CHEMISTRY AND YOU

POPULAR MECHANICS MAGAZINE

WRITTEN SO YOU CAN UNDERSTAND IT

DEC.
25 CENTS

SEE PAGE 823

News of Plymouth's Great New 1938 Car

IT'S AN EXCITING CAR TO SEE...TO DRIVE...NEW RICHNESS OUTSIDE AND INSIDE...NEW COMFORTS AND DRIVING EASE...MORE VISION...AMAZING VALUE!

PLYMOUTH'S STORY

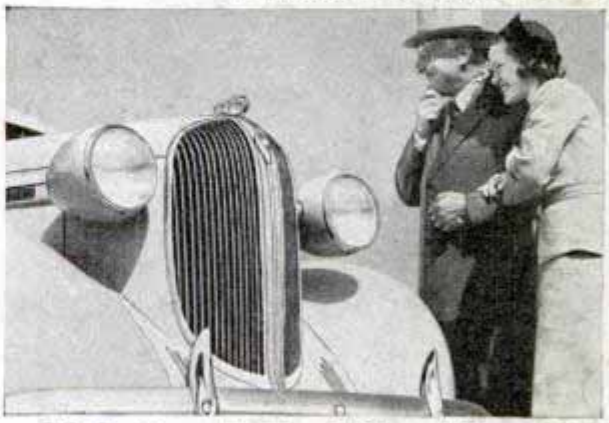
The new 1938 Plymouth celebrates the most amazing record in history!

10 years ago, people first saw Plymouth. And they bought by the *thousands!*

No car has ever made friends *so fast!*

Now, the 10th-year Plymouth is here... the greatest car we've built. See it!

COSTS AMAZINGLY LITTLE TO OWN. The Commercial Credit Company offers very easy payment terms on a new Plymouth—through Dodge, De Soto and Chrysler dealers. Tune in Major Bowes' Amateur Hour, Columbia Network, Thursdays, 9 to 10 p. m., E.S.T.

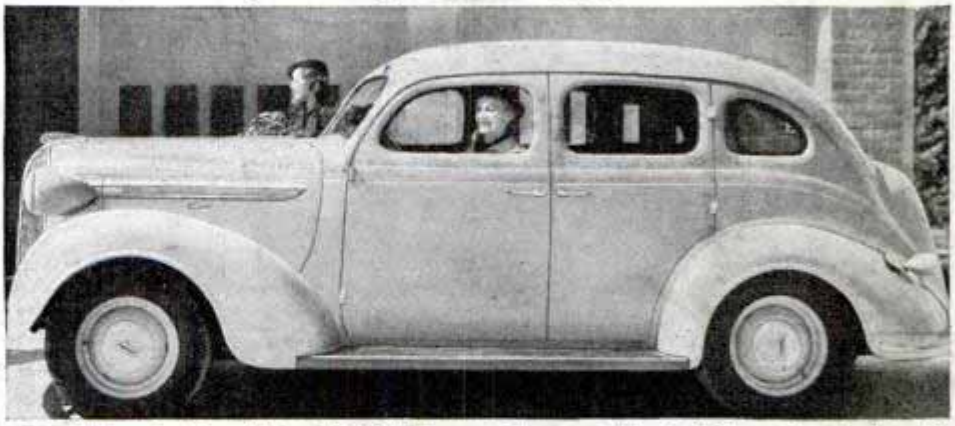


1 **Step Up** and look at this beautiful new 1938 Plymouth! See that long hood — bigger headlights—entire car is more distinctive.

2 **Stretch Out!** Enjoy the greater elbow room, head room and leg room. The whole car "floats" on Amola steel springs, with airplane-type shock-absorbers and rubber body mountings.

3 **Inside this Trunk** is *extra* baggage space . . . there's no sill to lift the luggage over. Just slide it in.

4 **New Dials** are easier to read, and the hand-brake is out of the floor, easy to reach!



5 **Here's the New 1938 Plymouth . . .** with *double-action* hydraulic brakes, *all-steel* body, *record* economy—*"the car that stands up best!"* PLYMOUTH DIVISION OF CHRYSLER CORPORATION, Detroit, Mich.

PLYMOUTH BUILDS GREAT CARS

See the 1938 Plymouth

This One


WINGS
FOR
WORDS
Reach for your telephone. The world is at your finger tips. Sixty-seven million times a day some one talks to some one over a Bell telephone. It's a national habit . . . and the Bell System a national institution.
BELL TELEPHONE SYSTEM

Popular Mechanics Magazine

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

December, 1937 Vol. 68, No. 6

Special Features

(Continued on next page)

Scientists of the Air

IF YOU seek the ultimate in thrills, take a power dive with a test pilot putting a fighting plane through its paces. Four miles up he gives it the gun and you rocket toward the earth at 500 miles an hour. Try to jump out now and you'll fall up. To slow down, the pilot opens his throttle still wider—another result of your speed. Then, for the pull-out, you loose a tremendous shout to constrict your stomach for the strain and your body begins to prickle. Right now your weight is more than half a ton. While you "enjoyed" the ride, the test pilot was jotting down the readings of flickering instrument needles and as you stagger away half-conscious he calmly hands in a record showing what that particular ship will do. You'll find the test pilot article in the January issue.

Next Month

THE textile industry has literally been made over with the aid of chemistry. So has the rubber industry. After reading the first of four articles by Dr. C. M. A. Stine in this issue, you will agree with us that chemistry is a fascinating subject when it is interpreted "so you can understand it." In January Dr. Stine discusses textiles and rubber, and this article also is illustrated with eight pages of Coloroto pictures.

"One—Two—Bob"

PERHAPS you prefer your thrills on the ground instead of riding with a test pilot. If so, may we recommend a bobsled ride down the mountain run at Lake Placid. It is a most exhilarating form of rapid transit because the proximity of the earth and the blurry scenery intensify the sense of speed. An article next month takes you through every turn on this run and we guarantee you'll have the ride of a lifetime.

Speaking of Movies

SPEAKING of movies—home movies—an article next month tells you how not to make them. There are several ways to ruin an otherwise good reel of parlor movies, and once you know what not to do, you'll discover that you are shooting real moving pictures and not a lot of animated snapshots.

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(Contents—Continued)

(Continued to page 6A)


Half & Half Makes One Swell Gift!
Christmas Greetings
HALF AND HALF
SMOKING TOBACCO
It's a present with a future—makes every day a holiday for the pipe-smoker. Cool as his thought of those gadgets he'll get. Smooth as his grin at a pound tin instead! Fragrant, friendly, full-bodied tobacco that won't bite the tongue—in a tin that won't bite the fingers. Made by our exclusive modern process including patent No. 1,770,920. Cool and smooth. Smells good. Makes his pipe welcome anywhere. Tastes good. His password to pleasure—your buy-word for smokers!
Copyright 1937, The American Tobacco Company
HALF AND HALF
The Safe Pipe-Tobacco
FOR PIPE OR CIGARETTE

(Contents—Continued)

TOOLS

MISCELLANEOUS

Craftsman and Shop Notes

AUTOMOTIVE

ELECTRICAL

FARMS

FURNITURE

HAND TOOLS

HOME IMPROVEMENTS

HOUSEHOLD

(Continued to page 8A)

When jobs are looking for men —thats news!

. . . . . NOW IS THE TIME! . . . . . .

RIGHT now, in many lines there is a search for really *good* men—managers, leaders—men who can take charge of departments, businesses, branch offices, and set things humming.

As always, there are not enough ordinary jobs to go 'round—but rarely before in the history of American business, has there been so much room at the *top!* New jobs are being created by the business pick-up in almost all lines.

Ordinarily, there would be plenty of men to fill these jobs—men in junior positions who have been studying in spare time. But most men have been letting their training slide during these dark years of depression . . . "What's the use?"—You have heard them say. Perhaps there has been some excuse for sticking to any old kind of a job one could get the past few years—but the door is wide open for the man with ambition *NOW!*

And don't let anyone tell you that "Opportunity Only Knocks Once"—that's one of the most untruthful sayings ever circulated. Opportunities flourish for *every* American every day of his life.

Far more to the point is to be ready—be *prepared*—to make yourself *interesting* to the big-time employer—and, LaSalle offers you a short-cut method of qualifying for opportunity jobs in accounting, law, traffic, executive management, and kindred occupations.

LaSalle Extension is 29 years old—nearly 40,000 students enroll annually—60 American firms each employ 500 or more LaSalle-trained men—surveys show that LaSalle students attain 40% average salary increase after graduation—nearly 10% of all C. P. A.'s in the U. S. A. are LaSalle alumni—in two states over 60% of the C. P. A.'s are LaSalle-trained men.

Why not find out what LaSalle has done and is doing for men in *your* position? Send and get the facts; see what LaSalle can do for you, personally!

There's no question about it—business is picking up—jobs are looking for *trained men*—the time has come for you to *qualify* for prosperity. Mail this coupon today!

LaSalle Extension University, Dept. 1264-R, Chicago.

Kindly send me your free booklet on the business field I have checked—and tell me how your training in that field can help me.

☐ Business Management ☐ Business Correspondence ☐ Salesmanship ☐ Law ☐ Commercial Law
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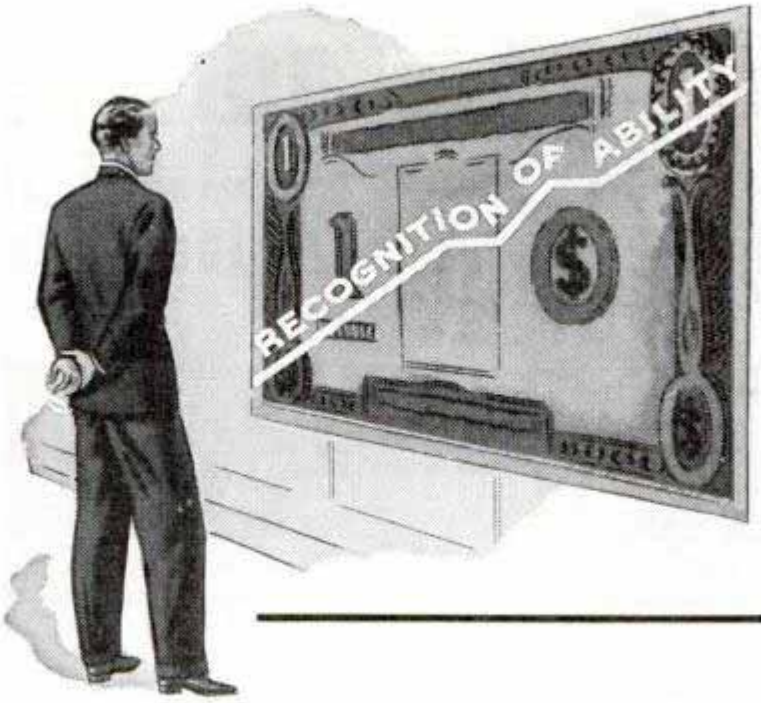
Name..... Position.....

Address.....

LASALLE EXTENSION UNIVERSITY

(Contents—Continued)



Money is MORE than pay

• "He's a twenty-dollar-a-week man" means far more than the actual cash a man receives in his pay envelope. It indicates the type of man he is. It indicates at least one thing beyond doubt—his training is limited. And thousands of men, tired of being twenty . . . thirty . . . forty . . . fifty-dollar-a-week men, have removed this limitation of training by mastering International Correspondence Schools Courses. When you complete an I. C. S. Course, you are a trained man! And you can do it in spare time. The coupon will bring you complete information.

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☐ Welding, Electric and Gas
☐ Reading Shop Blueprints
☐ Heat Treatment of Metals
☐ Sheet Metal Worker
☐ Boilermaker
☐ Telegraph Engineer
☐ Telephone Work ☐ Radio
☐ Mechanical Engineering
☐ Mechanical Draftsman
☐ Machinist ☐ Toolmaker
☐ Patternmaker
☐ Diesel Engines
☐ Aviation Engines
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☐ Railway Mail Clerk
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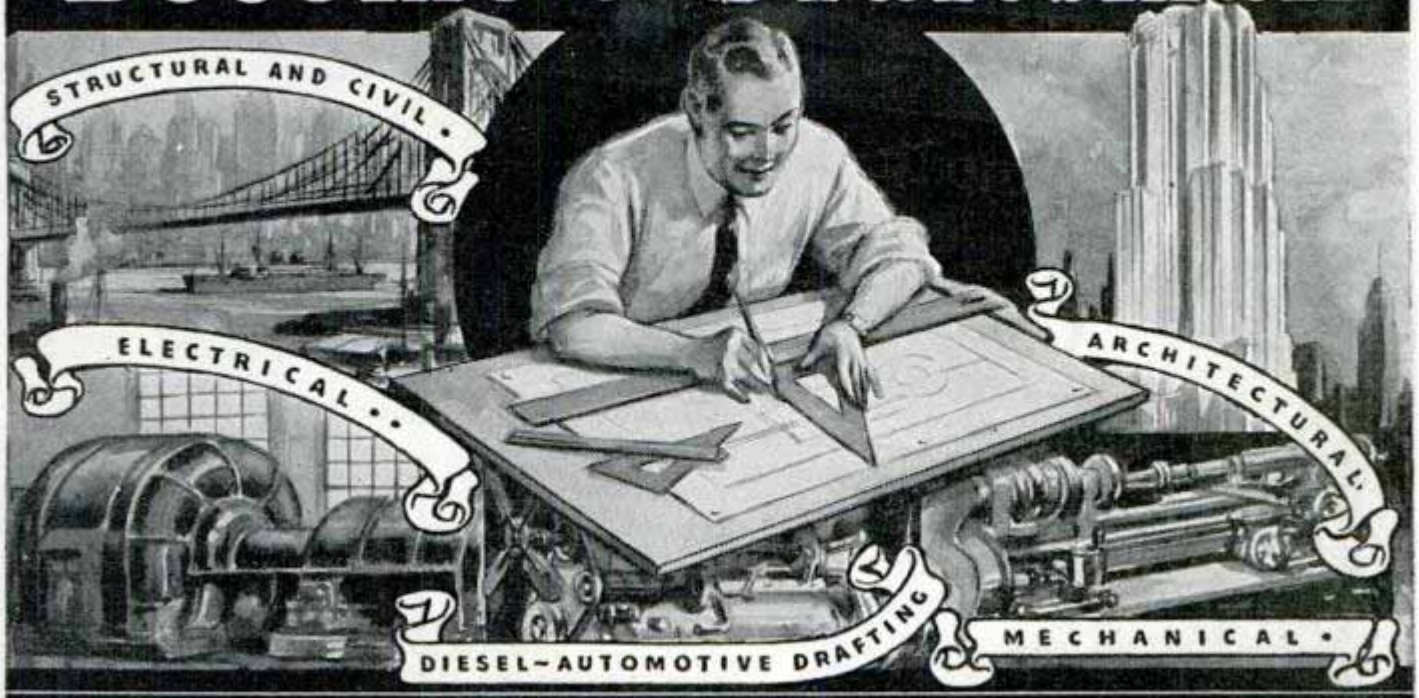
City.....*State*.....*Present Position*.....

If you reside in Canada, send this coupon to the International Correspondence Schools Canadian, Limited, Montreal, Canada

Become a Draftsman



Enjoy a Real Job in Industry

Steady Work

As nearly all manufacturing—construction—building starts on the drafting table, the draftsman is one of the first to be hired and one of the last to be laid off. It is his blueprints, his specifications, that give the last word in what the workmen are to do. No article—building or construction job is started before the plans drawn by the draftsman have been officially approved.

Good Pay

The draftsman has been called the Junior Engineer which title just about describes his work—position and pay. He combines his knowledge of principles, mechanism and construction details with the ability to draw and reproduce motions and methods on paper. On the average, his salary is considerably above the wages of the mechanic and, of course, less than that of the engineer.

Chance for Promotion

Working on plans, helping design new machines or new methods of construction, the draftsman is working directly with the important men of the organization. Consequently he knows what is being considered and planned. It may be the superintendent—the engineer—or even the prospective buyer with whom he consults. Because of these contacts, his experience and knowledge of the business in general he is in an excellent position to be promoted when next there is a good opening.

Young at 40

Athletes—farmers—and factory and shop workers who rely on muscle start growing old even before they reach 40 while office workers—executives—teachers—professional men, in fact, all kinds of brain-workers are just approaching their prime at 40 to 50. Training increases your value at once and continues to help boost your earning power as you mature and as you increase your experience and background for forming judgments of the firm's policies and methods.

Don't grow old at 40. Train now for the job you want at 50. Training helps you to be independent—self-supporting. It helps you to enjoy associations that are denied the untrained man. Training helps you to increase your earning power and by so doing to offer members of your family advantages far in excess of what you could give them as an untrained man. Train and enjoy PROGRESS—CONTENTMENT—INDEPENDENCE.

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Without the slightest obligation, send 2 beginning Drafting Lessons and free Bulletin.

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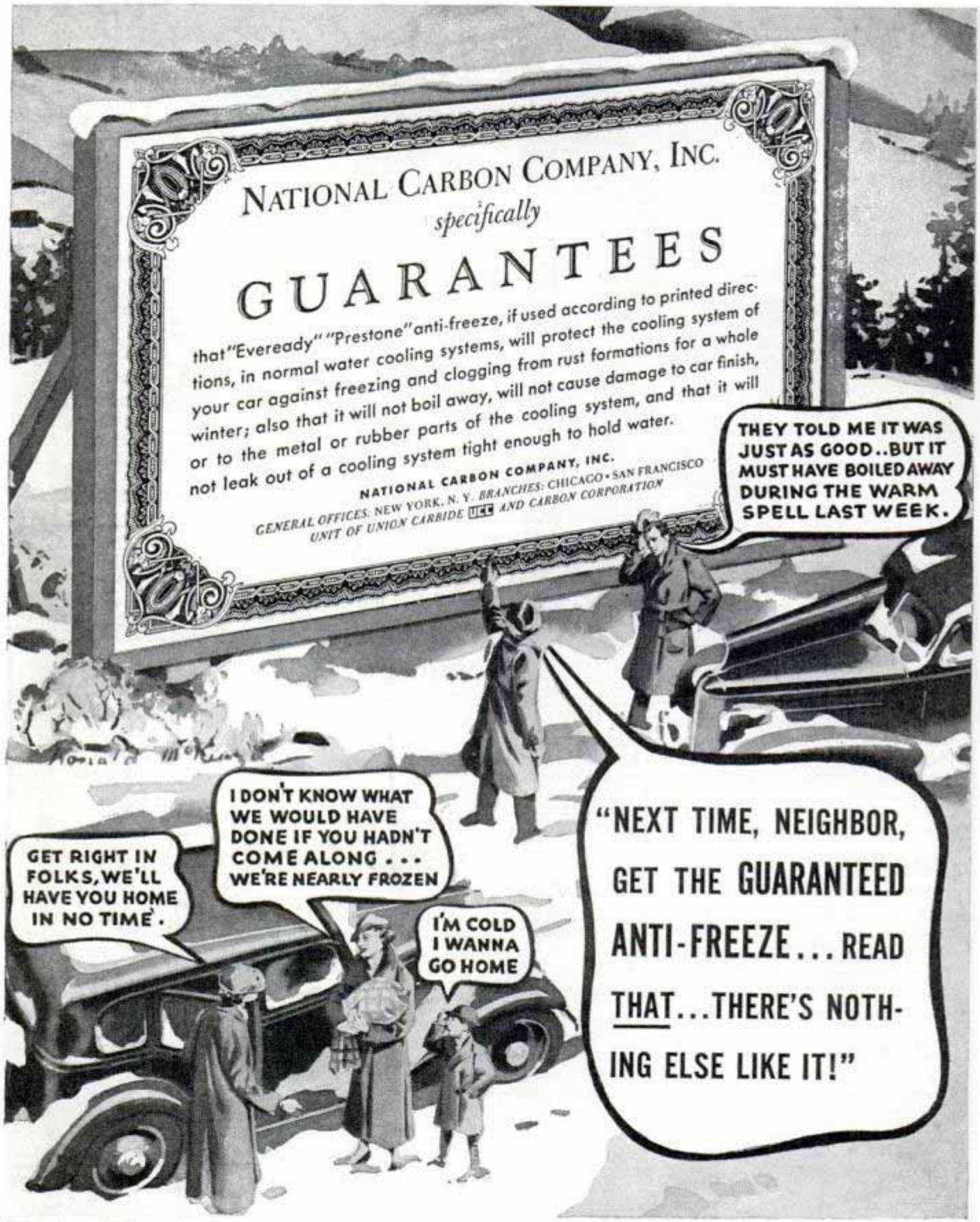

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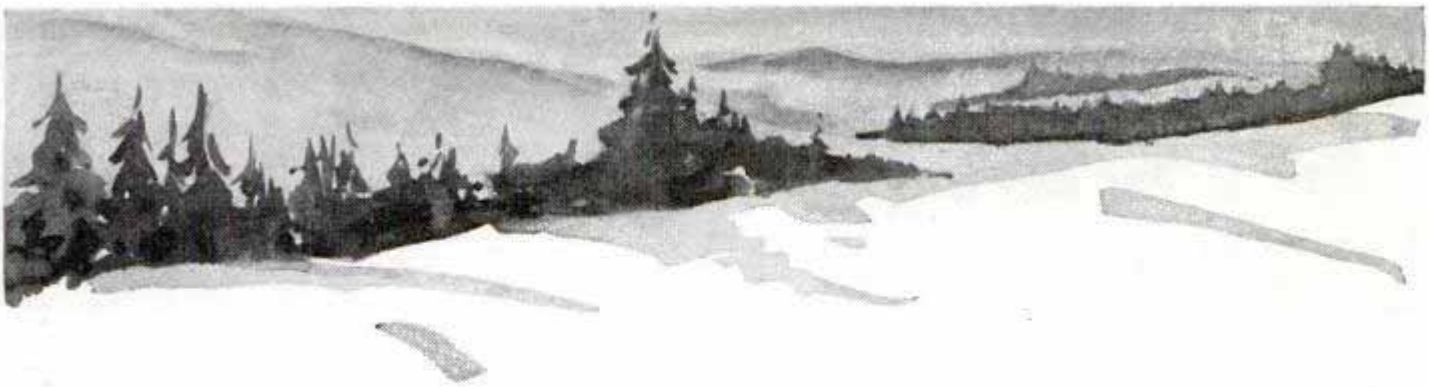
TRADE-

ANTI-FREEZE IS



AMONG all the brands available to U. S. motorists, there's no other anti-freeze like "Eveready" "Prestone." This anti-freeze is guaranteed, insures you against FREEZE-UP, BOIL-AWAY and RUST-CLOGGING, the three winter purse-snatchers that cost American motorists millions of dollars every year. • But when you gamble on anti-freeze you risk more than money...you take chances with your family's health and safety, hazard all-winter comfort, wreck your peace-of-mind.

• Every year millions more decide on safety, demand "Eveready" "Prestone" anti-freeze. So perhaps you should get yours early...*Today*, for example.

Buy "Prestone" anti-freeze from dealers who are properly equipped to service your car for winter driving.

PRESTONE

MARKS

GUARANTEED IN *Writing*

DIESEL PLANES
SPAN THE ATLANTIC

Giant Seaplane Reaches U.S. On Transatlantic Flight

Port Washington, N. Y.—The 19-ton, Diesel-powered seaplane, Nordmeer, landed here today after a 150-mile-an-hour flight from the Azores, 2392 miles away. The flight was the last leg of a survey trip from Berlin by way of Marseilles, Lisbon, and the Azores in advance of regular service over the same route early next year.

The Nordmeer and a sister ship, the Nordwind, both powered by four 600 horsepower Diesel motors, are scheduled to make seven more trips this year.

Los Angeles, Calif. — Commenting on the transatlantic flight of the seaplane Nordmeer, Ralph Hemphill, president of the Hemphill Diesel Schools, predicted today that "the time is not far distant when all trans-oceanic planes will be Diesel-powered, because of the safety from fire, and great dependability and economy."

New Horizons Conquered By Diesel Power . . .

One by one, Diesel engines are conquering every power need. This "miracle" power is sweeping the world

Land, Water, and NOW AIR

. . . yields to Diesel. With the successful completion of this spectacular flight, the years of Diesel aircraft experimentation come into the open It is now a challenge to the world.

Now added to the long roster of Diesel users—great truck lines, tractors for farm and industry, construction machinery, electric power plants, irrigation projects, ocean-going vessels, railroads, and numerous others—are these great seaplanes indicating universal Diesel power for aircraft, and

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. . . where you get training PROVED by the success of the many Hemphill graduates . . . where you learn on real Diesel engines . . . where you get the most thorough, most practical Diesel course available . . . where you have your choice of complete full-time or "home-and-shop" courses. Send coupon to nearest school.

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SEATTLE	501 Westlake North
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Many make $30 $50 $75 a week

I will train you at home for many Good Spare Time and Full Time Radio Jobs

Do you want to make more money? Radio offers you many opportunities for well-paying spare time and full time jobs. You don't have to give up your present job, leave home or spend a lot of money to become a Radio Expert.

Many Radio Experts Make $30, $50, $75 a Week

Radio broadcasting stations employ engineers, operators, station managers and pay up to $5,000 a year. Spare time Radio set servicing pays many $200 to $500 a year—full time jobs with Radio jobbers, manufacturers and dealers as much as $30, $50, $75 a week. Many Radio Experts operate full or part time Radio sales and service businesses. Radio manufacturers and jobbers employ testers, inspectors, foremen, engineers, servicemen, paying up to $6,000 a year. Radio operators on ships get good pay, see the world besides. Automobile, police, aviation, commercial Radio, loud speaker systems are newer fields offering good opportunities now and for the future. Television promises to open many good jobs soon. Men I have trained have good jobs in these branches of Radio. Read their letters. Mail coupon.

There's a Real Future in Radio for Well Trained Men

Radio already gives good jobs to more than 300,000 people. In 1936, Radio enjoyed one of its most prosperous years. More than $500,000,000 worth of sets, tubes and parts were sold—an increase of **more than 60%** over 1935. Over a million Auto Radios were sold, a big increase over 1935. 24,000,000 homes now have one or more Radio sets. More than 4,000,000 autos are Radio equipped. Every year millions of sets go out of date, are replaced with newer models. More millions need servicing, new tubes, repairs, etc. A few hundred $30, $50, $75 a week jobs have grown to thousands in 20 years. And Radio is still a new industry—growing fast!

Many Make $5, $10, $15 a Week Extra in Spare Time While Learning

Almost every neighborhood needs a good spare time serviceman. The day you enroll I start sending Extra Money Job Sheets showing how to do Radio repair jobs. Throughout your training I send plans and ideas that made good spare time money for hundreds. I send Special Equipment to conduct experiments, build circuits, get practical experience. I GIVE YOU A COMPLETE, MODERN, PROFESSIONAL ALL WAVE, ALL PURPOSE RADIO SET SERVICING INSTRUMENT TO HELP SERVICE SETS QUICKER—SAVE TIME, MAKE MORE MONEY.

I Give You Practical Experience

My Course is not all book training. I send you special Radio equipment; show you how to conduct experiments, build circuits illustrating important principles used in modern Radio receivers, broadcast stations and loud-speaker installations. I show you how to build testing apparatus for use in spare time work from this equipment. This 50-50 method of training makes learning at home interesting, fascinating, practical.

You Get a Money Back Agreement

I am sure I can train you successfully. I agree in writing to refund every penny you pay me if you are not satisfied with my Lessons and Instruction Service when you finish. I'll send you a copy of this agreement with my Free Book.

Find Out What Radio Offers You

Act Today. Mail the coupon now for "Rich Rewards in Radio." It's free to any fellow over 16 years old. It points out Radio's spare time and full time opportunities and those coming in Television; tells about my training in Radio and Television; shows you letters from men I trained, telling what they are doing and earning. Find out what Radio offers YOU! MAIL COUPON in an envelope, or paste on a postcard—NOW!

J. E. SMITH, Pres., National Radio Institute, Dept. 7NP
Washington, D. C.

Broadcasting Stations

Employ managers, engineers, operators, installation and maintenance men for fascinating jobs and pay up to $5,000 a year.

Set Servicing

Spare time set servicing pays many $5, $10, $15 a week extra while learning. Full time servicing pays as much as $30, $50, $75 a week.

Loud Speaker Systems

Building, installing, servicing and operating public address systems is another growing field for men well trained in Radio.

HERE'S PROOF THAT MY TRAINING PAYS

$80 Monthly in Spare Time
"I work on Radio part time, still holding my regular job. Since enrolling seven years ago, I have averaged around $80 every month." JOHN B. MORISSETTE, 809 Valley St., Manchester, N. H.

Makes $50 to $60 a Week
"I am making between $50 and $60 a week after all expenses are paid, and I am getting all the Radio work I can take care of, thanks to N. R. I." H. W. SPANGLER, 126½ S. Gay St., Knoxville, Tenn.

Operates Public Address System
"I have a position with the Los Angeles Civil Service, operating the Public Address System in the City Hall Council. My salary is $170 a month." R. H. ROOD, R. 136, City Hall, Los Angeles, Calif.

This Coupon is Good for . . . One FREE Copy of My Book

J. E. SMITH, President, Dept. 7NP
National Radio Institute, Washington, D. C.

Dear Mr. Smith: Without obligating me, send "Rich Rewards in Radio," which points out the spare time and full time opportunities in Radio and explains your 50-50 method of training men at home in spare time to become Radio Experts. (Please Write Plainly.)

NAME.....AGE.....

ADDRESS.....

CITY.....STATE.....

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SIX BIG AUTO BOOKS ALL SHIPPED FREE

on approval; whether you want to qualify as garage owner, auto repair expert or merely wish to know how to keep your own car 100% efficient, look at these books—they are sent to you for free examination. This **brand new** edition has been prepared by a large group of America's greatest automotive engineers. Anybody who can read will understand them, for this great automobile encyclopedia is a veritable gold mine of valuable facts. Take advantage of this offer now; send in the Coupon for FREE examination. You don't pay us a penny, you don't obligate yourself to pay us anything unless you decide to keep the books. Just tell us you want to see them and the full set of 6 great volumes, just off the press, will be sent to you! Read them, look them over and prove to your own satisfaction that one fact alone, which you will find in them, may save you an expensive repair or help you to a better job.

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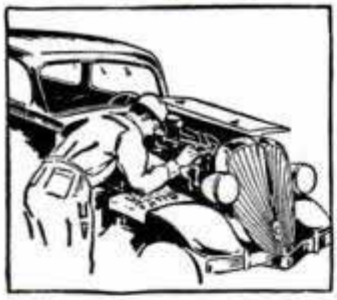

Can You Fix It?

Can you take out "play" in differential? Can you kill the "shimmy" in steering? Can you reset TIMING? Can you put your finger on engine trouble without guessing or tinkering? Can you pull the starter off and fix it? Can you adjust and repair transmission, engine, rear axle?

These Books Tell How

and tell you how to **do any and every** auto job right, the first time, and in addition cover Service Shop Management.

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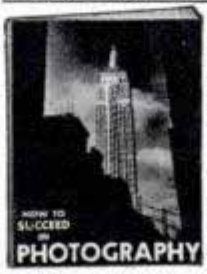

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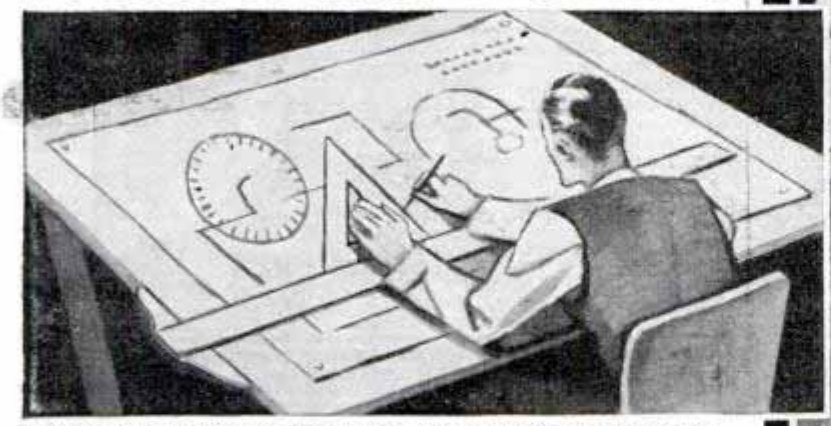

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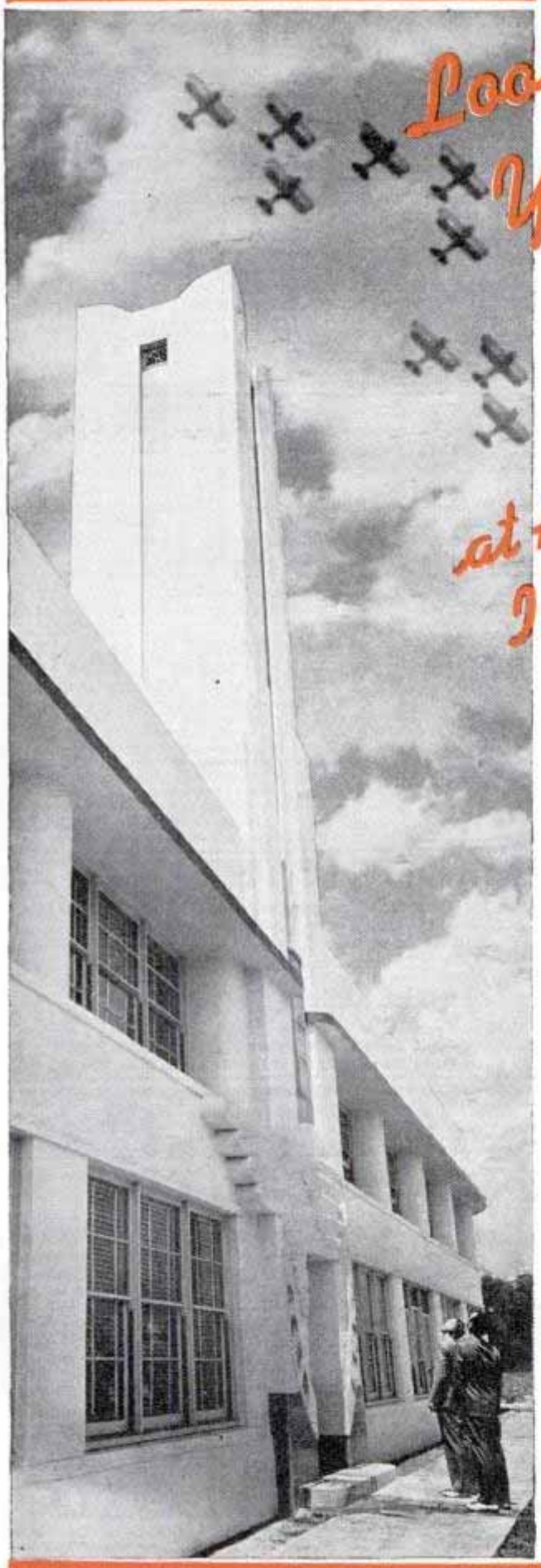

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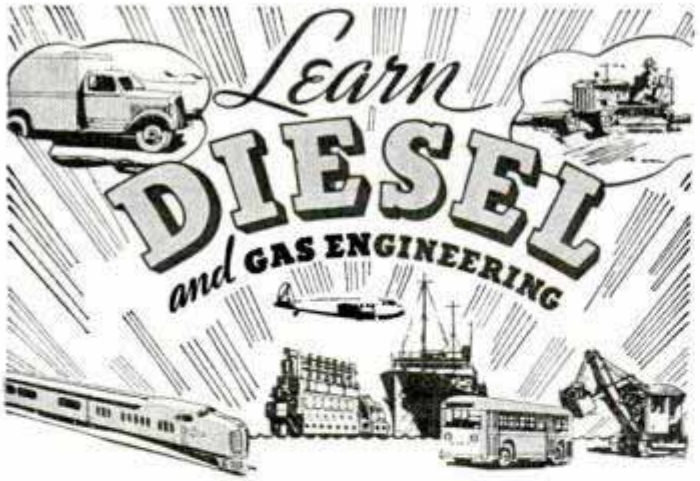

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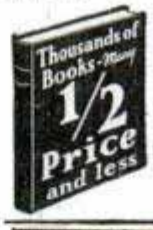

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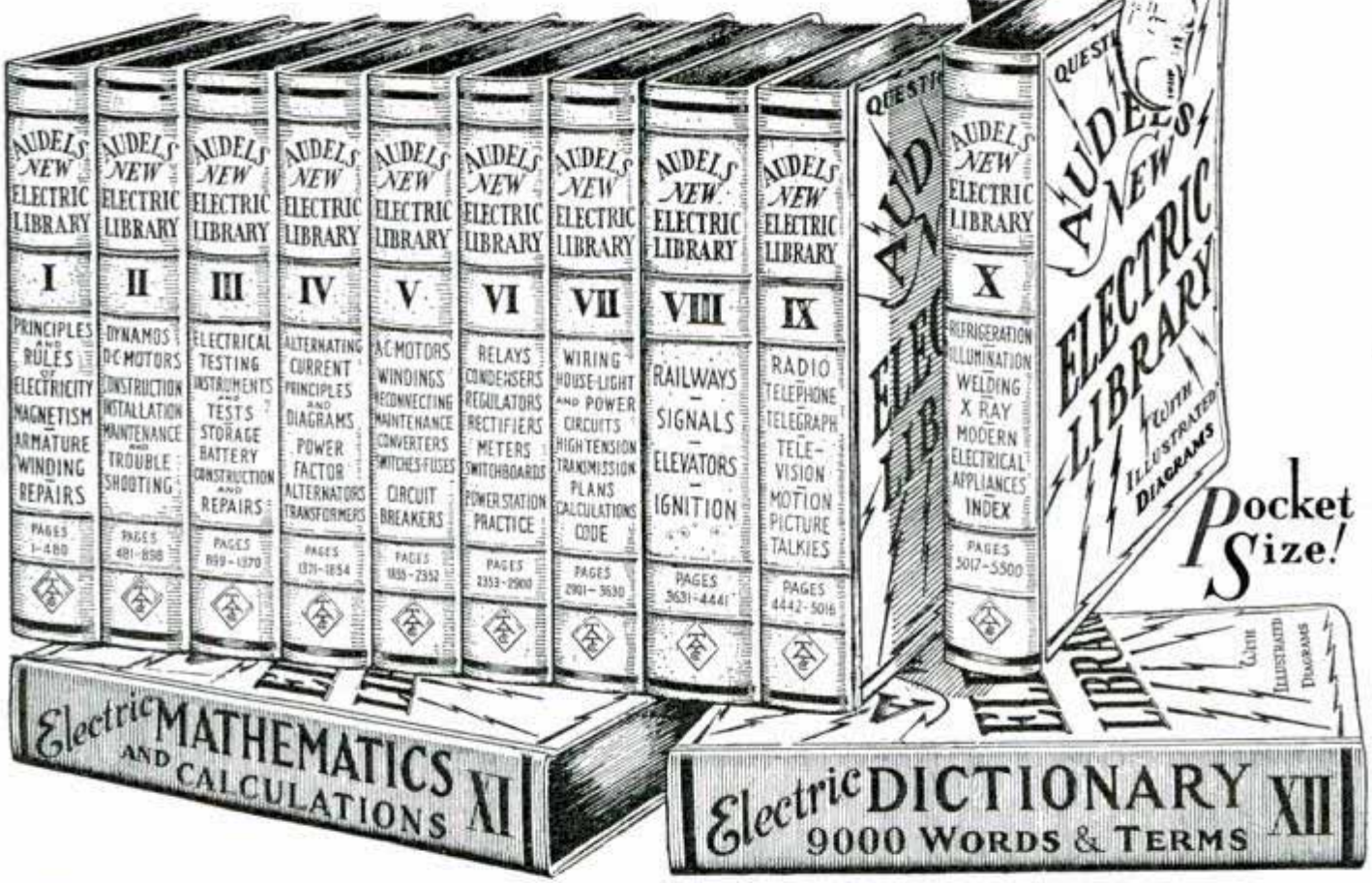

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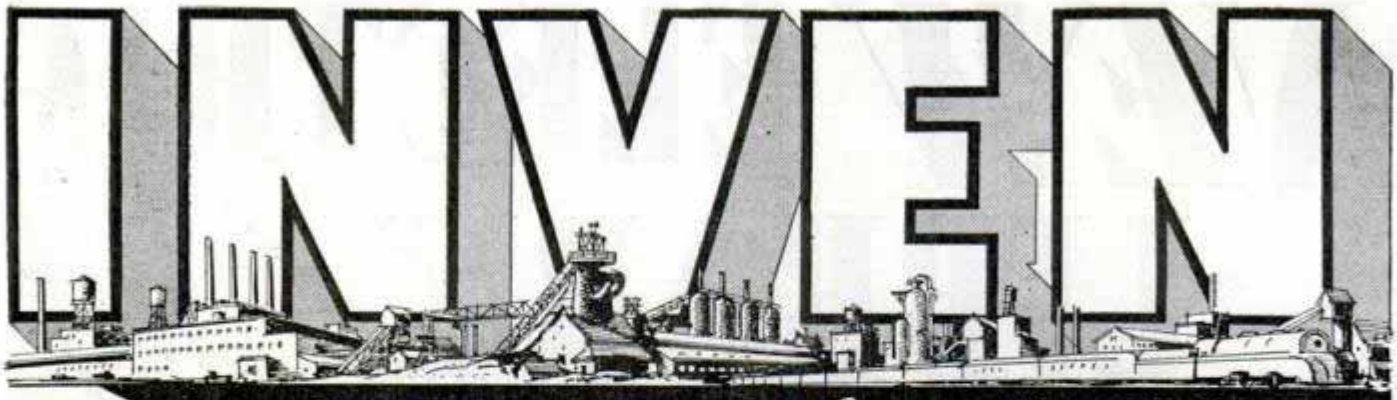

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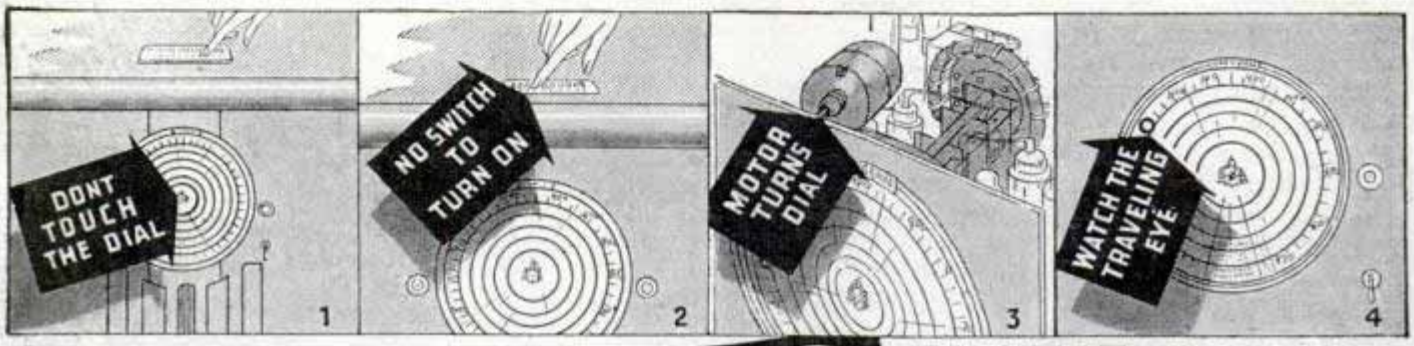

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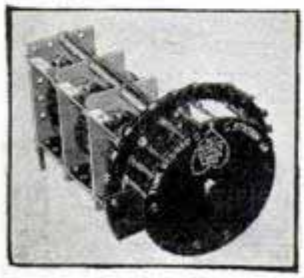

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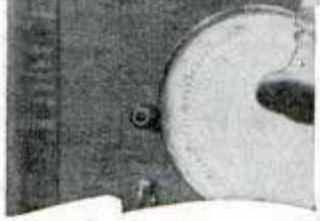

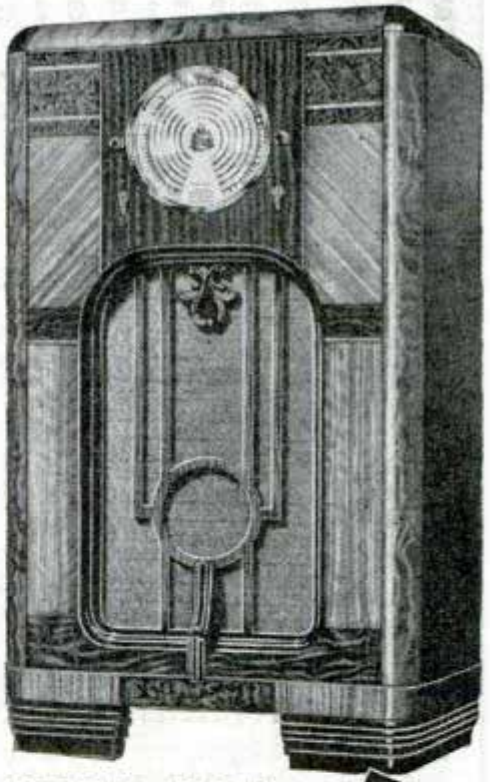

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2. Use only pencil or pen.
3. We return no drawings.
4. Print your name, address, age, occupation on back of drawing.
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A frank man to PATENTS-INVENTIONS

THE world of invention moves on. About a hundred years ago people were saying, "There's nothing left to invent"—today we know that is one of the funniest things ever said. Just think what has happened in the last hundred years! Autos, radios, airplanes, and thousands of useful, practical devices for home, shop and office have been invented and put on the market. Inventors are constantly making the world a better place to live in. Did you see a notice in the paper that an obscure worker, Hans Wach, has invented a simple device to utilize exhaust steam on steam boats? *Already, the report states, the steamship lines have saved more than $15,000,000 in fuel bills with his invention.* Almost in the same breath the Dept. of Commerce announced that it will soon test out a new, non-crashable aeroplane, which the average man can learn to fly in a day, which will travel at 110 miles an hour and sell at the price of a cheap automobile. An unknown Seattle man has invented a robot to go 5,000 feet under the sea and recover millions and millions of dollars worth of gold lying at the bottom of the ocean since the days of the early Spaniards.

Remember this: For every outstanding big invention there are thousands of small, simple things for use in the home, the office, the factory, on the farm, on every sort of travel conveyance. Little articles like you find on the counters of a 10-cent store, hardware store, drug store, toy and novelty shop.

Many Little Ideas Have Big Commercial Possibilities

A person finds something he's using doesn't work right, or it's clumsy, or costs too much. He gets a happy thought. He improves the old Article. That's contribution to human progress. That's the way that many, many men have reached the goal of financial comfort, independence and even wealth. Most of the things millions of us use didn't come from the brains of engineers and physicists. They came from the mind and maybe the crude home work bench of Mr. Average Man, busily engaged in earning his bread and butter at whatever chance or circumstance has given him to do. The "little" man's opportunity as an inventor was never greater than it is today.

Who Are Inventors?

You'd be amazed at the men we contact in the course of a busy year. Most of them do not consider themselves inventors at all. During their work or leisure they get an idea. They work it out on paper. They get in touch with us about Protection. Did you know that a dentist invented the stock ticker, a school teacher the telephone, a farmer the typewriter, an artist the telegraph? Did you know that the crinkly hair pin—sold by millions now—came about because a husband saw his wife twisting the old-fashioned straight hair pin to make it stay in place? **Poor men who have no thought of invention now will be financially well-fixed in a few years because of a happy thought that the world could use to advantage.**

Can You Answer These Questions?

Ask yourself these questions: How do the Patent Laws protect me? What easy steps can I take, without cost, to put myself in position to support my belief that I am the **first** man to think of **my invention?** Is a Patent worth the cost? Do I need a model? Should I try to sell my invention before I have it Patented? Is there any safe, business-like way to secure financial help? If I do apply for a Patent, how shall I reach people who can market my invention? Can I protect and sell an improvement on some invention that has already been patented? These are but a few of the questions which usually confront the average man. You need the answers! **YOU CAN HAVE THEM, without cost, trouble, or delay.**

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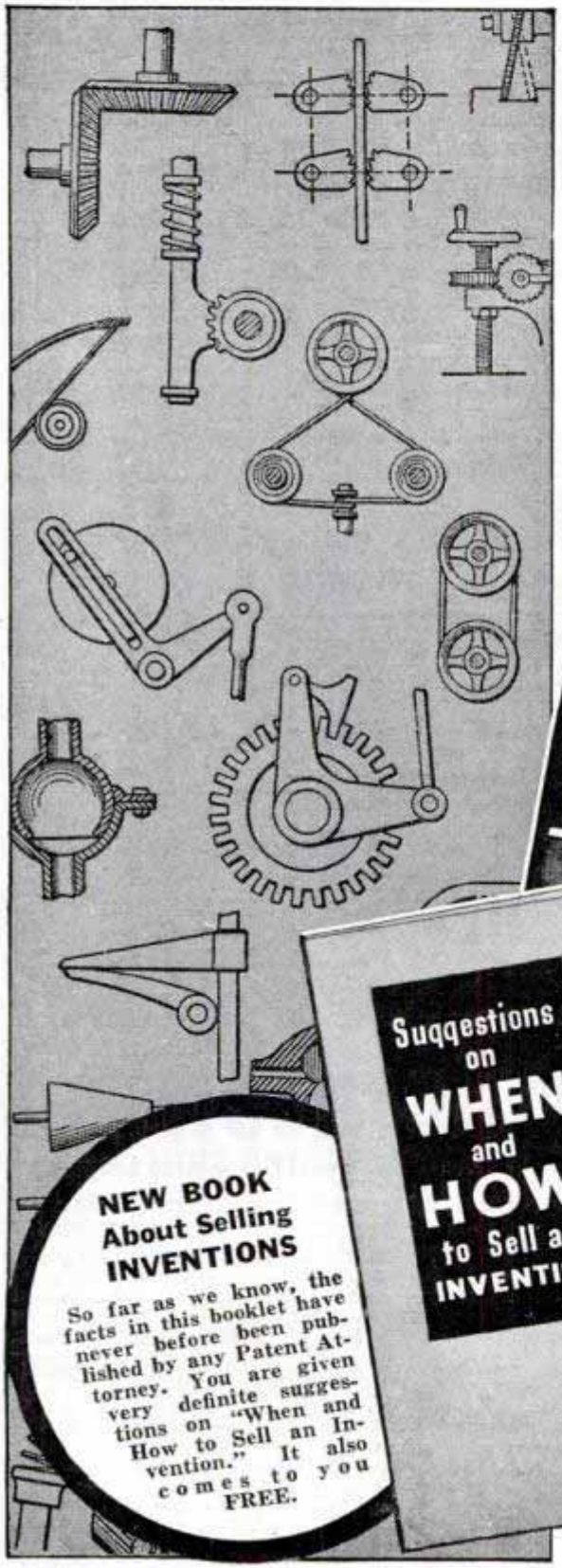

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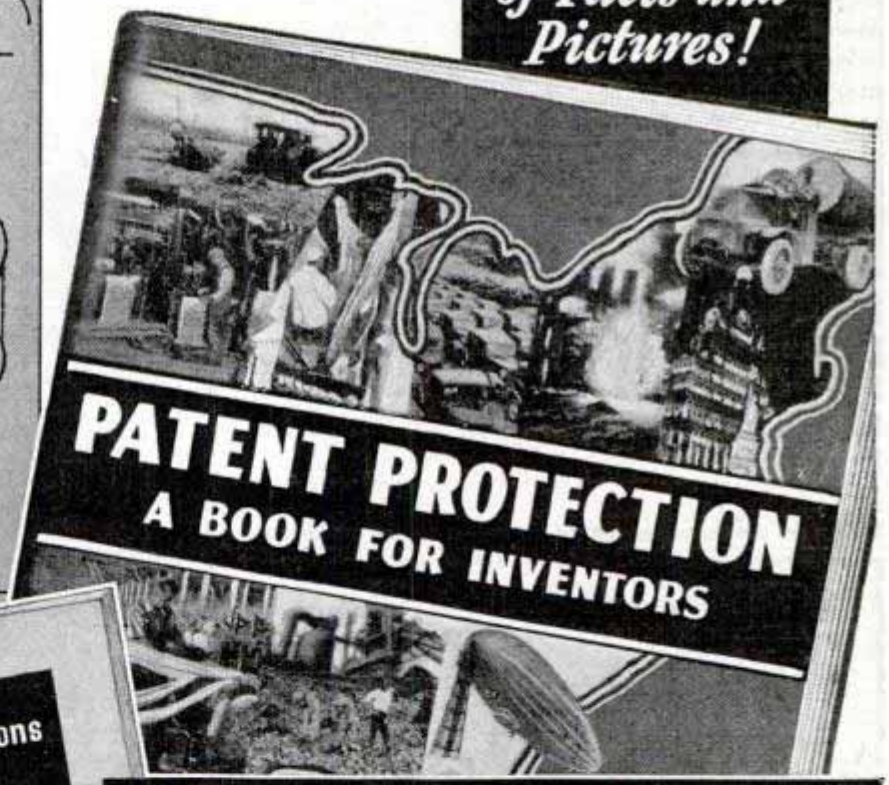

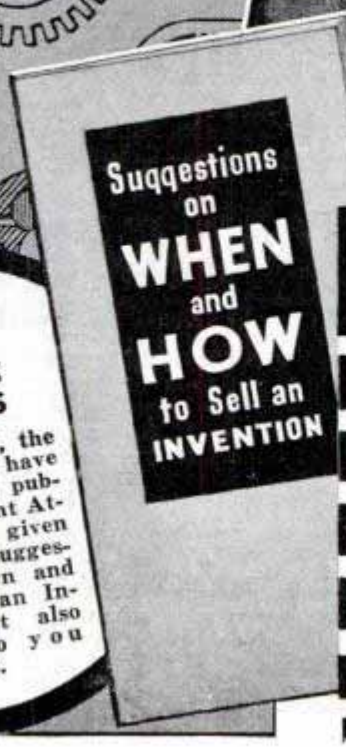

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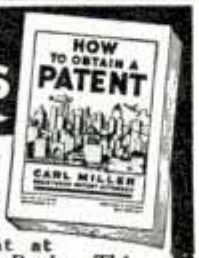

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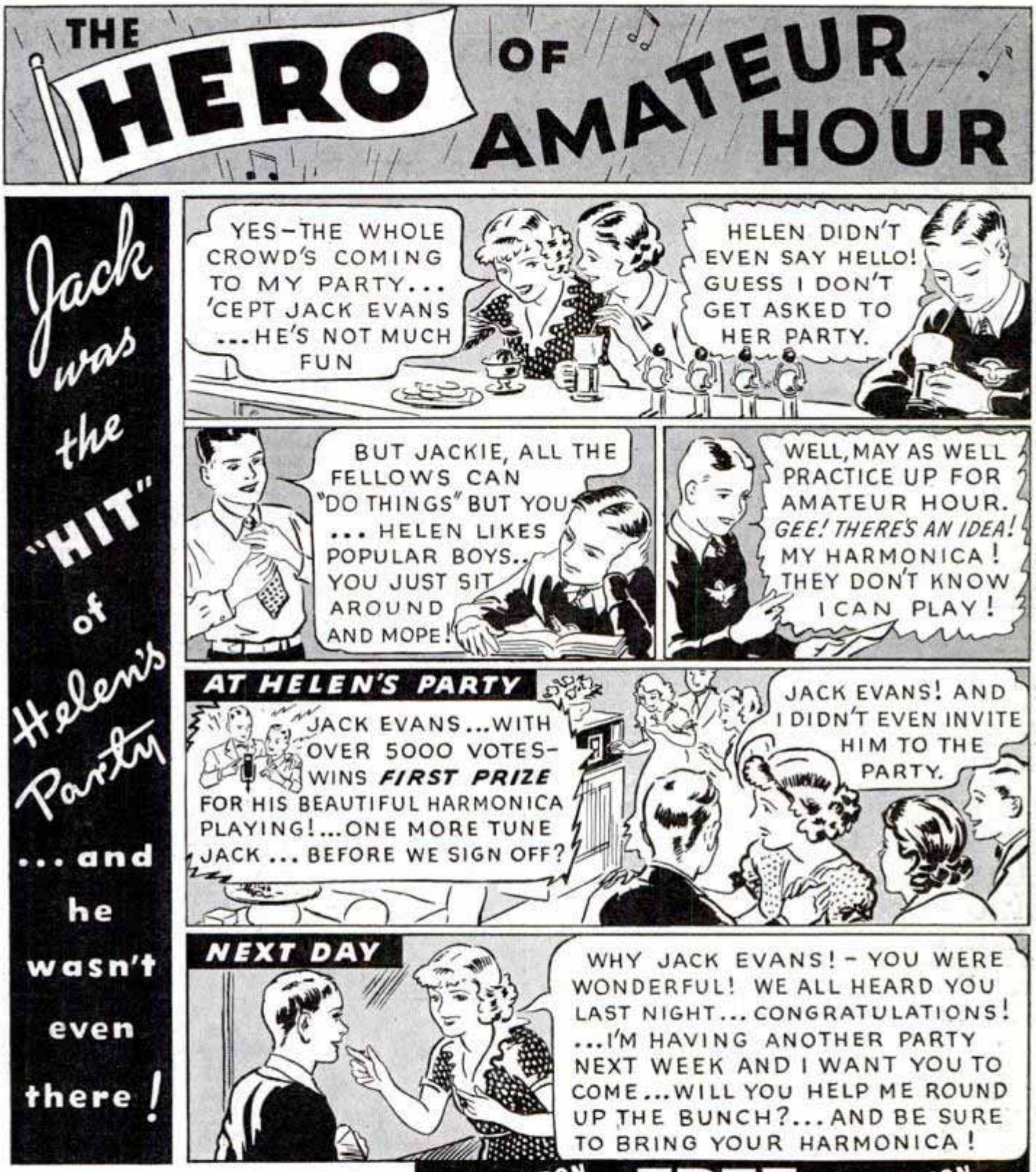

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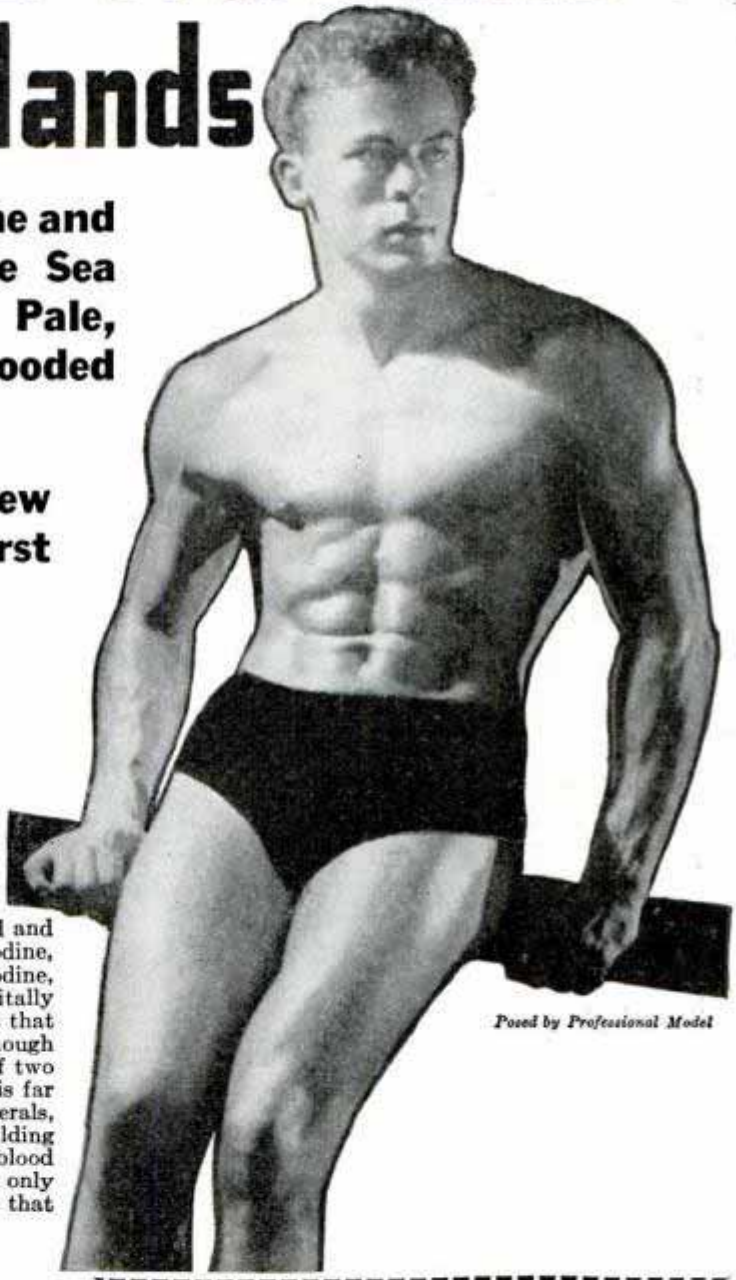

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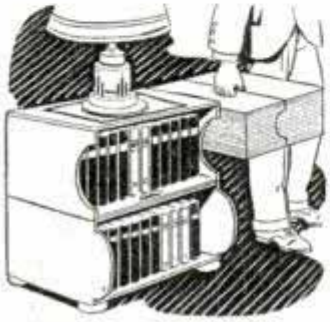
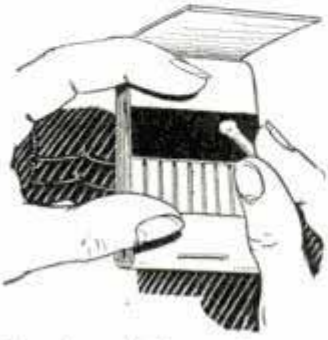


AN ATTRACTIVE lamp stand just patented would be an addition to the home. The stand consists of several metal rods looped together at one end to form the base. At the other end the rods are bent at an angle to form a supporting column for the socket, lamp and shade. The electric cord is concealed in the supporting column.

TO HELP guard against the other matches in the book catching fire when one is struck, a newly patented match package has an inner flap which covers the heads of the matches. This flap has the abrasive strip for striking matches so placed that the heads of the other matches must be covered before one can be ignited.



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(Continued to page 63A)

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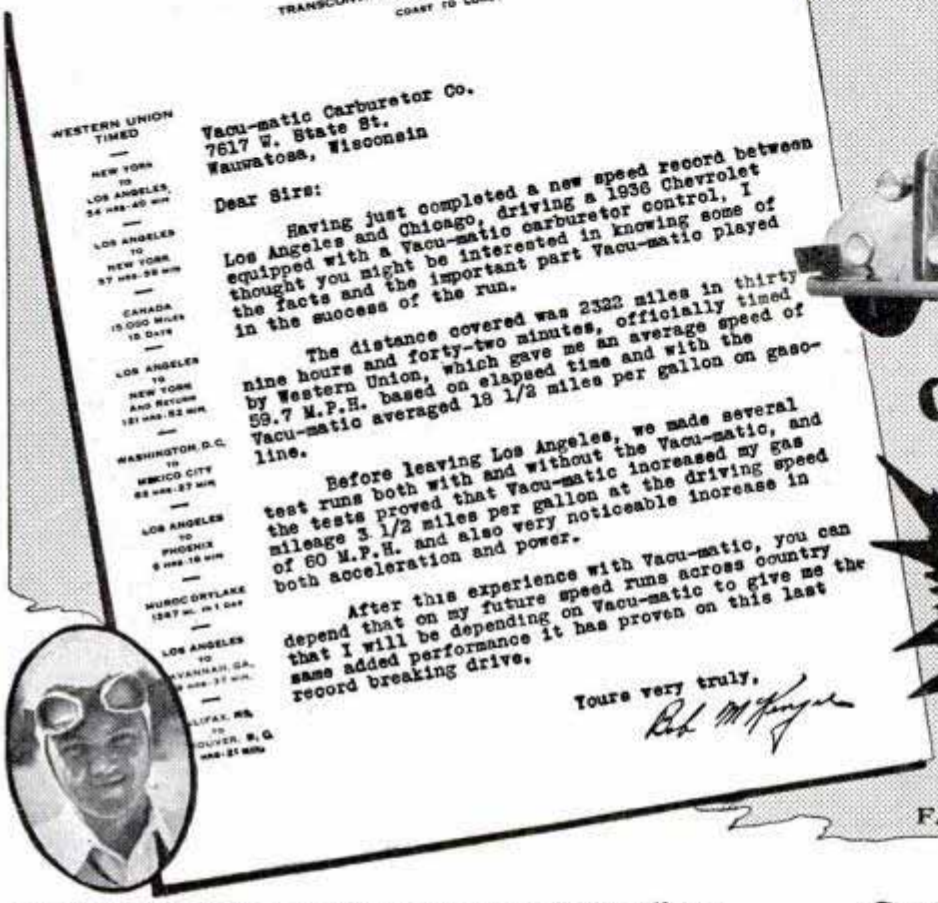

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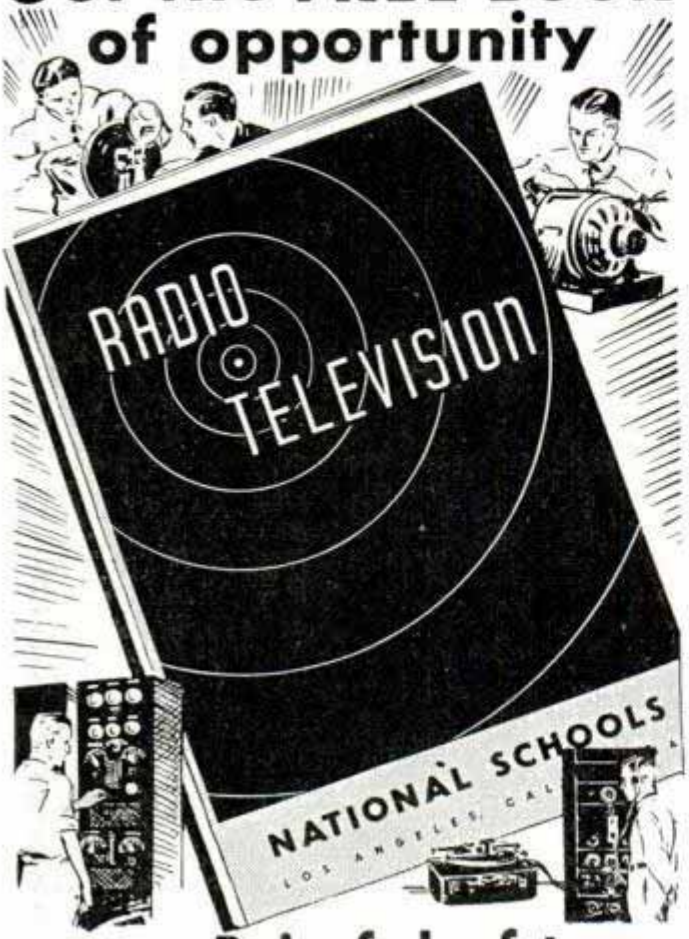

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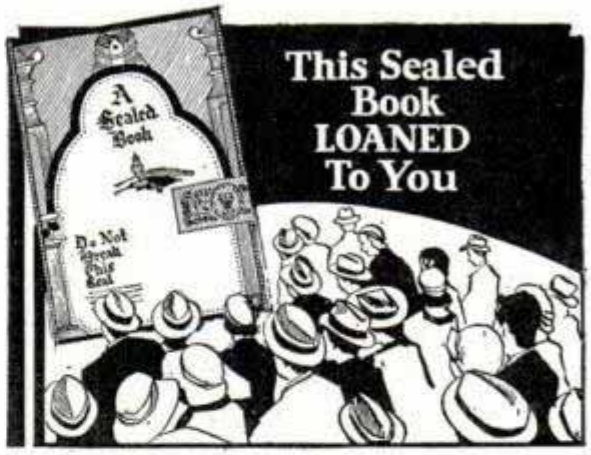

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State of Illinois, County of Cook, ss.

Before me, a notary public in and for the state and county aforesaid, personally appeared Willis S. Brown, who having been duly sworn according to law, deposes and says that he is the Business Manager of the Popular Mechanics Magazine and that the following is, to the best of his knowledge and belief a true statement of the ownership, management, etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, embodied in section 411, Postal Laws and Regulations printed on the reverse of this form, to wit: First. That the names and addresses of the publisher, editor, managing editor, and business manager are: Publisher Popular Mechanics Co., 200 East Ontario St., Chicago, Ill. Editor, H. H. Windsor, Jr., 200 East Ontario St., Chicago, Ill. Managing Editor, L. K. Weber 200 East Ontario St., Chicago, Ill. Business Manager, Willis S. Brown, 200 East Ontario St., Chicago, Ill. Second. That the owner is: (If owned by a corporation, its name and address must be stated and also immediately thereunder the names and addresses of stockholders owning or holding one per cent or more of total amount of stock. If not owned by a corporation the names and addresses of the individual owners must be given. If owned by a firm, company, or other unincorporated concern, its name and address, as well as those of each individual member, must be given.) Popular Mechanics Company, 200 East Ontario St., Chicago, Ill.; L. B. Windsor, 200 East Ontario St., Chicago, Ill.; H. H. Windsor, Jr., 200 East Ontario St., Chicago, Ill.; L. H. Windsor, 200 East Ontario St., Chicago, Ill. Third. That the known bondholders, mortgagees, and other security holders owning or holding 1 per cent or more of total amount of bonds, mortgages, or other securities are: (If there are none, so state.) None. Fourth. That the two paragraphs next above, giving the names of the owners, stockholders, and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company but also, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner; and this affiant has no reason to believe that any other person, association, or corporation has any interest direct or indirect in the said stock, bonds, or other securities than as so stated by him. Willis S. Brown, Business Manager. Sworn to and subscribed before me this 24th day of September 1937. J. GRAHAM, Notary Public. (My commission expires June 16, 1940.)

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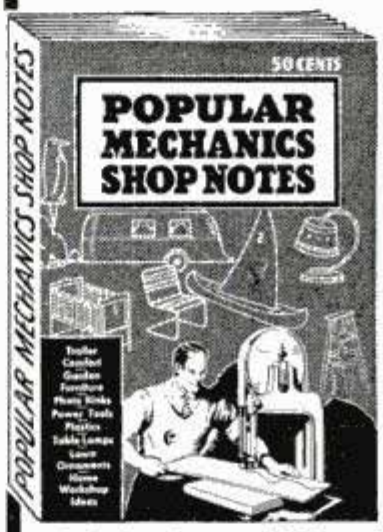

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OUR Money making offers will surprise you. Investigate at once. Literature free. National Mail Despatch, Box 135A, Gillespie, Ill.

STEADY Income easy! Start home business! No canvassing! Free booklet tells how. Century, 1261-P Broadway, New York.

AFTERNOONS Free for outdoors, movies. $340 month home. Unique plans. No canvassing. Prepare for surprise. Folio-F, Station D, Los Angeles.

DOLLARS-BY-MAIL! To win — "You must do something different"—New! Honest! Safe! 6000 word folio—"A Paying vs. a Playing Mail Business"—3c. Dr. Swearingen, Station "S," Los Angeles, California.

OPERATE Permanent, profitable social security service. Reliable party each county. Write immediately. Rimer, Box 309, Silver Springs, N. Y.

ADDED Income ideas. Mail Sales News magazine, copy 10c. Katz, 4254 No. Kimball, Chicago.

SELL Breniser mail order treatise! Particulars 3c. Green, 15788 Parkside, Detroit, Mich.

ENORMOUS Profits stamping names on key checks. We supply everything. Sample with your name-address 25c. Bohn Co., Box 86, Wilkes-Barre, Penna.

OPERATE A collection agency business from home or office. Quickly learned. Big income. Write, Cole Associates, Syracuse, N. Y.

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

INCREASE Your prestige and business. Just 1c daily for personal or 2c for business purposes, maintains permanent New York office. Co-Operative Mail Service, 126P Lexington Ave.

MAKE Money re-silvering mirrors. Formula only 15c. Boltach & Co., 5007 - 28th St., Detroit, Mich.

75 NEW Amazing money making ideas. Information free! Exchange, Box 61, East Orange, New Jersey.

NEW Marbleizing cement; makes building slabs, all sizes and shapes, for walls, ceilings, halls, etc., any place marble is used. Glossy snow-white, or colored. Can be sawed, drilled, cut to fit easily. (See samples.) They are waterproof. Dime brings surprising samples. Cowell Institute, Grayling, Michigan.

START A moth proofing business. No capital necessary. Formulas and instructions $1. Circular free. Druley, Box 42-H, Oak Park, Ill.

WE Pay cash for your spare time! Raise giant, patented mushrooms in your basement, shed, attic. Experience unnecessary. We supply guaranteed materials and buy your crops at contract prices. We need you now. Send for free details today. United, 3848 Lincoln Ave., Dept. 65, Chicago.

MAKE And sell your own antifreeze. Big profit during winter season. Mail one dollar bill for formula and instructions. Box 1491, Casper, Wyoming.

$20-$100 WEEKLY Operating small business from home, no canvassing, particulars free. Elco Publishing Co., 507-A 5th Ave., New York.

STOP Job hunting! Start your own light manufacturing business. Up to 1,000% profit. Hire agents. Information free. Thermo-M Works, Peoria, Illinois.

WE Are establishing associate manufactors. 500% profit. Something new. Troughton, Aurora, Missouri.

85 JOURNALISTIC Advertising money-making angles. Yield big earnings. Dollar. Syndicators, 3335 Diversey, Chicago.

OPPORTUNITY For man to get into something for himself—be own boss. No soliciting. Start with as little as $75.00—a tried and proven money-maker. No previous experience required. Write H. H. Wing, Box R, Central Station, Toledo, Ohio.

CO-PARTNERS Wanted. Complete mail-order business. Box P744, Charleston, W. Va.

COMPLETE Chemical service. Newest guaranteed formulas. Research analyses. Valuable literature free. Special low prices. Miller, Chemist, 1706-L, Tampa, Fla.

"SUCCESS Beacon" anniversary edition! 72 pages! Moneymaking schemes, ideas, plans. 13c. Jay, Publishers, 6054-P Kenwood, Chicago.

ATTENTION. Yale Clothing, Meriden, Connecticut, established 1900. Offers blue cheviot pants, $2.50; raincoats, $2.50; durable leather blucher shoes, $2.50; windbreakers, $2.50. Send sizes with money order.

2799% PROFIT. Griffin invested $40, made $1125. His report and our catalog free. Grinstead, 505 Fifth Avenue, New York.

NORTH Pole anti -freeze prevents frozen radiators; cost 15c a gallon, sells $1.50 up; formula $1.00. Mixed sample 25c. Nu-Way Sales Co., Box 243, Hornell, New York.

OPERATE Route penny gum and peanut machines. Steady cash income. Send stamp for particulars. Park Place Supply Co., P. O. Box 1983, Houston, Texas.

10c BRINGS Copy National Mail Order News, Box 1773-PM2, Roanoke, Virginia.

6,400—$1 BOOKS Sold by mail through small advertisement. Cost 6c each. Also brings repeat business. Book and plans 25c. Box 2695, Hollywood, California.

START Home Business replating fixtures, tableware, etc. Easy factory method. $5.00 course now $2.00. Ideal, 179P, Park Ridge, Ill.

OPERATE Electric simonizing station. Cash in on national advertising with proved labor-saving invention. Only $29.50. Should net you approximately $300-$400 month. Write Bissell's Mfg. Co., 3320-P Archer, Chicago. Distributors wanted.

QUARTERS, Dimes, daily by mail, complete plan with samples, dime, refund coupon included. Thomasson's, Minneapolis, Minnesota.

START Home business. Wonderful opportunity. Enormous profits made by many. Money making plans, formulas, etc. Free particulars. Barrymore, P. O. Box 784, Altoona, Pa.

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

BUILD Permanent business that will pay you far more than working for someone else. Our proven success plans tell you how. Profits begin immediately. Booklet free. Imperial Food Products Service, 2841 Girard Ave., Philadelphia.

"THE Mail Order Helper" 10c. Fox, 608 Rogers Ave., Brooklyn, N. Y.

AMAZING Opportunity! Learn to make genuine rubber molds. Instructions free. Stewart's Studio, 2927 Wilcox, Chicago.

MAIL Business, spare time. Free details. Floyd J. Rose, Meriden, Conn.

REPAIR Upholstered furniture. Highly profitable, full or spare time business. Illustrated instruction book covers most common repairs, estimating, where to buy supplies, etc. Price $2. M. Swider, Dept. B, 260 19th St., Brooklyn, N. Y.

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

EARN $25 Weekly working two hours daily. No canvassing or manufacturing. No investment necessary. Business Opportunities, Dept. 44, Box 5001, Saint Paul, Minn.

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 materials makes regular 10c store sellers. Rubber moulds furnished for speed production. Small investment brings big returns. Nationwide demand in these low priced goods for coming X-mas holidays. Ambitious men have chance for real prosperity. Plastex Industries, Dept. A, 1085 Washington Ave., New York.

MANUFACTURE Polishpuffs. Amazing proposition 10c. Particulars free. Hickorydell, Glenbeulah, Wis.

FREE Particulars hundreds of money making business opportunities. Larner, G. P. O. Box 238, Brooklyn, N. Y.

WE Start you in business, furnishing outfits and instructions, operating Specialty Candy Factory home. Men and women, earn $25 up to $60 weekly, all or spare time. (Our 29th year.) Booklet free. W. Hillyer Ragsdale, Inc., Drawer 4, East Orange, N. J.

PUBLISH A magazine of your own. Start a mail order business on small capital. Instructions and sample of magazine 10c (coin). Dickson Bureau, 2221 Mahon St., Pittsburgh, Penna.

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

SUCCEED With your products. Makesell them. Formulas. Processes. Accurate analyses. Catalog free. B. Thaxly Co., Washington, D. C.

DONUT, Potato chip, cheezed pop corn. Home made. Big profits. Vanderpol, Springfield, Ohio.

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

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

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

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

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.

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.

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

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

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

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

ARTIFICIAL Marble sanitary flooring, instruction 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.

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 S. 21st, Philadelphia.

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

ZERPID, Fertilizer, 25c. Necessity for thousands. Sanquist Co., Pomeroy, Iowa.

MONEYMAKING OPPORTUNITIES

BE Independent. No canvassing. Write Leslie, 3415 Fort Independence St., New York City.

MAKE Your hobby pay. We can suggest how. Ullrichs, 5419 Windsor Ave., Chicago, Ill.

MONEY Making opportunities! Big profits! Particulars free! Seco Service, Box 337, Alice, Tex.

BUSINESS Proposition resilvering mirrors, autoparts, reflectors, making chipped glass signs. Write, Sprinkle, Plating, 287, Marion, Ind.

MAKE More money. Profitable particulars free. Ralph Underhill, Beebe, Ark.

HOME Opportunities, money making plans, ideas, 10c. Otto Grube, Egg Harbor, N. J.

"SCHEMER" Magazine, Alliance, Ohio, supplies schemes, tips, ideas, formulas; winners! $10,000 to $25,000 reported. 39th year, $1. Special: trial six months only 30c, year, 50c.

$10 DAILY With authentic prosperity plans. 400% profit. Field unlimited. Literature free. Box 344, Summit, N. J.

MAKE honest money at home. Free details. John Grady, Cosman Apts., Ilion, N. Y.

DOLLARS Daily, gathering and selling names for profit. Complete plan 25c. Prieman, Box 103, Union City, N. J.

OPPORTUNITIES Galore—free! M. Murphy, 335 Manchester, Manchester, New Hampshire.

INCREASE Your earnings. Send for unusual budget of money-making opportunities. Euvico, Walnut Street, Statesville, N. C.

UNUSUAL Books, novelties. Interesting literature free. Novelty Shop, Downsville, Louisiana.

PROFITABLE Homework opportunities. Stamp brings particulars. Goldsmith, 1726 Roosevelt, Chicago.

PROFIT In vegetables, flowers, using chemicals. Remarkable yields. Quick growth. Experiment now. Proven formulas. Enough chemicals for 40 gallons solution and instructions $1.00 postpaid. Quick Growth Solutions, Hollywood Sta., Box 648, California.

MAKE Splendid profits in your own home. Circular free. Moese, 275 Post St., San Francisco, Calif.

MONEYMAKING Propositions, formulas, list, 10c. Daevis, Box 3004, Bridgeport, Connecticut.

$25.00 WEEK. Repairing sewing machines. Be independent, book real instructions $1.00. Connan, 508 S. W. Second, Portland, Ore.

SENSATIONAL Opportunities! Particulars free. Sine, 323 South Eighth East, Salt Lake City, Utah.

STOP Squealing—Start crowing! Work mornings home—drive to country—"movies"—afternoons! No canvassing! Folio-A, Station "D," Los Angeles.

START Profitable mail order business at home. Stamp brings details. Success Publishers, 5623 So. Flores, San Antonio, Texas.

DIME Brings "Buckeye Buzzer," 52 page magazine. Profitable plans, tips, cashing-in opportunities. Publisher, 257pm N. Washington, Tiffin, Ohio.

TURN Spare time into cash with typewriter! Addressing envelopes, mailing circulars, typing! 25c (coin) brings information. Ace TPM-6, 322 Empire, Birmingham, Ala.

SPARE Time propositions that pay. Complete instructions, big mail, dime. Thomasson's, Minneapolis, Minn.

OVER 100 Ways to make money. Home or office. Three months latest offers and our magazine, "Dividends," 25c coin. Texas Sales Office, Weslaco, Texas.

RESILVER Mirrors, build big business. Easy factory methods. $5.00 course now $2.00. Ideal, 178P, Park Ridge, Ill.

QUICK Home cash. Starting outfit free! Tell Service, PMD, 1451 Broadway, New York.

25 MAIL Order plans, real money-makers; 2 sample plans 10c. Barnes, Oakland Beach, R. I.

MAN In each town to plate auto parts, reflectors, bicycles, fixtures, mirrors, by late method. Simple plan of manufacturing at home starts you in good paying business. Free particulars and proofs. Gunmetal Co., Ave. N, Decatur, Ill.

UNUSUAL Mail order proposition. Big profits. Box 424, Anderson, Ind.

NEW All profit plans. Kurtz, 3541 94th St., Jackson Heights, N. Y.

RAISE Earthworms for profit. Information free, stamp appreciated. Bureau Zoological Research, 106A Broadway, Peoria, Ill.

132 PAGE Mail order trade directory for $1. Roth Products, Box 535, Kiefer, Okla.

PROSPERITY For home workers, 52 page magazine. Sample dime. Sizemore, 4917 N. Kostner, Chicago.

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

MOULDS, Guaranteed, for casting toy soldiers, Indians, trappers, warships, sinker moulds, 244 kinds. Send 5c for illustrat-catalogue. Henry C. Schiercke, 645 Spencer, Ghent, N. Y.

EASY To earn $50-$100 extra cash monthly during spare time. Operate your own business from home. Write for free particulars. Dixon Co., Box 776K, Springfield, Mass.

WHOLESALE Sources, 500,000 articles. Free directory. Maywoode, 925 Broadway, New York.

NEW Mailorder and local opportunities. Merchants Sales, 617M N. 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 St., New York.

LIKE To draw? Earn steady income tracing and duplicating advertising cartoons. Ad-Service, Argyle, Wis.

FORMULAS, PLANS, ETC.

FORMULAS. Analysis, free literature. Herstein, 128 So. Diamond, Grand Rapids, Mich.

THREE Mirror formulas $1.00: gold, silver, gunmetal. H. Bledsoe, 24 "G" St., Benicia, Calif.

WATERLESS Soap, wonderful for mechanics, fabrics. Formula $1. Jerome Jones, Hollins, Alabama.

FOUR Money making anti-freeze formulas $1.00 cash. Lamoureaux, Box 40, Hampden, Mass.

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

GREATEST Formula offer ever made. Manufacture modern products. Write for special prices. Philarst Company, Jefferson City, Missouri.

ANALYSIS. Research. Newest guaranteed formulas. Biggest catalog free. Special prices, leads. Gibson Laboratory, Chemists, BD-1142 Sunnyside, Chicago.

ORDER Your formulas from experienced chemists. Anything analyzed. Duplication guaranteed. Associated Chemists, Indianapolis, Indiana.

COMPLETE Chemical service. Newest guaranteed formulas. Research analyses. Valuable literature free. Special low prices. Miller, Chemist, 1706-L, Tampla, Fla.

2799% PROFIT: Griffin invested $40, made $1125. His report and our catalog free. Grinstead, 505 Fifth Avenue, New York.

100 MONEYMAKING Formulas 25c. Descriptive literature free. Harvey Teeple, Decatur, Ind.

THAXLY Formulas for perfect products. Accurate analysis assured. Resultful research. Catalog free. B. Thaxly Co., Washington, D. C.

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

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

CHEMISTRY

BUNSEN Burner for natural gas, new style, it stays lit, develops up to 2000 F. $1.00 postpaid. Free plans for inexpensive natural gas generator. Angelus Mfg. Co., Box 885, San Angelo, Tex.

RARE Chemicals. List, sample for dime. Ernest Snow, Lexington, Massachusetts.

CHEMICALS For all purposes. Equip your laboratory! Catalog 10c. McBee Chemical Company, 1624-K Boren, Seattle.

ANALYSIS. Research. Newest guaranteed formulas. Biggest catalog free. Special prices leads. Gibson Laboratory, Chemists, CT-1142 Sunnyside, Chicago.

HANDBOOK For chemical experimenters, hundreds of experiments, illustrated, 50c. Experiment booklet, 15c. Chemical catalogue, 10c. Reading Scientific Co., Reading, Penna.

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

FREE Chemistry catalog. Supplies at 5c! Equip complete laboratory. Send 3c for postage. Kemkit Scientific Corp., 397P Bridge St., Brooklyn, N. Y.

CHEMICALS, Laboratory glassware, apparatus. Send 5c for catalog CP-1. Biological Supply Co., 1176 Mt. Hope Ave., Rochester, N. Y.

AGENTS WANTED

STARTLING Invention—Pocket adding machine. (Metal) no toy. Adds up to million. Retails $2.50. Whirlwind seller. Big profit. Write quick for free sample offer. Calculator Machine Co., Box 1118, Chicago.

NEW Wrist-action plug ends kinking and twisting; prevents broken wires and burned fuses. Easy to sell. Big profits. Free sample offer. No-Tro Electric Appliance Corp., 821 W. Erie St., Chicago.

500% PROFIT Selling new 20-in-1 kitchen utensil. Retails 25c. Costs you $1 a dozen or $6 a gross. Sample 10c. New Method Co., PMM-60, Bradford, Penna.

NEW Soapless cleaning discovery! Amazing seller homes, everywhere. Sales guaranteed. Free samples. Chicago Products, AA-3968 Avondale, Chicago.

YEAR 'Round income selling typewriter ribbons, carbon paper to offices. Olson's Advertising Service, 225 W. 5th Ave., Gary, Ind.

55% COMMISSION Handing out gift cards. Information and outfit 25c. Streamline Distributors, R3, Pleasantville, N. J.

ATLAS For best gold reflecting window sign letters. Large sizes 3¼ cent each. Free samples. Atlas, 7941 Halsted, Chicago.

AMAZING Windshield defroster. Strange new chemical instantly removes frost, sleet, ice. Desperately needed. Samples sent on trial. Rush name. Kristee, 127, Akron, Ohio.

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. Sample and can of fluid 25c. New Method Co., New Method Bldg., Box PM-60, Bradford, Penna.

PORTRAIT Agents, cut prices, portraits, frames. Catalogue free. Friedman's Studio, 528 Cornelia, Chicago.

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. Z-817, Chicago.

SELL New and used clothing! Over 100% profit. Selling experience unnecessary. We start you furnishing everything. Catalogue free. Acme Merchandise, AL-1219 S. Jefferson, Chicago.

KLEEN-GLAS—Fast repeating 10c polishing and cleaning bag for garage, car owner, home. Big profits, sample 4c. Rex-Hide of Pennsylvania, Inc., E. E., Pittsburgh, Penna.

GENUINE Remington portable typewriter for 10c a day! Men wanted to take orders for this remarkable bargain. M. N. Rand, Remington Rand, Inc., 315 Fourth Ave., Dept. M-50B, New York.

BUSINESS Proposition, resilvering mirrors, autoparts, reflectors, making chipped glass signs. Write, Sprinkle, Plater, 128, Marion, Ind.

STRANGE Ironing cord. Prevents scorching. Saves electricity. Abolishes kinks and snarls. For telephones also. 150% profit. Sales guaranteed. Samples furnished. Neverknot, Dept. 12-A, 4525 Ravenswood, Chicago.

AT Home, your own manufacturing business, making popular $1 novelties. Cost you 3c to 15c. Everything supplied. Write So-Lo Works, Dept. Z-842, Cincinnati, Ohio.

COROSO Ring—Hand made, engraved initials. Make money. Samples 50c. Protected territory. Santos Hermanos, Mayaguez, Puerto Rico.

BIG Money applying initials on automobiles; $1.45 profit on each sale. Write for particulars and free samples. American Monogram Co., Dept. 40, Dunellen, N. J.

450% PROFIT Quick-Action automatic gas lighter. No flint. 25c seller to every home, office and restaurant. Free sample. New Method Co., Box PMG-60, Bradford, Penna.

500% PROFIT! Gold and colored sign letters for windows, offices, trucks, signs. Auto monograms. Easily applied by agent or customer. Neonite, Akron, Ohio.

ENGRAVE Your own Christmas cards, stationery. Signature raises changes to gold. Sample 25c. Williamsco, Box 766, Wilmington, Del.

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

AMAZING New scientific discovery cuts coal bills 40% to 60%. 75c package treats a ton. Every home and building a prospect. Agents cleaning up. Call for demonstration or write. WCS Products Co., Beverly, Mass.

MEXICAN Feather pictures, Christmas novelty. 4x9" costs 25c including duty, retails $1. Sample 30c stamps. Marquez, Apartado 1176-P, Mexico City.

MAKE Money without selling. Strange new idea pays Worman $410 in 2 weeks. You start by giving something away free to friends and neighbors. Tremendous business growing by leaps and bounds. What you make depends entirely upon how many free articles you pass out. It's sizzling hot! Complete instructions sent free. No sample outfit to buy. Nothing to sell. Hurry. Garden City, 6227 Broadway, Dept. C-1212, Chicago.

MEN-WOMEN—Wear fine hose I send without cost with outfit while taking orders for amazing new hosiery. Replacement guaranteed against holes, snags, and runs. Rush name and hose size. Wilknit, Desk 12B37, Greenfield, Ohio.

A SURE Cure for clogged drains. This tool sells on sight. Get a city and become independent. Silent Valve Co., 3420 Fletcher Drive, Eagle Rock, Calif.

NEW Sensation — Big commissions. Chamois-cloth metal polish. Full size sample 25c. Midwest Chemical, 1545 N. 17th, Omaha, Nebr.

NU-PLATE! Just rub it on—it plates! Instant demonstrator. Excellent profits. Sample 25c. Details free. Cee-Tee Products, P-608 Evergreen Ave., Brooklyn, N. Y.

SELL Something new. A sure repeater, 200% profit. Handle alone or with your present line. Sample 25c. Details free. Warrenfelt Supply Co., Indianapolis, Ind.

OVER 100% Profit selling glove and muffler, tie and handkerchief, hose and tie sets. Many other novelties. Write for catalog of 42 money makers and free sample swatches. Boulevard Cravats, 22 West 21st St., Dept. M-79, New York.

MAKE Full strength, non-explosive, non-inflammable, odorless cleaning fluid from benzyne crystals, 1c gallon. Sample 25c. Literature free. Western Reserve Laboratories, 6615 Denison Ave., Cleveland, Ohio.

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

"THE Pocket-Print-Press" prints signatures, handwriting, in black, blue, green, red, on Christmas cards, stationery, linen (wash proof) 3000 imprints. Retails $1.00. Agents $3.60 dozen. Sample 50c. Sinaprint, 24 West 61st, New York.

BIG Profit selling new typewriters and fabric "dry cleaning fountain brush." Retails $1.50. Write quick for amazing proposition. Rivet-O Mfg. Co., Orange, Mass.

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

AGENTS—Newly developed polishing wax for autos sells when other won't. Positively will not rainspot. Big profits. Send 50c for full size can. Details free. Protective Coating Co., 2242 Elston Ave., Chicago.

NEW Tinseled Christmas signs, 11x14; cost 5c—retails 25c. Make Christmas money. Sample free. Lowy, Dept. 745, 8 West Broadway, New York City.

1,000 JUMPING Beans, $1.60 postpaid. Also feather pictures, tablecloths, leather, lace-work, others. Phenomenal profits! Generous samples, 50c stamps. Free particulars. Marquez-P, Apartado 1176, Mexico City.

I'LL Give you groceries at wholesale besides splendid opportunity to make up to $45 in a week. Brand new Ford sedan given as bonus. Details free. Albert Mills, 2461 Monmouth, Cincinnati, Ohio.

THYDRO-X (Extra miles). Tremendous profits. Distributors wanted. Thermo-P Works, Peoria, Illinois.

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

COMPLETE Chemical service. Newest guaranteed formulas. Research analyses. Valuable literature free. Special low prices. Miller, Chemist, 1706-L Tampa, Fla.

FREE Sample dehydrated ink. Agents wanted. Exclusive territory. One pint 10 cents. King Permanent Ink Co., 912 Holland Bldg., St. Louis, Mo.

STEADY Work, good pay. Reliable man wanted to call on farmers. No experience or capital required. Pleasant work. Home every night. Make up to $12 a day. Wonderful new proposition. Particulars free. Write McNess Co., Dept. 5, Freeport, Ill.

MEN And women wanted: Sell Xmas signs, tree lights, cards, gifts, etc. Free wholesale catalogue. Liberty Sales, Dept. P, 24 E. 21st St., New York.

MAN In each town to plate auto parts, reflectors, bicycles, fixtures, mirrors, by late method. Simple plan of manufacturing at home starts you in good paying business. Free particulars and proofs. Gunmetal Co., Ave. H, Decatur, Ill.

SIGN Letters for store and office windows; 500% profit. Free samples. Metallic Co., 438-B N. Clark, Chicago.

BIG, Steady weekly profits for men and women with cut price food route. More than 300 fast selling household and farm necessities. Sensational premium deals get quick cash and build profitable routes quickly. Write Bleecker, 259 E. 4th St., St. Paul, Minn.

NORTH American oil burners. No experience needed. Free particulars. Wrenn Oil Burner Service, Nashua, N. H.

SELL Comic Christmas seals. Sensational! Different! Sample set 10c. Rogge, Grayslake, Ill.

AGENTS—To mail our literature. Good profits. Home business. Maywood, 149 Fifth Ave., New York.

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.

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

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

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.

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

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. P. W. Johnson, Manager Classified Advertising, Popular Mechanics Magazine, 200 E. Ontario St., Chicago.

BIG Money taking orders; shirts, ties, hosiery, underwear, raincoats, dresses, etc. Sales kit free! Experience unnecessary. Write Nimrod, Dept. 8, 4922-28 Lincoln Ave., Chicago.

MANUFACTURE Specialties, hire agents yourself. Big money. Free literature. Gilbert Supply, 1107-P Broadway, New York.

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

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.

HIGH-GRADE SALESMEN

SELL Nothing. $95 weekly. $500,000 punchboard firm announces new, no investment plan. Season starting. K&S, Dept. C1212, 6227 Broadway, Chicago.

BIG Season now! Sell America's most complete line of printing necessities, advertising book matches, gummed labels, political items, pricing sets, restaurant supplies, complete line sales books. Process engraved-like stationery. Also beautiful line of colorful Art Wall and Metal Calendars, holiday novelties, Christmas greeting cards for personal, business and professional use. Thermometers, ash trays, advertising pencils, business stimulators, and hundreds of other fast sellers. All competition undersold. Cash commission advanced daily plus extra bonus. Free gifts. Experience unnecessary. Huge complete outfit free. Northwestern, K-625 Jackson, Chicago.

REMINGTON Rand will employ local representatives for portable typewriter division. No experience or investment. Unusual opportunity for reliable man. Write M. N. Rand, 315 Fourth Ave., Dept. M-50A, New York.

GUARANTEED Gold leaf letters for store windows. Free samples. Liberal offer to car owners. Metallic Co., 438-A N. Clark, Chicago.

AMAZING Invention closes all doors silently, automatically. New oil principle. Easily installed. Never needs attention. Priced dollars less than other checks. Unlimited market stores, offices, factories. Free demonstrator furnished workers. Kant-Slam, Dept. Z-62, Bloomfield, Ind.

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WANTED County distributors. Excellent opportunity for earnings. Nationally advertising product. Large company. Dept. 251 Fyr-Fyter Co., Dayton, Ohio.

MEN Wanted by world wide industry. Write today for particulars about few good old Rawleigh routes that have paid well for years. Established, profitable business. Over 200 farm and home necessities. Industry and reliability main qualifications. Man with auto preferred. Give age, experience, references. Rawleigh's, Dept. LN-PPM, Freeport, Ill.

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ADVERTISING Book match factory offers you amazing opportunity. We are largest in world selling direct. Big cash comm., bonuses. Full-part time, big repeats. Samples and kit free. Match Corp. of America, Dept. E-12, 6041 Grand, Chicago.

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SALESMEN—Sell business stationery, $2.65 thousand. Calendars, book matches, advertising pencils, shelf moulding, labels, salesbooks, pricing sets. Business cards $1.50 thousand. 35% comm. daily. Free deals. Sales portfolio free. David Lionel Press, 312 S. Hamilton, Dept. VS, Chicago.

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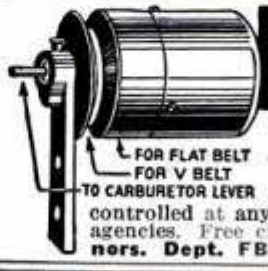

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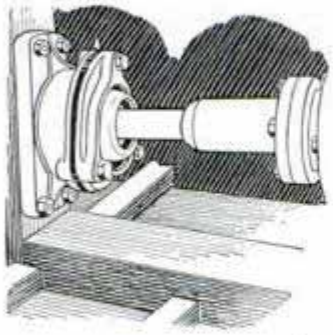
NEW INVENTIONS

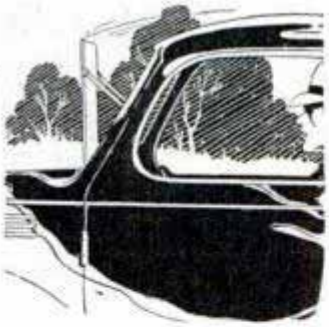
(Continued from page 38A)

MOTORBOAT owners find freedom from service problems in a new type of stuffing box which gives greater shaft protection, smoother operation and requires no attention. It is said to be flexible, full-floating, self-adjusting and self-lubricating.

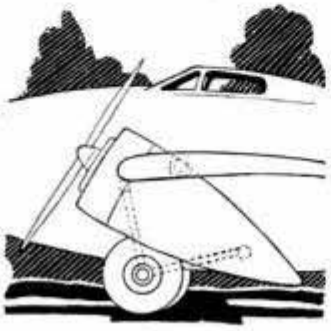


FOR home or public gymnasium use, a newly patented health machine exercises the muscles through vibrational movement of the legs and arms. An electric motor, connected to a swing arm and drive shafts, produces the movements through a harness for the feet and wrists. Exercises are taken while the user lies on his back.

VENTILATION of the automobile may be accomplished in a different manner if a new patent is applied. A windshield which may be opened at the top, instead of the bottom, is the key to the patent. When the windshield is open, and the car is in motion, air is directed above the opening, resulting in an ejector action which withdraws stale air from the interior.



UNUSUAL mounting of the aircraft engine is provided by a patent issued recently. The engine housing, to which the landing gear is rigidly attached, is pivoted. When the landing gear is in use, the engine is tilted at an angle from the horizontal. Once



(Continued to page 70A)

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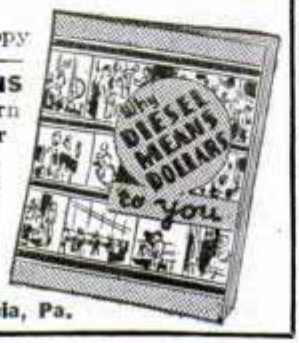

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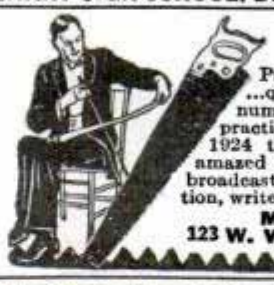

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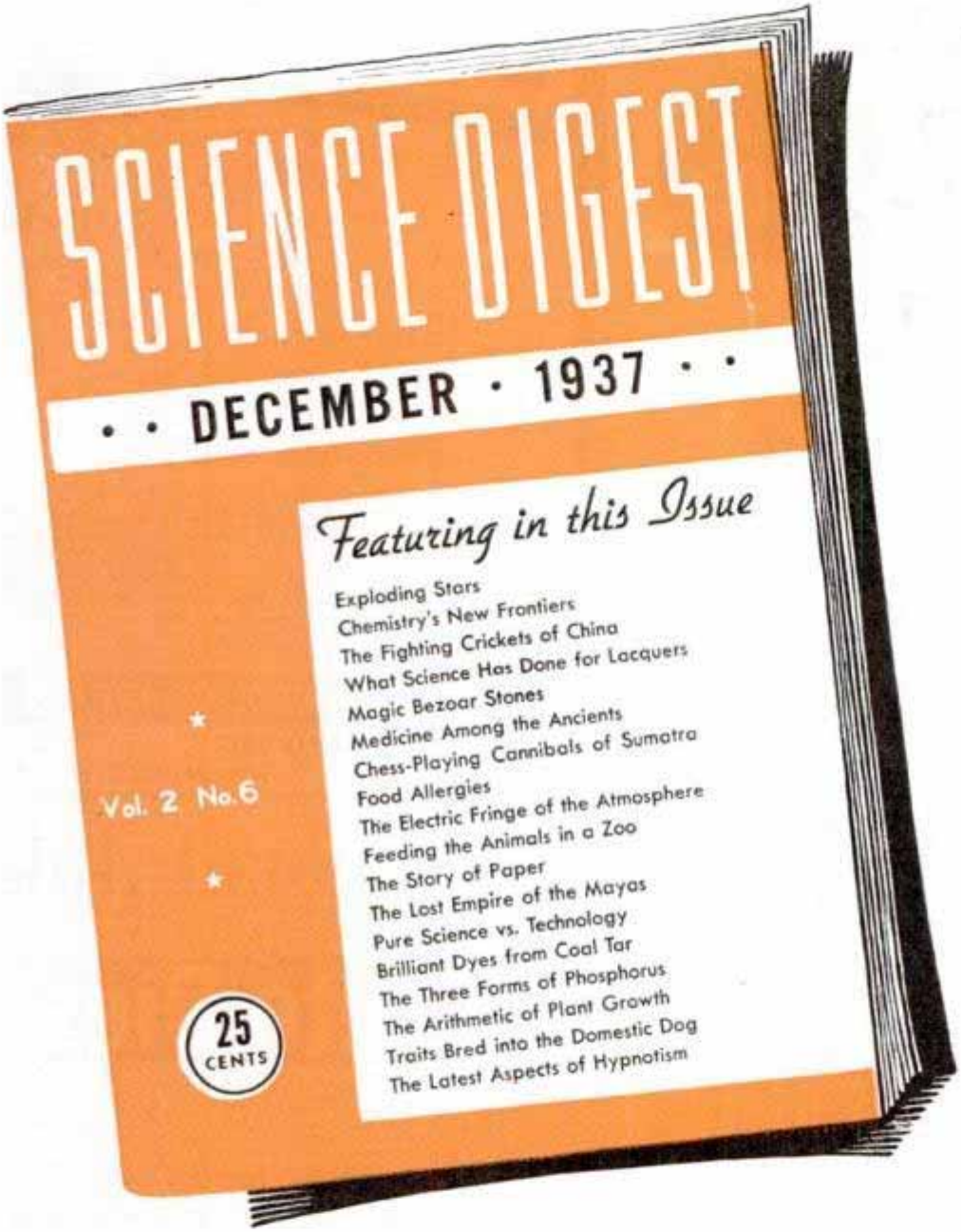

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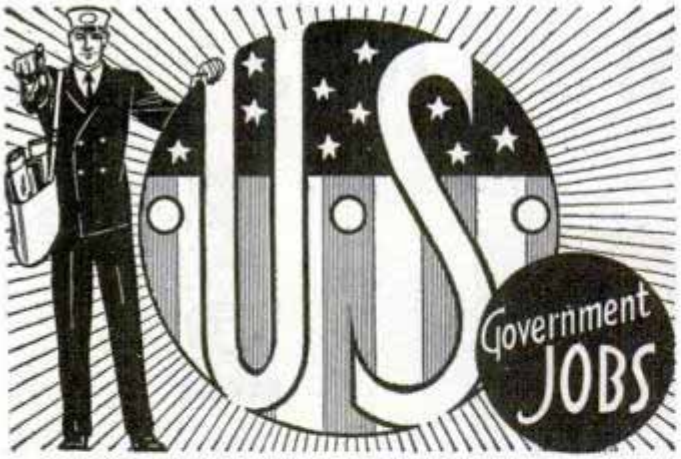

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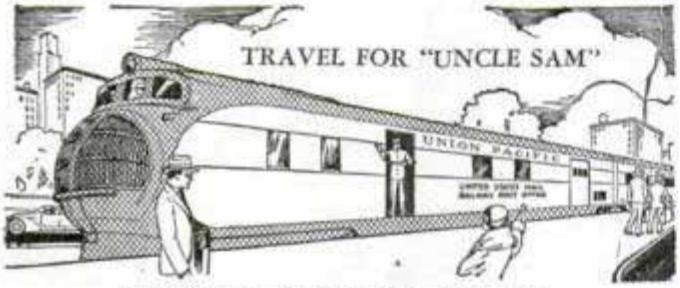

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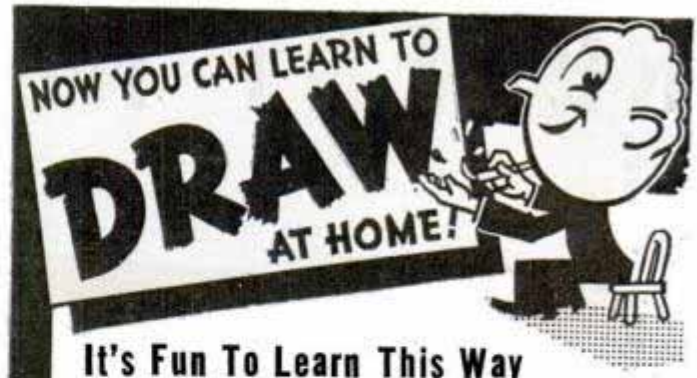

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es 1090

NEW INVENTIONS

(Continued from page 63A)

the craft is in the air, the landing gear is retracted by swinging the engine back to horizontal position. Thus the weight of the landing gear partially balances the weight of the engine, facilitating operation.

HANDY for the family taking the baby on trips is the combination luggage case and collapsible chair. During the journey, the chair is neatly folded in the case. Upon reaching destination, the chair is unfolded to form a chair for the baby. It is complete to the board which prevents baby from falling out. Set upon an ordinary chair, it serves the purposes of a high chair.

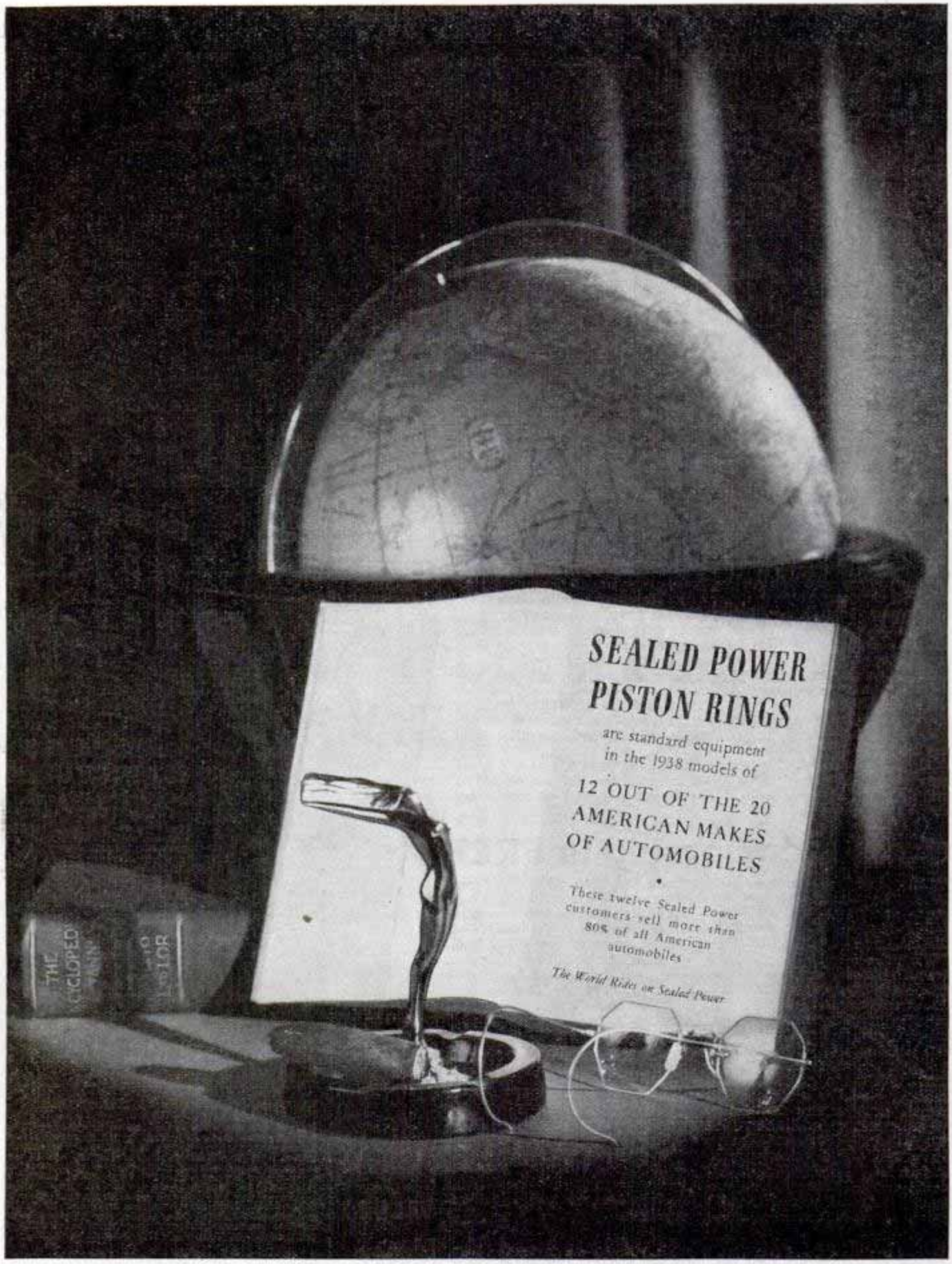
YOUNGSTERS would welcome a toy glider gun just patented. It consists of a small glider which is propelled into the air by means of a rubber band released by trigger. So swiftly is the glider shot forward that its momentum carries it soaring on a flight quite satisfactory to the young owner. The gun is cocked by pulling the glider back into position, stretching the rubber.

USE could be found for a new window-shade holder in almost any home or office. The holder, intended to keep the shade in lowered position until it is released, is a simple device. It consists of a metal strip for attaching to the wall with a hook located at right angles to the plane of the shade. A nail in the end of the wooden strip at the lower edge of the shade slips under the hook, holding down the shade.

AUTOMATIC detection of the passage of railway cars is provided by a new photoelectric-cell device. A light source on one side of the track projects a beam to the photocell on the other side until a passing railway car interrupts the light. This causes the photocell unit to set in motion a relay which operates a signal. The beam crosses the track at about the height of the standard car coupling.

DESIRE of the auto manufacturer to clear front compartments of the gear shift lever is reflected by a patent which probably will be applied at an early date. It calls for the gear lever to project from an opening in a housing extending upward from the transmission to the instrument panel. Thus, the lever, instead of consisting of a long rod extending from the middle of the floor, becomes a short rod projecting from a point just below the instrument panel.

DECORATING the out-of-doors Christmas tree might be made easy by using a recently patented clip for attaching electric lighting sets to the branches. Made of lightweight weatherproof metal, the clip locks around the small branches and holds the lighting set's double wire near each socket, thus helping to support the bulb in the position desired. Designed for attaching or detaching quickly, the clip has no sharp points that will injure tree or the hands. It will not come loose in high winds.



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Vol. 68 DECEMBER, 1937 No. 6

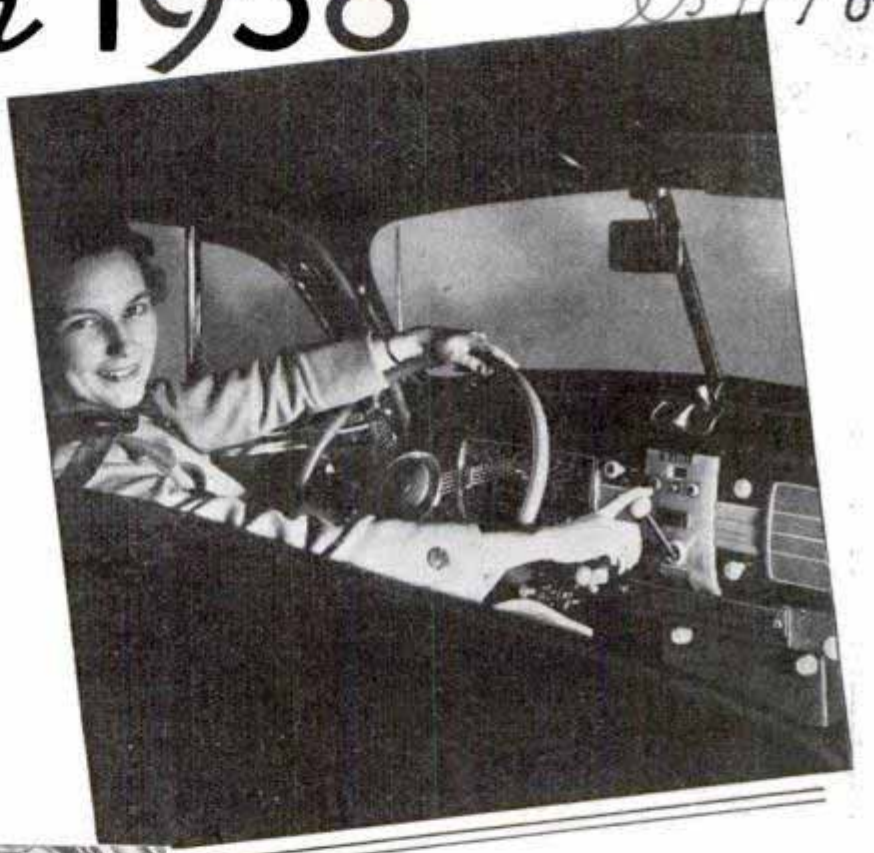
es 1170

EASIER SHIFTING in 1938

es 1170

CONCERTED action of the automobile industry to make gear shifting easier than ever before is revealed by the 1938 models. At least nine manufacturers offer means of controlling gears from steering column or dash, the others introduce improved clutches and transmissions designed to reduce the work of driving.

There are four types of gear controls in which the lever is removed from the front compartment floor: the self-shifting hydraulically operated transmission, optional on Olds and on Buick "40"; the selective automatic



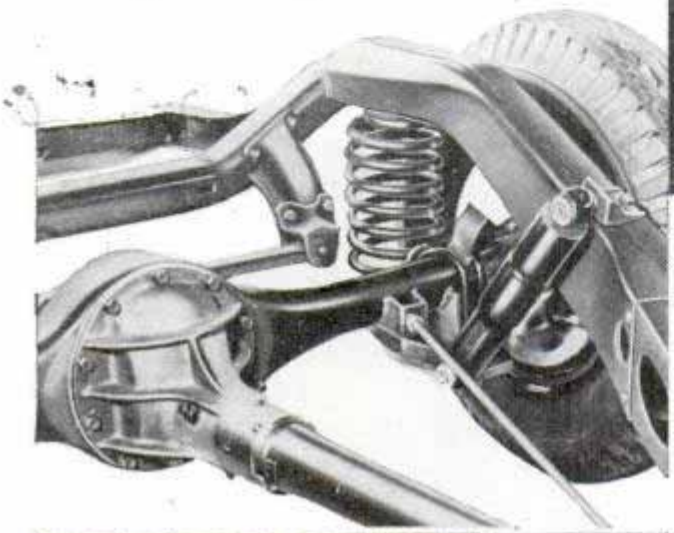
Top, location of vacuum shift lever on the Nash. Bottom, Pontiac with gear shift lever moved from floor to steering column

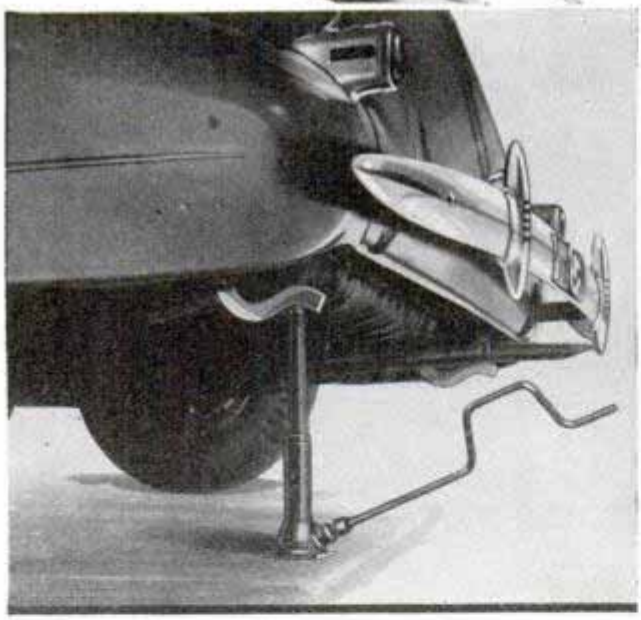
shift or "electric hand," optional on Hudson; the vacuum shift, optional on Nash, Studebaker and Graham, and the remote control, optional on Pontiac and standard equipment on LaSalle and Cadillac.

The first type, General Motors' self-shifting transmission, is controlled by a lever located on the steering column just beneath the wheel. It will shift itself once the car is under way and automatically provides a selectivity of gear ratios to meet all requirements. Incorporated into this transmission is a fourth speed, or di-

Leggett

rect drive, which permits the engine to run slower without reducing the car's speed and which saves gasoline and lengthens the life of the power plant. Introduced a few months ago as optional equipment on the Olds "8," the transmission requires use of the clutch only for starting and stopping. On down grades the driver may flip the control lever from high-speed range to the low range, thus employing second gear as a decelerating force.





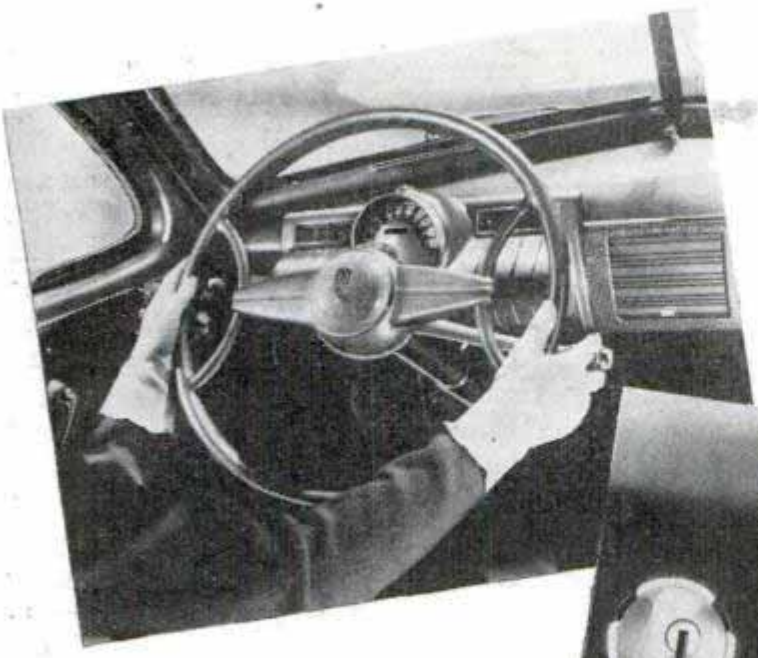
Top, back of Plymouth's front seat is thickly padded and rolled at top as emergency cushion in case of sudden stops. Center, Buick's coil spring suspension of rear wheel. Note hookup of spring and airplane-type shock absorber. Bottom, jack pad extends from rear of Pontiac chassis

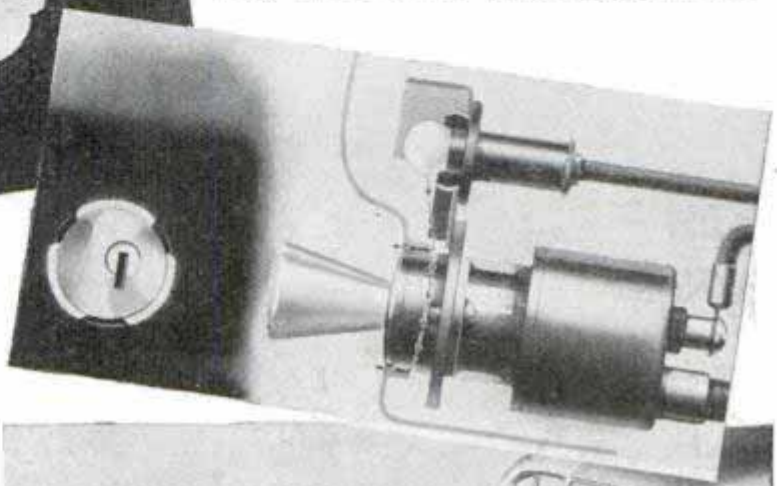
Hudson's "electric hand," first of the shifting devices to find wide acceptance, controls the gears by means of a lever on the steering post and automatic clutch action. The shifts are made in the usual manner, with a free-wheeling effect at speeds below eighteen miles per hour.

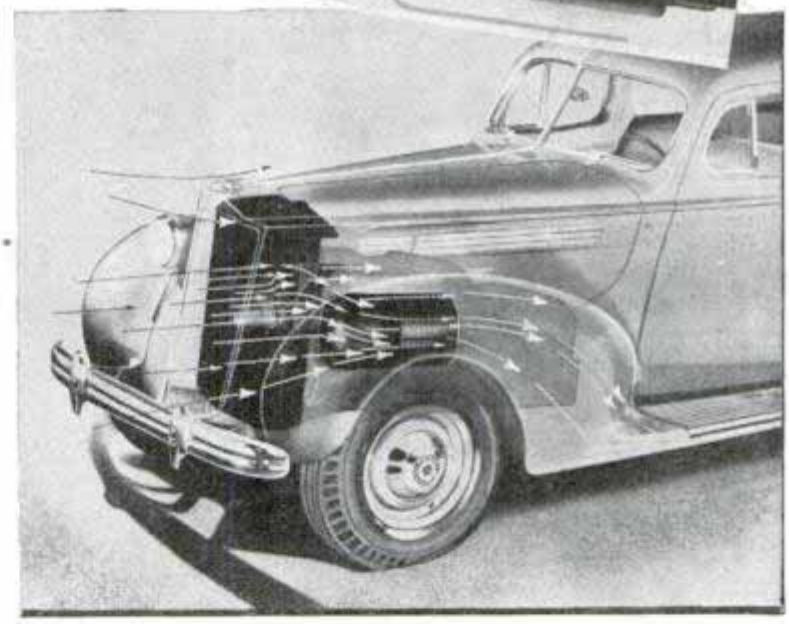
The vacuum shift, offered by Studebaker, Nash and Graham at extra cost, employs the power of vacuum to help the driver manipulate the gears. Gear shifting becomes a matter of finger-tip pressure applied to a short lever located on or just beneath the instrument panel and extending back to within a few inches of the right-hand position on the steering wheel.

Remote-control shifting, which consists of a steering column lever and proper linkage with the gears, employs none of the complicated mechanism of the automatic types. The driver shifts in the usual manner, using the clutch as he would with the conventional shift. The only difference between the remote shift and the conventional type is that the lever has been shortened and placed on the steering column instead of on the floor. The remote shift has two advantages, greater shifting ease for drivers of short stature and reduction of noise. The old type lever extending through the floor acted as a conductor of sound from chassis to the inside of the car.

Manufacturers retaining the conventional lever-on-floor transmission have improved clutches and parts of the gear-changing mechanism. Chevrolet introduces a simplified clutch which operates on the diaphragm principle and requires less pressure but gives more positive engagement than the one used last year.





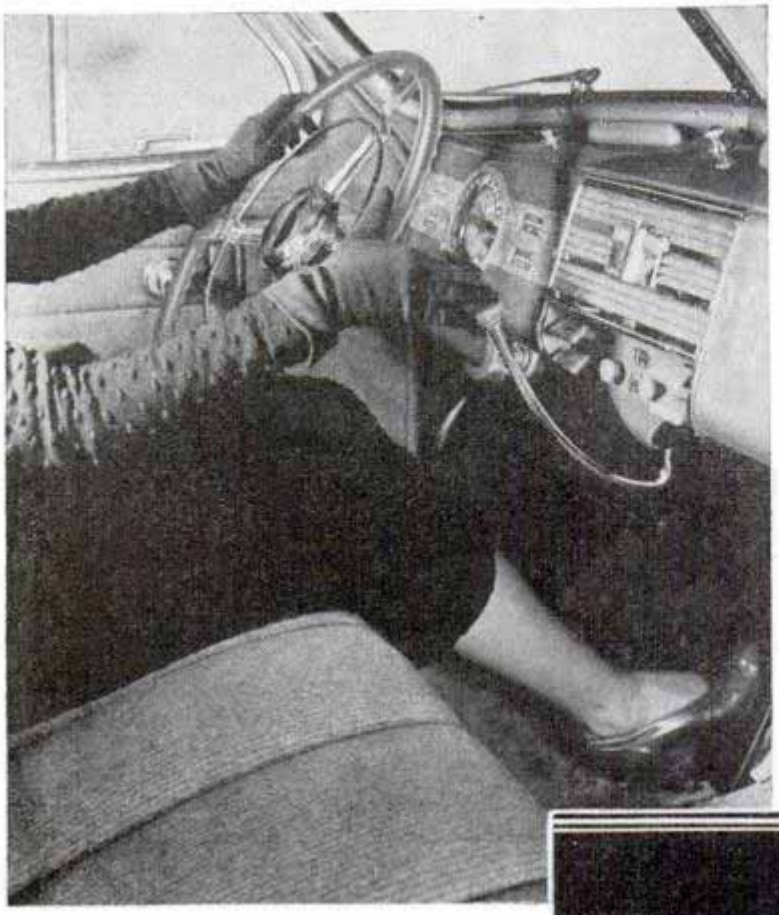


Top, Olds' automatic transmission is operated by short lever on steering column. Note the unusual dash. Center, Chevrolet's illuminated ignition lock. Bottom, Packard's system of conducting engine's heated air away under the car

Plymouth, DeSoto, Dodge and Chrysler all offer improved clutches which reduce driving effort. DeSoto and Chrysler have new blocker-type synchronizers in their transmissions to make the gears virtually clashproof.

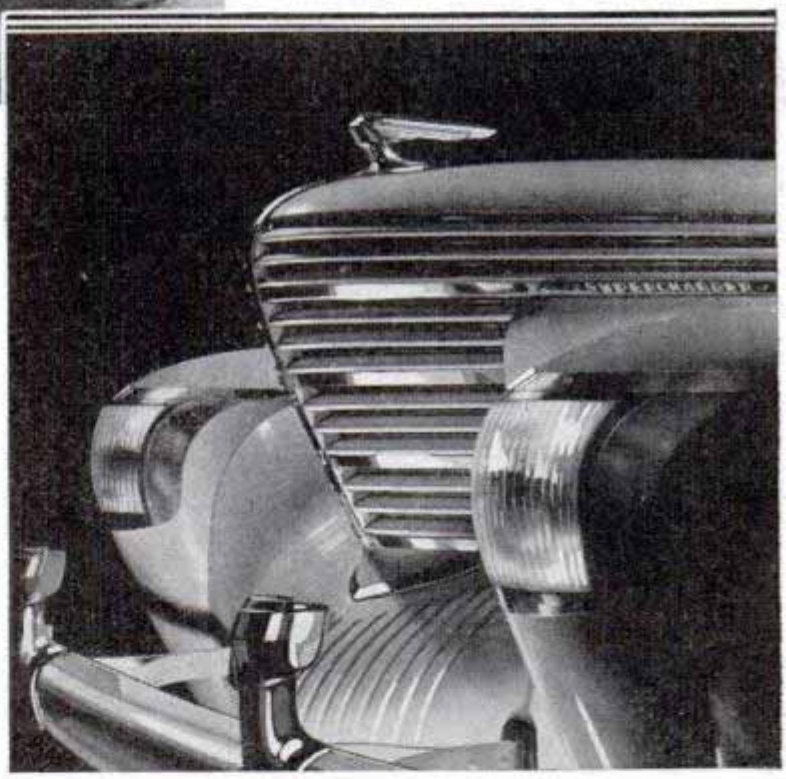
Significant in the 1938 automobiles is the first step toward independent suspension of rear wheels. To General Motors' "knee action" on the front wheels, Buick adds torque-free springing which involves the use of coil springs, airplane-type shock absorbers and a radius rod on the rear wheels. The coil springs are mounted on the rear axle housing behind the axle, increasing the car's spring base by five inches. The low-pressure shock absorbers are used at the rear and the radius rod locates the rear axle and the wheels sidewise. As a result of this suspension, rear wheels track exactly where the front wheels lead, tendency to skid on curves, graveled roads and wet or icy surfaces is reduced and riding comfort is improved. Replacing heavy multi-leaf springs with light one-piece coil springs eliminates shackles and shackle bolts, bulky spring covers and other parts. Lubrication of the rear suspension is unnecessary, thus cutting down on the number of points to which service-station attendants have given attention.

Packard also attacks the question of rear-wheel springing with a system introduced on the "junior" cars to give easy riding. Leaf springs are used, but static friction is practically removed from them. At the end of the spring leaves are cup-like depressions containing buttons, some of which are rubber and some oil-impregnated bronze. The forward ends of the springs are mounted in rubber, and rubber bushings are employed in the spring shackles. One end of these bushings has a thick integral rubber flange. A flange is formed on the other end when the shackles are drawn up, because the bushing is longer than the spring eye. This avoids metal-to-metal surfaces in the shackles. A lateral stabilizer and a roll control bar are parts of the rear spring suspension. Insulated with rubber, the stabilizer consists of a steel tube extending from the right rear spring pad to the end of a vertical bracket attached to the left side rail. There are two of these tubes on



eral new models. Packard Eight, with a wheel base of 127 inches, becomes successor to the "120" which had a wheel base of 120 inches. The Packard Six measures 122 inches from center of front wheel to center of rear wheel, a substantial increase over last year's wheel base. DeSoto and Chrysler Royal have 119-inch wheel bases, three inches longer than those of 1937. Hudson's body is two inches longer.

Distinctive styling is found in the Graham, which gives the illusion of high speed while the car is standing still. The front fenders, in which the headlamps are set flush with the leading edge, seem to be leaning into the wind and the same line is duplicated by



Top, Graham's vacuumatic gear shift lever, which is within easy reach of driver. Bottom, "face" of the new Graham suggests speed. Note unusual treatment of headlamps

the "senior" Packards. Two-way shock absorbers on the "junior" cars are mounted so that on one the arm extends forward, while on the other it extends to the rear. This mounting supplements the resistance of the more flexible springs against braking or starting torque reaction of the rear axle. Packard retains the independent front-wheel suspension.

Almost unanimous is the decision that the battery should be placed in a more accessible position for servicing than under the floor or front seat, so the 1938 cars have batteries under the engine hood. Some of them are housed in a special compartment provided with a duct through which is carried an air current for cooling the battery. Olds has a long, narrow battery located alongside the engine, permitting the use of short battery cables which reduces line loss of electricity.

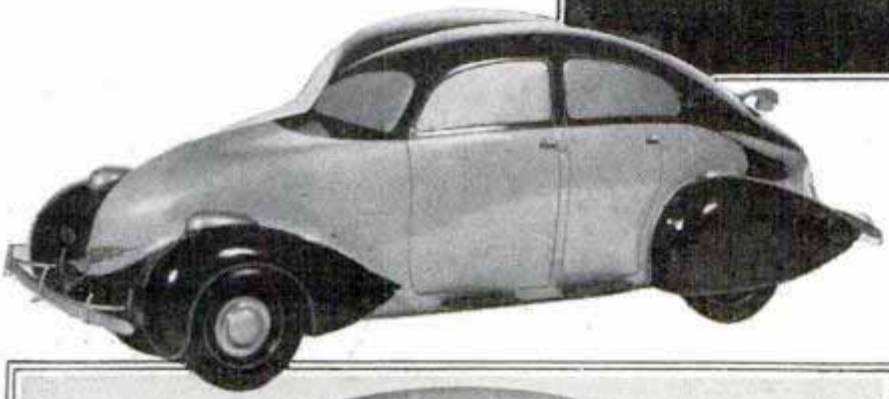
Increased wheel base is a feature of sev-

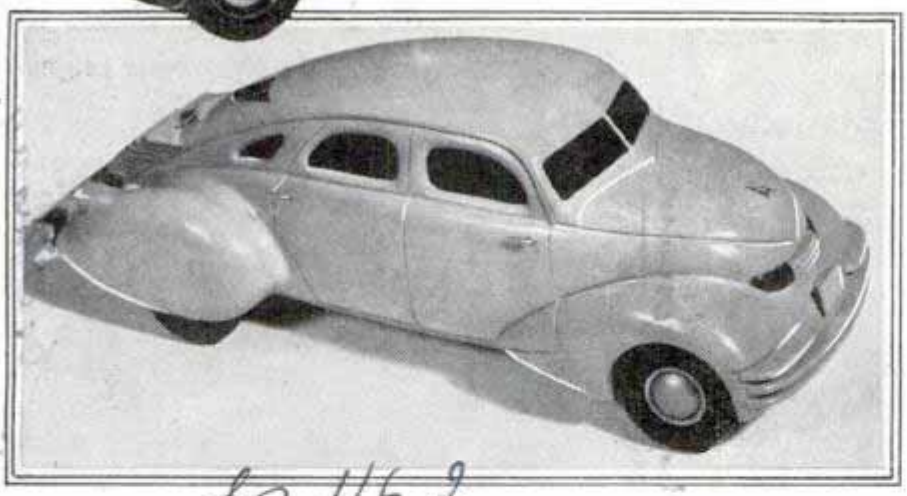
the radiator grille as it rises to the un broken sweep of the hood. Photographs of the car at a standstill have the same speed lines recorded in action pictures made at the speedways. Concealed door hinges, door handles which so blend with the belt molding that they are scarcely visible at a short distance and liberal use of plastics are other features of the Graham. Surrounding the instruments, decorating the

(Continued to page 154A)

Model Autos Reflect Boy Builders' Ability

Reflecting the creative ability of the boys who designed them, two model automobiles recently won scholarships for the builders. Entries were judged on originality of design and artistic merit, proportion and balance, workmanship, painting and color application, practicability and scale fidelity. The awards were made to the two boys, Teddy Mandel, aged fourteen, and Charles Bangert, Jr., nineteen, by the Fisher Body Craftsman's Guild. Young Mandel, competing in the junior division, submitted a two-tone model of novel design with the engine in front, while Bangert, in the senior division, placed the engine in the rear and stipulated that the semblance of a hood he left in front should house an air-conditioning unit. Both models were designed along recognized principles of streamlining, Bangert using the bulbous front and sloping lines to the rear. The Mandel entry resembles the sharp-nosed automobiles in use today.





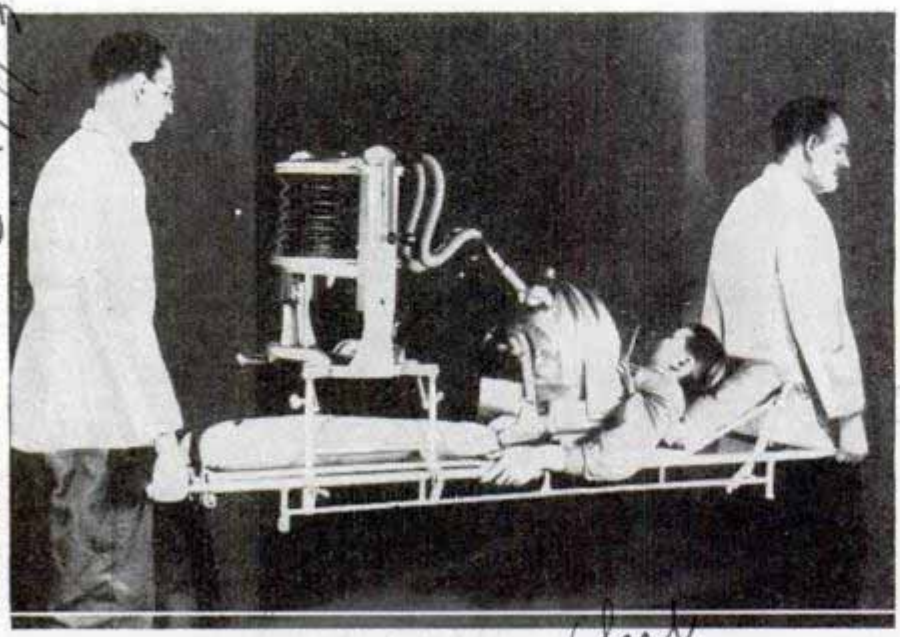
Top, Teddy Mandel, holding model, and Charles Bangert, Jr., standing behind him, as they were awarded scholarships. Center, Mandel's model. Bottom, Bangert's entry

Carbon Dioxide Inhaled by Pilot Reduces the Effect of High Altitude

By adding a little carbon dioxide to the rarefied air breathed by a pilot at high altitudes, the effects of thin air on the aviator's mind and body can be reduced by the equivalent of nearly a mile in altitude. Tests of this theory were made in Harvard fatigue laboratory, simulating the oxygen conditions of flight at 17,000 feet. In this thin air the memory and attention power of men dropped to sixty per cent of sea-level normal. But when three per cent of carbon dioxide was introduced into the air, the attention and memory figure rose to ninety per cent of sea-level normal, which is the percentage usually found in men flying at 12,000 feet.

es 1098

'Aluminum Lung' Permits More Freedom for Patient



Demonstrating simplified form of "iron lung" which permits the paralysis patient more freedom. It is made of aluminum

Made of aluminum and fitting over the chest and abdomen of the patient, a new type of respirator leaves part of the infantile paralysis sufferer's body free. Thus, much discomfort entailed by use of appliances covering the entire body are eliminated. The new "lung" allows for adjustments in treating kidney and other ailments.

Buildings Shaken to Remedy Annoying Vibrations

es 1125

By means of shaking machines, engineers are studying the vibration periods of buildings in an effort to eliminate one source of annoyance to tenants. These shaking machines, intentionally operated out of balance, transmit a vibration directly to rigid members of a building's frame. As the frequency and size of the intentional vibrations are changed, the engineers find certain ones to which the building responds as a whole. In one Atlantic City, N. J., hotel, annoying vibrations were analyzed and finally traced to machinery of a power plant near by. Vibrations of the machinery, transmitted through the wet sandy soil, were synchronous with one of the dominant periods of vibration of the hotel structure. In this condition of vibration resonance the annoying oscillations, while small, were passed on to the hotel's guests. Many things in, or around, a building may cause such vibrations. Sometimes unbalanced machinery will cause the trouble, or it may be wind gusts, subway or street traffic near by, or even the elevators.

es 1117

Wind Instrument Has Keyboard Like Piano

Combining keyboard action with wind horn effects, the latest musical instrument is said to be easy to master. It is played by blowing through a mouthpiece and by fingering the keys properly. This method of introducing the wind for the instrument creates closer coordination between player and instrument, as compared to lifeless introduction of air in many other instruments. The design is such that no strain, such as might interfere with proper manipulation of the keyboard, is put on the breathing apparatus of the player. Beautiful tones and effects may be produced by proper fingering and handling of the mouthpiece.

Playing the wind instrument. Note keyboard resembling that of piano or organ

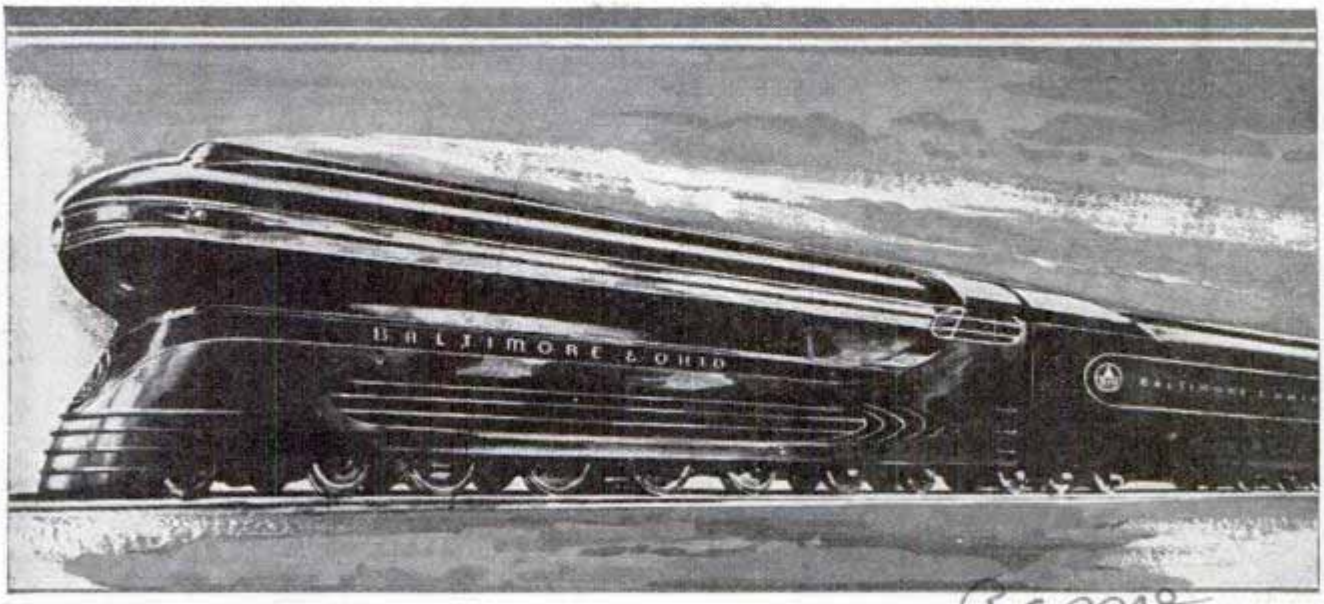
Dr. Wm. B. O. Sallir Carnalbrate 11/9/27

Hutzgart, W. Germany.

Nov. U. S. agent Inman

Science Service Felix Sontheimer, 57 Greenwich

Sixteen-Cylinder Locomotive Fast, But Quiet

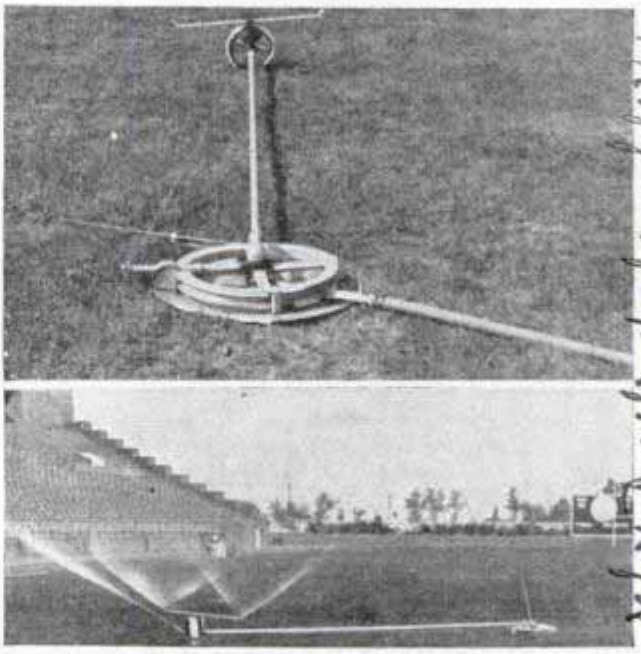


Here is the latest thing in steam locomotives. Its sixteen cylinders give it the smooth flow of power common to the multi-cylinder automobile. The streamliner is rated at 5,000 horsepower

Designed to operate with the smoothness of a multi-cylinder automobile, a 5,000-horsepower locomotive will pull fourteen heavy coaches at 100 miles per hour for the Baltimore and Ohio railroad. It will have sixteen cylinders arranged for constant torque and will produce thirty-two power impulses for every revolution of the steam motors. Absence of reciprocating parts will reduce vibration and track pounding. The locomotive, of streamline design, will have a four-wheel front truck, four pairs of drivers, a four-wheel trailer truck and a tank mounted on two six-wheel trucks and carrying twenty-three tons of coal and 22,000 gallons of water. Each of the four driving axles will be driven by a steam motor, each of which will have four cylinders directly geared to its axle. All moving parts of the motors operate in a continuous bath of oil. Total weight will be about 400,000 pounds.

Automatic Sod Sprinkler Moves Along Football Field

Sprinkling as it goes, an automatic device for keeping sod watered rolls slowly up and down the football field at the University of Nebraska. It was designed to sprinkle the field evenly without attention after starting. It is set to travel 130 yards in sixteen hours, in which time it will deliver one-quarter inch of moisture to the entire field. The sprinkler, after being started at one end of the field, is guided by a wire stretched between the goal posts. Water pressure operates the driving mechanism of a small outer wheel which travels in a circle. At the same time the sprinklers throw water the full width of the field. As the sprinkler revolves it turns a large wheel in the center, around which the guide wire runs, forcing the whole device to travel the length of the field. Use of the sprinkler saves the labor of several men.

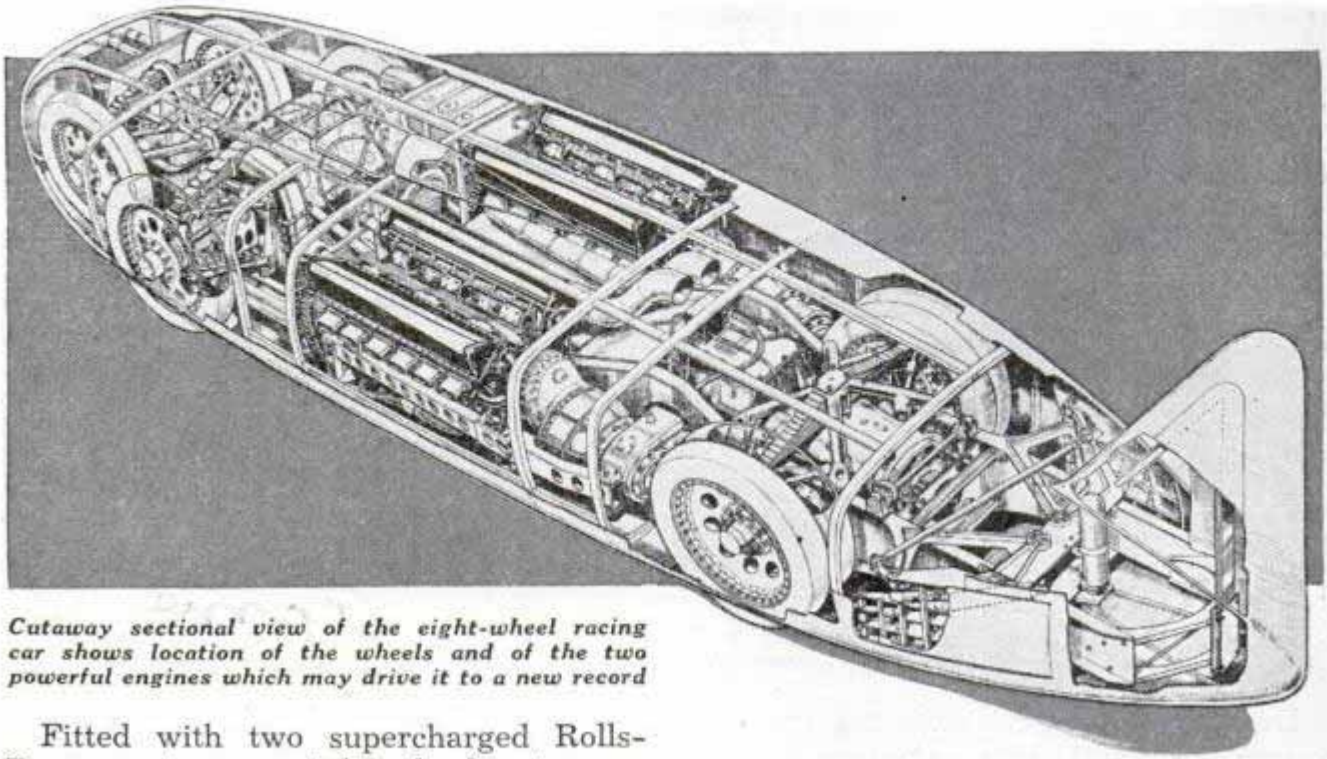


Two views of automatic sprinkler which rolls down field as it waters the sod

Mr. Harold B. Willoughby
Colombaire, 29 Bean Road
Bexleyheath, near London, Eng.

es1074

Eight-Wheel Racing Car Has Two Engines



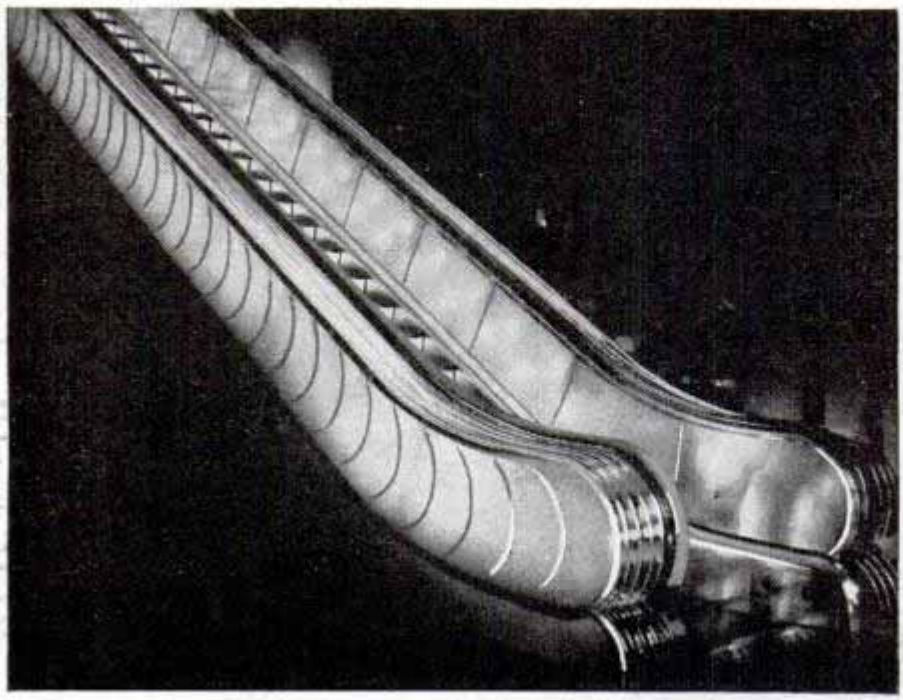
Cutaway sectional view of the eight-wheel racing car shows location of the wheels and of the two powerful engines which may drive it to a new record

Fitted with two supercharged Rolls-Royce engines, an eight-wheel racing car soon will be driven over Utah's salt beds in an attempt to break the world's land-speed record of 301.13 miles per hour. Steering is accomplished through the four front wheels. Tracks of the two sets of front wheels are different. The four rear wheels are installed side by side, dual fashion. A forty-gallon fuel tank is fitted on the seven-ton monster. Ahead of the two giant engines, which are placed side by side in the center of the chassis, will sit the driver, Capt. George Eyston of England. With the power plant developing 3,250 horsepower and eight wheels giving increased traction, Capt. Eyston expects the machine to attain 400 miles per hour.

es944

Glass Side Walls of Escalator Are Illuminated from Inside

Emporium



Night view of the inside-illuminated escalator designed with glass walls

With side walls constructed of glass, the escalators in a San Francisco department store offer something new in illumination. Electric lights inside the side walls cast a soft glow on the moving stairs, giving sufficient light for shoppers' safety and enhancing beauty of the fixtures. The side walls are made of etched glass, the pattern of which is outlined by the lights.

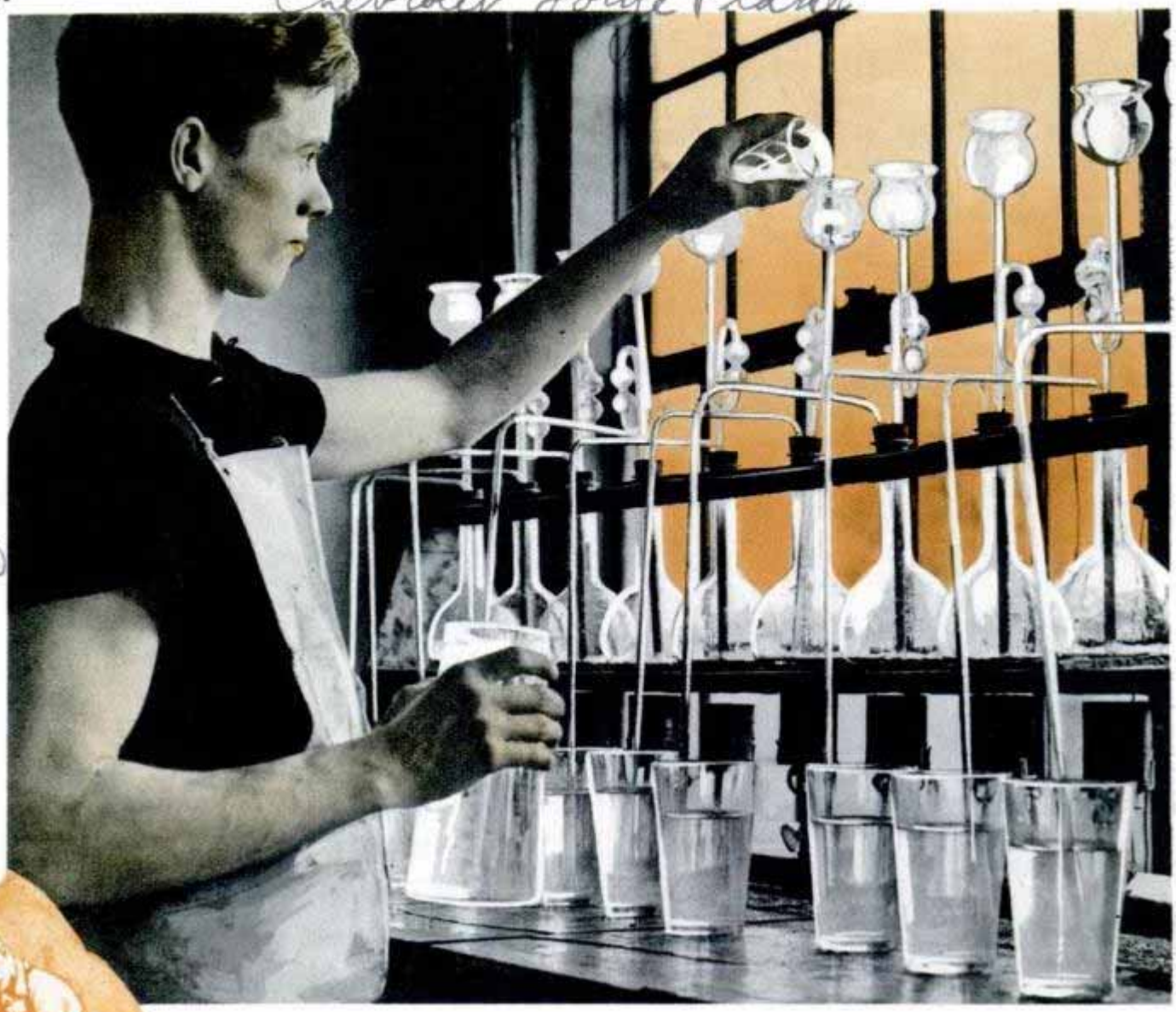
¶Our Bureau of Information will answer questions regarding articles in this magazine, if accompanied by return postage.

Architectural Forum.
Aug. 1937

CHEMISTRY *and* YOU

WITHOUT chemistry's assistance, particularly in the field of metallurgy, we could not produce or transmit the power to turn the wheels of industry.

Chevrolet Forge Plant



CHEMISTRY guards motorcar quality. Here a chemist is determining the sulphur content of steel samples in the Chevrolet plant.

By Dr. C. M. A. Stine

Vice-President E. I. du Pont de Nemours and Company

Wilmington, Del.

IN the past century there have been three great phases of development so basically revolutionary that much or all of our economic structure has been embraced in the radius of resultant change. These may be described as, first, the introduction of steam power to machinery; second, the utilization of electric power, and third, the application of the relatively new science of chemistry to the whole wide range of man's material problems.

Steam and electric power gave us a new type of existence. Manufacturing passed from the home to the factory, from the hand to the machine. Millions left the farm for the town. Mechanical transport supplanted animal transport. We learned to talk great distances over wires and finally without wires by radio. We learned to fly. The workday was reduced, leisure increased, and our standard of living was raised to a level previously undreamed.

Widely sweeping as they were, however, neither of these first two revolutions was complete by itself. Steam power gave us the locomotive but inventors were unable, despite numerous efforts, to apply steam satisfactorily to a highway vehicle. Success of the automobile had to await perfection of an electrical ignition system that permitted the use of gasoline, a new source of motive power. Too, steam power alone was insufficient to produce the telephone and the radio, or to effect any change in our methods of lighting, but when it was harnessed to a dynamo each of these impossibilities and

es 810

hundreds of others immediately became possible.

That is, they became possible within limits, but so definite were these limits that they precluded wide use of the more important inventions involved. Since the dawn of time man had been confined to natural materials to fill his needs. By no means were these always satisfactory, or as abundant as he would have liked, or as convenient to his reach, or as cheap. The materials of nature were filled with impurities, they were heavy

811

CHEMICAL research has played an important part in the improvement of the telephone. Here Alexander Graham Bell is opening the New York-Chicago line in 1892.

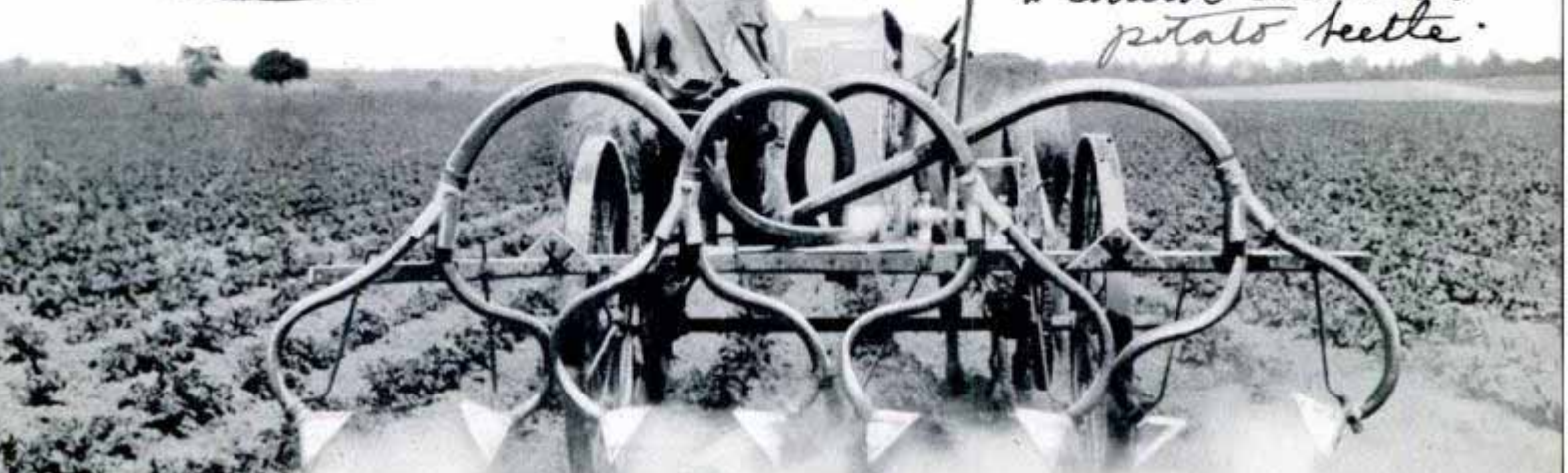
Photo courtesy Bell Telephone Laboratories

SAFETY glass is the direct result of chemistry. Below, dusting potatoes with calcium arsenate, a chemical.

when man would have preferred them light, soft when he wanted them hard, or solid when they should have been liquid. Progress halted before this barrier set up by a seemingly unchangeable and inscrutable nature.

The automobile is a notable example of how formidable this barrier was. To get strength in the car the early builders had to use metals such as went into locomotives and stationary engines. The result was a clumsy, unwieldy and expensive vehicle that no person of mod-

Dusting potatoes with calcium arsenate to control Colorado potato beetle.



in the electric lamp, and indeed in most of the products of invention. The fault was not in lack of human skill, not in lack of vision, not in lack of money, but in lack of the right kind of materials. Throughout the length and breadth of industry this lack was felt. On every front it checked us—until chemistry broke through the barrier!

The modern foundations of chemistry were being laid in Europe while we were fighting the Revolutionary War. With

BEFORE electricity and modern household appliances, many of them the result of chemical research, invaded the home to lighten household drudgery, women worked in kitchens like these.

Photo Courtesy Westinghouse

erate means could afford. This vehicle then was equipped with rubber tires that were more unreliable than the weather and wore out after a few thousand miles of highly uncertain travel. Windshields and windows were of glass that shattered at the least impact. The leather-covered seats rapidly disintegrated, the gasoline and lubricants available soon choked the motor with carbon and gum, the painted surfaces became cracked and dull in six to twelve months, while rust ate into the machine's vitals at a hundred spots.

Obviously this car of only a generation ago was little more than an uneconomic plaything. It was faster than a horse but so unreliable in operation and so costly that if the future of the automobile industry had depended on it, that industry would be of small concern to us today. Similar shortcomings were inherent in the telephone,

peace we were quick to grasp their significance and the chemical industry grew rapidly in America. In the main, however, its function was to supply known chemical materials and only casual thought was given to creating new materials. The period was marked by a wider and more intelligent use of chemicals in bleaching textiles, in papermaking, in tanning, in steel fabrication and other lines, but problems of synthesis interested few outside of college laboratories.

Nevertheless some highly important chemical strides were taken that pointed the enormous potentialities of the science. In 1828 Wohler, a German, synthesized urea, a waste product of animals and humans. This was the first evidence that man

CONTRAST this up-to-date kitchen with the old-fashioned ones on the opposite page. The magic hand of the chemist has reached into the home as well as the factory.

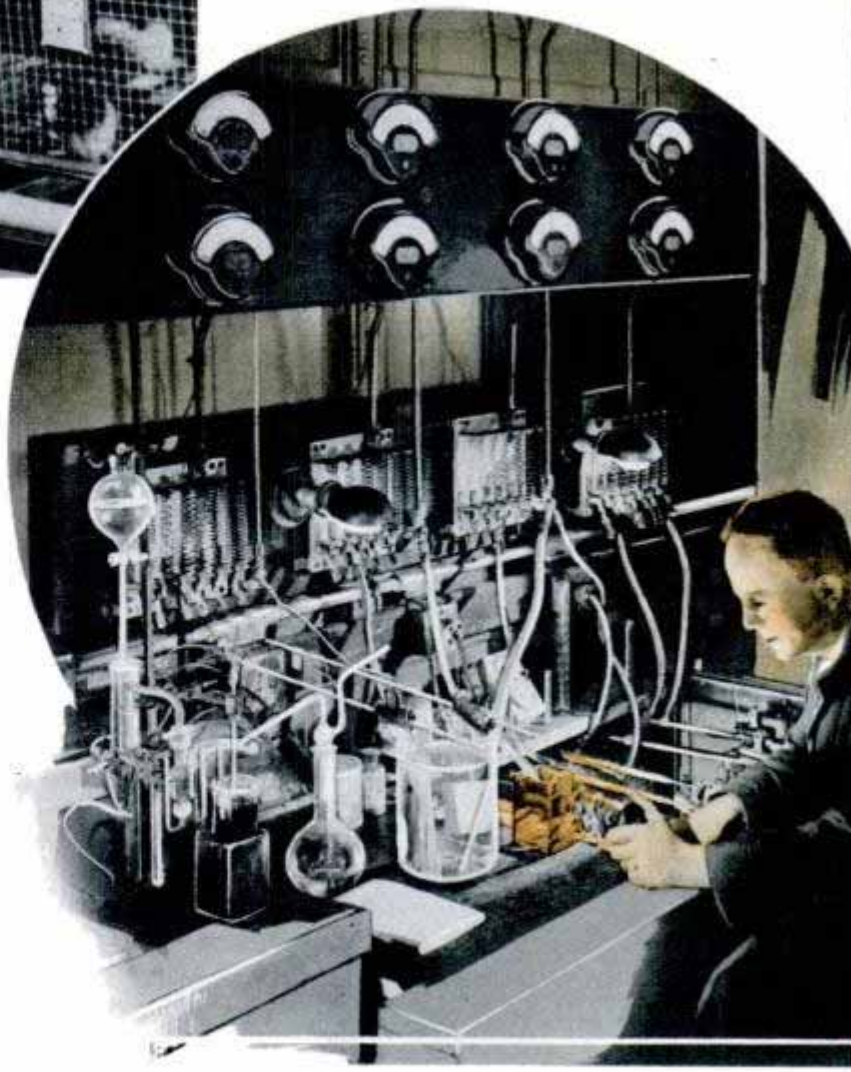
RATS being prepared for vitamin D assay in du Pont laboratory. Right, controlling current into electroplating bath, one step in furthering knowledge of plating.

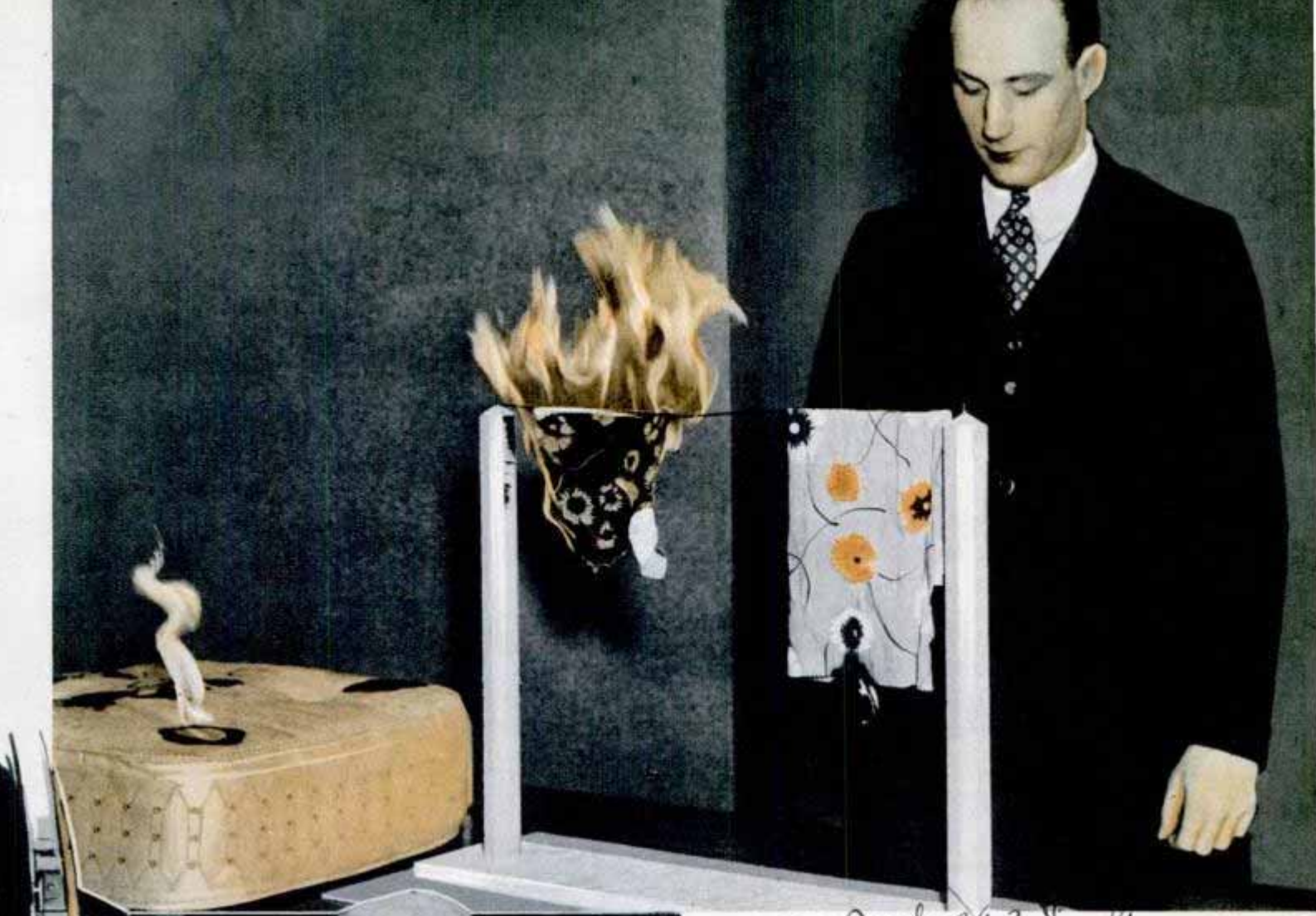
New Brunswick, N.J.

could make an organic substance, hitherto produced only in a living body, by chemically compounding inorganic substances. Seventeen years later another German, Schoenbein, treated cotton with a mixture of nitric and sulphuric acids and got a highly explosive new material he called guncotton, the technical term for which is nitrocellulose. Cotton, chemically, is almost pure cellulose, a chemical term you should remember, because you handle something made of chemically transformed cellulose almost every waking hour. Cellulose, which means literally "full of cells," is the fibrous material that makes up the structure of most plants and all trees. Therefore it is almost as abundant as the air.

Shortly after Schoenbein's discovery of nitrocellulose it was found that its explosiveness could be reduced simply by using less nitric acid. This gave us still another new material, pyroxylin. In 1869 Hyatt, an American, plasticized pyroxylin with camphor and created "Celluloid," the first of the synthetic plastics, out of which was soon being made a wide variety of things. Then de Chardonnet, a Frenchman, squirted nitrocellulose in solution through a spinnerette and got a fine filament or thread, which he then denitrated to reduce its flammability. This was the first man-made textile fiber, rayon.

These were basic discoveries. In them were the germ cells of a hundred new industries that in





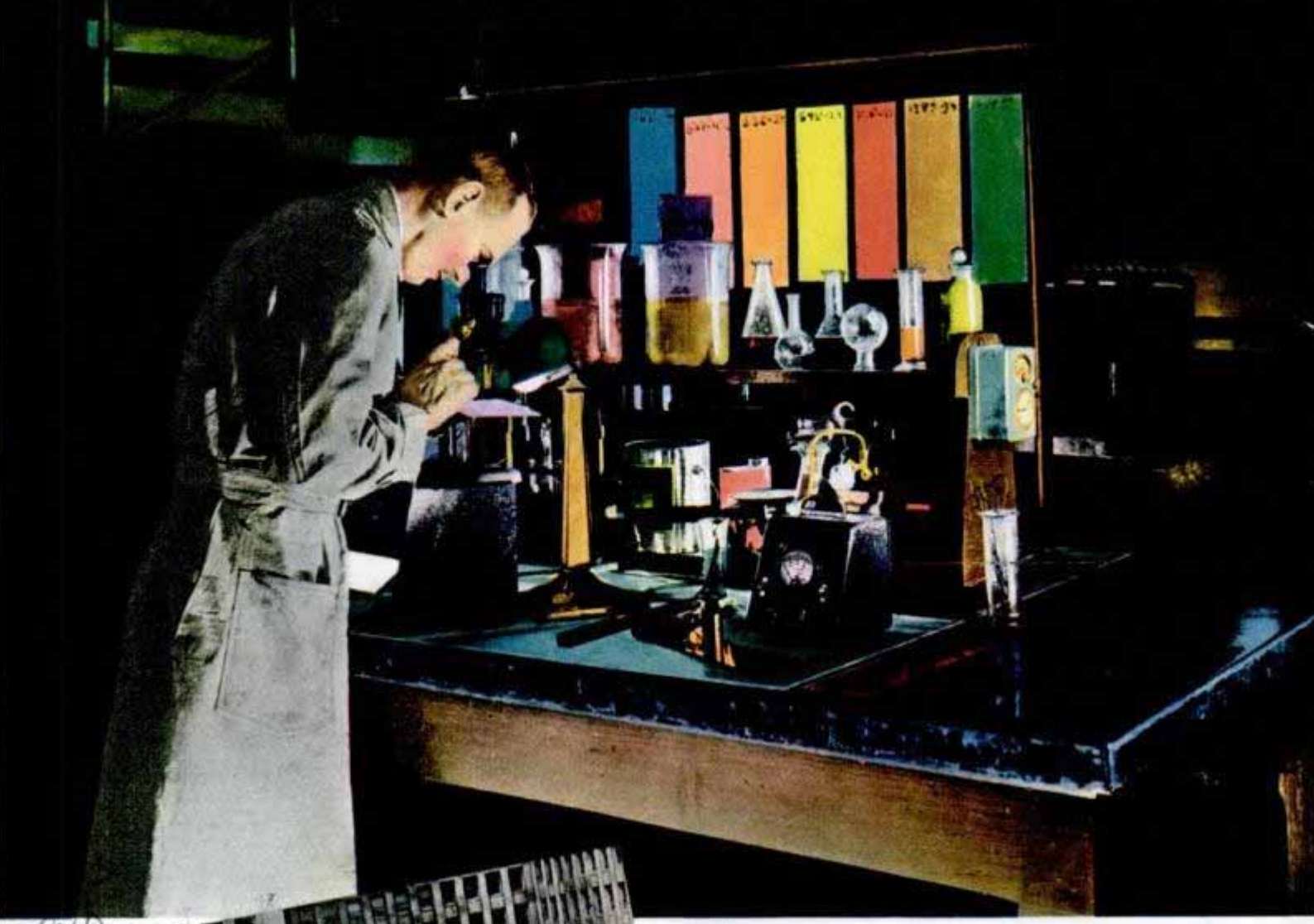
SPRAYING body of car in Pontiac plant. Durable, quick, drying finishes developed by chemistry have made possible the mass production of automobiles. Top, demonstrating a chemical agent for flameproofing fabrics. Untreated fabric is at left, the treated one at right. At far left is treated mattress on which gasoline has been ignited. The gasoline burns, the mattress does not catch fire.

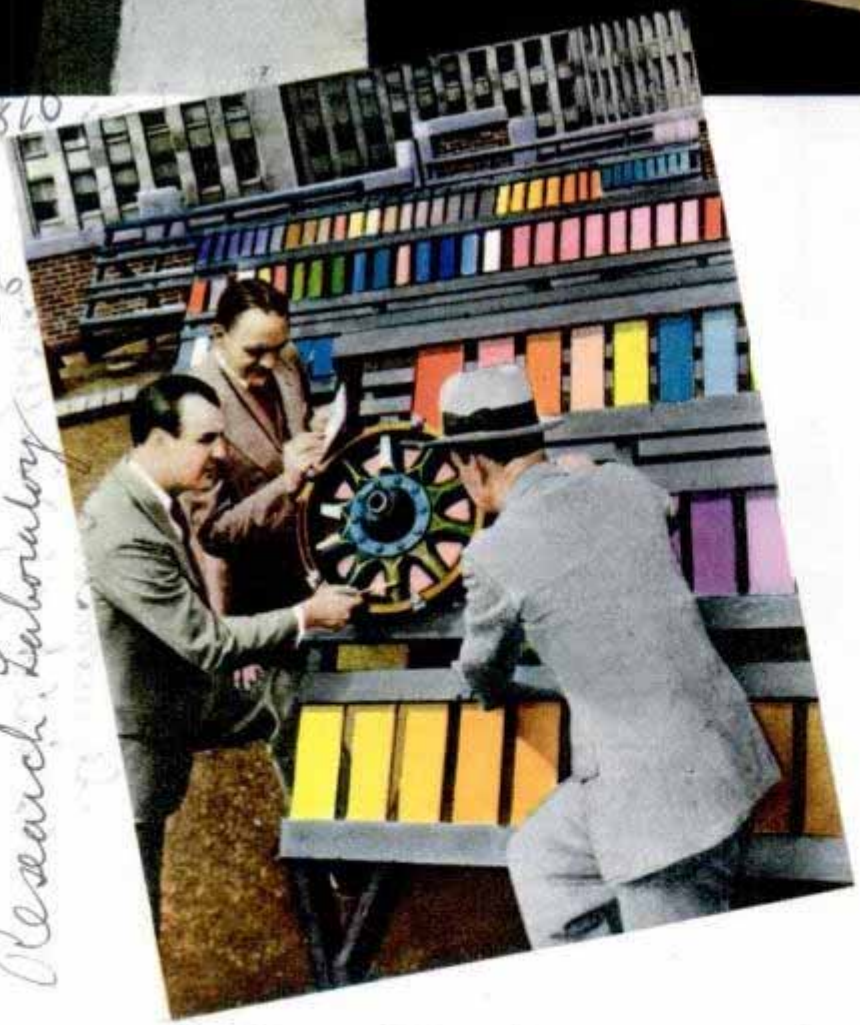
see July 1939 - 19

time would consume cellulose by trainloads. Equally important was the isolation of aluminum by electrochemical methods. This achievement by Charles Hall, a twenty-two-year-old chemistry student at Oberlin college, placed in common use a metal that previously had been almost as precious as silver. Then Perkin of England discovered dyes could be derived from coal tar, Goodyear found a way to vulcanize rubber, invention of the electric furnace led, among other things, to new abrasives and high-speed cutting tools, and a wholly new conception of chemistry's relation to medicine was effected by the work of two mighty pioneers of science, Pasteur of France and Ehrlich of Germany.

Many believe the World War led to the establishment of a chemical industry in America. What actually happened is that an already formidable American chemical industry woke at the time of the World War to its own enormous potentialities, and what is equally important, to its own deficiencies. In 1914 the official census did not bother even to list American-made dyes, although on dyes were dependent textiles, leather, paper and other industries employing 1,200,000 workers. Our farmers had to buy potash from Germany and nitrate from Chile. Our

E. B. Alvord, manager, Specialty Sales Section ~~Heavy Products~~





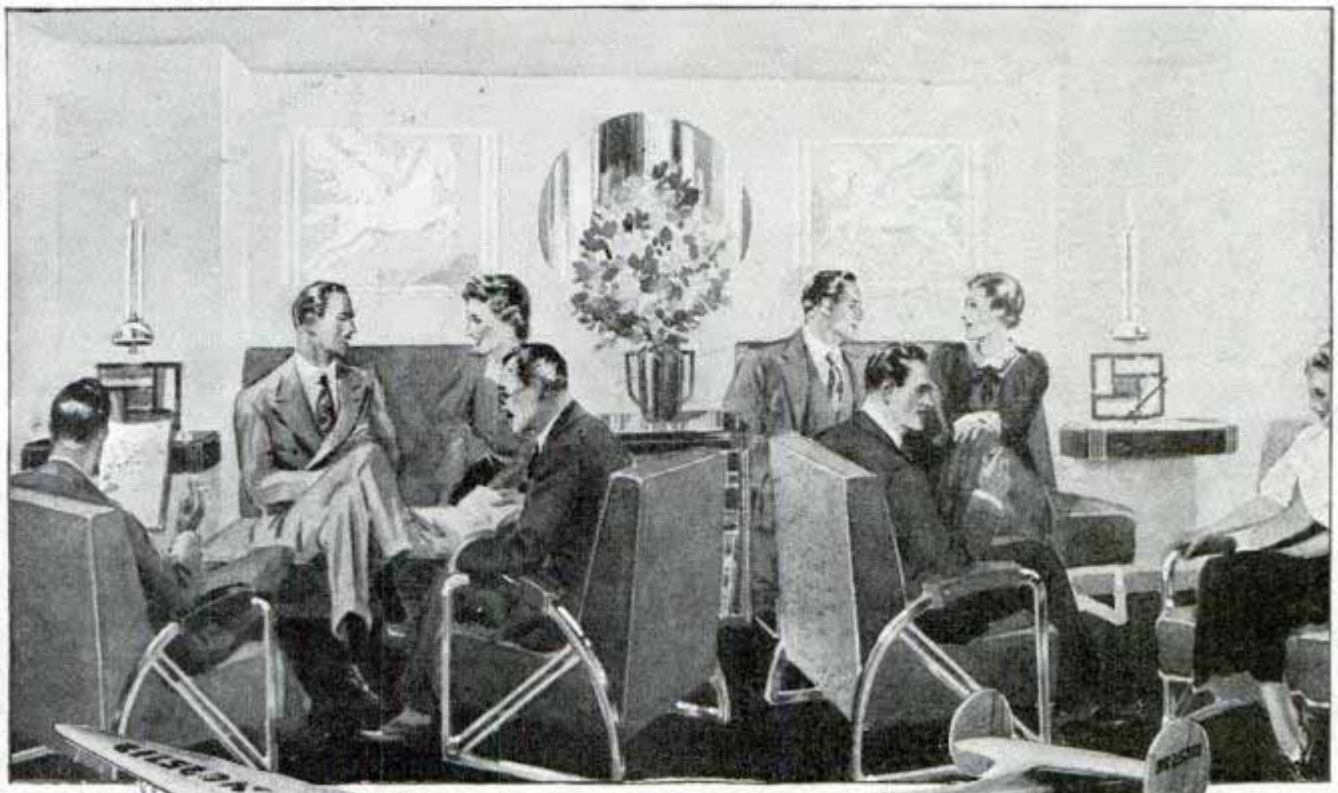
RACKS on roof for making exposure tests of finishes. Above, examining paint and lacquer samples for cracks or other imperfections.

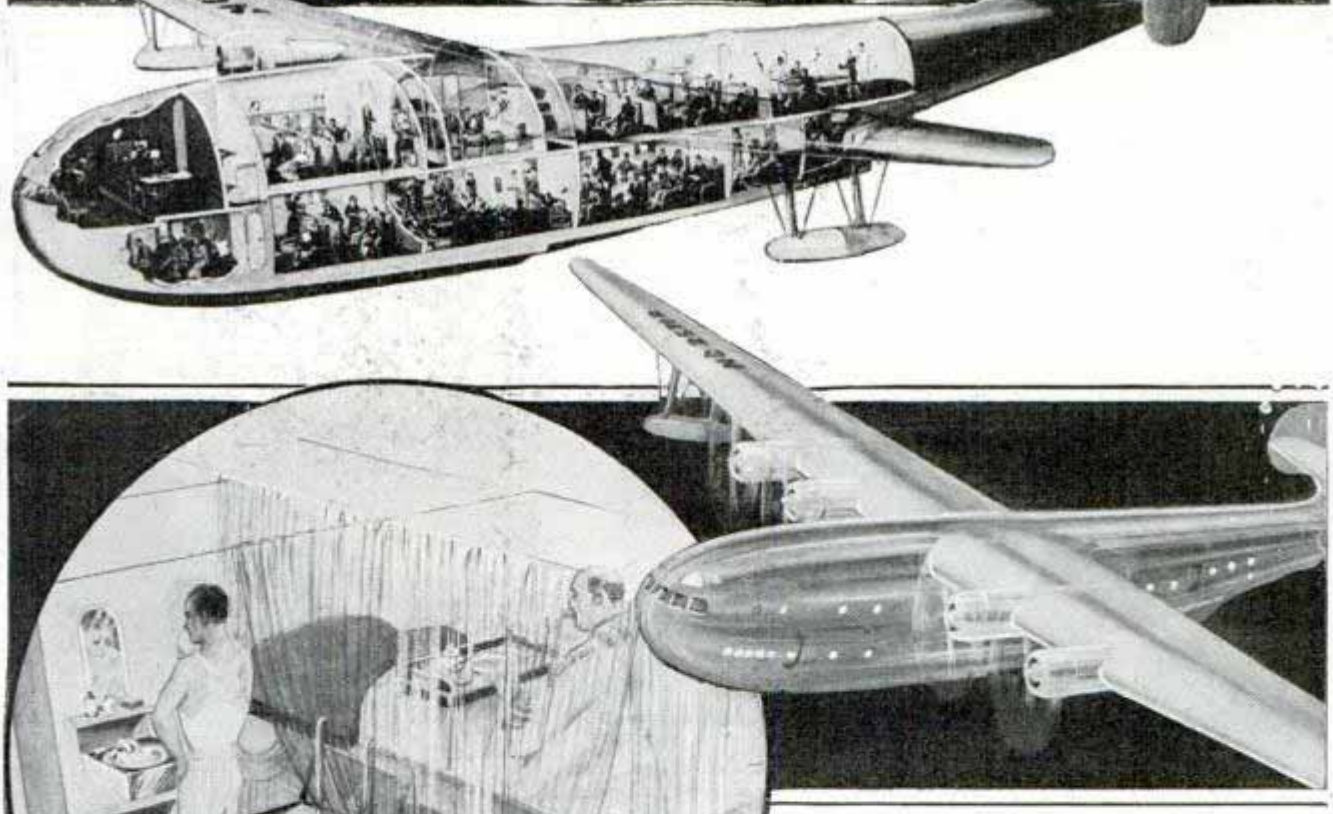
physicians and hospitals had to buy German medicines. In inorganic chemistry we were fairly well fortified, but Germany ruled the organic chemical world — the world of almost infinite promise. All of our coal-tar chemical plants together employed only 528 workers. Hard upon chemistry's awakening, more than $300,000,000 were invested in chemical buildings and equipment by American colleges and schools and an even greater sum was invested by the chemical industry. One company, du Pont, spent $50,000,000 in the development of dyes alone.

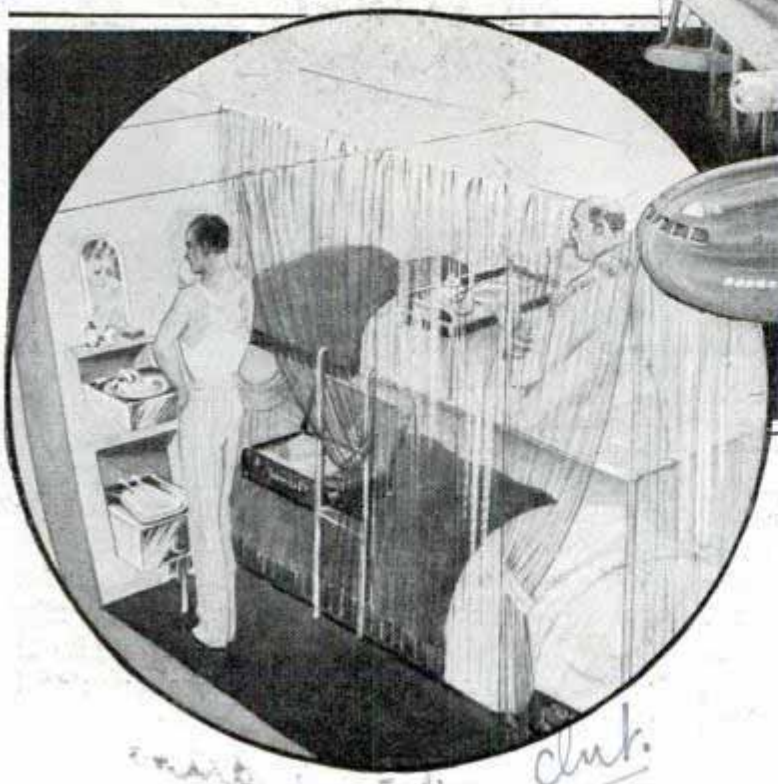
Only seventy-one doctorates in chemistry were conferred in 1914. This number multiplied seven times until in 1934 it was a third of all the doctorates conferred. The number of chemists rose from 14,000 to more than 30,000, while the corporal's guard of workers in coal-tar chemicals grew to an army of 11,000. Something of a similar nature took place in all of the leading nations, but nowhere was it

(Continued to page 132-A)

Giant Atlantic Flying Boat to Carry Sixty-Four



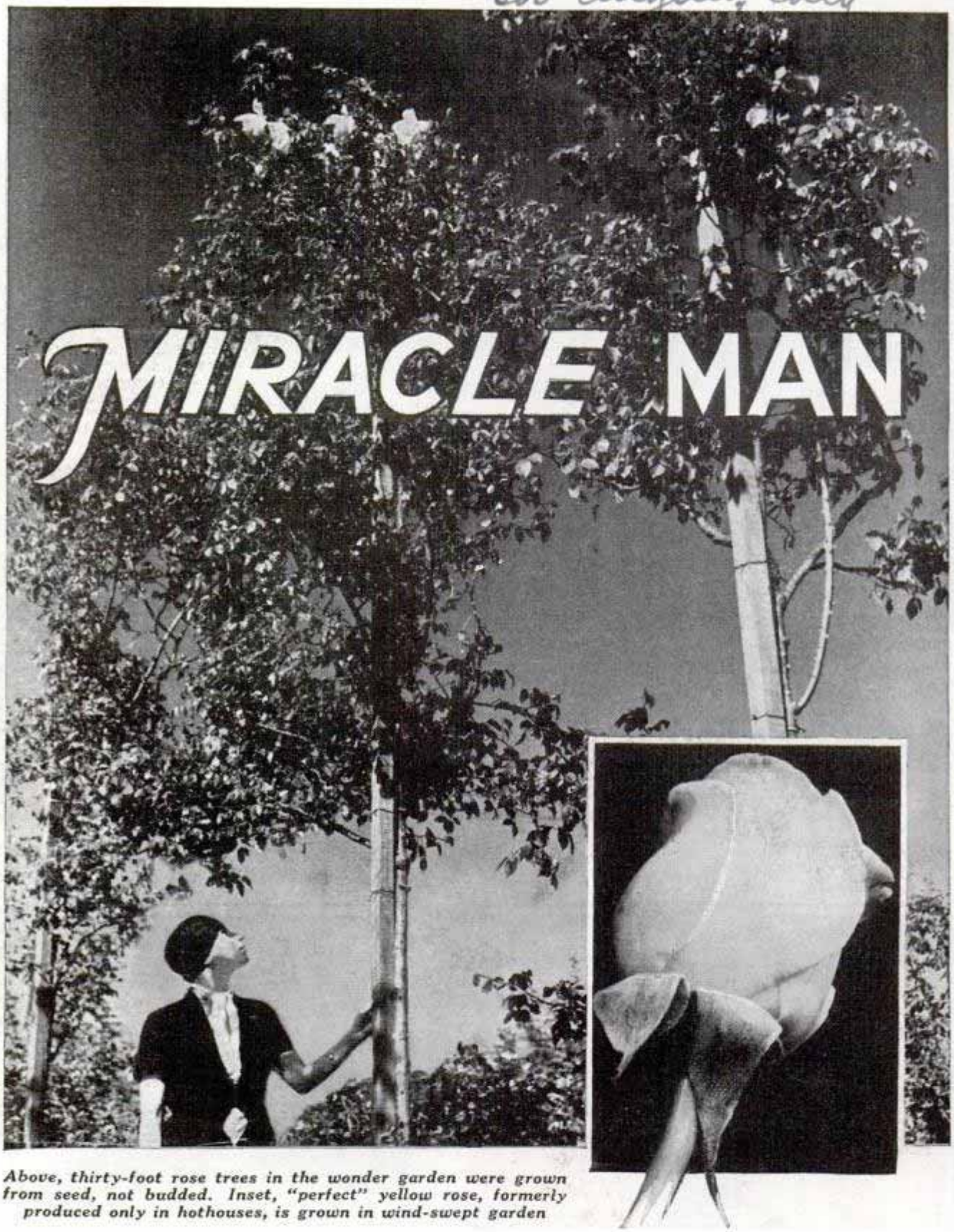




Here is an artist's ideas about how the transatlantic flying boat designed by Glenn L. Martin will look upon its completion. Top, lounge of the sixty-four passenger ship. Center, cross-section of the craft, and, below, night view of the fifty-five ton boat. Left, typical stateroom. Passenger accommodations include sixteen compartments, bar and lounge, observation deck and ping-pong room. Four engines will propel the great ship at a cruising speed of 170 miles per hour

457 South Serrano
Los Angeles, Calif.

MIRACLE MAN



Above, thirty-foot rose trees in the wonder garden were grown from seed, not budded. Inset, "perfect" yellow rose, formerly produced only in hothouses, is grown in wind-swept garden

AN ORDINARY little garden in Santa Barbara, Calif., is crowded with potentialities for tomorrow's science and realities in horticultural miracles. In it are roses which grow nowhere else on earth, roses with unbelievable colors and shapes, giants and dwarfs, roses with strange histories and stranger uses. The garden, which is one of the outposts in the struggle for scientific knowledge, represents the life work of Father George Schoener, a Catholic priest. Father Schoener says of his work, "The world is full of theories of how plants get their characteristic colors, shapes and smells, of how those characteristics may be changed from generation to generation. It

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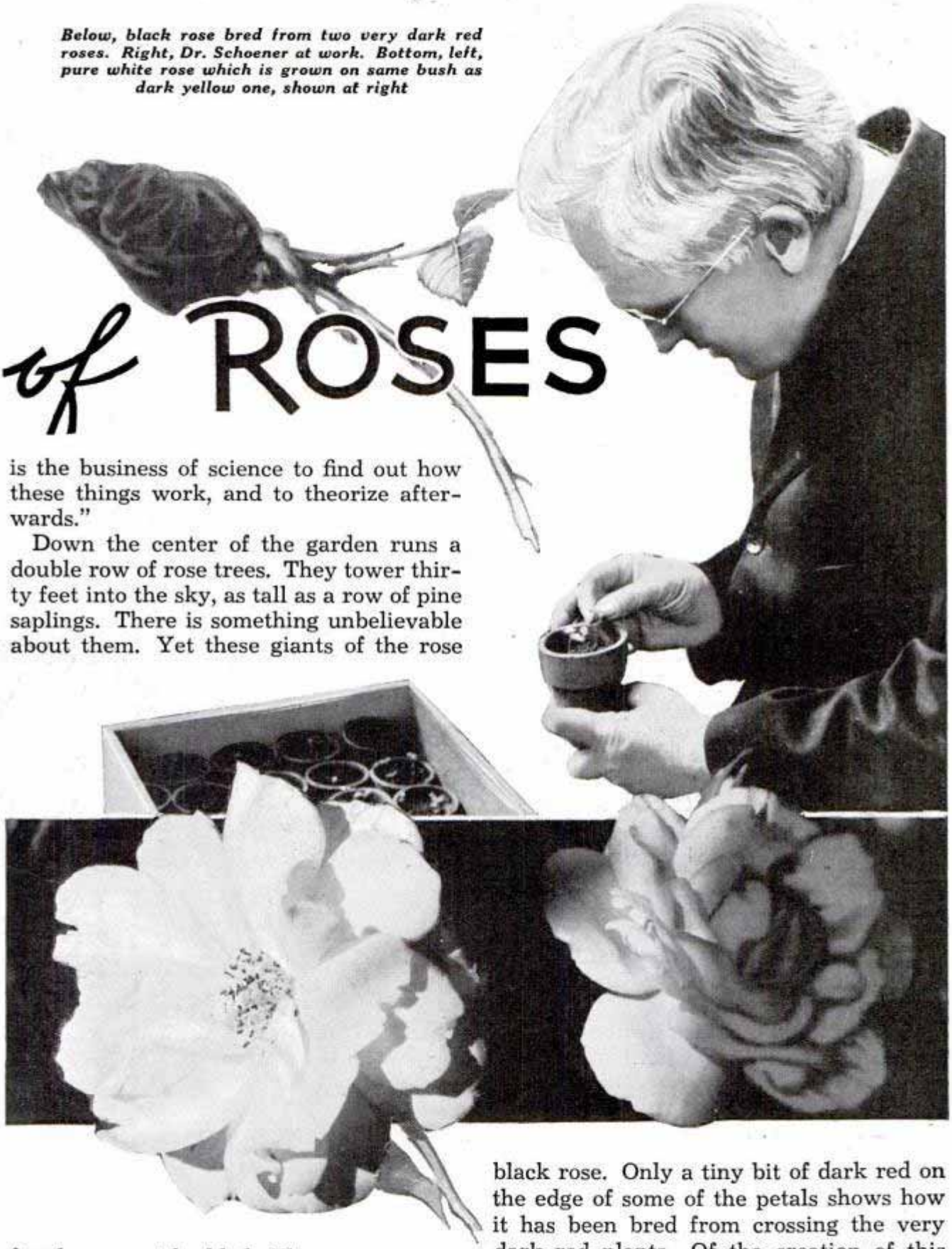
Below, black rose bred from two very dark red roses. Right, Dr. Schoener at work. Bottom, left, pure white rose which is grown on same bush as dark yellow one, shown at right

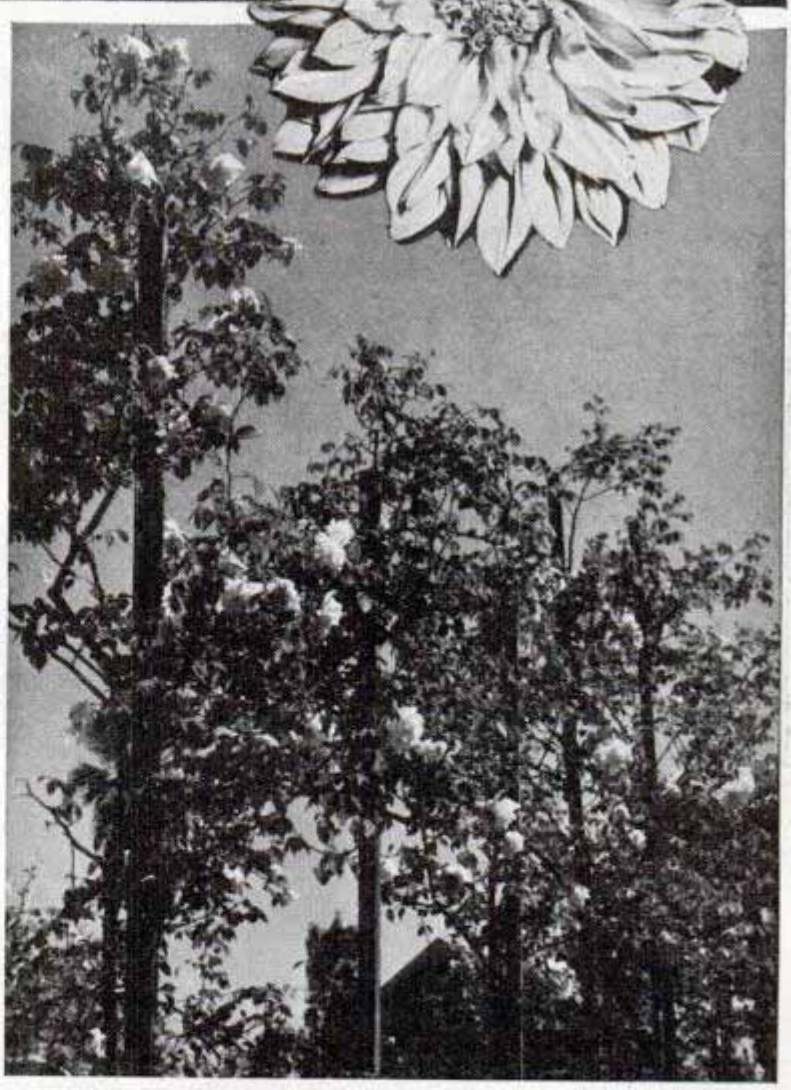


# of ROSES

is the business of science to find out how these things work, and to theorize afterwards."

Down the center of the garden runs a double row of rose trees. They tower thirty feet into the sky, as tall as a row of pine saplings. There is something unbelievable about them. Yet these giants of the rose family are not budded. They were grown from seed. A long history of careful breeding for a single characteristic, height, lies behind their gigantic size.

Close to the avenue of giant rose trees is an insignificant bush. It blooms irregularly, but when it does, the world sees a black rose. Only a tiny bit of dark red on the edge of some of the petals shows how it has been bred from crossing the very dark-red plants. Of the creation of this bud, Dr. Schoener says, "It is only logical to presume that if two very dark roses were crossed the next generation would contain a rose darker than either of the originals. Remember, that is only a theory. Science is not made of theories, but of



Top, tagged and listed sticks mark Dr. Schoener's dahlia plantings. Center, giant white dahlia which holds beauty longer than ordinary dahlias. Bottom, giant rose trees in bloom

facts. So I made my experiments, and eventually succeeded."

Near the black rose is a large and ordinary looking bush. It bears quite normal red roses. But when you come near the leaves of this plant you discover that the foliage gives off a scent. Crush the leaves in your fingers, and there arises an unbelievably strong smell resembling the Scotch sweet briar. There is good reason for this characteristic odor. It was from the Scotch sweet briar that the scent was bred into Dr. Schoener's red rose.

Climbing over the low fence which surrounds the garden is a rose with small oval leaves. This is far less stubborn than the black rose, and blooms regularly each spring. Its flowers are one primary color which roses never have—blue.

"It is simple," Dr. Schoener says. "After all, flowers must get their color from somewhere. There is only one place from which it can come—the ground. I once made an experiment. I impregnated the soil around a white rose with cobaltic acid. Within a few days the

flowers of the plant were a rich cobalt blue.

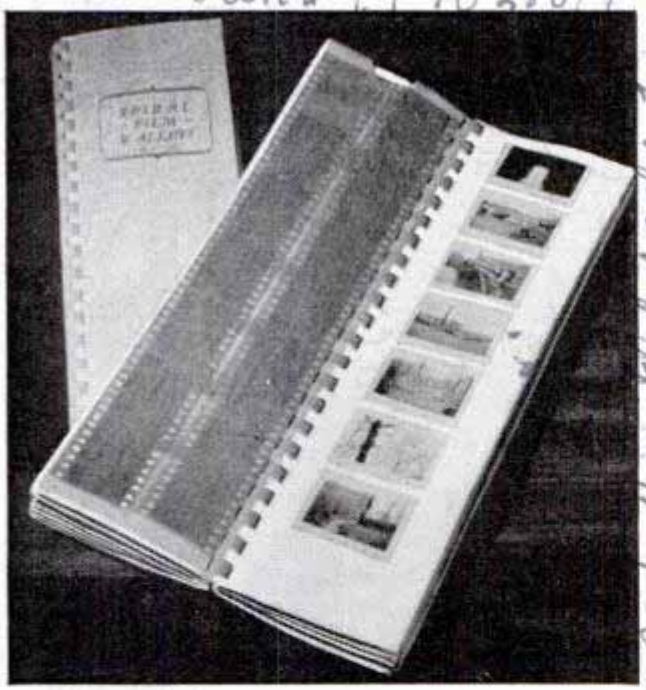
"Now what occurs in an ordinary rose? The cells which give a rose its color have the ability to collect and hold chemicals which combine to form a color. The soil contains chemicals which will produce a blue color. It is only necessary to find roses which chance to have to a small degree the power of secreting blue-producing chemicals—and then to intensify. I will show you what I mean by intensification."

In the center of the garden is a brilliant yellow rose. It has an intensity of color which makes the bright commercial yellow rose seem pale and washed out. All yellow

(Continued to page 144A)

Wallet for Small-Size Film Has Transparent Pockets

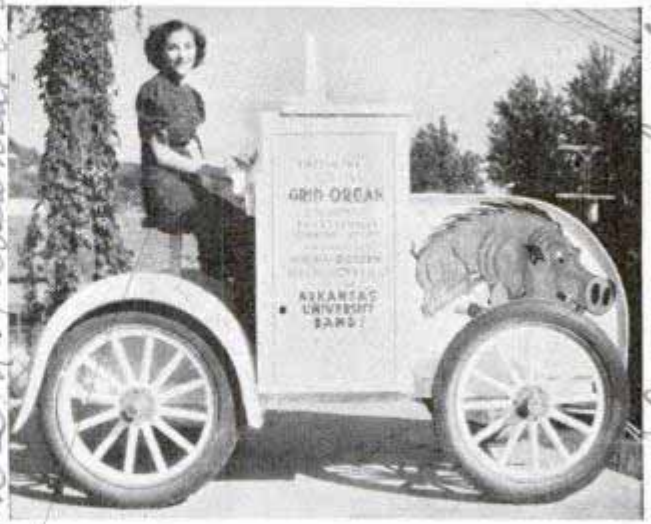
Candid camera enthusiasts using thirty-five millimeter film will find use for a wallet which provides space for forty strips of seven negatives, each in transparent pockets, making 280 frames. Alternating with the negative pockets are white pages ruled horizontally to produce eight spaces on



Handy film wallet. Prints on right-hand page identify each shot on the negative

each side of the page. These spaces are for placement of one by one and one-half contact prints so that they are adjacent to the negatives. There also is ample space for recording of data pertaining to the picture.

Electric Reed Organ on Wheels Is Played at Games



Playing the grid-organ. The instrument is designed for use at football games

Believed to be the only instrument of its kind in this country, an electric reed organ on wheels help the rooters for one college football team. It has four sets of reeds, a built-in tremolo and its own power unit. The music is picked up by a series of microphones inside the instrument and amplified. There also is an outside microphone, making it possible to broadcast announcements. Reeds, keyboard and other parts were taken from old theater organs.

Hole Bored in Bottom of Lake to Let Out the Water

When a Texas ranch owner wanted to use a shallow lake bed for growing pasture grass, he solved the problem of draining out the water by boring a hole in the bottom of the lake. Knowing that water was found in that locality about 400 feet down, in extremely porous structure, he bored a twelve-inch hole to a depth of 384 feet and tapped the porous section. In three days all the water drained from the lake. A fine screen over the hole kept mud and trash from stopping it up. So simple was the job, opening up forty acres of rich land to cultivation, that other ranchers in the same area are using the same method.

¶Sound films can be produced in any number of languages by recording music and noises separately from the language texts, then mixing them and copying on the picture strip.

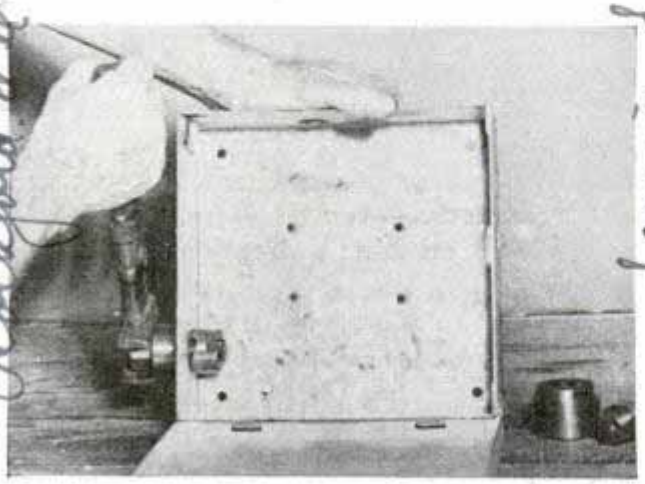
Cigarette Paper Tests Leather for Automobile Makers

Ready to test automobile leather samples with cigarette papers in oven

Color-fastness of leather samples is determined for the automobile manufacturer by a cigarette paper test. Inside an electric oven heated to 175 degrees, the paper reveals any tendency of the leather to ooze sub-surface oils, carrying pigments and dyes that might stain clothing.

Holes Cut in Heavy Metal with Simple Hand Tool

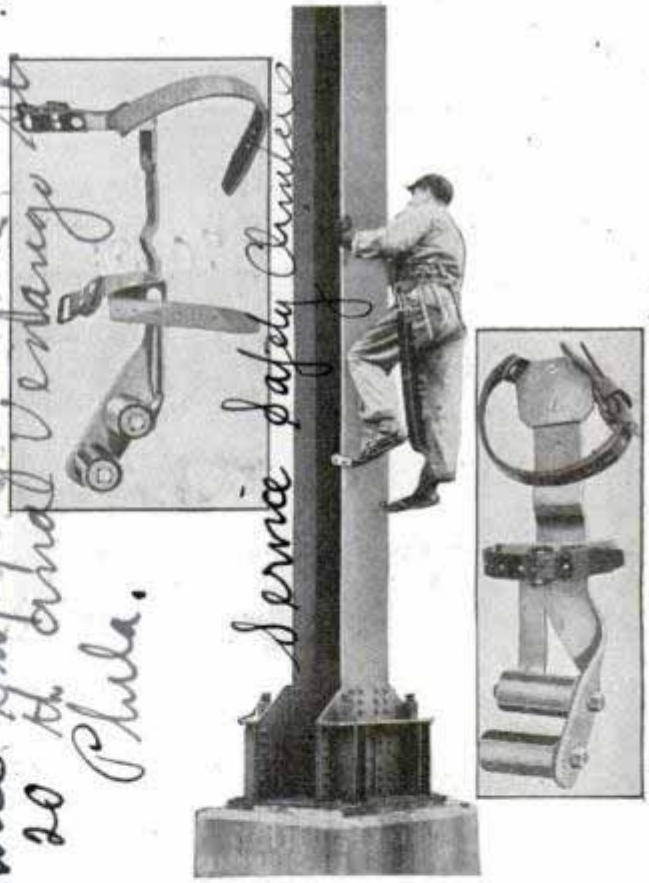
Holes corresponding to pipe sizes of the common diameters may be cut in metal cabinets or sheet metal of heavy gauge by a hand tool now on the market. The holes are made as quickly as a hexagon head bolt can be turned up with a wrench and the edges are as perfect as though done in a power press. Bolt and outside die are placed in a knockout hole, if one is in the side of the cabinet, and the cutting die is placed on the end of the bolt on the inside. Turning the bolt with the wrench forces the cutter into the recessed portion of the outside die and shears out the metal. If no hole is in the cabinet, a three-eighths inch one is drilled and the smallest die used. Then the size die required for the larger hole is employed to complete the job.



Cutting hole in metal cabinet with handy die set and an ordinary wrench

Climbing Steel Girders Is Easy with Non-Slip Shoe Irons

Vertical steel girders can be climbed almost as easily as stairs if the workman uses a new type of shoe iron now available. The edge of the girder is grasped between two roller-like grips which cannot slip once the rollers contact the girder. The irons, made of lightweight, durable steel, are strapped on the shoes, with the gripping rollers at the toe. All points of contact between climbing iron and girder are cushioned so that the iron cannot dig into the steel nor mar the paint surfaces.

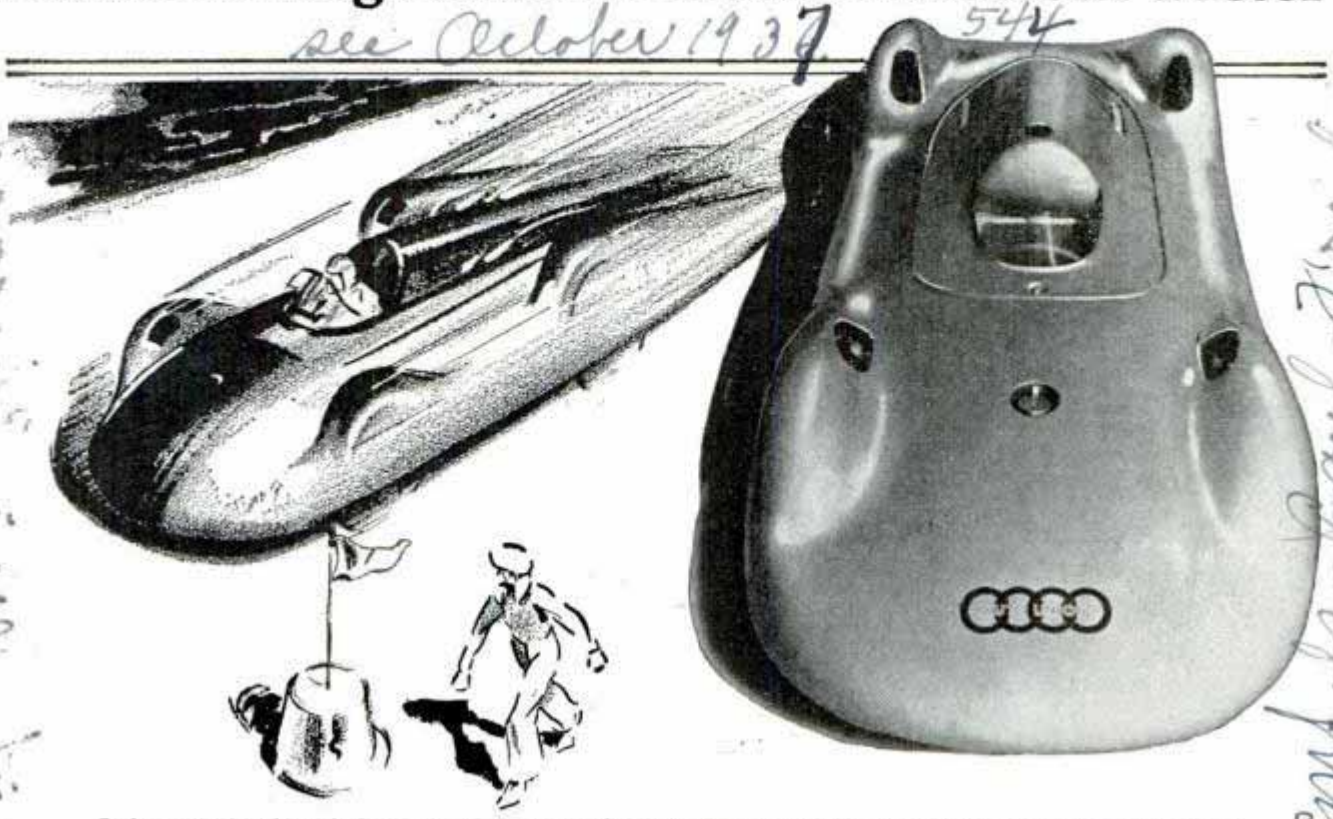


Climbing irons for scaling steel girders in use. Inset, views of the irons

1952 Built by Dr Porsche.

Streamlining Makes German Race Car Faster

see October 1937 544



Left, artist's idea of the Auto Union Speedster in action. Right, view of the car from the front. Note air inlets at various points to facilitate cooling of certain parts

Covered with a new streamline body to increase the speed, a German Auto Union racing car driven by Bernd Rosemeyer, winner of the Vanderbilt race in 1937, has established world's records over varied distances. The car, powered by a sixteen-cylinder motor, is similar to that in which Rosemeyer won the Vanderbilt event in the United States. The records, all set in Germany, include: over the flying kilometer, an average of approximately 243.5 miles per hour; over the flying mile, 243.65 miles per hour; over the five-kilometer course, with flying start, 235.15 miles per hour; over the five-mile course, with flying start, 241.56 miles per hour; over the ten-kilometer course, with flying start, 223.25 miles per hour, and over the ten-mile course, with flying start, 225.17 miles per hour. The kilometer is 3,280.8 feet, or about five-eighths of one mile. Under European racing rules, the car is permitted to weigh only 750 kilograms, just slightly over 1,650 pounds, without fuel, oil, water and tires. The streamline body covers all parts of the car's chassis and even the tires, resulting in reduction of air resistance to a low point. The driver sits in the center of the machine, with his face protected by a comparatively small windshield.

Auto Union A.G. Berlin Cicerostrasse, Germany

Screens for Automobile Windows will Keep Out Insects

$2.00 to $3.75 pair

Custom made to assure a perfect fit, screens for auto windows and doors are designed to keep out insects and to prevent children from putting heads and arms out of the car during a drive. Edges of the screens are bound in gray leatherette. The screens are rustproof. Attaching clips make installation comparatively simple, no tools being required. A zipper device on the left door screen permits signaling by the driver.

Frank Rose Mfg Co

Tiny Motorized Trailer Home Pushes Its Driver on Tricycle

This tricycle is driven entirely by hand, pushed by the motorized trailer which is furnished with home comforts for a long tour of this country

With a "pusher type" trailer for his home, a young Californian is touring the country on a tricycle. The miniature house on wheels has many of the comforts of home—bed, radio, running water and other furnishings, all packed in a compartment seven feet long and four feet wide. The trailer has a one-horsepower motor operated by remote control from the tricycle seat. The maximum speed is about thirty miles an hour. It is driven entirely by hand, the owner having lost the use of his legs in a childhood accident.

Reversible Motor Runs Toys at Variable Speed

Toys, window displays and self-winding electric clocks can be operated by a small, self-starting and reversible electric motor which runs at variable speed without commutator, brushes, reversing switches or rheostats. It operates on alternating current and can be adjusted to run at virtually uniform speed in either direction, regardless of sudden fluctuations in voltage and frequency. The motor is stopped, started, reversed, speeded up or slowed down by manually adjusting a segment which can be locked in any desired position. An alternating magnetic flux induces currents in the adjustable segment, providing a rotor propelling torque and a rotor opposing torque together at the same time, or separately. The rotor is in the direct path of the flux and induced current where repulsion and attraction are strongest, hence the turning motion.

Christmas Tree of "Cellophane" Never Needs New Lights

Electrically lighted Christmas trees with foliage made of Cellophane are on the market for decoration of table, mantel and window sill. One style is equipped with miniature electric bulbs, another with tiny

Four of the new Cellophane Christmas trees. A central bulb lights the tree

glass candles. The trees fit over a separate white painted wooden base having a central bulb from which the light passes through the glass rods of the decorations

to give the effect of burning candles or lamps. Hence, the miniature bulbs and candles never burn out or need replacement. The base is fitted with cord and plug for attachment to any electrical socket. The trees are obtainable in green, red, blue or white Cellophane with lamps or candles in assorted colors.

Trailer for Boat Is Attached to Motorcycle

Capable of carrying a 400-pound load, a boat trailer for motorcycle is reducing the costs of outings for one Californian. It is thirty-six inches long, thirty-nine inches wide and has a body thirty-two inches wide. Fitted with aircraft wheels and cantilever springs, the trailer weighs thirty pounds. The boat, a kayak, weighs forty-five pounds, leaving plenty of carrying capacity for camping equipment and supplies. The hitch is a ball-and-socket joint attached to the bow of the boat. This requires a sturdy craft. The kayak is sixteen feet long, thirty-two inches wide and it is covered with airplane fabric.

Ready for an outing, with boat trailer attached to motorcycle. Camping supplies may be carried in the boat

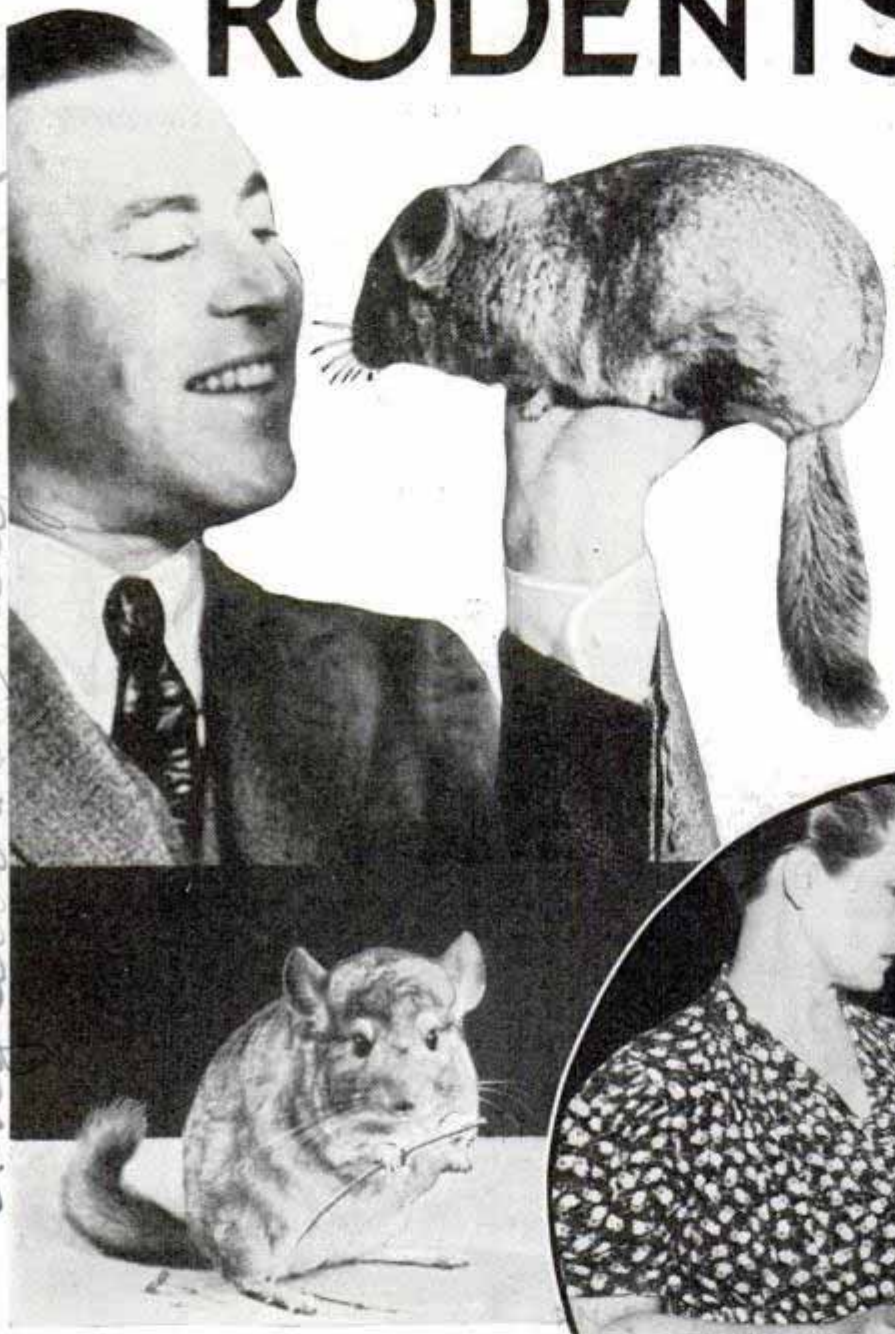
Weather Made to Order in Box for Testing Materials

You can literally "turn on the weather" in this cabinet, designed to test the durability of paint, rubber and other materials

By adjusting a few knobs and dials, any kind of weather desired—fog, rain or blistering heat—can be produced in a cabinet known as a weatherometer. This weather machine is used for testing the durability of materials under various weather conditions. Paint, building material and electrical insulation all can be tested in the cabinet, one of which is used by the city of Los Angeles to test products employed in transmission lines, towers and buildings.

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

RODENTS *worth*



Top, R. E. Chapman with chinchilla worth $1,600. Center, chinchilla which may reach an age of twenty years. Bottom, breeding records are kept for each animal on the farm

WHAT is the rarest fur in the world? That question put to a group of international pelt dealers would be productive of but one answer: chinchilla. Not only the rarest, the experts might add, but the most luxurious, the most expensive. Compared to chinchilla even Russian sable seems cheap.

Perhaps, you are a little hazy about this costly fur. If a live chinchilla were thrust into your hands you might dismiss it as one of Nature's mistakes, a rabbit with a squirrel's tail. But as soon as you had allowed your hand to sink into its deep, silky fur you would know instinctively that the little creature was an aristocrat among furbearers. A closer examination of the fur would reveal that the pearl-gray color of the back softens as it approaches the under side. This lends distinction to a coat of chinchilla because at every movement there is a rippling, chameleon-like color change.

If you were to go into the shop of a Fifth avenue furrier and offer $50,000 cash the chances are you couldn't get a chinchilla coat. You might be shown a cape but no coats. There just aren't enough skins available to make one. And if there were, a full-length coat would require be-

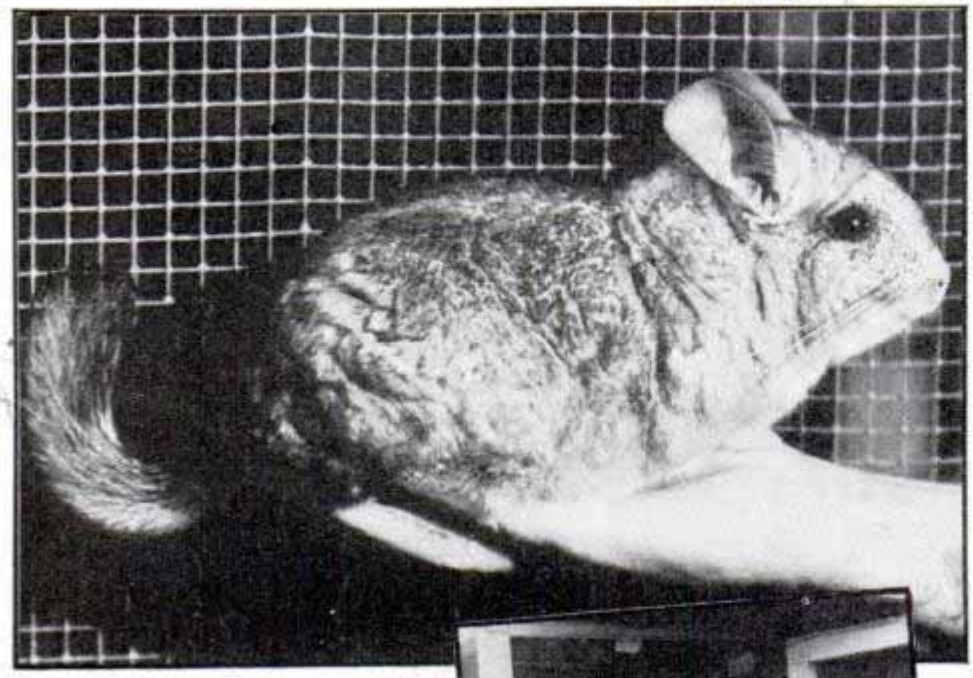
Willis E. Parker, c/o Chinchilla Farm

their WEIGHT in GOLD

Left, a chinchilla coat like the one above would be worth more than $50,000. Circle, marking the animals by tattooing a small number on the ear

tween 120 and 140 separate skins. At $90 to $100 per pelt, you can figure the cost yourself.

Small wonder then that pelt dealers and furriers are watching with keen interest the developments at a two-acre farm in southern California where $1,750,000 worth of chinchillas are being raised. The 1,108 animals on this tract represent almost a world monopoly, since they are virtually extinct in the wild state. Behind this unusual circumstance is the story of a country's misused natural heritage and the vision of an enterprising mining engineer. For centuries these toy-like rodents had lived on the barren slopes of the Andes in South America. A shy, furtive fellow, he made his home in the crevices of rocks and ventured into the open only at night to feed and exercise. His beauty hastened his



Top, the chinchilla looks like a rabbit with a squirrel's tail. Center, before entering the housing units, attendant must step in antiseptic sawdust to prevent germs from reaching the animals. Bottom, treating a chinchilla in the laboratory

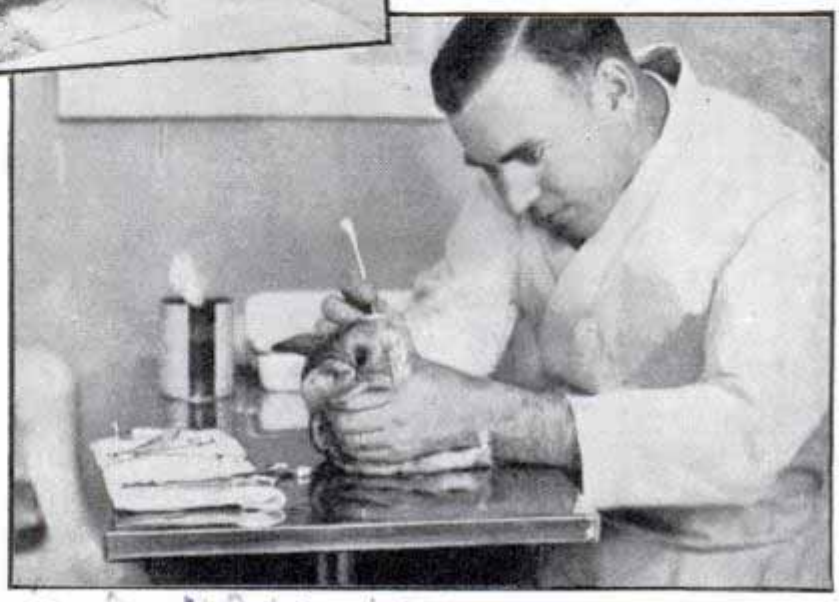
downfall. Chinchilla skins brought high prices and there was always a waiting market. With no thought of the future, hunters and trappers began slaughtering them in wholesale fashion. More and more pelts turned up in the world fur markets and by the turn of the century, the yearly export of skins from Chile reached an all-time high of 435,000 chinchillas.

The rodents might have survived this thoughtless butchery had it not been for the coming of hunt-minded Europeans to Chile. They brought with them the red fox, and the chinchilla was slated for a quick fade-out. Realizing it hadn't done right by the little fur-bearers, the Chilean government in 1918 placed an embargo on both hides and animals, forbidding their exportation. Although the hunters and trappers were restrained the red foxes were ready to carry out the chinchilla extinction program alone.

A year or so later, the late M. F. Chapman, a mining engineer, was working in Potrerillos, Chile, when an Indian trapper came down from the mountains with a chinchilla in a basket and offered to sell it to him. Chapman bought it and after watching the little creature for a while he was struck with the idea of bringing several of them to America to raise.

When he discussed his idea with his coworkers they told him it was a wild dream. Since the days of the Inca chieftains, chinchillas had lived in the rarefied atmosphere of the Andean peaks—they would never survive elsewhere.

But Chapman could not be dissuaded. Any animal that had thrived in such a mean climate could live anywhere, he reasoned, and set about to prove his point. Indian trap-



pers were given provisions and sent out to capture a sufficient number with which to start a colony. For three years, some twenty-three Indians under the supervision of the engineer combed the slopes before eleven of the creatures were captured.

From a camp 17,000 feet above sea level, the homeward journey was started. It was a tough trip, beset with trials and difficulties. Gradually, from one level to another, from the high peaks to the lower ranges and finally to the coast, the valuable cargo was transported. Although he had little difficulty in securing official permission to take the animals out of the country, the engineer was forced to cope with many other difficulties, according to his son, R. E. Chapman, present owner of the farm.

"Father had booked passage on a Japanese ship," he relates, "and the captain said the animals would have to ride in the hold. This was out of the question so father rigged up a cage in a trunk and with the aid of friends, smuggled the seven males and four females aboard.

"When the animals were safe in the cabin, father told the captain that they were worth $1,000,000 and that he would hold the shipping company liable for that amount if anything happened to them.

"I think he must have told the captain a few other things besides because he didn't come near the cabin during the voyage."

For three weeks, the engineer and his wife took turns in standing guard over the animals. They did everything in their power to keep them cool and healthy. When the boat landed, the eleven chinchillas were still alive. In fact, one had been born on board ship. However, the entire troupe had lost all their fur!

In the next two years, the experiment teetered on the brink of failure. There were many adjustments that had to be made. The animals were slow in acclimating themselves and would not breed. The third year proved to be the turning point, however, and Chapman's venture gave every indication of being a success.

Word of the experiment reached Switzerland and a fur syndicate dispatched an agent to the chinchilla farm to buy some animals for breeding purposes. The fur syndicate felt that Switzerland's climate was more suitable to the animals than that

(Continued to page 170A)

Trailer Chapel Has Altar and Loudspeakers

One of the missionaries standing at the rear of the chapel. Note the altar

Intended as the means of carrying two mountain missionaries on a two-year trip, a trailer chapel has been constructed with altar and loudspeakers. It also contains living quarters for the evangelists. The loudspeakers carry words of sermons preached in the open.

Reversible Waffle Iron Cooks Two at the Same Time

By using a reversible iron now available the housewife can cook two waffles at the same time. It takes no more space on the table than the usual iron. A heat indicator shows when the iron is at the proper temperature for use. The handle support is flattened at top and bottom to keep the iron upright. A double-expanding hinge at the back assures thick, light waffles.

Cmt. Geo. H. Eckhardt. 2047 N. Park Ave. Phila

Latest in MUSIC

WITH the introduction of symphonic music of the highest quality in motion pictures, the "filming" of the music becomes as much a piece of artistry and direction as the filming of the actual photoplay itself.

No longer is it sufficient to merely record the sound as the action in the picture is "shot." The music is no longer "sound," but becomes a definite artistic endeavor. With modern film recording of music with ultraviolet light and with the use of many microphones, effects are obtainable that are not possible with the actual orchestra in a concert hall. Using recordings on film, it is now possible for the director to secure a number of basic musical recordings, and in his studio he can "mix" these basic recordings, much as a painter mixes his primary colors on a palette, so that he can secure the effects which he desires.

The symphonic musical recording for the Universal film, "One Hundred Men and a Girl," is probably the most elaborate effort toward new effects in music that has ever been made, the art of the musician being combined with the skill of the engineer to present a new music.

Dr. Leopold Stokowski, the famous conductor, who, for many years, has studied sound recording and the possibilities of combining the skill of the musician and engineer for the production of a new music, worked out the details of this great experiment in sound recording. The action

Top, Leopold Stokowski conducting orchestra. Bottom, main mixing panel for recording of movie music. Each of seven channels reaches the panel and the seven can be mixed as the director wishes

Universal Pictures Universal City Calif.

Recording Engineer

Deanna Durbin es 781

adds Thrill to MOVIES

of the motion picture was filmed in Hollywood, but the symphonic music was recorded in Philadelphia. The reasons for this are: the acoustics of the Academy of Music, in Philadelphia, have been long rated as perfect; it was possible to obtain the services of the finest musicians without taking them away from their work in the midst of a concert season, and Philadelphia was close to the experimental laboratories and staffs of R.C.A.-Victor in Camden, N. J. Instead of taking a huge orchestra of 100 men to Hollywood, Dr. Stokowski took the music in a trunkful of sound film.

The recordings were taken on nine separate channels, or sound tracks. Stands carrying two velocity type microphones were placed in each of the sections of the orchestra. There were seven of these dual microphone stands, one each in the strings, brasses, percussion, wood winds, cellos, bass section, and harps. These microphones were each especially "tuned" to pick up that section to best advantage.

Top, girl actress with Conductor Stokowski as they appear in movie. Bottom, battery of sound recorders to catch orchestra's music

(Continued to page 116A)

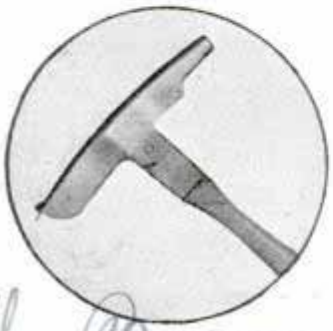
Deanna Durbin!

Water Atomizer Keeps Fruits and Vegetables Fresh

Fine spray keeps vegetables fresh. Inset, the atomizer connected to water line

For the fruit and vegetable merchant, the florist and the greenhouse operator, a simple water atomizer is available for spraying counter or shelves with an exceedingly fine mist. Thus may fruits, vegetables and flowers be kept fresh. The atomizer has three tips, the first providing an almost invisible mist, the second a heavier mist and the third a substantial spray. Double elbows make the nozzle adjustable to any angle. Another use for the atomizer is as a humidifier for home or office. Located over the hot-air register, it provides a fine mist that rapidly moistens the air, making it more healthful in winter.

Magazine-Loading Tack Hammer Carries Fifty Tacks in Head



Fifty tacks loaded into a magazine in the head of a tack hammer can be fed to the hammer, one by one, with a simple twist of the wrist. The hammer head works on a spring hinge. The tacks are neat, octagonal-headed staples, serving the purpose of ordinary tacks. Its operation leaves the left hand free to hold the carpet or material being tacked.

"Flashlight" Car Brake Tester Has Red and Green Lights

Can you stop your car within a safe limit? It is easy to check the efficiency of your brakes with a deceleration meter just developed. It looks like an ordinary tubular flashlight, but on its face are two small round windows, one green and the other red; and there is a bubble-level on top of the case which helps in placing it properly on the floor of the car for a test. Inside the brake meter is a column of mercury. If the brakes stop your car fast enough to indicate proper braking efficiency, the mercury slides forward far enough to close a switch and flash a light in the green window; if not, the mercury reaches only the red signal. The instrument is calibrated to indicate efficient braking if the car stops within twenty-five feet at twenty miles an hour, the standard requirement in some states. It can be set for any other stopping distance desired.

Checking up on safety of automobile brakes with flashlight tester, seen on floor of car

NEW TYPE OF GERMAN FIREP

A new type of paint has been developed in Germany for pro-
ecting wood against fire incorporating nitrogen salts with a
ynthetic resin product. Upon contact of flame with the painted
ood surface, the paint develops an insulating foam crust which
ffectively protects the wood against fire. This new type of fire-
esistant paint was exhibited at the Achema chemical equipment
xposition held in Frankfort in the early part of July and attracted
onsiderable attention from interested visitors.

Fireproof paints have been acquiring increased importance
Germany of late, especially for purposes of national defense
nd as protection against incendiary bombs discharged upon cities
time of war. Representative of the growing interest in these
roducts is the municipal ordinance recently issued in a well-know
ty of Southern Germany requiring that all wooden roofs be pain
th fireproof paints because of their resistance to the effect
cendiary bombs.

American Consulate Gener
Frankfort-on-Main, Germa
(Consul S. B. Redecker.
#15100 July 24, 193

Trailer Convertible into Permanent Cottage

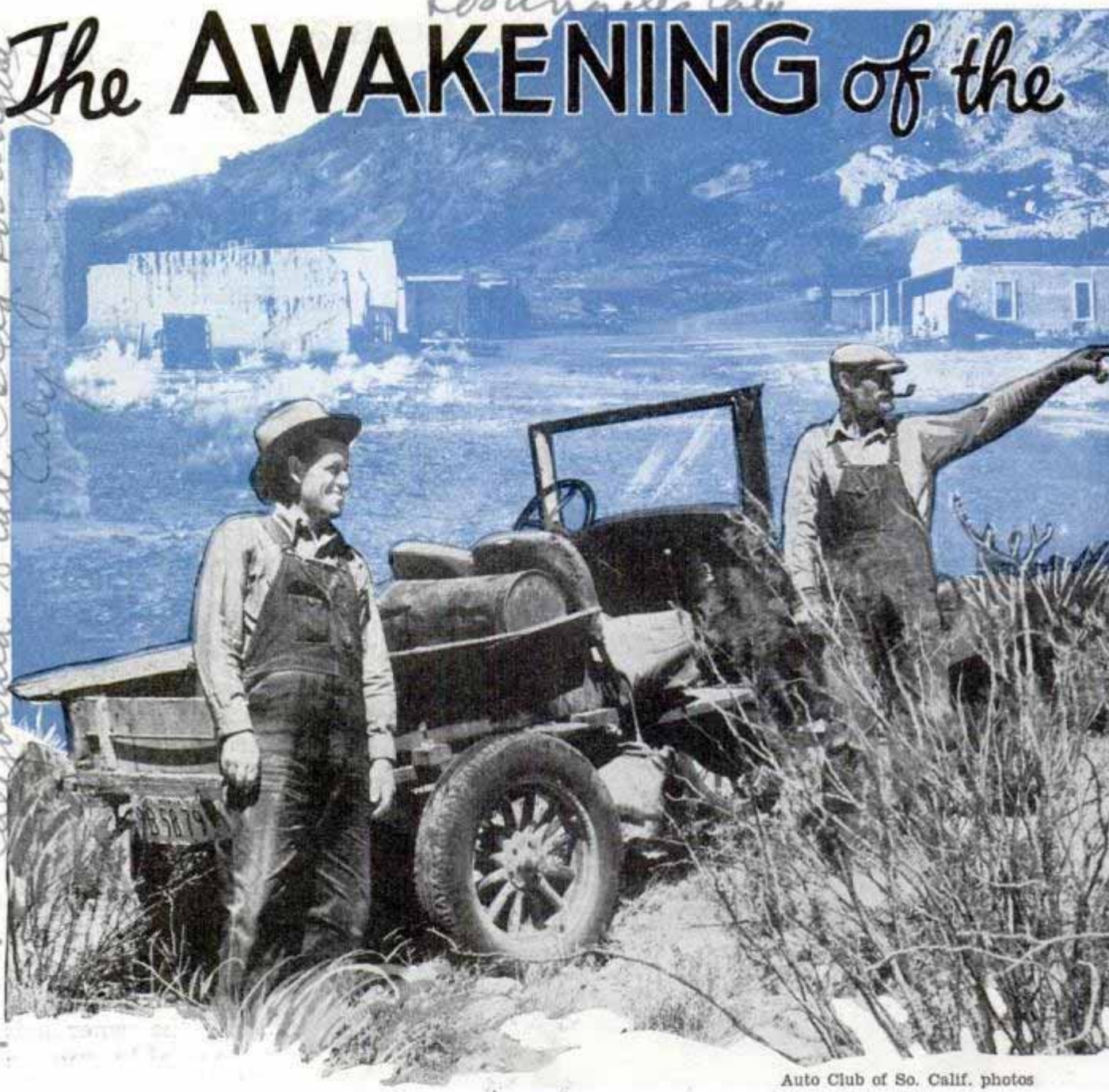
Designed for permanent living but retaining all the advantages of mobility, the latest trailer may be converted into a trim little cottage. It is made in two sizes, one fourteen feet long and the other twenty feet long. Two, three or more of them may be combined to make a house of several rooms by placing them in the form of an "H" or a "C." One trailer might serve as a kitchen, another as living room and a third as bedroom. The unit is mounted on a sturdy chassis and can be towed at speeds of thirty miles per hour. An insulation material, first used by explorers in the Antarctic, is employed in wallboard form, being cut in prefabricated sections and applied in two layers, with dead air space between. Thus is constructed a lightweight, but heat and cold-resisting wall. The trailer is equipped with built-in furniture and appliances. Plumbing fixtures are designed for connection to city water pressure systems instead of to tanks, as in the usual trailer. If the owner finds a desirable spot, a skirting around the wheels, lattice work for flowers and a set of steps may be used to convert the trailer into an attractive cottage with the air of permanency.

Top, trailer in temporary location. Center, looking toward the kitchen. Bottom, trailer in permanent location, with steps and wheel skirting in place

Fireproof Paint Guards Wood

Fireproof paint that may prove useful in resisting incendiary bombs in wartime has been developed in Germany. When exposed to flame, it forms an insulating crust of foam which is said to protect wood from burning. This paint is understood to contain nitrogen salts and synthetic resin.

The AWAKENING of the



Auto Club of So. Calif. photos

Modern prospectors in old car adapted to hill-climbing. In the background is the ghost town of Calico, former silver city of 4,000, that is still deserted

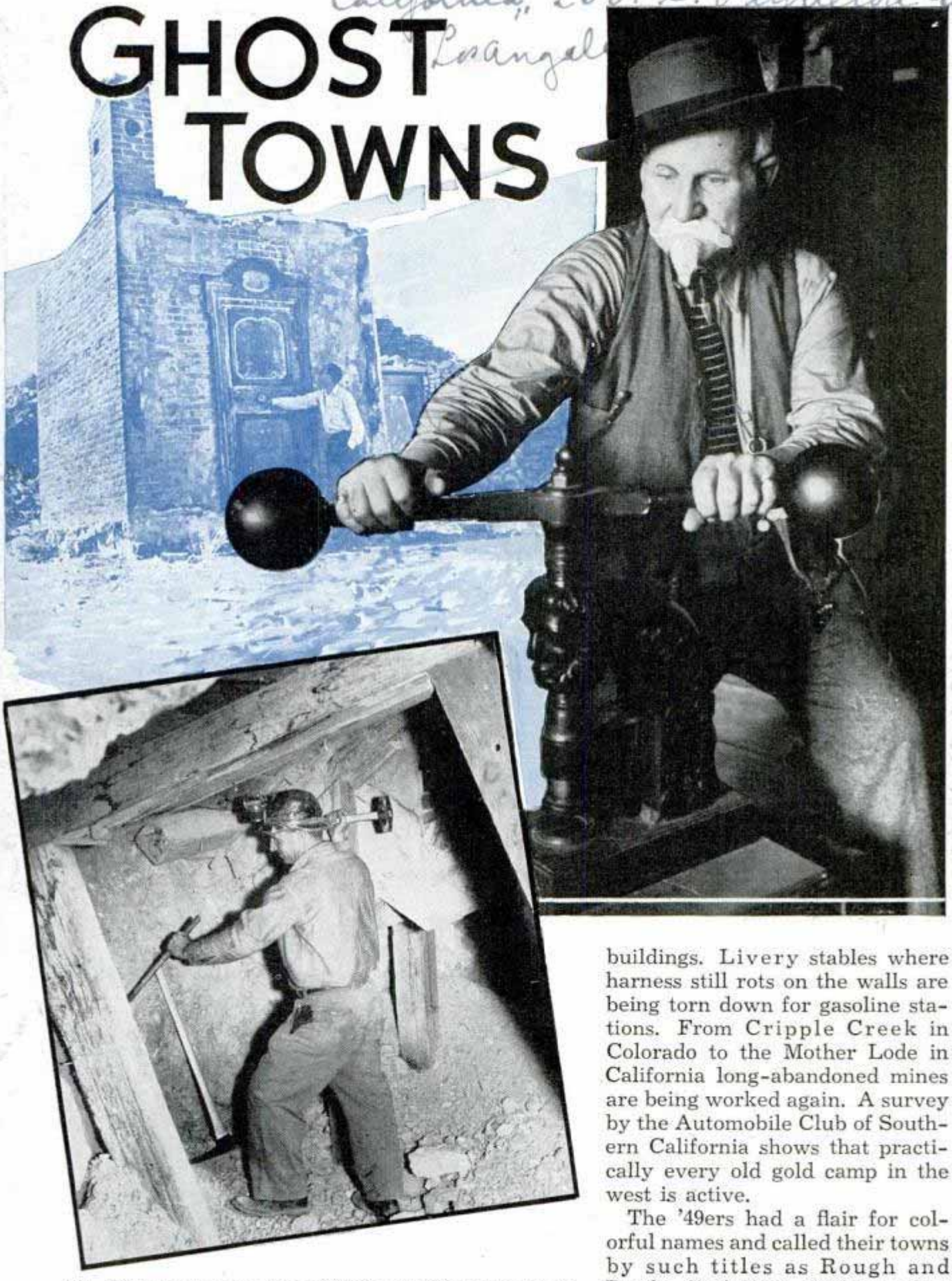
OUT in the west a few years ago you could drive off the beaten path and go exploring into the last century. Behind the shoulder of some hill or in a desert valley you would discover a full-sized town where no one lived. Along the sagebrush-covered main street would be weather-beaten stores, post office, banks, and saloons of a small city, flanked by blocks of unoccupied houses. In the eerie silence the flapping of old wallpaper behind a broken window or the creaking of a door would be the only sounds.

These ghost towns of the mining country were left intact when the gold fever died or when bonanza strikes in other districts caused the inhabitants to move away overnight. Towns like Rhyolite with a pretentious railway station and office buildings, or Bodie, built with tremendous hardship high in the mountains, were left complete right down to stacks of dishes still in the kitchens and files of records still in the banks.

Today the ghost towns are coming back to life. Towns that have been asleep for seventy-five years are stirring again under the excitement of high-priced gold. Modern air-conditioned stores are springing up next to the tottering ruins of old

Reference: [illegible] 1993.
Automobile Club of Southern
California, 2601 S. Figueroa St.
Los Angeles

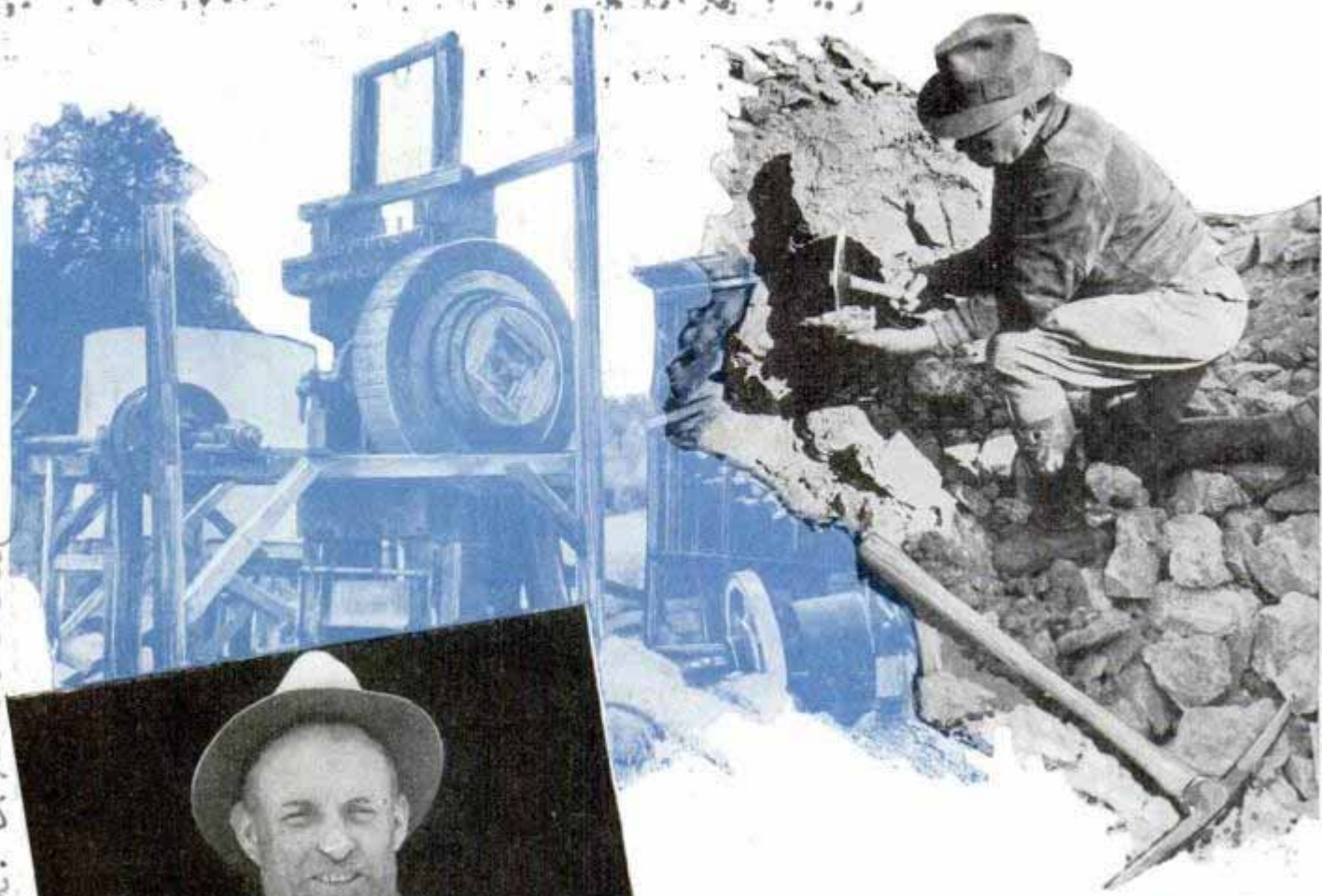
GHOST TOWNS

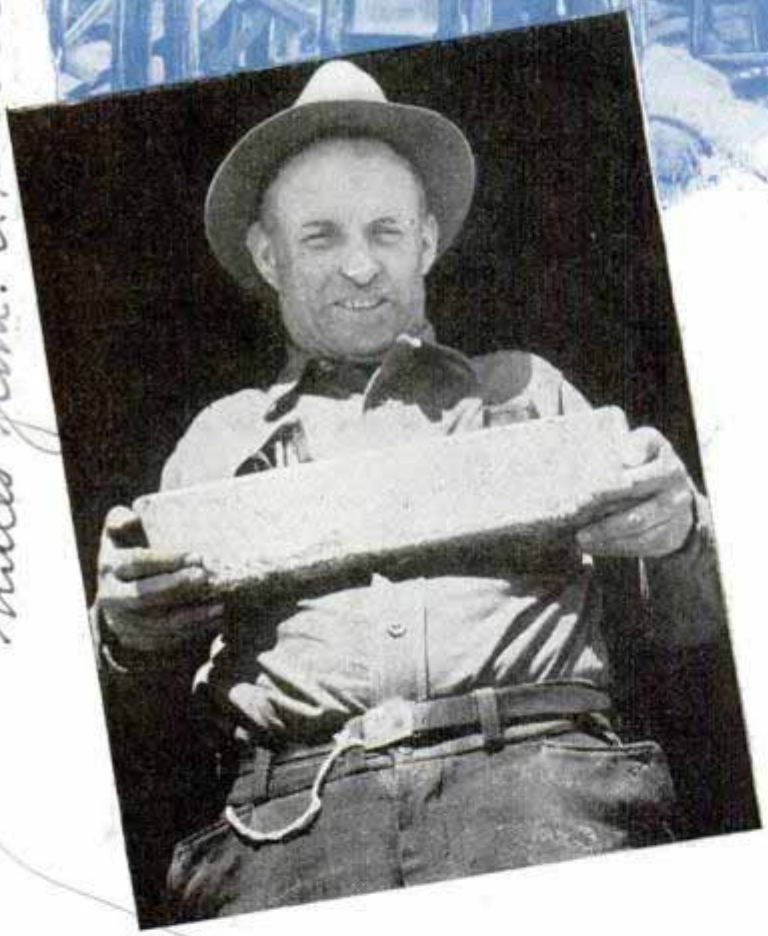


Top, left, iron door and walls of bullion vault in deserted town of Bodie. Right, press used for stamping gold slugs circulated as money in '49. Bottom, modern miner breaking out samples of ore from abandoned mine

buildings. Livery stables where harness still rots on the walls are being torn down for gasoline stations. From Cripple Creek in Colorado to the Mother Lode in California long-abandoned mines are being worked again. A survey by the Automobile Club of Southern California shows that practically every old gold camp in the west is active.

The '49ers had a flair for colorful names and called their towns by such titles as Rough and Ready, Red Dog, Whiskey Bar, Shirt Tail, Poverty Hill, Squabbletown, and Slumgullion. Some





Top, left, ruins of old stamp mill at Keysville. Right, prospector selecting samples of ore to be crushed and sent through recovery machines. Bottom, $10,000 bar of gold and silver recovered from hundreds of tons of ore

of the original names like Angels Camp, Yankee Hill, Coffee, French Corral, and Indian Diggins are still used today. One enterprising group of miners wanted to christen their settlement "23 Skidoo" but had to compromise on "Skidoo" when authorities of the postal department refused to recognize the number.

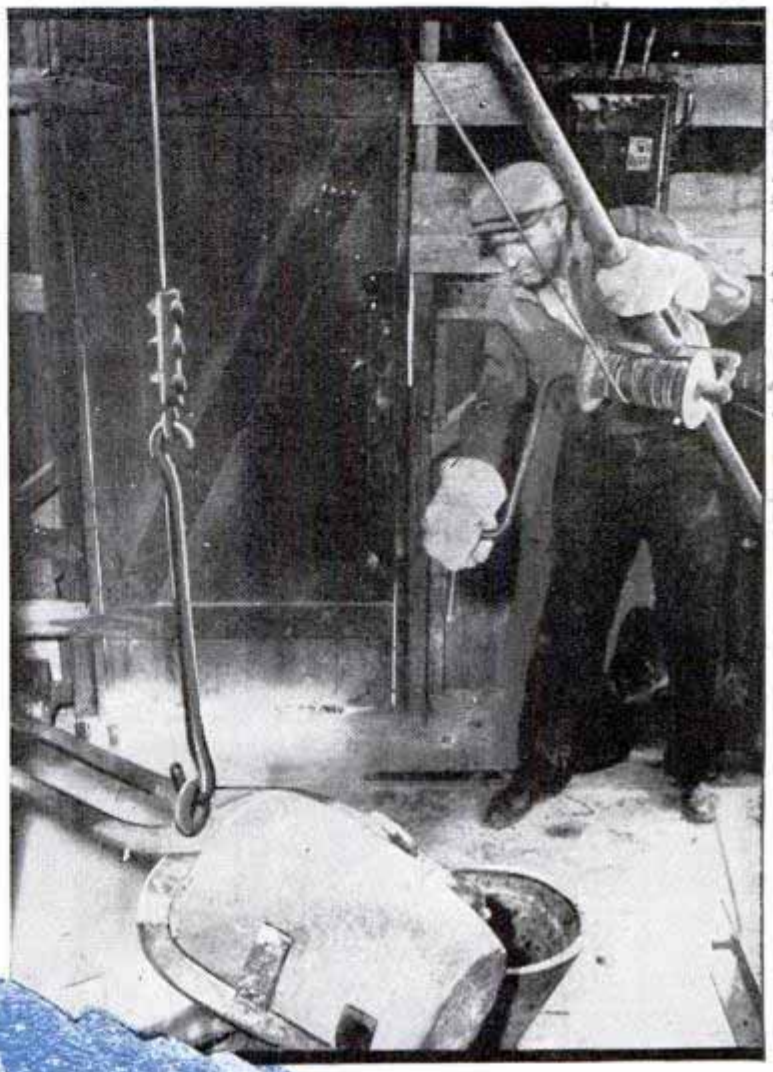
"In the old days a camp was apt to mushroom into a big town of six or seven thousand population in a few months," recalls one old desert rat. "People would start to flock in as soon as news of the new strike spread. At first they lived in tents. Then as freight services were organized and building materials were brought in a real town of stone, brick, and wood would be built.

"It usually cost ten dollars per mile to haul a ton of freight, but grand pianos shipped around the Horn, red-plush furniture, large mirrors, and fashionable clothing all were freighted hundreds of miles through the mountains to the latest boom town. Sometimes twenty mules per wagon were needed to move the freight over the roads. If drinking water had to be hauled to town it often cost more than gasoline does today.

"A few years later the whole town might pack up and leave. The population would fall from 6,000 to six or right down to zero in a few months. Shutting down of the mines, or a bigger, richer strike somewhere

else would cause the miners to leave. Usually they were in such a hurry that they didn't bother about their furniture and they rarely went back to get it later."

Until recently you could prowl through one of these abandoned towns and gather armloads of relics of the early days. Old gambling devices, cards, bottles that had turned purple from long exposure to the sun, records of early gold shipments lying scattered in the open bank vaults, all were there for the taking. Itinerant prospectors tore up the wooden floors of gambling halls and saloons to pan for gold dust that had spilled through the cracks. In Colorado smart treasure hunters looked for pack-rat nests in the abandoned towns. They were often rewarded by finding small collections of gold and silver coins, old watches, and other bright trinkets that the pack rats had stolen in the early days and hidden in their nests.



Above, pouring molten gold and silver into mold, the last step in mining

Auto Club of So. Calif. photos

Above, beehive kilns used in the last century still stand in the Panamint mountains. Right, gold panner in Fish canyon in the Sierra Madre mountains

near Death Valley

One collector of early relics, W. Parker Lyon of Arcadia, Calif., has assembled thousands of dollars worth of historical pieces from the ghost towns. Once he bought a furnished three-story hotel for fifty dollars when he wanted some of the

(Continued to page 122A)

Thirty-Five Foot Model Is Fair in Miniature

Top, workers completing model of exposition. Note tiny figures of spectators and of autos. Bottom, how the exposition will look from the air upon completion of all the buildings

Tiny lifelike figures, 5,000 autos much smaller than toy cars, many miles of esplanades, hedges, roads and canals are among the features of a thirty-five foot model of the 1939 Golden Gate Exposition. Every part of the exposition, and the man-made island on which it will be constructed, is shown by the model. Each tiny figure walking about the 400-acre grounds, reduced to a scale of one-sixteenth of an inch to the foot, is made of clay. Spectators seated in the model's athletic field bleachers are painted grains of rice. Under the artists' hands, crinkled Cellophane and spun glass have been converted into ornamental fountains. Carefully torn bits of animal and vegetable sponge have been made into trees. The model's palm trees

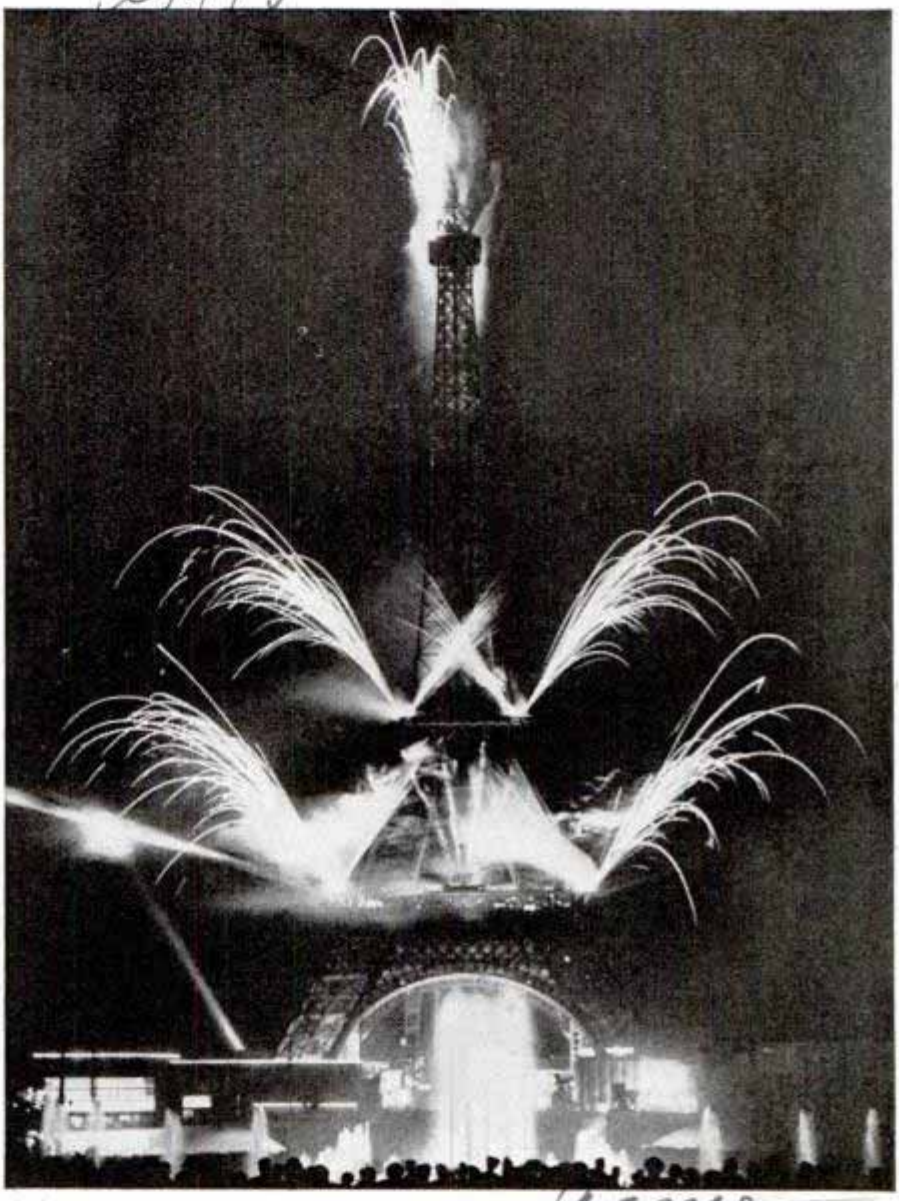
are colored strips of buckram, its bamboo is pampas grass and its low shrubbery made of cork and sawdust mixed with paint and varnish. The model is built on thirty sliding panels. It is being exhibited in its own structure, being a preview of the San Francisco fair.

Windmill's Wings Fold to Give More Power

Wings opposite the driving wing of the latest windmill fold automatically as wind pressure slackens on one and is picked up by another, reducing air resistance to a minimum and resulting in more power. On test models resistance to the air was reduced almost ninety per cent by the collapsible wings. Four oil-seated springs act as governors, allowing the blades to fold when the wind reaches sufficient velocity. Four blades constitute a unit. Increased power may be obtained by bolting additional units, one above the other, on a main shaft.

Model of folding wing windmill, showing how blades fold as wind pressure stops

Eiffel Tower Is a Giant Vase for Fireworks Spectacle

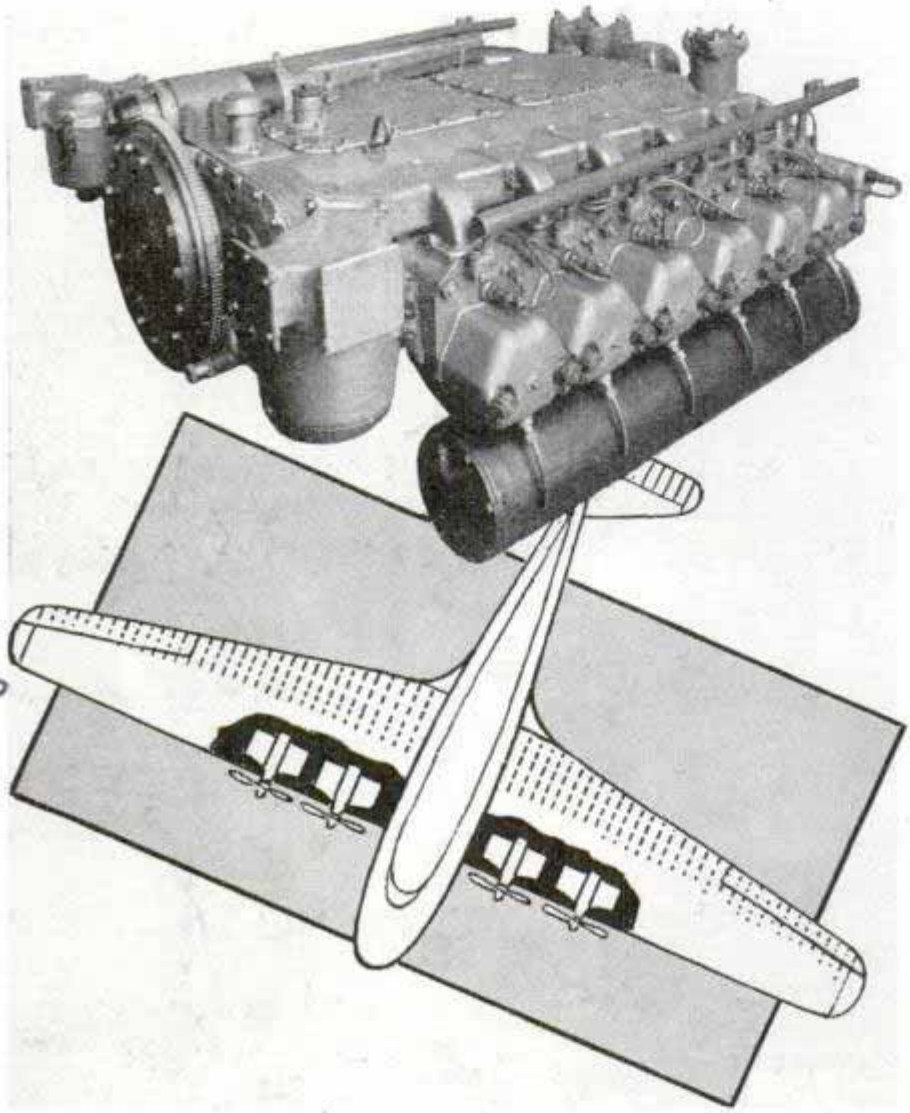


Spectacular view of the Eiffel Tower as fireworks are set off in one of the feature events of the Paris exposition

Fireworks stream up nightly from Eiffel Tower like great flowers of fire, growing swiftly and then vanishing. Built forty-eight years ago for the Paris exposition of 1889, the skyscraping tower is still a landmark and attraction for the exposition of 1937, and every night it is used as a great "vase" for the pyrotechnical display.

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

'Pancake' Diesel for Aircraft Permits Better Wing Design



Top, the flat Diesel engine for aircraft. Bottom, sketch showing how the engines may be installed in the wings of plane

Flat in the shape suggesting the name "pancake," Germany's latest Diesel engine for aircraft saves space and enables the designers to improve streamlining of the wings. The engine is somewhat similar in shape to the "pancake" gasoline motors being used in the United States for driving trucks and buses.

Water Made "Wetter Than Wet" by Synthetic Alcohol

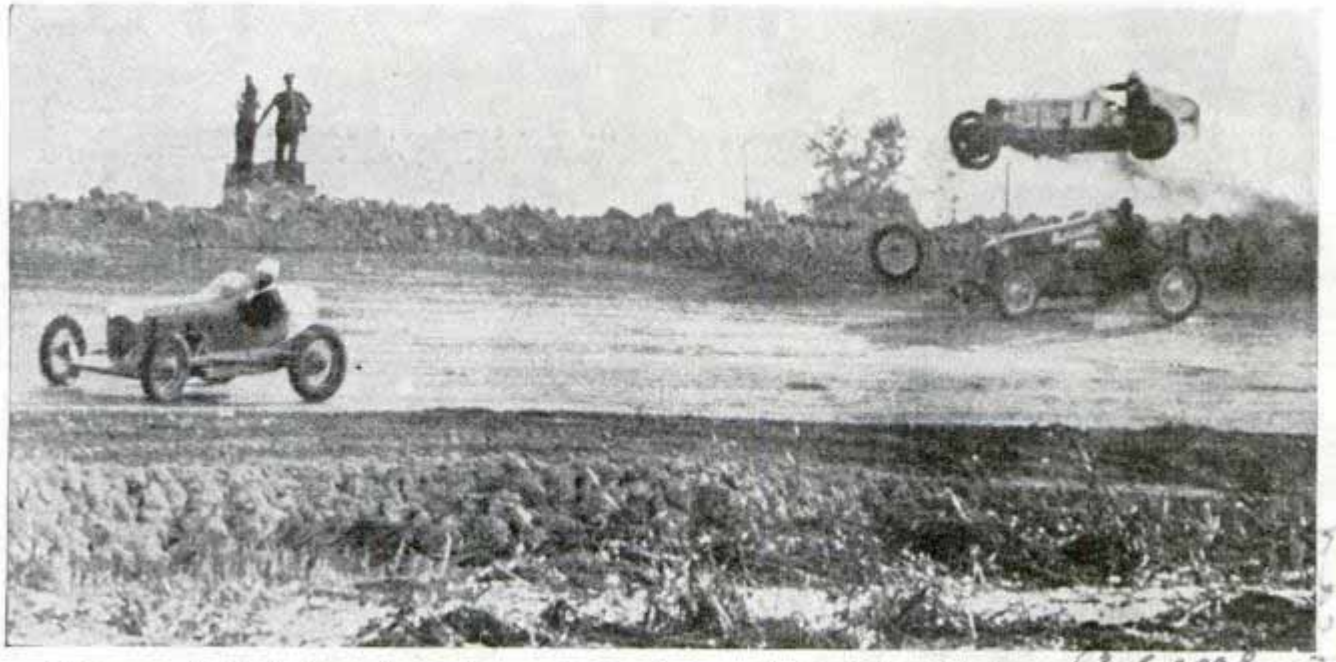
Even the most water-resistant fabrics may be soaked with water made "wetter than wet" by a chemical agent developed recently. It is expected to be of great value to industries which require uniform wetting of materials, such as textiles. Cotton fibers sometimes float on the surface of water for days without being thoroughly wet. This chemical, a synthetic alcohol, is effective even in hard water and makes it permeate the most resistant materials.

Auto Color Map Found an Aid to Car Builders

Helping the auto manufacturer to turn out cars which will please the customer is a color-preference map of the United States. The entire country is divided into seven zones or groups of states. Each week reports of customers' preferences in colors of cars are posted so that the trends may be seen at a glance. Strangely enough these trends do not vary greatly by season, but they do vary by geographical location. Black is the preferred color in the eastern and southeastern sections of the country, but lighter grays, browns, greens and blues are more popular in the far western states.

Posting the latest color preference for one state on the color map

Camera Catches Racing Car High Off Track

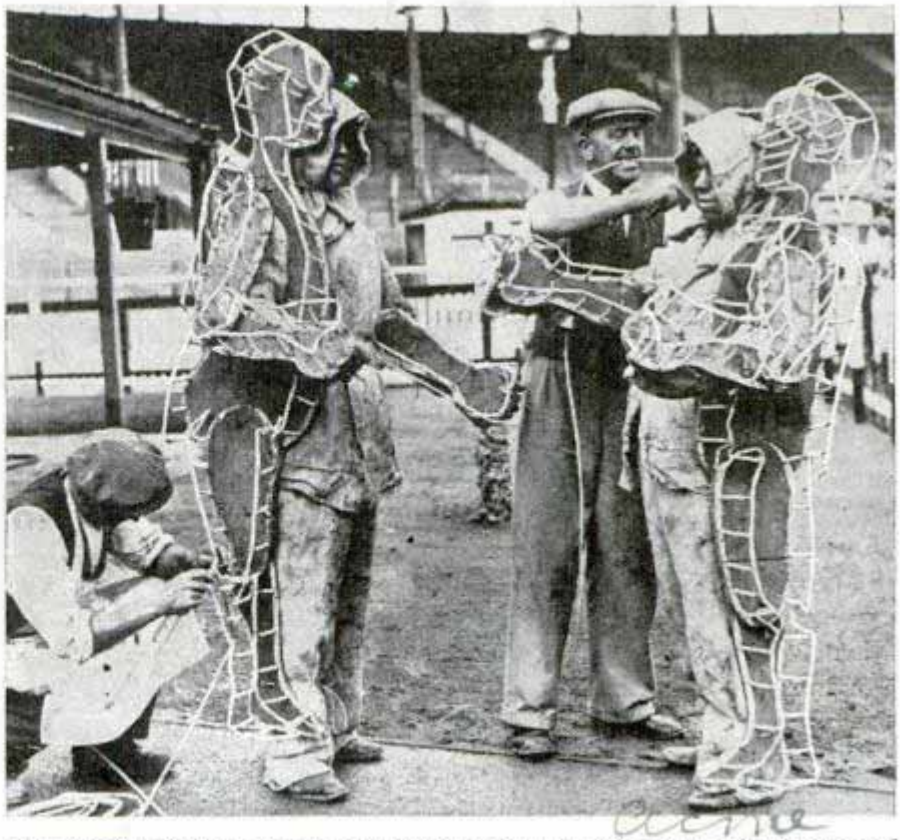


This remarkable photograph was the result of a photographer's alertness during a race. Note the car ***high off the track, the other speedster beneath and the wheel which caused the crash***

Snapped an instant after two racing cars crashed on an Indiana speedway, a picture made by an alert cameraman shows one of the autos high in the air, as though it were flying. The car, at the moment the camera was snapped, was right side up with the driver still in his seat. Just beneath was the racing auto with which it had collided. Loss of a wheel caused the crash, which resulted in serious injury to both drivers.

'Human Fireworks' in Asbestos Lend Action to Display

Asbestos suits protect two men who supply action for a spectacular display in which fireworks attached to their costumes discharge. The "human fireworks" engage in a boxing pantomime as the fireworks paint their moving arms, legs and bodies in colored fire. The heavy asbestos suits are equipped with hoods for protecting their heads. Extraordinary endurance is necessary because the men spend several minutes inside the hot suits.



Preparing two "human fireworks" for scene in which the fiery outlines of boxers will go through a sparring exhibition

¶Overheating the domestic water supply is a destructive practice, for corrosion activity doubles with every ten-degree increase in temperature.

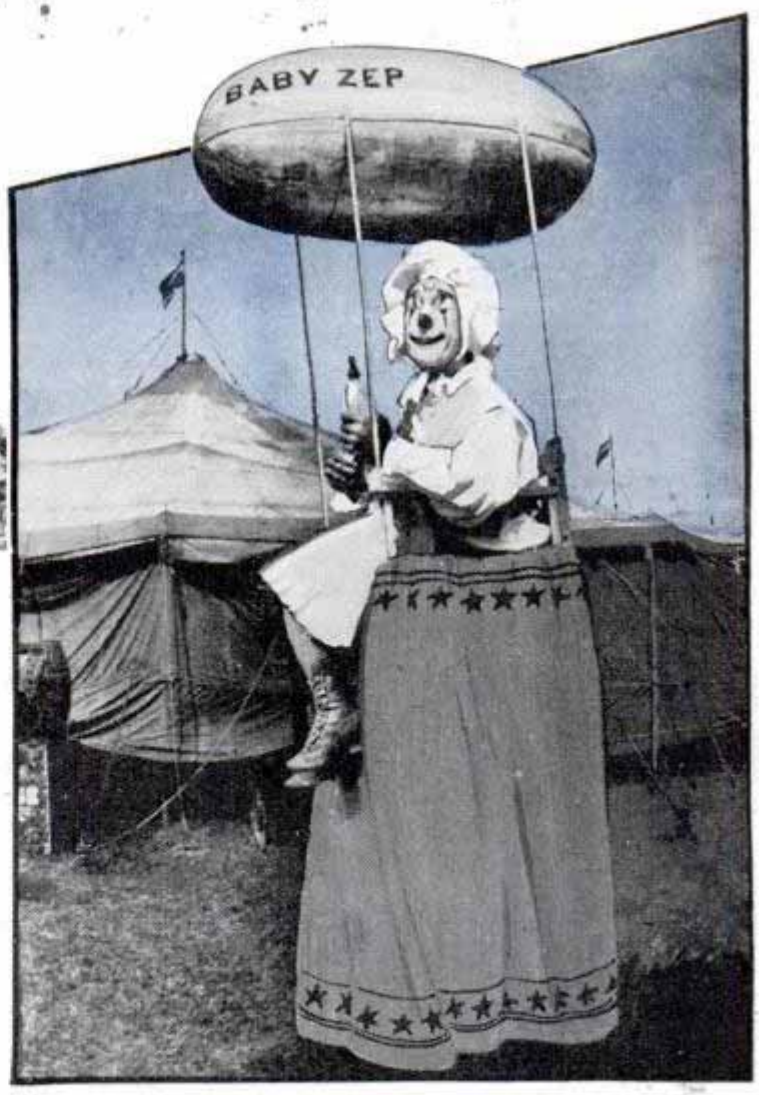
Fort Scott, Kans

INVENTING

"Big Head"

Clowning today is serious business—at least for the clown. Time was when he depended mostly on pantomime and ridiculous costumes for laughs. But today it takes more than a preposterous pair of pants and a couple of awkward feet to tickle your funny bone. It takes ludicrous ideas—new ones each season—staged as one-man playlets.

Modern clowns put over these ideas with the aid of props, the stage settings for their playlets, and they depend on mirth-provoking props as much as on pantomime and dress to

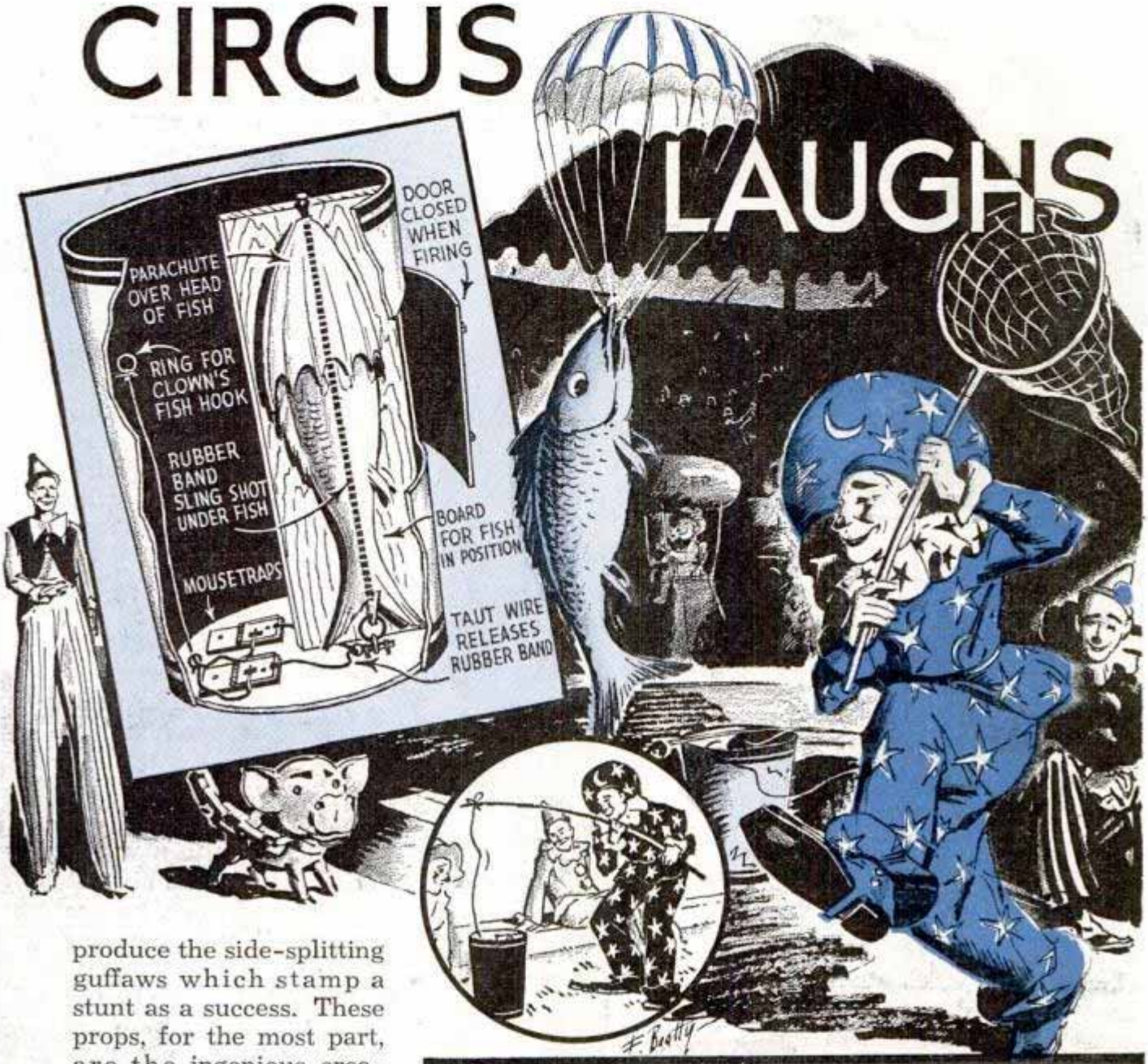


A CIRCUS clown bursts into the arena, his every movement simulating terror. Clinging to the back of his costume is a "stuffed" goose with wildly flapping wings. Around the hippodrome track flees the funny man, the angry goose in his wake, hanging on with a bulldog grip.

The crowd roars with laughter, partly at the antics of the clown, partly at the realistic appearance of the bird and partly at the whole ludicrous idea of a goose chasing a man. To the crowd, the "gag" seems something the clown thought up on the spur of the moment. Actually, it represents weeks of work, not by the clown, but by his "prop" man who "invented" the goose.

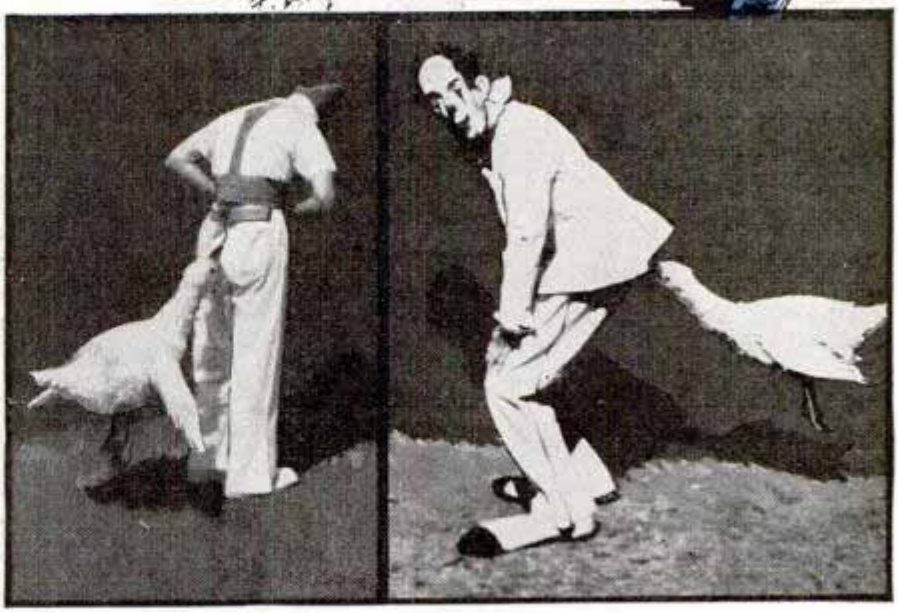
Top, a laugh-provoking oversize head for the clown's body. Bottom, "baby zep" rigged up by the "prop" man to amuse circus crowds

CIRCUS LAUGHS



produce the side-splitting guffaws which stamp a stunt as a success. These props, for the most part, are the ingenious creations of amateur inventors, friends or acquaintances of the funny men who are handy with tools and who often spend weeks or even months fashioning some contrivance intended only to make people laugh.

Many of the prop men who construct the complicated apparatus used by clowns do the work as a hobby, and not as a profession. They receive their reward in listening to the roars of the circus crowds as their favorite clowns enter the arena



Top, diagram of the fishing prop. When the fish floats down on parachute, the clown catches it in the butterfly net. Bottom, left, putting on harness which holds the goose. Right, clown being "chased" by the goose. Harness supports the goose in pursuing position

with props of their own creation. One amateur inventor who spends most of his winter evenings constructing next season's props for his favorite clown is E. M. Aronson of Fort Scott, Kan.

When the circus came to town, Mr. Aronson, as a boy, paid scant heed to the lions and elephants and aerial artists. His eyes were all for the clowns. And when other boys boasted they expected to be lion tamers or bare-back riders, he said he would be a clown when he grew up. But he wasn't. Instead he became the proprietor of a drygoods store. He still went to circuses to see the clowns, however, and sometimes wished he might meet a real clown without the white paint and funny clothes.

And finally his dream came true. One day a quiet, unassuming man came into the store and asked for some very large hooks and eyes. Told that they were no longer in stock, he expressed regret, adding that he needed them for a clown wardrobe. "Are you a clown?" inquired the astonished Mr. Aronson, staring wide-eyed. "Wait just a minute. I think I have some of those big hooks and eyes in a storeroom upstairs."

Mr. Aronson's customer was Lew Hershey, contortionist and clown for more than thirty years. The hooks and eyes located, the merchant invited his visitor back by the old stove to chat and thus began a friendship that made of the storekeeper a clown's prop man. Eagerly the merchant who had spent fifty years in the same town, in the same business and in the same home, questioned Hershey about circus life, about his travels, about his profession. Next season Hershey came back for another visit.

"If I could only find someone handy with tools, I would have some good gags for next season," he remarked.

"I'm your man," responded Aronson. "I've got the tools in a workshop in my basement at home and I know how to use them. Bring on your ideas."

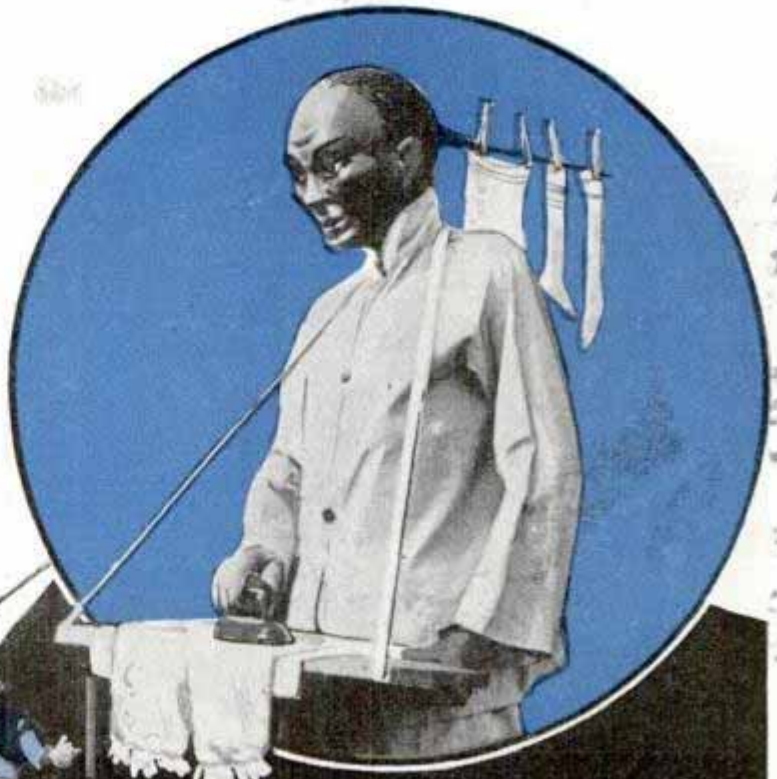
"Well, it's a hard one," replied the clown. "I

Top, Lew Hershey, veteran clown. Center, "What a Man" prop, with huge body and miniature head. Bottom, ridiculous-looking prop depicting the "retired clown"

don't think you can do it. I want a dirigible balloon supporting a high chair in which I sit, dressed as a baby, with dummy legs hanging over the front and my own legs concealed by a drape extending to the ground."

"How are you going to make a balloon stay in the air and support that chair?" demanded Aronson.

"That's your worry," replied Hershey with a grin. Then he added a few extra specifications. "The prop must be light in weight. It must be strong and durable. It must be waterproof. It must be



Top, Chinese laundry prop, with some of the washing hung out on the pigtail. Bottom, clown band of Al G. Barnes Circus, with Lew Hershey at extreme left

collapsible so it can be packed in a trunk."

"Anything else?" inquired the alarmed Mr. Aronson.

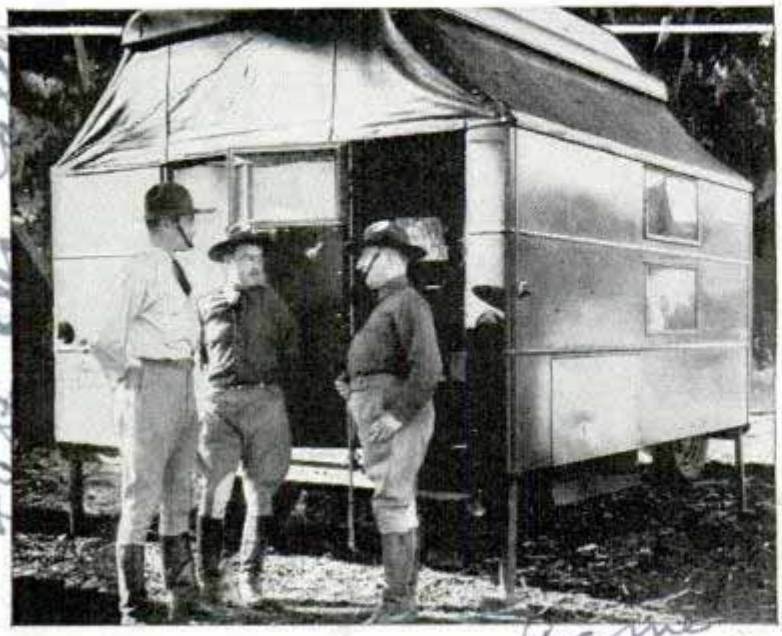
"Yes," added Hershey. "Paint 'Baby Zep' on the sides. That's the 'gag'."

Many times while designing that zep, Aronson wished he had stayed behind his ribbon counter and let clowns look out for themselves. But he kept at it. With the aid of geometry, he figured out the ellipse and designed a cigar-shaped dirigible thirty-eight inches long and sixteen inches in diameter. He constructed it in two halves, held together with clasps, saving half the space in packing. He made a wire frame, covered it with screen wire and applied several coats of aluminum paint. He built a chair, bored four holes in it, inserted four perpendicular rods and attached the balloon to the rods. Out of wire he fashioned a pair of baby's legs, covered them with shoes and stockings and attached them to the front of the chair at the seat.

Then he constructed a harness for the clown's shoulders to support the chair, the seat of which was built so it fitted around

(Continued to page 126A)

Trailer Is Staff Headquarters of General when Army Travels



This trailer, complete with many comforts, serves as traveling staff headquarters for four army officers

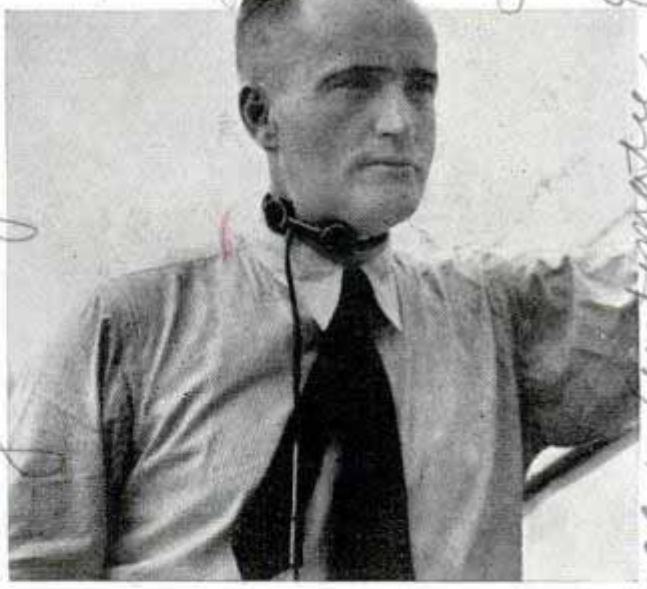
"Tenting tonight" means a trailer to the modern army general. A well equipped trailer serves as traveling staff headquarters during army maneuvers, providing sleeping quarters for four officers. It has an independent lighting system, facilities for cooking and refrigeration, clothes closets, wash basins and other conveniences.

Blades Coiled in Safety Razor Like Motion-Picture Film

Coiled inside a new-type safety razor is a metal ribbon, somewhat resembling motion-picture film, on which there are 180 double-edged blades. The ribbon is more than thirty feet long. It is coiled so that a quarter turn of a button on the side of the razor case projects the exact length of a new blade through a slot in the non-shaving end. This length of blade is broken off and fitted into place beneath the safety guard, which is raised by pressing another button. When this button is released the guard snaps back into place and holds the blade firmly. The ribbon blade, which is extremely flexible, is made possible by a process through which very thin chrome alloy steel, only .00315 inch thick, is made into ribbons. Automatic optical control during the grinding process assures uniformity of cutting edges. The last twelve blades in the case are marked with a blue line to remind the user to renew the ribbon. The razor, weighing less than four ounces, fits snugly into the hand.

Throat "Mike" for Pilot Reduces Hazards

Designed to reduce hazards of present large-size hand microphones, a small throat "mike" for pilots is under test. It consists of a necktie-like cord to which is attached a microphone about the size of a large button. This is held by the cord against the throat to pick up vocal sound waves through the neck tissues. Interfering noises, such as roaring of engines, are reduced sharply and the pilot's hands are left free for manipulating controls. In one accident, a hand microphone is believed to have dropped into the midst of the plane's controls, preventing their manipulation and resulting in a crash. The neck microphone is now in use in Italy and is being tested by the United States army.



Throat microphone in place, leaving pilot's hands free for other duties

Modeling Sheets Can Be Tooled Like Leather

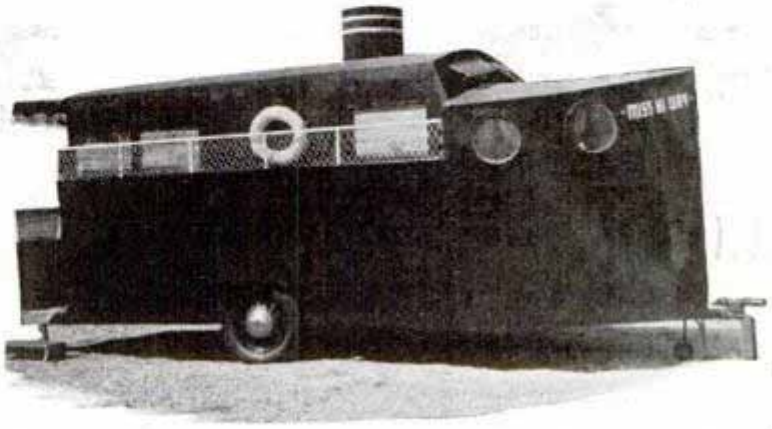
Home craftsmen can make decorative and useful articles with a kit of modeling sheets which are tooled like leather. The same technique, the same tools are used but the material is less expensive than real leather. The kit includes an assortment of sheets, patterns, tools, paintbrush and water colors. The tooling is not difficult, and skill comes with practice. First the pattern is laid over the waxy top side of the modeling

Above, two steps in use of the modeling sheets, which are tooled like leather. Below, a wastebasket, one of the many useful objects which can be made with aid of the kit

sheet, held in place with a paper clip and traced with a stylus. The back of the sheet is then moistened, the pattern traced more boldly, and then the design is raised or embossed with a flat modeling tool applied on the underside. Wastebaskets and lamp shades, picture frames, bookends, Christmas cards, desk sets, trays, nameplates, signs and relief maps are some of the articles adaptable to this tooling material.

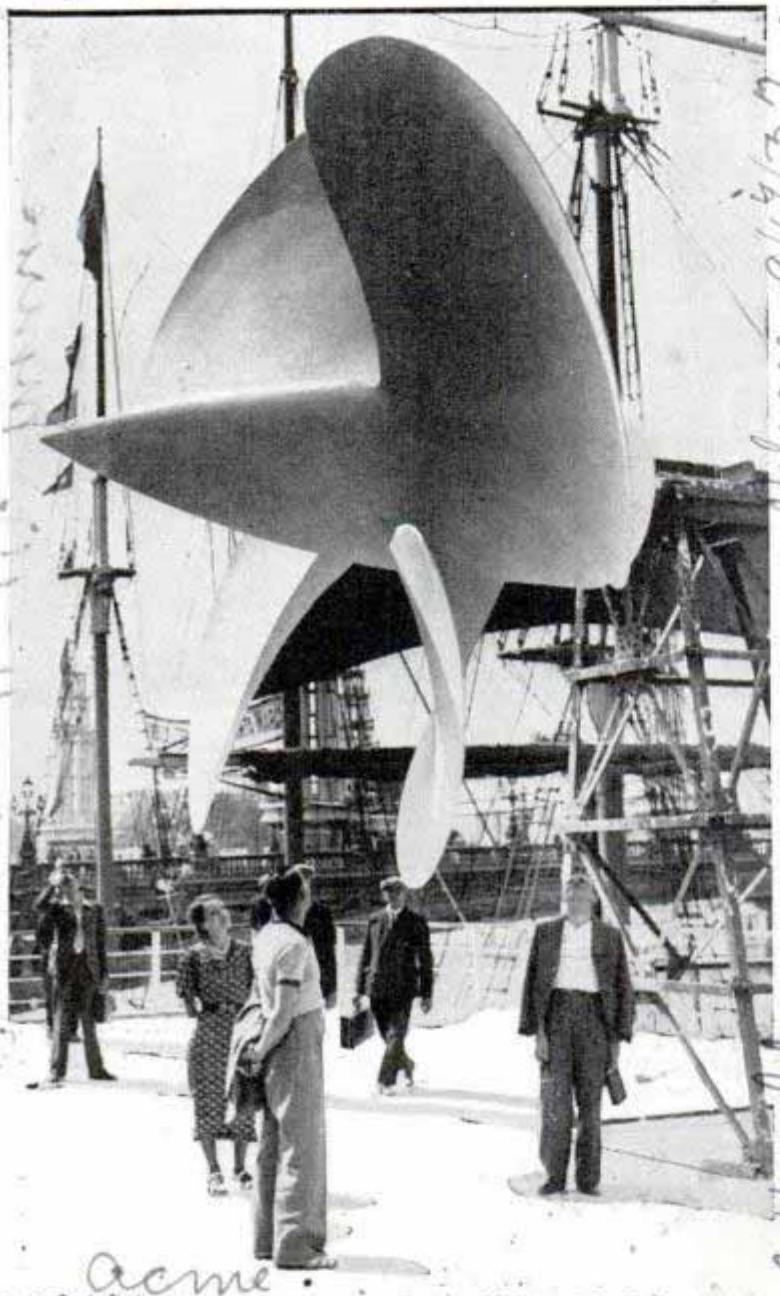
Auto Trailer Built Like Yacht Has Water-Tank 'Funnel'

Closely resembling an ocean-going yacht, the latest auto trailer is complete to the funnel in which there is a twenty-six gallon water tank. It has portholes instead of windows, imitation life rings strapped to upper deck and a small after deck which serves as a porch. The interior is fitted up like that of a yacht and consists of a galley with stove and icebox and sleeping accommodations for six people.



Here is the land yacht, resembling a small cruiser but equipped with wheels to serve purposes of a trailer

Giant Screw from 'Normandie' Is Shown at Paris Exposition



Here is one of the huge propellers which enabled the "Normandie" to win the transatlantic speed race

Memento of a historic race against time, one of the giant propellers of the French liner "Normandie" is on exhibition at the Paris exposition. After helping the big ship win the blue ribbon of the Atlantic, it was replaced by a new screw.

Fish Are Seasick on Boat

Fish which refused to escape when they had the chance because they were seasick—that's the kind of yarn brought back by scientific anglers. The men who vouch for the seasick fish—and they have the fish to prove it—are on the staff of the Field Museum of Natural History in Chicago. They were angling for museum specimens off the coast of Maine in a high sea and kept their catch in a "live tank" alongside the power boat. As the intensity of the waves increased, the water washed over the live car in such a manner as to provide escape for the captives. But the fish were actually and visibly seasick and remained miserably in the bottom of the live tank, manifesting no interest in swimming to freedom. Later they were transferred to tubs on board the boat and continued to suffer from the motion until port was reached.

Three-Speed Wheel Chair Is Run by Batteries

With two fifteen-plate auto starter batteries for power, a motor-driven wheel chair travels forty miles or more at a speed of ten miles an hour without recharging. It costs only about twelve cents to charge the batteries. It has three speeds and reverse, direct front-wheel drive, an electric-welded steel frame, adjustable springs and jumbo tires on its three wheels.

This battery-powered wheel chair attains a top speed of ten miles per hour

209 S. State St
Republic Bldg. Chicago

Comforts of Trailer Built into Rear of Car

Almost every convenience of the modern trailer has been built into the rear compartment of his seven-passenger car by Dr. C. D. Owens to relieve the tedium of long trips. The equipment, much of it constructed to his own design, folds or may be concealed so that the car presents a neat appearance when ready for day travel. At night the day lounge may be converted into double-decker beds for two persons, with steel rods to support the upper berth. Each bed has springs and comfortable mattress. Screens in the windows keep out insects. In the morning, the doctor turns on the faucet of a small basin and draws water from a hidden four-gallon tank for washing. Raising the top of the basin's drainboard reveals a mirror for shaving and combing the hair. Then comes breakfast, prepared on a small gasoline stove which fits beneath the lower bed. A folding table, large enough for four, is set up across the lower end of the bed, and dishes and cutlery from a dish locker attached to the right-hand rear door are laid out. The driving and passenger seats at the front are both reversible, providing seats for meals or card game. One feature of the car is the well cut into the floor of the rear compartment to provide headroom for dressing or moving about. This well is on a level with the drive shaft, leaving ample clearance.

Several views of the car with interior rebuilt to give conveniences of trailer

De Soto

eo 1023

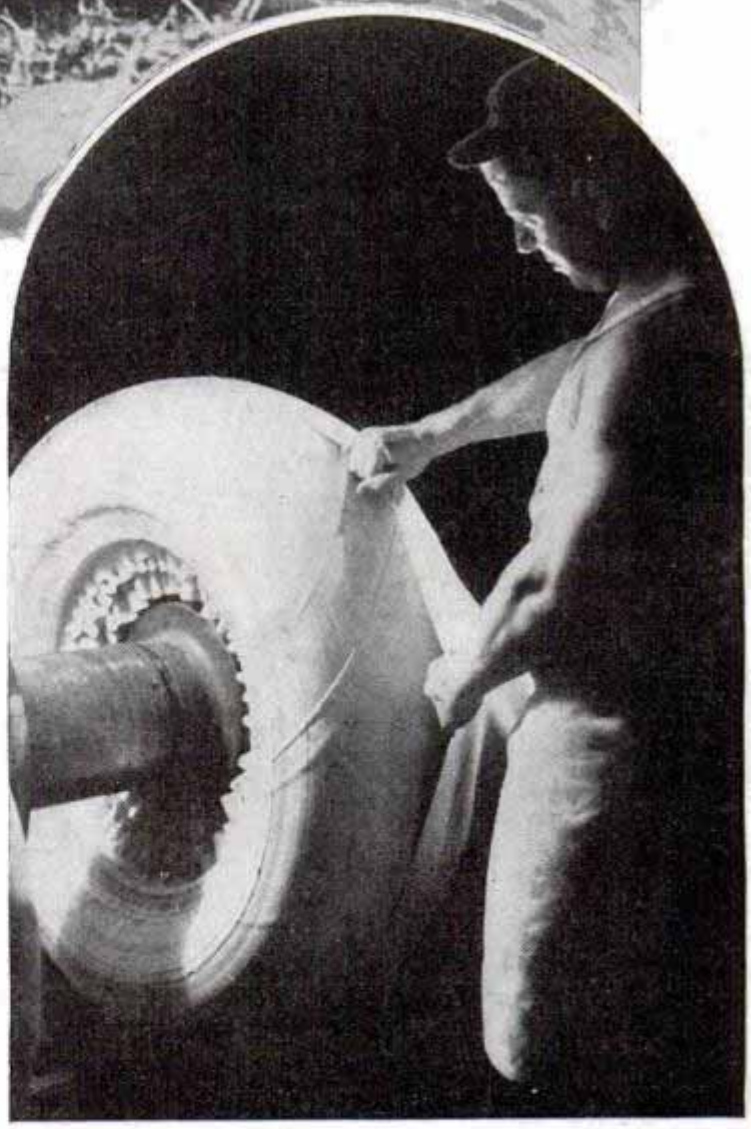
SUPER-TIRES *for the*

By Julian Leggett

ALMOST unbelievable mileage is being rolled up by a new tire designed especially for heavily loaded trucks and buses operating at sustained high speeds over long distances. Built to resist heat, the No. 1 enemy of rubber and fabric, this tire delivers from three to thirty times the mileage of ordinary tires—the harder the job, the greater the contrast.

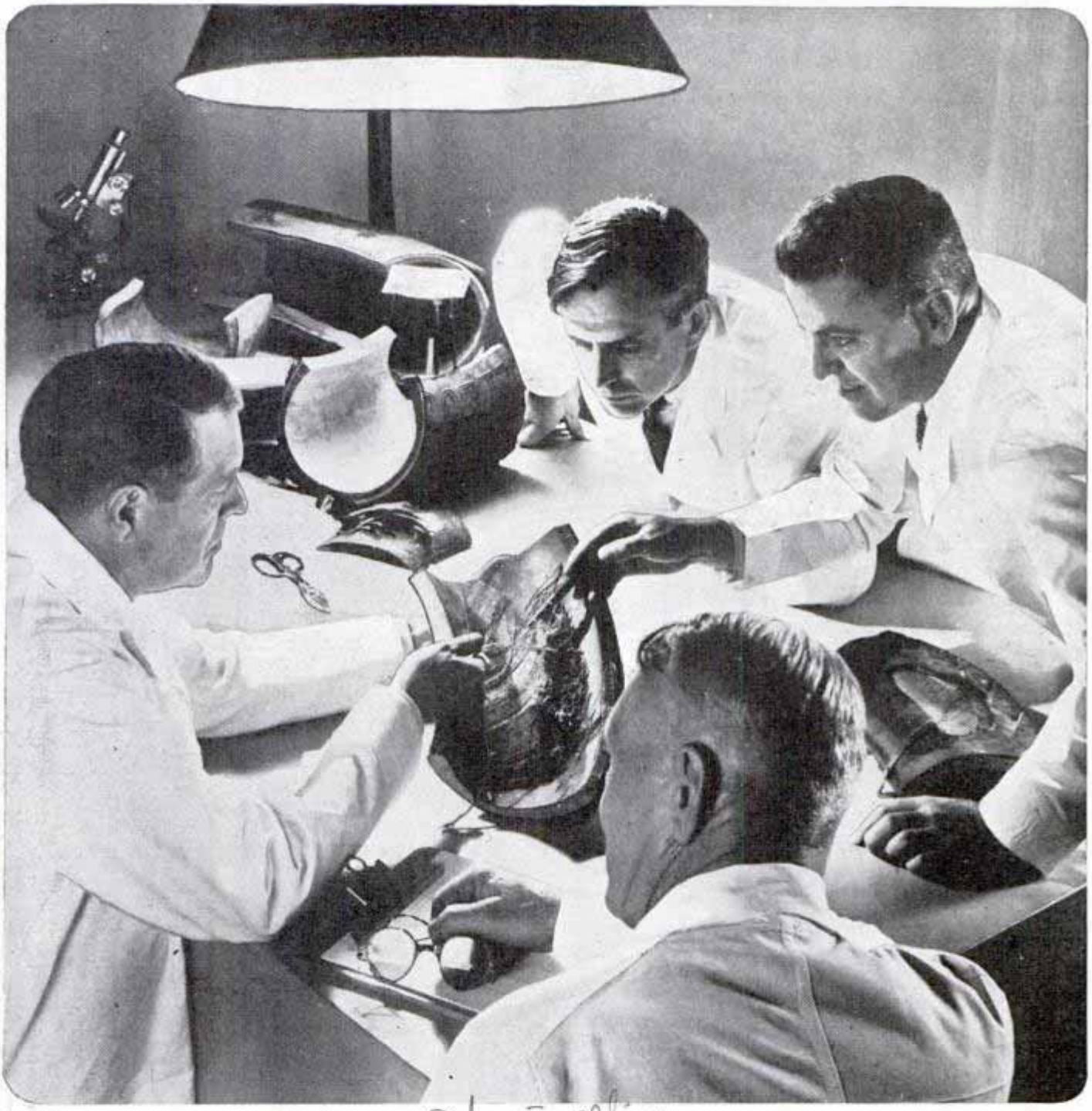
Just recently one of these tires was retired from service after 140,636 miles on a fast truck hauling very heavy loads between Hamilton, Ohio, and Chicago, Ill. A nail hole caused removal of the first tire of the same set after it had traveled 120,000 miles and the other two tires delivered between 120,000 and 140,000 miles each before being declared unsafe.

This record is exceptional, but records of seventy, eighty and even one hundred thousand miles are being reported so frequently that makers of the tire and operators of the nation's motor freight and passenger lines regard the new product as



Top, Dodge's severe truck tests mean real punishment for the tires. Bottom, applying the fabric, one step in the building of a tire

HIGHWAY EXPRESS

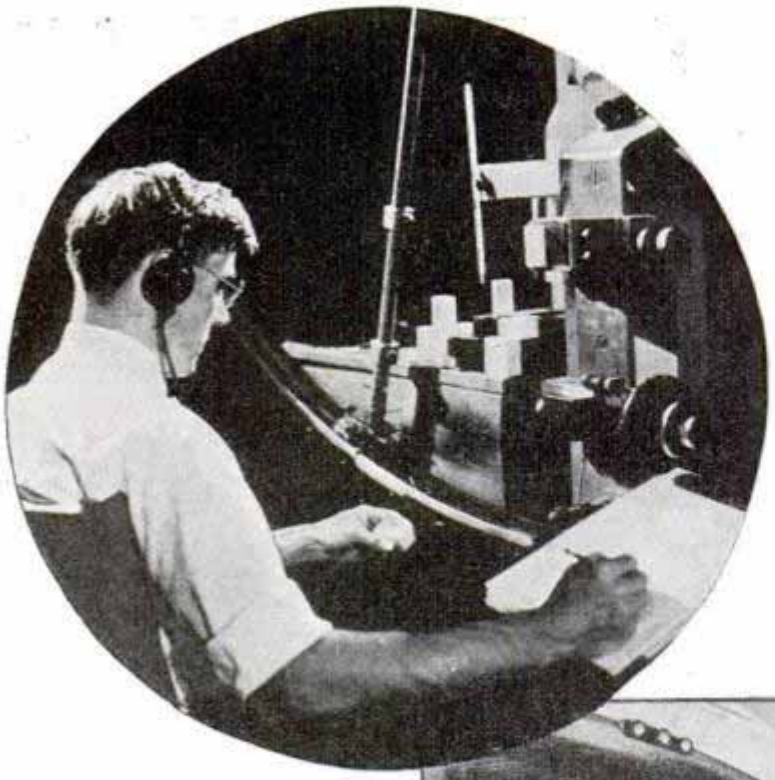


Courtesy Goodyear Tire & Rubber Co. Akron, Ohio

Here the tire experts are shown dissecting casings to find what makes them break down. Sometimes it takes years to trace the cause of failures, but the tire engineers never give up

a super-tire, the thing for which they have been searching for two decades.

Rayon, plus a patented secret process for bonding its silky smooth strands to rubber, is the secret of the tire which makes possible the operation of trucks and buses on limited train schedules. Repeated experiments, carried on over a period of many years, revealed that rayon would retain its high tensile strength under severe heat and that it was a practical material for use in tire building. After those two facts were established, more experiments brought to light a method of twisting the rayon filaments into yarns and cords, and special new-type equipment now does



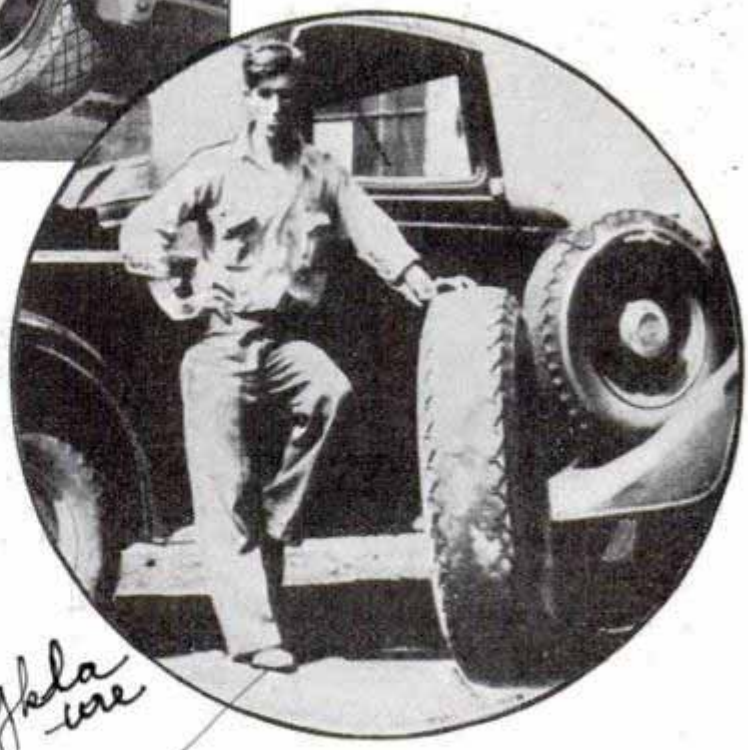
this job. Bonding the tough rubber compounds to the smooth rayon cord was another problem which was solved after many months of development of the secret process.

The completed rayon cord tire then was subjected to the most severe tests imaginable. On the Arizona desert trucks equipped with the super-tires, each loaded with 5,000 pounds, which represented a twenty-eight per cent overload for that size of tire, were driven twenty-one hours each day at fifty miles per hour. At the same time other trucks fitted with ordinary tires were operated at the same speed with the same load. With the temperature at eighty degrees, the conventional tire broke down at 6,000 miles; the rayon tire at 20,000 miles. With the heat at 106 degrees, the conventional tire stood up for only 600 miles; the other tire ran on for 18,000, thirty times as far.

Compared to the ordinary tire, the new product's rayon cords were revealed as possessing greater tensile strength in extreme heat; greater resistance to fatigue; better resistance to separation, and less tendency to generate destructive internal heat. At last the tire engineers placed their approval on the new product, recommending it especially for "murder runs."

Murder run is descriptive of a truck or bus operation which calls for sustained high speeds with heavy loads over long distances. Sustained high speed means speed kept up for long distances, perhaps 100 miles, without stops. Under these conditions, the tires are given no chance to cool off, no chance to dissipate the intense internal heat built up by the constant flexing of the sidewall cords under the heavy load and the high speed. Frequently the heat inside a tire used on murder runs reaches 250 degrees, simply burning up the cotton cords and causing them to lose their tensile strength, quickly resulting in a blowout.

Not long ago, but before the rayon cord tire was created, a heavily loaded truck was speeding along a Texas highway, blistering heat waves beating against the



Top, machine flexing sample rubber to determine its resiliency. Center, high-speed truck. Bottom, super-tire after 140,636 miles of hard service, a record hitherto regarded as impossible

cab. Inside, the perspiring driver pressed the accelerator with heavy foot and wrestled with the wheel; fighting against time to reach the terminal. Many miles lay ahead and his load was scheduled for delivery that night.

"Looks like we might make it," his helper spoke up and then qualified his prediction, "if those tires don't blow."

Punctuating his last word came a loud "bang!" Both groaned as the driver fought the swerving truck to a standstill beside the road and his helper turned wearily to haul out a spare tire. It was the left rear, a big hole gaping at the edge of the tread.

"That's the fourth one this week," the driver commented bitterly, "and this one's been on the wheel only three or four thousand miles. This heat breaks 'em down in a hurry. Just touch that casing. It's murder to put a tire on this truck and run it fifty miles an hour with such a heavy load on a hot day like this."

"Yeah," his helper replied as he touched the hot casing and hurriedly snatched away his hand, "and run it 300 miles without stopping long enough for it to cool off."

Both knew that they could not arrive on time. And that meant complaints from shippers, perhaps loss of the fast-run business and

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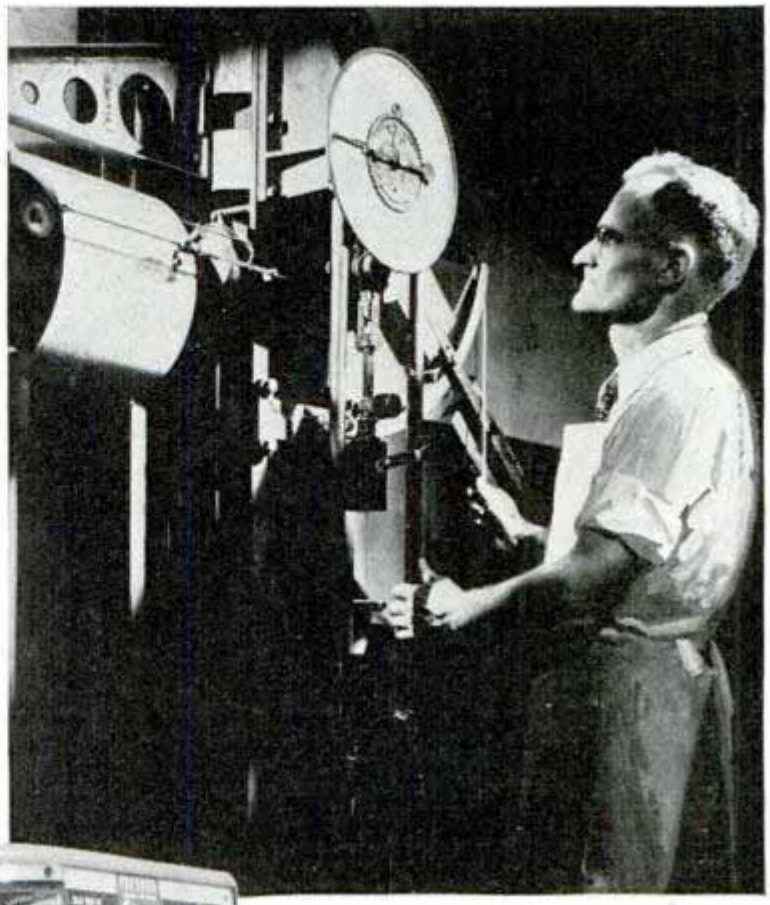
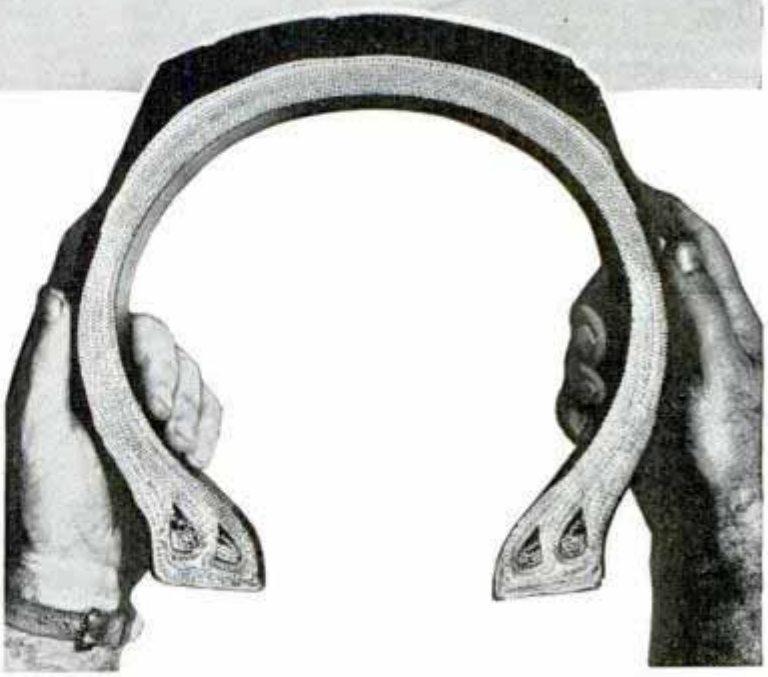
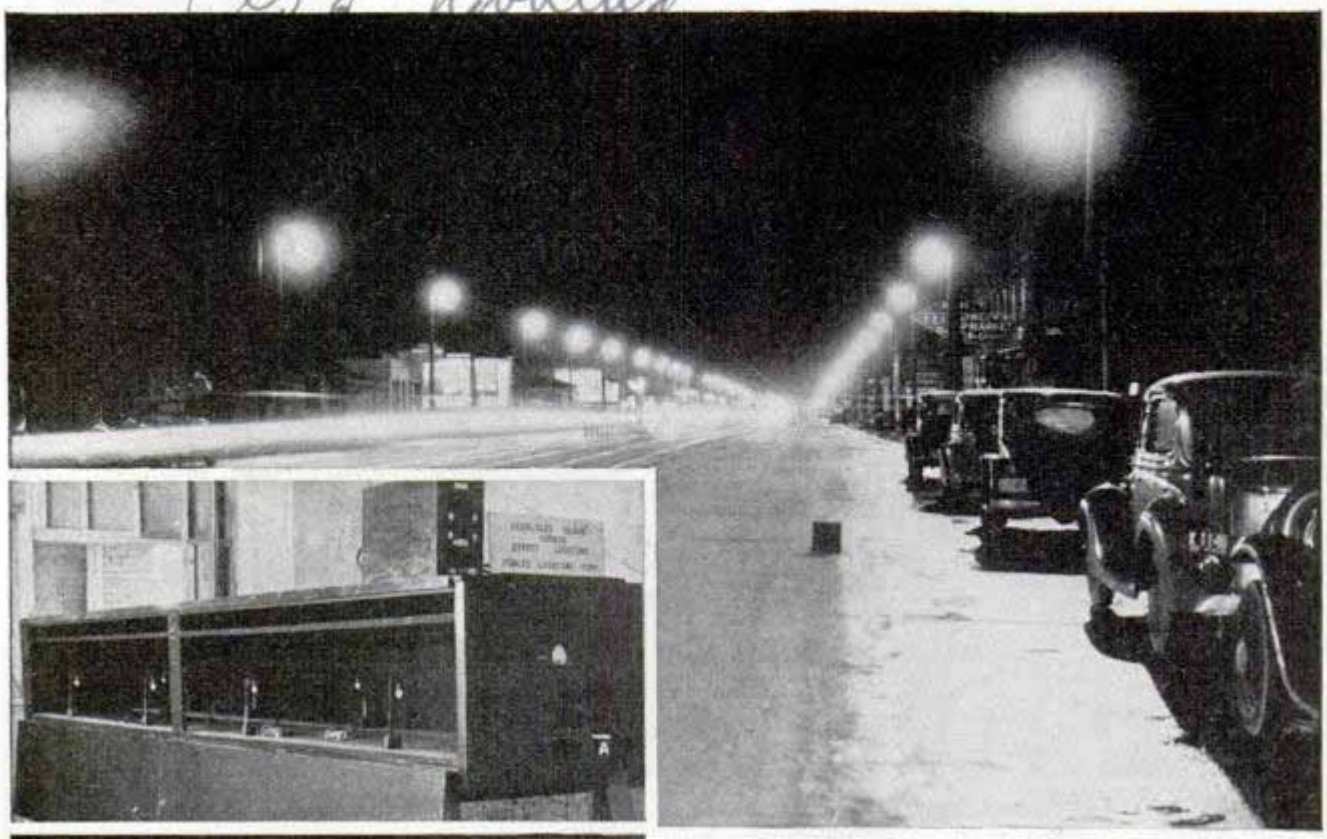
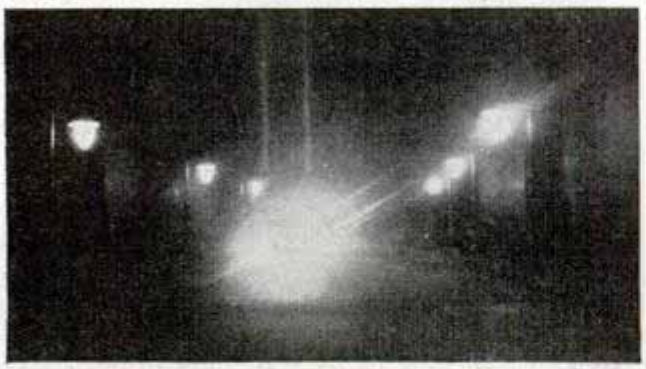




Top, testing bead wire for tires. Sample wire writes its own record on drum at left. Center, heavily loaded truck on the highway. Bottom, cross-section of a truck tire. Note the many layers of fabric necessary to give the tire great strength

Improved Street Lighting Reduces Accidents





Top, street with new lighting. Strip, top, model in which tests were made. Center, how car lights appear on well-lighted street. Bottom, glaring effect on poorly lighted street

On thirty-one miles of streets in Detroit, improved lighting has reduced the number of fatal traffic accidents. There were 146 night fatalities and twenty-one day fatalities on the same streets in 1934, 1935 and part of 1936, or about seven times as many night accidents as day. Since the new lighting has been in operation, the ratio has been reduced to 1.25 to one, only five night fatalities and four day fatalities being reported in the four to eight months that the system has been operating in some sections. Lighting along the thirty-one miles of streets has been increased from two to five times what it was. Reflectors of the luminaire-type lamps are arranged to produce even pavement brightness, and auto drivers are relieved of objectionable glare. In order to study the effect of auto headlight glare and its relation to street lighting a miniature street was built, on a forty to one scale. Inclosed to simulate darkness, the model represented 500 feet of a sixty-foot city street with street lights spaced 100 feet apart. Miniature cars were equipped with miniature lamps and camera lenses. The lighting was focused on an observation point to simulate the effect of bright headlights. The observation point was outside the inclosure and corresponded to the seated oncoming driver in the center of his driving lane. Both street-lighting intensities and headlight intensities were adjustable so that any conditions could be duplicated on the model. The tests on 100 drivers revealed that auto headlight glare is variable, that what is

glare to one driver is far from glare to another. Twenty drivers could tolerate three times the intensity and still see with the same acuity as another twenty. It also was found that the older the person, the more glare affects him. But outstanding was the finding that there is a definite relationship between auto headlamp glare, street lighting and visibility. For every value of oncoming headlight intensity there is a corresponding intensity of street lighting to provide a definite visibility. As oncoming headlights are increased in intensity, as is happening with each year's new cars, street lighting must be increased to keep the same visibility. As a general rule, in order to provide the same visibility for the auto driver and use depressed beams, two to three times the street-lighting intensity is required as when using parking lights. When bright headlights are used, five to six times the street-lighting intensity is necessary as when the auto's parking lights are used. To give the oncoming motorist the greatest visibility and the full benefit of street lighting, drivers should dim their headlights to a point where glare is not a factor under practical driving conditions.

Faucet with a Double Outlet Is Also Drinking Fountain

Plug the outlet of a new type water faucet and it becomes a drinking fountain. This bubbler for the home or office has a hole in the top of the spigot. When you want to drink, you merely turn on the water and hold a finger at the outlet, forcing the water up through the hole.

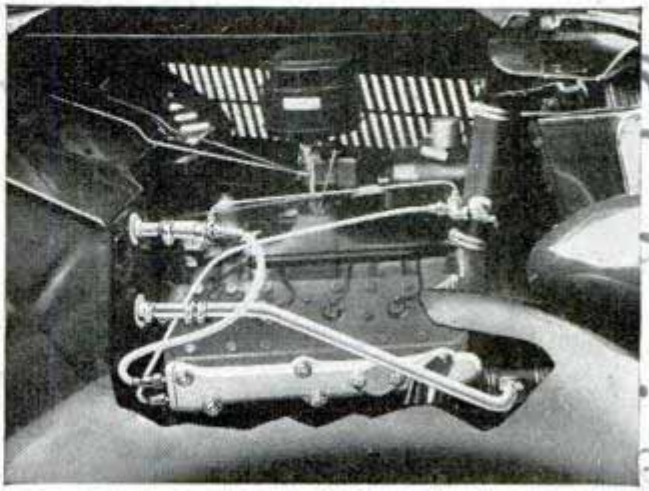
Speedy "Vest Pocket" Plane Not Much Bigger than Pilot

This photograph of the latest midget airplane shows that the tiny ship is hardly larger than the human figure standing beside it

Airplanes can't be built much smaller than the "vest pocket" edition specially built in a California aircraft factory. Big enough to carry an average sized man, it is actually not much larger than its pilot. The wing spread is only eight feet, and it is ten feet long. A seven-cylinder ninety-horsepower motor drives the little ship 220 miles an hour.

Steam Vapor for Car Heater Supplied by Simple Unit

Designed to be attached to car heaters now in use, a new unit injects vaporized steam instead of hot water into the heater. It is claimed that vaporized steam improves the efficiency of the hot-water heater.



Steam vapor apparatus installed on auto

Automatic Spading Fork Saves Work in Garden

Handy spading fork has many purposes, as this demonstration in Paris shows

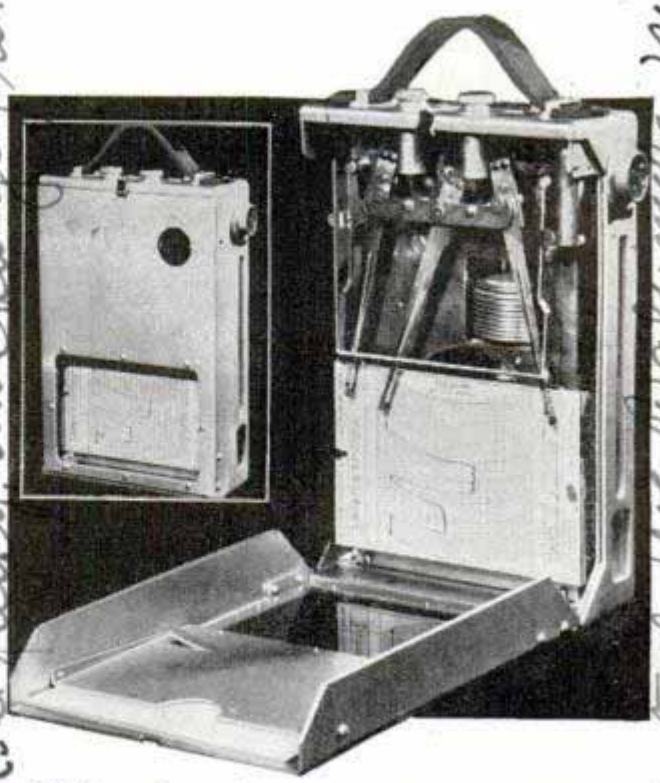
Back-breaking work of spading up the garden may be reduced sharply by use of an automatic fork introduced recently in Paris. The fork has a base with hinge arrangement which enables the user to lift a load of dirt from the ground simply by pushing downward on the handle. Turning the dirt to one side may be accomplished at the same time by operating a lever. As the work progresses, the garden tool is pushed along the ground on its base.

Coldest "Ice" Is Made of Carbon Frozen Near Absolute Zero

Man's closest approach to the frontier of absolute zero is carbon "ice," frozen to 446 degrees below zero Fahrenheit in the laboratories of Massachusetts Institute of Technology. Absolute zero, at which theoretically matter would vanish, is estimated at 459.6 degrees below zero Fahrenheit. Carbon is used in gas masks because of its "adsorption" power; gas particles adhere to it. Chemists call this energy of attraction the "heat" of adsorption. The scientists froze carbon in liquid gases—hydrogen, helium, air—and, reasoning that there was still the heat of adsorption present causing the carbon to stick to the gases, pumped off the adsorbed liquid and freed the frozen carbon from this heat. Carbon frozen in liquid hydrogen to nearly 400 degrees below zero dropped thirty-six degrees further when freed of hydrogen. With liquid helium, carbon was cooled to 446.8 degrees below zero.

Flight Analyzer on Air Liner Writes Log of Trip

Checking up on both pilot and plane from the moment of takeoff to the landing, a "flight analyzer" writes an automatic log on every trip of a United Air Lines transport. Like a robot secretary that is always on the job, it records on a three-by-five inch chart the rate of climb after the takeoff, the altitudes flown throughout the trip, the time elapsed, the rate of descent on landing, the length of time the ship was controlled by its automatic pilot, the comparative smoothness of flight at cruising elevations, and the number and time of radio telephone reports made by the plane to ground stations. At the end of the trip

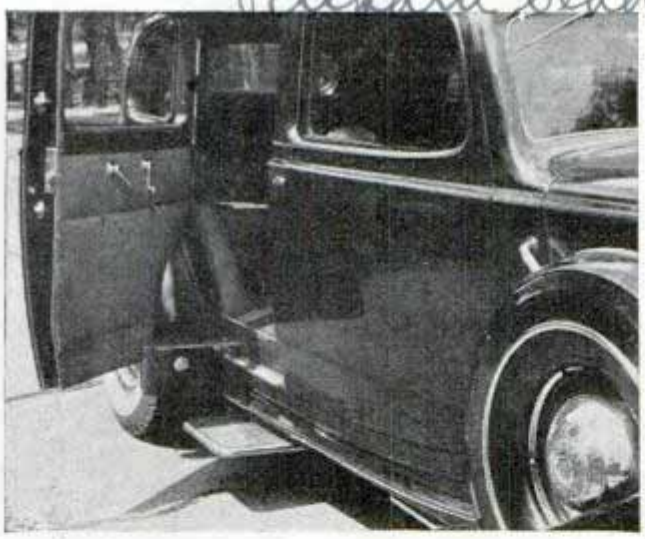


Flight analyzer for airplanes is contained in this metal carrying case

this record is delivered to the chief dispatcher of the sky line, who analyzes it and reconstructs the performance of plane and pilot. The instrument is housed in a duralumin case weighing three pounds. It consists of a barograph, clock mechanism, recording arms actuated by electrical impulses which record use of the automatic pilot and radio, recording pen and chart.

Vanishing Step on Armored Car Slides in When Door Is Shut

When government officials of Honduras ride in the armored car just built for them, they can feel pretty safe from assassins—even from bombers. The car carries 2,050 pounds of armor plate and laminated safety glass above its normal weight, and ninety per cent of the armor is built into the bottom of the car to protect it from bombs thrown beneath it. Five-ply glass windows one and one-fourth inch thick would shield the occupants from bullets shot from regulation army rifles at 2,700 feet per second. A special innovation in

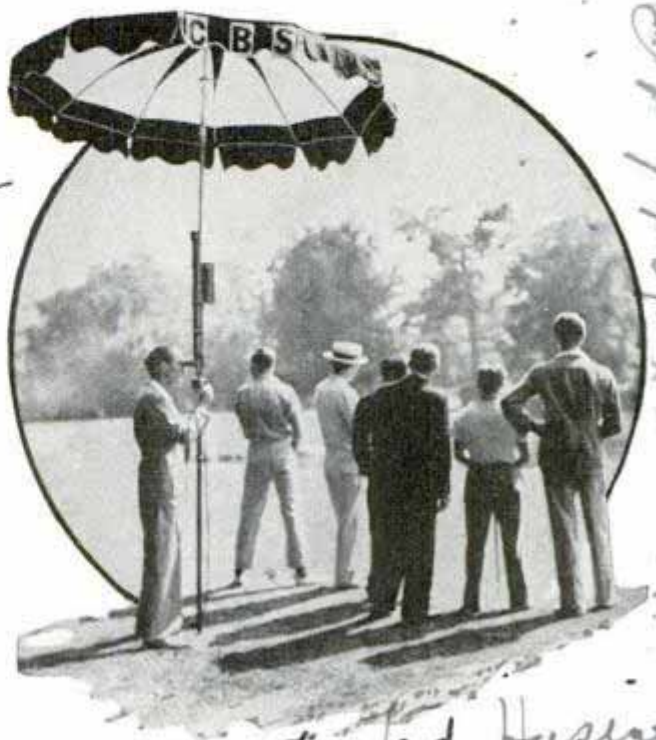


Showing the step on armored car which is visible only when the door is open

this car is the small, disappearing running board which, by means of a rod and spring arrangement, slides out of sight beneath the car when the door closes. This is to prevent attackers from boarding the car and firing at its passengers as did the assassins of King Alexander of Yugoslavia.

X-ray pictures on movie film have been developed in Germany by using a special lens and sixteen X-ray tubes, and production of sound X-ray films is now planned.

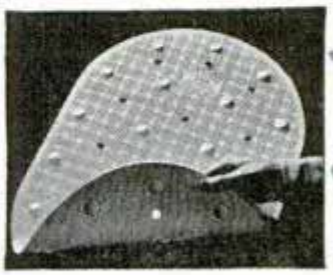
Periscope-"Mike" Enables Announcer to See Game



Here the announcer is looking over spectators' heads with periscope-microphone

Radio reporters covering a big golf match have their difficulties. If they edge into the "gallery" of spectators in order to see the play, their talking into the microphone may disturb the golfers. If they don't, they cannot see the shots well enough to describe them for the radio audience. A radio official solved the problem by inventing a combination of periscope and microphone mounted on the post of a big sunshade. The periscope sees over the crowd and magnifies the scene ten times so that the reporter can watch the play from a distance and tell the story to the "mike."

Bath Mat with Vacuum Cups Prevents Slipping



Suction cups are molded into the fabric of a bath mat to prevent it from slipping even on the wet surface of the tub. Its gripping power is doubled by its dual-cup design, one vacuum cup being molded within another.

MODERN MAGIC of the

Top, scientists check spectrograph built for Maj. Albert Stevens' stratosphere flight. Bottom, testing binocular prisms with an optical flat to determine accuracy of their surfaces

By Everett W. Melson

THERE was a frantic hunt one day in the grinding room of a great optical factory. A valuable lens had vanished—stolen, most likely, for men who spend months grinding a lens do not mislay it carelessly.

They found the culprit at last. It was no light-fingered sneak thief. It was an ordinary housefly. That polished crumb of glass, a perfect hemisphere no larger than the head of a pin, had been carried off on the feet of a fly, sticky with the wax used to hold the lens to the grinding spindle.

Imagine, if you can, the skill that goes into shaping a lens so small it can stow away on a fly's foot and so precisely polished that it is within six ten-millionths of an inch of absolute accuracy. If that is the baby among lenses, the titan is that seventeen-foot reflecting lens which, perhaps three years from now, will be focusing into the eyes of human observers on Mt. Palomar, Calif., the light from stars six sextillion miles away. One is a twenty-

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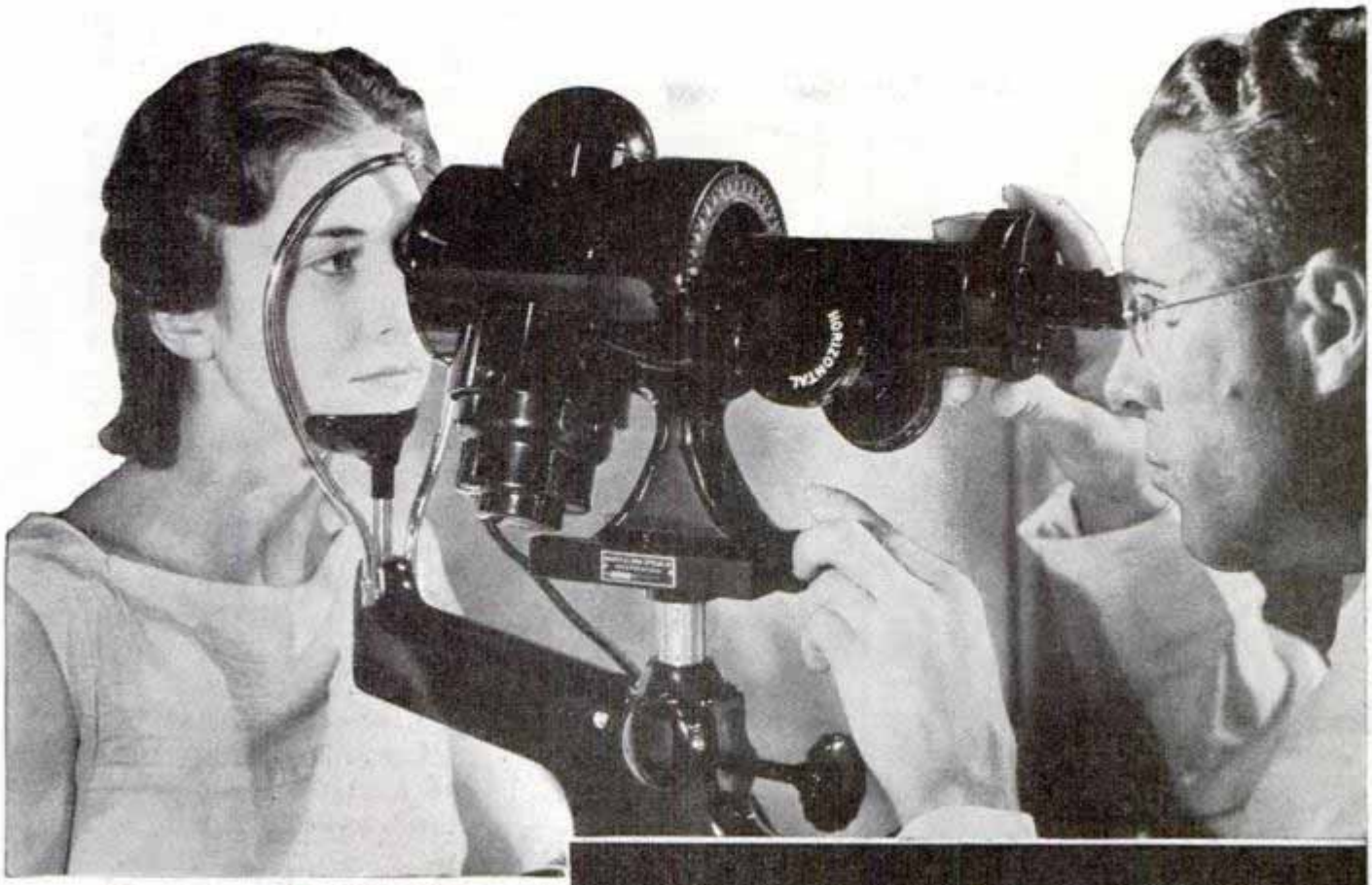
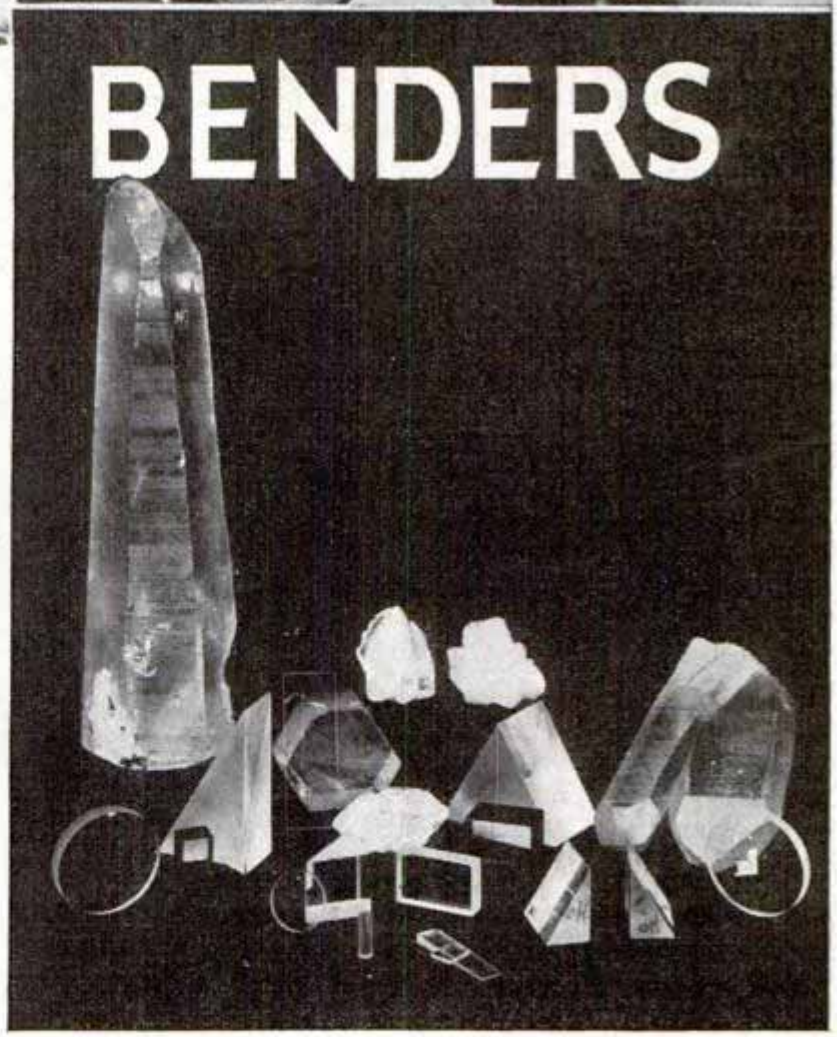


LIGHT BENDERS

ton glass mirror into which, if this were a flat and cloudless world, you might gaze from a California mountaintop and recognize friends on board a liner off New York harbor. The other is a microscope lens that magnifies a minute sea animal no bigger than a needle's point into an image the size of a trout.

Those two lenses are as different as the diatom under the microscope is from the distant nebulae caught in the 200-inch concave looking glass. Yet they are essentially the same, marvels devised by man to bend light to his will. Without these light benders the world of today would revert to the world of medieval days.

Possibly the fastest in the world is the photographic lens just completed, which takes pictures of light rays that left



Top, keratometer, which is a precision instrument for measuring the curvature of the cornea. Bottom, hexagonal quartz crystal in original state and a group of parts for precision optical instruments which were made from this natural crystal

Top, centering photographic lens. Center, magnified view of tiny lens on millimeter rule. Bottom, Elmer Cronk, who has spent fifty-six years grinding tiny lenses

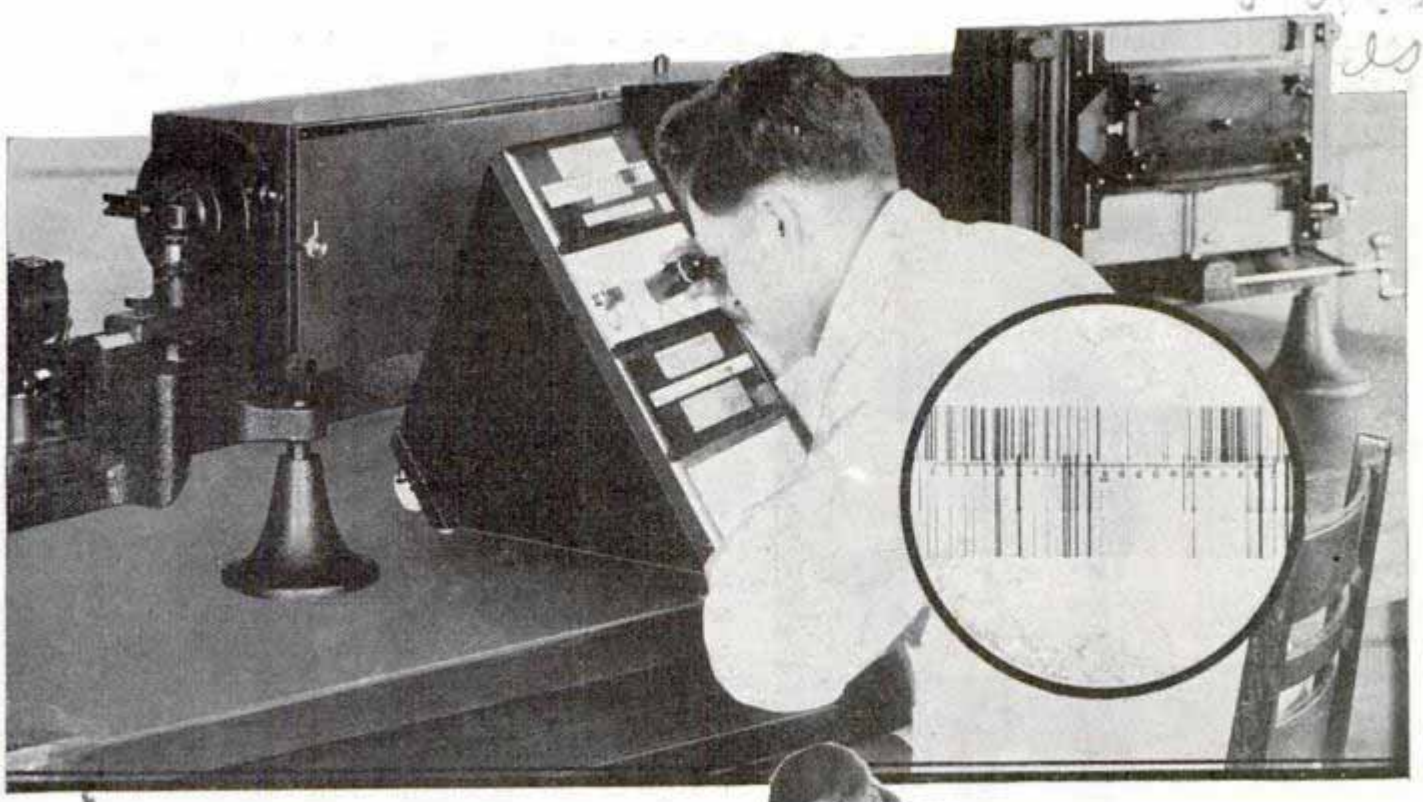
distant stars before dinosaurs trod the earth. Its speed is f0.59, six and one-half times the speed of the f1.5 lens used in the fastest candid camera. In conjunction with the hundred-inch reflector in Mt. Wilson Observatory, the new lens designed by Dr. Wilbur B. Rayton of the Bausch & Lomb Optical company has photographed the spectra of nebulae 30,000 times fainter than the dimmest star visible to the unaided human eye.

Picture to yourself a world without the optical lens. You may be one of the three persons in every ten who do not need to wear glasses. You are lucky, and your vision would not suffer in a world without spectacles. But look at your magazine and your newspaper. No photographs! No pictures without a camera lens, of course. Movie houses would be closed, medical science would be helpless, chemists and jewelers and metallurgists would be set back centuries. Dentists would have to grope blindly in your mouth without the aid of optical mirrors. Bacteria again would be an invisible enemy. War could be fought, but without the accuracy of the range finder that enables a gunner to spot a target 50,000 yards away. And the day of speed would end, for it is only through microscopic and spectroscopic studies of metals that engineers have been able to develop alloys capable of taking the punishment imposed on the engine and wings and propeller of an airplane boring through air at five miles a minute, on the axles of a million-pound streamline train booming over the rails at 100 miles an hour, or on the drive shaft of a racing car covering a measured mile on hard sand in a matter of a few seconds.

Optical glass is listed as one of the twenty-three vital raw materials

in time of war. War or peace, it is one of the most vital elements for scientific progress, even for life itself.

Until 1917, all optical glass was made in Europe, and when the United States entered the world war this country had nearly exhausted its supply of glass. But William Bausch had seen the need and had



begun experiments in 1912 in the production of quality glass. By 1917 he was able to equal the European product. And today the United States can declare its independence of foreign sources, even of the essential raw materials. Potash, once imported from the Stassfurt fields in Germany, is now available in America through the perfection of refining methods by domestic chemical manufacturers. In fact, domestic potash is better and less expensive than the German supply. Barium, too, is produced here, and clays for the melting pots are found in thirteen varieties in six states. Iron oxide is still procured from Canadian mines, the Bausch and Lomb Optical works at Rochester, N. Y., using more than 200,000 pounds a year for polishing lenses. It is specially refined and milled down to an almost structureless powder.

Top, operator reading spectrum plate with instrument which discloses tiniest fractions of an element. Inset, spectrum plate. Bottom, making glass melting pots from clay

Optical glass is as different from ordinary glass as the thoroughbred race horse from the plug or the steel of a fine watch spring from the steel of a nail. If it is to twist and bend light rays with a precision that can be measured only in wave lengths of light—and there are approximately 50,000 waves to the inch—glass must meet unbelievable standards of transparency, chemical stability, hardness, freedom from strain and bubbles; it must be homogeneous, infi-

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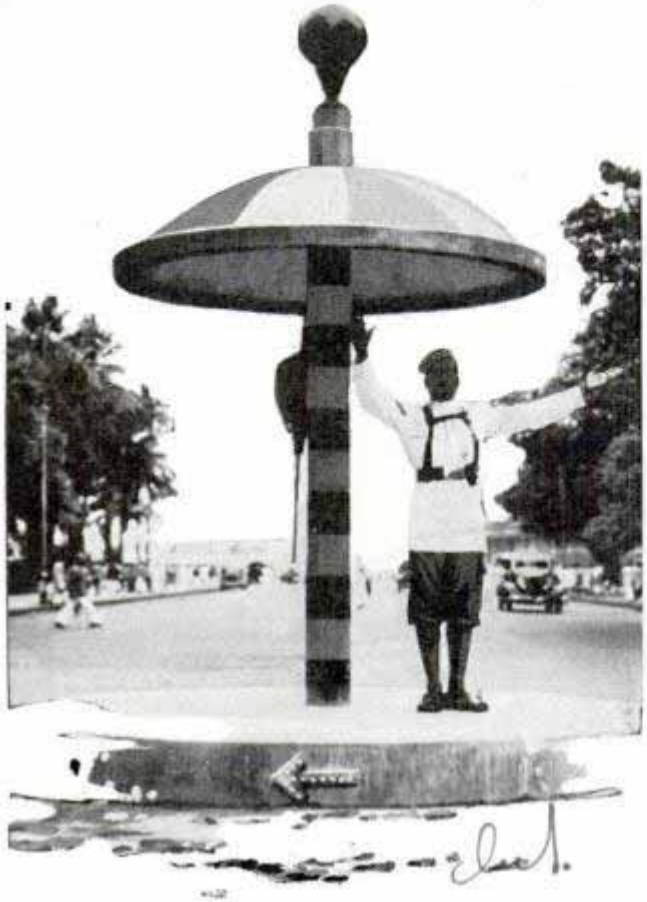
Concrete Umbrella Shades Cop from Broiling India Sun



This big traffic umbrella made of concrete helps the policeman keep cool

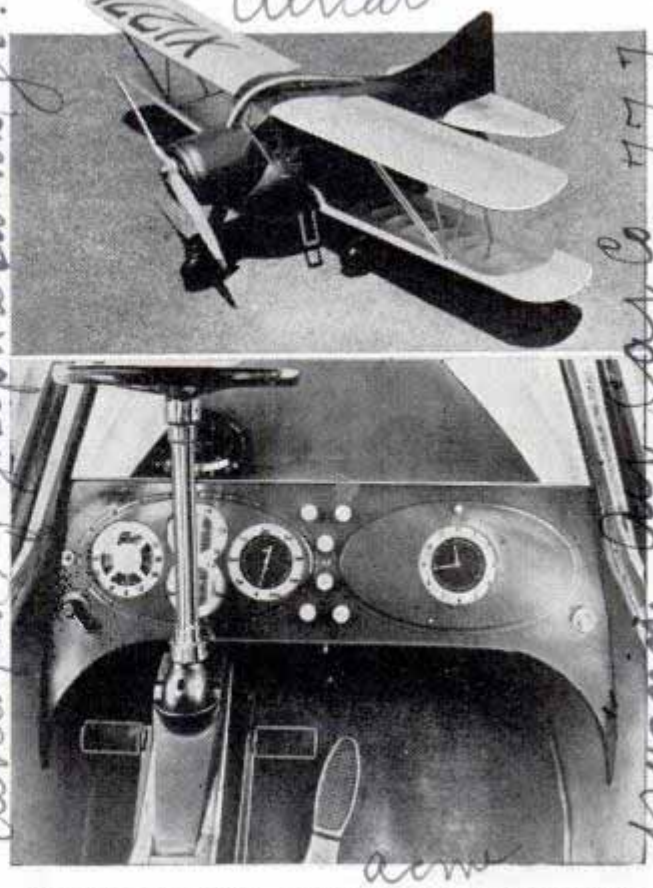
Being a traffic cop in India is a hot assignment under the best of circumstances, but the police in Bombay derive some comfort from the shade of concrete umbrellas. These big mushrooms are on safety islands in the middle of the street.

Daylight-Loading Film Container for Miniature Cameras

Miniature camera magazines can be loaded and unloaded in broad daylight by using a film container now available. To unload exposed film the magazine is placed in the open container and the end of the film is drawn from the magazine, threaded through a light trap and engaged by a receiving spool in a light-tight compartment. When the film container is closed, the exposed film can be unwound from its magazine and loaded on the container spool without fogging. To reload the magazine, new film is drawn from another spool in the container, which holds fifty feet of thirty-five millimeter film. Only about three inches of the film end are exposed in the transfer.

Plane Controlled Like Auto Speeds Amateur Flying

With its controls closely resembling those of an automobile, a new biplane tested recently is said to be easy for the amateur flyer to handle. It has safety features such as the tricycle landing gear and simplified controls. The wheel, like that of a car, is the plane's steering apparatus, directing air turns and governing ascent and descent. A pedal at the right of the wheel controls the gasoline flow, serving the same purpose as the automobile accelerator. The plane has a maximum speed of 120 miles per hour and a cruising speed of 109 miles per hour. The wing span is twenty-four feet and the plane's length is sixteen feet. Space is provided for pilot and one passenger.



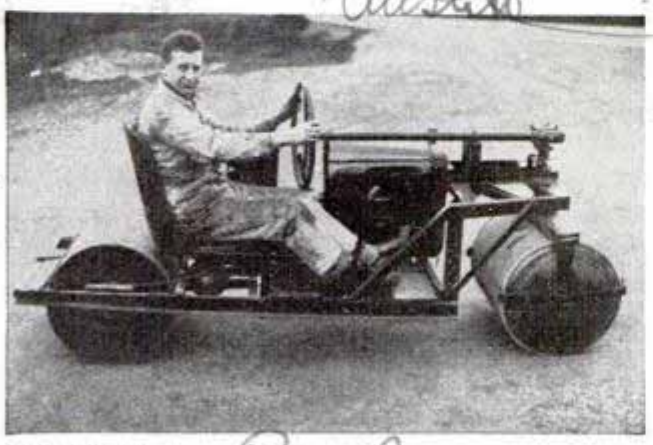
Top, the new plane. Bottom, controls like those of an auto make it easy to fly

Special Tires Increase Farm Tractors' Power

Providing the means for increasing traction, special tread tires are being produced for farm tractors to improve power. One tread, recently developed by the Goodyear Tire and Rubber company, closely resembles the lugs on steel wheels with which many tractors are equipped for work in mud, wet clay and gumbo. The high rubber cleats make the tractor unusually surefooted in mud, enabling the farmer to work wet and sticky soil. At the same time, this tire makes it possible for the tractor to be operated on paved highways without damaging the surface. In many states, tractors with steel wheels and lugs are barred from the paved roads because of this damage. Another special tread tire is designed for tractors working in sand, loam and other loose soil. A third is especially suited to cane and rice fields.

Top and bottom, special tread tires on farm machines. Inset, latest tread for working in mud

Motor Roller Is Built of Auto Parts Found in Junk Piles



© Photopress

Junked automobiles furnished the material for a homemade motorized roller. Its engine was that of a midget automobile, its chassis and gearbox came from old cars. For rollers, an old gas tank was cut into lengths and filled with cement. The steering controls also came from a dump. The roller weighs about 2,500 pounds.

¶Whenever you find that you wish to know more about any article in this magazine, write our Bureau of Information, inclosing return postage.

Film Staff Dressed in Black to Control Lighting

© Paramount Pictures

Black coverings for staff prevents odd light effects from appearing in movie

To prevent light reflections from spoiling movies in the making, directors and their assistants frequently cloak themselves in black. This eliminates reflection of light from their white shirts and light trousers, particularly in scenes where a mirror is used by a player. In one scene for "Angel," in which the leading woman uses a mirror, Ernst Lubitsch, director, and his cameramen donned black velvet drapes.

Motorcycle Speaker System Aids Traffic Safety

As a means of promoting traffic safety, a motorcycle of the Lincoln, Neb., police department has been equipped with a public-address system. Used in the congested business district, it enables the traffic officer to warn pedestrians crossing the street against the lights, to clear streets of cars attempting to park double, to speed up or slow down traffic and to warn drivers of minor violations of regulations. His voice can be heard clearly over a distance of one block. The safety cycle is equipped with the usual police radio receiver, two dynamic speakers and an amplifier for public-address work. An advantage is the ease with which the cycle can move in traffic. Traffic enforcement is made easier with the officer in the open than if he were in a car fitted with similar equipment.

Safety motorcycle, with speaker system, enables officer to control traffic better

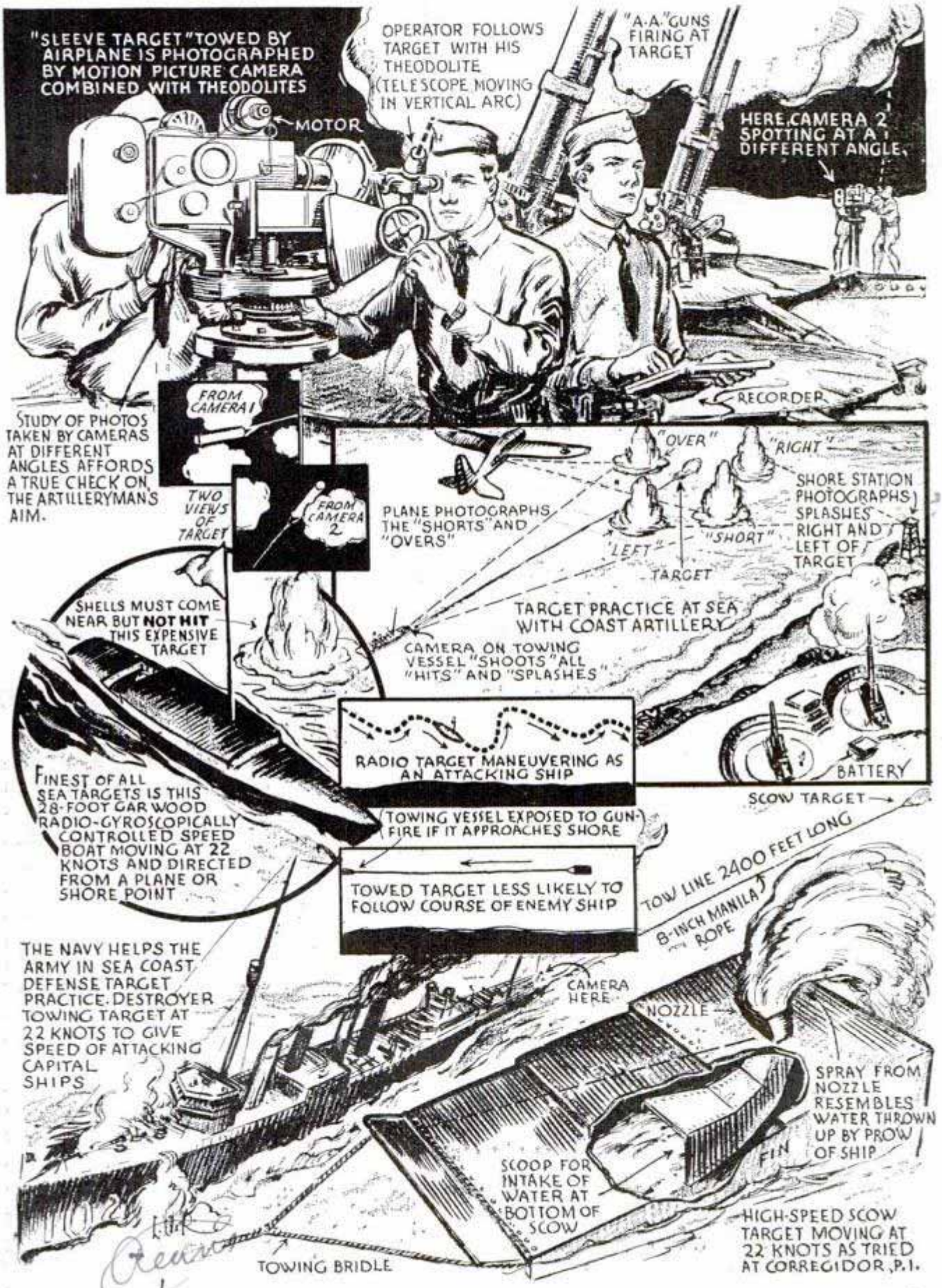
Tinning Any Metal Made Easy with Special Cleaning Flux

Cleaning and tinning in one operation, a flux recently introduced makes it possible to tin any metal including aluminum and cast iron, preparatory to applying solder. It is a granular flux and is applied with a wad of steel wool to a metal surface preheated to 450 degrees Fahrenheit. When

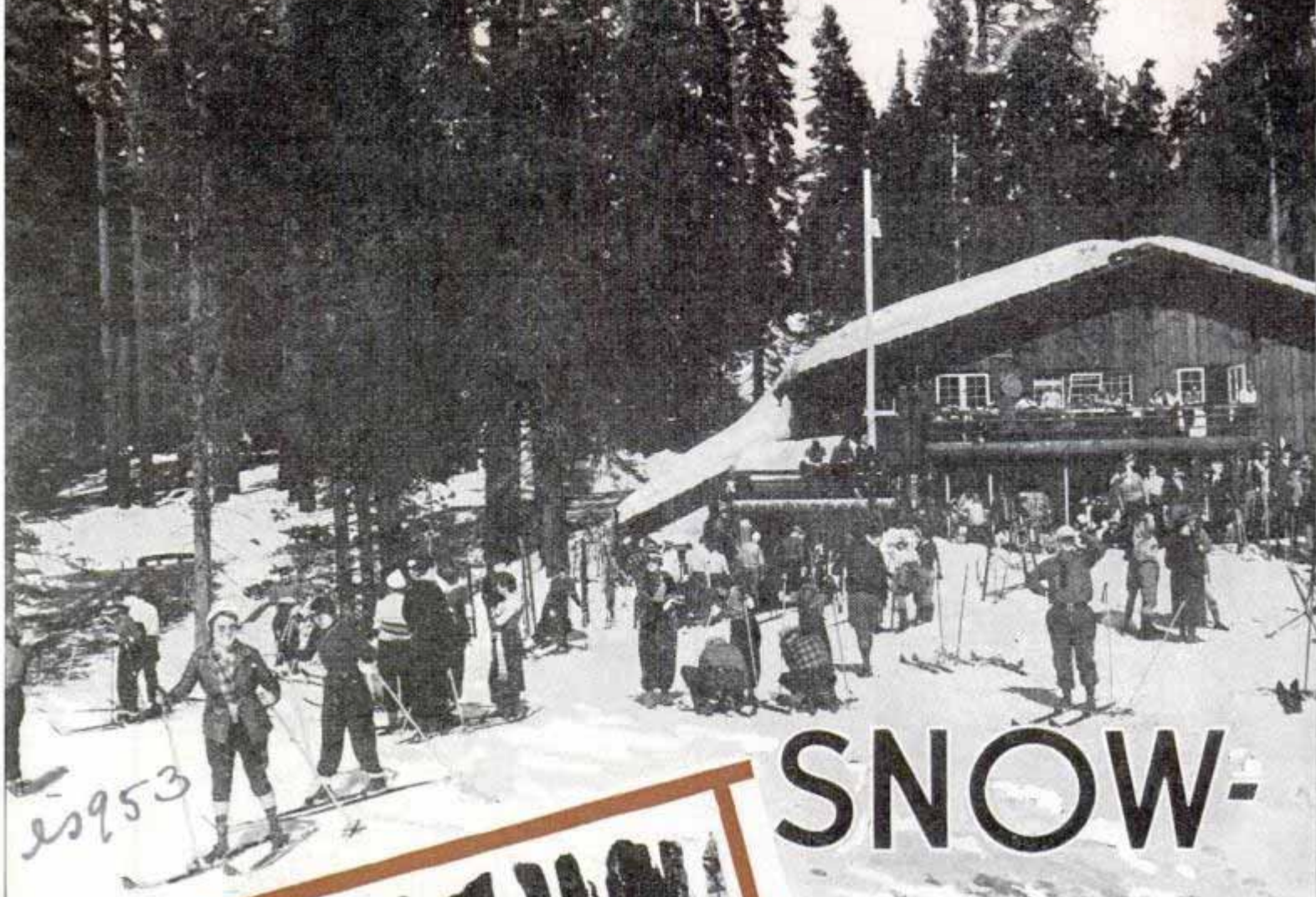
Tinning on auto is made easy with steel wool and a new granular flux

the wool is rubbed on the surface it removes film by both chemical and mechanical action, and thus a piece of rusty iron or steel can be tinned without previous cleaning, making the flux particularly useful in automobile body work. It is also suitable for general soldering work, for tinning bearings for rebabbitting and for repairing cracks in iron castings. One of the main ingredients of the new compound is pure tin in granular form.

Cameras Help Coast Artillery Improve Aim



Sketches of cameras devised by Major A. M. Jackson in use for spotting "hits" and "misses" of U. S. coast artillery in practice gunnery on air and sea targets. The cameras help the gunners to improve their aim, since photos of each shot reveal corrections necessary to increase the number of hits



SNOW-

Top, typical week-end group at Badger Pass ski house. Left, skiers getting lift to hilltop

TO CHILDREN in the northern states the first snow means snowballs, snow forts and snow men. To their elders it means cough lozenges, extra handkerchiefs and mustard baths; and to makers and dealers in rubber footwear, sleds, scarfs, gloves and mittens, it means harvest time. Snow means business, a business which can only be estimated at a billion dollars yearly, exclusive of the capital investment in factories for snow equipment, winter sport clothes and hotel resorts.

Winter vacations are making serious inroads upon summer vacations, swarms of city people traveling to deep snow for week ends on skis and snowshoes. To meet this demand, old hotels have been remodeled. Small mountain towns and resorts which used to hole up for the winter now keep snowplows busy so that cash registers will keep ringing. In larger cities and towns, merchants enjoy a profitable business in skis, snowshoes, toboggans and sundry accessories. People discuss ski technique with the seriousness of politics and golf. Colleges which are within traveling distance of snow country have added

Cont. Edgar M. Hoover,
Woodley Park Towers
Washington, DC
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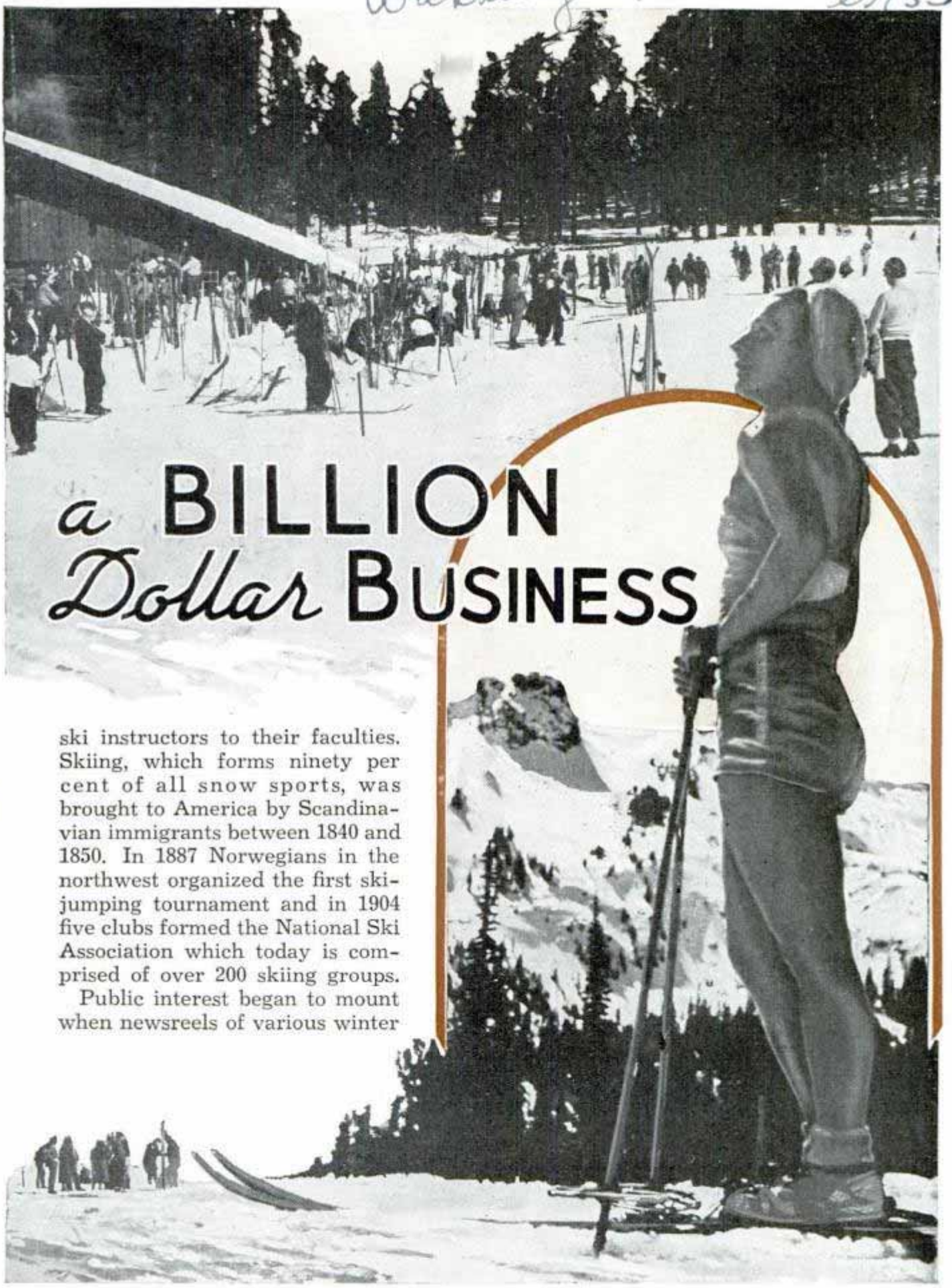


a BILLION Dollar BUSINESS

ski instructors to their faculties. Skiing, which forms ninety per cent of all snow sports, was brought to America by Scandinavian immigrants between 1840 and 1850. In 1887 Norwegians in the northwest organized the first ski-jumping tournament and in 1904 five clubs formed the National Ski Association which today is comprised of over 200 skiing groups.

Public interest began to mount when newsreels of various winter

In spite of the wintry appearance of scene at the right, the skier clad in bathing costume experiences no discomfort on the sunny side of Mount Rainier. The sun's rays counteract the cold

Top, looking over incline before starting the drop. Left, railroad snowplow almost buried in drifts

sports-meets were shown in the nation's movie houses. Then the 1932 Winter Olympics at Lake Placid, the 1936 Winter Olympics at Garmisch-Partenkerchen, Germany, pictures of Americans at Lake Placid and Montreal, the importation of ice-skating champion Sonja Henie for Hollywood productions and movies involving winter sports, all contributed to a stampede for winter clothes and sports equipment. The boom could not be confined to winter out of doors. Promoters found it profitable to bring winter in doors. Department stores rigged up slides covered with borax and hired instructors for their customers. Theaters found an easily handled chemical method of making ice on their stages for skating acts. A show in Madison Square Garden featured a ski-jump which ran from the rafters. For snow, tons of ice were ground into tiny particles and sprayed into blankets.

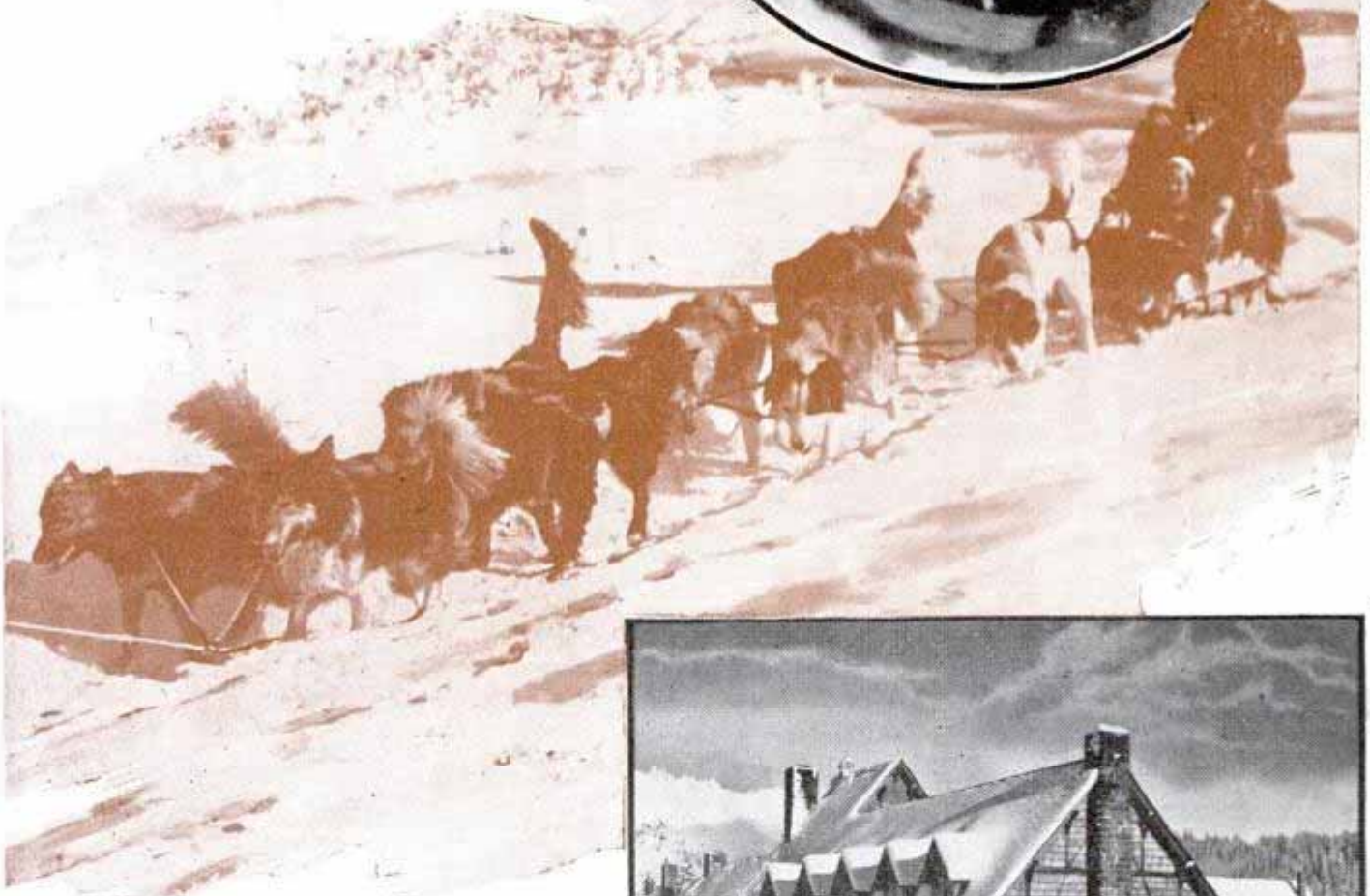
From 1931 to 1935 the output of snowshoe and ski manufacturers has doubled almost yearly, and today these items at the factory are valued over a half million dollars. Bobsleds, sleighs and children's sleds have factory values exceeding $1,500,000.

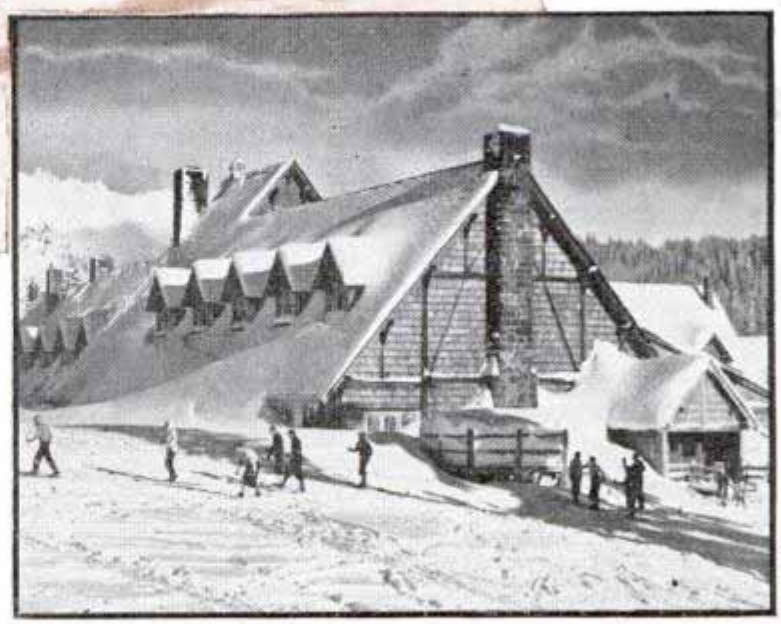
Ice skates have a factory output valued at over a million dollars.

Altogether there are about eighty winter playgrounds scattered through the Poconos and Alleghenies in Pennsylvania, the Catskills and Adirondacks in New York, the Green Mountains in Vermont, the White Mountains in New Hampshire, the Berkshires in Massachusetts and Connecticut, and the Rockies and coastal ranges of the far west. New England, with an extensive network of downhill skiing trails, gets most of the business from city week-end skiers. Starting with a few ski parties in 1930 the National Parks have increased in popularity until last year over 150,000 visitors crowded in for winter sports. Seven girls' schools feature a week of skiing in the National Parks as part of their curriculum.

Today there are toboggan slides, skating rinks and ski runs near almost every large city in the northern states. In most of the

(Continued to page 118A)





Circle, "ash-canning." Center, huskies hauling a winter vacationist. Bottom, 130-inch snow at Mount Rainier sends sports fans away for a day of fun

Chains Repaired Quickly with Double-Jawed Tool

Closing new link in tire chain after worn link has been spread open and removed by second jaw of tool

Repairing worn and broken tire chains is simplified by a double-jawed tool which takes the place of the hammer, cold chisel and bench vise. The chain is spread out on the ground and the closed link picked up between the spreader points of the tool. Slight pressure on the long handles forces open the link. Then the new link is inserted, placed between the notched jaws of the tool and another squeeze of the handles closes the link evenly and securely.

Weight of Aerial Maps Shows Acreage Devoted to Crops

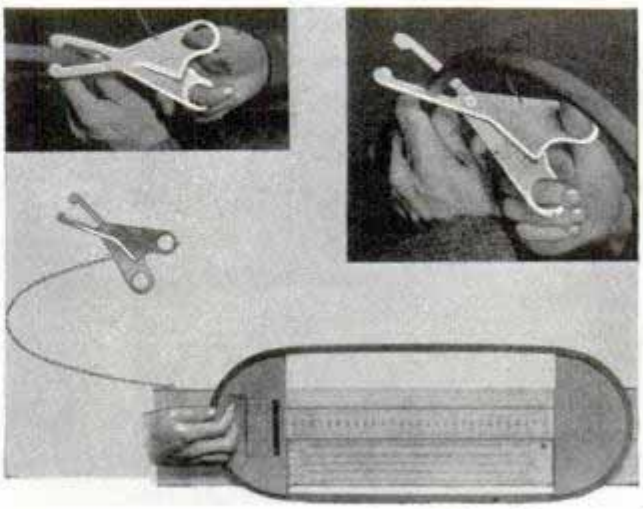
Close estimates of the acreages devoted to various crops in the Rio Grande valley were obtained by weighing aerial maps of more than 2,000,000 acres. Aerial photostatic prints were made of the growing crops on a scale of two inches to the mile in open country or four inches to the mile in congested areas. The various crops could be identified on these pictures and numbered or colored. Then the maps were traced on clear celluloid sheets and these were cut out on the boundary lines of the different crops. All the celluloid pieces representing wheat, for example, were then weighed and the weight converted into total acreage by comparison with the weight of a sample of known acreage.

Portable Steel Scaffold Units Built of Welded Tubes

Whether the job be painting the barn or redecorating the interior of a vast cathedral, as illustrated on the opposite page, steel scaffolding sections built of welded tubing offer maximum safety to the worker at a saving in time and cost. Made in portable units, this scaffolding can be assembled speedily and raised to any height without sacrificing safety. The parts come packed in a flat bundle, and adapt themselves readily to intricate architectural shapes for interior work. Erection requires no tools, and there is no chance of faulty construction. There are no projecting ends to damage woodwork or fixtures. There is no waste, for the scaffolding can be dismantled and used again indefinitely.

Scissor-Like Gauge Tells Size of Belts Used on Pulleys

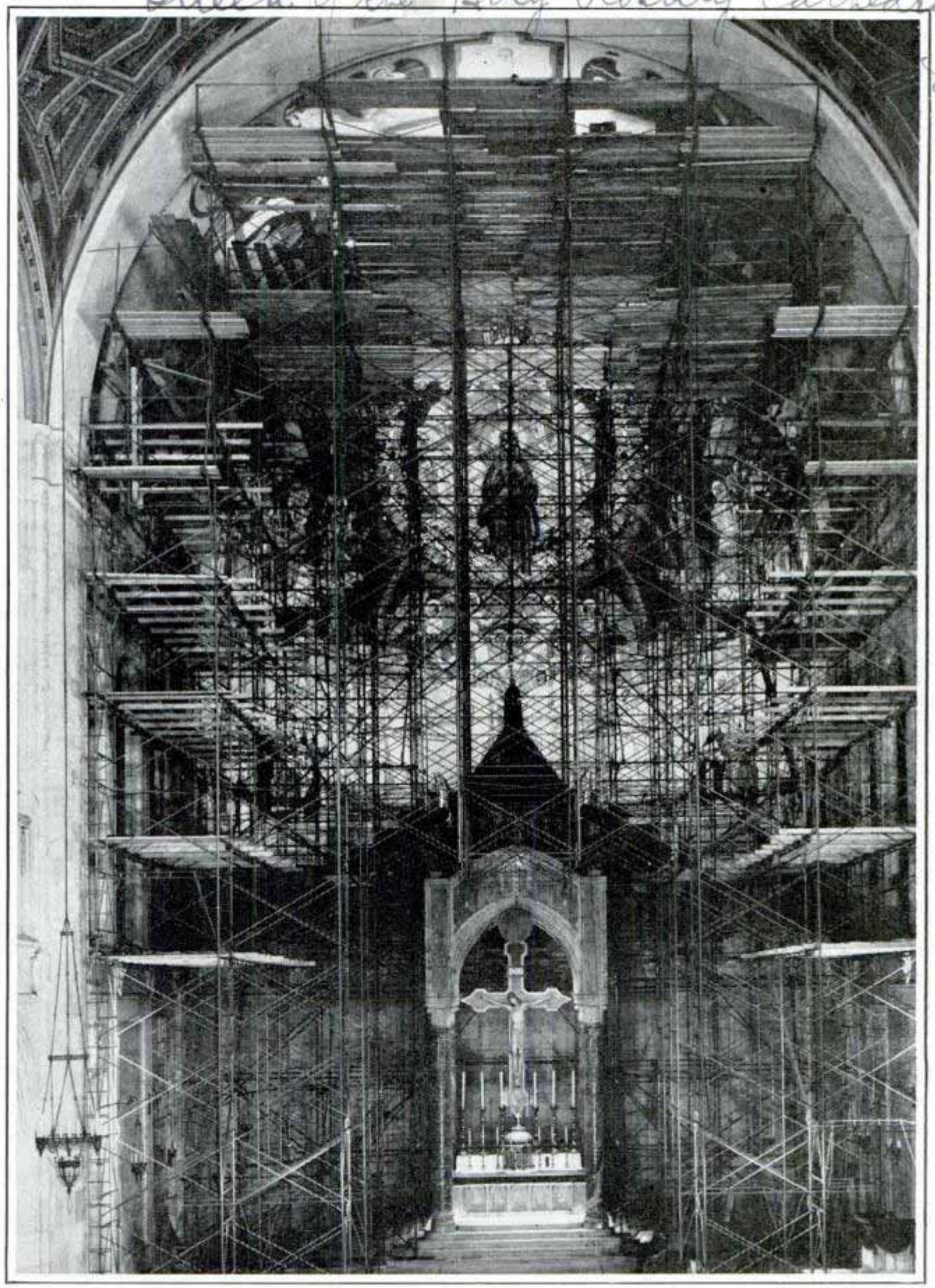
Pulley belts can be measured with a scissor-like gauge just introduced. It tells the angle, width and circumference of the belt, giving the angle graduations every two degrees from twenty to sixty and the linear measurement every sixteenth inch from zero to two inches. The inside circumference of the belt loop is measured on a board meter with readings every quarter inch from twenty-five to sixty inches.



Reading on scissor gauge tells width and angle of belt, board meter below shows inner circumference

Decorators Weave Web of Steel in Cathedral

Queen of the Holy Rosary Cathedral Toledo, Ohio



Scaffolding built up of portable sections adapts itself to contours of cathedral being redecorated. These units, made of welded steel tubing, are packed in flat bundles. Their use is described on opposite page

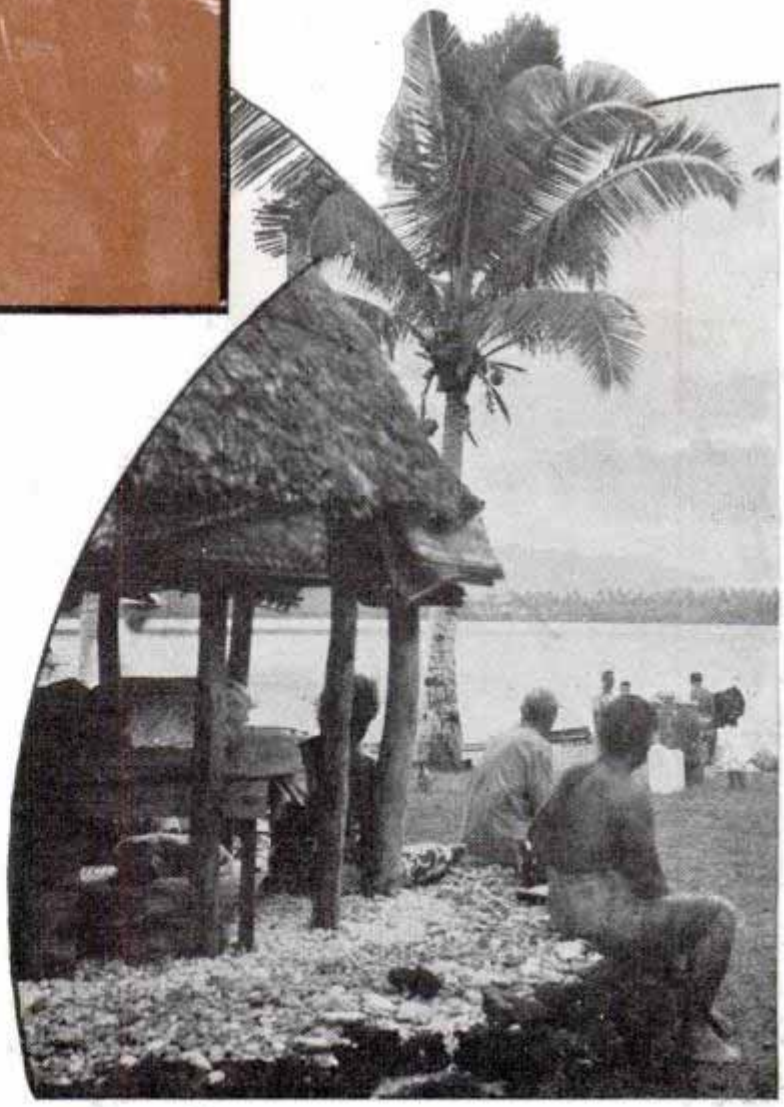
Euker Equipment Co

AROUND *the* WORLD

the sets in Hollywood. The manner, if not the actual technique, used in harnessing up these shots is familiar to movie-goers. Against these backgrounds, superimposed on transparent screens, the film players reenact the story on Hollywood stages.

Film-making expeditions as such are not new in Hollywood. Travelogues have been an integral part of the film fare for many

Top, Mrs. Tay Garnett, camera-woman, shaking hands with a Japanese screen beauty. Bottom, native members of "The Hurricane" cast rest while the weather delays production in Samoa

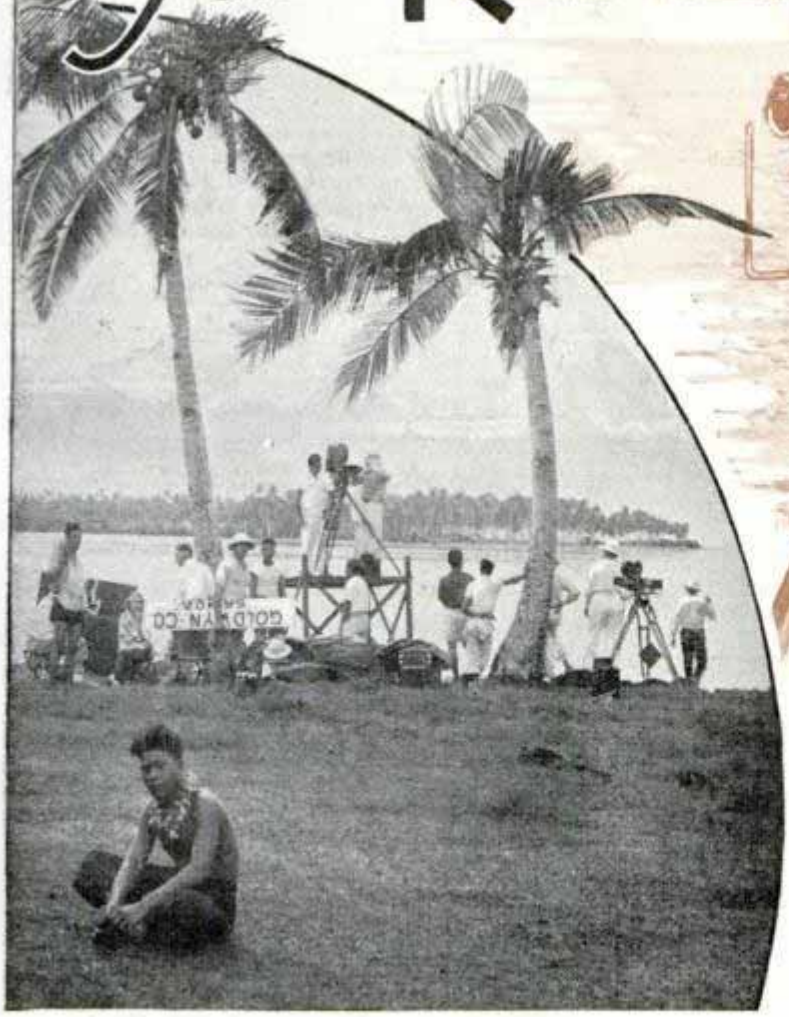


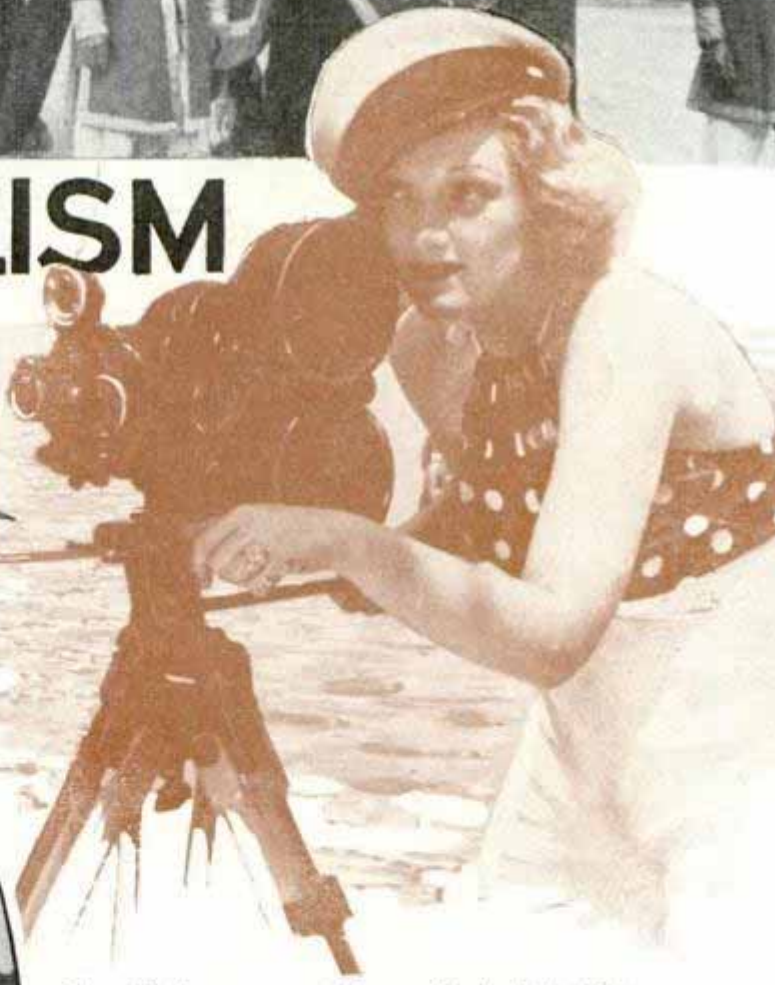
ONCE Hollywood boasted of having the world at its front door. Any spot, however remote, could be duplicated on the studio lots or by short location trips to the near-by countryside.

Technical crews could be dispatched to a convenient mountain range, a desert or a harbor—and presto, these places became the Canadian Rockies, the Sahara desert or Singapore's teeming waterfront. Add a few studio shots to the reels made at any one of these and the picture was complete.

Now comes a different plan. Film experts have journeyed to out-of-the-way corners of the world for romantic backgrounds that have never been used on the screen. They have learned that millions of dollars worth of authentic scenery can be filmed at a fraction of the cost that would be required to build

for REALISM



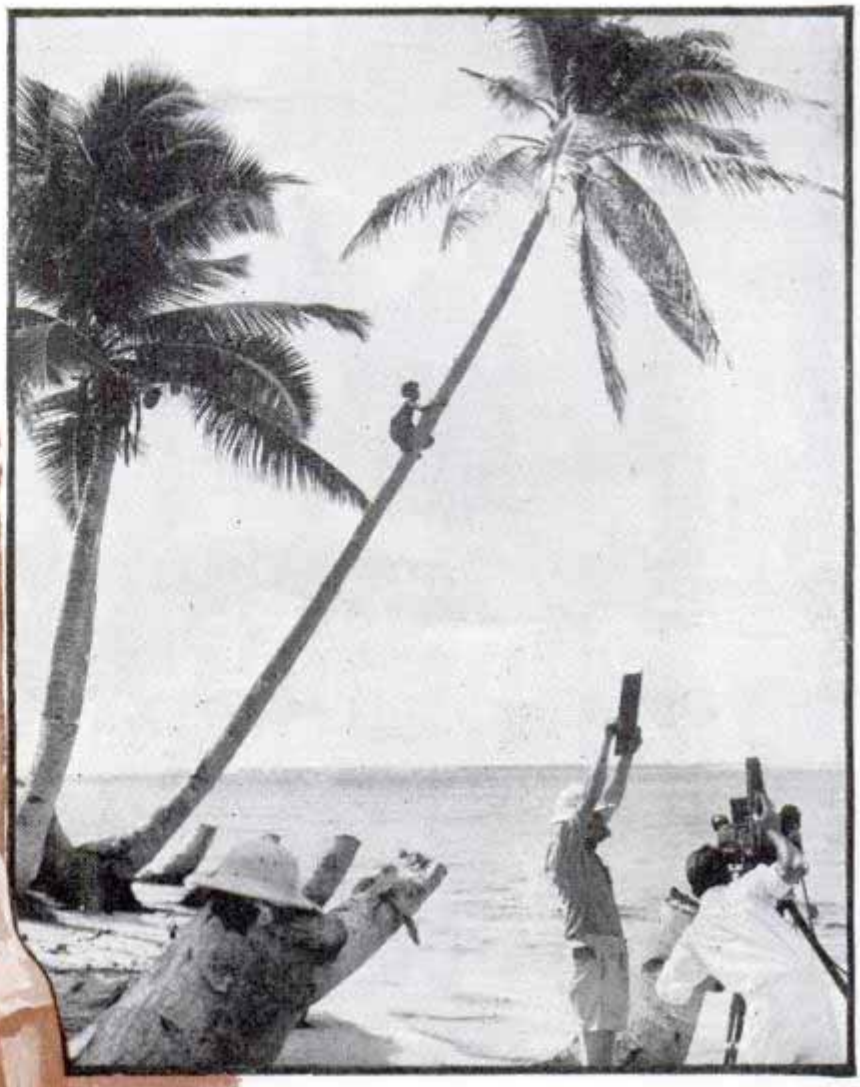


Top, filming ceremonial parade in Indo-China. Below, Mrs. Garnett getting a scene on the Saigon river in Indo-China

years. Likewise, there have been many pictures dealing with the lives and customs of the Polynesians, the Head Hunters of the Amazon, Eskimos and other strange peoples. Then, too, there have been location trips into remote

sections by directors, technicians, film players and cameramen. So many of these have either been dismal failures or marked by such high production costs, aggravated by damage suits growing out of location accidents or illnesses, that the majority of the studios have been content to build the world in their own back yards.

The practicability of traveling

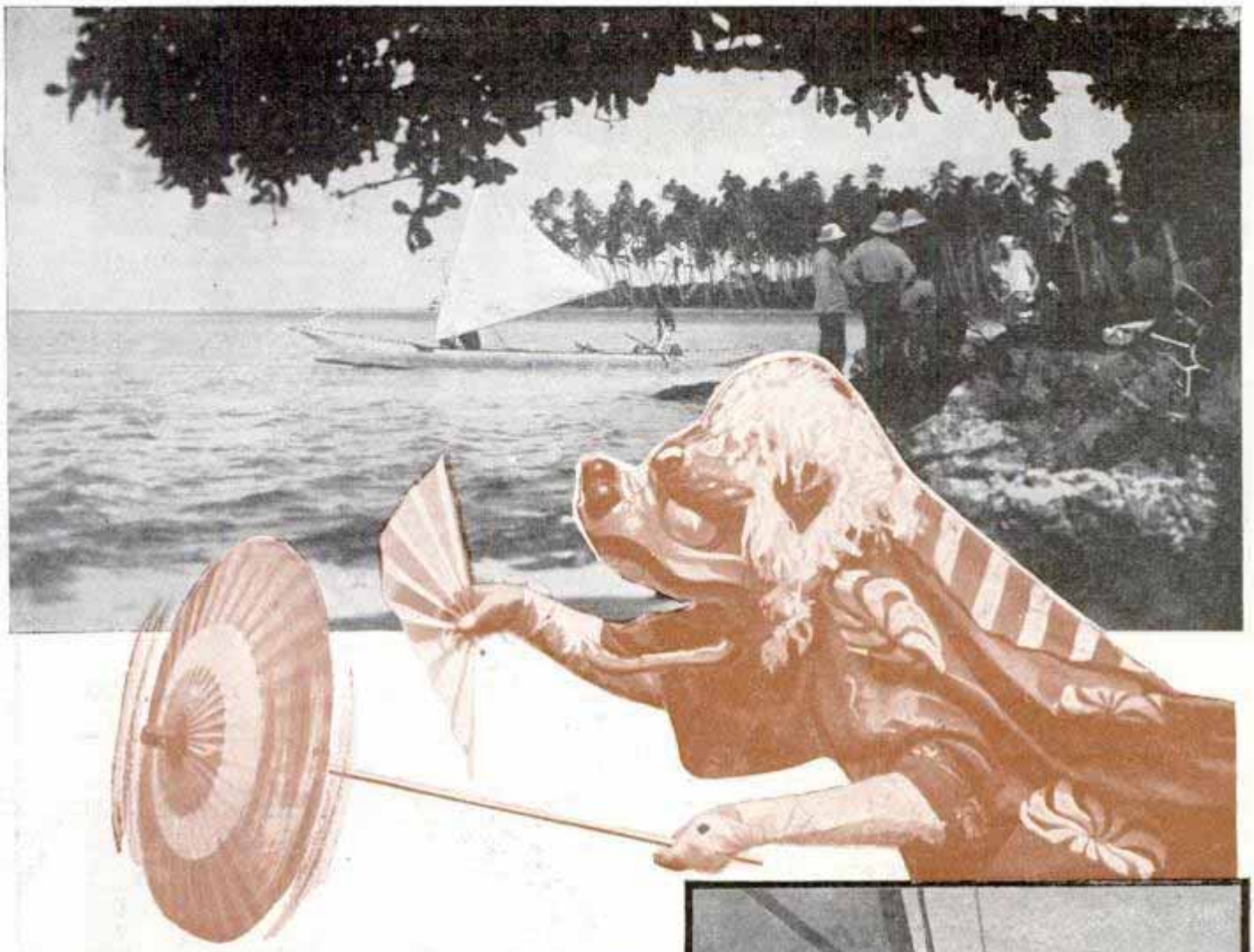


Top, ten-year-old native climbing tree in "The Hurricane" while cameras grind in American Samoa. Left, Paul Schwegler finds cigarettes more effective than money in getting natives to pose for the movies

into foreign countries for novel settings recently was demonstrated by Tay Garnett, a Hollywood director, who, with a party of fourteen, went around the world to shoot realistic backgrounds for "Trade Winds" and "World Cruise," two forthcoming pictures. Approximately eight months were spent in filming 65,000 feet of backgrounds in Hawaii, Japan, China, the Philippines, Saigon, Penang, Malaysia, Ceylon, and a flock of other places that are merely spots on the globe even to people who know their way around.

Before embarking on this 40,000-mile trip, Garnett sought to eliminate the difficulties that had beset other expeditions. The film safaris into the jungles, for example, had been headaches to the producers because of film spoilage. The sensitive cellulose substance could not stand the heat and humidity of the tropics. Frequently, the emulsion would come off the film two or three hours after it had been loaded into a camera.

James B. Shackelford, ace cameraman, was set to work on this problem. Veteran of eight shooting expeditions, including several into the Gobi Desert with Roy Chapman Andrews, Shackelford built a complete film laboratory aboard the thirty-eight-year old racing yacht that was used for the voyage. It was so designed that a constant temperature of sixty-five degrees could be maintained throughout the trip.



Top, camera crew preparing to film outrigger canoe in "The Hurricane" with palm and cloud background. Center, Japanese actor in weird costume at festival

Special equipment making possible the development of 800 feet of film an hour was installed. Provision also was made to place the reels in hermetically sealed containers so that they could withstand the extremes in temperatures.

Starting from Los Angeles harbor, the "Athene," which measures 102 feet overall, sailed across the Pacific and the Indian Ocean, through the Red Sea, the Mediterranean, and the Bay of Biscay, to England. Then across the English channel, through the Kiel Canal, touching Denmark, Norway and Sweden and back to England through the Bay of Biscay, past Madeira Islands. On the homeward trip, the craft crossed the Atlantic to Miami Beach and from there homeward to San Pedro via the Panama Canal.

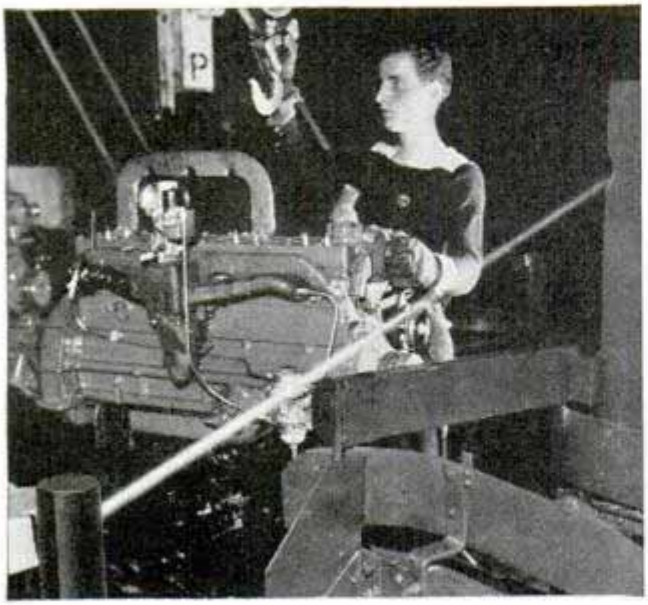
En route to Honolulu, the ship's tailshaft broke and the propeller was dropped onto the floor of the Pacific. Near Manila, the

(Continued to page 138A)

The Garnetts take a few shipboard scenes on their 40,000-mile cruise around the world to shoot realistic backgrounds for motion pictures

es 899.

'Electric Eye' on Motor Line Replaces Mechanical Trip



Electric eye stops assembly line as motor interrupts light beam (shown in white)

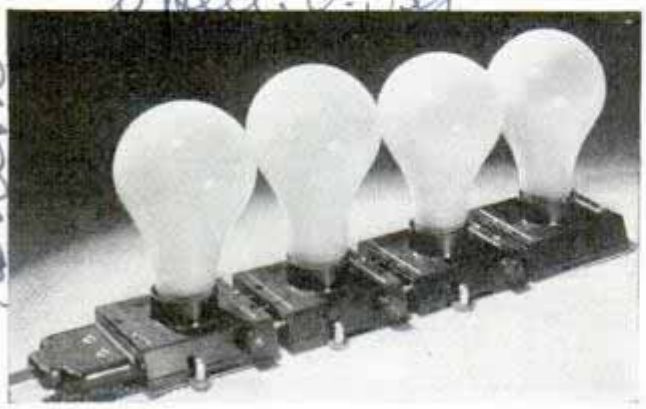
As a substitute for mechanical trips which wear out quickly, photoelectric cells, or "electric eyes," are used at the Pontiac factory to operate switches which stop the line of moving motors. Interruption of a beam of light causes the electric eye to halt the line so that a motor may be picked up and lowered to the automobile assembly line below.

es 1032

Simple Unit Flasher for Signs Replaces Costly Controls

Instead of costly motor or clockwork mechanisms, simple unit flashers may be employed to animate signs, window displays and exhibits. Hardly more complicated than a light socket and requiring no special mounting or wiring, the flasher is a self-centered automatic and adjustable timing device which plugs in on the lighting circuit or connects with a similar unit. The flashers are equipped with sockets, timing knob and grouping switch, as well as prongs and jacks for connections. The units are simply pushed together to couple them mechanically and electrically in a string. The first unit of the string connects with the nearest alternating or direct-current outlet and its bulb flashes on, followed by the second, then the third and so on. When all the bulbs have been on for a few moments, the entire string extinguishes and the cycle is repeated. The timing interval from one unit to the next may be made faster or slower by turning the timing knobs of the units. Two or more bulbs may be flashed simultaneously by means of the grouping switches.

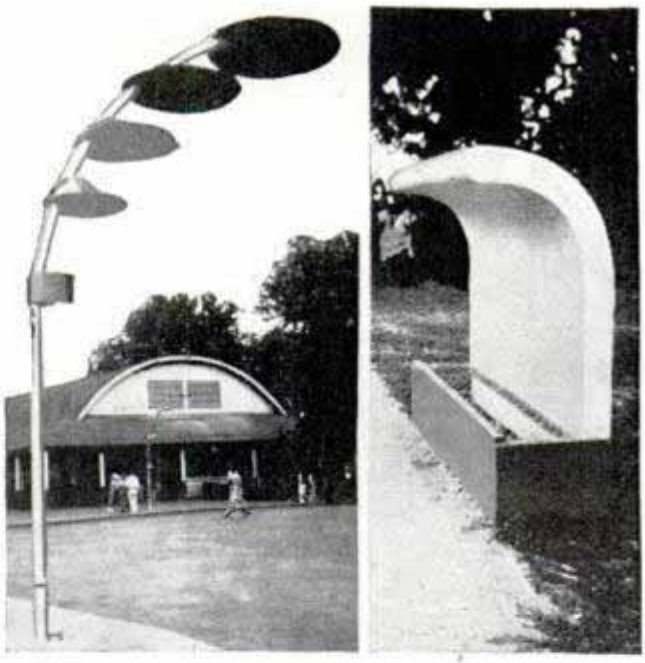
Spell. O. Tes



Four unit flashers with bulbs which may be set to light in sequence for sign

es 990

Driveway Lighted without Glare by Special Curved Reflectors



Lamps on curved post shed glareless light and soft glow is reflected from footlights of concrete wall

Two methods of lighting a driveway brightly but without glare are in use on an auto drive near Cincinnati. Lighting it from above are five circular fan-type lights mounted on a curved support. They throw a smooth mellow glow over the road without shining directly into the eye. The other light shines up from the ground and is reflected to the driveway by a white concrete surface curving inward.

Pontiac Motor Co, Pontiac, Mich

Beslee Products Corp Trenton N.J.

Cont. Ray Technol. Spotlight V-169

Taylor Cub - Taylor Aircraft Co. Bradford, Pa

Endurance Fliers Refuel from Speeding Auto

Playing "nurse" to an endurance plane from the ground calls for a quick hand and a quick eye. Two fliers trying for a new endurance record for small airplanes at a Detroit airport were refueled by their partners in a coupe that would race across the field with a can of gasoline whenever necessary. The pilot would dip his high-wing monoplane low over the runway, drop a rope, and as the plane swept over the car an assistant standing on the rear of the coupe would attach a can of fuel. Pulling it up, the fliers pumped the gas from the can into the tank of their plane. They were supplied with food and other requirements by the same method.

Left, while coupe races across runway of airport a can of gasoline is attached to the line dropped from endurance plane, and fliers haul it aboard. Above, crew pumping fuel from container into tank of plane

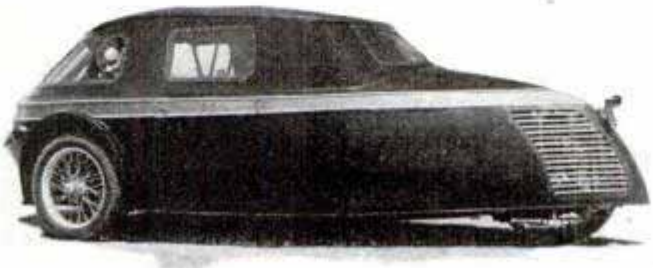
Acme

Marvin Parpe

C 1015

Three-Wheel "Teardrop" Car Has Motorcycle Engine

"Teardrop" design, light weight and a motorcycle engine combine to make a three-wheeled automobile economical in operation. This car was constructed by a boat builder. He installed at the rear a four-cylinder air-cooled motor which uses only a gallon of gasoline for fifty miles of travel at forty miles an hour, and has a mile-a-minute top speed. The car seats four passengers, is of standard width and fourteen feet four inches in length. There are two front wheels, one in the rear, and running from "bow to stern" of this boatman's automobile is a wind tunnel to cool the "cabin" and the engine. For springs, rubber straps are used which weigh thirty-eight pounds less than metal springs. The car weighs 975 pounds. The frame is of oak, the body of three-ply veneer.



What looks like radiator grille at right is really the rear vent of air-cooling wind tunnel through car

Builder - O. H. Griffin

Charles Blair and Scottie Bauer

O. H. Griffin, 3575 RD Moran St. Detroit Calif

Diego, California is 3520 Main Street.

Blacksmith Shop on Truck Travels to the Customer

This blacksmith shop installed in a truck enables the operator to drive in search of business and to do the job right on the spot

Installed in a truck, the latest blacksmith shop travels to customers in several states. When a horse loses a shoe, the owner calls for the mobile smithy and has the animal shod, much in the manner of having a tire changed on an automobile.

Shape of Molecules in Gasoline Determines Knock Rating

If chemists can learn to reshape the molecules of gasoline, they may develop knockless super-fuels that will drive smaller automobile and airplane engines more miles per gallon. Small quantities of such a high-test fuel have been made and tested under severe conditions in the laboratory, and it remains to produce it on a commercial scale. Automotive engineers have long known that increasing the compression ratio of a motor produced more power and economy, but with the available gasoline it was impossible to eliminate the knock entirely. Now the chemists have discovered that gasoline knocks badly if its molecules—the building blocks of nature—have a long, stringy shape; but if its molecules are compact and ball-shaped the gasoline is an excellent fuel. So great is the difference between molecules of the same size but of these two types that one gasoline may deliver fifty per cent more power than the other.

Shadowgraph Tests Piston Pins' Accuracy

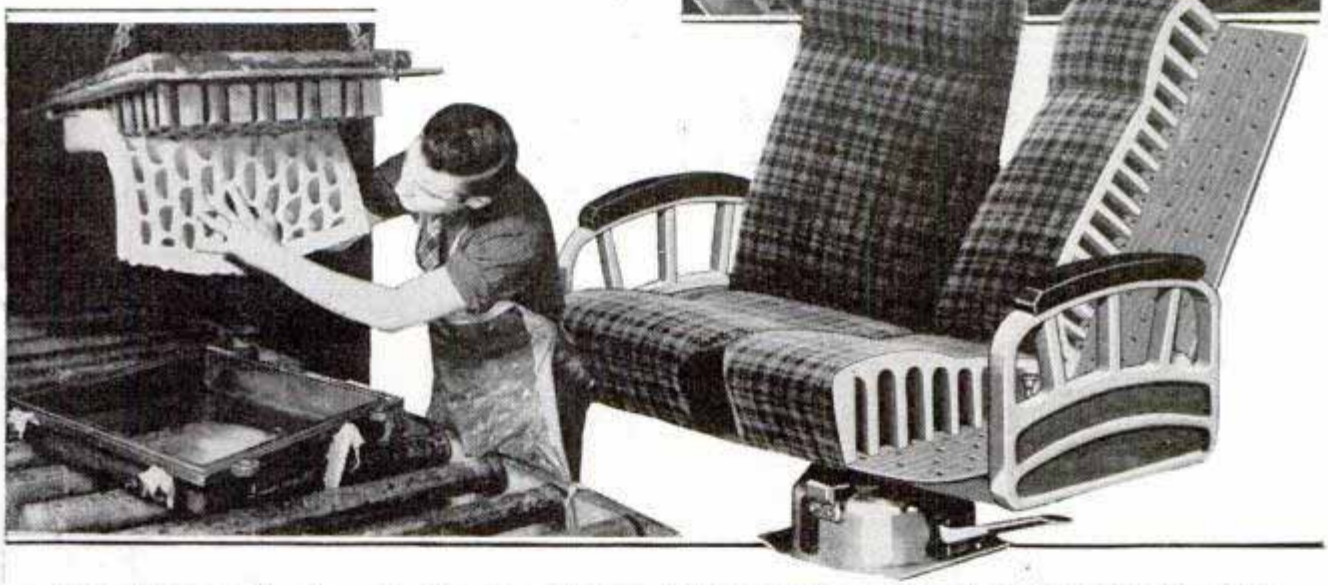
Accuracy to an extreme degree is achieved by checking the measurements of automobile piston pins on a "shadograph" used in the Dodge factory. The pins are pressed against two polished steel blocks provided with points of carboloy and contacted by a diamond-topped plunger. The pins translate their dimensions by means of amplified shadows detecting differences as small as one-ten-thousandth of an inch.

Shadowgraph, at top of machine, closely checks measurements of auto piston pin

Rubber Seats in Train and Bus Offer Comfort

Latex. White Sponge Rubber

New comfort and safety for passengers on trains and buses is made possible by the use of sponge-rubber cushioning materials in seats, seat backs, headrests and mattresses. Constructed with millions of tiny interconnected air cells the rubber cushion is intensely porous. It "breathes" easily, toning down and tapering off all riding shocks, to give the passenger exceptional comfort. A special process renders the surface of the cushion impervious to accidental ignition, giving the added feature of fireproofing. There are no metal springs to break, weaken or rip through the upholstery, causing injury to passengers and damage to clothing. The cushioning material is made by whipping latex, crude rubber, into a frothy cream-like liquid in much the manner of whipping cream and then applying molds of the proper shape. The size, shape and density of the cushions are scientifically engineered for the job they must do. Mattresses of the whipped latex are being used on railroad sleeping cars. The cushioning material is produced by Firestone Tire and Rubber company. Akron Ohio



Top, filling molding trough with whipped latex. Bottom, left, removing the latex cushion from the mold. Right, cutaway view of bus seat, showing air space which increases riding comfort

¶Popular Mechanics Magazine does not publish the name of the maker of, or dealer in, any device described in its pages, but this information will be furnished by our Bureau of Information upon request, accompanied by stamped envelope.

es 1009

Non-Clogging Shower Head Throws a Dual Stream

Dual Stream Aerator

Proof against clogging with lime, a shower head with a non-metallic face has all its working parts outside the water chamber. The shower head throws a double stream, not a hollow ring of water, and by turning a small handle its force is varied from a gentle shower to a stimulating needle spray.

Wusco Mfg Co

Hydraulic Jack Is Worked from Standing Position

Notice pump and release valve are at top of hydraulic jack and motorist can pump while standing

Without even stooping, a motorist can operate and release a hydraulic bumper jack just introduced. It has a metal toe swiveling on a threaded barrel, the toe adjusting to the exact height of the bumper or its bracket. Thus the car's weight is suspended on the swivel toe and the full sixteen inches of hydraulic lift can be applied to raising the automobile. Pump and release valve are at the top, letting the operator stand upright. The jack has a capacity of one and one-half tons.

Drought Precipitates Pure Salt in Great Salt Lake

Three dry years in succession evaporated so much water from the Great Salt Lake in Utah that pure table salt, sodium chloride, actually was precipitated in the lake. Over a long period of years the salt concentration of the lake has varied from fifteen to thirty per cent, and thirty per cent is the maximum concentration that will remain in solution. After a survey of the lake, Prof. Walter D. Bonner of the University of Utah reported its average saltiness is twenty-eight per cent, and that drought in the summers of 1934, 1935 and 1936 had caused considerable evaporation and precipitated pure sodium chloride in the brine. Sodium sulphate or Glauber's salt, used for medicine, was found in rather large quantities in Great Salt Lake. It is much more soluble in warm water than in cold, and pure sodium sulphate crystals frequently form in the lake during the winter months.

Bank Deposit Dropped in Chute without Waiting for Teller

Depositors need not wait in line at the teller's window in a Tulsa, Okla., bank. They simply make out duplicate deposit slips, place them with the checks in a special envelope and drop it down a chute. On the way down this metal tube the envelope interrupts a light beam and a photoelectric cell causes a bell to ring, acknowledging the deposit. At the bottom of the chute is a receiving container attended by tellers. The duplicate deposit slip is mailed back to the patron. The chute is intended to receive deposits by check only.

Depositor drops envelope in chute of bank and hears bell ring indicating receipt of deposit

Hunt Goeduck with Shovels on Puget Sound

Upper left, goeduck hunter plies his shovel speedily on spotting the long neck of his quarry protruding from mud to feed at low tide. Right, the hunter, a bit muddy but with a good catch. Below at left is a closeup of the big clams showing the elastic neck

Hunting the elusive goeduck is a rare sport. There are only two places in the world to hunt it: along the eastern coast of Africa, and along the northwest coast of America, notably in Puget Sound. There are few opportunities to capture it, for you can reach it only at extreme low tides. And you hunt the goeduck not with gun or fishing rod or net, but with a shovel. Despite its name it is not even remotely related to the duck. It is, rather, a giant clam that lives deep in the tidewater mud flats, sometimes attains a weight of seven pounds and grows an elastic neck that can shrink from two or three feet in length to five or seven inches when vibrations tell it an enemy is near. The goeduck hunter watches for this rubbery, hoselike neck protruding from the mud to feed on seawater organisms. Once sighted, he must ply the shovel speedily, following the goeduck's swift retreat into its shell perhaps three feet deep in the ooze. Sometimes a metal cylinder is sunk to prevent cave-ins while digging. Finally the hunter must reach down and pry the mollusk loose from the mud with his fingers. The goeduck—pronounced "gweduck" or "gooey-duck"—is creamy and tender, with a distinctive flavor. Its name is of Indian origin.

¶Expansion in summer adds an estimated sixty-one miles to the 111,350 miles of concrete highway in the United States.

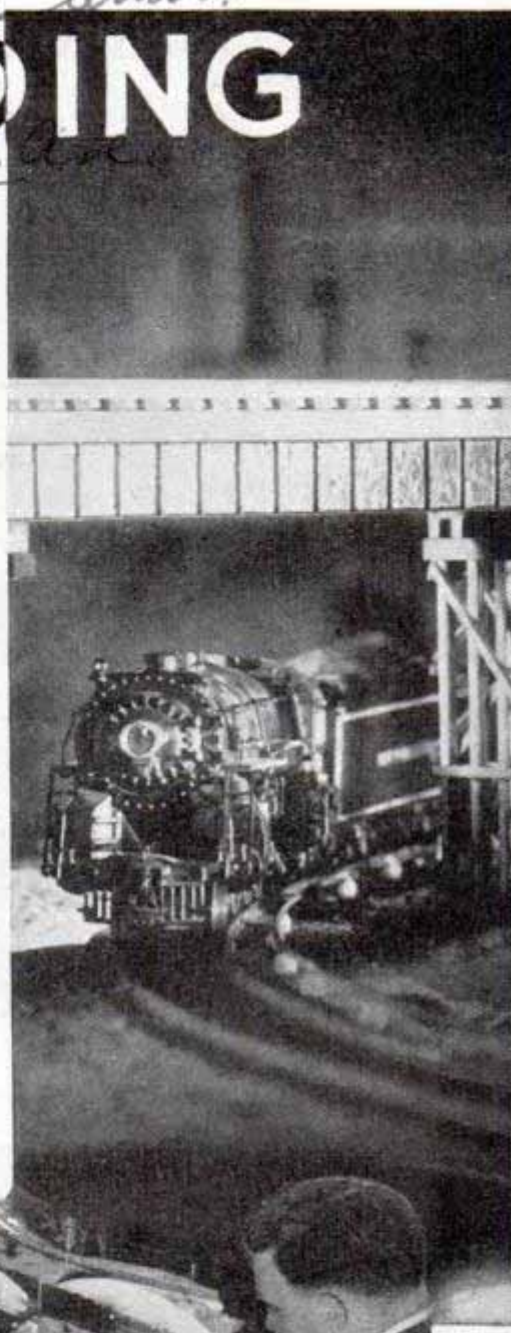
RAILROADING

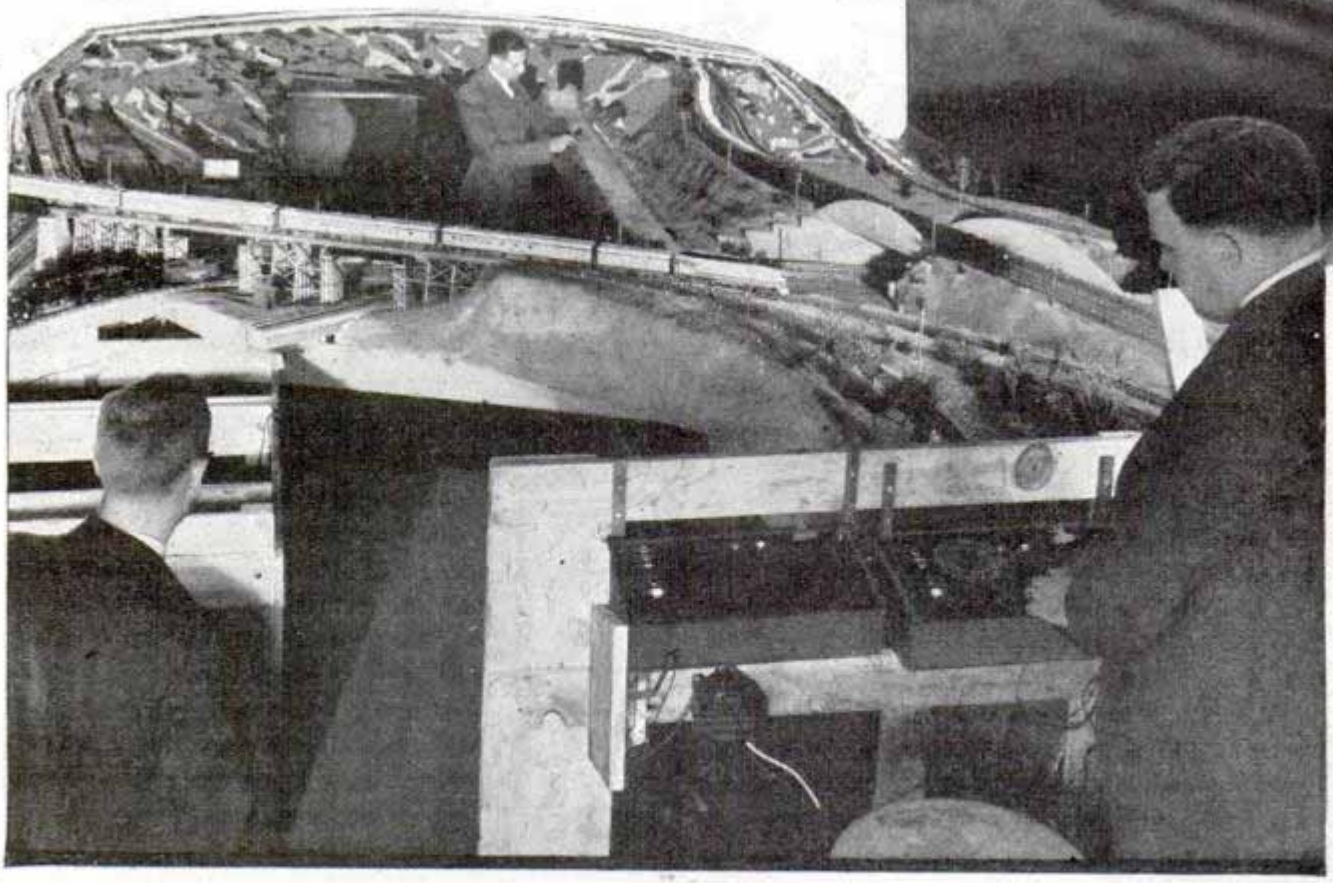
THEY pounded a golden spike into the last wooden tie of a new railroad the other day—a railroad for men only. High railway officials and artists and bookkeepers stood solemnly side by side and watched the ceremony.

It was the last of 88,000 spikes hammered laboriously by hand into 22,000 wooden ties on one of the longest short lines in the world; a railroad 1,100 feet long, from which women and children are barred except on exhibition days.

The golden spike was small enough to lose beneath your fingernail. It symbolized completion of the Milwaukee Union Terminal Railroad, and a few minutes after it sank into the diminutive wooden tie a streamliner, headlight gleaming and lights aglow in her sleek string of canary yellow cars, snaked out of the yards and down the main line.

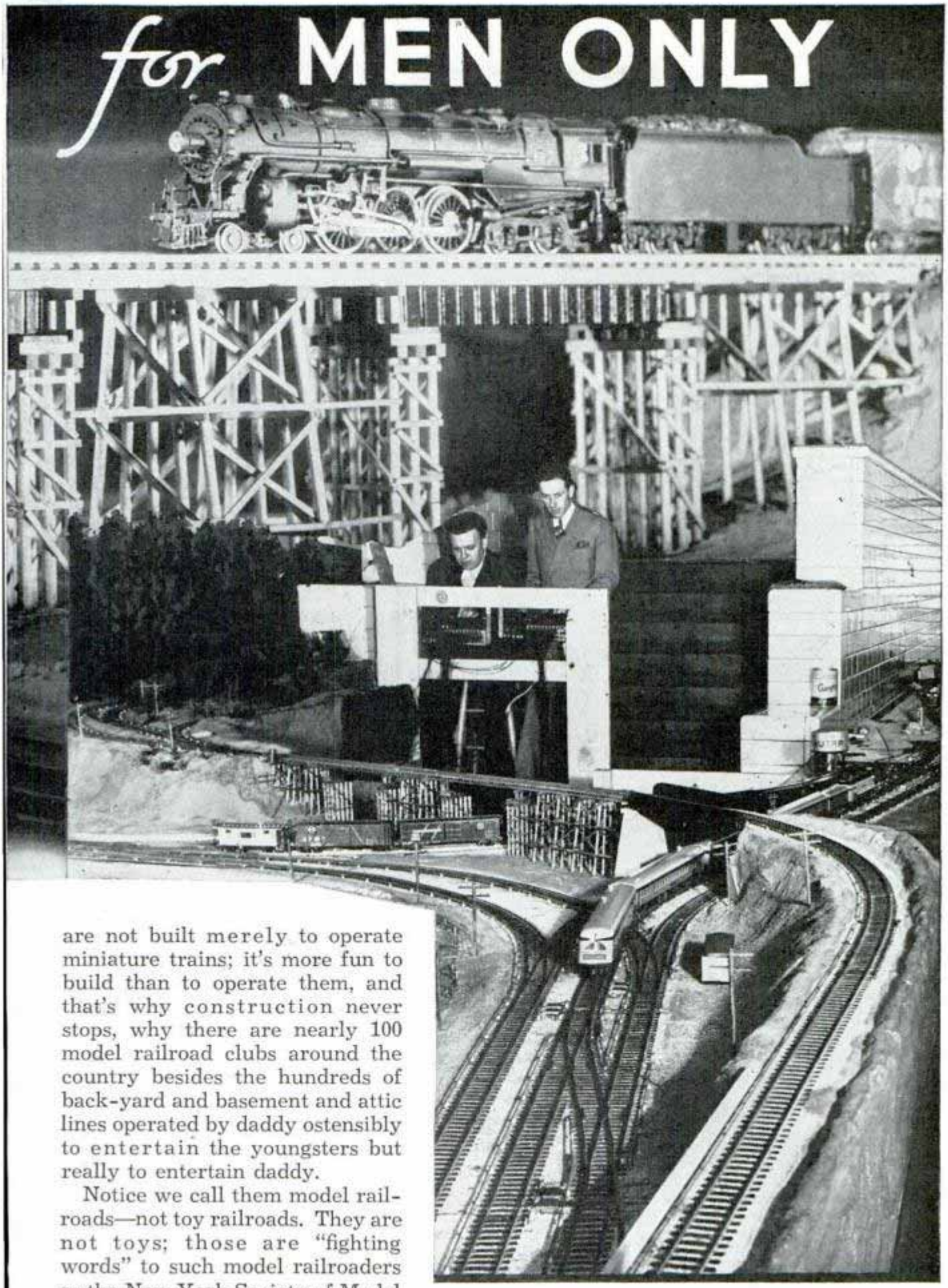
It was a mistake to say the railroad was completed. No properly run model railroad is ever finished. If it is, that railroad is a flop. Of course it is fun, as anyone from two to 102 years old will admit, to sit at the controls and, without even seeing the mixed freight as it glides along the westbound stretch in the next room, throw an electric switch and turn that train into the siding while you give the highball to the limited. But scale model railways





View from control tower of Milwaukee Union Terminal Railroad, with engineer, right, sending model streamline "Hiawatha" over trestle in foreground and freight snaking along main line at right

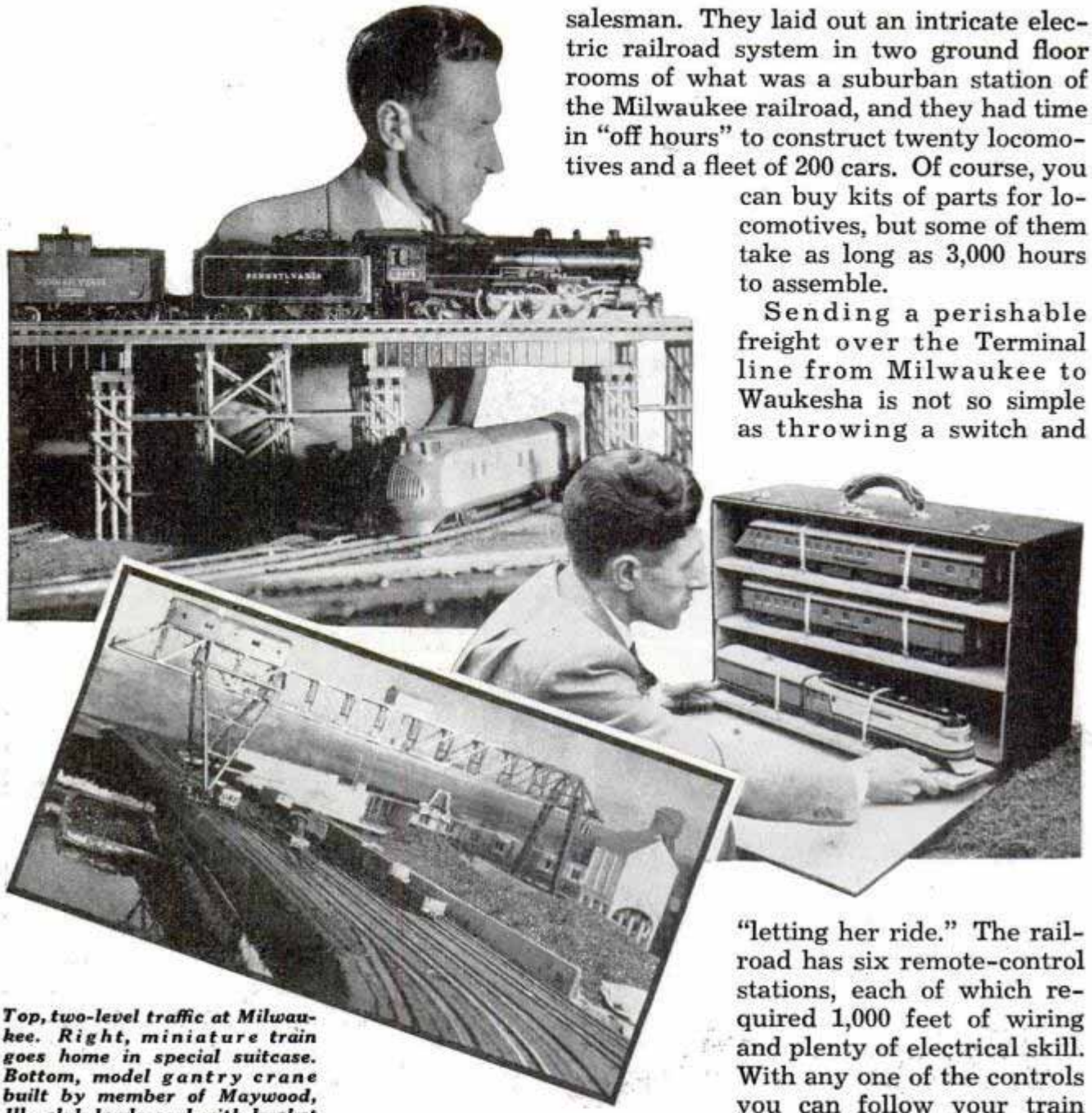
for MEN ONLY



are not built merely to operate miniature trains; it's more fun to build than to operate them, and that's why construction never stops, why there are nearly 100 model railroad clubs around the country besides the hundreds of back-yard and basement and attic lines operated by daddy ostensibly to entertain the youngsters but really to entertain daddy.

Notice we call them model railroads—not toy railroads. They are not toys; those are "fighting words" to such model railroaders as the New York Society of Model Engineers, who have been build-

Top, tiny freight crossing homemade trestle strong enough to carry man. Below, main line looking toward control tower



Top, two-level traffic at Milwaukee. Right, miniature train goes home in special suitcase. Bottom, model gantry crane built by member of Maywood, Ill., club loads coal with bucket

ing the thousand-foot Union Connecting Railroad for nearly ten years and hope they never finish it. Theirs is another line for men over twenty-one only. Men sneak away from the office, take quick lunches, and stay downtown evenings to "work" on the Union Connecting.

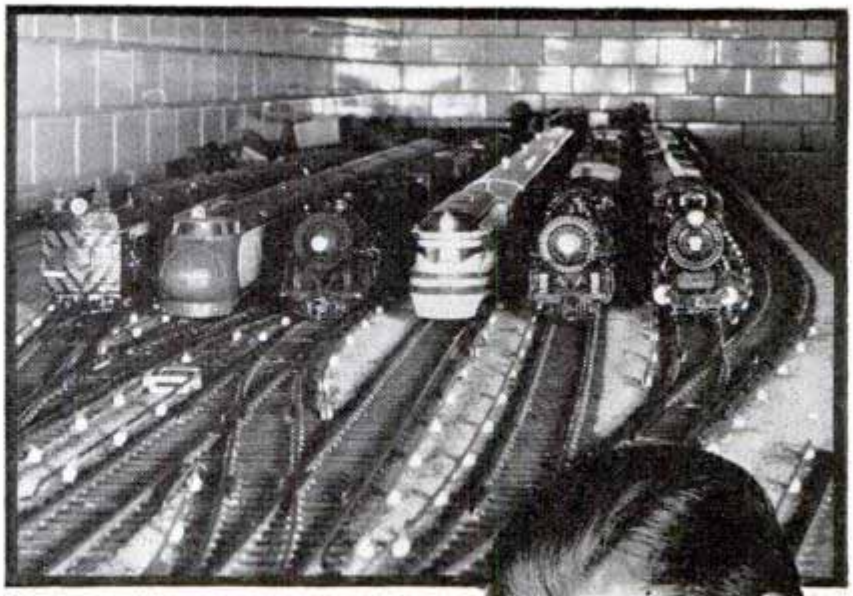
Maybe you think it isn't work? Try planning and laying 1,100 feet of track, 2,200 feet of brass rails spiked down to tiny ties, everything religiously on the quarter-inch-to-a-foot scale, as the Milwaukee railroaders did in six months. Their scenery painter is a steel company estimator, their chief electrician is a health department employe and the boss of the track-laying "section gang" is a typewriter salesman. They laid out an intricate electric railroad system in two ground floor rooms of what was a suburban station of the Milwaukee railroad, and they had time in "off hours" to construct twenty locomotives and a fleet of 200 cars. Of course, you can buy kits of parts for locomotives, but some of them take as long as 3,000 hours to assemble.

Sending a perishable freight over the Terminal line from Milwaukee to Waukesha is not so simple as throwing a switch and "letting her ride." The railroad has six remote-control stations, each of which required 1,000 feet of wiring and plenty of electrical skill. With any one of the controls you can follow your train around the system without interfering with any other "engineer," advancing the circular control each time the locomotive enters a new block. Visual signals, three-color lights, tell you exactly what block your train is in. Like any efficiently operated model railroad it is almost impossible to have a collision, for with "automatic train control" the warning signals are set and current is withdrawn from any train approaching in an adjoining block. Rheostats govern train speed. A two-way switch indicates train direction, alternating current supplying power for forward operation while direct current from batteries is sent into the line to put the locomotive in reverse. There is also a neutral position in which the engineer can

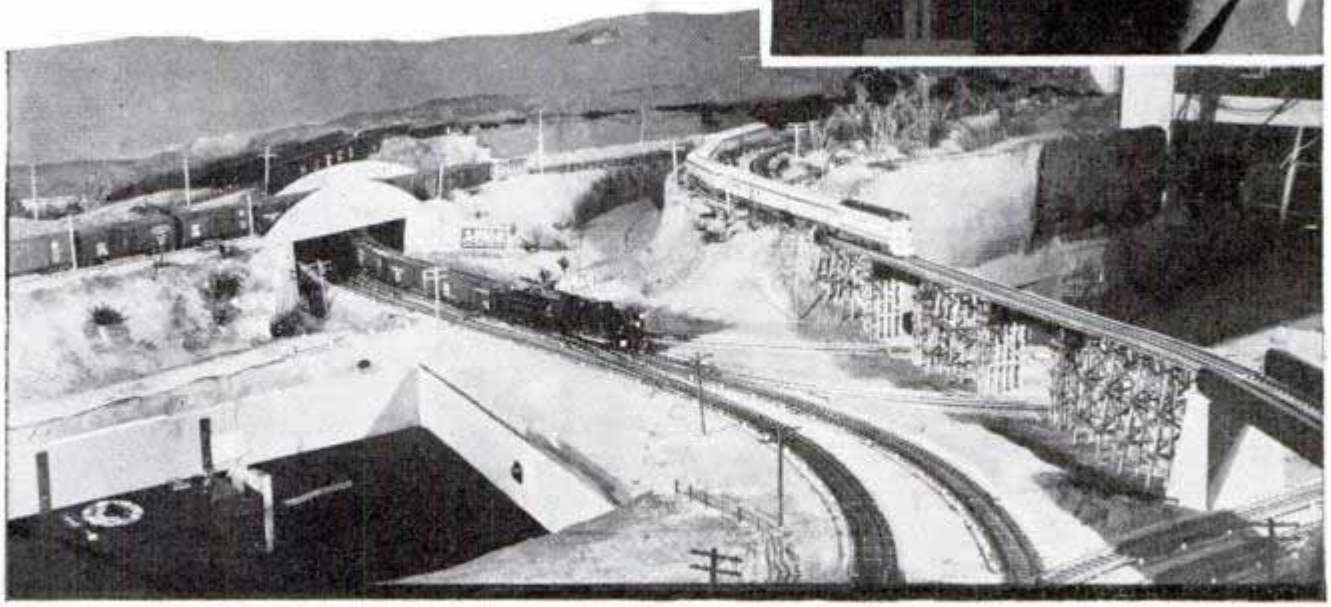
turn on train lights without moving the engine.

One man could, of course, operate this 1,100-foot railway single-handed. But on exhibition nights when wives and children and neighbors are allowed to visit, the operating department expands and a druggist may become yardmaster, a schoolteacher chief dispatcher, and there are ten to twenty switchmen and towermen and engineers. Besides each circular control switch the engineers have their clips for train orders. Telephone lines are manned at twelve to fifteen stations, carrying train orders and reports of car loadings and movements and the position of empties.

There are sixty-seven switches and five crossings on the Milwaukee Union Terminal, several bridges and a trestle, a tall wooden structure that is an exact copy of a trestle just outside Milwaukee. It was built by one of the club members from a photograph of the original, and despite its diminutive size it is sturdy enough to carry a man's weight. The steel bridges,



Above, headlights gleaming, six trains line up for work in the "home" yards of the Milwaukee Union Terminal. Right, loading a flatcar with shipment of diminutive farm tractors. Bottom, view showing intricate track layout. Notice telephone lines, fences, and auto waiting at crossing for freight to pass



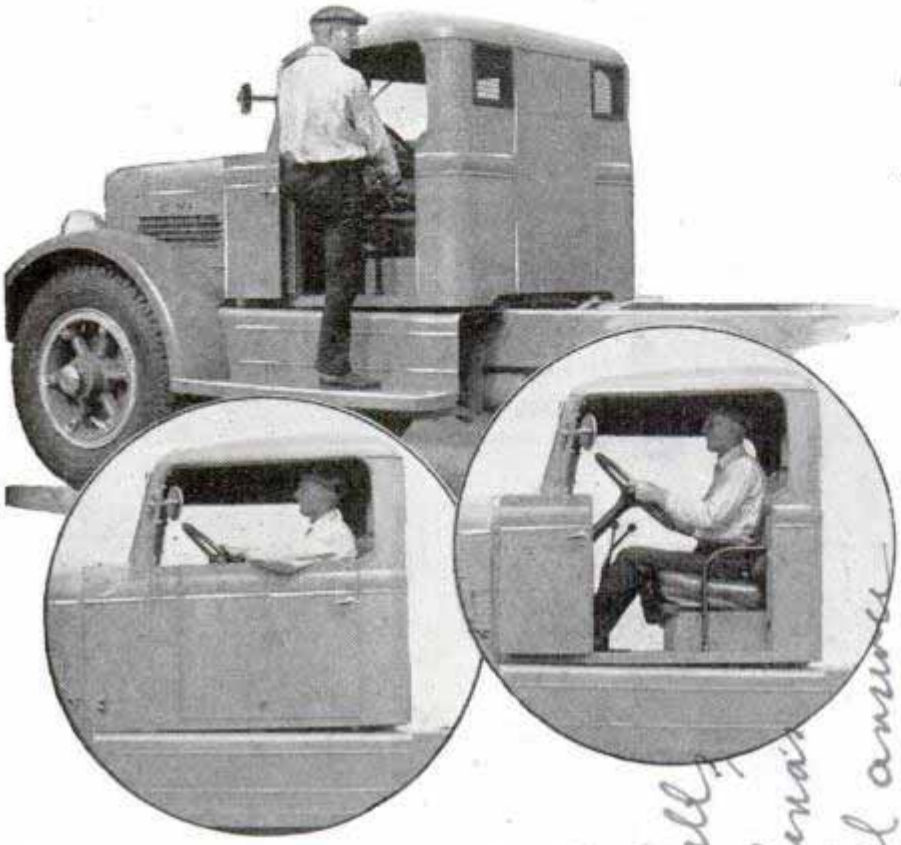
also faithful copies of real structures in the vicinity, are "welded" with solder.

Model railroaders can't stop as soon as the track is laid and the rolling stock is in running order. Real railroads simply build their lines across the country; the model railroaders build country around their

(Continued to page 120A)

es 983

Driver Stands Outside Cab While Backing His Truck



Three views of truck cab show how its door folds out of way of traffic and driver can stand on running board safely while backing truck

Truck cabs are now being arranged so that the driver can safely stand with one foot on the running board and one on the clutch, looking backward as he backs the truck. The cab door folds, its front half folding against the rear half and attaching to it with spring clips so that the door will not be caught by the wind. There is a safety railing at the end of the seat.

Mile-a-Minute Trains of U. S. Lead World in Mileage

es 1043

More mile-a-minute train service is offered in the United States than in any other country in the world. At the end of 1930 there were twenty-five runs, covering 808 miles, on which trains averaged a mile a minute. Six years later the number of runs had increased to 568 and the total distance covered had climbed to 30,047 miles. In the same year the total mileage of similar fast trains in other countries was: France, 12,487; Germany, 7,982 and Great Britain, 6,206. Other nations reported a total of less than 1,000 miles each. Of the American runs for 1936, there were 201 that were made by steam locomotives, 251 by electric trains and 116 by Diesel-powered engines.

es 980

Sidecar Is Equipped for One-Man Fire Department

Modern version of the smoky fire engine with its dashing horses is the "one-man fire department" of an Illinois town. The fireman rides a motorcycle with a sidecar in which all the equipment for swift action against a small fire is packed. This includes a one-inch hose with reducing connection to fit a standard two and one-half inch hydrant, a shutoff nozzle, five-gallon water can with hand pump, two and one-half gallon foam extinguisher, broom and hooked pike pole. Swift on the "getaway," this motorcycle is used chiefly for grass, rubbish and brush fires and saves the fire department an estimated twenty-five dollars for every run as compared with the automobile pumper with its crew of men.

All equipment necessary to battle small fire is packed in sidecar of motorcycle, inexpensive to run

The Autocar Co, Ardmore, Pa

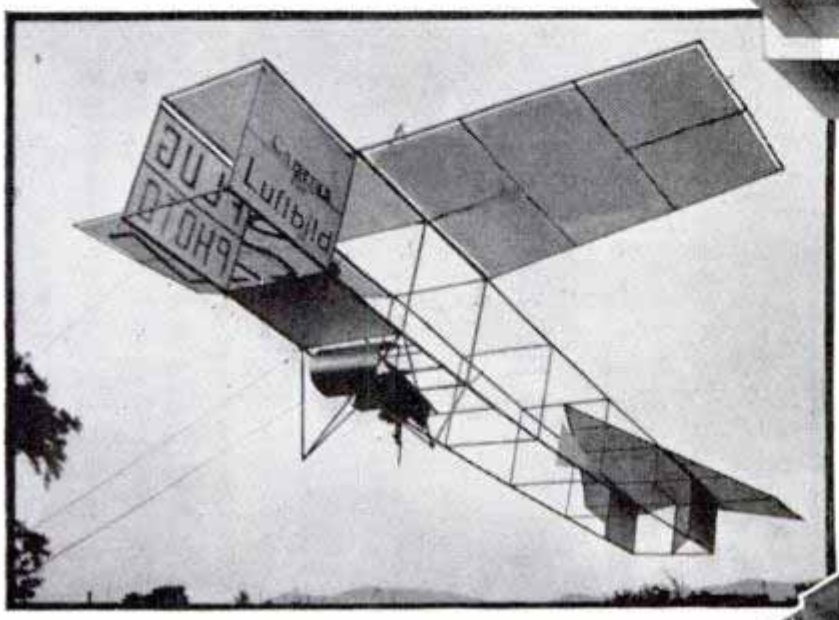
La Grange

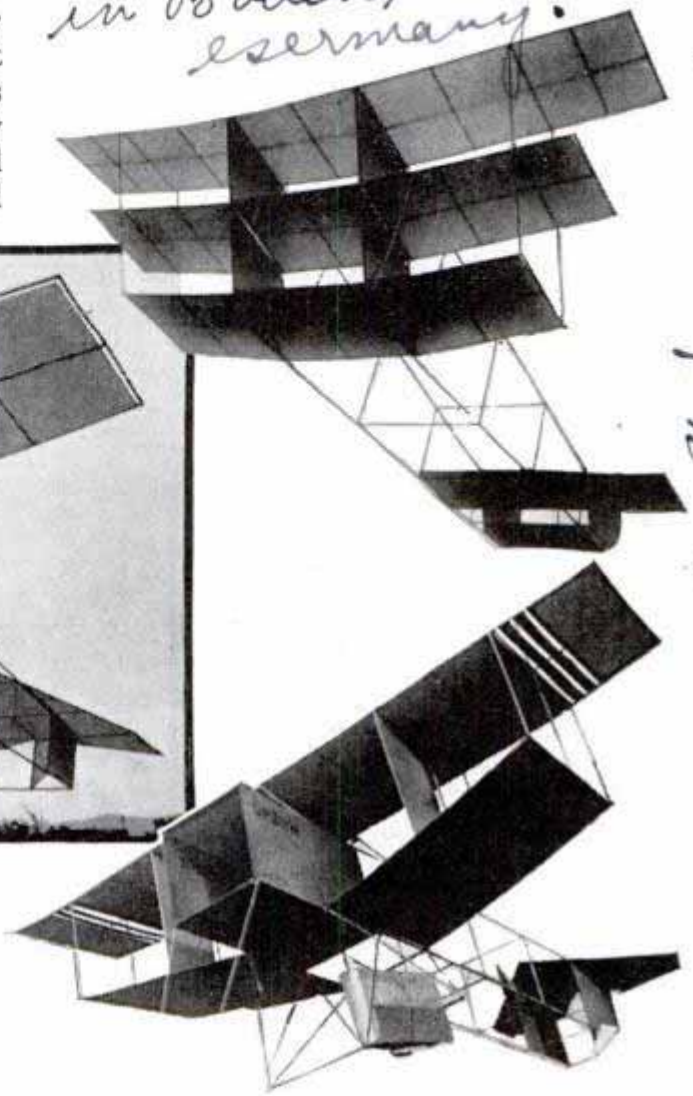
Baltimore and Ohio Magazine
Railway Gazette

home-made

Kites Used for Sky Billboards and Air Photos

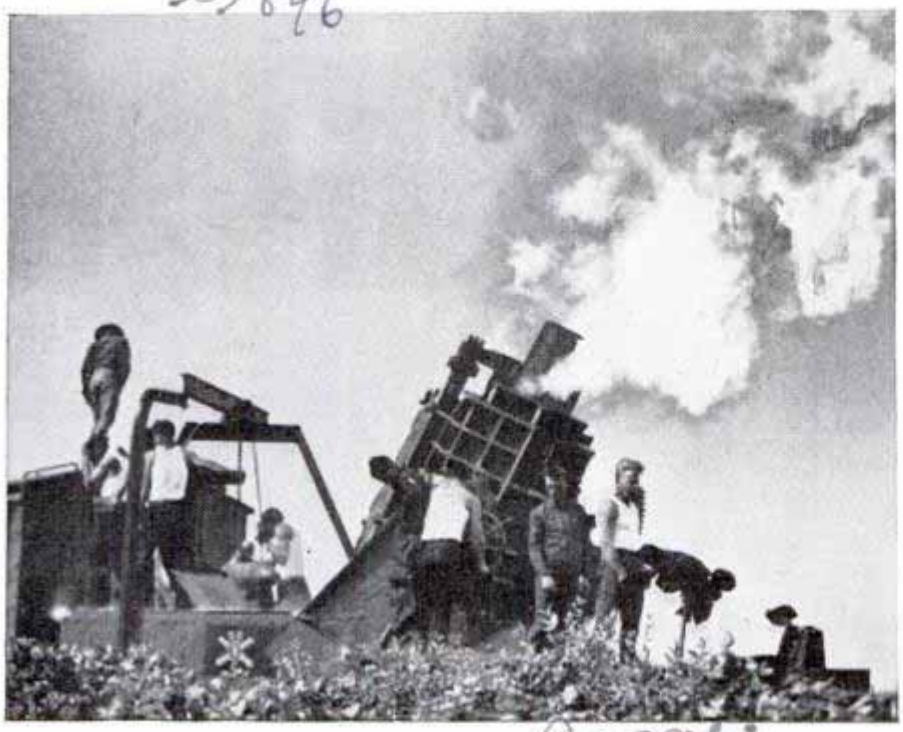
Kite-flying is more than a sport for youngsters in Germany. Huge kites built like airplanes, with advertising signs painted on their wings, are flown as sky billboards. Pamphlets are taken aloft and scattered from a special container fastened beneath the "biplane kite." Aerial photographs are even made by attaching the camera to the underside of a big kite and flying it over the scene.





Monoplane kite carries camera, biplane has container for dropping pamphlets. Triplane is latest type

Huge Coast-Defense Mortar Fired from Railway Track



Guarding the eastern seaboard from attack are huge mobile mortars, mounted on railway trucks for quick transportation to the firing zone. The twelve-inch mortar shown here has just been fired in artillery practice on the track at Fort Hancock. White smoke still belches from its mouth as the gun crew prepares to reload.

¶ Worn-out steel rails are converted into grinding balls by a Canadian firm, to be used for crushing ore.

Is 4 pg. article material from Eastman Kodak Co Rochester, NY

FOCUSING *Your* CAMERA

CHRISTMAS comes but once a year and lasts exactly twenty-four hours. That is, unless you have the formula for extending Christmas on and on into next year.

The formula is simple enough. Take a camera, load it with film, and start shooting Christmas atmosphere long before the big day. Don't stop shooting until the toy dog has broken his leg, the wreaths are packed away for another year and the fragrant pine tree is chopped up and set ablaze in the fireplace. Then you'll have a treasured collection of pictures to perpetuate that Christmas—for no two Christmases are alike. New faces join the family circle, old ones are missed, but pictures keep last Christmas always fresh.

Jot down a scenario for your scrapbook just as you would in planning a motion picture.

In the weeks before Christmas there are downtown shopping crowds to photograph. A youngster flattens his nose against a toy-shop window and gazes longingly; an old picture, but it's always new. Salvation Army Santa Clauses interview trusting kids; some times you can catch Santa Claus gazing, himself, into a cigar-store window with a longing look. Take a candid shot of your overworked postman toting holiday mail, and snap the first delivery

Decorating the tree on Christmas eve, and Christmas games—both of them interesting holiday shots that call for "booster" light

on CHRISTMAS

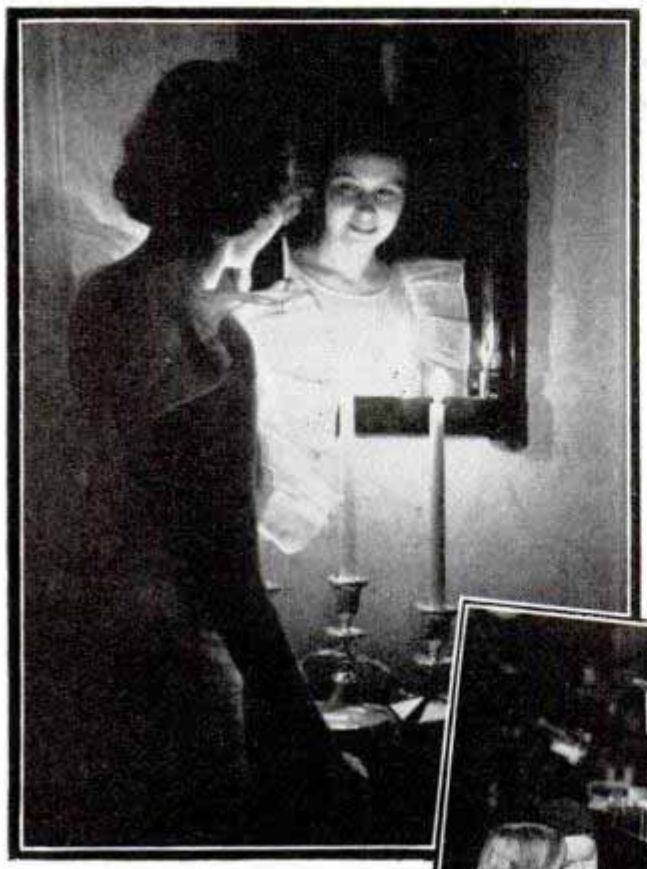
boys arriving with mysterious packages. Then the Christmas story goes indoors to the decorations, the pile of greetings on the living-room table, the wrapping of packages and lighting of candles.

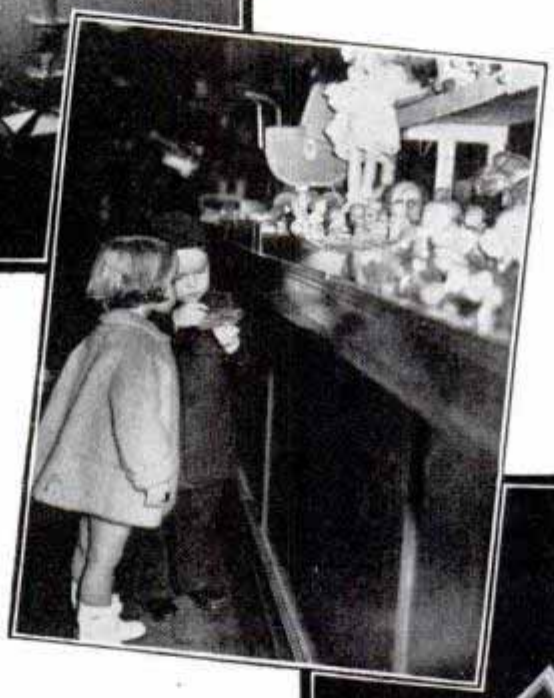
Load up with flash and floodlight bulbs for the climactic action of Christmas eve. The tree arrives, perhaps surreptitiously by the back door. Ornaments, tinsel, candy canes and packages adorn it. "Stockings are hung by the chimney with care." Someone tries out the mistletoe to see if it really works. Out in the kitchen there are dramatic picture possibilities in the tremendous activity around the stove.

Then on Christmas day there is the big climax—the youngsters racing downstairs in their pajamas to raid the tree, the new bicycle and pup, Dad monopolizing the electric train, Christmas dinner—a great chance to try out a natural color film with the indoor floodlights—and the drowsy household afterward.

In the early days, Christmas was seldom photographed. When the sun went south in the fall folks would put away the cam-

Here are two snapshots that belong in any permanent record of your Christmas celebrations





era until spring, thinking there wouldn't be much picture-taking during the winter. But now with the faster films, the electric lighting equal to daylight, and miniature cameras growing more popular daily, photography is a major indoor sport all the year around. Even when Christmas day is over there are the remnants of the holidays to pick up on a spool of film to round out the story in your album; broken toys, holiday parties with the young squire or the young lady of the family in the first formal outfit; New Year's eve celebrations, the Christmas-tree burning, and finally, the back-to-school movement.

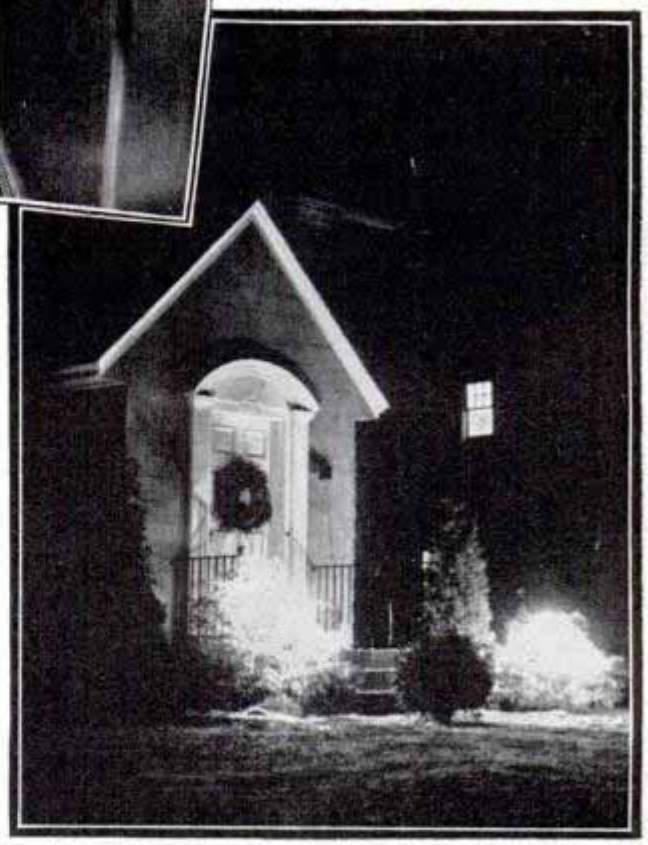
Make the holiday record intimate, personal, candid—something you and your friends will want to review and laugh over through the year. The story in pictures can even be made up into small albums as gifts next year for the persons concerned.

And if you want to make your own greeting cards from holiday snapshots, remember that you must do it a year ahead. When you suddenly decide next November or even early December to take some Christmasy pictures for your card, you'll find you are almost a year too late. So be prepared; make your shots of snow scenes, of the stockings and tree and wreaths this year, and you'll be ready for next year's greeting without any last minute rush.

For those Christmas eve snaps around the house you will need special lighting. With a battery of floodlights or flashes you can "fire" almost at random. There are two sizes of Photoflood lamps; if your camera has a lens rated at f6.3, two or three of the No. 1 Photofloods in reflectors will usually be adequate for close shots at 1/25 second, with the lens wide open. Faster lenses obviously require less light, or can be used with faster shutter speeds. These lamps will burn for about two hours. The No. 2 Photoflood lamp is larger, with three times as much power, and they make possible indoor snaps with almost any camera.

Of course, you should use a fast, supersensi-

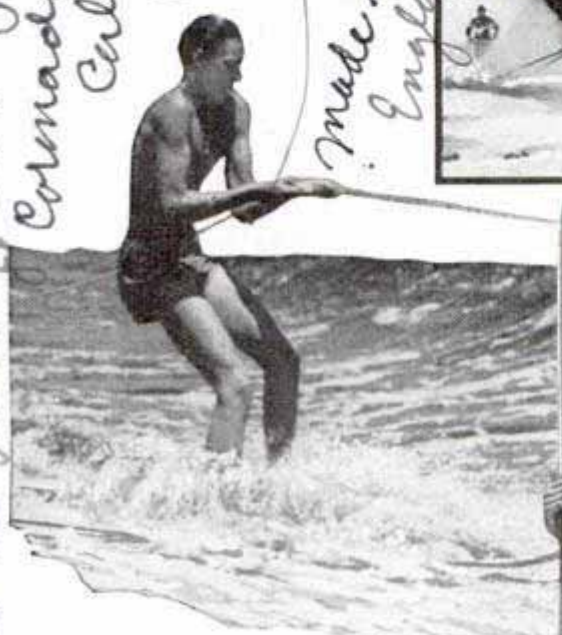
(Continued to page 116A)



Candlelight portrait, top, needed time exposure; photoflash caught children in toy shop. Bottom, three-minute exposure offers Christmas idea

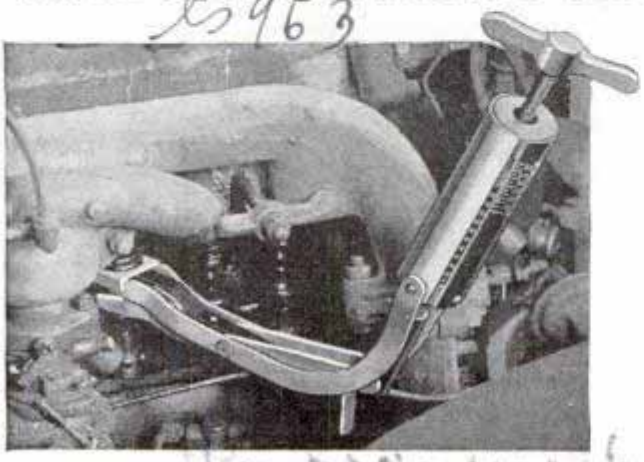
Skis Take to Sea After 'Skiplechasing' Season

There are plenty of thrills and spills in "skiplechasing" over the snow in tow of a galloping horse. Below, a surf-rider on skis rides a breaker behind a motorboat. Notice the "shoe" to grip foot on water ski at bottom



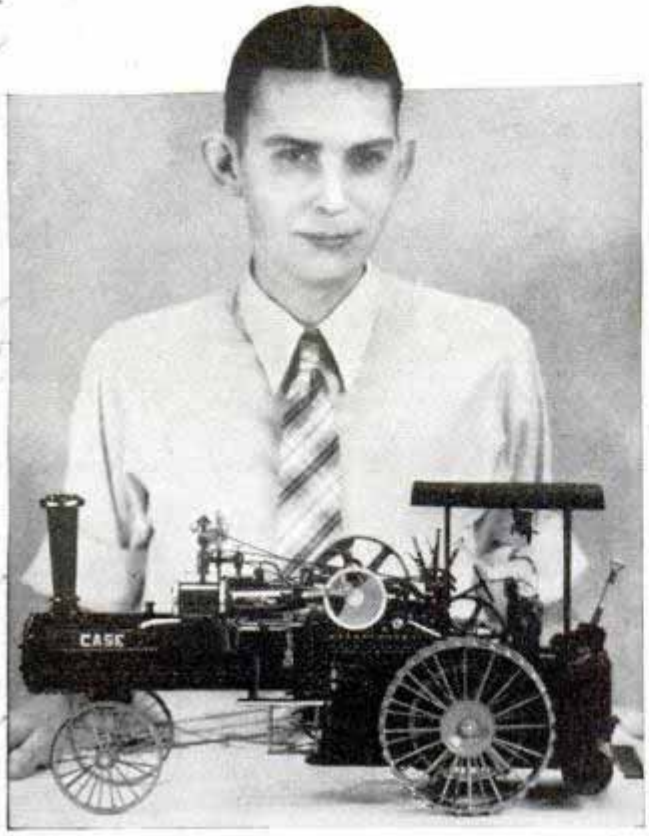
Surf riding on skis is always in season now—behind a horse on winter snows, behind a motorboat in summer. They have nicknamed it "skiplechasing," this thrilling dash over ice and snow towed by a horse, with your partner in the saddle. It's an old Scandinavian sport with a new name, being introduced to visitors at the winter sports resorts around Ketchum, Idaho. Sometimes the skier is pulled by a riderless horse which he must guide himself. The latest thrill along California shores is a surf ride on water skis behind a speedboat scudding through choppy waves at twenty-five to forty miles an hour. These skis are specially designed for water sports. They are about ten feet long and six inches wide, with metal fins, and on top is a built-on "shoe" to keep your foot from slipping. The great difficulty in learning ocean skiing is mastering the start, either from a boat landing on the shore or from a squatting position in shallow water.

Valve Spring Pressure Tested without Removing Head



Without removing the engine head of your car, the valve springs can be tested with a meter just developed for garage work. Pressure is shown in pound units on a direct reading scale. It is claimed that there is no danger of the lock dropping out while the spring is being raised for testing, since the pressure is applied directly beneath the locks. A special fixture is now being manufactured that is available to test valve and clutch springs located outside the car.

Model Tractor Run by Steam Made with Jeweler's Lathe



This steam traction engine model runs like the real thing, from throttle to steam gauge and whistle

It took a model builder five hours a day for more than a year to build a small scale model of a steam traction engine, complete in every detail. The steam gauge really shows pressure. The whistle, throttle, reverse, clutch and pump all work normally. There are eighteen flues in the boiler, and the tiny piston is complete with rings. Every part, even to the tiny bolts and rivets, was made by hand, using only a small jeweler's lathe—and there are more than 1,500 parts. The tractor model, excepting the labor involved, cost only $3.50 and of that amount $1.15 was spent for paint.

Earth Three Billion Years Old by Potassium "Clock"

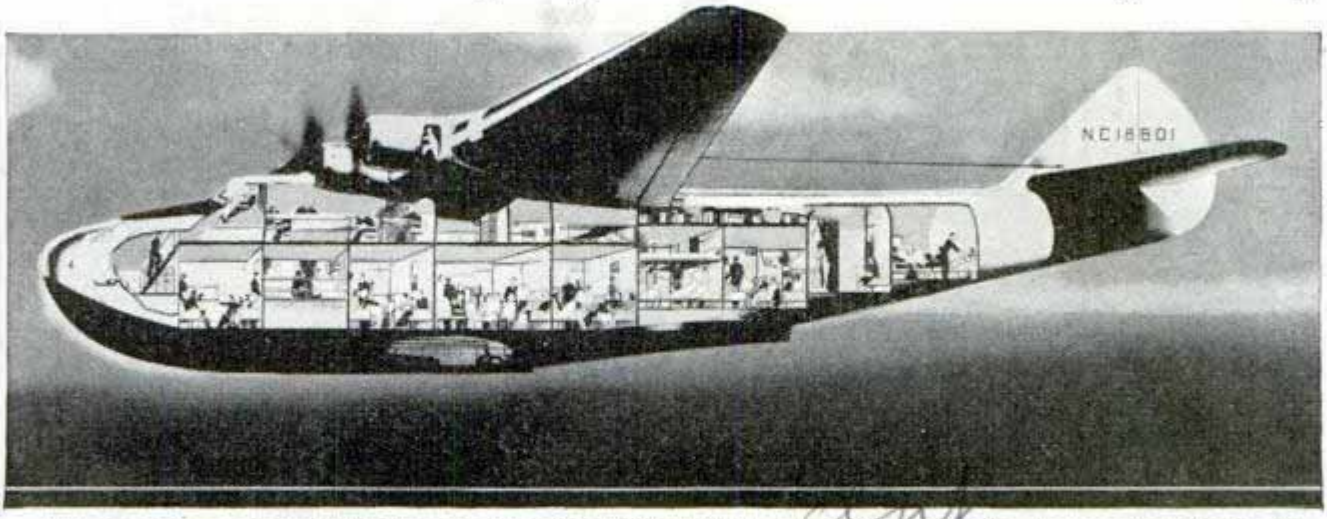
If scientists read the radioactive potassium "clock" correctly, the earth is less than three billion years old. Like radium, the world supply of radioactive potassium is diminishing and over a long period of time changes into calcium. Scientists compute the age of the earth from the amount of calcium known today and the rate at which radioactive calcium decomposes. Some 250,000,000 years ago, in the Carboniferous age, there was four to fifteen times as much radioactive potassium in the earth as today, and this may have had its effect on the changes in plant and animal growth in that period. According to the potassium clock, the earth's crust began to solidify 1,430,000,000 years ago.

Color Wheel Matches Shades of Auto Fabrics and Paint

For matching shades exactly in the manufacture of automobiles, a color wheel has been designed by Studebaker. The wheel has three colors which fuse into one shade when operated at high speed. A disk on the wheel is marked off in degrees and the colors on it are standard so that the amount of each color can be measured and reproduced with scientific exactitude at any time, or place. The shades chosen for fabric and body colors for new cars can be ordered by telegraph to paint and upholstery companies and reproduced on their color wheel in the identical shade. To this shade is matched the paint or the cloth. The wheel also enables the auto factory to keep a complete and lasting record of all the delicate shades that have been used on the cars and to reproduce them instantly whenever they are wanted.

When the tri-colored wheel is rotated rapidly the blend will match fabric's color

Transatlantic Flying Hotel Will Carry Sixty



Here is a chance to peek inside the sky hotel which will fly across the Atlantic. Larger than the boats Columbus sailed, it will carry sixty persons. Notice mechanic reaching motor from passage in wing

Fifty passengers and a crew of ten will ride in ease and luxury in the flying hotels being built for Pan American Airways' transatlantic service. Six of these flying boats are in production. A quartet of motors built into the high, wide wings will deliver a total of 6,000 horsepower, enough to hurtle the forty-two ton craft through the skies at a top speed of 200 miles an hour. There are private cabins and sleeping compartments in the lower, aft section of the cabin and a large dining lounge in the mid-section, beneath the cargo hold. Back of the pilot's cockpit is the chart room and the offices of the radio officer, navigator, engineer and captain. Passageways through the wings, which have a spread of 152 feet, allow the mechanic to reach each of the engines during flight. In the hold beneath the dining saloon are pumps to deliver fuel from the sea wings to the wing tanks. The liners will have a cruising range of 3,200 miles and weigh forty-two and one-half tons fully loaded.

Night-Club Set Moving on Rails Is Latest in the Movies

Mounted on steel rails, a night-club set constructed for a Paramount film creates something new in motion-picture effects. The entire set, with the exception of the walls, is movable on the rails. In one position the set has Martinique-type ornamentation on the walls. From this it is moved into position where it has an ultra-modern background of flexible glass and modernistic designs. Nearly 200 people may be in the scenes at the same time, seated at tables on raised terraces and balconies, while the set is moved in a semicircle by means of a powerful electric motor and cable. Tall telescoping doors, made from sheet steel, open and close during the scene. As a comedy turn in one part of the picture, one section of the set is left behind while the rest of the night club swings into a new position.

Moving night club set is shown leaving one table behind as comic touch

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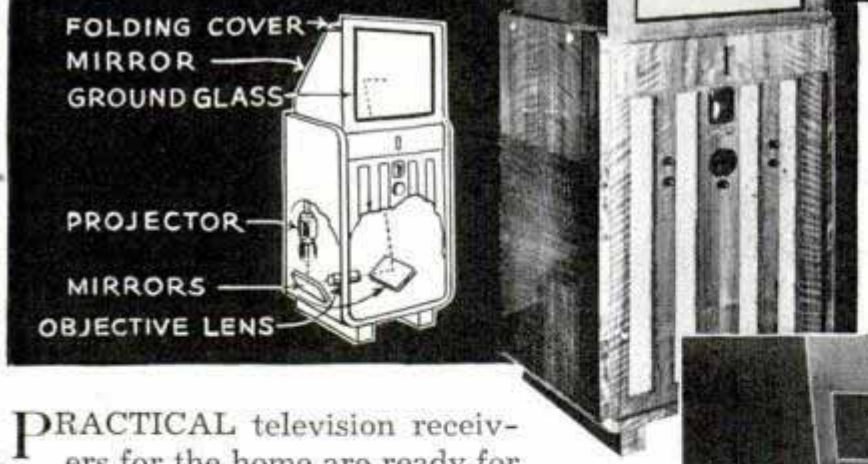
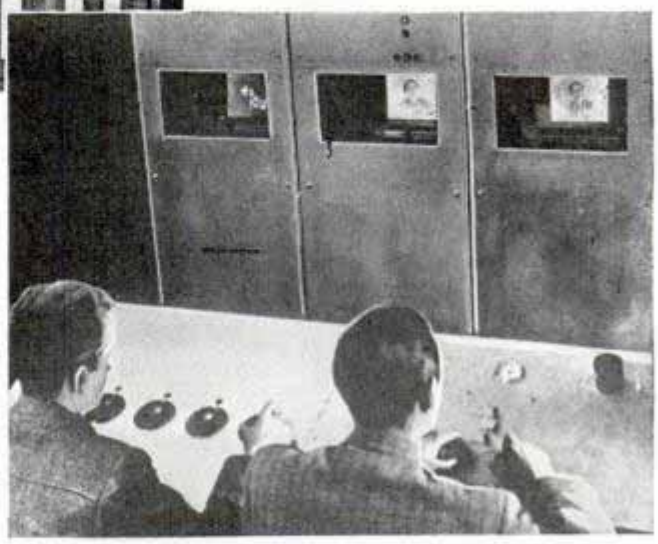
¶Popular Mechanics Magazine does not publish the name of the maker of, or dealer in, any device described in its pages, but this information will be furnished by our Bureau of Information upon request, accompanied by stamped envelope.

TELEVISION



PRACTICAL television receivers for the home are ready for Germany's radio fans as the result of extensive experiment with various types of apparatus necessary for transmission and reception. Latest developments include the announcement of a combination of television, radio and phonographic reproduction in a single cabinet. The radio is an all-wave receiver of the superheterodyne type. Another cabinet is a projection-type television receiver, which uses a very small cathode-ray tube and three mirrors and lenses to project a picture approximately thirteen by eighteen inches upon a ground-glass screen. One model has a screen which folds down. A third development is a projection-type receiver which reproduces on the screen a picture about thirty-nine by forty-seven inches. Two other sizes of home receivers

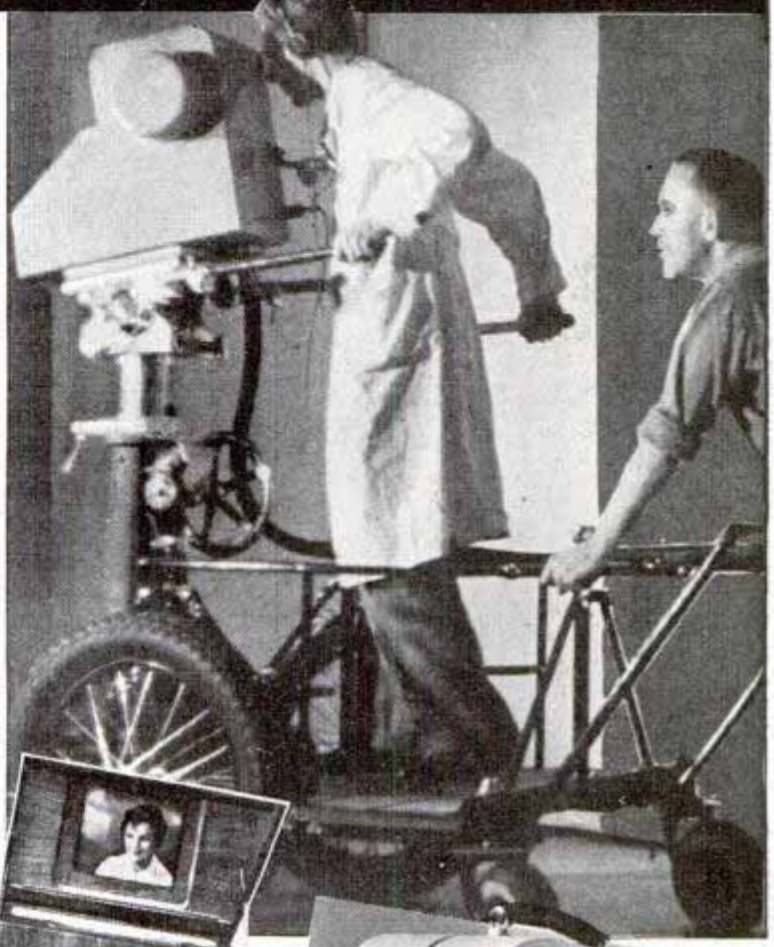


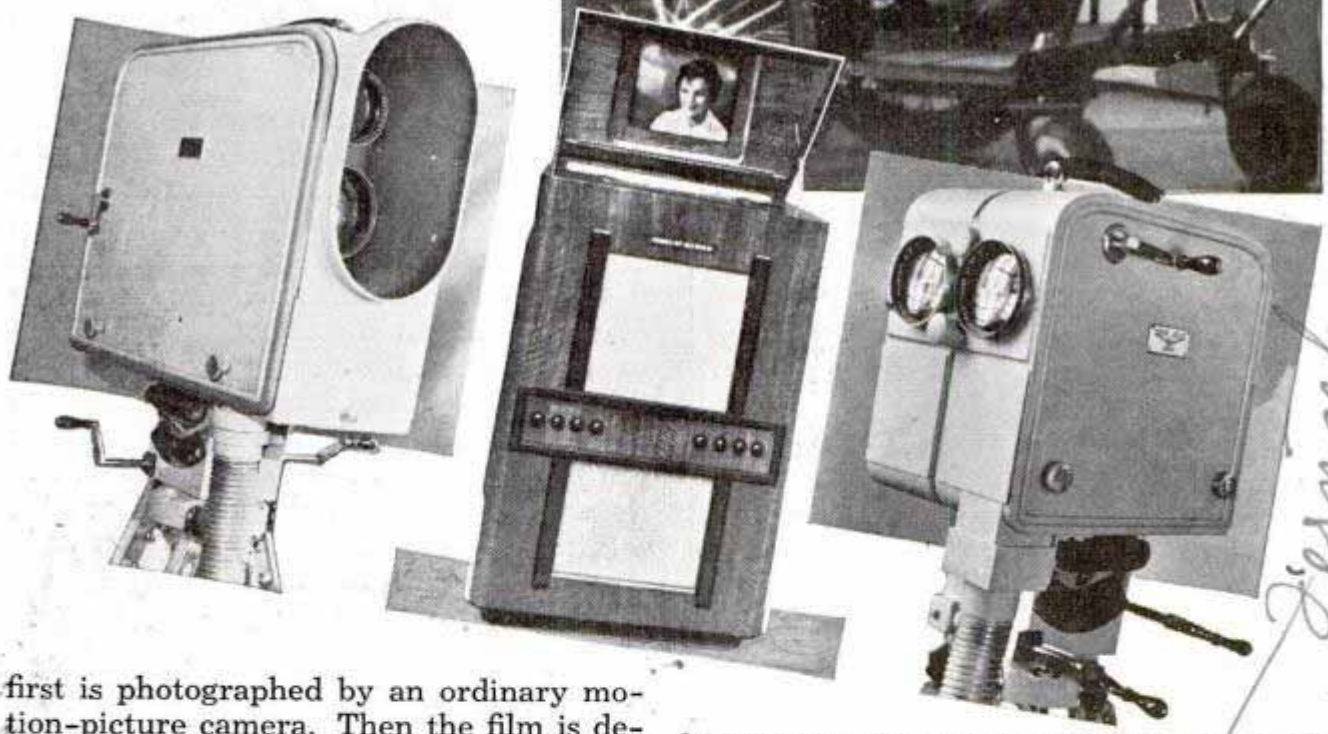
Top, preparing to shoot a scene for television. Center, photo and diagram of home receiver. Bottom, regulating the quality of television in broadcasting station by means of monitor panels

Television Broadcasting Station, Telefunken Co.

in GERMANY

provide for the picture to be viewed in a mirror. One employs a twelve-inch cathode-ray tube, the other a nineteen-inch tube. An outstanding development, from a standpoint of technique in transmission of television pictures, is a control board or mixing panel which enables the operator to "fade" a film television program into a direct pick-up. Thus, this control makes it possible to eliminate abrupt changes in fading from one program into another, adding to enjoyment of programs. Considerable progress in development of a fast film process is reported. In this process, the scene

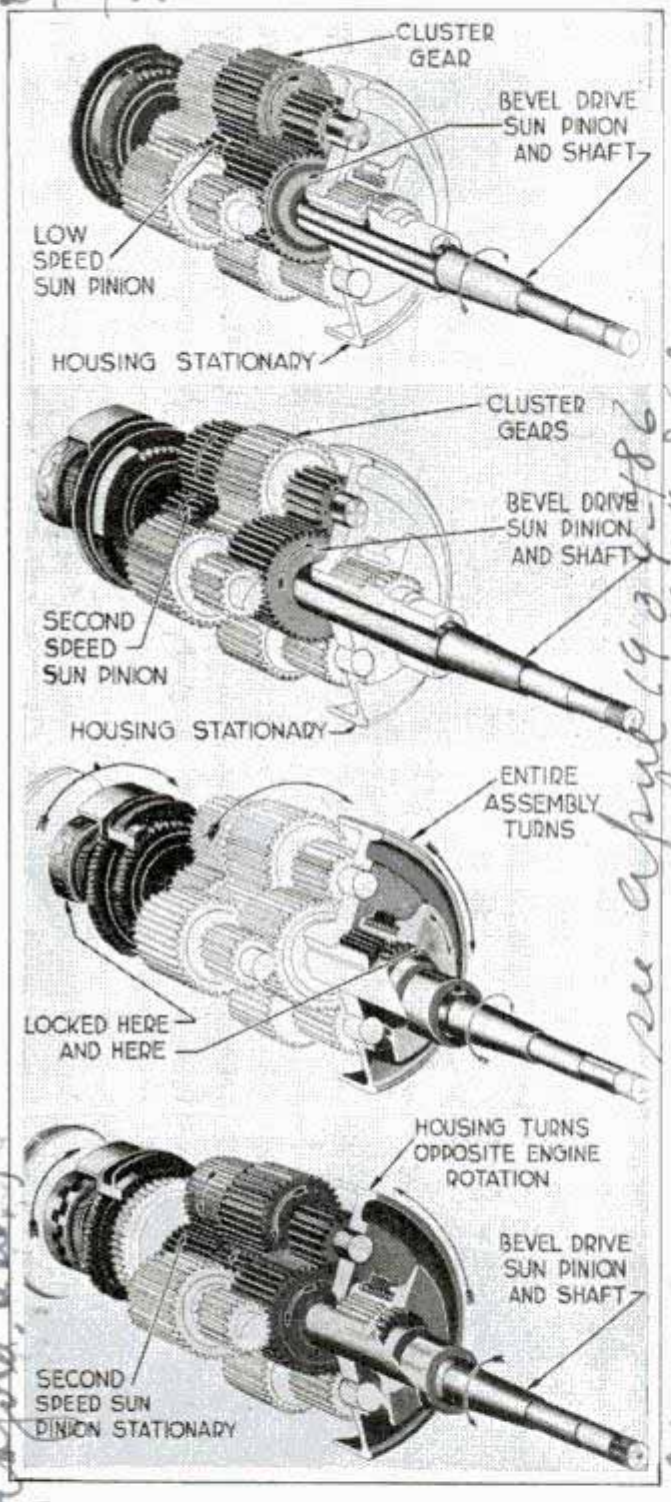




Top, how television pictures are taken. Bottom, left, electron-tube camera for use in stage work. Center, receiver with nineteen-inch cathode-ray tube. Right, small, easily portable television camera for indoor and outdoor work

first is photographed by an ordinary motion-picture camera. Then the film is developed quickly and the part intended for television is taken from the film and transmitted. The process employs the high technique of modern motion-picture camera and newsreel. One German company has perfected an intermediate film apparatus which is quite compact, the whole device, including the film-developing equipment, being enclosed in a box not much larger than a standard radio receiver. New film and chemicals for speedy developing have been brought out for use with the apparatus so that the lag between time of photographing the scene and of placing the development on the television transmitter is ninety seconds.

Automatic Transmission Passes Rigid Tests



Four positions of the transmission, three forward and one reverse speed

Hundreds of thousands of miles services on test vehicles have resulted in adoption of the Banker automatic transmission, known as the "mono-drive," as standard equipment for fleets of buses in Chicago and New York. The unit is completely mechanical, involving no hydraulic, electric or vacuum control, pumps, valves, cylinders or switches. The only control necessary is a lever on the dash. It has three positions, "forward," "reverse," and "starting." An automatic clutch of the expanding shoe type eliminates the necessity for a "neutral" position and also eliminates the clutch pedal in the vehicle. Shifting is accomplished through the accelerator pedal. When starting from the curb, the driver merely steps on the accelerator. This engages the clutch and starts the vehicle rolling in low gear. The clutch engagement is gradual, starting at 400 revolutions per minute of engine speed and being complete at around 800 revolutions per minute. To shift into second, the driver releases the accelerator pedal momentarily and then depresses it again. The same procedure is followed in shifting into high. When the vehicle is stopped, the transmission automatically returns to low-gear position. The "mono-drive" is the planetary type in which gears not only drive other gears, but also sometimes revolve around the driving and driven gears. From this revolving, like the sun and planets, the name planetary is derived. One-way roller clutches, somewhat similar to free-wheeling units, control the power path through the various gears in the different speeds. In direct or high gear, the housing within the transmission which contains the planetary gears revolves as a complete unit. At this time all the gears are locked against rotation by means of the clutches. In reverse, the housing revolves in a direction opposite to engine rotation. From low to second gear, the shift is accomplished by centrifugal weights which engage the speed clutch at the moment the accelerator pedal is released and engine speed synchronizes with transmission speed.

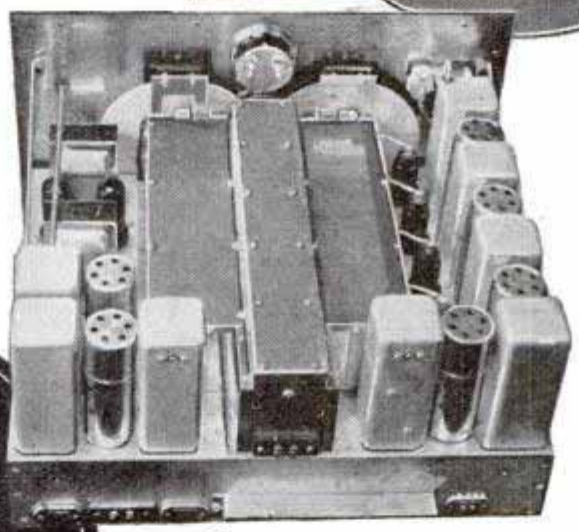
Epsom Salt Proves Harmless to Grasshoppers in Test

Epsom salt proved to be non-poisonous to grasshoppers in a large scale test this year. Use of the salt as insect poison was suggested last spring after an experiment in which grasshoppers died after eating bait dosed with epsom salt. Farmers who tried this in the field, however, reported no success and new tests at an agricultural college resulted in recommendation that the usual arsenic and fluorine poisons for grasshoppers be used.

Radio

Short-Wave SUPER *De Luxe*

TWO stages of r.f. amplification are employed in this 16-tube ultra-high frequency superheterodyne receiver on all bands from 7½ to 240 meters. Although designed for experienced short-wave listeners, advanced amateurs, professional operators and engineers, it is so simple to operate that a novice can usually tune in stations from any part of the world.



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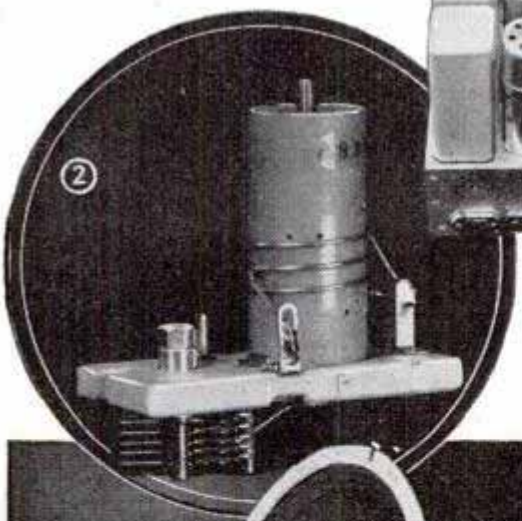

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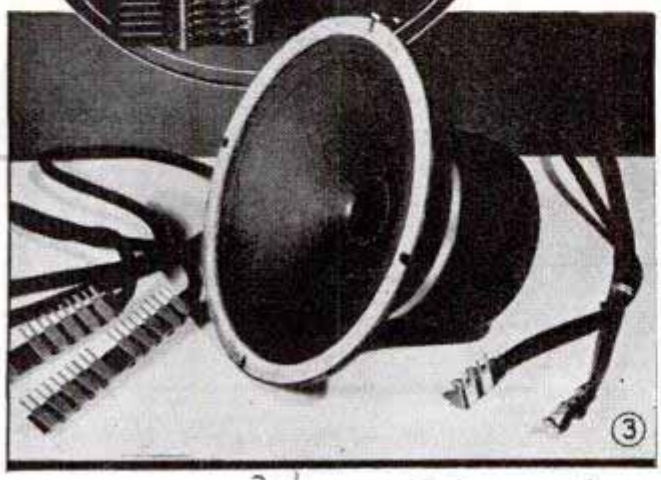


③

With a signal to noise ratio of 6 to 1 in the now popular 10-meter ultra-high frequency band, and almost total freedom from "two-spot" tuning, this new "super-pro" model includes several other special and highly desirable features. An electrical band-spread system permits the 28 to 30 megacycle amateur band to be spread over 90 divisions of the dial. This affords non-critical tuning without an unnecessary amount of dial turning. Additional features include crystal filter, calibrated band width, beat oscillator, audio and sensitivity controls, stand-by switch and automatic volume control.

The rugged self-contained tuning unit is shown in photo, Fig. 1; inset photo, Fig. 2, is a close-up of the 10-meter oscillator coil assembly. All coils with their air-type trimmer condensers are rigidly mounted on isolantite bases. Lower photo, Fig. 3, shows the loudspeaker and connecting cables for a separate power-supply unit not shown in the photos.

Hammarlund mfg Co

TWO-TUBE

By M. N. Beitman

HERE is a compact easily portable 2-tube battery-operated broadcast receiver that you can take along on hikes, mount on your bicycle or operate at the ball game to listen in on the broadcast while you watch the action. As a portable emergency set this inexpensive little receiver would have a definite value in flood, hurricane or earthquake areas where power lines were not available.

No special tools or skill are required for its construction; anyone who can handle a soldering iron will have no difficulty with the assembly. All parts are standard and there are no coils to wind. Two type-30 battery tubes are used and the set is compactly designed to fit into a standard instrument cabinet measuring only 5¼ by 5½ by 7½ in. There is sufficient room in the cover for headphones, and the batteries fit into the compartment below.

The B-battery is a small 22½-volt unit that will give continuous service for about 6 months. Two small dry cells of the flashlight variety, connected in series, supply A-power to the filaments and are good for about 5 hours continuous use. These cells cost only about 10 cents each and are easily replaced; larger dry cells could be employed but this would

FIG. 3-A

FIG. 3-B

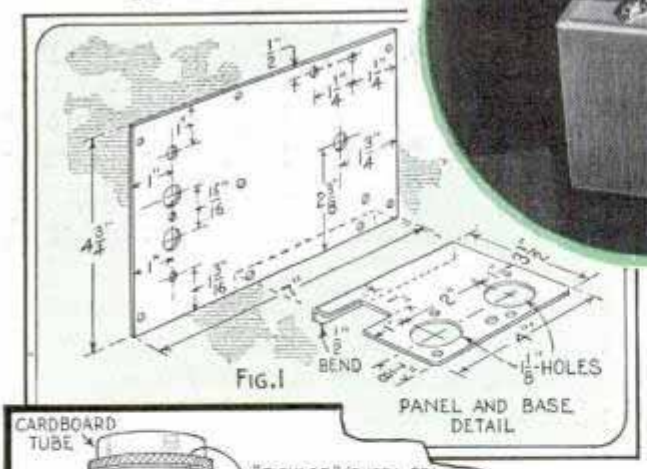


FIG. 1

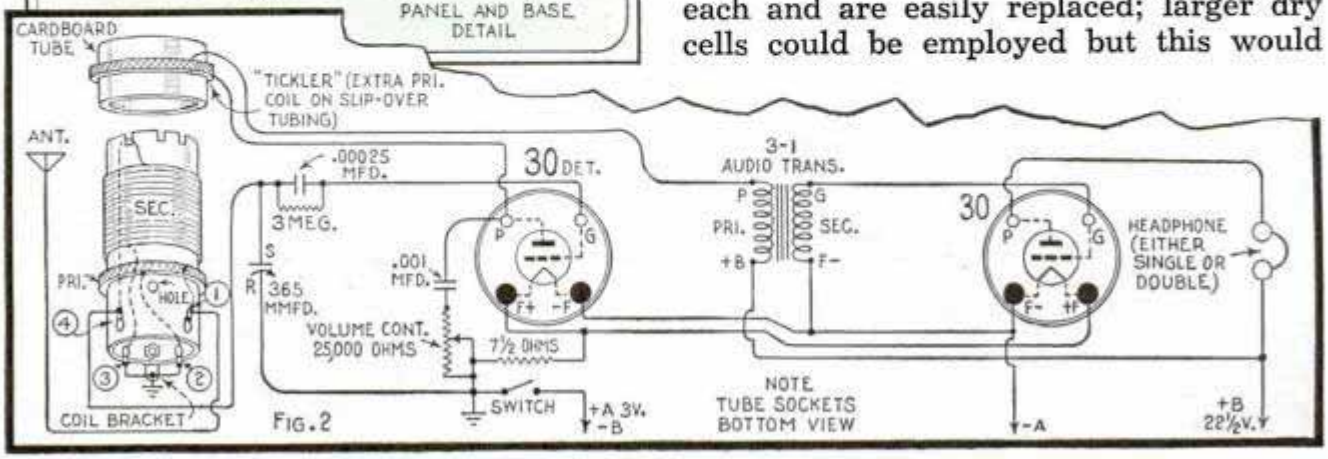
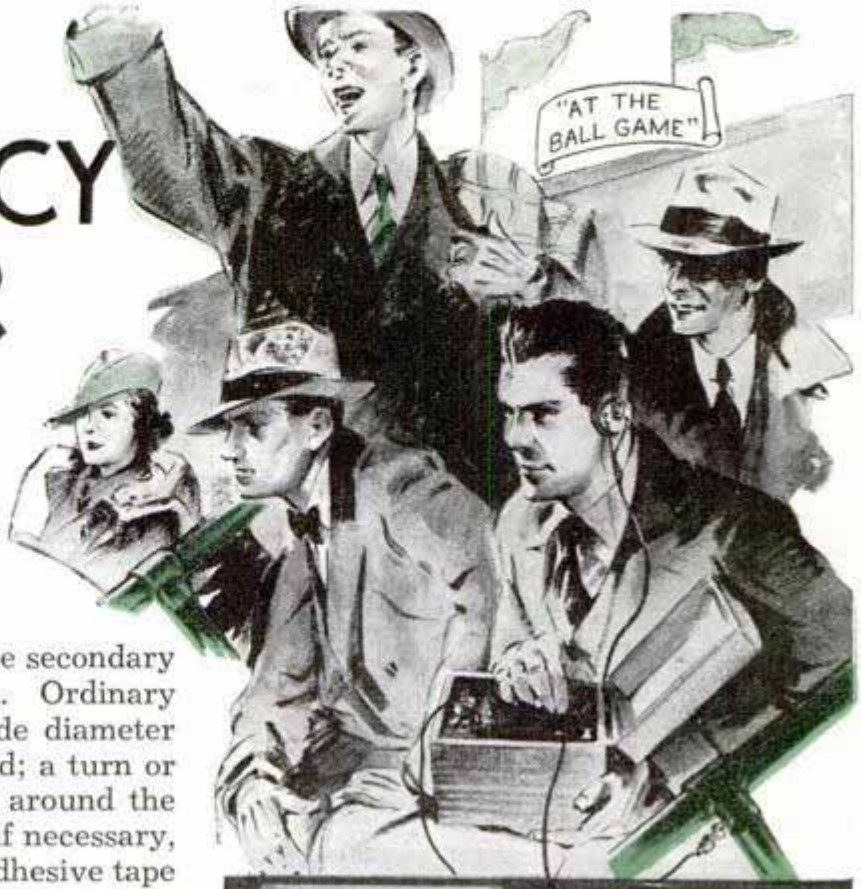


FIG. 2

Note—This self-contained portable receiver is designed for small "A" and "B" batteries; however, larger external batteries may be employed for stationary operation

Portable EMERGENCY RECEIVER

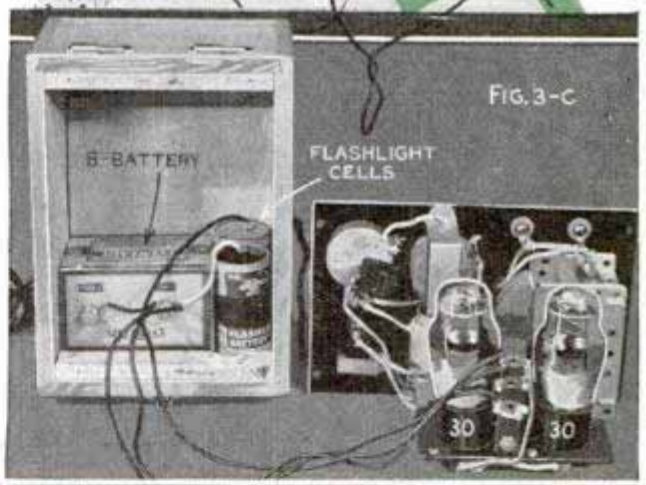


necessitate a larger cabinet.

A regenerative detector is used in the simple circuit, with an extra primary winding serving for the tickler coil. This winding is placed on a short length of cardboard tubing which is slipped over the secondary winding of the antenna coil. Ordinary mailing tubing having an inside diameter of about 1 in. may be employed; a turn or two of paper can be wrapped around the secondary of the antenna coil, if necessary, to provide a snug fit. A little adhesive tape or collodion will hold the tickler coil in position. This extra primary or "tickler" coil must be a "slip-over" type that will fit over the cardboard tubing. The inside diameter should be about 1⅛ in.

Details for the metal panel and base appear in Fig. 1; 1/16-in. sheet aluminum is used for both panel and base. As this material is difficult to solder, all ground connections to the base or panel are made with soldering lugs placed under the heads

(Continued to page 156A)



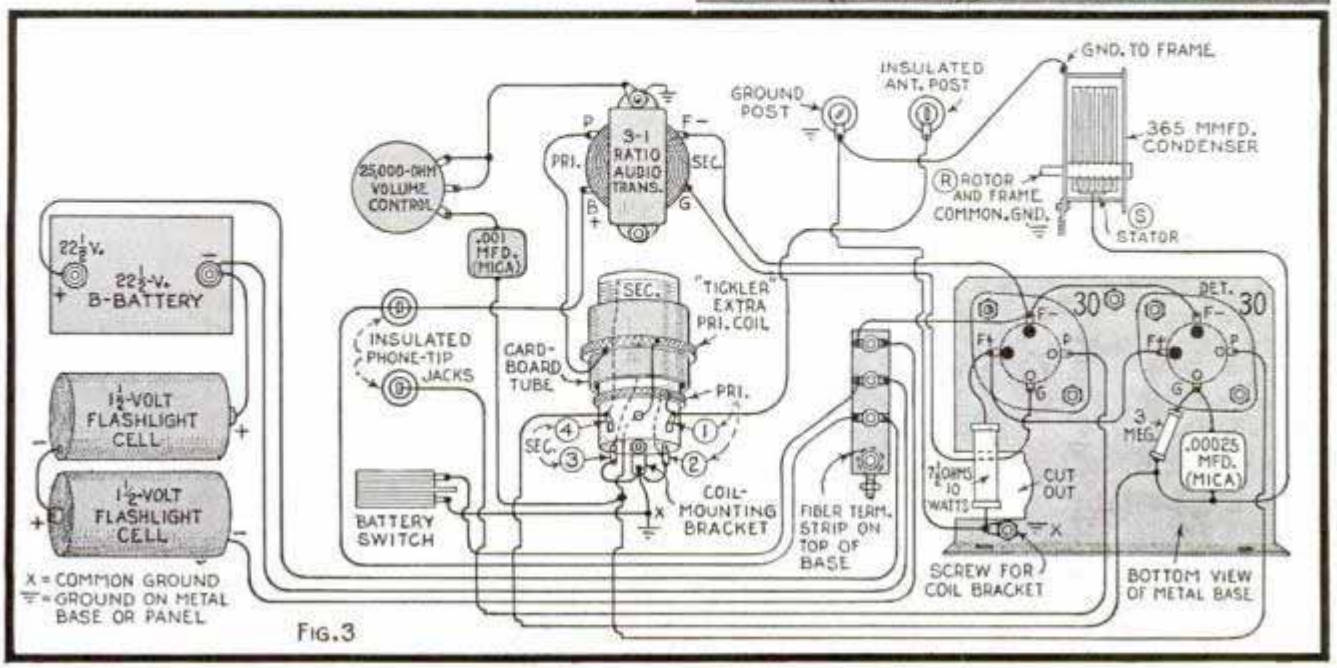


FIG. 3

Self-Powered Seven-Watt Audio Amplifier

By R. C. Hitchcock

NO transformers or chokes are required in this 13-tube a.c.-d.c. audio amplifier. Suitable for dance orchestras or ordinary public address with crystal microphone or phonograph pickup in medium-sized auditoriums, it employs a 3-stage audio amplifier with parallel push-pull output stage using 4 new "beam-power" tubes plus a dynamic volume expander. Four tubes are included in the rectifier section.

Construction is quite simple as

(Continued to page 150A)

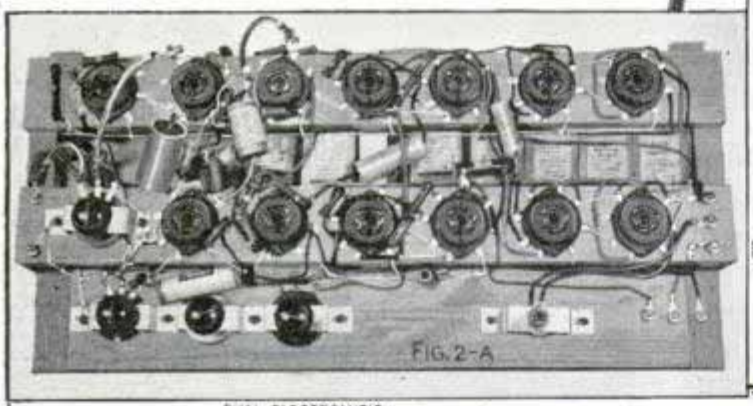


FIG. 2-A

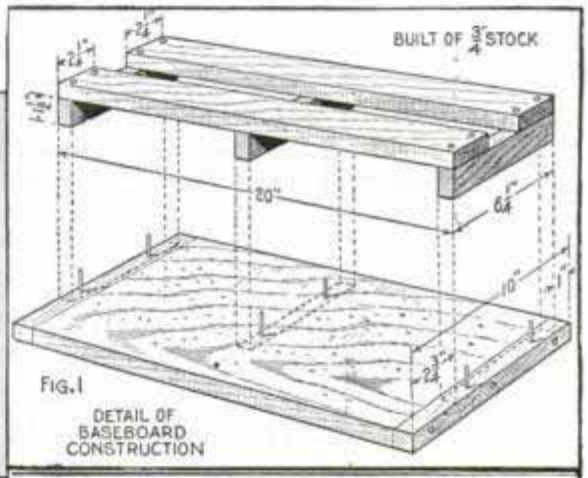


FIG. 1
DETAIL OF BASEBOARD CONSTRUCTION

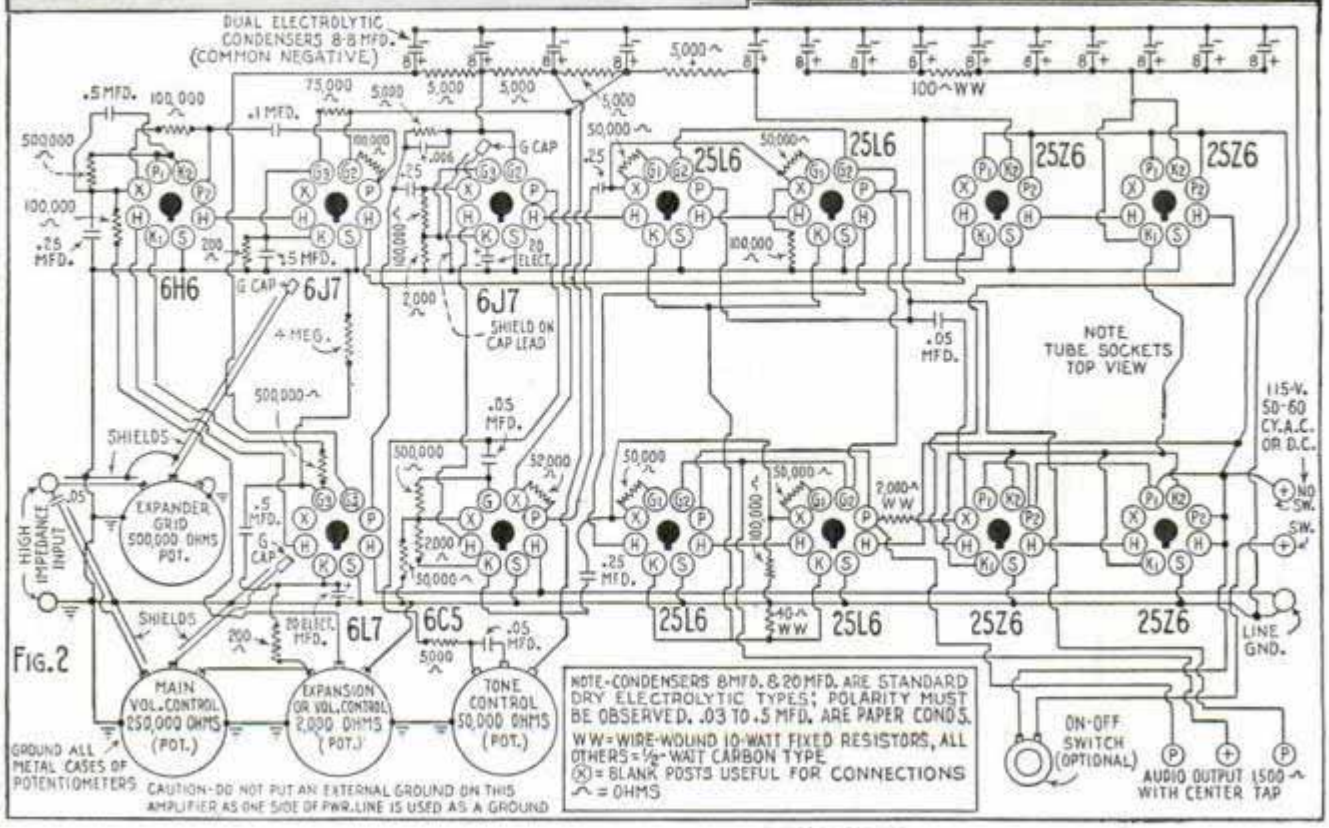
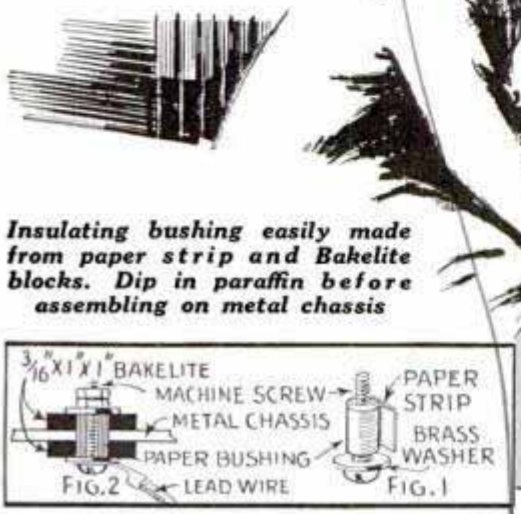


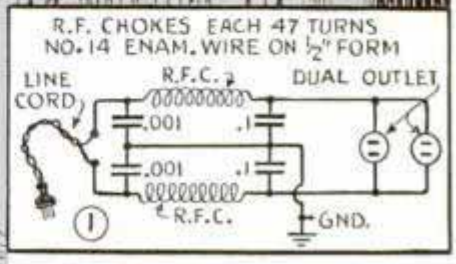
FIG. 2

61 Sherman St
Malden, Mass.

HINTS FOR RADIO EXPERIMENTERS

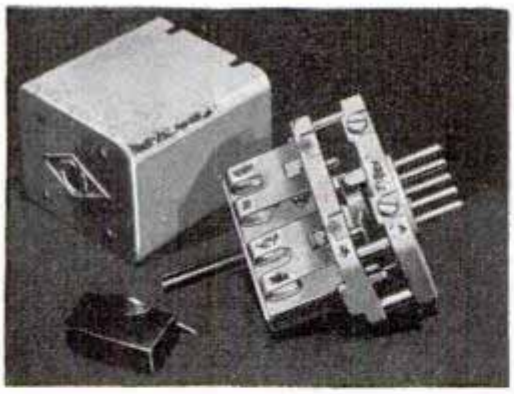
Homemade noise filter for power line eliminates interference caused by refrigerator or other apparatus operated on same line as receiver

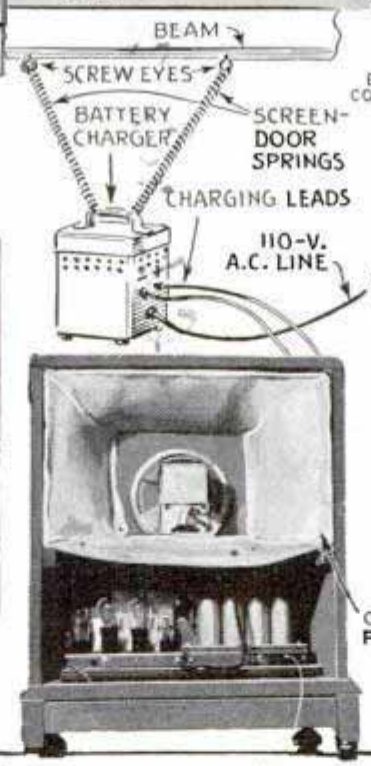


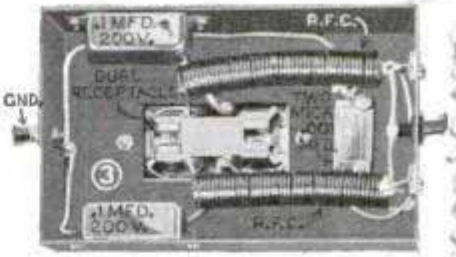


Insulating bushing easily made from paper strip and Bakelite blocks. Dip in paraffin before assembling on metal chassis

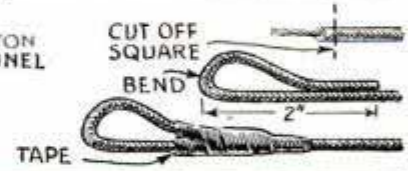
Below, multiple crystal holder for transmitter; four separate crystals selected by built-in switch. Right, spring suspension quiets battery charger; optional method, put charger on piece of asbestos placed on felt pad



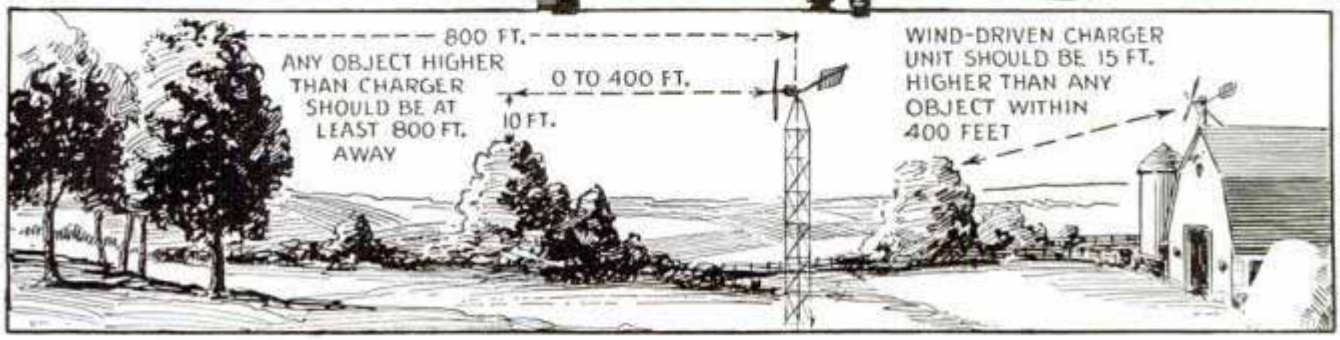




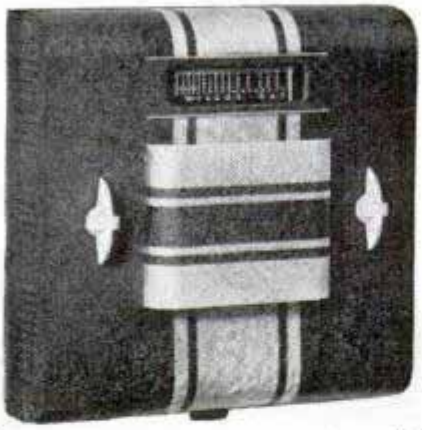
Below, simple method of taping the end of a wire to prevent shorts. Left, acoustical padding arrangement improves low-frequency response of older console cabinets



Sketch below shows suggestions for installing a "supercharger" or wind-driven battery charger to obtain unobstructed sweep of wind

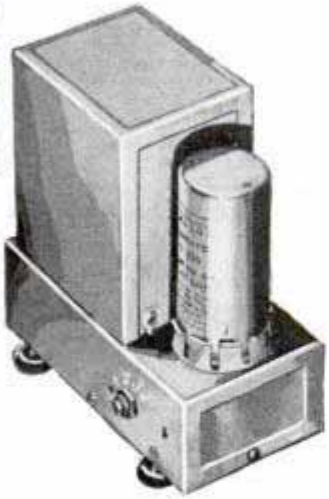


Radio Receiver Hangs on Wall



Designed to hang on the wall like an electrical clock, this radio set saves floor and table space in small offices or apartments. It is a 5-tube transformer-type a.c. superheterodyne with built-in antenna, automatic volume control and includes a dynamic speaker.

Portable Six-Volt Power Unit



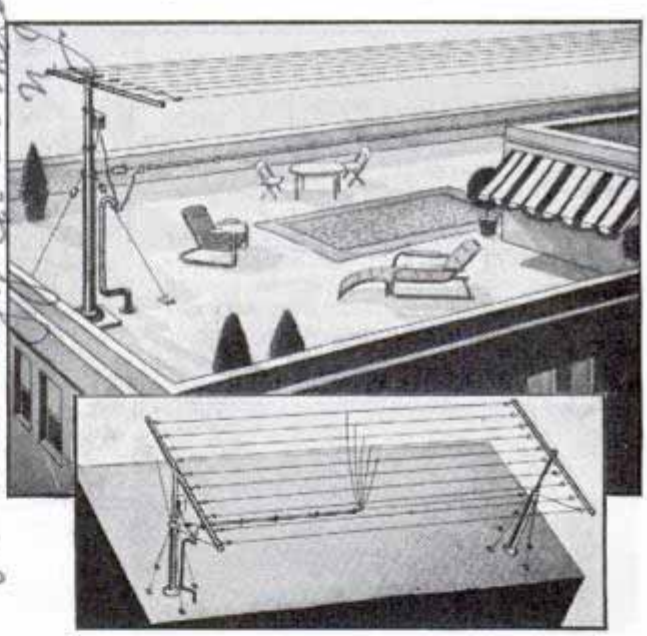
Working from a 6-volt storage battery, this vibrator-type power unit delivers up to 300 volts at 100 m.a. rectified d.c. for operating portable radio transmitters and public-address systems, also converts 110-volt receivers for 6-volt operation.

Variable Voltage Transformer

Service men can use this transformer to adjust line voltage for any requirement. It also supplies various ranges of voltage needed for testing radio sets. Ranges available are 0 to 256 in 2-volt steps or from 0 to 128 in 1-volt steps.

One Antenna Serves Many Sets

Doing away with unsightly individual antennas, this easily installed single-antenna system serves any number of receivers in an apartment building. It is claimed



to provide greatest possible pickup with minimum interference from electrically operated apparatus in the building.

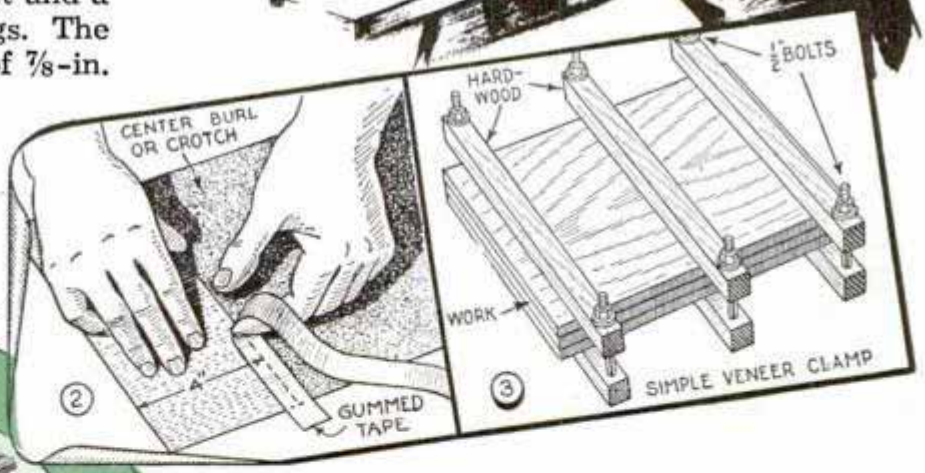
¶Blueprints covering radio construction articles in past issues are available for 25 cents each; original material lists and additional information can be obtained from our Radio Department without charge upon receipt of postage.

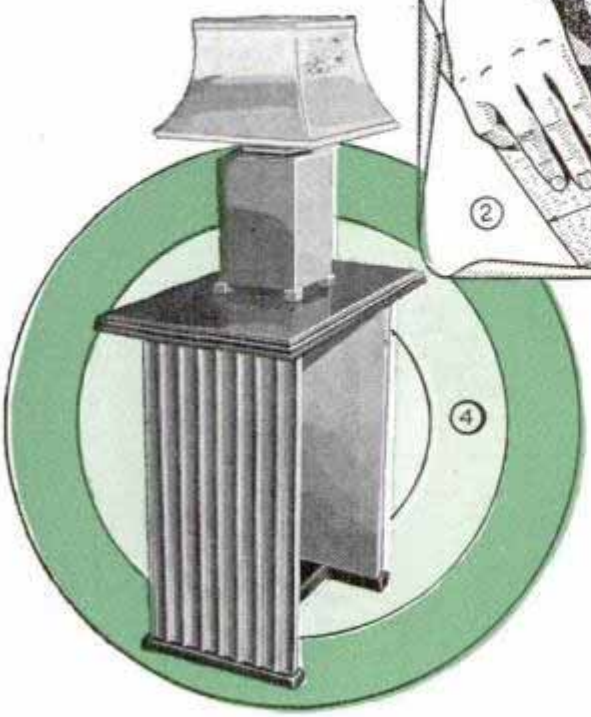
NEXT MONTH—How to Build a "Beam-Power" Four-Tube Bookcase Midget. This simple little a.c.-d.c. broadcast receiver employs a type-25L6 beam-power tube and a 3-in. dynamic speaker; designed for bookcase or end table. Also, **How to Build a Five-Meter Transmitter.** RK-34 tube is used as master oscillator.

New LAMP TABLE with matched veneer top

By WAYNE C. LECKEY

BONE-WHITE enamel in combination with fancy veneers in the natural color makes this lamp table especially attractive. Just about the minimum of stock is used in the construction. The "legs" are two pine boards, the outer faces of which are fluted to relieve plainness. Two feet and a stretcher finish off the legs. The top consists of a number of ⅞-in. strips of softwood edge-glued to build out to the proper width, this assembly making the core for the crotch veneer.





The veneers are prepared for laying by trimming a burl or crotch-figured piece with two straightedges and then taping 4-in. strips to the center piece, Fig. 2. These end strips should be of a straight-grained contrasting wood and should be cut so that the grain runs the short way. Then the veneer sheet is glued, tape side up, to the core, covered with heavy paper as in

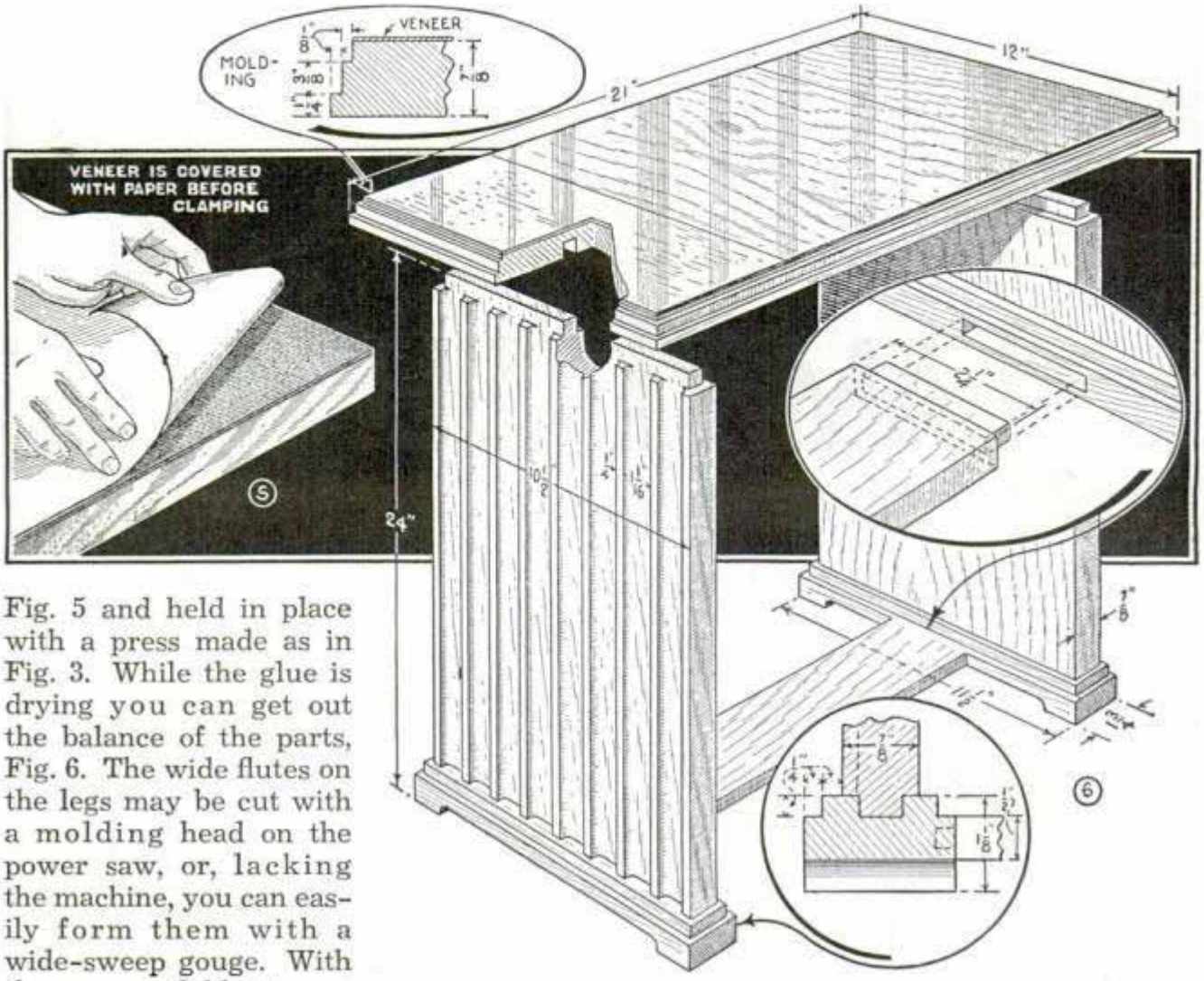


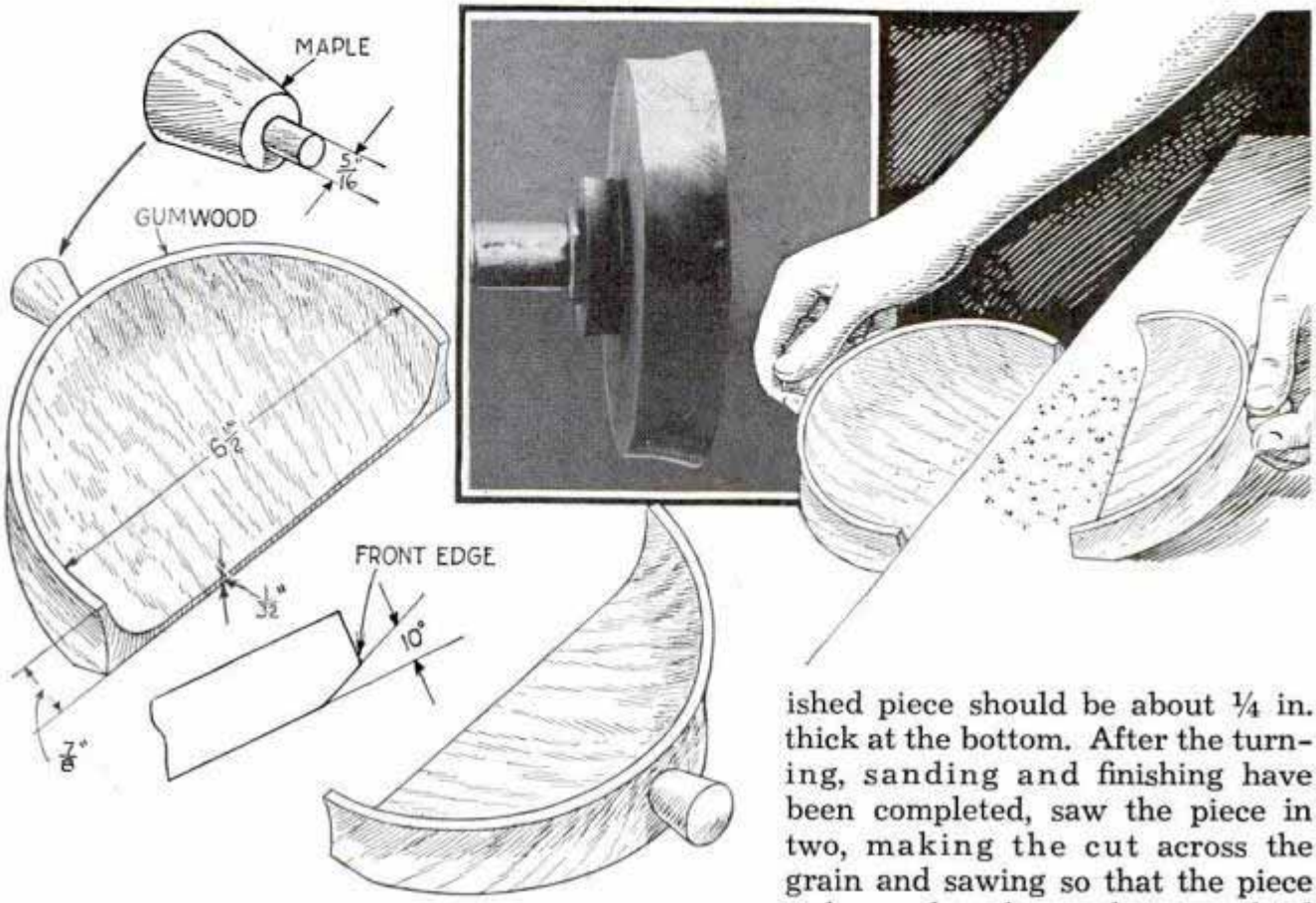
Fig. 5 and held in place with a press made as in Fig. 3. While the glue is drying you can get out the balance of the parts, Fig. 6. The wide flutes on the legs may be cut with a molding head on the power saw, or, lacking the machine, you can easily form them with a wide-sweep gouge. With the saw available, tenons are cut on the ends of the uprights and registering stopped grooves in the top and both feet, as shown. Without the machine these parts can be joined with either dowels or screws and glue. Now the top can be squared up to finished size and the edges molded. Fig. 6 suggests one style of molding which is suitable. Other designs could be worked out. This done, and the top fastened in place, sand and finish the veneer in the natural color with filler, shellac and wax. Enamel all edges and the feet black and finish the uprights in white, taking special care that the colors do not run. Then go over the whole thing with fine steel wool to dull the surfaces to a satin gloss. For a high-gloss finish flow on a final coat of enamel.

This Tinsmith's Toolbox Adapts Itself to Any Roof Pitch

In order to keep his tools close at hand while working on a roof, one tinsmith made this carrier, the box of which remains level regardless of the roof pitch. The carrier consists of a flat-iron frame between the ends of which is loosely pivoted a toolbox made from a length of 6-in. eave trough. The horizontal feet of the carrier are bent downward slightly and are pointed to prevent slipping on a roof.

¶When a negative sticks to the print paper, it can be loosened by soaking in hypo.

Crumb Tray and Comb Turned in One Piece



Just the thing to remove crumbs from a tablecloth, this comb-and-tray set is turned in one piece from hardwood. When turning the piece, allow for plenty of waste at the back so that the hole made by the screw chuck can be turned out later. The finished piece should be about ¼ in. thick at the bottom. After the turning, sanding and finishing have been completed, saw the piece in two, making the cut across the grain and sawing so that the piece to be used as the comb is one third the size of the other. Next, bevel the undersides of the severed edges at a 10° angle so that they are about 1/32 in. thick. Drill each piece at the back to take a knob or handle, which is turned as indicated.

—Dale R. Van Horn, Lincoln, Nebr.

Beehives Are Sterilized Thoroughly with Blowtorch Flame

An effective way of sterilizing beehives is to use a blowtorch. The hottest flame should be used, passing it slowly up and down the inside of the hives. Care must be taken in using the flame, of course, to avoid charring the surface of the wood. Every corner can be reached in this way and the hives are completely sterilized without leaving any disagreeable odor. All separate parts of the hive should be gone over with the flame.

—Truman Greenwalt, Litchfield, Ill.

There are no germs left in cracks and corners when you sterilize beehives with a blowtorch

Mixing powdered boracic acid, 5 grains, with each ounce of shellac to be used as an undercoat on wood causes the shellac to dry very hard so that it serves as a filler as well as an undercoat.

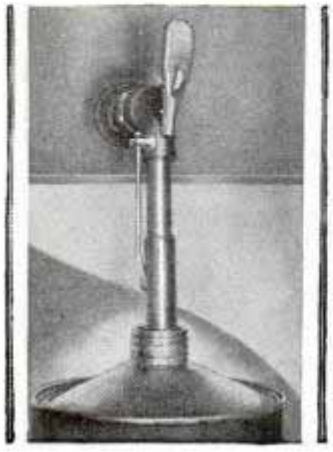
Composition Roofing Cut Easily by Length of Wire

This tool will cut felt roofing paper and linoleum smoothly without having to clean the cutter

The usually difficult job of cutting roofing paper, linoleum and similar material is done easily with this cutter. Made by bolting two lengths of wood together at one end, the cutter uses a length of piano wire to sever the paper, the wire being fastened to one of the bolts. In use, the wire is placed under the material to be cut and the wood strips are placed on top, after which the wire is pulled through the material as shown in the illustration.

Filler Pipe on Kerosene Barrel Telescopes for Easy Insertion

Attached to the faucet of your kerosene barrel, this telescoping filler pipe enables you to fill a stove reservoir or oil-burning heater easily. It is made from two lengths of tubing, the lower section of which is a snug, sliding fit on the upper section. The lower part is kept from dropping too far down by a stop rod. When the tank or reservoir is filled all you have to do is just move the sliding section upward to remove the tank.



— Edwin Kilburn, Spring Valley, Minn.

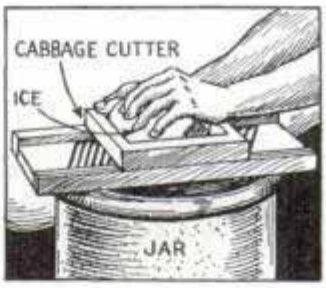
Chemist's Glass Bottle Tops Made from Small Tumblers

I have found that small glass tumblers, obtainable at a dime store, make excellent bottle caps for the amateur chemist to protect the necks of acid and reagent bottles from dust. Used in this manner, the glasses help to prevent the contents of the bottles from becoming contaminated.

—George Vias, Chicago.

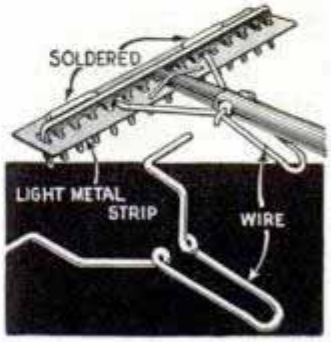
Cabbage Cutter Shaves Ice

When it is necessary to cool lemonade or other beverages quickly, ice can be shaved easily on an ordinary cabbage cutter. A piece of ice is merely placed in the sliding hopper of the cutter and moved back and forth under pressure of the hand. The ice shavings may be collected in a stone jar or similar receptacle large enough to support the cutter.—G. E. Hendrickson, Argyle, Wis.



Leaf Expeller on Garden Rake

If you use a garden rake to gather leaves from your lawn, this expeller is just the thing to free the rake teeth when they become clogged. It is nothing more than a strip of light sheet metal perforated to slip over the teeth and provided with a heavy wire handle bent to the shape

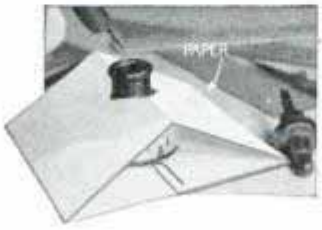


shown, soldered to the sheet metal and pivoted to the rake handle. In use, both the wire handle and the rake handle are forced together to remove leaves.

—Denver Jewell, Sullivan, Ind.

Bottle Holder for Drawing Ink Folded from Paper

When working on the drawing board and there is no holder for your ink bottle at hand, one can be made in a jiffy from a piece of fairly stiff paper. Cut the sheet 4½ in. wide and fold it into four equal parts. Then cut a square opening in the center and fold it as shown in the photo. Next take a piece of cardboard 4 in. square and slip it under the bottle, fastening the cardboard and paper together with paper clips.



—J. F. Schindler, East Syracuse, N. Y.

Christmas-Tree Lamps Tested in Your Flashlight

When you get ready to decorate your tree this Christmas, you can test the series type of lamps in a 2 or 3-cell flashlight. The flashlight battery is not strong enough to illuminate them at full brilliancy, of course, but it will cause them to glow sufficiently to tell whether or not they are burned out.—J. T. Whitmore, Aurora, Ill.

Screw those questionable Christmas-tree lamps into your flashlight to see if they are in good condition

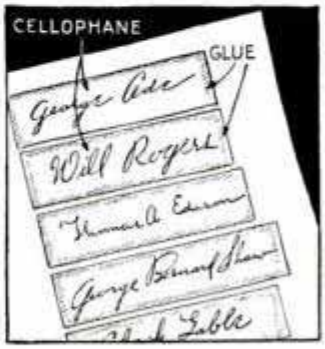
Reflector on Drawing Board Reduces Shadows

This reflector is quickly adjusted to direct a soft light on any part of a drawing board

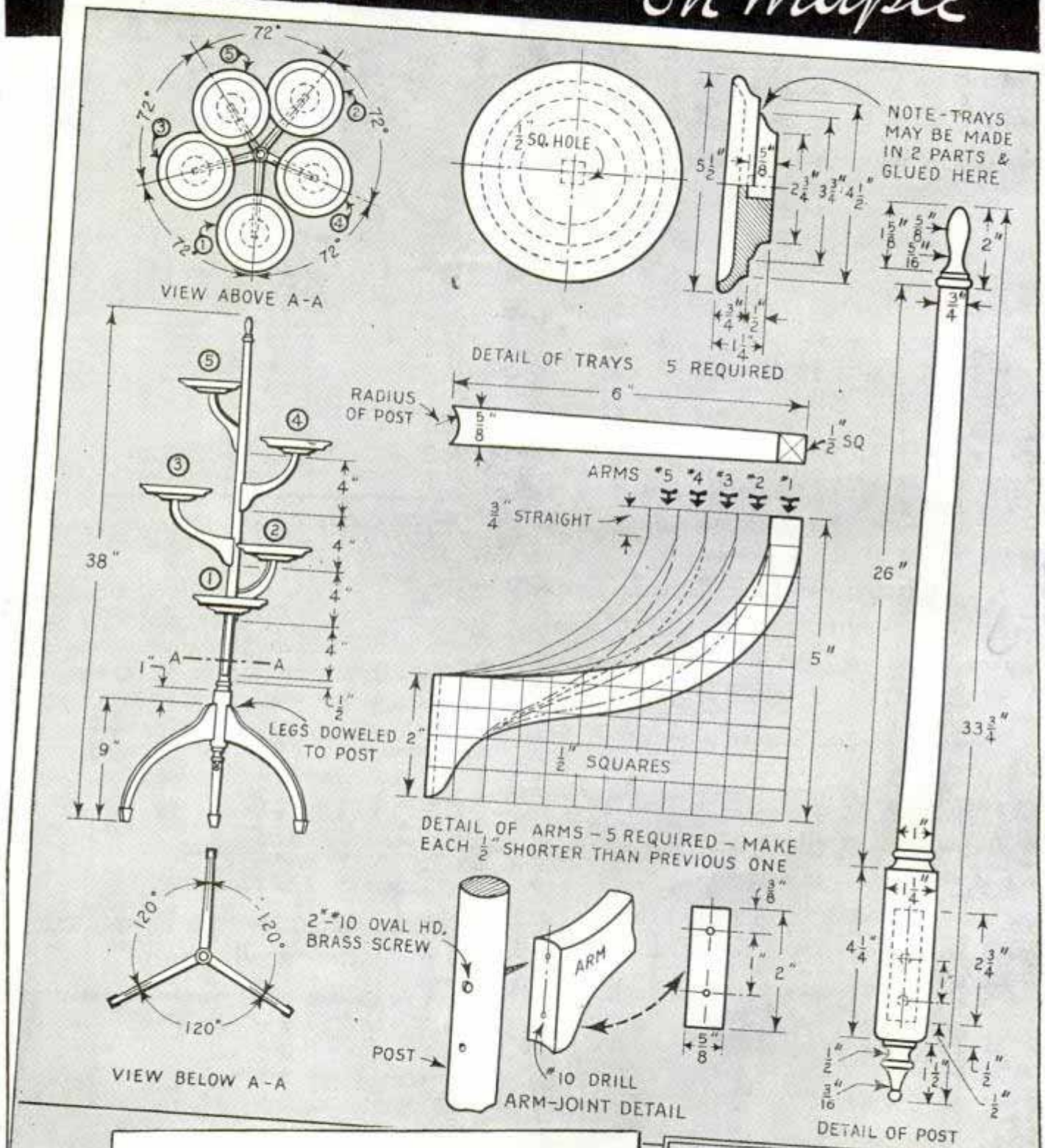
Shadows on a drawing board caused by incorrect lighting can be minimized by use of this reflector. It consists of a piece of polished aluminum or white cardboard tacked to a wood bracket, which is cut to the shape indicated in the detail. The bracket should be heavy enough to support the reflector without tipping. In use, the reflector is placed on the drawing board so that it reflects the light on the shadowed part of the work.

Autographs Are Protected by "Cellophane"

If you are a collector of autographs, the writing can be protected by gluing strips of Cellophane over the signatures. Clear Cellophane should be used and is hardly noticeable when put in place. Glue or regular Cellophane adhesive is best for attaching the strips, or you can get gummed Cellophane tape.



NEW "BLONDE" FINISH *on maple*

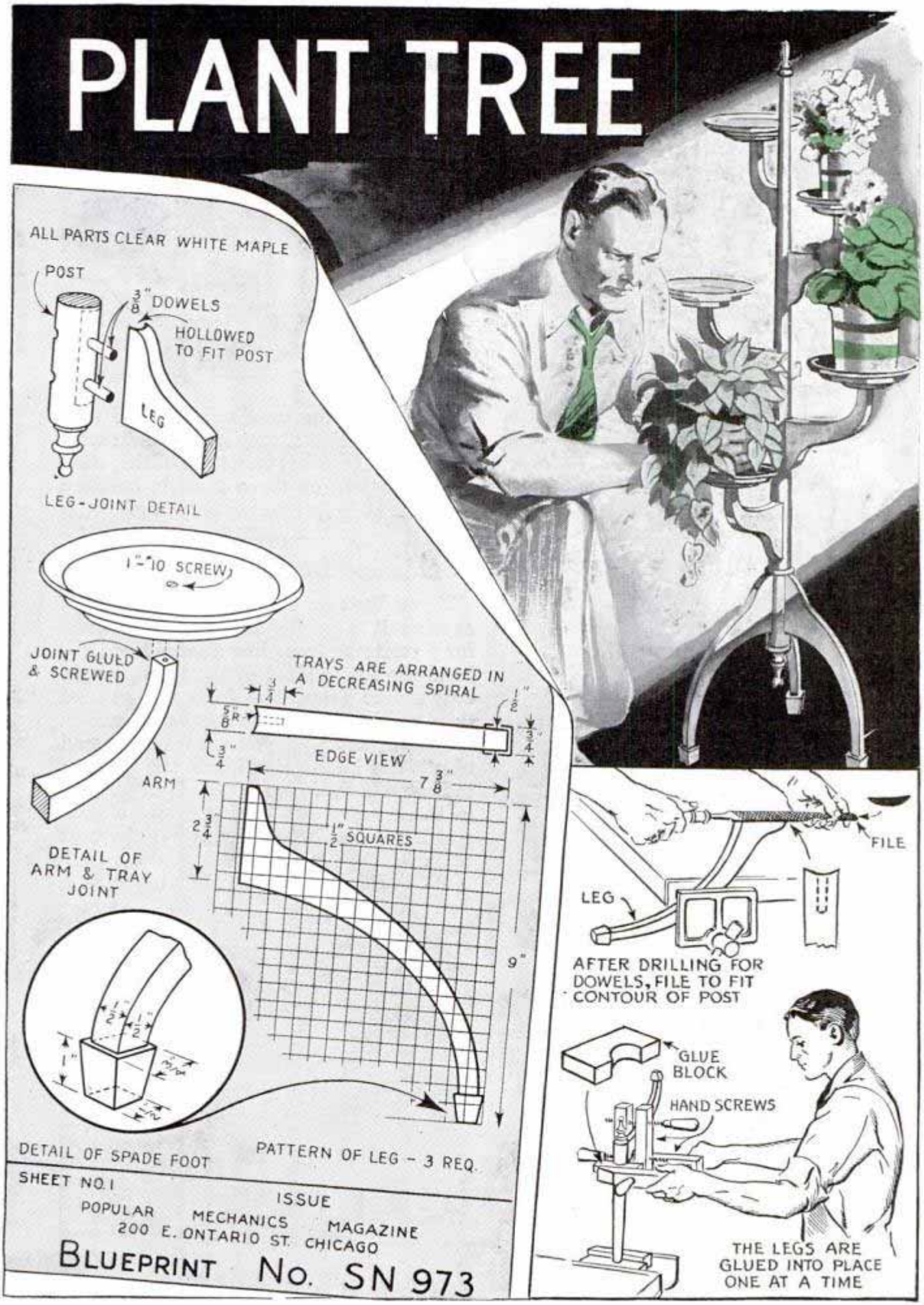


SCALE OF
DESIGNED
DRAWN BY

Holding five potted flowers, this plant tree may be used in any setting either modern or antique without detracting from its decorative value. The trays are arranged in a pleasing spiral line around the post and taper toward the top in pine-tree fashion. If the tree is turned from clear white maple, three coats of colorless varnish will produce a "blonde" finish that is so popular now

POPULAR MECHANICS MAGAZINE

PLANT TREE



SHEET NO. 1

ISSUE

POPULAR MECHANICS MAGAZINE
200 E. ONTARIO ST. CHICAGO

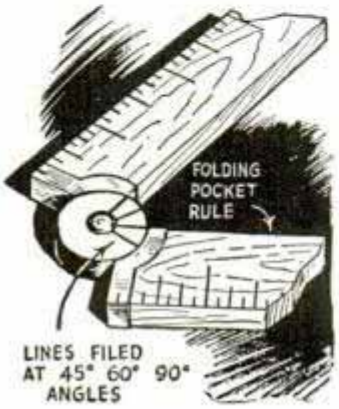
BLUEPRINT No. SN 973

Baby-Carriage "Saddle Bags" for Shopping Trips

If there isn't room in the baby carriage, these bags will hold your packages

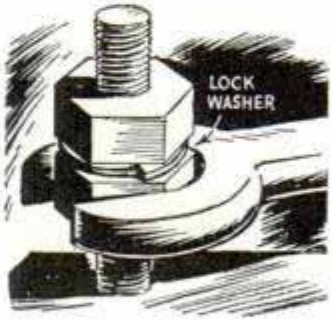
Busy mothers who must wheel the baby to the store to do the day's shopping will find that these bags are just the thing in which to carry packages. Joined with a leather strap or a strip of heavy canvas, the bags are hung across the carriage as indicated. You can make them of heavy canvas.—Opie Read, Jr., Chicago.

Protractor Scribed on Rule Joint Handy for Many Jobs



You'll find many jobs where a simple protractor scale scribed on one joint of your folding rule will come in handy in figuring angles. The scale is laid out with the aid of a protractor, lines being marked to indicate 45, 60 and 90-degree angles. Lines to indicate angles between these can be made, of course, if your work requires them.

Removing Tight Stud Bolts

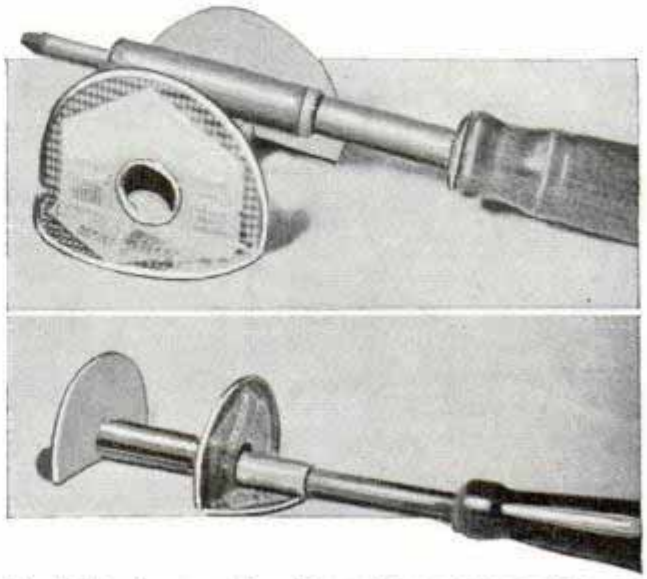


When removing a stud by means of two nuts locked together on the threads, place a spring-type lock washer between the nuts and there will be less possibility of damaging the threads. The washer keeps the nuts separated so that if they should both happen to turn together on a tight-fitting stud, there are two or three threads between them which help prevent stripping.

Soldering Iron Rest from Spool

If you have an empty wire solder spool at hand, it is quickly converted into a rest for a soldering iron. For a large iron, just bend the lower sides of the spool flanges outward to prevent it from rolling, and then lay the iron on the spool as shown in the upper detail. If you are using a small iron it can be inserted inside the spool as indicated in the lower detail. Using a spool in this manner not only provides a good rest but it also helps to conserve the heat of the iron.

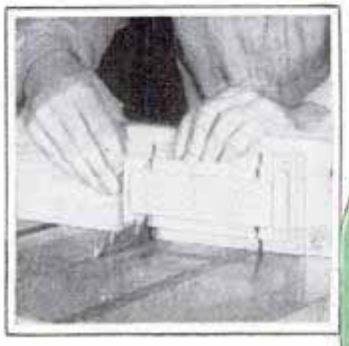
—R. C. Hitchcock, Upper Montclair, N. J.

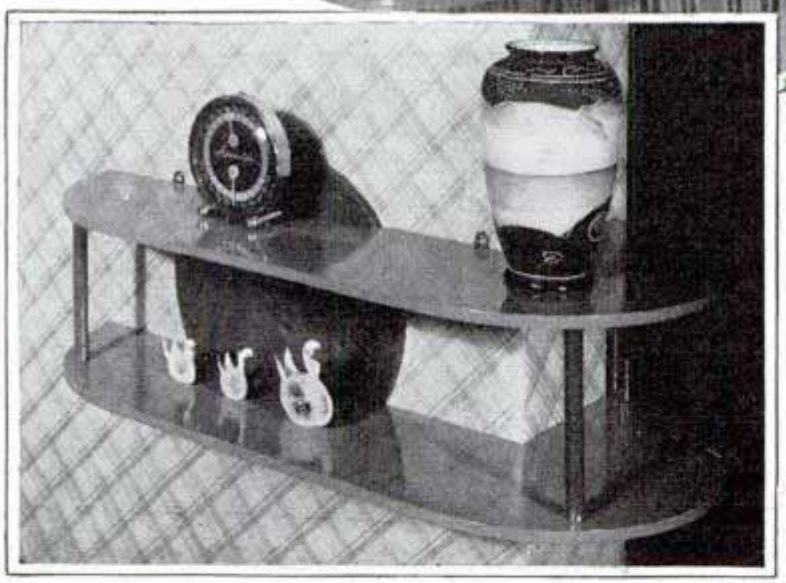


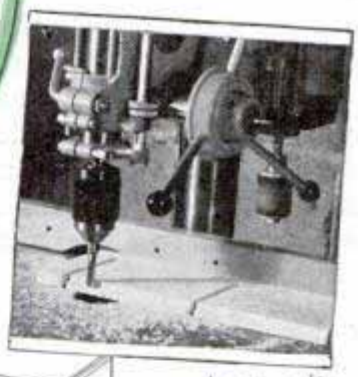
Bend the flanges of a wire solder spool at right angles and you have a rest for your soldering iron

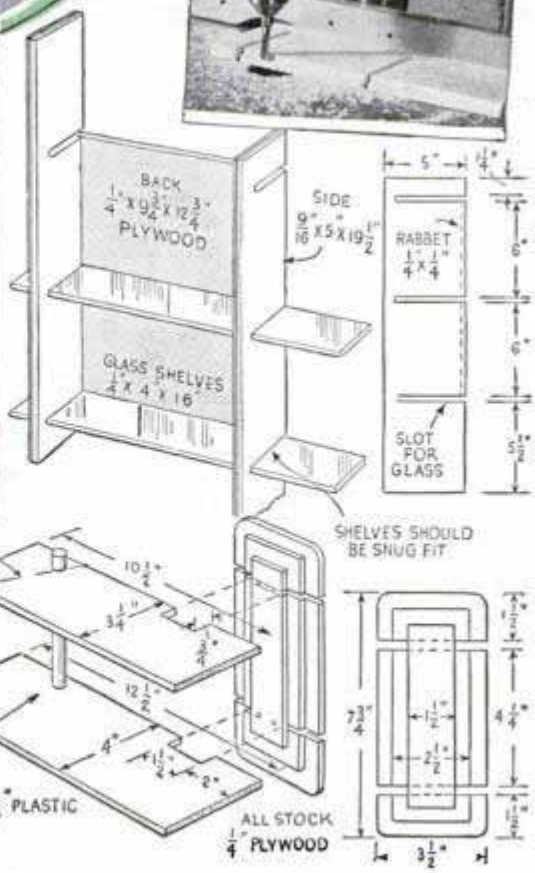
3 Little SHELVES

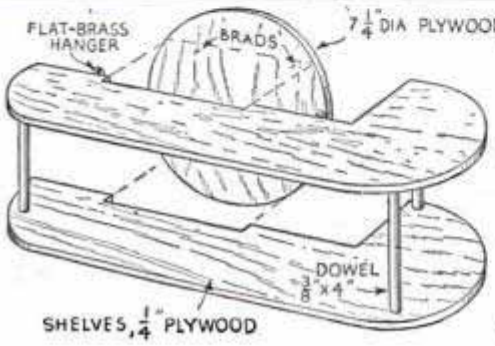
Any one of these attractive wall-shelf units can be made in one evening. The glass for the shelf at the right is regular shelf glass obtainable at a dime store. The two lower shelves are made of ¼-in. plywood. Notice how the wood is laid out for jig-sawing the outside corner shelf without waste. All the shelves are finished with paint or lacquer to suit. The edges can be painted black or in a contrasting color if desired

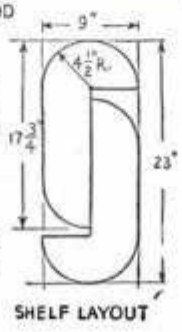










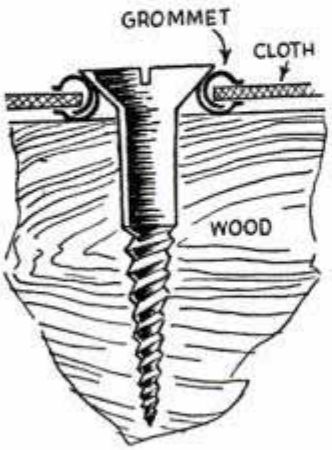


Sheet Metal Is Rotated on Pivot to Cut Duplicate Disks

Sheet metal rotated on adjustable pivot bolt to cut disks of almost any desired diameter

Difficulty of following scribed circles on sheet metal to cut a number of disks, caused one workman to rig up this simple centering device. It consists of a length of flat iron bent to the shape indicated and drilled at ½-in. intervals to receive a pointed stove bolt, which serves as a pivot for the work. In use, one end of the device is screwed to the bench top and the other end is held in a vise along with one handle of the shears. The metal sheets are center-punched and each one in turn is placed on the pivot bolt to be rotated at the desired radius while the shears are operated.

Applying Grommets to Sails

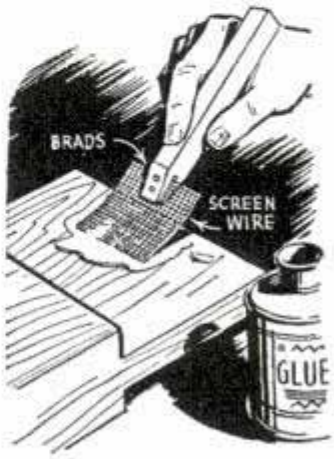


Here is an easy method of applying grommets to sails, tarpaulins and other material. Take a wood screw having a body of a size to slip easily through a grommet and drill a hole in a wood block to take the screw. To apply a grommet, arrange it in the hole in the cloth, and then place the assembly over the hole in the block. Next insert the screw and drive the head down on the grommet with a hammer. The screw should be hammered almost flush with the top of the grommet to give a tight job.

—D. G. Ellson, New Haven, Conn.

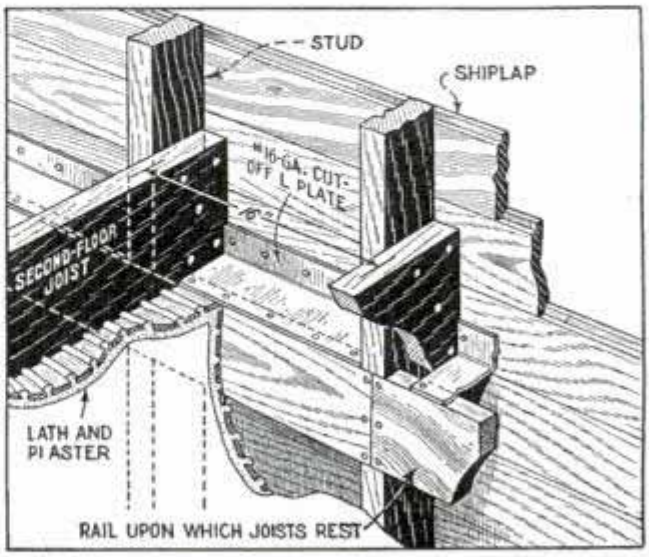
Screen-Wire Spreader for Glue

On many jobs a small square of screen wire tacked to a stick makes a better glue spreader than a brush. When dipped into the glue pot, the meshes of the wire fill with glue, which can then be distributed evenly on the work.



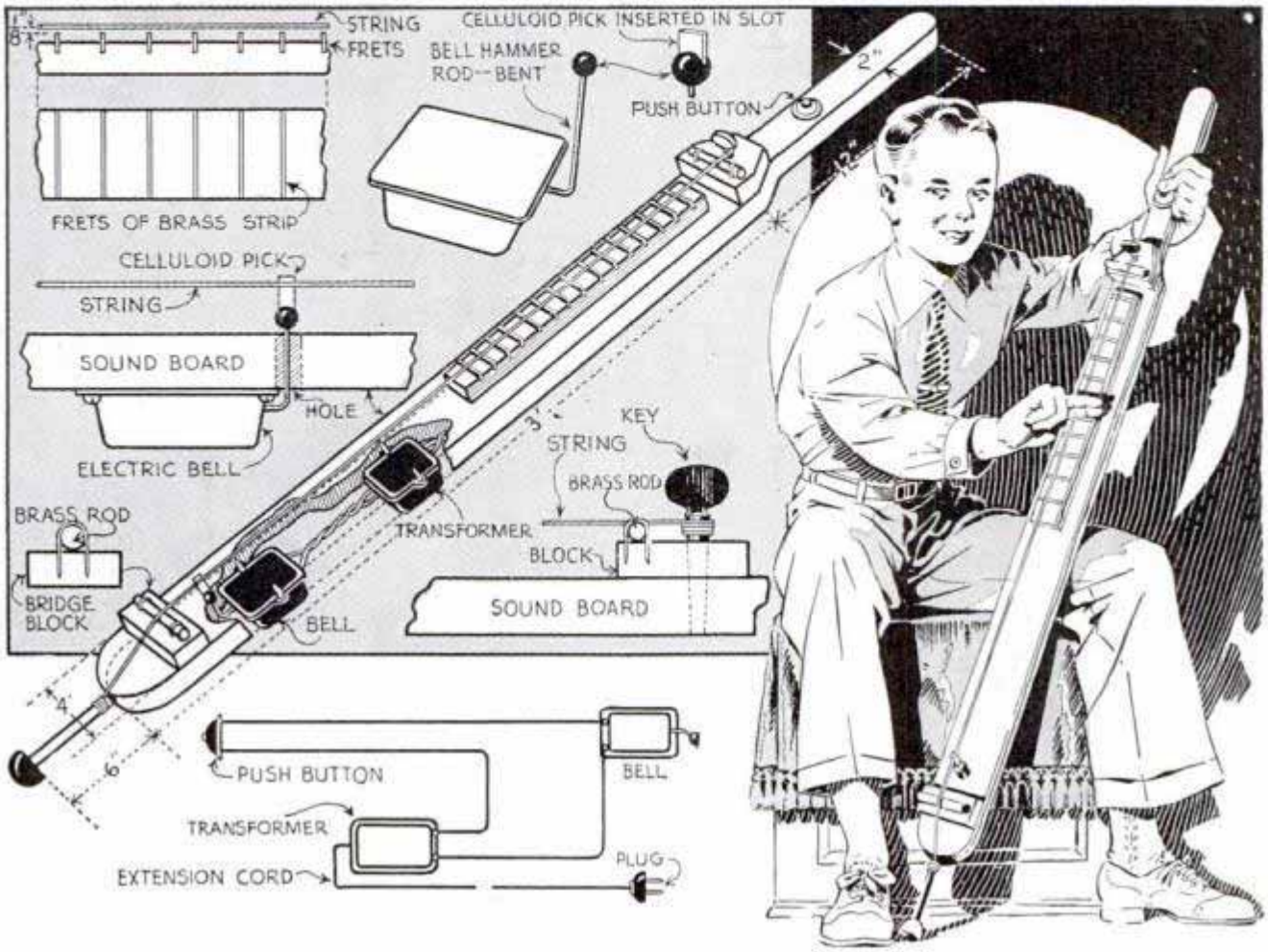
Fire Stop Between House Studs of "Balloon" Type Frame

When building a house that is to have a "balloon" type frame, which consists of running the studs full height of the walls, and it is desired to eliminate the flue effect between the studs resulting from this type of construction, a fire stop can be provided as indicated. The stop consists of strips of sheet metal installed on the joist rail at the second floor to close the air space between the studs. The metal is bent at right angles and is nailed to the sheathing and also to the rail on which the joists rest.



Sheet metal strips between studs seal off air space and prevent fire hazard caused by flue effect

Electricity Plays This One-String 'Vibro' Fiddle



Here's a one-stringed musical instrument that can be played wherever 110-volt current is available. Principal parts required are a sounding board, a steel guitar string, a doorbell and transformer with push-button switch and a few odds and ends of brass and steel rod. The sounding board is a length of ¾-in. pine, 48 in. long and 4 in. wide. One end is tapered for a comfortable handhold, the other rounded as shown. A hole in the lower end of the board takes a 6-in. length of steel rod, one end of which is fitted with a rubber chair tip. Blocks of softwood form a bridge for the string, which is tensioned with a key taken from an old banjo or guitar, and fitted into a tapered hole in the upper block. The fret board is of thin wood grooved at right angles for strips of sheet brass all cut to exactly the same width. These are placed at distances to give the proper pitched notes of the scale. Some experimentation will be necessary due to variations in the sounding board. The ball of the striker is slotted to take a celluloid pick as shown. The switch controls this action nicely. Holding down the push button slurs the notes, while releasing it between notes gives a staccato effect.

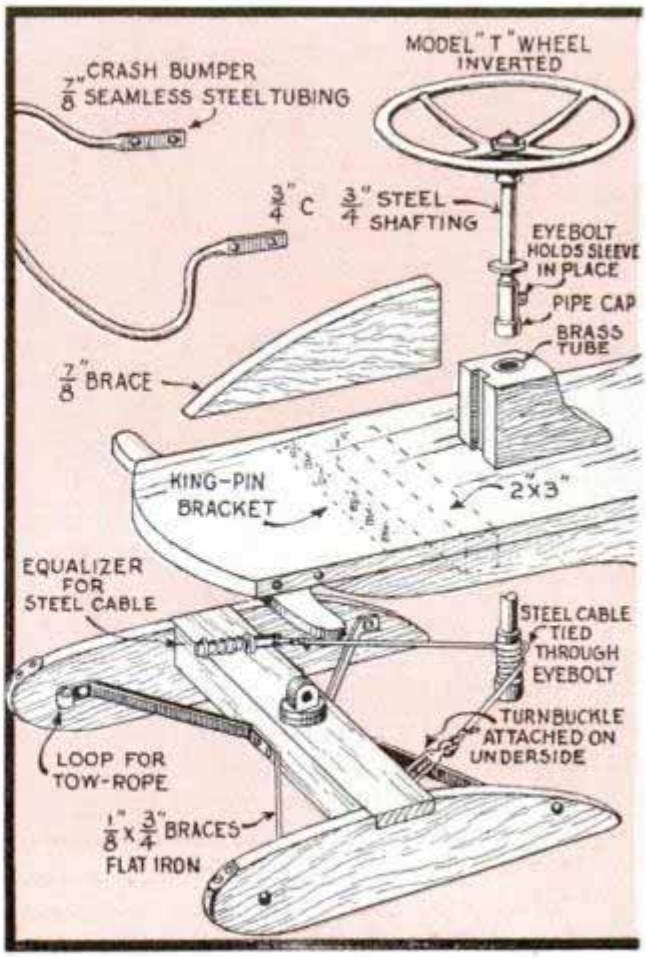
Paper Cone Holds Bottle Cap to Serve Hot Coffee

When hot coffee is carried in an insulated bottle, and no extra cup or container is at hand in which to serve it, a piece of paper from the lunch basket may be rolled to form a cone into which the bottle cap will fit quite snugly. With this holder, which keeps it from burning the hand, the cap will provide a convenient and comfortable cup for the purpose.

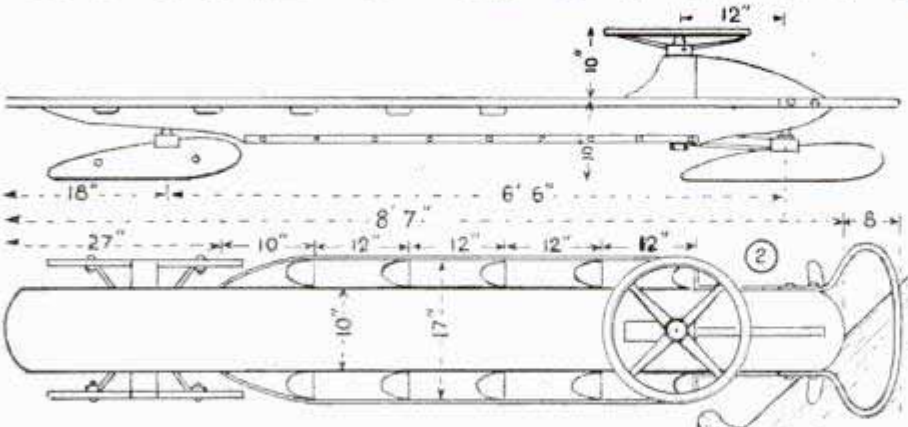
Express Ride ON THIS

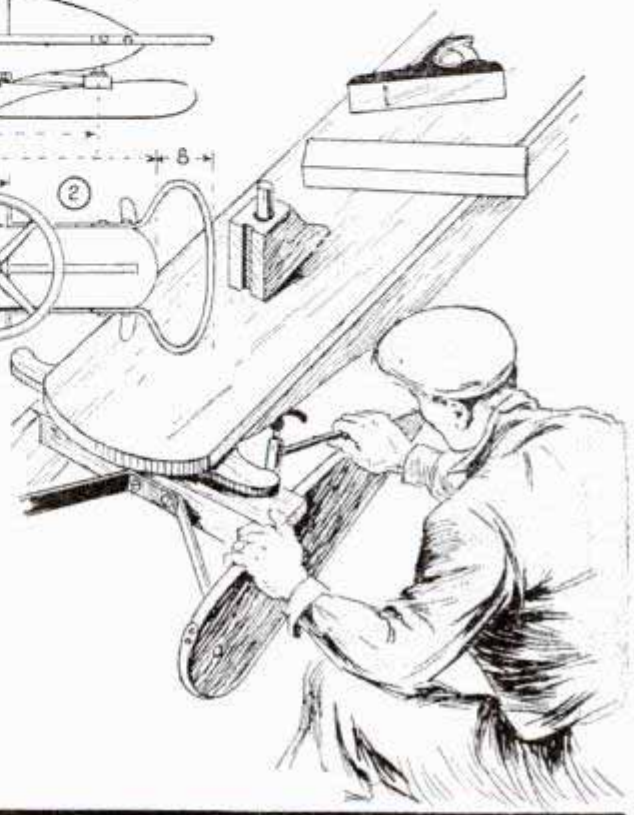
SAFETY features are built right into the streamline design of this speedy bobsled. The steering cables are always taut; feet, legs and arms of the passengers are lower than the seat and are protected by a heavy metal-faced guard which also serves as a footrest; a box-type body gives rigidity and strength combined with light weight, while a low center of gravity holds the liner true on its course at top speeds. Although this is a six-passenger job, it can be made to accommodate eight passengers, or cut back for only four persons without altering any dimensions save the over-all length.

General details are given in Figs. 1, 2 and 3. Assembly of the body is shown in Fig. 3, along with a sectional view of the box construction. Use brass or galvanized screws, with the heads countersunk, and waterproof casein glue in all joints. The bulkheads are of ⅞-in. pine. Side members are of ¾-in. pine with handholes spaced at 12-in. intervals as shown. To these are screwed the footrests, made up of individual pieces to simplify sawing. The strap-iron guard rail is screwed along the outside. For the steering assembly mount a steering wheel from a model-T Ford on a steel shaft. On the lower end, to increase the diameter only, fit a short section of pipe with a cap on the lower end. An eyebolt without nut is screwed into this and the shaft. This eyebolt also serves to keep the cable from slipping. A section of brass tube is installed in the upright block for a bearing as in Fig. 3. The curved wood brace is rabbeted into the upright block, and fastened with long screws up through the seat board. For the bumper a



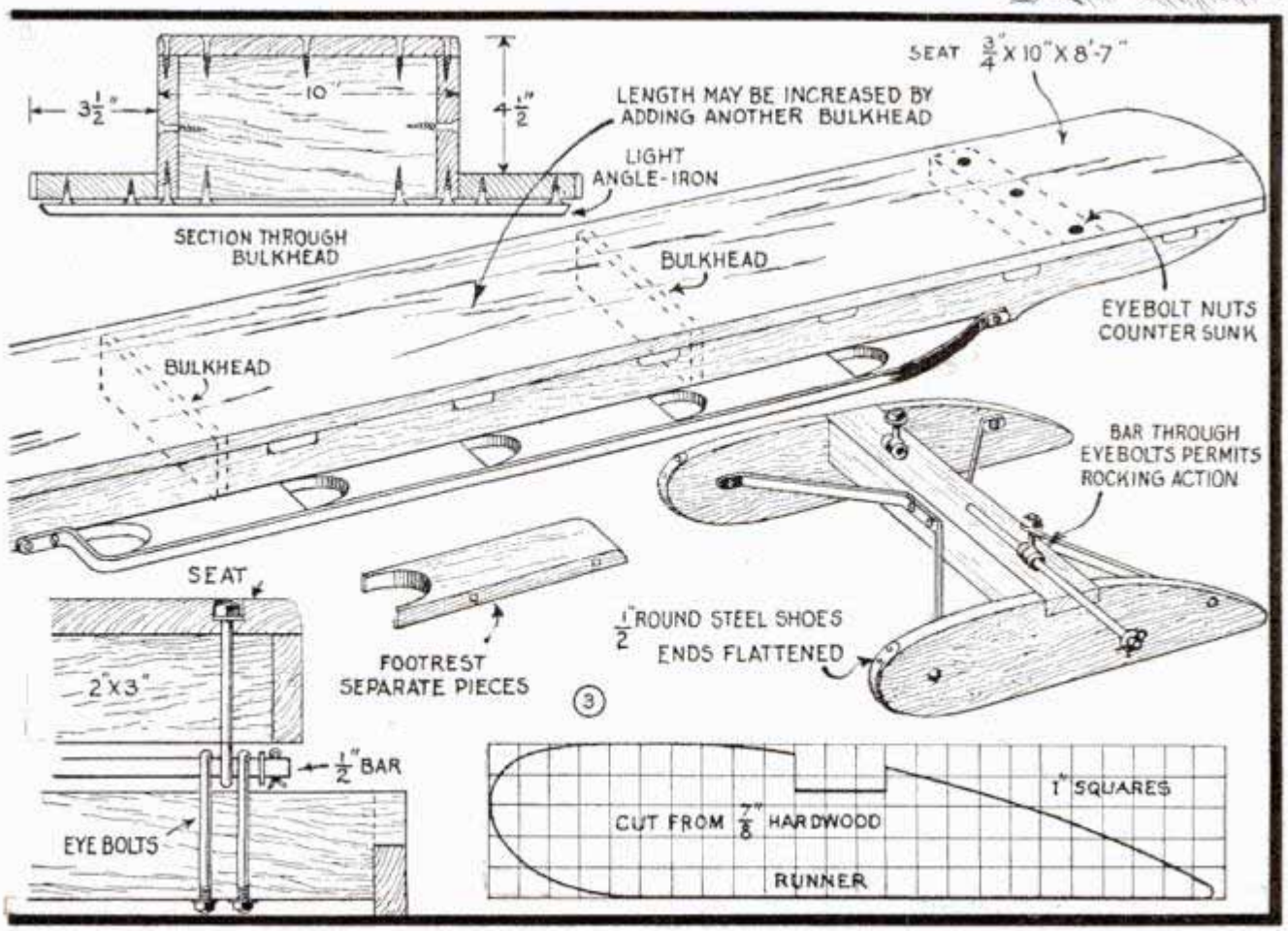
STURDY "SNOWLINER"

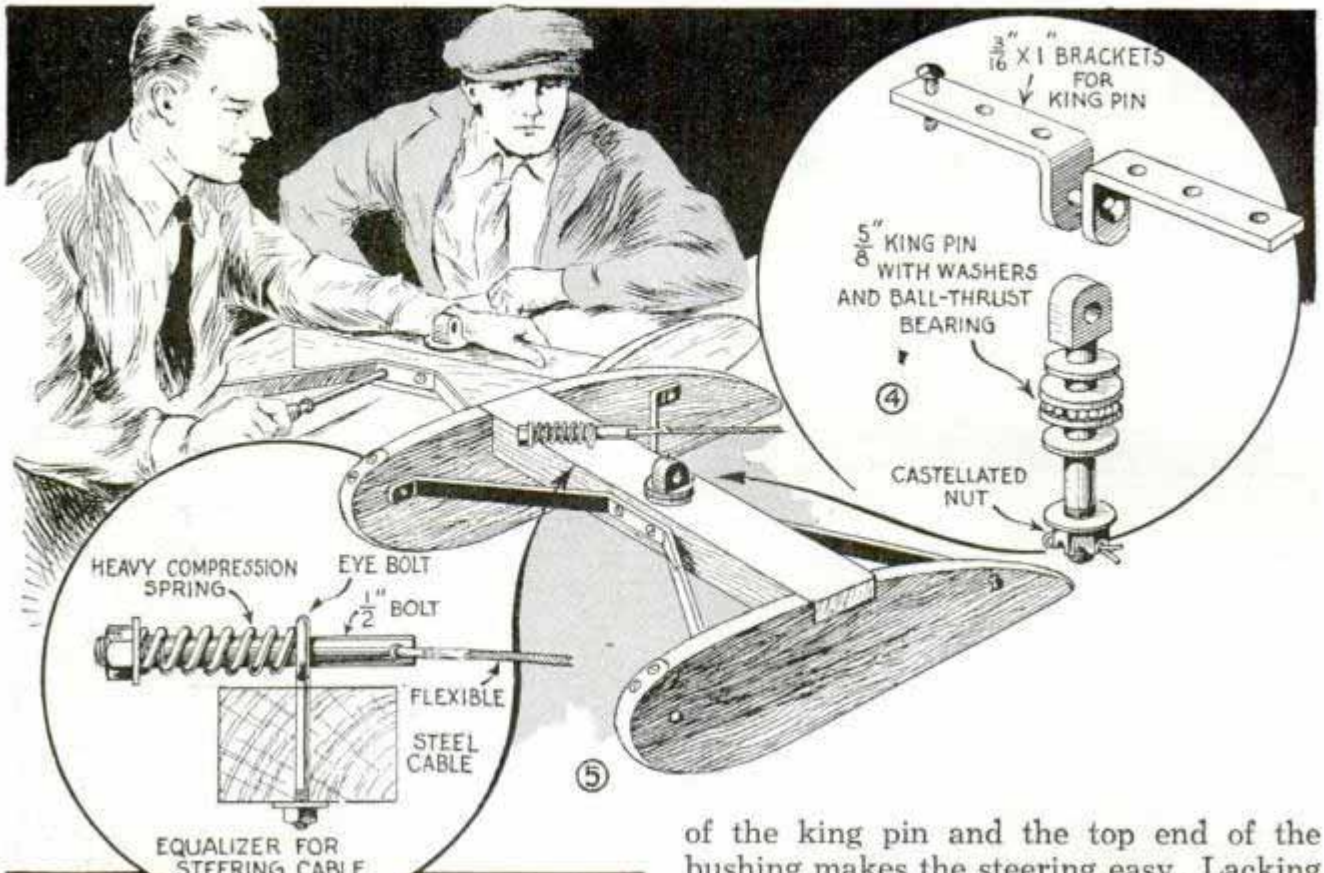


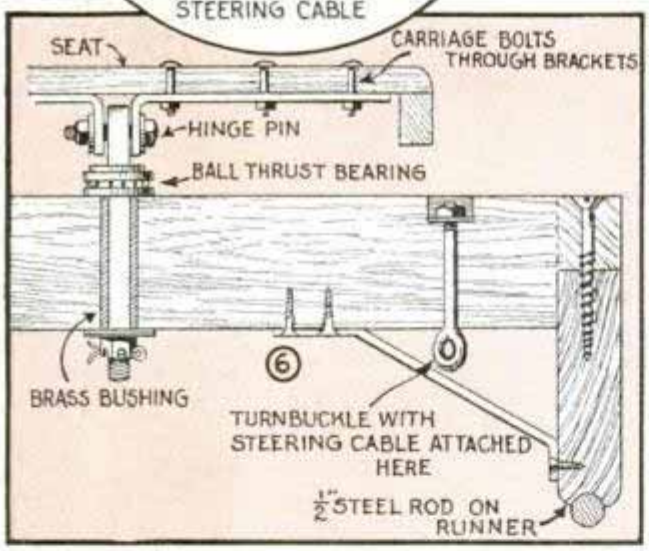


steel tube is bent to the form shown, flattened at the ends and fastened to the seat with heavy screws.

The front pair of runners is assembled as shown in Fig. 5, strongly braced and fitted with round steel shoes, flattened and screwed at the ends. The shoe fits in a groove about ¼ in. deep, Fig. 6. Note that the steering cable is connected on top of the cross member at one side and at the bottom on the other, so the cable will not



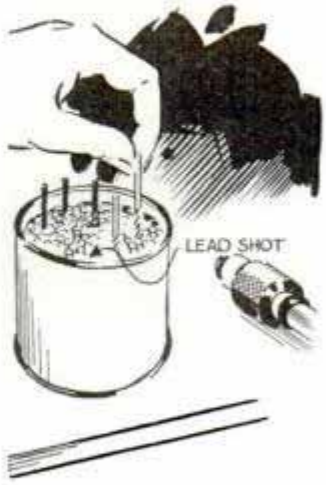




climb on the steering shaft. A turnbuckle is inserted at one end, and the other is connected with an equalizing coil spring, so that the cable will be under tension in any position. Use a 3/16-in. woven-steel cable.

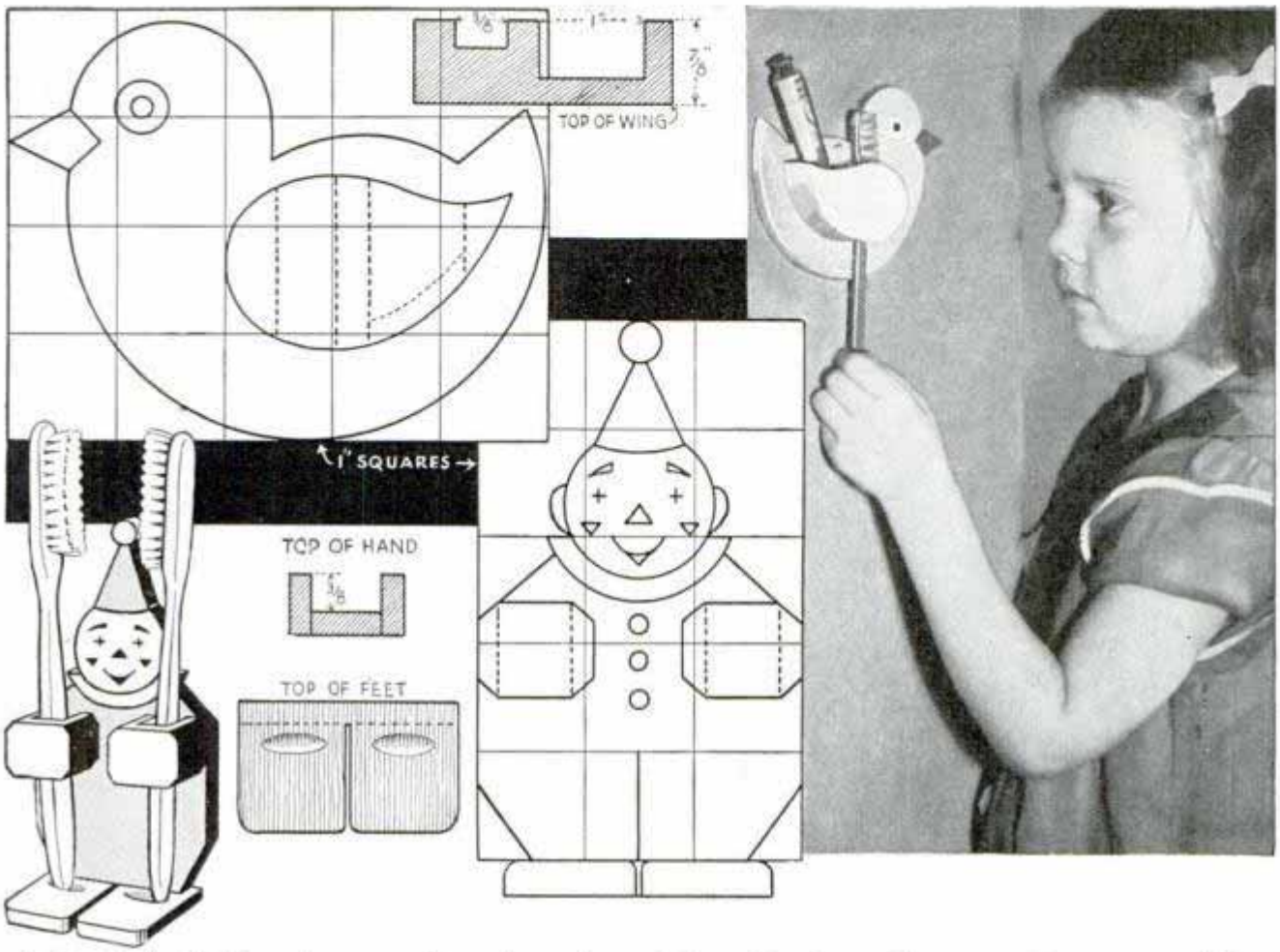
The front runners oscillate by means of a bracket made of two angles and attached to the bottom of the seat. A bolt through the two halves of the bracket and the flattened top of the king pin forms the pivot, as in Figs. 4 and 6. The king pin can be made by flattening the head of a 5/8-in. machine bolt, then drilling for a 1/2-in. hinge pin. The king pin turns in a brass bushing, Fig. 6. A ball thrust bearing between the head of the king pin and the top end of the bushing makes the steering easy. Lacking this, use a large washer riding on a brass one. A castellated nut is keyed to the lower end of the king pin. A profile of the runners, all being identical, is shown in Fig. 3. Use oak or maple for the runners and 2 by 3-in. maple for the cross member, to which the runners are joined with heavy screws and waterproof glue. In painting, use bright colors, such as orange, with black striping, leaving the runners and side members in natural finish.

Drills Held in Can of Lead Shot



Filled with small shot, a can or glass makes a good holder for your twist drills. This holder is heavy and is not easily upset, and a little oil dropped on the shot will help keep the drills from rusting. The can of shot also has an advantage over the usual type of holder in that the drills can be inserted anywhere without stopping your work to insert them carefully in holes.

Novel Toothbrush Holders for Small Children



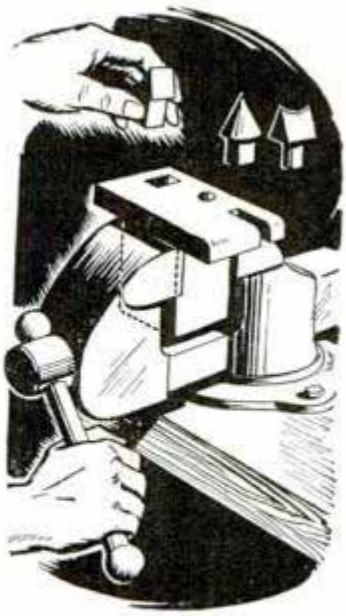
This little bird tucks a toothbrush and a tube of paste under its wing, while the comical clown teasingly holds two brushes in his hands and the paste on his feet. Both figures are scroll-sawed from ¼ or 5/16-in. stock. The bird's wing is notched on the inner surface for the brush and paste before gluing it in place. Hands of the clown are built up as indicated, while the feet are shaped from one piece, depressions being made in the top surface of the feet to take the ends of the toothbrush handles.

Mixture for Gilding

Equal parts of clear lacquer and lacquer thinner form an excellent vehicle for metal powders such as brass, copper, bronze and other colors used in gilding. Mix a small quantity of the powder, about a teaspoonful, with the two liquid vehicles to form the desired consistency. The mixture can be applied with a camel's-hair brush on all surfaces as readily as paint. It covers well and dries very quickly.

—Charles B. Barr, Stratford, Conn.

Simple Attachment Converts Vise to an Anvil



The home-workshop owner who has a bench vise can convert it into an anvil for light work with this homemade attachment. It is cut from a piece of steel to the shape indicated so that it can be gripped in the vise with the flat surface projecting above to take the various cutting tools.

¶ When streets and sidewalks are covered with ice, it's a good idea to stick a strip of adhesive tape crosswise on the soles of your shoes to keep from slipping. Friction tape can also be used for this purpose.

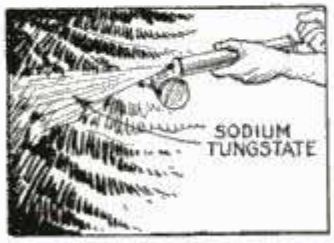
Tubes of Paint Are Identified by Color Tags

Soiled tubes of artist's colors quickly identified by use of color tags

Artists and others who use colors in tubes and have trouble identifying them after they have become soiled, will find that color tags are helpful. The tags are cut from cardboard and tied to the necks of the tubes, after which a little of the color is put on the tags. With this method, a glance at the tags will show you which tube to pick up.

Christmas Tree Flameproofed with Sodium Tungstate

If you illuminate your Christmas tree with candles, why take a chance of it catching fire when it's so easy to flameproof it with a strong solution of sodium tungstate? The solution can be applied to the tree effectively with a common insect sprayer and does not alter the appearance of the tree in any way. When the latter is treated it will stand considerable exposure to a flame before burning. If it does burn, however, it will not blaze but simply char. The tree should be sprayed and allowed to dry a day or two before putting it in use.



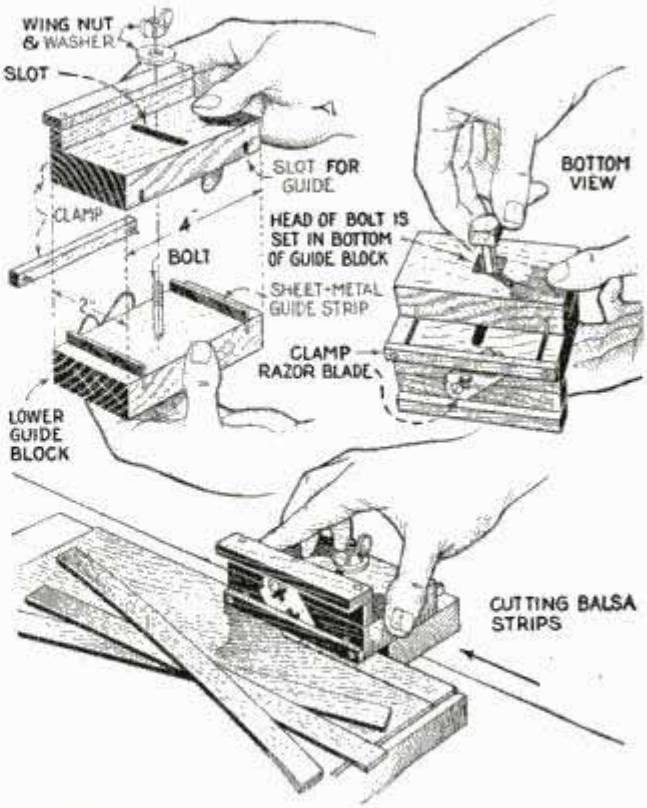
How to Remove Rust Stains from White Cloth

Rust spots can be removed from undyed cloth by soaking the spots in a solution of tin chloride, 2 oz., in water, 1 gal. As soon as the spot has vanished, rinse the material thoroughly in a large volume of clear water. This method should not be used on colored cloth.

Cutter for Thin Balsa Wood Utilizes Old Razor Blades

Just the thing for the modelmaker, this adjustable cutter will cut thin balsa wood into strips of almost any width desired. Assembled from wood blocks and an old safety razor blade as indicated, the cutter can be made any size needed. In use, the thin wood is laid on a table, bench or block of wood having a true side, which is used as a straightedge in guiding the cutter. If desired, a scale can be drawn on one end of the upper block as a guide in adjusting the width of cut to be made.

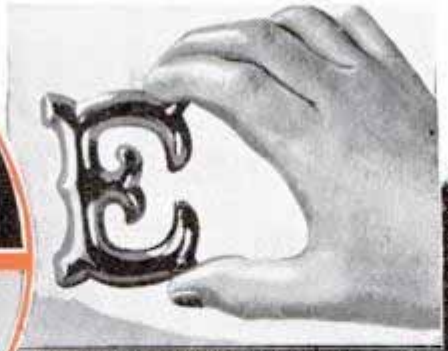
—Edward Hartel, Jamaica Plain, Mass.



Modelmakers will find that they can cut thin balsa into any size of strips needed with this cutter

Litharge CEMENT

has many household uses



SIGN LETTERS ATTACHED TO GLASS · · ·

RE-CEMENTING THREADED SHELL OF ELECTRIC LAMP BULB · · ·

"SHIMMING" LOOSE FURNITURE CASTER

WHEN finely powdered litharge, a form of lead oxide, obtainable at most drug stores, is mixed into a thick paste with glycerine, it quickly hardens into an adhesive, stonelike mass that requires a hammer and chisel to remove it. Although it has many industrial applications, the uses to which it may be put around the house and shop are not generally known. In addition to those shown, it is effective in filling cracks in stoneware, concrete and marble, in building aquariums and for similar purposes. In order to color it, mix the dye with the glycerine before adding the litharge. By partly mixing the plain cement with a portion of colored, a mottled appearance simulating marble is secured. Clean tools and mixing dish immediately, as the cement is difficult to remove once it has set.

REPAIRING TOOL HANDLES

SEALING PIPE JOINTS

INSULATING SOLDERING IRON

PLAIN OR COLORED PUSH PINS · · · MADE BY DIPPING HEADS OF · · · PHONOGRAPH NEEDLES IN CEMENT

LASTING REPAIR FOR TABLEWARE

CEMENT "STEREOTYPES" MADE IN METAL-CASTING MATS · · · ·

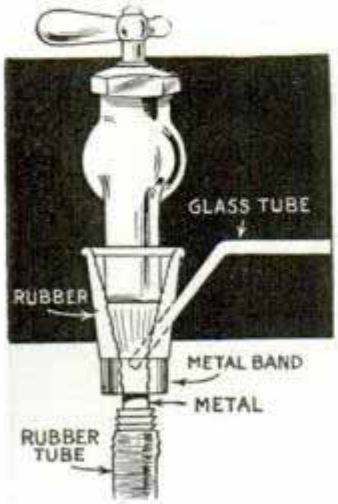
SCREWS IN ELECTRICAL FIXTURES HELD PERMANENTLY IN PLACE · ·

Index Pin on Drill-Press Jig Is Self-Engaging

Boring jig on drill press has self-engaging indexing pin for boring evenly spaced holes

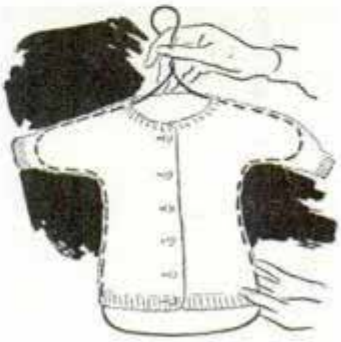
When drilling a series of evenly spaced holes on a drill press, one craftsman fitted his boring jig with an indexing pin, which he improvised from a window spring bolt. The spring action of the plunger permits the pin to self-engage in each preceding hole as the work is advanced. By rounding the nose of the pin slightly, it will locate in the hole more readily. In production work, the pin will speed up operation considerably.—Wayne C. Leckey, Aurora, Ill.

Aspirator from Dime-Store Faucet Connector



Having need of a cheap aspirator at my chemical experimental bench, I made an inexpensive one from a rubber connector used to attach a hose to a sink faucet. Such connectors can be obtained at any ten-cent store. The only alteration necessary is to drill a small hole into one side of the connector at a 60° angle to take a small glass tube as shown in the drawing. When this aspirator is connected to a faucet, and a good head of water passes through it, a vacuum is created, which is useful in accelerating filtration. If the connector is to be used for other purposes, the glass tube can be removed and a glass plug put into the hole.—George J. Vias, Chicago.

Garment Hanger Used as Form for Infants' Sweaters

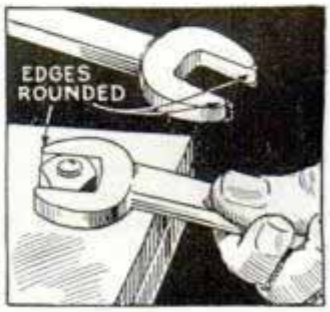


To keep an infant's sweater from shrinking out of shape while it dries after laundering, use this wire form, which is bent from a garment hanger. Then you can hang up the sweater so that it will dry faster than when it is laid out flat on a table.

Belt Lacing Used as Ice Creepers

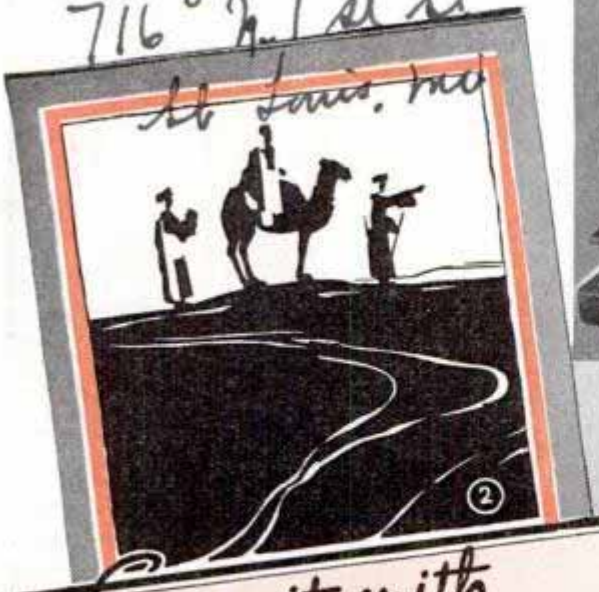
During some bad weather, which left roads and walks coated with ice, a Wisconsin hardware dealer made a quantity of ice creepers from steel belt lacing and skate straps. The lacing was riveted to the straps and the creepers were strapped under the instep of the shoe as shown.

Wrenches with Rounded Noses Slip over Nuts Easily



A set of end wrenches can be improved by rounding the ends as indicated. This makes it easy to slip the wrench over the nut, especially if it should be hard to reach.

Osborne suggest
Berry Machine Co
716 N. 1st St
St Louis, Mo



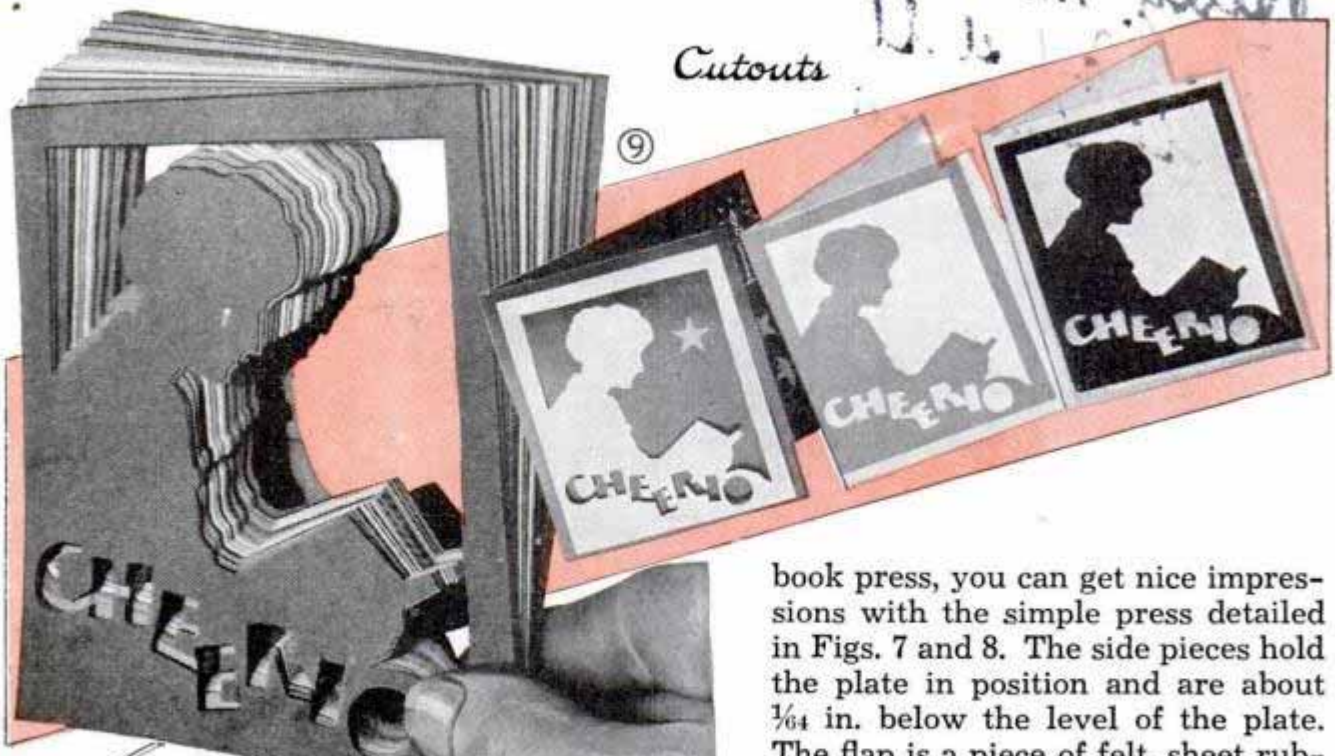
Say it with CHRISTMAS CARDS made at home

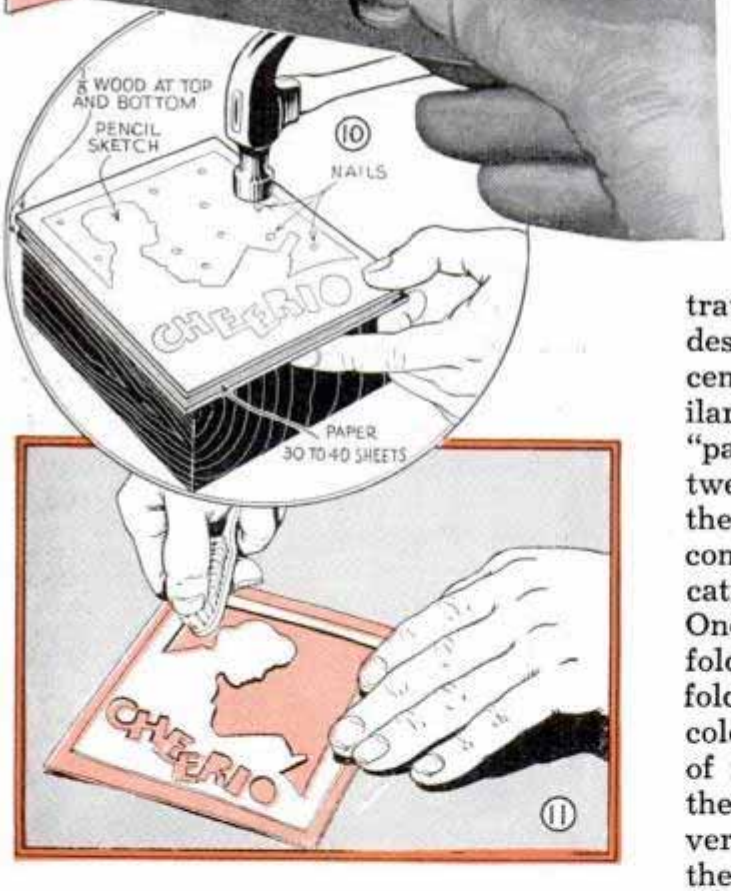
BLOCK PRINTS - CUTOUTS - ENVELOPES, -- NOVELTY AND PHOTOGRAPHIC CARDS

IT'S fun making your own Christmas cards, and the result is emphatically "greetings by you"—not a cold substitute purchased over the counter. Artistic ability is required for some of these cards; others demand no more skill than the ability to paste two pieces of paper together.

Let's start with linoleum block prints. The manner of making these has been told often so we will confine our remarks to a few of the high lights of the process. The printing plate is a suitable

Linoleum "engravings"

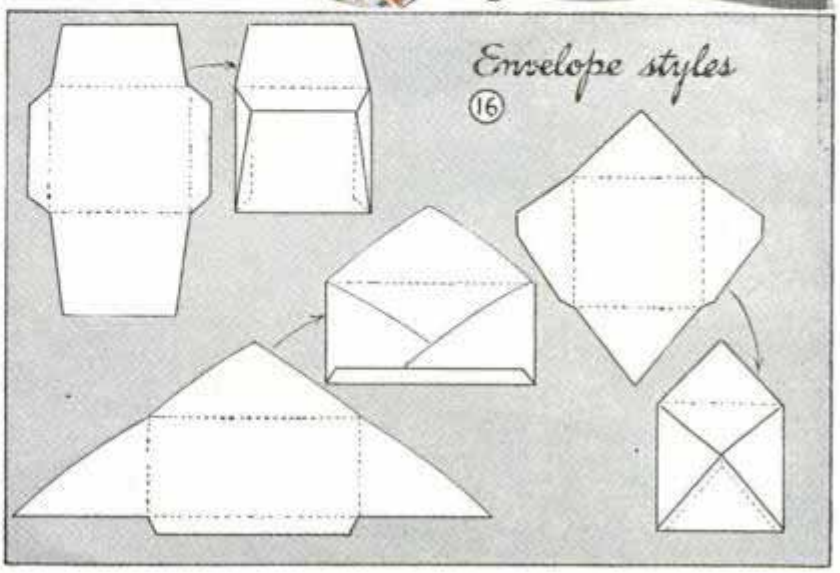




square of battleship linoleum, and on this is tooled the image of the picture which is to ornament the card. Tools for this purpose, together with a little booklet on how to do it, can be purchased from any stationer for about one dollar. After the plate has been made, it is inked with printers' ink, as shown in Fig. 1. The block is then placed in a book press, the paper is laid over it, and the clamp is turned down tightly to make the impression. Lacking a book press, you can get nice impressions with the simple press detailed in Figs. 7 and 8. The side pieces hold the plate in position and are about 1/64 in. below the level of the plate. The flap is a piece of felt, sheet rubber or cardboard. The impression is made by turning the flap down and rubbing with a rolling pin, as in Fig. 7. Typical examples of block printing are shown in Figs. 2 to 6.

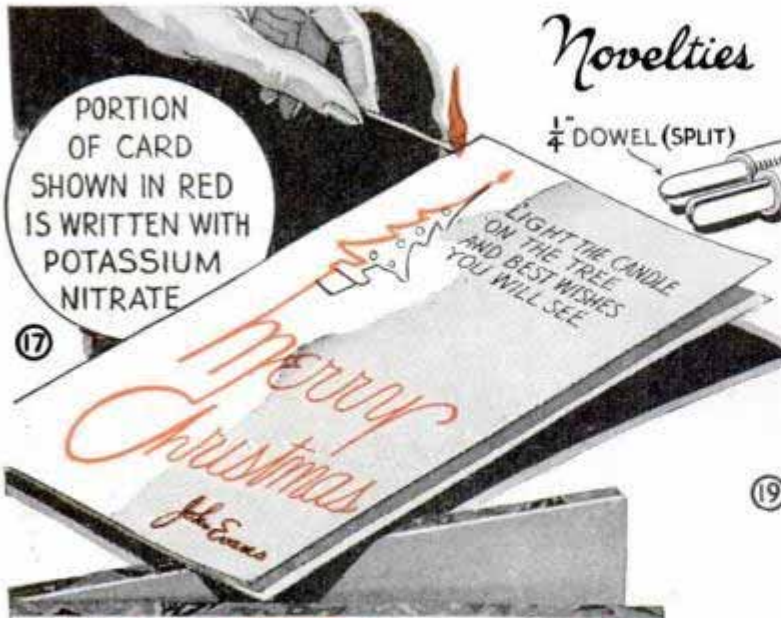
With a scroll saw, you can work wonders with paper cutouts, as illustrated in Figs. 9 to 11 inclusive. A suitable design is first drawn on paper which is cemented to a ⅛-in. piece of wood. A similar piece is used on the bottom of the "pad" with 30 to 50 sheets of paper between the two. See Fig. 10. The design is then cut on a scroll saw, resulting in a complete set of paper cutouts. Three applications of this cutout are shown in Fig. 9. One is a glazed black card with a short fold, the cutout being tipped on the short fold. Another shows a single fold of cream-colored paper, on which is tipped a square of red metallic paper on which is tipped the cutout. The third is a cutout in reverse. That is, the cutout in this case is the portion discarded in the other examples. The cutout is of silver paper and it is tipped on a black card. The lettering is "spatter work," applied by using a stencil and then spattering the color on with a toothbrush, as shown in Fig. 11. In Figs. 12 to 14, the Christmas tree, the moon, and the word "Noel" are cut out on the scroll saw. The edge of the tree is outlined with white and the tree cutout is backed with green metallic paper, while the moon and "Noel" are backed with red metallic paper.

Now we will consider something else: Envelopes . . . and paper. Ordinary stationery in tint colors often can be adapted for greeting-card use, and in this case you would have paper and envelopes to match. However, it's no trick to make your own envelopes, and by using decorative papers you can add a lot to the smartness of the card. Fig. 16 shows various envelope styles. A cardboard pattern should be made so that the outline can be transferred quickly to the paper and cut out. Envelopes should be ⅛ in. larger than cards. Folding is done over a square of cardboard, as shown in Fig. 15. The edges can be cemented, or Christmas seals can be used for this purpose. The paper for cards can be almost anything. Colored Bristol board is excellent and easily obtainable. Construction paper (the kind that children use in school work) is sold almost everywhere and can be obtained in all the colors of the rainbow. Its one fault is that it has a full soft finish. This can be remedied in many cases by using jackets of Cellophane. Decorative paper for cards and envelopes can be obtained from most stationers; also it can be obtained in 24-sheet packages at the dime store during the Christmas season. For other kinds of paper, see your local printer. He has sample books of numerous papers and will be glad to order for you.



If you like to emboss cards you can use the simple home-made press shown in Figs. 21 and 22. The dies are made of wood and cardboard, and should be registered accurate-

Novelties



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ly so that the top die fits neatly within the bottom one. Paper placed between the two dies and hammered will be embossed neatly. The dies will hold up nicely for about forty impressions. Embossing adds considerably to the card when block prints, photos or printed slips are to be tipped in.

A simple scroll idea which is a bit different is shown in Fig. 18. It is mailed in a small tube covered with decorative paper. Fig. 20 shows a new idea—two pieces of wallboard covered with decorative paper and hinged together like the covers of a book. An amusing application of a block print mounted on a roughly torn piece of wallpaper, is shown in Fig. 19. Underneath the cut is the inscription, "We tore the paper off the walls to send you Christmas Greetings . . ." The same idea could be applied to oilcloth from the kitchen table and also to old newspaper or magazine pages.

Another novel card is the burning card shown in Fig. 17. This is quite blank with the exception of the tree and the verse, but when the tip of a lighted cigarette is applied to the candle on the tree, a spark is started which magically spells out the familiar greeting. Any "burning" message can be written, and is perfectly invisible until a match or cigarette is applied. The writing solution is made by dissolving as much potassium nitrate as possible in a quarter-full glass of hot water, adding one or two pinches of gum arabic as a bond. Use

23

24

and Photos

25

a clean pen to write with, and apply medium pressure in writing. Join all the necessary letters together, and do not completely loop closed letters such as "o, s, y," etc. The paper used should be thin tracing paper. Some heavier papers will burn if the letters are gone over twice.

Figs. 23 to 26 are examples of easily made photographic cards. The one in Fig. 24 is made from five snapshots, one of which is shown in Fig. 23. These snaps are cut out and mounted on a piece of white cardboard. Rephotographing gives the finished negative from which the cards are made. All lettering is done on the pasted-up layout before copying. The photo heads of Fig. 25 are cut out and pasted up, after which the sketches of the snow men and the lettering are worked with black ink. The result is then copied and as many prints as may be necessary are run off. Fig. 26 shows the inside of this card, the greeting being hand-written. A neater method is to have the greeting printed on small slips of colored paper, tipping these in on the card.

26

And so, there are endless varieties of photographic cards that can be made. Pictures of members of the family, of the home, either inside or out, make such cards personal. You can use silhouette snapshots, fireplace scenes, with original pen-and-ink sketches and lettering added, depending entirely on your fancy.

There's still another interesting possibility in making attractive Christmas cards on ordinary blueprint paper. The paper costs very little and the only other expense is that of a few photo negatives. The result of this type of work is shown in Figs. 27 to 31 inclusive. In this particular

Blueprinted greetings

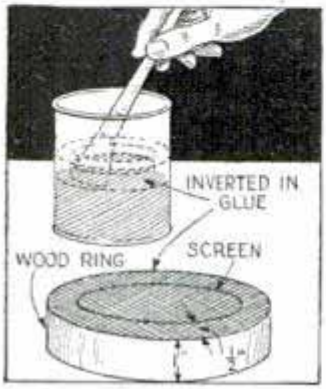
instance 7 by 9-in. sheets were used, the dotted lines in Fig. 29 indicating where the sheets were folded. The front of the card is displayed in Fig. 27 and the inside pages in Fig. 28. All lettering and photos show up in blue on a white background. A soft photo can also form the background over which a suitable verse appears, Fig. 29.

In preparing these prints you proceed as follows: Get a roll of blueprint paper to provide as many sheets as you desire. It is cut with a fingernail file to obtain a torn-edge effect. This must be done in a subdued light or the paper will be given a bluish tint. Then the paper is stored in a box until you are ready to print. Next, select negatives that will reproduce well in blue and white. You can letter the words "Season's Greetings," or something else, on the one that will be the front. Also get a negative of a verse or greeting which you desire for the inside. Cement the negatives to the glass of a printing frame, which is slightly larger than the size of the unfolded sheets. For a 7 by 9-in. unfolded card, use a 10 by 12-in. printing frame. Cement the negatives with their glossy side next to the glass, as in Fig. 30, using colorless fingernail polish or collodion at their edges. Then cut a mask from black, opaque paper as in Fig. 31, to fit over the photos and snugly inside of the printing frame. All masked parts remain white on the finished card. It is a simple matter to mount the sheets of blueprint paper in the printing frame, sensitized side facing the mask. This is done in a subdued light. Then exposure is made in the direct sunlight. After the correct timing has been determined, perhaps 10 min., you can expose as many sheets as desired, one by one, and they will all be uniform.

If you want a very light photo showing behind the lettering, you use a separate printing frame for this negative, which is cemented in place and masked, as already explained, taking care that this photo will come in register with the printed matter. Then after the first printing has been done, the sheets are put into the second frame and subjected to an exposure that will give the desired density behind the printed matter—perhaps one-third the exposure of the first printing. The prints are developed

by washing them in lukewarm water for about 2 min. Then they are put in clean, cold water for 5 min. After washing, the prints are spread out on newspapers to dry. The final step is trimming and folding. With this process the total cost of 150 cards and envelopes was only $3.05.

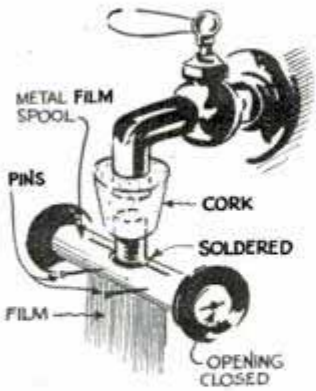
Float in Gluepot Keeps Brush from Getting Messy



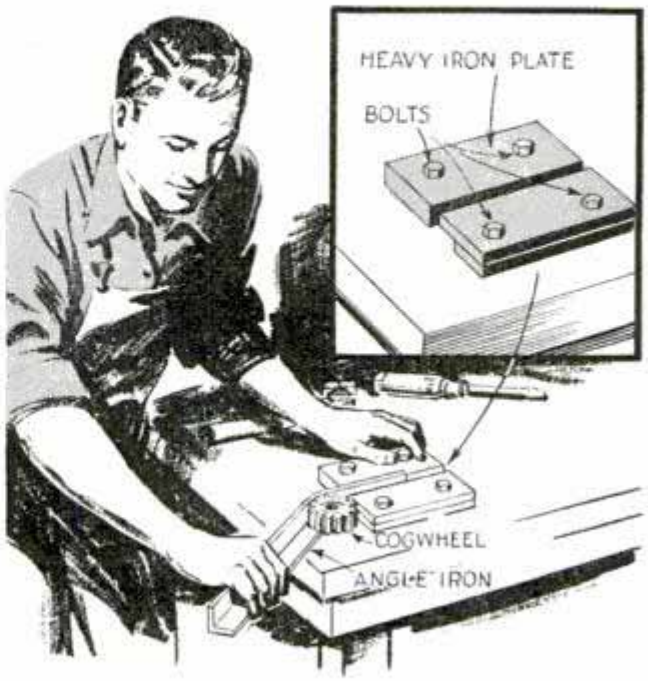
When using glue, cement, mucilage and similar adhesives, this float in the container will support the brush and keep the handle from getting smeared with the sticky liquid. Made of balsa wood, the float is merely a ring covered on the underside with a disk of screen wire. In use, the weight of the brush submerges the float enough to keep the bristles moistened.

Negative Washer from Film Spool

Utilizing the metal spool from a roll of used film, one photographer improvised a negative washer to which his roll film could be attached after development. All openings in the spool are soldered up except the long film slot in the lower side. A short length of metal tubing is then soldered over a hole drilled in the top of the spool, to which the washer can be coupled directly to the faucet with a cork when washing cut film, or to which rubber tubing can be fitted to suspend the film so that water will flow over its entire length. The film is attached to the spool with pins, which pierce the corners as it is inserted part way in the slotted opening. As a spray of water is maintained on both sides of the film, it can be washed in a few minutes.



Jig to Bend Light Angle Iron Quickly Improvised



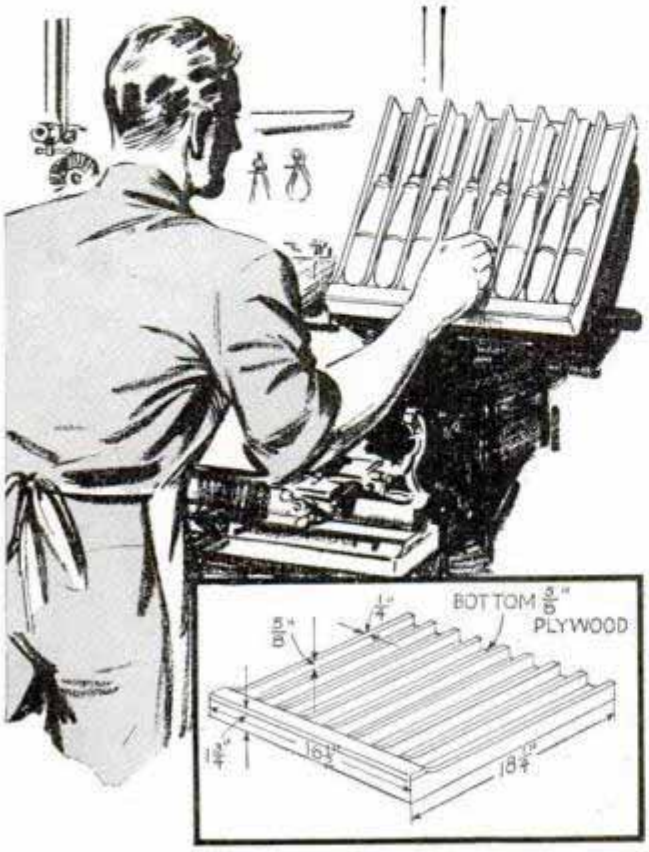
You'll be surprised how neatly you can bend light angle iron if it is heated and then bent on this jig

The home workshop owner who occasionally has a small job of bending light angle iron will find this jig helpful. It consists of three blocks of iron, one of which has a thickness equal to the combined thickness of the other two. These are bolted to the bench top as indicated in the detail. The narrow strip of iron on the bottom on the side where the two pieces are used should not be much thicker than the angle iron to be bent. The cogwheel is bolted to the bench in front of the iron blocks as indicated. In use the iron is heated, after which it is inserted between the iron blocks and then bent around the cogwheel. Bends of different sizes can be made by using different cogwheels.

Wax to Prevent Bleeding of Trees After Pruning Them

When pruning trees and shrubs, the following mixture makes a good wax to keep them from bleeding. To make the wax, melt pure coal tar, 1 lb., and add rosin, 4 oz. While the mixture is cooling, add coal oil to make a thin paste, and when cold, stir in lead arsenate, 4 oz. The paste should be applied to the wounds with a brush and should overlap the sides of the branches at least ¼ inch.

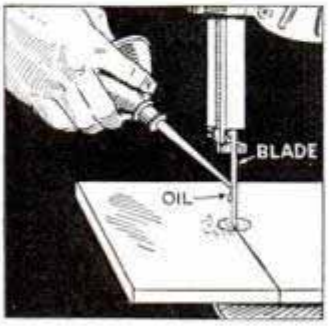
Rack to Hold Lathe Turning Tools Supported on Wall



This rack keeps your turning chisels within easy reach, yet out of dust and wood shavings

You can make this rack in a short time, and it will keep your turning tools conveniently at hand above the lathe, yet far enough to one side to avoid shavings and wood dust. If each tool is always kept in the same compartment, you will, after a little practice, become so accustomed to their position that you can reach for the tool wanted without looking at the rack.

Resin Kept Off Band-Saw Blade by Oil Coating



On a job of cutting out a number of articles from resinous wood on a band saw, it was found that the wood gum could be prevented from adhering to the saw blade, which caused it to bind in the guides, by coating it with oil occasionally. As oil tends to rot the rubber lining of the band wheels, they should be cleaned thoroughly of all traces of oil after the job is finished.

—Dale R. Van Horn, Lincoln, Nebr.

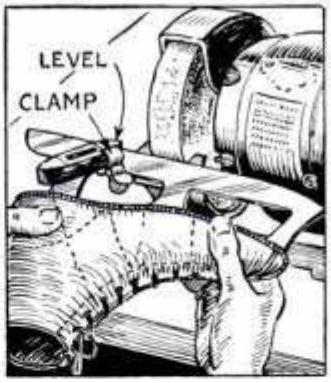
Photo Solutions Protected by Glass Marbles

As it is necessary to keep bottles of photo-developing solutions full to the stopper in order to exclude all air, the problem of replacing the solution as some of it is wasted in use is solved by glass marbles. These should be perfectly clean and are dropped into the bottle as required to keep the solution well up in the neck near the stopper at all times.

—Robert J. Williams, Chicago.

Level Clamped to Ice Skates Aids in Sharpening

After experiencing some difficulty in holding my skates correctly against a grinding wheel to sharpen them, I solved the problem by using a small level as shown. This was attached to a small spring clamp which was slipped over the skate blade to indicate when the blade was held horizontally against the abrasive wheel.

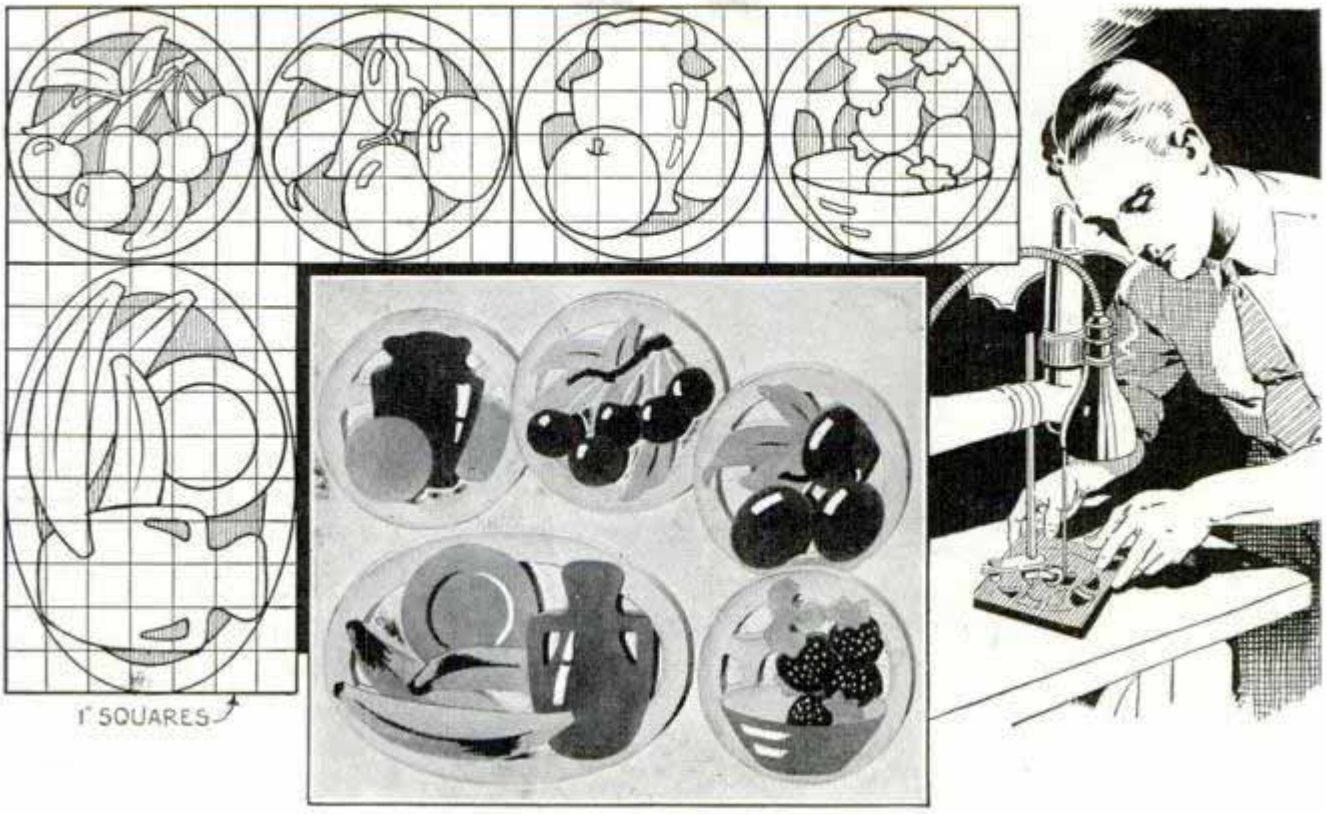


—Duane U. Norgren, Bremerton, Wash.

Rubber-Head Tacks in Rack Keep Towels from Falling

If you have trouble in keeping towels and wash cloths from slipping off the wood arms of a folding-type rack, drive three or four rubber-head tacks in the top surface of each arm. Friction between rubber and cloth will keep the towels from slipping.

Decorative Hot-Dish Mats Sawed from Wood

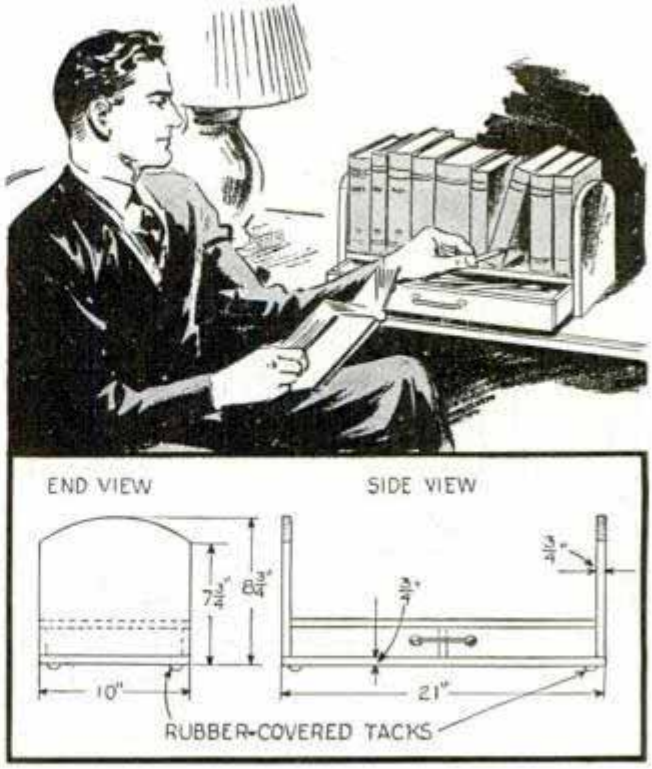


Simulating dishes of fruits, berries and even a serving tray with fruits, dish and water pitcher, these hot mats not only protect your table but they offer a decorative effect. If the designs are enlarged on paper marked off in ⅝ or ¾-in. squares instead of 1-in. squares as suggested, they will be suitable for coasters. The mats are sawed from ½-in. stock, and the coasters are cut from ¼-in. stock, which is then sanded and decorated as desired.

—H. F. Showalter, Davenport, Nebr.

Study Cabinet on Table Holds Books and Writing Paper

This small cabinet is just the thing for the student to keep his study materials neatly at hand. The two sides support books like bookends, and a drawer at the bottom provides a place for pencils, pens and paper. The simplest finish is to stain and wax. Rubber-head tacks on the underside will prevent scratching the table on which the cabinet is set.



Whitewashing Basement Walls

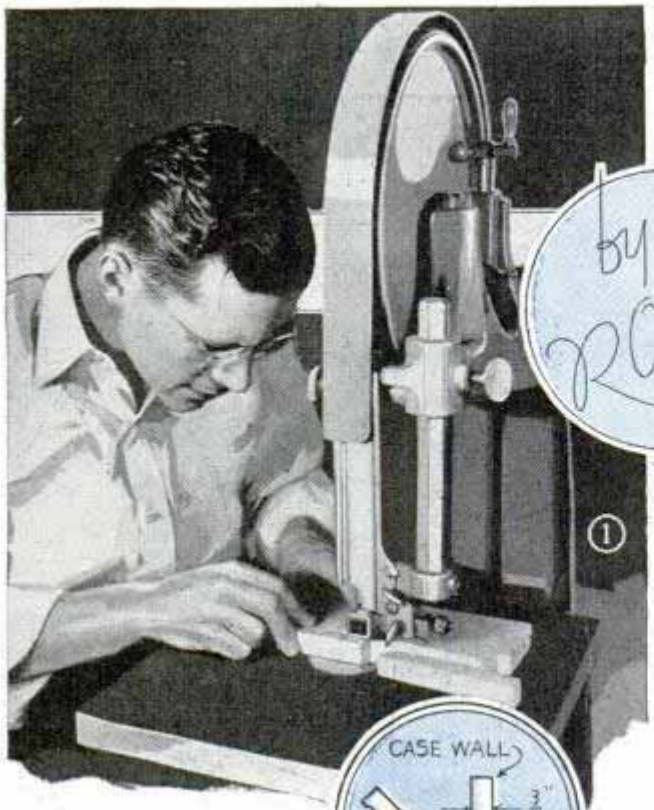
Here's a whitewash for masonry walls that I have found highly satisfactory. It is as easily applied as paint and does not flake off. To make it, mix dry, hydrated lime, one-half pail, common salt, 2 handfuls, a dime's worth of alum, and powdered glue, ½ lb. When ready to use, mix with boiling water to the consistency of paint.

—Chet Shafer, Three Rivers, Mich.

BOOK-

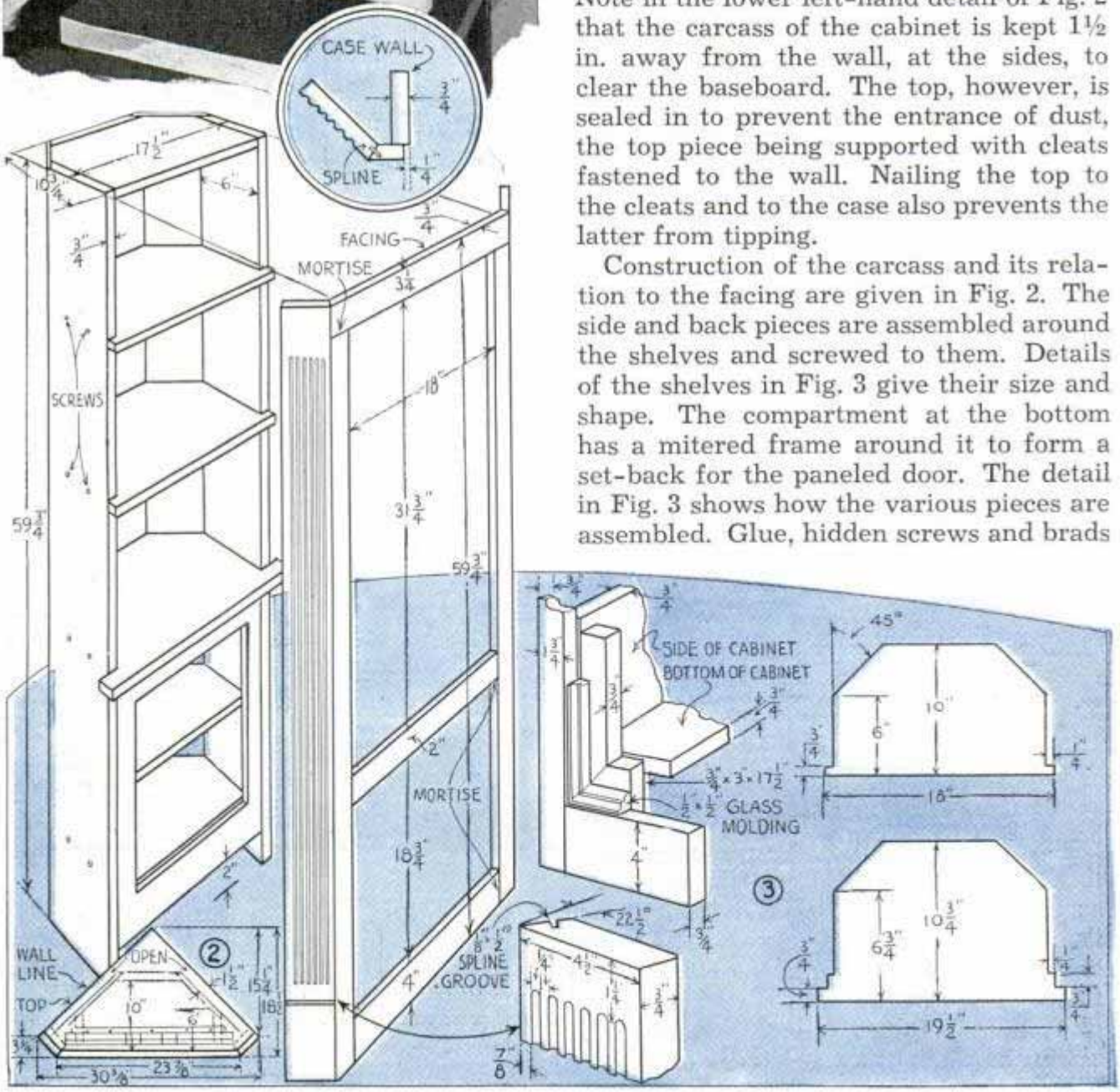
-- built in

by R O Buck



AN EXAMPLE of the classic type of furniture which will always find a place in your home, these corner bookshelves can be made of almost any easily worked wood, such as white pine, or even a combination of woods as they may be finished in stippled ivory enamel. Figs. 2 and 9 give the general dimensions of the piece. Note in the lower left-hand detail of Fig. 2 that the carcass of the cabinet is kept 1½ in. away from the wall, at the sides, to clear the baseboard. The top, however, is sealed in to prevent the entrance of dust, the top piece being supported with cleats fastened to the wall. Nailing the top to the cleats and to the case also prevents the latter from tipping.

Construction of the carcass and its relation to the facing are given in Fig. 2. The side and back pieces are assembled around the shelves and screwed to them. Details of the shelves in Fig. 3 give their size and shape. The compartment at the bottom has a mitered frame around it to form a set-back for the paneled door. The detail in Fig. 3 shows how the various pieces are assembled. Glue, hidden screws and brads

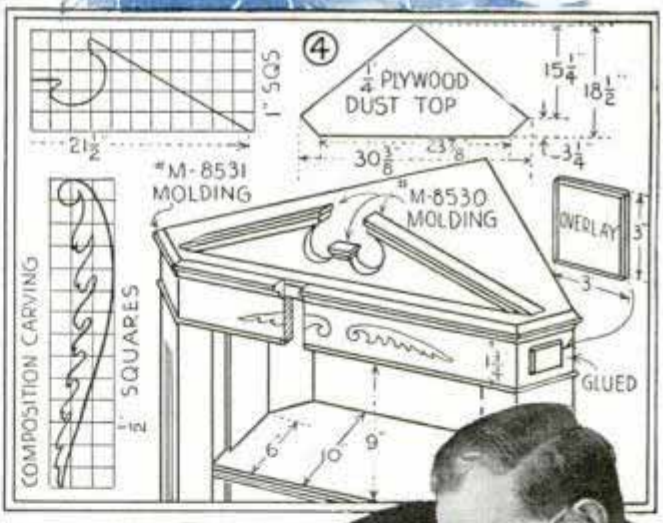


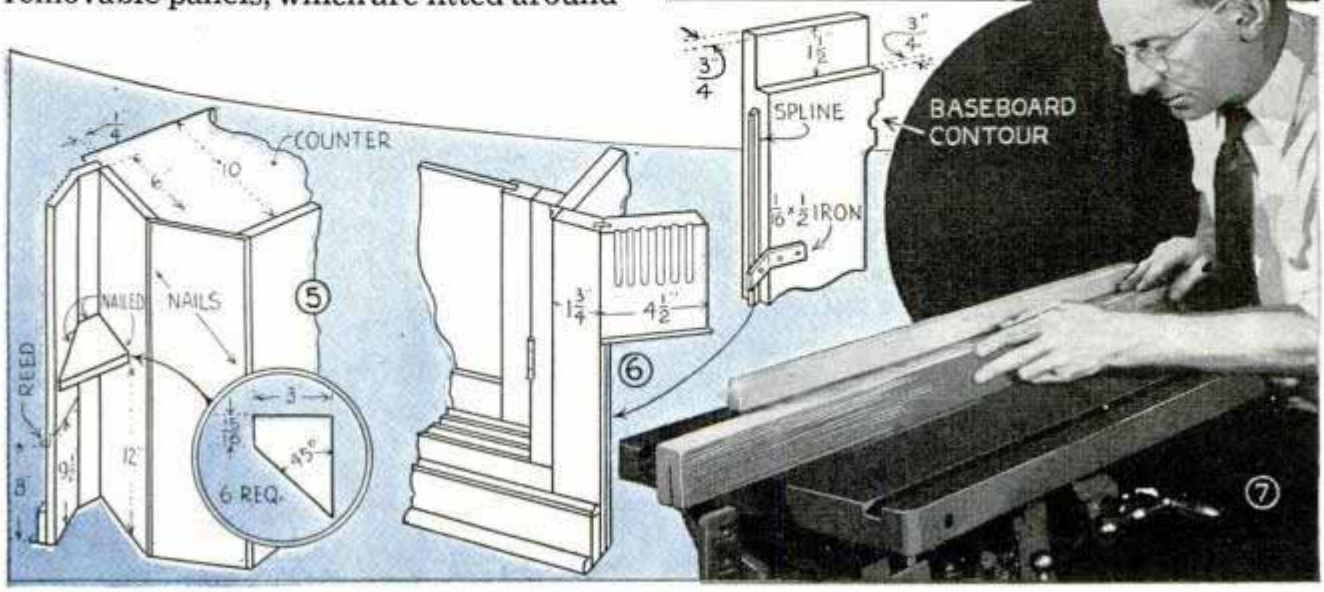
SHELVES

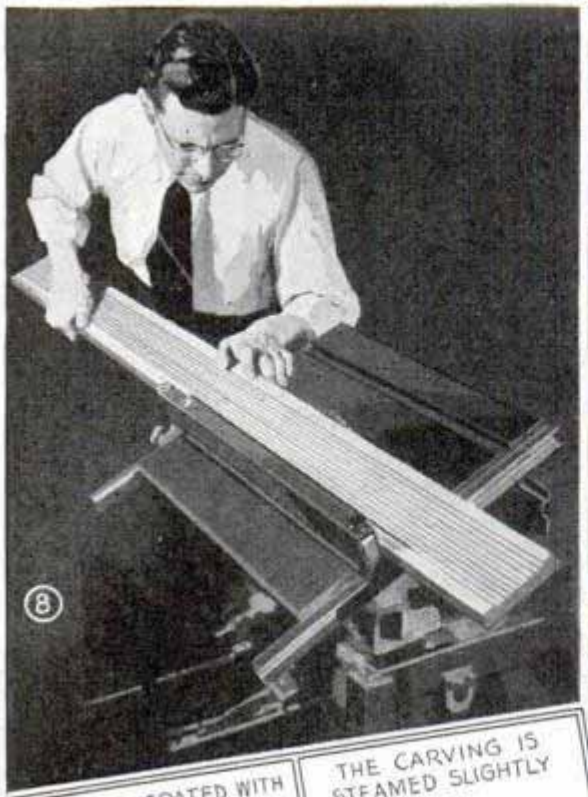
a corner - - - - -

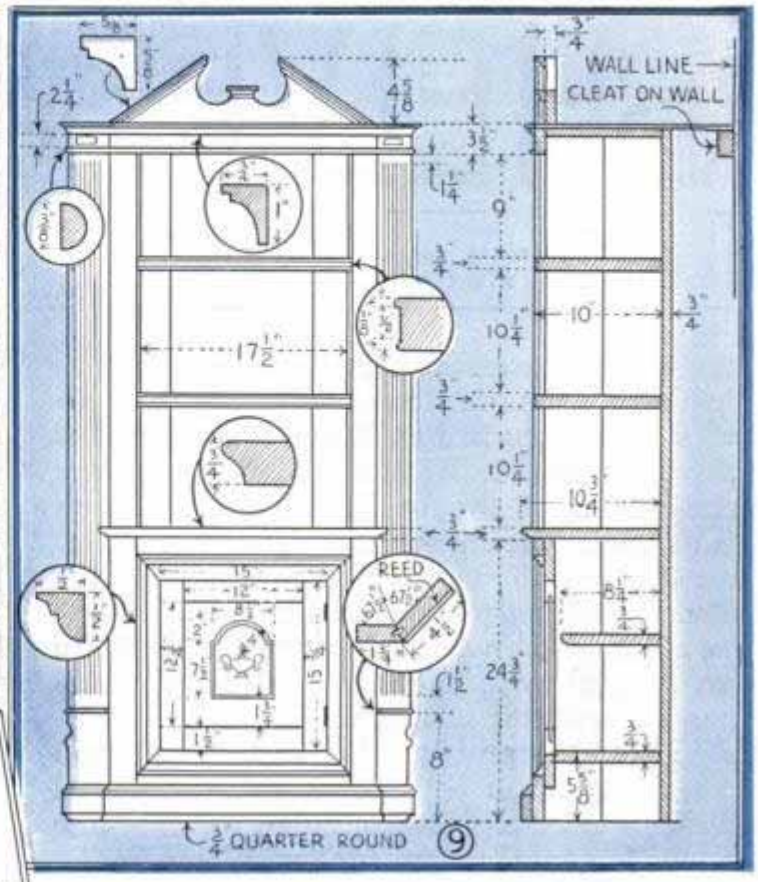
are used to fasten the parts in place. The facing, before the addition of the decorative features, is shown in Fig. 2, and a rear view is shown in Fig. 5. Note that the carcass laps the opening in the facing assembly ¼ in. on each side. The fluted side panels are set at an angle of 45° to the rest of the assembly. The beveled edges on these two pieces may be cut readily on a circular saw, Fig. 8. There are several ways to cut the flutes in the side panels; a fluting cutter, used on a router or drill press, is probably the easiest, although a molding cutter on a circular saw, arranged with proper stop blocks, is a good machine method, while a combination plane or just a small gouge run along a straightedge are practical hand methods. Splines and glue are used to fasten the side panels to the front. The grooves for the splines are cut with a circular saw as shown in Fig. 7. The grain of the spline should run the short way. The frame of the facing is assembled first, using mortise-and-tenon joints or dowels as preferred, after which the side panels are added to the glued-up frame. Six bracing blocks, Fig. 5, are also fastened at the back to keep the side pieces in line.

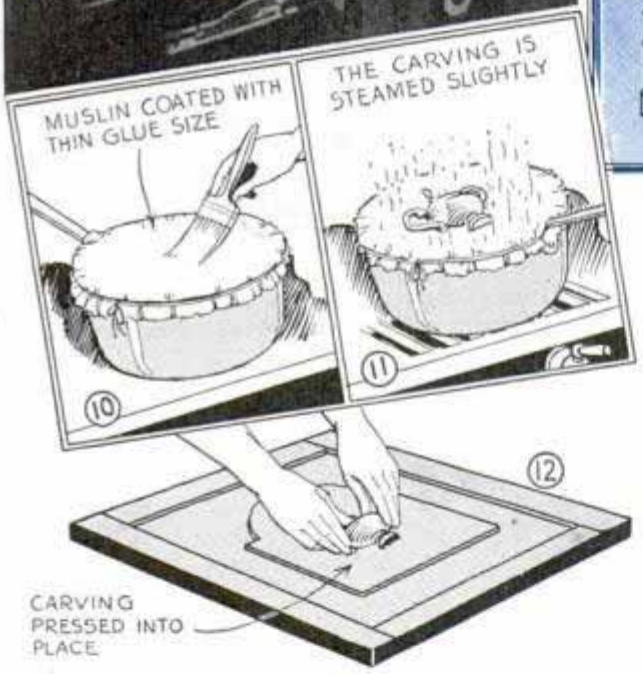
An unusual feature of the piece is the removable panels, which are fitted around











the baseboards of the room. This not only makes it convenient to do an accurate job of fitting, but also makes it possible to move the case to a new home, where, owing to a difference in the baseboard, new panels may be required. Fig. 6 shows a detail of the base and the removable block, together with the method of fastening it in place. The contour of the baseboard can be copied by fitting a piece of wire solder or soft copper wire around the piece, then carefully removing and marking on a piece of cardboard. The contour is then cut out for a true fit, before using it as a pattern. Fig. 1 shows how the cut is made on a band saw.

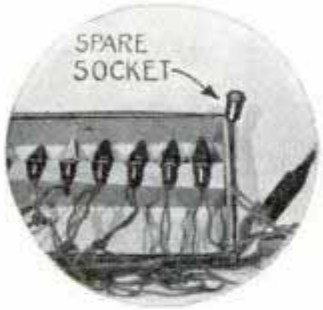
Details of the pediment, molding and decoration are shown in Fig. 4. The pediment is made as a separate unit and is fastened to the top by means of a cleat which runs along the back. The composition carvings and overlays are glued into place. The paneled door is detailed in Fig. 9. The framing is done in the conventional manner with mortise-and-tenon joints, after which the formed overlay panel is glued to the door panel, the urn ornament being glued to this.

Both the Grecian urn and the spray ornaments are of stock design and may be purchased for a few cents, yet their use gives a professional touch to the whole assembly that would be hard to obtain in any other way. The method of applying composition ornaments is shown in Figs. 10, 11 and 12. The carving must be steamed slightly so that it becomes somewhat pliable and thus can be pressed down in perfect contact with the surface to which it is applied. These ornaments are frequently curled somewhat when received but are readily flattened out after the steaming. Applying the glue by the method suggested causes it to penetrate the porous backing of the ornament and form a tacky surface that adheres well. No additional glue should be applied as it tends to ooze out around the lines of the carving where

it is difficult to remove. To assure getting the ornaments placed properly it is suggested that they be laid in the desired position before steaming and their outline traced with a sharp pencil. Placing a board and weight over the ornament after it has been glued, is also advisable.

Finishing of the cabinet, after it has been well sanded, is accomplished by applying two coats of enamel undercoat which has been slightly tinted with chrome yellow. The undercoats should be sanded lightly, between coats, to secure a smooth surface. The finishing coat of ivory enamel should be of the semi-gloss variety. As soon as the entire surface has been covered and the enamel has started to set, it should be gone over with a stippling brush or some brush that has short, stiff bristles, to break up the film of enamel into a pebbled effect. A pleasing antique effect may be had by working a little burnt umber, in oil, over the dry enamel. The color should be thinned with benzine. A cloth pad is used to apply the color which should be wiped off immediately after applying, wiping only over the surface and permitting the color to remain in the depressions. The trick in doing this successfully is to get the desired effect the first time over the surface, as a second application is apt to build up the color into solid tones.

Life of Christmas-Tree Lights Increased by Extra Bulb

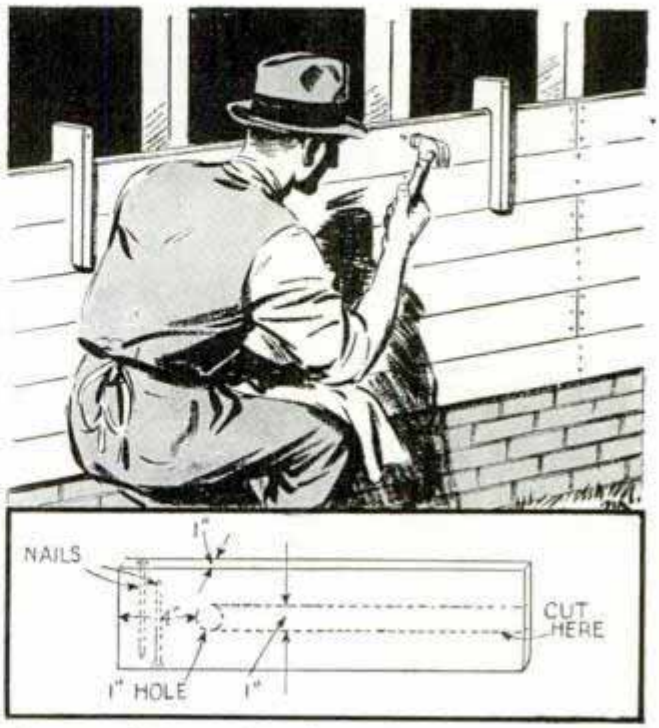


Addition of an extra lamp in a string of series-wired lamps in a set of Christmas-tree lights will greatly increase the life of the whole string of lamps. While the extra lamp reduces passage of current through the circuit, it does not noticeably reduce the brilliance of the lights. Spare sockets may be purchased with wires attached for the purpose.

—C. E. Packer, Chicago.

¶You'll be surprised how easily dry bread crumbs can be removed from a toaster by using a small paintbrush.

Long Weatherboarding Put Up with Aid of Wood Clip

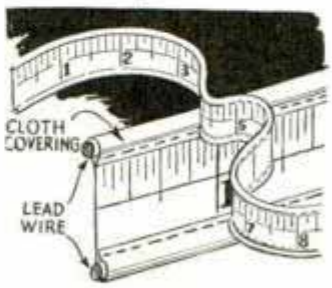


Two wood clamps slipped over long piece of weatherboarding hold it in place while nailing

By using a couple of these clips, the job of nailing up long pieces of weatherboarding single-handed is simplified. The clips are cut to the shape indicated, from hardwood or tough soft wood, nails being driven through the closed end to strengthen it against splitting. In use, a piece of weatherboarding is laid up in place and the clips are slipped over it, as indicated, to hold it in place while the lone workman nails it.

Tape Measure Has Lead Edges for Irregular Surfaces

One workman who had to measure long, irregular surfaces solved the problem of getting the tape measure into the depressions by sewing lengths of wire solder to the edges of it. The solder permitted the tape measure to be shaped to the contour of the work to get the entire surface measurement. Also, the tape measure is a handy aid in duplicating irregular surfaces as it will keep any shape if handled carefully.

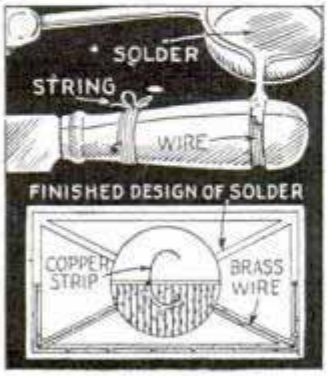


This Portable Clothesline Reel Is Easy to Handle

Use this reel and you can put up or take down your clothesline without tangling it or getting it dirty

Portable and light, this reel enables you to put up or take down your clothesline without getting it dirty or tangled, as the line does not touch the ground or have to be handled, and can be hung on a wall in the basement, pantry or washhouse. Hardwood is best for the reel, and it should be given a couple of coats of paint to protect the wood against dampness.

Repairing Broken Knife Handles



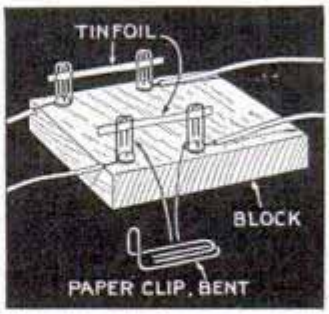
To repair split wooden handles on knives and small tools, place the broken pieces in the correct position on the tool and tie them together. Then cut grooves around the handle and wrap soft brass or copper wire tightly in the bottom of the groove, twisting the ends together. Using the wire as a solder base, run the groove full to make a complete band, and then file the solder flush with the wood. Flat wood surfaces can be artistically inlaid with solder in the same way. The design is first grooved or cut in the wood, after which soft brass wire is laid in the grooves, using small brass tacks or brads to hold the wire in place. Then the melted solder is dropped into the groove.—C. J. Hotz, Lincoln, Nebr.

Scale on Knitter's Handbag

Women who carry a crocheting or knitting bag will find that a scale marked on one of the handles is quite convenient and always at hand for measuring the work. The scale can be a 12-in. length of tape measure glued to the handle, or a scale can be scribed right on the wood. This can be done with a sharp-pointed instrument, after which some paint is applied, this being wiped off the surface of the handle so that it only remains in the depressions.

Fuse Block for Experimenters

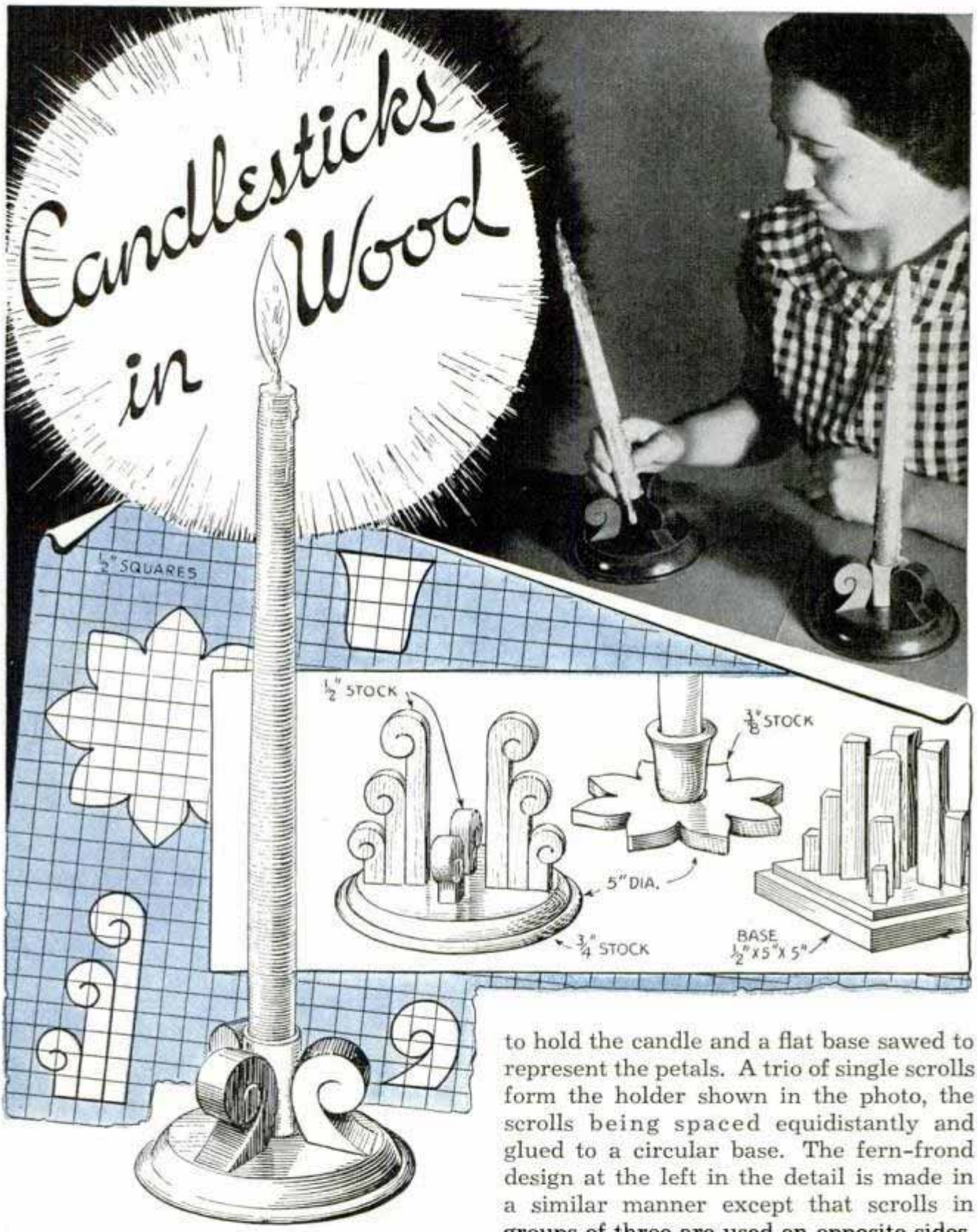
When experimenting with electrical devices of unknown voltage or wattage, this improvised fuse block will save fuses in the house wiring. Using narrow strips of tinfoil of varying widths as fuses, the block sets on the bench near at hand, and consists of a piece of wood with four wire paper clips fastened to it with thumbtacks as indicated. The block is installed in the electrical circuit between the wall outlet and the bench.



—A. H. Waychoff, Tempe, Ariz.

¶Clean powder puffs are handy for cleaning silverware; use one to apply the polish and one to do the buffing.

Candlesticks in Wood



Unusual in design but simple in construction, these wooden candlesticks suggest flower, plant and architectural forms. Scrolls and simulated fern fronds are used in groups of three or four as graceful supports for candles, and blocks of graduated sizes make interesting designs arranged on square bases. The jonquil holder shown in the center of the detail has a turned cup to hold the candle and a flat base sawed to represent the petals. A trio of single scrolls form the holder shown in the photo, the scrolls being spaced equidistantly and glued to a circular base. The fern-frond design at the left in the detail is made in a similar manner except that scrolls in groups of three are used on opposite sides. The geometric holder at the right of the detail is composed of four supports made up of three sizes of blocks, which are glued together and slightly rounded at the back to fit the candle. They are mounted on a square double base in diamond pattern.

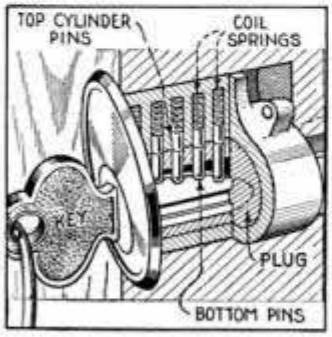
¶ Use a fly spray or an old atomizer to distribute polish on a dust cloth evenly.

Gluepot Is Kept Warm in "Cozy" for Several Hours

You can make this "cozy" in an hour and it will keep your gluepot warm without fuel consumption

Instead of keeping your gluepot warm over a gas or electric plate, try this "cozy," which will keep the glue liquid for several hours without fuel consumption. It is assembled from rings cut from pithy balsa wood, the rings being progressively narrower toward the top as they are stacked and nailed together. The lid and bottom are also balsa. In use, the glue is heated in the regular way, after which the inner part of the pot is removed, wiped dry, placed into the cozy and the lid put in place.

Repairing Worn Cylinder Locks



If you have a cylinder lock that refuses to work after being in use for some time, the trouble is probably caused by worn tumbler pins, which can be renewed quite easily. As shown in the drawing, this type of lock has two sets of pins of varying lengths, one set in the cylinder and the other in the upper part of the lock, the latter set being under pressure of small coil springs. When the cylinder is turned to the locked position and the key removed, the lower pins drop down, allowing the upper pins to enter the pin holes in the cylinder to keep it from turning. When the key is inserted, however, the lower pins are raised so that their upper ends are flush with the cylinder, forming a broken line between the two sets of pins so that the cylinder can be turned. Thus, a little wear on the ends of any lower pin will allow the upper pin to engage the cylinder. The only repair is to put in a new pin in place of the worn one, insert the key and file the upper end of the pin flush with the cylinder.

Soap Lubricates Knife Blade to Cut Rubber

When cutting a block of rubber into smaller pieces, or when cutting heavy sheet rubber, lubricate the edge of the knife with a soap paste and the job can be done easily. The paste is made by slicing laundry soap into water and boiling it until the mixture is of a creamy consistency.

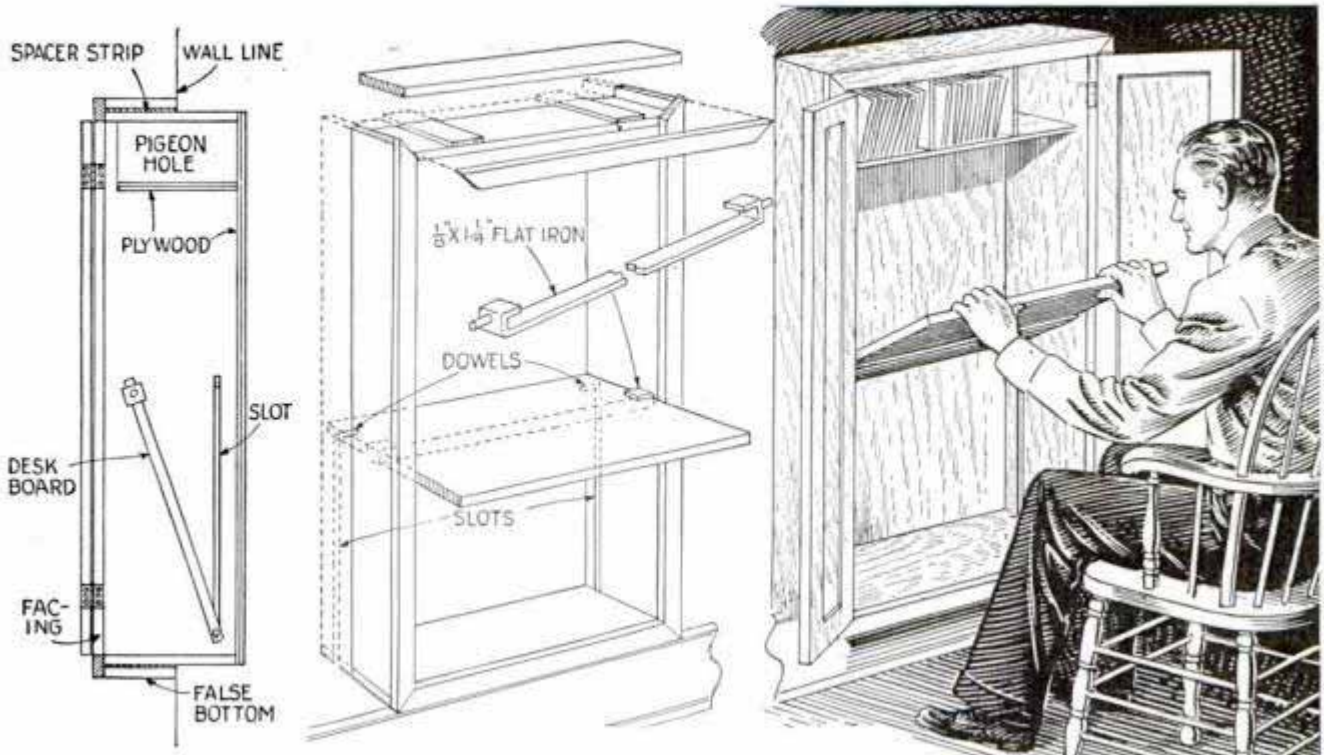
—A. H. Waychoff, Tempe, Ariz.

Holder Keeps Glass Stopper on Bottle Neck

It is better not to lay a glass stopper on the table after removing it from a bottle, but instead, to make a rubber holder to keep it right on the bottle. Such holders can be cut from inner tubes by merely cutting off strips of the right length and width, after which holes slightly smaller than the mouth of the bottle and the neck of the stopper are cut in the ends.

Burl Knutson, Bismarck, N. Dak.

Foldaway Cabinet Serves as Writing Desk



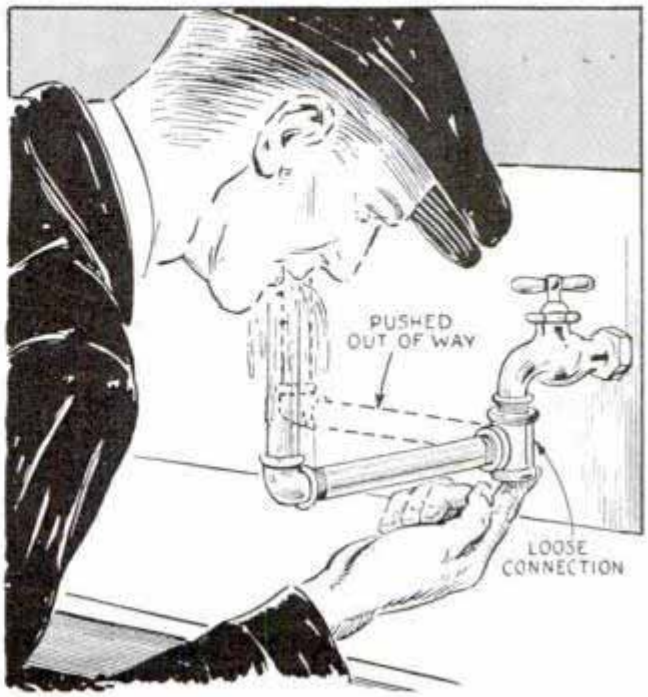
Tilting shelf should be about 26 in. from floor if used for typewriter desk, or 30 in. when used only for writing

Built into a wall, this cabinet is neat and takes very little space in a room, yet it has ample room for storing stationery, and a large tilting shelf, which serves either as a writing or typewriter desk. The shelf rests on a flat-iron support, the ends of which are pivoted to the sides of the desk as shown. Short dowels in the ends of the shelf near the rear slide in vertical slots cut in the sides of the cabinet. This arrangement permits the shelf to be folded away by lifting up the outer edge and letting the rear edge drop down, guided by the vertical slots.

—John E. Hyler, Peoria, Ill.

Drinking Fountain on Sink Faucet Assembled from Pipe

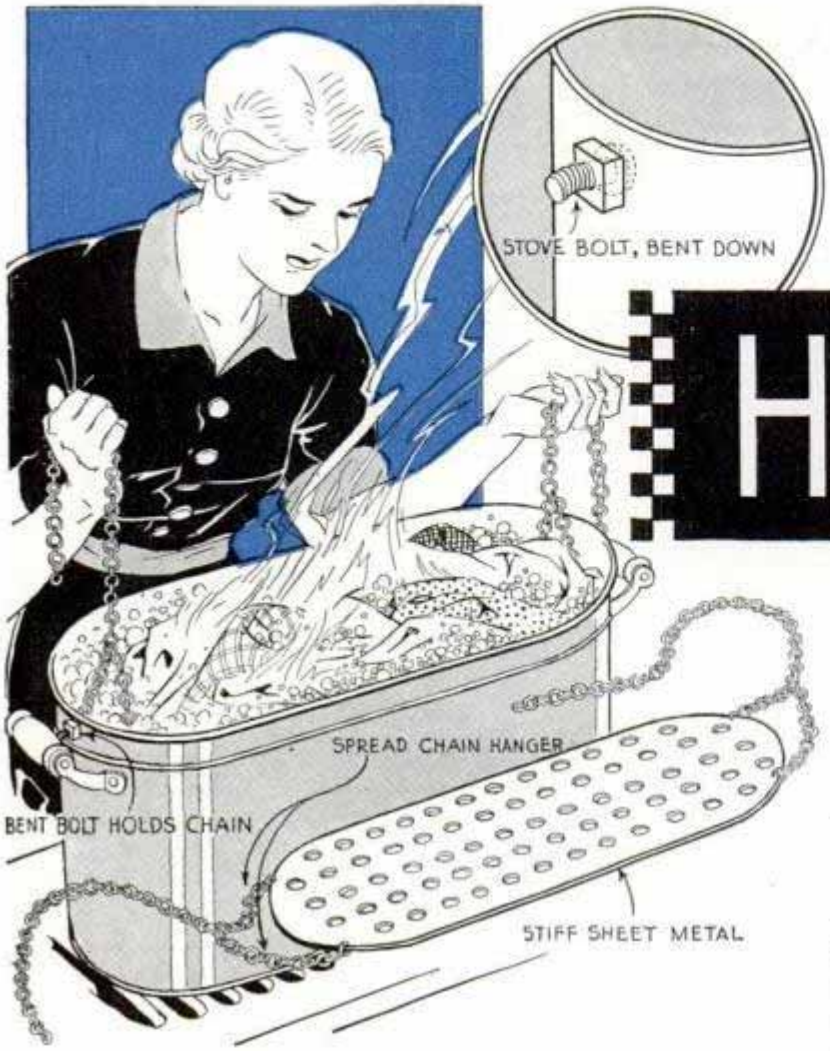
This simple pipe assembly will provide a sanitary drinking fountain to replace the cup or glass at the workshop sink. The fountain is attached to the faucet with a loose tee, which permits the assembly to be swung back out of the way when not in use. When using, merely hold the thumb or finger over the bottom of the tee which is left open to run water into the sink when desired.



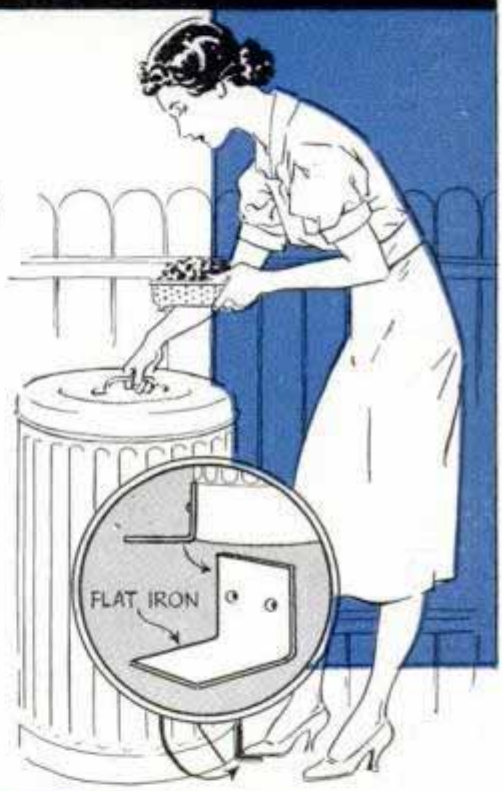
Taking the "Stick" Out of Doors

When a door sticks at the top, remember that there are two surfaces involved. Before planing the upper edge of the door, hold a block of wood against the frame and tap it firmly upward. This will usually raise the casing slightly.

EASY *for* HOME

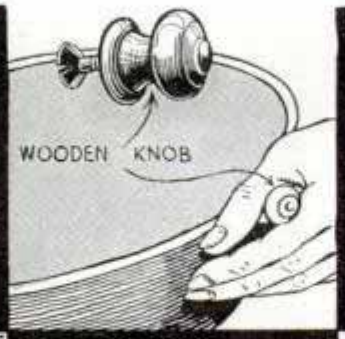


Retrieving small garments from the bottom of the wash boiler is a simple matter if you use a perforated false bottom as shown above. Just pull up on the chains, hook them over the projecting ends of the bolts and there you are

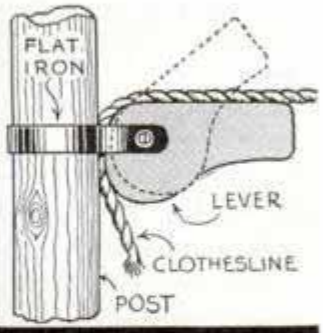


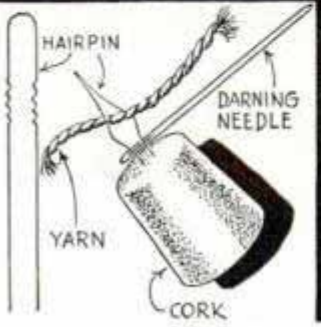
Snug-fitting lids on garbage cans are removed easily with one hand when this flat-iron bracket is riveted at the bottom of the can so that the foot can be used to hold it down

It's not hard to thread a needle with yarn if you use a fine-wire hairpin bent to the shape shown below and inserted into a cork to pull the yarn through the needle eye



Stretched around the edges of a scrubbing or scouring brush and tacked to the ends, a wide rubber band, cut from an inner tube, provides a dandy shield to protect the fingers





A wooden mixing or chopping bowl is easy to handle and turn about if a wooden knob is screwed to the outside surface near the top. The screw head should be countersunk

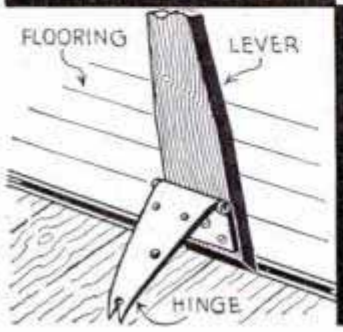
With this eccentric fastener, you can stretch your clothesline and hold it as taut as desired. And, there are no hard knots that have to be untied when you take down the line

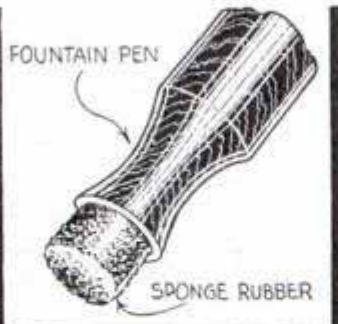
SOLUTIONS *Your* PROBLEMS

Concealed behind a door on folding brackets, this ladder pulls out to provide access to the attic in a one-story house where there is no stairway

Sagging leaves on the table at the left were repaired by screwing strips of wood shingles to the underside of the top to contact the swinging leaf supports and raise them at the outer end

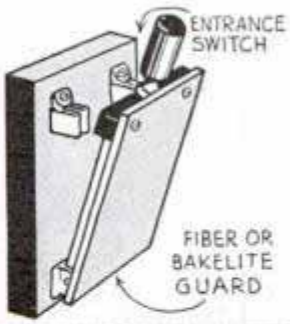
Here is a strong device for forcing warped flooring together for nailing. It consists of a board pry bar to which is screwed a strap or T-hinge with claws cut in one end





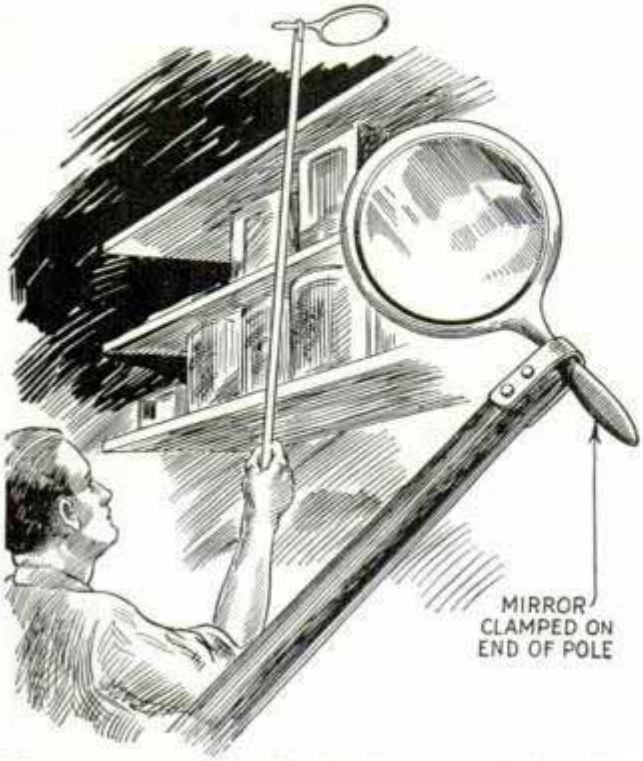
By replacing the pen point of a discarded fountain pen with a round piece of sponge rubber, you have a handy pocket device to carry for moistening stamps, envelopes and labels

For occasional capping of bottles, this emergency capper is quickly made. It consists of a short length of pipe with a coupling on one end, inside of which is a rubber washer



Screwed to the front of an unshielded knife switch, a piece of fiber or Bakelite will prevent anyone from accidentally touching the bare parts which might give them a shock

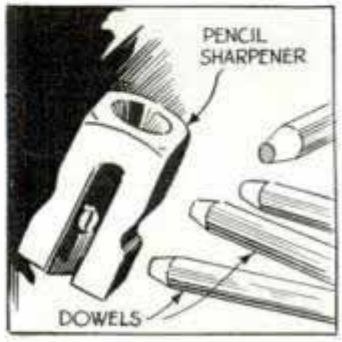
Looking on Top of High Shelves with Aid of Mirror



Use a mirror on a handle like this one to look on high shelves instead of climbing on a chair

If you have high shelves in a closet, pantry or storeroom, here's a good method of looking on them without climbing on a chair or ladder. Get a small pole, such as a broomstick or piece of bamboo, and bolt a piece of thin flat iron bent to a U-shape on one end to take the handle of a hand mirror. Then, when you want to look on top of the shelves, hold the mirror above them as indicated.

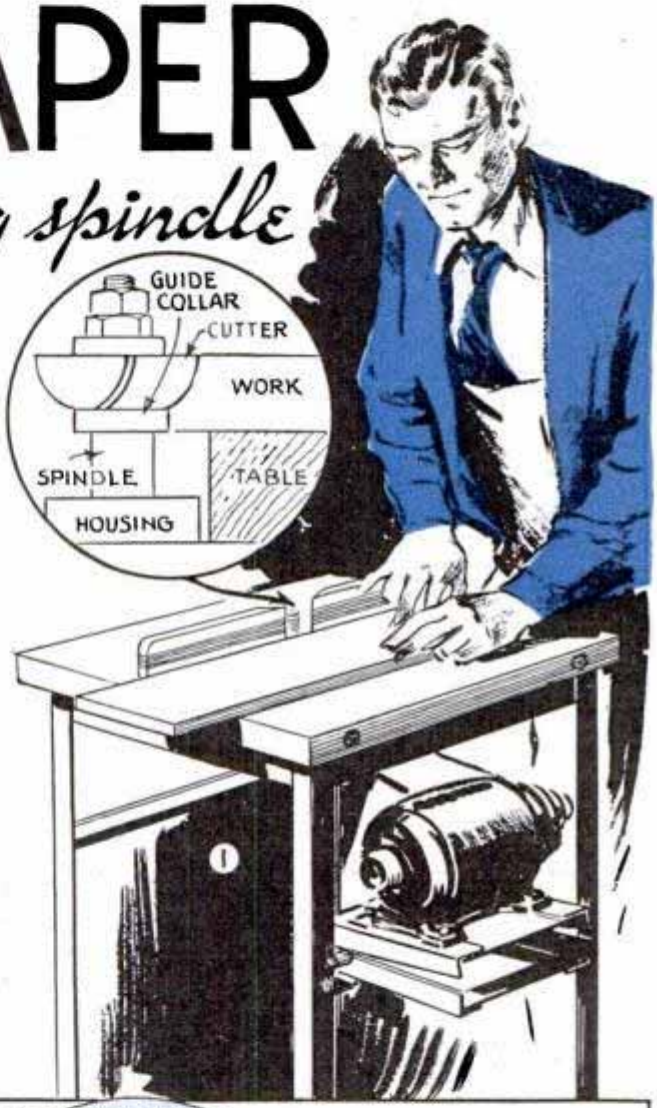
Small Dowels Pointed Quickly



Modelmakers and others who work on small projects with wood will find a common 5-cent pencil sharpener useful for pointing or chamfering the ends of small dowels and square sticks. The sharpener will last a long time, and can be bought at any ten-cent store.

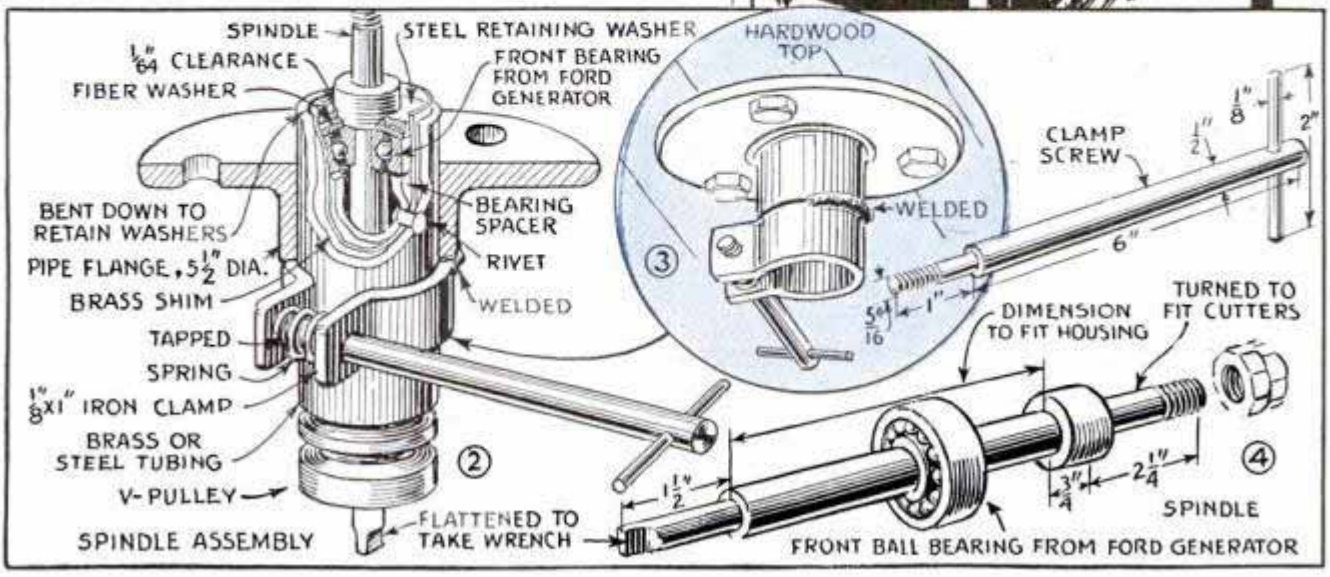
Homemade SHAPER has ball-bearing spindle

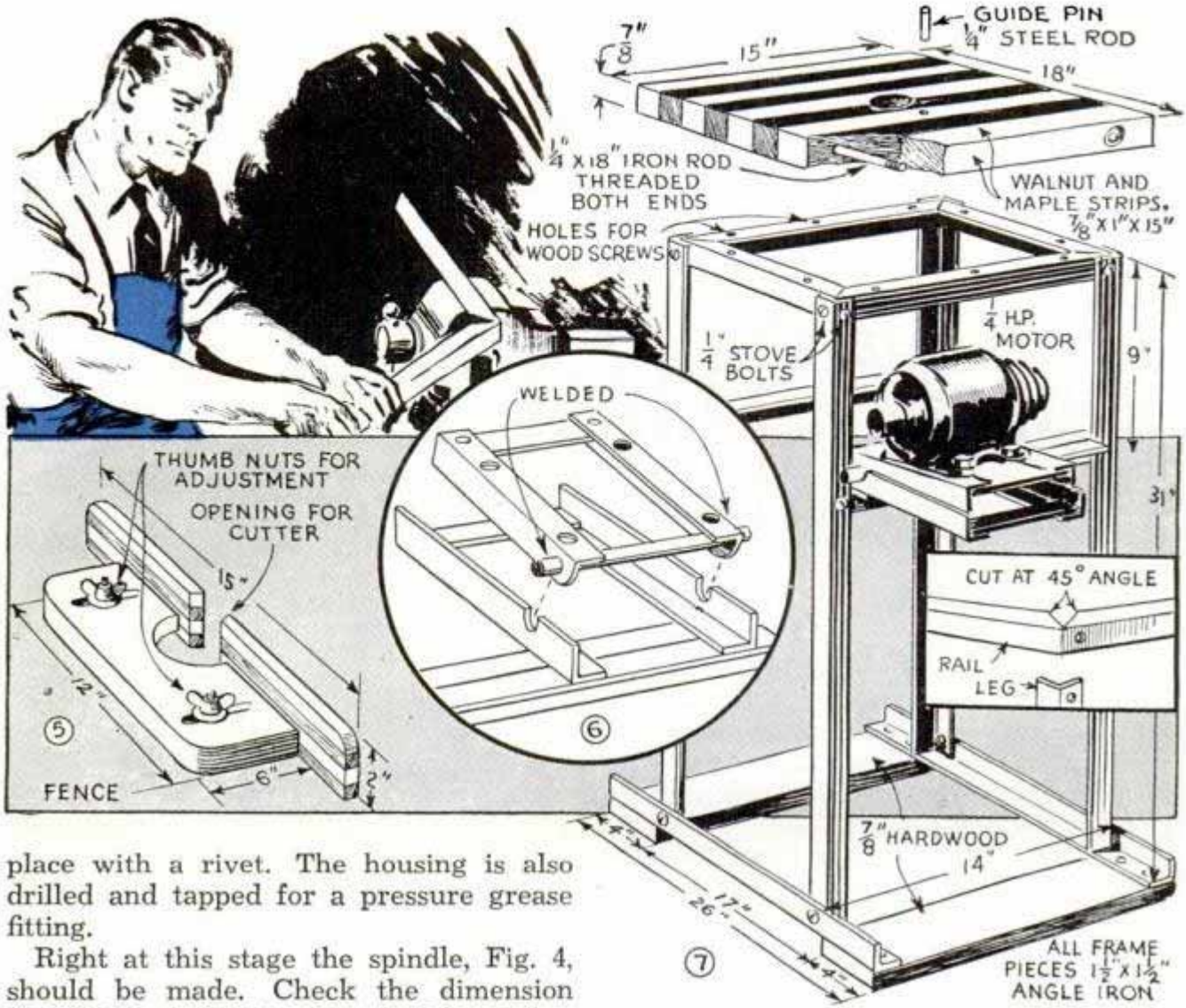
By ALBERT C. LARSON



WITH this shaper set up ready for work you are independent of the limitations of stock moldings, for, with an assortment of cutters you can make practically any molded shape you may require in a few minutes time.

The greater part of the story on construction of the spindle is told in Figs. 2, 3 and 4. The spindle assembly is housed in a 5-in. length of brass or steel tubing. This length is only an approximation for you may have to file the ends back slightly to get proper fit of the retaining washers. Note especially from Fig. 2 that there is an inner tube which acts as a bearing spacer and that between this and the housing proper is a light sheet-metal shim. The shim extends beyond the ends of the housing and the whole thing is held in





place with a rivet. The housing is also drilled and tapped for a pressure grease fitting.

Right at this stage the spindle, Fig. 4, should be made. Check the dimension through each of the inner ball races before you turn down the spindle between the cutter flange and the shouldered lower end, for this section must fit the inner ball races in a snug, press fit. Thread the upper end of the spindle while in the lathe as the thread must be true. When you assemble as in Fig. 2 make sure, before seating the retainer, that the spindle turns freely, without perceptible binding at any point, through a complete revolution.

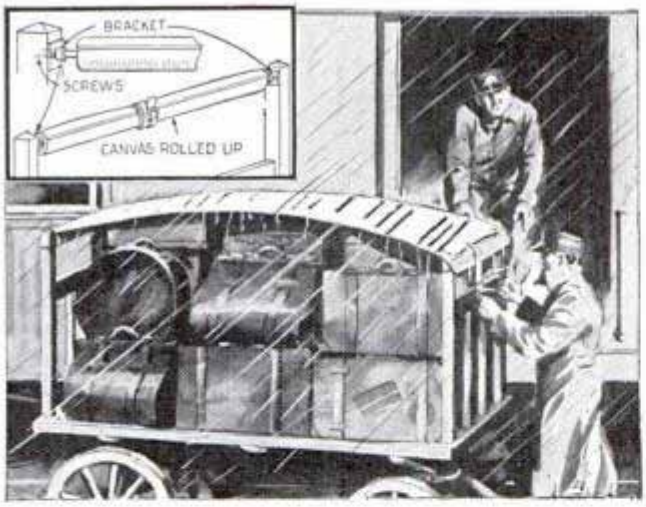
Next, you bore out the threaded sleeve of a pipe floor flange so that the spindle housing is a smooth, sliding fit. Then a clamp is bent from flat iron and welded to the lower end of the flange as in Fig. 3. One of the clamp projections is tapped; the other is drilled with a body drill to take the shouldered end of the clamp screw, Fig. 4. A coil spring is placed between the ends of the clamp when the screw is turned into place.

Figs. 5, 6 and 7 show how the spindle may be mounted on a convenient floor stand and driven with a 1/4-hp. motor. Fig. 6 suggests a good method of mounting the motor with the shaft in the horizontal position and driving with a half-crossed round leather belt. But, if you have a ball-bearing motor, you can simplify this installation by mounting the motor with the shaft in the vertical position. In either case, with a motor running at 1,750 r.p.m., you can use a 7-in. V-pulley on the motor shaft and a 2-in. pulley on the spindle. This combination will give the proper speed for the average work. The stand, as you see, is a very simple affair made from angle iron. The table top requires a little more care. It should be made of strips of hardwood glued together and drawn tight with iron rods threaded at both ends for a nut and washer. For accurate work it's essential that the table top be surfaced smooth and flat on both sides. Finish it with shellac. Notice the guide pin, Fig. 7, which is necessary for starting the work when no fence is used. It should not be more than 3 in. from the center or axis of

the spindle. When using the pin as a guide for the edge of the work when starting the cut, it is essential that the uncut portion of the stock ride on a guide collar as in the detail, Fig. 1. Although the pin can be used when starting either straight or curved work it's best to use a fence when molding straight stock. Fig. 5 suggests a simple type of fence, although it does not have an adjustment for offsetting the two halves which is necessary on certain kinds of work. A ready-made fence having this feature can be purchased at nominal cost. Three-lipped cutters should be used. They may be purchased ready-ground in a great variety of shapes together with suitable guide collars. Always use double nuts on the spindle and be sure that they are tight before starting the machine.

Roll Top on Baggage Truck Protects Load in Rain

To protect suitcases and parcels on a baggage truck when loading or unloading it during a rain, the agent at one railroad station provided the truck with a canvas top, which could be pulled quickly in place when needed. The canvas is wound around a roller, which is suspended between the



Canvas roll top for baggage truck at railroad station is quickly pulled in place when needed during a rain

truck corner posts at one end where it is held tightly rolled with a strap. When a cover is needed, it's a simple matter to unroll it and pull it over the top of the truck.

¶Placing a piece of rubber matting in a developing tray will prevent negatives from sticking to the bottom.

Window Trimmer Saves Steps by Using Large Mirror

Window trimmer can see how display looks from street by watching reflection in a mirror

Instead of taking time to walk outside several times to see how a show window looks as the work of arranging a display progresses, one trimmer uses a large mirror on a standard, which is placed outside on the sidewalk. This enables him to do the trimming and get the desired effect by watching the reflection in the mirror. Use of a mirror will be found particularly handy where the merchandise is displayed close to the glass.

Electrician's Tape Holds Pieces for Planing

The difficulty of planing thin pieces of wood, for want of some device to hold them, may be overcome in many instances by tacking a strip of electrician's friction tape to the workbench, with the sticky or gum side up. When the pieces are placed upon this surface, they will remain in position under ordinary planing pressure.

Wire Basket on Sliding Ladder Saves Time in Shoe Store

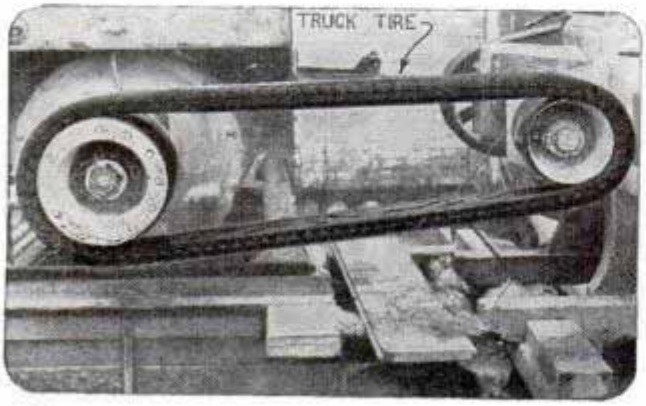
Shoe clerk can take several boxes of shoes from upper shelves when using this removable basket

Fastened to one rail of a sliding ladder in a shoe store, a wire basket will enable a clerk to remove several boxes of shoes from upper shelves and take them down in one trip. The basket is a wire file basket to which a hook is soldered to slip in a bracket bent from sheet metal.

Heavy Duty Belts Improvised from Old Truck Tires

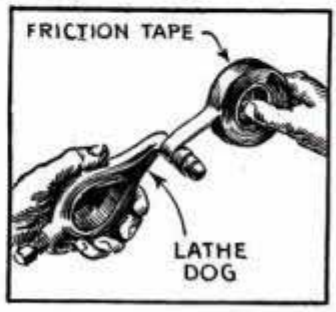
An operator of a portable feed grinder in one rural community has a novel arrangement, which has saved him many dollars on belts. As the motor and grinder are mounted close together on the truck frame, he is able to use a belt which he made from an old truck tire. This was done by cutting away the side walls of the tire about 1 in. from each side of the tread. In use, the tire is turned wrong side out so that the rubber surface lies next to the pulleys. It is claimed that these belts are durable and do not slip under heavy loads.

—Austin J. Griffin, Honey Creek, Ind.



Old truck tires make good belts when the motor and machine are mounted close together

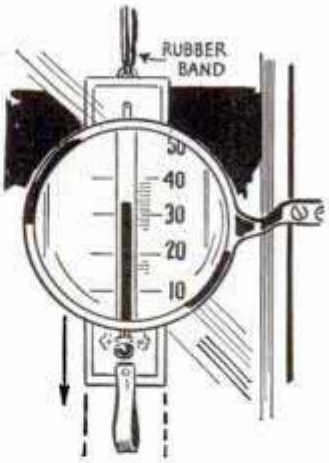
Noisy Lathe Dog Silenced by Wrapping of Tape



Noise made by a lathe dog striking the faceplate, when running the lathe without taking a cut, can be quieted by wrapping tape around the end of the dog as shown. The tape provides a cushion, which prevents a metal-to-metal contact between the dog and faceplate.

—Burl Knutson, Bismarck, N. D.

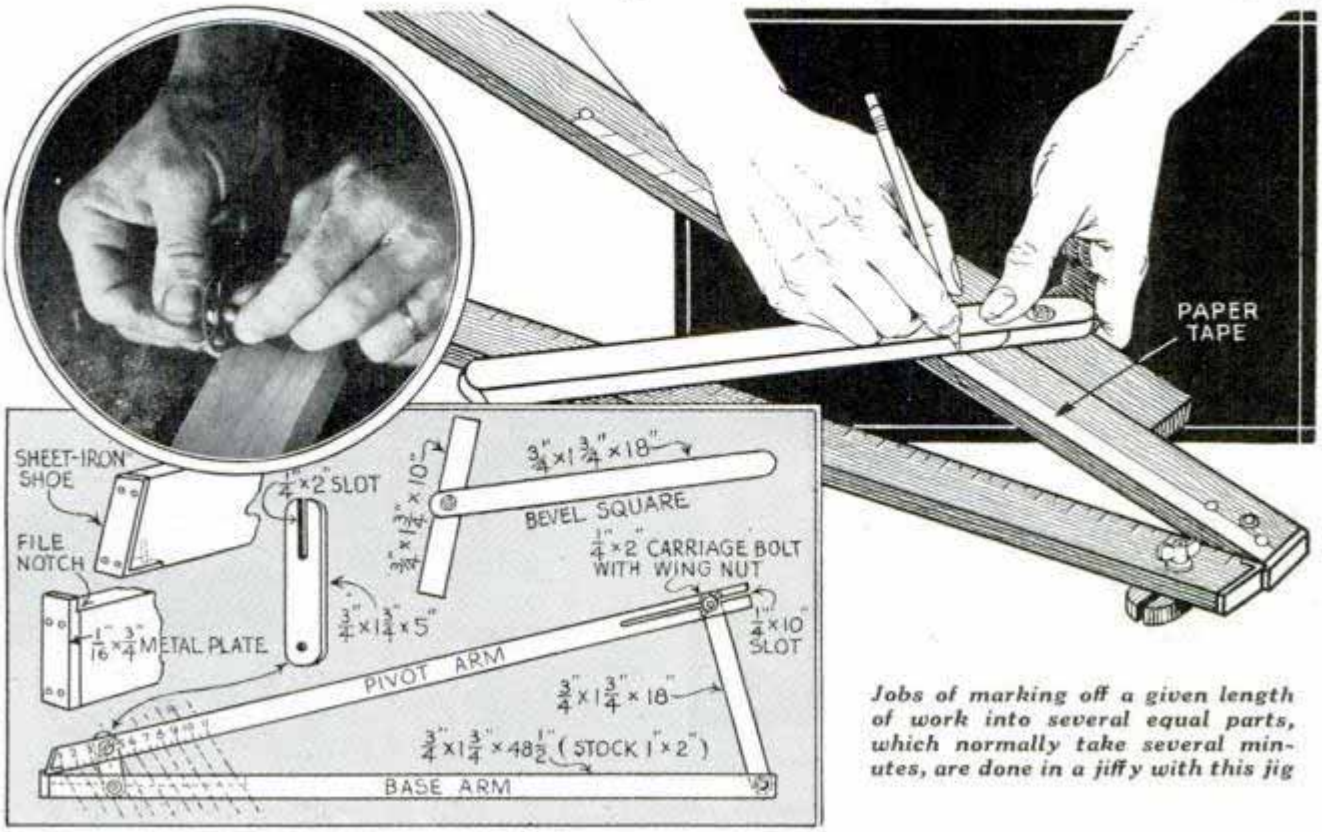
Refrigerator Thermometer Hung Behind Magnifying Glass



To avoid waste of time in reading the thermometer in his refrigerator, one butcher suspended it on the wall with a rubber band with a small magnifying glass permanently fixed in front of it. A strap at the bottom of the thermometer allows the instrument to be pulled down so that the reading can be taken when the mercury column is at any height. When at rest, the rubber band holds the thermometer so it is easy to read the lower figures without adjustment.

¶Plaster busts or ornaments can be cleaned by applying a liberal coat of heavy starch. After the starch has dried thoroughly, remove it with a brush.

Work Divided into Equal Spaces with This Jig

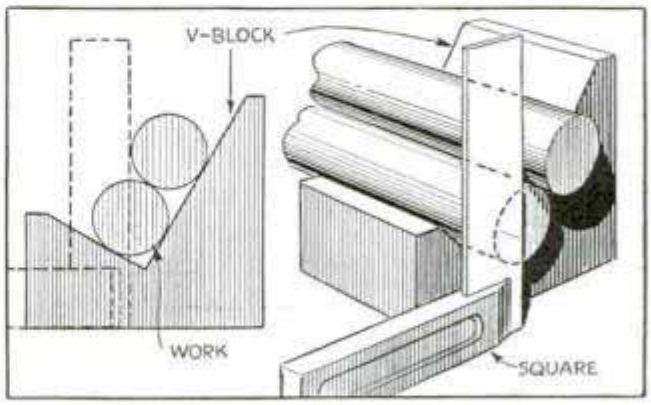


Jobs of marking off a given length of work into several equal parts, which normally take several minutes, are done in a jiffy with this jig

On work where it is necessary to divide a given length into several equal spaces, such as some jobs in shops making novelties and models, this dividing jig will save time. To make it, square two strips and shoe one end of each with iron as indicated at the left side of the detail, providing a reasonably long-lived pivot for the two arms of the jig. Calibrate the pivoted arm to any convenient unit. An easy way is to roll a clock wheel along the piece near the inner edge so that the teeth make light imprints. Mark every fifth imprint with a sharp lead pencil and every tenth one with a longer line, and number the larger units. Make two adjustable crosspieces to lock the arms in position. To use the jig, stretch paper tape on the base arm, the left end even with the pivot. Open out the pivot arm and adjust a bevel square so that the blade edge passes through the right end of the strip and an arm calibration corresponding to the number of divisions required. Shift the square from division to division, marking across the strip, and then use it to mark the work.

Quickly Locating Shaft Centers with a V-Block and Square

This special V-block enables you to locate quickly the center of a shaft, using two of the same diameter and a square as shown. After the block has been machined square, scribe a vertical line in the center, and some distance above the bottom, scribe a circle with the line as the center. Next scribe another circle the same size as the first one, touching the vertical line and the edge of the first circle. Now, scribe a line touching the edge of both circles and another at right angles touching the first circle. Machine the vee carefully to these lines.



A second shaft of the same diameter as the one to be centered is used, against which the edge of a square is rested

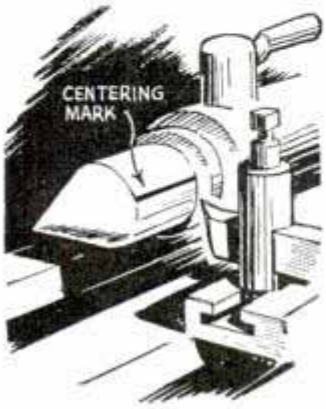
Burrs Left by Drill Inside Boilers Quickly Removed

This tool quickly removes burrs from holes drilled through boilers and other cylindrical objects

After drilling holes in a boiler to fit cylinder and mounting-block bolts, it is essential that the burrs left by the drill should be removed from inside the boiler. If this is not done, the burrs are likely to cut into the bolt and cause a leak later on. A simple tool for removing the burrs can be made from a steel bar as shown. In use, the bent end of the tool is inserted through the drill hole, after which it is swung around, the bent, pointed end scraping away the burrs.

—F. Doughty, Shipley, Yorks, England.

Lathe Tools Are Set Accurately by Guide on Tailstock Center



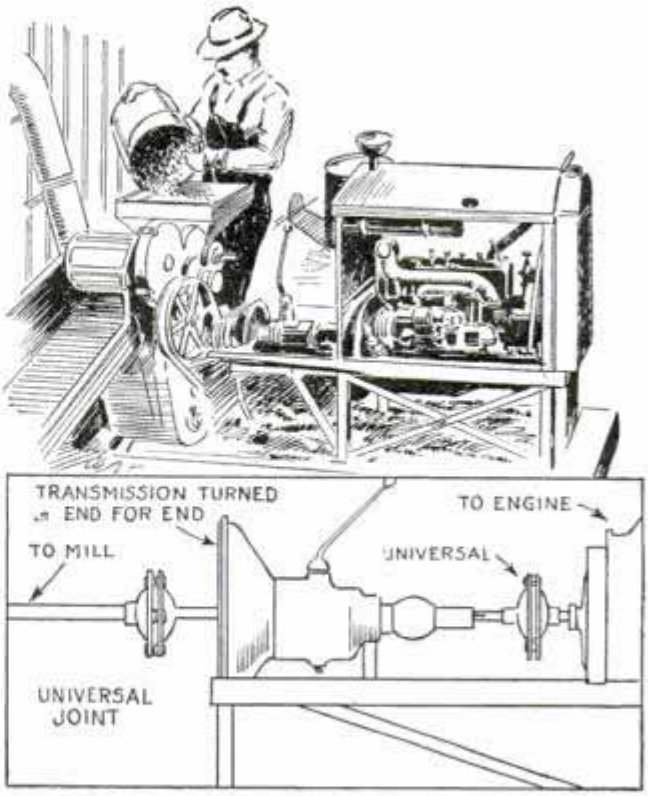
Here's an easy method I use for setting lathe tools, which have been changed or sharpened while the work is still between centers. After once centering the tool on the work, the carriage is moved back to the tailstock center, the point of the tool moved up to touch it, at which point a short scratch is made on the center. The mark thereafter serves as an accurate guide in setting the tool in the center of the work unless the tailstock center is moved.—Burl Knutson, Bismarck, N. D.

Sign Writer's Hand Support Sticks to Glass

Fitted at the ends with small vacuum cups, an ordinary metal towel rack makes a good support which can be stuck to the window glass to steady a sign-writer's hand. The vacuum cups can be attached to the end of the rod in one of several ways, using glue, cement, etc.

Grinder Driven by Transmission from Old Auto

Farmers and others who have only occasional use for a belt to drive a feed grinder or other heavy machines will find that they can save considerable money on



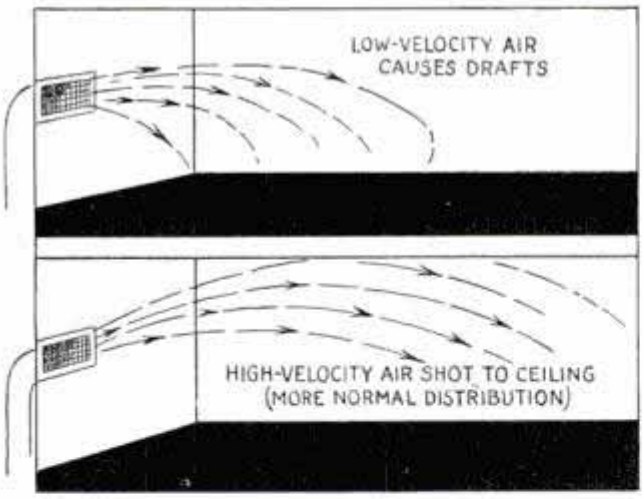
Farmer's feed grinder driven through old auto transmission saves belts, which soon rot

belts, which soon rot when not in use, by driving the machines directly through an old auto transmission. Besides taking the place of a belt, the transmission offers them a choice of three speeds. The transmission is turned end for end, or opposite to its position in the car, and run in second to give a 1¾ to 1 over drive. It is bolted to the frame of either the machine to be driven or to the frame of the motor and is connected to either of the latter by means of drive shafts and universal joints. In the lower detail, the transmission is shown mounted on the motor frame, a universal joint being installed in the drive shafts between the transmission and motor and between the transmission and the feed mill.

—H. G. Walker, St. John, Kans.

Installing Wall Grilles in Homes for Air Conditioning

After installing air-cooling systems, it is often noticed that some rooms feel rather drafty. The cause of this trouble will be found in the wall grilles where the air escapes into the room. Air coming through the grilles at low velocity falls to the floor



Too large grilles in cooling installations reduce air velocity into the room and cause drafts

about the center of the room, thus giving the impression of drafts to the occupants. One engineer avoids this trouble by installing wall grilles small enough to emit the air at a high velocity so that it is driven across the room above the heads of the occupants.—L. H. Georger, Buffalo, N. Y.

By exposing sensitized paper to a darkroom light and then developing it, you can determine if the light is satisfactory.

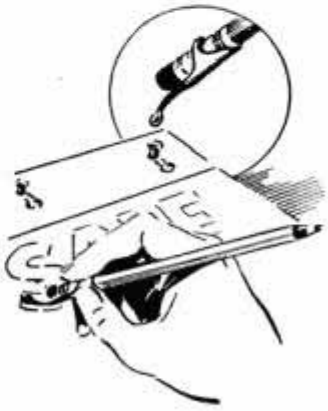
This Carving Board Has Prongs to Hold Meat Firmly

Roasts, chickens, etc., are easily sliced when impaled on the prongs of this carving board

The chef in one restaurant uses a novel carving board, which has two wooden prongs projecting through it to hold roasts, chickens, etc., while slicing them. The prongs are merely pointed, hardwood pegs which are driven tightly into holes bored through the board.

Ball Clip of Pencil Makes Stylus to Shade Letters on Stencils

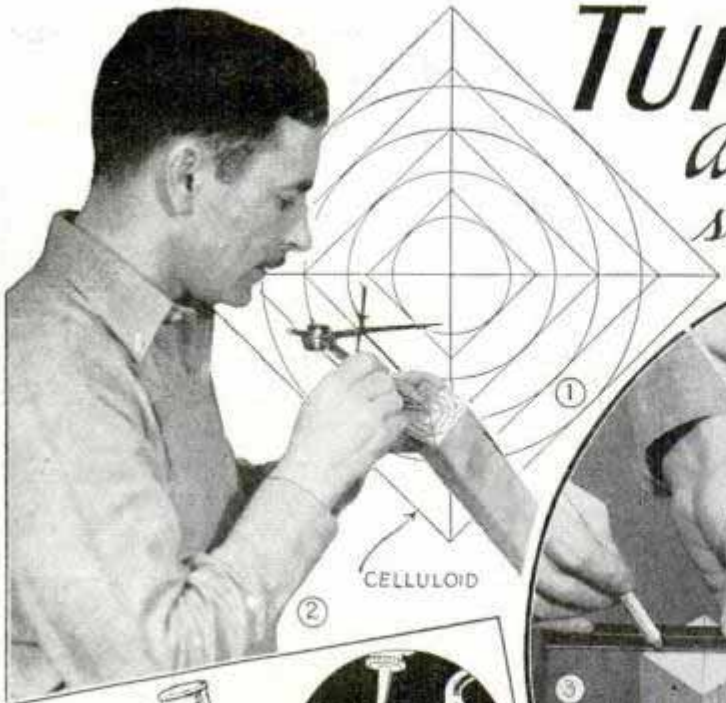
When a shading plate, or screen, is employed to shade open letters on a mimeograph stencil, the work can be done efficiently by using a pencil clip as a special stylus, as it will rub through the shading surface without tearing the stencil like the ordinary wire loop stylus so commonly employed is apt to do.

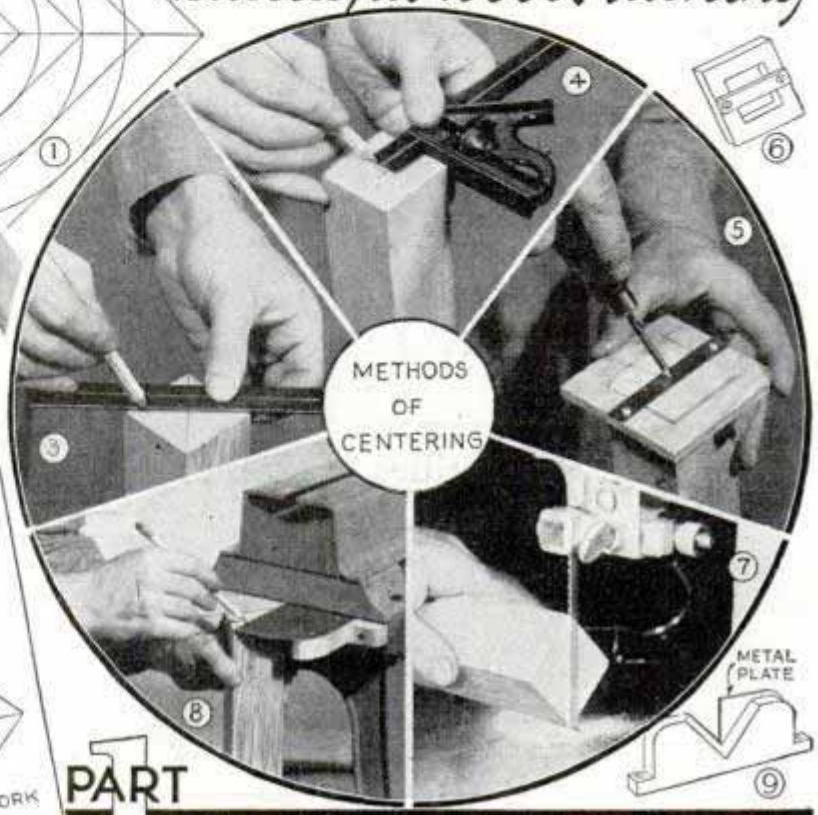


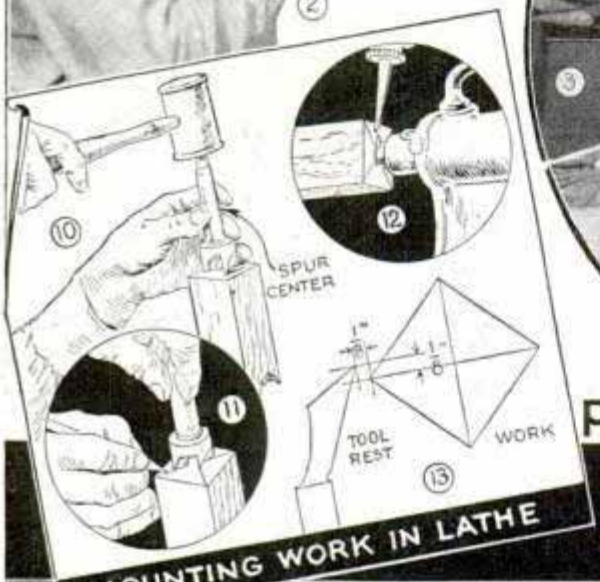
The clip is reversed on the pencil, which serves as a handle.

TURN RIGHT!

A complete guide to successful wood turning

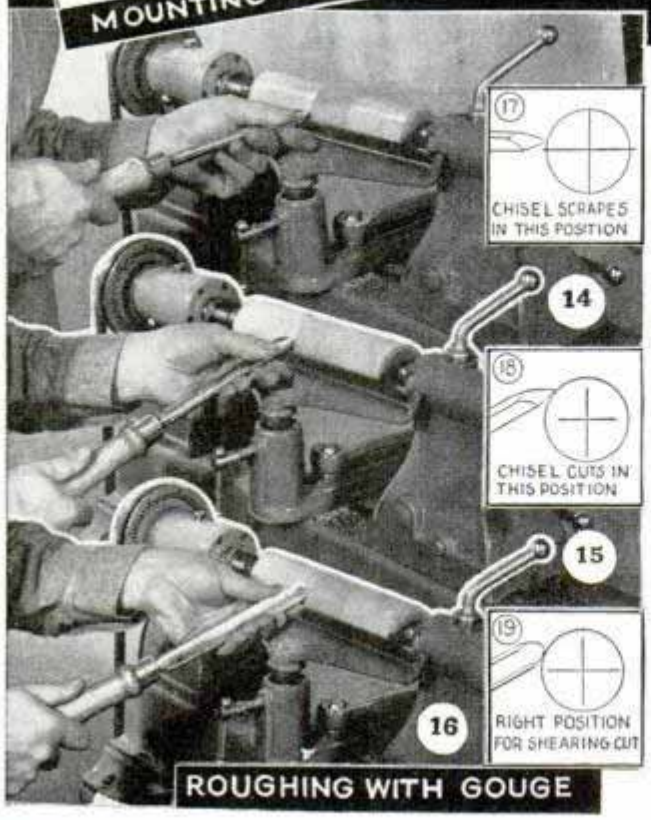






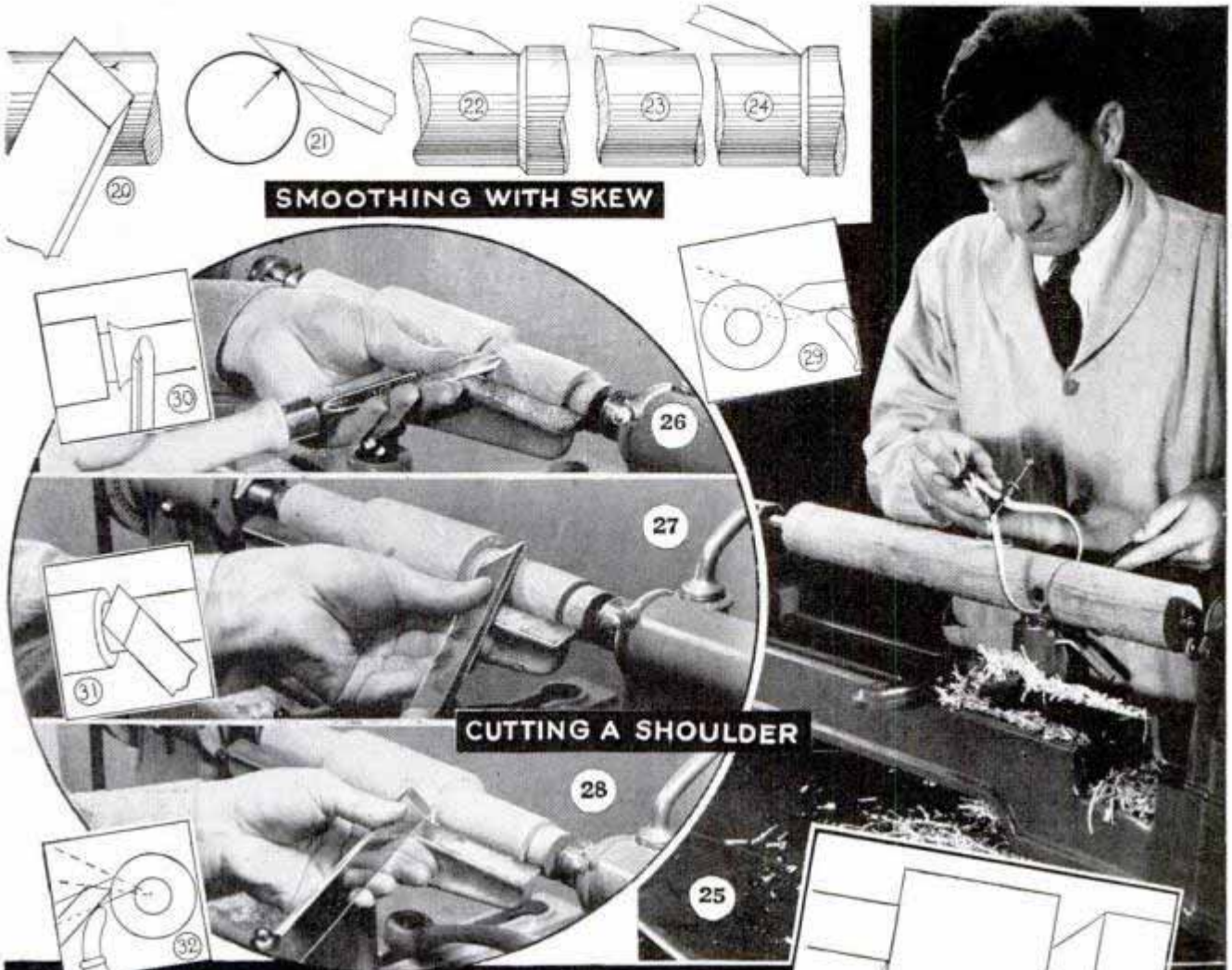
MOUNTING WORK IN LATHE

PART 1 SPINDLE



ROUGHING WITH GOUGE

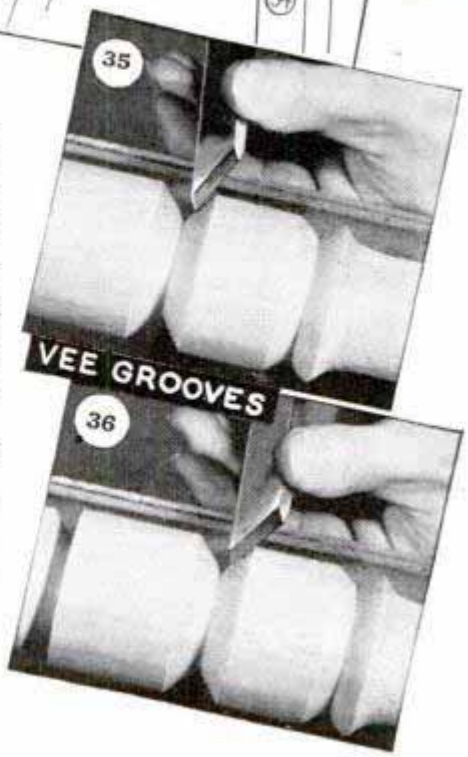
SPINDLE turning between centers is the groundwork for all wood lathe operations. The first step in making a spindle turning is centering the stock. The latter should be square, or nearly so, and the center at either end located and marked by any of the methods shown in Figs. 1 to 9 inclusive. After centering, the spur center is driven into one end of the work with a mallet, as shown in Fig. 10. Never drive the work onto the spur center in the lathe. Since the spurs of the center may not be exactly alike, nick one of them with a file and make a pencil mark opposite the nicked spur as in Fig. 11. Thus marked, the work may be removed from the lathe at any time and accurately re-centered when it is again mounted for turning. Mounting the work between centers is done by advancing the tailstock cup center

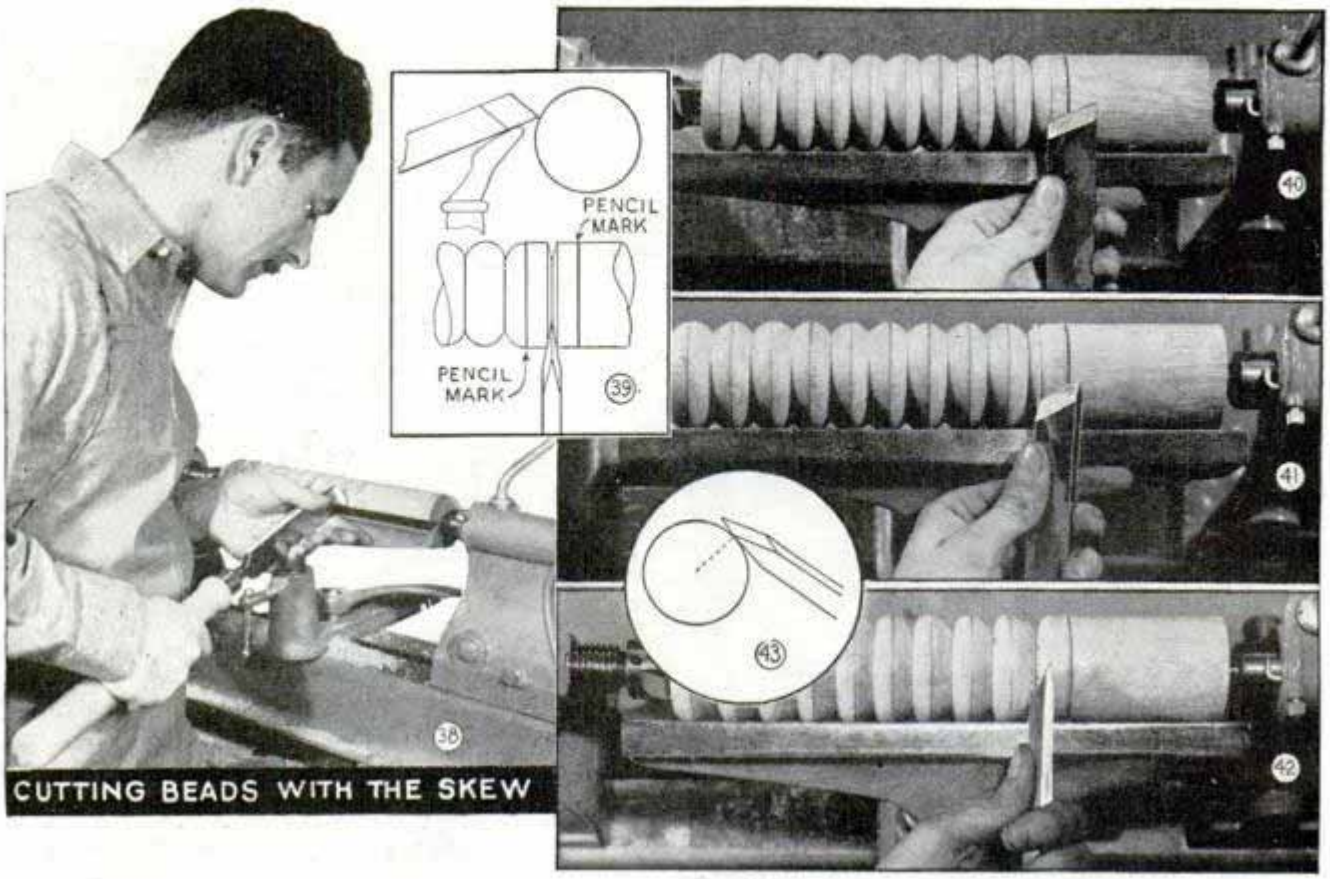


TURNING

into the work while the latter is being turned by hand. When the stock binds, the tailstock is backed off about one-quarter turn and locked. Apply a few drops of oil, as in Fig. 12, to prevent the wood from burning the cup center. Many turners use tallow or wax for lubricant, since this does not stain the wood. Fig. 13 shows the relative position of the tool rest with the axis of the work. As the square is turned into round, the rest is moved up by stages. About ⅛ in. above the axis and the same distance from the surface, is a fair rule to follow, although there are variations, of course.

The first turning operation is the "roughing cut," made with the gouge. Figs. 16 and 19 show the proper position—the bevel should be tangent to the work, and the tool rolled on its side. Figs. 14 and 17 show the wrong position, resulting in a scraping action. The position shown in Figs. 15 and 18 permits the chisel to cut, but lack





CUTTING BEADS WITH THE SKEW

of clearance prevents the easy, shearing cut possible with the correct position, Fig. 16. The final smoothing of the cylinder after roughing is done with the large skew chisel, the correct position being shown in Fig. 20, with the cut moving toward the right. By reversing the position of the chisel, the cut can be carried equally well to the left. The edge of the chisel should be tangent to the work, Fig. 21, and should contact the surface at the point indicated. The secret of successful smoothing with the skew lies in using the bevel of the chisel as a fulcrum, Fig. 22. If the handle is too low, the edge will not cut, Fig. 23, while if the handle is too high, Fig. 24, the edge will not be supported and will have a tendency to draw into the wood.

Next, the various diameters of the turning are set off with the parting tool, Fig. 25. The calipers are set slightly oversize, and are held against the revolving work until they slip over the stock remaining at the bottom of the groove. This is a scraping cut, which is the safest. A better action is obtained if the lower edge of the chisel is kept approximately tangent to the cylinder, Fig. 29, but the tool is a bit more tricky to handle.

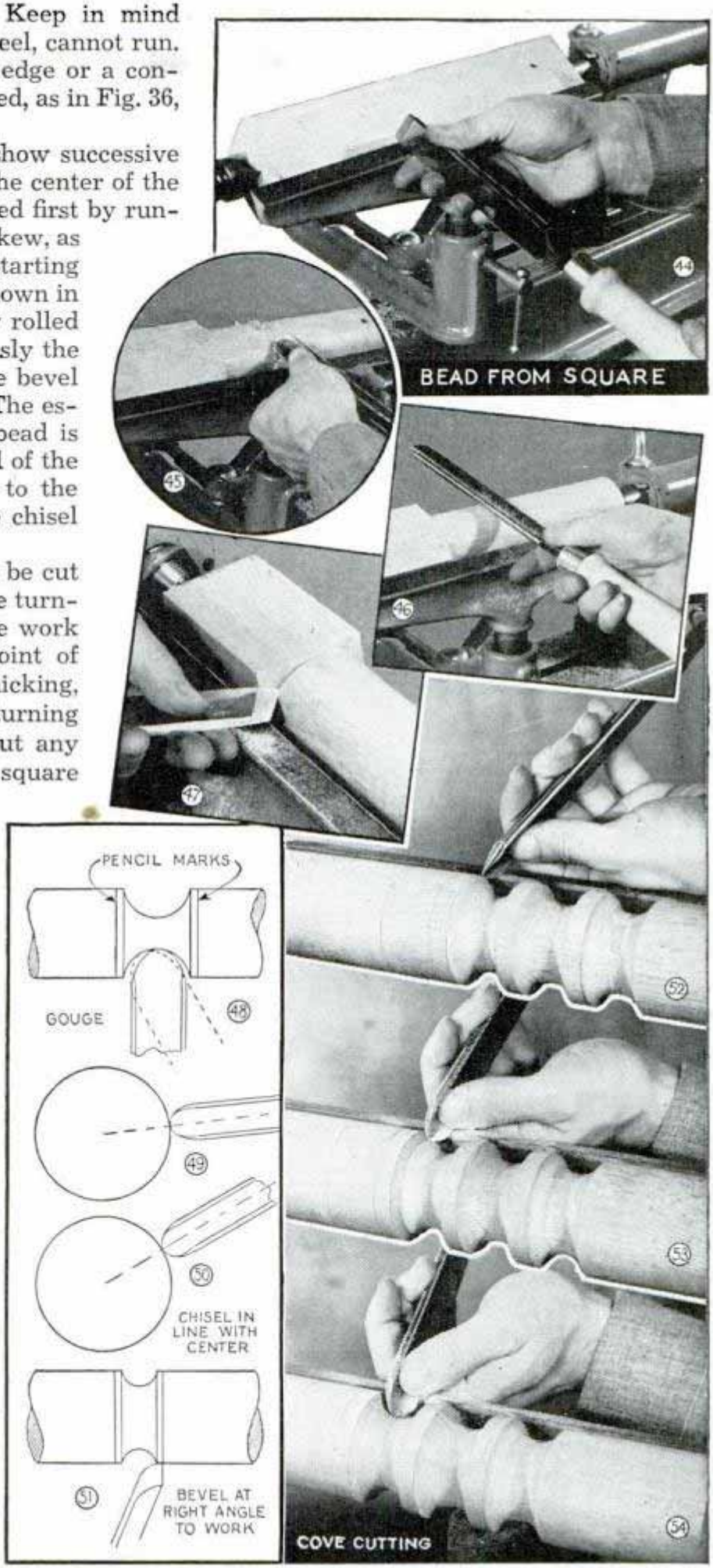
Following the parting tool, Figs. 26, 27, and 28 picture the cutting of a shoulder. In the first operation, the waste is cleared away with the gouge, Figs. 26 and 30. The heel of the skew is then used to smooth the new surface squarely into the shoulder, Figs. 27 and 31, while the toe of the skew is used to dress the shoulder smooth and to exact size, Figs. 28 and 32. When using the skew in this last position, the cutting edge should at all times point toward the center of the work, Fig. 32. A still more important point in making this cut is shown in Fig. 33. Here the line "B" is the cutting edge of the chisel; line "A" is the bevel. Notice particularly that the bevel A is exactly parallel with the cut surface, while the cutting edge is slightly turned away. The same general technique used in cutting a shoulder can be used for clearance cuts or for making vee grooves, as in Fig. 34. Vee grooves can also be made with the heel of the skew, as in Fig. 37. From this position, the handle of the chisel is raised to hinge the cutting edge into the wood. The same rule about not engaging the full cutting edge applies. Slightly exaggerated, Fig. 35 shows how the edge of the chisel is almost, but not quite, parallel with the surface being cut. This is correct. Fig. 36 shows the edge of the chisel exactly parallel with the cut surface, which is incorrect. When the edge is thus engaged, a

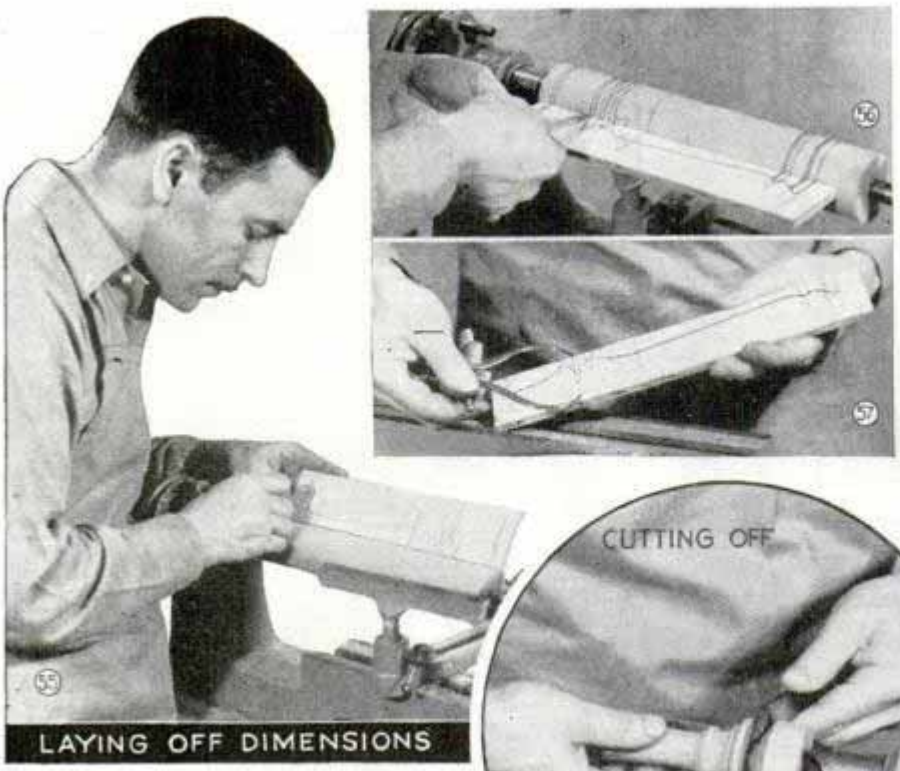
"run" invariably results. Keep in mind that a point, either toe or heel, cannot run. It is only when the whole edge or a considerable part of it is engaged, as in Fig. 36, that runs occur.

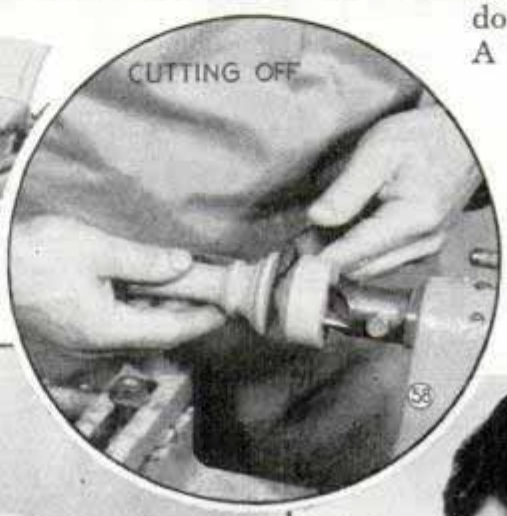
Figs. 38 to 42 inclusive show successive stages in cutting a bead. The center of the depression should be marked first by running in with the toe of the skew, as shown in Figs. 38 and 39. Starting the cut from the position shown in Fig. 40, the chisel is slowly rolled to the left and simultaneously the handle is raised to keep the bevel in contact with the wood. The essential point in cutting a bead is shown in Fig. 43—the bevel of the chisel should be tangent to the work. In this position, the chisel cannot run.

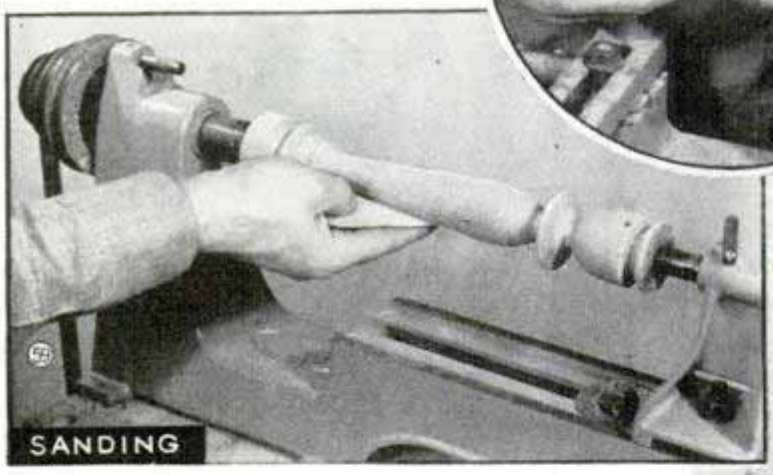
Quite often, a bead must be cut from a square portion of the turning. When this is done, the work is first nicked with the point of the skew, Fig. 44. After nicking, the round portion of the turning can be roughed out without any danger of splintering the square part, Fig. 45. After the round portion is turned down to a true cylinder—this is easily checked by placing the chisel flat on the revolving work to detect any "hammering" action, as shown in Fig. 46—the bead itself can be cut. This can be done in the same manner as previously described, although many turners prefer the simpler scraping operation with the toe of the skew, Fig. 47.

Figs. 51 and 52 show the start of the difficult cove cut, and Figs. 53 and 54 show the slight rolling action of the gouge as the cut progresses. Pencil marks are first made to indicate the edges of the cut, and the excess wood inside the marks is removed with the gouge, using a scraping position,




LAYING OFF DIMENSIONS


CUTTING OFF


SANDING


USE OF BACK STICK

Fig. 48. The entire cut can, of course, be made in this manner, the practice being quite common even among experienced turners. To proceed with the rolling cut, the first essential point is that the gouge must point to the exact center of the work. Whether the tool rest is low, Fig. 49, or high, Fig. 50, this same rule applies. The reason for this is simple: The exact point of the gouge which is thus engaged cannot run. The second essential point is shown in Fig. 51—the bevel of the gouge must form an exact right angle to the surface of the work. From this position the gouge is rolled into the cove, making one-half of the cut in one operation, and the opposite side of the cut in a second operation which is a reverse of the first. It's important that the tool handle be swung through an arc simultaneously, so that the bevel will assume the same relative position throughout the operation.

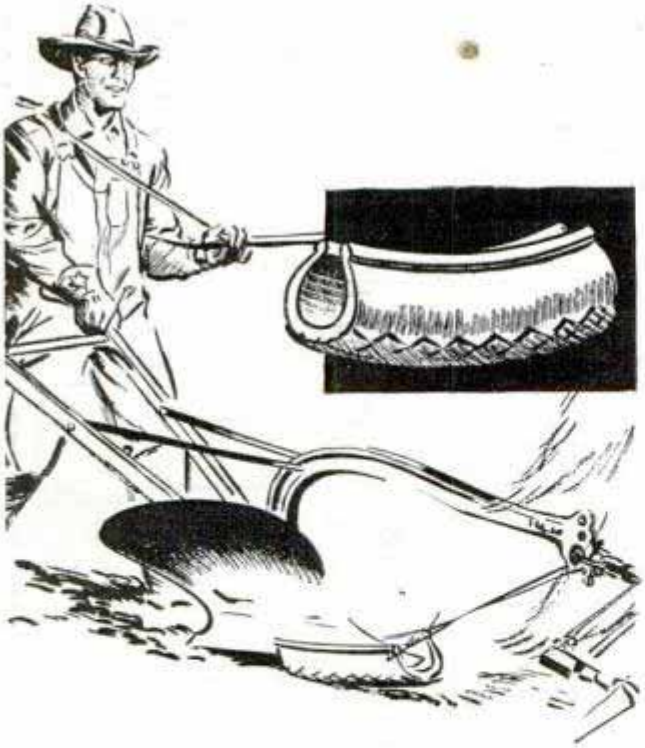
When the basic cuts have been mastered the turner can do any ordinary spindle turning. The essential points are illustrated in Figs. 55 to 60 inclusive. The first step after smoothing the cylinder is to mark off the dimensions. This is best done with a layout board. A layout board is simply a thin piece of wood on which is drawn a full-size half section of the proposed turning. Placing the board against the cylinder, the turner can quickly mark the various points along the turning, as in Fig. 55. Many turners place the board flat on the tool rest, Fig. 56, and mark the work while it is revolving. After marking the required lengths, the diameters are picked off, as shown in Fig. 57, and the caliper setting is then used in making the initial parting-tool cuts, and then the various forming cuts are made. A spindle turning properly cut is perfectly

smooth and should require but very little sanding. When sanding, remove the tool rest. Use very fine sandpaper, and keep it constantly in motion along the length of the turning to avoid scoring. The usual practice is to reduce the diameter at either end of the turning to about 3/16 in., and then cut the work free with the skew chisel at the driven end, as in Fig 58. The left hand lightly encircles the work, and prevents it from being thrown from the lathe. Slender spindle turnings will vibrate under the pressure of the chisel, making smooth cutting impossible. To eliminate this vibration, a center rest should be used. If the turner is not equipped with a center rest, good results can be obtained by using a simple back rest or back stick, as shown in Fig. 60.

(To be continued)

Walking Plow Pulled on Runner to Keep It Out of Ground

When moving a walking plow from field to field, a section of auto tire fastened to the beam to extend back under the point



When a piece of auto tire is held under the plowshare you can move a walking plow easily

of the plowshare will keep it from digging into the ground. When not in use, the piece of tire can be removed or tied up to the beam out of the way.

—G. E. Hendrickson, Argyle, Wis.

Dolly to Move Heavy Boxes in Your Store

Heavy boxes and crates up-ended on this V-block dolly are easily moved

In stores where an occasional job of moving heavy boxes does not warrant the purchase of a hand truck, this dolly will enable you to do the job easily. It is made by sawing out a large V-block from a piece of wood and screwing it to a roller skate. A small rope fastened to one end of the block with an eye bolt serves as a handle.

Microscope Specimen Measured with Thickness Gauge

Microscopists will find a thickness gauge a handy tool in their work, as it enables them to determine readily the thickness of any section. This may be done by using a high-power objective and focusing very sharply on the top of the section to be examined. Then, leaving the setting fixed, move the slide so that the specimen is out of range and insert the gauge under the objective, trying different combinations of the gauge leaves until a sharp focus on the top leaf results. A good gauge will measure a specimen as thin as .0015 in., or, if a metric gauge is used, .04 mm. This method can be used in the shop for determining thickness of shim stock, paper, etc., when no micrometer caliper is available.

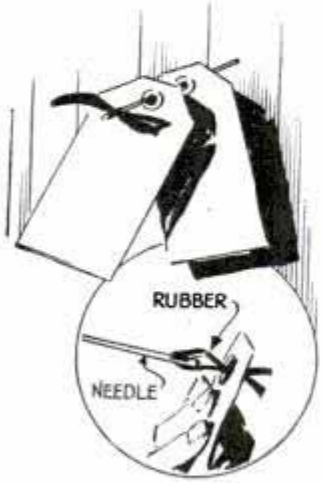
—W. C. Wilhite, Hornsby, Ill.

Blackboard in Furniture Store Helps Floor Salesman

By using a blackboard, a furniture salesman shows methods of arranging furniture in customer's home

In order to get an idea of the layout of a prospective customer's home, a floor salesman in one furniture store uses a large blackboard. On this he sketches a floor diagram of the customer's home along with the location of each piece of furniture. With the blackboard, the salesman can illustrate suggestions for rearranging furniture, or he is able to give his customers some helpful idea of what kind of furniture would look best.

Darning Needle Stuck in Wall Keeps Shipping Tags Safe



One produce buyer, finding that shipping tags suspended from hooks on the posts of the loading platform were often blown about and wasted, replaced the hooks with large darning needles. These were driven into the posts, as shown, and a section of a large rubber band was threaded through each needle eye. This arrangement permitted the tags to be slipped onto the holder with very little trouble but their removal was restricted so that they must be pulled off.

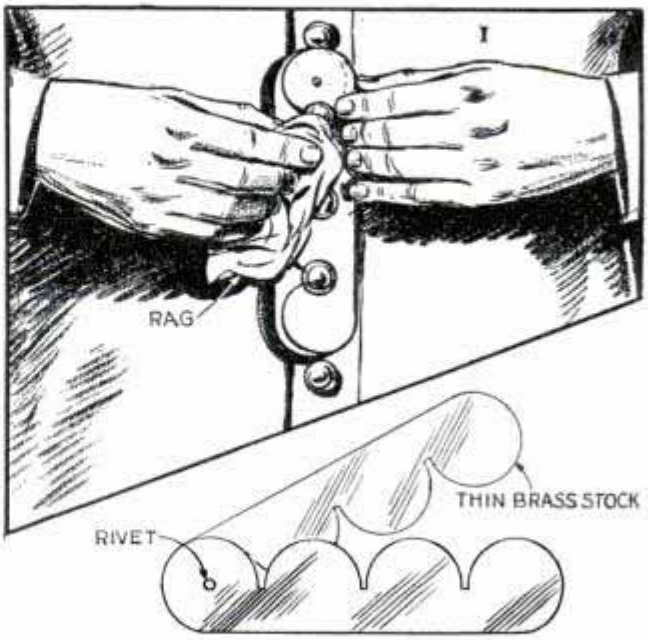
Rubber Washers Hold Rivets for Clinching

The problem of holding rivets, when assembling well tubing, cold-air ducts for furnaces, etc., until they could be clinched on a mandrel was solved in one shop by using rubber washers. These were square and were cut from an old inner tube, slots being made in the center of each one to slip over the projecting ends of the rivets to keep them from dropping out.

Shield Protects Cloth on Uniform While Polishing Buttons

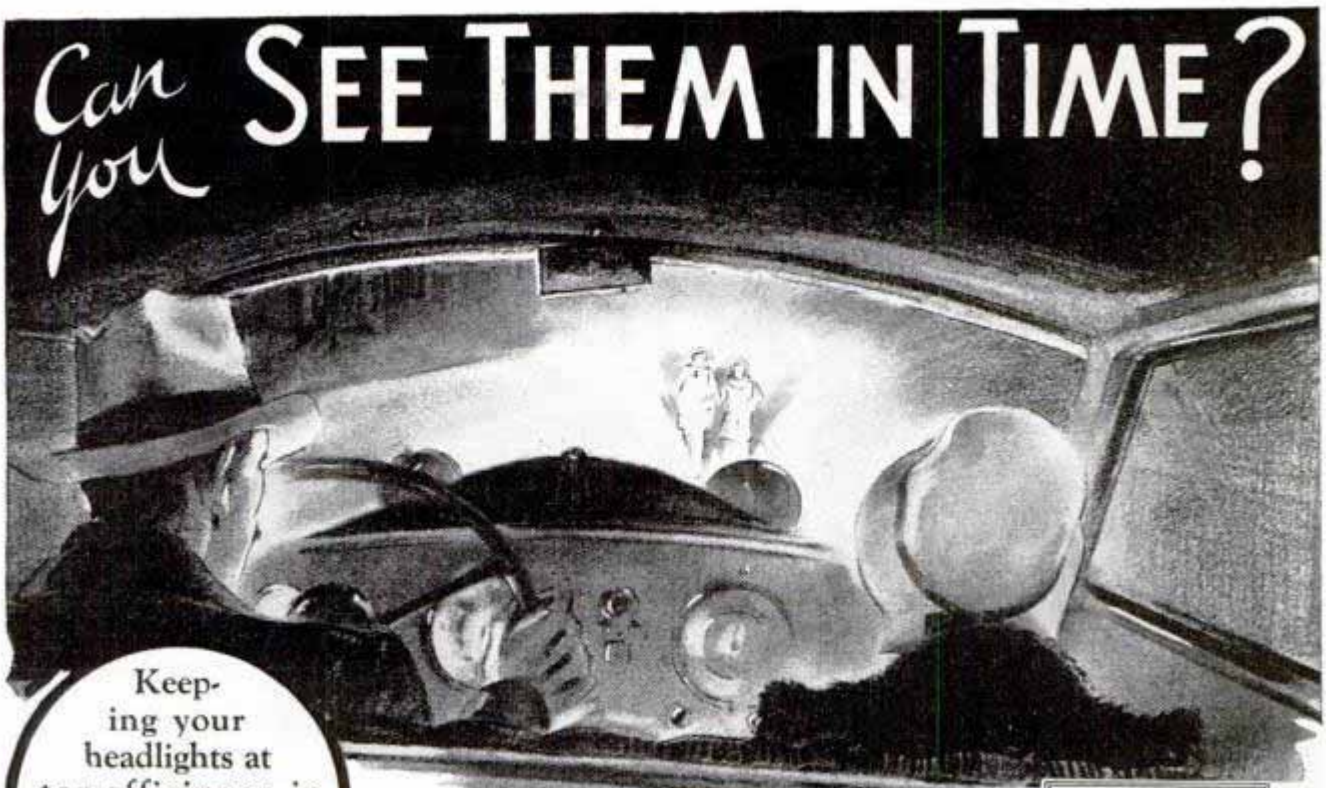
To avoid soiling the cloth of his uniform while polishing the buttons, one police officer uses this shield, which slips under them as indicated. Cut from thin sheet metal, the shield consists of two pieces, which are pivoted at one end, allowing it to be opened for easy removal.

—Sigmund Sameth, New York City.

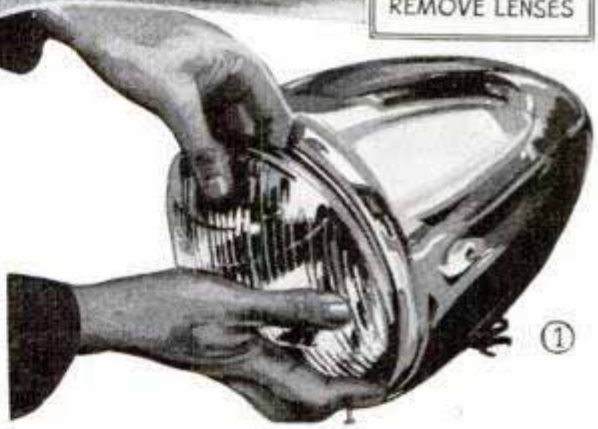


Police officer uses hinged shield to protect cloth of uniform while polishing the buttons

Can you SEE THEM IN TIME?

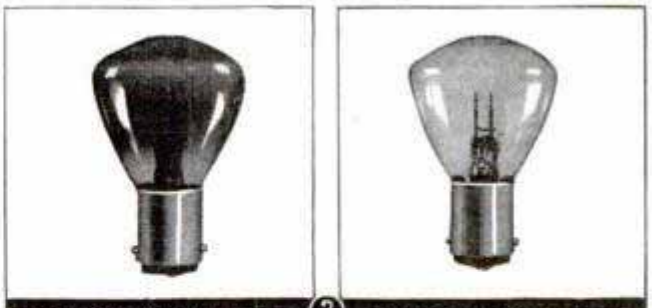


Keeping your headlights at top efficiency, is easier than polishing the car and, it may save a life



LOOK inside the headlamps of cars involved in an accident at night and you will often find dirty or tarnished reflectors, blackened lamp bulbs, mud-spattered lenses, which are the weapons that Death employs to make night driving at least four times as dangerous as day motoring.

Bulb blackening is a good index of headlamp life as it shows the condition of the lamp filament. Automobile lamps do not fail only because their filaments are broken by mechanical vibration or shock —the filaments simply wear out. Switching your headlamps on heats the filaments to such a degree that the tungsten vaporizes slowly. As the diameter of the filament wires becomes less, the wire becomes brittle and finally breaks. The vaporized tungsten condenses on the cool walls of the glass bulb, forming a black deposit as in Fig. 2. This blackening provides a reliable gauge of the condition of the filament, and an indication of when the lamp is about to burn out, for the blackening is greatest just before the end of the lamp's life. Repeated tests have shown that a well-made automobile headlamp is delivering 95 per cent of its maximum candle-



ADJUST CHARGING RATE

power when it is 80 per cent worn out. During the remaining fifth of its life, its light output drops rapidly because of the bulb blackening.

To determine when your headlamp bulbs need replacing, remove the lens, Fig. 1, take the bulbs out, hold them against a sheet of white paper or other white surface, as in Fig. 3, and see whether they are blackened appreciably. Although excessive bulb blackening naturally results in dim lights, dimness may be caused also by low voltage. The generator charging rate may not be high enough to keep the battery fully charged. This is remedied, as in Fig. 6, by adjusting the third brush until the ammeter shows an increased charge when the engine is running at normal driving speed. Loose or corroded electric connections in the lamp circuits will cause dim lights. Careful inspection of fuse clips, switch contacts, junction-box connections, instrument connections, lamp sockets and ground connections will eliminate the trouble. Burned-out lamps not traceable to natural wearing out of the filaments usually result from too much voltage. Over-voltage may be caused by low water level in the battery, Fig. 9, generator charging rate that is too high, and loose or corroded connections in the battery circuit, Fig. 8, the portion of the electrical circuit between battery and ground and battery and ammeter.

When replacing headlamp bulbs, insist upon the products of reliable manufacturers. The markets are flooded with so-called "gyp" bulbs, some of which are so poorly constructed that satisfactory performance is impossible. Filaments may be so badly centered that control of the beam is lost. One degree of inaccuracy will shift the beam 21 in. at a distance of 100 ft. The lamp may be crooked in the socket. Presence of water vapor in the bulb, improper evacuation or presence of undesirable chemical conditions may cause the bulb to blacken badly in a few hours of burning, even though the condensation of tungsten vapor is normal.

Headlamp lenses pick up mud and dust with amazing ease, and should be wiped clean whenever such deposits interfere with the light output as in Fig. 5. Wiping the lenses with a clean cloth every evening, before starting out, is a good habit. Alternate heating and cooling of air inside the headlamp causes the lamp to "breathe." This allows dirt to enter the housing and settle on the interior surface of the lenses, and on the bulb and reflector. Reflectors

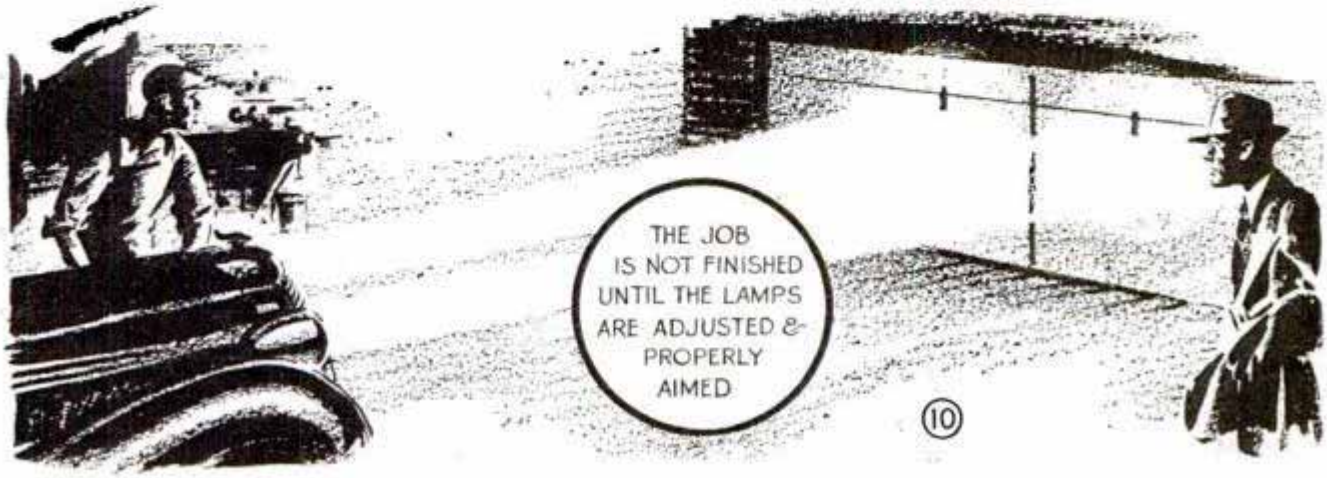
usually are made of silver-plated brass. Road scum and dust, coupled with a natural dimming of the luster, cause the reflector to lose its efficiency gradually. Twice-a-year cleaning, Fig. 4, will maintain it at a fairly high level.

There are on the market a number of suitable cleaning compounds. You can use one of these, or make up your own cleaner. Simply moisten a quantity of lampblack with alcohol (rubbing, denatured or wood), and use it as a polish. Use a soft cloth free from grit, and do not experiment with cleaning preparations not specifically recommended for reflectors, for the silver surface is very easily scratched. Engineers who have made comparative tests have failed to find any good reason why fog lamps should be yellow instead of white. About their only merit is that the yellow beam is less intense than a white one from the same sized light source, because much of the light is absorbed by the yellow lens or screen. This naturally reduces the amount of light reflected by the fog. Some motorists "cap" the ends of the bulbs, as in Fig. 7, with black lacquer to help reduce glare in fog. Most fog is less dense a foot or two from the ground than at a higher level. Therefore a headlamp positioned near the ground will throw its beam under the fog, and provide much better illumination because of less scattering of the light.

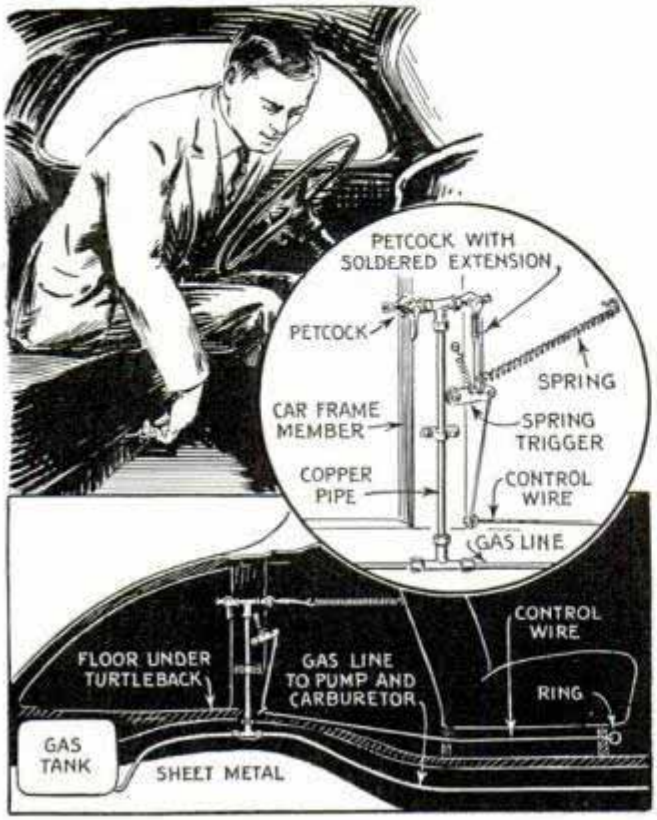
CHECK THE WIRING

AND TEST BATTERY

A very slight misalinement between the lamp filament and the reflector may destroy the beam pattern entirely, causing the light to shoot up into the eyes of approaching drivers and fail to illuminate the road surface. Always keep your lights adjusted and properly aimed. A chart, Fig. 10, is an essential to satisfactory adjustment.



Hand-Controlled Gas Line Vent Foils Car Thieves

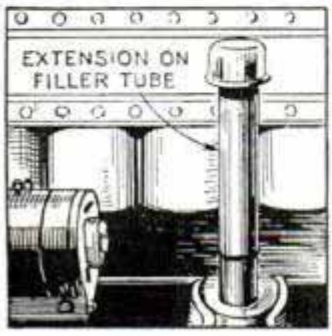


If a bandit enters your car at a stoplight, just open the cock vent to let air in the gas line

Here's a simple way to foil thieves in any attempt to run your car under its own power by merely pulling a ring, which opens a petcock and allows air to enter the gas line and stop the motor. A T-fitting is installed in the gas line to take a length of copper tubing, on the upper end of which is another T-connection and two petcocks. In this case, the installation applies to a coupe, and two cocks are used, one to be operated from the seat and the other extending into the luggage compartment, permitting one or both to be used.

—Robert E. Toms, Riverside, Calif.

Vapor from Oil-Filler Tube Gums Generator Brushes



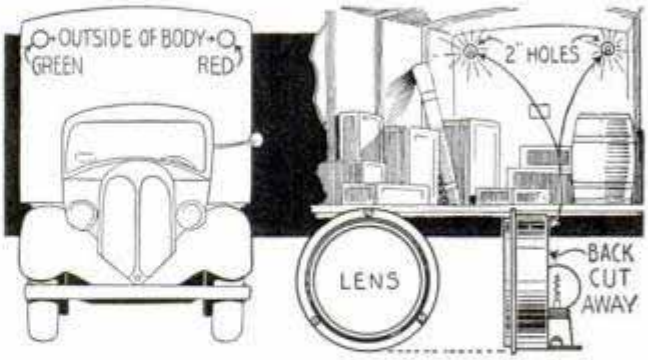
On some cars that have air-cooled generators, trouble is often experienced by oil vapor from the oil-filler tube being drawn into the generator, causing the brushes to gum up and stop charging the battery. This trouble is caused by the mouth of the oil-filler tube being too close to the rear end of the generator, and can be prevented by lengthening the tube with an extension piece.

—H. W. Lockhart, Massillon, O.

Grease Kept Out of Rear Brakes by Differential Breather

The tendency of grease to work out on the rear brakes of some cars in winter can be prevented by providing a breather in the differential. Without this, the expansion resulting when taking a car into a warm garage, or driving a cold car until the grease warms up may cause such expansion as to force grease into the brakes. On the other hand, the contraction may suck grease from the transmission on cars having torque tubes. While this trouble can be stopped by drilling a 1/16-in. hole in the axle housing, this is undesirable for it may start a break. It is better to remove one of the upper cap screws that hold the differential cover and drill a 1/16-in. hole through it lengthwise.

Interior of Truck Illuminated with Body Lights



By slightly altering front lights on truck body, they are made to help illuminate interior

For truck drivers who make deliveries at night and have no light in the body of the truck, I find that the red and green lamps that most trucks have on the front of the body can be used for the purpose.

First remove the lamps and cut 2-in. holes in the body just behind them. Then take the lens part of the lamp and fasten it on the body directly in front of the hole. Next take the back of the lamp and cut away a section so that the bulb is exposed to give light inside the truck, and place this part behind the hole.

—Russell Lattig, Rockaway, N. J.

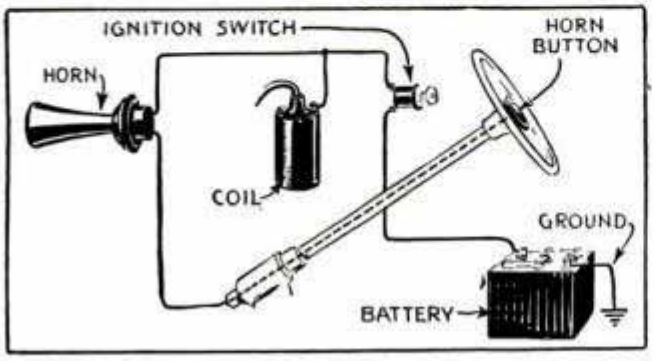
Puller for Axles and Driveshafts

For pulling axles, driveshafts, timing gears, etc., this tool is made easily by drilling and tapping the ends of various size wheel pullers to take the threaded end of a small rod, several inches long. A lock nut should be used on the rod to hold the adjustment. The end of the rod has a head, against which a knocker, made from a piece of driveshaft, is moved to pull the part.

—Jos. C. Coyle, Phoenix, Ariz.

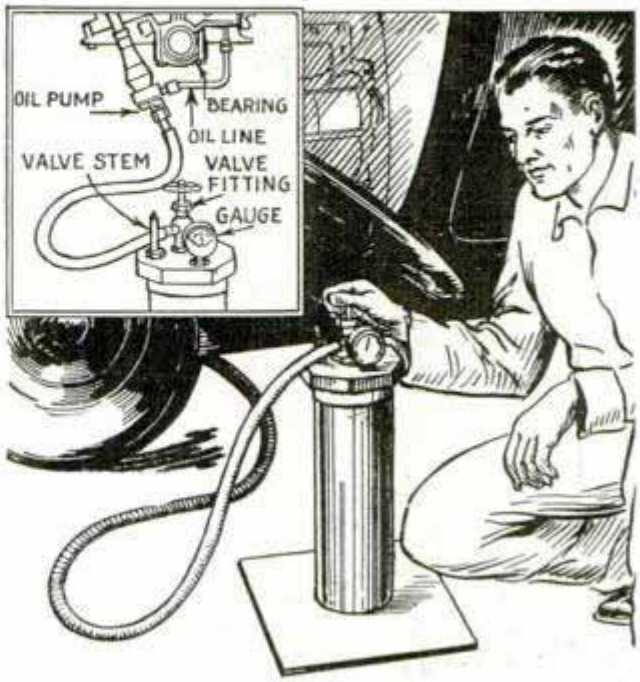
Horn Can't Be Blown by Children When Connected to Switch

Connected to the "dead" side of the ignition switch, the horn can be sounded only when the motor is running. This idea is especially convenient when the car is parked without locking it and is accessible to children. The horn wire can be connected to the coil wire running to the switch, or a wire can be run directly from the horn to the switch terminal.



If the horn is wired to the "dead" side of the ignition switch, it can be sounded only when motor runs

Loose Bearings Quickly Detected by Simple Pressure System



You can locate a loose motor bearing that leaks oil in a jiffy with this simple oil-pressure system

As loose bearings are often the source of oil waste in a motor, this pressure system to quickly locate the offending bearing will save time and money in making a repair. The system consists merely of a pressure tank that can be connected to the oil system of the motor, when the pan is removed, to force oil through it under pressure. The tank is made from a length of 4-in. pipe, which has a metal plate welded to the lower end and a cap fitted on the upper end. The cap is drilled and tapped for a pressure gauge, an air valve and an ordinary tire valve. In use, one gallon of oil is put into the tank, after which air is introduced under 50 lbs. pressure through the valve stem. Then a high-pressure rubber tube from the air valve is attached to the oil system of the motor and the pressure is turned on.

Oil in Cylinder Boosts Off Head

You have a hydraulic jack right in your motor for boosting off cylinder heads where the gasket has been shellacked in place. With all nuts or studs removed, just put a little oil in each cylinder, replace the spark plugs, step on the starter, and the head will be loosened. The pistons coming up against the oil provide the hydraulic action needed.—C. E. Packer, Chicago.

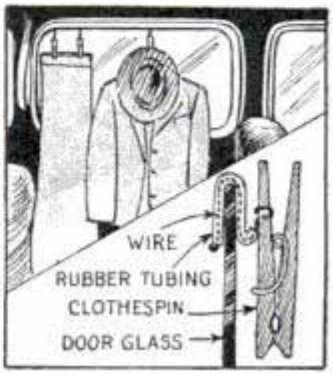
Latch to Engage Garage Doors When They Are Opened

When these doors are opened against the side of the garage they are automatically engaged by latches

To avoid using sticks or rocks to prop open the doors of his garage, one motorist has a pair of latches attached to the sides of the garage so that they automatically engage the doors when they are opened. The circular detail shows how the latches, which are shaped from a piece of flat iron, slip through slots cut in the doors, the slots being faced with pieces of flat iron to provide long-wearing surfaces for the latches to bear against.

Garment Hook for Car

Fitted with a wire hook, a spring-type clothespin makes a good garment hanger to hook over the lowered window glass of your car. The wire hook, which is covered with small rubber tubing to prevent chipping the glass, can be attached to the clothespin by wrapping one end tightly around one of the legs, or by drilling a hole in the latter to take the end of the wire.



—Don C. Higbee, Cantil, Calif.

The Next Issue

WHAT YOU CAN DO WITH CREPE PAPER

There's no end to what you can do in crepe-paper craft. Cigarette and jewel boxes, pin trays, tie racks, picture frames, pillow covers and many other useful and decorative articles are easy to make by simply applying twisted and braided strips of colored crepe paper over tin cans, cardboard boxes, etc.

TURNING WOOD ON CHUCK AND FACEPLATE

Solves the problem of the inexperienced woodworker in turning balls, disks, rings, bowls, boxes, etc. Tells what to do and shows how to use the chisels.

"BOWL-O"—FASCINATING PASTIME

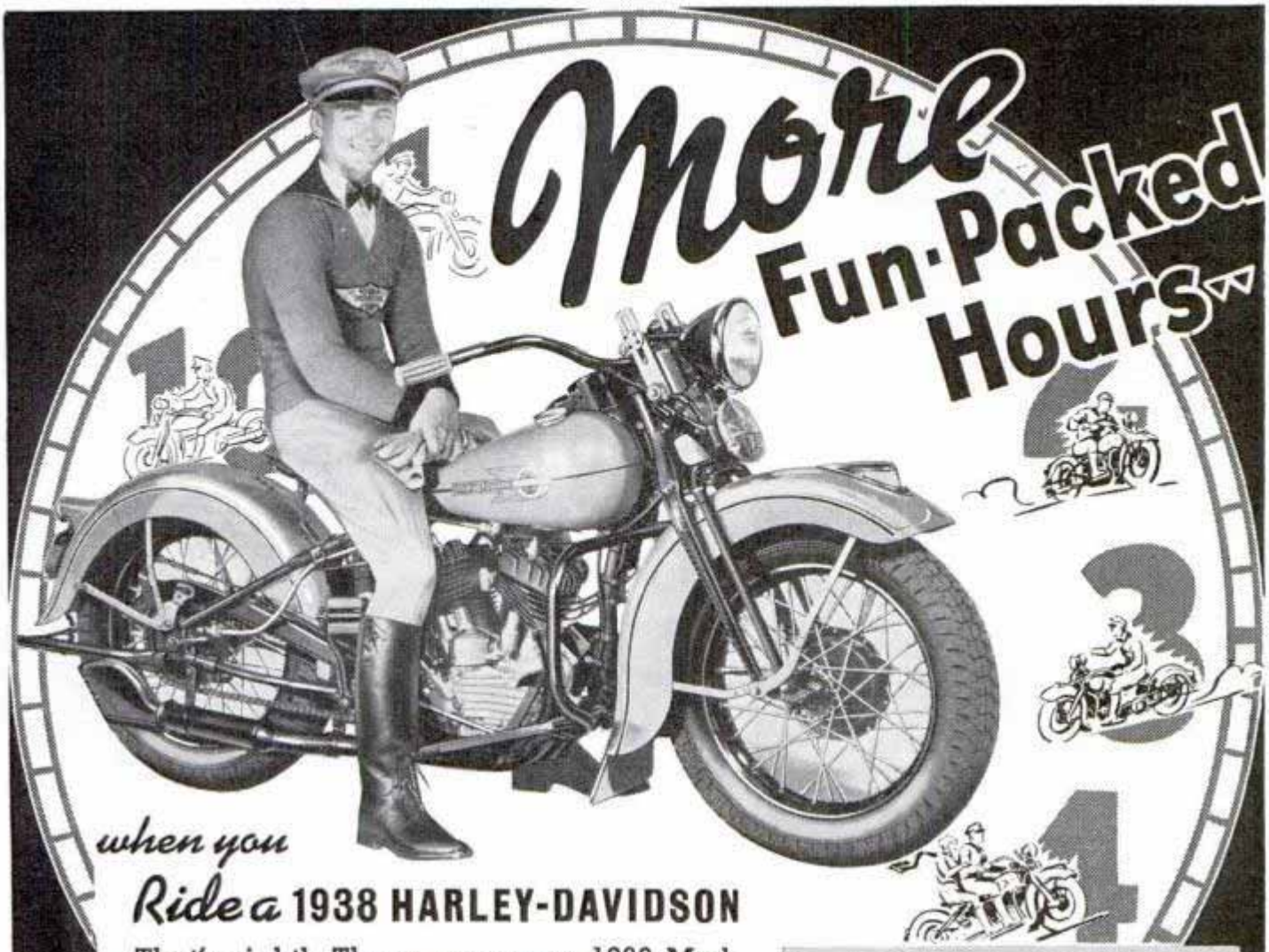
Table-cabinet game which requires skill to direct a plunger-shot ball into small ninepins by manipulating a flexible lining at one end of the cabinet.

SKATING ALONG WITH THE WIND

Two types of lightweight sails that you've wished for on those blustery days when ice skating. Sails are made of inexpensive materials available anywhere.

YULETIDE SHADOW BOX

Plywood cutouts mounted on slow-moving belt are silhouetted against indirectly lighted background to create typical desert scene. Operated by motor.



Ride a 1938 HARLEY-DAVIDSON

That's right! The snappy new 1938 Models are always "rarin' to go." And with one of these Harley-Davidsons you sure can pack every spare hour with pleasure —afternoons, evenings, holidays and vacations. So decide now that you're going to OWN a Harley-Davidson. . . The new 1938 Models have the power, zip and stamina to "go places" with real class. New streamlined style and advanced mechanical features make them "tops" in performance and ride value—with new "lows" in mileage cost.

See your nearest Harley-Davidson dealer NOW for a FREE RIDE—ask about his Easy Pay Plans — and send in the coupon!

Harley-Davidson wins all four 1937 National Hillclimb Championships at Muskegon, Michigan. Above: Hap Seamans, 45 and 80 Class "B" National Champion — Harley-Davidson mounted.

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My age is ☐ 16-19 years, ☐ 20-30 years, ☐ 31 years and up, ☐ 16 years. Check your age group.

HARLEY-DAVIDSON

Latest in Music

(Continued from page 831)

Each pair of these seven sets of microphones were so placed that they picked up that special section of the orchestra fully, with the rest of the orchestra sound as a background. Then from each pair of microphones went leads to recording machines. From one microphone of the pair, a lead went to a machine recording on a separate channel, and from the other microphone, a lead went to a mixing panel. Thus there were seven separate channels, and an eighth channel which was a mixture of these seven. The mixing panel

Special sound recording device which puts sound on film with aid of ultraviolet light

made it possible to "mix" these seven channels in any way desired.

There also was a general pick-up from a battery of microphones placed above the orchestra. This was recorded on a separate channel, making nine in all.

Other musicians were used in Hollywood to make the action part of the film. Then with these action films before him, and the nine channels of sound, Dr. Stokowski was able to add whatever musical and sound effects he desired.

In this way, for the first time, a musical director had at his service music in various shades and colors much as an artist has colors on a palette, and was able to mix this music to produce effects which no orchestra could produce without the engineer's aid.

Focusing Your Camera

(Continued from page 890)

tive film with artificial light. And the reflector is important, for a good reflector behind your floodlamp increases its effectiveness by as much as seven times. You can rig up a makeshift reflector yourself; you can buy an excellent metal one, or you can buy a very efficient yet inexpensive cardboard reflector at a camera store. In using any artificial light, remember that its intensity diminishes rapidly as you move it away from your subject. Keep the light as close to the subject as practicable.

Photoflash lamps operate on any current from that of a pocket flashlight battery to standard house current, and they produce a brilliant flash of highly actinic light. Simply set the camera for time or bulb, and when ready open the shutter, set off the Photoflash and close the shutter.

With a supply of fast film, a camera, lights for indoor snapshots and a good store of ideas in your head, you are equipped for almost anything. You may want to use a tripod for time and bulb exposures, and if you attempt extreme closeups you may need an accessory portrait lens, a simple, inexpensive slip-on lens. But keep your equipment as simple as you can; it will be more fun and less work.

During the holidays you may find opportunities for several photographic specialties—silhouettes, tabletop scenes of miniature reindeer pulling Santa Claus over cotton snow, firelight pictures around the hearth, double-exposures, and the like. But they are not so important to the Christmas record; save them for the "long winter evenings."

If you've never made an adequate photographic story of Christmas in your home, try it this year. A few months hence it will be priceless, and you'll want to repeat with a scrapbook story of Christmas, 1938. Don't forget that pictures of everyday and holiday home scenes are more important history to your family than the pictures that appear in today's newspaper.

¶Popular Mechanics Magazine does not publish the name of the maker of, or dealer in, any device described in its pages, but this information will be furnished by our Bureau of Information upon request, accompanied by stamped envelope.

America's fastest growing hobby

SNAPSHOTS at NIGHT

Just do this

1. Load your camera with Kodak "SS" Film

2. Use two or three Photoflood lamps in Kodak Handy Reflectors

THERE'S FUN for the whole family in snapshots at night. Baby in his bath . . . the older children with their pets . . . grown-ups at the piano . . . everybody enjoys the "shooting." And you, most of all—for you're snapping those intimate family pictures you've always wanted, never hoped to get.

You don't need an expensive camera for snapshots indoors at night—not any more. Any camera that can be loaded with Kodak "SS" Film will do the trick—even the simplest Brownie.

With "SS" Film, you use two or three of the new No. 2 Mazda Photoflood lamps, which last for hours, in the inexpensive Kodak Handy Reflectors. If your camera has an *f*.6.3 or faster lens, then No. 1 Photoflood lamps are powerful enough.

FREE BOOKLET . . .

Suggests a variety of picture opportunities . . . shows you how to arrange your lights . . . how to place your subject . . . tells you everything you need to know about two ways to make night pictures—*snapshots* with Photoflood lamps, *fast exposures* with Photoflash lamps. (You can use Photoflash lamps, each good for one picture, if your camera can be set for "time.")

Get a copy at your dealer's . . . Eastman Kodak Company, Rochester, N. Y.

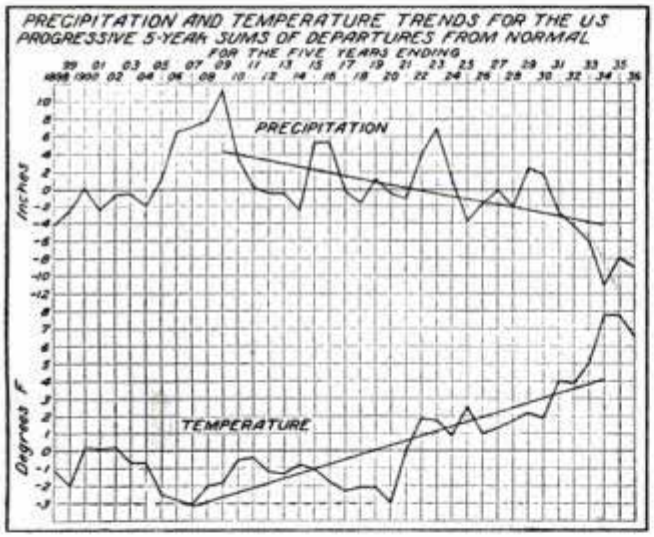
es 953

Snow—a Billion Dollar Business

(Continued from page 869)

resorts facilities have been laid out for other forms of sport less vigorous than skiing. Sleigh roads and snowshoe trails have been made and scenic splendors are stressed for amateur photographers. Dog-teaming attracts many visitors. In the National Parks there is a sport called "ash-canning," which consists of sitting in an ash-can cover and sliding down slopes while the cover spins.

Contrary to popular ideas, skiing is not an art of jumping. Only one skier in ten makes a practice of jumping and in Yosemite's Badger Pass it was found that the man-made ski jump was so little used that park officials dismantled it to make room for additional ski runs. Instructors report that anyone can learn to ski competently in three seasons. The beginner finds that



Showing how precipitation has dropped while average temperature has climbed

the most important item for enjoyment of this sport is the binding which holds his feet to the skis. A regular ski boot is almost a necessity because the heavy arch will stand the strain of continual bending. A binding on the ski which will permit no sideplay of the foot but only an up-and-down movement prevents discomfort. Skiers find that their clothing must be lightweight, to permit free movement of the body, warm and resistant to dampness.

Usually the skier goes from the period of rented skis, khaki breeches, and high-top boots, to the stage of owning a complete outfit. Gabardine ski pants and jacket, cap, boots, skis, poles, etc., can be bought for thirty or thirty-five dollars, but better grades cost sixty-five dollars and up. As he continues to follow the sport the skier adds to his outfit a lightweight parka or jacket, goggles, ski waxes, headlamp for night skiing, and a triangular pack sack to carry on his back. Skiers spent over $400,000 in Seattle, Wash., stores alone during November and December of 1936.

By auto or train the ski enthusiast will go to as many resorts as his purse can afford. In Yosemite he goes to the hotel and spends fifteen dollars per day or to the lodge which costs only five dollars per day. If stops are made outside the park, his expenses may be lower.

On the other side of the picture, snow is still the old-fashioned snow, the snow that means lots of work and expense. Highways and city streets have to be cleared. Reports to the government show an annual cost of over $11,000,000 for clearing federal state highways and about twice that amount for county road systems. Snow removal in cities is costly because the snow has to be hauled to sewer mains or city outskirts and mostly involves hand labor; $150,000,000 is regarded as a conservative estimate.

Railroads charge off $13,000,000 as snow and ice removal costs. In the severe storms in the West during 1936, the Northern Pacific railway spent over $300,000, and other western roads comparable amounts. Rock Island reported that "the aid of radio stations was enlisted and calls were put out over the air asking that any men who had warm clothing and wanted to work, report to the railroad and they would be given jobs shoveling out the line." As a result they spent over $100,000 to free snowbound trains and to clear their line.

With all of this money directly associated with the winter snows, many people are asking "Is our climate changing?" The United States weather bureau says it is not, and explains that climate is the weather average over long periods of time, 100 years or more, while weather refers to conditions for a day, a week, or even a year. However, weather records show higher temperatures and less precipitation since 1910. Sports enthusiasts need not worry about a lack of snow, even in face of this trend to mildness, because the winter resorts are in mountainous regions at high altitudes where snow is plentiful.

Railroading for Men Only

(Continued from page 885)

right of way. And that is where rival clubs exercise their ingenuity. Alongside the Milwaukee Union Terminal tracks are plaster highways with tiny automobiles waiting at grade crossings. Miniature rail

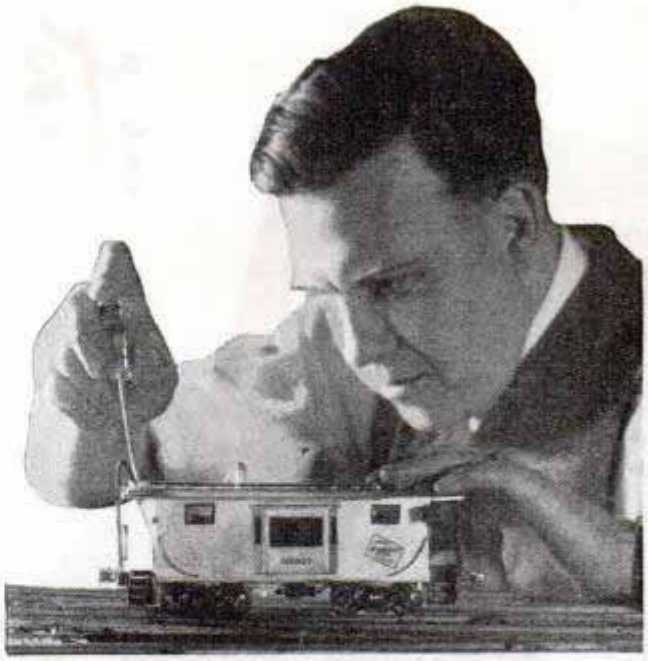
Terminal yardmaster operating switches and yard controls, with six trains waiting for orders

fences guard the right of way; tenuous copper wire stretches from one slender telephone pole to the next. Trees and shrubbery are bits of synthetic greenery from a florist's shop, or occasionally real twigs and leaves and moss shellacked or sprayed for permanence. An amateur artist painted scenery around the walls and simulated a mountain around the tunnels that lead into the back room. Roofing paper with a gravelly surface is used for ballast. Wire mesh forms the contours of the countryside; it is covered with paperboard and plaster.

The river that runs under the steel bridge on the Terminal line is made of water glass. A big model railway in Maywood, Ill., approaches even closer to nature with a real waterfall that tumbles down a rocky mountainside that slopes almost to the ceiling. In Maywood, too, there is a wide lake with a train ferry that noses up to a railway dock, lets a train roll aboard, and then under power of its twin side paddles, operated by two remotely controlled electric motors, it glides across the lake to a river mouth, guides itself—by cutting out one or the other sidewheel—under a motor-operated railway lift bridge and up a river to another railway dock to discharge the train. Cables dragged in the water under the ferry carry power from the remote-control switches. Spanning the freight yards beside the lake is a big gantry crane built by the consulting engineer who spends most of his time at his hobby. As he manipulates remote switches the crane travels to a coal pile, drops its bucket and picks up a load, rises and moves over to the dock to drop the coal into a barge.

It is almost sacrilege to touch a locomotive on these railroads for truant business men. However much you'd like to fondle the engines and cars you must leave them very much alone. They are to be operated entirely by electric controls. Even the cars are built with automatic couplers that lock when shunted together. If you do pick up a model engine when the dispatcher isn't looking you'll find it astonishingly heavy; most of these miniature locomotives weigh around fifteen pounds.

You need not be a mechanical genius to find a place on the staff of a model railway. If you know the trick of sandpapering celluloid windows for passenger cars, or making "earth" for the farms along the railroad out of coffee grounds or flour, water and salt; or if you can make over a clock face to tell "scale time" and write a

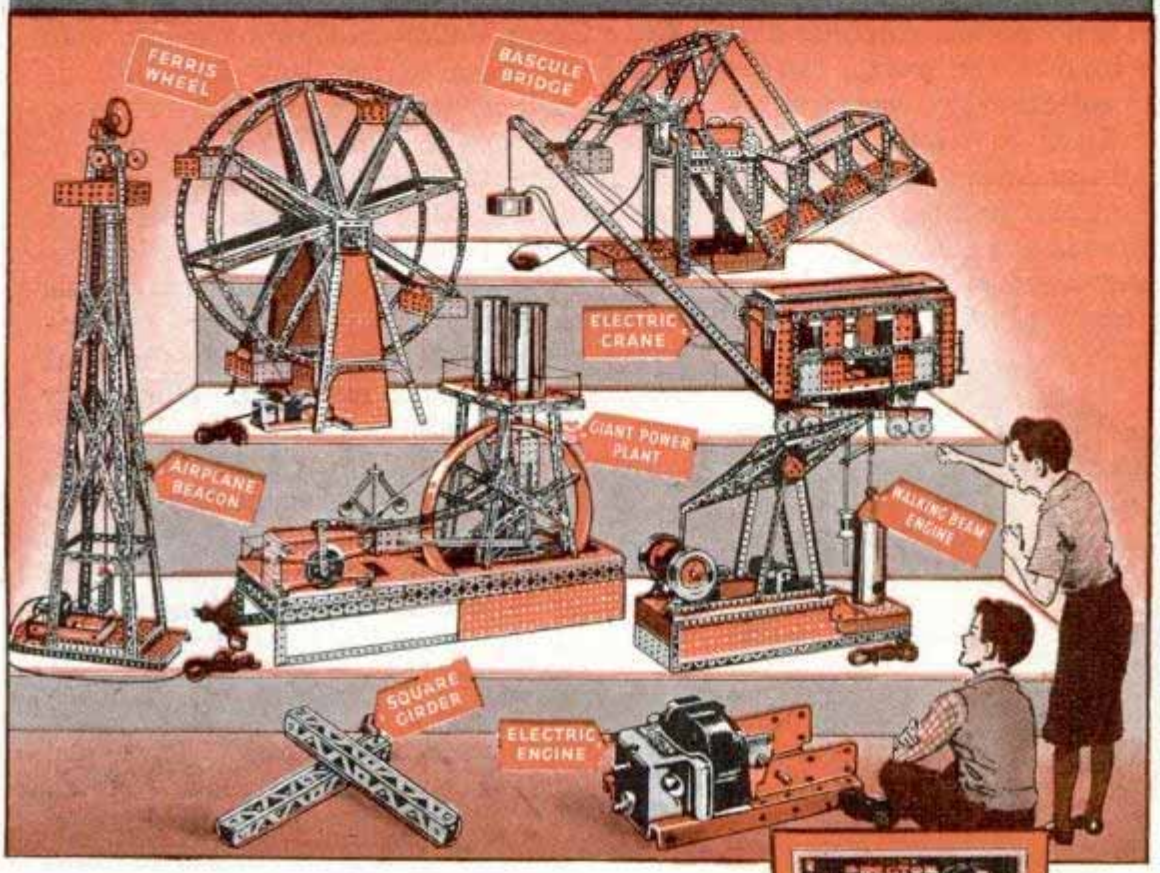


Repair work on aluminum-painted caboose, modeled after latest type with bay window instead of cupola

timetable for a miniature system, there's a job waiting for you. The section gang always needs men, for a model railway is never finished.

THE GILBERT HALL OF SCIENCE PRESENTS

The great New Speed ERECTOR



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500 HOURS OF THRILLING FUN

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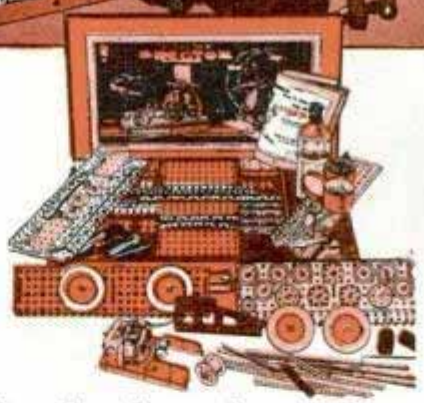

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FREE **"How-to-Sell-Dad" Poster and "Gimme Card"**

7 sq. ft. "How-to-Sell-Dad" Poster. Shows new Speed Erector in life size and full colors. Also, "Gimme" card to help you get what you want for Christmas. Send coupon or 1¢ post card.

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16 Erector Square
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Quick! Send me your colossal "How-to-Sell-Dad" Poster and "Gimme" card—both Free.

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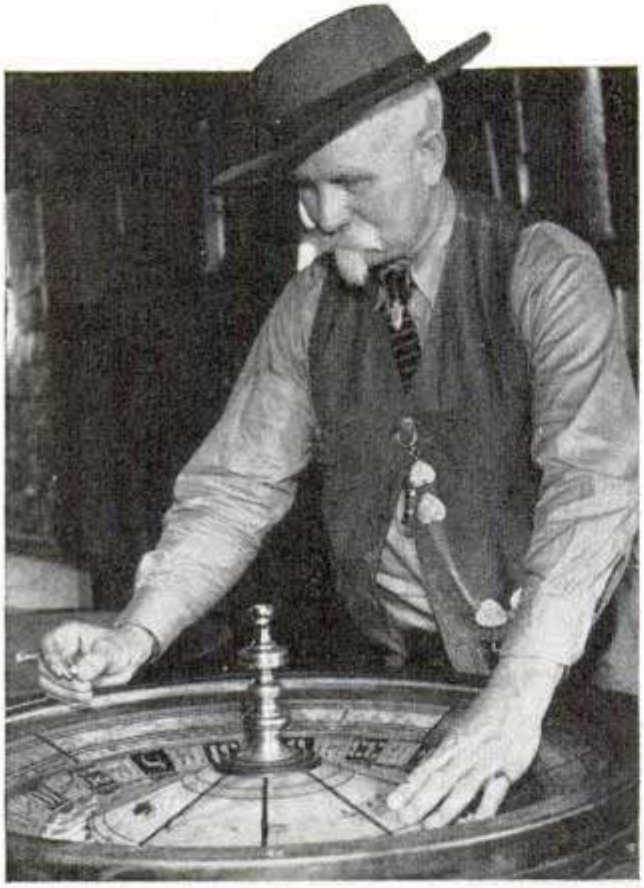
The Awakening of the Ghost Towns

(Continued from page 837)

furniture and equipment. Recently, while prowling through the gold country, he discovered an early fire engine complete to leather buckets and hose. When he took it apart to clean it he made a startling discovery. In the base of the pump, caught behind a metal projecting lip, was twenty-five dollars worth of gold dust. The fire engine had caught and saved the fine gold suspended in the water pumped through it while fighting fires in the early days.

Besides the increased price of gold that makes mining more profitable today, labor-saving short cuts and modern equipment in the mines and mills are enabling mines to make profit where none could be made before. Some rich mines that were abandoned when the lower levels were flooded by flows of water are being worked again because modern pumps are able to keep the shafts dry. Although every house is occupied again in many of the gold towns, some of the old silver camps are still asleep. The price of silver is still too low to pay for working some of the low-grade mines at a profit.



Roulette wheel found in good condition in an abandoned ghost town

Not all of the gold towns, of course, were ever completely abandoned. Some have been busy for fifty or sixty years because their mines have never been worked out. Near Grass Valley in California one vein has been followed for 9,000 feet and the ore is still as good as ever. At another mine high in the hills the miners live on the surface 2,500 feet above sea level and are carried 1,500 feet below sea level every morning by elevators to work at the bottom of the shaft. Places such as Angels Camp and Sonora on the Mother Lode became sleepy settlements when the first mining excitement subsided. Now they are booming again.

Some of the ghost towns have come back to life before. In the last century Cerro Gordo in the mountains above Owens Lake in California produced $17,000,000 worth of silver before it was abandoned. The mines also produced a lot of gold but no one had bothered to assay the ore for gold so it was thrown on the dump. There some smart Mexican laborers found it and claimed it. The silver ore alone was so rich that between freighting trips the bars of metal were stacked up outside the mill like cordwood. Although the Cerro Gordo ore also contained zinc and lead the town was deserted when the silver values began to fall. In 1911 the demand for zinc became active and for a time the early ghost town was active again. Now, with silver, lead, and zinc all on the upgrade, prospectors and leasers are moving back into the district and Cerro Gordo is returning to life for the third time.

There is still plenty of gold in the west for those who can get it. The famous San Juan Ridge in California contains more than $400,000,000 in gold dust and nuggets but the trouble is that it can be removed profitably only by hydraulic mining, and the trouble with hydraulic mining is that its debris overflows and buries good farm land. It was forbidden long ago. In the old days one hydraulic company built 200 miles of ditches and flumes to gather the water it needed, and another company made money working 41,000,000 cubic yards of dirt that contained only ten cents worth of gold per yard. The powerful

(Continued to page 124A)

COMPRESSED AIR FIRES BULLET IN NEW TARGET PISTOL

HIGHLY COMPRESSED AIR gives speed and power to the lead pellet being driven through the rifled barrel of the Benjamin air pistol.

HIGHLY COMPRESSED GAS mixture in the cylinders of your automobile engine gives extra power, more mileage, and that added responsiveness so important in emergencies. Only Ethyl permits you to get the full benefit of this compression—lets your car dealer advance the spark for maximum performance.

Practice arm demonstrates HIGH COMPRESSION principle of modern auto engine

THE greater the air pressure back of the air-gun's pellet, the further and harder it will shoot. The higher the compression in the cylinders of your motor car, the more power you get.

It's as simple as that. And that's why automobile manufacturers are using high compression engines in even the lowest priced cars. These cars squeeze more power, more mileage, more get-away from every drop of gasoline.

GIVES YOU A BETTER RUN FOR YOUR MONEY

To get these advantages go to your car dealer and have him set the spark for maximum performance *and then use a fuel made for high compression!* Stop at the "Ethyl" pump. There you get more anti-knock fluid (containing lead tetraethyl) than you get in the best regular-grade gasoline. By preventing harmful knock you make sure of 100% performance from your high compression engine.

And remember—at these Ethyl pumps you get all-round quality that is double-tested—by the oil company and by the Ethyl laboratories.

ETHYL

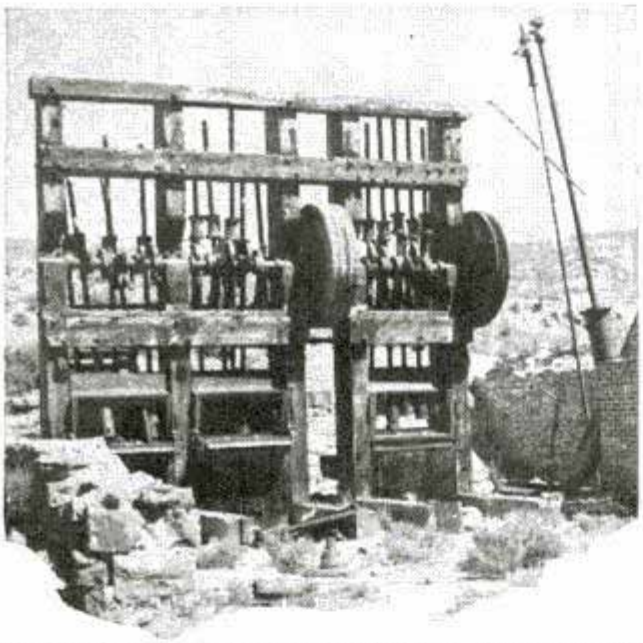
Look for this emblem on the base or globe of every Ethyl pump. It means best-grade gasoline.

ETHYL GETS FULL POWER FROM HIGH COMPRESSION

(Continued from page 122A)

streams of water tore a pit 550 feet deep and one and one-eighth of a mile long through a hill. Modified hydraulicking is going to be permitted again when dams to catch the water and debris and prevent their spread are constructed.

Huge gold dredges that scoop up tons of sand and gravel per hour can also make money on material that contains only a few cents worth of gold per cubic yard and many of these dredges are active in Alaska and California. New deposits of placer gold never worked before are being tested with dry land dredges that are not boats at all and that need only limited amounts of water for washing the gold out of the sand.



Ruins of stamp mill for crushing ore. All the heavy parts were freighted long distances

In hard rock mining the ore is ground down to dust under the blows of heavy metal stamp hammers. Then the gold is removed by shaking the metal out of the material, by flowing the ore over amalgamation tables coated with mercury that catches the gold, or by mixing the material in a tank with a cyanide solution that dissolves out the gold and silver. Still another way of milling is the flotation method by which oil and chemicals coat the particles of gold so that they float to the surface. One of these methods or a combination of them, depending upon the exact kind of ore that a mine contains, is able to extract as much as ninety-eight per cent of the gold. This is a much higher percentage than was possible a few decades ago and large quantities of new gold today are being extracted from the discarded dumps of early mines.

The boom in gold mining is indicated by the fact that last year California produced $36,700,000 worth of the yellow metal as against a production of only $8,500,000 worth in 1929. A good part of this increase, of course, reflects the present thirty-five dollars per ounce price of gold. About eighty per cent of the increased production comes from the re-opening of mines that had been shut down or that couldn't operate profitably at the former lower price of gold. The balance of the increase in production comes from new ore bodies and deposits discovered by "depression miners."

In all, twenty-one states mined gold commercially last year. California still produces more gold than any other state and last year produced twice as much as Alaska. The Philippines and South Dakota, with more than $20,000,000 worth of gold each, ranked next under California, which since the days of '49 has produced a total of nearly $2,000,000,000 worth of gold. More than $160,000,000 worth of gold will be mined in the United States this year, the greatest monetary record so far, although not a record in ounce production.

In the next few years, mining engineers believe, gold production will zoom to even higher totals. They expect that the present assessment moratorium law, which in the last few years has excused many holders of mining claims from the required $100 worth of work per claim per year, will soon be withdrawn. When these thousands of idle claims are worked again, they think, additional ore bodies will be developed, more new discoveries made, and production stepped up.

Auto Radiator Sealed by Valve to Save Anti-Freeze

To keep alcohol or other anti-freeze from evaporating, a valve has been developed which seals the cooling system of the automobile. It is fitted to the bottom of the radiator overflow pipe and opens only under pressure, letting the steam escape if the engine overheats. With this valve in operation one filling of anti-freeze should last all winter.

Evans Products Co

MOBILOIL ARCTIC makes all cars start Easy..run Sweet_in Frigid Weather

CHANGE TODAY

WINTER-PROOF TODAY

START QUICK with Mobiloil Arctic. **SHIFT EASY** on coldest days with Mobiloil Gear Oil. **RIDE QUIET** — Special Winter Mobilgreases end squeaks. **END FREEZE-UPS** with Mobil Freez-one—new radiator anti-freeze.

"BETTER ONE WEEK EARLY_ THAN ONE DAY LATE!"

THE PICTURE above is a warning to you! Cold snaps come suddenly...it pays to have your engine ready with Mobiloil Arctic!

Mobiloil Arctic is absolutely the finest winter oil for quick starting. It flows freely in a split second, yet protects your engine fully when it's running hot!

That's what you want this winter, isn't it? ...quick starts—and a safe engine. Stop today and change to Mobiloil Arctic.

MOBILOIL AND MOBILGAS

SOCONY-VACUUM OIL COMPANY, INC.

Mobilgas Mobiloil

Inventing Circus Laughs

(Continued from page 845)

the clown's waist. The completed prop weighed sixteen pounds and circus crowds of nearly every state of the Union have howled with delight to see Hershey, dressed in baby's clothing, with a rattle in one hand and a milk bottle in the other, legs covered from the hips down by a drape, parade about the arena with this "Baby Zep" balloon which appears to be supporting the "baby."

Hershey also wanted a Chinese laundry prop. Aronson promptly turned it out. In this one, the clown wore a Chinese mask and headpiece consisting of a "pigtail," or rigid steel rod, sticking out two feet behind. Dressed in blue Chinese pajama suit, with an ironing board strapped in front of him, and a washing consisting of infants' clothing hanging from the pigtail, he walked about the arena vigorously pushing a dummy iron over the board, and the customers all but rolled in the aisles.

With these two props and a few simpler ones, Hershey went on the road, traveling 21,000 miles in thirty weeks. At the end of the season, back he came to regale Aronson with more yarns of circus life. The couple ate clown, dreamed clown, slept clown. When winter set in, Aronson asked about new props for the coming season.

"The 'Baby Zep' and Chinese laundry gags were swell," said Hershey, "but I got a better one."

"What do you want now?" demanded Aronson suspiciously.

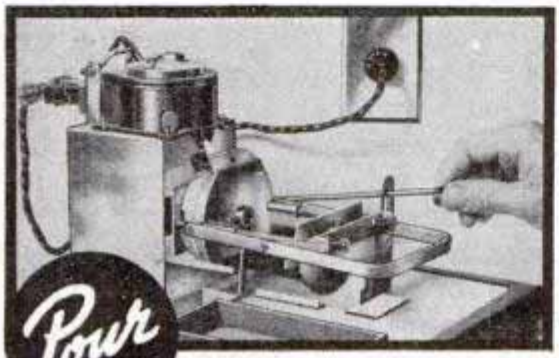
"A goose," declared the clown firmly. "A goose that looks like a goose to chase me around the track. I will be hollering and carrying a little ax, pantomiming that I started out to kill the goose and he got me by the seat of the pants. It was done years ago by one clown with a live goose, but even if I could train a live goose to do the stunt, my act would be ruined if the goose happened to die. So I want a stuffed bird that looks like a real one. Feathers and all."

Aronson scratched his head. He had a tool shop, but you couldn't turn out a goose on a lathe—at least, not the kind the clown wanted. The prop man thought any goose would do as a model. Then he found he was mistaken. The goose must be in a fighting, attacking attitude, crouching,

(Continued to page 128A)

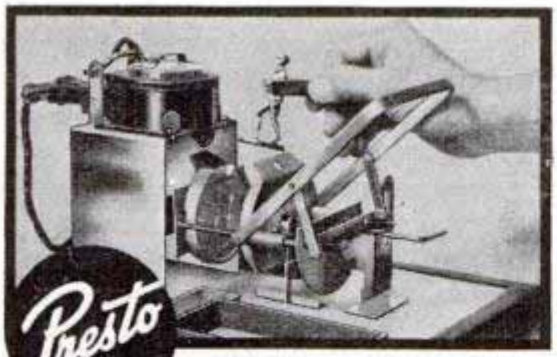
NEW GILBERT ELECTRIC KASTER KIT

First and only "slush type" Casting Outfit—makes life-like figures with fifty percent less metal



Lift the lever and molten metal flows into the mold. Developed ***by the Gilbert Hall of Science, Kaster Kit is automatic. Heats electrically. Safest, easiest, fastest casting outfit you can own.***

A twist of the "metal-saver" lever slushes off excess metal— ***producing a hollow casting. This revolutionary improvement makes possible fifty percent more figures from the same amount of metal.***



Out pops your soldier—"true mold"—correct proportions—not ***flat and thin like the ordinary kind. Color soldiers to resemble all the armies of the world.***

32 Different Molds

Soldiers, sailors, indians, athletes—these are but a few of the 32 Kaster Kit molds you can get. Set of 4 bandmen, 4 athletes, or 4 military figures, $2.00 per set.

• • •

See the new No. 7 Kaster Kit at your nearest toy store. Complete with 1 mold, 24 pigs of metal, tools and 2 paints, $6.50. Other Gilbert casting outfits from $1.00.

FREE **The Big Kaster Kit Parade—in full colors—shows all 32 Kaster Kit Molds that make realistic soldiers for you.**

The A. C. Gilbert Company
110 Erector Square, New Haven, Conn.
Please send me your Kaster Kit Parade—free

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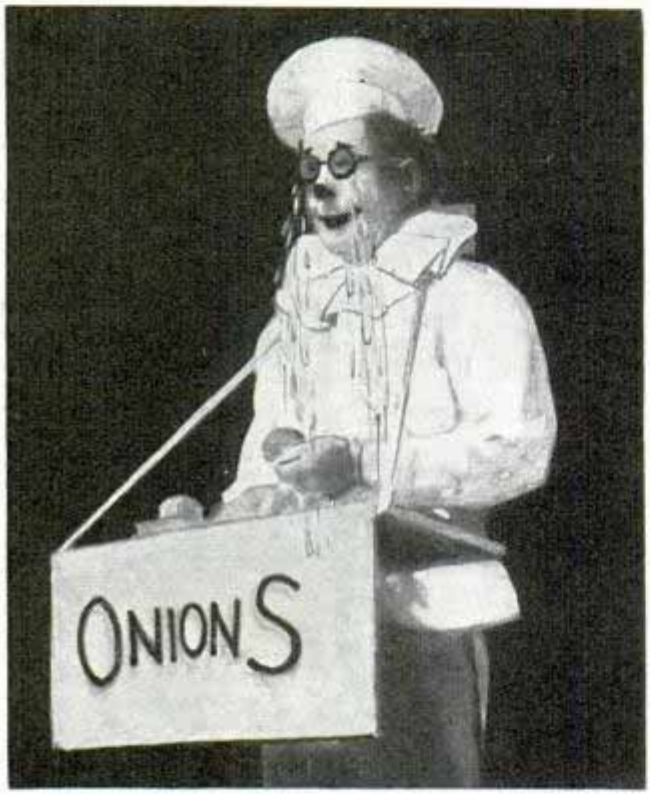
Inventing Circus Laughs

(Continued from page 126A)

neck out, wings lowered to the ground. He resorted to pictures for the right pose and looked at forty-seven before he found one two inches square which showed the attitude he wanted. He stepped it up to sixteen times its size, thus showing a goose which, if alive, would weigh fifteen to eighteen pounds.

He took a cardboard pattern of his enlarged goose and traced it on the workbench. Over this he bent in wire the outline of the bird, tacking it down while bending it. Temporary wires were soldered



Here is another side-splitter, the onion gag. Note the clown's copious tears

across to prevent springing, then the tacks were removed and the outline in wire was ready. Rings bent from wire to represent head, neck and body were soldered into place. Lateral and cross wires were run, each being tied and soldered. When the wire work was finished, the neck was severed from the body. In the body was anchored a pipe and through the neck was run another piece of pipe which emerged from the mouth. This arrangement allowed head and neck to be detached from the body by unscrewing one pipe from the other, thus saving space in packing. Detachable wings were made of wire and the goose began to assume the shape and proportions of a live bird.

Heavy linen cord was woven between the wire meshes and two separate covers of heavy muslin with light padding were sewed on by hand. Eyes were made from metal, bill and legs were covered with orange print, the feet were fashioned from an old inner tube. Then came the job of feathering. Enough feathers were obtained to cover a flock of geese but how to attach them?

Strips of muslin three inches wide were cut and feather after feather was sewed on by machine. Then the machine was run over the quills four or five times and this virtually matted them in, allowing the plumes to extend over the cloth strip. Twelve yards of these feathered strips were made, then, starting with the tail, the strips were sewed to the covering of the goose, this being done by hand, each strip overlapping the next like a shingle roof. That finished the goose. Its weight was seven pounds and it measured just thirty-three inches from bill to tip of tail. More than 400 feet of different gauge wire had been employed and more than 500 solder joints were required to hold it in place.

Now came the problem of attaching the goose to the clown. It must be suspended in midair, wings flapping, so a harness had to be devised to support it. A canvas harness was made and to the vertical piece running along the back, a length of strap iron was riveted after the iron first had been heated and bent to conform to the clown's body. Welded to the iron was a quarter-inch malleable rod with a pipe nipple welded to its end. The nipple at the end of this rod screwed into the coupling in the goose's mouth.

"It is a shame," says Mr. Aronson, "that the crowds can't see the harness some of the clowns wear to support the props! Often the hidden harness is more intricate than the visible contrivance."

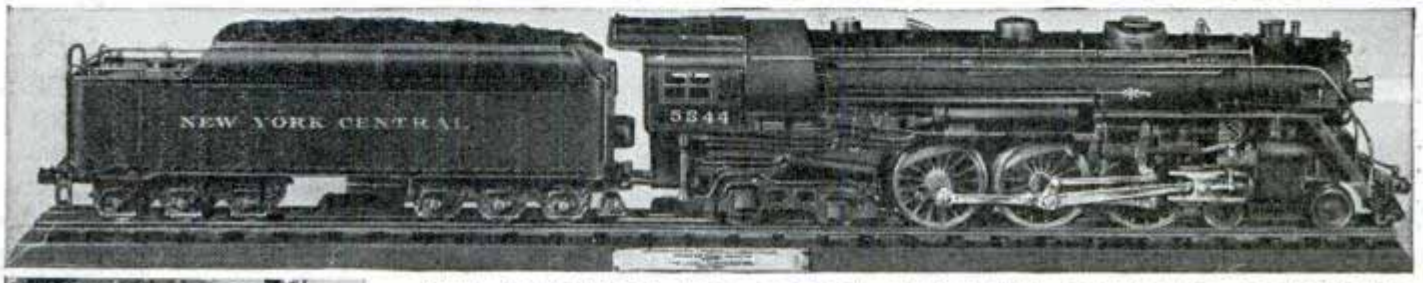
While they were at work on the goose, Hershey happened to see in a store window a miniature head used to advertise collars. Immediately he had a new idea, a gag to be dubbed "What a Man!"

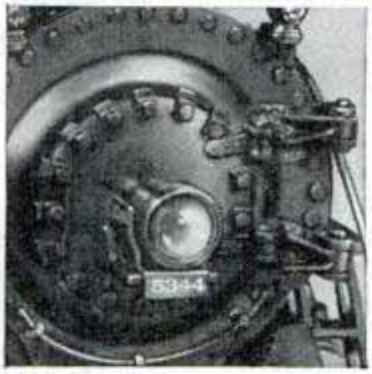
"Instead of the usual oversize head and

(Continued to page 130A)

Start a Railroad Empire with this...

LIONEL SCALE MODEL





Headlight is projected in parallel beams through optical lens. Lamp is concealed inside the smoke box.

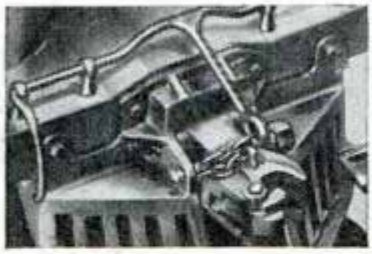
AUTHENTIC DIE CAST, WORM GEARED REPLICA OF THE MIGHTY HUDSON TYPE 5344-JIE

You men with a natural gift for things scientific... what in all this golden age of mechanical ingenuity can add up so many thrills as building a miniature railroad system all your own?

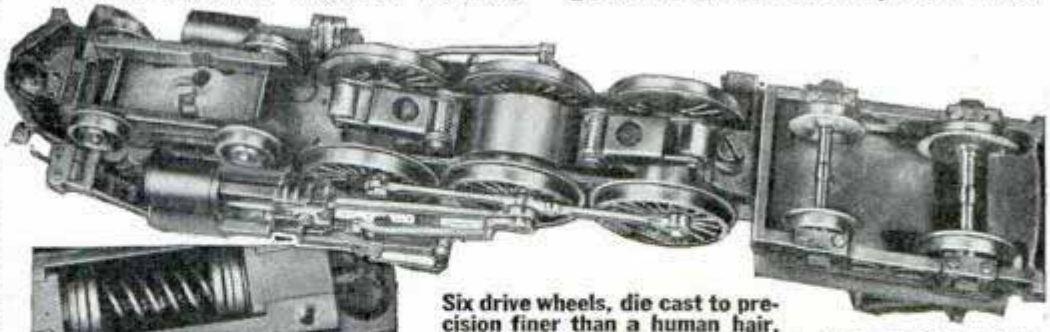
Particularly this year! For here at last is Lionel with a scale model, the crowning achievement of its 37 years of train building... an exact "O" Gauge replica of the New York Central's latest Hudson, the first authentic model of its kind.

Now at last the thrills of scale model railroading are within the reach of every man, for the vast resources of Lionel have made it possible to produce this model of models at $75... finished, ready to run. But there's not room here to tell you the whole exciting story so clip out and mail the coupon below for a copy of the 16-page Lionel scale model booklet.

THE LIONEL CORPORATION
15 EAST 26th STREET, NEW YORK

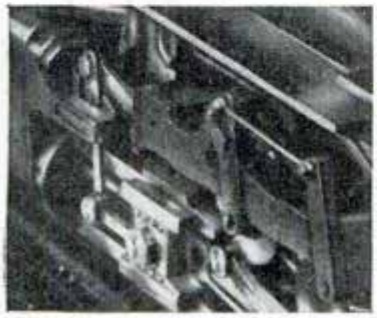


Retractible pilot coupler shown in service position. Pin lifting crank is fitted with a tiny link chain.



Six drive wheels, die cast to precision finer than a human hair, are fitted with seamless steel tires. Both outside and inside third rail shoes are provided, for operation on any "O" Gauge track having curves of at least three foot radius.

Equipped with ball bearings for the thrust, and worm gear so constructed that it is not self-locking.



Complete actuated Baker valve gear. Crosshead guides are stainless steel. Crosshead and rods are cast for detail perfection and plated.

Faithful to the finest details, the wheels are held by bearing caps that are bolted with hexagonal head bolts.

Free
A complete catalog of the Lionel scale model—get a copy from your dealer or send ten cents with this coupon.

THE LIONEL CORPORATION
15 East 26th St., Dept. No. 109
New York, N. Y.

Enclosed is ten cents for a copy of the new Lionel 16-page scale model locomotive booklet.

Name _____
Please Print
Address _____
City _____ State _____

Inventing Circus Laughs

(Continued from page 128A)

normal body," he told Aronson, "I want that miniature head and a giant body to go with it."

The prop man built a big wire frame, like a bird cage, to cover the clown's head and shoulders. On top of it was mounted the little head. The frame was padded on the shoulders and a long coat was made to cover the dummy's shoulders and extend down as far as an average coat. The sleeves were padded from the dummy's shoulders down to the clown's shoulders. From there on down, the clown's arms filled the sleeves. A screen opening in the front provided a peek hole for the clown as he walked around the ring carrying the oversize dummy—oversize, at least, except for the miniature head.

"How would it be," Hershey asked one day, "to show me walking around the track comfortably tucked in my own bed? We'll label it 'Retired Clown'."

For this one, Aronson built a bed two and one-half feet wide and five feet long, constructed of bamboo and collapsible. On a canvas cover he sewed a dummy with a big pair of pink feet sticking out from under a counterpane. The clown's head went through an opening at one end of the canvas and lay on a pillow attached to the head of the bed. Into this prop he strapped himself with an invisible harness, and a black drape extending to the ground concealed his feet. Thus the clown walked about the arena, apparently in bed, waving a hand to the crowds. The leverage necessary to support the bed extending five feet in front of the clown was gained by attaching two light but strong bamboo poles to the foot of the bed, the opposite ends resting in pockets in the canvas belt about the clown's waist. Thus both hands and feet were free although the bed weighed fifteen pounds.

The most intricate prop Aronson ever constructed involved fishing. Hershey wanted to come out with a bucket and fish pole and start angling. Then as he pulled up for the catch, he wanted a fish to shoot to the top of the tent and come floating down via parachute to be snared in a net.

Five weeks were required to build the mechanism for this prop, all of it concealed

(Continued to page 136A)

Sweeping the Country! New-TYPE CHEAP OIL BURNER INVENTED!

COOK *and* HEAT *without* COAL *or* WOOD In Your Present Stove or Furnace

TWICE THE HEAT AT LESS COST—NO DIRT OR ASHES

QUICK HEAT AT TURN OF VALVE

An Amazing New-Type Oil Burner Which Experts and Users Say BEATS ANY EVER GOTTEN OUT FOR LOW COST, PERFECT PERFORMANCE, Burns Cheap Oil a NEW WAY Without Pre-generating or Clogging Up, Cuts Fuel Bills in Half and Pays for Itself Quickly by What It Saves. READ BELOW HOW YOU CAN TEST THIS REMARKABLE SUPER FLAME OIL BURNER in Your Own Home or Business FREE OF RISK. Then Mail Coupon.

COOKS A MEAL for LESS

Why burn coal or wood with its dirt and drudgery of building and feeding fires? Why carry ashes and get uneven, slow-starting heat, when you can burn cheap oil a NEW WAY and get TWICE THE HEAT at LESS COST—and have QUICK HEAT regulated to any degree desired by a simple turn of a valve?

Your present coal or wood stove, heating stove or furnace can be fitted easily and quickly with our Super Flame "HEAT KING." Thousands have acclaimed it the most perfect oil burner. Nothing like it ever on the market—the lowest priced efficient oil burner—Positively guaranteed NOT TO CLOG, NOT TO CARBON OR STOP UP. The only oil burner that has a record of over 11 years constant use without ever needing any cleaning. Simple—safe—economical—no electrical connections—no moving parts to wear out—all unnecessary parts eliminated—does better work at less cost. Burns 95% air and 5% cheap oil and the result is TWICE THE HEAT OF COAL by simply turning valve. **What an Engineer of National Reputation Says:**

Combustion principles of the Heat King are simple, efficient, excellent—assures economical oil consumption and maximum amount of heat. Tests made on burner with one year's hard service prove there was no evidence of dirt or residue within the burner or any carbon deposit on any interior parts. There are no nozzles or tips to "coke up" or stop up with sediment, scale, etc.—C. W. Lovelace—K. C., Mo.

WHAT USERS SAY:

There are fifteen oil burners of different kinds here but Heat King is cheapest and best—J. R. Goldthorp—Washington.

I get more heat from your burner than I ever had from coal, wood or anything else I ever burned in my furnace—W. C. Nicholson—Ind.

My wife and her mother say they have reduced their coal bill fifty percent since they put your oil burner in—W. S. Collins, Pa.

Your oil burner is the poor man's friend—L. Gradner—N. C.

TRY AT OUR RISK—30 DAYS TRIAL

If you want to SAVE MONEY in cooking and heating you may try the "HEAT KING" AT OUR RISK—Prove that it ends drudgery and dirt of coal or wood, cuts fuel bills in half, pays for itself quickly by what it SAVES. You must be satisfied under our liberal guarantee or YOU PAY FOR THE BURNER ABSOLUTELY NOTHING.

Slips Into Any STOVE RANGE or FURNACE

—QUICK HEAT on or off AT TURN of VALVE

FREE SAMPLE *to Agents*

and salesmen offered to one energetic man or woman in each locality who will demonstrate and take orders. Send no money—just sign and mail coupon (or 1c postcard will do). You can't lose for here's a revolutionary cheap new type oil burner that is safe, economical and efficient. So mail coupon quick, be first in your locality to learn how satisfactory oil heat can really be and how you can MAKE REAL MONEY spare or full time. Mail Coupon or 1c postcard today—NOW

AGENTS SALESMEN DISTRIBUTORS— BIG MONEY

Startling low price puts this amazing new-type oil burner within the reach of everyone. No wonder so many homes, small business firms, oil filling stations, etc., are buying it — no wonder salesmen and distributors are breaking records in sales. All YOU have to do is to bring it to the attention of prospects and show how it gives QUICK HEAT, HOTTER, CHEAPER, WITHOUT DIRT AND ASHES, and how it quickly pays for itself by what IT SAVES — then, reap BIG CASH PROFITS. It sells fast because low-priced, cheap to operate, efficient.

WHAT SALESMEN SAY:

Greatly pleased with installations. Installed one when weather was 10 degrees below zero. Kept house well heated and owner is still raving about the wonderful burner. I can dispose of 250 "HEAT KINGS" before this year ends.—F. Silver—Canada.

Demand for oil burners is great. Have fifteen salesmen starting. Would like to turn out 200 burners a week—C. A. Pierce—N. Y.

Heat King satisfactory in demonstration to one of the largest oil companies—W. DeJeffers—Ohio.

I am a plumber, have installed all kinds of oil burners, but, I never knew before there was such a thing to get that much heat out of oil. There is money in selling them—W. C. Nicholson—Ind.

If you want to DOUBLE and TREBLE your earnings and own your own business, you can't beat the "HEAT KING" as a money maker. Get YOUR OWN OIL BURNER SAMPLE AT NO COST and CASH IN BIG PROFITS. Act quick—be FIRST in your locality —MAIL COUPON at right or 1c postcard today—NOW.

UNITED FACTORIES P-751 Factory Building Kansas City, Mo.

MAIL COUPON

UNITED FACTORIES, P-751 Factory Building,
Kansas City, Mo.

Without cost or obligation, rush generous TRIAL OFFER on the wonderful "HEAT KING" Oil Burner sent WITHOUT RISK TO ME.

Name.....

Address.....

City.....

State.....

☐ Check here if you also want to know how to make money in sales agency of your own and get NO COST SAMPLE. This does NOT obligate in any way.

Chemistry—and You

(Continued from Coloroto Section)

on a scale comparable to that in this country. Indeed, the world and particularly America swung into a new era of progress, which may be called either the Chemical Era or the Scientific Era. The change definitely marked the passing of economic leadership from the machine builder to the scientist, with chemistry serving as a common bridge between all of the sciences involved—and most sciences are involved.

The machine did not decline in importance—it is, perhaps, even more important than it was. But we have moved to a higher plane of progress, into a higher air of economic development, that begins where the plane of the Machine Age stopped. The machine is simply a means toward doing better and at less cost what was once done by hand and foot power. It is essentially a labor-saving device. Science is concerned with labor-saving too, but it is far more vitally concerned with creation—the creation of new knowledge, of new materials and new products, of new industries and new employment, and of improved health and material welfare for all of us, from the proudest to the humblest.

The awakening of the chemical industry was the birth of a new viewpoint and of a new idea of responsibility infinitely more daring than man had yet conceived. On the one hand it recognized the imperfections in our progress, while on the other it challenged the complacency which held imperfection to be an inevitable characteristic of human effort, about which little or nothing could be done. Under the old viewpoint we believed man could not possibly improve on nature's materials and deemed successful imitation of them the height of human achievement. Under the new viewpoint we threw attempted imitation to the winds and set out boldly to become creators in our own right of wholly new materials that nature had failed to supply.

Nature is still omnipotent in her own vast sphere. The chemist is seeking neither to paint the lily nor to perfume the rose. However, he is seeking, and finding, colors, perfumes and drugs far more satisfactory for man's purposes than any nature has provided in flowers and plants.

(Continued to page 134A)

(Continued from page 132A)

He is seeking, and finding, ways to improve natural foodstuffs to the end that we will be healthier. He is erecting barriers to protect us against the hazards of disease with which nature has surrounded us under her law that only the fittest should survive. The chemist is taking such common things as air, water, coal, salt, lime and the like and compounding them or their components into a great new category of materials capable of serving us better than any of the natural substitutes to the use of which we have been limited for centuries.

(Continued next month)

Electrical Theater of the Sky Has Rooftop Planetarium

In a nine-story building of modern architecture in Osaka, Japan, is the far east's only museum of electrical science. They call it an electric "theater of the sky," for on the sixth floor is a huge planetarium whose spherical roof is the ninth floor ceiling. The building is beautifully illuminated at night, and its thirteen-story tower has a great lighted star. The roof is a mammoth globe with lands and oceans marked in colored mosaic. The motor for the planetarium was too large for the elevator and had to be hoisted with a crane.

Inventing Circus Laughs

(Continued from page 130A)

in the bucket. A fifteen-inch stick was fitted at one end of a frame in the bucket. The fourteen-inch fish to which a parachute was attached was molded to the stick. A heavy rubber band was inserted in a notch in a trigger at one end of the stick, pushed down against the stretch of the rubber and locked in position with a hook through an eye in the trigger. A fine wire attached to the hook was fastened to a common mousetrap. The trap is set and locked in position so it can only be released by a tug on the string. Another such trap is hooked up with a friction flint ignitor, a cup holding black powder being in the path of the spark.

The entire mechanism is set before entering the arena. Then Hershey starts fishing and pulls up for the catch. Simultaneously both traps are sprung. The first jerks the hook from its trigger and the rubber band shoots fish and parachute high into the air. The second trap jerks the ignitor, its spark ignites the powder and there is a flash and a lot of smoke, the latter for effect only. Then the fish comes floating gently down to be caught in a net. A fine steel spring, coil springs and a rattrap all were tried for this stunt without success until the prop man hit on the slingshot idea.

"What do I get out of all this?" asks the drygoodsman who wanted to be a circus clown. "Well, each day I follow my friend over his route. Making allowance for the difference in time, I close my eyes and hear the blare of the band, sniff the familiar circus smells, see the big top crowded with people. I see my friend working this gag or that, the angry goose, the baby zep, the fishing stunt. I hear the roars of laughter, the applause. I live it over, each day and night performance, sitting here alone, waiting until the season is over and he comes back to me so we can get busy on the props for next season. It's my way of staying at home and traveling with the circus."

¶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.

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Around the World for Realism

(Continued from page 875)

main boom split near the gooseneck. At Madeira Islands, heavy seas washed away two of the lifeboats. There were several serious storms and upon leaving Guam, in the Marianas, the craft collided with the tail end of a typhoon that almost brought the excursion to an abrupt halt.

The land trips were replete with incident. According to Paul Schwegler, former All-American football star and Garnett's chief aide, governments that had seen their lands caricatured in American films avidly cooperated with the film expedition. This was particularly true in the Far East which, as any traveler will readily admit, has been grossly misrepresented by the Hollywood wizards. However, because of strict censorship in many countries, it was necessary for the camera crew

Director Garnett operating navigation instrument during the world film cruise

to make their pictures under the supervision of government attaches in military or restricted zones.

Establishment shots—those which can be put together in a picture—received the bulk of the attention in Singapore. These deal with the world-famous Raffles hotel, which has been a gathering place for the famous for almost two hundred years.

Thousands of persons who never heard of the Central Casting Bureau worked as extras without pay in the stock shots of the streets, harbors, buildings, and night spots of Cairo, Singapore and Tokio. In order to get these pictures, however, cameras had to be concealed under clothing and behind

(Continued to page 140A)

(Continued from page 138A)

curtained balconies as Chinese coolies are inclined to "mugg" just as the Hollywood extra does when given half a chance.

The educational aspects of such films are reflected in the shots of the wealthy estates of the Chinese mining kings of Penang. The homes on these estates have dining rooms that will seat more than one hundred guests. Perhaps, the most incredible pictures filmed were those of the wide, paved highways through the jungles of Indo-China where a tiger or an elephant occasionally halts traffic while crossing. The camera is looked upon as an instrument of evil by certain sects in India and China and the photographers had to exercise a great amount of tact in taking their pictures. The Lamas of Mongolia are extremely camera-shy as are the Bedouin Arabs, Schwegler says. Once, Mrs. Garnett disguised herself as an Arab woman

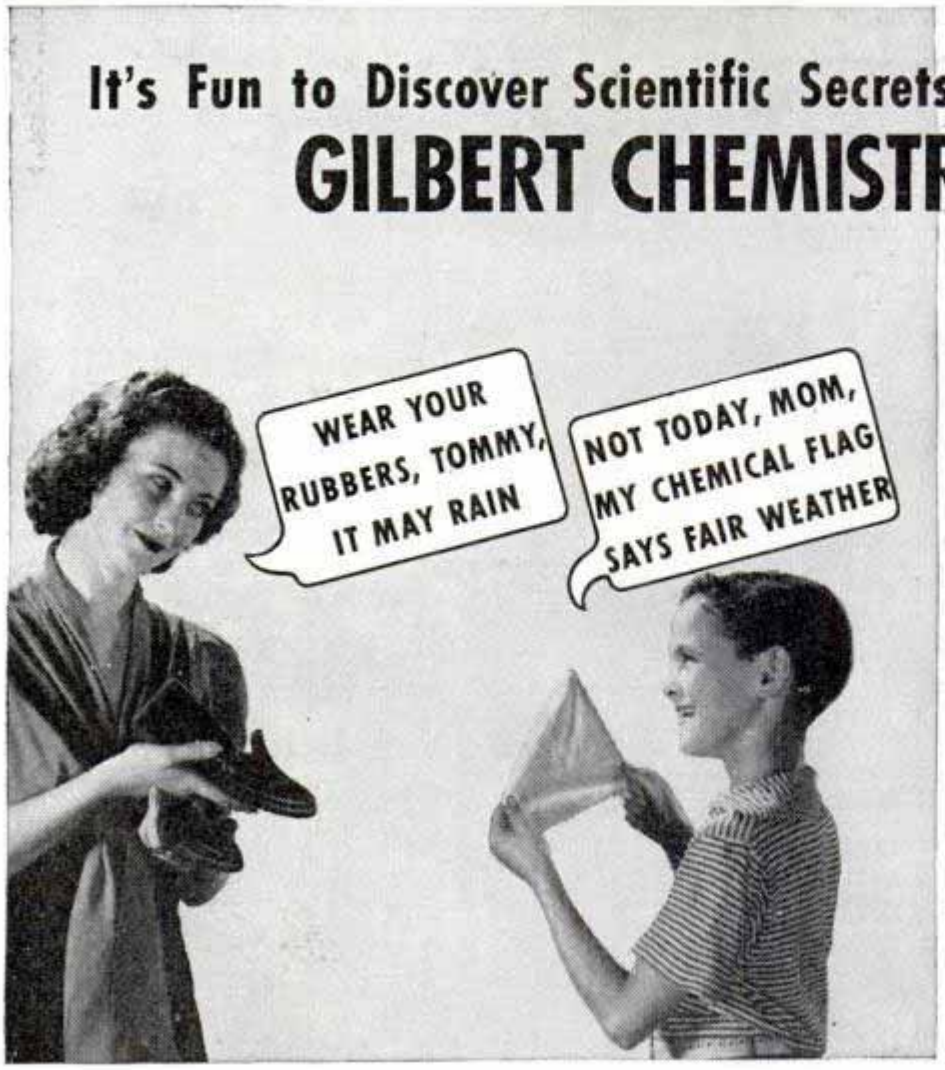
Village chieftain in Ceylon poses with his harem for the movie camera

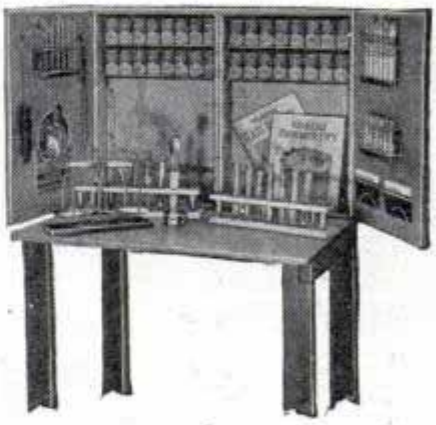
and with a camera concealed under her veil, attempted to shoot atmosphere pictures of the Bedouins as she rode through a village on a camel. The picture-making went well until the camel shied. In the ensuing confusion, Mrs. Garnett's blonde hair as well as her camera were revealed to the desert nomads. It was only by quick work on the part of her guide that trouble was averted.

Likewise, in filming religious exercises of the Mohammedans, Shackelford had to take care that his shadow did not cross tables containing food or sacred objects. It is their belief that the stomach of the

(Continued to page 143A)

It's Fun to Discover Scientific Secrets with the New GILBERT CHEMISTRY SET





New Gilbert Desk Type Laboratory Outfit—The latest triumph of the famous Gilbert Hall of Science. 5 feet of metal and wood shelf room and test-tube racks, mounted on sturdy wooden table. 76 chemicals and pieces of apparatus including scales. Puts 500 fascinating experiments at your finger tips. $9.95. Other Gilbert Chemistry Sets $1.00 to $19.50. See them at your nearest toy store. Up-to-the-minute book by noted Yale professors comes with each set.

Boys, exciting days are in store for you when you own a Gilbert Chemistry Set. Think of the thrill of making strange chemicals change colors, writing messages in fire ink, making your own paints, bleaching flowers and performing hundreds of other dazzling tricks.

More boys have won fame and big awards with *Gilbert* Chemistry Sets than any other chemistry sets made. One boy developed a candle that burns with a blue flame. Another boy discovered a way to write messages in invisible ink on his arm. A third boy worked out a chemical trick for catching a sneak thief. You, too, can perform such wonders, but first be sure to get a chemistry set with the name "Gilbert" stamped on the box.

$200.00 Annual Awards

To the boy doing what, in my opinion, is the most important research in Chemistry or Micro-Chemistry in 1938, I will award $100.00 in cash. To the ten boys doing the next most important research, I will award $10.00 each. Applicants must not be over 17 years old and must send me full description of their experiments by June 1st, 1938.

A. C. Gilbert, Inventor of Erector and Founder of the Gilbert Hall of Science.

Sugar crystals—as seen thru ordinary Microscope.

Sugar crystals—as seen thru a Gilbert Polaroid Jr.-equipped Microscope.

POLAROID Jr.—the Invention That Shows Nature's Wonders in Full Colors

The new Gilbert Micro-Chemistry Sets enable you to see the mysteries of chemistry and Nature *200 times larger* than they appear to the naked eye. The only sets of their kind with Polaroid Jr.-equipped microscope—bringing you sights far beyond the power of ordinary microscopes. Sugar crystals look like an array of brilliant jewels. Layers of cellophane take on weird and fantastic tones. Starch grains appear as luminous colored crosses. Gilbert Micro-Chemistry Set No. 7, complete with 38 fascinating pieces of apparatus and big illustrated manual, $5.00. Other Micro-Chemistry Sets from $2.50.

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Shows you whether each day will be rainy or clear. Free—with mammoth color poster showing the new Gilbert Chemistry Sets, if you mail coupon at once

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Gilbert Hall of Science
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Count me in on your big free offer. Send weather flag and mammoth poster.

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(Continued from page 140A)

Moslem will not digest food that has become contaminated by even indirect contact with infidels.

A primitive race that spoke a strange native dialect furnished an interesting camera study for Garnett's party when it visited the Laccadive Islands off the west coast of India. The 3,000 inhabitants, many of whom never before had seen white men were reluctant to pose for the cameramen. It was only after the crew had conversed with the chieftain in sign language and presents of cigarettes and canned goods had been offered that the Americans were accepted. The Hollywood director learned that these natives are the descendants of survivors of a Hindu ship that had been wrecked near the islands almost a century ago.

Shackelford's film laboratory was put to an acid test on the jaunt, as weather conditions ranging from sub-zero to 145 degrees Fahrenheit were encountered. While making pictures in the jungles, Shackelford covered the film cans with tarpaulins. Over these were placed water-soaked blankets that permitted the films to be kept at a temperature fifty degrees below the thermometer reading.

Through the cooperation of the United States navy department, a motion picture production unit recently journeyed to Pago Pago, American Samoa, to make realistic backgrounds of native life and island scenery to be used in the picturization of "The Hurricane." The cameras were set up on the island of Tutuila, which itself was partially destroyed by a hurricane a year ago. Natives from Samoa and Tahiti returned with the film unit to work in scenes shot on the Goldwyn lot.

Hollywood cameras are at present probing the depths of Africa's interior under the guidance of Mrs. Osa Johnson, famed explorer. The jungle pictures are to be used in a story based on episodes in the lives of Stanley and Livingstone, English explorers.

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

es1069

Miracle Man of Roses

(Continued from page 821)

roses fade when the petals fall—all but this one. Its fallen petals are as brilliant as they were when the bud first opened.

"I have intensified this rose," says Dr. Schoener, "by crossing many generations of the most brilliant yellow roses I could find. In this way I have made a yellow rose whose color has as much strength as that of a red rose. If I then cross yellow and red, what should be the result? Orange, of course. I am simply mixing colors."

And in Dr. Schoener's garden blooms a brilliant orange rose.

Following out this line of reasoning, a combination of a red rose and an ordinary

Giant thorns gleam like rubies. These were bred to prove theory of plant heredity

pale yellow one should produce brown. That is just what occurred. Dr. Schoener's brown rose has a deep rich color, slightly tending toward terra cotta.

In the same way that he intensified color, he intensified scent. He has produced a red rose with a scent so strong that in the early morning the odor can be detected a city block away.

Although the height of the giant rose trees satisfied Dr. Schoener that size can be controlled by breeding, he is toying with another "believe it or not rose." This is the smallest rose in the world, which he imported from Japan. Its tiny flowers are scarcely bigger than the eraser on a lead pencil, but they are true roses. Dr. Schoener plans to make some experiments of his own with the Japanese dwarf, with an eye toward producing even smaller blossoms.

Another experiment in intensifying a rose characteristic has produced gigantic blood-red thorns. It may seem that the ideal should be to breed thorns out of roses, rather than to increase their size. But under Dr. Schoener's touch even thorns have become things of beauty. These inch-long spines are translucent. Viewed with the sun behind them, they glow like rubies. But to go a step deeper, even the beauty of the thorns is not the reason for their culture. They were simply used as a medium for testing a theory of heredity.

Sometimes the theory does not work out —as in the case of a rose whose petals were white on one side and red on the other. Then, according to Dr. Schoener, you "enlarge the theory to include the new facts."

In another experiment with a combination of colors, he produced a bush bearing both white and yellow roses.

Although Dr. Schoener's interest is primarily with making illuminating experiments which later may be put to practical purpose, he has produced one rose which soon may increase the beauty of every back-yard rose garden. This is his perfect yellow rose. There is nothing new about perfect roses, roses whose petals form absolutely symmetrical flowers, but always before they have been bred in hothouses. This rose grew in a wind-swept garden. You can breed to perfection as well as abnormality.

You can also breed to strength. In fact, this is the center of Dr. Schoener's theory of plant immunity.

"People come to me," he says, "asking how to treat this and that kind of plant disease. They ask about spraying and fumigating. They never think of fighting disease at its source by increasing the immunity of plants. I predict that the biology of the future will see a great advancement in the scientific breeding of plants to make them resistant to disease."

(Continued to page 146A)

FISHER FACTS

SEALING STEEL *for* SAFETY
in the UNISTEEL BODY *by* FISHER

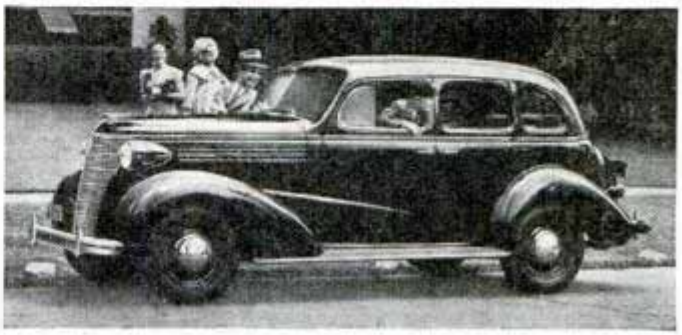
FISHER engineers are frequently asked: where does the Unisteel Body differ from steel body building precedents? What is the chief difference between it and steel bodies of the past?

The answer is simple. Fisher engineers do not build an all-steel shell and then add the necessary braces and supports. In the Unisteel Body the outer steel panels, the inner steel structure and all steel reenforcements are fused into one single solid steel unit.

From the famous steel Turret Top to the heavy ribbed steel floor, the Unisteel Body is not only all steel—but all one weave-proof, shock-proof, glorified steel structure with no semi-solid joints.

You can see what a difference this makes

WHERE STEEL MEETS STEEL *in the Unisteel Body, it is solidly fused together—there are no weak links, no joints to loosen and rattle. When finished, the Unisteel Body is all one shock-proof, weave-proof unit.*



YOU'LL BE AHEAD WITH CHEVROLET—*ahead in style, in comfort, in safety. For Chevrolet, "The Car That Is Complete," is the only car in its price class with Unisteel Turret Top Body by Fisher.*

• • •

in the smooth, unbroken contours of its built-in beauty. You can feel the difference in the luxurious silence of its interior, even when the going's rough. For, as a matter of fact, the Unisteel Body is not only insulated against heat and cold—but against road rumbles, inside vibration and outside noises, too.

Remember these facts before you decide what your next car will be. Look first at the General Motors cars—the only cars with Unisteel Turret Top Body by Fisher.

UNISTEEL TURRET TOP

GM GENERAL MOTORS

Body by Fisher

ON GENERAL MOTORS CARS ONLY:

CHEVROLET • PONTIAC • OLDSMOBILE
BUICK • LA SALLE • CADILLAC

Miracle Man of Roses

(Continued from page 144A)

As proof of his theory, Dr. Schoener seldom sprays his roses. Even weeds are only kept under nominal control. There is no coddling of the roses in that half acre of ground that has contributed so much to our understanding of the hereditary factors in the development of better plants, or of stranger plants—even an edible rose. Yes, a rose blooms in this garden whose buds have a rich tangy flavor, a cross between an apple and something else. For it was from a variety of apple that this freak was bred. A Spitzenburg apple was crossed with a rose and the result is a strange new taste, half apple, and half the taste of a rose.

Recently Dr. Schoener has turned to dahlia culture and produced a whole set of minor miracles—a new orange dahlia, a giant dahlia, and dahlias whose blossoms remain bright and fresh long after ordinary dahlias have faded and their petals dropped.

And it all comes of one man's passion to "make your experiments—and then you will know." Is this man a scientist? We are apt to think of science as a vast collection of apparatus, of microscopes and electroscopes, of charts and diagrams, and voluminous reports. But in reality, science is a method. A scientist makes observations, offers explanations of the phenomena he observes, makes experiments to test his theories, and draws conclusions from his experiments—the simplest conclusions that will fit the facts. Viewed in that light, science has flourished for twenty years in that little garden in Santa Barbara. It has achieved results. Dr. Schoener's roses have been exhibited in a dozen countries. He has been presented medals by many horticultural associations.

But there is one more thing necessary to make a man a scientist—purpose. "I am not interested in roses or dahlias," Dr. Schoener says, "I am interested in discovering what can and what cannot be done in breeding plants. I make no final conclusions. Science does not draw final conclusions. I merely say that when I do such and such a thing there is such and such a result. And," with a wave of his hands toward his garden, "I have my proof that all men can see."

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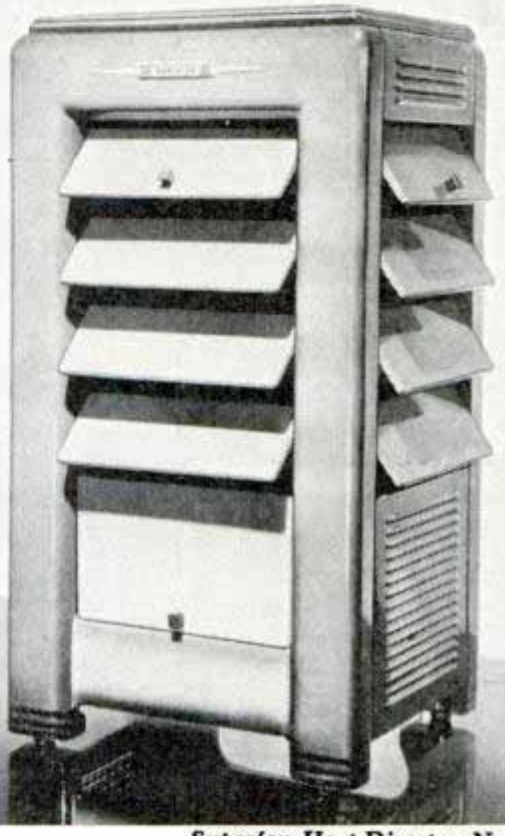

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HE GOT SO SKINNY AND PEPLESS

then he gained

15 lbs. QUICK

and beat his rivals out—

Walter Schoendaller

"A bad sickness robbed me of weight and left my skin in a horribly blotchy condition. I lost all my old-time pep, and when I did go out I noticed that my girl friend seemed to enjoy dancing with the other fellows more than with me. We used to quarrel about it and almost broke up several times. Then I started taking Ironized Yeast. In almost no time I began to fill out. I gained 15 lbs. in 10 weeks. My skin cleared up, too, and all my old pep came back. I'm not worrying about rivals any more and I thank Ironized Yeast."

—*Walter Schoendaller, La Crosse, Kans.*

Posed by professional models

New IRONIZED YEAST tablets give thousands 10 to 25 lbs.—*Quick!*

NOW thousands of skinny, rundown persons can say goodbye to unsightly bones, certain skin eruptions and lack of pep, which rob them of friends. For with this new easy treatment many have put on normal good-looking pounds, cleared their skin naturally, gained new pep—*in just a few weeks!*

Doctors now say thousands are thin and rundown only because they don't get enough yeast vitamins (Vitamin B) and iron in their daily food. Without these vital elements you may lack appetite and not get the most body-building good out of what you eat.

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The result is these marvelous little Ironized Yeast tablets which have helped thousands of skinny people who needed these elements quickly to gain normally attractive pounds and new peppy health.

Make this money-back test

If, with the very first package of Ironized Yeast, you don't begin to eat better and to get more enjoyment and benefit from your food—if you don't feel better, with more strength, pep and energy—if you are not convinced that Ironized Yeast will give you the pounds of normally attractive flesh you need—your money promptly refunded. So get Ironized Yeast tablets from your druggist today.

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To start thousands building up their health right away, we make this absolutely FREE offer. Purchase a package of Ironized Yeast tablets at once, cut out the seal on the box and mail it to us with a clipping of this paragraph. We will send you a fascinating new book on health, "New Facts About Your Body." Remember, results with the very first package—or money refunded. At all druggists. Ironized Yeast Co., Inc., Dept. 5312, Atlanta, Ga.

WARNING: Beware of the many cheap substitutes. Be sure you get the genuine Ironized Yeast.

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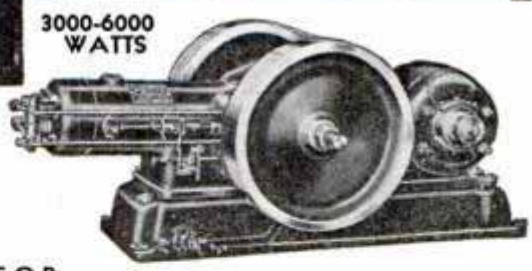

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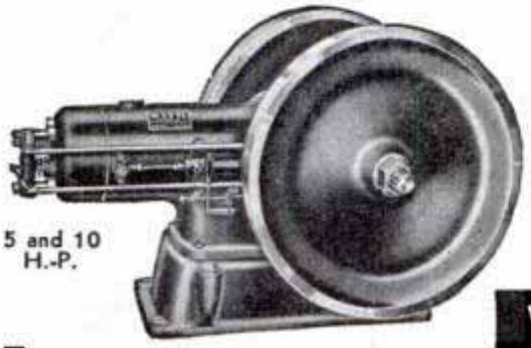

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• SOLDIER CASTING

Large 3 figure mould, clamps, handles, supply of lead, paints, brushes, electric ladle for making any number of big lead soldiers. Complete $2.00.

At your dealer's or send money order to

RAPAPORT BROS.
703 E. Ohio St., Chicago

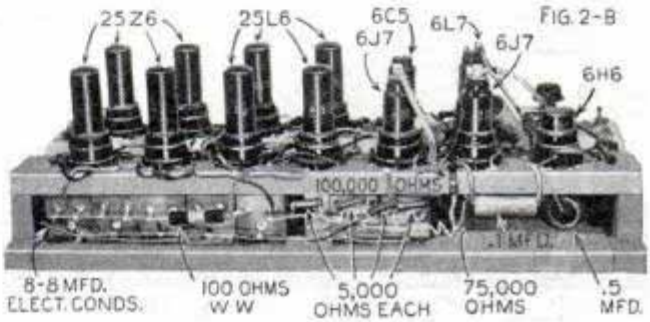
Seven-Watt A.C.-D.C. Amplifier

(Continued from page 900)

all parts are mounted on a 2-deck wood base that anyone can assemble as shown in Fig. 1. A simplified wiring diagram is given in Fig. 2. This view of the completed unit is shown in photo Fig. 2-A; rear and end-view photos appear in Figs. 2-B and 2-C.

One of the outstanding features of this audio amplifier is the fact that it may be operated either on alternating or direct current, a definite advantage where power sources often vary in different localities. The power required from the line is 95 watts, and the high-impedance input necessary is only ½ volt for full output. This completed unit, with all metal tubes in position, weighs 10½ pounds.

All parts are standard and easily obtained from reliable radio supply houses. A list of the original materials used and



further operating data, can be obtained upon application to Popular Mechanics radio department without charge. The blueprint number is R-246. A similar 6-tube amplifier, having only 3½-watt output, was described in the August, 1937, issue; the blueprint number for the smaller unit was R-241.

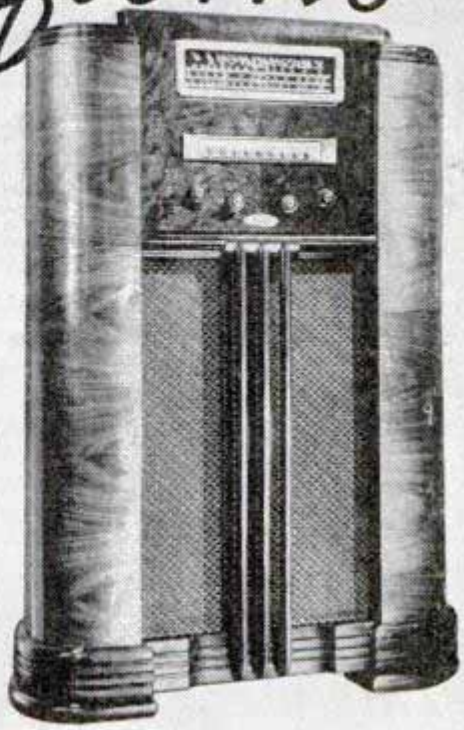
Five-amp. fuses should be connected in the power cable, and no external ground should be fastened to any part of the amplifier as one side of the power line is used as a common ground terminal. When plugging in try both ways and use the position that gives minimum hum. Since two sets of tubes are in series across the line, it is not advisable to pull out tubes while the power is on.

Although there are no power or interstage transformers in the unit, the speaker, of course, must have an output transformer on it. This transformer should have a 1,500-ohm center-tapped tube winding capable of carrying 100 ma. d.c. per leg, and

(Continued to page 152A)

The Radio Leader for 1938

AMAZING KNIGHT 11 TUBE ALL-WAVE SUPERHET



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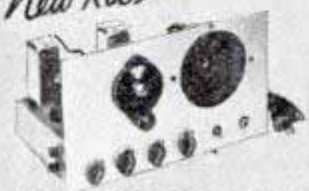

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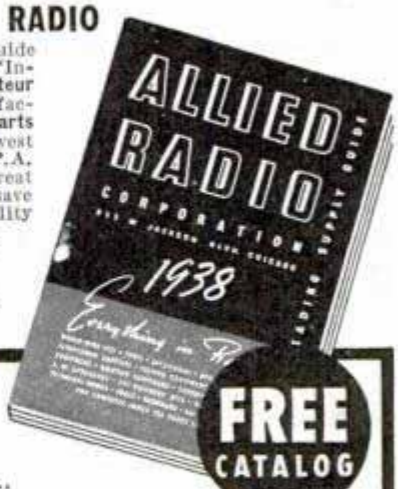

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EVERYTHING IN RADIO AT LOWEST PRICES

(Continued from page 150A)

secondary to suit the speaker. The "Peridynamic," and "Nokoil" and similar permanent-magnet speakers are all available with transformers of this description.

The tube heater connections must be as shown in Fig. 2. Note that an extra heater lead is used for the 6C5 and 6L7 tubes. Do not use the common ground bus-bar terminals for these heaters. The blank tube-socket terminals (X) make convenient places to solder wires that otherwise would be unsupported. Keep all grid leads as short as possible. NOTE—One lead was

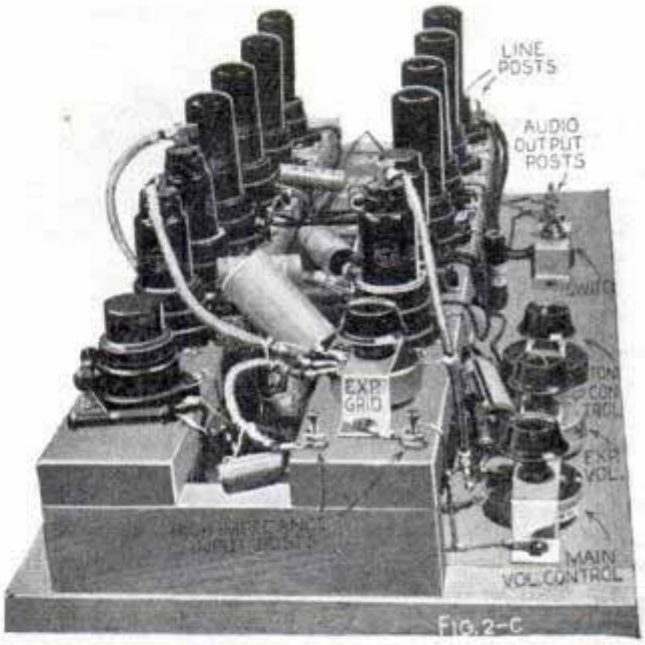

Fig. 2-C

omitted in wiring diagram Fig. 2; connect G2 of 25L6 tubes to left side of 100-ohm wire-wound resistor.

For the 6C5 tube the single conventional plate resistor is divided into two sections, permitting push-pull amplification with a single tube without using an input transformer. The cathode and plate resistors both carry audio frequencies, and the cathode resistors of the 6C5 must not be by-passed. Please note that one of these fixed resistors is 52,000 ohms; this unusual value is found by testing the six 50,000-ohm resistors specified in the list of materials. An ohmmeter will usually show one of these resistors about 2,000 ohms different from one of the others. The actual values of 52,000 and 50,000 ohms are not essential, only that it is desirable that they be 2,000 ohms different. Connect the lower value in series with the 2,000-ohm resistor in the cathode (K) circuit and the higher value in the plate circuit where 52,000 ohms are indicated.

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es 11/2/0

EASIER SHIFTING IN 1938

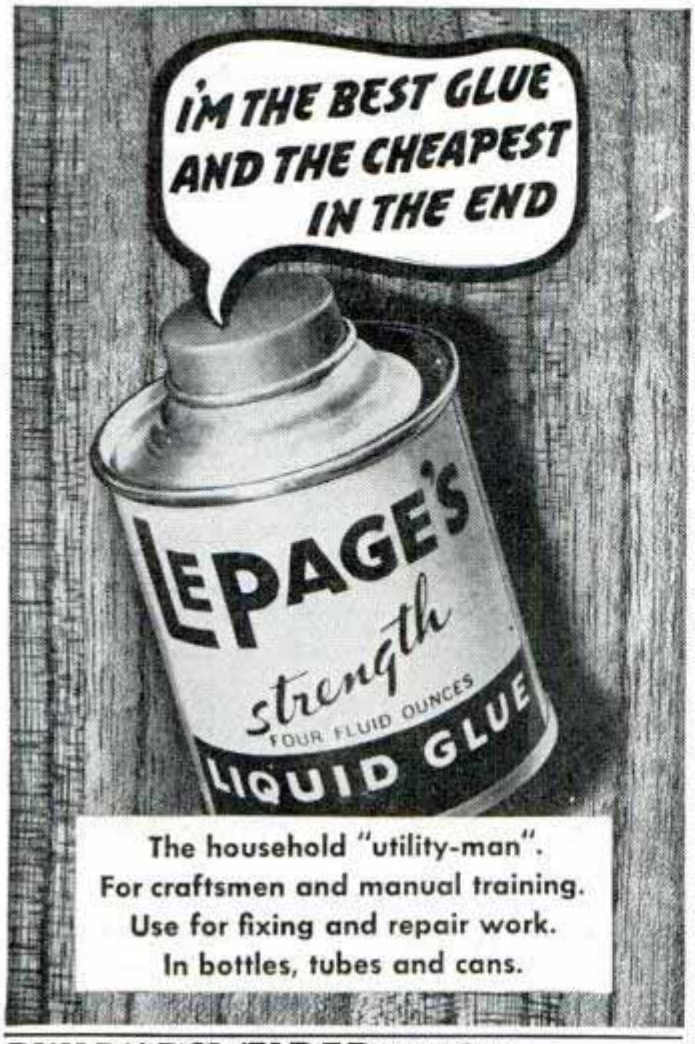
(Continued from page 804)

radio grille and used on control knobs and the hardware trim is an attractive plastic treatment. The de luxe steering wheel also is of plastic material.

Elimination of noise is another subject on which manufacturers have been busy during the past year. Packard uses eleven different sound-deadening materials. Buick's body bolts are mounted in zones of least vibration on the frame, reducing noise and vibration inside the car. The Chrysler line continues its soundproofing work with liberal use of rubber and new insulation sprays. Nash introduces a soundproofing method claimed to decrease noise twenty-five per cent. It consists of applying a sand compound to the under panel, adding density to the surface and damping out audible frequencies or vibrations.

Air conditioning of the automobile may be the next step for manufacturers, as a result of the optional system offered by Nash. The apparatus consists of a unit containing an air filter, a motor-driven fan and a hot-water heating element, for cleaning, warming and circulating the air inside the car in winter. Mounted under the cowl, the unit is connected to the cowl ventilator by a stack in which the air is spun by its own pressure, removing part of the moisture that is in the air if wet weather prevails. Then the air is carried into the unit through the filter, which cleans it, and past the fan, through the hot-water heating element and out into the car. The fan keeps air pressure constant when the automobile is traveling at high speeds. Drafts are eliminated because the system builds up within the car an air pressure greater than that outside.

Among other features of the 1938 models are: Packard's twice-a-year chassis lubrication; Buick's special dome-shaped pistons which permit controlled burning of the fuel mixture and a higher compression ratio without detonation, increasing horsepower seven to eight per cent without increasing bore and stroke; Cadillac's elimination of running boards on the low-slung "Sixty," a surprise entry into the field, and Chevrolet's special illumination of the ignition lock, in which the light from a small bulb shines through the spaces left by making the hole larger than the body of the lock.



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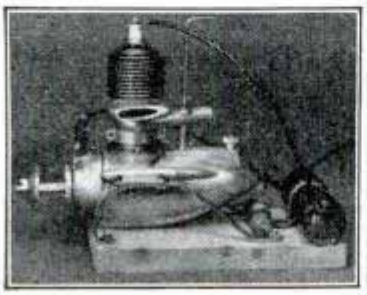

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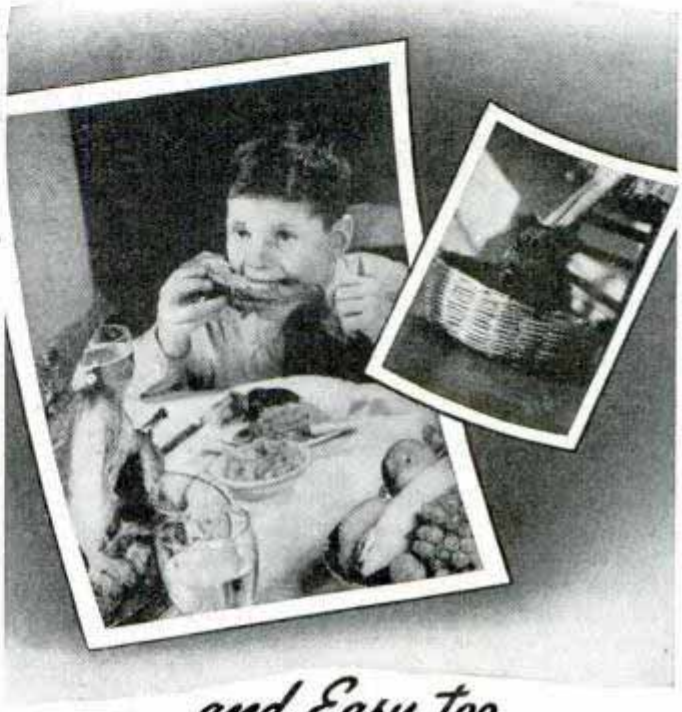

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Two-Tube Portable Receiver

(Continued from page 899)

of machine screws. A schematic circuit diagram is given in Fig. 2 and the simplified wiring diagram appears in Fig. 3.

Photos Figs. 3-A, 3-B and 3-C show various views of the completed assembly; 3-D and 3-E are rear and bottom views of

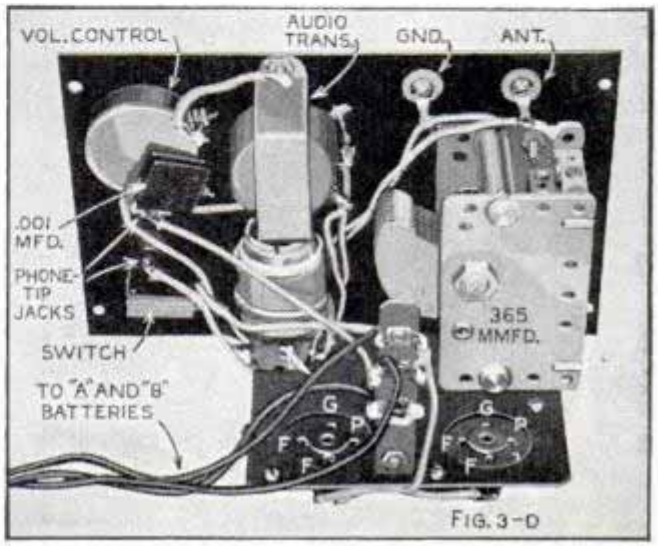

FIG. 3-D

the panel and base. A list of the original materials used can be obtained from Popular Mechanics radio department upon application without charge. The blueprint number is R-245. Short lengths of flexible insulated wire, terminating in grip-teeth spring clips, provide antenna and ground connections.

Volume is controlled with the potentiometer adjusting the feed-back action. To

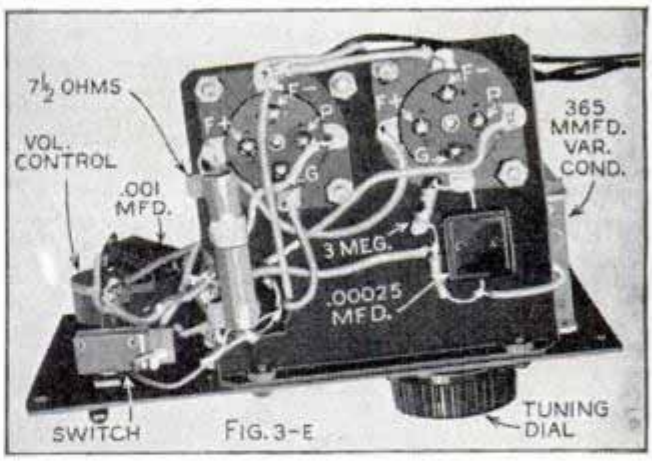

FIG. 3-E

install the set on a bicycle, use an adjustable rod-type antenna and insulate it from the frame; connect ground lead direct to frame. At the ball game or on hikes, clip antenna lead to a metal structure such as a railing, seat or fence; ground lead is not used in this case.

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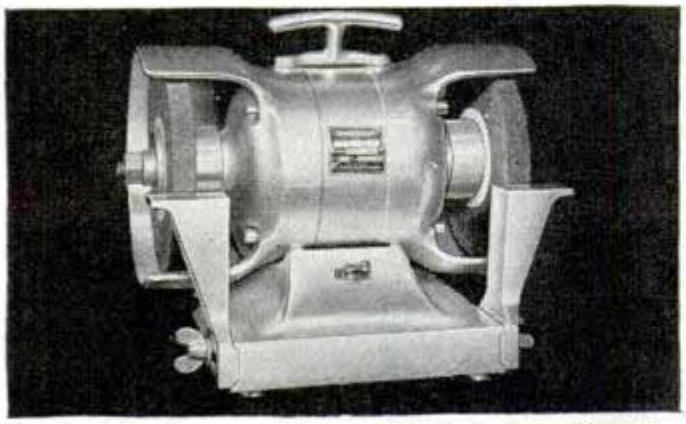

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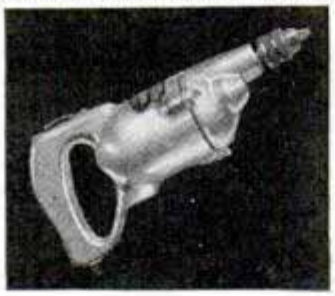

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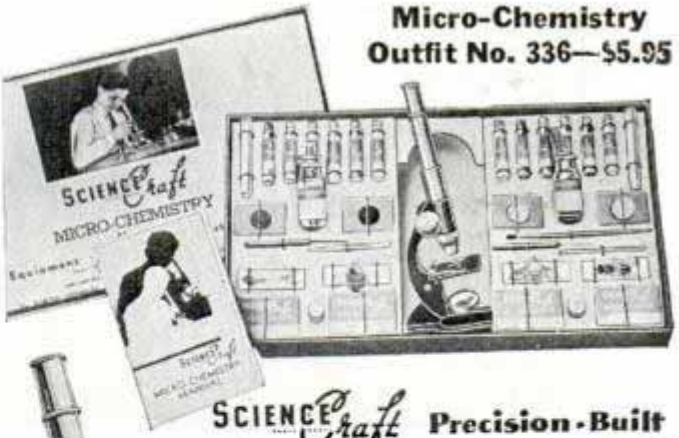

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MODERN MAGIC OF THE LIGHT BENDERS

(Continued from page 861)

nitely durable under weathering, and conform to fixed standards in its ability to refract and disperse light and its component color rays. These qualities are obtained by mathematical formulas which take into consideration the raw materials in the "recipe," the purity of those ingredients, the cooking temperature and cooling time. An infinitesimal error in the density of one ingredient, a variation of but one or two degrees in the temperature of the annealing oven, may destroy the value of an entire "batch" for optical purposes. The 200-inch telescope mirror was cooled over a period of months under control. Even

The vibrometer which photographs jolts and jars and measures vibrations

during the long grinding and polishing its temperature was maintained at a precise level, for the heat of a workman's body might have affected the lens enough to warp the sensitive material, perhaps to destroy its accuracy in reflecting the image of a star.

A watchmaker may consider his work finely done if he has machined parts within 1/10,000 of an inch. To the lens grinder, inch is too coarse a term. He talks in microns—the micron is 39/1,000,000 of an

inch—and in light waves. With abrasives as fine as flour and grinders that can supply tons of pressure or the gentle dab of a powder puff, he rubs down the prism or hemisphere to within a quarter of a wave length of sodium light, or 6/10,000,000 of an inch.

Talk about splitting hairs! One of the tests of the lens designer's skill is the sharp definition obtained when his lens is focused on a diatom, a minute form of algae with a siliceous skeleton. The diameter of a single bead of the diatom is no more than 1/100,000 of an inch, or 1/400 of the width of a human hair.

The engraved lines of micrometer scales used to measure infinitesimal objects under the microscope are as fine as six microns in width and spaced ten microns apart. Some of the engraving on glass in the microscope factory is so delicate that the slightest vibration of the building affects the accuracy of the lines, and special vibrometers have been devised to test the steadiness of the building by making a jolt photograph itself. A beam of light passed through a condenser lens and a slit is reflected by a mirror floating in a pool of mercury. The reflected light passes through another slit and is recorded on a photographic film traveling in a cylindrical camera housing, with a twenty-four hour clock mechanism moving the film. When the building vibrates, the vibration is transmitted through the mercury to the floating mirror, and as it moves, the light spot moves across the photograph film and shows, when developed later, the time and intensity of the vibration.

That is just one of the methods of the optical glass worker to assure perfection in the product. How close can he come to perfection? Here is an irregular prism for example; it has seven surfaces, only two of them parallel. Some surfaces are polished, some are ground. Each must be accurate within 6/10,000,000 of an inch. Some prisms are machined so finely that if the sides were extended for forty-three miles the error from the specified angles would be less than one foot.

If your camera has a range finder, you know how accurately this optical instrument tells you the distance from your camera to the object. The same two-eyed device enables the gunner to drop a shell on a target miles away and beyond his

Magic of the Light Benders

(Continued from page 160A)

vision. Compare the range finders of Spanish-American war days with those of today and you have an idea of the progress of the lens-grinder's science. Forty years ago 6,000 yards was the maximum distance measured for gunfire. Today the big guns make it necessary to measure ranges up to 50,000 yards, and range finders with thirty-foot bases can spot a target within 500 yards at a distance of fourteen and one-half miles.

Optical flats, the "measuring stick" for plane surfaces, are ground to an accuracy of one or two ten-millionths of an inch, which is close enough! If two perfectly flat pieces of glass or quartz are laid one on the other, touching at one edge but slightly separated at the other, an air wedge will be left between them. If the plane surface being tested is irregular, the pattern produced by the interference of light waves assumes the appearance of a contour map; if the surface is regular, the waves form concentric circles. By the position and number of the bands you can tell the location and amount of the surface irregularities. It is dangerous to bring face to face two optical flats, for the molecular cohesion will form them into a solid block almost impossible to separate without destroying their smooth surfaces. It takes from ninety-five to 100 pounds force per square inch to separate two flats.

If you are impatient and impulsive, don't ever try to become a lens grinder! It is a craft demanding infinite care; slow, patient work. It may take months to melt a "batch," months more to cool the molds of glass, and again more months to grind and polish the lens. Not more than ten per cent of a 600-pound pot of annealed glass ever reaches the form of finished lenses.

But if grinding optical glass appeals to you, start young! The experts are relatively few, and they started early. One man in a Rochester plant has been polishing tiny, magic light benders for fifty-five years and his hand and his eye still see true!

¶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.

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Works Off Any Storage Battery or Ordinary Light Socket . . .

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This New Electric Arc Welder is made possible by the invention of a low voltage carbon. Auto batteries may be used without removing from car. Uses about same current as four headlight bulbs. Can be used on 110 Volt electric light socket or 32 Volt electric light plant by using a Trindl Converter in place of battery. Broken parts are SIMPLY MELTED TOGETHER by the white HOT electric arc, in just a few seconds. Produces about 7,000 degrees heat.

HOTTEST FLAME KNOWN

Melts iron and steel instantly. Welds fenders, repairs radiators, holes in bodies, milk cans, tanks and brazes broken castings.

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7" & 8½"

2 Sizes of KITS give you 9 different Super 2-tool combinations.

. . with Forged ALLOY steel to Add Years of service to this Super Parallel Pliers, Lock-&-Ratchet Wrench, Hand Vise . . Plus. Has 1-oz. to 1-TON Power grips for ALL Shapes in ALL Positions, and a Million Sizes between 0" and 1¾"!

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Kar-A-Van Industries, Inc., 2001 S. Michigan Ave., Chicago, Ill.

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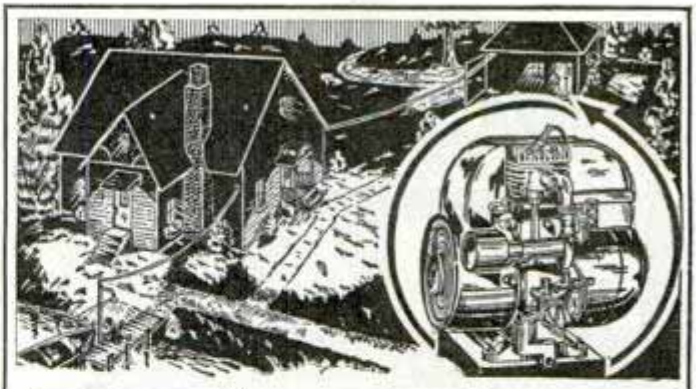

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World's Largest Exclusive Padlock Manufacturers
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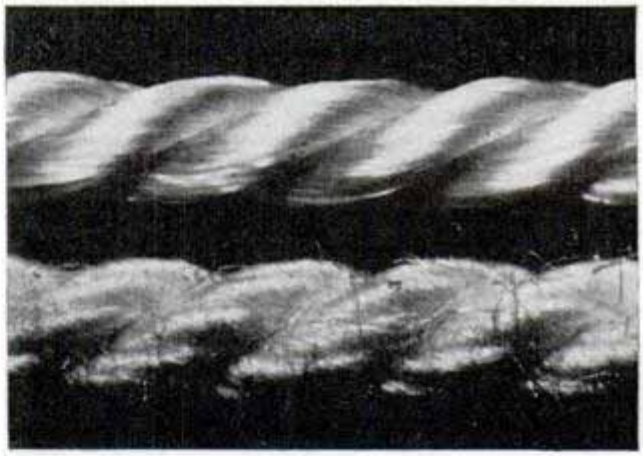
Super-Tires for Highway Express

(Continued from page 853)

of their jobs. To them and hundreds of other drivers, short-lived tires constituted a serious problem.

For many years tire manufacturers worked on the problem. They built tires that stood up well under ordinary conditions, where runs were short or stops frequent and long enough for the tires to cool off. But on runs like the one in Texas, their best tires burned up and blew out within a few thousand miles, sometimes within a few hundred. Meanwhile trucks were improving, loads growing heavier and speeds increasing—and the problem was becoming more acute. Almost feverishly tire engineers worked, driving tires to death and dissecting them afterward in the quest for the solution.

Then someone hit upon the idea of replacing ordinary cord, which could not withstand extreme heat, with another material. Armed with the results of prelimi-



Rayon cord, at top, compared to cotton cord. Note smoothness of rayon fiber

nary tests, Goodyear Tire and Rubber company turned to rayon and for seven years its engineers worked with the silky filaments and with rubber. Just recently came the announcement that their efforts had been crowned with success.

That the product was a success was demonstrated within a short time. On a 300-mile run in Texas, similar to the one already described, one company was having trouble with tires. Trucks left one end of the line at 4:30 p.m., made three brief stops, arrived at destination by midnight, unloaded and reloaded, then returned to the starting point at the same speed. So

(Continued to page 166A)

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(Continued from page 164A)

strenuous was the schedule that three trucks were being used, each making the round trip every third day and remaining in the service station forty-eight hours between trips.

Conventional tires of many makes were tried, with 3,000 miles the maximum for any tire. Each truck was refitted with two of the Goodyear tires. Truck No. 1 ran 67,000 miles before the tires broke down. On truck No. 2, one tire was destroyed by wheel failure at 73,000 miles, the other continued through 81,000, when a breaker strip began showing and it was removed to serve as a spare. On truck No. 3, one tire, run flat after a puncture, was taken

Inspector checks tire fabric for tensile strength and uniformity of twist

off at 54,000 miles. The other was removed and used as a spare after 84,000.

Cords used in the super-tire are made from filaments of a special rayon, entirely different from ordinary commercial rayon. The filaments are much finer and greater in number, running many hundreds to the cord, than in other rayon, and their tensile strength is much higher. The filaments are continuous, each running the full length of the cord, and in each tire, depending upon size, there are from sixteen to thirty-two million filaments, each anchored at its ends by tie-in around beads of steel wire.

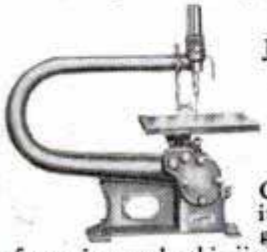
The tire is designed with what is called a high-profile shape which is said to decrease the amount of heat generated by rapid flexing over a long period.

GIFTS OF POWER TOOLS ENGINEERED TO LAST

B575 7" BENCH SAW $12.35

As shown, including guard and splitter, steel rip fence and miter gauge.

A Driver bench saw will relieve any home craftsman of much of his hardest work. The 7" blade on this tool cuts stock to 2¼" thick. 14" x 10" ground cast iron table tilts to 45°, permitting angle cuts. Saw arbor raises and lowers. Heavy steel ripping fence. Safety guard with splitter which facilitates sawing of green or damp lumber.



J505 14" JIG SAW $13.45

As shown, including pulley on machine. Motor pulley and belt extra.

Complete in itself for a great variety of creative work, this jig saw is built to give hour after hour of vibration-less, trouble-free performance. It has cast iron tubular frame with throat capacity of 14". Table 9" x 9", tilts to 45° and has accurate quadrant indicator. Enclosed drive mechanism lubricated by splash oil system. Plunger-type blower clears cutting line of sawdust.

For the beginner or veteran tool user, an inexpensive, precision-built Driver tool makes the ideal gift. Note the features on tools shown here. Proof that home craftsmen everywhere are right when they say, "Driver gives a lot of tool for the money!"

L540 GAP BED LATHE $18.50

As shown, including 34-in. V-belt and box wrench.

This low priced tool will handle the bulk of wood and plastic turning and metal turning jobs in the home workshop and do them well. It has sturdy cast iron gap bed 44" long and 3½" high. Morse Taper centers, bronze bearings, ball thrust bearing in head. Capacity: work 30½" long, discs 10" in diameter.

D570 DRILL PRESS $19.25

As shown, less motor. Includes Jacobs Key Chuck, belt and motor pulley.

Here's a superior drill press unique in its price class. It has a Jacobs (⅛" to ½") Key Chuck. Bronze bearings and ball thrust bearing. Rigid cast iron frame and adjustable 8" table. Spindle travels 2⅞". Four speeds.

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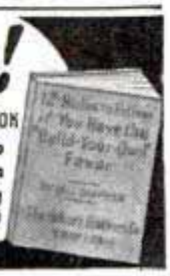

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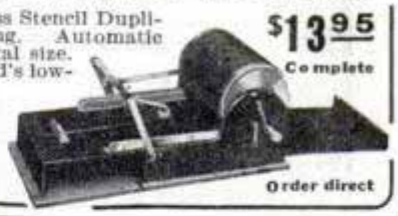

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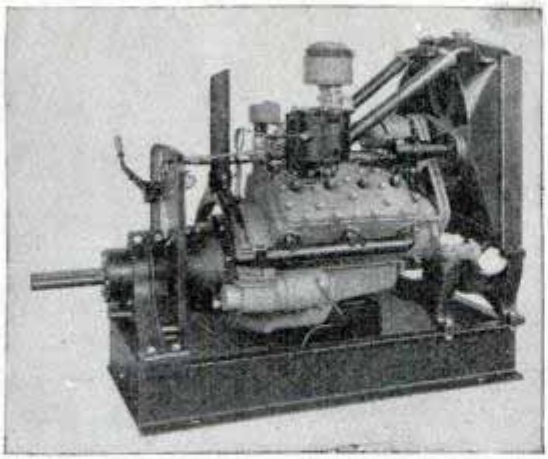

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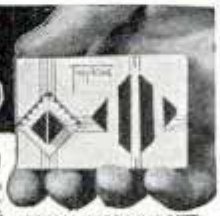

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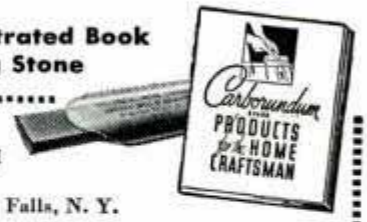

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Rodents Worth Weight in Gold

(Continued from page 829)

of California. Chapman realized the full potentialities of his plan for the first time and refused to sell the animals at any price. The upshot of this incident was that someone stole thirty-five of the farm's seventy animals.

Detectives chased the animal thief across the continent but he eluded them. He did not return to Switzerland but set up his own chinchilla farm in Germany. When he was finally located, pictures of the animals were sent back to California. They had not received the proper treatment and had

The late M. F. Chapman, who founded the chinchilla farm, with one of the tiny animals

changed in appearance. As a result, the animals were never returned. Rather than risk the dangers of upsetting his pure pedigree lines, the engineer decided to carry on with the ones that had been left behind.

What was once an accepted impossibility is now an actuality. The southern California farm with its twenty-five housing units, office and service buildings is no exhibition farm for the breeding and exhibition of fancy stock but a going concern, a potential industry, with a background of fifteen years' development.

Of course, the animals are not killed for their skins as yet. A pair of chinchillas are worth $3,200 or more than their weight in

(Continued to page 174A)

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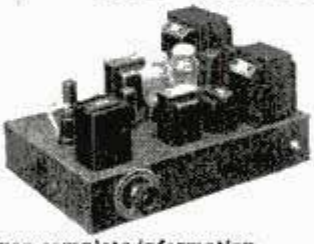

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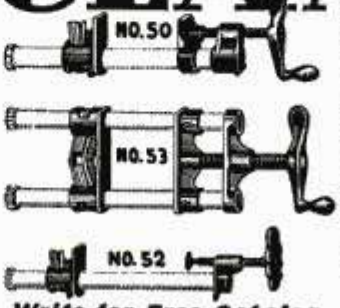

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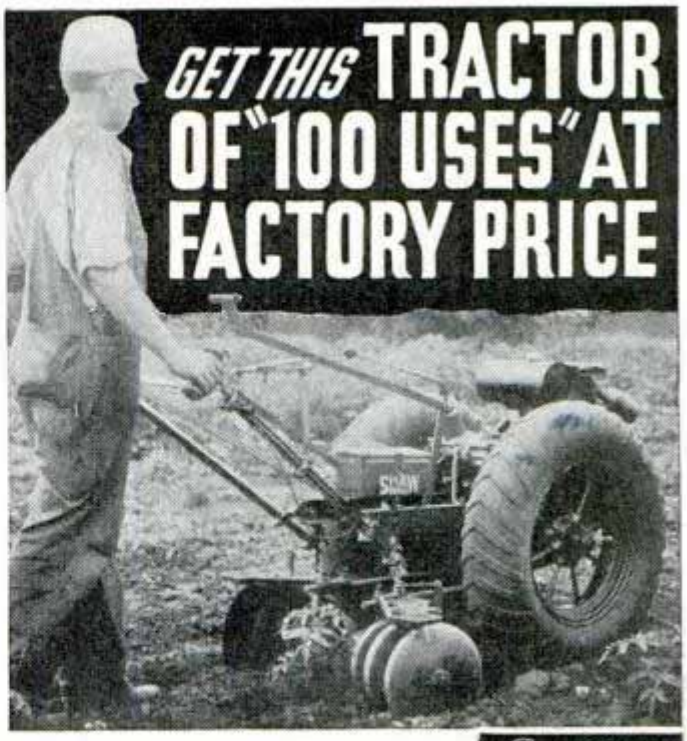

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(Continued from page 170A)

gold. At present the animals are being sold to big-time breeders who are setting up their own farms with an aim toward supplying the fur markets with chinchilla a few years hence.

Let's look in on the chinchilla in its California home. Cages with wooden floors and fine mesh wire sides are arranged in rows. They are so constructed as to keep out all rats, snakes, and other pests that might cause a sharp drop in profits by a single night's work.

Inside these cages are scientifically constructed boxes, approximately two by two by three feet with an indirect entrance near the top. These serve as the chinchilla's home, one to a cage. Since he is not given to burrowing, heavy walls are not required to contain him. In captivity, the chinchilla sleeps during the daytime and around sunset comes out to feed and exercise. Clean and dainty, the animal is easily tamed and has no vicious traits.

The chinchilla is strictly a family man and once he finds his mate they share the same cage for the rest of their lives, which is sometimes more than twenty years, according to Chapman. There are from one to three litters per year, with one to four babies per litter, an average of slightly less than two per litter. Chinchillas mature and mate at about one year, although some breed at six months. It is an interesting fact that the babies are born with their eyes open and within an hour after birth they are up and scampering around.

The little rodents have bird-like appetites and their yearly board bill for a varied ration of whole grains, commercially prepared pellets, alfalfa hay and a variety of fresh green vegetables is negligible.

Since the farm was started, breeding records have been accurately kept and it is possible to tell the lineage of any animal. For purposes of identification, every animal has a number tattooed inside the ear.

While there are no specific infectious diseases from which chinchillas suffer every precaution is taken against contagion. A well-equipped laboratory is maintained for treating the animals.

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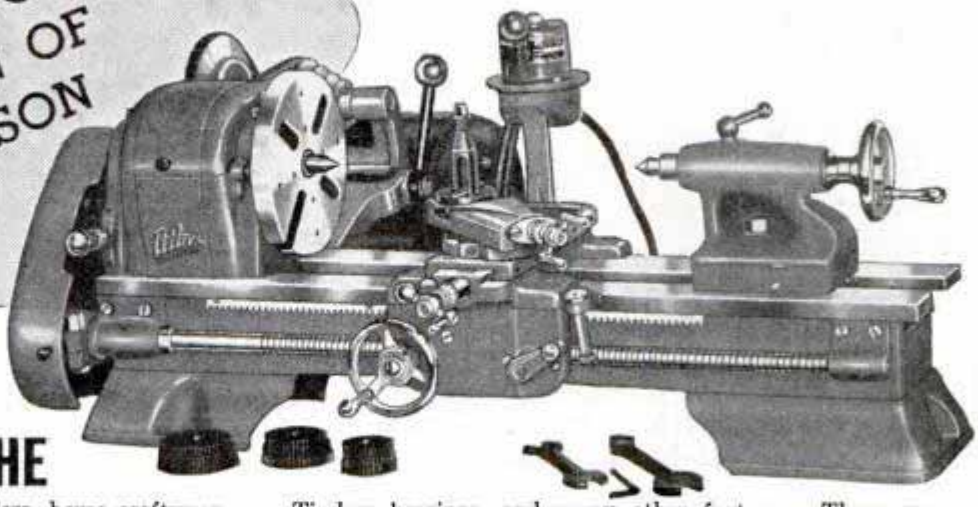

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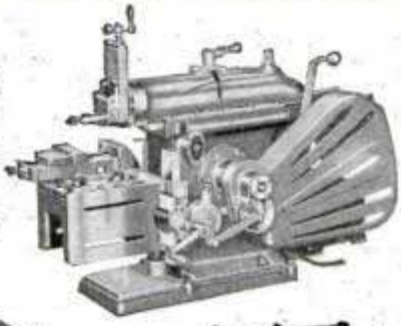

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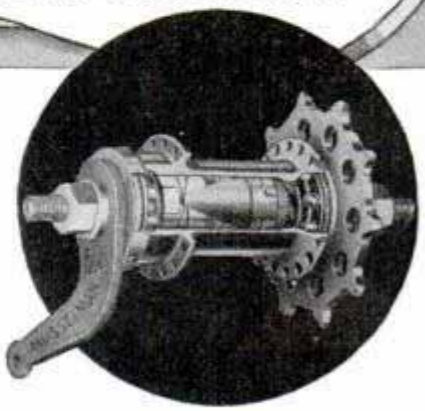

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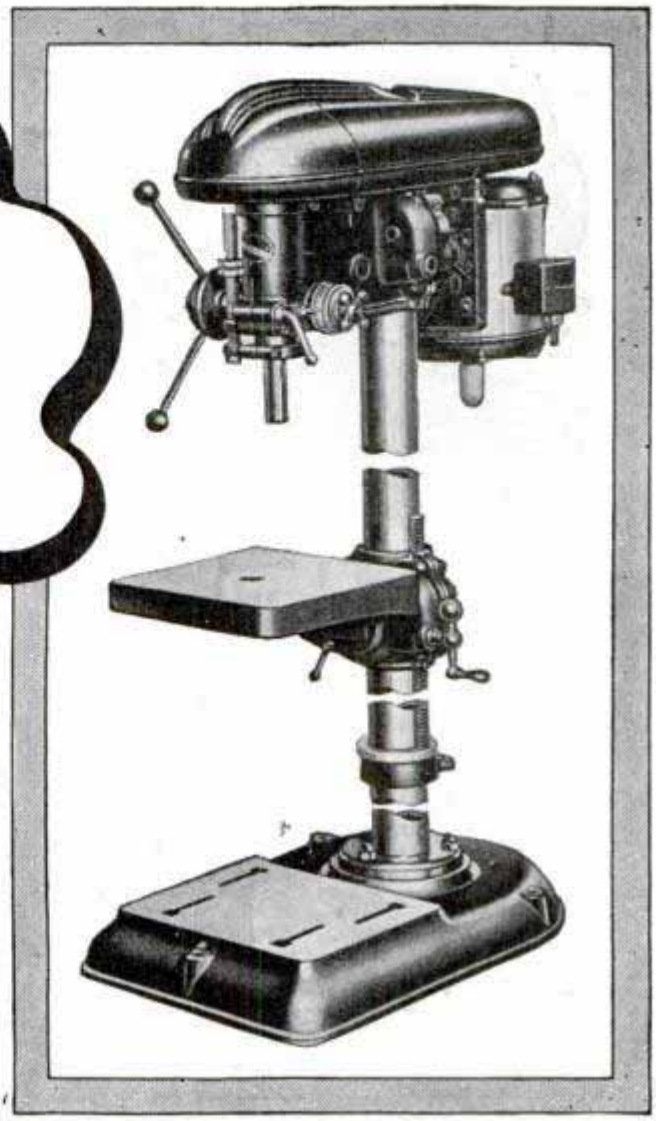

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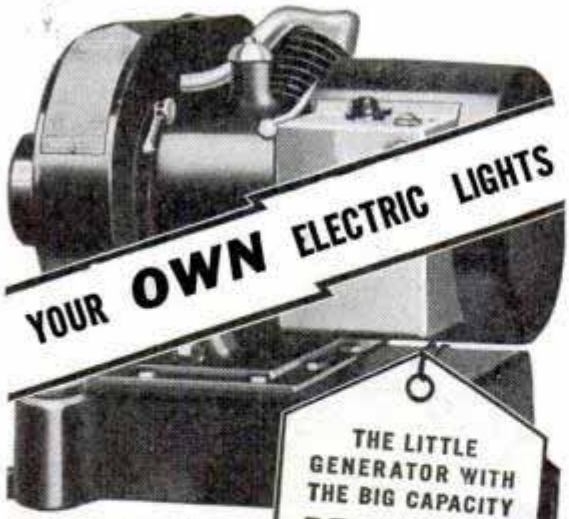

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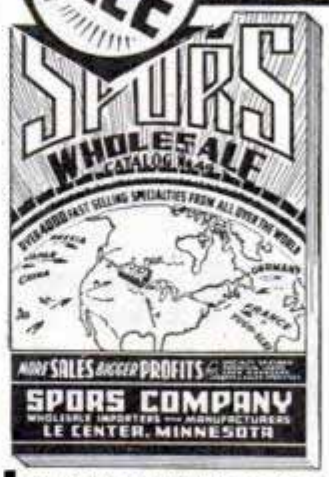

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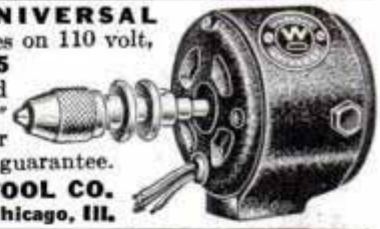

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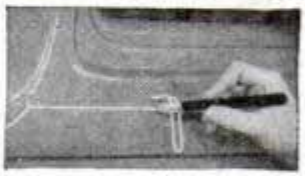

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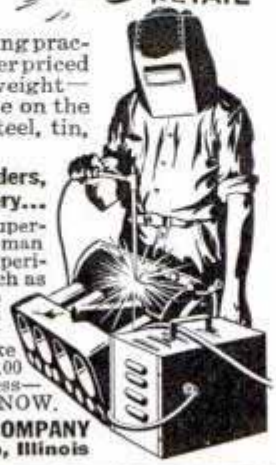

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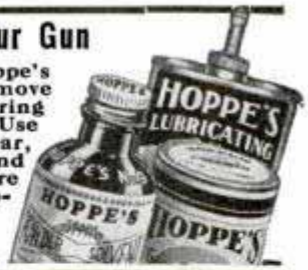

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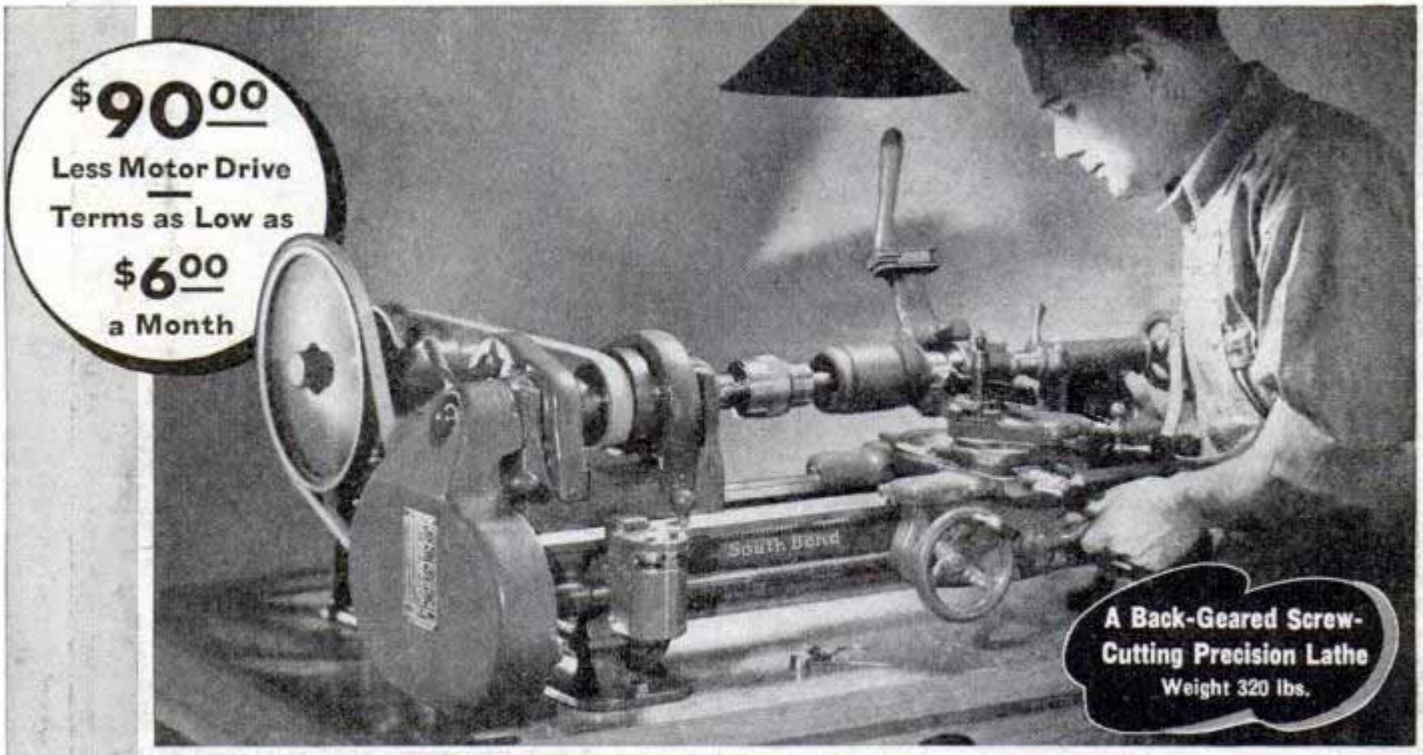

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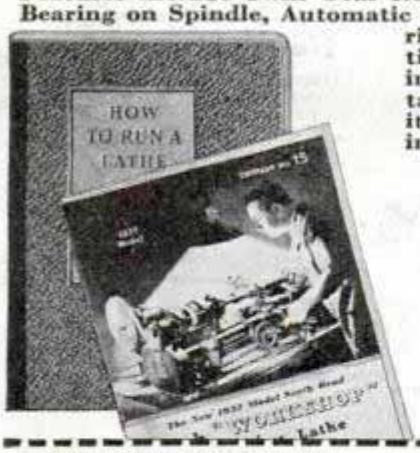

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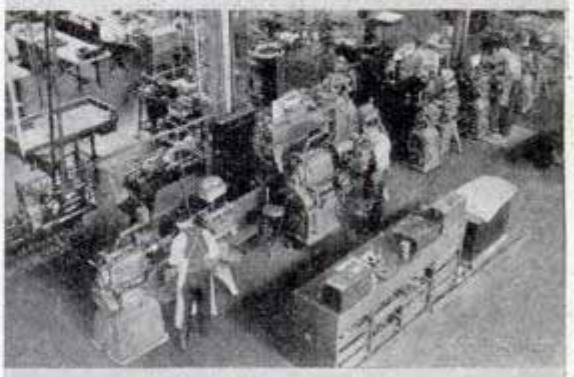

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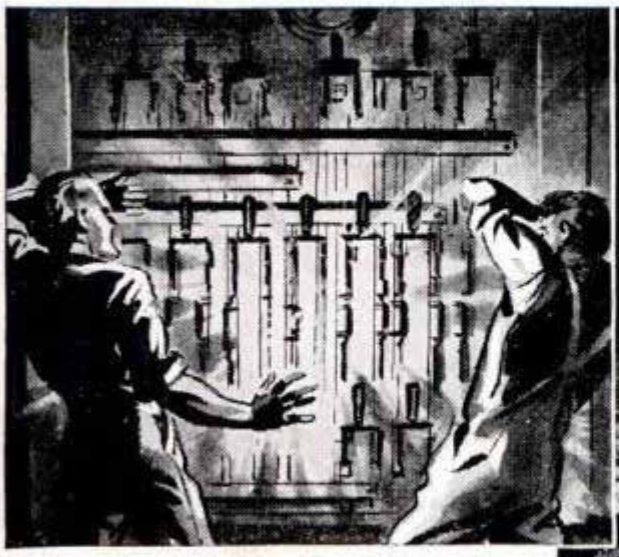

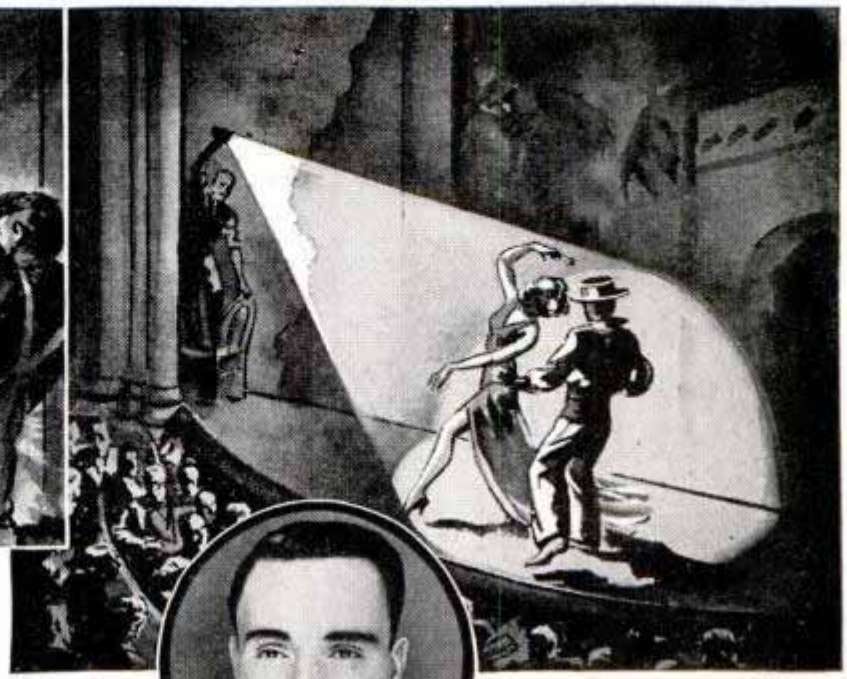

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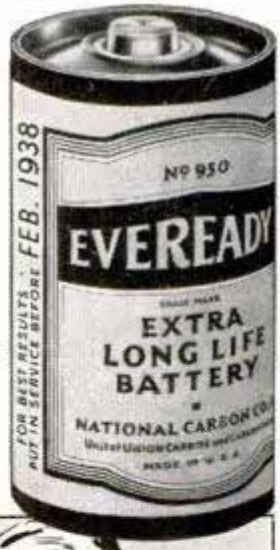

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