

HOW TO TAKE BETTER PICTURES

POPULAR MECHANICS

MAGAZINE



WHEN YOU UNDERSTAND IT

REG. U.S. PAT. OFF.

MAY
25 CENTS



SEE PAGE 647



NEW 1937 MOBILLOIL CHART

**OUT TODAY...
AT 79,000 DEALERS
FROM COAST TO COAST**

DO YOU know it's important to get the right grade of oil for your make and model of car?

That's why the Official Mobiloil Chart is worth money to you...

It tells the exact grade that gets utmost performance and mileage out of your motor!

Change to your car's grade of Mobiloil... today! Enjoy better driving with the world's largest-selling oil!

The Mobiloil Chart of Recommendations, 1937-33

Make and Model	1937	1936	1935	1934	1933	Make and Model	1937	1936	1935	1934	1933
AUBURN (6 Cylinder)	—	AF	AF	AF	—	LA SALLE	AF	AF	AF	AF	BB
AUBURN (8 Cylinder)	—	AF	BB	BB	BB	LINCOLN	AF	AF	BB	BB	BB
BUICK	A	A	A	AF	AF	LINCOLN ZEPHYR	AF	AF	—	—	—
CADILLAC (8 Cylinder)	AF	AF	BB	BB	BB	NASH (Models 11, 90, 12, 90)	—	—	—	BB	BB
CADILLAC (12 & 16 Cylinder)	BB	BB	BB	BB	BB	NASH (Cafayette Series 300)	A	A	A	—	—
CHEVROLET	A	A	A	A	A	NASH (All Other Models)	AF	AF	AF	AF	AF
CHRYSLER	AF	AF	AF	AF	AF	OLDSMOBILE	AF	AF	AF	AF	AF
DE SOTO	AF	AF	AF	AF	AF	PACKARD	A	A	A	AF	AF
DODGE	AF	AF	AF	AF	AF	PIERCE-ARROW	AF	AF	AF	AF	AF
FORD	AF	AF	AF	AF	AF	PLYMOUTH	AF	AF	AF	AF	AF
GRAHAM (6 Cylinder)	AF	AF	AF	—	—	PONTIAC	A	A	A	AF	AF
GRAHAM (All Other Models)	—	—	BB	BB	BB	REO	—	A	A	A	A
HUDSON	A	A	A	AF	AF	STUDEBAKER	A	A	A	AF	AF
HUPMOBILE	—	AF	AF	AF	AF	TERRAPLANE	A	A	A	AF	AF
LAFAYETTE (Series 3610)	—	A	A	—	—	WILLYS	AF	AF	AF	AF	AF
LAFAYETTE (All Other Models)	—	—	AF	AF	—						

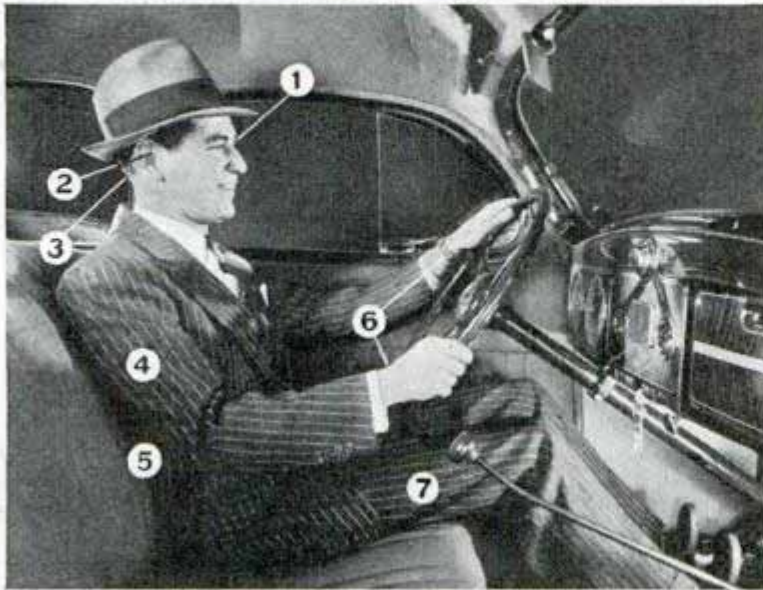
For all of the cars listed here, Mobilil Arctic is recommended for temperatures below 32° F.

MOBILLOIL AND MOBILGAS

SOCONY-VACUUM OIL COMPANY, INC.



WAR ON "DRIVING STRAIN" IMPORTANT NEW IDEAS END DRIVING FATIGUE



RIDE RELAXED (above) — Eye and neck strain (1 and 3) reduced by means of a wider windshield, safe-vision lighting.

Thorough, scientific insulation banishes tiring road noises that irritate ear-drums (2). Back and leg muscles (5 and 7) are rested and relaxed by comfortable, "chair-height" seats. Effortless steering plus easy, quiet shifting results in far less exertion for arms, hands and wrists (4 and 6).

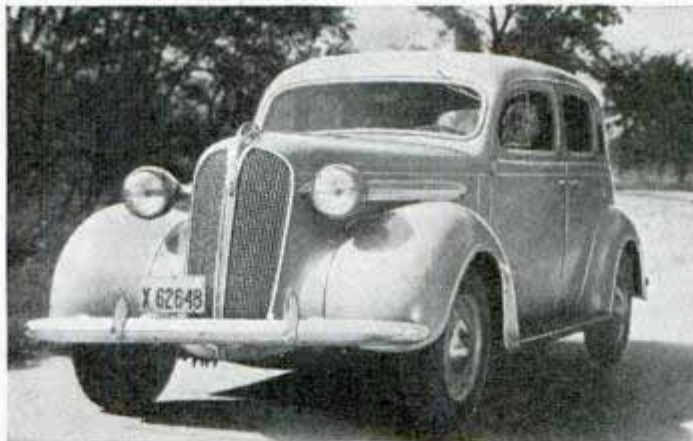
Causes of Fatigue Tracked Down

"THINK of the man who drives it!" That is the first consideration of Plymouth engineers.

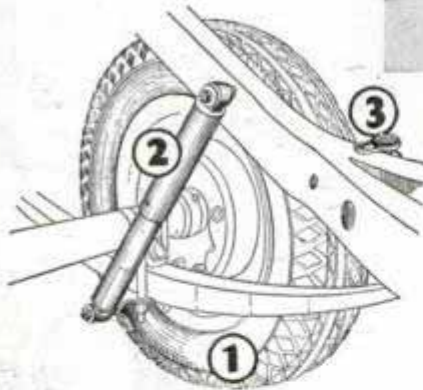
Eye and ear fatigue...muscular strain in neck, back and legs...no item was too small to escape their attention. They have made your Plymouth easier to handle...more restful to ride in...and therefore *safer*. PLYMOUTH DIVISION OF CHRYSLER CORPORATION, Detroit, Michigan.



MORE ROOM (above) — than ever before...for legs, shoulders, heads. Rumble and vibration are gone because the body is mounted on the frame on live rubber cushions.



NO LEANING SWAY (left) on curves. A stabilizer bar, mounted on the frame, is connected with the front axle...it keeps the car on an even keel.



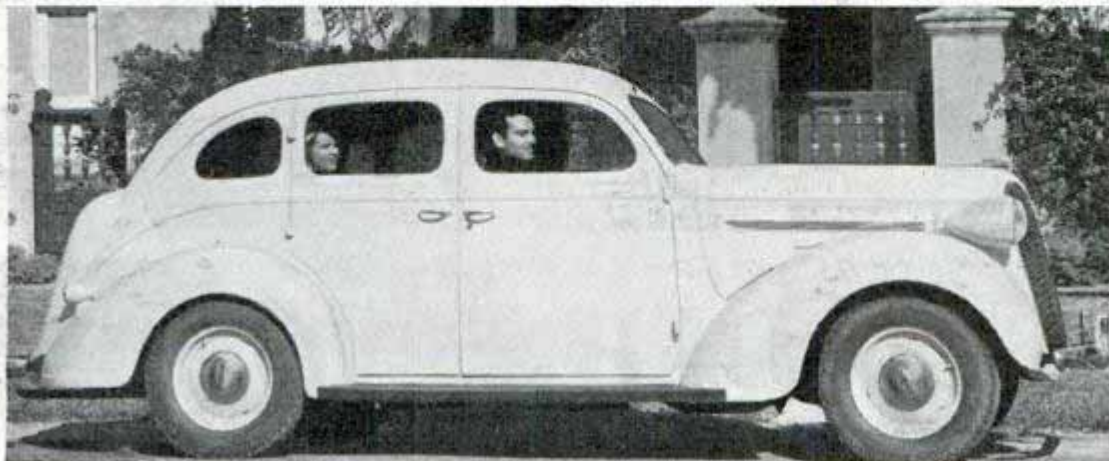
ROAD SHOCKS STOPPED (left) — large Airwheel tires (1), low-pressure shock-absorbers (2), and rubber body mountings (3) insulate the car from road vibration, bumps and jolts.

NOISE SILENCED (right) — Plymouth engineers analyzed sounds inside a car. Then they insulated the steel top, sides, doors and floor with five different materials...produced Plymouth's amazing "hushed ride."



PRICED WITH THE LOWEST

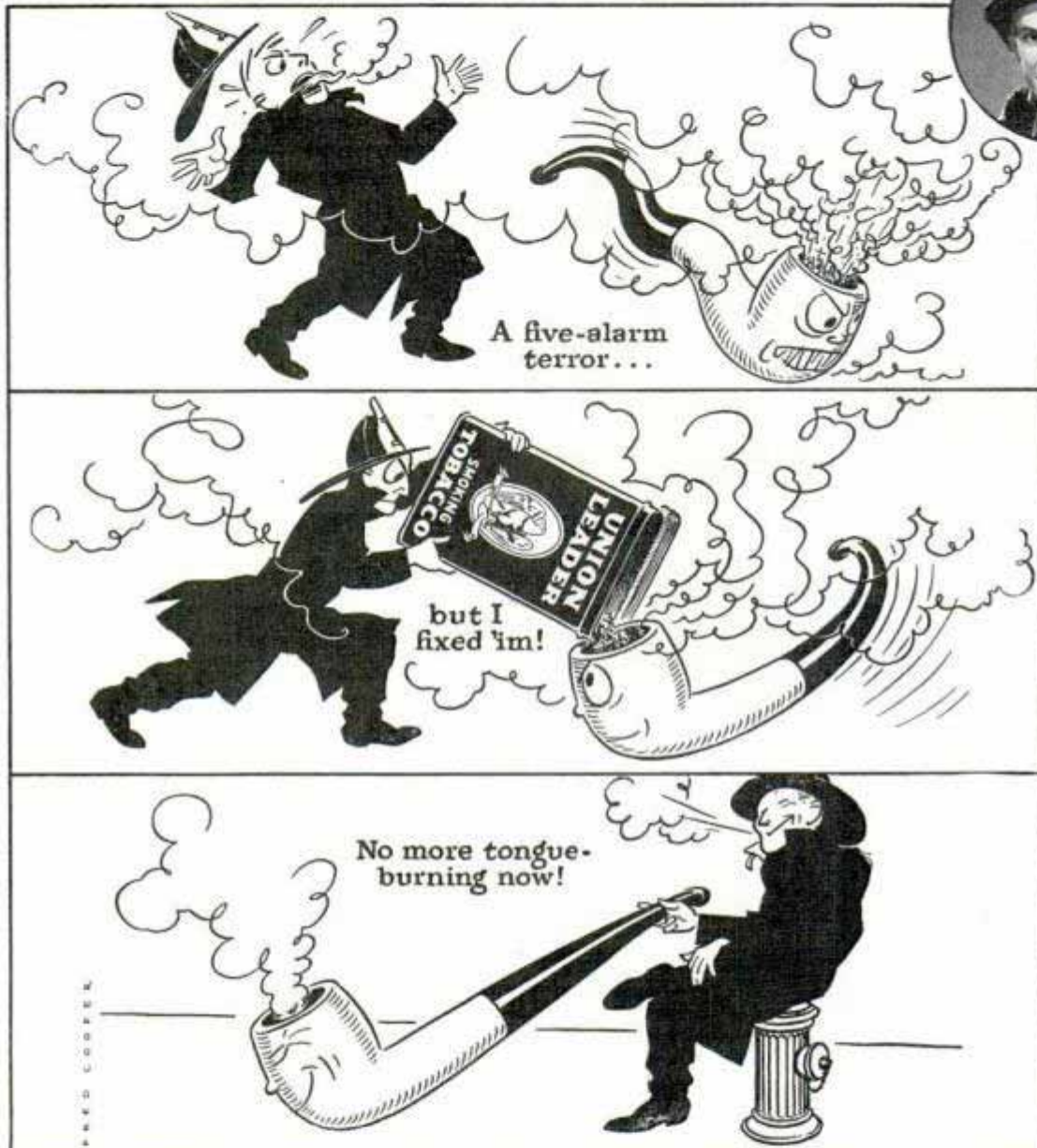
Today, you'll find Plymouth is priced with the lowest...and offers very convenient terms. You can buy a beautiful, big new Plymouth on remarkably low payments. The Commercial Credit Company has made available—through DeSoto, Chrysler and Dodge dealers—terms which you will find fit your budget...and make it exceptionally easy to purchase...and enjoy... a new Plymouth today.



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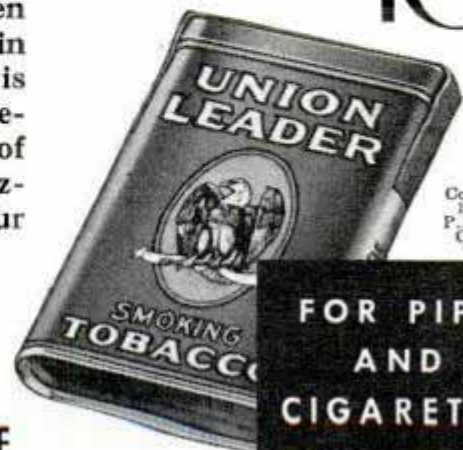
"How I Rescued Myself from a Burning Pipe"

By **SMOKY SAM**, the Fireman



You too, can put out Tongue-Fires

THIS EASY, INEXPENSIVE WAY! Many a tongue has been saved from burning when Union Leader's big red tin answered the alarm! That fine, fragrant Burley tobacco is "bred in Old Kentucky" to mellow ripeness; cured by special processes and *aged-in-wood*—to remove every cause of bite and burn. Result: Smooth, sweet coolness with amazingly rich flavor. Union Leader is fire insurance for your tongue! (Makes fine cigarettes, too.)



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THE GREAT AMERICAN SMOKE

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Popular Mechanics Magazine

H. H. WINDSOR, Founder

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

May, 1937

Vol. 67, No. 5

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Things Are Not What They Seem

MOTHER Nature offered man the materials to produce almost anything his mind could conceive, but she neglected to label her gifts. So, slowly and painfully, through the centuries, man has been trying to piece together bits of the colossal jigsaw puzzle she created. Strangely enough, he succeeded in isolating rare elements before he began to realize the treasures locked in such common things as wood, air, salt, water, coal and growing plants. But, having learned the possibilities of these everyday substances, industrial chemists in the past two decades have been making over the world by transforming products of the forest, the farm and the mine into new, man-made things of beauty and utility. Watch next month for the first of two articles describing the industrial chemist's contributions to your comfort and happiness. The eight pages of Coloroto pictures will make you, too, realize that "Things Are Not What They Seem."

Next Month

FREEZING is nature's oldest way of preserving food. It is man's newest. Quick freezing seals in the freshness and flavor of fruits and vegetables but does not damage the tissues like slow freezing. The grocery store of tomorrow may deal largely in foods frozen when picked and kept frozen until you cook them. An article next month discusses the possibilities.

He Fools Your Ears

EVER hear of a rain-making machine? We know a fellow who owns one. He fills a hopper with birdseed and when the seed trickles down onto a sheet of Cellophane, he gets rain—well, anyway, he gets a sound like rain. He's a radio sound-effects expert and can make a noise like a chugging locomotive or a galloping horse. Read how he does it next month and you'll agree that "You Can't Believe Your Ears."

Believe in Signs?

THE catcher of a sandlot baseball team uses signals—two of them. When he extends two fingers in his mitt, the pitcher tries a curve. One finger means a straight ball. In professional baseball everyone in the game uses signs. In an article next month Lew Fonseca interprets some of the wigwagging you observe on the diamond. It seems there's a reason for all the funny business.

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This One



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Whenever the exceptional is accomplished by motor car or by machine, you'll generally find Pyroil helping to make it possible. Look!

Used by the winners of the 1933, 1934, 1935 and 1936 Indianapolis 500 mile auto race.

Used by Sir Malcolm Campbell in establishing world land speed record, Daytona Beach, Florida, 1935.

Used in official Flour Mill machinery test with saving of \$5,000 yearly indicated, 1933.

Used by Barney Oldfield in world record of 64 M.P.H. with a farm tractor, 1933.

Used by Jesse White, salesman, driving 18 miles of mud in 6 hours —his car undamaged while others were ruined, 1935.

Used by Art Chester in setting new world record for light planes, Miami, 1935.

Used by Cummins Diesel Engine Co., in record transcontinental run of America's first Diesel powered passenger auto, 1935.

Used by Tommy Estlick in winning many cups and world records in outboard motor boat racing.

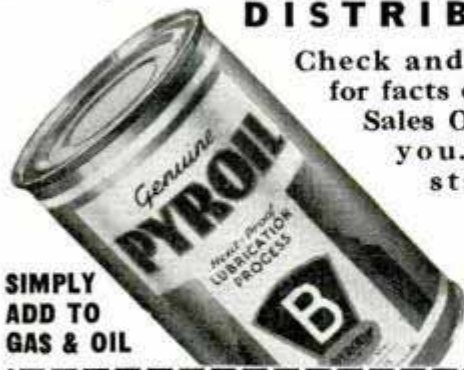
Learn for yourself Pyroil's performance boosting ability; its extra protection against strain and damage. Save money on operation costs; cut repair expense; increase operation capacity, whether engine or equipment is brand new or very old.

Mail coupon now or ask your service station or dealer to give you full facts about Pyroil. Sold the world over. Manufactured and Guaranteed by Pyroil Company, W. V. Kidder, Founder, 55 Pyroil Bldg., LaCrosse, Wis., U.S.A.

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- Send details of Premium Plan and Business Opportunity for me.

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"HOW COME THESE PEPPY CORDS ARE SO EASY ON GAS AND OIL?"

"WELL FOR ONE THING THEY HAVE SEALED POWER PISTON RINGS."

SEALED POWER PISTON RINGS

Best in New Cars! Best in Old Cars!



SEALED POWER PISTON EXPANDERS

Control Expansion and Piston Slap

When piston skirts collapse, they must be expanded if power and economy are to be restored. Sealed Power Piston Expanders restore collapsed skirts scientifically. They have spring tension, yet are entirely adjustable to compensate for variations in piston and cylinder wear. Ask your Sealed Power ace mechanic about this great expander. And use it for best results!

THOUGH they *look* expensive—hard on oil—actually the Cord boasts an amazing record of oil economy. And, of course, it has all the speed, pep and power any motorist could ask for.

Significantly enough, Sealed Power Rings are original equipment in all Cords—just as they are in Buick, Pontiac, Nash LaFayette, Oldsmobile, Terraplane, Willys and other famous cars. For the engineers of these great cars know Sealed Power Rings are designed right. They *seal* power properly.

New Ring for Old Cars—Sealed Power now offers owners of cars that have gone 10,000, 20,000, 30,000 miles or more—a new type ring, already proved in millions of cars. It is an expander ring with springs of finest imported Swedish steel which without excess tension create a perfect seal—ending "between meal" oil hunger—saving gas—restoring pep, speed, power and performance. Engineers recommend them.

But—perhaps your car needs new valve guides, bearings or Sealed Power Lo-Ex Pistons in addition to rings in order to get 100% oil economy. Only your repairman can tell you accurately what you need. Depend on him. Meanwhile, get your copy of our new, free booklet, "New Low Cost Way to Save Oil and Gas and Increase Pep." You'll like it.

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Manufacturers of Piston Rings, Pistons, Piston Expanders, Piston Pins, Valves and Cylinder Sleeves



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Happy Shaves Are Here Again

*when you use the blade
that was made for your razor*

HERE'S a suggestion for men who find shaving a task to be dreaded. Switch back to using Gillette Blades in your Gillette Razor. Then notice how smoothly your razor removes every trace of stubble.

You'll agree that an "All-Gillette" shave is the last word in shaving comfort. For the Gillette Razor and the Gillette Blade are made for each other. Rigidly matched in design and manufacture, they function together in perfect harmony. Buy Gillette Blades today; enjoy a real shave tomorrow.

Reputable merchants never offer substitutes for Gillette Blades. Always ask for them by name.

Tune in Gillette's "Original Community Sing" with Milton Berle and other stars Sundays 10 P. M., E. S. T., CBS Network, Coast to Coast.



Gillette Blades

Precision-made for the Gillette Razor

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Accountancy Home-Study

made interesting and practical
thru problem method

YOU know as well as we do that Accountancy fits many men for positions that pay three and five and ten thousand dollars a year—gives many other men unusual opportunity to start a profitable growing business of their own.

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The only question is—just how practical is it for you to train yourself adequately in Accountancy through home study?

And the answer lies in the LaSalle Problem Method.

For this modern plan of training not only makes Accountancy study at home thoroughly practical but makes it interesting as well.

And here's how:

You Learn by Doing

Suppose it were your privilege every day to sit in conference with the auditor of your company or the head of a successful accounting firm. Suppose every day he were to lay before you in systematic order the various problems he is compelled to solve, and were to explain to you the principles by which he solves them. Suppose that one by one you were to work those problems out—returning to him every day for counsel and assistance—

Granted that privilege, surely your advancement would be faster by far than that of the man who is compelled to pick up his knowledge by study of theory alone.

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Only—instead of having at your command the counsel of a single individual—one accountant—you have back of you the organized experience of the largest

business training institution in the world, the authoritative findings of scores of able accounting specialists, the actual procedure of the most successful accountants.

Thus—instead of fumbling and blundering—you are coached in the solving of the very problems you must face in the higher accounting positions or in an accounting practice of your own. Step by step, you work them out for yourself—until, at the end of your training, you have the kind of ability and experience for which business is willing and glad to pay real money—just as it was glad to pay these men.*

Five Men Who Tested and Proved It for You

For instance, there was the man who started Accountancy training with us in 1916. After a short period of study, he took a position as bookkeeper for a year, and then became accountant for a leading automobile manufacturer—with two bookkeepers under him. Today he is auditor of one of the foremost banks in his state and his salary is 325 percent larger than when he started training.

He writes, "My training is the best investment I've ever made, showing a cash value running into five figures."

And the young clerk, earning \$75 a month eleven years ago and now getting many times that as general auditor for an outstanding, nation-wide organization. Within six months after he began our training, he was earning \$125 a

month and within four years, he was earning \$250.

Do you wonder that he writes, "While LaSalle ads once seemed like fairy tales to me, now I know from personal experience that they are true."

Or let us tell you about two men—one a stenographer and the other a retail clerk—neither of whom knew more than the simplest elements of bookkeeping. One is now the comptroller and the other the assistant comptroller of a large company.

"LaSalle training in Higher Accountancy," write both, "was the important factor in our rapid climb."

And if you are thinking about the C. P. A. degree and a public accounting business of your own, read about the pharmacist who was earning \$30 a week eleven years ago when a LaSalle registrar secured his enrollment for Accountancy training. Eight months later he left the drug store to take a bookkeeping job at \$20 a week—less money but larger opportunity. Three years later he passed the C. P. A. examination and a year later yet he was earning \$5,000 a year. Now he has his own highly successful public accounting firm for which he says, "My LaSalle training has been largely responsible."

One-Tenth of All C. P. A.'s Are LaSalle Trained

If you want still more proof, remember that 1,200 C. P. A.'s—approximately one-tenth of all those in the United States who have ever passed the difficult examination for this coveted degree—are LaSalle trained.

And knowing these facts, ask yourself if there can be any further question about the practicability of this training for you—ask rather if the real question is not about the size of your own ambition and the quality of your determination.

For Accountancy is no magic wand for the lazy or the fearful or the quitter—it offers success only to the alert adult who has the courage to face the facts and the will to carry on till the job is done.

If you are that individual, the coupon below, filled out and mailed, will bring you free the information that can open up to you the future of which you have dreamed—ability and income and success.

Is it not worth getting that information?



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**Results Proved in
Millions of Cars**

Amazing Ramco Rings Revolutionize Entire Piston Ring Industry

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Even motors with pistons collapsed and cylinders out of round respond like magic to a Ramco Overhaul. You stop adding oil between drains, you save gallons of gas, enjoy a quiet, responsive, powerful motor again.

Actually, you’ll probably save the entire cost in a few months. As countless others have done. For a Ramco job—unlike its many imitations—is no new, untried experiment. Millions of cars for many years have been literally reborn—given many thousands of extra miles of economical, trouble-free life. Other manufacturers have tried to duplicate this record. The market is flooded with imitations. Thus you must *insist* on Ramco if you want to play safe.

Send the coupon for an interesting **FREE** booklet that tells how other car-owners have made astonishing savings, enjoyed vastly improved performance thanks to Ramco methods. Mail the coupon—now!



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All first class repair shops use and endorse Ramco

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St. Louis, Mo., U. S. A.

Please send me your free booklet which shows how Ramco Spring Piston Rings have restored new car pep, power, and oil economy in millions of cars.

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RAMCO MOTOR OVERHAUL

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RAMCO PISTON SKIRT EXPANDERS
PATENTED IN THE UNITED STATES AND CANADA. OTHER PATENTS PENDING

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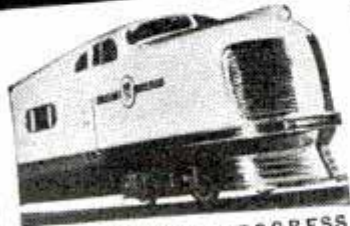


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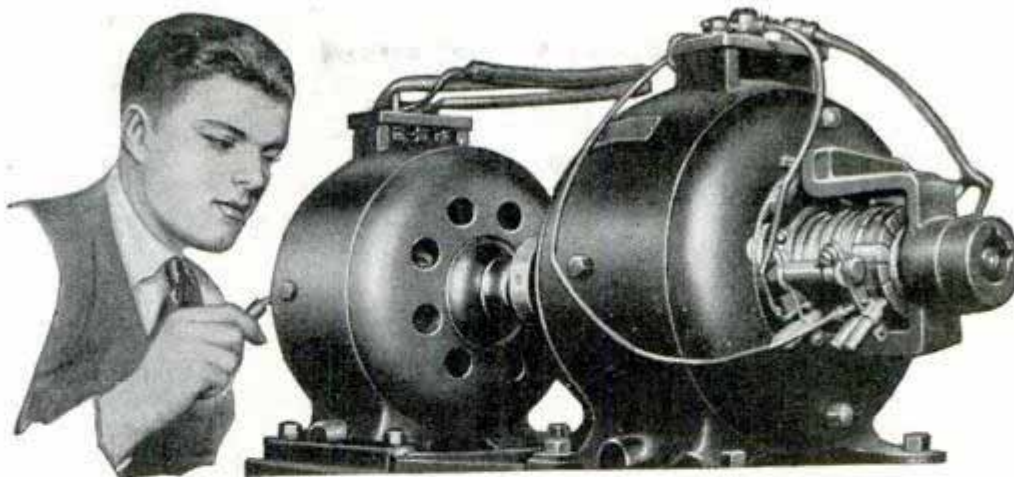
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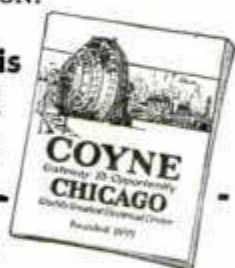
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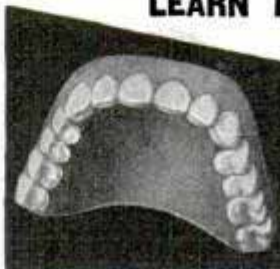
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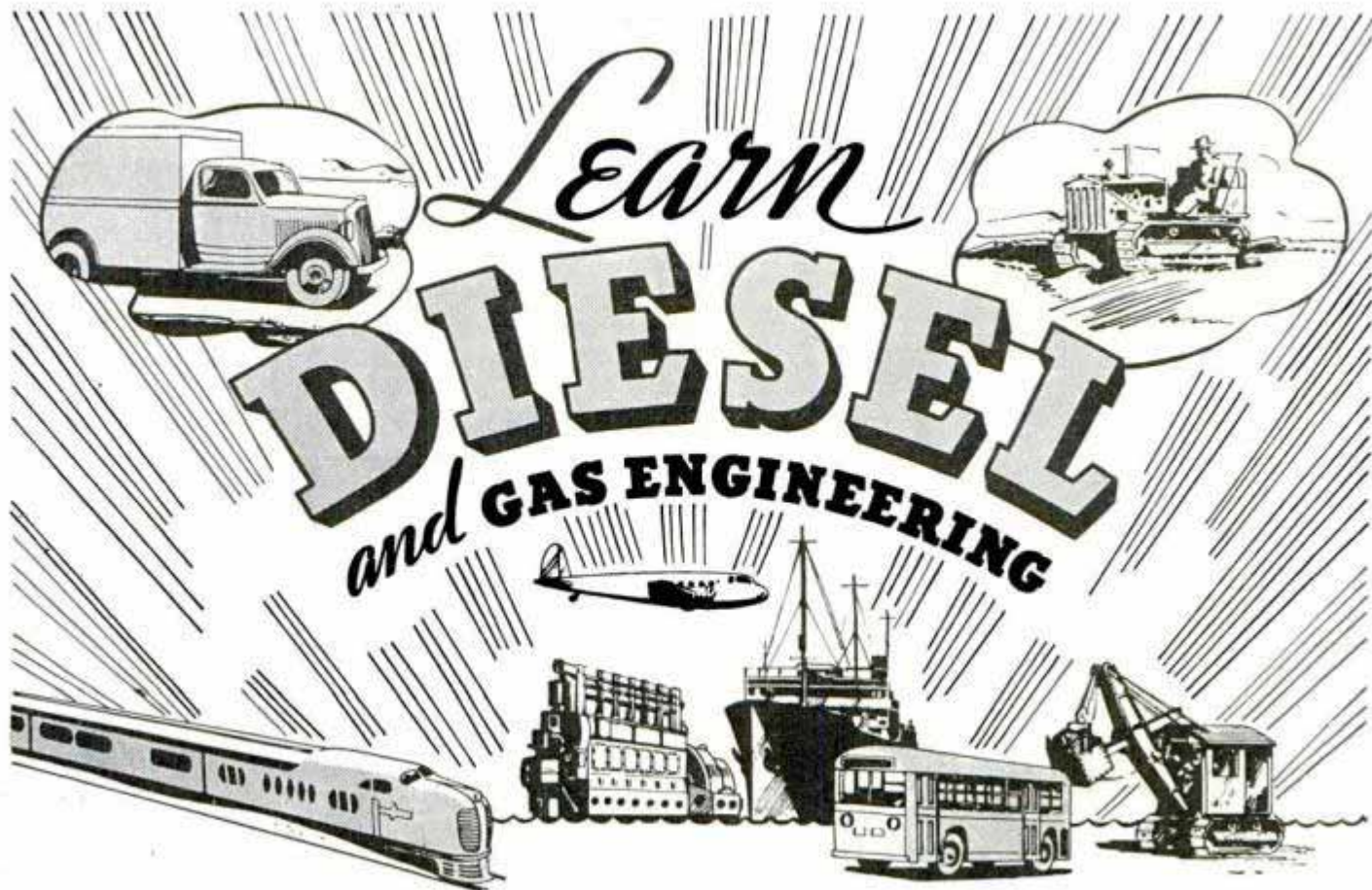
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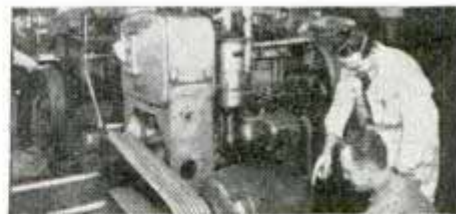
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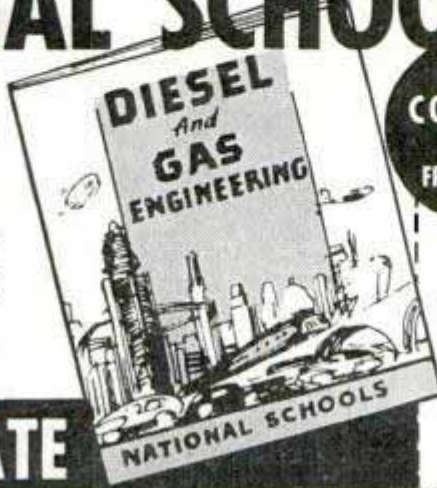


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Frequently inventors confuse the size or the complication of a device with the question of commercial value and patentability. These two factors, of course, have no relation to each other. Most of our present-day complicated machines represent a process of evolution, a series of inventions. On the other hand, every so often some inventor comes along with a very simple "gadget" which possesses the elements of broad utility and is patentable. Some of the most profitable inventions have been of this latter class. Shown above are a few such examples. Whether a device is simple or complex, if it represents a forward step to save manufacturing costs, to save labor, or to add enjoyment to human life, it may prove patentable and profitable. This subject is more fully discussed in the booklet entitled "Patent Protection" shown on the opposite page.



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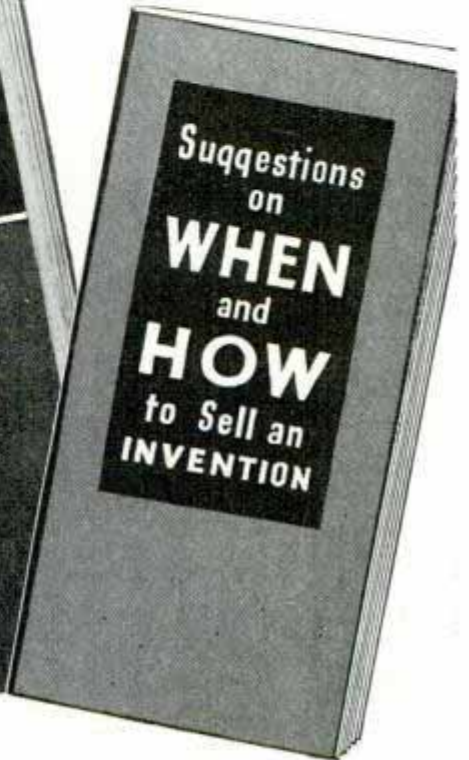
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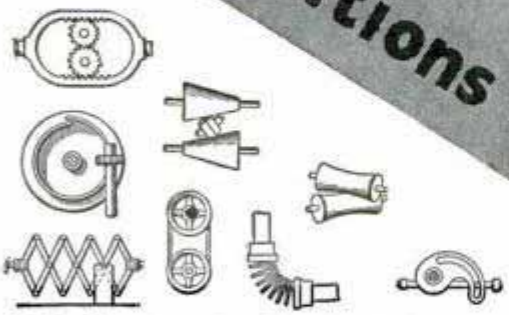


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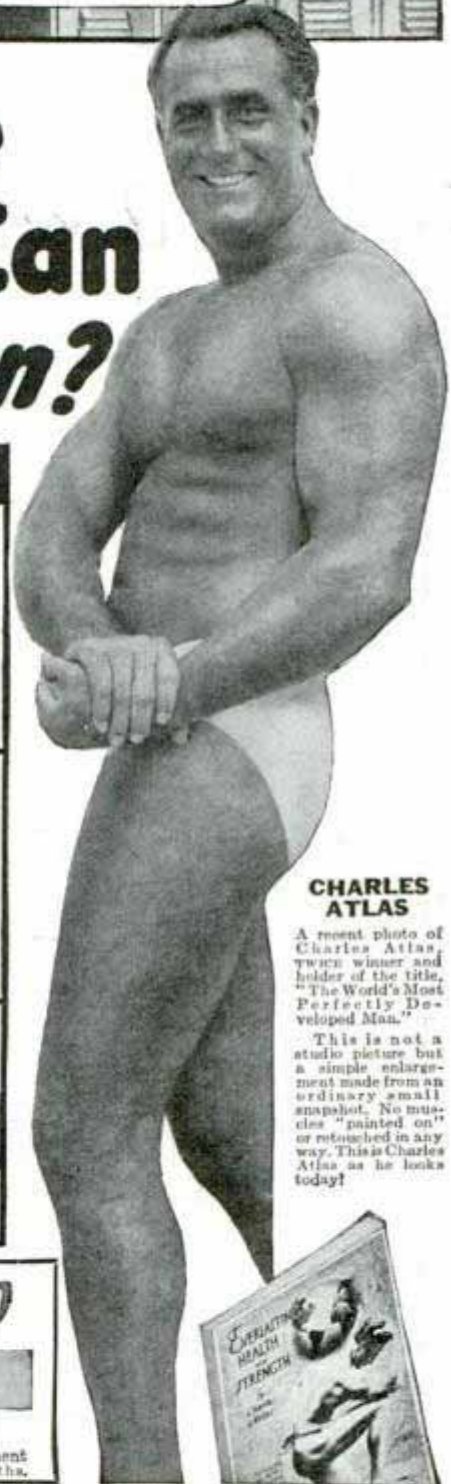
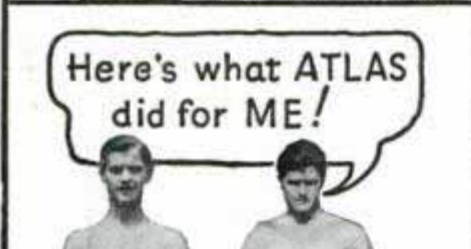


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Some recent stamp issues, including the semi-postal issue of Estonia, at top. The block in the center shows a recent addition to the stamps of South Africa

THREE basic forms of printing, engraving, typography and lithography, all are used in stamp manufacture. Many similar stamps have been produced by at least two of the processes, and in nearly every case one is more valuable than the other.

In Finland, the issue of 1901 showing the arms of Russia, was originally lithographed and later issued in typography. In Chile, the portrait issues of 1911 to 1913 were engraved, but in 1915 all of those in single colors were typographed, while the bicolored higher values were issued with engraved and typographed frames. In the United States stamps, designs which had been engraved originally were used for lithographed stamps in 1918-20.

These stamps are all easy to obtain and illustrate the essential differences between the various processes. Engraving provides the finest examples of stamp printing. In principle, it is exactly the reverse of type printing, for the ink which forms the design comes from the recesses in the plate rather than from the raised portions. Etchings are a simple form of engraving, and the line-engraved stamps of the United States are examples of fine engraving.

In all such cases the printing is done with ink which is retained in lines or recesses below the surface of the plate. The printing plate is a smooth and highly polished plate of copper or steel covered with

(Continued to page 34A)

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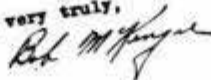
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 TO
 NEW YORK
 27 hrs. 26 min.
 CANADA
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 18 days
 LOS ANGELES
 TO
 NEW YORK
 AND RETURN
 181 hrs. 52 min.
 WASHINGTON, D.C.
 TO
 MEXICO CITY
 82 hrs. 27 min.
 LOS ANGELES
 TO
 PHOENIX
 8 hrs. 18 min.
 MURDOCK LAKE
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 LOS ANGELES
 TO
 CHARLOTTE, N.C.
 11 hrs. 27 min.
 ALPAC, W.V.
 TO
 DUNSMIRE, N.C.
 1000-21 min.



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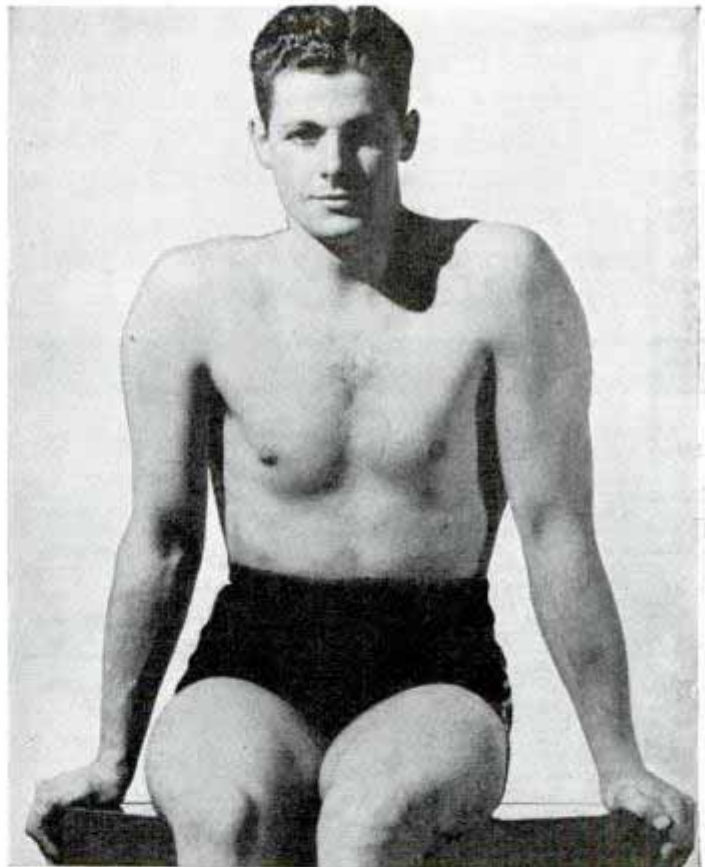
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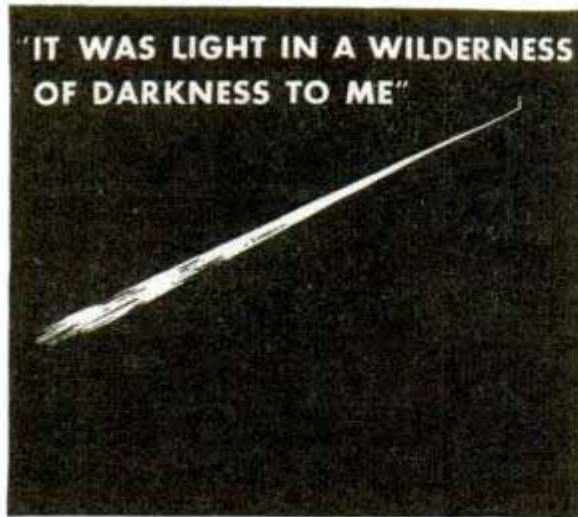
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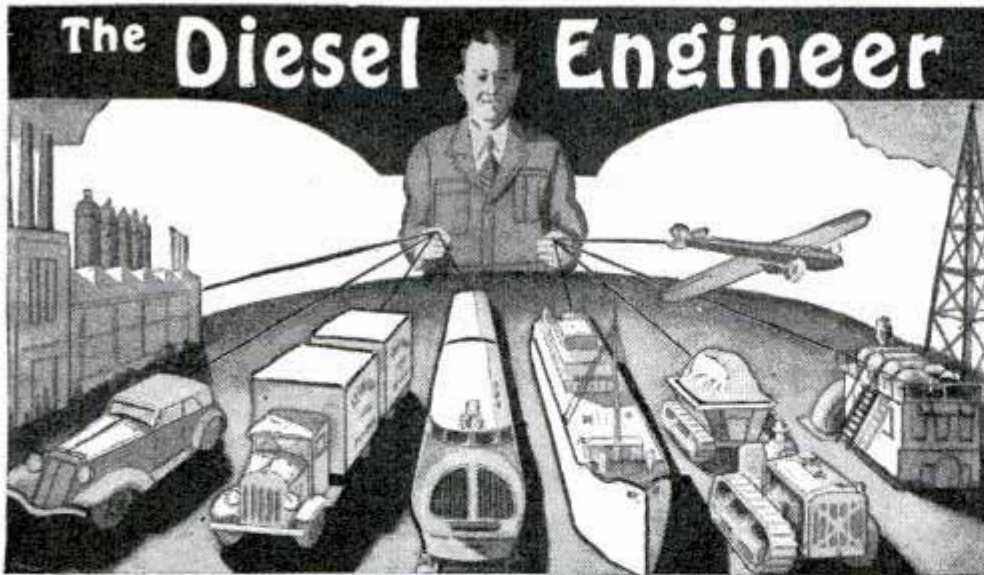


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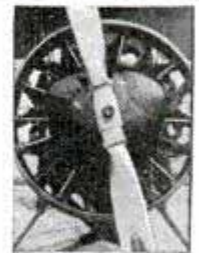
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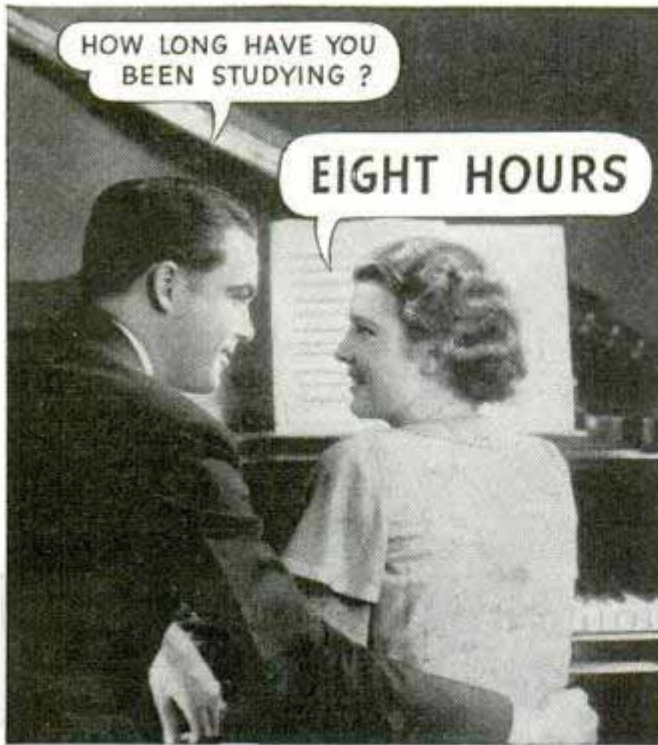


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(Continued from page 26A)

incised lines. When inking the plate a liberal supply is put on and wiped off in such a way as to fill completely all of the recessed lines. In regular plate printing the operator polishes the plate with the palms of his hands upon which he has rubbed a coating of French chalk. Other cleaner hands place the wet paper upon the plate and remove the printed sheets after the plate has passed the impression roller. This form of printing is done under pressure which forces the paper into every line of the plate to pick up the ink.

Having the paper wet aids greatly in the process, as does heating the plate, for this increases the fluidity of the stiff engraving ink at the moment of printing and does not prevent it from hardening quickly as soon as it is cool. An examination of recess printed stamps will show the ink raised above the surface of the paper and the coarser lines of the stamp indented on the back where they were forced into the recesses of the plate. Test an engraved stamp by placing a piece of smooth tinfoil over it and then a rather soft rubber eraser. If moderate pressure is applied carefully so the tinfoil is not distorted, the entire design will transfer to the foil.

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(Continued to page 37A)

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(Continued from page 34A)

of the stamp paper, but quite often is pressed down into it. This produces a printer's squeeze and the resultant raised effect on the back of the stamp is one of the surest checks for a typographed stamp.

Lithography, stone printing, is a form of printing which is made from a perfectly smooth plate of special stone, or zinc or aluminum. It is a chemical form of printing which depends upon the repellent force that exists between oil and water. If a design is transferred to the plate in fatty ink and the plate is then moistened, ink may be applied to the plate with a roller and will adhere upon the transferred design only and will be repelled elsewhere by the moisture on the plate. Sheets of paper now may be applied to the plate to pick up the impression of the design.

With the discovery that certain metals possess the qualities necessary for lithographic printing, it was possible to fit plates for cylinder presses, and to print on endless webs of paper. A further step came in the offset process wherein the ink is picked up from the plate by a soft rubber roller and then transferred to the paper. Lithographed stamps have a flat and lifeless appearance, are smooth, front and back, and the design is often marred by breaks and spots due to printing too many impressions from a transfer.

New Stamp Issues

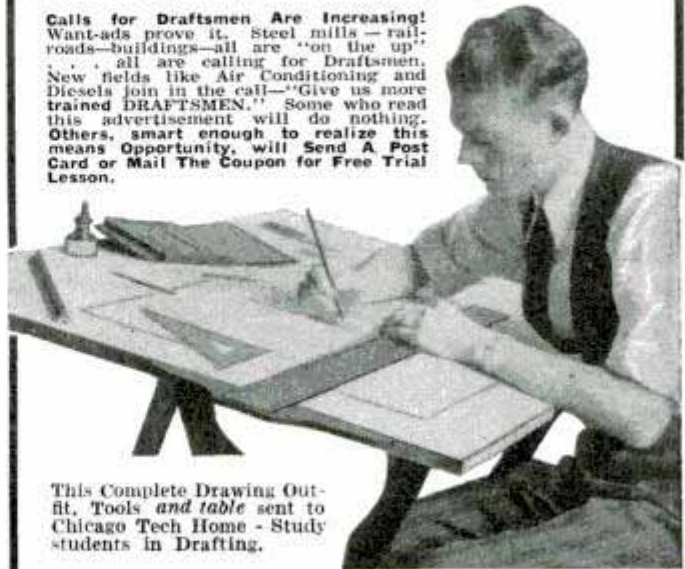
New stamp issues are plentiful since the adoption by many governments of semi-postal issues, used to raise funds for charitable enterprises. The illustration shows the semi-postal issue of Estonia placed on sale in January. The surtax upon these stamps is applied to the National Relief Fund. The designs show the arms of Paide, Rakvere, Valga and Viljandi. The large stamp at the top is one of three issued by the Dominican republic to celebrate the first anniversary of the change of name of the capital from Santo Domingo to Ciudad Trujillo. The stamp pictures an obelisk erected on the occasion, a portrait of the president of the republic and a tablet with a lengthy inscription.

The block in the center shows a recent addition to the stamps of South Africa and illustrates a pit head at a gold mine. The stamp was issued last November. The

(Continued to page 57A)

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\$5.00 TO \$500.00 Each paid for old coins. Keep all old money. Send 10 cents for illustrated coin value book. 4x6. Guaranteed prices. Buying and selling. Coin Exchange, Box 5, Le Roy, N. Y.

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\$30.00 PER Week with a typewriter! Earn comfortable income at home. Information mailed for 25c (coin). Ace, TPM, 322 Empire Bldg., Birmingham, Ala.

FREE! New "Self Help Bulletin" for those wanting to make more money. Self Help Opportunities, 517PM East Tenth, Amarillo, Texas.

UNUSUAL Opportunity for experienced real estate agent. Write for particulars. Box 97, Lake Placid, Florida.

OPPORTUNITY Offering, copyrighted price 50c. Money-making opportunities, formulas, now 10c. Tricity Service, Box 151, Davenport, Iowa.

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

MONEY Making deals. Particulars for stamp. Trader, 216 Degraw, Brooklyn, N. Y.

AMBITIONISTS: Let me help you acquire that spark and drive all topnotchers possess. Particulars free. Edward Johnston, 257 North Washington St., Tiffin, Ohio.

1,000,000 ARTICLES Wholesale. Latest directory 10c. Jelsmith, 163 Myrtle, Waltham, Mass.

INVESTIGATE Money-making opportunity; builds income on small investment; pays us, will pay you. Seneca Specialties, 24 Main, Geneva, N. Y.

BEDBUG Formulas and 100 labels 50c. W. Wooley, Peoria, Ill.

\$50.00 PER Week with a kodak! Sell your snapshots. Markets. Details. 25c (coin). Ace, "KPM," 322 Empire Bldg., Birmingham, Ala.

MEN Who have brains. Send dime to cover mailing. Miller Enterprises, Post Monmouth, N. J.

MAKE Big money easily and honestly right in your own home. Amazing plan that will do it, only 25c (coin). Allen, Box A, Zillah, Wash.

INFORMATION Worth many dollars to you sent postpaid for only 25c. Walter Moore, Jr., 2612 N. Fifth St., Harrisburg, Pa.

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

GOOD Income at home anywhere in U. S. Write E. Hoffnagle, Blue Island, Ill.

1000 MONEYMAKING Ideas, book 50c; literature free. Harvey Teeple, Decatur, Ind.

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

TO Win success you must do something different; particulars free. Publishers Sales Company, Box A-76, Nelson, Georgia.

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

BIG Money at home plating auto parts, reflectors, mirrors, chandeliers, by late method. Experience unnecessary. Free particulars. Gunmetal Co., Ave. N, Decatur, Ill.

FORMULAS, PLANS, ETC.

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

LIN-O-UTH!! Har-O-Uth!! Two amazing formulas! Davis, Box 1484-F, Clarksburg, W. Va.

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

CORRECT Formulas. Samples furnished. Details free. Box 768, Waco, Texas.

MANUFACTURER'S Formulas: Samples furnished. Chemical information. Dobin Laboratory, 1746 Roscoe, Chicago.

SAWDIX Makes colored marble floors. Directions \$1.00. Universal Supply Co., 777 Boulevard, Bayonne, N. J.

PRICKLY Heat remedy. Positive results. Formula \$2.00. Heelan, R. Ph., 618 1/2 So. 31 Ave., Omaha, Nebr.

5c WILL Make you \$1 profit. Free sample of product. Stanley Products, Lansing, Mich.

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

FORMULAS 25c. Cosmetics, silver plating, floor polish, exterminators, etc. Arthur, 37-10 First Avenue, Astoria, Long Island, N. Y.

KAR-O-MEL. Ten other popcorn formulas, including cheese, directions, etc. \$1.00. Dietz, Dept. B, Toledo, Ohio.

ANY Formula 50c or money back. List free. Ogg's, Tampa, Florida.

FORMULAS—Unexcelled. High-grade, proved fast-selling, easily-manufactured products. Get unequalled special offers. Philarst Company, Jefferson City, Missouri.

ANY Formula 50c!! ("Fifty Cosmetic Formulas," \$1.00!) Thomas Galuzzo, Wilkingsburg, Pennsylvania.

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

RELIABLE Products spell success. Formulas, analysis, literature free. Hertstein, Chemist, 1811 Paris Ave., Grand Rapids, Mich.

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

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

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

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

CHEMISTRY

FREE Chemistry catalog. Supplies at 5¢! Equip complete laboratory. Send 10¢ (rebatable) for postage and handling. Kemkit Scientific Corp., 135P Johnson Street, Brooklyn, New York.

MYSTIFYING Chemical novelty, chemistry magazine, book twenty experiments, chemical catalog, all four, 20¢. Chemco, Swedesboro, New Jersey.

FURNACE Electric, 2550° Fahrenheit, melting half pound copper. Muffle, 30 cubic inches, metallurgical, ceramic, chemical work. Silent, clean. Uses ordinary house current, alternating or direct. Easily built. Not expensive. Heat controlled. Drawings, directions, materials list \$1.25. Circular free. Pyroelectric Company, Box 6, Trenton, N. J.

SEND 25¢ For new illustrated chemical experiment book with over 300 formulas and tests. Also receive 32 page illustrated catalog of apparatus, microscopes, telescopes and chemicals free. U. Winn, 124 West 23 St., New York.

CHEMICALS—5¢—In glass containers, apparatus. Free magazine, price lists. Nawoj Syndicate, 2124 Iowa, Chicago.

25 CHEMICALS With experiments. 50¢. Kayare Chemical, 5522 P Ft. Hamilton Parkway, Brooklyn, N. Y.

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

RUBBER Latex. Dime brings literature, twenty experiments. Eastern Latex Labs., Box 61, Norfolk Downs, Mass.

CHEMICALS From waste products! Details, sample experiments, 10¢. Oklahoma Technical, Box 742, Oklahoma City.

BIOLOGISTS — Spirostomum, ciliates. Cultures \$5. Davis Laboratory, Box 753, Fort Valley, Ga.

CHEMISTRY, Mineralogy, microscopes, telescopes, binoculars. Catalog free. B. Teeko, Evanston, Illinois.

NEW Chemistry supplies catalogue, lowest prices, 10¢. Handbook for chemical experimenters, hundreds of experiments, 50¢. Reading Scientific Company, Reading, Penna.

SEND Your chemical problems to German chemist. Twenty years experience in research work. Box 451, Leonminster, Mass.

CHEMICALS In 5¢ quantities. Catalog 5¢. Fleischer's Laboratories, Everett, Massachusetts.

CHEMICALS, Laboratory glassware, apparatus. Send 3¢ for catalog CP. Biological Supply Company, 1176 Mt. Hope Avenue, Rochester, New York.

AGENTS WANTED

JUST A minute! That's all it takes for Jiffy Mend to permanently repair glass, wood, metal. New invention turns leaks and breaks into quick ready cash. Write for free sample offer. Big catalog of fast sellers. Clyde Collins, Inc., Dept. 21-D1, Memphis, Tenn.

BE Your own agent. 500% easily made selling fast repeating face bleach by mail and through agents. Removes freckles, makes the skin three shades whiter. Retail \$1.00. Costs 15¢. Perry Maharg, 1304 E. 75th St., Chicago, Ill.

450% PROFIT In perfected (1937) quick action automatic gas lighter. No flint or flame. Lights gas instantly. Retail 25¢. Costs you \$1.00 for dozen or \$8 for 12 dozen postpaid. Sample 10¢. New Method Co., Box PMG-53, Bradford, Pa.

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

KENTOL: Cleans windows, polishes silver. Provides clear vision. Reduces headlight glare. Particulars free. Sample 25¢. Kentol Mfg. Co., Boston, Mass.

SELL Wonder herbs. Big profits. Steady income. Sample free. Dalles Ruth, Wheelersburg, Ohio.

SELL Dog, bird, fish foods. Advertised line. Sample 15¢. Write C. K. Damon Co., Division B, 673 Baltic Street, Brooklyn, New York.

AGENTS! Dresses 33¢, men's suits \$1.50-\$2.00, shirts 46¢, ties 6½¢, chiffon hose 42¢. Amazing prices. Big profits. Catalogue free. Acme, AB-558W, Roosevelt, Chicago.

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

AGENTS: "Outasite" stainless steel tooth brush clamp holds anywhere, best under cabinet shelf away from wash water, etc. Two 10¢ postpaid. Buxton, 611 Truro, Hawthorne, Calif.

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

500% PROFIT Selling new "20-in-1" kitchen utensil. Retail 25¢. Costs you \$1.00 a dozen, \$7.20 a gross. Sample 10¢. New Method Co., PMM-53, Bradford, Pa.

MANUFACTURE Product yourself, chemical furnished prepaid. Quality Chemical, E-20030 Russell, Detroit, Mich.

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

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

TRANSPARENT Neon-like signs, 4¢—retails 25¢. Celluloid pricing sets, 50% commission. Sample free! Lowy, Department 711, 8 W. Broadway, N. Y.

ANNOUNCEMENT—Sheen. Perfect eye-glass cleaner. Now available direct from manufacturer. Sample 25¢. Doz. \$1.35. Associated Products, PM3, Box 694, Muncie, Indiana.

400% PROFIT In new perfected (1937)—quick action self-starting no-flint cigar lighter. Retail 50¢. Sample 25¢. Get details quick on wonder seller. New Method Co., Box PM-53, Bradford, Pa.

JOIN New profit sharing Guild Salesmen Association. Canvassers buy household products cheaper. Your own literature, latest premium deals. Paty Co., Dept. B, Somerville, Mass.

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

"CALIFORNIA Flower Sachet" perfume, 10¢. Sells fast. Sidella, Pottsville, Penna.

HOT Water all times. Plug in any socket. Results instantly. Hot Flash Electric Water Heater, pocket size. Agents sample prepaid \$1.25. Write for territory and special offer. Industrial Laboratories, Des Moines, Iowa.

SHAMPOO. Turns hair to golden glint. Trial 15¢. Superna Products, South Milwaukee, Wis.

OPPORTUNITY Calling experienced store demonstrators. Rams Laboratories, Brighton Station, Rochester, N. Y.

ENTIRELY New distribution plan for men's high grade clothes. Lucrative proposition. Free booklet. Western Wool Growers, 334 South Market, Chicago.

HAVE You read the Hillyer Ragsdale, Inc., advertisement under the heading of "Business Opportunities?"

WHIRLWIND Money makers! Painless eyebrow pluck cream, other specialties. Samples 25¢. Particulars. Hoffman Drug Company, Edmeston, N. Y.

NEW Kind of heat boils water instantly. Pocket size. Pays 218% profit—up to \$20 daily. Magic minute demonstration sells it. Free sample offer. Nu-Way, 509 10th, Des Moines, Iowa.

200% PROFIT Selling seeds! Send no money—write today for 30 10¢-packets of Vicks famous flower seeds. Sell them and send us \$1; keep the other \$2 for yourself! James Vicks Seeds, 878 Vick Bldg., Philadelphia.

JAPANESE Novelties—Superlative opportunity to agents. Sample and information 10¢. Maruni Co., Hideyoshi Bldg., Ginzaishi-5, Tokyo, Japan.

SELL New moth destroyer. Mother Nature's way. J. L. Lamp Co., 263, Willoughby, Ohio.

BIG Money selling old books, literature free. Fairmount, 9-11 Hester, New York.

SOAP Routes open. Apply at once. Start immediately; up to \$45 first week. Automobiles given as bonus. Write Albert Mills, 2367 Monmouth, Cincinnati, Ohio.

RAZOR Blades, neckties, shoe laces, etc., all big sellers. New bargain list. Heil Premium Co., M10, Gaylord, Minn.

MEXICAN Feather pictures. Unusual novelty. 50¢ (stamps) bring \$2.00 worth samples, details. Refunded if unsatisfied. Mexican Art, Apartado 1593, Mexico City.

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

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

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

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

AGENTS Get cash hourly. Thrilling new kind guaranteed silk hosiery plan. Start without experience. Full or spare time. Your hosiery free as bonus. Send size. Rush name. Wilknit, Desk 5B37, Greenfield, Ohio.

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

THYDRO-X (Extra miles). Fast seller! 25%-50% increases guaranteed. Tremendous profits! Automotive men—a million dollar market waiting. Particulars free. Thermo-P Works, Peoria, Ill.

MEXICAN Finest feather pictures, blankets, carved leather. Free particulars. Samples 10¢ stamps. Gampoco, Apartado 1176, Mexico City.

"UNVEILING The Universe: Where We Are—What We Are." Amazingly rapid-selling new \$1.00 book. Free circular. Research Publishers, Scranton, Pa.

AUTOMOBILE Parking mirror. New invention prevents damaging car. Installed inside. Price \$1.00. Auto Parking Mirror Co., 728 South Hill, Los Angeles, California. Sales agents wanted.

JIFFY Window burglar latch. Quick seller. Installs without tools. Sample 15¢ coin or stamps. Woods Specialty Sales, 7357 University, Chicago.

"HOLDS-UM" Cement defies the elements. Never shrinks or deteriorates. Agents pocket demonstrator advertising free. Dozen \$1.00, one can 20 cents prepaid. The Holds-um Company, 1111 Hoffman Ave., Royal Oak, Mich.

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

MAKE, Sell own nationally advertised products. Formulas, all lines. Specials. Phillarst Company, Jefferson City, Missouri.

BE FIRST To introduce new patented Ever-Flow Salt Servers. They make salt flow freely in wettest weather. No more shattered tempers or spoiled meals because of moist salt that won't flow from server. Sells on sight to stores, restaurants, hotels, beer parlors. Home models for house canvassing. Popular priced. Large profits for agents. Write quick for complete proposition. Ever-Flow Sales Corporation, Jacksonville, Florida.

BIGGER Profits selling your own products. Supply agents, stores. Free sample. Cee-Teo Products, A-608 Evergreen Ave., Brooklyn, N. Y.

STRANGE Ironing cord. Saves electricity. Abolishes scorching and kinking. For telephones also. 150% profit. Sales guaranteed. Big free offer. Neverknot, Dept. 5-A, 4525 Ravenswood, Chicago.

AGENTS—Make \$25-\$75 weekly. No peddling. Free outline of 107 plans. C. Murray, Whitewater, Wisconsin.

PORTRAIT Agents get new hexagon portraits, frames. Lowest prices. Catalog free. Picture-Man Friedman, Dept. 9, 528 Cornelia, Chicago, Ill.

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

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

AMAZING Ironing device. Saves electricity! Prevents scorching! Free offer. Iron-So-Ezee Company, Mt. Washington, Ohio.

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

CONSIGN Stores confection product. Sample free. Lorrac Products, Albany, N. Y.

BIG Money applying gold initials on automobiles. Easiest thing today. Free samples. Also, sideline salesmen for name plates and tire cover transfers. "Ralco," 1084 Washington, Boston, Mass.

MAKE Your own products. We sell formulas for highest quality toilet preparations, extracts and household specialties. Catalog free. Scientific Laboratories, 1950-W Broad, Richmond, Va.

ATTENTION Hustlers, clean up. Costs 10c. Sells for \$1.00. For particulars write J. M. Jones, 724 W. Trade St., Charlotte, N. C.

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

SALESBOARD Men—New put and take jars. Details, samples free. Tom Thumb, Dept. PM, Nauroo, Ill.

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

AGENTS: Smash go prices. Santos coffee 12c lb. 4-oz. vanilla 8½c. Razor blades 10 for 8½c. 100 sticks chewing gum 12c. 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 Company, Washington, D. C.

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

MAN in each town to plate auto parts, reflectors, bathroom fixtures, refinish beds, mirrors, chandeliers, by late method; experience unnecessary. Simple plan of manufacturing at home starts you in big money making business. Free particulars and proofs. Gunmetal Co., Ave. H, Decatur, Ill.

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

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

AGENTS: Stamping names on pocket-key protectors. Sample check with your name, address, 25c. Stamping outfits. Emblem checks, check-fobs, name plates. Hart Mfg. Co., 393 Degraw St., Brooklyn, N. Y.

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

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

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

PROFITABLE Home business. Legitimate. No canvassing. Maywood Publishers, P-223 Broadway, New York.

HIGH-GRADE SALESMEN

MAN Wanted—by shoe manufacturer established 34 years, for sales work. Ready cash daily and extra bonuses to producers. No experience needed. Your own shoes at factory prices. Sales outfit sent free. Write Mason Shoe Manufacturing Company, Dept. F-9, Chippewa Falls, Wis.

\$10 To \$21 Profit on every deal! This and other money making plans for all salesmen, distributors, cardmen, punch-board men and agents. 40 beautiful and exclusive RCA licensed models for home, auto and farm use. Money-back guarantee. Immediate profits and repeats. Write for free starting offers of this big money-making plan. DeLuxe Mfg., Dept. 314, 173 W. Madison Street, Chicago.

NEW Punchboard line. Free 32 page full color catalog. Nothing to carry. Larger cash commissions daily. Season now! Lea-Moore Co., 180 Adams, Chicago.

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

IF You are ambitious you can make good money with a Rawleigh route. We help you get started. No capital or experience needed. Steady work for right man. Write Rawleigh's, Box E-2-PPM, Freeport, Ill.

EVERY Business and professional man needs a dignified collection service. Sells for \$7.50. Send \$1.80 for complete system and exclusive territory. Bureau of Credits, Box 863, Rockford, Illinois.

SELL Nothing! \$95.00 weekly. \$500,000 punchboard firm announces new, no investment plan. Season starting. K&S, Dept. C125, 4329 Ravenswood, Chicago.

JAY-WAY Door holder. New. Sensational. Moneymaking. Jay-Way, One East 42nd, New York.

YOU Get paid first. Take orders for 200 home necessities. Pay after you collect. Big profits. Write Ho-Ro-Co, 2777-R Dodder St., St. Louis, Mo.

"BLUMER" Develops flowers and bank-rolls. Sample 10c. Ponoco, Sparkill, New York.

"HANDS Up"—"Mystery" trouser belt defies thieves, concealers and protects money and valuables. No betraying zipper. Absolutely new. Sensational profits. Free sample offer. Write Merchandisers, Dept. B-12, Merchandise Mart, Chicago.

SALESMEN—100% Profit selling Del-Jay Upper Motor Lubricant. Get details. Almo Corporation, Newark, N. J.

SELL Rubber Renewer to garages. Liner Co., Canton, N. C.

SOMETHING New in fire extinguishers—Red Comet automatics. Proved in west five years. Exclusive territory. Low price opens pocketbooks. Write Red Comet, 404 Comet Building, Littleton, Colorado.

TIRE Accessories. Guaranteed 10,000 mile Tiger Grip Tire Patch, and complete fast-selling line auto accessories. Salesmen-distributors easily make up to \$75.00 weekly, and over. Protected territory. Economy Rubber Products Co., 821 Burkhardt, Dayton, Ohio.

SALESMEN, Here's a hit! Sell the latest, improved cleaners with biggest profits. It's the new, the different that sells. See what inventors have done for filling station, garage, and business place cleaners. Write Harper Mfg. Co., 311 Main Street, Fairfield, Iowa.

EXCLUSIVE! Big income selling merchants and manufacturers top quality advertising book matches. Represent factory direct. Full or part time. Large comm. Extra cash bonus. Fast repeats. Kit free. Match Corp. of America, Dept. E-5, 6041 Grand, Chicago.

SELL Printing. Complete low priced line. Free outfit. Cut service. Give references. Arthan Press, 15 Park Row, New York.

SALESMEN: Take orders—business stationery \$2.65 thousand, book matches, labels, salesbooks, pricing sets, business cards, 35% commission daily. Free deals. Sales portfolio free. David Lionel Press, 312 So. Hamilton, Dept. SE, Chicago.

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

SELL To service stations \$—Auto necessities—Bulbs, fuses, valve cores, boots, repair kits, cement, fittings, etc. Large profits—Quick repeats. Distributors, Box 352, Grand Rapids, Mich.

SELL Universal basters—Fastest money making going—Spray—Cooks meats and vegetables better. Every home a good prospect. Sample \$1.95. Bordwell, 1008 Gas Building, Chicago.

NEW Counter game invention sells on sight to hotel, cigar, drug, restaurant and tavern trade. Big money maker. Advance commissions. Free details. Master Company, Dept. A-1, 173 West Madison, Chicago.

MAKE More money taking orders: Shirts, ties, hostery, raincoats, uniforms, dresses. Sales kit free! Experience unnecessary. Nimrod Company, Department 65, 4922-28 Lincoln Avenue, Chicago.

SALESMEN—Four \$15 sales to stores net you \$40 daily. Sayers Systems, Est. 1893, 2801-123 Sheffield Ave., Chicago, Ill.

GOOD Long profit side or main line. Exclusive makers radiator stop-leak and flush. Zenith, 3635-8-Lyndale, Minneapolis, Minn.

SALESMEN: Sell advertising novelties, calendars, fans, thermometers, etc., for nationally known firm. Liberal commissions. Stanwood Hillson Corp., 21 Station St., Brookline, Mass.

NEW Specialty—Sells every business and professional man. Four \$15 sales daily pay \$280 weekly. Ferrell cleared over \$1,000.00 monthly. Write, F. E. Armstrong, President, Dept. PM, Mobile, Ala.

BE Your own boss. Make the largest commissions selling our complete line of brushes. Write for sales plan. Wire Grip Sanitary Brush Corp., 220 Southern Boulevard, N. Y.

BRUSH Salesman—If you ever sold brushes write for our money making proposition. Donald Brush Co., Camden, New Jersey.

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.

HELP WANTED

WANTED—Local buyers to purchase used office machines for us. Positively no selling. Send stamp for details! Pruitt Co., 1104 Pruitt Bldg., Chicago.

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

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, Illinois.

ABLE Man to distribute samples, handle coffee route. Up to \$45 first week. Automobile given as bonus. Write Albert Mills, 2301 Monmouth, Cincinnati, Ohio.

NEW Ways to make money. Western Reserve Laboratories, 6615 Denison, Cleveland.

USE \$500.00! Raise canaries for us. Free particulars. Crimmins, 3741-B 60th Street, Woodside, New York.

EDUCATIONAL AND INSTRUCTION

MEN Wanted willing to learn landscape designing and fill big paying position as landscape architects. Free test of your natural ability and chance to win in \$750 contest. No experience needed to start. Earn while you learn. Write today for free test blank. American Landscape School, 837 Plymouth Bldg., Des Moines, Iowa.

MOTION Picture operating. Home study. Projection Institute, 128 Lexington Avenue, New York.

KNOCK 'Em cold. Learn police Jiu Jitsu. 13 secret knockout blows without fists. Illustrated course by world famous instructor. Price 15 cents. S. J. Jorgensen, 404 Maritime Bldg., Seattle, Wash.

OPERATE A collection business. Outstanding opportunity. Quickly learned. Fine income assured. Write Cole Associates, Syracuse, New York.

SHORTHAND Brings opportunities. Get details. Shorthand Institute, 6330c Clayton, St. Louis.

COLLEGE Courses at home. Degrees—Psychology, engineering, law, many others. Free bulletin. Temple Bar College, Missoula, Montana.

WORK For "Uncle Sam." Many 1937 appointments. \$1260-\$2100. Try next examinations. Full particulars free. Write immediately. Franklin Institute, Dept. C3, Rochester, N. Y.

BECOME An Investigator—Secret service agent. New "Test Problem Method." Develops your ability. Particulars free. International Secret Service Institute, (PM57), Hoboken, N. J.

WELDING, Bumping, metal finishing torch soldering taught. Days, nights. Jobs open. Men from this school getting good jobs right now. Free employment service. Licensed by state. Factory Trade School, 8807 Harper, Detroit, Michigan.

OIL Burners: Installation—Service. Practical homestudy. Write. Free lesson. National, 3943 Broad, Philadelphia.

BLUE-PRINT Reading taught by short easy home course. Prepare yourself now for boom and higher wages. Write today for details. Muffler's Blueprint Reading Institute, Box 5662 Metropolitan St., Los Angeles.

LEARN to be a tree surgeon. Interesting healthy outdoor work. Good pay. Write National School of Tree Surgery, 409 Willow St., Lombard, Ill.

COMPLETE Simplified bookkeeping system. Approved. Guaranteed. Extra sheets, free advice, when needed. \$3.15 postpaid. D. Ritchie, 723 Ada, Boise, Idaho.

AIRPLANE Mechanics trained and placed. Jobs waiting for qualified men. Warren School, Oldest in the West, 230 W. 18th, Los Angeles.

DIESEL: Air conditioning, refrigeration. Practical homestudy. Write. Free lesson. Institute, 3943 Broad, Philadelphia.

GET \$50 To \$87.50 every pay day on Uncle Sam's payroll. Many appointments expected soon. Our coaching helps qualify you for Social Security, liquor gauger, meat inspector, office clerk, stenographer, typist, customs, postal and many other positions. Write today for free book, list of positions, etc. Patterson School, (Arthur R. Patterson, former Government examiner, Principal), 8 Case Bldg., Rochester, N. Y.

GOVERNMENT Social security jobs. For men and women, age 18-50. Are you interested in obtaining one? Write immediately for full information and how to pass entrance test, etc. Instruction Service, 101, St. Louis, Mo.

BECOME Business Investigator. Earn \$1.00 hourly, upwards—spare time. Experience unnecessary; we teach you. Details free. Business Detective System, 1009 Oak, Elmira, N. Y.

HOME Study courses leading to degrees: Arts and sciences, philosophy, education, law, letters, theology, psychology, engineering, chemistry, business and commerce. Many others. McKinley-Roosevelt College of Arts and Sciences, Chicago.

SECRET Service. Particulars free. Write immediately. George Wagner, M-2640 Broadway, New York.

BIG Bargain catalogue educational matter 10c. Hanfling, Y-799 Broadway, New York.

MASSAGE, Hydrotherapy, dietetics, drugless therapeutics, chiropody, taught by mail. Evans Correspondence School, Montgomery, Ala.

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2 LINES 25c, 3 Lines 35c. Stamprite, FP43, Springfield, Mass.

2 LINES 25c, 3 Lines 35c. Stamp Works, Centerport, N. Y.

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FREE Samples, name printed envelopes, paper. The Democrat, Somerset, Penna.

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FREE—250 Business cards. Write for coupon. Hudson, 24 West 20th, New York.

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CIRCULARS, Envelopes, letterheads, statements \$2.85, 1000. Business cards \$1.75, 1000. Send cash with order. Fridlund Press, 106 Milwaukee, Elgin, Illinois.

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LETTERHEADS, 8 1/2x11, Heavy bond—envelopes. 100 each \$1.00. Evans, 44P North Tenth, Reading, Pa.

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(Continued from page 37A)

block illustrates the regular sheet arrangement of the stamps of this country which are inscribed alternately in English and in Afrikaans. This stamp was produced by photogravure and is in blue-green and gold. At the left of the block is the newest French commemorative, bearing the portrait of Pierre Cornielle and issued to mark the three hundredth anniversary of his production of "Le Cid," called "the most epoch-making play in all literature."

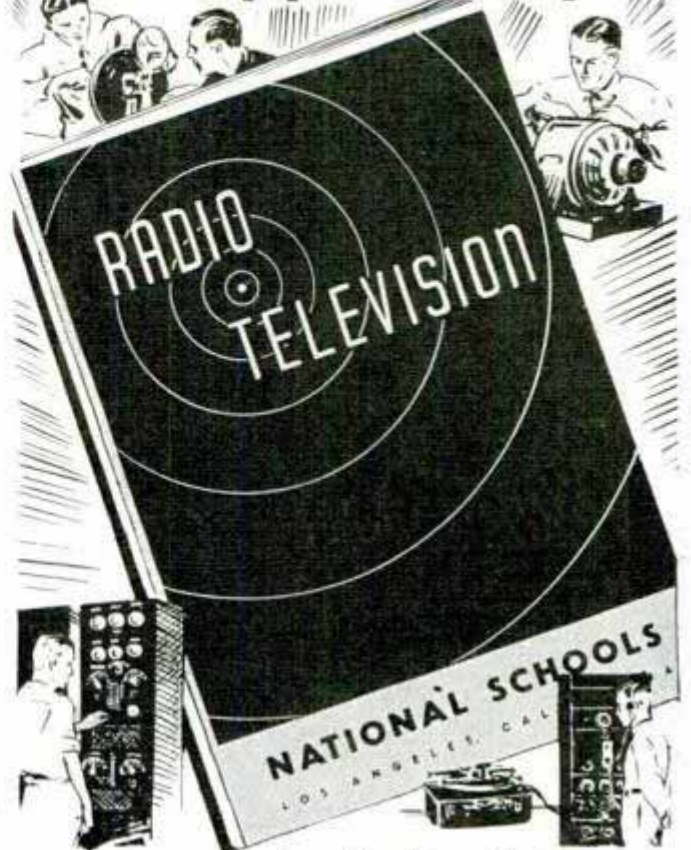
At the right of the block is one of two stamps issued by Romania to mark the anniversary of the annexation of Transylvania and the formation of the "Little Entente." The stamps are overprinted with the Romanian words for Czechoslovakia and Jugoslavia and with the dates "1920-1936." At the lower left are two examples of new Lithuanian stamps. The fifteen pastas value shows the portrait of President Antanas Smetona while the five pastas shows the arms and symbols of that country. At the bottom center is a French stamp inscribed "Chamonix-Mont-Blanc," and showing a skier in midair. At the right is a Danish stamp, one of three values issued in honor of H. P. Hansen, instrumental in the return to Denmark of a part of Slesvig which had been under German rule. The design shows the Dybbol windmill. The stamp at the lower right is one of a series of six issued by the commonwealth of the Philippines in honor of the thirty-third International Eucharistic Congress held in Manila last February.

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It is not easy to imagine what need there was for twenty-cent pieces. Perhaps they were depression quarters for use following the panic of 1873. They appear to be undersize quarters until a coin dealer quotes a price on a fine specimen. Then one believes they must be solid gold.

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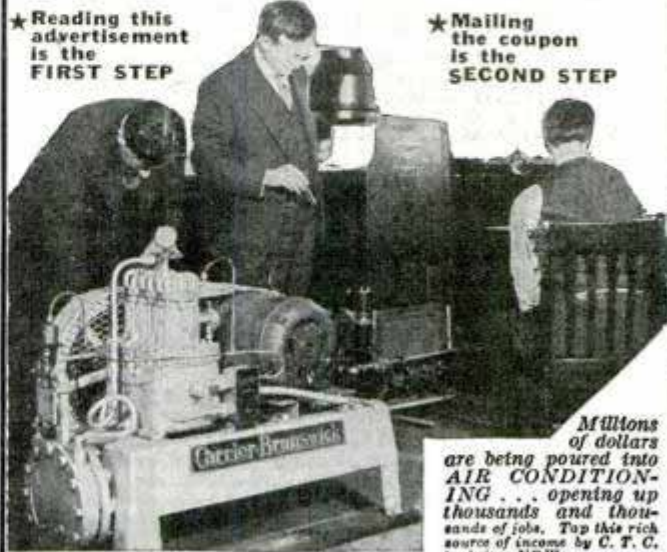
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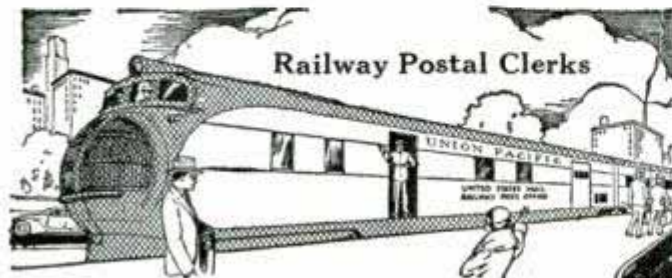
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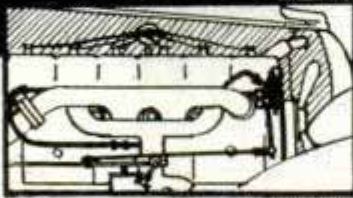
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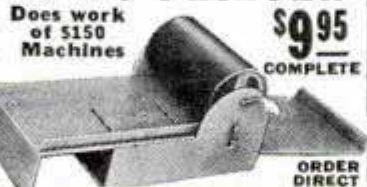
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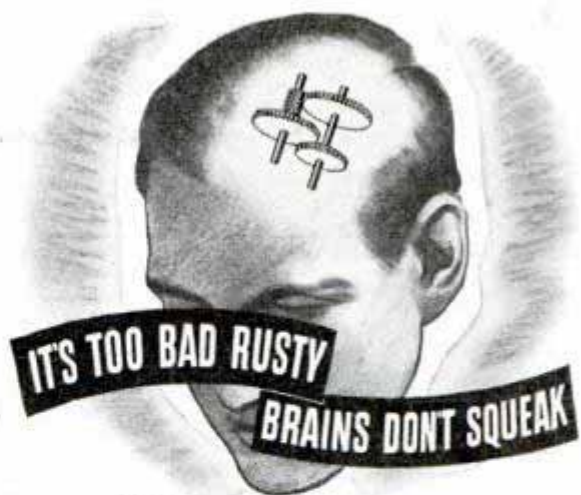
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MAY, 1937

No. 5

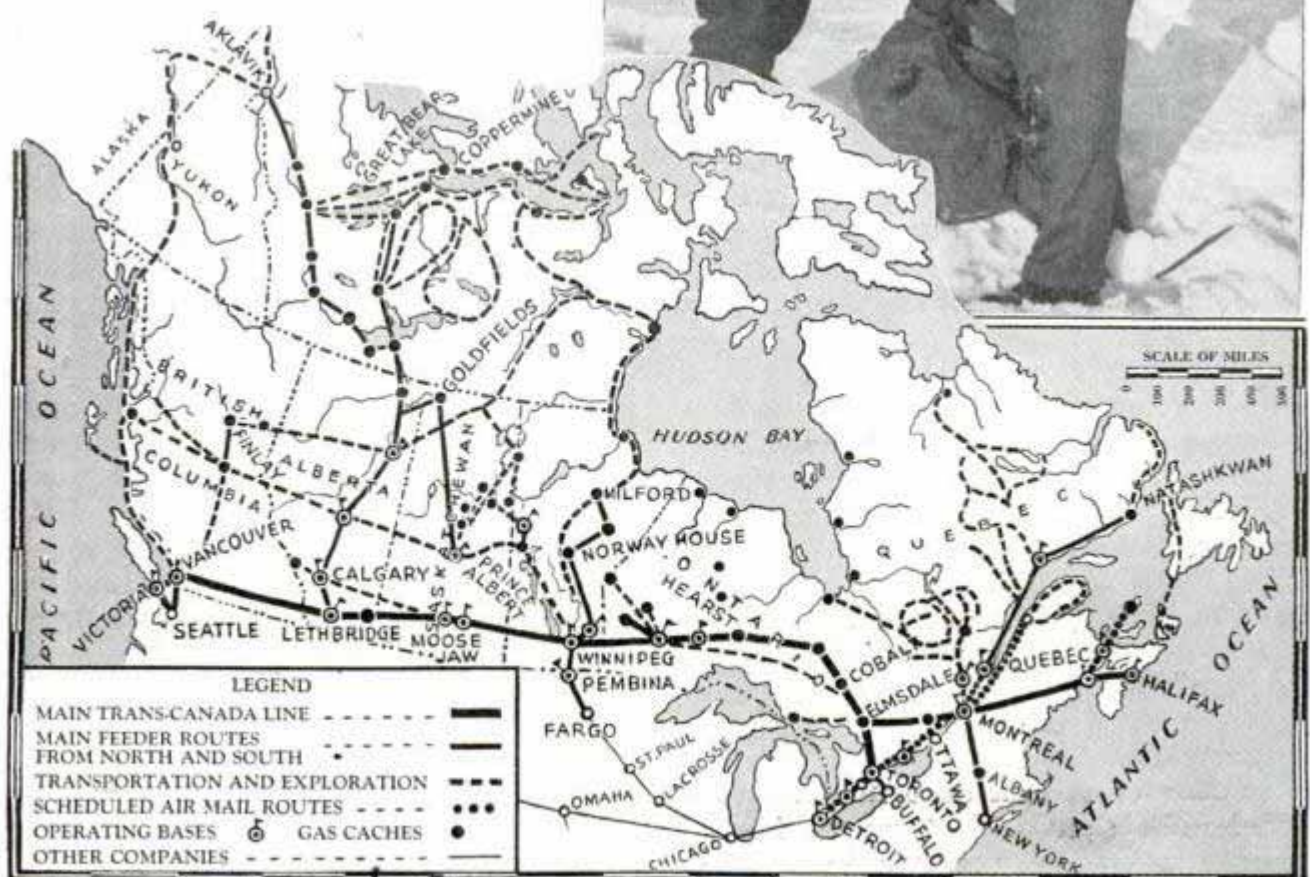
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CROSS-CANADA AIRWAY Next

FROM Halifax on the Atlantic coast to Vancouver on the Pacific, modern pioneers have blazed a 3,500-mile trail and in the summer of 1937 Canada will open her transcontinental airway.

The first regular flight will signal a victory over vast stretches of wilderness and towering mountains. Northern Ontario, a region of lakes and bush where few people live, has been bridged by the construction of nearly fifty intermediate airports.

Right, Canadian mail pilot hands the mail to northern trapper. Below, map of transcontinental airway, showing connections with United States and Arctic lines



Vertical handwritten text on the right margin, possibly a page number or reference.

Cont-James Montagnes, 517 641



Photo by Royal Canadian Air Force

Top, western terminus of airway on Sea Island, Vancouver, has landing facilities for land or sea planes. Bottom, fast British plane which will be used on the Canadian line



From Quebec to Manitoba an army of workers braved wintry blasts of twenty to thirty below zero and summer's plague of big, black flies to cut down trees, level off fields, dynamite and burn stumps and fill muskeg swamps with rocks and boulders. Even after the fields had been cleared it was no small task to prevent the fast-growing bush from reclaiming the land. Thus were created small oases in the desert of forests where planes might land.

Through the Rocky Mountains, where the lowest practical pass is 4,500 feet above sea level and surrounded by peaks towering to 10,000, the trail blazers fought their way, building twenty-five airports, at twenty-five to thirty mile intervals, so that a pilot might always be within sight of one. When radio beacons for beam flying were installed it was found that the mountains caused an echo in the directional radio signals. Instruments in test planes showed "on course" when the ships were far off their path. So instead of one

beacon at each location, two or more were installed to balance the echo. More radio beacons than ordinarily required were placed in service to increase safety.

Almost all the flying in Canada has been done with planes equipped with pontoons in summer and skis in winter to take advantage of the large number of lakes scattered through the country. But twice a year, at "freeze-up" and during the spring thaw, all operations had to be halted for a period of three to six weeks because planes could not land on the lakes. Since no air line could operate under such conditions the Canadian airway will have 100 air fields, many of them built beside the lakes where planes formerly landed, so that aircraft with wheels may land the year round. The lakes still may be used by planes with suitable landing gear.

The Haviland Dragon



Top, typical stretch of sparsely inhabited country in northern Ontario over which airway planes will speed. Bottom, water end of Toronto's airport is within five minutes walk of business district

While the new line will rely on the latest antenna from the United States other radio equipment, designed and built in Canada, will be used in planes and on the ground. Four-way directional signals will be provided at all times by the radio-beam stations. Pilots will talk to and hear ground stations over efficient two-way communication systems, and weather data will be transmitted by teletype. Pilots will rely entirely on the radio beam for guidance, finding their position from information relayed by ground stations scattered

from one end of the airway to the other.

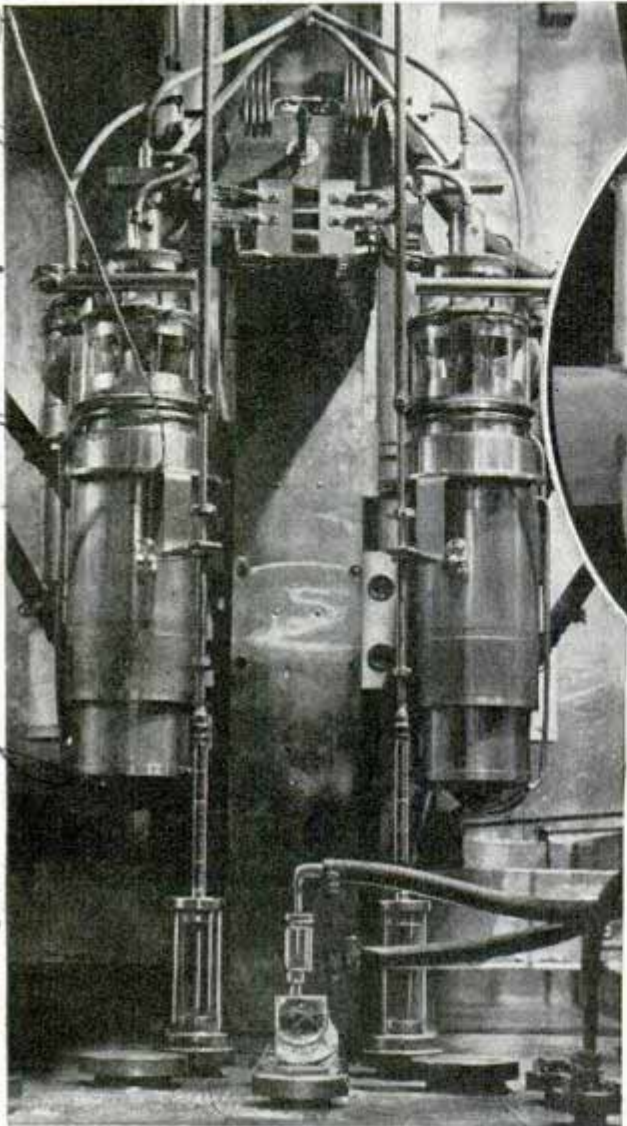
The entire chain of emergency and terminal airports from Halifax to Lethbridge will be illuminated by the latest type of lighting. The mountain route, from Lethbridge to Vancouver, will be flown only in daylight, as a safety measure. Telephones will link all emergency fields and weather service will be available instantly to pilots forced down at any intermediate field.

Close to \$10,000,000 has been spent in the construction of ground facilities for

(Continued to page 139A)

Giant X-Ray Machine Treats Five at a Time

*Columbia Presbyterian Center
Presbyterian Hospital, New York*



Harris and Long

Capable of generating radiation equivalent to \$100,000,000 worth of radium, a powerful X-ray machine recently installed in a New York hospital treats five patients at a time. It is intended particularly for treatment of cancer. Two large radio oscillator tubes comprise the heart of the machine, which can produce 1,250,000-volt X-rays. The powerful generator is the invention of Physicist Frank M. Exner of the Institute of Cancer Research.

1145 Amsterdam *new York* Gives Twice as Much Light

When the lamp is first turned on, an arc strikes, emitting a feeble bluish glow. In about five minutes the lamp is fully "warmed up" and gives a brilliant stream of light. Unlike present 250-watt and 400-watt mercury lamps the bulb-within-a-bulb operates from either a 110-115 or 120-volt line and without the need of a voltage stepup for starting. It is expected to prove useful in street lighting and photography. Tests are being conducted at laboratories of General Electric company.

☐The first farm tractor powered by internal combustion engine was built in 1901 and today there are 1,248,000 on farms in the United States.

*Ohio
Rela Park
Cleveland*

Left, giant tubes in X-ray machine. Right, adjusting lead stop in treatment port

Es 108 "Bulb-Within-Bulb" Lamp

Rated at only 100 watts but capable of producing as much light as a standard 200-watt lamp, an experimental mercury lamp is being tested. It is a bulb within a bulb, the outer one being six inches long and one and one-half inches in diameter. The inner bulb is made of extra-hard heat-resisting glass and is two inches long and one inch in diameter. Within it is a small amount of mercury and enough argon gas to "start" the lamp.



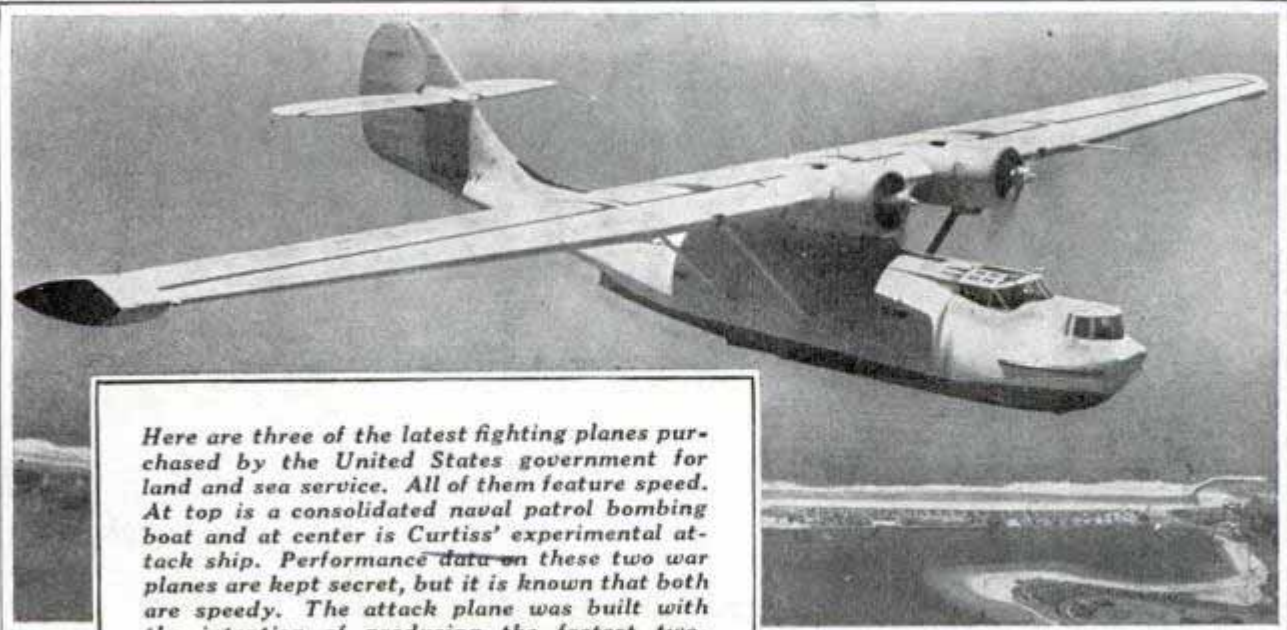
27 W. 39 St. New York

*S.A. & Journal
Feb 1937*

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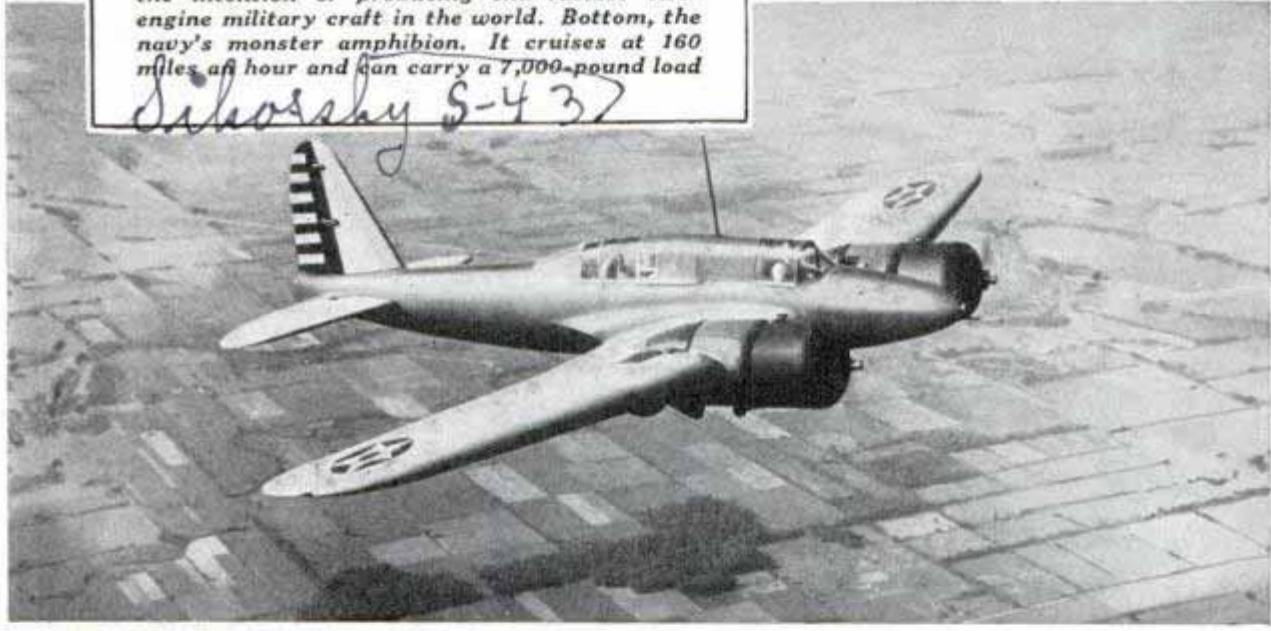
Capt. Chas. A. ...
Middletown Air Depot.
POPULAR MECHANICS 645
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Latest U. S. Fighting Planes Built for Speed



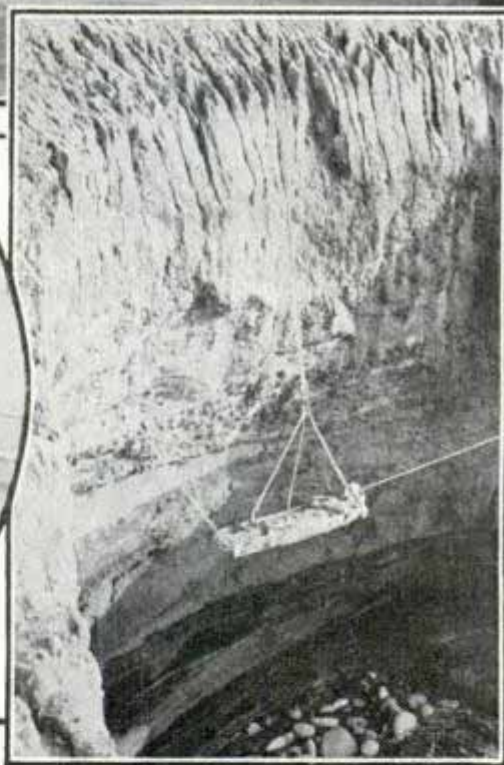
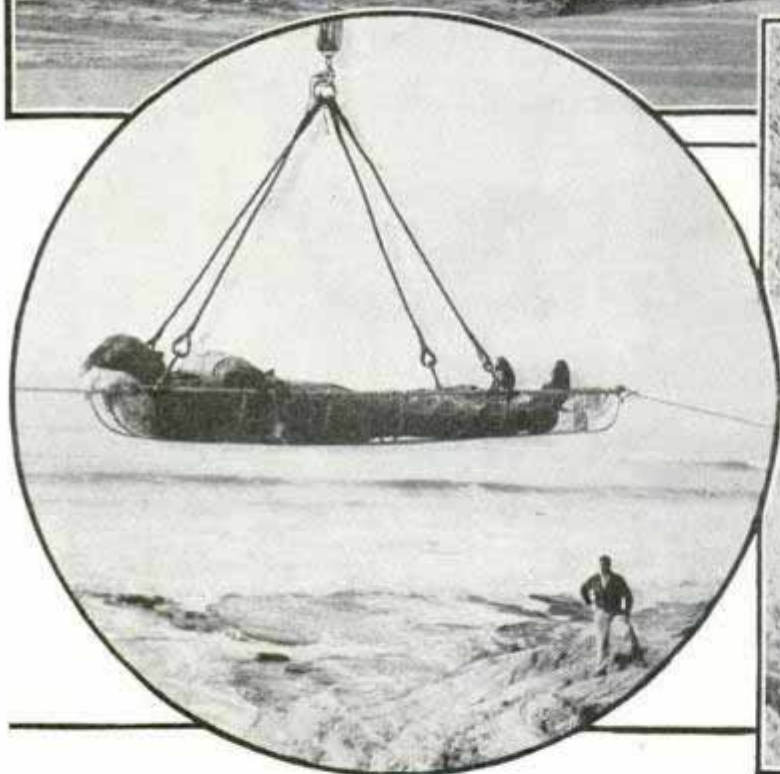
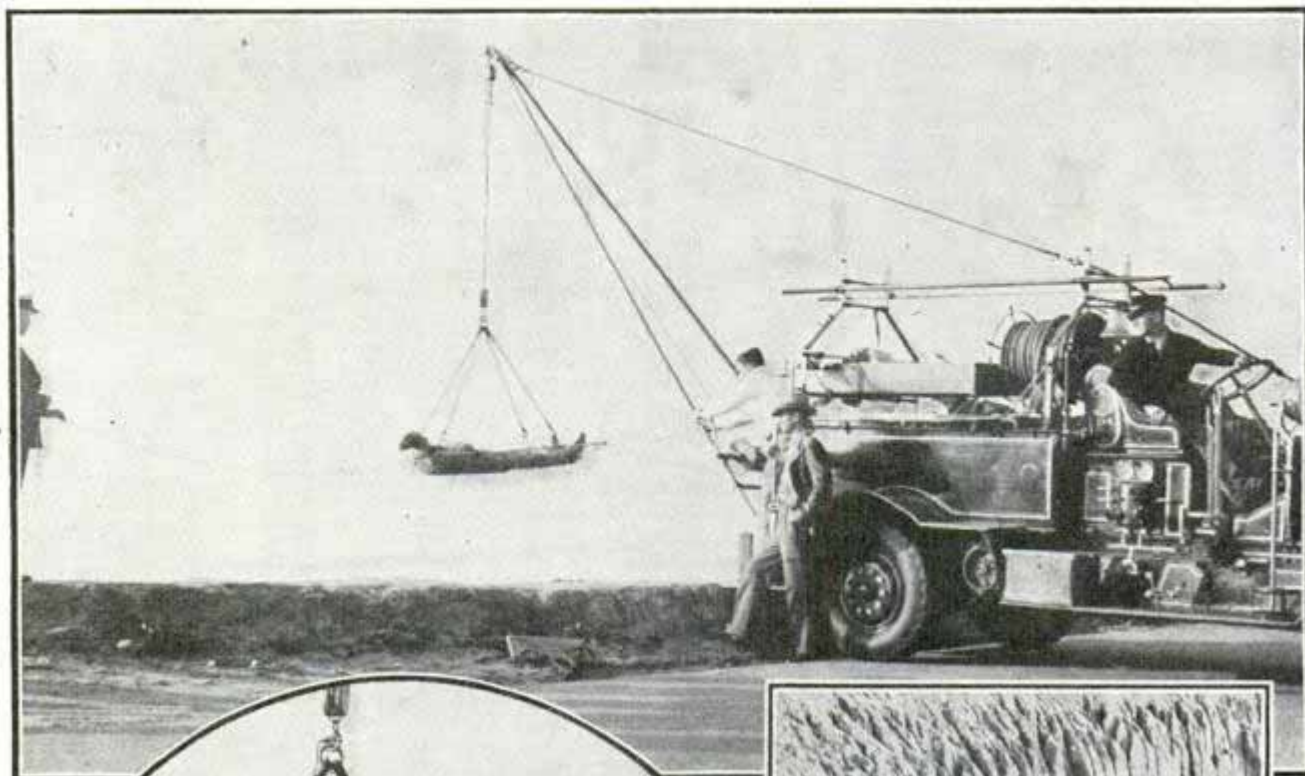
Here are three of the latest fighting planes purchased by the United States government for land and sea service. All of them feature speed. At top is a consolidated naval patrol bombing boat and at center is Curtiss' experimental attack ship. Performance data on these two war planes are kept secret, but it is known that both are speedy. The attack plane was built with the intention of producing the fastest two-engine military craft in the world. Bottom, the navy's monster amphibion. It cruises at 160 miles an hour and can carry a 7,000-pound load

Sikorsky S-437



Handwritten notes at the bottom of the page.

Windlass Lifts Rescue Basket Up Seaside Cliff



Top, hauling in rescue basket by hand windlass mounted on fire-department truck. Closeup of splint basket is shown below, and at right victim is hoisted up seaside cliff while guy ropes steady basket

San Diego firemen called upon frequently for rescue work along the Pacific shore have designed a splint basket drawn by a hand windlass to haul up victims who have fallen off the cliffs or been trapped by rocks or tides. It is arranged so that a boatswain's chair can be attached to lower and raise a rescuer along with the victim or patient, who lies supine in the basket. The windlass can be erected on the ground

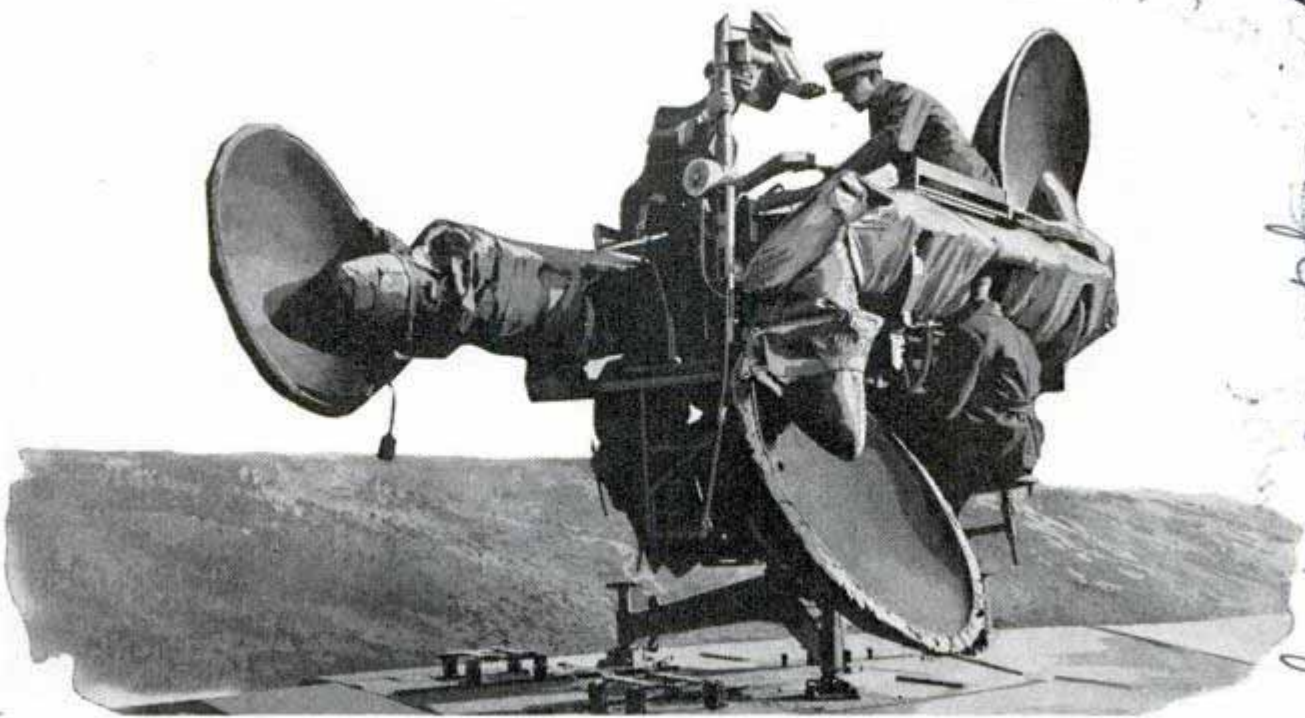
or attached to the rear of the fire engine, and the entire rescue apparatus can be assembled in a moment. Guy ropes stabilize the basket while it is being hauled up or lowered.

Without shutting down, a "scab" deposit eight feet thick was removed from the lining of a Birmingham, Ala., blast furnace by dynamiting it.

*Slow Sheffield Steel
L. S. Co.*

S. O. Rappaport, Fire Prevention Bureau

Sensitive "Ear" Spots Plane as It Approaches



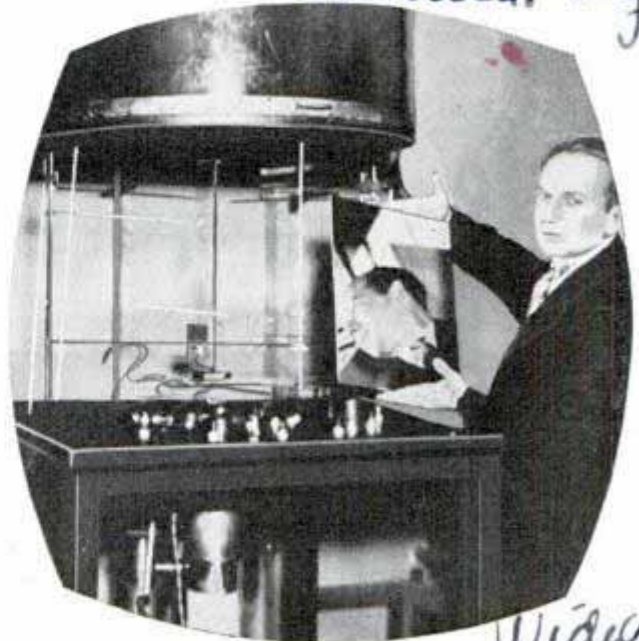
Airplane detector employed by Austrian flying corps to spot presence of enemy aircraft long before human eyes and ears can detect the ships.

Anti-aircraft guns are more efficient if the gunners are warned in advance of the approach of enemy bombers and their location, so most air-defense forces today are equipped with mechanical "ears" to detect enemy air raiders long before the attackers can be seen or heard by human eyes or ears. The apparatus pictured is the sensitive "ear" employed by the Austrian flying corps. Most plane recorders actually "listen" for the sound of the motors of approaching ships, picking up the noise of the engines and showing the direction from whence it comes. Faster planes, however, have decreased the efficiency of listening apparatus, due to the relatively low speed of sound waves as compared with light. As a result, experiments have been conducted with detecting apparatus using invisible infrared rays which travel with the speed of light, and ordinary high-frequency radio waves. The latter have been found to possess curious reflection characteristics and have been used to detect the presence of airplanes flying high above the clouds. A radio pulse is sent from the ground and the exact time of its departure is recorded. The time the reflected impulse comes back also is recorded. This provides a means for determining the plane's position.

es 156.

Mirrors Made of Metal Films Millionth of Inch Thick

Evaporated metal films, one-millionth of an inch thick, are being used in the manufacture of a new type of mirror. The films are aluminum, chromium and gold. This new business developed from a machine evolved when a Cornell University scientist wanted a new telescope mirror.

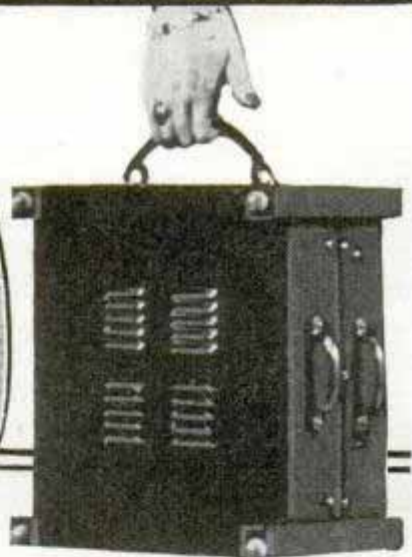
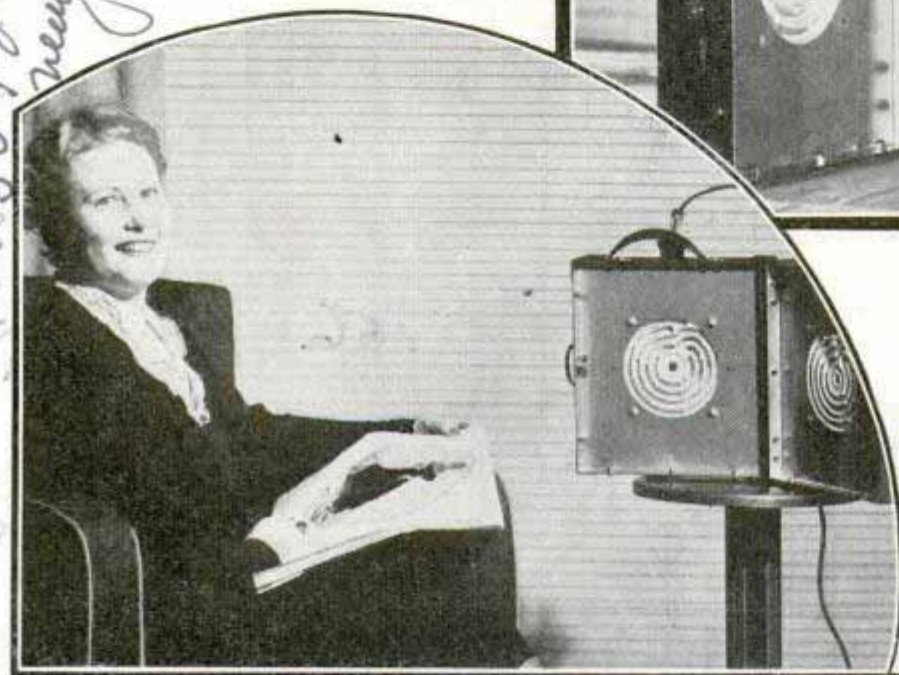


Here is one of the mirrors manufactured from aluminum, chromium and gold film

Widawald

Electric Stove Is Room Heater and Hair Drier

50.7 - 6th Avenue
20153
Journ
4-98
Pan Electric Products Co
New York



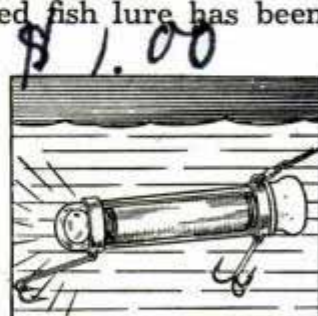
Two-burner electric cookstove used for toasting bread, as a hair drier, and to warm a room. At right it is folded for carrying

Especially useful in trailers, an electric cookstove which can double as a hair drier or a room heater is now offered. It is a two-burner folding type. Laid on a table horizontally it serves as toaster, broiler or cooker. Set up vertically, its twin coils shed a warm glow in the room, or become a double-beam drier for your hair. It folds in a compact case easy to carry or to pack away in the car for touring.

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.

Electric-Lighted Casting Lure Attracts Fish at Night

For fishing at night or in muddy waters, an electrically lighted fish lure has been developed. Flash-light battery, bulb and holder are enclosed in a housing with hooks, made watertight by a rubber cap. Made in several colors, it is used in casting or trolling, and when the electrical assembly is removed it can be used as a surface lure or on a fly rod.



20-190
Seigler's Night Fishing
7' Rod Co. Hunter Okla



“-and
There was
LIGHT”

Part II

DRESSING table equipped with tubular lamps and mirror flanked by two wall lights—a good example of efficient local lighting.

*Chicago Lighting Institute
20 N. Wacker Drive
Chicago*

650

41339

Westinghouse Electric & Mfg Co
Mansfield, Ohio

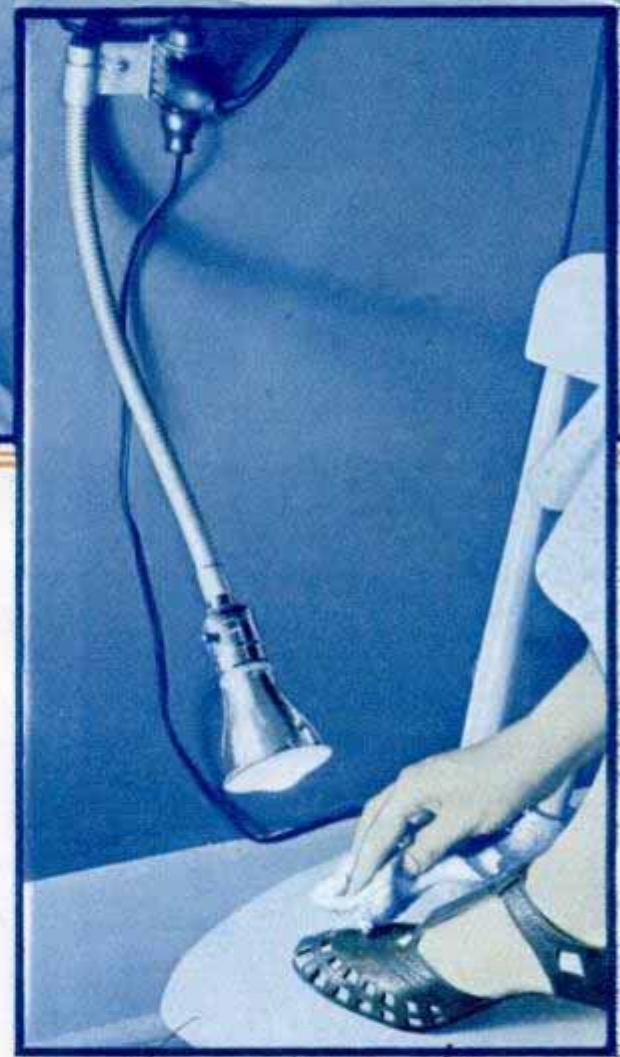


PRESSING a master switch beside the bed to flood entire house with light, inside and out, thus frightening away intruders. Below, gooseneck fixture which holds a "foot light" for polishing shoes.

By H. W. MAGEE

SIGHT is the most valuable of all our senses. Through our eyes, we gain more than eighty-five per cent of our knowledge and control eighty per cent of our actions. And today, with more things to be observed than ever before, we are in a position for the first time to do some real seeing after sundown.

It has taken us a long time to find it out, but we have discovered at last that the secret of seeing is light—light in the right amount and of the correct quality. The complex process of seeing involves more than our eyes. It involves our very selves, our nerves, our muscles, our brains, even our hearts. Most of us are born with good eyes, but it is a deplorable fact that in the United States one grade-school child in five, two college students in five and three middle-aged persons in five, have defective vision. And



No information

one of the principal causes of poor vision is poor lighting.

Our eyes see best in natural daylight, and if we did all our seeing out-of-doors in the day time, our eyesight would be conserved and fewer of us would peer through spectacles. Unfortunately, however, our eyes do much of their work indoors or after dark and we are forced to supplement or supplant daylight with artificial light. And the artificial lighting in most of our homes is not very far

Chicago Institute
20 N. Wacker
Drive Chicago

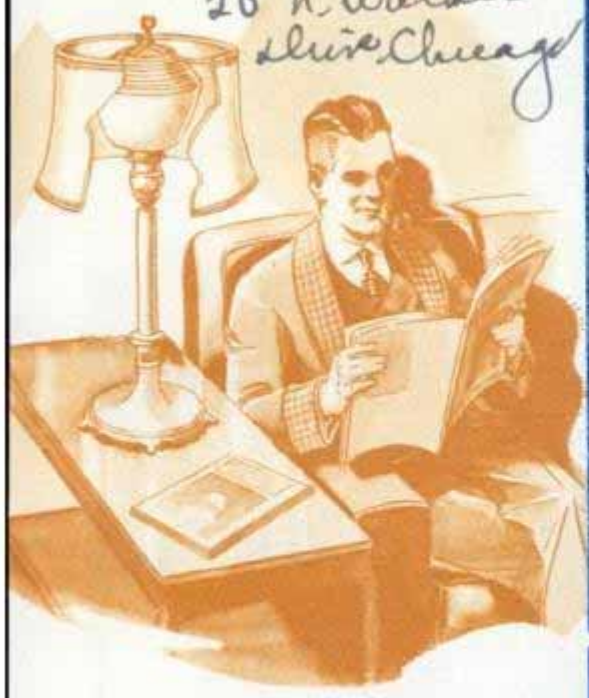
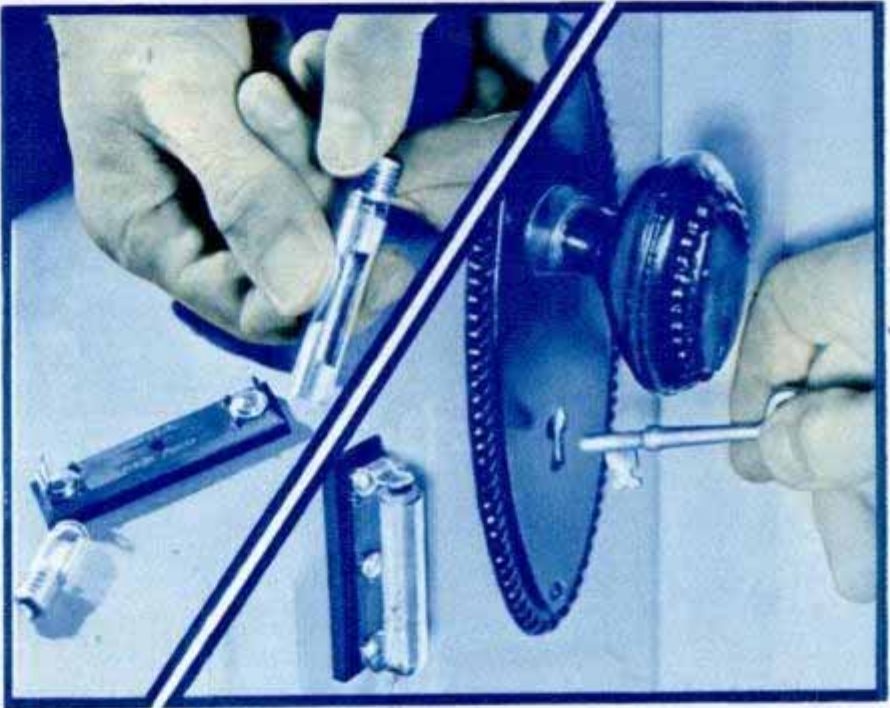


TABLE lamp, above, with frosted-glass globe to diffuse light. Top, right, bedroom lighted with lumiline lamps, "pin-it-up" lamp and ceiling fixture with diffusing bowl. Center, two six-volt radio dial lamps can be used to illuminate doorbell button or keyhole. Bottom, efficient local lighting for the bedroom.

beyond the tallow-candle age when we interpret light in terms of seeing, rather than in mere terms of lamps and fixtures.

Light, like oats or gasoline, can be measured and the foot-candle is the unit used to measure lighting in terms of seeing. A foot-candle is the amount of light you would get on your page held one foot from the flame of a standard candle. Outdoors on a clear day you'll find from 5,000 to 10,000 foot-candles, and on your porch on the shady side of the house there may be 500. But in your living room in the evening, you may have only five. Your eyes don't tell you they are being cheated, so you probably don't even realize your lighting is inadequate. Well, here's one way to



General Electric Co. 1234
Nela Park, Cleveland
No information
General Electric Co.

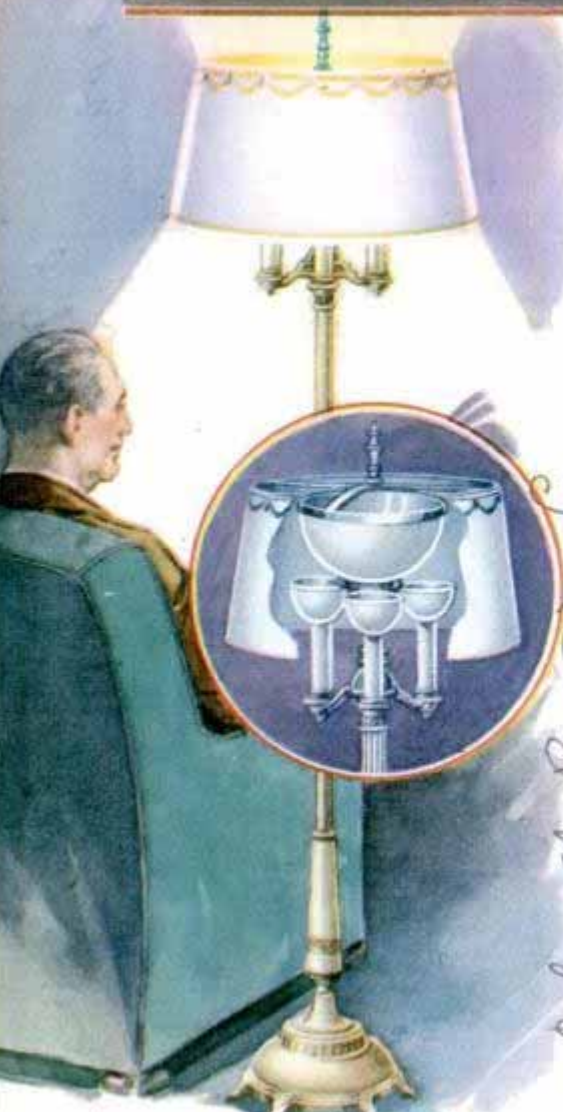
652

41337

General Electric Co. Nela Park
Cleveland Ohio



USING light meter to check intensity of illumination for reading. Below, all-purpose floor lamp with three candle sockets and large bulb with three light intensities.



Colonial Bryn Mawr Co. Chicago
450 W. Superior

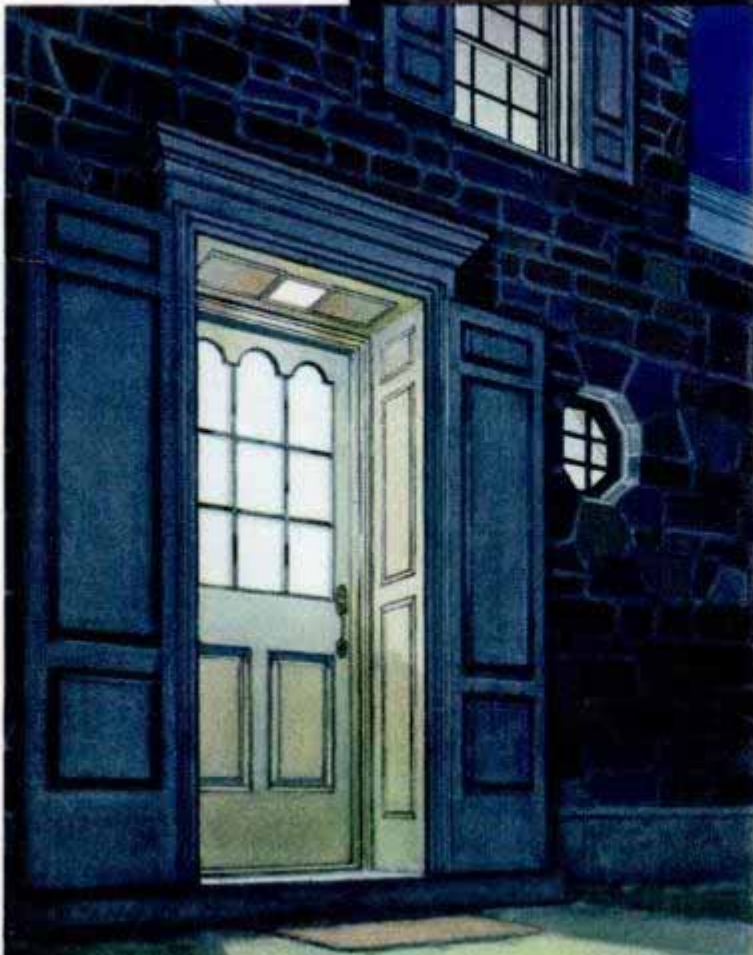
determine quickly whether you are providing enough light for your eyes to work. A marvelous little instrument known as a light meter does the trick. It contains a light-sensitive cell and registers the number of foot-candles on a dial. With its aid, you can find out exactly how much light for seeing you are getting in any spot in any room in your home. And, of course, your needs vary from room to room or even in two spots in the same room.

In the first place, you require both "local" lighting or light which is directed specifically on eye-work, and "general" lighting or illumination throughout the room. Ten foot-candles or less is the danger zone for close visual work but is satisfactory for casual seeing, as at the dining-room table or for card playing. As an example, five twenty-five watt bulbs in a good ceiling fixture probably will deliver from five to ten foot-candles of light to a table beneath it.

Ten to twenty foot-candles of local lighting is desirable for moderate visual tasks like reading good print on white paper, easy sewing on light goods, coarse knitting, the play of children, washing at tubs or sinks,



BOOKCASE made more attractive by indirect lighting under the shelves, and diagram showing how tubular lights were installed. Below, inexpensive lighting unit installed above doorway.



*Chicago Lighting (653)
 & installate 20 h washer
 ironing and cleaning vegetables.*

Two sixty-watt bulbs in a table lamp should deliver about twenty foot-candles at a distance of two feet, or a well-designed floor lamp with a seventy-five watt bulb ought to supply about twenty foot-candles at a distance of about thirty inches.

For rather prolonged and intense eye use, such as reading newspapers, sewing at a machine, fine mending, stamp collecting, drawing and shaving, you should have from twenty to fifty foot-candles. A 100-watt bulb in a table lamp should deliver about twenty-five foot-candles at a distance of twenty-seven inches.

*General Electric Co.
 Nela Park Cleveland
 Ohio*

Bloomfield N.Y.

BATHROOM mirror illuminated by lamps behind panels of diffusing glass, and floor lamp which has bulb in diffusing bowl to provide three light intensities.



*General Electric
Cleveland*

of course, often requires the use of supplementary "fringe" and decorative lighting for certain areas.

But the quantity of lighting is only half the story. Quality of lighting—the manner in which your light is distributed—is just as important. If you have glare, if there are areas of brightness and dark shadows, your lighting is inefficient, regardless of the quantity of light you have. What you want is light that is soft and pleasing, light that gives a minimum of harshness in contrasts. This is accomplished by having

For severe, prolonged and detailed tasks like reading fine print, sewing with dark thread on dark goods and home drafting, you need from fifty to 100 foot-candles and you can get them by using a 150-watt bulb in a table lamp at a distance of twenty-two inches. In order to maintain a satisfactory distribution of light throughout any room, the general lighting should be between one-fifth and one-tenth of the local lighting. This,

lights balanced throughout the room, by placing lamps to obtain the proper distribution of light.

Amazing advancements have been made by lighting engineers in the design of fixtures. Shades, reflectors and globes now are being formed scientifically to provide diffusion and reflection and produce a light that is easy on the eyes. In selecting lamps, certain qualifications must be kept in mind in order to obtain

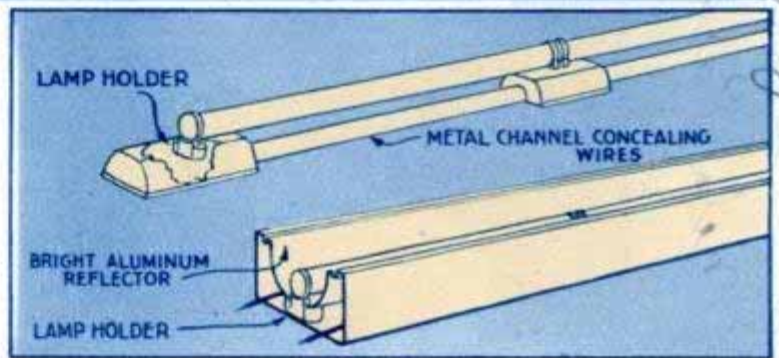
Wesley Park, Cleveland, Ohio



light scientifically correct for seeing. There should be sufficient height and shade size to cast the light over a generous area. Also, remember that white or near-white shade linings prevent coloring the light and distorting and wasting the light you pay for.

Except where lamps are on low tables, open-top shades usually are desirable because more light is shed up into a room, and you run less chance of harsh contrasts. Lamp bulbs housed in light-diffusing glass or plastic bowls, hidden under the shade, provide eye-comforting results. And be sure your shades have enough density so they don't stand out as bright spots against their background.

Modern light fixtures no longer attempt to imitate candles and kerosene lamps. They are made to conform to structural lines and decorative detail, and they are designed to use electricity and not to imitate tallow candles. They are large enough to conceal the lamp bulbs, they are designed to reflect or diffuse the light without glare, they quite often fit snugly to the ceiling and in some modern homes they are built into the ceiling and are as much a part of the house as the



MODERN all-electric kitchen. Note lighting over window and sink and small lamp over range. Below, one way to mount lumiline lamps, and the snap-button socket.

Westinghouse Lamp Co

Curtis Lighting Co. 11. 11.

General Electric Co.
Cleveland, Ohio
Nela Park



EFFECTIVE combination of candle lighting and modern electric lighting for the dining room. Left, window with illuminated scene placed outside.

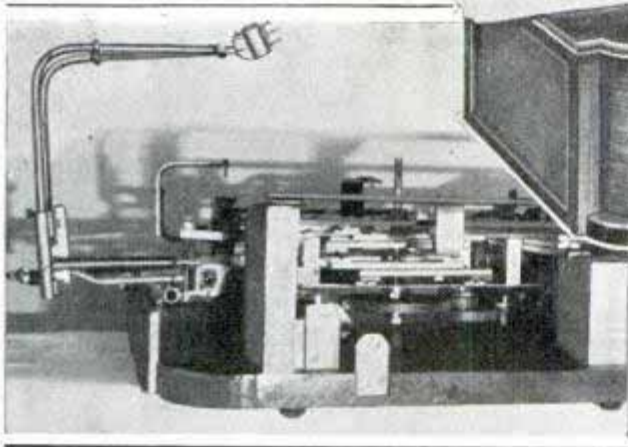


plumbing. And where wall brackets are used, they are employed for the specific and honest purpose of seeing—in the kitchen over the sink, in the bathroom on each side of the mirror, or in the living room to add interesting touches of “frill” lighting. Brackets of the urn and bowl type have been found to be decorative and at the same time to contribute materially to the effective lighting of a room.

This is all very well, you say, but who can afford it? That question could be answered by asking another. How much
(Continued on page 132A)

Robot Pen Copies Handwriting from a Record

Connect your fountain pen to a recording machine, write a letter in longhand and a robot penman will reproduce that letter, faithful in microscopic detail to your handwriting. The mechanical writer was developed to save busy executives time in signing letters and papers and writing other legends repeatedly. The signature or legend is recorded on a master record, comparable to a phonograph record, by a secret proc-



Above, reproducing pen writes a letter previously written by hand into recorder. Notice exact similarity of actual signature and robot pen's copy. Left, cabinet removed to show reciprocating plates which guide movement of penholder arm

ess. The disk is then placed in a portable reproducing unit about twelve by fifteen by six inches in dimensions. The master recorder has "broken up" the original writing into its component directional movements in every possible plane, and in the reproducing unit there is a reciprocating plate for each of these movements. Impulses from the disk strike these plates, pass to a central plate where they are "blended" into the movements of the original handwriting, then are transmitted to the mechanical arm holding the pen or pencil. A mere signature or a long text can be recorded and reproduced an indefinite number of times. Individual letters of your handwriting could be set up like type into a text not written as a whole. To prevent illicit use of a record, a small segment can be removed, without which the machine would write a meaningless scrawl.

Ring Seals Gasket Head on Pail Used for Shipping Fluids

Five-gallon pails with gasket-lined heads which can be sealed for shipping with quick-locking rings are being introduced by a barrel manufacturer. The head can be removed entirely, permitting easy filling with a minimum of spilling. Throwing a lever locks the ring over the head.



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

national Steel Barrel Co 3850 E 91st

2/14/37

Veteran Two-Cylinder Car Crosses the United States



Here is the 1900 auto, closely resembling a buggy, as it appeared in one city through which it passed. Note that its tires have worn off

Resembling a buggy, even to whip socket on the dash, a 1900 Schacht automobile recently was driven across the United States, a journey which occupied about three months. The car has a two-cylinder, seven-horsepower motor located under the rear of the body, chain drive with six forward speeds and one reverse, carbide headlights and an oil-burning taillight. Its top speed is fifteen miles per hour. The greatest expense of operation is for tires, which are solid rubber costing \$7.50 each and good for only one or two thousand miles. On one mountain grade encountered on the long trip, the brakes failed. The primitive construction makes the car almost impossible to steer at speeds above thirty miles per hour, but the driver, Paul Hubbard, stuck to the tiller as the car attained fifty miles per hour and managed to reach the bottom of the incline safely.

Foghorn Teams Up with Radio to Guide Ship into Harbor

Making use of the constant speed of sound waves, pilots guide their ships into port at Ludington, Mich., by checking the

harbor foghorn against the radio beacon. The Ludington lighthouse broadcasts a signal and sounds a foghorn at the same time. Out on Lake Michigan on the bridge of a steamer, a navigator hears the radio beam and notes the interval of seconds until he hears the foghorn. Sound travels roughly a mile in five seconds. If the foghorn is heard ten seconds after the radio beam, the pilot knows he is two miles from harbor.

Photo Film Washer Attaches to Any Water Faucet

Photograph negatives can be cleaned quickly and thoroughly with a film washer which attaches to the water faucet. It accommodates film of any size, and the hose attachment fits any faucet.



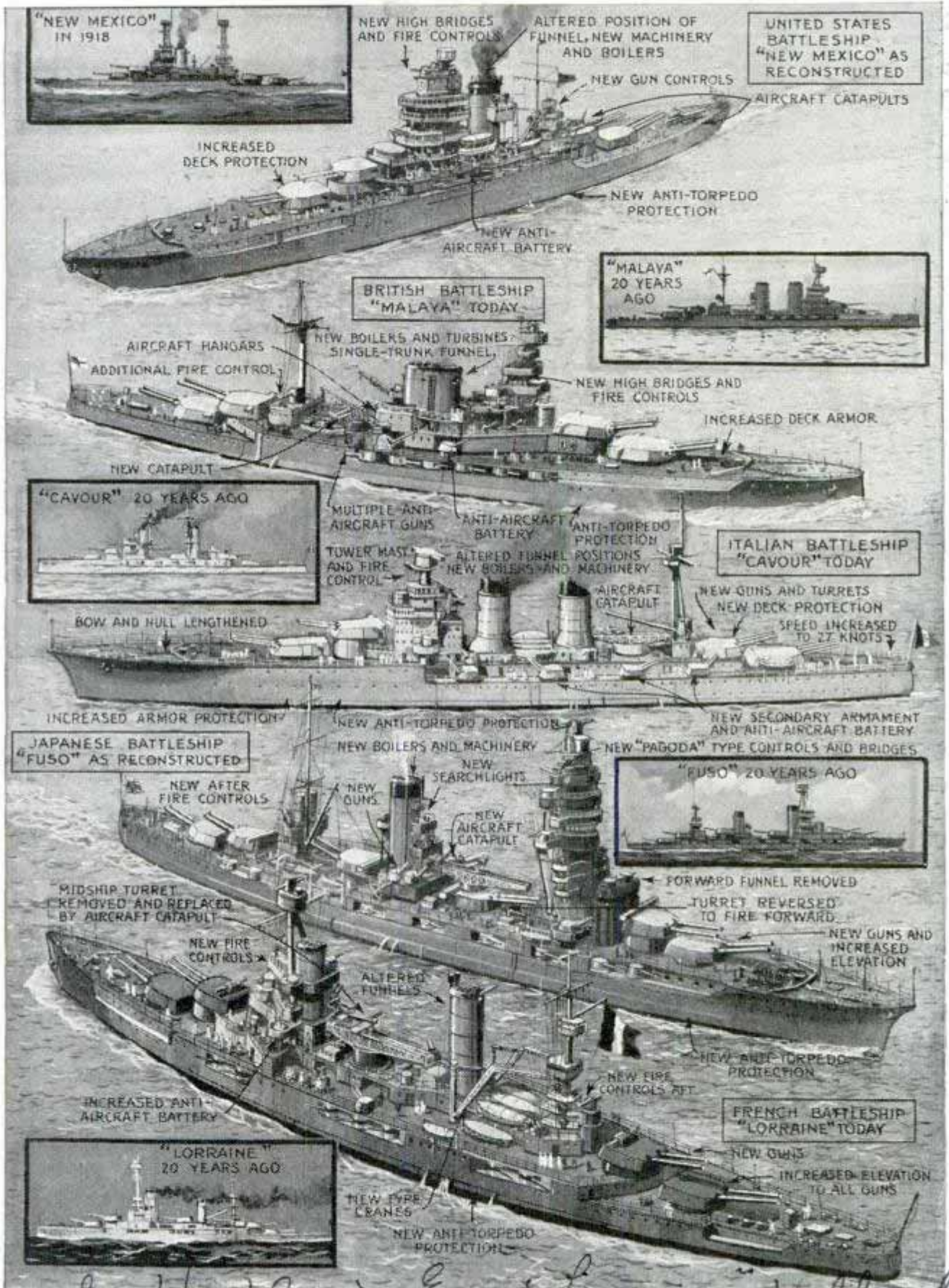
Film washer is adaptable to any faucet and sends stream of water over both sides of negative

Central Camera Co.
230 S. Wabash

Letter sent 9/10/37
Cml. Paul R. Hubbard 318
W. Noble St., Oklahoma City, Okla.

es 193

Old Battleships Made New by World Powers

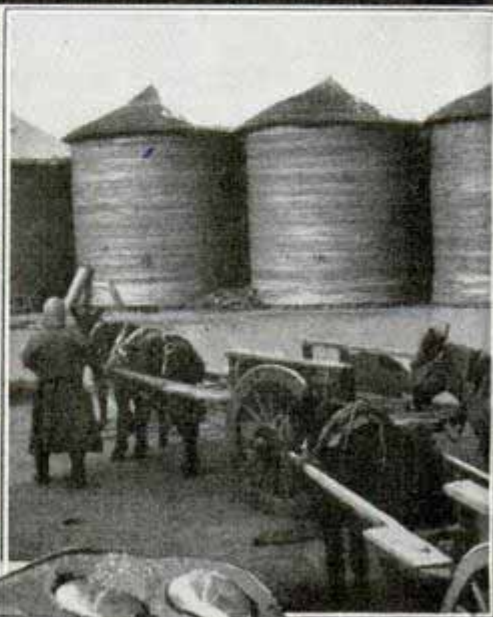


*Es. H. Evans Esq., Linnets, Hillside
 By reconstructing old battleships world powers comply with naval limitation agreements not to build new ones. Modernizing one ship costs millions of dollars. Frequently few parts of the original craft appear in the up-to-date ship. Note changes made in Italy's "Cavour" (center)
 Road Ewell, Surrey, England.*

The BEAN

W. J. Morse
Bureau of Plant
Industry, Washington
Dec

Emb. Walter L. Burton, Akron, Ohio
1032 Lincoln Ave.



WHAT is it you can find on the dining table, in a can of paint, on the floor, in a dead insect, on the pages of a newspaper, in the delicatessen and on the soap dish?

The answer to this riddle is "soy." For the soybean, an oriental legume of ancient lineage, is now on the threshold of a widespread conquest of the agricultural and industrial world. Already the number of food and industrial products modern science makes from this bean is truly amazing. Few other plants are put to so many uses. A research laboratory has been set up by state and federal agricultural experts for the sole purpose of studying the soybean and finding still more ways of using it.

The soybean plant is a hairy, leafy bush. There are many varieties, and the beans have a wide range of size and shape. The colors range from yellow to black. Ancient Chinese writings mention the grow-

Soybeans from Japan used as green vegetables and, above, some of food products made from soybeans

ing of soybeans for food. In 1804, somebody brought some of the beans to the United States, and for many years they were grown as curiosities. Toward the end of the past century, the bean began to take on some importance as a farm crop. State agricultural experiment stations began to study it. Today more than sixty varieties are in active cultivation. In 1917 less than 500,000 acres of soybeans were being grown. In 1936 the total acreage was 4,380,000.

Farmers have learned the soybean makes, in many ways, an ideal crop. It will grow almost any place corn or cotton can be raised. It is not bothered much by

price list on 'Plant' (Government Printing Office) for pamphlets on soybeans

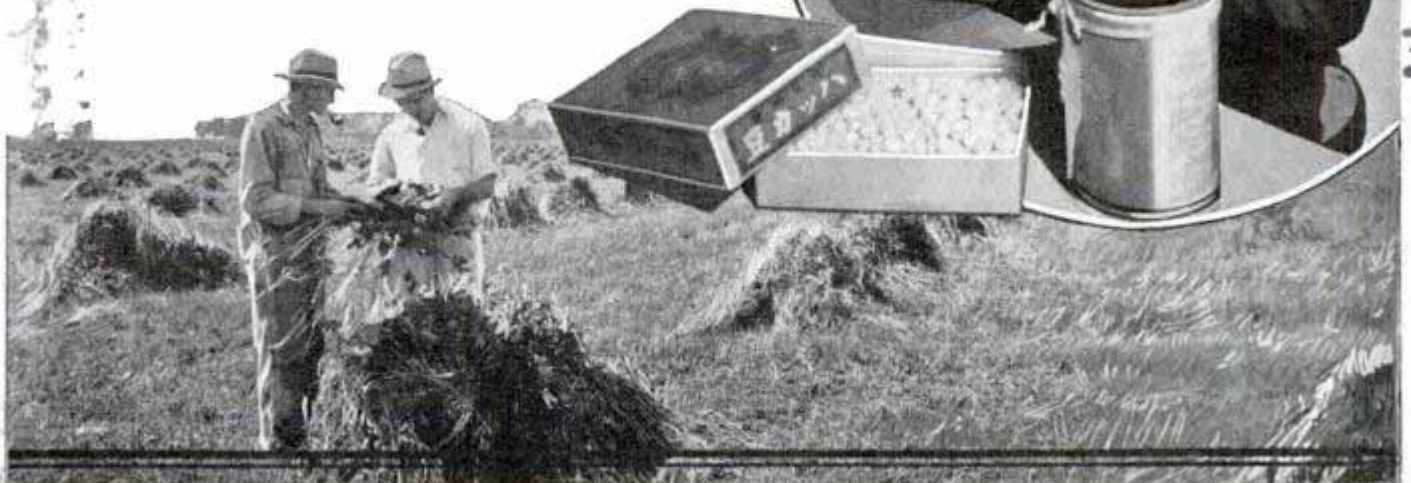
that MADE GOOD



Above, soybean storage yard in Manchuria. Right, candied soybean products from Japan. Bottom, field of soybean hay mixed with grain hay

insects, disease and adverse weather conditions. It is easy to plant, cultivate and harvest. It can be grown in combination with other crops such as corn. Like the pig and its squeal, almost every part of it but its shadow can be put to some profitable use. The soybean is adapted especially to the southern part of the corn belt and the northern half of the cotton belt. Almost any type of soil will grow soybeans, but the best are mellow, fertile and sandy loams.

Soybeans are, like other legumes, active nitrogen-fixation factories. They capture nitrogen from the air and convert it into useful plant food. But in doing this they



W. J. more of packing candied soybean products



In general, soybeans are planted in the spring and harvested in the fall. The beans can be separated from their pods in an ordinary threshing machine modified for the purpose, or in several ways. Binders, threshing machines that straddle the rows and collect beans from the standing plants, corn knives, flails, and other devices have been used. The combine has made headway since 1927 as a means of harvesting and usually is cheaper than other methods.

You are likely to meet a soybean, in one form or another, almost anywhere you turn—from the feed manger of a dairy barn to the shiny paint on your automobile. The plant itself is a competitor of grass, alfalfa and other crops which can be

dried and used as feed for farm stock. Soybean hay, rich in protein, makes an excellent ration for any farm animal. It may contain a considerable percentage of woody stems but this trouble can be reduced by proper growing and harvesting. Because of its high protein content, soybean hay is not fed alone, but is used in combination with other feed. The soybean is particularly suitable to

(Continued to page 120A)



must have an ally, hordes of bacteria that live in the soil and roots. If soybeans are planted in a field where there are no helpful bacteria, the plants are likely to be sickly. To prevent this, the soil is inoculated. There are many ways of doing this. Prepared cultures of suitable bacteria, obtainable from seed dealers, can be scattered about, usually by mixing them with the seed beans. Or a quantity of soil from a field where soybeans have been grown successfully, and which therefore is rich in the right kind of microorganisms, can be sowed along with the seed. Once the bacteria are "planted," no further inoculation is required if soybeans are grown on the area with more or less regularity. The presence of root nodules indicates the active cooperation of the right bacteria.



Top, crushing boiled soybeans in wood mortar in Japan. Center, making soy sauce in China. Bottom, inspecting root system of soybeans

Extension specialist and county agent.
W. Bator

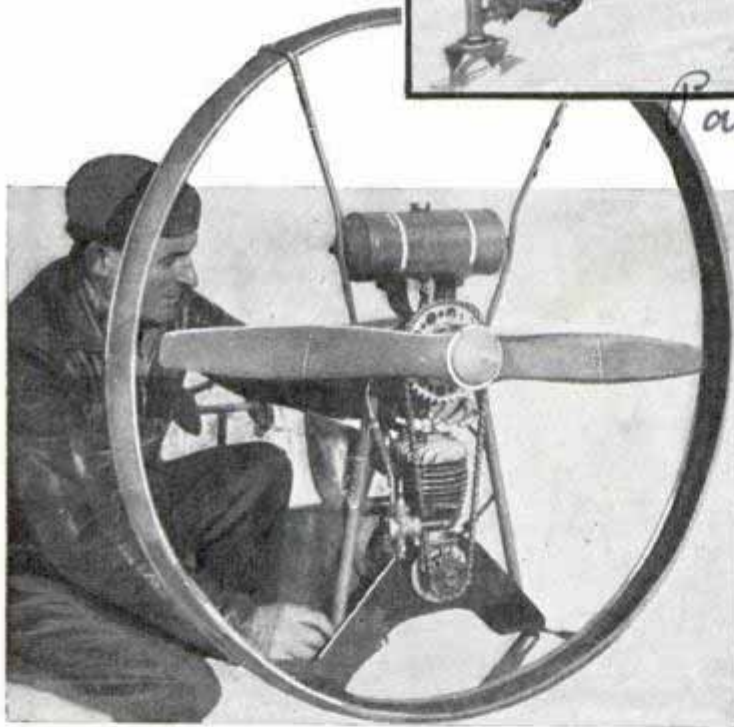
H. Needer, Chang, Fupoh, China

W. Bator, Agricultural Experiment Station, W. Bator Co.

Propeller Drives "Skate-Sled" on Ice or Water

Before no further date

Right, Paris inventor twists the propeller to give a demonstration of his skate-sled for a passenger. Triangular brace under rear end supports motor and keeps sled upright when not traveling. Below, tuning up the engine for a thirty-mile-an-hour run over the ice. Observe the chain drive

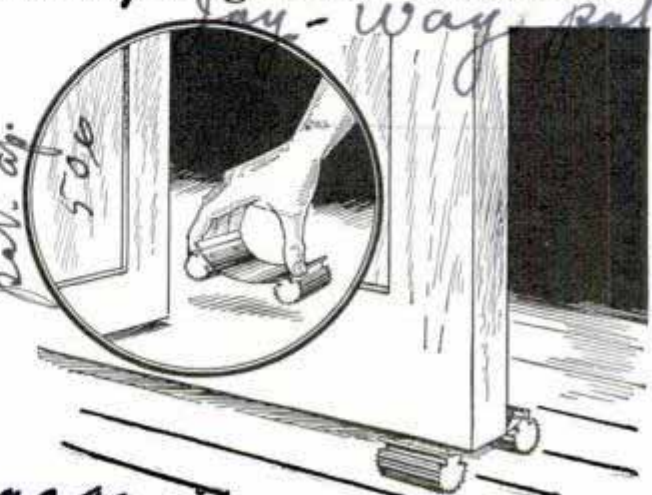


Paul's Photos

Two wide skates are the runners of a propeller-driven "skate-sled" which skims over the ice at thirty miles an hour. The invention of a French engineer, it is built so that pontoons can be added for traveling on water in summer. A triangular brace supports the rear end while the motor is being tuned. A chain drive spins the propeller at 5,000 revolutions per minute. The skate-sled is guided like a bicycle, with two long handle bars that extend back from the post which rests on the forward skate. A metal ring protects the whirling blades.

Holder Keeps Door Open for Any Degree of Ventilation

Any degree of ventilation can be obtained by using a small, inexpensive holder which slips under the door. It is not attached to the door. Made of two soft grooved cushions connected by a spring metal strip, the holder is placed in position by bending and slipping under the door. The metal strip then straightens and forces the cushions against the floor.



☐ The Hudson river once flowed past Sandy Hook in a gorge 4,000 feet deep now submerged beneath the ocean.

Compressed Air Magazine
Jan 19 37

*Both One & 1/2 yds
W. Lemmings*

es 185

Chimney Is Rid of Smoke by "Whistling" It Down



Smoke precipitates in flakes and settles to bottom of test jar after high-pitched vibration is set up

One way to eliminate the smoke nuisance is to "whistle" it down. High-pitched sound waves cause smoke to "clot" and drop in flakes while the cleansed gas emerges from the chimney top invisible. In a laboratory test of this method at the bureau of mines in Washington, white smoke was pumped into a glass jar, then vibration was set up which caused a screeching noise. The smoke precipitated in mid-air, and when the vibration ceased it dropped in chunks.

Human Body Keeps Growing Until Late in Life

Thousands of measurements made by Dr. Ales Hrdlicka and other scientists reveal that growth of the human body does not stop at twenty-four years of age, nor even at forty. A person may increase in height more than one-third of an inch after he is an adult, his legs and trunk keep growing slightly late in life and his arm length appears to increase slightly. Hands and feet tend to become larger and may grow even more than the body as a whole. A "grown" person's chest contin-

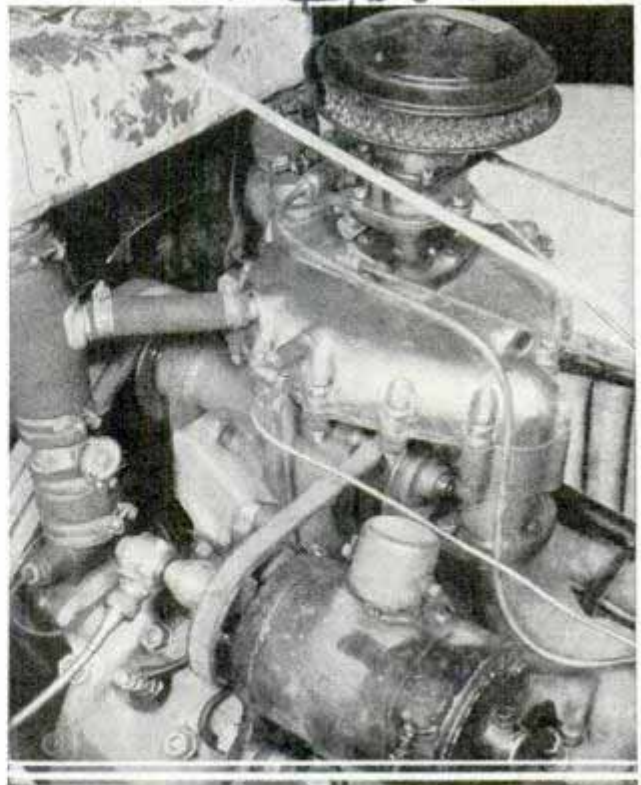
ues to broaden slightly until forty to fifty years, and sometimes later. Dr. Hrdlicka suggests that this new knowledge may be valuable in medicine. When normal growth changes are definitely determined for various parts of the body, it may be possible to recognize variations from the normal growth curves as pointing to defects in an individual's general constitution.

es 16a

Supercharger for Light Cars Fits V-Eight Engines

Designed to increase horsepower as much as thirty-eight per cent, a supercharger for V-eight engines of light cars is on the market. Claims by the manufacturer include better gasoline mileage, smoother performance and longer engine life. The supercharger consists of a centrifugal pump of special design coupled to the crankshaft. It revolves six times faster than the motor. Rotor vanes take the mixture from the carburetor, atomize it and pass it on to the cylinders. The supercharger is mounted on top of the engine in place of the carburetor intake. Horsepower of the Ford V-eight is said to be increased from around eighty-five to more than 120.

\$1 ~~74~~ 50



Here is a typical installation of supercharger on V-eight engine of late model Ford

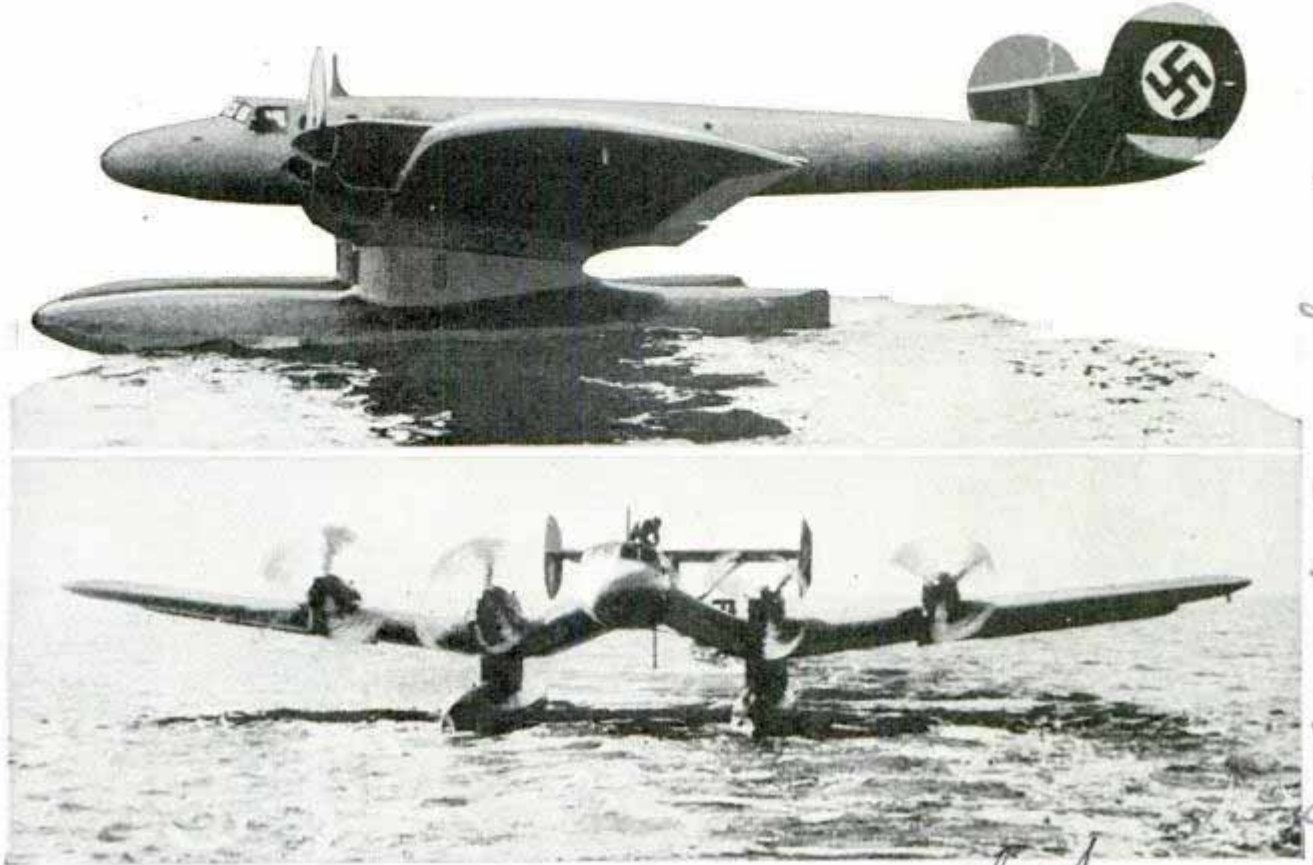
The Culloch Engineering Co. 1327 S. 70th

Developed by H.W. St. Clair

Survey Service 2/11/57

U.S. National Museum Washington D.C.

Sixteen-Ton Plane to Link U. S. and Germany



Here are two views of the huge plane which Germany has been testing for the Atlantic service scheduled to open soon. The pontoons are for emergency landings only, since the ship is not a flying boat

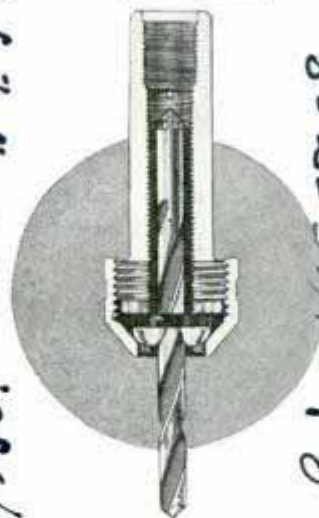
Constructed for service on a north Atlantic route to the United States, a sixteen-ton plane has been undergoing tests in Germany. It is not a flying boat, but is equipped with two pontoons which will support its weight if the ship is forced down on the water. Each pontoon consists of twelve airtight compartments. The plane is of the single wing design and can reach a speed of 186 miles per hour while carrying a full load. First flights across the Atlantic were scheduled by the Berlin postal authorities for the early spring.

Synthetic Odor Warns Miners of Underground Fire

Because an alarm bell might not be heard in the clatter of underground workings, factory-made skunk odor is used to warn miners in case of fire. It goes under the scientific name of butyl mercaptan, one of about 3,000 chemicals manufactured by Eastman Kodak company. Sent through the mine circulating system, it gives quick warning to those below.

Chuck Grips Broken Drill Ends and Does Accurate Work

Sharply reducing operating costs by making possible the use of broken drill ends, a keyless chuck has been designed



for lathes, drill presses, portable drills and other drilling machines. The broken drills are prepared to give a rounded section for contact with an adjustment screw which takes the thrust of driving and permits the drill, regardless of size, to run on true center.

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.

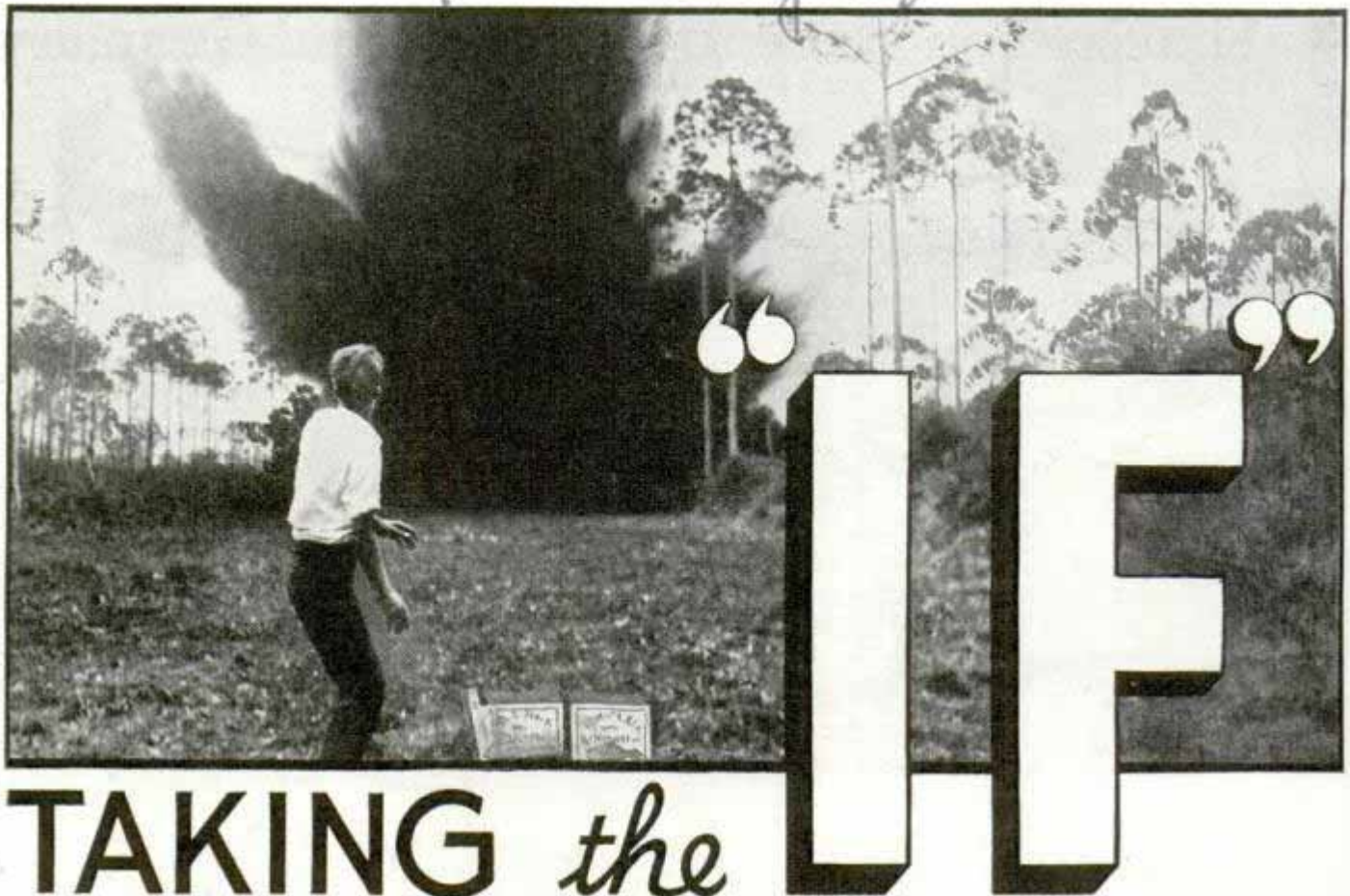
Rochester, N.Y.

Co. 1938 First City South
Pat. 1,453,838
Dr. H. Park mfg

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es 148
6.00 x 9.50
4.50

es 86 G. I. du Pont de Nemours
 & Co. Wilmington, Del.



TAKING *the* IF

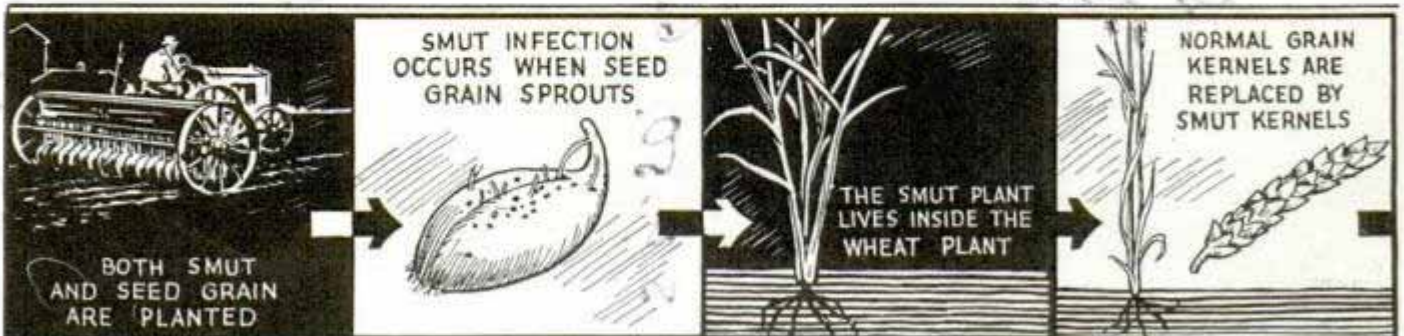
THE farmer is probably the world's greatest gambler. He has to be. Each year he assumes risks which make the wildest Wall street plunger look like a piker. His is a life of perpetual uncertainty. "If"—that's the little word that plagues him night and day.

If his seed is infected, there is no crop. If it doesn't rain, there is no crop. If it rains too much, there is no crop. If insect pests overwhelm him, there is no crop. And if he does get a crop despite bugs, droughts, hail, floods and frost, he still may lose money on it if the price isn't right.

Some of the biggest "ifs" of agriculture

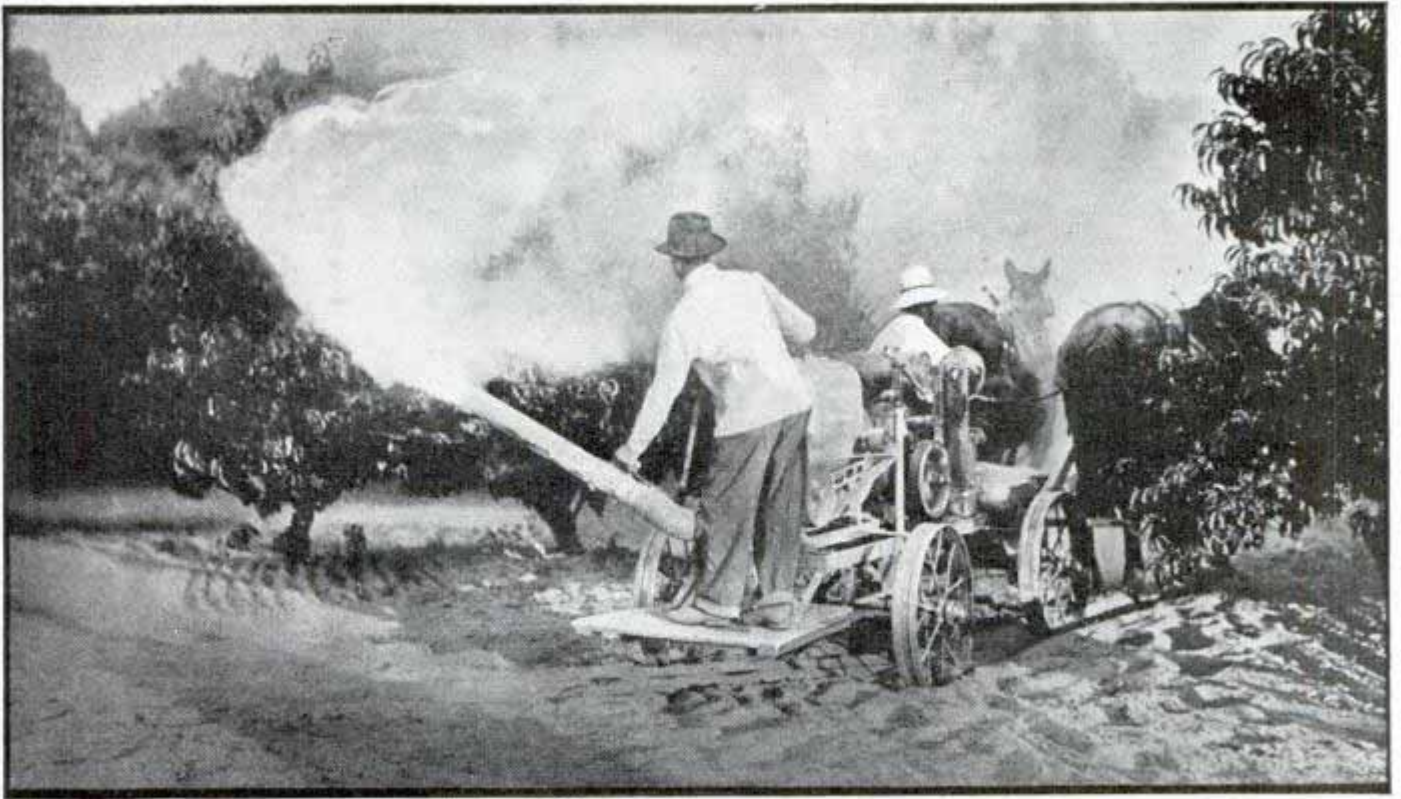
are being eliminated today by a new hired hand who is working for farmers everywhere. This hired man is the industrial chemist, a versatile chap who not only assists the farmer in raising his crop but also helps him sell it.

First of all, the industrial chemist is providing new and steadily expanding markets for farm products by finding new uses for them. By chemical skill, for example, he converts cotton into a man-made fabric, a lacquer, a plastic or some other thing of beauty and utility quite unlike the plant the farmer produced. And the more substances the chemist makes out of cotton,



Top, the agricultural engineer does his farming with a bang. With the aid of explosives, he straightens streams, digs ditches, clears land and remodels the contours of the entire farm. Below, drawings show the life cycle of wheat infected with smut and the place where smut can be stamped out by seed treatment

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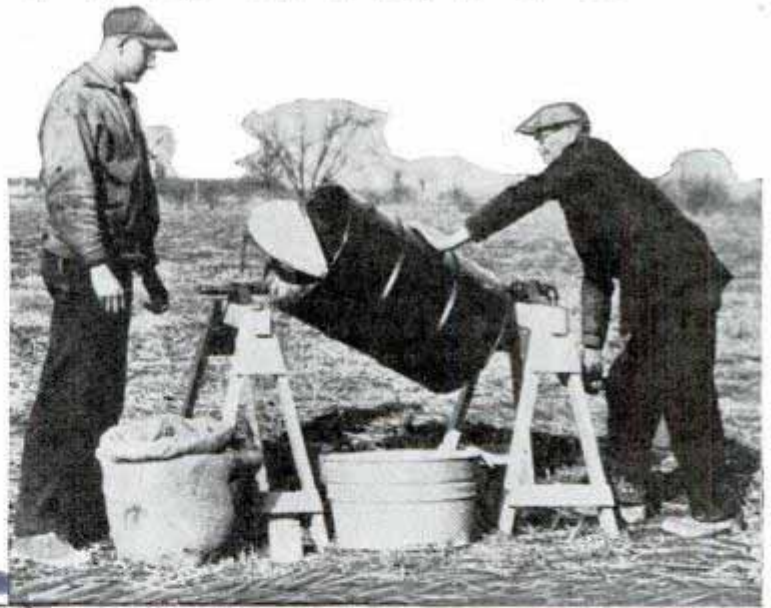
OUT *of* FARMING

the greater is the demand and consumption.

So efficient have chemists become in utilizing farm products in industry that men of vision see the day approaching when more farm crops will be consumed by the factory than are consumed as food. Feeding the world then will be only a part of the farmer's job. He will become essentially a manufacturer, turning out the raw products required by industry.

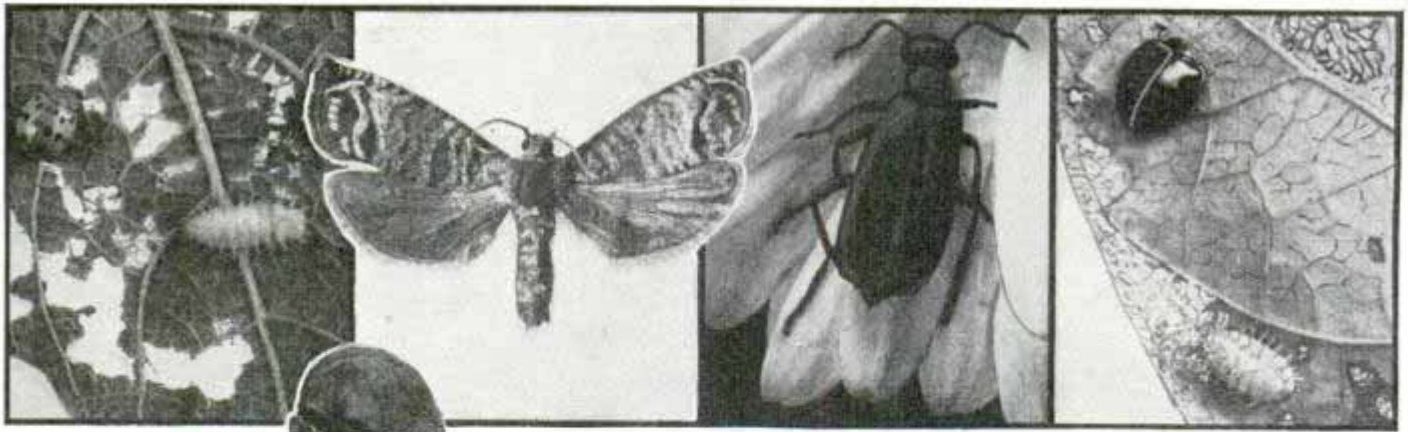
"Chemistry, especially organic

Photos courtesy E. I. Du Pont De Nemours and Co.



Top, dusting an orchard with an insecticide mixed with low-grade wheat flour which increases the adhesive property. Below, operating a homemade seed duster consisting of a steel oil drum fitted with an axle and crank and supported by two sawhorses. Seed is rolled and thrown against a mixing board and surges from end to end of the drum

Bayer Semesari
100 ...
667



Simple method of dusting small quantities of seed. Top, left to right, Mexican bean beetle, adult codling moth, black blister beetle, bean beetles at various stages of development, striped cucumber beetle and tobacco worms

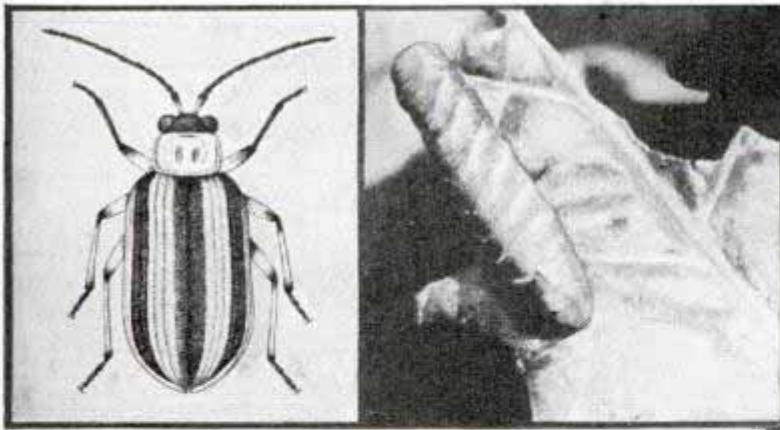
chemistry, as it is practiced today, is a science of revolution," says L. F. Livingston, manager of the agricultural extension section of E. I. du Pont de Nemours and Company. "The chemist has learned how to create, not by accidental discovery or by black magic but by cold scientific calculation based on experience and accumulated knowledge. His objective is no longer imitation or duplication of natural products, if it ever was that, but the creation of materials non-existent in nature. For example, rayon is not artificial silk but a new fiber with properties of its own. Neoprene is not a synthetic rubber but a material of totally different chemical composition that in many ways is superior to the natural product. But what is most to the

point, the chief raw materials of the organic chemist, the main tools of his trade, are organic things that grow from the soil. The organic chemical march toward change is over a road paved in large part by the products of American forests and farms."

But expanding the market for farm crops is just part of the industrial chemist's service to agriculture. He is also providing crop insurance for the farmer. Thus far, he hasn't been able to control the weather, but he has succeeded in eliminating or greatly decreasing other hazards the farmer faces. He has become, for example, the Nemesis of the innumerable pests which bedevil man, particularly the man engaged in farming.

Pests compete with man for his very existence. They attack from the air, the soil and the water, destroying man's plants, his animals, his food, his clothing, even his shelter. In order to exist, man must wage continual warfare against insects, rodents, fungi, bacteria, weeds and a host of other destructive agents. Insects alone cause an annual loss in the United States estimated at \$2,000,000,000 and losses to agricultural products caused by fungi and bacteria are estimated at \$1,000,000,000 a year. And the loss due to weeds, including actual damage and cost of control, is estimated at about \$3,000,000,000 a year. The farmer's new hired man is helping reduce these huge losses by waging chemical warfare against these and other crop pests.

Pest control with the aid of chemicals is not new. Arsenious oxide mixed with honey was used as an ant poison in the seventeenth century. In the past, however, most poisons used against insects have also been poisonous to man. Today chemists are seeking and finding insecticides of a



different kind, substances deadly to insect pests but non-injurious to man or plants.

They are seeking these dusts, sprays and repellents among organic, rather than inorganic substances, animal and vegetable products. Vegetable products in particular offer great possibilities as insecticides either directly or as the starting point for the preparation of synthetic compounds. Many insecticides used today are derived from such plants as tobacco, pyrethrum, cube, hellebore, larkspur, quassia, red ce-



dar and other plants from which essential oils can be obtained. The finding of rotenone, highly toxic to some insect pests but of low toxicity to animals, in the devil's-shoestring indicates how common weeds yield insecticides. Thus chemistry puts one pest to work eliminating other pests.

Many of the most destructive plant diseases are transmitted on, in or with the seed and one of the chemist's most important services to the farmer has been the development of seed disinfectants and also soil disinfectants to control certain soil-borne diseases of plants. Accident was largely responsible for teaching man how

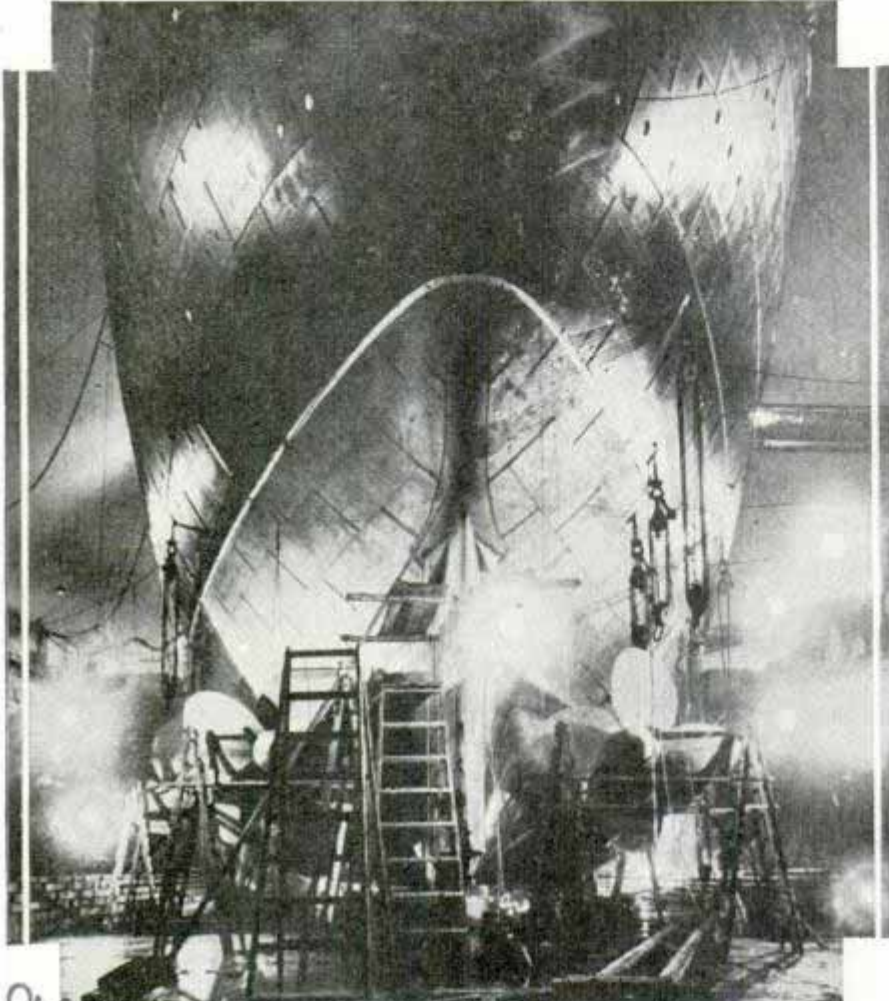
(Continued to page 156A)



Top, treating seed potatoes with aid of wire basket and barrel of solution. Center, meandering stream before it was straightened with aid of explosives and afterward. Bottom, cost and profit on cotton as result of seed treatment

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Floodlights on 'Queen Mary' Speed Up Dry-Dock Work



While the "Queen Mary" was being prepared for another season, this unusual photo was snapped, showing the big ship in dry dock

Repair crews worked night and day to hasten the great liner's return to transatlantic service when the "Queen Mary" was being overhauled recently in dry dock at Southampton, England. Each night a battery of floodlights illuminated every part of the mighty ship where work was going on, almost turning night into day.

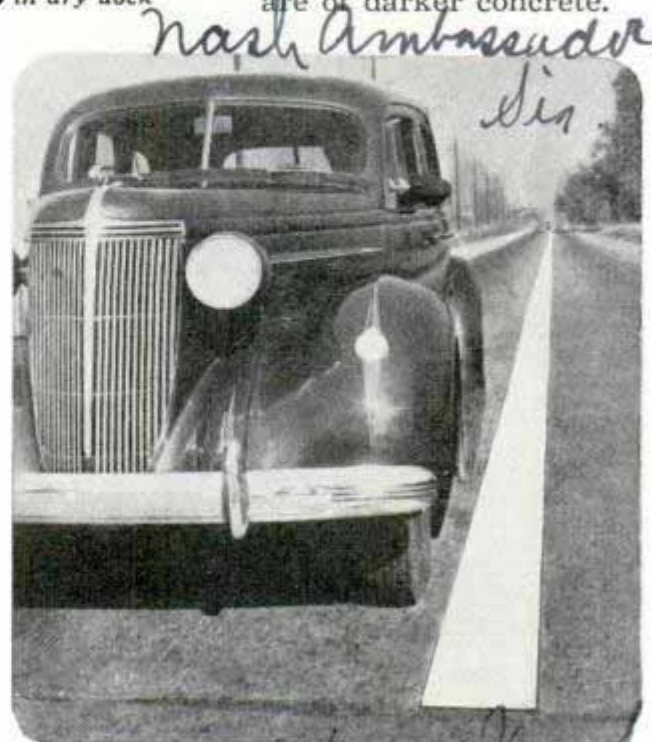
wire in the fog indicator responds quickly to this temperature change, lengthening and closing a contact that sends a signal to observers below. By night it lights a lamp by day it explodes a cap or releases a small parachute. Calculating with a theodolite, the weather observers estimate the height of the warm-air layer and predict the arrival of fog or cloud.

White Concrete Is Permanent Road Marker

Eliminating the necessity of repainting the center traffic line on highways, a white concrete strip is built into the latest road pavement as a permanent marker. Since this line will not fade or be erased by the tires of passing cars, the new construction is regarded as a safety factor. The traffic lanes on either side of the marker strip are of darker concrete.

Fog Finder Carried by Balloon Foretells Low Visibility

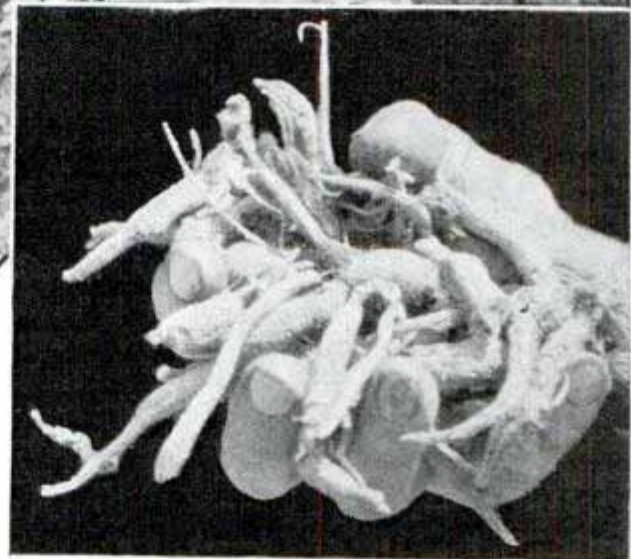
When foggy weather is on the way, weather bureau balloons can forewarn airmen several hours before visibility is bad. In some regions, particularly along the Pacific coast, a warm layer of air several thousand feet high means fog is coming. If the balloon during its ascent strikes a zone of rising temperature, a fine Nichrome



Nash Ambassador
Donor from Nash
Vol. 9 Motop

Gathering Wild Roots Is Odd, Lonely Job

While financial returns are not large, gathering wild roots, herbs and barks is a fascinating job which enables its follower to make a living and keep healthy. It's a lonely occupation because the quest requires trips into the remotest woodlands.



Two gatherers of herbs and roots at their lonely occupation. Bottom, right, a handful of roots before being prepared for sale

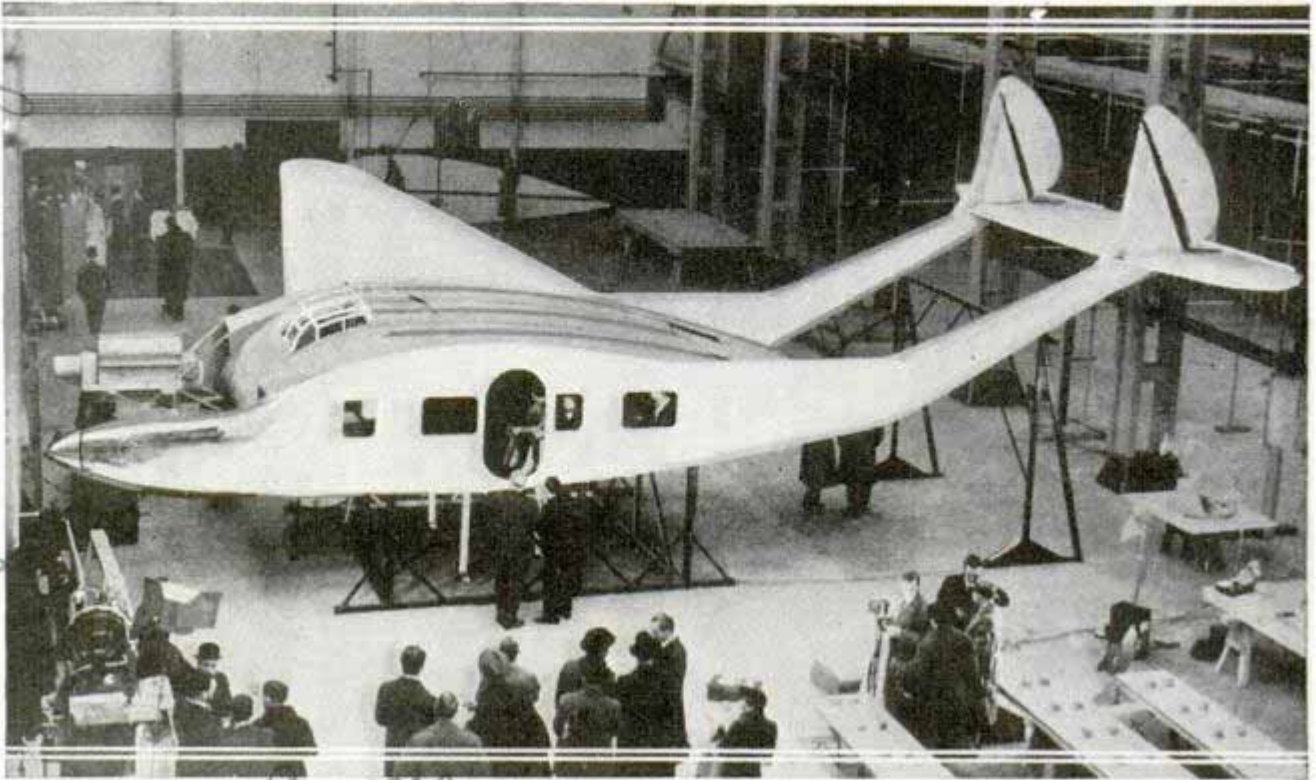
With bag over one shoulder and small grubbing hoe in hand, the root gatherer trudges wherever he knows certain plants may be expected to grow. There are in the United States more than 250 species of roots, barks and herbs of value in the manufacture of drugs. They range from the common dandelion to the almost extinct ginseng, golden seal or snakeroots. Leaves from the deer's-tongue plant are used in flavoring smoking tobacco. Roots and bark from the sassafras bush are used in making medicinal tea and perfumes. One wild herb is necessary in the manufacture of a silverware polish. The business is regarded as important by the government, which issues bulletins on the drying of medicinal herbs and the growing of ginseng, golden seal and the mints. Many common plants, regarded by most people as weeds, such as ironweed, mul-

lein, jimson weed, yellow dock, burdock and pokeweed, have a sale value. Often the root gatherer supplements his income by picking up and selling Indian relics, wild ferns and other plants and rare stones for rock gardens. One root gatherer in northern Indiana collects snakes for carnival performers. Now and then he sells information to lumber buyers on the location of trees in the country through which he plies his trade. Frequently the root gatherer lives in a shanty boat from which he makes side trips, then floats on down stream to a new location.

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

Fast Air Liner to Compete in Atlantic Race

Under construction at Southern Aircraft and Engineering Co. London, England.



Here is racing plane under construction, as it was being prepared for New York-to-Paris dash. Note that the left wing has not been installed. Unusual streamline effects have been achieved in this air liner

Equipped with a power plant which will give a speed of 225 miles per hour while operating at eighty-three per cent capacity, a big air liner has been prepared to represent England in the New York-to-Paris air race. The ship is expected to make the trip in fourteen hours. Weigh-

ing 15,000 pounds, the plane has two rudders, one at the end of each section of the divided fuselage or tail. A large cabin, with the pilot's compartment located at its front, is built between the wings and the two tail sections. The design of the ship is unusual for air liners.

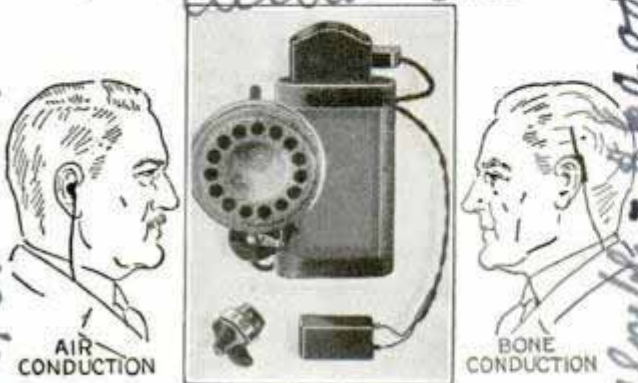
Tiny Earphone Fitted to Wearer Gives Better Service

Hard-of-hearing persons may select the earphone which enables them to hear the most clearly by using a fitting machine developed recently. By pressing small switches controlling transmitters, receiv-

ers, amplifiers and bone-conduction instruments the individual determines the proper combination. Then the company builds the earphone in accordance with the results of the tests. One of the latest developments in the same field is an electrical earphone which operates on a small flashlight battery which can be purchased at any hardware store for fifteen cents. This battery is tucked away in a case beneath the microphone so that the instrument is all in one piece. The new earphone weighs only seven ounces, small enough to be slipped into a man's vest pocket. Instead of a heavy amplifier on top of the battery the phone has a twin microphone, eliminating a booster. A single cord leads from the midget receiver which will fit into the orifice of any ear.

Standard Acetate \$40.00 to \$45.00

Electro-Ear



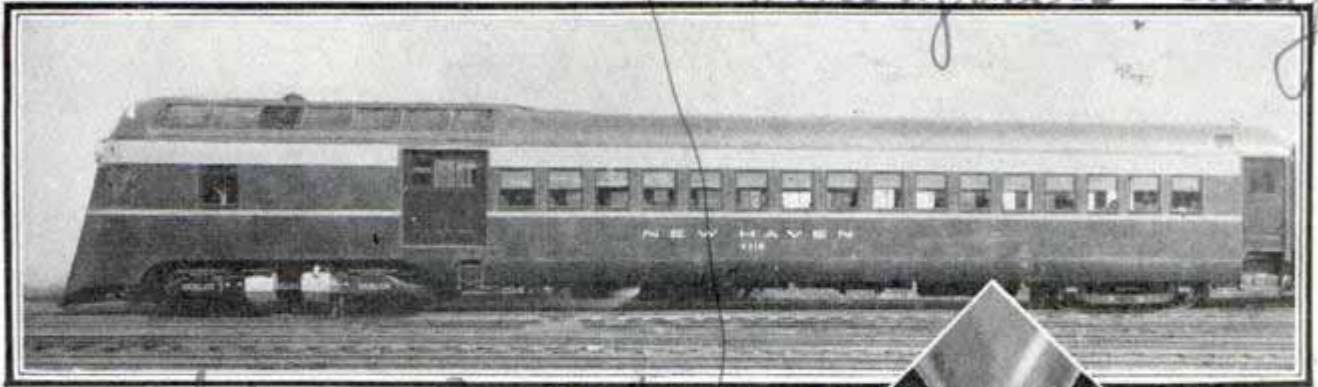
Small earphone to aid hearing. Left and right, two types of phones available

Double \$10.00 to \$15.00

American Earphone Co. 118 4th and New York

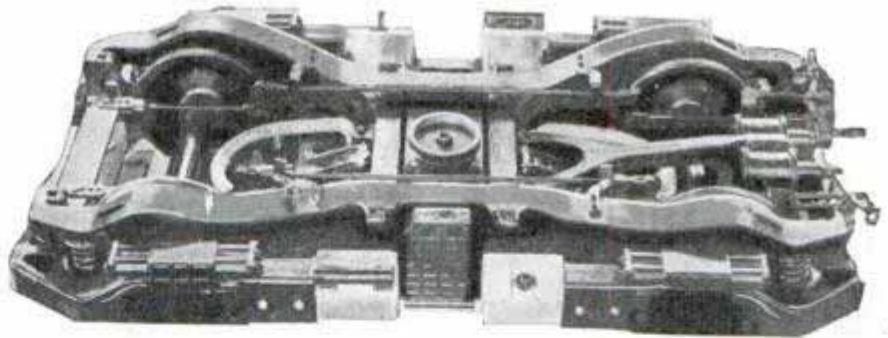
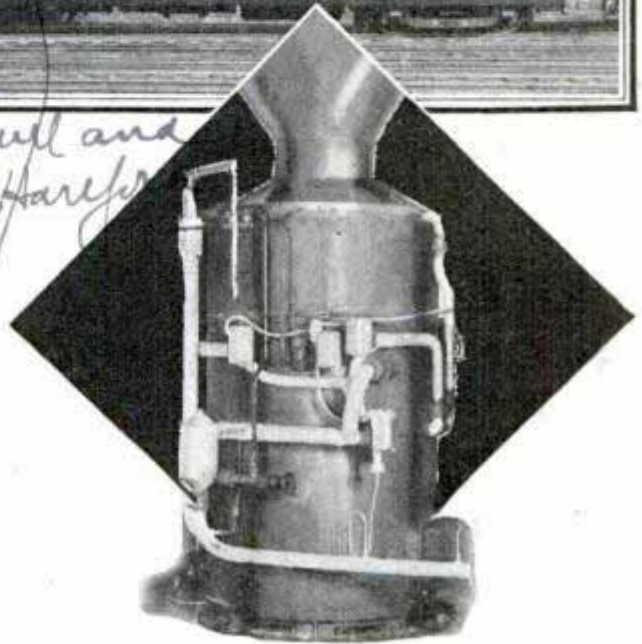
Besler Systems, 4053 Harlan St Emeryville, Calif.

Two-Car Streamline Train Is Driven by Steam



Between Bridgeport and Hartford

Two old railway coaches of the New York, New Haven and Hartford line have been converted into a modern streamline train driven by a high-pressure steam plant installed in an eight-foot space in the forward end of the front car. The two-car unit, with its compact steam engine and power truck designed by Besler Systems, replaced a steam locomotive more expensive to operate, a baggage car and two coaches. It was chosen as lighter and less costly than a Diesel-electric power car. The boiler, heated now by oil but convertible into a coal burner, automatically keeps steam pressure at 1,200 pounds, which is delivered to two high-pressure and two low-pressure cylinders located directly on the power truck. Steam first enters the high-pressure cylinders, then passes to the low-pressure cylinders, doing double duty; then it goes to the condensers on top of the train and repeats the cycle. Water enters the boiler at the top, passing down through pancake coils where it is heated, then boils in the helical coils at the bottom, surrounding the combustion space, passing on to the superheater coils above the firebox



Top, rebuilt railway coach with compact steam power plant installed in streamline forward end. Center, type of boiler used. Below, power truck

and emerging as superheated steam. Working pressure can be obtained from a cold boiler within four minutes. The train, which has driving controls at both ends, has reached eighty-two miles an hour. The engine delivers 500 horsepower.

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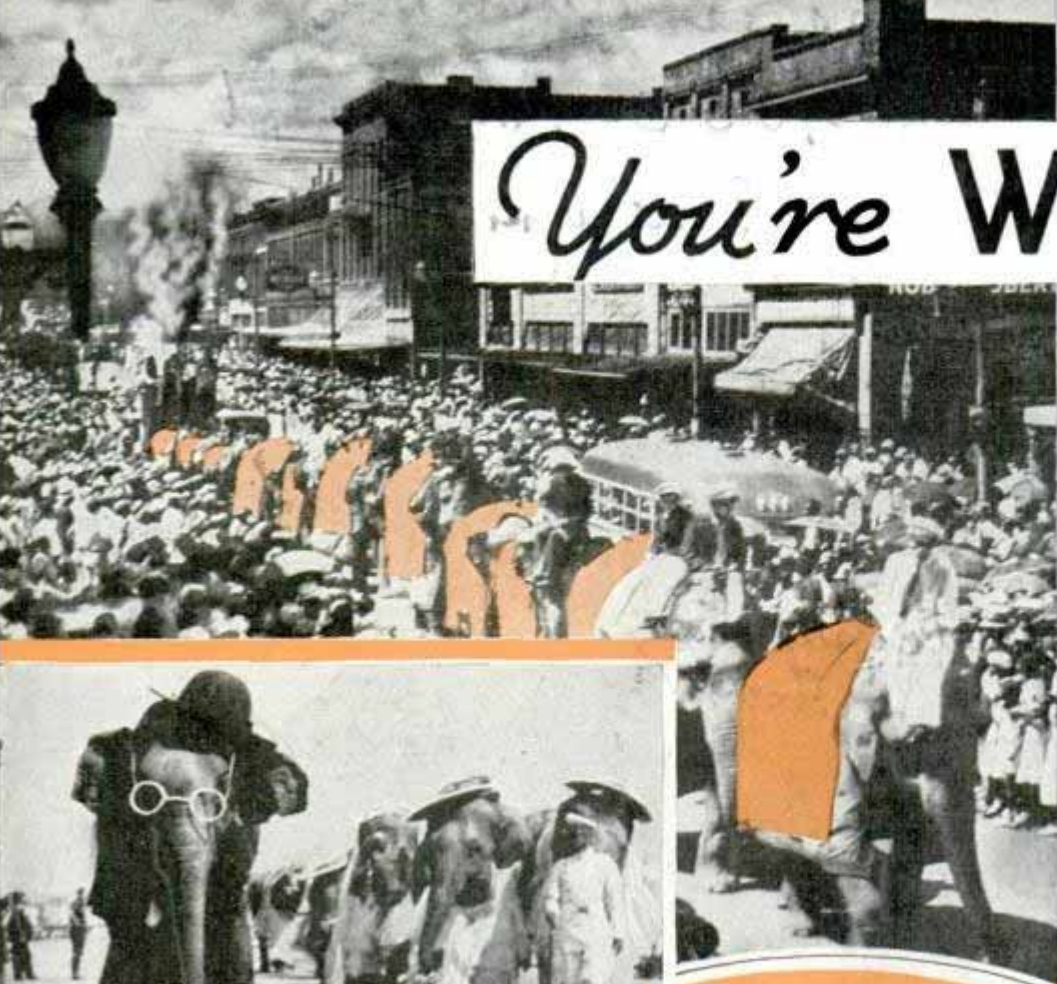
Age Cools Electric Heaters as Wires "Grow" in Length

If your toaster, percolator or iron seems to take longer to heat than it did when first purchased, it may be the result of "growth" of the alloy wires used as heating elements. This growth occurs in all

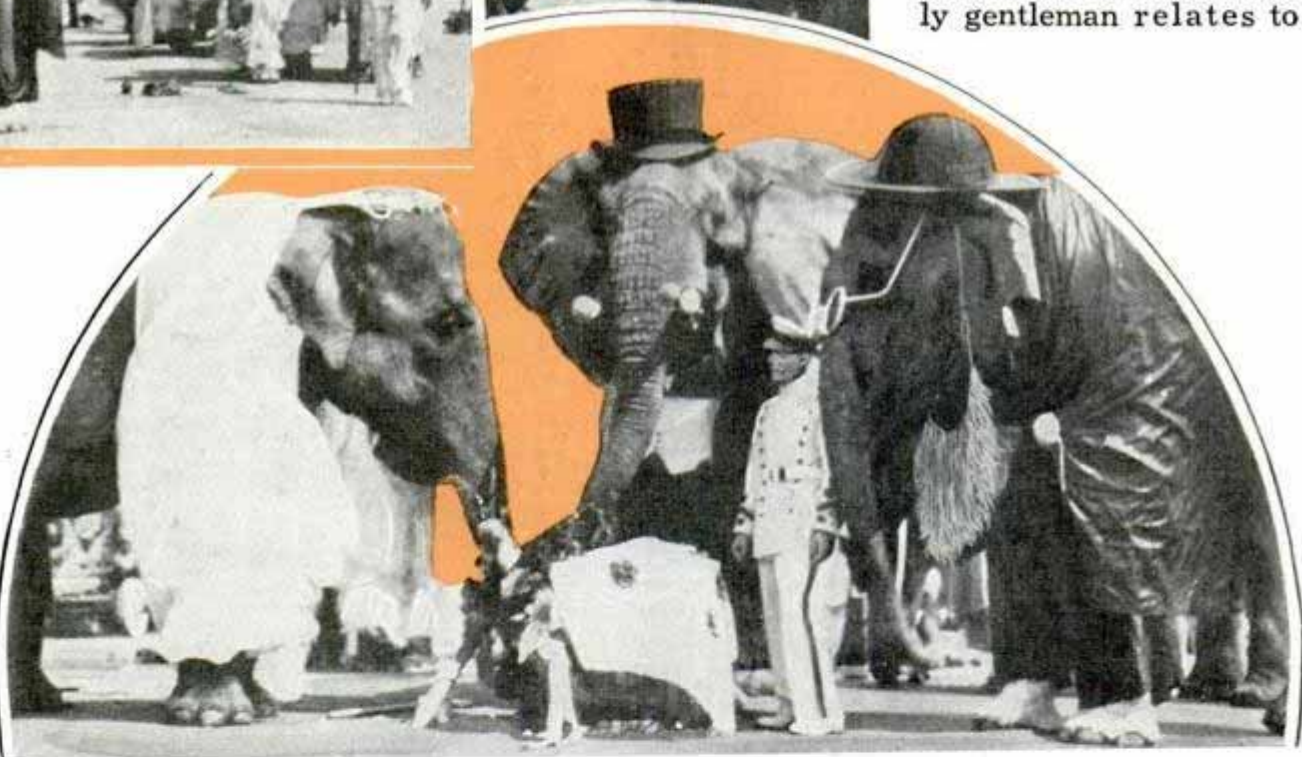
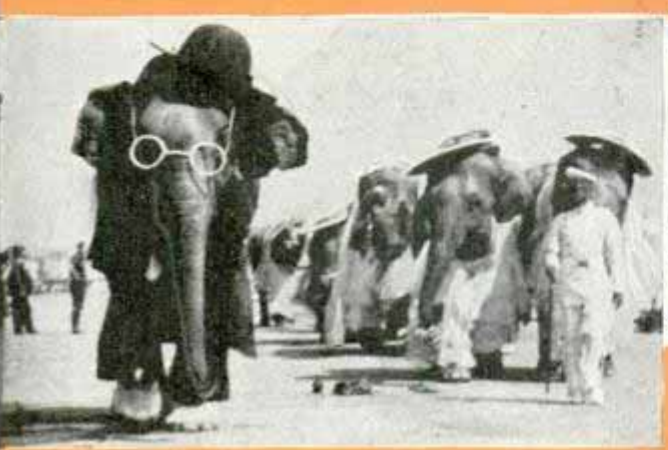
resistance wires, but is more pronounced in certain alloys used in inexpensive heating elements. The wire lengthens, building up resistance and cutting down wattage and heat.

Wilbur B. Sluice Co, Newark, N.J.

You're WRONG



derms. Despite this strong bond of friendship, however, the public probably knows less about elephants than about all other animals of the menagerie. A young man in the crowd explains to his girl friend that an elephant will bludgeon anyone who feeds him tobacco; a farmer tells his wife the big beasts live in mortal fear of cats, dogs and mice, particularly the latter which have a penchant for running up elephants' trunks; an elderly gentleman relates to



Top, elephants on parade—the big attraction of the circus. Center, wedding march of "Jumbo 2nd" and "Miss Ragoona." Bottom, another view of the elephant "wedding" party

By Eddie Allen

Veteran Animal Trainer

THREE-QUARTERS of an hour before the start of the big show the crowd moves gradually from cage to cage toward the elephant line—and stops. Here the circus fan, armed with a sack of peanuts, renews old acquaintances with the pachy-

his grandchildren their wonderful powers of memory, and someone else comments on the toughness of their hides.

I have spent fifteen years working, training, and studying elephants, and the opinions I have formed are decidedly contrary to popular beliefs.

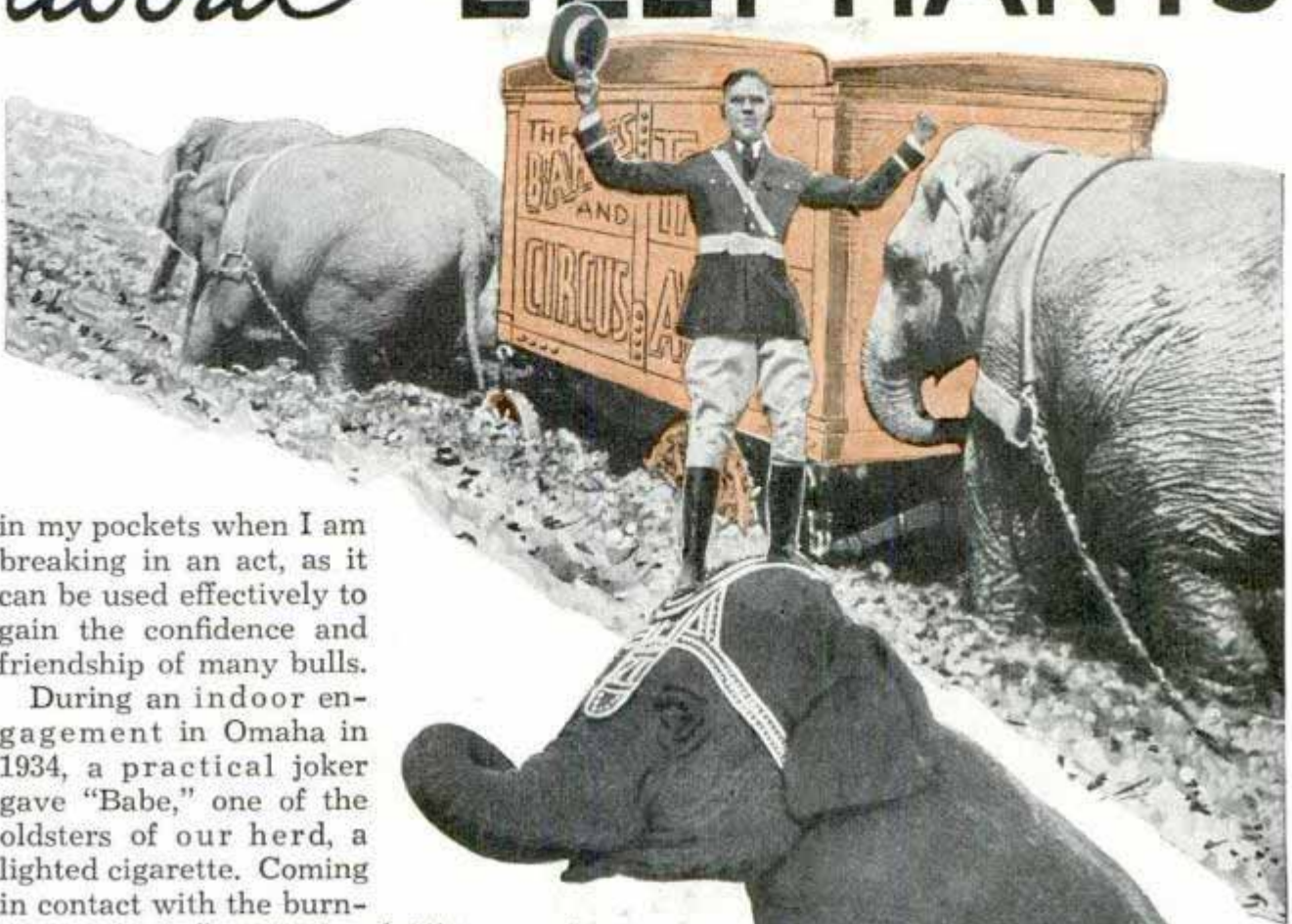
Elephants, especially the males, love tobacco. I make it a point to have tobacco

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Chief elephant trainer,
Cole Bros. Circus

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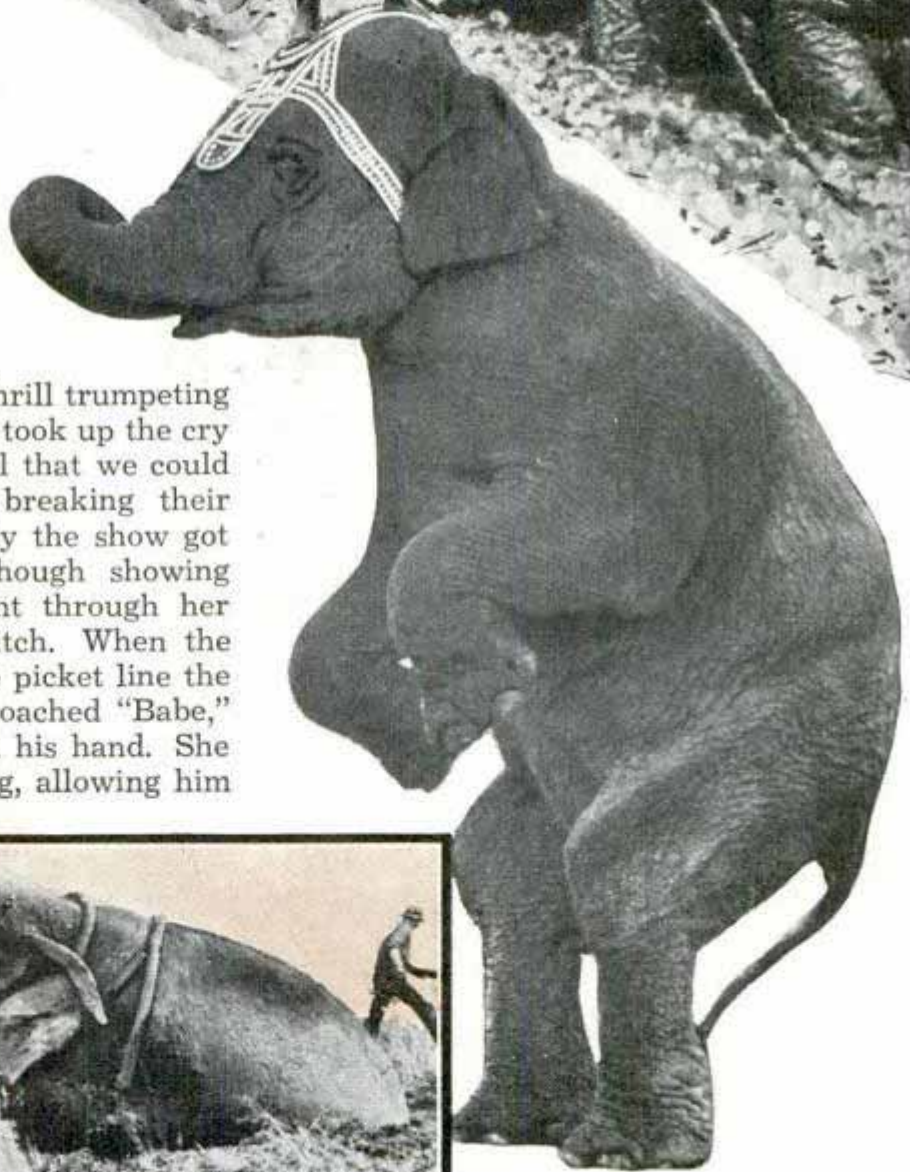
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ELEPHANTS



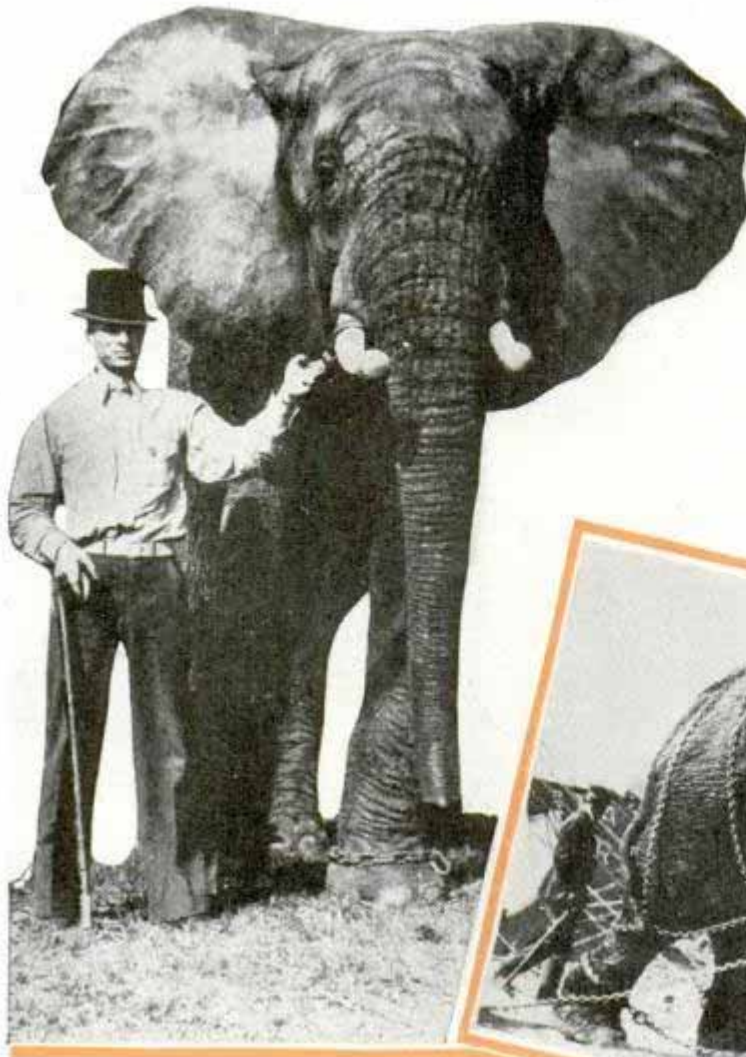
in my pockets when I am breaking in an act, as it can be used effectively to gain the confidence and friendship of many bulls.

During an indoor engagement in Omaha in 1934, a practical joker gave "Babe," one of the oldsters of our herd, a lighted cigarette. Coming in contact with the burning tip "Babe" emitted a shrill trumpeting blast. The other elephants took up the cry immediately and it was all that we could do to keep them from breaking their chains and bolting. Finally the show got under way. "Babe," although showing signs of nervousness, went through her performance without a hitch. When the bulls were returned to the picket line the practical joker again approached "Babe," this time with an apple in his hand. She accepted the peace offering, allowing him



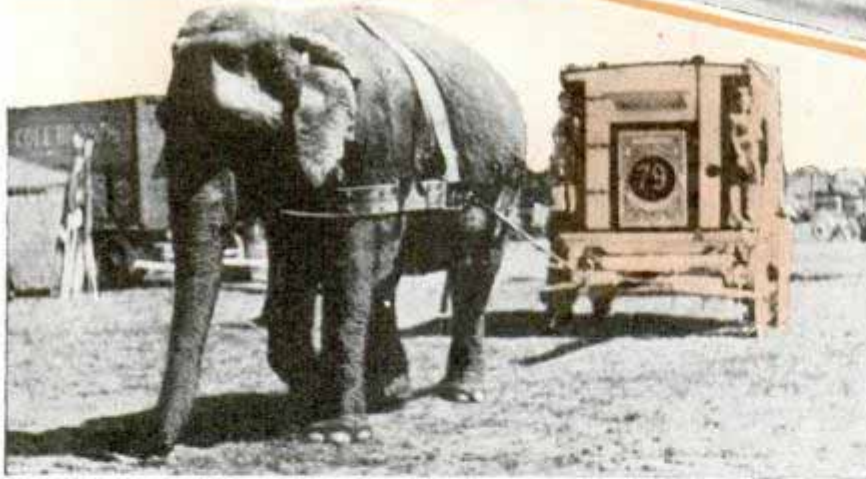
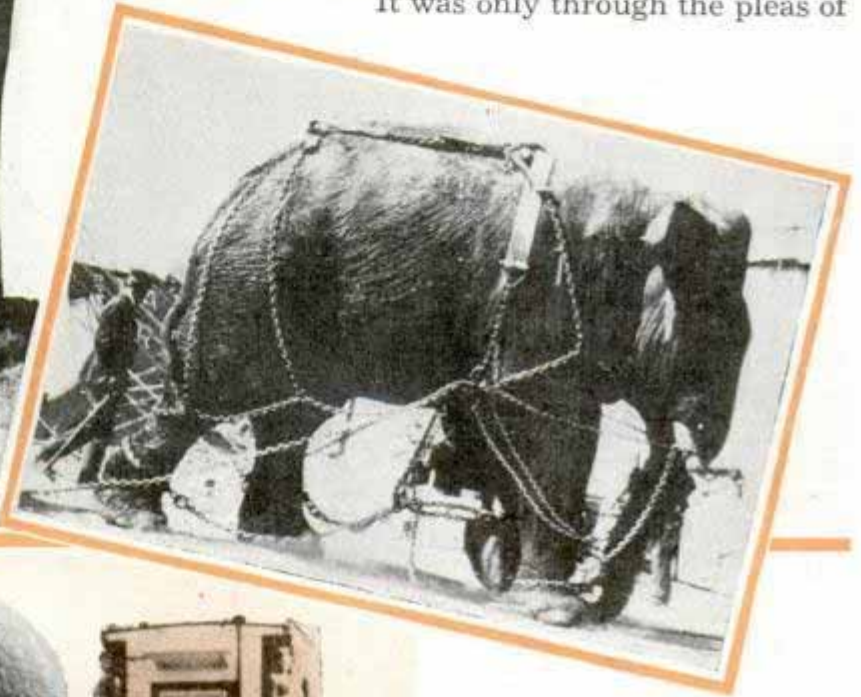
Top, elephants to the rescue, pushing circus wagons out of mud. Center, performance of this act calls for months of patient training. Bottom, big bull wallowing in mud, a delight to any elephant

*Capt. James M. Sullivan, 431
 Ill. 60th Service, City M*



phant carrying a grudge makes no effort to conceal it and when his enemy comes within striking distance he will slap him with his trunk until he is on the ground and will then proceed to do a headstand on the victim's chest. But "Willie" would bide his time until he would catch his victim off guard. Then in a twinkling he would wrap his trunk around the person, lift him to his mouth, and crush his skull. Seven persons fell victim to his treachery.

It was only through the pleas of



Top, Trainer Allen with "Jumbo." Center, "Tusko," giant Indian elephant, in chains. Bottom, animal den being pulled into menagerie tent by working elephant

to pat her, and they became good friends.

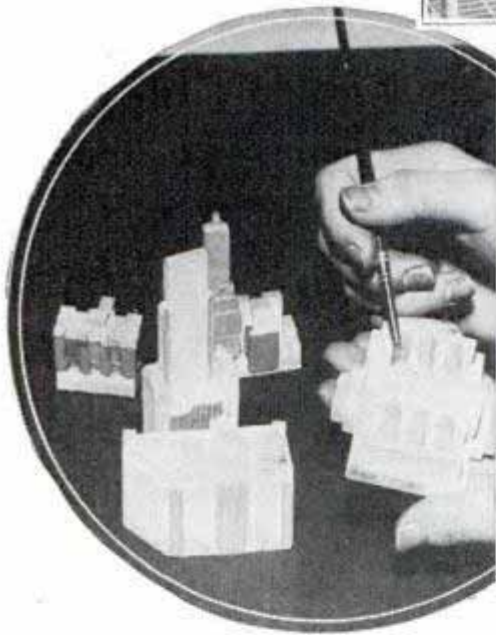
This instance upsets the theory that elephants have remarkable memories. There have been cases where they evened up old scores years later, but their memories are no better than those of other animals. They may remember their routines but not human beings. Evidence of this is shown in the case of "Willie," the gangster bull. "Willie's" tactics were different from most of his kind. The average ele-

his trainer that he was saved from the firing squad. This particular trainer, who had repeatedly befriended "Willie" in many other ways, left the circus for a short time and upon returning to the lot approached him, thinking "Willie" would remember him. As he drew near "Willie" knocked him down and wrapped his trunk around his body. Only the intervention of the entire menagerie force saved him.

(Continued to page 127A)

How Chicago Looks from 10,000 Feet in Air

Stand beside a thirty-eight foot table in a Chicago office and look down at the miniature city spread across the board. You see Chicago as you would see it from a balloon 10,000 feet up. It is a city carved from balsa wood: 387,426 tiny wooden models colored and carved to scale representing the 387,426 buildings in Chicago. If you live there, you can find your own street, the house you live in, the garage where



Above you see Chicago as you would see it from a plane 10,000 feet over city. Left, brushing the finishing touches on tiny model of big museum, and setting downtown section, studded with skyscrapers, into its place in vast diorama comprising 387,426 buildings and covering 836 square feet

you keep your car. This vast diorama, just being completed, measures thirty-eight by twenty-two feet, built on a horizontal scale of 300 feet to the inch and a vertical scale of one-eighth inch for the first floor of a building and one-sixteenth inch for every additional floor. The houses, apartments, factories and offices are colored according to building material; red for brick, white for stone or concrete, yellow representing wood. A field force gathered data, then the balsa models were made from drawings. The relief map is of value to engineers making studies of traffic, railroad terminals, school sites, fire protection, airports, street improvement and utility company services.

Fruit Juicer in a Quart Pitcher Is Handy on Breakfast Table

To obviate the trouble of emptying a tiny bowl several times for one or two glasses of juice, a citrus fruit juicer that holds a full quart has been introduced. It



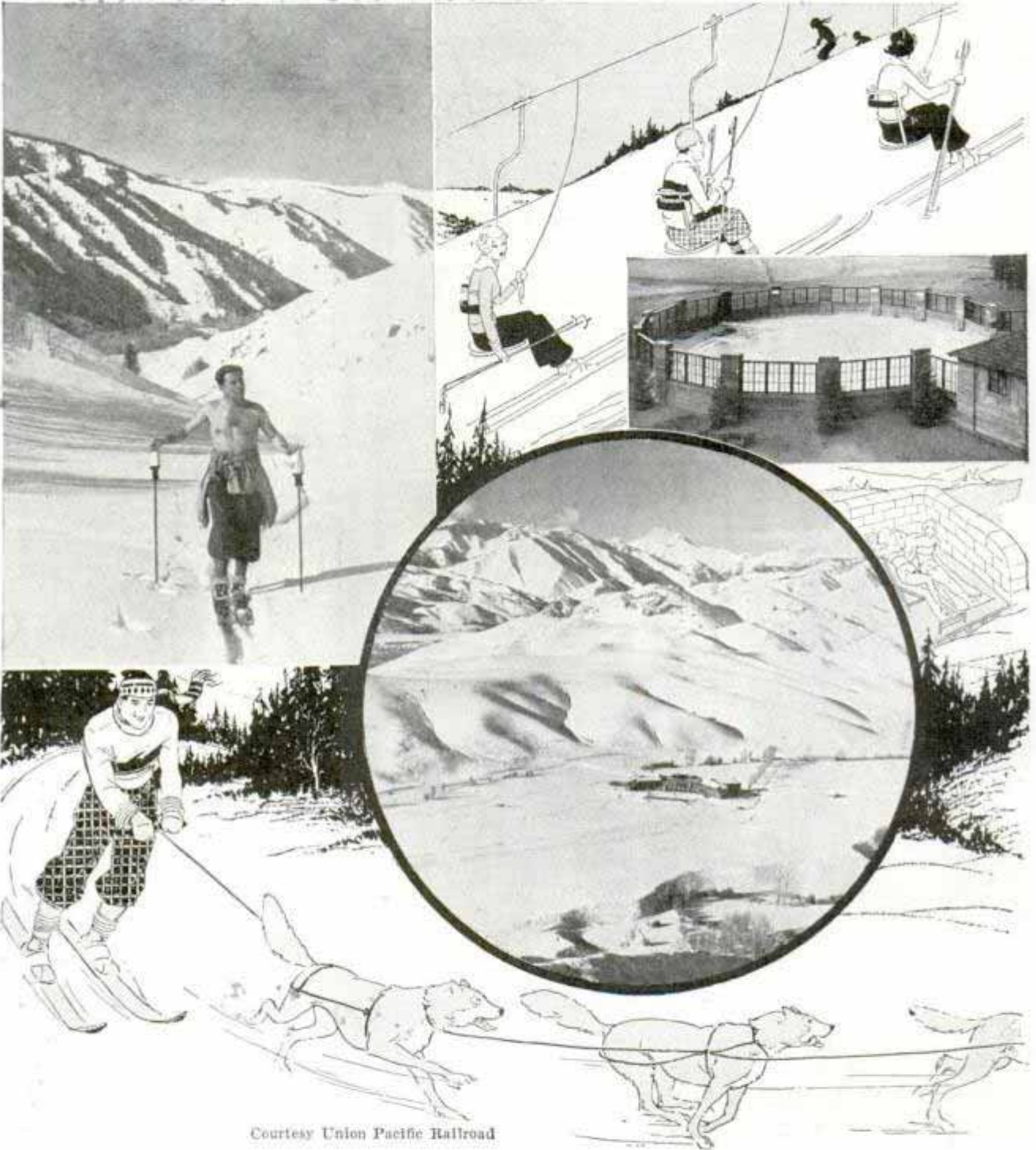
is a sturdy pottery pitcher containing an integral, scientifically constructed juicer. Gracefully designed and available in several colors, it adorns the breakfast table.

Bauer Pottery Co.
Los Angeles, Calif.

Best: Calypso Hardware Co.
Los Angeles, Calif.

Sportsmen Ski or Swim in Idaho Winter Resort

Swim Valley Lodge, Ketchum, Idaho



Courtesy Union Pacific Railroad

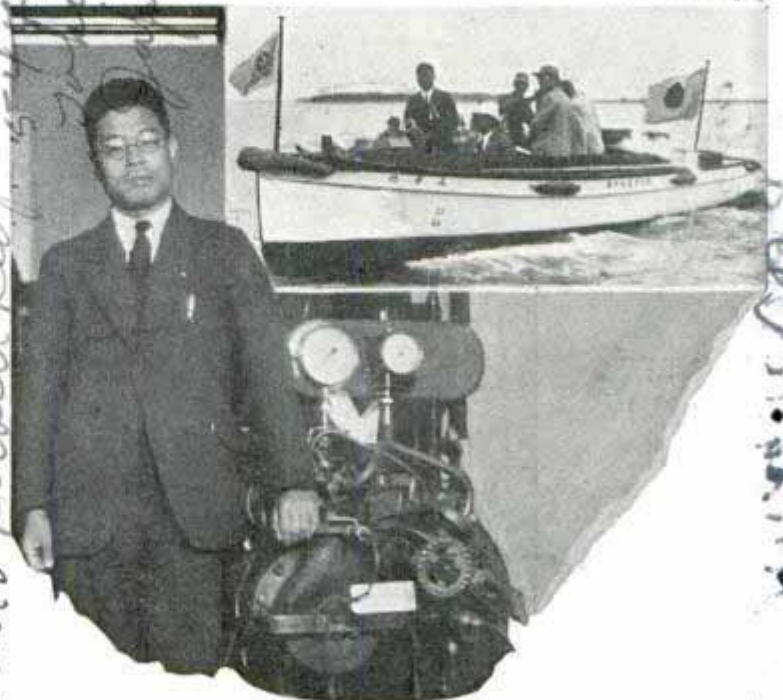
New winter resort in Idaho offers sunbathing on skis and in open "igloos," trolley seat to take skiers up mountain, and midwinter swimming in outdoor pool shown above at right, fed by hot springs

Swimmers splash beneath a February sun, skiers strip to the waist to glide over snow trails, winter meets summer in the Sawtooth mountains of Idaho where an outdoor sports center has just been opened. It is located in a valley near Ketchum, sheltered by an east-and-west mountain range from cold northern gales, and with a climate compared to that of the Swiss winter resorts. Adjacent to the new hotel

is an open-air swimming pool fed by hot springs and protected from wind by a glass wall. Cable-suspended lifts haul skiers up the mountainside with ease to a point 1,500 feet above the lodge where a two-mile run begins: The ride up is effortless, for chairs are hung on the moving cable at intervals and the skier simply grasps a rope suspended six feet ahead of the chair and eases himself into the seat as it comes

along. The chairs travel 400 feet a minute. There is also a ski tow or dragline which pulls the skier about 3,000 feet up a narrow valley to meet the chair elevator line. Three-sided "sunroom" igloos permit visitors to acquire a winter tan with daily sun baths, and winter sportsmen go in for sleigh rides, skating, and skiing and sledging with dog teams.

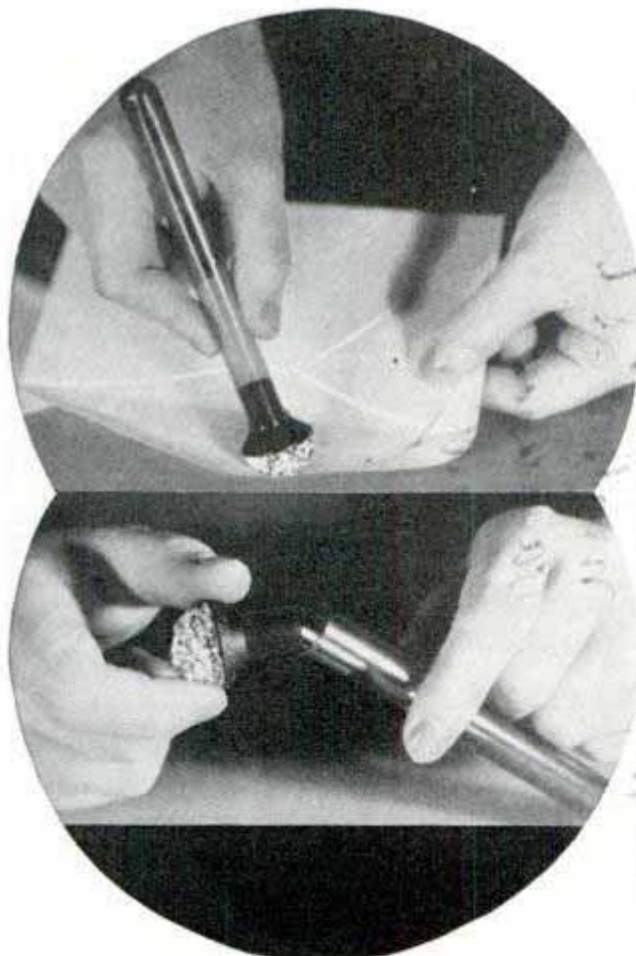
Engine Driven by Liquefied Air Propels Launch on Test Run



Inventor with liquefied-air engine. Inset, boat on test run. Note white cloud (near flag) of escaping air

Envelope Flap Moistened with Sponge Fed by Tube

For moistening envelopes and labels, the latest tongue-saving device is an unbreakable tube in which a vacuum mouth of sponge rubber is fitted. When the fingers press the tube vertically, the sponge draws moisture from the tube and applies it to the label or envelope flap. When pressure is released, the water automatically returns to the reservoir.



Pressing sponge rubber cap applies moisture to envelope. Vacuum cap is removable for refilling

Evaporation of liquefied air propels a twenty-seven foot launch equipped with a two-cycle engine invented by Jiro Okada of Japan. The engine, which operates under a pressure of forty atmospheres at a temperature of 100 degrees centigrade below zero, does not exhaust the air as it is vaporized, but liquefies it again. Hence the operation is almost continuous, except for the small quantity of air which must be introduced to make up for leakage from various parts of the power plant. The engine consists of a container of liquefied air, a pump, a vaporizer, a prime mover and a liquefier. The liquefied air is vaporized and forced into the engine cylinders under high pressure, where it causes the pistons to rotate the crankshaft.

Twenty Thousand Ice Cubes Cut in Hour by Machine

Capable of turning out 20,000 one and one-half inch ice cubes per hour, an automatic machine has been developed to meet demand for cubed ice. It is operated by feeding a full-size block of ice into the carriage. A twelve-inch saw cuts off the cubes and they pass down a chute.

Hydraulic Mfg. Co.
Des Moines, Ia.

City of Cleveland
Cleveland, Ohio

Jiro Okada, Building Engineer
 to Shunryu Iwami, Chamberlain

Es/28
 Emb. Perker...

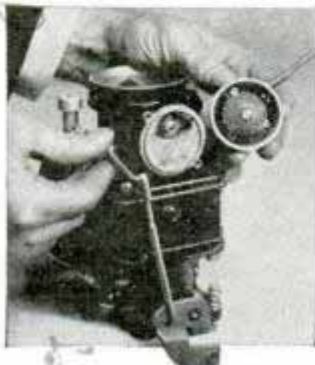
Propeller with Single Blade Is Fast and Steady



It looks like half a propeller, but this single blade outdoes performance of conventional type

Tests of a single-bladed propeller invented by a Baltimore aviation engineer indicate that it has far greater climbing power and speed than the traditional twin-bladed or triple propeller. It appears to be only half of a conventional propeller, a wooden blade set in the hub, with only a stub opposite it. In actual flight, an airplane equipped with the single blade took off in four and one-half seconds compared with nine seconds with its regular propeller, climbed one-third faster, and was twenty-five per cent faster in the air.

Electric Choke on Auto Engine Reduces Stalling

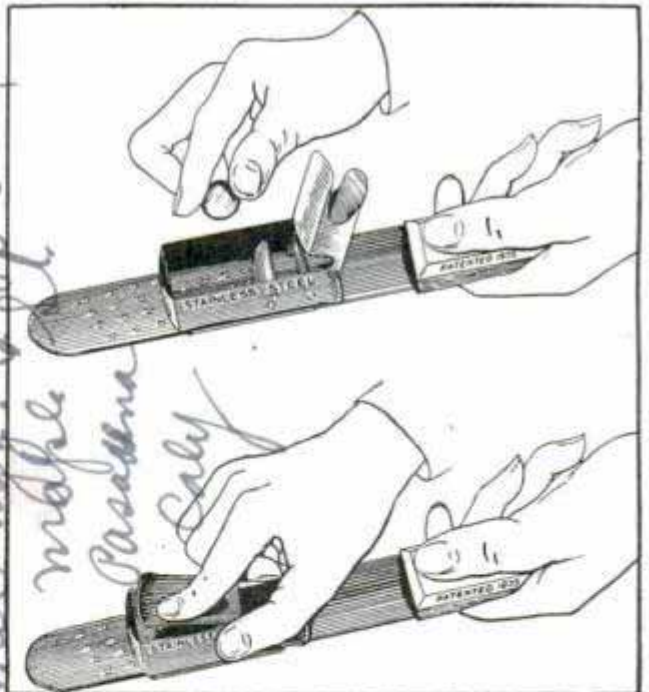


Fitted with an electric element which supplies heat for the thermostatic spring controlling the carburetor's butterfly valve, the latest automatic choke is positive

in action. Formerly heat from the exhaust manifold was used as a source of energy to open and close the valve. The electric unit, supplemented by the action of the thermostat, reduces stalling by preventing the choke valve from opening suddenly when air rushes against it after the engine is started. Thereafter the control permits only a gradual opening of the valve until the motor is warmed up. The heating element remains hot all the time the engine is running and thus causes the valve to stand open, reducing the possibility of flooding. When the ignition key is switched to off position the electric choke control cools off and allows the choke valve to close gradually until it is in the proper position for starting a cold engine quickly.

Combined Shredder and Grater Handy in the Kitchen

Providing a means of shredding small vegetables and grating the peel of citrus fruits, the latest kitchen tool is made of stainless steel and long-wearing maple



Two views of handy kitchen tool. Bottom, tool in use as vegetable grater

handle. It slices and minces garlic pods, onions, pimentos, green peppers, carrots, mushrooms, reduces nuts of all kinds and grates orange and lemon peel to the thinness desired. By separating the carriage from the handle, the whole lemon or

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Handwritten notes on the right margin:
es 126
es 78

orange may be grated, the curvature of the blade fitting the outside circumference of the fruit. The utensil is ten inches long, complete with its concave blade.

es 64.
Powerful Streamline Engines to Haul Fast Trains on Coast

es 64
Small Tractor Meets Needs of One-Man Farm

Designed to meet the needs of truck gardeners and operators of small farms, a light two-wheel tractor handles standard implements in preparing the soil and in harvesting the crop. It has a gasoline engine, automobile transmission and differential, wheels equipped with special tread tires to improve traction and may be converted for certain jobs by installing lug chains. Built of standard parts the tractor has a surplus supply of power which makes it possible for the operator to ride while cultivating. Normally the operator walks, guiding the plow. Operating costs are said to be five cents per hour.

es 64
James Sawyer
Myrtle Creek, Oregon



Lined up for exhibition on four parallel tracks are the first of a fleet of streamline locomotives for California passenger service



Farm tractor ready for plowing

Rated among the most powerful locomotives in the world, a fleet of streamline engines has been built to pull the fast passenger trains between San Francisco and Los Angeles on the Southern Pacific railroad. These steam locomotives develop 4,500 horsepower and have a top speed of ninety miles an hour. Accenting their racy lines are red and orange stripes, which are carried out the full length of the new trains.

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 64.
Kulter King
700.5 N.W. 114th Ave. Portland, Ore

F1691.

CAMERA SHOTS *that*



newspapers and magazines. You have—or you can get—what it takes. It takes a helping of ingenuity, three helpings of experience; an eye for composition, and a wide eye to spot photographic “game” worth shooting; some knowledge of tricks you can teach your camera. Besides that, about



Acme

YOU might have been burned as a witch a few score years ago for producing out of a little black box the startling effects you can achieve with your camera today.

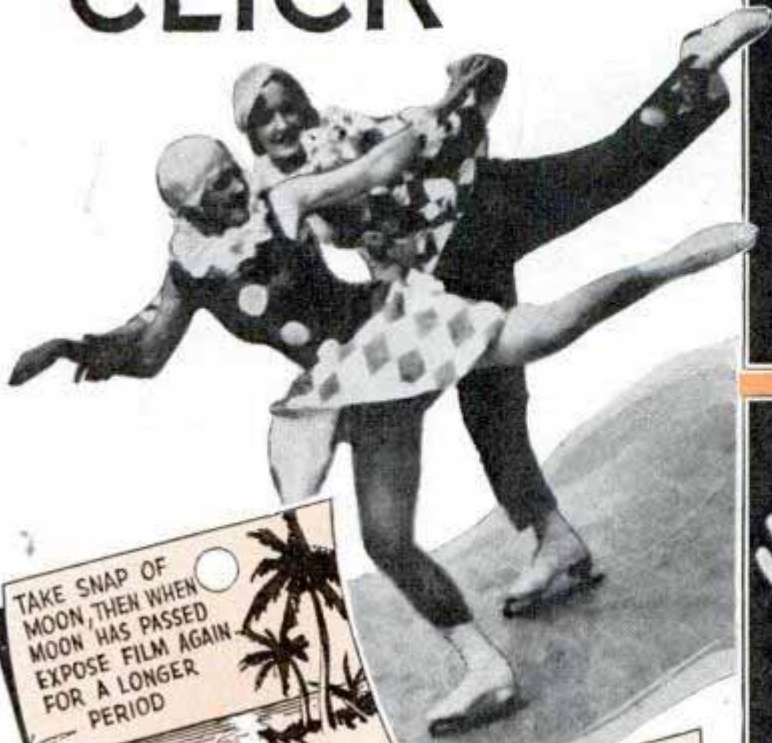
Instead of pulling a rabbit magically out of a hat, you can put a rabbit into a hat that wasn't in the picture by a bit of photographic legerdemain; introduce glorious clouds to enhance a landscape taken on a dull day; hang a full moon in a moonless sky or “shoot” the family clustered about the fireplace, their faces alight with the glow from a blaze that hasn't been started.

Simple tricks, all of these. It doesn't take costly apparatus, hundred-dollar lenses and intricate attachments to make “show” pictures—those shots that bring prizes at exhibitions and earn money in the news columns and roto sections of



Top, sunlight creates theatrical effect in smoky atmosphere of Grand Central station, New York. Bottom, child photographed in charming natural pose

CLICK



Skating picture taken at ice carnival calls for fast shutter to "stop" the action. The drawings show camera setup for silhouette and moon photographs

all you need is a camera, almost any camera, and a load of film.

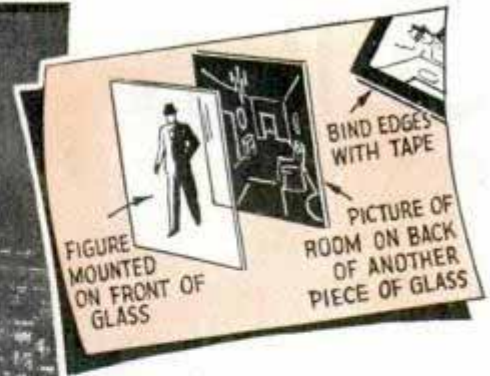
It was an ordinary box camera in the hands of a novice snaphooter, a cabin boy, that took the now famous news pictures aboard the sinking steamship "Vestris." There was no trick to that. The youth merely saw a scene packed with human drama and clicked his camera shutter. But the box camera has plenty of tricks in its repertoire. Perhaps, for example, you'd like to try a stereoscopic picture.

Twenty-five years and more ago stereoscopies were the rage. Folks would spend a Sunday evening looking through the twin eyes of the holder at travel scenes that had a third dimension, depth. Now the fad is returning, and amateurs make their own. You can do it with two box cameras strapped together so that their lenses are level, and about as far apart as



These pictures tell a story! Sequence taken in nursery catches quick changes in baby's expression

FIG 71



Sketch shows how to mount two exposures of same setting for stereoscopic effect. At left, a city poses in evening wrap and jewels—view of New York City at night with Empire State building at center

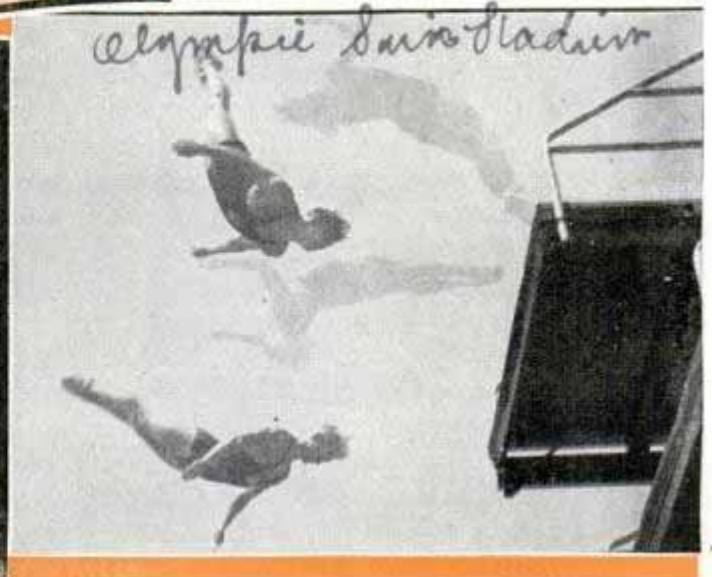
your own eyes, two and one-half inches. The shutters must be snapped simultaneously. Developed, printed and mounted on a card—the picture from the right-hand camera mounted on the left of the card—the photographs seen through the refracting lenses of the stereoscope appear to gain perspective and depth.

There is another way to obtain a stereoscopic effect. Have a friend pose before the camera in the foreground of a room, with a front light trained on him. Snap the picture. Then without disturbing the room or moving the camera except to wind a new film

into place, have your friend step out of the scene and take a second picture of the room, exposing long enough to bring out detail. Develop and enlarge both pictures to the same size; cut out the figure and mount it on the front of a sheet of glass. Place the print of the empty room on the back of a thicker sheet of glass, mount the two pieces of glass together in proper register with scotch tape and note the stereoscopic appearance!

into place, have your friend step out of the scene and take a second picture of the room, exposing long enough to bring out detail. Develop and enlarge both pictures to the same size; cut out the figure and mount it on the front of a sheet of glass. Place the print of the empty room on the back of a thicker sheet of glass, mount the two pieces of glass together in proper register with scotch tape and note the stereoscopic appearance!

A touch of finesse can raise what might have been just another picture into a photograph of "salon" caliber. You can break up the hard quality



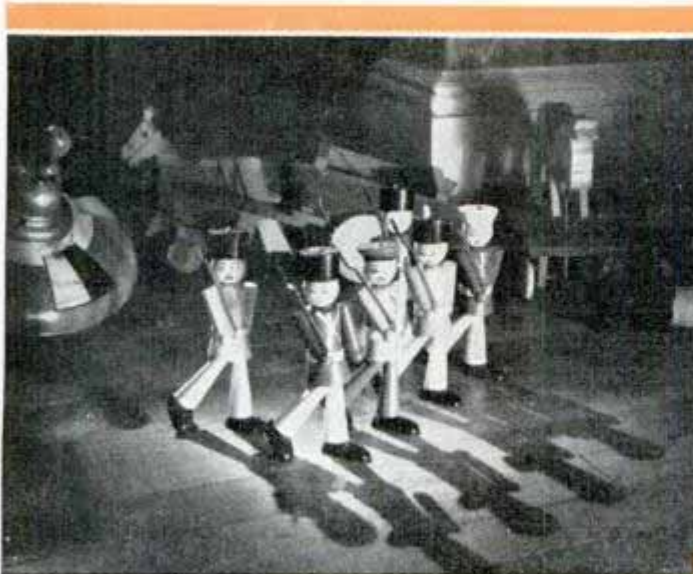
Toe dancer was "snapped" in one hundredth second; for stage photography you need an f 4.5 lens or faster. Shadow shot of two divers was obtained by tripping focal plane shutter twice

J. Frank Kutz, U.S.G.
W. J. ...

of a landscape by filming through silk. Cut out the center of an old lens cap and replace it with fine, transparent silk and expose through it until you obtain the soft, diffused quality you desire. One photographer, by dropping three pebbles to disturb the glassy surface of a lake with intersecting ripples, created a focus of interest and achieved a prized picture. Another, remembering theatrical effects of railway depot scenes where slanting rays of the sun pierced the smoke-laden air, captured the same effect with his camera in the woods, trampling dry leaves to send dust clouds floating up the long shafts of late afternoon sunlight. Take advantage of summer clouds; make a few negatives when they are at their fleecy best, and when you have a "baldheaded" landscape with uninteresting sky, improve on nature by double-printing in one of your cloud negatives.

You can improve on nature, too, with floodlights and flashlights. Hollywood professionals use booster light in broad daylight, and your own outdoor snapshots may be made more striking by spotting edgelights and highlights where they are needed. Even the

(Continued to page 114A)



Photoflash caught child and dog in amusing pose. "Table-top" picture of toy soldiers was a four-second exposure. Vivid shot of bucking motorcycle was snapped in one two-hundredth second

Signal Lamp for Airport Flashes Messages

London. & W. England



New neon lamp may be used to flash messages automatically at landing field

Numerous uses can be found for a neon signal lamp designed for airports. It may be used for sending messages from ground to planes by Morse code; it may be placed in corners of a flying field for boundary lighting, and it is fitted with automatic devices for flashing a Morse code message continuously.

Rotary Shears for Sheet Metal Have Automatic Self-Feeder

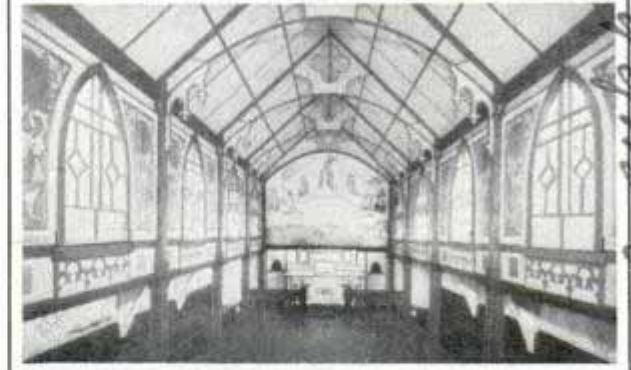


Rotary shears now available for sheet-metal cutting do the work with less effort than hand snips and eliminate manual operations with the attendant risk of hand injuries. The rotary cutter is light weight, easy to operate, and self-feeding. The roller cutters are set in motion by up-

and-down movement of the upper hand lever, while the lower lever guides the shears along the line marked. The tool can be backed out of the cut by inserting a wire nail in a hole in the axle carrying the ratchet. The cutting wheels can be removed for sharpening, and special knives are offered for cutting ultrahard steel.

Floating Church Is Built on Hull of Old Argentine River Boat

Instead of worshipers going to church, church goes to the worshipers on the delta of the Parana river in Argentina. Getting to church was always a problem for residents of the delta, with many streams to ford, until a practical "padre" solved it with the idea of a floating place of worship. In the government shipyard at



Exterior and interior views of cruising church which navigates delta of a river in Argentina

Buenos Aires a church, complete with stained-glass windows and steeple topped by a crucifix, was arc-welded on the hull of an old river boat 108 feet long. Now the church cruises to its congregation.

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.

Wandybeke Werkzeug & ml. P. C. Watkins, Super Power Co
40. Kuzge Reiche. Wandebek na Hamburg German

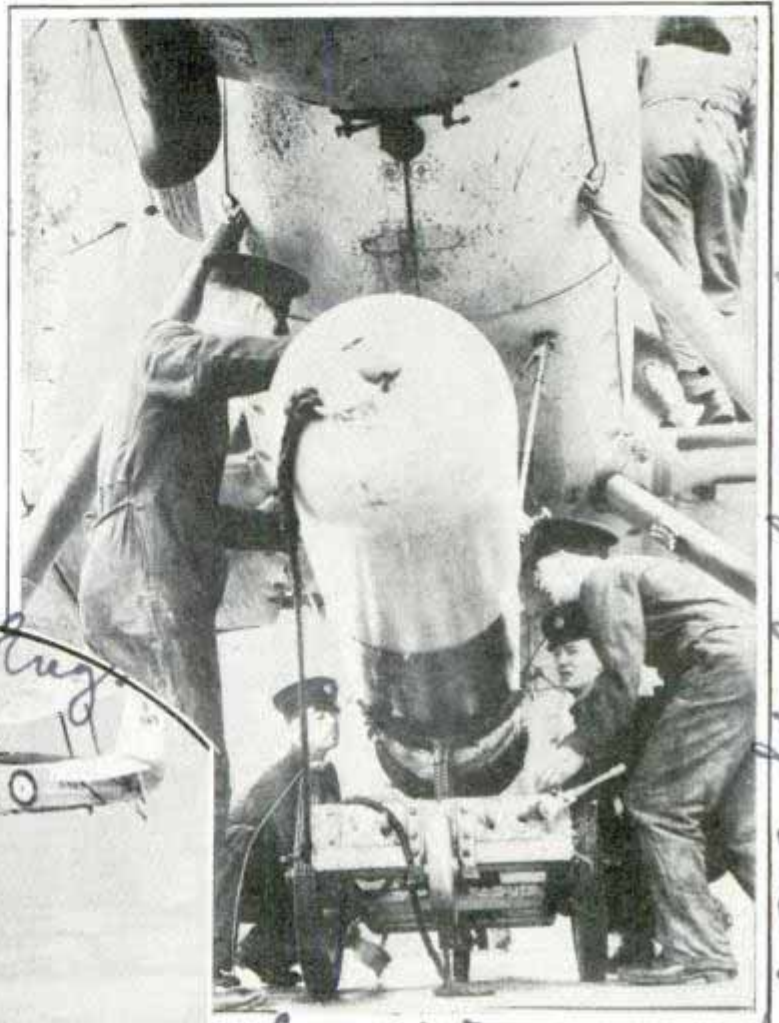
es 138 138
es 131
Natural supplied by Lighter Chile Co. 1901
Cob Road, Cleveland Ohio

Royal Air Force

Plane Fires Torpedo at Ships Attacking Coast

One important phase of the British coast defense is a squadron of fighting planes carrying torpedoes which are launched from the air against enemy warships. The torpedoes weigh 1,500 pounds and are capable of inflicting heavy damage on even the heavily armored vessels. The planes are specially built for this hazardous phase of warfare. The torpedo is fastened under the fuselage.

Right, British air corps men fastening 1,500-pound torpedo under coast defense plane. Below, plane swoops low and launches torpedo, which is seen dropping into sea aimed at side of enemy war vessel



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Bikes Break All Records.

Thirty million pounds of steel were used in more than 1,200,000 bicycles manufactured in 1936, the largest amount ever purchased in one year by bicycle makers. In 1899, the previous record year, 1,182,700 bikes were built, but only about twelve pounds of steel went into each, while the 1936 bike contains about twenty-five pounds.

Steel Facts

Fast Drivers in More Wrecks Than the Cars They Pass

Fast drivers head into more accidents than those who take it easy. Figures in Connecticut, at least, prove it. For six months traffic investigators recorded license numbers of cars, listing separately the drivers traveling faster than fifty miles an hour and those between thirty-five and forty-five miles an hour. Checking these

lists against accident reports, they found that thirty per cent more of the high-speed drivers had accidents than those in the moderate group, and the total number of accidents by fast drivers exceeded the slower group by forty-five per cent, without taking into consideration the severity or responsibility for accidents.

Survey of Service

Committee on Transportation. Yale University, New Haven

350 million tons of steel distributed in 1936

Guitar with Tone Control Sounds Like a Harp



Here is the radio guitar. Note tubes which amplify tones from the strings

Equipped with seven strings instead of six and with a tone control, the latest guitar produces music much like that of the harp. A supermagnet mounted in rubber creates a magnetic field from which vibrations from the strings are picked up and transmitted to an amplifier with tone control. Pick noises are eliminated and the tone softened. Called the "radio guitar," it is held on the knee instead of under the arm when being played.

Instantaneous List Finder Ends Tedious Work



Tedious thumbing of sticky pages is eliminated by an instantaneous list finder by means of which lists of telephone numbers, customers' addresses, rates, recipes, prices and

other frequently consulted memoranda are made available. To find any certain list of

names, the user slides a red arrow to the letter or numerical figure desired. Then, when a spring at the bottom is pressed, the device lifts the top leaves and snaps open at the page wanted. This is accomplished in two seconds. Made of molded plastic with aluminum trim, the list finder has a capacity of 1,380 names or items.

Model of Hotel on Road Sign Latest in Advertising

To increase the effectiveness of a roadside signboard advertising a Lakewood, N. J., hotel, a model of the hotel has been built against the board. At different hours of the day the sun throws different sides of the model into shadow, creating an illusion of reality. The outer edge of the model is supported by a two-by-four post painted white. The color of the post blends with that of the lower part of the advertising sign, making it almost invisible a short distance away. Thus the hotel appears to be unsupported.



Viewed from the road this model of hotel presents a realistic appearance

Bates Mfg. Co. Orange N.J. 30 Vesey St. New York

See page 4 of same

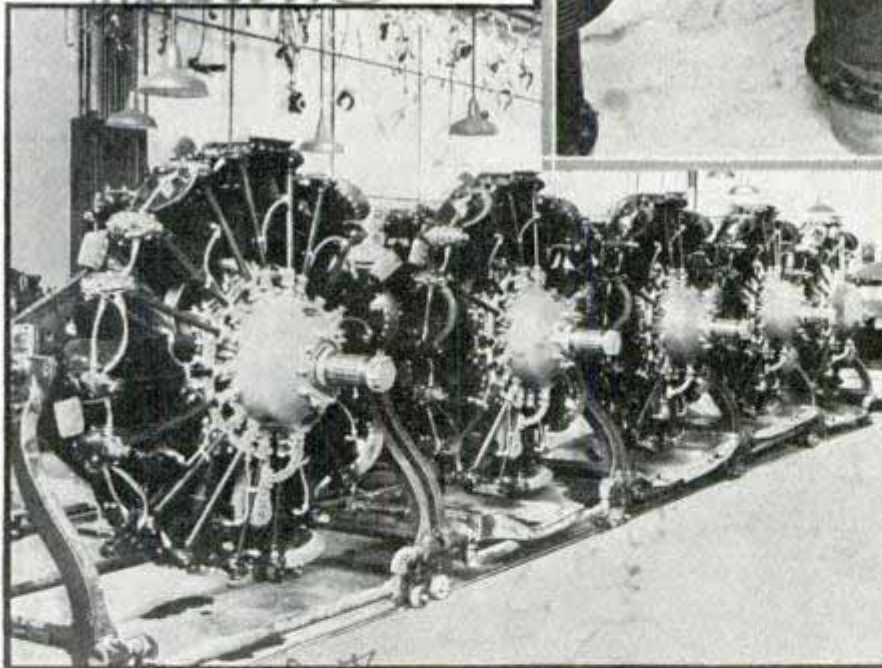
Eustice, Neb.

5124

may flower

Engine Builders Speed Up in Aviation Boom

Working at top speed to supply the military and commercial demand, airplane engine builders are producing hundreds of big power plants. Floors of factories are lined with giant cylinders which will be fitted into place on powerful engines. In some plants the big engines, some of which develop 1,000 horsepower, are ready to be installed in fighting planes ordered by the army and the navy. Pratt and Whitney, for instance, is building 794 engines for the navy and the Wright factory in New Jersey has an order for 180 power plants for the navy, in addition to a larger one from the army. One item in the army order is for 150 of the 1,000-horsepower models, the most powerful built by the company.



Write World

Top, row upon row of big cylinders ready to be incorporated into powerful airplane engines. Left, some of the giant motors assembled, waiting to be installed in military or commercial planes. Assembly of these engines is a job for experts

Rivers Polluted by Acid Seeping from Abandoned Mines

Engineers are endeavoring to stop the costly pollution of the Ohio river and its tributaries by sealing off abandoned coal mines which every day pour an estimated 20,000,000 pounds of concentrated sulphuric acid into the Ohio. Oxygen combines with iron sulphide in the mines to produce, eventually, iron oxide and sulphuric acid. The Monongahela river is

distinctly acid because of seepage. Purification plants for city water supplies far down the Ohio are affected detrimentally, and docks, dams, locks and even ships deteriorate excessively in acid waterways. By sealing the mines, the engineers hope to cut off the oxygen supply and decrease sulphuric-acid production, and to keep surface water from entering the mines.

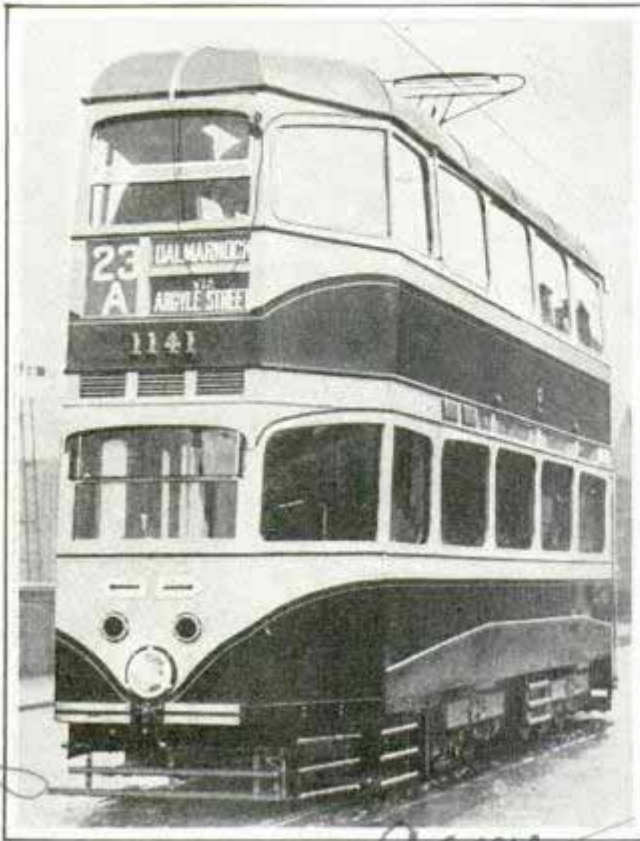
Acid mine seepage

E. H. Tisdale, Director, Division of Sanitation, U. S. Department of Health

State health Dept.

404 N. Wells Chicago

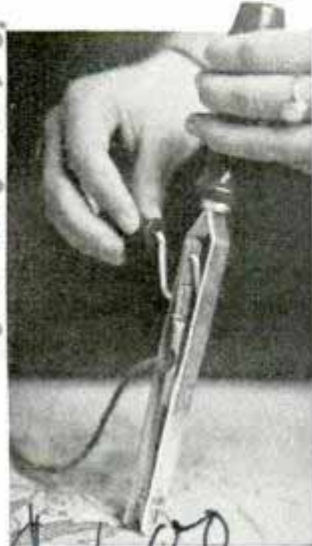
Double-Decked Streetcar Has Booth for Driver



Here is the latest streetcar in Glasgow. Note the full-vision driving compartment

With its driver in a small booth or compartment which protects him from weather, the double-decked streetcar has been introduced in Glasgow, Scotland. The car has front and rear entrances, fog lights and direction indicators.

Adjustable Needle for Hook Rug Makes Stitch of Any Length



Making hook rugs is simplified by an automatic needle now available, which can be adjusted for any desired length of stitch and saves much material. The needle has two points, the yarn feeding down through a hollow shank. It can be operated at a fast

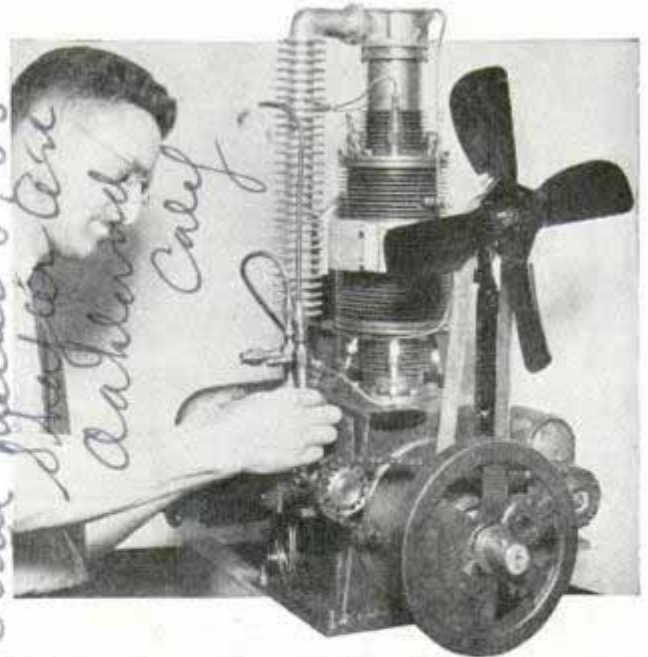
pace, stitches spaced accurately by turning the handle which pushes the needle's eye partly through the base fabric and loops the yarn evenly on the under side. There is no up-and-down movement of the main frame and handle.

Non-Skid Deck Coating for Boats Is Waterproof

Handy kits of cold asphalt in liquid and plastic form are offered the boat owner for applying to decks and cabin roofs. This material makes the deck less slippery, and is waterproof and durable. It is colored with mineral pigments which will not deteriorate, and the deck coating contains no oils or solvents. The maker claims it will not soften, crack or peel away. No special training nor equipment is needed to apply the asphalt.

Lightweight Air-Cooled Engine Produces High Power

Designed with few moving parts, a lightweight air-cooled engine operating on the double-action principle, holds the possibility of application to aviation and the



Double-action engine of light weight produces high power. Note cooling fins

automobile. The peculiar design of its pistons and cylinders provides for interior cooling, eliminating the necessity for a cooling system in which water or other liquid is used. Double action, which pro-

*Perfecto Rug Needle Co
5620 S. Lafayette
Portland Oregon*

\$7.00

*Paul Miller 5955
Shafter Ave
Oakland Calif*

vides a power impulse at both top and bottom of the stroke, is obtained with a conventional connecting rod between the piston and the crankshaft, greatly reducing the length, bulk and weight of the whole engine. As a result, cost also is reduced. The shape of the combustion chamber makes more practical the use of the two-cycle principle, which together with the double action, gives a highly concentrated, lightweight source of power. One model of the engine, weighing 120 pounds, produces thirty horsepower.

Es 122

Three Tanks Form Roof of Oil Man's Single Garage

Needing some elevated tanks and a garage for his pleasure car, an oil dealer in New Jersey combined them. He built a garage with three tanks forming the roof. An elastic seam compound was poured into the spaces between the tanks, and the roof is leakproof.

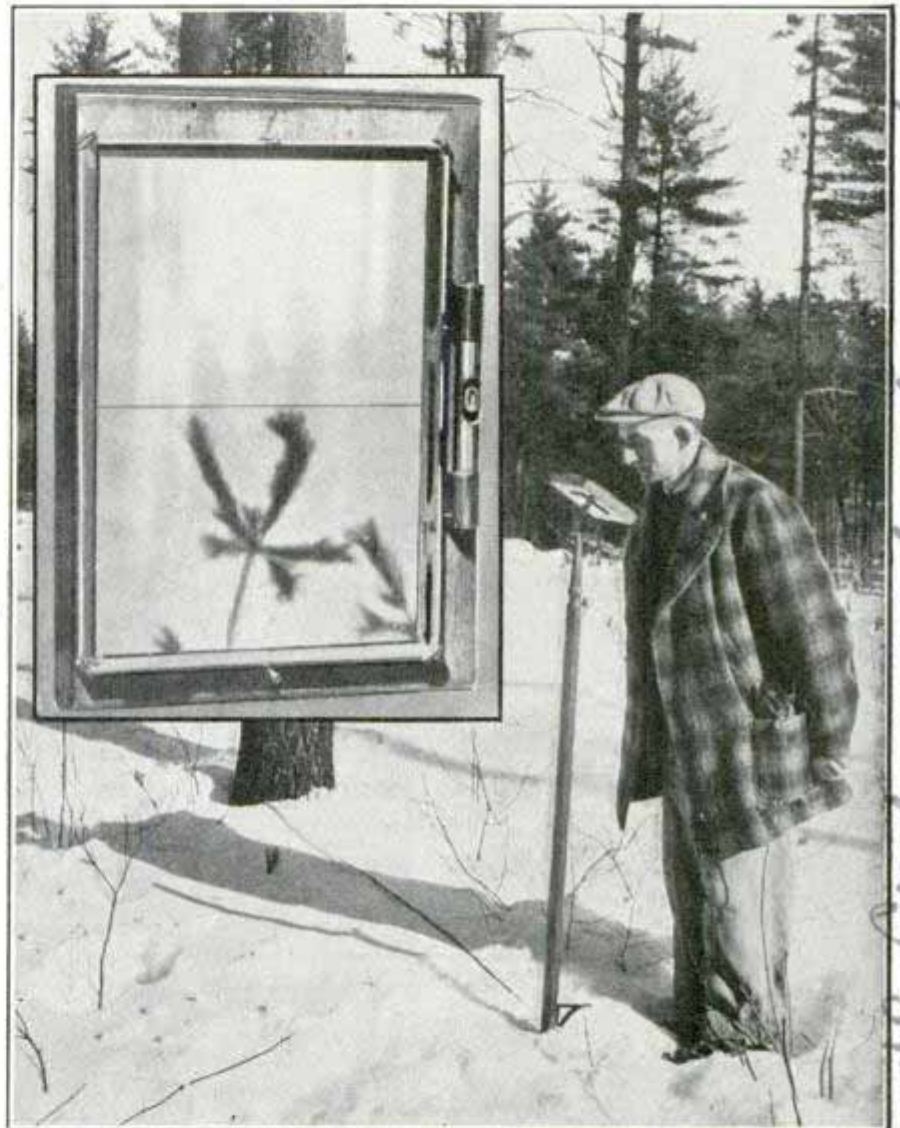
near Freehold.



Garage built by oil dealer has three tanks for its roof, the seams made leakproof by elastic compound

Es 66.

Tree Top Measured on Ground to Predict Possible Growth



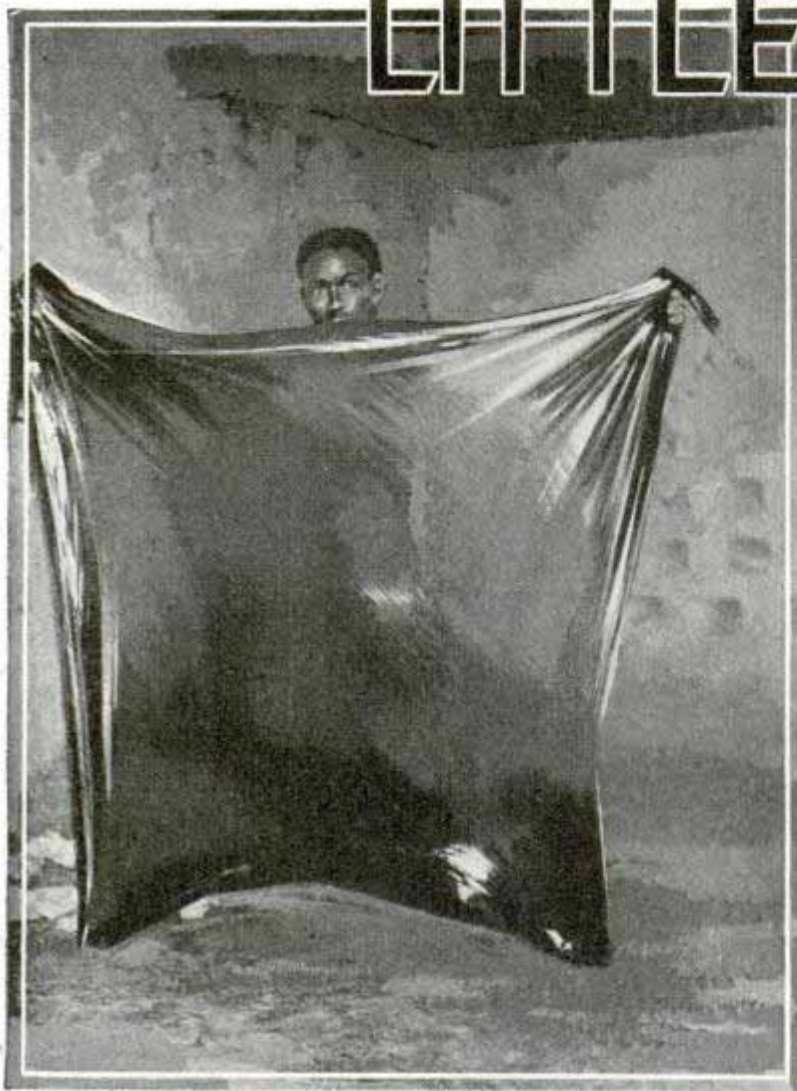
Forester measuring tree top with simple instrument. Inset, how top of tree appears on the measuring mirror

With the aid of an instrument called the reflecting crown meter, foresters may measure the tops of trees up to 100 feet high without leaving the ground. By measuring the "spread" at right angles it is possible to ascertain the possibility for future growth and to determine which tree should first receive attention of wood choppers. The instrument consists of a small mirror mounted horizontally on a four-foot Jacob's staff. This staff is pushed into the ground beneath the outermost points of the tree's crown. Reflections of these crown points are located by a center line on the mirror and lines are drawn joining the points established by the staff to form a reproduction of the crown area.

Developed by James H. Cupper, Inglewood, in forestry in Massachusetts State. Collect. Amherst, N.H.

es 16. / Wm. de Cerville, 875 N. Mauris
Oak Park, Ill

LITTLE BUGS



PLAGUED for centuries by insect pests, man today classifies all bugs as bad bugs. And why not? Locusts, grasshoppers, ants, flies, beetles, borers, moths, mosquitoes and a host of other flyers, crawlers, skippers and jumpers poison his body, ravage his crops, devour his food, ruin his clothing and even destroy his home.

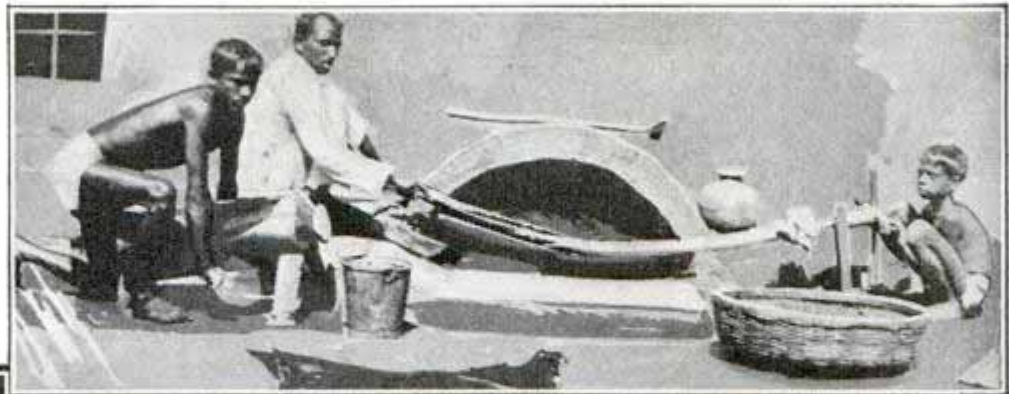
But there is at least one exception to take the curse off insects, an anomaly of nature, a beneficent little bug which works for man, an insect in industry, a bug whose product has become a big business. The world used more than 67,000,000 pounds of this industrious insect's "handiwork" in 1934 and paid up to a dollar a pound for it. And one pound represents six months of work for each 150,000 bugs hatched.



Above, toes, teeth and hands are used by the expert natives of India in stretching the shellac into sheets. Below, sifting and sorting the stick-lac

and **BIG BUSINESS**

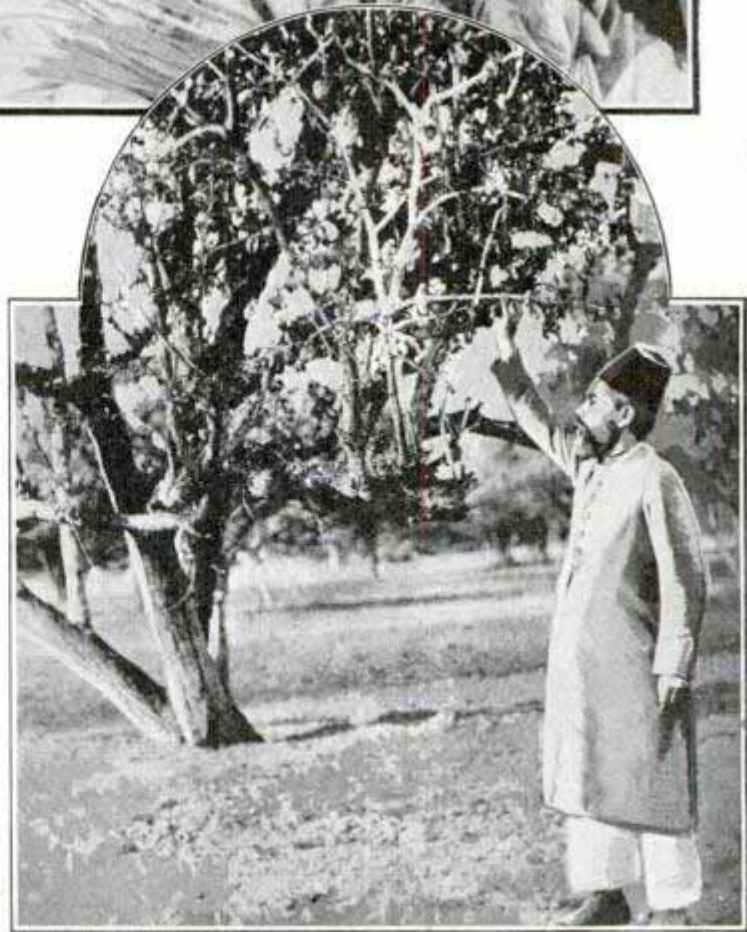
Right, squeezing molten lac from bag in front of fire. Below, exporter buying stick-lac. Price is kept secret by using fingers under cloth to settle value



Laccifer lacca is the euphonious name of this little insect which is important to man because nature endowed it with a trade secret—a formula which man has tried in vain to duplicate. The lacca family knows how to make shellac, one of the most efficient wood preservatives. Man has used shellac for hundreds of years. He has tried repeatedly to make it synthetically, but the best he has been able to do is to produce substitutes. Mr. and Mrs. Lacca still retain the world monopoly on the shellac business. When man needs real shellac today, he still must rely on a bug—and like it.

Not only has man failed to discover how the bugs make shellac; he has also failed to improve very much on the primitive way of extracting the commercial product from the substance the bugs non-

(Continued to page 146A)



White streaks on this plum tree indicate it has been inoculated with the lacca insects which in six months will produce a crop of gum

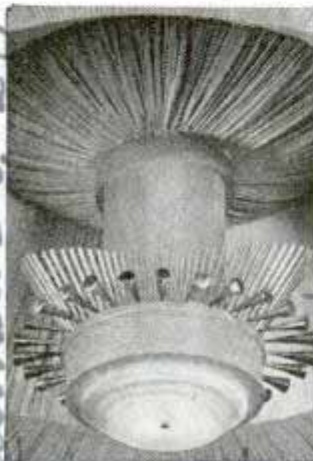
Engine Delicate as a Watch Built on Jeweler's Lathe



Its parts turned on a jeweler's lathe, this four-inch locomotive is run by a six-volt electric motor

Building a four-inch locomotive that runs is as delicate a job as making a watch. Squinting through a jeweler's eyepiece as he worked, a model maker spent three months fashioning a miniature engine of the Central Railroad of New Jersey, weighing one and one-half pounds and developing a drawbar pull of four pounds with its six-volt electric motor.

Chandelier Holds Organ Pipes Hung from Ceiling of Home



To install an organ in the limited space of a modern dwelling, a German pipe-organ builder combines the pipes with a chandelier suspended three feet from the ceiling of the room. There are 138 pipes, including twenty-

seven woods, grouped around a cylinder which contains everything except the console. At the bottom of the chandelier is a bowl-shaped lamp. The ceiling and upper walls are draped for sound reflection, adapting the organ to rooms otherwise unfavorable acoustically. The console occupies less than a cubic yard.

Beverage Dispenser Fits Bottle and Pours Without Spilling

Fitting over the top of the decanter, a beverage dispenser pours liquid in any quantity desired at the touch of its cap. A full glass is poured by pressing the cap all the way down, and a half glass by pressing it half way. If too much is poured, it can be withdrawn from glass to decanter. It does not drip nor spill.



Oil Drums Protect Shrubbery from Damaging Winds



Storm guards for shrubbery shown in place. After storm passes they can be removed

Empty oil drums cut in half have been found excellent protection for shrubbery subject to damaging winds, such as those along the seacoast. Two lengths of pipe,

*Hollywood
Alexander Wood
72 22 Melrose Ave
Los Angeles
Model Craft Supply Co*

*Commercial Day
when Corp
1900 S. 24th Cleveland
Ohio*

Es 155

Es 123

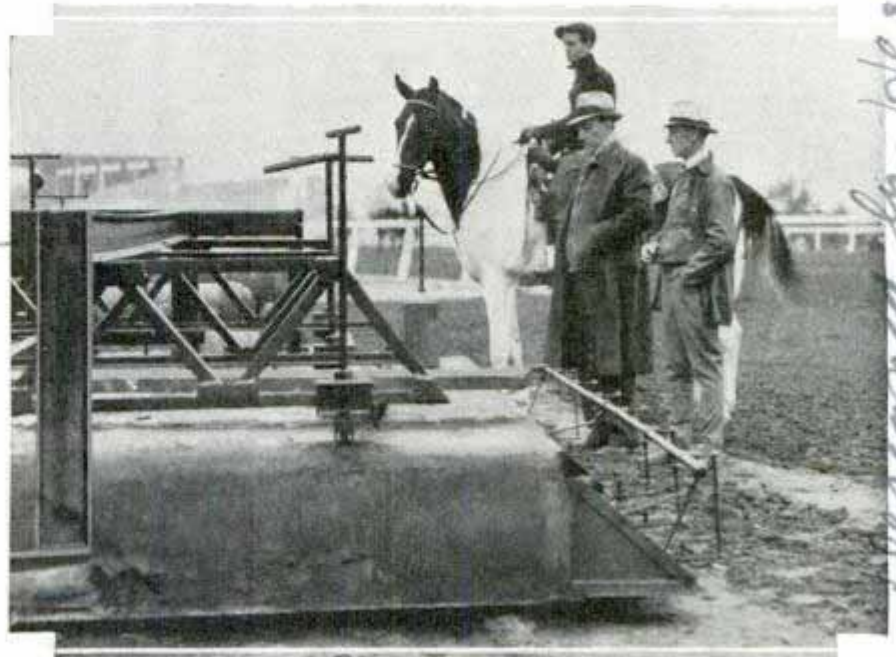
Es 145

*Lothar Hintz
Blumenstr. 224*

*Frankfurt a. Oder,
Lokmann*

bolted to the half drum, permit the home owner to anchor the shrubby shelters until the storm is over. Then the drums may be pulled up and stored until needed again. Sand blown by high winds frequently destroys privet bushes and other shrubbery around homes near the ocean.

Heater for Wet Race Track Puts an End to Muddy Turf



Soggy race track is "ironed" dry by this machine. Drawn over the turf, its steel plates heated to 3,000 degrees Fahrenheit bake the track.

201 75

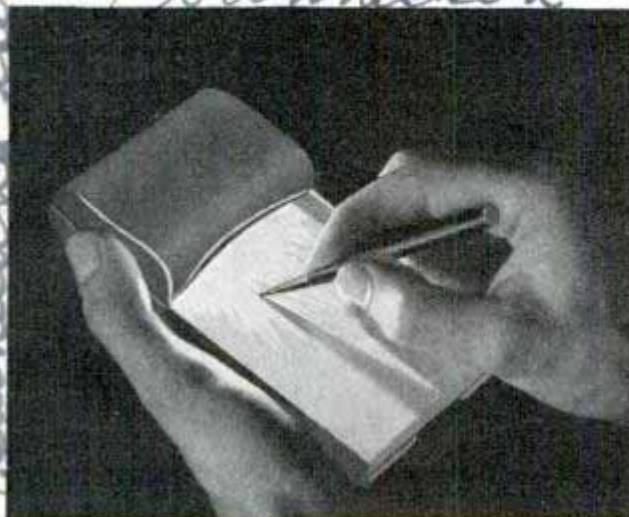
Worn Stair Treads Renewed by Cold Asphalt Filler

Stairs that have been hollowed and worn by long use can be leveled off with a cold asphalt product now available. It is furnished in plastic form, in various colors, ready for application without requiring any special skill. It is a long-wearing material and is especially valuable where a non-skid step is desired.

82

Memo Pad Is Lighted by Bulb When Pencil Is Withdrawn

For jotting down notes in the dark, a lighted memorandum block has been developed. When the pencil is drawn from its holder a flashlight bulb is lighted, and switched off when the pencil is replaced.



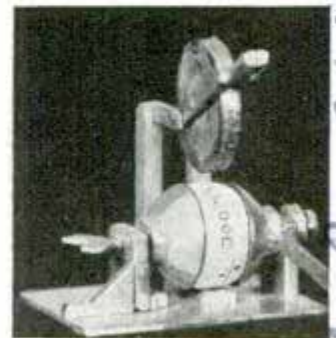
Memorandum pad is illuminated by a flashlight bulb which lights when pencil is withdrawn from holder

"Mudders" have seen their day if the race-track drier now being tried out is adopted generally. It is a huge machine similar to those used to melt asphalt in road building. The bottom is lined with steel plates heated by torches to 3,000 degrees. Drawn over a muddy track, it "burns" the turf dry.

13 4

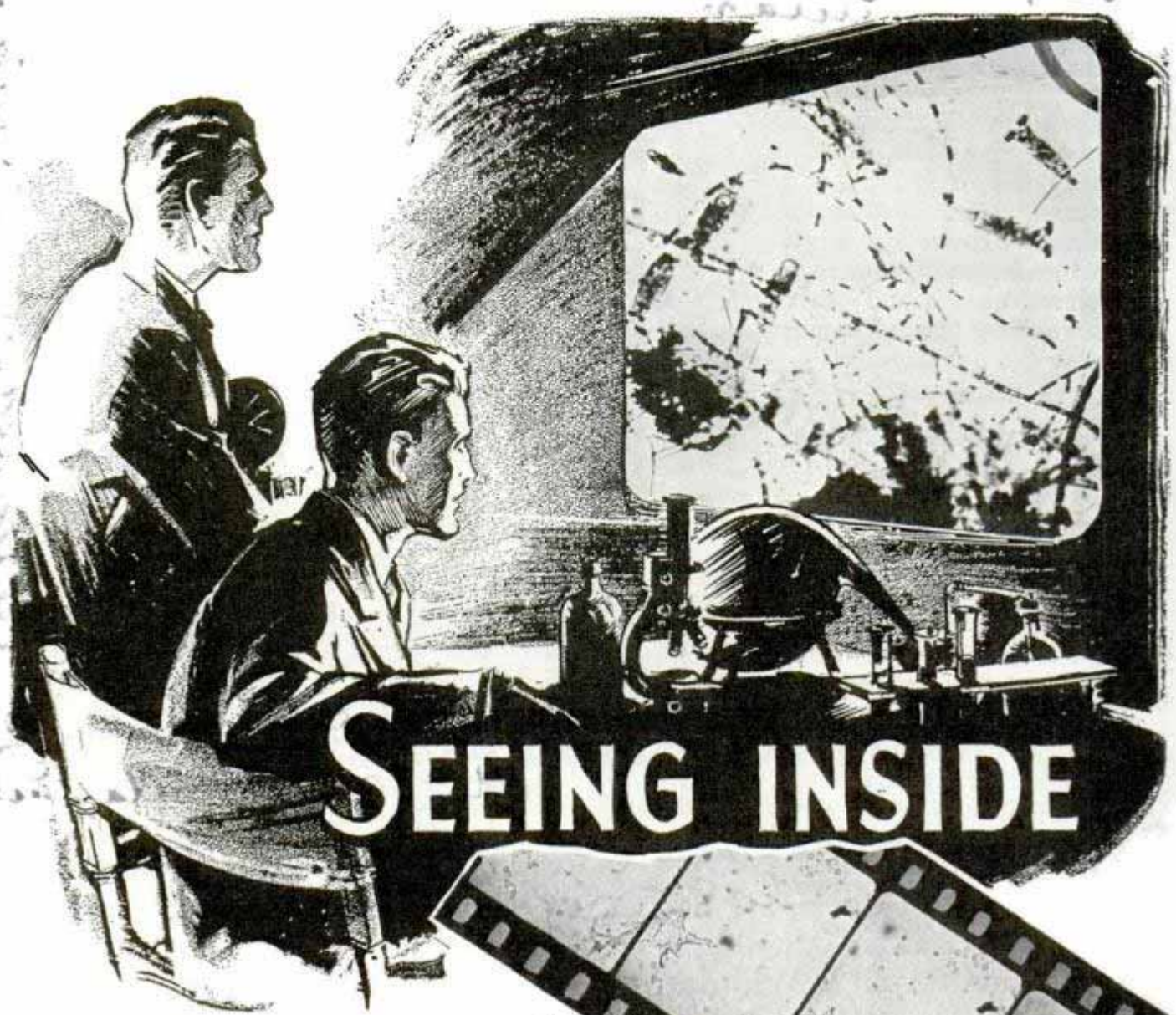
Marker Imprints Golf Ball with Owner's Name

Printing the player's name on his golf balls is made easy by a handy marker patented recently. The work is done by the "point type" method, but the points of ink are so small that the wind cannot cause the ball to hook or slice by striking them. The ink is deeply imbedded in the surface of the ball, making the single impression permanent. A decrease in the number of golf balls lost through lack of identification is expected to result from use of the marker.



L. J. Wallace
Shawnee Sporting

209. Mrs. Miss U. L. White
 115 W. 70th, NYC

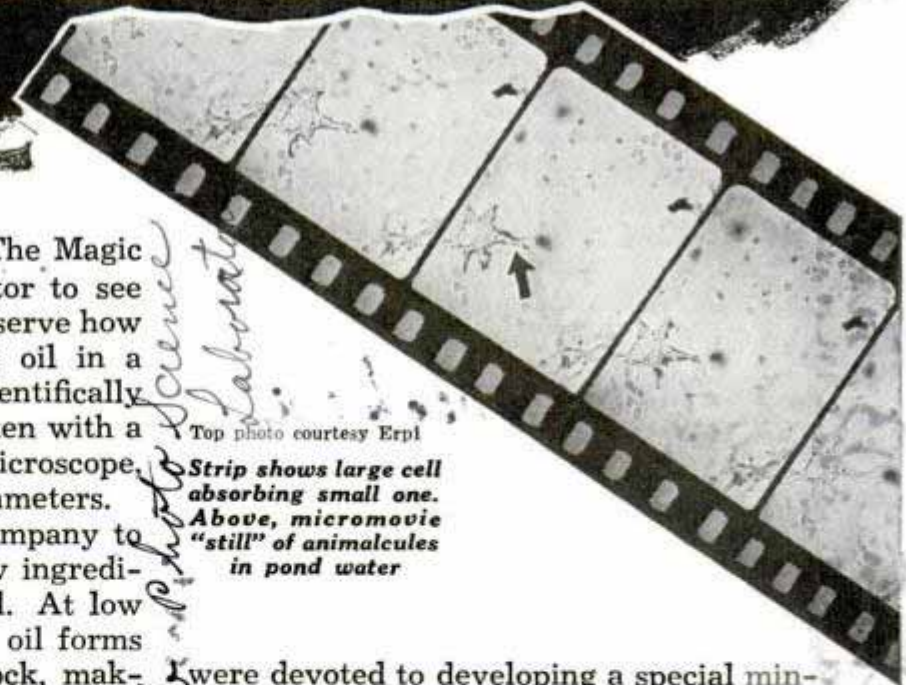


SEEING INSIDE

A RECENT motion picture, "The Magic of Oil," enables the spectator to see inside two drops of oil and to observe how temperature changes affect the oil in a motor. The whole picture, scientifically accurate in every detail, was taken with a special camera built onto a microscope, magnifying as much as 2,000 diameters.

The picture enabled an oil company to demonstrate the effects of a new ingredient added to ordinary motor oil. At low temperatures the wax in motor oil forms crystals large enough to interlock, making the oil stiff. But the addition of small quantities of the new ingredient to ordinary motor oil, the picture showed, kept the wax crystals small and round, not touching each other. Oil so treated remains more fluid at low temperatures. Microscopic views of oils at twenty degrees below zero were shown on the screen, and in making these several weeks

Top photo courtesy Erpl
 Strip shows large cell absorbing small one.
 Above, micromovie "still" of animalcules in pond water



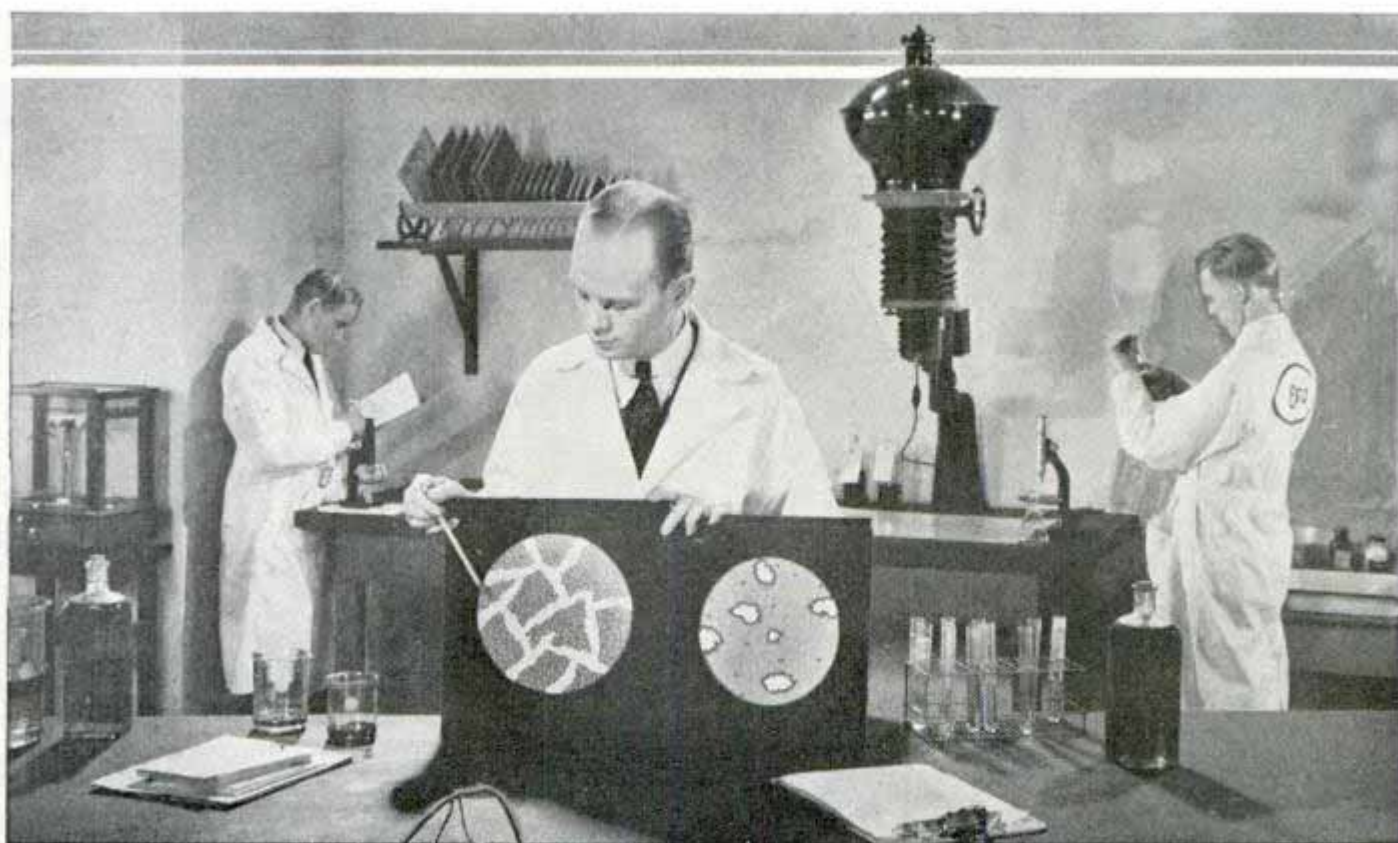
were devoted to developing a special miniature refrigerating unit to cool the oil on the microscope.

Pictures that disclose the inside workings of very small particles and organisms are not trick photography, but the result of the scientific development of "microcinematography." In a laboratory in Connecticut, Dr. Henry Roger, one of the country's specialists in this art, and his as-

Road Photo Science Laboratory

Sandy Hook
 Conn

25.9



a DROP of OIL

Top photo courtesy "Esso"

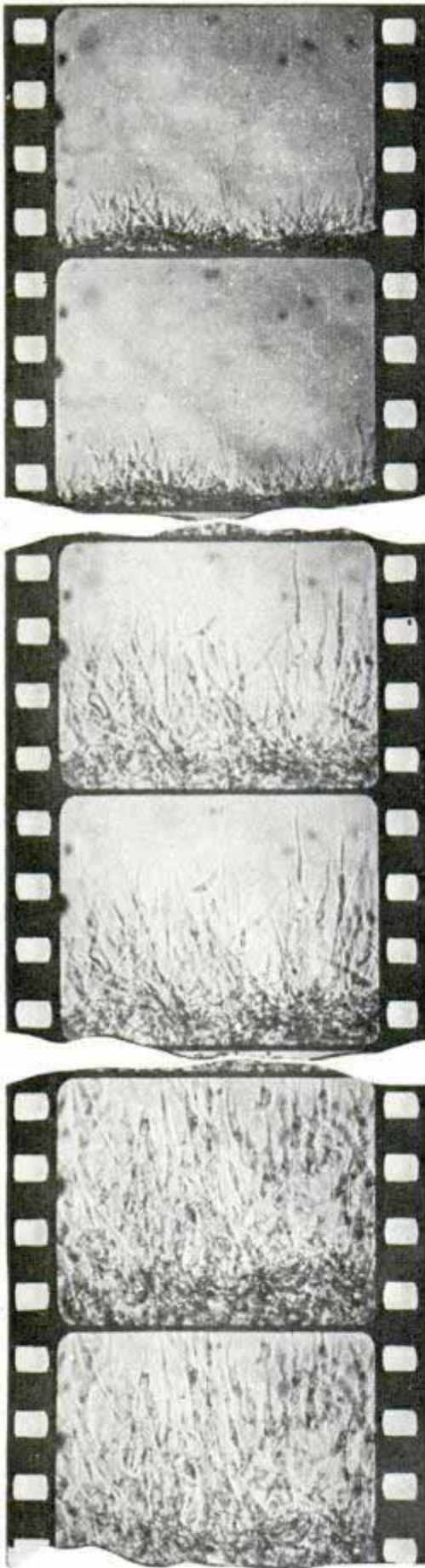
Above, chart showing difference in wax in drop of treated oil and drop of untreated. Left, housefly greatly magnified and strip showing division of white blood corpuscle



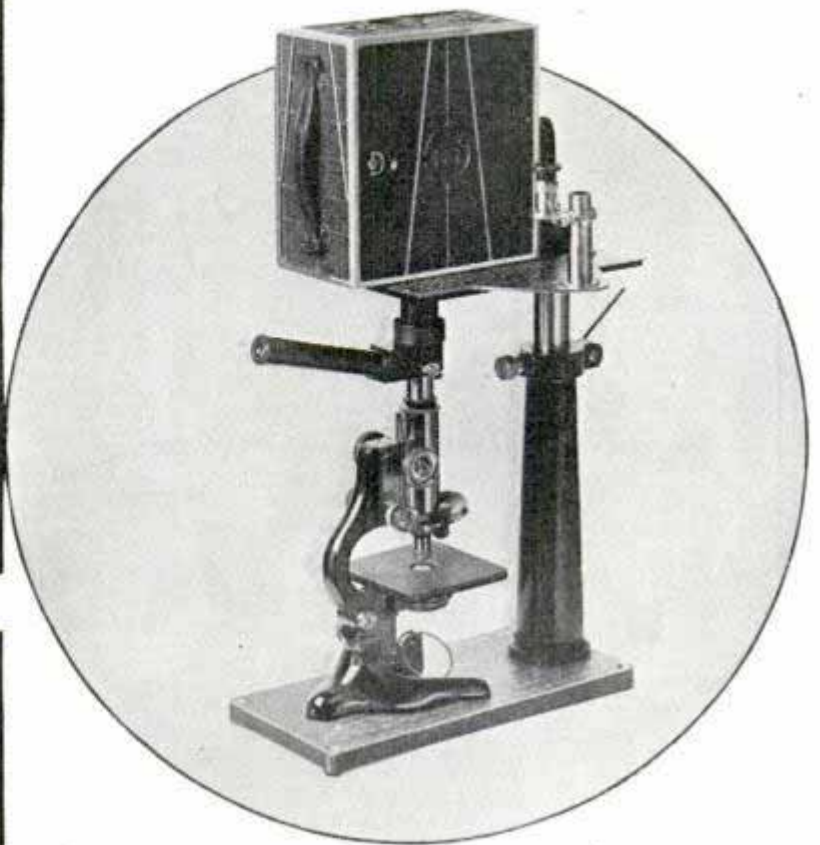
sociates work with special apparatus combining the advantages of the microscope and of the motion-picture camera. With this equipment and many special types of cameras they produce scientifically accurate microphotographic effects.

Micromotion-picture photography differs from ordinary microscopic photography. In the latter the specimens are inactive or dead and are often stained or otherwise prepared to show structural details. The material for micromotion pictures is active and must be kept under its own normal conditions while being photographed. This work is complicated by the fact that living material is extremely delicate and sensitive to light and heat, and when active objects are magnified, any vibration of the microscope, itself, would be magnified in the same degree. Precautions, therefore, must be taken.

The standard equipment now often used for this work has been evolved by a slow



Micromotion picture apparatus and strips showing various stages in the growth of living tissue as recorded with the aid of this equipment



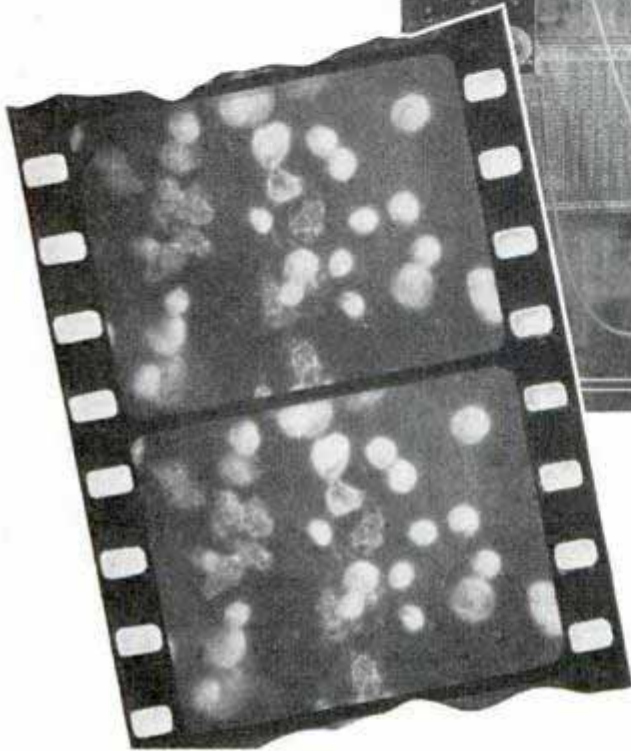
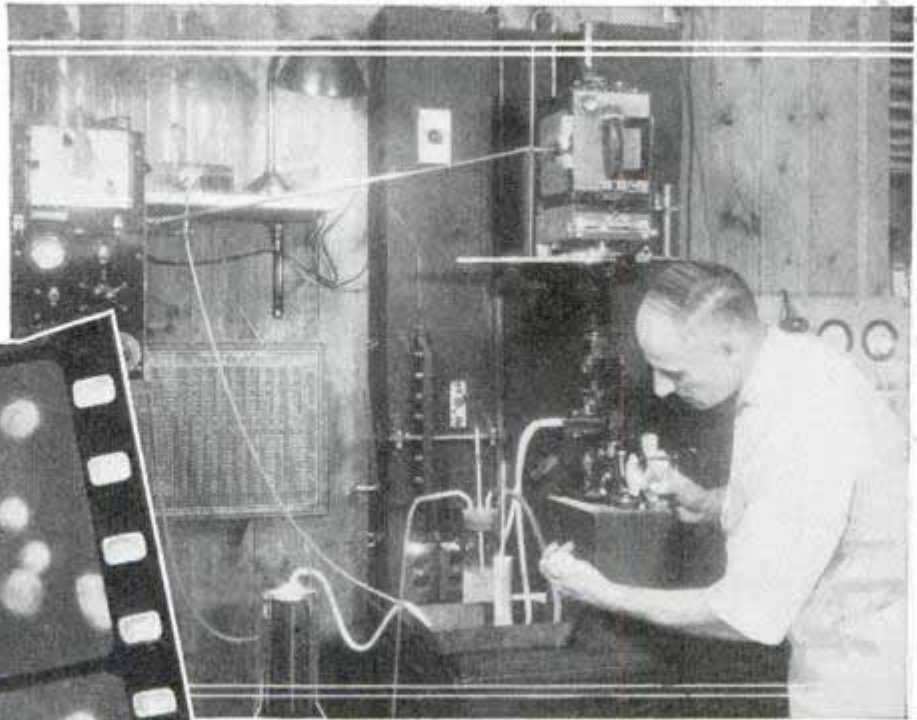
process of development over a period of about twenty years. The operation of this apparatus is as simple as possible without sacrificing accuracy. To avoid vibration as far as possible, the standard equipment is heavy, largely made of cast iron, and vibration absorbers are placed under the legs of the optical bench and of the camera support, making these units "floating."

Dials and timing devices are used for setting the time intervals, per hour or per minute, and a time clock makes it possible to start and stop the apparatus automatically at any predetermined time within twelve hours. The whole apparatus can be set to take successive photographs automatically as the object under observation develops and changes. A chart shows the time required for photographing any material, in terms of length of film, number of images and rate of exposure. In working with tissue cultures and bacteria, it is necessary to control the temperature. Consequently, the microscope is surrounded by an incubator which can be removed and replaced in a few seconds without touching the microscope.

Micromotion pictures are used for research, for educational purposes and in various ways in industry. They have even been introduced as evidence in law courts. Amateurs sometimes take up this art as a hobby, often using a machine which takes a sixteen-millimeter picture, instead of the standard thirty-five millimeter.

This type of photography has helped scientists

Making micromovie of drop of motor oil while holding temperature of oil at twenty degrees below zero and, below, culture of white blood corpuscles just removed from the blood



learn about living cells of blood and tissue, bacteria, and various diseases and has been particularly helpful in the study of cancer. By means of these photographs an important discovery was made concerning the action of the white corpuscles of the blood. For many years it had been known that these white corpuscles combat infection but scientists could not understand the ability of a white corpuscle to "scent" bacteria or dead cells even when these were at a considerable distance. Micromotion pictures revealed an undulating membrane many times larger than the cell itself, and surrounding the white corpuscle. When a foreign body comes within this membrane, the white corpuscle is after it.

Many film records taken for research have never been used with a projector but have been made in order to study, frame by frame, every minute change in specimens under observation. By the projection of micromotion pictures we learn new facts about all sorts of things hitherto hidden from our gaze. Because of the microscope and time-lapse photography we can

see a plant unfold before our eyes, learn about lower forms of animal life, or be warned in graphic form of certain dangers to our health from the spreading of germs.

By one such picture the housewife is warned of the danger from the common housefly. The life development of the fly is shown, its habits, and how it spreads disease by carrying germs to food. Scientific educational films are becoming an important part in modern teaching and the demand is growing for accurate films for use particularly in the natural sciences—physics, chemistry, biology and entomology. One picture shows the growth of the pea plant from the time the seed first sends out its root and stalk until the ripened seeds are scattered. Another gives the entire life cycle of the frog.

Appreciating the effectiveness of these micromotion pictures for revealing unrealized qualities of various products, business men use these films in production studies and for advertising purposes. By means of these pictures the food industry can study conditions in packing and canning. Fermentation and the effects of refrigeration are revealed, and the durability of various metals and paints under certain conditions have been determined. One soap manufacturer has recently used micromotion pictures to emphasize the necessity for cleanliness and from other such films we learn of the effects of face creams and powders on the skin.

*Highway Carriage Corp
3100 S Redzie
Chicago*

20/28
**Ice-Cream Slot Machine
Sells Five-Cent Brick**

*Borden's Ice Cream Co
2350 7th Ave. New York*



While waiting for a subway train, a customer drops a nickel in the slot and gets an ice-cream brick

Ice cream is now for sale in slot machines. Drop a nickel in one of the vending machines in the New York subway stations and you receive a five-cent brick. Dry Ice keeps it properly refrigerated.

20/154
**Brake-Lining Mortar Solves
Replacement Problems**

*Benders Product
Corp Benders Lignite
and*



Sand Cement

By using a new mortar the repairman may build a firm foundation for the lining and solve problems incidental to automobile brake replacements. The mortar fills and

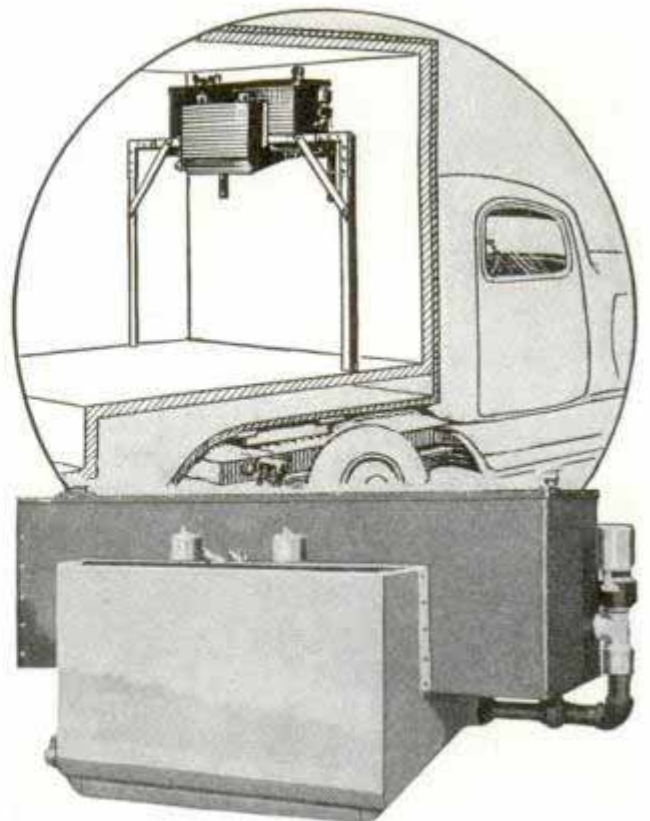
hardens in any irregularities in the brake-shoe rim incurred in service or in the liner segment through fabricating processes. The mortar eliminates the spongy feeling in brake operation, retards tendency to-

ward brake "fade-out"; helps to eliminate brake friction noises and prevents moisture from getting between the brake-lining segments and the brake shoes.

20/106

**Refrigerating Unit for Truck
Uses "Dry Ice" and Alcohol**

Substantial payloads of meat or other perishables can be kept at twenty-seven to forty-five degrees in a Dry Ice, thermostatically controlled refrigerating unit designed for trucks. The Dry Ice chills alcohol which circulates on the thermosiphon principle through a system containing a cooling surface similar to that of an automobile radiator. Small electric fans blow air downward through this radiator onto the payload. As the chilled alcohol is warmed by this air, it automatically rises in the system and its place is taken by colder alcohol freshly drawn from the bottom of the insulated Dry Ice compartment. The process continues until the temperature in the truck reaches the level at which the thermostat is set, at which point a valve stops circulation of the alcohol. The only power required for operating the unit is that taken from the truck storage battery to drive the small fans.



Refrigerating unit for truck. Sketch shows how it is installed in cooling compartment

20178 Air France, Channel Ferry
610 Flight One New York

Flying "Club Car" Is Channel Ferry De Luxe



Air France is building a fleet of luxurious air leviathans to ferry forty passengers between Paris and London. Main lounge, above, is spacious and has comfortable seats. Notice observation lounge in nose of plane at right



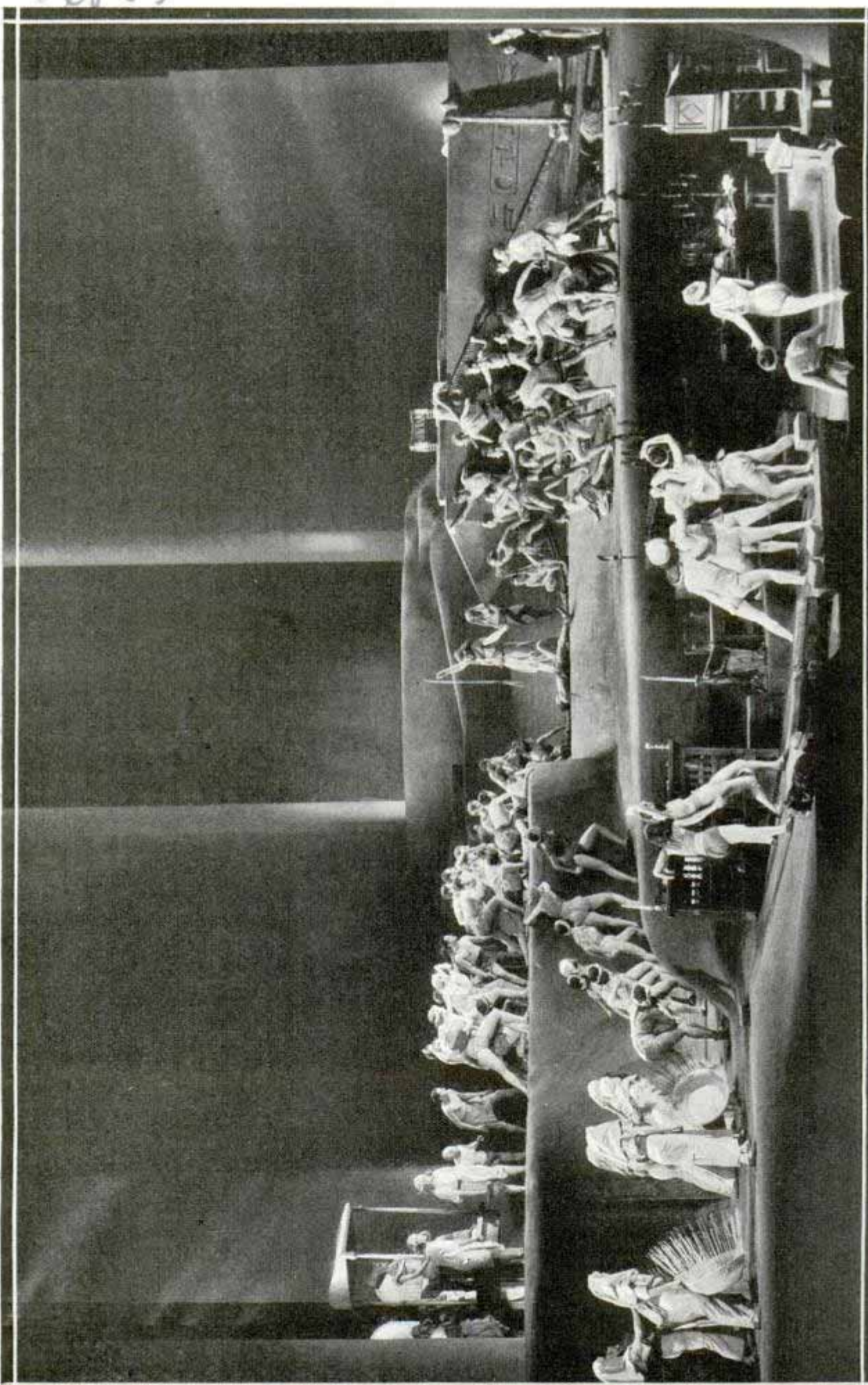
Passengers commuting by air over the English channel are served at a buffet counter, shown above, in the center of the flying "club car." Right, a view of the unique "winter garden" in the forward cabin of the "Farman 224"



Above, the library corner. The ship is powered by four engines, two of them mounted tandem as pushers. With top speed of 220 miles per hour, it will fly between Le Bourget and Croydon airports on seventy-minute schedules

Avion Identi and marque Farman, 1669 me de Filly Villamont - France

Handwritten notes at the top of the page, including the number "6889" and some illegible text.



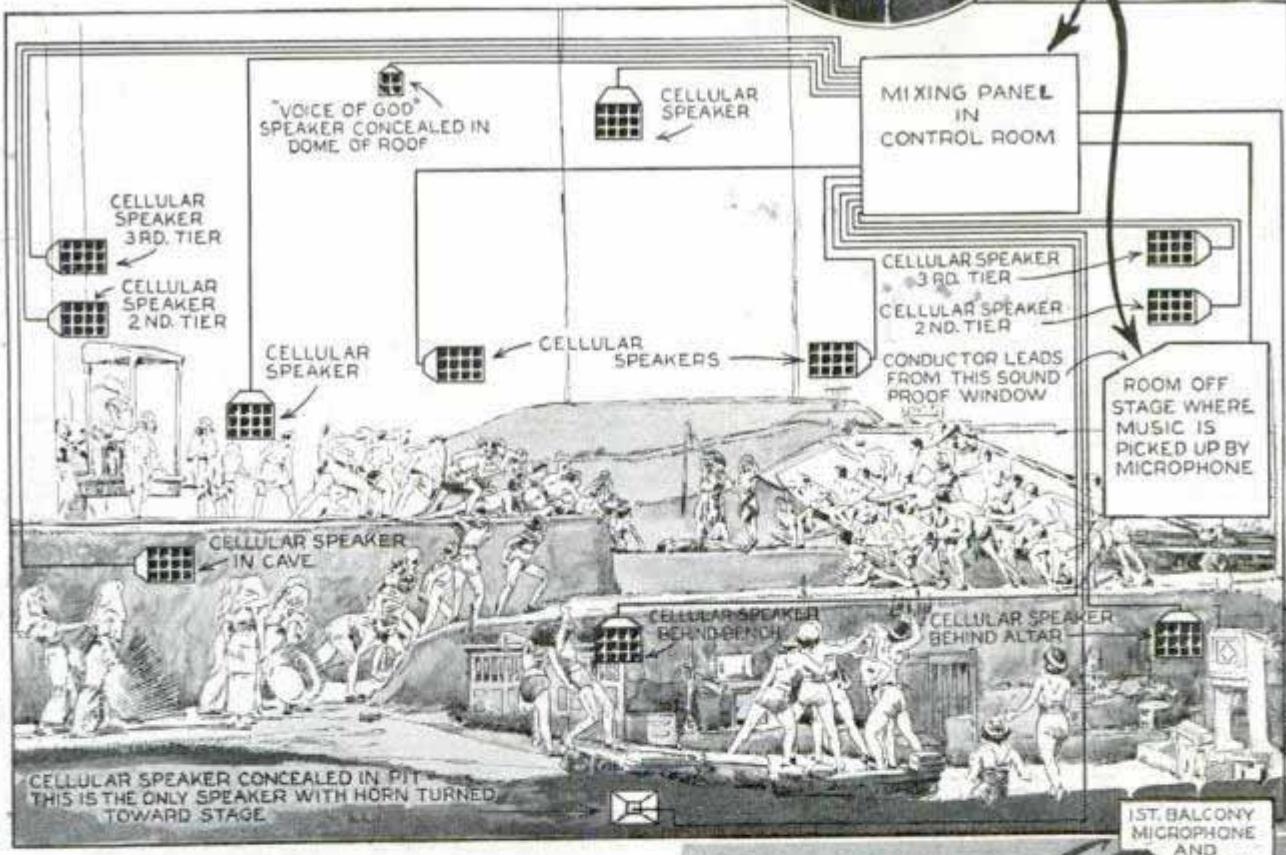
Spectacular scene from Max Reinhardt's stage production, "The Eternal Road," showing the revolt of the slaves in Egypt. On opposite page is a sketch of the same scene showing the location of each loudspeaker, which has been carefully concealed from the audience

es 83 Cmt. George A. Cahoon.
 2047 North Park Av.
 Phila.

SOUND ENGINEERS help the stage

A WE-INSPIRING effects for a Biblical spectacle in which 300 actors appear in a New York theater are achieved by sound engineers. From the "heavens" come angel choruses and the "voice of God," from some parts of the great stage are heard huge volumes of orchestral music and from other parts come choral numbers—all blended with scientific precision into the action and spoken parts of the big cast. Two men, working calmly in a sound-proof room in the dress circle, control all

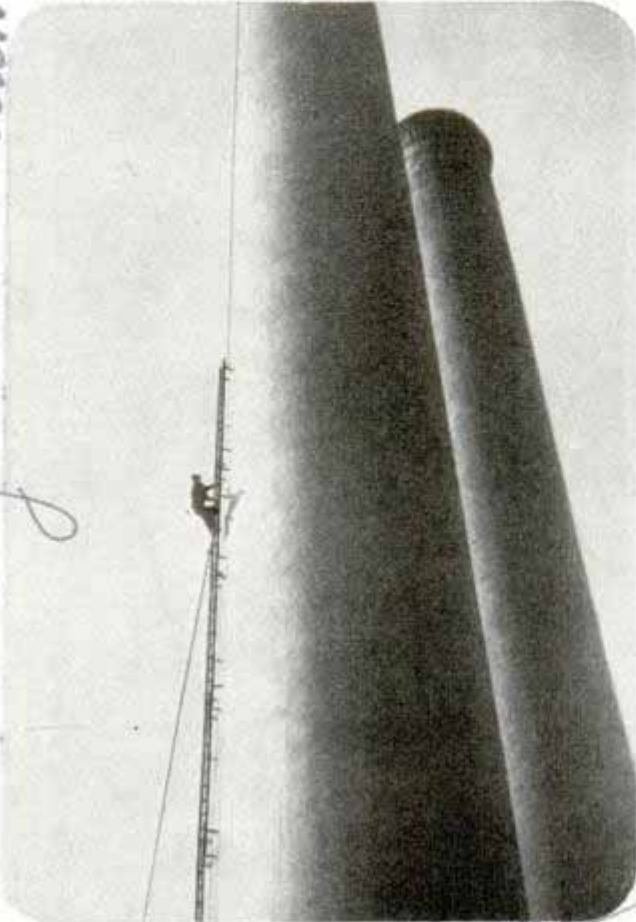
(Continued to page 144A)



Here is a diagram of the slaves' revolt scene. Note the twelve loudspeakers, which are concealed from the audience. One, designated as "voice of God" speaker, carries answer of the Lord to praying people. Photo, top, shows mixing panel in main control room. Circle, Conductor Isaac Van Grove, Dr. Leo Kopp, his associate, and Kurt Weill, composer, during sound-film recording. Bottom, signaling from recording room



Worker Climbs Big Stack on Ten-Foot Ladders



Intrepid stack worker on his way up giant chimney. Ten-foot sections fit into his ladder

Climbing to the top of lofty chimneys to make repairs is a job which requires unusual skill and daring, but the feat of a steeplejack who scaled a 285-foot stack in Washington, D. C., recently was almost too much for even the spectators. Using only ten-foot sections to build his ladder as he ascended, this expert calmly made his way to the very top of the Benning power plant's chimney to replace a broken lightning rod. His work done, he descended and the spectators breathed easier.

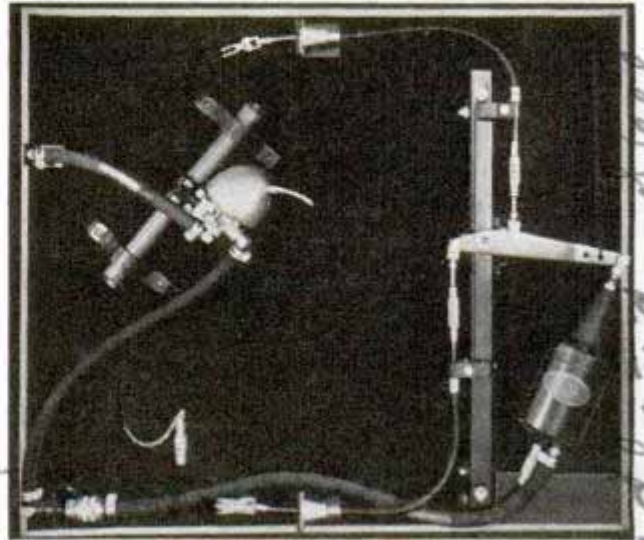
es 115
Argona
Lava Woods
at Benning Power Plant

tal cost to about \$1,750,000,000. Great Britain, Russia, Germany, France and Italy lead the European group in spending \$677,000,000; Japan and other Asiatic countries are spending \$99,000,000; Canada and the United States \$112,000,000, and Latin America \$20,000,000. All the countries will build 28,500 new planes. Of this total, 21,150 will be constructed by the United States, Great Britain, Russia, France, Germany, Italy and Japan. More than two-thirds of the American planes will be civil or commercial.

es 47

Trailer Brake Set by Valve on Car's Steering Post

Controlled by a valve lever mounted on the steering post of the tow car, the latest trailer brake is vacuum operated. The valve permits metering the amount of vacuum power desired to bring the trailer to a gradual stop, independently of the action of the automobile brakes. The lever is hand-operated. For down or upgrade parking, the lever can be locked to hold the trailer as long as the auto engine runs.



Top, trailer brake control lever is shown mounted under wheel. Bottom, the brake system

Billion Dollars for Airplanes to Be Spent in Year

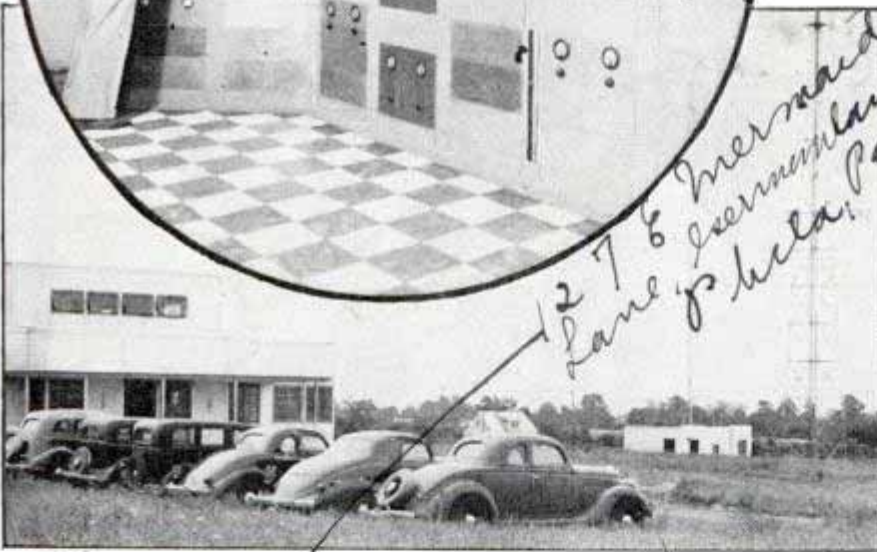
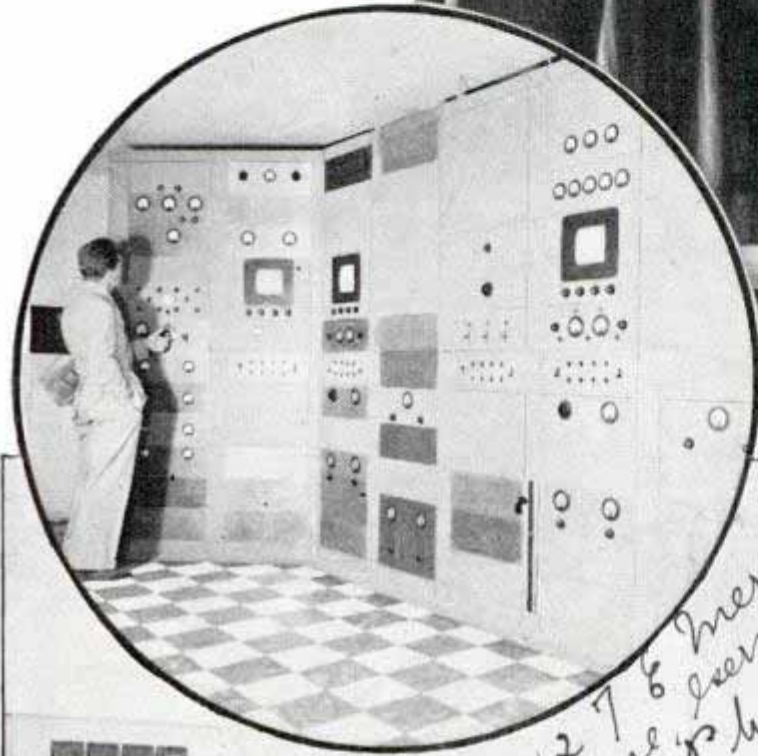
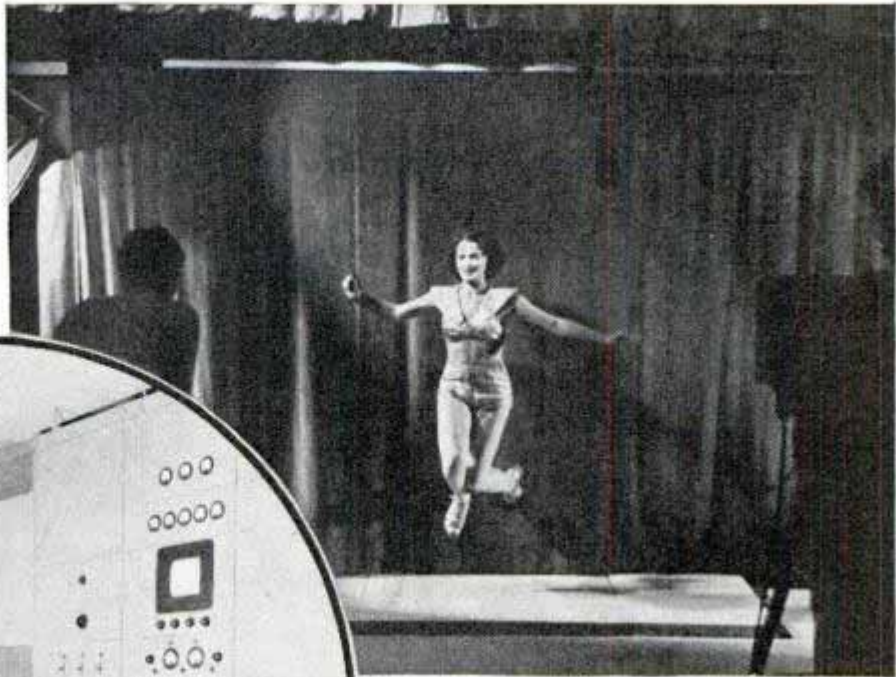
Fifty-six countries are spending almost one billion dollars for new airplanes this year, according to estimates by the Bendix Aviation corporation. Four-fifths of this amount will go for military craft. Maintenance of air corps personnel and upkeep of airways and airports will bring the to-

es 182
H.A. Bruno and Associates
106 N. Cleveland

Washington
106 N. Cleveland

High-Definition Television Broadcast to City

Built in the suburbs of Philadelphia, the Farnsworth high-definition television station "shoots" its signals into the city, using directional broadcasting. Experimental broadcasts employing 441-line definition in its



pictures are being radiated from a 150-foot tower situated on the highest point of land in the vicinity of Philadelphia. The station operates on 62.75 megacycles, the highest frequency ever used in television broadcasting, by means of cold-cathode tubes in the transmitter for modulating and amplifying over the broad band frequencies required. Experts believe directional broadcasting will minimize interstation interference when television stations are located in cities near by.

© Farnsworth Television, Inc. Top, performer before television camera. Circle, controls in transmitting room. Bottom, station and directional antenna tower

Flowers Are Kept Warm by Ice in Air-Express Shipment

Cut flowers shipped by air express are kept from freezing at high altitudes by coating them with ice. The flowers are packed in an ordinary shipping box wrapped tightly with wax paper, then surrounded with thirty thicknesses of newspaper which have soaked up about ten pounds of water. This again is wrapped in waxed paper to keep the moisture in, and the package then is placed in a paper-

board shipping box covered with fifteen layers of newspaper. In the zero temperatures of high altitudes the water-soaked paper freezes, liberating the "heat of fusion" of the water, which keeps the inside temperature above thirty-two degrees.

Oil production in the United States reached 1,090,000,000 barrels in 1936, sixty-three per cent of the world output.

Survival To Fisher Compressed Air magazine
Refrigeration Special
Jun. 1938

Es 20
2047 N. Park Ave
Phila

1276 Mermaid Lane, Germantown, Phila, Pa

2515

EASY CARD and ROPE TRICKS

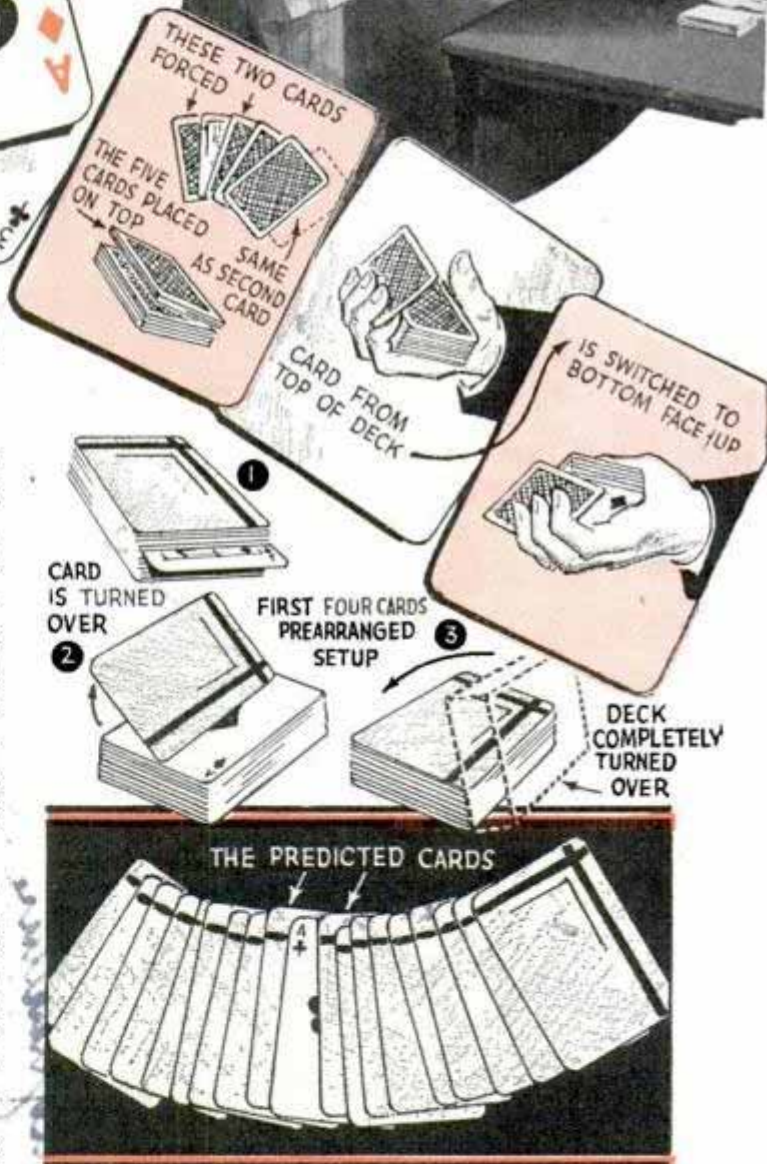


4529. Malden St.
Chicago
By Anthony Marks
(Professional Magician)

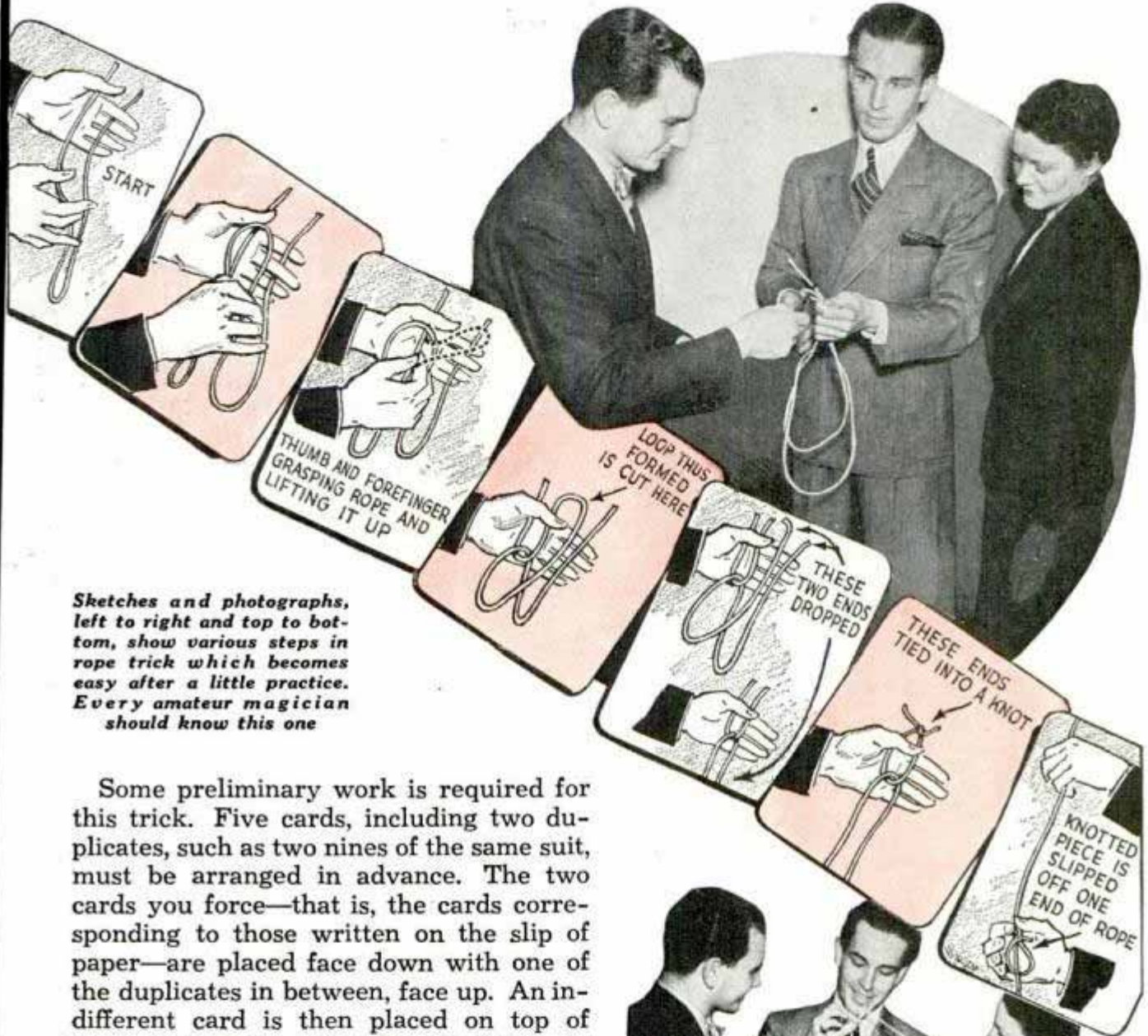
THERE is an irresistible appeal in magic for everyone from six to sixty, and this is particularly true of card tricks.

Nearly anyone can perform at least one card trick and make a stab at others. People discover the secrets of card tricks more quickly than other forms of magic, however, so the beginner should confine himself to a few simple tricks learned to perfection rather than muddle through a routine in which he deceives no one but himself.

Card predicting meets with favor whenever it is properly presented, and here is a sample. Write the suit and number of two cards on a slip of paper and place in a sealed envelope. Then casually pick up a deck and flip the top card onto the table with its face showing. Ask some person to place this card in the deck, face up, stating you will predict the card above and below it. When the sealed envelope is opened, it is discovered that the two cards on the slip correspond to the suit and number of the cards between which the face-up one has been sandwiched.



These sketches show steps in the card prediction trick. Though it appears difficult, this trick is easy if the amateur practices a little and prepares his cards properly. At bottom is shown the deck with the two predicted cards, face down, with the identifying card, face up, between them. Arrows point to cards which the performer shows audience



Sketches and photographs, left to right and top to bottom, show various steps in rope trick which becomes easy after a little practice. Every amateur magician should know this one

Some preliminary work is required for this trick. Five cards, including two duplicates, such as two nines of the same suit, must be arranged in advance. The two cards you force—that is, the cards corresponding to those written on the slip of paper—are placed face down with one of the duplicates in between, face up. An indifferent card is then placed on top of these three with the other duplicate on top of it. This entire setup tops the deck when the trick is begun.

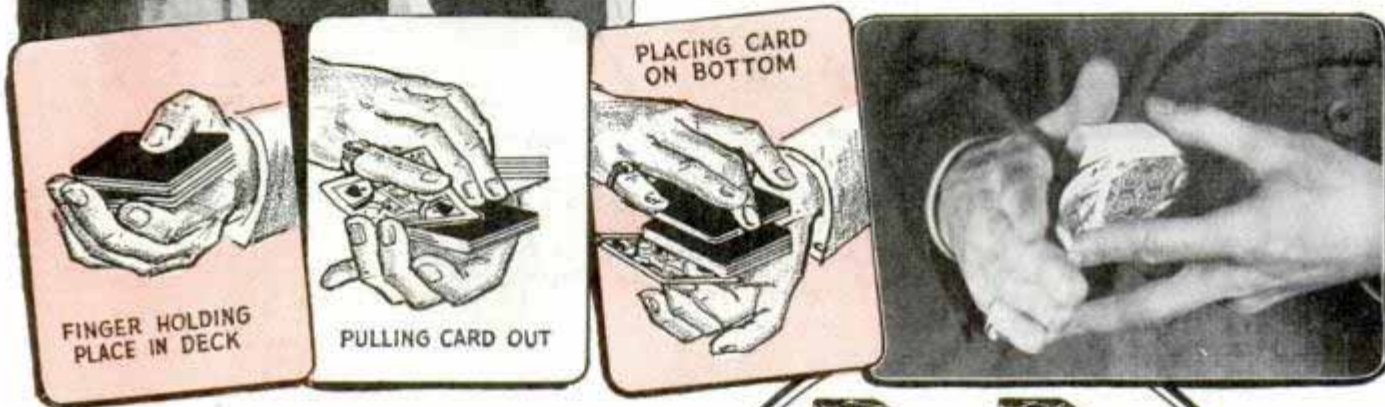
Upon completion of your explanation, flip off the top card, one of the duplicates, in an offhand way for someone to pick up. While this is being done, slip the top card between the first two fingers of the hand holding the deck and switch it to the bottom to give the pack a double back. In the next movement turn over the deck so the cards are face up, although they appear to be backs up to the audience because of the top card. Thus when the bystander inserts the card discarded at the start of the trick into the deck he believes it is going in face showing. In reality it is facing the same as the other cards. Now take the deck in both hands and while it is being turned over, change the position of





the movements and with the second finger you lift this card and shove it a little way out of the pile. By using a ring and your little fingers you pull the card all the way out and put it at the bottom of the deck.

Then divide the deck into two portions, retaining the bottom half that contains the selected card. While the spectator is examining his portion, you shove the selected card up from the bottom to the top of the pack with the first finger of the left hand into the palm of the right. Then skim through your cards. While the spectator places his cards on the table, hold yours in the left hand at your side. When explaining the purpose of the trick, grasp the top card in your own portion of the deck between the first two fingers and shunt it



the bottom card so all are running in the same direction with the exception of the prearranged setup on the top of the deck. Cut the cards to bring the setup to the middle. As the spectator reads the suit and number on the slip of paper, skim through the deck, pulling out the three cards to prove your prediction has been correct.

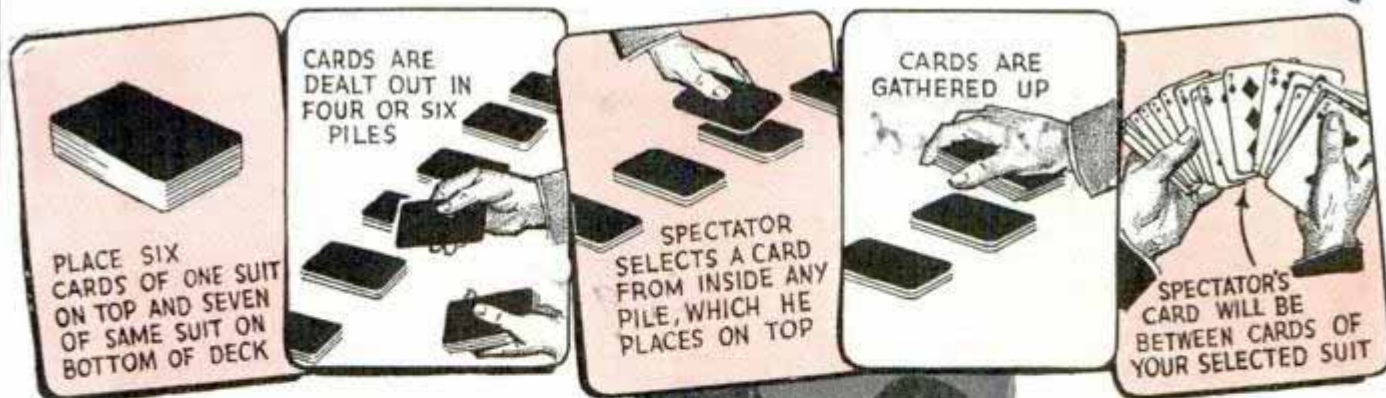
Another mystifying routine is to have a card selected by a bystander as you riffle through the deck. Cut the deck in two portions, giving one to the spectator and retaining the other. The two piles are again cut and stacked into one deck. You then find the selected card by having it appear face up in the deck.

This is effected by a few deft movements with the selected card. You riffle through the deck until the spectator tells you to stop. After he looks at the card momentarily, you snap the stack shut, but hold the spot with the second finger. Your other hand is then brought over to cover



Various steps in picking out the card selected by spectator while magician riffles deck. Circle, dealing and reassembling the cards for the spelling trick

to the bottom, turning it and bringing it face up. Dividing the cards into four piles you restack them, being careful not to show the face-up card at the bottom. When the cards are spread out the selected card appears with its face up.



A spelling trick can be done with cards. Four people are handed a number of cards and while you turn your back each selects one card from the respective packs and after looking at it places it at the bottom of each pile. The cards are gathered up and you spell out each of the four selected cards, spelling the name of the card by counting off one from the top of the deck for each letter.

To perform this feat eliminate four cards from the deck in advance so as to leave forty-eight, each spectator being given twelve. Although not foolproof entirely, it is possible to spell out virtually every card in the deck. For example: t-h-r-e-e-o-f-c-l-u-b-s-o-r s-e-v-e-n o-f s-p-a-d-e. Some will finish on the singular of a particular suit, others on the plural. After the four packs have been picked up, the selected cards will become twelve, twenty-four, thirty-six, and forty-eight in position. Be careful to pick up the four piles in the opposite order to which they were handed out. Then ask the No. 1 spectator to name the card he placed on the bottom of his pile and



Top, easy trick in which magician picks out card selected while his back is turned. Left, method by which the four aces can be made to vanish from beneath spectator's hand and reappear in another pile of cards

when this is done, take the top card for the first letter, the second for the second letter, and so on until you spell out each of the four selected cards. So long as the number of the card, plus the name of the suit, plus the two letters "of" total twelve, the trick works. You can prepare for this trick by working out the various combinations which will add up to twelve, such as "deuce of clubs" instead of "two of clubs."

Another trick is to deal out four piles of cards in

(Continued to page 128A)

es 34

Pyrometer for Molten Metal Easily Kept Calibrated

Pyramid



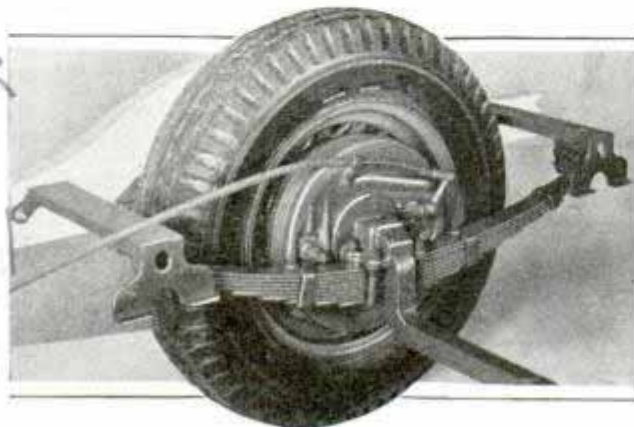
\$ 4.00

Taking the temperature of molten metal by means of thermo-electric pyrometer with flexible arm

Temperatures of molten metals can be taken with great accuracy by means of a pyrometer that can be kept in perfect calibration quite easily. It is reset by a simple turn of a small set screw on the dial. The pyrometer works on the thermo-electric principle, has a lightweight aluminum extension tube and a flexible arm adjustable to 180 degrees in any direction. A pistol grip affords ease of handling.

Torqueless Axle for Trailer Runs Smoothly, Steadily

Designed to eliminate torque, cranking and whipping strain, the latest axle for trailers carries only the weight. Its construction is a simple "Hotchkiss" drive through spring and spring saddle, con-



Showing new style drop axle for trailers in relation to spring, brake and the wheel

verting the axle into nothing more than a spacing bar between the wheels to carry the weight of the steel or wood chassis. Of the drop-axle design, it has a spring spread of fifty-three and three-fourths inches on a sixty-four inch tread. Smooth and steady in operation, the axle provides for a low floor line, as well as high road clearance.

Boxcar Has Removable Roof to Make Loading Easier

To facilitate loading and unloading of automobiles, timber, newsprint rolls and other heavy, bulky objects, the latest freight car has a removable roof. Built in three sections the roof is held in place with

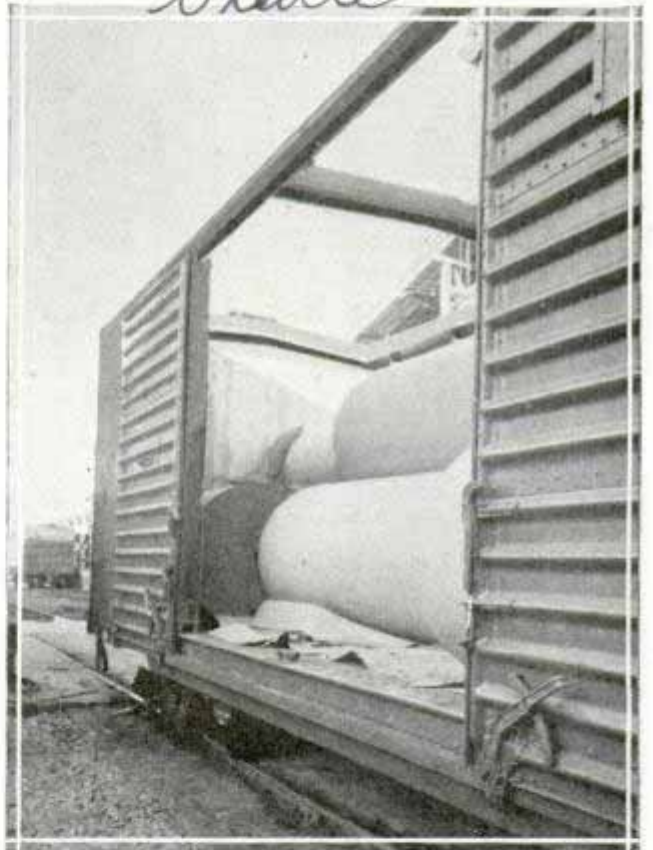


Photo courtesy of Armstrong Cork Co. Here is freight car with roof removed to facilitate loading of large objects

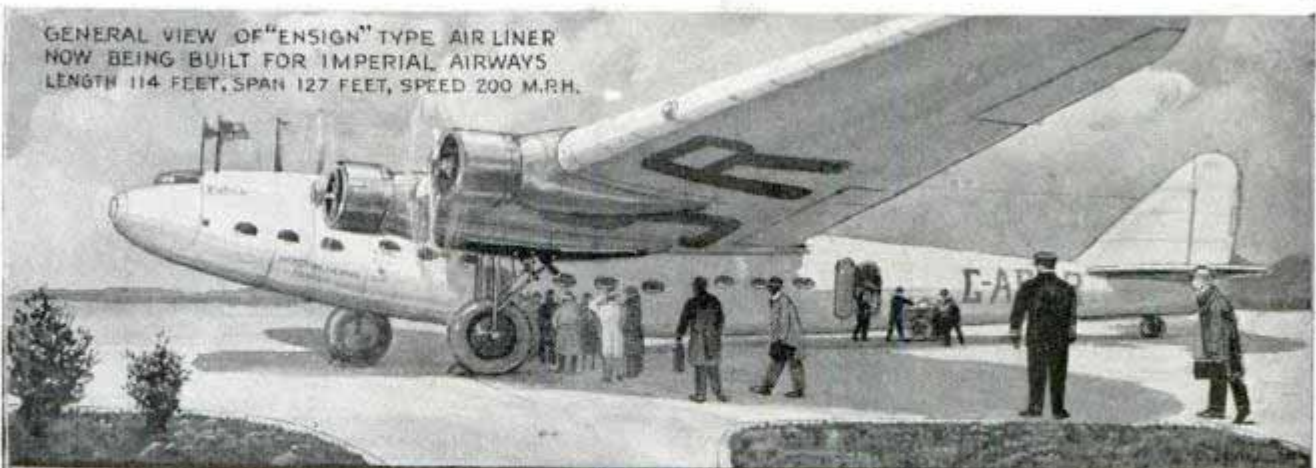
clamps which lock and unlock by manipulating hand levers inside the car. The sections are entirely removable or may be stacked at one end, one on top of the other. The car has the customary side doors, permitting it to be used in the usual manner, thereby not restricting operation. In tests thirty rolls of felt paper weighing 1,660 pounds each were loaded into the car, compared to nineteen rolls comprising capacity load for the ordinary car.

Armstrong Cork Co. Lancaster Pa.

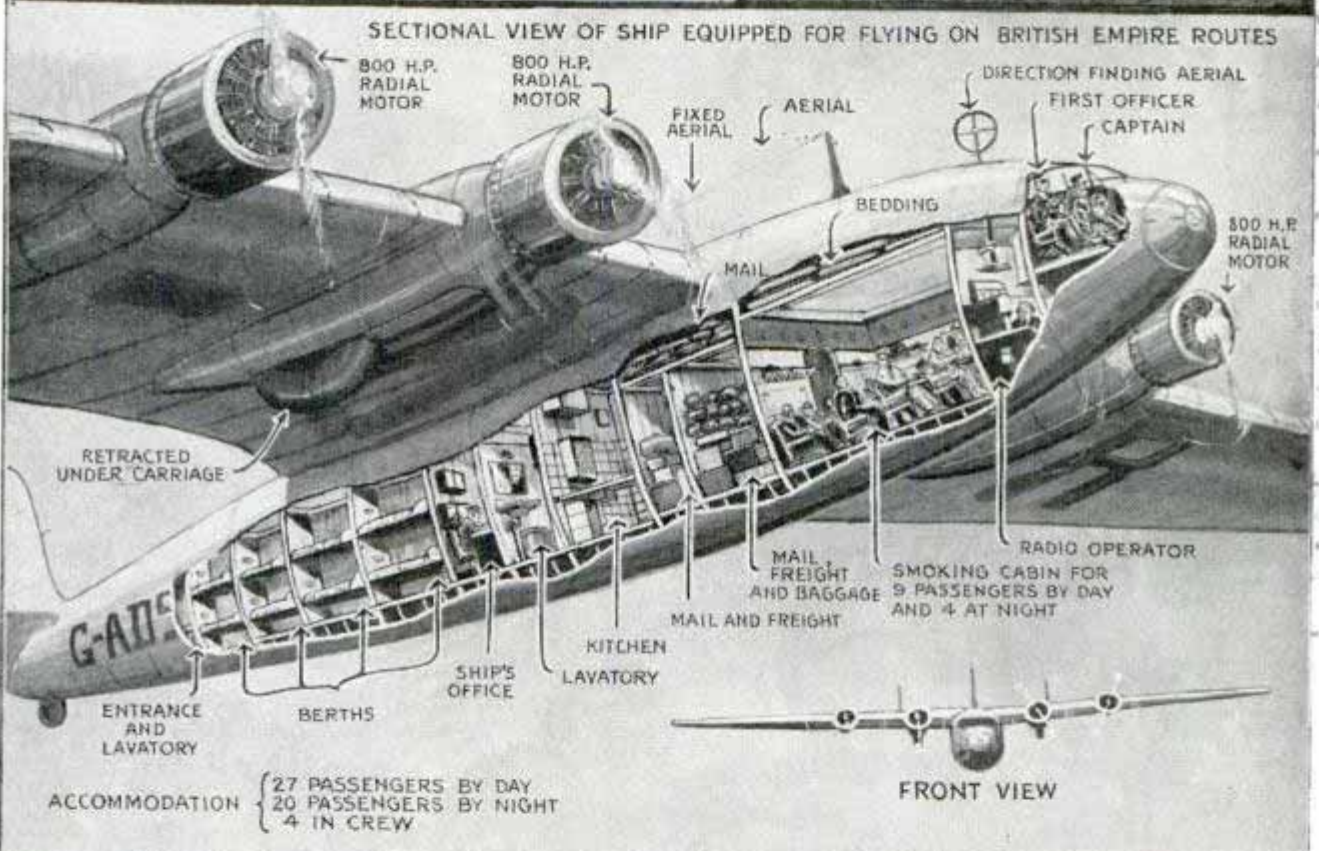
Samirgo Sillia Co, 228. La Salle, Cheay
es 55
Hammer Blow Tool Co Wausau, Wis

Fleet of Big Air Liners to Fly British Routes

GENERAL VIEW OF "ENSIGN" TYPE AIR LINER NOW BEING BUILT FOR IMPERIAL AIRWAYS LENGTH 114 FEET, SPAN 127 FEET, SPEED 200 M.P.H.



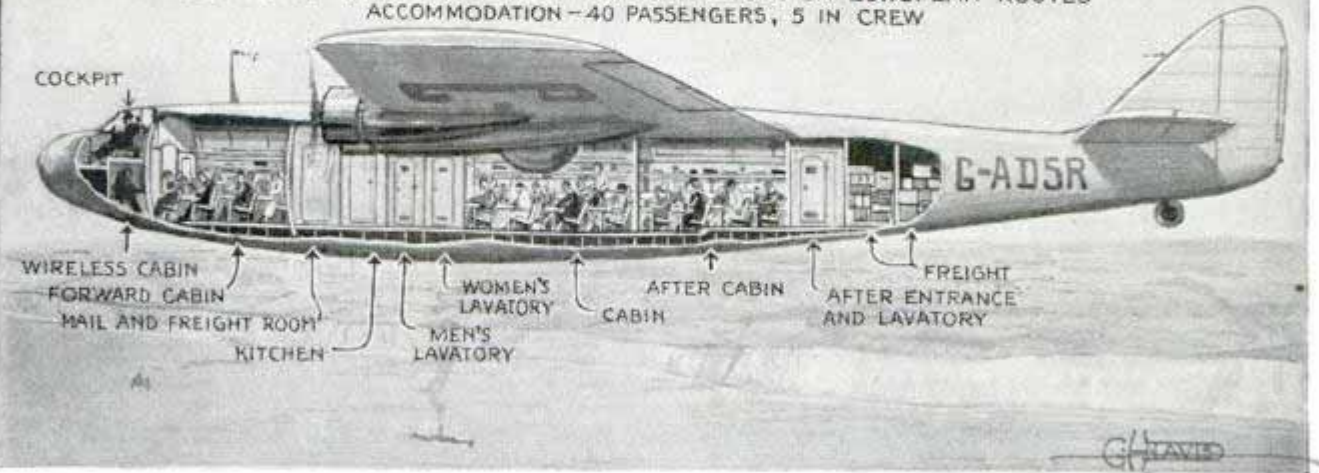
SECTIONAL VIEW OF SHIP EQUIPPED FOR FLYING ON BRITISH EMPIRE ROUTES



ACCOMMODATION { 27 PASSENGERS BY DAY
20 PASSENGERS BY NIGHT
4 IN CREW

FRONT VIEW

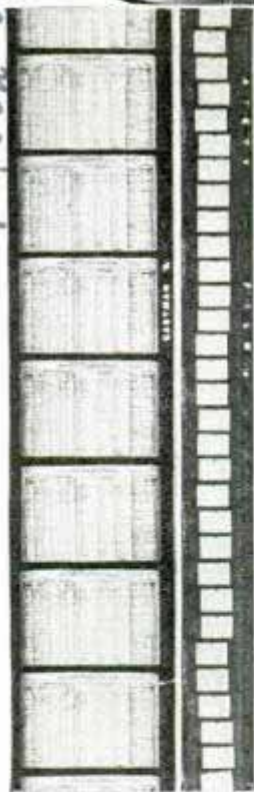
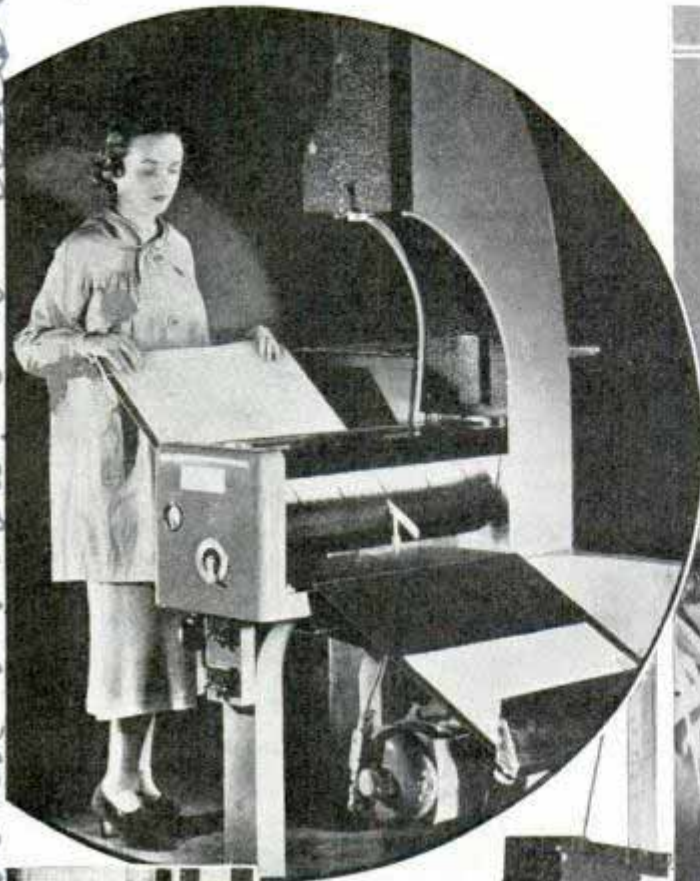
SECTIONAL VIEW OF "ENSIGN" CLASS FOR USE ON EUROPEAN ROUTES ACCOMMODATION - 40 PASSENGERS, 5 IN CREW



Top and bottom, giant land plane being constructed for Great Britain's European routes. Center, flying boat which will fly Empire air lanes. Forty ships of these two designs will be constructed.

Emp. ... Lemmer ... Road, Ewell Surrey

Historic Census Lists Copied on Movie Film



Yellowing pages from the United States census rolls are being copied for permanent preservation on motion-picture size film, so small that the written record on the photographic negative seems microscopic. Yet the special projector at the census bureau throws the record up clearly, one-half size larger than the original page. Cameras eleven feet high perform the copy work, starting with the citizen rolls in the censuses of 1880 and 1900, these names being of particular value in administering the new Social Security Act. Loose pages are fed down a sloping tray and a suction roller carries them under the camera lens

Upper left, pages of census roll are fed down sloping tray to suction roller and filmed as they travel beneath camera lens. Right, projector throws up image one-half size larger than original page although negative is too small to be read. Below, at left, are reproduced at about half their actual size a thirty-five-millimeter film of census sheets and sixteen-millimeter film of 1900 census cards. Camera at bottom is photographing pages of bound volumes

filled film made up Eastman Kodak Co. Rochester NY

Cent. John L. County 221 The Mavery 19th and 1st St. W. Washington

which films them "on the move." Other cameras photograph pages of bound volumes, a carriage moving the book back and forth automatically to film each of the two facing pages. Thirty-five-millimeter film, standard size for professional movies, is used in copying pages and sixteen-millimeter film records the census cards. When the records of 1880 and 1900 are completed, the bureau plans to go back to the earlier documents which include the names of Washington, Jefferson, Madison and other founders of the nation. By preserving these records on film, further wear and tear by reference to the paper volumes are eliminated; the films can be circulated among historical societies, and considerable storage and transfer cost is saved. One roll of film less than four inches in diameter holds the names of 70,000 persons, which on paper occupy a volume twice the size of a large dictionary. The 1880 census alone contains 50,000,000 names and required 1,024 volumes, and that of 1900 recorded 76,000,000 names on 33,000,000 cards.

Right 1200. Nippon and American Es 62 Philadelphia
Vise Removable from Base for Drill-Press Jobs
"Yankee"



Vise removed from base may be used, as illustrated, to hold work under drill press

20143
Fly Box Has a Transparent Lid with One Small Opening

Fishermen can choose a fly readily and obtain it with ease from a circular fly box with transparent, revolving cover. The box is divided into compartments and there is one section of the lid that opens above a single compartment. Selecting his fly, the fisherman twirls the cover until the opening is over the right compartment, flips the sectional lid up, takes his fly and lets the lid spring shut.



Fisherman can flip up lid over small opening and remove fly without disturbing other compartments

Serving as a two-in-one tool, a handy vise now on the market may be removed from its swivel base and used to hold work firmly in the drill press. The vise may be obtained with or without the base. Hardened steel blocks with V-shaped grooves for holding round stock are available. Made in four sizes with the smallest about five inches long over-all, the vise can be locked on the swivel at any handy position.

20944
Instrument Board on Bicycle Has Clock, Speedometer

Fitted with clock and speedometer, an instrument board is standard equipment on the latest bicycles. It is attached to the handlebar bolt. Besides offering means of telling time and speed, the board adds to the appearance of the bicycle.



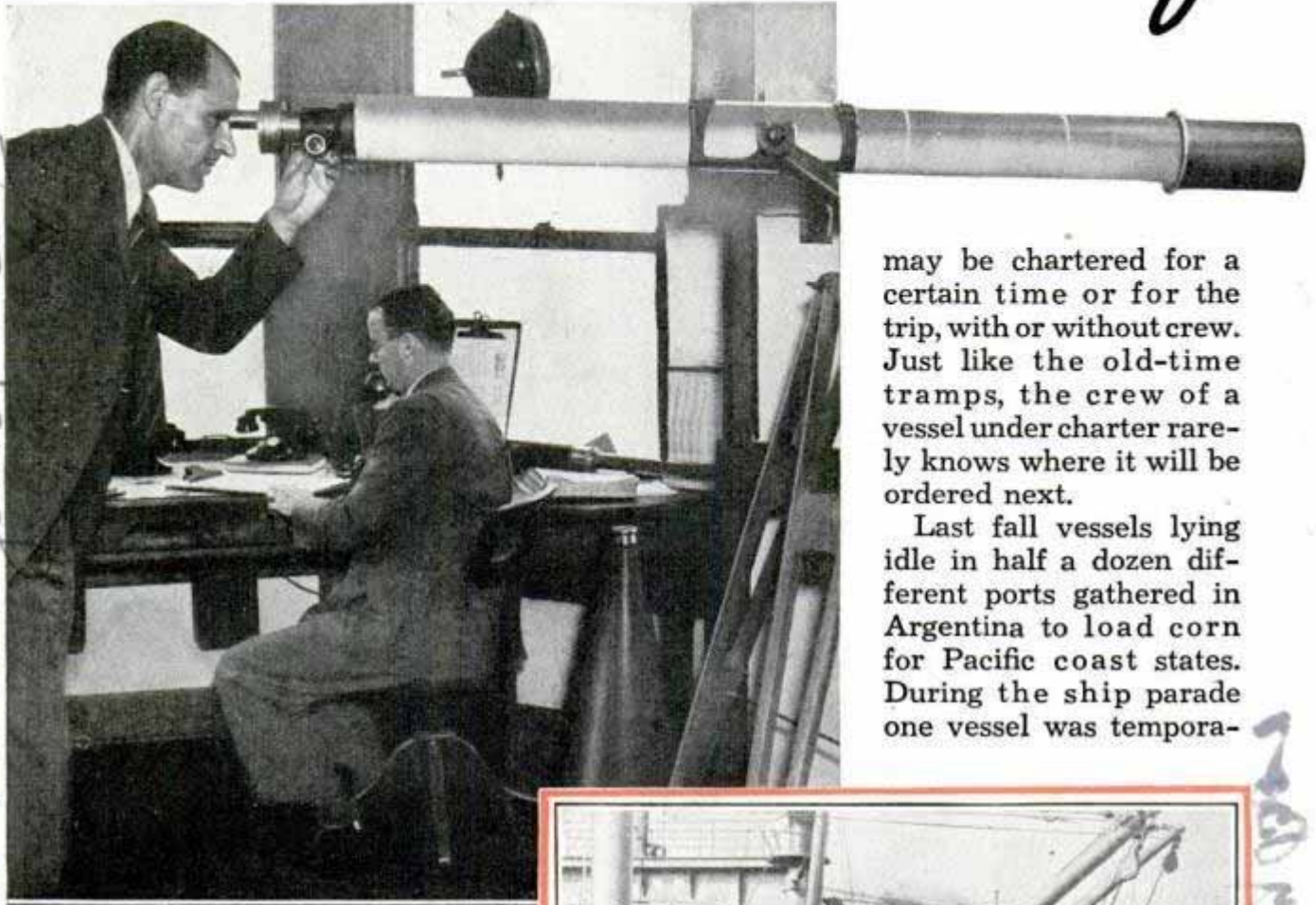
adds to the appearance of the bicycle.

J. H. Leyburne, Leaning Fly Box

*Junior \$3.50
 Senior \$3.75*

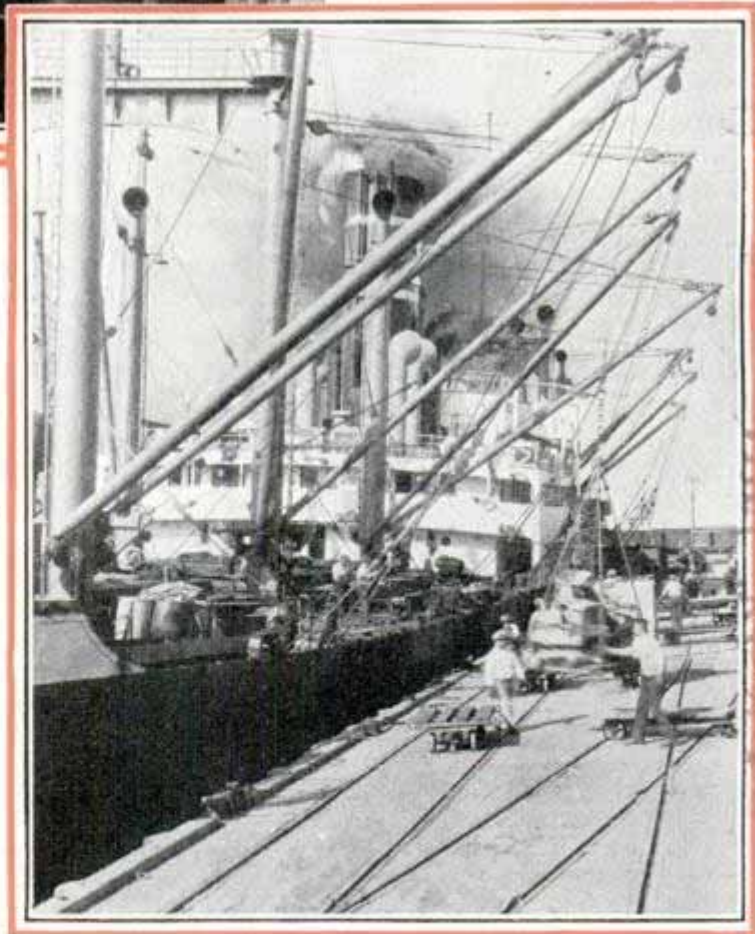
*Westfield Mfg. Co.
 911 North 1st St.*

NOMADS *of*



may be chartered for a certain time or for the trip, with or without crew. Just like the old-time tramps, the crew of a vessel under charter rarely knows where it will be ordered next.

Last fall vessels lying idle in half a dozen different ports gathered in Argentina to load corn for Pacific coast states. During the ship parade one vessel was tempora-



UNDER a dozen flags trim fleets of freighters are prowling around the world, modern ocean tramps scouting for cargoes in every latitude from Cape Horn to the Baltic.

"In the old days," says one ship operator, "a tramp ship was a broken-down vessel grimed with soot from worn-out engines. Their modern counterparts are economical, medium-sized freighters often built especially for the service. Some ship operators who like gambling in world markets wouldn't think of entering any other sort of trade."

In the early days a tramp carried goods for many shippers on the same voyage but under modern arrangements a ship usually loads with one commodity for one destination. Vessels that earn their keep by tramping the seas

Top, marine exchange officer identifying inbound ship through telescope. Bottom, modern freighter being loaded with cargo for another of its adventurous trips

Cont. Thomas & Steam, Jr. 10555 Hollywood
 Are Los Angeles Calif

Ref

Capt. Chandler, Marine Dept.

Capt. Chandler, Marine Dept.
 Chambliss, P. Rimmey

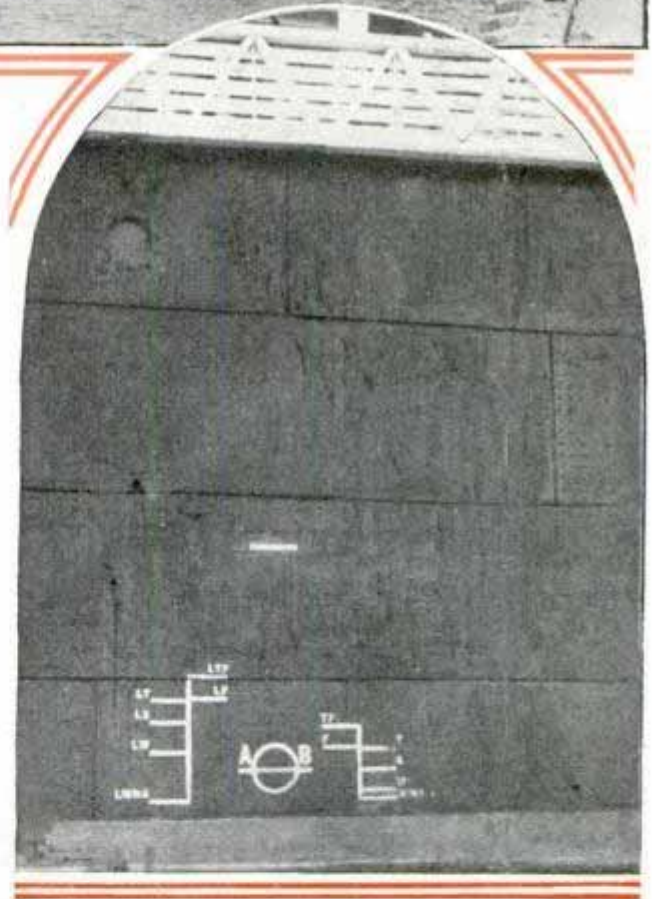
the SEVEN SEAS



rily disabled by striking a rock, while another rammed an iceberg on its way around the tip of South America. No one knew just where the boats were bound, for their instructions were that they would receive final orders by radio while approaching Los Angeles. Meanwhile their agents shopped for the best markets and at the last minute radioed the directions that sent them to several ports.

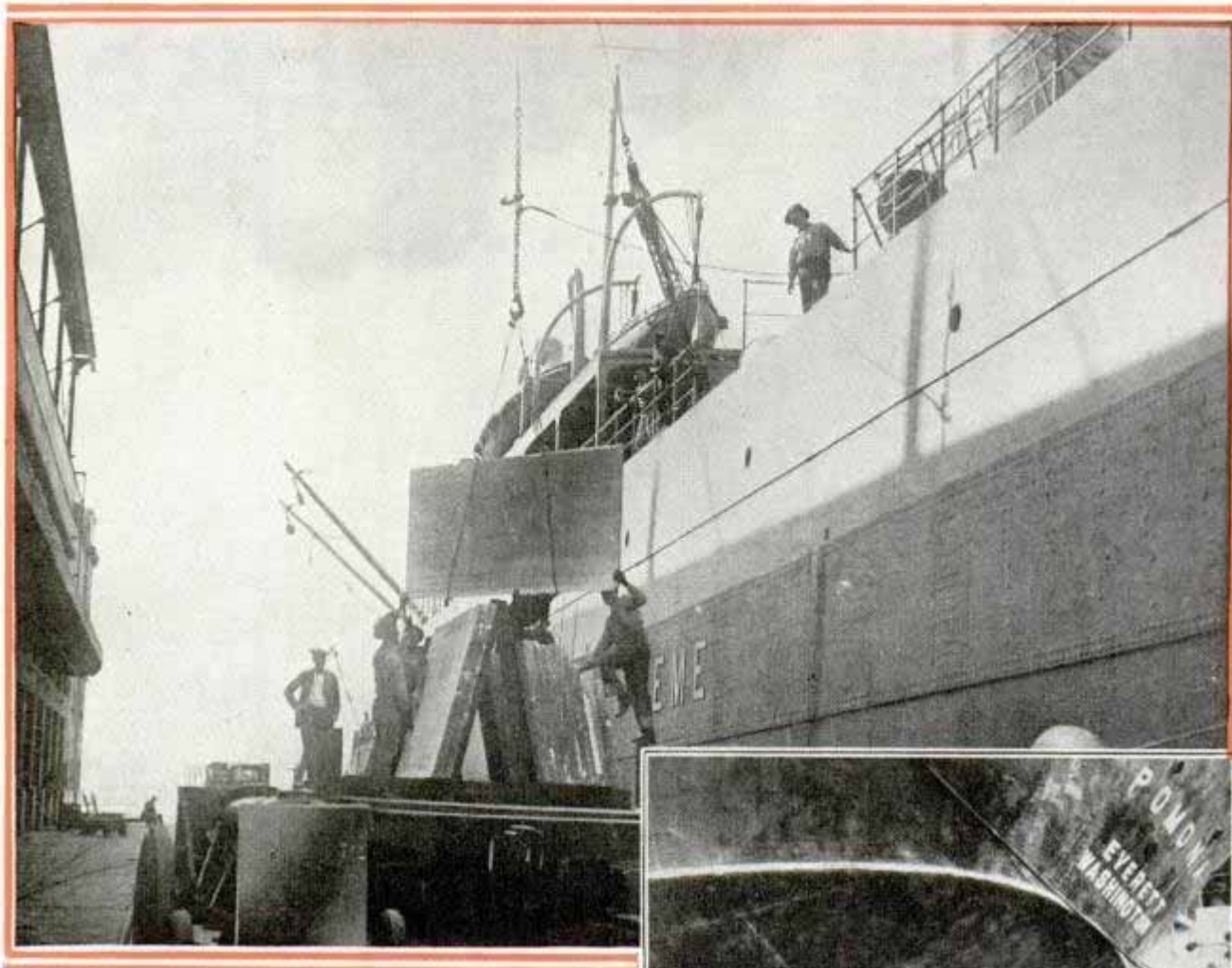
"On a typical tramp voyage a vessel may leave Liverpool with coal for the River Platte," outlines a ship operator. "At Montevideo, if nothing else offers, she may lay over six months waiting for grain for Los Angeles. There she may get a load of tires for Seattle, or may go up in ballast to the Puget Sound to pick up lumber for China. On the way across the Pacific her owners and agents are offering her in the world markets as being free at Pukow at a certain date. If there is a demand for soybeans in the United Kingdom she may load with them and return at once to Liverpool. Or she may steam down to French Indo China to pick up a load of rice for Cuba. From there she may carry sugar to the continent, or, if Australia needs asphalt, she sails to Trinidad for a cargo of that material.

"Where a vessel will go next depends upon the prices she gets for carrying goods, which in turn depends upon the ever-



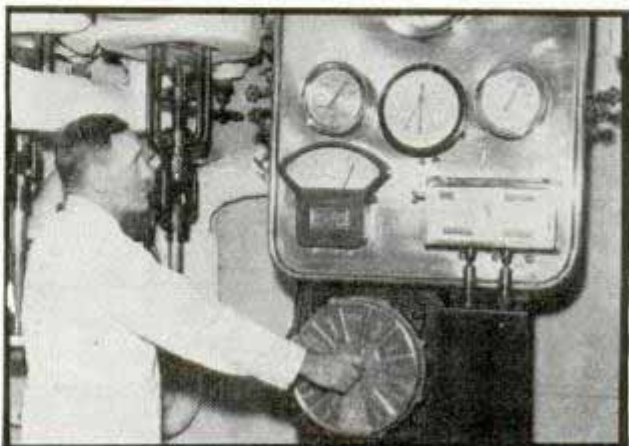
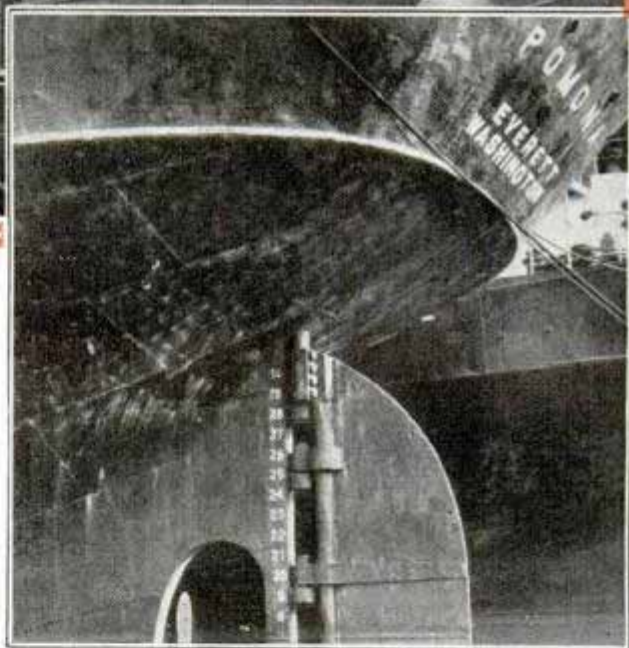
Top, freighters berthed for discharging cargo. Bottom, marks on ship showing safe load lines for different seasons in different oceans

changing demands in international markets. Sometimes it pays to turn down a profitable charter if she has to make a long trip in ballast afterward. The problem of the tramps is to keep the ships always running and always full. This calls for a constant watch on world markets with a weather eye on possible shifts in trade."



Often freak movements result from conditions such as a rice famine in China or a corn drought in the United States. Changing embargoes and tariffs influence the markets and a ship that one year carries copra from the Celebes Islands to an American soap factory may be bound for the same destination next year with a cargo of Brazilian cottonseed oil instead. Phosphates, grains, ores, coal, and lumber are important items upon which the tramps depend for business. Oil is another important commodity and in this specialized service a whole fleet of tankers keeps on the move.

Modern "liner service" freighters that operate on fast schedules have taken much business away from the tramps in the last few decades. Competition is so great that practically all of the little out-of-the-way ports that once depended upon an occasional tramp are visited regularly. But the freight liners, carrying general cargo and operating on schedule, can't meet the demand when shiploads of special materials must be moved across the oceans.

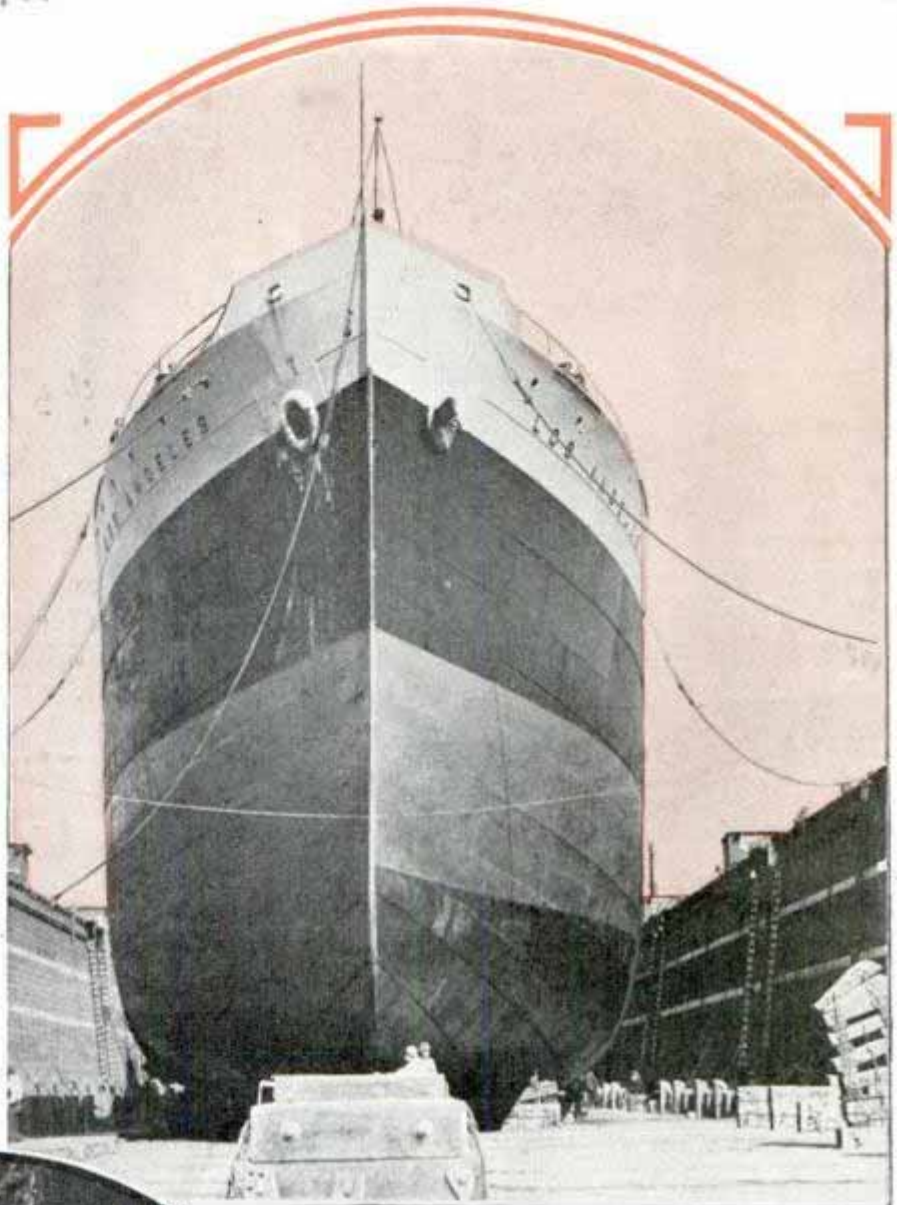


Top, unloading slate. Center, numbers on rudder show how ship is trimmed. Bottom, engineer turning telegraph

Up-to-date tramps are oil burners that steam along at twelve knots. They carry from 5,000 to 7,000 tons of cargo, since larger ships might go half empty part of the time. They are equipped with all the latest fire-prevention and fire-detection devices, including smoke detectors, automatic fire alarms, and steam smothering lines.

In the early days nearly every freighter was a tramp. Owners sent their ships to sea expecting that the captains would shop at every port for the best bargains they could get without knowing when or with what kind of cargo the ship would return.

Upon entering a strange port a captain would fly his house flag marked with some letter or symbol that the local agent of his owner could recognize. Then the captain



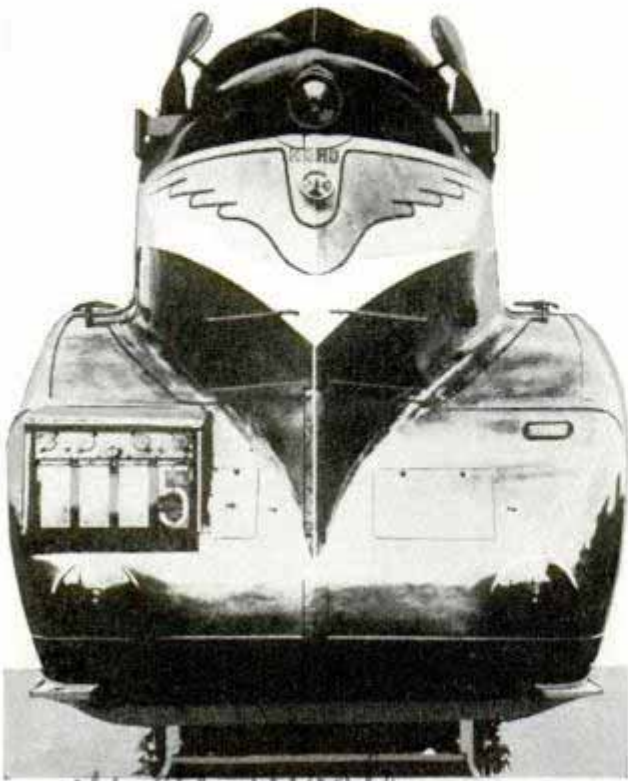
Top, oil tanker in dry dock. Bottom, scene in ship's hold during unloading of raw silk from Japan.

would look for a similar flag to be run up at one of the wharves. In that way he would know where to berth his ship. If he had cargo to discharge he might not get to sea again within a week. Storage space in a warehouse had to be cleared, arrangements made to pick up other cargo, longshoremen hired, and a score of other details attended to. The trouble with such arrangements was that they were too haphazard to last. Ships lying idle in a port "eat their heads off" without earning revenue.

Radio has cured some of these troubles and clocklike precision in cargo handling has fixed the rest. These days all shore ar-

(Continued to page 124A)

High-Speed French Engine Has a Streamline Face



Striking head-on view of streamline locomotive on French railroad, upper part resembling speedboat

Built for fast passenger service on the Nord railway, a French locomotive shows the world a new streamline face. Its design embodies the latest European ideas of aerodynamic lines and speed-train construction. The upper part of the locomotive resembles the prow of a speedboat.

Truck Signals Tell Car Driver If It's Safe to Pass

Designed as a new aid to highway safety, red and green signals have been at-

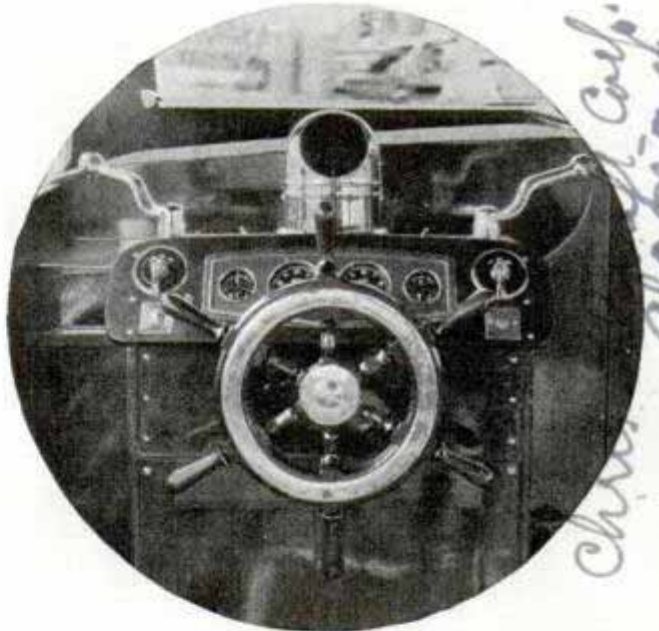


Driver points to signals which he controls from dash when car seeks to pass

tached to his truck by one commercial driver. When an automobile driver blows his horn, the driver may flash the green light, marked "O.K.," to indicate that the road is clear and that it is safe for the car to pass. The red light, marked "no," tells the driver behind that it is dangerous to pass. Thus may be reduced the number of accidents resulting from auto attempting to pass a large truck when the driver cannot see the road ahead.

Smart Boat Instrument Panel Has Dual Engine Controls

Equipped with dual controls for operating two engines, a smart new instrument panel is a feature of the latest Chris-Craft boats of thirty-two feet length, and up. The controls are designed for independent



Instrument panel for latest motorboat. Note the dual controls and indicators

operation so that either one or both engines may be used. Tachometers on each side of the instrument panel show engine speed. Twin rudders connected with a heavy drag link are also fitted.

"Walking Pugmill" Speeds Up Surfacing of Highways

Instead of mixing the paving materials before laying a new highway surface, a "walking pugmill" speeds up road building by reversing the process. Trucks spread gravel or stone, sand, and asphalt in proper proportions and then the pug-

*Emir C. Denthorpe
Duchner, Md.
D.M.*

*Employer of car
Shopper dispatched
between lanes at
signal*

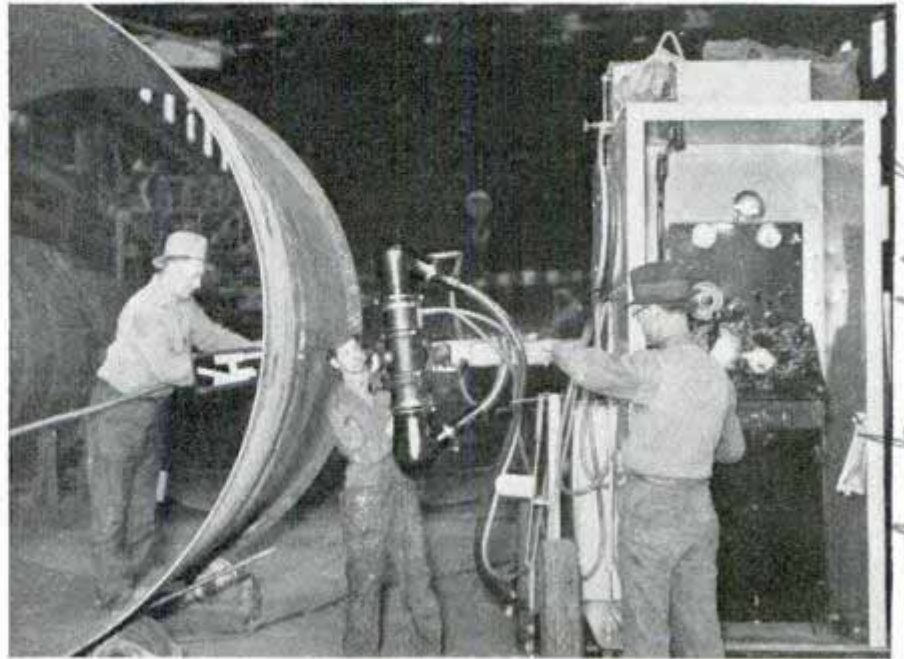
2045

*Chris-Craft
alg triad*

*Galger Machine Co
Columbus Ohio*

mill comes along, mixes the materials where they lie and levels them. Rollers follow the pugmill, and it is claimed the road is ready for traffic ten minutes later.

X-Ray Gun on Wheels 'Sees' Through Heavy Steel Pipe



Subjecting steel pipe to rays from portable X-ray machine at right. Photographic film on inside of pipe records flaws in metal

Plant Traps a Frog to Vary Its Diet of Flies

No shy little prairie flower is the "Venus's fly-trap." Its usual diet consists of flies and other small insects which are caught and digested when they touch the sensitive "fingers" of the plant. But when it is really hungry this strange plant will even eat a frog! The fly-trap grows profusely in the region of Wilmington, N. C., and a florist searching the woods for some plants came upon a flytrap which had seized a small frog in its "jaws." The frog

Operating on 100,000 volts of electricity, a powerful X-ray machine on wheels "sees" through heavy steel pipe and makes a record on photographic film held against the inside of the pipe. The rays are projected through an aperture in the center of the "gun," penetrating two-inch steel. The equipment is used in construction of siphons and delivery lines of the Colorado aqueduct to test the pipe for flaws.



Emir C. Henthorn lives

near Kansas City.



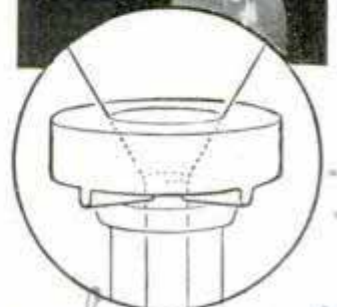
Photo courtesy Adams Studio, Wilmington, N. C. This Carolina plant was strong enough to nab a baby frog and hungry enough to eat it

was only a youngster, yet it is remarkable that the plant had sufficient strength to clutch it until the frog was dead.

Prospectors for oil last year drilled 74,000,000 feet of holes in American soil, sufficient to bore clear through the axis of the earth and halfway back again.

Funnel Speeds Filling Without Spilling Fluid

To keep funnel from tipping and speed pouring of fluid into a bottle, a new rubber core funnel has been invented. The core is tapered, holding the funnel upright. Four ribs underneath provide air vents so fluids pour through the stem without gurgling.



Wilmington Chamber of Commerce

Fisher Scientific Co. 711 Forbes St

Clump of and especially by the Westward Pipe and Steel Co.

Eight and a Half Foot Giant Gives Tailor a Big Job



The tallest young man in America wears trousers longer than his tailor is tall

They don't carry clothes in the men's stores big enough for Robert Wadlow. Even the tailor finds it a full-size job to give him a fitting, and to do it right he needs a stepladder. An Illinois youth, Robert Wadlow is eight feet five inches high, the tallest human being known. He is eighteen years old.

Plane for Model Boat Makers Rounds Off the Hull

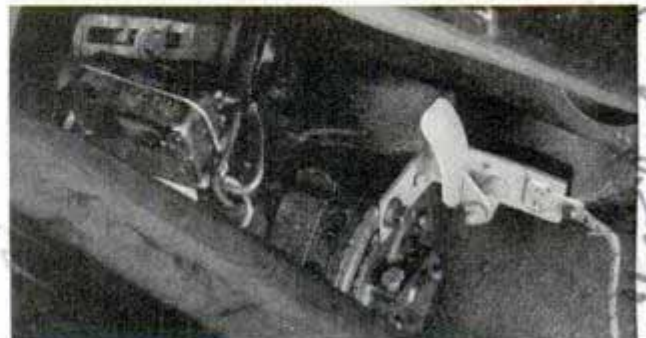
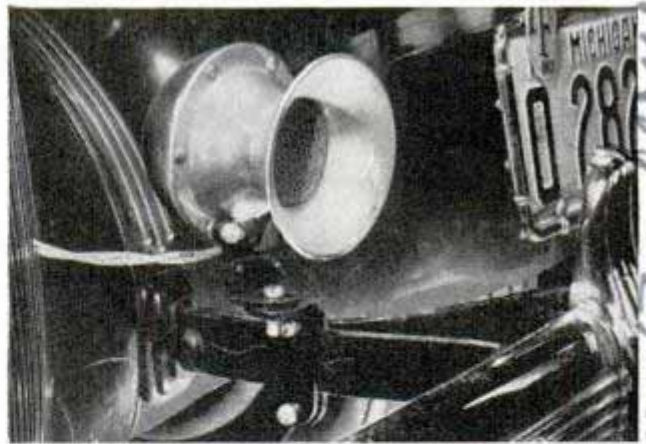


Constructed with a curvature at the bottom to make easier the task of rounding off the hull of

model ship or boat, a handy wood plane for the craftsman has been placed on the market. The tool decreases the time required to plane any object into circular or semicircular shape. It enables the model maker to turn out ship hulls correctly proportioned and rounded in much less time than craftsmen usually spend on such jobs.

Motor Fan Cuts in Louder Horn for Fast Country Driving

Capable of producing an ultraloud sound of warning, a horn designed for fast country driving is switched into the regular horn circuit by the air stream from the motor fan. As the automobile's speed rises the increasing air stream from the fan closes a switch and cuts in the loud horn so that it sounds with the regular horn when the button is pressed. At moderate speeds a spring holds the switch open and only the regular horn sounds. The sound of this horn penetrates closed windows of other cars, is audible above the roar of truck engines and reaches far ahead to warn the farmer turning onto the highway. The bracket switch which controls the horn may be attached anywhere on the motor, so long as it is in the air stream from the fan.

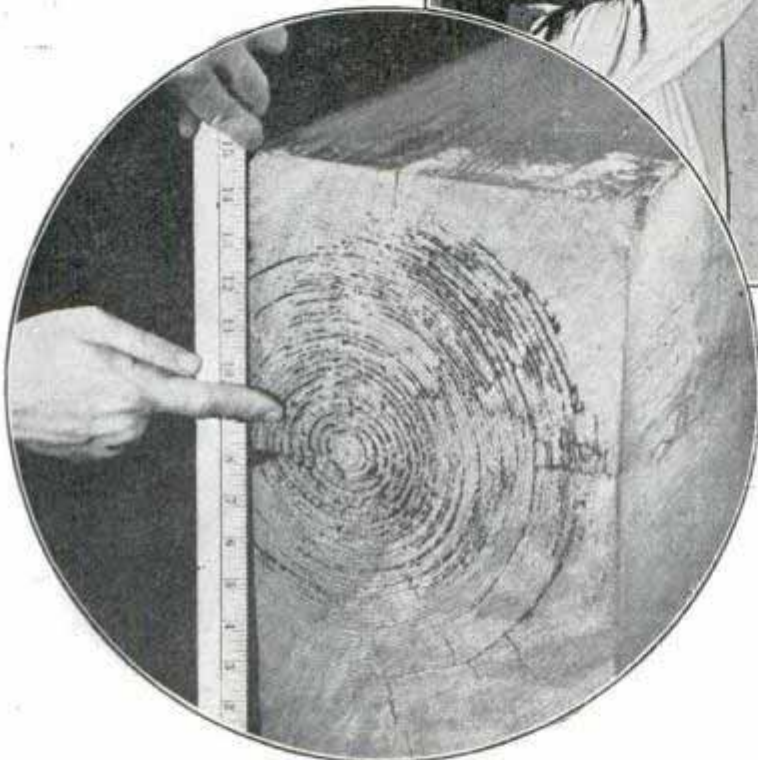


Top, ultraloud horn. Bottom, wind vane (colored white) which controls the horn

Stanley Tool Co
195 East W
Chicago
11659
3044 W Grand Ave
3044 W Grand Ave
Chicago, Ill.

Pressure Gun Injects Termite Poison in Wood

Right, injecting the patented chemical into house timbers with pressure gun. The liquid permeates wood, evaporates and leaves a crystalline barrier of poison which stops any encroachment of termites. Below, cross-section of beam showing destructive work of termite colony

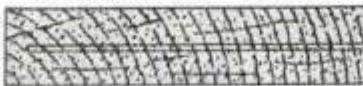


Surface or Spray Treatment



Brush or spray treatments cannot penetrate wood. The termites still work on the inside.

Terminix Pressure Treatment



Terminix penetrates deeply and is injected into the wood under high pressure.

INSIDE PENETRATION

Man is carrying the war against termites right into the insects' parlor. Deep in the timbers of your house, impossible to see, termite colonies may be eating away the heart of the wood. To stop their advance where it has begun, and to block any future invasion, a Memphis company has developed a liquid poison called "Terminix" which, shot deep into the wood with high-pressure guns, evaporates in a few hours leaving a lasting crystalline barrier which the termite cannot pass. The chemical itself is harmless to man or ani-

mals. Thorough insulation against termites is achieved by first inoculating the soil, then treating all contact points in foundation walls and supports, and finally impregnating all understructure wood members at their bearing points on all supporting construction with the chemical, forced through the wood by the pressure guns. A few hours later the liquid has evaporated and there remains a toxic chemical shield. It is estimated that termites cause \$50,000,000 damage every year.

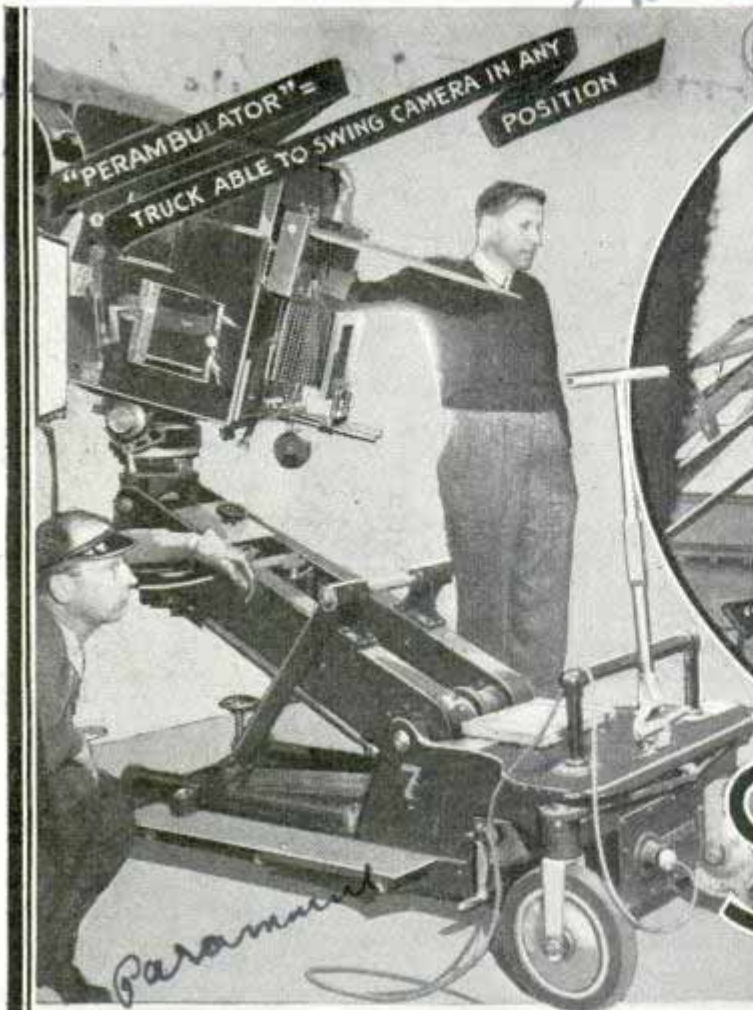
Brain Increases in Size Till Age Fifty or Sixty

Human brains that are mentally active continue to grow in size up to the age of fifty or sixty years, Dr. Ales Hrdlicka of the Smithsonian Institution has found. There is, however, no evidence to show that any change in brain functions accompanies the increase in brain dimensions. The head itself enlarges very gradually until the changes of old age enter the picture, and since there is no growth of the frontal sinuses nor thickening of scalp or bones after age thirty in men and twenty-five in women, the conclusion is that the growth of the head is attributable to enlargement of the brain.

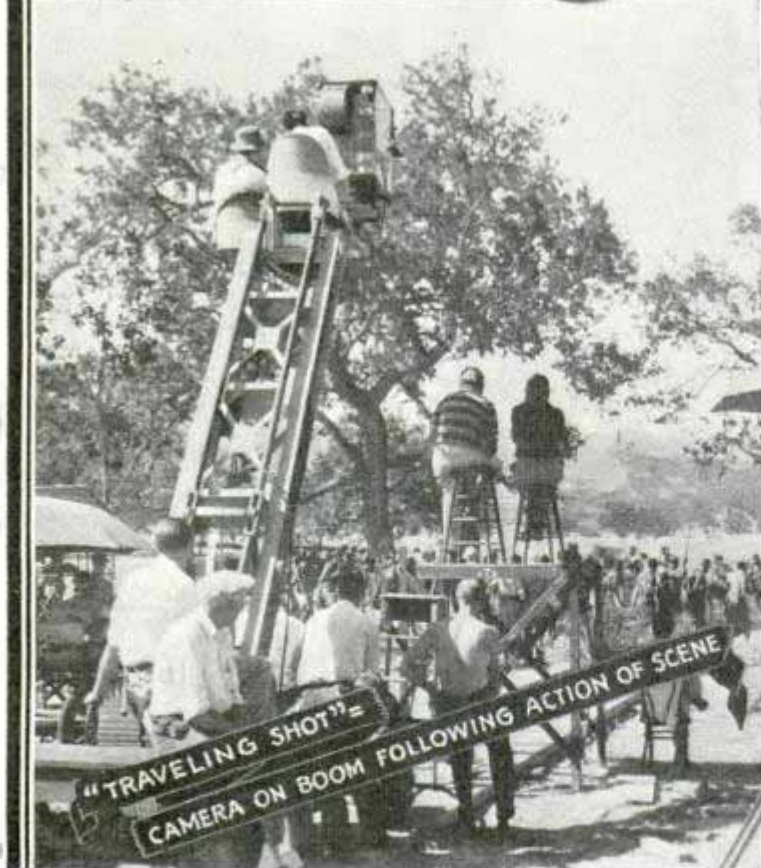
Washington D.C.

Handwritten notes:
about 8/15 0.00 per house
L. O. Bruce Co., Terminix Memphis
Memphis, Tenn.

F14# 8649 *Local maintain
Hollywood Calif*



STRANGE LINGO



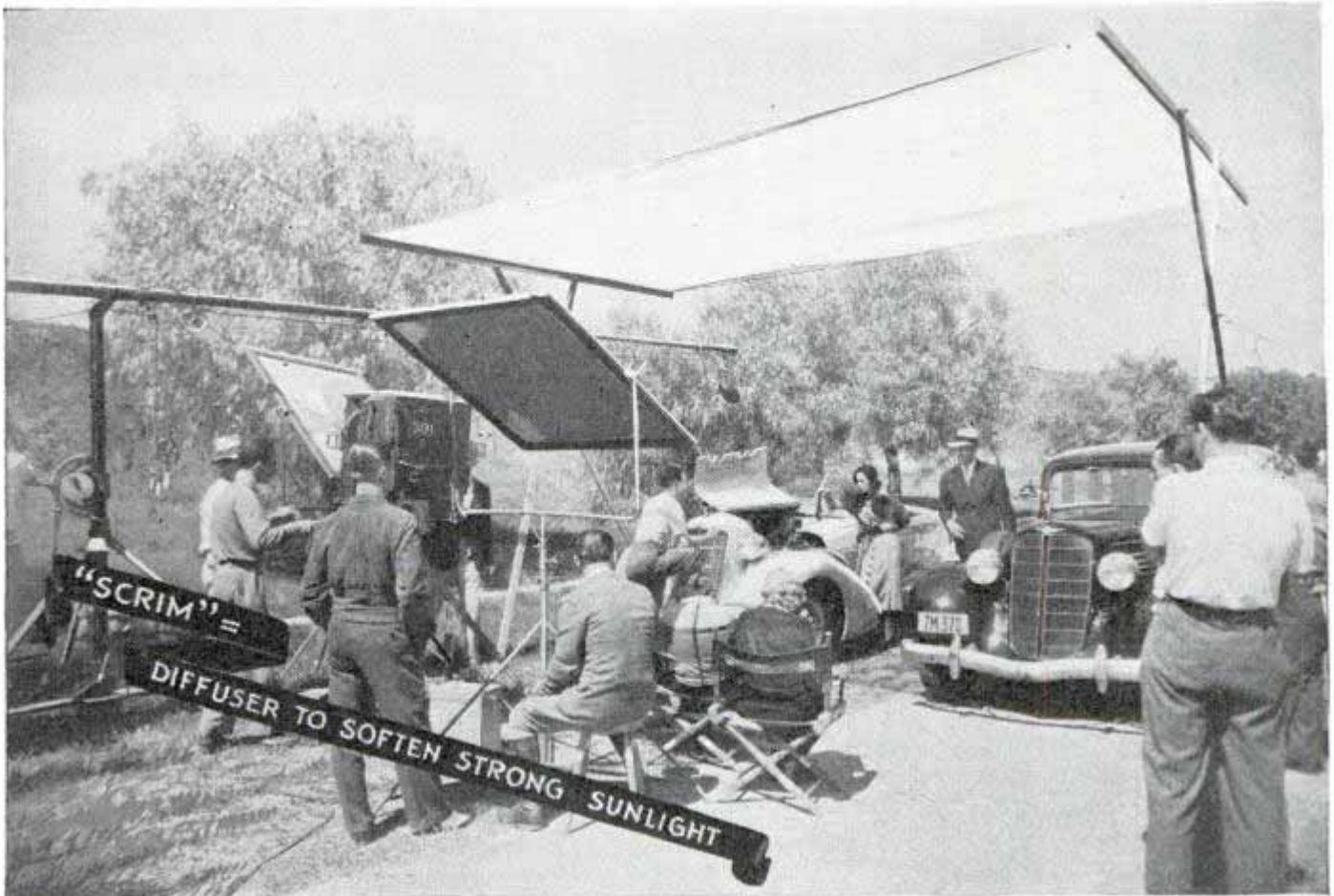
© Paramount

Three odd terms used in movies are illustrated. In circle, top, note the P. A. or public-address system. The big horn conveys instructions to extras in the scene being filmed

MOTION-PICTURE workers have developed a strange lingo unintelligible to the outsider. It is a short cut consisting of technical slang, phraseology, and peculiar words that have come into use to speed up filming and to convey a more exact meaning than could be done with a regular vocabulary.

Each studio department, of which there are more than sixty in most film plants, ranging from police, postoffice, factories, to the shoeshiner, has a special slang.

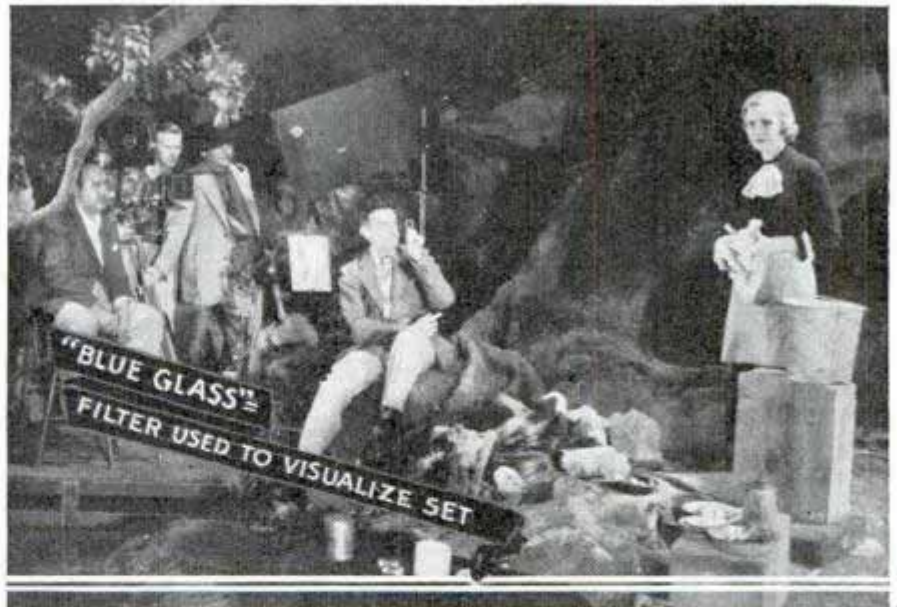
"Break-away," to the construction man, means a prop made of plaster or balsa wood used in movie scenes where the materials are to be broken, such as imitation dinner plates. "Glass" is the cameraman's name for a lens. "Soup" is used to develop photographic films, while anyone going



of the MOVIES

to the studio restaurant is going to "grab a sandwich" whether they intend eating soup or salad. The extra hanging around a casting office is "speck-in' a job." A "bon-bon" to an electrician is the name for a light. "Minnie" is the studio name for an electric truck used about the studios where silence is essential.

The movie language is composed of words often descriptive of a peculiarity of a piece of equipment, or adopted as a result of some incident. Once an electrician dropped a lighting unit. Now, much to his chagrin, the light is known by his name. The "milk" is not put in the icebox in the studio; instead, the camera is put in the



© Paramount

Top, note the "scrim" over players' heads. This device softens sunlight. Bottom, cameraman giving the setup the "blue glass" to determine how the scene will photograph

Karl Stuss

"milk." It is a soundproof box used for silencing camera noise, and the name came from the fact that once a studio worker kept his lunch milk in a discarded one. A

select - el pino 60

30/30/30/30/30



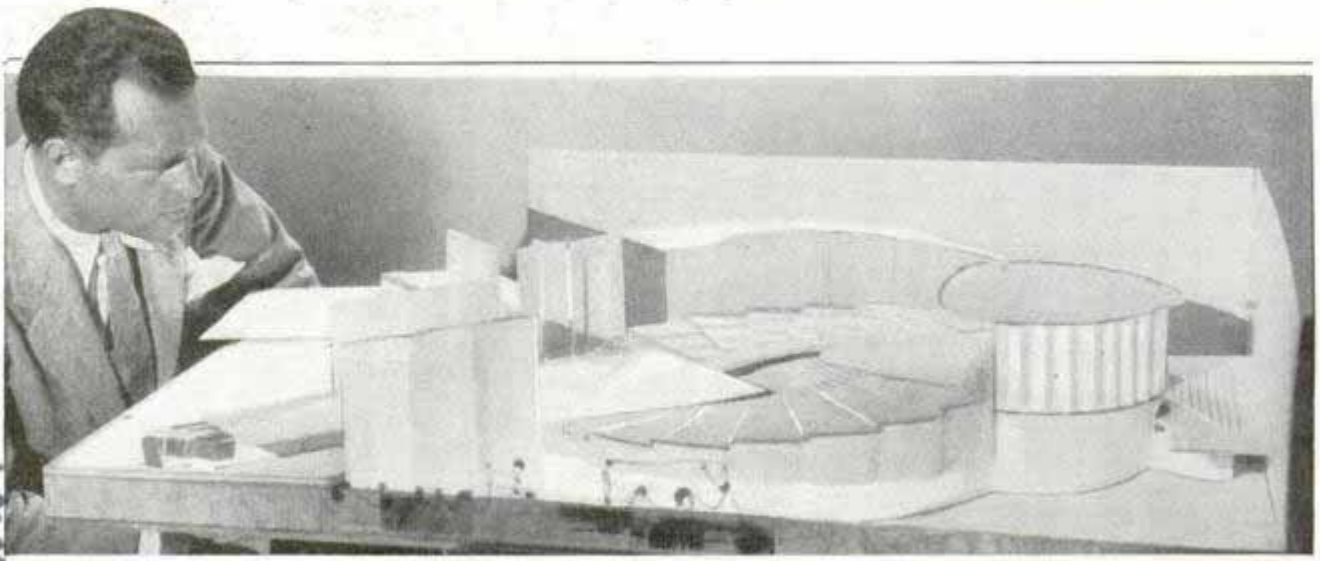
© R.K.O. Radio Pictures, Inc.
Cameraman "lining up" the set, directing the electrician, or "gaffer" in placing lighting equipment

"milk" is also known as a "blimp" because it is large and may be likened to an airship when being floated about the setting on a huge "camera crane" during the filming of a "moving shot." A "camera crane" or "boom" is a five or ten-ton piece of machinery that resembles a steam shov-

el and is used for maneuvering the camera to follow the actors in intricate scenes. A moving camera shot is known as a "pan."

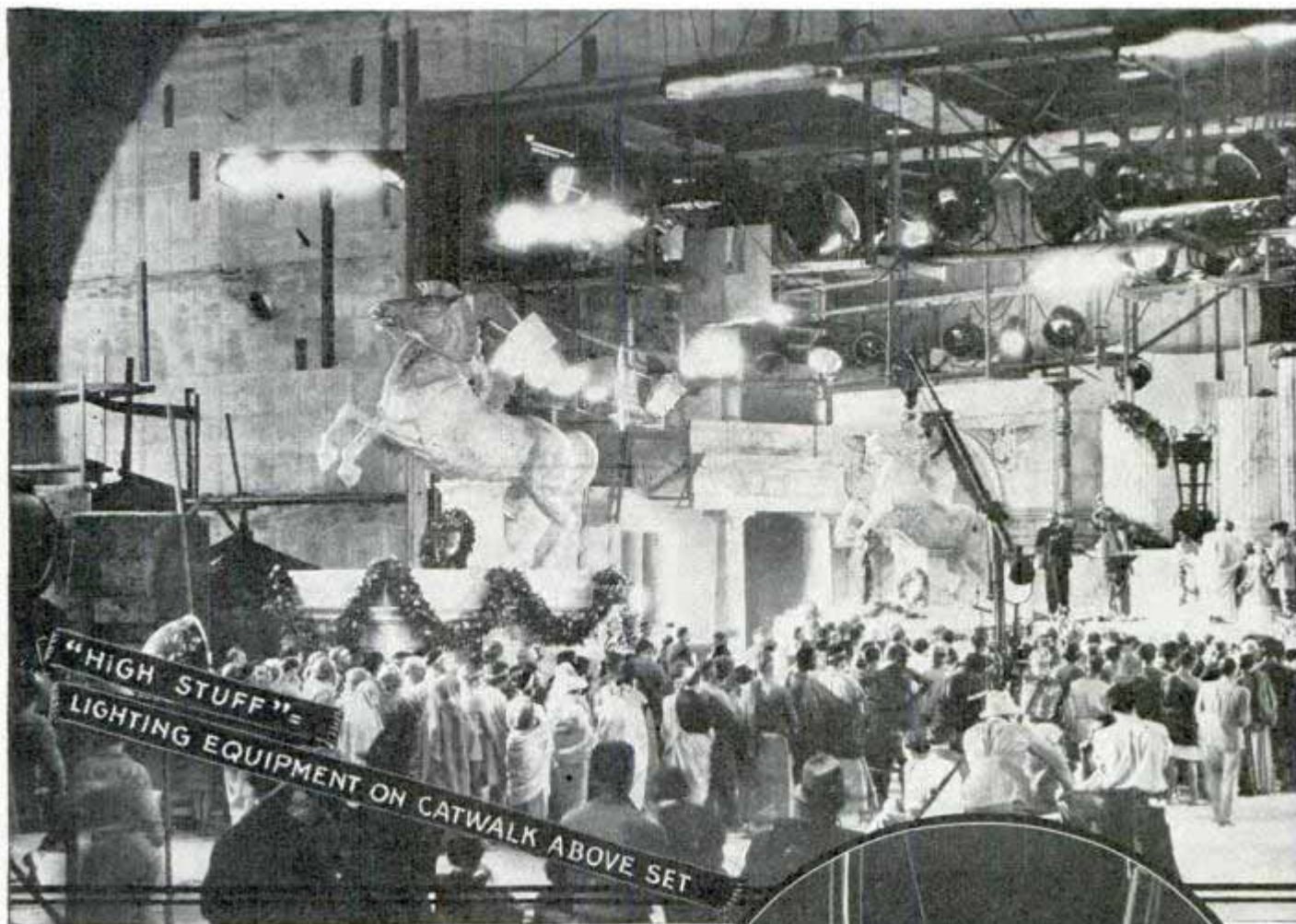
A "dolly" is the platform set on rubber-tired wheels on which the camera is anchored for ordinary moving or "running" scenes. A visitor to a movie set needs an interpreter. Often one or two apparently meaningless words will be elaborate instructions for fifty or a hundred men. "Strike Capra on eighteen," for example, will be the terse instructions to a gang foreman to dismantle Director Frank Capra's set located on sound stage number eighteen. To tear down a set, the laborers "pull toe-nails from the flats," a toe-nail being a double-headed nail that can only be driven into the wood to the first head. The second head protrudes so the claw hammer may hook the head for easy removal. A "flat" is a rectangular section of a setting, groups of which fit together to make the desired set. The studios have "flats" that may be fitted to-

gether to make any sort of home or building. The "fly-squad" is the gang of "grips" that help the "set-dresser" move furniture and arrange the setting before shooting begins. "Furniture" designates props too large to carry in the hand, while a "hand-prop" is a small item such as a vase.



© R.K.O. Radio Pictures, Inc.
Set designer pictured with model of set used in scene played by Fred Astaire and Ginger Rogers in "Swing Time." The model represents a large stage for the dance number

Boyz n' the Hood



Often a set dresser may be heard to order a "grip" to "scoot over and get some stuff to sweeten 'Another Dawn' on ten." "Ten" is the stage number where "Another Dawn" is being filmed, while to "sweeten a set" means to add frilly feminine things.

Perhaps the most picturesque language is used by the cameraman and the electricians when they are "lining up the set." The cameraman, eye glued to the camera finder (the device used for focusing and centering the lens), works with the head electrician to get the setting properly illuminated. "Catch the hot-spot on Colbert's shoulder; throw a baby on her" is the cameraman's way of saying the illumination on Claudette Colbert's shoulder is too intense; that the light must be softened, otherwise the attention of the audience will be drawn away from Claudette Colbert's face.

The head electrician is known as the "gaffer" or "juicer." Under him is his first assistant or "best boy," while his crew is known as the "rigging gang" because they

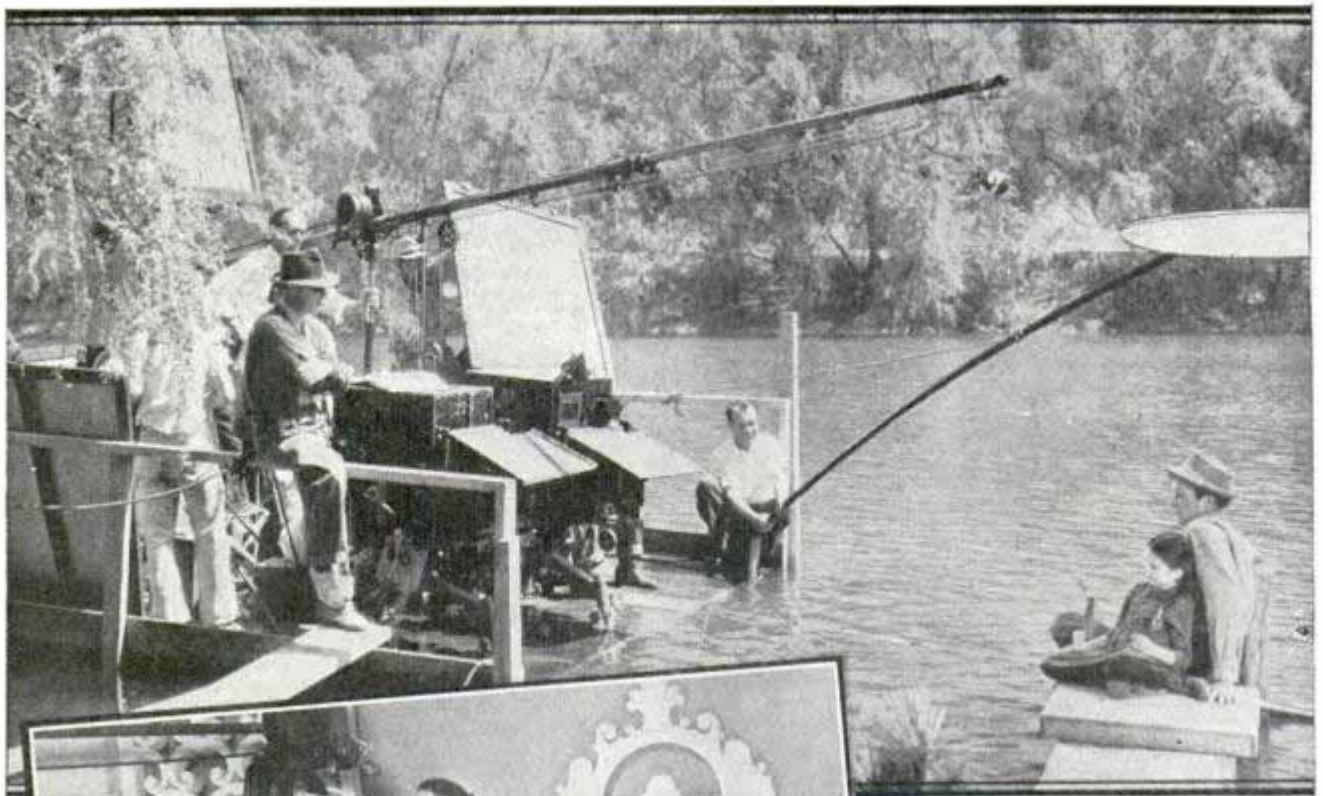


© Paramount

Top, "catwalks" fifty feet above set hold the lighting units. Bottom, sound man at controls of boom which moves microphone in "traveling shot"

rig up the set with the light units, cables, and electrical paraphernalia.

In order to soften down the "hot-spot," the "gaffer" would issue instructions such as, "change that 'rifle' and put a 'cello' on the 'go-devil.'" The "rifle" is an intense



© Paramount



Top, "butterfly," made of gauze, is held above players to diffuse sunlight. Bottom, "grips" polish floor while "lensers" prepare camera for shot from "dolly" on which camera will be rolled back as players advance

spotlight usually placed on the "catwalks" or platforms built high above the setting under the roof of the sound stage. The "rifle" is used for highlighting desired portions of the setting. A "cello" is a diffuser for the lights and is composed of a sheet of celluloid with frosted surfaces mounted in a frame for inserting in the slots in front of the light housing.

The term "inkie," derived from incandescent globes, is the name for a "soft light" in contrast to the "hard light" obtained from the arc light. The arc light is "hard" because it is bluer and gives a more sharply defined shadow and a harsh-

er photographic image. The "inkie" has relatively more orange-red in its content which permits a softer and more pleasing effect. The globes used in the "inkies" are called "eggs" at Paramount Studios and "bottles" at Universal Studios.

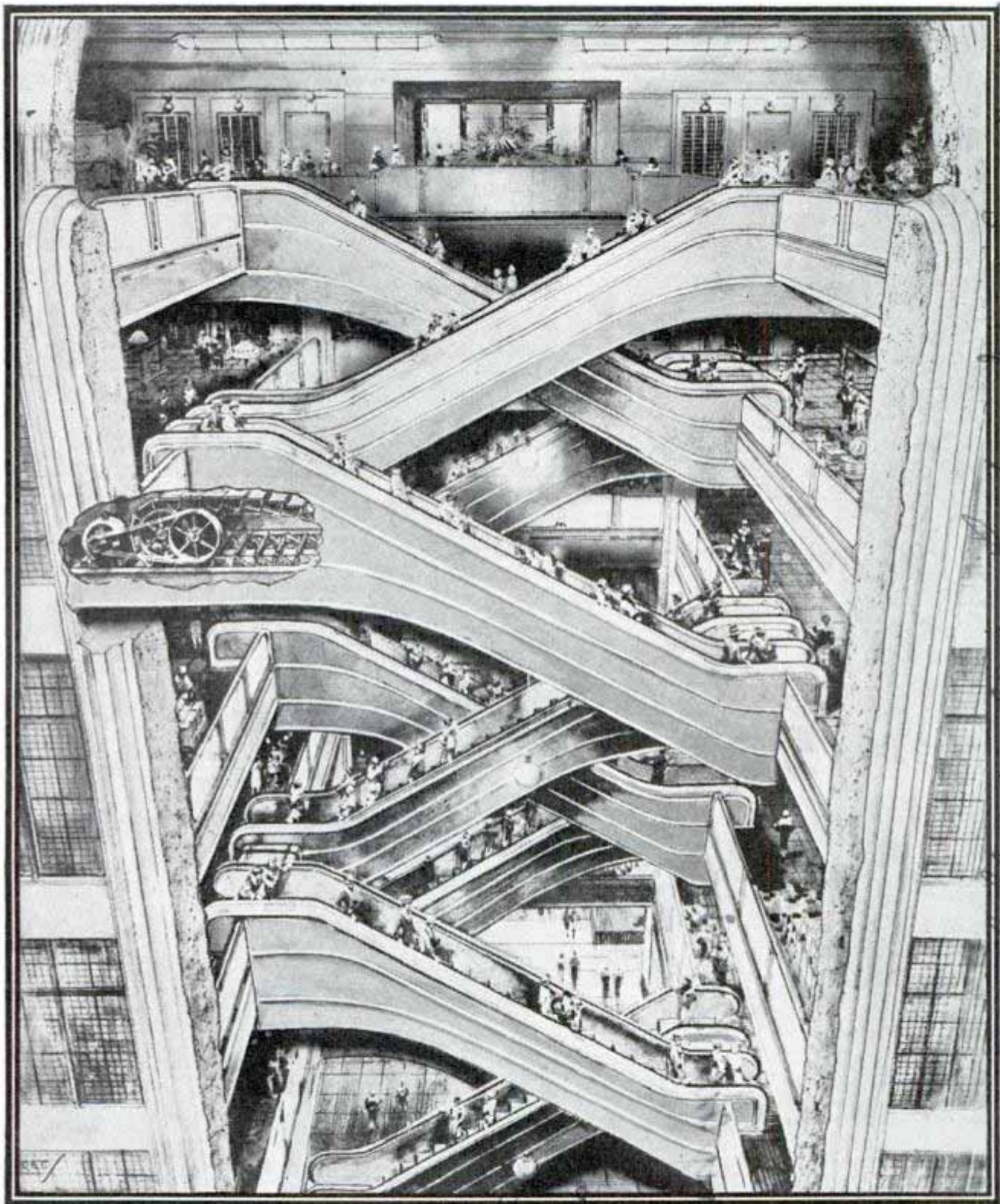
A "Lupe" light is named after Lupe Velez because this light, which is easy to operate and may be employed to follow actions, is used where this temperamental and rest-

less actress works. A "bon-bon" is a large round spotlight that uses a globe of 2,000 watts, or enough "juice" to light a dozen homes. The "cracker-box" is a similar light of 500 watts. The "broad" is a light unit used very often overhead the set in banks for "filler," or over-all illumination. A "baby" is a small spotlight used for special effects such as the light on an actor's face when he lights a cigarette. The "twin" is a double-light unit used for obtaining a wider beam of illumination.

The "sky-pan" is like a huge inverted dishpan hanging over the setting and con-

(Continued to page 116A)

Ten Moving Stairways Serve Big London Store

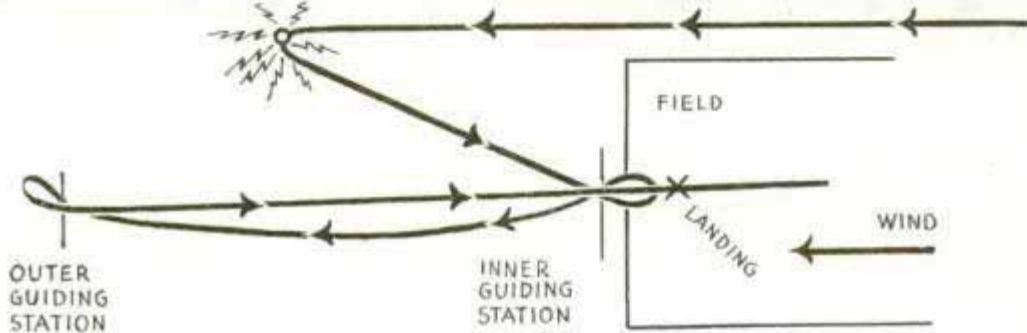
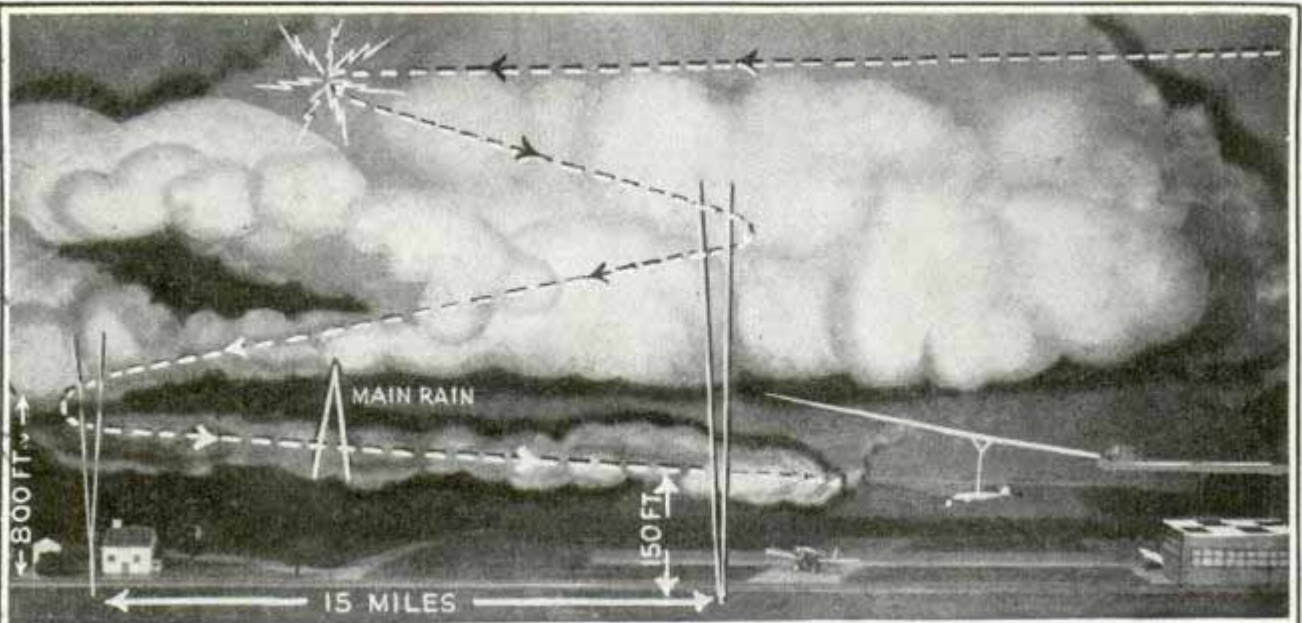


Here is a sketch of the ten escalators installed recently in one of London's big stores on Oxford street. Designed to accommodate the maximum number of people entering the store the moving stairways are reversible and could all operate downward in case of fire. Lower escalators are driven by nine-horsepower motors, the upper ones by seven and one-half horsepower motors. Cutaway view at left, center, shows one of the motors. Every precaution has been made for noiseless operation. All departments of the store are accessible from the central hall in which the escalators move. Elevators and stationary stairways also are provided in the building.

*Installed by J & E. Hall
Stratford Kent, England*

A Illustrated London News Jan 4 1911

Toy Plane Shows How Blind Landing Is Made



BLIND LANDING SYSTEM
 The display shows the method used in making a blind landing in fog, or bad weather



Top, general view of three-dimension model which demonstrates blind landing system. Arrows in this photo, and those in sketch pictured below, indicate progress of the toy plane from the moment radio signal is received until the ship comes to rest on the ground. Bottom, disk which enables the tiny plane to make the various turns necessary. The plane moves on an endless chain as it goes through the maneuvers to land by radio direction as artificial clouds obscure the miniature airport. This model, used at Wright Field, and the blind landing system are explained more fully on the page opposite

Col Charles J. Davis Dayton Daily News
 May 1935
 Dayton, Ohio

GREATER

The complete **FISK**
line:

- Fisk Balloon*
- Fisk Rugged Heavy*
- Duty*
- Fisk Rugged*

The country is taking to the road
placements in staggering numbers

For nearly 40 years the name **FISK**
mark, has been the best buy in
FISK is an assurance of maximum

The public puts its faith in **FISK**
stock, you have an investment tha



The motorcycle trailer was made by Otto Gerling of Ellendale, North Dakota. Last summer he made a 6000 mile trip, with no hotel bill, averaged about 60 miles to the gallon of gasoline. The trailer loaded weighs about 500 lbs., and is equipped

—Photo by Bernard L. Kobel
the current coming from the motorcycle
The windows are screened, and there is also
a roof ventilator. It is 7' long

Latest Blind Landing System Explained by Model

How airplanes may land in murky weather by using the latest blind landing system is shown by a three-dimension working model at Wright Field, Dayton, Ohio. The miniature scene, ten feet long and four feet high, depicts an airport countryside obscured by low-hanging artificial clouds. A four-inch plane suspended from an endless chain simulates the movement of radio-guided aircraft. The landing system, now being installed at a number of airports, employs the radio compass, which when tuned on a station gives a needle indication of the plane's flight direction in relation to the station. To fly straight to the station the pilot keeps the needle centered on a dial. Arriving over the station, the pilot sees the needle fluctuating sharply, so he tunes in on a portable radio station located near the field boundary and radios his altitude as indicated by the altimeter. From the ground he receives by radio a correction based on prevailing atmospheric conditions. As he flies toward this station he loses altitude and when directly over it he notices the needle again fluctuating. The pilot then tunes in another portable station fifteen miles away, placed in the direction in which the wind is blowing. Still losing altitude he crosses the outer guiding station at between 600 and 800 feet and a red light flashes on his instrument panel on radio impulse from the ground. The pilot makes a 180-degree turn and tunes in on a line formed by the guiding stations. Still gliding he crosses the inner station at between 150 feet and 200 feet, receives another red flash if in correct position, and settles to a landing. In the working model the plane executes all the movements of a ship making a blind landing, even to the three-point landing. On the turns the model ship banks by passing around a disk. Toy trucks are placed to represent the guiding stations.

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.

Ether Preheater Mixes Gas Properly for Patient



Giving ether to patient. Note the apparatus which converts ether into pure gas

Reducing the danger of ether pneumonia and nausea, a small preheater prepares ether so that it is a pure gas mixed with air or oxygen when drawn into the patient's lungs. The device consists of an ether container and a hot-water jacket which retains the heat.

Seven-Foot Trailer Is Home for Motorcyclist on Tour

Tiny but complete, a seven-foot trailer towed by a motorcyclist touring the west contains his bed, kerosene stove, and radio, storage space for food, utensils and suitcase, and it is electrically lighted. This home on wheels cost sixty-five dollars to build. It is forty-three inches wide.



Motorcyclist with the trailer he built for a home while touring the western states

*Otto Gerlinger
El Paso, Texas 2/10*

2025 D. Brand

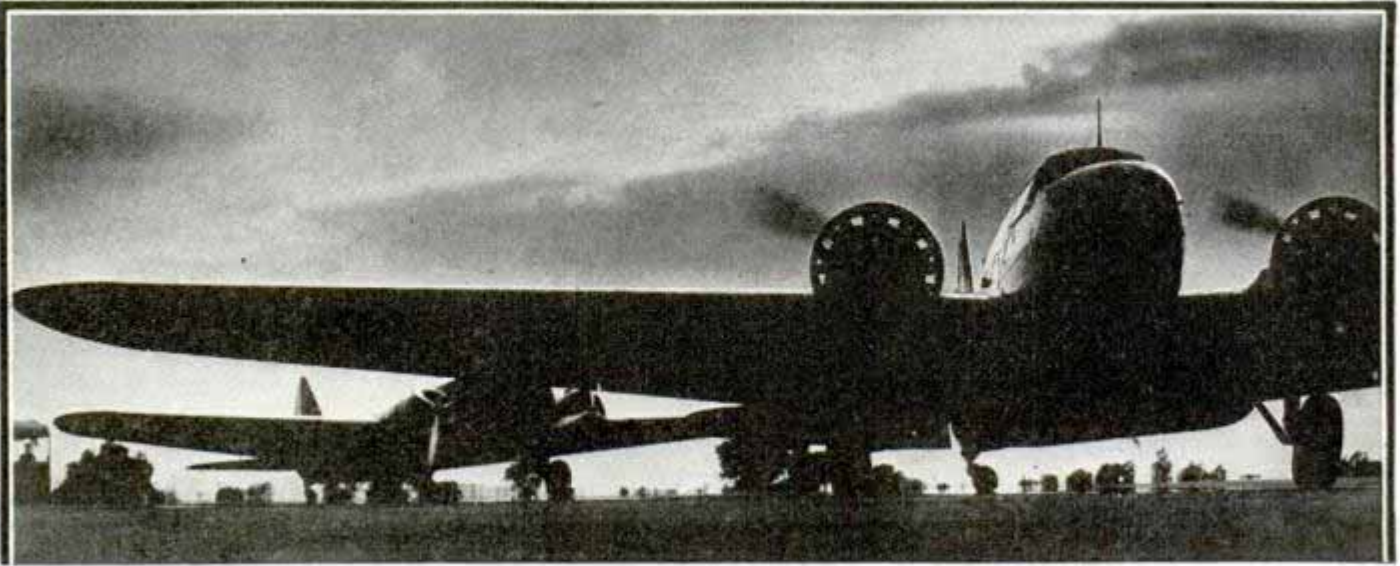
565

Los Angeles, Calif.

F1323

Capt. Don Macquinn
4 W. 10. 3 rd
Newark

STOP and GO at the



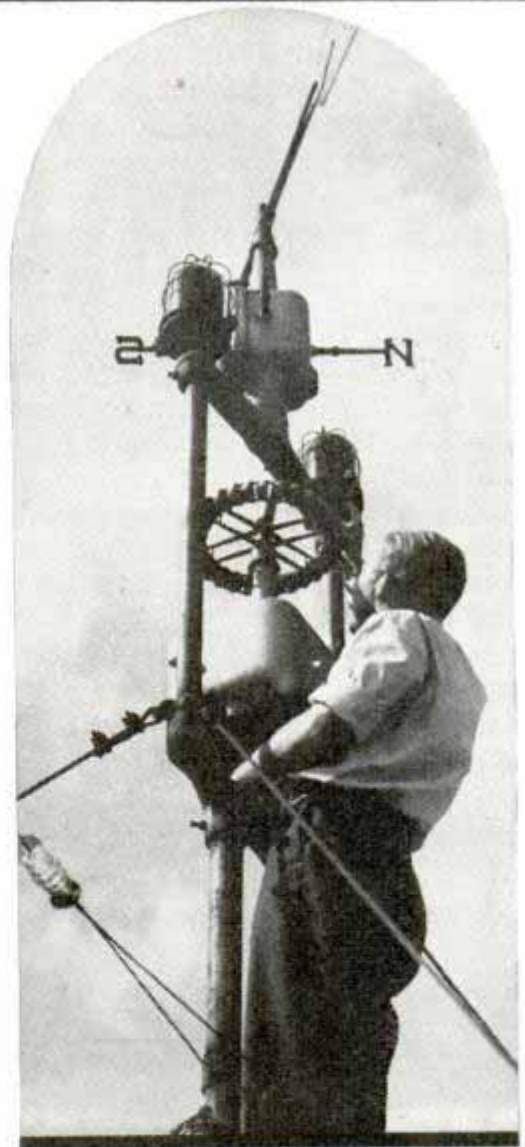
BUZZERS, jingles, the crackle of static and the sharp voices of dispatchers in the control tower at Newark, N. J., indicate when the night traffic jam starts over the world's busiest airport. Fleets of scheduled transports come booming down the radio ranges from north, south and west. And when those boys arrive, they want to get down without a moment's delay.

Newark airport handles more mail, express and passengers than Tempelhof, Berlin; Croydon, London; and Le Bourget, Paris, combined. At present the traffic averages 210 flights per day, including 118 scheduled flights. More than thirty per cent of all traffic in air passengers, mail and express in the United States is cleared through Newark.

The traffic operators dish out sharp radio commands and while talking, they listen for incoming requests and keep an eagle eye on the field operations. The traffic control operations are more complicated by night than by day. Information about conditions on the field, the weather and the movement of traffic is given in great detail and pilots are led in as carefully as if they were blind.

Pilots have their own preferences about landing lights. Some want lots of illumination, some would rather land in a dark field. The field lights are turned on and off by the traffic operator. At Newark there is a bank of twenty-five floodlights with an intensity of 35,000,000 candlepower. From the air, Newark airport glows like a spot of incandescence on an otherwise black earth.

Lights or no lights, the hazards of night operations at a busy airport allow for no mistakes. The field is marked by boundary lights. Construction work, chimneys, tanks, and other obstacles are



Top, transports ready to take off at dusk. Below, inspecting wind-direction and velocity indicator at Newark airport, the world's busiest landing field

WORLD'S

Busiest AIRPORT

lighted and emergency crews are always available. Roughly the area lying within a fifty-mile radius of Newark airport is within the jurisdiction of the traffic control tower. Ordinarily the pilot "checks in" at this point and thereafter is kept in-

Top, Newark airport at night. Right, tower operator using stop and go light. Below, plotting plane movements





The transport pilot, above, keeps in constant touch with the ground through the radio operator, below

formed of traffic movements and field obstacles from the control tower.

One of the traffic officer's duties is to keep privately owned planes out of the way of transports. Since most privately owned ships have one-way radio, the traffic officer's job is all the more difficult. Communication with private planes may be as follows:

"That blue and red plane—if you're receiving me, kindly wiggle your wings."

Apparently the pilot doesn't hear. He glides across the field, and without clearance from the traffic tower, takes off. The traffic officer whistles softly. The pilot

disobeyed two regulations. He took off in a crosswind and he did not wait for clearance from the traffic tower. These violations are sufficient to ground a pilot.

If radio connections fail, the traffic operator may use his special traffic light, which operates day or night. It can be seen for five miles in daylight and for twelve miles by night. If the airport runways are clear, he turns the green light on; if he wants to warn a pilot against changing his position, he turns on the red light.

The transport pilot observes all regulations carefully. He takes no chances. He follows the "highway" and sticks to his schedule; he never deviates except in an emergency or in compliance with

orders from his superiors. Airways are as accurately laid out as roadways. The airline pilot sticks to the right side of an imaginary line which runs down the center of his airway. The line is a radio beam signal, corresponding to the white streak painted down the center of an auto road.

Transports coming from Washington make radio contact with the airport upon reaching Elizabeth, N. J. They charge down the radio beam at a cruising speed of about 180 miles per hour, and soon are sighted by the control tower. The traffic officer then calls:—

"All clear 120...variable northeast..."

come straight in but keep your eye on that small ship down there...let it go if you're ready!"

The conversations between the traffic control operator and the transport pilot reveal what scrupulous care they exercise.

"You're over Harrison, Dick," says the traffic man. "You're descending to the field. You cannot get through construction area on the south side—so go around it."

The night pilot flies by sight and sound. He works the range most of the time, observes the flashing beacons when they are visible, listens for the identification signal of the range station, and compares the weather reports. He need not look at the ground until he approaches his destination. Modern instruments not only keep the transport on a given route but also reveal the movements of adjacent aircraft.

Eyes and ears are a good sense-combination for the transport pilot, but the reliability of aviation instruments has reached the stage where it is possible to

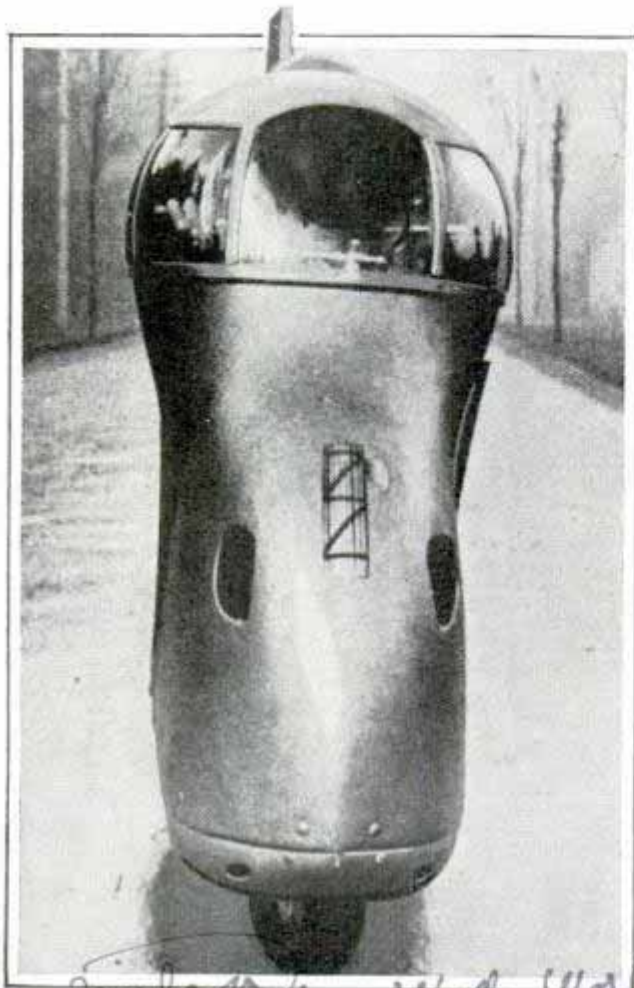
(Continued to page 118A)



Top, stowing the mail into nose of a modern transport. Center, talking and listening at once during rush of traffic. Below, traffic officer's desk and control tower at Newark

131 Cleveland
Elkhart club

Motor 'Bike' Is Streamlined to Cut Wind Resistance



Italian motorcycle enclosed in weather-tight body streamlined for least possible resistance to wind

Completely enclosed in a metal body with glass windows, a streamline motorcycle is not only weatherproof but wind-resistant. The emblematic fascias on the front are evidence of its Italian make.

Radio "Hams" on Six Continents Join in Vast "Round Table"

In twenty-one minutes operators of six amateur radio stations located on as many different continents exchanged greetings in a recent world-wide "round table." W. S. Burkhart of Goulds, Fla., operator of station W4DLH; M. Mozoomder, operating VU2CQ, Bombay, India; E. M. Chorlian, at SU1CH, Cairo, Egypt; Antonio J. Restrepo, at the microphone of HK1Z, Cali, Colombia, South America; Fred W. Miles, G5ML, Kenilworth, England, and Frank Nolan, VK4LO, Brisbane, Australia, were the "ham" operators participating in the round

Amateur Radio News

table which was the result of months of experimentation. While the stations in North and South America were being operated at 7:30 a.m., the English amateur was at lunch and it was 2:30 p.m. in Egypt, 10:30 p.m. in Australia and 6 p.m. in India.

Tiny Maps Magnified in Globe for Driver or Executive

Designed to afford coverage of a large area, yet small enough to be used on the instrument panel of an automobile, a handy revolving globe fitted with magnifying lens enlarges minute details of tiny, almost microscopic maps. Each map has complete information useful to the automobile driver or busy executive.



Autos Freed of Static Charge by Flexible Rod on Bumper

Many motorists have experienced the shock which occurs when their hands touch that of the toll collector at bridges. The shock is the result of the passage of static electricity, built up in the moving car by friction, from the car into the ground through the medium of the collector. An automatic static discharger, con-



Small rod shown touching bumper of car releases static charge and prevents shock

New York Tribune Judge

American Radio West Hartford, Conn. Relay League.

es 105

Milan Wild Walk

es 80

es 99

sisting of a stream of water which played on the wheel of the car before the car reached the toll collection window, solved the problem for summer, but when cold weather interfered with this method, another was devised. This consists of a flexible rod which touches the car, shunting the static charge before the driver touches the hand of the collector. Being flexible, the shock eliminator does not damage the car.

2044.
Electric Iron Folds into a Compact Travel Case

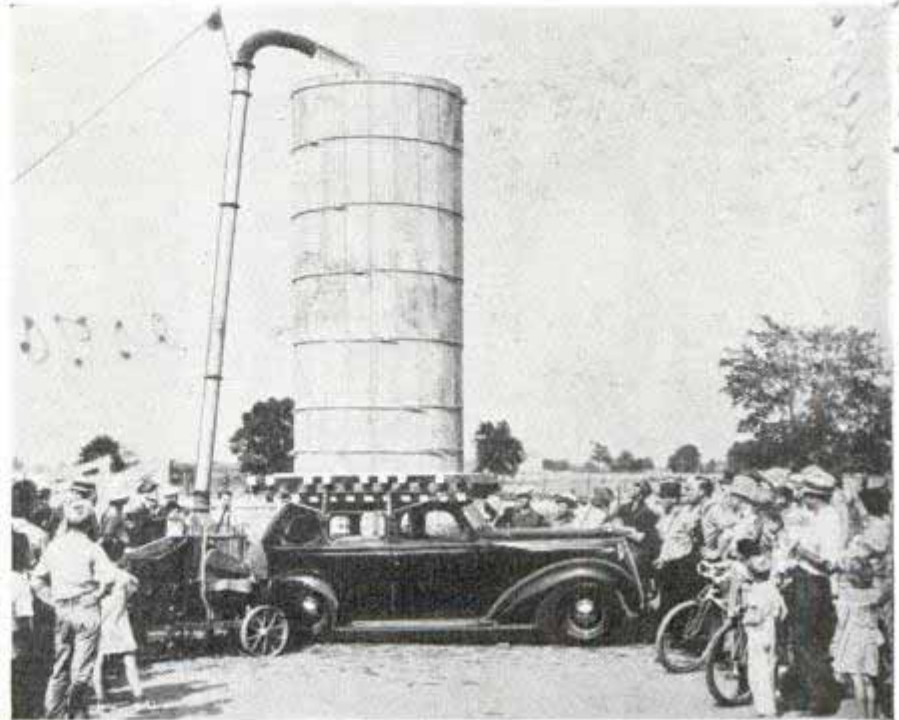
Convenient and practical for travelers, a folding electric iron that fits into a handy, small suede case has been placed on the market. Although the iron has a full-sized ironing surface, the entire outfit, including kit and cord set, weighs but two and one-half pounds. The case, six and



Lightweight electric iron set up for use and folded to fit into compact case for traveling

one-half by nine inches, is only one inch thick. The folding handle snaps into position securely and has a six-foot cord.

es 103
Five-Ton Silo on Top of Auto Shows Strength of Steel Body



As if a five-ton weight were not enough proof of strength of a steel car body, silo is filled to show what a load the automobile can "take"

Studebaker Corp. - South

To demonstrate the sturdiness of modern automobiles, a concrete silo weighing 10,000 pounds was loaded on the top of a new sedan at a farm exhibit in Indiana. A wooden platform was securely fixed on the roof of the car and the big silo was hoisted upon it. Finally several hundred pounds of silage were blown in. At the end of the test there was no indication of strain on the all-steel body, the doors opening and closing as easily as before.

es 112
Torpedo Dropped by Parachute Circles in Search of Enemy

Italy has developed a "crazy torpedo" that is dropped by parachute and starts circling as soon as it strikes the water. Bombing planes would release such a bomb over a hostile harbor. The impact of hitting the sea would start mechanism spinning a small propeller; the parachute cord, impregnated with a chemical, would burn through at the touch of water and release parachute from torpedo. A set rudder then would guide the torpedo in a broad circle, on the theory that it would be certain to strike a ship or dock.

David Low Co. Chicago Tribune 1/28/39

"Electric Eye" Flashes Red Light When Auto Travels Too Fast

*Exhibited by Radio Corporation of America
30 Rockefeller Plaza
New York*



Demonstrating highway speed warning which flashes red light ahead when car is traveling too fast

Like the automatic train control which signals the engineer when his locomotive exceeds the allowed speed, a highway danger signal has been devised to warn speeding motorists. Two "electric eyes" are so arranged that they flash a red light on the road whenever an automobile passing them is exceeding a predetermined rate of speed. Ahead of him the driver reads the red warning signal: "You are driving too fast."

Flight Recorder for Planes Latest Aid to Safety

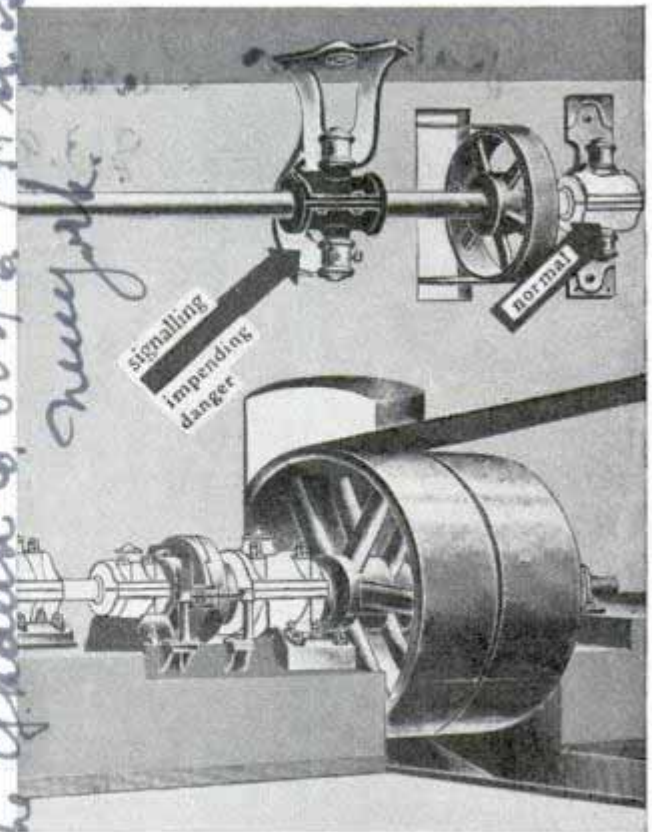
*New York Times
2/4/37*

Offered as a means of increasing air safety, a flight recorder for airplanes makes a record of altitude and other features under the control of the pilot. It is essentially a barometric altimeter, equipped with a drum and three recording pens which automatically set down the story of the flight. One pen traces the altitude from takeoff to landing, another records the time and the number of times the pilot makes use of his two-way radio in communication with the ground and the third sets down the record of the radio beacon

receiver, showing whether it functions and for how long. The instrument is designed to make pilots "altitude conscious." Low flying, government and air-line officials believe, has been responsible for a number of accidents. Hitherto there has been no way of checking the altitude, save when a disastrous crash revealed that the pilot had been too close to the ground. One feature of the system is the possibility that the cards on which the instrument pens its records may be made in the form of route or contour maps so that the tracings will actually follow the route flown.

Paint Gives Warning of Danger by Changing Color

Paint that changes its color with excessive heat is being used in industrial plants to warn of overheating at danger points. One type of paint changes color at 300 to 734 degrees Fahrenheit and must be re-coated after the change. Another type, however, changes at 104 to 464 degrees and when cooled reverts to its original color. This paint can be used through twenty-five to fifty changes of color. Power plants use the paint where excess heat would cause damage to bearings.



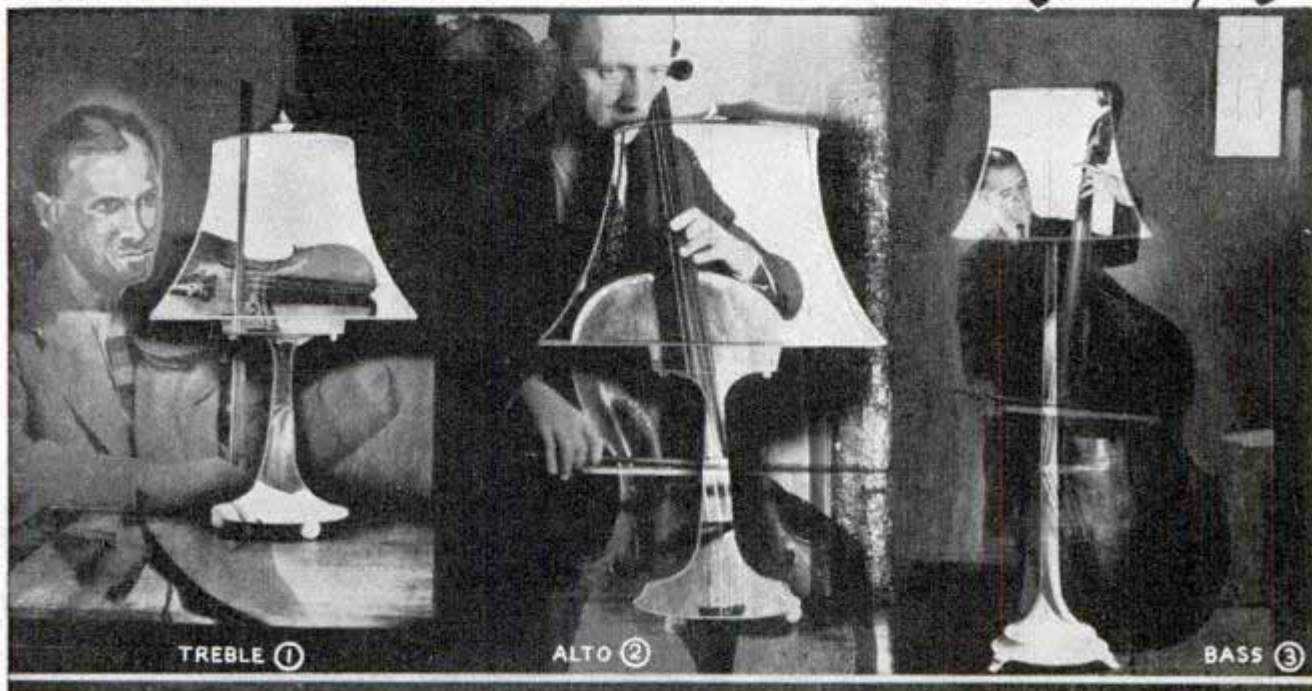
Danger spots in industrial plant are coated with paint that changes hue when overheated

Bureau of Air

R A D I O . . .



RADIO SPEAKERS *in Lamps*



HORNS stood on end and disguised as lamps, give a three-dimensional quality to the tone of a modern receiver. The lamps are connected to any radio set by means of a remote control box, which in turn is connected to the receiver output tube by means of a simple adapter.

Three lamps, two table and one floor model, comprise the group that bring the sound of each instrument out of the radio cabinet into the room. A six-inch speaker is mounted in the head of each lamp shaft which acts as an exponential air column. Fig. 1 shows the complete assembly; bass notes are reproduced by the floor model, while the alto and treble ranges are correctly handled by the table types.

The control box is available either as a separate unit or built into a specially designed 8-tube receiver as shown in the lower photo. One or more of the lamps may be used in combination with your set speaker to "brighten" any particular tone.

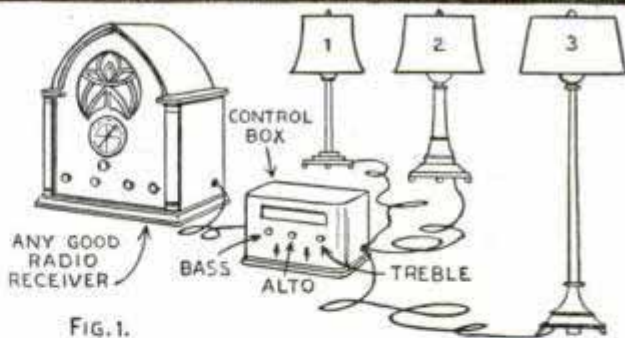


FIG. 1.



*Radio Lamps Co. Inc.
744 Madison Ave
New York*

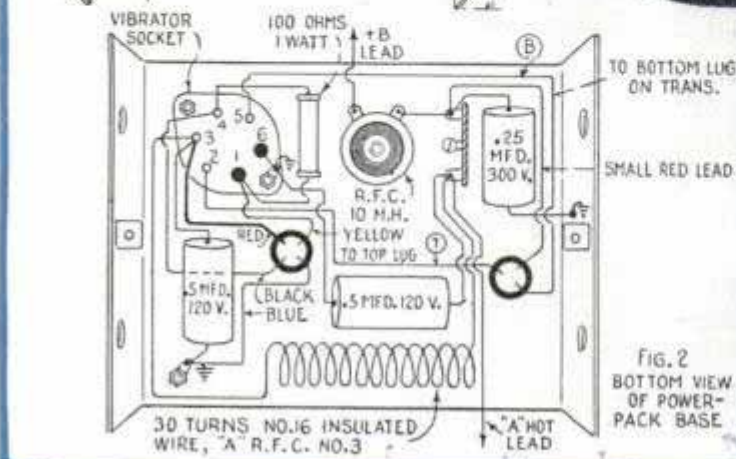
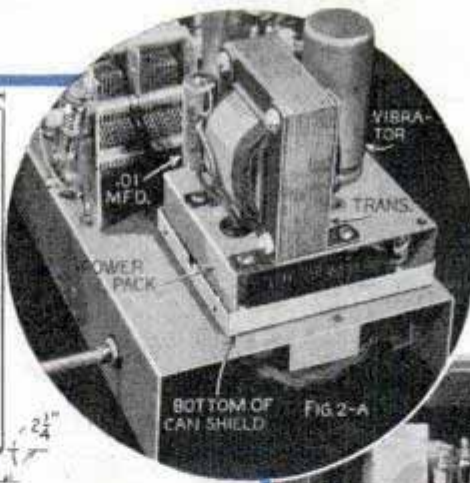
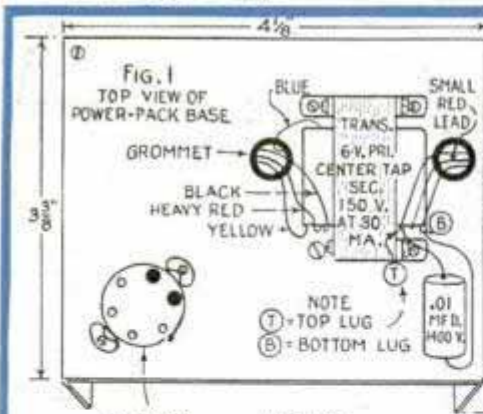
One 6-Volt STORAGE



BY CUTTING the filament drain in half, a new series of 6.3-volt tubes now solve the troublesome problem of keeping a 6-volt storage battery fully charged by means of a windcharger, auto generator or similar battery-charging methods. These tubes draw only .15 amp. filament current as compared to .3 amp. for previous 6.3-volt tubes commonly used in six-volt broadcast receivers for the home, automobile and boat, where all power must come from a single 6-volt storage battery.

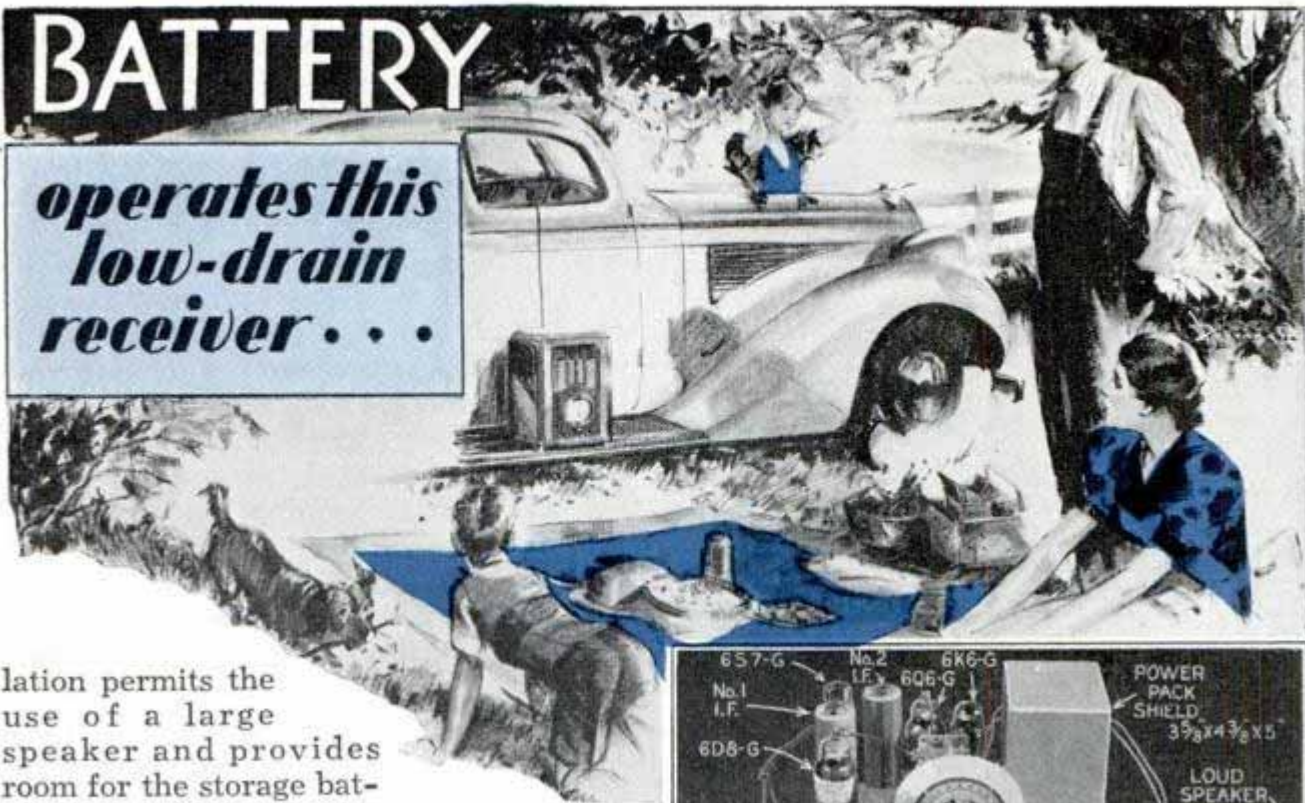
Although of simple design and easy to build, this 4-tube receiver is a full super-heterodyne and has the efficiency of a 6-tube set. It is a real distance-getter, with tone and volume equal to that obtained with the same number of tubes operating on regular 110-volt a.c. supply lines. Automatic volume control, tone control and the use of a permanent-magnet dynamic speaker leave little to be desired, in fact, nothing has been omitted to

make this up-to-date receiver suitable for a wide range of useful applications. Owing to its compact design it may be housed in either a table-type cabinet or console. The console instal-



BATTERY

*operates this
low-drain
receiver...*



lation permits the use of a large speaker and provides room for the storage battery, as will be noted in the photos. On the other hand, if housed in a small cabinet it can be taken in the car on picnics, used in a boat or wherever

(Continued to page 142A)

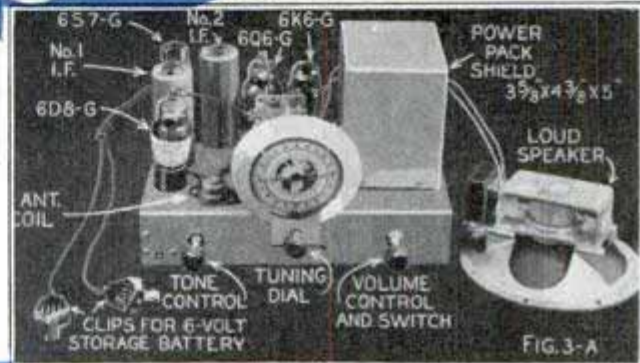


FIG. 3-A

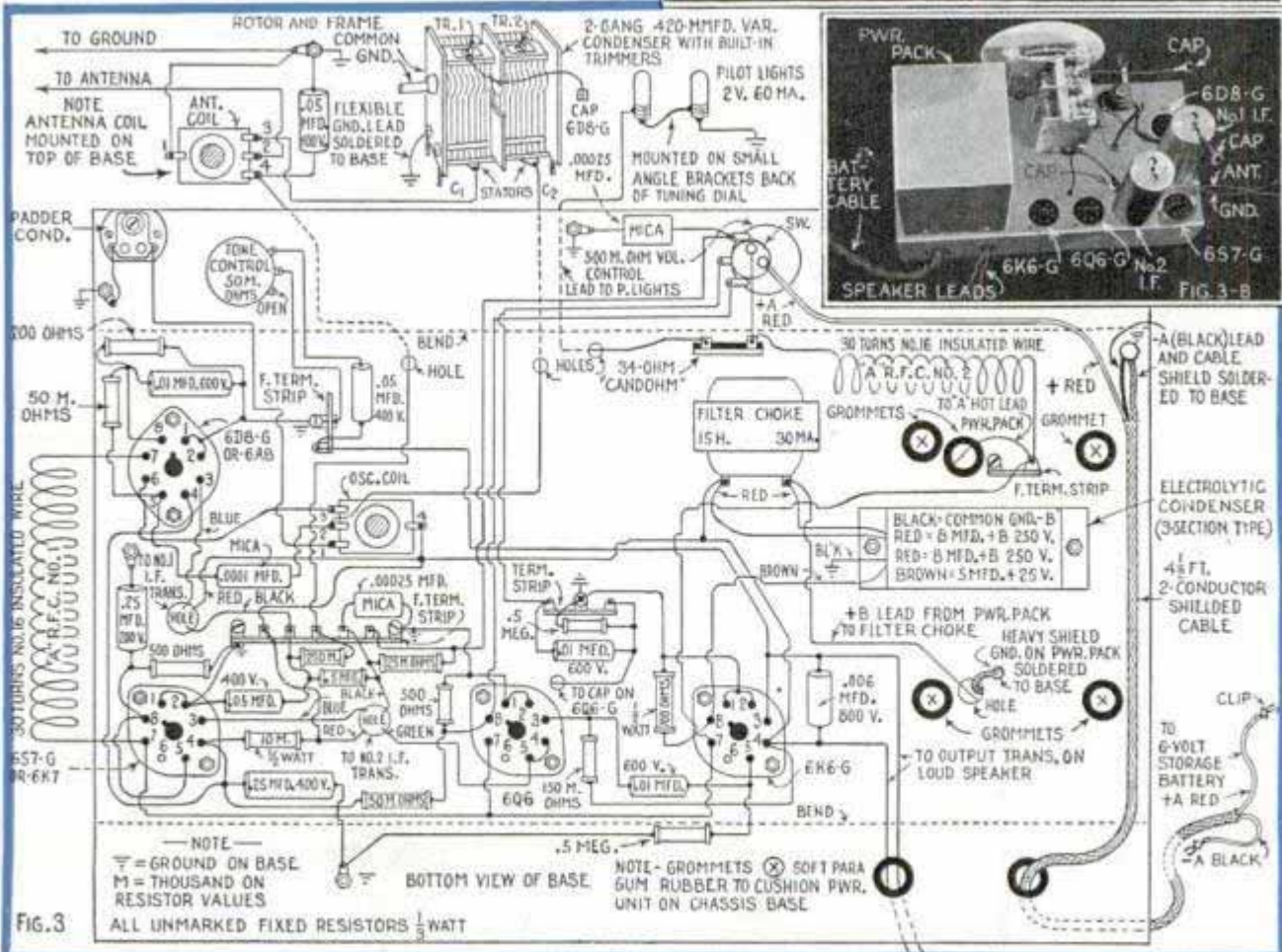


FIG. 3

Code-Practice Oscillator Built in Coffee Can

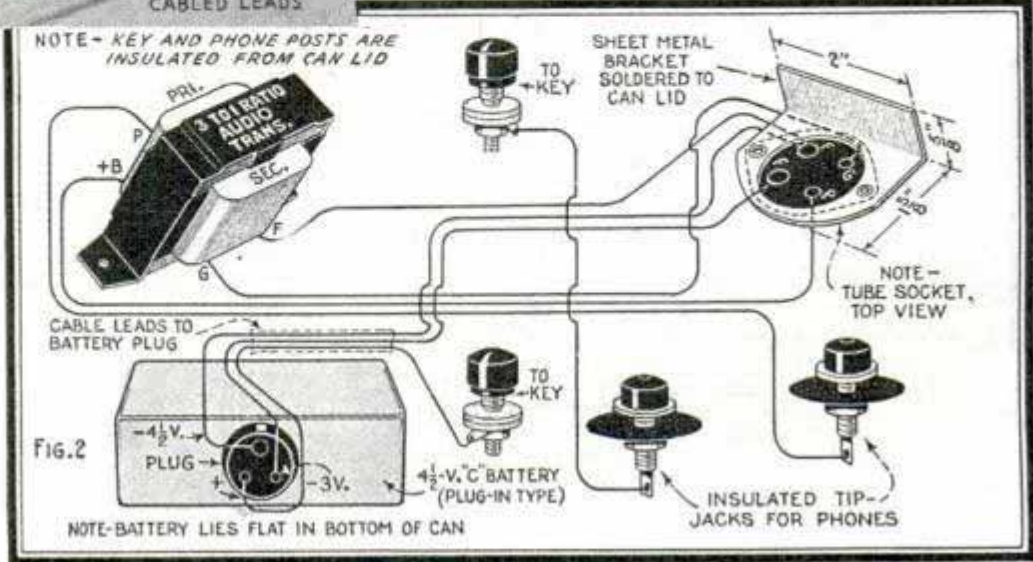
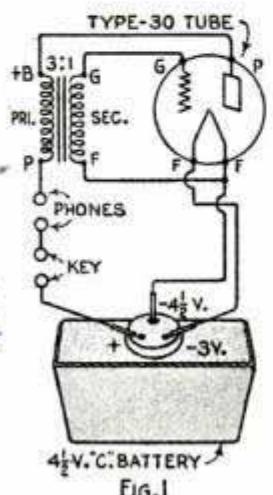
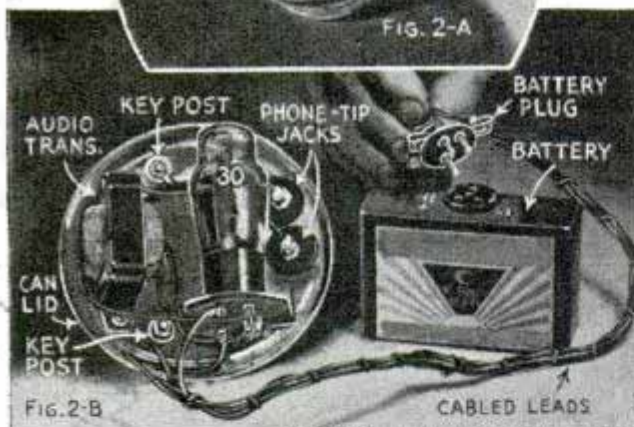
By M. N. Beitman

ONLY a few radio parts and an empty coffee can are required to assemble this vacuum-tube audio oscillator. When hooked up with a key and headphone it gives the future "ham" a means for needed practice and will familiarize him with the actual tone of code signals.

All parts, including the tube and battery, are housed in the can. Fig. 1 shows the schematic circuit diagram, and a simplified wiring diagram is given in Fig. 2. It will be noted in photos 2-A and 2-B that the parts are all mounted on the underside of the can lid; a small metal bracket, soldered to the lid, supports the wafer-type socket for the RCA-30 tube. The battery leads terminate in a plug that fits a socket in the top of a 4½-volt "C" battery which lies flat in the bottom of the can. These plug-in type "C" batteries are now available from any radio supply house. The plug acts as a switch to disconnect the battery, and is removed when the unit is not in operation. Only 1½ volts are used for the filament of the tube, the remaining voltage being applied to the plate.

Plain binding posts are specified for the key connection and small pin-type jacks for the headphone. Please note that these binding posts and tip-jacks must be insulated from the can lid.

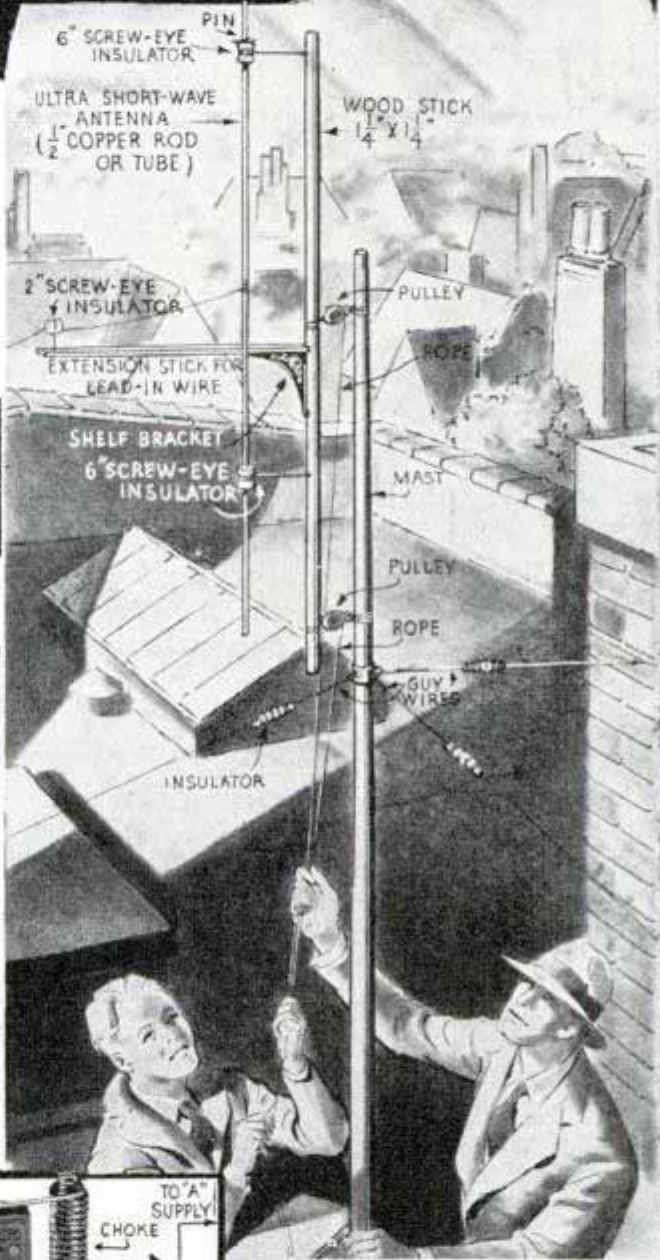
To place the oscillator in operation, plug in the battery connector and attach the phone and key; the signals, controlled by the key, will be heard in the headphone.



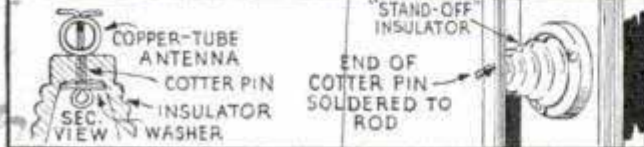
*John - Deussen
Co., Canton, Mass*

Hints for RADIO EXPERIMENTERS

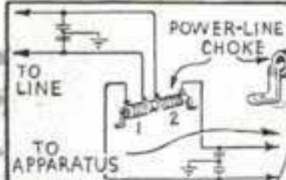
Right, added height above the mast tip to increase sending and receiving range of a vertical 5-meter antenna easily gained by using simple rig shown in detailed sketch. Extension stick keeps feeder out of antenna field. Guy wires are fastened below top to reduce absorption losses



Left, husky r.f. choke for transmitter, random-wound, filling flutes of two stand-off insulators

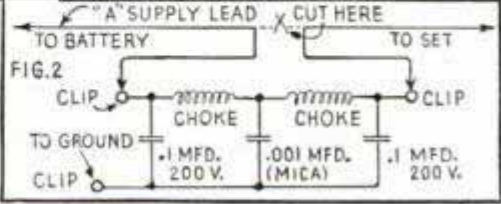
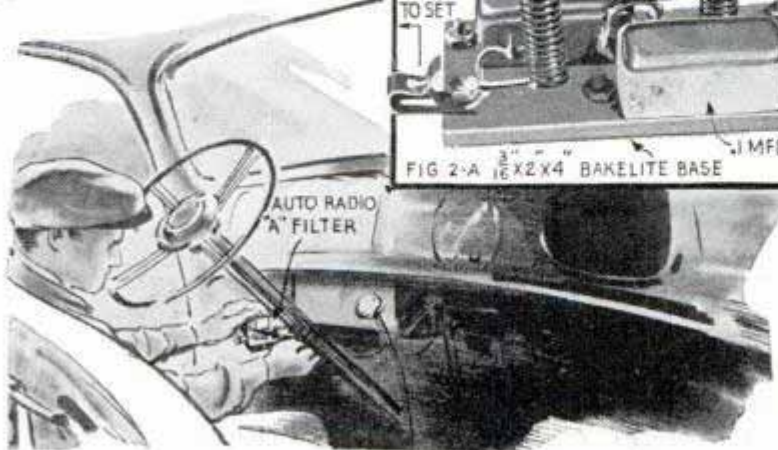
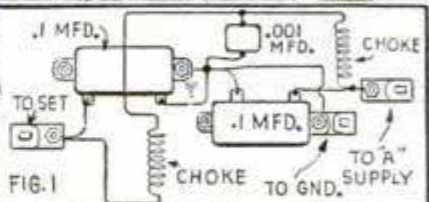
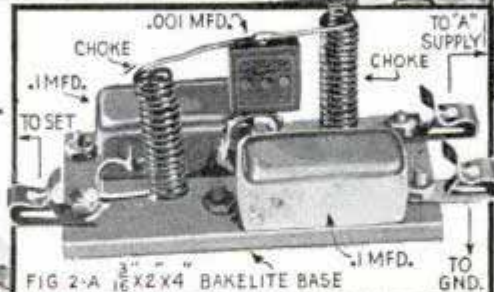


Above, efficient mounting for a long vertical tube or rod antenna for 10 and 20 meters. Right, flexible insulated coupling takes 3/4-in. shafts. Below, twin power-line chokes keep interference from electrical apparatus out of receiver. By-pass condensers .1 mfd., best location found by trial



Right, noise filter for electric razor prevents interference with morning broadcast while whiskers are being removed

Figs. 1, 2 and 2-A show homemade noise filter for auto radio "A" battery lead



Chokes are 17 turns No. 14 enameled wire wound around a pencil

*Nationality Company, Inc. 61 Sherman, Malden, Mass.
Ward Product Corp. 1523 E. 4th St., Cleveland, Ohio*

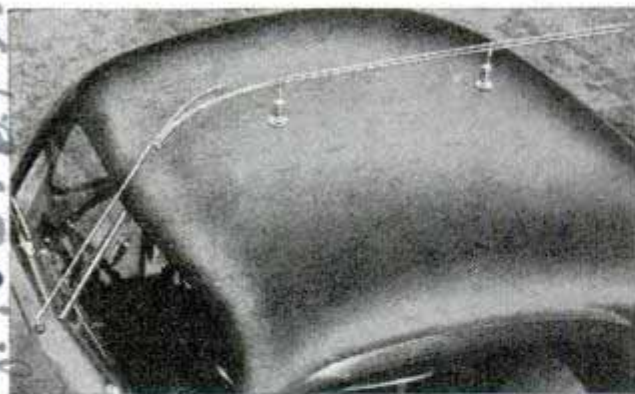
Modern Answer to Old Problem



Left, unit containing individually shielded plug-in coils in a cast-aluminum container; a twist of the knob at lower center on panel above, moves unit into position and plugs in coils

Retaining the convenience of knob-controlled range changing without the use of a coil switch, this 12-tube super, of advanced design, employs a movable-coil tuning unit containing highly efficient plug-in coils for 5 ranges from 540 kilocycles to 30 megacycles. Idle coils are completely isolated, leads are short and calibration is permanent.

Universal Turret-Top Antenna



Adjustable to fit all body styles, coupe, coach or sedan, this chrome-finished antenna for turret-top cars is easily installed

without drilling the car top. Stand-off insulators, in a choice of red or ivory finish, prevent shorts in wet weather; a special mounting cement insures rigid installation.

Oscilloscope for Amateurs

Designed especially for use in conjunction with amateur transmitters for checking purposes, this self-contained low-cost oscilloscope employs the new RCA type-913 midget 1-in. cathode-ray tube. The tube is mounted at an angle above the controls so that the viewing screen is in line with the eyes of the operator.



Sliding Scale Time Converter

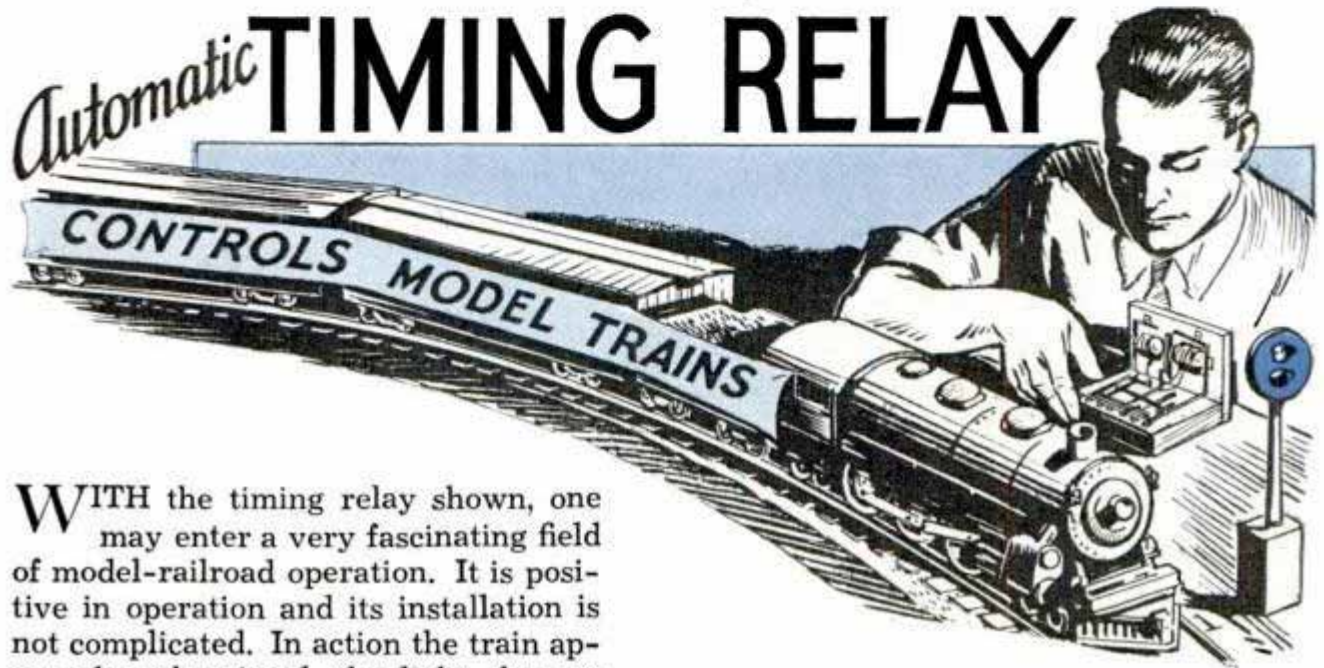
The purpose of this sliding scale is to convert instantly, in a simple operation, the time and date of any one country to that of any other, as well as Greenwich mean time (GMT) to local time the world over. A helpful aid for short-wave DX listeners and owners of all-wave receivers.



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 Compact Portable Amplifier. Designed to fit into a standard portable speaker case, this amplifier is easy to build; suitable for outdoor or indoor use, window demonstrations, schools, and for amplifying stringed instruments. Also, **How to Build a 5-Meter Transceiver for Bicycle Installation.**

*Chicago
N. Salzman
565
W. H. Weeks*



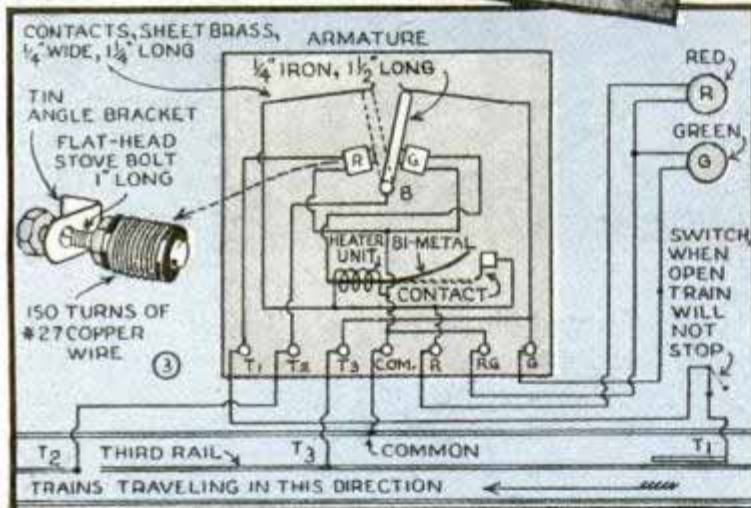
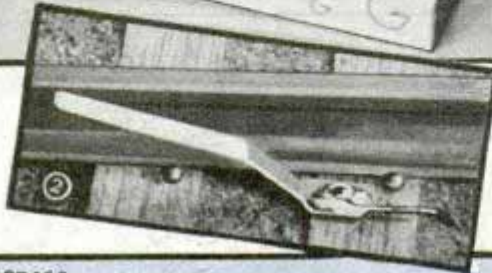
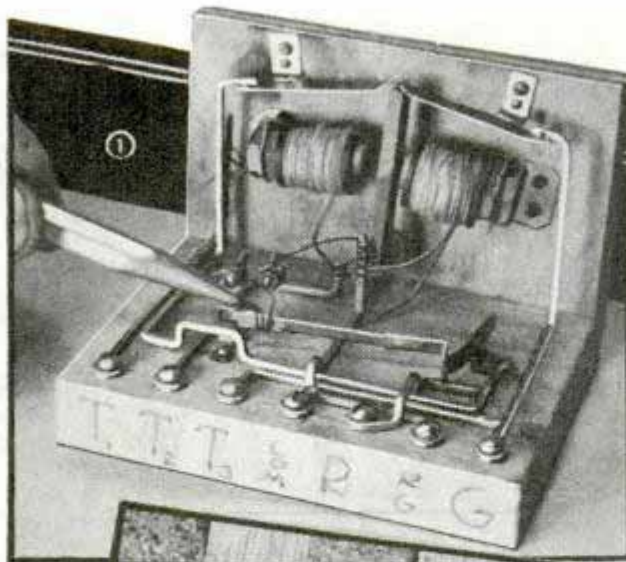
WITH the timing relay shown, one may enter a very fascinating field of model-railroad operation. It is positive in operation and its installation is not complicated. In action the train approaches the signal, the light changes from green to red and the train comes to a stop. After a few seconds the light changes back to green and the train proceeds. This action is repeated each time the train approaches the signal controlled by the relay.

The completed unit is shown in Fig. 1. It consists of a base $2\frac{1}{2}$ by $3\frac{1}{2}$ in. with a thin board about 3 in. wide nailed in an upright position to the back as shown. The relay switch is mounted on the back board and consists of an armature actuated by the two magnets R and G in Fig. 3. This armature is pivoted at the point B by means of a brass screw. A bushing of copper tubing $\frac{1}{2}$ in. long is soldered on the end of the armature to provide a bearing. The two magnets R and G are 1-in. flat-head stove bolts, mounted on small angles of tin. Each is wound with 150 turns of No. 27 copper wire and mounted one on each side of the armature as shown. The distance between the armature and the core of the magnet should not exceed $\frac{1}{16}$ in. The contacts are soldered on small angles of tin and mounted so as to make contact with the armature as it is drawn

toward either magnet. The adjustment of these should be such that they make firm contact but do not impede the free operation of the armature.

The timing is done by means of a thermostat mounted on the base. The arm is a section of bi-metal taken from a thermometer. This arm is 2 in. long and is mounted on a small angle of tin after determining in which direction it will swing when heated. When properly mounted it should swing toward the contact. The heater unit is a piece of wire 1 in. long, taken from the heater element of a toaster. It is insulated by means of a strip of mica obtained from the same source.

The wiring is clearly shown in Fig. 3, and should be followed carefully to insure proper operation. Brass screws are used as terminals. To install this unit it is necessary to remove the pins from the third rail of the track section at the location of the signal. This section will be dead when the signal is red, and energized when the signal is green. The contact T_1 is of very thin brass and is placed about 6 in. from the entering end of the dead section. This



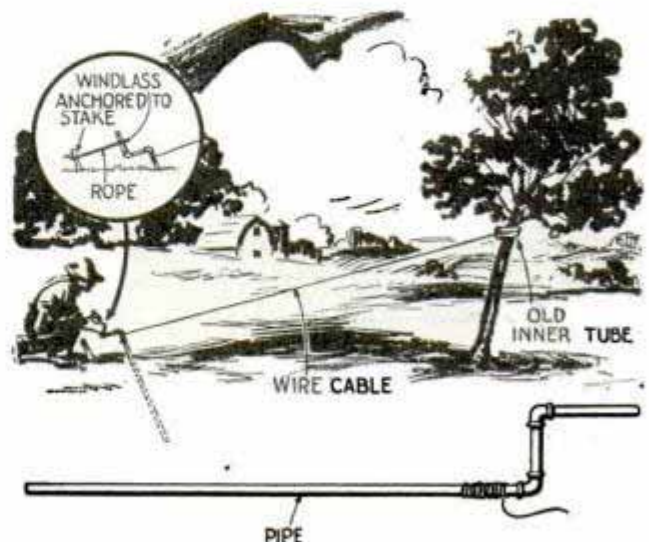
contact is shown in Fig. 2. It is mounted alongside the third rail, close enough so that the shoe on the locomotive will form a bridge between it and the third rail.

In operation the normal indication of the signal is green. When the armature is in contact as shown, current flows from T_2 through the armature into the contact energizing the section fed by T_3 and lighting the green light. When the train approaches the signal the third-rail shoe on the locomotive forms a bridge between the third rail and the contact T_1 . This energizes magnet R and draws the armature over to the position shown by the dotted lines. When the armature is in this position current is no longer being fed to T_3 , and the train stops. Current is then fed to the heater unit and the red light. When the unit is heated, this swings the thermostat arm over in contact and energizes magnet G . This draws the armature over to its normal position and the train proceeds. The thermostat cools in a few seconds and returns to its normal position. The unit may be concealed in a small building along the track or in the lower part of the signal.

Leaning Tree Is Straightened Up by Simple Windlass

When a small tree leans at an angle which detracts from its beauty, it can be straightened up with this windlass made of 1-in. pipe and fittings. The windlass is driven into the ground at an angle opposite to that of the tree. Several wrappings of old inner tube should be provided under the windlass cable where it is attached to the tree. Over a period of several weeks, the tree is gradually straightened by frequently tightening the windlass, the crank of which is held by a short rope and ring dropped over a stake near by.

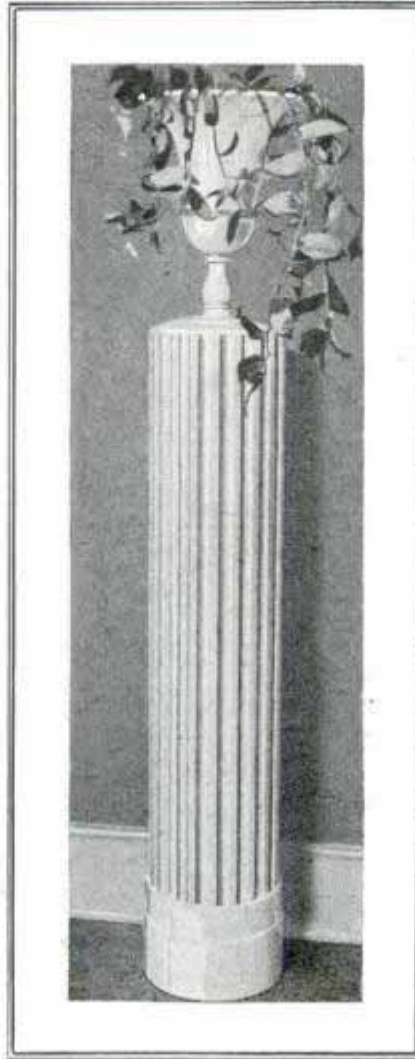
☐ Lamp chimneys cleaned with a newspaper on which a little kerosene has been poured will give a clearer light and be less likely to crack.



A fair-size tree can be straightened by tightening up the windlass at regular intervals

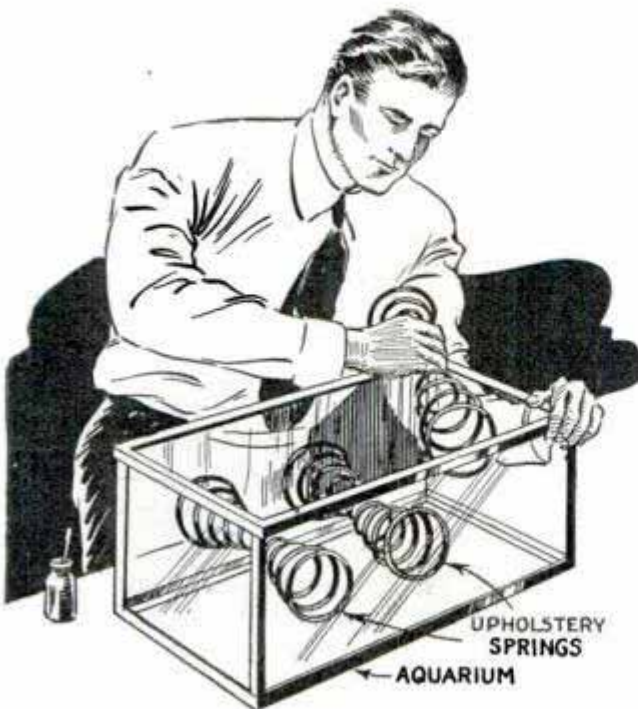
Urn-Top Columns Add Beauty to the Home

Truly graceful in themselves, urn-top columns enameled in the popular bone-white finishes lend a striking decorative touch to bare walls and corners when used alone or as flower vases. The whole job can be done on the wood lathe, the column being formed by gluing up eight tongue-and-groove segments cut from 1 $\frac{1}{8}$ -in. stock and clamped together until the glue dries, with clamps made from flat iron. A wood disk is screwed to each end, then the job is set up in the lathe and turned to the cylindrical form. To get the reeded effect, the column is covered with half-round molding which can be obtained in various stock sizes. The base is built up and turned in the same way, but is left plain as shown in the illustration. The urn is made by stacking a number of wood disks, with glue in all joints, then turning to contour in the lathe. After turning, coat the urn inside and out with shellac.



Finished in white, these columns will help to modernize the living room or sunroom

Coil Springs Hold Aquarium Sides While Cement Sets



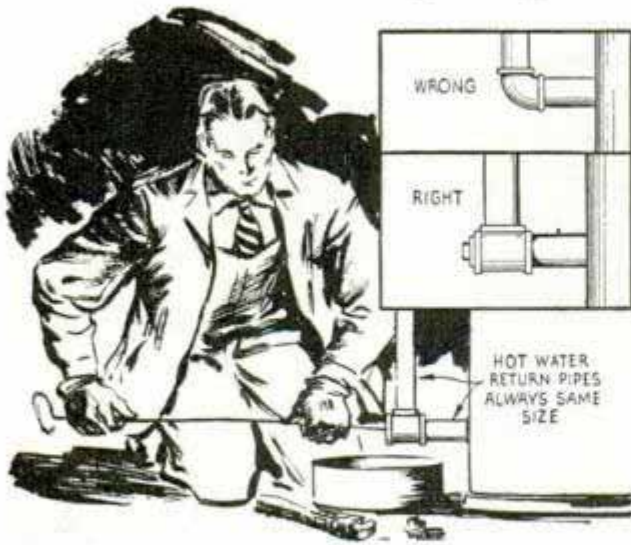
The often difficult job of holding the sides of an aquarium firmly in place until the cement sets is made easy by using three or four upholstery springs, which can be picked up at almost any junk yard. After the cement has been applied to the aquarium frame and the sides set in place, the springs are put between them, where they will exert enough pressure to hold the glass firmly in the cement.

Bouquets Colored by Water

To obtain unusual bouquets of cut flowers I use fruit coloring in the water. You can have bouquets of delicate pink or creamy yellow lilacs, spirea, iris or any other flower which is naturally white. The amount of coloring to use depends on the amount of water in the vase.

—Mrs. Edward O'Berg, Merrill, Wis.

Tee in Return Line of Boiler Permits Removing Sludge

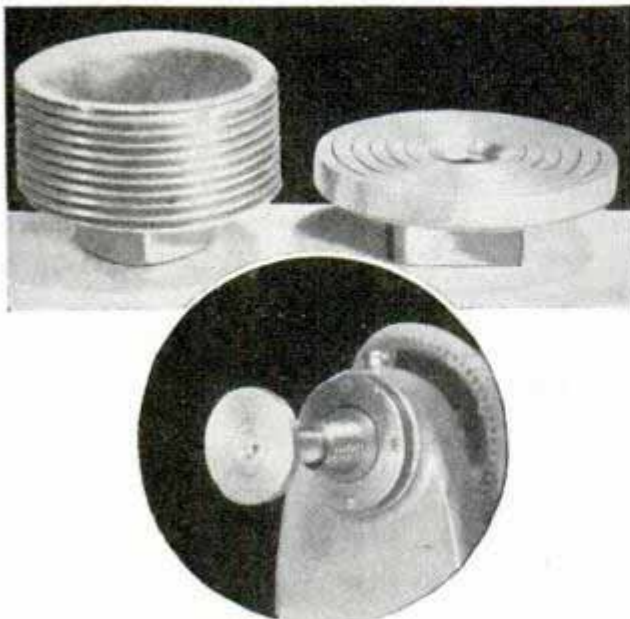


Sludge that accumulates in the boiler nipple of a heating plant is readily removed when a tee is used

Instead of connecting the return pipe to the nipple of a hot-water boiler in a heating plant, which is often done, use a tee with a brass plug in the opening. Then you can remove the sludge which accumulates in the nipple in a few minutes by simply taking the plug out and running a wire brush through the nipple.

Small Faceplates for the Lathe

Small faceplates for the lathe can be made from standard pipe plugs, which are obtainable in a variety of sizes. First, the threaded section of the plug is cut off

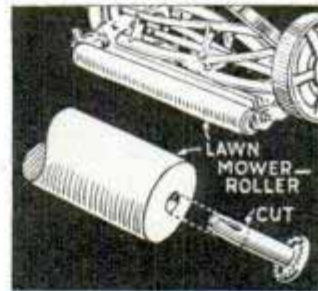


You can make a number of small faceplates for regular or special jobs from pipe plugs

down to the back wall. This will leave the closed end of the plug in the form of a rough plate, with more than enough thickness to make the finished job heavy and rigid. Then, the rough plate is fitted to the spindle which is to carry it by drilling a hole through the center. The projecting end of the plug which ordinarily takes the wrench provides ample material for threading or fitting with set screws, as the spindle may require. Next, the plate is run on the spindle and trued up, front, back and edge. Holes may be drilled, or slots cut in the face as desired.

—Kingsley W. Greene, Wood Ridge, N. J.

Bearings for Lawnmower Roller from Caster Sockets



If the wooden roller on your lawnmower is of the type that turns on small projections extending from the castings and the roller is not fitted with

bearings, you can improvise some from caster sockets that will last quite a while. Just saw off the slotted ends of the sockets as indicated and drive them into the holes in the end of the roller. The sockets should be selected to fit the projection.

Eraser Shielded with Tape

If you carry an eraser in your pocket, it's an easy matter to keep it from becoming soiled by simply wrapping Cellophane tape around the eraser. The



tape, which can be obtained at most ten-cent stores, is gradually peeled back as the end of the eraser wears down.

—Lawrence B. Johnson, Spokane, Wash.

☐ When it is necessary to send coins through the mails, fasten them to the inner surface of a piece of folded cardboard with a strip of gummed paper.

Mounting Your MODEL

LOOKING at the various types of mountings shown here you will see that several are designed to portray the model in action. This makes it doubly attractive and in no way detracts from the constructional features of the model itself.

For example, a mounting for a model speed plane can be a pylon, as shown in Figs. 1 and 2, the plane being held in place with a length of piano wire. Details of the general proportion between plane and pylon are shown in Fig. 2. Simple bracket mountings like that in Fig. 3 are always effective. The bracket can be made from plywood, metal or plastic.

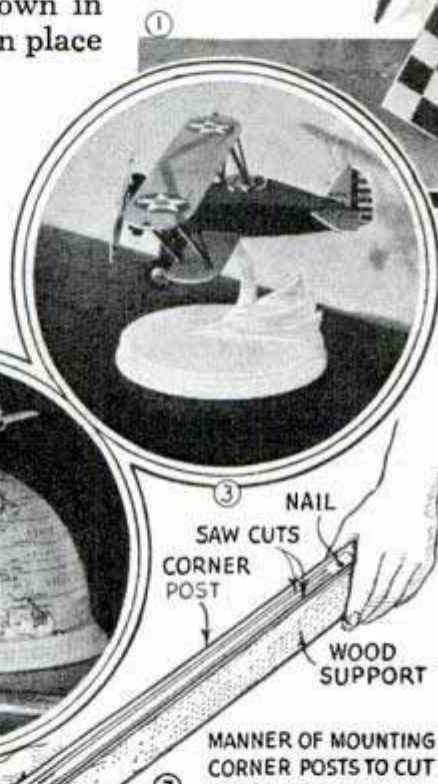
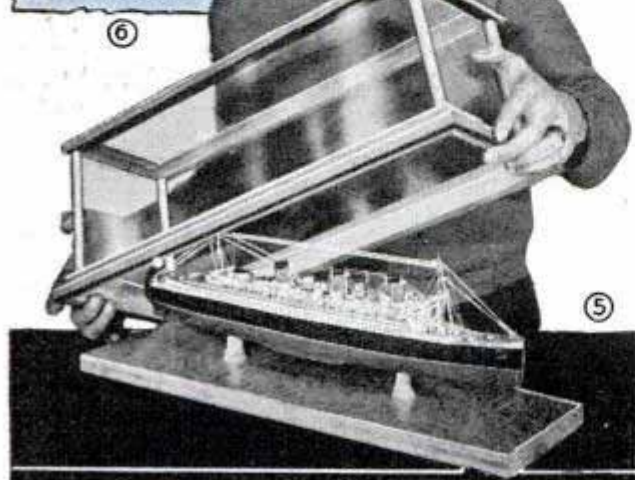
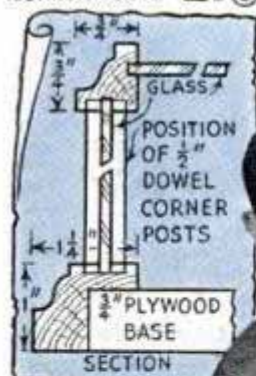
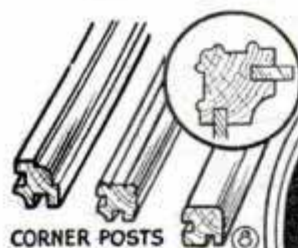
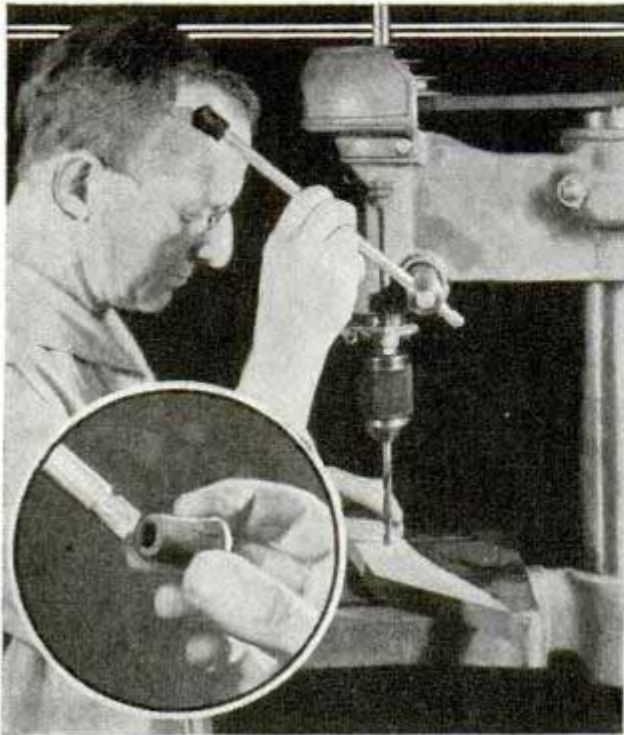


Fig. 4 shows the popular "top of the world" mounting for transport planes. The size of the globe is dependent on the size of the model. Small globes, about 6 in. in diameter, are suitable for plane models up to about 5 in. long. In Figs. 3 and 4 the base is a wood turning, that supporting the globe being turned from $\frac{3}{4}$ -in.

$\frac{1}{4}$ in. to fit inside the globe. Larger models, especially the delicate kind that cannot be dusted, are best mounted in the museum-type glass case as in Fig. 5, a cross section of this case being shown in Fig. 6. The moldings are grooved to take double-strength glass. The corner posts can be made from $\frac{1}{2}$ -in. dowels, by nailing an oversize length of the stock to a wood support as in Fig. 7 so that the grooves can be cut on the circular saw. The posts are then cut to length and doweled into the corners of the framework. Other corner-post designs, made on the shaper, are shown in Fig. 8. These can also be made on the circular saw.



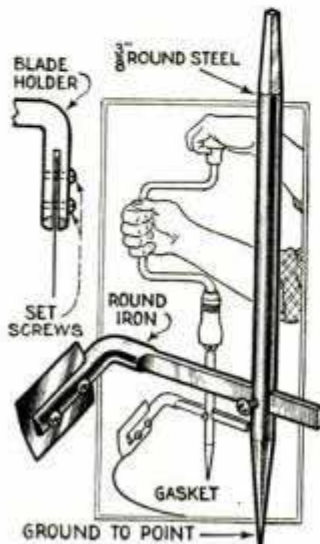
Drill-Press Handle Shielded to Protect Your Head



A rubber crutch tip slipped over your drill-press handle may prevent an injured eye or bruised face

Handles of drill presses having powerful springs for raising the spindles can cause serious injury to the eyes or other part of the face if they accidentally fly upward when released. One way of eliminating most of the danger is to cap the ends of such handles with small rubber crutch tips which can be purchased at drug stores. Besides acting as a safety device, the tips form convenient grips.

Adjustable Gasket Cutter Uses Razor Blades



Easily made to any size desired, this gasket cutter is always sharp as it uses an old safety-razor blade, which is quickly replaced by removing two screws. Used in a drill brace, the cutter holder consists of two iron or steel rods, one of which has shoul-

ders ground at one end to fit the brace and a point at the other end to perforate the work and serve as a center. The second rod serves as an arm which carries the razor-blade cutter. It is ground flat on four sides from one end to about the center to slip into a hole in the other piece as indicated, where it is held by a set screw. The arm is bent at right angles and is slotted to take the blade, which is clamped in place by two set screws.

—L. B. Robbins, Harwich, Mass.

Line Inked on Drawing Board Aids in Lettering

Not having a triangle with the correct slant for lettering, I inked a line on my drawing board as shown, so that a 60°-30° triangle could be used. I measured up the working edge of the board five units and



Using a T-square and a regular triangle to draw the guide lines for letter work

two over, which gives the correct slant for lettering. It is then a simple matter to fit the triangle to this line, put a T-square in place and, tightly holding it, slide the triangle along and draw the guide lines wherever needed.

—Clarence Hamersen, Florissant, Mo.

Dry-Cleaning Soap

A soap that is soluble in naphtha and, therefore, can be used in ordinary dry-cleaning solutions to add to their effec-

tiveness is made by thoroughly mixing oleic acid (red oil), 10.7 lbs., butyl cellosolve, 2.7 lbs., and naphtha (dry cleaners'), 2.5 lbs. This mixture is inflammable and should be heated carefully over a water bath away from a flame to a temperature of 140° Fahr. In another container prepare the following solution: Potassium hydroxide, .85 lb., and water, 1.35 lbs. When dissolved add triethanolamine, 1.97 lbs. After stirring thoroughly, this solution is heated to 140° Fahr. and is poured into the first solution while stirring vigorously. The stirring should be continued leisurely for a half hour or until an even and fairly clear solution is obtained. To use the soap, add a small quantity of it to cleaners' naphtha or other spirit-cleaning mixture.

Lettered Trees Along Fairway of Golf Course Aid the Player



Golf balls hooked or sliced into the timber along this fairway are located by taking a bearing on the lettered trunks

Mandrel on Leg of Workbench for Shaping Sheet Metal

Screwed to the leg of your home-workshop bench, this removable pipe nipple will come in handy for occasional jobs of shaping light sheet metal and similar work. It is attached by means of a floor flange which is screwed to the bench leg. Several nipples of different sizes can be accommodated by using pipe bushings in the flange.



Pipe nipple on bench leg provides mandrel which can be removed when not in use

At a golf course in Bartlett, Ill., the trunks of the trees along one of the fairways have letters painted on them in white, which serve as a guide in locating a ball that has been sliced or hooked into the rough. The player merely watches the ball and notes the letter of the tree nearest the spot where it falls. Or, if the ball goes far into the timber, he takes a bearing from the tee on two or more of the lettered trees in line with the flight of the ball.

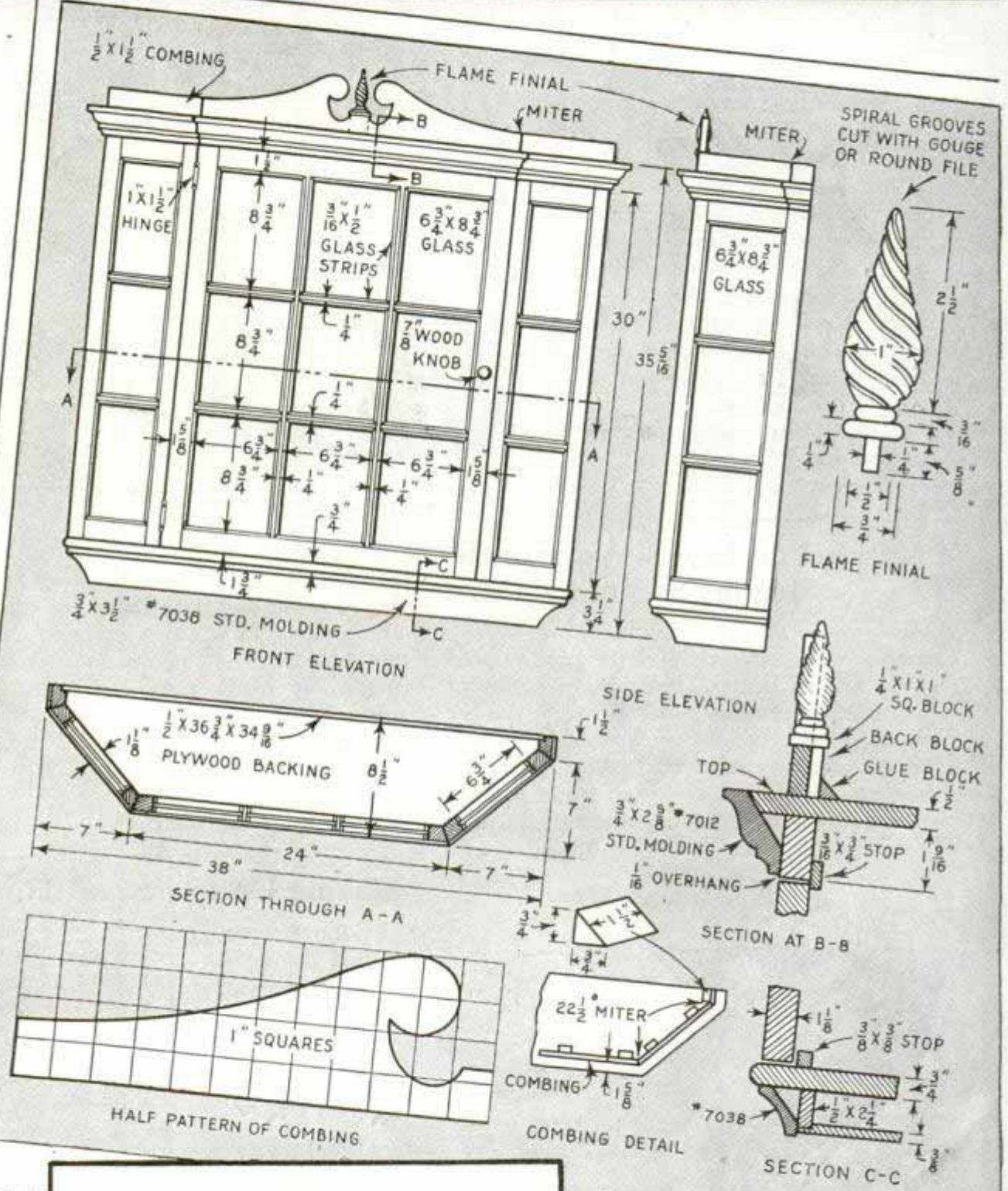
Making Uniform Seed Furrows

If you have trouble in making furrows of uniform depth for sowing seeds that must be planted near the top of the ground, a short length of garden hose will solve your problem.



Just take a sharp knife and make a slit through opposite sides of the hose, near the center, to take the corner of your hoe as indicated. The hose, which can be adjusted on the hoe so that the latter will make furrows of different depths, will "ride" on top of the soil.

Hanging CHINA CABINET

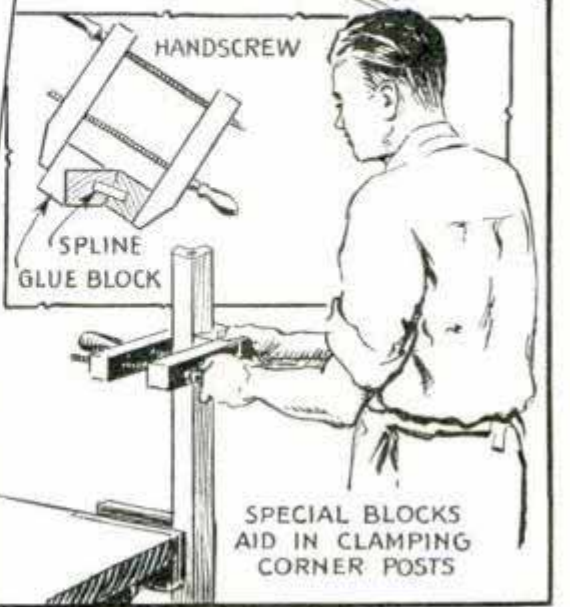
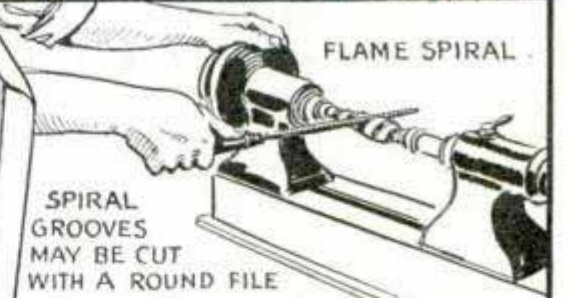
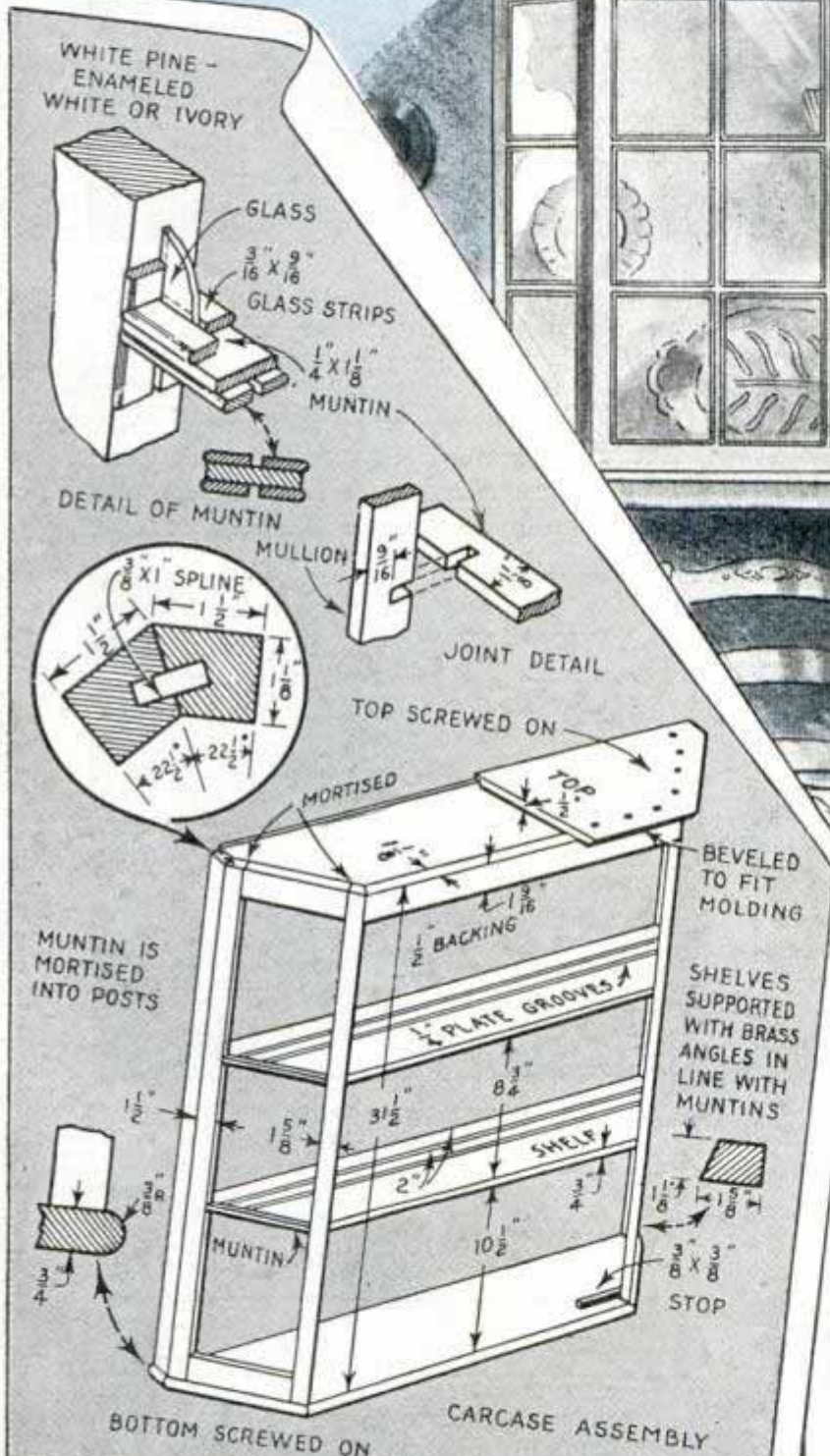
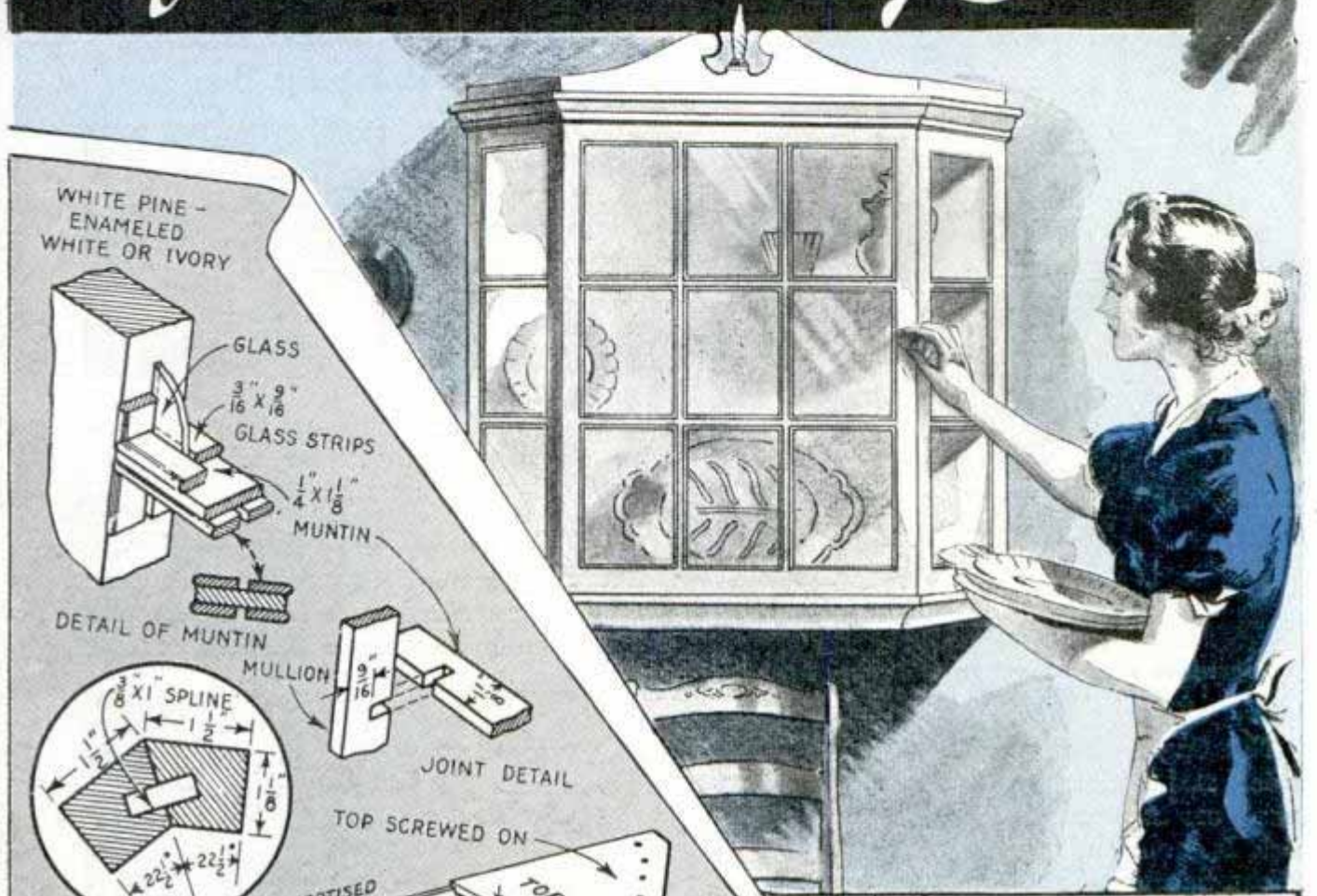


SCALE OF
 DESIGNED
 DRAWN BY

Especially suitable for the small dining room in a home where space is limited, this hanging china cabinet not only adds a decorative touch to the room but also has the advantage over the usual cabinet in that it does not take up any floor space. It is easy to build as ready-made molding is used which eliminates the necessity of using a shaper

POPULAR MECHANICS
 MAGAZINE

of Colonial Days



SHEET NO. 1

ISSUE

POPULAR MECHANICS MAGAZINE

200 E. ONTARIO ST. CHICAGO

BLUEPRINT No. SN 961

Artist Stores Paper and Drawings in Steel Kitchen Cabinet

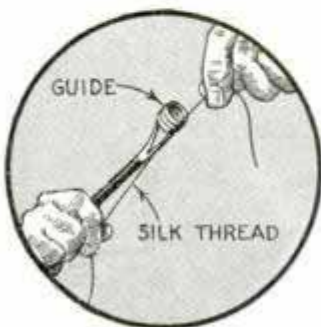


Inexpensive steel cabinet provides good storage space for artist's materials

Needing a storage cabinet for his paper stock and unfinished drawings, one artist used an inexpensive steel kitchen cabinet. It should be fitted with casters so that it can be moved about easily. A letter file placed on top of the cabinet provides storage space for drawing instruments, a spring pencil holder being attached to the underside of the lid for brushes, pens, etc., while scales, triangles and other instruments are kept in the bottom of the file.

Rough Guide on Fishing Pole Often Breaks Line

Have you ever had a fine, silk fishing line break near the end of the pole after it was used a short time? If so, you will probably find that the inside surface of the guide on the end of the pole is rough enough to fray the line. The roughened part of the guide may be

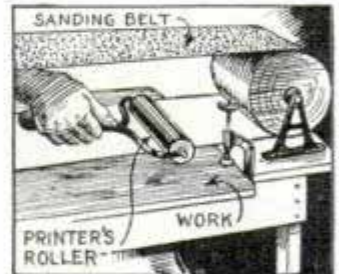


too small to detect with the eye, but you can quickly make a test by holding the

line and pole as indicated and slowly passing the line over the inside surface of the guide with a revolving motion of the hand.

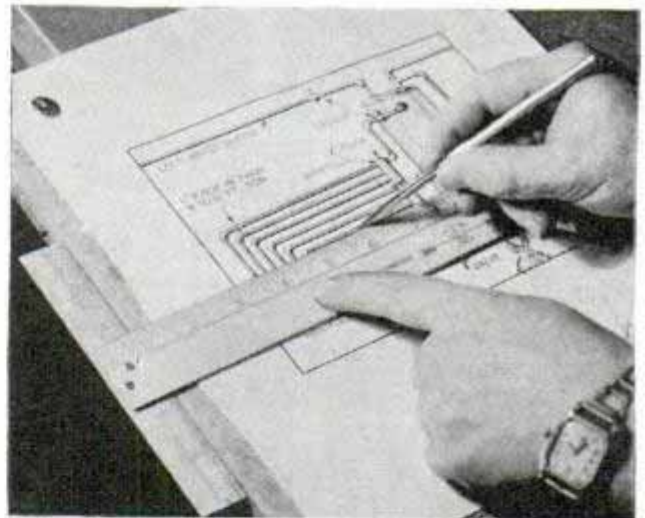
Ink Roller for Stroke Sanding Avoids Wear on Belt

By using a heavy, rubber ink roller in place of the regular stroking block for surface sanding, one home craftsman prevents wear on the belt of his sander. As the roller rotates when in contact with the belt, there is no friction.



T-Square From Two Rulers

An inexpensive T-square for school use may be constructed by joining a 6-in. and a 12-in. ruler as shown. In order to get



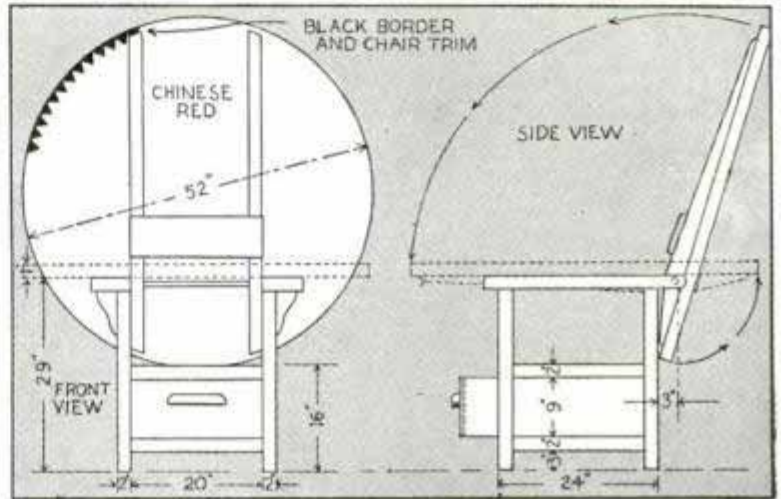
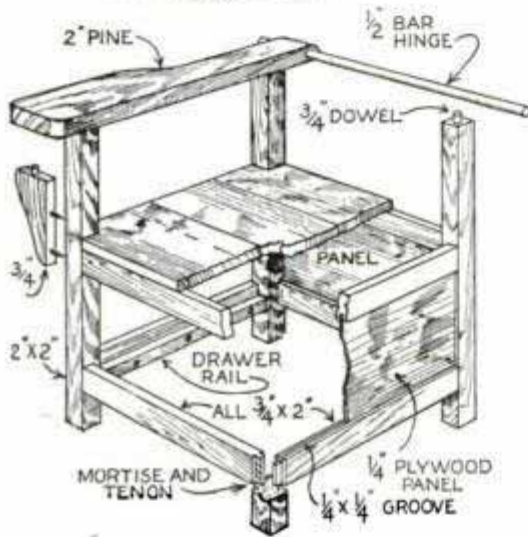
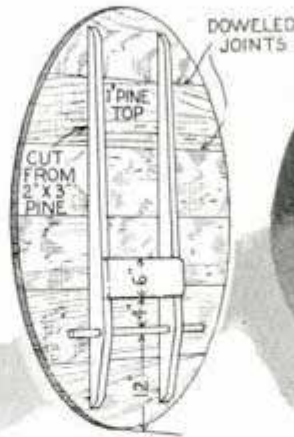
It takes only a few minutes to make this T-square from a couple of cheap rulers

them accurately set at right angles a carpenter's square is helpful. The rulers are held together with small screws or brads.

A Photo of Your Workshop

Can you help us make up an interesting photo collection on "Home Workshops of Popular Mechanics Readers"—where you and others find relaxation in various hobbies? Your offering will be appreciated and with it let's know your favorite hobby, besides your name, address and professional activity. Send to Workshop Photo Editor, Popular Mechanics Magazine, 200 E. Ontario St., Chicago.

This Arm Chair Has Back to Form Large Table



Serving either as an arm chair or as a dining table, this attractive piece of furniture, with its tilting back and large drawer for storing linen, is particularly adapted to the cottage or porch. In making the chair, white pine is used for the frame, which is assembled with mortise-and-tenon joints, and plywood is used for the panels, these being rabbeted into the frame. Tapered members of 2-in. material

serve as cleats for the circular top, which is built up of 1-in. boards glued together. The top is hinged to the chair arms by means of an iron rod, which is located so that the top tilts back a few inches at the upper side to prevent its falling forward when used as a chair. The original chair was given a pleasing appearance by finishing it in Chinese-red brushing lacquer with black trim.

Insecticide Spray to Kill Insects on Bushes and Vegetation

For spraying ornamental bushes and vegetation to kill insects which commonly infest the foliage, a preparation is made by dissolving any good grade of soap chips, 5 lbs., in hot water, 10 gal. When the soap has been dissolved completely and the mixture has cooled, nicotine sulphate, 1 oz., is stirred in, after which kerosene, 10 gal., is also stirred in vigorously. The mix-

ture forms a white, milky preparation. Although the nicotine sulphate is poisonous, the small amount contained in this preparation does not offer any particular hazard. A quantity of the spray may be made and kept for future use if it is well stirred immediately before using. A garden sprinkler can offers the easiest means of applying the insecticide.

"DILATOSCOPE" *takes guess-*



EYE PUPIL DILATES OR CONTRACTS ACCORDING TO INTENSITY OF LIGHT. COMPARING SIZE OF PUPIL WITH A CHART GIVES EXPOSURE TIME

With this exposure meter you compare the eye pupil with dots on the chart and refer to the figures giving lens openings and shutter speeds

By ALEXANDER MAXWELL

WHAT'S wrong with your photos? Are some as black as ink and others show only a ghost of a picture? In that case you need an exposure meter which will tell you where to stop the lens and what fraction of a second the exposure should be made. If you will cut out the chart on the last page of this article and apply it to an auto rear-vision mirror, after removing some of the silvering to take the chart and some more for two "peepholes," you will have a "dilatoscope" all ready for use with super-panchromatic film. In assembling the dilatoscope, cut out a piece of stiff cardboard the size and shape of the mirror. Glue the chart to the cardboard, which is held in place against the back of the mirror with cellulose tape.

The dilatoscope depends for its accuracy on the sensitiveness of the human eye. When you look in the mirror you will notice the pupils of your eyes are not

always the same size. In bright light the pupil becomes a mere "pin point." On a dark night just the opposite takes place, the pupil dilates to receive all the light possible. Dilation of the eye is in direct proportion to the amount of light present and as the eye is always the same size when a specified amount of light is present, it can be calibrated. By checking the human eye against a photometer the table of values as given in the chart was evolved. It is consistent and works equally well indoors and out, summer or winter.

To use the dilatoscope aim at your subject, holding the mirror about one foot from the eye. Look through either of the 1 by $\frac{3}{4}$ -in. windows until your eyes become regulated to the light, then look into the mirror and compare the pupil with the chart figures. Under each is a double column marked s and f; s is for shutter speeds and f for diaphragm stops. The

work out of exposure



simpler cameras have but one shutter speed, which is $\frac{1}{25}$ sec., and one stop which is usually f 11. With them good results can be obtained only in bright sunshine. In the case of a box camera with three stops, they are f 11, f 16 and f 22, the speed being $\frac{1}{25}$ second. From here, speeds and stops multiply rapidly up to the expensive newspaper cameras which may have twenty shutter speeds and fifteen stops. Fortunately, amateur cameras stop at a reasonable number, and with proper handling such numerous settings are not needed.

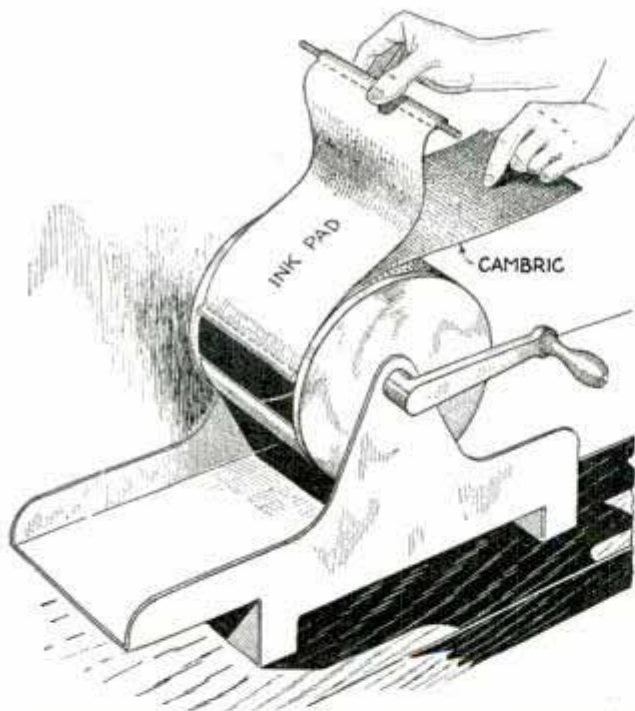
When making adjustments on speed and lens opening, a few facts should be kept in mind. If the picture is a still life it is gen-

erally best practice to shoot it at the maximum time, with the lens stopped down in accordance with the figures in the chart. This setting brings out details in deep shadows much more than a faster speed, and also tends to sharpen the focus. Where there is any movement, shutter speeds and lens opening will have to be increased. To illustrate the points just mentioned, suppose you want to take a picture in the back yard showing the progress of a flower garden. There is no action and you want sharp detail, so you choose a high f number. The higher the f the sharper the picture, but the slower the shutter speed must be. For a second example, suppose the children and the dog are romping on

from the film, burning the silver into a dense black mass without quality or character. To guard against this, to a certain extent, films have an anti-halation coating on the reverse side. This is a light absorbing dye which prevents reflection. On very high-speed film, such as is used in "cat's-eye" cameras, the celluloid itself is gray instead of being clear. A normal exposure should be sufficient to enable the strongest light entering the camera just time enough to reach the lower layer of silver grains. With a negative of this type the whites will be crystal clear and the deepest darks not yet black. This is what we are seeking, and is what we will get by the proper use of the dilatroscope.

Mimeograph Ink Pad Improved with Cambric Cloth

When a mimeograph machine has been used for some time, the fibers of the ink pad often become pressed into the per-

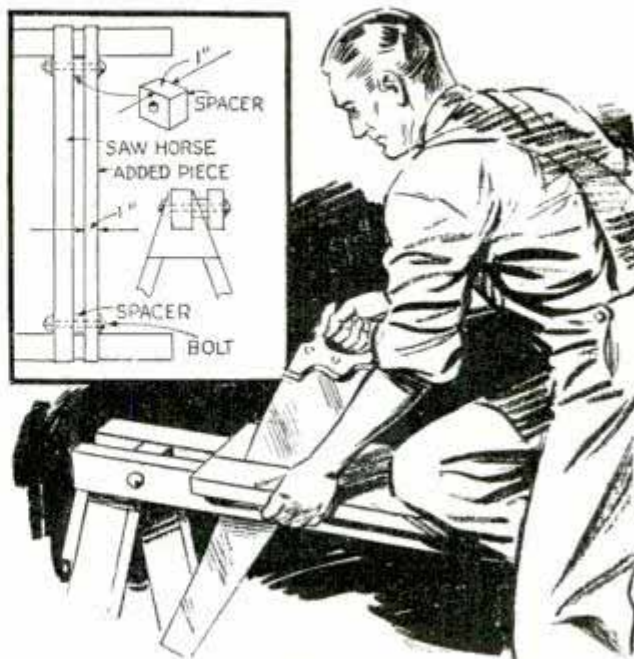


Inserting cambric cloth under mimeograph ink pad to prevent fibers from clogging cylinder perforations

forations of the cylinder so that the ink flow is impeded and the reproductions are faint or spotty. To avoid this trouble, lift the pad from the cylinder and insert a sheet of white cambric under it as shown. This will prevent the fibers from packing into the perforations and allow the ink to flow freely.

—G. E. Hendrickson, Argyle, Wis.

Sawhorse Converted for Ripping by Extra Top Member

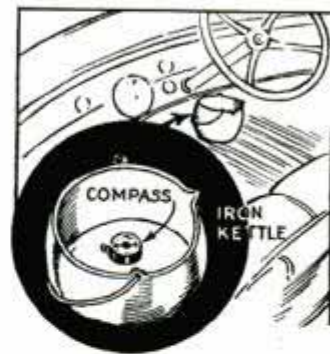


Piece of 2 by 4-in. stock bolted to top member of sawhorse to hold work for ripping it by hand

Here is a way to convert your sawhorse to support work while ripping it by hand. Just bolt a piece of 2 by 4-in. stock to one side of the top member, using 1-in. spacer blocks to provide a slot. It takes only a couple of minutes to remove the member when not needed.

Shielding the Motorboat Compass in an Iron Kettle

Copying an idea of Newfoundland fishermen, who venture far out in 30 and 40-ft. motor skiffs and must depend on their compasses, the owner of a small motorboat, or even the motorist, can shield a compass against the magnetic attraction of the motor by placing it in an iron kettle. Unless the compass is protected, the reading may be inaccurate.



Unless the compass is protected, the reading may be inaccurate.

☞ Place a piece of cheesecloth under the grating of your cold-air register and it will filter dust and lint from the air and, also prevent anything from being dropped inside the air duct.

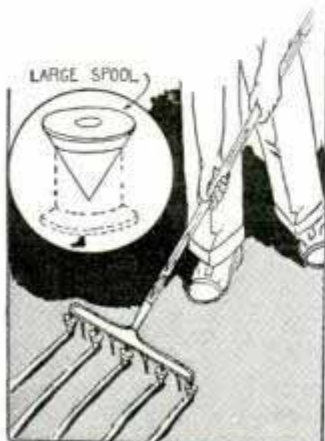
Swing Cradle for Corn Popper Eliminates Scraping Noise



If you use a coal stove, get up a bed of hot coals and set the cradle over one of the lid openings

To eliminate the scraping noise of a corn popper on the stove, and also to prevent wear on the thin bottom of the popper, one man uses this swinging cradle, which sets over a burner of the stove. Consisting of a heavy wire frame of the shape shown, the cradle supports the popper above the flame at any desired height. The swinging U-shaped wire on which the popper rests can be made to support the popper at a set height, or, it can be folded double at regular intervals and the folded portions bent to form hooks, which permit it to be swung at different heights.

Adjustable Garden Row Marker from Rake and Spools



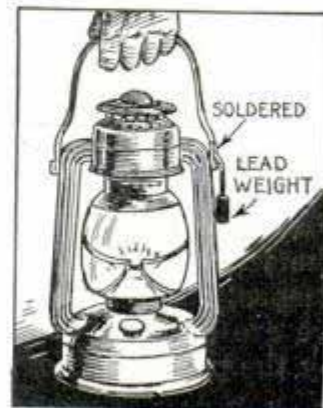
By cutting off one end of two or three empty thread spools and whittling them to a cone shape, they can be slipped over the teeth of your garden rake to mark off evenly spaced rows in your garden. For shallow-planted

seeds, you can even make the small furrows with the rake.

—A. H. Waychoff, Tempe, Ariz.

Lantern Bail Stays Upright

By simply attaching a lead weight to a short length of wire, which is in turn soldered to one side of your lantern bail as indicated, the bail will remain in a vertical position when the lantern is set down. The weighted wire should be soldered to the bail in a position to clear the lantern frame.

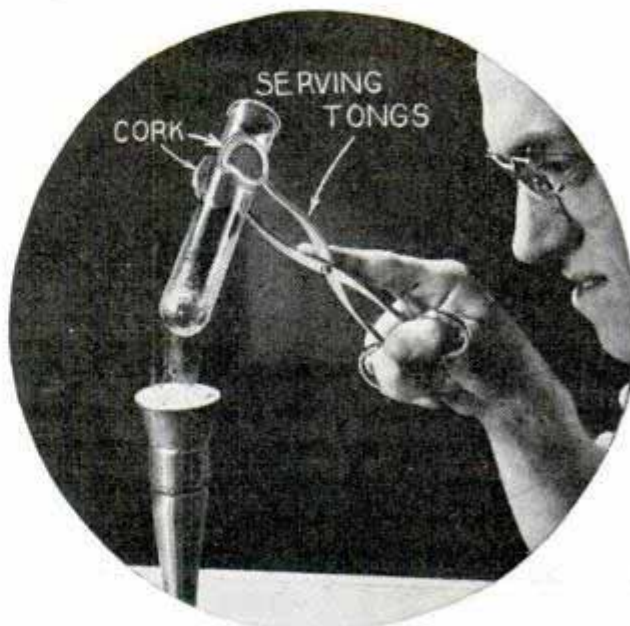


—Frank S. Reynolds, Ft. Morgan, Colo.

Serving Tongs Handle Hot Flasks in Home Laboratory

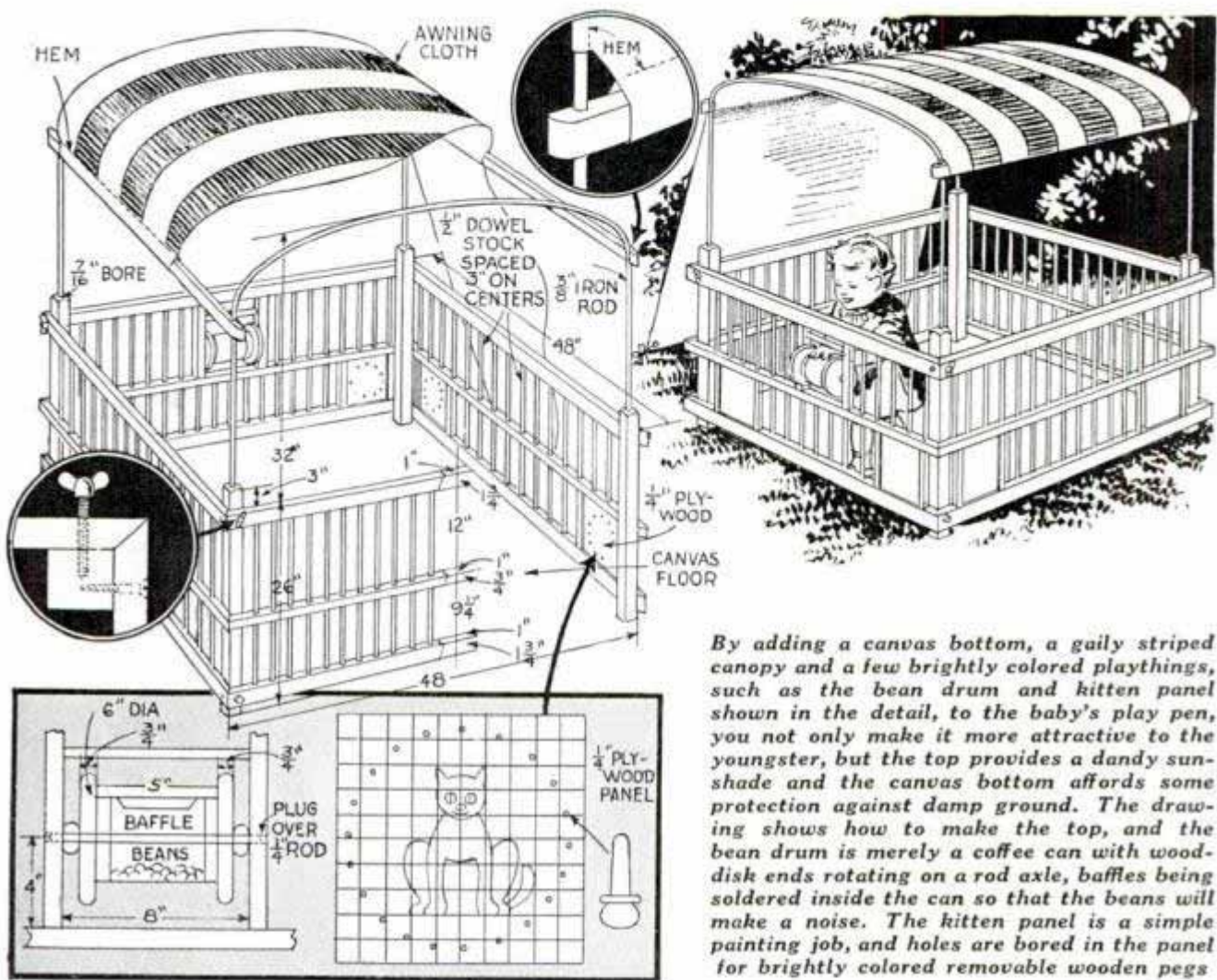
By gluing pieces of sheet cork to a pair of ten-cent serving tongs as shown, they come in handy in the home chemical laboratory for gripping hot flasks, beakers, test tubes, crucibles, etc. The cork is cut to the shape of the tong jaws and is glued to their inner surfaces, providing a non-slip grip against the glass.

—George J. Vias, Chicago.



Cork glued to jaws of serving tongs provides non-slip surface to handle hot test tubes, etc.

Canopy and Playthings on Baby's Play Pen



By adding a canvas bottom, a gaily striped canopy and a few brightly colored playthings, such as the bean drum and kitten panel shown in the detail, to the baby's play pen, you not only make it more attractive to the youngster, but the top provides a dandy sunshade and the canvas bottom affords some protection against damp ground. The drawing shows how to make the top, and the bean drum is merely a coffee can with wood-disk ends rotating on a rod axle, baffles being soldered inside the can so that the beans will make a noise. The kitten panel is a simple painting job, and holes are bored in the panel for brightly colored removable wooden pegs.

This Strong Gate Closer Makes Use of Lock Unnecessary

If you have your property fenced to keep a small child or pet inside, here is a closer for the gate that makes it unnecessary to use a lock or catch as two springs hold it so tightly against the jamb that a large dog or small child cannot open it. All you need to make it is two lengths of 1 by 3-in. wood, two screen-door springs and three small strap hinges. The two wood pieces are hinged together, after which one end is hinged to the center of the gate and the other to a near-by building or a post set 18 to 24 in. from the fence. The springs are attached to the fence and to the hinged pieces in approximately the position indicated.—George Vias, Chicago.

☛ If the inside surfaces of the ferrules of your casting rod are polished with a piece of wax paper, it is not likely to stick at the joints when taking it apart.



Building the

BILOXI



It is used quite extensively for rowing, and is sometimes towed behind a launch, and behaves splendidly for both these purposes. For sailing it is excellent, and I do not think I have ever sailed a small single-sail boat that is so well balanced.

"The little Gorenflo boat which I bought performs under sail better than any small boat of its kind that I have seen, and has proved quite dry under power.

As a sea boat the little thing is quite astounding. With two in her she rides like a duck. Our inlets here are notoriously treacherous, with a current of four knots or more. That against an ocean swell rolling in with a southeasterly breeze behind it kicks up some nasty water but, using motor, we play around in any ordinary weather out to the break of the outer bar and ship nothing but an occasional quart or so of spray.

he: Gorenflo Dinghy.

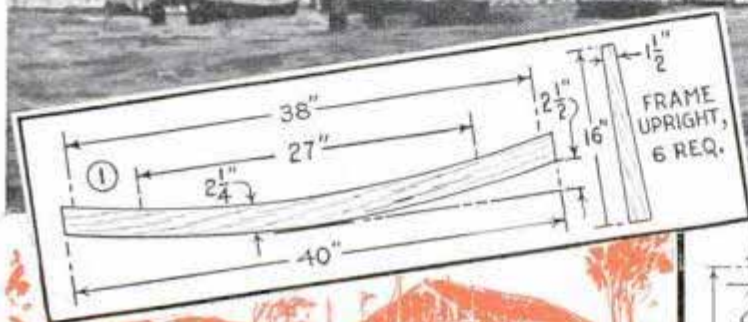
You may be interested to learn that Region eight comprising six States have decided to adopt the Dinghy as a Sea Scout project and will lend effort and time towards having the boys build a number of the boats. It is contemplated that these boats may

HERE'S just what prospective builders of small sailboats have been looking for, as you will see from a glance at the facsimiles on the left, which reproduce excerpts from letters written by enthusiastic owners. And, the Biloxi Dinghy is not only seaworthy, as they say, but it's easy to build. Look over Figs. 1 and 2, which detail the frames and stern board, or transom. There are several points to keep in mind before you begin cutting the parts: The lower cross members of all frames are cut to the same radius; the top cross-pieces are a given distance above the lowest point of the curved member, and the frame uprights are joined to the curved members with an angle joint housed in gusset plates, as in Fig. 2. With the frames, stern board and building board made, the work on the hull is well along.

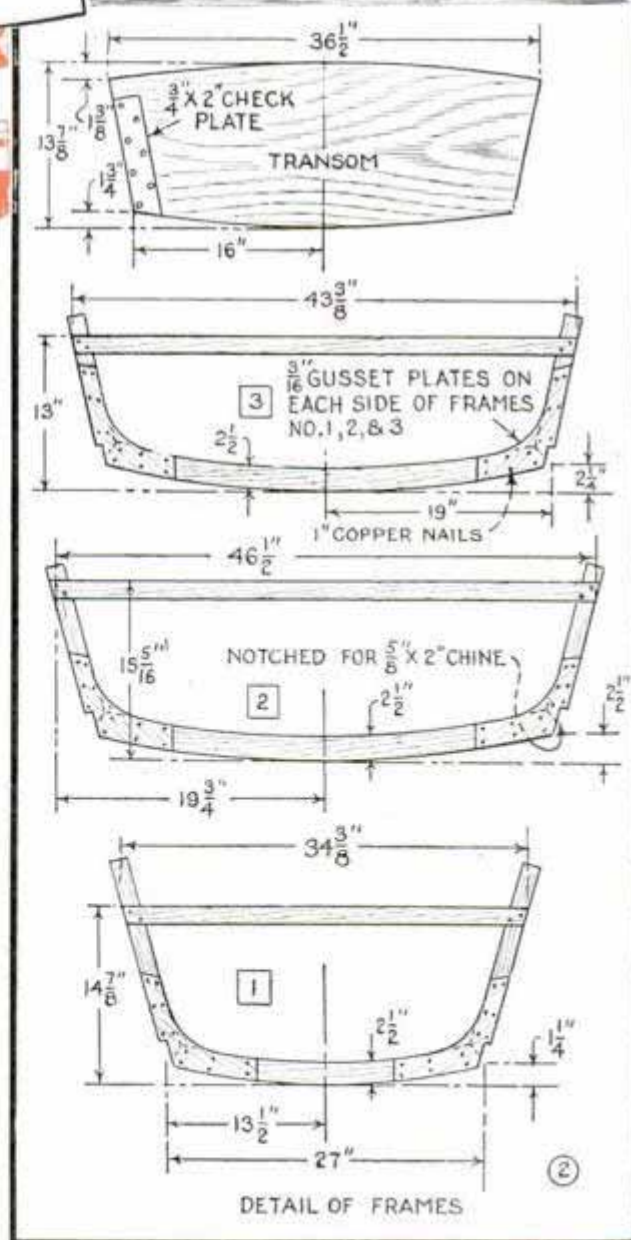
You start assembling the boat by placing the building board on two sawhorses as in Fig. 3. The lines marked on the building

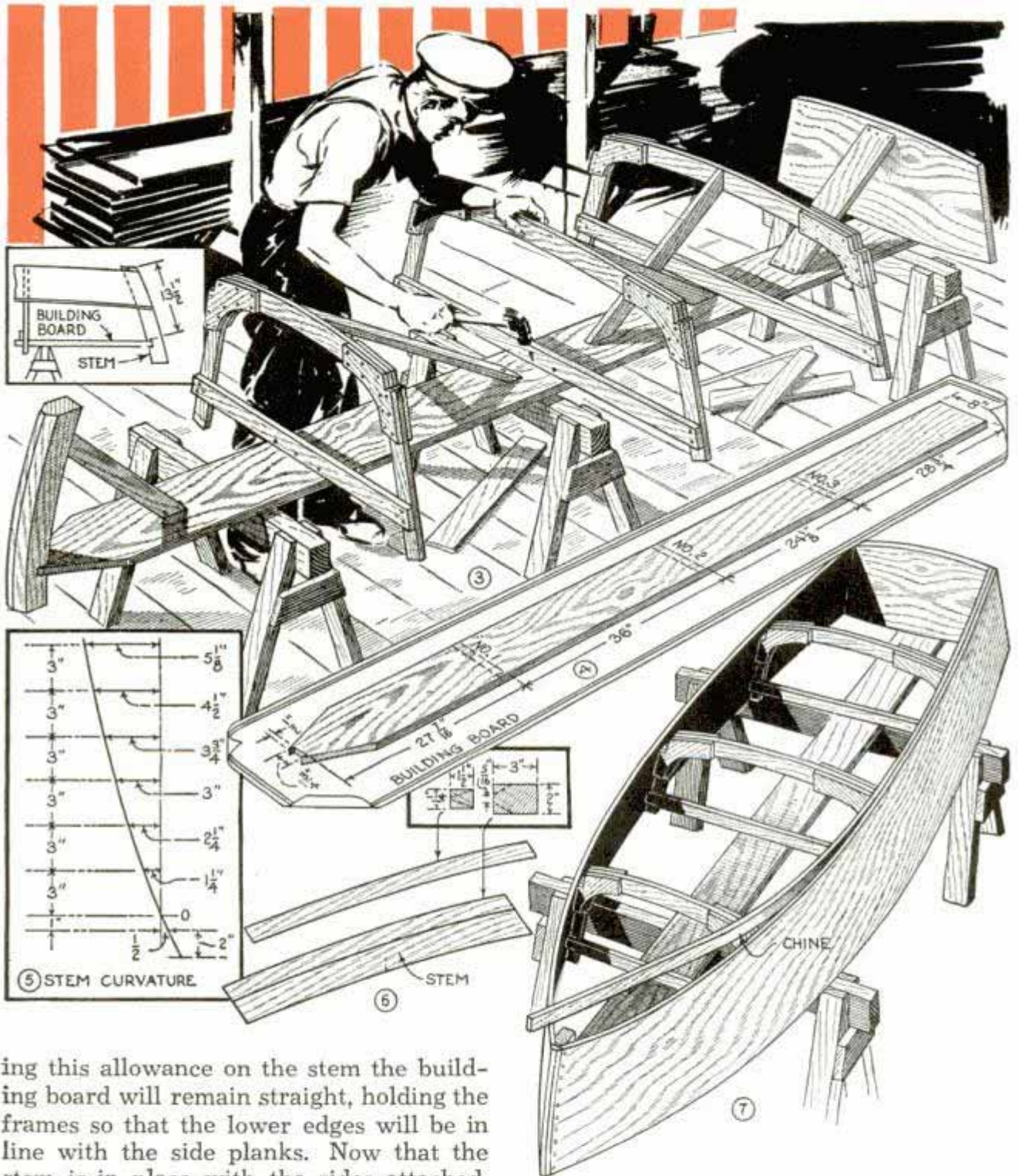
DINGHY

by
L. J. Gorenflo



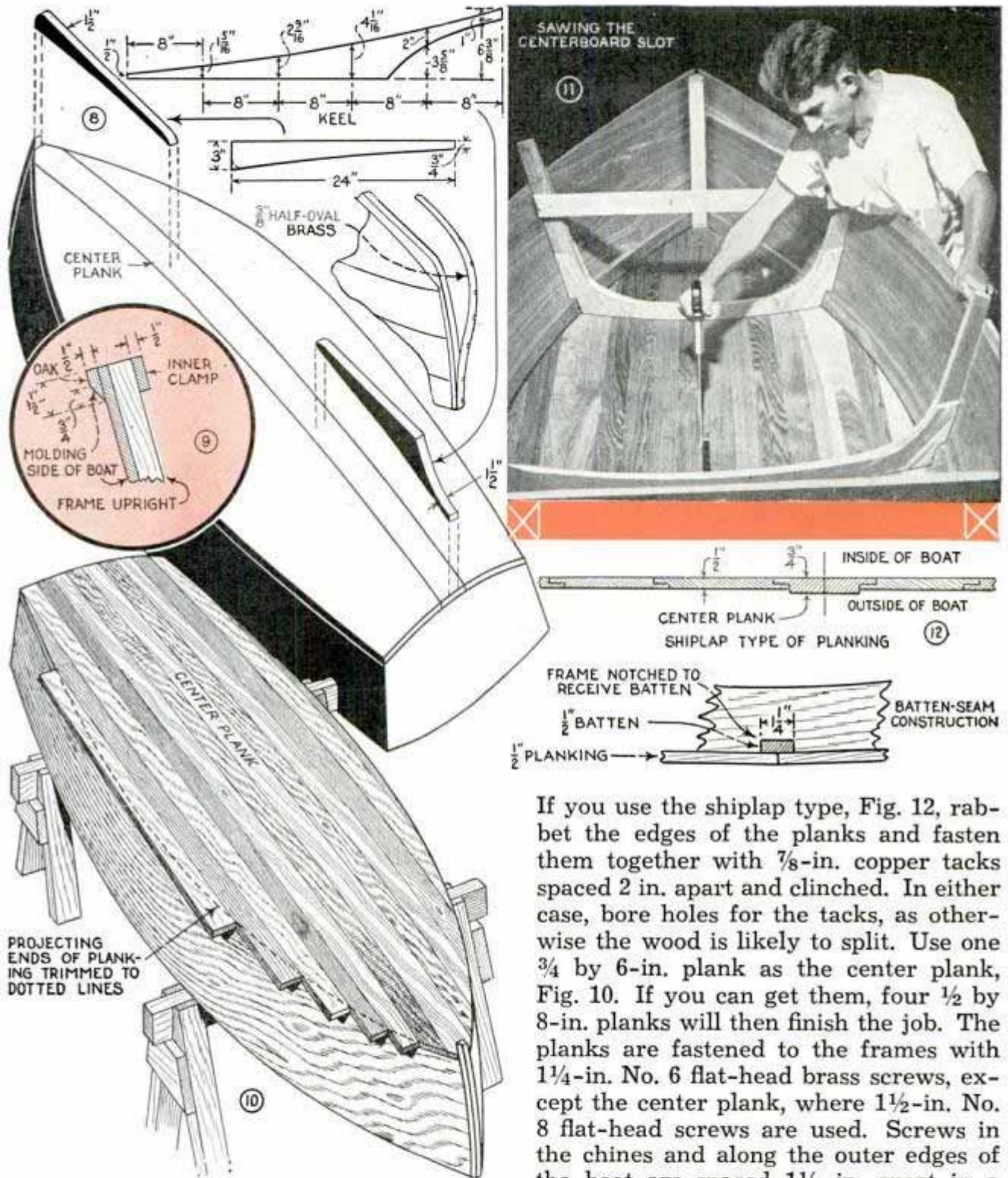
board, Fig. 4, indicate where to place the frames. These are placed upside down and the center line of the building board must match up with that on the frames. Place frames Nos. 1, 2 and 3 along the lines and fasten through the building board with 8-d common nails or 1½-in. screws, also a brace to each frame. After all three frames have been attached to the board, the next step is to fasten the sides to the stem, Fig. 6. This can be done before mounting the stem on the building board although it is shown mounted with the frames in Fig. 3. If the sides are built up of several pieces, you simply screw the two lower planks to the stem, but should the sides be made up of narrow planks, the first plank on the lower side should be at least 8 in. wide. When building up the sides you can use shiplap construction which will eliminate battens. The stem is fastened to the sides at the zero (0) line, Fig. 5. Use 1½-in. No. 8 flat-head brass screws spaced about 1½ in. apart, in a staggered row. In Fig. 3 is a detail showing the exact distance from the lower edge of the boat to the building board. By mak-





ing this allowance on the stem the building board will remain straight, holding the frames so that the lower edges will be in line with the side planks. Now that the stem is in place with the sides attached, you may continue by bending the sides around the frames and holding them in place with a piece of rope. Fasten the sides to the frames with $1\frac{1}{2}$ -in. No. 8 flat-head brass screws. The transom is also fastened with $1\frac{1}{2}$ -in. flat-head brass screws driven into the check plate and 2-in. screws driven into the end grain of the transom. Fig. 16 shows the offsets and also the exact positions of frames Nos. 1, 2 and 3. Be sure to mark these positions on the sides before bending the latter in position around the frames. The lines are

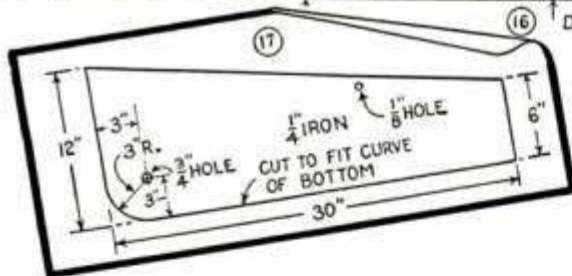
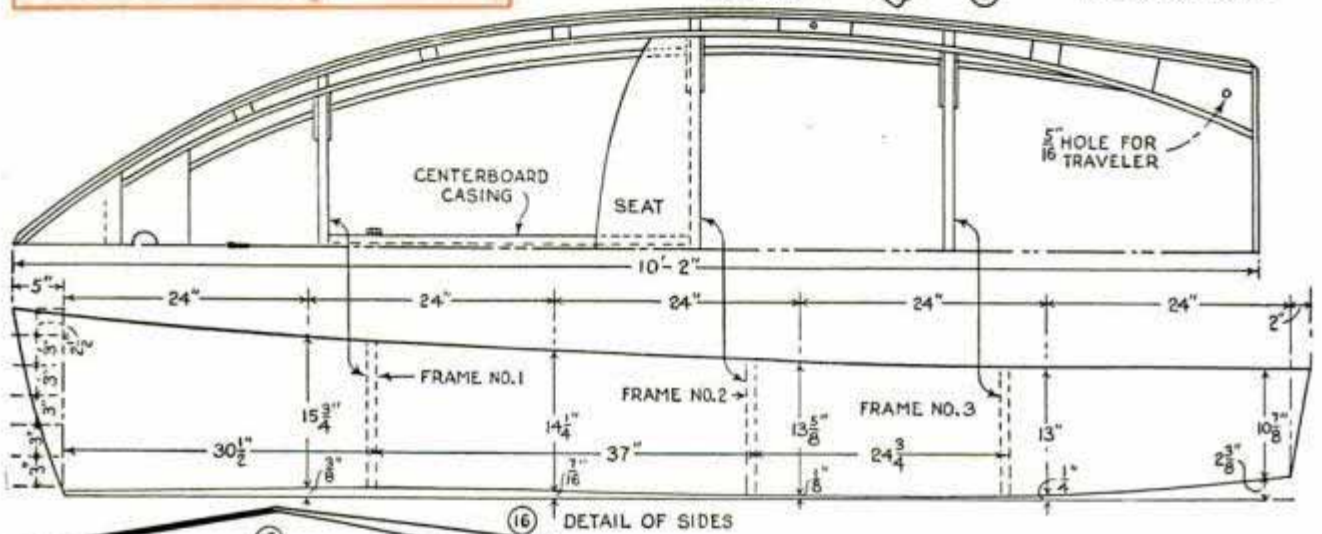
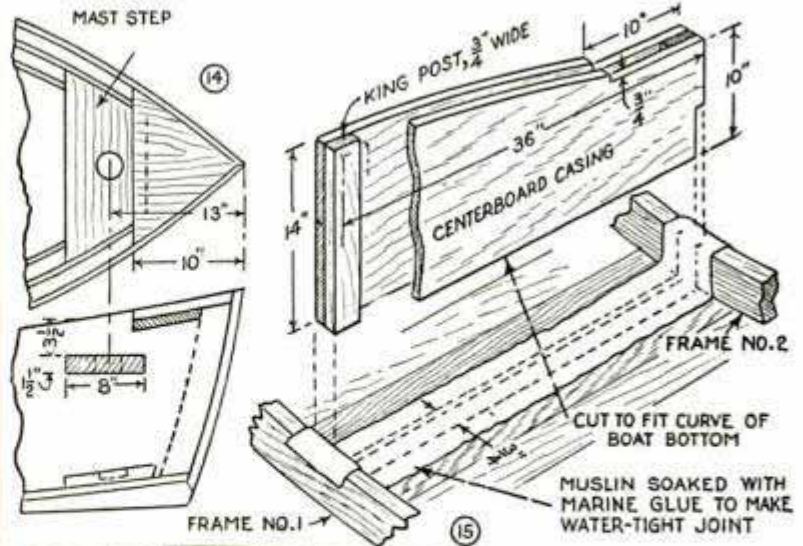
drawn at right angles to the base line and serve as a guide to placement of the frames in an upright position. Move the temporary braces if necessary to bring the frames into the proper position. Now the second and third planks are placed on each side. The shiplap joints are fastened with $\frac{7}{8}$ -in. copper tacks spaced $2\frac{1}{2}$ in. apart and clinched across the grain. Use marine glue to make the joint waterproof. When the sides are fastened, the next step is to insert the chines as in Fig. 7. Chines are fastened to the frames with $2\frac{1}{2}$ -in. No. 8



flat-head brass screws and to the sides with $1\frac{1}{4}$ -in. No. 6 flat-head brass screws spaced $1\frac{1}{2}$ in. apart in a staggered row. Then fair off the sides, transom and stem, a job which must be done carefully to avoid leaks. At this point, select the type of bottom construction. If it is to be the batten-seam type, battens must be mortised at the proper places and the planks are fastened to the battens with $1\frac{1}{4}$ -in. copper nails spaced 2 in. apart and clinched.

If you use the shiplap type, Fig. 12, rabbet the edges of the planks and fasten them together with $\frac{7}{8}$ -in. copper tacks spaced 2 in. apart and clinched. In either case, bore holes for the tacks, as otherwise the wood is likely to split. Use one $\frac{3}{4}$ by 6-in. plank as the center plank, Fig. 10. If you can get them, four $\frac{1}{2}$ by 8-in. planks will then finish the job. The planks are fastened to the frames with $1\frac{1}{4}$ -in. No. 6 flat-head brass screws, except the center plank, where $1\frac{1}{2}$ -in. No. 8 flat-head screws are used. Screws in the chines and along the outer edges of the boat are spaced $1\frac{1}{2}$ in. apart in a staggered row. Use $1\frac{1}{4}$ -in. No. 6 flat-head brass screws along this line, as well as into the lower edges of the transom.

This done, the boat is turned over and the centerboard installed. Make up the centerboard well or casing as in Fig. 15. The oak king posts are fastened to the casing with $1\frac{1}{2}$ -in. No. 8 flat-head brass screws, spaced $1\frac{1}{2}$ in. apart. The case should fit snugly against the bottom of the boat, and should be notched out at the after end to fit over the No. 2 frame. A

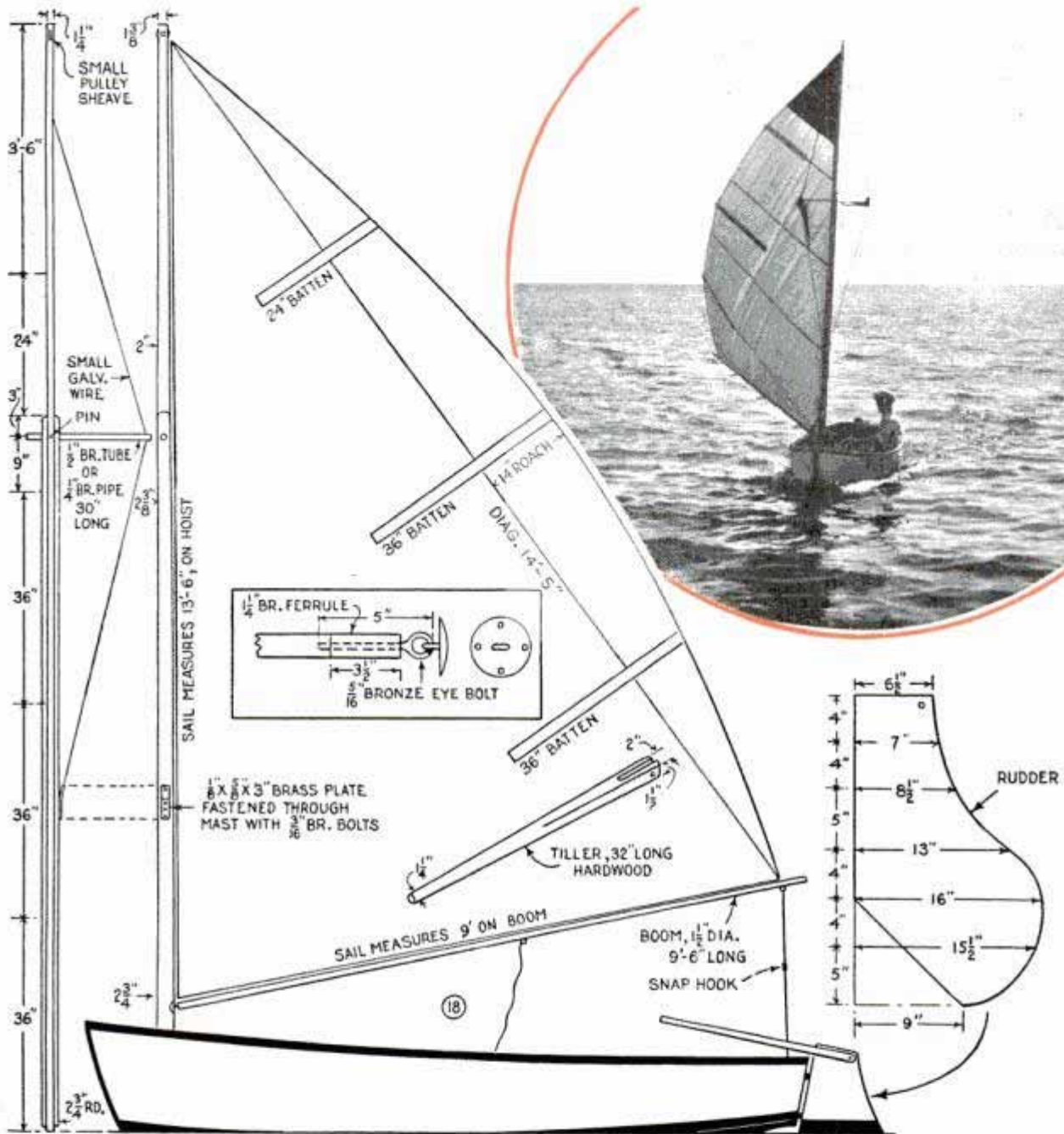


$\frac{3}{4}$ -in. slot is cut in the boat bottom along the centerline as in Fig. 11, the slot being the same length as the opening in the casing. The slot is covered with a gasket made of heavy muslin and coated with marine glue to insure a water-tight joint. The casing is fastened to the bottom with 2-in. screws placed $2\frac{1}{2}$ in. apart. The iron centerboard, Fig. 17, has a $\frac{3}{4}$ -in. hole drilled 3 in. up from the bottom edge and 3 in. in from the side as shown. A hole is bored in the centercase with an $\frac{1}{16}$ -in. bit and the pin used to pivot the board is a $\frac{3}{8}$ -in. pipe nipple, 3 in. long, with a lock nut on each end. By placing a small gasket or piece of cotton behind the lock nut and tightening it, there will be no chance for a leak at this point. A piece of jack

chain is used to raise and lower the board, a pin made of $\frac{1}{4}$ -in. brass rod being slipped through the chain to act as a stop.

The cross member of No. 2 frame is now removed and the seat, Fig. 16, put in place. The seat fits over the lower end of the casing and notches into the uprights of the No. 2 frame on each side. This joint beneath the seat must be water-tight as it is near the level of the water on the outside. A cap of $\frac{3}{8}$ -in. material, 3 in. wide, is bent over the curved portion of the casing.

The breast hook, Fig. 14, is made of two pieces of wood with the grain running at right angles. The mast partner, cut from $1\frac{1}{2}$ -in. material, is fastened through the sides with 2-in. screws. Now screw the stern knees in place and put the inner clamps in position, Fig. 16. The knees are fastened with 2-in. No. 8 flat-head brass screws and the inner clamps with $1\frac{1}{2}$ -in. No. 8 screws. Between the sides and the clamps, the filler blocks, Fig. 16, must be placed. These are made of $1\frac{1}{2}$ -in. material, 2 in. long with the exception of those



between No. 2 and No. 3 frames, which are 6 in. long and drilled for the oarlock sockets. The boat is now turned over and the keel and skeg put in place as in Fig. 8. When these pieces are made to fit they are fastened from the inside with $1\frac{1}{2}$ -in. and 2-in. screws. Before fastening the skeg (forward), the cutwater is shaped up to fit in its proper position. When the cutwater fits perfectly, you calk the ends of the sides and fasten the cutwater in place permanently, which is done with 10-d galvanized finishing nails spaced 3 in. apart. The cutwater is trimmed with $\frac{3}{8}$ -in. half-oval brass, which extends from the top edge of the boat to about halfway down the skeg. Finally, the molding, Fig. 9, is

fastened in place with 1-in. No. 6 screws spaced 10 in. apart. Use $1\frac{1}{2}$ -in. screws through molding at both stem and stern. Bore two $\frac{1}{4}$ -in. holes in the stern knees and put in $\frac{1}{4}$ -in. cotton rope for the traveler. Finally, the rudder is made up as in Fig. 18, and attached with rudder irons to the stern. The lower edges of the rudder are slightly tapered to prevent dragging.

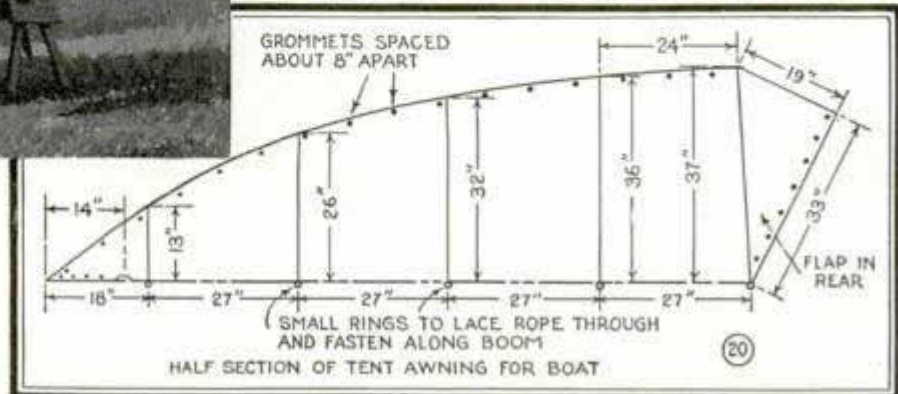
The mast, Fig. 18, is quite simple to make by using one $1\frac{1}{4}$ by 3 in. by 16-ft. piece of cypress and two pieces of $\frac{3}{4}$ by 3 in. by 10 ft. Casein glue is used to assemble these parts. With a table saw set at a 45° angle you can rip off the corners up to the 10-ft. mark. This will give you an eight-sided section that can be rounded easily



by hand with a small plane. The portion above the 10-ft. mark can be left as it is. At a point 3 in. below the 10-ft. mark a $\frac{1}{2}$ -in. hole is bored through the mast to take the spreader, which is a $\frac{1}{2}$ -in. brass tube, 30 in. long. A small brass pin through the tube and mast holds the spreader in place. Small holes are drilled in the ends of the tube for the galvanized rigging wire which can be of single strand. It is fastened to the mast 5 ft. above the spreader and 5 ft. below. A $\frac{5}{8}$ -in. mast track starting 10 in. below the top sheave extends 12 ft. down the mast. Details of the gooseneck are shown in Fig. 18. The boom is tapered to $1\frac{1}{4}$ in. and a ferrule is slipped over the end, extending $3\frac{1}{2}$ in. back.

When the mast is made up and all the fittings are in place, you install it in the boat. Bore a hole through the mast partner, Fig. 13, and allow the mast to go through until it reaches the step, which is made of $1\frac{1}{2}$ -in. material placed in the bow as far up as possible. Do not nail or fasten it in position until you have set the mast plumb. Scribe a line around the squared end of the mast and another outlining the location of the step on the bottom. Then cut a rectangular socket in the step into which the foot of the mast fits snugly. Fasten the step with $1\frac{1}{2}$ -in. and 2-in. screws through the bottom and into

the skeg. Two upright deck blocks are placed one on each side of the mast on the mast partner. One of these pulleys is used to hoist the sail and the other takes care of the top'n lift. Cleats are attached to the sides of the centercase. A tent cover, Figs. 19 and 20, is quite simple to make and is a protection to the boat and occupants when making short cruises. The edges are held down by a series of screw eyes spaced 8 in. apart just beneath the molding.



HALF SECTION OF TENT AWNING FOR BOAT

MATERIAL LIST

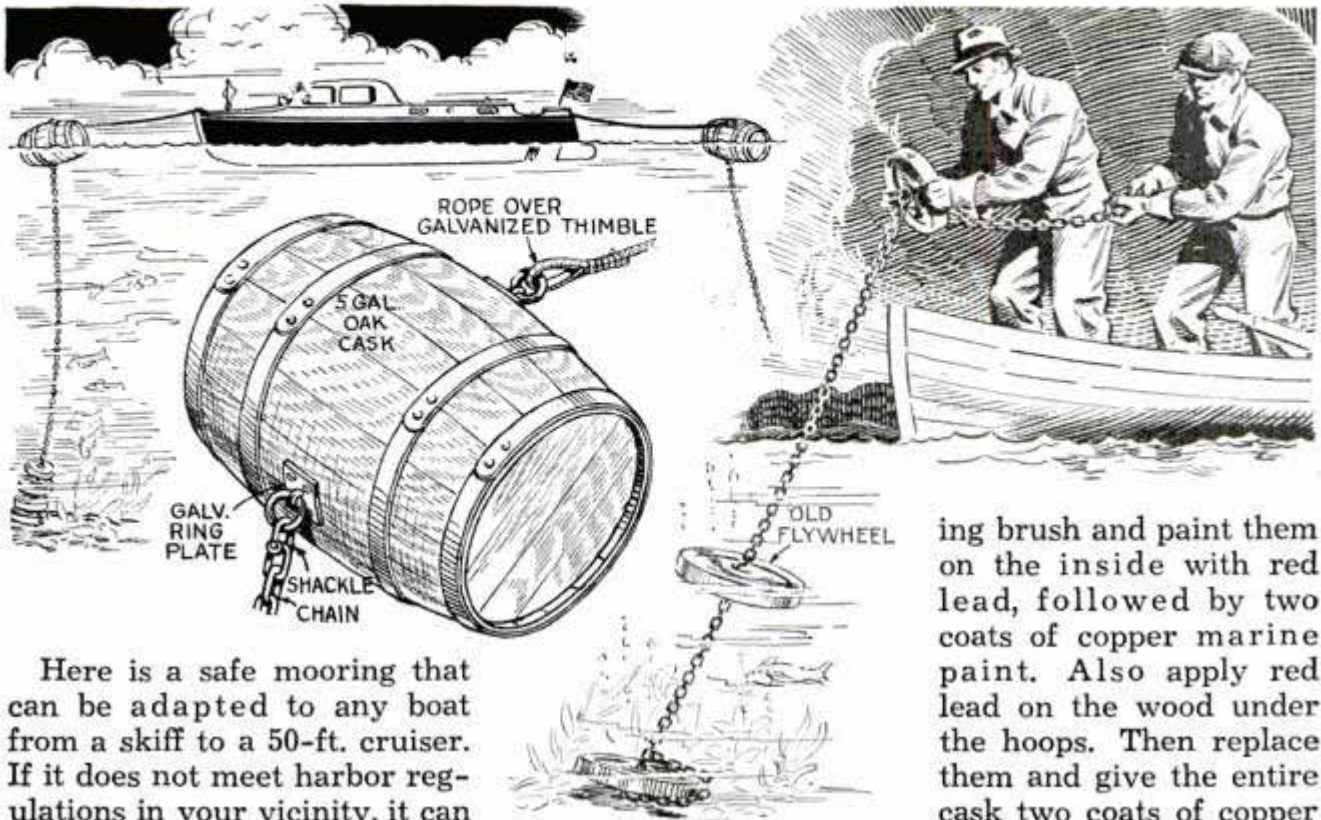
2 pcs. $\frac{1}{2}$ x 18 in. x 12 ft. (or equivalent in narrow widths)	side pieces
1 pc. $\frac{5}{8}$ x 6 in. x 10 ft.	chines
1 pc. $\frac{3}{4}$ x 6 in. x 10 ft.	bottom center plank
4 pcs. $\frac{1}{2}$ x 6 in. x 10 ft.	(2 each side)
2 pcs. $\frac{1}{2}$ x 8 in. x 8 ft.	(1 each side)
6 pcs. $\frac{1}{2}$ x $1\frac{1}{4}$ in. x 10 ft.	battens
2 pcs. $\frac{1}{2}$ x $1\frac{1}{2}$ in. x 10 ft. 6 in.	inner clamps
1 pc. $\frac{3}{4}$ x 14 in. x 6 ft.	sides of centercase
1 pc. $\frac{3}{4}$ x 2 x 26 in.	king posts
1 pc. $\frac{1}{4}$ -in. iron	for centerboard
1 pc. $\frac{3}{4}$ x 14 x 30 in.	rudder
1 pc. $1\frac{1}{4}$ x $2\frac{1}{2}$ x 30 in.	tiller
1 pc. $\frac{3}{4}$ x 14 x 38 in.	transom
1 pc. $1\frac{1}{2}$ x 8 x 20 in.	mast partner
1 pc. $\frac{3}{4}$ x 10 in. x 4 ft.	seat
1 pc. $\frac{3}{4}$ x 10 in. x 12 ft.	frames and crosspieces
1 pc. $\frac{1}{2}$ x 3 in. x 12 ft.	oak molding
1 pc. $1\frac{1}{2}$ x 8 in. x 1 ft.	mast step
2 pcs. $1\frac{1}{2}$ x 4 in. x 1 ft.	stern knees
1 pc. $1\frac{1}{2}$ x 8 in. x 4 ft.	skeg and keel
1 pc. 2 x 8 x 24 in.	stem and cutwater
1 pc. pine $\frac{3}{4}$ x 8 in. x 12 ft.	building board
1 pc. $1\frac{1}{4}$ x 3 in. x 16 ft.	mast
2 pcs. $\frac{3}{4}$ x 3 in. x 10 ft.	mast
1 pc. 2 x 2 in. x 10 ft.	boom

Hardware

2 gross $1\frac{1}{2}$ -in. No. 8 flat-head brass screws
$\frac{1}{2}$ gross 2-in. No. 8 flat-head brass screws
5 gross $1\frac{1}{4}$ -in. No. 6 flat-head brass screws
$1\frac{1}{2}$ lbs. of $1\frac{1}{4}$ -in. copper nails (if battens are used)
$\frac{1}{2}$ lb. copper tacks, $\frac{1}{8}$ -in. (if lap joint is used)
1 sheave for top of mast
2 swivel pulleys for sheet line
2 deck blocks for halyard and top'n lift
1 flat deck block for top'n lift
75 ft. $\frac{1}{4}$ -in. cotton rope for lines and rope traveler
$\frac{1}{2}$ pint, C-quality marine glue
$\frac{1}{4}$ lb. casein glue
Brass and brass volts for guy-wire attachments
3 ft. $\frac{3}{8}$ -in. half-oval brass for bow trim
25 ft. galv. wire
$\frac{3}{8}$ -in. brass tubing, 30 in. long
2 ft. jack chain for centerboard lift

Woods generally used for small-boat construction are: Spruce or oak for frame; pine or oak for the stem, and mahogany, cedar or cypress for planking. Knees, mast steps, inwales and other small parts either visible or subject to strain—oak or mahogany.

A Seaworthy Mooring to Hold Your Boat



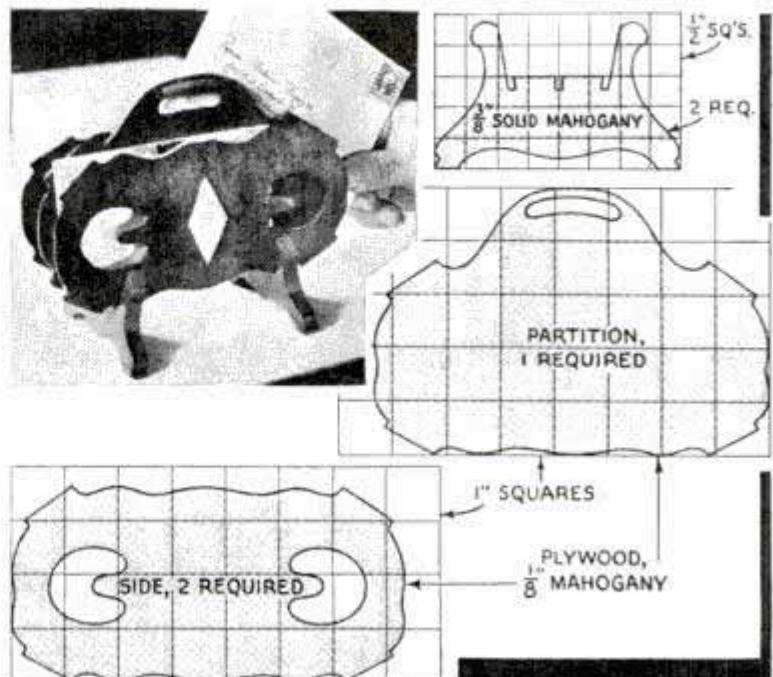
Here is a safe mooring that can be adapted to any boat from a skiff to a 50-ft. cruiser. If it does not meet harbor regulations in your vicinity, it can be modified easily. The mooring consists of an airtight oak cask having galvanized or copper ring plates attached to staves on opposite sides to take the anchor chain and rope or chain fastened to the boat. Before attaching the ring plates, remove the iron hoops, one at a time, clean off rust with emery paper or a buff-

ing brush and paint them on the inside with red lead, followed by two coats of copper marine paint. Also apply red lead on the wood under the hoops. Then replace them and give the entire cask two coats of copper paint. Any scrap metal

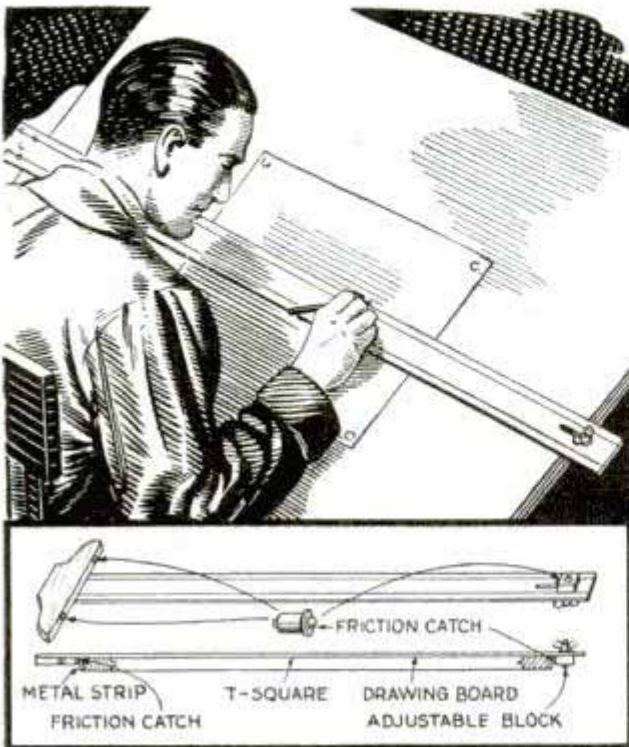
can be used for the anchor, old motor flywheels being handy as they can be slipped over the chain one at a time until the anchor weighs about 300 lbs., depending on the size of your boat. The chain from anchor to buoy should be about 2 ft. longer than the depth at high-water mark.

Scroll-Sawed Letter Rack a Pleasing Novelty on Your Desk

Here is a novel letter rack for your writing desk—a simple job of scroll-sawing. You use $\frac{1}{4}$ -in. wood, either solid stock or plywood. The original model was especially attractive in that the sides were slightly rounded in shape. This is done by first gluing together two pieces of $\frac{1}{16}$ -in. veneer, with the grain running at right angles. When dry, the piece is scroll-sawed to shape, then the surface having the horizontal grain is moistened. The result will be that it assumes a convex shape. Then the parts are assembled, stained and finished. If desired, small contrasting overlays, such as the diamond shape shown, may be added.—A. Holm, Chicago.



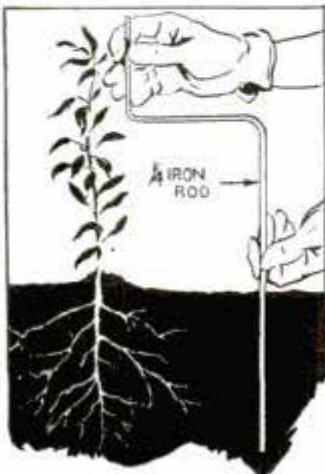
T-Square Held in Any Position by Friction Catches



Friction catches hold T-square firmly on the drawing board, yet allow it to be moved easily

To permit a T-square to remain at any set position on his tilted drawing board, one artist equipped it with small friction catches. These were fitted to the head and to a small block fastened to the underside of the blade as shown. By adjusting the block to allow the spring-loaded catches to bear slightly against the edges of the board, the square can be moved across the drawing board easily, yet it will remain at any desired position. Narrow strips of metal along the edges of the board permit the square to move smoothly.

Bent Shrub Support Clears Roots



Instead of driving a stake into the ground near a shrub or plant to support it, which may injure the roots, take a length of heavy wire and drive it into the ground several inches from the base of the shrub. Then bend the

support over to the plant as shown. The first bend may be made at the top of the ground, or higher up to support the shrub its entire length or just at the top.

Hooks and Eyes Replace Tacks for Furniture Curtains

When curtains are hung around a homemade dressing table, stand, chair and other furniture, they will be easy to remove for laundering if attached with hook-and-eye tape. The eyes are sewed to the edges of the curtains.

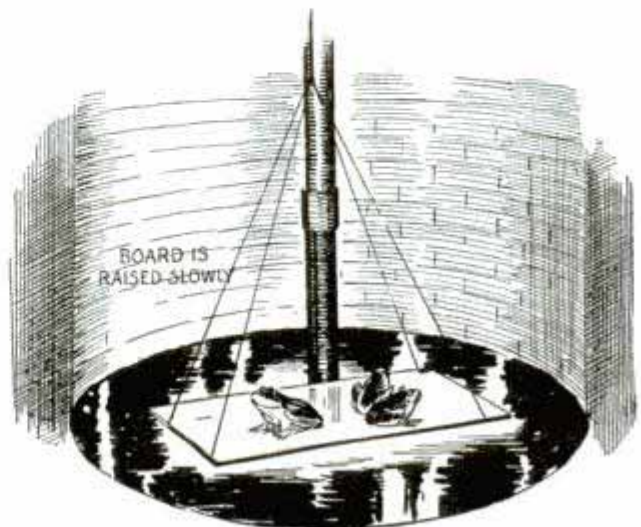


—G. E. Hendrickson, Argyle, Wis.

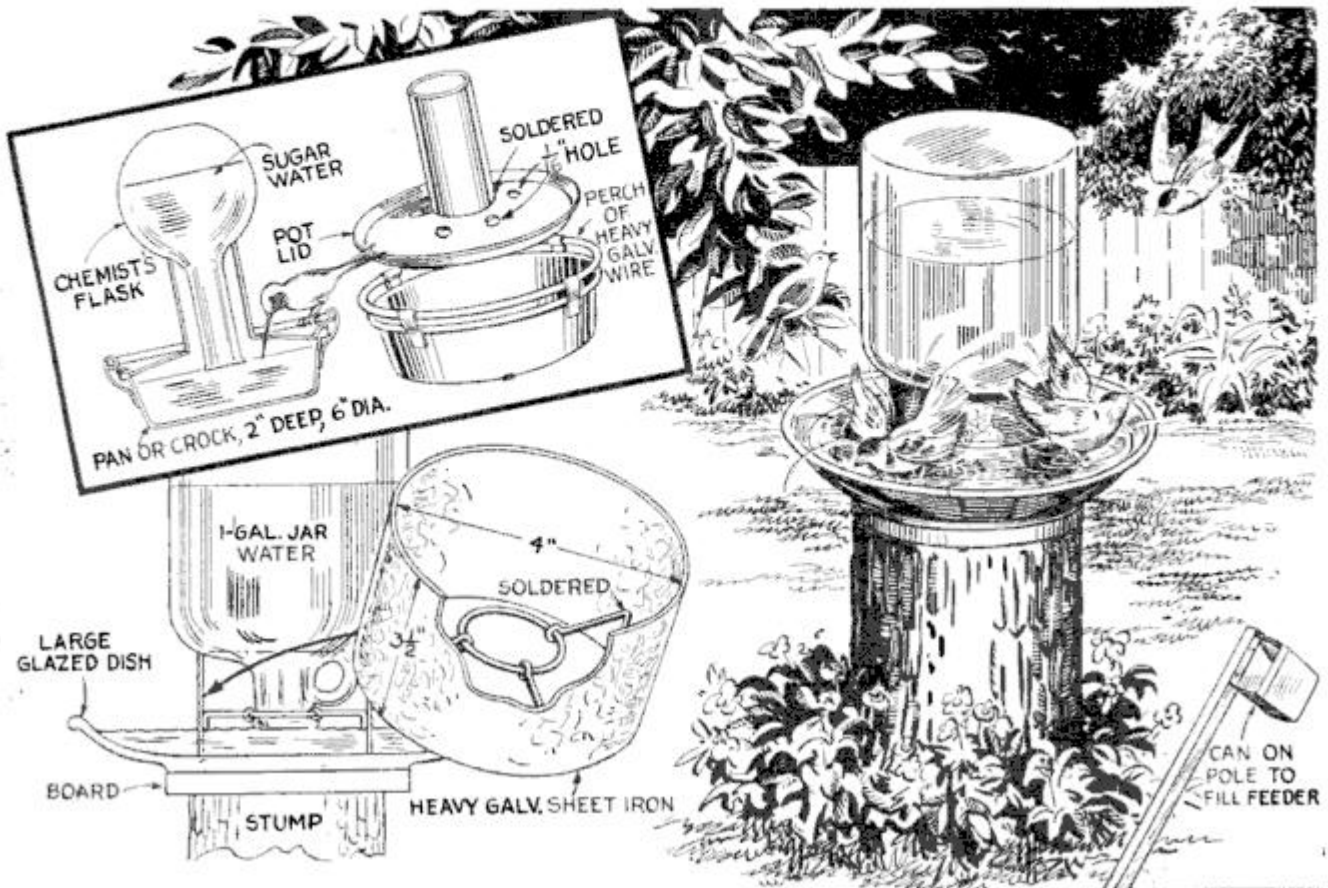
Frogs in Well Removed on "Lift"

During the dry weather last year when many wells were contaminated by frogs getting into them in search of moisture, one Illinois resident removed them in a novel but effective manner. He took a wide board as long as could be lowered into the well horizontally, tied stout cords to the four corners and lowered it to float on the water overnight. The next morning the frogs in the well would be sitting on the board, which was then raised to the surface. If this is done slowly and carefully without jarring the board, the frogs will stay on the board until it is taken out of the well.

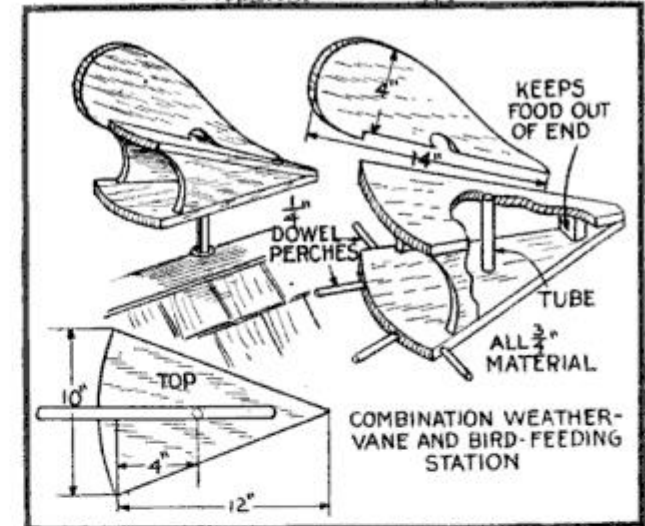
—Truman Greenwalt, Litchfield, Ill.



Keeping the Birds at Home in Your Garden

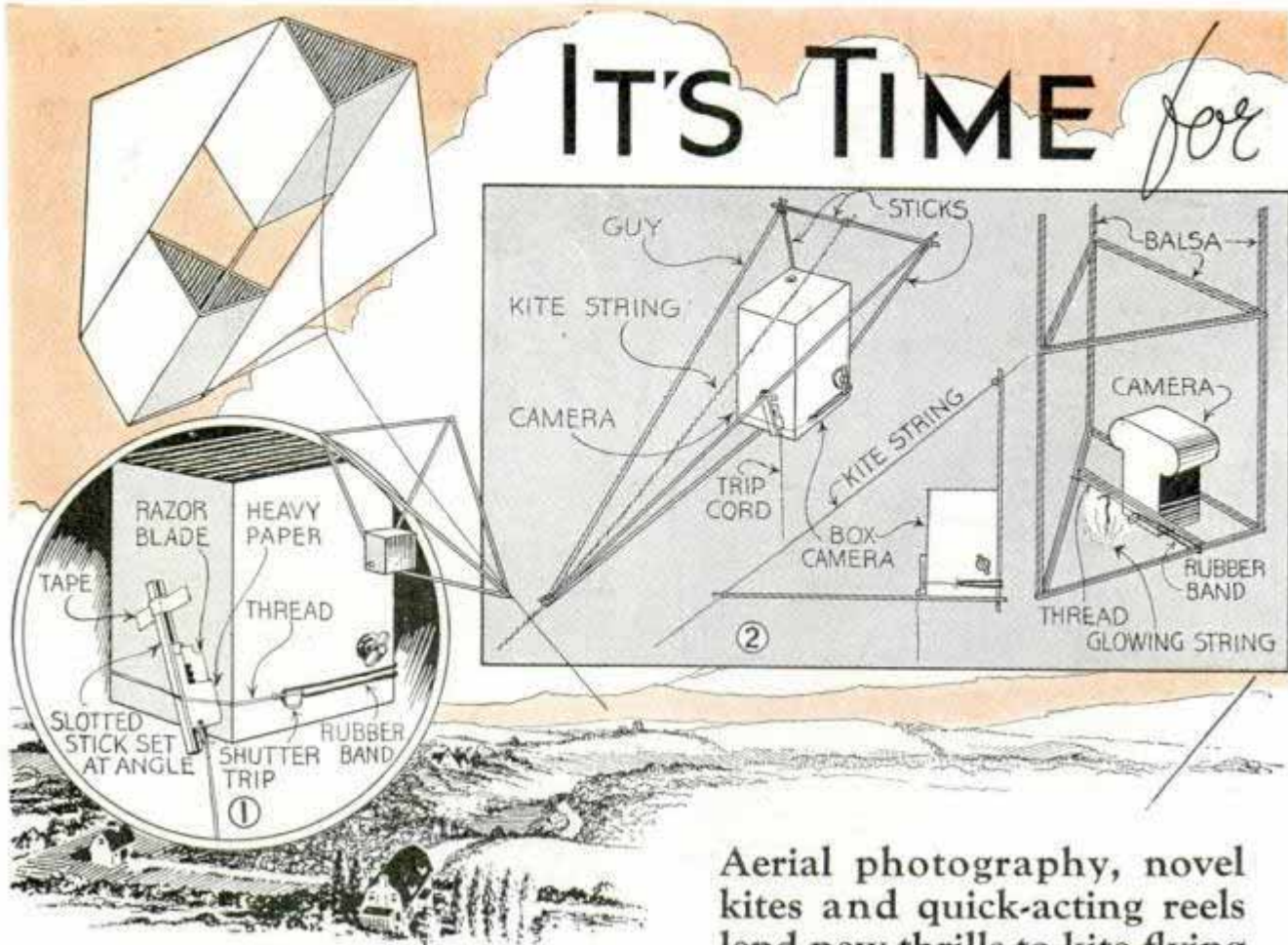


Chances of attracting birds and keeping them around are increased if you will provide water which is readily accessible to them. Where water quickly evaporates from a shallow dish, a constant supply can be maintained by using inverted flasks or jugs held a short distance above the bottom of the pans or dishes as shown in the pictures above. Take the simple type of bird bath at the right: A large, shallow dish, preferably light green in color, is set on a stump or pedestal and a gallon jug of water, fitted with a sheet-metal collar, is placed inverted in the center of the dish. The collar is wide enough to keep the mouth of the jug above the bottom and a wire frame in the collar serves to hold the jug in position securely. The result is a constant supply of water until the jug is empty. The same principle is used in making the small sugar-water feeder at the left. In this case, a flask or bottle is used as the reservoir while the pan is covered with a perforated cover to minimize evaporation. The cover should be located just above the level of the liquid so that birds will have no difficulty in getting at it. A California bird lover succeeded in attract-



ing hundreds of hummingbirds to his grounds by using such feeders. For hummingbirds, the feeder should be arranged so that they have access to the liquid while on the wing as they seldom alight. The lower detail shows a protected feeding shelter in which crumbs can be placed. The shelter is pivoted to rotate and the vane on top keeps it pointed into the wind. Keeping the feeder supplied with crumbs is easy if you use a long stick or pole having a can nailed to the top end.

IT'S TIME *Joe*



Aerial photography, novel kites and quick-acting reels lend new thrills to kite flying

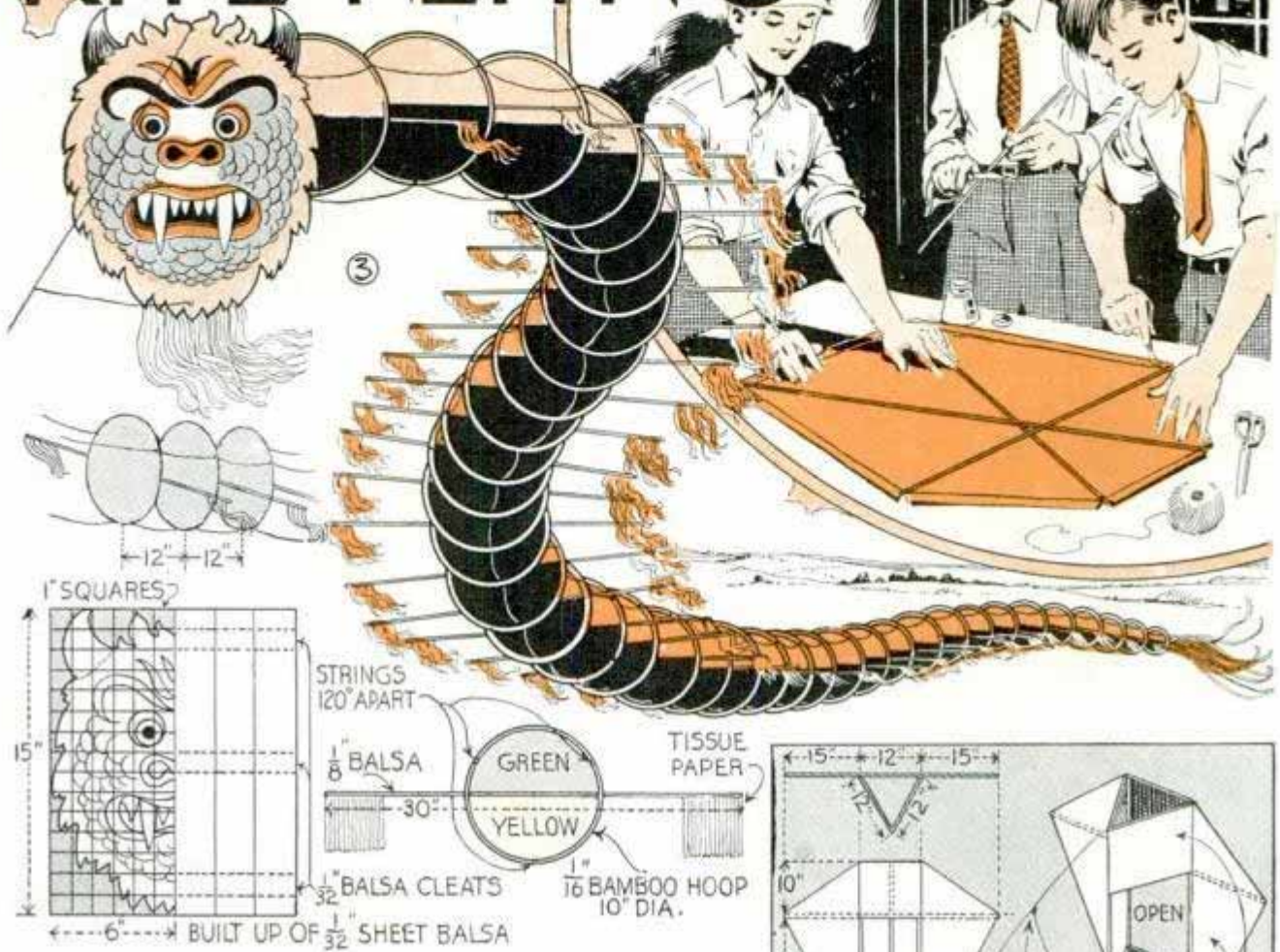
THINK of the fun you'll have taking pictures—real aerial views of the countryside from a high-flying box kite. It's easy when you rig the simple apparatus detailed in Figs. 1 and 2. A triangular frame, to which the camera is lashed, is fastened to the kite string just below the bridle. The camera is lashed in the bottom triangle with a thread holding the shutter release against the pull of a rubber band. Underneath the string is a safety-razor blade sliding in a slotted stick

as in Fig. 1. When you pull the trip cord, the razor blade severs the string attached to the rubber band, thus tripping the shutter. Another arrangement, shown at the right in Fig. 2, makes use of a glowing string, the latter attached to a thread holding the shutter release. The string can be 4 or 5 in. long. No separate sling is used, the camera being lashed directly to the frame of the kite. When you're ready for launching, you light the end of the string and blow out the flame as soon as the string starts to glow. Then send up the kite in a hurry. When the glowing string reaches the thread holding the shutter, you have your picture. The secret of taking good pictures in this way is the selection of a day when the wind is blowing steady so that you can maneuver the kite into the desired position.

Fig. 4 details the type and average size of the kite required for carrying a small camera aloft. Such a kite will lift a pound or less in a very light breeze. It's simply a triangular box kite with wings, the frame being made from $\frac{1}{4}$ by $\frac{1}{4}$ -in.



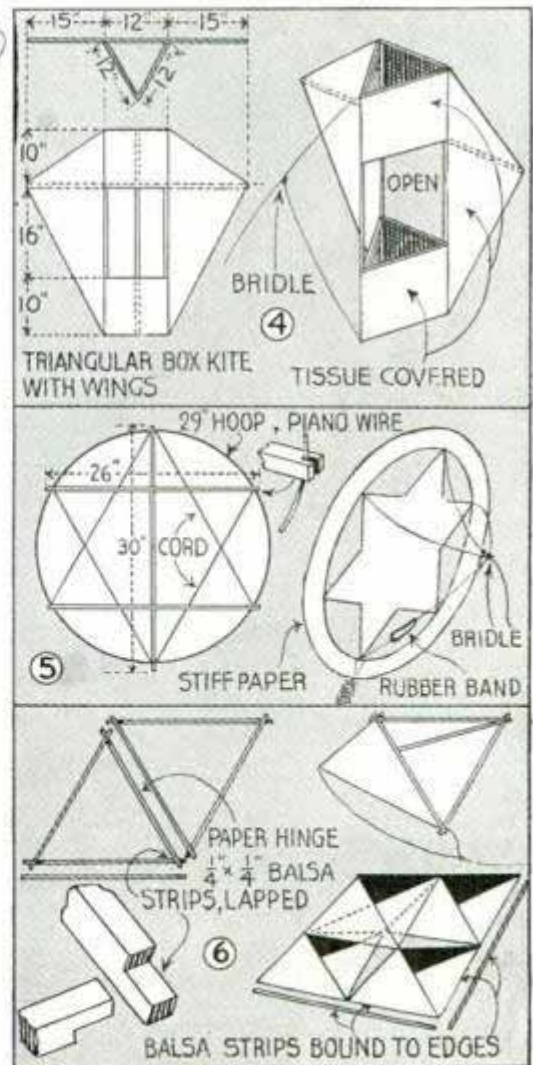
KITE FLYING

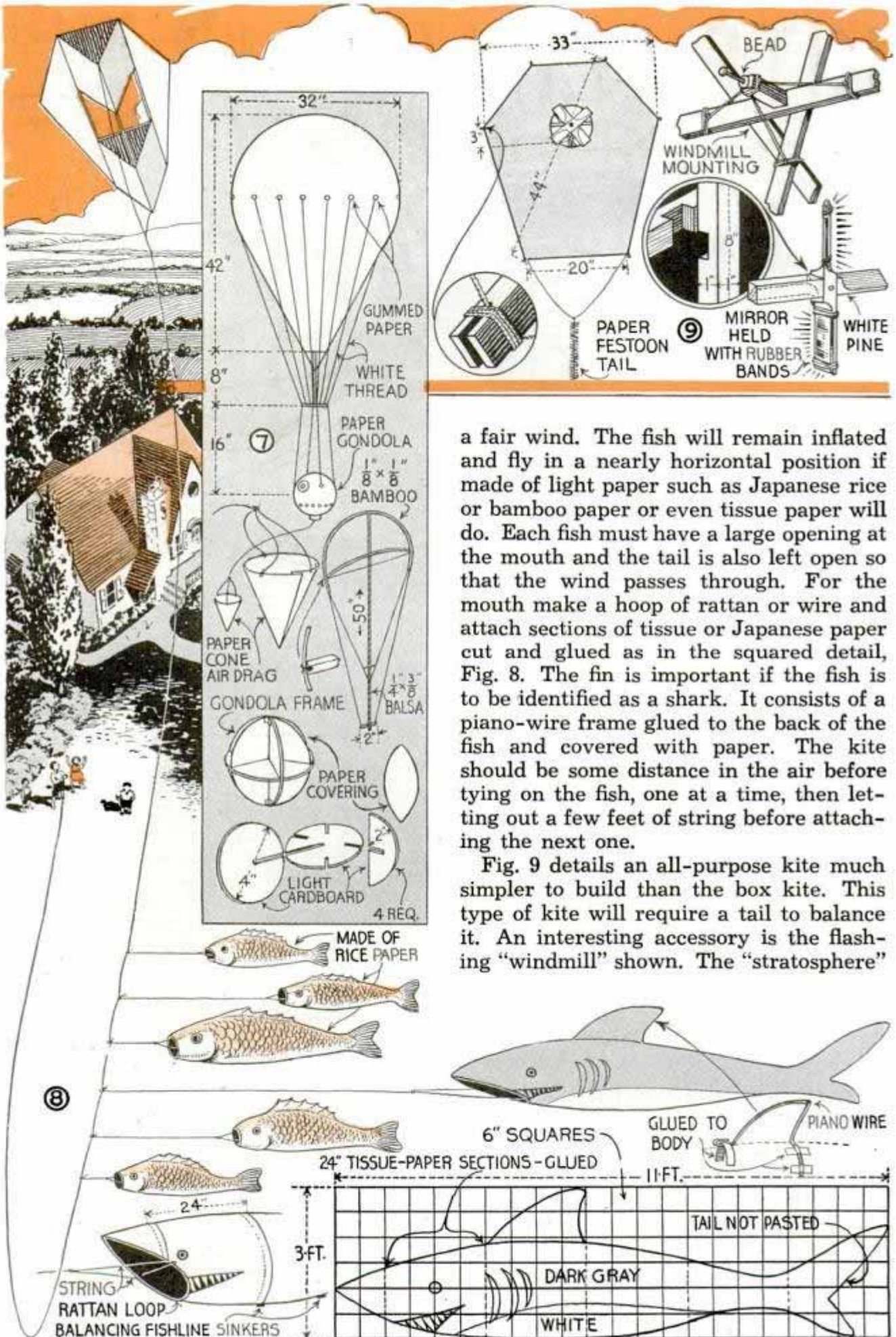


strips of either balsa or spruce and covered with medium heavy wrapping paper. In constructing this kite and others like those shown in Figs. 5 and 6, model-airplane cement is used to assemble the frame, and glue or wing dope will do to stick the paper to the frame.

Now for something different which you'll find in Fig. 3. Dragon kites demand accurate workmanship and some experimenting to get them into the air successfully. The disks should not only be extremely light, but accurately made and evenly balanced. Rings and balancing sticks are of bamboo about $\frac{1}{16}$ in. in diameter, or lighter. Make the head of very thin strips of sheet balsa with cleats across the back as shown in the squared detail, Fig. 3. Streamers on the chin serve as a balance. A two-string bridle is attached to the top and bottom of the head. First, try out ten or twelve disks, then add others in decreasing diameters until the kite is the desired length.

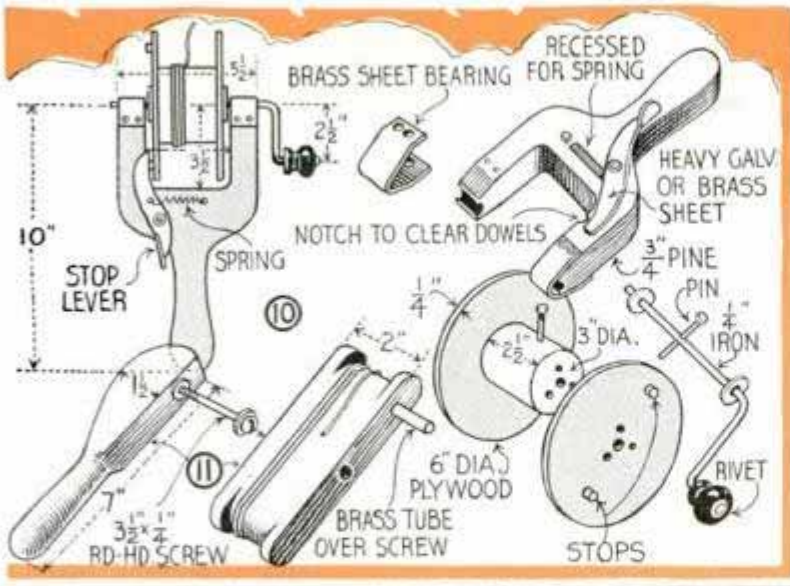
A shark chasing a school of fish high above the housetops as in Fig. 8, will create a sensation. A box kite will keep several 10-ft. fish in the air in





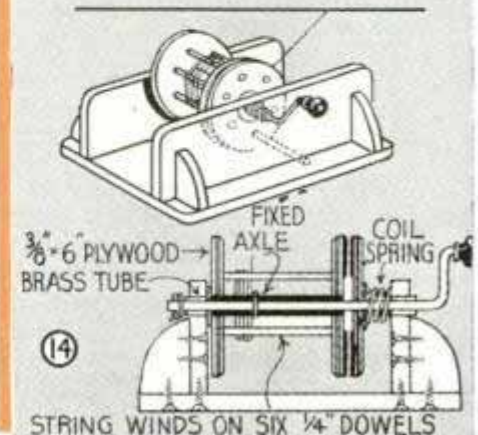
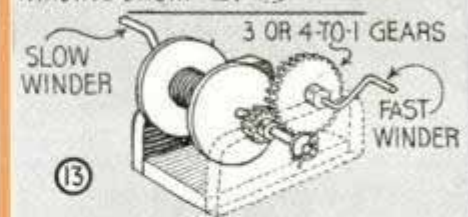
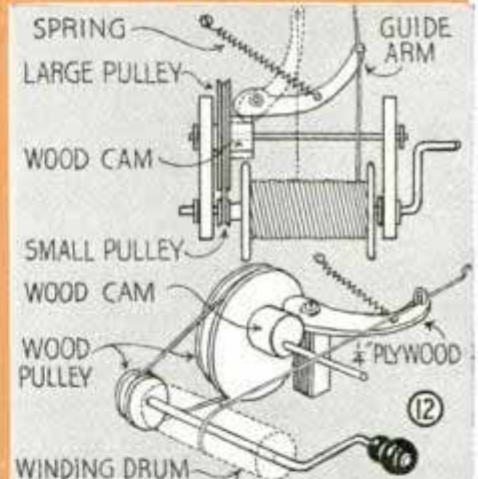
a fair wind. The fish will remain inflated and fly in a nearly horizontal position if made of light paper such as Japanese rice or bamboo paper or even tissue paper will do. Each fish must have a large opening at the mouth and the tail is also left open so that the wind passes through. For the mouth make a hoop of rattan or wire and attach sections of tissue or Japanese paper cut and glued as in the squared detail, Fig. 8. The fin is important if the fish is to be identified as a shark. It consists of a piano-wire frame glued to the back of the fish and covered with paper. The kite should be some distance in the air before tying on the fish, one at a time, then letting out a few feet of string before attaching the next one.

Fig. 9 details an all-purpose kite much simpler to build than the box kite. This type of kite will require a tail to balance it. An interesting accessory is the flashing "windmill" shown. The "stratosphere"

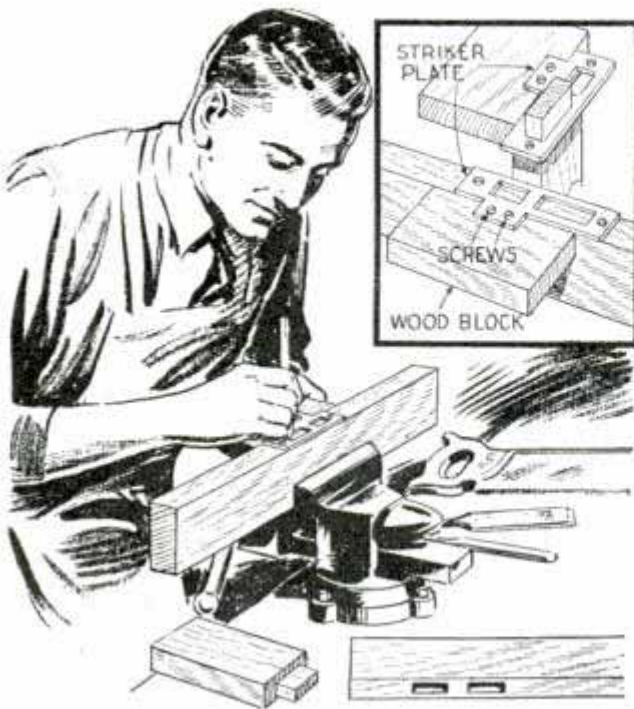


kite, Fig. 7, is designed for novelty, and must be made of light materials, slightly bowed at the back. With exception of the bow it is similar to the well-known two-stick kite with bowed top. A six-pointed star kite, Fig. 5, is not only easily made but is a striking design when the paper covering is of different color in bright shades. For example, use silver paper on the points, red for the center and blue for the circle. The star kite also requires a tail. Tetrahedral kites, Fig. 6, require a stronger wind for successful flying than do the flat or bowed kites. To make them, light balsa sticks are cut to lap and made into a pair of equilateral triangles. Match them up for size and then cover with paper. When dry, put a gummed paper strip or hinge along the edges of the triangle and with an extra stick, set them to form a "vee." Four of these can be built up to form a larger kite by binding a stick along the edges to keep the units together.

A simple hand reel is shown in Fig. 11. A piece of tubing over a screw makes a good crank. In Fig. 10 is a more elaborate job of the same general type, with a stop to prevent the string running out when the hand is off the crank. To wind the string evenly on the drum a cam-arm design is shown in Fig. 12. The cam is merely a wooden cylinder mounted eccentrically, and the arm made of plywood. The slower the cam revolves in relation to the drum, the better job of winding it will do. The two-crank model in Fig. 13 gives a variable winding speed. For fast winding the geared-up crank is used; the direct crank for slower and heavier work. One of the best arrangements for handling a large kite is the free-wheeling reel with a clutch, shown in Fig. 14. The crankshaft is divided in the middle—one end fixed in the hub by means of a pin, the other sliding in and out. Normally it is forced in by a coil spring, bringing into contact the two clutch faces of garnet paper cemented to rubber.



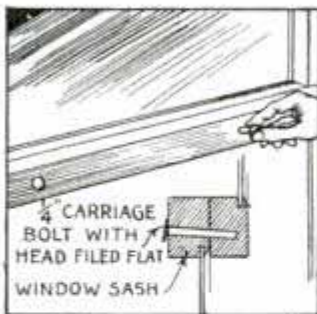
Accurate Lock Mortises Laid Out with Aid of Striker Plate



You can get the lock mortises accurate in a door if you use the striker plate as a template

To save time in accurately laying out any number of duplicate door-lock mortises, the striker plate will serve as a guide. The lip of the plate is drilled and is screwed to a hardwood block to aid in holding it on the edge of the door.

Invisible Catches on Windows Keep Out Intruders



Two small holes drilled through the upper frame of the lower sash and partly through the lower frame of the upper sash, will take pins to lock the window.

For pins, you can use small carriage bolts with the heads filed flat, or even large spikes cut off to the right length. The pins will be unnoticeable under a curtain.

Making Asbestos Cement

Asbestos boiler covering mixed with boiled linseed oil makes a cement that will stick to iron or brick, when heated, almost

like iron itself. We have tried it to point up or repair the firebrick in two fireplaces and to cement firebrick in a conversion gas unit around the door opening. Judging from appearances now, the repair is as permanent as the brick themselves.

—C. M. Lyman, New Hartford, N. Y.

Golf Club Strapped to Wrist Prevents Accidents

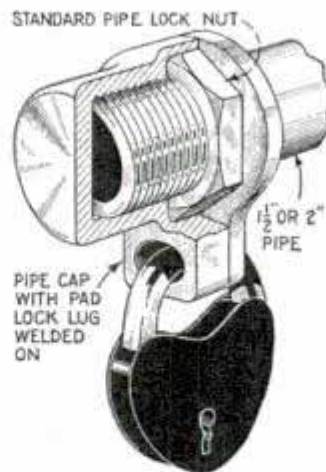
Looped over your golf club and slipped over the wrist as shown, a small leather strap may save you from injuring someone should the club accidentally slip out of



your hands when the handle is wet. The strap, which should be long enough to allow free movement of the hands, can be carried in the bag when not needed.

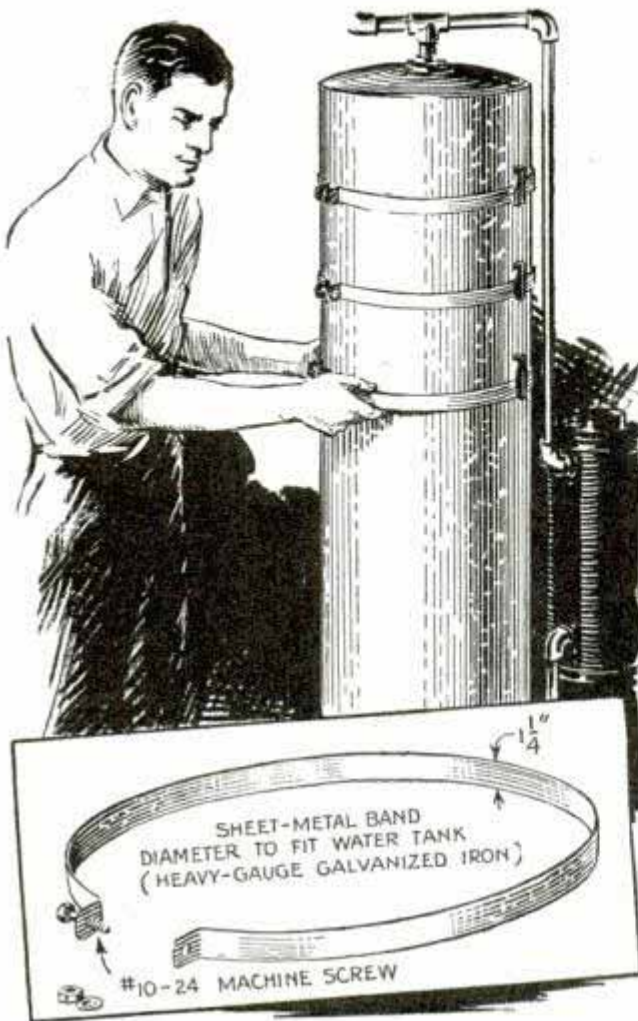
Lock Cap for Filler Pipe of Fuel-Oil Tank

If you want a lock cap for the filler pipe on a fuel-oil tank, here is one that you can make and install without altering the pipe in any way.



From $\frac{5}{16}$ -in. flat iron, saw out a piece large enough to be drilled and tapped to screw onto the end of the pipe. Make the upper portion of the piece rounding with a lug formed on the lower end,

which is drilled to take the shackle of a padlock. Drive this onto the end of the filler pipe and lock it with a pipe nut. Then take a pipe cap and counterbore the open end so that it will clear the pipe nut when driven onto the end of the pipe. Weld a lug onto one side of the cap and drill it to take the padlock, aligning the hole with the one in the flat iron.



piece of $\frac{1}{4}$ -in. Bakelite. Brass strips equipped with silver contact points are mounted on the Bakelite part as shown.

When the units have been assembled, the adjusting screws "A" should be set so that the contacts on the brass strips do not touch the silver contacts of the thermostatic strips. The units are mounted rigidly on the hot-water tank as shown, and wired with an 8-wire cable to an indicator box fitted with eight switch points and a rotary switch lever. Connections for hooking the indicator box to the transformer and the thermostats are shown in the diagram. A doorbell transformer delivering 12 volts should be provided, preferably a heavy-duty type.

In order to adjust the thermostats once and for all, set the switch lever on the indicator box on contact 1 when the tank is cold. Then turn on the heat and as soon as the water in the tank adjacent to the top thermostatic unit has become hot, the adjusting screw "A" of this unit should be tightened up carefully until the lamp on the indicating panel is illuminated and

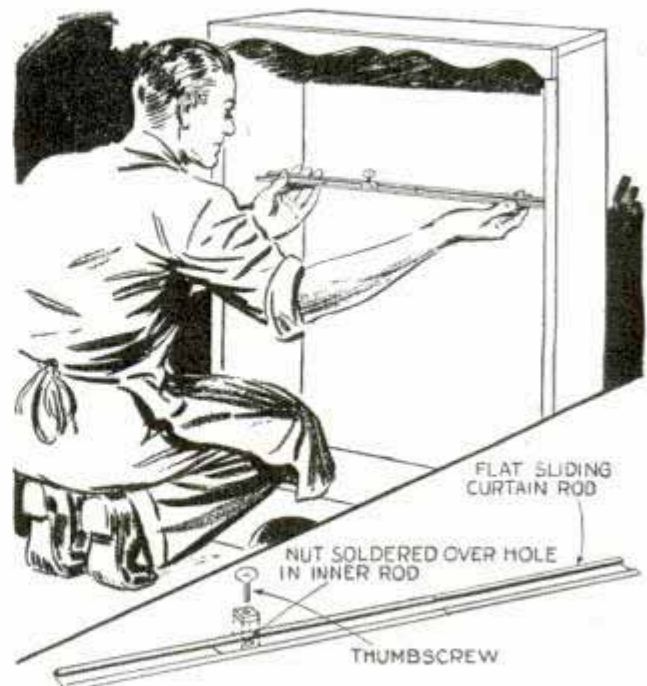
the bell rings. Next, the switch is set to point 2, and the operation repeated. The process is continued until all seven of the thermostats have been adjusted so that their screws cannot slip and easily get out of adjustment. When the water cools to a sufficient amount so that the bimetal strips contract, the light will go out. Inasmuch as the continuous ringing of a bell when hot water is available is not desirable, a snap switch of any convenient size should be inserted in the line.

In use, this apparatus is extremely convenient. If it has been found that one-third of a tank of water is adequate for the bath, then the switch lever can be set to point 3 and the heater turned on. When this quantity of water has been heated, the light will be turned on and the bell will sound. By this means, it is possible to heat just the amount of water required.

Accurate Inside Measurements with Sliding Curtain Rod

To quickly obtain accurate measurements when fitting cabinet shelves and similar work, where it is necessary to transfer an inside dimension, a sliding curtain rod will be found handy. A nut soldered to the rod as shown, and fitted with a thumbscrew, holds the adjustment.

—Wayne C. Leckey, Aurora, Ill.



Thumbscrew and nut hold adjustment of sliding curtain rods while transferring measurement

"Cartridge Candle" Produces Hot Flame

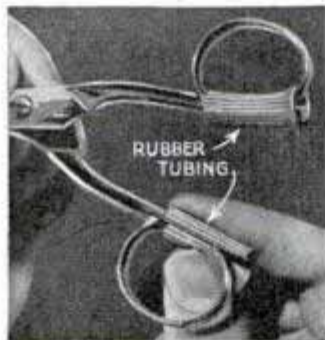


For the boy who likes to perform experiments and needs a small flame for heating test tubes, beakers, etc., but does not have a bunsen burner, this cartridge candle will solve the problem.

It is a discharged shotgun shell filled with melted paraffin. To use the candle, ignite the rim of the shell and let it burn a few minutes.

Padded Scissors Ease Strain on the Fingers

If your work requires using a pair of scissors for long periods, and the handles make your fingers sore, pad them with short lengths of small rubber tubing. Just slit the tubing along one side



and slip it over the handles as shown, using an all-purpose cement inside the tubing to attach it to the handles. If the holes in the handles are large, put the tubing clear around instead of just on one side.

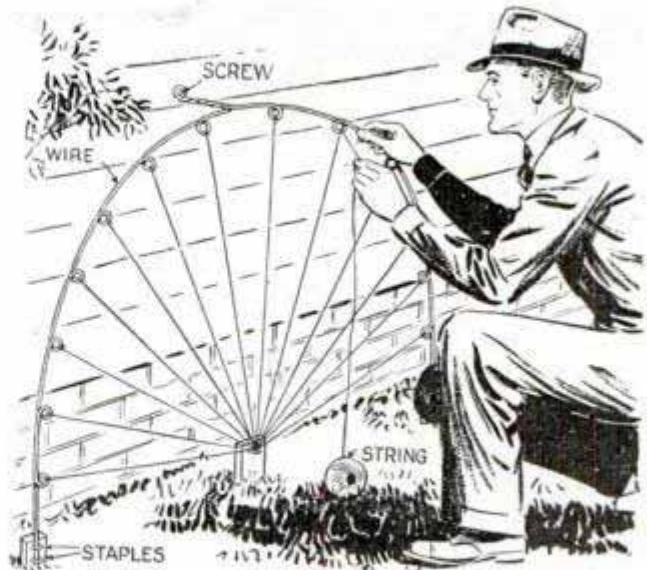
Insect Bait Wired to Fishhook



When using grasshoppers or other insects for fishing bait, and you have trouble keeping them on the hook, take a hairpin or a piece of soft wire and form a holder on the hook for the

bait as shown. Just run the hairpin through the eye of the hook and then twist the legs around it in opposite directions, turning up the ends at right angles.

Fan-Shaped Trellis Easily Made for Small Vines

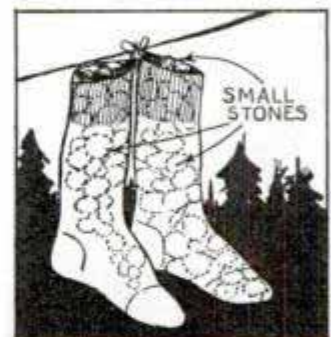


When frost comes, you can pull up both the dead vines and the trellis and store the latter until spring

Shaped like a fan, this wire trellis will hold small vines neatly spread and away from the wall of the house. The wire is bent with evenly spaced loops, including one or more long ones for attachment to the house, and the full length of the wire is bent in the form of a half circle, with the ends attached to stakes driven into the ground. From a third stake driven into the ground, stout strings are fastened and drawn up to attach to the loops.

Shrinking of Wet Woolen Socks Avoided with Stones

If you get your woolen socks wet, while on a hike or a camping trip, fill them with small stones before hanging them up to dry. The weight of the stones will tend to stretch them and help prevent shrinking. The socks can be pulled into shape when dry. Woolen socks should never be dried near an open fire. If the wool is even slightly scorched, it will tear apart quickly.—S. Sameth, New York City.



Woolen socks should never be dried near an open fire. If the wool is even slightly scorched, it will tear apart quickly.—S. Sameth, New York City.

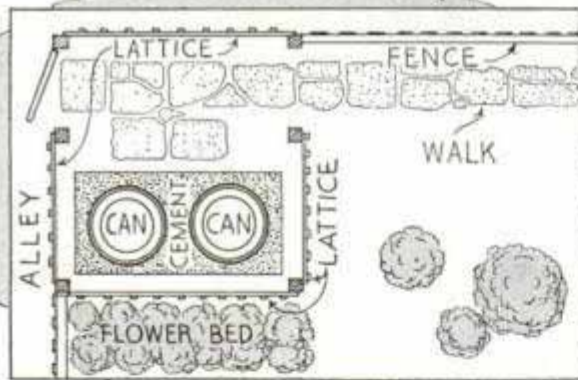
Asbestos covering from a boiler can be used again by softening it with water.

EASY SOLUTIONS *for*

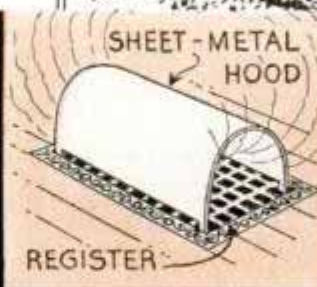


A vine-covered arbor adjoining the rear gate will conceal refuse cans in your back yard. The plan view gives a suggested arrangement and shows the offset at one side to accommodate the cans. You will find it much handier to reel up your clothesline than to remove it in the usual way. Besides, by installing the reel in a wooden box permanently fastened to the post, the rope will be kept clean. Construction of the box and reel is shown in the detail below

Arbor Conceals Refuse Cans

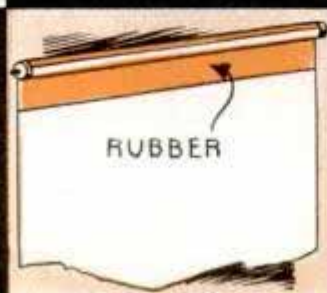


Set over the hot-air register of a pipeless furnace, this sheet-metal hood, which is 13 in. high, tends to deflect the heated air so that it will spread over the lower portion of the room

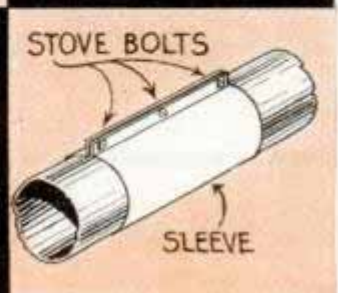


Long lines of stove-pipe can be made rigid without wires by clamping a sheet-metal sleeve around each pipe joint, using small bolts to draw the ends of the sleeves together

Eccentric stop solves the problem of holding open a window sash that has no weights. The stop is merely a small hardwood disk, which is pivoted off center on the window frame

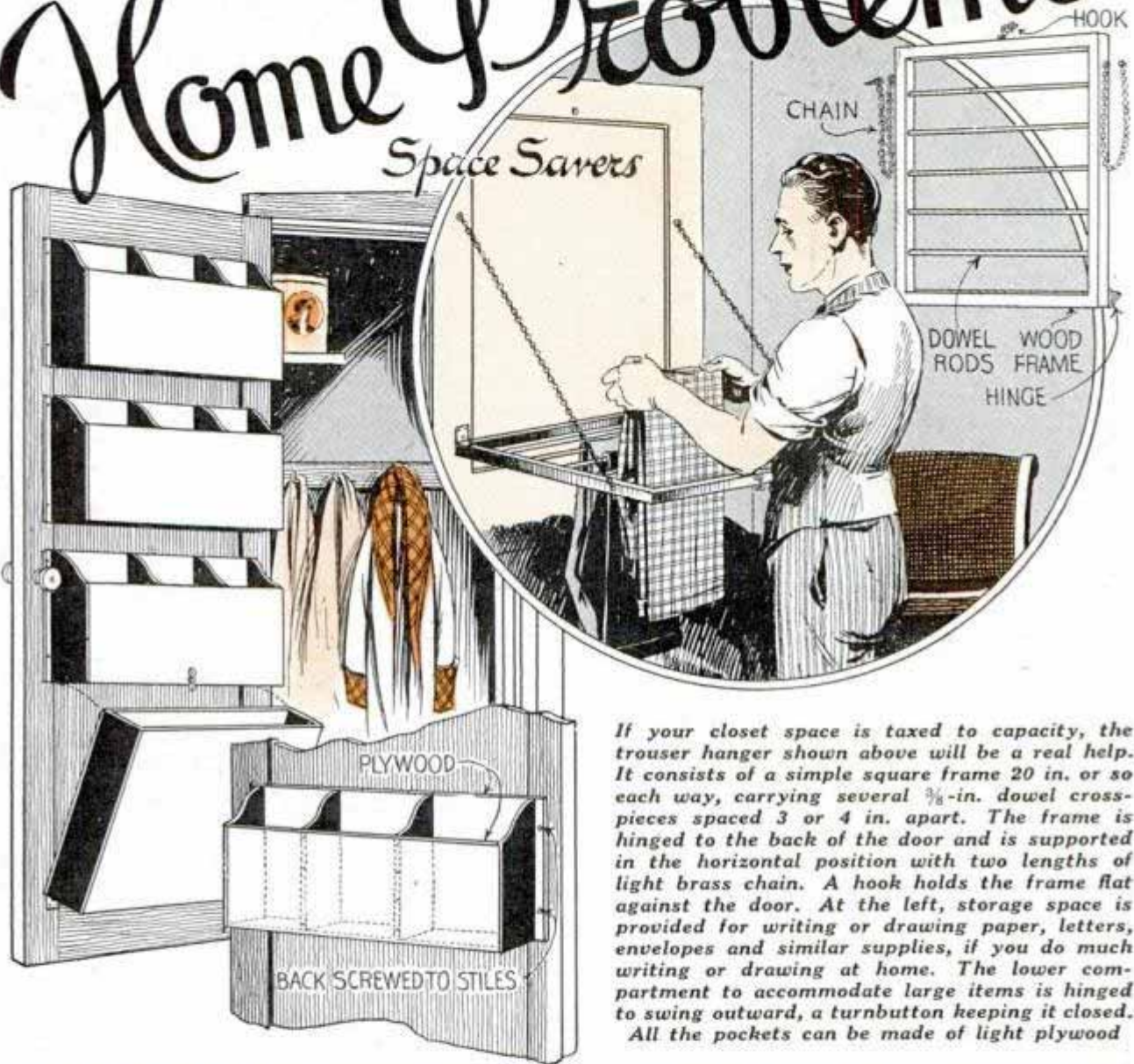


By attaching window shades to the rollers with 3-in. strips of rubber sewed to the ends of the cloth, you provide shock absorbers that will prevent the shades from being torn off



YOUR Home Problems

Space Savers



If your closet space is taxed to capacity, the trouser hanger shown above will be a real help. It consists of a simple square frame 20 in. or so each way, carrying several $\frac{3}{8}$ -in. dowel cross-pieces spaced 3 or 4 in. apart. The frame is hinged to the back of the door and is supported in the horizontal position with two lengths of light brass chain. A hook holds the frame flat against the door. At the left, storage space is provided for writing or drawing paper, letters, envelopes and similar supplies, if you do much writing or drawing at home. The lower compartment to accommodate large items is hinged to swing outward, a turnbutton keeping it closed. All the pockets can be made of light plywood



Small match boxes that lie around on your smoking table can be embellished by covering them with fancy colored paper such as used for many of the better-grade envelopes



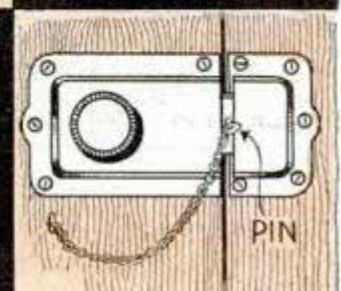
TWINE

If a door latch is not fitted with a catch to lock it from the inside, just drill a small hole in the bolt, as shown, to take a steel pin, which can be kept on a chain fastened to the door

When you hang a picture on a nail, make an inverted V-cut in the wall-paper as shown so that the paper can be turned back over the hole if the nail is removed later



A coconut with facial features painted on one side and dressed in a bandana-handkerchief hood with large brass earrings attached to the cloth, forms this 'mammy' twine holder





BY HOLDING WORK
ON DESIRED LINES
ACCURATE MITERS
ARE EASILY MADE

Protractor on Table of Sander for Accurate Angle Work

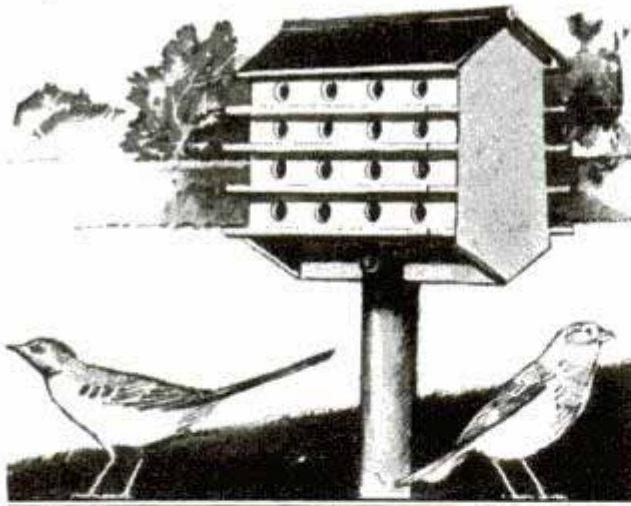
Drawn on the table of a disk sander, a large protractor scale will enable you to finish accurately, miters, bevels and other angles. The scale is drawn with the aid of a straightedge and is simply an enlargement of one on a protractor scribed in the surface of the table.

—A. H. Waychoff, Tempe, Ariz.

Window-Cleaning Fluid

Here is a solution with which you can clean and polish your windows with a minimum of labor. To make it, mix ammonia (strong 28 per cent), 4 fl. oz., alcohol (denatured), 8 fl. oz., whiting, 8 oz., and water, 7 pts. The solution can be bottled and kept, but it must be shaken thoroughly before using.

It's Easy to Build Bird Houses



that will attract peppery little wrens, martins, bluebirds and others. Our plans include a wide variety of nesting boxes that not only look good to the songsters, but also add a delightful touch to the garden.

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Any six of these blueprints will be sent postpaid upon receipt of \$1.00. Address Blueprint Dept.

POPULAR MECHANICS MAGAZINE, 200 East Ontario Street, CHICAGO



Works on light current.

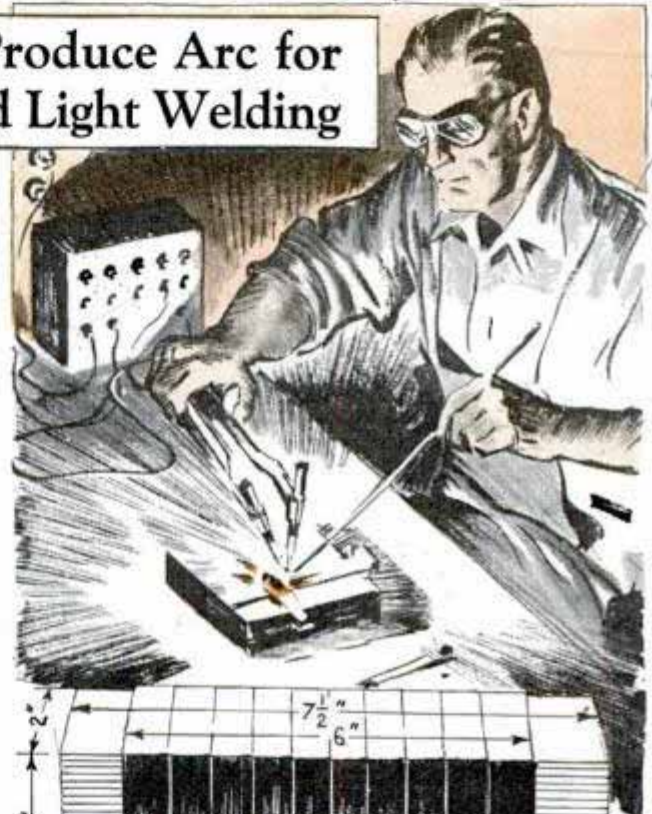
Electric ARC TORCH

Carbon Electrodes Produce Arc for Soldering, Brazing and Light Welding

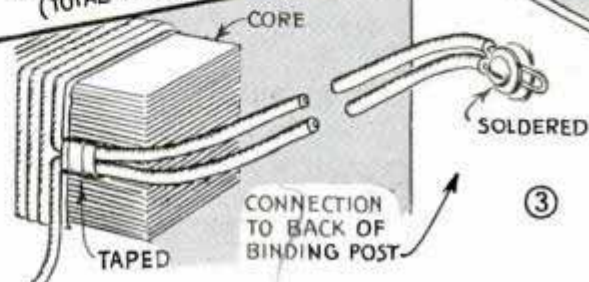
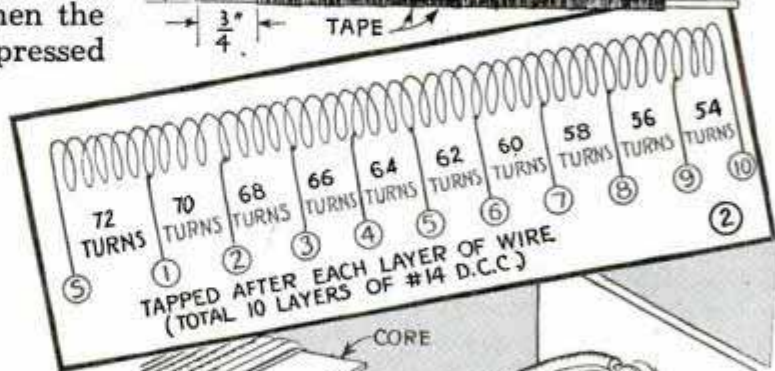
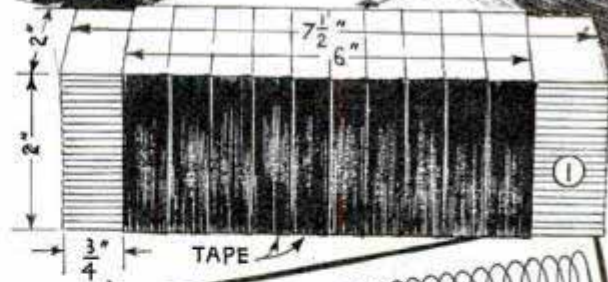
By C. A. CROWLEY

HERE'S a tool you'll find handy. It's light and easily made, ready for use on a wide range of small work where it is unnecessary to heat large areas or quantities of metal. Dental laboratories have used it for melting alloys in connection with the casting of bridgework. It has also proved satisfactory on light welding jobs where a $\frac{1}{16}$ -in. welding rod can be used.

The complete unit consists of a reactance coil connected in series with a carbon holder. Fig. 1 shows the core dimensions for the coil. A pile of transformer steel or, for that matter, stove-pipe iron will be satisfactory. The iron is piled 2 in. thick from laminations each 2 by $7\frac{1}{2}$ in. as shown. The exact thickness of the steel is of no importance so long as it is no thicker than ordinary stove-pipe iron. When the core has been stacked to a compressed thickness of 2 in. it is bound securely with tape. Upon this core are wound 10 layers of No. 14 double cotton-covered magnet wire. The first layer consists of 72 turns of wire. The starting end of the wire should be left 8 in. long and marked S, as in Fig. 2. When the first layer has been wound in place, the wire is folded out as shown in Fig. 3 to form a tap connection. After this, the second layer is wound on without cutting the wire. A total of 70 turns should be wound in the second layer. When this layer has been finished,



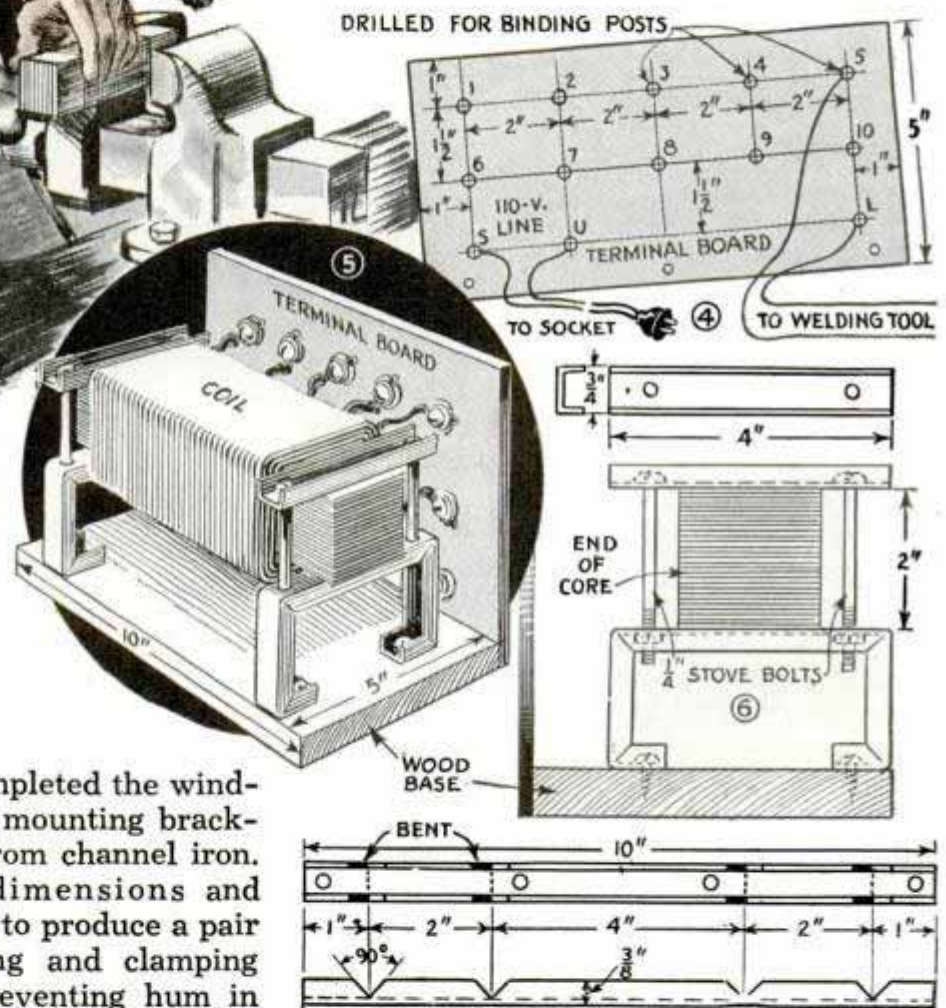
*B.P.
006*





it is tapped exactly as previously described and succeeding layers wound on with the number of turns indicated in Fig. 2, tapping at the end of each layer. As the taps are made, they are numbered 1, 2, 3, and so on. Having completed the winding of the coil, a pair of mounting brackets, Fig. 6, are formed from channel iron. The detail shows the dimensions and method of forming these to produce a pair of combination mounting and clamping brackets suitable for preventing hum in the core and for mounting the coil on a base as in Fig. 5. The various tap wires from the coil are connected to binding posts on the terminal board, detailed in Fig. 4. Fig. 8 shows a back view of this terminal board together with all of the connections needed to put the unit into service. It should be noted that the taps from the coil are marked on this detail with the same numbers as were used in Fig. 2 for winding and in Fig. 4 for the terminal board.

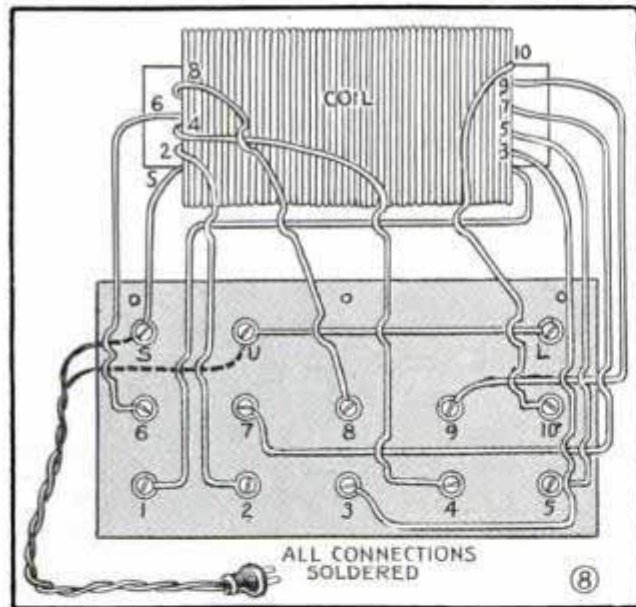
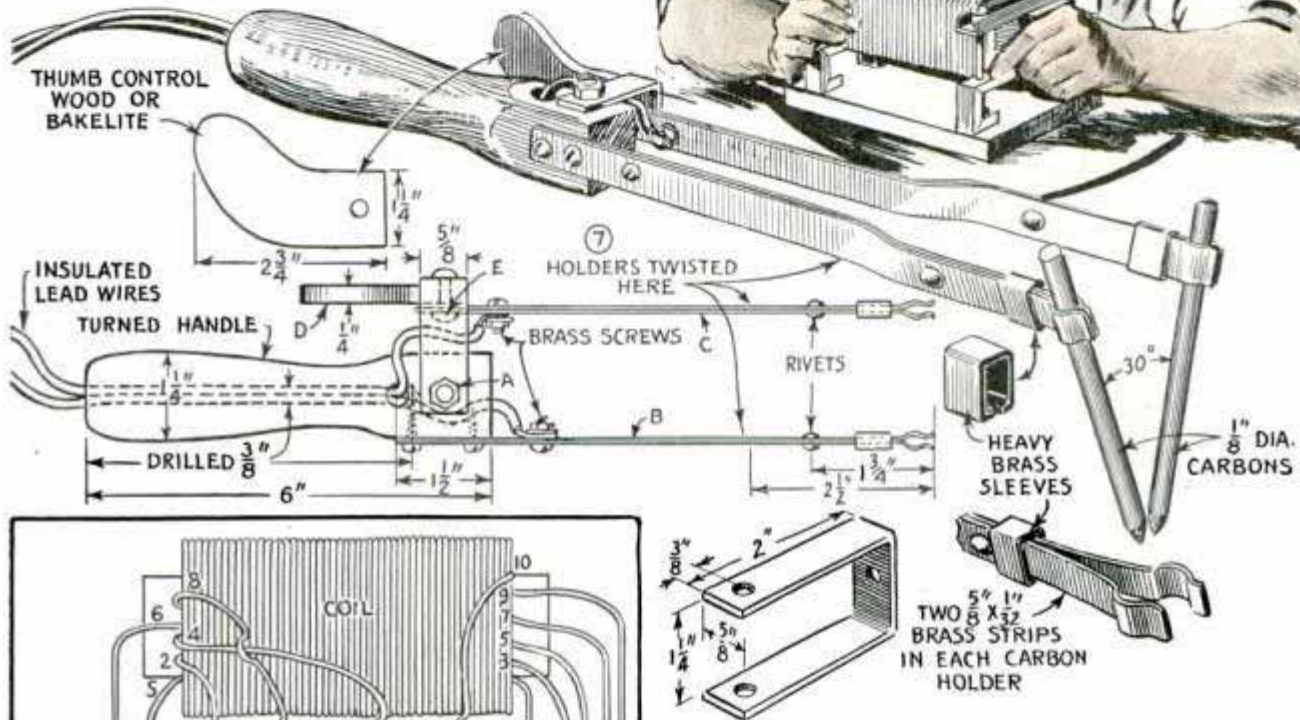
With these connections completed, a length of flexible cord equipped with a plug is attached to the binding posts marked S and U in Fig. 8. One of the wires from the electrode holder, Fig. 7, is connected to binding post L. The other wire from the holder is connected to binding post No. 5 for the preliminary trial. This connection may be made to binding posts Nos. 4, 3, 2, or in rare cases, No. 1, if a heavier current is desired and to binding posts Nos. 6, 7, 8, 9, or 10 to produce small values of welding current. The binding post to which this connection is made should be determined in each case in accordance with the



current requirements for the particular job. This arrangement gives great flexibility to the unit and will enable the user to do many jobs which would not be possible if all work had to be done with a fixed value of welding current.

The electrode holder detailed in Fig. 7 is used for the holding of a pair of $\frac{1}{8}$ -in. carbons. Larger size carbons should not be used, inasmuch as this unit was designed to give a large, intensely hot arc

with this particular size of carbon. The permanently fixed carbon-holding bracket detailed as B in Fig. 7 is made from two strips of heavy sheet brass $\frac{1}{2}$ or $\frac{5}{8}$ in. wide. This composite pair of strips is fastened to the handle with a pair of wood screws. It is important that care be taken to prevent the wood screws from coming into contact with the wires in the handle. The carbon-holding bracket, C, is similarly constructed from a pair of heavy brass strips and fastened to the angle bracket, E.



This bracket as well as a wood or Bakelite thumb control, D, is attached to the U-bracket, which in turn is screwed to the handle. The joint should be just tight enough so that when the handle is gripped you can easily manipulate the thumb control and thus adjust the arc. As indicated, the sections of brass used to make the carbon holders are riveted together $1\frac{3}{4}$ in. from the ends and twisted just back of the rivet joint so that the carbons will be giv-

en a 30° angle. Of course, some experimenting will be necessary to bring the carbons to just the right position.

To use the torch, connect the leads from the carbon holder to the unit as previously described, plug into the power supply and bring the carbons together by adjusting with the thumb. The arc is easy to pull and can be maintained without difficulty. For soldering or brazing, the torch is applied to the work and the brazing spelter or solder slowly fed in. The same procedure is used when welding. Welding rods should not be placed in the holder. Use the unit as a torch to supply the heat and feed in the welding or brazing rod in much the same manner as is standard practice in gas welding.

When a wood screw becomes loose, force a match stick into the enlarged hole and then drive the screw into the stick and it will usually hold.

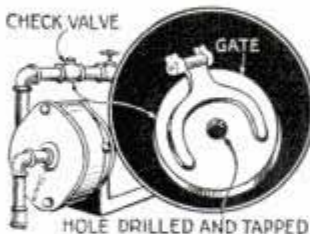
Merchandise Displayed on Scales Gets Customers' Attention



Grocer's display shows quantity of merchandise in given number of pounds

Here is a method of displaying fruit, vegetables, etc., that not only shows up the merchandise to good advantage but also assists customers in estimating the quantities of the various items desired. It is especially useful for advertising specials, and in moving perishable fruit which might otherwise be wasted. Having several filled bags near the scales saves disturbing the display after each sale.

Centrifugal Pump Kept Primed by Hole in Check Valve

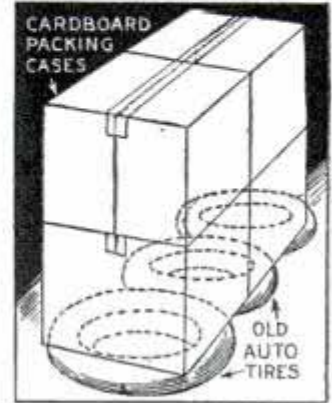


If a centrifugal water pump loses its prime, when a foot valve is used at the submerged end of the suction line and a check valve in the delivery line, the trouble often can be eliminated by drilling and tapping a small hole in the gate of the check valve so that a No. 10 brass machine screw can be inserted. The hole allows enough return water to keep the pump primed without destroying the effectiveness of the check valve. The hole may be closed any time a com-

plete seal of the valve is necessary by inserting the screw. This method has been used on check valves from 2 to 4 in. in diameter under lift heads to 400 feet.

Cardboard Boxes Set on Floor Protected by Tires

One merchant who kept cardboard cases and boxes stored in his basement, found that several old auto tires laid on the damp floor gave the boxes better protection against absorbing moisture from the concrete than

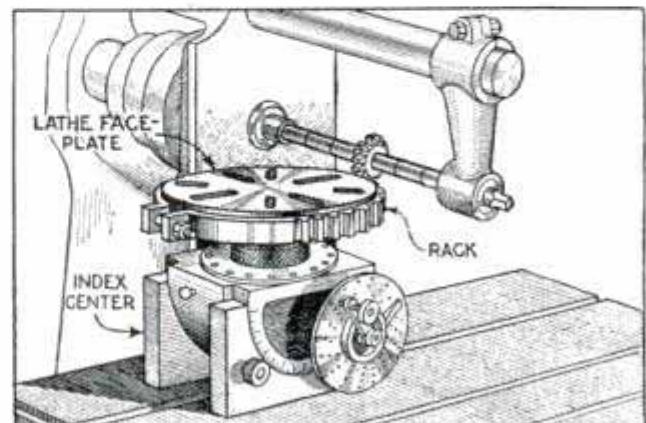


wood. In addition to the protection afforded the boxes, the tires last much longer than wood, which soon rots

Rack Cut on a Milling Machine Without Vertical Attachment

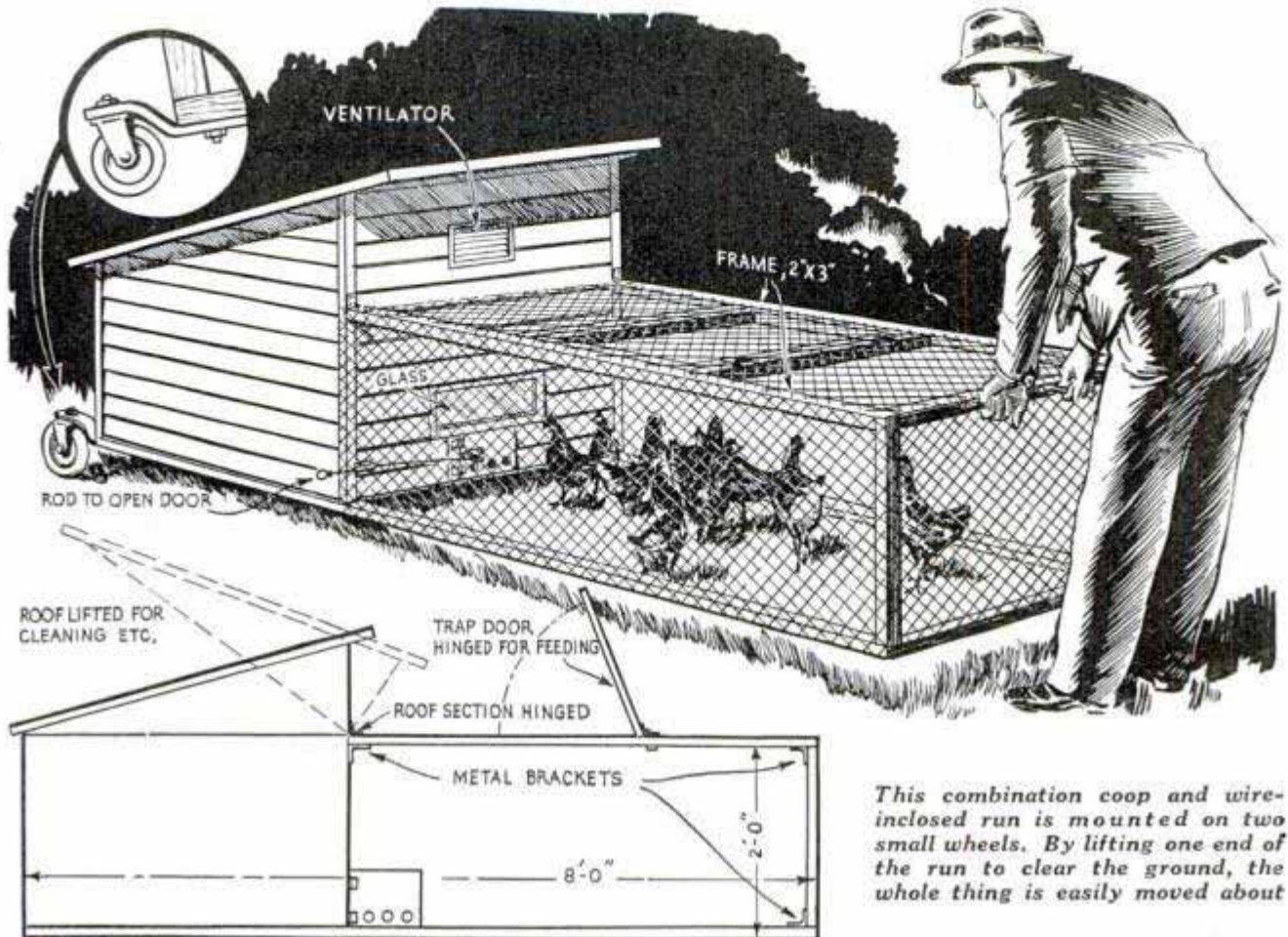
In a shop where a 6-ft. rack had to be cut, and the milling machine at hand had no vertical attachment, the job was done on the dividing head. A large lathe faceplate was fitted to the head and the stock for the rack was fastened around the faceplate with a bolt as shown. After the teeth had been cut in the rack, it was removed and straightened out, and then a gear to suit was cut in the regular way. This method, of course, is suitable only where extreme accuracy is unnecessary.

—Charles Kugler, Philadelphia, Pa.



Stock for rack clamped around faceplate in indexing head to cut teeth in milling machine

"Poultry Yard" on Wheels Is Moved Easily



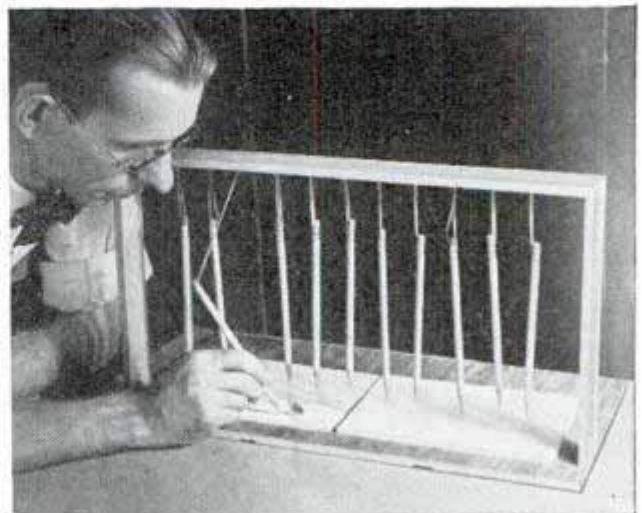
For the city or small-town dweller who keeps a few chickens and wants to change the location of the pen at intervals, this movable coop is just the thing. It is framed of $1\frac{1}{2}$ by $1\frac{1}{2}$ -in. pine and is covered with 4-in. lap siding. This is broken at one joint on three sides and the top section is hinged so that it lifts for clean-

ing. The frame of the run is joined to the coop, and all corners are stiffened with metal brackets. Fine poultry wire covers the top, sides and one end. A small trap door is framed into the top and is hinged so that it can be lifted for feeding. The 6-in. wheels are mounted on brackets made from $\frac{1}{4}$ -in. flat iron.

Pencils Are Tried Out by Customers Before Purchasing

To assist his customers in selecting a pencil with a lead to suit their needs, a merchant suspended one pencil of each type carried in stock from a small wood frame with rubber bands. The frame was kept on the counter with a tablet on which the customer could try out each pencil. The rubber bands were hung on small screw hooks so that the pencils could be removed easily for sharpening.

☞ To rid tubers and seeds of vegetables of many diseases, wash them in a solution of formalin, 1 pt., and water, 30 gals., before planting them.



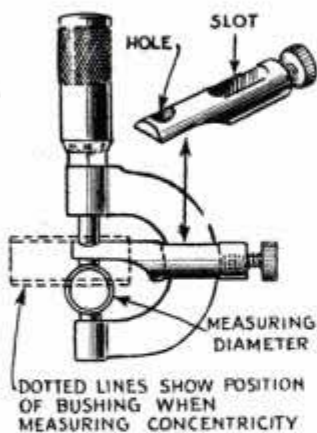
"Knocker" Nailed to Grain Chute Is Always at Hand



Give the grain chute a slap with this "knocker" and the resulting vibration will loosen packed grain

If you have overhead bins in your barn or granary and the grain or ground feed packs in the chutes leading from them, good knockers to loosen the grain can be had by tacking old harness traces to the chutes as shown. These knockers are always at hand, and a couple of slaps with them will usually loosen the grain.

Concentric Micrometer Adapter

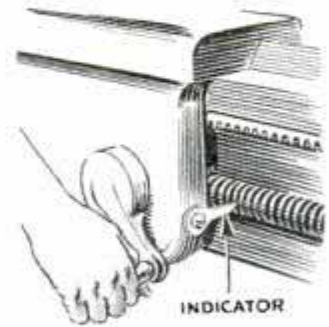


On a job of making a number of steel bushings, which called for close diameter limits and strict concentricity, the micrometer adapter shown was used during the grinding operation. The adapter is a piece of round steel ground to fit the bore of the bushing, slotted to suit the micrometer frame and tapped for a tightening screw. The end of the slot that bears against the frame is rounded suitably as shown, and a hole is drilled through the adapter to clear the

micrometer spindle. The last operation consists of grinding away the adapter sufficiently, to allow the bushing to go between it and the anvil of the micrometer.

Indicator Helps Engage Half Nuts on Lathe Lead Screw

By attaching a piece of metal on the side of the lathe carriage apron to act as a pointer, the half nuts may be meshed into the lead screw with ease. A small hole

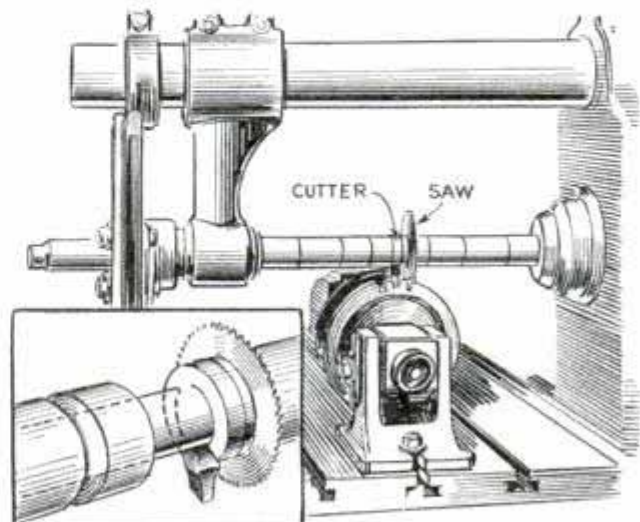


is drilled in the apron and is tapped to take a bolt which holds the indicator. The indicator should be of a thickness to match that of the threads on the lead screw, and should be long enough to just miss them. Bend it so that it is in line with the top of a thread when the half nuts are in mesh.

—Burl Knutson, Bismarck, N. D.

Gears Cut in One Operation

Instead of making two cuts with a fly cutter to form the teeth on a blank gear, a mechanic completes the job in one operation with the milling-machine setup shown. The fly cutter is bent to fit the milling arbor and is set central to the old gear, then a slitting saw is put on the arbor. The saw rough-cuts one tooth while the fly cutter finishes the preceding one.



Using a fly cutter and a slitting saw to cut gear teeth in one operation in a milling machine

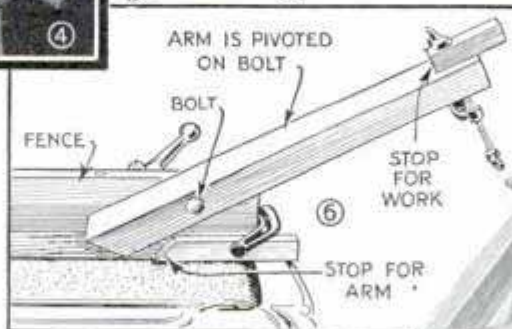
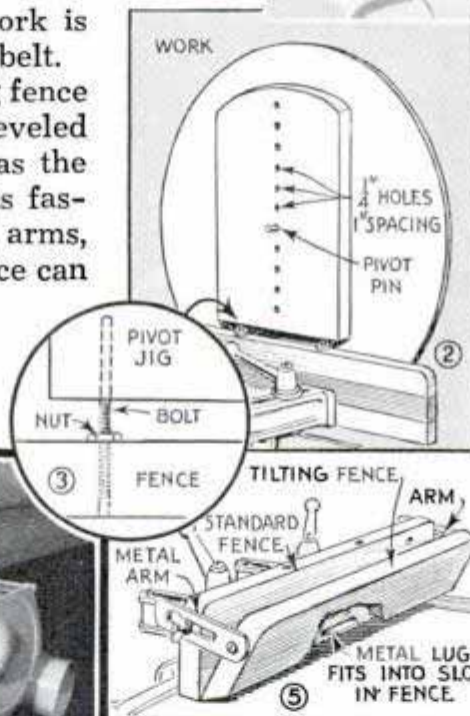
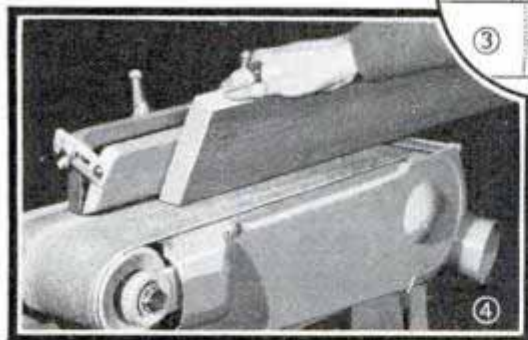
Simple JIGS

for the BELT SANDER

ACCURACY and speed in belt-sander operations are possible with simple jigs. A typical operation, Fig. 1, shows the sanding of a disk. The stock is roughly band-sawed to shape, then finished accurately on the sander by pivoting it on a vertical support. This is a piece of $\frac{3}{4}$ -in. stock about 8 by 12 in., with a line of $\frac{1}{4}$ -in. holes on 1-in. centers, Fig. 2. The jig is fitted to the sander fence with two carriage bolts, the heads of which have been cut off. A nut on each, as in Fig. 3, permits adjustment for any size disk within the capacity of the jig. The work is revolved against the sander belt.

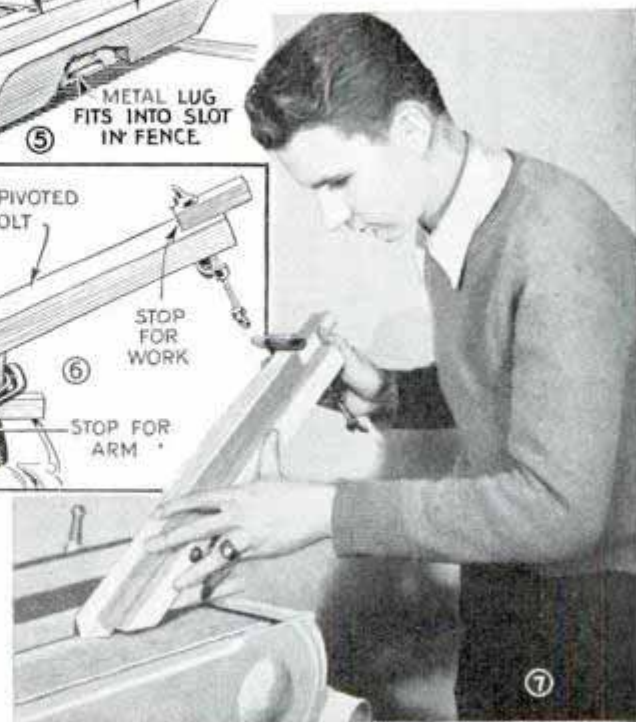
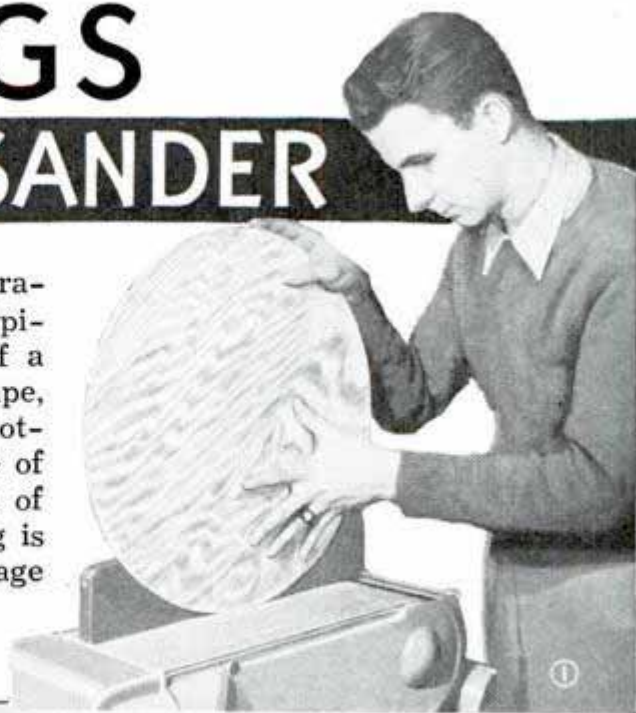
Figs. 4 and 5 show a tilting fence for sanding or cutting beveled edges. It is the same size as the standard wood fence, and is fastened to it with two metal arms, which are slotted so the fence can be tilted up to 45° . To prevent the bottom of the tilting fence from riding

can be seen, it consists of a narrow table which is pivoted to the standard fence by means of a bolt. Work to be cut is placed on the pivoted arm, which is swung upward, bringing the work in contact with the sanding belt until the stop block is reached. Many jobs, such as pointing square stock, can be done with this jig.



the sanding belt, the fence is fitted with a metal lug. This fits into a corresponding slot cut near the bottom of the standard fence. The slot should be wide enough to permit the lug to rest in it at all settings of the fence. The tilting fence can be left on the standard fence as a permanent fixture or it may be removed if desired.

One of the simplest, yet most useful jigs for end work is shown in Figs. 6 and 7. As



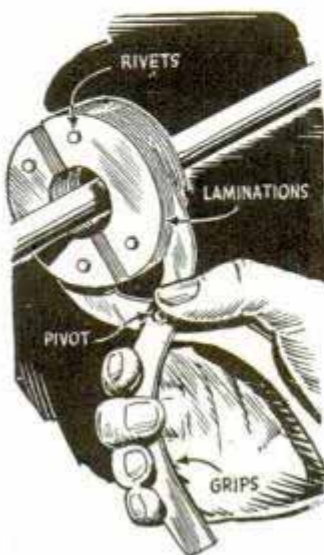
Basket Hooked on File Cabinet Saves Time for Clerk



Basket of letters or bills, etc., to be filed, is attached conveniently right on the filing cabinet

Those who do file work in offices will find that a mail basket fitted with a hook to engage brackets on the fronts of the file-cabinet drawers will save time and labor, as the work to be filed can be stacked in the basket and kept right at hand. If you do not care to go to the trouble of putting brackets on the drawers, it may be possible to arrange a hook on the basket to slip over the drawer handles or over the edge of the drawers.

Simple Electric-Current Indicator



Without making an electrical connection or disturbing the insulation in any way, you can tell if current is flowing in an electric power line with this indicator. It is especially handy for determining which wire of a three-phase circuit is open, or for testing stator connec-

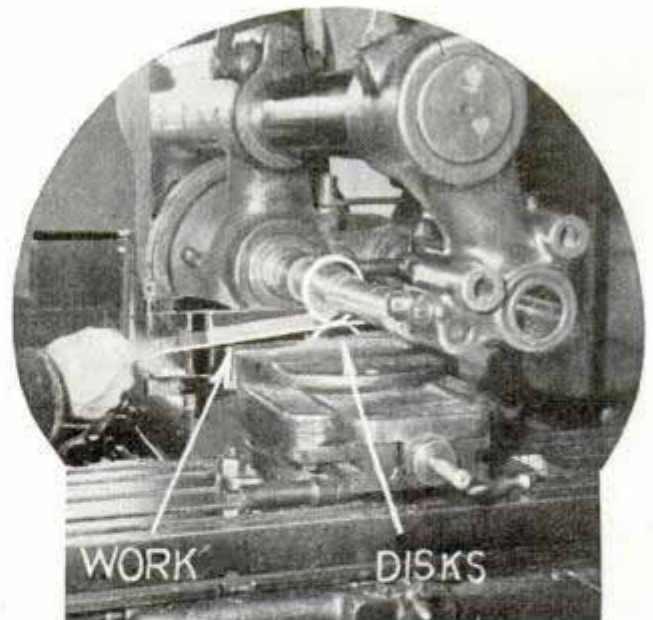
tions on generators. In use, it is slipped over the wire to be tested, and the jaws closed slowly. If there is current in the line, they will suddenly snap shut. The jaws, which are $\frac{1}{4}$ in. thick, are made of transformer iron or silicon steel, and are about 2 in. in diameter when closed with a 1-in. opening in the center. The handle consists of two pieces of heavy fiber.

Fowls Have Spur Guards on Feet to Avoid Injury in Fights

When an old male bird of a poultry flock is given free range with others, it often happens that he becomes a nuisance on account of his desire to fight and injure the weaker members. To avoid this, one poultryman obtained a length of small rubber hose from which pieces were cut somewhat longer than the spurs and slipped over them.



Cutting Sheet Plastics Neatly



Scoring both sides of sheet plastic in milling machine so that it can be broken neatly into small squares

On a job of cutting several thousand small squares of $\frac{1}{8}$ -in. plastic, and sawing left a ragged edge and too much clinging sawdust, a clean break was obtained in the work by running it between

two sharp disks, which scored the material deeply on both sides so that it could be broken cleanly. The disks were mounted in a milling machine, one on the arbor and the other on an idler, which was mounted in a vise on the machine table. The latter was moved until the proper depth of mark was obtained. A guide similar to the rip fence on a circular saw was clamped to the vise, making it a simple matter to keep the marking parallel to the edge.—D. R. Tompkins, Pasadena, Calif.

Shipping Clerk Clips Stamps to His Apron

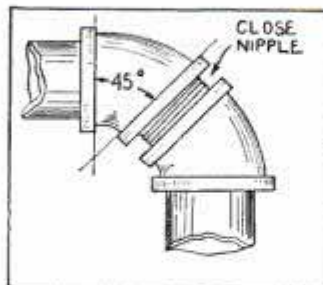


One shipping clerk who had to go into the shipping room and onto the loading platform to stamp boxes and packages, carried the stamps used most frequently on an apron around his

waist. The regular spring holders for the stamp handles were attached to small wood blocks, which were in turn attached to the apron front with screws, large washers being used under the screw heads to keep them from tearing out of the cloth.

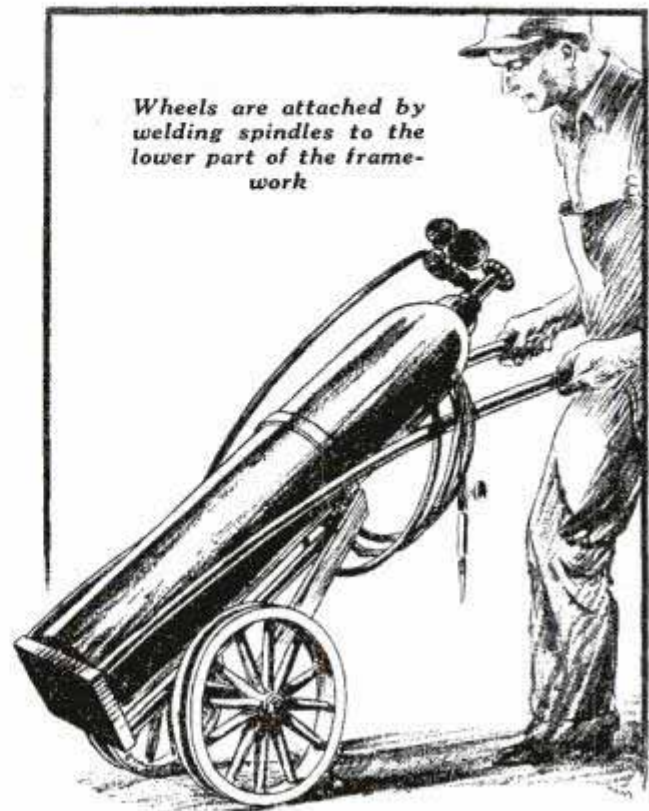
Gas Pockets in Refrigerant Lines Prevented by Two Elbows

One mechanic solved the problem of gas pockets in pipes carrying refrigerant by substituting two 45° elbows connected with a close nipple, for each 90° elbow in the line. It was found that the sharp turns caused by the right-angle elbows increased the flow at these points to such an extent that gas pockets formed at the top sides of the elbows, while the wider turns formed by the two 45° elbows reduced the flow sufficiently to prevent the pockets.



—L. H. Georger, Buffalo, N. Y.

Welding Unit on Auto Wheels Is Easy to Push



Old auto wheels are excellent for use on the usual type of acetylene-welding truck. They may be attached quickly by welding the spindles to the framework at the bottom of the truck. Rubber tires may be used if desired. The platform for the carbide container may be elevated to better balance the unit so that the oxygen tank rests on the floor when the truck is tilted upward. A metal band with a hook at each end holds the tank in place, and is quickly removed when the tank is empty.

—Jos. C. Coyle, Phoenix, Ariz.

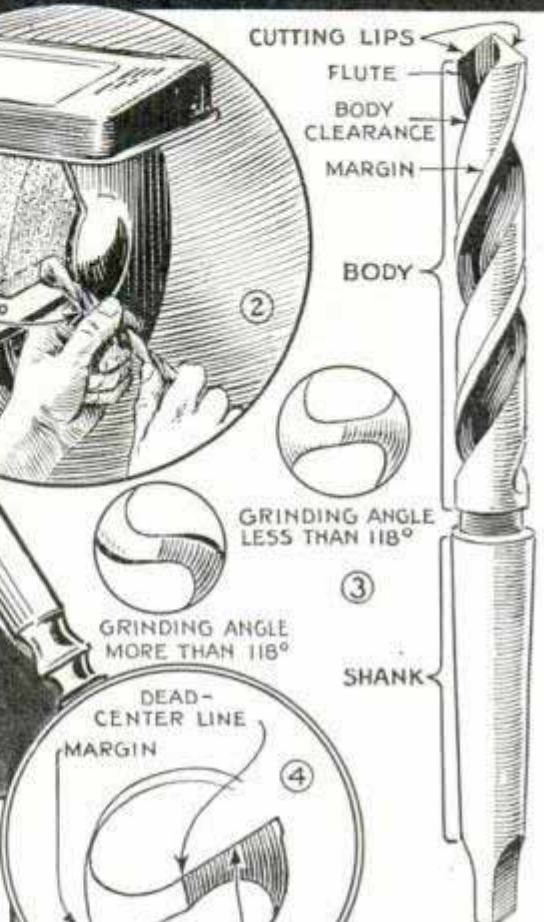
Wrist Memo Pad for Policeman

By wearing a tiny pad of paper on his wrist like a watch, a police officer always has a memo pad at hand for instant reference where he can keep data such as car licenses, etc. The paper pad is slotted near the sides to take a watch strap with which it is attached to the wrist.



—Opie Read, Jr., Chicago.

The MECHANICS



DRILL SPEEDS AND FEEDS (5)

FINDING DRILL SPEEDS
 I - NORMAL SPEED (N) WILL BE FOUND ON CURVE AS 1/4" OR .250" DRILL (BOTTOM) REQUIRES 450 R.P.M. (LEFT)
 II - MULTIPLY (N) BY VALUE SHOWN IN TABLE BELOW

METAL TO BE DRILLED	KIND OF DRILL	
	CARBON STEEL	HIGH SPEED
CAST IRON (ANNEALED)	2 1/3 X N	5 X N
CAST IRON (HARD)	N	2 1/3 X N
MILD STEEL	N	3 1/3 X N
DROP FORGINGS	2/6 X N	2 X N
MALLEABLE IRON	1 1/6 X N	3 X N
CAST STEEL	2/3 X N	1 1/3 X N
TOOL STEEL	5/6 X N	1 2/3 X N
BRASS, BRONZE AND SOFT METALS	5 X N	10 X N

LUBRICANTS

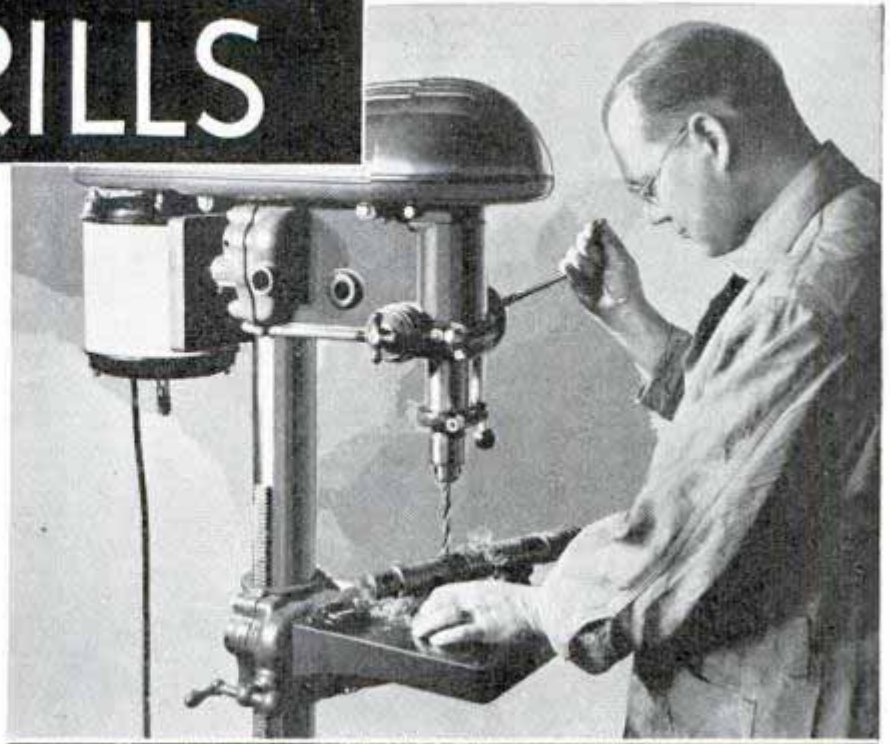
Cast Iron—None	Tool Steel—Lard Oil
Mild Steel—Lard Oil	Cast Steel—Lard Oil
Drop Forgings—Lard Oil	Brass and Bronze—Dry or Paraffin Oil
Malleable Iron—Soda Water	Wrought Iron—Lard Oil
	Aluminum—Kerosene



of DRILLS

PART I

Practical data for every shop man on the technique of using drills; how to select the right type for certain jobs, what speeds for efficiency and many other pointers













CLOSE examination of a drill of any size will reveal that there are three main operating parts which enable this tool to do its important job. As you will see from Fig. 3, these are the shank, the fluted body, and the cutting lips. Like all cutting tools which remove material in the form of chips, the lips of the drill must be ground with a clearance and rake angle. Each lip is really a chisel, each must have exactly the same clearance and rake, and, due to the characteristics of the drill and the nature of the materials in which it must work, the uniformity of these angles determines its performance.

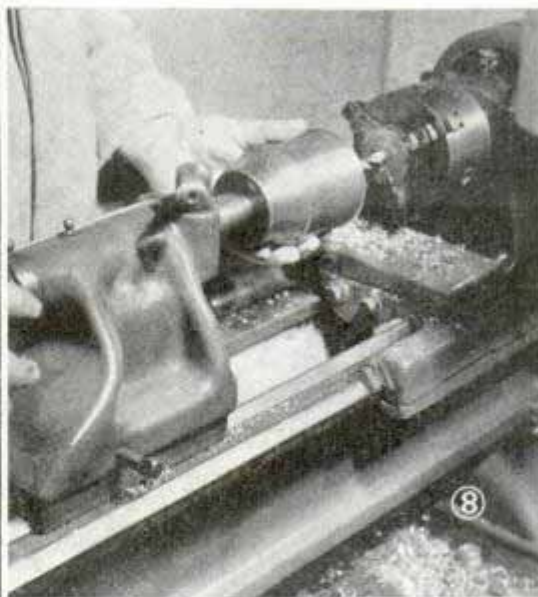
Types of Twist-Drill Shanks: Fig. 6 shows the four standard shanks which are in general use. The taper-shank drill is used in a drill press, the hollow spindle of which has an internal taper. When the shank does not fit the drill-press socket, a suitable adapter is used. The straight shank is the type most commonly used. It fits both drill-press and hand-drill chucks. Bit-stock shanks may be used in ordinary bit braces. The type of drill used for wood only has a sharper point than do the others and, by observing the point angle, it is possible to easily distinguish wood-working drills from those made for metal.

Body and Flutes: The body of the drill, Fig. 3, consists of a spirally fluted section to give strength, curl the chips, provide a

means whereby they may be ejected, and to allow for the entrance of oil or cutting compounds to lubricate and cool the drill. Note that the outside edges of the flutes are ridged to form a margin of slightly greater over-all diameter than the rest of the body. The recessing back of the margin is very slightly tapered toward the shank to give the drill body clearance and prevent binding. The angle between the flutes and work when the drill stands perpendicularly, Fig. 10, is the rake angle. The steeper this angle, the tighter the chips are rolled. For most jobs the angle produced when the drill is manufactured is satisfactory.

Cutting Lips and Grinding Methods: From the standpoint of shop care, the most important parts of the drill are the point and cutting lips. Fig. 4 shows an enlarged point-on view from which it should be observed that the faces on either side of the dead-center line are ground to a very definite angle and when this is done, the edges of the cutting lips are parallel as shown. If a gauge, Fig. 11, is placed across the tip of a properly ground drill with its edges parallel to the cutting lips, it will be found that the angle is 118° . As it is possible to grind a drill more on one side than on the other and still produce this angle, the marks on the gauge should also be observed. With the point registering with

Causes and Cures for Drill Troubles ⑦		
TROUBLE	CAUSES	CURES
 <p>A—Broken Drill</p>	1—Work mounted so that it is springy 2—Not enough lip clearance 3—Dull drill 4—Speed low or feed too fast 5—If drilling wood, brass or soft metal, chips may pack in flutes	1—Fasten work rigidly so it cannot spring 2—Regrind properly 3—Grind 4—Increase speed or feed slower 5—Increase speed, grind drill with more lip clearance or use drills designed for the material
 <p>B—Breaking of Cutting Edges—Particularly at Corners</p>	1—Too much lip clearance 2—Material has hard spots, sand inclusions or scale 3—Drill running too fast 4—Wrong cutting compound or lubricant 5—Feed too rapid	1—Regrind and reduce lip clearance to between 12 and 15 degrees 2—Reduce speed 3—Reduce speed 4—Use proper lubricant or compound 5—Reduce feed
 <p>C—(High-Speed Drill) Chipping or Checking</p>	1—Drill heated or cooled too rapidly while drilling or grinding 2—Feeding too rapidly	1—Warm drill slowly before using—Do not use cold water while drilling or grinding 2—Reduce feed
 <p>D—Oversize Hole</p>	1—Lip angles are not equal	1—Regrind drill and equalize lip angles
 <p>E—Oversize Hole</p>	2—Length and angle of lips not equal	2—Regrind drill and equalize lip angles and lip lengths
 <p>F—Oversize Hole</p>	3—Length of lips not equal (Lip angles o.k.)	3—Regrind and equalize lip lengths
 <p>WORN SPINDLE BEARING</p> <p>G—Oversize Hole</p>	4—Spindle of drill press loose	4—Tighten or adjust until spindle is rigid
 <p>H—Broken Tang</p>	1—Poor fit of tang in socket caused by nicks, burrs, dirt or wear 2—Mutilated tang	1—Ream out socket or replace with new one. Cleaning sockets before use lengthens their life. 2—Dress or replace
 <p>I—Hole Is Rough</p>	1—Drill dull 2—Drill not properly ground 3—No lubricant or wrong lubricant 4—Feed too rapid 5—Work poorly supported	1—Grind 2—Inspect and regrind 3—Use proper lubricant 4—Reduce feed 5—Support work rigidly and free from vibration
 <p>J—Form of Chips Tells How Work Is Progressing</p>	1—Chip changes form 2—Lubricant not reaching proper location	1—Drill chipped, dulled or damaged—Inspect and regrind 2—Remove drill and check lubricant



the center "O" line, the readings at the points where the edges of the lips meet the gauge should be the same to insure that the cutting lips are at the same angle with respect to the center line of the drill. In the case shown, this value reads one in both cases, therefore, the drill has not only been ground to the proper total angle but it is also ground with equal cutting-lip angles. A drill which is ground so that one of the cutting lips is longer than the other will not drill accurately. Fig. 7 shows the troubles which result from improper cutting-lip angles. Other illustrations in Fig. 7 show the cause and cure for other drill difficulties.

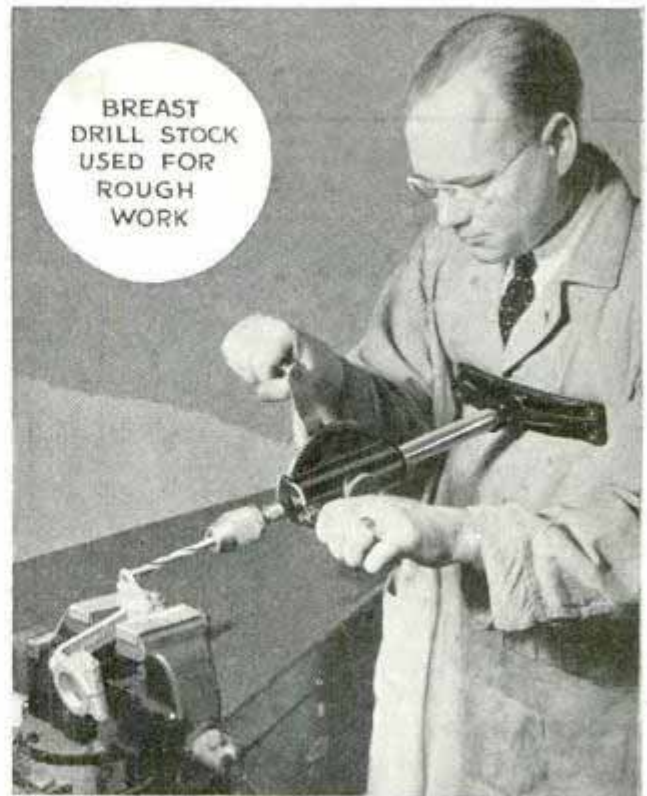
Clearance Angle: If the gauge, Fig. 11, is rotated until its edges meet the two points of the faces back of the cutting lips, it will be found that the gauge no longer rests on the flat surfaces. Fig. 12 shows this condition clearly. The angle at this point is therefore less than 118° . The difference between 118° and this angle is the clearance angle. If a drill has no clearance, that is, the angle across the points shown in Fig. 12 is 118° , the flat areas will ride on the work without cutting. To get a better idea of the necessity for lip clearance in all cutting tools, look at Fig. 9 and the left detail in

Fig. 10. The angle between a line drawn squarely across the point with a line drawn between the cutting-edge tip and the heel or trailing edge of the lip should span an angle between 12° and 15° for best results.

For a practical method of determining when the lips of a drill have been ground to a proper angle compare the two point-on views in Fig. 3 with that in Fig. 4. Note the variations in the curve of the cutting edges caused by varying the angle. On the other hand, when the drill is properly ground as in Figs. 1 and 2, with the correct clearance angle, the cutting edges will be parallel as in Fig. 4. In other words, the cutting edges are in the form of a straight line offset by the dead-center line and the trailing edges back of them are rounding.

When drilling very hard material, it has been found helpful to modify the rake angle slightly, as shown in Fig. 17. The nearer this angle is made to 90° the tighter the chips will be rolled and the less will be the likelihood of breaking or chipping the cutting lip. This modification should not be made except in those cases where very hard material is being drilled and when the use of proper lubricants, as explained later, has failed to produce satisfactory results without damage to the drill.

Grinding High-Speed Drills: When grinding carbon-steel drills they are cooled by immersion in water to avoid burning. This practice must not be used with high-speed drills as sudden changes of temperature check, crack, and weaken them. They will stand high temperatures if heated slowly. Accordingly, they should be ground slowly to avoid sudden overheating and must be allowed to cool in the air to prevent checking. For grinding drills, a good grade of vitrified Alundum wheel should be selected, the most acceptable type being grade K, grain M. The grinder should be operated at a surface speed of between 4,000 and 5,000 feet per minute. A good rule for finding the speed in r.p.m. required is to divide the diameter of the wheel in inches into 14,000. Thus, a 10-in. wheel should run at 1,400 r.p.m. The drill is carefully brought up to the edge of the grinder as shown in Figs. 1 and 2, and should be held rigidly, the angle between the wheel and the drill being maintained at 59° . After a little practice, this is a simple operation and the eye will be adequate to insure an accurate job. As the drill is brought up to the wheel, it should be rotated clockwise while at the same time the angle is gradually decreased to produce the clearance.



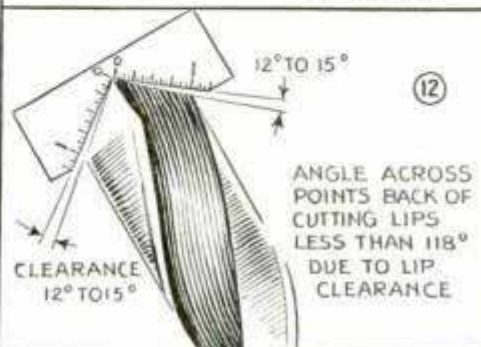
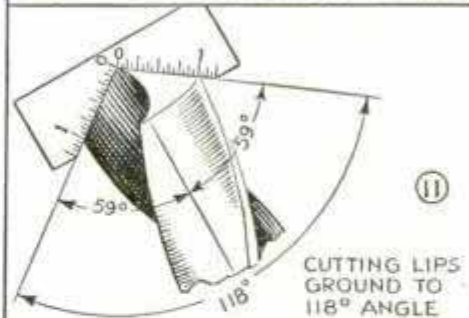
ALL CUTTING TOOLS MUST BE OPERATED WITH CLEARANCE

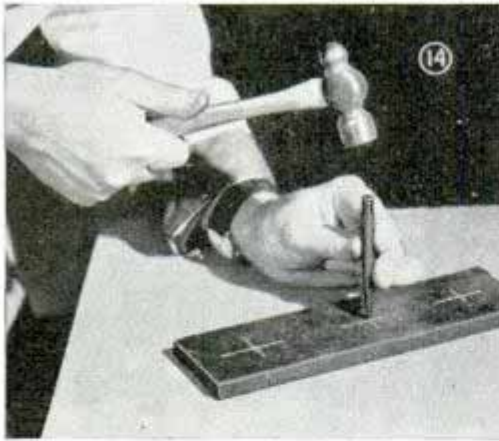


CLEARANCE ANGLE PERMITS CHISEL TO CUT ⑨



WITH A LARGE RAKE ANGLE THE CHIPS ARE CURLED TIGHTLY ⑩





Sizes, Feed and Speeds: The ordinary jewelers' drills, or, as they are sometimes called, steel wire-gauge drills, are numbered from 1 to 80, the No. 1 drill being the largest and No. 80 being the smallest. Letter-sized drills bear the alphabetical letters from A to Z, the A drill being the smallest and the Z drill the largest of the series. In addition to wire-gauge drills and letter drills, jobbers drills are made in sizes ranging upward in steps of $\frac{1}{64}$ in., from $\frac{1}{32}$ in. to several inches in diameter. To make it convenient to select the proper size of drill for any purpose, refer to Fig. 13 which includes the various size drills of each type listed in the order of increasing sizes. Although power-driven drill presses constitute the most satisfactory means of using drills, various drill stocks, both manually and electrically driven, Fig. 15, are in common use. Many exacting drilling operations are also handled in the lathe as in Fig. 8. For small drills, light-weight high-speed geared hand-drill stocks should be selected. The larger sizes of hand-drill stocks are made so that the driving wheel can be set for either one of two speed ratios, the low ratio being used for larger drills. The handle also can be adjusted to increase the leverage. Ordinary drill presses are usually equipped with $\frac{1}{4}$ -hp. motors. These are satisfactory for drilling holes up to $\frac{3}{8}$ in. in diameter. For heavier work, larger motors should be

FIG. 13
Steel Wire and Jobbers Drills in Sizes Up to $\frac{1}{4}$ "

Wire Gauge Drills	Jobbers Drills	Decimal Size	Wire Gauge Drills	Jobbers Drills	Decimal Size
No. 80		.0135	No. 37		.1040
No. 79		.0145	No. 36		.1065
No. 78		.0160		$7/64"$	.10938
No. 77		.0180	No. 35		.1100
No. 76		.0200	No. 34		.1110
No. 75		.0210	No. 33		.1130
No. 74		.0225	No. 32		.1160
No. 73		.0240	No. 31		.1200
No. 72		.0250		$1/8"$	.12500
No. 71		.0260	No. 30		.1285
No. 70		.0280	No. 29		.1360
No. 69		.02925	No. 28		.1405
No. 68		.0310		$9/64"$	.14063
	$1/32"$	.03125	No. 27		.1440
No. 67		.0320	No. 26		.1470
No. 66		.0330	No. 25		.1495
No. 65		.0350	No. 24		.1520
No. 64		.0360	No. 23		.1540
No. 63		.0370		$5/32"$	.15625
No. 62		.0380	No. 22		.1570
No. 61		.0390	No. 21		.1590
No. 60		.0400	No. 20		.1610
No. 59		.0410	No. 19		.1660
No. 58		.0420	No. 18		.1695
No. 57		.0430		$11/64"$	.17188
No. 56		.0465	No. 17		.1730
	$3/64"$	.04688	No. 16		.1770
No. 55		.0520	No. 15		.1800
No. 54		.0550	No. 14		.1820
No. 53		.0595	No. 13		.1850
	$1/16"$	.06250		$3/16"$	.18750
No. 52		.0635	No. 12		.1890
No. 51		.0670	No. 11		.1910
No. 50		.0700	No. 10		.1935
No. 49		.0730	No. 9		.1960
No. 48		.0760	No. 8		.1990
	$5/64"$	.07813	No. 7		.2010
No. 47		.0785		$13/64"$	.20313
No. 46		.0810	No. 6		.2040
No. 45		.0820	No. 5		.2055
No. 44		.0860	No. 4		.2090
No. 43		.0890	No. 3		.2130
No. 42		.0935		$7/32"$	.21875
	$3/32"$	.09375	No. 2		.2210
No. 41		.0960	No. 1		.2280
No. 40		.0980		$15/64"$	.23438
No. 39		.0995		$1/4"$	.25000
No. 38		.1015			

Letter and Jobbers Drills, $15/64"$ and Larger

Letter Drills	Jobbers Drills	Decimal Size	Jobbers Drills	Decimal Size
A	$15/64"$	.2344	$33/64"$	.5156
B		.238	$17/32"$	.5313
C		.242	$35/64"$	.5469
D		.246	$9/16"$	.5625
E	$1/4"$	.2500	$37/64"$	.5781
F		.257	$19/32"$	.5938
G		.261	$39/64"$	.6094
H	$17/64"$	.2656	$5/8"$	.6250
I		.272	$41/64"$	.6406
J		.277	$21/32"$	.6563
K	$9/32"$	.2812	$43/64"$	.6719
L		.290	$11/16"$	.6875
M	$19/64"$	.2969	$45/64"$	.7031
N		.302	$23/32"$	.7188
O	$5/16"$	.3125	$47/64"$	.7344
P	$21/64"$	.3281	$3/4"$	.7500
Q		.332	$49/64"$	.7656
R	$11/32"$	.3437	$25/32"$	.7813
S		.348	$51/64"$	.7969
T	$23/64"$	.3594	$13/16"$	.8125
U		.368	$53/64"$	.8281
V	$3/8"$	.3750	$27/32"$	.8438
W	$25/64"$	.3906	$55/64"$	.8594
X		.397	$7/8"$	.8750
Y	$13/32"$	.4063	$57/64"$	.8906
Z		.413	$29/32"$	.9063
	$27/64"$	.4219	$59/64"$	.9219
	$7/16"$	.4375	$15/16"$	.9375
	$29/64"$	.4531	$61/64"$	.9531
	$15/32"$	.4688	$31/32"$	.9688
	$31/64"$	.4844	$63/64"$	.9844
	$1/2"$	.5000	$1"$	1.0000

used, as indicated in Fig. 18. Small drills must be operated at much higher speeds than larger ones. To calculate the proper speed with the various metals and in connection with both carbon steel and high-speed drills, make use of Fig. 5. This chart will be found a great shop convenience as it condenses several pages of hard-to-read figures into easily used form.

Laying Out Work for Drilling: In laying out drilling jobs, a combination square may be used for measuring angles, for locating centers, etc. A scribe and other tools are indispensable to accurate work. Having located the exact point to be drilled, it next remains to impress into it a center punch mark of sufficient depth to insure that the point of the drill will be guided properly as in Fig. 14.

Drifting a Wandering Drill: Sometimes a drill will show a stubborn tendency to wander off the punch mark when starting the hole. To correct this you first check up on the condition of the drill and see that the work is level. After eliminating these possibilities, remember that the relation between the circle described by the dead-center line of the drill and the diameter of the punch impression has a definite bearing on accurate starting of the drill. If the first circle is larger than the second the punch mark will have no wedging or "drawing" effect on the drill, thus failing to hold it on center until the lips begin to cut. The remedy is to use either a punch with a shorter bevel, Fig. 14, or spot the hole with a smaller drill before introducing the larger size. Where the work requires extreme accuracy, holes are frequently spotted with several progressive drill sizes. Another method used where dimensions are not critical is that in Fig. 16. Here the drill, starting off-center as at A, is drifted back by means of cold-chisel impressions as at B and C.

Drill Blocks: Blocks and flat sections of steel are useful around the drill press. When sections of cold-rolled steel plates about $\frac{1}{4}$ in. thick are used as pads under the work, the drill may be allowed to go through without damaging the drill-press table. Materials which tend to form a burr on the bottom are drilled clean if a plate is used under the work.

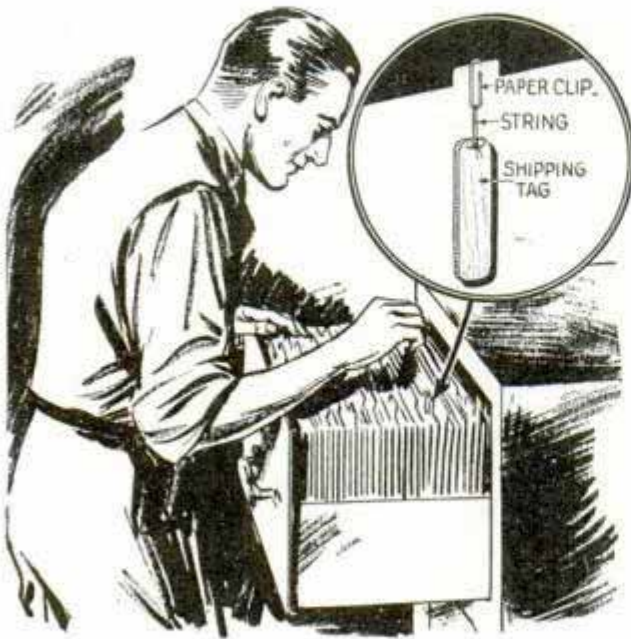
In drilling fiber, soft metal, plastics, and other materials which tend to form a burr



or jagged edge as the drill cuts, it is advisable to clamp a thin piece of metal on top of the work as well as place a drill pad under it. If the work, together with the top plate and drill pad, is clamped to the bed of the press, it is possible to drill through the assembly without forming burrs on either top or bottom. Where it is not possible to drill through a top plate, a hole of the required diameter is drilled in a piece of flat metal and this is placed over the center-punched fiber. With the drill lined up with the punch mark, through the hole in the top plate, the clamps are tightened and the job completed.

(To be continued)

Filing-Cabinet Marker Shows Where Folder Was Removed



When a folder is removed from a filing cabinet, clip this marker to the divider

By clipping a small shipping tag, or even a piece of thin wood to the top edge of a divider in your filing cabinet, you can see at a glance where a folder has been removed. If a number of these markers are kept handy, they will save time.

"Safety-Pin" Tool Holder on Farm Machines



If tools are jostled out of the toolboxes on your farm implements, and lost when driving over rough ground, this "safety-pin" holder will solve the problem. It consists of a length of iron rod bent to the shape shown,

a half loop being formed on one side to slip under a nut on the machine.

—Benjamin Nielsen, Aurora, Nebr.

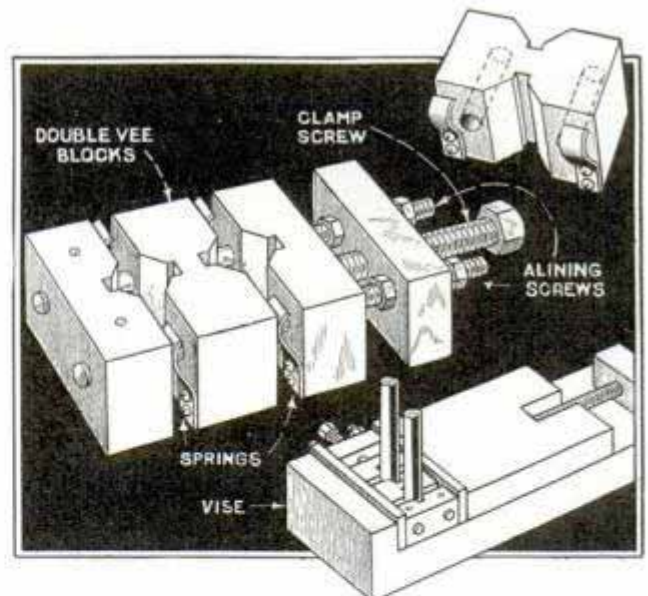
Shavings Keep Fruit in Cars from Freezing

To keep fruit from freezing while in transit, layers of wet shavings were placed

on the floors of the refrigerator cars with the idea in mind that freezing water gives off a certain amount of heat per pound. When the car temperature falls to 32°, the water in the shavings begins to freeze and the heat which is released prevents the temperature from falling very far below that point until all the water in the shavings has been frozen. It is claimed that this method of keeping fruit from freezing has less adverse effect than the use of heaters which might produce enough heat to cause damage.—A. P. Child, Kansas City, Mo.

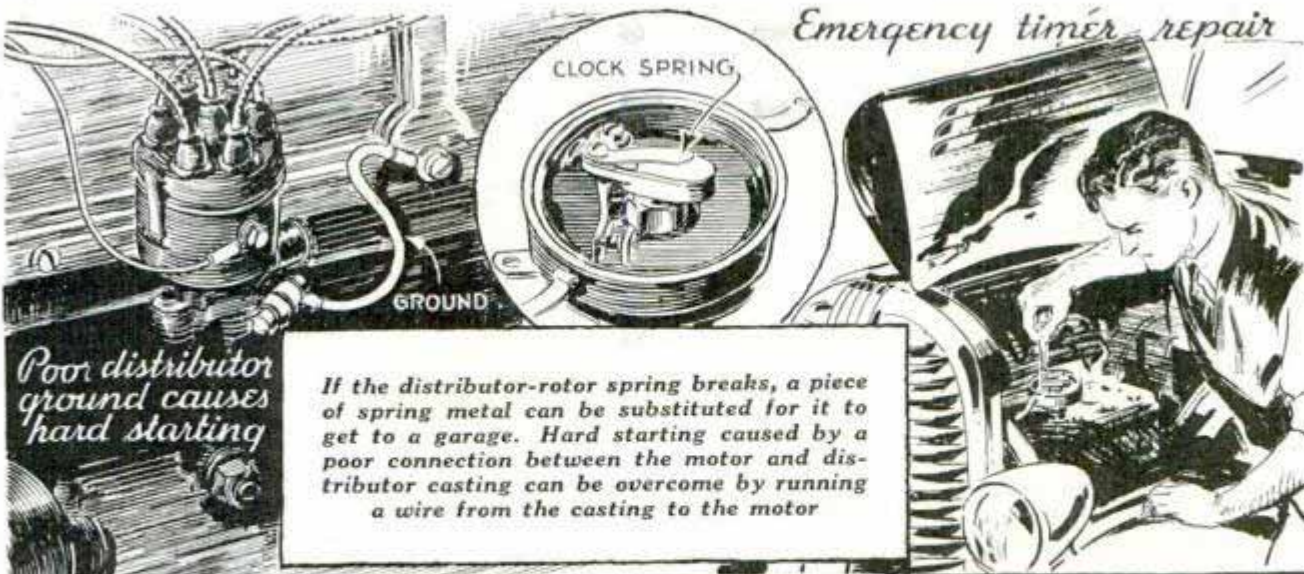
Flexible Milling-Machine Fixture Cuts Costs on Small Jobs

In shops handling small milling jobs, labor cost can be reduced considerably if the change-over from one job to another can be done quickly. For such shops, the fixture shown will be found handy. It consists of a series of double V-blocks through which pass two alignment rods. The rods are pinned to one end block, the other end block being made adjustable by means of nuts on each side of it. This block is drilled and tapped in the center for a clamp screw, which tightens the



This simple clamping block permits quick change-overs from one job to another

blocks on the work. Small, flat springs between the blocks spread them when the screw is loosened to permit easy removal of the work. The fixture can be made any size desired by adding V-blocks. For milling special work, blocks of the required contour can be used.



Emergency timer repair

Poor distributor ground causes hard starting

If the distributor-rotor spring breaks, a piece of spring metal can be substituted for it to get to a garage. Hard starting caused by a poor connection between the motor and distributor casting can be overcome by running a wire from the casting to the motor

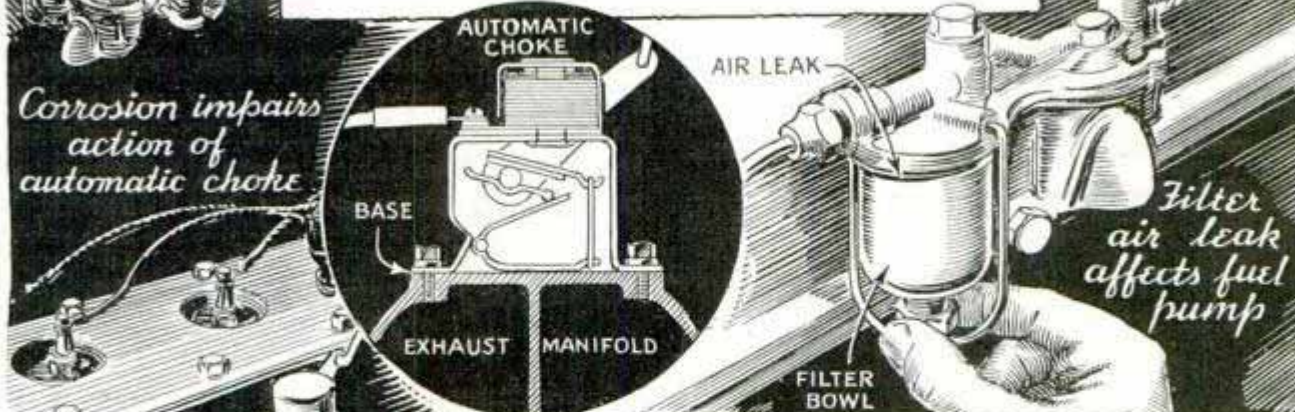
Auto SHORT CUTS



Starting "drowned" motor

Preventing vapor lock

Vapor lock in the fuel line can be prevented often by insulating the line where it passes near the motor with electrician's loom. When the ignition system gets wet, here's an emergency trick that seldom fails to start the motor: Just take out about half of the spark plugs and space the gaps to take a piece of tin cut from a can. The weak spark will usually fire these plugs, and, with the motor running on half the cylinders, the others will soon "cut in," after which the altered plugs are set correctly

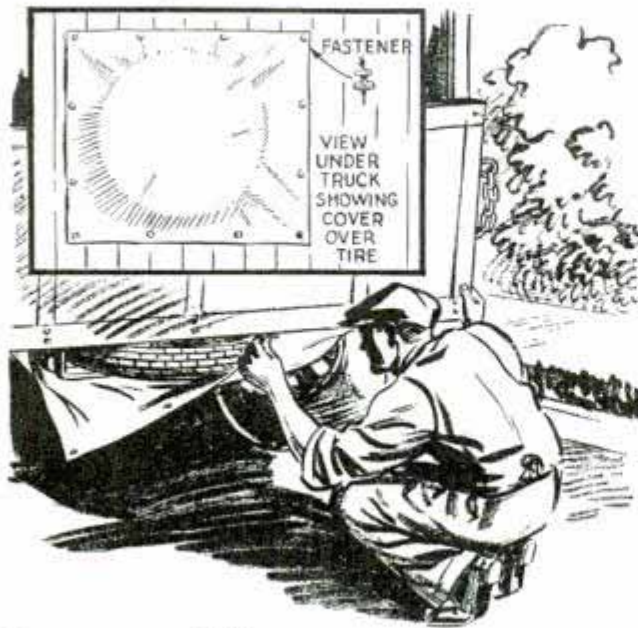


Corrosion impairs action of automatic choke

Filter air leak affects fuel pump

Corrosion between the exhaust manifold and an electrically controlled automatic choke often causes sluggish operation of the latter, which results in hard starting. To cure the trouble, remove the choke and clean the contacting surfaces. If your car is new or the motor has just been overhauled, and it misses or stops, look at the gasket on the fuel filter bowl. Perhaps it wasn't assembled tightly and air is leaking into the fuel pump

Truck Spare Tire Shielded Against Road Grime



Heavy canvas shield protects truck tire against road grime and exhaust gases

To protect the spare tire of his truck against road grime and exhaust gases, which tend to deteriorate the rubber, one driver shielded it with a piece of waterproofed canvas. It is tacked to the underside of the body at the front of the tire, and is provided with fasteners at the rear end so that it can be dropped quickly to remove the tire.

"Police" Sign on Squad Car Illuminated at Night

To illuminate the sign "police" on squad cars at night, lamps were installed directly above the signs, shades directing the light downward. The lights were wired to a convenient switch on the instrument

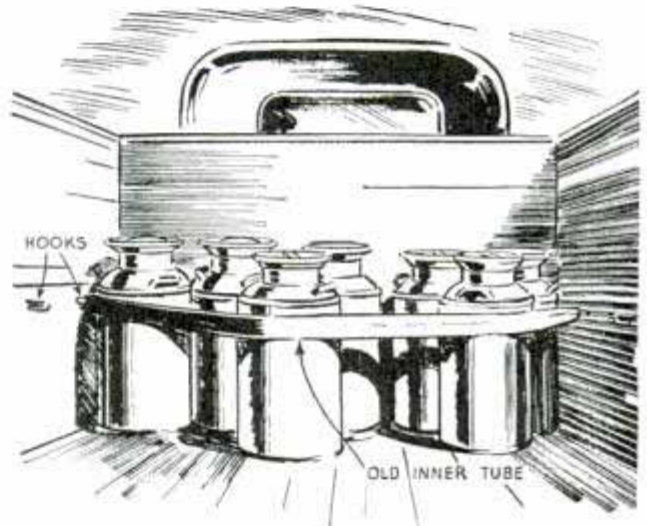


Police officers illuminate sign on side of squad car to show motorist their identity

panel and to the wiring at the ammeter. Where signs are located on the door panels, a length of heavy standard rubber-covered cable should be arranged to permit the door to open fully without any strain on the cable. Rather than using a shaded lamp of the usual type, which would project too far and perhaps be subject to constant breakage, a flat, wide fixture can be used. It would not be difficult to install a small socket inside a brass drawer pull to suit the purpose.

Cream Cans Kept Upright

Truckers who haul cream cans and similar containers will find that an old inner tube stretched across the body of the truck as indicated will hold the cans so



Inner tube stretched across truck keeps cream cans and similar containers from upsetting on rough roads

that they will not bounce around and tip over. Heavy wire rings on the ends of the tube engage hooks placed at intervals in the truck sides which permit the tube to be adjusted for a few cans or a full load.

Repairing Worn Adjusting Screws on Valve Tappets

Sometimes the top of a valve tappet wears concave where the stem hits directly on the face of the adjusting screw, making it impossible to set the tappet clearance accurately. When a thickness gauge is slid between the stem and the screw, it passes over this concave surface and only measures the space between the valve stem and the outside edge of the adjusting

screw, thus making an inaccuracy in the adjustment equal to the depth of the concave surface. Instead of going to the expense of buying new adjusting screws, I remove them and grind down the face on the flat side of an emery wheel, after which they are smoothed on an oilstone.

—Raymond Moore, Roosevelt, L. I., N. Y.

Window Glass of Car Covered While Painting

Before spray-painting a car, coat the windows with a thin paste of powdered chalk and water. Then, after the job is finished, a dry cloth rubbed over the glass quickly removes the dry chalk, and any paint that got onto the windows.

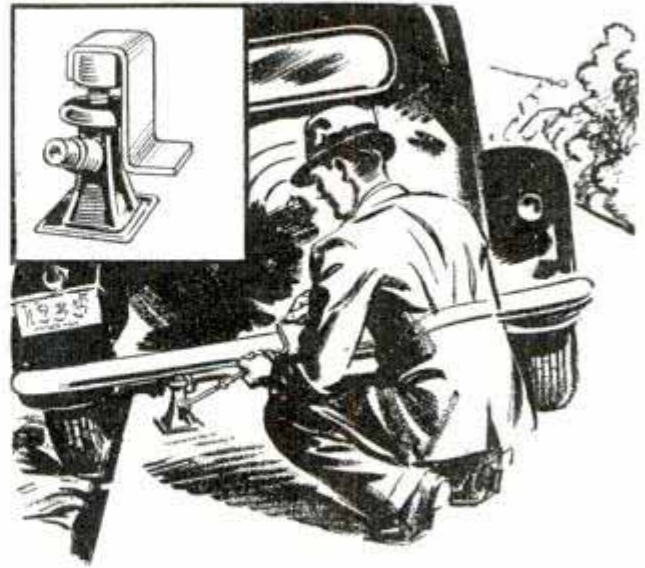
Step Cut in Corner of Tailboard to Enter Truck

By simply cutting a semicircular opening in the lower corner of the tailboard, one driver provided a step to enter the rear end of the truck. The bottom of the step is covered with a piece of angle iron to prevent wear on the wood.



This step is never in the way and is always right where you want it when the tailboard is lowered

Car Jack Has Underslung Arm to Raise Low Axle



If you get a rear wheel down in the mud, this attachment will enable you to raise it with the jack

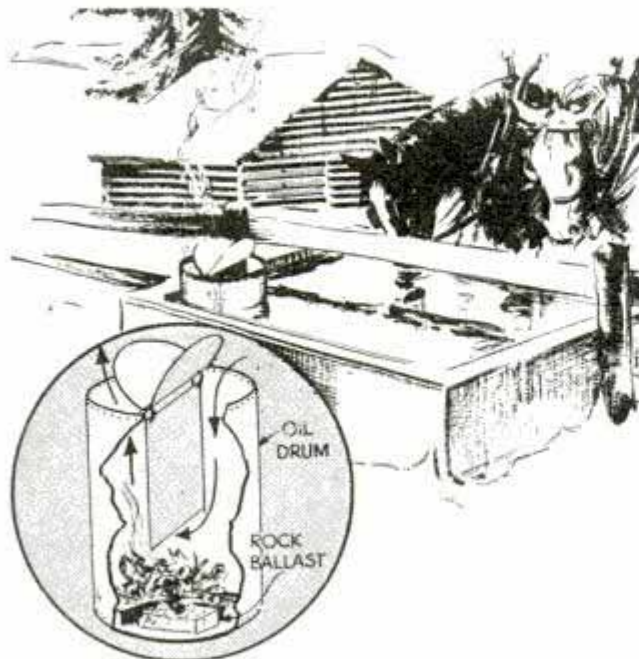
Have you ever accidentally run off the road and got stuck on the soft shoulder along the pavement? If so, you probably found that the rear axle was too low to get the jack under to raise the wheel so that something could be placed under it to afford traction. For such emergencies, a short length of heavy flat iron bent to the shape shown and welded to a collar that fits over the top of the jack screw, can be carried in the car. The lower end of the flat-iron piece is slipped under the axle.—Opie Read, Jr., Chicago.

Separating Spot-Welded Metal with a Drill

In repairing car bodies, one mechanic finds that he can separate spot welds by drilling through them with a $\frac{1}{8}$ -in. drill. If the drill does not separate the welds, it weakens them enough to permit prying them apart with a screwdriver. In reassembling the parts, the drill holes can be used for rivets if the nature of the work permits their use. Otherwise, the holes can be filled with solder.



Oil Drum to Heat Water Tank Has Novel Draft Arrangement



This inexpensive tank heater will burn wood, coal, corncobs or other solid fuel

Costing practically nothing, this watering-tank heater is simply an oil drum with the upper inside portion divided by a

sheet-metal flap so that a draft is provided over the fire in the bottom. The top is cut so that two sections may be bent upward to serve as deflectors, and the flap, which is equal in width to approximately the inside diameter of the drum, is suspended within 12 in. of the bottom. When the heater is sunk to the bottom of the tank with rocks, and a fire is started, air enters at one side while the fumes and smoke go up the other.

Cement to Hold Tool Handles

Cement to hold tools in their handles can be prepared by mixing rosin, 4 oz., beeswax, 1 oz., and fine brick dust, 1 oz. Grind the rosin and brick dust to as fine a powder as possible with a mortar and pestle. Then melt the mixture, stir it thoroughly and fill the hole in the handle. While the mixture is still molten, force the tool into the handle. To give added firmness, it is a good idea to roughen the tool shank with a file before forcing it in place. The melted cement may be poured into molds and be kept for use as required.

The Next Issue

MASTERING ROD AND LINE TO CAST A FLY

There's a real thrill in whipping a fly over fast water but you must know the tricks in handling the tackle used by fly fishermen. This article gives suggestions on selecting the proper rod—why a tapered line is generally used, the fine points of casting the fly, etc.

ELECTRIC FURNACE GIVES HIGH TEMPERATURE

Especially useful for annealing and enameling metals, certain heat-treating jobs and the production of alloys, requiring temperatures up to 1650° Fahr.

TOY STEAM ENGINE HAS ROTARY VALVE

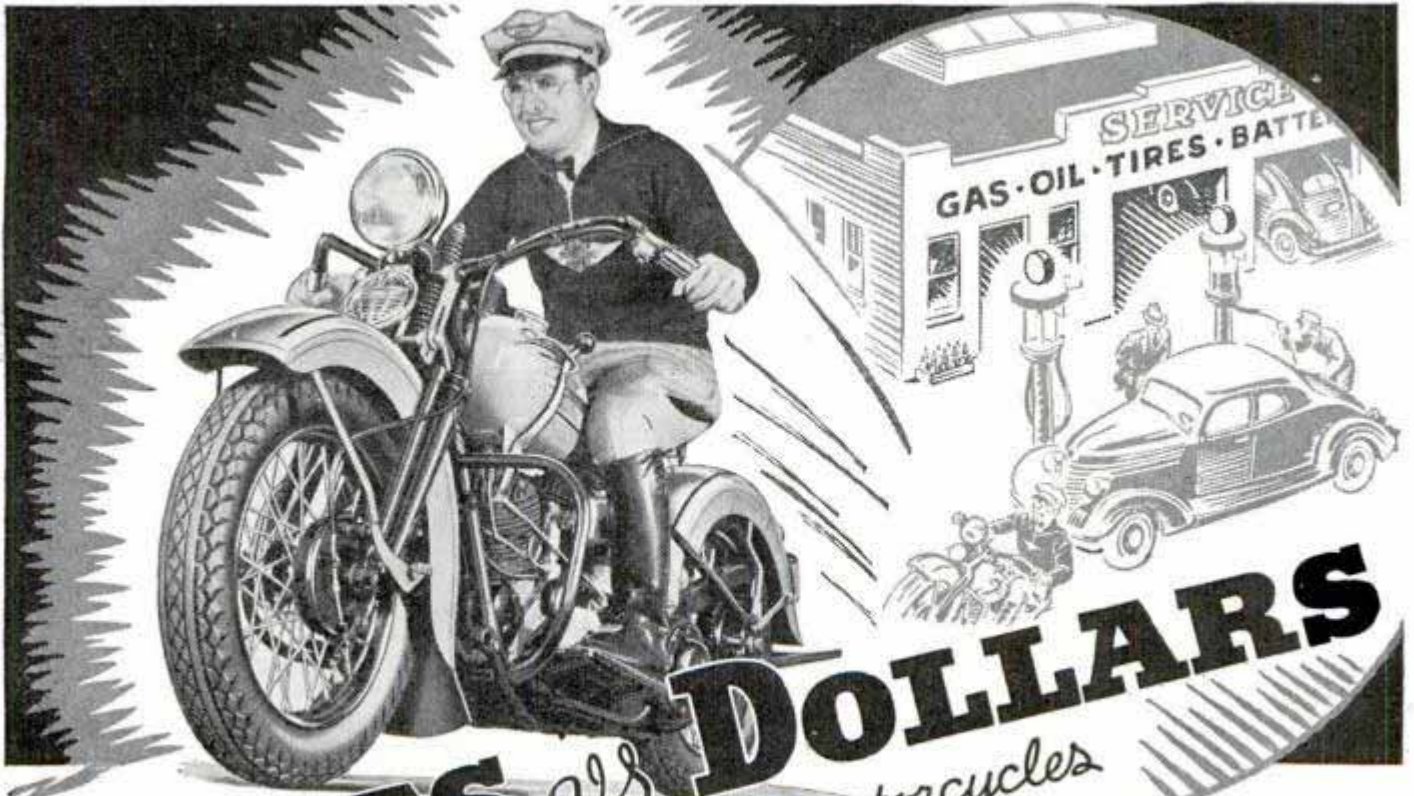
High-speed engine that will propel toy boats, autos, cranes, steam shovels, etc. Practically all the work is done with file, drill and soldering iron.

THE "MAYFLOWER" IN MINIATURE

This 11-in. model of simplified design is easy to construct. The hull consists of three wood blocks roughly cut and then carved and sanded to shape.

MONTEREY BREAKFAST SET

Buffet, table and chairs in Spanish style, reminiscent of early California. To build it, use ordinary hand tools and lumber which is available in any locality.



DIMES vs DOLLARS

with HARLEY-DAVIDSON Motorcycles

It's vacation time! And the ground you can cover—the number of places you can go—need no longer depend on the size of your pocketbook. When you own a 1937 Harley-Davidson—dimes will take you where it costs dollars to go by other transportation methods! The 1937 models are built for stamina....but they're built for economy, too! Stream-line design and snappy color combinations are matched by motor improvements that give greater sustained horsepower, that cut gas and oil costs to the bone. You don't have to be a millionaire to run a 1937 Harley-Davidson....but you sure feel like a millionaire when you ride one!

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My age is 16-19 years, 20-30 years,
 31 years and up, under 16 years,
Check your age group.

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Camera Shots That Click

(Continued from page 685)

desert sun was not enough for the movie cameramen when they were filming "The Garden of Allah" recently, and high-powered lamps were called for to help Old Sol produce the effect of intense sunshine. If you are trying for a picture of angry



Dramatic lighting in this self-portrait was achieved by holding a single photoflood below the face

clouds after a storm, with sunlight bursting through, underexpose the negative to enhance the dramatic effect. In trapping lightning with your shutter, be careful not to overexpose. Train the lens at a point where lightning is most frequent, open the shutter at "time" and close it after the flash. But remember that lightning is intense, and a very small lens opening is sufficient—an aperture of perhaps f22 or f32.

Night scenes require practice, but today such sensitive film is available that pictures made by long exposures a few years ago are taken in a few seconds today. To show the versatility of film, two men took prizes for snow pictures "shot" at night with only street lights for illumination; one made an exposure of less than a minute on fast film with an aperture of f11, the other used a slower film, an aperture of f4.5 and an eight-minute exposure. An-

other thrilling moonlight scene in winter was given a thirty-minute exposure at f6.3. Only by your own experience can you be sure what your camera will do.

For an unusual scene of a city at night, place the camera on a windowsill or tripod and, at dusk, make an exposure of one-third the usual time; then leave the camera undisturbed, shutter closed, until lights appear in the buildings. A second short exposure of the same film then will record the city lights. If you try planting the moon on your film with a long time exposure, you'll find, of course, a curved white track in the picture, for the moon moves. Instead, when the moon is hanging just where you want it over the mountain or back of the elm tree, screw the camera on a tripod, aim, and fire—leaving the shutter open only a few seconds to capture the moon; then when the moon has passed out of the scene, give the landscape its longer second exposure. To film a night scene in broad daylight, face the sun, shading the lens with your hat to prevent direct rays striking the lens. Undertime the picture to produce the effect of darkness, and, if you like, double-print a moon in the sky. A figure, tree, or boat in the foreground improves such a scene.

Attractive family pictures suitable for greeting cards are easily made. Seat the family around the fireplace, placing the camera at one side to focus on their faces. Run an extension cord into the fireplace and instead of a log fire put a flashlight bulb there. When everything is set, open the lens, set off the flashlight and close the lens. The light on your subjects will appear to be that of the fireplace, and the effect may be enhanced by dyeing the print red. For a picture of the log fire itself, try a double exposure, the first to obtain detail of the fireplace and room before the logs blaze up; the second after setting a match to newspapers under the wood.

There is a world of fun in table-top photography, building landscapes of doll houses and twigs and cotton snowmen, lakes of glass and rivers of Cellophane, and clouds of cotton or cigarette smoke. Dolls and toy soldiers and animals are the

(Continued to page 136A)

MAN BEATS NATURE AT OWN GAME



Saves Money for Motorists with Man-Made Rubber for Spark Plug Wiring!

What does the development of man-made rubber have to do with the performance of *your* car? Just *this*: Those vital, power-giving spark plug wires in your car wear out *all too soon*. Their cotton braid and lacquer covering (both of vegetable origin) can't forever stand the torture of heat, cold, oil and abrasion that goes on under the hood! This covering breaks down—often within 10,000 miles of driving. Then corona, an "electrical field" which surrounds any high-tension wire, reacts on air to form ozone—and ozone destroys the insulating power of *rubber*! As soon as this deterioration takes place, your car loses pep—gets away slowly at traffic signals—starts poorly—and wastes costly gasoline.

Again Science Supplies the Answer

Packard, oldest and largest maker of automotive wiring, has continually applied the discoveries of science to improve its products. And from the scientists Packard obtained a secret-formula inorganic compound that resists all the formerly unbeatable

enemies of spark plug wire—oil, heat, cold and corona. This new man-made rubber, derived from coal, salt and water, now sheathes Packard FOUR-FORTY spark plug wires—providing protection that is impossible with coverings of vegetable origin.

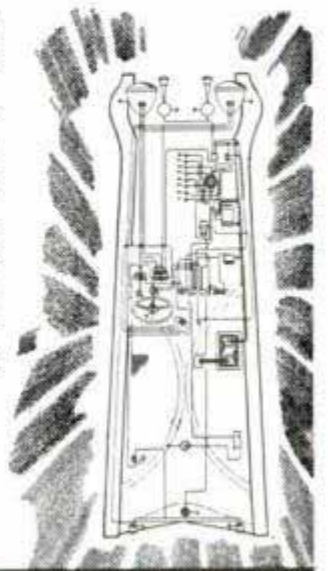
Packard FOUR-FORTY Pays for Itself

Packard FOUR-FORTY spark plug wires, in sets for all cars, are available at better garages and service stations; and take only a few minutes to install. A set of Packard FOUR-FORTY spark plug wires will pay for itself in gas saved and in the elimination of minor repairs caused by weak and irregular firing.

When you prepare your car for summer driving, remember that the *wiring system* is the nervous system of your car. Efficient, trouble-free operation of lights, battery, generator, spark plugs—all depends on proper wiring. Don't drive with costly faulty wiring any longer. Re-wire with Packard FOUR-FORTY spark plug wires, and replace worn battery cables and ground straps with genuine Packard cable today! Packard Electric Division, General Motors Corporation, Warren, Ohio.



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THE STANDARD WIRING EQUIPMENT OF THE AUTOMOTIVE INDUSTRY

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Strange Lingo of the Movies

(Continued from page 726)

tains five globes each of five-kilowatt rating. It is used to evenly illuminate large surfaces, while the "orange-peel" is used for lighting flat wall surfaces. Other lights such as the "strips" containing a series of



"Standing chair" permits actor to rest between scenes without wrinkling costume

globes in a row, "mamma Dietz" lights, "square-heads," "eighteen-inch," "twenty-fours," "thirty-sixes," are only a few of the lights used. The largest light is the "sixty" which means the light is six feet across the face with a six-foot reflector.

"Save it" or "cut the hardlight" means switch off the lights. A "pin-box" is a plug at the end of an electric cable into which may be plugged a number of other cables. "High-stuff" is the lighting paraphernalia anchored above the settings on "parallels" and "catwalks." "Parallels" are platforms usually set on rollers, ranging in height from two feet to thirty or forty. A "nigger" is a flat, black shield used to prevent illumination on the set from striking the camera lens or spreading to unwanted places.

A "mixer" is a sound engineer who controls volume of the dialogue or music and blends the various sounds for proper dramatic effect during the filming of a scene. "Get the 'duck' nearer" means, to a sound

man, that the microphone should follow the players more closely. The "duck" or "mike," is suspended over the actors' heads out of "camera lines" on a "boom."

After suitable rehearsals of the actors and all is in readiness for filming, the assistant director shouts, "Silence, roll 'em!" In a few moments off to the side of the setting comes the announcement from the sound man "Speed," then the director shouts, "Action; camera!" That procedure, which has become ritualistic in all studios, first, starts the motors going, then announces when they have attained speed, and the orders for the actors to start the action. If the "take" is good the director says, "Print that one" which means that he wants to see the scene on the screen the next morning. The film shown the director the next morning is called "rushes" or "dailies" because they are rushed through the finishing laboratories for a trial projection. A "lily" is a "good take."

An actor who wrings his hands and overacts "chews up the scenery." "Turn



© R.K.O. Radio Pictures, Inc.

"Character lights" enhance illumination during filming of outdoor scene

on the personality" is the dance director's way of saying that he wants his "lineup" to smile and be more vivacious.

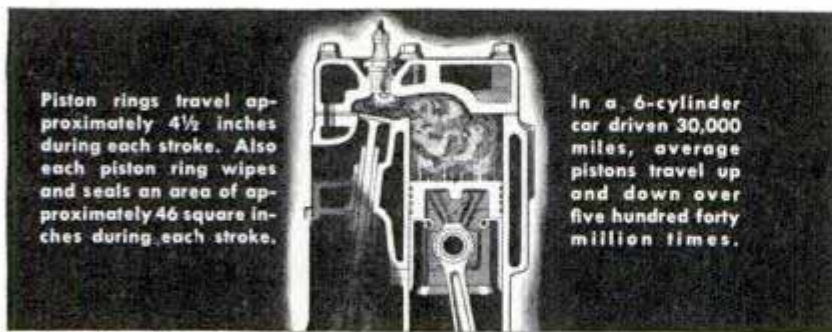
When the day's work is done, all the workers understand "wrap it up" as time to go home. Will Rogers varied this with "All right, Santa Monica Canyon."

Clayds of London

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New Engines for Old

WITH MIRACULOUS NEW-TYPE EXPANDER PISTON RINGS



Piston rings travel approximately $4\frac{1}{2}$ inches during each stroke. Also each piston ring wipes and seals an area of approximately 46 square inches during each stroke.

In a 6-cylinder car driven 30,000 miles, average pistons travel up and down over five hundred forty million times.

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50 Times a Second the pistons flash up and down when you drive at about sixty miles an hour. When cylinders become worn, they are larger at the top than at the bottom. That means the piston rings must expand and contract fifty times a second to seal

the cylinder walls properly. Ordinary rings aren't equal to this terrific task, but Perfect Circle X-90 Piston Rings have solved the problem. They have an amazing ability to flex lightning-fast and seal worn cylinders without paralysis, even at highest speeds.

New-Car Pep and Oil Mileage Restored by PERFECT CIRCLE X-90 RINGS

AT LAST a piston ring that actually cuts piston drag! No towing the car after installation. No breaking in. It seals even badly worn cylinders. Brings back original performance and oil mileage. Doesn't paralyze even at highest speeds.

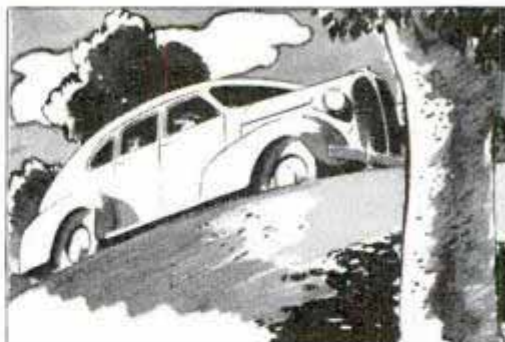
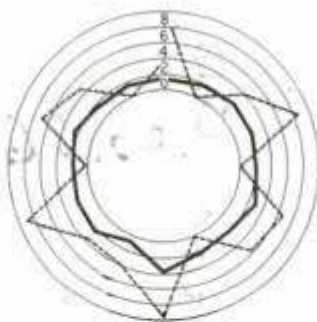


"Nope! Don't Need Oil." Increased oil mileages up to 500% amaze owners who install Perfect Circle X-90's

Why the X-90 Saves You Money.

Six individual double-leaf springs operate independently, giving the X-90 ring amazing flexibility. Friction and piston drag are cut to the vanishing point. The heavy black line in this pressure chart shows the uniform, circular pressure of X-90 rings. A better seal is effected. More oil and compression are saved.

The dotted line shows how old-type expander rings "stiff-arm" cylinder walls. The pressure varies from 12 pounds to zero.



Old Bus Takes It in High. Worn cylinders mean lost compression. Horsepower snaps back to new-car pep with X-90 Rings

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Stop and Go at the World's Busiest Airport

F1323

(Continued from page 733)

fly by ear alone. The technique of piloting while blindfolded was demonstrated recently by Luis de Florez, member of the Council of the Institute of Aeronautical Sciences, who flew for forty minutes at a time, depending solely on the ability of his brain to interpret differences in sound which occur when sound waves strike the ear unevenly. Mr. Florez showed he could pull a plane out of a spin while blindfold-



Dusk at Newark airport and a transport plane waddling down the field for a night flight

receiving orders from his company's operations office. If the weather is thick and the visibility is very poor, the trip may be held up indefinitely. The different companies have different rulings, but ordinarily, a plane does not leave the ground unless visibility is more than 500 feet.

When the weather is thick, the pilot is like a blind bird. The traffic officer may tell him to fly for ten minutes on a compass course of 150 degrees, without turning in either direction. If he clears the overcast, the pilot is then allowed to take care of himself. Ordinarily the pilot traveling on a compass reading of zero to 179 degrees must fly at an odd altitude, that is, 3,000, 5,000 or 7,000 feet. When traveling between 180 to 359 degrees, he must fly at an even altitude. Thus from Boston to Newark he flies at an even altitude, and from Newark to Boston, he flies at an odd altitude. The department of commerce assigns different altitudes in a fog. If the regular altitudes are unsuitable, the pilots may travel at emergency altitudes of 4,500 feet westbound and 3,500 feet eastbound.

ed. Such experiments are expected to be of assistance to transport pilots who must fly through "soupy" weather. The hearing sense can be a valuable check on the accuracy of flying instruments.

One of the marvels of aviation is the system by which pilots are enabled to keep "on course" from city to city without having to navigate by landmarks. Radio stations are about 200 miles apart, and they send two Morse signals, the letter "A," which is "dot dash" and the letter "N," which is "dash dot." If one of these signals is superimposed upon the other, the combined signal becomes the letter "T," merely a dash, signifying the pilot is on course. If the pilot flies on a "T" he goes directly to the source of the signal, a "cone of dead silence." When the radio suddenly goes dead, he knows he has arrived at his destination.

However, the pilot usually knows his position before he reaches the cone of silence. Upon nearing the airport, he "checks in" and identifies himself. No commercial pilot leaves Newark airport without first

Three agencies direct the operations and movements of commercial aircraft. First, the traffic tower, then the company operations office, and finally, the department of commerce. The latter employs men to broadcast weather, maintain the radio beacons, transmit information and inter-city traffic movements and enforce the federal regulations regarding the altitude at which planes fly.

Mine Drill Digs Five-Foot Hole Fifth of a Mile Deep

Future possibilities of mining with a newly developed drill are enormous, according to the American Institute of Mining and Metallurgical Engineers. The drill digs a hole five feet in diameter and 1,125 feet deep, slightly more than one-fifth of a mile. When the 1,125-foot level is reached a chamber can be hollowed out and operations repeated for another 1,125 feet, and so on. The drill works on the principle of the old-fashioned cookie cutter except that it carves out a cylindrical section of rock weighing about eleven tons.

City, Calif.
es 186
Newada
1907-1923
Newson
Idaho Maryland



S. S. VAN DINE

Celebrated author of popular mystery thrillers and creator of "Philo Vance"

40-50-60 MILES AN HOUR! THEY ALMOST HAD THEIR MEN WHEN... *BANG!* A BLOW-OUT!

Read S. S. Van Dine's breath-taking description of Sergeant McCabe's* thrilling man hunt

"**T**HERE they are! Not more'n a quarter mile ahead of us. We'll overhaul 'em before they reach the Bad Lands." Sergeant McCabe's voice was excited and triumphant.

And just then a sharp explosion rent the air, and the police car leaped from the narrow road and lurched crazily to a sudden stop in a rock-strewn sandy field.

"A blow-out!" snarled the driver. In the distance the faint tail-light of the criminals' car could be discerned, rapidly disappearing into the now unbroken blackness.

"No chance now," the Sergeant complained sullenly. "They've escaped."

The criminals did escape that time. But, thanks to the persistence of Sergeant McCabe and his men, they were later captured.



It's bad enough to have a man-hunt frustrated by a bursting tire. Think of how terrible it must be, though, to have an innocent, carefree motorist start off on a pleasure trip only to have a blow-out catapult his car crazily into anything that blocks the way.

The solution to all this havoc on the highways has seemed to me to depend on the manufacture of a *safer* tire. That's why the invention of the Life-Saver Golden Ply by Goodrich should be the "Good News" to every American Motorist that it was to me. As one of the Goodrich engineers explained, "This Golden Ply, which is now found in every Silvertown Tire, is a layer of special rubber and full-floating cords, scientifically treated to resist the terrific blowout-causing heat generated inside *all* tires by today's high speeds. By resisting this heat, the Golden Ply provides motorists with *real* protection against high-speed blow-outs."

No wonder thousands of motorists are changing to Silvertowns. Silvertowns *below* mean *safety above*. Remember, you can purchase these at Goodrich Silvertown Stores and Goodrich dealers everywhere.



**Names and localities are fictitious, but the episode is suggested by an actual occurrence.*



Goodrich SAFETY Silvertown

With Life-Saver Golden Ply Blow-Out Protection

The Bean that Made Good

(Continued from page 662)

pasture hogs, usually as a supplement to a corn ration. Soybeans also improve the soil by increasing the nitrate content.

The bean, after removal from the hull, lends itself to a wide variety of treatment for the production of food for human consumption and stock feeding, and for a surprisingly wide variety of industrial products. The soybean, rich in protein but low in starch, contains a high percentage of both fat-soluble and water-soluble vitamins, and other materials that make it a desirable food.

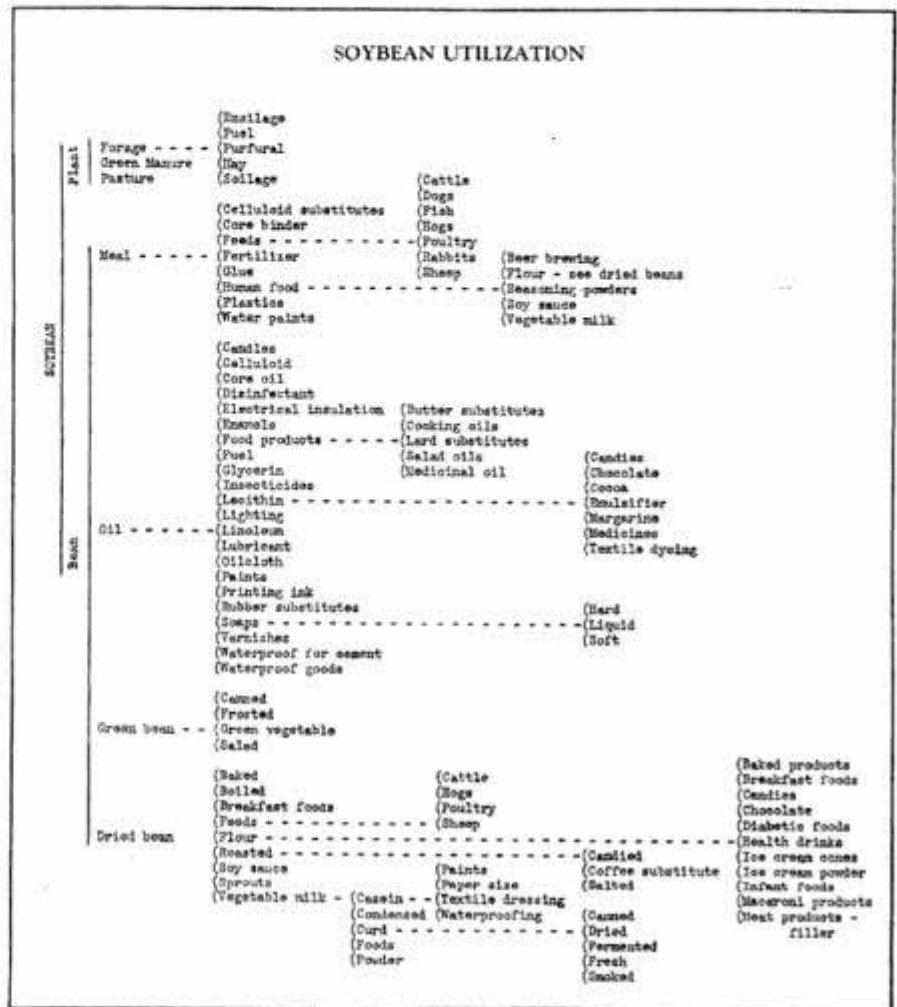
Soybeans may turn up at the dinner table in a variety of forms. The dried beans can be prepared like navy beans. Dried soybeans, properly roasted, become the basis of a cereal beverage resembling coffee. Shortly before they mature, they can be prepared like green peas or lima beans. The oil is extracted either by pressing or by removing it with solvents, which later are recovered and used over again. Extraction of the oil leaves a compressed cake, which can be put to a great many uses.

Soybean flour is produced by grinding either the whole bean, the pressed cake, or the cracked or flaked bean from which most of the oil has been removed by a solvent. It has been used for years as a food for invalids and infants. The flour, when mixed with wheat flour in about the proportions of one-fourth to one-half soy flour, makes baked goods which, because of the low starch content of the soy flour, are suited for diabetic persons and others who require a low-starch diet. Soy flour is rich in vitamin B, contains considerable vitamin G and some A; and vitamin C is present if the flour was made from germinated seed. Soy flour is a cheap food, be-

ing surpassed only by lard, sugar and corn meal as a cheap source of energy.

Refined and deodorized soy oil can be used, like any other table oil, for salads, in cooking, and in the manufacture of butter and lard substitutes. The best known soy food outside of the orient is soy sauce or shoyu. It is a dark-brown liquid used as a condiment or relish. A mixture of cooked soybeans, roasted wheat or barley, salt and water is ground up. A culture of bacteria called rice ferment is added and the preparation stored in vats for six to eighteen months to ferment. Food experts have recommended soybean sprouts as a green vegetable for the winter diet. These sprouts are obtained by arranging seed beans on a cloth that is kept moist, and letting them germinate and grow until the shoots are two inches long.

A vegetable milk that closely resembles



This chart shows the scores of uses for the lowly soybean. Note that both the plant and the bean are utilized

\$80,000 — Awards for boys in the United States

Fisher Body Craftsman's Guild announces
TWO competitions for 1936-37
of which one is new and entirely different

- ➔ Four \$5,000 University Scholarships
- ➔ 882 Cash Awards Ranging from \$25 to \$100
- ➔ 36 Trips to the 1937 Guild Convention
- ➔ **922 AWARDS IN ALL!**

Here is the biggest and most interesting news that you have read in a long time. If you are from 12 to 19 years of age, you are eligible to try for a university scholarship, or for one of

the many cash awards, or one of the all-expense-paid trips offered by the Fisher Body Craftsman's Guild in these two competitions.

There are TWO competitions THIS year!

1. Napoleonic Coach Competition

The Napoleonic Coach project remains the same as it has been for the past 6 years. In it, you build a miniature model Napoleonic Coach to the same specifications as in the past. In this competition forty-nine boys have won scholarships ranging from \$500 to \$5000 during the past six years. This year, there are state and regional awards which add to the interest of the competition.

2. Model Car Design Competition

The Model Car Design competition is new and will appeal to all of you who would like to try your hand at something different. You start from scratch here. All you have to do is fashion a miniature automobile embodying your own ideas of motor car design. This competition has to do only with the outside appearance or design of the car.

So send in the COUPON at once

The requirements are simple. Decide now whether you choose to build the Napoleonic Coach or a modern automobile of your own design. Then fill out and mail the coupon for membership in the Fisher Body Craftsman's Guild.

As soon as we hear from you, we will send you free of charge your membership card, the official Guild button, and all the scale drawings, specifications, and instructions you will need to construct either the Napoleonic Coach or the scale model automobile of your own design.

These drawings, specifications, and instructions show everything to do in making your coach or car—step by step. You can't go wrong.

But the more time you have, the better job you can do. Don't wait. Fill out the coupon now, tear it out, and mail it at once.

There are no dues or fees. Guild membership and competitions are open to all boys in the United States between the ages of 12 and 19 inclusive.

\$80,000 in Scholarships, Cash and Trips. 922 Awards

1

Napoleonic Coach Competition
 216 Awards, Cash Value, \$32,650

Grand National Awards TOTALS
 1 Junior and 1 Senior, 2 Scholarships—
 \$5,000 each \$10,000

1st State Awards

1 Junior and 1 Senior, in each of the 48 states and District of Columbia—
 \$100 each \$9,800

2nd State Awards

1 Junior and 1 Senior, in each of the 48 states and District of Columbia—
 \$75 each \$7,350

18 Regional Awards

A trip to the 1937 Guild Convention for 9 Juniors and 9 Seniors.

2

Model Car Design Competition
 706 Awards, Cash Value, \$47,350

Grand National Awards
 1 Junior and 1 Senior, 2 Scholarships—
 \$5,000 each \$10,000

1st State Awards

1 Junior and 1 Senior in each of the 48 states and District of Columbia—
 \$100 each \$9,800

2nd State Awards

1 Junior and 1 Senior in each of the 48 states and District of Columbia—
 \$75 each \$7,350

3rd State Awards

1 Junior and 1 Senior in each of the 48 states and District of Columbia—
 \$50 each \$4,900

Four cash awards of \$25 each for both Junior and Senior in each of the 48 states and District of Columbia \$9,800

18 Regional Awards

A trip to the 1937 Guild Convention for 9 Juniors and 9 Seniors.

Rules and Regulations

In both competitions, the following regulations will prevail. Boys 12 years old or older, and not yet 16 on September 1, 1936, compete in the Junior division. Boys 16 years old or older, and not yet 20 on September 1, 1936, compete in the Senior division. All boys within these age limits are eligible for Guild membership. There are no dues or entrance fees of any kind. Each member shall receive, without charge, an Official Guild membership card and button, and a full set of Guild drawings and instructions. The Napoleonic Coach competition closes August 2, 1937 at midnight. The Model Car Design competition closes July 1, 1937 at midnight.

FISHER BODY CRAFTSMAN'S GUILD
 8-168 General Motors Bldg., Detroit, Michigan.

Gentlemen: Please enroll me in the Fisher Body Craftsman's Guild for 1937 in the

- Napoleonic Coach Competition,
 Model Car Design Competition.

Also please send me my official membership card, button, and full instructions, free of charge.

Name.....

Address.....

City..... State.....

I was born on the.....day of.....19.....

Be sure to check the class in which you wish to be enrolled.

FISHER BODY CRAFTSMAN'S GUILD

An Educational Foundation sponsored by General Motors

GENERAL MOTORS BUILDING • DETROIT, MICHIGAN

(Continued from page 120A)

2567
 cow's milk, both in appearance and nutritive value, is prepared from soybeans and used widely in the Orient. It is made by soaking dried soybeans in water for a number of hours, crushing them, and then boiling for a half hour in three times their volume of water. The milk is separated from the solid mash by straining. Milk can be made equally well from soybean cake or meal from which the oil has been extracted. The residue is valuable as a food for cattle, or for grinding into soy flour. If hot soybean milk is treated by adding rennet, lactic acid, calcium or magnesium salts, a grayish-white curd is precipitated. It is made into a considerable variety of dried, fermented and smoked cheeses.

Industrial applications of the soybean have centered largely about the oil. Soybean oil is a type known as a semi-drying oil. That is, it will dry into a solid if exposed to air sufficiently long. It is classed about midway between linseed and slow-drying cottonseed oils. Soybean oil is being used in paints and enamels as a substitute for part of the linseed oil. For making hard soap, it first must be treated with hydrogen, which makes it a substitute for cottonseed oil. Properly refined, the oil lends itself to an almost endless variety of uses in the manufacture of foods. It is also being utilized in the making of candles, printing ink, linoleum, waterproof goods, and for lubrication.

Water paints, glue, paper sizing, celluloid substitutes, medicinal substances, vegetable casein, textile waterproofing material, paper sizing and a vegetable milk powder are among the products that have been made from soybean meal either commercially or experimentally. Usually soybeans grown in this country are not bothered much by insect pests. Grasshoppers sometimes damage soy crops. They are combated by poisoning with arsenic or paris green. Blister beetles, or Spanish flies, also have caused trouble. They are killed by dusting with powdered sodium fluosilicate and hydrated lime.

Mexican bean beetles, leaf hoppers, and the green clover worms are the remaining most dangerous enemies of soybeans. The plants may be attacked also by other insects, and by bacterial blight, bacterial pustule, soybean mosaic disease, and several other ailments. An interesting disease

is root knot, caused by tiny eelworms or nematodes growing in the roots. Rabbits and woodchucks also sometimes destroy soybean plants but in general, the soybean is easier to raise than many other farm products. Its future will be made more secure by the activities of a soybean laboratory recently established at the University of Illinois, by the U. S. Department of Agriculture and twelve north central states. The soybean scientists at the laboratory are working toward three objectives—finding new ways of using soybeans in industry, and improving the applications already made; studying the effects of different processes on quality and quantity of soybean products and working out better methods of testing different varieties of soybeans as to adaptability for industrial uses.

It is the industrial angle that the laboratory will emphasize, at least for the present. Most future increases in growing activities are expected to be for the purpose of providing beans for use in making paints, foods, linoleum, rubber substitutes, insecticides, plastics, glycerin, varnish and a wide variety of other useful things. One thing the laboratory hopes to discover is why one variety of soybean shows analysis of twelve per cent oil and twenty-eight per cent protein under one set of conditions, and twenty-six per cent oil and fifty-four per cent protein under another. Lecithin, a product of soybean oil used in the making of medicines, candies, chocolate and margarine also is being studied.

The soybean, although one of the oldest known cultivated plants, seems just now to be on the threshold of a new era of popularity. Agricultural experts expect a sudden big increase in soybean growing, particularly in the middle west states. The demand for soybean products for industrial uses is greater than the supply, and importations reach a considerable figure. The future of the bean seems to be linked closely with the use of automobiles, modern houses and other products of our industrial civilization.

It looks as if there might be a lot of jack in the soybean stalk, for farmer and manufacturer alike. And the general public will benefit too, from new foods and the scores of industrial products this bean makes possible.

"Hello Old Man!"

Get yourself a Barbasol Face

Barbasol does to your face what it takes to make the ladies want to touch it.

Barbasol not only gives you the smoothest, sweetest shave of your life.

It also keeps your skin soft to feel, young and handsome to look at.

That's the beauty of Barbasol—no harshness to bite the skin. No dry, tight feeling after the shave.

Being a wonderful cream—no brush, no lather, no rub-in—Barbasol soothes and refreshes your face like the cool kiss of dawn.

If you have never tried Barbasol, buy a tube, use it for two solid weeks, and note how much



smoother and younger your skin looks.

Then you'll understand why Barbasol is favored by millions of men—why Barbasol is

America's fastest-selling shaving cream. Generous tube, 25¢; giant size, 50¢; family size, 75¢. And for 15¢, five scalpel-sharp Barbasol Blades. At all drug stores!

For modern shaving



No Brush—No Lather—No Rub in

PRIZES FOR GOOD GUESSERS

Are you good at guessing? If you are, you may win any one of the valuable prizes given away every week—a new automobile, big money prizes, hundreds of \$3 Barbasol Razors. Absolutely free to enter, takes only a few seconds to do. Simply guess a number, that's all. For details, tune in Singin' Sam (NBC Blue Network) every Friday evening. See local paper for time.

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Nomads of the Seven Seas

(Continued from page 717)

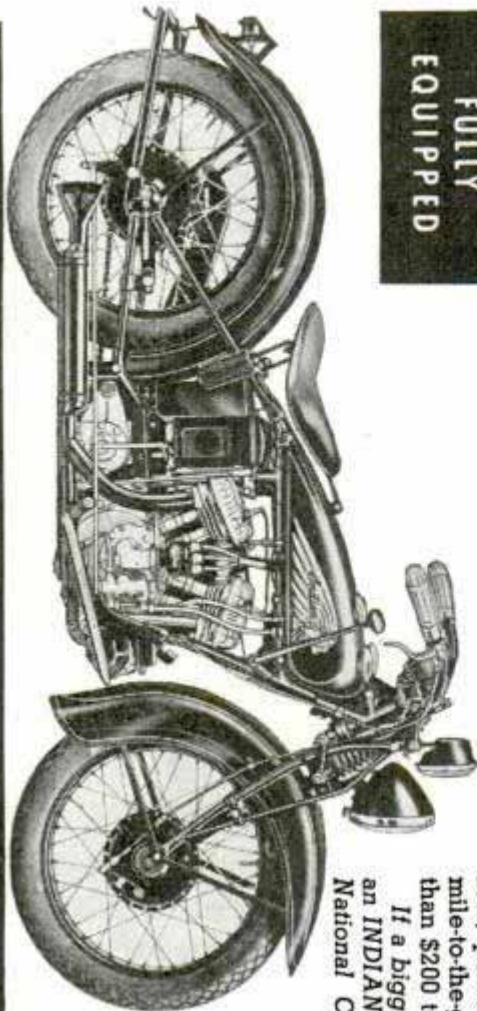
rangements are made ahead of time. A day or so before he is due in port a captain radios his expected time of arrival and later on, while he is still miles at sea, corrects it to within a minute or two. Preparations on shore are started while the ship is still out of sight. Before the ship arrives trucks are already backing up to the wharf. Longshoremen report for work and begin clearing space for handling the cargo. Goods on railway cars and trucks as far as 100 miles away begin moving toward the port so that loading of the new shipment can start as soon as the discharging is finished. While the cargo is being worked, fuel barges move up alongside the ship, fresh-water connections are made with the shore, and ship's stores and food supplies begin to come on board.

Even such a task as loading cargo is done according to a scientific plan. Masters and mates have to study cargo loading just as they study navigation and seamanship. If a vessel is to pick up general assortments of cargo at New York and Philadelphia for several Pacific coast ports, an officer prepares a chart of his cargo spaces and plans to take the shipments on board so that they can be unloaded without disturbing other consignments. Cargo for Portland, for example, must not be loaded on top of shipments to be discharged at Los Angeles or San Francisco.

At the same time heaviest items such as steel rails must be stowed low in the ship to preserve stability. Likewise heavy shipments are balanced fore and aft so as not to affect the trim of the ship. What are known as offensive items can't be stowed near materials that might be affected by them. It would never do to place a shipment of fishmeal near sugar, since the sugar would absorb some of the odor.

In the old days it was not uncommon for a tramp captain to load cargo for half a dozen different ports and then skip some of the stops if he learned of a richer shipment that could be had by hurrying elsewhere. In that case he would calmly discharge all of the cargo consigned to the ports he was missing at the nearest port of call, possibly 1,000 miles away. The owners of such shipments would know nothing about the changes in plan until

(Continued to page 126A)



F. O. B. FACTORY
\$195.
FULLY
EQUIPPED

FOR THIS GREAT TWIN CYLINDER

YOU CAN'T BEAT IT!

More motorcycle per dollar than ever before! A real, powerful, twin-cylinder motorcycle with 70 mile-to-the-gallon economy—yet costs you less than \$200 to own.

If a bigger machine interests you—Ed Kretz on an INDIAN SPORT SCOUT just won the 200-Mile National Championship Road Race at Daytona Beach, Florida, in record time.

You can see both of these machines at any Indian Dealer's—they can be bought on easy terms. And when you order you get a FREE RIDER'S HELMET and WINGED PIN!

Indian Motorcycle Co.,
Springfield, Mass.

Indian

JUNIOR

Scout



FREE



MAIL
COUPON
TODAY!

INDIAN MOTORCYCLE CO., Springfield, Mass.—Please send me at once, with or without obligation, the new Indian Motorcycles and related folder described in the new Indian Motorcycles and related folder of VALUE entitled when I place my order. CERTIFICATE of VALUE as illustrated when I place my order.

Name.....

Address.....

Please be sure to check your age group:

16-19 years

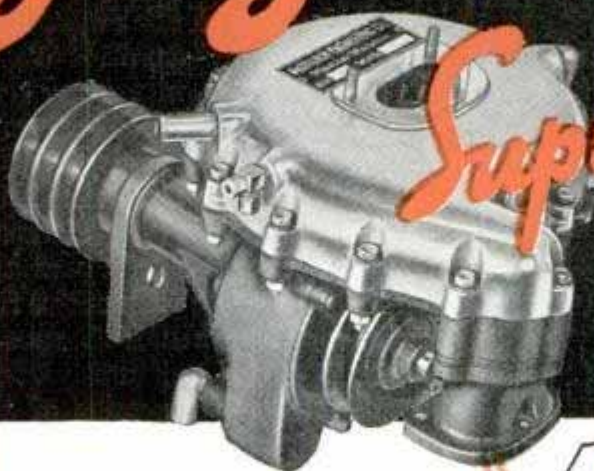
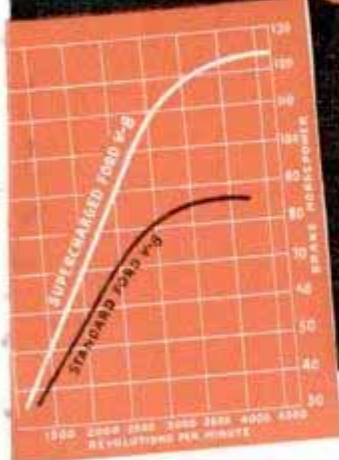
20-30 years

under 16 years

F.M.I.

31 years and up

THE *Mighty* NEW McCULLOCH



Supercharger

FOR FORD V-8 ENGINES

\$84.50

Develops 124 Horsepower!

Power that defies the steepest hill. Power that plows through stubborn desert sands. Power that makes you master of all traffic. 38 per cent more power by actual dynamometer tests! That's the quiet, overwhelming power you'll get from the *Mighty New McCulloch Supercharger*.

LIKE THE FINEST EUROPEAN ENGINES

For many years the highest priced cars in Europe have had supercharged engines. Airplane designers also employ them to compensate for reduced atmospheric pressures at varying altitudes — the perfect remedy for sluggish performance. Now you can have the utmost in motor car performance — saving gas and prolonging engine life.

7.3% to 19.7% BETTER GAS MILEAGE

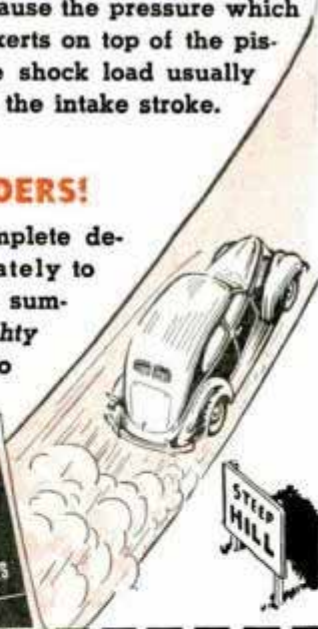
124 Horsepower! But even that's not all. Gasoline is mixed and distributed more efficiently with the *Mighty New McCulloch*. The already remarkable acceleration of the Ford V-8 engine is also increased. No wonder the McCulloch plant is already behind in its orders.

Fuel mixed by the action of the rotor in the *Mighty McCulloch* under tremendous centrifugal force, is

so well atomized and evenly distributed to all cylinders that there's amazing smoothness and steadiness. This Supercharger is also perfectly quiet. Any mechanic with the simplest tools can install it in a short time. Engine life is prolonged because the pressure which the incoming fuel mixture exerts on top of the pistons counteracts the reverse shock load usually imposed on the bearings on the intake stroke.

FACTORY BEHIND IN ITS ORDERS!

Mail coupon at once for complete details. You must act immediately to have this mighty power this summer! . . . Order your *Mighty McCulloch* today. Send no money. We will ship C.O.D.



McCulloch Engineering Co.
1327 S. 70th St., Milwaukee, Wis.
 Please send literature and further information.
 Please rush.....McCulloch Ford V-8 Superchargers to me at once C.O.D.

Mail Coupon **NOW!**

DEALERS: WRITE FOR FRANCHISE

Name.....
(Print or write plainly)
City..... State.....

67.



NOW'S THE TIME TO CLEAN OUT YOUR RADIATOR

PUT your car in shape for summer driving, right now. Remove anti-freeze and clean out all the rust and sediment that are clogging your radiator. You can do it yourself for ten cents—in a few minutes. Just get a can of Sani-Flush.

Pour a little in the radiator (directions are on the can). Run the motor. Drain. Flush. Then refill with clean water. Sani-Flush removes lime and scale from the cooling system. Opens the circulation of water. Insures an efficient flow through the cooling system. Sani-Flush cannot injure aluminum cylinder heads or motor fittings. Most bathrooms have Sani-Flush for cleaning toilets. Sold at grocery, drug, hardware, or five-and-ten-cent stores—25 and 10 cent sizes. The Hygienic Products Co., Canton, Ohio.

Sani-Flush *Safe NOT CAUSTIC*
KEEPS RADIATORS CLEAN

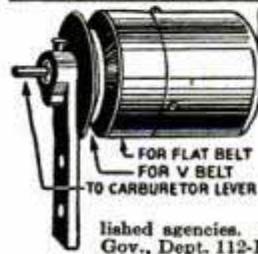
NEW BENJAMIN AIR PISTOLS

Powerful—Accurate—Economical—Practical—Adjustable Shooting Force—Amazing Maximum Velocity—cal. 177 or 22 and BB—For Target and Small Game—the only Genuine Compressed Air Pistol on the market—Single Shot with Bolt Action—Hammer Fire—Hair Trigger—Safety. Price \$7.50. Also 177 and 22 Single Shot Air Rifles \$7.50—Single Shot BB Air Rifle \$6.00—25 Shot BB Repeater Air Rifle \$7.50—at Dealer or Direct—No license required—Safe for indoor use. FULL DETAILS—TARGETS—FREE—WRITE TODAY. Benjamin Air Rifle Co., 691 N. Broadway, St. Louis, Mo.



AUTO ENGINE SPEED CONTROL GOVERNORS

To control speed of any make of auto or truck engine, regardless of load changes, when used as a stationary or portable power plant. Fully guaranteed. No cash down. Governor speed range from 400 to 3000 R.P.M. Fine opportunity for established agencies. Send for free circulars. Mrs. Candee-Smith Gov., Dept. 112-E 215 No. L. A. St., Los Angeles, California.



When writing to advertisers please mention Popular Mechanics

(Continued from page 124A)

they received storage bills for the goods from some waterfront warehouse.

In the past, also, the master of a tramp might advertise for cargo, collect the freight money in advance, and then sail away in the night, leaving the cargo on the wharf. Another way to make money was to sign on a crew and then haze them all through the voyage so that they would desert at the first port, leaving their uncollected wages behind them.

Unscrupulous masters used to load their vessels away past the point of safety in order to collect the freight money on a few extra hundred tons of cargo. Later on when load lines were required to be painted on the sides of ships the trick was to "hog" a vessel by overloading it at the bow and stern, thus bending the ship up in the middle so that the Plimsoll mark was still above water.

These days a seaworthiness certificate must be issued to every ship on each trip before leaving port. Before a certificate is issued the inspectors make sure that the ship is not overloaded and that the cargo is stowed safely. In some cases the inspectors may allow a vessel to sail even if it is slightly overloaded, if it is certain that she will encounter good weather during the first part of her voyage. By the time she reaches an area where rough weather may be looked for, weight losses from fuel consumed on the trip will raise the hull up above the line of safety.

es 189.

Steam Heat Keeps Road Clear of Winter's Snow and Ice

No matter how heavy the snowfall, a Pennsylvania estate keeps its road clear by steam heat. A discarded water-heater coil was installed in an empty oil drum below the road level. Two-inch galvanized iron pipe was run from the top of the coil along one side of the road and back along the other side, with a two-inch vent at the high point farthest from the heater. The pipe is buried eight inches deep. Gas is used for heating, and the system needs no attention except to introduce water through the vent once a month.

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

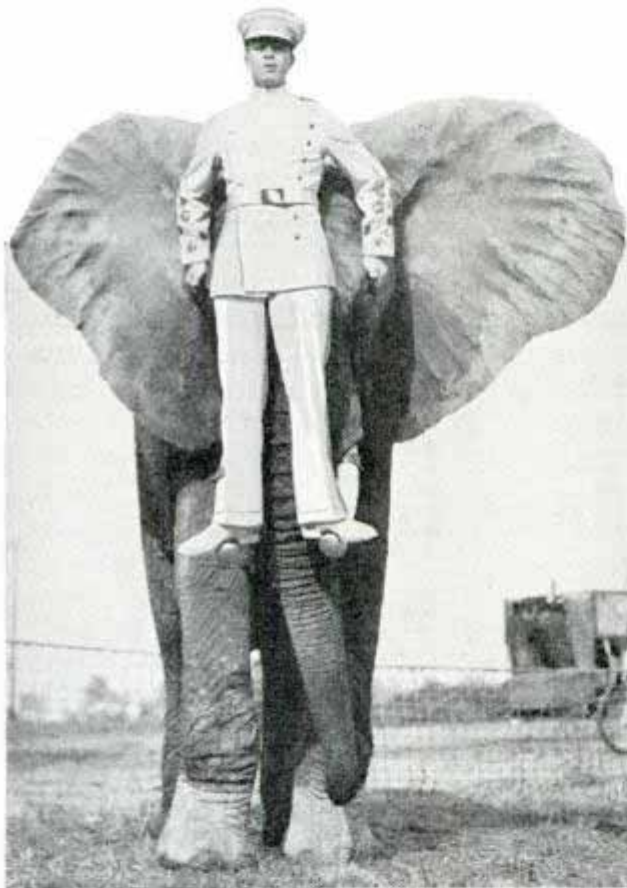
Wm. Wynne D. Brock. 166 Kansas St. Bradford Pa.

You're Wrong about Elephants

(Continued from page 676)

That a mouse could run up an elephant's trunk is ridiculous. On the tip of the trunk is a finger, or feeler as it is called, which is the most sensitive part of the beast's body. Here more than forty thousand nerves are centered and this finger acts as a cap to close the vents of the trunk. It is virtually impossible for anything to get into the trunk unless the elephant wants it.

To dispel the idea that elephants are afraid of mice I have taught one of my charges to pick one up with its trunk. The



Trainer Allen in circus uniform perches on the tusks of "Jumbo," giant pachyderm

stunt was successfully worked after two months of training.

An elephant's hide is not tough. The reputed toughness comes from inner muscles. The hide itself is so sensitive that elephants spend hours blowing dirt and chaff on their backs to keep flies from biting them.

An elephant has poor eyesight, but its sense of hearing is very acute. Sudden noises frighten it, but with training it grows accustomed to them. As part of a

(Continued to page 128A)

WIN PART OF \$200.00 CASH



FREE ENTER THIS BIG CONTEST TODAY

Write an advertising slogan for the spectacular 1937 Model Musselman Coaster Brake. See this superior coaster brake at your dealer's and read this advertisement carefully so you can write a winning slogan in 10 WORDS OR LESS. Here's a simple slogan, "The 1937 Musselman obsolesces all other coaster brakes." Your slogan must refer to the

MUSSELMAN Replaceable Cartridge COASTER BRAKE



THE AZ CARTRIDGE UNIT

Here are some EXCLUSIVE FACTS that will help you. The Musselman 1937 Model Coaster Brake is superior in every way; it is years ahead in mechanical simplicity and actually makes every old style brake obsolete. The AZ Cartridge can be instantly applied as easily as changing a razor blade. The smooth mechanism requires 10% less leg power for pedaling. Built for quick stopping and the only brake ever made that stood the Pike's Peak test—a steep 25 mile down mountain ride braking all the way. It is self lubricating. The only brake using only three moving parts while pedaling and no moving parts while coasting (except ball bearings). The brake that wins all coasting contests.

DEMAND THE MUSSELMAN 1937 COASTER BRAKE WITH YOUR NEW BICYCLE. IT WILL BE PROVIDED BY ALL MANUFACTURERS AT NO EXTRA COST. DON'T BUY AN OBSOLETE BRAKE — BUY MUSSELMAN.

Prizes are: 1st Prize \$100.00; 2nd Prize \$35.00; 3rd Prize \$15.00; and 25 prizes of \$2.00 each. Write your slogan and mail to

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

Musselman patented brakes are used today on leading airplanes because they are safe.

You're Wrong About Elephants

(Continued from page 127A)

bull's training we take barrels and steel drums to the loft of the elephant barn in winter quarters and drop them on the concrete floor below near the picket line. After repeating this a few times the elephants pay no attention to the noise.

Bulls become restless fifteen to twenty minutes before a thunderstorm. Their means of warning is to put their trunks high in the air as if to smell the moisture, at the same time trumpeting and weaving. If they are led into the open and chained to stakes with their heads facing into the storm, they will quiet down. Last year we were playing in upstate New York when a terrific wind and rain storm came up as the show was starting. The elephants were just out from under the menagerie top when it was blown down. The entire lot was thrown into a panic, but the elephants gathered in a huddle and did not move until the storm had passed.

In order to acquaint elephants with other animals, dogs and cats are housed in the elephant barn at winter quarters and run in and out among the big beasts' legs

without causing any excitement. In Tyler, Tex., in 1925, three lions escaped into the arena during the show. Gaining their freedom, two of them headed toward the line of elephants waiting to enter the arena. The crowd screamed and shouted. We expected the elephants to bolt as soon as they saw the charging lions. One of the lions darted between me and the lead elephant and ran in front of the entire group while the other cat ran to the rear. Instantly there was a low, sharp trumpet from the lead elephant. As though obeying a command the fifteen bulls immediately bowed their heads and remained in that position until the lions had been recaptured.

Last summer at a town in Pennsylvania, the six-horse team pulling the steel calliope bolted. The driver shouted to the elephant men just ahead to get the bulls out of the way. Immediately the elephant men started speeding the bulls until they were lumbering along at a full run. After seven blocks they were crowded onto a side street allowing the calliope to go by.

Easy Card and Rope Tricks

(Continued from page 709)

rotation until the deck has been exhausted. You turn your back and one card is taken from the middle of any of the four piles and placed on top of it. When all the cards have been gathered together again you go hurriedly through the deck and find the selected card.

Prearrangement for this calls for the removal of all cards of any one suit, placing six on top of the deck and seven on the bottom. The fact that there are six spades, for example, on top and seven on the bottom arranges them so that the top and bottom cards are each a spade. Thus when a card is selected from the middle and placed on top of the packs it is bound to be between two spades. Then by running through the deck you can detect the card instantly.

The vanishing aces trick deserves a place in the repertoire of every amateur magician. The four aces are removed from the deck and placed face up on the table and on top of each of these are put three

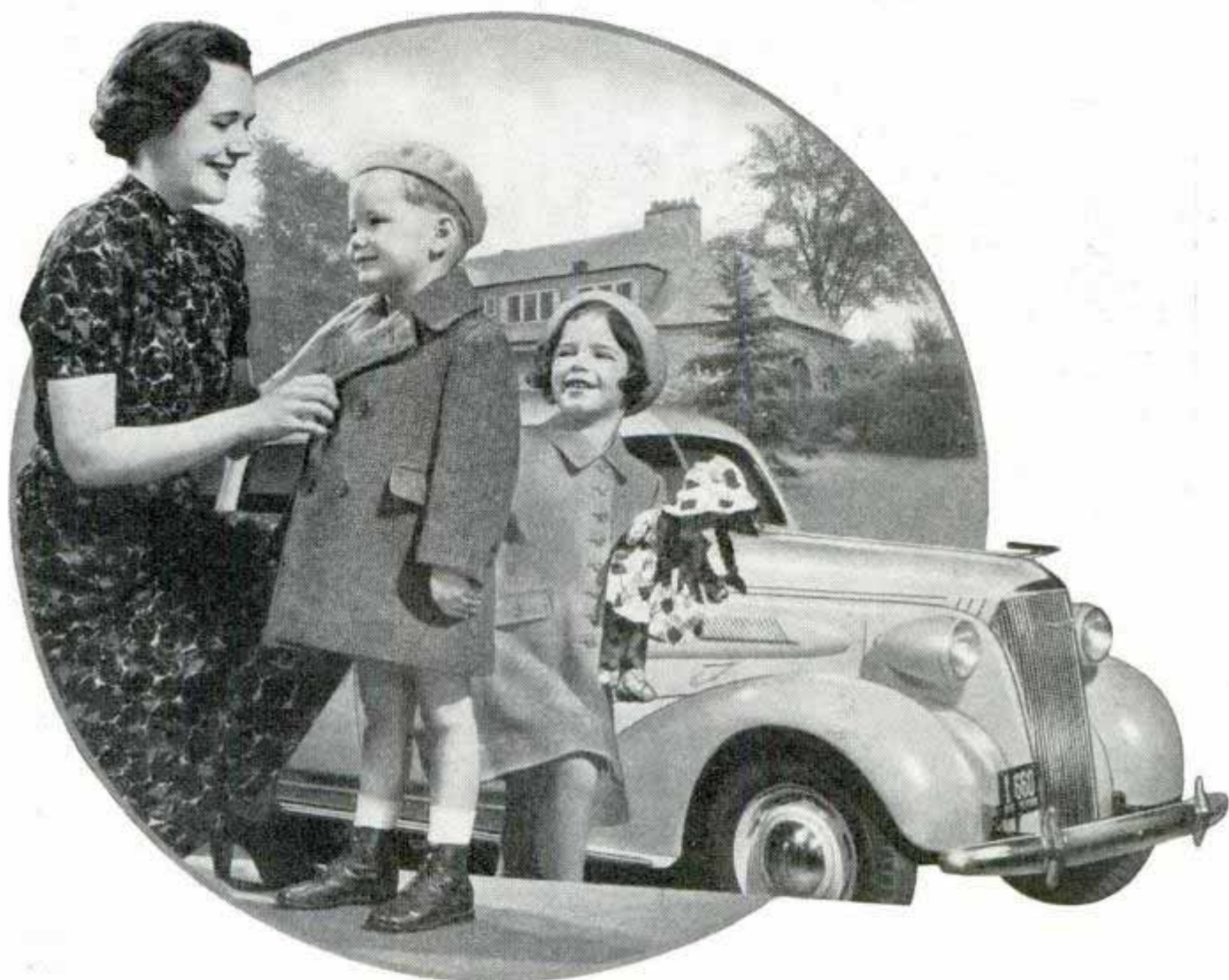
regular cards. The packets are picked up one at a time and the three indifferent cards of each are thrown off onto the table face downward. The aces are placed on the table the same way and the twelve remaining cards are returned to the deck and three packs of cards of four each are dealt off in rotation. While the spectator holds his hand over the pile containing the aces, you cause the aces to disappear from under the spectator's hand into another pile which you show the audience.

To do this, spread out the four aces with three regular cards on top of them. Pick up the first packet by the left hand with their faces upward. Discard the first two cards but upon coming to the third flip off the ace instead of the indifferent third card. This is done by shoving the third card out about half an inch. As the hand turns over the thumb draws the third card back into the palm and at the same time the fingers throw the fourth out in its stead.

(Continued to page 130A)

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Easy Card and Rope Tricks

(Continued from page 128A)

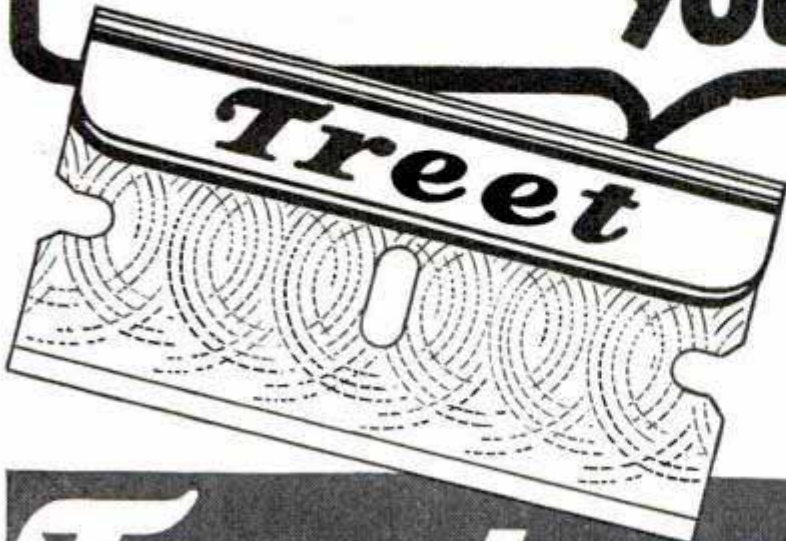
Thus the fourth card, which the bystander believes to be the ace, is put in a separate pile to one side. When all the packs are separated the aces are the first, fourth, seventh, and tenth cards respectively in position. Place that packet on top of the deck. When you deal the three piles of four cards each in rotation the aces automatically fall into the first pile. Then as the spectator covers the pile of cards at one side, the pile in which he believes you placed the aces, you announce that the aces have vanished from under his hand into the first of the piles of cards you have just dealt. Upon picking up this pile the spectator finds the four aces.

The rope trick also is mystifying. The spectator cuts a piece of rope with a knife and it is then knotted together. You then restore the rope to its original form, the knot disappearing.

At the outset, hold the rope with one end in each hand. Place the end in the right hand in the left hand and draw up the center loop and place it between the two ends. In order to satisfy the audience that the rope is all right, grasp the loop in the teeth and allow the ends to fall. Then gather up the two ends in the left hand. As you pull up the loop this time hold it by the thumb and cover it with the fingers of the left hand. Loop the end of the rope nearest the palm through the center fold so it will take the place of the latter when the cutting is done. After it has been cut by the spectator, allow the two outside pieces to drop down so that four cut ends are visible. While the knot is being tied in the ends at the top, be careful to conceal the loop with thumb and fingers. After the knot has been tied securely roll the rope around your hand and while doing this, slide the false knot off the rope, and slip this small piece into the pocket. To achieve a convincing performance you should practice this trick before trying it on an audience.

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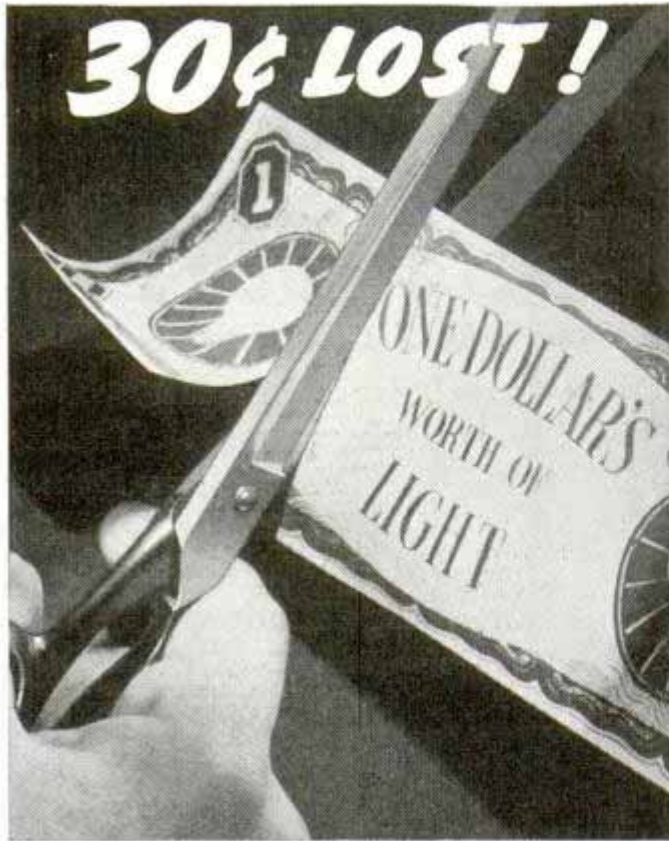
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(Continued from Coloroto Section)

are your eyes and the eyes of your family worth in dollars and cents? Aside from this, however, you'll find a pleasant surprise awaiting you when you have finished lighting your home for actual seeing. The original cost of modern fixtures and the light bill, you'll discover, both are lower than you anticipated. This will be due, in part, to the fact that you have replaced outmoded fixtures with modern ones which give you more useful light.

You probably will be forced to bid a sad farewell to some antique shades, lamps and fixtures to which you have clung for years, but in their place you will have charming new shades, graceful efficient lamps and modern fixtures designed primarily for seeing, rather than for decoration. And when you've weeded out glare, shades with colored linings and closed tops and dirty lamp bulbs, you've rid yourself of wasteful enemies which sometimes steal as much as one-half of the light you pay for. Then you're ready for real economy, because every one of your lighting dollars will buy more useful light.

As for electricity costs, you'll find that the difference between poor lighting and efficient lighting makes very little change in your light bill, once you are equipped with fixtures to give you efficient light. A living room about thirteen by twenty feet, with light wallpaper and ceiling, for instance, can be well lighted for eye comfort by using a total of about 900 watts in lamp bulbs. At an average current rate, this amount of light, with full usage, will cost a family of four a little more than two cents per person per day. And an average kitchen can be well lighted with one 150-watt bulb in a ceiling fixture and one or two sixty-watt lamps for close work at the sink and stove at an average cost of a little more than one cent an hour.

Once you've witnessed the magic of light, seen it bring new beauty and comfort into your home, observed how it enriches the patterns of upholstery fabrics and drapes and brings out new loveliness in pictures, you'll be ready to try the dramatic and luxurious things which can be done with light. You'll consider built-in lighting for bookcases, night lighting for

(Continued to page 134A)



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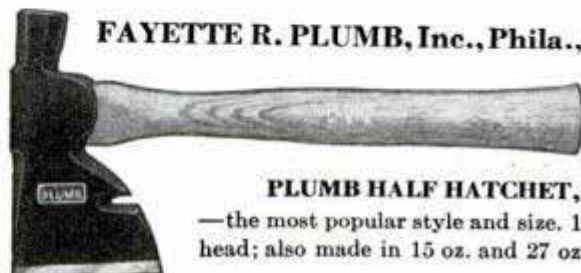
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(Continued from page 132A)



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And you'll discover that color in lighting lends a new beauty to your home, when properly used. In fact, color and light are the same thing in their general sense. A flower appears of a certain color because it absorbs light of a certain wave length. Thus, a blue flower absorbs red, orange and yellow rays. All colors of the spectrum are contained in daylight because it is a mixture of all the wave lengths of light.

Perfect daylight is thirty-two per cent red, thirty-two per cent green and thirty-six per cent blue. For years lighting engineers have been searching for a combination of artificial light which will offer a similar color band, and thus provide real man-made daylight. Recently a light has been developed which gives real daylight within two points.

Perhaps you'll discover that the color lighting in your home will "match your eyes." Brown and black-eyed people usually prefer red and other colors associated with autumn, russet, brown, gold, purple, orange and the darker shades of green. Blue-eyed people are partial to blue as well as the lighter hues such as yellow, pink, jade and light green. But if you're color blind, you won't care what color scheme is used because, in one type of color blindness, red and green appear gray, while in another type, blue and yellow also appear gray. You'll find, too, that optical illusions can be created with the aid of colors. The flag of France, for instance, has its three stripes made in the proportion of thirty for blue, thirty-three for white and thirty-seven for red so they will appear to be of equal width when seen side by side.

But, whether or not you go in for color, you'll discover, as others are doing, that once you begin to enjoy the real magic of good lighting, once you begin to really see after dark, nothing could induce you to go back to those "cozy" dim lights with which you used to abuse your eyes. Those dim lights hidden under big, heavy shades you'll see for just what they are—relics of the tallow-candle age, decrepit heirlooms of the past.

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INVENTORS Be Sure to See Page 23A

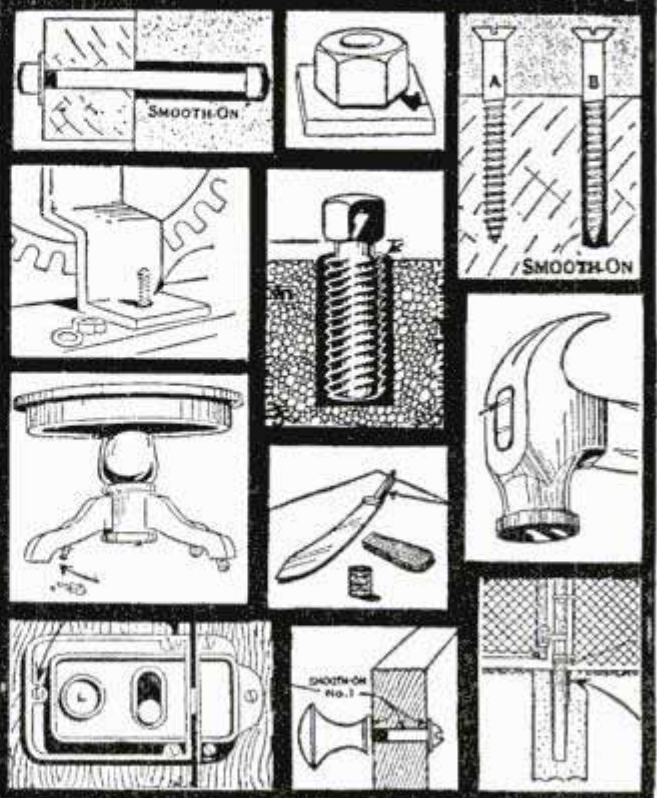
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(Continued from page 114A)

actors in table-top camera dramas. Fruits and vegetables can be made into grotesque figures.

There are two easy ways of making silhouettes. Stretch a sheet across the room and place floodlights some distance behind it, facing the camera. Station your subjects so that they are outlined against the white sheet—either in front of the sheet or behind it, according to the effect desired. Then make a short exposure. In this case you must forget the old rule to expose for the shadows; expose, instead, for the light. Another method is to cover a window with white tissue paper or cloth and paste cut-outs on it—a candle, a



Swift action enhanced by lights and shadows as five skiers race down mountainside against setting sun

wreath, or a lettered greeting. Or a child's profile, or a family pet, can be silhouetted in the window. Again, a short exposure will do.

Be alert for the unusual and the beautiful: patterns in sand, a dog's ear cocked attentively, the view from behind a dentist's chair with his drill silhouetted against the window; frogs posing in your home aquarium, a trail in deep snow, giant locomotive wheels shot from a close angle—all these pictures are worth money to someone, worth a place in your own "gallery."

And remember, as the shutter clicks—the cameramen who are "tops" today were amateurs day before yesterday.

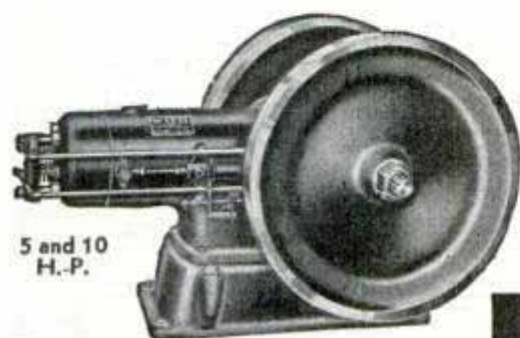
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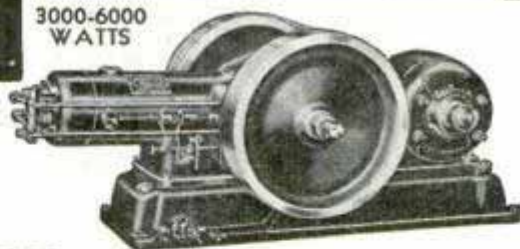
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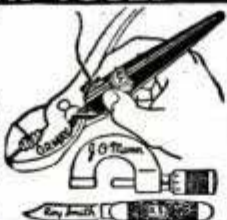
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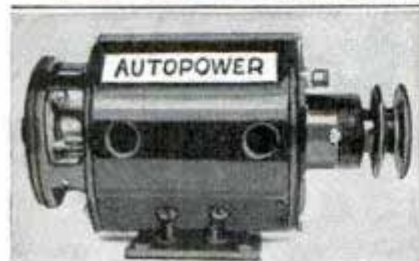
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Cross-Canada Airway Next

(Continued from page 643)

the airway by the Canadian government. Safety has been stressed at every point. For instance, when surveyors found that fog was prevalent near Lake Superior the route was changed to run farther north through a region known to be free from such weather. Because of Canada's low temperatures in winter the operators do not expect interference with flights from ice forming on the wings. This condition, which has caused serious difficulties in the Great Lakes and Atlantic coast regions of the United States, occurs when the temperature is hovering around freezing point and the atmosphere is heavily charged with moisture.

The Canadian airway will operate for the first year as a mail carrier, although some express may be accepted. Passenger service may be offered on limited sections of the line. The operators will be a private company, with railway and Canadian government helping financially. Ground operations will be under direction of the air-service branch of the Dominion department of transport.

Mail has been taken off inbound ships by government planes for several years, saving twenty-four to forty-eight hours in delivery as far west as Winnipeg. This service has been operated only in summer. But the new airway will send faster planes to meet all ships coming to Canada on the Atlantic and the Pacific and will accept first-class mail at no extra cost for faster delivery to any point in the Dominion. When transatlantic service from England is begun air-mail costs within the empire, which includes Canada, will be three cents per half ounce.

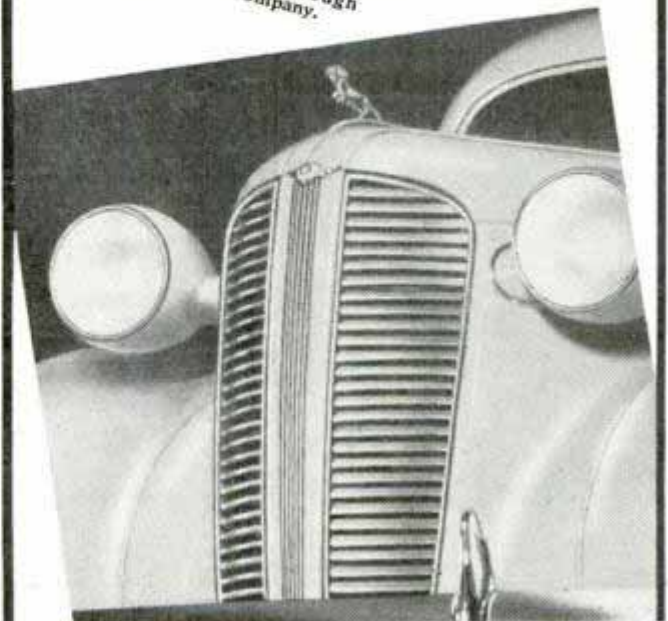
The route of the airway will be from Halifax to St. John, New Brunswick, across the state of Maine, to Montreal, where the transatlantic and United States routes will connect. From Montreal via Ottawa, Elmsdale and Cobalt the air liners will speed west across northern Ontario to Winnipeg. At Elmsdale planes from Toronto and Buffalo connect. Then the route touches Regina, Lethbridge, Cranbrook and Princeton before arrival at the Pacific coast destination, Vancouver. Connections with United States lines are made at Winnipeg and Vancouver and with Arctic routes at Winnipeg and Lethbridge.

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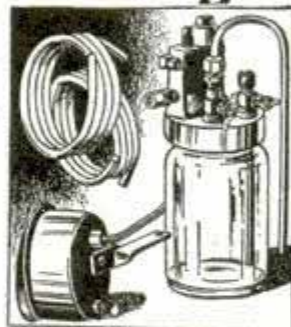
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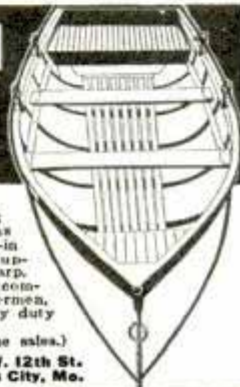
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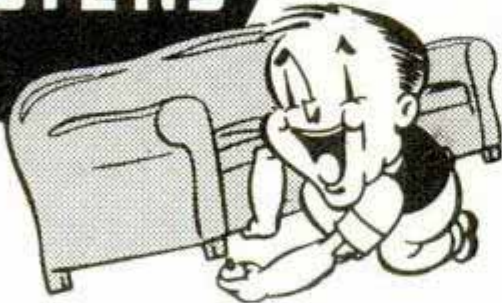
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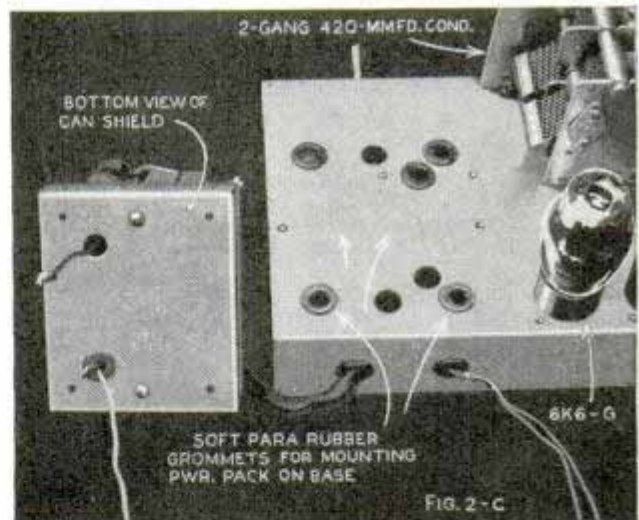
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Six-Volt Battery Receiver

(Continued from page 739)

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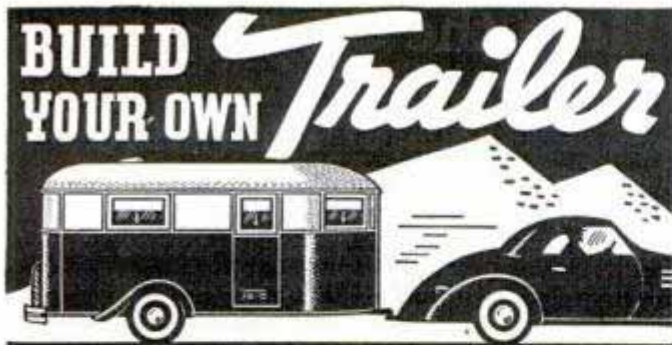
The power pack is built on a separate sub-base and then assembled on the chassis by means of shock-absorbing para-rubber grommets to insure freedom from noise. It employs a 6-prong synchronous vibrator of the standard plug-in type used in high-grade auto receivers. Figs. 1 and 2 show simplified wiring diagrams of this unit; a photo of the complete assembly appears in photo 2-A. The 6-volt vibrator transformer delivers 150 volts at 30 ma. and has a static shield built into the core; this is grounded on the base by means of the blue lead. Photos 2-B and 2-C show under-



side views of the completed unit. This power pack is available assembled and wired, if desired.

A carefully prepared simplified wiring diagram of the receiver proper appears in Fig. 3, and the complete schematic circuit diagram is given in Fig. 4. Photos 3-A, 3-B and 3-C show various views of the top and underside of the completed receiver. All parts specified for this set are available at reasonable prices; the type-G tubes have glass bulbs and are equipped with octal (8-prong) bases. These tubes cost no more than former types and the set is designed so that similar metal tubes may be used. However, the metal tubes

(Continued to page 152A)



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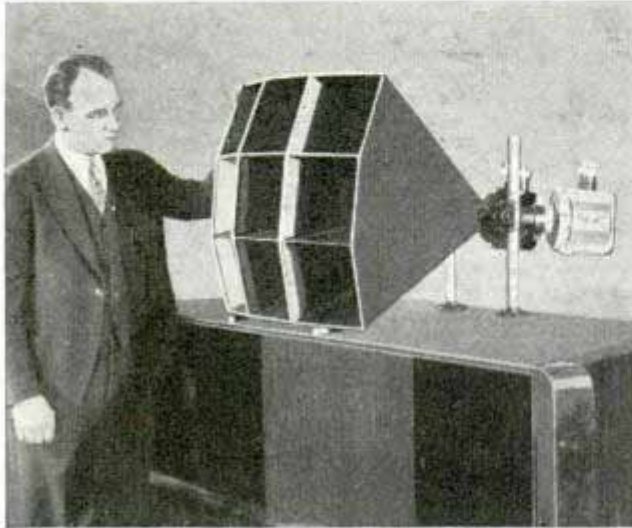
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Sound Engineers Help the Stage

(Continued from page 703)

of these sounds for the play, "The Eternal Road." Their means of producing the various effects are the work of experts in the recording and reproduction of sound film. To achieve the fidelity necessary, a process employing ultraviolet light in sound-film recordings and a new type of loudspeaker



Special cellular-type loudspeaker which sends out sound in many directions

which directs sound in many directions were used by the engineers. Sound films made in ultraviolet light instead of ordinary white light possess clearer detail, which is especially important in reproducing the higher-frequency tones.

Picked orchestras and choral singers were used in making recordings on three separate film sound tracks. In voice recordings it was necessary that singers hear the orchestra while they sang, but if the orchestra recording had been played while they sang, it would have been picked up again by the microphone. So each singer wore a tiny oscillator on his temple, enabling him to hear through bone oscillations. There was no audible sound. The singer heard the orchestra but the microphone "heard" and picked up nothing but the singer's voice.

With the sound recordings it is comparatively simple for control men to dispatch each channel to the loudspeaker where it is wanted. Thus a voice from heaven comes from a loudspeaker high above the stage, or orchestral music from several speakers located at other points.

In one scene a host of angels appears. A

loudspeaker concealed in their midst produces music sung by the best voices obtainable, creating the illusion that the angels are singing. Thus is solved the problem of finding angelic-looking actors who can sing. Since the recordings and loudspeaker do the singing the actors are picked for appearance only. The hum of praying worshipers is produced in another scene by concealing a loudspeaker in their midst. Thus the actors speak their lines to the accompaniment of low-voiced prayers.

A real orchestra, which is invisible to the audience, also is used in the play. It plays in a room of the theater and its music is picked up by microphone and sent out over loudspeakers, with control-room men regulating volume to blend with the recorded sound effects. This orchestra and some of the actors are really in a broadcasting studio. The conductor, looking out of a window onto the stage, is on constant telephonic communication with the control room. One control man is at the mixing panel where he modulates the sound from a score which has each part marked off in electrical units as well as music. The other control man dispatches the sound to the proper concealed loudspeaker.

Up in the first balcony is a microphone, connected with the control room. Through this the control men hear what the audience hears and regulate volume accordingly. A sentry, seated beside this microphone, has a telephone by which he communicates criticism of the sound to the control room.

All these special sound effects are carried to the audience by cellular-type loudspeakers which consist of two parts, an upper one to send out higher frequencies and the lower to carry low-pitched sounds. Instead of directing sound in one direction, as most loudspeakers do, this cellular speaker sends it in many directions.

So much electrical power is required for the play that a special vault constructed beneath the stage houses two transformer stations.

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NEXT TIME GET ETHYL . . . A BETTER RUN FOR YOUR MONEY

Little Bugs and Big Business

(Continued from page 693)

chalantly turn out by the millions of pounds. Here is one almost indispensable material which science, after years of effort, is unable to reproduce or even to improve upon to any great extent.

The versatile tribe of lacca worked for man even before shellac was used widely. Originally the creatures were the source of a red dye. Man found how to make a synthetic red dye, but the bugs still hold the secret of shellac. The insects are natives of India and for protection wear overcoats of their own making. When they discard these garments, man gathers them up—and has shellac in the raw. The hard-



Crated shellac ready for shipment abroad

working bugs secrete a resinous material called lac which acts as a protective coating for the makers. When treated, the same substance becomes a protective coating for man-made things.

Laccifer lacca is red, about one-fortieth of an inch long and shaped like an apple seed. The babies swarm soon after hatching. The fortunate ones reach the twigs of certain trees, bore through the bark to reach the sap and are fixed for life. Then they begin to secrete lac gum. This hardens and eventually encompasses them. At the end of six months the female hatches a family of about 1,000 babies and dies. The babies feed on her body until they swarm. There are two life cycles each year but, due to varying weather conditions and to different kinds of trees selected for feeding, four lac crops are produced annually in various parts of India.

After the swarming, natives collect the discarded overcoats—known as stick-lac.

This is ground in hand mortars to break up the original cells. Dead insects, twigs and bark are sieved and washed out and the result is seed-lac which is dried and blended, rosin and a bleaching agent sometimes being added. The mixture is placed in a cloth bag twenty or thirty feet long and two inches in diameter. The bag is slowly revolved in front of an open charcoal or coke furnace by two natives, one at each end. As it heats the ends are twisted in opposite directions to squeeze out the melted gum. This gum is kneaded on a cylinder filled with hot water until quite molten. Then comes fun.

A native grasps the mass with toes, teeth and hands and stretches. This pulls the mass into a thin sheet. When cooled and cured the sheets are broken into small sections resembling shells—hence the name, shellac. While a few secret processes are employed in which machines are used, about three-fourths of all the shellac used today is made by the ancient hand methods. This is due in part to the fact that lac gum is very reactive to heat and the natives acquainted with the exact amount of heat necessary to melt the gum become experts at producing a high-grade, uniform product.

Most of the material used in this country was originally orange shellac, so named from the color of the gum. Modern processes and modern chemicals are employed in bleaching and removing impurities, but otherwise the shellac used today is quite similar to that used a century ago. Bleached gum shellac dissolves in alcohol to form white shellac varnish, the wood-preserving agency. Varnish, to most of us, means a solution of drying oils and a gum. This definition does not apply to shellac varnish. It is not an oil varnish but a spirit varnish—shellac gum and alcohol.

An oil varnish dries by oxidation or polymerization—rearrangement of the atoms of the molecule. Shellac varnish dries by the speedy evaporation of the alcohol, leaving a sealed surface with the pores of wood filled with gum. Thus a mahogany or walnut stain may be sealed under the thin film of shellac. No one knows how long a shellac varnish will

(Continued to page 148A)

CHAMPIONS AT 1936 INDIANAPOLIS 500-MILE RACE

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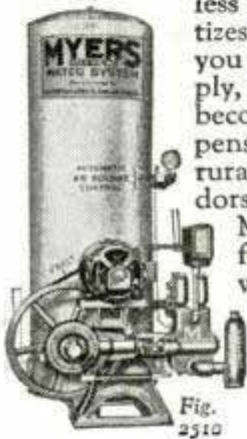


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(24-7)



(Continued from page 146A)

protect wood for hundreds of ancient pieces protected by shellac still are in use, seemingly as good as when the shellac was applied.

Shellac varnish makes wood resistant to termites and also tends to eliminate warping of wood due to an uneven distribution of moisture. Shellac varnishes and oil varnishes each have their own places in preserving and finishing wood today. It is now common practice to apply an oil varnish over the protective shellac coating, the oil varnish serving to protect the shellac coat from moisture.

Cleaning a floor or other surface coated with shellac requires care since you must deal with a gum produced by nature and not by man. One expert recommends that where the surface is well covered with shellac, it be scrubbed with turpentine and steel wool. Where the wood is rather bare, this may redden the floor, so instead a mild soap can be used with the steel wool. Rinsing with a solution of seventy-five per cent water and twenty-five per cent vinegar removes any action left by the soap. If any parts of the floor require bleaching, this should be done before the rinsing treatment by using a solution of one-half pound of oxalic acid in one-half gallon of hot water.

Few realize the wide applications of shellac. It is used as a sizing for cloth, felt hats, millinery materials, playing cards, plaster and paper. As a protective coating it is spread on floors, furniture, bowling alleys and it also is used on mirror backs, tennis racket strings, tin foil, gold leaf, as a leather and rubber coating, on linoleums and in shoe polish, lithograph ink and cold top enamels. As a cement you will find it in sealing wax, marble cements, light bulb bases, brush bristle cements and ceramic cements. It is employed as a dielectric in the manufacture of laminated cloth, paper and mica and it is very widely used as a molding material in making phonograph records and grinding wheels.

Almost daily new applications are being found for this age-old material. But a bug in India with a yen for turning out overcoats continues to baffle modern science by concealing within its red body the formula for this substance so widely applied by man.

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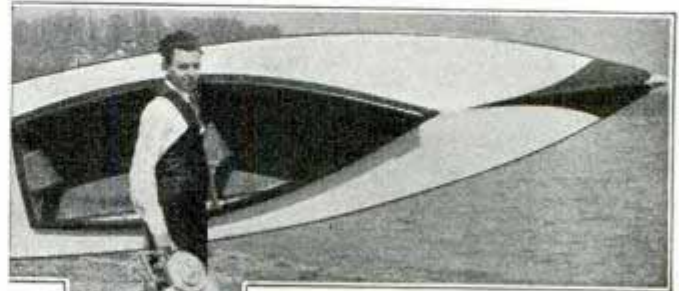
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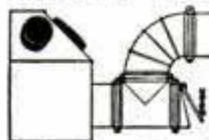
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K-R-O KILLS RATS ONLY

(Continued from page 142A)

will draw more current than the low-drain types and are therefore not economical especially when the owner is depending upon a windcharger to keep the battery up. An original list of all materials, and further information, can be obtained from Popular Mechanics radio department, without charge. The blueprint number is R-238.

Before starting construction, the builder should make sure that he has all parts just as specified. Do not buy cheap parts for a receiver of this type. The plug-in vibrator unit is replaceable and should last a long time under continuous use.

It will be noted that the simplified wiring diagram, Fig. 3, shows an underside view of the base. Every connection is clearly indicated and all parts are in their relative positions. The receiver parts on top of the base are sketched above, so that every lead is shown. Please note that a

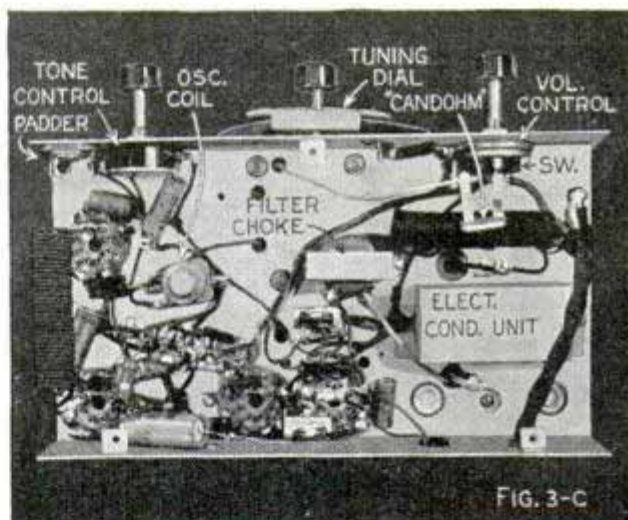


FIG. 3-C

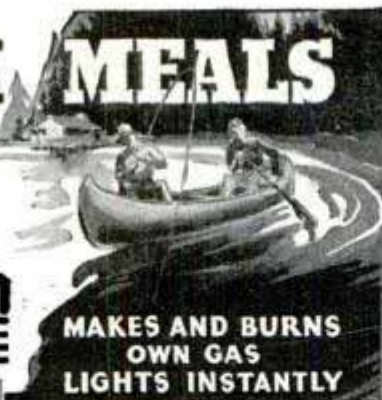
flexible lead is used to ground the 2-gang condenser on the base, as this condenser unit "floats" on three soft-rubber grommets mounted on the base to prevent vibration. Three machine screws pass through the grommets, and hex nuts are threaded on the underside. All "A" r.f. chokes are hand wound on a wood or cardboard form $\frac{5}{8}$ in. in diameter. The form is then withdrawn as each coil is self-supporting. Every circuit connection should be soldered carefully with rosin-core solder. Make all grid and plate leads as short as possible. Be sure that the power pack is well insulated from the base by the rubber grommets and is grounded only

(Continued to page 154A)

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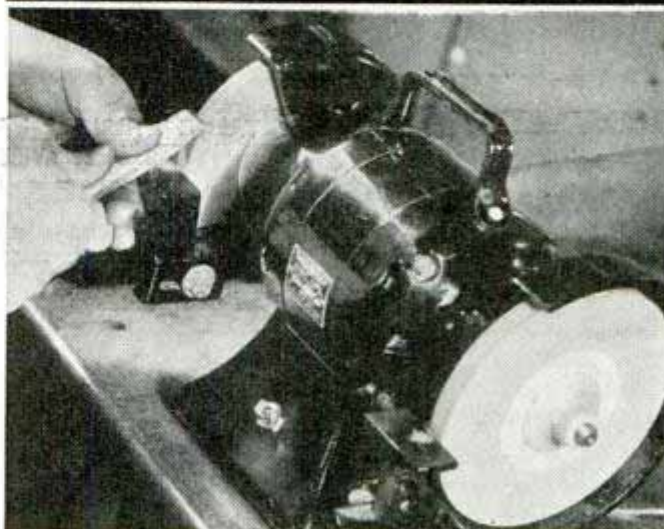
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Taking the "IF" Out of Farming

(Continued from page 669)

to control wheat smut and this started him searching for methods of control for other plant diseases transmitted by the seed. In 1670 a vessel laden with wheat went down off the coast of England. Farmers salvaged some of the grain, found it too saturated with sea water to use for flour, but planted it for seed. And, to their astonishment, they found the wheat from the wreck was fairly free from smut. Soon the brining of wheat became a general practice. Later other substances replaced salt but all were liquids and involved soaking the seed.

In 1917 Darnell Smith, an Australian, suggested dusting wheat seed with copper carbonate to kill smut spores. Others ridiculed the idea. Might as well dust it with talcum powder, they said. But copper carbonate worked and wheat production during the world war, when every bushel counted, was greatly increased by dusting the seed with it. About the same time it was found that organic mercury compounds were effective seed disinfectants but the cost was high. Chemists began making hundreds of such compounds and thousands of modifications of them and found a way to produce them at less cost.

Today those English farmers who sprinkled their grain with sea water, or their sons who waited for hours while the seed soaked in a copper-sulphate solution, would be amazed at the sight of a modern seed-treating plant treating grain as it passed through a gravity treater at a rate of 500 bushels per hour. And our children probably will laugh at our own clumsy efforts because new advances in seed treating are being made daily. The cereals are only one of the many kinds of plants now being freed of seed-borne diseases. Cotton, corn, vegetables, flowers, potatoes and many other plants each have their parasites, fungi and bacteria transmitted through the seed. By seed disinfection, science has placed in the hands of the farmer one more effective weapon to take the "if" out of agriculture.

But the variety and extent of the problem confronting the plant pathologist can be realized only if we remember that the use of chemicals for the control of seed-borne diseases represents only one phase

(Continued to page 160A)



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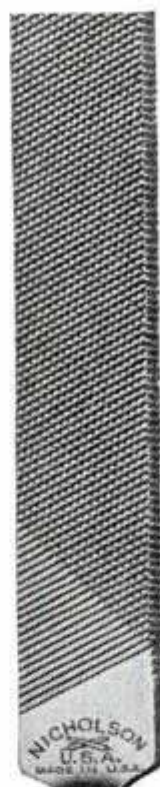


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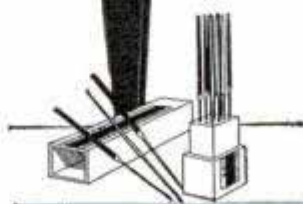
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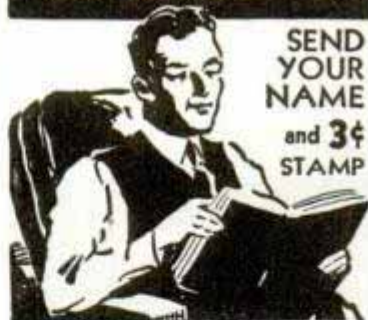
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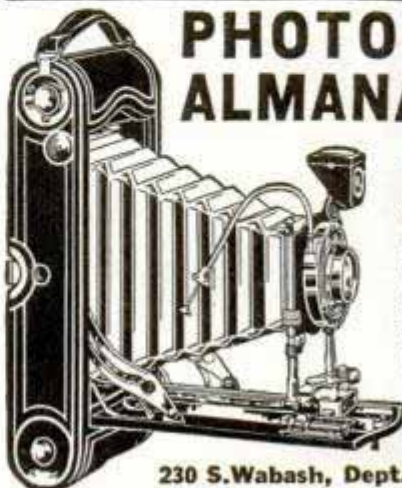


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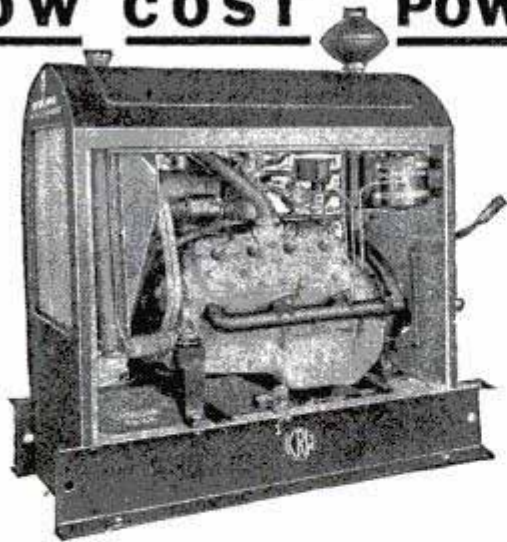
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(Continued from page 156A)

of man's struggle with plant afflictions. Thousands of diseases call for an entirely different form of control measure. Working hand in hand, the chemist and the plant pathologist have developed the use of sprays for the protection of fruit and foliage, fumigants and disinfectants for soils and many other methods of increasing production. And of course the extensive development of fertilizers has likewise been a task for the chemist and agronomist.

Since pests of various kinds continually threaten man's existence, it would seem that man should bend his efforts to exterminating all bugs, all fungi, all bacteria, all molds, all weeds and everything else likely to prove a nuisance. If man should do this successfully, he would perish.

There is a beautiful system of checks and balances in nature. Entomologists have declared that insects, if freed of their natural enemies, would devour the earth and slaughter mankind. On the other hand, insects are necessary for man's existence. The farmer might plant seeds and the orchardist grow trees, but before these yield crops, the insects must function. A honey bee can pollenate a field of buckwheat much better than any mechanical method man has been able to devise for doing the task.

Because it is easier to kill insects indiscriminately than to kill particular kinds of insects, the bees are being slaughtered in man's war on pests. An airplane is an efficient weapon in dusting a field with insecticide and can cover more ground in a day than 100 men could cover with wheeled or hand apparatus in a week. But the good insects perish with the bad. Here again the industrial chemist is coming to the aid of agriculture. He is attempting to develop poisons or repellents for insect pests which will not attract or kill other insects which aid man. Man's task is to control the insect world, not to exterminate it.

Science and mechanics have joined forces with chemistry in developing methods of selective control. Each kind of insect seems to have a weakness. Codling moths insist on laying their eggs in the dark—so flood an orchard with lights and the moths won't reproduce. It has been noted that mosquitoes are attracted by the

360-cycle hum of an electric furnace, the heat of which kills them. This may lead to the development some day of an "electric chair" for the exclusive use of mosquitoes.

Experiments also are being conducted with high-frequency electric waves as death rays for insects. It has been found that at a frequency of about 3,000,000 cycles per second, they will kill all insects within their field. Between 12,000,000 and 15,000,000 cycles they kill plants. Perhaps some day it may be possible to use particular cycles to kill particular insects. One method of selective picking of insects is with ultraviolet light. The Japanese beetle, for instance, is responsive to a particular wave length of black light which does not appear to attract other insects.

One outstanding service of chemistry to agriculture has been the development of agricultural explosives. The use of such explosives for removing stumps and stones, for drainage, stream correction, sub-soiling and tree planting enables the farmer to improve and maintain his land today in a fraction of the time and with but little of the human drudgery formerly necessary. In the old days grandfather boasted if he had been able to clear forty acres of land during his lifetime—and he had a right to boast. Today thousands of farmers, with the aid of a few hundred pounds of explosives, clear forty acres in a few years of part-time work.

Agricultural explosives have also brought to the farmer another ally, the agricultural engineer. With a few sticks of dynamite and some blasting powder judiciously used, the agricultural engineer can make over a farm until the old homestead looks like a different place. He not only blasts out stumps and boulders, he straightens streams, digs ditches, drains sink holes, plants trees, blasts wells, excavates cellars and even digs post and pole holes. The agricultural engineer's method of "farming with a bang" has relieved the business of much of its back-breaking toil.

In the development of refrigerants for mechanical refrigeration, the chemist has rendered a service not only to farmers but to city people who consume the products of the farm. Without such a method of preservation, there would be no market

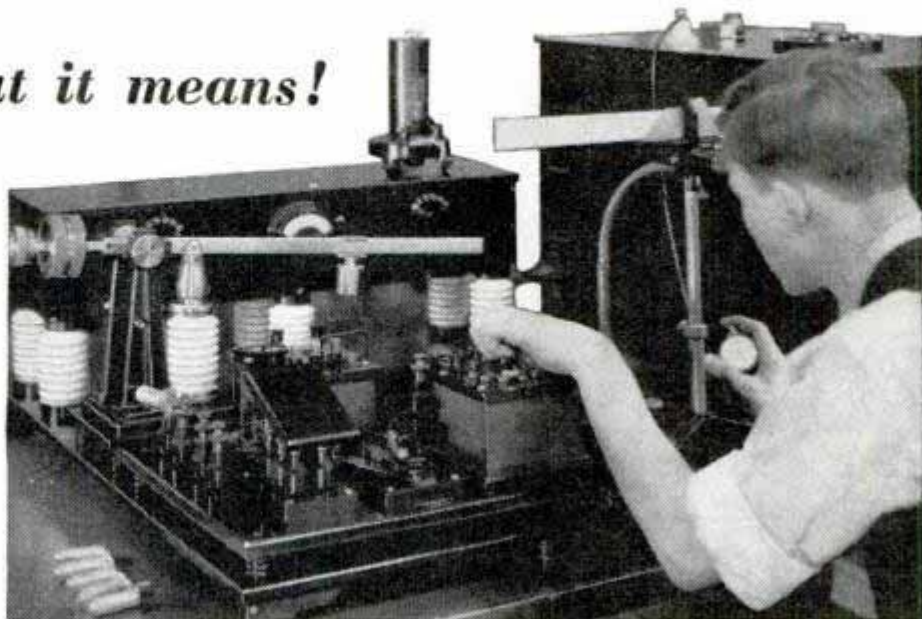
(Continued to page 162A)

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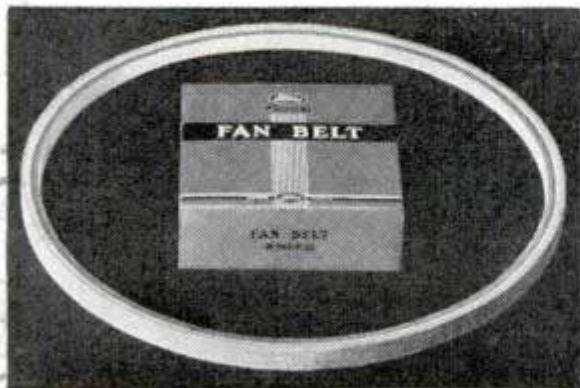
tion. And piston-pin holes must not vary more than three ten-thousandths of an inch. These are but a few typical examples of the care used in making all Genuine Ford Parts.

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Genuine Ford Parts may be obtained at all Ford dealers or at any garage that displays the sign, "Genuine Ford Parts."

FORD MOTOR COMPANY
DEARBORN, MICHIGAN
Prices subject to change without notice.

Genuine Ford V-8 Piston Rings. Complete set of 16 compression and 8 oil regulating rings, \$1.90.



Genuine Ford Fan Belts, like many other Genuine Ford Parts, are packaged for your protection. Ford V-8 car fan belts are only 50c to 60c, according to car model.



This kit contains all of the necessary parts to do a complete job of spindle rebushing. Price complete, \$2.70.

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WHY

CLIPSHAVE'S SIMPLIFIED TWO-WAY
SHEARING HEAD *gives*

SMOOTH shaves
CLOSE shaves . . .
QUICK shaves . . .

1. It shaves *in plain sight* at the leading edge. You always see exactly what you are doing, so hard-to-reach places do not exist for Clipshave. Trims sideburns accurately.
2. The V-shaped openings are so designed that all types of hair—long or short, fine or coarse—enter freely and are shaved skin-close with amazing comfort. Clipshave's unique triple-impulse motor is a marvel of swift, silent, vibrationless power.
3. Because all hairs are ejected from the shearing system and not into it, Clipshave is absolutely clog-proof, and needs no special cleaning. Clipshave's very simplicity, with the fewest possible moving parts, makes it the most efficient electric shaver and lowers its cost to you. Operates economically.

BUY A CLIPSHAVE TODAY

If your dealer can't supply you, send \$10 to Dept. B, Clipshave, Inc., Port Chester, N. Y.



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(Continued from page 160A)

for many of the products of the soil. Today mechanical refrigeration is recognized as just as important on the farm where the food originates as in cold-storage plants, retail shops and in the home. Milk, eggs, fruits, berries, vegetables, poultry, meats and many other foodstuffs must be refrigerated before they are consumed and in most cases, the sooner they are placed under refrigerating conditions, the higher will be their quality. Modern farmers are realizing this and reaping greater profits from their products.

Thus this new hired man of the farmer, the industrial chemist, begins by treating the seed the farmer plants and finishes by preserving the crop the farmer harvests until it reaches the consumer. And each year, in the quiet of the research laboratory, he is finding new substances and new tools to eliminate more and more of the drudgery and uncertainty from one of man's oldest occupations—tilling the soil.

es 169

Trim Hat Box Is Made of Cork Tinted in Pastel Shades

Cork is being used to make trim-looking hat boxes and other household articles such as hampers, yarn holders and book covers. They are lightweight and soft, and can be tinted in pastel colors.



Here are some of the household articles being made from cork—decorative hampers, scrap book covers, desk set, and a hat box in pastel colors

The main and
Morgan 4030
Bendish Island
Los Angeles, Calif.

New 6-Volt TRINDL Electric ARC WELDER

PATENTS PENDING

**Works on Storage Battery
or with Converter on
110 Volt Light Circuit**

A REAL WELDER

Men, here is the hottest specialty item that has come along in years. A real honest to goodness electric arc welder that does a man size job. Built sturdily of the finest materials. Requires no mechanical knowledge—any one can use it. Every demonstration should make a sale. This new Trindl Electric Arc Welder is made possible by the invention of a low voltage carbon which gets white hot from the current of an ordinary 6 volt storage battery such as in your automobile. It only uses about 20 to 25 amperes of current which is about the same current drain as 4 head-light bulbs, yet develops about 7000 degrees of heat.

**MELTS IRON AND STEEL
INSTANTLY**

The Trindl Welder is simple to use. Expert welding can be done by anyone. It is ideal for making permanent fender repairs—also for brazing broken castings and water jackets, repairing radiators, holes in auto bodies, hog troughs, small tanks, milk cans, radios, batteries, etc. Iron, steel, brass, copper and tin can be worked on for a quick and permanent repair. The repaired part will be as strong as before.

NEW 110 VOLT CONVERTER MAKES FULL SIZE PROFESSIONAL UNIT

This new converter is used on any 110 volt 60 cycle electric light socket in place of a storage battery. It is especially designed to be used with the Trindl Electric Arc Welder—**COSTS LESS THAN A GOOD BATTERY**—The combination makes a full size professional electric arc welder that everybody can use. Ideal for fender and repair shop needs. This is a sensation, not only in price but also in actual results. The converter represents the same fine construction and engineering skill as the arc welder. The complete outfit, including the transformer, is easily portable so that it can be brought right to the job.

USERS SWEAR BY IT—The price is so low that now anyone can afford to have a real welding outfit. Think of the profit you can make introducing this Trindl Welder and Converter—a simple five minute demonstration should make a sale to every interested prospect, especially when they hear the amazingly low price. Garages, radio and battery men, tanners, sheet metal workers, janitors, farmers and home-owners all need the Trindl Welder and Converter.

ACT NOW! There are big profits and a steady business waiting for you taking care of your territory for us. Don't let someone else get in before you—Send coupon Today.

TRINDL PRODUCTS
2229-K A Calumet Ave. Chicago, Ill.



FACTS

Here are just a few excerpts from the many letters of praise we have received from Trindl Electric Arc boosters.

"Please find enclosed for 12 welders by return mail for I am about sold out now. They are selling fine."—W. C. Anderson, Nebr.

"Received my Trindl Arc Welder and am both pleased and surprised."—Louis F. Glier, Ohio.

"Results are very gratifying with your welder. I am enclosing an order for 12 more Electric Arc Welders."—Nelson O. Lyster, Florida.

"I received my welder, and it is a regular repair shop in itself."—J. R. Harper, La.

"I sold 4 of your Trindl Electric Arc Welders in three minutes."—C. Gillies, Canada.

"I sold 9 welders in my first ten calls."—F. W. Stice, Iowa.

\$10.50 a day profit for you for only selling 6 Trindl Arc Welders. No matter where you turn, you will find people who will want to buy arc welders from you. Garages, shop men, radio repair men, farmers, home-owners, mechanics, janitors, all of them need Trindl Electric Arc Welders. Be the man in your territory to clean up with Trindl.

MAIL COUPON NOW!

TRINDL PRODUCTS
2229-KA, Calumet Ave.
Chicago, Illinois

Yes! Rush me free particulars of how I can make big money with Trindl Electric Arc Welders and Converters. This does not obligate me in any way.

Name

Local Address

City

State



GET INTO ELECTRIC WELDING—MAKE \$150 TO \$300 EXTRA MONTHLY!

Low Investment . . . Liberal Time Payments . . . Easy to buy the New Guaranteed FlexArc Welder.

Hundreds of shops are now taking in new high-profit jobs by providing customers with the big savings of electric welding. YOU can do the same with low investment. But make sure you get a wide-range, high-capacity set. Don't make the mistake of buying a welder that can only handle small jobs. The New FlexArc is the one machine that does all types of welding at lowest cost. Revolutionary new-type design; easiest to use on the market today; makes welding completely safe.

Backed by Written Guarantee—Westinghouse, a company that has made electrical history for 50 years, is the only manufacturer that has dared put its guarantee in writing.

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Electric-Driven FlexArc—Portable or stationary types available. If you have electric power this is most profitable FlexArc for you.

Gas Engine Driven—Portable or stationary models, Dodge truck engine, with electric starter.

Earn While You Buy—New Easy-Payment Plan enables you to pay for your FlexArc out of monthly profits. Send coupon NOW for details. J 20248



GASOLINE DRIVE



ELECTRIC DRIVE

30-Day Trial
Easy Payments
Priced Right

Westinghouse Electric, Room 5N1, East Pittsburgh, Pa.
Without obligation send your new "1937 Catalog of Popular FlexArc Models." I am interested in: Building my own Electric Driven FlexArc Gas-Engine Driven 30-Day Trial Easy Payment Plan.
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Address _____

Westinghouse Flexarc Welder

FASTEST SELLING WELDER ON THE MARKET TODAY

Atlas

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METAL WORKING LATHES \$45.50 to \$124.50

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style

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"Scout"

\$44

15 POUNDS

F. O. B. Milwaukee



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Write today for catalog on the 15 lb. Scout and brilliant new Evinrude Streamflow models for 1937. Address, EVINRUDE MOTORS, 5178 N. 27th St., Milwaukee, Wis.

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EVINRUDE SEND FOR CATALOG

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"The Mightiest Midget of Them All"

Loads of fun and designed for practical use. Powered by the famous Briggs & Stratton Motor with engine starter, clutch-mission and real brakes. An honest to goodness vehicle. Can be ridden by anyone that can ride a bicycle including women and small girls. Can be used instead of a bicycle for pleasure, rental service or commercial.

Extremely high gas mileage. Speeds up to 25 M.P.H. Safety controls. Meas. uses only 57 inches over all and 33 inches high. Weighs only 92 lbs.

\$98.50

F. O. B. Chicago

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BUILD CLOCKS for PLEASURE—PROFIT



Wall clocks are high priced in stores—you can make good money building them or electrifying spring clocks. Dime brings drawing of easily built Grandfather Case with "HOW" Book pricing banjo, desk, mantel, RADIO, spring, ELECTRIC, chime, BATTERY from \$1.40. Brass weight movements from \$16.95. Start now.

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WOODWORKERS Send for Free Catalogue.

Large Chicago Warehouse Stock

PLYWOOD AND VENEERS AT WHOLESALE PRICES
PLAIN AND FANCY INLAID TABLE TOPS
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"25 years in Veneers"

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Men & Women Earn Cash at Home!

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Est. 1908 UNITED CO., 3848 Lincoln Ave., Dept. 310, CHICAGO

New "Delta" Tools

More complete than ever before, the Delta line for 1937 includes a full line of wood working and light metal working tools and all necessary accessories and incorporates many new features and improvements and new units. This year the Delta line includes:

Combination Ten-Inch Circular Saw Six-Inch Jointer



A remarkable NEW Belt Sander; Revolutionary NEW 17" Drill

Presses, a NEW Precision 4' Jointer; a NEW Precision 11' Drill Press; Improved 14' Drill Presses; Improved Combination Units; NEW Tapping Attachments; NEW Shaper Cutter-head; NEW Tenoning Collars; NEW Belt-Drive Buffer; NEW Belt Guards and Improved Safety Features.

Write for Catalog

Send today for latest 1937 Delta Catalog containing photographs, prices, and full details on the complete line of Delta motor-driven tools.

DELTA MFG. COMPANY

Dept. A-537, 600-634 E. Vienna Ave., Milwaukee, Wis.



New 17-inch Drill Press

NEW SEVENTEEN-INCH DRILL PRESS. The greatest drill press value ever offered. Nothing quite like it on the market today.

Learn BRASS TAPPING

FUN and PROFIT! Get this big new outfit. Learn "raised metal" work. Sell gift and art wares. **Complete Outfit \$2.00** Make Bookends, What-Not Racks, Twin Plaques. Equipment includes non-tarnishable jewelers' metals, handcraft hammer, plywood backing-board, noiseless tapping tools, special nails and design patterns. Send \$2.00 money order for outfit complete. State choice Brass or Copper. ("Silver" or "Gold" \$2.50.) **FREE CATALOG** with outfit or send 3c stamps. Write today. **RAPAPORT BROS., 701 W. Ohio St., Chicago**

SELLEY-TEX REARWIN SPEEDSTER

patented **FLYING MODEL AIRPLANE KIT**, with moulded fuselage, wheel shoes and cowl practically crashproof. Nothing else to buy. Kit complete... **SHIP MODEL FITTINGS**—Die-cast—box-wood brass. Most complete catalog 5c. **SELLEY CO., Dept. 805, 1375 Gates Av., Brooklyn, N.Y.**

75c



16" Wingspan.

INVENTORS Be Sure to See Page 23A

Make Money at Home

GROW MUSHROOMS in cellar or shed, with AMI selected-spore spawn and step-by-step, easy-to-follow **MANUAL OF INSTRUCTIONS**. Book Free. **Anglo-American Mushroom Industries, Dept. 110, Toronto, Ont.**



Neon Truck Signs

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DISTRIBUTORS WANTED

Old, established factory wants financially responsible business executives—to handle distribution in exclusive territories. Signs fill long-felt Advertising need! Enable any advertiser to have brilliant, colorful, attention-getting Neon Advertising message on trucks, both day and night. Expected to quickly sweep country! Easily installed on top driver's cab. Amazing **NEW TRANSFORMER** enables Sign to operate on any truck's standard 6-volt auto storage battery—using only about same amount current as an extra tail light. Novel method tubing installation protects against breakage. Reasonable capital handles exclusive Distributorship Contract. Big Profits. No sign experience necessary. We furnish entire product. **FREE LITERATURE** gives details, explains liberal proposition. Write today! **E. E. SOUTHER IRON CO., -1952-A-36 Kienlen Ave., St. Louis, Mo.**

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NUFOND GIANTS WEIGH UP TO 3 LBS. EACH

EASY TO START!

Markets Waiting. Frog legs in big demand at good prices the year 'round. Millions used yearly!

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Men and Women starting in every state and Canada. See what others already doing. Small pond starts you. **FREE FROG BOOK** explains our unusual offer to beginners! Now's the time to begin! Write today!

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WITH A

SEA GULL

\$ 39.50 UP

Yes sir - the 1937 SEA GULLS "hit the high spots" of anyone's requirements! Quality - power - performance - everything has soared **except the cost.** For as little as \$39.50 you can buy the famous SEA GULL Outboard Motor! 2, 4, 6 and 16 H. P. models are available - all with . . .

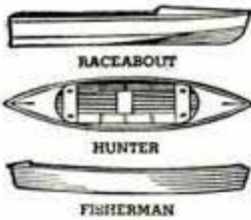
THESE EXCLUSIVE FEATURES:

- Automatic float-feed carburetor
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- Underwater exhaust
- New type sensational magneto
- Carburetor control in steering handle.

STEEL BOATS

\$24.50 UP

Send for complete details of our money-saving 2-IN-1 Offer. Any one of our steel boats - safe, sturdy, seaworthy - and a SEA GULL Outboard Motor of the size you require - at a **combination price** that will amaze you!



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NATIONAL OUTBOARD MOTOR CO.
DEPT. PM MARSHALL, MICHIGAN



WINCHESTER

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Model 697 Bolt Action
Six Shot

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Telescope Sight
.22 Rim Fire Rifle
and 'Scope to Fit it*

YOU will instantly want this new Winchester pair. Lower in cost than lots of .22 repeaters with ordinary sights. A full man's size, fast-handling, finely accurate rifle equipped with Winchester telescope-sight mount blocks. No metallic sights. Superior bolt action. Positive safety lock. Six shot repeater. Shoots .22 short, long and long rifle cartridges, both regular Winchester Staynless and Super Speed. Take down. Weight 5 lbs. New popular style universal-focus telescope sight—choice of 2 3/4 or 5 power—with micrometer adjustments . . . If you want a single shot rifle for less, Model 677 . . . Or there's choice of Model 67, 68 or 69 ready equipped for interchangeable use of metallic sights and a scope sight. Ask your Dealer. For FREE folder write Dept. 46-C, Winchester Repeating Arms Co., New Haven, Conn., U. S. A.

When writing please mention Popular Mechanics

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TURN PIN MONEY INTO DIAMONDS

Don't Pay Extra For Credit!

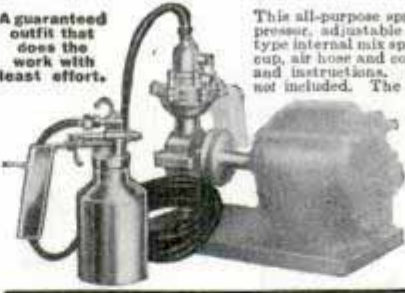
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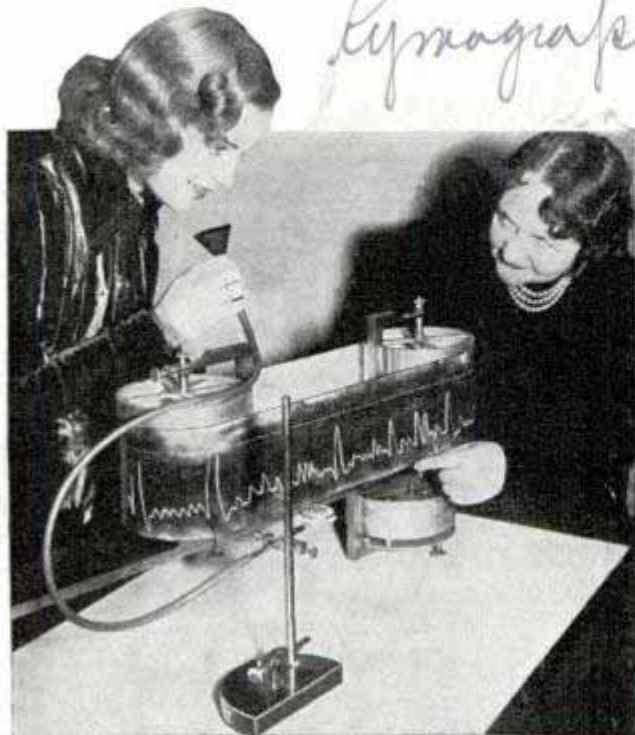
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Voice Tester Shows Mistakes and Aids in Training

Kymograph



White wavy lines on voice tester reveal defects in speaking or singing

Writing down voice vibrations in graph form, the latest device to aid in the training of actors or speakers quickly reveals mistakes in speech. The subject can see at a glance the point at which the vocal chords fail to function as desired, enabling him to concentrate on correcting the mistake. Called the kymograph the device was developed by a London physicist.

Self-Energizing Drill Chuck Needs No Tools Nor Key

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MADE BY

WILLIAMS OIL-O-MATIC HEATING

selling for less than \$200

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Included are an inside storage tank, a combustion chamber built to fit your heating requirements, plus all installation costs! Only local permits are extra!

Amazing? We'll tell the world! Orders are simply pouring in! Production is limited! So—don't wait! Act at once!

BUILDERS ATTENTION! Investigate this new Williams Oil Burner! It is what you have been looking for!

STUDY THESE FEATURES!

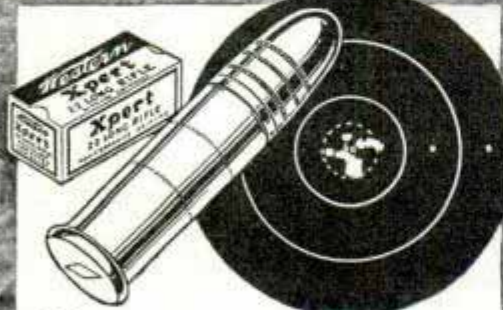
- ★ Fully Automatic
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- ★ Williams engineered throughout
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Please give me full particulars about your new low priced Williams Oil Burner.

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NEW Xpert .22's For GREATER ACCURACY



Here's a new cartridge for all-around use and target shooting! MORE ACCURATE than ordinary .22's yet NO HIGHER IN PRICE!.. Western XPERT .22 Long Rifle is built of same components as SUPER-MATCH, the sensation of 1936!... XPERT .22's are available also in Shorts and Longs. SMOKELESS! NON-CORROSIVE! Lead lubricated bullets! Ask your dealer to stock XPERT .22's! Mail Coupon!

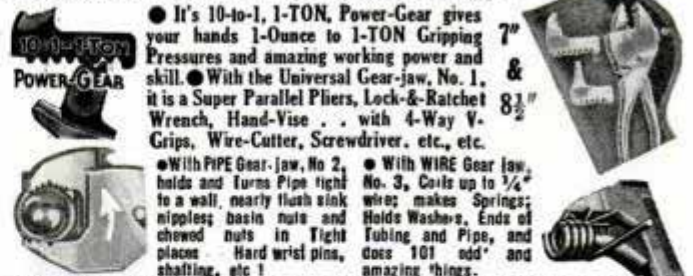
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Send, FREE, the new Western Ammunition Handbook—a complete guide to modern shooting that tells all about the new Xpert .22's.

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● It's 10-to-1, 1-TON, Power-Gear gives your hands 1-Ounce to 1-TON Gripping Pressures and amazing working power and skill. ● With the Universal Gear-jaw, No. 1, it is a Super Parallel Pliers, Lock-& Ratchet Wrench, Hand-Visc . . . with 4-Way V-Grips, Wire-Cutter, Screwdriver, etc., etc. ● With PIPE Gear-jaw, No 2, holds and turns Pipe tight to a wall, nearly flush sink nipples; basin nuts and chewed nuts in tight places. Hard wrist pins, shafting, etc! ● With WIRE Gear jaw, No. 3, Coils up to 1/4" wire; makes Springs; Holds Washers, Ends of Tubing and Pipe, and does 101 odd' and amazing things.

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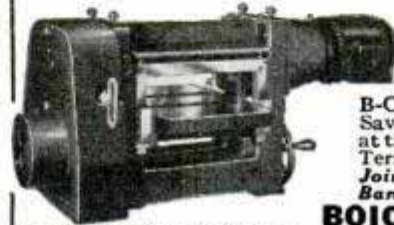
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12' x 4' Capacity Thickness Planer Finished lumber from low cost rough stock in your own shop with a B-C 12"x4' Thickness Planer. Save planing cost and waiting at the mill. Pays for itself. E-Z Terms. Also, B - C Saws, Jointers, Sanders, Shapers, Band and Jig Saws.

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Fun and Profits raising Frogs. Wonderful, easy method. No experience needed. Complete 20 lesson course tells all: catching frogs, how to use back yard, how to mate, breed, raise jumbos up to 3 lbs., prepare for sale, etc. WE BUY FROM YOU! Just pay postman \$1 plus postage, or send dollar now and we pay P. O. charges, 6 days trial. Money back guaranteed. Send today!

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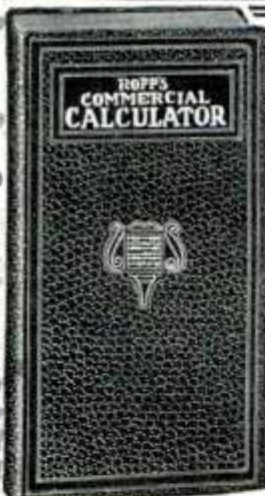
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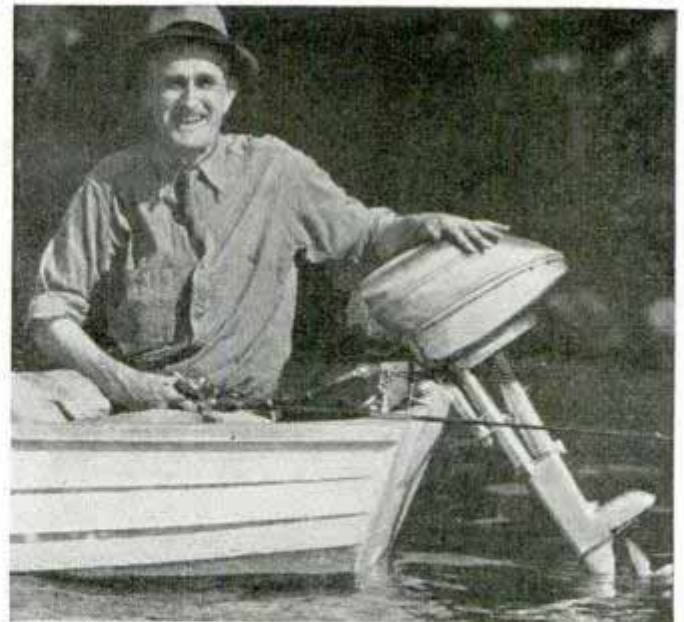
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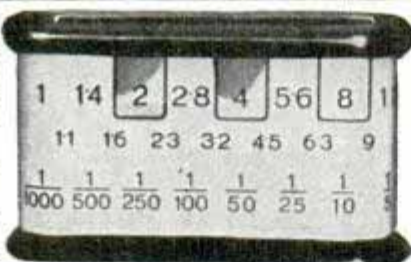
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Windmills Fight Corrosion

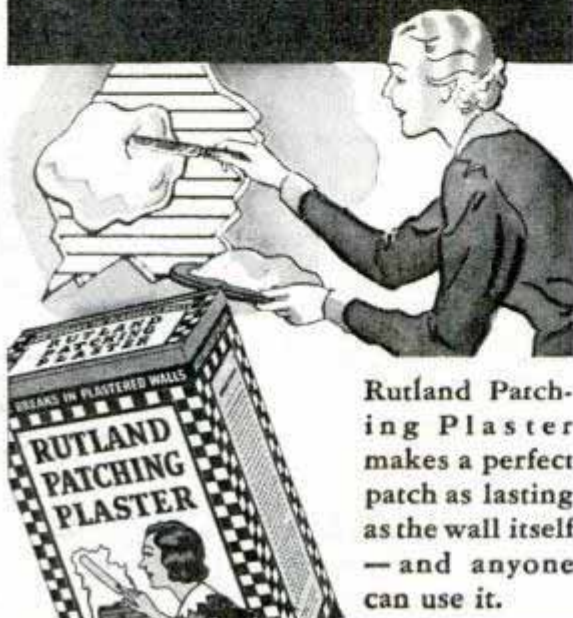
Transmission lines and internal-combustion engines almost doomed the windmill to extinction, but today the windmill is making a comeback as a means to combat corrosion in pipe lines. Iron and steel pipes in moist ground are attacked by electrolytic corrosion, a one-ampere current from pipe to soil carrying away as much as twenty pounds of steel in a year. To change the current and make ions of iron flow toward the pipe instead of away from it, pipe-line windmills are erected to supply low-voltage current.

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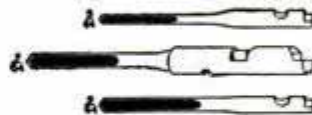
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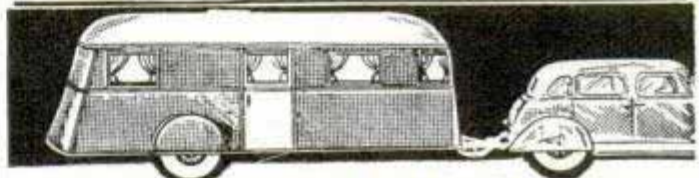


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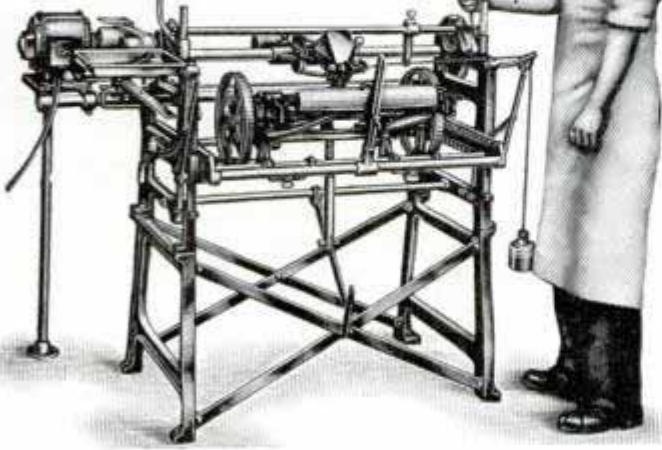


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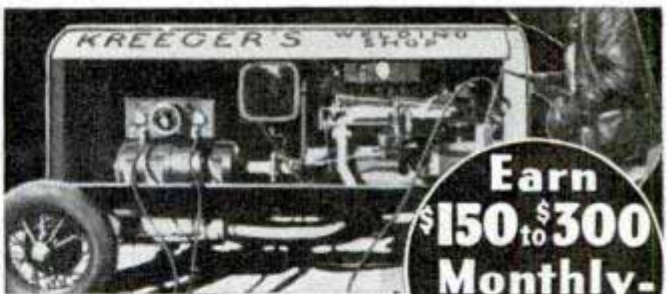
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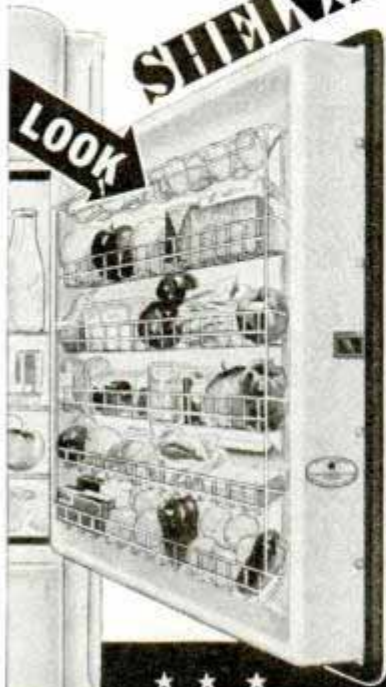
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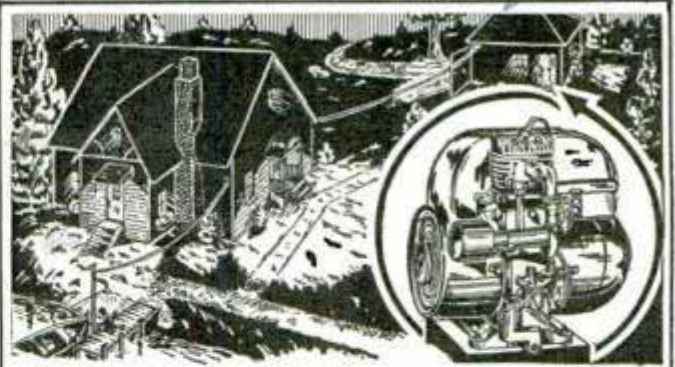
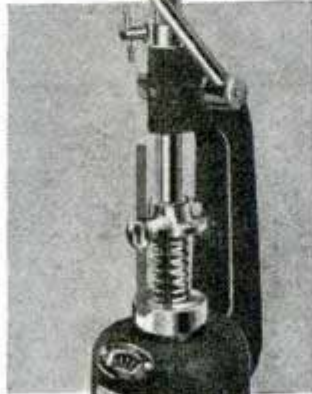
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Less Motor Drive
—
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A Month



A Back-Geared Screw-Cutting Precision Lathe
Weight 320 lbs.

No. 415-YA 9 1/4" swing by 3' bed Workshop Bench Lathe with Horizontal Motor Drive, \$116⁰⁰
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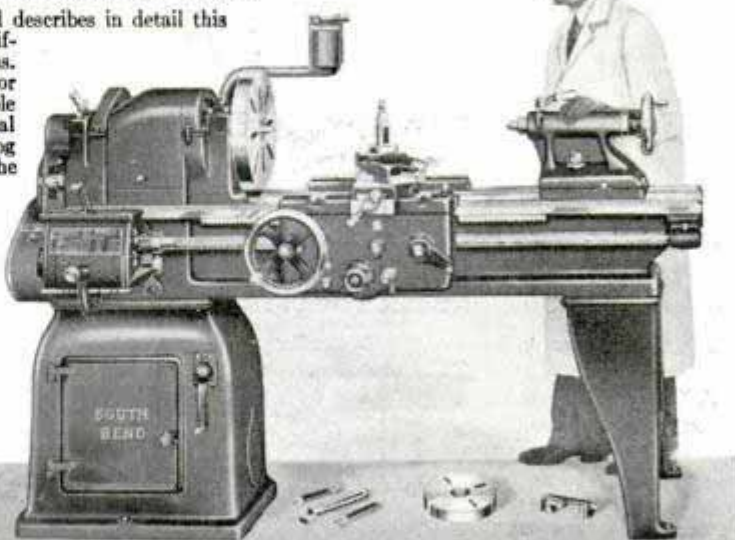
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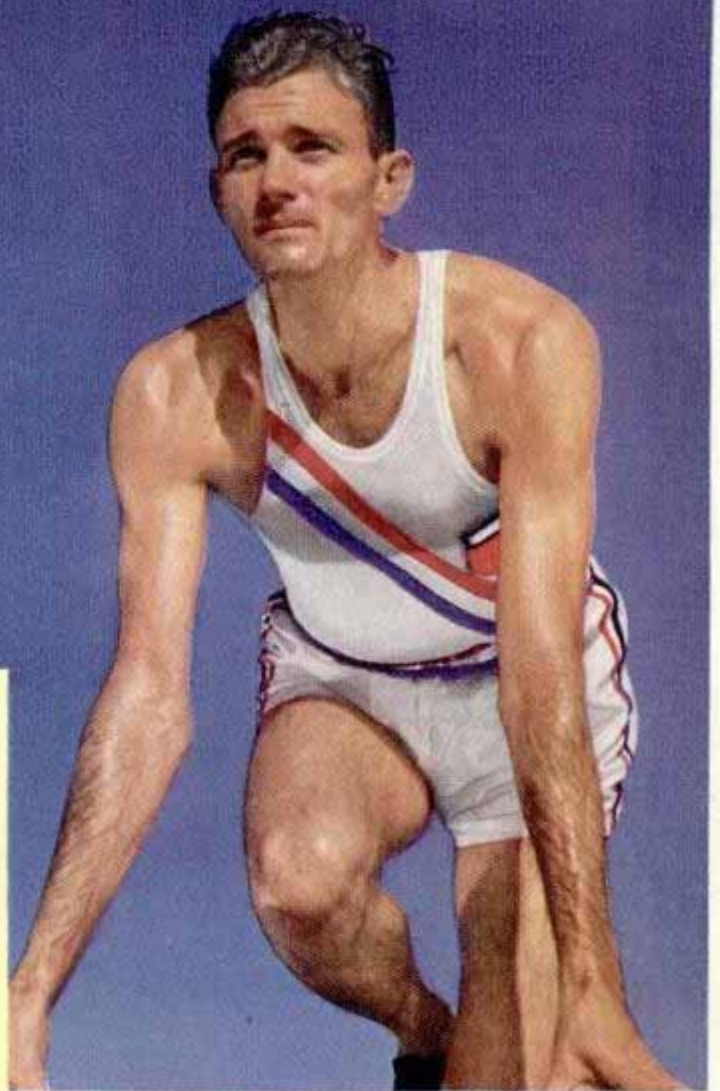
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