far from perfect as far as their shapes are concerned. Most of them could fly twenty or thirty miles per hour faster on the same power if they were better streamlined.

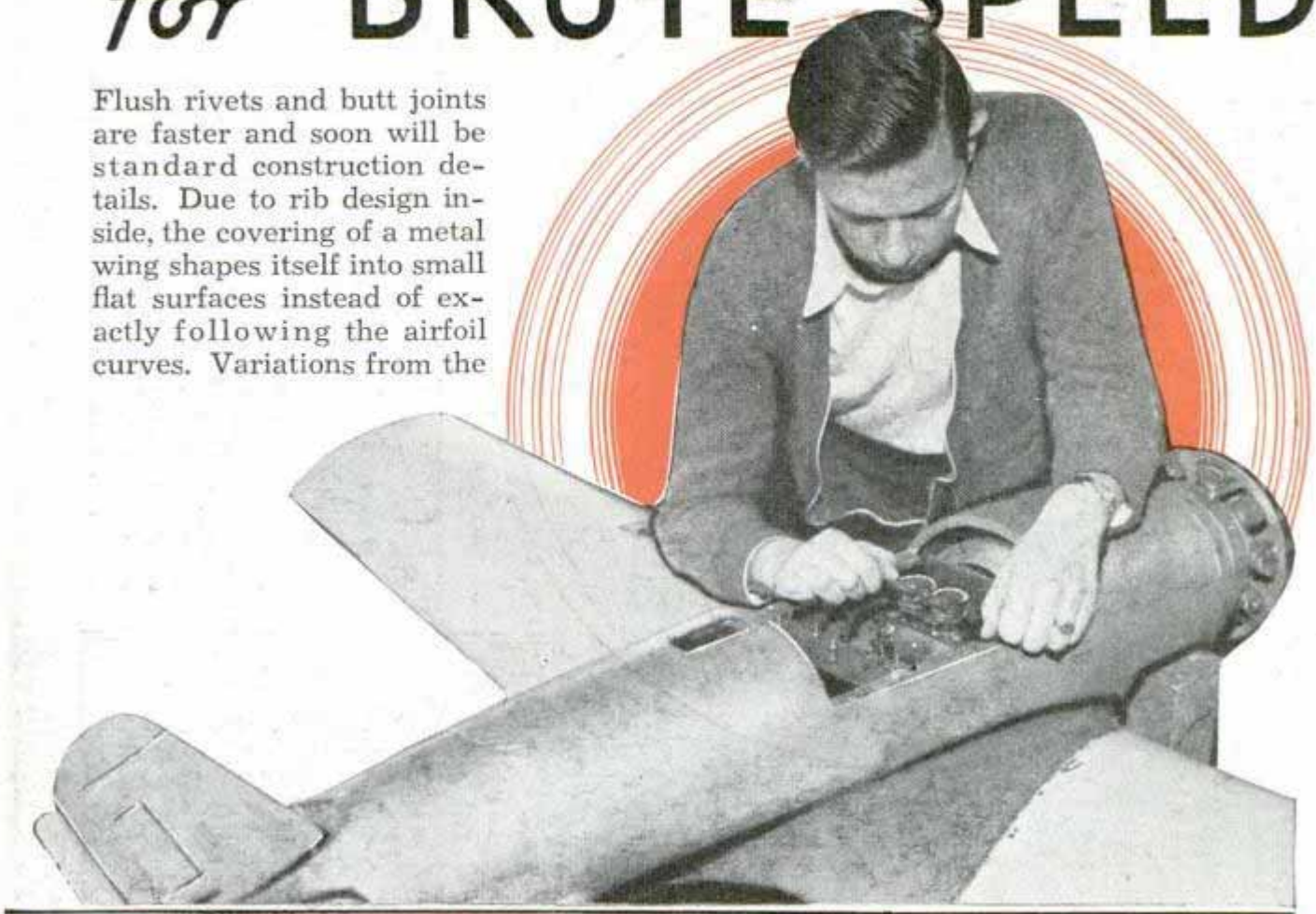
For one thing the big planes are built of overlapping metal sheets riveted together. One wing alone has thousands of tiny rivet heads sticking above the surface. Each rivet and each point where the metal overlaps plays its part in retarding speed.

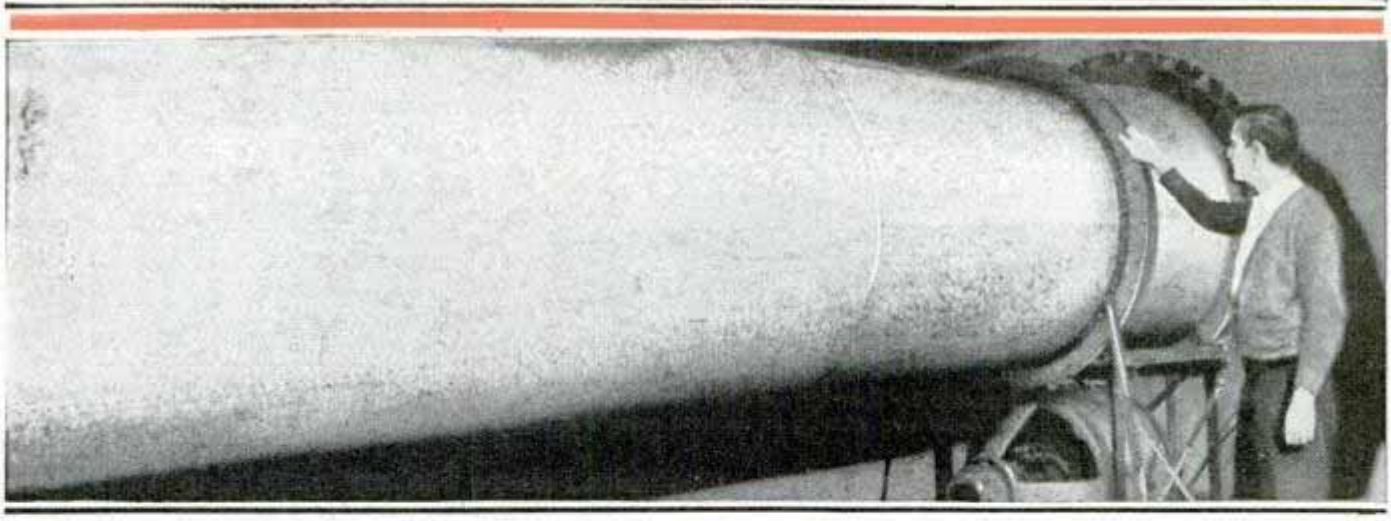


Top, wing and tail surface ready for testing. Bottom, high-speed wind-tunnel fan

for BRUTE SPEED

Flush rivets and butt joints are faster and soon will be standard construction details. Due to rib design inside, the covering of a metal wing shapes itself into small flat surfaces instead of exactly following the airfoil curves. Variations from the





Top, electric motor of wind-tunnel model turns propeller to obtain true effect of slipstream. Bottom, long wind tunnel used to provide smooth flow of air around model

true curve may be so slight you can hardly see them, but one-thousandth of an inch makes a difference at high speed.

When Howard Hughes built his record-breaking racer he called for a wood covering for his wing because wood can be worked to exact shape and is not so much affected by temperature changes as metal. Hughes' racer is one of the few almost completely streamline planes in the world and aviation already is applying lessons his flights have taught. Giant four-engined transports under construction for TWA are going to have smooth exteriors from which the radio mast and loop antenna will be the only projections. Landing wheels will be drawn completely into the fuselage in flight. Pilots and passengers will look through window surfaces set flush with the streamline contour.

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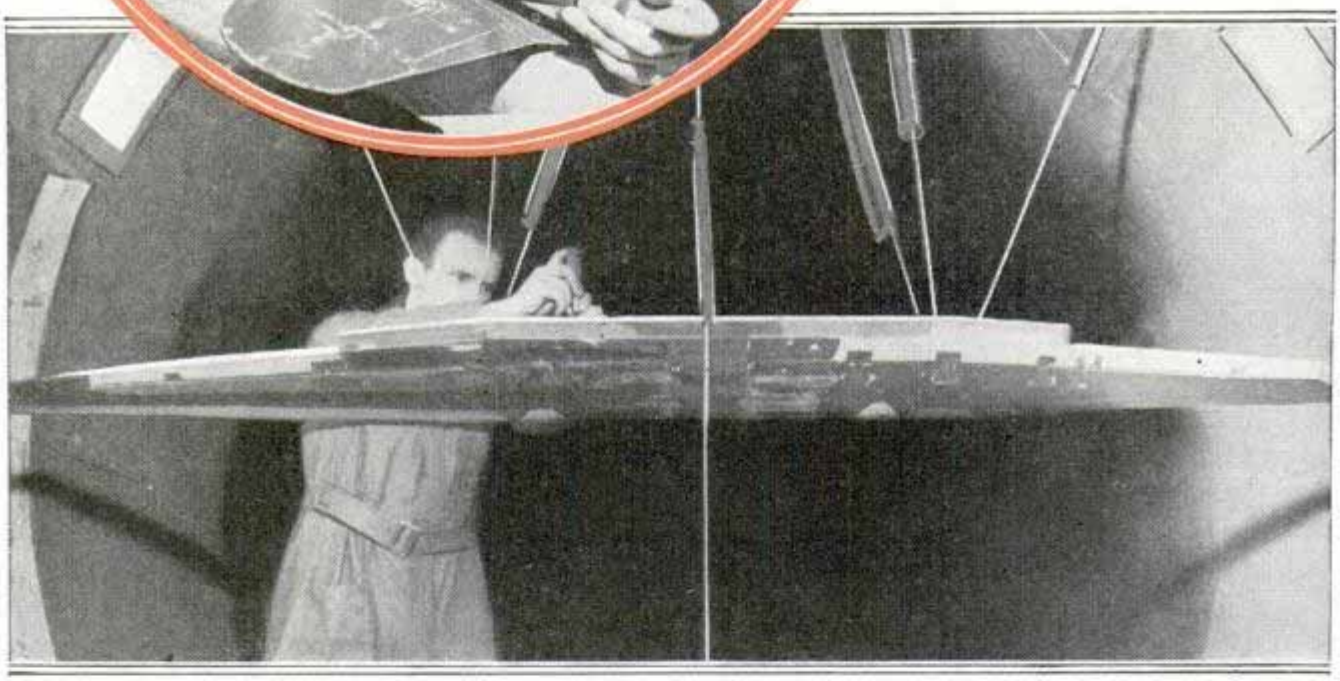
Usually these changes in streamline shapes are too slight to be detected by untrained observers. Modern transport wings are much better streamlined than those of five years ago although here again the differences are so slight that they can hardly be seen.

Streamlining for sheer speed doesn't mean, however, that the more you stretch the streamlining the faster the plane will go. The surface added by extra streamlining creates additional friction with the air. The best



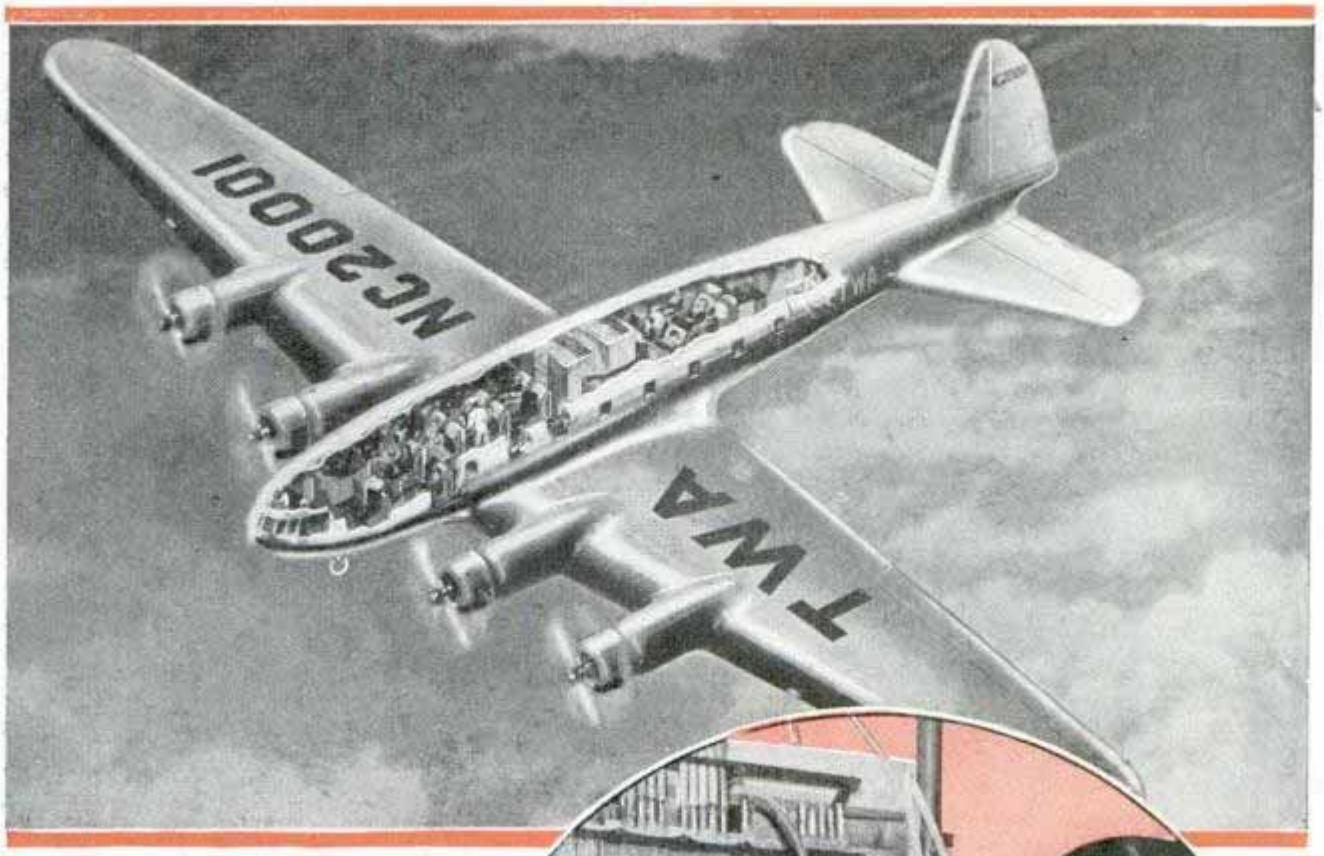
Top, changing shape of tail group by ironing in clay between control surfaces. Bottom, preparing wing for test. Here the flaps are extended to test wing's behavior at low landing speed

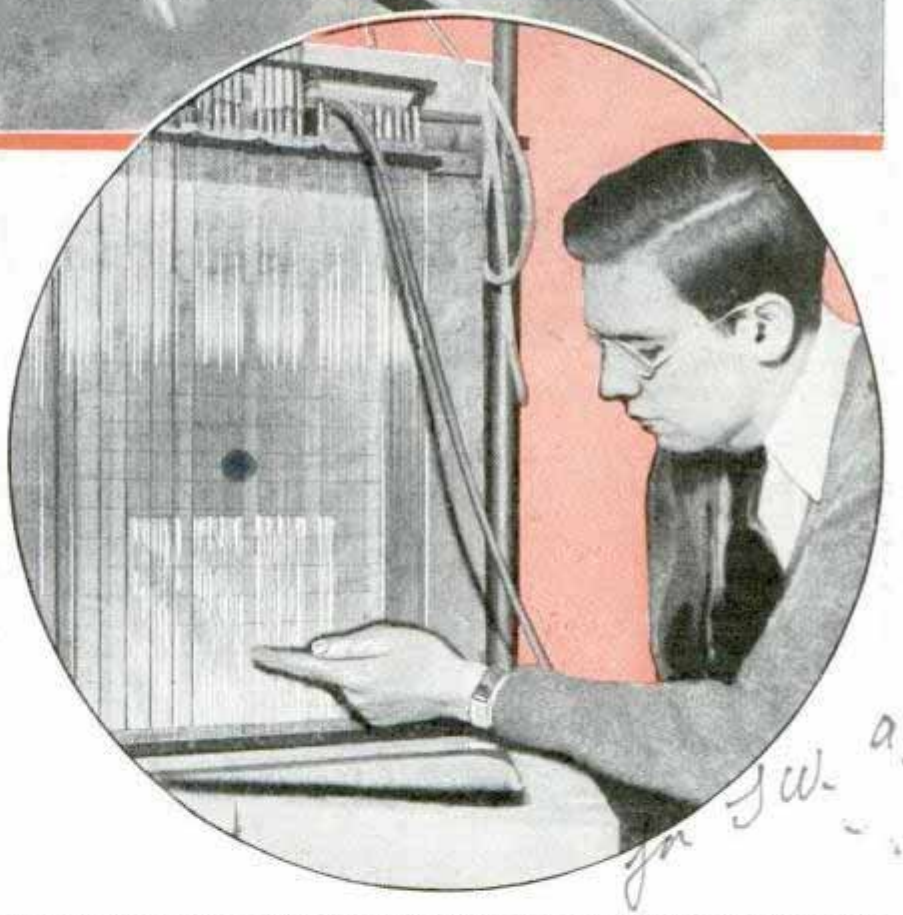
At the wind tunnel of the California Institute of Technology, where Hughes' racer was designed, you learn that streamlining varies according to speed and that there is only one perfect shape for each speed. A wing streamlined for 200 miles per hour is no longer efficient at twice that speed because the air flowing around the top and bottom surfaces doesn't meet smoothly in the back. In effect a partial vacuum is created along the trailing edge and this drags down speed. To overcome this the streamlining has to be extended out to where the air meets smoothly.

streamline shape for any certain speed is a happy medium in which streamlining is as complete as possible without increasing skin friction too much.

"There are three kinds of resistance that tend to hold an airplane back," explains W. C. Rockefeller of the California Institute of Technology. "These are profile drag due to shape, skin friction caused by the movement of air along its surfaces and induced drag resulting from turning the wing at an angle in the air to obtain lift. A thick narrow wing has comparatively little skin friction but it does have a great

Aeronautics Laboratory
Pasadena, Calif.





Top, drawing of huge four-engine transport being built by Boeing Aircraft company. Cabins will be designed for flying at 20,000-foot levels. The ship will cruise at 250 miles per hour. Bottom, glass tubes containing liquid used to register pressure of air around model in wind tunnel

deal of profile drag. If you streamline this wing by extending the trailing edge, profile drag starts to go down and skin friction mounts. The best streamline shape is a compromise, the lowest possible combination of skin and profile drag. This combination varies with the speed of the wind flowing past the wing.

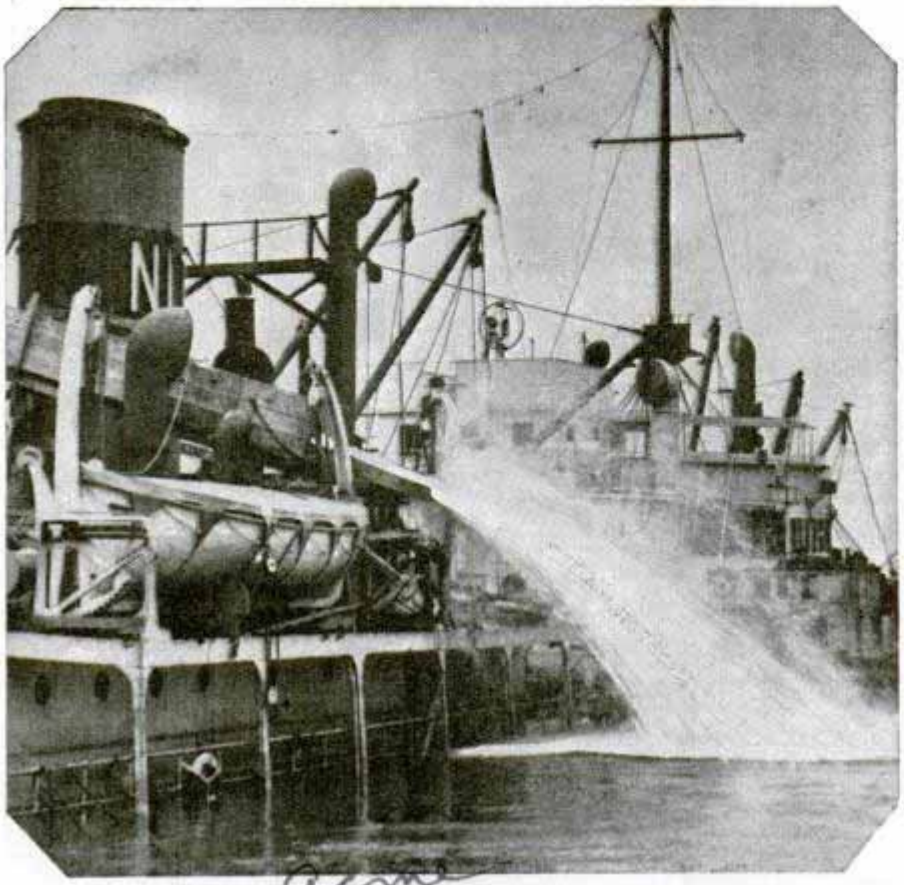
Eight or ten years ago planes were so poorly streamlined that profile drag was excessive. Today we have reduced it to a point where from eighty-five to ninety per cent of the total drag of a wing is accounted for by skin friction. Profile drag could be reduced more by changing the shape of the fuselage to more closely resemble that of a Zeppelin, but this would cramp passenger accommodations."

If some practical way of reducing skin friction can be found airplane speeds will be able to go up and up without tremendous increases in power. An extremely smooth skin helps to reduce this friction, and wind-tunnel models are smoothed and polished before they are tested.

"Boundary layer control" is one of the problems in aerodynamics. At high speeds,

(Continued to page 132A)

Sunken Ship Raised by Pump from Big Bonneville Dam



Sunken craft being raised by pumping out water after repairs have been made. Giant pumps are emptying the ship at 10,000 gallons a minute

When the Italian motorship "Feltre" sank in the Columbia river recently after a collision, it was raised with the aid of big pumps from the Bonneville dam project. Divers repaired the forty-foot gash torn in the ship's side by the collision and then the pumps were started. Water was emptied out of the sunken vessel at the rate of 10,000 gallons per minute, gradually lifting the ship from the river bottom.

Hunt for Crackproof Concrete Offers Inventors a Challenge

Widely used as portland cement is, the mysterious process that makes it effective is still unfathomed by engineers who seek a concrete that will not crack. When cement is moistened, a molecular process is begun which resembles lifelike growth. A material known as gel grows, brush-like, from the surface of each cement grain, filling the voids between the particles and forming concrete. The farther the gel grows, the sparser it becomes, and voids of large size are filled with a weaker gel. Engineers have not yet found the secret of designing the void spaces to fit the gel-producing power of the cement and attain maximum strength.

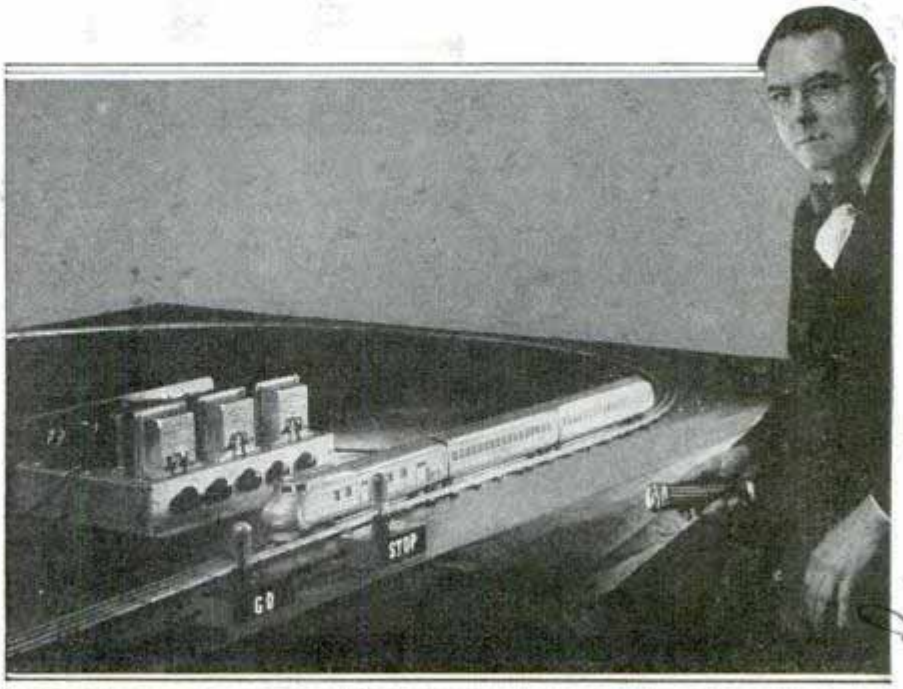
Latest Trailer Has Wardrobe with Mirror

Among the latest features offered in trailers is a built-in wardrobe with a mirror in its door. Equipment of the modern trailer includes draperies, cushions for studio and dinette, shower, refrigerator, hot-water system, cooking stove, heating stove, modern lighting fixtures, linoleum, power generator, water tank and pump, handy cabinets and built-in furniture.

Wardrobe with mirror on inside of door is latest equipment of the trailer

Magnets Control Power without Vacuum Tube

Consisting of magnetic cores, copper and insulation, an apparatus for amplifying and controlling electrical currents has no vacuum tubes, moving parts and no contacts. The device amplifies tiny currents into currents large enough to do useful work, achieving an amplification of more than ten million to one, hitherto possible only with vacuum tubes. In apparatus depending upon the photoelectric principle, such as opening and closing doors by means of a beam of light and a photoelectric cell, it has been necessary to use vacuum tubes to step up the extremely small current from the photocell. In some apparatus this means that when the photocell furnishes a current of five microamperes the amplifier delivers up to twenty watts. The new magnetic apparatus is a different arrangement of the copper-oxide rectifier, used in telephone and railway signal work, and saturating reactors, which are similar in construction to small transformers. The copper-oxide rectifier consists of alternate layers of copper, or some other soft metal, and copper-oxide, held together with considerable pressure, which allows current to pass through in only one direction. The apparatus, developed by Alan S. Fitzgerald, is strong and not subject to shock, giving it advantages over vacuum-tube equipment. It is expected to find wide use where lights are turned on and off automatically by means of photocells, such as street lights, unattended lighthouses and other positions where severe conditions make the life of vacuum tubes very short.



© J. Edward Kain

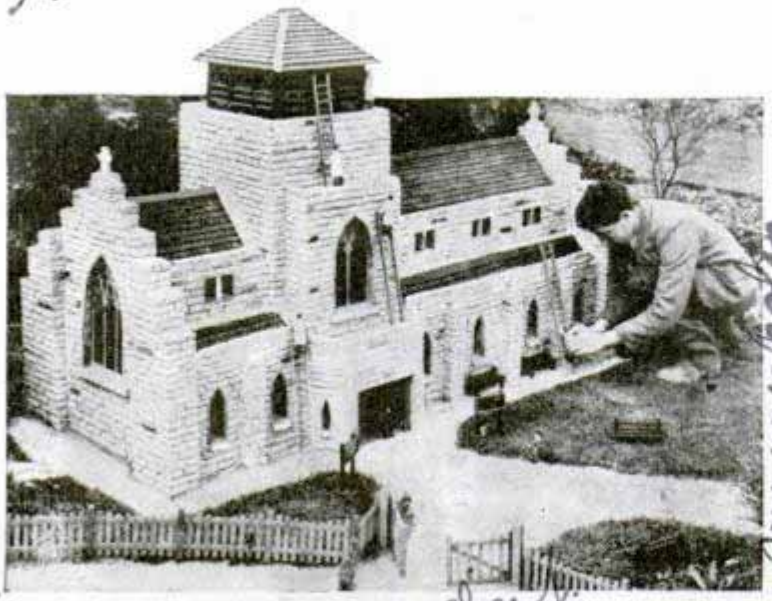
Magnetic transformer controls power for operating train. It has many applications in field where photocell is now used

Odd Tree Puller Can Clear Land Fast as Fifty Workers

Land-clearing machine at work, pulling up small trees and brush on Texas ranch

Doing the work of about fifty laborers using axes, an odd machine developed recently cuts a twelve-foot swath through land covered with mesquite, cactus and native trees. It uproots the trees and tangled brush, windrowing virgin growth, at about forty cents per acre for fuel, lubrication and labor. With a working speed of two miles per hour, it clears fifteen to twenty acres per day. A blade sticking out in front like a huge feeler bends the trees over, while a snub-nosed "bulldozer" behind hits the trees at or below ground level and roots them out. The machine was designed for use on the million-acre King ranch at Kingville, Tex.

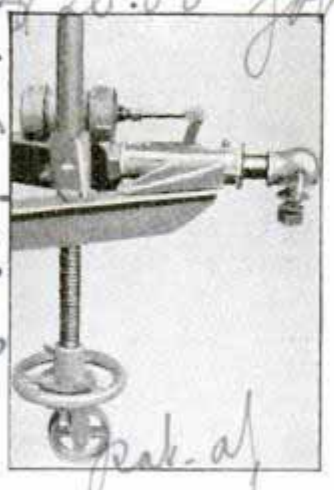
Model of Memorial Church Is Built in Midget Village



Here is scale model of memorial church. Note tiny figures of workmen on ladders around the building

Among the latest structures added to the model village at Bekonscot, England., is a miniature of the projected memorial church to G. K. Chesterton, author. Called the church of St. Teresa, it measures seven feet six inches by five feet. It is complete in every detail and even the model workmen, shown on ladders around the small building, are constructed to scale. The toy village is often visited by children of the English royal family. It contains stores, country club and many other buildings.

Trailer Brakes Made Automatic by Surge Control



By equipping the trailer with a surge brake coupler, the brakes can be made automatic. The harder the trailer surges forward when the automobile's brakes are applied or deceleration begins, the harder the brakes are applied by the control. The brakes are released automatically when the trailer slows down enough to pull on the car. Filled with hydraulic brake fluid, a cylinder in the control contains a piston with a small hole through it. The speed at which the piston travels, and consequently at which the brakes are applied, is governed by the size of the hole.

Talking Road Tells Driver Car Is Too Close to Edge

"Talking highways" that would warn the motorist when he drives too near the edge of the pavement are suggested by engineers at the University of Minnesota highway research department. They said an iron pavement could be constructed that would emit a pleasant hum when a car was properly driven and give a screech when it is close to the shoulder.

"Fifty-Gallon Chair" Is Built of Old Gasoline Drum

Making easy chairs from fifty-gallon gasoline drums is a side line of the village smithy at Arcadia, Fla. The "fifty-gallon chair" makes a comfortable seat for patrons and employes of gasoline stations and roadside stands.

Stuffed pad lends extra comfort to this chair made from an old gasoline drum

Boy Builders to Create Original Auto Designs

Original motorcar designs represented by models will be submitted in a nation-wide competition sponsored by the Fisher Body Craftsman's Guild this year. Models may be of the solid variety, fashioned from a single block of wood, or other suitable material, but must be constructed to a scale of one inch to one foot and conform to the designated length, height and width, so that an actual car built to the same specifications would have sufficient headroom, leg room and breadth to accommodate five or six persons. The competition, like the Napoleonic coach event also conducted by the guild, is open to boys from twelve to nineteen years of age. Those under sixteen are enrolled in a junior division and those over that age in the senior classification. University scholarships are among the awards posted for boy craftsmen submitting the best designs.

Here are several steps in the fashioning of model auto. Top, showing how model must be built to scale. Bottom, working on models. Original designs are sought in the contest

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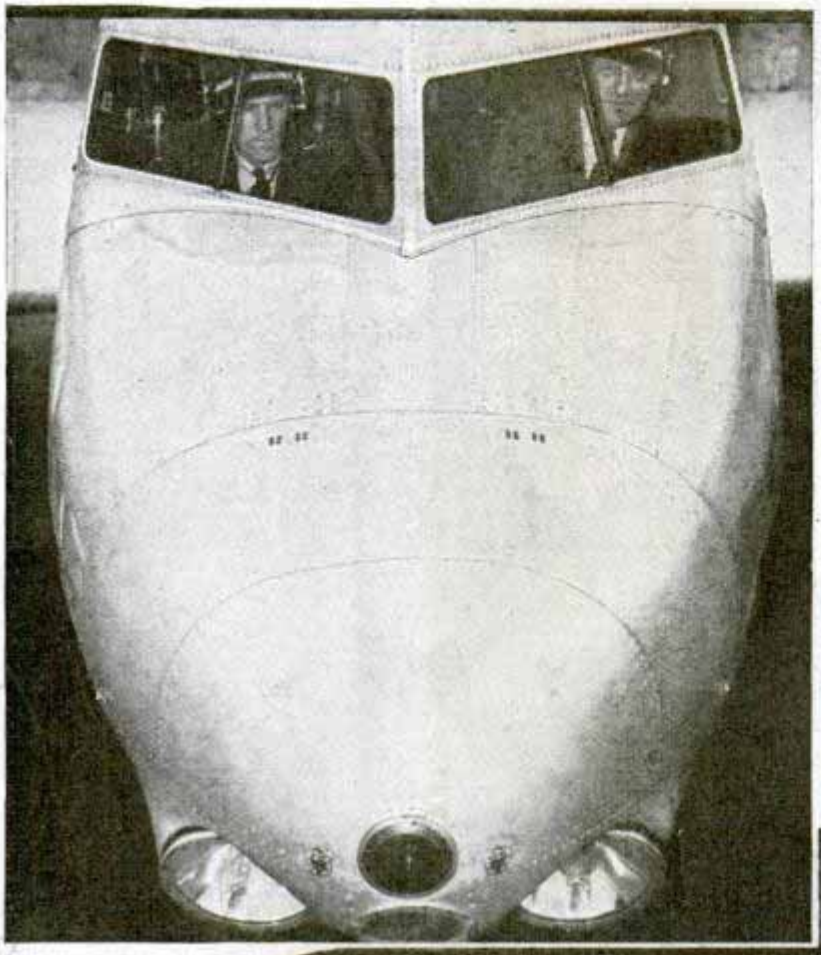
Blue Coat on Metal Saves Eyes in Laying Out Templates

Coating metal with a thin, blue liquid before laying out templates or dies protects the worker from irritating eyestrain caused by light reflected from the metal surface. A special liquid developed for this purpose contains no water nor oil, dries quickly and leaves a good surface for layout designs. The soft blue is restful to the eyes. It can be removed easily.

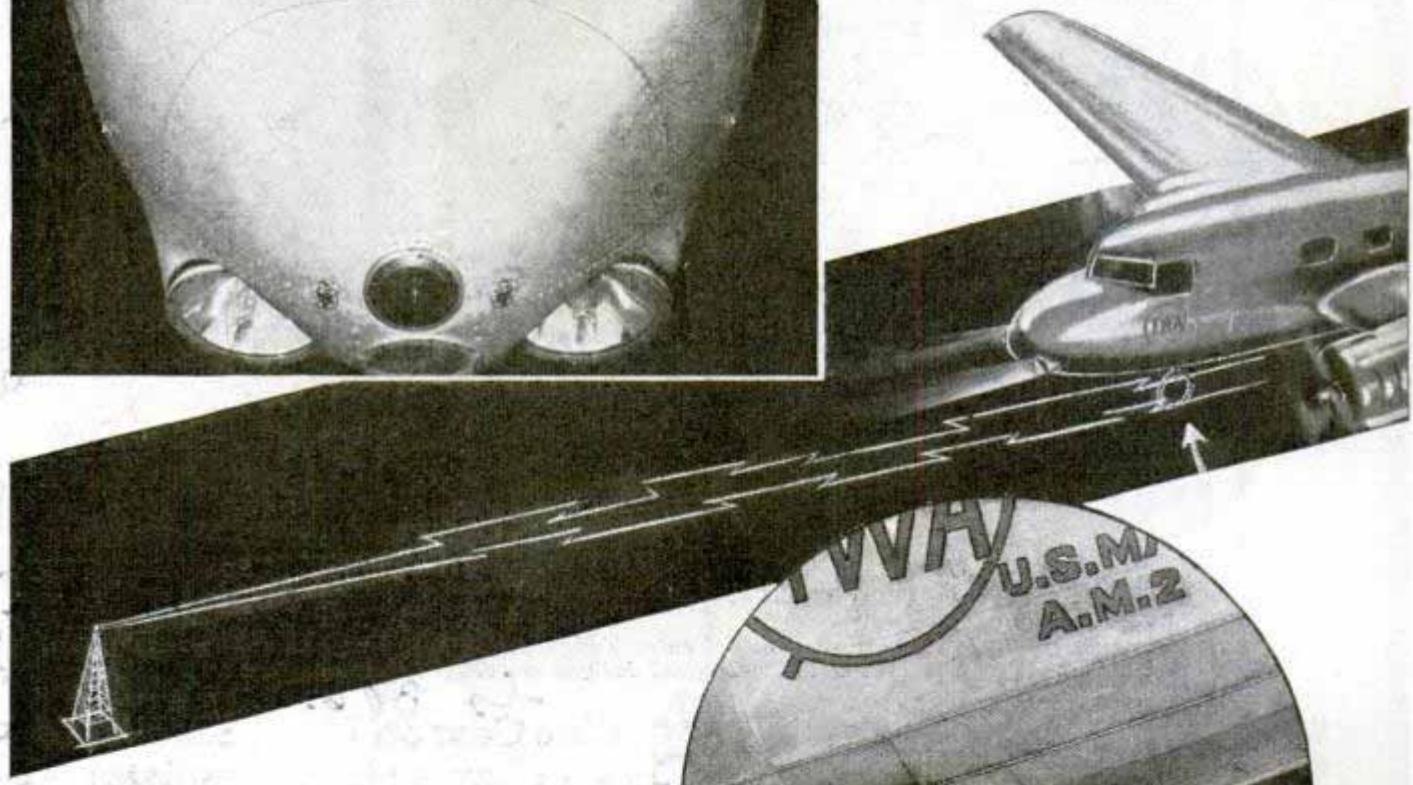
es 16. Capt. Thomas G. Dawson, Jr.
10555 Holman Ave
Los Angeles, Calif

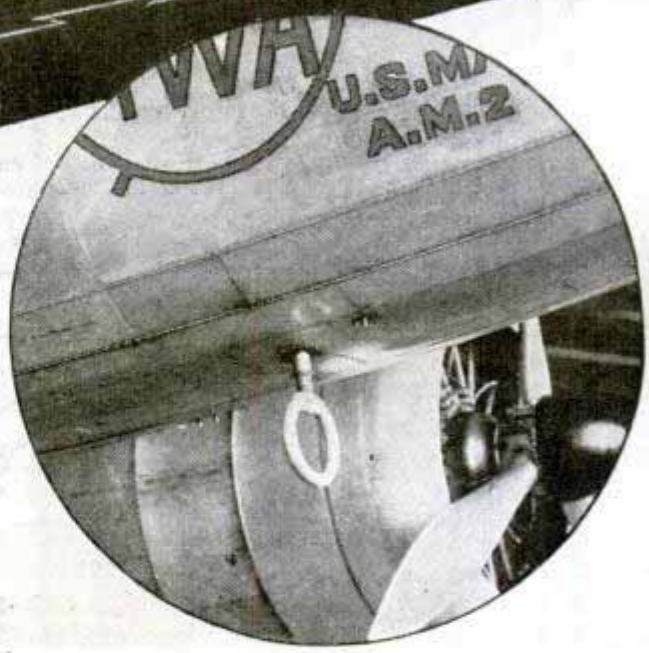
RADIO EYES



captain would have turned his ship around and gone back to the last field. But tonight Dowling merely signals with his hand. First Officer John Magden, co-pilot, twists around and throws a radio switch. Then, bending over a new instrument mounted on the throttle pedestal between the

Left, nose of air liner with pilots wearing earphones. Center, plane uses minimum radio signals for finding direction. Bottom, loop antenna under cockpit

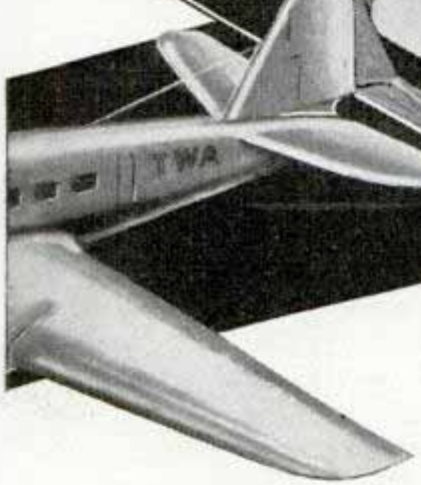




IN THE black night, Captain William Dowling, at the controls of the TWA air liner, can see nothing except his running lights. But he doesn't need to bother because he's flying by radio beam, guiding the plane by the steady "on course" hum in his earphones. As long as he stays on his course and checks his progress by the "squawker" radio beacons along the airway he can't get lost.

But tonight the reassuring tone of the radio begins to fail. A high hissing note drowns it out. Finally Dowling loses it entirely. A few months ago the air liner pilots, he cranks a needle around the dial until its ends rest in zones marked "Rain Static." Immediately the interference fades and the beam signal comes back

for the AIR LINERS

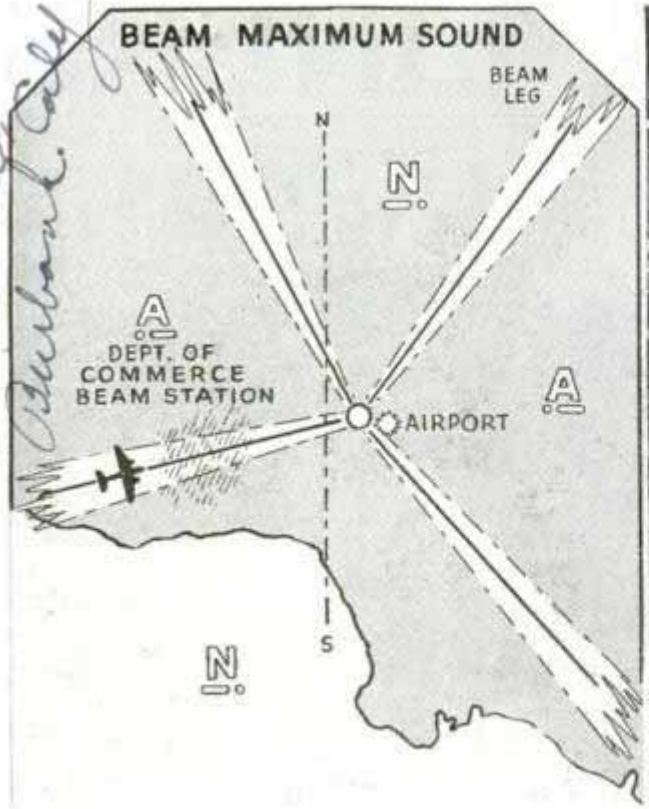


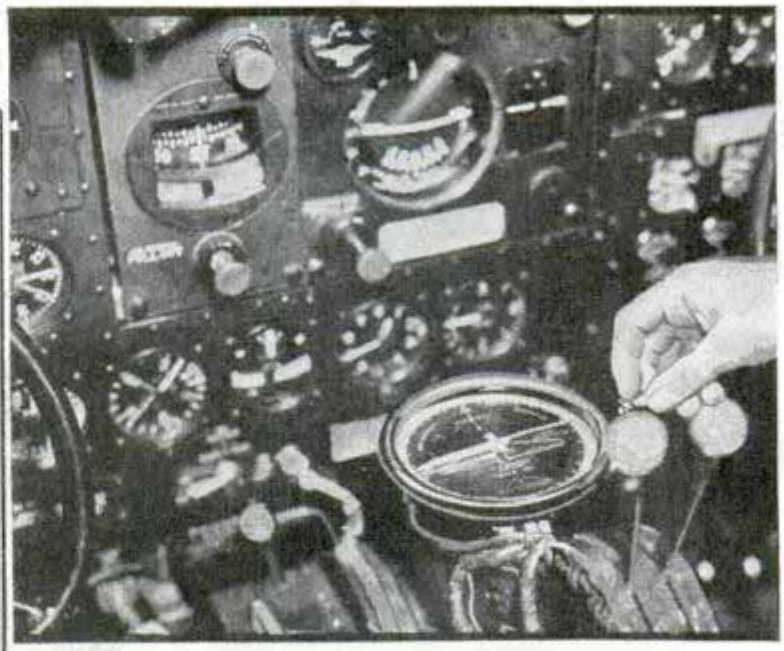
strong in the earphones. The air liner keeps on its way.

All the co-pilot did was to shift the radio to the new shielded "homing" loop antenna that sticks out in the wind under the cockpit. Inclosed in an aluminum case grounded to the plane, the loop is not affected by the static caused by rain, snow, hail, or dust.

Once, before all the TWA passenger transports had been equipped with the new loop, two planes took off on schedule from Albuquerque bound for Los Angeles. One had the new loop and

Top, close-up of loop. Bottom, pilot receiving instructions on how to plot his position by taking radio bearings with loop antenna



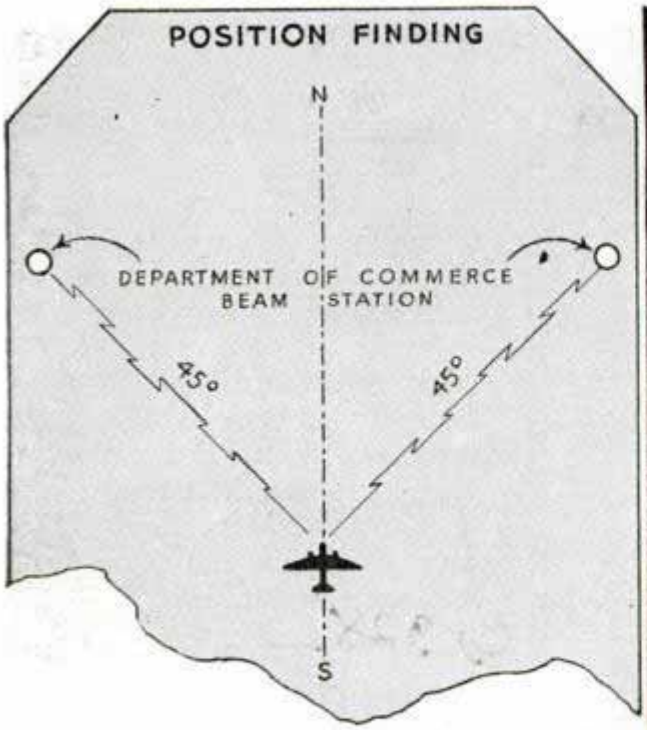


Left, if signals are blocked out while pilot is flying toward beam station, pilot switches on loop and rotates it to "rain static" position, where outside circumference of loop is parallel to line of flight and signal reception is at maximum from station ahead or astern. Signals blocked out on main antenna again become audible. Right, dial shows position of loop

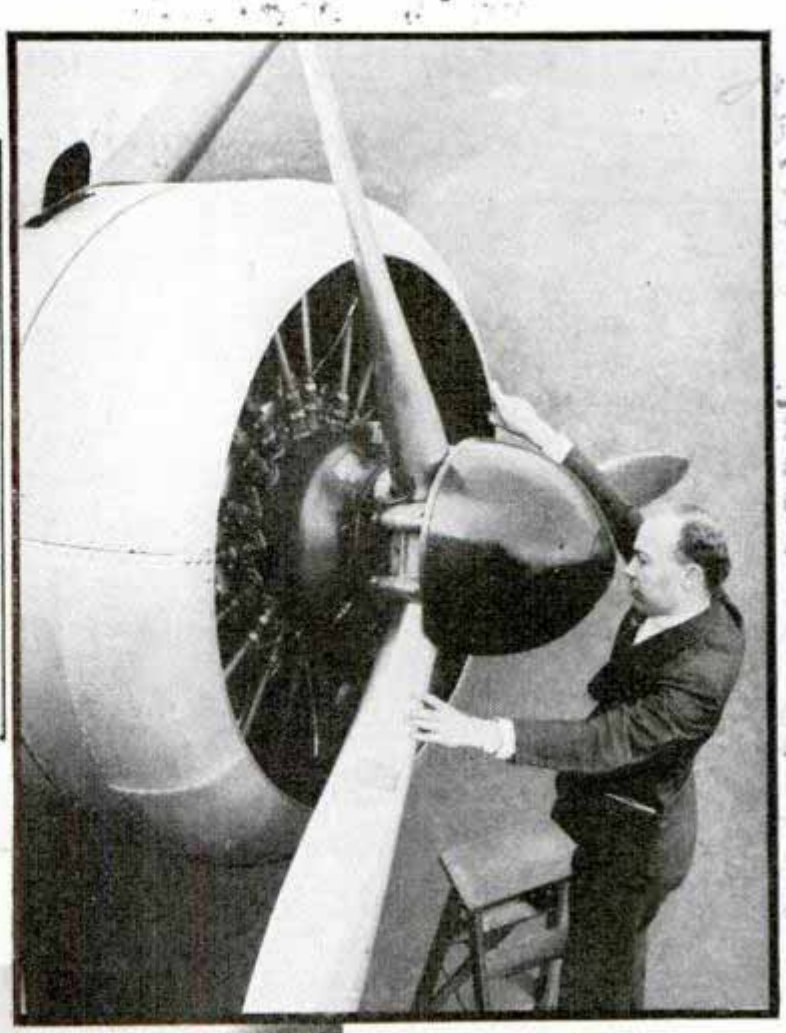
the other had not. Half way to Los Angeles the planes entered a storm area and encountered rain and static. The plane with the loop followed the beam and landed on schedule. The other plane had to give up the flight when static drowned out the beam signals. It returned to Albuquerque for a five-hour delay. Static-free radio reception is only one of the things this new loop does. Its chief purpose is to prevent a pilot from getting lost. Used as a direction finder, it allows him to find the direction to a radio station near his field and fly straight toward it without having to follow an airway radio beam.

Ordinary radio beams, with their "A" and "N" off-course sectors, help a pilot find his way home if he gets lost. The trouble is that under some circumstances he may not be able to tell whether he is flying toward or away from the station to which he is listening. He may have to hunt around for fifteen minutes or longer before he finds a leg of the radio beam and gets back on the airway. With the new loop he can find the direction to the radio station in three minutes or less and can fly straight toward it without hunting the airway beam. To find the direction to a certain radio station the pilot tunes in the station, then turns the loop with a hand crank until the signals fade out. Instead of turning the loop to find the position of maximum reception the pilot does the opposite. Maximum reception comes in over quite a wide angle while the fade-out position is only a few degrees wide and allows more accurate navigation.

When the pilot has tuned out the signals he knows the loop is pointing directly at the transmitting station. The needle on the cockpit dial follows the loop around, so a glance at the needle tells the pilot just how much he needs to change course to head directly for the station. Pilots tune to the regular airways beam radio transmitters instead of commercial broadcast stations because the airways radios are close to regular landing fields. Also, the airways stations send identifying call letters at short intervals, while a pilot might have to wait for a quarter of an hour before receiving a station identification during a commercial broadcast. Pilots also use their radio compasses for checking their progress along an airway. To find out just where he is a pilot simply tunes in two or three stations, one at a time, and notes the angles at which the signals fade out. On his airway strip map he plots the angles to his course and makes a pencil dot at the point where the lines cross. The pencil dot is his "fix" and shows the location of his plane.



Above, with plane flying north, pilot rotates loop to right until minimum signal is obtained on beam station at right. Then receiver is tuned to beam station at left and loop is rotated until minimum signal is obtained. Plotting directional readings then fixes position of plane



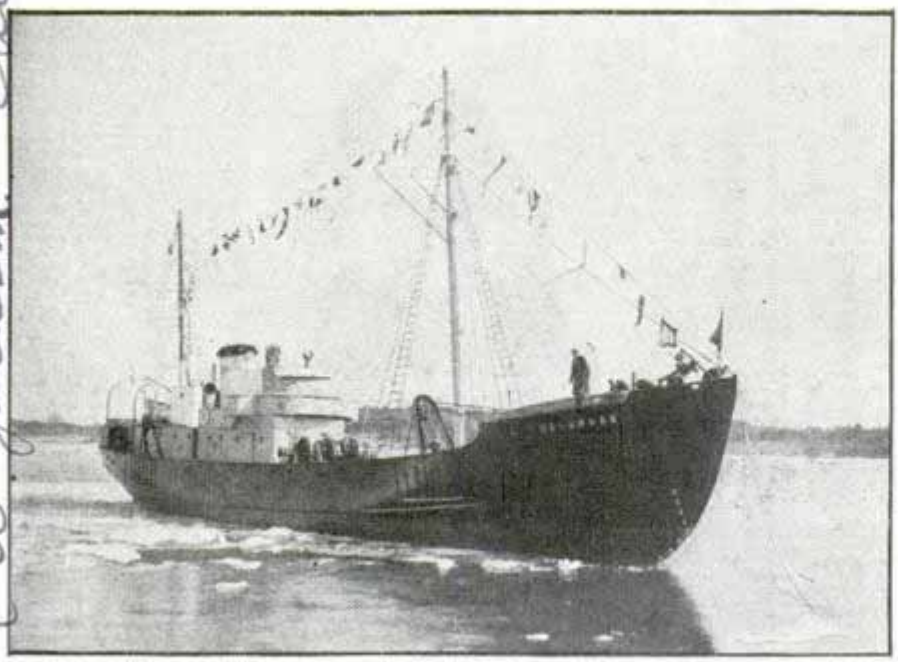
Top, right, castor-oil spinner on propeller hub retards ice formation. Bottom, plane with loop antenna shielded in streamline housing

Direction-finding loop antennas have been used by ships at sea for years. The TWA loop was perfected by J. C. Franklin after two years of research and testing. Similar loops used on airplanes are sometimes housed in streamline metal shells that shield the loops from static. Still another loop is permanently fixed. In this case the pilot turns the airplane in the air to tune signals in or out.

A solution to one of aviation's last hazards may be found in short-wave radio. By means of his altimeters a pilot is always able to tell his altitude above sea level but these instruments give him no idea of how high he is above the ground under the plane. After dark or in zero visibility he can't see down and he has to depend on his navigation to tell when he has crossed over the mountains. If he happens to make a bad guess he might begin to fly down to a terminal before he had actually cleared peaks that he believed he had passed. What aviation still needs is a simple reliable way of telling an airplane's height above ground. Some research workers are attacking the problem with sound waves, measuring the time that

(Continued to page 126A)

Trawler Built Like a Yacht for Race to Port with Cargo



Built for fast runs between fishing grounds and port when the market is favorable, this big trawler can carry 400,000 pounds of fish

Stealing the lines of a fast racing yacht, the 146-foot trawler "Delaware" promises to be the swiftest boat of its type in American waters. Launched recently at Bath, Me., the huge vessel was designed to race home from the fishing grounds when its fish hold is full to its 400,000-pound capacity. The hold is insulated with thick cork and lined with nickel-clad steel. With its radio room on the upper deck, the "Delaware" could summon aid even if the engine were submerged.

Permanent Gloss for Autos Promised by New Coating

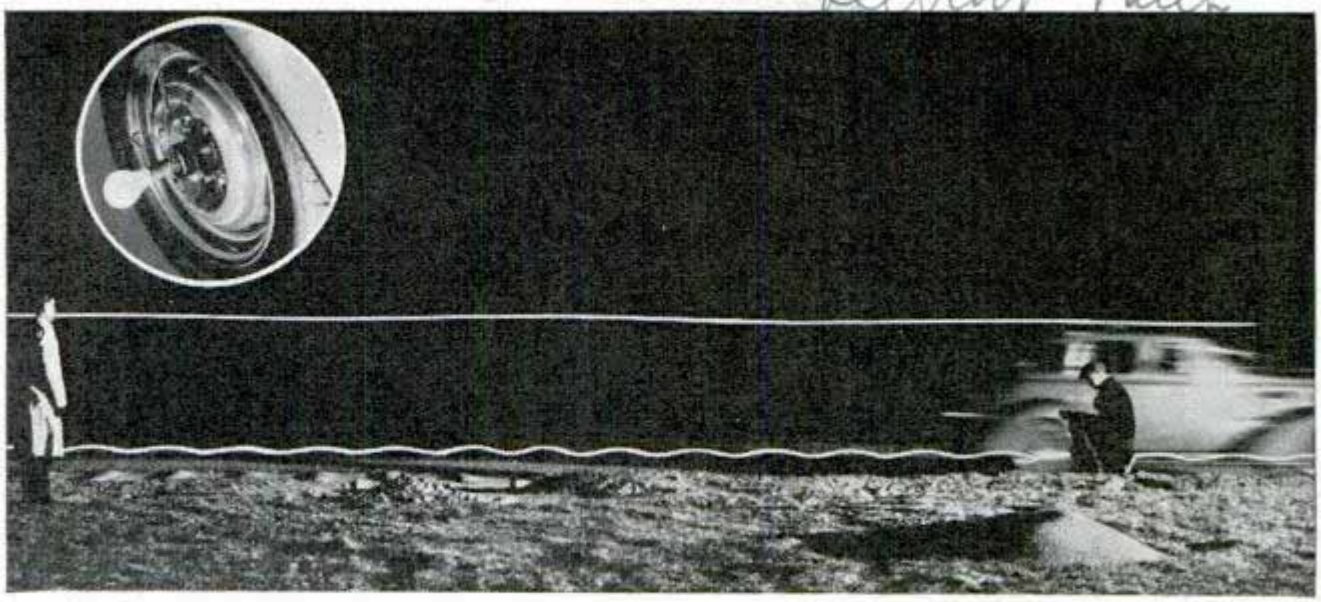
Consisting of a pigmented cellulose ester varnish under a top coat of clear cellulose ester lacquer, a new lacquer enamel coating for metal and fabric surfaces promises a permanently glossy finish for automobiles. The finish is said to have withstood accelerated testing for more than eighteen months without losing the gloss. The mixed ester top coat will not give this effect over present enamels, but must be used over enamels made with cellulose mixed esters. According to W. E. Gloor of the Hercules Powder company, the new cellulose esters also make possible the preparation of noninflammable, water-resisting dopes for cloth airplane wings and fuselage, as well as durable, flame-resisting coatings for awnings, electrical cables, and furniture coverings. In green and maroon tints these mixed esters give improvements over the lacquer enamels now used, reducing fading. The combination coating system is necessary, however, to obtain the permanent glossy finish.

Troops in Arctic Dress Like Explorers

Swedish infantrymen participating recently in maneuvers in frozen Lapland resembled something between an Arctic explorer and a winter sport enthusiast. They carried complete equipment for making their way through heavy snows, including a shovel, as well as weapons.

Ready for any emergency, this Swedish soldier is garbed like Arctic explorer

Lights on Top and Hub Show How Car Rides

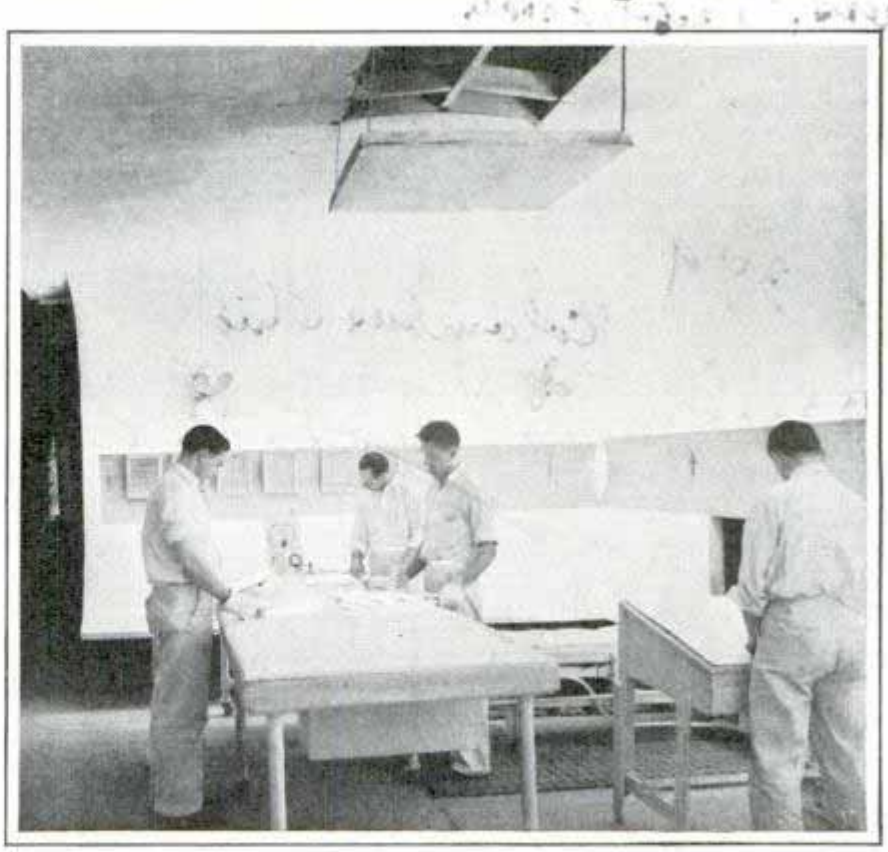


Upper white line is impression made on photographic plate by light on top of car. Lower line was made by light on wheel (inset). Car is shown at right as it sped over rough ground

How an automobile rides while speeding over rough ground is demonstrated by placing an electric light on the car's roof and another on the front-wheel hub and recording on a camera plate. The finished photograph shows a wavy, up-and-down white line made by the light on the wheel and an almost straight line made by the roof light. The demonstration was arranged to show the effectiveness of the front-wheel suspension. A test crew checks the car's movements and times its travel.

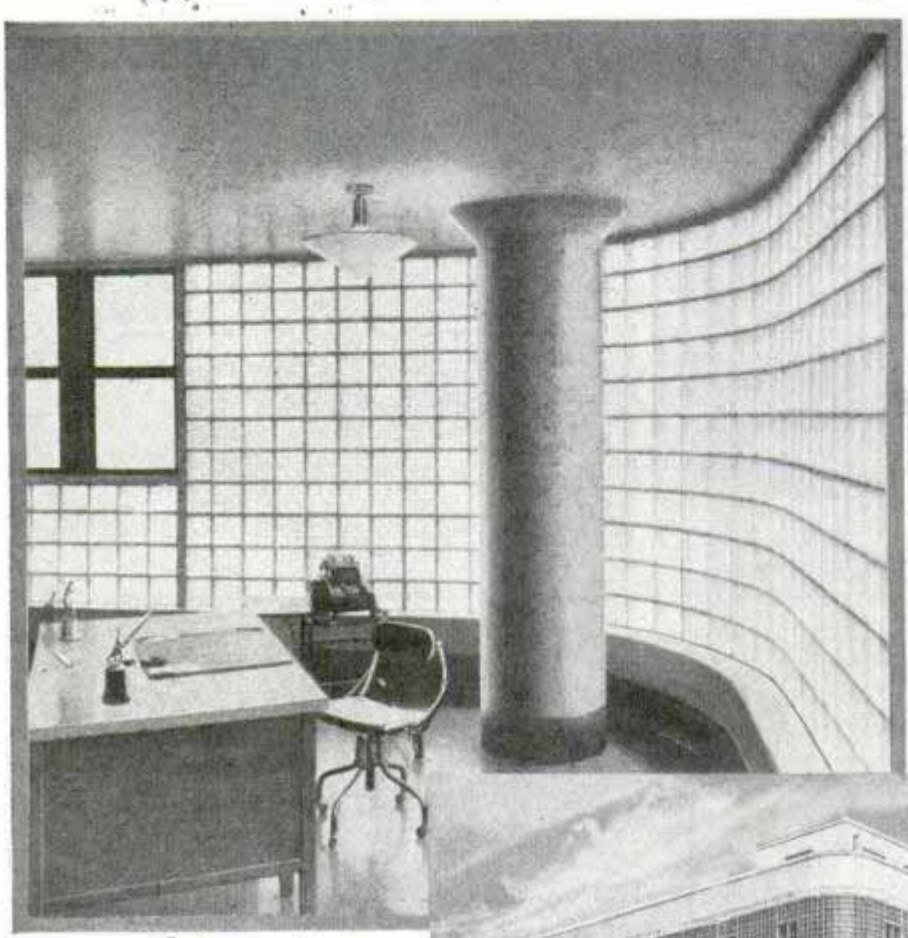
Porcelain Colors Matched in Shadowless 'Light Tunnel'

You would not buy a stove or refrigerator whose panels varied in degree of whiteness. White varies from white just as one shade of blue from another. To assure uniformity, the Westinghouse Electric and Manufacturing company has built a cornerless "tunnel of light" for inspecting and matching porcelain colors. It is so drenched with light that a pencil held anywhere in the room would cast no shadow. The inspectors are clothed in white. Both incandescent and mercury vapor lights are used, so spaced as to provide an average light intensity of 114 foot-candles throughout the room.

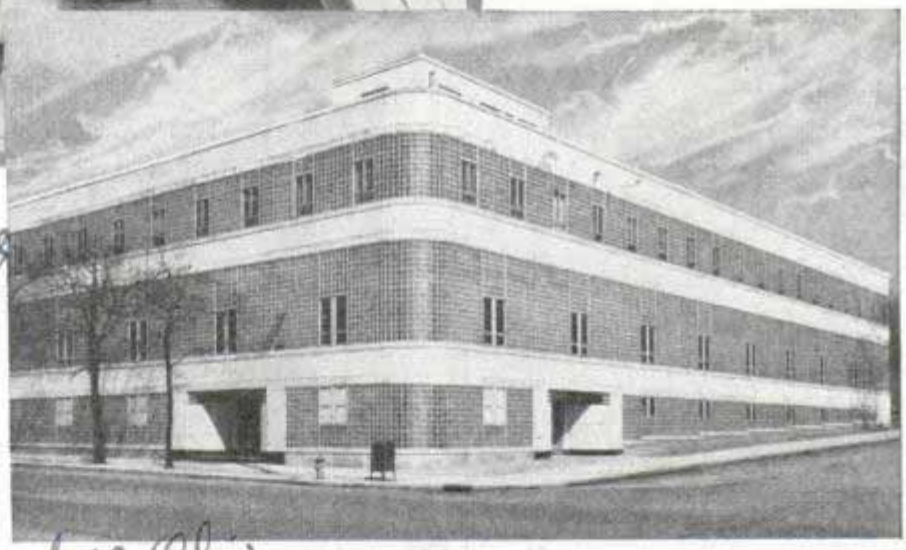


Batteries of both incandescent and mercury lights are arranged to flood this "light tunnel" evenly for matching colors in porcelain ware

Glass Walls Admit More Light to Building



Constructed with uninterrupted glass-block walls, a publishing company's new building receives more daylight than buildings with conventional windows. The blocks admit natural light, but diffuse it to prevent glare. The structural frame is reinforced concrete. Interior partitions of the third-floor executive offices also are of glass blocks. Superior appearance, light-diffusion qualities and maintenance economies are some advantages claimed for glass blocks.



Interior and exterior views of publishing company's building whose walls are of glass blocks. An advantage is that the blocks admit more natural light than conventional windows, but diffuse it to prevent glare

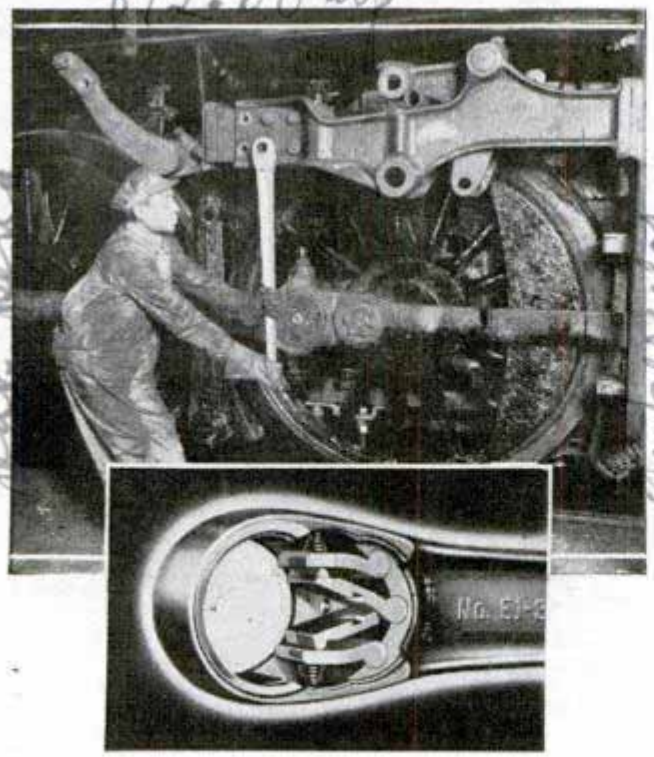
Driest State Has Heaviest Rain as Well as Deepest Snow

Sunniest regions in the United States are the California-Arizona border, averaging 300 or more clear days a year, and St. Petersburg, Fla., with usually less than five sunless days. Yet California, noted for sunshine, also holds records for the heaviest snow and wettest month, and its Arizona-Nevada border is the driest part of the land. A compilation of weather tables for the last half century, assembled for the benefit of agriculture and weather-dependent industry, shows that rainfall averages but five inches along the southeastern edge of California. Heaviest snows are along the western slopes of the Cascades and Sierra Nevada mountains, and the record snowfall was seventy-five feet on Mt. Tamarack, near Alpine City, Calif., in 1906. Helen Mine, Calif., holds the record for sixty-nine inches of rain in January, 1909. Washington state is cloudiest, with 180 overcast days per year, and the north Pacific coast has the heaviest annual rainfall, 200 inches. There, in the Olympic mountains, rain spells sometimes last thirty or forty days, and around the Great Lakes sometimes twenty to thirty days. Precipitation is most even in New

England, averaging just over three inches a month, and severest cold waves occur in the east. The thunderstorm center lies on the central and eastern Gulf coast, with seventy to ninety storms a year. Thunder is rarest at San Jose, Calif. Lightning kills 500 to 700 persons every year, with the greatest mortality in the Ohio valley and middle Atlantic states.

Four-Pawl Ratchet Wrench Takes Crushing Hold

Instead of a single pawl, a heavy-duty reversible ratchet wrench just put on the market provides increased strength by having two pawls engage two teeth for both "on" and "off" rotation of nuts. It is possible to rotate a nut completely with only an eighteen-degree swing of the handle. The four pawls are of hardened tool steel.



Reversible ratchet wrench at work on a locomotive, and, below, view showing how it takes hold

Mirror Helps Teach Baseball by Reflecting Player's Faults

Posed before the mirror, the player sees faults in position and can correct them under coach's instruction

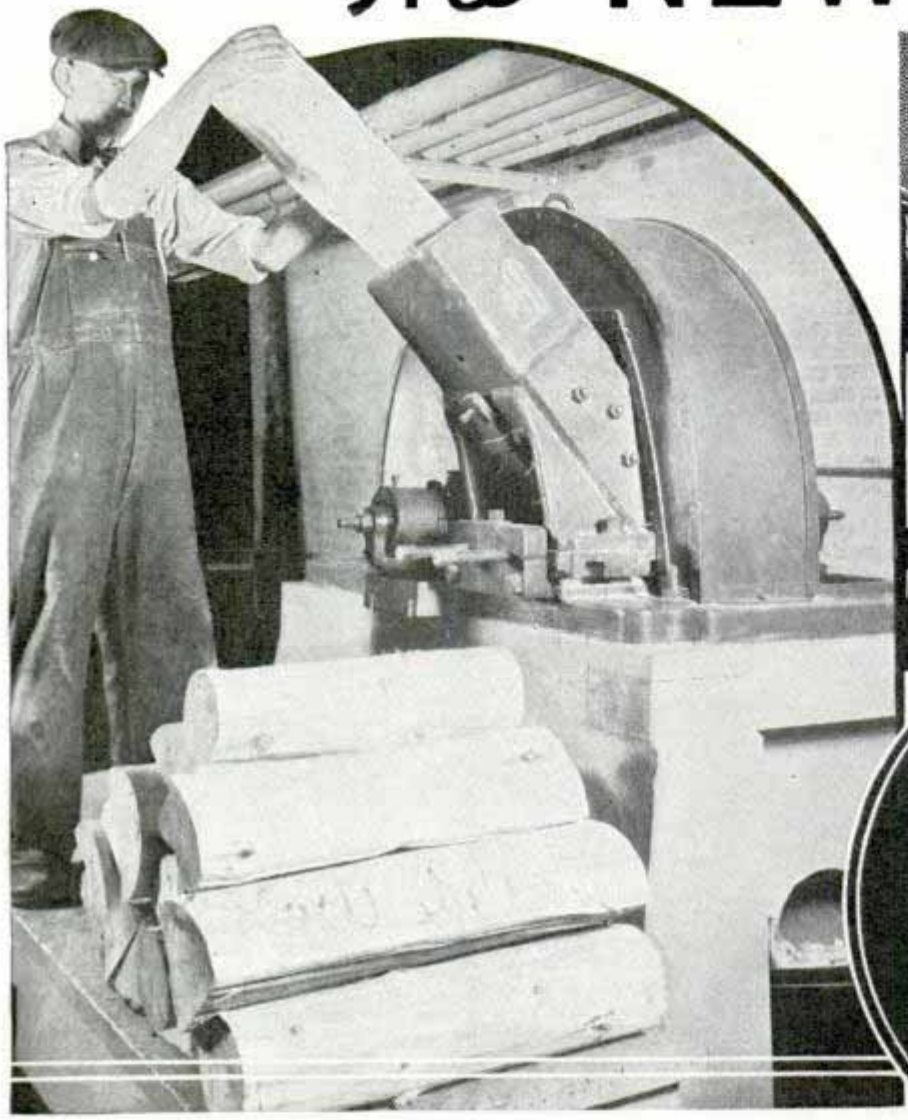
By reflecting the player's faults, a mirror helps to train candidates for the baseball team at an American college. The player faces the mirror as he bats or plays his position and thus is able to see what he does wrong. With the coach's aid, he may correct the faults and see how he looks when performing properly.

Sea Water Operates Lamp

Operated by the action of sea water, a new electric marine lamp has many adaptations, including anchor lights, running lights, emergency lights, cabin lights, life-jacket and ring-buoy lights. The operating unit consists of two pieces of metal and carbon which produce electricity upon contact with sea water. As long as supplied with sea water the unit gives light.

¶Inquiries as to makers of articles described in Popular Mechanics, will be answered by our Bureau of Information upon receipt of return postage.

The NEW AGE



Top, left, plastics start with chopping of logs. Circle, right, X-ray photograph of pine. Note how porous is this wood

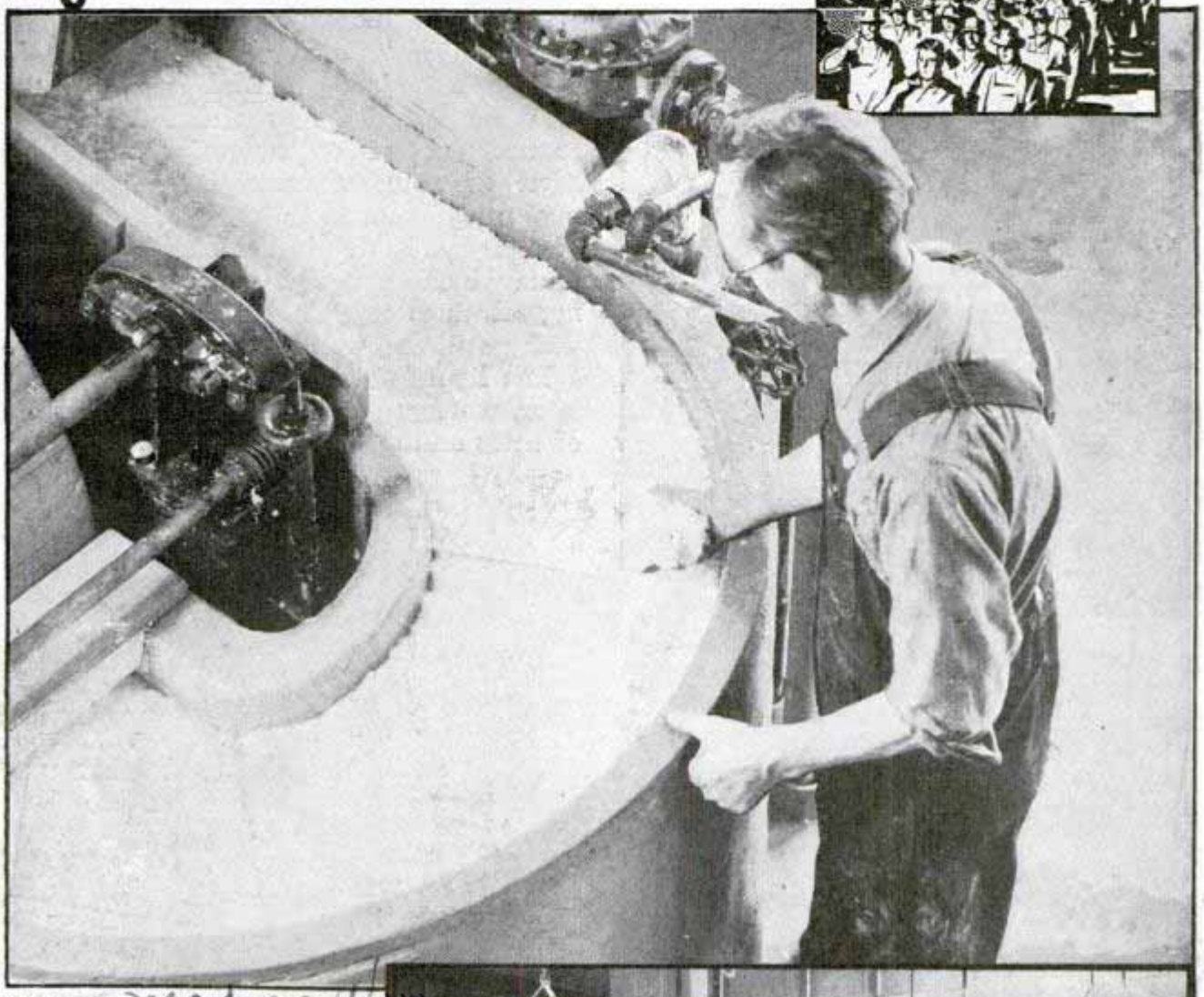
By Charles Morrow Wilson

HISTORIANS might call this period the age of plastics, so important to man is the work being done in that field. Or, they might call it the second age of wood, because wood and plant fibers are fast becoming the foremost source of plastic materials.

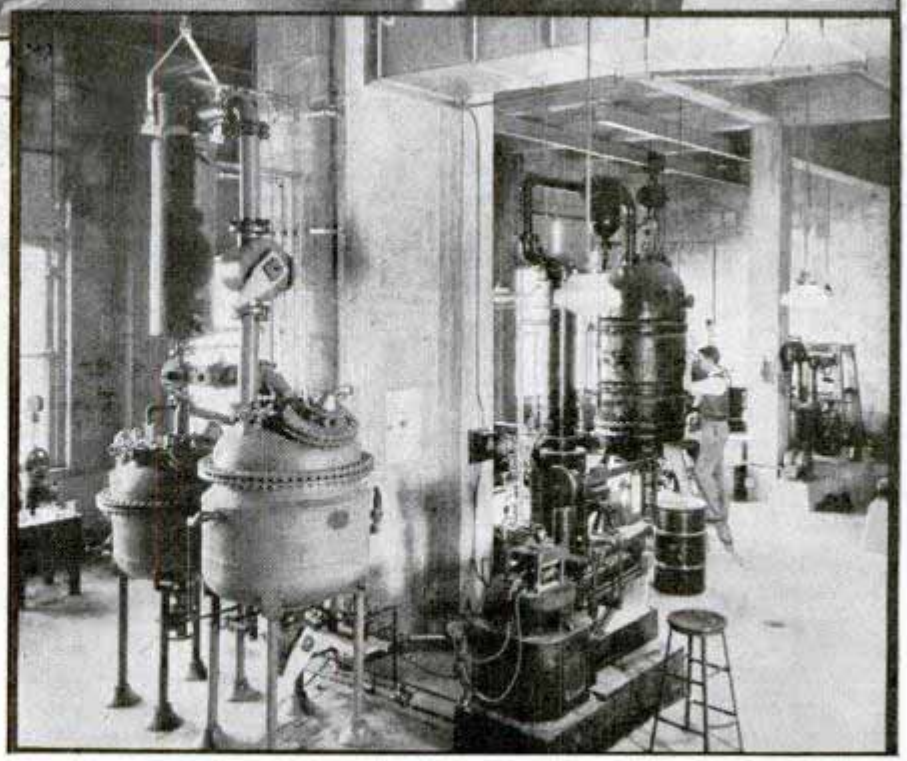
Newest developments in the field revolve about a substance called lignin, which is the natural cement that gives stiffness to trees, plants and all woody substances and makes up twenty-two to thirty-three per cent of all wood. The lignin molecule is extremely large, a compound of carbon, hydrogen and oxygen. Chemically lignin is closely akin to coal tar.

Lignin has been the "black sheep" of the wood-pulp industry because removing it from wood pulp is the biggest expense in manufacture of paper and causes a waste of more than fifteen million tons of wood material every year. Truly a waste product, lignin can be recovered from sawdust, shavings, wood scraps or wood-pulp wastes at costs ranging from one to five cents a pound.

# of WOOD



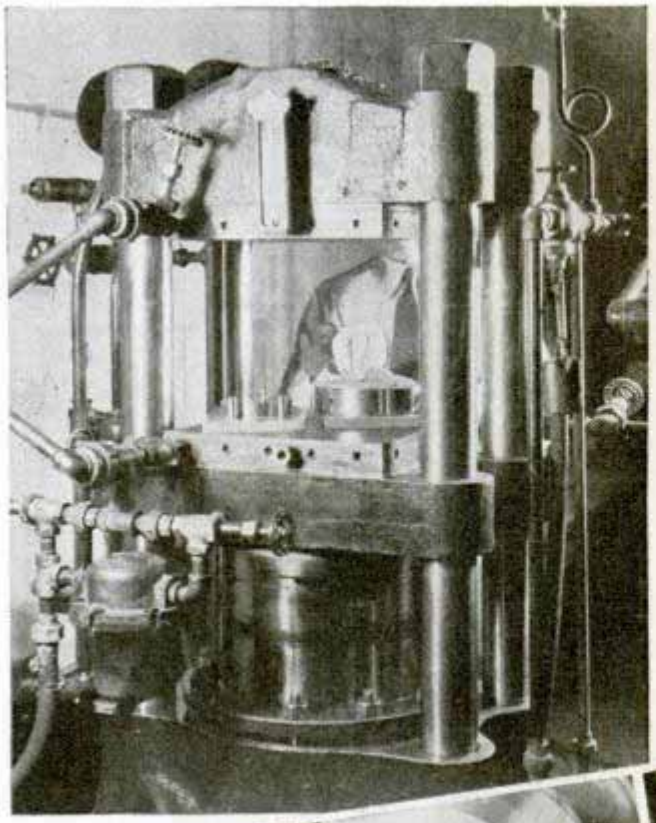
Courtesy Madison, Wis.
U. S. Forest Products Laboratory



Top, wood pulp, logical source of plastics made from cellulose and lignin portions of wood. Bottom, wood-waste processing vats

Manufacture is simple. Wood waste is placed in a steel tank equipped with an airtight lid and is hydrolyzed by addition of dilute acid, usually sulphuric, under regulated heat. Acid vapors caused by steam bring about the chemical change. After cooking, the product is a dark powder covered with a tarlike sirup. The liquid is drained off, the powder is dried and made ready for molding.

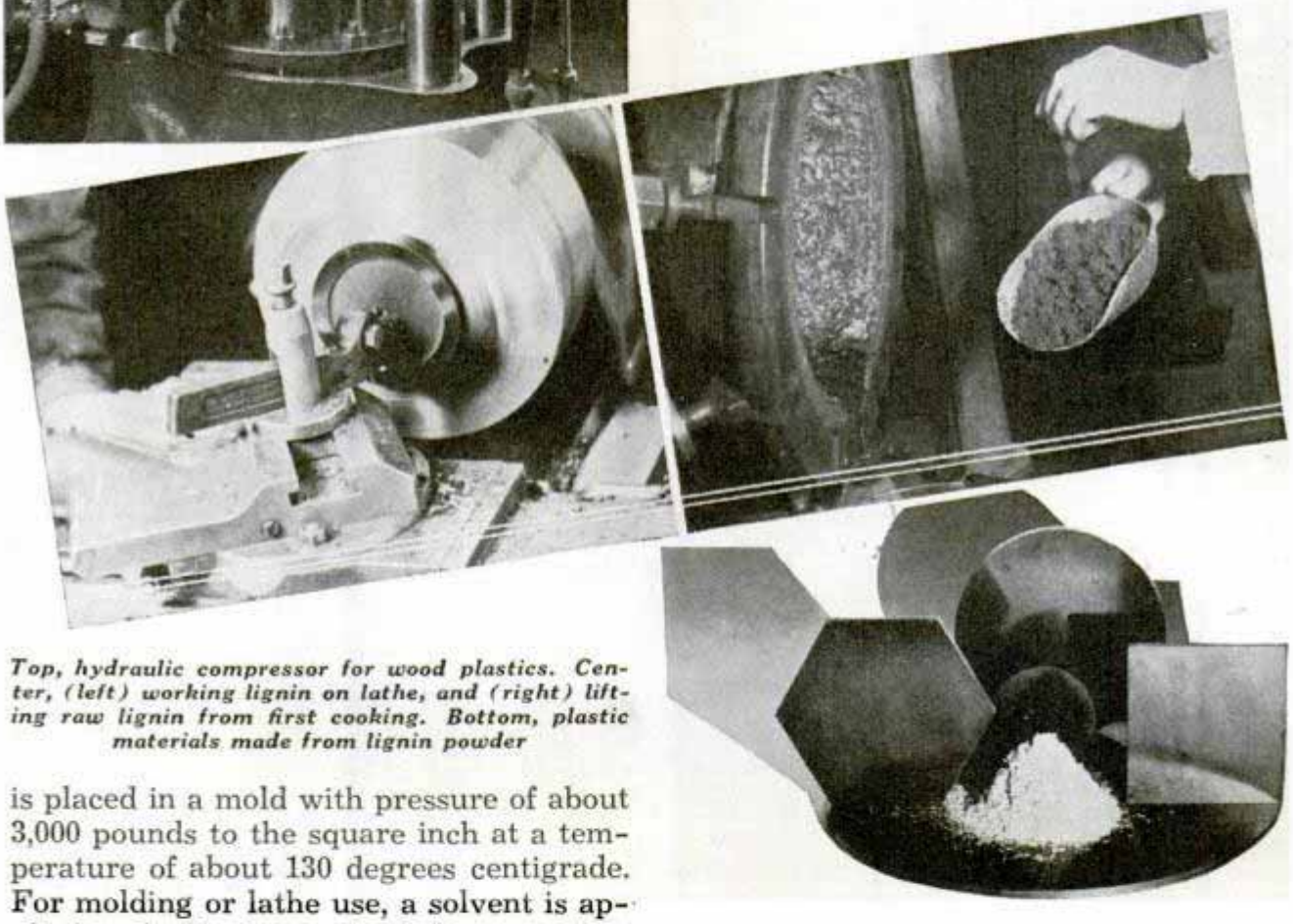
For making plastic wallboard or sheet coverings the lignin powder



quers, and wallpapers. Thus interior finishes of a home literally can be built into the walls so that they can never fade or come loose, so that they can be scrubbed or cleaned without injury.

The natural finish of lignin plastic is shiny black. The material is so hard it must be drilled for structural use and it cannot be scratched or easily disfigured. First experiments indicate that its cost may range from a tenth to a fifth the cost of most synthetic plastics made by a formula which creates plastics by compressing solutions of phenol and formaldehyde with powdered wood as a filler.

The lignin plastic is an excellent insulator, waterproof and suitable for storage of acids and chemicals. Its density is 1.4,



Top, hydraulic compressor for wood plastics. Center, (left) working lignin on lathe, and (right) lifting raw lignin from first cooking. Bottom, plastic materials made from lignin powder

is placed in a mold with pressure of about 3,000 pounds to the square inch at a temperature of about 130 degrees centigrade. For molding or lathe use, a solvent is applied to the lignin powder before pressing. One of the best solvents is furfural, which can be recovered from almost any type of wood or plant fiber wastes by distilling the waste in sulphuric acid.

Almost all types of wood veneers including mahogany, oak, maple, cherry and basket weaves can be imbedded upon the lignin plastic and so become an integral part of the material. So can bronzing powders, paints, varnishes and lac-

virtually airproof, and its coefficient of expansion happens to be almost the same as those of aluminum and copper, which means these metals can be imposed upon the plastic. The plastic's high resistance to heat and moisture makes it a promising wall material for the air-conditioned home and suitable for use in flooring, table covers and drainboards. Heated into solution with resin, camphor or other adhesive solvents, lignin plastic can be lathed

or molded with great accuracy into plating, knobs, flanges, insulators, dishes and trays and pans, auto and radio accessories and similar goods. Liquids which result from cooking lignin materials are being condensed as a top dressing for roads to prevent dust, and as an adhesive base for laying linoleum, asphalt, and other types of coverings.

Scientists of the U. S. Forest Products at Madison, Wis., believe that since lignin can be nitrated the same as coal tar, it is also a potential source of dyes. Usable dye already has been produced from lignin. Thus far the color range is confined to orange and browns. Du Pont chemists are now using lignin wastes as an "intermediate" for many of their elaborate chemical dyes. Oxalic acid, the common bleaching agent used by laundries, is another product easily recovered from lignin. Vanol, base for synthetic vanilla flavoring, is another product.

Since crude lignin is humus material, forest laboratory experts are also studying its value as a commercial fertilizer. Its effect upon most vegetables, grasses and field crops seems beneficial. However, lignin is poisonous to a few plants, including thistles and dandelions, two pests.

Lignin is natural bedfellow of cellulose, now king of the plastics. In converting softwood to pulp it is likely that about forty-five per cent of the content is cellulose, about twenty-four per cent hemicellulose, about six per cent extractives and about twenty-five per cent lignin. A new method of pulp refinement removes true cellulose and hemicellulose together, which raises total cellulose recovery to as high as sixty-nine per cent of content.

From the cellulose acetate group, wood pulp treated with acetic acid, are being made pocket combs, fountain pens, sun glasses, lipstick casings, all sorts of ornamental coverings, fancy beads and imitation jewelry. This also produces the "dry-spinning" process for making rayons.

The greatest source of wood fabrics is now from the viscose process which, besides making rayons, produces imitation Cellophane, sausage casings, various wrapping materials and imitation linens. The cellulose nitrate or "celluloid" process of recovery from wood is pretty well

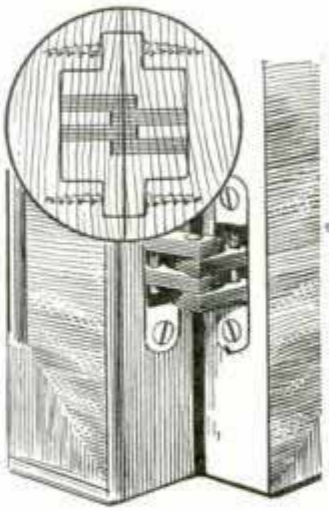
(Continued to page 144A)

Hat Made of Aluminum Shavings Is Matched by Dress Bow

Dress bow of aluminum shavings is worn with this hat, made of same material by Paris milliner

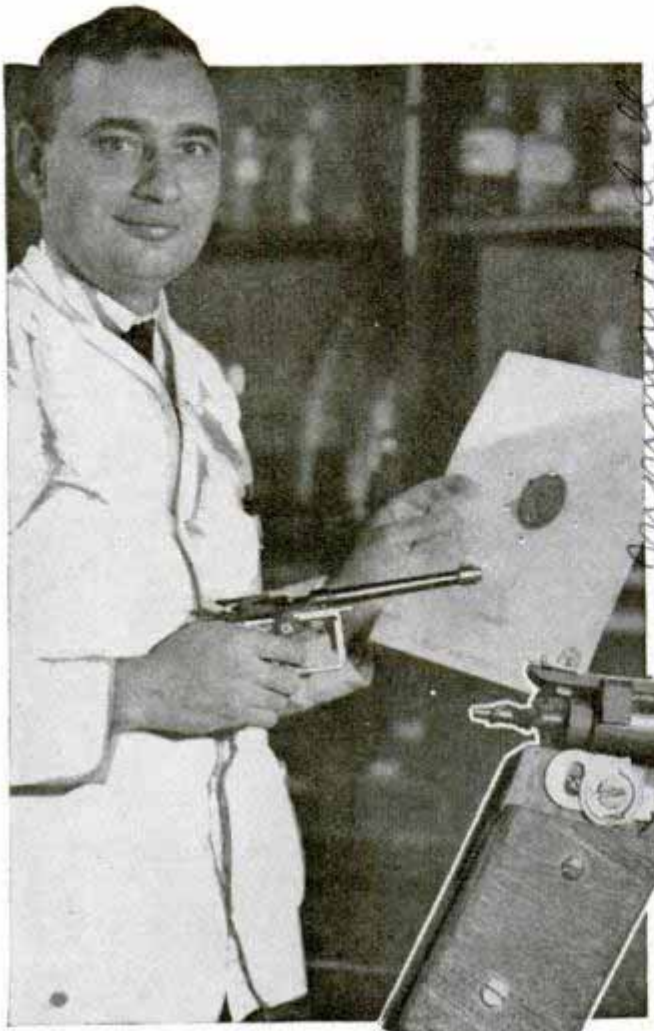
Hats made of metal shavings are the latest idea in millinery. One Paris milliner designed a glittering hat of aluminum shavings, and a bow of matching material was fashioned to adorn the dress.

Invisible Hinge Built into Door Is Safe from Tampering

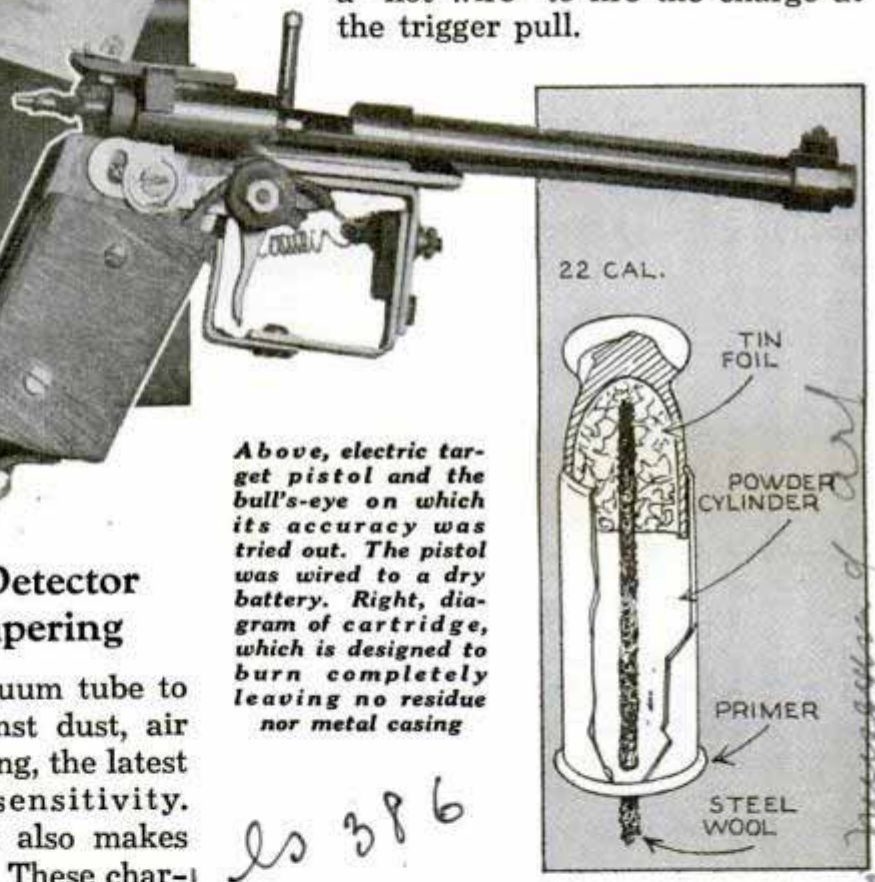


Not only does an invisible door hinge enhance the beauty of the home, but it is safer. No part of the hinge is exposed when the door is closed and it cannot be tampered with. A hinge recently introduced is built into the door. It consists of a series of specially heat-treated plates and pins operating in a track and forming a rigid, non-sagging truss supporting the door firmly regardless of its position.

Electric Pistol Fired by a Small Dry Battery



Electric firearms may displace the present-day rifle and revolver just as they outmoded the old flintlock gun. Dr. G. W. Thiessen of Monmouth college has developed a target pistol whose .22-caliber bullet is fired by a four and one-half volt radio battery. Hammers, extractors, ejectors and the metallic and paper casings now used for shells are eliminated. Instead, cartridges which burn completely are used, and Dr. Thiessen believes gunpowder will be supplanted by a better explosive, perhaps liquid. His first model employed the jump-spark principle requiring a coil and miniature spark plug, but this method was discarded in favor of a "hot wire" to fire the charge at the trigger pull.



Above, electric target pistol and the bull's-eye on which its accuracy was tried out. The pistol was wired to a dry battery. Right, diagram of cartridge, which is designed to burn completely leaving no residue nor metal casing

Vacuum-Tube Fire Detector Guarded from Tampering

Wholly contained in a vacuum tube to protect the mechanism against dust, air and the possibility of tampering, the latest fire detector has unusual sensitivity. Unique vacuum-tube design also makes possible accurate calibration. These characteristics are maintained over long periods of time which extend through the normal life of the protected property. Because of greater efficiency and reliability the detector has been approved for larger coverage, reducing the number of units required. The detector is approved for both open and closed circuits up to 250 volts. It may be used where unusual temperature conditions prevail and may be installed with sprinkler systems to give an alarm prior to operation of the sprinkler head.

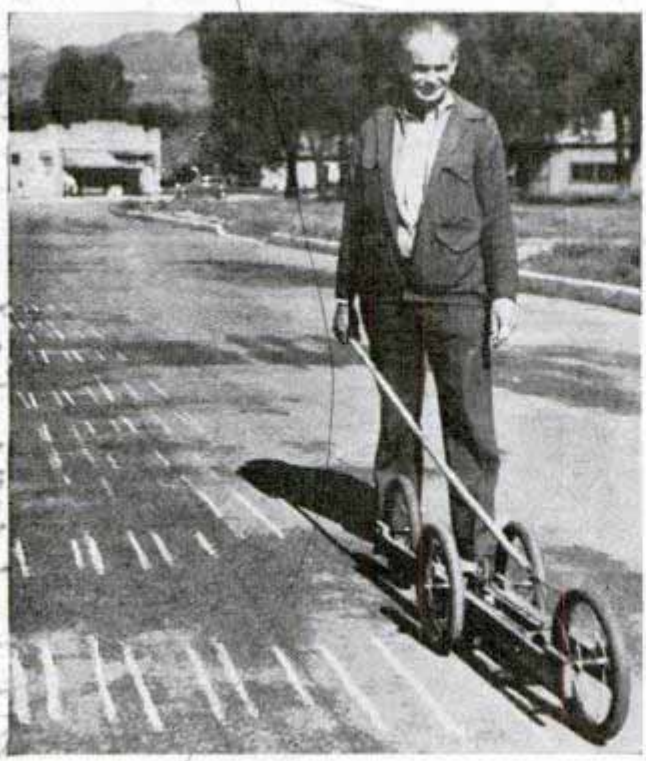
Alloys May Revive Armor Suits to Protect Modern Fighters

Development of firearms put suits of armor out of style three centuries ago, and now the development of alloys and hard metals may bring back armor for future warriors. A medieval's knight's armor weighed only fifty pounds and was no more uncomfortable than the equipment of a world war soldier, but as firearms came in the metal plates became so heavy

a fighter was hampered by their weight. Steel helmets were used in the world war, and iron mail was tried as an eye protector for British soldiers, but this was unsatisfactory as it caused dizziness. Light, hard metals now manufactured may restore armor to usefulness.

'Bumpograph' Hits High Spots Where Street Is Uneven

If the street surface is uneven by as little as one-sixteenth of an inch, the "Bumpograph" will tell you. This sensitive instrument was devised by a California state engineer to mark uneven places in the pavement. As the machine is pushed along the street, it charts the high spots with chalk marks to guide road roller and grader operators in smoothing the surface.



White lines marked on street by the "Bumpograph's" chalk finger show where pavement needs leveling

Tiny Furniture Is Fashioned to Scale by Skilled Craftsman

Some of the miniature furniture constructed by London craftsman

Miniature furniture that reflects a high degree of skill is being manufactured by a former London policeman in his shop. Built to scale, the tiny pieces are complete in every detail. Small dishes, vases, lamps and other accessories are used with the furniture.

"Periscope" Rear-View Mirror Mounted on Cab of Truck

With a rear-view mirror mounted on the roof of his cab, a truck driver can watch the traffic behind him regardless of cargo or trailer interfering with his rear window. This mirror assembly comprises three reflectors, one set in a water-tight hood fixed eight inches above the cab top, another set in the roof and the conventional reflector facing the driver.

Streamline Carrier on Bicycle Holds Rider's Packages

Odd funnel-shaped device is streamline package carrier for bicycle

Something new in streamlining is displayed by an English bicycle rider. It is a package carrier, designed in the shape of a funnel, mounted on the handlebars. With its small end to the front, the carrier offers less resistance to the wind and also provides space for the rider's packages.

Future Car to Lack Spare Tire and Running Boards

Automobiles of the near future will lack running boards, protruding door handles and spare tires. Engineers already are busy on plans to increase the width of the interior, which is expected to result in elimination of the running boards. To smooth out the appearance of the car, door handles visible from the front will disappear, these engineers believe. Instead there will be recessed controls for opening and closing the doors. Controls of this type might be installed almost immediately because equipment companies have developed at least one variety and are working on others. Disappearance of the spare tire entirely is expected to accompany introduction of puncture and blowout-proof tires, of the low-pressure type. These tires would be about nine or ten inches wide and carry ten to twelve pounds of air, giving a softer ride than any tire now available. Hand in hand with these developments will come the "marine type" of construction, which produces the chassis and body in a complete unit and which results in light weight and greater strength. Experimental work looking to this end already is being done. Engine designers, some of whom are engaged in experiments that may bring the rear-motor car within twelve months, are working on smaller and lighter power plants. This work involves changes in combustion-chamber design, valve systems and fuel supply. Next year's cars may offer unusual transmission developments, including at least one automatic transmission. Several new transmissions are being tested. Lightweight engines which will require less space may be expected, engineers say, in 1939 and 1940.

Grandstand of Welded Oil Pipes Cuts Building Cost in Half

Pipes salvaged from the oil fields were used to build an attractive grandstand at Sapulpa, Okla., and the employment of this scrap material saved half the cost of the project. Various sizes of pipe formed the framework, railings and seat supports, the joints being welded for strength.

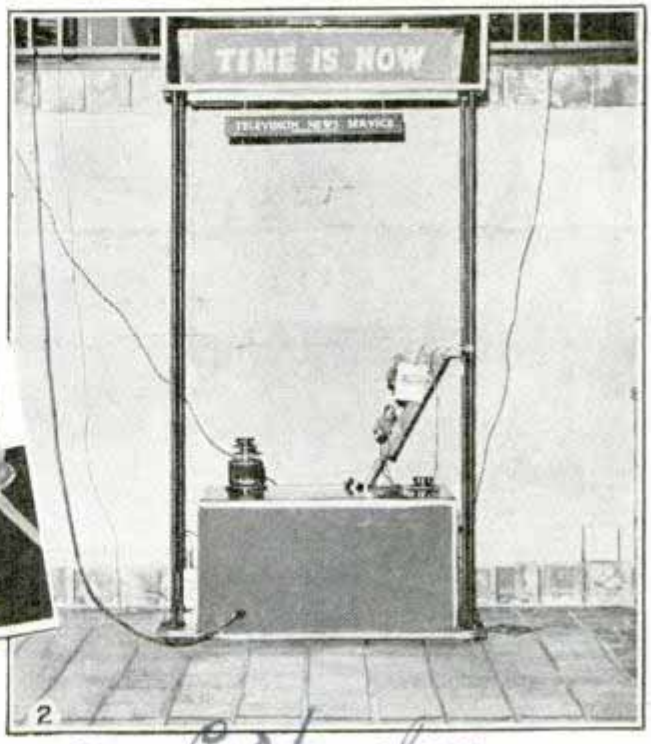
Scraps of pipe picked up in the oil fields were used to build this grandstand. The joints are welded

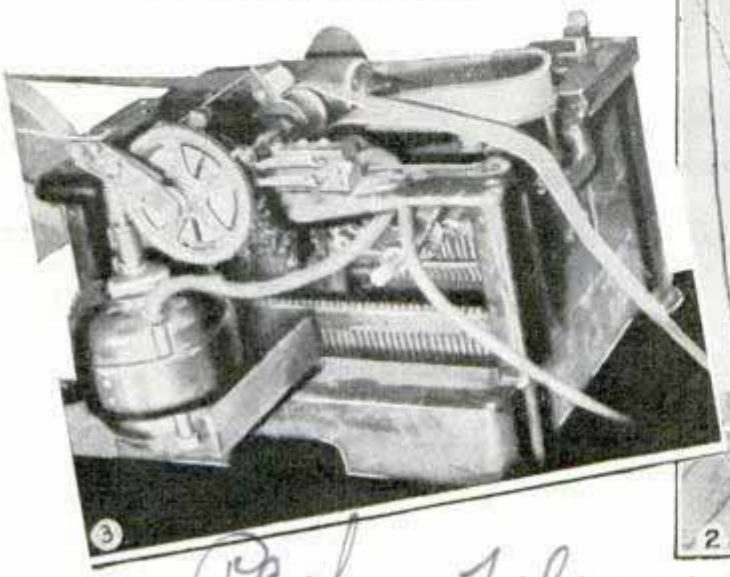
News Bulletins by Television

BALL scores, stock-market reports, correct time and the latest news bulletins chase each other in rapid succession across an 8 by 30-in. television screen in a receiver recently demonstrated by William H. Peck for use in hotels, restaurants and business offices where a loudspeaker system would not be desirable.

At the transmitting station, shown in Fig. 1, the young lady is operating a specially constructed electric typewriter that prints the news bulletins in ¼-in. letters upon a strip of transparent tape. The disk shown through the door of the transmitting rack at the right contains reflecting lenses which cause a light beam to scan the transparent typed tape, through which it passes to a

(Continued to page 142A)





Peck Television Corp. due
66 W. Broadway New York

A.C.-D.C.

By Frank M. Lund

UNUSUALLY small and compact, this tiny 3-tube tuned r.f. receiver meets all requirements for a truly portable, highly efficient set suitable for tourists, traveling men and vacationists in out-of-the-way places where line-supply facilities are likely to be either a.c. or d.c.

Although small enough to slip into the travelers' hand luggage, it employs a 5-in. dynamic speaker and has a full ¾-watt output. The construction details are simplified for the beginner and only a few inexpensive, but carefully selected standard parts are required.

The set actually performs with 4-tube efficiency, as one tube is of the dual-purpose type. This new octal (8-prong) base tube, known as the 25A7-G, is a combined power-amplifier and rectifier in a glass envelope, as indicated by the letter G. The power-output section is similar to the type-43 tube, and the rectifier is a half-wave type somewhat like the 12Z3.

A schematic circuit diagram is given in Fig. 1 and the metal-base details are clearly shown in Fig. 2. It will be noted that the base is shaped so as to provide ample room for all parts above and below the chassis, and to lower the tubes so that the completed set can be installed in a cabinet only about 6 in. high, 7 in. long and not quite 5 in. deep. This base can be formed by bending sheet metal clamped

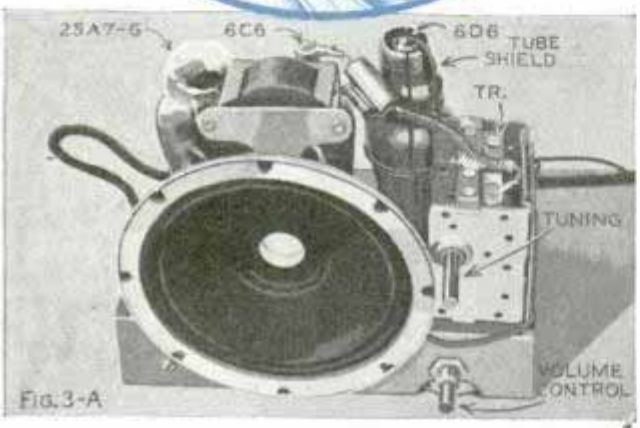


Fig. 3-A

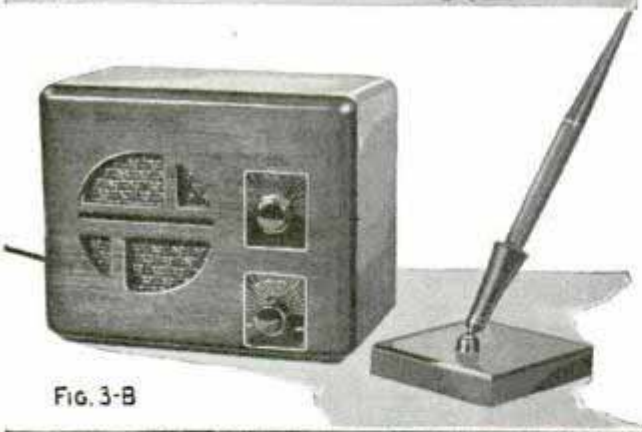


Fig. 3-B

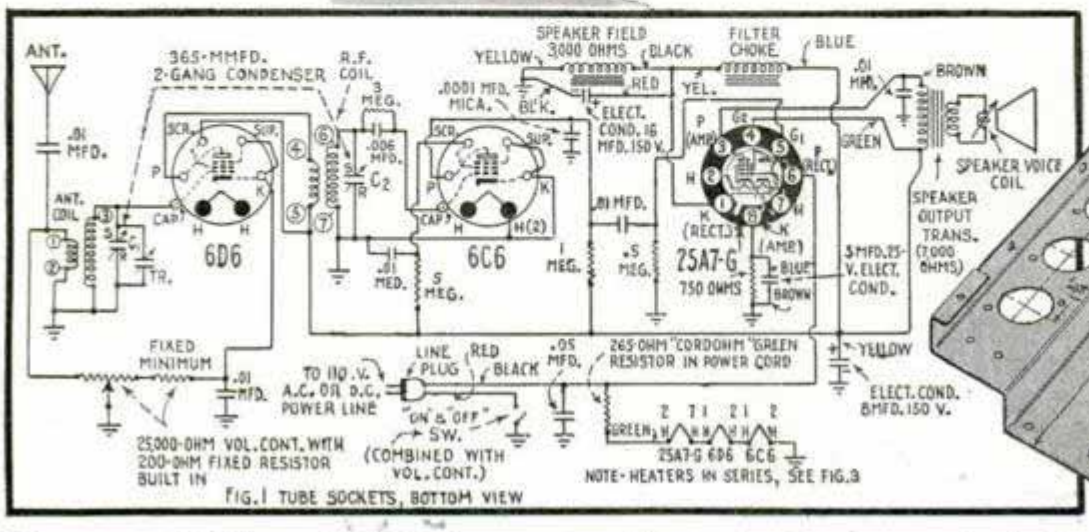
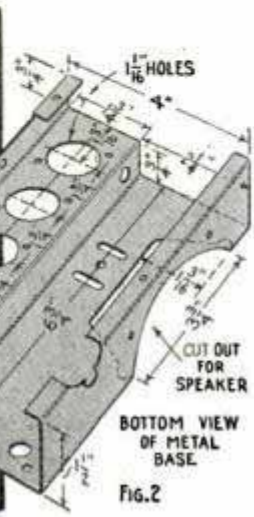


FIG. 1 TUBE SOCKETS, BOTTOM VIEW



BOTTOM VIEW OF METAL BASE

Fig. 2

LITTLE GIANT "PUP"

Portable 3-Tuber for Travelers or Summer Home . .

between pieces of wood in a vise or it may be purchased formed and drilled, if desired.

The simplified wiring diagram, Fig. 3, shows an underside view of the base with all parts in their relative positions; the parts mounted on top of this base are also sketched in detail above and at the right, so that every lead can be traced easily. Photos 3-A, 3-C and 3-E, show top and bottom views of the completed chassis with various parts marked for identification. Figs. 3-B and 3-D are photos of the finished set installed in an inexpensive wood

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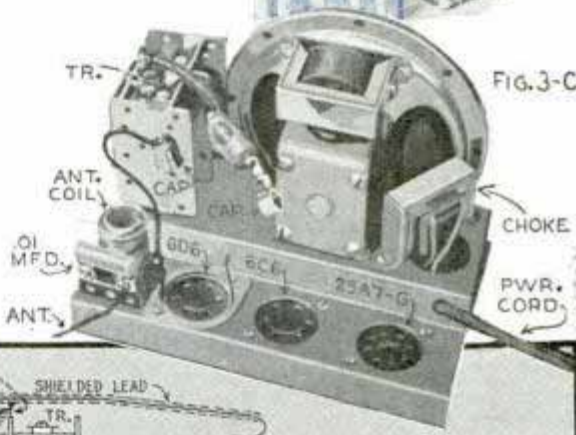


FIG. 3-C

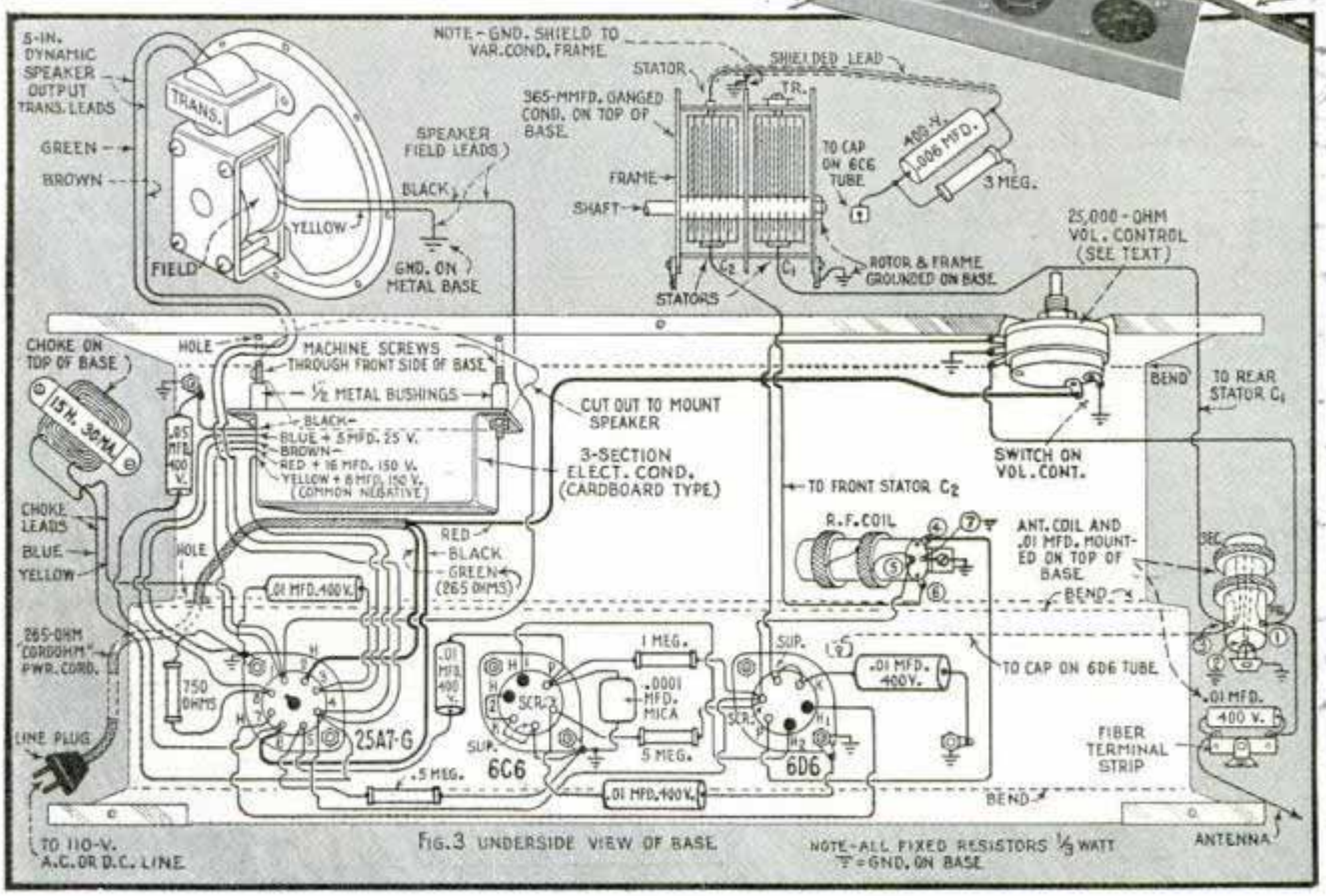
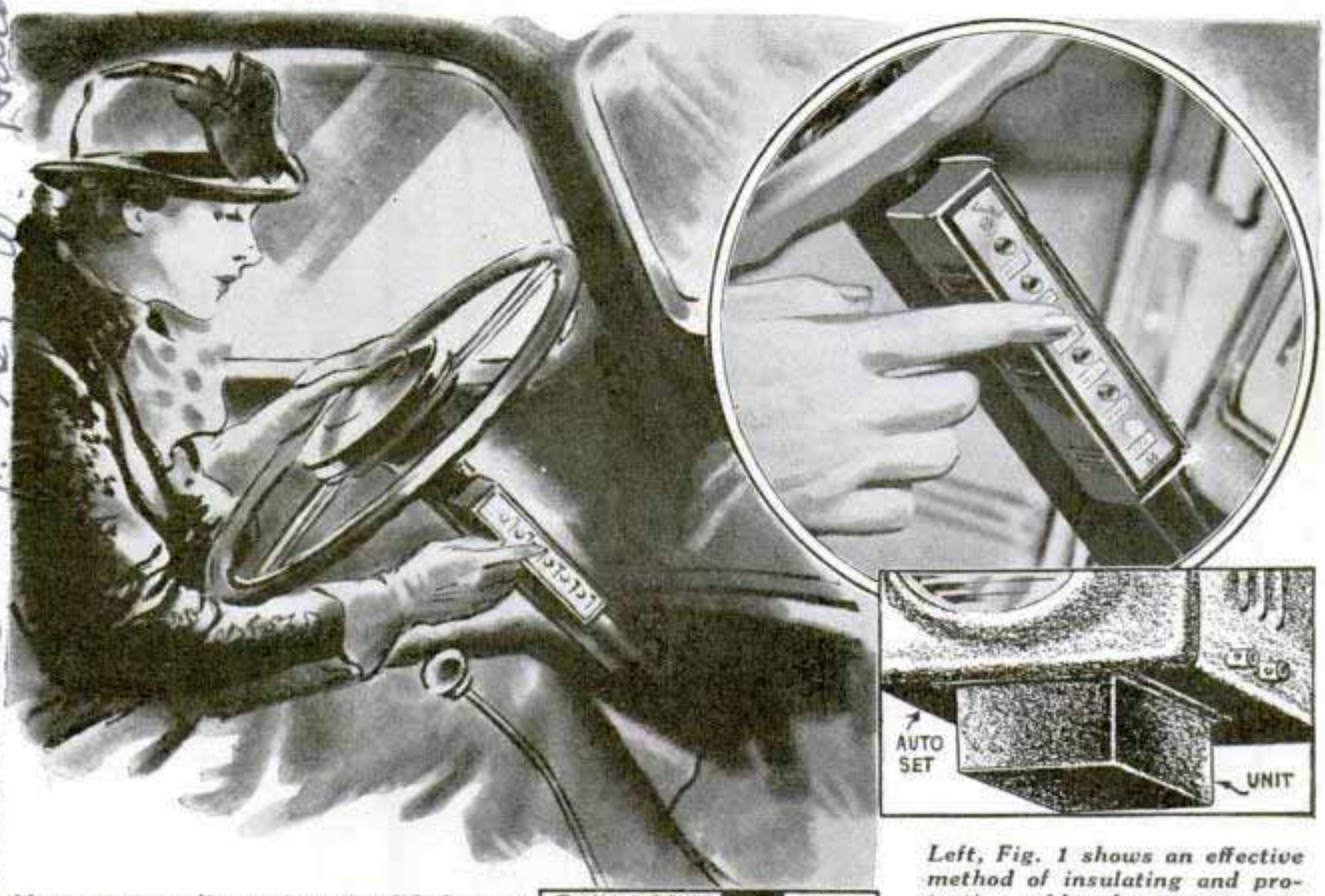
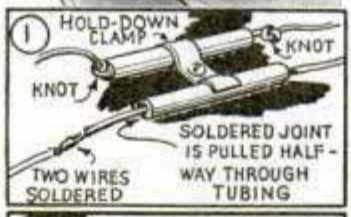


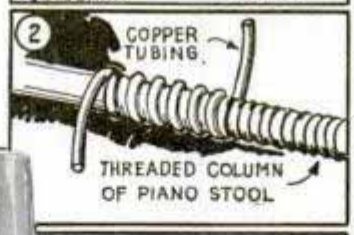
FIG. 3 UNDERSIDE VIEW OF BASE

Easy Solutions for Everyday Radio Problems

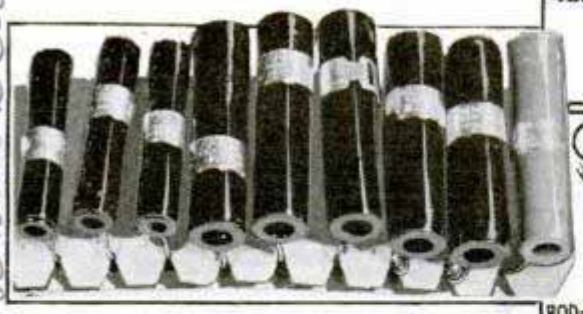


Above, auto-radio tuning simplified to push-button operation by means of an automatic tuning unit easily added to any auto-receiver installation. The control mechanism can be adjusted to tune five stations and may be mounted on the steering post, or dash, to supplement the dial. Inset photo at upper right shows windows provided for station call letters. The automatic tuning unit, shown below, is housed in a metal box fastened to the side of the receiver

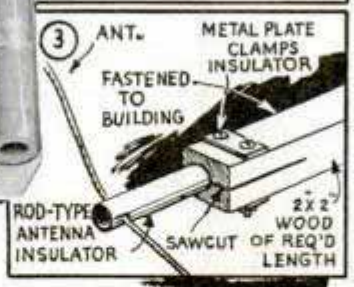




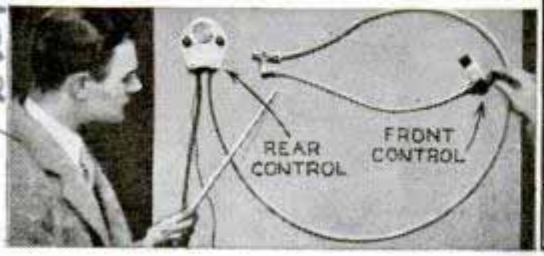
Left, Fig. 1 shows an effective method of insulating and protecting soldered connections in flexible leads when wiring set assembled on a metal chassis; the short lengths of fiber tubing are clamped to the base. This method is permanent and safer than taping. Fig. 2 illustrates an idea used by one of our readers for winding space-wound short-wave transmitting coils, of small diameter, with heavy copper tubing

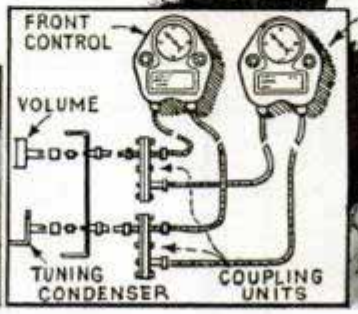


Above, vitreous-enameled fixed resistors for damp climates. Below, and right, dual remote controls permit tuning any auto set from rear seat, or dash



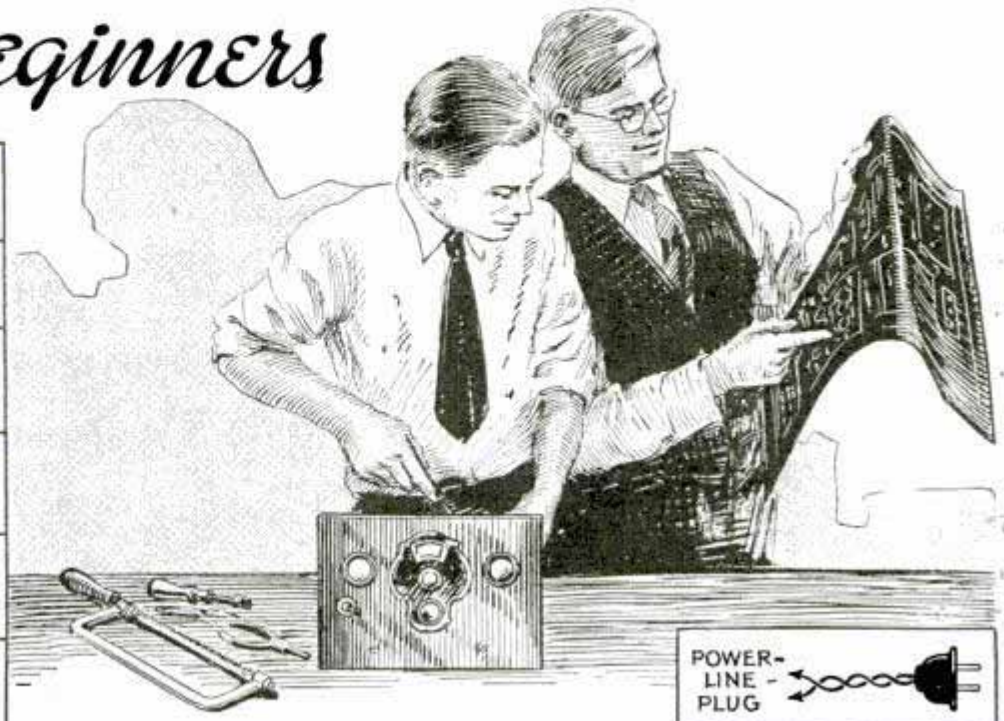
If antenna lead-in wire must clear the corner of the building, a rod-type insulator may be mounted in a wooden standoff as shown in Fig. 3

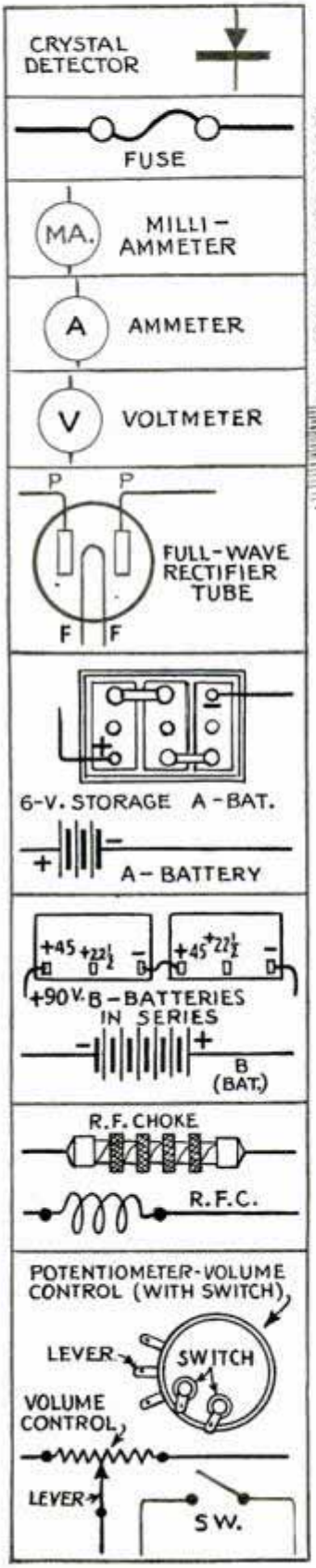




RADIO SYMBOLS

for Beginners

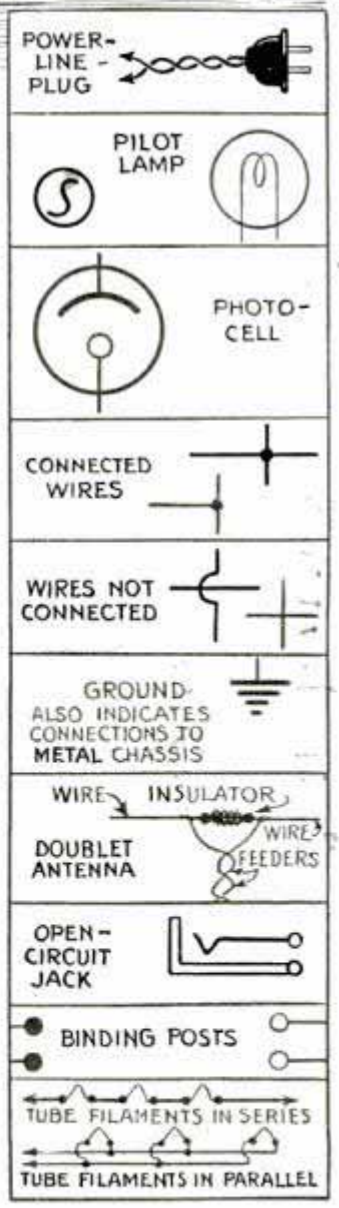




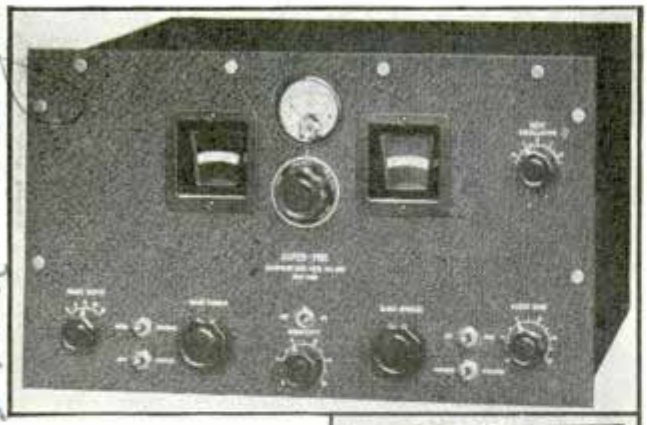
SOME of the common symbols and abbreviations used in radio diagrams appear on this page. The list includes a few sketches of the parts represented by the symbols, where the symbol alone seems to puzzle the beginner. This group completes the list given in a previous issue and will aid those who have been using picture diagrams exclusively, to check their work with the "schematic" circuit diagrams in which the symbols are employed to indicate the actual parts in their proper relation in the circuit. Although these graphic symbols are not fully standardized, they are quite well known through popular use.

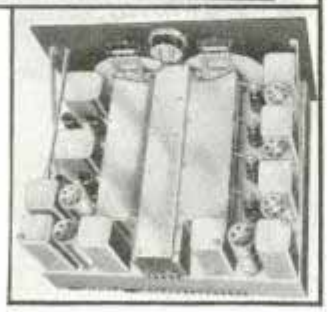
Tubes are commonly diagramed showing bottom views of socket connections and there is a standardized terminal-numbering system that applies to all tubes regardless of the number of prongs. Complete tube manuals are available from the tube manufacturers, therefore no attempt has been made to include the various types of receiving tubes. In the radio construction articles that appear in Popular Mechanics Magazine, the numbering

(Continued to page 142A)



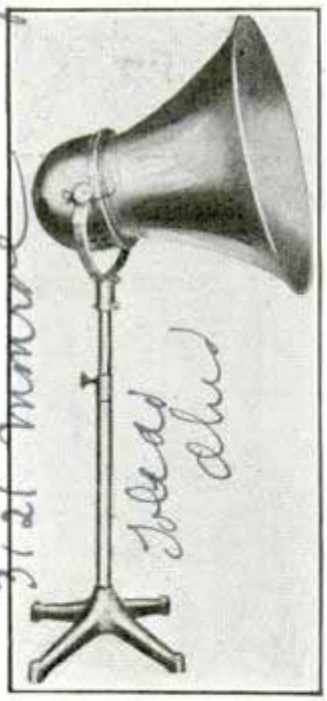
All-Wave Set of Advanced Design





This "super-pro" professional-type receiver employs sixteen tubes, eight of which are of the metal variety. The compact well-shielded chassis is shown at the right. New features include calibrated band-width control, visual tuning meter and graduated selectivity and audio-gain controls.

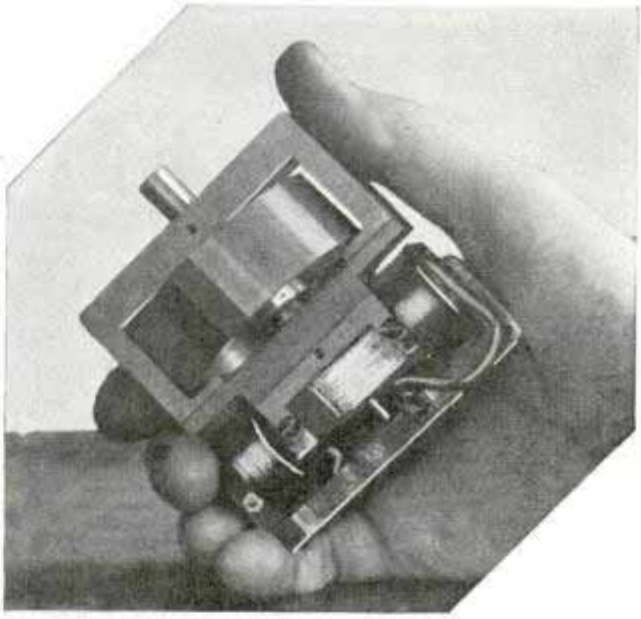
Speaker in Baffle-Type Horn



Any standard 12-in. speaker can be installed in the cast aluminum throat collar of this baffle-type horn. The collar provides a sturdy foundation for mounting the speaker and is supported by an adjustable cradle. A back cover of heavy metal is provided with an air by-pass so that the speaker can "breathe," thus eliminating distortion. The baffle has a bell of 29 in. and is 20½ in. deep. Available with adjustable stand, this rugged horn is designed for utmost output, and is suitable for both indoor and outdoor use.

Midget Motor and Scanning Disk

Although small enough to be carried in the palm of a man's hand, this mechanical television scanning system is said to have several advantages over cathode-ray systems. The scanning disk is only 2 in. in diameter and weighs but 1¾ ounces. As very little power is required to rotate the disk, a miniature multi-speed synchronous motor automatically keeps the disk



in step with any television transmission regardless of the number of lines per frame, or frames per second being sent, or whether the transmitted signals are intended for mechanical or cathode-ray reception in the home.

¶Blueprints covering radio construction articles in past issues are available for 25 cents each; original material lists and additional information can be obtained from our Radio Department without charge upon receipt of postage.

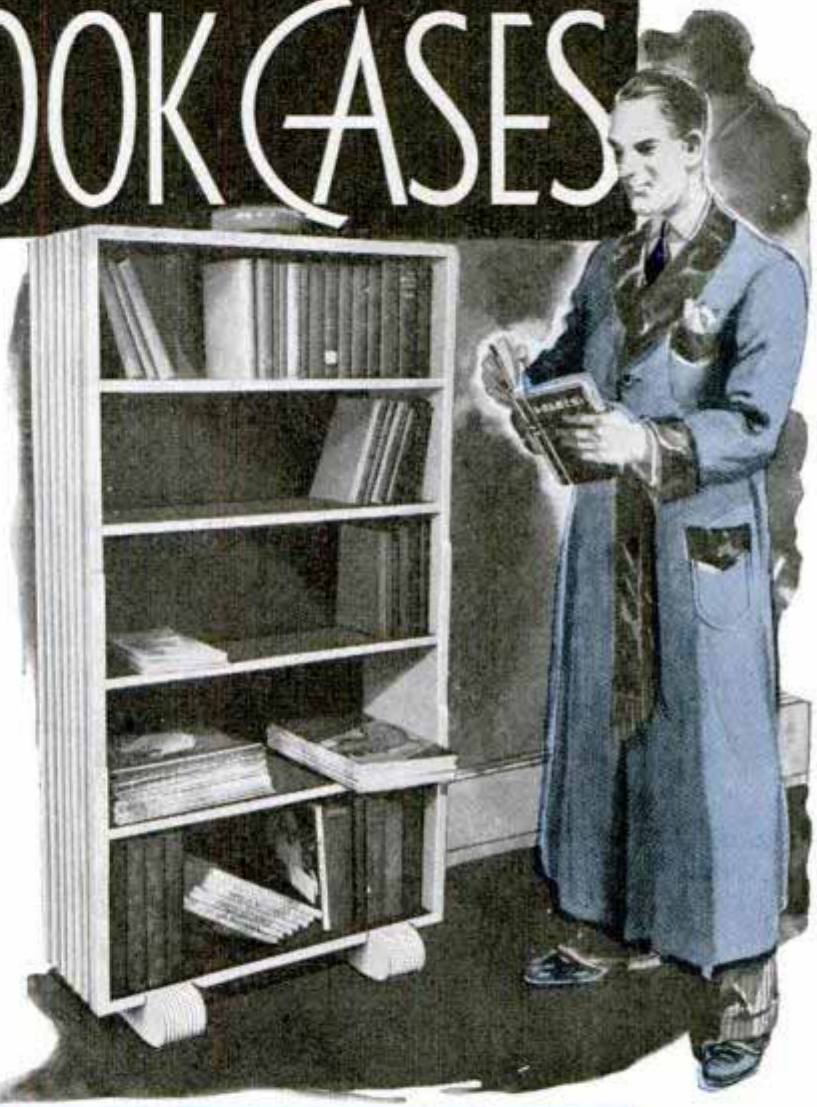
NEXT MONTH—How to Build a Self-Powered Six-Tube A.C.-D.C. Audio Amplifier Without Transformers or Chokes. An inexpensive breadboard-type 3½-watt amplifier that you can use to bring your old phonograph up to date; excellent tone, easy to build. Also construction details for **"Cold-Oven" Crystal Holders**

Distinctive BOOK CASES

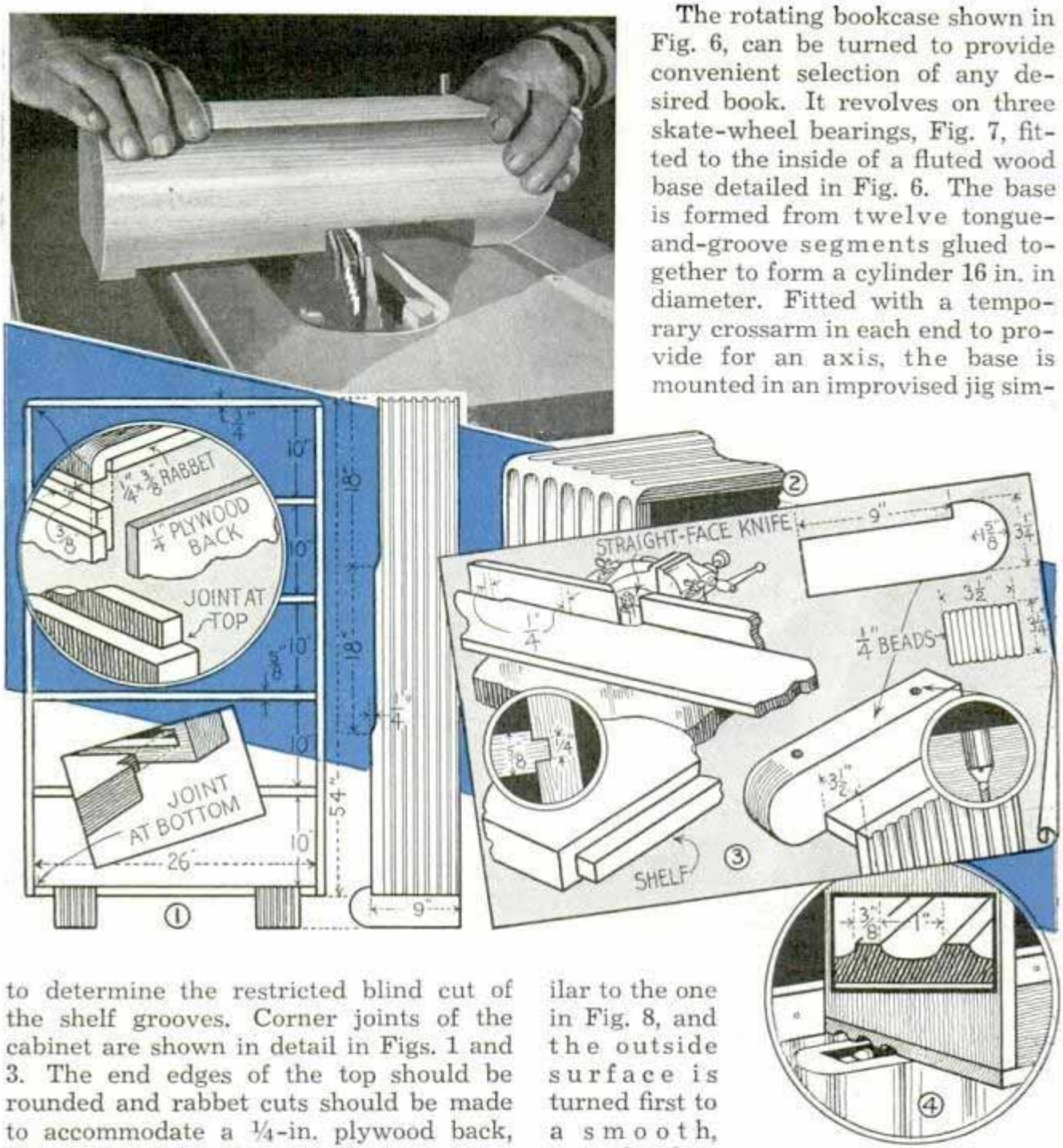
Fluted, open bookcase improves room balance while "turntable" type is handy at armchair

By WAYNE C. LECKEY

FINISHED in the popular bone-white and walnut or mahogany combination, these bookcases will go well with almost any modern furnishings, and they can be made inexpensively right in your home workshop, using any close-grained wood that will take a smooth coat of enamel. The case at the right is the modern, open-shelf type, while the one below is round and can be rotated on its base. To make the open-shelf wall bookcase, first, cut the four shelves and bottom to identical length, allowing for tenons. Dimensions are given in Fig. 1. After cutting the side pieces to their over-all length, the receding front edges are shaped in order



Pleasing bone-white exterior and contrasting mahogany-finished back and shelves give the case above, with its "sled-runner" feet, a distinctly modern appearance, while the rotating one at the left, which is similarly finished, serves the triple purpose of a bookcase, end table and lamp table

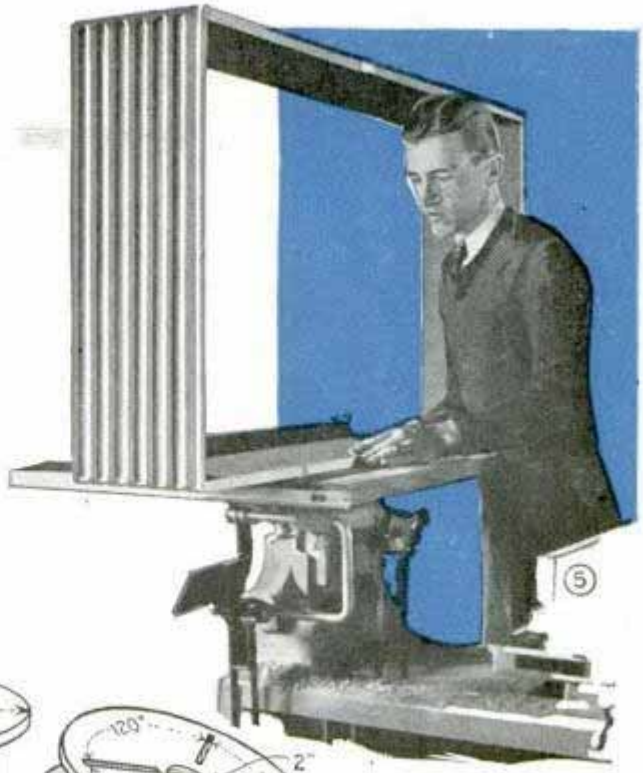


The rotating bookcase shown in Fig. 6, can be turned to provide convenient selection of any desired book. It revolves on three skate-wheel bearings, Fig. 7, fitted to the inside of a fluted wood base detailed in Fig. 6. The base is formed from twelve tongue-and-groove segments glued together to form a cylinder 16 in. in diameter. Fitted with a temporary crossarm in each end to provide for an axis, the base is mounted in an improvised jig similar to the one in Fig. 8, and the outside surface is turned first to a smooth, round cylinder after which it is indexed and fluted.

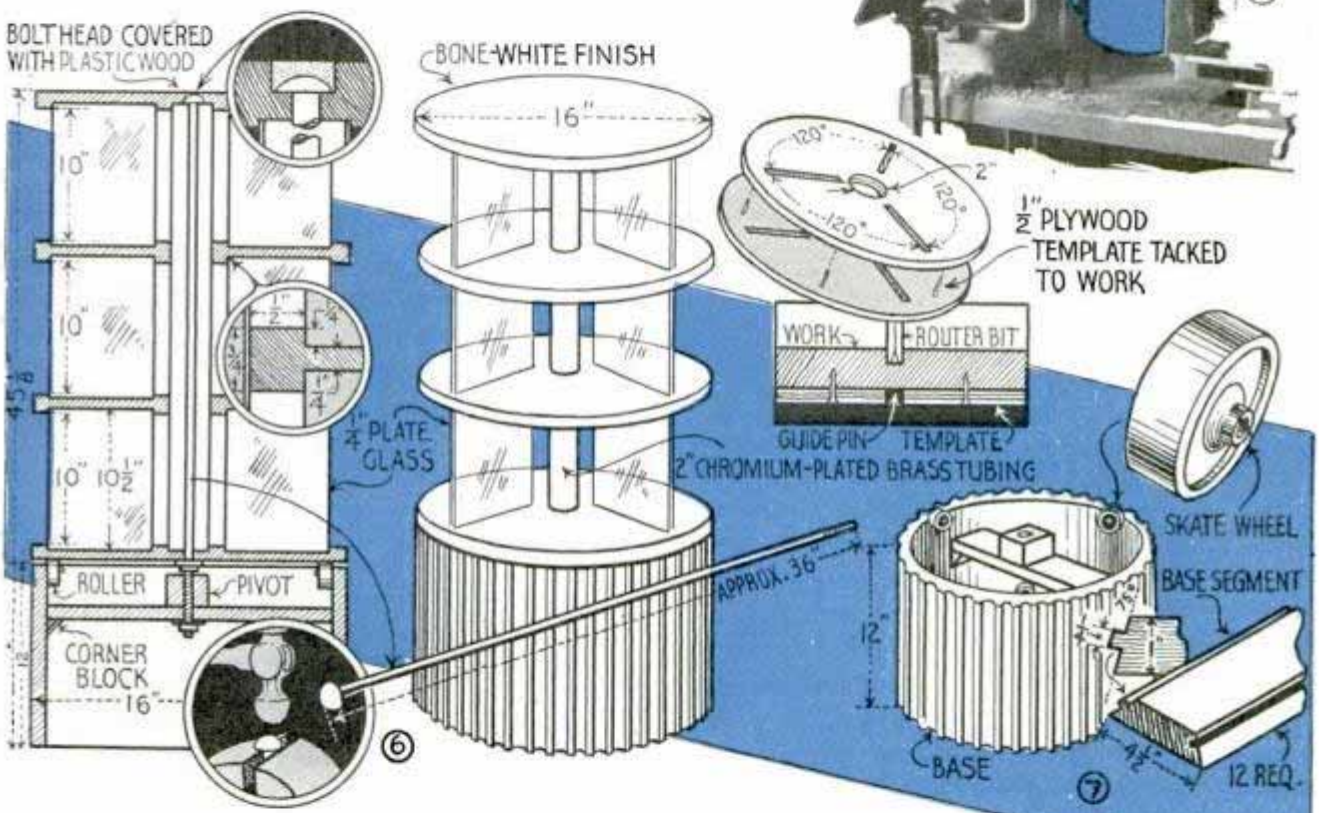
to determine the restricted blind cut of the shelf grooves. Corner joints of the cabinet are shown in detail in Figs. 1 and 3. The end edges of the top should be rounded and rabbet cuts should be made to accommodate a ¼-in. plywood back, before gluing and clamping the carcass together. The fluting of the case is done after assembly as the cuts extend into the end grain of the top. Although the fluting can be done with a universal hand plane if necessary, a 1-in. knife in a molding head will allow the work to be done quickly on a circular saw as in Figs. 4 and 5. The "runner" feet are rabbeted to hook over the front edge of the bottom shelf. They are band-sawed from solid blocks to the dimensions given in Fig. 3, and are rabbeted with a dado cutter. The round nose of each foot is decorated with ¼-in. beads. The feet are attached with screws inserted in counterbored holes.

The upper assembly, composed of plywood disks spaced with plate-glass vanes radiating from a polished center tube, is held together with a ⅜-in. tie rod, threaded at one end to pass through a wooden hub fitted in the base. The four plywood disks stacked in sandwich form, with an additional piece of ¼-in. plywood, which is to be used later as a template, are carefully band-sawed as one piece to a diameter 16 in. Only the two center disks are bored completely through to fit over the center tube, the top and bottom disks being recessed to center the tube. Grooves

in the surface of the disks to hold the radiating panes of glass can be routed accurately by first cutting a template, which, when tacked to the work, engages a guide pin fitted in the drill-press table directly beneath and in line with the router bit. Care should be taken in cutting the template as any variation will be duplicated in the top surface of the disk. When the grooves are routed on one side, the template is tacked to the opposite side directly over those cut on the underside. With one end of the tie flattened to form a head, it is then passed through the center tubing, drawn securely with nut and washer, and finally attached to the base.

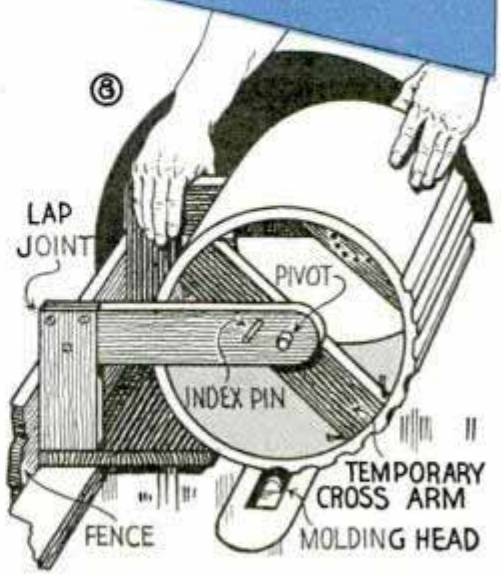


⑤



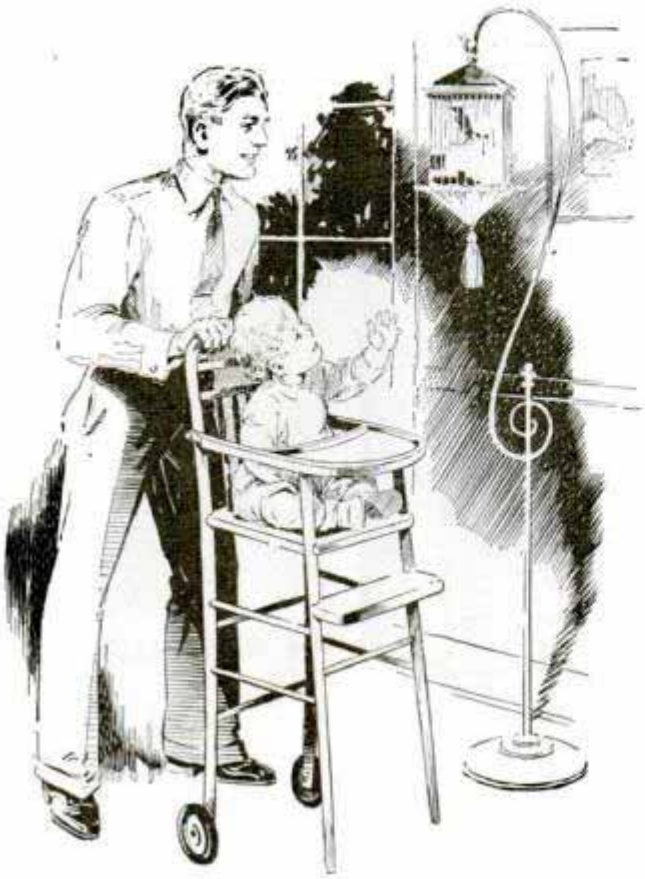
⑥ ⑦

Now to finish. Enamel coats require just as careful preparation of the wood as any varnish or wash finishes, and the first thing to do is to go over all exposed parts with progressively finer grades of sandpaper. A sheet of sandpaper wrapped around a large dowel will get into the wide flutes while steel wool is the thing for cleaning up beads on the curved feet. The important thing is to see that all surfaces to be finished are smooth without any indentations or tool marks. The first application should be a suitable undercoater. When thoroughly dry, this is gone over lightly with fine steel wool. Then the first coat of enamel follows, this being laid on in long strokes with a fine bristle brush and when dry is rubbed lightly with fine steel wool. Then you can apply the final coat.



⑧

High Chair with Wheels on Legs Is Easy to Move



Small wheels on rear legs of high chair make it easy to move the chair and baby from room to room

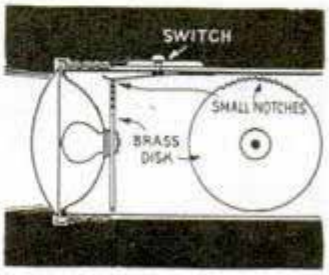
As many mothers often desire to move a high chair while the baby is sitting in it, a couple of small wheels on the rear legs will save lifting as the chair can be tipped back slightly and pushed forward. And there is no possibility of the chair moving when set down as the front legs rest on the floor. Wheels about the size of those used on small scooters are ideal for the purpose. The rear legs, of course, should be sawed off so that the chair will set level when the wheels are attached to them.

Chains on Oars Teach Beginners to Row a Boat

Noticing that it was a common failure among beginners in boating to dip their oars too deeply into the water, one resort owner attached a pair of chains to the inside of each boat and fastened them onto the oars to restrict the dipping to the proper depth. This not only accomplished the purpose intended, but also prevented much wear of the oars on the locks.

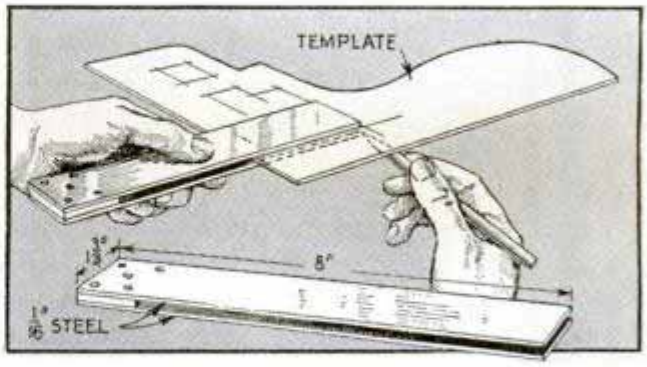
Improving Your Flashlight

Have you ever had your flashlight fail to operate just when you needed it badly? If the battery and bulb were in good condition, the trouble was probably caused by corrosion at the switch contacts. Many flashlights have a brass disk behind the bulb against which the sliding switch arm contacts, and if a little corrosion forms on the arm the light may not work. However, if the edge of the disk is serrated where the arm slides over it, the points formed by the serrations will cut through the corrosion.—E. T. Gunderson, Humboldt, Ia.



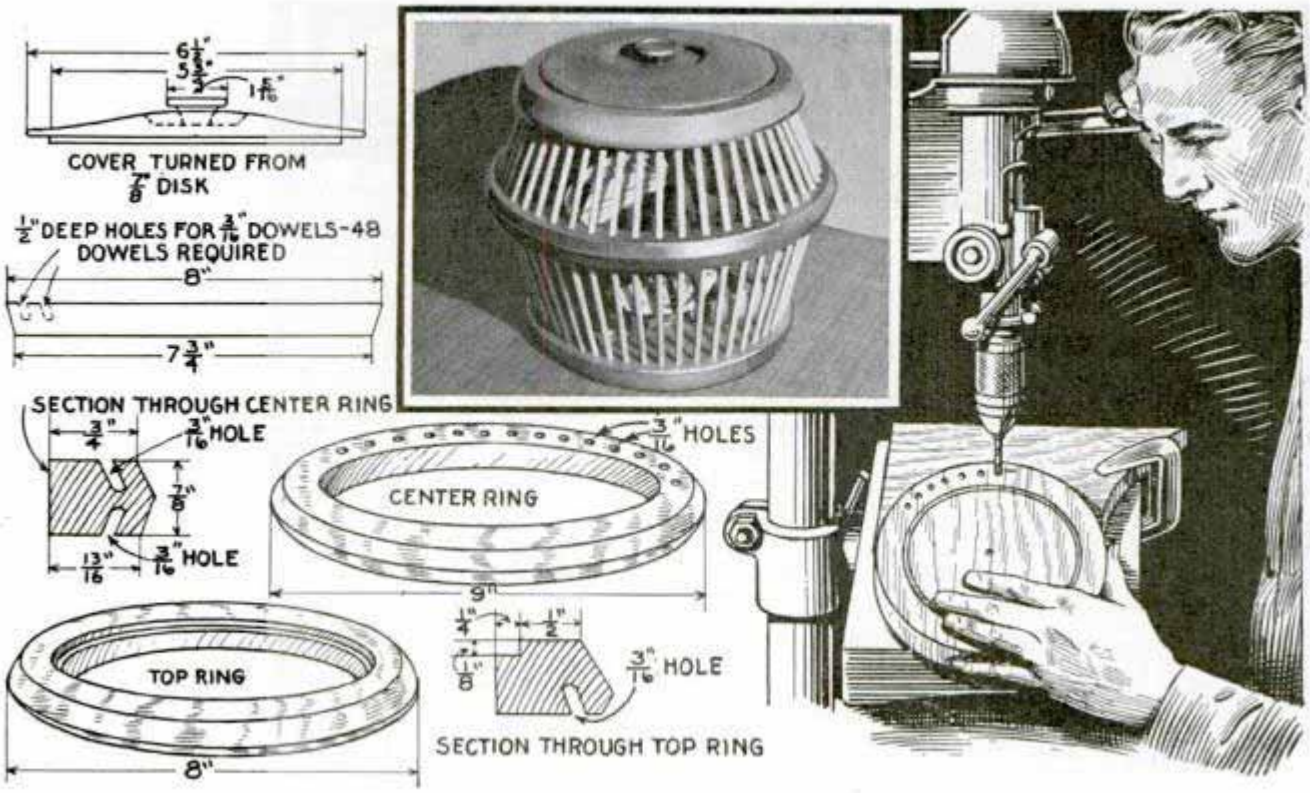
Straightedge Transfers Lines to Opposite Side of Work

Transferring a line from one side of work to the other is done accurately with this double-blade straightedge. It consists of two pieces of 1/16-in. brass or steel, riveted together at one end with a spacer block between them. Thickness of the spacer is best made to suit the thickness of the work most often used. Edges of the tool should be absolutely square and the two pieces must be assembled in perfect alinement to assure accuracy.



Double-blade straightedge saves time in transferring lines from one side of work to the other

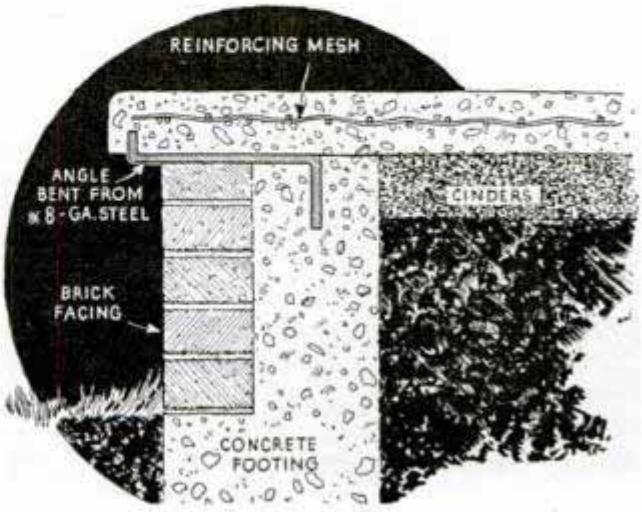
"Cage" Basket Holds Your Sewing Materials



Ideal for darning or knitting materials, this simple basket requires four pieces of wood and ninety-six dowels or skewer sticks. Figured gum makes a lovely basket, but if you finish the dowels in their natural color, more contrast can be obtained if walnut is used. The base is a simple turning job with a slightly beveled edge, but the top and center rings require different treatment. To make them, turn the outside and inside until nearly through, then sand and finish in clear lacquer or other suitable finish. Now, with a parting tool or skew held edgeways, cut clear through the work at lowest lathe speed and then finish the inside surface. A full-size pattern should be laid out on paper to better determine the angles of the outside edges of the rings. Dowel holes are easily drilled at the correct angle in the rings by tilting the drill-press table. The cover is turned from a 1-in. piece, and the design shown permits providing a neat knob for easy removal. The dowels for the upper half of the basket are 3 in. long and those for the lower part are approximately 4 in. long. The entire job is assembled with glue.

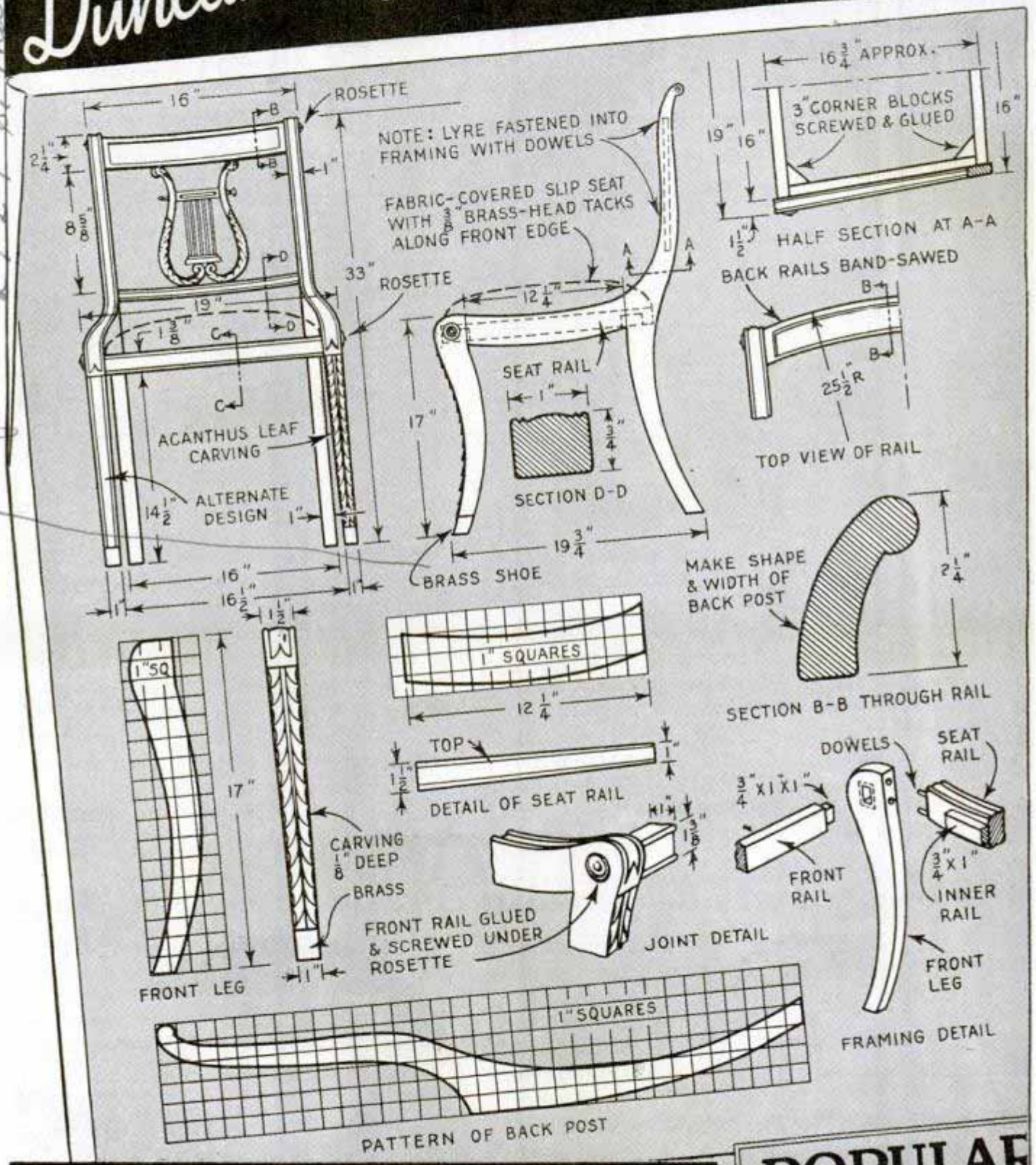
Concrete Porch Reinforced at Edge with Long Steel Angle

If you are going to build a decorative concrete porch of the type shown, which has the floor extending slightly over the supporting wall, be sure to reinforce the projecting portion with a steel angle. If this is not done, the edge is likely to break off in time. Bent from No. 8-ga. sheet steel, the angle runs the entire length of the porch, one side being set into the wall and the other into the edge. Besides strengthening the edge, the angle provides a water seal to keep moisture from working in between the floor and the wall, which is necessary if the porch is to last.



Craftsman Wood Service
227 S. Pearl St. Albany

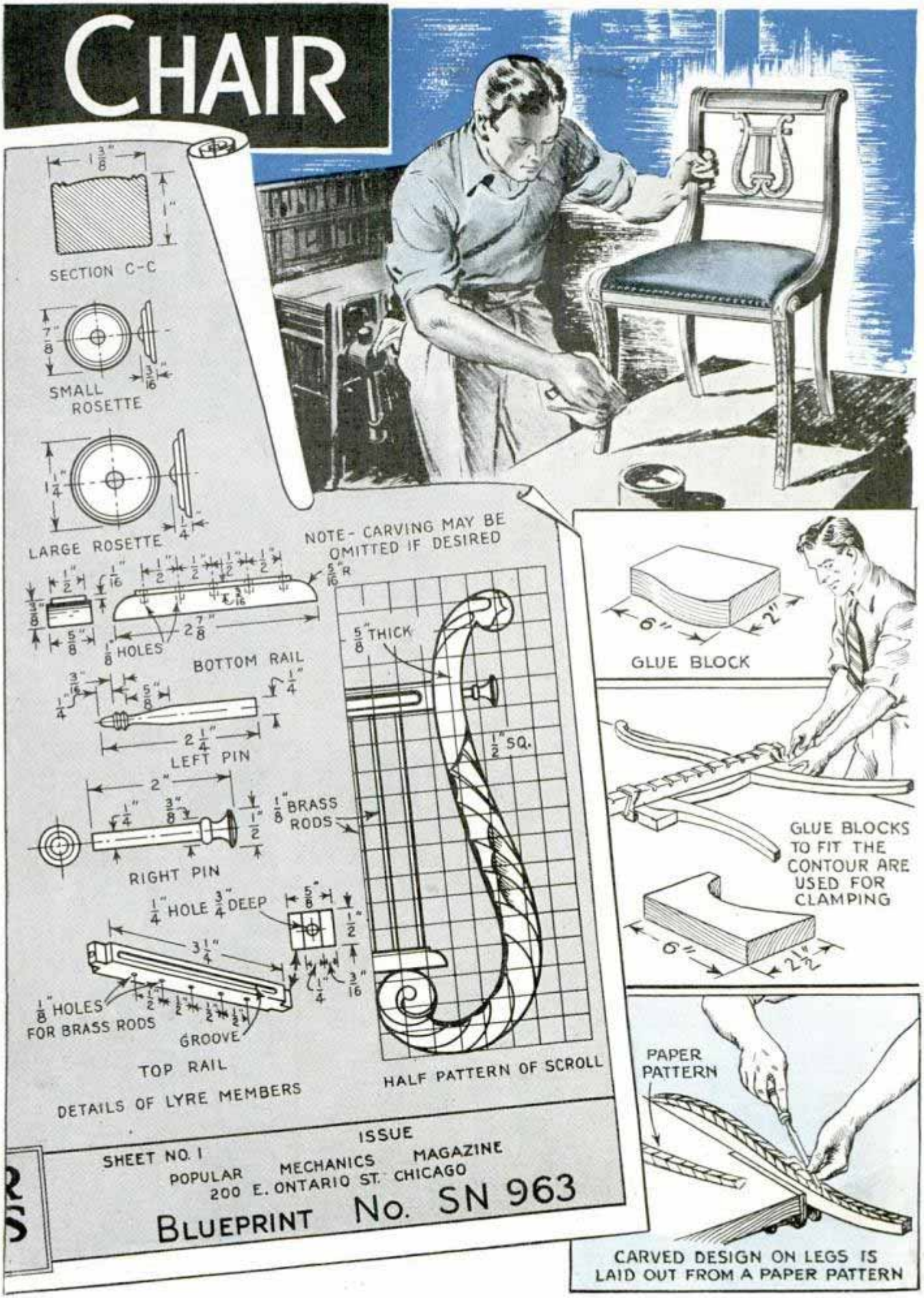
Duncan Phyfe LYRE-BACK



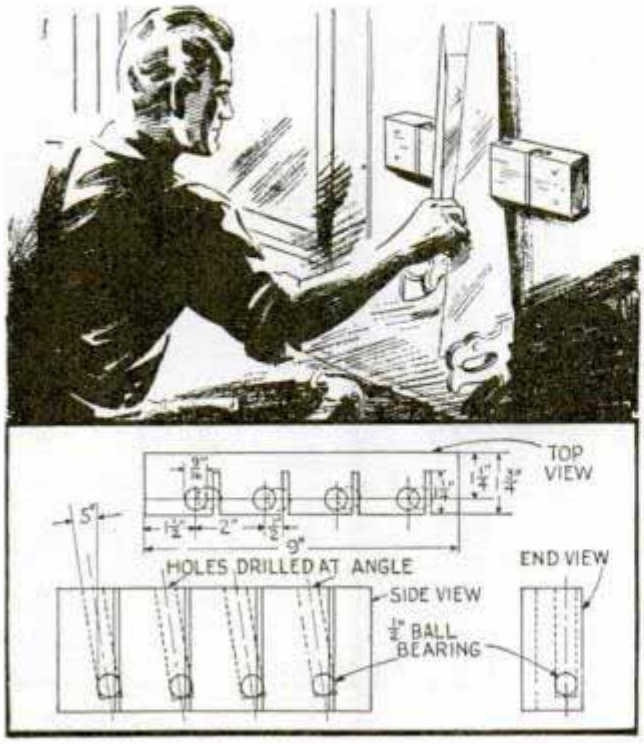
If it's your hobby to make pieces of exceptionally fine furniture, you'll find it worth while to get out a set of these exquisite dining-room chairs. Although they have been made entirely by hand, a band saw and shaper will save much time and tedious effort

POPULAR MECHANICS MAGAZINE

CHAIR


SECTION C-C
SMALL ROSETTE
LARGE ROSETTE
NOTE- CARVING MAY BE OMITTED IF DESIRED
1/8" HOLES
BOTTOM RAIL
LEFT PIN
RIGHT PIN
1/8" BRASS RODS
1/4" HOLE 3/4" DEEP
1/8" HOLES FOR BRASS RODS
GROOVE
TOP RAIL
DETAILS OF LYRE MEMBERS
5/8" THICK
1/2" SQ.
HALF PATTERN OF SCROLL
GLUE BLOCK
GLUE BLOCKS TO FIT THE CONTOUR ARE USED FOR CLAMPING
PAPER PATTERN
CARVED DESIGN ON LEGS IS LAID OUT FROM A PAPER PATTERN
SHEET NO. 1
ISSUE
POPULAR MECHANICS MAGAZINE
200 E. ONTARIO ST. CHICAGO
BLUEPRINT No. SN 963

Hand Saws in Friction Rack Easily Removed

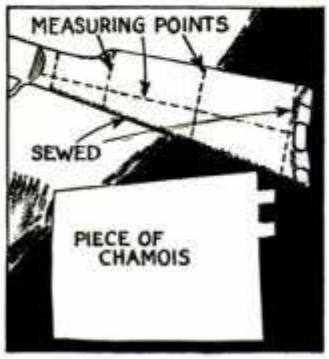


Just push a saw into this rack and it is gripped instantly, while an upward lift removes it

Screwed to the wall above your workbench, this rack holds your saws firmly, yet a slight upward lift will remove them in a jiffy. The rack, which can be made to hold as many saws as desired, is a length of 2 by 4-in. stock having vertical saw slots made a little over halfway through it with holes drilled at 5° angles to break into the slots. Marbles or steel balls dropped into the holes bind against the saws to hold them.

—Ashton R. Wilson, Weldon, Ia.

Gunstock Sheathed in Chamois to Protect the Finish



If you have a gun that is prized highly, why not sheath the stock in chamois skin to protect the finish against scratches? The chamois is cut to fit snugly by measuring the stock at the points indicated, leaving two strips at one end to fit around the butt. After the sheath has been fitted carefully and sewed, any surplus chamois at the seam is easily cut away with a sharp razor blade.

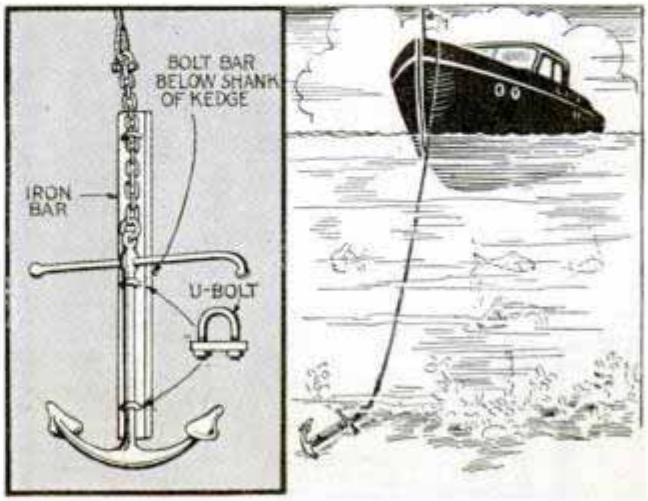
—Truman Greenwalt, Litchfield, Ill.

Silk Pockets over Shoe Heels to Put on Galoshes

Women who have difficulty in putting galoshes on over high-heel shoes, because the edges of the heel tend to cut into the lining, will find that a couple of pockets made from heavy silk cloth to slip over the heels, solve the problem. The pockets can be attached to the galoshes with a thread so they will not be lost.—G. E. Hendrickson, Argyle, Wis.

Boat Anchor Made More Efficient with Iron Bar

Bolting a lead weight or an iron bar alongside the shank of a light boat anchor will increase its holding power considerably. While the bar may be fastened permanently, the best plan is to attach it with removable U-bolts so that it can be kept stowed out of the way. If you use rope instead of chain for the line, it is best to use chain at the anchor to prevent sharp rocks from cutting the lower part of the sagging line.—J. Emmett, Edgewater, Md.

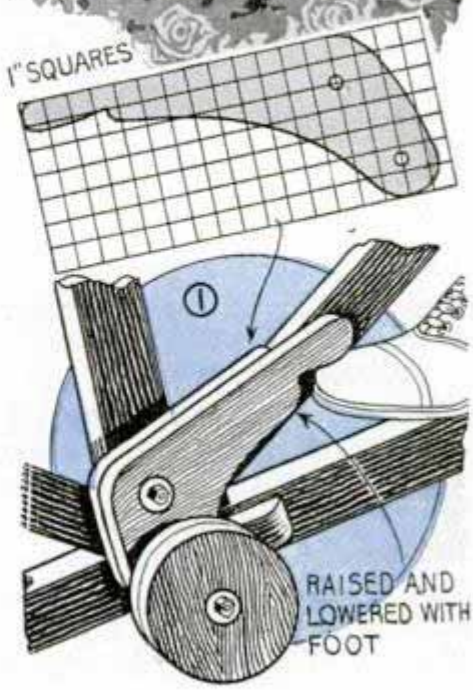


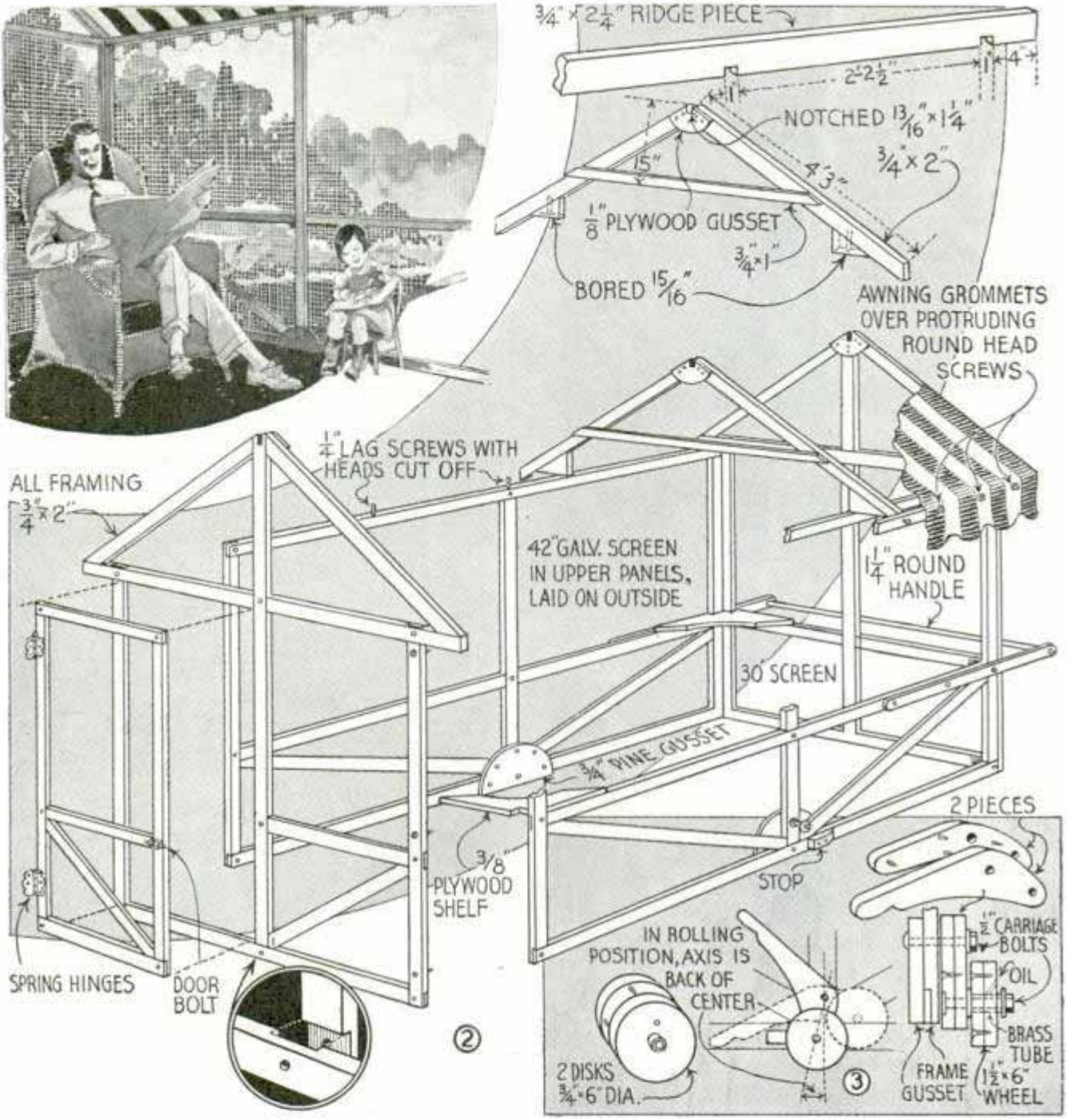
Weight clamped to shank of light boat anchor makes it hold better

ROLL "Your" PORCH "into the garden"

ACCOMMODATING four persons with room for chairs and a card table, this light, screened shelter or "rolling porch" can be moved in wheelbarrow fashion to any spot in your garden to get the breeze on hot days and nights. Fitted with two wood retractable wheels, permitting the structure to set firmly on the ground, the shelter has a colored-canvas awning which overhangs all around and gives protection against sun and rain.

Light pine framing is used throughout, the joints being lapped and fastened with dowels and waterproof casein glue as in Fig. 2. Each wall is a separate unit so that the structure can be dismantled and stored flat. Diagonal braces in the lower panels of the ends and walls strengthen each, and the ends are identical except that one contains a screen door. The frames are designed for 42-in. screen in the top panels and 30-in. screen in the lower ones. Three pairs of intermediate rafters are made in units that can be lifted off for storage, and the ridge piece is notched





to retain them. Note the semicircular gussets in the center of the base of the side walls, which, with the braces, reinforce the frame at the points where the entire weight is carried when the shelter is being moved.

A lever, Fig. 1, raises and lowers each wheel, and its construction, along with the retracting mechanism, is shown in Fig. 3. Note that in the rolling position, the wheels are located a little to the rear of the center line so that they will not shift when the shelter is being moved. For strength, each lever is made up from two pieces of pine screwed and glued together with the grain at right angles. Carriage bolts serve as lever axis and wheel axles, and one or two washers should be placed between the various members. It is a good idea to countersink the heads of the bolts serving as axles so that they will not interfere with action of the lever.

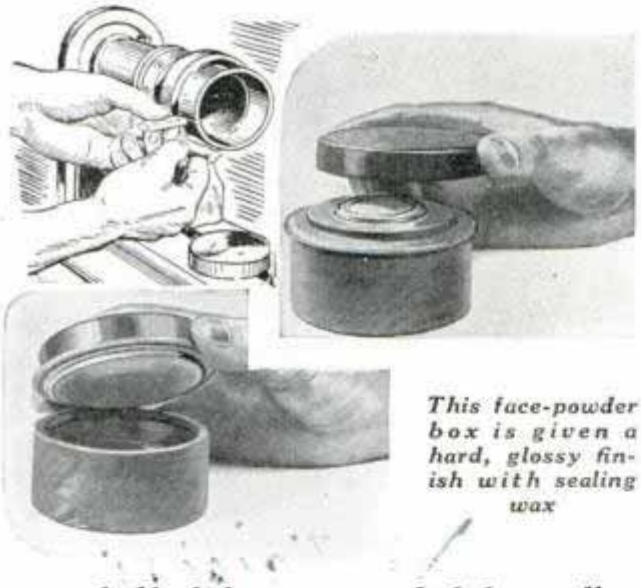
To make each wheel, two 6-in. disks of 3/4-in. pine or oak are screwed and glued together with the grain at right angles, and a short piece of 1/2-in. brass tube is used as a bearing. The awning is laid over the ridge and rafters and is held to the eaves by means of round-head brass screws through grommets.

A Cheap All-Purpose Cleaner

One of the most popular types of all-purpose cleaners, which can be used for cleaning rugs, woodwork, floors, dishes, painted surfaces, linoleum, glass, porcelain, etc., consists of the following inexpensive solution: Trisodium phosphate, 1 oz., in water, 1 gal. A similar cleaner, and one preferred for many purposes, consists of trisodium phosphate, 1 oz., liquid soap, 2 to 6 oz., and water, 1 gal., while a third cleaner, which is particularly suitable for polishing glass, consists of sodium metasilicate, 2 oz., in hot water, 1 gallon.

Novel Powder Box Has Rouge in Double Cover

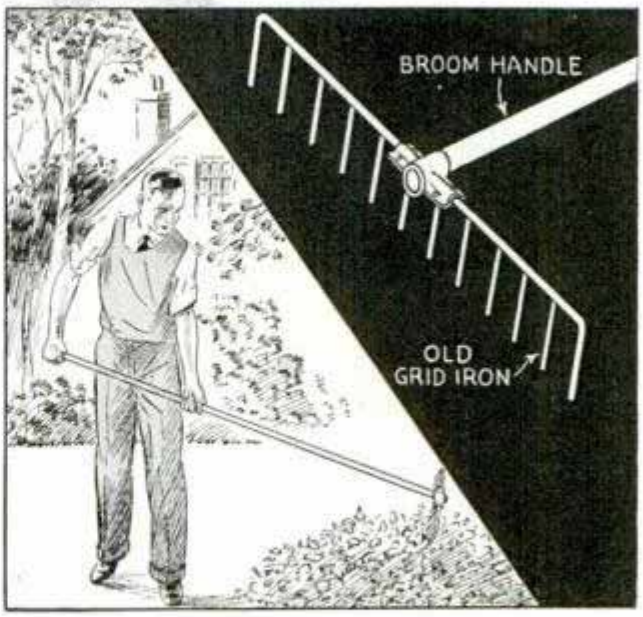
Here is a face-powder box of walnut that can be turned easily in your lathe, and it has a cover made in two parts as shown in the upper right-hand detail. The lower part of the cover has a receptacle turned in it to take a cake of rouge. The



This face-powder box is given a hard, glossy finish with sealing wax

upper half of the cover is slightly smaller in diameter than the lower half so that it is easy to lift either the top to reach the rouge, or the entire cover to reach the powder. The box has an unusual finish of sealing wax. This should be of the high-grade type available in stationery stores and can be obtained in a variety of colors. The wax is applied by holding it against the box as the latter is rotated rapidly in the lathe, applying enough pressure so that friction will soften the wax. The thin wax film thus applied is smoothed out with a cloth pad.

This Slender-Tooth Leaf Rake Cut from Old Gridiron

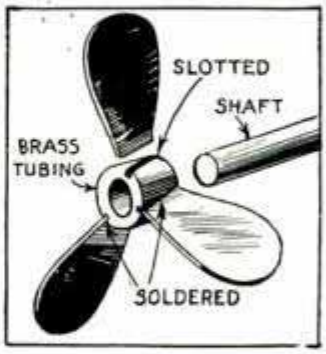


The rake is handy for collecting leaves and dead vegetation around the home

If you have an old gridiron, such as used in ovens of most stoves, it is easily converted into a useful rake for leaves as the slender teeth may be cut to any desired length. After cutting off one side of the grid, clamp it to a broomstick. The clamp is made from heavy sheet metal, stove bolts holding the two parts together.

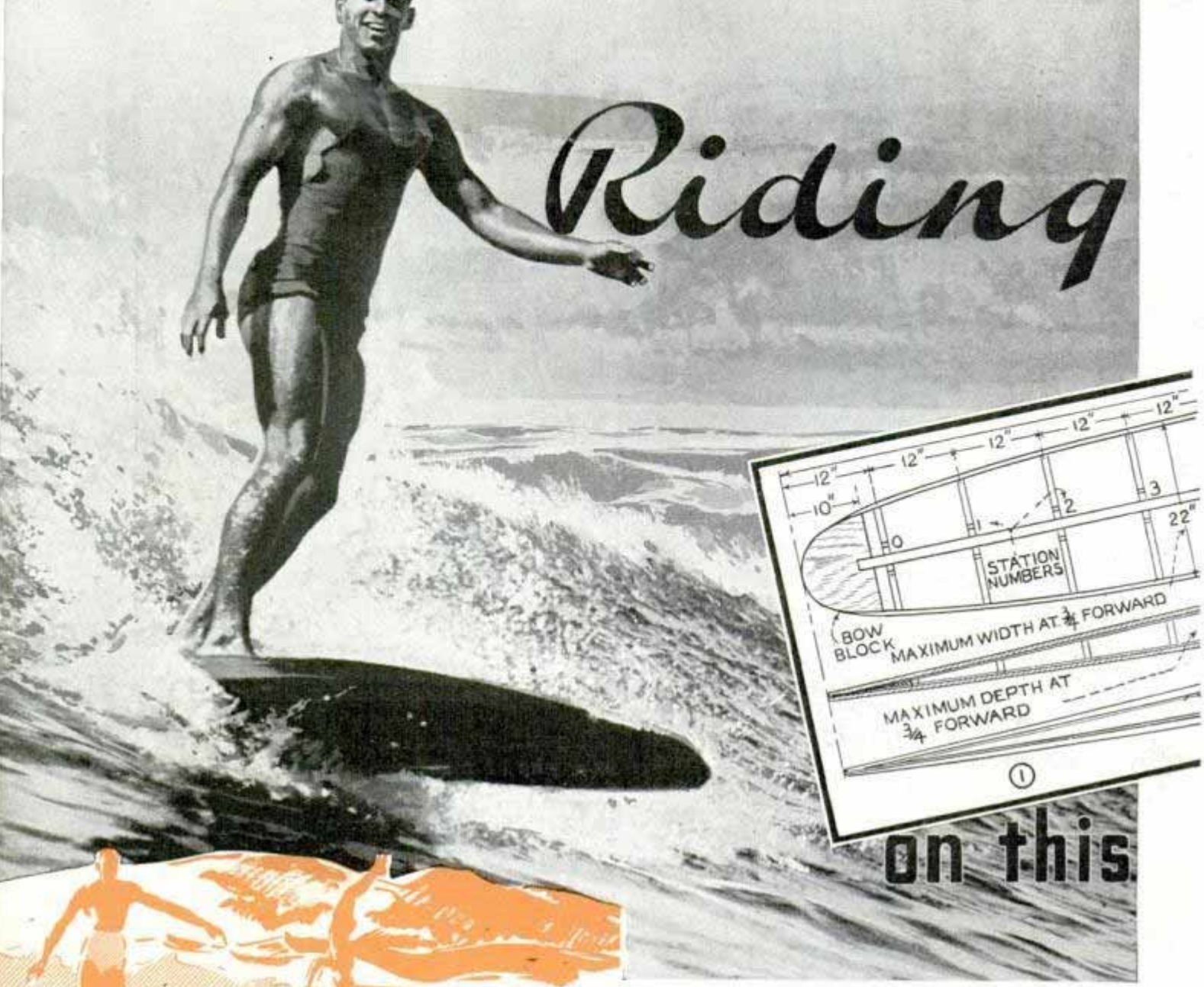
Propeller for Model Boat Is Made Easily

I recently built a model of a large cruiser on a small scale, and not wishing the added expense of buying a propeller, one was made as indicated. I took a piece of brass tubing having an inside diameter slightly larger than the diameter of the propeller shaft and cut off a short piece from one end, after which three slots were cut in the surface of the tube as indicated to take propeller blades. These were cut from thin brass and soldered into the slots and then bent to shape.



—Harry Kenth, Chicago.

Riding on this



It's built like a boat, with deck and bottom planking over frames, and is so light that one person can handle it either ashore or afloat

Letter returned 11/8/38.

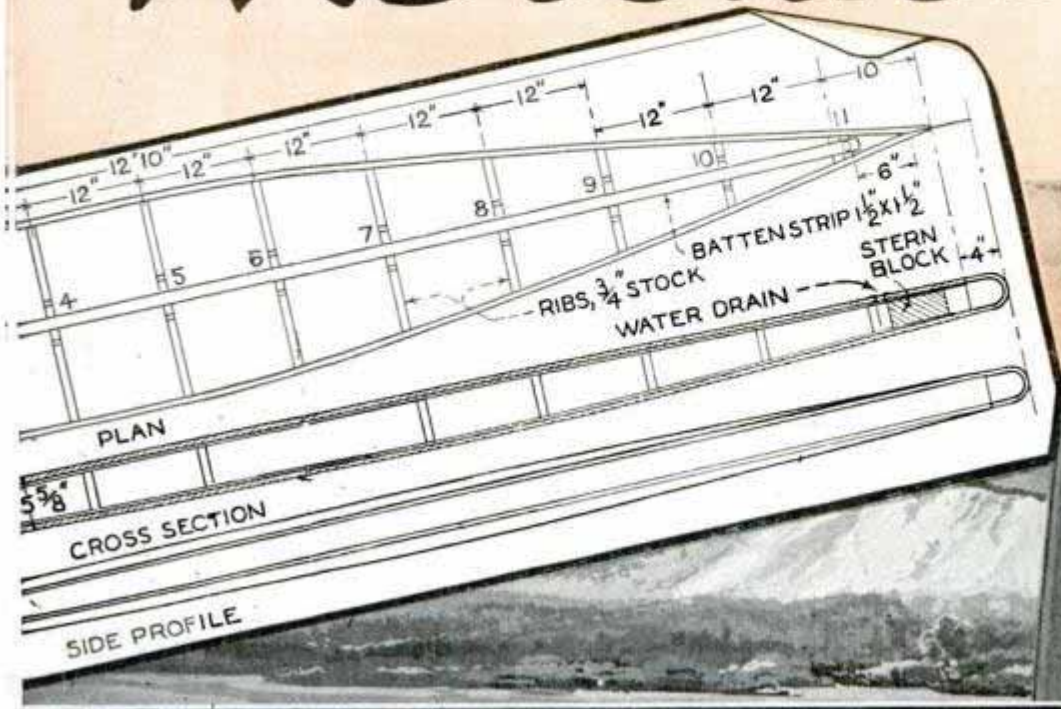
By TOM BLAKE

To Waikiki Tavern and Inn Honolulu, Hawaii

YOU'LL get plenty of thrills when you try this speedy hollow surfboard, either riding the waves of the open ocean, freeboard aquaplaning in the wake of a speedboat, sailing or just paddling about on fresh-water lakes. It's nothing more or less than a shallow pontoon, light, structurally strong and virtually unsinkable. So great is the safety factor that it has been officially adopted in many localities as standard lifesaving equipment.

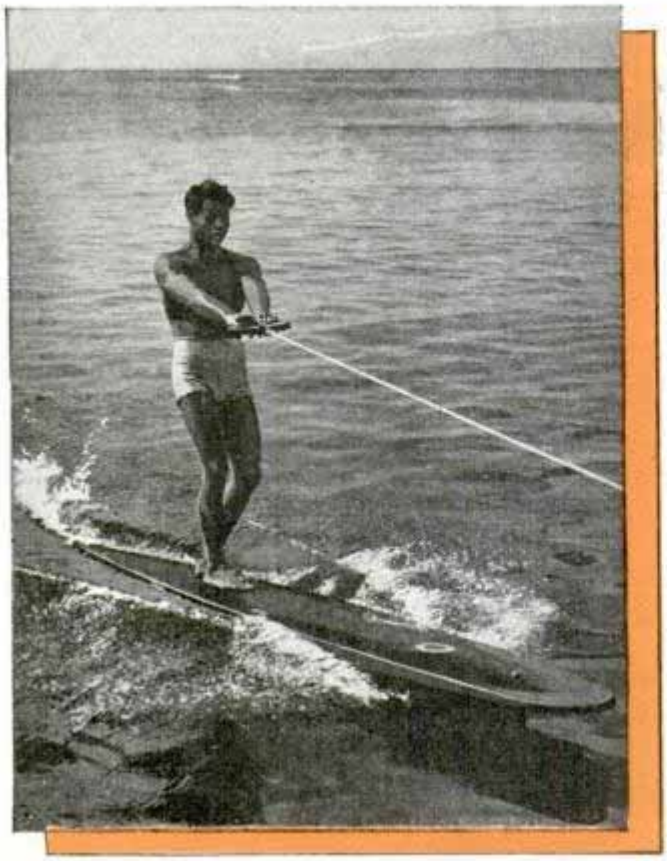
Size and Framing: For a person of 125 to 200 lbs. weight, the standard-size board is desirable. This is 12 ft. 10 in. long, in width 22 in. maximum, and in depth 5⅝ in. maximum. For lakes and rivers it may be made of lighter material than specified, for this model is more for heavy duty in the ocean surf and will weigh from 70 to 75 lbs. The entire board may be made of any wood desired, spruce for frames and African mahogany for planking being first choice. See Figs. 1 and 2 for general details and sizes of stock. The framework

the Breakers!



HOLLOW HAWAIIAN *Surfboard*

consists of transverse braces or ribs, a bow and stern block and sides or rails to hold all these parts in place, Figs. 3, 4 and 5. Two lateral battens extend down the center of the frame to form a seat for the center seams. The ribs are fastened to the side rails with headless copper nails, Fig. 4, countersunk and covered with putty. This allows ribs to pull free from the sides of the board when expansion of the decks takes place after seasoning a few weeks in the water. The expansion of the decks amounts to about ⅜ in. on each side, and therefore the rib must be free to leave the rail that much. This makes it wise to omit the deck screws through to the ribs transversely, until expansion has occurred in the water, otherwise the screws may pull loose. However, by deeply countersinking and covering the screws, they will tend to bend with expansion of the decks and not show from the outside of the board. Due to the structural features, however, the former procedure is recommended. Sides take the curve of the board without steaming. Clamps easily bring them into position. The grain of the bow and stern blocks should run with that of the decks. This is important as it allows all



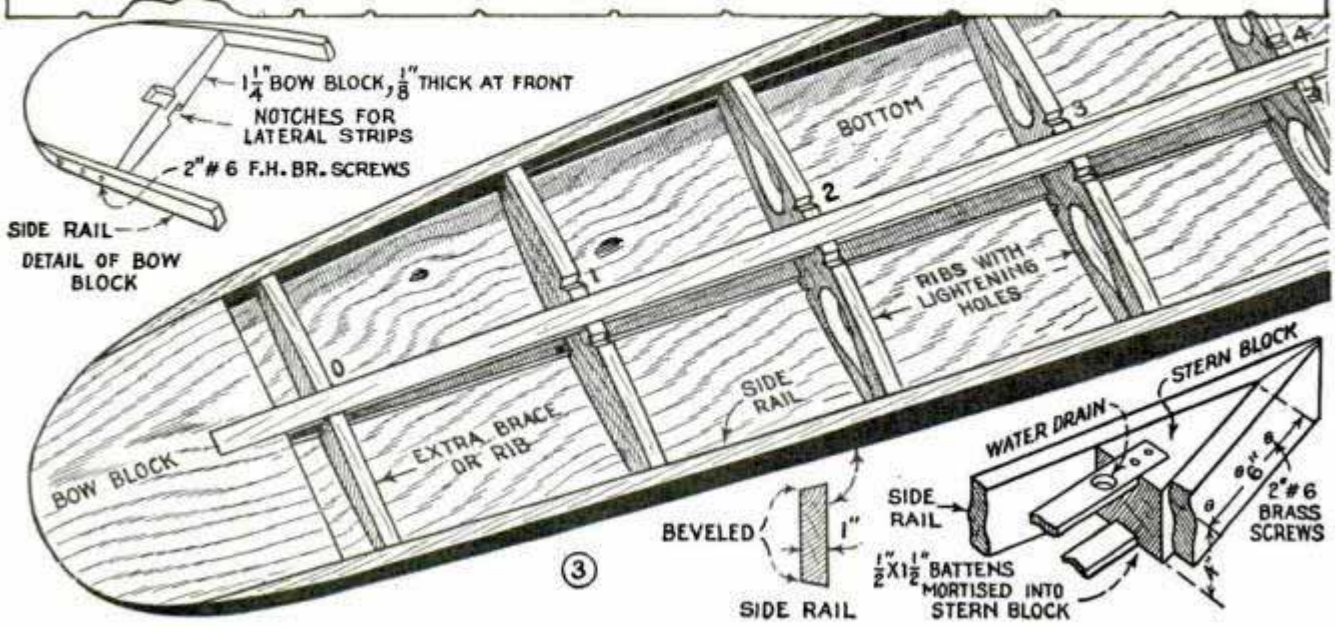
parts to swell equally in all directions. Sides are fastened to bow and stern blocks with 2-in. flat-head brass screws.

Decks: Decks (top and bottom of the board) can be cut from a plank 12 in. wide, 14 ft. long, and ¾ in. thick. Using stock of this width, it is necessary to select each plank very carefully. Decks should be fastened to the frame with flat-head brass screws spaced 2 in. apart. The center batten seam and the rail joints are taped and coated with marine glue when assembling. Screws should be countersunk and the holes plugged to make a neat job. Use a waterproof casein glue under the screw-hole plugs. A hole to drain the water is located near the stern, and each rib is notched to form limber holes on each side of the center batten. The stern handle is made of ½-in. brass tubing bent to shape by packing with sand and using a vise. Packing the tube with sand prevents flattening at the bend. The ends are flattened, let into the stern flush and fastened with screws. The bend extends about 4 in. past the stern.

Now a few precautions to observe: Special care must be taken in fitting decks. For instance, the line down the center battens is straight, but due to the convex shape of the top and bottom of the board the seam edge of the planking describes an arc. One way to get the proper curve is to clamp one plank to the frame, leaving both ends in proper position. This will

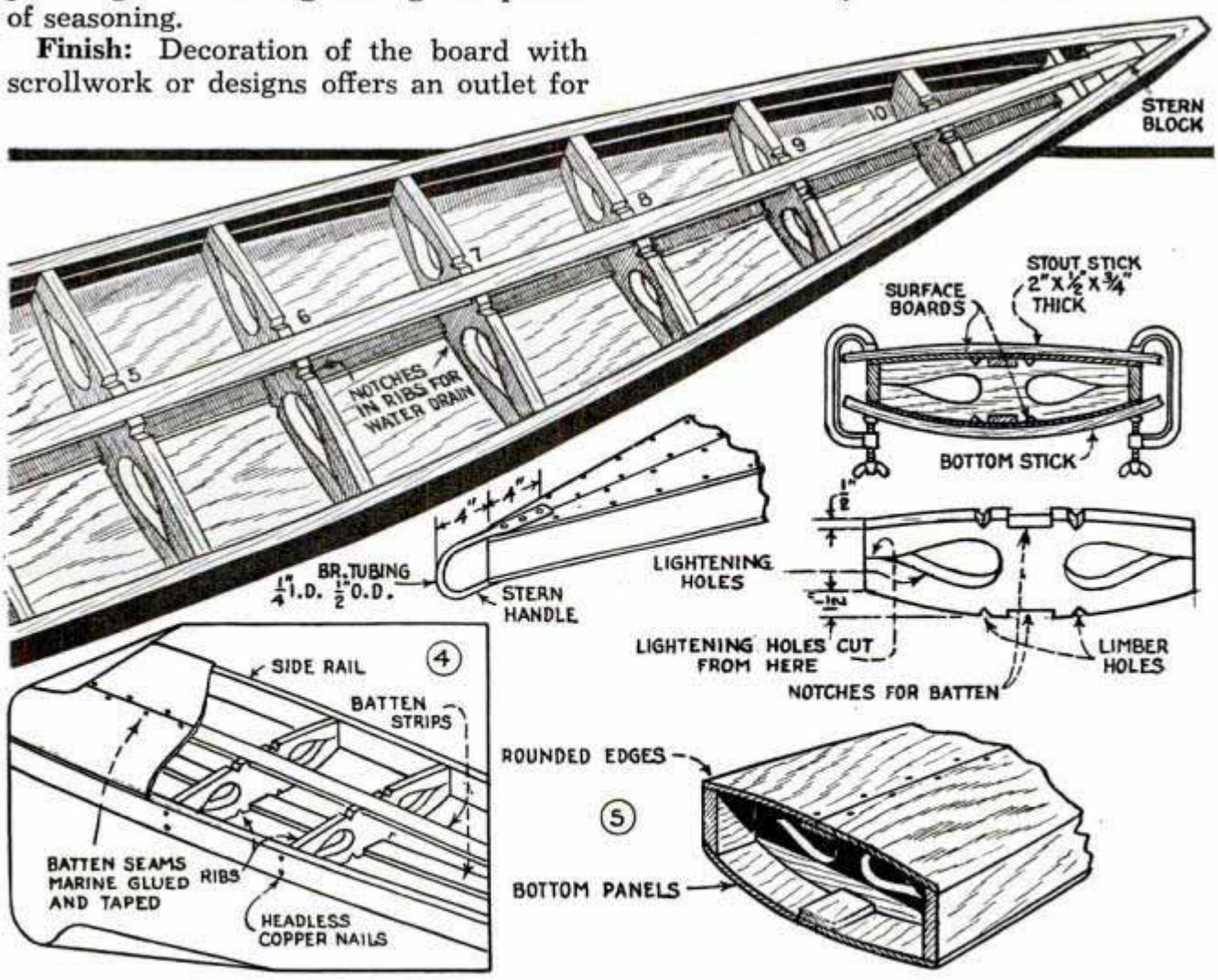
DIMENSIONS GIVEN IN INCHES AND EIGHTHS ②

STATIONS	0	1	2	3	4	5	6	7	8	9	10	11	12
HEIGHT OF SIDES & ENDS OF RIBS	6¾	1	1½	1⅞	2⅛	2⅜	2⅝	2¾	2⅞	3	3	3	3
LENGTH OF RIBS	15	17⅛	18⅛	19⅞	20⅛	20¼	19⅛	17⅜	14¾	11½	7½		
TOP CROWN OF RIBS	⅜	4½	⅝	¾	¾	¾	¾	¾	⅝	½	⅜		
BOTTOM CROWN OF RIBS	½	1	1⅜	1½	1½	1½	1⅜	1¼	1	⅝	⅜		

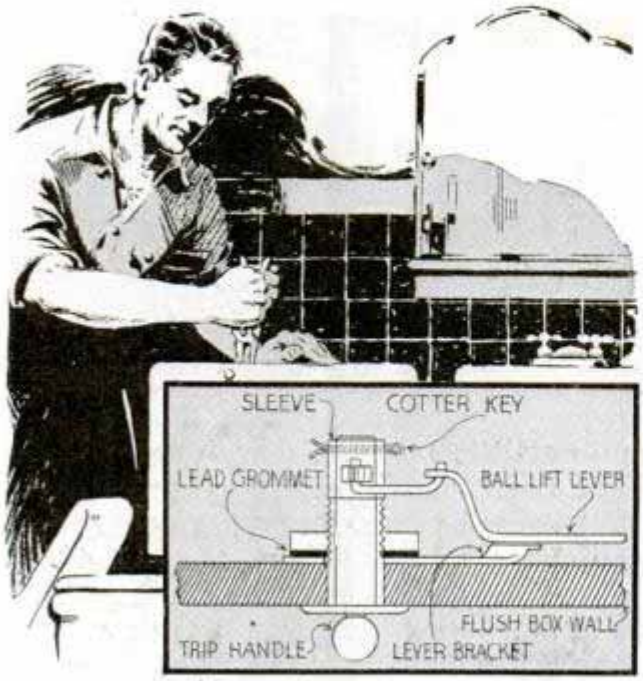


leave the middle of the plank out of plumb. Now fasten a chalk line at both ends of the plank and snap it to mark the curve. Without a form on which to assemble your board the difficulty of bending deck and bottom planking to the frame, transversely, can be overcome by using the clamp and caul method shown in Fig. 5. First, you set the clamp and drive home a few screws, then advance the clamp and repeat the same operation. It's well to examine the planks carefully before you clamp them in place. Look out for surface checks or any irregularity in the grain that might cause the plank to split under pressure of the clamp or later on when seasoning. Another thing to watch is the equal spacing of the screws and nails. Uniformity in spacing tends to equalize stresses on both planking and framing during the period of seasoning.

Finish: Decoration of the board with scrollwork or designs offers an outlet for one's artistic talent, although some leave their boards plain, considering the grain of the wood to be decoration enough. If you're careful in selecting the individual planks you can usually match the grain to form a pleasing figure. This should be done when placing decks in position to band-saw to the curve of the board. Waterproofing paint may be used to protect the inside of the board, while three coats of spar varnish finish the outside, leaving the board ready for the water.



Repairing Loose Trip Mechanism on Bathroom Flush Tank

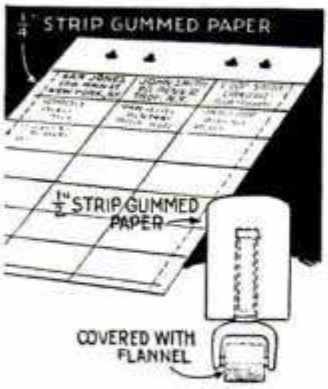


If the nut holding the trip mechanism on your flush tank loosens, a lead grommet will hold it

If the trip mechanism on a flush tank has a tendency to loosen, a lead grommet 1/16 in. thick will solve the problem. The grommet, obtained at any hardware store, is slipped over the handle shaft, which extends through the tank, and the nut on the shaft is driven tightly against it.

Letters Addressed with Stencil

If you use a mailing list and do not have an addressing machine, considerable time can be saved in getting out the mail by using a mimeograph stencil. First, divide the stencil vertically into three columns, and then put a 1/4-in. strip of gummed paper on the underside of the left-hand edge and a 1/2-in. strip on the right-hand edge. Now type the names and addresses in the columns and cut the stencil into horizontal strips, each strip containing three names. Next, make an inking roller from a furniture caster by fitting it with a short handle and covering the wheel with flannel, smooth side outward. This done, you are ready to start printing. Put a little duplicating ink on a smooth surface and run the roller over it two or three times. Then lay the stencil strip over the work to be addressed and run the roller over it.

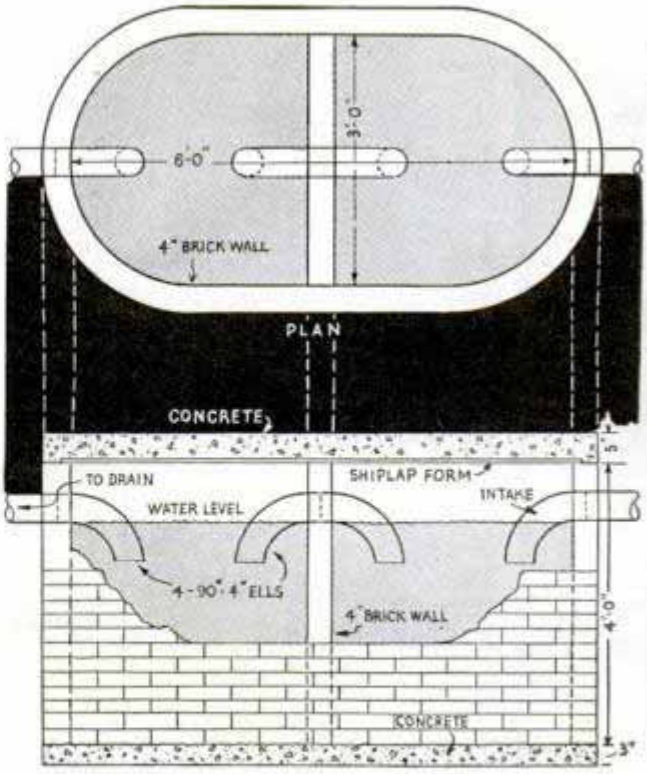


—Joseph Conan, Syracuse, N. Y.

This Septic Tank Seldom Fills with Solid Material

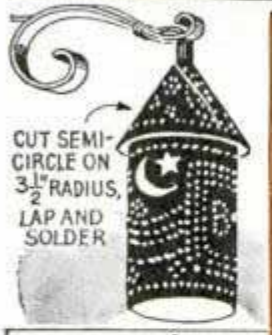
Here is a septic tank that differs from the usual cesspool in that it never has to be cleaned out or maintained in any way. The refuse enters the airtight tank on one side where it is acted on by bacteria and reduced to liquid. It then passes over into the other side where it is further purified and drains off as nearly pure water. Such an arrangement has been used by a family of six for eight years without trouble. All waste from the six-room house goes into it and the drain goes to the storm sewer of a small village. Where connection to a sewer is impossible, a few lengths of clay tile may be laid to permit the liquid to seep into the ground. The tank has a concrete bottom and top while the sides are brick. The two 90° elbows can be leaded together for a small charge.

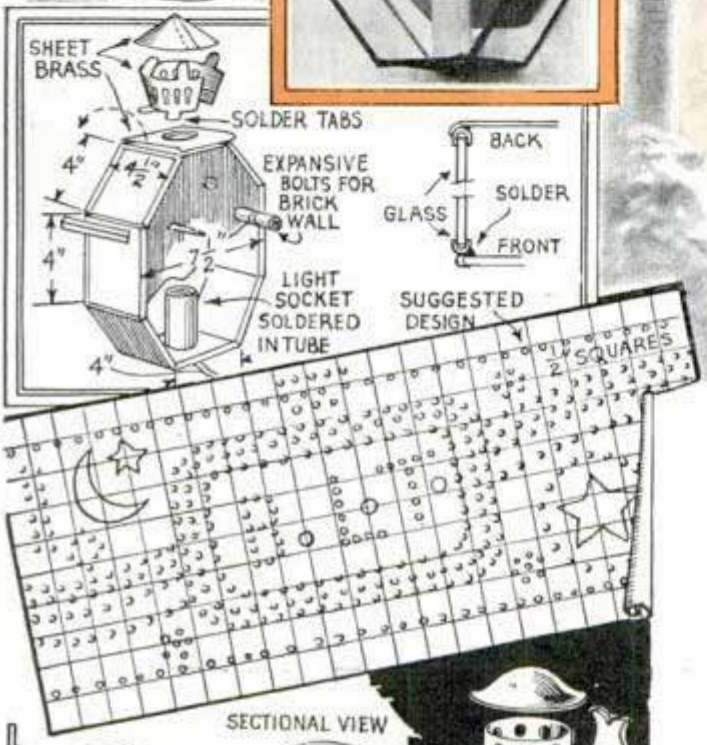
—F. L. Hansen, Omaha, Nebr

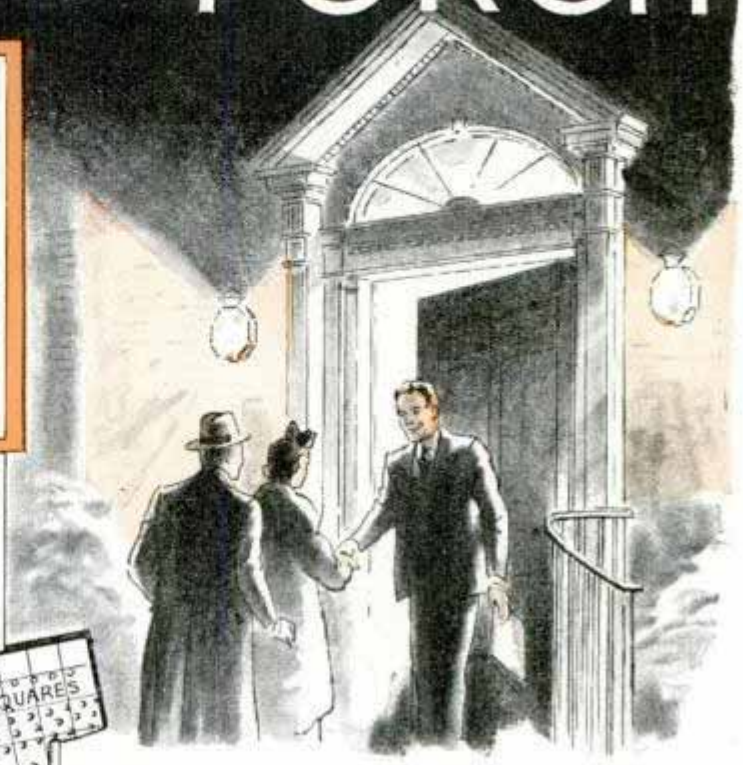


Sewage entering this tank is reduced almost entirely to water, which then passes into the ground

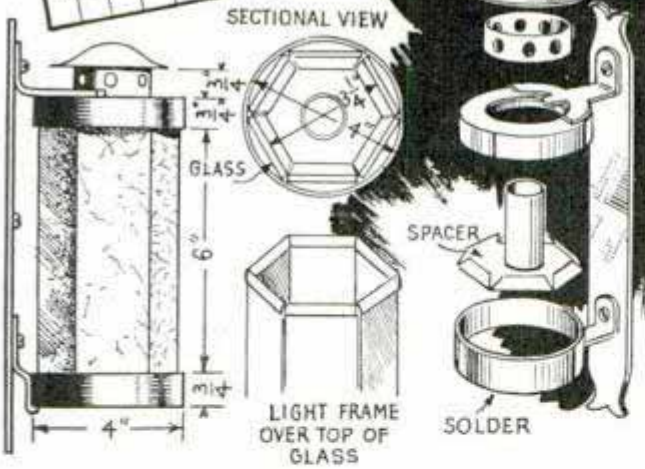
LIGHT *on the* PORCH

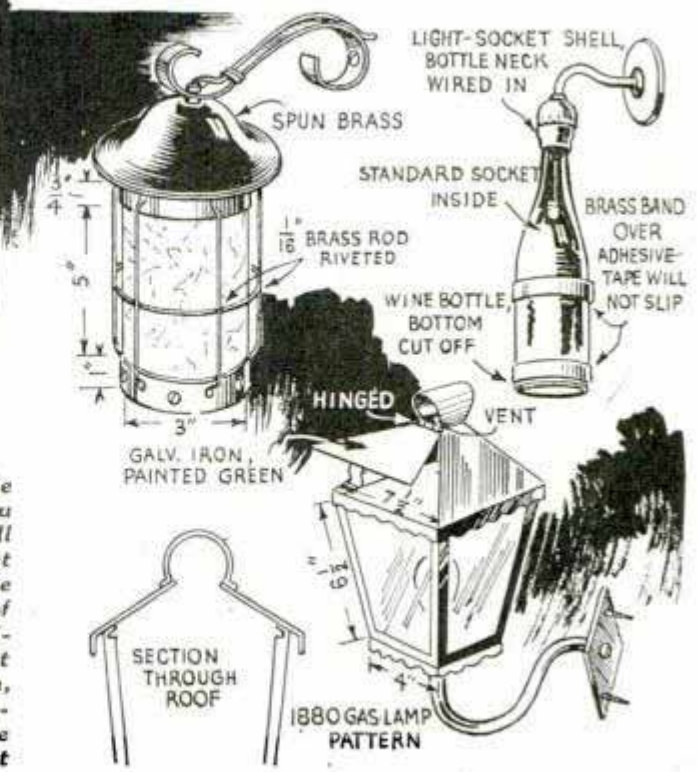






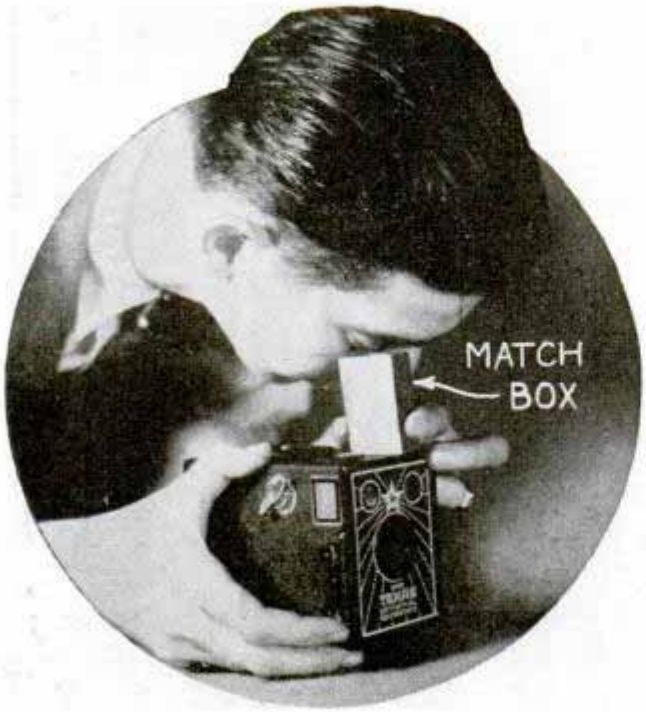
The lantern at the upper left can be made up from two pieces of sheet copper or even tin. The designs are punched in the pieces with a large nail, after which they are formed to a cylinder and cone, and soldered together. The octagon lantern consists of eight small squares of glass, each framed with brass channels soldered at the corners. Then the frames are soldered together over a form





For the cottage you can use a porch light made from a bottle. Much depends on the bottle you select, but if it is round, two brass bands will match the brass socket shell at the top. Sheet brass makes the top and bottom frames of the hexagonal lamp above. The sides are pieces of amber glass held in place by brass channels soldered to the frames. Other lamps of different design but of somewhat similar construction, are shown at the right. One involves a spun-brass top and hangs from a metal scroll while the other is supported on a "goose-neck" bracket

Shading Box-Camera View Finder on Sunny Days



You can see the image in a box camera clearly on a bright day if you shield it with a match box

If you have trouble on bright, sunny days in seeing the reflected image in the view finder of a box camera, just hold the outside shell of a penny match box over the finder. This will keep out the bright light so that the image can be seen.

Bench Stop from Safety Razor

One of the simplest of bench stops can be had by using an old safety razor as shown. The comb guard of the razor is removed and is replaced in reverse position, after which a hole is drilled in the bench top to receive the handle of the razor.

—G. E. Hendrickson, Argyle, Wis.

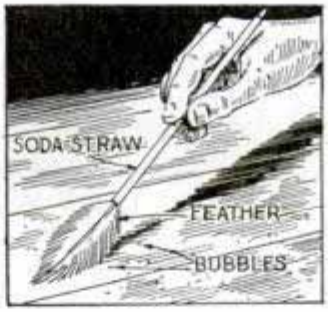
Ink to Write on Porcelain

Ink which can be applied with an ordinary pen or brush, and is rendered permanent by heating over a flame, is made as follows: Mix sodium carbonate, monohydrated, 1 oz., borax, 2 oz., potassium bichromate, 3 oz., and water, 40 fl. oz. The marking is made on the clean porcelain surface and is held near a flame to evaporate the water, after which it is strongly heated in an oxidizing flame—one which has more air than normal—to develop a green color from the chromium compound.

Wire Serves as Funnel Air Vent When Filling Bottle

When filling a jug or bottle with a funnel, bend a short wire at right angles and insert it into the mouth of the container alongside the funnel. This will raise the funnel slightly so that air can enter.

Bubbles Removed from Varnish with a Feather



If air bubbles appear in a freshly varnished surface, they can be removed with a feather. To provide a handle for the feather, insert it into a soda straw.

Passing It On to Others

Although the solution of many minor everyday problems around the home, in the workshop, concerning the car, or pertaining to your daily work, may seem rather insignificant to you, there are perhaps thousands of others who have the same problems. If your solution was unusual, but simple and practical, why not pass it along to others to help them? These pages are a "clearing house" for such ideas and if you have any new ones that are exceptionally outstanding, don't hesitate to tell us about them. We are always looking for such short cuts that will save time, work and money. And, of course, we will send a check in payment for anything that we use.

Write to Shop Notes Editor

POPULAR MECHANICS MAGAZINE

200 E. Ontario St. Chicago

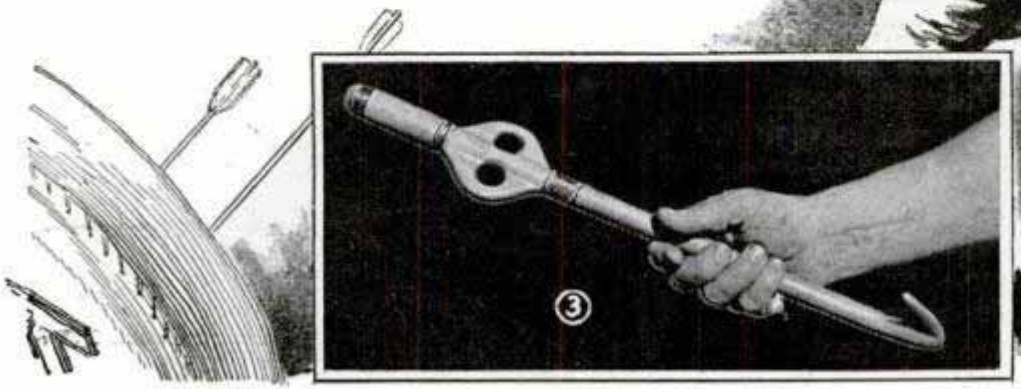
"HUL-CHE"

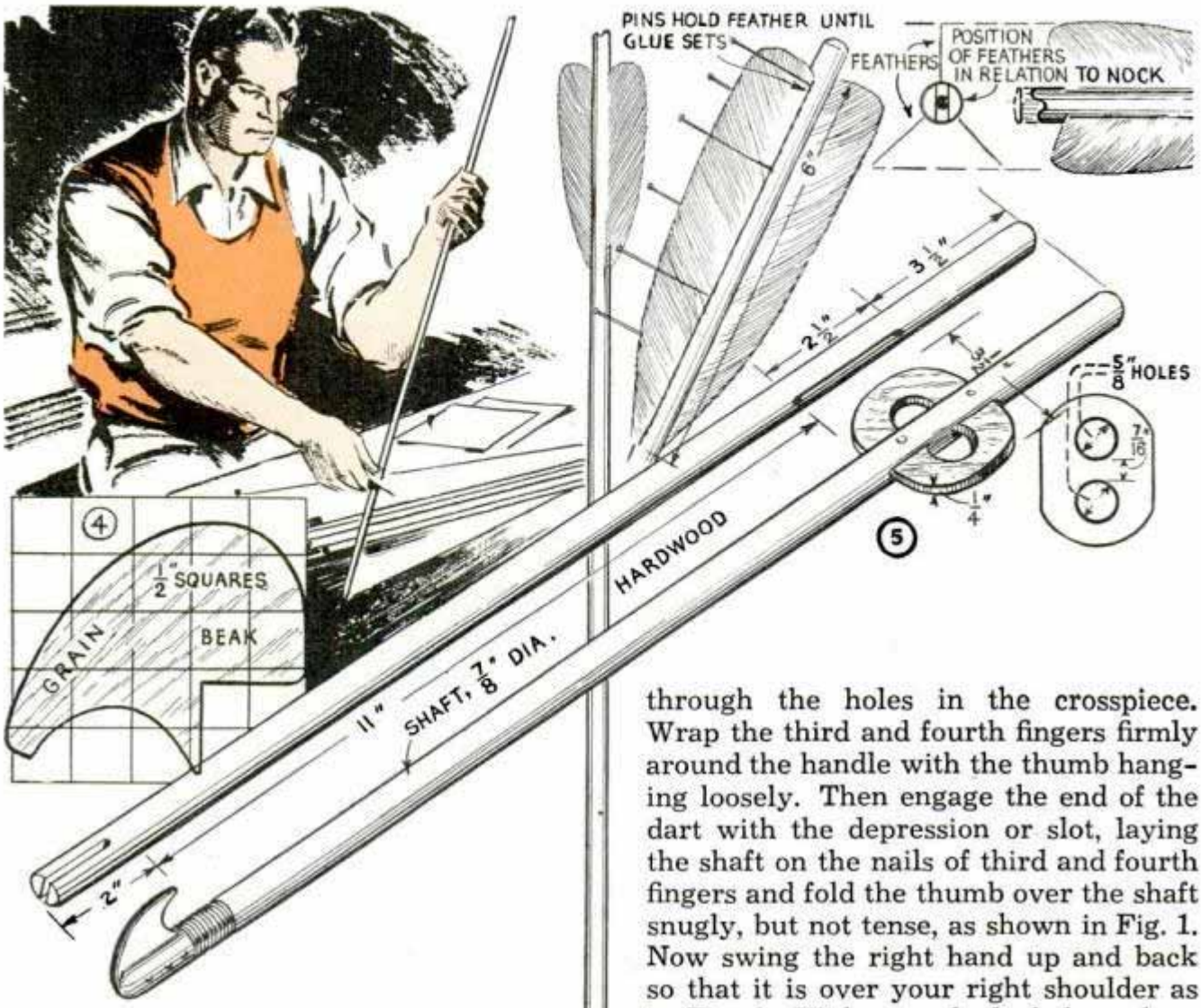
a Re-discovered American Sport

By
EARL B. POWELL

REMINISCENT of the ancient Mayas who could throw a 4½-ft. javelin with the speed and accuracy of a bullet, hul-che is the rediscovered method of throwing short spears and darts for sport's sake. Copied from specimens dredged from the Sacred Well at Chichen-Itza, the dart and thrower shown are made of hardwood, shaped and highly polished.

For an ordinary man-sized throwing stick or hul-che, such as shown in Fig. 3, take a round piece of hardwood about ⅞ in. in diameter, or it may be elliptical in cross section, say about 1 by ⅝ in. Set the beak or hook piece, Fig. 4, in the end edgewise and the crossbar, Fig. 5, which is about 2½ in. wide, is set in a slot near the other end and is fastened with wooden pins and glue. It is a good idea to lash the stick as shown in Fig. 6 to avoid splitting. Slot the end at right angles to the cross-piece and set in the beak piece in the same

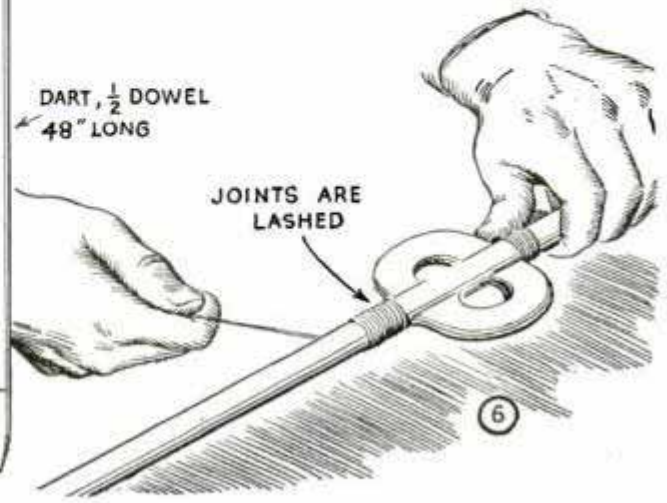




way. The grain of the crosspiece should cross the shaft, and the grain of the beak should run the same way it points. When assembled, round the edges of the crosspiece and make a smooth rounded point on the beak.

The darts are made of ½-in. hardwood dowels 4 or 4½ feet long. You can use regular arrow heads or ferrules of tubing on one end for heads. A semicircular depression is made in the other end to take the hook of the throwing stick. Or, you can slot it in the same way an arrow is slotted for a nock. In this case, one side of the slot is cut down about ¼ in. to take the hook. In feathering the dart, set one feather in line with the slot and space the other two equally around the dowel. The feathers should be about 6 in. long, very high and as stout as you can get them.

To throw a dart, take a throwing stick in the right hand with the palm up, putting the first and second fingers through the holes in the crosspiece. Wrap the third and fourth fingers firmly around the handle with the thumb hanging loosely. Then engage the end of the dart with the depression or slot, laying the shaft on the nails of third and fourth fingers and fold the thumb over the shaft snugly, but not tense, as shown in Fig. 1. Now swing the right hand up and back so that it is over your right shoulder as in Fig. 2. With your body balanced on your right foot, use the left leg as a counterpoise, and bring the right hand forward with an overhand swoop, at the same time lunging forward and twisting the body so that the right shoulder comes to the left. This following through with the hand makes throwing accurate. With a little practice, you will be able to hit the target at 60 yards, time after time.

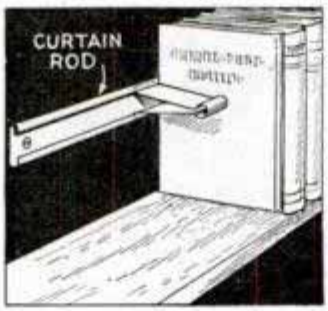


Pinhole Monocle for Nearsighted

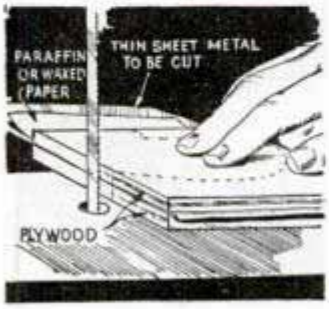
If you are nearsighted, and have lost or misplaced your spectacles, a piece of cardboard or heavy paper pierced with a pin and held close to one eye will aid you in an emergency. The convergence of light rays through the pinhole, which acts like a camera lens stopped down to increase depth of focus, will correct your vision sufficiently to enable you to see distant objects easily.

Adjustable Stop Holds Books

If you keep a number of magazines or reference books in your workshop, here is an adjustable holder that keeps them neatly on a shelf. The holder is nothing more than the outer member of a telescoping curtain rod, fitted with a strip of heavy-gauge sheet metal which is bent to slide in the rod. The assembly is screwed to the wall, just above the book shelf and the sliding strip is set against the end book.



Wax Paper Lubricates Saw Blade When Cutting Metal



You'll find in cutting thin sheet metal on a scroll or band saw that the blade is less likely to bind if a sheet of wax paper is applied to the metal to be cut. The paper tends to lubricate the blade, and it can be held in place by putting the metal and paper between two pieces of thin plywood.

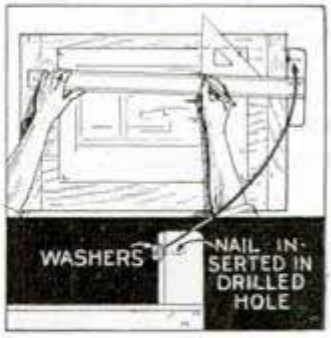
Inverted Umbrella on Tree Limb Holds Picnickers' Garments

Hang an opened umbrella on a tree and it will keep your extra garments away from crawling insects

When at a loss for a safe and handy place for hats, wraps and other small articles while picnicking in the woods, open your umbrella and hang it from the limb of a convenient tree. This will afford a receptacle in which such articles can be placed, keeping them off the damp or wet ground and out of the way of ants and other crawling insects.

Setting T-Square at Angle

When it is desired to use a T-square with its blade at a slight angle from the vertical or horizontal, such as when drawing tapers or screw threads, the square can be held correctly at the desired angle as follows: Drill a small hole at the inner edge of the square head to take a nail. If the thickness of the nail head does not tilt the square the desired amount, washers of various thicknesses can be slipped under the nail head to get the required angle.



—E. T. Gunderson, Jr., Humboldt, Ia.

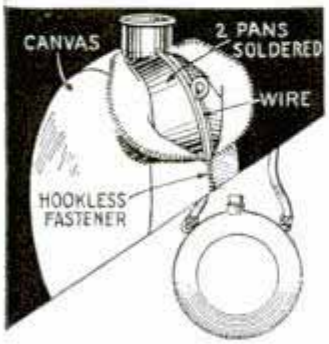
Clothes Hangers Kept Separated to Hold Damp Garments

Dry garments hung on this clothes rack are not dampened by contact with wet ones near by

To keep damp garments from touching dry ones when hung up, the hangers on the clothes rack of one hall are spaced apart and held by wire. The wire, which is fairly stiff, is simply given one twist around each hanger as indicated. Spacing the hangers in this way also keeps the lighter garments from being crushed by the heavier ones.

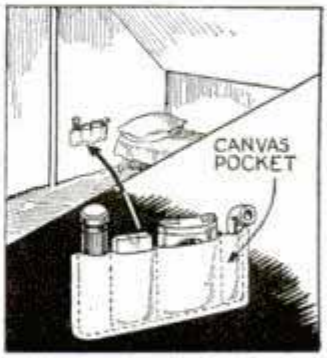
Canteen Made of Two Tin Plates

For the young hiker or fisherman, this canteen is just the thing. Costing practically nothing, it is made by soldering together two tin plates, first cutting a small half circle in the edge of each plate to take a neck. This is soldered in place and can be made by shaping the metal over a small bottle. Strength is added by soldering a strong wire over the seam between the two plates, eyes being formed in the wire on each side of the neck to take a carrying strap.



—C. E. Packer, Chicago.

Wall Pocket on Camper's Tent Reached from Cot

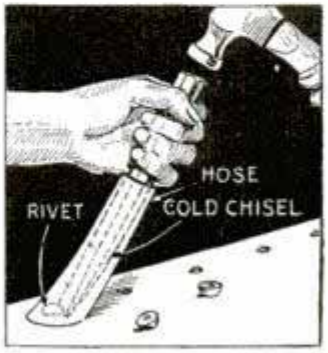


Stitched to the inside wall of a tent, where it will be within an arm's reach of one's cot, a canvas pocket will prove handy for storage of a flashlight, pipe, tobacco and other articles. The pocket can be made any size desired, and it can be divided into as many parts as needed.

Caning of Chair Seats Made Easy by Use of Golf Tees

For securely holding the ends of loose strands of cane while weaving chair seats, one craftsman uses golf tees as pegs. The cup-shaped heads provide a convenient grip for insertion or removal, and the pointed ends of the tees are easy to insert after several strands of cane have been passed through a hole.

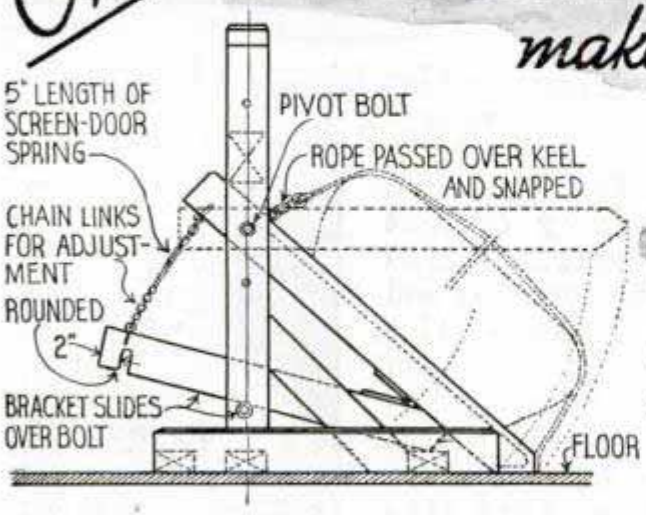
Cold Chisel Shielded to Catch Flying Rivet Heads

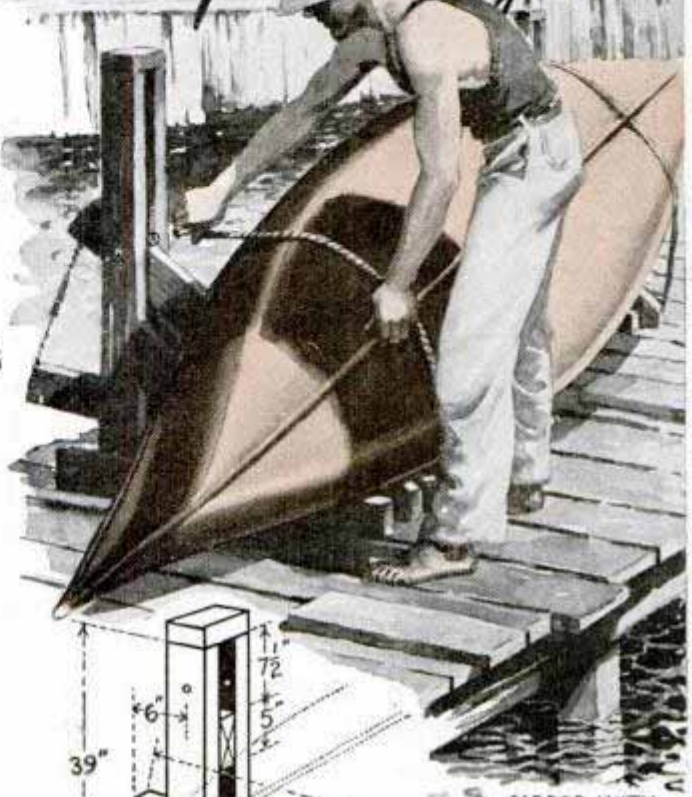


When a cold chisel is used to cut off rivet heads, danger of a flying piece of the metal injuring the eye is avoided by using a piece of hose over the cutting end. The lower end of the hose is cut at an angle to permit the chisel to be held correctly.

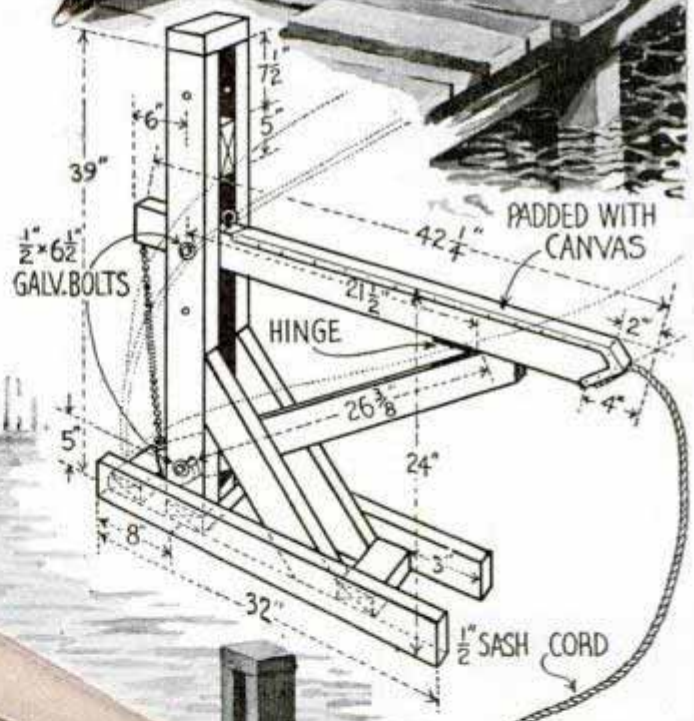
One-man BOAT TRESTLE

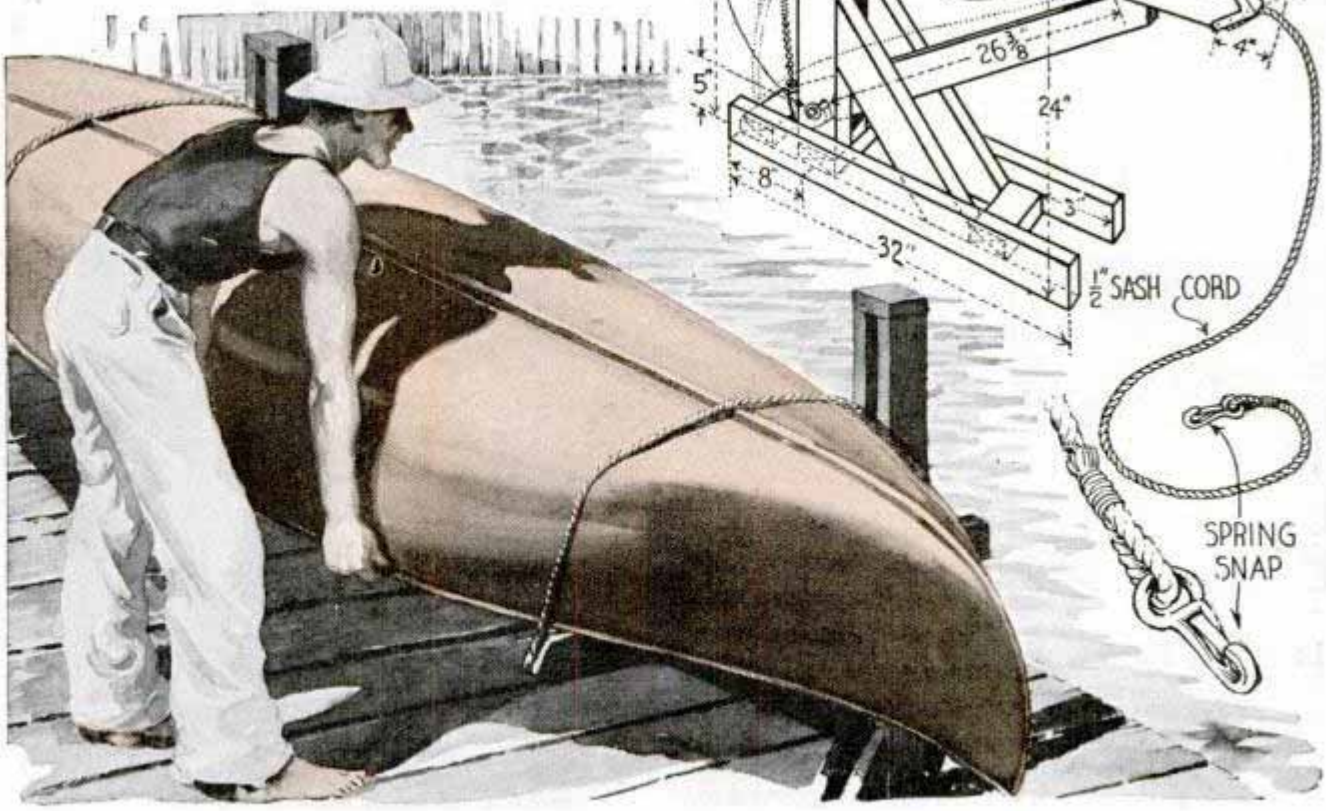
makes storage easy



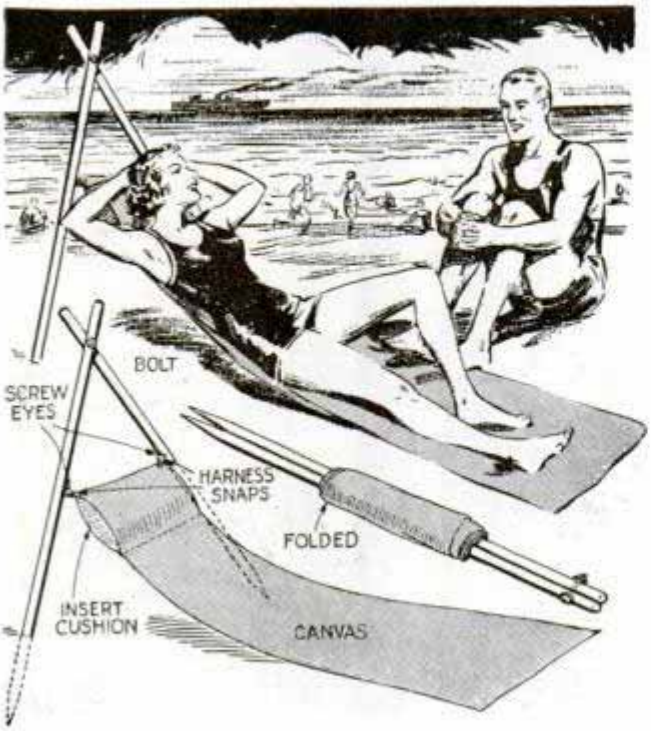


With this collapsible trestle one man can rack a large boat easily, either indoors or out. It's especially handy in the boathouse where space is at a premium, as the portability of the trestle unit makes it unnecessary to build in permanent storage racks. Each unit is made from 2 by 4-in. stock and consists of an upright which supports a pivoted arm and bracket, the latter being hinged as shown. The lower end of the bracket is slotted and drops over a bolt when the arm is raised. Heavy cords hold the hull in position on the arms. Dimensions indicated make a trestle suitable for medium-sized boats and large canoes. By using heavier stock and larger parts the trestles can be used for storing fairly large craft





"Lazy-Back" Chair for the Beach Folds into Light Bundle



Here's just the thing for those warm days at the beach so you can stretch out for a sun bath

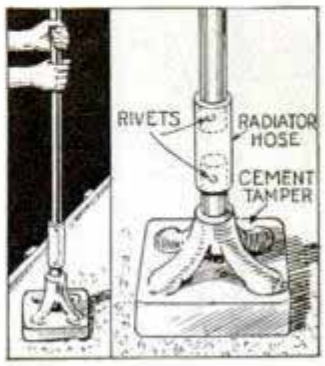
A comfortable "lazy-back" chair that can be folded and carried to the beach easily consists of a strip of canvas and two stout sticks. The sticks are pointed at one end and are bolted together at the top. Two screw eyes driven into the sticks take harness snaps which are attached to the corners of the canvas. You can stitch a pocket in the upper end to receive a cushion.

Measuring Speed of Shafts

When it is necessary to measure a shaft speed, and a revolution counter is not at hand, the job can be done with a crayon if the speed is not too high. Simply run a pencil or scriber along the rotating shaft to mark it spirally, at the same time measuring the period of time in which the marker is held against the shaft in seconds with your watch. If the time is 10 sec., the number of spirals multiplied by six gives the speed. If the time is 5 sec., multiply by twelve. In any case, 60 sec. divided by the time of marking gives the proper factor by which to multiply the number of spirals to obtain the revolutions per minute.

—Philip R. Tarr, Akron, Ohio.

Tamper Has Shock Absorber to Reduce Arm Strain



Steady use of a heavy cement tamper is tiring on the forearm and wrists of the workman and can be reduced greatly by using a piece of heavy radiator hose that fits snugly on the handle. The latter is cut off a few inches above the tamper and the severed ends are forced into the hose. Rivets with large washers will hold the assembly.

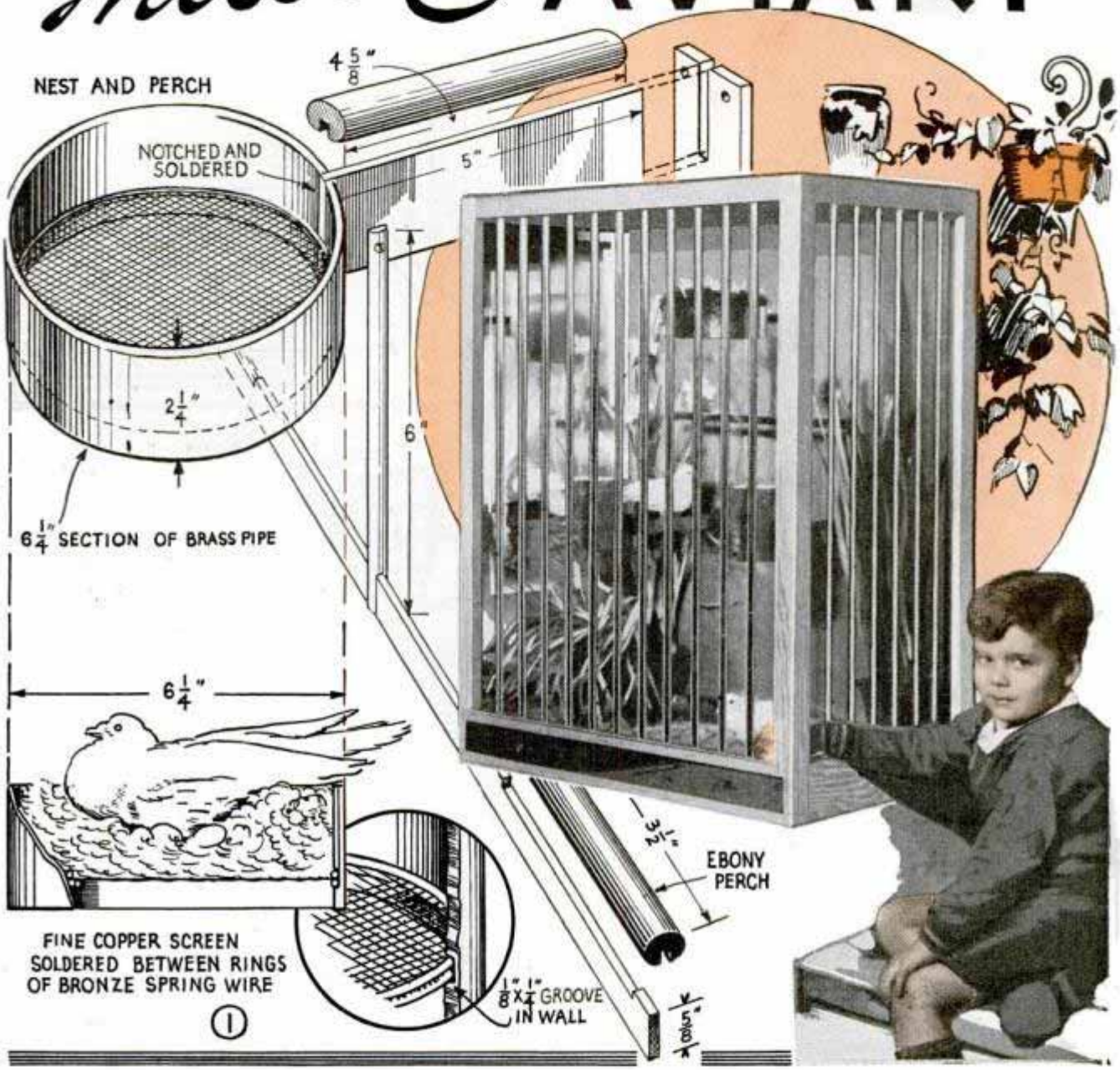
Celluloid Envelopes Shield Book on Chemists' Workbench

Have you ever used a reference book at your experimental bench and accidentally dropped acid on the pages or otherwise soiled them? If so, a couple of celluloid envelopes, which can be picked up in various sizes at a ten-cent store, will avoid this trouble. Just open the book and slip the envelopes over the pages, pushing the edges of the envelopes tightly together.

—George Vias, Chicago.

Two celluloid envelopes slipped over the pages of an open reference book will protect them

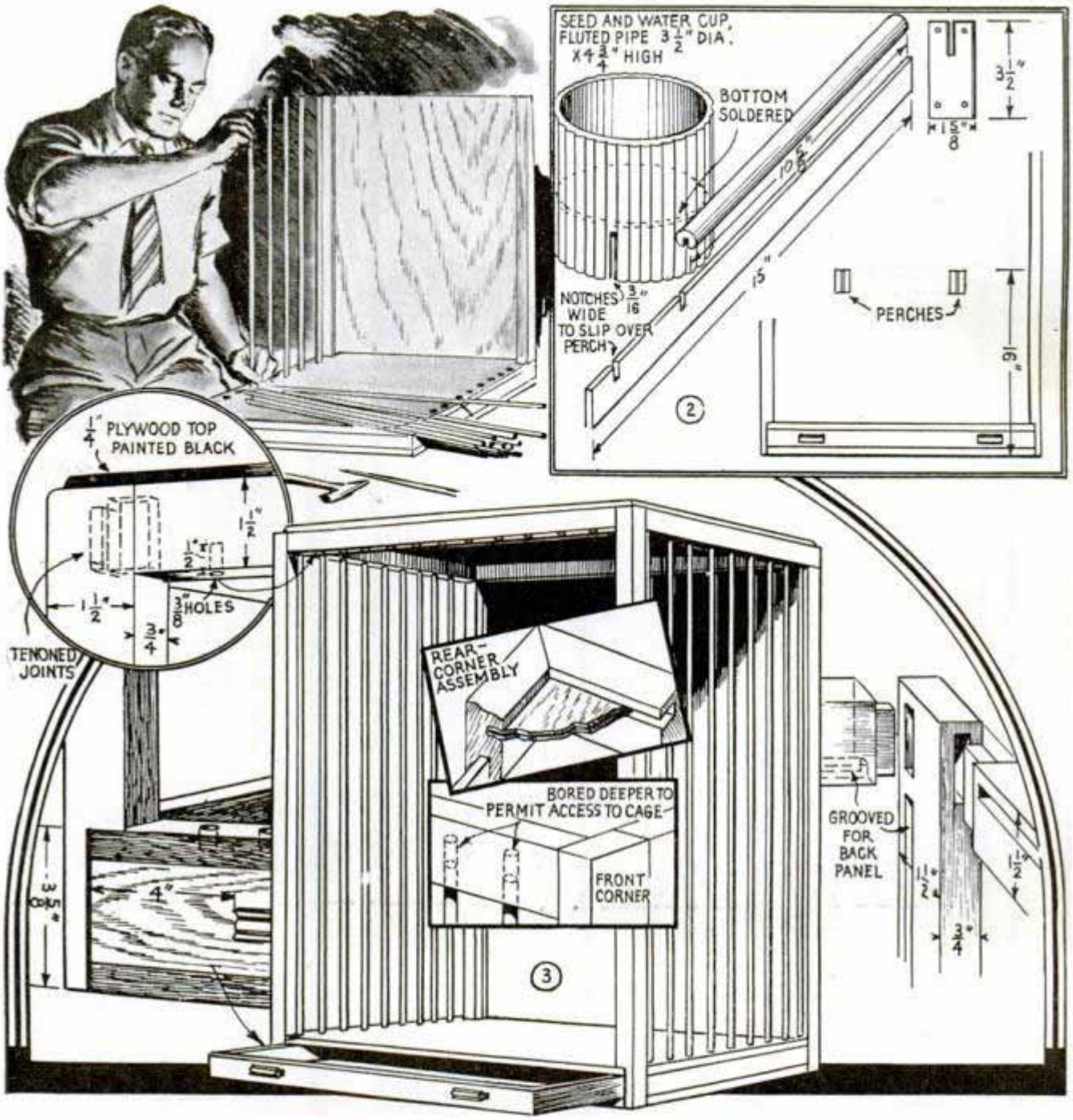
Indoor AVIARY



By OSKAR J. W. HANSEN

BUILT of mahogany and chrome-plated tubing, this aviary, with variations in the spacing of the bars, is suitable for a number of varieties of birds. Of course, you can substitute other materials for those specified and still utilize the same idea in design. Another variation, entirely practical, is the installation of a full-size mirror in one side of the structure, the mirror being fastened to a plywood wall with screws at each corner. This has the effect of multiplying the size of the cage and the occupants, giving the illusion of a whole flock of birds.

As you will see, the construction has been limited to such plain lines that getting out the parts for the frame is a short job on the circular saw and can be done with hand tools if need be. The tray, made of tin with a wood front, fits in a groove cut in the lower rails. If you have no tools to cut the groove, then 3/8-in. strips tacked to the rails is the practical alternative. Fig. 3 shows the assembly and how the frame is joined at the corners, glue being used on all joining members. Chrome-plated brass tubing, 3/8 in. in diameter, is set into holes equally

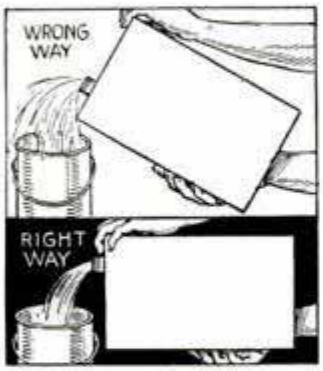


spaced in the frame rails. Of course, these tubes or bars are put in before the cage is completely assembled. Notice in Fig. 3 that holes for two of the tubes are bored deeper so that these bars may be removed for access to the interior. In Figs. 1 and 2 are suggested designs for perches, seed and water cups, and the nest. The frames for these accessories are made of 1/8-in. flat brass and brass tubing, all chrome-plated. The perches fitted to these frames are oval strips of black ebony, grooved to fit over the edges of the frame so that removal for cleaning is easy. Other less expensive woods will do very well. Seed and water cups are of chrome-plated fluted brass tubing. This combination of materials works out in harmony with the balance of the design.

Sizes and position of these interior parts must be varied to suit the birds you intend to keep. For example, if these should be canaries, the perches will need to be relatively smaller in section than they would be made for parrots or macaws. The same is true of the seed and water cups and also the nest. The mahogany frame of the cage is finished in the natural color of the wood and waxed. The plywood back is enameled a dark blue with the tray front a matching color. Of course, this color combination can be varied.

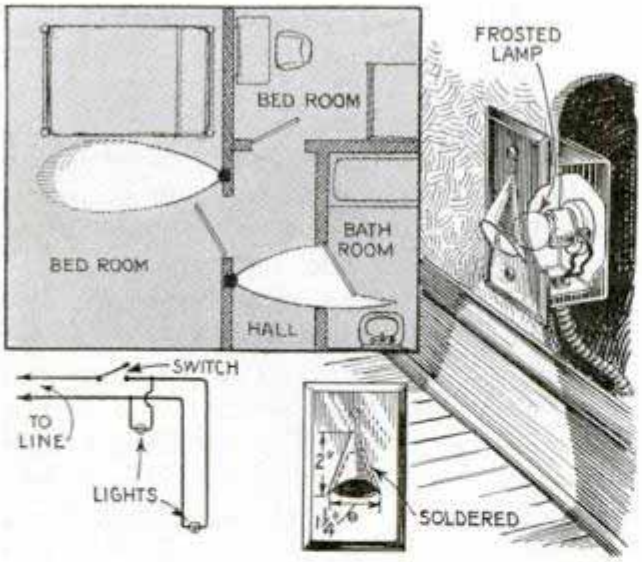
Pouring Liquids from Cans

When pouring liquid from a can which has a screw-top opening near one edge of the top, hold it as shown in the lower detail. Holding the can in this manner allows air to enter over the surface of the liquid. It then comes out in a steady stream instead of in a wide spray as it does when the can is held as shown above.



Dim Night Lights for Your Home Set in the Wall

Provided with one switch at your bed or some other convenient location, or with individual switches, these indirect wall lights can be turned on to illuminate the floors when you get up at night, without disturbing the rest of the family. Located 15 or 20 in. above the floors, the lighting system consists of nothing more than the regular metal wall outlet boxes in which are fitted small 110-volt lamps and sockets. These are wired to the house lines through conduit or flexible cable. Slots 1¼ in. wide and 2 in. long are cut in the brass plates and are covered by cone-shaped deflectors made of brass and soldered in place.



Illuminating the floor with a soft, dim glow, this night lighting system can be installed by anyone

Workshop Shelf for Magazines Keeps Them Filed Neatly

Kept in this case in groups of five, magazines are easy to remove and insert

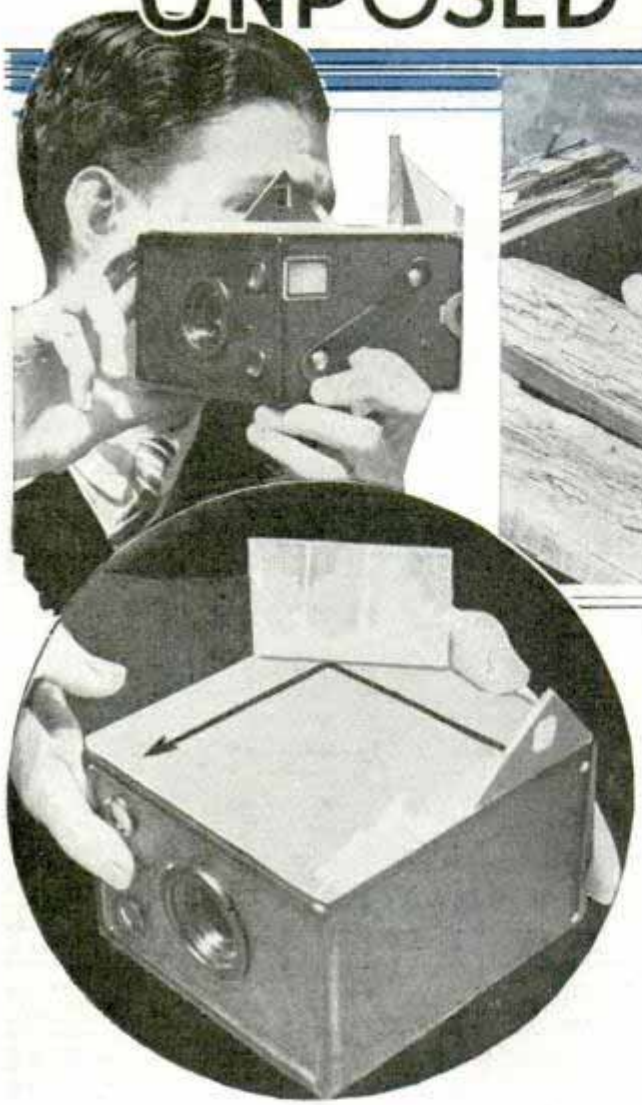
For the owner of a home workshop who likes to have a file of magazines at hand, here is a simple case that keeps them in groups of four or five so that it's easy to remove any one. The case also permits grouping the magazines under associated headings. If desired, a lid or curtain to fold back over the top of the box can be provided to keep out dust.

—Burl Knutson, Bismarck, N. Dak.

Wire Handle to Hold Solder Prevents Burned Fingers

If you are using wire solder on a job where it is necessary to grip the solder close to the end to apply it properly, this simple handle will prevent burning the fingers by conducted heat. Just bend a length of wire to the shape shown, forming a small eye at the lower end through which the solder is fed.

"UNPOSED" PHOTOS with your



Unsuspected shots with angle view finder

Simple tricks to disguise your real purpose enable you to get people in those natural poses that make photos interesting

By SIGMUND L. SAMETH

UNPOSED photographs, taken while the subject is unaware of the photographer, are always more natural and interesting than the stiff expressions and positions which people assume before the camera. Such photographs may be taken with an ordinary box camera by the simple process of silencing the noise of the shutter and then operating the camera in such a way that it is effectively concealed from the subject.

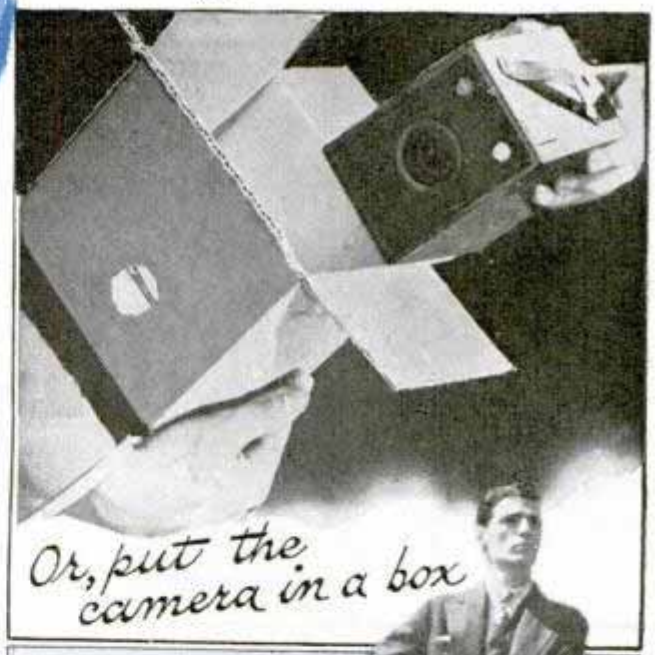
The camera is pointed rather than sighted. Finders on box cameras are not suitable because of the limitations of the finder. The usual angle of view of the box camera is about 45° so that the camera may be pointed and the rather wide angle of view allowed to include the subject wanted. With a very little practice the camera may be aimed from the hip in this manner with perfect exactness. By the use of a small mirror mounted on the top of the camera box as indicated in the photo, an angle view finder can be made. With this arrangement it is possible to point the camera one way and in reality take a picture in the other direction. The mirror can be fastened with adhesive tape. A small aperture is then cut in a piece of cardboard, which is fastened to a corner of the camera box. The cardboard supports may be fastened to the camera box with a spot of glue or adhesive tape. Once you have the finder properly adjusted you can take pictures of persons near you without their being aware of what you are doing.

A useful method of concealing the camera is to cut a small hole in a newspaper and shoot through this. The upper portion of the paper may be allowed to bend down over the hole until the moment of

BOX CAMERA

Candid Photos taken through newspaper

Midget camera concealed in a handkerchief



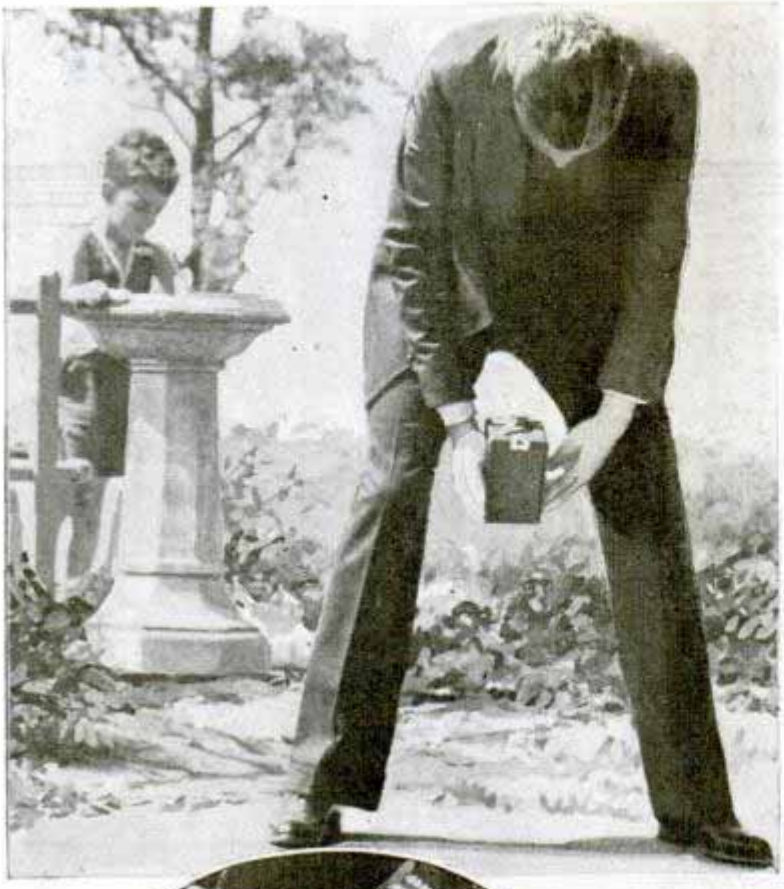
Or, put the camera in a box

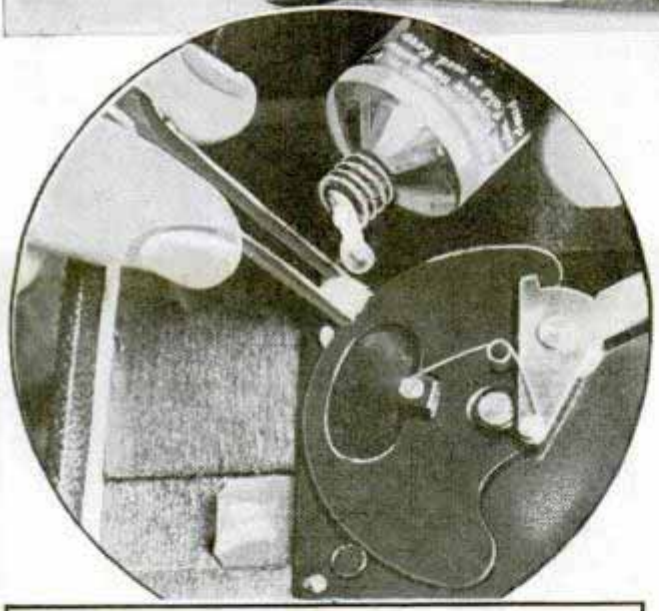
and take the picture like this

exposure. It is then raised. The paper is held in one hand and the exposure made with the other. The silent shutter will be undetected, and after the picture has been taken, the paper may be allowed to fall back to conceal the camera beneath. A similar stunt, shown in one of the photos, is to conceal a small camera in a handkerchief. In this way you can shoot pictures in close quarters without detection.

Another trick is to cut a small aperture for the lens in one end of a cardboard carton and another at the side so that the finger can reach the shutter trigger. If a cable release is used, it may be allowed to project through a small hole. In using the cardboard box, the hand is kept over the lens aperture until ready to shoot. After each picture, the camera must be removed from the box and the film wound to the next exposure.

An ingenious method of using the box camera is often resorted to by press photographers who are taking candid or forbidden shots. The photographer turns his back to the subject and holds the camera





In taking unsuspected photos, it's important to silence the click of the shutter. To do this you glue a small wad of cotton to the shutter stop in the position shown above

with lens pointing toward himself in front of him. The hand is on the trigger. To take the picture it is only necessary to stoop for a moment, press the trigger and stand up again. The picture is snapped between the photographer's legs. A much published series of photos of a prominent person who objected to being photographed was secured in just this manner. Of course, in this case you must be far enough from the subject so that you can catch and center the figure or object quickly in the limited range of the camera finder.

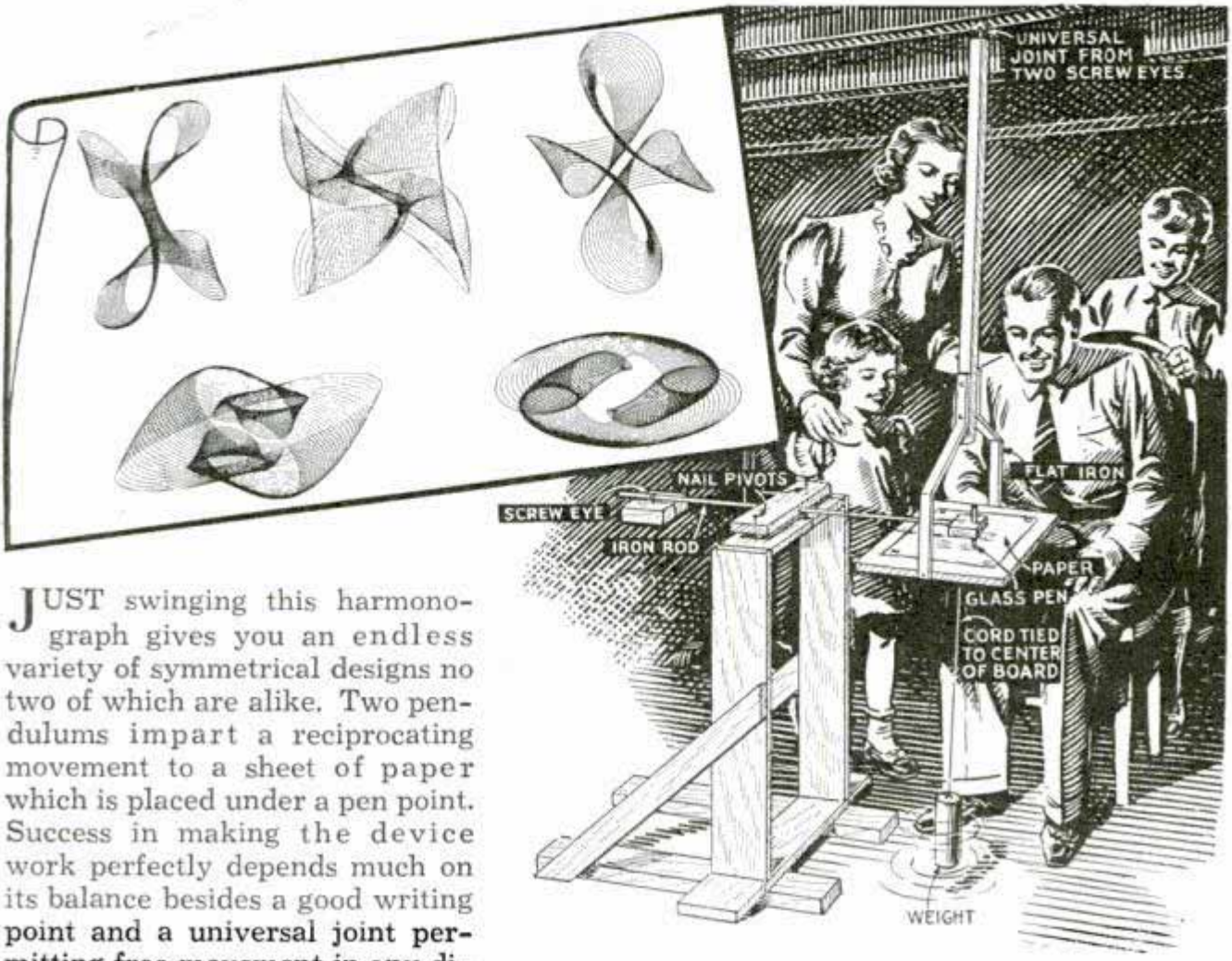
To make the shutter of the box camera noiseless, remove the front of the camera by taking out the screws which hold it. It will be seen that there is a small metal projection on the shutter blade which strikes against an immovable stop. This prevents the shutter swinging too far, and it is this projection which makes the sharp "click" when taking a picture. With a drop of glue, fix a small wad of absorbent cotton or a piece of pipe cleaner next to this projection so that it will act as a buffer and deaden the click. After this has been done, the shutter will be absolutely noiseless, and the front of the camera may be put back in place.

Prop under Fruit-Tree Limb Has Rubber Yoke at End

If you have to support the limbs of a heavily loaded fruit tree this summer, here is a prop that will do the job without any possibility of injuring the bark. The prop is a length of 2 by 4-in. stock with a section of old auto tire nailed to the end to straddle the limb. Countersink the nail heads so that they will not chafe the bark.

Here is a tree-limb prop that will not chafe the bark, and the wind cannot blow it down

Harmonograph Fascinates Young and Old



JUST swinging this harmonograph gives you an endless variety of symmetrical designs no two of which are alike. Two pendulums impart a reciprocating movement to a sheet of paper which is placed under a pen point. Success in making the device work perfectly depends much on its balance besides a good writing point and a universal joint permitting free movement in any direction. A long stick is fastened to the ceiling with two screw eyes that form the universal joint. The lower end of the stick is fitted with two flat-iron brackets that hold a writing table on which a sheet of paper is mounted by means of thumbtacks. The stick and table form one pendulum while a cord and weight suspended from the exact center of the table form the second one. To make the writing point you can take a length of glass tubing, heat it and draw out one end to a point through which ink can flow to produce a fine line. Or, you can use a round-pointed writing pen, although this makes coarser lines. The writing point is held on a pivoted arm which is entirely independent of the pendulum, and is adjusted to rest lightly on the paper. Note the method of supporting the arm so that it can move up and down but not sideways, and how the pen pressure on the paper is regulated by means of a sliding counterweight. In using the harmonograph, first set the writing table in motion and then let the pen come down to contact the paper. By making the pendulums move in opposite directions, at right angles to each other, or in any combination of swinging movements, you'll get all kinds of interesting designs.

Stepladder Rests on Small Cans When Set on Soft Ground

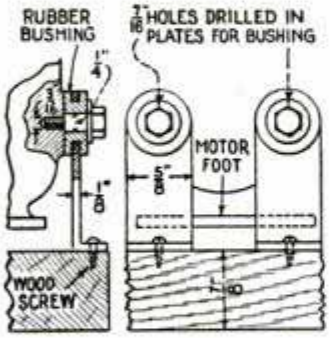
Spring house cleaning often necessitates using a stepladder out doors for washing windows and other purposes, and, if the ground is soft, the legs of the ladder are apt to sink down. To avoid this, get a couple of small tin cans and tack one onto the bottom of each of the smaller ladder legs.

Wheelbarrow Has Canvas Cover to Hold Light Material

This cover is quickly pulled over your wheelbarrow to keep wind from scattering light material

When hauling leaves, ashes and other light material in your wheelbarrow, a canvas cover which can be pulled over the top and fastened will prevent the wind from scattering your load. The canvas is fastened to a window-shade roller, which is attached to one side of the wheelbarrow with metal brackets, hooks being screwed to the other side of the wheelbarrow to hold the free end of the canvas.

Motors "Floated" on Rubber to Absorb Vibration



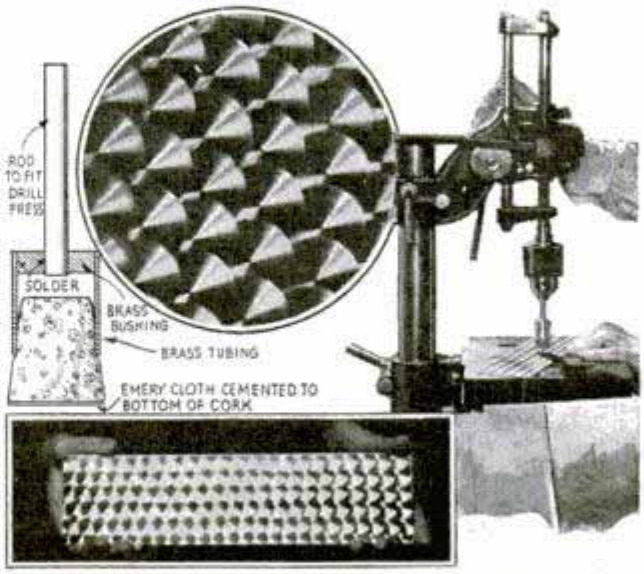
If you have some small electric motors in use around your home and they produce annoying vibration, it's a simple matter to mount them with soft-rubber bushings, which will stop the trouble. The bushings, which can be purchased in any electrical store, are pressed tightly into holes drilled in the ends of flat-iron legs and take stud bolts in the ends of the motor. Four legs are used, and they are screwed or bolted to a base, the legs being long enough to keep the motor from touching the base.

Paintbrush Cleaner

With the following solution, you can clean a paintbrush in a jiffy. Mix kerosene, 1 gal., in oleic acid, ½ gal. In a separate container, mix denatured alcohol, 1 pt., and ammonia (strong 28 per cent), 1 pt., and stir it into the kerosene solution until the mixture is smooth. In use, the dirty brushes are allowed to stand in the solution overnight, after which they are washed out with warm water.

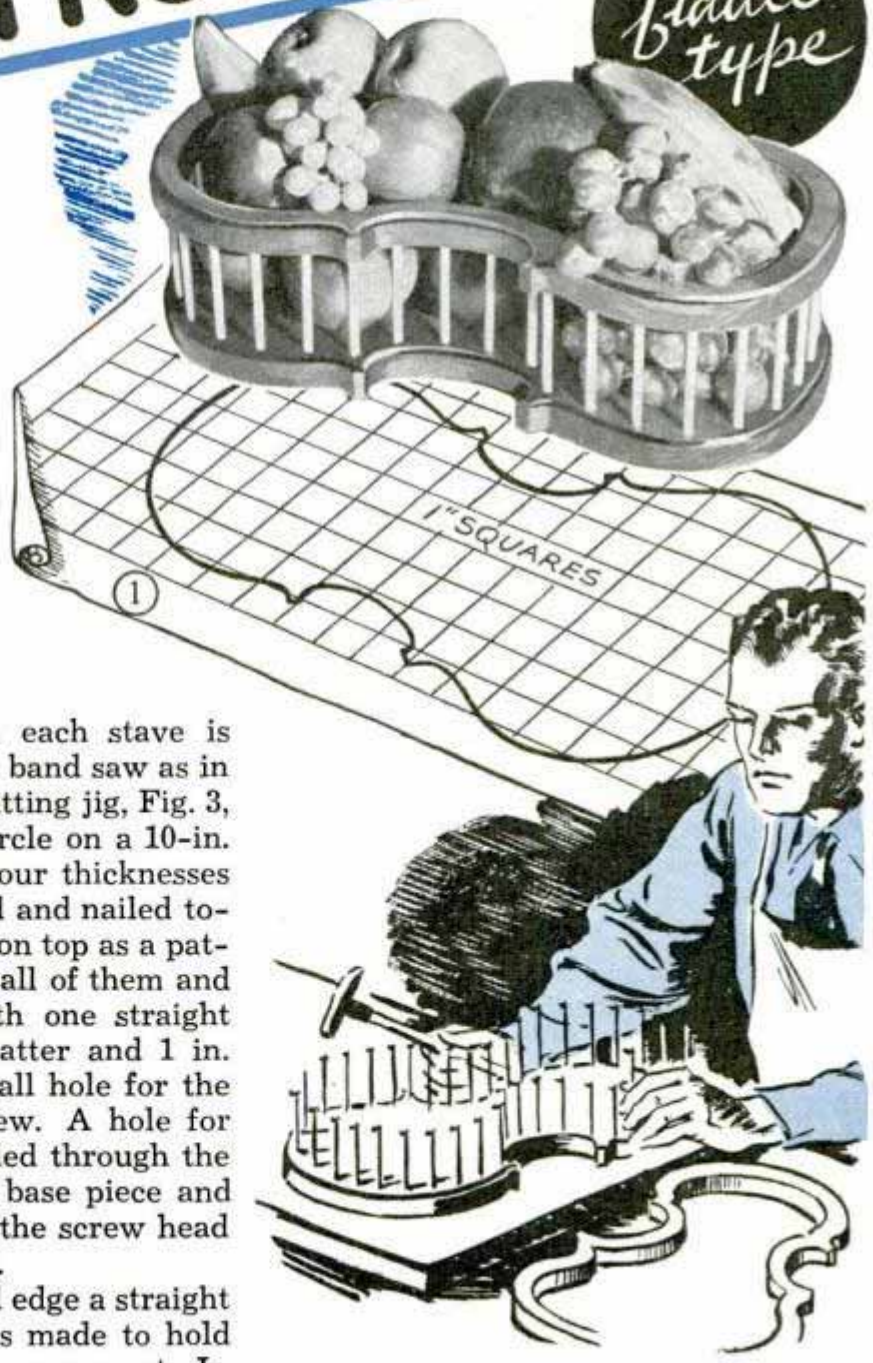
'Engine-Turned' Finish on Metal Made in Your Drill Press

The decorative effect, which is known as "engine-turned" finish, on bare metal parts may be duplicated easily on metal parts in your home workshop. The required equipment consists of the tool shown, to hold a cork, which has a disk of emery paper cemented to the large end. To produce the finish, rotate the tool in a drill press, bringing the abrasive end of the cork to bear lightly against the surfaces to be finished. Each successive contact is made so that the scroll pattern of circles produced by the paper overlaps at least half their diameter. Where surfaces of odd shape are to be decorated the cork should be replaced with a wad of steel wool.—Philip R. Tarr, Akron, Ohio.



The beautiful finish shown in the photo is easily made on metal in your home workshop

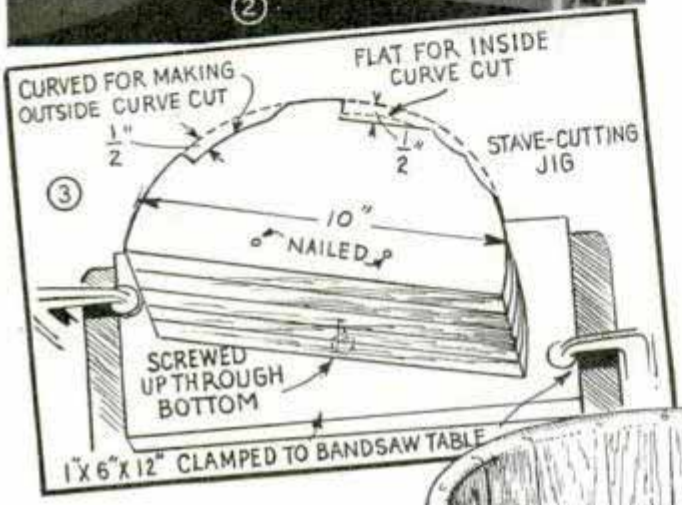
NEW FRUIT BASKETS



Once you have the jigs made, you can make up any number of these baskets by duplicating the parts

LOOKING at the first one, the "barrel" type, you'll see that it's made up of staves held together with metal bands, just like a barrel. Instead of being assembled and then turned, each stave is sawed to shape in a jig on the band saw as in Figs. 2, 3 and 5. The stave-cutting jig, Fig. 3, is made by scribing a half circle on a 10-in. length of 1 by 6-in. stock. Four thicknesses of the same stock are stacked and nailed together with the scribed piece on top as a pattern. Then you saw through all of them and get a semicircular block with one straight side. At the center of the latter and 1 in. from the edge you drill a small hole for the threaded end of a wood screw. A hole for the body of the screw is drilled through the center of a 1 by 6 by 12-in. base piece and the hole countersunk so that the screw head will clear the band-saw table.

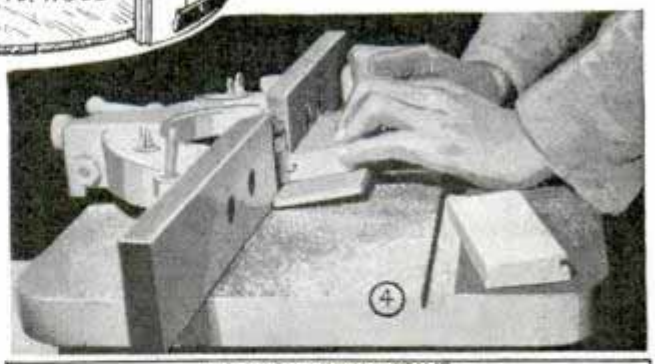
Now, in a part of the curved edge a straight cut with a square shoulder is made to hold the stave blank for the inside curve cut. In

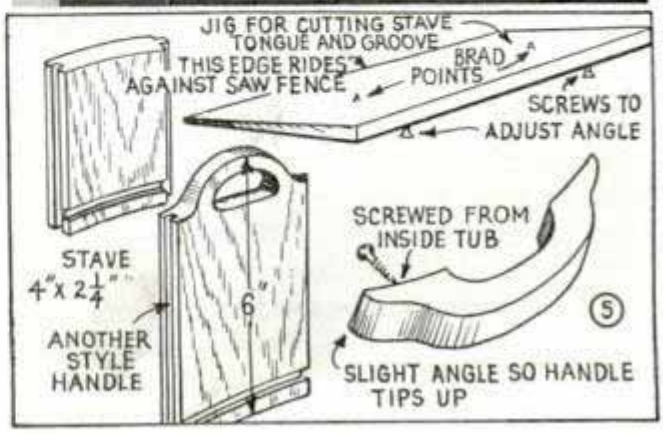


another section of the rim a second cut is made with a curved side and square shoulder as shown in Fig. 3. After being cut to length the blank is held against the flat section to make the inside curved cut. After running the first cut on all the staves, the jig is readjusted and the staves, one at a time, held in the other position and the outside curve sawed.

For cutting the tongue-and-groove joint in the edges, a jig consisting of a thin board, a piece of beveled siding will do, is used as in Figs. 4 and 5. The thinnest edge rides against the shaper fence. Two short screws are turned into the under side of this piece for adjusting to the exact angle at which the staves are to meet the shaper cutters. Small brads driven through from the under side with the joints just protruding, will hold each stave firmly as it is passed over the cutters. Another shaper cut is the groove at the bottom of each stave for the edge of the 1/4-in. plywood bottom. A 1/4-in. cutter combined with a depth collar of the proper diameter is required for this operation. Handles are cut from 3/4-in. stock as in Fig. 5. Hoops are 1/32-in. brass 1/2 in. wide. Abutting ends are soldered, then the hoops are heated slightly and tapped into position.

The "fiddle" basket is shaped to the outline of a violin as in Fig. 1. The pattern, shown on 1-in. squares, is enlarged to full size and the design traced on 1/2-in. stock. After sawing top and bottom pieces to the outline you scribe another line all the way around the top piece 1 in. from the edge. Then the center is cut away with the jigsaw. Sanding and a concave molding cut finish the edges of both pieces. Drilling equally spaced holes for the 3/16 by 4-in. dowels is easy. A spot of glue on the ends of each dowel will hold the parts together. Either hard or soft wood can be used for both projects. Birch or oak will make attractive staves for the barrel basket, while a combination of walnut top and bottom with hardwood dowels finished natural makes an attractive fiddle basket. Birch can be stained and finished to match other woods. Oak staves should be filled with a natural filler and shellacked and waxed.

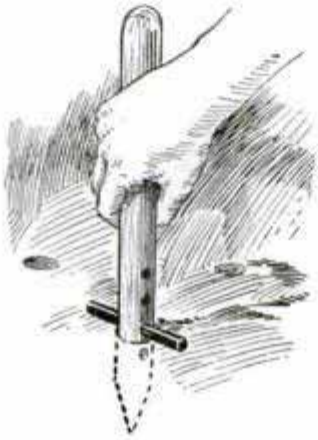




Keeping Wire Solder Handy

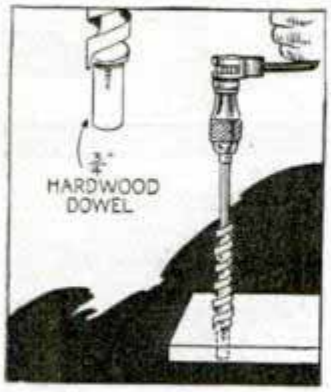
A good method of keeping wire solder at hand is to put the spool in an improvised holder and suspend this from the underside of your workbench, letting the free end of the wire extend up through a hole in the bench top. The solder can be pulled up as needed, and the end can be folded over against the bench top when not in use.

Adjustable Dibble Sets Plants at Uniform Depths



The problem of setting plants or bulbs at a uniform depth is solved by an adjustable dibble. This dibble differs from the usual type, which is nothing more than a pointed stake, in that holes are drilled through it near the pointed end to take a short dowel, which serves as an adjustable depth gauge.

Auger Bit Has Short Dowel Pilot to Enlarge Holes



The next time you have to enlarge a hole in wood, try using a short dowel on the screw point of the auger bit to serve as a pilot, which will assure cutting concentrically. The dowel, which should be of the same diameter as the hole, must be accurately centered on the screw point of the bit. It may be necessary to sand the dowel lightly and lubricate it with soap or wax so that it will turn freely in the hole.

Umbrella Carried in Golf Bag for Sudden Showers

A "soaking" from an unexpected shower is avoided if you carry an umbrella in your golf bag

As a protection against sudden showers while out on a golf course, why not carry an umbrella right in your bag? Just take a length of old inner tube and after cleaning it, cement one end shut. Then sew it inside the bag to take the umbrella. You'll find that it takes surprisingly little space and will not be damaged by the clubs.

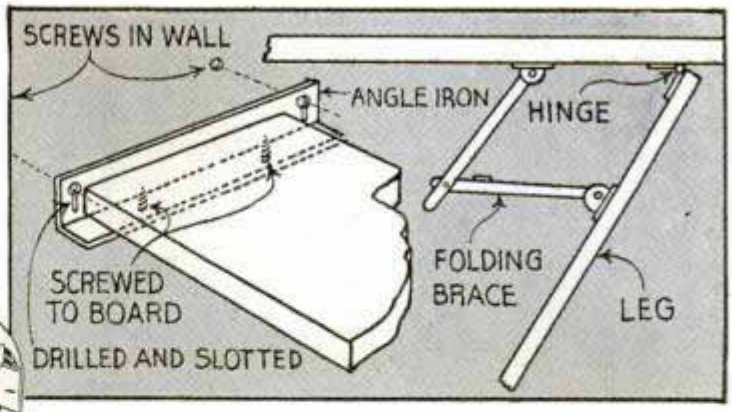
Kinked Wire Straightened with Half Hinge

Wire which has been kinked may be straightened easily by drawing it through the pin loops of a half hinge, the center loop being bent slightly out of line. The hinge should be clamped in a bench vise as shown, to hold it rigidly.

A simple way of straightening kinked wire is to draw it through a half hinge

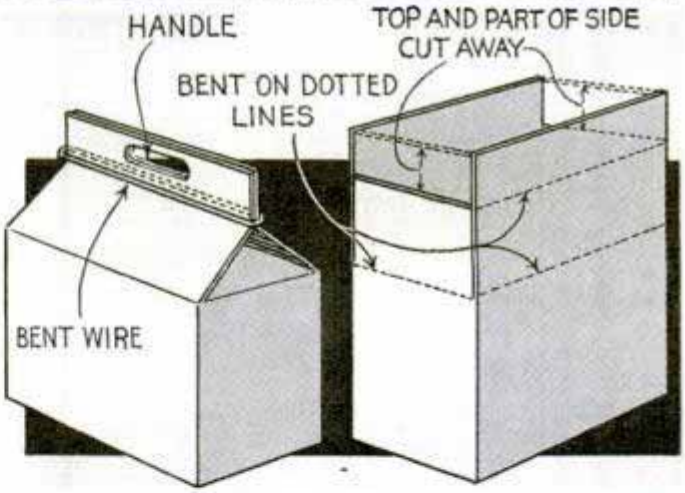
Easy Solutions for Your HOME

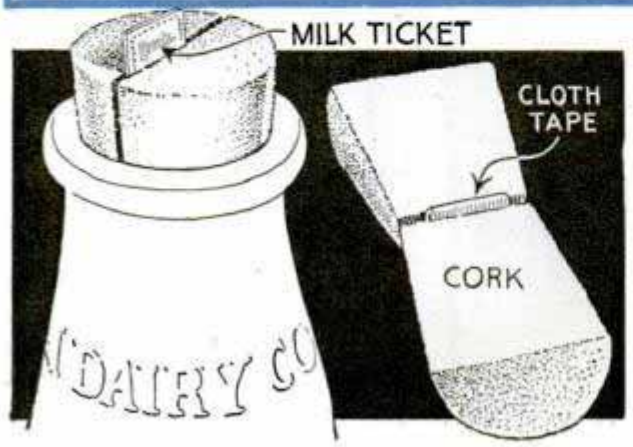
Rigid ironing board



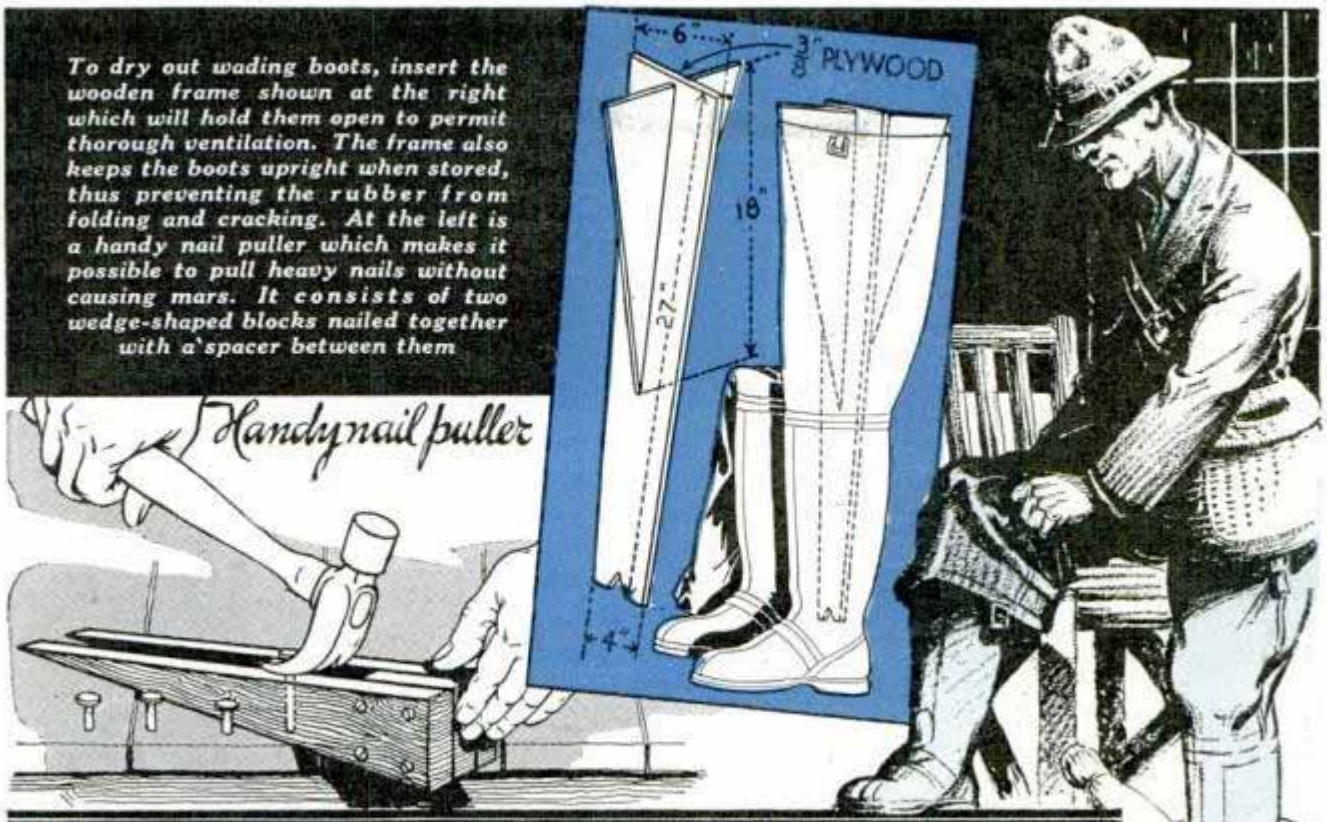
Here's a rigid, single-leg ironing board, one end being supported solidly against the wall. A piece of angle iron of sufficient length to cross two studs, is screwed to the wide end of the board, slotted holes near the ends permitting it to slip over screws driven into the wall studs. The leg is hinged to the board and is fitted with a folding brace. When the ironing is done, just lift the board from the screws, fold the leg and store it

The carrying bag at the right is made by cutting away the top and part of the sides of a cardboard carton, after which the ends are folded inward. The sides are held together with a wire loop. Below, large cork split in half and hinged together holds ticket in empty milk bottle. Below, right, apply a strip of transparent cellulose tape to frosted glass so you can see through it. This applies only to glass frosted with an abrasive and is not effective on the molded glass

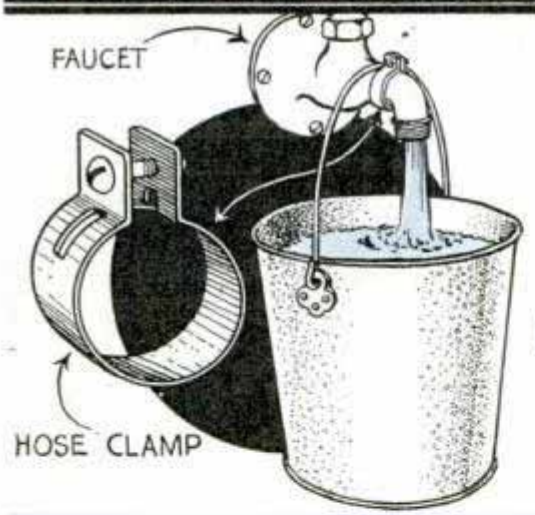


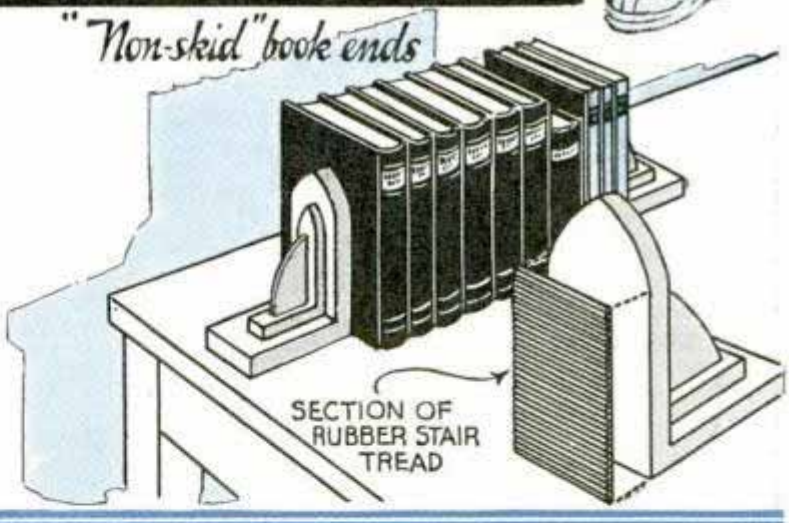


To dry out wading boots, insert the wooden frame shown at the right which will hold them open to permit thorough ventilation. The frame also keeps the boots upright when stored, thus preventing the rubber from folding and cracking. At the left is a handy nail puller which makes it possible to pull heavy nails without causing mars. It consists of two wedge-shaped blocks nailed together with a spacer between them



PROBLEMS





Center left detail shows how a hose clamp is used to keep a bucket bail from slipping off a faucet. Tendency of tall or heavy books to spread or tip a pair of light bookends can be prevented by gluing pieces of rubber stair tread to their inner and underside surfaces. A lasting patch for a composition-paper roof is shown at the left. Tack a piece of screen wire over the hole in the roof and cover it liberally with a mixture of melted asphalt and ground asbestos. The mixture is worked into the wire, after which the surface is smoothed and coated with roofing cement

"Wood" to Turn Novelties Is Glued Up from Paper

You'll be surprised at the various colors it is possible to work into a turned novelty with this process

If you are looking for some colorful material from which to turn out novelties, you can make it by gluing up layers of different colored paper to the thickness desired. The pages of old catalogues offer a good supply of paper, and when glued to a block of thin wood and turned, the edges appear in different colors. After sanding the edges of the turning, give it a coat of shellac.—L. E. Hudson, Rockledge, Fla.

Solution to Clean Bottles

Bottles and other glassware are readily cleaned with a hot solution made by dissolving a small amount of the following mixture in boiling water. Sodium metasilicate, 1 oz., soda ash, 2 oz., and trisodium phosphate, 2½ oz. The ingredients are mixed together in a dry state to make the cleaning powder. The solution made by dissolving this powder in water may be used for a number of cleaning operations.

Venetian Blinds to Dress Up Your Windows

Tilted slats let in air and light without glare. They provide pleasant shade in summer, draft-free windows in winter and privacy the year 'round. Our blueprints 926 and 927 cover the construction of three different types of Venetian blinds and will be sent postpaid upon receipt of a 50c remittance.

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"ZIP," MODEL RACING YACHT—880 to 884: 50 in. long. Plans include full-size lift templates. Four prints $1.00.

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Any six of these blueprints will be sent postpaid upon receipt of $1.00

Blueprint Department, Popular Mechanics Magazine, 200 E. Ontario St., Chicago

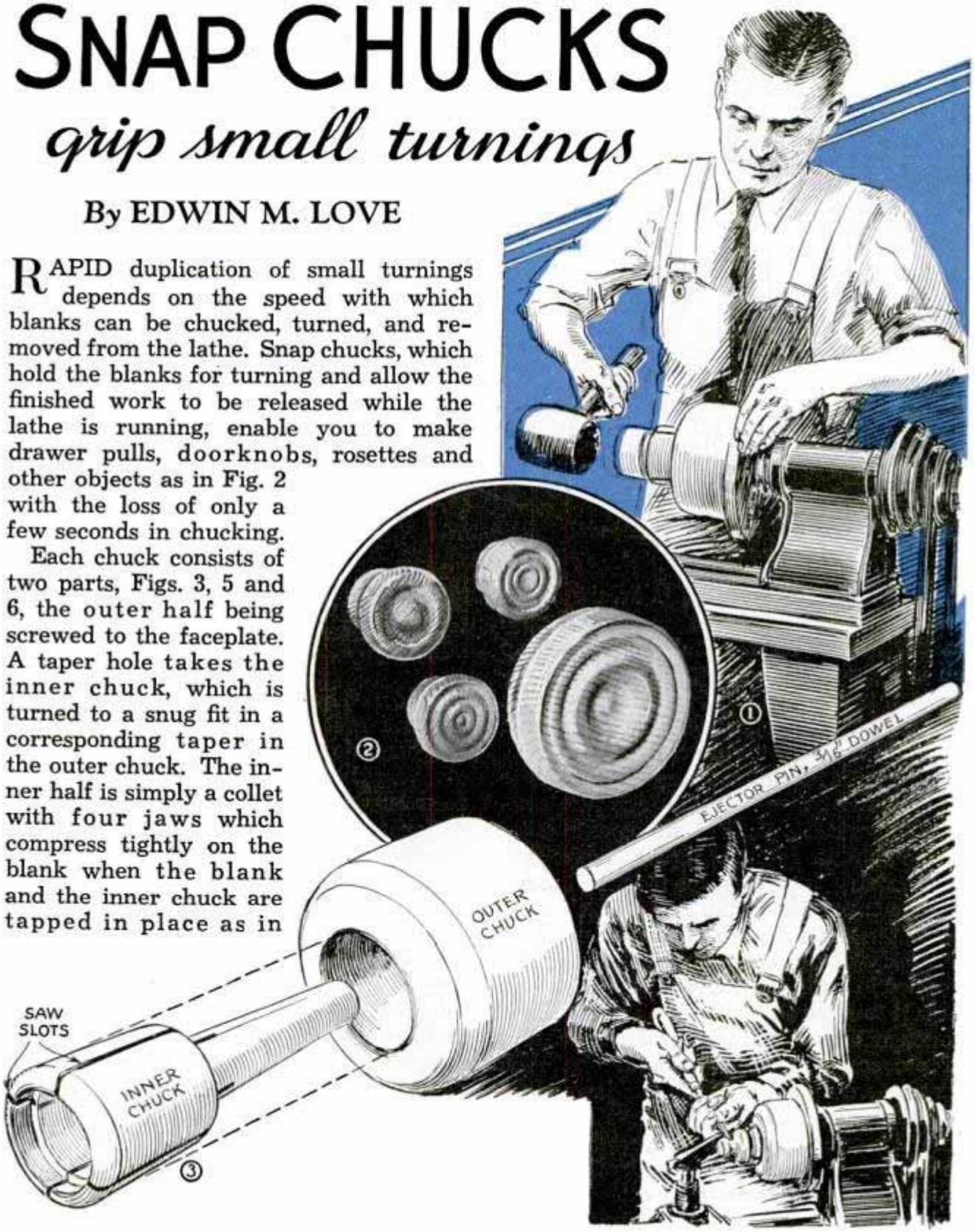
SNAP CHUCKS

grip small turnings

By EDWIN M. LOVE

RAPID duplication of small turnings depends on the speed with which blanks can be chucked, turned, and removed from the lathe. Snap chucks, which hold the blanks for turning and allow the finished work to be released while the lathe is running, enable you to make drawer pulls, doorknobs, rosettes and other objects as in Fig. 2 with the loss of only a few seconds in chucking.

Each chuck consists of two parts, Figs. 3, 5 and 6, the outer half being screwed to the faceplate. A taper hole takes the inner chuck, which is turned to a snug fit in a corresponding taper in the outer chuck. The inner half is simply a collet with four jaws which compress tightly on the blank when the blank and the inner chuck are tapped in place as in



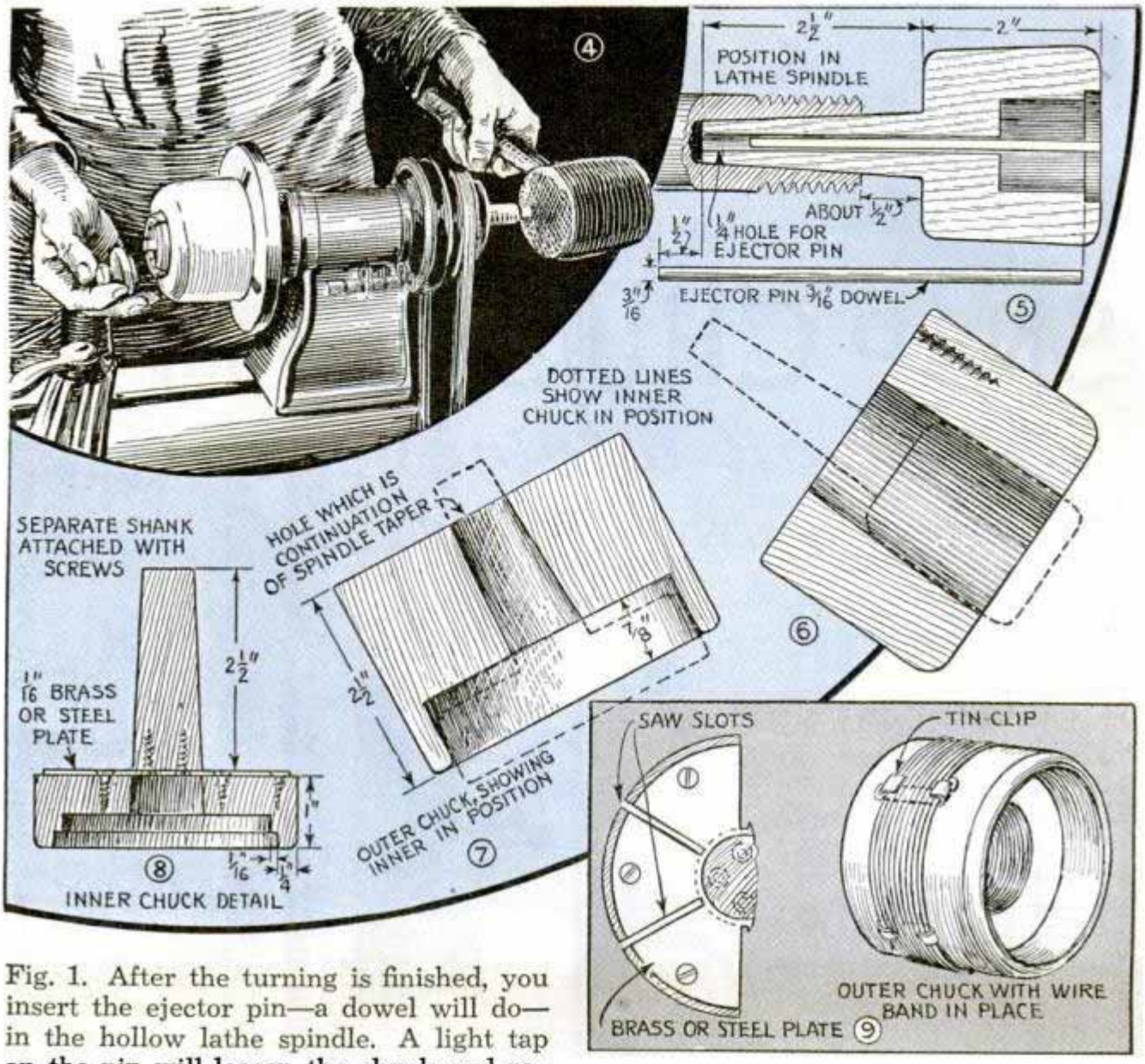


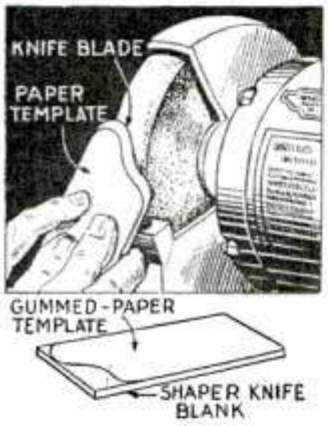
Fig. 1. After the turning is finished, you insert the ejector pin—a dowel will do—in the hollow lathe spindle. A light tap on the pin will loosen the chuck and release the work. With blanks of uniform size, these two operations can be done without stopping the machine.

There are some necessary variations to suit different types of work and also several important details in the construction of the chucks. In the first place, some care is necessary in turning the meeting tapers, that is, the taper on the inner chuck must be of the same degree as that turned into the body of the outer chuck, but slightly greater in both small and large diameters. This is to assure that the jaws of the inner chuck will grip the blank with a minimum of movement. The size should be such that when forced in until the jaws close together, the latter will project about ⅜ in. Also the inner chuck must be bored to such size that it will just take the blank freely. To make sure that each blank is held at the same position, the inner half is shouldered about 1/16 in. as shown in Fig. 3, to form a stop for the blank. After this has been done, two saw cuts are made at right angles along the axis to form the four expansive jaws.

For larger turnings, such as rosettes, the single-piece inner chuck is not practical. Instead you make up the chuck for this work as in Figs. 7 and 8. First a disk is turned from 1-in. stock. To the back of this you attach a light metal disk with six screws equally spaced around the outer edge. This assembly is then turned down to fit in a recessed outer chuck, Fig. 7, in which it can be finished to take the blanks, while in the outer chuck a hole is centered through to the metal disk so that a shank may be attached with screws, Fig. 8. The body is then slotted as in Fig. 9 so that the jaws will be flexible. The procedure in chucking and turning the work

is the same as described before. For continuous high-speed operation the outer chuck should be reinforced with wire as in Fig. 9. Piano wire, 1/32 in. in diameter, wound tightly over equally spaced tin clips will serve this purpose very well. Winding tension on the wire can be obtained by dragging it through a clamp while turning the lathe by hand. When the band is of sufficient width, the projecting ends of the tin clips are bent up and soldered to hold the wire band in place. It's a good idea to sweat-solder the whole band together. Inner chucks of the types described can be hollowed or "stepped" to fit two or three sizes of blanks, and, as other sizes are needed, you can turn out new inner chucks and soon have on hand a large selection.

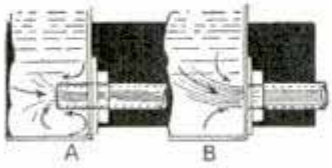
Shaper Knives Ground Accurately



To grind duplicate sets of blank shaper knives for special molding cuts, a craftsman produces a sharp grinding line by cutting duplicate templates of the desired shape from gummed paper. These are stuck to the face of each knife which prevents them from shifting while the edge is being ground, and makes constant testing unnecessary.

How to Connect Pipes to Tanks

After making experiments on one factory, it was found that pipe connections to liquid transfer tanks should not project inside of them as the projecting ends of the pipes caused considerable friction against the flow of the liquid as indicated at A. When the connection was made as indicated at B, the resistance to the flow was less than half of what it was when the pipe projected inside.



—L. H. Georger, Buffalo, N. Y.

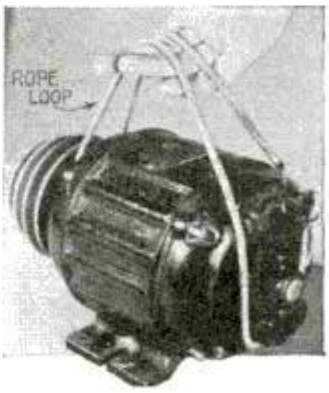
Sand Is Screened Automatically by Its Own Weight

Work of scraping sand over a screen is saved when you use this wheeled box

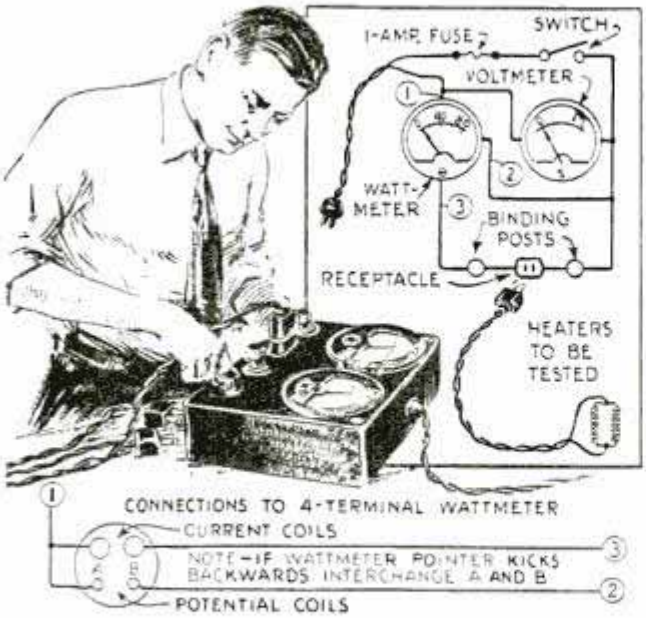
Sand screening was simplified by a Wisconsin contractor who had no power sifter by providing an ordinary screen with a counterweighted, wheeled frame, arranged to slide back and forth over the screen. Workmen shovel sand into the frame which, when loaded, starts moving downward spreading the sand uniformly over the entire surface of the screen and causing it to sift through rapidly. Piling up of the sand is prevented by the movement of the frame. As soon as enough sand has been sifted to lighten the frame sufficiently, the counterweight pulls it back to the top. Then the process is repeated, and it is not necessary for the worker to constantly scrape the screen with his shovel to keep the sand going through.

Carrying Small Motors

In a shop or factory where it is often necessary to carry a small motor, a stout rope will provide a handle. The ends are tied together, and the rope slipped around the motor as shown.



Portable Electric Meter Box Aids Trouble Shooter

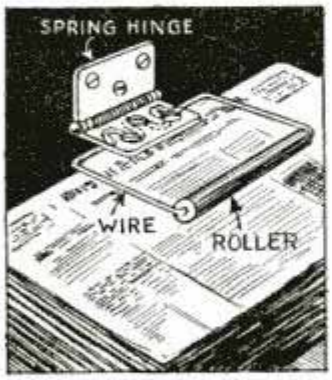


Test meter box helps trouble shooter locate quickly seat of trouble in electrical appliances

To save time when checking electrical appliances, the service men of one electrical repair shop were provided with portable test boxes, each containing a wattmeter, voltmeter and a plug-in receptacle. By simply plugging the appliance into the receptacle, its electrical consumption in watts can be read directly on the wattmeter, verified by the voltage reading. The box will be found exceptionally handy in testing appliances that have numerous heaters or elements, such as some beauty-parlor equipment.

—Pat Fairmont, Cleveland, Ohio.

Papers Clamped on Newsstand under Spring Roller



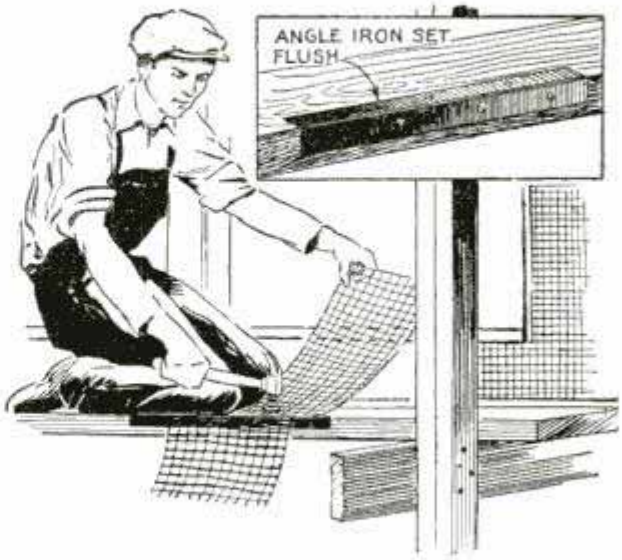
Screwed to the back of his paper stand, a spring hinge with a wood roller attached to it was found ideal by one news dealer in holding down stacks of papers. The roller was better for the purpose than a weight as it allowed a paper to be removed from the top of the stack by simply giving it a jerk. The roller was slipped over a length of heavy wire, bent to a rectangular shape and the ends passed through the screw holes of the hinge and soldered to it.

Removing Cast-Iron Pulleys

When cast-iron pulleys must be removed from a line shaft, one mechanic claims that he saves money by breaking them off instead of going to the expense and trouble of removing the shaft and a number of other pulleys in order to get the iron pulley off. The rim and spokes break easily, and two men can usually break off the hub in a short time. One of them holds an anvil against the top of the hub, while the other uses a sledge hammer on the underside. In this way, there is no danger of springing or otherwise damaging the shaft, and it is easier to apply considerable pressure against the shaft from the top than from the lower side.

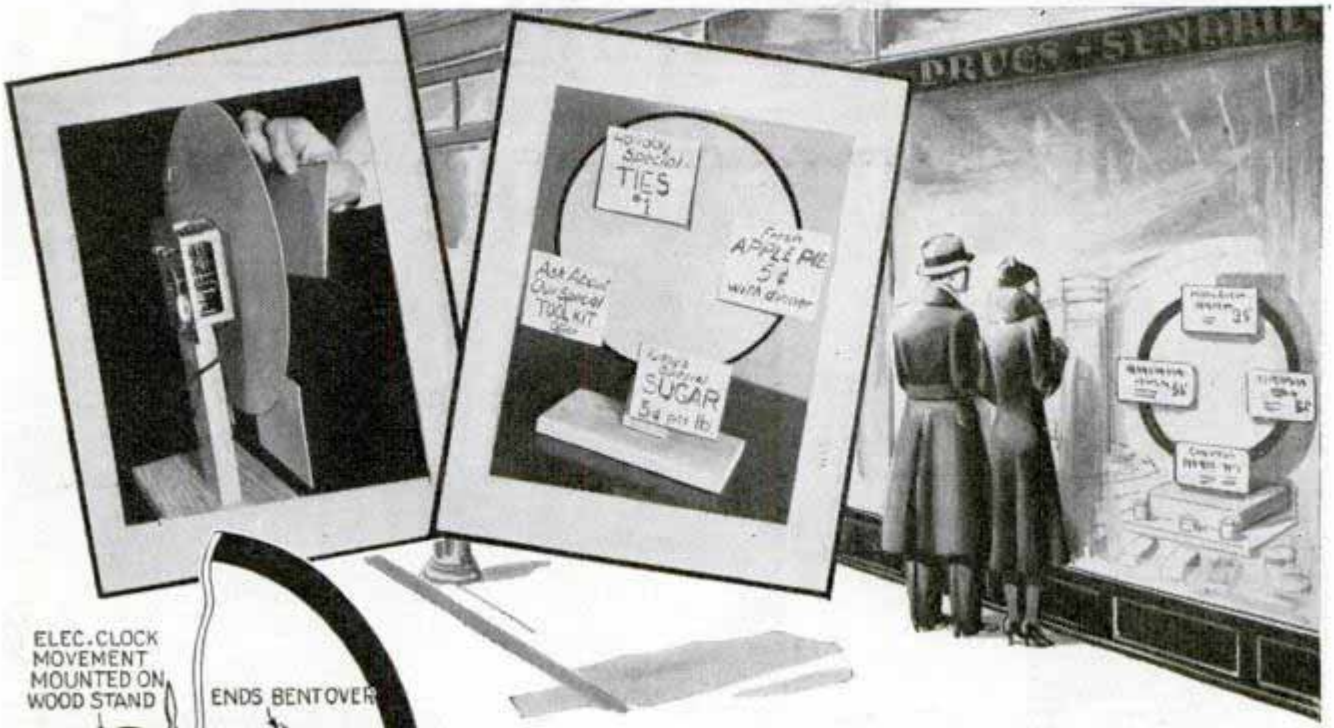
Angle-Iron "Anvil" on Scaffold Has Many Uses

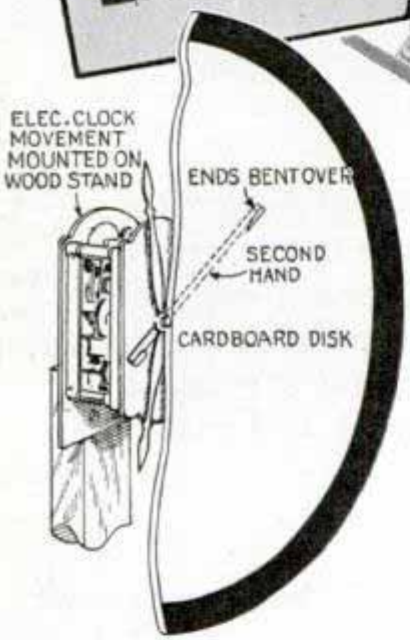
Screwed to the edge of an outside plank of a carpenter's scaffold, a length of angle iron will serve as an anvil for straightening nails, for shaping and bending metal shingles and flashing. Also, the sharp edge comes in handy for cutting wire mesh and metal lath. If an old bed rail is available, it is better than angle iron, as it is harder. It should be set flush with the surface of the plank to avoid any possibility of the worker tripping over it.



Angle iron on edge of scaffold plank is handy for straightening nails and metal and for cutting wire mesh and metal lath

"Ferris-Wheel" Display Is Turned by Clock



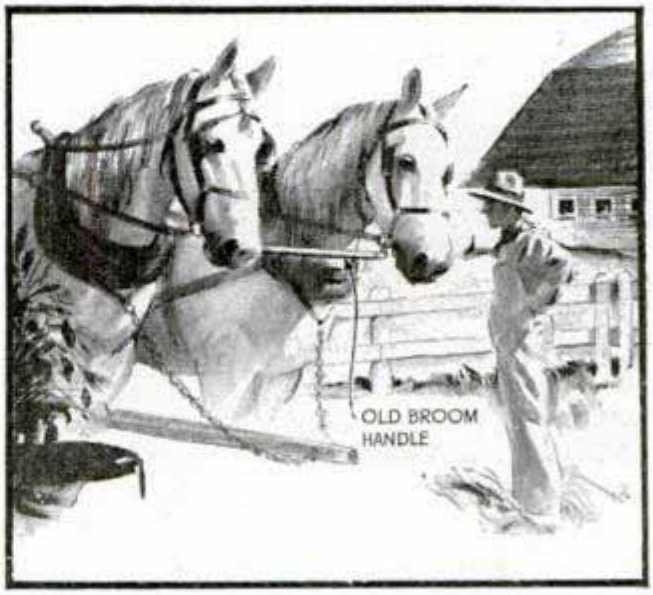


Making one revolution per minute, this rotating display is operated by an inexpensive electric-clock movement. A cardboard disk is fastened to the second hand by bending the ends of the latter through holes punched in the disk. The message cards are pinned to the disk, near its edge, so that they are free to turn. Size of the display depends on total weight of the disk that the clock can turn, and also on the strength of the second hand. Care should be taken to get the disk perfectly centered and the cards should also be attached so that the assembly will be well balanced.

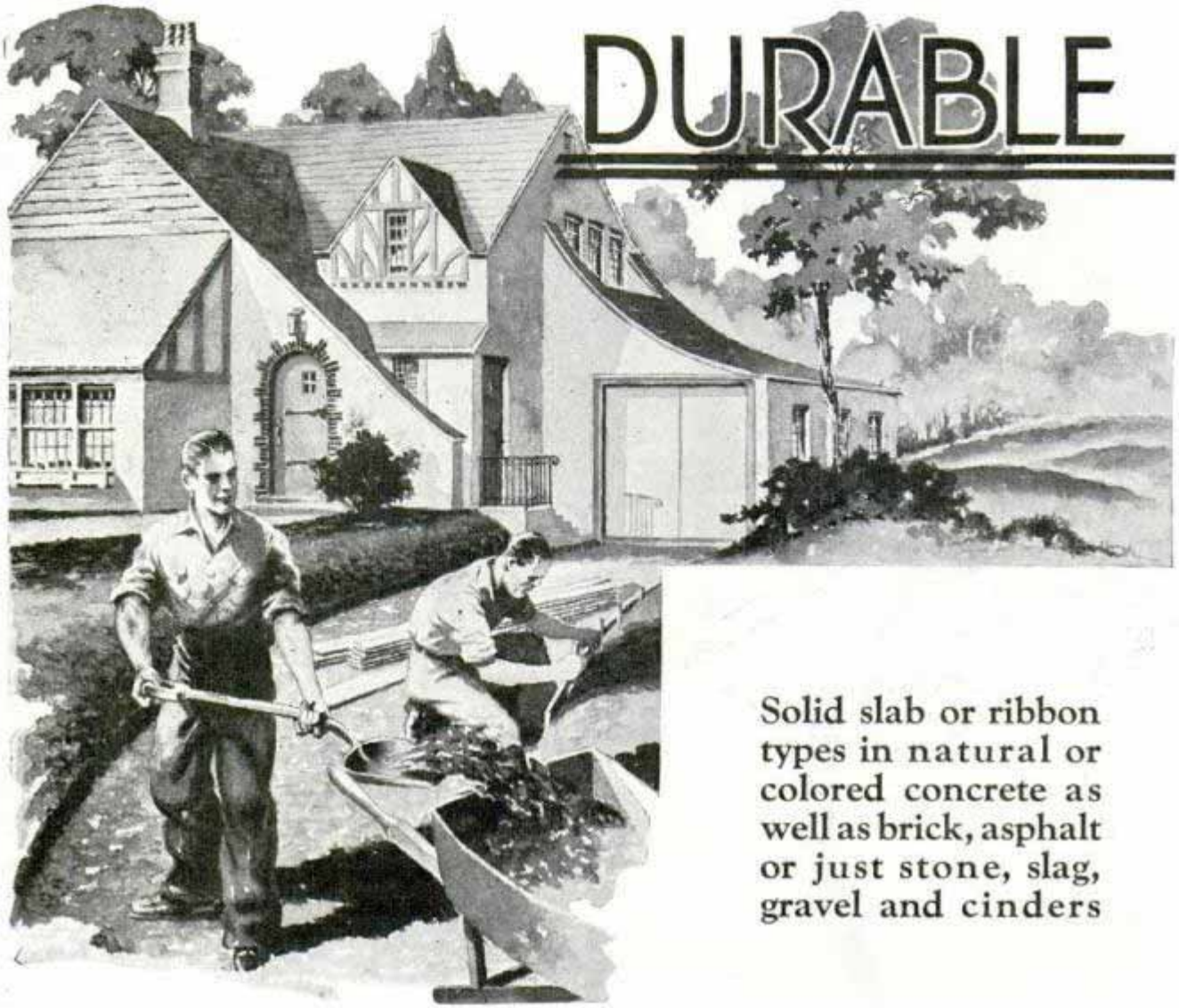
Jockey Stick Between Bridles Quiets Quarrelsome Team

Experiencing considerable trouble by having his team of horses fight and bite each other when hitched, a farmer eliminated the difficulty by keeping their heads spread apart with a length of broomstick. A harness snap is attached to each end of the stick by means of short straps, and the snaps are hooked on the inside ring of each horse's bridle bit.

¶In one shop where a bending machine was used to shape ¼-in. rods, the teeth of a dog-and-ratchet mechanism, which disengaged during each bending operation, were made to last longer than normal by applying a facing of wear-resistant, cobalt-base alloy; after 18 months' use, wear on the teeth was hardly noticeable.



This team is kept from quarreling by a length of broom handle snapped between their bridles



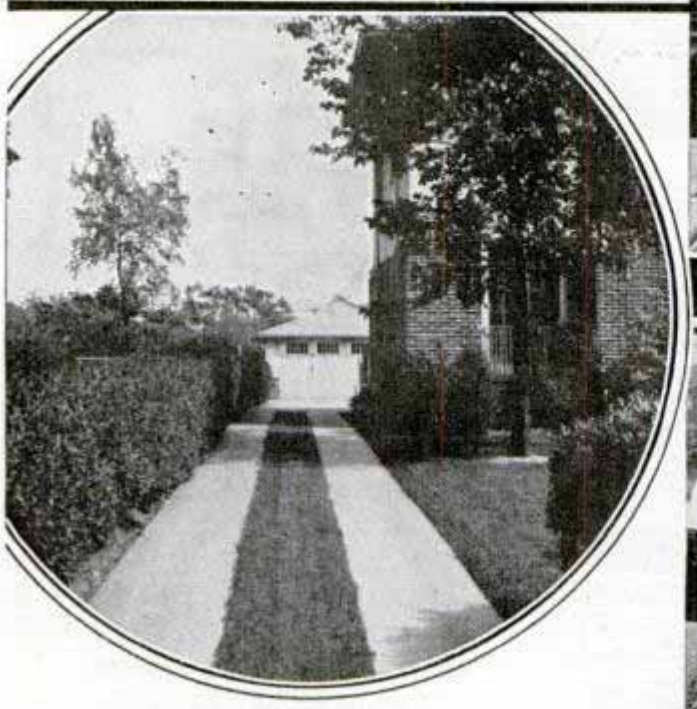
DURABLE

Solid slab or ribbon types in natural or colored concrete as well as brick, asphalt or just stone, slag, gravel and cinders

FEW improvements add more to the external appearance of your home than a well-built, durable and attractive driveway. Even if you do not wish to do the work yourself, it's a good idea to know how a good job is done so that you get exactly what you want. It can be made of brick or concrete, asphalt or even crushed stone, gravel or cinders. You can surface the entire drive or just two "ribbons" but the latter is recommended only for rather light traffic and where the drive is straight or only slightly curved. Total outside width of a drive should not be less than 7 ft. Ribbons should be 2 ft. wide each, if made of concrete or asphalt and 28 in. wide if made of gravel, stone or cinders. On curves having a radius of 25 to 50 ft., the over-all width of the driveway should be increased by 2 ft., and where the radius is more than 50 ft., the increase is about 1 ft. The matters of drainage, grade, prevention of surface erosion and the like are determined largely by the surroundings. Although it is not always possible to avoid steep grades, the space in front of the garage should be as level as practicable because a sloping drive on which a car must be left standing is a hazard. If necessary, 4-in. drainage tile can be installed 1 ft. below the drive surface, and covered with sand, gravel or other porous material that will let water trickle through as in Fig. 18.

Concrete Driveways: For a driveway that is permanent, reasonable in cost and which requires little maintenance, concrete is one of the best materials. The table in Fig. 12 will be helpful in determining the amount of concrete needed. The U. S. Bureau of Public Roads recommends that a continuous or "slab" type of concrete drive should be at least 5 in. thick if used for ordinary service, and 6 or 7 in. thick for heavy trucks. Perhaps the 6-in. thickness suggested by the Portland Cement Association is a good all-round

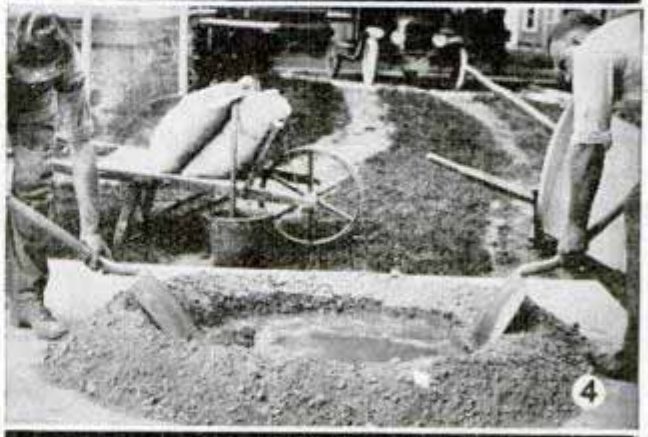
DRIVEWAYS



ADDING CEMENT TO THE SAND

MEASURING THE CRUSHED STONE

INGREDIENTS ARE MIXED DRY –



AND WATER IS ADDED ....

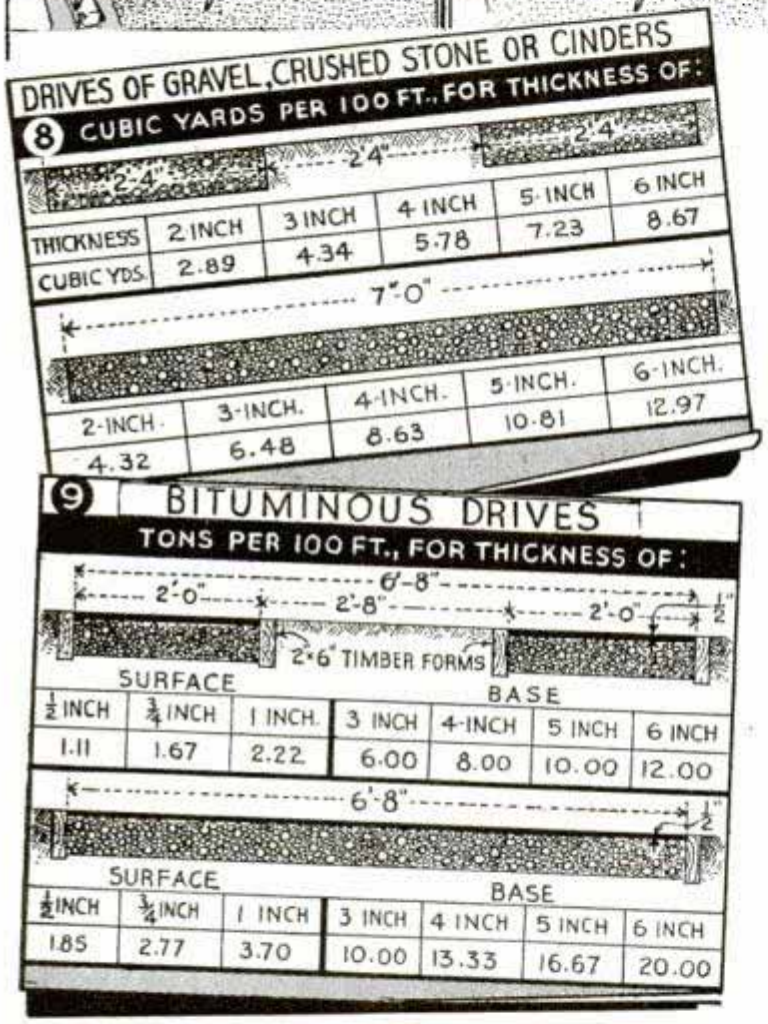
standard. Where water is to be drained away, the drive can be lower in the center or at the edges, to form a shallow ditch. Although it requires a little additional concrete, a curb 3 to 4 in. high along the edges is a distinct advantage. A curb can be used also on ribbon-type drives. Slab-type driveways can be built level, with a crown at the center or with the center lower than the edges. Crowned driveways usually are 1 to 2 in. higher at the center than edges. The center may be 1 or 2 in. lower than the edges, if the "sunken crown" type is used.

First step in actual construction is to excavate to the desired depth and width, allowing room for the forms, which are 2 by 6 or 2 by 8-in. boards placed on edge and held with stakes. If the ground is well drained, you can lay the concrete directly on it. If the drainage is not good, however, it's best to use a 6-in. subbase of clean cinders, slag, crushed rock or gravel, and install drain tiles emptying into storm sewers or side drains. If the porous material is not drained properly, water will collect in it, and freezing in winter will raise and break the concrete. Compact the subbase material by tamping, rolling, or even driving a car over it. Be sure

5 Spreading color mixture

6 Floating on the color

7 Laying out the pattern



DRIVES OF GRAVEL, CRUSHED STONE OR CINDERS

8 CUBIC YARDS PER 100 FT., FOR THICKNESS OF:

THICKNESS	2 INCH	3 INCH	4 INCH	5 INCH	6 INCH
CUBIC YDS.	2.89	4.34	5.78	7.23	8.67

2-INCH.	3-INCH.	4-INCH.	5-INCH.	6-INCH.
4.32	6.48	8.63	10.81	12.97

9 BITUMINOUS DRIVES

TONS PER 100 FT., FOR THICKNESS OF:

SURFACE			BASE			
½ INCH	¾ INCH	1 INCH.	3 INCH	4-INCH	5 INCH	6 INCH
1.11	1.67	2.22	6.00	8.00	10.00	12.00

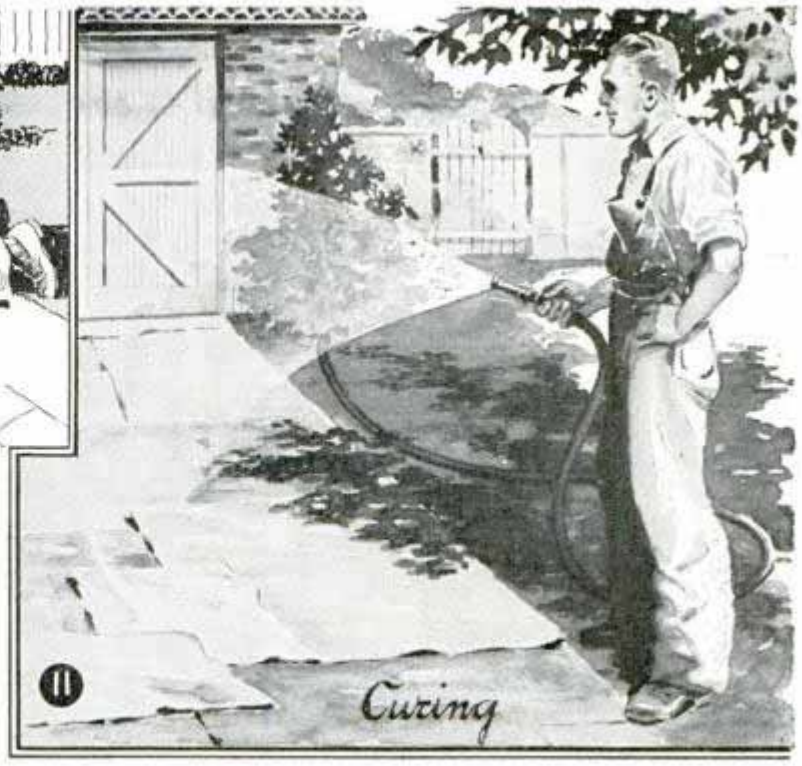
SURFACE			BASE			
½ INCH	¾ INCH	1 INCH	3 INCH	4 INCH	5 INCH	6 INCH
1.85	2.77	3.70	10.00	13.33	16.67	20.00

there are no loose rocks or boulders, or soft, yielding spots.

Now you come to the most important step, mixing the concrete. The ingredients of good concrete are portland cement, sand, gravel, and water. The sand or fine aggregate includes particles ranging in size from those just a little larger than dust particles to pieces that will pass through a ¼-in. mesh screen. Gravel or coarse aggregate includes broken stone and pebbles from ¼ to 2 in. Use only clean, well-graded sand, and pebbles that are washed free of organic matter and other dirt. The method of specifying concrete mix in terms of the proportions of cement, sand and gravel is no longer correct. Not long ago it was discovered that the quantity of water used is of utmost importance. Extensive studies of the relative proportions of water and cement have provided reliable information on this phase of concrete making. Quantities of water required for each single sack of cement, to which 2¼ parts of sand and 3 parts of gravel are added, are given in Fig. 16. Because the amount of water already contained in sand and gravel varies, it is advisable to make a test batch before mixing concrete in quantity. Start first with the 1, 2¼, 3 mix for which the quantities of water are specified. If the resulting mixture is too dry, add more cement and water, say in the proportion of ¼ sack of cement and 1 gal. of water. If the mixture is too wet, add more sand and pebbles, in small amounts, until the consistency is right. Then use the same proportions in mixing concrete to be used in forms. The quantities for one cubic yard are given in Fig. 14.

Figs. 1 to 4 inclusive, show how to mix the concrete on a smooth, level surface such as a wood platform, or in a mixing box. Measure the sand, and spread it out into a little mound. Spread evenly over it the cement, and with a shovel mix the two until the coloring is uniform, no streaks remaining. Then measure out the gravel and spread it over the sand-cement mound. Exercise the shovel again, until the pebbles are distributed uniformly.

10 Troweling smooth

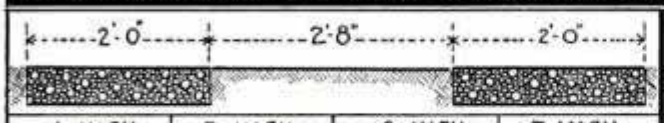


11 Curing

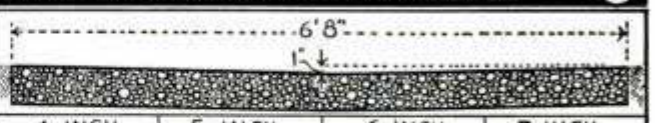
Make a hollow place in the middle of the pile, and add the exact amount of water, little at a time, while turning the mixture. Continue mixing until each particle of sand and each pebble has been coated with cement. Put concrete into the forms immediately after mixing. Tamp it down or work it with a shovel until it fills every part of the space. This "puddling" also works the coarse aggregate down into the mixture, and produces a smooth, uniform surface consisting mostly of concrete and sand. Failure to puddle properly results eventually in weak spots and shallow holes where large pebbles have chipped out as a result of wear or frost action.

For shaping a crowned driveway or a ribbon having a curb, use a wood template as in Figs. 13 and 15. This is a board with one edge cut to the contour of the finished drive. Draw it back and forth until the concrete is scraped to shape. Edges of the forms act as guides for the template. Allow the concrete to set until it becomes stiff but still can be worked. Then smooth the surface, Fig. 10. One way of doing this is to use a wood float. Wood produces a surface of about the correct roughness. Metal floats make the surface too smooth from a non-skid standpoint. Finally, after the concrete has set hard enough to prevent marring, cover it with earth, sand or straw, and keep the covering moistened

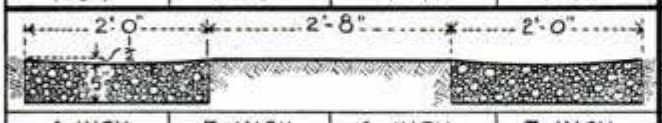
CUBIC YARDS CONCRETE PER 100 FT. OF LENGTH OF VARIOUS THICKNESSES 12



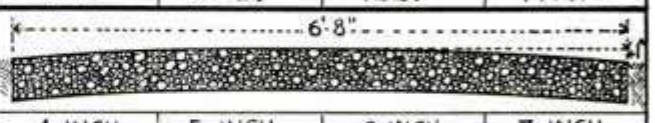
4 INCH	5 INCH	6 INCH	7 INCH
4.94	6.18	7.42	8.65



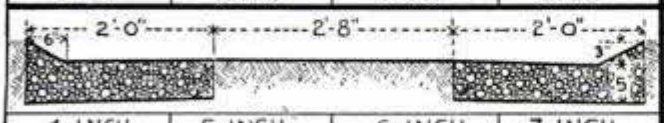
4 INCH	5 INCH	6 INCH	7 INCH
8.23	10.29	12.35	14.41



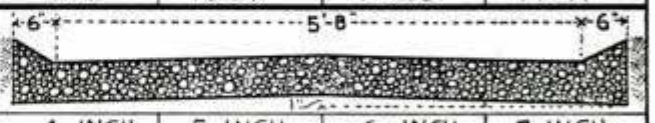
4 INCH	5 INCH	6 INCH	7 INCH
5.26	6.48	7.70	8.96



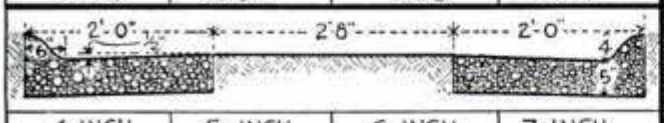
4 INCH	5 INCH	6 INCH	7 INCH
8.23	10.29	12.35	14.41



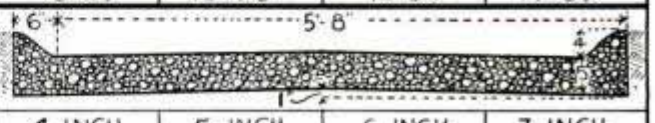
4 INCH	5 INCH	6 INCH	7 INCH
5.40	6.64	7.88	9.11



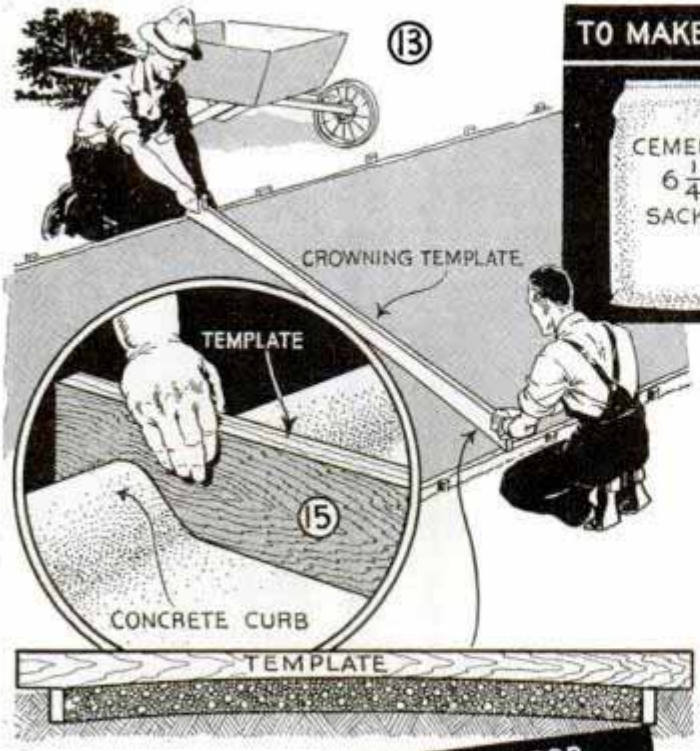
4 INCH	5 INCH	6 INCH	7 INCH
8.69	10.76	12.84	14.89

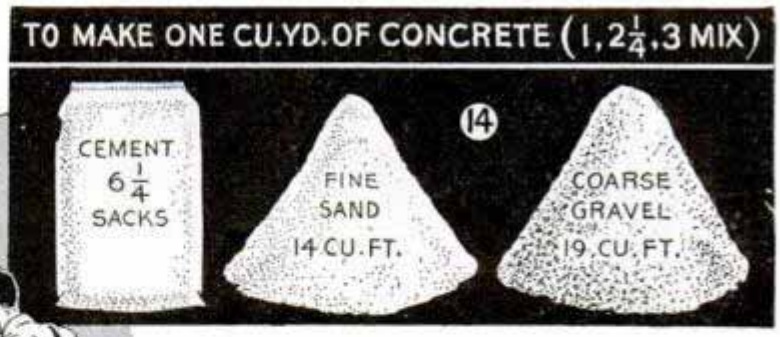


4 INCH	5 INCH	6 INCH	7 INCH
5.76	7.00	8.24	9.47



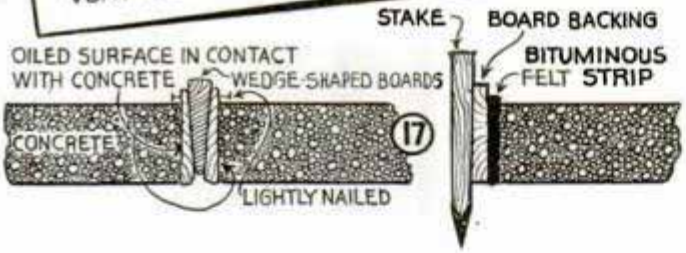
4 INCH	5 INCH	6 INCH	7 INCH
9.05	11.12	13.18	15.22





16 QUANTITIES OF WATER REQUIRED FOR SINGLE-SACK BATCHES OF CONCRETE:

DAMP SAND AND PEBBLES	5½ GAL.
WET SAND AND PEBBLES	5 GAL.
VERY WET SAND AND PEBBLES	4¼ GAL.



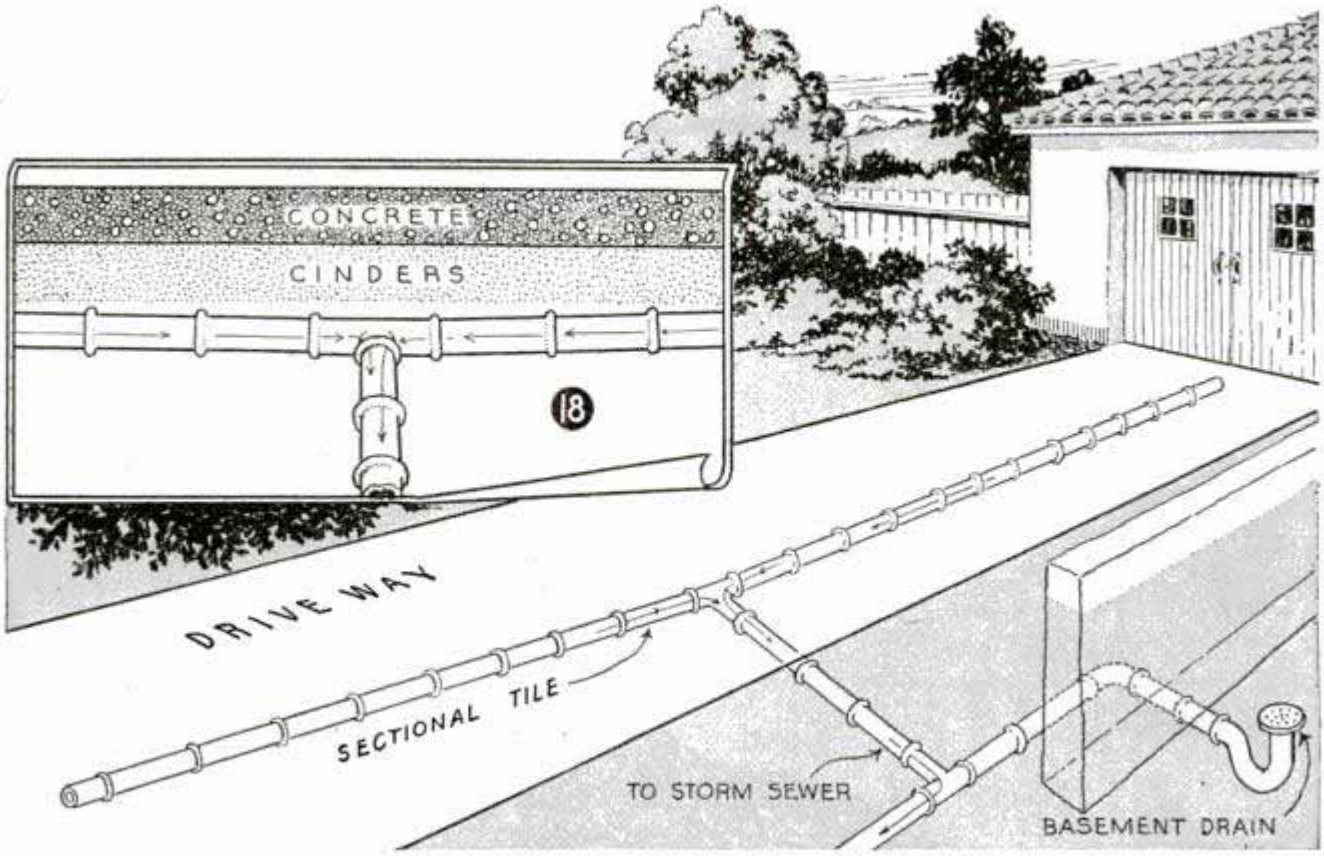
with water, Fig. 11. It is best to let the concrete cure in this way for at least 10 days before using the drive.

Expansion joints are necessary in concrete driveways more than 40 ft. long, to prevent cracking from temperature changes. There are several ways of making such joints, two of which are shown in Fig. 17. You can obtain tarred felt or other prepared joint material. Back the felt strip with a board, staked in position. Place the concrete up to the joint, and after it has hardened, remove the board before continuing the placing of concrete. When sections on each side of the joint are hard, trim off excess felt with the edge of a shovel. Sometimes only a wood strip is used to form a joint, the wood being left in place, thus serving instead of a bituminous felt strip. An expansion joint should be placed every 20 to 30 ft. of driveway length.

The use of colored concrete for driveways is becoming popular. Concrete can be colored by adding pigments. It usually is best to purchase cement already mixed with pigment. For economy, the color may be confined to a thin top layer. The dust-on method of applying color to a concrete slab is to mix portland cement, 1 part, with dry aggregate, 1 to 1½ parts, and the required amount of color. Materials are proportioned by weight, and are mixed dry until color is uniform. The dust-on mixture is applied at the rate of at least 125 lbs. per 100 sq. ft. of area, and is floated or worked into the concrete, as in Figs. 5, 6 and 7. Usually two applications of color are required. The surface is finished by troweling or otherwise treating the slab to get the desired texture. Possible color schemes are endless.

Brick and Cut-Stone Driveways: Brick and cut-stone driveways are more expensive than concrete because they have to be laid over a concrete base. About the only advantage is an attractive texture. Paving brick, not building brick, should be used. The concrete base should be crowned slightly. When the concrete is dry, a 1-in. layer of sand is smoothed over the surface and then the bricks are laid. Spaces between them are filled with melted tar or a creamy mixture of cement and sand, brushed into the cracks with a broom. Expansion joints are placed every 20 ft. when the cement binder is used.

Bituminous Driveways: Because bituminous materials require special equipment, it is best to hire a contractor to lay a driveway of this type. Bituminous-mix and asphaltic concrete drives consist of a 5-in. bed of well-graded gravel or crushed stone covered with a ½-in. layer of surfacing material. Forms similar to those



for concrete are used. A crown of ½ to 1 in. for drainage is suggested. The forms are 2 by 4 or 2 by 6-in. stock placed on edge, to shape the edges of the base. The finished bituminous surface generally is made about ½ in. higher than the edges of the forms. The gravel base is compacted, preferably by rolling, before the surface coat is applied. Most asphaltic concretes consist of heated aggregates mixed with bituminous materials, and spread and rolled while hot. There are bituminous mixes that can be laid at normal temperatures. The amateur builder can handle these with fair success. Lacking a power roller, he can compact the material with a 25-lb. tamper whose surface in contact with the ground is not over 48 sq. in. Fig. 9 gives the quantity of material needed.

Another way of constructing a bituminous drive is to put the aggregates (gravel, etc.) in place, and roll them until compacted; and then spray over the surface a hot or cold bituminous liquid which trickles down among the aggregate particles and binds them together. Then coarse sand is spread thinly over the surface.

Gravel-Type Driveways: Lowest in cost and easiest to build are driveways of gravel, cinders, crushed stone or similar materials. Fig. 8 shows the amount of material needed. Thickness of surfacing on new gravel-type drives should be 6 in. and the width from 7 to 9 ft. Sometimes the job of improving a driveway that already has some surfacing will consist merely of spreading 2 in. of gravel or similar material on top of the existing surface. In selecting gravel, care should be taken to obtain material of proper grading. The Bureau of Public Roads recommends that no particle larger than ¾ in. in diameter be used, to avoid roughness. There should be present a sufficient amount of fine material to produce good compacting. The larger pieces resist wear, while the smaller particles act as binders.

Gravel type drives require some maintenance to keep them in good condition. During the compacting period of several days after construction, frequent rakings may be necessary. Muddy driveways can be remedied by addition of cinders or sand, when the surface is damp. Dusty drives can be treated with oil (old crankcase oil will do) or calcium chloride. Calcium chloride, when mixed with refuse lime or some other gravel-like materials, assists in compacting because it keeps the mass slightly moist.

¶An easy way to clean carved furniture is to dip an old toothbrush in furniture polish and rub over it.

Job of Using Pneumatic Drill Eased by Inner Tube

These workmen don't have to push down on their pneumatic drill—an old inner tube does the job

To ease the job of handling a pneumatic drill, two workmen use an old inner tube to help force the drill into the work. The tube is cut in two, after which it is passed over the top of the drill and the ends are fastened to a 2-in. block. This has a hole in its center to take the bit. The workmen hold the block with their feet and balance the drill with their hands.

Pistol-Grip Soldering Iron Handy for Electricians

Electricians, especially those engaged in wiring fixtures, will find that a light soldering iron, the shank of which is bent to provide a pistol grip, may be used to great advantage. The reduced distance between the hand and the work allows the point to be directed more easily and positively; and there is much less tiresome strain on the arm and wrist muscles. The iron is just as easily heated with a blowtorch and, the shaft length being the same, the heat is dissipated as readily before it reaches the handle.

—G. E. Hendrickson, Argyle, Wis.

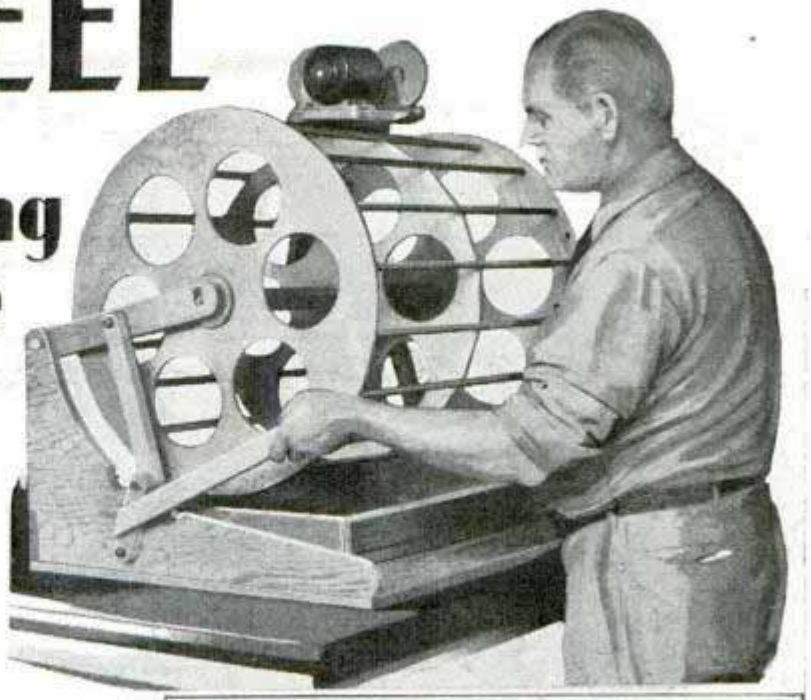
Tacking of Sale Bills Simplified by "Palm Hammer"

Bill posters, who are often inconvenienced in using a common hammer for tacking bills and signs, will find that this palm-hammer is always convenient and leaves both hands free for spreading the card or paper upon the board. The hammer is made from a length of pipe, with caps screwed onto the ends and a leather strap riveted onto the side. The strap provides a loop by means of which the hammer is attached to the hand. If the hammer is not heavy enough for some purposes, it may be filled with shot or sand.

Seeds Germinated and Tested in a Magazine

To germinate and test a number of small seeds, one may use a discarded magazine that is printed on coarse news-stock or pulp paper. The magazine is soaked in lukewarm water and then opened for the placement of the seeds with suitable spacing between. Several pages of the magazine should separate the different layers of seeds. The magazine should be placed flat within a shallow pan and water applied from time to time to keep the pulp moist.

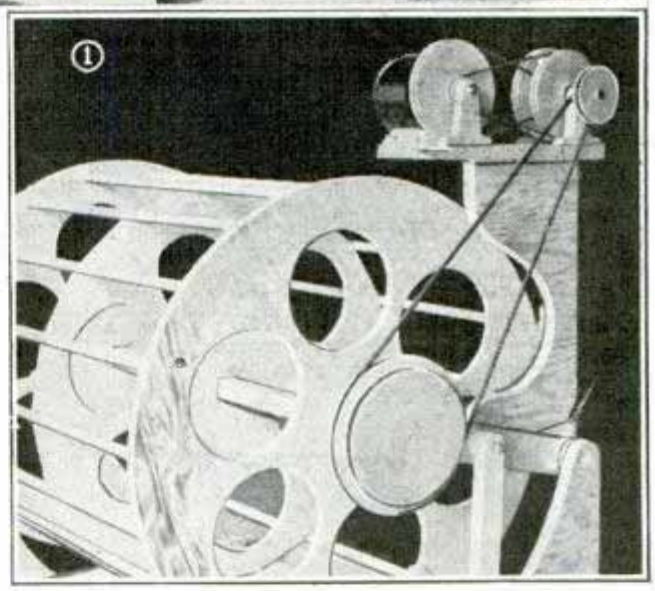
Power-Driven REEL for developing home movie film

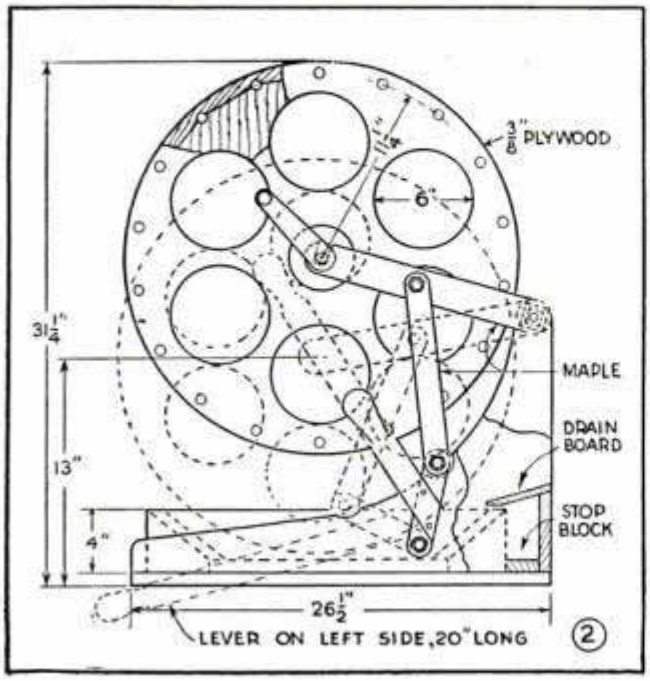


Any home movie fan can do his own developing with this reel which holds a hundred feet of film

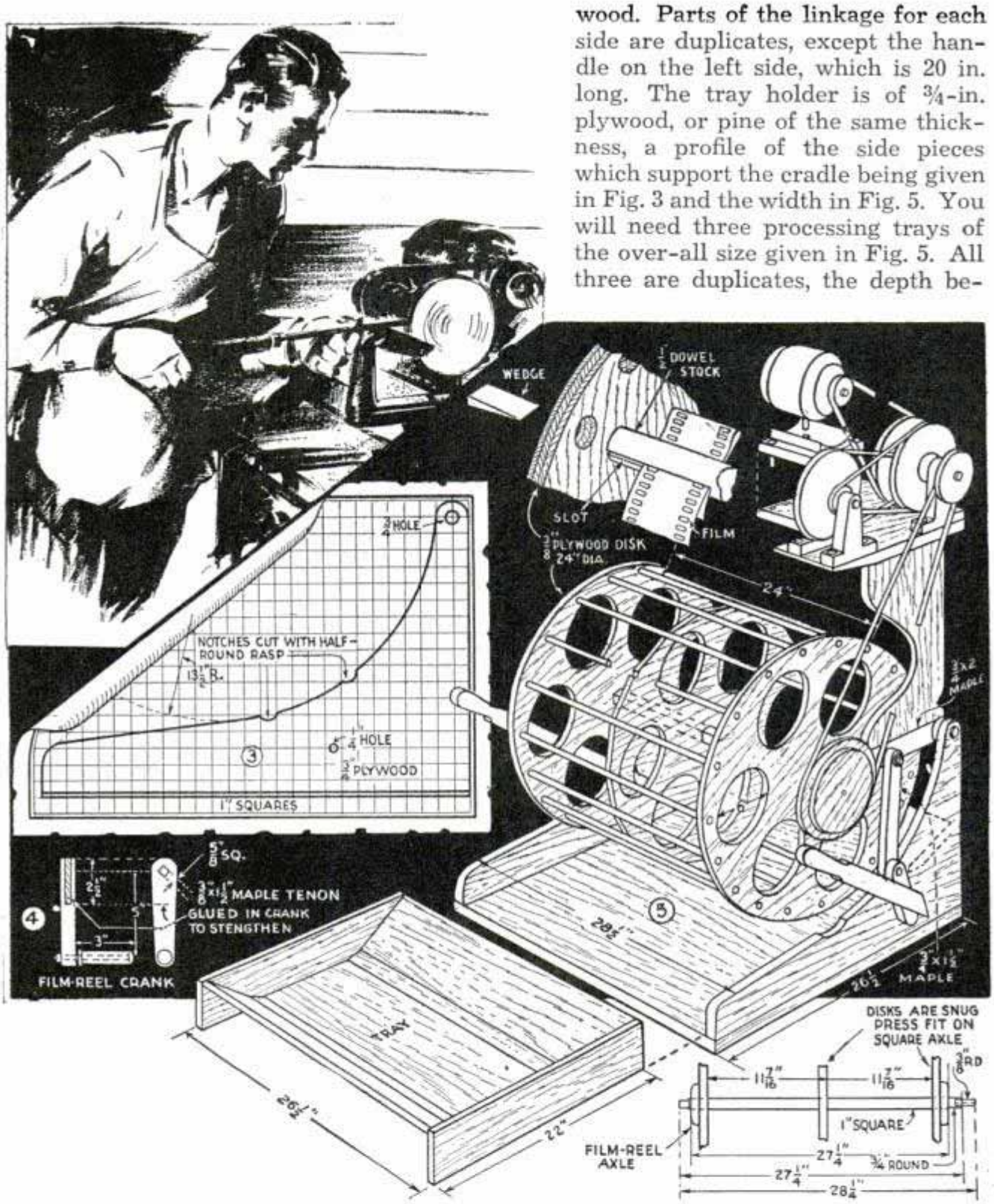
THIS outfit, built of materials you can get anywhere, handles either 8-mm. or 16-mm. film without the slightest danger of damage. Since many of the operations must be done in the dark, the reel is so mounted that it can be lowered easily and revolved in the chemical and washing baths. It can be turned with a power drive or by hand with a crank. Trays are designed to contain the right amount of developer to wholly submerge the film when the reel is lowered. All parts are finished with a special acidproof paint.

Fig. 1 shows how the reel can be driven with a small motor belted through reduction pulleys to the main shaft. Details in Fig. 6 give sizes of pulleys to be used with a motor running 1,750 r.p.m. Two-step drive pulleys are used from the countershaft to the reel, the outer pulleys being used only when winding the film. Developing speed is obtained with the belt running from the small pulley on the countershaft to the larger step pulley on the reel shaft which turns at about 8 r.p.m. Fig. 2 gives general details of the over-all size and Figs. 3, 4 and 5 show the assembly. The outer disks of the reel are 24 in. in diameter. On a radial line 11¼ in. from the center of each disk and equally spaced, eighteen holes are bored for ½-in. dowels. The center disk is only 22½ in. in diam-





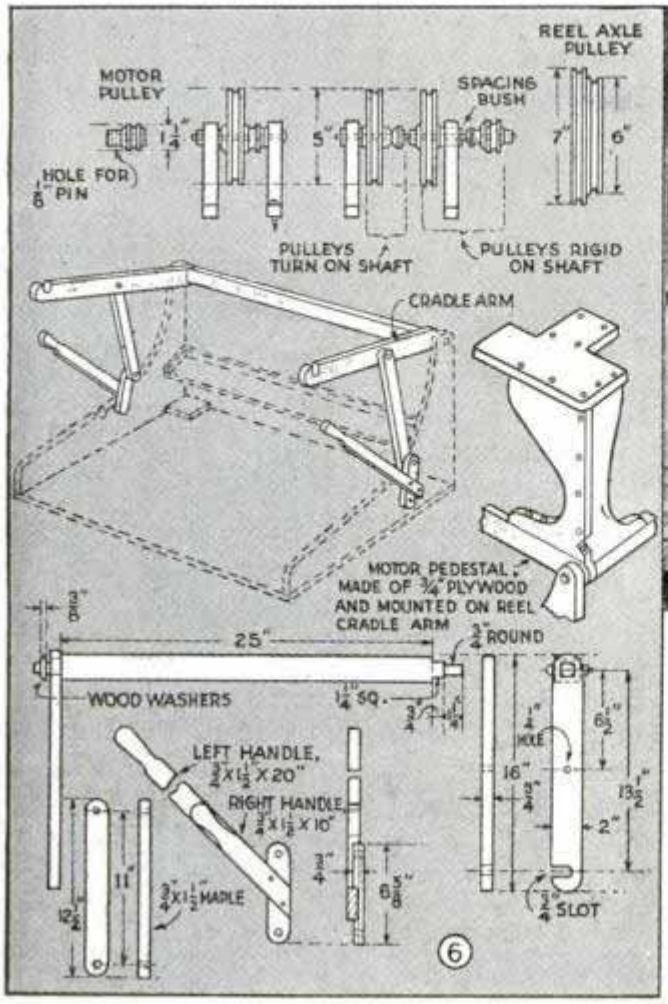
wood. Parts of the linkage for each side are duplicates, except the handle on the left side, which is 20 in. long. The tray holder is of ¾-in. plywood, or pine of the same thickness, a profile of the side pieces which support the cradle being given in Fig. 3 and the width in Fig. 5. You will need three processing trays of the over-all size given in Fig. 5. All three are duplicates, the depth be-

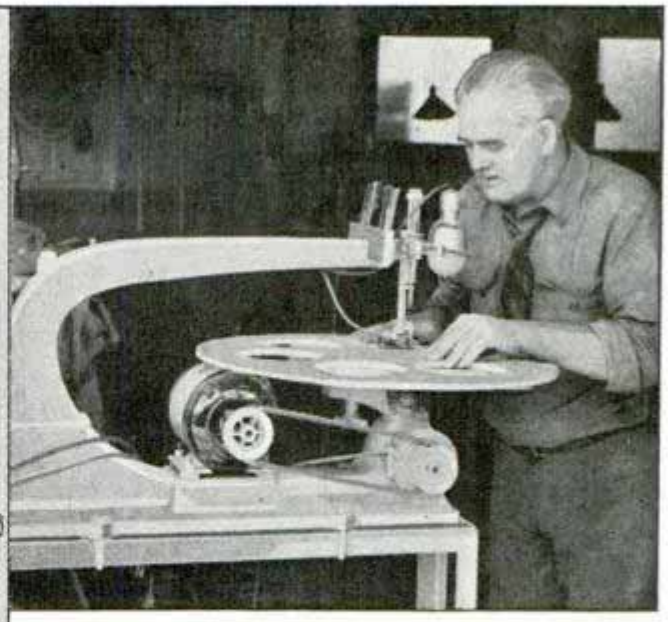


eter when finished but is first cut slightly larger so that eighteen ½-in. holes can be equally spaced on a radial line 11¼ in. from the center. Then the rim is sawed away to the finished diameter, the saw cut running through each of the holes. The center disk acts merely as a support for the dowels on which the film is wound.

You'll find details of the reel cradle in Fig. 6. The arms, handles, and parts of the lifting linkage are made of ¾-in. hardwood. Parts of the linkage for each side are duplicates, except the handle on the left side, which is 20 in. long. The tray holder is of ¾-in. plywood, or pine of the same thickness, a profile of the side pieces which support the cradle being given in Fig. 3 and the width in Fig. 5. You will need three processing trays of the over-all size given in Fig. 5. All three are duplicates, the depth being 3¼ in. inside. For washing, you can provide a fourth tray of the same construction, only 1 in. deeper and fit it with a drain and rubber-hose connection from the water tap. Trays are notched individually so that you can identify them in the darkroom.

Now there are several important details in connection with assembly of the reel. To begin with, both ends of each of the eighteen dowels are slotted the width of a





single saw cut and to a depth of about 3 in. When the disks are assembled on the axle, the ends of the dowels are forced into the holes and held with thin tapered wedges driven into the outer ends as in the upper detail, Fig. 5. Also the slots provide a convenient means of attaching the film to the reel. The axle carrying the reel is square, only the ends being turned round to fit the slots in the cradle arms. The raising and lowering linkage is joined to the arms with either copper rivets or small bolts. Cradle arms are pivoted on a crosspiece which is essentially a duplicate of the axle except that the rounded sections at the ends are a trifle longer.

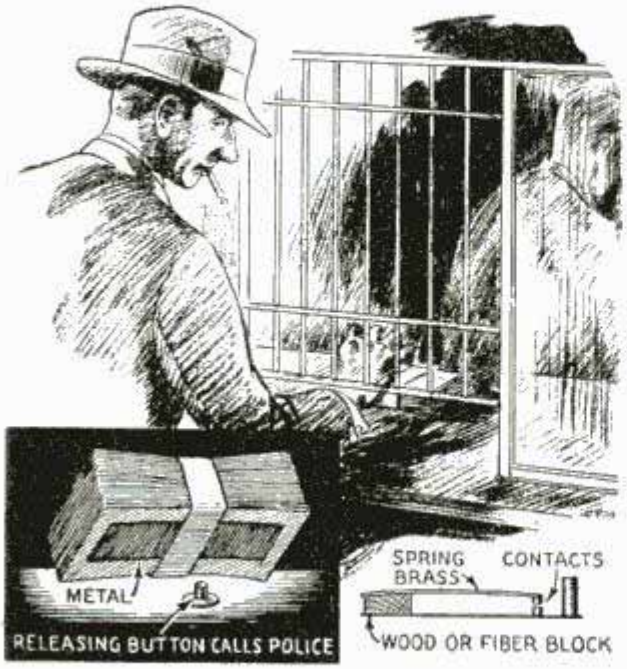
The essential thing in assembling the cradle and reel is close, accurate fitting so that the assembly operates freely yet is not loose and wobbly. Figs 5 and 6 also show the construction and position of the motor bracket, or pedestal, which is made of ¾-in. plywood and joined with screws.

Steam 'Boiler' to Shrink Paper Covering on Model Airplane

Here's a timesaving method of steaming paper covering on a model airplane to shrink it so that it will be taut. A short nipple is soldered to the top of a closed can to take a 4 or 5-ft. length of small rubber tubing. The can, partly filled with water, is set over a low flame on a stove to supply steam from the open end of the hose. The steam, played over the paper, produces uniform shrinkage without soiling it. The entire surface of an average size model can be shrunk in a few minutes.

¶When cutworms begin taking toll of corn, tomatoes and other vegetables, mix a quart of wheat bran with a teaspoonful of paris green and sprinkle around the plants; the pests will be eradicated quickly.

Decoy Stack of Money in Bank Sounds Police Alarm

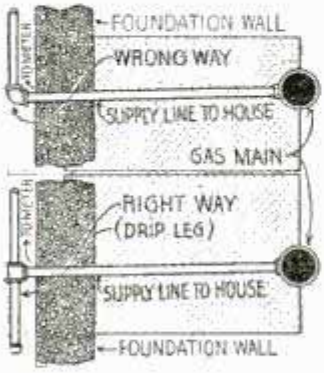


Bank bandit picking up decoy stack of money near cashier's window sets off alarm

Picking up an authentic appearing stack of money near the cashier's window in one bank causes a burglar alarm to sound in the police station. The stack, which is made up of paper cut to size, has an authentic bill on top and a metal plate on the bottom to give weight, and it rests on an electrical switch projecting through the top of the counter. When the stack is lifted, the switch contacts come together.

Moisture in Gas Line Collected in "Drip Leg"

When rock or other formations make it necessary to lay a gas line near the ground surface, and branch lines to homes must slant downward to the foundations, the problem of moisture accumulating at the lowest point can be taken care of by a "drip leg" as shown in the lower detail. Instead of installing an elbow after the line passes through the foundation wall, as indicated in the upper detail, a tee is installed and a nipple is screwed into the lower opening. The nipple is capped at the lower end and provides a small reservoir for the moisture.

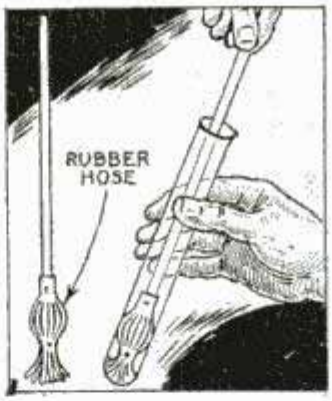


—L. H. Georger, Buffalo, N. Y.

Shoes Displayed on Coat Hanger

Lacking sufficient racks to display a large assortment of shoes in the show window, a store clerk used wire garment hangers. The hook of each hanger was bent at right angles to provide a support for the sole and a projection to engage the heel. The rest of the hanger was then doubled back to provide a base.

Test Tubes Cleaned Easily with Rubber Swab



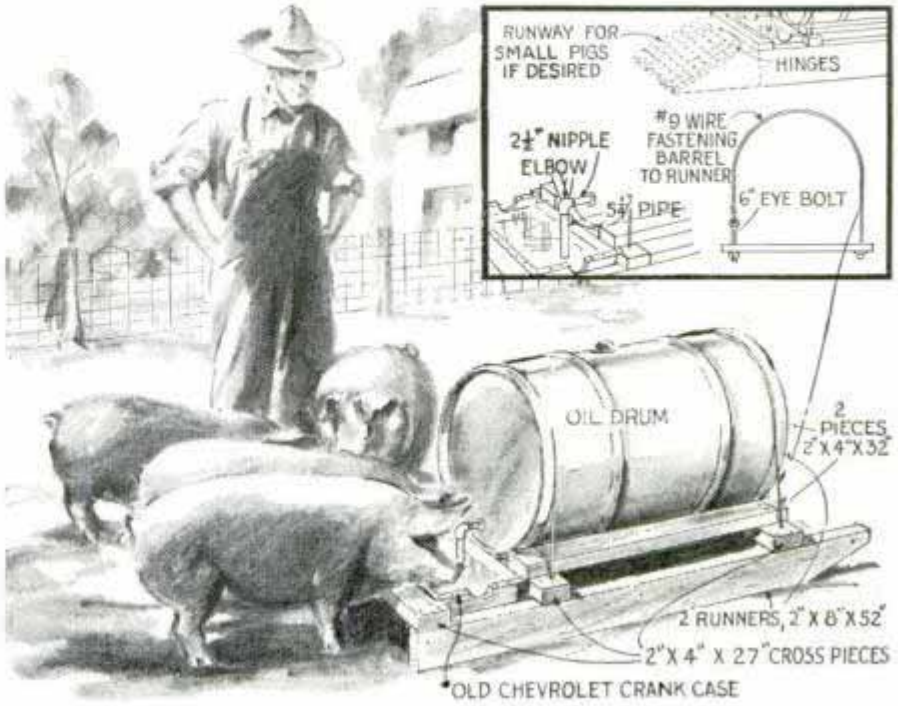
Test tubes, which are difficult to clean when used in certain laboratory work, can be washed easily with this rubber swab. It is nothing more than a short piece of small rubber tubing slit as shown and tacked to the end of a dowel, which serves as a handle. When attaching the rubber to the handle, push the ends together slightly so that the slit portion in the center will bulge outward.

Cypress Shavings Make Fine Polish

Although the shavings of almost any wood will serve as a polishing aid on turned work, where oil or wax is first applied, the use of the latter gives darker tone to maple, holly, ash and the lighter woods. It is claimed, however, that the natural oils and wax contained in unkilned cypress provide an excellent polish, which does not shade down the colors of

white and light-tone hardwoods. A piece of resinous grain cypress 2 by 2 by 24 in., as green as possible, turned down with fine cuts will yield a generous supply of material moist with the oils of the tree. To prevent drying out, this should be caught on a newspaper spread under the turning and immediately put away in an airtight can with a ball of rags or cotton, saturated with turpentine to preserve the oil moisture. In use, simply hold a handful of the shavings against a turning or, for flat work, apply with a canvas pad or mitten, using no oils or wax other than that in the shavings. Friction heat does the rest.

Portable Watering Fountain on Runners Is Pulled by Team

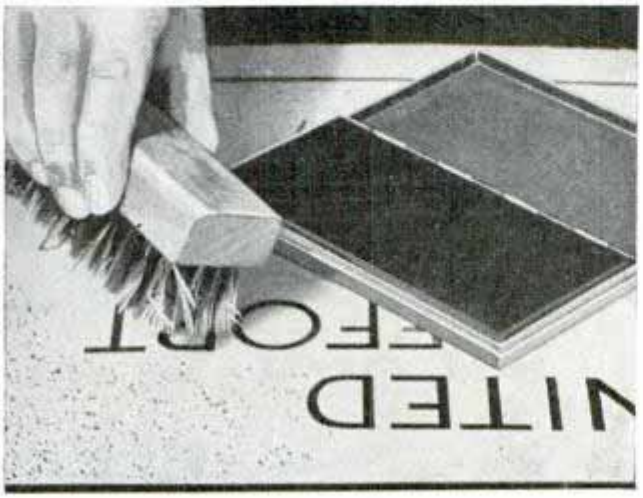


The chore of watering hogs pastured in fields away from a well is made easy with this portable fountain

If you pasture your hogs in fields not handy to a well, here is a portable watering fountain that will save time and work. Mounted on a pair of runners, the fountain can be pulled to the well, filled and then returned to the field with a team, truck or tractor. The fountain consists of a large oil drum for a reservoir, and an old car crankcase for a fount in which a certain water level is maintained by the vacuum principle. Water runs from the drum to the pan through an assembly of a pipe elbow and two nipples screwed into the end bung. When the water level in the pan reaches the end of the nipple the flow stops. The drum must be airtight of course, a gasket being used at the filler hole, which is the bung on the side of the drum.—V. M. Stump, Anderson, Ind.

Stiff Brush and Stamp Pad to Stipple Show Cards

For stippling the background of show cards, a Wisconsin sign artist claims that the easiest and most controllable results are possible with a stiff-bristle brush and a rubber-stamp ink pad. The bristles are cut to about one half of their original length and the brush is used as a stamp. The background may be stippled freehand or with the aid of stencils.

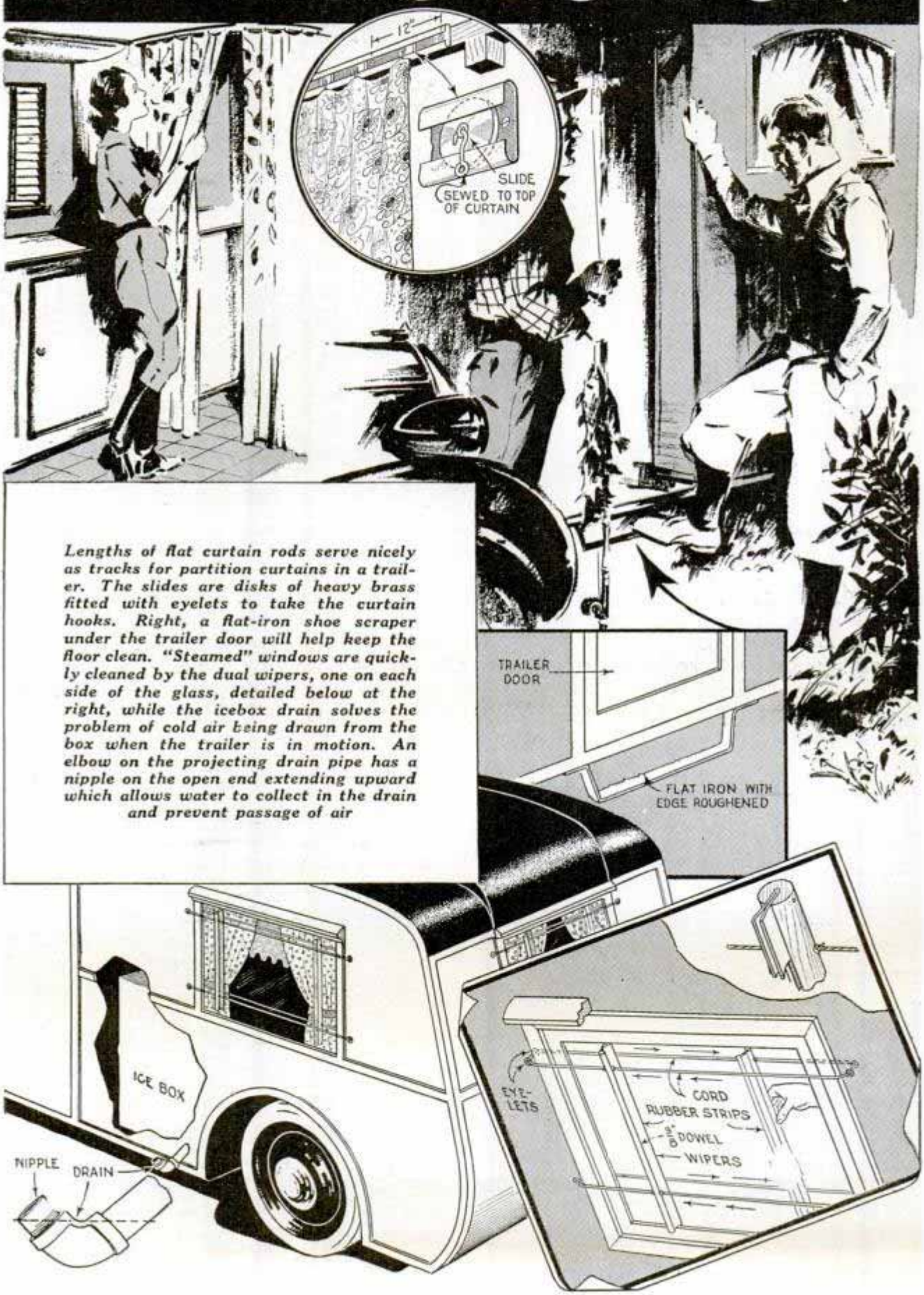


Backgrounds of show cards neatly stippled with a stiff-bristle brush and rubber-stamp ink pad

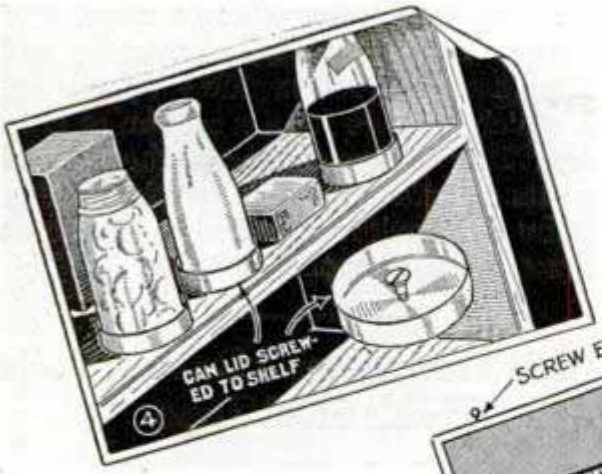
Non-Corrosive Soldering Flux

A non-corrosive soldering flux that is superior to plain rosin may be made by melting together equal parts of stearic acid and rosin. This flux is very useful for electrical work although it may be used on practically any metal provided the surfaces are cleaned carefully.

INSTALLING COMFORT

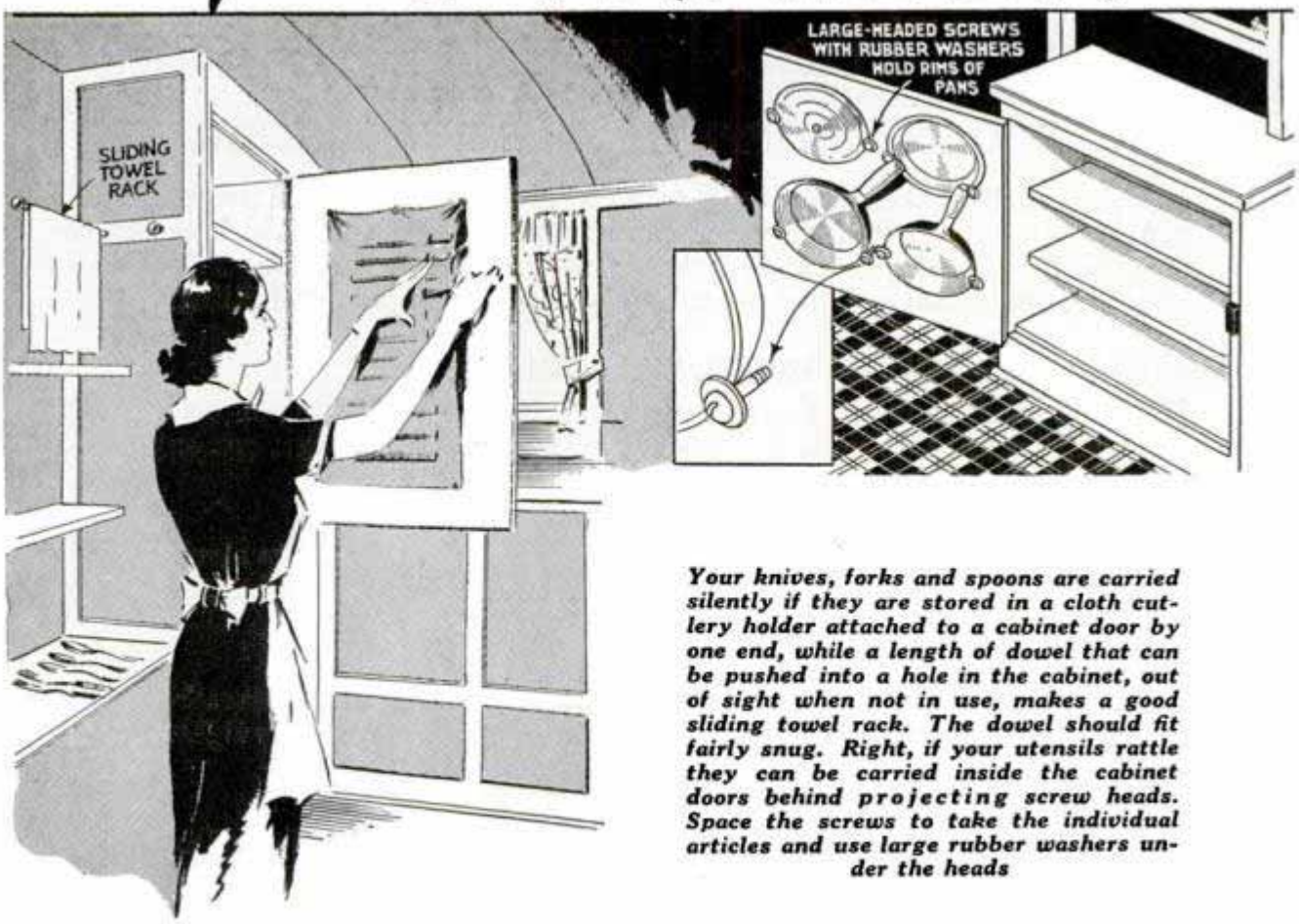


Lengths of flat curtain rods serve nicely as tracks for partition curtains in a trailer. The slides are disks of heavy brass fitted with eyelets to take the curtain hooks. Right, a flat-iron shoe scraper under the trailer door will help keep the floor clean. "Steamed" windows are quickly cleaned by the dual wipers, one on each side of the glass, detailed below at the right, while the icebox drain solves the problem of cold air being drawn from the box when the trailer is in motion. An elbow on the projecting drain pipe has a nipple on the open end extending upward which allows water to collect in the drain and prevent passage of air



A frame in which a mirror and picture are mounted back to back, is either a dressing-room or living-room fixture when the same compartment of a trailer must be used for both purposes. Above, shallow tin-can lids screwed to the kitchenette shelves keep small jars and cans from skidding around when the trailer is on the road

in your TRAILER · ·



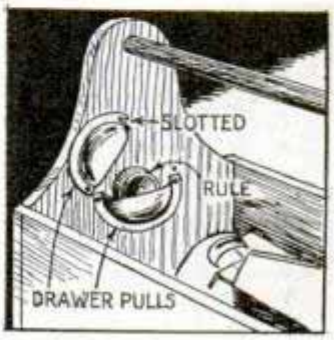
Your knives, forks and spoons are carried silently if they are stored in a cloth cutlery holder attached to a cabinet door by one end, while a length of dowel that can be pushed into a hole in the cabinet, out of sight when not in use, makes a good sliding towel rack. The dowel should fit fairly snug. Right, if your utensils rattle they can be carried inside the cabinet doors behind projecting screw heads. Space the screws to take the individual articles and use large rubber washers under the heads

Belts Trimmed and Spliced on Leg Pad

Section of auto casing to fit on leg to splice belts saves walking to workbench

In shops or factories where a number of belts must be kept fitted, the trimming and splicing may be done in safety upon a leg pad, which is made from a section of auto casing. This clamps snugly on the leg and presents a surface upon which the cutting may be done without carrying the work to some suitable bench or table.

Pocket Formed with Drawer Pulls Holds Steel Tape



To have his steel tape at hand in an open toolbox, one carpenter formed a neat pocket from two drawer pulls. These were screwed to the box with their open sides facing, one of the screw holes of the upper drawer pull being slotted to slip over a screw head so that it could be swung upward to remove the tape.

The Next Issue

HYDRAULIC RAM SUPPLIES FREE RUNNING WATER

For the practical man who wants to build his own. Simplified design data so anyone can figure how high water can be pumped by a ram, which works automatically when furnished with water from a spring or stream. Tells how to plan an installation and how parts can be made from pipe and fittings.

"SEA-BEE," GAS-DRIVEN MODEL SPEEDBOAT

It's great sport to watch this racer speed past at about 30 m.p.h. on a 300-ft. circular course. You build the 32-in. hull and install a midget gas engine.

ARE YOU PROVIDING FOOD FOR MOTHS?

No need of having clothing and furniture ruined when there are simple, effective methods of ridding your home of moths and preventing further infestation.

KITCHEN PANS TO PHOTO LAMPS

Aluminum pans and music stands provide the material for assembling two photoflood lamps, which have unusual features for diffusing the light.

NEW-STYLE FLOWER STANDS

Three original designs that combine gleaming metal with polished wood and brilliant plastics to make distinctive, modern stands that are easy to build.

See the Other End of the Highway
from the saddle of a HARLEY-DAVIDSON
You don't have to WISH you could see the glorious sights at the other end of the road — and along the way — when you own a Harley-Davidson. Just hop into the saddle and SEE them! No set schedules to follow — go when and where you please — even ride the trails to out-of-the-way places where trains and autos can't go. Boy, that's the life! Go places and see things — on a new 1937 model that's got everything you could ever wish for in style, power, speed, and riding ease—plus amazingly low-cost mileage. Many remarkable motor improvements and streamlined design!
See your Harley-Davidson dealer RIGHT AWAY—for a FREE RIDE — and details of his Easy Pay Plans. And send in the coupon — NOW!
HARLEY-DAVIDSON MOTOR CO.
Milwaukee, Wis.
Department P
MAIL THIS COUPON
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

Shooting Modern History

(Continued from page 45)

Capable cameramen, not the daredevils of a few years ago, are chosen to shoot modern history. There is too much at stake, especially when the work is being done in a foreign land. Newsreel companies try to protect their cameramen and

Germany's Bismarck in one of earliest historical newsreels, made between 1896 and 1898

their expensive equipment and to avoid international complications which might involve the United States government.

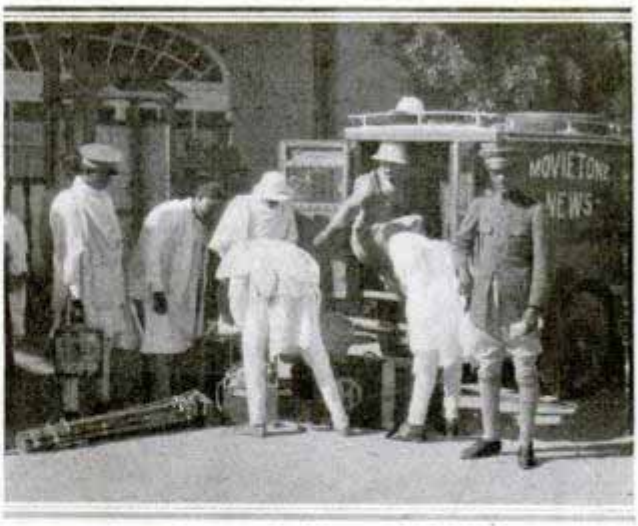
Foreign nations, realizing the value of the newsreel man, have taken steps to protect him as he goes about his work.

"Behind each foot of modern history which is shot is the most detailed preparation which science makes possible," states Dan Doherty, executive of one newsreel company. "And this is true whether the event is filmed in civilized America or in one of the uncivilized corners of the globe such as the Bonney Powell expedition into the Gobi or the Ethiopian expedition.

"Of course, lucky breaks may occur, such as when Mejat caught the assassin in action, but without thorough scientific preparation beforehand the breaks, if and when they do occur, may not be so lucky. Take the Ethiopian expedition for example. There was a case in which more than a news story was to be shot. Modern history was in the making—waiting to be shot. Shooting pictures in the hottest, dampest, most pestilential zone on the map called for something more than an ordinary camera set-up. Special equipment had to be bought, built or contrived to cheat the jungle's torrential rains, damp rot and destructive heat. Specially built motor trucks with all sorts of protective compartments were ordered. A fleet of side-car equipped motorcycles was bought. Raw stock, specially treated, and safes to preserve it after exposure had to be secured. Miniature laboratories for making tests on the ground were designed and built. Just a lot of detail but every single bit of it requiring understanding of equatorial conditions and the ingenuity to combat them. Men adventuring into a primitive country, torn by war, must be prepared and ready for every emergency. A single screw missing could upset the whole applecart."

What happens to the newsreel shot after it has been made and at what stage of the game does it cease to become part of a newsreel, becoming instead a page of modern history?

From the very second that the negative leaves the camera great care is taken to preserve it for future generations, Mr. Doherty explains. The procedure is the same with all newsreel companies. After the negative is developed, it is screened but once. A "lavender" print is then made which is printed on particularly sensitive film stock. Then from the lavender print,



Newsreel crew arriving at Addis Ababa, capital city of Ethiopia, to film war scenes

duplicate negatives are made which are as good as the original negative. It is from these duplicate negatives that prints are made and rushed to the motion-picture theaters in the form of newsreels.

(Continued to page 116A)

Inexpensive, Simple to use—*and how they step up your Picture-Taking Skill*

KODAK PORTRAIT ATTACHMENT

The ordinary hand camera is not designed to take pictures at extremely short distances. But a Kodak Portrait Attachment slipped over the lens of your Kodak or Brownie keeps the image sharp.

You can make "close-ups" of your family and friends, as well as clear-cut, close-range pictures of flowers, art objects, and still-life subjects in general.

The attachment slips quickly over the regular lens. And the camera is operated as usual, without any change in timing or lens opening. Price, 75¢.

KODAK SKY FILTER

Slipped over your regular lens, it holds back the light from the blue sky, and gives you beautiful cloud effects. The darker portion of your picture, the landscape, gets full exposure. Price, depending on camera, $1, $1.50, $3.30.

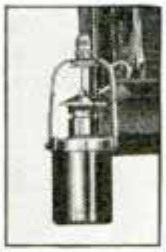
KODAK COLOR FILTER

Holds back blue and violet rays reflected from highly colored landscapes, gives weaker shades time to register. With it black-and-white pictures render all colors more nearly as the eye sees them; they're more natural. Price, depending on camera, $1, $1.50, $3.30.

KODAK ADJUSTABLE LENS HOOD Prevents "lens flare" in bright light, in making artistic back-lighted shots. Two sizes, 85¢ and $1, depending on diameter of lens or lens attachment over which hood is to be used.

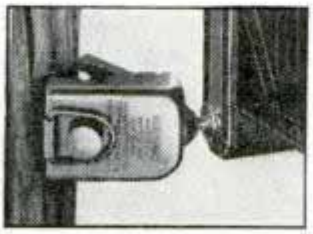
KODAK METAL TRIPODS

Light, compact, rigid; fit any standard tripod socket. Sections telescope neatly to give small collapsed size without sacrifice of strength. Three models, ranging from 13½ to 15½ inches long, closed. Nos. 1 and 2 have revolving heads; camera may be swung in any direction. Prices, No. 0, $2.75; No. 1, $4.50; No. 2, $5. Rubber tips, to cover metal spurs for indoor use, 10¢ for set of three.



KODAK SELF TIMER

Lets you get in the picture yourself. You clip it to cable release, set it, and, in a sufficient time interval, the shutter is automatically tripped. Price, $1.25. Cable release (specify name of camera) 35¢ additional.



THE KODAPOD

Toothed jaws grip tree or fence, other end threads into any standard tripod socket. Clamping screw adjusts camera to correct position. Carried in coat pocket. Price, $1.75.

KODAK POCKET RANGE FINDER

Used with any camera that has a focusing scale. Look through the eyepiece, turn the knurled ring until the two halves of the image are perfectly matched, and there's your correct distance, indicated by a pointer. Set for that distance, and subject is in focus. Spring pocket-clip. Price, $7.

SEE THEM AT YOUR DEALER'S

Eastman Kodak Company, Rochester, N. Y.

(Continued from page 114A)

The original negative is stored in a special vault, thoroughly air conditioned to protect the film from shrinkage, evaporation and deterioration. Millions of feet of this original negative, telling in graphic form the history of the past twenty-six years since the newsreel came into existence, are stored in the vaults of the various newsreel companies. Recently, one of the oldest of the newsreel companies went over millions of feet of film stored in its vaults and tried to confine in two reels the outstanding historical events of the past quarter of a century. The result amazed scientists and educators when they realized how faithfully the march of events during this period had been recorded by the motion-picture camera—events which would take many volumes to tell in detail by means of the written word but which could be vividly told on the screen in exactly twenty minutes.

These living pages of history go back to pre-war Europe. The newsreel cameramen shot pictures of such former rulers as the Kaiser, the Czar and the Emperor Franz Joseph and filmed the rise of Lenin, the airplane flight of the Wright brothers, the Indian durbar in 1912, Teddy Roosevelt hunting in Africa, the fall of the old rulers, the World War and the rise of Mussolini, Stalin and Hitler. Valuable as these scenes are today, they will be even more so fifty years hence.

In the vaults of another newsreel company are nearly 400 one and two reel historical films valued at $5,000,000. Among the most treasured strips of film is one just twenty feet in length showing Germany's great statesman, Bismarck. This is believed the first historical motion picture ever made. Just who made it and when, is not known. It was shot between 1896 and 1898, the year of Bismarck's death. Many newsreel men who have seen this picture were amazed to learn that the forerunner of the newsreel camera was in existence as early as 1896 when the Lumieres of Paris had so improved upon Edison's kinetoscope of 1889 that they sent an expedition around the world to photograph subjects of historical interest.

These and other living pictures of history in the making will come into increasing use during the next few years and some day will play an important part in the teaching of history and of other subjects, according to Theodore Karp, Rockefeller Foundation Fellow, who is making an extensive investigation of the subject. "The need for the newsreel cameraman in shooting motion pictures for visual education today is on a par with the need for him as a news medium," states Prof. Karp.

Star Means the Same the World Around

(Continued from page 37)

into the U. S. Naval Academy Boat Club Fleet. With Star boats tucked away on the deck of a training ship, these boys are ready to race in any part of the world. The midshipmen hope to compete next summer with the Flotta della Regia Accademia Navale at Livorno. Young Roumanian officers, who sail in the Constanta Star fleet, and Germans from the Reichsmarine also may enter the races.

Compared to most types of boats, a Star is simple to build. It is of the square chine, shiplap construction. Although it must conform strictly to specified design, dimensions and construction, there is some option allowed on materials. The hull is usually built of mahogany, fir or cedar, three-fourths inch thick. Stem and frames are built of oak; keelson of seven-eighths-inch yellow pine, or any other suitable material. The spars are of solid or built-up construction. They may be round or oval, or streamline within certain limits. Hollow spars are barred. Mast and boom may have optional fittings.

Most of the rigging, standing and running, is optional, with a few exceptions. Sails must conform to the standard plans. All-silk, or perforated, or other freak sails are barred. Skeg and rudder must be built according to the plan and constructed of wood, not less than one inch thick. The International Star Class Yacht Racing Association of New York handles all details concerning Star boats, including official measurement and certification. Each Star carries her official number on the sails and on the upper part of the keelson.

WHY YOU'LL LIKE VELVET BETTER

1. *Fine old Kentucky Burley aged-in-wood.*
2. *Flavored with pure maple sugar for extra good taste.*
3. *An altogether different fragrance.*
4. *Cut to pack easy in a pipe—cut to roll smooth in a cigarette.*
5. *Every tin contains 2 full ounces.*

Velvet

better smoking tobacco

for pipe or cigarette

Copyright 1937
LIGGETT & MYERS TOBACCO CO.

The High Cost of Playing Safe

(Continued from page 61)

ican market. When Harry Winston, New York diamond dealer, bought the stone in London he arranged for the $2,000,000 in insurance before completing the sale, and the policy took effect the moment it passed into his hands. The insurance companies, to keep the risk entirely under American observation, stipulated the use of the registered mail, and of an American liner to transport the diamond across the Atlantic.

At the gangplank in New York an armored truck was waiting, and the prize was conveyed to the American Museum of Natural History to be opened in the presence of experts. The policy covered the stone in transit by ship and armored car, in its owner's vaults, and in the vaults of Lazare Kaplan, diamond cutter who was chosen to cut it. From June, 1935, to April, 1936, Mr. Kaplan and his son, Leo, studied the stone under powerful glasses and special lights. They made more than 1,000 plaster and more than 100 lead molds. Finally, they reached a decision and planned the cutting. For a week cutters fitted with diamonds wore a groove around the huge stone, along the grain. Then, Leo placed the edge of a steel wedge in the groove, his father tapped it with a special hammer, and the great stone split cleanly along the cleavage line. From the parts were cut twelve stones, the last one finished on December 18, 1936, and when they were through the dozen cut diamonds were valued at more than twice the cost of the original stone, despite the fact that 300 carats had been lost in cutting and polishing.

The largest finished stone is the third largest cut diamond in the world, exceeded only by the two huge fragments of the Cullinan, which now ornament the crown and scepter of the new king of England.

The part played by insurance in the romance of a "Queen Mary" liner, a Golden Gate bridge or a Jonker diamond is only one small angle of the influence insurance has had on the daily lives of every living person.

Because insurance premium rates rise when losses mount, buildings are better designed and built, automobiles are being made safer, airplanes improved, factories safer places to work, and the home a safer place to live. Fifteen or twenty years ago it was not unusual for some make of automobile to acquire a reputation for frequent fires. Fire insurance premiums went up, buyers shied away, and the insurance underwriters laboratories began investigations. Between them the insurance men and the manufacturer found the cause and cured it. Another car suddenly proved popular with auto thieves, and the insurance men immediately started hunting the weakness in the car lock. Auto bumpers were improved in the same way, at the insistence of insurance men.

The development of fireproof and fire-resistant roofs for homes and other buildings has been largely the result of work done by the insurance laboratories, supplemented by higher premiums charged for buildings with inflammable roofs. Insurance men are particularly interested in roofing because, while they can calculate the chance of a home catching fire from within, they cannot calculate the chances of a dozen or a hundred homes, some a mile or more away, catching fire from blazing brands borne by high winds and falling on inflammable roofs.

In the popular mind Lloyds of London is usually associated with freak insurance, and such things are often referred to as a "Lloyds gamble." Actually all such policies are based on an insurable risk, meaning that the insured faces a possible financial loss unless protected. Even twin insurance comes under such a head, for the parents face extra expenses raising twins. Last September William J. Pringle, Jr., of Los Angeles, collected $5,000 from Lloyds because his wife gave birth to twins, a boy and a girl. The premium cost him $200. These policies must be applied for at least four months before the birth, and both twins must live at least twenty-four hours after birth. Several years ago a Chicago broker lost a $25,000 claim against Lloyds because one of his twin children died twenty-three hours after birth.

One of the queerest Lloyds policies in years was issued a few weeks ago to a Chicago man, covering the face value of his life insurance if he should commit suicide during the first year, when the life

(Continued to page 120A)

"I'd like your cheek Old Boy—

...if you had a Barbasol Face"

No woman likes to see a man's face getting old and wrinkled when he's still in his prime.

What's this got to do with Barbasol?

We'll answer that with another question. Why do men in the tropics look old at forty?

It's the sun—the hot sun drying out the skin, making it wrinkled and old looking.

Old-fashioned shaving methods work the same havoc with skin. Containing alkalis, they tend to bite, dry and wrinkle it.

With Barbasol, it's an entirely different story. Being a cream, Barbasol soothes and refreshes and leaves the skin feeling soft, looking young, after every shave.

Get a tube of Barbasol today, try it for two solid weeks, and see how much smoother and younger your face looks. Get yourself a Barbasol Face and keep the ladies happy.

What need to mention that Barbasol gives the finest, cleanest, sweetest shave a man ever had! The fact that it is America's largest-selling shaving cream speaks for itself. Large tube, 25¢; giant tube, 50¢; family jar, 75¢. And five scalpel-sharp Barbasol Blades for 15¢. At all drug stores.

For modern shaving

No Brush—No Lather—No Rub in

The High Cost of Playing Safe

(Continued from page 118A)

policy was contestable under its suicide clause. The man had applied for a bank loan, and the life insurance was taken out to protect the bank if he should die before repaying it. The bank also insisted on protection during the suicide period, and Lloyds issued the insurance.

One of the most important fields for Lloyds in the United States is insurance of new experimental airplanes during their construction and test flying. The London underwriters are practically the only people writing such insurance. A new type ship, such as the huge Boeing bombers and forthcoming transatlantic flying boat, or the new Douglas super air liner ordered by a group of American air lines represents an investment of about $1,500,000, and the manufacturer cannot afford to carry that risk himself.

Airplane insurance is an expensive item, despite the fact that rates have been cut in half or less than half during the past ten years. A year's insurance on a $100,000 Douglas air liner costs about $13,300. The hull, or ship itself, is insured against fire, crash, windstorm or land damage (meaning damage while on the ground) at eleven per cent, or $11,000 premium per year. This insurance is subject to certain deductibles, just as in automobile insurance, the owner paying the first $100 to $500 or $1,000 for damage from the various causes.

Insurance against death or injury of passengers is sold in two ways, one by the seat, the other based on passenger-miles. If the air line wants $5,000 liability coverage per seat it will cost sixty dollars per year, while $25,000 per seat coverage costs $100. Then the air-line operator needs property damage, to protect against claims if his ship runs into or falls onto property of others, life insurance for the crew, and, finally, theft insurance. A twenty-one passenger air liner is not an attractive object for thieves, who would find it something of a super white elephant, so a year's theft protection costs only twenty-five dollars or so.

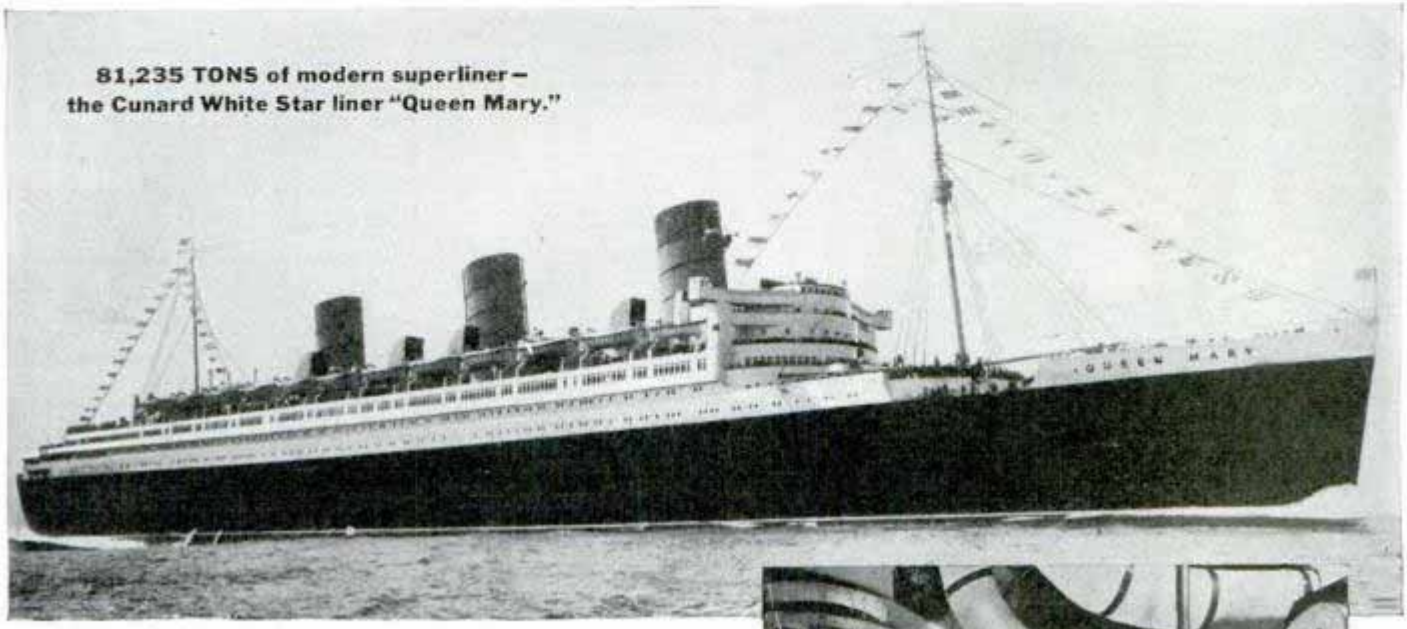
When passenger liability is purchased on the passenger-mile basis it runs somewhat higher than under the coverage per seat rates already quoted. This is due to the increase in seat occupancy and the increase in flying time which has come with more frequent schedules and longer flights. The total coverage of all risks in insuring a big air liner may have a gross face value of $1,500,000 or more. In fact the loss, including that in public confidence, of a single air-line wreck is estimated at $3,000,000.

The very high cost of airplane insurance is a powerful influence in getting operators to change to newer and safer models as fast as they appear, and to adopt and utilize every new invention which helps make airplane operation more safe. In that regard it follows the path marked in nearly every line of invention and manufacture. Check protectors are usually sold on the strength of lower forgery and fraud insurance rates. Cash registers and similar office and store devices have the same appeal. Every casualty company maintains its own engineering and inspection staff and will not insure a factory until safety rules have been complied with and danger spots eliminated. The necessity of public liability insurance to protect spectators at sporting events has influenced the design of stadiums, grandstands, public halls and coliseums. Burglary insurance, which includes bank, residence, open stock, safe, messenger and paymaster burglary and holdup protection, has been a boon to inventors of better safes and other protective devices, because the insurance underwriters help, through their control over rates, in selling new inventions to the public.

Mechanization of the average American home has introduced all sorts of insurance problems. You can get a policy protecting yourself against oil-burner or gas-furnace or stove explosion, but, as yet, you cannot buy insurance to specifically protect your family against injuries sustained while operating electric washers, wringers, food mixers, juice extractors, irons, fans, stoves and similar machine-age products. Accident and health companies do sell limited accident insurance for housewives, which include these coverages, and also policies which cover hospi-

(Continued to page 124A)

SUPER-PRESSURE STEAM secret of liner's 200,000 H. P.

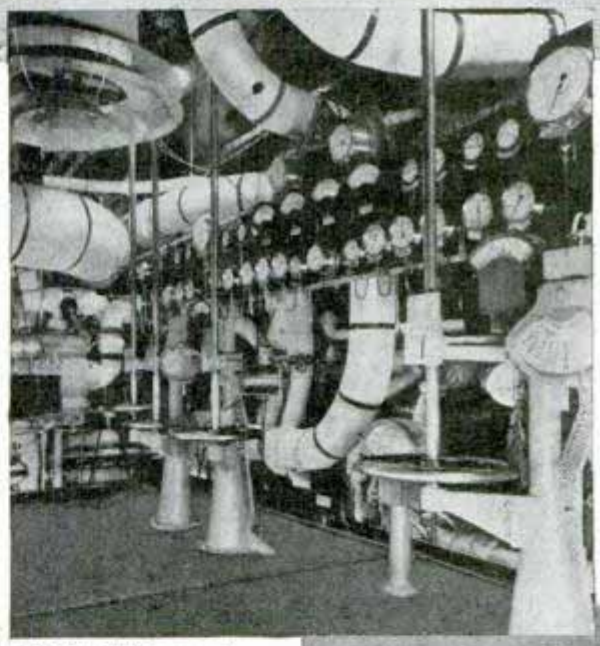


"Queen Mary" engines illustrate HIGH COMPRESSION feature of modern autos

MARINE ENGINEERS now get more power out of every gallon of fuel oil by super-heating steam—increasing operating pressures. Automobile engineers give you more from every gallon of gasoline by increasing compression ratios—building modern cars with high-compression engines.

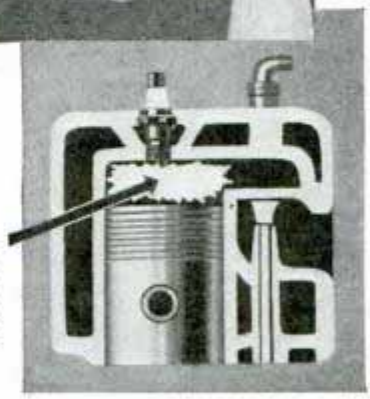
Cars in every price class today offer the extra power, extra mileage, extra responsiveness that high compression gives. But to get all these advantages you must set the spark for maximum performance and use high-compression fuel!

Where do you get high-compression gasoline? *At pumps marked "Ethyl"!* Ethyl is at least six octane numbers higher in anti-knock value than regular-grade gasoline. That's why it gives smooth, high-compression power, prevents harmful knock that overheats the engine and wastes gas and oil. Ethyl assures you of 100% performance—plus all-round quality that is *double-tested*—by the oil company and by the Ethyl Gasoline Corporation.



STEAM at 440 lbs. per sq. in. and 700° Fahrenheit from 24 boilers drives the huge turbines. Here you see one of the control rooms, or "starting platforms," from which the "Queen Mary's" 200,000 horsepower is controlled.

GIVES YOU A BETTER RUN FOR YOUR MONEY



FUEL mixture is compressed in the cylinders of the average modern cars to less than one-sixth its original volume. You need ETHYL to prevent "knock" under this HIGH COMPRESSION.

ETHYL GETS FULL POWER FROM HIGH COMPRESSION

F1578

The Secrets of Safe Driving

(Continued from page 69)

speed up to the light?" he asked. "He didn't get away from it as soon as I did. I used a minimum of gas, and he splashed it all over the place. I don't know anybody these days that can afford to throw money away just for the kick of wheeling up there and setting her down hard."

At the next traffic light, "Cannonball" was again off ahead of the speed demon, who, in his eagerness to get away, took one front wheel over the curb while going around a truck. Baker saw this. He saw,

Top, a twenty-foot break in pavement 2,000 feet away is no more noticeable than hair held at arm's length. Bottom, at forty-five miles per hour, only point at which eye gets clear picture of foreground is about eighty feet ahead of car

too, that the fellow had a pair of new tires on the rear wheels. The front ones were fairly old.

"Did you see those tires?" he asked. "Most folks pay too little attention to their tires. I'll bet that fellow doesn't know the proper air pressure for them, and if he does, I'll bet he doesn't check it. When a manufacturer builds a tire for a certain pressure, it'll wear longer if you string along with him.

"And that fellow didn't help his tire much when he went over the curb. Jars like that hurt rubber. I've seen tires blow when something like that happened, or shortly afterward. And speaking of blowouts, if that fellow was smart he'd have his best tires on his front wheels, because a front wheel blowout is twice as bad as one in the rear."

That sounded more like a safety than an economy hint, and from a safety angle, Baker's driving differs radically from most in one respect. The average motorist drives with his right foot on the accelerator and his left poised over the clutch. When he wants to stop quickly he presses down with his left foot, transfers his right as quickly as he can to the brake pedal, and shoves.

"Cannonball" drives with his right foot on the accelerator and his left over the brake pedal. He ignores the clutch altogether. He makes a quick stop simply by lifting the right foot and pressing with the left.

"I save the time I'd waste in transferring my foot from one pedal to another," he explained. "The clutch is still in, so I've got the engine helping me. That compression not only aids the brakes, but prevents skidding. Of course, people say that leaving the clutch in will kill the motor. What of it? Which would you rather kill, yourself or the engine? You can revive the engine a lot easier."

Baker has an enormous pair of hands, and when he puts them on that steering wheel he really grabs it. None of this two-finger driving for him at any speed.

"It's like handling wild horses," he says. "As long as you're the boss everything is fine. But when it comes to the pinch, what counts is your ability to hang to that wheel against centrifugal force, torque and all that horsepower."

There was ice on the road, but Baker took curves in stride, without reducing speed and without an inch of skid. How did he manage that?

"When I took those curves, I kept jiggling the wheel a couple of inches in each direction," he explained. "That's the secret. If you just set your wheels into a

(Continued to page 124A)

AUTO-LITE

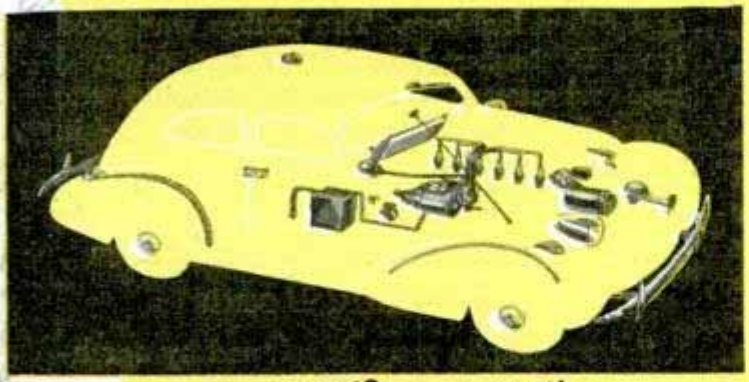
COMPLETES THE IGNITION SYSTEM WITH THE

first SPARK PLUG

Ignition Engineered by Ignition Engineers

DEALERS
Be sure your customers get real spark plug performance... Stock Auto-Lite Spark Plugs now if you have not done so already. For complete information, write us, or ask your jobber salesman.

Yesterday, Spark Plugs were just another accessory. Today, Auto-Lite Ignition Engineers have developed the Auto-Lite Spark Plug as a component part of the ignition system. The first spark plug built to work in perfect harmony with the rest of the ignition system—and as a result, produce perfect performance. The FIRST Spark Plug Ignition Engineered by Ignition Engineers. With such a background of Ignition experience, it is only logical that Auto-Lite Ignition Engineers should produce a basically better spark plug.



26 YEARS BUILDING STARTING, LIGHTING AND IGNITION

For 26 years, Auto-Lite has provided original starting, lighting and ignition systems for a majority of engine manufacturers. Today, the following use one or more Auto-Lite products: **Allis-Chalmers . . Auburn . . Brockway . . Chris-Craft . . Chrysler . . DeSoto . . Diamond T. . Dodge . . Federal . . Ford . . Graham . . Gray Marine . . Hudson . . Hupmobile . . International Harvester . . Kermath . . Lincoln . . Lycoming . . Nash . . Plymouth . . Packard . . Reo . . Studebaker . . White . . Willys**

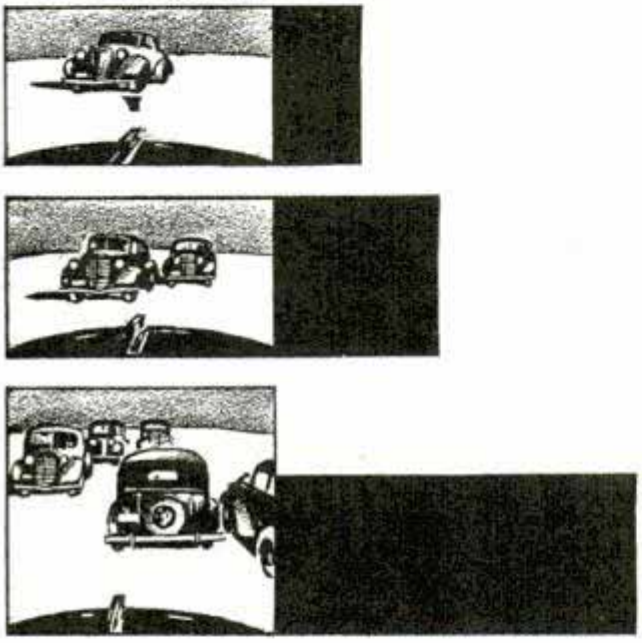
AUTO-LITE SPARK PLUGS OFFER MANY NEW, IMPROVED FEATURES

To make this better spark plug possible, Auto-Lite Engineers developed new and improved features. Konium, for example, is a new electrode superior in vital characteristics to anything heretofore available. Ziramic is a new insulator material developed and made by Auto-Lite. These, and many other features of the Auto-Lite Spark Plug insure longer plug life and greater economy, plus balanced ignition performance so essential to modern motor cars. . . Merchandising Division, The Electric Auto-Lite Company, Toledo, Ohio.

(Continued from page 122A)

curve and let her go, you're giving centrifugal force a chance to work up momentum. Incidentally, if you hit the curve a little too fast and try to slow down, that's just an invitation for it to push you off the road. If you hit a curve that way and feel yourself going, step on it. That gives you more traction to combat centrifugal force. Better yet, slow down before you hit the bend.

"But about that jiggling. It sounds as though it would heave you right into a skid, but it doesn't. It is a way of showing all that horsepower under the hood that



If driver has two cars to consider instead of one, reaction time increases fifty per cent. Five cars double the time

you're the boss. It cuts that big arc of the turn into a lot of little ones that are practically straight lines, and centrifugal force never gets a chance to start. I've taken right-angle turns at seventy miles an hour by doing that, and had no trouble. You couldn't do it that fast, but you can use it at safe speeds to advantage. As a matter of fact, I jiggle the wheel all the time I'm on a slippery surface, curve or not.

"You've got to practice all these things, of course, until you've got 'em down cold. Try them at slow speeds first, and step it up gradually until you can do 'em at your customary road speeds. And when you've got 'em, you'll save yourself a lot of money, and keep your health. And last of all remember this: any fool can make a modern car do seventy. It's no trick. But it takes brains to drive safely."

The High Cost of Playing Safe

(Continued from page 120A)

talization and doctor, surgical, nurse and X-ray expenses.

The casualty insurance companies offer you an owner-landlord-tenant policy to protect you against injury suits brought by guests in your home who might prove injuries due to your negligence. Negligence law is a large volume in itself, and hard to prove. A guest who cut himself while slicing oranges, or who, looking over his shoulder to talk to you, stuck his fingers into the juice extractor, could not show negligence on your part, but if a worn-out extractor broke and a piece of steel flew up into his eye he could sue you.

One of the oddest fields of modern insurance coverages arising from the mechanical age is what is known as "Inland Marine." It includes all insurance on "anything of a movable nature taken from place to place and used for the purpose for which it was designed."

The famous violinists carry Inland Marine policies on their violins, and in the same way you can cover your camera, gun, fishing tackle, or other sporting or musical instruments. Inland Marine underwriters invested in a headache last winter when they offered ski coverage. For one dollar they guaranteed up to fifty dollars coverage on the loss by fire, theft, perils or transportation or by breakage while in use of any ski, ski pole or strap and other lashings. The policy was good from December 1 to May 1 and covered skis whenever they were outside the owner's home. Loss claims were far in excess of premiums, however.

Seismographs Help Engineers in Building Roads

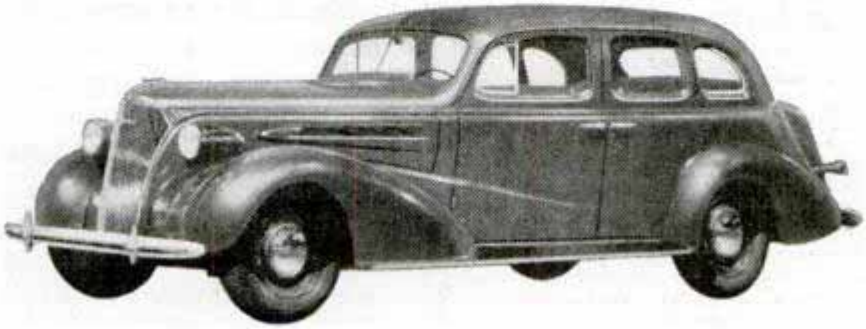
Seismographs were developed by earthquake scientists, but today highway engineers use the seismograph to determine what kind of road foundation to build. They start small artificial earthquakes with dynamite explosions, and from the record of the returning waves as shown by the seismograph they estimate the depth of bedrock. Knowledge of the depth of rock and the nature of the soil above it helps the engineers plan foundations for safer and longer-lived highways.

"And when the boy grows older – he'll be just as comfortable and safe in a

KNEE-ACTION CHEVROLET!"

CHEVROLET **NEW HIGH-COMPRESSION VALVE-IN-HEAD ENGINE — NEW ALL-SILENT, ALL-STEEL BODIES — NEW DIAMOND CROWN SPEEDLINE STYLING — PERFECTED HYDRAULIC BRAKES — IMPROVED GLIDING KNEE-ACTION RIDE* — SAFETY PLATE GLASS ALL AROUND — GENUINE FISHER NO DRAFT VENTILATION — SUPER-SAFE SHOCKPROOF STEERING*. *Knee-Action and Shockproof Steering on Master De Luxe models only. General Motors Installment Plan — monthly payments to suit your purse.**

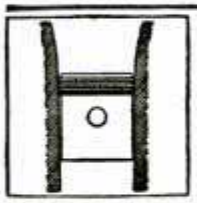
CHEVROLET MOTOR DIVISION, General Motors Sales Corporation, DETROIT, MICHIGAN



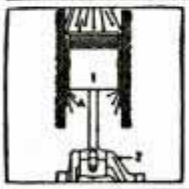
THE ONLY COMPLETE CAR — PRICED SO LOW

LIFE BEGINS AT 25 THOUSAND MILES

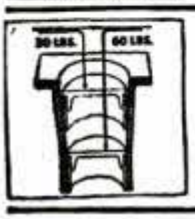
How amazing new Perfect Circle X-90 Piston Ring restores new-car pep and oil mileage — doubles engine life! . . .



1. After 25,000 to 30,000 miles, the cylinders wear larger at the top than at the bottom. (The diagram, of course, is greatly exaggerated.)



2. Compression is lost (a) and the power delivered to the crank shaft (2) is wasted—car is sluggish. Oil also escapes up past the piston rings when cylinders become worn, causing carbon, blue smoke, and excessive oil consumption.



3. Ordinary type piston rings, in attempting to make up for the cylinder wear, use a single expander spring which exerts high pressure—30 to 60 lbs.—against the cylinder walls—causes piston drag, cuts horsepower.

4. Perfect Circle X-90 Piston Rings introduce an entirely different principle. 6 double-leaf springs, acting independently, apply light, uniform pressure, 20 to 25 lbs., from top to bottom of cylinder walls.

5. X-90's have the amazing flexibility to seal worn cylinders, without drag—at any speed. Oil mileage is increased up to 500%. New-car pep is restored. The life of the engine is doubled.

Free **68-Page Life- and Car-Saving Book** . . . There are 192 other amazing facts of vital interest to every car owner in this marvelous book offered you free. Thirteen sure ways to save gasoline! How to safely pass a car with blinding headlights! How to double the life of your car! How to restore new-car pep, power, and oil mileage after 25,000 to 30,000 miles! This book may save you hundreds of dollars, even your life. Send for it.

PERFECT CIRCLE

Piston Rings ***Piston Expanders***

(Trade-mark Reg. U. S. Pat. Off.)
Copyright 1937, The Perfect Circle Company

THE PERFECT CIRCLE COMPANIES
Hagerstown, Ind., U. S. A. and Toronto, Canada PM 7-7

Please send me your booklet, "How to Double the Life of Your Car," and information on my car. I have filled in each line very carefully.

Name.....
Address.....
City..... State.....
Make of car or truck..... Model..... Year.....
Mileage..... Trouble.....
Name of my repairman.....
Address.....

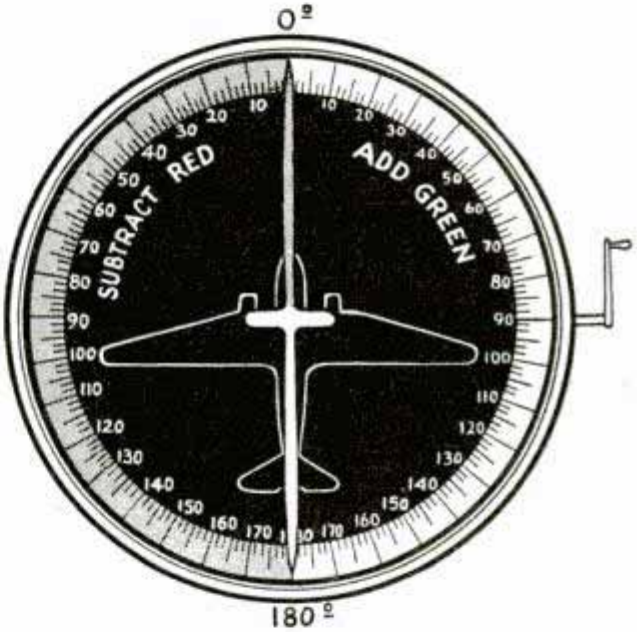
Radio Eyes for the Air Liners

(Continued from page 85)

elapses before the echo is received to measure the distance. Others, including Dr. Lee De Forest, are looking for some kind of radio measuring stick.

"Obviously, if a pilot could glance at an instrument and read his actual height above ground he would be safer than ever before," Dr. De Forest says. "He would still use his altimeter for flying a level course at the altitude he selects, but alongside this dial would be another calibrated in feet to show him how far down it is to the ground.

"It may be that the best mechanism to operate this new instrument dial will be found in short-wave radio. One possibil-

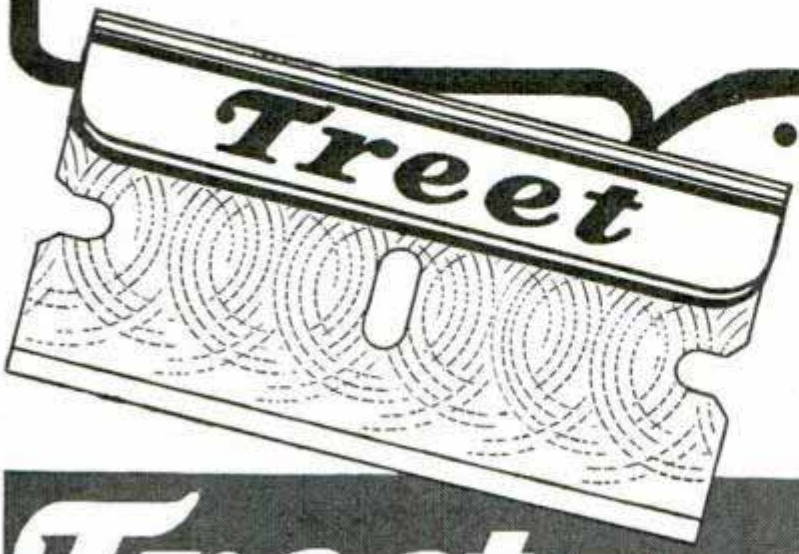


Sketch of radio direction-finder dial in cockpit. Note crank for rotating loop

ity is a sort of radio range finder that would measure distances up to several miles and still be accurate for twenty or thirty feet away. It may be that by mounting a small compact short-wave transmitter in one wing tip, with a receiver in the opposite wing tip nearly 100 feet away, the waves bounced against the ground by the transmitter can be picked up and the angle measured.

"Another possibility is a broadcast set that creates a radio field around an airplane like the field set up by a short-wave burglar alarm. An adaptation might result in an automatic warning to a pilot when the airplane approaches within several hundred feet of the ground."

"I'M KEEN FOR YOU"



• For a quick, cool breeze through your whiskers, try Treet Blades! Extra stropping gives their edges greater keenness – gives you greater shaving comfort! Get more shaves for your money—get Treet Blades, today!

Treet Safety Razor Corp., Newark, N. J.

Treet BLADES

FIT GEM AND EVER-READY RAZORS

4 FOR 10¢

BE at Home ON STRANGE ROADS

With a Hull Auto Compass you never get confused on strange country roads or city streets. It always tells your direction of travel, saving you miles, money, worry and delays at a cost of only $2.95 at your dealer. Two-piece model $1.95. Write for circular.

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SELLEY-TEX REARWIN SPEEDSTER

patented

FLYING MODEL AIRPLANE KIT, with moulded fuselage, wheel shoes and cowl practically crashproof. Nothing else to buy, kit complete... SHIP MODEL FITTINGS—Die-cast—boxwood brass. Most complete catalog 5c.

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Rocky Mt. States West, $2.25. Postpaid

ADJUSTABLE BUMPER HITCH $1.35

This hitch can be put on, taken off, or adjusted to 6 different positions with a wrench. Postpaid, $1.35 without ball. (Rocky Mt. States West $1.50.) Write for catalog on trailer hardware and camping trailers.

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Please send, without charge or obligation, the new price list of TOMGUT Tennis & Badminton Strings, Racket Frames, and Restringing Equipment.

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Things Are Not What They Seem

(Continued from Coloroto Section)

natural rose oil. Today every perfume on the market depends on a man-made product for its individuality and character. The whole gamut of aromatics now consists of about 1,000 materials instead of 200 or so, and the number is increasing.

The chemist's greatest triumph in this field of aromatics has been the production of man-made musk. Musk is a fixative which blends into one fragrance all the odors of a perfume and confers permanence on them. Incidentally, it is said to be the most fascinating of all odors to humans. Natural musk is obtained from a gland of a male deer in Tibet and in its impure form is valued at about $560 a pound. Natural musk cannot be produced free of all impurities, but if it could, would probably be worth $40,000 a pound. Man-made musk—not to be confused with artificial musk—has every quality of natural musk, is produced without impurities and is comparatively inexpensive. But the chemist has done more than reproduce the fragrance of the flowers. He has created new odors—fascinating scents of which nature never even dreamed.

Now let's forget coal tar and consider salt. Give one of these du Pont chemists a pinch of salt and a few other simple materials and he will create as many products as he makes out of a spruce tree or a lump of coal. Out of salt he produces things as far apart as insecticides for the farmer and cosmetics for the farmer's wife, materials to caseharden metals and others to bleach cloth as white as snow.

From salt, limestone and coal the chemist evolves neoprene—rubber that never saw a rubber tree. This substance is not synthetic or artificial rubber, but a man-made product with all the properties possessed by rubber and a number of excellent qualities which rubber does not possess. It resists oil and greases and acids and alkalies much better than natural rubber, does not check and crack on exposure to sunlight to the same extent as rubber and does not deteriorate with age as rapidly. Like rubber, neoprene must be mixed with certain pigments and vulcanized by heating and the finished product may be soft and flexible or hard and tough. It is being used widely today in the manufacture of oil and gasoline hose, printing rollers, belting, molded parts for automobiles and refrigerators, hospital sheeting, packing and piston seals for pumps and compressors, gloves and oil-proof electrical wires and cables.

Thus, from salt, we have chemistry that stretches. Salt, too, is the base of methyl chloride, a fast-freezing refrigerant; of chlorine which safeguards your water supply and of various cleaning solvents. And sodium cyanide, chemically derived from salt, makes the gears of your car wear-resistant without sacrificing strength. Other products starting from salt and known as metal cyanides are used to produce the decorative and durable finishes you find on silver-plated tableware and other metal-plated products.

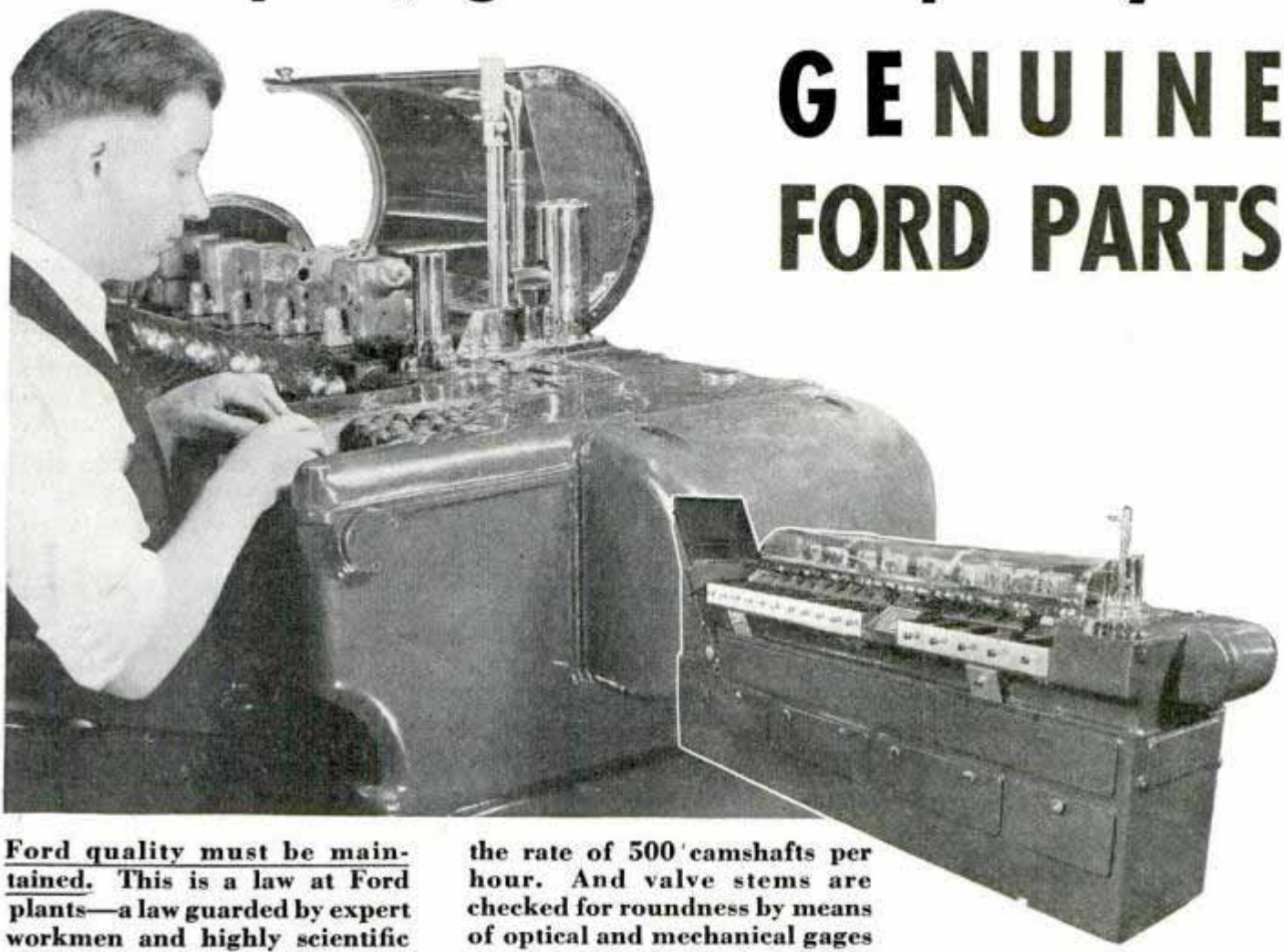
Every product thus far mentioned has as its base cellulose, coal or salt. From other simple products of nature the industrial chemist evolves an array of man-made materials just as impressive and just as useful. From molasses and yeast, for instance, he gets alcohol and carbon dioxide, a refrigerant. Sulphur, charcoal and saltpeter yield black powder; sulphur plus air yields sulphur dioxide, a refrigerant; sulphur plus coke yields carbon disulphide, used in making viscose rayon, and sulphur, air and water yield sulphuric acid whose uses are legion. Nitrogen from the air and hydrogen from the water are combined under pressure with the aid of coal to produce ammonia—and then we have, not chemistry that stretches, but chemistry that blows hot or cold.

For ammonia, changing from a liquid to a gas, absorbs heat, lowers the temperature and provides refrigeration. Use the same air, water and coal with which we started to make ammonia, change the mixture of gases, vary the pressure, and you have the chief ingredient, not of a refrigerant, but of an anti-freeze to keep the radiator of your car from freezing.

Thus, man, by taking apart the simple substances provided by nature and rearranging the patterns, has progressed. Today nearly everything you use has been either created or improved by chemistry. Almost every part of your motor car, for

(Continued to page 130A)

Inspections, which no human skill can equal, guard the quality of GENUINE FORD PARTS



This automatic valve lifter inspection machine performs eleven different inspections on 35 valve lifters per minute — a total of 385 inspections.

Ford quality must be maintained. This is a law at Ford plants—a law guarded by expert workmen and highly scientific inspection machines during every phase of the manufacturing of Genuine Ford Parts.

One machine, for example, checks piston pins for smoothness, hardness, straightness, roundness and diameter at the rate of 1500 per hour. At one stage in the inspection an automatic scleroscope checks the pin for hardness. A small hammer is allowed to fall upon the pin. The rebound of the hammer measures, to a fine degree, the hardness of the metal. If the metal is of the correct hardness, the hammer rebounds to intercept a light beam from a photo-electric cell which automatically allows the pin to proceed for further inspections.

Another inspection machine gages camshafts at 25 points at the rate of 500 camshafts per hour. And valve stems are checked for roundness by means of optical and mechanical gages that keep the limit of variation within two ten-thousandths of an inch.

Because of such accurate and scientific inspections, because of Ford quality materials and Ford precision manufacturing, you can be sure of getting the best parts for your Ford by buying them from your Ford dealer or any garage that displays the sign "Genuine Ford Parts."

All Genuine Ford Piston Pins are inspected for smoothness, hardness, straightness, roundness and diameter. Diameters are held within a variation of one ten-thousandth of an inch of specified sizes.

Genuine Ford Cut-outs have large coin-silver contact points. Layers of the shunt-coil windings are insulated individually. Series coil winding has full generator output carrying capacity.

GENUINE Ford PARTS

Clutch Disc Assembly. All discs are carefully inspected to make certain that all parts measure up to specified requirements.

FORD MOTOR COMPANY • DEARBORN • MICHIGAN

STERNO CANNED HEAT

CONTEST

50 CASH PRIZES

1st Prize, 50 $2 Bills ($100)
2nd Prize, 50 $1 Bills ($50)
3rd Prize, 50 Half-Dollars ($25)
4th Prize, 50 Quarters ($12.50)
5th to 50th Prizes, 50 Dimes ($5 each prize)

IT'S EASY

Just answer this one question:

"What one event has contributed most to American prosperity in the last 50 years (the period during which the Sterno Corporation has been in business)?"

YOUR answer might be "The invention of the automobile," or any one of hundreds of other events.

Put reasons in not over 100 words. Send entry with one STERNO label or facsimile, and dealer's name and address. DEALERS: There's at least $5 for you (or your clerks) if your customer wins on entry blank you signed. Display Sterno during the contest. Explain conditions relating to it. Enter the contest and win a prize yourself.

FOLLOW THESE RULES

1. Anyone except STERNO employees may enter.
2. Write on STERNO GOLDEN JUBILEE PRIZE CONTEST blank (ask your dealer for one) or on a plain sheet of paper: (a) What you consider to be the event that has done most to contribute to the prosperity of America during the past fifty years (the period during which the Sterno Corporation has been in business) and (b) give reasons for your choice in not more than 100 words. Literary style isn't important — awards will be based on the merit of your reasons.
3. All entries must be accompanied by label or facsimile.
4. In case of tie, duplicate prizes will be awarded. Judges' decisions are to be final.
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MAIL YOUR ENTRY TODAY TO DEPT. PM-7

STERNO INSTITUTE

9 East 37th Street, New York, N. Y.

(Continued from page 128A)

instance, has been touched by the magic hand of the chemist and, because of chemical research, your clothing is made of better fabric and contains better dyes, your food has better protection and refrigeration, your home has better paint, furnishings and equipment But scarcely one of these better things is what it seems. Rayon does not look like a spruce tree, the blue of your suit does not look like coal tar, the fuel hose at your neighborhood filling station does not resemble salt or coal or limestone. Yet all were produced from just such simple materials.

And every year the development of our natural resources continues. New products, new man-made substances even more marvelous than those with which we are familiar are being born so rapidly in the chemical laboratory that man hardly learns the possibilities of one substance before another has been offered to him.

One of the latest is "Lucite," a resinous plastic material evolved by du Pont chemists which is as clear as glass but much lighter and so unbreakable that it can be bounced on a stone floor. It is produced in rods, sheets and tubes and as a molding powder which becomes plastic when heated. It can be made as a crystal clear product and in an almost unlimited variety of brilliant transparent, translucent and opaque colors. In optical qualities, clarity and general appearance, it closely approximates natural quartz crystals. A ball of natural quartz crystal costs thousands of dollars; one made of this plastic costs only a few dollars and it is difficult for even an expert to differentiate between them.

The light of the firefly can be imitated with this substance. If a rod of it is held over the rays of a mercury-vapor ultraviolet light, the material converts the invisible ultraviolet light into visible rays which glow when the rod is removed from the lamp. "Edge" lighting is also a property of this "glass." Light passes through sheets and rods, even around corners formed of the material, being visible only at the edge or fringe of the substance. Light from an electric lamp passing through a rod of "Lucite," for example, causes the end of the rod to glow like a cigar in the dark.

This quality of transmitting light edgewise through a sheet or around a curve may make this substance useful for ad-

Plastics Div, Arlington, NJ

vertising signs, for the indirect lighting of instrument panels in automobiles, airplanes and radios and for many other purposes. The material can be machined on a lathe, sawed, cut, drilled, carved, molded and worked in other ways. This glass-like resin is made of a colorless liquid, known to chemists as methyl methacrylate. This liquid is rendered solid by polymerization, a method of treatment by which small particles of the original material grow into big ones and change their optical and structural qualities. This material is likely to be used for a thousand purposes in industry within the next few years as more and more manufacturers adapt it to their products.

To most of us, the production of a substance like "Lucite" from simple materials of nature seems a miracle. To the research chemist, it is the result of sweat, not magic. It took twelve chemists five years to produce "Lucite." When they had finished, they had evolved not an artificial glass or a substitute for glass, but a brand new product with the transparency of glass but also with many admirable qualities glass does not possess. The same is true of the other man-made products described. Rayon is not a substitute for anything. It is a man-made fabric which has found its own place in our scheme of things. The lacquer on your car is not a substitute for paint or varnish. It does a job paint and varnish could not do.

And research chemists, pioneers in creating the many new products we enjoy today, are continuing their work, studying strange new things, adding to their knowledge of raw materials and the laws which govern their combination.

"New goals are constantly envisioned by those engaged in scientific research," says C. M. A. Stine, vice-president of the du Pont company. "There will be continued effort toward lower costs of production, improved quality, and new uses for existing products. And the chances are that new products will be created in an ever-increasing volume. The farther science penetrates into the nature of things, the wider becomes the horizon of opportunity."

So, more and more, in the future, we shall say, "things are not what they seem," And, because of that fact, this will be a better world in which to live.

"I Never Owned Such an Economical Car!"

"With the Savings I Am Experiencing, My Dodge Will Cost Me Less Than the Small Car I Originally Thought of Buying," says Miss Emelie Gingell, Sunnyside, N.Y.

"THE way Dodge saves on gasoline, oil, tires and general upkeep has amazed me," continues Miss Gingell. "I never owned such an economical car!"... and there are literally thousands the country over who are making the same discovery Miss Gingell has made. In fact, more than 140,000 people have *switched from other cars to Dodge* in the past year. And these are in addition to the thousands of Dodge enthusiasts who regularly repurchase and say they would have no other car but Dodge!

See and drive this new Dodge today! And remember, Dodge now delivers for just a few dollars more than the lowest-priced cars.

DODGE
Division of Chrysler Corporation

Switch to DODGE

and Save Money!

Easy terms gladly arranged to fit your budget, at low cost, through Commercial Credit Company.

A new sponge made (like rayon) of Cellulose. Soft, durable, sanitary, absborent.

Get this AMAZING SPONGE FREE

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No. 7 POLISH

WE make this generous offer so that new thousands of car owners will try No. 7 Duco Polish immediately, and see how greatly it improves the appearance of the car. You should use No. 7 Polish on new cars as well as old. It keeps new cars beautiful and restores the color and lustre of old finishes dulled by grime and Traffic Film.

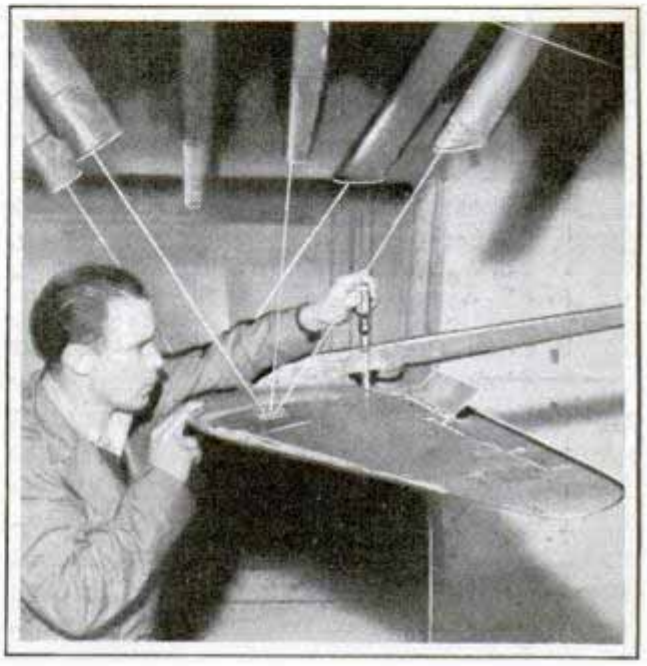
Now we offer a Du Pont Cellulose Sponge (25c size) FREE to everyone who buys a pint can of No. 7 Polish. (Offer good in U. S. only.) This sponge, created by du Pont chemists, is ideal for bath and household cleaning, as well as for the car. See your dealer WHILE THEY LAST!

GRIME DOES NOT PAY . . . USE No. 7

Streamlining for Brute Speed

(Continued from page 77)

the engineers explain, air seems to have a sort of viscosity. A certain amount of it seems to cling to the wing surface, or rather, is slowed down by friction as it flows across the surface. What the engineers would like to do is to prevent this slowing down. The problem is a double one since the lifting ability of a wing is also impaired by the slowing down of the air. At California Tech, an experimental



Model mounted upside down to measure strain exerted on proper supporting wires

wind-tunnel model is being built in which series of slots are cut into the top of the wing. An electric fan inside the fuselage sucks outside air in through the slots, the expectation being that if the boundary layer of air can be removed as soon as it has traveled across the wing far enough to start to slow down, fresh high-speed air will replace it and this in turn can be whisked away as soon as friction starts to rob it of its speed. The engineers believe such slots may help to lift heavy loads steeply off the ground, and reduce landing speeds. It seems practical that the slots could replace landing flaps, or be used in conjunction with them to reduce present landing speeds by as much as one half.

Another idea for increasing the speed of the boundary air layer which is in the experimental stage is to provide an upper wing surface that consists of a wide end-

(Continued to page 134A)

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INVENTORS Be Sure To See Page 23A

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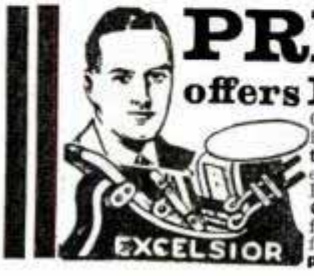

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Just pour a little Sani-Flush in the radiator. (Follow directions on the can.) Run the engine. Drain, flush and refill with clean water. Clean radiators regularly, twice a year. Sani-Flush cannot injure aluminum cylinder heads or motor fittings. Kept in most bathrooms for cleaning toilets. Sold by grocery, drug, hardware, and five-and-ten-cent stores—25 and 10 cent sizes. The Hygienic Products Company, Canton, Ohio.

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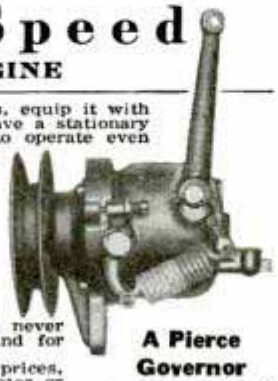
Pierce Universal Governors are standard controls on gasoline engines for commercial purposes—for electric lighting plants, refrigerating units, air compressors, feed grinders, hoists, saw mills, welders, etc.

Pierce Universal Governors are the time-tested flyball type and respond instantly to each change in engine load, maintaining uniform speed. Belt driven, either V or flat. Easily installed and never equaled for close regulation of speed and for dependable performance.

Write for illustrated literature and prices, whether you want to equip one used motor or a thousand new ones.

The Pierce Governor Company
1600 Ohio Avenue, Anderson, Indiana



A Pierce Governor puts "brains" into any gas motor.

(Continued from page 132A)

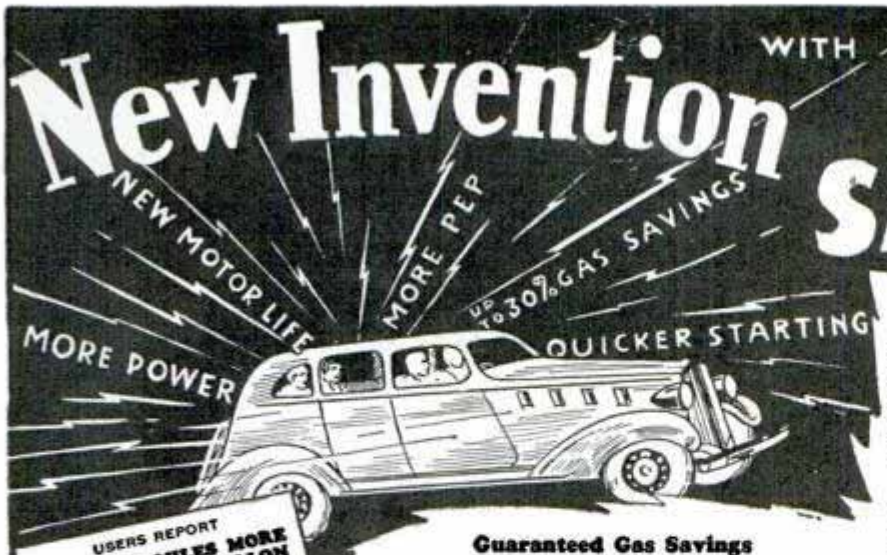
less belt traveling from the front of the wing toward the rear. If the wing skin can be kept in motion there will be less friction with the boundary layer, and drag should be reduced and lift increased.

Wind-tunnel models are built with even more precision than full-sized planes, since the slightest imperfection might be magnified many times in real aircraft. The models range up to those having wing spreads of eight feet, and for large airplanes may be built on a scale of one to twenty. Wind velocities in the tunnel range from 180 to 200 miles per hour, and the effect of the wind on a model is measured by means of the pull that the model exerts on wires leading from it to indicators outside the tunnel. In some tests the speed of the air near any part of the model is measured by a hot wire anemometer, a wire so delicate that it can hardly be seen and that carries a heating current of electricity. The cooling effect of the wind affects the conductivity of the wire and from this the velocity of the airstream may be gauged.

More horsepower is going to play its part in attaining higher speeds. Even the rocket action of engine exhausts has been studied and engineers estimate that at 200 miles per hour about one per cent is added to the effective power by having the exhaust exert its push backward instead of to the sides. There is an arbitrary speed limit that racing pilots and other fliers will never be able to exceed. "As far as we know now, 575 miles per hour is about the fastest man will ever be able to fly in today's type of airplane," Rockefeller says. "At about 750 miles per hour, pressure waves of air begin to separate from the airplane wing instead of flowing around it. Already we have had to curtail propeller speeds by gears or by providing additional blades, since the blades are nothing but airfoil shapes just like wings. When they move too fast they separate the air and then merely churn around instead of pulling the plane ahead."

A top-speed plane would have to have an engine big enough to provide from 700 to 1,000 horsepower for every square foot of frontal area, probably 7,000 or 8,000 horsepower in all. This plane would be little more than "an engine with a saddle behind it."

New Invention WITH SUPERCHARGE PRINCIPLE SAVES GAS



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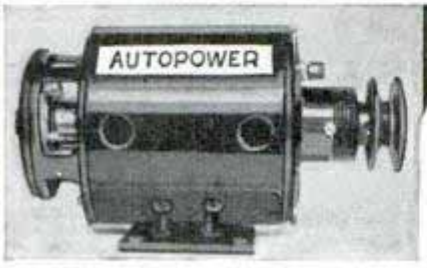

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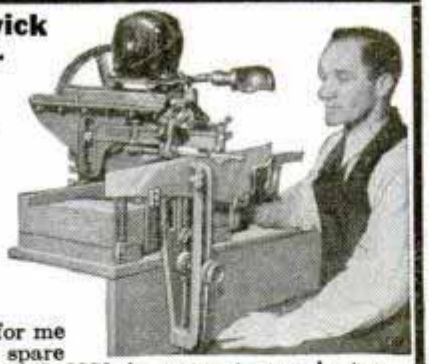

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174B Oakland Ave. Kansas City, Mo.

WITTE ENGINE WORKS

Super-Steam

(Continued from page 22)

pressure, the temperature of saturated steam is 567 degrees. But a big turbine at the Ford plant uses steam at 1,200 pounds pressure and its temperature is not 567 degrees but 900 degrees. Why? Because it's superheated in a pipe away from contact with the water—thereby increasing its energy more than twenty per cent because the hotter the steam, the more energy in it. And the steam is not only super-hot, but super-dry. So it forms no moisture until it leaves the turbine.

But here's something even more remarkable. One-thirtieth of a second—just the blink of an eye or the click of a camera—after that 900-degree steam enters the turbine, it emerges at the other end and then its temperature is no longer 900 degrees but only seventy-nine degrees—steam cooler than human blood, steam so cool it would not boil an egg.

And that's not all. This steam has not only decreased in temperature from 900 to seventy-nine degrees in one-thirtieth of a second, but it has expanded to 1,000 times its original volume. On its way through it left some of the nozzles with the speed of sound, thirteen miles a minute. And as it progressed, blowing against buckets of the various wheels, it changed direction many times as it shot from nozzle to bucket and from bucket to the next nozzle, but its general direction was parallel with the horizontal shaft on which the wheels are mounted.

If you were to bore a hole somewhere between the steam chest and the middle of a General Electric turbine, for example, hot steam would come out. But if you bored a hole between the middle of the turbine and the exhaust connection, air would rush in. In theory there is some point near the middle where a hole would neither emit steam nor allow air to enter because as the steam progresses through the turbine, it loses not only its temperature but its pressure, and about midway of its journey it reaches atmospheric pressure. When it leaves the turbine its pressure is about the same as that of the atmosphere fifteen or sixteen miles above the earth. The pressure of the steam as it enters corresponds to that in the ocean half a mile below the surface.

(Continued to page 138A)

10¢ A DAY
Buys Sensational NEW *Movie* CAMERA!

30-DAY TRIAL

WRITTEN GUARANTEE
If UniveX does not live up to your highest expectations, you can return it and we will refund your money without question or argument. One-year written guarantee bond *protects you!*

The most amazing movie camera value in the world—and yours for only 10c a day! The only one selling for less than $30... the only one using UniveX Cine Film costing only 60c a roll—that makes movies at less cost than snapshots! Sturdily built for a lifetime of enjoyment. Beautifully designed, finely-balanced, so compact it can easily be held in one hand. No complicated gadgets. Easy to operate. Sharp, clear, theatre-quality movies that screen up to 34"x 24". All you do is press a button!

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WRITE for free illustrated book, photos, complete details.

DEALERS Many have sold 40 to 60 the first few weeks. Get Spl. Offer!

THE CUSHMAN MOTOR WORKS, Dept. 59, Lincoln, Nebr.

(Continued from page 137A)

So you have steam expanding 1,000 times its original volume, steam changing in temperature from 900 to seventy-nine degrees, and steam dropping in pressure from 1,200 pounds to less than that atop the highest mountain—all in a tiny fraction of a second. What makes it act that way? Nothing at all, just a vacuum!

If you've watched a vacuum type coffee maker at work, you've seen the principle of a turbine. As the water in the appliance boils, pressure of the steam pushes the water up a tube and into the container holding the coffee.

Turn off the heat and the appliance cools, the steam in the lower container condenses and creates a partial vacuum. So the same steam which pushed the water up now sucks or pulls the coffee back down. While the vacuum in the lower container is sucking the coffee down, it functions like the condenser of a turbine.

This condenser creates a vacuum that reaches clear up into the turbine, decreasing the pressure and allowing the steam to expand. When the steam, expanded 1,000 times and at low pressure and low temperature, has struck the last bucket of the last wheel, giving up its last bit of energy, it is sucked into the condenser and travels at high speed between thousands of pipes through which cold water is pumped. The pipes cool the seventy-nine degree steam to below the boiling point for that pressure, the steam condenses and in so doing shrinks to one three-thousandth of its original volume and creates the vacuum to pull in more steam.

Thus the condenser provides the pull while the boilers give the push and we have the spectacle of ingenious man utilizing nothing at all—a vacuum—to double the power of the turbine and the electricity which its generator can make.

After the steam has shrunk to water, it falls to the bottom of the condenser and is pumped out, thus keeping the vacuum continuous. Since turbines need no oil inside—an advantage over old steam engines—the water and steam always stay clean, so the water pumped from the condenser can be warmed in a feed water heater and pumped back to the boiler.

And so this cycle continues endlessly in a turbine—the boilers turn the water into steam, the steam expands and pushes

(Continued to page 140A)

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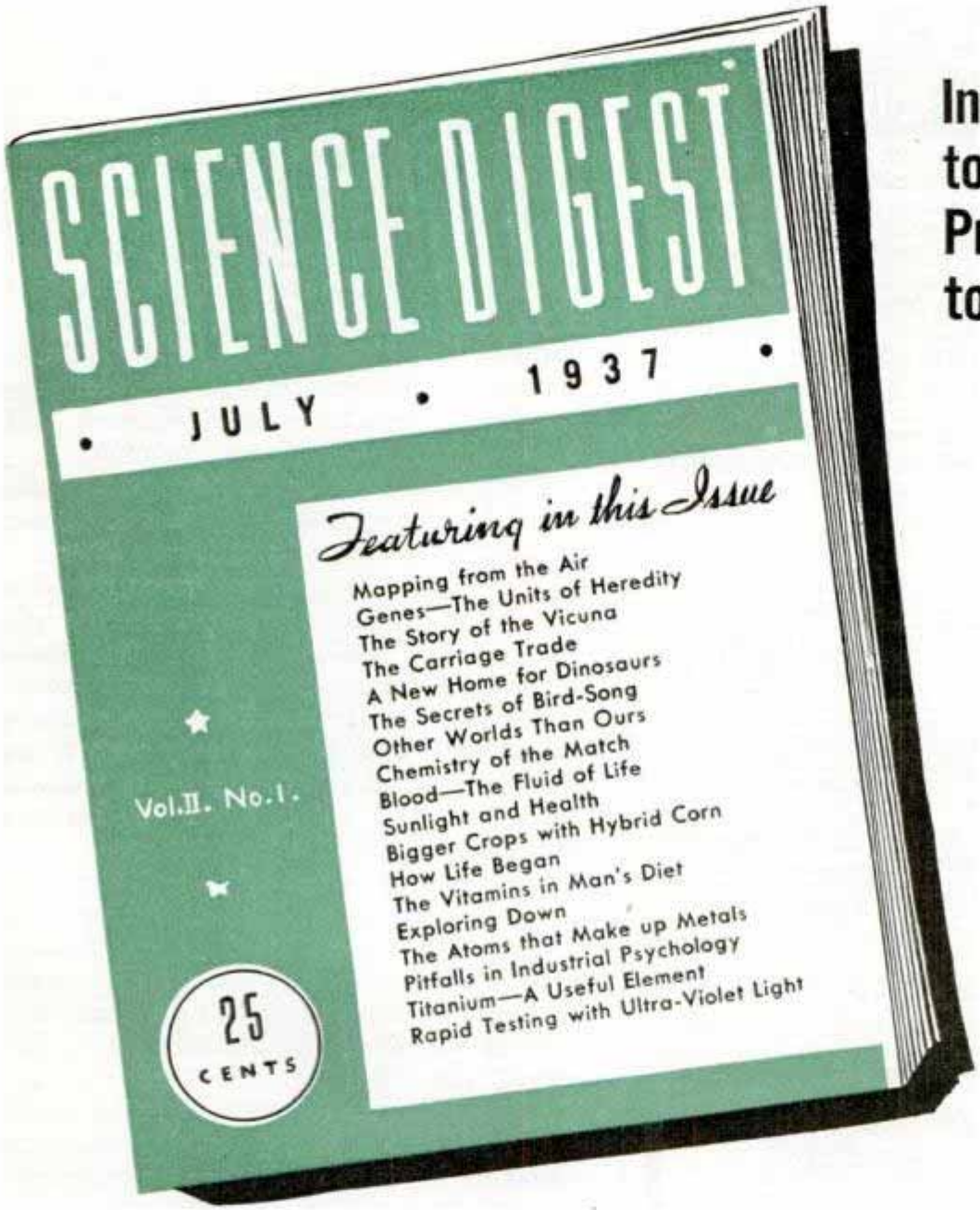

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AUTOMOBILES—SERVICE STATIONS...Locks—Door, Switch, Tire. Door Dovetails. Checks. Window Slides. Motor Oil. Cylinders—blow in plug holes or manifold. Gaskets. Springs, Hood, etc.
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FARMS...Locks. Planters. Coating Seeds. Gaskets. Packing. Pipe Threads. Machinery Pumps. Bearings. Gears. Chains. Field and Hand Tools. Motors—see Auto Uses, etc.

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YOUNGSTOWN STEEL CAR CORP.
DEPT. O NILES, OHIO

(Continued from page 138A)

round the wheels inside the turbine, then the steam is sucked into the condenser, turned back into water, heated and pumped back to the boiler and converted to steam again—round and round and round. And it comes out super-power!

One reason turbines have supplanted steam engines in big power plants is this high vacuum—about ninety-six per cent perfect or equal to the air pressure sixteen miles above the earth—which can be gotten into a turbine, allowing the steam to expand twenty times as much as in a compound condensing engine. It can expand to this volume because the exhaust connection between the turbine and condenser can be made so large—almost 1,000 square feet for the biggest turbines.

Through such a huge passage the cool steam is sucked down into the condenser at a speed of 200 miles an hour after expanding to 1,000 or more times its original volume. When engines were the best prime movers, it was a very fine compound condensing one that would permit steam to expand from three cubic feet to 180 cubic feet per pound—only sixty times. No steam engine could have a vacuum comparable to that of a turbine because the exhaust port of the engine would have to be larger than the cylinder itself. And without the high vacuum, the steam cannot expand enough. That's where the turbine has its great advantage. The steam continues to expand and to do work until it pushes against the buckets of the last wheel. And that last wheel takes a very large installment of energy from the steam.

It took brains to figure out that steam could be made to do twice as much work by making it pull as well as push, by superheating it, by utilizing a vacuum, by varying the pressure and the temperature. And it took brains too, to build a turbine to withstand the terrific punishment necessary for its most efficient performance.

A turbine shell must not only withstand pressures of from 800 to 1,200 pounds per square inch, but it must run almost red-hot, withstanding steam temperatures of from 750 to 900 degrees Fahrenheit, hot enough to melt solder, tin, zinc, lead and even tellurium. Superheated steam is queer stuff and building turbines to harness it has been an outstanding engineering achievement of this century.

(Concluded next month)

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TURN TREES INTO MONEY WITH A BELSAW

FARM MODEL $49.00

Three capacities: 10, 14 and 20 ft. Accurate set works positive dogs. Full or one way type power feed runs on low power—Many owners use old auto engine. *Pays for itself quickly*—thousands in commercial service, everywhere. *Write for free* lumber *handbook* and *catalog* of mills, supplies, tools, saw tables, and woodworking equipment.

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Astounding performance! Cuts up to 1" or more, with smooth, clean edges. No sanding required. Accurate, sturdy, efficient—a revelation to skilled craftsmen in handling both intricate designs and heavy work. Ideal for cutting light metals, veneers and plastics. Operates on 60 cycle, 110 volt AC, without motor or any reciprocating parts. Requires no oiling. 10" square table; 13½" throat; adjustable guide; variable stroke. Complete with underwriters approved cable and rubber plug. Built for years of continuous service.

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Magneto Model SM $71.50 | Batt. Ign. Model SB $64.50 | All-Electric Outboard $36.50

All Prices F. O. B. South Bend *(less batteries)*

FAST FIRING!

Sensational new magneto delivers hottest spark ever known to outboard motoring—even at low cranking speed! Rugged! Permanent magnet life.

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ECLIPSE
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THE HANDIEST POCKET KNIFE EVER DESIGNED!

● Once you've used it, the Christy Sport knife will have as warm a place in your heart as your favorite fishing rod . . . Neat, handy, useful, and durable . . . Brass frame, heavily chromium plated. Blade of finest razor steel.

Smart . . . Practical

Graceful design, light weight; fine enough to wear on your silver, gold or platinum chain . . . sturdy enough to stand up under the use to which you put a knife.

Three blades in one

Instantly opened or closed with one hand. No broken finger-nails. Blade locks easily in any one of three lengths. . . . really three blades in one.

GUARANTEED TO PLEASE

Sent postpaid on receipt of $1.00. Please use coupon below. Satisfaction guaranteed.

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NOTE—Those ordering knife from this ad may get a famous Christy "Light-as-a-Feather" Razor and 26 Blades by adding $1.*

THE CHRISTY CO., Fremont, Ohio. PM-7

Enclosed is $1.00, for which please send me a Christy Sport Knife. If I am not entirely satisfied with the knife, I may return it and my $1.00 will be refunded. (Ohio orders add 3c for sales tax.)

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News Bulletins by Television

(Continued from page 97)

photocell, the output of which is fed to an amplifier in the top of the rack. A compartment in the lower part of the rack holds a sufficiently large loop of tape so that the instrument will continue to transmit during the absence of the operator for as much as a half hour. The reel on the right side of the cabinet takes up the typed tape as it is run through the transmitter at the rate of about 5 ft. a minute, with 300 letters being shown in that period. Fig. 3 shows a closer view of the electric typewriter.

A receiver as installed for a demonstration at a hotel in Quebec, Canada, appears in Fig. 2. The cabinet at the bottom houses all the receiving, amplifying and scanning apparatus; the screen, mounted in a shadow box, is supported above on metal rods about 6 ft. long. A mechanical scanner is used, with reflecting lenses, and an automobile headlight bulb is employed as a light source. This light bulb, and the light modulator tube, are mounted on top of the lower cabinet.

Radio Symbols for Beginners

(Continued from page 101)

system and tube symbols are both employed, with underside views of the actual socket connections. The following tube-terminal abbreviations are used in common practice: F—filament; H—heater; P—plate; K—cathode; G—control grid; Gs or Scr.—screen grid; Sup.—suppressor grid; Ga—anode grid; Go—oscillator grid; Gm—modulator grid; Dp—diode plate; Nc—no connection; Xs—external shield; S—metal-tube shield.

G-type tubes are "octal-base" (8-prong) glass-bulb types; they are identified by the letter "G" following the type number. Most of these tubes have corresponding metal types. Some of them have an internal shield which is brought out to pin No. 1. Socket connections for such types designate pin No. 1 as "Shield." For G-types without shield connections, pin No. 1 is marked Nc.

It is a good idea for the beginner to redraw schematic diagrams for practice, using the proper symbols. This will enable you to trace out circuits in apparatus for which no diagrams are available.

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INVENTORS Be Sure to See Page 23A

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GERSTNER TOOL CHESTS
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IN BUILDING INDUSTRY—with machine and process producing permanent construction with savings of 1/3 labor, 1/2 mortar, and 1/3 material costs — ashlar, hollow, veneer or solid walls — plain or 40 colors.

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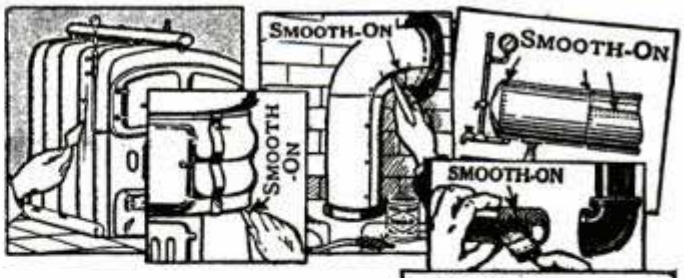

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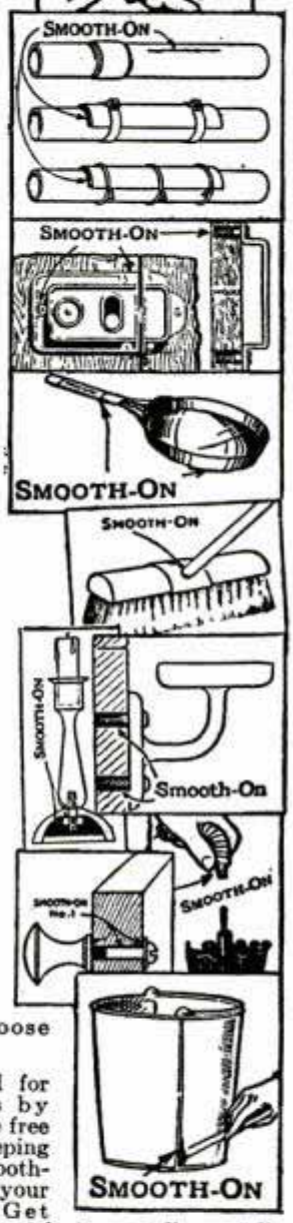

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Do it with SMOOTH-ON

The New Age of Wood

(Continued from page 93)

known. It consists of treating cellulose extractive with nitric acid. Highly nitrated products such as gun cotton are explosive. Lower nitrates, rendered plastic with camphor or furfural, form the com-

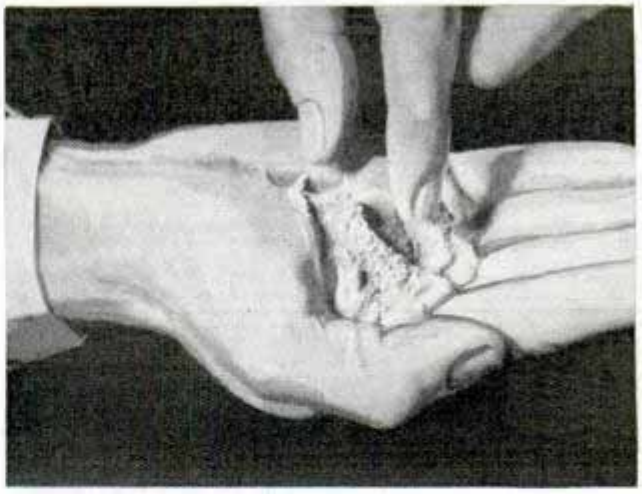
Floor, door and drawer knobs and other fixtures in this home are lignin plastics

mon celluloid products and the basis of nitrocellulose lacquers and varnishes. Artificial leathers, carpet and rug materials, inner soles for shoes, hospital and surgical absorbents are among other products made from the cellulose portion of wood.

The growing understanding of the hemicelluloses offers man a key to another of nature's great storehouses of sugar. Wood is a sweet substance and sugar is a very logical recovery from wood pulps and plastics. If our sugar imports should be cut off entirely, American lumber industries might very probably open commercial manufacture of wood sugars and sirup. At present, however, most recovery of wood sugar can best be fermented and converted to alcohol. Recovery of wood alcohol, which now includes ethyl or drinking alcohol as well as methol or the common industrial alcohol, also allows profitable recovery of acetic acid from the hemicellulose wood factors which separate true cellulose from lignin. Cooked in sulphuric acid this portion of the wood can be converted to sirups with qualities closely similar to those of common corn sirups. Treated with partial hydrolysis, sawdust becomes a possible source of feed for cows and horses, with a nutritive value similar to that of ordinary hays.

Natural extractives in woods include such common materials as tannin, used in leather manufacture; waxes, resins, sap products, such as maple sirup and storax or sweet gum, and two great products which now have an extremely important place in the tobacco industries—maple for curing cigarette and plug tobaccos, storax as the adhesive for plug tobacco. Bark, usually a complete waste in lumber processing, is now becoming a commercial source for certain natural dyes and pharmaceuticals. Inner barks of various trees contain poison as a native protection against fungi and borers.

Freeing wood of the structural faults of swelling, shrinking and decay is another project on which experts have been working. Wood is a highly porous material, and if its capillaries can be closed to moisture the problems of swelling, shrinking and decay are solved. The technique is to treat the wood with a substance which has



Courtesy U. S. Forest Products Laboratory

This is how raw lignin powder looks before being placed in the mold

natural affinity for water, and after the substance has been absorbed by the wood to cause conversion to resin which forms a water-resistant coating inside the wood. The process is already in use for preparing wood used in golf clubs, shoe lasts, electrical insulators and battery boxes.

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ELECTRIC LANTERN

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2 lights on a double action switch. 800 ft. spot beam from the front reflector; broad floodlight from top. Handle reverses. Unbreakable lens. 6½ inches high. At sport, hardware, electrical dealers or write

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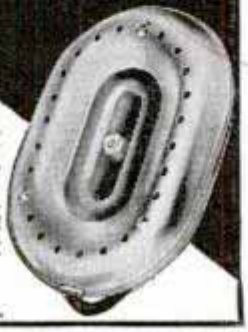

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TUFTED AIR CELLS

K & W RUBBER CORP., Delaware, Ohio
Dept. PM-78

Little Giant "Pup" Receiver

(Continued from page 99)

cabinet provided with a speaker grille.

Hook-up wire with push-back insulation is employed for wiring the circuit; use rosin-core solder, and wherever ground connections to the metal base are indicated, solder the connection directly on the base. Where soldering lugs are

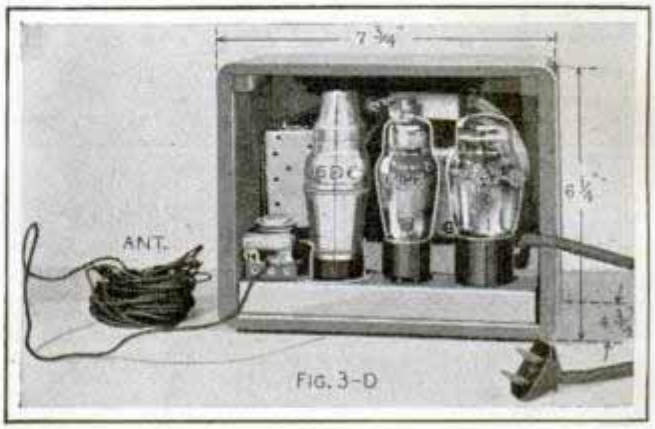

FIG. 3-D

used under mounting screws, solder the nut to the base. A detailed list of the original materials used in this set may be obtained from Popular Mechanics radio department, without charge. The blueprint number is R-240.

To balance the receiver, connect a flexible 20-ft. cloth-covered antenna permanently to the lug indicated on the fiber terminal strip and plug in the supply line

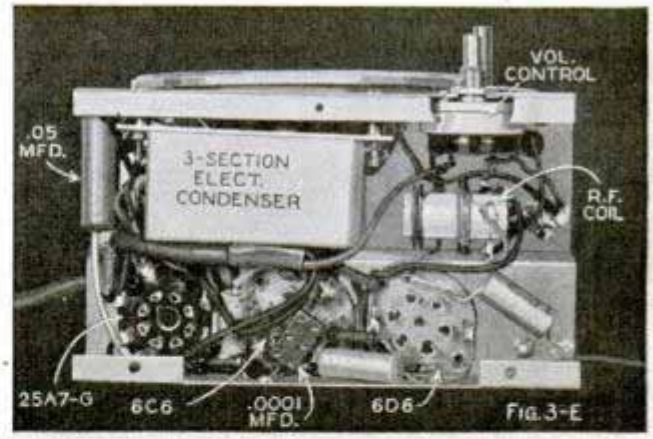

FIG. 3-E

cord. If the line is d.c., it may be necessary to reverse the plug in the wall socket; allow time for the tubes to heat and then tune in a fairly weak station. Now vary trimmer (Tr) on top of the rear (C_1) section of the 2-gang condenser with a small screwdriver for loudest signal and the set is ready for use. The antenna may be thrown over a door casing or placed behind picture molding; no external ground is used.

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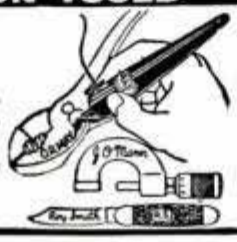

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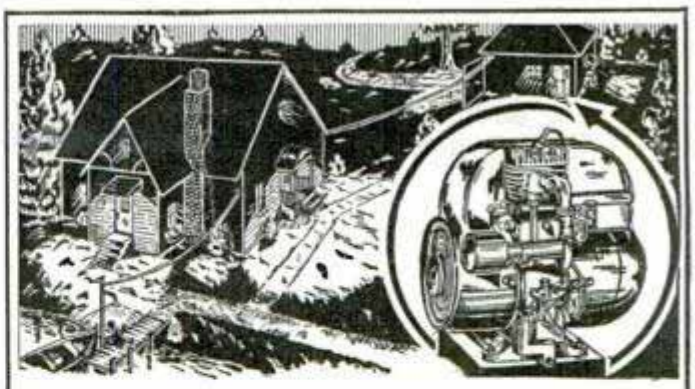

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PROVIDENCE, RHODE ISLAND

WRITE TODAY for Special OUTFIT OFFER

It's America Against the World

(Continued from page 30)

last fall, averaged less than sixty-six miles an hour for the 300 miles. The man who wins this year probably will have an average around ninety.

The rules, surprisingly free of "don'ts" last year, have been made even broader. Compulsory pit stops have been eliminated, maximum piston displacement has been changed from 366 to 396.63 cubic inches, wheel tread width restrictions have been removed and riding mechanics will be prohibited. There never have been restrictions on such things as weight, wheel base, supercharging, type of fuel or size of fuel tanks. So it's virtually a free-for-all, permitting the designer the widest latitude.

If history keeps on repeating itself, as it has started, America won't win this year, or even next. It was not until the fourth race for the original Vanderbilt cup that an American won. That was in 1908—there was no race in 1907—and the winner was George Robertson, now Major George H. Robertson, vice-president and general manager of Roosevelt Raceway. That contest was a racing classic.

Robertson drove a four-cylinder Locomobile and terrified competitors by donning metal goggles—pieces of metal with slits to peer through—which made him appear to be driving blindfolded. The country roads of Long Island had been sprinkled with oil to lay the dust. The night before the race it rained and the water and oil made this course as slick as grease in places. Robertson did not start very auspiciously. At the end of the first lap his radiator was steaming and he stopped for water. His handlers had gasoline in red cans, water in white and oil in blue—a system Robertson fondly believed was foolproof until he saw a fellow pouring something from a red can into his radiator. Then he wasted precious minutes threatening to run down the entire pit crew the next time around.

After that, things went better. At the half-way point Robertson was being pushed by Lytle, another American, but wasn't worrying until he hit the Motor Parkway about the time Lytle hit the Jericho Turnpike. These were the only two decent stretches of road in the whole

(Continued to page 150A)

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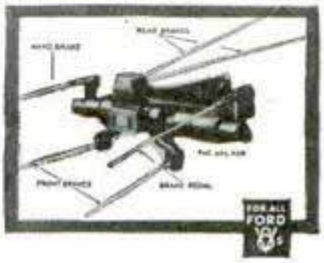

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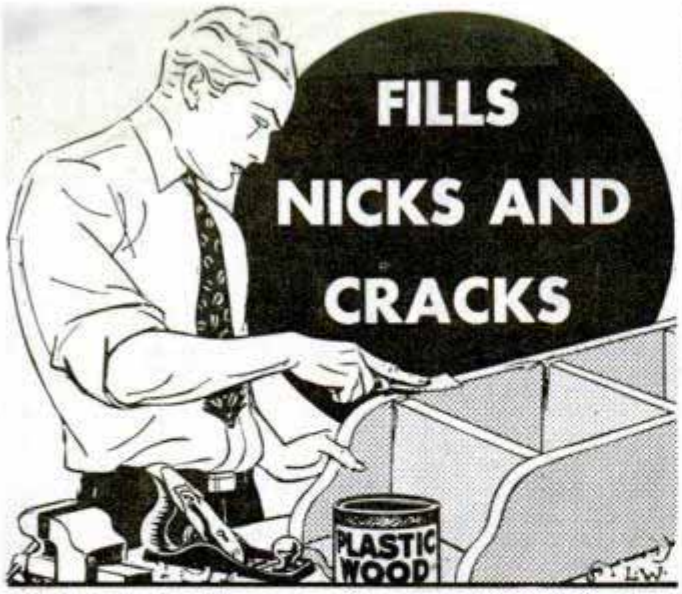

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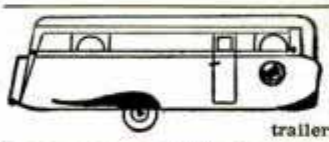

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Name.....

Address.....

(Continued from page 148A)

course so Lytle started to burn up the Turnpike and Robertson opened 'er up on the Parkway. Ahead of Robertson ambled Salzman in a Thomas—right in the middle of the ten-foot road.

Salzman's mechanic was supposed to watch for approaching cars but he didn't look back so Robertson began to shout. Then his mechanic shouted and waved his arms. Salzman remained serenely in the middle. Finally Robertson had an inspiration.

"Hand me that extra tire wrench," he shouted to his mechanic. The astonished man obeyed. Robertson half rose in his seat and the wrench swished through the air, straight at the driver in front. Just then Salzman's mechanic looked back. He yelled a warning, Salzman swerved, the wrench bounced off his left rear wheel and Robertson roared past.

It was still nip and tuck as the leaders neared the last lap. Then Robertson blew one of those tires guaranteed for 1,500 miles. The previous race would have meant a delay of half an hour, but demountable rims had come out and Robertson was using them. He and his mechanic made the tire change in about two minutes, then set out to make up the lost time. Spectators gathered on the course each time a car passed, unmindful of other cars thundering along in their wake. That last lap Robertson literally drove through the crowds in the road. And he not only won but set a new record with an average of 64.38 miles an hour—only about a mile slower than last year's winner!

Robertson modestly admits there probably will never be another race just like that one.

"That's one point where history won't repeat itself," he declares firmly. "No modern speed demon is ever going to clear a path to victory on Roosevelt Raceway with a tire wrench. There aren't many restrictions in road racing, and we don't demand Chesterfieldian manners of our drivers, but tire wrenches as calling cards are definitely out."

¶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.

More Miles in New "Gas"

(Continued from page 3)

two. In premium motor fuels the octane number is raised to seventy-eight or eighty by the addition of small amounts of tetraethyl lead, a compound that helps gasoline undergo orderly combustion instead of exploding.

In the cracking process waste gases of exceptionally high antiknock value are released. The latest discovery is that these gases can be transformed into liquid fuel that also resists detonation. The petroleum engineer takes "unsaturated" gases from these waste gases and recombines the molecules by applying heat and pressure. This polymerization process takes place in vertical electrically heated towers. The heat forces the hydrocarbon molecules apart, while the pressure reassembles them into liquid units.

Today iso-octane is manufactured by extracting isobutene gas from the waste gases and polymerizing it into di-isobutene. By a hydrogenation process hydrogen is added to the di-isobutene, converting it into iso-octane. By a somewhat similar process propylene, another hydrocarbon waste gas, is changed into isopropyl ether, a liquid that has an even higher antiknock value than iso-octane. These polymer fuels, also, are of extremely uniform composition. That feature permits better and more even combustion.

Fuels such as iso-octane and isopropyl ether are far too expensive to be poured directly into gasoline tanks. The best way to use them is in a blend to bring up the octane number of gasoline that is less antiknock. For some strange reason a small amount of 100-octane liquid blended with lower-grade gasoline raises the octane number of the mixture higher than could be expected from the arithmetical proportion. Most 100-octane fuels used by airplanes today consist of almost equal proportions of aviation gasoline and iso-octane or isopropyl ether, to which small amounts of tetraethyl lead are added.

It is estimated that 300 billion cubic feet of waste gases are created by petroleum cracking plants in the United States every year. From this gas more than one billion gallons of 100-octane gasoline can be created by polymerization and blend-

(Continued to page 154A)

Everything you need to take and show clear theatre-quality movies at less cost than snapshots.

UniveX Cine "8" Camera	$9.95
UniveX 8 mm. Projector	14.95
Eveready Case for Camera	2.00
30′ Roll of UniveX Cine Film	60c

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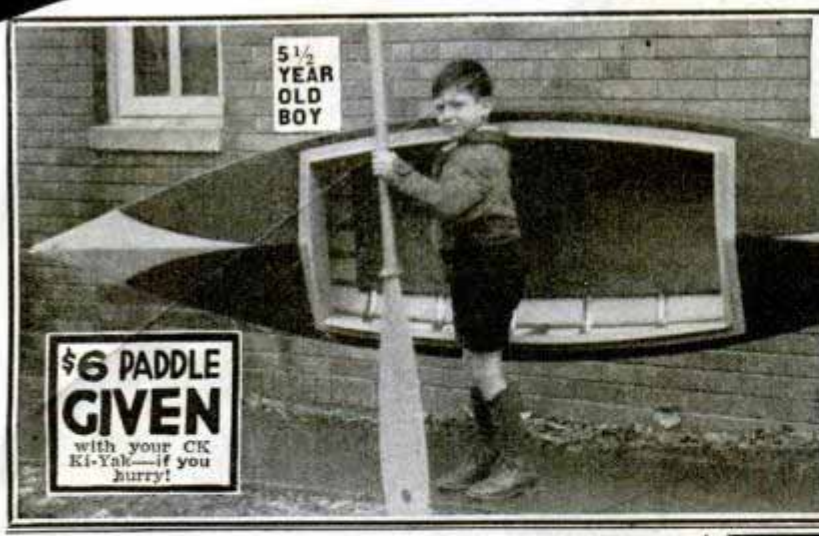
CINE "8" UniveX



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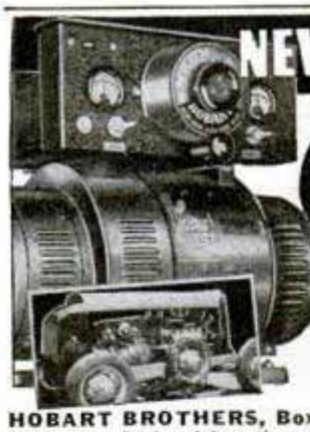

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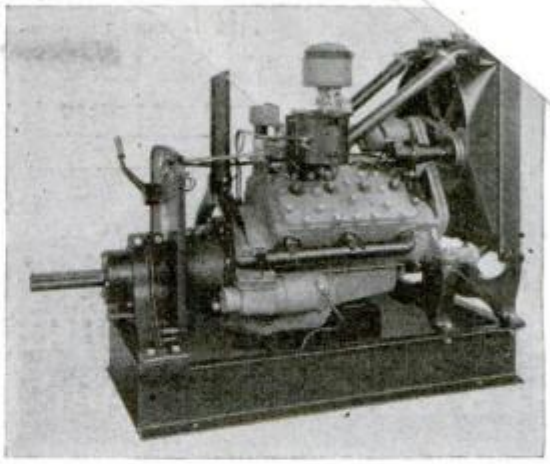

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We Spent $68,000 to Produce an Ink That Works Equally Well in Steel or Fountain Pens

When scientists tested The Parker Pen Company's new $68,000 ink creation—Parker PERMANENT Quink, in Royal Blue, Blue-Black and Black—they found it to equal or surpass the 8 U. S. Gov't. Specifications shown above. Makes office accounts, records, documents, etc., as PERMANENT as paper. PERMANENT Quink flows at exactly your writing speed in steel or fountain pens—is anti-deposit forming, 24 times better than Gov't. Standard, and 56% more anti-corrosive. Also Parker Quink does this:

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Send for Complete Details.

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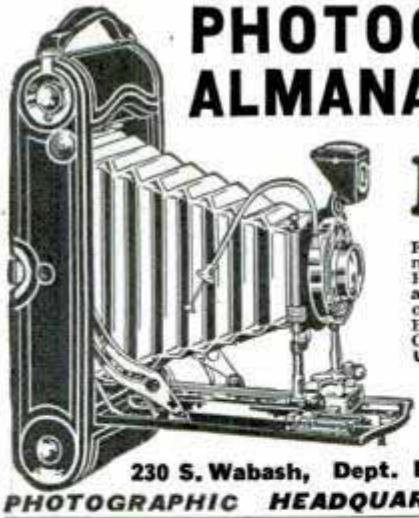
(Continued from page 151A)

ing. This amounts to about one-seventh of the total annual consumption of gasoline. However, upon demand research is expected to considerably increase this proportion. Refiners may eventually be able to crack and then polymerize the paraffin gases that are wasted even in the present polymerization process.

Automobile engines designed for the new fuel are still a number of years off, of course, because for a while aviation needs will about account for the whole supply. Progress in design will be evolutionary and will keep step with the increasingly antiknock gasolines that refiners will be able to deliver as their facilities increase. High compression ratios and moderate supercharging will be the two main changes from present types of engines, growths that already have occurred in aviation engine design. Already, however, a few truck operators are supercharging their engines and are using the highest premium antiknock fuels to obtain greater operating economy. One 125-horsepower truck engine that moves twenty-one tons was stepped up to 160 horsepower simply by shifting from seventy-octane gasoline to eighty-octane fuel and by using a variable speed supercharger. This allowed the truck driver to pull hills in higher gears than before, resulting in less time and less fuel per trip. Variable speed superchargers in their present stage of development have to be regulated by hand according to the desires of the driver. For pleasure-car driving supercharger speeds will have to be regulated automatically, possibly by a barometric control that will supply more or less pressure as it is needed.

Just like the automotive industry, rocket experimenters are searching for perfect fuels. The possibilities of 100-octane gasoline for rocket propulsion are being studied, although some rocket men think that a fast-exploding fuel rather than a comparatively slow-burning fuel will prove to be the best. For real efficiency, they think, the fuel should burn so fast that combustion is completed in the combustion chamber. Fuel that leaves the combustion chamber while still burning is not able to transfer as much of its heat energy into kinetic energy of flow.

Tomorrow may bring super-power fuels superior to even 100-octane gas.



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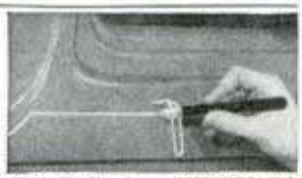

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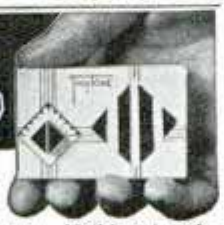

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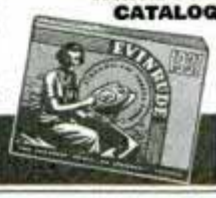

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ONLY 10c Full of beautiful things easily made—14 pages of lumber—hard to find foreign woods—lovely crotch, butt, burl, fiddle back, etc. Veneers, panels and Solid Woods—Hard to find Hardware. Lists and illustrates 76 Blue Print Designs for Scroll Patterns, Inlay Table Tops, etc.

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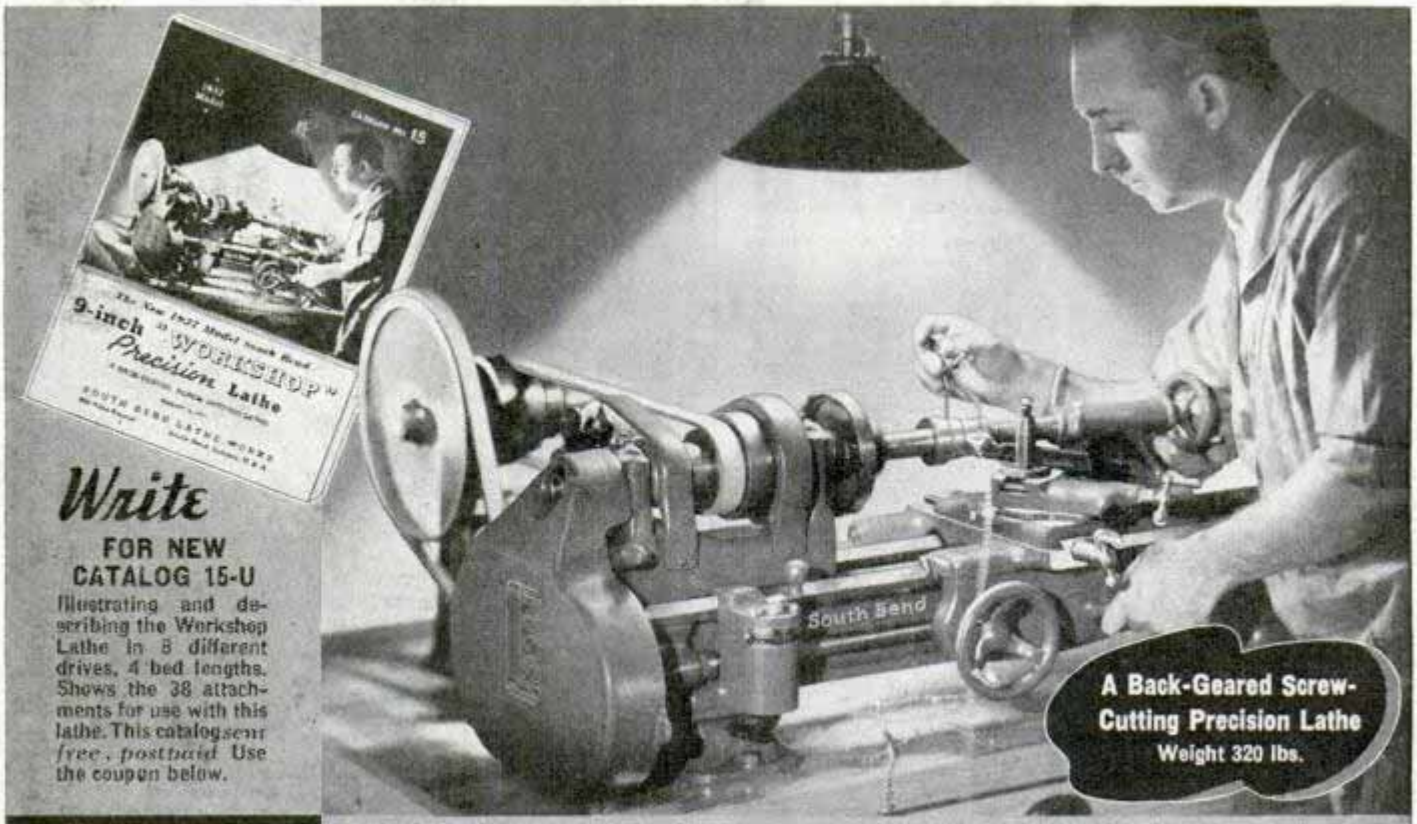

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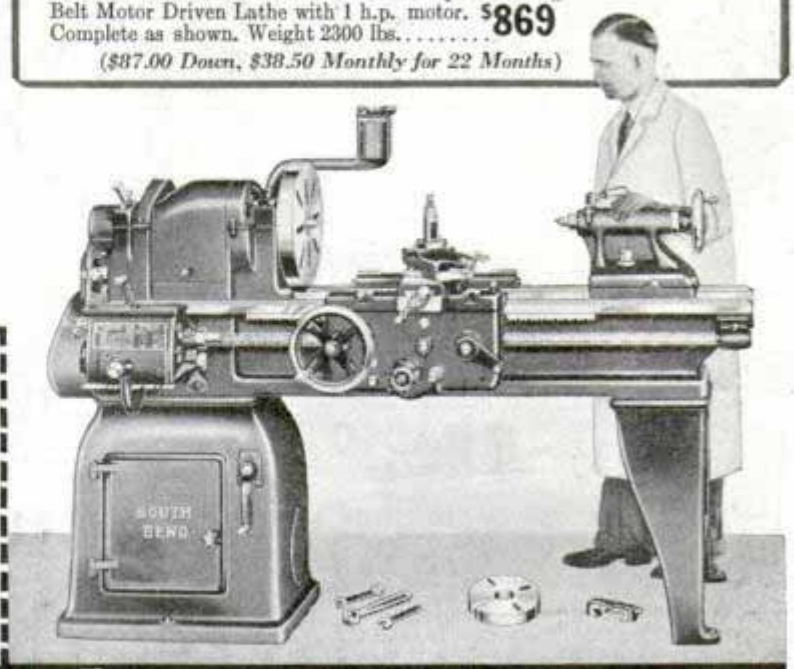

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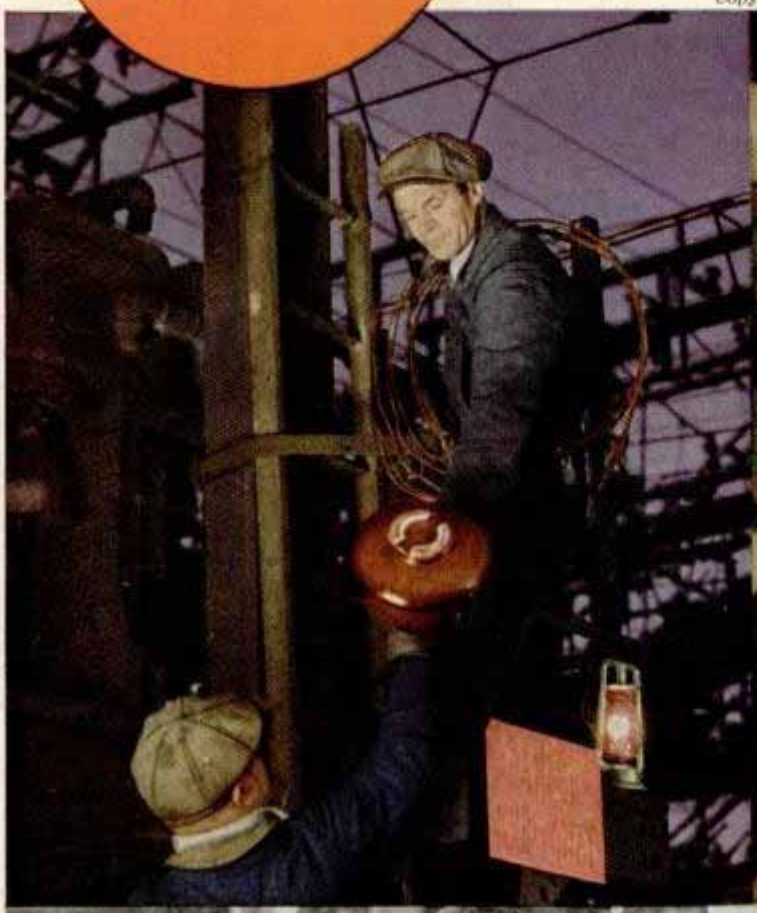

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