

OCTOBER

25 CENTS

POPULAR MECHANICS

MAGAZINE

WRITTEN SO YOU CAN UNDERSTAND IT

REG. U.S. PAT. OFF. TRADE MARK GREAT BRITAIN NO. 40425

REG. U.S. PAT. OFF.



NEPTUNE'S BATTERING RAMS
PAGE 620

Make an Electric A.C. Set of your Present Radio!

**NO CHANGES IN WIRING
NO HARNESS OR ADAPTERS
USE YOUR OLD TUBES**

OF course you want electric operation of your radio. Everybody does! Radio was never so convenient, never so carefree as now when its only demand on you is the snap of an electric switch.

But if you have a good radio now, don't discard it. A good time-tried circuit, using efficient time-tried tubes is naturally better than new untried circuits and tubes. There isn't a better A. C. set made than your present radio converted to use A. C. power.

And Kuprox has made conversion so easy! You don't have to change a single wire or alter the set in any way. No harnesses or adapters . . . no tricky wiring . . . not even new tubes are necessary. Just connect the Kuprox A. C. Power Pack to the battery terminals of your set, plug it into the nearest lamp socket, and your radio operates entirely from A. C.

Then compare your radio with the best A. C. set you ever heard. Compare the tone, the power, the dis-



tance getting ability, the selectivity and ease of control! In your set there's not the slightest hum, no distortion or crackling because of faulty tubes, none of the failings that variations in electric current can cause in A. C. sets. A good battery set, Kuprox equipped, is A. C. reception at its finest!

The Kuprox A. C. Power Pack contains no moving parts, nothing to wear out or break down. It is a permanent addition to your radio that does away with all attention. Several models are offered, some supplying filament (A) current only for those who already have a "B" eliminator, some supplying plate (B) current only, and several compact units that supply all current (A, B, and C) and make the entire set A. C. They are priced from \$32.50 up, and any good radio dealer can show you the various models.

In case you first desire more information, or specific information about your own set, fill in the coupon, tell us exactly what set you have and the number of tubes. We'll recommend the proper model Power Pack you need, and send you literature giving a full description.



Kuprox Multi-rate Rectifier,
for trickle charging, dynamic
speaker operation, etc. Ad-
justable rate up to 1-ampere.
Price \$11.50



Kuprox Replacement Unit,
eliminates acids, liquids,
bulbs on all standard trickle
chargers.
Price \$5.00

THE KODEL ELECTRIC & MFG. CO.

Formerly the Kodel Radio Corporation

517 E. Pearl Street - - Cincinnati, Ohio

USE THIS COUPON

Please give me full information on Kuprox A. C. Power Pack

Name

Address

City

State

No. of Tubes

Make of Set

KUPROX

A.C. POWER PACK

Popular Mechanics Magazine

200 E. Ontario Street, Chicago, U. S. A.

H. H. WINDSOR, Founder

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

London: Hachette & Cie.,
15-17 King William Street, Charing Cross, W. C. 2

Paris: Hachette & Cie.,
111 Rue Reaumur

Melbourne: Gordon & Gotch
509-513 Little Collins St.

ISSUED MONTHLY

SUBSCRIPTION:

SINGLE COPY, 25 CENTS

In United States and its possessions, also Canada, Cuba, and Mexico, per year, postpaid - \$2.50

To all other countries in the Postal Union - - - - - 3.00

All subscriptions are discontinued at expiration. Please examine the date printed on your wrapper.

Entered as Second Class Matter Sept. 15, 1903, at the Post Office at Chicago, Illinois, under Act of March 3rd, 1879.

Entered as Second Class Matter at the Post Office Department, Canada.

Published monthly by POPULAR MECHANICS CO.

Copyright, 1926, by Popular Mechanics Co.

Copyright in Australia. Copyright in France

Vol. 50

Contents for October, 1928

No. 4

Special Features

Can Flyers Conquer Thunderbolts	536
Guardians of the Sea	546
Trapping Wild Elephants	557
Solving the Secrets of Life	563
Fighting Fire with Fire	570
Making Aircraft Airworthy	580
Sunspots Forecast Better Radio	594
Teaching Bees New Tricks	603
Learning to Fly, concluded	611
Neptune's Battering Rams	620
A New Highway for an Old Empire	627
Growing Wings for the Army	642
Advertising	
flying billboard has lights underneath wings	552
plane as flying billboard shows signs by flags	579
tank in form of pineapple for canning plant	560
Agricultural Implements—cultivator saws the soil for better planting	552
Airplanes	
fly from ocean liner with aid of catapult	545
queer new, tailless, with movable wings	632
Archæology—Ur tombs reveal ancient sacrificial cus- toms	630
Architecture—new ideals of beauty shown in European cities	588
Astronomy—world's biggest lens to solve Mars riddle	636
Automobile—combined with bike for deliveries	593
Automobile—Accessories	
bed concealed in top simplifies touring	617
folding armrest adds comfort in driving	576
safety seat for baby	568
top over rumble seat quickly taken off	569
Automobiles—Batteries—oilier for storage prevents cor- rosion	561
Automobiles—Driving	
"cat's eye" traffic lights guide motorists	602
four-wheel brake tester aids safer	609
Automobiles—Equipment and Supplies	
gasoline vaporizer replaces carburetor	592
roof top rolls back at pull of tab	619
Automobiles—Repairing	
trouble lights worn on head aid	553
vacuum cleaner to paint car and oil springs	630
Automobiles—Tires—twin, decrease jars	555
Automobiles—Touring—washing cabinet contains first- aid kit	601
Aviation	
aided by old fire engine as cleaner for motors	578
airplane loaded in flight from metal chute	591
air sickness prevented by pungent vapor	609
air sign boards aid flyers win endurance record	574
glider sails four hours on American flight	592
road sign for air travelers shows wind direction	600
Baby Carriage—fly screen guards infant's sleep	625
Bath Attachment—fountain for soapsuds and other toilet preparations	602
Boats and Boating	
boat inflated like tire, fits in knapsack	555
boat propelled by pumps develops high speed	647
electric lifeboat launched in three seconds	592
folding boat fits on auto running board	598
outboard hull like plane gives high speed	607
sailing boats with big kites is latest water sport	591
Borax—to kill mosquitoes	562
Building Construction	
hoist run by truck is latest aid	617
houses built flat on the ground and raised to posi- tion	635
Corks—easily removed without turning	636
Cotton—gas mask protects driver of duster for boll weevil	637
Digestion—human body portrayed as a factory	626
Doors	
folding partition is substitute for	608
rubber cushion silences slamming	553
Door Snubber—ends slamming and helps fight flies	577
Electricity	
power from a new kind of perpetual motion	554
power tapped from wire without stopping cars	577
Electric Plug—with safety light to help prevent fires	636

[Continued on Page 4]

[Contents—Continued]

Fire Fighting—rubber suits for dock firemen keep wearers afloat	633
Floors—block, without nails, deaden sound	636
Furnace—air moistener promotes health	609
Gas, Poison—carrier on motorcycle is latest army unit	591
Highway—super, proposed for autos to cross the nation	561
Hoe—with adjustable head saves extra tools	633
Household Devices	638
House Plan	703
Humidifier—air in homes is "washed" to guard health	578
Incinerator—in form of tree improves looks of yard	575
Keys, Automobile—case prevents rattling and loss	616
Lathe—to true brake drums for servicing	625
Light Waves—easily bent around ball	574
Milk Can—cooler for, simplifies handling	641
Mines and Mining—Edison's miners' safety lamp to prevent explosions	586
Motorcycle—center rest aids flying start	575
Moving Pictures—camera in phone box helps trap crooks	555
Music Lessons—on multiple keyboard aided by lights	619
Newsstand—portable, helps patrons catch cars	587
Nuremberg Castle—magic beauty revealed by floodlights	601
Police	
motor tricycle carries five men	608
walking faults revealed by treadmill test	618
Pump—three-way spout eliminates adjustments	630
Radio	
headgear for airmen to aid communication	587
headphones on loud-speaker lines	663
identification of aerial and ground connections	664
neutralizing r.f. stages	664
Radio—Aerial	
handy kink	662
misused antenna insulation	663
Radio—Applications—new tests for radio waves as disease cure	560
Radio—Broadcasting—tower on mountain reached by cable cars	568
Radio—Eliminator	
build this compact B	649
direct A—supply from charger	660
Radio—Installation—better reproduction	653
Radio—Loud Speaker	
dynamic, is operated from light socket	651
novel unit	651
Radio—Pictorial	659
Radio—Receiver	
a Spanish-desk cabinet	654
keeping the set dry	662
modernizing old installations	660
portable, is equipped with screen-grid tube	653
Radio—Reception	
fading signals in a.c. sets	661
razor blades make headphone diaphragms	661
Radio—Repairing	
A. F. transformers	664
safety insulation for screwdriver	663
Radio—Television—new parts for experimenters	652
Railroad—two-deck sleeping car has hotel comforts	569
Razor, Safety—sharpener whets both edges	633
Reflection—of sun and moon upon ice-crystal clouds	599
Rifle—fired with one hand, wins British prize	632
Roadster—electric, seats two and goes anywhere	640
Roller Skate—quick clamp prevents accidents	553
Safety Device and Measures	
escaping gas sounds alarm to prevent accidents	545
fog lamp for traffic police	637
Sand, Beach—screened for lost valuables	640
Saws and Sawing—portable electric in kit carried like baggage	641
Senses—tested by looking at world upside down	562
Ships and Shipping	
illuminated flagship in fleet display	629
stainless-steel propellers reduce shipping costs	551
Shoes—wheel to assemble speeds production	607
Siphon—automatic, also filters	648
Smokers Accessories—cigar lighter without wire latest auto convenience	545
Submarine—Uncle Sam's biggest mine-laying	634
Swimming	
portable camp bathing pool serves auto tourists	577
rubber tube harness helps beginners	593
Swing—flying, like airplane adds to child's sport	551
Target Practice—bullets trace lines of fire to aid marksmen	586
Taxicab—with radio to attract passengers	600
Tear-Gas—club for policemen to help conquer crooks	599
Telephone	
directory in outdoor booth serves public	641
wires in plant form show cable structure	576

Tires—gauge and deflator helps protect valves	598
Tool, Metal Worker—three-in-one latest shop aid	551
Traffic—danger bell traps autos running past lights	562
Window Cleaning—safety brush to be used from the inside	648

AMATEUR MECHANICS

Advertising—novel window manikins from pipe cleaners	682
Automobiles—guard for the starter keeps children from meddling	680
Automobiles—Repairing—anti-rattlers for hood clips	686
Automobiles—Tires—trough for testing those that leak slowly	676
Belt—expansion buckle	679
Boats and Boating	
handholds facilitate carrying rowboat	683
more speed from the outboard boat	665
Bookplate—how to make a color stamp	669
Boomerang—throwing is great sport	671
Camping	
large, folding grate for campfire	684
old auto chain holds pots over campfire	675
salt and pepper shaker	676
Clothesline—preventing double from slipping on pulley	676
Cockroach—sure-catch trap	685
Corks—to remove from bottles	674
Dents—removing from metal ware	680
Door, Basement	
holder for	683
simple base prevents sagging	680
Fish and Fishing	
holder for the fishing rod	668
loosening stiff fishing-rod joints	666
two handy tools for the fisherman	679
Flashlight—carried on boot	678
House Numbers—made from old auto license plates	667
Lantern—medieval easy to make	681
Locks—for windows	666
Motor, Automobile—governor for stationary	670
Motor, Outboard—preventing loss of propeller	675
Razor—using carborundum stone for sharpening	676
Rings—cleaning large set	685
Shoestring—splicing broken	683
Sink—clean-out plug for drain	684
Stirring Rod—heavy, for chemists	679
Stove—substitute for broken oven-door spring	686
Stumps—pulled with help of a keg	678
Tennis—a solo game	668
Tents—elastic stay ropes for	667
Tools—porch cabinet for garden	677
Trap—unusual for rats	677
Trap, Bow—how to make	670
Windows, Porch—hinging to avoid trouble	678
Wire—unrolling, single-handed	685

SHOP NOTES

Angles—laying out accurately	694
Automobiles—Repairing—device helps to reline brake bands	694
Blueprints—holder prevents soiling	694
Boats, Toy—your boy will like this liner	691
Cabinet Work—attractive wooden trim for	687
Clamp, Spring—for leather workers	695
Corn, Seed—storage shed for	696
Drilling—kinks for accurate	702
Furniture—designing, to cover radiators	697
Gauge—for duplicating diameters takes place of caliper	690
Incubator—reading the thermometer	690
Lathe—to turn a large pulley	698
Linoleum—fitting snugly against raised concrete border	698
Machine Parts—accurate measuring of keyways and grooves	699
Milk Can	
rack for auto truck	696
rack for draining	699
Photography—holding small steel articles for photographing	701
Pipe, Brass—how to handle	700
Reaming—with drill press	696
Saws and Sawing	
handy pocket saw	695
how to cut duplicate pieces on a bandsaw	699
Steel—prevention of scale when hardening	695
Tools—cementing tangs in handles	701
Tractor—inexpensive, for light farm work	689
Wall Studs—spotting	702
Washers—counterboring	695

Popular Mechanics Magazine

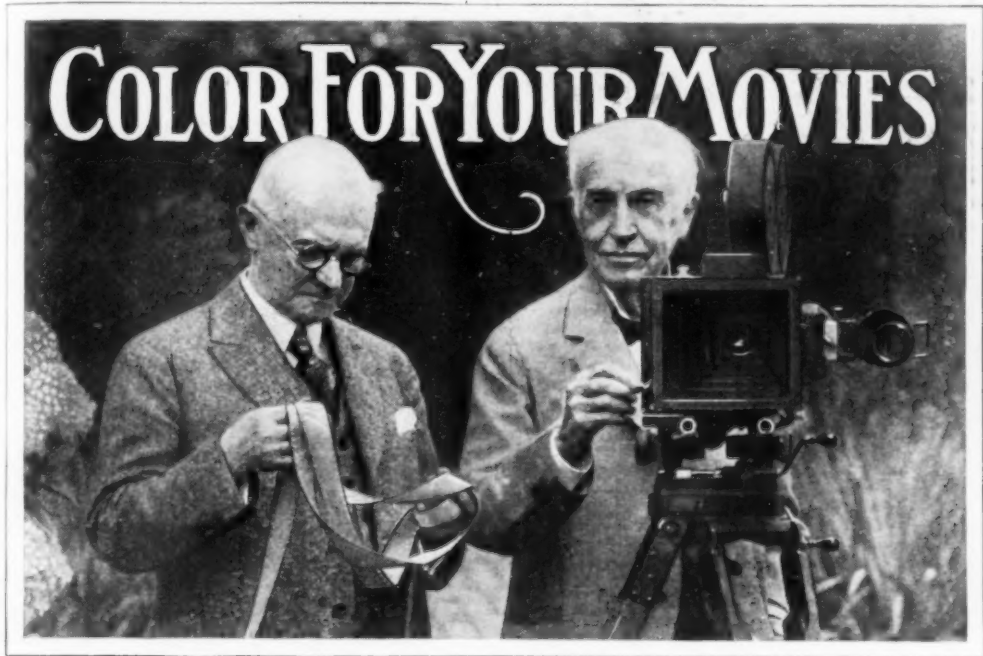
REGISTERED IN U. S. PATENT OFFICE

WRITTEN SO YOU CAN UNDERSTAND IT

Vol. 50

OCTOBER, 1928

No. 4



George K. Eastman, Left, and Thomas A. Edison at the Former's Rochester Home When He Demonstrated before the Inventor of the Movies the New Amateur Color-Film Process

MOVIES in color, produced by an inexpensive and practical process, the dream of producers for years, have arrived, but the infant of the movie industry, the amateur who makes his own pictures, will have the exclusive use of this invention.

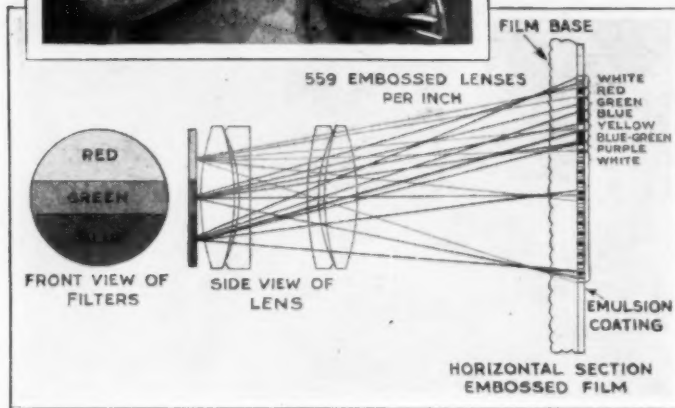
When George K. Eastman, of Kodak fame, demonstrated the new color-movie process recently in his Rochester home before Thomas A. Edison, Gen. John J. Pershing and a host of other eminent guests, he pointed out that it will be of no value for professional use, for it cannot be reproduced in a large number of prints, the original film being the only one.

The colored movies are made without color in the film. Instead, a myriad of microscopic lenses, molded of the film material itself, and a pair of color filters, one on the camera and one on the projector, produce color as an optical illusion. When the amateur movie process was developed in 1923, it was brought within reach of the

average pocketbook by eliminating the expense of printing a positive film for projection from the negative made in the camera. Instead, the camera negative was, in the development process, reversed to form a positive. Because of this reversal of the original negative duplicate prints are impossible.

A comparatively unknown member of the Eastman research staff, John G. Capstaff, is given the major credit for developing the new process, but insists on sharing the honors with Dr. C. E. Kenneth Mees, director of the Eastman laboratories. It was Mr. Capstaff who worked out the process for the original black and white amateur movie film five years ago. The color process was developed from an idea patented in France before the war, but never perfected. The Eastman company bought the rights, and since 1918 Mr. Capstaff has been at work on it.

On the side of the film which is exposed



Dr. C. E. K. Mees, Head of the Eastman Laboratories, and a Diagram Showing How a Filter and Embossed Film Make Colored Movies Possible

different from the making of plain black-and-white movies. The film is developed in the usual way, and, to the eye, looks like an ordinary film, since it comes out in black and white and various shades of gray, with no hint of color. But when it is placed in the projector and a light passed through it, the embossed lenses reverse the process and refocus their particular rays to pass again through the proper sections of a color filter placed in front of the projector. Red of the original goes back through the red of the filter, and blue and green do the same.

The effect of the rapid movement of the pictures completes the optical illusion, just as the effect of movement in the film is itself an illusion when the eye is tricked by the succession of images.

Almost simultaneously with the Rochester demonstration, scientists of the Westinghouse electric and manufacturing company, at East Pittsburgh, gave a public exhibition of radio movies. Developed in the space of only two months' work, the radio-movie projector, which, in its

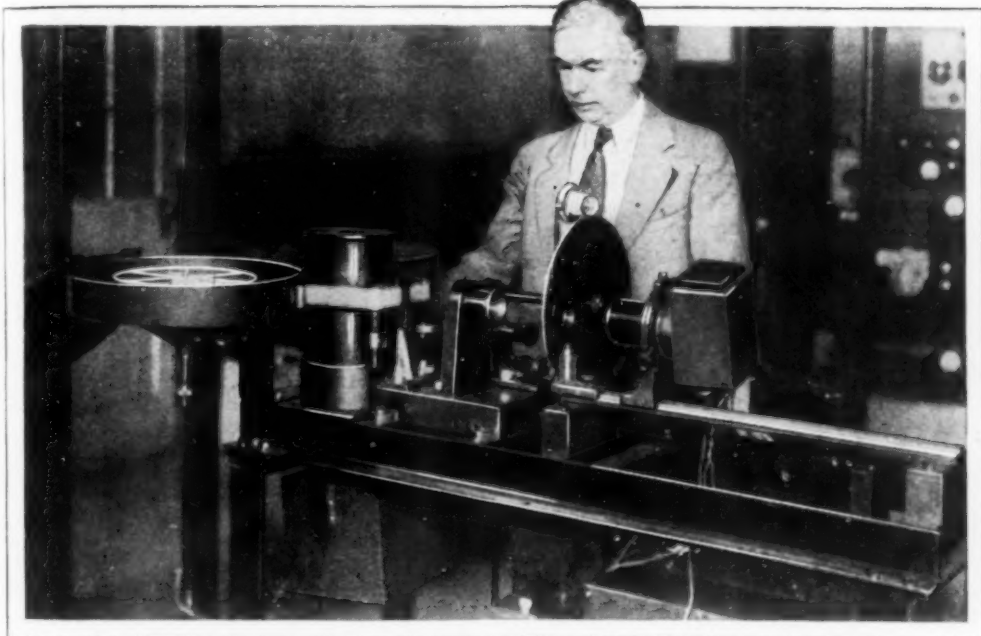
workings is not essentially different from television, may, it was said, soon be ready for the market.

While movie films have been transmitted by radio before, the Westinghouse demonstration was radically different in two prime factors. The first was the use of scanner disks of sixty holes each drawing sixty lines to the picture, and the second the use of a powerful mercury-vapor lamp for projection, instead of the red-tinted glow of a neon lamp.

In front of the lens of an ordinary amateur movie camera, a color filter is installed. The filter is divided into three segments colored red, green and blue. Slipping the filter into place and loading with the special film is all that is required to take colored movies.

Within the space of little more than a year, television apparatus has progressed from scanner disks of twenty-four lines to the inch, to more than thirty, then forty-eight, and now sixty. The addition of every few lines means more clarity in the received image. With sixty lines, the received picture is as clear as the average newspaper half-tone illustration, which has just about the same number of lines.

When the lens is uncovered and the crank begins to turn, a third of the light entering the camera passes through each segment of the filter. One admits only red rays, one blue rays and one those that are green. The tiny embossed lenses focus parts of the light beams on their portion of the film. The rest of the process is no



Dr. Frank Conrad, Assistant Chief Engineer of the Westinghouse Company, Demonstrating the Radio Motion-Picture Projector; the Scanning Disk Is in the Center

The successful use of a powerful projection light, however, is even more important. All television processes heretofore have used the fluctuating beam of a neon lamp, operated directly by the received current, to produce the necessary gradations in color, which, in combination with the revolving scanner disk, produced the illusion of a picture.

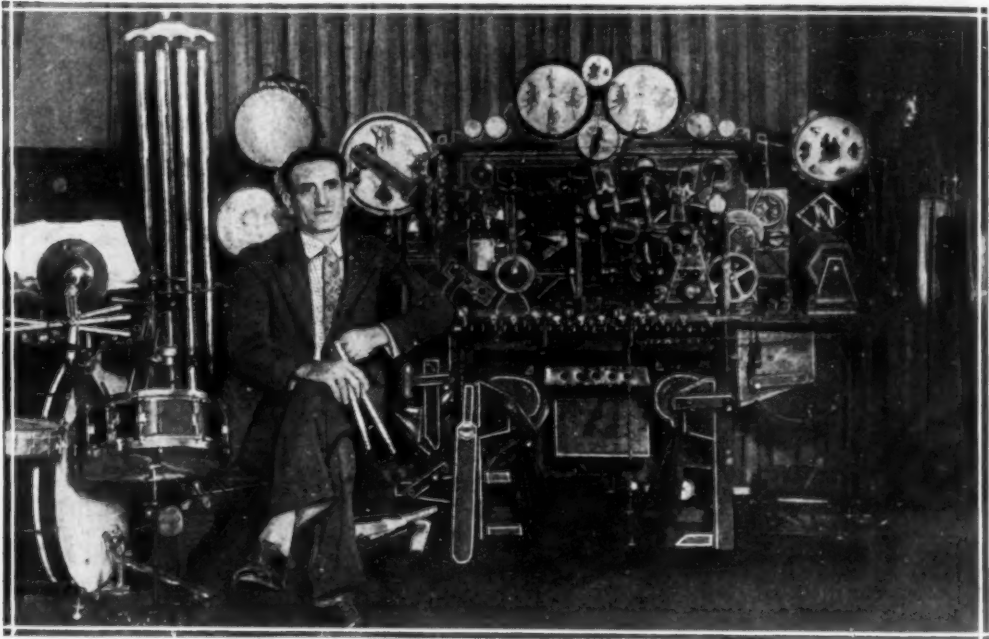
The light output of a neon lamp of a size that could be operated by the fairly weak current available was necessarily low, and the picture could not be projected in any size onto a screen. With the Westinghouse discovery, the radio current is used to control the mercury-vapor lamp just as it controls the valve of a radio tube. As the received current varies in strength the mercury lamp grows bright or dim.

The increase in the number of scanner lines was made possible in turn by the development of a more sensitive photoelectric cell. The limit on the number of lines per picture is always the ability of the cell to absorb the fleeting impressions, transform them into electrical impulses, send the impulses and prepare itself to repeat the process for the next line. In

transmitting movies sixteen pictures pass before the scanner each second, and, as the new scanner has sixty lines for each picture, it means that 960 of the little holes in the scanner disk flash past the photoelectric cell each second. The new photoelectric cell employs caesium, a material which, because of its far greater sensitiveness, is replacing the potassium and selenium cells used in the past. Although selenium cells have been used experimentally for some fifty years, science is just beginning to develop the substitutes.

New light on the romance of pictures, movie or still, was cast recently when Dr. Mees told the American Chemical society that the science of photography rests on the fact that cows eat mustard and other plants which in turn produce impurities in the cow's skin. From the skin, the gelatine which goes into film is made. The presence of the impurities, it has been found, is responsible for the chemical action of the metallic silver in the sensitive coating, which, instead of shining as metallic silver should, appears under the microscope like dark bits of coke. The sensitiveness of high-speed film is credited entirely to the action of these impurities.

MOVIE NOISE "FACTORY" ADDS REALISM TO FILMS



Inventor with Noise-Making Outfit Which Reproduces Scores of Different Sounds to Add Realism to the Films; Many of the Devices Are Operated by Electric Motors

Scores of different sounds are accurately reproduced on an electrically operated noise maker to be used with motion pictures. Small electric motors, controlled by push buttons, actuate most of the sound units which can be combined and altered to produce fading, distant and other effects. The entire outfit is compactly constructed in a single cabinet or table, about five feet high and less than two feet deep, and is intended to be operated by the drummer. The sound of falling trees, crashing glass, trolley cars, doors slamming, handsaw and acetylene torch are a few of the unusual noises that this unit successfully imitates. How the sound of the trolley car was produced gives an idea of the elaborate care the inventor took in constructing the apparatus. He first studied the noise carefully and then made repeated experiments at duplication, finally succeeding in imitating the sway of the trucks, the hum of the motor, the bell, air brakes and other parts. The wheels of six pairs of roller skates, numerous gears and pulleys, two motors and compressed air were finally arranged to make all the usual noises of an electric car in motion, and

in starting and stopping. Lights are arranged to illuminate part of the machine when desired.

ELECTRIC SEALING-WAX SET ELIMINATES FLAME

Sealing packages and letters with wax has been simplified with an electrically operated unit that eliminates the use of a flame and other bothersome hand processes. Wax is melted by an electric heating element in a small crucible and is applied through a hollow shaft connected to the wax container. The seal is at the base of this shaft. It is moistened with a sponge and then pressed upon the hot wax. The outfit is especially useful in offices where a large number of articles is handled daily of such nature and value that they need to be sealed for shipment.



CHEMICALS TO REPLACE GUNS IN WARS OF FUTURE

A thousand airplanes, each carrying 5,000 pounds of chloroform, could put the inhabitants of cities as large as Chicago or New York to sleep in a few moments, in time of war, according to Dr. Gustav Egloff, a research chemist, who points out that scientists are developing means for making war more humane instead of more horrible. He suggests that anaesthetics, far more effective than are now known, may be introduced in the near future and that applications of them from planes flying above trenches, might put whole battalions of soldiers to peaceful slumber. They could be awakened later and suffer relatively little harm. To put a city to sleep, the chemist declares, it would only be necessary to mix the air with anaesthetic amounting to no more than one per cent by volume, and such doses could be so administered that the use of masks would be futile.

WEED FATAL TO MOSQUITOES PUZZLES SCIENTISTS

Man has a valuable ally in his warfare against the mosquito in a humble aquatic plant that grows in many parts of the United States. According to Cornell University scientists, it not only prevents mosquito "wigglers" from growing to maturity, but actually kills them. The specific property that makes the plant deadly to the pests has not yet been discovered, and the plant itself is something of a mystery. In some ways, it seems to be related to the seaweed family, but, in others, it stands alone in the plant family, a sort of botanical orphan.

On Its Way to the Launching; the Fuselage of the Seaplane "Romar" Being Hauled from Factory in Berlin



GIANT TRI-MOTOR SEAPLANE TRAVELS IN STREETS

To launch the huge seaplane "Romar" its fuselage was trundled from the factory through the streets of Berlin on a special truck recently. The big plane has three motors of a combined capacity of 7,200 horsepower, it can carry more than 2,000 gallons of gasoline in the wing tanks and other containers, and has a cruising radius of 2,500 miles.

SUGAR PREPARED FROM CORN MAKES "LEMONADE"

Lemonade or orangeade can be made without the fruit by using a special sugar that absorbs the acids of these products, chemists reported recently. The sugar is manufactured from corn by a process developed for this particular purpose.



"Roman" Riding on the Waves with Hobbyhorse Surfboards, a Popular Sport That Requires Skill in Balancing, Especially When Changing Positions on the Way

HOBBYHORSES AS AQUAPLANES TEST RIDERS' SKILL

Additional thrills are derived from the sport of aquaplaning with hobbyhorse boards. Each accommodates two riders or more and gives the passengers ample opportunity to test their skill at balancing while standing on the backs of the horses after the manner of Roman riding on real horses. A fast motor boat is used to tow the boards.

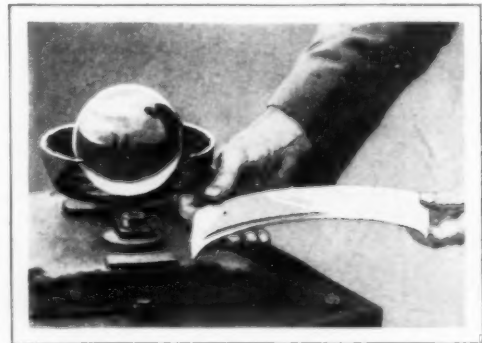
CORROSION OF OIL-PIPE LINES LAID TO ELECTRICITY

Corrosion of pipe lines that carry oil has perplexed scientists for some time, but bureau of standards investigators, after a number of tests, have announced that they are of the opinion the action is due to electricity. Running through soils where the ground is of different chemical composition and of varying moisture content, the pipe is subjected to the results of a discharge and a collecting of electrical current at different points. The earth, in other words, becomes a sort of huge battery of cells formed by the different soil sections. By measuring the electric current on several parts of an oil-pipe line, it was discovered that, at some points, elec-

tricity was being collected and, at others, it was being discharged. The places of discharge corresponded, on the whole, with the places where the line was corroded.

CRYSTAL BALL BURNS HOLES TO RECORD SUNSHINE

One of the instruments used at the British air ministry to record weather conditions, is a crystal ball that burns holes in a strip of cardboard as the sun shines through it. The board is marked off in hours and the ball acts as a burning glass, focusing the rays of the sun so that they record their shining in a parched path along the cardboard.



Part of Crystal Apparatus and Card That Has Been Scorched by the Sun's Rays

MICROBE TO FIGHT CORN BORER AND SAVE CROPS

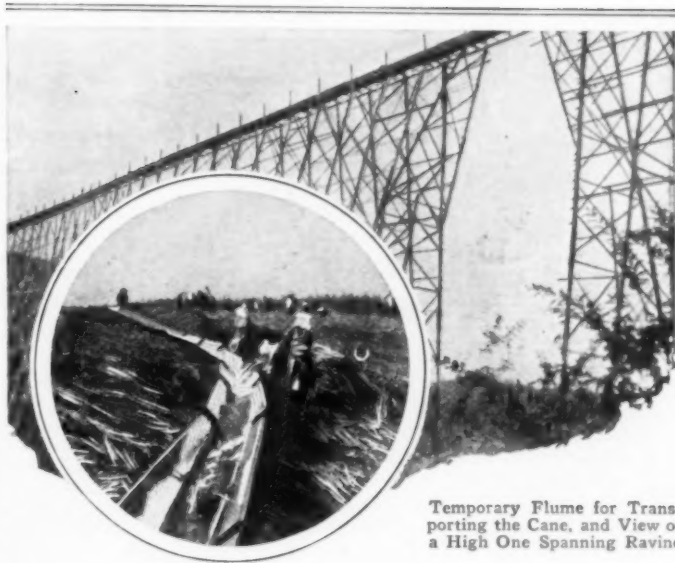
Scientists in France are studying a malady somewhat like the silkworm disease which caused Pasteur so much trouble but also brought him fame. This sickness attacks the corn borer, and it is hoped that, if ways can be found to spread it among the pests, an effective means will have been discovered for checking the inroads of the destructive insects. The sickness is believed to be caused by tiny single-celled animals which are parasites and are found in the internal organs of the borer larva. Another disease that may be directed against the corn pest, spreads like an epidemic, destroying the digestive organs of the borer.

HOPPER FOR RECEIVING CHANGE PROTECTS GLASS COUNTER



To eliminate the inconvenience of picking up small change from the top of a glass counter, and to protect the cabinet from breakage and stains, a hopper cup has been introduced. Coins are placed in the top and the customer receives them by placing his hand under the hopper, raising a square tube underneath a trifle, which allows the money to fall into his open hand. There is nothing about the unit to get out of order, and the base may be used for advertising legends.

☛ Those wishing further information on anything described in the editorial pages can obtain it by addressing Bureau of Information, Popular Mechanics Magazine, Chicago.



Temporary Flume for Transporting the Cane, and View of a High One Spanning Ravine

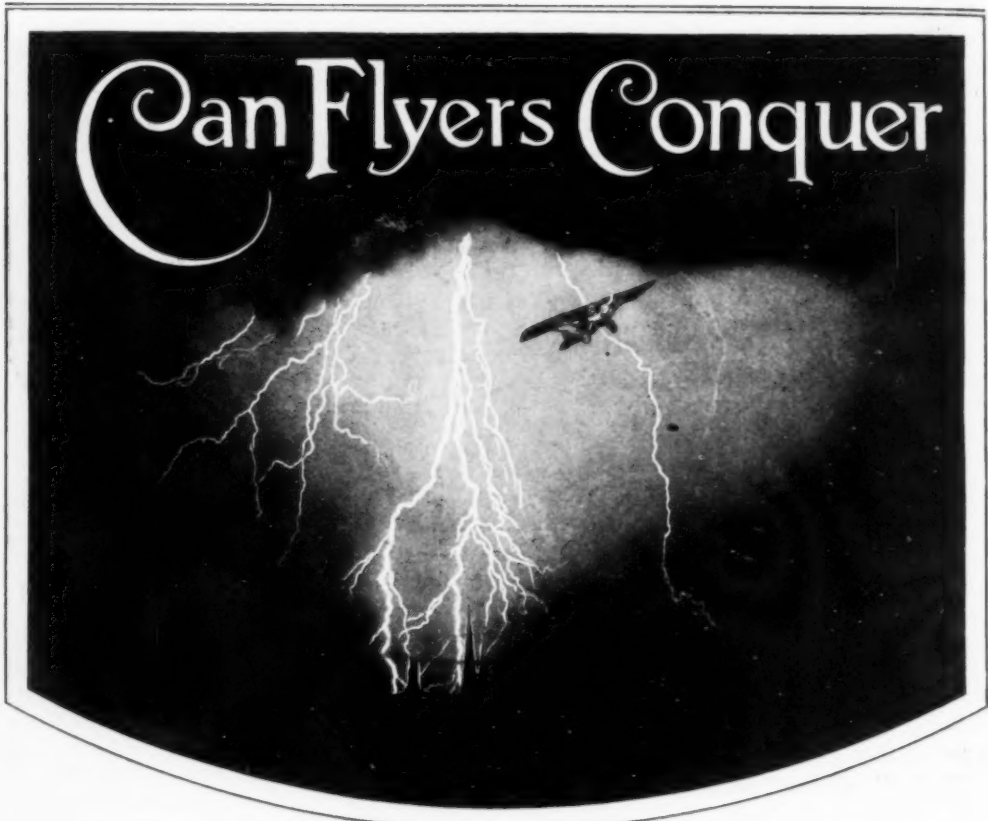
SUGAR CANE FLOATED TO CARS IN PORTABLE FLUMES

Portable wooden flumes are employed on some of the sugar plantations in the Hawaiian islands to convey the cane from the fields to the cars in which it is shipped to the mills. These movable flumes, which are placed from 250 to 300 feet apart, carry a powerful current of water which is turned on after the cane has been piled into the trough. The ducts lead to the permanent or main flume which takes the cane to the central loading station.

CHEMICAL EXPLODES IN WATER AND TAMES GAS

Chemistry has given man another valuable aid in a substance that is expected to prove of great service in war and in peace, a preparation which explodes with great force in water and also neutralizes poison gases of various kinds. Dr. C. R. Kokatnur, a consulting chemist, recently described the compound as an organic peroxide. In some forms, it will explode with terrific power in water—a valuable characteristic when it is considered that most of our present explosives are useless when damp. It can also be used to tame vapors such as mustard gas. A counter cloud of it, the chemist declared, might render destructive gases harmless.

Can Flyers Conquer



There Is No Authentic Record of a Plane in Flight Ever Being Struck by Lightning, Though Many Balloons Have Been Destroyed and Their Pilots Killed by Bolts

TWO airplanes crashed a few weeks ago, one in New Jersey and one in Pennsylvania, both, presumably, shattered by lightning. In the first Capt. Emilio Carranza, Mexican flying ace on a good-will voyage to the United States, died, and in the other perished Morris M. Titterington, inventor of the earth-inductor compass that guided Lindbergh to Paris, and a woman flying pupil.

Six weeks earlier, lightning destroyed three balloons in the national balloon race a few miles from the start at Pittsburgh. Two of the balloonists were instantly killed and a third terribly burned.

The question immediately arose whether an unlooked for peril had cropped up to menace aerial navigation.

That Capt. Carranza was a victim of lightning is in doubt, despite the first reports to that effect. A careful examination of the scene indicated he probably had lost his direction in a terrific thunder-

storm and flown blindly into the earth while under the impression that he was at a safe altitude. There were marks of his plane along the tree tops for 1,800 feet before the final crash.

That Titterington was killed either by a direct lightning bolt or by the wrecking of his plane by lightning is also doubted by both flyers and lightning experts, for in all the history of flying there is no proved case of a bolt striking a plane while in the air.

That the balloons were struck, however, is beyond question, and there are abundant cases of similar accidents on record for 200 years.

What happens when a balloon, filled with inflammable hydrogen, is struck, was graphically told by Ward T. Van Orman, the Goodyear-Zeppelin pilot, winner of many national and international races, whose bag was destroyed and whose aide, Walter Morton, was instantly killed.

Thunderbolts?

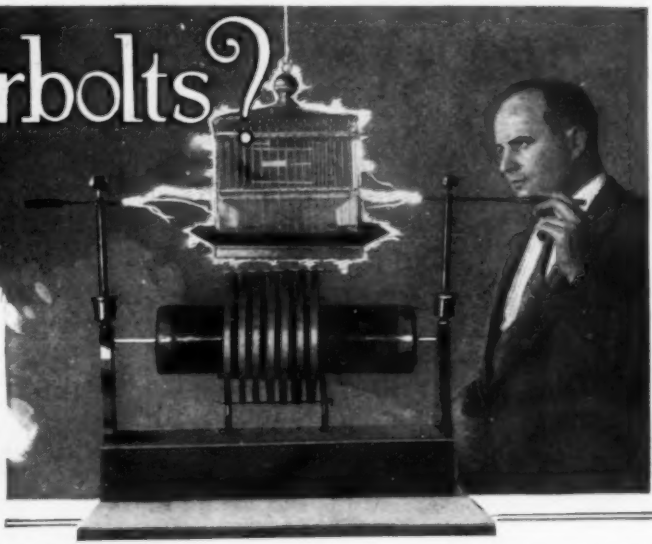
"I was looking directly at the flash," Van Orman said. "The thing that impressed me was its smallness, hardly thicker than my finger, certainly not more than five-eighths or three-quarters of an inch.

"It passed within two feet of my eyes. I had time after the flash to look up over the edge of the 'rain dodger' we had spread across the top of the basket and note that the bottom of the bag apparently was still intact. Probably it was two or three seconds after the flash before the concussion knocked me unconscious.

"How high we were, I don't know. A few moments before, in the terrific rain-storm, we had been blown down until we touched the ground, then bounded up again. It was a typical summer line squall, like the one that destroyed the 'Shenandoah,' with rising and descending air currents moving at high speed only a few feet apart. As we were blown down to the ground, we passed within 500 feet of Capt. E. W. W. Kepner's army bag, going up. We were so close, his aide, Lieut. W. O. Eareckson, shouted across to me.

"It was only a few minutes later that we were struck, probably the army balloon was within a few hundred feet of us, though neither of them saw our bag burn. We might have been 300 feet up, or we might have been a thousand.

"After I passed out, the bag burned and the basket, with Morton and me in it, fell to earth. It hit hard enough to burst the pontoons underneath, and cans of food among our stores were telescoped by the impact until they were an inch shorter than originally. The basket turned over on its side, and, still unconscious, I got a



The Bird in a Cage, Immune Because the Current Passes through the Metal, Suggests a Way of Safeguarding Balloonists

bump on the back of the head that kept me out for three and a half hours.

"When I came to, my head was lying outside the basket, with rain falling on my face. I felt Morton beside me and tried to take his pulse, but could find no sign of life. Thinking he must be seriously injured, I jumped up to run for help, and discovered that my leg was broken and my back so badly injured I couldn't even crawl. I began to yell for help, and, fortunately, a farmer, living half a mile away, woke up just about that time, found his bedroom was getting stuffy, and, as the rain was nearly over, he got up to open the windows, heard my cries and came to the rescue."

As a result of the disaster to the balloon race, the army, navy, weather bureau, several universities and the Goodyear-Zeppelin company have set to work to make ballooning safe from lightning.

The solution, they believe, lies in an adaptation of an old laboratory stunt in which a canary in a metal cage is hung between the electrodes of a high-frequency machine and artificial lightning shot at it. The metal of the cage conducts the electricity, and the bird is perfectly safe.

A metal birdcage, built into the balloon basket, is to be tried in an effort to provide sufficient electrical capacity to save the pilots from shock. If the pilot can



St. Elmo's Fire, Above, Flaming from Lightning Conductors in an Alpine Village, and, at Right, the Army "No. 3" Leaving Pittsburgh Shortly Before Lieut. Paul Evert Was Killed by Lightning

be protected, the firing of the balloon bag is not a serious matter, as the balloonist can pull the rip cord, deflate the bag of its burning gas, and let the bag parachute within its net to bring him safely down, or, in case that should fail, can leave the basket with his own parachute.

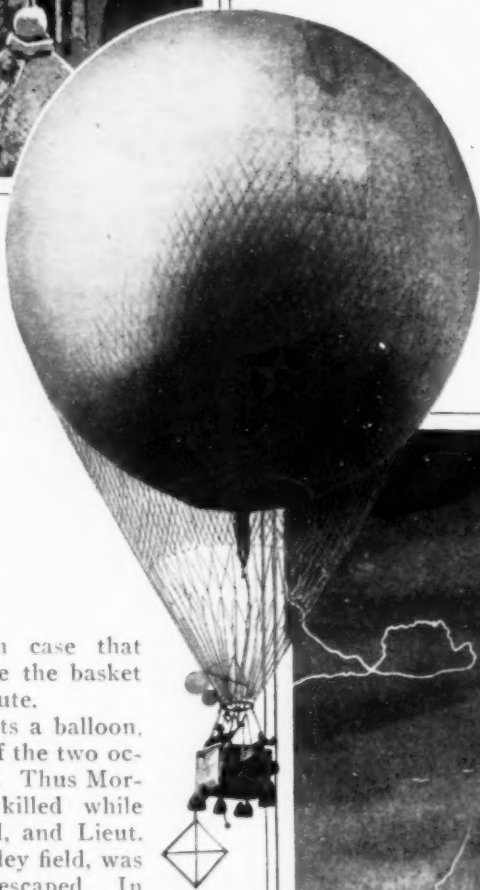
When lightning hits a balloon, it always picks one of the two occupants as the target. Thus Morton was instantly killed while Van Orman escaped, and Lieut. Paul Evert, of Langley field, was killed and his aide escaped. In the third bag destroyed in the Pittsburgh race, James P. Cooper, aide of the "City of Cleveland," was struck and badly burned, but survived, the only man in history to live after being struck by lightning in a balloon.

Eight balloon accidents have been due to lightning in recent years. In 1897, a

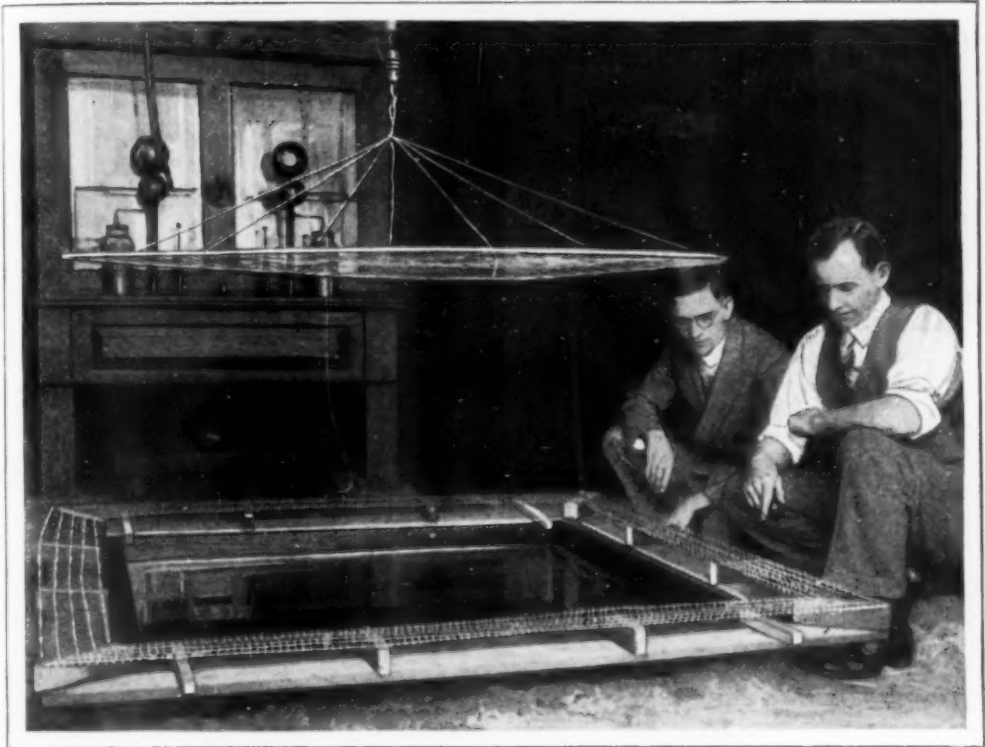
balloon, not in a race, was destroyed and both occupants killed, one by lightning and the other in the fall. In 1923, when the international balloon race was held in Belgium three bags were destroyed in the air and that of Captain Honeywell, the American, on the ground. Five of the six in the bags destroyed met death, the sixth pulling the rip cord and parachuting the bag until he was low enough to jump into a swamp, breaking both legs.

Two of the dead were Americans, Lieuts. Olmstead and Choptaw, in an army balloon. They were blown into another bag at the take-off, but managed to get clear, only to be struck by lightning, Olmstead being instantly killed and Choptaw dying in the fall.

The following year, 1924, two more American balloonists were killed in a storm in Illinois. They were Dr. C. LeRoy Meis-



The World's Tallest Lightning Rod, the Thousand-Foot-High Eiffel Tower in Paris, Photographed Just as It Was Struck in a Storm



A Variation of the Birdcage Theory Being Tested in a Los Angeles Laboratory as a Means of Protecting Oil-Storage Tanks from Being Fired by Lightning

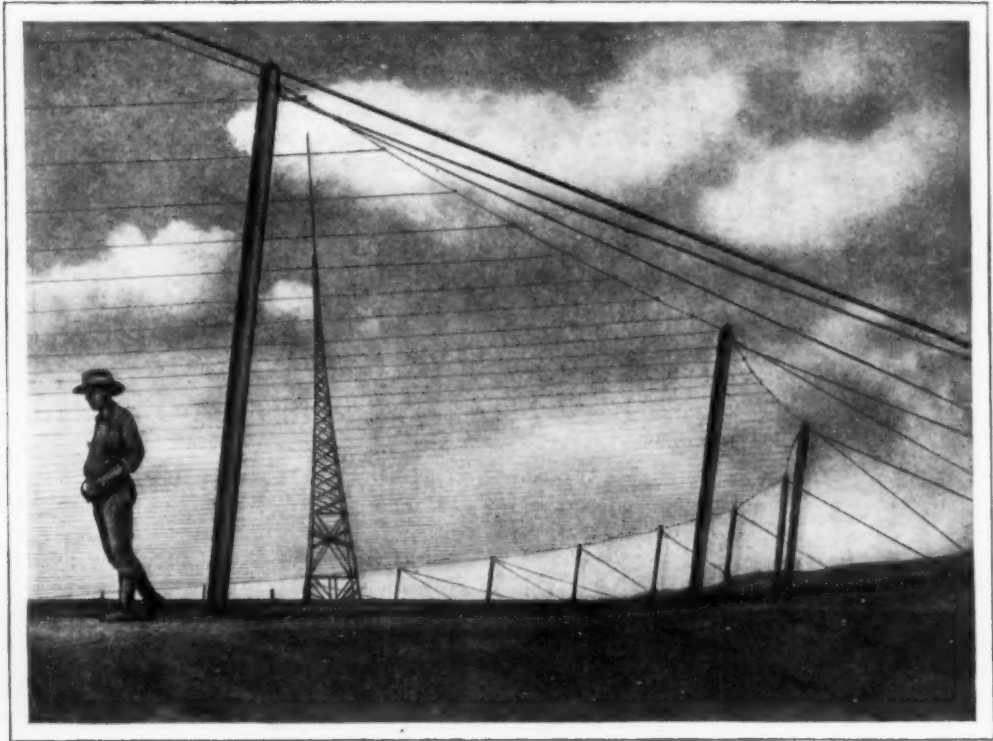
inger, a weather-bureau scientist, who had been making a study of thunderstorms by flying through them, and Lieut. James T. Neeley, an army-balloon pilot from Scott field, Belleville. Dr. Meisinger was struck and killed by the bolt. Lieut. Neeley did not have his parachute tied to him, but grabbed the rope and jumped, attempting to hold the rope in his hands. When his body was found, the palms were badly burned from friction, showing he had been unable to keep his hold until he reached the ground.

Curiously enough, the huge Zeppelins, with millions of cubic feet of hydrogen compared with the few thousands in a free balloon, are immune to lightning. More than 100 of them have been struck, but a Zeppelin never has been destroyed in that way. The birdcage nature of their metal framework is responsible for their immunity, it is believed. The great mass of the metal absorbs the shock. Part of the metal fuses under the intense heat, but the bolt passes out, leaving no serious dam-

age behind. The only dirigible on record as being destroyed by a bolt was one of the Italian semirigids, which had only a metal keel, instead of a complete metal framework.

There is no evidence, according to Van Orman and to lightning experts of the underwriters' laboratories, that either a balloon or an airplane, has any attraction for lightning. If one is hit, it is just the accident of fate that placed it in the path of a bolt passing between two clouds or from a cloud to the earth. A balloon, drifting before the wind, doesn't even build up a frictional static charge, since its speed is virtually the same as the wind, and hence there is no friction. This is shown by the absence of St. Elmo's fire on balloon rigging.

An airplane flying through a storm, on the other hand, is frequently covered with the ghostly radiance of the St. Elmo fire. Under such conditions sparks four or five inches long may be drawn from metal parts by advancing the finger toward them.



Another Birdcage Installed over a Huge Oil Reservoir in California; the Network of Grounded Wires Absorbs the Charge and Carries It Safely Away from the Liquid

One interesting possibility, which has been advanced to explain some of the airplane accidents in storms, is that the pilot received such a shock and was so surprised he lost control of his ship and went into a spin from which he could not recover. St. Elmo's fire is often seen at sea, playing about the rigging. It resembles the purple corona glow which can be produced by a Tesla coil when the electrodes are too far apart for the energy to jump the gap.

The problem of protecting balloons, and possibly airplanes, from lightning, opens a whole new field of research. Lightning protection on the ground is fairly easy, inasmuch as it only involves providing conductors of sufficient size to carry the current down to the ground. But in the air, with no ground connection, the problem is radically different. The success of the Zeppelins shows that, given metal of sufficient mass to absorb the shock, the airship is safe from destruction, but whether enough metal can be added to a balloon basket without destroying the lift of the bag remains to be seen.

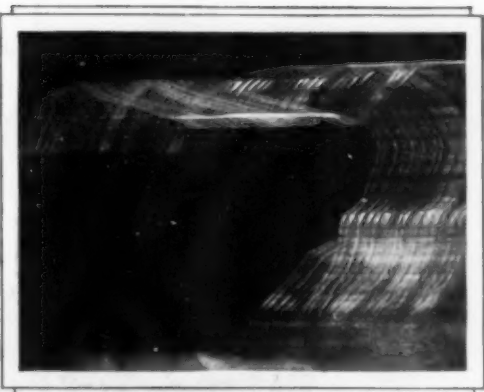
The group working on the problem is collecting the experiences of all the flyers who have met lightning in the clouds, to study its manifestations and its actions. One difficulty is the fact that the eye may frequently be fooled. Stories of the queer pranks of so-called "ball lightning" are fairly common. Observers have described balls of fire coming into their homes, rolling down the stairs, across the floors, and disappearing through the windows. A famous ball-lightning story in the west is of a ball of fire that rolled along the backs of a tight-packed herd of cattle, until it finally fell off one cow's tail, hit the ground, exploded and killed a score of cattle.

Actually, scientists now believe, ball lightning does not and never did exist. It is merely an optical illusion. The eye has a habit of retaining bright images for some seconds. Look directly into an intensely bright light, an arc or one of the Kleig lamps used by the movies, then shut your eyes and turn your head away, and the image lingers in the eye for a period of several seconds.

In the same way a person dazzled by a blinding flash of lightning may shut his eyes and turn his head away, but the vision persists and seems to be a ball of fire rolling around the room, wherever the eyes are turned, until it gradually dims and finally vanishes.

One of the most interesting experiments with lightning is now being conducted in the foothills of the Allegheny mountains near Lake Wallenpaupack, Pa., where engineers have been making experiments to ascertain the effect of lightning on high-voltage transmission lines. The latest achievement is a photographic record of a lightning stroke.

This picture, taken on a Friday noon, the first of its kind ever made in the world, reveals a stroke on the transmission wires of approximately 2,500,000 volts. It was made automatically by a high-speed camera which can record what happens in a mil-

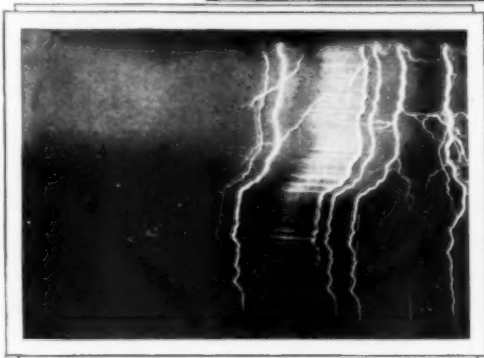


lionth of a second, or even a fraction of such a brief interval.

The negative showed that before five-millionths of a second had passed, the voltage wave on the 220,000-volt line had climbed to more than 1,500,000 volts. A local disturbance, due to an induction flash-over and reflection, caused a rise to 2,500,000 volts in a fraction of a millionth of a second. This

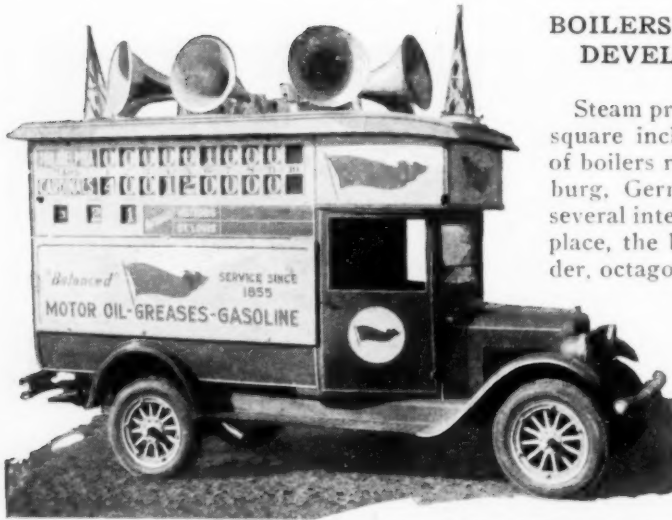
splash or ripple then died down in a millionth of a second and the wave passed to below dangerous value in about ten-millionths of a second and to zero—all in a total of forty-millionths of a second.

The mountain laboratory where the picture was made was planned with the expectation of continued observations on natural lightning, with the realization that a great deal of data will be required for practical solution of lightning control on transmission systems.



Photographing Electric Flashes with a Moving Camera; the Plate Separates the Discharges. Top Picture, into Many Separate Flashes

Halibut weighing as much as 650 pounds have been caught.



Truck Equipped as Scoreboard and Radio Apparatus, to Announce Progress of the Games; Phonograph Music Also Is Furnished

RADIO TRUCK SHOWS SCORES OF BASEBALL GAMES

Residents of a mid-western city, interested in sports, welcome the appearance of an advertising truck equipped with an efficient radio receiver on which the latest news of the baseball games is heard. As scores are announced, inning by inning, they are visibly shown in squares on the exterior of the truck. The traveling news station also has a phonograph with amplifying apparatus to entertain listeners with music when there is a lull in the game reports.

BLACK SHEETS INDUCE SLEEP

By using black sheets and pillow cases instead of white, an Italian physician reports good results in persuading unruly insane patients to go to sleep. The doctor declares that the plan is effective with sane persons in insomnia cases.

BOILERS SHAPED LIKE TOWERS DEVELOP HIGH PRESSURE

Steam pressure of 3,375 pounds to the square inch is developed in a battery of boilers recently tested in Charlottenburg, Germany. The plant involves several interesting features. In the first place, the boilers are shaped like slender, octagonal towers and the fuel, coal dust, is blown in at the top together with a blast of preheated air. Combustion takes place in the open space at the center of the boiler which is surrounded by the water tubes. An extremely high fire-box temperature is produced in this manner and steam raised to over 3,000 pounds to the square

inch and to a temperature of 450 degrees Centigrade. The amount of ash produced is small and falls out at the bottom, while the combustion gases are turned back to warm up the preheater for the air blast. So completely is the heat consumed that the outside of the towerlike boilers is said to be but little warmer than the air.

SUPPORT FOR ROD IN TROLLING HELPS HOOK FISH



Pole Holder That Helps Hook the Fish

Clamped to the seat of the boat with thumbscrews, a steel support for the fishing rod is said to be of special aid when trolling for game fish because of the position in which it keeps the rod. It holds the pole rigid, so that when the fish strikes, the rod springs back, helping to set the hook. The holder may also be used when stillfishing from the boat, although not primarily made for that purpose.

HOW TO UNMIX OIL AND WATER BAFFLES CHEMISTS

Oil and water do not mix as a chemical compound but mingle as an emulsion, that is, with extremely fine drops of one suspended in the other, and how the two can be separated without troublesome and costly processes is something that oil producers and chemists would like to know. According to Dr. Gustav Egloff, there are more than 100,000,000 barrels of this emulsified crude oil in storage tanks and sump holes in the ground, and refiners are seeking a cheap way of separating the oil from the water, as the emulsified product represents many millions of dollars of potential value. One of the chief aims of the refiners is to produce lubricating oils that will not emulsify in motors and turbines under service conditions.

DESK AND TABLE COMBINED TO ENCOURAGE STUDY

Equipped with a removable drawing board, charts and other appliances, a combination child's desk and table is adjustable to different heights as is the seat that comes with it. On one side of the board, is a slate which takes colors for sketching or painting, and the desk part may be taken off so that the table can be used separately, if desired. The charts are on scrolls that can be quickly changed.



Child's Desk That Folds into a Table and Has a Removable Drawing Board



Setting a Pole After the Hole Is Dug; the Endless-Tread Tractor Is Fitted for Rough Travel

HOLE BORER AND POLE SETTER AIDS POWER LINE WORK

Constructed for duty in rough country, a combination unit for boring holes and setting power and telephone-line poles, has been introduced. It is run on an endless-tread drive so that it can climb hills, traverse ditches and surmount other obstacles, and is equipped with an efficient auger for boring the hole in any kind of soil as well as at angles and also has a derrick arrangement for hoisting the pole and lowering it into the hole. It can handle poles forty-five feet long, and may also be used for dragging them from the supply pile to the place where they are to be set. In digging, the dirt is piled at the side of the hole for convenient refilling.

SOAP FROM WASTE FRUIT

Avocados, not up to market standard, contain oil that can be successfully utilized in the manufacture of hard soap, chemists of the department of agriculture have discovered. Tests have shown that the oil does not become rancid even after a year's storage under ordinary conditions.

ELEVATOR ON HOME STAIRWAY AIDS INFIRM PERSONS



Elevator in Use, and As It Appears When Folded against the Wall at Bottom of Stairs

For installation on the stairway of a private home, an electrically operated elevator has been introduced. The occupant sits in a comfortable chair or seat and controls the lift with switch buttons on the car and at the top and bottom of the stairs. The carrier runs on a roller track alongside the stairs. When not in use, the platform and seats fold up against the wall so that they take up but little space and do not interfere with the ordinary use of the stairway.

BUFFALO HUNT CENTURIES AGO SHEDS NEW LIGHT ON MAN

Interesting evidence on the question as to when man first appeared in North America, has been discovered near Folsom, N. Mex., in stone arrowheads lying close to the bones of bison of a kind supposed to have been extinct long before the white man arrived on this continent. If the arrows were shot at the living game, as the evidence indicates, the conclusion of some scientists is that the hunters must have been there at least 25,000 years ago, possibly even several hundred thousand years. The bison bones were fossilized and there have been no discoveries to

show that animals of this variety have existed in America in recent times. Additional clues as to the age of the bones and of the weapons are the depth and formation of the earth in which they were found. The excavations were conducted by the Colorado and the American museums of natural history.

NON-ELECTRIC DAYLIGHT SIGN SHOWS BRILLIANT LETTERS

Daylight is used as a substitute for electricity in an advertising sign recently marketed. It is of simple construction, consisting of but three parts, a special glass on which the legend is painted, a reflecting mirror and the inclosing box. The glass forms the top and is so made that its grained or pebbled surface functions as thousands of minute prisms which focus and intensify the light that shines through the glass. Letters in the sign are formed by blocking out the space around them with opaque paint, leaving the characters clear. They are projected through the open front of the box by means of a mirror set at an angle of forty-five degrees. By using stained glass, signs may be made in any color or combination of colors. The letters have no halo of light around them as often occurs in electric signs, so that they can be identified at great distances, there is no operating cost and practically no upkeep expense and the sign is simple to install. It is adapted especially for automobiles and trucks, store fronts, windows and road signs. Experiments are being made in illuminating the prismatic glass in order to achieve the same brilliant display effects after dark.



Drawing of the Lightless Sign, Showing How Letters Are Reflected by Mirror through Prism Glass

Five feet, five inches is the average height of human beings.



Catapult on Steamer "Ile de France" to Launch Planes; the Biplane Shown Here Was Superimposed on a Photograph of the Vessel

PLANES FLY FROM OCEAN LINER WITH AID OF CATAPULT

Flying service from the "Ile de France" to the shore is expected with the installation of a catapult to launch the planes from the liner's deck. The apparatus is similar to that used on battleships and will make possible quicker landings of passengers, mail and other "rush" cargoes.

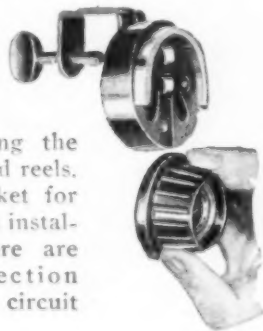
ESCAPING GAS SOUNDS ALARM TO PREVENT ACCIDENTS

Gas is made to sound its own warning, should it escape from the mains, in an alarm device demonstrated by an eastern inventor. It is so sensitive that it will respond when the air space in a room contains as little as one one-hundredth part of gas, the inventor declares. In a recent test, an open bag of illuminating gas was held near the alarm, a boxlike contrivance, and in a few seconds, an electric bell connected to the box, rang the warning. The

signal is applicable to various home and industrial uses, and could also be employed to detect the presence of war gases, it is claimed. As a guard against explosions, it has been adapted to use in gas plants.

CIGAR LIGHTER WITHOUT WIRE LATEST AUTO CONVENIENCE

One of the chief features of a cigar lighter, especially adapted for use in an automobile, is that the heater itself may be removed from its socket and passed around in the car eliminating the bother of cords and reels. A clamp-on bracket for the base, simplifies installation, and there are cords for connection from the battery circuit to the lighter.



Guardians



EARLY in June an old-time windjammer set sail from the coast of Connecticut carrying beginners in the art of seamanship. The boys aboard came from all parts of the United States—from farm, office and shop. To many of them the voyage brought the first taste of the sea.

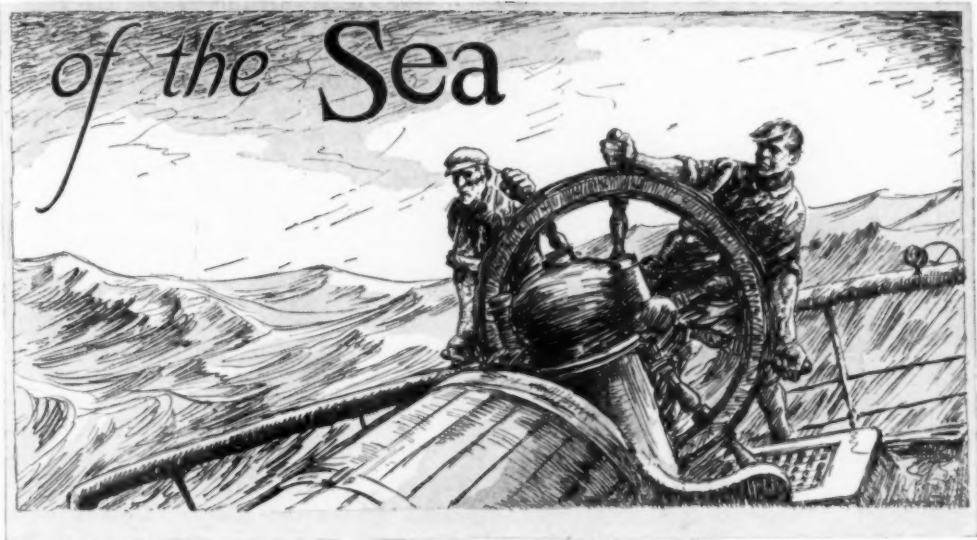
Three months later, the young landmen went ashore at New London versed in the language of salt water and well grounded in the science of navigation. They were landmen no more. Ninety days of brisk training had transformed them into sailors.

The cruise is a part of the plan for training men as officers of the United States coast guard, that arm of the government which maintains the life-saving service on stormy coasts and treacherous waterways. Their craft is the "Alexander Hamilton," practice ship of the coast-guard academy, with a colorful record in the navy as the gunboat "Vicksburg." In her new life, the vessel bears the name of the father of the coast guard—Alexander

Hamilton, first secretary of the treasury and the man whose formal recommendation resulted in the creation of the organization which was the foundation of the present service.

The coast-guard academy, at New London, has kinship with West Point and Annapolis as a training school for the officers of the future. Members of the cadet corps are selected youths, appointed for their seeming fitness. They receive pay and allowances similar to those granted West Pointers and navy midshipmen. Graduation is followed by appointment to the rank of ensign, as in the case of the man who graduates at Annapolis. From this commissioned grade the promotions follow the course prevailing in the navy, with the post of admiral as the ultimate possible goal.

The academy itself is the center of training and educational activities, but the real romance of the work belongs to the sea, aboard the barkentine practice



ship, a three-master of a thousand tons. In this craft, the cadets have a seagoing college, 168 feet long, thirty-six feet wide, and drawing twelve feet of water. In her early days as the "Vicksburg," the vessel formed a part of the blockading squadron off the harbor of Havana, during the Spanish-American war. Later, she carried Brigadier General Frederick Funston in the Philippines, for the capture of the rebel chief Aguinaldo, returning to Manila with the leader and his fellow-prisoners on board. The period of the European war found the vessel in active patrol duty on the Pacific coast.

When the youth from the farm or shop enters the coast-guard academy, his first contact with the sea comes with the practice cruise of the "Alexander Hamilton." The voyage may take him and his comrades to various European and north African ports, affording a touch of travel combined with a course of elementary training in seamanship. On this cruise, the green hand is taught to be a sailor in the real sense of the word, for the coast-guard policy is that no man belongs in the life-saving service until he is a full-fledged seaman, capable of doing everything that may be required of a sailor, and doing it in approved fashion.

This sea training carries the full flavor of the days when commerce was borne on sailing ships. From the beginning of his

course, the cadet is surrounded by the romance of the sea. He studies salt water as the collegian studies books. His campus is the broad Atlantic, his schoolroom a "Nautilus" of a past generation.

When the "Alexander Hamilton" puts out to sea, the new cadet goes through a course of training which gives him a true taste of the thing for which he entered the academy—the life of the ocean. Starting with such simple tasks as splicing knots and handling lines, he is taught to manipulate sails, man the small boats and carry on the general work of a sailor, including the care and upkeep of a ship at sea. That he escapes deck scrubbing is due to the custom of leaving this task to the crew while the student learns jobs of greater importance. Growing familiarity with the workings of the ship brings the newcomer's introduction to the mysteries of taking sights, "shooting" the sun and stars for calculating the vessel's position, figuring out the position by means of dead reckoning, and similar fundamentals of navigation.

This introductory cruise serves likewise to train the cadet in the work of the ship's lookout—the man who stands forward and reports "sail to starboard," "whale off the port bow," or "smoke dead ahead." Another bit of schooling connected with his future work as a life-saver is afforded by frequent turns at the "life-



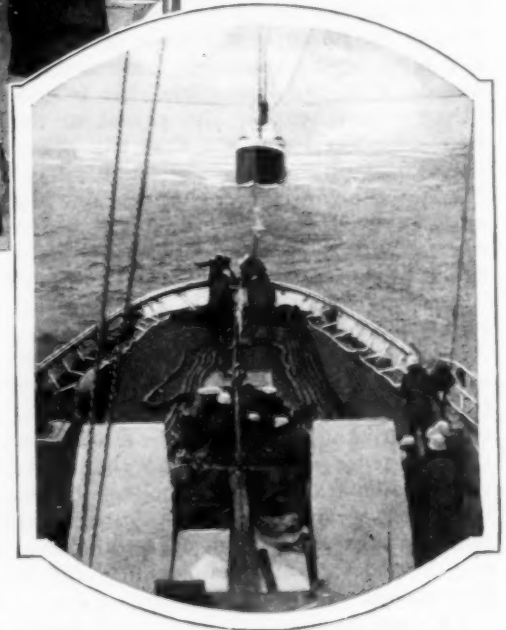
buoy watch," during which the cadet stands by the buoys for prompt action in case of "man overboard" or similar emergency. He receives, too, a course of training at the wheel, with a second-year student instructing him in the proper handling of the steering apparatus.

The practice cruise affords practical application in the theoretical subjects taught in the academy. Added value arises from the opportunity given the officers aboard the ship to observe and study the individual inclinations of the cadets when they are away from their accustomed land environment, to note their fitness for a seagoing occupation, and to instill into them the traditions and standards of the coast-guard service.

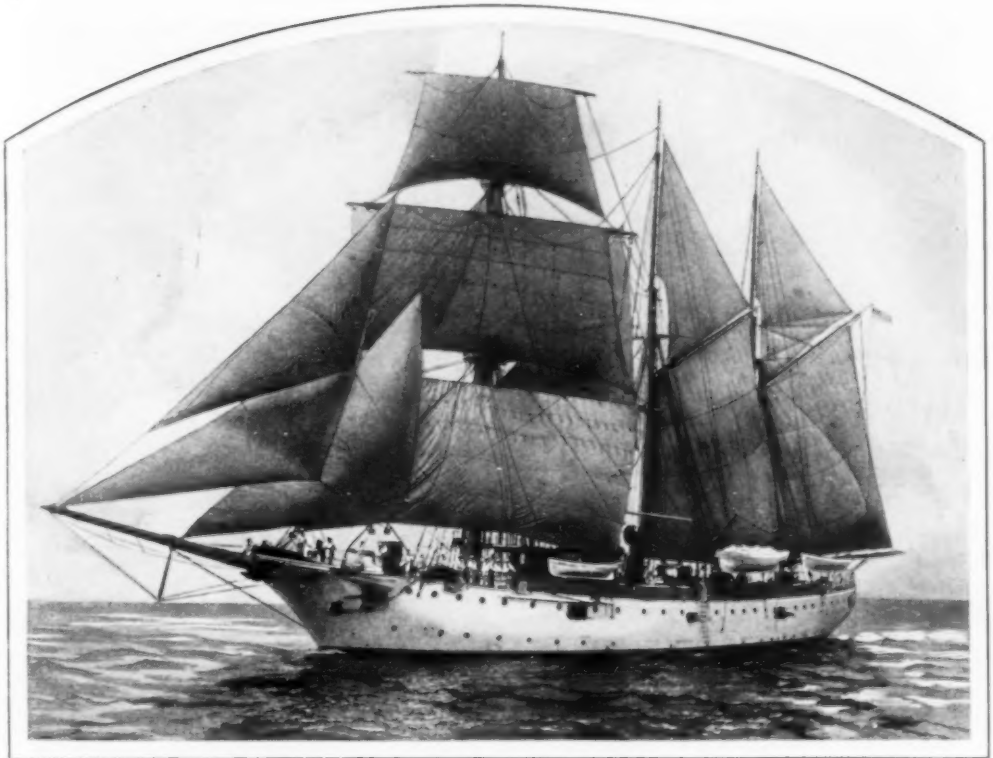
After the first summer's cruise, there comes a winter's study at New London, during which the cadet is introduced in the theory of navigation in its scientific aspects. The following summer brings a second cruise, giving a chance to apply the theory acquired in the winter studies at

the academy. In this cruise, the student may become a coxswain, or he may attain the post of captain of a gun's crew. Either position affords a lesson in giving orders to the new crop of first-year men under him. Experience has shown that the work of the second summer does much to perfect the cadet's knowledge of navigation and to fit him for the post of cadet officer of the deck, achieved a year later, during his third cruise on the school ship "Alexander Hamilton."

The duties of the cadet officer of the deck tend to transform the student into a real navigator and captain of men. Under the watchful eye of a commissioned officer, the cadet takes responsibility for handling the ship at sea and in port, getting under way, dropping and raising the anchor, docking and undocking, and doing the various things that are supposed to be done by one of the mates. In this work the commissioned officer leaves the cadet officer



A Breeches-Buoy Rescue from the Mine Sweeper "Swan"; Life-Line Firing Practice, and a Cutter Towing a Disabled Steamer in Bering Sea



The Coast-Guard Training Ship "Alexander Hamilton," in Which the Recruits Are Taught Seamanship and the Handling of the Fast Disappearing Type of Sailing Cutter

to his own devices and does not interfere with his activities, except in cases of emergency where more seasoned skill is demanded. By the end of this cruise, the successful cadet is a qualified navigator.

The academy gives a comprehensive course of studies which is intended to produce well-rounded men for the commissioned personnel of the coast guard. As the oldest armed force for the protection of the American seacoast—antedating the navy—the service has built for itself a tradition covering 138 years of achievement. No branch of the national defense takes greater pride in living up to its traditional reputation for gallantry in action and for readiness to serve. The guard's sphere of usefulness is both civil and military, with the primary object of saving life and property, but with additional duties covering the various maritime functions of the federal government.

Because of its wide range of activity, the coast guard requires officers of superior type—men who are capable of

meeting situations of diversified character. For aiding vessels in distress and effecting rescues at sea, there is need for heroism of the highest type and the ability to lead men in the face of the utmost peril. The destruction or removal of wrecks, derelicts and other floating menaces to navigation calls for resourcefulness of another sort, requiring judgment and skill of more than ordinary character.

Still other forms of ability and training are demanded in the ticklish work of protecting the government against custom smugglers and rum-running enterprises. In these undertakings, the coast guard acts as an armed force which must be ready to compel respect through the use of three-inch guns whenever there is occasion for such drastic treatment of a situation.

Further duties involve the enforcement of navigation laws and quarantine regulations, the suppression of mutinies on merchant ships, the protection of seal and other fisheries in Alaskan waters, and the



All Night Long, the Coast Guards Patrol Their Beats, and When a Wreck Is Sighted, a Rocket Summons the Entire Crew with Surfboat, Breeches Buoy and Lyle Gun to Aid in the Rescue

summer patrol of the iceberg regions off the Grand Banks of Newfoundland. Added to these responsibilities is the task of policing regattas and marine parades in the interest of public safety.

With this varied program of routine work, and with the additional prospect of serving as a part of the navy in time of war, the coast guard stands forth as a versatile service requiring the highest type of commissioned officers. The training afforded by the academy and the practice ship is of a nature designed to produce the desired material. The cadet who masters the course acquires academic education as well as seamanship. His courses have embraced English and French, mathematics and such studies as mechanics and chemistry, gunnery and physics. He has studied the science of ballistics, dealing with the travel and force of projectiles, their pathways and their impacts. He has been schooled in drill regulations, service regulations, the custom laws of the United States and the general aspects of international law as pertaining to the seas. In short, his preparation for the coast

guard has qualified him to appear to good advantage wherever he may be thrown, and to uphold the traditions of the guard.

The full course occupies three years. Its satisfactory completion marks the beginning of the graduate's work in the general organization of which he has become a full-fledged part.

Life on the "Alexander Hamilton" possesses the lure of the sea in its fullest aspects. In the whole realm of American shipping, there is no better place for absorbing the traditions of salt water or obtaining the thrill that comes with a favoring wind and full sail ahead.

GRASS PUSHING BACK THE SEA TO AID FARMERS

Acres of land which is covered by the tide twice daily, are gradually being won from the sea and turned into valuable soil for farming, by means of a special kind of grass. It is a rushlike variety and collects mud about its fine roots and slender stalks. Inch by inch, it builds up the shore level.

RIVETLESS BOAT CUTS PATH THROUGH ICE FIELD

That the cutter "Northland," the successor to the veteran coast-guard boat "Bear," is well constructed for its duties in the north was shown by its recent victory over an ice field off Point Barrow. It came through unscathed after ripping and plowing its way through ice six inches thick. The test was considered a point for the special type of construction of the vessel. There are no rivets in the hull, the body being electrically welded throughout. Some engineers predicted that this form of hull would not stand the strain of the ice but would buckle. No such trouble occurred. On the other hand, the "Bear" once suffered a couple of cracked timbers while breaking through ice but three inches thick.

THREE-IN-ONE METAL WORKER LATEST SHOP AID

For general use in a sheet-metal shop, a bench machine with interchangeable faces has been introduced. It may be employed in wiring, turning or burring, the different faces being easily removed and attached to the shafts. Adjustments are made for material of different thicknesses and the gears are completely inclosed for longer life and added safety.



Metal-Working Unit and Three of Its Operations; Note the Inclosed Gears



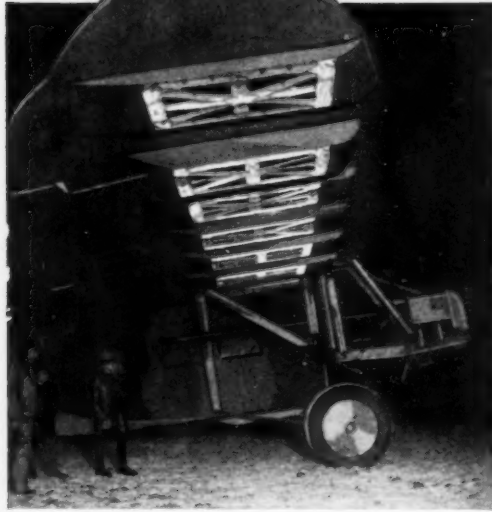
Airplane Thrill Is Provided for the Youngster in This Flying Swing

FLYING SWING LIKE AIRPLANE ADDS TO CHILD'S SPORT

Shaped like an airplane with a spinning propeller at the front, a child's swing now on the market holds three youngsters at a time and is suspended at four points so that it cannot tip. The wings are of wood, the body is four feet long and there is room for a passenger in front and behind the pilot's seat. The swing can be set up in a few moments and is suitable for outdoor or indoor use.

STAINLESS-STEEL PROPELLERS REDUCE SHIPPING COSTS

Stainless-steel propellers have been attached to four ferryboats operating in San Francisco bay, and their use is expected to effect a saving of at least \$25,000 a year by eliminating some of the drydock intervals necessary with the usual equipment for repairs and renewals. A further economy is promised in a reduction of fuel consumption, as the propellers are more efficient than the usual kind. The blades do not deteriorate so rapidly and can be re-pressed into shape more easily than those of cast steel.



Lighted Letters on the Plane Wings Are Visible from Great Distance and Are Interchangeable

FLYING BILLBOARD HAS LIGHTS UNDERNEATH WINGS

Effective use of airplanes for night advertising is seen as a possibility in an experiment in Berlin, where a huge three-motored ship was fitted with lighted letters on the under surface of its wings which had a spread of ninety-five feet. The letters could be interchanged automatically to enable the display of more than one message. The sign could be read when the plane was more than a mile high.

BURROW UNDER SKYSCRAPERS WHILE DIGGING SUBWAYS

While millions of persons walk about in the heart of New York's financial district, a crew of men toils far below the surface, bolstering up the foundations of the huge buildings while the new subway is under

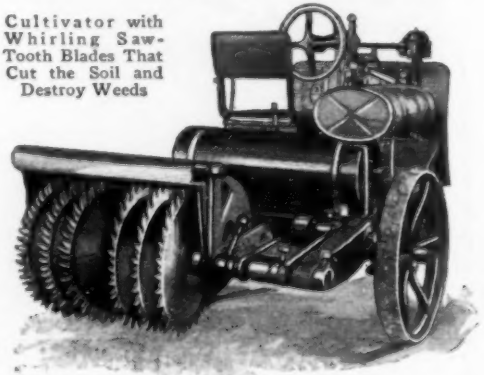
construction. They work in heat comparable with that of a Turkish bath, as they are surrounded by big steam pipes. The main problem involved is to extend the present foundations to a point below the level of the floor of the subway. The supports for the new foundations are steel cylinders in sections, varying in diameter from

twelve to sixteen inches, and in thickness, from one-eighth to three-eighths of an inch. In placing these sections, a small pit is dug under the column to be supported and a hydraulic jack set in position beneath. The cylinder is then pressed down by the jack, since the building column cannot be raised. When the jack has been extended to the limit, pressure is released, and another section of cylinder placed on top of the first and forced down until the bottom unit reaches such hard ground that it will go no farther. To hold up some of the columns, more than twenty steel piles will have to be forced down.

CULTIVATOR SAWS THE SOIL FOR BETTER PLANTING

Applying the principle of sawing to the soil, an Indiana man has devised an implement that plows, disks, harrows and rolls the ground, all in one operation. Large revolving blades with sawlike teeth are said to cut into the ground to a depth of ten inches, pulverizing it and, at the same time, destroying weeds and rodents.

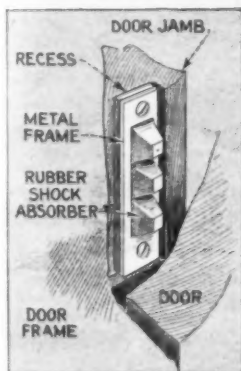
Cultivator with Whirling Saw-Tooth Blades That Cut the Soil and Destroy Weeds



STEEL PILOT GUIDES PLANE WITHOUT HUMAN HELP

A "steel pilot" which operates an airplane without human help, was tested successfully recently at Istres, the great military airport near Marseilles, France, by French army flyers. The mechanical pilot, invented by Major Max Bouchard, weighs only sixty-seven pounds, and it is claimed for it that it is far more effective than a human pilot, and makes it impossible to get a plane into such a position that flying speed is lost, the trouble that usually precedes a tailspin. Flying blind, in fog or other conditions that make it impossible for the pilot to see some object by which he can fix his position, is the cause of many tailspin accidents. Unable to orientate himself by a glimpse of ground or sky, the pilot loses all sense of direction, unless he watches his instruments carefully and obeys them rather than his own sensations. The steel pilot consists of electric motors which operate the longitudinal and lateral controls and also steer the ship.

SLAMMING DOOR IS SILENCED BY RUBBER CUSHION



Mounted in the face of the door frame, a small rubber buffer effectually silences the slamming door. Projecting rubber tips absorb the shock. The cushion is easily attached, a small brass frame giving it a secure foundation.

WHEN GEESE WEAR SHOES

Geese are often driven long distances to market in central and southeastern Europe and, to protect their feet on hard roads, they are given curious "shoes" of tar and sand. They are first made to walk over an area that has been coated with the tar and when their feet are thoroughly smeared, they tread over sand. These shoes wear well, even for several days.



Changing Tire with Aid of Electric Lamps That Are Worn on Headband for Better Vision

TROUBLE LIGHTS WORN ON HEAD AID IN FIXING AUTO

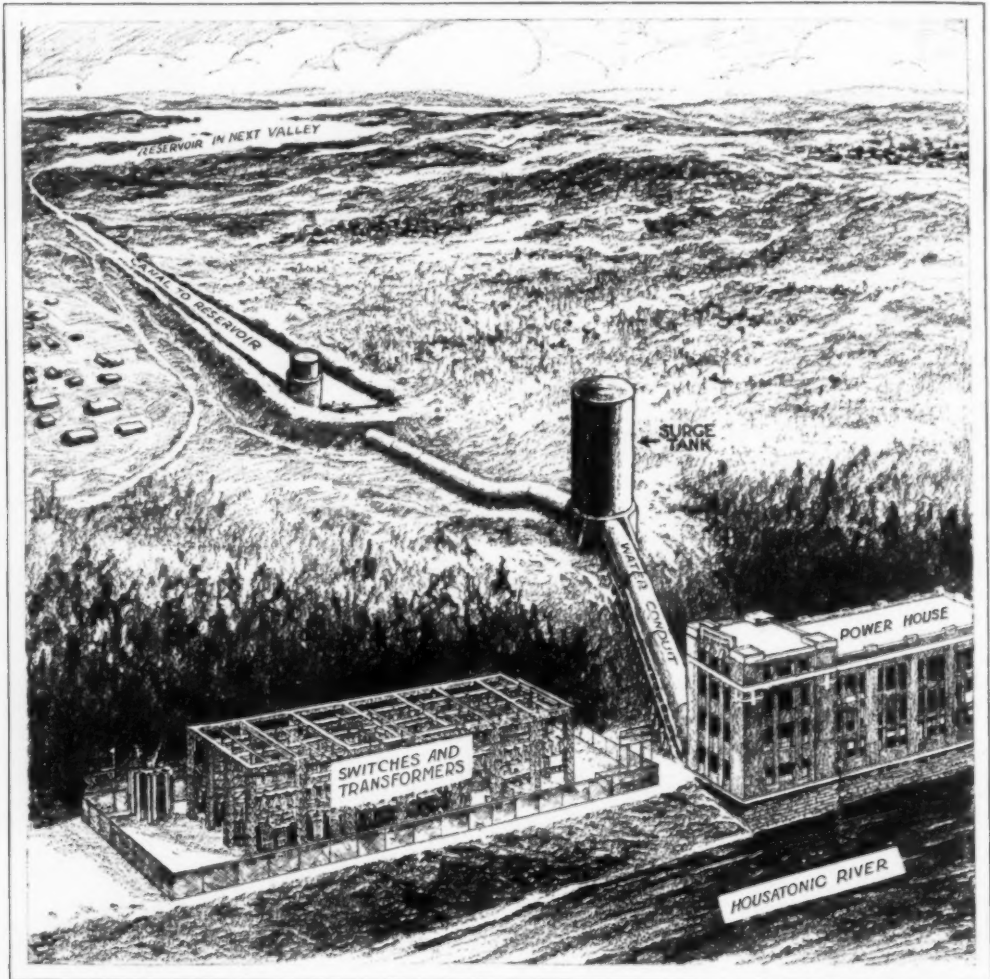
Connected to the automobile batteries and worn on a band about the head, two efficient electric lamps direct their rays where most needed when repairing the car, are not in the way and need no extra adjustment after once put on. The headband is comfortable and secure, both hands are left free for use, and each light can be turned so that the rays may be thrown in any direction desired.

QUICK CLAMP ROLLER SKATE PREVENTS ACCIDENTS

Roller skates that can be put on in less than two seconds, the manufacturers state, have an adjustable clamp with a locking device that fits into a slot on the heel. Once fastened, this catch cannot come loose accidentally. For stage work, the skate is especially desirable, as it is light and comfortable and may be put on in the wings, saving the risk of walking from the dressing room while wearing the rollers.



POWER FROM A NEW KIND OF PERPETUAL MOTION



The Nearest Approach to Perpetual Motion Is This Hydroelectric Plant That Generates Current to Pump Water up a Hill, So It May Flow Down and Generate More Electricity

Generating electricity from water power, and using the current to pump the water back up the hill and let it run down again to generate more electricity looks like an attempt at perpetual motion, but is actually being done with success at the Rocky River plant of the Connecticut light and power company on the Housatonic river. As losses from friction, plant inefficiency and other causes make it impossible to pump as much water as was used to generate the current consumed to do the pumping, the arrangement does not appear profitable, at first glance, but actu-

ally it is. The answer is that the river is on the job twenty-four hours a day, generating current, without regard to noon hours, Saturday afternoons, Sundays, holidays and night time, when the demand for electricity drops as the factory load is shut off. The water flows whether or not current is required, and once it passes over the dam cannot be recalled. So the engineers did the next best thing and arranged to utilize the power that otherwise would be wasted. Two motor-driven centrifugal pumps, each with a capacity of 112,500 gallons a minute, elevate the water 230

feet up the hillside back of the power house and pour it into a reservoir in the next valley. Then, when a peak load comes and more generator capacity is needed, the water runs back down the same pipe and turns the turbine wheels, passes on into the river, and flows down to operate other power houses farther down the stream. Another advantage of the scheme lies in the fact that the storage reservoir in the next valley has a capacity of 45,000,000 gallons, but the natural drainage into its basin supplies only about one-quarter of that amount, leaving space for the pumps to fill.

TWIN TIRE ON AUTO WHEEL DECREASES JARS

A new type of wheel having two tires, one within the other, and said to be adaptable either to motor or trolley cars was exhibited recently. The outer tire is of solid rubber, the other, inside it, is pneumatic and is incased in a steel frame next to the hub. This arrangement is said to take the strain from the outer tire while the inner one acts as a shock absorber. Punctures are also eliminated.

BOAT IS INFLATED LIKE TIRE AND FITS IN KNAPSACK

Designed especially for camping trips, a rowboat, exhibited in Germany recently, can be folded into a knapsack and, when ready for use, is blown up like a tire. In addition, it has a waterproof covering that fits over the top as a tent to protect the occupant from inclement weather.



"Tire" Boat in Use; It Is of Fabric That Can Be Folded into Small Bundle When Deflated



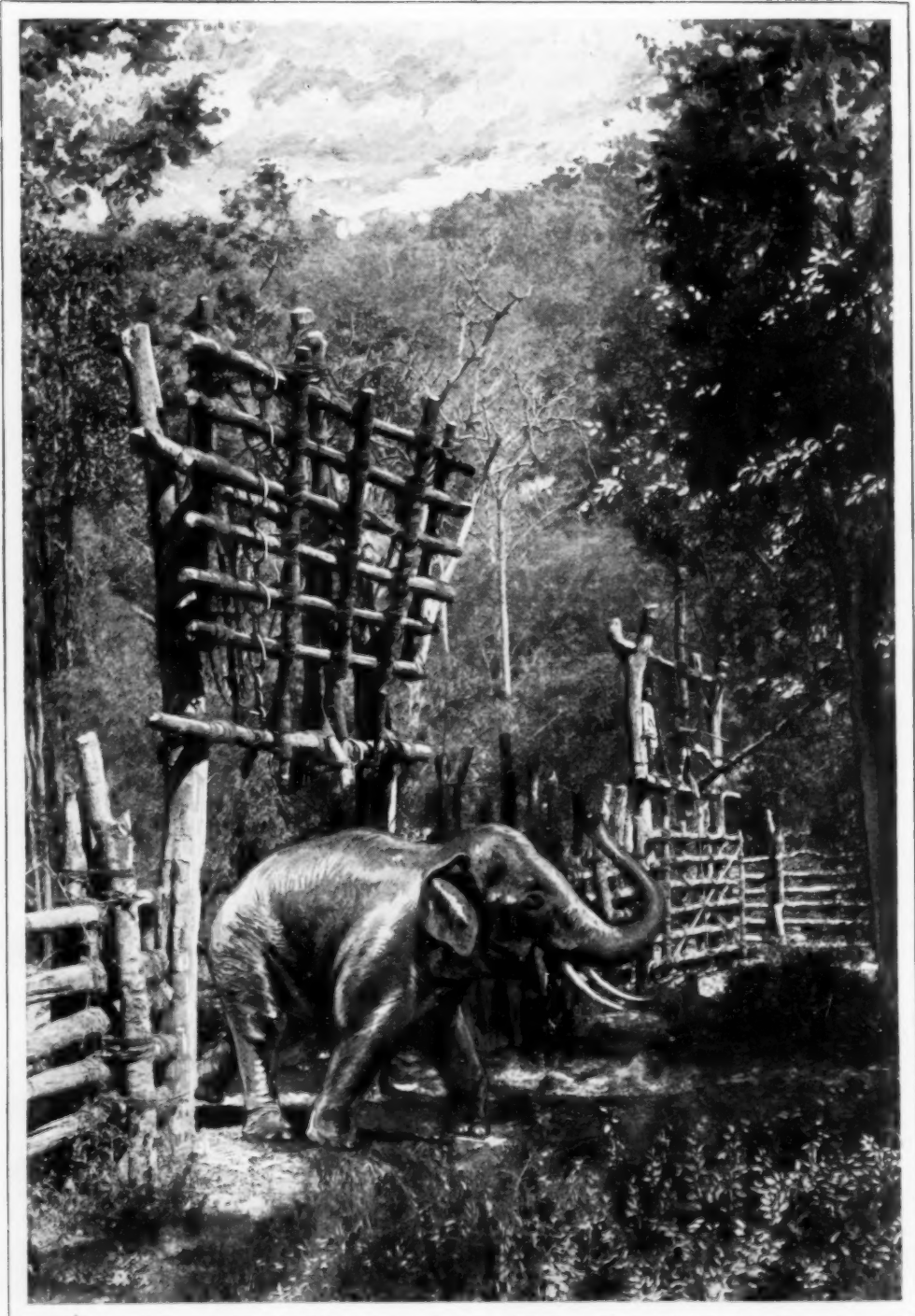
Automatic Telephone Box That Conceals a Motion-Picture Camera for Trapping Criminals

MOVIE CAMERA IN PHONE BOX HELPS TRAP CROOKS

Inclosed in an automatic-telephone box, a motion-picture camera devised by a western inventor, takes pictures of persons without their knowledge. It is intended to be of aid in trapping bank robbers and others. The camera carries sixteen feet of film, is operated automatically and, in tests, has taken pictures of persons eighty-five feet from the instrument.

NEW PAPER MONEY TO BE AGED TO PROLONG WEAR

The life of paper bank notes is about eight months but this might be increased to a year, treasury officials declare, if the paper were aged properly before being circulated. The process delays cracking and tearing. Between 1917 and 1920, the calls for currency were so heavy that the bureau of printing and engraving was unable to keep the pace and new money was issued without the usual aging period. The new notes, which are to be about two-thirds the size of the present ones, are to be thoroughly aged before being issued, the treasury department reports. They will resemble those in use in the Philippines.



A Wild Elephant Charging through the Main Entrance to the Keedah, or Stockade, Used to Trap the Jungle Herds in the Round-Ups in Mysore State, India; the Guards on the Second Gate Are Armed to Check Any Attempted Stampede, and the Fence Is Protected by a Deep Ditch

Trapping Wild Elephants



The Tame Squad Waiting for the Signal to Enter the Stockade and Start Cutting Out the Wild Animals, One by One, So They Can Be Hobbled and Chained to Trees

By CAPTAIN J. P. WILLIAMS

TRAPPING wild Indian elephants, to be domesticated for circuses and parks throughout the world, or put to work piling teak and doing other heavy work at home, is a regularly organized business in the native state of Mysore.

A vast wild-elephant preserve, a hundred miles from the state capital, has been set aside to raise the tuskers. At least once a year a jungle round-up, carried out in many ways like a cattle round-up on a ranch in the western United States, brings scores of the animals, with their cows and calves, into the fold. Pleasure is usually combined with the business, and the round-up becomes a gala celebration in honor of distinguished guests.

Weeks of preparation are necessary before the actual elephant drive starts. An enormous stockade, built of logs driven into the ground and chained together, is erected in a jungle clearing. Inside the fence a deep ditch, carefully revetted with

sharpened poles, is dug around the clearing, except in front of the gates. The ditch discourages an organized attempt to uproot the fence, which probably would crash if an entire herd could run into it.

From the stockade, a long and broad avenue is cleared through the jungle, the undergrowth being piled along the edges to encourage the elephants to keep to the open path. Four to six hundred natives of the district usually are enlisted as beaters, and a herd of tame work elephants is brought down from Mysore city in specially constructed railroad cars, each built to hold one animal.

When the appointed day for the round-up arrives, the beaters, distributed around miles of territory, start their work, beating drums and pans, firing guns and fireworks, and making as much noise as possible. The startled elephants in the jungle begin to mill about, until they find in one quarter there is no noise, so they head in



that direction. The gathering herd eventually stumbles on the cleared roadway and takes to it, as offering an easier avenue of escape than the trackless forest.

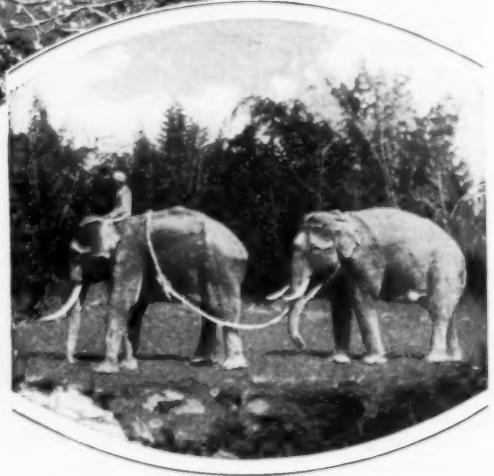
Down the roadway the herd stampedes until they reach the stockade gate and pass through it. The watchers, hidden in near-by trees, release the catch and the gate falls, barring escape of the herd.

The tame elephants are then brought up and picketed near by, waiting until the captured wild animals get over their first fright. As they calm down, the gate is opened and a troop of wily old tuskers, able to fight if need be, and trained for the work, march in and surround the nearest animal, forcing him out away from his mates. Once outside, he is shoved and pushed around until he reaches a picket tree, when natives attach hobbles and chains and tie him up to get used to captivity. One by one the entire wild herd is treated in the same manner. Some fight,

some are stubborn and lie down and refuse to move, while others quickly accept the new order of things and yield.

For several days the captives are kept chained to trees. Then they are yoked one by one to tame elephants and led down to water, and permitted to take a dust or mud bath. The same training goes on day after day until they become sufficiently broken to be worked alone. It usually takes a month or so to tame them sufficiently to be yoked to work animals, and several weeks more before they are sufficiently domesticated to be worked alone.

Then comes the annual elephant auction, attended by elephant buyers from all over India, as well as zoo and circus agents from foreign lands. The best of the work animals go to the lumbering operations, where they are able to carry enormous logs with their tusks.

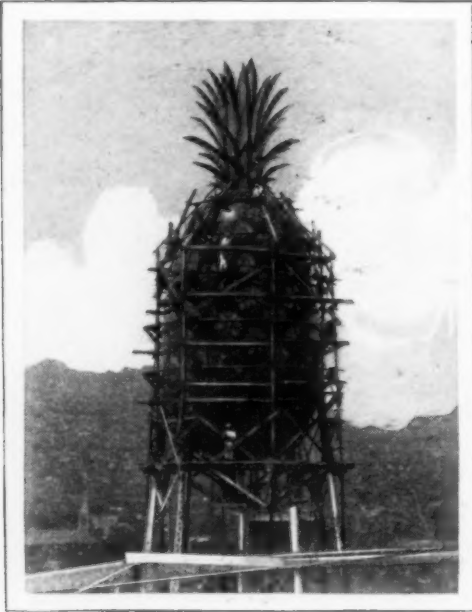


Going to the Round-Up by Bullock Cart; Half-Tamed Young Elephants in the Stockade, and a Wild One Being Led to Water



The Arrival of a Wily Old Tusker at the Round-Up Scene; the Tame Herd Is Transported a Hundred Miles by Specially Built Railroad Cars, Each Designed to Carry One Elephant, and Equipped with Special Shackles to Prevent an Accident if the Occupant Becomes Frightened during the Journey; Below, the Pit That Guards the Stockade against Attack by the Wild Herd; the Deep Ditch Is Revetted with Sticks to Further Discourage Any Attempt at Rushing the Wall





Water Tank in Form of Pineapple at Canning Plant in Honolulu

TANK IN FORM OF PINEAPPLE ADVERTISES PRODUCT

Water for the sprinkler system in a canning plant at Honolulu is contained in a huge tank, shaped like a pineapple to advertise the company's product. The tank holds 100,000 gallons, is sixty-four feet high and is mounted on a steel tower, 135 feet tall, so that it can be seen from almost any part of the city. Painted sheet-metal strips were used to form the crest of the "pineapple," which weighs fifty-five tons.

PUTTING MOLD TO WORK

Mold, a form of plant growth which spoils bread and other foods, is being put to constructive work. It long has been employed in the making of cheese and now scientists have found use for it in producing citric acid, formerly derived chiefly from lemons and other sour fruits, and to reduce the cost of another useful substance, gluconic acid. This formerly cost \$100 a pound. With the aid of mold, it can now be made for some thirty cents a pound. In the opinion of H. T. Herrick, of the department of agriculture, chemistry is just beginning to realize the possibilities of this queer fungus growth. It

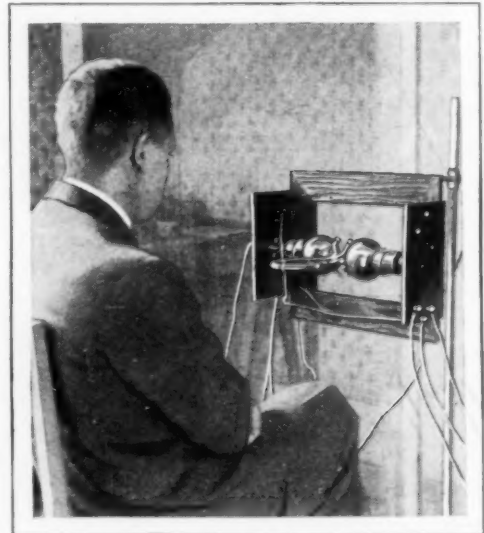
may be harnessed to perform many other useful tasks, he believes, when the right kinds of food are supplied for it and more is known about its functions.

MAGIC LANTERNS IN SUBWAYS ENTERTAIN PASSENGERS

Patrons of a Paris subway line are enjoying picture shows as the trains speed through the tubes. Four magic lanterns have been installed in each car, two on each side, and the views are projected on the dark walls of the subway. Advertisements, pictures of celebrities and other features are shown. The lanterns operate automatically, and the show begins as soon as a train leaves the station.

RADIO AS DISEASE CURE GIVEN NEW TESTS

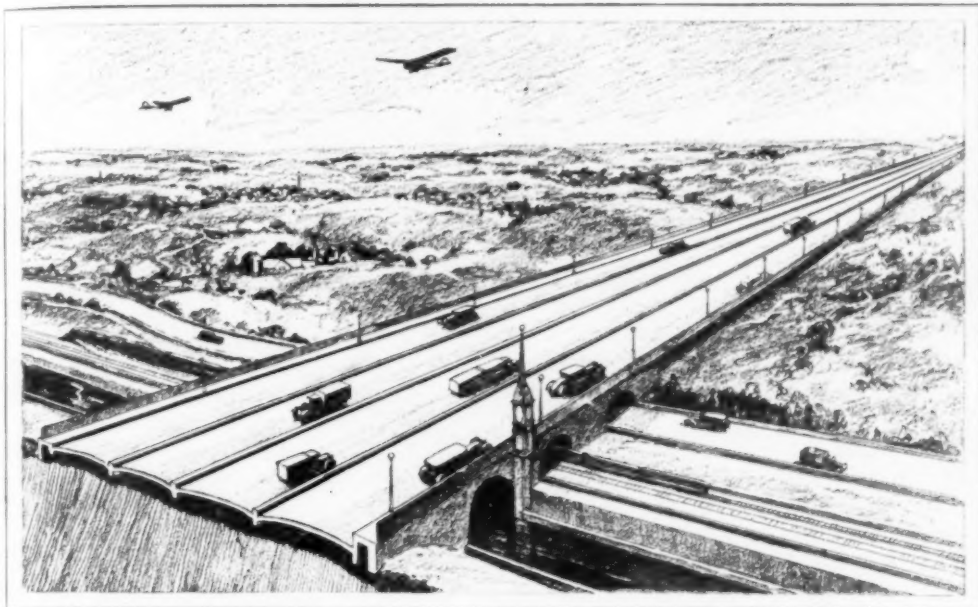
To test various theories as to the efficiency of radio waves in treating disease, a special apparatus has been devised in France. It is so arranged that the radiations may be better directed upon the affected parts and, at the same time, there is a means for measuring the amount of absorption. In a test, a coil of copper



Part of the Apparatus Used in French Laboratory to Test the Curative Power of Radio

wire is wound around the arm, leg or other part, acting as a radio receiver.

SUPER-HIGHWAYS FOR AUTOS TO CROSS THE NATION



Sketch of Proposed Automobile Highway across the Country; the Inner Lanes Would Be Devoted to Heavy Bus Traffic, the Outer Ones for Pleasure Cars

Two wide automobile highways, spanning the country, one on the north and one on the south, are proposed by R. A. Carpenter, chief engineer of a Chicago park system, to provide for the great increase in motor traffic. The southern road would run from Savannah, Ga., to Los Angeles, Calif., a distance of approximately 2,800 miles. The northern route would extend from Boston to Portland, Oreg., some 3,350 miles. Each roadway would be 250 feet wide and have four different traffic lanes, two on the outside for lighter traffic and the two inner ones for heavy bus and truck business. The lanes would be separated by curbs and on each side of the highway would be a sidewalk, six and one-half feet wide. Mr. Carpenter proposes to have a right of way acquired for the roads, just as was done in building the railroads. He estimates that both lines could be constructed for \$4,600,000,000, including the cost of the land which could be obtained by condemnation proceedings. Although the sum is a large one, it is believed that a toll charge would rapidly defray the cost, and that the highways would be heavily patronized, as they would eliminate delays,

permit higher speeds than now maintained and eliminate detours. The big roads would be devoted chiefly to commercial and through traffic, entrances would be provided at intervals of ten miles or more, and it is thought that they would form the basis for a later system of lateral highways to connect them.

OILER FOR STORAGE BATTERY PREVENTS CORROSION

Troublesome corrosion of automobile storage-battery terminals is prevented by an oiling unit devised by an Ohio inventor.



It consists of a lead oil reservoir, shaped like a large washer, which fits about the battery-terminal post, and a felt washer above the reservoir. The two pieces are held in place by the terminal clamp.

Lubricating oil is poured into the reservoir, a few drops being added each month. It forms a thin film on the terminal.



Traffic Light with Alarm Attachment Rung If Car Crosses the Line; the Signal Wire Is Seen at Right

DANGER BELL TRAPS AUTOS RUNNING PAST LIGHTS

One policeman can supervise the lights along half a mile of streets under a system recently introduced in England. It operates in somewhat the same manner as the automatic signal controls except that the human attendant makes the changes by means of an electrically operated lever. Should a car run past the stop light, it passes over a wire which causes a bell to ring, warning the motorist and signaling the policeman at the same time.

BIG WINDMILL RAISES WATER NINE HUNDRED FEET

Using windmills to pump water, generate power and perform other tasks is not a new idea, but not many persons realize what great improvements have been made in the mills in the last few years. Wheels are now made as large as twenty-two and one-half feet in diameter, they have tapered roller bearings, unusual oiling capacity and are otherwise equipped for long service with a minimum of attention. On a southwestern cattle ranch is a wheel sixteen feet in diameter, used to pump water from a well 900 feet deep. It is mounted on a tower thirty-five feet high and the complete millhead weighs 2,800 pounds. In spite of this great lift, the pump is operated efficiently even with little wind.

BORAX FATAL TO MOSQUITOES

One and one-half parts of borax to a thousand of water proved fatal to mosquito larvæ, Cornell University scientists have found. They used it with good results on rainwater barrels, cisterns and other places where the mosquitoes multiply, and discovered, also, that the borax holds its larvæ-killing powers for a long time. One experiment lasted nearly two months but the solution did not lose its strength. The investigators add, however, that the borax should be used only where its effects on animals and on plant life will be of no serious consequence.

LOOK AT WORLD UPSIDE DOWN TO TEST SENSES

Glasses that show all objects as though inverted, are worn by subjects taking special tests at an eastern university. Since they isolate the sense of sight from its co-ordination with the other senses, they help determine how intimately the senses are related when the subject tries to perform tasks while gazing through them.



Looking at the World through Glasses That Show Objects Upside Down to Test the Senses

Solving the Secrets of Life

WHEN Ray Keech, daring motor racer, drove a specially built car at a velocity of 205 miles an hour, shattering all automobile-speed records, the world acclaimed his feat.

Yet the thrilling speed which he attained was a snail's gait compared with the possible velocity of atoms and their electrons. The latter, which are following circular and elliptical courses, make trillions of revolutions a second at speeds which man cannot even conceive. An atom of air moves a mile a second—twice as fast as a bullet moves.

In a single gram of radium, for example, many billions of atoms explode every second, each shooting a helium-atom nucleus 12,000 miles a second or sending out electrons with approximately the speed of light.

Radium emits a new kind of high-frequency radiation called "gamma rays." When exposed to these rays, iron is as transparent as glass. Eleven distinct explosions occur in the various transmutations of radium atoms and after each explosion, the atom changes into an entirely different element.

An atom is the smallest unit possessing the characteristic properties of any chemical element. Small wonder they are difficult to study, for forty thousand million million of them at rest would cover an area of but one square inch. If atoms were as large as baseballs, a mere thimbleful of air would provide enough to bury the United States under a blanket 1,000 feet thick. Despite the indescribable smallness of atoms, science has developed an effective method of weighing them

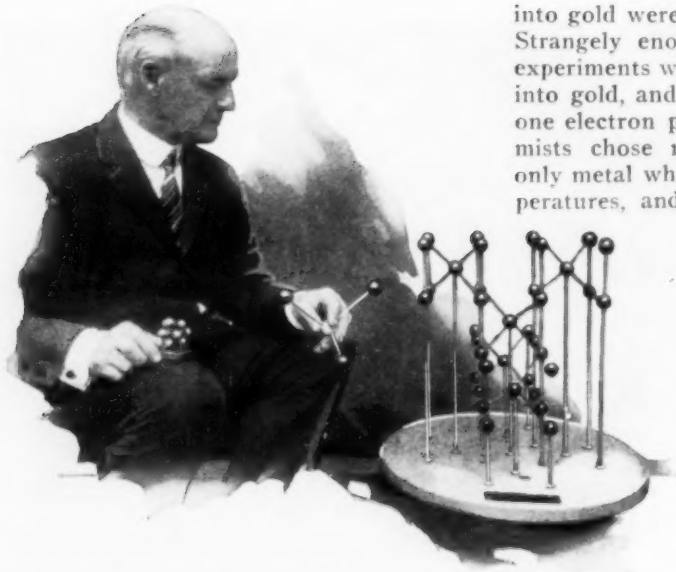


Model Illustrating, in Six Spirals, the Formation of the Quartz Crystal, with a Knotted Thread Marking Each Electron

after they are shot from electric guns. They also have been photographed. The atom in action resembles a shooting star speeding through space. Its collisions with other atoms produce light or fire. By proper amplification, the sound of an atom striking a target can be tuned to the perception of the human ear.

The cherished dream of the alchemists may eventually become a reality if future adventures in atom hunting yield such valuable discoveries as have past experimental quests. Atoms of many elements already have been broken up by shooting electrons from these atoms or shattering their nuclei. Scientists now seek to build up such nuclei at will. When they master that art, science will be qualified to transmute elements—an epochal eventuality.

Once the world thought there were four elements—fire, air, earth and water. Then the number kept on increasing until, about the middle of the last century, scientists thought the total probably was innumer-



Mr. H. D. Hubbard with Three Models: Carbon Nucleus, Left, Carbon Atom, Center, and Diamond, at Right

able. Now science has cut the number down to just ninety-two, of which ninety are known. The question immediately arises of how science could write down the list from hydrogen, No. 1, to uranium, No. 92, and put a period there, definitely saying there is nothing beyond uranium, nothing before hydrogen, and nothing in between the elements on the list.

The answer is that every element is composed of atoms, and every atom is made up of one proton, a unit of positive electricity, and a varying number of electrons, or negative electricity, the latter revolving around the proton.

The atoms of the various elements are now believed to be made up this way, the difference between any two consecutive numbers in the list of elements being one electron per atom. In other words, hydrogen, first on the list, is made up of atoms having one proton and one electron—the simplest structure of all. Helium, the rare gas used to inflate American dirigibles, comes next, with one proton and two electrons per atom. Lithium is third. If science could find a way to add one electron to each atom of hydrogen, that highly inflammable balloon gas would be converted into safe helium.

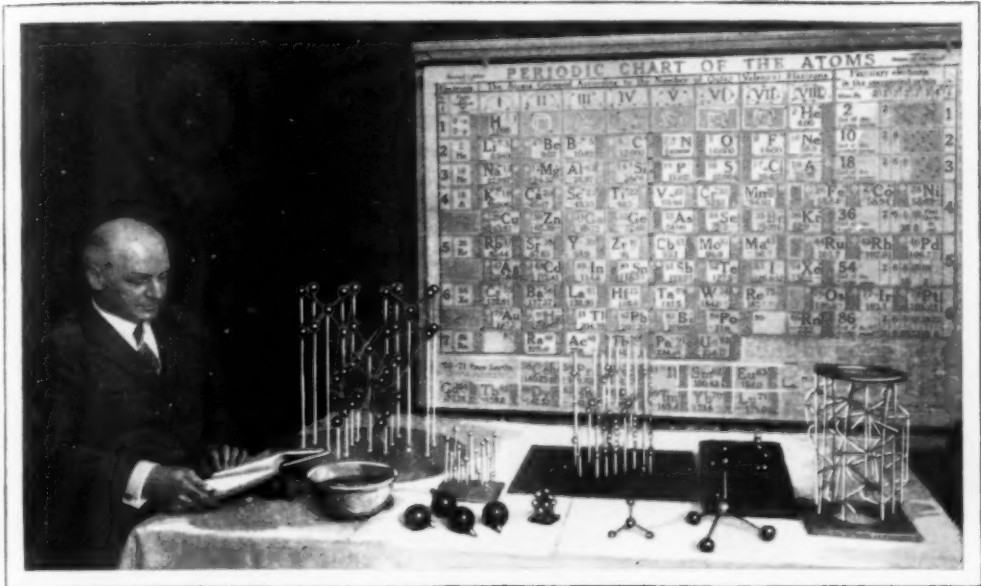
In other words, the ancient alchemists who sought to transmute other elements

into gold were working on the right idea. Strangely enough, one of their favorite experiments was to try to change mercury into gold, and mercury and gold are just one electron per atom apart. The alchemists chose mercury because it is the only metal which is fluid at ordinary temperatures, and they reasoned it was already in such an unstable state that it might be easy to make gold out of it. Recently scientists have demonstrated that it is probably entirely feasible to make the change, but that it would cost so much for electricity that it would not be profitable.

But why does science know that there are only ninety-two elements? The answer is that, as more electrons are added,

the structure of an atom becomes increasingly complex until finally it reaches a stage where it is no longer stable. The result is radioactivity, which is possessed not only by radium, eighty-eighth on the list, but also by the four that follow: actinium, thorium, uranium X, and uranium. These five, being unstable, are constantly breaking down and changing into simpler forms, and it seems certain that beyond uranium the atomic structure would be so intricate that it just could not live.

The alchemists, whose misplaced efforts were for so long a joke, really were scientific in their way, and laid the cornerstone for modern chemistry. One of them, Brand of Hamburg, Germany, sought to make gold by combining everything he could find in his retorts, and eventually discovered phosphorus, the first element ever discovered in a laboratory. More than fifty years later a Swedish chemist, Gustav Brandt, investigating some curious ore found in German copper mines, discovered another. The ore looked like copper, but the miners had found they could extract no copper from it, so they called the stuff "Kobold," after a demon who was supposed to be intent on annoying miners. From the ore Brandt extracted and named our modern cobalt. In 1751, the German chemist A. F. Cornstedt,



Periodic Chart of the Atoms and a Group of Atom Models Devised by H. D. Hubbard, Secretary of the Bureau of Standards, to Illustrate Theories of the Composition of Matter

by the same methods, extracted another element from the same ores, which he named nickel, taking the word from "kupfernickel," meaning "copper devil," another name the miners applied to the demon Kobold.

Those discoveries were the foundation of modern analytical chemistry. In the latter half of the eighteenth century, Henry Cavendish discovered an old formula written three centuries earlier by the great alchemist Paracelsus and from it prepared a gas he called "inflammable air." That gas was hydrogen, still used to fill balloons and airships when helium is not available.

The element nitrogen, that forms four-fifths of the air, was discovered by a botanist, Prof. Rutherford of the university of Edinburgh, in 1772. Two years later, Joseph Priestly, of Philadelphia, separated the life-giving element of air, oxygen. In the same year Scheele, of Sweden, discovered the element chlorine, first poison gas used in the World war, and the purifying agent in most municipal water plants.

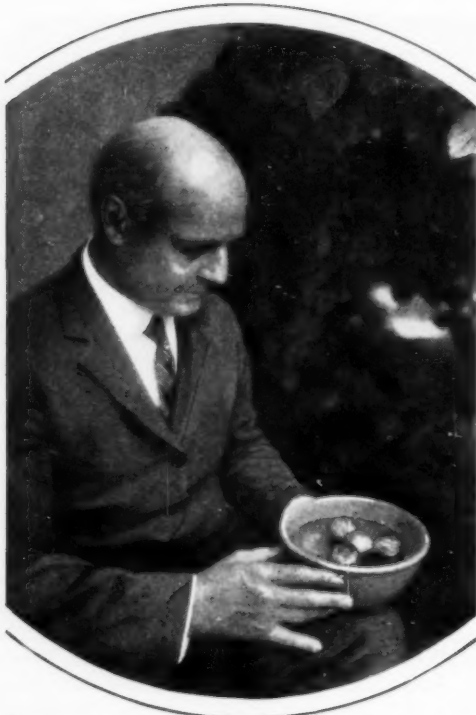
By 1804, twelve new elements had been added to the list of such common ones as gold, silver, copper, iron, tin and a few others known to the ancients. Three years later, Sir Humphrey Davy, the inventor of the miners' safety lamp, added a whole list of new substances. Davy,

a druggist's clerk, had discovered nitrous oxide, and on the strength of that obtained a chemical appointment. Experimenting with the effects of an electric current on various chemicals, he discovered sodium, potassium, calcium, strontium and barium. His was one of the greatest achievements in chemical research, until the invention of the spectroscope initiated the method of investigation used today.

The spectroscope is simply an arrangement of prisms to break up light into its primary colors, producing artificial rainbows by refraction. Its value lies in the fact that when any element is heated to the point where it gives off light, that light, when analyzed, contains exactly the same wave bands as any other sample of light from the same material. It is because of this that astronomers know what elements are in stars millions of light years away.

With the spectroscope to aid them, scientists added new elements rapidly. By 1920, there were only six of the ninety-two missing, and now all but two have been found. The last one located, illinium, was found by Prof. B. S. Hopkins, of the University of Illinois, and named for his state.

The two missing ones are Nos. 85 and 87 in the scale. No. 85 is expected to be



Demonstrating the Attraction of Unlike Electrons with Floating Magnets of Celluloid and Cobalt Steel

somewhat similar to the familiar element iodine, and No. 87 is expected to be like the series of alkali metals, that is, lithium, sodium, potassium, rubidium and caesium. Because of its location next on the list to radium, it also is considered probable that it will show traces of radioactivity.

Much of the credit for the elucidation of the atomic theory goes to Henry D. Hubbard, secretary of the U. S. bureau of standards and compiler of the periodic chart of the atoms used in classroom instruction. The chart is really the foundation of modern chemistry and the alphabet of the universe. He also has originated numbers of models to show the structure of various materials.

One of his sets of models, depicting the formation of carbon nuclei, carbon atoms and diamonds, visualizes the hidden reason for the diamond's exceptional hardness and strength, as well as its clarity. Strength and hardness are due to the arrangement of the atoms, and clarity to the "space patterns" which their peculiar arrangement provides. Pure silicon, gray Germanium and tin have about the same gen-

eral structure as the diamond, but lack both its stupendous strength and density and the space patterns that make the precious stone transparent.

Edison once said that "some day we shall say to an atom in a rose, 'come and go into this other flower.'" Science already is able to accomplish transformations much more subtle, for, by merely shooting electrons of the right speed or by use of rays of light of the right frequency, it can change the electron arrangement of an atom. "We are fast learning," says Mr. Hubbard, "the exact voltage to use in removing any electron from any atom, or for moving such electrons from any energy level to any other at will."

It is to further this work that the Germans are attempting to trap 30,000,000 volts of lightning on a Swiss mountain top, and scientists of the Carnegie Institution are attempting to produce equally high man-made lightning charges in the laboratory. With 30,000,000 volts it is believed any atom can be broken down, its energy released, or its nature converted into some other element.

With a group of cobalt magnets inclosed in celluloid balls about the size of golf balls, Mr. Hubbard illustrates the formation of atoms through the arrangement of electrons about the central proton. Placed on a smooth-glass desk top or floated in water, the magnetic balls always arrange themselves in characteristic patterns, according to their number. With one positive nucleus and three negative electrons, the four balls will always form a group with the positive one in the center and the three negatives grouped around it equidistant from each other. They can be jiggled about and moved at will, but when released will always return to their own arrangement.

One positive and two negatives always form a line, with the positive in the middle. Two positives and one negative form the same sort of line, with the negative between the other two. Three negative balls placed in a basin of water move as far apart as possible, for like charges repel. It is the attraction of opposites that keeps the electrons grouped about their proton in the atom, and the opposition of like charges that keeps the electrons distrib-

uted in their space pattern. In one of Dr. Hubbard's demonstrations, two positive and two negative balls form a cube in the water, with plus and minus alternating around the square. Each edge of the square, with one positive and one negative ball, represents a hydrogen atom, and the entire square a hydrogen molecule.

The arrangement of the atoms is responsible for the various characteristics of each element. Lead, aluminum and similar metals are soft and ductile because their flat, cubelike atoms are face-centered, that is, their flat surfaces face each other, and atoms in one layer can slip smoothly across those in the next. On the other hand, iron, tungsten and similar hard metals have body-centered atoms, interlocked so that they do not slip easily.

One of the marvels of modern chemistry is the way in which the experimenter takes the atoms and fits them together into new synthetic products.

Thousands of these atom groups have been produced by the chemist, such things as their or caffeine, which stimulate gently without developing intoxication; like adrenalin, which duplicates nature's control of the heart and lungs; like the synthetic dyes that produce new colors, the synthetic perfumes that rival the flowers of nature, and like the many medicines that heal disease, relieve pain or produce sleep.

"Atoms are veritable wonder workers," concluded Mr. Hubbard. "They are responsive as living things, and they also may be energized like the human body; they labor industriously as jewelers of nature and crystal builders, while they are also the expert makers of molecules, and even manufacture far-away stars. We stand on the threshold of the very mastery of nature through the control of atom combinations and the release of the energies they can absorb."



Leading Dog to the Training Grounds; Animal Is Watching the Man He Is to Attack

TRAINING SCHOOL FOR DOGS AIDS POLICE DEPARTMENT

To train dogs for police duties, special schools are maintained under the direction of experts who understand the animals and know the tactics of criminals. One of the teachers wears a padded coat so that the dog cannot injure him.

GUARD FENCE AROUND PLANE PROTECTS AIRPORT CROWDS



Fence in Front of Airplane to Protect Visitors

Spectators have caused so many near-accidents at the Oakland, Calif., airport that officials have constructed a portable fence to keep persons away from the propellers. As soon as a plane lands and has taxied to its position on the field, the guard is immediately set in place around the ship so that visitors are kept at a safe distance from the whirling propeller blades.



Seat in Place; How It Is Adjusted under Cushion, and in Use, with Straps about the Baby

SAFETY AUTO SEAT FOR BABY SAVES MOTHER WORRY

Infants ride in the automobile with safety when strapped to a special seat that rests securely by the driver's side. The bottom part fits under the cushion, which holds it in position, while bands attached to the back are carried about the baby's waist and chest. The unit is of special service when driving with small children.

ALTIMETER TO DEFEAT FOGS AIDS SAFER FLYING

Among the devices being tested by the army air corps for safer flying is an improved altimeter that registers the exact distance between the plane and the ground objects below at all times. This would give a pilot reliable information as to his altitude even if he were flying through fogs or in darkness. Instruments now in use are operated by atmospheric pressure and show distance above sea level. Few of them are effective below 1,000 feet. Other experiments are being made with an installation to reduce the danger of landings in bad weather. It is a series of wires, radiating from the center of the airport and from each wire signals are sent to the

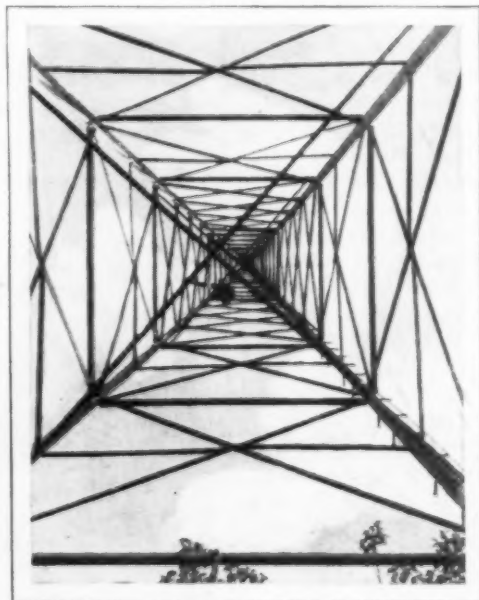
receiving apparatus in the plane, telling the pilot how to govern his descent when visibility is poor.

RICHES FROM THE JUNK PILE CUT RAILROAD EXPENSES

Bright new tin buckets, cups and other articles are being manufactured from old metal roofing, empty powder and carbide containers and other junk salvaged by the railroads. Old broom handles are made into staffs for signal flags, old canvas is transformed into curtains for the locomotive cabs and coaches, steam-pipe coverings and aprons. Thrift practices such as these save the carriers hundreds of thousands of dollars annually, according to the American Railway association.

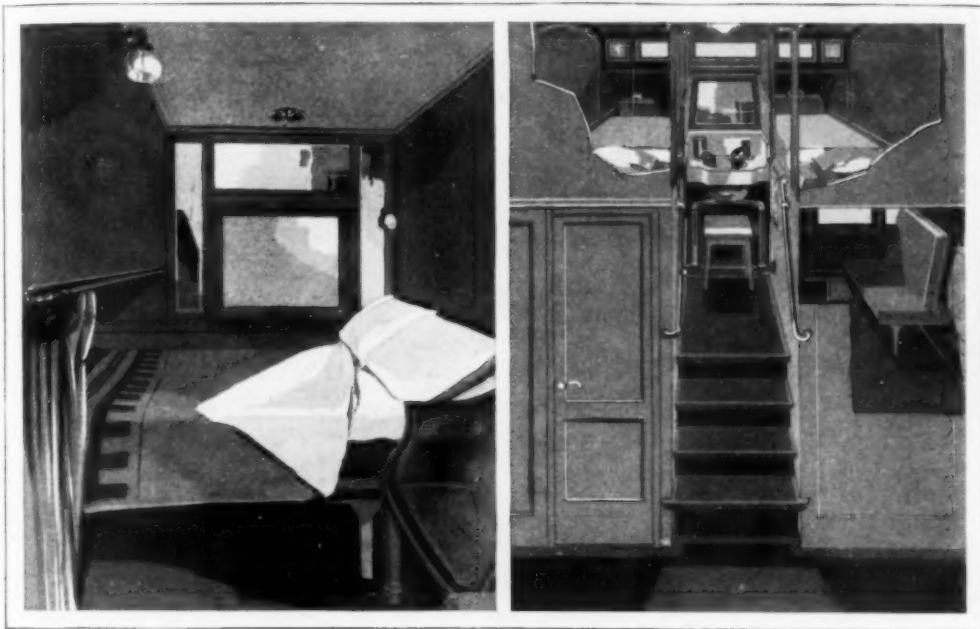
RADIO TOWER ON MOUNTAIN REACHED BY CABLE CARS

Radio waves speed to all parts of the world from station WOKO at Mt. Beacon, N. Y., but to reach the broadcasting towers, visitors use a cable car on one of the steepest inclined railways in the country. The high steel supports, resembling huge spider webs, when viewed from below, are 1,540 feet above sea level.



Looking Up under One of the Radio Broadcasting Towers at Mt. Beacon, New York

TWO-DECK SLEEPING CAR HAS HOTEL COMFORTS



At Left, Lower Room of Double-Decked Sleeping Car, with Berth Made Up, and, at Right, Steps Leading to Platform, and View of the Upper Berths with the Washstand between Them

Conveniences of a hotel room or a liner cabin may be enjoyed on the railroad in a double-decked sleeping car designed by an eastern architect. It provides better facilities for dressing, greater privacy, and each berth, or room below, has an individual washstand and other plumbing, while the same advantages are provided for each pair of upper berths. Instead of the usual center aisle, a passageway runs along the side of the car for about two-thirds of its length. From this passage seven rooms open, each with complete plumbing. The ceiling height is about seven feet. There is a comfortable armchair and a seat which, at night, forms part of the double bed and, during the day, may be shifted to any position desired. An ample recess provides space for luggage. Between the rooms, and opening from the passageway, are steps leading to the upper berths. There are sixteen of these cross-wise of the car, with a window at either end. There are also lockers for luggage, and the berths are two feet longer than the usual kind. The steps lead to a platform between the berths. At the foot of each bed is a washbasin and other plumb-

ing, and under the basin is a stool that may be used in dressing and to assist a person in getting into bed. Passengers occupying these "duplex" berths also have access to a day room, which may take the place of the club or lounge car.

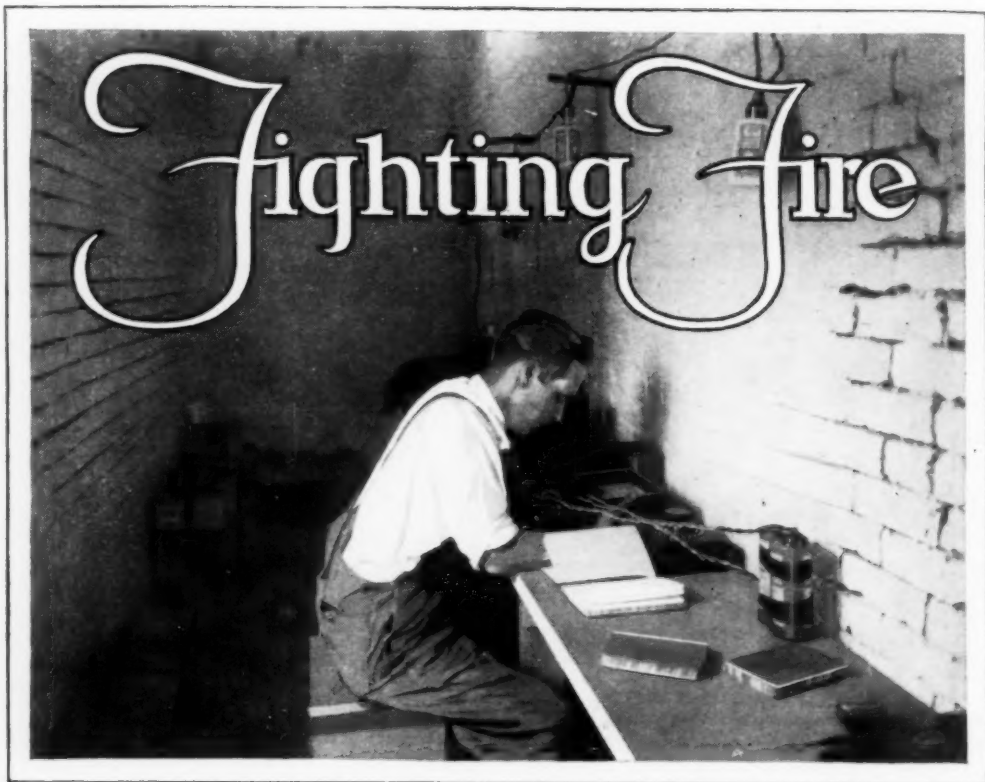
TOP OVER AUTO RUMBLE SEAT QUICKLY TAKEN OFF

For the protection of persons in the auto's rumble seat, a top has been introduced that can be taken off or put on in a few moments. It is snapped into place



To Shield the Riders in the Rumble Seat, the Adjustable Top Stretched from Back

and keeps off sun and dust. Side curtains may be added for protection against rain.



In the Dugout Where Bureau of Standards Scientists Took the Pulse of a Burning Building by Batteries of Electrical Thermometers in the Search for New Facts about Fires

WHAT happens when the water hits the fire?

The fire goes out, true; but why, and does it go out right away, or does the water, as many experienced firemen claim, make the fire burn with a fiercer blaze just at first?

Firemen have been pouring water on fires since the days of volunteer bucket brigades, but ask any half dozen of them what happens when the water meets the flame and there is apt to be a disagreement.

On a recent Sunday morning the cream of Washington's fire department, supported by rows of policemen, turned out to watch the government burn down a five-story brick building with a two-story annex. It was a different sort of fire, for not a drop of water was spilt, and the firemen stood at ease while the floors crashed to the basement and the walls tumbled out on vacant lots on either side. For days afterward, they kept watch while flames continued to play through the debris until the last stick of inflammable ma-

terial had been consumed and the red-hot iron and almost molten bricks cooled down to normal temperature.

It was a scientific fire, and, in a heat-proof dugout several hundred feet away, groups of scientists, working in relays, kept watch for days over the recording ends of several score electric thermometers which had been placed throughout the building and crashed with it.

They learned things about fires which had never been known before, particularly the things that happen when a conflagration sweeps a section of the city and spreads so fast firemen can't reach the heart of it with their hose lines.

Keeping watch with them were representatives of every important office-safe and filing-cabinet maker in the country, for each had placed samples of his product, shiny in new paint, in the buildings, stuffed them with old ledgers and papers and then watched them go down with the ruins. Days later, when the ruins had cooled down, the safes and filing cabinets were

with - Fire



Just as the Walls Began to Fall; a View of the Five-Story, Washington, D. C., Building Burned by Government Scientists to Study the Effect of Fires on Office Safes

dug out, jimmied or burned open, and the contents examined to see if they had come through intact, charred but yet readable, or whether they had been completely destroyed.

For the first time science learned the temperatures which can be reached in an unchecked fire. Some of the 110 electric thermocouples recorded temperatures as high as 2,500 to 3,000 degrees. At noon the next day, thirty hours after the walls had crashed to the ground, recording instruments in the debris were still showing temperatures of 2,000 degrees, which is 400 degrees above the fusing point of iron.

Had water been turned on the fire at its

height, it is probable the firemen would have seen the flames increase for an instant, for at such temperatures the elements of water, hydrogen and oxygen, would be dissociated and burn as a gas. The same process, blowing steam into a furnace in which coal is heated to incandescence, is used in making water gas.

After the first flash, however, the fire would quickly subside, owing to the cooling of the burning material below the point of combustion. The water, and the steam generated from it, may also have some blanketing effect, excluding oxygen in the air from the flames, but the cooling effect is the chief one in putting out a fire.



The chief information the bureau of standards obtained from its personally conducted fire in Washington, however, is the temperatures a fire can reach when uncontrolled, and the time it can linger in the debris. The two buildings burned were part of a row

being removed to make way for new government structures. To prepare them for the fire, a new steel roof was installed, to keep sparks from being carried upward and spread over the city, and the brick walls of the five-story structure were reinforced near the top with heavy steel rods, an inch and a half thick, stretching from wall to wall. The heat, however, was so intense that the mortar and bricks gave way, and fire experts estimated the rods did not hold the walls up for more than ten or fifteen minutes longer than they would have stood alone. When the bricks on one side gave way the red-hot bars whipped through the air like rubber bands and fell in an adjoining lot.

To duplicate conditions in an average office building, 150 tons of old lumber was stored in the building, representing the fuel that would be furnished by a normal quantity of office furniture. In one segment of the building, the fuel loading was seven and a half pounds per square foot

of floor space, in another double that, and in a third, it reached thirty pounds to the foot, the amounts representing three types of office and factory conditions.

Scattered on the various floors were the thirty-two safes and steel cabinets. In each one was an alarm clock, with an ingenious trip lever to stop it when the safe tumbled through the floor, giving the exact moment at which it fell. The safes ranged from 600 to 3,200 pounds in weight, and they fell from fifteen to fifty feet, depending on the floor on which they were placed. Besides the alarm clocks and their

load of books and papers, each safe contained from two to four maximum-temperature recording thermometers to show the greatest heat reached within the steel container.

The actual test, while the walls and floors held, was not so severe as that given safes in the



Rigging the Thermocouples, Setting an Alarm Clock in One of the Safes, and, Bottom, the Basement-Debris-Temperature Takers

fire underwriters' laboratories, where they are heated for hours in furnaces and then dropped three floors onto a hard concrete platform; but after the building collapsed the containers lay for days in the intense heat of the slowly cooling debris.

The bureau of standards has erected and burned a number of buildings during the last five years, most of them one-story brick, tile or wood structures, packed with obsolete furniture from various government departments. The opportunity, however, to destroy a five-story structure in the heart of a big city was unique. A mass of information has been collected from the fires and is being used to develop standards for fire-resisting building materials and construction.

Types of construction with different materials are first tested in gas-heated furnaces, and the time they will stand, for varying thicknesses, charted. Then experimental buildings are erected, loaded with furniture, and touched off, while electric thermometers record the temperatures reached. A sample office-building fire, with twenty pounds of combustibles to the square foot, is equivalent to a two-hour furnace test, and



The Fire at Its Height, a Few Minutes after the Start; in the Background Is the Post Office Building

with fifty-five pounds to the square foot, it is equal to an eight-hour furnace fire.

Brick walls stood the flames for an hour, in the case of four-inch unplastered walls, to thirteen hours, for foot-thick ones. Plaster on both sides increased the wall's fire resistance about two and a half hours.

AUTO LIGHT THAT PIERCES FOG PROMOTES SAFETY

For automobile lamps or airplane landing-field lights, a special lens now on the market, projects an amber-colored beam which is said to penetrate fog much more effectively than the usual white light. The color is produced by the rays shining through a curious mixture of minute me-

tallic particles that give the beam a contrasting shade as it is reflected from a highly polished metallic mirror. This makes it much more visible through the white mist, and the lens also reduces the glare. Pilots at a landing field in California report that one of the small lights, with a lens of this kind, can be seen through fogs and at distances when the big 7,500,000-candlepower beacon is invisible.



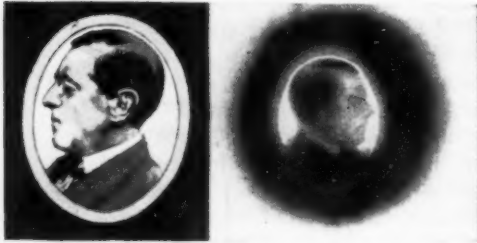
Scoreboard on Ground That Told the German Endurance Flyers How Many Hours They Had Remained Aloft and Gave Them an Encouraging "Bravo" to Cheer Them On

AIR SIGN BOARDS AID FLYERS WIN ENDURANCE RECORD

One of the aids to the German pilots who recently set a record of more than sixty-five hours of continuous flying, was a large scoreboard that showed the number of hours the men remained in the air. The figures were changed as the race progressed so that the flyers could tell at a glance by looking down on the board on the ground, just what performance they had made.

LIGHT WAVES EASILY BENT AROUND BALL

That light waves can be bent around a solid object as easily as sound waves overcome obstacles has been demonstrated by Mason E. Hufford, of Indiana University,



Original Photograph of Woodrow Wilson, Left, and Photo Made with Steel Ball as a Lens

who takes pictures using a steel ball for a lens. Mounting a picture in a small hole cut in a box, and focusing light waves from a carbon-arc lamp through the hole, Dr. Hufford suspended a steel ball halfway between the box aperture and a photographic plate, and succeeded in obtaining a clear photograph, instead of the shadow of the steel ball that might have been expected. The light waves, striking the ball, have their paths changed as they pass into the shadow behind the ball until they either unite or destroy each other, so that the ball acts as a focusing lens. By placing a figure of any kind in the opening in the box, an inverted image is obtained on the plate. Moving the ball closer to the negative enlarges the picture, while moving it toward the photographic plate reduces the size of the image.

SIX-HEADED CABBAGE PLANT HAS EIGHT-FOOT STALK

That controlled temperature has a more important effect on various crops than is generally known, has been shown by experiments at Cornell University, where a six-headed cabbage plant was grown on a stalk eight feet high after two years' cultivation under a constantly high temperature. Only when the plant was removed to a cooler place—it had been grown under seventy degrees Fahrenheit and above

—did it stop producing heads and form seeds. The tests indicated that the plant continues its growth so long as it is kept at a higher temperature, and seeds are not produced until a lower temperature, resulting in changes in the plant, is induced. Further experiments show that a cabbage plant requires only a two months' rest period in storage at thirty-five to forty degrees Fahrenheit before it can be transplanted to a greenhouse for seed production. Ordinarily, farmers and seed-growers put the plants in storage through the winter and set them out the second spring to produce seed. The newer method compresses the two-year cycle into one. Other experiments with cabbage by the department of agriculture have shown that increasing the amount of light to which the plants are exposed has little or no effect in hastening maturity, but that the temperature control is of prime importance.

CENTER REST FOR MOTORCYCLE AIDS FLYING START

Faster starts on the motorcycle with less trouble are possible by using a support that is adjusted to the bottom of the frame near the center of the machine. It eliminates lifting the rear wheel, as is necessary with the old type of stand, is easily and quickly attached and folds back against the



Support for Motorcycle Which Permits a Faster Get-Away and Is More Easily Lowered

footrests, out of the way, when the cycle is in motion.

RUBBISH BURNER IN TREE FORM IMPROVES LOOKS OF YARD



Rubbish Burner Disguised as a Tree Stump: It Is of Concrete and Realistically Grained

In place of the often unsightly incinerator, a concrete burner in the form of a tree trunk has been fashioned by a California man. It is finished in realistic color and graining to resemble a stump.

WAR ON BLINDNESS

Although some fifteen per cent of the 100,000 blind men and women in the United States lost their sight through accidental causes, there has been a marked reduction in the number of persons blinded through industrial mishaps in the last few years, according to the national society for the prevention of blindness. Educational work has been done among more than 3,000,000 men and women in industry, during the last year, teaching them the importance of correct lighting and other ways to conserve their eyes and prevent accidents to them.

Whenever you find that you wish to know more about any article in this magazine, write Bureau of Information, Popular Mechanics Magazine, Chicago.



It Resembles a Plant, but Is a Section of Phone Cable with Smaller Wires Exposed

PHONE WIRES IN PLANT FORM SHOW CABLE STRUCTURE

To illustrate how a large cable is made up of many wires, a London company arranged the strands of a small section into the form of a plant. In all, there were 2,000 pairs of wires, and the novel display showed how they were wound and grouped.

FOODS MADE BY CHEMISTRY TO PREVENT FAMINE

Science will provide food no matter how rapidly the population increases, Dr. H. E. Barnard, an industrial chemist, declared recently in discussing a theory held by some persons that possibly a universal famine might result should the world become overcrowded with people. Legislation will prevent such an occurrence, Dr. Barnard believes, but even if the population should grow until there remained only one square yard of arable land for each human being, man still would be able to nourish himself with synthetic food. By putting yeast

plants to work to make food, thirty men, working in a factory the size of a city block, could produce as much food as 1,000 men cultivating 57,000 acres under present conditions. New types of vegetation that will store up solar energy with the same efficiency that coal has done, can be cultivated in parts of the earth such as the Sahara desert, where a section of land, forty miles square, receives in six hours as much solar heat as is produced by all the coal burned in twenty-four hours throughout the world. If necessary, chemists can extract fats and sugars from shale oil, coal or petroleum, and the vitamins necessary for growth and health can be synthesized in the laboratory. Science has reduced the average working day from fifteen hours to eight, Prof. Harry N. Holmes of Oberlin college declared.

MILL USES SALVAGED LUMBER AND CUTS LOGS IN SHAPES

Logs are cut into shapes instead of into flat boards by a system of sawmill operation introduced on the west coast. Salvaged lumber is also utilized to make built-up flooring. Scraps as small as one and one-quarter inches wide and sixteen inches long can be employed in fabricating room lengths in strips seven inches wide. The new method is said to offer distinct economies in mill operation and in freight costs.

FOLDING ARMREST FOR AUTOIST ADDS COMFORT IN DRIVING



Drawing of the Armrest, Showing How It Tilts

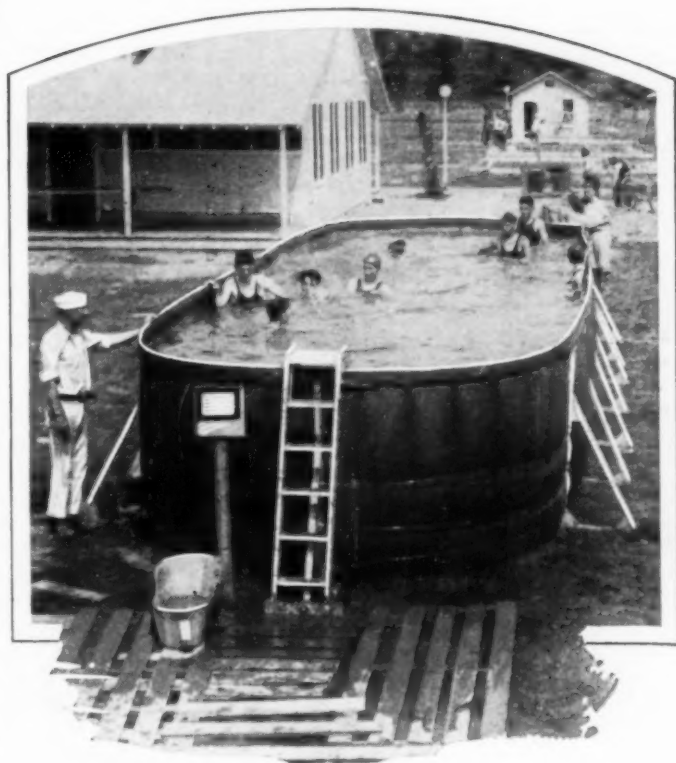
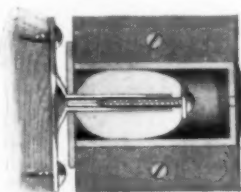
For the convenience of the automobile driver, an armrest, easily attached to the door or interior of the body, has a folding sill that rises flat against the side when not in use so as to be out of the way. The attachment is of special benefit when the glass is closed, can be put on quickly and will not damage the upholstery.

TEN-MESSAGE CABLE TO SPAN THE ATLANTIC

Ten messages may be transmitted at the same time, five outgoing and five incoming, on the latest Atlantic cable being laid from Newfoundland to the Azores. Engineers declare that it will be the fastest in the world. It incorporates an electrical principle known as "tapered loading" which permits it to be operated "duplex" or at full capacity, in both directions. The line will bring the number of Western Union cables in the Atlantic up to ten and will afford connection from New York to Germany, Italy and Africa through automatic relays at Newfoundland and the Azores. Since the beginning of the World war, cable traffic under the Atlantic has doubled, officials report. Last year, 93,000,000 words were handled, as compared with 39,972,000 words in 1913, the year before the war.

DOOR SNUBBER ENDS SLAMMING AND HELPS FIGHT FLIES

Doors cannot be noisily slammed and are kept tightly closed by means of a simple snubber unit which can be attached to any door in a few moments. It is merely a plunger-and-cylinder arrangement, the cylinder being placed on the door frame and the plunger on the door, at top, middle or bottom, and directly opposite the cylinder so that the plunger will enter the cylinder when the door closes. A special feature of the device is the adjustment screw, whereby the plunger may be made to fit properly into the cylinder.



For Tired and Dusty Auto Tourists, the Portable Swimming Tank Set Up at Western Camp Accommodates a Number of Swimmers

PORTABLE CAMP BATHING POOL SERVES AUTO TOURISTS

Motorists visiting a western tourist camp enjoy the luxury of a swimming pool, provided in a portable canvas tank. It is easily moved from place to place, is large enough to accommodate a number of swimmers at once and can be set up in a short time.

TAP POWER FROM TROLLEY WIRE WITHOUT STOPPING CARS

Electric current may be tapped from the trolley wire with a recently introduced device which does not have to be removed when the street car passes beneath it and, so, does not interfere with traffic or with the work in progress. The unit consists of a special clamp that makes contact with the trolley wire and is attached to a support by a hinged arm so that the trolley wheel of the car can pass along the wire without interference.



Drawing to Show Installation of the Air-Washing Cabinet; the Spray Is behind the Wall

AIR IN HOMES IS "WASHED" TO GUARD HEALTH

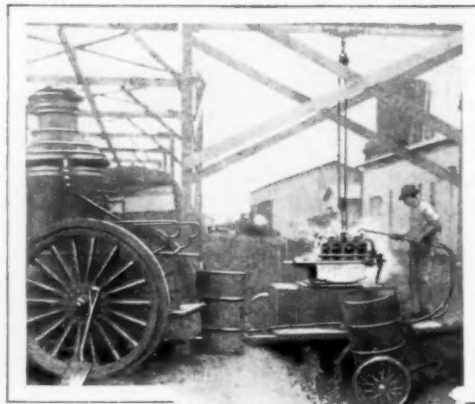
Connected to the main water-supply system and easily installed in new or old buildings, an air-washing unit has been introduced to maintain healthy humidity of the air inside at all times of the year. It is essentially a spray and air circulator which cleanses and moistens the air, evaporating sufficient water to keep an average humidity of about forty per cent. Water is tapped from the city main and passes out at the top of the cabinet, which is installed within the wall, through two fine spray nozzles. At the top of the cabinet is a register, flush with the wall, where the air is drawn in. The water falls as a fine mist to the bottom of the cabinet, where the excess flows off to a drain pipe. The humidified air is forced out through another register near the base of the washing chamber. A constant, even circulation is thus maintained and a regu-

lar supply of fresh, clean, moist air is always discharged. The washer operates cheaply and with practically no noise.

FLOWERS FIFTY CENTURIES OLD FOUND IN EGYPT

Varieties of plants and flowers that flourished in Egypt fifty centuries ago, still grow in the valley of the Nile just as they did in ancient times, study of specimens found in sepulchral monuments reveals. An interesting collection of floral mementoes has been gathered in the national museum of Egyptian antiquities at Bulak, near Cairo. They indicate that the same kinds of flowers that the boy Moses or the children of Joseph probably liked to pick, still bloom unchanged in form or color. The larkspur which loving hands laid upon the bodies of those who died 1,000 years before Abraham and Sarah went down into Egypt, still blossoms in sprays of blue as it did many centuries ago. In some of the tombs of later date, various fruits, vegetables and grain have been found with hollyhocks and chrysanthemums. Around the necks and upon the breasts of those who died at the time Solomon reigned in Jerusalem, garlands of celery were discovered. The plant does not appear to have been used as a vegetable at that time. Plants intended for funeral ceremonies were subjected to great heat, the process helping to preserve them.

OLD FIRE ENGINE AIDS AVIATION AS CLEANER FOR MOTORS



Old Fire Engine Cleaning Motor

No longer useful for fighting blazes, an old horse-drawn fire engine, in St. Louis, has been adapted by an airplane manufacturer to clean the motors. Steam is generated in it and blown over the engines through a flexible hose to remove grease and oil before and after the motors are overhauled and given running tests.

CHEMISTS DECLARE MAN IS WHAT HE EATS

That man is modified by the soil on which he lives, just as plants adapt themselves to their surroundings, is the opinion of chemists who are studying the effects of various kinds of food upon the human body. The relation is not so direct as in the case of plants but is definite and far-reaching, the scientists declare. For instance, when food supplies were almost wholly of local production, various diseases were developed in certain sections more than in others and could be traced to deficiencies in the soil of those regions. In parts of Switzerland, dwarfishness and feeble-mindedness were pronounced. Examination of the soil showed that there was not a sufficient supply of iodine. In other sections of the world, there is not enough sulphur, lime or phosphorous materials and this lack is manifest in various racial characteristics among the people. The value of insulin in the treatment of diabetes, is believed to be due to the fact that it contains certain chemicals that are beneficial to the human system afflicted with the disease. The relation of food to the body is still involved in mysteries, the chemists admit, among them, the riddle of why certain persons are sensitive to certain substances. For instance, why do some persons acquire the hives after eating certain kinds of fruit, why do some sneeze when sleeping on a downy pillow or why do others cough when walking through the woods? These are mysteries, but chemistry may offer a solution, the experts believe.

☐Paper is being made from grape-vine cuttings in California.



Chain of Flags Bearing Letters and Towed from Plane to Form Message Which Is Visible for Many Miles

PLANE AS FLYING BILLBOARD SHOWS SIGNS BY FLAGS

Sky writing with flags is the system a foreign pilot employs in displaying advertising and other messages. There is a letter to each banner and the flags are carried in a cartridgelike container under the fuselage. When released, they drop out and form a chain of letters in the proper order, and trail behind the plane like the tail of a kite. The words are visible at a considerable distance.

HORSE'S HOOFS START FIRE

More than 2,000 acres of forest land in California were swept by fire recently, the blaze being started by sparks from a horse's hoofs, according to the report of the state forester. This is believed to be the first verified instance of an occurrence of this kind although other fires, starting in this manner, have been reported.

Making Aircraft



Examining a Model of One of the NC-Boats, the Navy's Flying Ship That First Crossed the Atlantic; Scale Models of Every Type of Airplane Are Built for Wind-Tunnel Tests

By K. M. PAINTER

"IT CAN'T be done—a man might as well try to fly." When a man said this," remarked Wilbur Wright, "he was understood as expressing the extreme limit of impossibility." From earliest records, the faculty of flight has been given to the spirits, the gods and their satellites of mythology and religion. Strange tales of flying deities, dragons, and demons; winged angels, aerial horses, the antics of witches and sorcerers, fill the poetry and legends of the centuries. But man willed to fly and the projects, attempts, achievements, and failures of aerial locomotion for centuries were targets for the shafts of short-sighted scientists, critics, authors, and the world at large. The invention of the balloon and Franklin's proposed addition of dirigibility added only new fuel to the inventive fire.

In the days when aviation was young, aircraft were designed on inspiration by geniuses who generally had nothing more exact than their own theories on which to base their designs. Every test of a new plane that might bring with it important improvement necessitated the actual risk

of the pilot's life, and even these tests, made at such great risks, were highly inaccurate as well as tremendously expensive. Designers were against a stonewall of fact. There was no way of predicting the performance of a plane without actually building it and attempting to fly it. That many of these attempts ended in disaster and retarded the progress of aviation was inevitable.

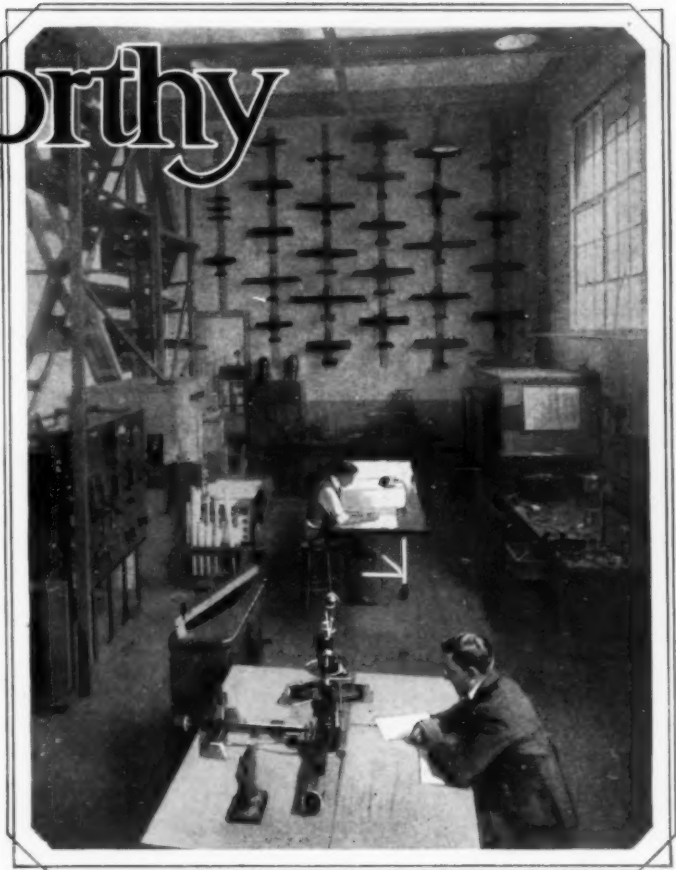
The wind tunnel was the means developed to remove the hazards and guesswork from the designing of aircraft and substitute a practical, exact, scientific way of testing new designs with no risk at all to human life. Thus, today, before a plane of a new design takes off, the wind tunnel has given an affirmative answer to the question, "Is this craft airworthy?"

One of the first tunnels to be built is located at the navy yard in Washington, and in it all the proposed designs for naval airplanes and airships are tested. The tunnel is made of wood and takes the form of an elongated doughnut. A large fan (or propeller), driven by a 500-horsepower motor, furnishes the wind at a maximum

Airworthy

rate of 180 miles an hour. When a new design is under consideration, an exact scale model of it is made at the government shops under the supervision of R. F. Smith, chief draftsman of the tunnel operations. This model is placed in the tunnel, attached to recording instruments that show the operator (in the control room above) the amount of pressure expended upon the model at varying wind velocities. And by exact calculations it is possible to figure the lift, drag, and pitching moments of the surfaces presented to the wind. By combining engine and propeller statistics (also determined by wind-tunnel tests) with these structural data, predictions are made with certainty as to the performance of the proposed craft: its high speed, cruising speed, landing speed, rate of climb, ceiling and controllability.

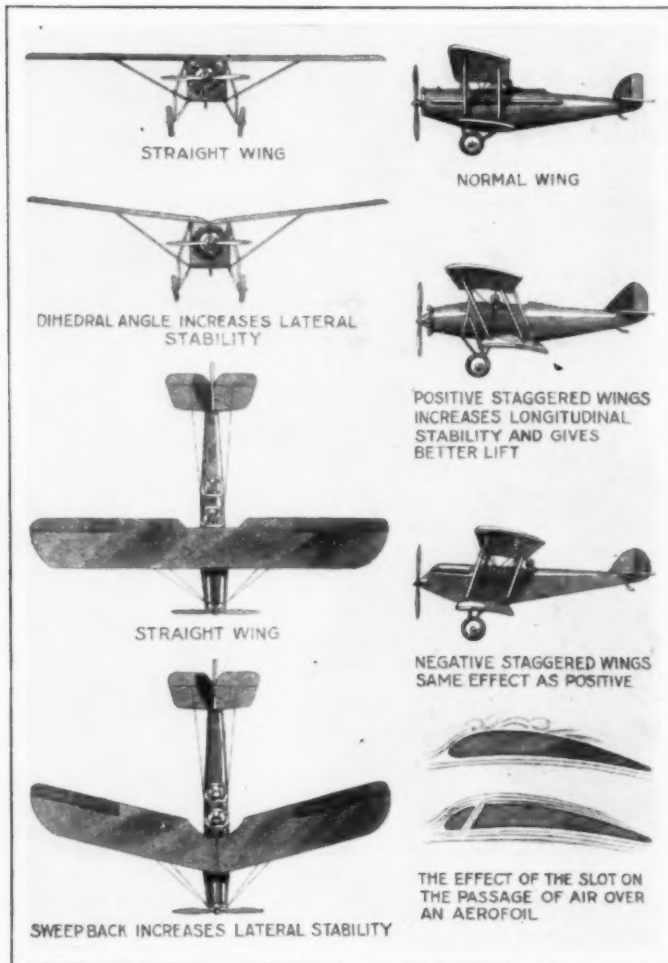
And in due course of operations, the new dirigible for which congress recently appropriated building funds is "on the block" at the navy yard wind tunnel. This leviathan of the skies is to take the place of the ill-fated "Shenandoah," having three times the capacity of its predecessor. It will be recalled that the "Shenandoah" was lost in a squall encountered near Zanesville, Ohio, in 1925. The force of the elements tossed the ship around until the structure broke in two, and the control car very quickly wrenched free in the air. To avoid a recurrence of this mishap, the new dirigible will have a larger diameter in proportion to its length—will be "fatter." Tunnel experiments have



The Control Room of the Navy Wind Tunnel; the Operator at the Desk in the Foreground Charts the Returns from the Instruments

shown that the new shape affords much greater strength, and, surprisingly, presents less wind resistance, giving greater speed in proportion to power. Also for strength, it will have two keels instead of one, thus distributing the strain and giving the five engine nacelles or "power eggs" better support. The control car, instead of being merely fastened to the framework by a strut structure, will be directly attached to the frame of the ship.

When the proposed model of the dirigible was first tested in the tunnel it had eight control surfaces on the tail, but the wind tunnel showed this to be undesirable, and, eliminating one at a time, the most efficient number finally was found to be four. This elimination of tail surfaces saved thousands of dollars for the navy department, and was a direct result of the wind-tunnel findings.



Some of the Important Things Airplane Designers Have Learned Since the Days of the Wright Brothers' First Crude Ship

The wind tunnel was largely instrumental in proving that as airships become larger, the ratio of useful-load capacity to structural weight improves materially, and that to double the volume and gross lift of an airship requires only an increase of twenty-six per cent in linear dimensions. From this it can be seen that it is perfectly possible and highly practicable to build dirigibles of enormous lifting capacity without reaching prohibitive dimensions. A ship of this type, inflated with 10,000,000 cubic feet of helium gas, would be able to accomplish a non-stop round trip to Europe, about 6,000 miles, returning with a reserve fuel supply for an additional 3,000 miles, and still transport a

military load of about 190,000 pounds.

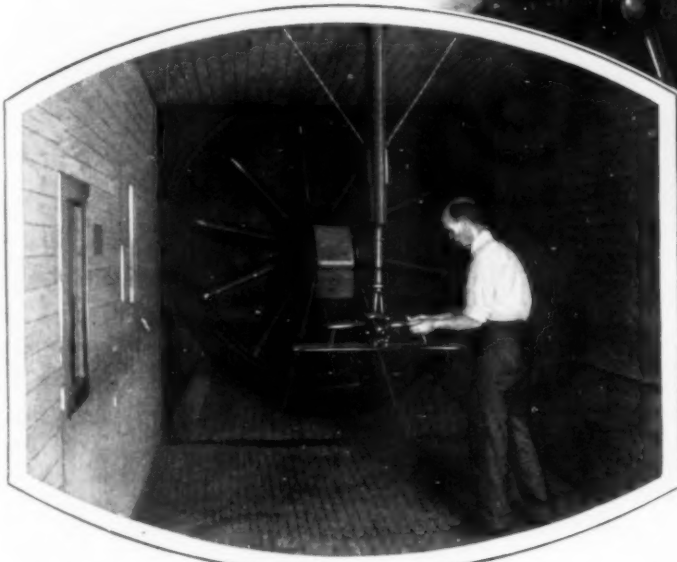
And airship tests form a small part of the routine work in the tunnel. Through extensive research it is anticipated that the world airplane-speed record will soon be won again by the United States, and if it is, the wind tunnel should certainly share in the glory. Models of the record-breaking "Mercury" racer that is to be built for Lieut. Alford J. Williams, U. S. N., are now being tested for airworthiness. The plane will be powered with a new twenty-four-cylinder X-bank motor that develops about 600 horsepower. Wind-resistance experiments proved that the best type of craft to maintain the astounding speed that must be made by this hope of a nation would be a monoplane, and, further, that much speed could be gained by placing the wing midway of the height of the fuselage, that is to say, on a level with the engine crankshaft.

Racing planes are notoriously tricky and even racing pilots fear the effects of kinks in new designs, but this one has been thoroughly tested for unusual behavior and all the discoverable kinks eliminated in the wind-tunnel tests. The results of these tests are for the most part confidential, but there is little doubt that Lieutenant Williams will come very close to the unprecedented 400-mile-per-hour speed, and none at all that he will break all existing speed records.

Two extremes—our largest airship and the world's fastest airplane—owe their airworthiness to the wind tunnel. And then there are the usual everyday findings that save thousands of lives and millions of dollars in an unassuming, unrecognized

way. Little wonder that the pilot of today looks to the wind tunnel as to his closest friend, and takes the findings for life value.

The perfection of the new Handley - Page slotted wing, American rights to which, for military use, have been purchased by the government so that it can be applied to all army and navy planes, is credited to



Preparing a Model for Test, Top, and Mounting One in the Wind Tunnel; in the Background Is the Blower

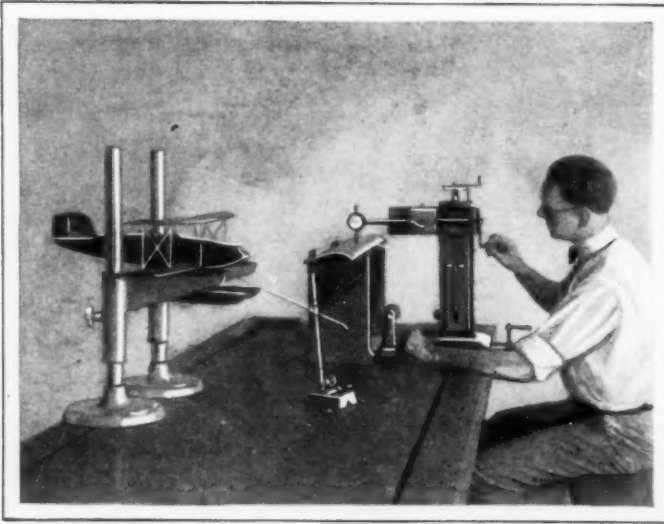
wind-tunnel observations. The slot is designed to eliminate the fatal accidents which result from stalling an airplane in flight. When the speed of the plane falls below flying speed, the air flowing over the top surface of the wing, where the greatest lift normally is exerted, becomes turbulent and broken into eddies, lessening the lift. When that happens, the wing slot opens automatically and begins feeding additional air to the top of the wing, drawing it from the underneath surface. With the additional air, the wind-tunnel tests showed, the air stream on the top of the wing was restored.

In actual flight, planes with slotted wings

can be put through strange maneuvers. Captain Geoffrey de Havilland, the famous British designer, whose war-time plane was produced in quantities for the American army, fitted slots to one of his light planes and found it impossible to put the ship into a tailspin from a stall, as the wing slots always brought it into level flight. He allowed

the plane to stall, and, with the slots working, came vertically downward until he struck the ground with sufficient force to crumple the landing gear—yet escaped unhurt in the crash.

Wind-tunnel tests also have done much to improve knowledge about the types of plane design that are most stable and safe in flight. They show how combinations of what airplane designers call the dihedral angle, sweepback and wind stagger, all make a plane less inclined to get out of flying position and go into a spin. The dihedral angle is the angle at which the wing tips are sometimes elevated above a straight line; sweepback is



The Models to Be Tested Are Carefully Checked; the Tester Is Going Over a Wing Surface to See If the Curve Is True

a similar angle, seen when looking up to or down on a plane whose wings, instead of extending straight out at either side, are inclined backward at the tip; and stagger is the placing of the lower wing of a biplane either slightly back or slightly in front of the upper wing.

Boys who fly model planes learn much about the effect of a high dihedral angle and sweepback, for both give a plane more lateral stability, thus preventing the ship from falling off on one wing and going into a tailspin. The ship with a straight wing looks faster and more trim to the eye, but isn't nearly so safe.

Wing stagger, on the other hand, provides more longitudinal stability and increased lift, for the arrangement of the wings lessens air disturbance between them, increasing their lifting effect, and the ratio of total wing depth of the plane is greater, so it has less tendency to soar or dive.

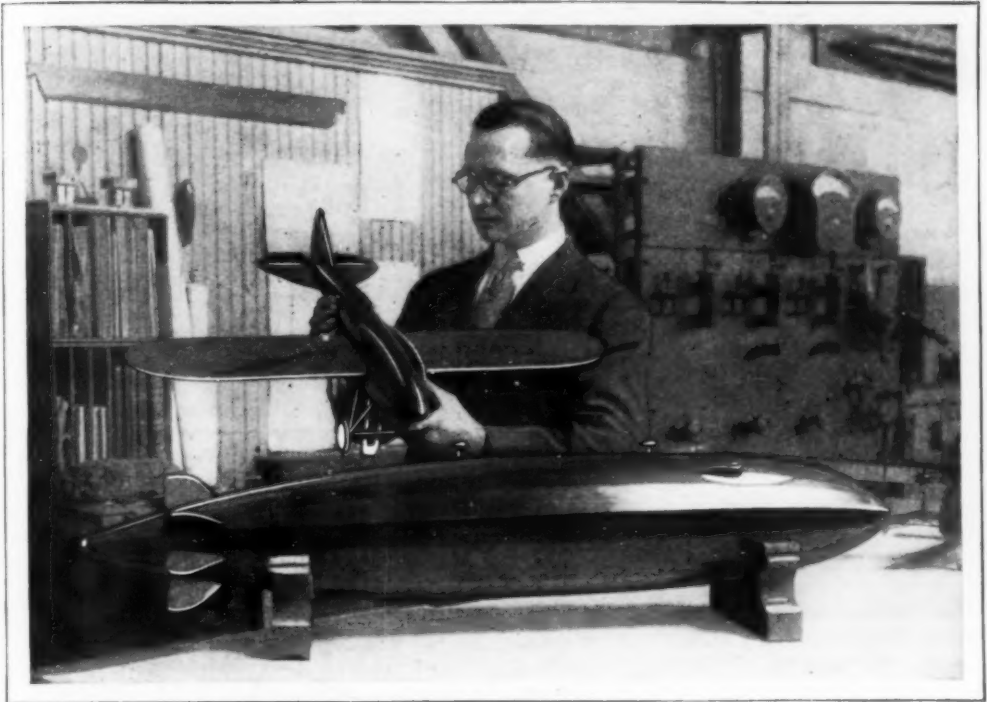
A new plane designed at the California Institute of Technology has an adjustable lower wing, so the pilot can move it forward or back to reduce or increase the amount of stagger while in flight. As a result, he can vary the lift to suit the speed of the motor, and can diminish the landing speed of the plane so much that it will come to a stop within thirty feet after touching the ground.

The university of Michigan recently an-

nounced the opening of an air-research laboratory and a giant wind tunnel. The most outstanding research laboratory in the United States for airplane development, however, is that of the army air corps, at Wright field, near Dayton, in which air conditions are exactly controlled by ingenious mechanical means. The new dynamometer laboratory of the army air corps takes into consideration two outstanding features of modern aircraft engine development—air-cooled engines and greater horsepower. The facilities for testing have been increased recently by fifty per cent and the large dynamometers will be capable of absorbing 100 horsepower in a single unit. A feature of the dynamometer laboratory is a blower system for furnishing a blast of air to the air-cooled engines that will simulate the speed of normal flight and cool the engines under test.

Another new apparatus will measure the performance of engines at simulated altitudes, that is, the air entering a specific carburetor will be conditioned so that the volume and temperature of air can be definitely measured and controlled and temperatures as low as sixty degrees below zero obtained. The wind-tunnel installation consists of a five-foot and a fourteen-inch tunnel. The former is capable of a wind speed of 240 miles per hour; the latter of 500 miles an hour. When funds become available, it is planned to erect a ten-foot tunnel which will materially enlarge the scope and accuracy of aerodynamical tests.

Aside from the improvements in airplane design, based on wind-tunnel experiments, the navy laboratories likewise have done much to improve engine design. The famous Wright "Whirlwinds" that carried Lindbergh, Byrd, Chamberlin, and a host of other flyers, overseas, were developed in co-operation with the navy department, to meet the navy's need for an efficient air-



R. N. Smith, Chief Draftsman of the Navy, with a Model of the "Mercury" Racer, Which, It Is Hoped, Will Bring the Speed Record Back to the U. S.; on the Table Is a New Dirigible Model

cooled engine. The navy experts helped the makers until the engine had been perfected, and gave the initial orders which put the factory on a production basis. Similarly, naval orders were the incentive behind the development of the Curtiss racers that won the Schneider cup for America.

The making of an airplane engine that will stand up hour after hour under the grueling load of running "all out," or even at cruising speed of 1,900 revolutions or so a minute, is a miracle of science. Special alloys have been developed to give lightness and strength and, for every part, a metal particularly suited to its purpose is evolved.

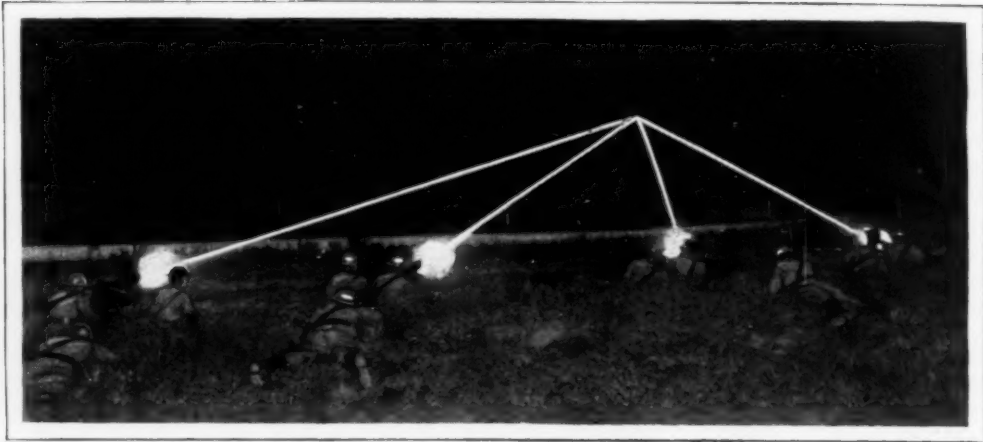
The crankcase alone of the Wright "Whirlwind" has been described as the finest aluminum casting ever made. In its making, metallurgists, engineers, draftsmen, foundrymen and machinists have co-operated. The alloy which goes into it is mixed only from new and unused metal—no melted-down scrap being permitted—and from every crucible of molten alloy a bar is poured for rigid chemical

and physical tests, on the results of which the entire heat of metal is either accepted or rejected.

Each crankcase is subjected to heat treatment to assure full strength in every section; each is tested under water by air pressure to make sure there are no porous passages or blowholes, and each one is acid-etched to make sure that no minute defects may pass unnoticed. The machining, too, is an exacting and slow process.

The navy standard for several years has been fifty-hour tests. An engine had to run successfully for that length of time before its type was approved. At the time the test was established, no airplane had remained in flight for anywhere near that length of time, but within recent months the world's endurance record has been broken three times, and now is above sixty hours.

On the basis of past developments, it is probable that future refinements within a few years will produce engines capable of running for more than 100 hours at cruising speed, and that the endurance record will be boosted accordingly.



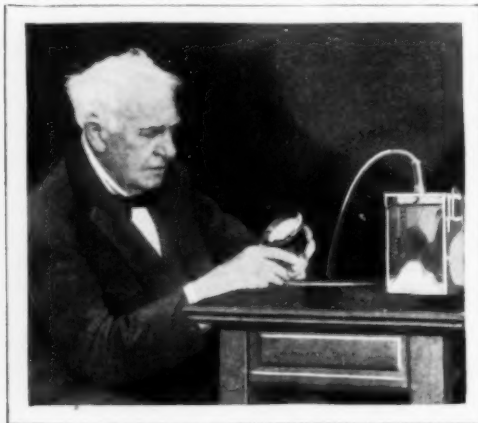
Geometrical Pattern in Lines of Light Formed by Tracer Bullets during Night Target Practice with Machine Guns; the System Provides a Visible Means of Sight Adjustment

BULLETS TRACE LINES OF FIRE TO AID MARKSMEN

Cadets at the University of Missouri used the sky as a blackboard and tracer bullets as chalk during gunnery practice at recent maneuvers. The bullets blazed lines of fire from the muzzles of the guns to the targets and, when several guns were being fired at once, a geometrical pattern was produced. The lines assisted the marksmen in adjusting their sights for night firing.

EDISON'S MINERS' SAFETY LAMP TO PREVENT EXPLOSIONS

Although he is past eighty, Edison is still busy with his inventions, and one of



Edison with Model of the Safety Lamp Which Has a Battery Involving 50,000 Experiments

the latest is a safety lamp for miners, to reduce the likelihood of gas explosions. Its special feature is a battery on which Edison is said to have performed more than 50,000 experiments, to improve it to its present high state of efficiency.

FOURTH OF ACCIDENTAL DEATHS OCCUR IN HOMES

Figures gathered by the national safety council show that approximately one-fourth of all accidental deaths in the United States occur in homes. Last year, between 23,000 and 25,000 persons were killed by falls, burns, suffocation or other causes in their dwellings, about the same number as died from industrial accidents. For each home fatality, an insurance company paid 200 claims for non-fatal accidents, so, on that basis, some 5,000,000 non-fatal mishaps occurred in American homes. Thirty-five per cent of the fatalities were due to falls, nineteen per cent to burns and but two per cent to electricity. During the four weeks, ending July 14 of this year, automobiles were responsible for the deaths of 514 persons in the seventy-seven large cities of the United States, the council reports. Last year, the figures show that approximately 23,250 persons were killed in automobile accidents throughout the country, not including fatalities in collisions of automobiles with trains or street cars or in motorcycle accidents. Counting these in, the total is nearly 25,800. The 1927 figures represent

an increase of nearly 21,000 over 1911, also an increase in the number of deaths per 100,000 population but a decrease per 100,000 automobiles registered. In 1926, there were but 170 airplane deaths as compared to 185 in 1920. Between 1918 and 1920, the average number of miles flown per fatality in airway operations was 97,587. Between 1924 and 1926, it was 1,387,964, showing there has been a marked improvement in safety.

MOTOR FUMES INJURE TREES WITH ROUGH LEAVES

Chestnut and other trees with furrowed leaves along Paris boulevards, have been injured by sulphurous dust from motor-exhaust fumes, experts report. On the other hand, trees with smooth leaves have not suffered to any noticeable extent because rains and winds keep the leaves clean. Dust clogs the pores of rough leaves, interfering with their "breathing."

PORTABLE NEWSSTAND HELPS PATRONS CATCH CARS

An enterprising newsdealer in England has devised a way to give his patrons aid in catching street cars. On a rack above the stand are large numbers announcing the route number of the car next to leave, and his booth is on wheels so that he can reach more customers in the area.



News Booth on Wheels and That Carries Schedule of Departing Cars on Rack Above

RADIO HEADGEAR FOR AIRMEN TO AID COMMUNICATION

Aviator with Helmet That Carries Headphones; the Mouthpiece Is Adjusted for Convenient Talking



Wireless messages will be received and sent more easily from airplanes, it is predicted, by using an improved headgear recently tested by men of the signal corps. The phones are inclosed in a snugly fitting helmet which shuts out most of the noise, and the mouthpiece of the transmitter is securely held to the chest in a convenient position for clear speaking.

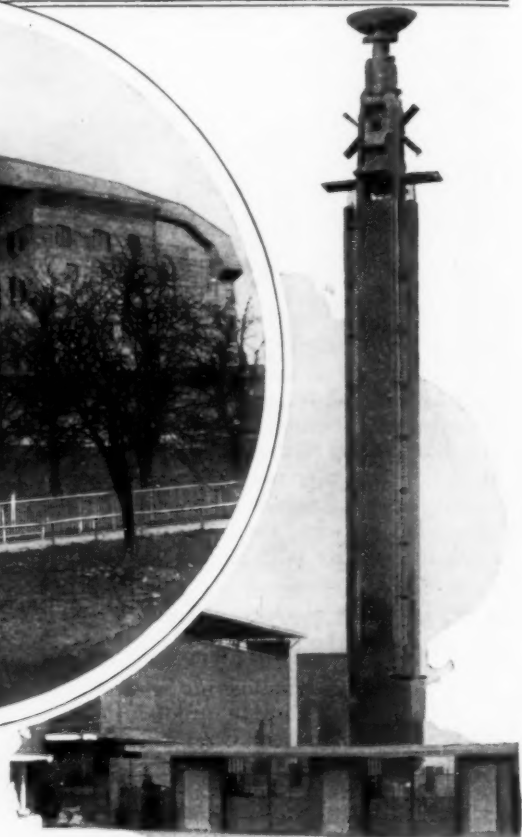
CANDLES AT MOUNT VERNON REPLACED BY ELECTRICITY

Without marring the beauty of the estate, electric lights have been installed to replace candles in most of the buildings at Mount Vernon, the home of George Washington and the shrine of the nation. All the structures except the mansion itself, are supplied with current through underground and carefully shielded conduits to make them inconspicuous and to reduce the fire hazard. The old kitchen, one of the most interesting spots at Mount Vernon, has been completely electrified. It now has an electric range and an electric refrigerating system. Other historic estates near Mount Vernon have also been electrified, many of the fixtures being exact reproductions of the candle holders on the walls of Washington's home.

UNUSUAL BUILDINGS SEEN IN EUROPEAN CITIES

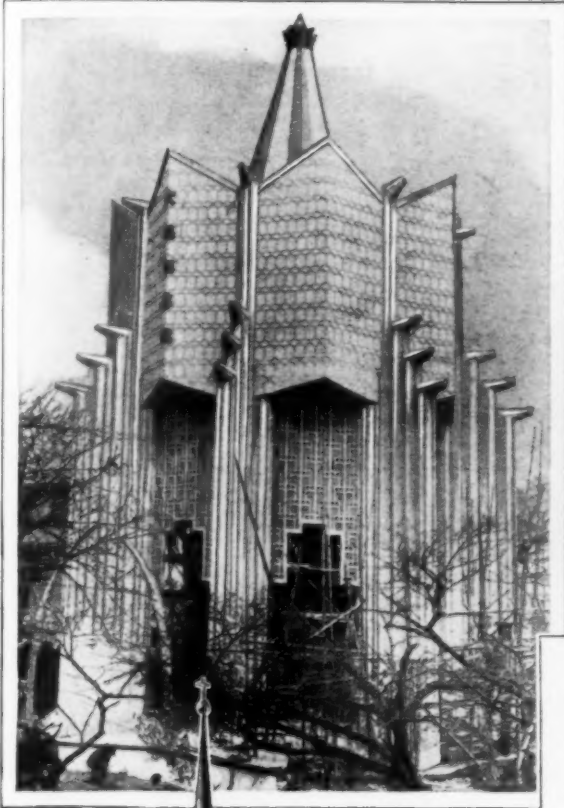


Modern Architecture Appears in Bale, Switzerland, in This Massive Structure, a Temple Erected in Honor of Goethe, the German Poet; at Upper Right Is Tower at the Entrance to Stadium, in Amsterdam, Where Olympic Games Were Held; It Harmonizes with the Modern Lines of Other Buildings Surrounding It

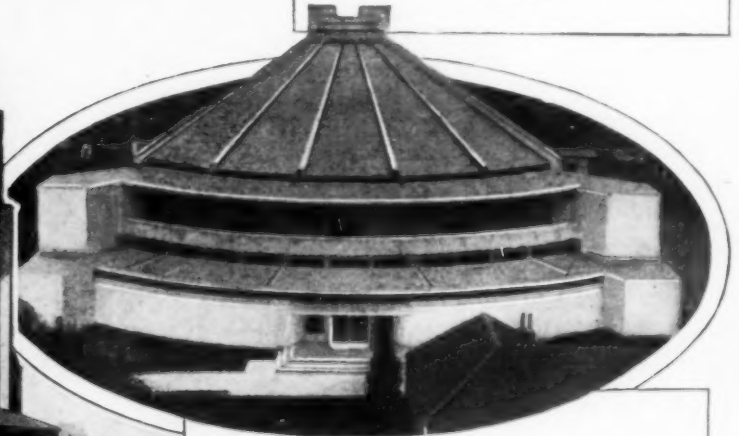
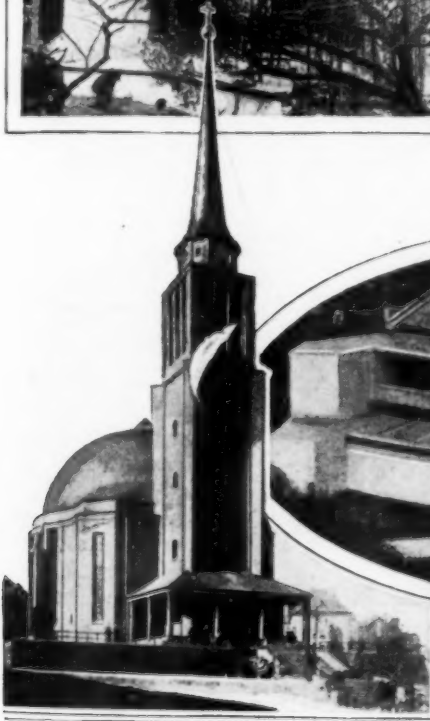


"Slums" of a Progressive City of Today; Building Erected by Amsterdam Municipal House Corporation for Its Poor; Design Affords Ample Light

REFLECT NEW IDEALS OF BEAUTY AND UTILITY



Modernism Reaches Out to Japan with the Result on the Left, a Building Being Erected in Commemoration of the Coronation of Emperor Hirohito; Little of the Pagoda Influence Is Seen; Above, an Office Building in Hanover, Germany, Which Is an Interesting Adaptation of the Dome and the Long Lines of a Modern Skyscraper



Church of St. George in Frankfort, Germany, Embodying Late Ideas in Architecture and, Above, the Oddly Shaped Structure Devoted to the Uses of a Modern Religious Cult; It Was Recently Dedicated in Amsterdam

MULELESS ARMY OF FUTURE SEEN IN MOTOR UNIT



© U. & U.

Part of the Motor Unit in Muleless Army Column; in the Rear Is the Special Anti-Aircraft Gun on Its Truck

Just as the motor has replaced the horse to a large extent, so it promises to send the mule to the discard in one of its last strongholds, the army. A completely mo-

torized unit has been assembled at Fort Leonard Wood, composed of about 200 vehicles and 1,100 men. A test march was recently staged, although old-time soldiers wondered

how "an outfit could do any marching without mules." One of the pieces of equipment was a special anti-aircraft gun, hauled on a fast four-wheel-drive truck and capable of being fired while in motion. Records were kept as to the speed made

STUDY THE BRAIN WITH X-RAYS TO LOCATE TUMORS

Operations on the brain may become less hazardous as a result of a Swiss physician's use of the X-rays to examine the organ. He finds tumors with the aid of the rays by pumping air into the cavities of the brain. If one of the cavities contains a tumor, the air cannot penetrate, and the fact is disclosed on the X-ray photograph by the absence of the usual white patch that indicates a cavity filled with air. Oil is employed in examining the part of the brain just above the spine. The oil is heavier than the spinal fluid

and so flows down, appearing as a black strip. If there is a tumor in the canal, the strip stops at the edge of the growth. Experiments with a lighter oil may locate the lower edge of the tumor.

CHANGEABLE-DATE LICENSE TAG REDUCES EXPENSE



License Tag with Changeable Date Insert Which Eliminates Necessity of Attaching Complete New Tag

To reduce the cost of making automobile license tags, a marker, patented by an Oregon man, has a changeable date tag, the numbers remaining fixed. When a new license is necessary, the numerals forming the proper year are simply inserted in the slot that is cut for them.

FIVE TONS OF BEEF REQUIRED FOR BYRD EXPEDITION

Estimating food and other supplies to last sixty men two and one-half years is one of the tasks Sydney Greason, chief steward of the Byrd antarctic expedition, has had to handle, and his figures, compiled after determining the probable daily ration per man, will interest everyone who has had to plan a camping trip. Among the articles Greason is providing are two tons of ham, three of bacon, five of beef and one of chicken. Five hundred cases of eggs will be carried, two tons of tinned butter, a ton of powdered milk, 1,200 pounds of cookies and a ton of jams, jellies and marmalade. The men will be equipped with sixty razors and 1,200 packets of blades, nearly 9,000 cakes of hand soap and 1,200 sticks of shaving soap. Five tons of dried fruits will be taken and two and one-half tons of candy. The cooking utensils will weigh one ton. The expedition's stores will include 800 sheets, 400 pillow cases, five folding bathtubs and a number of folding cots and chairs, besides two electric washing machines, twelve barrels of washing powder, thirty dozen tooth brushes, five dozen hand brushes and the same number of hair brushes. Most of the equipment is for use at the base camp on the Ross sea.

GAS CARRIER ON MOTORCYCLE LATEST ARMY UNIT

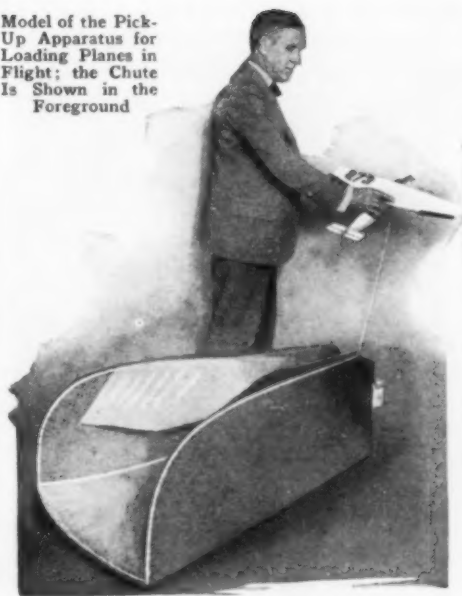
For rapid transportation of containers of poison gas in the army, the French have



Motorcycle Sidecar Equipped as Poison-Gas Carrier for a Unit of the French Army

devised a motorcycle carrier. A large holder is placed on a sidecar support. The new unit was demonstrated recently at special maneuvers.

Model of the Pick-Up Apparatus for Loading Planes in Flight; the Chute Is Shown in the Foreground



AIRPLANE LOADED IN FLIGHT FROM METAL CHUTE

Airplanes can pick up supplies while in flight from a special loading unit developed by a western inventor. It is of metal and is shaped somewhat like a funnel split in two, being wide at one end and tapering down to a narrow mouth where the package to be picked up is placed. A cable and ball on a reel are lowered from the plane into the wide part of the funnel, the package attached, and then automatically shot out to relieve the strain of a sudden jerk as the plane flies away.

SAILING BOATS WITH BIG KITES NOVEL WATER SPORT

Visitors at a Wisconsin lake enjoyed a novel form of boating by using large kites as substitutes for sails to propel the craft. One sportsman had good results with a five-foot kite which he released to an altitude of about 700 feet. By changing his position in the boat, he was able to be of help in guiding it.

Popular Mechanics Magazine does not publish the name of the maker or seller of any device described in its pages, but this information may be obtained, free, by addressing our Bureau of Information.

ELECTRIC LIFEBOAT LAUNCHED IN THREE SECONDS



Model of the Lifeboat Which Can Be Launched in Few Seconds by Pressing a Button

An electric apparatus by which lifeboats can be launched in three seconds, according to reports, has been devised by a western sea captain. The control buttons are in the pilot house and simply pressing one sends the boat down.

OIL TANK BLASTS PREVENTED BY WASTE GAS

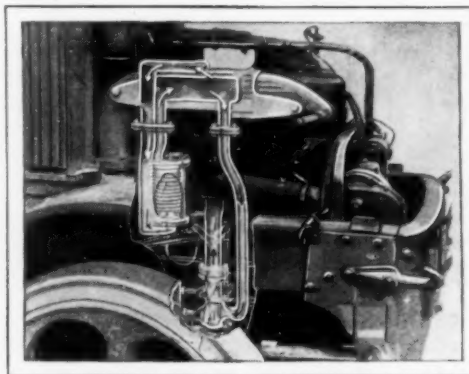
By utilizing the waste gases from the ship's boiler fires, a way has been found to prevent explosions on a large tank vessel. The method seems incongruous at first as the vapors leave the stack at a temperature of 400 to 500 degrees Fahrenheit and it would be supposed that they would prove a menace when introduced into the oil tanks. But the gases are first cooled with a salt-water spray before being let into the tanks and, as they are devoid of oxygen, they act as an effective "smothering blanket" to

prevent an explosion. Experience has shown that one of the common causes of such accidents as the tanks are being pumped out, is that the atmospheric oxygen, mixing with the vapors remaining, form an explosive gas, extremely dangerous. The waste fire gases effectively remove the oxygen. An additional precaution has been taken when filling the tanks. Under old methods, explosions sometimes occurred when incoming oil drove out gases through vents in the tanks where they combined with the oxygen in the air and blew up. In this tank vessel, the vapors are forced into the hollow mast of the ship and discharged at the top at a safe elevation above the deck.

GLIDER SAILS FOUR HOURS ON AMERICAN FLIGHT

Peter Hesselbach, German pilot, remained aloft over four hours in a glider during a recent flight above the cliffs of Cape Cod. The feat constituted an unofficial record for America, the previous mark being held by Orville Wright, who remained up nine minutes and forty-five seconds in 1911 while experimenting with planes. Hesselbach's American performance is far short of the world's record for gliders, however, as a solo flight of more than fourteen continuous hours was made in Germany some time ago. Hesselbach has flown in a motorless plane for more than five hours with a passenger. His glider is launched with elastic ropes.

GASOLINE VAPORIZER FOR AUTO REPLACES CARBURETOR



Drawing to Show the Vaporizer Installed

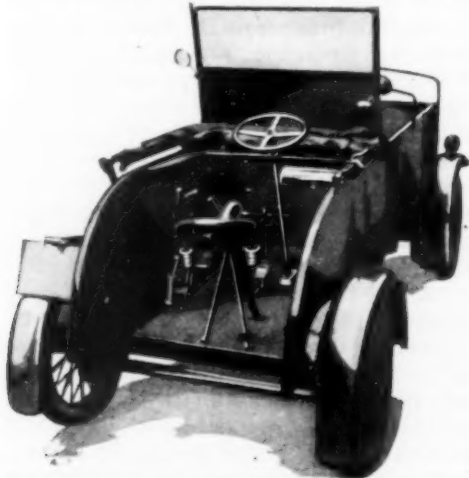
Saving of fuel and more efficient operation of the motor are claimed for a gasoline vaporizer that replaces the carburetor, according to reports. It is said to supply "dry" gas to the cylinders, reducing waste, giving more complete combustion and eliminating most of the carbon troubles.

PLANE SETS WORLD'S RECORD FOR NUMBER CARRIED

What is probably a world's record for the number of people flown in one airplane within a short time was set recently in Scotland, when 2,100 people took joy rides in a single airplane in the course of two consecutive days. The plane, one of the giant twenty-passenger cross-channel air liners of the imperial airways, had flown to Scotland in a race with the "Flying Scotsman," the famous non-stop passenger train, beating the train by a good margin. It remained two days at the Glasgow airdrome and, in that time, the pilot made 105 flights with a full passenger list each time, at a price of half a guinea (\$2.50) per passenger, earning a total of more than \$5,000 in the two days. No trouble marred the unusual performance.

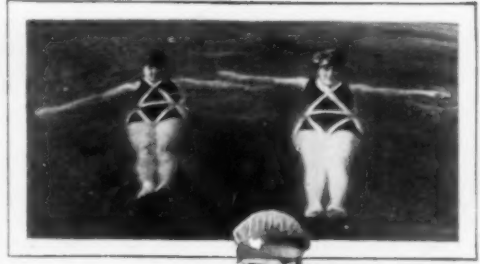
AUTO AND BIKE COMBINED FOR DELIVERIES

Features of an automobile and a motorcycle are combined in a delivery car that has a spacious compartment for packages in front and a saddle like that of a cycle for the operator to sit on. This is considered more efficient than an ordinary car seat as he can get in and out of it more quickly to attend to his deliveries. The vehicle has four wheels, but is said to be as



Rear View of Combination Auto and Cycle, Which Affords Fast Delivery Service

easily managed in heavy traffic as a motorcycle and develops high speed.



© Henry Miller
Floating with the Tube Suits, and How the Preservers Are Worn without Hampering Movements

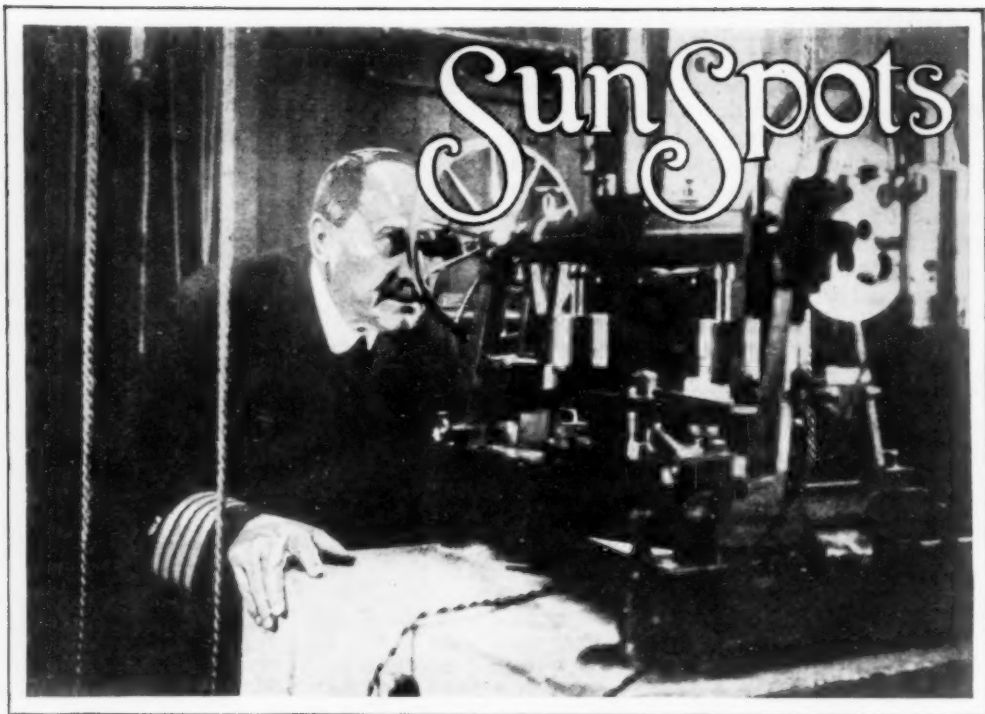
RUBBER TUBE SWIM HARNESS HELPS BEGINNERS

Pneumatic tubes, worn about the body in such a way that they offer a minimum of interference to the swimmer's movements, have been introduced to help the beginner. They are easily adjusted and there is no risk of their coming off.

CLOUDS BOMBED TO PREVENT HAILSTORMS

In an effort to break up a hailstorm and prevent damage to crops, Swiss scientists recently bombed the clouds with high-explosive rockets. Opinion after the experiment was divided, however, as to the value of the results achieved. The hailstorm, which swept the Swiss-French frontier, caused enormous damage. Hailstones as large as plums stripped fruit trees and entire vineyards were washed away.

☐ Popular Mechanics Magazine does not publish the name of the maker or seller of any device described in its pages, but this information will be furnished, free, by our Bureau of Information.



Captain T. J. J. See, Director of the United States Naval Observatory at Mare Island, California, at One of His Instruments; the Naval Astronomers Are Seeking New Stars

BBETTER radio reception for the next few years, and also a decrease in sunburn for summer bathers, were predicted recently when the Astronomical society of the Pacific met to compare notes on a year's observation of the heavens.

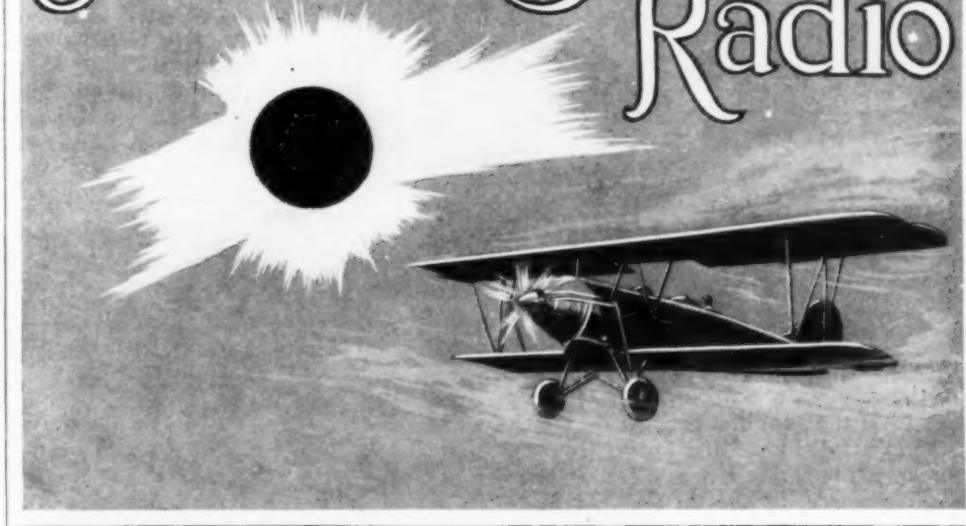
The good news for wireless fans and swimmers is credited to the same cause, a decrease in the number of sunspots, or solar hurricanes. Judging by past performances, the number of sun storms will decrease steadily for some years, and then slowly increase until they reach a maximum again in about eleven years. The present cycle, which reached its maximum about March, 1927, followed the previous one by only 7.3 years, but observations stretching over more than a century indicate it may be another hundred years before such a short cycle is reached again. The last previous one was the storm maxima of 1829 and 1837.

Sunspots are responsible for the magnetic storms and unusual displays of the northern lights, which register on the radio receiver as static. Also, according to Dr. Edison Pettit, there is a striking agree-

ment between the number and size of the spots on the sun and the amount of ultraviolet light reaching the earth, and ultraviolet rays are the ones that cause sunburn, when the body gets too much of them. For four years, Dr. Pettit has measured the ultraviolet rays received at Mt. Wilson observatory by passing the sunlight through a filter of thin gold and a similar filter of silver, the one cutting off the short violet rays and the other passing them without obstruction. At times, there was a fifty-per-cent variation in the amount of ultraviolet light within the space of a month, and each time the rise or fall of the amount of short rays coincided with the rise or fall in sun storms.

Another discovery made at Mt. Wilson as a result of work by Dr. Seth B. Nicholson, the astronomer who, in 1914, won for himself a place in star history by finding an unknown moon of the planet Jupiter, is the presence of boron, the chief element of the familiar boric-acid eye lotion, in the sun, thereby clearing up the identity of hitherto unknown lines in the sun's spectrum. None of the lines of boron

Forecast Better Radio



The Corona of the Sun during an Eclipse Seen in England Last Year; the Event Was Photographed by Astronomers Flying in Airplanes Far above the Cloud Line

alone have ever been found in an analysis of the sun's light, as it is broken up by the spectroscope, but when Dr. Nicholson combined boron with other chemicals, characteristic light bands in its spectrum checked with some of the unidentified elements of sunlight.

The present year may go down in astronomical history as one of the greatest since the invention of the telescope, for, somewhere out in space, near three billion miles away from the earth, a new planet may possibly be rushing into view.

Prof. William H. Pickering, head of his own observatory in Jamaica, has spent several years observing mysterious deviations in the orbits of Saturn, Uranus and Neptune, outermost members of our solar system. On the basis of his calculations, he has advanced the theory that the only explanation lies in the presence in their vicinity of an unknown planet, of a mass as great, or greater, than that of our earth.

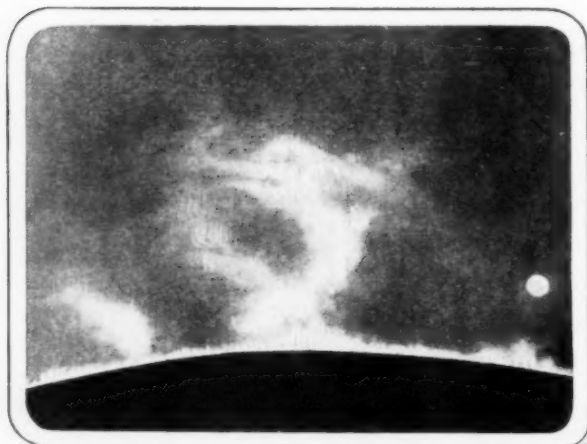
Yerkes observatory, at Williams Bay, Wis., the Harvard observatory, at Cambridge, Mass., Mt. Wilson and Lick, on Mt. Hamilton, in California, the observa-

tory at Flagstaff, Ariz., and others in Peru and Chile have been busy for several months photographing the heavens in the region beyond Saturn's rings and between Uranus and Neptune in hope of finding a ninth planet, but so far without success.

That there probably is one more and possibly two undiscovered planets, is generally accepted by astronomers. While Dr. Pickering's calculations are not entirely approved, his standing as the discoverer of the ninth satellite of Saturn lends weight to his theory. More than thirty years ago, he calculated that this unknown moon must exist, and figured that it should be found in a certain location. When the telescope was trained on the spot, he found the satellite, to which the name "Phoebe" was given.

His theory of a ninth planet far out beyond the limits of the known solar system is based on the erratic behavior of Neptune. The eight known planets, in their order from the sun, are Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus and Neptune.

Johann Elert Bode, a German astrono-

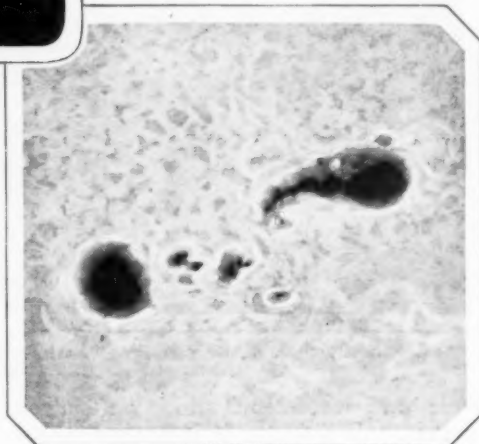


Flaming Storms on the Sun's Surface, with Streamers 85,000 Miles High; the Small Circle Indicates the Comparative Size of the Earth; at Right, Huge Spots When the Storms Were at Their Maximum in 1926

mer, who died in 1826, established the fact that the planets are arranged in regular order from the sun, in a proportion which is represented by adding four to each number of the series 0, 3, 6, 12, 24, 48, etc. In other words, as the distance of Mercury—36,000,000 miles—is represented by four, then three plus four represents the distance from the sun to Venus, and so on. The distribution of the planets, according to Bode's law, checked so perfectly that, when it was found there was none between Mars and Jupiter, where the distance represented by twenty-four plus four called for one, astronomers decided the planet in that location must have met with an accident, and so began looking for the fragments. Since that time, hundreds of small planetoids have been found, until the number known is now more than 700, and growing at the rate of about thirty a year. The two largest are only 400 miles in diameter, and the majority are probably not more than fifteen or twenty miles across.

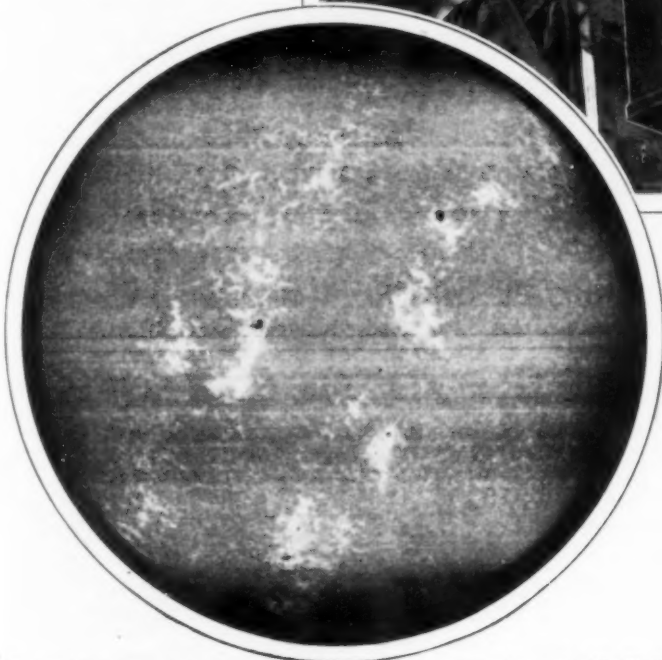
If there is another planet outside Neptune's orbit, the Bode law fixes its position as almost inconceivably remote. It is 2,796,528,000 miles from the sun to Neptune, and 92,998,000 miles less from the earth, so that astronomers must look with the eyes of their cameras across nearly two and three-quarter billion miles of space before they reach the farthest known planet, at the period when it is closest to the earth, and, according to the Bode law, the next

member of the solar family, if it exists, must be a couple of billion miles farther away. How far, it is impossible to actually say, for Bode's law is only roughly correct, showing an appreciable error in the case of Neptune, for example. According to the rule, the planet should be nearly thirty-nine times as far from the sun as the distance from the sun to the earth, whereas actually the distance is about thirty times.



If another planet outside of Neptune is found, its period of rotation around the sun will be measured in hundreds of years. It takes Neptune 165 years to make the complete circuit, and, as it was not discovered until September, 1846, it has not as yet made one trip around its orbit under observation. Before Neptune had been discovered, however, its presence had been deduced from the eccentric conduct of Uranus, just as Neptune's deviation from its charted course gives rise to the conclusion that it is being drawn away by the force of gravity exerted by some tremendous mass farther away from us. As early as 1834, astronomers, following Uranus' path, began calculating the position of a possible planet farther away, and by 1846 had determined not only its probable location, but the path it must be traveling. The calculations were so exact that when, on a September night, the Berlin observatory started the search, the planet was located within a few hours.

The next year Sears Cook Walker, of the National observatory in Washington, started computing the past positions of the planet, and discovered that it was identical with a star observed twice by Lalande at Paris in 1795. Search of the records in Paris disclosed that the French astronomer,



Spectroheliogram of the Sun on May 2 of This Year, Showing a Double Chain of Sunspots; Right, Telescopic Camera with Five-Inch Lens and Focal Depth of Fifteen Feet, Used at Lick Observatory in the Search for a New Zone of Planets

finding his two observations did not agree in position, decided one was in error and marked the other doubtful. Had he gone back to his telescope to determine which of his figures was correct, he would have found his supposed star had moved again, and thereby discovered the planet half a century before it was actually found.

The probable size of Pickering's supposed planet, if it exists, is also of interest to astronomers. Neptune, located because of its influence on the orbit of Uranus, is the larger of the two. The suspected ninth planet, being nearly twice as

far from Neptune as the latter is from Uranus, probably would have to be of even greater mass to have any observable effect. The orbit of Neptune has been more or less of a puzzle from the start, as it is more near a circle than the usual elliptic path of planets, stars and comets.

If found, the ninth planet probably will be a frozen world, for temperatures fall rapidly with distance from the sun. The normal temperature of Neptune is estimated

at 218 degrees below zero, centigrade, whereas the earth's normal, according to the same scale, is nineteen above zero.

FLOODLIGHTS IN CHURCH

At night and on dull days, persons attending an English church may still enjoy the effect of stained-glass windows by means of a special system of colored floodlighting. The lamps are controlled from central points and different effects can be produced to harmonize with the various stages of the services.



Boat on Auto Running Board, Ready for Use, and Partly Set Up; It Is Made of Mahogany Pieces Joined by Canvas

FOLDING BOAT FITS ON AUTO RUNNING BOARD

So compact that it can be collapsed into a small bundle for the auto running board, a folding boat is made of mahogany pieces joined by waterproof canvas and can be put together in less than two minutes. It weighs under 100 pounds, and is about ten feet long and three and one-half feet wide. No tools are required in assembling it, and it can be used with an outboard motor.

TIRE GAUGE AND DEFLATOR HELPS PROTECT VALVES

Fitted for testing all kinds of tires, a combination gauge, calibrated from ten to 160 pounds, has a deflator attachment so that air can be let out from the valves



without using a match, the thumbnail or other means likely to damage the part. The unit is of a size that prevents its becoming lost easily, yet can be carried in the pocket, and is durably built.

NON-SKID MOTOR ROAD MATERIAL STOPS ACCIDENTS

Interesting tests with a non-skid type of pavement on fifty miles of highway are being made in California. The surface consists of ninety-eight per cent of hard, crushed rock or gravel, screened so that no piece is more than three-eighths of an inch in greatest diameter. This is thoroughly mixed with asphalt and the composition is then spread and rolled into the asphaltic-concrete pavement while hot. Rolling is continued until the screenings are thoroughly impacted into the paving. The surface sheds water readily, resists accumulations of oil, is not expensive, and tests with it have been successful, according to the report of the highway commission.

MOTH PREVENTIVE IN HOLDER PURIFIES AIR

Besides destroying and preventing moths, a chemical inclosed in a small container is said to purify air in bathrooms, closed cars and similar places. It gives no unpleasant odor, is effective in protecting rugs, furniture and other articles, and although the chemical is volatile, a single filling will last about three months.



CHART GIVES CORRECT TIME ANY PLACE IN WORLD

A chart that tells the correct time any place in the world has been prepared by the bureau of standards for sale through the government printing office. It consists of a heavy cardboard disk mounted on a larger card. The revolving disk is

divided into fifteen-degree segments, half of which are in white, numbered from one to twelve, for the hours from midnight to noon, and half printed in black, with the same numbering, for the period from noon to midnight. The base card also contains a circle, laid off in fifteen-degree segments, with secondary lines every seven and a half degrees. The principle of the card is that time changes one hour for every fifteen degrees of longitude. Because the astronomical day starts at noon instead of midnight, time is reckoned from Greenwich, England, the base longitude line, and the international date line, where days change, is halfway around the world, on the 180th meridian. Knowing the local time, it is only necessary to revolve the inner disk until the correct time is opposite the operator's local time zone. The correct time and place around the earth can then be read from the outer circle.

TEAR-GAS CLUB FOR POLICEMEN TO HELP CONQUER CROOKS

Tear-gas "billies" have been allotted to emergency squads of the New York police department to help them arrest criminals. The gas compartment is concealed in one end of what appears to be an ordinary club. This arrangement permits introducing the gas through narrow spaces and small openings that could be reached only with difficulty by ordinary gas bombs.



Tear-Gas Container in Policeman's Club for Emergency Use in Subduing Crooks



Reflection of the Sun on Clouds of Tiny Ice Particles; a Phenomenon Observed from Mountain Peaks

ICE-CRYSTAL CLOUDS MIRROR SUN AND MOON

A beautiful phenomenon, sometimes seen from airplanes or from the top of high mountains, is the reflection of the sun or moon upon clouds formed of tiny ice particles. It is not a common sight as the clouds that produce it must be at a high altitude and the reflection appears only on their upper surface. The accompanying illustration of the "under-sun" was taken from the summit of one of the peaks in the Tyrolean Alps. Occasionally, the image is surrounded by a circular or elliptical halo of small diameter. The phenomenon was first observed at an ascension of French balloonists in 1850.

WORKERS WEAR TAIL LIGHTS

"Trouble shooters" employed by the Cleveland electric railway are being equipped with belts of red reflectors similar to those used at dangerous highway curves, to help prevent accidents. They can be seen at a considerable distance and will warn other employes that men are working on the lines.



For the Guidance of Airmen, This Sign Shows the Wind Direction and Points to Town

ROAD SIGN FOR AIR TRAVELERS SHOWS WIND DIRECTION

Development of aviation has brought a need for special signs to guard the aviator by day and night. One of the latest steps in this direction has been taken along a southern air-mail route, where a marker has been set up with a "sock" to show the direction of the wind, a large arrow painted with the name of the city or town to which it points and a smaller arrow that points due north. The sign thus gives the pilot three essential bits of information. It can be seen, when the weather is clear, from an altitude of 3,000 feet.

IDEA OF EXPLOSION ENGINE OLDER THAN STEAM

Gasoline and other motors that operate by the force of an explosion are of such comparatively recent development, that few persons realize the basic idea of such engines was conceived long before the appearance of the steam engine. In 1680, Huygens described an explosion motor which was to be operated by discharging a quantity of powder to drive the air out of a cylinder and raise a piston. To that

point, his engine relied on a force somewhat similar to the working principle of those today, but the useful work was to be done by the piston being forced down by the pressure of the atmosphere against it, thus lifting a weight or doing some other task. There is no record that this engine ever was operated. The steam engine of 1705 functioned on about the same plan, that is, steam was used to lift the weight of the piston, and after this was done, the atmospheric pressure was relied upon for the real work. After Huygens, almost 100 years passed before inventors caught the vision of rotary motion from their engines. His idea simply involved a piston and a cylinder. In other respects, there was no more similarity between his engine and those of today than there is between a steam hammer and a stone hatchet.

RADIO FOR TAXI'S PASSENGERS HELPS ATTRACT FARES

Radio music drowns the click of the meter and helps draw fares to a taxicab an eastern driver operates. He installed a set for his own amusement when not on the road. He soon found, however, that it proved popular with his customers and arranged it as a permanent feature of his cab. It occupies a convenient space at



© U. & U.

Radio Set, Installed beside Cab Driver, Attracts Attention of Public and Entertains Passengers

the driver's right where it does not interfere with the operation of the vehicle.



Old Castle at Nuremberg as It Appears under the Floodlights; in the Foreground Is an Illuminated Statue of Albrecht Durer, the City's Most Famous Son

MAGIC BEAUTY OF OLD CASTLE REVEALED BY LIGHTS

One of the prominent objects in Nuremberg on festive nights is the floodlighted castle that stands on a steep sandstone cliff near the center of the city. It can be seen from a great distance, towering high above the other buildings. This year, the city is celebrating the memory of Albrecht Durer, its most famous son, and special illumination has been provided for his statue which stands in an open plot below the castle.

SMOKE BOMBS ON SUBMARINES TO AID IN RESCUES

So that persons on sunken submarines may signal their location to boats on the surface, a system of smoke bombs has been developed by Swedish engineers. The bombs are placed in groups on the deck or the conning tower and are released by air pressure. When they burst at the sur-

face, they give off dense smoke and a flame that will stay lit for three minutes and is visible from a great distance. If the submarine is moving, the distance between the bombs will in a measure indicate to the rescuers how fast the craft is drifting and in what direction.

WASHING CABINET FOR AUTOIST CONTAINS FIRST-AID KIT

For the convenience of auto tourists, a cabinet tank and basin, to wash the hands and face, also has room for a first-aid packet. The tank contains just enough water for half a dozen washings, and the liquid is kept pure by a chemical treatment which is applied to it in the tank itself.





Suds Tank Dispenses Lather Directly without the Need of Working It Up during the Bath

SOAPSUDS FOUNTAIN FOR BATH LATEST TOILET AID

Press a button and soapsuds, salt water, scented water or other toilet preparations gush from a spout in a bath attachment a California inventor has introduced. As many containers as desired can be connected to the arrangement and they are installed in a convenient position for use while bathing.

PROPELLER RESEARCH AIMED TO IMPROVE FLYING

Two goals are being sought in the propeller experimental laboratory of the army at Wilbur Wright field, Dayton, Ohio, to make flying safer and better. One is a metal propeller, to be strong but lighter even than aluminum, and the other is a variable-pitch propeller, the pitch of which can be changed while in flight. Frank W. Caldwell, who developed the composition propeller known as "micarta," a pressed affair of fabric and glue, is in charge of the work. Present propellers are built with the most efficient pitch for the average speed at which they are to be flown,

but in landing and taking off, when the speed of the plane is below flying speed, the pitch is entirely too high. Inventors for years have wrestled with the problem of designing such a propeller.

RADIO KEEPS MILK FRESH FOR SEVERAL DAYS

Wireless waves have been adapted by a Vienna scientist to keep milk from spoiling. A special generator is fitted to a pasteurizing outfit, or two cylinders are employed, the milk being heated slightly in one and then subjected to the radio waves in the other. According to reports, milk so treated, is kept from turning sour for four days and for a period of two to three weeks if it is cooled.

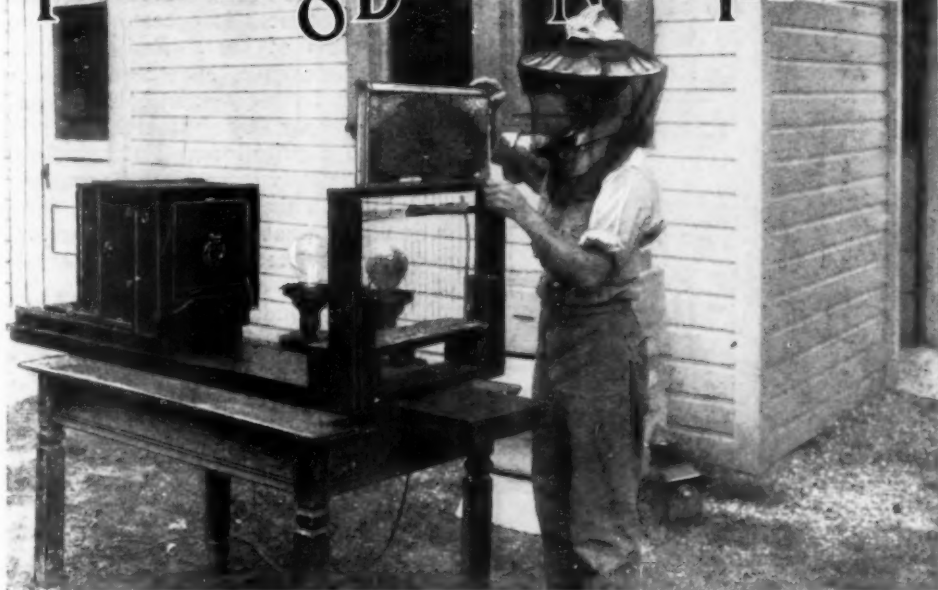
"CAT'S EYE" TRAFFIC LIGHTS GUIDE MOTORISTS

In addition to the regular safety zones for the protection of passengers boarding and leaving surface cars, "cat's eye" light signal towers have been introduced in Berlin. The units are simply reflectors that catch the glow from other sources and are mounted on vertical supports where they can be seen at a considerable distance. They are of particular service in warning motorists to detour around the safety areas.



"Cat's Eye" Lights on Safety Guards at Street-Car Loading Station Help Protect Passengers

Teaching Bees New Tricks



Ascertaining the Egg-Laying Ability of a Queen Bee by Photographing Her Brood Comb, and Then Counting the Sealed Egg Cells by Placing the Picture under a Magnifying Glass

By G. H. DACY

WHETHER to "bee" or not to "bee" is a puzzling question, of personal interest to millions of folks both in this country and abroad who would like to operate apiaries for profit and pleasure but are deterred because of the great amount of misinformation in circulation about honeybees.

Twenty-five years ago, your Uncle Sam established the world's largest bee-culture laboratory near Washington in order to solve mystifying secrets of apiculture and, as far as possible, to standardize commercial beekeeping. Bees win the blue ribbon as keepers of secrets. For some twenty centuries, scholars, scientists, philosophers and private experimenters have sought to unravel the baffling mysteries of the beehive and honeycomb, but how the bee makes honey remains an enigma.

The government search for authentic facts and figures about bees has hatched out into a conquest. Our national experts and various co-operative research agencies

have discovered more new facts about bees during the last decade than did the Egyptians, Greeks and Romans in several centuries. Comprehensive experiments have disclosed that bees have measurable capacity for learning and can be trained. Worker bees have been taught to distinguish between different colors. For example, a red light was placed near a food supply. The busy bees learned quickly to associate that color with food. No matter where the red light was placed, the bees would find it and fly to it whenever they were hungry. If the food was removed from the neighborhood of the red light to a position near a green light, the bees, instead of massing near the former, organized scouting parties and began explorations, seeking the disappeared food station. Having eventually found it near the green light, they soon learned to recognize that color as the dependable sign post that indicated food. This test was repeated time and again, until all the colors of the



spectrum had been used, and the bees never failed to find the wandering food, nor to identify it for future reference, by the colored light which marked its position.

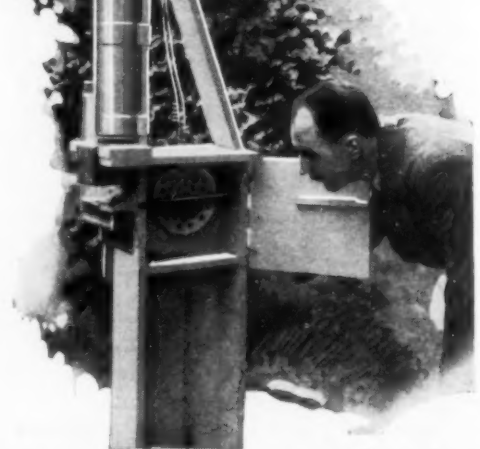
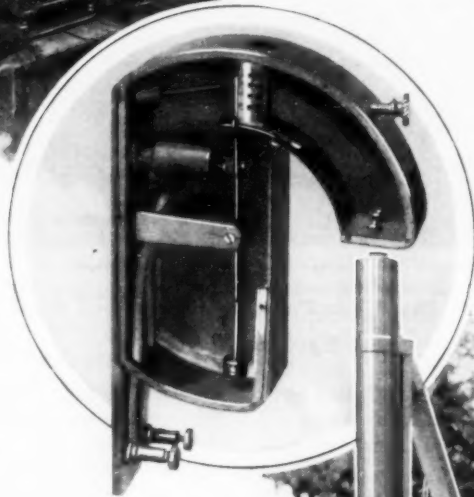
The average life of a worker bee, it has been found, is six weeks during the peak of the honey-making season. Four weeks of this period is devoted to nectar-gathering flights, while the balance is spent in the hive. Science, by producing more robust, vigorous worker bees that will live longer and spend only one additional week in the field, can eventually raise the American honey crop by about one-fourth. On the basis of last year's output, this would mean an increased cash return of over \$9,000,000.

The long-winded and better-flying bees of the future will facilitate the establishment of apiaries farther from satisfactory "pasturage." The general practice at present is to locate beehives not farther than two miles from an abundant and permanent source of flower nectar and

pollen. It may be that during the years to come this distance can safely be increased to four miles.

The selective breeding of bees will also make available nectar which under existing circumstances is accessible but to a limited class of bees. Red-clover blossoms, for example, have unusually deep corollas and their nectar content can be exploited only by bumblebees, whose tongues are quite long. Future selection will aid in vastly increasing the number of such bees. This will result in the conservation of valuable flower nectar which now "goes to seed," because ordinary bees cannot reach it.

Weather conditions vitally affect the honey-manufacturing activities of the beehive. Any beekeeper will inform you, for example, that, on warm and bright days, his bees are gentle, while during cold, cloudy weather the insects are irritable and more apt to sting

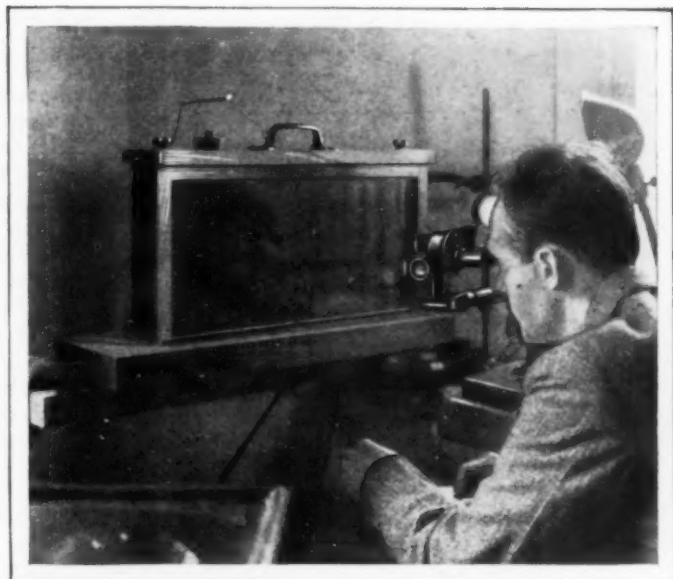


Studying the Effects of Weather on the Activities of Uncle Sam's Bees, and, Center, an Electric Flight Detector That Measures Their Trips

whoever comes near their hives. Selective breeding will facilitate the multiplication of workers endowed with remarkable resistance against weather hardships and disease. This also will be reflected in increased honey production. The winter losses in American apiaries throughout the snow and cold-weather belts range from \$8,000,000 to \$10,000,000 a year. Various bee diseases collect an additional annual tribute amounting to at least \$1,000,000. Such monetary losses can be curtailed by breeding better bees. And this is exactly what science purposes to do.

Special glass-faced hives which can be illuminated at night and are equipped with microscopes, so that the experts can keep tab on the events which occur in the honeycomb, have assisted markedly in untwisting the tangled skein of normal beehive history. The observation hive, originated by a Vermont banker who kept bees as a hobby, has been improved by the government. It is the dependable motion-picture show of honeycomb enterprises and beehive life cycles. Small wonder that national experts have sat by night and day with eyes glued to these microscopes. They have actually seen and interpreted the "daily doings" of these industrious insects.

You can watch the queen depositing the equivalent of her weight daily in eggs; eggs that are minute, elongated and no larger than two or three fine needle points. Three days after the egg is laid, the white, blind, footless larva emerges. During the next six days this larva performs a record feat in rapid growing. It increases 1,500 times in weight. If the average six-pound baby of the human family made corresponding growth, it would weigh four and one-half tons when one week old. Exactly twenty-one days after the egg is deposited, the adult bee is ready to emerge and assume the duties of a nurse bee.



Science Solves the Beehive Secrets by Watching the Busy Workers Day and Night in a Special Glass-Faced Hive

You can even study the superior system of business management which dominates the beehive. Sanitary engineers maintain the honeycomb in cleanly, healthy condition. You can easily visualize bee policemen directing traffic throughout the congested chambers, cells and paths of this large insect tenement. Bees that become crippled or die are disposed of forthwith. The buzz of the beehive is an anthem of industry and not a signal of warning. To certain bees is delegated the task of ventilating the hive during warm weather and of heating it during the season of cold. They flap their wings in unison, simulating fans. To generate heat, they consume large quantities of honey—a ranking energy food—and indulge in bodily contortions. Bees have quickly increased the temperature in the hive from fifty-seven to as high as ninety-five degrees Fahrenheit. During the most severe winter weather, the bee-firemen maintain an almost constant temperature inside of the hive.

German scientists claim that bees chat with one another by means of a vibratory dance. Their American cousins at the federal bee-culture laboratory have never verified this pretty theory. Uncle Sam's experts, however, have observed these dances which are reputed to facilitate bee



communication. There is this to be said, though, that constant activity is in progress in the honeycomb. Bees literally work themselves to death. The worker, at birth, is charged with a certain amount of energy. Each day of its life as an adult it becomes weaker. Bees rest occasionally, but these pauses in their labor are not productive of rebuilt tissue and restored energy. The worker bee resembles an electric battery. It starts out charged to capacity. Day by day, it runs down and finally dies when it has exhausted the original charge.

By placing a hive of bees on an island five miles from a source of flower nectar, it has been demonstrated conclusively that the workers will fly that far in quest of food. In the mountainous states of the west, apiculturists report that honeybees have flown as far as seven miles in search of raw materials for honey. The average worker bee weighs eighty milligrams and is able to carry a burden in flight equal to one-half its weight. It carries nectar and

water in a sack, while pellets of pollen are stored in stiff bristle baskets located on the hindlegs.

In the basement of the government laboratory, a colony of bees—during the summer flower season it contains from 80,000 to 100,000 worker bees—rests on a delicately adjusted balance which is connected with a continuous chart recorder and weighs the daily production of the hustling honeybees. It records exactly the time in the morning when they leave the hive, the frequency of return trips, discriminates between good and bad days for honey making and indicates correctly the approach of a storm. Bees are excellent weather prophets and usually mass

back to the hive several hours before the rain or windstorm breaks.

This device has proved that bees do not observe regular hours, but, on bright warm days, leave the hive as early as 4:00 a. m. and continue their nectar flights until seven or eight in the evening. The



More Weather Observations, Top; the Electric Penman, Center, and a Recorder That Charts the Comings and Goings of the Bees

various workers make from four to thirty flights each day, the water carriers bringing back more loads and making more frequent trips than do the nectar gatherers. Under ideal conditions, as much as twenty pounds of honey have been made in this experimental hive in twenty-four hours.

Another interesting apparatus now in use at Uncle Sam's scientific apiary is a technical simulation of a flower which contains a constant supply of nectar. The device accommodates ten bees at a time and is located outdoors near the sixty colonies, comprising a maximum population of 6,000,000 Italian honeybees. An electrical contact device is hooked up with a float in the dish of bee food and records on a chart the amount removed, the number of times the bees visit the feeder and the effects of varying weather conditions on these flights.

An efficient method of grading honey by color and flavor has been developed by the Washington specialists. An instrument originated by a physicist at Johns Hopkins university, which transmits various wavelengths of light through the honey samples, makes honey grading a rapid and simple process. Honey is now inspected and graded like wheat, potatoes, tobacco, cotton and apples.

Despite popular opinion to the contrary, worker bees do not recognize their owner and he is no more immune from stings by his own bees than the ordinary stranger.

"If a honeybee stings you," advises your Uncle Sam, "don't run for help but stand still and scratch. The bee that stings you injects its stinger, the poison sac and surrounding muscular tissue into the wound. It's your job to scratch this foreign material as speedily as possible from the wound with your fingernails. Dig it out at once and the wound will not swell while the pain will soon cease. The government experts have never discovered any remedy for bee stings. The wounds are so small that it is impossible to introduce any solution in sufficient quantity into the tiny puncture to accomplish any good."



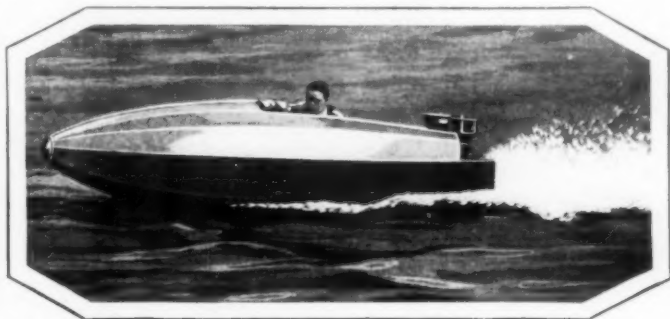
Wheel for Rapid Assembly of Shoes; It Makes 600 Pairs in Eight Hours

WHEEL TO ASSEMBLE SHOES SPEEDS PRODUCTION

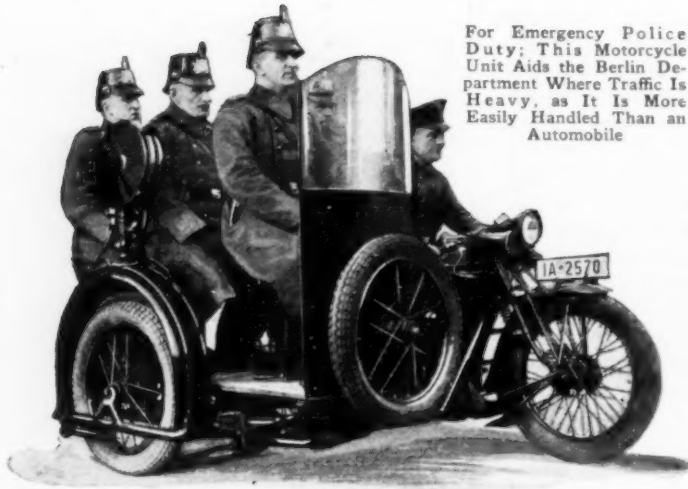
Six hundred pairs of shoes can be made in eight hours with an assembling-wheel apparatus introduced in France, according to reports. Separate parts of the shoes are placed on holders about the circumference of the wheel and the stitching and other processes quickly accomplished.

OUTBOARD HULL LIKE PLANE GIVES HIGH SPEED

Increased speed in outboard-motor boats has been attained in a craft with a body somewhat like the streamlined fuselage of an airplane. Features of the flying boat have also been applied to the craft to decrease bottom friction.



Outboard Boat with Hull like Fuselage of Plane, to Decrease Wind Resistance and Water Friction



For Emergency Police Duty: This Motorcycle Unit Aids the Berlin Department Where Traffic Is Heavy, as It Is More Easily Handled Than an Automobile

MOTOR TRICYCLE FOR POLICE CARRIES FIVE MEN

Successful experiments have been conducted in Berlin with a motor tricycle that carries four policemen and a chauffeur. It is speedy, easy to handle in heavy traffic and strongly constructed for the sometimes rough service it has to perform.

RADIO-ECHOES SECRET SOUGHT HIGH ABOVE EARTH

One of radio's most perplexing mysteries, the strange "echoes" that sometimes cause serious confusion in receiving messages, is being investigated by scientists at the university of Chicago. A photographic film that moves five feet a second on a revolving drum, registers a series of multiple, diminishing "echoes" coming in at an interval too short for a complete journey around the world and too long for reflection from the peculiar strata of electrons that lie from seventy-five to 150 miles

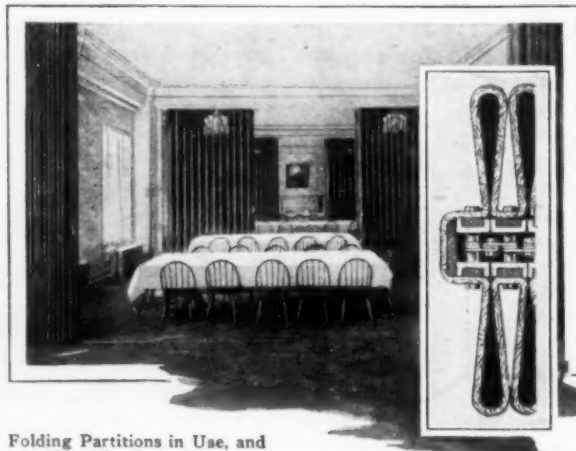
outside the earth, the Kennelly-Heaviside layer. The vagrant waves being photographed apparently take an excursion several thousand miles more than the direct path from the transmitter to the receiver, in the opinion of Dr. J. Barton Hoag, one of the investigators, who is endeavoring to record and classify the signals in hope of co-ordinating them with definite phenomena on and above the surface of the earth.

He believes that some of the waves may circle the north pole and return. During a mimic game of warfare recently, a radio operator received the code "4," meaning to open the port of New York. The sender had relayed the message "V," meaning to close the port. The odd mistake had been caused by an echo. The receiving operator had caught a dot making the sign "4." In reality, it was not a dot but the echo of a dash of the signal "V." It had passed around the world but its echo had been received first.

FOLDING PARTITION LIKE DRAPE SUBSTITUTE FOR DOORS

Wall partitions that fold up when pushed back, and that may be covered with tapestry or other

materials to match the scheme of decoration, have recently been introduced. They are constructed with a steel framework, do not sag or get out of order and, if desired, may be made fireproof. Another feature is that they absorb sound.



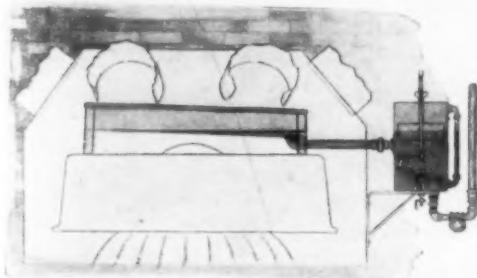
Folding Partitions in Use, and Cross Section of One

CALL LETTERS FOR AIRCRAFT AID RADIO CONTACT

To simplify radio communication to and from airplanes, the craft are assigned specified call letters so that the identification of a particular plane is positive and operators are spared time in sending and receiving messages. The purpose of the plan is essentially the same as the system of designating broadcasting stations by a series of letters. As worked out by the international bureau, at Berne, airplanes will have five letters in their calls. The first will signify the nationality and the other four will be the registration mark of the plane.

AIR MOISTENER FOR FURNACES PROMOTES HEALTH

To insure proper humidity in the home, a moistening outfit easily installed in the hot-air furnace is said to greatly promote health and comfort and to save fuel. Its essential feature is that, as the water is evaporated, a fresh supply is constantly



Drawing of the Moistening Outfit Installed in Hot-Air Furnace; Note Supply Chamber at Right

introduced from the house system through an automatically regulated valve that keeps the vaporizing pan filled to the desired point at all times. This eliminates the need of refilling the pan by hand.

PLANT THAT RESISTS FIRE TO HELP GUARD FORESTS

Further protection of forests from fires is seen in a plant imported from South Africa which is fire-resistant. It is composed largely of water yet is said to grow abundantly in arid regions and is good for cattle feed. It will especially help prevent brush fires, forest experts believe.



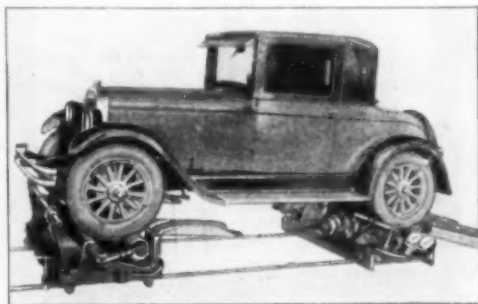
Inhaling Vapor to Relieve Air Sickness, through Apparatus Designed to Be Carried on Airplanes

AIR SICKNESS IS PREVENTED BY PUNGENT VAPOR

For the aid of persons who may become airsick while on flying journeys, an inhaling apparatus has been introduced. The subject breathes a pungent vapor through a mouth and nose piece, the gas being released in any quantity desired from a tank container. According to reports, the substance fortifies the system against nausea.

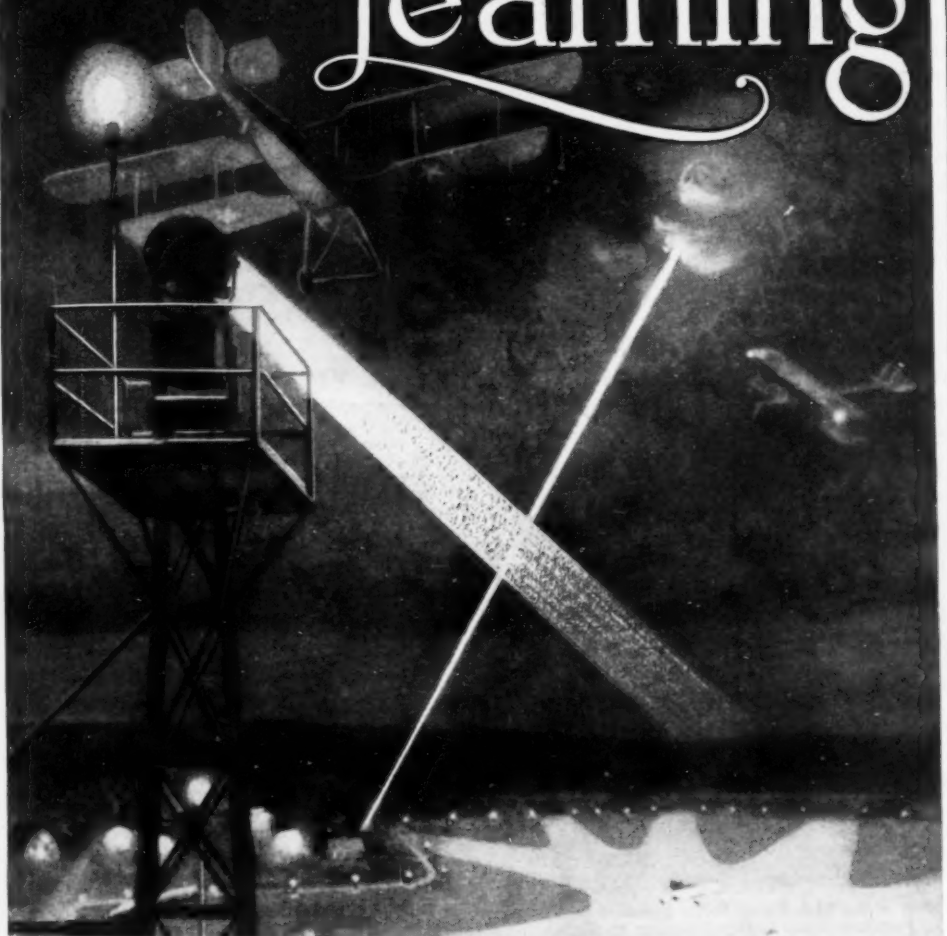
FOUR-WHEEL BRAKE TESTER AIDS SAFE DRIVING

The braking power on each auto wheel and on all four at once is quickly and accurately indicated on a testing outfit that takes into consideration the weight of the car. It provides an effective means for equalizing right and left wheels and balancing front with rear.



Testing Stand for Four-Wheel Brakes

Learning



An Airport by Night; in Front Is the Main Beacon Tower, with the Searchlight That Guides Flyers to the Field; behind It, Rising from the Hangar Roof, Is the Wind Cone, Illuminated by a Cluster of Lights; the Runways Are Illuminated by Powerful Floodlights, So Arranged That Their Rays Are Spread across the Ground, Rising Only a Few Feet in the Air; the Border of the Field Is Marked at Regular Intervals with Small Lights. While, in the Background, a Thin Pencil Beam, the Ceiling Light, Is Thrown on the Clouds to Show Just How High Visibility Extends; the Lights Shown Are the Standard Equipment Recommended for a First-Class Airport by the Aeronautical Branch of the Department of Commerce



Courtesy Aviation Service

The Link between Instructor and Student Is a Voice Tube, Terminating in a Receiver Worn beneath the Helmet; after the First Flight the Student Moves to the Rear Cockpit

By J. EARLE MILLER

(Concluded from September Issue)

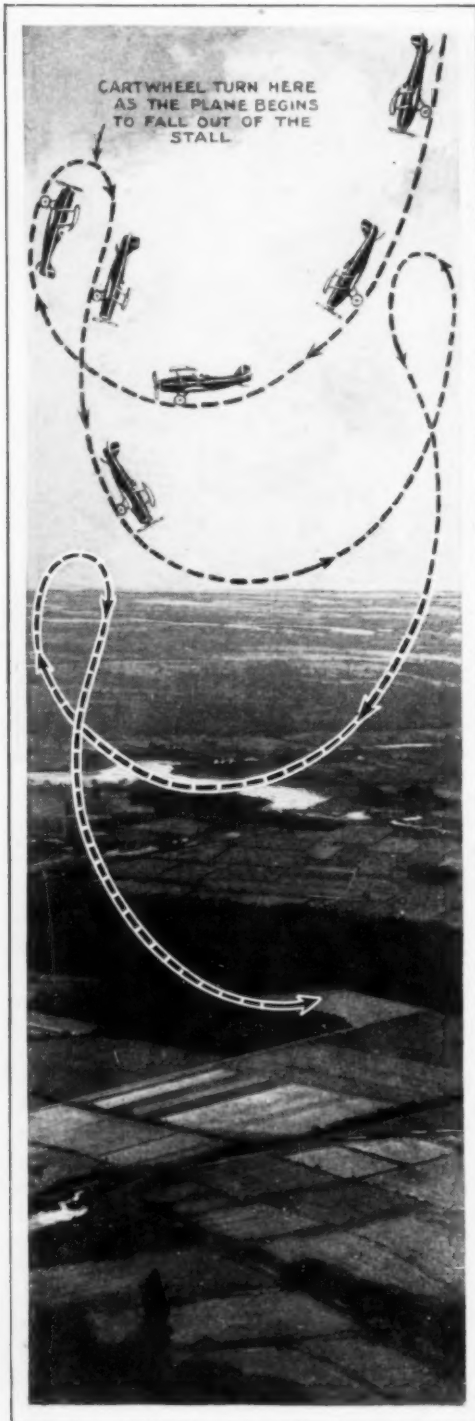
"WE WILL practice landings again today," says the instructor as the student straps himself into the rear cockpit; there is nothing new in the announcement. Taxi out to the end of the runway, turn the plane until it heads into the wind, open the throttle until the engine speeds up to 1,400 a minute, shove the stick all the way forward and keep it there until flying speed is reached and the pressure begins to lessen, then let it come slowly and smoothly back as the plane leaves the ground, point the nose up a few degrees for a slow, steady climb, and fly straight into the wind until you get enough altitude to make a bank safe.

You turn then and fly across the wind, keeping well out from the border line of the field, turn again and go down the side with the wind, turn and cross the other end until you are opposite the end of the runway from which you took off, keeping 1,500 feet from the end, as the field rules

require. A final turn, point straight for the runway, "cut the gun" until the engine idles down to three or four hundred revolutions, immediately drop the nose to keep flying speed, and glide in in a long, gentle descent. Keep your wings carefully leveled up, shift the rudder, if necessary, to keep the runway flowing smoothly toward you, pull up the nose a bit as you near the ground to level out and lose more flying speed, then, as the ship settles to the ground, ease the stick back farther and set the tail down just as the wheels touch.

That's landing practice, to be done over and over again. If you came in smartly, you set her down near the end of the runway and can at once open the throttle and take off, "drag" the field and repeat.

Two or three rounds, and the instructor, instead of signaling for the final bank around to land, motions to keep straight ahead out across country. You leave the scattered houses behind and are over the



The "Split Ess" Is a Quick Way of Losing Altitude Gracefully: the Ship, with Power Off, Dives, Rises to a Stall, Does a Wing-Over and Dives Again

open farmland. Straight flying has become a habit, something to be done automatically. You remember your lessons, look first over the right side, then across and over the left, watching the fields beneath. Each time your eyes sweep across the instrument board you check the instruments, make sure the thermometer shows normal temperature, the pressure gauge the proper oil circulation, and the tachometer indicates that the engine is delivering the accustomed number of revolutions.

Occasionally a pointed hand to left or right signals for a turn, until you lose track of place and direction. Suddenly the even roar of the engine dies to a soft purr, and you instinctively nose down to keep flying speed—your first lesson in forced landings.

Ahead is a large level meadow, big enough to fly a brick house into. It looks easy, and your gliding angle is just right to clear the near fence. Everything is rosy until the instructor opens his throttle again and wildly waves both hands. Something is wrong, but what? He points off to the side, but you see nothing interesting over there. He continues to point, and you obligingly bank around to go over and see what all the excitement is about.

Immediately the throttle is jerked back, you nose down, and again the engine picks up its roar and you start to climb. Suddenly a distant smokestack, the black plume from a train or one of the many other wind gauges gives the clue. Teacher has caught the student napping with a forced landing and a tail wind. You should have circled into the wind and then picked out a field to land on, instead of trying to drop into the first one ahead. Another lesson has been learned: always to remember where the wind is, and be prepared to turn instantly into it in an emergency. A plane always lands and takes off into the wind, if there is time to pick a field and the size and shape of the ground permit it.

The lesson goes on, and at every turn you mentally recheck the wind, verifying your memory by watching for smoke, the rustle of the grass below, the movement of the trees, or even a washing flapping on a backyard clothesline.

That lesson out of the way, another fol-

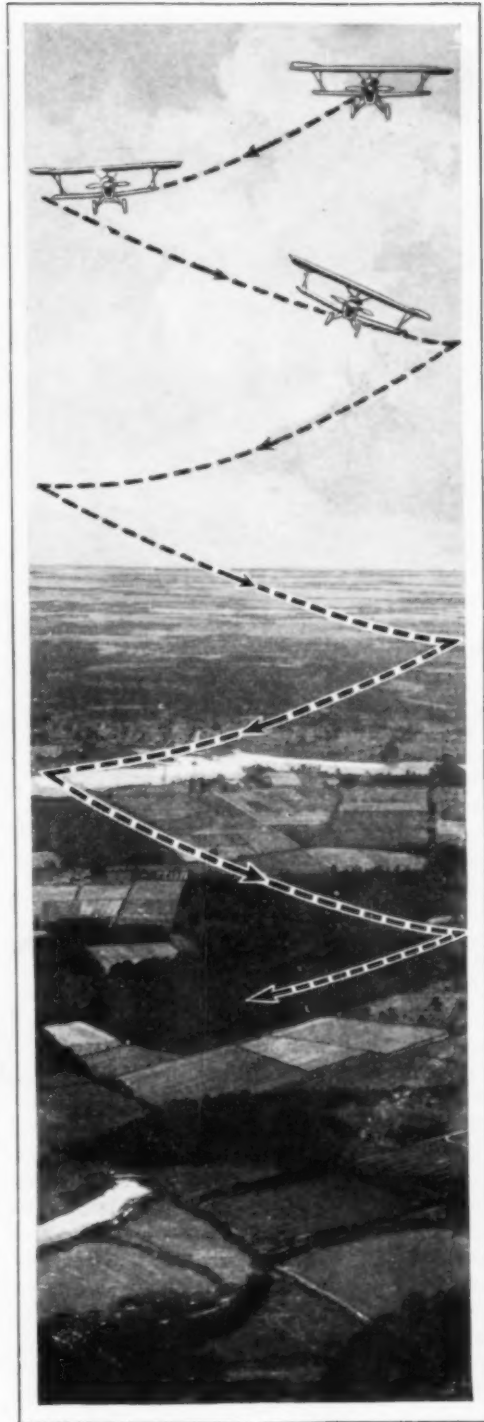
lows in short order. The signal comes for a bank, and another to come out of it. All the indications are that the ship is being lined up on some object ahead. You check the wind, and find it dead ahead. The throttle comes back, you shove the stick a bit forward and begin to nose down. The best field is quite a bit ahead, just right to reach with a long, slow glide. At that angle, the engine cowling hides the view, but a glance over the side places the fence around the field, so you know you can make it easily. The fence glides beneath, you nose down to lose more altitude—and directly in your path is a tree!

Teacher has carefully lined you up on an obstacle which calls for quick thinking and quick acting, and you learn lesson number two of the day.

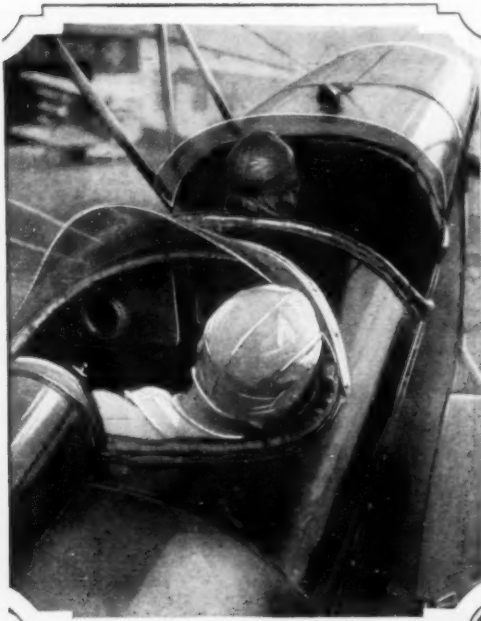
That's the way flying instruction goes. Very little is said on the ground before you start, and if you are flying by signals, nothing is said in the air. After each twenty-minute hop, you taxi in to the line and get a critical review of the day's mistakes. As training progresses, you may get in two or three hops in a day, if you have the time and other students are not waiting their turns, or you may take forty minutes in one hop to get more landings in one day.

Figuring eight hours dual instruction for the average student, three twenty-minute lessons to the hour, and allowing for bad weather, a flying course may stretch out for a month or more. Students have been soloed in one day, as a stunt, but instructors don't recommend trying to hurry things. Twenty minutes a day or forty later on, and then twenty-four hours to think it over, and digest what has been learned, is best, they say. Planes can fly in most any kind of weather, but students can't be taught landings on a windy, gusty day. It takes a trained pilot to keep his wings level in bumpy weather, and the slightest drop of a wing tip when landing at thirty-five or forty miles an hour may be serious for the ship, and probably for the passengers, too.

Army experience has shown that three twenty-minute hops, on successive days, are nineteen times as valuable as one flight of one hour's duration. Flying muscles have to be broken in to the work of con-



Most Graceful but About the Most Difficult of All Acrobatics Is the Falling Leaf, the Plane, Stalled in Level Flight, Sideslipping Back and Forth



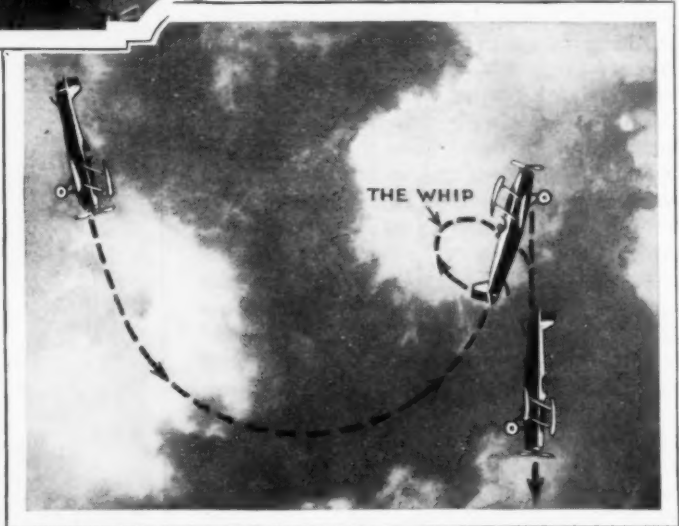
Taking Off in a "Swallow" Training Plane, and, at Right, the Whip Stall, in Which the Plane for an Instant Moves Backward before Whipping Around to Fall in a Nose Dive

trolling a ship. After twenty minutes they begin to tire, and the student loses the "feel" of the ship as well as his mental alertness. It is better to come down then, for continued flight is more or less wasted. The better schools will not allow more than twenty minutes to a hop, and require at least three hours on the ground between these flights.

Before the day comes for the solo flight, most of the schools give one lesson in "aerobatics," teaching how to get into and out of the dreaded tail spin. Strangely enough, the dangerous tail spin is one of the easiest of all flying stunts, and is usually the way out of all uncontrolled maneuvers, but is so easily stopped that, given sufficient altitude, there is never cause for alarm. The reason so many flyers have been killed by tail spins is that their spins occurred so close to the ground

there wasn't time to recover level flight and avoid a crash.

A spin usually starts when the plane loses flying speed, though some of the modern ships will stall, then nose down and pick up flying speed without spinning. The easiest way to deliberately spin a ship is to nose it up into a stall and give left or right rudder with corresponding stick. If the spin occurs while flying under power, you immediately close the throttle—"cut the gun" is the flyer's term—and come out of the spin by using opposite control. That is, if you got into the spin by pulling the stick back to lift the nose, then to the left rear corner, at the same time applying left rudder, you come out by shoving the stick forward to the right, applying corresponding right rudder. As soon as the ship gets out of the spin, you nose down to pick up flying speed and



open the throttle. There is no hurry and no excitement about the stunt, given sufficient altitude to perform it safely. If you are using the voice tube, the instructor's voice, calm and collected, settles any feeling of panic.

You learn another thing about aerobatics—that there is one position in flying when your ailerons become reversed, just as your ailerons work in reverse order when taxiing on the ground. That is in a vertical bank, and in all the acrobatics in which the plane passes through such a

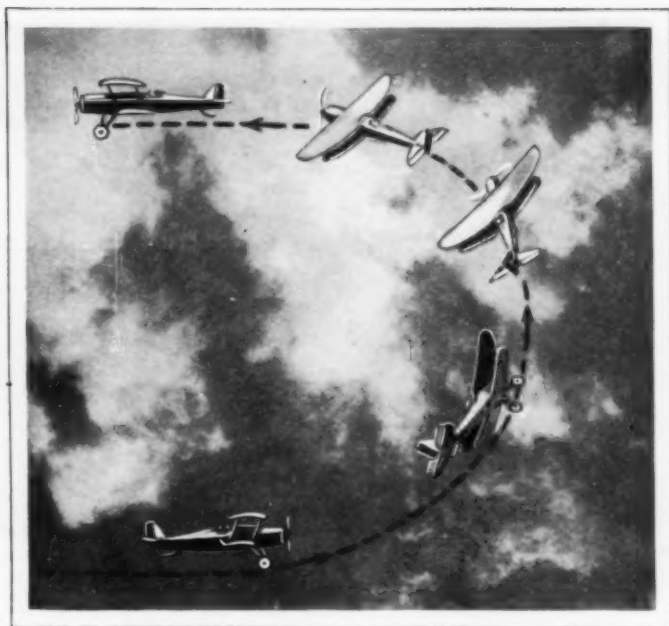
bank. In normal flight, the fore-and-aft movement of the stick turns the tail flippers, or elevators, up and down, to dive or climb the ship, and the rudder bar moves the rudder side to side, to turn to left or right. But when the plane is in a vertical bank, with one wing pointing straight down to the earth, the normally vertical rudder is in a horizontal position and acts as an elevator, so that the rudder bar climbs or dives the ship, and the usual horizontal elevators are in the vertical position, so they act as a rudder.

Outside of an emergency turn to miss another plane, the commercial flyer has no occasion

to make turns so tight as to require a vertical bank. In acrobatics, every half roll and roll and Immelmann turn includes a moment when the ship is banked into that position, but they, with the falling leaf and similar stunts, are left for more advanced instruction. The average training plane can do all but two of the aerobatic stunts. Those two are the Immelmann turn and the outside loop, which has been performed by less than half a dozen aviators. The training ships, usually fitted with an OX-5 motor, haven't the power to do the half roll at the top of an Immelmann turn. This particular stunt, the invention of the famous German war-time ace, starts like a loop, but at the top of the loop the plane is rolled over until it is right side up but facing in the opposite direction. To get up enough speed to do the roll at the top of a loop, a low-powered ship would have to be dived from a great height, and might not hold together under the strain.

It is possible, though, to do a cheat on the Immelmann, a tight, fast climbing turn, called a "chandelle," which, from the ground, would fool anyone but an expert.

All the while that air tricks are being learned, the landing practice continues.

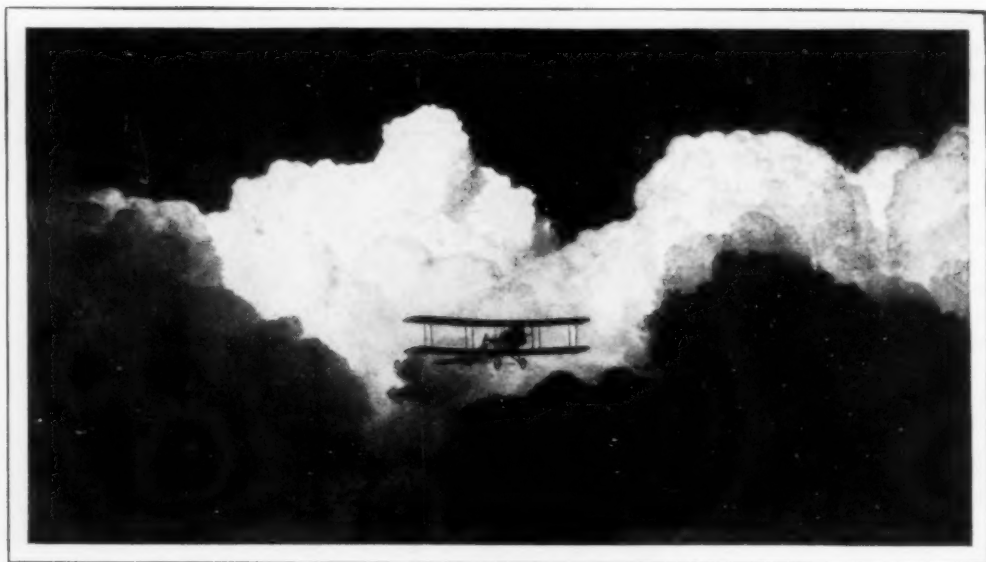


The Chandelle, a Cheat on an Immelmann Turn, Is a Tight, Fast Climbing Turn for Planes That Can't Roll at the Top of a Loop

A landing is easy to describe, but only constant repetition can make it perfect. You soon learn that a plane has but one landing speed—that at which the movement through the air ceases to be fast enough for the air to support its weight. It can't, therefore, land slower than that, and if you try to land faster, by forcing the nose down until the wheels touch, the result is a "two-point" landing, and as soon as you drop the tail, the wheels will bounce off the ground.

The trick is to learn to gauge height and distance so perfectly that you can cut the gun, glide into the field just above flying speed, level out a few feet above the runway and then hold the stick neutral, with the tail up and the ship in flying position, until you lose the forward speed and the craft begins to settle to the ground of its own volition. At that moment the stick is pulled back and the tail dropped until skid and wheels touch simultaneously in a perfect three-point landing.

The average student takes eight to ten hours before he is ready to solo—about three hours on straight air work and the rest on landings and air work combined. When the final check pilot takes him around without advice or assistance, sees



When Higher Clouds Throw Their Shadows across Those Below, Weird Pictures Are Painted in the Sky by Sunlight and Dark, and through Them the Aviator Wings His Way

him make a perfect landing, and authorizes the solo flight, the trick has been so well learned that it has no terrors.

Most schools include an hour's solo flying in their course—three twenty-minute hops, which give opportunity to make a dozen or so landings alone. To take the training course, since the department of commerce regulations went into effect, a candidate for flying is issued a student's license, following a physical examination by an authorized physician. The student license covers the training period and the first ten hours of solo flying. He is then eligible for a private pilot's license. To get a limited commercial or industrial license, to carry passengers or goods in designated areas, takes fifty hours, and a full transport license; to fly any kind of plane anywhere with any load, requires 200 hours, plus a rigorous examination.

A course of instruction, ground school, flying training and fifty hours' solo in a ship owned by the school, costs, on an average, between \$900 and \$1,000, though the rates vary somewhat in different parts of the country. A school course and flying instruction, including one hour solo, averages from \$350 to \$450 or \$500.

Some students cut their expense somewhat by forming a club of twenty or more solo graduates, putting in about \$150 each and buying a plane. They then pro-rate

the cost of repairs and upkeep, and each pays for his gas and oil. The latter, in the average training ship, costs from \$2.50 to \$3 an hour. Some schools operate graduates' clubs in which title to the club ship remains in the school, and in exchange a licensed instructor is furnished to supervise the club flights, make inspections and check flights of the plane each day, and certify the members' logbooks.

Altogether it is a great game, not too difficult to learn, not especially dangerous, and far more interesting than driving an automobile or a fast motorboat.

CASE FOR AUTO KEYS PREVENTS RATTLING AND LOSS



Four keys are securely and conveniently held in a small leather case that prevents them from rattling against the auto dashboard and also protects the pocket. The case insures against loss and is so adjusted that any one key is easily selected for use.

ICE KING'S TOMB FOUND ON ALEUTIAN PEAK

The tomb of an ice king, who lived thousands of years ago, in what is known as the Stone Age, has been found in the Aleutian islands, off the Alaskan coast, by the Stoll-McCracken expedition of the American Museum of Natural History. The expedition went to the islands to seek mummies older than those of Egypt, as a link with the civilization that may have crossed the ancient land bridge of Bering strait, by which the animals of what is now the Gobi desert came to America. On the summit of an almost inaccessible island they found a double tomb, in one compartment the mummy of a person apparently of high rank, and in the other the bodies of two adults and a child. All four were perfectly preserved, with their clothes, weapons and other belongings. The ice king wore a tanned otter-skin coat over a shirt of bird skins, and was wrapped in a shroud of animal skins, which in turn was inclosed in a layer of sea-lion intestine. It is possible the bodies may prove to be Stone Age Eskimos, or, perhaps, early Indians of a still remoter time.

AUTO BED CONCEALED IN TOP SIMPLIFIES TOURING

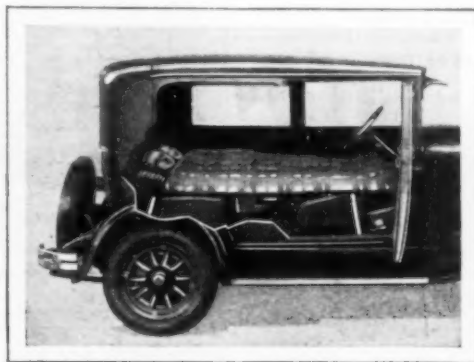
When not in use, a full-length bed inside the automobile is concealed under the top. It is quickly lowered and the upholstery of the top interior is unhooked to form covers for the sides. Further privacy is afforded by a special curtain around the front of the car over the windshield. The arrangement is practical for tourists and for doctors who use their cars as ambulances.



Auto Harnessed as a Hoist; Lowering of the Bucket without Reversal Is Done with the Lever Control

HOIST RUN BY TRUCK OR CAR LATEST BUILDING AID

Easily installed on the motor truck or car, a hoisting outfit has been introduced to serve builders of all kinds. It can be adjusted in a few minutes, is detachable and interchangeable and is controlled by a single lever. It is quickly connected to a rear wheel, which is jacked up and is always turned in a forward direction, no reversing of the transmission and racing of the motor being necessary to lower the bucket.



Auto Bed Lowered for Use; in Daytime It Is Raised and Concealed in the Top

Popular Mechanics Magazine does not publish the name of the maker or seller of any device described in its pages, but this information is kept on file and may be obtained, free, by addressing Bureau of Information.



Testing a Policeman's Walk on the Special Treadmill Which Helps Reveal Defects

TREADMILL TEST FOR POLICE REVEALS WALKING FAULTS

Correct walking is important to all, but especially to policemen who are on their feet most of the time they are on duty. To emphasize this fact, a foot specialist recently tested the policemen of Providence, R. I., in a special treadmill, which enabled him to illustrate various points as the subject "performed" and revealed faults in his carriage, the manner of placing his feet and other details.

HELIUM USED IN RADIO TUBES ALSO FOR DRYING

Once considered a rare element, and extremely costly to produce, helium is now available in commercial quantities and is being utilized for many purposes, besides inflating balloons and dirigibles. It is especially serviceable in the preparation of a synthetic atmosphere for deep-sea divers and caisson workers, where abnormally high pressures often cause "the bends" or caisson sickness. This painful and sometimes fatal ailment is believed to be due to the release of nitrogen previously dissolved in the blood. The advantage of helium, which is mixed with oxygen, is that

it is not only more inert than nitrogen, but has the lowest solubility in water of any gas known. Its use therefore increases the limits of the pressure at which work can be performed and also lessens the time of compression and decompression of the operator. Helium is gaining favor in annealing and other metal operations as it is practically insoluble in molten metals. It is being used for filling radio tubes, and glow lamps and tubes for signs, and as a cooling medium in electric transformers and high-speed generators. Because it is chemically inert, has high heat conductivity and low density, and can therefore be circulated rapidly, it is particularly suitable for drying organic and inorganic chemicals quickly. It is also used in toilet preparations.

PLANTS TREATED WITH RADIUM TO SPEED GROWTH

By coating flowerpots, vases and other containers with a substance that gives off radium emanations, a way has been found to stimulate the growth of plants and flowers. Used on stakes and other articles placed in the ground, it also helps trees and field crops. As the emanation is given off, it explodes and produces a gas which is beneficial to the plant. The ma-



Results of Growth in Three Plant Specimens of the Same Kind, to Show Benefits of Radium Treatment

terial lasts for many years, so that its effects are not diminished and the action continues, night and day and at all seasons.



Teaching Four Music Pupils at One Time with Lights and Special Keyboard

LIGHTS AID IN PIANO LESSONS ON MULTIPLE KEYBOARD

Several children can be taught at once on a multiple-keyboard arrangement for instruction in piano playing. As the teacher depresses a key, a small light appears above a corresponding key on the pupil's board. After a few minutes of practice with the lights, a trial is given without them from memory. The method is said to have been successful in helping the beginner to become familiar with the piano and to master both the white and black keys. The child is also amused by the lights and much of the drudgery of the lessons is eliminated.

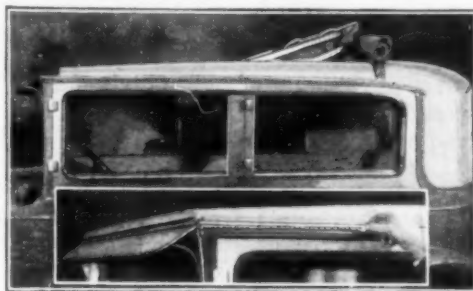
GAS IS BOILED OUT OF METAL IN ELECTRIC FURNACE

Scrap metal is made to produce volumes of power gas by treating it in a high-frequency, induction vacuum furnace. An old automobile piston gave up thirty-three times its own volume in fuel gas. Two cubic feet of cast iron furnished vapor with energy equivalent to about ten horsepower for a duration of some twelve minutes. The gas burned with a clear flame and had a heating value equal to three-fourths that of illuminating gas. After the vapor has been removed, the metal is more satisfactory for making magnets than ordinary iron, has a brilliant

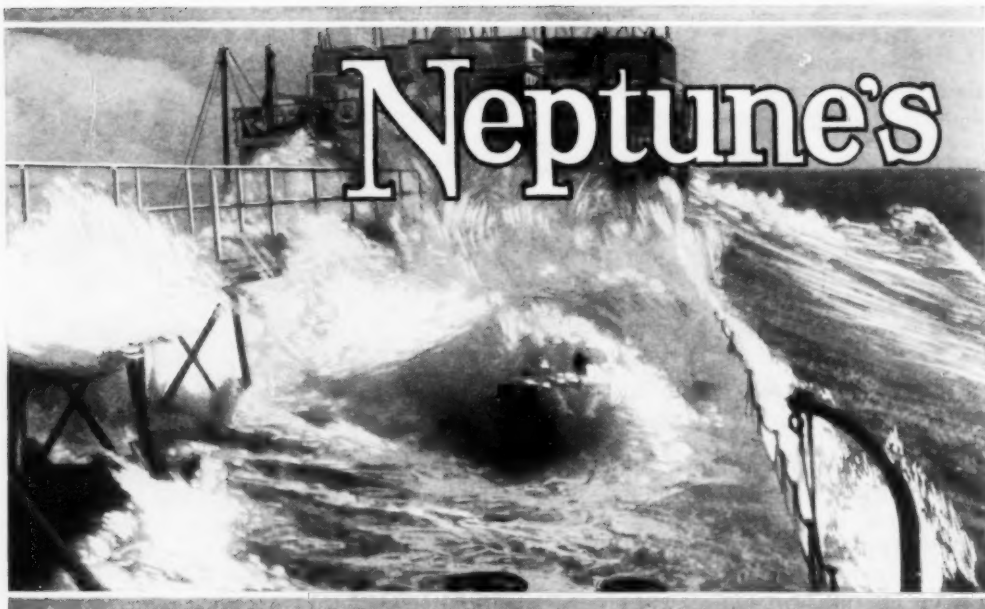
sheen and holds its luster for several months. The treating furnace is an odd contrivance for, though it melts the hardest metals quickly and would distil them like so much water were they left in long enough, it will not scorch a paper or burn the hand. The walls are of glass and the melting pot is a crucible surrounded by a coil of tubing. Electricity is directed into the tubing where it reverses itself 30,000 times a second, inducing a sympathetic current into the metal that has been placed in the crucible. Impurities evaporate and are pumped through suction tubes into containers for analysis.

AUTO TOP ROOF ROLLS BACK AT PULL OF TAB

To admit light and air into the closed car, a style of body now on the market is equipped with a roll-back roof. It is held in place by interlocking links like those on traveling bags, overshoes, and other articles. To release the roof, a tab is simply pulled along and the top is fastened by pulling the tab back. This makes the change from an open to a closed body an extremely simple and easy operation.



Top of Car Rolled Back, and Side View to Show the Interlocking System of Fastening



The American Steamer "Trimountain" with All Her Well Deck under Water as a Giant Atlantic Wave Rolls Over; the Battering of Tons of Water Can Do Immense Damage

By CALVIN FRAZER

LAST spring the "Leviathan," the world's largest ship, arrived at New York with her forecastle superstructure badly damaged as the result of an encounter with a huge wave. Her foredeck, sixty feet above the water, was stove in; seven steel stanchions supporting it were twisted; four large lifeboats were smashed to splinters; crew and third-class accommodations were flooded, and a searchlight on the foremast, eighty-five feet above the sea, was broken by solid water.

Many similar cases are recorded in the newspapers every year, and a great many more reported to the hydrographic office and the weather bureau. Some are much more disastrous in their effects. Just a few years ago, the Red Star liner "Arabic" came into port with seventy-five passengers on the injured list. They had been knocked about by an enormous wave which battered the ship from stem to stern and which, according to one account, was 100 feet high.

The steamship "Rheinland," Captain Randle, was nearly sunk by a "solitary" wave some years ago while crossing the Atlantic. Her commander, from his elevated position on the bridge, observed a

gigantic wave coming toward the steamer at high speed; took precautions to insure a maximum of safety, and leaped from the bridge to a more lofty position. Soon the sea so completely submerged the vessel that Captain Randle, from his coign of vantage, could distinguish only her foremast and funnel. Her whole hull was buried for a time. One man was washed overboard; the second mate, the carpenter and several members of the watch suffered from broken limbs; every boat disappeared, and the engine room was almost full of water.

There has been a great deal of discussion about the extreme height attained by waves. The usual method of measuring their height from a ship is for the observer to climb the rigging or otherwise place himself at such an elevation that, as the wave advances, his eye will be just on a level with its crest and the horizon when the ship is in the hollow. The height of the eye above the ship's water line is then taken as the height of the wave. This method is subject to some errors, especially those due to variations in the altitude of the point of observation on account of pitching and rolling. In a few

Battering Rams



When the Sea Turns to Mountains; a Striking Photograph from the British Warship "Snapdragon" in the Bay of Biscay, Showing the Next Ship in Line in the Distance, While the "Snapdragon" Lies in the Trough of the Wave; Below, the Steamer "Discoverer" Bucking the Heavy Seas Crossing the Gulf of Alaska; Ships Bury Their Bows under the Waves, Then, as the Water Lifts, Hurl Tons of Water High into the Air and Backward over the Bridge; as the Bow Dips Down, the Angle Makes Waves Appear of Tremendous Height, Giving Landsmen an Exaggerated Idea of Their Size



cases a very sensitive barometer has been used to measure the lift of a ship while she passes from trough to crest of waves. Many exaggerated reports concerning

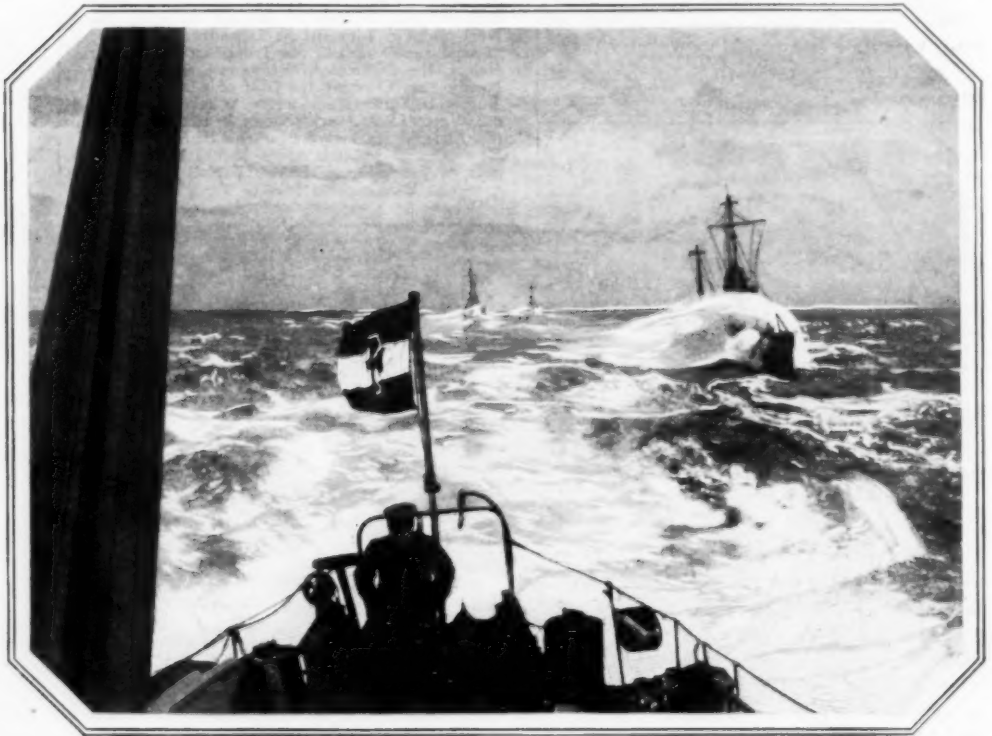
the height of waves are explained by the fact that the breaking of a wave against an obstacle, such as the bow of a vessel, throws the water to a far higher point than the unbroken wave could attain. Moreover, a vessel may encounter a wave while pitching forward, as her stern is lifted by a preceding wave, so that normally lofty objects, such as the crow's-nest, are relatively near the water.

In December, 1922, waves of extraordinary size were observed during a storm from the White Star liner "Majestic." On account of the comparative steadiness of this great vessel, the conditions of observation were unusually favorable. Several officers, including Sir Bertram Hayes, the commander, estimated the height of the waves at between eighty and ninety feet. Dr. Vaughan Cornish, the well-known English authority on waves, has accepted this figure as probably correct, though it greatly exceeds the maximum hitherto believed to be possible for ocean waves caused by wind alone. Waves of this

height, or higher, sometimes are produced by submarine earthquakes.

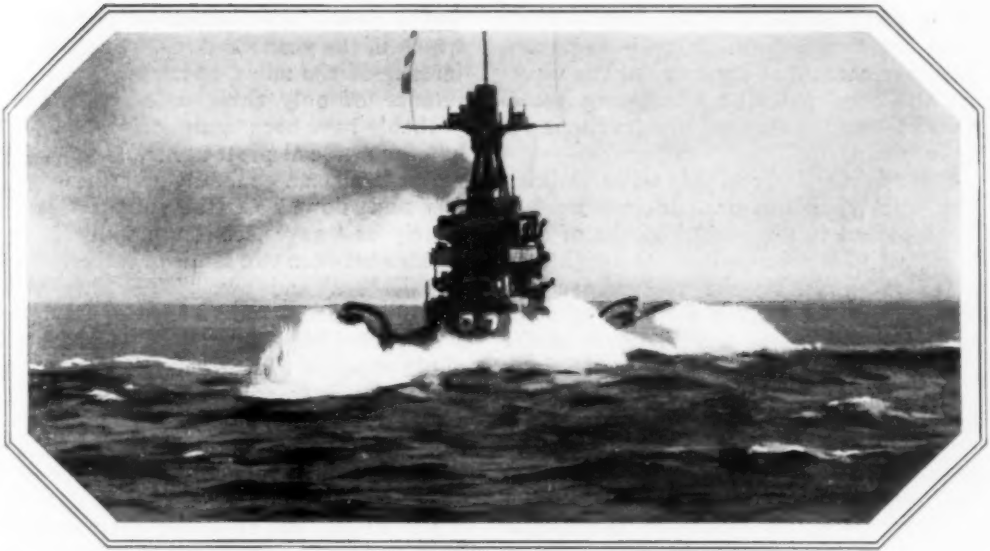
Cornish states that the average height of the waves encountered in a severe storm at sea is twenty feet, while the tallest waves in the same storm reach about thirty feet. In storms of very exceptional violence the average may be thirty feet and the maximum forty-five feet. The same authority finds that, as a rough average, the height of a wave in the open sea, in feet, is about one-half the velocity of the wind in miles per hour.

How does the wind cause waves? Why should the movement of air over the surface of the ocean lift masses of water weighing thousands of tons far above their ordinary level? Complete answers to these questions cannot yet be given, despite the many studies of waves made by such brilliant scientists as Lord Kelvin, in the last generation, and Dr. Harold Jeffreys, within the last two or three years. It is well known that all winds near the earth's surface are "turbulent"—full of



Courtesy The Illustrated London News

Destroyers, Those Lean, Overpowered, Tremendously Fast Terrors of the Sea, Are Among the Worst Storm Vessels Afloat, Continuously Swept by Waves in Every Tempest



Courtesy The London Sphere

A Battleship Weathers the Storm; H. M. S. "Marlborough" Plowing through the Combers in the Bay of Biscay, Showing How Small a Part of a Huge Vessel May Be Visible in Heavy Weather

gusts and eddies, up-currents and down-currents. Thus a wind, besides tending to drag the water along by friction, must subject it to a great deal of unequal pounding, which depresses it in some places and heaps it up in others. Once waves are formed by this process, there are two agencies that tend to increase their size and movement. One is what Jeffreys calls the "shelter" effect, due to the difference between the wind pressures exerted on the windward and leeward sides of each wave. The other is the suction of the wind on the convex surface of the waves—the same upward pull that helps to lift the curved wings of an aeroplane.

Waves in the open sea, though they may race along at the speed of an express train, do not carry the surface water far with them. If we watch a floating log as a wave sweeps under it, we shall see that it makes little or no advance, but merely rises and falls and has a small movement to and fro. Each particle of water in a wave travels nearly in a vertical circle, returning approximately to its starting point. It is the form and not the substance of the wave that moves along the surface. The depth to which ocean disturbance extends is not certain. Laboratory experiments indicate that it may reach downward 350 times the height of the wave, so that a twenty-foot

wave would be felt at a depth of over 1,100 fathoms. The movement at this depth would, however, be only a small fraction of an inch.

The length attained by ocean waves—the horizontal distance from crest to crest or from trough to trough—is as impressive as their height. The length of a wave increases with the force of the wind producing it and also with the extent of open sea over which the wind has traveled, this distance being known as the "fetch." Waves 500 to 600 feet long are common. The longest ever reported was measured by Admiral Mottez, of the French navy, in the Atlantic ocean a little north of the equator. Its length was 2,700 feet. In general, the longest waves and also the tallest are those of the "Roaring Forties"—the region between latitudes forty and fifty south—where the "Brave West Winds" have an uninterrupted sweep encircling the globe. Nowhere else in the world do waves have such a fetch.

That a steel steamship should be bruised and battered by big waves breaking over her is not surprising when we consider the observed effects of waves on objects along exposed shores. According to Thomas Stevenson, who invented an instrument known as a "marine dynamometer" for measuring the impact of waves, the maxi-

mum force of an Atlantic wave is three tons per square foot. French engineers, however, state that the force of the waves on the breakwater at Cherbourg sometimes amounts to three and a half tons per square foot.

At Peterhead, Scotland, water striking the breakwater has been thrown upward 120 feet and has displaced blocks of concrete weighing forty tons at heights of seventeen to thirty-six feet above low water. At the Bishop Rock lighthouse, which is exposed to the full force of the Atlantic waves, an iron column weighing over three tons was thrown up twenty feet and landed on top of a rock. At the harbor works of Bilbao, Spain, a solid block of the breakwater weighing 1,700 tons was overturned by the waves and dropped into the ocean. At Ymuiden, Holland, a block of concrete weighing twenty tons was lifted twelve feet by a wave and landed on a pier five feet above high water. The beating of the waves is constantly altering the shapes of the coasts, cutting cliffs, terraces and caves, and producing curious sculptural effects. This process is called "wave erosion." Some shores are worn back by this process at the rate of several

feet a year. The island of Heligoland, which in the year 800 A. D. had a circumference of 120 miles, today has a circumference of only three miles, and would probably have been completely worn away but for artificial protection.

The landsman generally describes all the ups and downs of the ocean surface merely as "waves," but the sailor distinguishes between two kinds of waves, which he calls "sea" and "swell." They may exist separately or together. Sea is produced by the wind blowing at the time and place of observation, while swell is due to winds prevailing over some other part of the ocean or winds that have blown previously at the place of observation. When waves are once set up in the open sea they may travel great distances, gradually decreasing in height but retaining their original length and velocity. Thus the ocean may be heaving with a long, regular undulation even when the air is perfectly calm. The appearance of swell is often the first indication of the approach of a storm, especially a tropical hurricane, as the waves produced near the storm center travel much faster than the storm itself.

When swell reaches a coast, its charac-



Rearing Dozens of Feet into the Air, Tons of Water Fall Back with a Mighty Crash; the Picture Shows a Huge Wave Striking the Sea Wall at Colombo, Ceylon, in the Far East

teristics are often much changed. Shoaling water increases both its height and its velocity, and it therefore has much more powerful effects than in the open ocean.

The heavy seas, locally known as "resacas," that occasionally visit the Bay of Rio de Janeiro and the adjacent coasts, afford another interesting example of swell traveling for long distances and being converted from long, smooth undulations of the water into leaping and destructive waves. At Rio these waves, on striking the sea wall, sometimes send a solid sheet of water 100 feet high.

The dangerous swell that frequently occurs in the open roadsteads of Morocco is generally due to cyclonic storms crossing the Atlantic. For the past seven years it has been successfully predicted on the basis of wireless reports from Portugal and the Azores of sea disturbance in those regions. There is an interval of about fifteen hours between the occurrence of a northwest swell on the Portuguese coast and its appearance at Morocco.

"Tidal waves," so called, usually have no connection with true tides. This name is sometimes applied to abnormally large "solitary" waves encountered by ships at sea, but, in many cases, to submarine earthquakes, and sometimes to great waves or a sudden rise of the waters along low-lying shores, caused either by passing storms or by earthquakes. True tidal waves, due to the pull of the moon and sun, occur twice a day in all parts of the ocean, but their slope is so gradual that they are quite imperceptible as waves. Even at the head of the Bay of Fundy, where the tide rises and falls fifty feet, there is no appearance of a wave, but in the Petitcodiac river, which discharges into this bay, the conflict of tide and current produces a conspicuous wave, called a "bore." A similar effect is seen in several other tidal rivers.



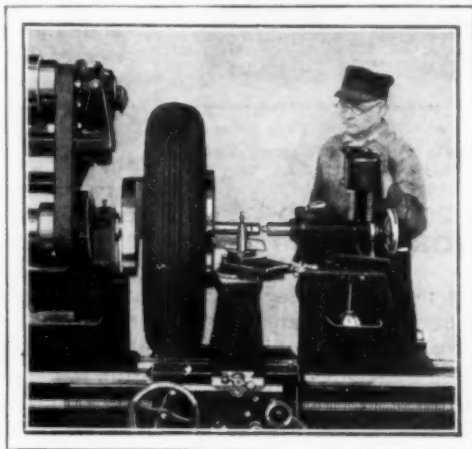
Adjusting the Transparent Screen over Infant in Carriage; Protector Is Concealed When Not in Use

FLY SCREEN ON BABY CARRIAGE GUARDS INFANT'S SLEEP

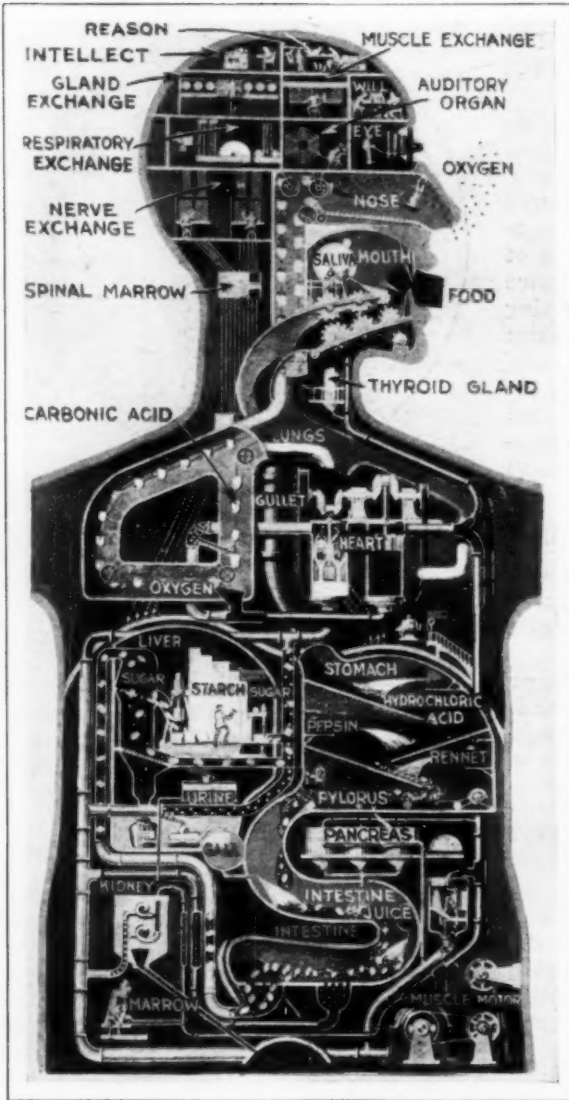
To shield the baby from flies, dust and other disturbing and injurious things while in its carriage outdoors, an adjustable screen for the front has been introduced. It is securely attached and, when not needed, tucks back into the hood of the buggy, where it is entirely concealed and out of the way.

LATHE TO TRUE BRAKE DRUMS SIMPLIFIES SERVICING

Truing brake drums and doing general servicing to all sizes and types of automobile wheels are easily accomplished on a lathe with universal mandrel and bearing adapters. It does all the jobs that are performed on an ordinary type of lathe, but permits mounting the wheel on it in the same manner as it is mounted on the axle, so that tests and repairs may be made on the hub, the brake drum, felloe, hub flange and wheel rim. Accurate results are thus assured.



Auto Wheel Adjusted on Lathe Which Trues the Brake Drums and Performs Other Service Tasks



© Photo Union, Berlin
 The Human System as a Factory, a German Diagram That Explains How the Body Does Its Work

HUMAN BODY IS PORTRAYED AS A FACTORY

The human body as a mechanical factory was demonstrated at a recent exhibition of dietetics in Berlin. Starting with the introduction of oxygen molecules into the nose, the graphic drawing showed a bucket-conveyor system carrying the oxygen to the lungs, where it combines with the hemoglobin in the red corpuscles of

the blood. The oxygen-charged blood is then conducted to the heart, represented by a pump and pressure gauge, and the pressure raised high enough to start the circulation through the system. The carbon dioxide set free by the various oxidations going on in the body is carried to the lungs and escapes through the nose. Next food is shown entering the mouth, to be ground up by the teeth, represented as shredding wheels, mixed with saliva and passed down the gullet into the stomach. Here hydrochloric acid, pepsin and rennet, the three secretions of the stomach, start the chemical process of digestion. The food is propelled on by a motor-driven conveyor, and passes through the pylorus, represented as a valve controlled by an attendant, and into the intestine, where three more juices, bile from the liver, the secretion of the pancreas and the intestinal juice, continue the chemical work. The effect of all these processes is to reduce food to its three great constituents: carbohydrate, protein and fat. The first, in the form of sugar tablets, and the protein as round disks, are shown entering the blood stream, by which they are taken to the liver. There both are further acted on, the sugar being stored as a variety of starch, and the protein reduced, until eventually it passes, with some of the starch, once more into the blood stream. Bone-marrow supply, muscle motors, kept running by a pipe line from the blood stream, the intricate chemical

plant centering in the kidneys, complete the bodily functions. The brain, controlling the entire operation by nerve centers, is represented as the offices.

Popular Mechanics Magazine does not publish the name of the maker or seller of any device described in its pages, but this information is kept on file and will be furnished, free, to anyone addressing our Bureau of Information.

A New Highway for an Old Empire



Combination Dynamite Drill, Stump Puller and Traveling Cook Shack, One of the Unique Tools Used to Build the Tamiami Highway through the Wilderness of the Everglades Jungle

AMERICA'S one tropical jungle, the waterlogged 5,000,000 acres of the Florida Everglades, home of giant alligators, furtive Seminole Indians, brilliantly plumed tropical birds and silent water moccasins, was opened to the world a few months ago, when six years of road-building ended with the completion of the Tamiami trail. The new highway across the jungle swamp is the shortest road between Tampa and Miami, and one of the scenic wonders of the world's highways.

The little party of pioneer surveyors who staked out the route, spent more than three weeks in forging their way across the narrow state, a distance of 110 miles. Their transport was a weird six-wheeled automobile that traveled on a roadbed of wire netting. While one roll was stretched in front of the car, another was being picked up behind it.

The automobile itself was a homemade freak. The drive was removed from the rear axle of a light car and fitted instead to a jackshaft stretching across the chassis. From this shaft it was carried to

a pair of huge tractorlike wheels, placed amidships. Their broad cleated treads furnished traction, and the smaller wheels fore and aft served only to balance the machine as it tilted and slithered through the muck.

Where they went in twenty-three days of hard traveling, the roadbuilders followed, with tractors, steam shovels, dynamite and drills. Their equipment was mounted mostly on endless treads and mud boats. The cook shack was carried along by building it as a second story over the scow that carried the drill used in setting dynamite charges. Now, after six years of work, automobiles can cross the Everglades in a few hours, and the state is pushing the work of draining the huge swampland to release its 5,000,000 acres of productive muck and marl land for agricultural exploitation.

Capt. George F. Cook, his son Erben, an experienced engineer, with four helpers, were the original trail blazers who conquered the riddles of gasoline travel through the tropical Gladelands. The

627

wheels of their homemade six-wheeled car, which they named a "gadget," were equipped with flat wooden tires, thirty inches wide. Steering was done by braking on first one wheel and then the other.

"We started our land cruise," Captain Cook said, "with the car loaded with one ton of supplies and two light pontoons for use, if necessary, when we reached the Gulf of Mexico. Erben drove the car. Two men on foot scouted a trail about one-half mile ahead, and a third with a shovel dug wells as we had to run the car constantly in low gear, so that the radiator was boiling all the time.

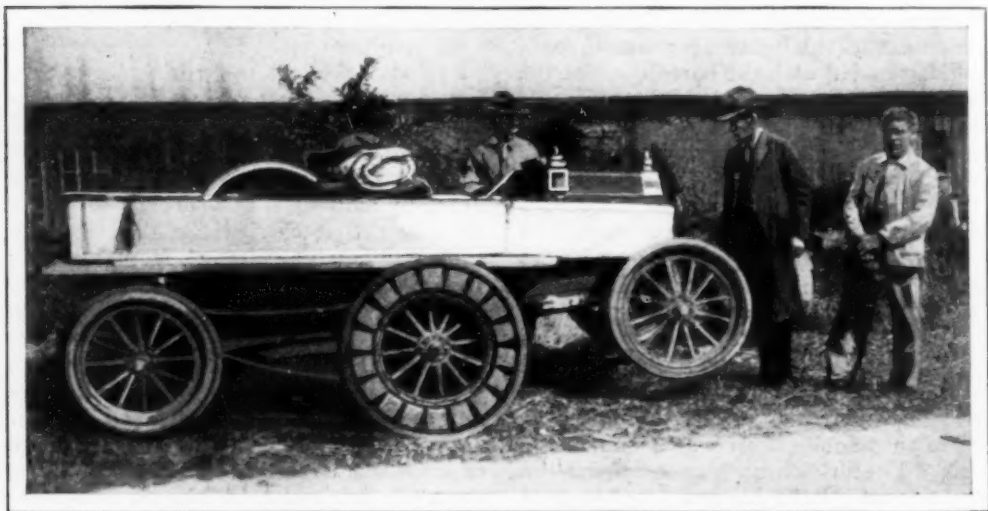
"Progress was as slow as snail travel. On good days, we advanced about six miles, while on rainy days in bad territory we frequently traveled from sunup to sunset only 300 yards. At times, we had to pull the car out of holes with block and tackle. On other occasions, we had to carry small trees long distances to get footing for the wheels. Sometimes, the car would sink so deep in the mire that all of us had to labor desperately with shovels to extricate the machine before it was hopelessly 'bogged down.'

"It was ten days before we sighted a human being. He happened to be a Seminole, a Shark river Indian. The gun he carried bore the manufacturing date of 1856. It was of the type that has hung largely on the walls of museums for the

last half century. Our car was the first automobile he had seen. After examining it, he said, 'Fool white man's canoe; everybody walk and feed him water.'

"We shook hands with the Everglades just as nature had left it, with difficult barriers of fallen trees and water courses getting deeper daily as we approached the Mexican gulf. Landmarks? There were none. We had no speedometer. Daily we retraced our steps many times. A pocket compass was our only guide. We had to feel our way through the swamplands and across the sawgrass prairies. But finally after many hardships, including short rations for several days, we completed the exploration. The back trail to Miami was almost as difficult. This first trip led to a second several months later in which we used a four-wheel-drive tractor and trailer. However, after breaking the king pin of the tractor, we were forced to abandon it and again employ the 'gadget' as the most dependable 'Glades vehicle available.'

The new highway is built of limestone rock blasted directly along its right of way. An abutting drainage canal was formed by this dynamiting campaign, the rock being deposited as foundation material for the highway. The Everglades is a region anchored on a rock-ribbed base. The decay of sawgrass and other organic material for generations has deposited a



The "Gadget," a Homemade Six-Wheeled Auto, Balanced and Driven on the Two Huge Center Wheels, and Used by the Survey Party to Cross the Uncharted Everglades to Map the Road

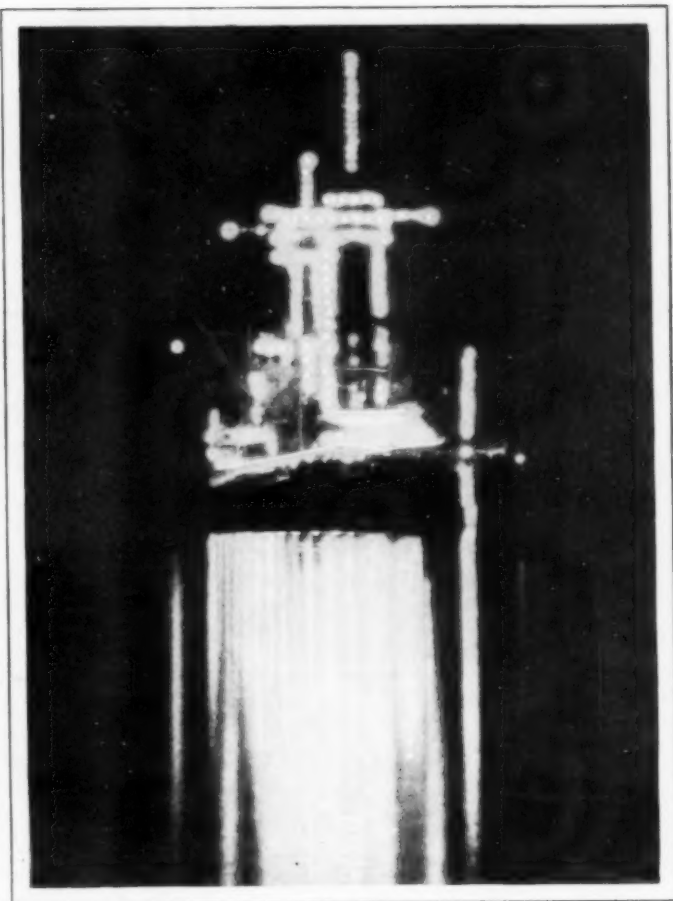
layer of muck soil from one to eight feet deep on top of this rock. The roadbuilders excavated all the earth and constructed a pure rock-base highway.

It took three months of hard labor and cost \$6,000 to deliver and put to work a compressed-air dynamite hole driller on this job. This was but typical of the transportation difficulties involved in moving all the heavy machinery to and through the waterlogged, isolated, uninhabited domain. Ingenuity evolved unique uses of the machines when delivered "at the front." The compressed-air dynamite drill was mounted on a steel ditching frame, which was also provided with a drill sharpener, forge and similar tools, as well as commissary and living quarters for the crew of five men, to work many miles in advance of the excavating shovels.

Another interesting feature was the stump-pulling attachment of this remarkable machine. It was built in the form of a skidder and consisted of a small tractor with the wheels removed, mounted on a stoneboat and geared slow so as to produce a dead pull of thirty-five tons on a steel cable 600 feet long. This stump puller yanked forty-foot trees, twelve to eighteen inches in diameter, from the earth's crust as though they were no more firmly planted than jackstraws.

The Everglades is really a spacious prairie dotted with wooded hammocks elevated from one to three feet above sea level. The highest point along the Tamiami trail is about the center of the state, being only twelve feet above sea level.

☐ The tallest trees in Iceland are but fifteen feet high.



Flagship "California," as It Appeared during a Recent Display in the Harbor at Honolulu, a Weird Structure of Lights

FLAGSHIP PUZZLE OF LIGHTS IN FLEET DISPLAY

Residents of Honolulu witnessed an unusual spectacle recently when the U. S. S. "California," flagship of the fleet, was brilliantly illuminated at night while at anchor in the harbor. The reflection of the powerful batteries of lights added to the weirdness of the display.

PLOWSHARES FROM AUTOS

Scrap steel from old automobiles is to be used at a western plant in the manufacture of plows and other farm implements. The steel mill is in a district where a supply of natural iron ore is difficult to obtain, but it is equipped to handle 10,000 tons of scrap each month.



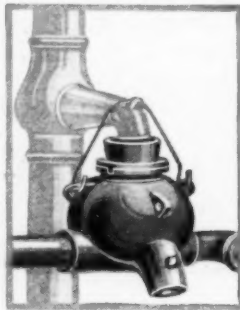
Using the Cleaner to Remove Dust from Car Interior and as a Sprayer for Painting.

VACUUM CLEANER PAINTS CAR AND OILS SPRINGS

For the convenience of the automobile owner, a combination vacuum cleaner and sprayer has been placed on the market. The air pressure is utilized to operate a spray gun for applying paint, to oil the springs, cut grease from the undergear and for many other operations.

THREE-WAY SPOUT FOR PUMPS ELIMINATES ADJUSTMENTS

Easily attached to the pump, a three-way water conductor permits filling three separate containers without removing it or making special adjustments of the pipe. One opening is made in the form of a spout for convenient filling of buckets, and to turn the water in any direction, all that

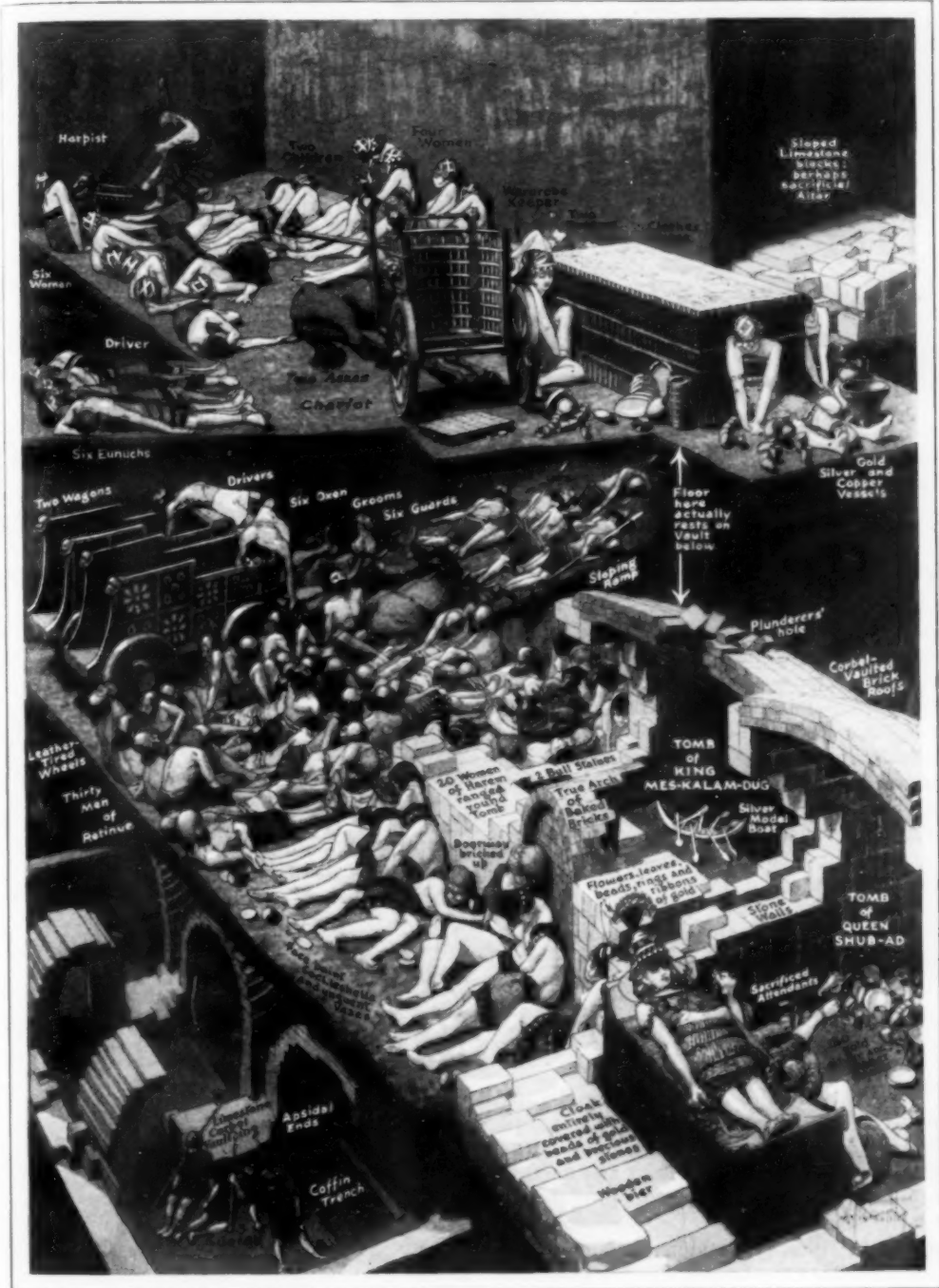


is needed is to adjust a simple shifting device which is held in place by a notch. The unit is of special usefulness in connection with the farm pump.

UR TOMBS REVEAL ANCIENT SACRIFICIAL CUSTOMS

Fifty-nine servitors of a king and queen who died more than 5,000 years ago, were killed to serve their master and mistress in the next world, it was disclosed recently when the joint expedition of the University of Pennsylvania and the British Museum dug into the royal tombs of Ur of the Chaldees, better known as the home city of the patriarch Abraham. The king and queen whose retainers were slaughtered to serve them in death were the Sumerian rulers, Mes-Kalam-Dug and Queen Shub-Ad. Soldiers of the guard, women of the harem, men and women servants, grooms, wagon drivers, harpists, and even two children, probably pages at court, were the victims, as well as six oxen and two asses. The discovery of the tombs is the greatest find yet made in the excavation of the ancient civilization of the Euphrates, and, because of the far greater antiquity, equals if it does not surpass anything found in Egypt. The royal tombs were placed one above the other, indicating the king died first. The shaft through which he and his retainers had been buried had been filled with earth, but was later reopened down to the roof of the king's tomb, and a burial place excavated for the queen. The burial party apparently took advantage of the fact to break through into the lower tomb and loot it of almost everything of value. The queen's clothes chest was then placed over the opening to conceal the robbery. Among the few things left in the king's tomb, however, was a two-foot boat model in solid silver, which bears a striking resemblance to the boats still used on the near-by Euphrates marshes. Aside from the importance of the objects and the discovery of the sacrificial custom of killing a ruler's household, the excavators disclosed in the tomb entrance a true arch of baked bricks, the oldest example of this form of construction. The find moves the birth of one of the most important discoveries in architecture back many centuries,

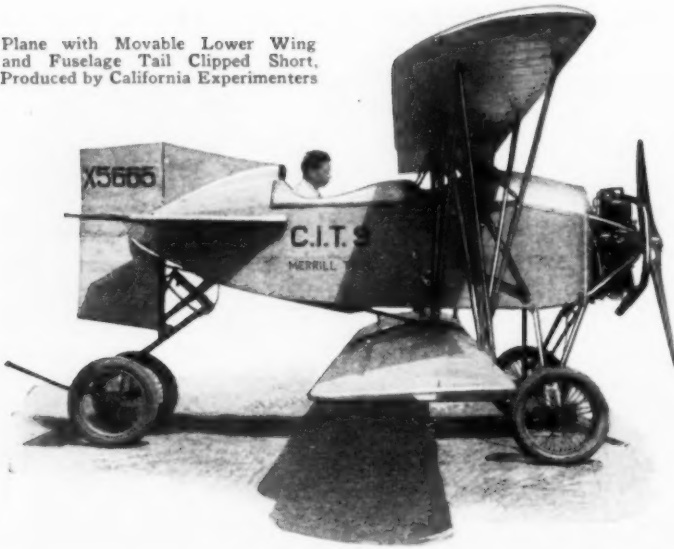
HUMAN SACRIFICES AT TOMB OF AN ANCIENT KING



Copyright, S. W. Clatworthy

Artist's Reconstruction of the Slaughter of the Royal Household of King Mes-Kalam-Dug of Ur, to Provide Attendants for the King and Queen Shub-Ad in the Next World; the University of Pennsylvania-British Museum Expedition Found the Tombs While Excavating Ur of the Chaldees

Plane with Movable Lower Wing and Fuselage Tail Clipped Short. Produced by California Experimenters



QUEER NEW TAILLESS PLANE HAS MOVABLE WINGS

An airplane with its tail clipped short and the lower wing movable fore and aft, so that the pilot can change the amount of stagger at will while in flight, has been developed by a western flying school and successfully tested. Airplanes are built with the wings staggered, one being set behind the other, to improve their longitudinal stability and increase the lifting power. By building the lower wings as a single unit, suspended below the fuselage on pivoted struts, and then arranging a control to move it back and forth, the lift can be suited to the speed of the motor, making stalling of the ship almost impossible, while, in landing, the set can be fixed to bring the ship to a stop in thirty feet.

INVENTOR GIVES "PLANT PILL" DISCOVERY TO NATION

The "plant pill" discovered by Dr. W. F. Gericke, of the university of California, which makes rose cuttings and other plants grow in water, without any earth, is to be given free to the people, the inventor has decided. Dr. Gericke, who spent the summer lecturing in Europe, expects to place the formula of his discovery in the hands of state universities and agricultural colleges for free distribution next spring. Dr. Gericke found that small

branches clipped from rose bushes in August, placed in jars of water with his concentrated plant food added, could be raised in the house and would supply blossoms for Christmas time.

HOT WAVES BORNE BY WARM AIR FROM GULF

Heat waves that afflict the eastern part of the country in the summer are caused by warm air from the Gulf of Mexico, weather experts declare. It passes over Texas and the central states, is

heated during the long days and fails to cool sufficiently during the short night. The process may continue until cold air from Canada pushes down from the northwest and mixes with the heated air.

RIFLE FIRED WITH ONE HAND WINS BRITISH PRIZE

A prize of \$15,000 has been awarded Brig. Gen. John T. Thompson by the British war office for his rapid-fire rifle. It is operated in somewhat the same manner as a revolver, and is said to shoot twice as rapidly as the usual rifle.



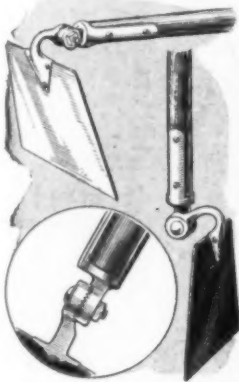
Looks Like a Revolver, but It Is a Rifle; the One-Hand Weapon That Won Big Prize

COLOR-EATING GERMS BLAMED FOR FADING HUES

Why colors fade, even though they may pass the usual light, damp and acid tests, has been solved by the analyzing microscope. The answer is a color-eating germ that thrives on the pigment in the paint, dye, ink or stain used. When it begins work on printed matter, the color gradually disappears, leaving first a yellow tint and then successive darker stages until all the pigment has been eaten away. Placing an infected sample under the microscope and adding a drop of water, the glass shows millions of spindle-shaped bacilli swimming about. Poster work for outside display is immune from destruction, as the sun quickly kills all germ life. Printed matter and colored fabrics should not be stored in damp, dark places.

HOE WITH ADJUSTABLE HEAD SAVES EXTRA TOOLS

Garden and field tasks that ordinarily would require different tools for satisfactory performance can be done with a hoe that has an adjustable head. It can be turned to any position simply by loosening a bolt. By virtue of this arrangement, it can be used for plain hoeing, scraping, weeding or trimming the edges of turf and similar purposes.



TAPE TO RECORD PHONE CALLS LATEST SERVICE AID

Attached to the ordinary telephone instrument and operated through the regular circuit, a tape recorder enters the number of the telephone that makes the call when the person called is not present. The number is perforated by means of a key arrangement operated at the other end. When he returns, the person called can tell by a glance at the tape if his telephone has been rung during his absence.



For the Firemen Who Serve along the Wharves, This Rubber Suit Acts as Life Preserver

RUBBER SUITS FOR FIREMEN KEEP WEARERS AFLOAT

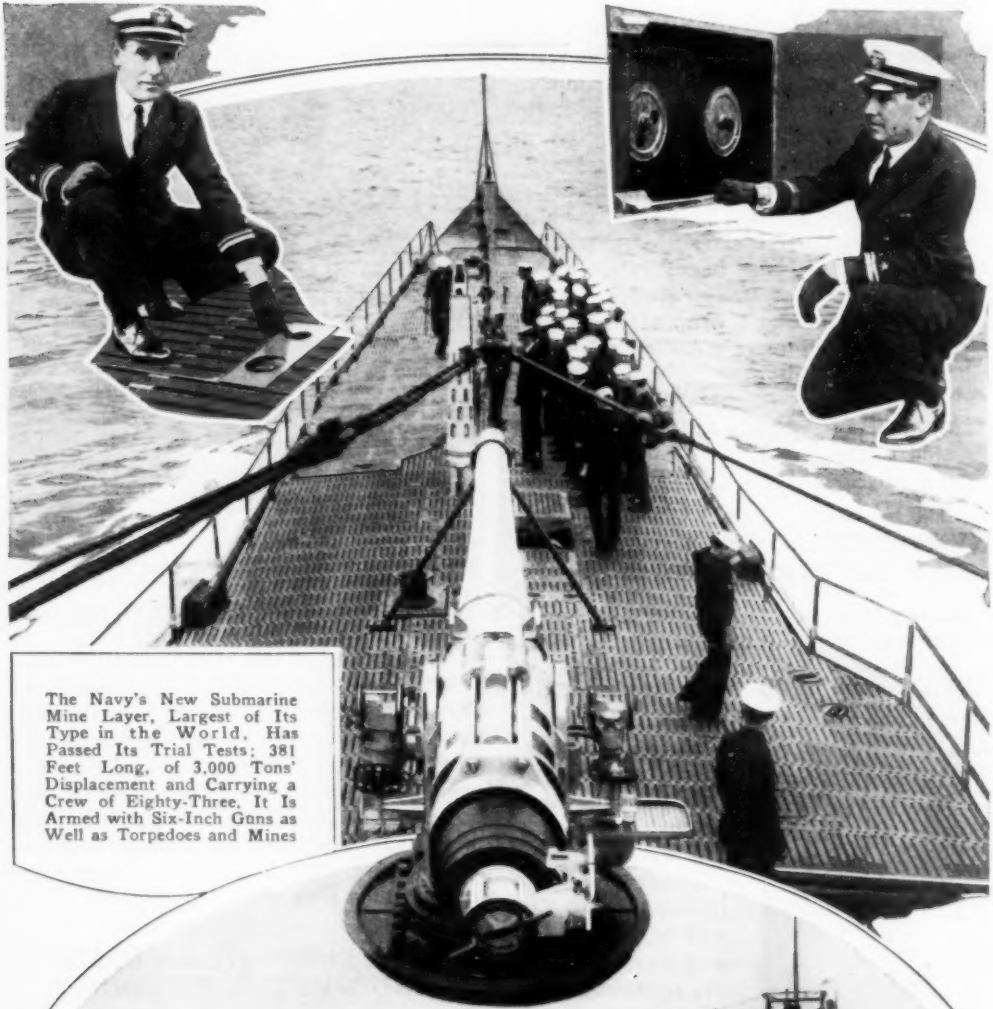
Designed especially for men who fight fires along the wharves at Long Beach, Calif., rubber suits have been devised. They keep the wearer cool and dry and prevent him from sinking should he fall into the sea, as, from the nature of his service, he is not unlikely to do. Successful tests were performed with the equipment during a recent trial.

SHARPENER FITS ON RAZOR AND WHETS BOTH EDGES

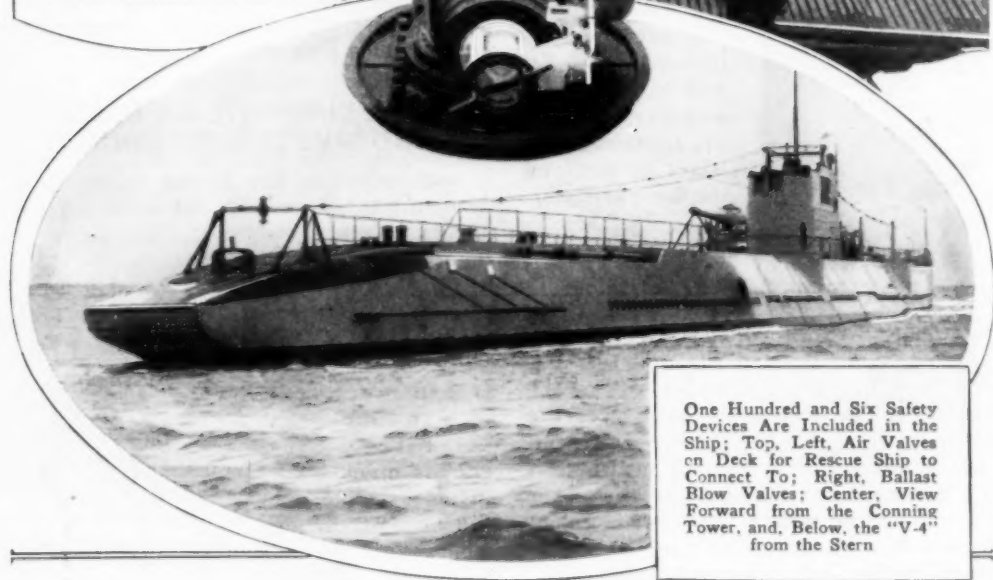
Both edges of the double safety-razor blade are sharpened without removal from the razor by a combination hone-and-strop device recently introduced. A few quick strokes back and forth are said to be sufficient to produce keen edges. The sharpener is quickly adjusted or taken off and strikes the blade while it is in the most suitable position for forming a sharp edge.



UNCLE SAM'S BIGGEST MINE-LAYING SUBMARINE



The Navy's New Submarine Mine Layer, Largest of Its Type in the World, Has Passed Its Trial Tests; 381 Feet Long, of 3,000 Tons' Displacement and Carrying a Crew of Eighty-Three. It Is Armed with Six-Inch Guns as Well as Torpedoes and Mines



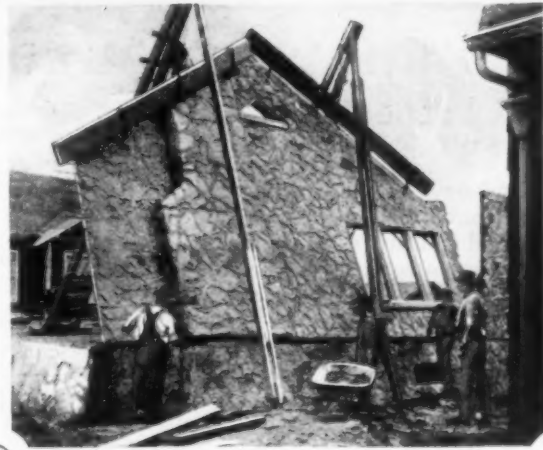
One Hundred and Six Safety Devices Are Included in the Ship; Top, Left, Air Valves on Deck for Rescue Ship to Connect To; Right, Ballast Blow Valves; Center, View Forward from the Conning Tower, and, Below, the "V.4" from the Stern

HOUSES BUILT FLAT ON GROUND LIKE SIDEWALKS

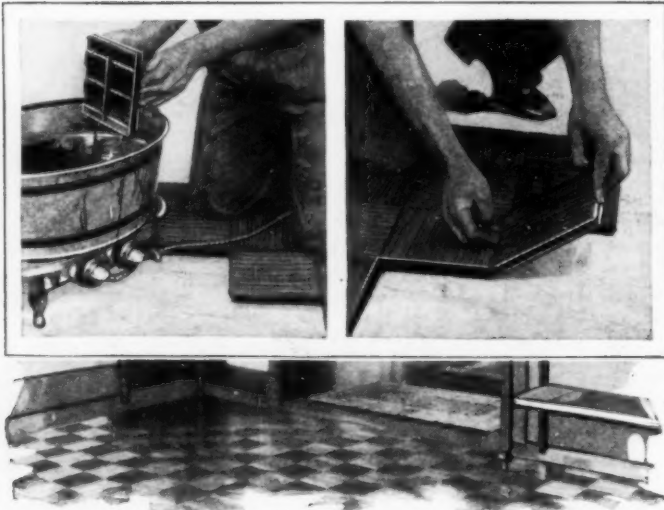
Houses are built flat like pavements and then raised into position by a construction method that is intended to effect savings in time and money. The system was developed during the war in the rapid erection of barracks and is said to have been applied to peace-time homes with good results. The foundation walls are fashioned in special forms, using tar paper, concrete, reinforcing and an outside finish in rock-block or any other style desired. When the wall has dried thoroughly, it is hoisted into place on the foundation footings, cemented to them and the ends laced together with rods and steel mesh. The corners are poured in special forms. Spaces for floor joists are formed by wooden blocks, set at the right locations and removed from the wall. Side walls are built in the same manner as those for the foundations, except that an insulated fiberboard material is employed instead of tar paper, and window sash and doors are set while spaces for plumbing and other niches are allowed. This method is applicable to a wide variety of architectural styles and effects and is said to permit building a home that will compare favorably with old-world houses that have stood for centuries.

NEW KINDS OF CABBAGE TO REDUCE ROTTING

Instead of cultivating larger cabbage heads, producers are now striving for smaller ones, to meet the needs of the small family and the city dweller whose storage space is limited. Heads that weigh but two or three pounds are preferred. One of the latest varieties is a real red-head cabbage of far deeper color, and another that has grayish purple leaves.



Top to Bottom. Finishing One of the Walls, Hoisting It, and View of Completed House



Dipping the Blocks in the Special Preparation That Helps Deadens Sound; Fitting Together, and Section of Finished Floor

BLOCK FLOOR WITHOUT NAILS DEADENS SOUND

Handsome wood floors, in fabricated blocks put together with pegs instead of nails and laid in a special preparation that helps deaden sound, have been introduced to effect savings in construction costs and time. The blocks can be placed on top of cement or subfloors of wood, attractive patterns may be developed, and, when properly installed, they eliminate squeaking and sagging. The pieces are dipped in a special liquid preparation which is heated and quickly cools.

SAFETY LIGHT IN ELECTRIC PLUG TO HELP PREVENT FIRES



Intended to save current and prevent fires caused by leaving appliances connected too long, a safety light has been added to the plug. It shows through a small opening when the switch is on, giving a warning that the toaster, iron or other appliance is still connected.

WORLD'S BIGGEST LENS TO SOLVE MARS RIDDLE

In a few years, a huge telescope, ten times as powerful as any now in use, may give an answer to the question whether Mars is inhabited and may solve other celestial mysteries. According to Prof. G. W. Ritchey, who has been working on the instrument for four years, it will make plainly visible the features of the landscape on Mars and, although the figures of any persons there cannot be seen, their habitations should be discernible, he

declares. The telescope is to be of the reflector type and will be mounted on the edge of the Grand Canyon in Arizona, according to present plans.

CORKS ARE EASILY LIFTED OUT WITHOUT TURNING

Bottle caps or corks, large and small, are easily removed with a small unit recently introduced. It has pins for taking out corks or milk-bottle caps, is simple to operate and saves purchasing extra tools.



BRIGHT BINDINGS ON OLD BOOKS ATTRACT MORE READERS

Library workers have found that little-read books often become more popular when dull-colored or soiled covers are replaced with brighter bindings. A special cover, coated with a material similar to a chemical finish used on automobiles, has been introduced. It is waterproof, fingermarks and stains may easily be washed off, and it can be obtained in a wide variety of colors and designs.

YELLING HELPS CURE DIZZINESS IN HIGH-SPEED FLYING

Attacks of sudden dizziness while flying in an airplane can sometimes be relieved by giving a loud high-pitched yell, emitting as little breath as possible, naval flight surgeons declare. This forces blood into the smaller veins in the region of the head. An aerial "jolt" often causes the blood to leave the veins temporarily, resulting in a sensation of dizziness. During certain maneuvers at high speeds, a decrease in the blood supply to the brain may cause fainting, although the effects vary with the individual. Yelling contracts the abdominal muscles, the diaphragm and chest muscles, and the pressure forces more blood toward the head.

GAS MASK PROTECTS DRIVER OF COTTON DUSTER

To rid cotton plants of the destructive boll weevil, a poison-gas treatment has been developed. The fumes are made from a special powder in a fire box on the machine, which is driven over the field. The heavy smoke settles and is confined in a relatively small space within a canvas shield close to the plants where it kills the weevils. Enough powder to cover a field of twenty acres is carried in the hopper, and the cost is about twenty cents an acre. The driver is protected by a gas mask. The mules or horses that pull the machine are out of the range of the gas.



Treating Cotton Plants with Poison Gas to Kill Boll Weevil; Driver Is Protected by Mask

"Lighthouse Helmet" for Policemen on Foggy Days and Nights; Batteries Are Worn on Belt



FOG LAMP FOR TRAFFIC POLICE PROMOTES SAFETY

Traffic policemen in England have been equipped with head lamps, somewhat like those carried by miners, to aid them in guiding pedestrians and cars on foggy days and at night. The lights are supplied with electric current from batteries attached to the belt.

WAVES IN ASPHALT PAVEMENT REMOVED WITH SHAVER

To smooth the waves that form in asphalt pavements, a unit somewhat like a road grader has been introduced. It has specially designed blades that shave off the irregularities, often caused by the heat of the sun. A light covering of thin cement is pressed into the pavement with a small roller, to complete the repair.

Those wishing further information on anything described in the editorial pages can obtain it by addressing Bureau of Information, Popular Mechanics Magazine, Chicago.

New Ways to avoid



Added Amusement and Instruction Are Afforded Children in This Combination Desk, Game Rack and Table Set; as Illustrated, the Top with Holders for Games and Books, Folds Down to Become the Table Top



These Perforated Aluminum Plates Form Air Space between the Food and Cooking Utensil So That Contents of Dish Will Not Burn on Gas, Coal or Electric Stove; They Also May Be Used under Hot Dishes on Table

Many Uses Are Found for Sponge-Rubber Dish Washer, Below, Especially Fitted for Cleaning Interior of Bottles and Jars; It Has Extension Handle with Pan Scraper on One End



Clothespins Are Not Needed with This Twisted Line, Which Is Easily Spread, to Admit Garments, and Springs Back of Itself to Hold Them without Tearing

Home Drudgery



Decorative Window-Sill Shelves for the Flowerpots; Require No Screws, Protect the Sill and Keep Pots from Falling



Cleanliness and Convenience Are Features of This Mop That Unwinds Fresh, Clean Fabric from a Roll at the Center and Supplies Oil or Water from Tank at the Top



Baby Harness of Soft White Webbing, Easily Laundered, Keeps the Infant Securely in His Crib, Yet Permits Him to Roll Around in Comfort; It Is Especially Suited for Use When Traveling in Railroad Cars or Steamers and Requires but Little Space



To Protect Hands and Fingers While Sealing or Removing Jar Caps; a Rubber Wrench with Molded Threads Inside to Afford a Firm Grip

MINER SCREENS BEACH SANDS FOR LOST VALUABLES

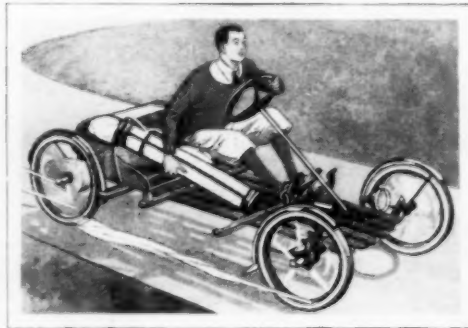


Screening the Sands at Swimming Beach in Hunt for Articles Lost by Bathers

Articles of jewelry, coins and other valuables lost by bathers at Venice, Calif., are often found by a former prospector who has been awarded the contract of keeping debris off the beach. He carefully screens the sands in a rocker sieve, which separates any lost objects from the material, and uses a hand scraper, specially made for the purpose, to collect the sand.

ELECTRIC ROADSTER FOR TWO GOES WHERE AUTO WON'T

Operated from automobile storage batteries, an electric roadster seating two persons has many uses in sport and business, for it can be turned around in a narrow driveway, may be parked almost anywhere and can be driven across the lawn without dam-



Electric Roadster Saves Time to Golf Links; It Can Make Twelve Miles an Hour

age to the grass. It develops a speed of twelve miles an hour, is fully equipped with emergency brake, parking lock, lights and other units common to the regular automobile, and is especially convenient for short trips when use of the larger car involves difficulties because it cannot always be driven all the way to the destination. A smaller electric roadster is designed for youngsters.

JUNE WEATHER ALL THE YEAR IN BIG BANK BUILDING

Electrical ice boxes will be hooked up with steam heat, air washers, air filters and giant ventilating fans to manufacture comfortable weather at all seasons of the year in the Union Trust bank building now under construction in Detroit. On a hot day, the tenant will simply open a register in his office, and clean, cool air, at a temperature of seventy degrees or less, will pour forth. Each room has its own air control. The building's refrigerating plant, if used for ice making, would freeze 700 tons a day. The ventilating fans will blow 440,000 cubic feet or 33,000 pounds of air per minute.

EXPLORE MYSTERIES OF EELS IN TWO YEARS' CRUISE

In order to learn more about the habits of eels, Prof. Johannes Schmidt, of the university of Copenhagen, has embarked on a two years' cruise. He will endeavor to solve the riddle of the spawning grounds and migration routes of the Pacific eels as he did for the Atlantic species. As far as it is now known, the story of the

eel is one of the most interesting in natural history. For ages they were shrouded in mystery. Young eels were never seen descending a river, but old ones never went any other way. No one had seen an eel's egg. The young ones came up from the sea, the old ones went down

to the sea, but what happened there remained a mystery for centuries. For seventeen years, Prof Schmidt labored on the riddle. He discovered that the young eels come up out of the sea and persistently ascend the rivers. They live and feed in fresh water for several years. When full-grown, they go down to the sea, swim across the whole width of the North Atlantic to an area northeast and east of the West Indies, where they fertilize their eggs and die. The young eel larvæ are leaf-shaped, flat, thin and as transparent as glass. How they find their way back across the ocean without guides, still is a mystery. One of the strangest parts of the story is that, though American and European eels breed in the same general region of the ocean, their respective young always unerringly find their way back, each kind to its own proper side of the Atlantic, a migration which is said to take them three years more or less.

COOLER PLACED IN MILK CAN SIMPLIFIES HANDLING

Milk is quickly cooled without pouring it from the can by means of a revolving coil placed inside the container and connected to a faucet through a short length of hose. A small turbine, actuated by the water, turns the coil, which agitates the milk and so hastens the cooling process. Water circulates through the coil, emerges through small holes in the lid and then flows down on the outside of the can. The unit is so constructed that no water can get into the milk. When the content is cooled sufficiently, the apparatus is easily lifted out and placed in another can



Operating the Saw, and as It Is Carried in the Folding Case



PORTABLE ELECTRIC SAW IN KIT CARRIED LIKE BAGGAGE

Built in a sturdy frame that may be carried like a suitcase, a portable electric saw does rip or crosscut work, mitering, grooving and beveling, and will work lumber up to three inches in thickness. The quarter-horsepower motor may be used for driving other tools, and there is a long extension cord for power connection.

DIRECTORY IN OUTDOOR BOOTH SERVES PUBLIC FREE

City directories are placed in outdoor booths at filling stations and other convenient localities by a Cleveland publisher. The book is attached to the door of the booth, which opens like an old-fashioned desk, leaving the directory in convenient position for reference, and may be tightly closed to protect the volume from rain.



Growing Wings *for the*

AN AIR-corps primary training plane skimmed gracefully in front of the operations office at Brooks field, Texas. It hesitated, wavered for an instant and settled to the ground in a three-point landing. The instructor in the front cockpit raised his goggles to his forehead and turned around in his seat.

"You're pretty hot this morning; skidding a bit on your right banks, but you'll do." He climbed leisurely out. "Think you can take 'er around yourself without cracking up?" he asked.

"Yes, sir," the pupil replied confidently; "shall I take off?"

"Sure; and listen! The air's pretty rough and you'll have to watch your turns; remember to keep plenty of speed. Don't try to turn until you have three or four hundred feet altitude. Come in for a landing in a straight glide—no funny business yet. Don't level off too high; remember your tendency. Now, if you'll remember everything I've taught you, you won't have any trouble, but watch your step. You know how to get out of a spin, but if you fall into one, I'll break your neck, when I get to you!" He added the last sentence with a smile.

"All right, sir," the young pilot laughed. He was feeling a bit nervous by this time. The instructor lighted a cigaret and then walked away. His nonchalance gave the student more confidence in himself. Yet he was somewhat doubtful. He wished the instructor would "stick around." He thought: "What if I do fall into a spin? Well, here's one flying cadet who's going to fly high!"

He eased the throttle open. The mo-



In Less Than Five Minutes He Will Be an Aviator; the Instructor Is Giving Final Orders to a Brooks Field Cadet Before He Takes Off on His First Solo Flight

Army



Testing Future Flyers on the Ground; the Pilot of the Ruggles Orientator Has Put the Student in an Upside-Down Position and Is Watching His Efforts to Right the "Ship"

tor ceased the plop-plop of idling and rose to a mighty roar. The ship quivered, moved slowly out across the field and picked up speed. The controls felt light to his touch, the plane was almost ready to come off the ground.

Cr-r-r-r-m-m-m! he heard the roar of another motor above his own. The sound came to him as an angry growl. A shadow flitted overhead and he caught a glimpse of a yellow-winged plane flashing past within ten feet of his upper wing! The man in the front cockpit was shaking his fist angrily. "What have I done wrong now?" the cadet muttered.

The ship was in the air, climbing steadily, holding straight to its course. The ground seemed far away, and there came the thought that he was far removed from every living being. The altimeter registered 800 feet; he was high enough.

He banked over, remembering the times his instructor had said: "Gosh, you're dumb! Get that stick and rudder action

together; get some coordination; want to spin us in? Easy now—that's better—take off a little more rudder." He followed instructions exactly and brought the ship around and headed back for a landing.

The time for landing had come, and he viewed it with some misgivings. He suddenly found that he was tense; that he gripped the controls with taut muscles; his legs ached from shoving on the rudder; there was cold perspiration on his hands. No excuse for that; maybe he was scared. He drew a deep breath to quiet the pounding of his heart, idled the motor and nosed the plane down. He listened to the whine of the wires and pulled the nose up—mustn't come in too fast, that was what made it hard to land. He thought of his instructions: "When you bounce, don't wait until the ship has killed its speed; you do that and you'll crack up. Gun'er right now!" He gripped the throttle tighter. "Don't level off too high; that's your trouble," he remembered.

Wh-u-m-p! There was a violent jolt. He slammed the throttle open and let the ship pick up speed again. Well, he had bounced, but he hadn't cracked up. He wondered if his landing gear was still intact; what if a wheel had given way under the strain! He looked back over his shoulder at the ground. There was no landing gear down there on the ground, so he decided nothing had broken. He tightened his lips into a grim, straight line and started around again.

The second time he came in slower. There was an agony of waiting just before his wheels touched. He juggled his stick a little and eased the plane down. The wheels rolled. He taxied back to where the instructor was standing, still puffing on a cigaret.

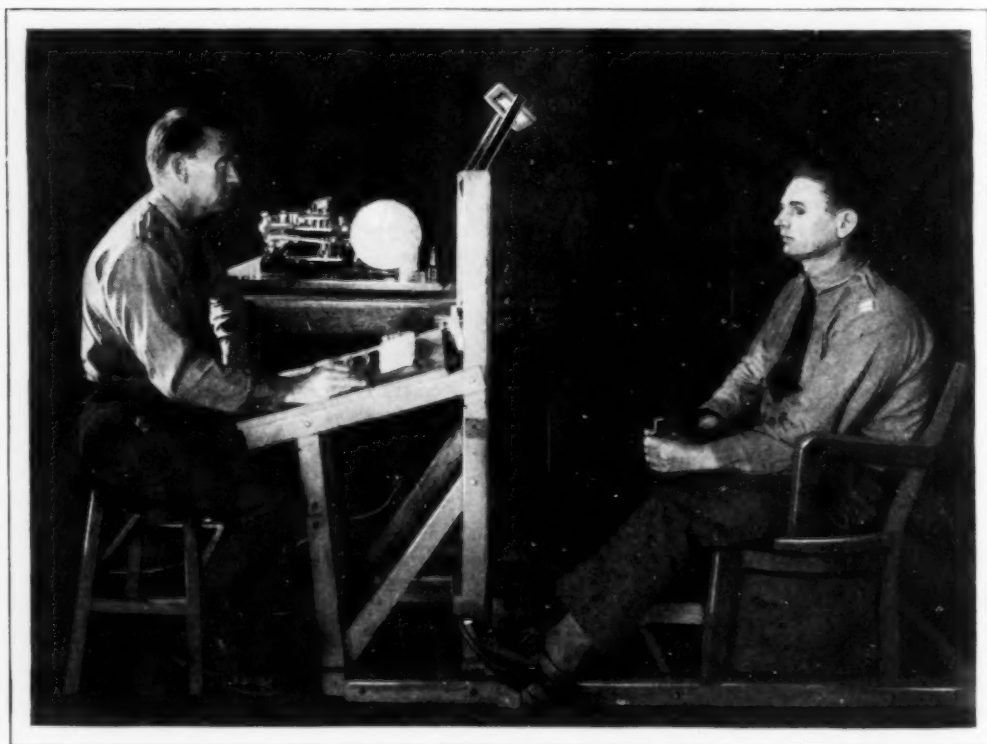
"Not bad," the latter said, "except you almost got killed. That ship almost landed on top of you; you know enough to look around before you take off. You pull a stunt like that again and I'll wash you out!"

"I won't, sir," the cadet replied. He is

one of nearly 700 young men between the ages of twenty and twenty-seven who annually begin flying training in the army air corps. His reactions, his fears and worries on his first solo flight are no different from those experienced by any man who flies alone for the first time. There are probably more emotions packed into the five minutes of the first solo than any other five minutes of a man's entire life.

The men to whom the army offers flying training are usually college graduates or have had two or three years of university work; they are physically almost perfect; they are without mental or moral flaw. In short, they are the pick of the young men throughout the country who wish to learn to fly. They are offered this training at no cost whatever; the army pays for everything connected with it.

The duration of the course is one year. Eight months of this time are spent at one of the primary schools, Brooks field at San Antonio, or March field, at Riverside, Calif. During the first eight months, students learn to fly; in the remaining



The Complex Coordinator, at Brooks Field Primary Training School, Tests the Ability of Flying Candidates to Make Their Hands and Feet Respond to Eye and Brain



This Is the Reaction-Time Testing Machine, Which Measures the Interval It Takes the Hand to Respond to a Message Delivered through the Eye to the Cadet's Brain

months they learn to use airplanes as military weapons. They learn to fire machine guns from the air, to drop bombs accurately, to master any of the difficult problems which arise in military flying.

Flying is a misunderstood profession. A few days ago a man asked about the advisability of sending his boy to the air-corps schools. "Benny is a fine boy," he said; "he'd learn that stuff in a hurry. He's got brains, and he'll work hard; I'd rather have him learn to fly in the army than anywhere else."

"He might not get through if you send him to the army; he might be washed out," was the reply.

"Benny? Don't worry; he'll pass anything they have down there. That boy of mine has brains."

That seems to be the prevailing idea. If a young man applies himself, the layman thinks, he'll have no more trouble than if he were going to college—a combination of hard work, sand and persistence. But unfortunately that idea is erroneous. It seems never to occur to most laymen that there may perhaps be something of an art connected with flying an airplane. But there is an art, a very difficult art, and one which is as lacking in some students as the art of violin playing is to the average bricklayer.

The completion of the year of flying training in the air corps is to no individual

at all certain. There is a matter of "inherent flying ability," just as in athletics there is an inborn ability in some individuals which is more or less lacking in others. And for that reason, of each new class at the air-corps primary schools, perhaps only one of every five students will eventually become a skillful pilot, and graduate and receive his wings.

In military flying a man must be able to fly. He must daily perform maneuvers in the air which in commercial flying would be unnecessary and extremely dangerous. So, in the same way that perhaps only one person of any five or six might be trained to virtuosity as a piano player, only the same average can be trained sufficiently to be safe in military flying. And it makes no difference that a man works hard. He may actually slave to learn, yet be entirely incapable of overcoming his inherent lack of ability.

To overcome some of the waste and delay in money and time, and to avoid as much as possible the disappointment customary to those who fail to pass the course, the corps has devised several varied and interesting tests by which the relative degree of ability of each new student is determined. Flight surgeons and scientists have been working along these lines for several years, and are now able to tell with a fair degree of certainty whether or not a student will be able eventually to fly



Mechanics Working on a Curtiss Observation Plane; This Type Has a High Speed of 140 Miles an Hour

—and this before the student has been near an airplane.

One of these tests is performed with the aid of the Ruggles orientator. This is a device resembling the cockpit and fuselage of a modern airplane. The cockpit is equipped with controls which function exactly as do the controls of an airplane in flight. With the student in the cockpit of the apparatus, an operator on the ground handles another set of controls, and is able to put the fuselage in any desired position, regardless of the wishes of the student. The length of time the student requires to recover from a given position, such as upside down, furnishes an index to his reaction time, and hence to his native flying ability.

There are other, and more involved, tests. In one of these, the student is seated before a board containing a number of red, green and white lights. He has before him, in the same relative position as in an airplane, a set of controls, the movement of which will turn on certain lights. The problem is to line up certain lights on a given row. If the student is violent in his movement of the controls, that error shows immediately on a paper graph. Similarly, any and every mistake he makes is shown.

The first four months at the primary schools are spent on flying instructions of an elementary nature. The student is taught the ABC's of flying in a small, rather low-powered ship. He is expected, of course, to get the plane up and get it down without wrecking it, but quite often he flies counter to expectations. During the fourth month he is taught acrobatics, and in these maneuvers he learns to be comfortable in any position of the plane, whether hanging upside down by his belt or flying level.

In the last four months at the primary schools the student is given work with a service-type plane.

He undergoes a refining process, a developing of his skill to the point from which he can safely take up the problems to be encountered in military flying. He learns to fly the plane by feel. No longer must he thrust his head out of one side or the other to feel the wind blast for a side slip or a skid.

The student of flying at the primary school graduates to the advanced school with a new confidence in this ability. He is not overconfident to the point of cockiness, yet he has a healthy state of mind which brooks no fear of flying.

At the advanced school, at Kelly field, he has four branches of aviation from which to choose in preparing to be a military aviator. He has studied each at length and, depending upon his temperament, may choose either pursuit, observation, attack or bombardment.

In pursuit, he will be able to satisfy his fighting instinct. Pursuit is contemplated for the sole purpose of combat; the ships have been designed with that in view; the plane reminds one of a huge, formidable hornet.

The observation pilot and his observer, on the other hand, are not supposed to fight. Theirs is a peaceful mission—if possible; but on occasion they are capable



Filling the Gas and Oil Tanks of a Two-Engine Martin Bomber, One of the Biggest Planes the Cadets Learn to Fly; the Cockpit in the Nose Is the Forward Machine-Gun Nest

of just as stubborn a resistance against attack as the "pursuiter."

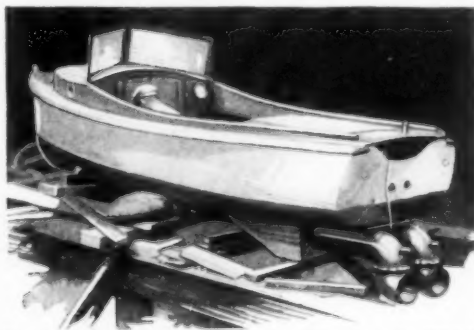
The students devoted to attack aviation are popularly termed the "Suicide Squad." Attack planes are those which sneak upon the enemy unawares, that dive over a hill and spray the enemy infantry with lead and bombs, and are gone as suddenly as they come. They fly just off the tree tops, fifty feet or less, and if a motor fails when the plane is over rough country, there is no possible way in which the pilot can avoid a crash.

Bombardment aviation is perhaps less spectacular than the other three branches. It operates at great altitudes and, usually unseen, drops the "pills" upon enemy towns and ammunition factories, far to the rear of the front lines. But while it may lack in appeal to the imagination, bombardment has its dangers, too. There is enemy pursuit to think about, and occasionally anti-aircraft fire. There is also the thought: "If a bullet should hit one of these bombs, we'd be blown out of the sky."

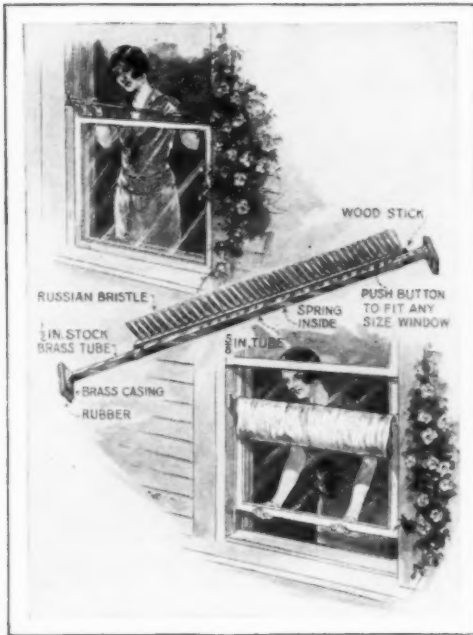
It requires a year to develop the student's wings, a year of constant, grueling work. But that year changes a man, it molds his mind to new ways of thinking. And as time goes on, and he flies day after day, he discovers a more complete mastery of his airplane, his nerves, his will. His sphere becomes the air; seated behind a roaring motor, with the wind whipping back into his face, he is in his element. The plane becomes a part of him, something to handle as subconsciously as one walks or talks or eats.

BOAT PROPELLED BY PUMPS DEVELOPS HIGH SPEED

As a substitute for the usual propeller arrangement, a western inventor has rigged a boat which is run by pumping water into two cylindrical pipes and discharging it at high pressure. The rudder is also eliminated, steering being accomplished by shutting the water off in one of the pipes while the other is left running to turn the boat.



Rear View of Boat Showing Outlets through Which Water Is Forced to Propel the Craft



Adjusting the Window Brush; Close View of the Stick and Bristles, and Cleaner in Operation with Cloth

SAFETY BRUSH CLEANS WINDOW FROM THE INSIDE

Window panes are cleaned on the outside from the interior with a safety brush now on the market. It is attached within the sash groove and extends the full width of the window, the bristles resting against the glass. A cloth, dipped in warm water, with ammonia or kerosene added if soot has gathered on the panes, is placed on the brush and by raising and lowering the window, a thorough cleaning results. The unit may be used for either the upper or the lower sash and is furnished in two sizes, for windows of varying width.

NORTHERN LIGHTS HELP RADIO IN ALASKA, TESTS SHOW

While the northern lights often seriously interfere with radio reception and sending in various parts of the world, F. P. Ulrich, magnetic observer of the coast and geodetic survey, reports that, at Sitka, Alaska, where he has been making tests for five years, they do not cause such difficulties. In fact, he says, "good radio reception is very much more apt to occur than poor reception during a bright or

faint aurora." He declares, as a result of his findings, that the condition of the earth's magnetic field is no index of the quality of radio reception. The question remains one of the greatest scientific mysteries. For years, scientists have been making careful observations, recording the hourly and daily variations in the earth's magnetic forces at widely scattered observatories from Samoa to Honolulu and in Alaska. Efforts are also made to connect the phenomena with such occurrences as earthquakes and sunspots in order to gather more knowledge of these mysterious forces.

MOVING A FOREST

More than ninety trees, some of them over two feet in diameter at the base and from forty to fifty feet high, have been transplanted from a natural woodland to an eastern estate. The work was done in the winter when the earth was frozen in a ball around the roots. Holes to receive the trees were dug a foot larger than the root clump, the space between being filled with fresh earth and the roots kept undisturbed. Winter is the best time for such work as the sap is dormant.

SIPHON AND FILTER COMBINED RUNS AUTOMATICALLY

For filling bottles, removing cream, draining goldfish bowls, and many other purposes, a siphon starts and stops automatically, can be run at different speeds or continuously and will not splash or foam, the manufacturers declare. It eliminates the unsanitary suction methods usually employed. Extra attachments are provided so that it can be used for washing dishes, or as a grease gun. The siphon filters as it fills and the tubing is equipped with a spring clip to prevent kinking.



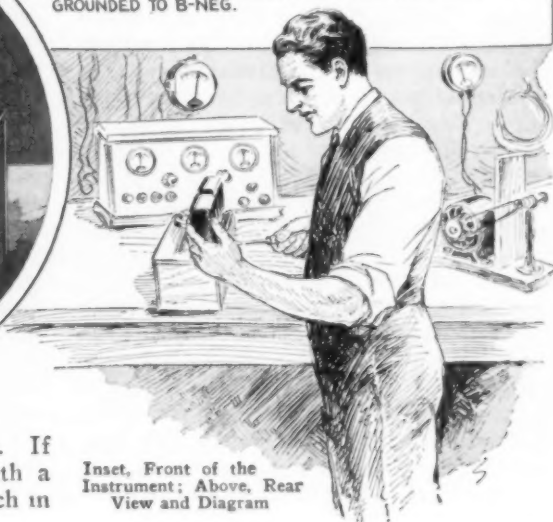
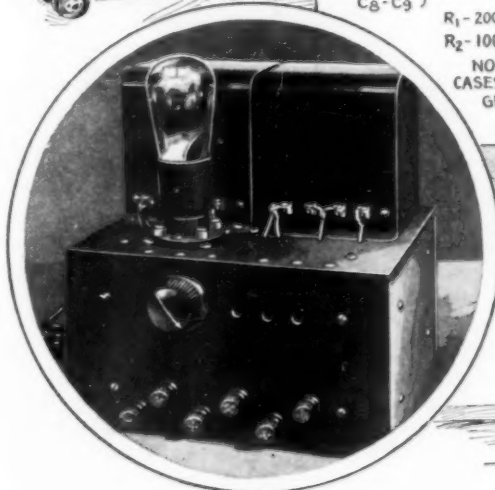
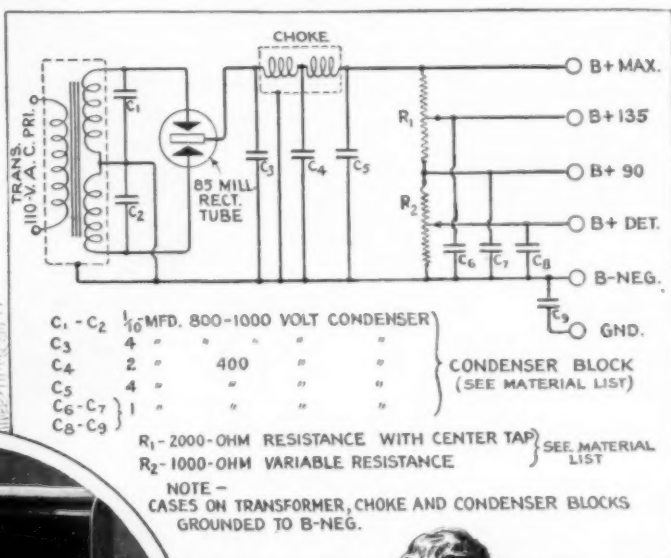
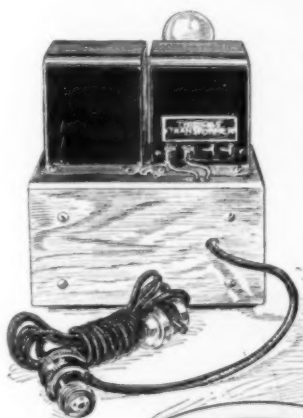
Build This Compact B-Eliminator

By R. C. MORTON

THE B-ELIMINATOR described in this article is not only compact, but economical to build and highly efficient in operation, and will supply ample voltage for the operation of any standard receiver which may employ either a 112 or 171 power tube in the last stage.

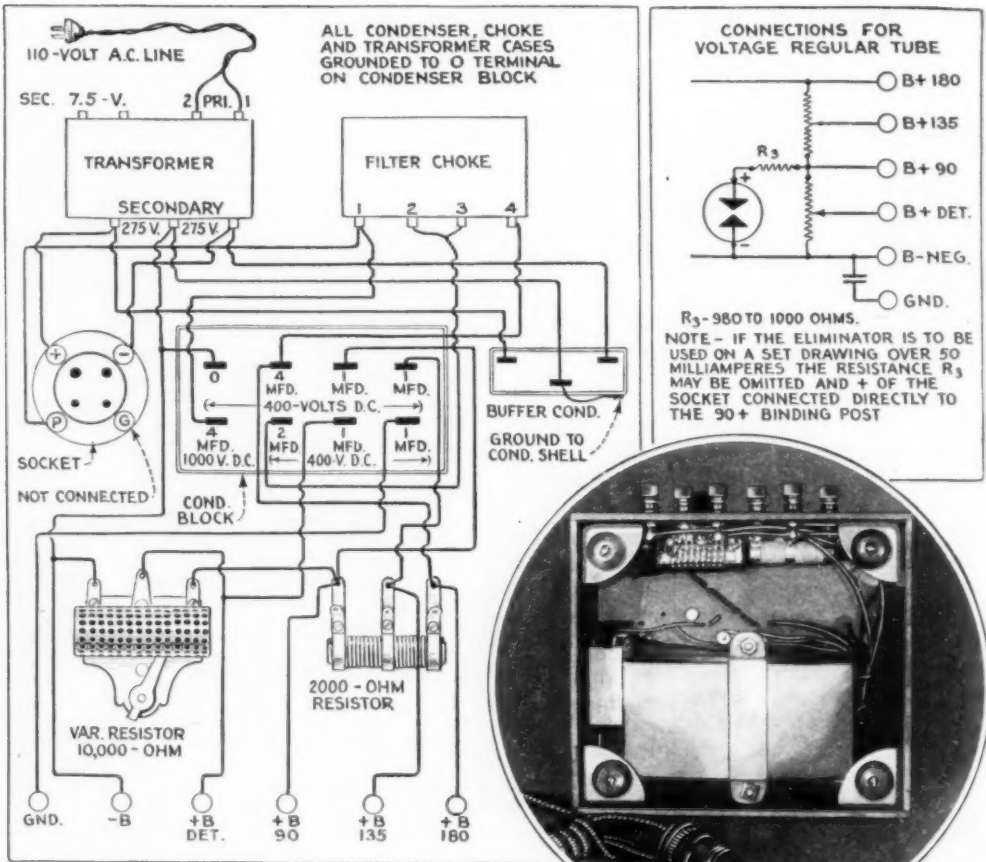
Begin construction with the box. Four pieces of hardwood, 1 in. square and $4\frac{1}{4}$ in. long, or eight brass corner pieces, as in the model illustrated, may be used as braces. These brass corners can be purchased at most hardware stores for five

the lamp cord so that the instrument can be turned on and off. The top and front consist of bakelite panels, $\frac{3}{16}$ by $7\frac{1}{4}$ by 8 in. and $\frac{3}{16}$ by $4\frac{1}{4}$ by 8 in., in dimensions, respectively. All holes for mounting the various instruments are located by placing these in position and marking the points for drilling with a pointed tool. The back panel is $\frac{3}{16}$ by $4\frac{1}{4}$ by 8 in., and the two side panels are $\frac{3}{16}$ by $4\frac{1}{4}$ by $6\frac{7}{8}$ in. Bakelite may be used if desired for these panels, too, but veneered wood was used in the model described.



cents each and also the rubber feet. If the eliminator is not to be used with a relay, it is well to incorporate a switch in

Inset, Front of the Instrument; Above, Rear View and Diagram



Simplified Wiring Diagram, and, Right, Photo of Bottom, Showing the Simple and Compact Construction

The transformer and filter choke are now mounted on the top panel and the tube socket directly in front of the transformer. The space in front of the filter choke is purposely left vacant in case the builder wishes to add a voltage-regulator tube. Next remove the enamel from the side of the condenser block with a file or emery cloth, so as to make contact with the metal case and strap which holds it in position. The strap is $3\frac{3}{4}$ in. wide and 5 in. long, its ends being bent up over the sides of the condenser block, as shown in photo on this page, and drilled to take two threaded brass rods, 4 in. long. The rods may be of the machine-screw type and are inserted through holes drilled in the top panel between the transformer and filter choke at front and rear. The supporting strap is then held in place by means of two nuts threaded on the rods.

Now with a file remove the enamel on the mounting lugs of the two-unit buffer condenser, which is then mounted as indicated in the diagram and screwed to the side of the box by means of two short brass machine screws. The ground connection for the shell of this condenser is taken from one of the mounting lugs and connected to the center terminal. A short wire is also used to ground the cases of the transformer, filter choke and large condenser block. This connection is made, on the underside of the top panel, to the mounting screws and rod at front. The wire is then soldered to terminal O on the condenser block, which is grounded to negative B. To avoid confusion, these grounding connections are not shown in the diagram.

Place soldering lugs on all the trans-

former and filter-choke terminals, taps 2 and 3 on the filter choke being joined by soldering the lugs together. Use heavy rubber-covered flexible stranded wire for the circuit and run the leads down from the instruments mounted on the top panel through holes drilled at convenient points. Check all wiring with the diagram to make sure no mistakes have been made; then assemble the side of the box and tighten the screws.

The instrument is now ready for use. Insert the rectifier tube in the socket and connect the eliminator to the set. Before turning on the 110-volt 60-cycle house-lighting supply, place a 1-mfd. filter condenser in series with the ground lead from the receiver.

In order to do this, disconnect the ground wire from the receiver and connect it to one side of the 1-mfd. condenser, then run a wire from the other side of the condenser to the ground post on the set. The ground post on the eliminator is connected as shown in sketch. The condenser in series with the ground lead to the set is necessary where the 110-volt line is grounded outside the house, in which case the condenser will prevent any damage to the receiver.

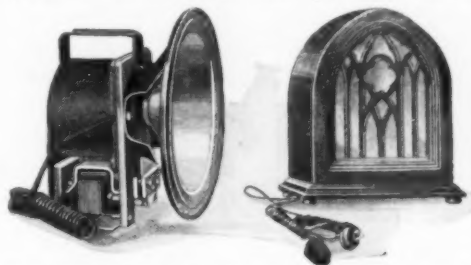
Turn on the set before switching on the eliminator and always turn off the eliminator before shutting off the set. A relay can be employed for this purpose, enabling the operator to control the entire installation with the set switch.

The complete eliminator will cost about \$38.50, the parts used are all high-grade, insuring long service and maximum results. If the builder wishes to add a voltage-regulator tube, all that is necessary is to provide the additional tube and socket at an expense of about \$6.50. The connections for this tube are shown in the diagram at the upper right on page 650. The schematic diagram on page 649 is given for those who prefer it to the simplified type.

A material list specifying the make and cost of each item used in the construction of the eliminator will be mailed free to any address. A large blueprint of all wiring diagrams may be obtained from Popular Mechanics radio department, 200 E. Ontario st., Chicago, for 25 cents to cover cost and packing.

Dynamic Speaker Is Operated from Light Socket

Electrodynamic cone speakers are rapidly gaining popularity with those who wish to realize the full possibilities of

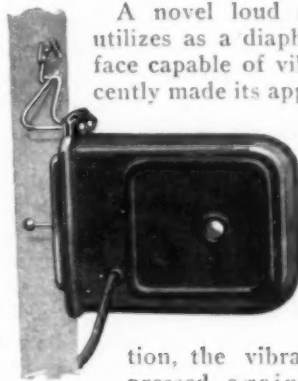


Left, Console Unit Showing Rectifier Element; Right, Unit Housed in Gothic-Type Cabinet

power amplification. The free-edge cone unit is of the usual type, but the loud-speaker unit operates on a different principle from that applied in the permanent-magnet type. A large field coil is excited by an external source of d.c. in order to produce the necessary magnetic force. A moving coil is suspended in the field of this coil and is fastened directly to the small free-edge cone. The drive is applied directly to the cone in speakers of this type and eliminates drive-rod troubles, which are a frequent cause of distortion in other types. There are several other advantages that make this type of speaker especially adapted for use with power amplification.

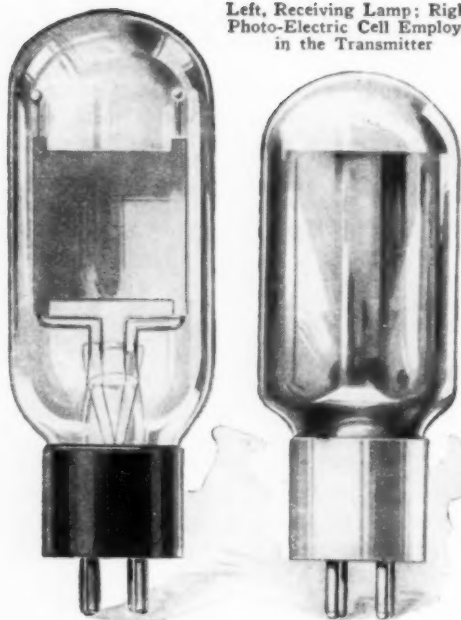
Novel Loud-Speaker Unit

A novel loud speaker, which utilizes as a diaphragm any surface capable of vibration, has recently made its appearance on the



market. It may be fastened to the wall of a room, the top of a table, or the glass in a window as shown in the illustration, the vibrating tip being pressed against the surface used as the diaphragm. It is claimed to give excellent rendition of music with any receiver capable of operating a speaker.

Left, Receiving Lamp; Right, Photo-Electric Cell Employed in the Transmitter



New Parts for Television Experimenters

The demand for reliable parts for use in television experiments has resulted in several new and efficient types of photo-electric cells and neon lamps, as well as scanning disks and other necessary apparatus. The special receiving lamp shown in the photo at the left is simple in construction and operation. The straight-sided, clear-glass bulb contains two flat metal plates placed parallel and quite close together in an atmosphere of neon. If a voltage greater than 220 is impressed on the plates, the negative one glows with a vivid pink light. The ionized gas in the tube results in increased or decreased brilliancy with the slightest change in current intensity due to the amplified signals. It is this varying light, in conjunction with holes in the revolving scanning disk of the television apparatus, which weaves a pattern of light dots into a living image. The device is employed in place of the usual loud speaker in the output of a power tube. The photo-electric cell shown at the right is an improved device for translating light variations into varying signal intensities; it is employed in the transmitter in the conventional manner of photo-electric cells.

Practical Hints for Set Builders

The best radio results are obtained simply by close attention to details. The receiver can be no better than its components, and to slight any detail, whether it be an instrument, a feature of the work of assembly and wiring, or a phase of the operation, is to invite unsatisfactory operation. Good material should be used throughout. One inferior part may render useless an otherwise good set.

Switch for Comparing Speakers

With the rapid improvement of speakers and amplifying devices there is a demand for some quick method of comparing the merits of various speakers or amplifiers. The switch shown consists of a bakelite turret, molded in the form of a hollow truncated cone. Around the base of this cone five pin jacks are mounted, all of which are connected to one side of the input lead, and which form one series of outlets to five speaker circuits. Directly above each of the jacks, five others are mounted in such a way as to allow the switch arm to make individual contact with the terminal of each one of them. The switch arm may be turned so as to connect five different speakers if desired, for comparative tests. The device is also handy for set owners who have wired their homes for speaker outlets in various rooms. They can arrange the circuits so that it is possible to project the output from a set to any one of five speakers located in different rooms.



Purpose of the Speaker Filter

The speaker filter is designed primarily for the purpose of protecting the windings of the speaker when used in connection with tubes requiring high plate voltages, such as the 171 and 210-types. The high plate current of the tubes may be sufficient to burn out the ordinary speaker unit; hence the filter is used to isolate the speaker from the heavy direct current but permits the a.c. sound-carrying current to reach the diaphragm. It will not improve

the quality of reproduction except where the a.c. impulses are greatly amplified. If low power is used, these devices sometimes cause a sharp drop in volume and greatly impair the tone quality.

Better Reproduction

The filter shown in Fig. 1 is designed to eliminate extraneous noises and consists of a bank of low-capacity fixed condensers connected across the loud speaker. A switch, of the tapped type commonly used for inductances, may be mounted on a small board or panel and the condensers arranged for short connections. The fixed condensers, from left to right, should be of the following values: .001, .005, .01, .05 and .1 mfd. The greater the capacity in the speaker circuit, the better the elimination of the higher extraneous frequencies. Fig. 2 shows a variation, the degree of filtering being controlled by the variable resistance. In Fig. 3 the filter is designed not only to cut off the high-frequency noises, but also to compensate for peaked amplifiers and reproducers. As in Fig. 2, the degree of filtering is controlled by the variable resistance. Using the given constants, the filter will cut down audio frequencies around 3,000 cycles most of all, and diminish higher frequencies somewhat.

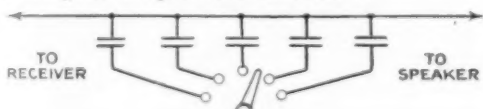


FIG. 1

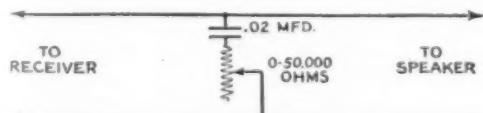


FIG. 2

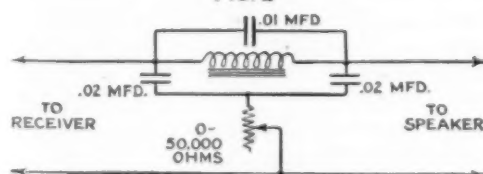


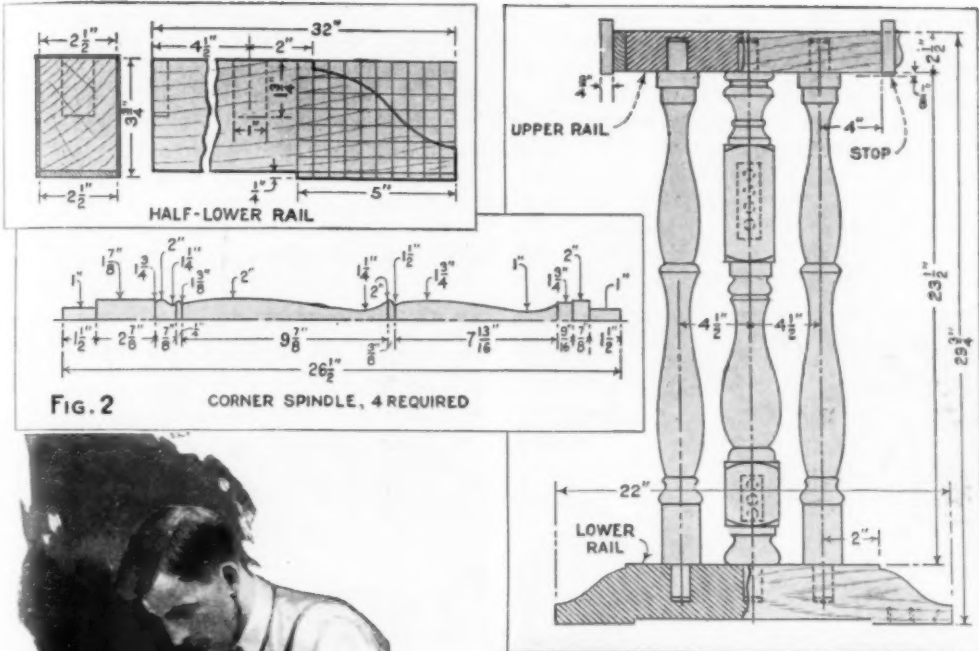
FIG. 3



Front View Showing Portable Receiver Ready for Use; Below, Back Opened Showing Arrangement of Tubes and Batteries

Portable Receiver Is Equipped with Screen-Grid Tube

A portable radio set employing a screen-grid tube and four tubes of the 199-type is now available. It is so compact that it may be taken anywhere as easily as your luggage. Programs may be enjoyed from distant stations with this set because the screen-grid tube is many times more powerful than the ordinary tube, yet requires only .132 amp. and operates on 3.3 filament volts. Therefore such a tube is ideal for portable sets where dry cells must be used for the A-battery supply. The volume and fidelity of tone are surprising; the loop antenna is inclosed in a frame in the hinged cover and need not be detached. Binding posts are provided for external antenna and ground connections when extra-loud reproduction is desired on distant stations. The volume, when so connected, is equal to that of the average stationary, five or six-tube set. When fully equipped the set weighs only 30 pounds, and is not as large as the usual Gladstone bag. The rear cover is hinged to give easy access to the batteries. Three No. 6 dry cells furnish the A-supply and the B-battery consists of two medium-sized 45-volt units.



Left, Scribing the Centers of the Square Sections on the Center Spindles; Right, Rounding the Corners; Upper Right, End Elevation, Showing Rails, Corner and Center Spindles

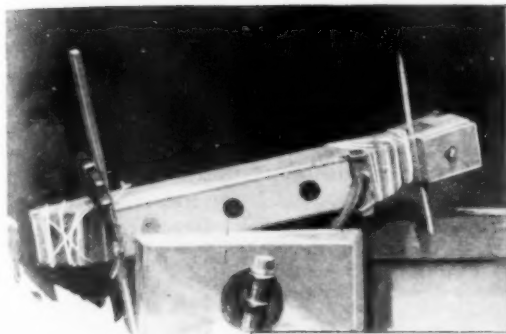
larly if a good-sized skew chisel is not at hand, and the home mechanic may find it easier to trim them after squaring up, using a narrow chisel.

When the dowels of a center spindle are turned, remove the piece from the lathe and saw to length. Lay it on a bench, blocking the square sections if necessary, and with dividers set to the center, scribe lines on two opposite sides of the flat parts. From these base lines, draw lines establishing opposite sides and reduce one section to squareness. Then aline one face of the other section, testing by sighting over a straightedge balanced on corre-

sponding faces and finish squaring that part. Lastly, round the corners to a radius of $\frac{1}{4}$ in., and fill. The corner spindles, shown in Fig. 2, are turned from rough 2 by 2-in. stock.

The upper rails are dimensioned in the end elevation at the right, Fig. 2. Cut 17-in. lengths of 3 by 3-in. pine or fir, which, mill-surfaced on four sides, is about $2\frac{1}{2}$ in. net. Bore the dowel holes before veneering the sides.

Surface a piece of walnut, $2\frac{3}{4}$ in. wide, gauging the edges for a veneer thickness of $\frac{1}{8}$ in. Rip alternately from one edge and then the other. Veneers less than

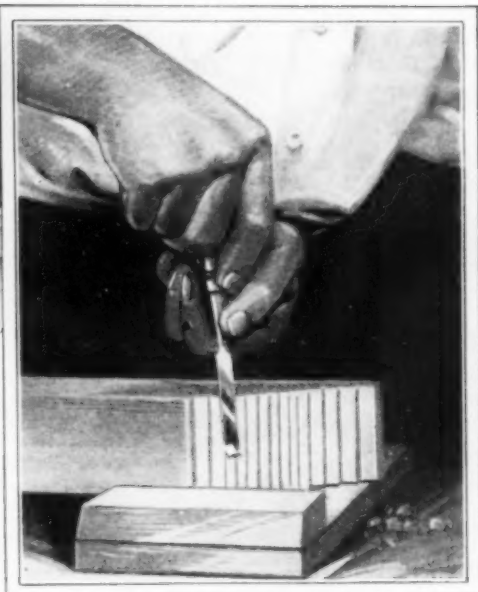
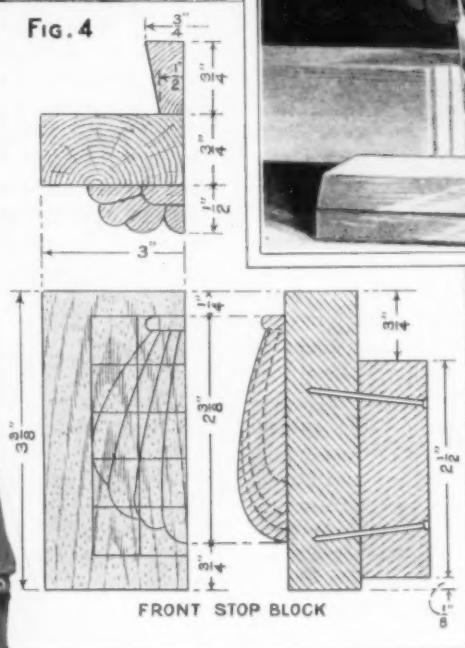


Above, End Veneer Clamped in Vise, Showing the Method of Lacing the Veneer to the Curves for Gluing; Below, Smoothing the Stretcher-Rail Arches with a Half-Round File; Right, Details of the Stop Blocks and the Carved Seashell Ornaments for the Stand Ends; Upper Right, Shaping the Lower Rail Ends, Chipping Out the Waste and Trimming Smooth with a Chisel



Size the end grain with glue so that it can dry while the veneers are being made. Glue on the side veneers as described for the upper rails, trimming them to the profile when dry. Cut the curve veneers less than $\frac{1}{16}$ in. thick and soak them in water. Glue in place while still wet, holding the upper ends with clamped blocks while lacing the rest to the curves and using thin blocks to distribute the pressure, as shown in the upper left-hand photo in Fig. 4. Small wedges, forced in here and there, will tighten contrary places. Hold the ends with clamps improvised from pairs of blocks held with bolts through the centers.

FIG. 4



The small vertical end veneers at the top of the curves can be held in place by the clamps holding the curved veneers, but the lower end veneers must be glued after the curves are trimmed, being secured by clamps lengthwise of the rails. The top veneers are put on last. When dry, surface these to $\frac{1}{32}$ -in. thickness and round the corners slightly, to prevent wear of the finish at these points and also to hide the joints.

Fig. 3 dimensions the stretcher rails. The upper is cut from 1 by 4-in. rough walnut, hand-surfaced to get the maximum thickness. Cut to length and bore the four $\frac{1}{2}$ -in. dowel holes in each end. Lay out the carving and the arches, noting that the centers of the latter are $\frac{1}{4}$ in. above the lower edge, to avoid the effect of flatness. The lower edge of the carving is curved to a radius of $5\frac{3}{8}$ in., centered on the arch diameters and $2\frac{3}{4}$ in. below the centers.

Cut the arches with a keyhole saw. Smooth them with a half-round file moved

from left to right at right angles to the sides, pushing forward with a twisting motion at the same time to get a shearing cut. Occasionally trim off the back



Sanding the Arches

corners to prevent splinters from being raised. Use a sawed-out block for sandpaper backing.

The lower rail is $\frac{1}{8}$ in. shorter than the upper and bored with dowel holes in the upper edge to fit those in the upper rail. Most of the carving can be laid out with gauge and try-square. The curved centers are traced from a cardboard pattern. Outline the carving of both rails with a narrow chisel, held vertically between the fingers and struck lightly with a mallet. Keep $\frac{1}{16}$ in. inside the lines. Trim the center to a flat ground, $\frac{1}{8}$ in. deep, when the edges may be pared to the guide lines.

Make a matting tool by filing a flat end on a large spike, across which two pairs of V-shaped grooves are filed at right angles to each other with a three-cornered file. With this tool, go over the carved ground, striking it light blows with a small hammer. Cut the ends of the lower-rail ornaments to line with the borders and vertical bars, curving them back $\frac{1}{4}$ in. to give the appearance of passing under. The depth at these points is $\frac{1}{16}$ in.

The pyramidal center ornaments are cut with four vertical strokes of a $\frac{3}{8}$ -in. chisel, held beveled side in, the center then being sloped from the four sides. The blossom ornaments on the upper rail consist of four simple elliptical depressions. A $\frac{1}{2}$ -in. turning gouge is excellent for this part of the carving.

Turn the five spindles as dimensioned at right in Fig. 1, from 1-in. stock. If flats appear, turn them to the back in assembling, and they will not be seen. Fit the dowels loosely enough to the rails to permit trial assembling before gluing up. Assemble the end frames, and set them in such a position that the rails will line with each other. Test for squareness and allow the glue to dry.

The stop blocks that hold the case in place are detailed in Fig. 4. The dovetail cleats are both glued and nailed to their backs. The front blocks are enriched with a carved seashell on each. Make a paper pattern of the outline. With a coping saw cut out two blanks, to be shaped to the profile shown with a sharp chisel. Draw the veins with a pencil. Cut these deeply with an eye tool and round off the sections individually, smoothing well with a chisel. The high spots may be rubbed off with sandpaper. Put a dab of glue in the center of the carving and its block, and press the shell in place with the small end $\frac{1}{4}$ in. from the top.

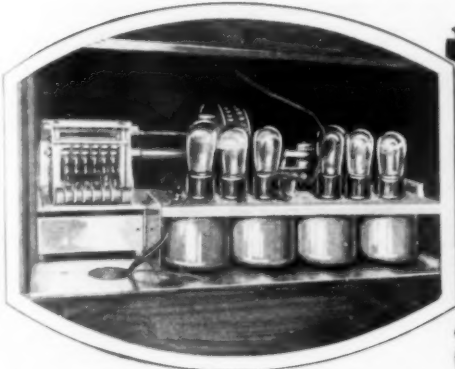
When the stand ends are dry, mark the dowel-hole positions from the holes in the stretcher, and bore them $1\frac{1}{2}$ in. deep. Assemble the stand by clamping as directly over the rail ends as possible, squaring by holding a framing square against the stretcher and sighting across the tongue at the footrail. To attach the stop blocks, bore $\frac{3}{4}$ -in. holes, vertically centered $\frac{3}{4}$ in. from the ends of the upper rails. Saw out wedges $\frac{1}{2}$ in. wide in front. Drive the glued stop cleats in from above, until the blocks project $\frac{1}{8}$ in. below.

(To Be Continued Next Month)

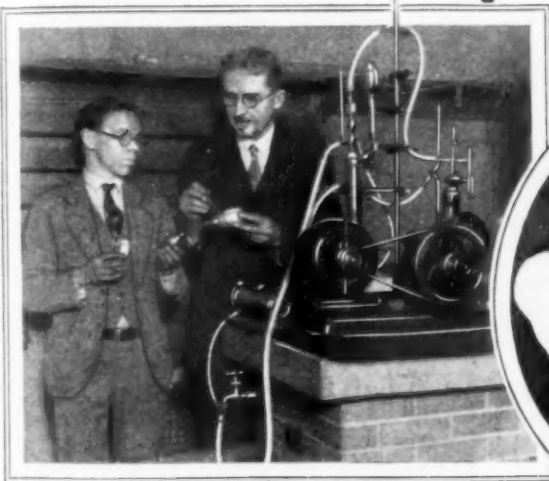
Special Fuses Needed to Protect the A. C. Receiver

The modern a.c. receiver should be protected by small fuses in the supply line, as serious damage to the set might occur before the 10 or 15-amp. house-line fuse would blow. A small standard fuse of about 2 amp. should always be included as a part of the receiver installation and inserted in one side of the 110-volt line. The use of such fuses will meet with the approval of the fire-insurance underwriters and provide protection to the receiver and tubes at a cost of but a few cents.

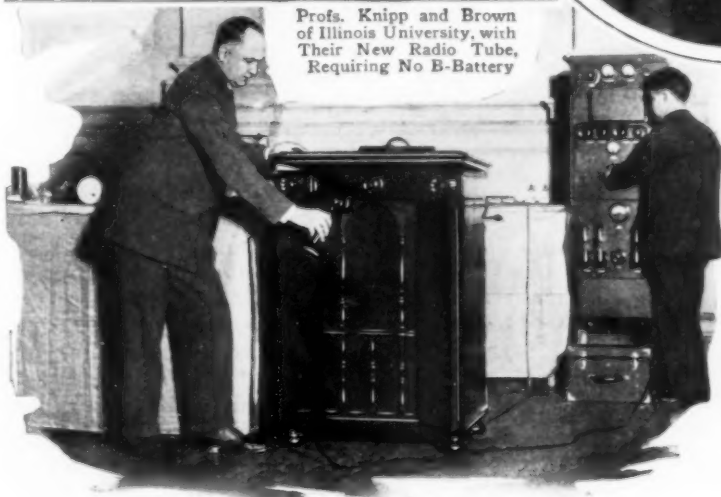
Facts and Fads for Radio Fans



Right, Comm. E. F. McDonald, the Arctic Explorer, Demonstrating the New Automatic Radio Receiver Which Is Operated by Pressing One of a Series of Buttons That Automatically Tunes In the Particular Station Desired; Left, an Interior View, Showing the Tuning Mechanism



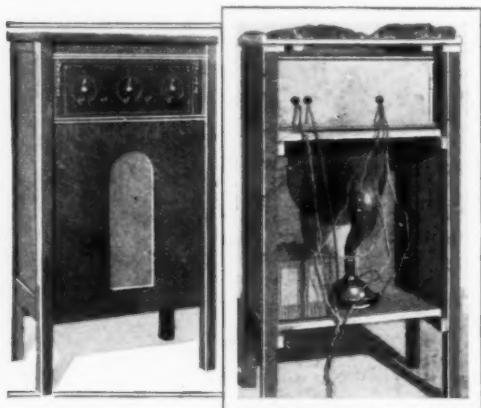
Profs. Knipp and Brown of Illinois University, with Their New Radio Tube, Requiring No B-Battery



Above, Jerry Fasano, of New York City, Builds Loud Speakers that a Violin, Mandolin or Guitar Is Made; These Speakers Are Said to Reproduce the Clear Tones of Each Instrument in the Orchestra as Sent Out from the Broadcasting Station; the Builder Is a Musical-Instrument Maker and Has Devoted Much of His Time Recently to Perfecting Loud Speakers of This Type; Left, Sergius P. Grace, of the Bell Telephone Laboratories, Demonstrating a New Electrical Machine for Converting Speech into Gibberish and Turning It Back to Normal at the Radio-Receiving End for the Purpose of Transmitting Secret Telephone Messages

Modernizing Old Installations

The radio installation of a year or so ago, with the old-style gooseneck speaker and batteries scattered around, is now



Left, Front View with Set in Position; Right, Rear View, Showing Arrangement of Speaker and Batteries

quite out of date, and justly so, both from a point of neatness and efficiency. The table cabinet housing the set is usually presentable and may be combined with a homemade console-type cabinet as shown. The cabinet is 44 in. high, 24 in. wide and 13 in. deep, the front and side panels being of three-ply veneer taken from an old wooden bed. The opening in the front panel may be cut with a coping saw or sharp knife and the edges neatly finished and stained. This opening is then backed with gold cloth in the manner of the usual console-speaker grill. The horn is placed just back of this opening, and the batteries may be arranged on either side. In building the cabinet, no set rules or dimensions were followed. There is no need of a back, except a curtain to keep out the dust.—Irvin L. Oaks, Pleasant Hill, Ohio.

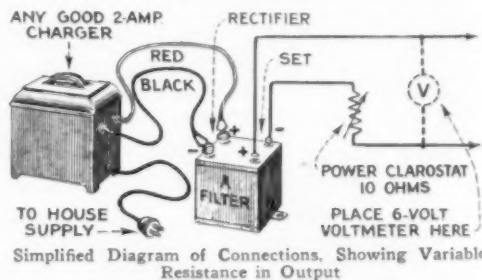
Screen-Grid Tube Kinks

The wide-spread interest in the new screen-grid tubes encouraged many experimenters to build sets employing them, but in some cases the results were not what the builder expected, owing to his ignorance of their proper use and installation. It must be remembered that in dealing with these tubes certain precautions must be followed if the extraordinary possibilities of the tube are to be realized.

The first is that of careful and complete shielding of each r.f. stage and the second, correct design of the r.f. or coupling transformers. There is nothing about the new tube that will eliminate undesirable inter-stage coupling in electromagnetic and electrostatic forms, and therefore shielding in a two-stage screen-grid amplifier must receive approximately the same attention as would be given to a four-stage r.f. amplifier. To be at all effective, shielding must include not only the metallic protection used to isolate each r.f. stage but also some means of preventing coupling through the battery or eliminator circuits. Very thin shields are practically useless; aluminum used for the purpose should be .08 in. thick, copper may be thinner but should not be less than .05 in. in thickness. The lead from the plate of one tube to the coil of the next stage should be shielded by means of a small grounded metal covering such as tubing. To eliminate battery coupling, use r.f. chokes and by-pass condensers in the plate circuits.

Direct A-Supply from Charger

An A-filter device has recently made its appearance on the market which may be attached to any good 2-amp. charger for complete elimination of the A-battery. It consists of the necessary chokes combined



in a single case with a condenser block of 7,600 mfd. A battery charger capable of delivering 2 to 3 amp. and a means of voltage regulation, either by taps on the transformer or by a heavy-duty rheostat in the secondary, are required. A trickle charger cannot be used except possibly for dry-cell sets using the 199-tubes, with a total filament-current consumption not in excess of the charger output. Trickle chargers cannot be used for more than two of the A-type tubes.



Fading Signals in A. C. Sets

The radio user who has changed to an a.c.-operated set is often puzzled by fading signals that did not occur in the battery type. One moment the signal from a local station will be loud and then, apparently for no reason, it will fade below normal. The interesting thing about this is the length of time between the high and low-volume points, for the signal fades for prolonged periods unlike the fading caused by natural conditions. The trouble is not to be found where you would expect it. So, do not blame the tubes or the set, as all the trouble lies in the supply current. Upon checking up the current drawn from the house-lighting circuit, it will be found that fading occurs at the times when an extra load has been placed upon the supply. Most houses are wired to handle only a moderate amount of current, and when electric heaters, toasters, vacuum cleaners and flatirons, not to mention washing machines and refrigerating devices, are used, the load on the light circuit exceeds the carrying capacity of the

wiring. The result is a drop in the signal strength. This drop affects the household devices only slightly, but the transformers that furnish the current to the set are immediately affected by the reduced supply. Voltage-regulating devices are now on the market to relieve this situation, and closer attention to this factor at power houses will also do much to improve conditions.—J. B. Bayley, chief engineer, Station WAAT, Jersey City, N. J.

Razor Blades Make Headphone Diaphragms

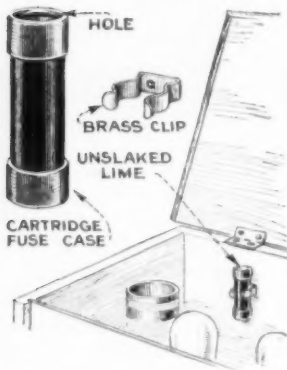
Aboard ship, there are times when we have to use headphones in officers' quarters so as not to disturb those who might be sleeping. While experimenting with these in the usual loud-speaker jack to retain the full efficiency of the set, I hit upon the following idea which smooths the volume and brings out the bass notes with surprising results: Unscrew the phone caps, take out the diaphragms and use thin safety-razor blades instead, placing one in each unit. Cut note-paper disks, using the dia-



Phone Cap and Diaphragm Removed for Substituting Paper Disk and Razor Blade

phragm as a template, and place a disk in each unit so that the blade will not come in direct contact with the magnets of the phones; then replace the screw caps in the usual manner. Fairly heavy note paper of good quality may be used, although the writer made them from a magazine cover because that thickness seemed to give better results.—A. R. Snyder, radio operator, S. S. "Delta Queen," San Francisco, California.

Keeping the Set Dry



A handy device for keeping moisture out of the radio set may be made from an old cartridge-type fuse filled with unslaked lime. The case is cleaned and the fuse link taken out, the cap at the upper

end being left open by removing the large washer used for holding the link. This cap may be left off if there is no hole at the top, or a few small holes may be drilled in the cap. The case is then filled with unslaked lime, which absorbs moisture readily. A small clip, made of brass or copper, is fastened inside the cabinet as shown in the sketch, and the fuse case is then slipped into this clip. To test the efficiency of the device, place it under a glass with a few drops of water; if the lime is fresh the water will disappear almost immediately.—H. R. Wallin, commercial radio operator, Brooklyn, N. Y.

Proper Tube Selection

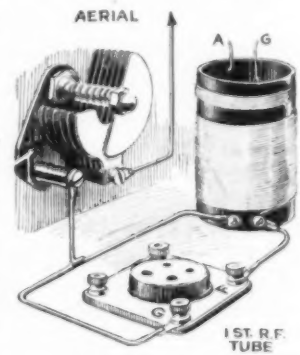
There are now a number of special-purpose tubes on the market designed for highest efficiency in the position they are to be placed in the set. More and more radio builders are realizing the importance of selecting such tubes for specific positions, yet many are still content to count the sockets and order as many A-type tubes. Needless to say, this is very poor practice and the results will not be those

obtained by proper selection. Manufacturers of radio tubes are well informed as to the characteristics of their product; therefore, if the carton states a certain B and C-voltage combination, use the voltages specified. Never increase the B-battery voltage beyond the limit marked on the packing slip and be sure the C-voltage is correct for that value. The operator may find that, when using 135 volts of B-battery, there is no noticeable difference in the loud speaker, whether $4\frac{1}{2}$ or 9 volts of C-battery is used, but it makes a big difference in the life of the tube and B-battery. Before deciding to use a 171, 112 or 240-tube, look over the data on these tubes and use the information to determine which you need in your particular set. Some experimenters are inclined to employ special-purpose tubes in positions where they are not specified in the circuit; sometimes they work, but appearances are deceiving and the tube will probably not last long. It is well to remember that the manufacturer has spent thousands of dollars to determine the proper conditions under which the tube is to be operated and the user will profit by following the directions carefully.—John B. Eccles, studio director, Station WJR, Detroit, Mich.

A Handy Aerial Kink

When an indoor or a very short outdoor aerial is used with the standard broadcast receiver, a great deal of distance-getting ability as well as volume is lost. This may be remedied by means of a small variable condenser of

the midget, or balancing, type. Remove the aerial lead from its binding post on the set and connect it directly to the grid of the first tube, with the midget condenser in series, as shown in the sketch.—Bert E. Smith, engineer, Allan D. Cardwell Mfg. Corp., Brooklyn, N. Y.

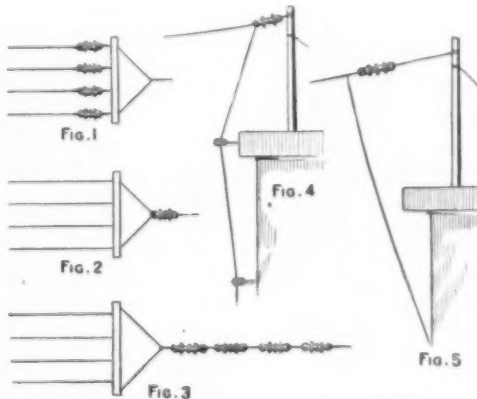


Safety Insulation for Screwdriver

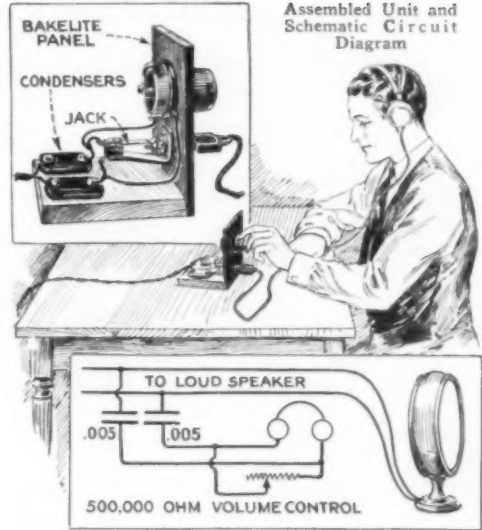
When minor adjustments are necessary in a radio set, the handiest tool available is, of course, the screwdriver, but to be used safely its metal shaft should be well insulated in order to avoid damages to the set—often expensive—through short-circuiting. Select one having a long shaft which will permit clear vision when working in different locations and insulate the shaft with a length of rubber tubing long enough to cover all the exposed metal surface except the tip.—M. M. Paggi, chief engineer, Station KFWO, Catalina Island, California.

Misused Antenna Insulation

Insulators, properly used, are an important part of the antenna system, but many believe that the more insulators one uses the more effective will be the insulation. This is not altogether true, as a little thought will show. An antenna with the insulators placed as in Fig. 1 is a common sight. No doubt it works, but the designer is not getting full benefit of his insulators, as the total resistance of the latter, when connected in parallel, is much less than that of one single insulator, placed as shown in Fig. 2. If the insulator supply is plentiful, several may be used in series, as shown in Fig. 3, with greater efficiency, since the full resistance value equals the sum of the individual insulator values. Another misuse is shown in Fig. 4. The writer has noted that the tendency seems to be to use stand-off insulators for the lead-in wire at points where they are not needed. These insulators decrease the efficiency of the antenna and are unnecessary if the lead-in is extended beyond the building as shown in Fig. 5. In this case, the lead-in may be brought directly to the set.—C. Harold Campbell, engineering department, Station WICC, Bridgeport, Connecticut.



Proper and Improper Use of Aerial Insulators

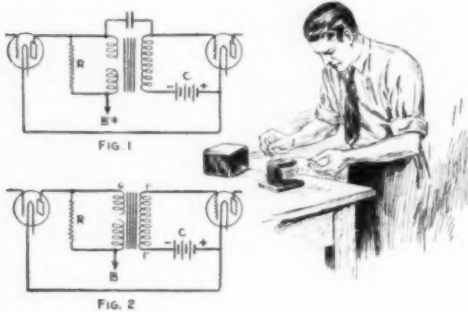


Headphones on Loud-Speaker Lines

An idea that I have found useful when small volume is required for operating headphones from the same lines that are operating loud speakers, may be helpful to others. The accompanying sketch and illustration show how this may be done without reducing the volume of the speakers. The idea is especially applicable to home receivers where no phone jack is installed in the set. It is also handy where several speakers are used at remote points and the listener at some particular point desires less volume. A 500,000-ohm variable resistance is placed across the phones to control the volume, and the fixed condensers in the line prevent shorting the loud-speaker leads which would reduce their volume. A simple panel arrangement, such as shown, will be handy for tapping the speaker line at any convenient point. This unit can be permanently connected to the speaker line and the phones plugged in whenever desired.—H. B. Nebe, chief engineer, Station WSMB, New Orleans, La.

Repairing A. F. Transformers

The writer was recently called upon to rewire a radio set employing a two-stage tuned-impedance a.f. coupling unit. After



the set was completely wired, it was found that the primary winding of the first tuned-impedance coupling unit was open, that is, it was burned out. As the customer was in a hurry and the writer did not have time to put in a new coupling unit, the repair method illustrated in Fig. 1 was used with good results. A non-inductive resistor R , of about 100,000 ohms, was shunted across the primary winding as shown, and the ear could not distinguish any difference in reception then and after a new coupling unit was installed. Later we had a similar case where the open was in the primary of an ordinary a.f. transformer. The same method was used here and with approximately the same results. A 100,000-ohm resistor was connected as in Fig. 2.—G. N. Garrison, consulting engineer, East Orange, N. J.

Neutralizing R. F. Stages

Oscillation in the r.f. stages may be controlled very simply by shunting a variable 800-ohm resistance across the primary of each r.f. transformer, as shown in the diagram. Receivers employing this method of neutralization have done amazing DX-work, and the quality of the signal is par-

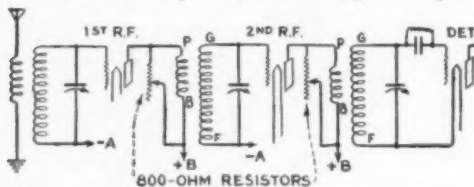


Diagram Showing the Variable Resistors Shunted across the Primaries

ticularly clear. The adjustment is very simple; set the dials at the lower end of the broadcast band and adjust each resistance so that no oscillation will occur at this point. At this setting, the receiver will not oscillate at any point within the broadcast band, and is ready for operation.—M. J. Weiner, chief engineer, Station WODA, Paterson, N. J.

Reducing Local Interference

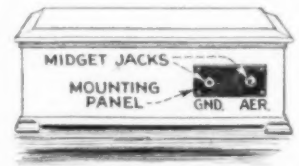
Noises and interference picked up by a receiver in a building lighted by electricity are largely brought in over the supply line. These noises may be reduced and often eliminated by using r.f. choke coils in the lighting line. A coil consisting of 20 ft. of wire, of the same size as that used in the house wiring, may be wound on a broomstick and cut into each side of the line at the meter. The coils will not interfere with the light line but will choke r.f. currents that follow it, thereby reducing the noises. They also prevent r.f. energy generated by apparatus in the building from being transmitted to the neighbors.—Chas. Middleton, chief engineer, Station WRAF, LaPorte, Ind.

Aerial and Ground Connections

Frequently the housewife would like to dust behind the radio console or radio table, but hesitates to do so for fear she may seriously interfere with the aerial and ground connections. The very simple arrangement shown was devised by me and has solved the problem. A hole, about 2 in. wide and 3 in. long, was cut in the rear of the cabinet and covered with a piece of bakelite; two midget jacks were mounted as shown and leads soldered to them and connected to the ground and aerial posts in the set. The external leads were identified with tags and connected to midget plugs. These plugs may be withdrawn when cleaning and then replaced.—J. B. Bayley, chief engineer, Station WAAT, Jersey City.



MIDGET JACK AND PLUG



REAR VIEW OF SET

AMATEUR MECHANICS



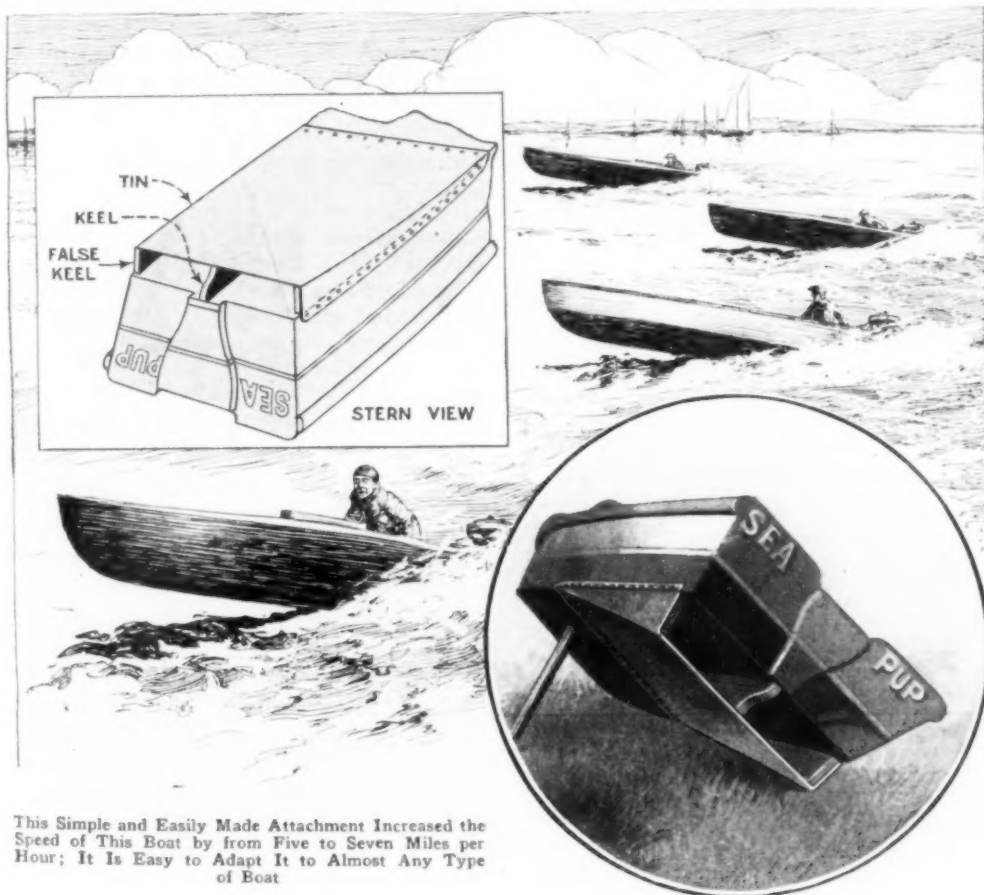
More Speed from the Outboard Boat

By CLYDE HANSLEY

THE OUTBOARD motor fan who would like to increase the speed of his boat by from five to seven miles an hour will find the simple plan described in this article well worth a few hours of his spare time. It can be adapted to almost any type of hull, and, for those who like speed

but cannot afford a specially built boat, or who doubt their ability to build one, it offers a very satisfactory substitute. The writer tried it out on an ordinary skiff, and the results were splendid.

The first step is to take careful measurements of the keel of the boat. From these



This Simple and Easily Made Attachment Increased the Speed of This Boat by from Five to Seven Miles per Hour; It Is Easy to Adapt It to Almost Any Type of Boat

measurements, make two duplicates of the keel—the false keels—and screw one of these to the underside of the stern, on each side, as shown in the accompanying drawing. It will be noted that, on the original boat, the keel, and consequently the false keels also, taper from the stern to a point 4 or 5 ft. forward. If the keel on your boat is straight, it is usually not a difficult matter to replace it with a keel that will taper from a 6 or 8-in. depth at the transom (sternboard) to a thin section forward. When attaching keels, use either galvanized or brass screws, or bolts. They can be nailed in place, but nails may cause leakage and cracking later on. Next a piece of tin or light galvanized iron is cut to fit, bent and screwed or bradded forward and along the sides of the false keels as in the drawing. That is all there is to it.

When the hull is at rest, there will, of course, be water between the metal plate and the bottom of the hull. When the boat is under way, and when a speed of more than eight miles an hour is attained, the hull will begin to "plane," and the stern section will glide along on the metal. This allows the water to drain out of the hollow stern, and seems to form an air cushion, which adds to the speed, as the stern, instead of dragging, now glides on the surface of the water.

Locks for Windows

Numerous houses in the vicinity had been entered by thieves, and the problem of making the windows as secure as possible, came up the last minute before going on a summer vacation. Window catches in general use are so easily broken or sprung that it was decided to fasten



the sash by drilling a hole directly under the catch from the inside but not quite through the outer sash, and slipping in a ten-penny nail. This not only reinforced the catch, but prevented a blade

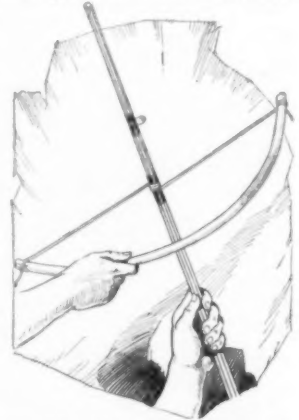
from being slipped in between the sash to unlock the catch.—C. D. Paterson, Worcester, Mass.

Repair of Rubber Balls

Rubber balls of the air-filled type lose their bounce, if there is a small hole in them through which the air escapes. An effective repair can be made by forcing air into the ball with a bicycle pump, holding the hose tightly over the hole while pumping. Then remove the hose quickly and apply a rubber patch, the surface of the ball having been previously cleaned and coated with rubber cement. The cement should be thoroughly dry before applying the patch.—F. H. Taylor, Stratford, Can.

Loosening Stiff Fishing-Rod Joints

Telescope joints of new fishing rods frequently stick so that it is extremely difficult to loosen them without damaging the rod. A Wisconsin fisherman, experiencing this difficulty, made a small bow from a twig and split the ends to receive a length of fishline, as shown in the drawing.



When the line is wrapped a few times around the joints of the rod, the bow is operated to slide the line over the joint.

This produces considerable heat, expanding the outer ferrule of the joint so that the rod sections can be pulled apart without the least difficulty.

Corkscrew for Untying Knots

When one wishes to save a string in which there is a hard-tied knot that defies ordinary means of loosening it, it is well to try to unfasten it with the aid of a small corkscrew. One trial will convince you that it is about the handiest and most effective tool for this purpose.

Cleaning Old Paint Brushes

Old paint brushes, which have been allowed to become stiff or caked with paint to such an extent that turpentine does not loosen the bristles, can be softened in the following way: Take a package of any of the well-known brands of powdered soap and make a very thin paste, using cold water. Let the brushes soak in this paste until they are soft. Any brushes worth saving at all will come out clean and pliable.—John M. Lang, Portland, Oreg.

Pads for Winding Coils Prevent Finger Injuries

In winding radio coils or magnets one's finger tips are usually blistered by friction against the wire as it slides between them. A pair of small pads for the fingers will make the job much more comfortable in this respect. Sew a piece of felt to the inside of the thumb and forefinger of a pair of old gloves. When wearing these, the wire can be grasped and allowed to slide through without risk of injury.

House Numbers Made from Old Auto License Plates

When it is necessary or desirable to provide large house numbers in order to insure greater visibility, get some old auto-license plates. Cut out the numbers with a pair of tin snips, punch holes through each number at the top and bottom for small screws or nails, with which they are fastened. Such numbers are very neat and can be seen for a considerable distance.—Frank W. Bentley, Jr., Missouri Valley, Iowa.



Large, Visible House Numbers Can Be Made from Auto-License Plates



Elastic Stay Ropes for Tent Hold It Taut and Help Prevent Damage to Canvas

Elastic Stay Ropes for Tents

Rubber bands, made by cutting old inner tubes lengthwise, can be used as part of the stay ropes of a tent, and will keep the canvas taut, so that it sheds water more readily. Equipped with these, a tent will also withstand a high wind without damage as the elasticity of the rubber prevents sudden jerks, which strain the canvas. Similarly, damage is prevented if it should happen that a person or animal trips over the stay ropes.

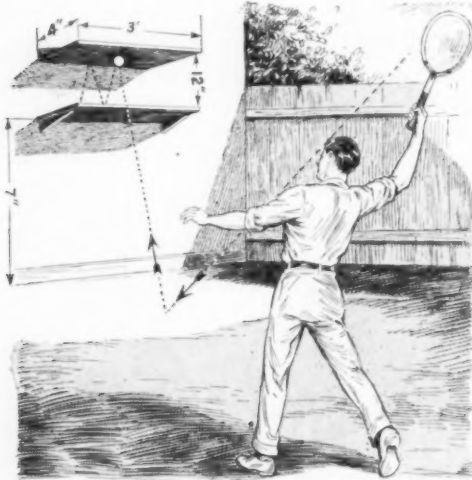
Waxing Surface of Photographs

A pleasing finish can be given to photographs by waxing the surface with ordinary floor wax. It is applied and polished in the same way that it is used on woodwork. This kind of finish is especially suitable for photos that have been tinted with oil or water colors, as it forms a protective coating and at the same time removes many irregularities. Two applications may be necessary before a perfectly even coating is obtained.—Walter E. Burton, Kenmore, Ohio.

Erasers can be kept in good condition by rubbing them on fine sandpaper.

A Solo Tennis Game

Every tennis player has felt the desire to get out and play at times when neither court nor partner are available. As a



Game for the Lone Tennis Player Which Gives Exercise and Tests Skill

substitute outlet for one's energies, the simple game illustrated in the drawing has been found satisfactory. Two boards, 4 in. wide and 3 ft. long, are attached to a wall about 1 ft. apart, the lower one 7 ft. above the floor or ground. From a stand 12 ft. away, the player serves the ball against the ground so that it rebounds, strikes the upper board and rapidly vibrates between the boards for some time. Failing to do this, the ball rebounds and returns to the player so that, if he is skillful, he can return it time after time. One such set-up has often been in use continually the whole day, some players becoming able to place the ball between the boards several times in succession.

Improved Blower for Church Organ

We have a large reed organ in our church, and it requires a great deal of pedal work to keep the bellows inflated. Electric blowers for reed organs could not be had for less than \$100, and we did not feel justified in making the purchase. A good substitute, however, was improvised. An ordinary vacuum cleaner was obtained and a hole was cut in both the back of the bellows and the floor, to ac-

commodate the length of hose which came with the cleaner. The hose was attached to the bellows, extended through the floor to the vacuum cleaner, which was set on a shelf just below the bellows. A switch near the keyboard controlled the cleaner. Plenty of pressure is obtained in this way. —Warren Brown, Galesburg, Mich.

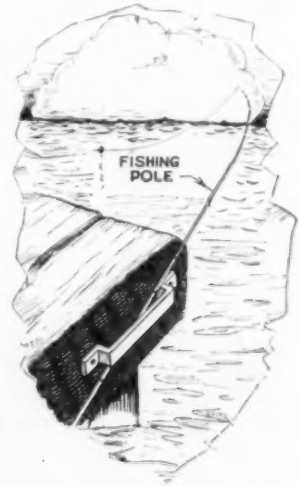
Timesaving in Casting Type

In print shops that do casting from mats, it is often necessary to cut a hole in the finished cast, inside of the border, to insert the firm name, or a price, etc. The average shop does not have a router or jig saw with which to cut this hole, and it is a long and tiresome job to do the work by hand. A quick and efficient method of providing for the hole at the time the casting is done is to cut a block of wood, the size of the desired hole, and nail it to the mat in the proper place. The wood base of an old stereotype can be used for this purpose. When the cast is made, the metal will flow around the block and form the hole. —Fred Birch, Jr., Glendive, Mont.

Holder for the Fishing Pole

When fishing from a dock or pier, one cannot lay the fishing pole down without risking that it may be pulled into the water

by an energetic fish that takes a notion to bite just when you are not looking or, occupied in preparing bait, etc. One fisherman experiencing this trouble had a simple holder made from a piece of flat iron, bent to the shape shown. It is nailed to the



edge of the dock so that the end of the pole can be inserted in it and will then be held securely against the pull of any fish. —W. Kuecker, Chicago, Ill.

Make This Color Bookplate Stamp

For making a bookplate stamp, odd pieces of rubber tile and smooth linoleum flooring will be found handy, and this material can be obtained almost anywhere. Lay out the design on a piece of paper, making a reversed carbon copy on that paper and on as many other sheets as are

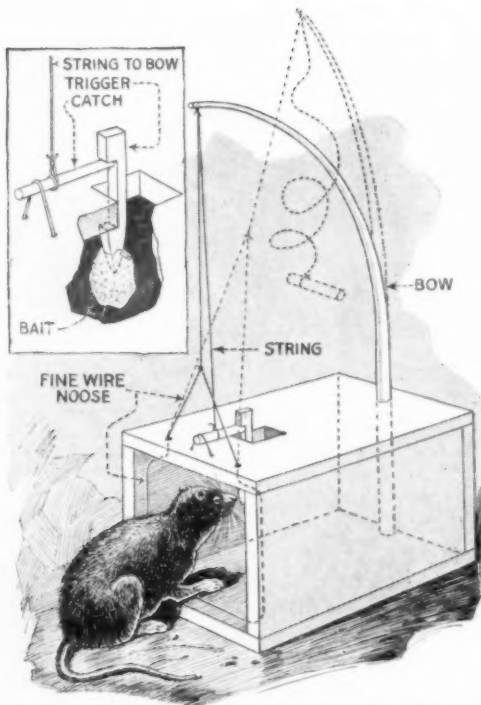
a good grade of glue. To insure that all the stamps register, or print in the proper space, a clamp of the kind shown in the



necessary to make up the desired number of stamps for the various colors of the bookplate. The outline of the stamp in actual size should be laid out at the same time so that both copies can be matched. Cut the linoleum or rubber to the size of the stamp, making two, three or more pieces, according to the number of colors to be used. On the smooth side of these pieces, glue carbon copies of the design. The parts to be of one color can be cut in relief by means of a sharp safety-razor blade. Cut away the part not to be printed, leaving only the design raised. To obtain a straight-line cut, press the sharpened edge of the blade straight down or at a slight angle into the material along the line, as shown at A in the detail, and cut away the undesired portion at an angle, as at B. After cutting the patterns, they can be mounted on wooden blocks to which suitable handles are attached. The mounting is done by means of tacks and

drawing can be made up. It consists of a base to which an L-shaped piece of wood is attached, a flat spring being fastened to this piece as indicated. In printing, several sheets at a time are held in the clamp, and the stamp is held against the corner of the L. Each stamp is printed in its color in turn. It is advisable to use printers' ink on these stamps. The ink is spread out on a flat piece of metal, and a hard-rubber roller is run over the ink, the ink adhering to the roller being transferred to the stamp by passing the roller over it. With reasonable care some fine prints can be made in this way.—F. Paulsen, Pittsburgh, Pa.

☐ Before storing rugs and carpets, clean them thoroughly and, after spreading them out, cover with paper that has been sprinkled with turpentine; this protects them against moths. Also wrap them in paper, gluing all overlapping edges.



Any Boy Can Make This Bow Trap for Catching Rats and Mice

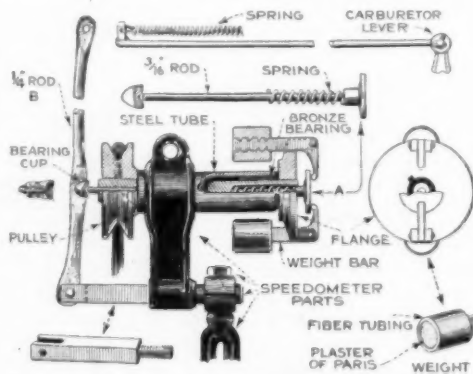
How to Make a Bow Trap

A bow trap is easily made and is very effective for killing rats and mice. To make one suitable for rats, nail together four boards, 8 in. long and 5 in. wide. Drill two holes, 1 in. from one end, to hold the bow as shown. Also cut an opening, 2½ in. from the opposite end, for the trigger. Drill two holes, 2 in. in front of the trigger hole, for the noose, which should be made of fine wire. The bow is then attached; it should be quite supple and strong. Whittle out the trigger and catch, and nail a small loop of string to the box to hold down one end of the catch, the trigger being used to hold the other end. Tie strings from the bow to the noose catch as indicated, carefully taking

up all slack from the noose. Adjust the catch string so that the noose will fill the space in the box opening when the trap is set.—W. A. Bonsfield, Wellesley, Mass.

Governor for Stationary Auto Motor

The drawing shows a simple governor to keep steady the speed of an auto motor used as a stationary engine. The device was built around the steering-knuckle clamp portion of a speedometer-cable fitting. The bearing housing for the governor spindle consists of a length of steel tubing, held by the clamp, and into the ends of which bronze bushings are pressed. It may be found necessary, with some clamps, to ream them out to fit the tubing. The shaft carries a V-pulley on one end, and a flange, turned from a Ford starting-clutch ratchet, on the other. The flange is slotted to carry the governor weight levers, and the slots must be no deeper than necessary, in order to prevent the weights from striking the bearing housing. The shaft is bored for a ¾-in. rod, A, which is provided with a disk soldered to one end, and a 3 or 4-lb. coil spring. The shaft and rod are assembled as shown. The weight levers are filed from ¾ by 1½-in. steel, and carefully fitted. The weights consist of ¾-in. fiber tubing, filled with plaster of paris. Lead cannot be used because of its inertia at high speed. The control lever, B, must be made to suit the throw of the throttle lever on the carburetor used; ¼-in. bronze rod was used for this part on the original. The bearing cup on rod A is filed and drilled as indicated, then soldered to



Constructional Details of a Homemade Governor for a Stationary Auto Motor

the end of the rod, after the bracket that supports the control lever has been screwed in place. A long rod, shown at the top, connects the control lever to the throttle lever on the carburetor, and a screen-door spring, fitted as indicated, serves to keep the throttle closed and to adjust the speed.

Boomerang Throwing is Great Sport

by Keenan
H-Ward

ZIP! Away it goes, skimming the surface of the ground for a distance of 250 ft. or more, and then, rising like a bird in its flight, it wheels and comes hurtling back to the thrower, landing almost at his feet. Believe it or not, there's real fall sport in boomerang throwing.

The boomerang comes from Australia, where the flat country makes an ideal arena for their manipulation. The little brown Bushmen of the Arunta tribe, who depend on them almost entirely for hunt and defense, make no less than twenty different forms of boomerangs, ranging all the way from a 14-in. bird stick to the heavy 4-ft. war boomerang.

Most Australian boomerangs are in the shape of an obtuse triangle, flat on one side and convex on the other, measuring about 2½ ft. from tip to tip. The brown men use acacia wood in their construction, but your homemade one can be fashioned quite nicely from a piece of hickory or second-growth ash, ⅝ in. thick.

In making your own boomerang, the first step is to map out the paper pattern. Do this on a sheet of paper, 29½ by 12¾ in. The paper plan is shown in Fig. 2.

Only a rough adherence to the plan is necessary in order to insure a successful boomerang. Note that the width of the boomerang arms, near the angle, is 2 in., while they narrow down to 1⅝ in. at the rounded extremities.

Cut out your paper model and draw two lines across it in positions somewhat similar to those shown in the lower drawing. Now, place your pattern on the wood stock and trace out each half of the boomerang, as in Fig. 3, the portion of the pattern between the two lines being part of both halves. After the outline has been penciled in, take a keyhole saw and cut out the two portions, as shown in Fig. 4. The next step is to cut each end of the boomerang, between the lines, into shape for a half-lap joint, as pictured in Figs. 5 and 6. A miter saw is the tool for this task, but a good



hacksaw serves quite well. The joint is then glued and set in a press until dry, after which a single row of small nails are driven into place along the center, as indicated in Fig. 7.

Now, with spokeshave and knife, trim down one side, and

one side only, of your boomerang to a convex shape, as shown in Fig. 8. In shaving, only the sharp edge is taken from the wood at the center in order to leave the joint almost full strength, but the remaining part is cut down to a feather line at the edge while retaining the full $\frac{5}{16}$ -in. thickness at the center line.

Additional nails are then driven into the joint, and aluminum reinforcing strips, cut to shape with tin snips, are nailed to the center and tips of the boomerang on the flat side, as shown in Fig. 9.

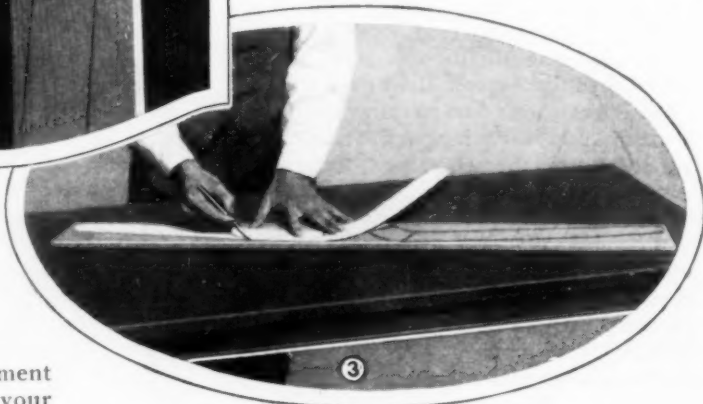
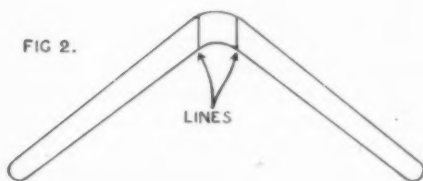
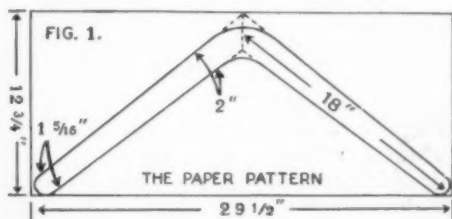
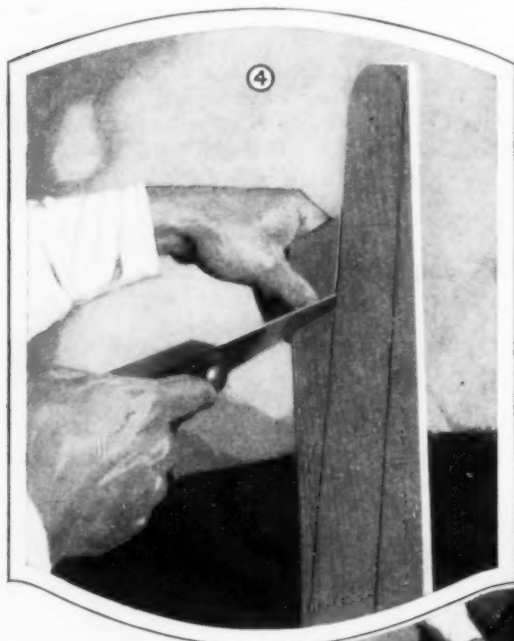
The final operation, Fig. 10, consists in giving the whole thing a coat of stain or varnish. A bright color paint should be used instead of stain if you are contemplating throwing in deep grass, in order to make the boomerang more distinguishable where it falls.

And now to the throwing. The average person thinks that the throwing of a

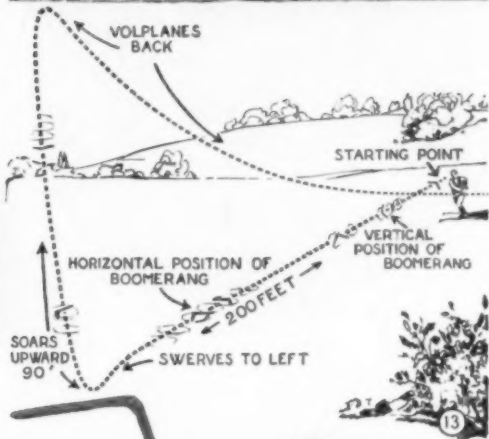
own far more readily than the pulling of a forty-pound longbow.

The first rule is that the boomerang must always be thrown against the wind. It is against the wind only that the magic stick is self-retrieving.

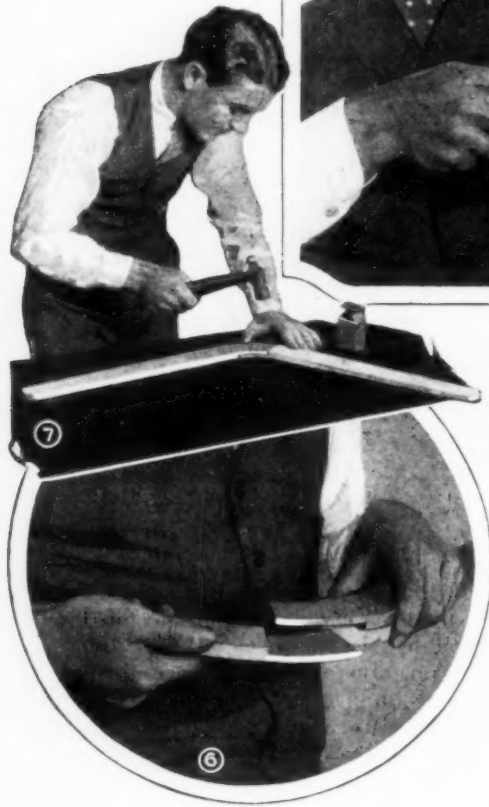
So, facing the wind, you hold the boomerang in your right hand with the rounded side inward; that is, the round side should be the left side of the boomerang, when held in throwing position by a right-hand thrower. Holding firmly to one end, bring the stick over your head until you reach the position shown in Fig. 11. Then, bringing the arm forward in a straight overhand swing to the position shown in Fig. 12, release the stick with a short upward jerk of the hand, somewhat like that used in cracking a whip. This is important. Without this sharp jerk, the boomerang gets off to a slow spinning start and will not revolve fast enough to



boomerang is something which can only be acquired through long and continuous practice, but that idea is entirely erroneous. Throwing the curving stick is an accomplishment which you can make your



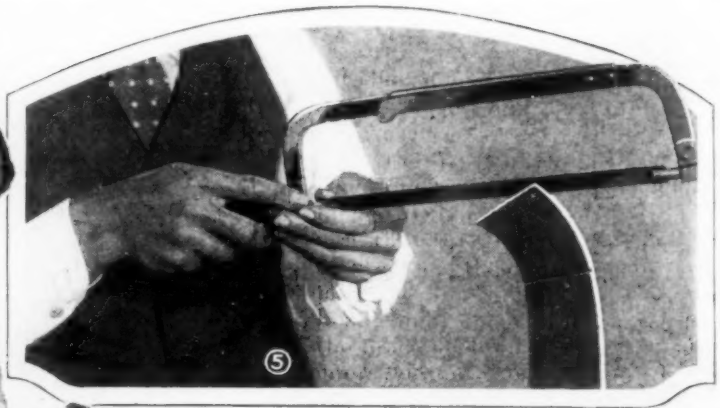
make the return journey; with the snap correctly done, the



boomerang will fairly zoom forward, spinning so rapidly that it is apparently transformed into a circular plate of wood of a diameter equal to a straight line joining the two ends.

That's all there is to it. The average beginner learns boomerang throwing somewhat like this: He pitches a few into the ground; he sails anywhere from two to thirty times with no visible signs of a return journey; and then—success, after which the knack is very seldom lost.

In a successful boomerang flight, the missile will swoop straight forward in a nearly vertical plane for a distance ranging all the way from 100 to 350 ft. As it covers this distance, it changes to an almost horizontal plane, and then, swerving to the left, it soars aloft like a bird and then comes swooping back in a long vol-plane, to land at the thrower's feet.



The parabolic flight of the boomerang is a beautiful thing to witness. Although the throw is generally as described, the magic stick can be made to perform a score of other graceful arcs. A slight variation of the snap, a small deflection of the throwing angle, and the boomerang can be made to shoot inward with terrific swiftness, curve outward in a lazy arc, or shoot upward in spinning flight. Almost any object, be it a rabbit hiding behind a stump or a pheasant on the wing, is a fit mark for the flying stick.

After some proficiency has been gained in directing the flight of the boomerang, you can erect a target consisting of a burlap sack filled with straw and aim your stick at this. You will soon acquire sufficient skill to score a hit fully half the time at a distance of from 40 to 60 yd.

And if you do miss, well, back it comes, like a trained eagle wheeling in the breeze!

Removing Cork from Bottle

It often happens that corks in bottles and jugs are shrunk or are pushed down into the neck so far that it is difficult to remove them. An

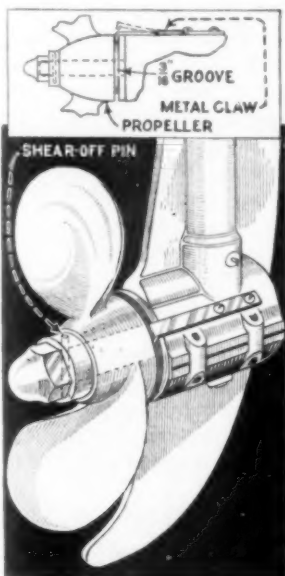


easy and effective method of overcoming this trouble is to drive a screw-eye or wood screw into the cork as indicated. With this arrangement, the cork can, in most

cases, be removed without any trouble.—James F. Hobart, Chicago.

Preventing Loss of Outboard Motor Propeller

The propeller shaft of every outboard motor is provided with a small brass shear-off pin, which holds the propeller, from turning on the drive shaft. The pin is designed to break off when the propeller strikes any submerged object, so that the motor will not be damaged. However, quite frequently a broken shear-off pin is the cause of losing the propeller, a part that cannot always be replaced easily, and which costs from \$3.50 to \$5. With a broken shear-off pin the propeller freely turns on the shaft and backs up against the end nut on the shaft, often with sufficient force to turn the nut and let the propeller slide off. After losing several propellers in this way, I decided to prevent recurrence of this loss. The end nut could not be keyed onto the shaft because the shaft is too hard to be easily drilled, so I arranged a metal claw as shown. To install this device, it is only necessary to remove the propeller, place it in a lathe and cut a $\frac{3}{16}$ -in. groove in the end next to the



propeller-shaft housing. The claw is made of spring brass and is fastened to the housing with two screws. The lip of the claw rides in the groove cut in the propeller and keeps it from sliding off the shaft if the shear-off pin breaks. Inasmuch as the propeller cannot be forced back, it will not loosen the

end nut on the shaft, but even if the nut came off, the propeller would still be held on the shaft, free to rotate but not to slide off. As the claw is made of spring metal, the end can be lifted out of the slot in the propeller to remove the latter.—John Edwin Hoag, Los Angeles, Calif.



Pots and Pails Suspended over a Camp Fire by Means of an Old Auto-Tire Chain

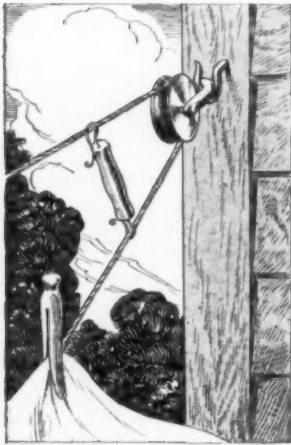
Old Auto Chain Holds Pots over a Camp Fire

In the absence of a grate, an old auto-tire chain will be found convenient for holding pots and pails over a camp fire. One of the side chains and all but three or four of the cross links in the middle are removed, and the remaining part is then stretched between two stakes, as shown. The ends of the chain are fastened by means of short pegs, pushed through the end links. The pots and pails can be suspended from the cross chains, and the fire built underneath. Another cross chain, with a strong stick pushed through the end link, can be used for removing and handling the pots when hot, as in the upper detail.

Driving Ants Out of Ice Boxes

Ants are often difficult to drive out of ice boxes in the summer home. However, the following method will prove effective: Mix a solution, consisting of a small amount of tartar emetic, sugar and water, in a saucer, and apply it in the corners and around holes where the ants will come in contact with it in their attempt to get inside. They will soon disappear.—L. H. Georger, Buffalo, N. Y.

Preventing Double Clothesline from Slipping on Pulleys



Double clotheslines, used on pulleys as shown, have their disadvantages: When the wind blows, it often causes the line to shift, moving the clothes toward one end, until they may touch the pole or the side of the house and get

soiled. To prevent this, it is a good idea to slip a hook over both lines at each end. —Mrs. R. A. Jessen, Keansburg, N. J.

Trough for Testing Tires That Leak Slowly

Tires having slow leaks often fail to show any evidence of such leakage when the tubes, removed from the casings, are only partly inflated. The writer, experiencing this



trouble, made a testing trough from a section of discarded auto casing of large size. This was nailed to a piece of 4-in. wood, to hold the trough in an upright position, as shown. The wheel with the leaky tire is raised by means of a jack so that the trough can be slipped under the tire. —A. C. Brundage, Rochester, Minn.

Using Carborundum Stone on Razor

It is rather difficult to keep a straight-blade razor honed to barber-shop efficiency, but here is a method of doing it which I have used for fifteen years. Get a carborundum stone of the finest grain,

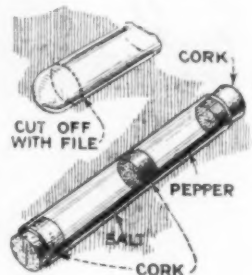
and give your razor a few strokes on the dry stone just before stropping. You will find the edge is improved by this treatment. —A. M. Parker, Edmonton, Can.

Getting More Mileage Out of Your Ford

I have a model-T Ford and I averaged 36 miles per gallon on ethyl-gasoline. To obtain this result, I had $\frac{1}{8}$ in. of the metal planed off the face of the cylinder head where it fits on the block. This brought the head closer to the pistons and thus increased compression without weakening the head, since the force of the explosion is taken by the bolts with which the head is held to the block. When replacing the head, $\frac{1}{8}$ -in. washers should be put under the bolts to prevent twisting them off. The valves and piston rings must also be in good condition, and the carburetor must be adjusted lean for the greatest fuel economy. After this alteration, I found it was impossible to make the motor knock except when going five or six miles an hour uphill and with the throttle wide open. I have run this car about 2,000 miles since and there is still no fuel knock. It is not advisable to use ordinary low-test gasoline with this high-compression head, but it can be used if care is taken in advancing the throttle slowly to prevent knocking. In a Ford motor, a $\frac{1}{8}$ -in. slice off the head reduces the compression space about 14.5 per cent, and compression will be correspondingly greater. —C. H. Howard, Hannibal, Mo.

Salt and Pepper Shaker for the Camper

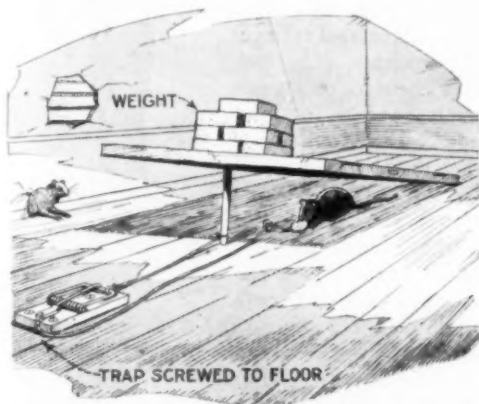
To save space in the camping kit, every unnecessary item should be eliminated, and, if possible, one article made to serve several purposes. Instead of having separate salt and pepper shakers, the two can be combined as shown in the drawing. Get a test tube of large size, which can be purchased at any drug store, and, with a file, cut off the closed end, smoothing off the sharp edge so that



it will not cut. Push one cork to the center of the tube and provide two more for the open ends. You now have two separate compartments, one for salt and the other for pepper, and as the container is glass you can see which is in each. An unbreakable combination tube can be made from a section of bamboo, with a joint in the center, and the contents scratched on the outside.

Unusual Rat Trap

I had considerable trouble with a rat which always succeeded in keeping out of the spring trap I set for it. Determined to get it, I rigged up the unusual trap shown in the drawing. It consists of an old cabinet door, about 2 ft. square; a short stick 6 in. long, a weight and a spring trap. The latter is screwed to the floor; the cabinet door is raised so that one edge rests on the stick, which is set under the door as indicated. A suitable weight is laid on the inclined door. The spring part of the trap is connected to the stick with a stout cord. Another cord is tied to the trigger at one end, and to the bait at the other, which is laid on the floor under the center part of the door. The trap is then set so



Novel Rat Trap Consisting of a Large Board Which Falls on the Victim

that, when sprung, it jerks the stick from its position, and the door, being unsupported, falls down. When the rat takes hold of the bait, and before it has time to get away, the door falls on it. The trap caught the rat that had evaded the former trap and did great execution among the others.—W. L. Hadlock, Chicago.



Handy Cabinet for the Garden Tools Can Be Built in the Porch Floor

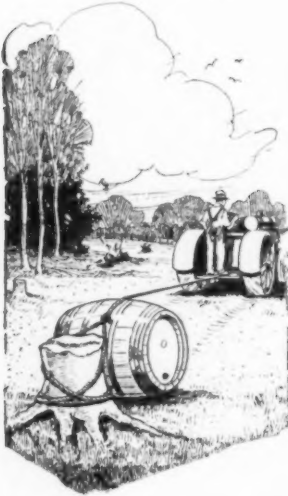
Porch Cabinet for Garden Tools

In the absence of a suitable shed or garage, garden tools, such as hoes, rakes, spades and shovels, are usually kept in the basement, and this location is often rather inconvenient. One garden enthusiast found a much more suitable place for the tools. He built a cabinet in the porch floor, as shown in the illustration. It is long and wide enough to accommodate all the tools, with some room to spare. The lid, when closed, is flush with the porch floor, and sufficiently reinforced to allow walking on it safely. A sunken ring enables the door to be opened whenever necessary.—L. H. Georger, Buffalo, N. Y.

Saving Time in the Haying Season

Ordinarily hay is raked, loaded on the wagon and then hauled to the barn, if it is to be put in the mow. If it is stacked in the field, the hay is drawn to the stacker with sweeps, then stacked and hauled in on racks. One man has his hay shed only a few yards from the alfalfa field. Instead of hauling the hay in on a wagon, he lays one of the slings on the ground, sweeps the hay directly onto it from the field and then hoists it under cover, thus saving a good deal of time and labor.—Dale R. Van Horn, Walton, Nebr.

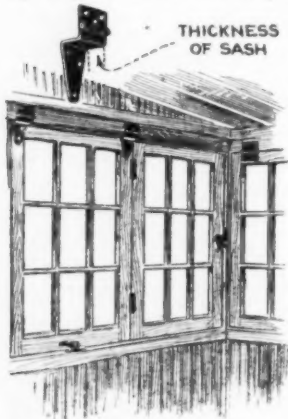
Keg Helps to Pull Stumps



When pulling stumps or large roots with a tractor, a strong keg can be used to good advantage. The cable is attached to the stump near the ground and the keg is then put under the cable near the stump as shown. When the tractor pulls there will be an upward as well as a side-wise strain on the stump.—James W. Cottrell, Hammonton, N. J.

Hinging Porch Windows to Avoid Trouble

Glazing a porch is usually a simple job, the sash being made to fit the openings and hinged to permit swinging them up so that they can be fastened to the ceiling. This arrangement works well in many cases, but trouble is often encountered when the sash are at right angles to each other, as at the ends of the porch. The end windows should be arranged to swing up higher than the adjacent ones at the



front, which entails considerable calculation and careful adjustment. The difficulty can readily be avoided, however, by hinging the two windows, nearest to the corner on the front side, together, as shown in the drawing. After the end window is folded over the second one, which is hinged at the top, both can be

swung up together. In many cases, a pair of offset hinges are necessary. The detail in the drawing shows how these hinges are bent at right angles, so that the pivot section comes flush with the surface of the end sash when it is folded onto the other window. The bent part should be sunk also into the top member.

How to Prevent Loss of Tools in Overhauling Auto

Whenever I am working on my car outdoors I take along a flat box, turn it upside down and lay my tools on it. That is better than putting the tools on the ground where they may be lost. If the repair work is very extensive, the car can be run onto a piece of old canvas, so that all nuts, cotter pins, and other small pieces will be caught on it without chance of loss.—Arthur Flinger, Wichita, Kans.

Flashlight Carried on Boot

When out hunting, a small flashlight can be carried in a leather holster sewed to the boot, as shown in the drawing. In this position it is always handy, leaves both hands free and relieves the pockets. The holster consists of a piece of leather, 5 in. long and 4 in. wide. Place the flashlight against the leg of the boot and wrap the piece of leather across the light as indicated. Sew the two side edges to the boot so that it clamps the flashlight tightly and close the lower opening with a strip of leather. A tight fit is necessary to keep the light safe, no matter how violently the leg may be moved.—L. B. Robbins, Harwich, Mass.



Removing Ink Stains

Recently one of the clerks in the store where I am employed dropped a quart bottle of ink on the floor and broke it. The result was a large black stain, about 2½ ft. in diameter. I mixed up some car-

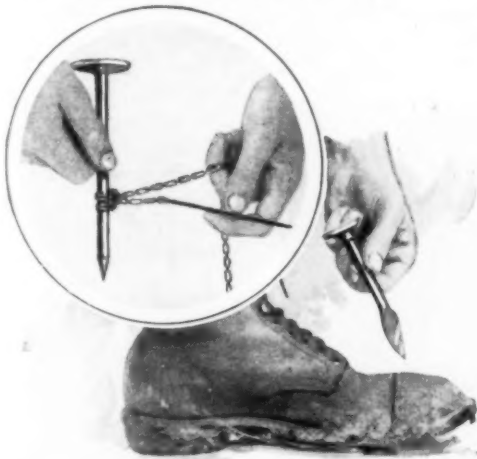
bicarbonate of soda and chloride of lime, in equal parts, and added water until the fluid had the consistency of cream. This was rubbed over the ink stain with a damp cloth and left the floor clean. The method also works on clothing, and is the best I know of for removing photographic-developer stains from the hands.—Warren Hubbard, Decatur, Ill.

Heavy Stirring Rod for Chemists

A wooden stirring rod for the chemist or photographer is not practical because it absorbs the chemicals and therefore cannot be used in different solutions. A regular stirring rod is rather thin and unsuitable for use with large quantities of solutions. An ideal rod, which costs only 10 or 15 cents, depending on the size, is an ordinary towel-rack glass rod, which can be had at the 5 and 10-cent store. It has a knob at each end, which is excellent for crushing undissolved chemicals.

Two Handy Tools for the Fisherman

To facilitate keeping a string of fish where you want it, the handy tool shown in the insert will be found useful. It is made from a discarded auto or tractor valve, the end being ground to a point. Your muddy shoes or boots can be scraped clean quickly by using a similar valve, but preferably a smaller one having the end flattened and ground down as indicated.—F. W. Bentley, Jr., Missouri Valley, Iowa,



Fishermen May Find Good Use for Discarded Auto and Tractor Valves

Expanding Belt Buckle Made from Spring Wire

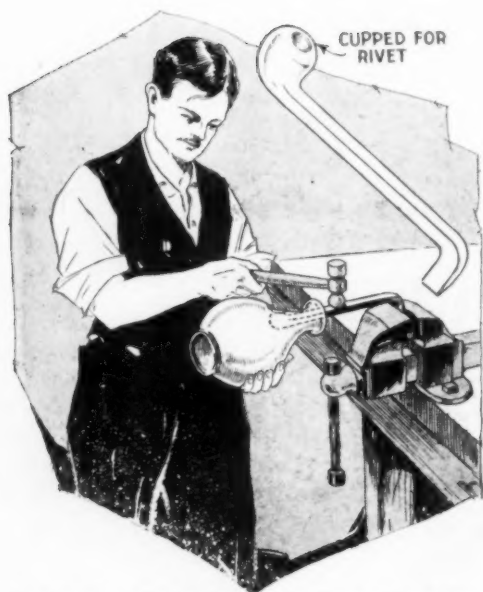


Expansion Belt Buckle

A novel expansion belt buckle can be made by using a 52-in. length of No. 10 gauge brass or steel wire, or any spring wire of similar size. The drawing shows a flattened portion at one end of the buckle, which, inserted in the belt holes, keeps it from slipping. The other end is shaped so that the belt can be attached in the usual way. The spirals are made by wrapping the wire snugly about a piece of strap iron, about $\frac{7}{32}$ by $1\frac{1}{16}$ in. in dimensions. If the turns are hard to make, hold the strap iron in a vise and also fasten one end of the wire, then wrap it as closely as possible, using a block of hardwood and a hammer to force the wire into shape. The belt will be found comfortable.—Truman R. Hart, Ashtabula, Ohio.

Brushing Lint from Heavy Fabrics

When lint accumulates on a garment of heavy fabric, it is almost impossible to remove it by ordinary brushing, as the friction of the dry brush creates static electricity and causes the fine fibers to cling more firmly than ever. If the brush is slightly dampened by holding it over a steaming teakettle, the lint can be removed without difficulty.



Tool Bent at Both Ends Helps to Remove Dents from Metal Ware with Narrow Necks

Removing Dents from Metal Ware

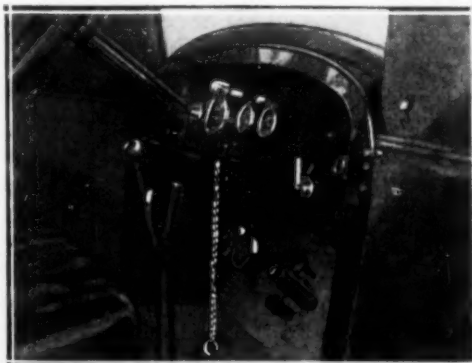
As dents in metal ware usually are made from the outside, they must be hammered out from the inside, which is difficult to do in the case of vases or other articles with narrow necks. A form of hammer for this purpose is shown in the drawing. It is made from a steel bar bent in opposite directions at the ends. After fastening the tool in a vise as shown, the vase is slipped over it until its other end is in contact with the dent. Hitting the bar with a hammer will cause the inner end of the bar to vibrate and strike rapid blows on the dent. Repetition of the operation while the vase is manipulated so that the blows hit the whole dented area, will soon remove the dent. To prevent serious marks, the tool should be padded. A similar tool can be used for riveting, in which case the hammer end should be cupped so that it fits the rounded end of the rivet.

Simple Brace for Cellar Door Prevents Sagging

Cellar doors usually have a tendency to sag. To prevent this I braced the doors with a piece of 2 by 4-in. wood, long enough to rest on one of the middle steps when the doors were closed. The brace is hinged to one door and projects beyond it so that the other door also is supported by it. When the door is opened, the brace falls back and is out of the way. This particular door opened on a porch floor, and the brace made it possible to walk on the doors without causing them to sag.—C. J. Gose, Kinderhook, Ill.

Guard for the Auto Starter Keeps Children from Meddling

Children often get into autos and meddle with the switches, gear-shift lever, accelerator and starter. The consequences are usually not serious if the ignition key is removed, but the continual use of the starter soon runs down the battery. If the ignition key has been left in the lock, the youngsters can sometimes start the motor and may even start the car. For this reason, I placed a guard over the starter, which prevents the children from operating it. The guard consists of a length of 1-in. pipe and a pipe flange, which are slipped over the starter and screwed to the floorboard. The pipe extends about 3 or 4 in. beyond the starter, and only by inserting a short length of wood, such as a piece cut from a broom handle, in the pipe can the starter be forced down. When I leave the car, I take this piece of wood along and the children have not yet discovered the trick.—Clifford L. Burdick, Milton, Wisconsin.



Guard Placed over the Starter of an Auto Prevents Children from Operating It

☑ White sinks, bathtubs, washbowls and toilet bowls may be cleaned with a soft cloth, moistened with turpentine; use kerosene where there is rust.

Medieval Lantern Easy to Make

by E. Gilmore

HERE is an artistic antique lantern that gives a touch of beauty to any room or den, when hanging from an electric socket in the ceiling or from a bracket fixture on the wall.

It may be made at very little expense. With the exception of liquid glue and gesso, all the materials necessary are: an empty salt or oatmeal box, or any box of cylindrical shape (Fig. 1), and an electric-light socket, plug and cord, which may be bought at any 10-cent or hardware store for a total cost of about 40 cents.

The first step is to be sure that the top and bottom of the box are glued securely in place. Then cut a round hole in one end, of about half the diameter of the box, and slit the remainder of the end so as to form eight little tabs, as in Fig. 2. Bend alternate tabs up as indicated; these are to hold the lantern top in place with glue.

To make the top, take an old dry-goods box, or any similar piece of cardboard having the same thickness as the salt box and cut out a circular piece, with a diameter equal to one and one-half times the length of the round box (Fig. 3). Draw a line from the center to the outer edge.

Cut on this line with scissors, then roll the disk into a conical shape, so that it will fit correctly over the top of the box, and glue the edges of the cone together. Now fasten the roof of your lantern on top of the box by gluing the tabs made for this purpose,

as shown in Fig. 4, on the inside.

In cutting the windows in the box be careful not to make them too large, as they would then weaken the walls. Cut out the rectangular window opening in the lantern first, then make an overlapping frame of cardboard with as many sections or lights as you desire. Glue this over the opening you have cut in the lantern (Fig. 5).

Colored isinglass, celluloid or paper may be glued in the windows and this gives the lantern a beautiful appearance, although a tinted bulb will serve just as well. The heads of heavy pins may be cut off, leaving a short shank, and pushed through the lamp as indicated in the headpiece, to simulate rivets.

Make a door in the bottom of the lantern by simply cutting out a square opening large enough to admit the electric bulb, and then make a cover of the same shape from heavy cardboard. Cut it larger than the opening in the box so it will not fall out. A bone ring is attached to the door in the lamp photographed, and another, heavier, ring is used at the top. Holes are punched in the upper ring, through which the electric cord is threaded, as indicated in Fig. 6.

The next step is the finishing: First apply a coating of liquid glue over the entire lantern and let it dry thoroughly. To make the gesso, mix a 1-gill can of liquid glue, $1\frac{1}{4}$ cups of whiting, 3 teaspoonfuls of varnish and 3 teaspoonfuls of linseed oil, and ap-



FIG. 1

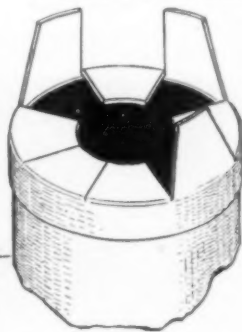
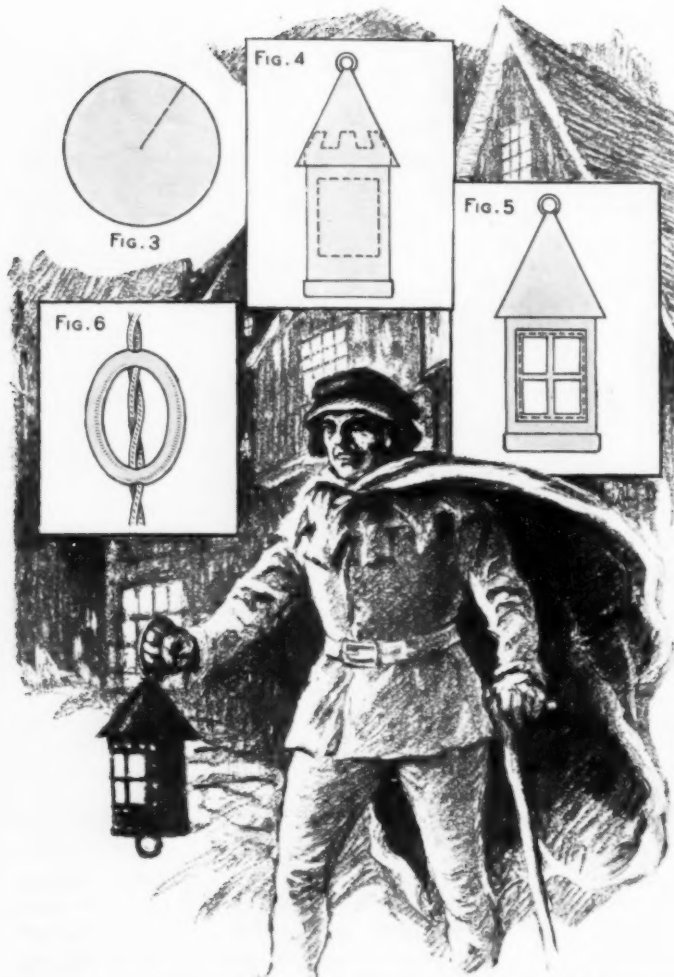


FIG. 2



ply this mixture all over the lantern, modeling it with the aid of a stiff brush or knife. Try to model the gesso so that the effect will be that of deeply pitted iron or bronze, but do not make the surface too rough. Allow the gesso to dry 24 hours, and you are ready to color.

First, cover the gesso with a coating of bronze powder mixed with banana oil. When this is dry, apply the paint, which may be burnt umber or green, with a touch of deep red here and there. Squeeze a small quantity of color from the tube onto a piece of

cloth, and rub this on the bronzed surface until the desired color is obtained. If you wish to procure a very ancient effect, dust powdered rottenstone over the entire surface and rub down very carefully.

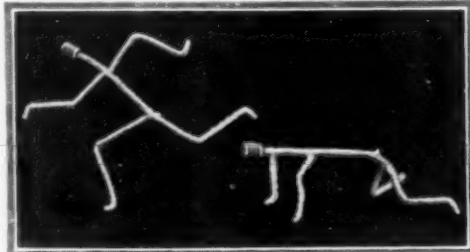
Silencer for Rebound Clip

The small rebound clips on the springs of model-T and A Fords often become loose and rattle. By using a longer bolt and a coil spring, the clips can be kept tight without much attention. For the front springs of model-T cars, a 2½ or 3-in. machine bolt, ¼ in. in diameter, with a washer and a radius-rod ball-cap spring are needed. The rear spring requires the same outfit, except that the bolt should be 3¾ in. long. The model-A front spring, having a width of 1¾ in., uses a 3-in. bolt. The rear spring has a rebound clip, but the spring is nearly covered by the frame cross member, and

for this reason, it is impossible to substitute a longer bolt.—E. T. Gunderson, Jr., Humboldt, Iowa.

Novel Window Manikins

To emphasize a sign in a window display, some odd manikins were made from pipe cleaners. They are simple to make as they bend easily. Set before a dark background, they are quite noticeable. A single thumbtack over the foot of a vertical figure holds it nicely. Heads can be made from small corks.



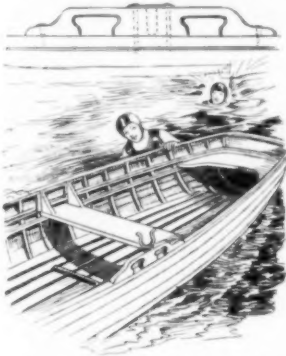
Small Manikins Made from Pipe Cleaners May Be Used for Changeable Window Display

Removing Dust from Inside of Violin

It is generally a quite difficult and tedious task to remove dust from the inside of a violin. A good method of doing this is to drop into the body a cupful of perfectly dry rice and shake the whole well. A rag should be held over the sound holes to prevent the rice from coming out during the shaking. You will be surprised how much dust can be removed in this way in a few seconds.—L. H. Georger, Buffalo, N. Y.

Handholds Facilitate Carrying Rowboat

Carrying a rowboat is usually an awkward task as there is no permanent equipment for lifting the boat. Of course, if it is turned upside down, it can be carried by two men, but a large boat may be too much of a load. Besides, it may not be desirable to turn the boat upside down. By providing the boat with oarlock pads having handholds as shown in the drawing, the task of carrying the boat will be



lightened considerably. Two holds are cut in each oarlock pad so that, when it is screwed down, there will be plenty of room for the hand to be inserted. The edges are nicely rounded. Four pairs of holds can be provided on a large rowboat to enable as many men to carry it at an even keel.—Newcomb Leonarde, Mystic, Conn.

Holder for the Basement Door

The illustration shows a cheap and easily made device for holding a cellar door open. It consists of a length of hoop or band iron, about 1 or 2 in. wide and long enough to be fastened to two joists, besides extending 6 or 8 in. beyond the door when it is swung open. Punch or drill two holes in the iron strip at points where it passes under the joists and attach it with nails or screws. Bend the free end of the

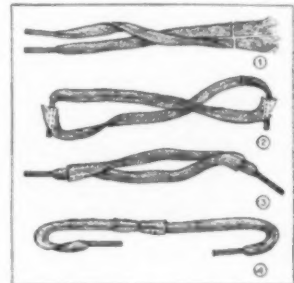


Spring-Metal Strip Nailed to Joists Holds Basement Door Open

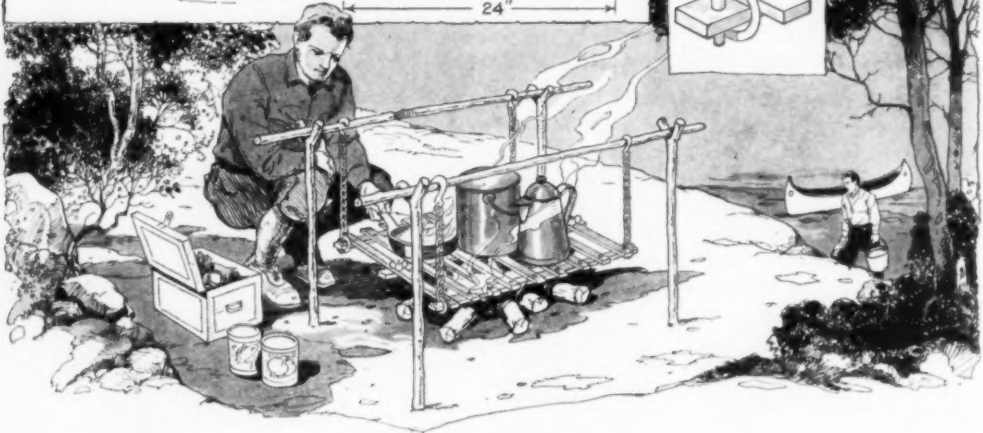
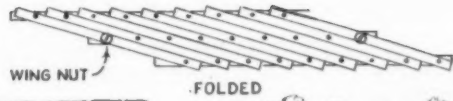
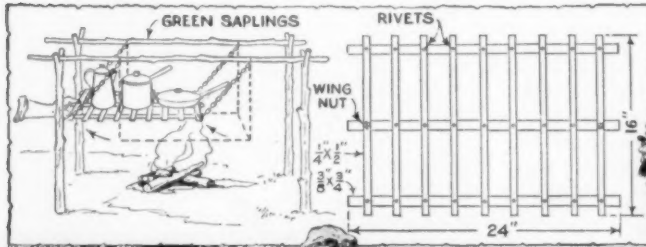
strip to form a catch that will hold the door securely, yet not allow it to strike against the end of the strip as it is opened from the outside, but slide under the strip as indicated. The holder should be located as far from the hinges as possible.—C. D. Paterson, Worcester, Mass.

Splicing a Broken Shoestring

Instead of tying a knot in a broken shoestring when it has parted near the center and the ends are still in good condition, try splicing it as shown in the drawing. Anyone can do this, and the appearance of the repaired string will be much neater and less troublesome to lace than if the broken ends were knotted. First cut off the broken ends as in Fig. 1. Cross the two pieces to be joined and insert the tips into the cut ends. Then thread the tips through a small hole cut about 1/2 in. from each end, as in Fig. 2. All that is left to do is to pull each end and the splice will look as shown in Figs. 3 and 4.—J. F. Goodman, Imlay City, Mich.



Handy Campfire Grate of Large Size Can Be Suspended Horizontally over the Fire, and When Folded, Takes Little Space among the Camping Equipment



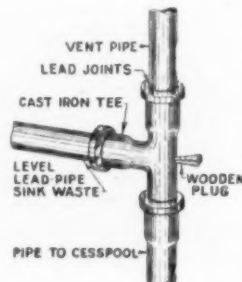
A Large Folding Campfire Grate

Many campers use a stove for cooking, but there are also many who get more "kick" from doing it over an open fire. To these, the large folding grate shown in the drawing will be a convenience. It is made from three 24-in. lengths of iron or cold-rolled steel bar, $\frac{3}{8}$ by $\frac{3}{4}$ in. in dimensions, to which are riveted, at equal intervals, nine 16-in. strips of $\frac{1}{4}$ by $\frac{1}{2}$ -in. stock. The rivets should be free enough to allow the grate to be folded. The end holes of the middle strip should be fitted with $\frac{1}{4}$ -in. bolts and wingnuts, which are tightened to make the grate rigid when in use. Four lengths of chain, provided with hooks at the ends, serve to suspend it over the fire, the chains being hooked to a suitable improvised framework made of wood. The chains are attached to the grate by slipping the end links over the ends of the bars and holding them in place with taper pins. No matter which way the grate is swung, it always remains horizontal and this prevents utensils from slipping off easily. When folded up as shown in the

upper detail, it takes very little space and can readily be carried along with the other camping equipment.

Clean-Out Plug for Sink Drain Is Simple and Efficient

The occupant of a cottage was greatly troubled by frequent clogging of the sink waste pipe, which had been run level for some distance, and hence required repeated visits of a plumber. To eliminate this trouble and expense, the owner drilled a hole in the vertical pipe and stopped the opening with a plug as shown. Whenever necessary, a wire can be passed into

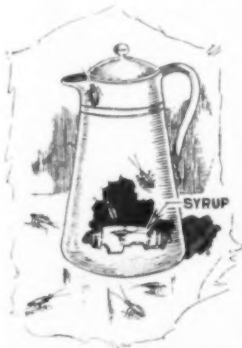


the horizontal pipe to loosen the obstruction so that it is easily washed away with water. The wooden plug was afterward replaced with a regular pipe plug, the hole being tapped to suit.

How to Detect Short Circuits in Toy Railroads

Sometimes the locomotive of miniature electric trains refuses to run. In such a case one should go about locating the trouble in a systematic way. Be sure that the battery or transformer switch is closed and determine whether the house-lighting circuit is in good condition by trying the lights. Test a storage battery with a hydrometer and dry cells with an ammeter. If the current flows as far as the tracks there may be a short circuit in a section of the latter. Test for this by touching one wire to an outside rail and one wire to the inside or middle rail. If a spark occurs, there is a short circuit; if not, the section is all right. Rail shorts are usually found in the clamps holding the third rail down to the ties. These may have cut through the insulation and caused a short with an outside rail. If so, bend up the clip, remove the old insulation and replace it with new, then bend down the clip again. The locomotive can be tested for short circuits by holding one wire on the shell of the machine and the other wire on one of the motor brushes.

A Sure-Catch Roach Trap



To make a good roach trap, get a small glass sirup or molasses pitcher, with the spout nearly level as shown in the drawing. It should be large enough to admit the big roaches. The cover of the pitcher has a lip which fits tightly down over the spout opening and must be turned aside when used as a trap, leaving the spout opening uncovered. Put some jelly, gravy or bits of fish in the bottom of the pitcher, and the roaches will find their way in through the open spout. They cannot get out, however, because they are unable to hold their bodies up while they attempt to get on the horizontal part of the spout from the inside.



Barbed Wire Is Hard to Unroll Single-Handed but Easy with This Rig

Unrolling Wire Single-Handed

All that is necessary to unroll a reel of wire single-handed is a good wheelbarrow, a broomstick or length of pipe and four 20-penny nails. These are driven into the sides of the wheelbarrow as shown in the drawing. The roll of wire is placed on the broomstick or pipe, which is then set across the sides of the barrow, between the nails. After the loose end of the wire on the roll is tacked or tied to a post, the wheelbarrow is pulled away from the post, which unrolls the wire without any trouble.—Joseph Enos, Brownsville, Oreg.

Cleaning Large Set Rings

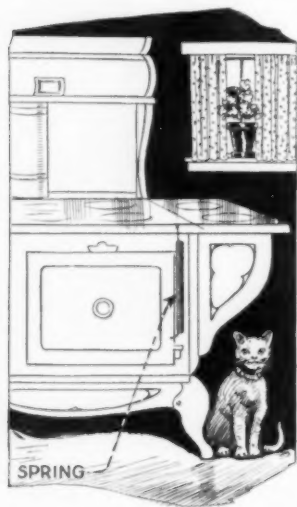
It is often rather difficult to find some convenient and effective method of cleaning large set rings. An ordinary pipe cleaner can be used as indicated in the photo, and it will do the work without causing damage to set or mounting.



☐ Chewing gum can be removed from different materials by soaking in turpentine.

Substitute for Broken Stove-Door Spring

When the spring of an oven door is broken, the door may drop over unex-



pectedly, which means danger of breaking the hinges. A substitute for the spring can easily be provided. Drill a hole through the edge of the door about 2 in. from the hinge at the bottom, and drill another hole through the edge of the stove, as indicated.

Hook the ends of a coil spring of suitable length into these two holes.

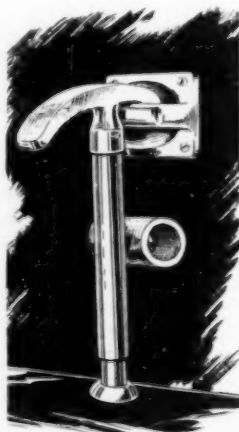
Homemade Soft Soap and Its Use

A good soft soap for laundering can be made as follows: Dissolve $\frac{1}{2}$ lb. of sal soda in about 5 gal. of hot water and then add 20 bars of ordinary laundry soap. This will form a jellylike mass and, when it is cool, stir in 1 cupful of strong ammonia water, $\frac{1}{2}$ cupful of turpentine, $\frac{1}{2}$ cupful of kerosene, $\frac{1}{2}$ cupful of carbon tetrachloride, $\frac{1}{2}$ cupful of water glass, and 1 cupful of denatured alcohol. This mixture may be made in a boiler and kept stored in closed jars or crocks. Soak the clothes overnight in water to which the above mixture has been added in the proportion of 1 qt. to half a tubful of water. Hot water is best. The soap dissolves at once even in cold water, but its great value lies in saving the time needed to prepare the soaking solution for the clothes with ordinary soap. About 2 qt. of the mixture should be put into a crock, and collars, handkerchiefs, shirt sleeves and cuffs, and other very soiled pieces, are immersed in it. Set the crock in a tub, into which water is poured up to the edge of the crock. The next morning the contents of the crock should be emptied into the

washing machine, or tub, if washing is to be done by hand, and hot water added. Five minutes' washing will be sufficient. The water with the soap mixture in it will feel soft to the hands and will not injure the skin. Only extremely dirty pieces have to be rubbed, but after soaking in the strong soap mixture all night, only a little rubbing is necessary. The slight odor of turpentine will disappear if the clothes are rinsed in two waters, and the clothes will come out whiter than one would think possible with so little labor. In order to whiten clothes, such as workmen's shirts, that will not readily wash clean in this way, make up a mixture of equal parts of clear lime water, turpentine and kerosene and shake until creamy. Use a cupful of this mixture to a boilerful of water and boil the clothes for half an hour.

Anti-Rattlers for Auto-Hood Clips

Many makes of automobiles have no rubber anti-rattling devices on the handles that hold down the hood, and the spring clips used for the purpose often cause unpleasant rattling. The trouble can be eliminated by bolting short pieces of heavy rubber tubing or hose to the hood just under the spring handles, so that the rubber will bear with a slight pressure against the clips. The drawing shows how it was done in one make of



car. The same applies to practically any other make also. Four 1-in. lengths of heavy-walled rubber tubing, about $\frac{3}{4}$ in. in outside diameter, were used. They were fastened to the hood by means of 6-32 machine screws, 1 in. long. —Charles F. Felstead, Los Angeles, Calif.

☛ If a little turpentine is added to starch, it will prevent the iron from sticking to the goods.

SHOP NOTES



All Shop Notes published in 1927, in book form—Fifty Cents—from our Book Department

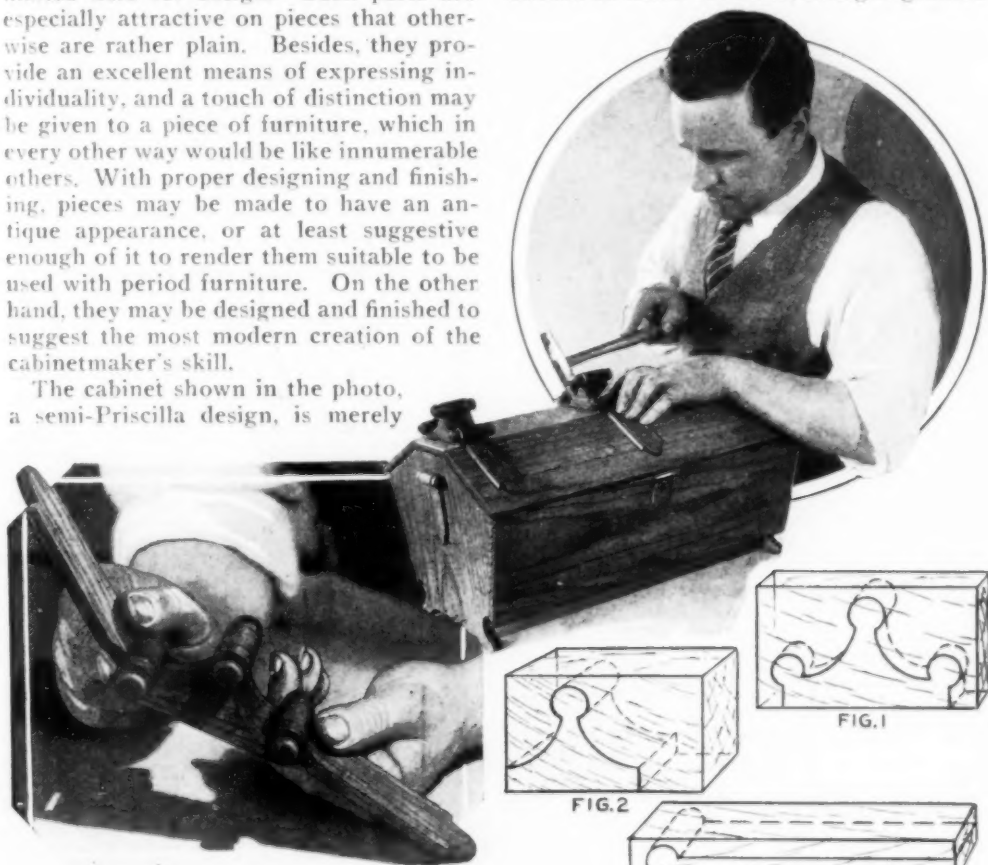
Attractive Wooden Trim for Cabinetwork

By CLAUDE WEST

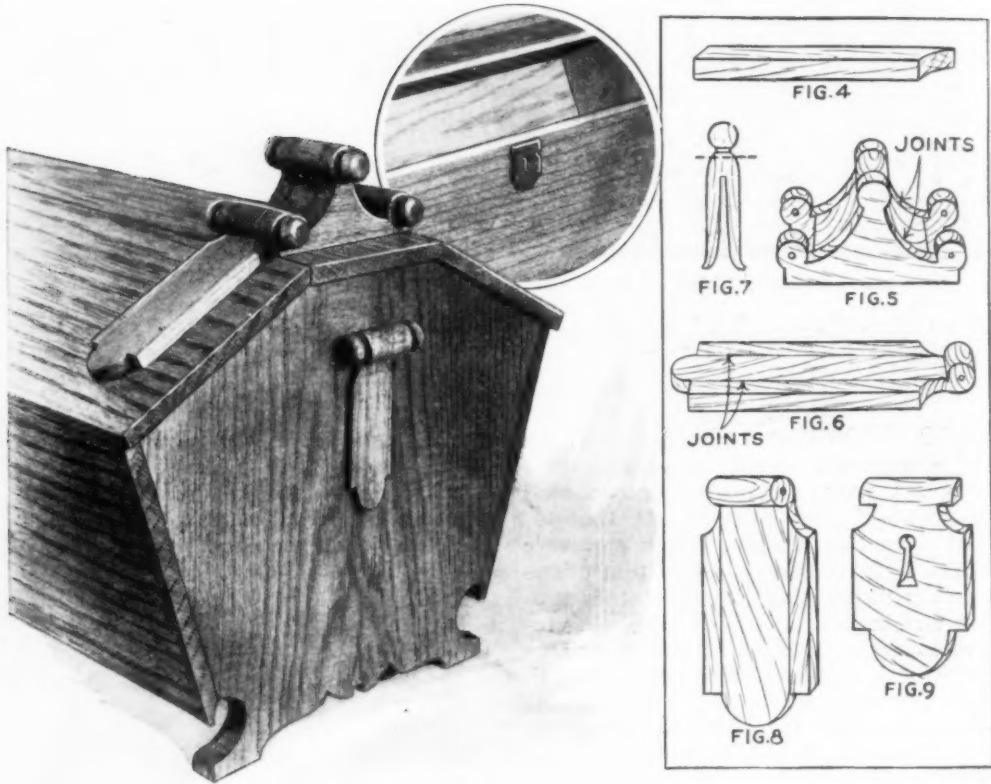
WOODEN hinges, handles and escutcheons, worked out along artistic lines, are very pleasing as ornamental parts for cabinetwork, and afford an unlimited field for design. Such parts are especially attractive on pieces that otherwise are rather plain. Besides, they provide an excellent means of expressing individuality, and a touch of distinction may be given to a piece of furniture, which in every other way would be like innumerable others. With proper designing and finishing, pieces may be made to have an antique appearance, or at least suggestive enough of it to render them suitable to be used with period furniture. On the other hand, they may be designed and finished to suggest the most modern creation of the cabinetmaker's skill.

The cabinet shown in the photo, a semi-Priscilla design, is merely

used as an example, and no dimensions or details for its construction are given except for parts to be mentioned later, which are shown in Figs. 1 to 9. The hinges should be made of sound, straight-grained



Ornamental Wooden Hinges of Many Designs Can Be Made by Cutting the Pieces Out with a Coping Saw and Gluing Them Together



Figs. 1 to 9 Show the Patterns for the Various Parts of the Fittings on the Box Shown in the Photos

hardwood and the handles and escutcheons should match. In cases where it is possible to do the work on a bandsaw, the parts may be cut from solid stock of a thickness equal to the width of a hinge, and no gluing is necessary. However, as the work will be done by hand in most cases, the method illustrated shows how to cut out the pieces with a coping saw, and, as thinner stock must be used, the pieces will have to be glued together afterward. The drawings show a double hinge having one middle section and two end sections, each section being made of three pieces glued together. Pieces of the same thickness may be used so that their combined thickness equals the width of the hinge, but in this cabinet the middle piece is as thick as the outside pieces together. Fig. 1 gives a side view of these pieces of the middle section, two of them being required. The lines indicate the pattern laid out on the wood ready to be cut out. Fig. 2 shows the single center piece of the mid-

dle section, and Fig. 3 shows the center piece for the end section, two of these pieces being needed, one for each of the two sections. The material used for the latter should be of the same width as the material used for the piece shown in Fig. 2. Fig. 4 shows the outside pieces for the end sections, four pieces being required, two for each section. The material should be of the same thickness as that used for the piece shown in Fig. 1.

When the patterns have been laid out on the stock, as indicated by the lines, the cutting can be done with a coping saw. The stock should be long enough to be held down firmly on top of a bench or table, while the pattern being cut out projects over the edge to permit sawing. The saw should be held as nearly as possible at a right angle to the stock, so that the cutting will be done squarely, and the sawing must be done slowly and carefully, the pattern being followed just outside the lines. Any irregularities can

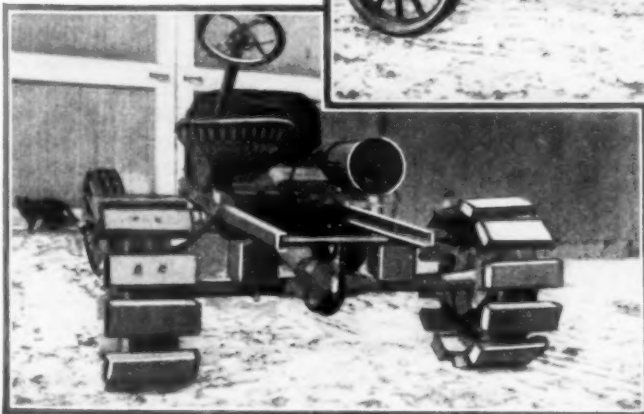
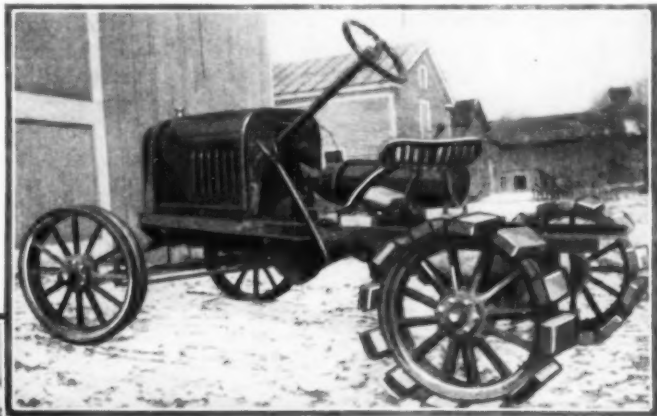
then be smoothed out later. When the pieces have been cut out, they should be glued together as shown in Figs. 5 and 6, the former showing the middle section and the latter the end sections. The gluing must be done with care, so as to be sure that each piece is exactly in its proper position. After the glue has set thoroughly, scrape off any surplus and work out all the irregularities with a wood rasp or with coarse sandpaper. Then drill the holes for the hinge pins, for which small nails with the heads cut off will serve. Put the hinges together and finish smoothing and sandpapering, using fine sandpaper. The knobs, which appear to be the heads of the hinge pins, are simply glued in place, the pins being cut slightly shorter than the width of the hinge, to prevent interference. The knobs used for the hinges shown in the photo were clothespin heads, cut off as indicated by the dotted line in Fig. 7. The handles in Fig. 8 are made up of three pieces, cut out according to the pattern shown in Fig. 3. After being glued up, they are cut out as shown in Fig. 8. The escutcheons are shown in Fig. 9. They should be made of stock about $\frac{1}{8}$ in. thick.

These examples are intended only as guides to the method of making up the pieces, and are capable of endless variation. The design, of course, should harmonize with the piece to which the trim is to be applied; therefore, in the cabinet illustrated, they are

rather plain. For more elaborate work, the trim can be scrollsawed, carved or decorated in any manner desired.

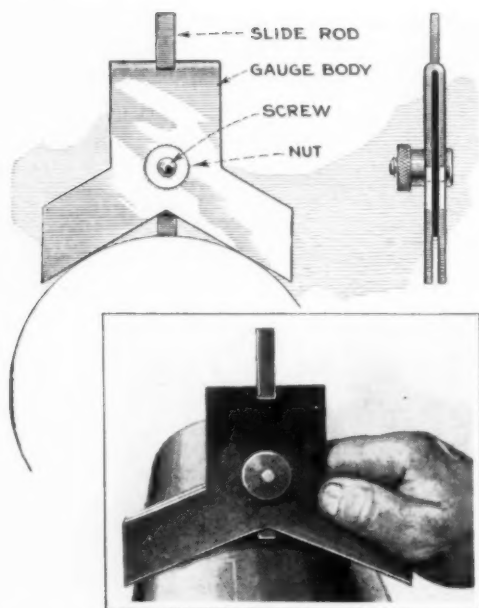
Inexpensive Farm Tractor for Light Work

The principal parts of the tractor shown in the photos are a Ford chassis and a light three-speed transmission. The front end of the extra transmission was milled to fit the rear end of the Ford universal joint, a piece was cut from the front end of the Ford drive shaft, and the remainder was milled to fit the rear end of the transmission. The rear spring was removed and the frame was bolted to the rear-axle housing. An extra rim was bolted to each wheel and the rear wheels were fitted with wooden lugs. A farm-implement seat was added and a few minor changes and additions were made, which made the cost of the completed tractor about \$17 besides the chassis, which the farmer had on hand. The two transmissions, working together, give this tractor a very wide range of power and speed, and it will pull a plow, harrow, pulverizer, roller or any other farm implement of about the same size.



Two Views of a Light Farm Tractor, Consisting of a Ford Auto Chassis Equipped with an Extra Transmission of the Three-Speed Type; This Arrangement Gives a Wide Range of Power

By raising the rear end of the tractor, the large rear wheels may serve as pulleys in running belt machinery.—Leland A. Dye, Boston, N. Y.



Handy Gauge for Duplicating Diameters Where Regular Calipers Cannot Be Used

Gauge for Duplicating Diameters Takes Place of Caliper.

An unusual type of gauge that I have found handy on repair work is shown in the photo. It is not always possible to caliper a size when duplicating a piece, owing to obstructions caused by the piece being in place on a machine, or perhaps an auxiliary part fitted to it after it was turned. If I cannot get the calipers on a job, I use this gauge. It is made by bending a piece of sheet metal double and cutting it a V-shape on the contact end. A slot is then filed on the top to take a sliding rod, which is made of the same stock. A nut and screw, similar to those used on a depth gauge, complete it. For duplicating a diameter, the gauge is placed on the old piece and the slide rod is pressed down until it touches the surface; then the nut is tightened to hold

the rod immovable and the new piece is turned until the gauge fits it in the same way.—Harry Moore, Montreal, Can.

Cleaning Terra Cotta

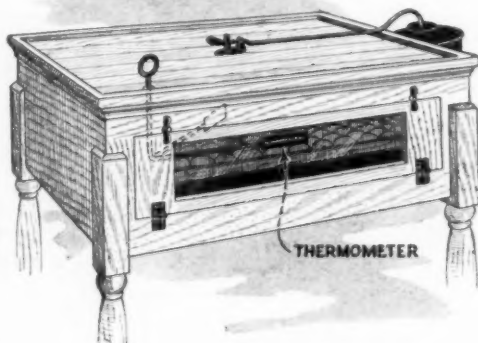
In cleaning terra cotta the bureau of standards has found that sodium hydro-sulphite is effective and does not corrode the glaze. Fluo-silicic acid also cleans the material satisfactorily but attacks the glaze slightly. Trisodium phosphate is a good cleaner on standard finishes but unsatisfactory for glazed finishes. Soap powder cleans slowly and has a tendency to scour, thereby roughening the glazed surface, and hydrochloric acid, which is also a fair cleaner, has a slight corrosive effect on the glaze. Hydrofluoric acid should never be used on terra cotta.

Reading the Incubator Thermometer

Incubators are often located in places where darkness makes it almost impossible to read the thermometer without opening the machine and withdrawing the egg tray. As this is likely to chill the eggs, one poultryman devised a simple fixture by which the thermometer is held in place over the center of the egg tray, or can be swung into plain view against the glass at the front of the machine without opening the door. The holder consists of a stout wire, bent at right angles and inserted through a small hole in the top of the incubator. A loop at the end of the perpendicular arm rests on the top of the machine, and supports the bracket, so

that the thermometer, attached at the end of the horizontal arm, is suspended at the proper distance above the eggs. Turning the loop at the top of the machine swings the thermometer against the glass of the door and after it has been read, it is swung back to its former position.—G. E. Hendrickson, Argyle, Wis.

Thermometer Read in Incubator with This Swinging Holder



Your Boy Will Like This Liner

By HI SIBLEY

THE toy-boat builder, having worked out ingenious designs in craft powered by clockwork, rubber bands and electric motors, will find a real steamer a fascinating novelty. Only a fraction of the countless ships that sail the seven seas are powered with anything besides steam, and a toy steamer affords a great thrill, for it has the action and sound of a full-size ship. There are no difficulties in making one, but if the young shipbuilder has a small upright steam engine among his toys, half the job is done.

Use white pine for the hull, which is made up of three pieces—bottom, main-hull block and deck. Lay out your outlines on the central block, which is 30 in. long, 6½ in. wide and 3 in. deep, and, after boring four holes at the corners of the hold, saw out the inside piece with a

the boiler. These can be bought at a very reasonable price; in fact, the engine used in the original of this model cost only eighty-five cents and is an exceptionally capable performer.

Set the engine amidships with quite a tilt aft so that the crankshaft will be nearly in line with the propeller-shaft position. Locate the engine, but do not fasten it. Now bore a hole through the stern just large enough to receive a brass tube of ⅜-in. inside diameter. This should line up with the center of the flywheel.

Cut a length of stiff brass wire for the propeller shaft and straighten it. The propeller can be cut from a tin-can lid or, better, a sheet of brass; solder it to the brass wire. Make two lead bearings, or plugs, for the ends of the propeller-shaft tube by pouring molten lead or babbitt,

the latter being preferable, into a hole bored in a block of wood having a nail, of the same diameter as the shaft, in the center. When cold, the nail is easily pulled out, leaving a hole for the pro-

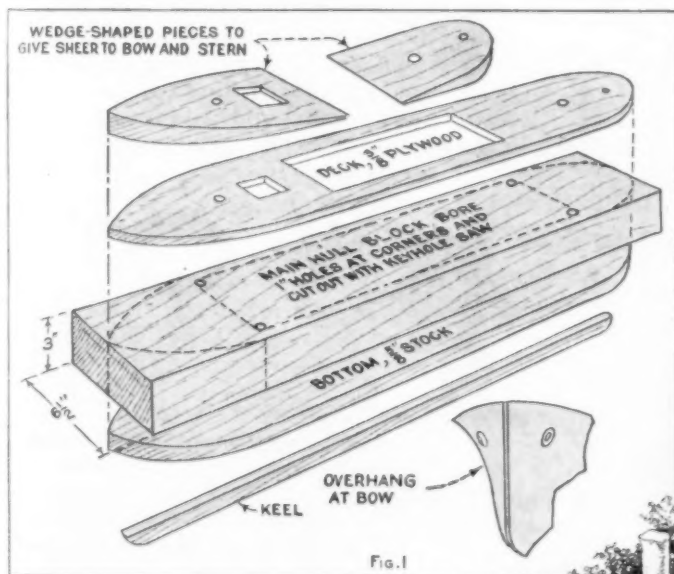
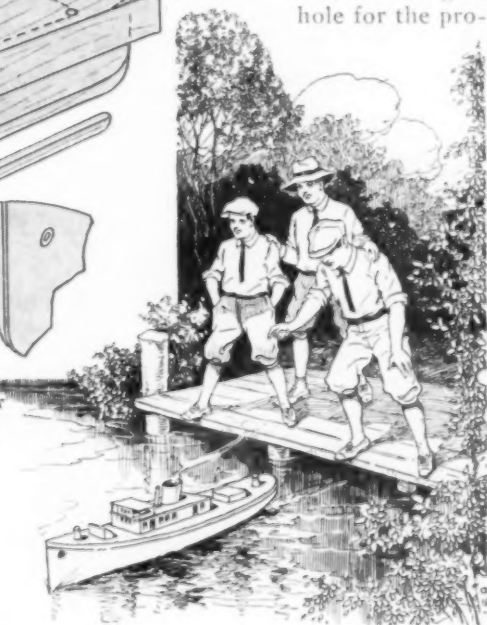


Fig. 1

keyhole saw, and then cut away for the bow and stern, as indicated by the dotted lines in Fig. 1. Nail the 5/8-in. bottom board firmly to the main block, and you are ready to install your power plant.

The steam engine best adapted to this model is a small upright type, in which the crankshaft runs through the center of



propeller shaft. File the plugs to a taper, so that they can be driven into the ends of the brass tube. The plug at the propeller end can be driven in permanently, but that at the other end should be loose enough to be taken out when assembling the various parts. Some sort of thrust washer, which may be a battery nut, for example, should be used between propeller and bearing.

It is almost impossible to line up an engine with a long propeller shaft accurately enough so that it will not bind, without using a universal joint. The latter, however, is simply made and permits the shaft to turn very freely at all times. Two brass or tin strips are cut, perforated and bent as shown, one for the flywheel and the other for the inner end of the propeller shaft. They are connected by means of a brass-wire "spider," shown in Fig. 2.

Most cheap steam engines have a lead

flywheel and hub, and the latter can be drilled a short depth to receive the small brass screw that holds the universal arm. A drop of solder will fasten it more securely. Having assembled your propeller shaft, bearings, etc., in the boat, you can solder the universal arm to the inner end of the shaft and insert the spider. When all turns freely, fasten the engine securely to the bottom of the boat with screws. At this point, you can test the boat out in the water, first having given the hull a coat of paint on the outside to prevent water soaking in. Also it would be well to set a tin shield around the engine, as high as the universal and open in front, so that the wood will not scorch.

Tin, lined with asbestos, such as is used in pipes for hot-air furnaces, is excellent material for this shield. Fasten the upper end of the propeller shaft tube to a notched crossbar so that it will not vibrate.

Assuming that your newly launched liner meets the "engineer's" specifications and expected performance, finish up with the deck and cabins. The main cabin, directly over the engine, is made of $\frac{3}{8}$ or $\frac{1}{4}$ -in. stuff, and lined with tin and asbestos. The roof is also of tin, asbestos-lined, with a large funnel soldered over the opening for the top of the engine. This funnel

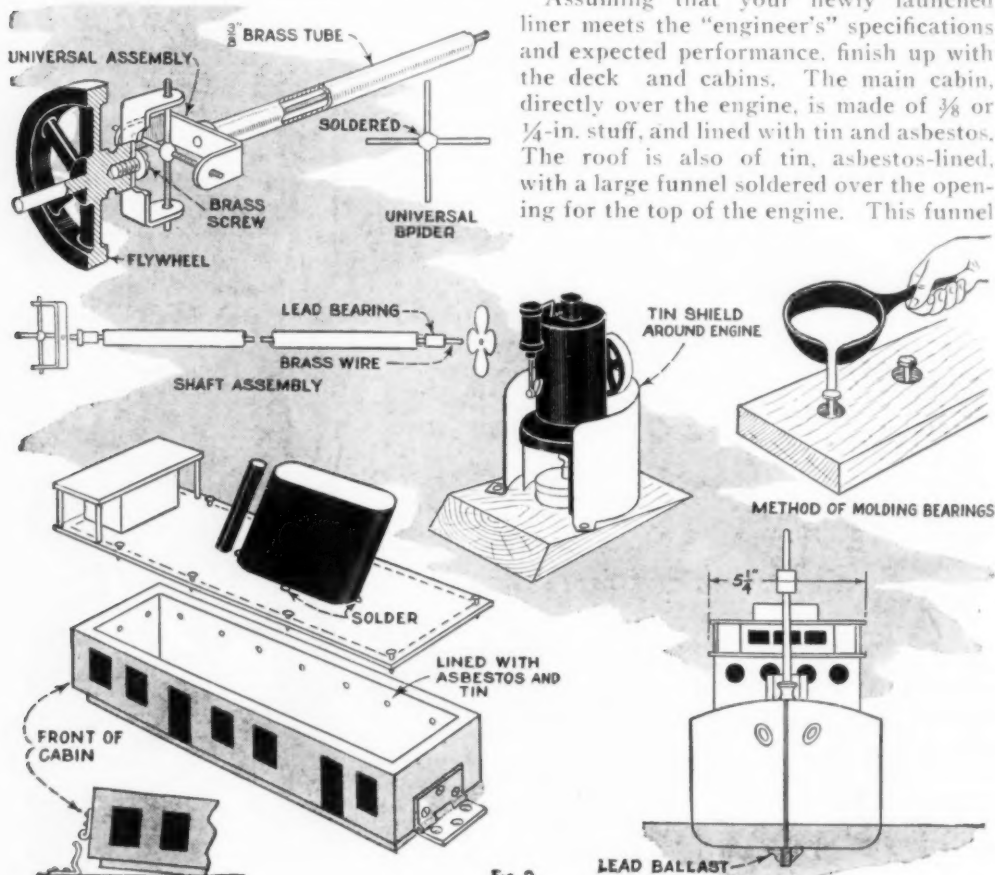


FIG. 2

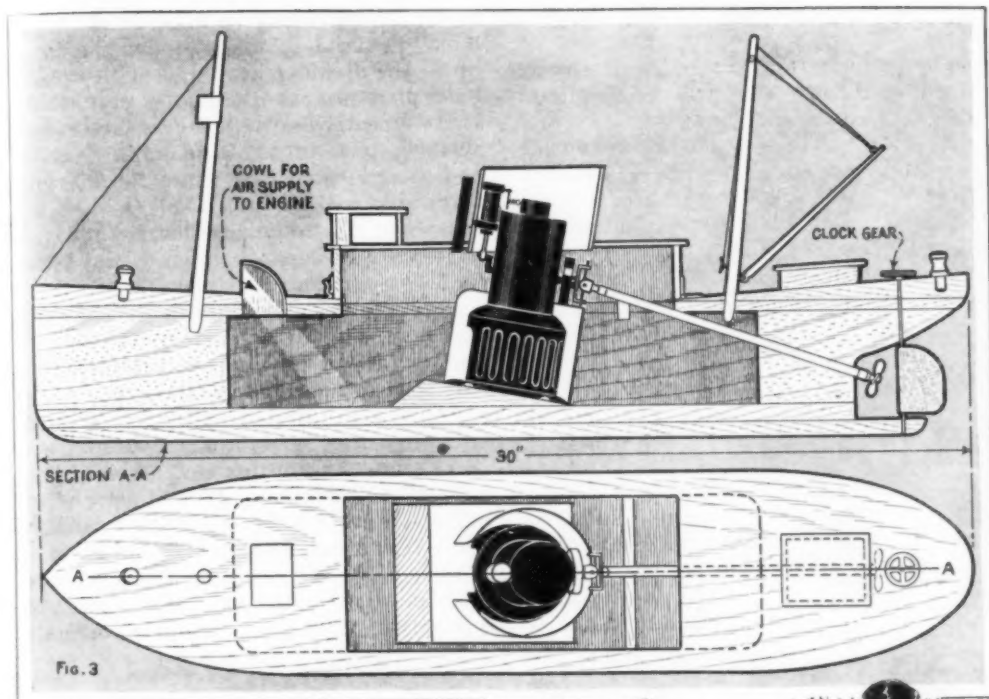


FIG. 3

must be of generous proportions, so that it can carry off the heat without danger of setting the boat on fire. The entire cabin is hinged at the back so that it may be tilted up when refueling or filling up the boiler. The catch at the front end can be made of tin or sheet brass. A solid block of wood will serve for the wheelhouse and also for the after cabin or hatch, which has no function except for appearance.

The rudder is of galvanized sheet iron or brass, with a large clock gear at the top of the rudder post for turning it. Masts, capstans, crow's-nest, etc., are made as indicated in Fig. 3. An important item is the lead ballast, two triangular strips of lead, on the sides of the keel.

Paint the hull a bright red below the water line, black above, and deckhouses cream, with doors, windows and portholes outlined in green. Varnish the decks, and give the funnel a red band at the top.

Rubber Gasket for High Pressures

Even the best grades of sheet-rubber packing for use with high-pressure steam



work will sometimes blow out under pressures of 150 or 200 lb., while the cheaper grades are seldom satisfactory for pressures over 100 lb. But the latter can be used for high-pressure work if it is prepared in the following way: Cut out the gasket or washer in the usual way and give one side an application of fairly thick liquid shellac. Have ready some cuttings made by using a coarse rasp on a piece of babbitt. Lead raspings will do in most cases, but the babbitt is better. Sprinkle the raspings freely over the sticky surface. Install the gasket in the usual way and tighten well after the joint is heated up with steam. So prepared, a gasket will seldom leak, nor will it blow out any quicker than those made of the more expensive material.—James E. Noble, Toronto, Can.

Device Helps to Reline Brake Bands

When relining auto brake bands, the jig shown in the drawing will be found of



great assistance. It is made of $\frac{1}{4}$ by 2-in. flat-iron stock, bent double as shown. A small pin to fit the rivet holes in the bands is welded on as indicated, and a hole the size of the diameter of the pin, and exactly in line with it, is drilled in the opposite side of the jig. In use, the brake band and lining are held in the

jig, which is clamped in the vise. The hole in the jig guides the worker in drilling holes through the lining, the pin fitting in the hole of the band directly underneath.—A. C. Cole, Chicago, Ill.

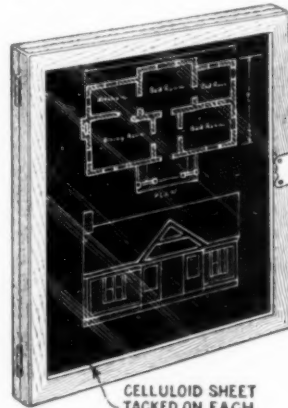
Laying Out Angles Accurately

Dividing a circle into equal parts represented by degrees, and the further subdivision of these degrees into minutes, is a task that few mechanics accomplish accurately. However, here is a simple method of laying out angles by making use of the 18-hole and 27-hole index plates that are provided with a universal milling-machine dividing head. This method is based on the fact that 40 turns of the index crank are necessary to cause the work to make a complete revolution. Hence it is obvious that each turn advances the work an angle of 360 divided by 40, or 9° . To subdivide this angle, use an index plate having a number of holes being an even multiple of nine. With an 18-hole plate a turn from one hole to the next represents $\frac{1}{2}^\circ$, or 30 min., and to the second 1° . By using the 27-hole plate, the movement from one hole to the next equals $\frac{1}{3}^\circ$, or 20 min. As an example, suppose you want to scratch two lines that

make an angle with each other of $20^\circ 20$ min. Proceed as follows: Set the work up in the dividing head and, with the 27-hole plate set on the index crankshaft, scribe a center line with the surface gauge. Two complete turns of the crank give 18° , and a turn equal to 7 times the distance from hole to hole (or 7 holes) is $\frac{7}{27}^\circ$, or $2^\circ 20$ min. By following this method, any angle can be laid out quickly and accurately. If you have to lay out an odd number of minutes, the following will be of help. It gives the number of minutes that a one-hole movement in the different standard index plates makes: 15-hole plate, 36 min.; 16-hole plate, 33.75 min.; 17-hole plate, 31.76 min.; 19-hole plate, 28.42 min.; 20-hole plate, 27.00 min.; 21-hole plate, 25.71 min.; 23-hole plate, 23.47 min.; 29-hole plate, 18.62 min.; 31-hole plate, 17.41 min.; 33-hole plate, 16.36 min.; 37-hole plate, 14.59 min.; 39-hole plate, 13.84 min.; 41-hole plate, 13.17 min.; 47-hole plate, 11.48 min., and 49-hole plate, 11.02 minutes.

Holder Prevents Soiling of Blueprints

A Wisconsin builder, noticing that his workmen soiled and eventually ruined many valuable blueprints, devised a simple holder to protect them.



It consists of two wood frames, hinged together and covered with celluloid sheets, obtained at a near-by auto-accessory store. The blueprints were inserted in the frame so that two floor plans or two elevations were exposed to view at either side. A latch was provided to hold the frames together and facilitate the removal or replacement of the prints.—G. E. Hendrickson, Argyle, Wis.

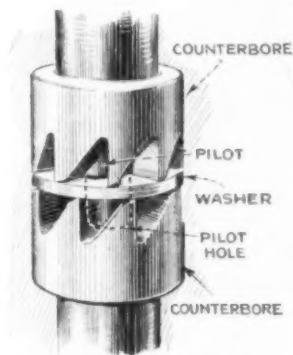
☛ Stain putty to match the finish before applying it on high-grade work.

Prevention of Scale When Hardening Steel

One of the things to watch out for when hardening steel is the scale or oxide that forms on it. This is a matter for consideration when the piece must be true to size after hardening, because scraping off the scale usually makes it undersize. To avoid this, proceed as follows: Instead of placing the piece to be hardened in an open fire, as is usually done, put it in a container made from a length of pipe, threaded at each end for a cap or plug to shut out the air, and place the container in the fire. No scale can form because no air reaches the piece to be hardened. As a matter of fact, any sealed metal container can be used, depending on what is at hand. It is brought to the required heat in the usual way and quenched in water or brine.—James McIntyre, Hartford, Conn.

Counterboring Washers

Some washers, about $\frac{1}{8}$ in. thick, had to be thinned down to $\frac{1}{32}$ in. The only way to do this was by counterboring, which involved the problem of holding the washers securely. I obtained duplicate counterbores and removed the pilot from one. This I held in a chuck bolted to the machine table. The one with



The pilot still in place was held in the drill-press spindle. With this set-up I laid a washer on top of the pilotless counterbore, and brought the other one down until the pilot passed through the washer and into the pilot hole of the stationary counterbore. A glance at the set-up will show that one of the counterbores will cut. If the washer turns around with the moving counterbore, the stationary one will cut, and if the washer bites into the stationary counterbore, the moving one will cut.—Harry Moore, Hamilton, Can.



A Strong and Convenient Strap Holder Is a Timesaver for the Harness Repair Man

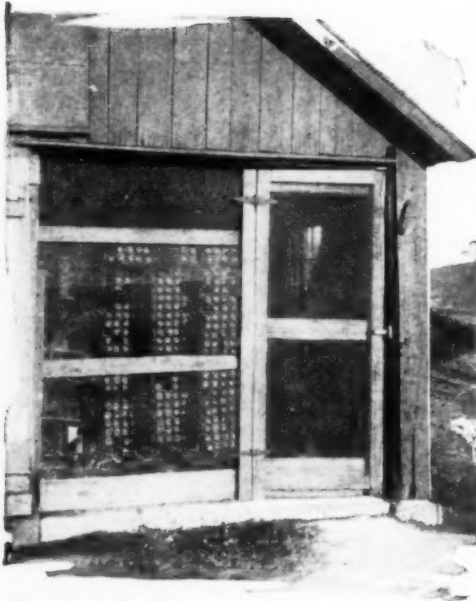
Clamp for the Harness Repair Man

Belt makers, harness repair men and other tradesmen who have to work with leather, rubber or fabric strips on a bench, will find the illustrated spring clamp very useful. The leaf of a discarded auto spring is bolted to the underside of the workbench at the end most convenient, and, through the eye of the spring, is fastened a double hook made from a length of $\frac{3}{8}$ -in. round steel with the ends sharpened. When splitting or trimming a belt or strap, it is placed flush with the end of the bench, as shown, the hooks being raised and then released to hold the strip securely at the far end, while the other is kept immovable by the left hand.

Handy Pocket Saw

Nearly every mechanical device used around the home seems to be assembled with screws. When tightening or loosening them one is apt to spoil the slot in the head, but the slot can readily be deepened by means of a short piece of hacksaw blade. It will be found handy to keep such a piece on one's keyring.





Wire Mesh, Replacing One Wall of Storage Shed for Seed Corn, Permits Proper Ventilation

Storage Shed for Seed Corn

Seed corn should have plenty of ventilation and also be adequately protected from chickens, mice and rats. A good storage shed which meets these requirements has been constructed by an Indiana farmer, and is shown in the accompanying photograph. The corn is held on a number of wooden racks near one end, the wall at this end of the shed being replaced with wire mesh. This permits plenty of air and sunlight. The foundation and floor are well fitted to prevent the entrance of rodents.—J. C. Allen, Lafayette, Ind.

Stop for Reaming with Drill Press

In the manufacture of certain interchangeable machine parts using a taper pin, difficulty was experienced in getting all the machine-reamed holes exactly the same depth. Various stops were tried on the drill-press spindle, but they always slipped and it took too long to set them up. Finally the operator hit upon the idea of drilling a hole of the correct depth in a parallel on which the piece was taper-reamed. The reamer cuts through the piece and the end comes against the bottom of the drilled hole in the parallel, which gives a positive stop. This method eliminates all worry about the reamer slid-

ing up into the chuck or the collar on the spindle slipping, and, of course, the time required for setting up is reduced to a minimum.—Arthur F. Parker, Philipsburg, Pennsylvania.

Tinning Cast Iron

To solder cast iron or fill a hole or crack in it is difficult, because the surface cannot be tinned readily. Grinding, filing or polishing does very little good, and a really satisfactory job of soldering is seldom obtained. However, a railroad shopman accidentally discovered that the surface could be effectively prepared for tinning by sandblasting. This method is especially adapted to the tinning of bearings that are to be babbitted. The sandblasting cuts away the carbon in the cast iron, but has little effect on the metal itself, except that it leaves it bright and clean. The solder clings to this clean surface almost as readily as it does to steel or tin plate. Sandblasting greatly assists in obtaining a good welding job with a gas torch. When tinning the sandblasted surface, regular soldering flux is used.—Avery E. Granville, LaGrange, Ill.

Milk-Can Rack for Auto Truck

One farmer who delivered milk to a neighboring town with a truck, was unable to load it with feed and other products on his return trip, because the empty cans, although light in weight, required all the space. To overcome this difficulty, the farmer built special racks on the sides of the truck to hold the empty cans, as shown in the photo. This left plenty of space for whatever extra load he wished to carry back home.



Racks Built on Sides of Auto Truck Hold Empty Milk Cans

Designing Radiator Furniture

By THOS. W. BENSON

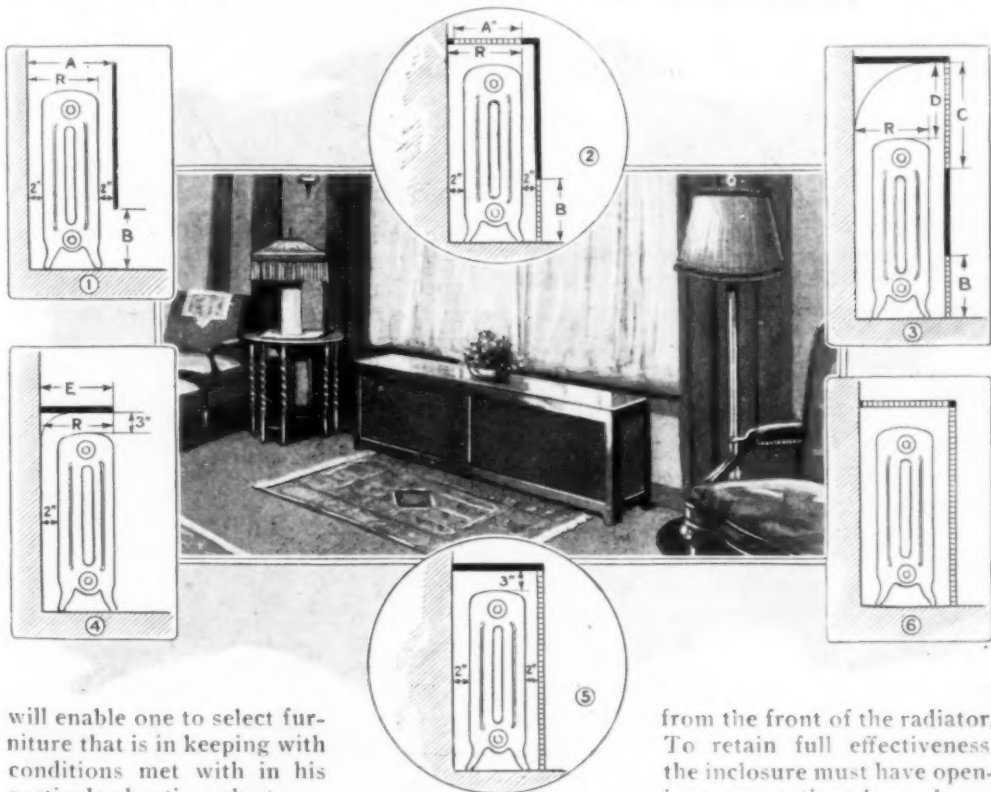
THE USUAL steam or hot-water radiators are seldom things of beauty and when making furniture to improve their appearance, it is well to remember that the inclosure will influence the effectiveness of the heating system. Practically all the heat from the radiator is dissipated by convection, that is, by having the heat carried off by the air flowing over and through the radiator. Radiator inclosures sometimes increase, but too often decrease, the flow of air and thus lower the heating effect of the radiator.

In the accompanying illustration six general types of inclosures are shown diagrammatically. The following paragraphs

rate of flow and improves the heating. A change in proportions will usually result in reduced efficiency and the arrangement shown is possibly the best from the heating standpoint. Such an inclosure, on the other hand, does not prevent smudging of the wall and is not very decorative.

If screens are added, as in Fig. 2, with the opening B as in the previous case and A equal to R, the screens reduce the air flow and the arrangement is but 5 per cent better than the plain radiator.

In order to prevent smudging of the wall by dust carried up by the rising stream of warm air, it is necessary to use a solid top and discharge the warm air



will enable one to select furniture that is in keeping with conditions met with in his particular heating plant.

In Fig. 1, when dimension B is equal to R, the radiator will be 10 per cent more effective than before. This is due to the solid screen forming a well-defined path for the air circulation, which increases the

from the front of the radiator. To retain full effectiveness, the inclosure must have openings proportioned as shown in Fig. 3, where D is equal to R and C is twice B. The structure is rather high but any lessening of the discharge opening will reduce the flow of warm air and the radiator becomes that much less effective.

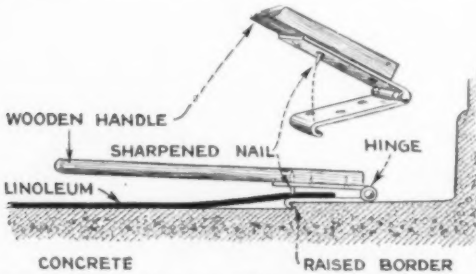
The practice of mounting a shelf over a radiator for flowers or books, as in Fig. 4, is a very poor one, and affects heat radiation to a greater extent than would seem possible. When the width of the shelf E is but half of dimension A in Fig. 1, there is a drop of 10 per cent in heat radiation. When E equals A, the reduction is 20 per cent and, in extreme cases, where E is one and a half times A, the loss is 35 per cent. Putting a screen in front, as in Fig. 5, with the solid top E equal to A, results in a 30-per-cent loss, but an all-screen inclosure, as in Fig. 6, reduces the effectiveness only 5 per cent.

Summing up, it is apparent that any attempt to use a solid-top radiator inclosure,

except when it is arranged as in Fig. 3, will reduce the heat thrown off by the radiator. It is possible to disguise the radiator with open or screen-top inclosures, while still retaining heating efficiency, but the disadvantage of smudging the walls is still present. Loss of effectiveness of the radiators can be offset by carrying higher temperatures in hot-water systems and higher pressures in steam-heating systems, but the forcing of the heater leads to coal losses. Other alternatives are the use of larger radiators, or fans to circulate the air faster. It is for the individual to decide whether his heating plant will permit the use of radiator furniture, and these facts will aid in an intelligent decision.

Fitting Linoleum Snugly against Raised Concrete Border

Cutting linoleum to fit snugly against a raised concrete border is a task that re-



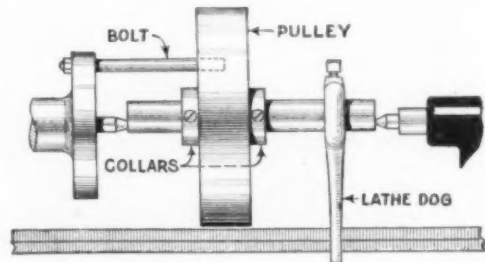
Device for Marking the Edges of Linoleum So That It Will Fit Snugly

quires considerable care, and the usual method of scribing is impractical in this particular case. The work is facilitated by the use of the simple tool shown in the illustration. It consists of a 4-in. strap hinge, screwed to a 12-ft. length of 1 by 2-in. board. The free portion of the hinge is bent over as indicated, and a sharpened nail or screw is driven into one of the holes in the other part, the point of the nail being directly over the bent edge and consequently directly in line with the edge of the raised border. In use, the loose leaf is fitted over the edge of the linoleum as shown, and the handle is depressed to make a punch mark, which indicates the exact point where the linoleum is to be cut to make a snug fit against the concrete border. The hinge is then slid along

the edge and the operation repeated at 1-ft. intervals, leaving a row of punch marks that serve as a guide in scribing the cutting line. This device eliminates the frequent shifting of the linoleum necessary when scribing in the usual way.—Mary Gleeson, San Francisco, Calif.

Turning a Large Pulley in a Small Lathe

We had a number of 16-in. pulleys to turn down on a 14-in. lathe, a job which seemed impossible at first thought. However, the illustrated set-up shows how the work was done. A mandrel, on which the pulley made a running fit so that it could be rotated, was mounted 1/4 in. off center, as indicated. A lathe dog was attached to the mandrel near the tailstock, the dog being large enough to project beyond the ways of the lathe bed in order to prevent the mandrel from turning. A bolt was fastened to the faceplate to serve as a dog for driving the pulley.—C. Kugler, Philadelphia, Pa.



Set-Up Showing How a 16-In. Pulley Was Turned in a 14-In. Lathe

Sawdust Cakes for Kindling

Where a great deal of sawdust accumulates, as on the farm, good kindling cakes for the kitchen stove can be made as follows: Get a length of 3-in. tile and stand it on the fluted end on a smooth board. Make a plunger from a section of a small log and fit a handle to it on one end. Mix up sawdust with enough flour paste to make a crumbly but not too sticky mass. Throw some of this into the tile and tamp it down with the plunger. Then lift the tile off the cake and proceed to make another. When dry and hard, the cakes should be piled carefully in a dry place. One or two cakes will suffice to start the fire either by sprinkling with kerosene or placing them over lighted newspapers.—L. B. Robbins, Harwich, Mass.



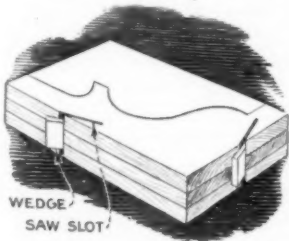
Rack Constructed from Lengths of Pipe Facilitates the Draining and Airing of Milk Cans

Rack for Draining Milk Cans

An Alabama farmer has constructed a simple rack for draining and airing milk cans. It consists of two lengths of iron pipe, arranged along a fence as shown. One of them is held securely in place by crosspieces, which are nailed to the posts and have holes drilled through them for the pipe. The other length of pipe is held in a similar way in holes drilled through the posts. The milk cans are set on the lower pipe, upside down, and lean against the upper pipe. To remove them the handle is grasped and the cans are dislodged from the lower pipe.—J. C. Allen, Lafayette, Ind.

How to Cut Duplicate Pieces on a Bandsaw

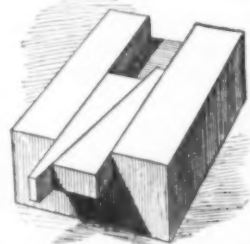
It is often necessary to cut out a number of duplicate pieces on a bandsaw. Sawing three or four at once means, of course, quite a timesaving, but the pieces must be securely held together during the operation. An easy means to this end is to cut two or more tapered slots, about 1 in. deep, in two adjacent edges of the material as indicated and then drive a small wedge into each slot. The wedges will hold the pieces together firmly and prevent their slipping apart while the sawing is done.—Neil Nelson, Kansas City, Mo.



adjacent edges of the material as indicated and then drive a small wedge into each slot. The wedges will hold the pieces together firmly and prevent their slipping apart while the sawing is done.—Neil Nelson, Kansas City, Mo.

Accurate Measuring of Keyways and Grooves

When cutting keyways and grooves in machine parts, a very simple method of measuring them accurately is to use a pair of steel wedges, or an adjustable parallel with which every shop man is familiar. Place the wedges in the groove and slide them together until they are tight in the groove, letting the ends project. Then, by using the micrometer on the outside of the wedges, a true size can be obtained.



Aluminum castings may be ground on a disk grinder without filling the abrasive material, if a coat of paraffin is applied to the wheel.

How to Handle Brass Pipe

By HORACE G. WOODWARD

I AM "right handy with tools" and do a great deal of repair work about our place. When preparing to make a new service connection with the city water main, I decided to have all pipes carrying water for the house of brass. Before starting the job, however, I made some inquiries about brass pipe and to get "kinks" of knowledge about such jobs. I am passing on some of the main points which may be useful to others doing similar jobs.

It is necessary to remember that brass, being an easier metal to work, does not require the force that would be applied to iron pipe, either in the vise or the wrench, or the stock and dies. Working in standard iron-pipe-size brass pipe, it is desirable, for the vise, to split an iron-pipe coupling for such-size pipe with a hacksaw, lay a sheet of lead over each half and insert these on opposite sides of the brass pipe in the vise.

I was surprised to learn that threading may be done without any lubricant at all, but a characteristic squeak is then produced, which may be avoided by using soapy water or oil. The dies are the same as for iron pipe, but should have perfect teeth, and these in the best dies are shaped to advance in the work like a cultivator plow, lifting out the shaving. Experts say that the stock should not be jerked when cutting threads on brass pipe, but pulled with a steady movement in order to insure perfect threads, and I find this method gives fine results.

Another important thing in either brass or iron pipe is not to put too many deep

threads on the pipe; six or seven perfect threads are sufficient, and more will simply weaken the pipe beyond the joint. Fittings should have a

good reinforcing bead, and there is a fitting available that will extend upon the pipe beyond the perfect threads, giving great strength to the joint. The fittings should be of good quality brass, not iron.

Friction wrenches should be used on the pipe, and to turn elbows or tees, I use a monkey wrench, the jaws extending beside the part that projects sideways. A pipe wrench may be used on brass pipe, but has the same

objection as on galvanized-iron pipe, cutting the pipe excessively if not carefully handled. Pipe wrenches should not be used at all on fittings. Powdered rosin, applied to the faces of the vise clamps or the friction faces of the wrench, will overcome the tendency to slip on the pipe.

The amateur worker, and many plumbers, may not realize the importance of reaming both iron and brass pipe to remove the burr at the ends. I have used a round file for this purpose with satisfactory results. I have observed in 1/2-in. pipe a burr formed by a wheel cutter which reduced the capacity of the line fully one quarter. When pipe and fittings are accurately threaded no filling or dope is needed in the joints, but a paste of linseed oil and red lead is used by many plumbers to insure tight joints.

Brass pipe for laying in the ground should not be ordinary "yellow" brass, but annealed or otherwise suited to sustain settling strains.

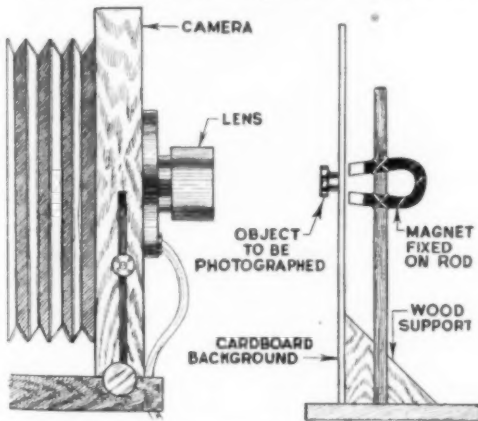


Cementing Tool Tangs in Handles

A quick-setting cement for anchoring the tangs of small tools in wood or fiber handles can be made from pure shellac. Buy the dry shellac and dissolve it in just enough alcohol to make a paste, which is then put in a tin dish or can and ignited. Immediately after the flame has died down, and before the shellac has a chance to cool and harden, fill the handles with the cement thus made, and drive in the tangs, which should be heated. When cool, the cement will be found to be very strong and practically waterproof.

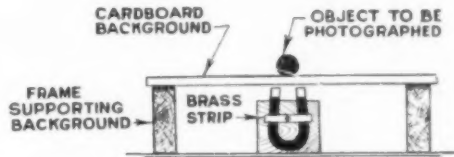
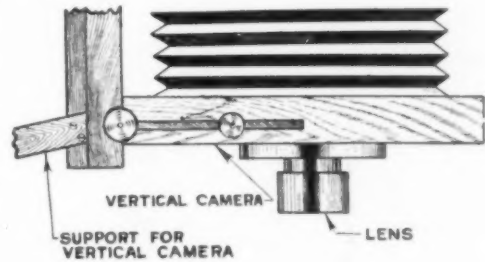
Holding Small Steel Articles for Photographing

When small steel or iron articles are to be photographed without showing any support, a magnet can be used to hold them as shown in the drawings. Fig. 1 shows the general arrangement. The background is a sheet of cardboard which is held to the base by triangular pieces of wood at each side. Behind the background and close to it, a strong permanent magnet is supported by a wooden rod, to which it is fastened with a few turns of copper wire. If the object is set against the cardboard, the magnet will hold it securely. When one item has been photographed it is simply lifted off and the next one placed in position. In this manner a great deal of time can be saved and re-touching is reduced to a minimum because no support shows on the photo. A discarded magneto magnet is suitable for



Permanent Magnet, Securely Supported on Rod, Holds Small Iron and Steel Objects for Photographing

this purpose and, for very heavy objects, several magnets may be placed side by side, or a small electromagnet may be used instead. The current is taken from



Spherical and Other Irregularly Shaped Pieces Can Be Held Securely on Flat Surfaces

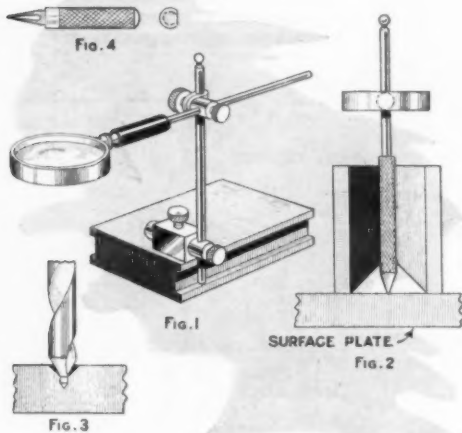
a few dry cells, and as the current is only used for short periods of time, the batteries will last very long. Even with a vertical camera, a magnet support is sometimes valuable, especially if the object is irregular in shape or spherical, so that it may roll about or tip over during the process of photographing, particularly if some machinery is working close by, as in factories. The arrangement in this case is shown in Fig. 2. The magnet can be held by a block of wood, a strip of brass and a wood screw being used to fasten it to the block. Do not use a steel strip for this purpose as it will short-circuit the magnet.

This method is not confined to steel or iron objects. Many other articles can be held as suggested if a short iron pin can be inserted in them. For instance, if a smoker's pipe is to be photographed, an iron pin may be placed in the bore. The magnet will attract this and the object will cling to the background exactly like a solid steel body.—C. A. Oldroyd, Barrow-in-Furness, Lancs., England.

When the drawers in a chest, cabinet, or other storage place for tools, stick or are hard to pull, apply a little grease along the sides and other bearing surfaces.

Kinks on Accurate Drilling

I have been using a few kinks in laying out jig work for the drill press with great



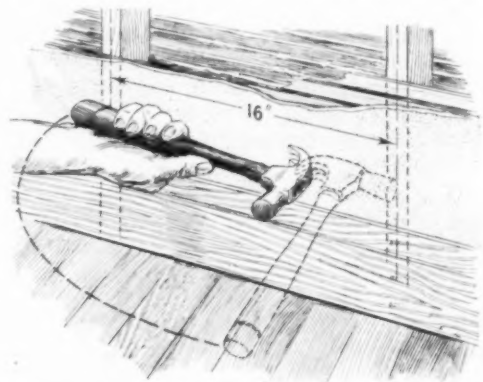
Sharp Tools and the Application of a Few Handy Kinks Will Help in Drilling Accurate Holes

success. A large magnifying glass, held by a clamp so that the worker's hands are free, is better than a small one. One method of holding the glass is shown in Fig. 1. It can be set to any angle. If no precision center punch is available, the surface gauge or a V-block can be used as in Fig. 2. This keeps the punch at right angles to the work. A flat scribe of the kind shown in Fig. 4 should be used, as a round one sometimes causes inaccurate work. The punch should be accurately ground to a sharp point, which will facilitate marking the work at the intersection of two lines. Use a center combination drill of a diameter smaller than that of the center-punch mark, and make the angle sharper. For instance, if the center punch has an angle of 60° , that of the drill should be about 70° . Then follow this up with a drill like the one shown in Fig. 3. This has a tendency to make the drill follow the hole. If dividers are used, keep them sharp at all times. Whenever possible, use a scale graduated in fiftieths or hundredths of an inch, because the lines on these scales are finer than those on more coarsely graduated rules. Such fine graduations enable you to set your dividers more accurately. If you are not sure of

the accuracy of a layout, drill small holes, that is, smaller than the finished size, insert the drill rod of the correct size and measure over all with a micrometer. If there is any error, use a round file to enlarge the holes so that the next-size drill corrects the error. I have found that it pays to blue the work, even though it costs more than rubbing bluestone on it, as this enables you to see the lines more clearly. If the above rules are strictly followed, and the tools are kept in good condition, no trouble will be experienced in drilling holes within limits from .003-in. center-to-center distance.—Charles Kugler, Philadelphia, Pa.

Spotting Wall Studs

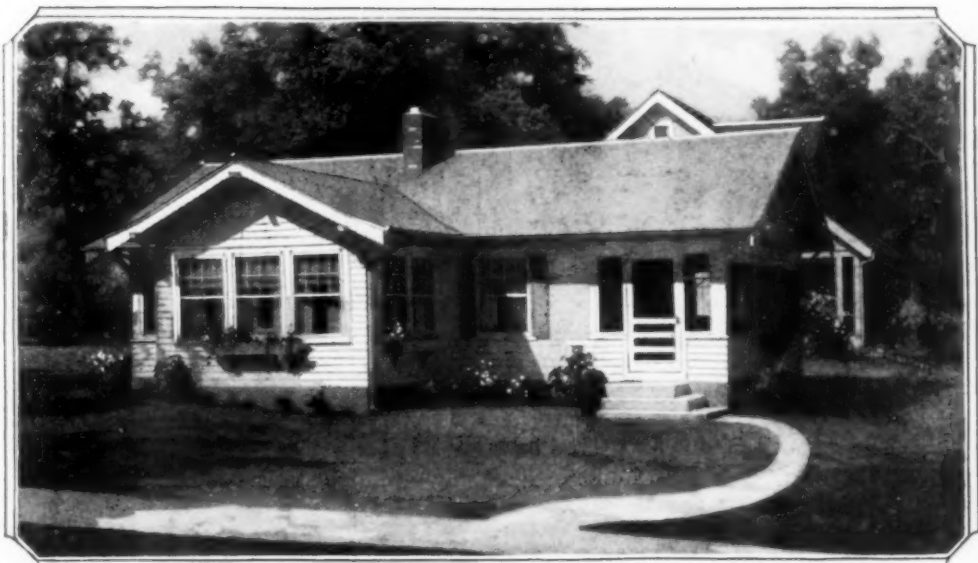
The drawing shows how a carpenter's hammer may be used to space off for locating points in baseboards, hook strips, chair rails, etc., at which to nail them to the wall studs through the plaster. After finding one stud, by sounding or other methods, place the driving face of the hammer at this point and roll it forward over the claws, until the end of the handle strikes the surface of the board. The end has previously been scored, as shown, so that the mark comes exactly in line with the next stud, 16 in. from the first. This



Marked Hammer Handle Enables Quick Measurement for Stud Nails in Baseboards and the Like

is an accurate and quicker method than sounding for each nail or using a rule.

Crude petroleum oil, diluted with gasoline, makes a good brown wood stain, resembling dark-oak finish.



© POPULAR MECHANICS MAGAZINE

PLAN 61-L.F.

A House Complete for \$2500⁰⁰

NOW you can build that home and buy that car. If you are undecided which to spend your savings on, the following idea may suggest how to have both and without pinching your pocketbook for years to come.

Why not build a little house? Yes, a very little house. Equip it as efficiently as a modern city flat. Build only enough house to give you comfortable shelter, style and convenience. But don't doll it up to look like a miniature mansion. Dolling up costs money. Keep it simple. Remember that above everything else it must be a timesaver. You will need that time to drive your new car.

You would be willing to build such a house if it did not place a yoke of indebtedness around your neck for years to come. All right. Then study this plan and read the story of how the owner built this house complete for \$2,500.

It started out as a lake cottage on the outskirts of a

big city. The owner liked it so well, he decided to live in the house all year round. And in a climate where the winters are cold. Motoring to and from the city was a matter of only ten miles. What is ten miles when you can save on taxes, building costs, upkeep and at the same time enjoy the health, happiness and blessings of the countryside?

Here is how he did it: Partially excavated the cellar. Used a small hot-air furnace which keeps the house comfy in all kinds of weather. Fully insulated the floors, sidewalls and ceiling to make the house warmer in winter and cooler in summer. Used wallboard as an interior finish.

In every other respect the house is of standard construction: Frame with shingle roof, either wood or composition; siding exterior. The house would look well with shingled sidewalls. Or it might be stuccoed.

Now study the plan and see how

A NEW SERVICE

To help our readers get started on one of life's most glorious experiences—building and owning a home—Popular Mechanics Magazine will supply readers a one-sheet blueprint of the house here illustrated for \$2. This blueprint does away with the necessity of first purchasing a complete set of plans to find out whether you can afford to build. It contains floor plans, elevations, a section, detail, size of joists, studs, etc., and also a brief specification. Submit it to tradesmen and dealers for building estimates.



efficiently it works out to save time, space, labor and money. There's a large, inviting living room with stone or brick fireplace. A dining porch opens off the kitchen and living room. This, too, can be used for living purposes or even sleeping quarters in an emergency. A compact kitchen, fully equipped with cupboard space, a rear porch, a well-fitted bathroom and one bedroom complete the equipment.

While there is only one main bedroom, a closet or concealed bed opens into the living room from the closet beside the fireplace. This adds extra sleeping accommodations and saves the cost of another bedroom—a saving, according to builders, of between \$500 and \$1,000. A broad screened porch stretches across the entire front of the house. You may want to glaze this in for permanent living quarters.

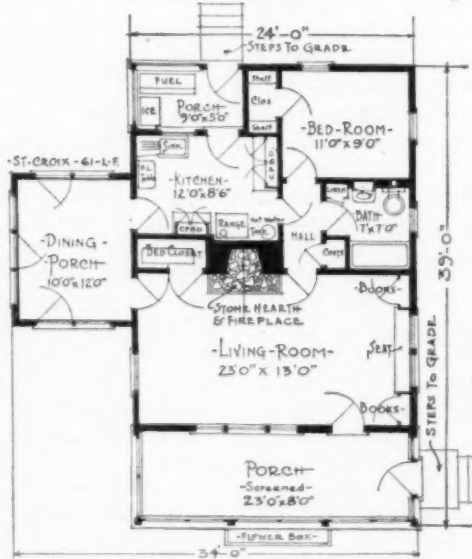
Further savings were made by making space and materials do double duty. Wall-



board replaced lath and plaster. A closet bed did away with a second bedroom. Partial cellar excavation saved a tidy sum.

This house may have started out as a summer cottage. It finished, however, as a mighty comfortable all-year dwelling. Savings were made without sacrificing any of the comforts of the family, and there was enough cash left for the purchase of a more up-to-date automobile.

The cost of building this house obviously will depend upon how thoroughly you equip it, where you build, and what materials you select for it. If you are trying to make your dollars do double duty—provide a home and a better car at the same time—it's worth while to investigate this idea of making space also do double duty. It is one of the easiest and surest ways of accom-



EDITOR'S NOTE: Popular Mechanics Magazine has prepared a new plan book, "Twenty Popular Low Cost Homes and Ten Commandments for Home Builders." These are selected homes and show labor, space and time-saving ideas. They are \$5,000 homes and less. Send 10 cents in stamps to cover postage. Address Building Editor.

plishing that desirable purpose by keeping down costs.