

NOVEMBER Television for You?—Page 820 25 CENTS

OCT 8 1928

PERIODICAL RATE  
GENERAL MAIL  
MAY 15 1928

# POPULAR MECHANICS MAGAZINE

WRITTEN SO YOU CAN UNDERSTAND IT

REG. TRADE MARK GREAT BRITAIN NO. 40926

REG. U.S. PAT. OFF.



SEE PAGE 717

# 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.

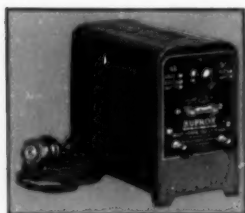
Then compare your radio with the best A. C. set you ever heard. Compare the tone, the power, the dis-



ance 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 \_\_\_\_\_

Make of Set \_\_\_\_\_ State \_\_\_\_\_

No. of Tubes \_\_\_\_\_

# 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.,  
16-17 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, 1928, by Popular Mechanics Co.

Copyright in Australia. Copyright in France

Vol. 50

Contents for November, 1928

No. 5

## Special Features

Inventors of Circus Laughs.....	722
The New Age of Electric Heat.....	730
Twenty-Five Years of Flying.....	739
Air-Picked Gold Fields.....	754
Easy Tricks with Thimbles.....	765
Cheating the Sea.....	770
The Master of Light.....	778
The Champion of the Fleet.....	786
What Are the Northern Lights?.....	792
Crashes Made to Order.....	804
What Television Offers You.....	820

Acoustics—sound velocity in helium twice that in air.....	752	Aviation—continued	
Agriculture—berry patch grown on cars.....	768	uniform markers for airways.....	737
Airplanes		will rocket planes reach the stars?.....	717
flying fort lifts 5½ ton load.....	785	Awning—inside control for.....	769
modeled after "Blimp".....	818	Barbecue—electric, for stores.....	802
to transport rubies from Burma mines.....	797	Bird Houses—model village for birds.....	764
world's biggest seaplane.....	728	Blueprints—drawings produced direct from positive.....	721
Aluminum—plating on metals by electricity.....	811	Book—concealed in ring.....	813
Ants		Building Construction—apartment houses of Biblical	
African, secret water supply.....	813	days rebuilt.....	762
man-eating.....	759	new, eliminates plastering.....	737
Apples—stored in gas to prevent decay.....	791	Buildings	
Archæology		"health hotel" shaped like a steel ball.....	783
famous Biblical rock in Horeb.....	761	house in form of big globe.....	729
find stables of King Solomon.....	810	Clipper, Lawn—cuts tall weeds.....	816
Architecture—late styles in.....	813	Clothing—women's winter apparel more healthful than	
Automobile Bus—for road or rail.....	758	men's.....	784
Automobiles		Crane—carries house over sea.....	736
carved Chinese for bridal parties.....	707	Disease—radio transmitter helps treat.....	801
chassis oiling system operated by engine heat.....	726	Door—peep glass in.....	801
clerk's office on wheels.....	764	Electric Iron—without cord.....	726
magnets on bumper clear road of nails.....	801	Electric Power—Diesel engines may displace super-	
Automobiles—Accessories		power.....	802
fan on auto heater.....	784	Engines—oval cylinders reduce friction.....	791
gas tank cap prevents spilling.....	799	Engines, Marine—new type of magneto.....	727
spring greasing clamp.....	819	Fires, Forest—destroy fertilizer.....	729
Automobiles—Tires—pop valve for.....	784	Floods—chain of bonfires warn of expected.....	753
Aviation		Frogs—lids move upward when blinking.....	729
arrow on roof guides airplanes.....	817	Garage—basement used as.....	777
beacon on border honors Mexican flyer.....	775	Gauge—for bevel cutting also serves as compass.....	797
flying police for airport traffic.....	752	Geysers—new in Yellowstone National Park.....	817
Grand Canyon air trip latest thrill.....	789	Golf—putter, mechanical, tests grasses best for greens.....	753
mask for aerial camera man.....	759	Guns	
model airplane as wind vane.....	810	army mortar lays smoke screens.....	763
naval flyers get weather data.....	763	gas, like fountain pen.....	736
plane flies without pilot.....	802	Hammer—nail holder on.....	776

[Continued on Page 4]

## [Contents—Continued]

Hedge Trimmer—electric, prolongs life of vines	799	Snow—rollers clear roads of	782
House Plan	879	Sprinkler, Lawn—underground	811
Household Devices	814	Steel—secret of Damascus, known by Romans	752
Insects		Street Cars—mirror on door causes women to alight forward	720
have larger wings than birds proportionately	727	Table	
that devour insects, protect plants	735	Combination table-top and picture panel	819
trap attached to casters	729	folding, for picnics	809
Lamp—clamps on book	729	with concealed ironing board	815
Lifeboat—launched by tractor	721	Telegraph—telegrams sent in Chinese	818
Lightning—measure speed of with two-lens camera	785	Theater—outdoor, water curtain hides stage	811
Logging—safety brake for saves time	788	Trees	
Lubrication—oilcan seal prevents waste	790	dead, felled with dynamite	727
Magnet—rids road of nails	810	examine trunk with X-rays for defects	759
Measuring—depth of sea	784	Tricycle—operated by rowing	803
Metals—mystery of rusting	782	Tunnel—eight-mile railroad breaks record	710
Models—cathedral carved with jackknife	816	Vending Machines—stamp dispenser gives correct change	761
Mosquitoes—spray tank on motorcycle helps kill	752	Ventilation—headaches caused by poor circulation	816
Motorboat—racing, speeds seventy miles an hour	811	Vibrations—"death whispers" from quartz kills small animals	738
Motor Bus—Pullman of road includes berths and diner	799	Violin—vibrations break crystal goblets	818
Moving Pictures—lenses on screen give depth to Navy, U. S.—makes amends	761	Water—purified with tablet	775
Oil—study of spots on the sun aids search for	758	Water Power—water speed in plant exceeds fastest auto	790
Pearls—fake, revealed by camera	738	Weather—dust from volcanoes affects	802
Phonograph—record folds up in cigaret case	817	Welding—arc to replace casting of machine parts	788
Pins—office, holder saves time and fingers	710	Window—portable false electrically lighted	803
Pipe—cat helps clean	803		
Pipes, Smokers'—self-adjusting cleaner	783	<b>AMATEUR MECHANICS</b>	
Plant Ills—spies to detect, to protect home crops	790	Advertising—turntable facilitates window decorations	845
Playground—Ferris wheel for, boy's invention	790	Automobiles—Repairing—removing broken lamp	860
Police—use thumb cuffs instead of handcuffs	789	Bird Houses—made from flowerpots	847
Psychology		Boats and Boating	
do faces reveal fortune?	777	carrying a canoe on a sedan	846
intelligence tests for babies	764	quick hitch for a rowboat	854
Radio		Clock, Alarm—opens hen-house door	843
device reduces motor interference	840	Clothesline—safe and handy hanging of	846
guides ship without crew	707	Cot, Folding—equipped with casters	860
Radio—Apparatus—r.f. transformers for screen-grid tubes	840	Cream Whipper—electric, homemade	861
Radio—B—Eliminators—voltage divider for	840	Cushions—leather, improvised	861
Radio—Batteries—trickle charger, homemade	826	Drill Press—small hand, treadle feed for	858
Radio—Cabinets—a Spanish desk	828	Games—two homemade ball	862
Radio—Coils—homemade r.f. choke	834	Gymnasium—how to make, for home	849
Radio—Condensers		Incubator—thermometer lighted by small lamp	847
reducing line interference	827	Keys—making a key impression	845
variable, drilling templates for	840	Musical Instrument—how to make a Chinese fiddle	848
Radio—Construction		Nails—holding small securely	854
hints for set builders	827	Paints and Painting	
panel saw, homemade	827	getting ivory color	858
Radio—Loud Speaker—employs double diaphragm	834	keeping paint cans sealed	857
Radio—Receivers		moisture resisting paint	844
amplifier for crystal set	826	Partitions—retrieving articles lost in	858
expert discovers tone purity by ear	738	Piston Rings—keep edges sharp	854
new perfect-tone six	835	Polishing—use kerosene on stove before	857
regenerate, keeping detector tube from spilling over	826	Pot-Cover—wire holder	844
Radio—Reception—tone filter for magnetic pick-up	825	Pottery—decorative, made from paper scraps	859
Radio—Repairing—by-pass condensers	827	Scissors—handy in the kitchen	856
Radio—Television		Screen Doors—removable sash for	857
condensing lenses aid	797	Shadow Pictures—a fascinating pastime	841
in natural colors	750	Steel—punching small hole in thin	844
Radio—Tubes—r.f. transformers for screen-grid	840	Stockkeeping—"want tags" for hardware store	847
Railroads		Toys—walking duck, how to make	855
boiler inspection hottest job on	760	Trailer—support for trailer tongue	844
elephant wrecks railway in India	819	Transformers—cutting core strips for	860
rubber pads for	729	Trapping—handy trap placer	857
Rays		Wardrobe—curtain and shelf form space for	862
cosmic, linked with creation of matter	714		
invisible, pierce fog to guard ocean liners	799	<b>SHOP NOTES</b>	
lamp for health treatment	769	Auger—post, marking handle to test depth	878
ultraviolet, crystal mine yields lenses for	813	Batteries—removing terminals	878
Safety Devices and Measures		Chuck—grinding, quick-tightening	878
auto rings warning bell at grade crossing	760	Clay—modeling, use for in workshop	874
portable electric alarm warns section gangs	796	Concrete Forms—method for cutting the wire for	878
Sawdust Burner—installed with furnace	761	Door—securing with loose-pin hinges	873
Sculpture		Fence—barbed-wire, stringing tightly	874
circus display in butter	818	Furniture	
fisherman modeled in sand	782	how to make rush or fiber seats	875
Ships and Shipping		two tables of modern art	863
automatic SOS receiver	760	Gate—for the farm	872
false stacks used as storage rooms	763	Greenhouse—back porch used as	874
four day liners launched in Germany	751	Mechanical Drawing—paper clip holds triangle	877
quest for faster liners	769	Shaper, Bench—how to make a 6-in.	869
service station for	776	Sports, Winter—snowshoes made from tennis rackets	873
Shoes—shining stand has screen for women	710	Tamper—made of concrete	877
Skating—skate with jointed blade	753		
Skis—water, for soldiers, substitute for boats	791		
Slate—Indians used as mirrors	817		
Sled—foot propelled ice, develops high speed	785		

# Popular Mechanics Magazine

REGISTERED IN U. S. PATENT OFFICE

WRITTEN SO YOU CAN UNDERSTAND IT

Vol. 50

NOVEMBER, 1928

No. 5



Diver Getting His Breath Preparatory to Another Descent, and a Close View of the Improved Breathing Mask

TWO men recently spent a quiet afternoon diving into a great tank at the navy yard, Washington. They wore bathing suits and on their heads was a curious-looking device not unlike an ordinary gunny sack with a rubber tube attached to the wearer's mouth.

First one man would disappear slowly beneath the surface. His every move was visible to the few spectators above, for the water was absolutely clear. Treading water, he would find the bottom and then, by means of some magic powers attached to the head device, he would re-

main down there, may be half an hour, possibly longer. Safe on the surface once more, he would watch similar maneuvers of his companion diver.

Since the apparatus is so built as to work efficiently only from the bottom up, rather than from the surface down, it was necessary to inclose the diver's head into a device looking like an inverted half of a barrel. It served the purpose of entrapping a substantial quantity of air, thus permitting quick descent.

Extremely simple as those diving operations appeared to be, they meant much to



First Stage in Descent with the Diving Bell; Diver Climbing Inside for Lowering

humanity—the possibility of avoiding loss of life in submarine disasters.

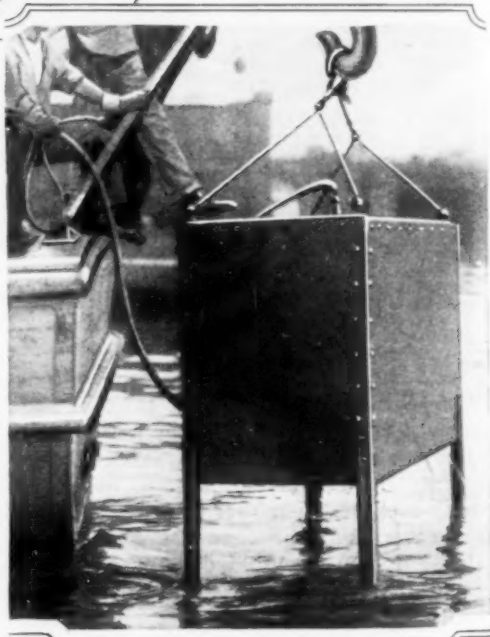
The two divers are counted among America's best-known experts on submarine life-saving devices—Lieut. C. B. Momsen and Chief Gunner C. L. Tibbals. For six months they had been working night and day on the breathing device they had invented in conjunction with F. M. Hobson, civilian engineer in the naval bureau of construction.

Following the tank tests in sixty feet of water, the experts took their apparatus a few miles down the historic Potomac, recently choked with mud through flood. Instead of the inverted barrel, an especially rigged up diving bell, weighing about 1,500 pounds, was employed to convey the diver to the bottom. During the descent, he was located within the bell in such fashion that, while standing on a platform, his head was inside a bubble of air. Slowly he was lowered, his

system meantime becoming gradually accustomed to the steadily increasing pressure until he reached the bottom, 110 feet below the surface.

Fundamentally, the apparatus has all the essential characteristics of standard European life-saving apparatus, but the new navy device weighs only two pounds—many times lighter than others of its kind, which range around twenty-one pounds. Then, too, the re-breather is small, about eight by ten inches.

Lieutenant Momsen, one of the inventors of the newcomer, gives a graphic description of its operation on the scene of actual disaster. "There are two ways," he explains, "whereby it may be used to advantage. First of all, when no help seems to be at hand and the crew of



Close View of the Bell That Aided in Rapid Descents during Breathing-Mask Tests by the Navy; Note Air Hose and Connection

the wrecked submarine must brave the treacherous depths alone; and secondly, when a diver has descended, ready to give aid. In the first case, it will take the men only a few seconds to don the apparatus.

"At this point one might well inquire, how in the world the men will be able to withstand the terrific pressure that prevails at 200 to 300 feet. Here is the answer: Under normal atmospheric conditions we all are under a pressure something like 14.7 pounds. Down around 200 feet the pressure jumps to 88 pounds. Certainly that is a terrific force to beat against a man's body. But after all, it is a relative matter, since pressure conditions become equalized all over the body.

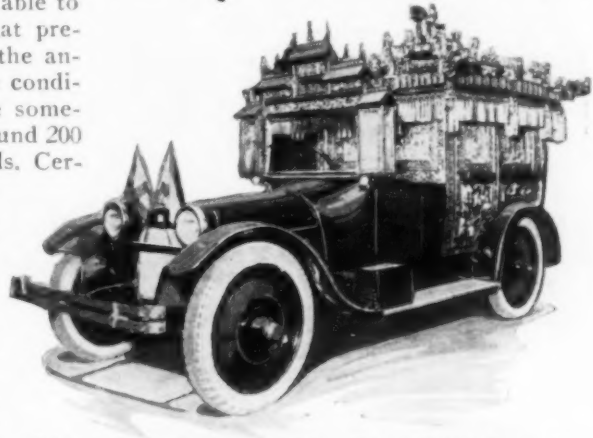
"Nor should we forget that nature has equipped us all with a remarkably devised pressure resistor, the Eustachian tube, a tiny structure running from the mouth to the ears. So, with the aid of that and the new device, the men in a sunken submarine should be able to gain the surface without experiencing that terrific pull on the eardrums which sometimes spells death to a diver. All the while, of course, there is no heavy weight to hold the men down and, when they have stepped outside the wrecked craft, the buoyancy of their bodies will hurtle them to the top. Once there, granted that other human beings are fairly close by, their lives should be saved.

"Of course, a somewhat different situation exists when the crew of the submarine happens to have an expert diver from above come to their aid. In such case, the submarine's commander may send the men out of the wrecked craft one at a time. Thereupon the diver, being attached to a strong rope, need merely signal to his helpers up above, and the two men will reach the top quickly. Another diver will then go down and the procedure be continued until every man is saved.

"However, the chief point to emphasize in the new instrument lies in the fact that it enables life-saving operations to be conducted and completed without the slightest interference with salvage maneuvers. Once the crew has reached the surface, the submarine commander may aid materially in salvaging his craft."

### EAST AND WEST MEET IN AUTO CARVED FOR BRIDAL USE

Oriental splendor and tradition ride on a modern motor car in an elaborate chassis carved for bridal processions in Shanghai.



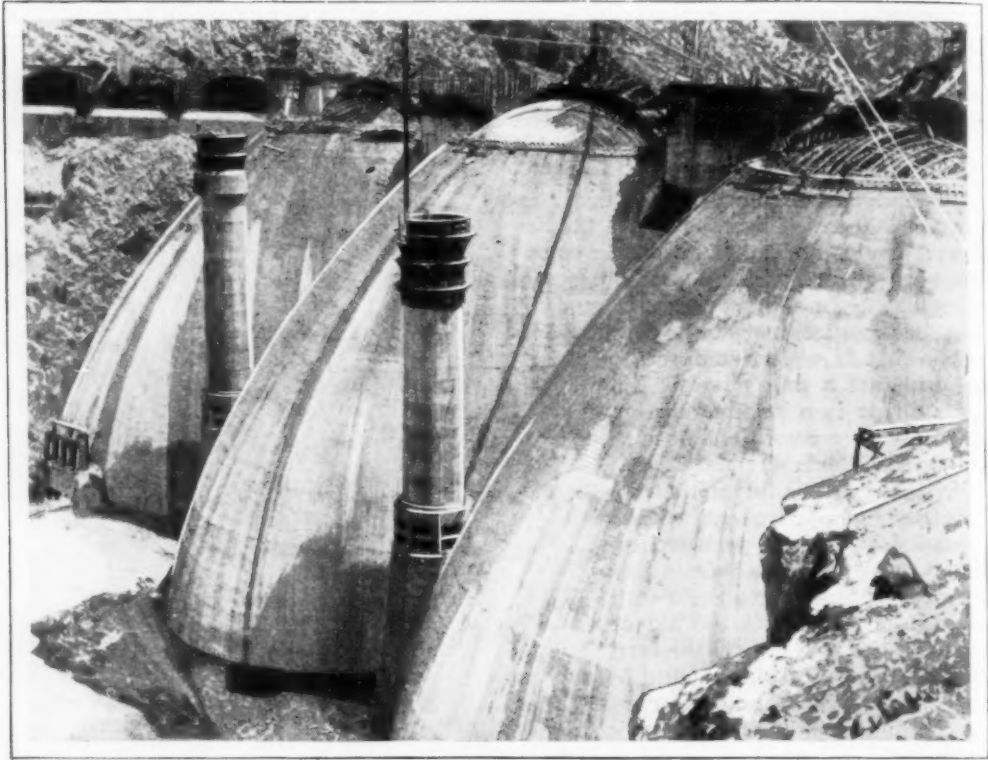
Elaborate Motor Car Designed for Chinese Bridal Processions; Its Ornate Carvings Conform to Old Oriental Traditions

Rich decorations, an ornate chair, hangings and tassels of silk, with other trinkets, feature the vehicle, which is a motorized duplicate of carriages used in China when the bridal party parades abroad.

### RADIO GUIDES "PHANTOM" SHIP SAILING WITHOUT CREW

Radio control of ships has been further demonstrated in Germany with the directing of the "Zaehringen," an 11,000-ton vessel, through complicated maneuvers without the aid of a single person on board. The ship's only point of contact with the outside world is its antennae, the wireless orders being sent from a mother ship some distance away. The "Zaehringen" started, stopped, slowed up and changed its course wholly by radio control. Besides these performances, an interesting series of other functions can be executed by wireless direction, for instance, if the oil burners should cause a fire. By radio, automatically governed extinguishers can be put into action and, should the oil-feeding apparatus break down and the ship stop, rockets are automatically fired off to signal the operators on the mother ship that something has gone wrong.





Constructed to Withstand Severe Strains; the Multiple-Dome Coolidge Dam across the Gila River, near Phoenix, Ariz.; It Has Been Built at a Cost of Almost \$3,500,000

### THREE-MILLION-DOLLAR DAM TO RECLAIM DESERT

Work on the Coolidge dam across the Gila river not far from Phoenix, Ariz., is rapidly nearing completion and engineers are studying it with special interest because of its form of construction. It is of what is known as the multiple-dome type and is said to be the largest of this kind in the world. The buttresslike form is intended to give greater strength. The dam has been built by the United States reclamation service and the Indian department at a cost of approximately \$3,500,000.

### TELEVISION INVENTOR PLANS FULL-SIZE PROJECTION

Projection of television images on a large screen, in the same manner in which movies are shown, is planned by C. Francis Jenkins, televisior and radio-movie inventor. If the method on which he is working succeeds, the chief problem of

television reception—the smallness of the image possible with all existing systems—will be solved. In the old Jenkins process, as in all others, a scanner is used to reproduce the picture. The Jenkins scanner had forty-eight holes, drawing forty-eight successive lines of light, and, as the picture is square, the effect is of forty-eight times forty-eight dots, or a total of 2,304 separate units. Behind the scanner disk is a neon light, the intensity of which is controlled by the received signal, and the illusion of a picture depends on the persistence of vision in the eye, the light of each line lingering until all of them have painted a complete picture. In his new system Jenkins is using 2,304 small incandescent flashlight lamps, mounted closely together in a square bank. A revolving switch or commutator connects the lamps successively to the radio set to receive the incoming signals. But, unlike the neon light, the filament of the incandescent lamps continues to glow for an instant after the current is turned off.

Thus the background does not merely appear to be bright, but actually is bright, though the glow from the lamps which have been turned off is not bright enough to detract from the light of those that are in circuit to form the picture. The net effect, however, is a much larger picture with infinitely more light than a neon lamp can produce, so it is possible to place a condensing lens in front of the lamp bank and project the picture on a screen. Jenkins is trying a similar system at the transmitting end, with 2,304 small photo-electric cells on which the image, focused by a lens, will fall.

#### HOW CROCODILES ARE HATCHED REVEALED BY PHOTOS

Interesting stages in the hatching of crocodiles have been obtained by photography by training a camera on a number of eggs that were taken from a Java river bank and hatched in a laboratory under favorable conditions. One of the remarkable features of the young reptiles is their great development as they leave the shell, one specimen showing the naturally savage



Just Emerging from the Shell, a Baby Crocodile Surveys the World and the Camera

tendencies of the species by opening its jaws when a finger was moved close to it.



Puncture Trap That Can Be Quickly Extended across the Road to Halt Cars; Pressing a Button Releases the Rack

#### PUNCTURE MAT TO STOP CARS HELPS FOIL BANDITS

Stop your car or puncture your tires, is the forcible warning behind a mat of sharp spikes that can be spread across the road at a moment's notice to halt bandits traveling in automobiles or drivers of stolen cars. A press of a button expels the mat from its holder at the side of the street.

#### VESUVIUS ON VERGE OF NEW OUTBREAK OF LAVA

Mount Vesuvius, the world's most famous volcano, is approaching a new eruption, according to Professor Malladra, who operates the observatory on the mountain slope. The mountain's outbreaks occur from twenty to thirty years apart, and, as the last one of any size was in 1906, another is just about due. The conditions which give warning of an approaching eruption are the failure of springs around the mountain, a series of earthquake shocks, and the filling of the volcano crater with lava. The crater has been practically full since 1926, but the other two manifestations of approaching activity have not yet appeared. In each major eruption the stored-up energy in the mountain blows out the lava which clogs the crater and clears the volcano's throat, so it can "breathe" easier. Then the crater clogs up again and the process continues until the collected lava closes most of the vent and backs up pressure enough to cause another outbreak.



Using the Electric Shoe-Shining Stand with Protecting Shield for Women

### ELECTRIC SHOE-SHINING STAND HAS SCREEN FOR WOMEN

Equipped with a shield in front and a motor-driven brush, a shoe-shining stand now on the market is especially designed for women patrons. The operator's stool is a separate unit and carries the motor underneath. The customer's chair is easily mounted, has a comfortable seat and back, and as entrance is gained from the side, there is no danger of catching the clothing on protruding parts. The electric brush, it is said, produces a higher degree of polish than can ordinarily be obtained with the usual hand tools and, of course, also saves time.

### OFFICE-PIN HOLDER SAVES TIME AND PROTECTS FINGERS

Waste of time, pricked fingers, and other unpleasant features, are avoided in a special holder for office pins. It has a top so arranged that when it is pressed, a pin emerges head first from a little opening where it can be grasped with the thumb and forefinger, ready for immediate use. The container holds 200



pins, is attractively finished and does not spill the pins, as they come in special refill tubes ready for insertion in the holder.

### EIGHT-MILE RAILROAD TUNNEL BREAKS RECORDS

An eight-mile tunnel through the Cascade mountains, the longest bore in America and fifth longest in all the world, is nearing completion in the northwest. When trains start through it, probably about the first of the new year, the Great Northern's route to the coast will be shortened by many miles, the climb over the mountains reduced 505 feet, a two-and-a-half-mile tunnel abandoned, and six miles of costly snowsheds eliminated. The new tunnel is to cost \$10,000,000, but the saving on upkeep of snow and avalanche sheds alone is expected to pay for it. When President Coolidge, on May 1, pressed a telegraph key in Washington and set off the blast that holed through the pioneer bore alongside the big tunnel, he marked the beginning of the end, after two and a half years of labor. The pioneer bore is a smaller shaft, parallel to and sixty feet distant from the big one. It cost several millions to drive the preliminary tunnel, but the savings it made possible made the outlay worth while. Only two gangs, one starting at each end, can work at one time in a single tunnel, but by rushing the smaller bore through the mountains for eight miles, the engineers were enabled to drive short connecting shafts sidewise to the line of the big bore, and then start additional crews from each shaft, working in either direction. In this way the main tunnel was attacked from eight different places, the two outer portals and six in the mountain, with two crews working in each direction from the six, or a total of fourteen crews working at one time. Seventeen and a half miles of the present railroad line will be eliminated, along with the old tunnel and the 505-foot climb to its level. The new bore eliminates also track curves that are equivalent to nearly seven complete circles.

Write our Bureau of Information, if you wish to know who makes or sells any article described in this magazine. Send no postage; the service is free.

AMERICA'S LONGEST TUNNEL NEARING COMPLETION



Cross Section of the Cascades, Showing the New Tunnel 500 Feet Below the Present Railroad Line; Photograph of the Range under Which the Big Bore Passes, and, in Circle, One of the Compressed-Air Shovels That Works in Limited Quarters to Clear Away the Rock



Examining Big Bomb on the Fighting Plane, Which Also Carries Four Machine Guns and a Crew of Two

### DIVING PLANE FOR BOMBING CARRIES FOUR GUNS

Tests with one of the fastest fighters of the skies were conducted at Mitchell field recently when pilots rode a diving bombing plane through varied maneuvers. This ship, which is equipped with a "Wasp" motor, is capable of a speed of 170 miles an hour and can dive at a rate of 300 miles an hour. Besides four machine guns, it carries a big bomb under the motor and is manned by a crew of two.

### CAMERA RECORDS ITS LOCATION ANYWHERE ON EARTH

Accurately recording its position on the earth at the point where the picture was snapped, a sextant camera that has been included in Commander Byrd's equipment for the South Pole adventure, is expected to prove of great service to all navigators by sea, land or air. With one motion, the user can determine his position, whereas, for centuries, a number of instruments and more or less elaborate calculations have been required. It will function even when no ground markings are in sight, and the picture will also show the exact time at which it was taken, the day of the month and the angle at which the exposure was made. This remarkable camera was developed by Comm. M. R. Pierce

of the United States navy in co-operation with the Eastman Kodak company. It takes pictures of the sun, and one of the secrets of its operation lies in its ability to "fold and wrap light into a small package." The finished photo is smaller than the hand, 100 pictures can be made on one roll of film, and as each exposure is made, it is cut out and deposited in a dark box. The various recording instruments are housed inside the camera, and the light beams are brought into focus on the film, where they record the data es-

essential for determining the exact position of the camera at the time.

### PHONOGRAPH IN WATCH CASE PROVES ACTRESS' VOICE

Practical use is claimed for a tiny phonograph that fits into a watch case and is operated by a small spring. Its records will hold about fifteen spoken words, and these can be reproduced by the owner to show the quality of her voice as reproduced for the talking films. The entire outfit can be carried in a vanity bag.



Gwen Lee Demonstrating the Watch-Case Phonograph, Which Plays a Record of Her Voice



## CIRCUS STAGED WITH PUPPETS ATTRACTS CROWDS



Where Puppet Clowns and Actors Present an Eight-Ring Circus; Views of the Elaborate Motor-Driven Arena and the Entrance

One of the most attractive features of an eastern amusement park is a miniature eight-ring circus, in which all the performers are puppets that go through realistic movements by the action of electricity. A tiny band wagon furnishes the music, while midjet animals, jugglers and acrobats perform, roller coasters, merry-go-rounds and aeroplane swings operate, and practically all the lively thrills of a real circus are duplicated in miniature. The elaborate installation is the result of a country merchant's plan to attract customers to his show windows. Trade was dull, so he exhibited a few manikins, dressed in the latest fashion and operated by clockwork mechanisms. The device grew so popular that it was gradually enlarged until it became a complete circus.

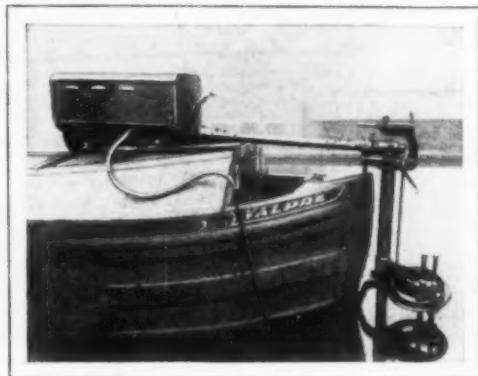
#### NEW WOOD FOR TOBACCO PIPES SEASONS MORE QUICKLY

Due to the shortage of genuine briar, a substitute wood has been grown by grafting the gnarled, knotted roots of the bruyere to ordinary red and white hawthorn and with satisfactory results, according to reports. Pipes made from this hybrid wood are said to be light in weight, to absorb nicotine readily, give a cool, sweet smoke, and can be seasoned in about three months as against the three years necessary for the real briar. Another advan-

tage claimed is that the roots grow to three or four times the size of the briar's so that more pipes can be cut from them.

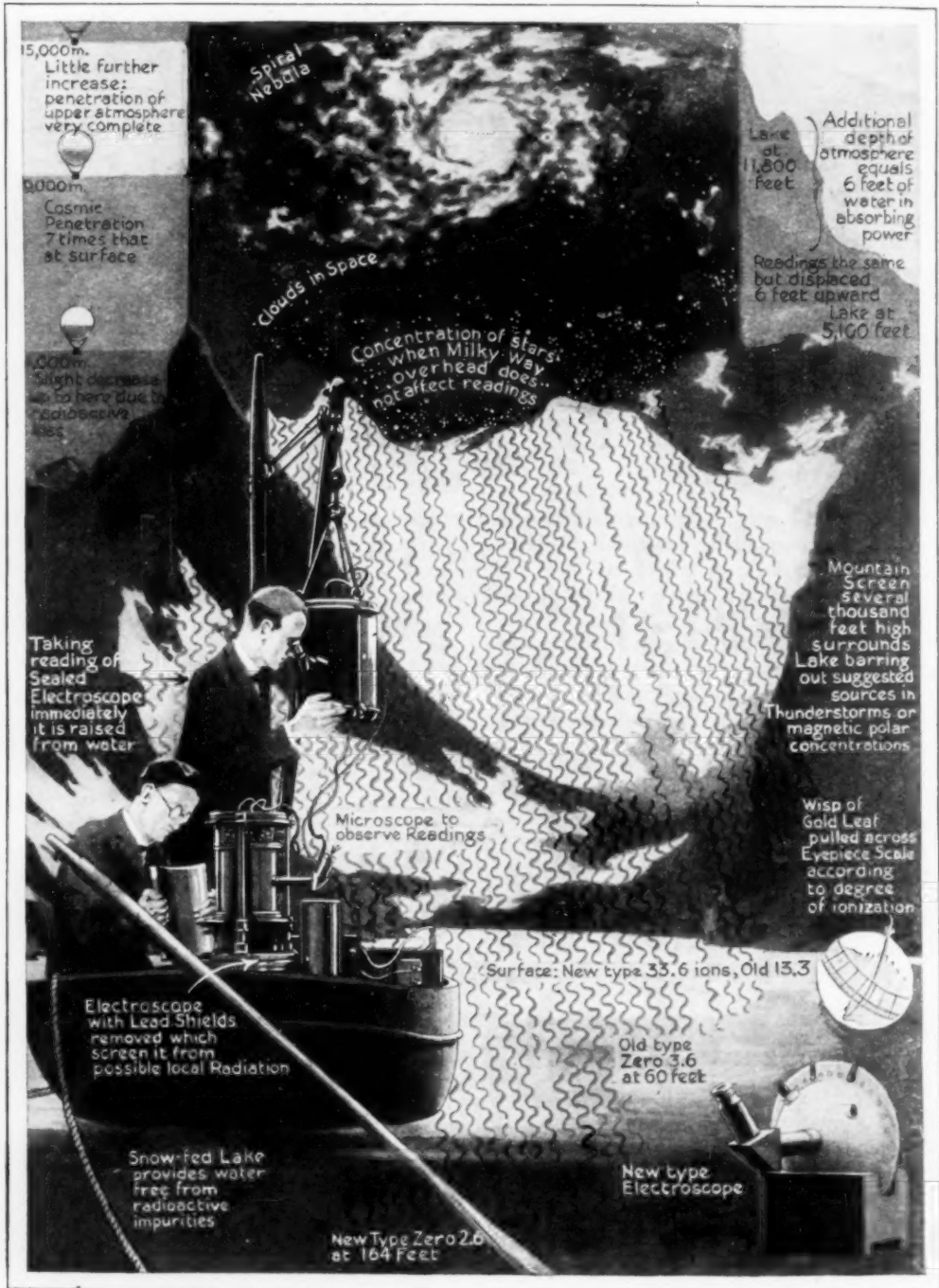
#### DETACHABLE MOTOR FOR BARGE HAS SAFETY PROPELLER

To speed canal traffic, an English inventor has introduced a motor which may be removed or attached in a few minutes and has power enough to tow three fully loaded barges. Its chief feature is that the propeller is so adjusted that, should it strike an obstacle, it automatically rises above the obstruction to prevent damage. This is an important point when running in shallow waters.



Propeller of This Detachable Motor Rises When It Meets an Obstruction, to Prevent Damage

# COSMIC RAYS LINKED WITH CREATION OF MATTER



© S. W. Clatworthy

Artist's Diagrams Showing, Center, How Cosmic Rays Were Measured in a Mountain Lake; and, in Inserts at Left, Earlier Experiments with Electroscopes Sent Up in Sounding Balloons

## CREATION OF MATTER IN STAR SPACE EXPLAINS RAYS

The cosmic rays discovered a few years ago by Prof. R. A. Millikan, the famous California scientist, are the waste energy generated by the creation of oxygen, magnesium, silicon and iron in the vast laboratories of outer space, according to a recent announcement by their discoverer. The cosmic rays are the most minute, yet most powerful radiations ever detected, with wavelengths less than one-hundredth of those of radium, and yet requiring the enormous electrical potential of 59,000,000 volts to generate them. Their initial discovery was made by sending electroscopes into the upper atmosphere, attached to sounding balloons, and then studying their recorded findings when the gas bags came back to earth. In his latest experiments, Professor Millikan measured their penetration in the clear waters of a high mountain lake. The presence or absence of the billions of stars which compose the Milky Way had no effect on their intensity, so they apparently come from more distant realms of space. Professor Millikan found that the rays were able to penetrate 16.7 feet of lead or 190 feet of water.

## SEEK CAUSE OF PAINT SCALING TO PROTECT WOODS

Paint adheres to wood chiefly by gaining mechanical grip in minute openings on the surface of the wood, forest products laboratory experts have concluded after an investigation into the causes of paint scaling and other factors connected with paints. What is needed, they declare, is an improvement in painting practice, a method that will cause the paint to cling more firmly rather than scale off. The effect of the grain of the wood on the durability of a coat of paint can be seen on wood that has wide annual rings. The part that grew rapidly in the spring contains more openings than the summer part, which is denser. Paint scales off this summer band much more quickly than it does from the spring wood, the investigators found.

Every hour, fires destroy two human lives and approximately \$60,000 worth of property in the United States.



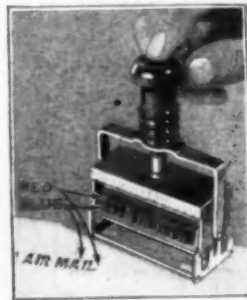
West Point Football Players Refreshing Themselves at the Nozzles of the Gridiron Water Wagon

## SPRAY WAGON FOR FOOTBALL SUBSTITUTE FOR SPONGE

Football men at West Point have discarded the old unsanitary sponge in favor of a water spray wagon from which eight men may refresh themselves at the same time and with much less trouble. A fine spray is forced through the nozzles in such a way that it reaches the face and neck with cooling effect and without spilling so much water on the suits. The wheels are equipped with heavy rubber tires so that the wagon can be trundled over almost any ground with little difficulty.

## AIR-MAIL STAMPER PRINTS TWO COLORS AT ONCE

Ordinary envelopes are quickly identified for delivery to the air mail with a stamping outfit that prints the words "via air mail" in red and blue, conforming to the postal regulations. The contrivance is fitted with a self-contained pad, the rubber die being adjusted for automatic self-inking, in the same manner as most other similar stampers for quick and efficient work.





Apparently Holding an Ordinary Club, But Actually Taking Picture with Camera Hidden in Baton

### CAMERA IN POLICEMAN'S CLUB TAKES TWENTY PICTURES

Concealed in the policeman's club, a miniature camera takes from ten to twenty pictures at one loading, and the negatives, although but an inch square, are so sharp that they will stand enlargement up to four inches square or more, it is said. To make an exposure, all that is necessary is to press a button, then turn an unexposed film into place. Time or instantaneous pictures may be made as readily as with an ordinary camera.

### TELEVISION TO CONDUCT MUSIC OF HIDDEN ORCHESTRA

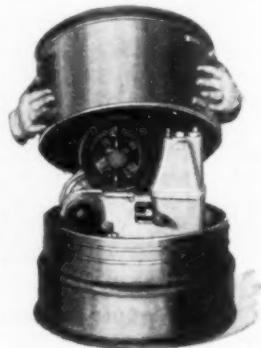
Practical use for television has been proposed by an orchestra leader in directing a group of musicians who play off stage during a symphony. Heretofore, it has been the custom to have an assistant leader, who peered through a hole in a wall, took his cues from the conductor and then directed the hidden players as he looked through the opening. By television, the leader's movements will be projected on a screen so that all the second-orchestra members can see them and the need for an assistant conductor will be rendered unnecessary.

### LILACS BLOSSOM AT CHRISTMAS WITH AID OF CHEMICAL

Lilacs, flowering almonds and other blossoms may be had for Christmas decorations by exposing the potted plants to the vapor of a special chemical, Dr. F. E. Denny, of the Boyce Thompson institute for plant research, recently reported. The trick is an easy one, the chemicals are obtainable on the market and about the only precaution to be taken is that the gas treatment should be done in a tightly closed room. Ethylene dichloride or ethylene chlorhydrine is used and almost any florist can arrange a treatment room without great expense. Dr. Denny recently demonstrated the effectiveness of the method with two twigs on the same branch, as much alike as possible. The treated twig responded quickly while the other remained dormant. He has also applied chemical "awakeners" to various other plants and has succeeded in getting seed potatoes to grow soon after harvesting. This is expected to be of considerable commercial importance.

### WATER SYSTEM FOR THE HOME WORKS AUTOMATICALLY

Advantages of a city water-supply system may be enjoyed in farm and country homes through an electric pumping and pressure outfit that starts and stops itself, is economical to operate and is furnished in two sizes to give either 210 or 420 gallons per hour. The unit is compactly constructed and housed under a hood that can easily be lifted off for oiling or inspection; only two pipe connections are required, and, if desired, the unit may be employed in connection with a big storage tank. The outfit can be installed in two hours. Users do not have to press any buttons or operate any switches and the pump is self-oiling, so that the apparatus requires practically no attention.



# WILL ROCKET PLANES REACH THE STARS?



The Perfect Streamlining of the Lockheed "Vega" Plane, Which Sir George Wilkins Flew across the Arctic, and Art Goebel Flew Non-Stop across the Continent, Shows How Great Speed Can Be Obtained by Proper Design, One of the Problems the Rocket-Plane Makers of Germany Are Attempting to Solve; the "Vega" Fuselage Is Pressed from Wood Veneer

**C**ONSTRUCTION of man-carrying rockets capable of crossing the millions of miles of outer space and reaching the planets is scientifically possible and may eventually come, according to Fritz von Opel, the German automobile builder who, within a few months, has produced a rocket automobile and a rocket airplane.

But such ideas, he adds, are still far off, and have nothing to do with the practical work of introducing the rocket age, which he visions as an era of almost unbelievably fast transportation over the face of the earth. Rocket planes, he says, will span the Atlantic in an hour and a half, rising miles above the earth's protective envelope of air into a realm where there is neither air resistance nor the vagaries of weather to be reckoned with.

What such speed, 2,000 miles an hour, would mean can be conceived by comparing it with the non-stop flight across the continent, made by Col. Arthur Goebel, winner of the Dole race, who landed in New York just eighteen hours and fifty-eight minutes after leaving Los Angeles. His average speed for the trip, which

broke all existing records, was 142 miles an hour. At that speed he clipped two hours and fifty minutes off the fastest previous crossing of the continent, Lieut. Russell L. Maughan's famous "dawn to dusk" flight. But, more interesting still, the latter was made in a specially prepared racing ship, an army pursuit type, and in a series of hops, as the plane could not carry more than a few hours' gas supply. The flight of Goebel's Lockheed "Vega" plane was non-stop, carrying a full load of gasoline, and the ship itself was a stock model commercial plane, with cabin room for five passengers. The difference between Lieutenant Maughan's record and Colonel Goebel's achievement represented just four years' progress in airplane and engine building.

Only one plane had ever crossed the country non-stop before, piloted by Lieutenants MacReady and Kelley, and Goebel cut nearly eight hours off their record, besides making the flight in the opposite direction, so that he had to lift his entire load of gas over the Rocky mountains in the first hours of the flight, instead of



reaching the high mountains near the end of the journey, when his ship had been lightened by the consumption of most of its fuel.

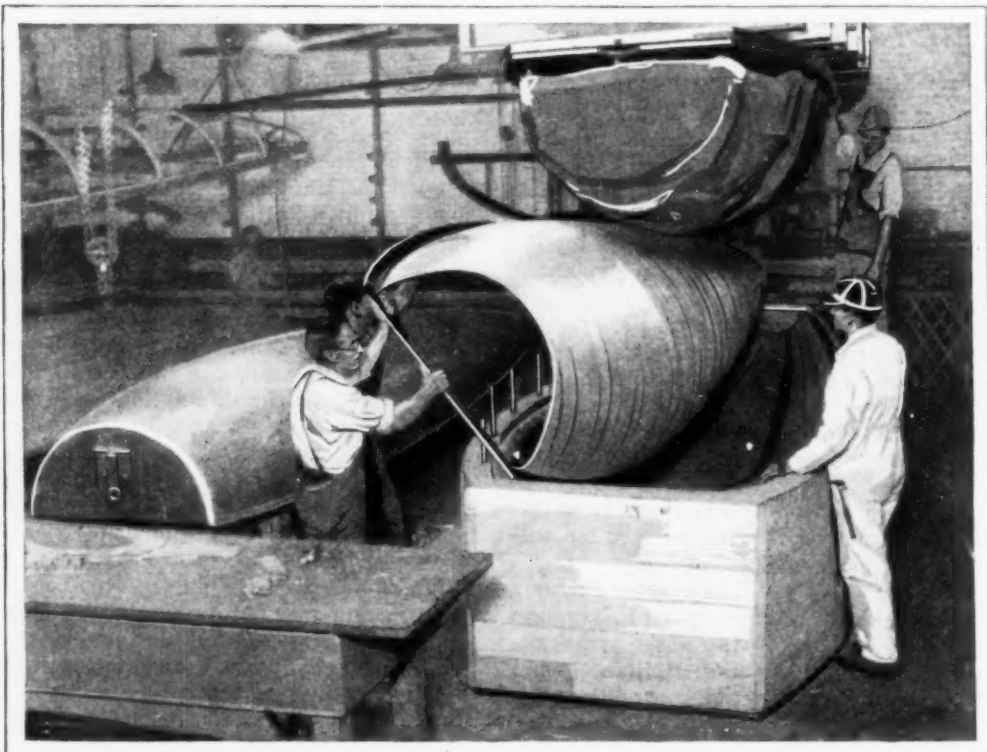
Opel's rocket-car and rocket-plane experiments are important because the rocket offers the one method yet discovered for navigating space at high altitudes, above the earth's envelope of air. All existing motors depend on air for their operation, and all existing types of propellers screw their way through the selfsame air. The rocket, on the other hand, can be shot out into space and attain tremendous speed by escaping the resistance of the air.

The rocket idea is not new. Prof. R. H. Goddard, at Clark University, Worcester, Mass., made some experiments and calculations as long ago as 1912 and 1913, to prove that it was technically feasible to shoot a rocket to the moon and explode a giant charge of magnesium powder, producing a flash big enough to be observed by telescopes on the earth.

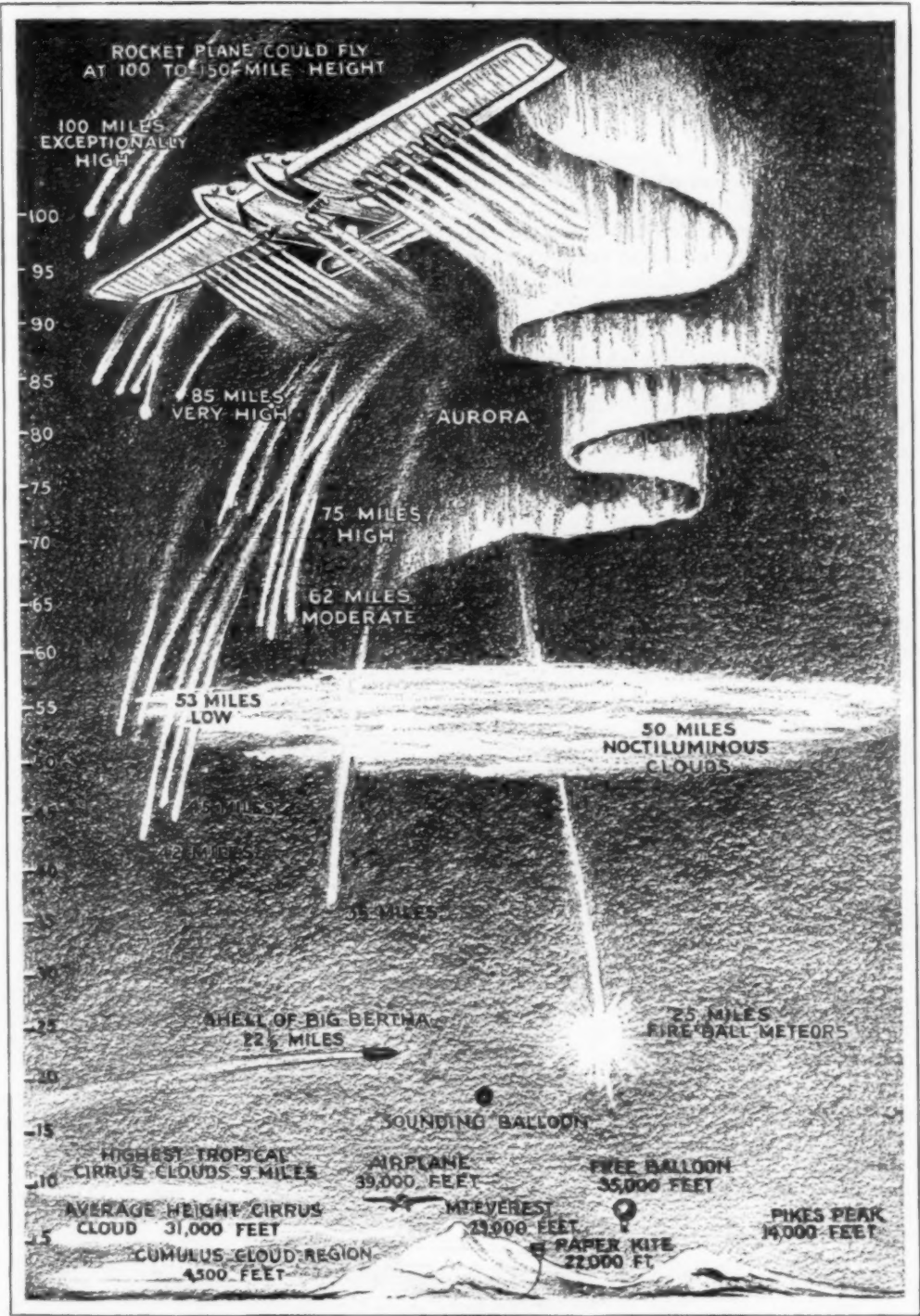
Three German engineers, H. Oberth, W. Hohmann and Max Valier, and the work

of the latter largely inspired Herr Opel's rocket car and plane. Valier has calculated that a rocket plane could be shot from Berlin to New York in ninety-three minutes, dividing the journey in three stages. He would start from the German capital and come down at Vigo, Spain, take off there for an island in the Atlantic, and make the third hop to New York. He would shoot his rocket into the air at the steep angle of seventy degrees in order to reach the region of rarefied air in the shortest possible time. A minute and five seconds after the take-off, the plane would be thirty miles above the earth and nearly forty-five miles from the starting point, and would have attained a speed of more than 4,500 miles an hour. Allowing 100 seconds to get under way and reach full speed and 1,500 seconds for gliding, Vigo would be reached in twenty-seven minutes from Berlin.

The only objection he sees to rocketing across the ocean is the weight of the explosives required. Fully sixty-nine per cent of the entire weight of the ship on the



Sheets of Vencer Are Glued Together. Then Placed in This Concrete Mold and Formed into Fuselage Halves under a Pressure of Fifty Tons; Two Halves Are Then Joined



Courtesy New York Times

An Artist's Conception of a Rocket Plane in Flight Out in Space beyond the Earth's Envelope of Air, Where It Would Have for Neighbors the Northern Lights and Occasional Meteors

first leg of the journey would have to be given over to fuel, and seventy-six per cent for each of the ocean stages. To transport a ton of pay load from Berlin to New York thus would require about fifty-two tons of fuel.

If the speed of the gases could be increased, the amount of fuel could be cut down. Valier estimated that if, instead of the technically possible 7,200-feet-a-second velocity, the gases could be made to move at 13,000 feet a second, the fuel would be cut from fifty-two to sixteen tons.

In Professor Goddard's experiments, using smokeless powder, he obtained gas velocities of 8,000 feet a second. The fastest rifle bullet has a muzzle velocity of not over 2,500 feet per second. As every marksman knows, increasing the muzzle velocity of a bullet increases the kick-back of the gun, so Professor Goddard's 8,000-foot-a-second gases should produce an enormous recoil to propel the rocket on its way.

One problem that remains to be solved is whether the human body could withstand the terrific strains involved in being shot into space at such speeds. In experiments with a rocket car mounted on railway wheels and operated on a track, Opel placed a cat in the seat to see how it would withstand the strain. The car, however, blew up and the cat was killed, so nothing was learned.

### TWO SHIFTS GIVE MORE DAYLIGHT

Employees of an eastern mill enjoy nearly half a day of daylight out of the shop each working day, and the company has been benefited, officials report, as the result of a two-shift, eighty-eight-hour week schedule that

has been in effect several years. The first shift goes on at 6:30 o'clock in the morning and works until 2:30 p. m., when it is replaced by the second shift which is on until 11:42 p. m. On Saturdays, the first shift works until 12:30 p. m. Lunch time deducted each has a forty-four-hour week. Younger men prefer the second shift, for it gives them a long week end, from Friday night until Monday afternoon, and the older men favor the first shift with its shorter day. From the company's standpoint, the plan reduces overhead costs and machinery gives a maximum return before it becomes obsolete. The three-shift program is necessary in some establishments, but in this particular business, the two-shift schedule has been practiced as a happy medium. Elimination of the third shift, from midnight on, has not meant a serious loss, for studies have shown that this is the least productive period.

### MIRROR ON STREET-CAR DOOR HELPS PROTECT WOMEN

Street cars in Germany are being equipped with mirrors on the exit doors to induce women to face forward just before alighting and

thus prevent a possible fall. Such accidents are common among women, an explanation being that, due to centuries of experience in carrying children on the left arm and working with the right, she naturally uses the right hand to grasp a support when leaving a street car or train. This causes her to face to the rear, the wrong position. Since the mirrors have been installed, accidents have decreased in number, it is reported, and women passengers appreciate the additional mirror.



Mirror on Street-Car Exit Door Induces Women to Face Forward When Alighting

## LIFEBOAT LAUNCHED BY TRACTOR SPEEDS RESCUES



Launching the Big Lifeboat with Aid of Tractor That Hauls It across Sands and Rough Shore, Pushes It into the Water and Hauls It Out Again

To speed up the launching of lifeboats rushed to the rescue of sinking or distressed ships off the English coast, the British royal national lifeboat institution recently tested a tractor and auto trailer that hauled a lifeboat and crew to the aid of a ship off the dangerous shore of Dungeness, on the English Channel. The tractor, named the "F. W. D. Roadless," brought the lifeboat over a rough shingle road to the shore and then launched it by pushing the boat and its carriage into the

sea. The tractor then backed, and by an ingenious device, pulling on a cable which travels around a pulley at the rear end of the boat and passes to the bow, pulled the lifeboat off the carriage and sent it in a seaward direction. When the launching had been accomplished, the auto tractor hauled the carriage to the shore, while the seven-ton lifeboat rowed out to the distressed ship. On loose shingle and sea-soaked sandy shores, the new auto tractor has operated successfully.

#### DRAWINGS REPRODUCED DIRECT FROM POSITIVE

Positive prints of drawings and other subjects, that are said not to fade and that can be made as easily and as economically as blueprints, are prepared from a positive under a patented process. Dark lines are revealed on light tinted paper as in the original and are not reversed. No liquid or water is used; the undeveloped print, after exposure, is merely inclosed in

a box containing a dish of ammonia water or any compound which gives off ammonia fumes. These act upon the paper to produce the picture. The print can be removed in five or ten minutes and needs no further attention.

☐ 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 upon application to our Bureau of Information,

# Inventors of



Camouflaged Stilts and a Balloon Are Parts of This Grotesque Costume Worn by a Balancing Artist

By PAUL PADDOCK

ONE of the most valuable automobiles in the world is an old car likely to fall apart any instant; it back-fires unexpectedly, often chases anyone who gets in front of it, and, without warning, rears on its hind wheels and may spill its occupants backward. The average driver would refuse it as a gift, but its owner and designer, Myron "Buck" Baker, chief of the automobile clowns in Ringling Bros., Barnum and Bailey's circus, wouldn't part with it for a small fortune. It has made

him famous, has moved millions of persons to laughter and has brought thousands of dollars into the coffers of the show.

The chief reason is that this old car and the stunts it does, furnish the chief ingredients for laughter, a priceless phenomenon for which the circus, and other institutions devoted to entertaining the public, spend millions yearly. Say "circus" to anyone and the first word that pops into his mind is likely to be "clown." The two are synonymous in the minds of almost everyone, and that explains why the shows carry hundreds of these entertainers and why the performers themselves are constantly looking for new stunts, rehearsing and improving old ones and seeking new ideas. The clown department of a circus is similar in some respects to a separate show in itself. It



"Trained" to Break Down with a Loud Explosion, the Bridal Taxicab Has Inspired Millions of Laughs



# Circus Laughs



Myron "Buck" Baker at the Wheel of His Famous Flivver That Runs on Its Hind Wheels, Chases Him and Performs Other Tricks Developed from a Thorough Knowledge of Auto Mechanics

has its producing clowns—the idea men—trainers and critics who pass on the merits of an act before it is offered to the public.

Long before he joined the circus, Baker was a trick bicycle rider. He discovered that unexpected mechanical feats brought thrills as well as laughs. When the automobile came along, he seized upon it, altered its normal working parts, disguised it and otherwise changed it until he had developed it into a star circus performer, one of the most effective on the entire lists, not excepting the trained animals and the acrobats. Henry Ford once told him that he "was the only man he knew who could get more out of a Ford car than was put into it."

Baker stages seven acts with his trick autos. They fall apart, explode, apparently obey commands without a human driver as well as with one, and do other amazing stunts, but everyone of them is based on mechanical processes that Baker has carefully worked out, tested and improved in his "laugh laboratory" at Sarasota, Fla., where the circus has its winter quarters. While animal trainers are rehearsing and caring for their pets, Baker

looks after his squad of trick automobiles. He has invented more than a score of special attachments and several devices for general use, not associated with the circus. One of these is a lifting rack for garages, an idea he worked out from his experiments with automobile tricks.

"Why do people laugh at the cars?" Baker replied while tuning up for a recent performance. "I've wondered about that myself sometimes and I'm not sure I know.

"Laughter is a mystery, I guess. I sometimes work out an elaborate stunt that I think is funny, but it doesn't go across half as well, may be, as a simple little thing like an unexpected back fire. I figure this is because the more complex stunts are hard to follow, people are busy watching other things, and then a lot of them have had experience with balky cars. When they see me in trouble with mine, it tickles them. They laugh at me and not at the car. Of course, they know that I am making the car back-fire on purpose, but the stunt seems to recall unpleasant experiences of their own and they're glad they don't have to worry about the car that won't run."



A Favorite Fire Brigade of Circus Fans Everywhere; the Midget Engines and Their Crew; Baker, the Inventor, Is the First Standing Figure at the Left

According to psychologists, Baker's explanation is a logical one. It is human nature to laugh at the other fellow, they say. We chuckle because we're glad we are not in his position. Laughter of this sort is a kind of self-congratulation. We don't stop to make the analysis at the time; laughter just happens naturally, as does all the other emotional and nervous processes that are still mysterious to us. Surprise, suspense, incongruity and various other elements are mixed up in the complex cause of a chuckle, and Baker's trick automobiles are such successful laugh getters, because they furnish all these requirements with a good measure of mystery on the side.

One of the most amazing of his cars this season was a tiny racer, "Sarasota," carrying "Tip," a small monkey, in the driver's seat. It tore around the arena at high speed, mystifying everyone because monkeys have not yet been trained to manage gear-shift cars, but this one has all the attachments and speeds of a full-size racer. Some persons say that a human driver is concealed in the car. But it is little more than six feet long and has been driven within five feet of the front rows, yet no one has been able to see a hidden pilot, if he is there. Mechanics told Baker that he couldn't build such a

car. He did it, and the secret of its operation is known only to a few.

Months of planning and experimenting were devoted to the construction of the chief auto trickster, the old paint car that breaks in two, chases a man and rears on its hind wheels. The balking is accomplished by a feat of balancing. Three 300-pound weights, disguised as paint pails, are hung on the rear of the body. To make the front wheels leave the ground, the occupants of the car have but to tip back slightly. An amazing thing about the car is that it will rear up even if a heavy man stands on the front axle, and Baker says that his weight apparently has no effect on the tipping. Getting the car on its rear wheels was not so difficult, but Baker found that he had a number of unexpected problems to solve after he had done so. For instance, the gasoline wouldn't run into the carburetor at such a steep angle. He had to install an auxiliary tank under the hood back of the radiator and also control the oil so that it wouldn't run out of the engine. Then, the two rear tires had to be inflated at the same pressure or the machine would start going in circles and possibly run into a ring or the grandstand.

Another difficulty appeared. When the front wheels are in the air, Baker is unable

to see them. It is highly important that they be straight ahead when he comes down or the car will plunge off to one side of the track. He therefore made a compass out of his steering wheel by bending and twisting it in such a manner that he could tell by the irregularities, when the wheels were properly turned for the descent. He has never had an accident in the ring. The car is locked so that it cannot be thrown into high speed.

The loud back fires are made in various ways. One is to fire off blank cartridges in a big spring affair like a large rat or mousetrap. Holes are punched in the top of the radiator so that water can be forced through to simulate a violent boil-



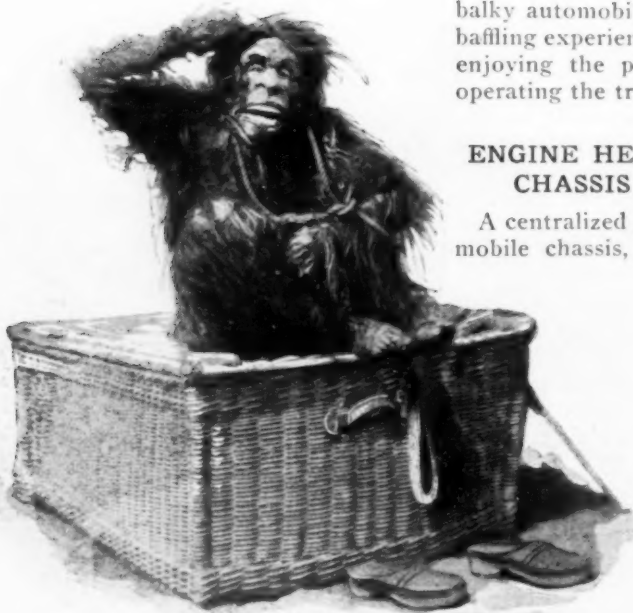
Like a Goldberg Cartoon and It Works—Sometimes; the "Trick" Cigar Lighter and Its Inventor



One Reason Why the Circus Tent Has to Be High; But Is a Log Chain Necessary to Hold a Pup?

ing over, while the "shimmying" effect is attained by cams on the rear wheels. One of the most baffling stunts the car performs is to chase the driver, apparently obey his whistle or a wave of the hand while he stands several feet away, and back up without any evident shift of gears. Again, persons have said that this is done by a hidden pilot, but that is not the fact. Baker has worked out an ingenious method of remote gear control whereby he can operate the car at a distance of fifty feet or more, about as well as if he were in the seat. Concealed wires, a reel hidden in his sleeve, and one or two other items, are required to operate the distant-control system, which is being kept secret in order that circus-goers may not be robbed of the pleasure of seeing the mysterious performance.

Long after other memories of the circus have faded, children and adults, too, recall the tiny fire engines, almost perfect replicas of the full-size apparatus. These were also designed by Baker, who supervised the construction of special parts and adapted odd pieces to the cars to make them realistic imitations of the larger engines. When he had nearly finished one, he discovered that there was no room



When Man Imitates the Monkey: Clown Actor in Realistic Costume That Never Fails to Puzzle the Circus Crowd

for a gasoline tank. This proved a puzzler for a moment, but since the engine was air-cooled and had no use for the ordinary type of radiator, this unit was converted into the gasoline tank. The famous wedding taxicab that empties its load at an unexpected moment, is a real cab, the body literally sawed in two and hinged so that it tips back. It is kept from falling off entirely by means of chains and is held upright by buckle supports which can be unfastened from the inside.

According to circus managers, laughs are increasingly difficult to produce as the public is indifferent to many things that inspired response a few years ago. Clowns and cartoonists unconsciously work hand in hand, borrowing and exchanging ideas, although Baker prefers to leave the "funny papers" alone in order that he may give the audience something that they have not seen before.

One of the effective acts in this season's circus was the demonstration of a trick cigar lighter which functioned with the elaborate detail of a Goldberg cartoon and proved a taking burlesque. When it failed, the audience was as pleased as when it worked, because, as in the case of the

balky automobile, many of them had had baffling experiences with lighters and were enjoying the predicament of the clown operating the trick lighter.

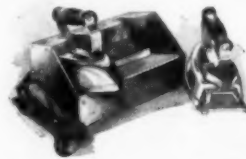
### ENGINE HEAT OPERATES NEW CHASSIS OILING SYSTEM

A centralized oiling system for the automobile chassis, operated by the heating of the engine, has been adopted by one American manufacturer, and foreign rights sold in Germany, France, Italy and England for use on cars of those countries. A sealed tank, holding a quart of oil, is attached to the exhaust manifold, with piping leading to all of the chassis parts that are to be oiled. The short tubes connecting to the bearings contain wicks. In operation, as soon as the engine is

started, the oil tank begins to warm up, the heated oil building up pressure which forces it through the pipe system to the bearings. When the engine is stopped, the oil reservoir cools and a vacuum is created which draws the oil back from the bearings, preventing waste through dripping. The quart reservoir holds enough oil to last for from 3,000 to 5,000 miles, the manufacturer claims. Ordinary crankcase oil is used.

### ELECTRIC IRON WITHOUT CORD REDUCES FIRE HAZARD

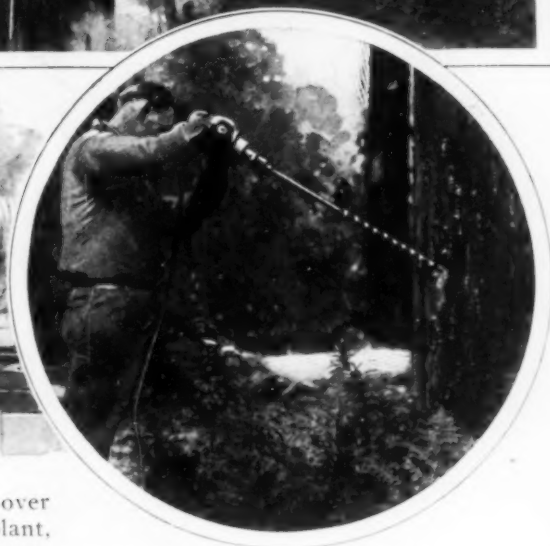
Instead of having its cord directly attached, an electric iron now on the market, is heated through a contact in a metal holder which is connected to a lighting socket. Two irons are employed with



the outfit, one being used while the other is left in the cabinet to be heated. The arrangement eliminates the bothersome cord that often becomes entangled or frayed, prevents fire and supports the irons safely.

## TREES FELLED WITH DYNAMITE TO CHECK FIRES

Trees Falling at Blast; Partial View of the Portable Electric Power Plant, Showing Switch being Thrown to Set Off Explosion, and Drilling a Hole for Explosive with a Motor-Driven Auger



To remove dead trees in burned-over areas, a portable electric power plant, drills and dynamite are being used successfully by forest rangers. Charges of the explosive, placed in holes drilled by electricity in the dead trunks, fell the tree much more rapidly than could be done by other methods and several can be destroyed at once. The dead trunk in a section that has been swept by fire, is considered one of the most dangerous menaces to other trees when a new fire occurs.

#### NEW TYPE OF MAGNETO HAS NO REVOLVING ARMATURE

A new type of magneto, which has neither revolving armature, slip ring or distributor, is being marketed in England for marine engines. The magnetic field

is produced by permanent bar magnets to which are attached pole pieces carrying the primary and secondary windings. An armature is at one end of the poles, and high-tension current is produced by pulling the armature away from the coils and breaking the primary circuit. The return of the armature closes the circuit and completes the cycle of operations. The intensity of the spark is entirely independent of the speed at which the engine is running. The mechanism for moving the armature is shaft-driven so the magneto can be fitted to existing engines without alteration.

☛ In proportion to the size of their bodies, insects have larger wings than birds.



## WORLD'S BIGGEST SEAPLANE FLOWN SUCCESSFULLY



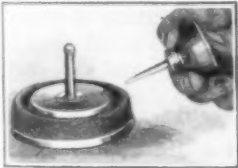
The Biggest Flying Boat Ever Built, the Triple-Engine Rohrbach "Romar," Was Successfully Flown on Its Initial Trials after Being Launched Recently at Travemuende, Germany. The Huge Craft Develops 2,160 Horsepower and Carries 2,114 Gallons of Gasoline in Its Wing Tanks. Owing to Its Boatlike Construction, It Can Ride Out a Storm at Sea If Forced to Alight; Three of the Boats Have Been Ordered by the German Air Lines for Service to South America, to Be Flown in Three Hops, the Longest Being from the Cape Verde Islands to Fernando Noronha, off the Coast of Brazil; the Planes Have a Wing Span of 121 Feet and a Length of Seventy-Two Feet Eight Inches, and Weigh 41,140 Pounds with Full Load

### DESTROYED FERTILIZER INCREASES TOLL OF FOREST FIRES

Besides the enormous quantities of timber and game they destroy, forest fires do great damage by burning natural supplies of fertilizer on the ground of wooded areas. For instance, in a pine forest, where the fall of needles insures a rich supply of nourishing materials for the plant growth of the future, this abundant fertilizer is converted into ashes by a fire, driving off the beneficial oxygen in the form of a gas that is lost to the soil and otherwise impoverishing the ground. Experts have estimated that to replace the helpful materials on one acre of pine forest, after it has been swept by a fire, it would require the addition of seventy pounds of sodium-nitrate fertilizer at a cost of about \$3, and a blaze may do \$10 to \$15 per acre damage by this destruction alone.

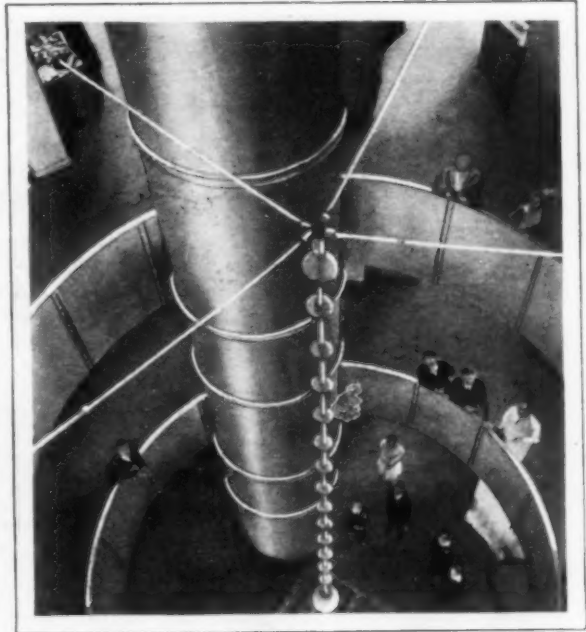
### TRAP ATTACHED TO CASTERS FOILS INSECT PESTS

To keep ants and other insects from entering cabinets, refrigerators and other pieces of furniture, a felt trap, saturated with kerosene or other anti-bug liquid, is attached to the casters. The felt holds a liberal supply of liquid, is easily put on and seldom needs renewal.



### RUBBER PADS FOR RAILROADS GIVE SMOOTHER RIDE

Specially processed rubber pads are being installed along the right of way of railroads in the Federal Malay states to deaden the sound of the engines and cars and to absorb unpleasant vibrations. According to reports, they have worked successfully on a trial mile of track. The pads also help protect the ties.



Central Court of the Spherical House Built for Exposition in Germany, Showing the Wide Space for Light and Air

### HOUSE IN FORM OF BIG GLOBE WELL LIGHTED INSIDE

One of the chief features of the huge, ball-shaped house constructed for the "Technical City" show in Dresden, is the central court or passageway from the top to the bottom. This admits light to the hallways that radiate from the center of the building and also affords ample means for effective ventilation.

### LAMP THAT CLAMPS ON BOOK HELPS PROTECT EYES

Clamped on the edge of the book and having a wide shade that keeps all glare from the eyes, a reading lamp is of special convenience for persons who like to read late or for use in the sick room. Since the light is directed entirely upon the pages, it does not disturb others.



☛ When frogs wink their eyes, the lids are moving upward.



The Latest Thing in Electric Welding, the Atomic-Hydrogen Process; Hydrogen Fed to the Arc Has Its Molecules Broken into Atoms, Which, in Recombining, Produce Intense Heat

By CALVIN FRAZER

WHEN you tell the average person that electrical heating has made revolutionary progress within the past few years, he thinks of his domestic furnace, now burning coal, oil or natural gas, and asks whether the time has come to discard these fuels for something better. Let us therefore explain that the new era of electric heat does not yet affect to any marked extent the problem of keeping your house warm in winter.

The "house without a chimney" flourishes on certain reclamation projects in the west, where cheap electricity is a by-product of irrigation under the auspices of a paternal government. It prevails to some extent in Europe, where water-power electricity is equally cheap. Electric "heat reservoirs" have been installed in many Swiss and German houses. These are huge tile-incased stoves, of ancient

pattern but with electric heating elements placed inside instead of the usual coal or wood fires, to heat the heavy slabs of slate or soapstone that compose the walls. Current is supplied to these devices during the off-peak hours of the night at low rates, and they store enough heat to last all day. A few "all-electric" houses in England are heated on a similar basis, hot water being used to retain the heat.

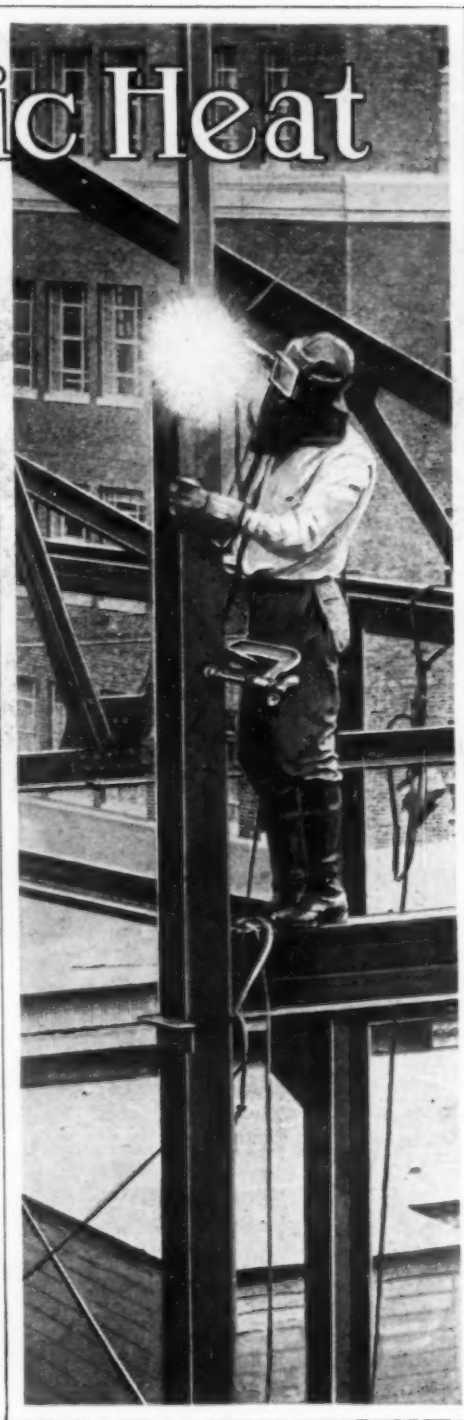
Generally speaking, however, the heating of entire houses by electricity does not yet loom on the horizon, though small portable electric heaters for single rooms—especially bathrooms and bedrooms—are common. Even as applied to ordinary household cooking, electric heat is still unable to compete with coal and gas in most communities. Its uses in the home are mainly in small appliances that consume but little current, including toasters,

# of Electric Heat

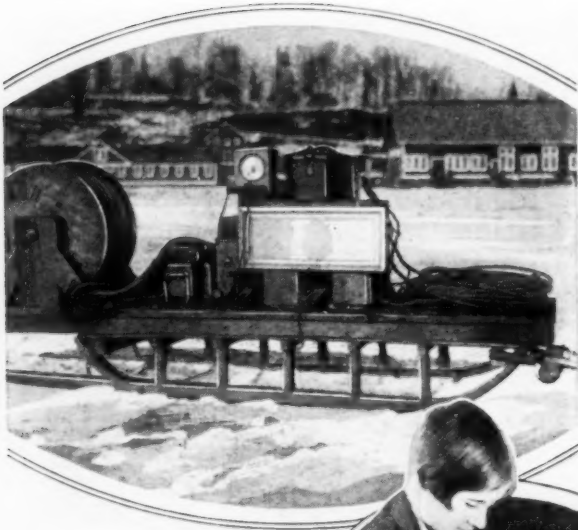
grills, chafing dishes, percolators, flatirons, curling irons, bed warmers, hair driers, and so on. These domestic conveniences are steadily increasing in number, and their advent may be said to mark a new epoch in housekeeping, but it is in the industrial field that the amount of electric energy used as heat has lately become truly enormous. A well-known engineer has recently predicted that before the year 1935 we shall see as much electricity used industrially in this country for heating as is used in turning the wheels of machinery.

This development was undreamed of a generation ago. Look back to the year 1882, and you find Edison establishing in New York city the first public plant for supplying electricity. A 200-kilowatt generator sufficed for its needs and the output was devoted entirely to lighting. A few years later the motor load began to figure in central-station operations, with the advent of desk fans in offices. Electric elevators and other applications of the motor followed. By the early nineties of the last century, electricity was driving a large variety of machines, electric railways were rapidly multiplying, and the business of producing and selling electric current had come to be known as the electric-light and power industry, a name that it still retains. In the statistics of the industry, the part of the output used for lighting is usually segregated, while that used for driving motors, for heating and for electrochemical purposes is lumped together under the head of power. Not until the second decade of the present century did the central stations begin to supply more energy for power than for lighting, and only within the past six or eight years did the portion of the former applied to industrial heating begin to bulk large.

Let us now see how this new electrical giant is serving the needs of industry.



Putting Together a Steel Building by the New Process That Promises to Banish the Rat-a-Tat-Tat of Pneumatic Riveting Hammers



There are two ways in which electricity can be used for heating: the arc method and the resistance method. The arc is, of course, a special case of electric resistance (the air or other gas between the electrodes being the resistant medium) but it always produces intense heat, while the resistance of a solid conductor can be adapted to producing any temperature desired. The arc method is therefore confined to the melting of metals, including iron, steel, brass, etc., and to welding. In using the resistance method, the electric current may be sent directly through the material to be heated, produced by induction in this material, or sent through a heating unit separate from the material to be heated. The last of these three processes is the most versatile and the most widely used.

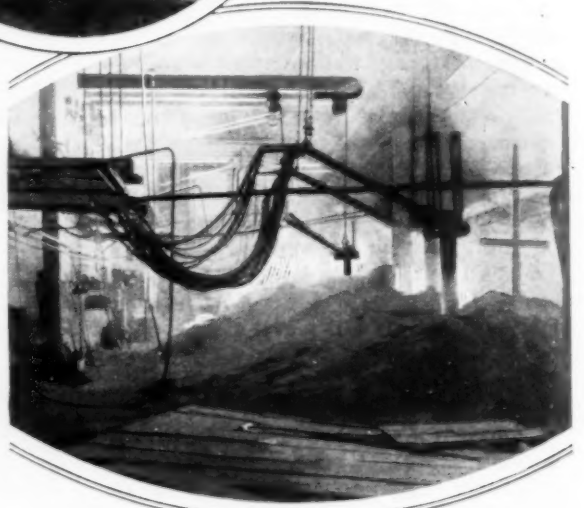
Electric heating costs more, per unit of heat produced, than heating by the use of fuel, but it offers many striking advantages over



the latter process, and it is also in many cases much cheaper in the long run on account of incidental economies realized in its use. Heating with fuel means combustion, and combustion means that a great amount of air must be heated, much of this heat escaping up the chimney; that undesirable fumes and soot are produced, and that exact regulation of temperature is difficult or impossible. Electric heating is not a combustion process; it requires no air; produces no soot or fuel gases, and can be regulated as perfectly and easily in ordinary industrial work as under the conditions of

the electrical laboratory. One of the many incidental advantages of electric heat is that it can generally be used without raising the temperature of the air in workrooms, and thus it is not, like combustion heating, a source of discomfort to the workmen.

No type of equip-



Thawing Machine on the Alaska Railroad; a Small Electric Furnace Used to Glaze the Porcelain on Artificial Teeth at a Temperature of 1,945 Degrees, and Furnaces Making Abrasives





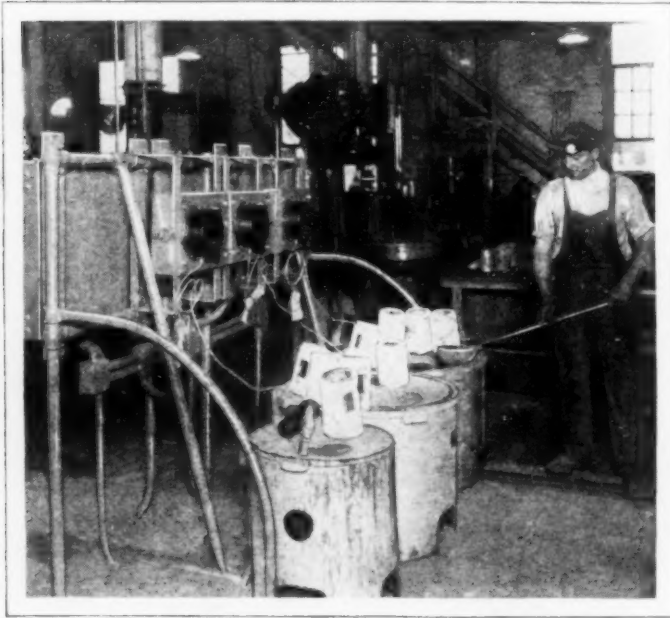
Pouring the Molten Charge from an Electric Steel Furnace; a Large Percentage of All the Energy Generated at Niagara Falls Is Used as Heat in Various Manufacturing Processes

ment for applying electric heat has had a more spectacular success in the industrial world than the electric furnace, of which there are several varieties, some working on the arc principle and some on the resistance principle. Among the main uses of the electric furnace are the melting and the heat-treatment of metals. In the iron and steel industry, for example, a high grade of pig iron is produced by the use of the electric furnace in place of the blast furnace. A much more important application, however, is in the making of steel. In the electric furnace, the charge is melted in a closed chamber. There is no oxidation, no contamination from fuel gases, and the temperature can always be perfectly controlled. Thus, steel of crucible quality can be made much more rapidly than by the crucible process. The electric furnace is used especially for making the various alloy steels, and for super-refining steel made by the open-hearth and Bessemer processes. It is also widely used in melting steel for castings. Lastly the electric-heat-treatment furnace provides a far more perfect control of temperatures

than any fuel-heated furnace, and is therefore the ideal means of annealing, hardening and tempering metal.

The triumph of electric steel dates essentially from the year 1915, when the demand for high-grade steel was greatly stimulated by the requirements of warfare. Since that time, electric heat has come into extensive use for the melting and heat treatment of brass and other non-ferrous metals. In a long list of metallurgical operations, electricity introduces the exactness of laboratory practice into the workshop and at the same time minimizes the need of skilled labor.

The most romantic feats of the electric furnace are those achieved by the use of temperatures unattainable by fuel-heated furnaces, as, for example, in the manufacture of artificial abrasives and in the fixation of atmospheric nitrogen. Carborundum, of which thousands of tons are produced annually at Niagara, owes its existence entirely to electric heat. All the aluminum made in the world is produced in electric furnaces. The same is true of calcium carbide, calcium cyanamide, alu-



Battery of Electric Babbitt Pots Used by a Street-Railway Company to Melt Metal to Be Poured into Car Bearings

mina and a large number of other highly useful compounds.

The electric oven, used for baking, drying, etc., at temperatures lower than those of the electric furnace, offers similar advantages of accurate temperature control, facility of operation and freedom from the contaminating effects of combustion. These ovens are now used in the preparation of hundreds of important products, ranging from pies and doughnuts to glassware, enamel ware, motor armatures, piano keys and watch dials. Chinaware is fired more easily and successfully in the electric oven than in combustion ovens, as the former provides a perfectly uniform temperature in all parts of the heating chamber, and any desired temperature can be exactly reproduced for each batch fired.

The electric "lehr" or annealing oven has recently come to the front in the glass industry. The quality of the glass annealed in it has proved so superior that many large users of glassware now specify in their orders, "must be annealed by electric lehr." One nationally known maker of ginger ale, after experiencing an average bottle breakage of two per cent in his filling machines, made the astonishing record of filling and capping 720,000 elec-

trically annealed bottles with the loss of only four from the entire lot!

To describe, even briefly, all the applications of electric heat in industry would require a large book—which would be out of date by the time it was published, as interesting new developments are cropping up every day. The following are a few random details of the story:

Electric heat is used to stimulate oil wells that are running dry. Heating coils are lowered into the well to melt the heavy-oil accumulation and permit it to flow freely.

The evenness of heat essential to the correct curing and vulcanizing of rubber is automatically

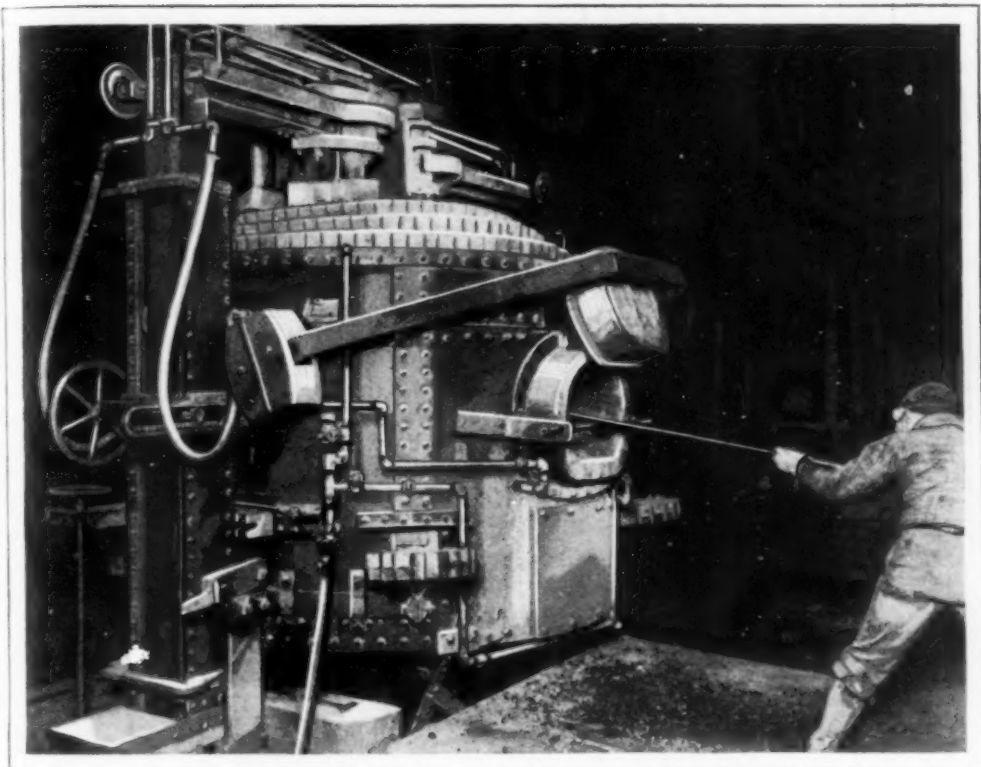
obtained by the use of electric apparatus to produce steam. In this process, the operation is confined to a single self-contained unit and does away with all piping.

Power and light companies find it profitable to use electric heat in purifying transformer oil. The oil is placed in a rotating apparatus which separates the suspended carbonized particles. The application of heat then vaporizes the contained water and other impurities, leaving the oil in proper condition to be used again.

In the preparation of effervescent salts, electric heat is found to be the most effective means of expelling moisture. It is now widely applied to drugs that must be packed in a perfectly dry condition.

Electric melting pots attached to typesetting machines are a boon to the printing industry. With the even temperature thus secured, the operator's attention is no longer diverted at frequent intervals to watching the thermometer, and production is said to be increased from fifteen to twenty-five per cent. Moreover, the appearance of the typography is much improved, as a sharp, clear type face results from maintaining exactly the right casting temperature.

Electric heat is used with great ad-



Courtesy Iron Trade Review

Goggled to Protect His Eyes against the Glare of Molten Steel, the Attendant Tests the Charge to See If It Is Ready for Pouring; Electric Steel Is Expensive but Best

vantage to melt glue in the manufacture of paper boxes, shoes, furniture, books, pianos and automobiles. It is also the ideal means of melting lead and tin, as well as solder, babbitt and similar alloys. The electric melting pot maintains the correct temperature automatically, without the danger of burning and without slag.

The electric welding of steel and other metals began half a century ago, but it has lately assumed many new forms and has been applied to a great variety of purposes. One of its newer feats is to add metal to rails where they are worn at the joints without removing them from the track. Various automatic welding machines have come into use, especially for welding the seams of tubes and pipes. Electric arc welding has had sensational success during the last two or three years as a substitute for riveting in the construction of steel-frame buildings, and also in shipbuilding.

Another important application of welding is in the construction of airplane fuselages. Metal has practically displaced wood in American-built commercial planes because of the superior strength of special alloy tubing, with no appreciable difference in the weight of the completed machine. Tests of properly welded joints invariably show that the weld is stronger than the rest of the material.

"Heat it electrically," is the new watchword of industry.

#### INSECTS THAT DEVOUR INSECTS TO PROTECT PLANTS

Orchardists in South Africa have been calling upon California for supplies of a certain species of beetle that devours the troublesome mealy bugs attacking trees in Africa. Growers are attempting to cultivate the beetles and raise a large army of them against the mealy bugs.

### GAS GUN LIKE FOUNTAIN PEN TO AID BANK CLERKS



Pen-Shaped Gas Holder for Repulsing Bandits; It Shoots Fumes Twelve Feet and More

Shaped like a fountain pen, a small container for gas fumes, to foil bandits, has a lever that shoots the vapors a distance of twelve feet and more. It is intended for the use of bank tellers, clerks and others, and is deceptive to an intruder as its appearance gives no indication of its purpose. The "pen" unscrews in the middle for the insertion of a gas cartridge.

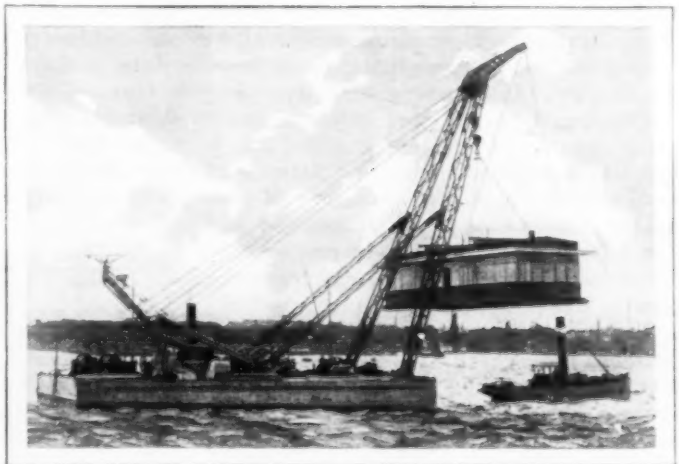
### IRON WIRE ACTS AS NERVE ACID TEST SHOWS

The expression, "he is a man of iron nerves," may be more true literally than has been supposed, an interesting series of tests just concluded by Prof. Ralph S. Lillie, of the University of Chicago, indicates. His experiments have revealed a striking similarity between nervous action, particularly heart action, and the behavior of iron wire in a nitric-acid bath.

A pure iron wire, one to five centimeters long, was immersed in a nitric-acid solution of sixty to eighty per cent. A colorless film immediately formed over the wire and, if one end was scratched, a wave traveled rapidly along the wire. When a glass tube was placed in the acid, around one end of the wire, rhythmical waves passed the length of the piece at the rate of fourteen to 120 times a minute, depending upon the strength of the solution, the temperature and the length of the wire. Dr. Lillie concluded that a sort of battery was formed. The film, only one molecule in thickness, acquired an electrical charge negative to that of the wire. When the film was scratched, a current was set up which dissolved the film next to the bare spot. This continued until the bare spot, which was seen as a wave, had passed the length of the wire. The film forms again after the wave has passed. The influence of temperature, electrical polarization, concentration of acid and length of the wire, have been shown to be the same as their influence on living nerves.

### HOUSE TRAVELS OVER THE SEA ON POWERFUL CRANE

A sturdy crane picked up a house and floated it several miles across the water to a new location in Rotterdam recently. The crane was part of the equipment of a powerful harbor vessel, used in wrecking, dredging and other heavy tasks.



Giving a House a Ride: Powerful Crane Carrying Dwelling across Stretch of Water to New Location at Rotterdam



© U. & I.

Assistant Secretary of Commerce William P. MacCracken, Jr., and Art Goebel Examining Sample Markers Proposed for Use on the Airways of the Country to Guide Flyers

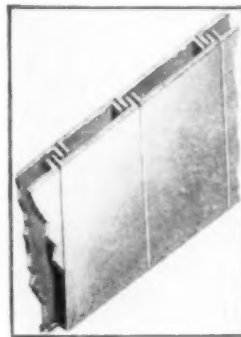
### UNIFORM AIRWAY MARKERS TO AID FLYING

Department of commerce officials are endeavoring to induce the adoption of a uniform style of markers to guide flyers along the airways of the nation. Different colors will be used for different cross-country routes, and other distinguishing details will be employed, according to present plans, to make it easy for the pilots to tell where they are. When the proper form of markings has been decided upon, it is intended to have them widely displayed to make them known.

### NEW WAY OF BUILDING WALL ELIMINATES PLASTERING

Greater economy, a saving of time, and other advantages, are claimed for a patented form of wall construction which leaves the interior in such a finished state that it is not necessary to use plaster. The essential feature of the method is its interlocking units which may be made of metal, concrete, fiber, gypsum or other materials

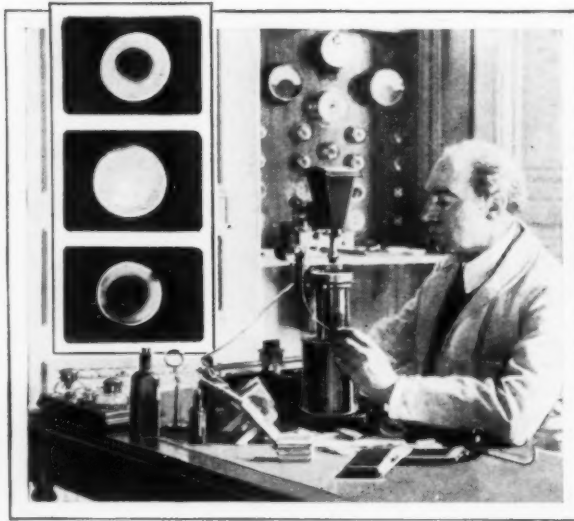
suitable for wall construction. These units are molded in long channel shape and are set on end instead of being built up as the ordinary wall of blocks or of brick. The length of the channel depends upon the height of the story, it is two feet or more wide and has an interlocking flange that holds it to the channel placed next to it. The depth of the channel depends upon what thickness of wall is desired, and the interior of the unit forms a dead-air space



which affords insulation or may be used for wires, pipes or other conduits. Where a column is desired for support, the space may be filled with concrete. When finished, the wall requires no stone or other covering on the inside, while the

joints on the outside may be concealed beneath any appropriate form of finish.





Using the Pearl-Inspecting Camera, and a Close View of Three Genuine Pearls Showing the Internal Structure

### FAKE PEARLS ARE REVEALED BY SPECIAL CAMERA

French experts have recently introduced a camera that takes pictures of the inside of pearls so that the genuine may be told from the imitation. Detailed views of the interior structure, and other points that are impossible to detect with the unaided eye, are said to be clearly revealed so that successful passing of the false for the genuine is not likely to occur after an examination with the instrument.

### DEATH WHISPERS FROM QUARTZ KILL SMALL ANIMALS

Further interesting experiments with inaudible sound waves have been performed recently by Alfred L. Loomis, who causes a quartz crystal to produce vibrations at the rate of two and one-half million per second, called "death whispers," because they kill small organisms in water. In earlier experiments, he produced vibrations at the rate of three-quarters of a million per second. The more recent effects have been obtained with a tiny slab of quartz, less than an inch long, about three-eighths of an inch wide and one-sixteenth of an inch thick. Its high rate of vibration is partly due to its smaller size as compared with the other crystal, and to the more rapidly oscillating electric current to which it is submitted to cause

vibrations. Plant and animal cells were killed by the violent stirring of their contents. The cell walls of the plants were not broken, as they were evidently too tough and strong, but the contents were seen to be swirled into a disorganized mass by the action of the weird whispers of death.

### TONE TESTER LOCATES RADIO TROUBLES BY KEEN HEARING

Listening to radio programs through loud speakers, as many as 250 of them a day, is the task of Martin T. Olsen, a veteran in one of the most highly specialized activities in the world. He is a tone tester. Just as the tea taster's sense of taste has been developed to a point where he can detect the slightest difference in blends, so Olsen's ears can distinguish the least variation in pitch. The average person can tell the difference in tones or notes up to about 5,000 or 6,000 frequencies per second, scientists say, but Olsen, in a competitive test, demonstrated that he was able to distinguish notes at frequencies of over 10,000 cycles per second. During a broadcast program, he can usually tell if distortion or extraneous noise is the fault of the microphone, is in the station studio, or if the interfering noise or faulty tone is caused by the set itself, and if so, where the trouble lies. His chief business is to listen to the loud speakers manufactured by a radio company to determine if they are up to the standard of the master model in tone and pitch. If they are not, Olsen's keen sense of hearing aids in locating the difficulty.

Martin T. Olsen, Testing Tone of Loud Speaker



# Twenty Five Years of Flying



A Wright Pusher Type of 1910 alongside a Modern Twelve-Passenger Tri-Motored Cabin Plane; the Old Wright Machine, Still in Flying Condition, Escorted the New Ship on Its First Trip

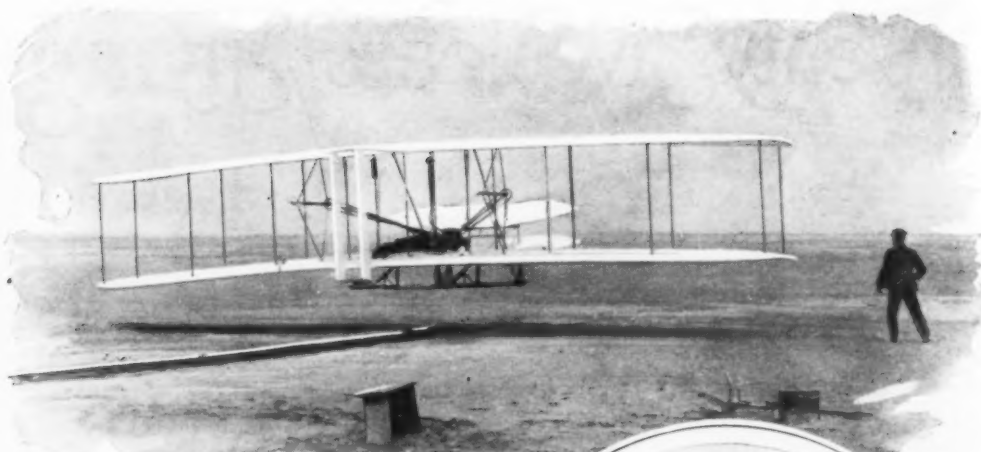
**T**WENTY-FIVE years ago, the seventeenth of December, a crude structure of bamboo and silk, powered with a homemade motor, shot down a wooden rail in the lonely sand dunes at Kitty Hawk, N. C., and took to the air. It flew along for 260 yards and settled gently to earth.

A feat that had intrigued the minds of men since the dawn of recorded history had been accomplished. Two bicycle builders from Dayton, Ohio, Wilbur and Orville Wright, had flown a power machine through the air.

Less than a quarter of a century later the descendants of that first crude flying machine had flown the Atlantic and the Pacific, remained in the air more than sixty hours, traveled more than 4,200 miles without a stop, had been to the North pole, played a vital part in the greatest war in all history, were carrying mail and passengers day and night on regular schedules, and were performing a thousand useful tasks. All that happened within the lifetime of youths who cast their first votes this year, for, while the initial flight was made in 1903 it was not until 1908 that public flights were made.

The pilot on that first flight was Orville, while his brother, the late Wilbur Wright, supervised the take-off. To launch the ship into the air, they mounted it on a rail and used a weight, dropped from a derrick, to give it the initial starting impulse. The motor, built in their Dayton bicycle shop, turned a pair of propellers, through bicycle chain gearing, at the slow speed of 400 revolutions a minute, as compared to the speeds of 1,500 to 1,900 revolutions common in modern airplanes.

The first flight of the motor-powered plane had been preceded by years of experimentation with gliders, in which they had made several thousand flights. Before they tried power, both brothers had learned to fly their gliders in winds with a force up to thirty-five miles an hour, to maneuver them in the air and land safely. In all their glider experiments they had but one accident, when Orville fell thirty-five feet and escaped without a scratch. By the time they were ready to build the power machine for the famous flight of 1903, they knew more than anyone living about the problems of flying



Above Is the First Airplane Flight Made by Man, at Kitty Hawk, N. C., on December 17, 1903; Wilbur Wright Is Running alongside the Plane, Which Has Just Left the Catapult Track, and Orville Wright Is at the Controls; at Right, Herring Flying One of Octave Chanute's Gliders over the Sand Dunes of Indiana, Just Outside Chicago; Chanute's Experiments Were the Connecting Link between Lilienthal and the Wrights



The Original Langley Aerodrome Ready to Be Tested over the Potomac River; It Fell into the Water, but Years Later Was Rebuilt, Re-engined and Flown



Right, Chinese Military Attache at Washington Learning to Fly; Note the Aileron Controls Strapped to the Shoulders



An Early Farman Biplane, of the Days When Planes Still Carried Stabilizers in Front; the Clothes of the Spectators in the Foreground Give a Hint as to the Year; at the Left is the First Aerial Bomb in All History; Its Inventor, Riley Scott, a West Point Graduate, is Attaching the Device to His Plane; the Place is Rockwell Field, San Diego, and the Year is 1913; the Bomb Weighed Six Pounds, in Contrast to the 4,000-Pound Monsters Carried by the Huge Bombing Planes of Today; the Plane Has a Steering-Wheel Control, a Device That is Coming Back into Use for Some of the Bigger Ships Today

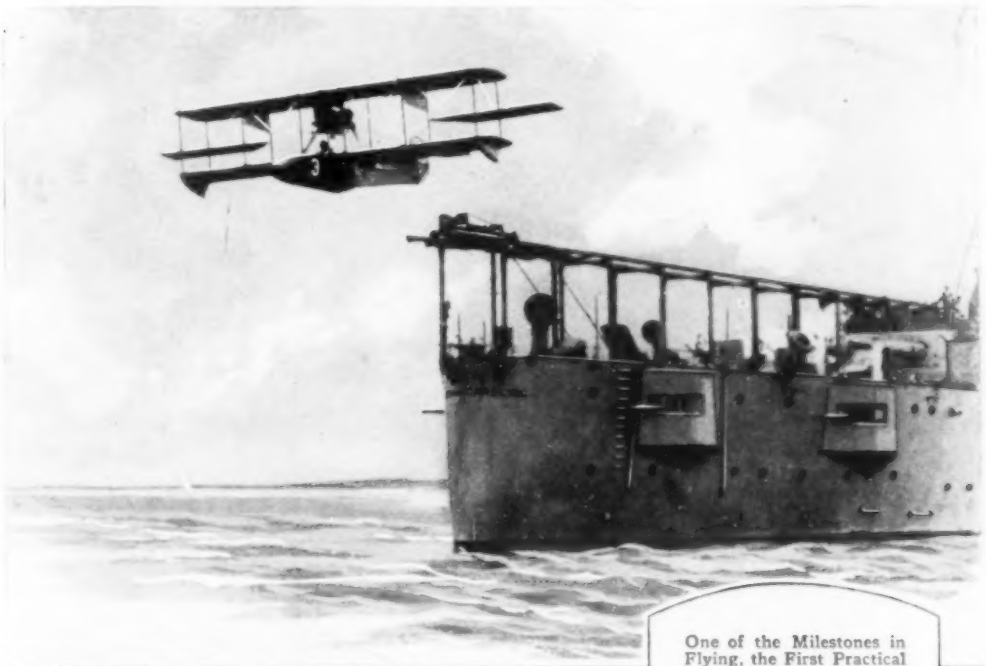


It Was Just Twenty Years Ago That the Army Bought Its First Plane, the Wright Machine Shown Above, at Ft. Myer, Va., in 1908; in the First Demonstration Lieut. Selfridge, the Army's First Flyer, for Whom Selfridge Field, Mich. Is Named, Was Killed and Orville Wright Badly Injured; at Left Is Capt. Holden Richardson, U. S. N., in a Sixteen-Year-Old Curtiss Seaplane, Recently Resurrected from the Navy Store House, Assembled and Flown; the Old Machine Is a Pusher Type with the Propellers behind the Wings

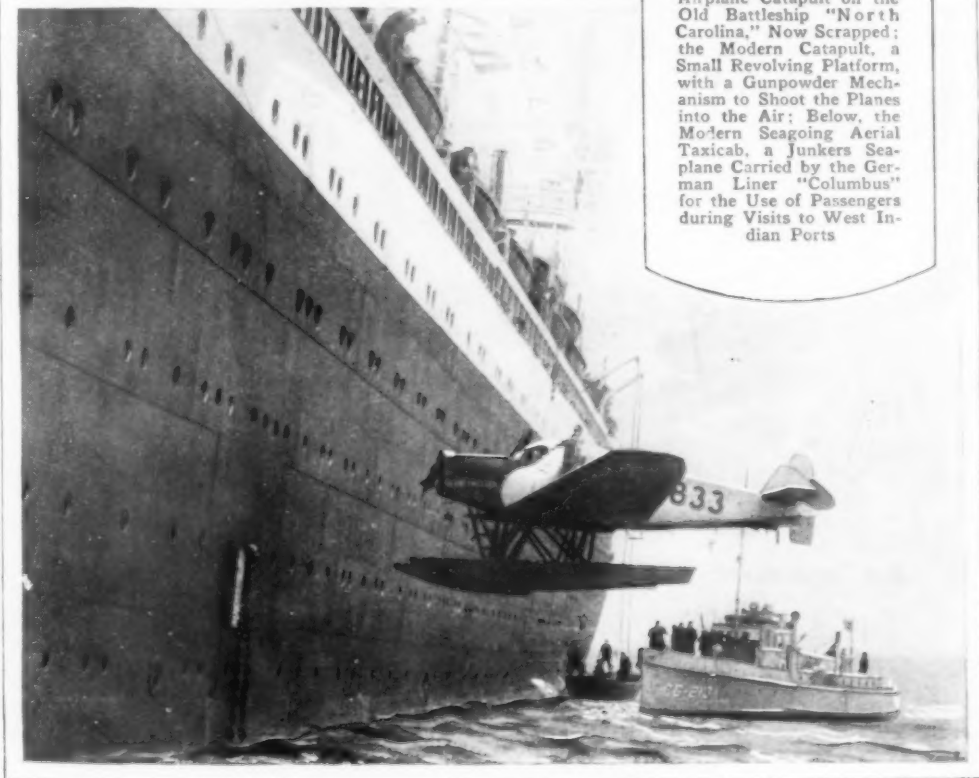


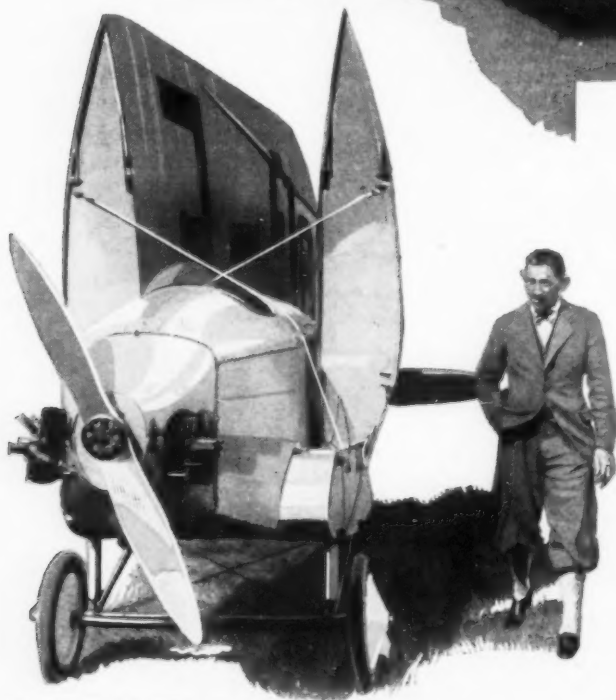
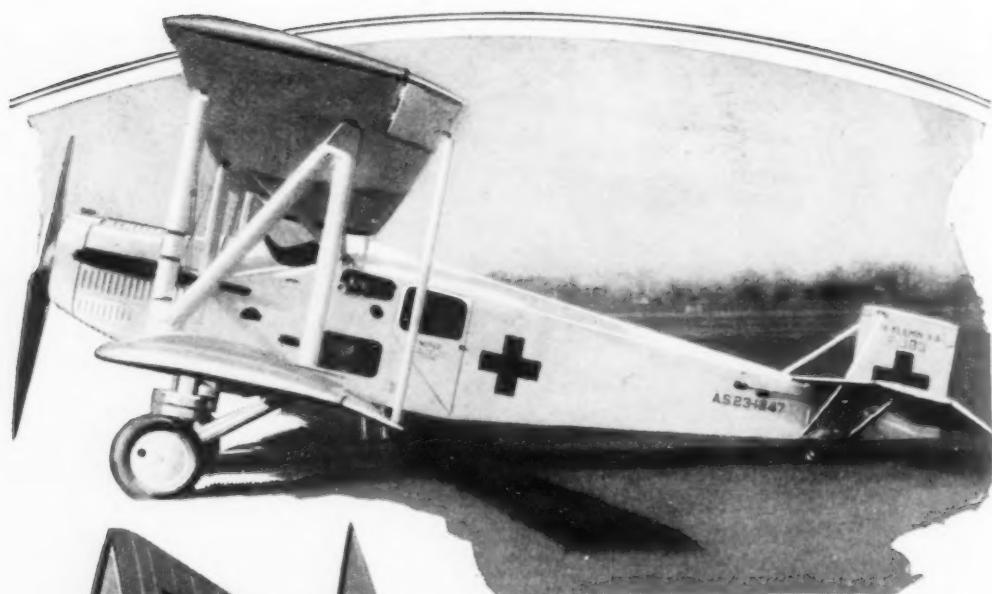
The First Curtiss School of Aviation at North Island, San Diego, Calif.; Glenn Curtiss Himself Is the Man with Cap and Mustache, Second from the Left





One of the Milestones in Flying, the First Practical Airplane Catapult on the Old Battleship "North Carolina," Now Scrapped; the Modern Catapult, a Small Revolving Platform, with a Gunpowder Mechanism to Shoot the Planes into the Air; Below, the Modern Seagoing Aerial Taxicab, a Junkers Seaplane Carried by the German Liner "Columbus" for the Use of Passengers during Visits to West Indian Ports

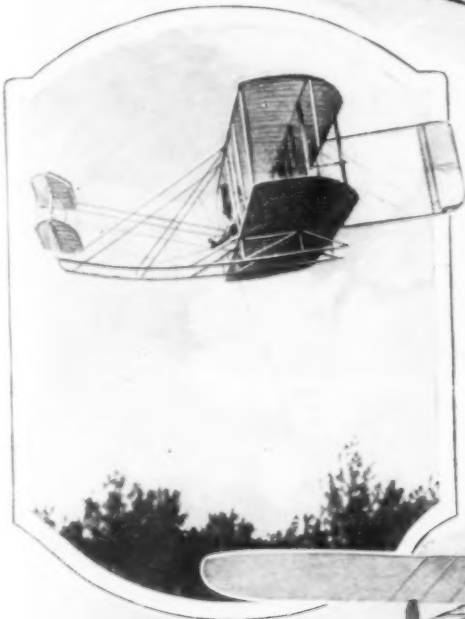




In the Years Since the War, Airplanes Have Developed Rapidly, Both for Military and Commercial Purposes; Above Is a Modern Flying Ambulance; the Army and Navy Use Airplanes Fitted with Stretchers and First-Aid Equipment to Carry Patients to Hospitals, and They Have Proved Especially Useful in Rescuing Victims of Aerial Accidents, Frequently Getting the Injured to the Hospital in Time to Save Their Lives, Whereas Normal Transportation, Often from Isolated Districts, Might Have Been Fatal; at the Left Is a British Monoplane with Folding Wings, Which Can Be Kept in a One-Car Garage; Its Spread of Wings Has Been One Drawback to the Airplane, but with the Advent of Folding Wings, Especially Adaptable to Monoplane Construction, the Ship Is Easily Stored, or Can Be Hauled through a City's Streets behind an Auto Truck, without Obstructing Traffic

At the Right Is One of the First of the Amphibians, Capable of Landing or Taking Off Either from Water or Land; Comm. Richard Byrd Used Loening Amphibians in the Arctic with the MacMillan Expedition, and the Army Flew Them around South America



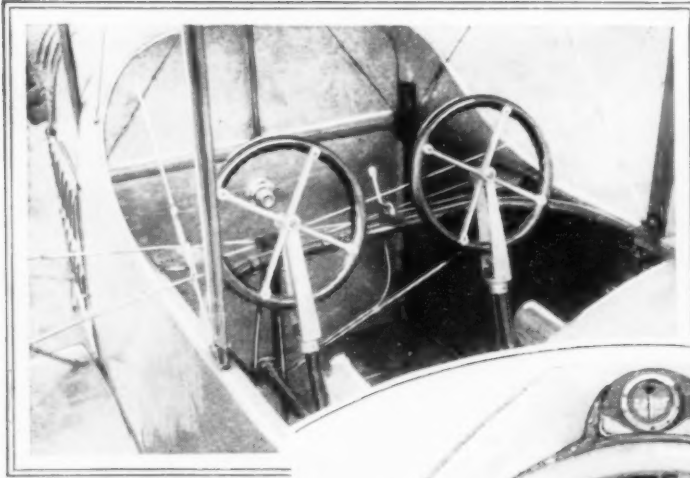


Lincoln Beachey, Later a Famous Airplane Pilot, Got His Start with This Crude Little Dirigible; the Pilot, Straddling a Triangular Frame, Ran Back and Forth along the Keel to Point the Ship Up or Down, as the Bag Itself Had No Elevator Planes; at Left, Wilbur Wright Flying at Le Mans, France; This Is the Plane with Which He Electrified Europe by His Sensational Flights in 1908 and 1909



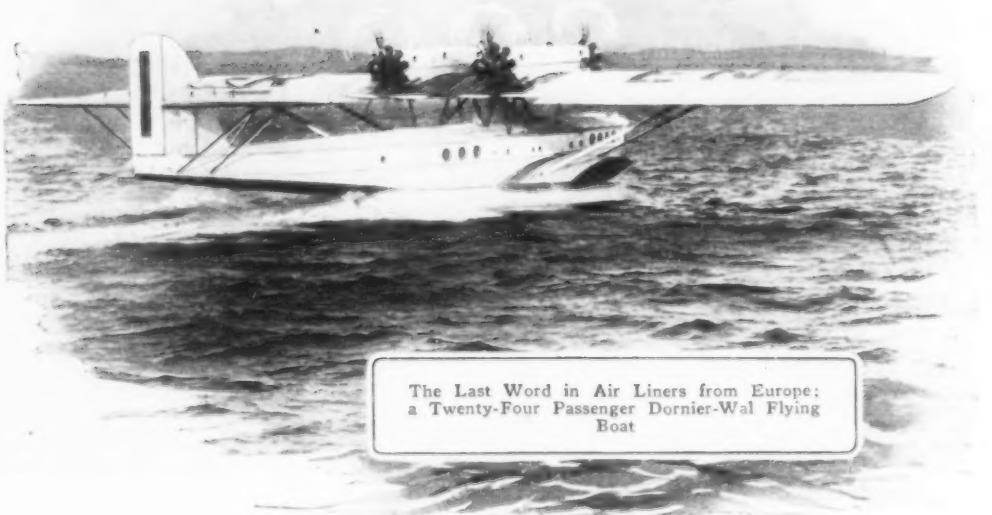
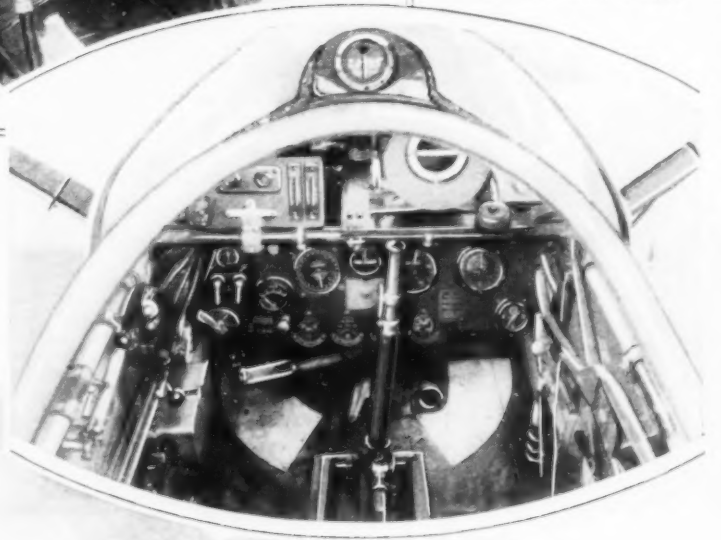
Drexel Taking Off in His Bleriot Monoplane; It Was in a Mate to This Ship That the Designer Wrote His Name into Aviation History When He Flew across the English Channel in 1909; Nineteen Years Later the "Southern Cross" Was Spanning the Pacific





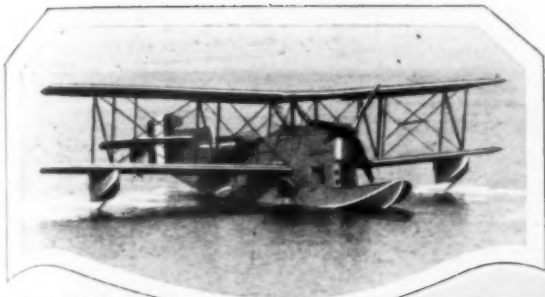
An Early Airplane Cockpit Fitted with Dual Control for Training, but with a Dash Bare of Instruments, Whereas Even a Student Ship Nowadays Is Fitted with Oil-Pressure Gauge, Water Thermometer, Altimeter and Engine Tachometer; the Early Controls Were Varied, the First Wright Ships Having Two Hand Levers, One for the Elevators and the Other Operating both Rudders and Wing-Warping Controls, While There Was No Rudder Bar; the Curtiss Ships for a Time Used a Shoulder Harness to Work the Ailerons as the Pilot's Body Swayed

At the Right Is a Modern Cockpit, with So Many Instruments They Have Overflowed from the Board; Compass, Bank and Turn Indicators, Drift Indicators, Dual Ignition Switches, Lights, Altimeter, Tachometer, and a Multitude of Gauges Are Among Those Included



The Last Word in Air Liners from Europe; a Twenty-Four Passenger Dornier-Wal Flying Boat

Cockpit  
 Control for  
 Dash  
 Where-  
 Now-  
 l-Pres-  
 arm-  
 Engine  
 y Con-  
 First  
 Two  
 or the  
 or Co-  
 and  
 trols,  
 Rudder  
 for  
 Har-  
 ons as  
 yed

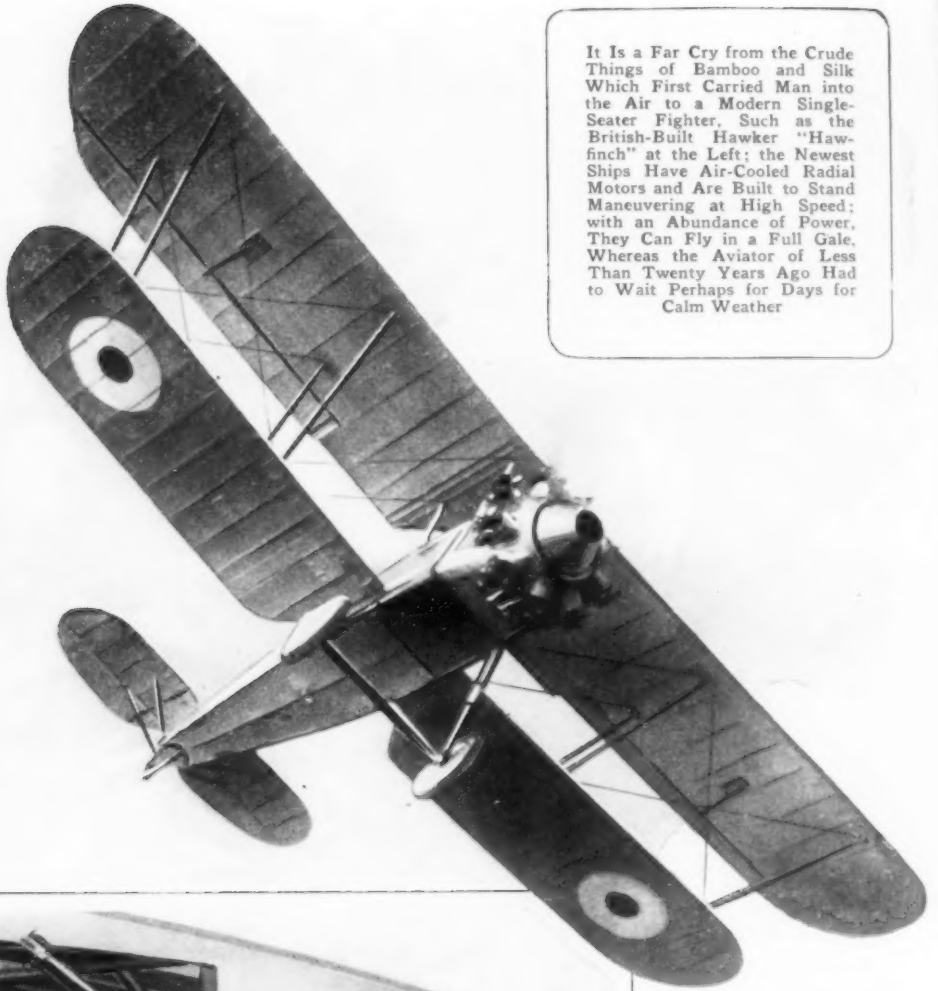


Loening Amphibian, with Three-Bladed Propeller; the Same Type Ship Is Being Produced as an Air Yacht, with Comfortable Cabin



One of the Strangest Planes That Has Been Successfully Flown Is the Auto-Gyro, Invented by a Spaniard and Produced in England; Instead of the Usual Wings, It Has Four, Revolving like the Blades of a Propeller; a Rope Is Wound around the Shaft and Pulled, to Start the Wings Turning Before the Plane Takes Off; Once in the Air, the Speed of the Plane Keeps Them Revolving; the Queer Ship Is Very Stable in the Air, and Can Descend Almost Vertically; at the Right Are the Three Engines and Part of the Metal Hull of England's Largest Flying Boat, the Short "Calcutta" Type

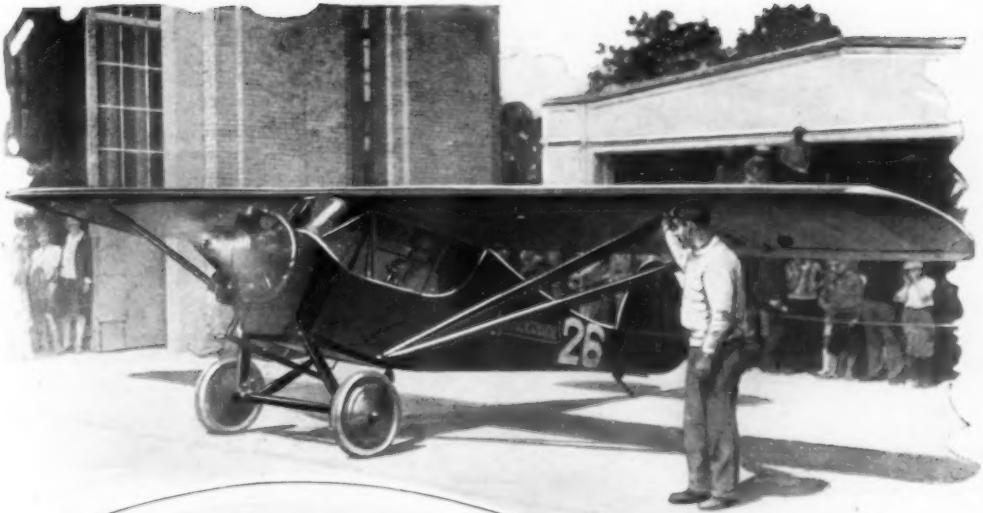




It Is a Far Cry from the Crude Things of Bamboo and Silk Which First Carried Man into the Air to a Modern Single-Seater Fighter. Such as the British-Built Hawker "Hawfinch" at the Left; the Newest Ships Have Air-Cooled Radial Motors and Are Built to Stand Maneuvering at High Speed; with an Abundance of Power, They Can Fly in a Full Gale, Whereas the Aviator of Less Than Twenty Years Ago Had to Wait Perhaps for Days for Calm Weather



One of the Queerest Inventions to Aid Aircraft Is the Propeller of the Constant-Speed Generator Used to Operate the Wireless Transmitter: the Propeller Has Only One Blade, with an Ingenious Arrangement That Keeps It Turning at a Fixed Speed despite Variations in the Speed of the Plane through the Air; the Photograph at the Left Shows Capt. Pietro Bonelli, Navigator and Radio Operator of the Sesqui-Plane "Roma," Built for Captain Sabelli's New York to Rome Flight; a Sesqui-Plane, as the Name Indicates, Has One and a Half Wings, the Lower Wing Really Being Merely a Broadening Out of the Struts Which Otherwise Would Brace the Wing of a Normal Monoplane

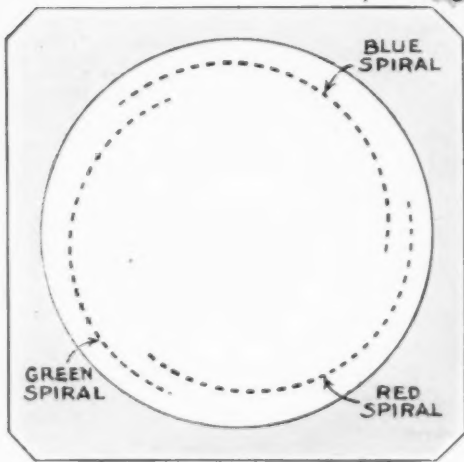


Above is a Flivver Monoplane Piloted by a Woman in This Year's Ford Reliability Tour; Powered with an Air-Cooled Engine and Fitted with a Luxurious Cabin for Two People, It Costs Less Than \$2,700; at the Left is the First Plane with Sea Pontoons to Fly the Atlantic, Miss Amelia Earhart's "Friendship"; Hers Was the First Seaplane to Make the Trip, and the First Plane Capable of Landing on Water Since the Initial Flight of the Navy's "NC-4" Flying Boat; All the Other Crossings Were Made by Land Planes without a Chance to Survive at Sea.



Modern Cabin Plane with Folding Wings; the Fairchild Monoplane John Henry Mears Used in Round-the-World Trip

## PICTURES IN COLORS ARE SENT BY TELEVISION



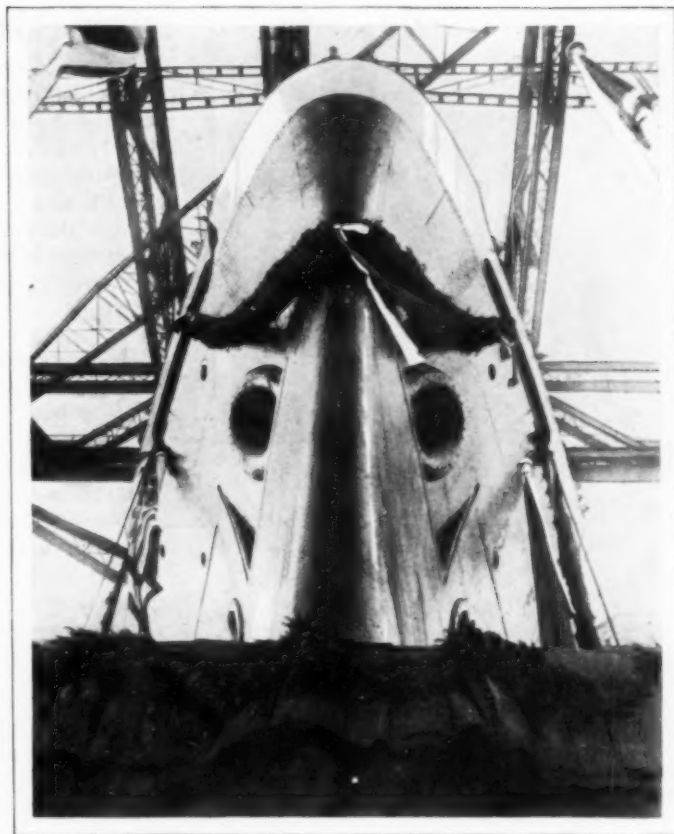
Transmitting a Daylight Television Picture; Drawing to Show the Perforated Transmitter Disk That Helps Produce Color Effects, and Demonstrating Receiver

**T**HE PROBLEM of perfect television has been brought a stage nearer solution by the recently successful tests of two devices invented by John L. Baird, English expert. Mr. Baird has succeeded in transmitting by his radio television in daylight, with the sun hidden by clouds, the images of the head and shoulders of a man, whose living picture appeared clearly on a screen in the interior of a darkened room. He next attacked the problem of

transmitting by radio television the living pictures of objects in their natural colors. In this successful transmission, the receiver showed a small image about as large as a visiting card, but in perfect detail. For radio-television in this process, the English inventor uses a three-color device, in which the three primary shades of blue, red and green are made to transmit successive images of a live or still object. In rapid succession, a green, a blue and a red

image are presented to the eye watching the receiving screen. They are seen as one white image. The new device consists of a transmitter disk perforated with three sets of holes set around the edge of the disk in spirals. One spiral is covered with a red filter, one with a blue and the third with a green filter. Light is projected through these holes so that, as the disk rotates, the object televised is traversed first by a red spot of light, then by a blue, then by a green. At the receiving station, a similar disk revolves at the same speed and its holes are also covered with red, green and blue filters. Behind the disk, and in a line with the observer's eye, are two lamps, one of them a neon-filled glow lamp, and the other filled with mercury vapor and helium. These lamps are the source of the colored rays, and are operated by current from the transmitter. A commutator arranges that the neon lamp, the red-ray source, is alight during the time in which the radio eye views the image of the object through perforations covered by the red filters. When the blue and green images of the object are being transmitted, and the radio eye is viewing the image through the blue and green filters, the mercury and helium lamp, emitting blue and green rays, is in operation.

Another advance in the Baird television processes, is the reproduction of living images in stereoscopic relief. Here a similarly perforated disk is used. Pencils of rays from a spotlight lamp scan the object to be transmitted through lenses, so that it is explored from two points, one to the right and the other to the left. On the receiving disk, the two images are viewed through two prisms, making the observer see an apparently solid object.



Bow View of the "Europa," Taken from the Launching Stand Just Before the New German Liner Slipped Down the Ways

#### FOUR-DAY SHIPS LAUNCHED IN GERMANY

A battle for ownership of the speed honors of the North Atlantic, held for many years by the now aging "Mauretania," is in prospect with both England and Germany building larger and faster ships. The German yards have launched two 46,000-ton liners, to be named the "Bremen" and "Europa," and both the White Star and Cunard lines are preparing to build 60,000-ton ships which will equal the ill-fated "Titanic" in size, being longer than either the American-owned "Leviathan" or the British "Majestic," both of which, incidentally, were built by German yards just before the war to make a bid for the Atlantic de-luxe passenger business, but fell into the hands of the allies. The two new liners recently launched are expected to cross the Atlantic in four days.



Police Plane That Keeps Order in the Air; the Command, "Land at Once," Requires Immediate Notice

### FLYING POLICE FOR AIRPORT PROTECT PLANE TRAFFIC

When flyers skim too low over the city of San Diego, Calif., perform dangerous stunts against the air regulations, or otherwise jeopardize traffic, a police plane takes off, flies alongside the offender and informs the pilot by the message written on the side of the ship to stop his acrobatics and "Land at Once." The force has been organized by the San Diego board of air control and is expected to prove a valuable aid to aviation at this port, where traffic of the skies is almost daily becoming more congested. The written order was decided upon to make identification of the police plane easy and to save the patrolmen's voices as it would be almost impossible to yell the orders loud enough to make them heard above the roar of the motors.

### SECRET OF DAMASCUS STEEL KNOWN TO OLD ROMANS

That some of the Roman blades which conquered the world of their time was of a workmanship that later became known by the name of Damascus, is the interesting conclusion of Prof. B. Neumann, of the Institute of Technology at Breslau. He has just completed an extensive research in metallurgy based on fragments of a number of Roman swords which were found buried in a German peat bed where they had lain for more than 1,600 years. Since they were preserved from the action

of the air by the damp earth, they were in far better condition than other specimens of Roman steel. Apparently, the bars from which these swords were made, were prepared by sandwiching alternate thin layers of high and low-carbon steel and then "sweating" the whole together. Left straight, the bar could be forged into a blade with a striped or ribboned effect. Twisted and then forged, it produced a blade with a vee-damascening. Two twisted bars sweated together and then forged into a blade gave a W-pattern on the finished sword. Some of the Roman blades also show a curled or "rose" pattern, but how the smiths achieved this is not yet known. Professor Neumann's examination of the steel samples shows that the Romans tempered only the outside of the blade so that it would give a hard edge and point backed up by a tough body.

### SPRAY TANK ON MOTORCYCLE HELPS KILL MOSQUITOES

Motorcycles have been enlisted in the warfare against mosquitoes in suburbs of Chicago. A thirty-five-gallon tank of an acid tar oil is carried on the machine and the liquid is sprayed over small pools of water where the insects breed. The rider operates the spray hose without leaving



Spraying a Small Pool from the Anti-Mosquito Motorcycle with Its Tank of Tar and Oil

his seat and, in a single day, can cover a wide territory. A district comprising more than seventy-five square miles, has been visited by the cycle throughout the season, and a marked reduction in the number of mosquitoes has been noticed.

☛ Sound passes through helium almost twice as fast as it does through air.

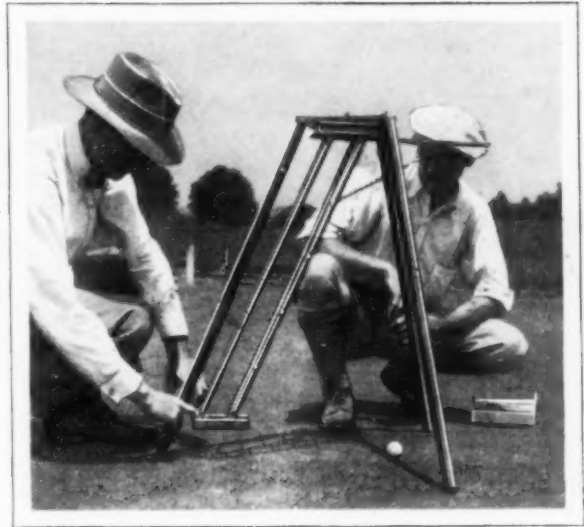


### BONFIRE CHAIN PLANNED BEFOREHAND TO WARN OF EXPECTED FLOOD

The greatest bonfire chain since the news of the approach of the Spanish Armada was "telegraphed" by that means around the coast of England, was organized this past summer in Kashmir, India, to send the news should an ice barrier break in remote Tibet and send an avalanche of water down the valley of the Indus. Several years ago a glacier slid across the river Shyok, one of the tributaries of the Indus, and formed a lake 17,000 feet above sea level. Behind the ice barrier, 120,000,000 tons of water collected, the lake finally growing so great that it became apparent its waters probably would break through when the level reached the top of the barrier and the sun this summer began softening the ice. The government of Kashmir prepared by laying a chain of bonfires 140 miles long, each in sight of the next, and stationing a sentinel to touch off the pile when the waters started. In charge at the lake end, Col. E. B. Howell, British resident attached to the Kashmir government, established a camp on the glacier itself, more than three miles above sea level and fourteen days' march from civilization. All the villagers in the lowlands were moved out by troops and preparations made to abandon a great part of the famous Vale of Kashmir if the flood came. Colonel Howell's post, on the "roof of the world," was one of the most lonely spots that could be found, with no one but a small escort of Tibetan mountaineers to keep him company.

### PUTTER TESTS KINDS OF GRASS BEST FOR GOLF GREENS

By actual tests with a mechanical putter, experts at the turf garden of the United States golf association near Washington, D. C., decide what varieties of grass are best for the greens. The device is essentially a pendulum arrangement which simulates the stroke of a player in putting, and the force of the stroke can be regulated by means of a spring. Tests have been made



Applying Science to the Game of Golf, to Test Varieties of Grass; the Mechanical Putter in Operation

on some 500 plots and with many different kinds of grass. The trials have revealed that certain varieties are not successful, as they impede the progress of the ball unnecessarily or deflect it from a straight course. The advantage of the mechanical putter is that strokes of exactly the same force can be made and the ball always struck in the same way.

### SKATE WITH JOINTED BLADE REDUCES FOOT STRAIN

Greater ease in skating is claimed with a jointed-blade skate now on the market. It adapts itself more readily to the movements of the feet without interfering with forward progress, and is said to enable the wearer to easily keep his balance.



Jointed Skate That Is Said to Reduce Foot Strain without Impairing Speed



# Air - Picked

Transportation in the North, as It Has Been from the Beginning Down to the Advent of the Airplane; Because of Limited Carrying Capacity and Speed the Dogs Are Being Displaced

By JAMES MONTAGNES

"THEY'RE off!" That phrase signifies a race. Make it an airplane race. Make its starting point New York. Watch two pontoon-equipped cabin monoplanes wing their way upward from the waters of Long Island sound. See them head for Montreal and then disappear in the distance.

They stop at the biggest city in the Dominion. Their arrival is a few hours apart, since they did not start together. They refuel, are custom-inspected, stand the gaze of hard financiers, and then they taxi over the waters of the St. Lawrence in their hop for Shirley air station near Ottawa. Another rest, the pilots are but beginning their race. Those first 700 miles were the easiest. Now they head for Winnipeg, 1,600 miles westward. It's a big hop, but it is also a big race—for gold.

Winnipeg finds the two pilots a little fagged out. Stewart J. Cheeseman is at the stick of one plane, while Capt. Charles Sutton flies the other.

Then they set their compass for The Pas, 500 miles northwest. That is the last place of civilization they will see. Here

Cheeseman will pick up some prospectors. From now on the race really becomes a race. It is the sprint. The last lap. A jump of 1,200 miles until Chesterfield Inlet, at the top of the western shore of Hudson Bay, comes into sight. And it is Chesterfield Inlet and the surrounding millions of acres of rock-strewn country that are the final goal of these two modern marathons. There they will meet their supply ships, the "Morso" and the "Michael and Patrick."

Gold and diamonds are what those prospectors, being rushed to the subarctic by sea and air, expect to find in that lonely land. Adventurers all, from the financiers in the big city, who are backing them with millions of dollars, to the newest of the mining engineers in the rival parties, they have started on one of the biggest commercial adventures of recent years. For two years they will fly over that land which is unexplored as yet, and will bring out of the earth minerals in quantities as yet entirely unknown.

One concern felt so certain about the



# Gold Fields

Unloading Supplies Brought by Air to the Jackson-Manion Mines in Ontario; with a Vast Network of Frozen Lakes and Rivers on Which to Land in Winter, the Planes Can Go Anywhere in the North

value of those unknown mineral deposits, that they asked the Dominion government for exclusive exploration rights for three years in that district, in return for which they would map and photograph a large part of it from the air.

Why this sudden rush to the far north in search of precious gold? Why this adventurous use of the airplane in unexplored and lake-studded, rock-strewn wilderness?

After an impatient rail journey of 1,000 miles, a young man from Hamilton, Ont., stepped off the transcontinental train at Sioux Lookout in northern Ontario. He was in a hurry. He had never been to Sioux Lookout before, yet he seemed to know the way, as if by intuition. The airplane hangar was the goal of his quick search. Within a few minutes he had made arrangements for a plane to take him north that day.

He set out to buy some supplies, food, clothing and mining tools. At the hangar at the appointed time, the airplane was ready for him. He hopped in, the plane took off and set its course northward, over

a rough, desolate and lake-covered country. For more than one hundred miles the journey continued, when a larger lake hove in sight. Another twenty miles and the seaplane began to descend, at last alighting at a mining camp.

Here the passenger stepped out, strapped his kit on his back and set off to an office to get directions. Then on the trail, which quickly led into the bush. Here and there men were busy examining the ground. Notes on the trees told him that others before him had made their stakes. But he continued. Then, after a few days, an airplane took him out again, this time to the recorder's office at Gold Pines.

"I want to stake these claims, and register them," he told the representative of the government. "My father came out here thirty years ago and staked these claims, but we have never worked them. Now I am staking them anew."

Thirty years ago this young chap's father had invaded the virgin bush of northern Ontario around Red Lake in search of gold. He had found what looked like possible locations, had recorded them

and gone away. At that time there was no railway within a few hundred miles, as now, nor was the airplane a means of transportation. A trail which led over hills, portages and lakes, through heavy bush in a black-fly-infested country, there was little likelihood of those claims being worked. The cost of getting materials in would have been far in excess of the output. So the claims were unworked.

Then, in 1926, came news of a gold strike in the Red Lake country. Prospectors from every part of the continent and even from other continents left home and set out for the frozen north. They arrived at Hudson and Sioux Lookout on the railway in thousands, old-timers and newcomers. Dogs were at a premium, and food sold at unheard of prices, eggs bringing \$1 apiece. This in the latter part of the winter.

Airplanes soon made their appearance, as several companies decided to make a clean-up, if possible, from these men who were so anxious to get into the rich unearthed gold fields. There was rivalry in the air as to which plane could cover that trip, which took twelve days by land, in the fastest time. They did a thriving business, \$200 for each passenger and \$1 a pound for baggage.

The prospector is not the only one who uses the plane to get into rough inaccessible territory in Canada's north. Two young New York stockbrokers flew into Quebec early in July for the purpose of

looking over some claims. They flew their own plane, making their way over a rather wild section of Quebec. They were forced down by engine trouble on Lake David, some 200 miles northeast of Quebec city. A Canadian plane came to their rescue, and they continued their work.

As a means of fast freight transportation, the airplane is unequaled in the northland. There came one day a letter to the office of the Western Canada airways at Winnipeg. Would the company make an offer to transport thirty-five tons of machinery, diamond drills, food, gasoline and similar material as well as forty men? Yes, the company would, and so started one of the most remarkable feats of modern airplane transportation into the forbidding wilds.

The mine was located at Cold Lake, northern Manitoba, 400 miles northwest from Winnipeg as the crow flies, near The Pas, well-known jumping-off point and winter-resort center, famous for its dog races. By air, it is a matter of 150 miles from The Pas to Cold Lake. One Fokker Wright - Whirlwind - equipped universal was allotted to the job. It made its trips between The Pas and Cold Lake with regularity of the Twentieth Century. In record time that order which had seemed so big to the mining people, was safely delivered, enabling one of the largest camps of Manitoba to get under way.

Patricia Airways and Exploration limited is another concern which flies from Sioux Lookout, Ont., about 1,000 miles north of Chicago, to the Red Lake mining country. They have operated there since early in 1926. Capt. D. S. Bondurant, a native of Cairo, Ill., and now one of the best-known of the Canadian transport pilots, states that flying in that north country is by no means child's play.

Last winter he was en route with a load of supplies for one of the camps at Red Lake. The thermometer hovered around forty-eight degrees below



Capt. D. S. Bondurant with His Cabin Plane in the Red Lake Country; Scene of a Gold Rush Two Years Ago



In Summer, Pontoons Replace the Winter Skis; This Is an American-Built Cabin Monoplane with Folding Wings; Wheels Are Never Used in the North as There Are No Landing Fields

zero, when he left. Gone about halfway, his motor froze, and he brought his machine down in a ten-foot snowdrift. A biting wind was sweeping over the desolate white landscape. It was cold, and the thought of facing a mush on snowshoes to the nearest camp, some twelve miles distant, was still more chilling. But Bondurant determined to set out to get assistance.

"When I reached the camp I was black," he tells us. "My nose and ears were frozen early in the trip. Then, when I took snow to rub over my ears and nose, my hands froze. The whole of the underside of my face was stiff and black, frozen. My feet froze, and I reached my destination more like a solid icicle than a human being. I was stiff for a week."

But he got a crew together and the ten of them went out with tents and a small stove and all the necessary tools to bring the big ship out of the snowdrift. The weather had become warmer. It was now only thirty-five degrees below zero. After several days of digging and warming the engine, Bondurant flew his ship on to its destination.

At another time he was flying over a

number of small lakes in a hydroairplane, which had a wing spread of seventy-four feet. The gears meshed, and he glided down to a small lake. Getting in was quite a feat, but it was accomplished by means of sliding and slipping. Repairs were quickly made, and the situation looked over. It was a small lake, blind at one end and at the other end a big cliff hid a curve where the water flowed over a narrow route into another lake, a little bigger than that where he now was floating.

Paddling the plane to the farthest shore from the gully connecting the two lakes, Bondurant started the motor. She roared in that still wilderness, and her echo rolled between the cliffs. Then, giving her the gun, she taxied for the opening, but would not rise. Again and again the attempt was made with the full load the machine was carrying. At last, when it looked as if he would be stranded through lack of gasoline, she rose, and with one wing in the water as he banked into the curve, the heavy plane made the passage, landing on the lake on the other side, from where it was easier to take off and sail to the nearest gasoline cache.





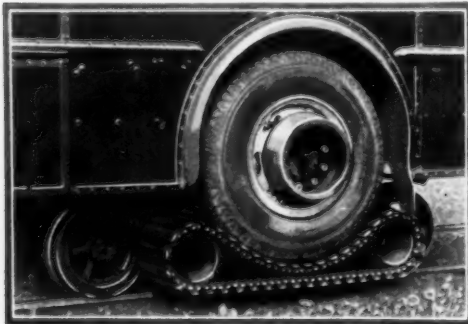
The Howey Mining Camp at Red Lake. Showing Typical Country over Which Prospectors and Supplies Are Regularly Transported; Practically All the Planes Are Built in the U. S.

The small lakes, uncharted and unnamed, that abound in Canada's northland make incidents such as this fairly frequent. To get out of such places requires a skilled pilot—the reason why all Canadian air companies operating in that northern country are so particular about employing only the most experienced flyers.

Passengers and tools for mining camps are not the only loads carried by the airplane transports of the north. Everything in this mining game, whether it be the transportation of a mining engineer or a case of dynamite, requires speed.

#### AUTO BUS FOR ROAD OR RAIL TO EXTEND MOTOR TRAVEL

Wider use of the motor bus is promised through the introduction of a vehicle that



Motor Bus with Flanged Wheels Adjusted to Travel on Rails; Traction Is Afforded by the Endless Tread

can be run on rails or on an ordinary road without undergoing any changes in its body design or arrangement. This is made possible by flanges on the wheels and a series of special sockets and lugs. Traction on the rails is furnished by gearing and an endless-tread arrangement operated by the pneumatic-tired wheels.

#### STUDY OF SPOTS ON THE SUN AIDS SEARCH FOR OIL

There seems to be little connection between the occurrence of spots on the sun and a prospector's success in finding oil or minerals, but scientists believe there is a definite relation and are making further study to establish their theories. The effects of the sunspots on the earth are not known for a certainty, but the phenomena are believed to be associated with magnetic storms here, from time to time, disturbances that cannot be perceived by the senses but that are detected by the action of delicately suspended magnets. When there is such a storm, the magnet behaves strangely, its needle often deviating from the true north to a far greater degree than normally. Oil prospectors who are using the magnetic system, keep in touch with coast and geodetic survey observatories where records are kept of the magnetic storms, and are thus guided in their activities and findings.

## MAN-EATING ANTS PROVE TERROR AT NIGHT

In parts of Africa and other tropical regions, a species of ant that marches as an army, destroying animals and insects as it goes and even attacking human beings, has given more than one traveler an exciting adventure. Dr. Hanns Ewers relates one experience he had with the marauders. They entered his cottage one night, killed mice, spread over the carpet and slowly came toward him. He took refuge on a chair, then on a table and finally mounted a washstand and stood in a pitcher of water. He was horrified to see that the ants made a living bridge to the stand and would have reached him had he not jumped to the bed, which was standing in pots of kerosene, one to each leg. The insects will not pass through the liquid, and he was safe. Naturalists report that these ants have been known to devour alive horses, leopards, apes and other large animals. They work with incredible swiftness, march only at night and apparently the sole obstacle that diverts them from their path is a pool of kerosene or some such liquid. As in other ant colonies, the division of labor is highly developed. Besides the warriors with their huge "jaws," the tribe has workers of various types, sorters that decide what things are to be brought into the nest or be discarded. One of the few effective enemies of the ants is a kind of beetle which secretes an intoxicating substance on its hairy body. When the ants are stupefied by this, they are killed by ant lice.

Greater Comfort for the Flying Camera Man; Face Mask for Winter Picture Work



## MASK FOR AERIAL CAMERA MAN AIDS IN WINTER FLYING

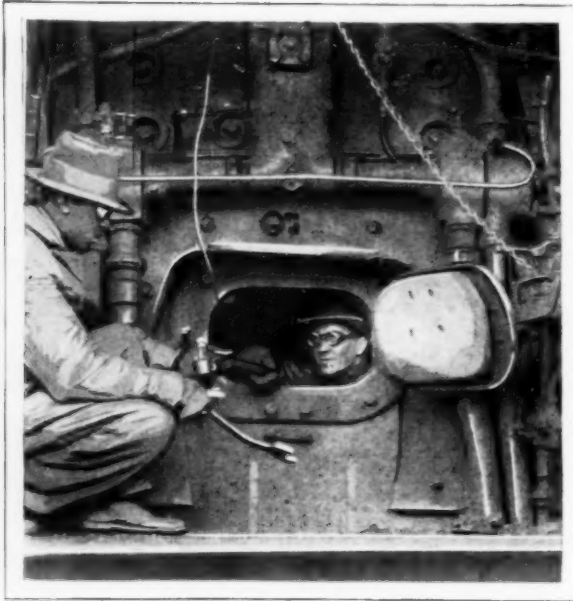
Storms and cold weather are difficult for almost all aviators, but work particular hardships with the aerial camera man who must expose his face to the wind over the side or above the cockpit as the plane speeds along. To protect himself from this discomfort, an eastern photographer has devised a special mask which covers practically all his face and fits tight without stopping the circulation.

## EXAMINE TREES WITH X-RAYS TO FIND TRUNK DEFECTS

Hidden defects and diseases in tree trunks are revealed by means of an X-ray outfit which shows conditions that cannot be detected by ordinary examination. The outfit illustrated herewith is one of the first to be developed and has since been improved into a more compact form. The apparatus is also useful in inspecting poles that carry power or other wires, to determine if any of them are dangerously decayed inside.



Courtesy Eastman Kodak Co.  
Taking X-Ray Photo of Tree Interior



Into the Fire Box of the Broadway Limited after a Run, to Inspect Boiler While Engine Is Still Hot

### HOTTEST JOB ON RAILROAD INSPECTING BOILERS

Soon after the fire has been dumped in a locomotive at the end of a run, an inspector climbs into the fire box to make a thorough examination of flues and other parts. His job is one of the hottest in the entire work of railroading, yet, after training, the inspector can remain inside the torrid chamber for twenty or thirty minutes and longer without harmful results at all seasons of the year. The chief reason that he must enter the box when he does, is that there is not time to allow the engine to cool off before it is again needed for service. Inspecting boilers is just one of the unusual jobs around the railroad, where scores of different occupations are included in the diversified operation of a large system. A big railroad's roster will include farmers, Y. M. C. A. secretaries and aviators, besides the expected

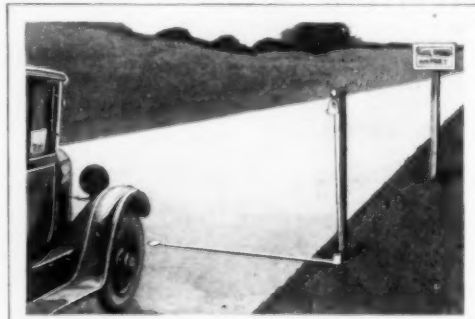
quotas of firemen, engineers, conductors and the like. The Pennsylvania railroad, for instance, hires a number of deep-sea divers in connection with the operation of its ferries and other craft.

### AUTOMATIC SOS RECEIVER RELIEVES SHIP CREW

Distress signals are now registered on automatic receivers installed on several British boats so that operators do not have to sit constantly on the watch with earphones on their heads, awaiting a possible SOS. The automatic alarm has changed the method of sending the signal. Before a steamer gives the distress call, twelve four-second dashes are tapped off the transmitter with a one-second space between each dash. The automatic receiver revolves a selector apparatus on the receipt of these dashes, which causes three bells to sound, two in the wireless rooms and the third on the bridge. Thus aroused, the operator listens for the familiar SOS call and the position of the ship sending it.

### AUTO RINGS WARNING BELL AT GRADE CROSSING

To further protect grade crossings and prevent automobile accidents at such places, an Illinois inventor has introduced a simple device whereby cars sound an alarm bell at the side of the road as they approach the railroad tracks. This is accomplished by striking a small bar which projects partly across the pavement or road where it is sure to be run over by an approaching car. The alarm can be placed sufficiently far from the crossing to provide an adequate warning, and is expected to be of special service at night and when there is a fog.



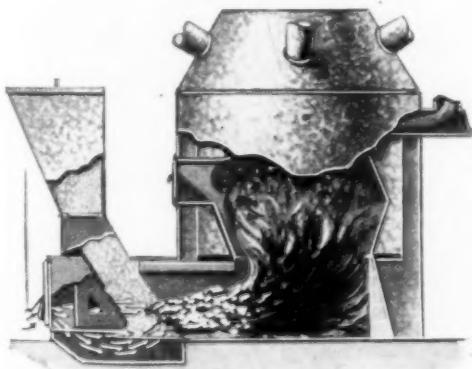
Warning Bell at Crossing and Trap Bar by Which It Is Rung as Auto Passes

## LENSES ON SCREEN GIVE DEPTH TO MOVIES

Movies in three dimensions, a problem on which several fortunes have been spent in recent years, is achieved in an entirely new way by an English inventor who has developed a movie screen which has for its surface 900,000 tiny glass lenses, each barely a quarter of an inch across. The screen is made by first coating the usual surface with a thick layer of white lead and then affixing the glass globules by hand to this coating. The stereoscopic effect is then obtained with ordinary film and a standard projector, for the myriad tiny lenses split up the light into hundreds of thousands of minute beams which are individually magnified on the screen so that each lens gives depth in relief and produces the illusion that the spectator is looking around the object photographed. The lenses themselves are not visible to the spectator unless he is seated almost directly under the screen, looking upward along its surface.

## SAWDUST BURNER FOR HOMES REDUCES FUEL EXPENSE

Sawdust and other mill waste are used for fuel to heat the home in a burner that



Sawdust Burner Installed with Furnace; the Hopper Holds a Generous Supply of the Fuel

can be installed in a short time and is said to be simple to operate. The grates are removable so that free access may be had to the interior, a large hopper holds sufficient fuel for several hours and, if desired, an automatic control may be employed. It is made in various sizes.



It Functions as a Clerk; Machine That Sells Stamps and Returns the Correct Change

## MACHINE THAT SELLS STAMPS ALSO MAKES CHANGE

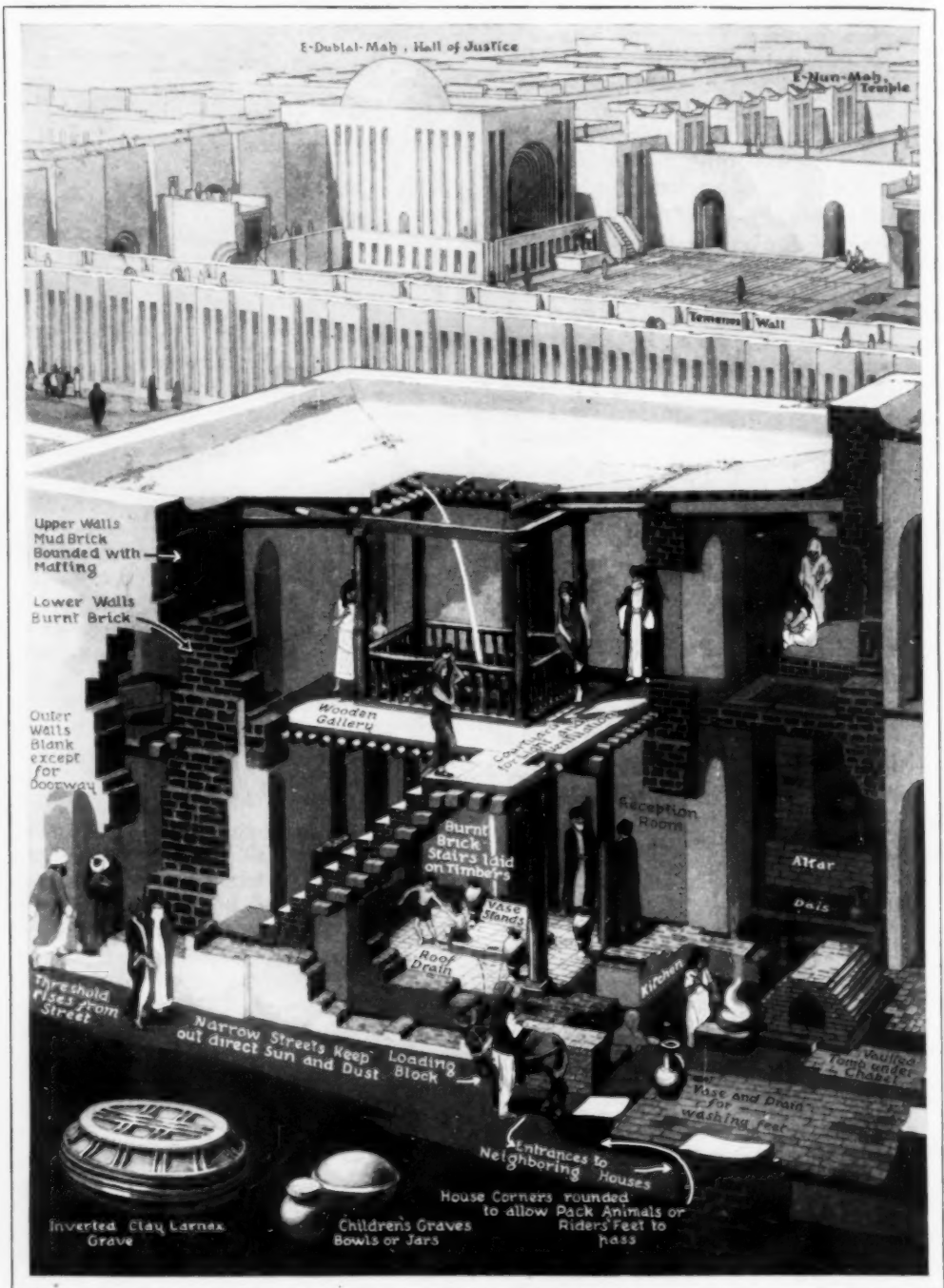
Dispensing stamps and making the correct change at the same time, a coin-in-the-slot machine recently introduced takes the place of a clerk and saves the customer a trip to the post office. The outfit was demonstrated a short time ago in Los Angeles where it is being used successfully.

## BIG ROCK THAT MOSES SMOTE STILL GIVES WATER

Explorers from the Field Museum of Natural History have come across the famous rock in Horeb, which, legend states, was struck by Moses and yielded water for the thirsty Israelites crossing the desert. A stream still trickles forth and forms a creek, the Wady Musa or stream of Moses. The rock is a large one, and the discoverers were unable to determine what part of it Moses struck. To find the apparent source of the water, the travelers had to peer into a small cave in the center of a mass of stone. The water spot is now surrounded by a series of wells stretching to the north, toward Damascus, and another to the east, toward Bagdad.

¶ We want all our readers to write us freely and often whenever they wish additional information on articles published in this magazine. Address Bureau of Information, Popular Mechanics, Chicago,

APARTMENT HOUSES OF BIBLICAL DAYS REBUILT



Copyright S. W. Clatworthy

Reconstruction Drawing of One of the Homes of Ur, the Famous City of the Chaldees; They Were Built Much Like Modern Spanish Architecture, the Roof Draining into a Central Patio; Walls Were of Sun-Dried Brick and Interiors of Timber



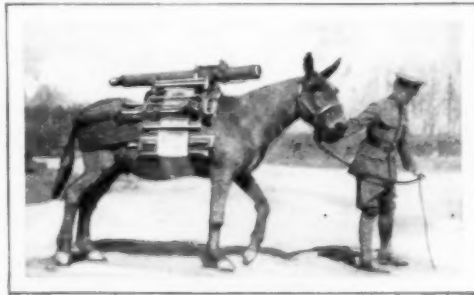
## HOME LIFE IN ABRAHAM'S DAY RECONSTRUCTED FROM RUINS

How people lived in Abraham's time is now more clearly understood as a result of the discovery of a well-preserved town-site at Ur by the joint expedition of the British museum and the University of Pennsylvania. The accompanying drawing shows one of the houses as fully restored. The lower rooms were for the public; the upper, for private use. If the owner left for some time, he merely bricked up the entrance doorway, probably the only opening in the outer walls. Burial places were found under the chapel walls, where present; in their absence, under any floor. Vaulted tombs were used again and again, the previous remains being merely thrust aside, one having as many as ten.

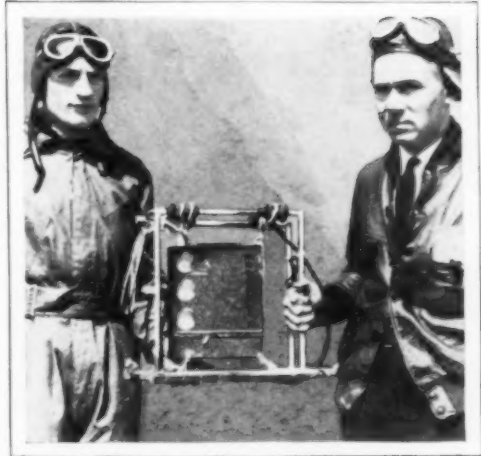
## LIGHTWEIGHT ARMY MORTAR LAYS SMOKE SCREENS

Especially suited for service in rough country, a lightweight portable mortar can be fired at the rate of ten to twenty shots per minute. It is intended for laying down smoke screens, spreading gas or throwing explosives. It has an effective range over 2,500 yards. In firing, a shell is slid from the muzzle to the breech where a firing pin strikes its priming cap. This ignites the propelling material which is placed in rings at the base of the shell.

The range of the projectiles may be altered by changing the elevation of the barrel or by increasing or decreasing the number of rings of explosive used. The mortar can be carried on the back of a pack animal or on a special cart which has space for a supply of ammunition. This unit was first designed by the British but later adopted by the United States army after some minor modifications.



Light Mortar as It Is Packed on Mule Back, and the Truck Outfit Which Also Carries Ammunition



Naval Flyers with One of the Weather-Recording Instruments Used in Observations above the Clouds

## FLYERS GET WEATHER FACTS ABOVE THE CLOUDS

In San Diego, Calif., a naval flyer goes aloft every day to obtain data about weather and flying conditions. One of the instruments useful in securing the information is a special registering device attached to one of the wings of the plane. It automatically records facts which enable a more accurate estimate and prediction of weather conditions for next day.

## FALSE STACKS ON BIG LINERS USED AS STORAGE ROOMS

With the change to oil-burning equipment, not all of the stacks on some of the big ocean liners are now used for smoke, but have been converted into storage space for tarpaulins, rope and other supplies. Even new steamers built for oil burners and needing but one funnel, are commonly provided with two or more, for the public are used to seeing them and like them.

Bird Village of Tiny Homes with Its Community Bath and Flag-pole



### MODEL VILLAGE FOR WILD BIRDS HAS COMMUNITY BATH

Birdhouses have been arranged as a model village near a western tourist camp. The tiny town has a bungalow, a schoolhouse, an apartment building, a church and lodge hall besides a community bathing pool. A flagpole is the feature of the commons at the center of the village, which attracts many birds.

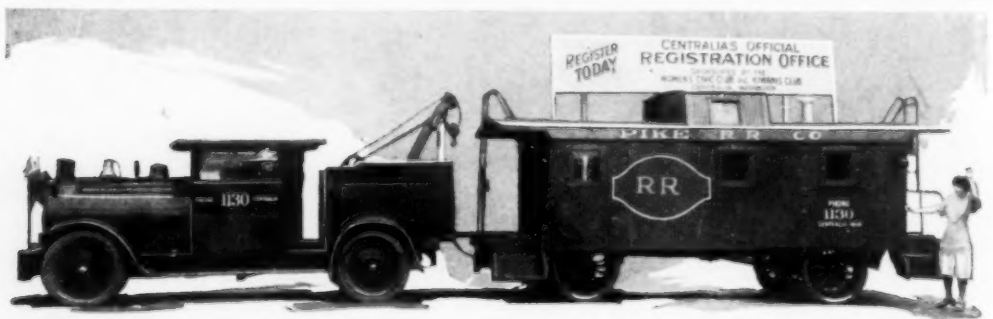
### INTELLIGENCE TEST FOR BABIES SHOWS MENTAL GROWTH

Tests intended to measure the mental development of babies, from one month up

to one year of age, have been devised to show how rapidly the infant's mind progresses and whether it is up to the normal standards. H. E. Linfert and H. M. Hierholtzer, of the Catholic University of America, after many experiments, found that, at one month of age, the majority of babies will grasp a pink ring placed at their finger tips. At the age of four months, ninety-eight per cent of them responded to the test in this way, but none of the one-month-old babies tried to put the ring in its mouth. This was done when the infant had reached the age of two months, but only two per cent of them did so, and, at four months, thirty per cent of those tested placed the ring in the mouth. Because of the rapid mental progress of the subjects, two sets of tests had to be devised. One was for babies up to four months and the other for those from six months to a year old. The investigators declare that the difference between a baby one month old and one twelve months of age, is probably as great as that between a pupil in the first grade of the public schools and a university student.

### CLERK'S OFFICE ON WHEELS HELPS COLLECT VOTE

Determined to arouse the eligible voters of Centralia, Wash., to their civic duty, City Clerk Jessie J. Ward, fitted up a temporary office in a motor outfit disguised as a railway caboose and toured the town to urge the voters to come out and to haul them to their registration places. The office was in a trailer chassis towed by a car fitted to resemble an engine. The campaign was continued for fifteen days.



Registration Special at Centralia, Wash.: It Was Driven about the City to Haul Persons to the Booths and to Stimulate Civic Interest in the Coming Election

# Easy Tricks with Thimbles



**I**N the good old days a thimble was used mostly by dressmakers, but today it is a valued magical property which has more than usual possibilities.

How's this? The performer exhibits three thimbles, colored gold, white and silver. He drops the three thimbles into a hat. He takes out the gold thimble and places it in his pocket. He takes out the silver thimble. And, now, what thimble is left in the hat? The answer is, of course, an emphatic "the white one," but it is the silver thimble and not the white one which is found in the hat, while the white thimble and the gold one are removed from the performer's pocket!

Here's the equipment: One gold thimble, one white thimble, one silver thimble, all No. 7. You will also need an additional silver thimble, No. 8. This is concealed in the lining of the hat. And now for the trick. The three thimbles are dropped into the hat. The gold one is taken out, and placed in the pocket. Then, apparently, the silver thimble is taken out, but it is not the original silver one at all; it is the concealed silver thimble nested over the white one, in the manner shown in the illustration. Nested in this fashion,



One Spare Thimble. Slightly Larger Than the Others, Forms the Nest for a Feat of Legerdemain

the double thimble is apparently the silver thimble only.

And so the trick is finished. Although you have openly taken the silver thimble from the hat, it is still there, while the gold and white thimbles are removed from your pocket, leaving the extra silver thimble behind.

Did you ever see a pair of thimbles smoke? No? Well, try this. Place a few drops of hydrochloric acid (spirit of salt) into one of the thimbles. Treat the second thimble to a few drops of ammonia. When the two thimbles are placed together, a heavy vapor resembling tobacco smoke will pour forth.

In the next effect, the performer ex-

hibits three large thimbles and a dime, which he places on the table. When he turns his back, someone is asked to cover the dime with one of the thimbles. The performer, on turning around, points out the thimble under which the dime is.

The secret of this trick is absurdly sim-

ple. The dime used is prepared by having a short length of hair fastened by beeswax to one of its sides. The hair projects beyond the rim of the thimble, and, although quite invisible to everyone else, it serves as an index to the performer in making his mystic divination.

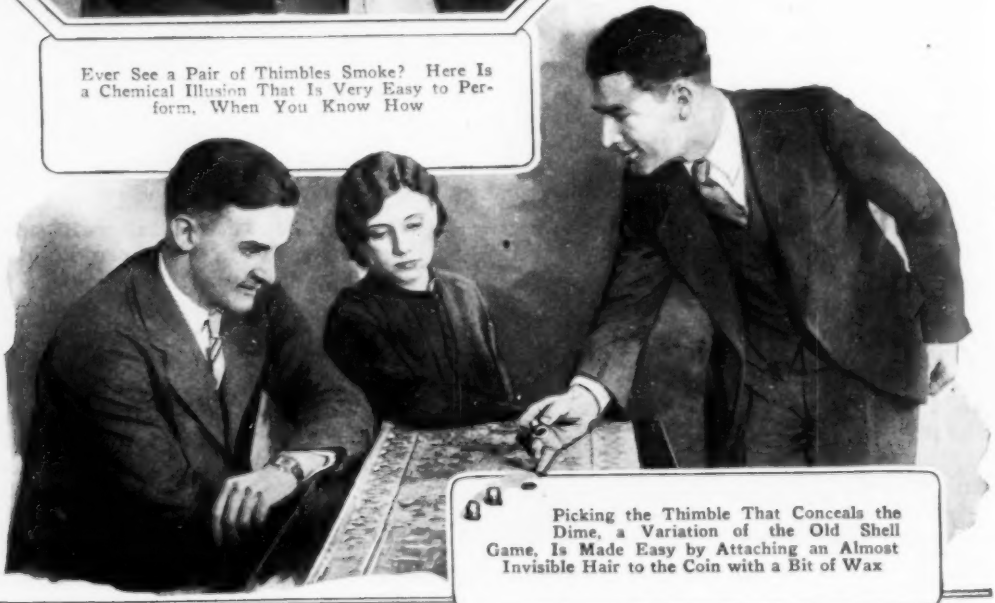
And now comes a bit of manipulation. It's really quite easy. Don't skip it!

The performer exhibits a thimble on the forefinger of his right hand. He places his forefinger in the palm of his left hand. He closes his left hand and carries away the thimble. But no, the magician shows his left hand empty, while the right hand reproduces the thimble from the air!

Here's the how: The illustration shows the starting point; the right forefinger with the thimble on it is placed in the left palm. Now, both hands swing in slightly to the position indicated. In this position, the thimble is carried back and clipped at the crotch of the thumb. The empty forefinger now resumes its original position, as pictured. The left hand then surrounds



Ever See a Pair of Thimbles Smoke? Here Is a Chemical Illusion That Is Very Easy to Perform. When You Know How



Picking the Thimble That Conceals the Dime, a Variation of the Old Shell Game, Is Made Easy by Attaching an Almost Invisible Hair to the Coin with a Bit of Wax

the right forefinger. The left hand apparently takes the thimble away, while the right-hand forefinger subtly serves to misdirect by pointing to it. And then the left hand is opened. The thimble is gone! It is reproduced by simply inserting the right forefinger into it and bringing it to view. Try it! In the language of the street: "It's slick!"

The following effect is one which can be worked equally well with a ball, coin, or other small object, but since this is an article on thimble magic, we'll do it with a thimble. The thimble in question is placed in a spectator's hand. She is instructed to close her hand as quickly as possible on the count of one, two, three. All right, one, two, three, close!

But, the thimble is in the performer's hand, while the fair young spectator finds herself holding a fistful of nothing more nor less than nothing! Of course, it's a trick! On the count of three, the performer hits the side of the spectator's hand a sharp rap,



Six Stages in the Popular and Mystifying Disappearing-Thimble Trick: a Clever Performer Can Make the Sewing Implement Vanish at Will

and as a result the thimble is transferred to the performer's hand, although the spectator may be quite unaware of the change.

Here's another manipulative effect; the thimble this time, being apparently swallowed.

Like this: Start, as shown, with the thimble on your right forefinger. A quick flourish is

made and the thimble is apparently placed in the mouth. In reality, however, it is thumb-palmed while doing the preliminary flourish, and the empty forefinger is then carried to the mouth. The right hand follows the imaginary course of the thimble as it is being swallowed, and then reproduces it from the region of the waist line.

And now comes a little juggling conceit. The performer takes two thimbles and, after some difficulty, succeeds in balancing them, one on top of the other, although the rounded ends would apparently make this impossible.

And, of course, it is impossible to anyone but the magician. He, however, has previously stuck a minute portion of chewing gum on the tip of his thumb nail, and during the preliminaries he casually





Do You Know How to Swallow a Thimble, and Then Extract It from the Region of Your Lower Vest Button? The Implement, of Course, Is Palmed, as at the Upper Right, and Concealed in the Hand as the Finger Traces Its Course



gets this onto the end of one of the thimbles where it furnishes sufficient foundation for the second thimble to stand erect.

#### BERRY PATCH GROWS ON CARS TO AVOID FROSTS

Although the climate is ordinarily too cold for the growing of strawberries up in

the mountains of Sierra county, California, one planter there enjoys a crop each year, for he has a portable patch. It is in boxes, about six feet long, three feet wide and a foot deep, which are placed on the trucks of old mining cars.

When the nights are cool, the entire patch is simply wheeled into an old mining tunnel where it is protected from frost. As the tracks of the mine still remain undisturbed, this involves but little work.

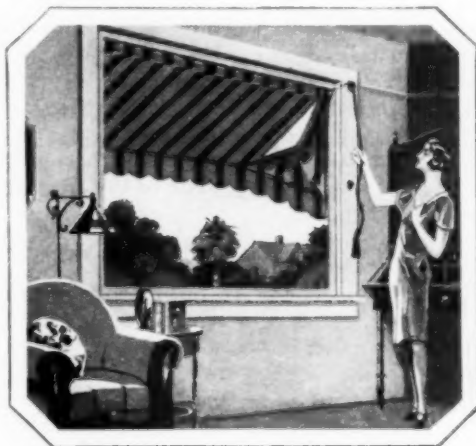
Whenever you find that you wish to know more about any article in this magazine, write our Bureau of Information.

### QUEST FOR FASTER LINERS REVIVES CLIPPER SPIRIT

Something of the spirit of the clipper days when speed on the seas was the keenest quest of the nations, has appeared again in the five-party race for faster liners. The shipyards of England, Germany, France and Italy, together with those of the United States, are active and plans have already been announced for several vessels to reduce the passage time across the Atlantic and to provide greater comfort for passengers. According to reports, Germany contemplates, early next year, the first voyages of the "Bremen" and the "Europa," which have been designed to lower the present speed record held by the "Mauretania." The 1,000-foot, 60,000-ton "Britannic" of the White Star line, is scheduled for launching before many months, and six 1,000-foot vessels are planned by the Transoceanic corporation for four-day service from Montauk Point, Long Island, or New London, Conn., to Plymouth or Le Havre. The very latest ideas in ocean transportation will be incorporated in these ships and while present liners make fourteen trips a year, some of the new vessels, it is expected, will make at least twenty-five.

### INSIDE CONTROL FOR AWNINGS SAVES OPENING WINDOWS

Awnings may be lowered or raised from inside the house with a patented automatic spring control that operates simply by pulling a single cord hanging from a pulley on the interior wall. This arrangement saves going out in the rain, raising windows or screens and eliminates unsightly rods and crank boxes. The pulley and the cord, which are the only inside fixtures, are both designed to form decorative features.



Lowering Awning by Manipulating Cord Inside

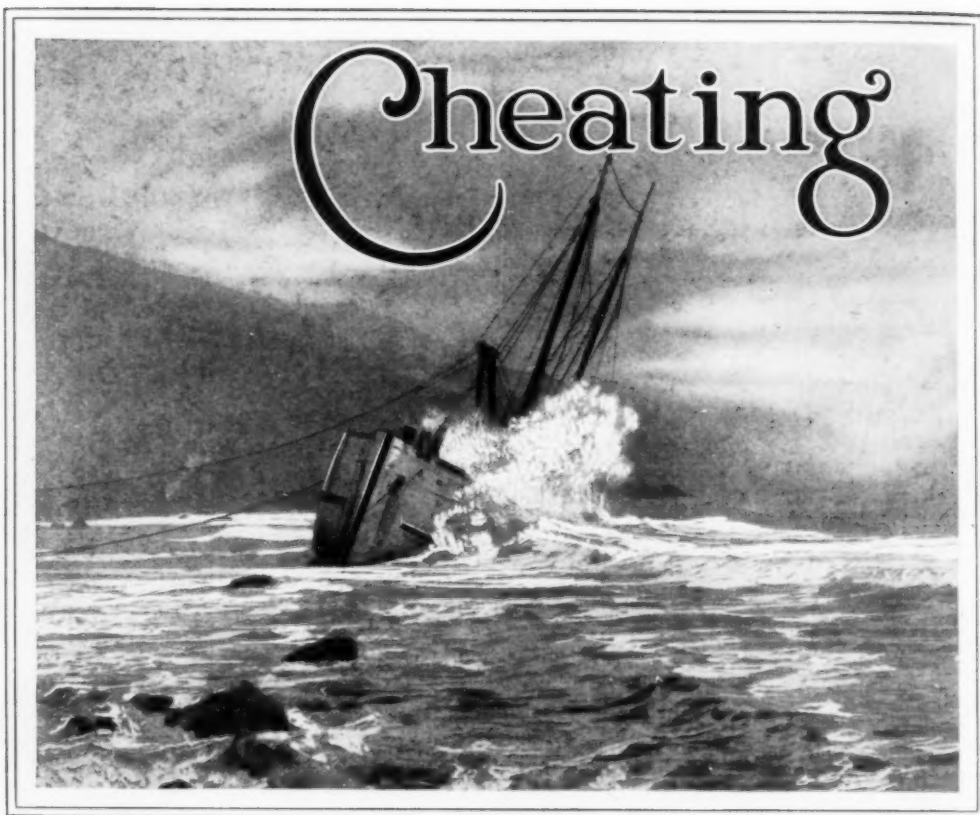


Two Practical Applications of the Health Lamp, Which Is Designed to Exclude Harmful Rays

### LAMP FOR HEALTH TREATMENT REMOVES HARMFUL RAYS

Several interesting features are claimed for a health lamp now on the market, and one of the most important is that rays which would be harmful to the body are filtered out before they can reach the skin.

A saving is also effected by the method of adjusting and feeding the carbon electrodes to reduce waste. The entire electrode is used up before a new one is needed and this is loaded by the simple turn of a thumbscrew. The lamp can be set to give either the infra-red (heat rays) or the ultra-violet rays and is operated from any electric-light socket.



"A Terrible, Always Hungry Monster, with Long White Teeth, Is the Sea," Says Captain Whitelaw, and Here Is the Sailing Ship "Majestic" Slowly Being Crunched to Death

By CAPT. T. P. H. WHITELAW

THE SEA is a smiling witch one day—a terrible monster the next. With strength incomprehensible to the man who has not fought it, the combined force of winds, waves, currents and tides make piles of splintered wood and steel from the best of man's sea-riding constructions. But, though we cannot hold the wind-jammer or the liner out of the grip of the sea, mechanical developments in the art of salvaging have brought us to the point at which, like surgeons, we are able to save life after an accident. For ships, let me say, have individuality, each leading its own life, sometimes against the will of man. Some ships survive almost incredible disasters, as do some men, while others leave their wood and steel bones on the first reef against which they are thrown.

Yet few ships, unless they are sunk in deep water through collision with other

ships or with icebergs, need be listed as losses, provided the salvager is equipped with proper tools, adequate barges and tugs, and trained divers. A tug recently completed a 4,600-mile voyage to pull an American steamer off a rock in the South seas, and succeeded in saving ship, crew and the greater part of the cargo. Many years ago, a steamer from San Francisco went to the northeastern coast of Siberia, released a lumber schooner frozen in a huge ice floe, and both vessels returned in safety.

More than a third of a century ago, I sat on the hatch of a 220-foot freighter as she lay fast on the rocks off Point Montara, on the California coast. All of my men had gone ashore. There came a rending crash, and the after half of the hull, on which I was sitting, fell away from the forward half as cleanly as if cut by a

# the Sea

knife. I leaped to my feet, ran up the deck, already slanting stiffly in its slide into deep water on the seaward side of the ledge. As the crack between the halves widened, I put all my strength into a jump—and made it, across rather better than fifteen feet of gaping space.

The second I caught my feet on the steadier half of the wreck, still hanging to the rocks, the forward mast, with all its rigging, came crashing down. Then the mizzenmast fell on top of it. Half of the hull, released by the parting of the after section, swung suddenly

to port, pivoting on the pinnacle of rock which bound it to the shore. As it rolled, the great weight hurled the masts and rigging overside, and I stood free, unharmed by so much as a splinter. This was the "Respigerdo," and not much of that ship was saved. That escape gave me my first idea of the dangers which beset the salvor of ships, the man who goes down to the sea after the sailors have done their best, and puts them and their vessel back on the water again.

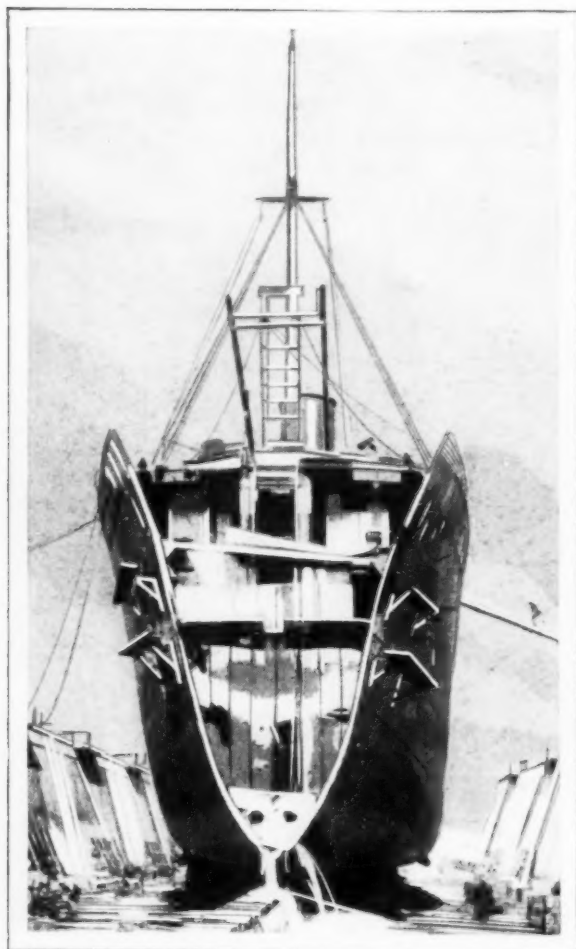
The underlying principle of all victories won over the sea is to compel the wrecked vessel to float. The hull cannot be lifted from the sands or the rocks, because the wrecking ships cannot get sufficient "purchase" on the surface of the sea to give their cranes enough leverage to raise several thousand tons of water-filled hulk. Therefore, the ship salvager must do the same thing that the shipbuilder does—he must create an artificial buoyancy within



Capt. T. P. H. Whitelaw, Eighty Years Old, for Sixty Years a Ship Saver, Giving Instructions to One of His Divers

the hull great enough to make the vessel lighter than the water she displaces, and he must do it under conditions far more difficult than those confronting the shipbuilder. In accomplishing this result, the salvager is constantly confronted by new conditions, for no two wrecks are alike.

Take the oil tanker "Rosecrans," which went on a reef on the Oregon coast, with the loss of twenty-three men. They told me I could not save the "Rosecrans," but I did. Though the distance from her topmast to her keel was 140 feet, the white-lipped waves rolled their spray so completely over her that sometimes she was hidden entirely from the view. About six feet of rock, some ten feet wide at the base, projected into the hull of the tanker. This could be reached only from the inside, but the opening into this section of the hull was so small that a diver, fully dressed, could not pass through it. The only way to save the ship was to remove



With Her Bow Torn Off, This Ship Was Saved, Floated and Towed to Port, with a Wooden Bulkhead in Place

this rock. So I put a small charge of dynamite under one of the deck plates, blew it up enough so that the men could remove the bolts and take off the entire plate. The divers went down through this hole and placed a tiny blast in the rock, blowing it up gently, inside the hull, yet without damaging the ship. Then steel plates were bolted across the hole.

These plates did not fit tight, owing to the jagged shape of the hole, so we filled the crevices with cement. The tide, of course, was moving in and out of that hole all the time, while the surf, pounding against the bottom of the ship, added to the difficulty of getting both plates and cement in place. To enable the divers to work, we installed pumps, forcing water

into the hull while the tide went out, and sucking it out as the tide came in. This equalized the pressure until we got the plates down and the cement set.

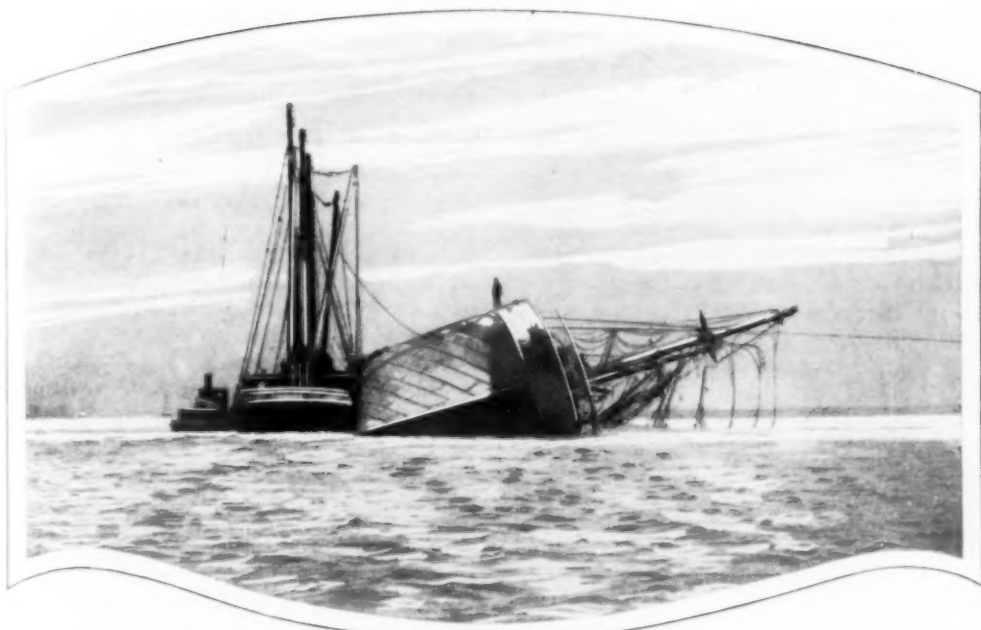
When virtually all the leakage was stopped, we passed chains and hawsers to the hull from the salvage ship, "Greenwood," and started to pull the "Rosecrans" off the rocks. We had been working on her for nearly twenty days, and, quite naturally, the tanker had settled somewhat. With the spring in the hawsers, the power of the salvage tug, and the force of heavy waves which struck her just as the tug started to pull, the tanker leaped from her bed like some living monster of the sea and dashed straight at the little "Greenwood."

Instantly, we cut the lines, turned the tug hard a port, and the great tanker dashed past, not twenty-five feet from the salvage vessel. A moment's delay would have seen us all in the water, with our tug smashed to toothpicks. Then we had to overtake the "Rosecrans," which dashed out to sea, and "rope" her, much as a cowboy ropes a runaway steer. She was towed to drydock and thus a \$250,000 ship was saved for the owners.

In marked contrast to the method of salvaging that vessel, is that with the "Umatilla," which went on the rocks at Cape Flattery. After being pulled off successfully, she was patched sufficiently to permit her being towed to the harbor at Esquimault. No sooner did she arrive, however, than she sank in about sixty feet of water. We then built a cofferdam completely around the hull, rising from the sides of the deck to about two feet above the surface of the water. This cofferdam not only had to be water-tight, but it had to be so braced from within that it would withstand the external pressure when the water was removed, or it would have crumpled like so much cardboard.

Large tanks, filled with water, were sunk alongside the "Umatilla" and lashed





The "Blairmore" Turned Over in San Francisco Harbor; Captain Whitelaw Is Shown Standing on Her Hull, Directing His Rescue Crew While They Prepare to Right the Steamer

to her with chains, passed by divers from pontoon to pontoon, beneath the hull. Then we sucked the water out of the cofferdam, the hull, and the pontoons. This made the ship lighter and caused the pontoons to lift her from the bed of the sea. As soon as the water was all pumped out, she came to the surface like a cork. It took us 160 days to prepare for raising this ship, and twenty minutes to get her to the surface.

Occasionally a ship is in collision in comparatively shallow water, with either her bow or her stern stove in as a result. In these days of ship construction, watertight bulkheads confine the damage to one compartment, but in the older ships, it is necessary to send divers into the dark and dangerous hold to put in a wall of planks, two to four inches thick and a foot wide, set on end, to keep out the water. Then again, by applying pumps to the interior, behind this wall of planking, the water which the ship has "swallowed" is sucked out, her buoyancy restored, and she floats. But without the divers, the ship salvor would be almost powerless. And the diver in this work is a highly specialized man. He must be not only a competent diver, thoroughly familiar with all underwater

work, but he must be a carpenter, a steel worker, a riveter and, to some extent, a shipwright. He also must have at least an elementary knowledge of hydrostatics, and be able to estimate the strength he must build into his bulkheads, patches and cofferdams, while working in the dark.

Indeed, it was as an impromptu and untrained diver that I started this work of sixty years, which has taken me into almost every port in the world, and given me salvage work on many oceans. When I was twenty, I was nearing the end of my apprenticeship as a ship carpenter at San Francisco, working on a drydock. The diver at the dock became ill, and I, though I never had put on a diver's suit, applied for his place. I was permitted to try it, and found the hardest part of the job was driving nails under water. I mastered this, and in three weeks had the position permanently.

Then the schooner "Golden Rule" was hit by a steamer in San Francisco bay. The drydock owner took the job of repairing her as she rested on the bottom, and I was sent down to patch several holes in her hull. I did the job in six hours, though I was supposed to remain under water only four, and my employer gave

me a \$200 bonus in addition to my regular pay. This was the turning point in my life, and with the \$200 I purchased a diver's suit and became what was then known as a "wrecker," afterward converted to the higher-sounding term of "ship salvor."

Not all the disasters to ships are at sea. The "Blairmore," a full-rigged ship of British registry, once turned completely over while in her berth at San Francisco. The stevedores, in unloading her, took out all the cargo, without putting in any ballast, and her heavy masts, coupled with an unusually strong tidal current, tipped her upside down as neatly as if she had been dropped into the bay on her rigging instead of her keel. Her deck was completely under water, and only a section of the bottom, near the keel, was visible.

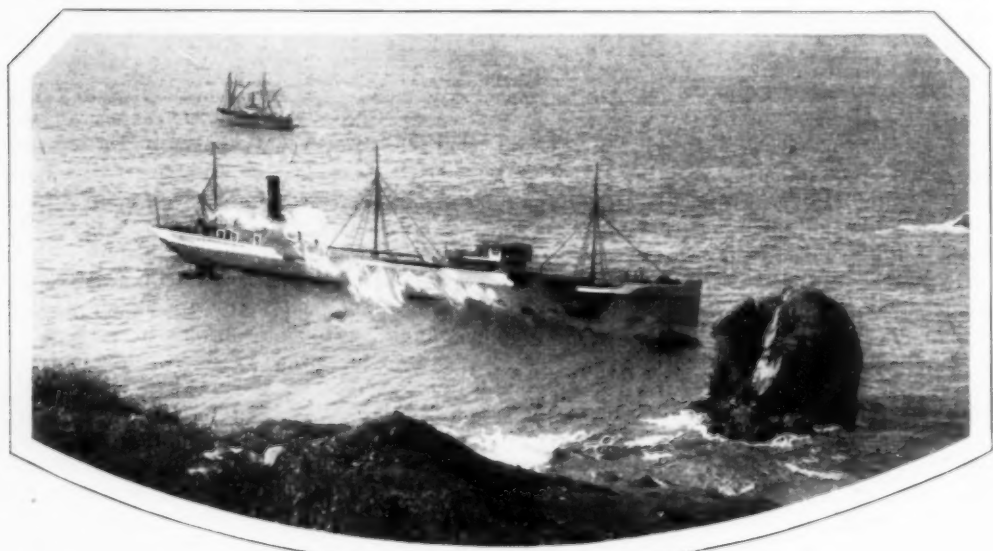
Here appeared still another problem in salvaging: This vessel had to be righted before she could be pumped out, and again we made the ship save herself, as must be done in all ship-rescue operations. On the exposed part of the hull, we built a platform lengthwise of the ship, extending over the keel at an angle of about forty-five degrees, a kind of huge lever, with which, if weight enough could be placed on the outer end, we could right the ship. At the outer end of this platform, we built four large water-tight tanks.

Divers then attached lines to the "Blair-

more's" masts, on the bed of the bay. These lines were carried to wrecking tugs, and, as these tugs pulled upward on the masts, water was pumped into the tanks on the platform. Between the lift and the lever, the ship slowly turned on her longitudinal axis, and soon the tanks on the platform were touching the surface of the bay. Then it became necessary for the tugs to hold up the ship, by the masts, while the platform and the tanks, emptied of their water, were moved farther up the side of the hull, so as to repeat the leverage from a higher point.

This was accomplished, and, when she was upright, part of the water was pumped out of her hold, leaving enough to counterbalance the lofty masts, and she was towed to shallower water. There we completed the pumping out, stored her with ballast, and towed the ship back to her berth, where she was filled with cargo and sent on her way. Probably more than half of the ships rescued during my sixty years of this work are still in service, some of them being sailing ships, out on remote trade routes, and others iron and steel steamers, which, apparently, are just as good as they ever were.

There are times, however, when the powerful hand of the sea reaches right into the work of the salvor and wrenches an almost saved vessel from his grip. So



Many Vessels Are Lost during Fog Almost within Sight of Port: Here Is the Tanker "Lyman Stewart" on the Rocks of Golden Gate, Only a Few Miles from Her Berth

terrible is the pounding of tides and currents that a ship driven on exposed rocks will be aged twenty years in a week or ten days. Take the "Drum-barton," wrecked some fifteen years ago on Point Pedro, on the California coast. We were certain we could save her, with tugs and barges standing off shore and a number of men working on board. All at once, there came a series of grinding crashes. The men leaped overside into their boats and pulled to the barges. In less than half an hour there was not even a splinter of wood or a steel plate remaining on the rocks to indicate that a ship ever had been there. An hour before, she had seemed perfectly solid, except for a hole in her hull, which, we believed, could be patched with comparative ease at low tide, and the vessel lifted off at high tide.

Thus, such inanimate enemies, tides, winds, currents, rocks, reefs, hard sands and quicksands, are more dangerous to the diver than all the supposedly threatening life beneath the waters. It has been my experience, and that of my divers, that sharks are afraid of a man in a diving suit, whatever they may do to the undressed swimmer. The octopus, however, is a real menace, though, fortunately for the ship-salvaging business, these great devilish seldom appear near a vessel unless it has been in the water for months.

#### AVIATION BEACON ON BORDER HONORS MEXICAN FLYER

In honor of the late Capt. Emilio Carranza, Mexican flyer, a powerful aviation beacon is to be erected on top of a building in Tia Juana. Its rays will be visible for twenty-five miles on both sides of the border, and it is intended to serve as a re-



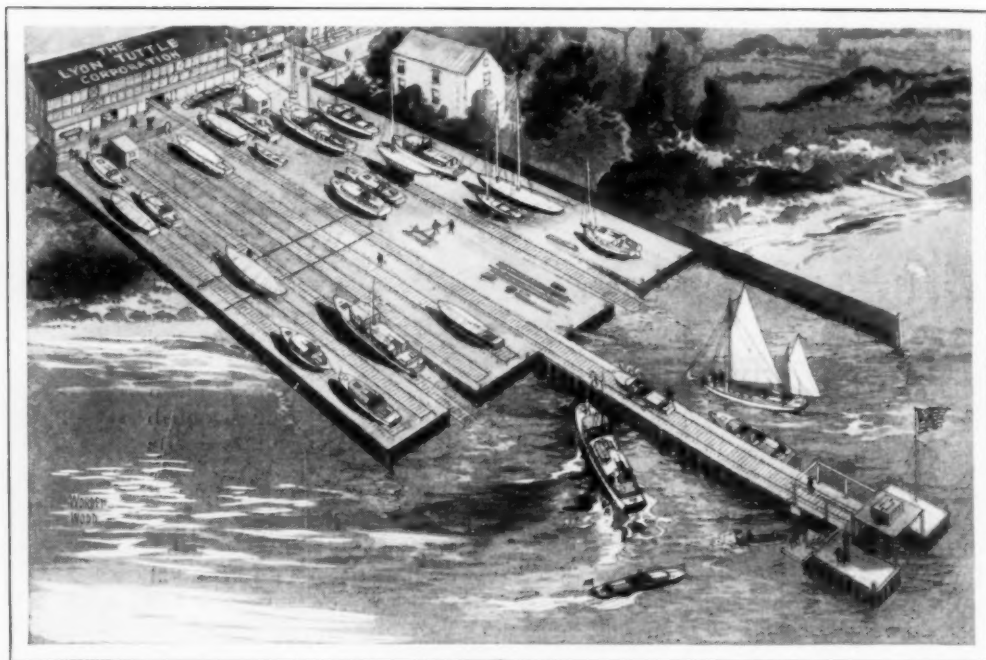
Bell Tower at Tia Juana, on Top of Which a Brilliant Beacon Will Be Placed in Memory of the Late Capt. Emilio Carranza

minder of the friendly feelings inspired by Captain Carranza's flight to this country. He was killed in attempting a non-stop flight back to Mexico City.

#### PURIFY WATER WITH TABLET INSTEAD OF BOILING

Army chemists report the successful use of a chemical to purify water when boiling is not practical. It is prepared in the form of a small tube about the size of a cigaret, and one tablet is sufficient to treat thirty-six gallons of water. Chemicals have been used for some time to purify water, but the chief advantage of this preparation is that it is said not to deteriorate and affects the taste of the water but little.

Our Bureau of Information will answer all questions regarding articles appearing in this magazine.



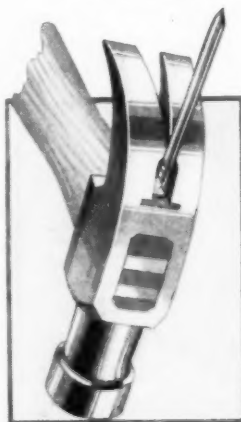
Drawing of the Big Service Station for Boats, Showing the Rail Lines on Which the Craft Are Hauled from the Water and Launched, and the Repair Building in the Background

### SERVICE STATION FOR SHIPS PROLONGS LIFE OF CRAFT

Not far from New York city, a completely equipped service station for repairing and storing boats has been established, along somewhat the same lines as an automobile shop. Craft of various kinds can be quickly hauled from the water up trackways that lead to the main building, where repairs and servicing are done. The beaching and launching apparatus is so convenient that boats are taken from the water at the end of each trip. They are thus subjected to less wear and tear when in dry storage. The station has accommodations for 100 large cruisers and yachts and under-cover storage for at least 150 runabouts. There are 300 feet of waterfront, and the marine railways are capable of handling yachts up to 150 feet in length. At low tide, the water in front of the station is twenty feet deep, so that even the largest yachts can be accommodated. Boat owners patronizing this dock can step ashore immediately after the trip, and when they wish to go out, they can telephone to have their craft launched and meeting them at some certain point and

time, if they desire. At this yard ten 110-foot submarine chasers and ten 150-foot ice-breaking steel tugs were produced during the war.

### NAIL HOLDER ON HAMMER HEAD LEAVES ONE HAND FREE



Especially adapted for overhead work, or for other places where it is difficult to hold the nail with one hand and the tool with the other, a special driving hammer has been introduced. It has a holder for the nail on the back side just above the claw. The nail is inserted between

two metal points that are pushed back and return to position through the action of springs. The nail is driven in with the back side of the hammer, released and then driven home in the usual manner.

## DO FACES REVEAL FORTUNES? NO SAYS SCIENCE

Telling fortunes from faces is an unreliable method for practical purposes, psychologists of Wesleyan University have decided. Persons destined to become famous as lawyers, surgeons, or in other fields of enterprise, carry no shining mark upon their countenances—at least, none that an employer could safely rely upon. The findings were derived from an interesting test. Forty photographs of men graduated twenty-five years ago were shown to psychology students who were asked to judge as to the success or failure of each and the line of work for which each subject appeared to be best fitted. "In practically every case, the observers disagreed and the same person might be assigned from ten to fifteen different vocations," declared Dr. Carney Landis and L. W. Phelps, who conducted the experiment. The photographs were of lawyers, physicians, teachers and engineers. The five most successful individuals in each profession as well as the five who had achieved the least success were shown. Ten of the twenty students who studied the portraits decided that one of the successful engineers was a clergyman. Six voted that he had succeeded in that line, while four concluded that he was a failure. A man in a minor teaching post, was rated as a successful banker by six of the judges. One of the main conclusions was that an applicant's photograph should not be the basis of employment.



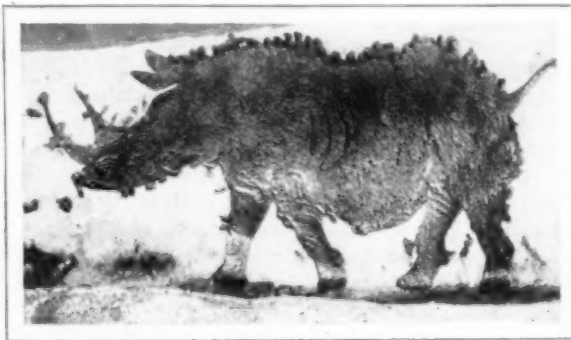
Typical Arrangement for the Basement Garage Which Insures a Warm Place for the Car and Saves Lots of Space

## BASEMENT USED AS GARAGE SAVES SPACE AND COST

Utilizing the basement as a garage is becoming increasingly popular with home owners who have small lots and do not wish to go to the expense and trouble of building a separate building. The first floors of the homes are of concrete, the plan utilizes space that often would not be occupied, and entrance to the basement garage is gained by way of a ramp.

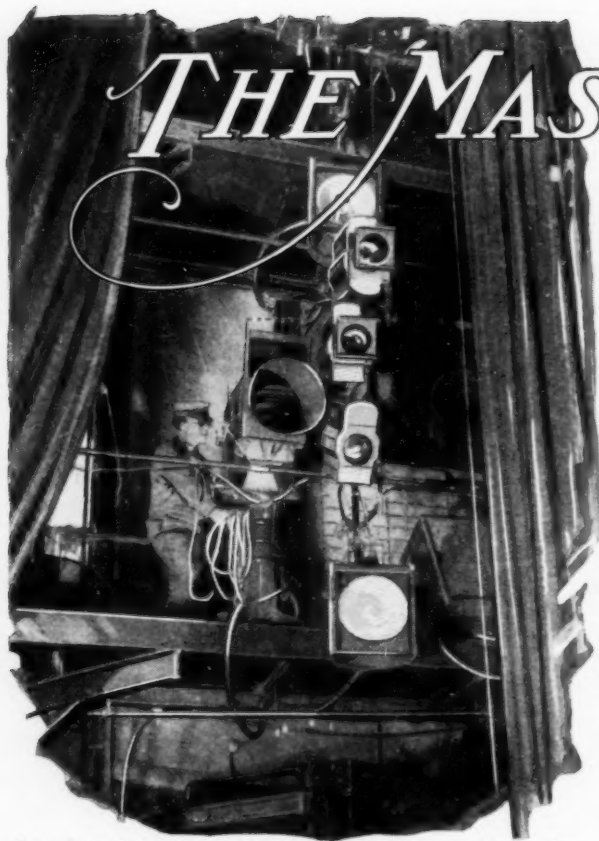
## RHINOCEROS PICTURE ON ROCK SHOWS DAWN OF ART

A glimpse of the days when artists worked on rock instead of canvas, and when crude cutting tools served as brushes, has been revealed by the discovery of a picture of a white rhinoceros on basalt rock in southern Africa. It is believed to have been carved by an artist from 25,000 to 50,000 years ago and is in excellent preservation.



An Artist's Masterpiece of Centuries Ago: Rock Carving of a Rhinoceros Recently Found in Africa





# THE MASTER OF

One of the Floodlight Bridges in Roxy's Theater, with the Battery That Produces Light Effects for Stage Spectacles

By FAIRFAX DOWNEY

**T**WO pictures: Then and Now.

A green light flashes on the board beside the music rack. The piano player speeds up. On the motion-picture screen before him, the villain and his followers are in full flight with the hero and his cowboys in hot pursuit.

Isolated up in the clatter of the projection booth, the operator-manager of the little coal-town, one-reeler theater, S. L. Rothafel, presses his green-light button again. More headlong music answers from below, until the villain is caught and duly baffled.

Then a yellow and a blue beacon shine on the board. Music, soft and sweet and low, for the sentimental conclusion.

The other picture, twenty years later: On the screen, the hero still pursues, the villain flees. The leader of a one-hundred-

and-ten-piece orchestra presses a button on his music rack. The electrical impulse travels the length of almost a city block up to the projection booth of the largest theater in the world. A red light glows. The projectionist retards the speed of his film a trifle. The music ends with a triumphant burst exactly as the hero triumphs.

But in this picture the operator is not the same man. Roxy, known as such to the nation by radio, is up in his office on the sixth floor of his Roxy theater, New York City. Follow him up to the projection booth, which is equipped with three projection machines. By automatic shutter-control shifts, one machine follows another, projecting a second picture as soon as the first has been completed, without the loss of a second's time. An asbestos safe holds the films until required. A ventilating system supplies cool air. A radio microphone and loud speaker insure communication with the stage manager.

Watch with Roxy the feature film as it runs its length. The theater house lights are turned up at its conclusion and you find your eyes are minus much of that weary, smarting feeling which can be recalled from the earlier days. For that you have to thank Roxy's invention of a new shutter for the projection machine.

As the film strip passes before the lens at the average rate of twenty pictures a second, it is cut off one-half of the time by the opaque half of the shutter. For the open half, Roxy substituted a translucent shutter of the three primary colors, red, green and blue, overlaid, giving the white light which those colors make in combination, but a beam which showed on the screen in a far softer and more natural tone than the unfiltered ray. Luminosity

# LIGHT



Roxy Himself Conducting His Broadcasting Orchestra, Which Has Made the Famous Theater Owner's Name Familiar throughout the Land among People Who Have Never Seen His Shows

was not impaired, and much of the ultra-violet light, which was so hard on the eyes of the early movie goers, was eliminated. Further softness he achieved by blue edges to the shutter, which, at the cut-off point of the opaque half, eased the "pull-down" or passage before the light ray. This shutter device is now universally used.

Say that you have not been to a movie in recent years, and a Roxy theater usher shows you to a seat well on the side. Past experience would draw a demand for center or nothing, for you would expect a distortion of the figures on the screen; some of them would look as broad as they are long. But the side seat will do nicely. At Roxy's instance, manufacturers developed for him the first lens of increased diameter whereby the pictures keep their sharpness and the optical illusion of their depth without the necessity of an increase of light. By collaboration with the screen manufacturers, he obtained a screen which the pictures fitted exactly, with a diffusion

of light so nearly even that the images retain approximately the same brilliance from all angles.

Also you will note the novelty of the projection booth, inclosed in the center of the balcony directly facing the screen, not set in the back wall or shoved off to one side. With the angles removed, the more parallel projection further does away with distortion. That innovation cost space for 400 choice seats. But the Roxy reasoning was: What's the use of 400 seats, if customers who like to see things on the screen as they ought to look, won't come in and fill the other seats?

If you are grateful for the fact that you enter the theater while the picture is running, not through the inky blackness of yore, but rather through a mellow twilight with colored lights glowing in the proscenium balconies, accompany Rothafel back several years to a night stroll along the Hudson river. The powerful searchlights of a fleet of battleships are playing about the sky. The inventive spark burns,



How a Huge Theater Looks from the Wings; the Orchestra Pit Has Been Lowered to the Basement; the Cut-Away Section of the Upper Balcony Shows Spotlights and the Movie Booths

too, and the stroller asks himself why these searchlight beams would not work in a theater. They would. The idea grew into the first employment of high-tension arc lights, now generally used for projecting motion pictures with a fifty-percent increase in luminosity, as well as for stage-lighting effects.

Once a week Roxy and his staff stand by while the next week's show is jointly conceived in the conference room of the theater. Ideas all in, they are plotted on a blackboard. The show is born. Part of the raising of the young hopeful you may witness if you sit with Roxy in the trial projection room of the theater of a Friday evening. There he has already seen and selected the feature picture and the bits for the news reel.

Now the music. Roxy swears he cannot read a note, but his musical memory is a regular encyclopedia. A shot of Italian aviators—that draws the "March Reale." For a boat dive, a march with a sudden silence during the actual plunge.

President Coolidge is awarded an echo of his college days, "Lord Geoffrey Amherst." An American horse winning the Grand Prix—that is given a gallop with "Yankee Doodle" at the finish. The music librarian hurries with the list to the long steel files where music is indexed and cross-indexed by title, type, tempo, composer and nationality. He comes back with the scores, and a pianist plays the selections as the reels are run again, and each piece is fitted exactly to the film it accompanies. Then a third musician receives the amended scores, for which he will orchestrate parts for every instrument. Monday morning the orchestra will be rehearsed and ready for the news-reel magazine when it flashes on the screen for the first show.

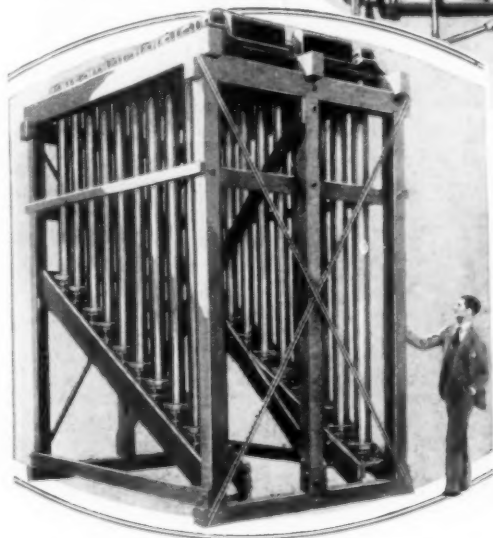
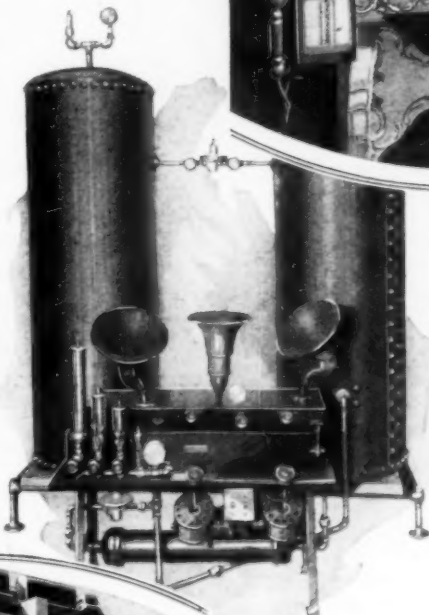
Ready, too, are uniformed ushers trained by marines, in which corps Roxy has served. They are equipped with flashlights, answers to any question and small phials of spirits of ammonia for emergency treatments. In a lounge on a lower floor,

a shoemaker is ready to reattach any high heels which may be lost.

The audience moves through a magnificent marble rotunda over a floor covered with a huge \$35,000 rug. An organ in the foyer balcony plays people briskly into the 6,186 seats. This organ is operated automatically and plays rolls. In the pit another organ rises on an elevator. It has three separate consoles played by three organists at the same time.

Those who enter the theater sit comfortably in cool, fresh air produced by the ventilating and refrigerating plants which are noteworthy parts of the equipment.

In summer the refrigerating machines, with a capacity of 500 tons of ice, cool and wash air sucked in through a duct in the roof of the building at the rate of 275,000 cubic feet a minute. The heating plant is located beside the refrigerating apparatus. It uses the same outlets and is equipped with a filter from which sometimes



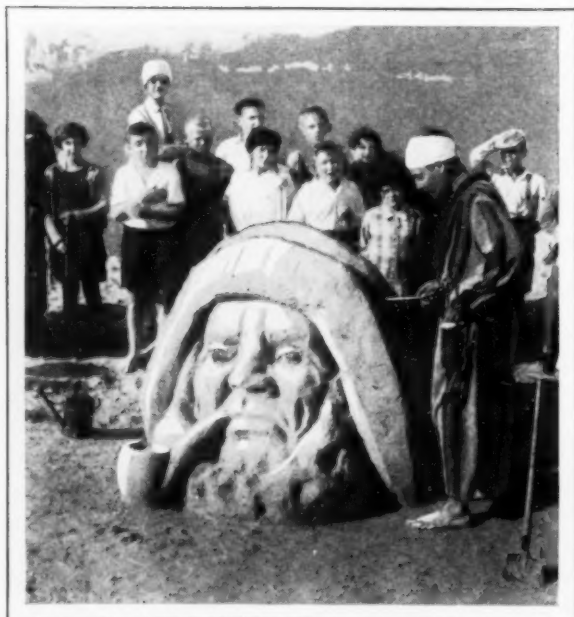
The Orchestra Leader's Film Controls; Compressed-Air Effects to Reproduce Noises, and Section of Pipes

as much as an inch of mud, as the result of air impurities, is removed at weekly cleanings.

The audience, safe from distraction by stuffy air, heat or cold, the show may proceed. The gorgeous lighting fades a stage day into a stage night with the finesse of Mother Nature. The acts and ballets, Roxy was a pioneer in

adding to the movies, go on and off with pace and verve and time-table exactitude. The amplifier system picks up the tenors and sopranos of the chorus in boxes on one side of the house, blends their voices with those of the altos and basses on the other side and carries the harmony distinctly to the most distant seat.

Into its making have gone musical rehearsals, first and dress rehearsals, lighting rehearsals with Roxy presiding at his light board, a most intricate contrivance, until long past midnight. Marvelous mechanical devices have joined their forces to human ingenuity which created them. At the huge power switchboard and the radio control board, men swiftly achieve the effects. Art conceals the art.



Sand Sculpture from Life; a Fisherman's Head in Graphic Detail, the Work of a Skillful Beach Artisan

### FISHERMAN MODELED IN SAND SHOWS SCULPTOR'S SKILL

Sand serves as clay for a sculptor at one of the ports along the Baltic sea, and he demonstrates his skill by modeling the heads of fishermen and of other human subjects. Considerable ingenuity is required in fashioning a base or armature for the pieces, as the sand lacks the consistency of customary modeling materials.

### SNOW ROLLER CLEARS ROADS WITHOUT SHOVELING

To open the snow-clogged roads of a Colorado town to traffic, huge rollers, seven feet in diameter, are run over the drifts, packing the snow so hard that horses and automobiles can pass over the surface with little difficulty. The outfit is pulled by a four-horse team and



Packing the Snow with Big Roller Instead of Shovel  
It Away; How Roads Are Kept Clear in Colorado

works so well that, last year, some of the roads were open during the winter for the first time in history.

### MYSTERY OF RUSTING METALS PERPLEXES ENGINEERS

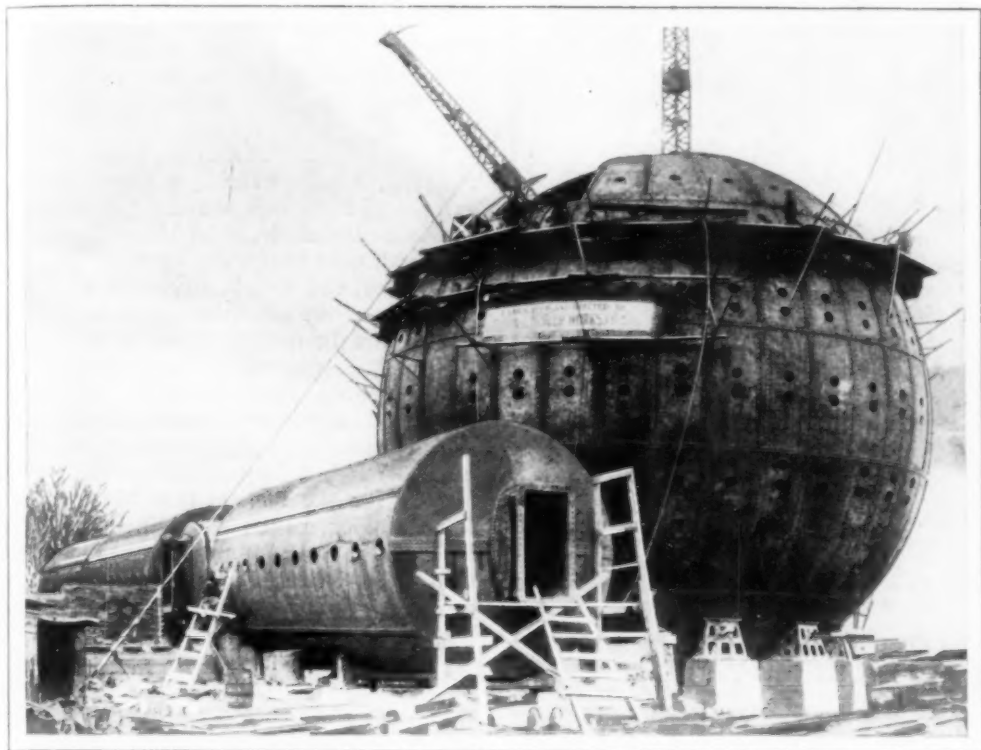
While rust or corrosion is a familiar phenomenon, in iron and other metals, the exact causes of its formation are not fully understood, although oxidation is commonly accepted as a basis of the process. It causes enormous damage in iron, but, in some instances, it may form a tough protecting coating over aluminum in temperate regions, while in tropical climates, the film is porous and accounts for the unpleasant taste often felt when drinking from aluminum receptacles in those countries. Zinc is also protected by the thin white film that

forms in the presence of moist air and carbonic acid, and that is the chief reason why galvanizing—coating with zinc—prolongs the life of the metal beneath. When plates of metal are cut by shearing or are punched, engineers have noticed that the edges are more likely to become corroded than the rest of the area. This is due to the fact that the shearing and punching slightly alter the physical properties of the metal, including the electrical potential. Hence, in the presence of moisture, the slightly dissimilar parts of the same piece of metal, act like the two dissimilar metals

in a voltaic cell, and rusting is accelerated by electrolysis. In alloys, the same process is often noticed. Duralumin, an alloy of aluminum, is an example. It contains numerous hard particles, imbedded in a softer mass. Here again, electrolytic action contributes to corrosion, and starts with minute pits.



## MILLION-DOLLAR STEEL BALL IS "HEALTH HOTEL"



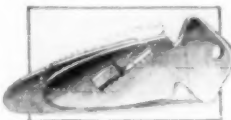
Big Steel Ball and the Passage Chamber under Construction; in These Odd Structures, Oxygen Treatments Will Be Administered to Patients for the Relief of Diabetes

Resembling a huge balloon, a five-story sphere which will serve as a "health hotel" for treating diabetes sufferers, is nearing completion at Cleveland, Ohio, at a cost of \$1,000,000. It is made of steel and is essentially a big pressure tank in which patients will be subjected to an oxygen treatment at a pressure about twice that of the normal atmosphere at sea level. This method is not new, having been in use for the past eight years, but it will be practiced on a scale never before attempted in the big ball-shaped hospital. A cylindrical corridor joins the tank to a brick building of conventional design and in this passageway, on each side of a central aisle, are treatment rooms for the patients. The first floor of the sphere is occupied by a dining room, the next three are private rooms, and on the top is a large recreation hall. Entrance to the "tank" is effected through a series of steel doors, resembling those in the water-tight compartments of

ships and so arranged that the pressure in the sphere is sealed and the person is not exposed to a too sudden change. Constructing the big steel ball so that it would be strong enough to stand the pressure, without leakage, and devising the special air compressors, humidity and temperature-control units and other items, proved to be difficult engineering problems.

#### SELF-ADJUSTING PIPE CLEANER FITS ANY SIZE

For the tobacco-pipe user, a reamer now on the market has a sliding extension that will reach into a deep bowl. The device is tapered to conform to the shape of the bowl, has no springs or other parts to get out of order and adjusts itself for the most efficient operation.





© U. &amp; U.

Part of the Echo-Measuring Apparatus, and the Bomb Which Is Exploded to Help Gauge Depths

### ECHO OF EXPLODING BOMB TELLS DEPTH OF SEA

One of the methods employed for measuring the depth of the sea while a ship is in motion is to explode a bomb of T N T and note the time consumed by the echo of the explosion in returning from the ocean's bottom. A microphone on the underside of the vessel picks up this echo and, with the speed of sound in water known, the depth can be determined.

### FAN ON AUTO HEATER HELPS WARM CAR QUICKLY

Installed under the dash, an odorless heater for the automobile utilizes hot water from the motor and is fitted with an electric fan that blows the warm air to all parts of the interior. The unit is compact, easily attached, requires but little room and no more current than a tail light.



### WOMEN'S WINTER DRESS MORE HEALTHFUL THAN MEN'S

Man lives in a tropical climate while women enjoy a cool, dry atmosphere like that of the Alps, and all because of a difference in clothing, the odds being entirely in favor of the women, a German professor declares. He has made a careful study of the wearing apparel of both sexes and finds that the dress of women, in winter especially, is far more conducive to health than that worn by men. In the first place, the weight of man's clothing averages about four times that of a woman's, the temperature inside is nearly eighty-eight degrees Fahrenheit with a relative humidity of seventy, while the temperature under woman's clothing is slightly more than eighty degrees and the humidity is but fifty-five. But the worst feature for the man is that his clothing is so closely woven and lined that the healthful rays of the sun cannot reach his skin while women's light and porous garb provides comparatively free access for the beneficial radiations. The professor recommends seeking protection from the cold with heavier outer garments to be removed when coming into heated houses rather than wearing thicker underwear.

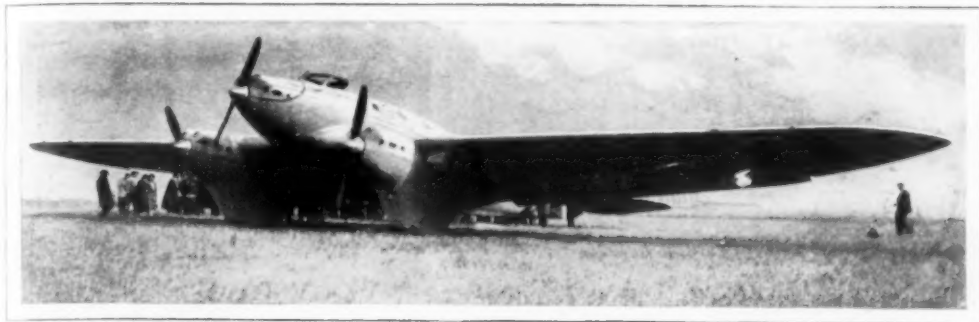
### POP VALVE FOR AUTO TIRES PREVENTS OVERINFLATION

Tires can be inflated to the proper pressure in the dark, or without using a gauge, with the aid of a special pop valve, lately introduced. It is so arranged that, when enough air has been let into the tire, a signal sounds and any further air is by-passed and runs outside instead of into the tube.



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 upon application to our Bureau of Information.

## FLYING FORT LIFTS FIVE-AND-A-HALF-TON LOAD



Courtesy L'Aeronautique

All Three Engines in This Huge Army Plane of French Design Are Started at Once and, If One Stops in Flight, the Controls Are Automatically Corrected to Compensate for the Difference

A starter for three-engined airplanes which starts all three motors at the same time has been developed by a French inventor and tried successfully on a five-and-a-half-ton military plane, virtually a flying armored fort. The inventor also has perfected means of automatically correcting the controls if one of the wing engines stops. After being flown successfully in a number of tests with three 180-horsepower engines, the center motor was removed and a 600-horsepower engine substituted. The ship made one successful test flight, but on the second it crashed and the pilot, Maurice Drouhin, one of the most famous flyers in France, and his mechanic were both killed.

#### MEASURE SPEED OF LIGHTNING WITH TWO-LENS CAMERA

Science has put the stop watch on a lightning flash in the form of a camera with two whirling lenses and reports that it takes about a seven-thousandth of a second for a flash to complete itself and no part of it lasts more than approximately one-thirty-five-hundredth of a second. In addition, the old dispute as to whether lightning strikes downward from the clouds or jumps upward from the ground has been

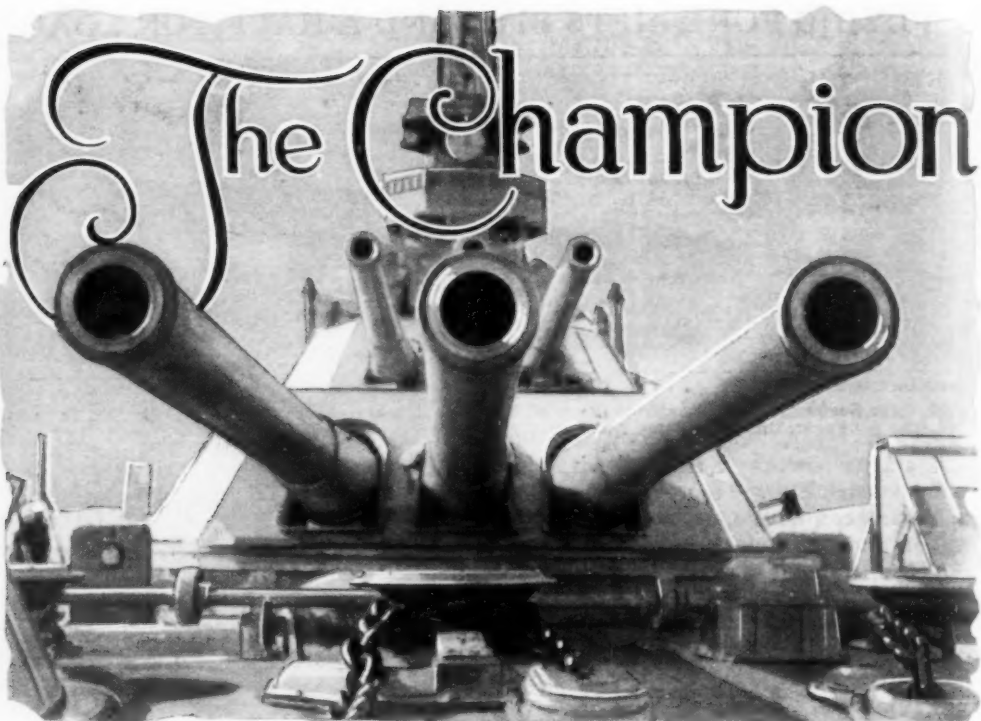
settled. Actually it does both. It starts from the cloud and the ground at nearly the same instant, and about one seven-thousandth of a second later, the two ends unite in mid-air. These interesting observations have been made by Prof. C. V. Boys, a British physicist, who has been measuring lightning flashes for twenty-six years. His camera is equipped with two lenses, mounted on a disk that whirls rapidly while the instrument is pointed at a cloud that promises good lightning flashes. When one occurs, the camera is closed and the plate developed. Two pictures are obtained through the double lens, the image in one being slightly displaced in a direction opposite to the other. By careful comparison of these two pictures and accurate measurements, the rate of travel of the flash can be determined.

#### FOOT-PROPELLED ICE SLED DEVELOPS HIGH SPEED



Foot and Hand-Propelled Sled with the "Pusher" Arm at the Rear; Note the Lightweight Construction

Healthful exercise and sport are obtained with a foot-propelled ice sled that is said to develop a speed of twenty miles an hour under favorable conditions. It is suitable for adults or children and collapses into a small bundle, easily carried by anyone, when not in use.



The "Loud Speakers" of the "New Mexico"; the Six Big Guns in These Two Turrets Are to Be Elevated When the Ship Is Modernized, to Bring Their Range Up to Its Limit

By THOMAS W. KUNE

OUT in the Pacific, where the battle fleet of the American navy maneuvers, steams and shoots throughout the year in preparation for any emergency, an unusual event has taken place.

One ship has captured all of the naval efficiency trophies in the battleship class. She is the only battleship in the navy that ever has accomplished this feat. She is the first electrically driven battleship our navy placed in commission. She is one of the older vessels, having been commissioned in 1918. The ship that wears all these honors is the "New Mexico."

Every year there is keen competition in the navy for three trophies: the gunnery trophy, awarded to that ship which excels all other ships in her class in the various target practices; the engineering trophy, presented to the ship which steams more efficiently than other ships of her type, and the communications trophy, given to that ship which stands first in visual signals and radio. And to the ship which has the highest average in gunnery and

engineering goes the kingpin of all—the battle-efficiency pennant, known throughout the navy as the "meat ball."

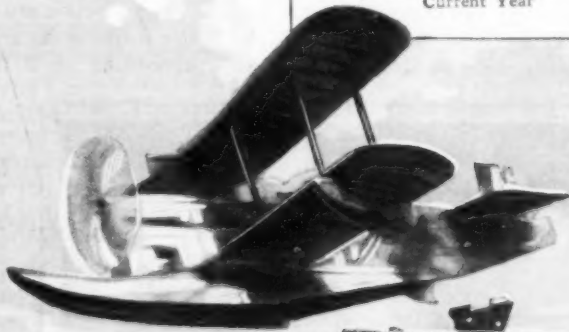
For winning the gunnery trophy, the "New Mexico" now possesses a beautiful bronze plaque, which has been the navy's prize for the best-shooting battleship since 1902, in the days of the famous old "Oregon." A large white "E," standing for excellence in gunnery, adorns the ship's conning tower, where her guns were so effectively controlled during the past competitive year. "E's" also decorate various guns about the ship, significant of scores made at target practices which measured up to the navy department's standard for excellence. There also are "E's" on the sleeves of many of the men who manned these guns and prize money has been paid to the men who helped win the gunnery trophy for the ship.

The honor, however, that the ship as a whole prizes most of all, is that in the most difficult practice of the year—long-range battle practice—her four three-gun,

# of the Fleet



The Chief Engineer Holds the Paint Pot for the Youngest Fireman as He Paints In the Big White "E," Emblematical of the Engineering Championship of the Fleet for the Current Year



Catapulting a Big Amphibian Plane into the Air to Act as Eyes for the Ship on the Target Range; the "New Mexico" Carries Three Airplanes for Scouting and Observation Duty, in Common with All the Battleships in Uncle Sam's Navy





fourteen-inch turrets established a world's record, and one which will last for many years to come. Steaming at full speed on a course convergent to a target representing an enemy battleship, the "New Mexico" straddled the enemy with salvo after salvo of 1,400-pound projectiles, registering enough hits to put her antagonist out of commission in less than five minutes.

For winning the engineering trophy, the "New Mexico" was given a bronze tablet of magnificent design which has been the navy's prize for the best-steaming battleship since 1910. A block letter "E," six feet in height, standing for excellence in engineering, is painted on each side of her smokestack. "E's" decorate the sleeves of the 300 men constituting her engineering force. The black gang also has been awarded prize money. It is significant that the present engineering force has

raised the "New Mexico" from last place to first in the fleet engineering race in exactly eighteen months.

The highest honor, the battle-efficiency pennant, is a bit of red bunting with a black ball in its center. It resembles the red pennant flown on navy ships at the yardarm during meal hours, and received its sobriquet of meat ball from a bluejacket in the early days of naval competition because it resembled the meal pennant so closely and because, at meals in those days, the favorite meat dish was a sort of hash made up in the form of a cannon ball.

The navy has established these trophies in an effort to progress along scientific lines. The spirit of striving to excel has been built into the fleet. Progress along scientific lines has followed research and experiment. The race for the meat ball has been responsible.

#### SAFETY BRAKE SET FOR LOGGING SAVES WORK AND COST

For handling loads of logs downgrade, a brake set anchored at the top of the hill and controlled by a hand lever has been found efficient. It permits working areas at a comparatively low cost, as fewer expensive roads have to be built and the work of sanding hills is also saved. The

speed of the load is under perfect control of the operator and the line can be marked to show the exact location of the load.

#### ARC WELDING TO DISPLACE CAST MACHINERY PARTS

The electric arc welder will soon displace the foundry as a source of machine parts, according to a recent announcement by the Westinghouse manufacturing company, in opening what is said to be the largest arc-welding laboratory in the world. The company has been experimenting for some time with welded steel buildings, replacing rivets, and has completed ten such structures, as well as two large welded bridges. The new laboratory will turn out turbine-generator frames, locomotive frames, electric-motor frames and spiders, machinery bases, floor plates and tanks, industrial heating apparatus, steel pipes and shop furniture, all welded instead of being cast.



Controlling the Speed of Logs' Descent down Steep Grade with Braking Appliance at the Top of the Hill

## GRAND CANYON AIR TRIP LATEST TRAVEL THRILL



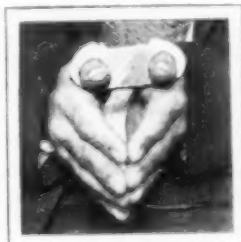
Seeing the Grand Canyon from the Air; Train Passengers May Enjoy This Thrill without Interrupting Their Schedule, as They Are Returned to Their Train at the Next Station after Flight

Travelers in the west may leave their train, take a huge three-motored airplane and enjoy a ride over and down into the Grand Canyon of the Colorado. The ship then flies to the railroad and lets them out at a point where they catch the same train they left, thus not interrupting their journey and providing a delightful side trip by which they can see more of the canyon in an hour or so than they would in days by the usual methods of travel. Contrary to expectations, the flyers have found that the air over the canyon is remarkably smooth instead of bumpy, and the trips are accomplished with complete comfort to passengers in the large planes, which have room for several persons, toilet facilities and ample space for baggage. Besides the special trip for train passengers, other journeys are made, from fifty to 240 miles long, over the scenic district of the canyon. One of the popular shorter trips is over the "north rim" country. Occupants of the plane can see the mysterious Navajo mountain, the painted desert and many other scenes of interest. This hop

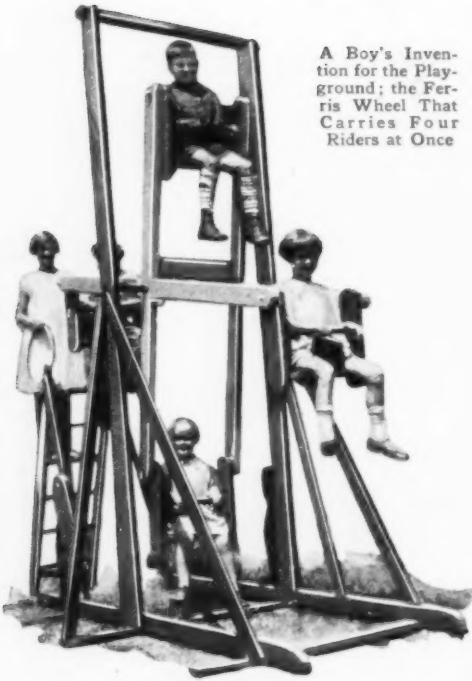
takes but thirty minutes. A ride of nearly three hours' duration leads to Phoenix by way of Sunset peak, the lava beds, Oak Creek canyon, Roosevelt lake and the Apache trail from the terminal at the Grand canyon. The flying time for the train and back to train trip is less than two hours.

#### THUMB CUFFS FOR PRISONERS PREVENT ESCAPES

As a substitute for the usual handcuffs, the Evanston, Ill., police department has been testing thumb cuffs to shackle prisoners. They are clamped tightly over each thumb and are said to offer greater security, for the wearer cannot try to get them off without suffering



greater pain than when the bonds are on the wrists.



A Boy's Invention for the Playground; the Ferris Wheel That Carries Four Riders at Once

### BOY INVENTS FERRIS WHEEL FOR CHILD'S PLAYGROUND

A seventeen-year-old boy is credited with the invention of a revolving wheel for the playground. It operates on somewhat the same principle as the famous Ferris wheel, the "cars" being supports for the riders who cause the entire frame to make a revolution by "pumping" as they would in a swing. While it is intended chiefly for children, larger models may be made for adults, and it is said to afford helpful exercise as well as amusement.

### WATER SPEED IN HYDRO PLANT EXCEEDS FASTEST AUTO

The fastest man has ever traveled on land, slightly better than 200 miles an hour, is far exceeded by the speed of the water jet that drives the waterwheels in the new Big Creek plant of the Southern California Edison company. Falling 2,300 feet down the mountainside through a big conduit, the water jet, passing through an eight-and-a-half-inch pipe, strikes each bucket of the wheels with a velocity of 255 miles an hour, exerting an impact force of 90,000 pounds. The waterwheels, the

largest pair ever built, are rated at 56,000 horsepower. The two bearings on each unit are said to be the largest oil-ring bearings ever built. They are seven feet long and have a thirty-two-inch bore. The total load carried on the bearings is about 700,000 pounds.

### SPIES TO DETECT PLANT ILLS TO PROTECT HOME CROPS

In order to detect the presence of injurious diseases in plants of foreign countries before domestic growths are exposed to them through importation, the national plant board has planned to send "spies" into lands abroad to make a study of plant ills. It is pointed out that most of our worst plant pests and diseases are of foreign origin and there are potential ills abroad that have not yet been brought to America. It is therefore considered an economical move to determine what these diseases are, what plants are infected and so prevent their being sent to this country. An initial move in the campaign has been proposed with reference to a citrus black fly that is now troublesome in parts of Central America. It is planned to search Asia for a natural enemy of this insect, so that its inroads may be curbed before it crosses our borders.

### OILCAN SEAL PREVENTS WASTE AND AIDS LUBRICATION

Attached to the tip of the oilcan spout, a soft-nosed sealing unit keeps the oil from running out the sides and directs it into



the bearings and other places, where but little usually penetrates with the ordinary oiler. It fits any oilcan, is especially useful with pressure oilers and is adaptable to cups of practically every kind. The seal can be put on in a second or two and is popular among

mechanics, as it eliminates the spilled oil that generally has to be wiped up.

### DECAY OF APPLES IS RETARDED BY GAS STORAGE

By keeping them in an atmosphere containing about eleven per cent oxygen and ten per cent carbon dioxide, apples have been stored for longer periods without decay, English investigators report. The treatment is said to be especially effective with apples "sick" with a disease called "brown heart." The malady spreads to other apples in storage because those afflicted as well as the others, continue to live and breathe after they have been picked and the air soon becomes contaminated from those that have the "brown heart."

### MODEL PLANE AS BILLBOARD TURNS TO SHOW SIGNS

Interest in aviation has been turned to advertising purposes in a California city where a full-size model of a plane has been mounted on a tall standard and is turned by a concealed motor. The sides of the fuselage are used to bear legends of the various products advertised.



Advertisers Capitalize the Public's Interest in Aviation; the Model Plane That Serves as Billboard



Foot Pontoons for the Soldiers Who Patrol the Danube River; Waterproof Sacks Inside Keep Their Feet Dry

### WATER SKIS FOR SOLDIERS SUBSTITUTE FOR BOATS

Austrian soldiers who patrol along the Danube river, have been equipped with foot pontoons with which they can walk on the water or propel themselves along with a double paddle while seated. Inside the "skis" are waterproof sacks to keep the feet dry.

### OVAL CYLINDERS FOR ENGINES TO REDUCE VIBRATION

Several advantages are claimed for engine cylinders of oval cross section instead of round, according to experts who have been testing them—a development that was first suggested during the World War by an English engineer. In practice, it is said they work quietly with considerably greater clearance than must be observed in motors of the conventional types, and that the piston rings, which, in round cylinders, often tend to creep until their slots line up and permit the escape of compression, are bound to remain stationary in the oval pistons. They also occupy less longitudinal space, a distinct advantage, especially in the case of rotary airplane motors in which all the pistons work on a single crankshaft throw. This means that thirteen oval cylinders will take no more space than nine round ones, with gain in power, less whipping and vibration and larger valves, allowing more complete filling and quicker exhaust of the cylinders.

# WHAT ARE THE



The Aurora Borealis, or Northern Lights, from a Photograph by Prof. Carl Stormer; the Electrical Display Apparently Has Some Connection with Storms on the Sun

By JAMES NEVIN MILLER

**W**ILL science ever solve the mystery of the earth's magnetic attraction, which is closely bound up with the steering problems of the mariner and aviator, and is related with those strange and marvelous manifestations of nature known as the Northern Lights, or Aurora Borealis?

This great earth of ours, with its more than 80,000,000 square miles of land, and something like 120,000,000 miles of water, is in effect a giant magnet possessed of imaginary poles that have a tremendous drawing power. The fact was discovered 'way back in 1600, and since that time the world of science has sent explorers to the most remote corners of the globe to probe new theories on the subject.

To William Gilbert, famed Englishman, goes credit for the original discovery. He pointed out that there is a marked parallel between the action of an ordinary magnet and the widely separated poles of the earth. It will be found by trial that there are two places in a magnet, near each end,

at which the attraction is greatest, and that there is a neutral line near the middle where the effect of the attraction dwindles to zero.

Of course there are no actual magnetic poles within the earth's confines, but the imaginary poles, mentioned by Gilbert, have been computed on the basis of expeditions conducted throughout the world, so that authorities now agree that the north magnetic pole is about a thousand miles from the north geographic pole, just inside the arctic circle and a little distance north of Hudson bay; whereas the south magnetic pole is down on the south polar continent, below Australia.

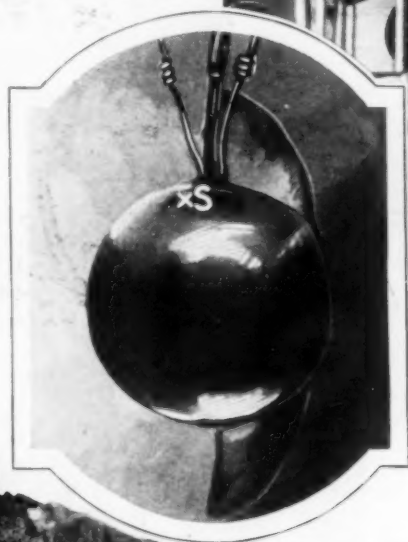
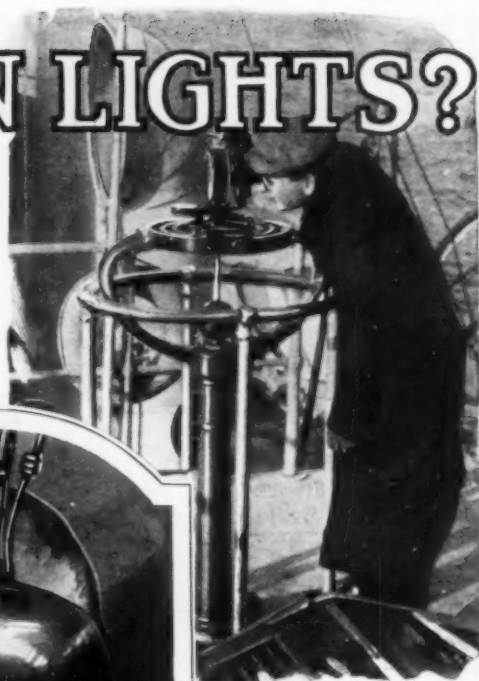
Fairly recent exhaustive tests have indicated that the sun likewise has a magnetic field, substantially like that of Mother Earth. Daniel L. Hazard, expert on magnetism of the geodetic survey, even goes so far as to say that it is probable that all celestial bodies are surrounded by such fields. Indeed, it has been suggested that



# NORTHERN LIGHTS?

every large rotating mass, such as the earth, in a manner not yet determined is an electromagnet endowed with stupendous magnetic force.

Ever since it was first observed that a magnetized piece of iron would assume an approximately north-and-south position if permitted to move freely, navigators have experienced difficulty in shaping their courses. The trouble has been that at certain times and in different places the compass points considerably away from an exact north-and-south direction. This variation is due to the fact, as observed above, that the magnetic poles do



not coincide with the geographic poles.

This discovery was made by none other than Christopher Columbus. Today, the fact is borne out even more strikingly. At points along a line running

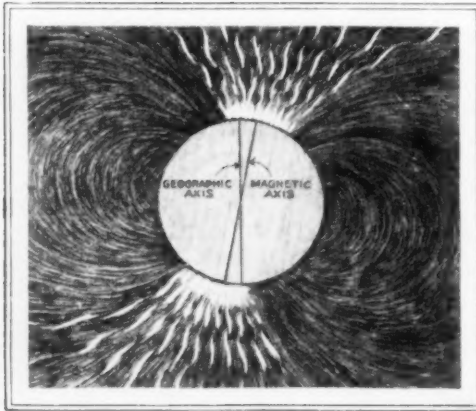
through eastern Kentucky and Tennessee and thence through South Carolina, the compass points directly north. At all localities in the United States east of this line, the compass points west of north; at all places west of the line, it points east of north. The extremes of compass variation in this country are found in Maine and in the state of Washington, ranging from twenty degrees west of north in the one locality to twenty-five degrees east of north in the other.

Not only does the north magnetic pole lie about a thousand miles from the north geographic pole, but it seems to lie far beneath the earth's surface. Consequently in the northern hemisphere the compass does not come to rest in a horizontal position but dips downward. Along a line running near Washington, D. C., and St. Louis, thence northwest to a point near



Courtesy Carnegie Institution

Observing Magnetic Dip at Sea; a Magnetized Iron Sphere Demonstrating Possible Cause of Northern Lights, and Scientists Burying Electrodes



Seattle, it dips seventy degrees. In general, as one goes northward, the dip, or angular distance from Mother Earth, increases until it becomes ninety degrees over the magnetic pole.

Besides this curious fact, it is known that magnetic conditions are slowly changing throughout the world. At the present time the dip is increasing slowly in most parts of the United States, while the north end of the compass needle is ever moving slowly westward.

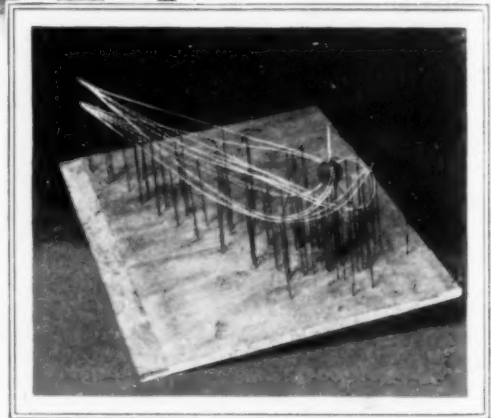
In an endeavor to map completely the earth's magnetic field, the Carnegie Institution has sent out no less than 170 land expeditions. Observations covering more than a million miles have been made at 5,700 points. The experts have penetrated remote portions of the globe, oftentimes amid great difficulties and dangers. Among the most notable of these expeditions may be mentioned: the complete crossing of the Sahara from Algeria to Nigeria; a caravan trip from Peking to Turkestan and across the Himalayas to India; the crossing of central Australia; the crossing of Africa in the equatorial and southern regions; hazardous journeys in Central

and South America; difficult trips into the interior of Asia Minor and Persia, and extensive expeditions by canoe into the little explored regions of British America.

In 1899, a systematic magnetic survey of the entire country was begun by the government. It has now been completed. To meet the needs of local surveyors, the work was based largely on the county subdivision of states, with a magnetic station at every county seat. Most of the stations were marked in a permanent manner, so that they would be available for future use. At intervals of about five years,

observations have been repeated at selected stations distributed over the whole country, to keep track of changes.

Closely allied to the consideration of the earth as a great magnet is the study of the peculiar electrical situation in the space surrounding the globe. Magnetic storms, which mysteriously cripple our telegraph and telephone systems, arise from unknown electrical causes and scientists are working overtime these days in an effort to shed light on the subject. Instruments have been devised which work on the

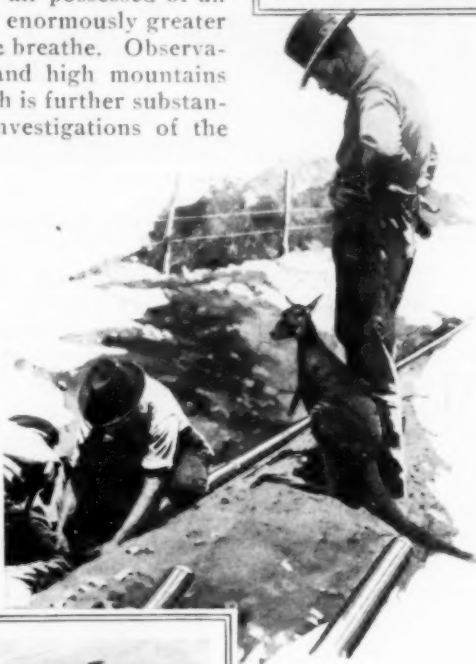
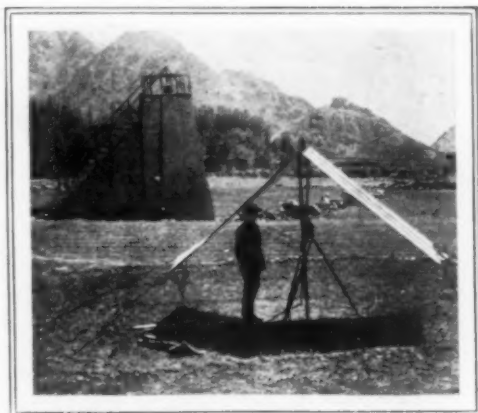


At Top, Model Showing Earth's Lines of Magnetic Force; Center, Scientist Studying Atmospheric Conditions, and, at Bottom, Model Explaining the Aurora

automatic principle, continuously recording the strength of the atmosphere's electrical discharges at different points.

While the origin of the electrical currents on and around the earth is not known, there is abundant evidence that from some source or other the charge is constantly replenished. Certain investigators have made tests which they claim indicate that the sun is the cause of the renewal, while others say lightning discharges may be the cause. However, one point meets rather general approval—that somewhere high above the earth's crust there exists a layer of air possessed of an electrical conductivity enormously greater than that of the air we breathe. Observations from balloons and high mountains back this theory, which is further substantiated by thorough investigations of the behavior of radio waves many miles above the earth.

Then again, it is well known that transatlantic radio transmission is better in winter than in summer and that distant stations can be picked up more readily at night than during the day. In their attempts to discover the why of these conditions as well as the reasons

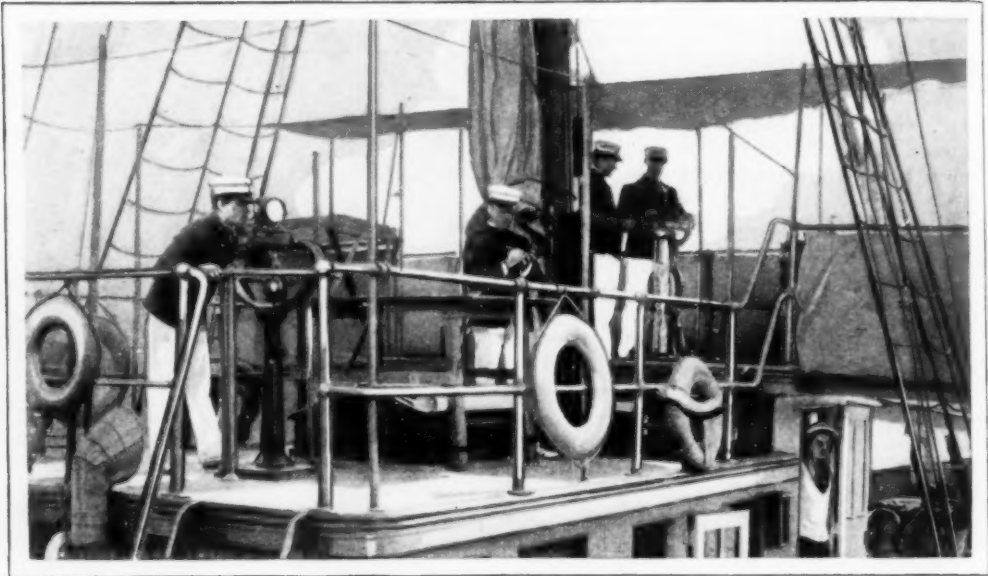


Top, an Eclipse Station in Far-Away Tibet; Center, Magnetic Study in Australia, and, at Bottom, Workers under the Burning Desert Sun

for the fading of radio messages, investigators likewise have endorsed the theory claiming the existence in the upper air of a belt in which electrical conductivity is much greater even than has been found in the highest balloon observations. Various theories have been offered to explain the existence of the earth's great magnetic field. Certain scientists believe that magnetism arises from the earth's habit of continuous rotation. They point out that tests have

shown that a piece of iron may be magnetized by rotation.

As for the Northern Lights, the highest visible natural phenomena in the earth's atmosphere, their study, in the words of Charles F. Talman, of the U. S. weather bureau, constitutes the most romantic chapter in the history of upper-air research. Certainly their characteristic manifestation is so colorful and luminous as to hold the imagination spellbound for long moments. Most of us tend to think of the auroral displays as being characteristic only of the northern United States and sections of Canada. But Mr. Talman



Courtesy Coast and Geodetic Survey

Scientists of the Carnegie Institution Making Magnetic Observations Aboard the Famous Ship "Carnegie," Which, Because of Its Construction, Is the Only Non-Magnetic Vessel Afloat

explains that the Northern Lights are actually more common in Europe than in America. Often they take a distinct arch shape, but then, too, they are liable to light up almost the entire sky with their varicolored beams and massive curtains.

Well up in the arctic regions there is more or less of an irregular belt in which the displays occur with some frequency, sometimes being visible south, rather than north, of the observer. People in the torrid belts occasionally see the aurora, notably the East Indians and the northern Africans. The southern hemisphere offers similar displays, occurring with like frequency, and known commonly as Aurora Australis.

Notable among the scientists who have made careful probes of the magnificent Northern Lights have been the Norwegians, particularly Professor Birkeland of the University of Christiania, and Prof. Carl Stormer. As a result of their investigations, they have agreed on at least one substantial point—that "an auroral display is an electrical discharge in the rarefied gases of the upper atmosphere, probably produced by the absorption of cathode rays in the upper air that were attracted to the earth's magnetic poles." Professor Birkeland goes on to explain

that cathode rays from the sun are at the root of the aurora, setting up electric currents in the atmosphere which in turn give rise to more cathode rays. Not long ago he supported his theory by the feat of producing artificial auroras within his own laboratory.

Using a magnetized steel ball to represent the earth, he suspended it in a tube almost entirely exhausted of air and exposed to cathode rays. Professor Birkeland's colleagues were highly pleased with the results of the tests, particularly since they resembled so closely the conditions under which the genuine auroras probably are produced by nature, master magician. The steel ball was given a phosphorescent coating so that the sphere glowed in realistic fashion in two zones located in miniature relation to the earth's auroral belts.

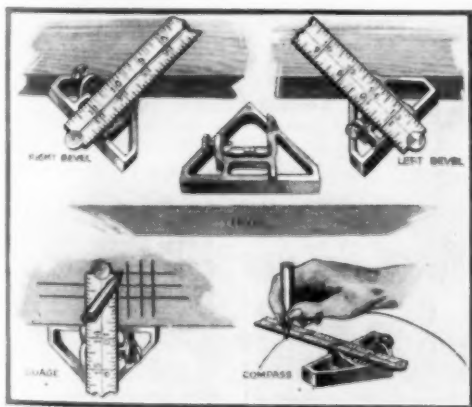
#### PORTABLE ALARM ON RAILWAYS PROTECTS SECTION GANGS

Portability is the essential feature of an alarm bell for railways to warn section gangs of an approaching train. It is electrically operated and consists of a switch, which is clamped to the flange of the rail, is closed when the train runs over a cam, projecting slightly above the rail head.

and is opened again by coil springs after the wheels of the cars have passed the cam. Electrical connection, to a bell alarm at the place where work is going on, is thus established and broken, causing the bell to ring intermittently as long as the train is running over the switch. By arranging the switch at a suitable distance from the section gang, in either direction from the crew on a single track and on both tracks of a double-tracked road, the workers receive warning of a train's approach in ample time to seek safety. The switch is sturdily constructed to stand shocks, and all parts are protected against the weather. Instead of a bell, a light can be installed or both may be used to make the device more effective.

#### BEVEL GAUGE AND RULE IN ONE ALSO SERVES AS COMPASS

Several useful tools are combined in a single pocket unit for the carpenter, mechanic or other worker. It consists of a ruler attached to an angular frame, the sides of which are shaped to align the rule at different angles to the right or left for making bevel cuts. By placing a pin through a hole in the point of the frame, the unit can be swung about as a compass, and under the ruler is a spirit level. Almost any rule, two feet long or so and not too wide, can be used with the holder, which has a socket and screw for keeping the rule in proper position. The meas-



Typical Uses of the Combination Bevel, Gauge and Level Showing Ease of Adjustment

ure is quickly removed when the gauge is to be placed in the pocket.



Behind Four Large Lenses Are the Photo-Electric Cells That Change an Image into Electrical Impulses

#### FOUR LIGHT CELLS ARE USED TO BROADCAST FACE

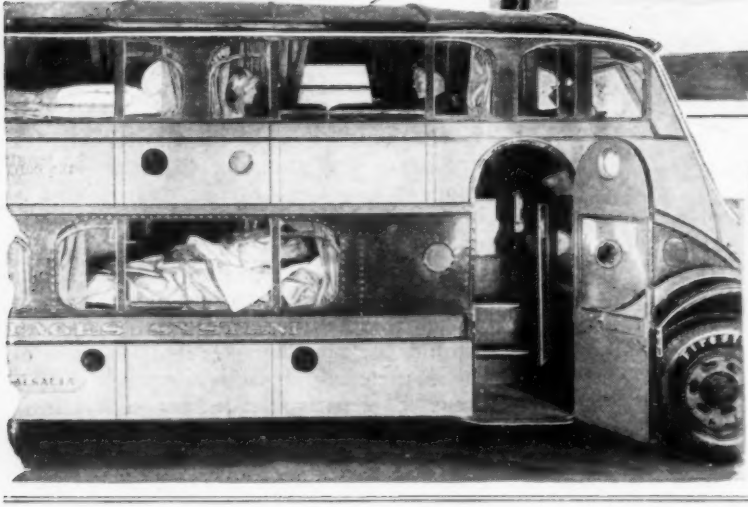
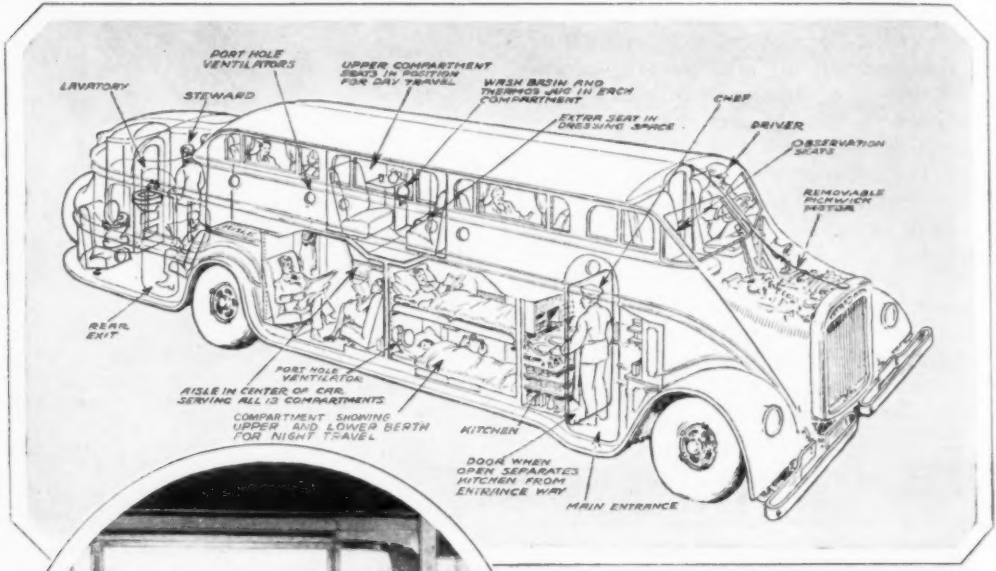
Four photo-electric cells, receiving light from huge condensing lenses, were used in a public demonstration of television at the recent New York radio show. By dividing the burden among four light-sensitive tubes and then combining their output, a more sensitive televisor is obtained.

#### RUBIES CARRIED BY AIRPLANE TO FOIL JUNGLE THIEVES

To avoid the animals and robbers that have menaced convoys through the jungles from the ruby mines of Burma, still rich although worked for many centuries, engineers are planning to transport the gems by airplane. Strong guards have to be sent with the porters as the rubies are of the famous and exceedingly valuable pigeon-blood variety, and although the journey is not a long one, it continually presents difficulties to the mine owners. Should the plan be executed, the use of the planes would seem a curious fulfillment of a native legendary superstition which holds that sometimes in the dead of night, a mysterious white bird swoops down on the mines and carries away a priceless gem in its beak.



NIGHT COACH PROVIDES NEW HIGHWAY LUXURIES



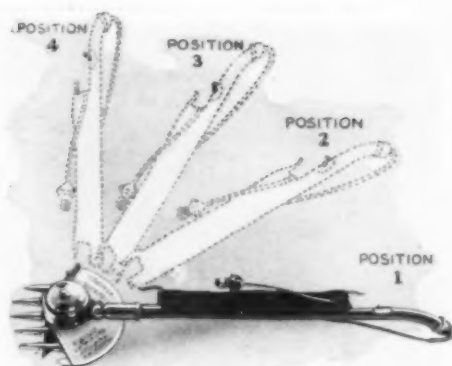
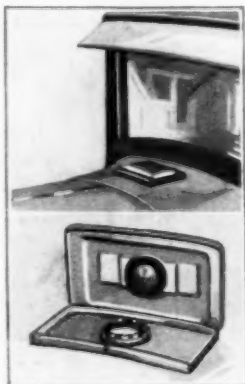
The Motor-Coach Sleeper, Showing the Arrangement of Berths at Night and Seats by Day, and, at Top, a Diagram Illustrating the Positions of the Driver, Chef, Steward and Passengers; the Car Is First of a Line Which Will Run from Los Angeles to Vancouver, and Later May Extend across the Continent

## PULLMAN OF ROADS INCLUDES BERTHS AND DINER

A Pullman of the highways, with berths for twenty-six passengers, kitchen and dining facilities, and all the other features of a de-luxe railroad train, has been completed in California as first link in a coach line that will reach from Vancouver, B. C., to Los Angeles, and later may be extended across the continent. The motor sleeper-diner is thirty-four and a half feet long, eight feet wide and stands ten feet three inches high, being exceptionally low for a double-deck coach, because of its unique construction. The car, which weighs 14,000 pounds and cost \$30,000 to build, has no chassis in the ordinary sense. Instead, a heavy steel I-beam around the car just beneath the lower-berth windows provides means for carrying the under-slung body and also furnishes protection for the passengers in event of accident. The driver sits above the engine instead of behind it, and the engine itself, a special 110-horsepower motor, is so mounted that it can be removed and a new one installed in twelve minutes. Complete engine assemblies are to be carried at the terminals for change in event of trouble. The thirteen two-passenger compartments, which, like Pullman berths, become seats by day, are reached by a step down or a step up from the central aisle. Each berth is six feet four inches long.

## GAS-TANK CAP FOR NEW FORDS PROTECTS COWL IN FILLING

To keep gasoline from spilling over, when one is filling the tank of the new Ford cars, a combination tank cap and drip pan has been devised. It is attached in place of the standard cap, with a large collar nut, and, in appearance, is similar to the cowl ventilators on many cars. It also prevents splashing fuel on the windshield.



Using the Electric Hedge Trimmer, and Drawings to Show Positions to Which It May Be Adjusted

## ELECTRIC TRIMMER FOR HEDGE PROLONGS LIFE OF VINES

Besides saving time and work, an electric hedge trimmer, recently introduced, is said to leave the plants in better condition than when using a hand cutter, as it produces a smoother surface and cuts with a natural drawing stroke. The unit is operated on either alternating or direct current from any convenient lighting socket, has 100 feet of cord and a blade that revolves past slotted points that draw the vines to cutting position.

## INVISIBLE RAY TO PIERCE FOG GUARDS OCEAN LINERS

Among the equipment on two German liners recently launched, is an apparatus for projecting an invisible ray that penetrates fogs. The beam is said to increase by twenty times the distance through which the human eye can see, is as efficient by night as it is by day and retains its power even in fogs. It is expected to play an important part in promoting greater safety at sea.



Placing Pigeon in Its Berth for a Trip on Dog Back to Soldiers at Distant Point

### PIGEONS CARRIED BY DOGS TO HELP IN TRAINING

Carrier pigeons acquire the ability to return home largely through training, and one of the methods used in the army is to send the pigeon to soldiers stationed at distant points where the birds are released and allowed to fly back. Dogs have been taught to carry the pigeons in one army unit. A harness with side pockets is strapped about the dog, the pigeon placed in one of the pockets and taken safely and comfortably to its destination.

### RADIO PHONES ON WHALERS KEEP FLEET TOGETHER

Science has been changing many of the time-honored methods followed by the whaling fleets. Harpoons are no longer hurled by hand but by guns, improved ways have been developed for lifting and cutting the whales when they are caught,

and now the fleets are installing wireless telephones to help keep the boats from losing their mother ship. This reduces anxiety and saves wasted time while enabling a more efficient movement of the fleet when on the hunt. Radio direction finders are employed with the telephones to help guide the vessels.

### WIRE WHEELS DISPLACE DISKS IN AUTOISTS' FAVOR

The steel-disk wheel, which a few years ago threatened to eclipse the old-style wooden artillery type, has in turn been displaced by wire wheels, according to production figures for the first half of 1928. The output of wire wheels, on the basis of figures for the first six months of the year, will exceed one million for the first time, while the disk wheel output will drop below the million mark for the year. The preliminary figures show an increase in wire-wheel manufacture of more than 800 per cent since 1925, while, in the same period, the disk-wheel output has dropped to one-third of what it was at the peak. The changing fashion in wheels is attributed partly to the general introduction, on high-priced cars, of the practice of carrying two spares mounted on either fender, as practically all cars coming equipped with six wheels use the wire-spoke type. Another contributing factor has been the reduction in cost of wire wheels through improvements in manufacturing processes.

### PISTON SETTER SAVES TIME AND FITS ALL SIZES



To simplify the task of setting pistons in the cylinders, a spring-frame holder keeps the rings in place and enables the operator to use both hands. The holder accommodates all sizes.

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

### POCKET RADIO TRANSMITTER HELPS TREAT DISEASE

By treating them with ultra-short radio waves, a German investigator reports that he has successfully kept mice from dying of tuberculosis. Thirty of the animals were inoculated with the germs of the disease. Fifteen of them were subjected to the radio waves and the others left unattended. After a month, the former group were alive and well, but all the rest died within a short time. There is considerable danger in using the rays, the experimenter reports, as they increase the temperature of the human body one degree centigrade per second and also cause the disintegration of some of the cells of the body. In connection with his tests, he has developed a radio transmitter, smaller than a cigar box, and has used it in sending wireless messages a considerable distance even with a small amount of energy. He is able to send telephone messages with ultra-short waves of but three meters length.

### PEEP GLASS IN HOUSE DOOR HELPS FOIL INTRUDERS

So that the housewife may see who is knocking, a glass lens, set in a metal frame in the door, has proved an effective means of preventing the entrance of tramps or other undesirables. It is placed so that the person inside can see the one outside clearly without opening the door.



Making Sure Who Is on the Other Side of the Door; the Peephole Helps Bar Intruders



Every Car a Road Sweeper with This Set of Magnets That Gather Nails and Other Metal Hazards

### MAGNETS ON AUTO BUMPER CLEAR ROAD OF NAILS

Automobiles are being fitted with magnets attached to the front bumper a few inches above the pavement, to gather nails and other bits of metal that might puncture the tires. Current is supplied from the car's generator, and the magnets are placed sufficiently high to prevent damage over bumpy roads. With this arrangement, individual cars perform much the same function as the special road-sweeper magnet trucks that have been used by automobile clubs and other associations.

### PAPER SUITS FOR FIREMEN SEEN IN NEW PROCESS

As a result of the process he has developed for fireproofing paper, a German chemical engineer predicts that firemen will be equipped with paper suits when entering burning buildings, that safes can be made of the material in compressed form which will resist blazes, books can be made which will not burn, and many other uses will be found for the substance. In a recent test, he wrapped a newspaper in a covering of the fireproof paper and held the ball over a flame that would have melted glass or burned a hole in a plaster wall. The wrapping was not damaged, and the paper inside was not even scorched after a few minutes' exposure to the blaze, according to reports.



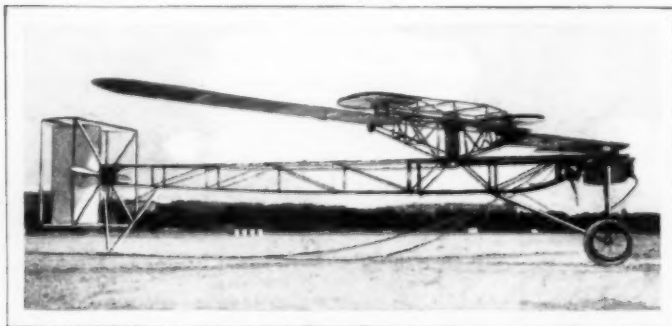
Electric Barbecue for the Lunch-Room Counter; the Knife Sharpener Is at Extreme Left

### MEAT ROASTER TOASTS BREAD AND SHARPENS KNIVES

For drug stores, lunch rooms and other places serving meals, an electric barbecue occupies little space on the counter and can be used for frying or toasting. It also has attachments for sharpening knives or polishing silver.

### PLANE RUN BY REVOLVING WING FLIES WITHOUT PILOT

Foreign aviation experts have been interested in experiments with an airplane that is propelled by a "hub screw" revolving wing, twenty-three feet long, which turns horizontally. Tests have been made without a pilot and the ship is reported to have risen from the ground successfully.



Odd Plane Which Is Reported to Have Flown Successfully in Tests without a Pilot; the Long Wing Revolves Horizontally

### DIESEL ENGINES MAY DISPLACE SUPER-POWER PLANTS

Super-power, the hooking together of electric generating plants throughout the country with long transmission lines, a development that seemed assured as late as two years ago, may be abandoned as a result of the latest developments in the electrical industry. For small Diesel-engine-driven generators are proving so efficient that they are rapidly being installed, particularly in the southwest. The reason for super-power was that the efficiency of a steam-boiler plant and the efficiency of a steam turbine increase with their size. It was cheaper, therefore, to build one giant plant and then transport the output for long distances over high-tension wires than to build a number of smaller plants. For the first time in power history, however, the small Diesel engine offers a prime mover as efficient as a large one. Hence, in communities where the power load is not strung out along miles of line, a small Diesel plant is cheaper than one large generator station, with transmission lines to widely separated communities.

### FINE DUST FROM VOLCANOES AFFECTS WEATHER?

Does a big volcanic eruption have a direct effect upon the weather? Studies made by Prof. W. J. Humphries, of the weather bureau, and by other scientists indicate that there probably is a connection between these phenomena and the weather conditions over a wide area, perhaps over the entire world. The reason is believed to be that the volcanoes, shooting enormous quantities of dust high into the air, thereby form a veil which has a marked effect on the degree of heat that reaches the earth from the sun's rays. In 1816, the "year without a summer," there was a marked change in weather conditions the world over. Just the year before, a terrific explosive eruption of the Tomboro volcano had occurred. Again in 1883,



the East Indian volcano Krakatoa shattered the island on which it stood and killed 35,000 persons. Three years later, Alaskan and New Zealand volcanoes were active, and the low-temperature period that followed this group of volcanic explosions was second only to that of 1816. Four eruptions of note have occurred this year, although none of them compares with the disturbances already mentioned. Scientists point out that there is no way of telling whether they may be merely the preliminary bouts of a really huge outburst which may again bring us a year without a summer.

### CAT SERVES AS LIVING BRUSH TO HELP CLEAN PIPE

Until recently, the pet cat in a western factory lived a life of ease and indolence, but the animal is now hard at work helping to clean the interiors of long pieces of pipe and apparently enjoys its occupation, the shop managers report. It had been the custom to roll a small bowling ball, with a string attached, through the seventy-foot pipe which was ten inches in diameter, but this proved a slow and often hard task even for the shop's best bowler. After the string was passed through, it was attached to a small rope and when this was hauled through the pipe, a cable was connected and a plunger pulled back and forth to clean the pipe. One day, the pipe man saw the cat dozing near by. He was struck with an idea. He seized the animal, tied a string about its neck then placed the cat in the pipe. The outside was pounded gently with a hammer and the cat scurried through to the other end, emerging with the string, which was quickly attached to the rope and the cleaning accomplished in a fraction of the time formerly required. The cat now does its pipe dash several times daily.

### ELECTRIC WINDOWS FOR INSIDE GIVE OUTDOOR EFFECTS

To brighten gloomy interiors, a false window, electrically lighted and showing



False Window with Electrically Lighted Background, to Give Outdoor Appearance to Basement Room

what appears to be an outdoor scene, has been introduced. It is portable, can be set up in a few moments and electricity is obtained from a wall socket. The window is intended especially for basement restaurants, sales rooms and other places where a natural view is lacking. Where these installations have been made, it is said the depression felt by workers in such surroundings has been greatly alleviated.

### TRICYCLE OPERATED BY ROWING AFFORDS GOOD EXERCISE

Rowing on dry land is the healthful exercise derived from a tricycle unit introduced in France.



Tricycle Propelled by Rowing; It Develops Considerable Speed

The main wheels are operated by two "oars" or handles, which in turn work a chain and sprocket gear. A small guide wheel in front facilitates steering, done by pulling harder on one handle than on the other. Coil springs attached to the oars facilitate the strokes.

# Crashes



Movie Players Inspecting the Wreck of a German Fokker, Which Was Crashed into the Roof of a House during the Filming of a War-Time Aerial-Thrill Picture in Texas.

By I. ELAND S. JAMIESON

A SMALL group of movie actors were crowded around a camouflaged Spad airplane. The pilot was talking with the director of the picture. From time to time he looked up and examined the ground in "no man's land" appraisingly.

"Just take it easy," the director was saying. "If you can't get free of the cockpit and down into the shell hole right after you crash, just take it easy and don't spoil the shot. I'll have plenty of men out there to help you after the scene is made. You don't need to be afraid of fire; I'll have a whole fire department right there."

"But, Bill, you've got your camera men in such a position that I'll have to fly over no man's land down wind. I'll have ninety-miles-an-hour speed when I hit the wire, can't you put them on the other side of where you want me to crash?"

"No," said the director, "the light's bad that way; you'll have to do it this way."

The pilot shrugged his shoulders. "All right, but you be ready to pull me out."

"We will. Well, good luck, Dick." They gripped hands for a brief second and the pilot clambered into the plane. The group of movie people scurried back to safety from the whirling propeller as the plane swung around and into the wind. The ship thundered into the air, leaving a cloud of drifting dust and a group of apprehensive men and women.

The Spad climbed and spiraled up in wide, graceful circles. It disappeared into a fluffy white cloud. Then it reappeared, but this time there was a plane "on its tail," a plane which bore black crosses on each wing—a "German." The German ship was persistent, it could not be shaken by the Spad; it banked and turned and whipped through the maneuvers of the dog fight with deadly precision. The Spad rolled over on its back and started earthward in a sickening vertical dive. The Fokker rolled over likewise and started down. Both ships dived 2,000 feet and leveled out. The Spad was still in front;

# Made to Order



Dick Grace, Movie Dare-Devil and Stunt Flyer, Standing beside a Plane Which He Crashed into the Ground at a Speed of Ninety Miles an Hour

the German ship still maintained its position of advantage.

A thin gray wisp of smoke spurted from the Spad. The ship seemed to pause for a moment, then headed directly toward the battery of cameras. The camera men stood with hands on their cranks, waiting for the director's order to start grinding. The plane came on, lower and lower; it skimmed the wire of the "German Lines" and started across no man's land.

"Camera!" the director shouted through his megaphone. A dozen men commenced their slow grinding.

The plane floated out its speed. Suddenly it dipped, the landing gear hooked over a rugged cedar post, the nose smashed into the ground with violent force. There was a crunching of wood and a ripping of fabric. The nose of the plane buried itself in a fury of dust. The tail rose like a whip, careened over the buried nose and fell onto the ground with an ominous crash.

A figure scrambled out of the wreckage and paused a moment at the side of the

plane, apparently undecided as to where to take refuge from the spray of "bullets" from the German Fokker. The figure dived into a shell hole and lay still. The Fokker dived at the wreck again and again; then, with a flaunting zoom, it sped away toward its own lines. Thus one of the greatest crash scenes in motion-picture history was made.

It is placing a great strain on the layman's credulity to expect him to believe that the crash shots of the moving picture "Wings" are not "faked." Never before had such crash scenes been attempted; even the producers were doubtful whether they could be consummated successfully. Yet they were, and with only one exception, and that on account of the unavoidable destruction of one of the crash planes by a windstorm, and the scenes were real—in all essentials actually performed as shown in the finished picture.

How these things were accomplished has baffled the public. "How," many have asked, "can a pilot intentionally completely wreck an airplane and escape being hurt?"

In one scene, the scenario called for the shooting down of a German plane just as it took off in pursuit of an American pilot who had stolen a Fokker plane from a German airdrome. It was impossible to use a model airplane on this shot because of the evolutions the craft must perform just prior to the crash. Besides, a model does not possess the speed and the inertia to simulate an actual crash with realism, unless it dives straight into the ground. So it was necessary to use a real airplane, flown by a real, live pilot.

The stunt pilot who crashed the Spad earlier in the picture, volunteered for the job. It looked easy, compared with the first crash, for the ship would not yet have attained great speed and, in all probability, would not turn over when it struck the ground. But the pilot went about his preparations with the thoroughness which had marked his previous crashes. He padded the inside of the cockpit thickly with cotton and leather; he removed all sharp instruments and parts of the plane which would be a menace to his safety, and he built a special belt which could be placed around his shoulders to prevent his body from being snapped forward by the

suddenness of the impact when he rammed the ship into the ground.

The batteries of cameras were placed in the proper position and the scenes preceding the take-off were shot. The pilot, Dick Grace, cranked the plane and took off as nonchalantly as if he had been going on a hundred-mile cross-country flight. He jockeyed the plane into the air; then, when about ten feet above the ground and directly in front of the cameras, he shoved the control stick forward and slammed the nose of the plane into the ground. The landing gear collapsed, the plane ricocheted a few feet and skidded to a stop.

To those of us on the ground watching, it seemed a very ordinary and undramatic crash. But Grace did not climb out of the cockpit with his usual celerity, and after the cameras had stopped their grinding, he was lifted out. His entire right side was paralyzed. A subsequent X-ray showed that the fifth vertebra of his backbone had been dislocated and that one vertebra in his neck was broken. For



Grace, in Center, before the Wreck of a German Fokker, Which He Crashed; After He Was Lifted Out of the Cockpit, It Was Discovered His Neck Was Broken

three months he wore a plaster cast.

Grace was injured in a crash which was "mild" in comparison with a great many others he had performed for moving pictures. The fault was in the material of the belt; it had broken under the strain and his head and shoulders had been snapped forward with sufficient force to break his neck.

One of the great difficulties encountered in crashing airplanes for the movies is that the exact results of the crash can never be known until after it is all over. A crash which to the eye appears to contain all the essential thrills for the scene, may be, when reproduced upon the screen, a complete "flop." The cameras may have been taking the scene from a bad angle; the light may have been poor because of a passing cloud; the pilot may have inadvertently let the ship get too far away from the cameras before crashing it—any one of an unbelievable number of things may ruin the shot. And when a crash has been completed, the equipment has been destroyed and there may be no more to take its place. Hence directors must use utmost care in preparing the scenes.

In one picture it was necessary to have a German Fokker crash into the side of a stone house while in full flight. Naturally the plane and the house both would be wrecked. If the shot turned out badly, and a retake was necessary, it would require days to rebuild the house and procure another plane. Also, it was a foregone conclusion that the pilot of the plane would have only a remote chance of escaping the crash with his life. Therefore it was necessary to have the plane fly pilotless, into the side of the house.

After much calculation and discussion



An American Plane Shoots Down a German Sausage Balloon in Flames as One Thrill for the Film

with his staff, the director hit upon the idea of constructing a high runway, from which the ship could be flown. Experiments were conducted with the plane, to determine exactly how long a run would be necessary to get it into the air, and the plane was rigged so that it would fly straight ahead rather than to either side. With all the available information at hand, the runway was constructed at a distance of about 300 feet from the house. Grooves were built which would hold the wheels and tailskid in place until the ship got into the air.

The plane was then dragged to the top of the runway and the controls lashed in a position to maintain normal flight. Chocks were placed in front of the wheels, the motor started and tested. A dozen camera men were stationed on the ground at various positions and, at a word from the director, began to crank. A mechanic





One of the Most Spectacular Shots Ever Made; the Camera Caught the Plane Just as It Was Turning Over on Its Back

by the side of the plane opened the throttle wide and stepped back; another mechanic jerked the chocks from in front of the wheels. The plane leaped forward and down the runway.

It gained speed so quickly that it rose into the air before it reached the bottom of the runway. Headed directly toward the house, it seemed about to climb over the building. If it should miss the house, it would go on into space, a wandering, pilotless juggernaut of the air. Just before it reached the house, a gust of wind threw the ship down a few feet. It plunged into the house at terrific speed, half burying itself in the roof. Bits of the plane and slivers of wood from the house flew high in the air. Skill and calculation, plus a whim of nature, had done the trick.

One scene in the same movie depicted a German Fokker falling in flames behind a hill. The burning ship dropped from several thousand feet in a tailspin and, just before it struck the ground, a hill hid it from the view of the cameras. Immediately after it had disappeared, a great cloud of black smoke and a sheet of flame flared up over the brow of the hill. To those in the audience who had seen an ac-

tual crash, this shot was just as realistic as the real thing. They could almost hear the crunching of the plane as it ground itself into the earth; they waited for the muffled explosion before the flames appeared; they could see the mass of twisted metal and wires.

This shot was obtained by placing the cameras on one side of a high hill and having the plane crash on the other. Just over the crest of the hill, away from the cameras, was placed a pile of wood and brush, which had been heavily soaked with gasoline. An electric detonator was hooked up to be operated from one of the camera stands. The burning-plane effect was obtained by releasing a

stream of lampblack from a hopper on the ship as it fell in a spin toward a point back of the hill which was directly in line with the brush pile and the cameras. Just before reaching the ground, and when well out of sight of the cameras, the pilot kicked the plane out of the spin and dived away. As soon as it was out of sight, the detonator was set off and the fire started, apparently just where the plane fell.

In another scene of the finished film, a huge German Gotha was shot down by an American pursuit ship. The Gotha spun down to the ground and crashed into flames. French peasants and American soldiers ran up to the burning wreck and looked on while the victorious American pilot made repeated dives and pumped it full of machine-gun "bullets."

For the purposes of the picture, a German Gotha plane was actually built at the flying field. It was not to be flown, but in all respects it exactly duplicated the famous German ships. The directors planned to crash it from a runway in a manner similar to the Fokker, but a day or two before, a windstorm came up during the night and blew the Gotha away, thoroughly wrecking it.



Flying Low to Inspect the Damage; an American Plane Swoops Down to Look Over the Burning Wreck of a German Gotha, Shot Down But a Moment Before in an Aerial Dog Fight

With weeks of work ahead of them unless they could in some way utilize the wrecked plane, the directors hit upon the scheme of using a model airplane for that particular scene. They constructed one, and built a miniature landscape duplicating the spot where the Gotha was to have been crashed. Very ingeniously they "spun" the model down from a height of six or seven feet into the miniature set, and when it struck the ground a dynamite cap exploded, setting off a small charge of powder, thus simulating the effect of a real crash.

By trick photography the camera men were able to make the miniature scene look exactly like the real one would have, had the Gotha been crashed from flight. The wreckage of the full-sized Gotha was soaked with gasoline and ignited, and while the American plane dived furiously at the blazing mass, and French peasants and American soldiers ran frantically toward the wreck, cameras ground out their film and preserved the continuity.

In man-made crashes, as one pilot expressed it, "You won't get hurt if you know just what you are trying to do. You've got to crash your plane the way

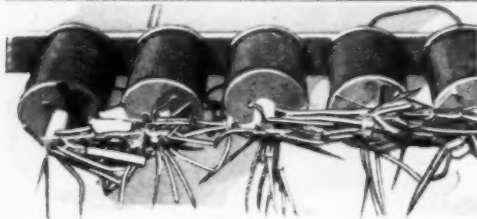
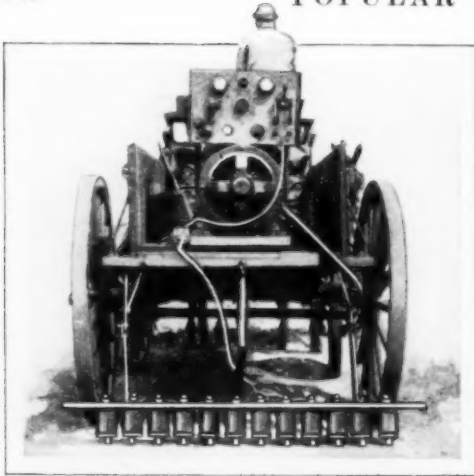
you want to crash it; you've got to fly the plane from the minute you hit the ground until the last bounce is over and the ship has stopped."

### FOLDING TABLE FOR PICNICS HELPS CURB INSECTS

For the convenience of motorists and campers, a folding table rolls up into a small bundle when not in use. The top comes off and fits about the legs. The table will support considerable weight.

Folding Table of Convenient Height for Picnic Use; the Top Is Detachable and Rolls into Small Bundle





Nail Picker in Operation, and a Close View of Some of the Magnets, Showing Objects Gathered from Road

### MAGNET RIDES ROADS OF NAILS TO PROTECT AUTO TIRES

Nails, pins, bits of steel and other metal objects that might cause punctures, are removed from roads with the aid of a magnet comb the army signal corps has been using. The teeth of the comb consist of a series of individual magnets energized from apparatus carried in the truck which draws the comb over the road.

### SOLOMON A DEALER IN HORSES STABLE DISCOVERY SHOWS

That King Solomon was a lover of fine horses and a successful dealer in them has been further proved by the discovery of the ruins of his famous stables at Armageddon, in Palestine, where an expedition of scientists from the Oriental institute of the University of Chicago has been at work for more than two years, exploring the debris of this historic spot. According to a report of the find from P. L. O. Guy, field director of the expedition, the stables were laid out systematically, the stalls being arranged in double rows. The horses, about twelve to the row, stood facing each other with a passage between the

two rows for the grooms to feed and control them. In front of each horse was a manger and the rows of mangers were divided by massive stone hitching posts, which still contain the original tie holes for the insertion of the halter ropes. Dr. James Henry Breasted, director of the institute, believes that the discovery is of great historical importance and reveals an interesting side of Solomon's life which is suggested in the First Book of Kings as follows: "And the horses which Solomon had were brought out of Egypt and the king's merchants received them in droves, each drove at a price." Solomon's marriage to the daughter of the Pharaoh of Egypt gave him close connection with the Egyptian court, and he therefore enjoyed opportunities for securing the best horses on the markets, Dr. Breasted points out.

### MODEL AIRPLANE AS WIND VANE HELPS FLYERS LAND

To show pilots which way the wind blows, a vane in the shape of a monoplane, twenty feet long and with a wing spread of twelve feet, has been mounted in a conspicuous place at the Oakland, Calif., airport. At night, it is lighted with neon lamps which can be seen at an altitude of 5,000 feet, flyers report.



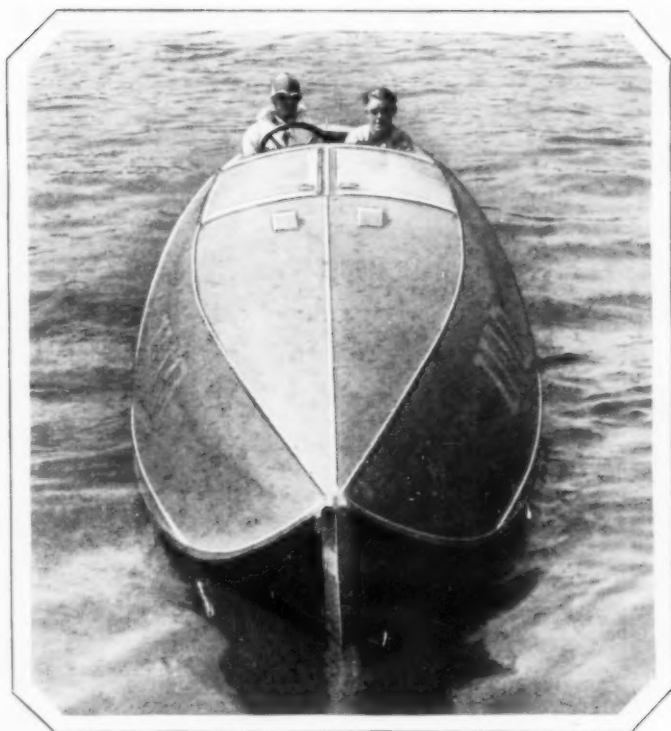
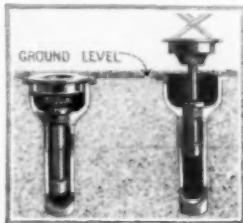
Dummy Airplane That Serves as Wind Vane; It Is Brilliantly Lighted at Night

## ALUMINUM PLATING ON METALS WILL SAVE MILLIONS

A process for plating aluminum on metal by electricity has at last been developed, Prof. D. B. Keyes of the University of Illinois announced recently to the American chemical society institute, and scientists are predicting that the discovery will prove beneficial in many lines of industry and will help in the saving of millions of dollars. Housewives, for instance, can now have aluminum-plated utensils with the strength of steel, but at a price cheaper than the pure aluminum, Professor Keyes pointed out. The plating can also be applied to machinery parts in the manufacture of fuel, in generating power in locomotives and in many other places. Professor Keyes said that the new plating process may have universal application to all metals. Among them he named boron, the hardest metal known, tungsten, which would greatly lengthen the life of electrical equipment, and titanium.

## SPRINKLERS ARE SET IN GROUND TO ELIMINATE HOSE

Watering the lawn is a simple task with the aid of a system of sprinklers set underground, and where the nozzles will not interfere with the lawn mower. Simply turning a valve sends a number of sprays into action, insuring a thorough watering without dragging the hose about. A special nozzle gives a whirling motion and falls back when the water is turned off.



Streamline Design of Fast Motorboat That Has Made Seventy-Five Miles an Hour and Is Expected to Exceed That Mark

## RACING MOTORBOAT SPEEDS SEVENTY MILES AN HOUR

During a recent test run, the "Miss Los Angeles," a sixteen-cylinder 750-horsepower motorboat made a dash at the rate of nearly seventy-five miles an hour in Long Beach harbor, California. This approaches the world's record for craft of this kind, the high mark, at the time the test was made, being slightly more than eighty miles an hour.

## WATER CURTAIN HIDES STAGE IN OUTDOOR THEATER

As a substitute for the usual curtain, an outdoor theater in Philadelphia has been using one of falling water, illuminated with colored lights. The water pours in a concealing sheet from an overhead pipe and falls into a trough at the bottom where it runs off. When the curtain is to be "poured" or "raised," all the operator has to do is to turn the valve of the water supply on or off.

# SECRET OF AFRICAN ANTS' WATER SUPPLY SOLVED



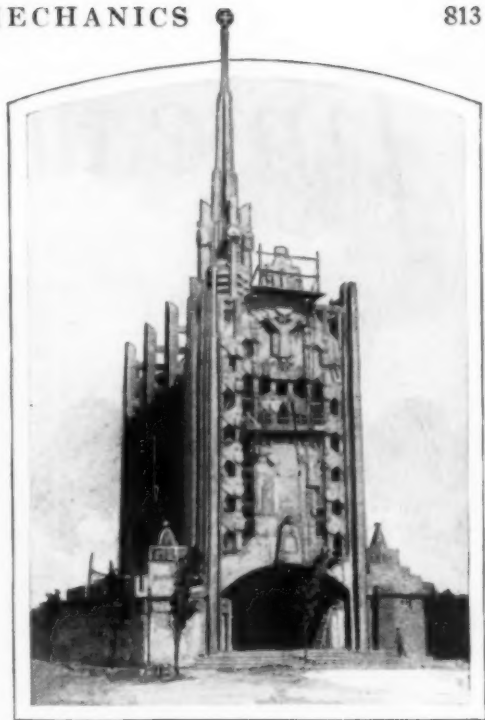


### SCIENCE DISCOVERS TERMITES DIG THEIR OWN WELLS

The mystery of how the termite ants of Africa keep up their water supply during years of drouth, a problem that has perplexed science since Dr. Livingstone first suggested the little insects must extract water from the atmosphere, has been solved by accident. Exploring a sixty-five foot dry well, a naturalist discovered a termite shaft which went on down to water some distance below. The ant nest, which is frequently built up for many feet above the plain, rose alongside the well. In digging the shaft, the workers had uncovered the ants' well. The ants had closed up the breaks, but by reopening them, the naturalist could watch continuous files of workers going down for water and coming back up. He colored occasional ones with dye, and found they averaged one-round trip every half an hour. The termites live mainly on fungus, and maintain fungus seed-beds far underground, near the water supply, bringing up fresh seed daily to replace that destroyed by heat in the nest gardens. The artist's sketch on the opposite page shows, at the left, the termite well in relation to the dug shaft, while the larger drawings at the right give a section of the nest.

### BOOK CONCEALED IN RING CONTAINS LONG POEM

So small that it can be carried under the setting of a ring, a tiny book contains the complete Rubaiyat of Omar Khayyam with pictures. While this is said to be one of the smallest books in the world, there are thousands of midget volumes in existence, and a collectors' society has been organized to gather and study them. During the war, the British government had half a million copies of the Koran printed in a size so small that Mohammedan soldiers could wear them over the breast as an amulet.



Where Modern Architectural Ideas Have Been Given Full Sway; the Church of New City near Paris

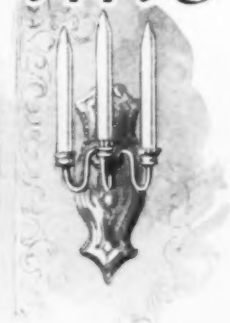
### LATE STYLES IN ARCHITECTURE FEATURE FRENCH CITY

Examples of modern architecture are seen in many places, but near Paris, the French are building an entire city to exemplify the latest ideas in ornament and design. Its church illustrates how radically the modern architect has departed from some of the older ideas. The main entrance is behind a single arch that spans almost the entire width of the structure. Figures used for decorations on the exterior are unusually large, and the steeple is a tapering "shaft of angles."

### CRYSTAL MINE YIELDS LENSES FOR ULTRAVIOLET RAYS

Cast aside during the gold rush of '49, large crystals taken from a California mine are now sought for the making of lenses and fused quartz for ultraviolet-ray instruments. Several years ago, a single crystal, weighing 2,200 pounds, was dug out of gravels, where, it is said, more than \$2,000,000 in gold was taken during the famous rush period. Many of the crystals weigh 100 pounds and more.

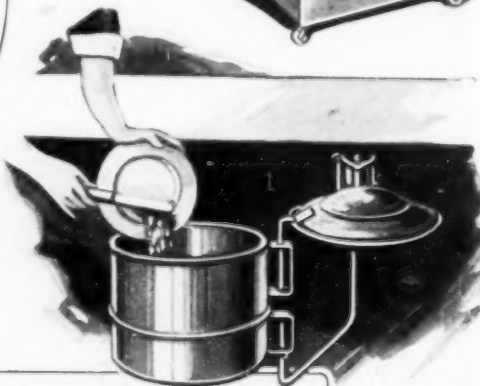
# Time and Money



Candle-Shaped Bulbs for Wall Brackets Glow with an Even, Mellow Light throughout Their Entire Length; They Are Made in Different Sizes and Colors and Produce Interesting Effects in Various Styles of Fixtures



Operated from a 110-Volt Lighting Socket, an Electric Ironing Outfit Folds Up into a Handy Table on Casters When Not in Use; It May Be Rolled under Kitchen Sink or Table When It Is Collapsed



Long Handle for the Scrubbing Brush Saves Getting Down on the Knees, and Brush Clamps On with Setscrew That Permits Quick Renewal; at Right, Sanitary Container for Scrapings Swung under Table

# Saving Things for your Home



To Hold It in Position, This Hot-Water Bag Has Vacuum Cups That Keep the Bottle on the Body without the Use of Straps or Ties

For the Convenience of the Reader, This Combination Book Holder and Lamp Protects the Eyes, Is Adjustable to Many Positions and Leaves the Hands Free; Especially Useful When One Wishes to Read While Reclining



Vacuum Attachment to This Carpet Sweeper Makes It Work More Thoroughly, Eliminates Dust and Helps Keep the Brushes Clean



Handy Table with Concealed Ironing Board Saves Time and Space; It Has Porcelain Top, Drop Leaf and a Drawer

Completing the Model of the Cathedral of Ulm; Carver Fashioned the Replica in Wood with a Jackknife and a Few Other Tools



### NINE-FOOT CATHEDRAL MODEL CARVED WITH JACKKNIFE

Using a jackknife as his only carving tool, a Los Angeles craftsman has completed an accurate model of the cathedral of Ulm. It is nine feet high, eight feet long and more than three feet wide. The small wooden pieces were put together after being carved separate. About two years were devoted to the work.

### SCIENCE TO WEIGH HEADACHES FOR BETTER VENTILATION

In connection with tests being made on different methods of heating and ventilating, experts are seeking a way whereby a reliable measure can be taken as to the severity of headaches. These troubles occur in stuffy, poorly ventilated rooms. Persons complain that the headaches become worse or better, as the case may be, but so far, science has devised no way of actually measuring the pain. If this effect on the human system could be more accurately gauged than the sufferer's opinion of it allows, engineers might be able to regulate ventilating conditions more efficiently, it is believed. "We want a comfort measure or discomfort indicator of

some sort," said Prof. J. E. Emswiler, of the University of Michigan, who has been conducting some of the tests. "We want to go behind what the subjects say. We must discount their temperament and substitute the findings of an instrument as a basis for a statistical headache report." The relation between stagnant air and discomfort was established by a series of experiments in 1902. Persons became nervous and developed headaches when shut up in rooms where there was no air stirring. When circulation was resumed, the unpleasant effects disappeared shortly, although the temperature of the rooms was unchanged. By these, and other experiments, engineers have proved that an essential requirement of adequate ventilation and heating for health is to have the air in motion.

### CLIPPER TO CUT TALL WEEDS IMPROVES LAWN

Weeds that spring up rapidly and mar the looks of the lawn between regular mowings are easily cut down with a special clipper now on the market. It is not meant to replace the mower, but to do work that the usual cutter will not do, topping the taller growth and snipping off long stems that the mower passes over.

Clipper That Cuts Wide Swath and Mows the Taller Grasses and Weeds, Difficult to Reach with the Regular Lawn Mower



## NEW GEYSER IN YELLOWSTONE SPURTS HUNDRED FEET

Eclipsing all other known geysers as to violence and size, a huge volume of hot water and steam broke out in Yellowstone national park recently, and because of its regularity of eruption and its spectacular performance, it bids fair to become one of the chief points of interest in the park. It reaches an average height of sixty to seventy-five feet with occasional spurts to 100 feet, and rises from a great crater, elliptical in shape, 100 by 120 feet in its two diameters, and eight feet deep. The eruptions last three hours or more, coming in intervals of fifteen or twenty seconds. Two of these long eruptive periods are staged every twenty-four hours. The volume of water ejected is enormous. The end of a "play" comes as suddenly as the beginning and the last of the violent steam explosions seem as energetic as the first.

## INDIANS USED SLATE AS MIRROR RARE RELICS SHOW

Although they knew nothing of glass making, some of the Tsimshian Indians who lived on the extreme west coast of British Columbia and in the valleys of the Nass and Skeena rivers, enjoyed a crude form of mirror when they wished to make their toilets. These articles were fashioned from a dark-gray slate and only eleven specimens of them are known to exist. Evidently women of the higher families wore them around their necks from cords of twisted fiber or strips of bark, and the slate was made to reflect an image by wetting it or covering it with a thin coat of oil or grease. Some of the mirrors had two polished sides, but most were smoothed on the face only and the back carved with simple conventional designs.



It Served the Indians, but Would Hardly Suit a Modern Miss; Slate Mirror Used by Tsimshian Women

## HUNDRED-FOOT ARROW ON ROOF GUIDES AIRPLANES

So that aviators may find their way to Lowry field, in Denver, Colo., Van Schaack & Co. have erected a huge wooden arrow on top of a downtown roof. It is sixteen



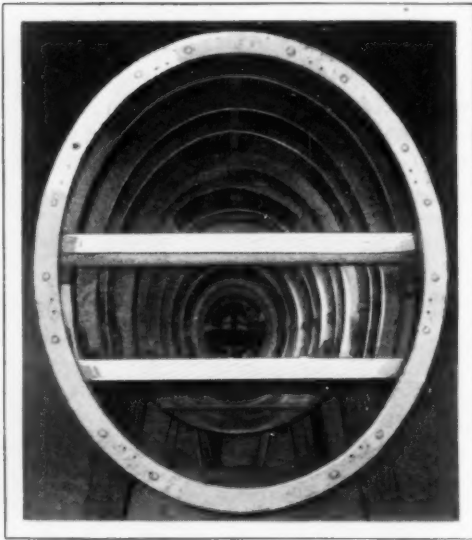
To Point Airplanes to Landing Field; Arrow on Roof of Denver Store Is Visible at Altitude of 5,000 Feet

feet wide and 100 feet long, painted white and visible at an altitude of 5,000 feet.

## PHONOGRAPH RECORD FOLDS UP IN CIGARET CASE

Phonograph records that can be burned, jumped on or folded up in a cigaret case without injuring their playing qualities have appeared in England. They are of filmlike thickness, but so durable that the needle can be drawn across them without ill effects, it is said. According to one report, a record was played repeatedly for twenty-six hours and was still good.





Looking into the Fuselage Framework of the Airplane Constructed for Wilkins' Proposed South Pole Flight

### PLANE FOR SOUTH POLE FLIGHT MODELED AFTER "BLIMP"

A special airplane is being constructed for Sir George Hubert Wilkins' proposed flight over the south pole next summer and one of its chief characteristics is the development of the streamline effect to decrease wind resistance. The fuselage is patterned after the body of a dirigible, being of a tapered cigarlike shape.

### TELEGRAMS SENT IN CHINESE WITH RAISED LETTERS

For the first time in history, Chinese writing is being sent by telegraph. Service was recently started between Peiping and Mukden with the system operating successfully. It is a form of picture tele-

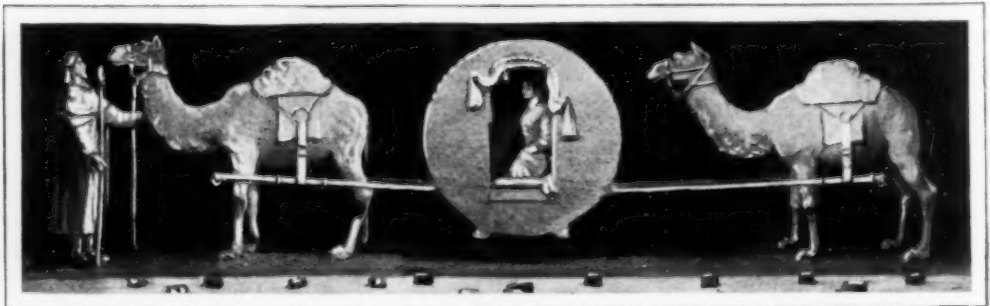
graphy. The messages are written with a thick ink which, when it dries, leaves the characters in relief. The message is then relayed through a special transmitter to a receiver where a photographic reproduction of the writing is made. Before this method was devised, telegrams were sent in Chinese with the aid of a numerical code which had to be deciphered and the right characters substituted for the numbers sent by wire.

### MYSTERY OF BROKEN GOBLETS TRACED TO VIOLIN

One after another, four choice crystal goblets in the home of Zlato Balokovic developed long, disfiguring cracks although no one touched them. The mystery was finally explained by the vibrations of the musician's violin on which he practiced in a near-by room. The impulses set up sympathetic vibrations in the glasses and, being too fragile to withstand the strain, they cracked. The phenomenon has been known for some time, but scientists expressed surprise that the violin tones should cause the effect at such a distance from the instrument. Caruso could break goblets by singing a certain tone that would cause them to shatter under the vibrations set up in the glass.

### CIRCUS DISPLAY IN BUTTER SHOWS MOLDER'S SKILL

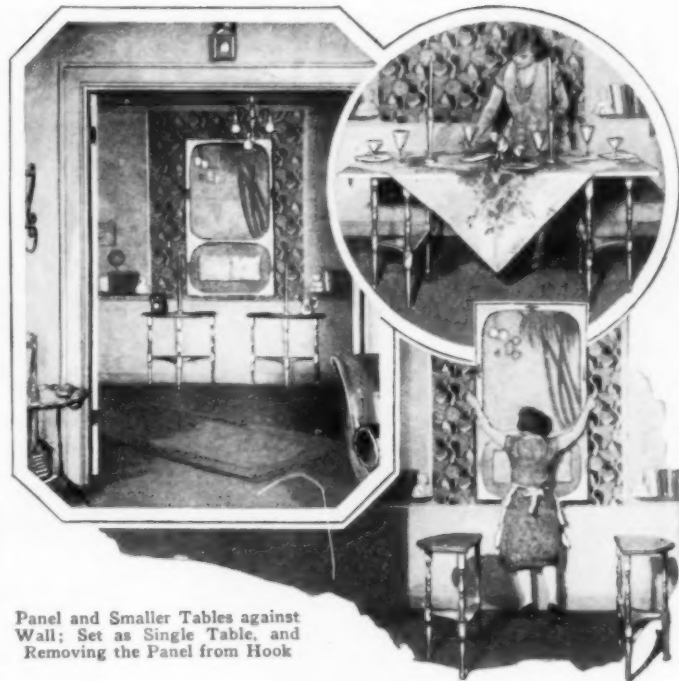
An almost life-size reproduction of a circus camel palanquin in butter was an interesting exhibit at a recent Florida fair. The butter was molded upon forms of wood which were built from sketches of the original display.



A Bit of the Circus in Butter; Realistic Model Prepared from Camel Group and Exhibited at Florida Fair; in the Foreground Are Pound-Packages to Show Comparative Size

## ELEPHANT WRECKS RAILWAY IN INDIA

How a solitary "rogue" elephant wrecked part of new railroad line constructed to a mine in Mysore, India, was told recently by an engineer who had returned from the jungles. The line was being built through dense wilderness where animals were numerous. Natives reported that a solitary elephant was lurking about but none of the construction crew encountered it. One night after the workers had gone back to their camp, the elephant strode out of the jungle and started down the newly built right of way. Ties were ripped up, rails bent and twisted and other equipment destroyed. When the builders arrived the next morning, they found a wreck like that left by a tornado, they reported. Operations were not halted, however; the damage was repaired, and the railroad was finally completed.



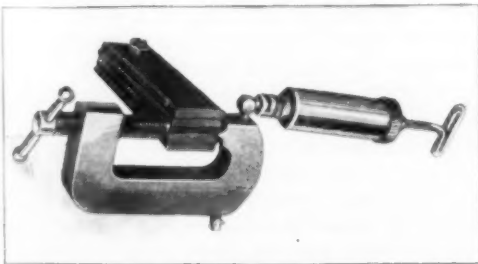
Panel and Smaller Tables against Wall; Set as Single Table, and Removing the Panel from Hook

## TABLE THAT HANGS ON WALL SERVES AS PICTURE PANEL

To save space in small rooms and apartments, a combination table top and decorative panel has been introduced. It is made of plywood, ornamented to form an attractive wall piece, and is hung from a concealed hook when not in use as a table. Small handles on the sides afford a convenient grip when the panel is to be taken down and placed with the decorated side down, upon two smaller end tables. In this position, there is ample space for six persons. The panel and two smaller tables form an attractive group for the room. The change from wall panel to large table may be made in a few seconds, and the plywood board can be decorated in a wide variety of designs. The accompanying illustrations show one ornamented with a special clay composition which does not chip or mar and forms an attractive frame for a gaily colored picture.

☐ We want all our readers to write us freely and often whenever they wish additional information on articles published in this magazine. Address Bureau of Information, Popular Mechanics, Chicago.

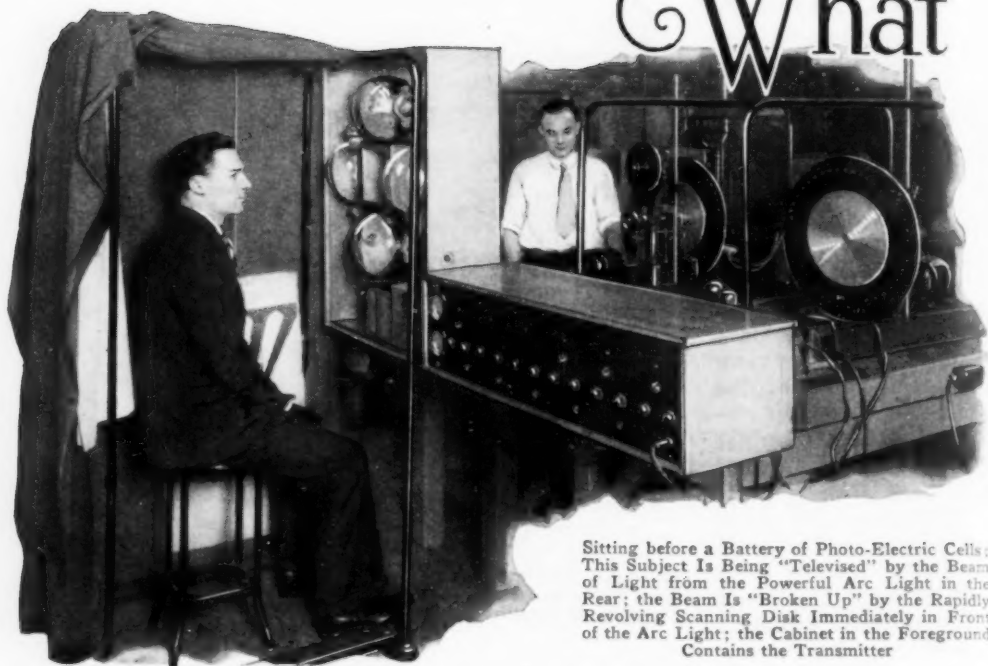
## AUTO-SPRING GREASING VISE SAVES TIME AND WORK



Auto Spring-Greasing Clamp in Position, Showing How It Pries the Leaves Apart

Automobile springs are given a thorough greasing in one operation, with a viselike apparatus introduced by a western inventor. It has small wedges that force the leaves of the spring apart and these are drilled to permit the flow of grease, forced from cups on the body of the clamp part of the vise.

# What



Sitting before a Battery of Photo-Electric Cells; This Subject Is Being "Televised" by the Beam of Light from the Powerful Arc Light in the Rear; the Beam Is "Broken Up" by the Rapidly Revolving Scanning Disk Immediately in Front of the Arc Light; the Cabinet in the Foreground Contains the Transmitter

**W**HEN will radio television and radio movies be available to the average radio fan for home reception?

That question, asked by untold millions, has provoked more and a wider variety of answers than has been evoked by any single phase of the radio industry's development.

Dr. Lee De Forest, inventor of the radio tube, says, "this development may be a matter of ten years or more."

Dr. C. Francis Jenkins, famous movie and television inventor, says "radiovisor receivers will be available for Christmas presents this year," and, "we expect to be broadcasting baseball and like entertainment by this time next summer."

David Sarnoff, vice-president and general manager of the Radio Corporation of America, estimates four or five years are yet needed for perfection.

H. P. Davis, vice-president of the Westinghouse Electric and Manufacturing company, declares, "anything so far demonstrated in television in my opinion would be premature if offered to the public as a service."

And the manufacturers of television kits say television has already arrived.

There are five different views, ranging from right now up to ten years—and probably every one of them is absolutely correct—a paradox that arises not through disagreement, but through different interpretations.

Messrs. Sarnoff, De Forest and Davis see television as something that should not be offered to the public until it is as complete, as simple, as perfect and as fool-proof as radio broadcasting is today—after years of experimental development.

Dr. Jenkins and the various manufacturers of television kits and parts believe there is a host of radio fans who got a lot of joy out of tinkering with crystal sets, coherers, fancy home-wound coils, and all the other accessories on which radio was raised from a pup, and who will get equal, if not greater, pleasure through a vicarious association with the development of television.

Anybody with an average acquaintance with the insides of a radio set, with fair mechanical ability, and \$45 to invest, can buy one manufacturer's kit, including an electric motor, scanning disk, neon lamp and other parts, fit a television receiver together, hook on some batteries

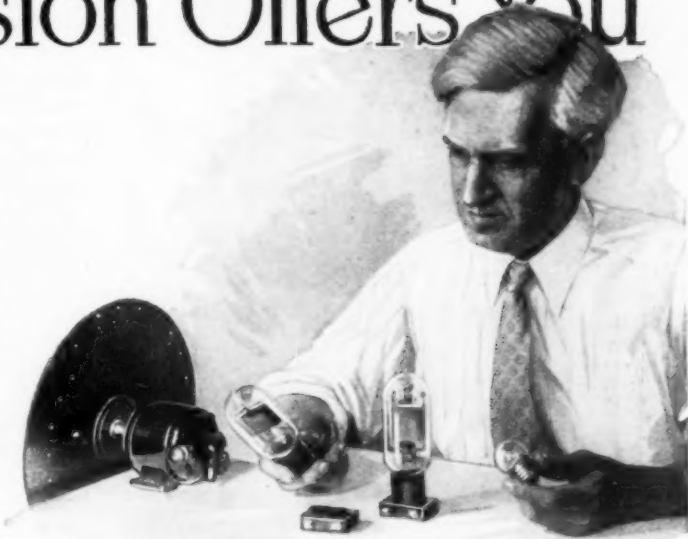
# Television Offers You

and his existing radio receiver, insert a few tubes and start receiving pictures.

They may be, in the words of Dr. De Forest, "small, poorly illuminated, coarse-grained, unclear silhouette and half-tone effects." But they will be pictures, either mirrored images direct from life, if you tune in on some stations, or radio movies, if you are in range of others. They will be pictures, and they will come through the air to you, and if you got a thrill a few years ago out of a jumble of DX-squeals, there is a bigger thrill in seeing an image in the frame of a homemade television receiver.

It is true that the image may be a tiny, black silhouette, about as clear and exciting as watching the fat gentleman across the street doing his setting-up exercises in a lighted room behind a drawn blind—in other words, it's a shadow picture, but it does move and live. Or it may be a rather sketchy half-tone effect requiring considerable exercise of the imagination to smooth out the blobs of dark and light into a mental picture of the face. But the first photographs transmitted by wire and radio were not perfect, either.

The companies that see millions in television as a regularly established commercial product are not interested, naturally, in the fan who wants to tinker with a homemade piece of apparatus. When they do go on the market, it will be with complete outfits in fine cabinets—press a button, turn a dial and the set does the rest. Popular Mechanics asked seven men who have been intimately associated with television and broadcasting for their opinions. Those seven included four who have been active in developing television and radio movies, one famous radio engi-

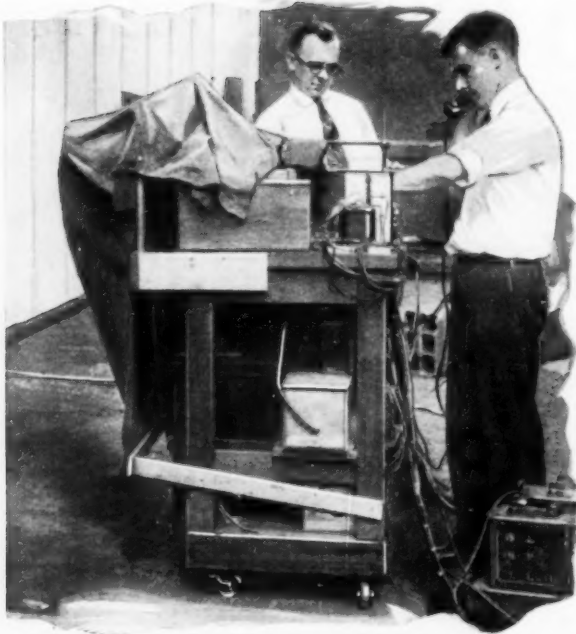


Some of the Apparatus Now Available to the Amateur; Scanning Disks, Special Motors, Photo-Electric Cells and Neon Lamps Are All on the Market

neer, and two who are leaders in radio manufacture and broadcasting. The four inventors of television and radio movies are Dr. Herbert E. Ives, who perfected the apparatus demonstrated by the Bell Telephone laboratories; Dr. E. F. Alexanderson, inventor of the General Electric company's television set; H. P. Davis, vice-president of the Westinghouse company and interested in the radio-movie outfit created in their laboratories; and Dr. C. Francis Jenkins, of Washington. The other three were David Sarnoff, of the Radio Corporation of America; Merlin Hall Aylesworth, president of the National Broadcasting company, and Dr. De Forest, the inventor of the radio tube.

From their replies listen to the following extracts. H. P. Davis of Westinghouse is speaking:

"Both television and radio movies are accomplished facts in electrical engineering laboratories, and, so far as laboratory research is concerned, there are no fundamental principles involved which today have not been solved. However, before these developments leave our laboratories and are offered the public in the manner in which radio broadcasting now offers public service or as adjuncts to broadcast



This Apparatus Transmits, by Means of Recently Developed Photo-Electric Cells, Pictures "Taken" in Daylight

programs, a considerable period will ensue, during which various elements entering into television and radio movies must be perfected and co-ordinated.

"Leading scientists and engineers all over the world are now working on the problem. There is an overwhelming public interest in its solution. Thus we have a supply of engineering talent and a public demand which should hasten practical development. I do not hesitate to state that the day is coming when television and radio movies will be at the service of the radio public.

"Since radio broadcasting is on such a high plane, serving a public which expects only the best from those organizations involved, I cannot believe that, in good faith, we should offer anything which, as yet, is in an experimental condition. It is my belief that the development period in television should be passed in the laboratories and that, when it is offered to the public, it should be a finished product. Anything so far demonstrated in television in my opinion would be premature if offered to the public as a service."

Now for the views of Francis Jenkins, an inventor himself and one who believes in letting all the amateur inventors in:

"Radio movies on forty-six meters are broadcast Monday, Wednesday and Friday evenings from our station and regularly received in many homes already. Our transmitters will soon be attached to stations now broadcasting music and radiovisor receivers will be available for Christmas presents this year. From this beginning the art will grow rapidly. We expect to be broadcasting baseball and like entertainment by this time next summer."

Lee De Forest has frequently voiced warnings against being overoptimistic about television, repeatedly pointing out that, when it comes, it will always be better over telephone wires, because free from static interferences. He repeats them now:

"Satisfactory television in the home is a very long way off. For the next few years radio fans will, however, derive much interest and

amusement from receiving small, poorly illuminated, coarse-grained, unclear silhouette and half-tone effects. All this talk about motion pictures by radio in the home and color by television, etc., as being just around the corner is the veriest bunk, and, in the interest of fact, common sense and on behalf of theater owners and sincere purveyors of motion-picture entertainment, some of whom are actually panicky concerning the future, such pipe dreams should be conscientiously discouraged.

"Real television will some time arrive, but will always be much more satisfactory over the wire than by radio. I consider this development may be a matter of ten years or even more."

Dr. De Forest's opinion on the effect of radio movies on the present motion-picture industry raises an interesting point. Harry M. Warner, president of Warner Brothers Pictures, Inc., first to produce satisfactory talking movies when he brought out the Vitaphone process, and Carl Laemmle, of Universal Pictures, who is going in for talkies on a large scale, were asked their opinions. Says Mr. Warner:

"Dr. De Forest is absolutely correct in



his statement that theater owners have nothing to fear from television. Television will no doubt be an advancement in transmitting photography, but to affect an industry which supplies entertainment is out of the question. On the contrary, should this invention be successful, it will be the greatest help to places of entertainment by stimulating interest direct in the home."

Mr. Laemmle is equally emphatic in his views, for, he says, "in the twenty-two years I have devoted to motion pictures I have never seen the time when science and invention damaged the industry. On the other hand, I have seen the business elevated to an art largely through the help of inventive genius. Therefore, whether television and radio movies are years away or just around the corner, I predict that, when they do come, they will prove a blessing and not a curse, and I sincerely urge those who may be panicky to remember that progress cannot possibly harm them. The very thought that these new wonders may at some time be perfected gives me a thrill of pride and greater confidence in the moving-picture industry."

So much for the great argument about the location of the corner which television must turn to enter the public's street. But what is the situation today?

Francis Jenkins, as he has stated, is broadcasting radio movies three times a week from his station in Washington on a wavelength of forty-six meters. He uses a system of forty-eight lines to a picture—

more will be said about that a little later.

The General Electric station at Schenectady, N. Y.—WGY—is broadcasting television images of twenty-four lines to the picture on several days each week.

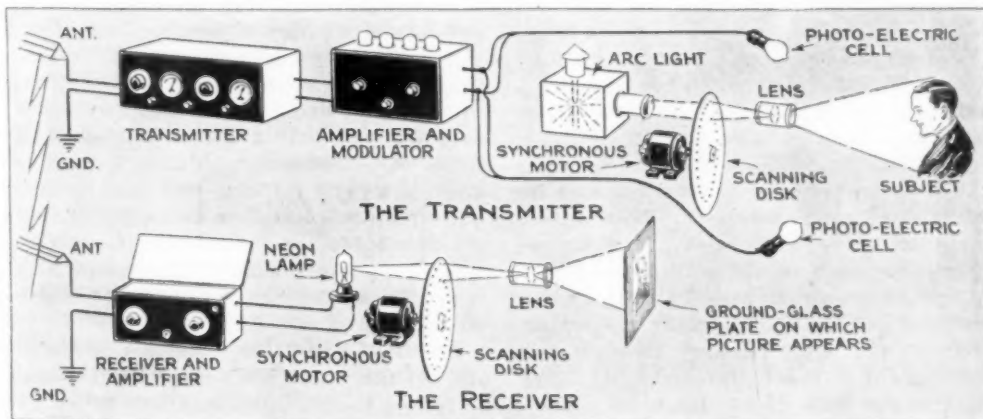
In New York city WRNY is broadcasting television on a system employing thirty-six lines to the picture.

Before this article can appear in type, it is probable that several other broadcasters will be on the air.

Each broadcaster so far, regardless of the number of lines to the picture, is producing pictures one and one-half inches square. If you look directly into the picture frame in front of the revolving scanner disk, that is the size image you see. Obviously the amount of action and detail that can be crowded into a picture only an inch and a half square is limited. One human figure, or at most two, may be produced with fair results, but to attempt to crowd a baseball diamond, a prize-fight ring, or a political convention into that space would mean complete loss of detail.

Jenkins has improved on other systems by installing a large magnifying glass in front of the picture frame, giving the illusion of a picture some four inches square. Enlargement beyond that size, at least by any means known today, is impossible.

The reason lies in the scanner disk and the number of "lines" employed by it in transmitting the scene. The great difference between ordinary radio broadcast of music or voice and the broadcast of television is that the first is a one-dimensional, straight-line affair, and the second



This Diagram Shows, in the Simplest Form, How the Light Waves from the Subject Are Transmitted by Radio and Converted Back into a Picture at the Receiver

is two-dimensional, having both width and length. The music is a series of successive signals, transmitted one after the other. The picture must be a complete square.

No one has ever found a means of transmitting an entire picture as an entity. Instead an optical illusion is utilized, the same optical illusion which makes the movies possible. It is called the retentivity of vision. When the eye sees a thing and telegraphs the intelligence to the brain, the image lingers for a fraction of a second. Because of this lingering, if approximately sixteen pictures are shown the eye each second, and each picture is slightly different from its predecessor, the eye is fooled with an illusion of movement.

In television the radio engineer goes farther than that. He cuts each picture up into a number of sections, transmits each section through the air as a straight-line radio signal, and then pieces the sections together before the eye so rapidly that the images of all linger as one picture.

The cutting process is done with a scanner, a large metal disk, revolving at high speed and containing a series of holes, arranged in a spiral. In all disks so far used, the distance between the outer hole of the spiral and the inner hole is one and a half inches, and the result is a picture one and a half inches square.

The number of holes that can be used and the number of pictures which can be transmitted each second—in other words, the speed at which the disk can be revolved, for each revolution transmits one complete picture—depend entirely on the sensitivity of the photo-electric cell, which receives the light passing through the holes in the disk and transforms its varying strength into electric impulses of corresponding intensity.

Photo-electric cells are improving rap-

idly. Hardly a year ago the best cells would not respond rapidly enough for a disk of more than twenty-four lines. A better cell made the thirty-six-hole disk possible; still better brought the forty-eight-hole disk, and lately the Westinghouse company has demonstrated radio-movies using sixty lines to the picture.

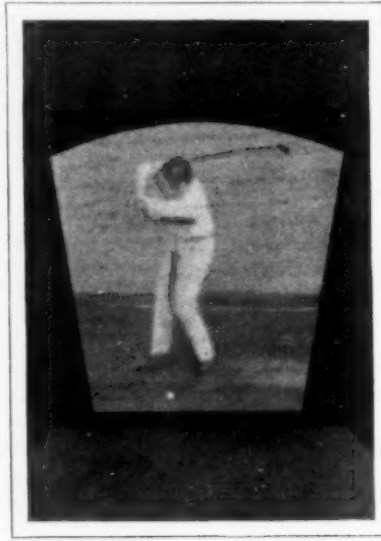
What does such a picture look like? The average newspaper half-tone illustration has sixty-five lines to the inch; in other words, sixty-five dots each way in its screen. That rating is to the inch, and all television images to date have been an inch and a half square, so the best transmission yet, with sixty lines, has been spread over an area fifty per cent greater each way than the newspaper illustration.

The illustrations in Popular Mechanics have 110 lines to the inch, against forty to the inch for the best television experiment, with the new Westinghouse apparatus. Engravings for reproduction on fine calendered paper may be made with 120 lines, 133 or even 150 lines to the inch. From these

figures it is easy to estimate the relative clearness of a television image.

Remember that each television picture consists of a series of lines—twenty-four, thirty-six, forty-eight or sixty, as the case may be. Put an enlarging glass in front of the image and you get the same result as when you hold a magnifying glass in front of a newspaper illustration. Enlarge it a little bit, and you see the dots quite plainly. Keep on enlarging it, and the dots spread so far apart they cease to form a picture. That's the reason why television, as yet, can't be thrown life-size on a screen, like movies.

Scientists expect to solve this problem, and all the other problems of television. The experimenter who wants to get in on the fun can buy a kit and build a set, but finished television, has not yet arrived.



The Above Illustration Shows the Exact Size of the Received Image with Approximately the Same Color and Definition

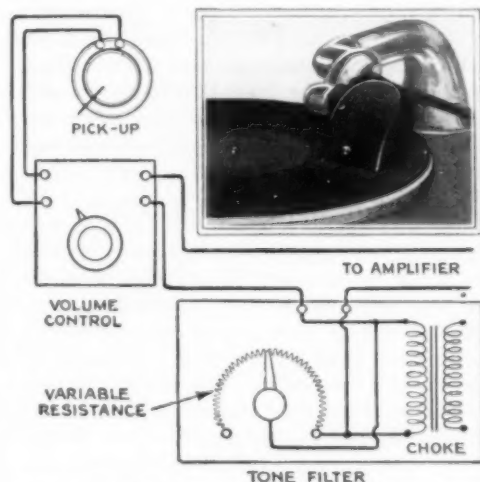


### Tone Filter for Magnetic Pick-Up That Anyone Can Arrange

The magnetic phonograph reproducer offers the radio owner an opportunity to listen to music perfectly, through the radio amplifier and loud speaker. All that is necessary, having the radio set and speaker, is some form of phonograph turntable and the magnetic reproducer or pick-up, which rides the record instead of the old reproducer. The pick-up is connected with the a.f. amplifier in the radio set by means of an adapter placed in the detector socket. Such a unit usually includes a volume-control resistance, and sometimes a "scratch filter" to eliminate the needle noise. The magnetic pick-up changes the vibrations of the record into electrical impulses, corresponding to the sound waves ordinarily reproduced. It is a simple matter to play tricks with these impulses, one of which uses the tone filter illustrated in the diagram.

This simple filter permits the operator to obtain any desired balance between the bass and high notes; the unit may be assembled in a small box and placed where it can be changed at will. The choke coil consists of the primary winding of an old a.f. transformer. The secondary of the transformer is not used and the ends are left open. Any type of a.f. transformer may be employed. An 0 to 200,000-ohm variable resistance is connected across the primary winding as shown in the diagram. The choke acts as a retard coil for the a.f.

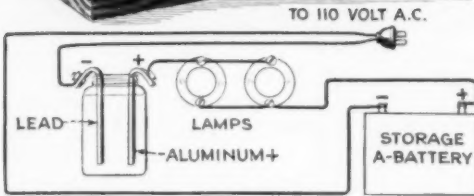
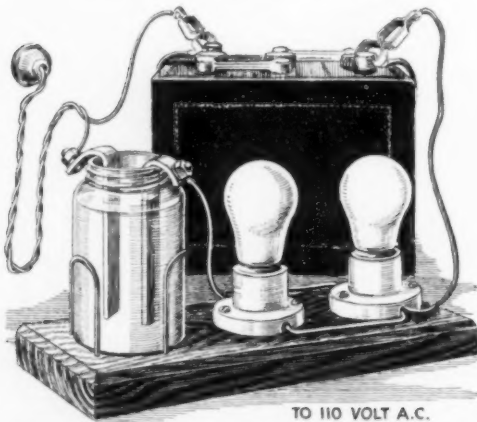
currents passing through the unit. With the maximum resistance in, this tone filter will offer an impedance at 5,000 cycles—a very high note—or about fifty times more than at 100 cycles—a very low note. Thus, with this resistance, the bass parts of a record will be much more prominent than the high notes. With only half the resistance in, the bass notes are still favored, and when entirely out, the music is reproduced faithfully without favoring either bass or treble. As the resistance is increased the volume must also be increased by means of the control for the



Magnetic Pick-Up Mounted on Phonograph Tonearm; Connections for Volume Control, and Filter

latter feature.—H. R. Rawson, chief engineer, Station WOS, Jefferson City, Mo.

Homemade Trickle Charger



Completed Trickle Charger Mounted on Wood Base, and Wiring Diagram Showing Connections

All that is necessary to make an efficient trickle charger for your storage A-battery, is a plain fruit jar, a strip of aluminum, a strip of lead, a socket or two for ordinary electric lights and a little borax and water. Take a piece of aluminum, as pure as you can get it, drill a hole through one end in which mount a battery binding post or a brass machine screw and nut. Bend the aluminum strip over so that it will hang on the edge of the jar. Do the same with the lead strip, hanging it on the other side of the jar so that the two strips will not make direct contact with each other. These two strips should be about 1 in. wide, and any thickness between  $\frac{1}{8}$  and  $\frac{1}{4}$  in. The aluminum strip is the positive electrode and should be connected to the positive terminal of the storage A-battery through a pair of ordinary electric lamps, connected as shown in the diagram and sketch. The negative terminal of the battery is connected to the other side of the 110-volt a.c. lighting circuit. This device will not work on d.c. lines; therefore be sure to check the type of current you are using before attempting to build the device. The pint or quart fruit jar should be filled with a saturated solution of borax and water, the two strips placed in

position and the connections made to the battery and the lighting circuit. Adding more lamps or lamps of higher wattage will increase the current flow and cause the battery to charge at a faster rate. However, if this rate is too fast, the solution will heat and crack the jar, or cause sparking. A charger of this type will not be suitable for a battery that is completely discharged, but will keep the battery up if used continuously when the set is not in operation.—W. F. Crosby, engineer, Wireless Radio Corporation, Brooklyn, New York.

Amplifier for Crystal Set

Crystal reception on a loud speaker without distortion appeals to the home experimenter and a number of sets of this type are now in use in this locality. The diagram shows a simple circuit that costs very little to operate and will work a speaker on stations several hundred miles away if a long outside antenna is used. For locals, a short aerial will do, but the longer the aerial, the better the volume and distance. A diamond-weave variocoupler with seven taps, a variable condenser provided with a vernier dial and fixed condensers of the mica type are used. Make all leads as short as possible and use two a.f. transformers of either three-to-one or three-and-one-half-to-one ratio.

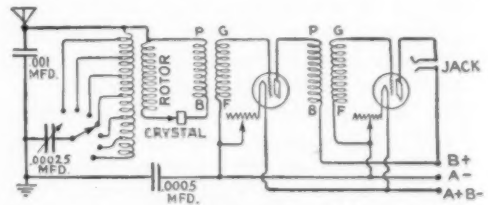


Diagram Showing a Simple Method of Amplifying the Crystal Detector

Two 45-volt B-batteries supply the necessary plate voltage and the connected series, according to whether 201A or 190 tubes are used. The 201A tubes will give the greater volume, and are preferable.—Collins Pentz, designing engineer, Minneapolis, Minn.

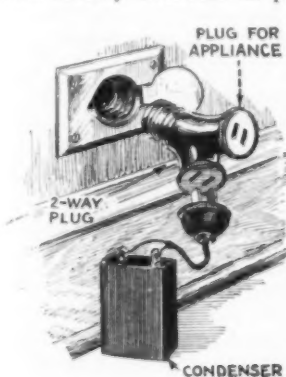
When operating receivers of the regenerative type, the detector tube may be kept below the spilling-over point by turning back the filament rheostat.

### Hints for Set Builders

Annoying situations frequently crop up to try the patience of the amateur builder of a radio receiver. The following hints may help those of little experience. One common annoyance is the dropping of a nut or screw in some awkward place where it cannot be reached with the fingers or pliers. A simple way to recover the part is to place a strip of tape over the end of a screwdriver and press it against the nut or screw. This will make it stick to the tape and it can easily be removed. The same idea may be applied to starting small bolts, screws or nuts in difficult positions. Never use a metal tool, such as a screwdriver, in a set unless the tubes and batteries have been removed. If a repair must be made after the set is installed, use a wood spudger or insulate the shaft of the screwdriver with tape or rubber tubing so as to prevent short circuits. Frequently a builder will discover that he has not a drill of the right size for the work in hand; in cases of this kind, a tapered reamer is an excellent substitute. Long round-hole lugs may be bent together to form short soldered connections where wired connections are difficult. Always complete all wiring possible on the sub-panel before screwing on the front. This will greatly speed up the assembly.—E. H. Sieg, service engineer, Red Wing, Minn.

### Reducing Line Interference

Electrically operated household devices are an increasing source of radio interference. The simplest method of reducing or eliminating this is shown in the sketch and merely consists in placing a suitable

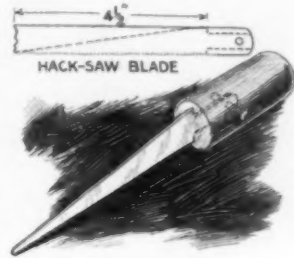


condenser across the 110-volt line from which the appliance takes its current. It is, of course, necessary to use a heavy-duty filter condenser of either 2 or 4-mfd. capacity. Noises caused

by small motors may also be corrected in this manner. The condenser is wired to an ordinary plug for insertion in a two-way socket as shown, making a handy arrangement that may be moved from one appliance to another.—E. S. Capron, consulting engineer, Buffalo, N. Y.

### Homemade Panel Saw

Cutting holes in radio panels is a rather difficult task unless special cutter and tools are used. For large round or irregular holes for meters, bezels, drum dials or similar apparatus the small saw shown will do very well. A hacksaw blade



is cut down to the shape indicated by grinding on an emery wheel. The blade may be made of any size, but one 4 1/2 in. long is about right. A small hole is drilled in the blade at the wide end, a piece of dowel being used for a handle. A screw or rivet is driven through the handle and filed flush with it. To cut a large hole, first scribe the outline with a pointed tool, then drill a series of 1/4-in. holes around the inside of the circle; the solid portions between the small holes are then cut away with the saw and the rough places around the inner edge of the large hole smoothed off.—Herman R. Wallin, commercial operator, Brooklyn, N. Y.

### Repairing By-Pass Condensers

The service man frequently encounters by-pass condensers that cannot be replaced without considerable trouble or loss of time. In such cases, disconnect the condenser from the set and connect it across the 110-volt a.c. line for a second or two, after first making sure that there are fuses in the line. Nine condensers out of ten, burned open in this manner, will stand up indefinitely on battery voltages of 135 volts or less; the idea is not practical, however, if much higher plate voltages are used.—Chas. Middleton, chief engineer, Station WRAF, La Porte, Ind.





## PART II

**T**HE BOX consists of a framework sheathed on the ends and top with  $\frac{1}{4}$ -in. three-ply figured walnut. (See Fig. 5.) Build each end of three stiles and two rails halved together, made from 1 by 2-in. pine. When the glue is dry, rabbet the front stiles  $\frac{1}{4}$  by  $\frac{1}{4}$  in., and smooth the joints.

The bottom is preferably made from  $\frac{3}{4}$ -in. five-ply pine, but two widths of 1 by 10-in. solid stock, doweled together, may be used. It is dimensioned in Fig. 8. Assemble with the ends, bracing them at right angles with diagonal strips tacked on the edges. Reinforce the joints with two  $\frac{3}{8}$ -in. dowels in the back stiles and one in the middle and front.

Cut a back upper rail from 1 by 2-in.

pine, getting the length from the bottom between the stiles. Size the ends with glue so that they can dry while the front stile is being made. The latter is of walnut, dimensioned in Fig. 5.

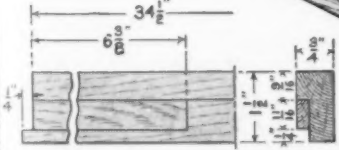
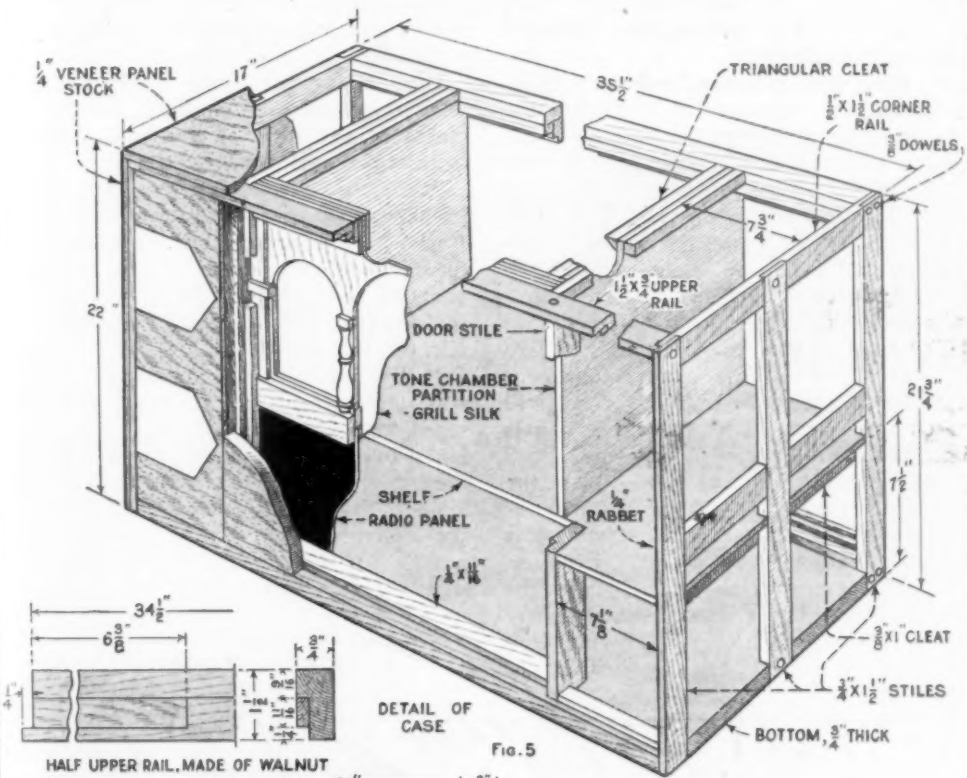
Glue the back rail in place, laying a clamp lengthwise to hold it while a couple of dowel holes are bored in the corners. In the same way place the front rail, putting one dowel into the thick part.

Two walnut door stiles are cut from rough stock to sizes given in Fig. 5, rabbeted  $\frac{1}{4}$  by  $\frac{13}{16}$  in. on one side and  $\frac{1}{4}$  by  $\frac{1}{4}$  in. on the other, and notched on the upper ends, to fit around the upper rail. Size the ends.

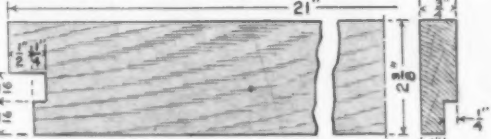
The shelf, of three-ply pine, is dimensioned in Fig. 5. The ends are marked by contact with the box end stiles and are notched around them. The front edges of the ends are flush with the  $\frac{1}{4}$ -in. rabbets, but the front edge of the shelf is notched back  $2\frac{3}{8}$  in. farther for the center section, terminating  $7\frac{1}{8}$  in. from the ends.

Force the shelf into place with the underside  $7\frac{1}{2}$  in. above the box bottom. Support the ends with  $\frac{3}{8}$  by 1-in. cleats, glued and brass-screwed to the box stiles. A couple of screws through the shelf into each cleat will suffice to hold it in place.

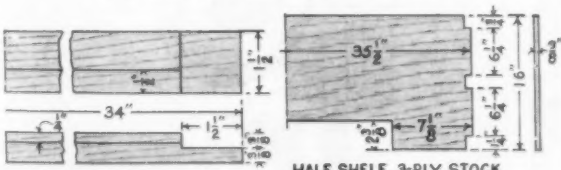
Joint the door-stile edges to allow for the end panel veneer to be glued in front. Set them with the inner rabbets  $7\frac{1}{8}$  in. from the corner-stile rabbets. Put a dowel into each end. Glue a shelf-support cleat to the back edge of each stile, a stop strip



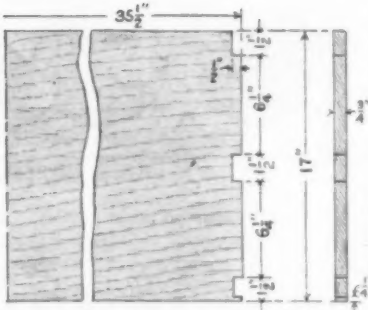
HALF UPPER RAIL, MADE OF WALNUT



DOOR STILE, OF WALNUT, ONE PAIR REQ.

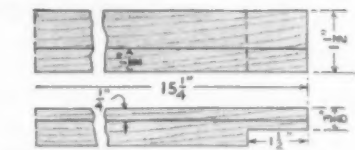


HALF SHELF, 3-PLY STOCK



HALF BOTTOM, MADE OF 5-PLY STOCK

HALF BACK-PANEL RAIL, 2 REQ.



HALF BACK-PANEL STILE, 2 REQUIRED



along the bottom, flush with the rabbets in the panel spaces, and a walnut stop,  $\frac{1}{4}$  by  $1\frac{1}{16}$  in., to the bottom, flush with the backs of the rabbets.

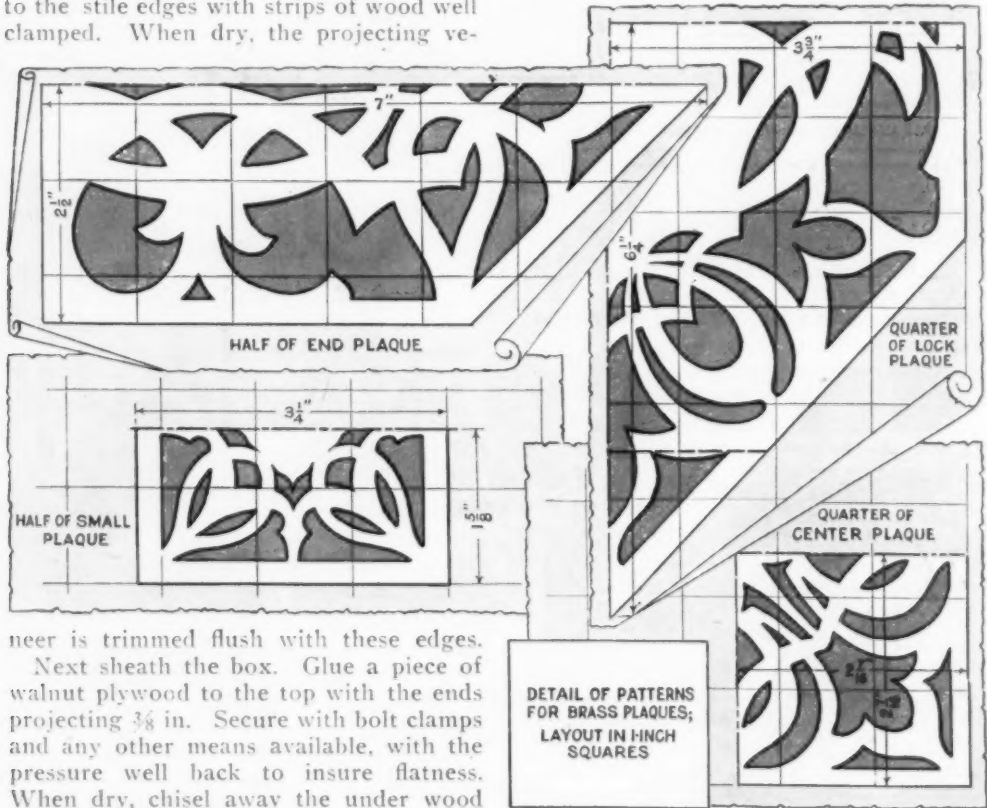
To complete the tone chamber, fit three-ply partitions between the shelf and the top, the back edges coming flush with the shelf and the front ones being  $\frac{1}{2}$  in. back from the shelf edge, forming backing for the grill. The outer faces are  $7\frac{3}{4}$  in. from the insides of the box-end frames. Temporarily nail the lower edges through the shelf, and the upper back corners with nails through the rail.

The front of the door desk and the two end panels are made from the same piece of walnut veneer, so that the grain will match straight through. Fit the panels tightly to their rabbets, making them a full  $7\frac{3}{8}$  in. wide. Rabbet the stile edge on the back face of each, paring away the inner veneer and core until the front veneer is stripped. Glue in place, laying the box on its back, so that the panels can be weighted. The veneer must be held tightly to the stile edges with strips of wood well clamped. When dry, the projecting ve-

ner from the veneer projecting, cut the end-pieces, and glue them on, making sure that the veneer joins perfectly with the upper ends.

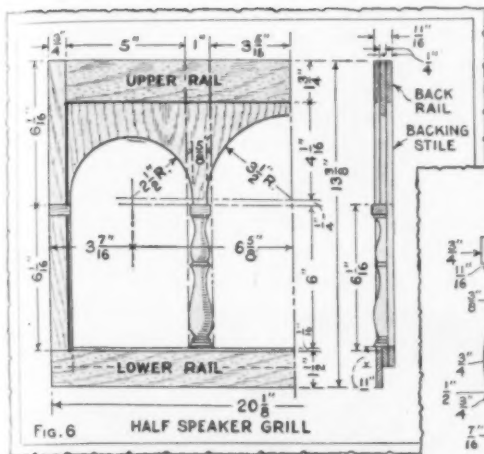
Glue triangular cleats inside the four corners of the tone chamber, and square cleats at the tops of the compartments against the partitions.

Make the arched upper section of the speaker grill of walnut plywood. (See Fig. 6.) The arches are centered  $\frac{1}{4}$  in. above the lower edge. Make two end posts of  $\frac{1}{4}$ -in. walnut,  $\frac{7}{8}$  in. wide by  $7\frac{1}{4}$  in. long, and a lower rail  $\frac{1}{4}$  by  $1\frac{1}{16}$  in. by 1 ft.  $6\frac{3}{8}$  in. A front rail,  $1\frac{1}{2}$  in. wide and 1 ft.  $8\frac{1}{2}$  in. long, an upper rail,  $1\frac{3}{4}$  in. wide and 1 ft.  $6\frac{5}{8}$  in. long, and a pair of stiles,  $\frac{3}{4}$  in. wide by  $12\frac{1}{2}$  in. long, are glued over the others, as shown, to make the assembly. The front lower rail shows a  $\frac{1}{16}$ -in. margin on the one behind, while the stiles give a margin of  $\frac{1}{8}$  in. on the posts. Fit caps,  $\frac{7}{16}$  in. wide, over the stiles, letting them project  $\frac{1}{16}$  in., to correspond to the caps of the turned pilaster.



ner is trimmed flush with these edges.

Next sheath the box. Glue a piece of walnut plywood to the top with the ends projecting  $\frac{3}{8}$  in. Secure with bolt clamps and any other means available, with the pressure well back to insure flatness. When dry, chisel away the under wood



pletes this. Joint the front edges of the box and glue a 1/16-in. veneer over them, mitering the corners.

Glue up the door, using walnut plywood outside and in, with a center core of three-

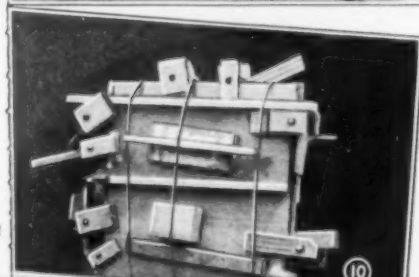
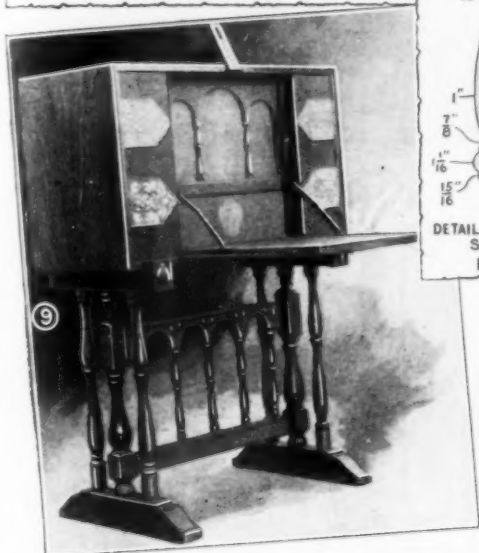
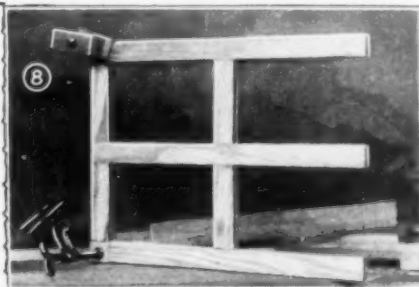
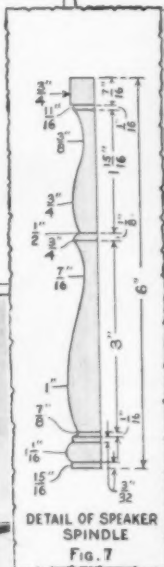


Fig. 8, Box End Frame; Fig. 9, the Desk Open; Fig. 10, Veneered Box with Glued-Up Desk Door

ply pine. Bind with wire, force wedges underneath, and add clamps to the edges. When dry, fit it snugly, screw on the piano hinge, and scribe the edges with a clearance at sides and top of 1/16 in. Glue veneers on these, to hide the plies, and surface with sandpaper.

Turn the latter as a single spindle, to be ripped down the center.

Stretch brocaded silk over the back of the grill, placing the design with respect to the arches and holding it in place with backing stiles and rails, 1/4 in. thick. Two 3/4-in.-wide stiles are added between the arches to carry the pilasters, which are nailed from the back with brads.

Install the grill in front of the tone chamber, with the lower front rail bearing against the shelf. Make two walnut side stops, 3/8 by 3/4 in., notch them to fit against the grill, so that the back edges line with the back of the grill rail and the bottom stop, and tack in place with three brads each. A stop at the top, 1/2 in. wide, com-

The back of the case is closed with a cane panel, the frame being built of 1 by 2-in. pine, halved together at the corners. (See Fig. 5.) Wet the cane webbing before tacking on. Trim the edges and tack a flat molding in the rabbets. When dry, the cane will be stretched as tight as a drumhead, and the panel can be fitted into the box. Put a stop along the top, and secure the panel with four brass screws,

so that it can be quickly removed to get at the set.

Cut down the hasp hinge as required, mortising it into the upper door rabbet, and mortise the staple into the door. Have them plated to match the plaques.

Half and quarter patterns for the brass plaques are given on page 830. Cut the plaques out and paint one side of each with asphalt varnish. Heat them to the smoking point, and allow to cool. Coat the reverse sides with wax. Trace the patterns onto the asphalt, afterward scratching through the paint with a sharp metal point. Build a dike around the edges with wax, to hold dilute nitric acid in the proportion of one to five,  $\frac{1}{4}$  in. deep. Some parts may be eaten through ahead of others, spilling out the acid; but the others will be so thin that they can be easily knocked out. Clean off the paint and smooth the rough edges. Give them an antique finish, or etch the surface lightly with acid, and coat with clear lacquer.

The old Spaniards were fond of red-velvet backing under the plaques, but velvet is a dust

catcher, and a coat of magenta lacquer will be found much more satisfactory, or the finished wood itself will give a good effect. Use small round-headed escutcheon nails to attach the plaques.

Sandpaper the cabinet carefully before filling. The amateur will find oiling and waxing the easiest finish to apply, and it is much to be recommended. Repeated oiling, from time to time, combined with "elbow grease," will result in a fine finish,

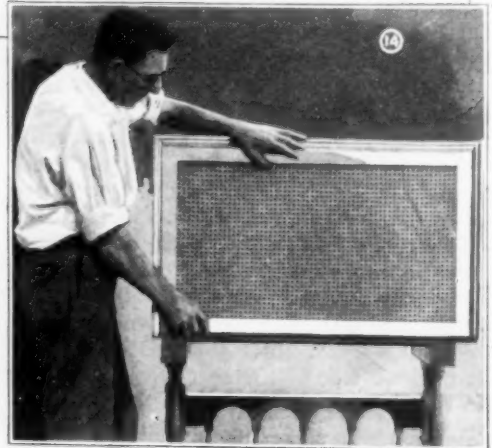
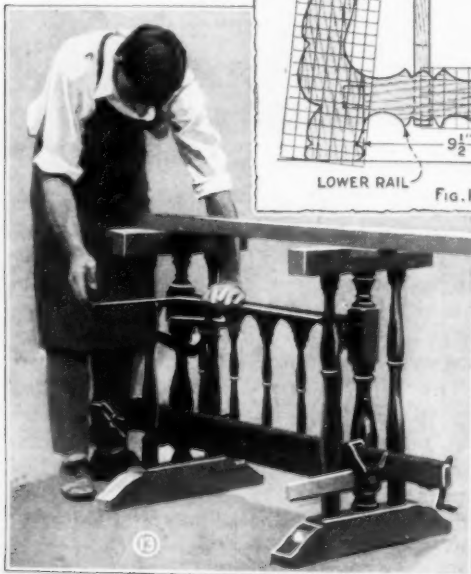
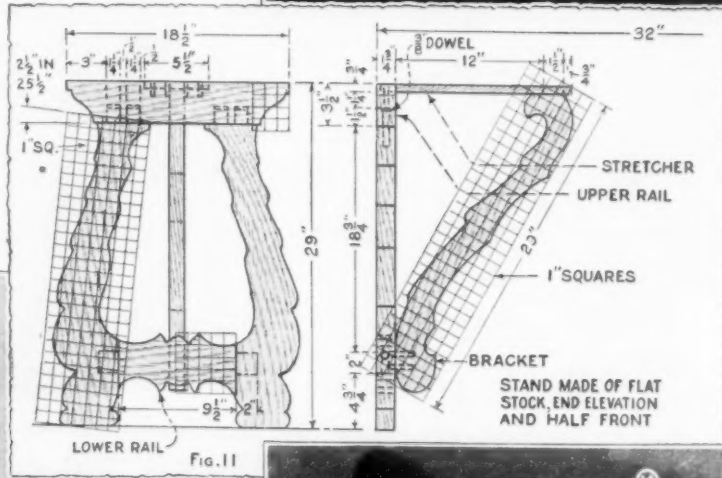


Fig. 12, Measuring Acid for Etching; Fig. 13, Squaring the Stand; Fig. 14, Trying the Back Panel



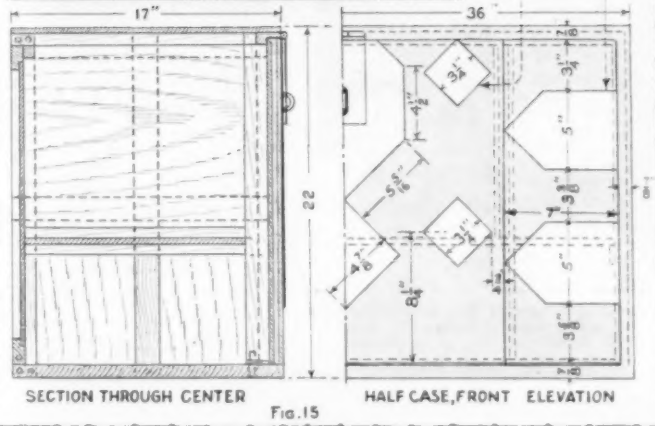


Fig. 16, Carving the Flower Ornaments; Fig. 17, Shell Ornaments in Process of Carving; Fig. 18, Outlining the Carving

more beautiful from an artistic standpoint than the gloss of polished varnish.

are attached to the legs with double tenons. Saw the parts roughly to profile,

#### MATERIAL LIST

##### For Cabinet

- 2 pieces,  $\frac{1}{4}$ -in. three-ply figured walnut panel veneer, good one side, 18 in. by 6 ft.
- 1 piece,  $\frac{1}{2}$ -in. three-ply figured walnut panel veneer, good one side 24 in. by 4 ft.
- 1 piece,  $\frac{1}{4}$ -in. three-ply pine panel veneer, good one side, 36 in. by 5 ft.
- 1 piece,  $\frac{1}{4}$ -in. five-ply pine panel veneer, good one side, 17 by 36 in.
- 1 piece, 3 by 3 in. by 5 ft., rough walnut.
- 1 piece, 2 by 2 in. by 9 ft., rough walnut.
- 1 piece, 1 by 6 in. by 10 ft., rough walnut.
- 1 piece, 3 by 3 in. by 3 ft., pine or fir, S4S.
- 1 piece, 3 by 4 in. by 4 ft., pine or fir, S4S.
- 5 pieces, 1 by 2 in. by 8 ft., pine or fir, S4S.
- 1 piece, cane webbing, 18 by 34 in.
- 1 qt. liquid glue.
- 4 ft.  $\frac{1}{2}$ -in. hardwood dowel.
- 6 ft.  $\frac{3}{8}$ -in. hardwood dowel.
- 1 pt. light oak filler.
- 2 ft. piano hinge.
- 1 heavy iron hasp and staple.
- $2\frac{1}{2}$  sq. ft. No. 21 gauge, sheet brass.

##### For Flat-Stock Stand

- 1 piece, 2 by 7 in. by 10 ft., rough walnut.
- 1 piece, 2 by 4 in. by 3 ft., rough walnut.
- 1 piece, 2 by 5 in. by  $2\frac{1}{2}$  ft., rough walnut.
- 1 piece, 2 by 6 in. by 5 ft., walnut, S4S.
- 1 piece, 1 by 6 in. by 3 ft., pine, S4S.

smoothing them when they are assembled. A 1 by 6-in. pine stretcher joins the upper rails, being housed in and further secured with  $\frac{3}{8}$ -in. dowels. The lower ends of the brackets are doweled to the lower rails, while tenons on the upper ends fit into through mortises in the stretcher.

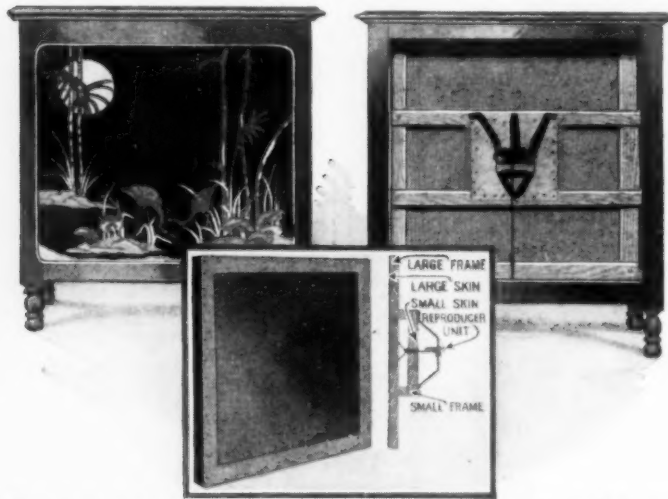
The radio installation is made entirely

from the back, but the grill must be removed from the front.

Full-sized blueprints of the half and quarter patterns for the brass plaques may be obtained from Popular Mechanics radio department, 200 E. Ontario St., Chicago, for 25 cents to cover cost and packing. Specify blueprint No. 137.

### New Speaker Employs Double Diaphragm

The speaker shown in the illustration consists of two vibrating diaphragms,



Top, Left, Speaker Installed in Cabinet with Tapestry Front; Right, Rear View; Below, Construction Details and Front View of Large Diaphragm

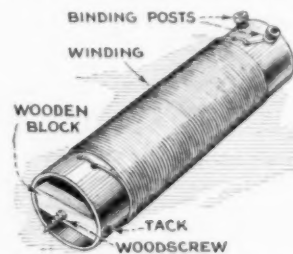
tightly stretched upon two frames, the center point of each diaphragm being connected to the other. The pin of the reproducer unit is fastened to the balanced center point. The speaker may be used with all 210 and 171 power amplifiers and is suitable for all types of amplifiers including the 50-watt power type. It is said to give a uniform response from 50 to 10,000 cycles, reproducing with practically equal facility all notes from that of the bass viol to the highest note of the piccolo.

### Homemade R.F. Choke Coils

Radio-frequency choke coils are a necessary part of most modern receivers. These coils are not costly, but if you prefer to make your own, cardboard tubing from tissue rolls is about the right size. Shellac

the tubing and allow it to dry thoroughly, then place it in a warm oven for half an hour. Two holes are punched in the tubing,  $\frac{3}{4}$  in. from the starting end of the coil; then the wire is threaded through these holes to anchor it, leaving an end about 6 in. long. For standard broadcast wavelengths wind about 250 turns of No. 32 d.c.c. wire on the tube and secure the finishing end through two small holes as at the start. Both ends of the coil are then connected to two small binding posts or Fahnestock clips at the finishing end, the starting end being brought up inside the tube. The mounting block consists of a piece of  $\frac{1}{2}$  by  $\frac{1}{2}$ -in. wood rounded at the ends to fit into the bottom of the

tube. This wood strip is drilled at the center to take either a wood or machine screw for mounting the coil upright on the subpanel or baseboard. Choke coils of this type may be used also in short-wave transmitters, but in that case the wire should be No. 26. The number of turns



necessary for wavelengths below 100 meters should be about 130. No. 26 wire is of sufficient size to carry the plate current

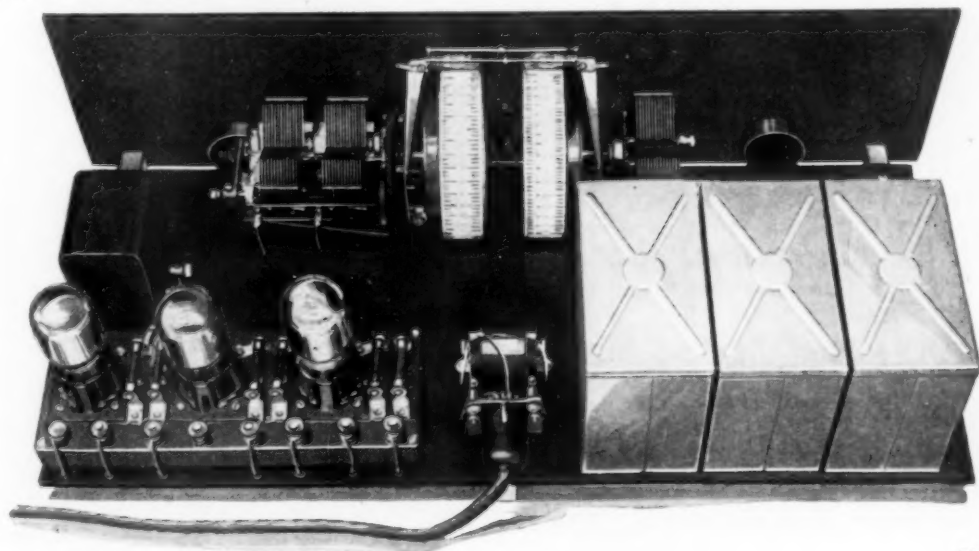
of a 500-watt transmitter, yet small enough so that the necessary number of turns may be wound on the tube.

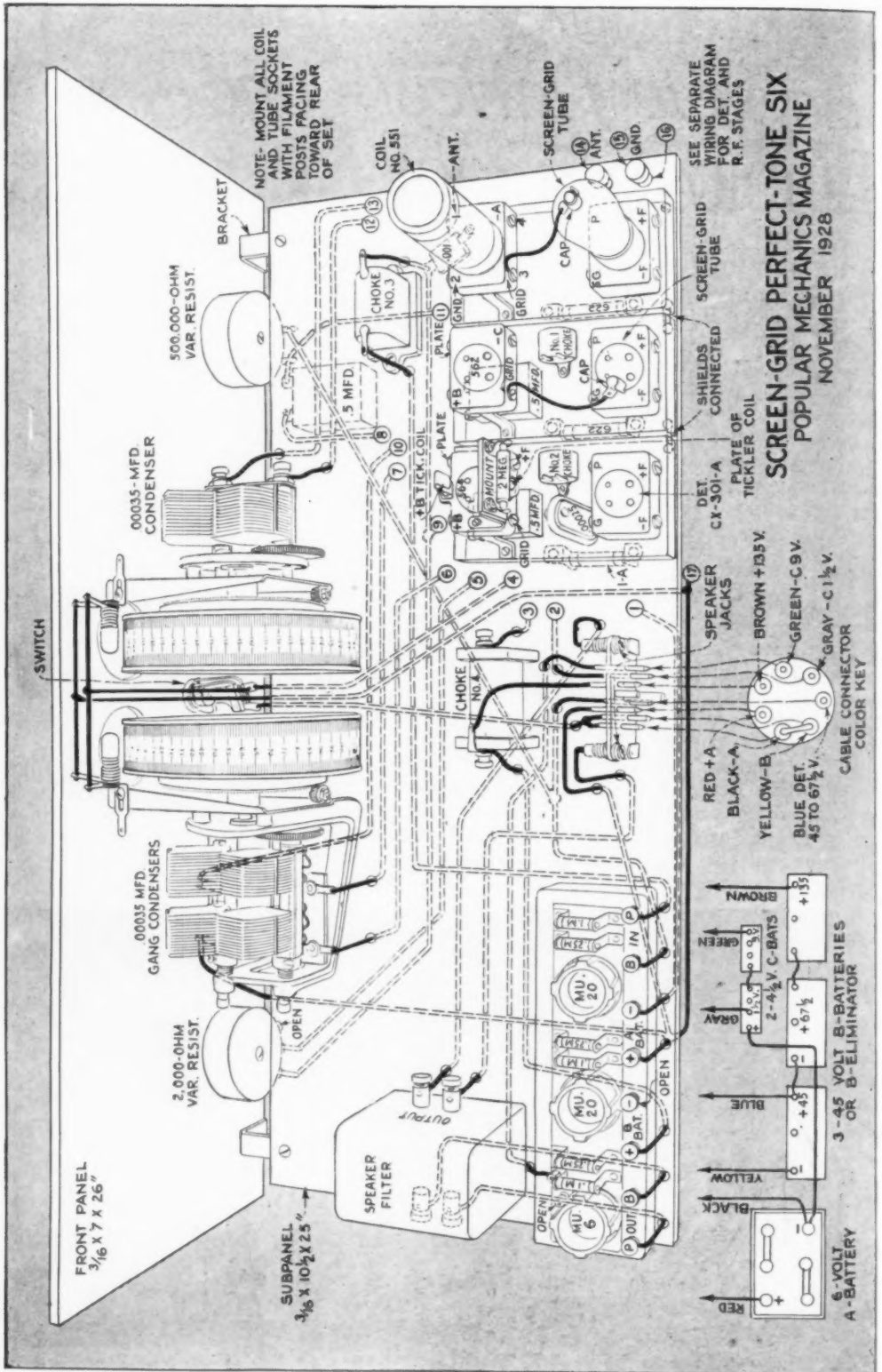
# New Perfect-Tone Six Employs Screen-Grid Tubes

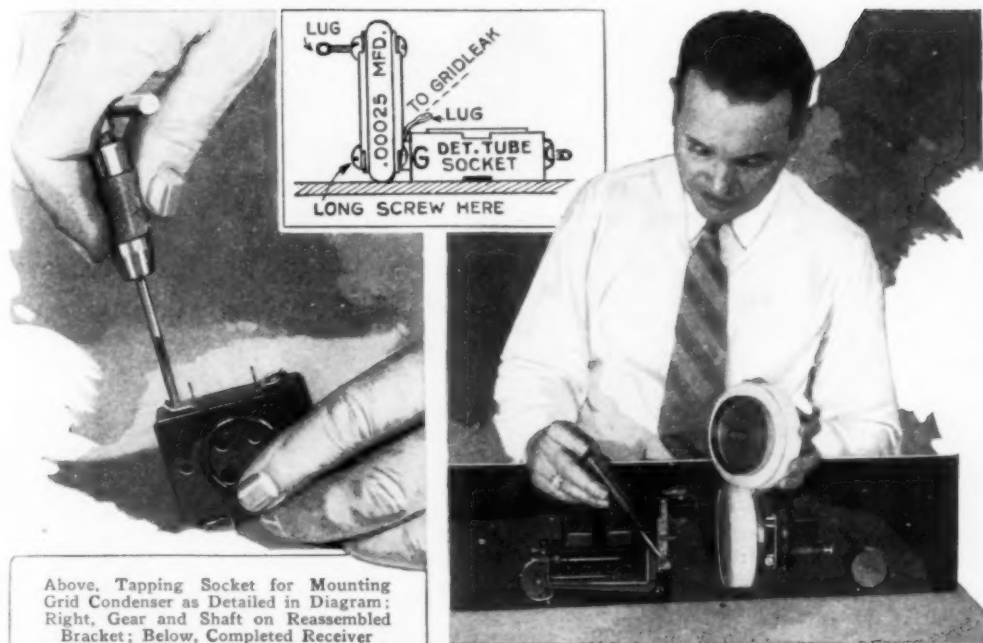
THE PREVIOUS perfect-tone six receivers have proved to be among the most popular instruments ever designed in Popular Mechanics radio laboratory, and resistance-coupled a.f. amplification owes some of its present popularity to these particular sets. The advent of the new screen-grid tube with its remarkable r.f. amplifying qualities, together with improved coils and tuning units offered possibility for further improvement. Laboratory experiments show that the tonal quality cannot be improved without going into expensive power amplification; therefore we have retained the original resistance-coupled a.f. unit and have taken advantage of the latest electrical and mechanical devices to improve the circuit. Wider range, owing to greater amplification of weak distant signals; better selectivity, due to improved shielding methods; simplified tuning and regenerative detector under control, to provide greater sensitivity, make this new set interesting to the critical circuit fan. The tone is all that the name implies, when used with any good modern speaker.



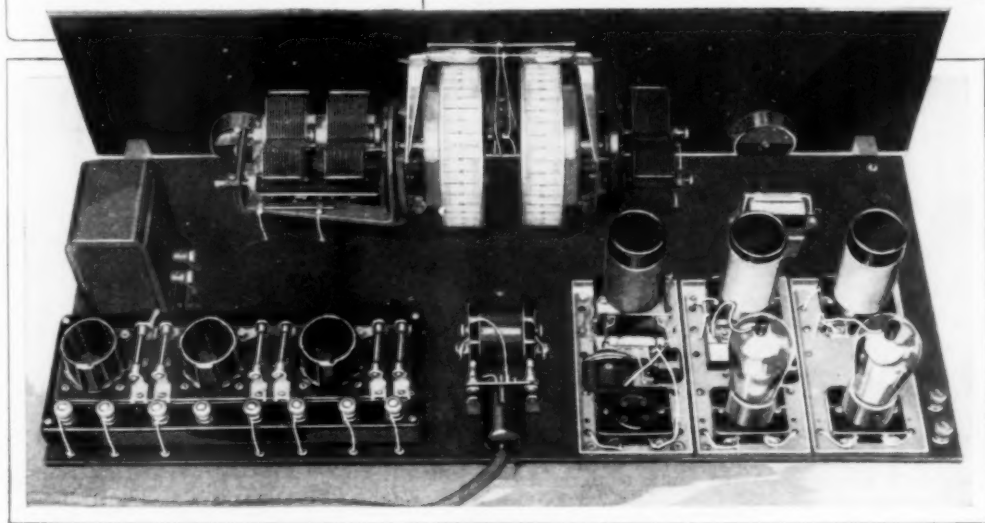
The rear views of the completed instrument, together with the simplified diagrams, tell the story of construction so plainly that little comment is necessary. To prevent confusion in the limited space available in the large diagram for the detector and r.f. stages, an additional diagram of these stages, showing the wiring in detail, will be found on page 839. The wires are numbered on both diagrams, so that no difficulty will be encountered in tracing the circuit, and a large blueprint of the entire wiring in one unit and







Above, Tapping Socket for Mounting Grid Condenser as Detailed in Diagram; Right, Gear and Shaft on Reassembled Bracket; Below, Completed Receiver



a built-up assembly of the a.f. amplifier are available. Drilled and engraved panels may be had if desired, greatly simplifying the work of assembly.

The instruments on the front panel are mounted first, and the photos on pages 837 and 838 clearly illustrate the method of mounting the variable condensers and drum dials. The single variable condenser is screwed to the bracket shown at the right on this page, and the drum dial is

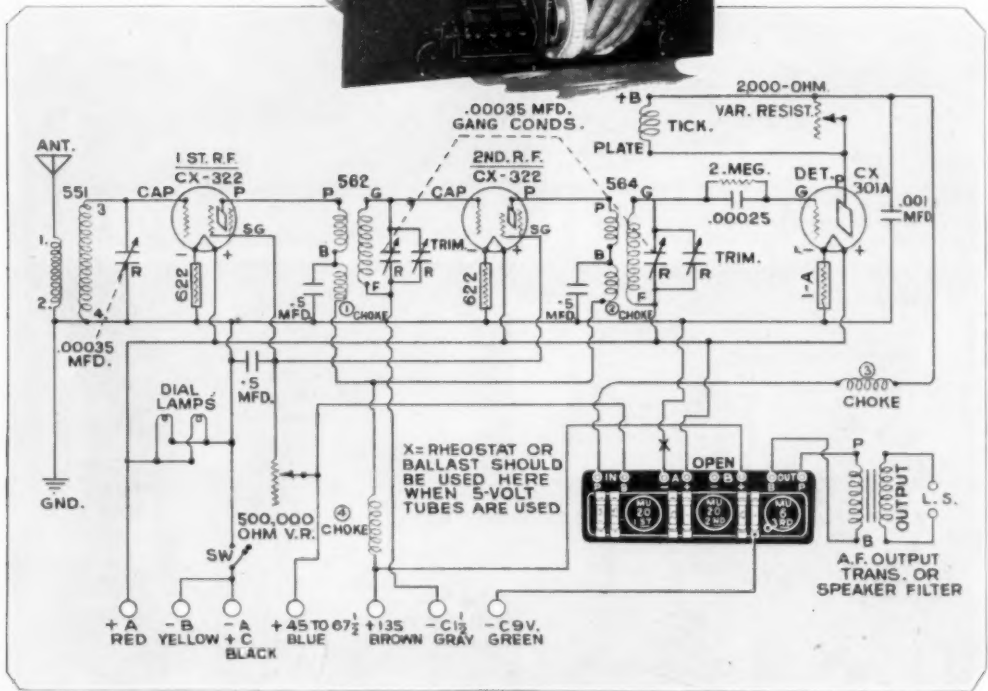
then mounted on the shaft. No change is necessary in this bracket; it is mounted just as it comes from the carton. The bracket at the left, for the gang condenser, however, must be reversed and reassembled. Remove the shaft and take off the small brass gear, replace it with the extra gear provided with the unit and remount the shaft in the lower slot on the bracket. This makes the condenser dials rotate in the same direction with similar rotation of



the control knobs. The gang condenser is next screwed to the bracket; a small right-angled bracket supplied with the unit is then fastened to the rear of the condenser frame so that, when it rests against the subpanel, the condenser will be supported in a horizontal position. The dial is now mounted on the shaft as shown in the photo on this page, the



rear directly below the cable connector-plug and the No. 4 choke coil. Mount the shield bases of the detector and r.f. stages with short brass machine screws. The tube sockets are set at the rear directly on these bases, and the coil sockets fitted above the bases on the brass brackets supplied with the shields. See that



dial being pressed on the shaft and tightened by means of a small setscrew.

The filament switch is mounted between the dials in the position shown. In the original model, this switch is mounted directly on the escutcheon plate between the dial knobs, and, as no hole for the switch is provided on the plate, a 1/4-in. hole was drilled and enlarged to the correct size with a tapered reamer. If the builder does not care to do this, the switch may be mounted directly below the plate.

The subpanel is supported by three brackets, the center one being fitted at the

all socket filament posts face the rear. The contact plate for the tickler coil comes with this part and is mounted on the top of the socket in the detector stage. The gridleak bracket is placed on top of this plate, and the entire assembly is then screwed to the brass supporting brackets. The grid condenser is screwed directly to the grid post of the detector-tube socket as shown on page 837. A No. 6-32 brass machine screw is used for this purpose, and it may be found necessary to drill and retap this hole for the 6-32 screw.

The filament-control units are fastened

through holes in the shield bases by means of a single machine screw through the center of each mounting. Unit 1-A is the 1/4-amp. type for the detector tube, and units No. 622 (see diagram below) are special types for the screen-grid tubes. Chokes Nos. 1 and 2 are fastened on the shield bases, as shown in the illustration.

Wire the circuit with standard, flexible, rubber-covered hookup wire throughout, with two exceptions: the leads from the screen-grid tube plates to their respective coil terminals in the next stage. These leads have a braided metallic covering which is grounded to the negative-A line. The wire used is the armored flexible ignition wire used in airplanes.

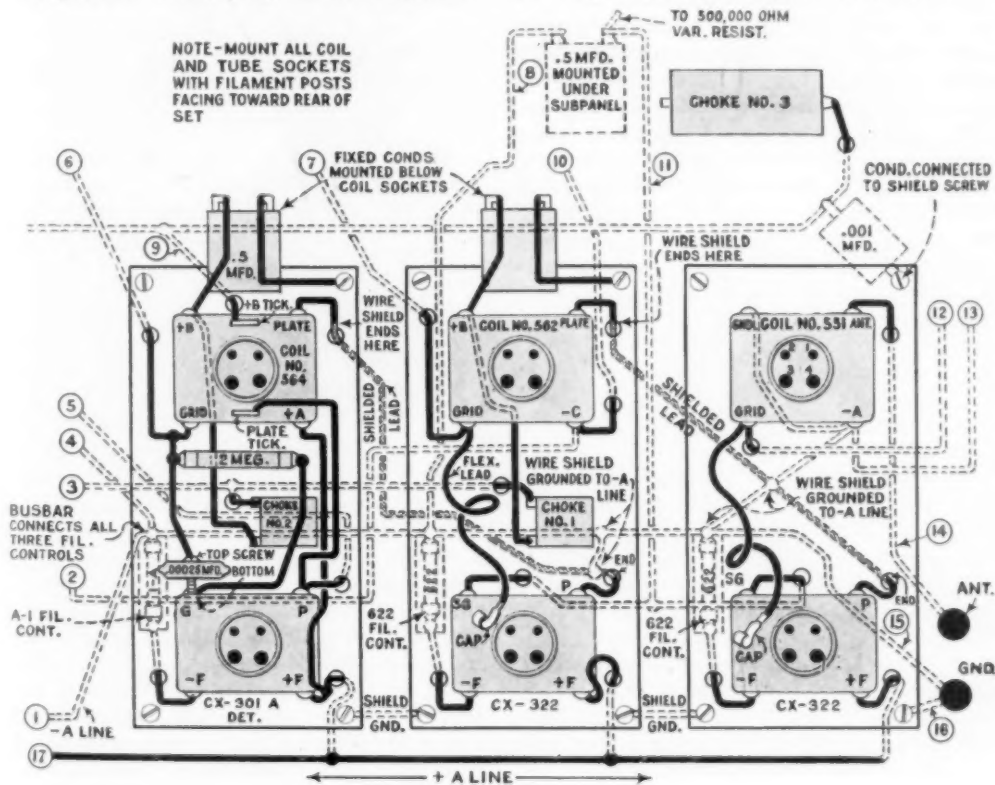
Connect the batteries, as shown in the diagram on page 838, and test the filament circuit by placing a tube successively in each socket; if the tubes light as they should, the set is ready for operation. Place the caps at the ends of the flexible leads (which come with the coils) on the top of each screen-grid tube.

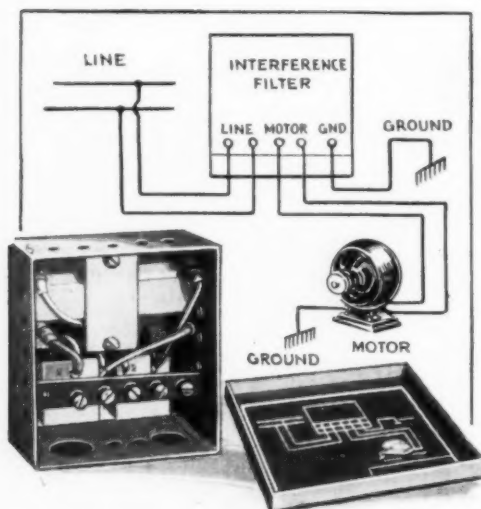
To operate the set, connect the aerial and ground leads, plug the loud-speaker

cord tips into the small jacks mounted on the cable connector, and turn on the filament switch. To balance the ganged condensers refer to the instruction sheet that comes with the condenser unit; this is a simple matter and well covered in the instructions. Facing the receiver, the volume control is at the left, the sensitivity control at the right. The dials are tuned in step, and when the set is balanced, should tune about alike, but there will be some variation in the setting of the dial controlling the single condenser. Grid-leaks from 2 to 8 meg. should be tried, as the best value will be found by experiment.

In this particular receiver it is advisable to use no other parts than those specified in the material list, except where the instruments substituted are of exactly the same type both mechanically and electrically. A postal card will bring you this list free of charge.

The blueprints of the combined wiring diagrams and drilling templates can be obtained from Popular Mechanics radio department for 15 cents to cover cost and packing. Specify blueprint No. 138.





Above, Simple Diagram of Connections; Below, Interference Filter with Cover Removed

### Device Reduces Motor Interference

A new device for reducing interference from motors up to 5 hp. at 220 volts is now available; this type is shown in the photo and a similar device has been designed for smaller motors of the household type. The unit is built, in accordance with code requirements, in a ventilated metal box, for attachment to wall or machinery. The terminals are brought out to a bakelite strip with heavy screw posts and knockouts are provided in the bottom of the box for attachment to standard BX or conduit. The type shown is specially designed for elevator motors, motor-generator sets and other types of interfering electrical apparatus employing large motors. The smaller type referred to is designed for use with motors on oil burners, under-grate blowers, electric refrigerators, and for small motors on vibrators, fans and sewing machines.

In many cases the interference is such that it can only be reduced and cannot be entirely eliminated; however in a majority of cases the filter device is claimed to reduce the interference to a point where it is no longer noticeable.

Popular Mechanics' radio department offers its information service free to all readers of our magazine. We will be glad to help you with your problems, and will promptly answer all inquiries.

### Drilling Template for Variable Condensers

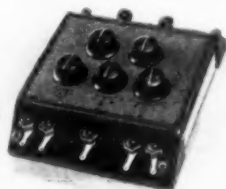
When mounting variable condensers, or similar apparatus requiring accurately located holes in the panel, a template of some type is necessary for good work. If that supplied with the part is lost, one may be made from a sheet of paper. Cut a small round hole in the proper place for the condenser shaft, making this hole a trifle small to insure a tight fit. Place the paper over the shaft and force it down over the mounting holes in the condenser, pressing it firmly over the holes so as to leave a good impression on the paper. Remove the paper and place it on the panel, centering the shaft hole in the proper position; then, with an ice pick or other sharp tool, locate the centers of the remaining holes.—R. J. Plaisted, Cleveland.

### R.F. Transformers for Screen-Grid Tubes

Radio-frequency transformers for use with screen-grid tubes should have a high primary impedance in order to give the amplification of which the tubes are capable. This means that the inductance of the primary winding should be about the same as that of the secondary.

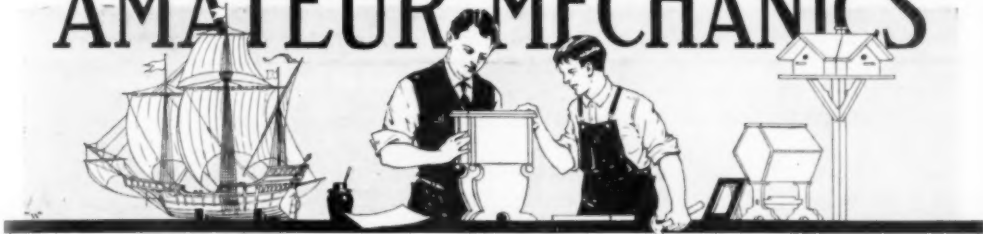
### Voltage Divider for B-Supply

The voltage divider shown in the illustration provides a complete resistance unit so constructed that, by simply connecting it to the output terminals of the filter, proper plate and grid voltages for the radio receiver are obtained. This device simplifies the construction of



B-power units both for the professional and amateur builder. Wire-wound resistors are used, each being provided with five adjustable contacts. The unit is not only flexible enough to meet all receiver current conditions, but, owing to the design, it is possible to calibrate the adjustable contacts. It is also possible, by use of the tables and graphs supplied with the device, to adjust the output to the proper voltages without the use of an expensive high-resistance voltmeter.

# AMATEUR MECHANICS



## Shadow Pictures—a Fascinating Pastime

By R. GREGG

OF COURSE you're not an artist. But, if someone sketched a dark shadow on a piece of paper, you could, artist or no artist, take a pen and draw a line around it? Certainly you could! Then you can make shadow pictures. Besides being a lot of fun, these shadow pictures are a

any photographer can enlarge your snapshot negatives to the required dimensions.

Fig. 1 is the photograph "in the raw." Take a pen and with black ink outline all of the dark portions in the picture. Paint in these dark portions with a black, opaque water color or black ink, as shown in Fig. 2. In a profile view like this, all of the smaller black portions, such as the ear, the mouth, the eye and eyebrow must be connected to one of the two main black areas, either to the hair or the black background which surrounds the picture.

This is done so that, when you cut out the white portions, which is the next step, your black areas will form a continuous mass. (See Fig. 3.) In cutting out the whites, use a very sharp penknife or a pair of small scissors. The penknife is the best for detail, while the scissors are especially



distinct ornamental unit which can be used to good advantage in decorating lampshades, side-lights and window panes.

First of all, get a photograph of yourself. This should be at least 3 by 5 in. in size. If you have none on hand of this size,

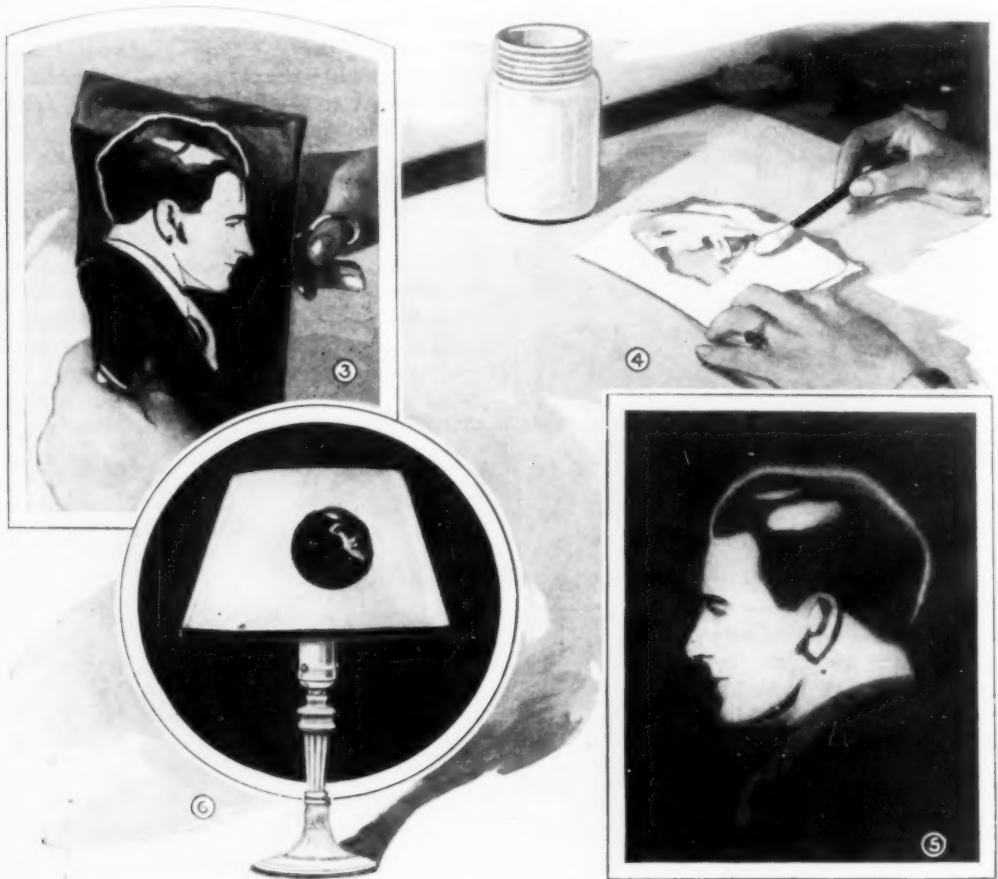
suit for larger areas. If the hair of your picture is dark, it will be necessary to cut a white line entirely around it in order to keep it distinct from the background. Care must be taken, of course, not to cut this line so far that any piece of the picture will drop out.

After the white portions of the picture have been cut out, cover the reverse side lightly with paste, as shown in Fig. 4, and then mount it on a thin sheet of white paper, the same size as the photograph. Paste another sheet of white paper in place on the front side and press the whole thing out flat. The finished picture, when held to the light, will appear somewhat like the one shown in Fig. 5. In this form, it makes a rather attractive novelty—something a little different from the ordinary photograph.

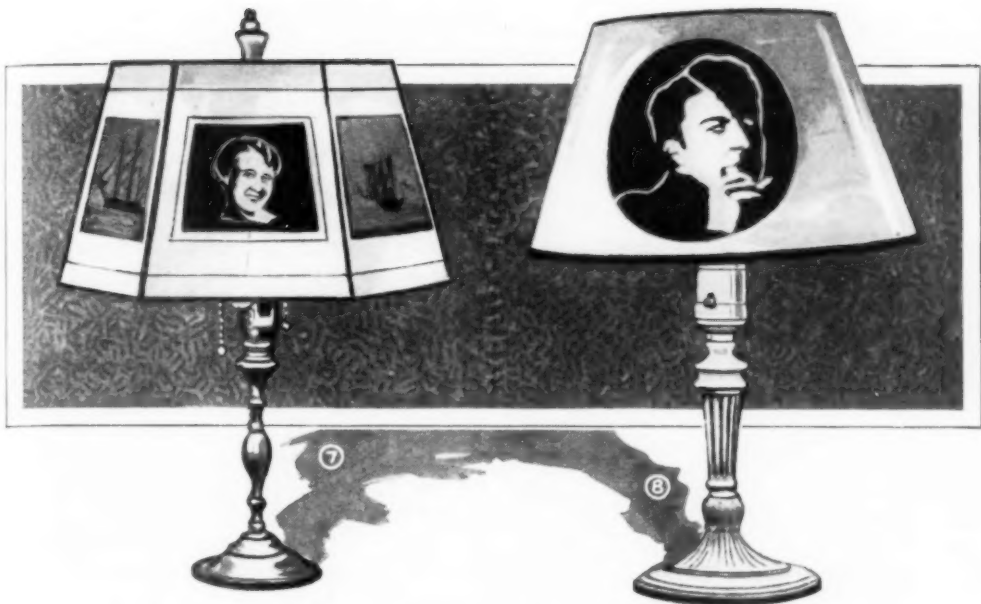
If you wish to preserve these shadow pictures, you can do so by mounting them

on a lampshade. The type of shade to use is that of undecorated parchment, which can be purchased at any department store. They come in a variety of sizes and shapes, and in selecting one, you should get it of a size in proportion to the picture to be mounted on it.

In the mounting, no paper backing is needed. The picture is coated with paste on either side and pasted directly to the inside of the shade. After the paste is dry, the lampshade can be placed over the bulb and the light switched on. The result will be something like those shown in Figs. 6, 7 and 8. In making full-face shadow pictures, like the one in Fig. 7, where the eyes, nose and mouth are unconnected to the main shadows, the simplest method for the amateur is to have two prints made of the same size, and use one as a sort of template. Black in and cut out one only, cutting the eyes, etc., out







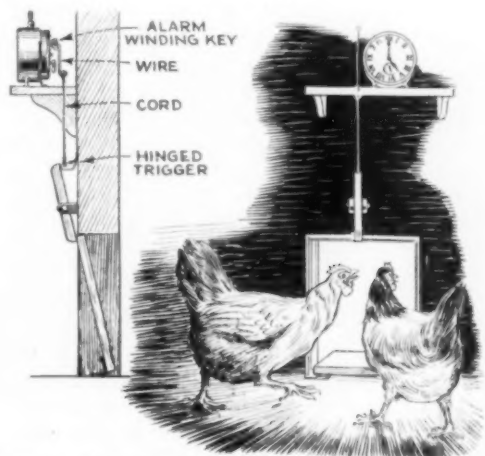
separately; then stretch a sheet of thin tissue or tracing paper over the untreated photo, coat the parts of the shadow picture and paste them in place on the tissue paper, registering the parts with reference to the full photo below. The shadow picture, with its paper backing, can then be mounted as before.

Actual photographs are only one medium in making these shadow pictures. Any of the thousands of printed photographs found in newspapers and magazines, as well as paintings and drawings, can be treated in the same manner. It is simply a matter of selecting the dark shadows and then painting them in. It takes a little knack to get really good shadow pictures, and you will probably spoil a picture or two before you get something which brings you real satisfaction. Once the simple technique of the thing has been mastered, you will find shadow pictures easy.

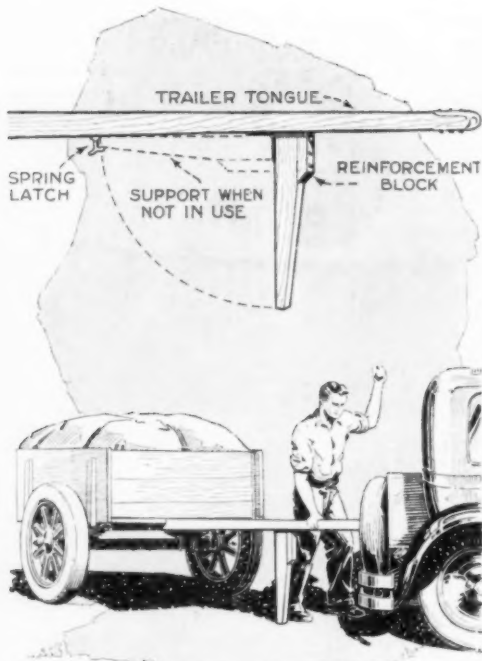
#### Alarm Clock Opens Hen-House Door

Poultry owners often close the hen-house trapdoor during the night in order to keep rodents out and prevent drafts. The door must be opened early in the morning and this is sometimes rather inconvenient. One poultry owner overcame this objection by fixing the trapdoor so

that it opened automatically at a predetermined time. The installation consists of an old alarm clock, set on a small shelf above the door, a couple of hinges with which the door is pivoted at the bottom, a latch and hinged trigger to hold the door shut, a stout cord attached to the trigger and to a short piece of wire which is in turn attached to the alarm-winding key of the clock. When the alarm rings at the time for which it is set, the winding key jerks the cord so that the latter pulls the trigger loose and the door consequently drops.



Alarm Clock Opens Poultry Trapdoor Automatically in the Morning



Hardwood Support for the Trailer Tongue Is a Help to the Motorist

#### Support for the Trailer Tongue

Any motorist who occasionally makes use of a two-wheeled trailer has undoubtedly experienced difficulty in handling it, owing to the necessity of dropping the trailer tongue on the ground, or finding some support for it, which is not always available. Here is a good solution for the difficulty. Simply make a support from a length of 2 by 4-in. hardwood and a small reinforcement block of the same stock. Hinge the support to the tongue with a strap hinge placed on the side toward the trailer, as shown, so that, when not in use, the support can be swung back and held in place by a spring latch. There is little or no danger of the support falling down when the trailer is towed, but even if it should, no damage would be done, as it would swing back and drag.

#### Moisture-Resisting Paint

Moisture-resisting paint for wood or stone can be made by mixing 12 oz. of rosin in 6 gal. of fish oil and 1 lb. of melted sulphur. Rub up some ocher, or any coloring substance, with a little linseed oil and mix this with the prepared solution.

Apply several coats, the first of them rather thin. This paint has been found satisfactory by an experienced painter.—Charles Latour, Jr., Plattsburg, N. Y.

#### Punching Small Hole in Thin Steel

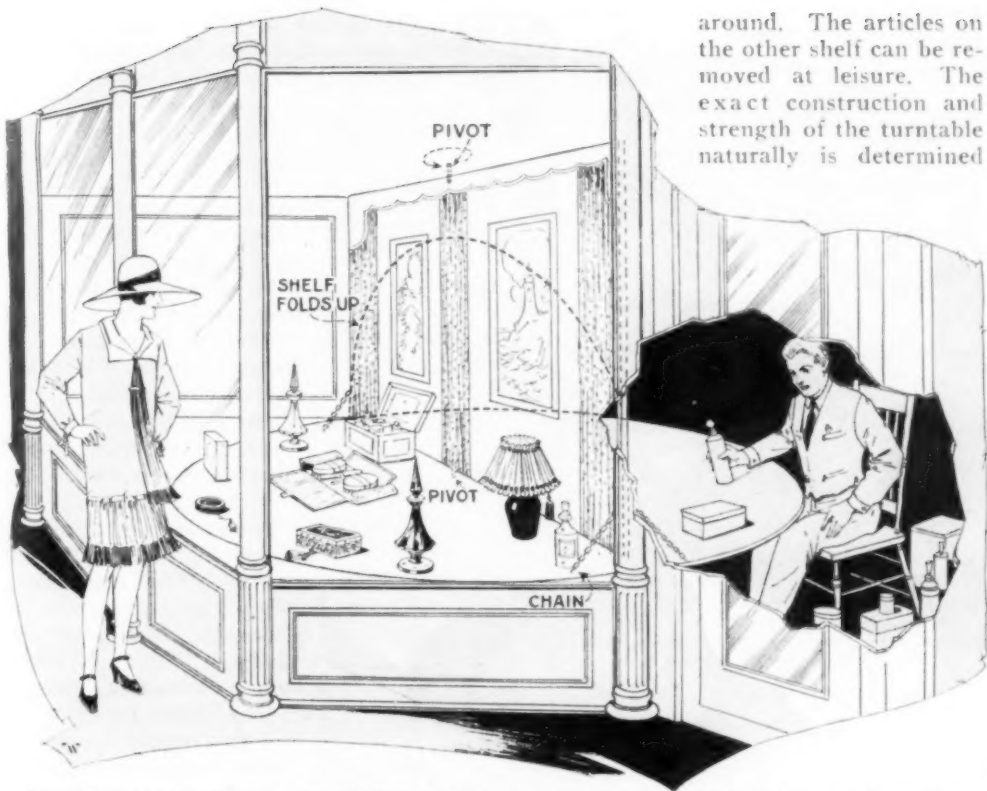
I wanted to drill a tiny hole through a steel strap  $\frac{1}{16}$  in. thick, but unfortunately broke the drill. After some thought, I took a centerpunch and, holding it over the spot where the hole was wanted, struck it with the hammer, which raised a "pimple" on the opposite side of the piece to be drilled. I filed this point off smooth, then punched the opposite side, again filing off the raised metal. After a few repetitions of this process I was able to run a small wire clear through.—G. H. Mansfield, Cuyahoga Falls, Ohio.

#### Wire Pot-Cover Holder

Pot covers can be conveniently kept in the simple wire holder shown in the drawing. Take a 46-in. length of No. 9 galvanized-iron wire and bend it to the shape shown, the dimensions of the straight parts from bend to bend being indicated in the detail. It only takes a few moments to make a holder, which can be hung on a nail in a suitable location near the stove or in the pantry.—C. Newkirk, Chicago, Ill.



A Length of Galvanized-Iron Wire Makes a Good Pot-Cover Holder for the Kitchen



Large Turntable Consisting of a Pivoted Wallboard Partition and Two Hinged Shelves Facilitates the Arrangement of Displays in Store Window

### Turntable Facilitates Window Decoration

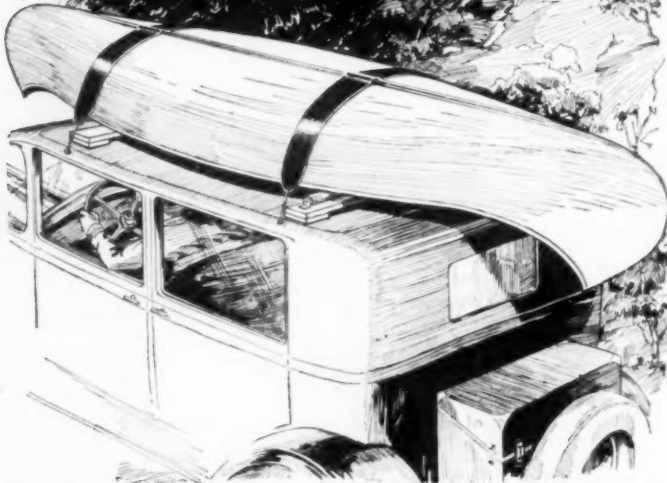
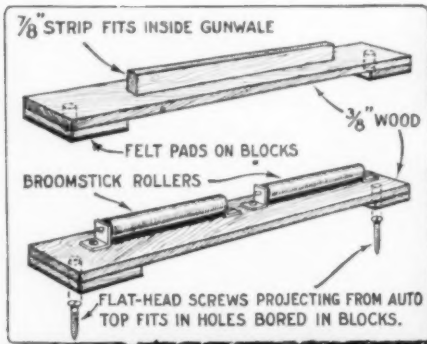
Frequent changing of a window display allows the passer-by to see more of a merchant's wares, but is usually delayed because of the work connected with it. One enterprising merchant devised the novel turntable shown in the drawing, which enables him to arrange the new goods to be displayed inside of the store, while the old goods are still in the window. The turntable consists of a pivoted partition, made of wallboard, suitably braced with 2 by 4-in. wood. On each side of this partition a shelf is hinged as indicated. These shelves can be folded up against the partition, catches being provided to hold them there when they are not in use, or they can be lowered to a horizontal position where they are securely held with chains. When the window scene is to be changed, the decorator merely unhooks and drops down the rear shelf and proceeds to arrange the articles to be displayed, after which the turntable is swung

around. The articles on the other shelf can be removed at leisure. The exact construction and strength of the turntable naturally is determined

by the kind and the weight of the wares that it is to hold. It should also be remembered that the window ledge should be built circular to conform to the curve of the turntable shelves. The upper and lower pivots, which support the turntable, must be in a true vertical line so that the shelves will always be in a horizontal position.—E. R. Smith, Walla Walla, Wash.

### Making a Key Impression

There are many methods of getting key impressions where the original key cannot be left for comparison. An accurate method of matching is to make an impression as follows: Fold tinfoil from a cigaret package several times to form a rectangular pad, slightly longer and wider than the blade of the key. Lay the key and pad over some hard flat surface and tap the tinfoil down on the key. A clean, accurate impression will be made, which is useful for comparison when filing a new key.—F. W. Bentley, Jr., Missouri Valley, Iowa.



This Easily Made Canoe-Carrying Rig Will Not Spoil the Appearance of Your Sedan; Insert, Details of Holding Blocks

### Carrying a Canoe on a Sedan

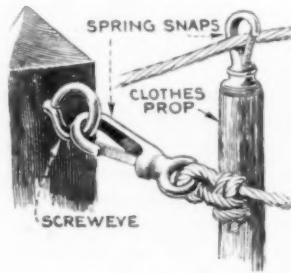
City residents who like canoeing are restricted in their choice of summer resorts because that type of boat, in most cases, cannot be had for hire. But if you have your own canoe, you can take it anywhere by providing a carrying rig on your sedan as shown. The permanent fittings on the car are only four wood screws and four screweyes. The screws are driven into two cross braces of the top and serve as dowels to hold padded blocks in place, holes being drilled in the latter to fit over the screws. The screweyes also are driven into solid parts of the roof frame, at the edge and near the blocks, and their purpose is to provide means of attaching rubber straps, which are slipped over the canoe to hold it down on the blocks. The construction of the blocks is shown in the insert. The rear one is provided with

wooden rollers made from broomsticks, and must be located close to the back end of the auto top so that one man can raise a canoe until it rests on the rollers without marring the edge of the top. It is then comparatively easy to push the canoe, upside down, on the rollers until the other end of it is over the front block. A 7/8-in. strip of wood of suitable length to fit inside of the gunwale is screwed onto the front block. The blocks bear the weight of the canoe and the rubber bands, which may be cut from old inner tubes, simply hold the canoe and prevent it from being dislodged. It was found convenient to attach spring clips to the ends of the rubber bands for quick attachment to the screweyes. A canoe supported in this way will ride nicely at any speed and can be as easily removed as it is put in place.

The rig itself may also be taken from the car with little trouble.—R. L. Brehmer, Circleville, Ohio.

### Safe and Handy Hanging of Clothesline

My clothesline is arranged so that it can be taken down in an instant if necessary. The ends of the line are tied to ordinary spring snaps of the kind shown in the drawing, and screweyes are driven into the posts. A large spring snap, attached to the top of the clothes prop, is also useful. It will hold the line securely so that



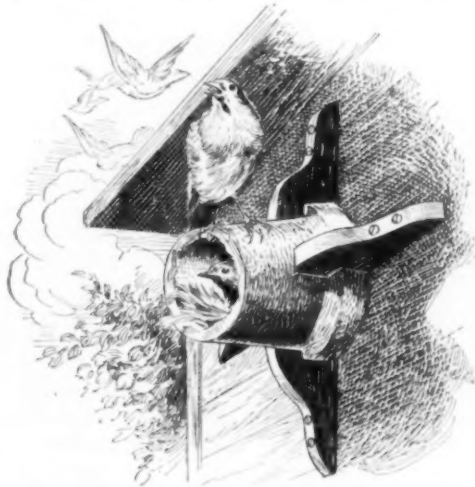
there is little danger of having it come down, leaving the clothes dragging on the ground.—Mrs. C. D. Haddaway, South Park, Ky.

### "Want Tags" for the Hardware Store

In most retail stores a "want book" is used to list the materials which are out of stock and must be ordered. A Wisconsin dealer, finding that this sometimes was neglected in the press of other duties, substituted a more convenient method, which practically prevented neglect. Into each drawer section containing the smaller articles, he put a red tag on which was printed the kind of merchandise in that drawer. The clerks were instructed to leave these tags in their respective places until the stock represented became low, when the tags were to be removed and placed in a convenient file. The order clerk could then make a circuit of the departments at regular periods, gather up the tags and place orders for the goods needed. When the new goods arrived and were placed in the drawers, the tags were likewise returned. This method, the hardware man claims, has worked successfully, mainly because the sales clerks need not do any writing.—G. E. Hendrickson, Argyle, Wis.

### Bird Houses Made from Flowerpots

Flowerpots that are no longer used, make good bird houses if the bottom is knocked out and they are held against the house or barn wall by means of four wooden brackets. The brackets are cut from 1-in. material, to fit the pot snugly. In mounting the house three brackets are first screwed on; then the pot is inserted between them and the fourth bracket attached. The best location is just under the gable. —Wm. C. Thomas, Chicago, Ill.



Old Flowerpots with the Bottom Broken Out Make Good Bird Houses



Small Lamp Installed Inside of an Incubator Facilitates Reading the Thermometer

### Incubator Thermometer Lighted by Small Lamp

Lighting the inside of an incubator to facilitate reading the thermometer can be accomplished by installing a small 3.8-volt flashlight lamp, held by a miniature screw socket, in a position just in front and toward one side of the thermometer, so that the latter will be illuminated. Only two dry cells are needed to furnish current for the lamp,

and these can be held on a small shelf attached to the underside of the incubator, as shown. An ordinary door-bell switch is mounted on the outside, and as the lamp lights only when the switch is depressed, it cannot be left on by mistake. The wiring of the circuit is given in the insert. As the incubator need not be opened, cooling of the eggs is avoided.



### Make This Mellow-Toned Chinese Fiddle



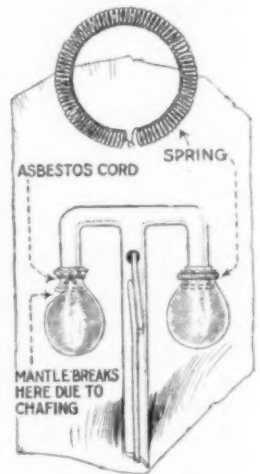
Homemade Chinese Fiddle Which Gives a Surprisingly Soft and Pleasing Tone

Although a one-string fiddle does not seem to be much of a musical instrument when compared with a regular violin, yet a surprisingly mellow tone may be obtained from a Chinese fiddle. With a little care and patience anyone can make it. The body consists of a pasteboard tube, 7 or 8 in. long and 4 in. in diameter. It is shellacked inside and out to prevent absorption of moisture. The neck is a 27-in. length of  $\frac{3}{4}$ -in. hardwood, 1 in. wide, which is braced by means of a piece of  $\frac{3}{4}$ -in. hardwood, 12 in. long, curved at one end to fit the tube. The brace is fastened to the neck with wood screws, and the curved part is glued to the tube. Care must be taken that no parts are loose as they would then rattle from the vibration when the instrument is played. The prong, or floor rest, is a length of  $\frac{1}{8}$ -in. brass rod, about 12 in. long, threaded about 2 in. at one end. It is held on the tube securely by means of two wooden blocks, two washers and two nuts, assembled as shown in the upper-left detail. Heavy-pasteboard disks are cut to fit snugly in the end of the tube, shellacked on both sides, and carefully glued in place. One of the disks is perforated to accommodate a child's toy trumpet, which is inserted in the hole after the glue holding

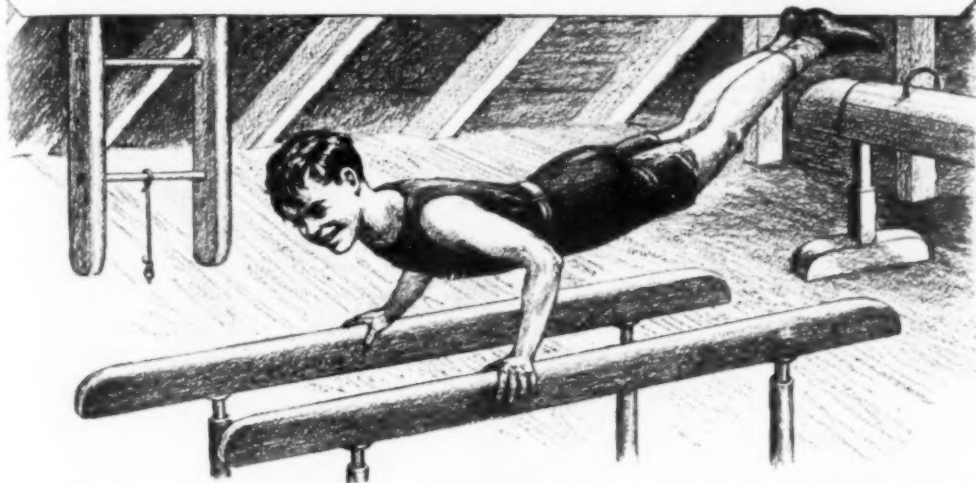
the disk in place has dried thoroughly, the reed being first removed from the mouth-piece. Either a curved or a straight horn may be used for this purpose. The bridge is cut out of hardwood or bone, and is about  $\frac{1}{4}$  in. thick, 1 in. long and  $\frac{1}{2}$  in. wide. Some experimenting will show the position to place the bridge in order to elevate the string so that it is parallel to the face of the neck, for easy fingering. The peg at the head of the neck is an ordinary violin peg and it is fitted into a tapered hole of corresponding size, which is drilled about 2 in. from the end. The string used is an ordinary gut violin E-string. To improve the appearance of the instrument stain the neck ebony or walnut and paint the body and horn with bright-colored lacquer, such as "mandarin red," allowing sufficient time for the lacquer to dry thoroughly before handling. The instrument is played in the manner of a cello, as shown in the illustration, or as a violin. In both cases, an ordinary violin bow is used.—Truman R. Hart, Ashtabula, Ohio.

### Holder for Gasoline-Lamp Mantles Prolongs Life

Gasoline-lamp mantles often chafe and break at the point of contact with the supporting tube. The reason for this is that the mantle itself is usually rather loose on the tube even though the asbestos cord holding it may have been drawn up tightly when the mantle was attached. An effective method of holding the mantle to the tube securely at all times is to use a coil spring made of 36 to 40-gauge nichrome resistance wire, obtainable at most radio and electric stores. The spring is made by wrapping the wire around a nail. The ends are bent so that they can be hooked together. Held by such a spring, the mantle will not chafe.



# YOUR HOME GYMNASIUM



WITH a little outlay of time and money an attic or basement can easily be fitted up with homemade apparatus as a gymnasium, where the "daily dozen" can be taken with more zest and interest than is usual with the light movements of calisthenics. Lacking sufficient headroom, rings and the flying trapeze are pretty much out of the question, but a well-selected group of other devices is possible.

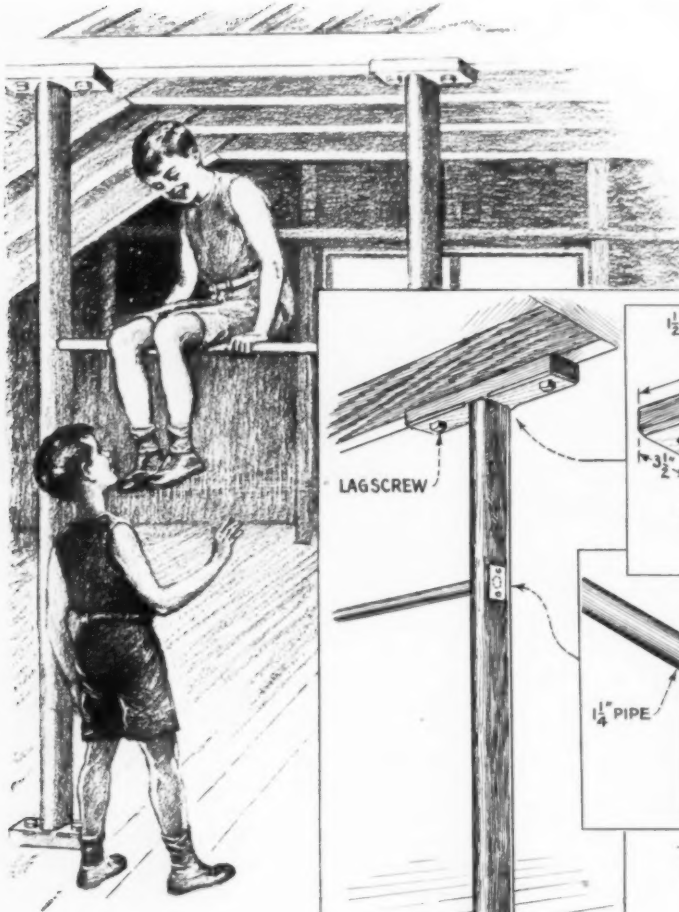
A trapeze bar is useful, even when the ceiling height is not sufficient to allow of much work above it. Obtain two pieces of 2 by 4-in. pine, or other wood not likely to splinter, mill-dressed on all sides, and cut them  $\frac{1}{4}$  in. shorter than the distance from ceiling plaster or joists to the floor. Round off both edges to semicircular profiles by gauging lines on the faces  $\frac{3}{4}$  in. from the edges, jointing off the corners to octagon shape, and ending by removing the new corners formed, until the pieces can be finished with scraper and sandpaper. Centering on each end, work a tenon,  $1\frac{1}{2}$  in. square and  $1\frac{3}{8}$  in. long, by notching in from the edges 1 in. These form the uprights for carrying the bar.

For secure fastening to floor and ceiling, cut a piece of 2 by 4, 8 in. long, and one 1 ft. 6 in., working mortises in each,  $1\frac{1}{2}$  in. square, through the thickness of the stock

and centering on the faces, by boring a  $1\frac{1}{2}$ -in. hole and chiseling out the corners. Bore  $\frac{1}{4}$ -in. holes for lag screws 1 in. from each end, and chamfer the edges of the faces back to the point of joining with the uprights.

To erect the uprights, note the direction of the ceiling joists, so that the ceiling cleats may be turned lengthwise or crosswise of the joists as the case may require, and slip the cleats on the tenons. Place the ceiling cleat of an upright so that the screws will enter the joists, and slide the lower end with its cleat to its place. Plumb in both directions, using a straightedge with the level in case the upright is sprung, and drill  $\frac{1}{8}$ -in. holes in floor and ceiling to receive the lag screws. Use a washer under the head of each screw, and turn down as tightly as possible. Preferably, the uprights should be 5 to 6 ft. apart, but this distance, of course, will be determined by the space at hand.

A length of  $1\frac{1}{4}$ -in. pipe forms the bar. Determine the height of one end and level across the other upright, and bore holes large enough to allow the bar to be forced through. When it is in place, screw over each end a plate, about  $\frac{1}{8}$  in. thick, 2 in. wide and  $2\frac{1}{2}$  in. long, drilled and countersunk for No. 10 screws. To prevent turn-

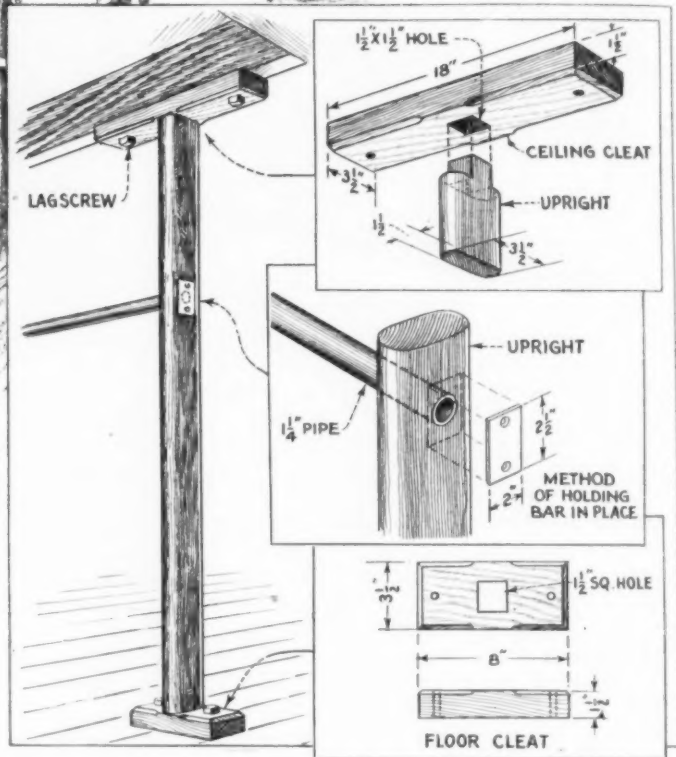


ing, drill a  $\frac{1}{4}$ -in. hole through each upright from edge to edge, passing through the bar, to receive a cotter pin made of a 16-penny common nail. Two coats of boiled linseed oil are a sufficient finish for the wood, although a coat of shellac followed by two of varnish lessen the chance of splintering.

The parallel bars are so simple of construction as to hardly require a description. The bars are 5 ft. long, of 2 by 3-in. stock, surfaced four sides, with upper edges and ends rounded as described for the trapeze uprights.

The post sockets are made by screwing into one end of a tee-fitting a 1-in. pipe, cut 2 ft. 3 in. long and threaded at one end, and into the other end a  $3\frac{1}{2}$ -in. length of pipe. A piece of 3 by 4-in. pine, 16 in.

long and rounded at the corners, is bored through from edge to edge, centering, to fit over the short pipe of each socket. Unite the sockets of each bar with a 1-in. pipe stretcher, 3 ft. 2 in. long, threaded at both



ends and screwed into the tee branches. Turn the bases at right angle to the stretcher, and  $\frac{1}{2}$  in. above the lower edge of each, drill a  $\frac{1}{4}$ -in. cotter hole passing through the short pipe.

The posts are of  $\frac{1}{2}$ -in. pipe, cut 2 ft.  $9\frac{3}{4}$  in. long. Starting 4 in. below the upper ends, drill  $\frac{1}{4}$ -in. holes through the posts every 2 in. to within about 8 in. of the lower ends. Locate the holes in the bars for the sockets by comparison with the assembled stands. Sixteen-penny nails serve as pins to adjust the height of the bars. Put the posts in the bars, slip a washer over each, and mark for a  $\frac{1}{4}$ -in. cotter hole.

For the body of the buck or "horse," make from 2 by 8-in. stock four bulkheads, 10 in. long, as shown in the detail. The semicircular edges, 5 in. in radius, are most easily cut by repeatedly sawing off corners, and finishing with a chisel and spokeshave. Two of these, forming the ends of the main body, are drilled 1 in. and 5 in. above the lower edges for  $\frac{1}{4}$ -in. bolts, and counterbored on the face to sink the bolt heads flush. The other two are notched  $\frac{3}{4}$  in. wide and  $2\frac{1}{2}$  in. deep,  $3\frac{3}{8}$  in. from each end. Just above these notches, on one side of each, nail a  $\frac{3}{4}$  by  $1\frac{1}{2}$ -in. strip, and 1 in. above it bore two pairs of  $\frac{1}{4}$ -in. holes, as shown, to receive the legs of the U-bolts that secure the handles.

Each post is of 3 by 3-in. stock, sized to  $2\frac{1}{2}$  in. square, and cut 2 ft. 11 in. long. Five inches below the upper end cut notches  $2\frac{1}{2}$  in. wide on opposite sides and  $\frac{3}{4}$  in. deep. Centering on these sides, bore  $\frac{1}{2}$ -in. holes every 2 in. below the notches to within 8 in. of the lower end. Centering on the other sides, bore two  $\frac{1}{4}$ -in. holes, one  $2\frac{1}{2}$  in. from the upper end and the other  $3\frac{3}{4}$  in. below it.

Bolt the posts to the end bulkheads with  $\frac{1}{4}$ -in. machine bolts,  $\frac{1}{4}$  in. long. Cut two pieces of 1 by 3 in., sized to  $\frac{3}{4}$  by  $2\frac{1}{2}$  in., 2 ft. 9 in. long,

and unite the two posts by gluing the ends of the strips into the post notches and holding them with two No. 10 wood flat-head screws. Slip the other bulkheads

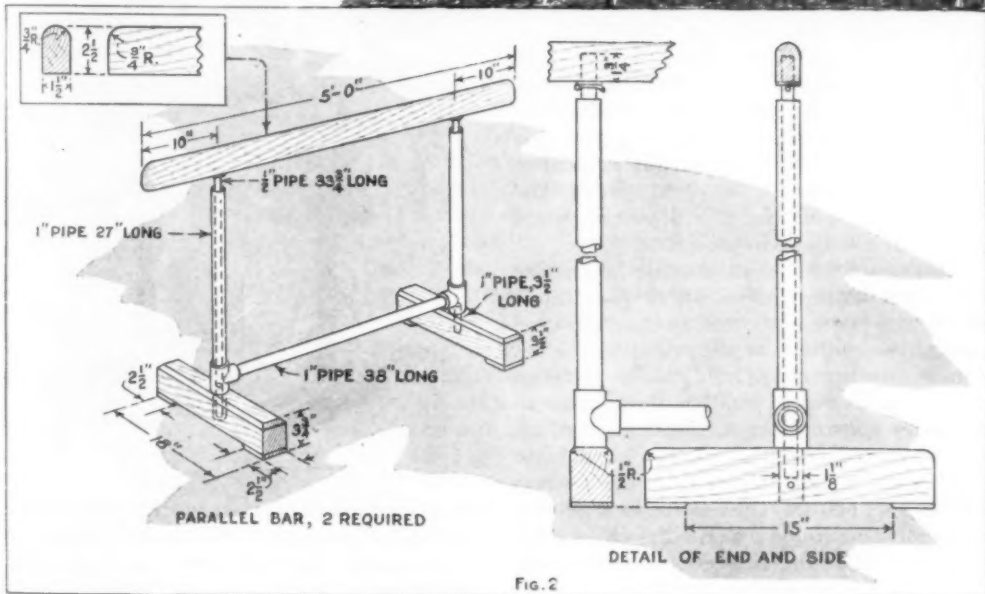
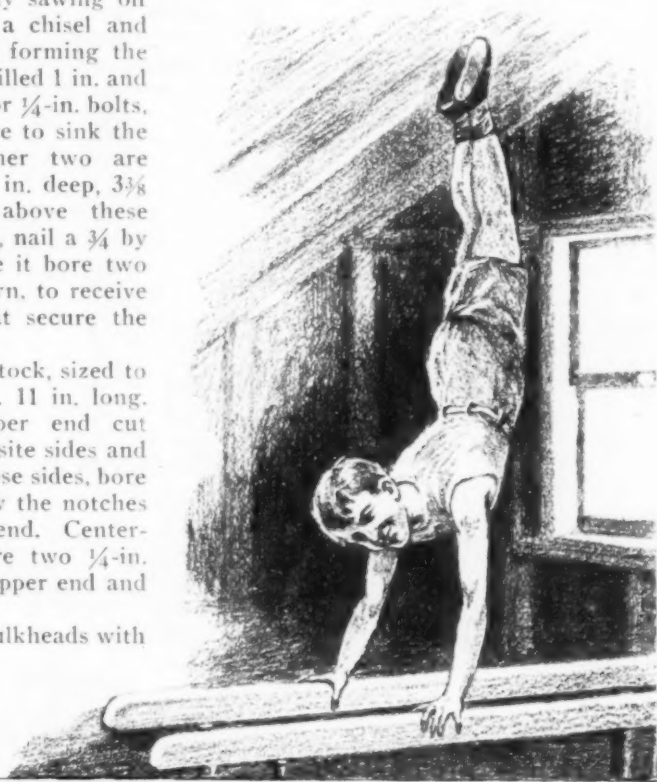
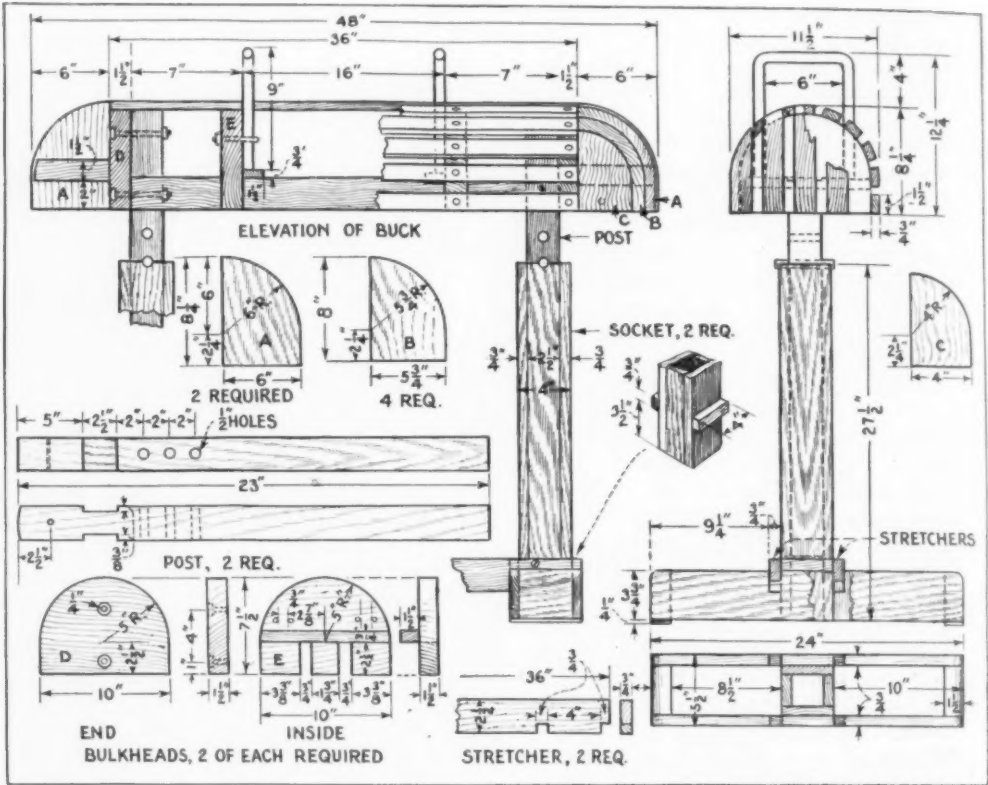


FIG. 2



over the strips, cleats toward the center, with 7 in. between end bulkhead and the inner. Nail the cleats to the strips.

Make two handles by bending pieces of 1/2-in. round iron, 2 ft. long, into "U"s as illustrated, with 6 in. between the legs. Bolt these to the inner bulkheads with 1/4-in. U-bolts, resting the legs on cleats.

Now cut eleven 3-ft. strips of 3/4 by 2-in. pine and tack to the bulkheads as shown, with equal spaces between. Bore and countersink for No. 10 flat-head wood screws at each bulkhead.

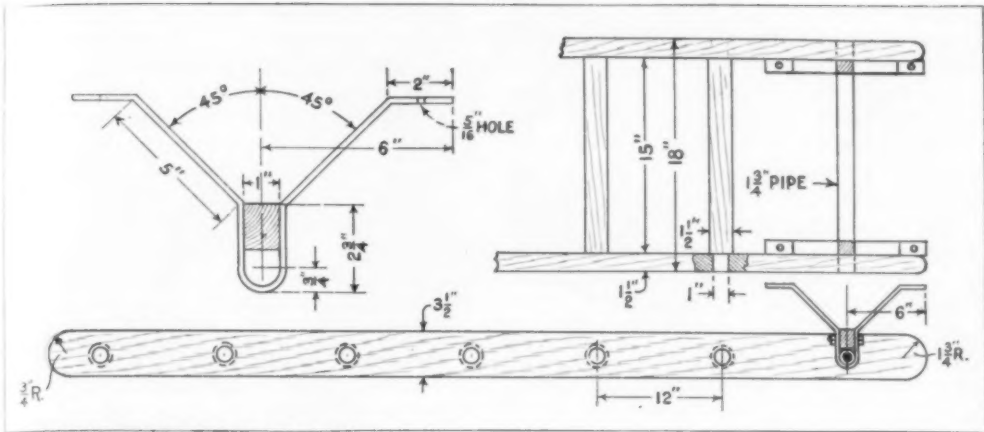
The rounding ends are made by cutting the three sizes of 2-in. stock illustrated. Make the large sizes and nail to the centers of the end bulkheads, and nail on each side a spacing strip 1 in. thick. Nail in place the four next smaller segments, nail on other spacing strips, and lastly nail up the sidepieces. Chisel off the corners to the desired roundness.

The sockets are square tubes made by gluing and nailing a pair of strips, 3/4 by 2 1/2 in. by 2 ft. 3 1/2 in., between two pieces of the same thickness and length, 4 in. wide.



Glue and screw across each wide board side a 3/4 by 3/4-in. cleat 3 1/2 in. from the lower end. For the feet, cut four 2-ft. lengths of 1 by 4-in. stock, finished to 3/4





by  $3\frac{1}{2}$  in. Glue and secure with two screws, butting the upper edges against the cleats as shown; or if it is desired to make them removable, use four screws without glue. Give an equal projection at each end, and be sure they line with each other and are square with the sockets. Cut a 2 by 4-in. block between each end, nailing solidly, and put across the bottom a  $\frac{1}{4}$ -in. strip,  $1\frac{1}{2}$  in. wide, to prevent rocking of the buck in case of twisting of the material. Flush with the socket sides, cut  $\frac{3}{4}$ -in. notches,  $\frac{3}{4}$  in. deep, to receive the stretchers.

The stretchers are of 1 by 3-in. stock, cut 3 ft. long, with the longer corners notched  $\frac{3}{4}$ -in. square, and similar notches cut 4 in. behind them. Slip these into the foot notches and put two screws in each end into the sockets. Put the posts into the sockets, and hold them at any desired height between 3 ft. and 5 ft. with hardwood pins passed through holes in the posts. Make a semicircular hole in the top of each socket to bed the pins.

Pad the body with rags and cover with burlap, folding the edges neatly underneath and nailing with upholsterers' tacks.

The ladder, shown in the last illustration, is an excellent exerciser. Like the uprights of the trapeze, the ladder slides are rounded on both edges, but their length is 2 in. less than the height of the room, and the ends, instead of being tenoned, are rounded off. Starting 6 in. from one end, bore 1-in. holes every 12 in., centering on the sticks, until the last round, which is also placed 6 in. from the end. The upper round is a piece of  $\frac{3}{4}$ -in. pipe.

Make the necessary number of rounds  $1\frac{1}{2}$  ft. long from  $1\frac{1}{2}$ -in. full round. Taper the ends and assemble with the sides as these lie on a pair of sawhorses. With the frame squared, set a pair of dividers to  $1\frac{1}{2}$  in., less the distance the round ends are entered, and scribe the tenon shoulders. Remove the rounds, saw in carefully  $\frac{1}{4}$  in., and pare the tenons true.

Reassemble the rounds and the sides, applying glue to both mortises and tenons, and clamp solidly together. Wipe off excess glue while it is soft. When the glue has set, smooth the wood very carefully, since the ladder is used for heavy hand work, and splinters or rough places will mean injury.

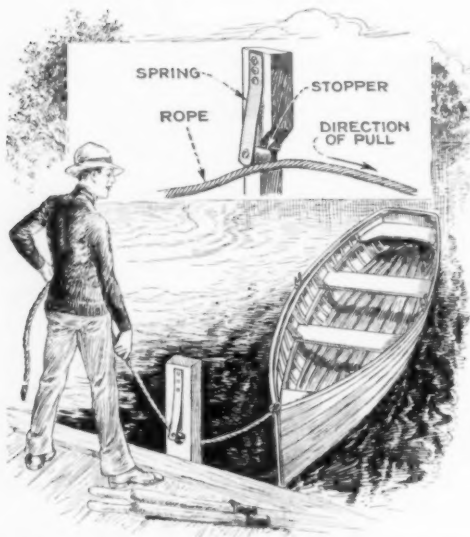
The two hangers are bent from  $\frac{1}{4}$  by 1-in. strap iron, cut 21 in. long and bent at the middle with a 1-in. pipe as a mandrel. Bend back the sides  $2\frac{3}{4}$  in. above the bottom of the curve to angles of  $45^\circ$ , and bend the ends back 2 in. until they line with each other. Drill  $\frac{5}{16}$ -in. holes in the ends to receive  $\frac{1}{4}$ -in. lag screws, and drill simi-

lar holes through the loops, where bolts, passing through wooden blocks, can clamp the pipe round at the upper end of the ladder to prevent bounding when in use.

Screw the hangers to 2 by 4-in. cleats, similar to the ceiling cleats for the trapeze uprights, and screw the latter to the ceiling joists. To support the other end, when the ladder is up from the floor, put up a ceiling cleat with a stout screweye, and loop a rope under the round. A like device near the floor on the wall or a screw-eye in the floor holds the ladder vertical.

For use in conjunction with the ladder in abdominal exercises, build a stout little bench for a seat.

### Quick Hitch for a Rowboat



This Simple Fastening Device Permits Anyone to Dock a Rowboat Securely

Many persons who like to row are not familiar with the proper method of fastening a rowboat to the dock. Some knots will slip and others may come untied. By providing the simple arrangement shown in the drawing, anyone can quickly fasten the boat so that it will not come loose and drift away. A short plank is spiked vertically to the edge of the dock, and a hole, somewhat larger than the tie rope or painter, is drilled through it about 4 in. above the floor. The hole should be tapered with a sharp knife so that the opening facing the water is at least  $\frac{1}{4}$  in. less

in diameter than the opposite one. A hardwood stopper, about half as large across as the hole, is made and fastened securely with a wood screw to a strip of spring steel, which is bolted or screwed to the plank above the hole so that it forces the stopper into the hole. The spring should rest flat against the plank. When the boat is docked it is only necessary to push the rope through the hole for a short distance. The pressure of the spring forces the stopper against the rope, and any pull by the boat will jam the stopper even tighter.

### Holding Small Nails Securely

It is often difficult to hold and start small brads and nails. Here is a method which enables you to hold the brads securely. Cut a fairly deep slit in the rubber eraser on the end of a lead pencil and slip the brad into the slit. Hold the pencil so that the brad is set in the proper position and drive it down with the hammer.

—Frank W. Bentley, Jr., Missouri Valley, Iowa.



☐ Piston-ring edges should be left sharp, and only a slight burr removed.



This Realistic and Amusing Walking-Duck Toy Offers an Opportunity for the Home Craftsman to Display His Talents and Amuse the Youngsters at the Same Time

## The Walking Duck

By H. C. McKAY

**W**ALKING toys are always popular with children, and, in fact, many adults like to watch their antics. Toy builders are familiar with many mechanical devices for imparting the walking motion, such as joints, cranks, interrupted or eccentric wheels, but the least complicated and most effective is the form that operates through the forces of gravity and momentum. One of the simplest toys incorporating this principle is the walking duck, although, as will be seen, the same principle may be applied to any toy whose shape allows it to rest in equilibrium.

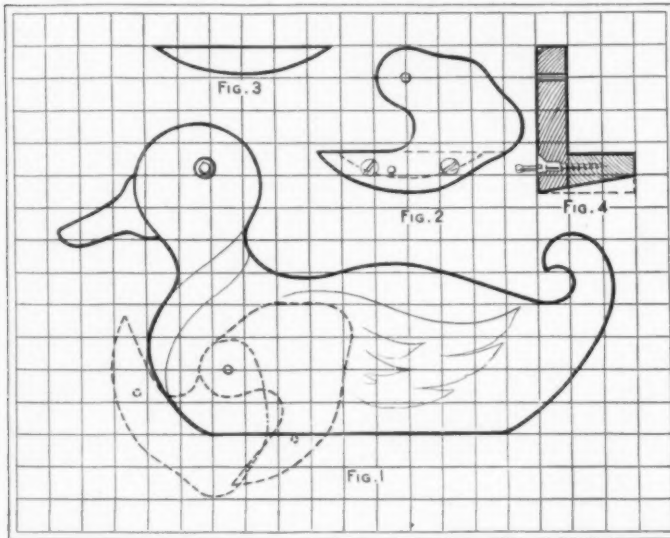
The toy is cut from  $\frac{1}{2}$ -in. wood. Fig. 1 is the layout for the body. The feet are shown dotted in order that the proper relationship between them and the body may be seen, although, of course, the body is cut out without feet. It is drilled for the foot pivot as shown. This hole should

be at the exact point indicated for best results. The eyes and wings are next painted. In fact, the entire body should be fully enameled and the details added before assembly. When this is done, the feet are made.

Two feet are cut out of  $\frac{1}{2}$ -in. wood as shown in Fig. 2, following the heavy line. These are placed together in a vise and carefully shaped so that they will be exactly alike, and exactly like the pattern, and the pivot hole is bored while both are clamped together. Take care to get this hole straight through and do not let it run at an angle.

The construction of the actual foot will be more easily understood by referring to Fig. 4. The cut-out piece (Fig. 2) has a piece of wood fastened to the bottom edge with small screws and glue. This piece is shaped to conform to the lower curve in

Fig. 2. When this assembly is complete, the foot will have the "leg" portion rising from one side, and will be supported upon a "rocker,"  $1\frac{1}{2}$  in. wide, since the squares in the diagram represent  $\frac{1}{2}$  in. This rocker form should be true, so that there will be



a uniform forward motion to the walk.

The next step is the most important one in the construction, and the most difficult. Clamp the foot in a vise with the bottom of the rocker uppermost. With a fine file bevel the outside edge of the rocker, removing the portion shown by the dotted lines in Fig. 4. This removal is uniform on all surfaces of the bottom of the rocker, making its outer edge concentric with, but smaller than, the inside curve.

The dotted lines in Fig. 2 show the effect viewed from the side, while Fig. 3 shows the relative size and shape of the outer edge of the rocker. When this is complete and the assembly stood upright, the leg will no longer stand perpendicular but will lean toward the outside. The other leg is made to correspond, the bevel being in the opposite direction, of course.

The legs are now attached to the body of the duck with a pin of such size that they will swing freely. To prevent any binding, a washer should be placed between each leg and the body. The ends of the pin also receive washers and are then upset or flattened to prevent the legs from coming off.

The duck is now placed upon the table and pushed forward until the extreme front portion of the rockers lie upon the table surface. Mark the place where the legs strike the body. Into the inside of each leg drive a brad at this mark, leaving about  $\frac{3}{8}$  in. projecting. This brad serves as a stop to prevent the foot from swinging too far back.

A cord is now attached to the front curve of the duck's breast. This completes the toy. If it is placed upon the floor and pulled by the string, the pull will throw the body to one side or the other. If it goes to the left, the surface of the left foot acts as a balance, and the duck moves forward upon the left rocker. Gravity swings the right foot forward, and the reaction throws the body to the right and it topples over, only to be stopped by the

surface of the right rocker coming into contact with the floor. It moves forward upon this while the left foot swings forward. This motion is continuous, the body of the duck swaying from side to side, the feet alternately advancing and retreating. The result is a very amusing simulation of the duck's waddle.

The decoration of this toy is left to the builder. A full-size blueprint of the toy is available for those who find it difficult to lay out by the square method. Send 25 cents to the Amateur Mechanics department, specifying the "Walking-Duck" blueprint.

#### Scissors Handy in the Kitchen

A pair of sharp scissors will cut meat for curries, pies, etc., in about one-half the time required to do it with a knife. They can also be used for cutting up oranges, dates, figs, grapefruit, etc., and are handy for trimming fins from fish. For stoning large cherries I have found nothing better and for cutting string beans scissors are hard to beat.—Mrs. James E. Noble, Toronto, Can.

### Keeping Paint Cans Sealed

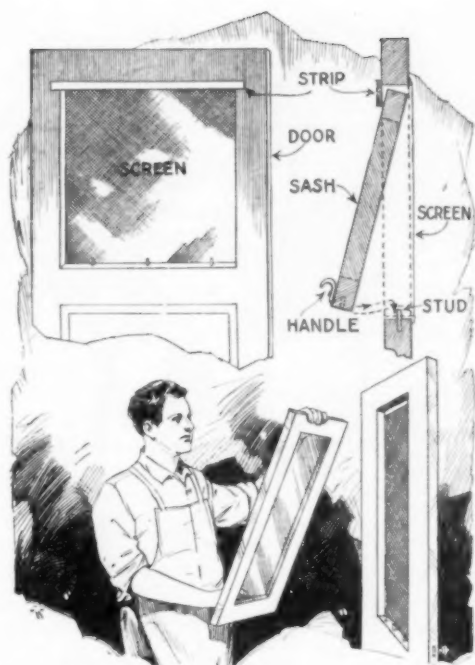
I had a quart of screen paint, part of which I wanted to use, but upon trying to pry the cover off with a screwdriver, I found that it had been pressed in firmly and that some paint, previously smeared along the edges, had dried and cemented the cover in place. The lid did not budge, so I punched two holes in it with the screwdriver, one near the edge and the other in the center. The paint could then be poured out easily. After using the paint, a film formed over the holes, which, when dry, made the can air-tight and kept the contents in perfectly good condition.—Joseph Pauly, South Chicago, Ill.

### This Trap Placer Is Handy

I do quite a bit of trapping for muskrats and have found it rather difficult to place the traps in the proper position without getting into the water. Of course, I have boots, but found that I could accomplish the work much more quickly and easily by using a simple homemade pair of tongs, as shown in the illustration. This tool can be made from two old hayrake teeth, bent and flattened near the center where they are pivoted by means of a rivet. The handles are shaped by bending the ends to form rings, about  $2\frac{1}{2}$  in. in diameter. A trap held by this tool can be set where it is wanted without any risk of snapping it shut.—Luther Strosnider, Onaga, Kans.



Pair of Tongs Made from Old Hayrake Teeth Useful for Setting Muskrat Traps



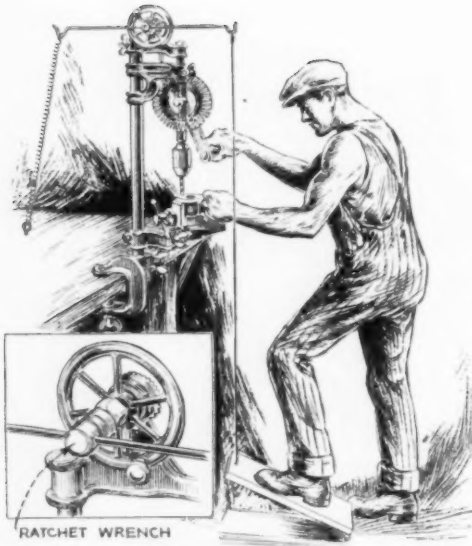
Ordinary Screen Door Fitted with Window Sash Saves Cost of Storm Door

### Removable Sash for Screen Doors

Instead of having separate screen and storm doors I have found it much more convenient to make a sash to fit in the screen door so that it can be removed or inserted in a moment. This saves the cost of a storm door and the trouble of hanging it each season. To fit a sash to a screen door, nail a 1-in. strip of wood across the top of the screen opening as shown, and drive three finishing nails, or nails with the heads cut off, at the bottom, letting them project about  $\frac{1}{2}$  in. above the surface of the wood. The sash for the glass is then made to fit the opening but should be  $\frac{5}{8}$  in. shorter. Three holes are drilled in the bottom edge of the sash to fit over the nails in the door frame. The method of inserting the sash is clearly shown in the upper right-hand detail.—A. Stenson, Gardena, Calif.

☐ Just before polishing a stove with blacking, it is well to rub the surface to be polished with a rag dipped in kerosene; this seems to increase the life of the polish after it has been applied. Another advantage is that kerosene will prevent rust.





The Treadle Feed for This Drill Press Permits Workman to Use Both Hands Freely

### Treadle Feed for Small Hand Drill Press

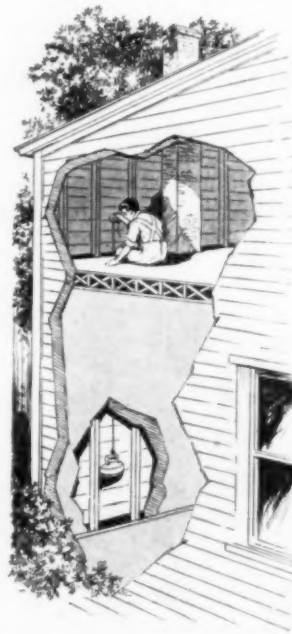
Many small workshops are equipped with a drill similar to that shown in the drawing. As one hand is needed to turn the feed wheel, there are many jobs that are quite difficult. A simple and inexpensive attachment, which can be fastened to the feed-wheel shaft, and is operated with one foot, leaving the hands free to hold the work and to turn the crank on the drill, will, therefore, be found convenient. It consists of a ratchet device, such as found in many automobile wrench sets, a fairly strong hinge, a screen-door spring, an iron rod, about 18 in. long, and two pieces of 1-in. wood, about 4 by 12 in. in dimensions. The ratchet device is attached to the shaft by means of a setscrew, which has previously been placed in such a position that it passes through the bushing in the hexagon end of the ratchet. An excellent bushing for this purpose may be made by using a hexagon nut. In some drills, it may be necessary to remove the feed wheel. A hole of the same diameter as that of the iron rod is drilled through the top of another socket wrench, which fits the ratchet. Through this hole, the iron rod is passed for half of its length and is fastened by burring. If desired, the rod may be halved and then inserted in tapped holes. One end of the rod is fastened to the spring, and this is in turn fastened to

the bench, as indicated. To the other end of the rod a stout cord is attached and this is run to a treadle made by fastening the two boards together with the hinge.—Myron L. Harmon, Chicago, Ill.

### Retrieving Articles Lost in Partitions

While I was talking to an electrician friend of mine who was wiring in the attic of an old house, his pair of pliers fell out of his hand and dropped three stories down a partition. The problem of recovering the pliers did not seem to worry him much, and he soon had them fished up with the aid of a clothesline, an old flatiron, some coarse wire mesh and about a pound of putty. He put a few layers of wrapping paper on the bottom of the flatiron to keep it clean. On this he put a  $\frac{3}{4}$ -in. layer of putty and then placed the wire mesh over the putty, bending the mesh in over the top of the iron, after which a 2-in. layer of putty was spread over the mesh. He tied the end of a sufficiently long piece

of clothesline to the handle of the flatiron and then lowered the latter into the partition as shown. In a very short time he pulled up the flatiron with the pliers clinging to the putty. The purpose of using the wire mesh, he explained, was to make all the putty share in lifting the pliers. He said that he had, on other occasions, lifted things weigh-



ing several pounds in this way.—Herbert A. Freeman, Willimantic, Conn.

❏ Ivory color is made by tinting white with medium yellow; a touch of black gives old ivory.

# Paper Scraps Make Decorative Pottery

By HAROLD JACKSON

**M**AKING something ornamental and useful out of waste material is not always an easy matter. However, by the simple method described here very pretty and bizarre vases can be made from old pickle jars or similar bottles. Clay flower-pots can be made much more attractive by this interesting process. It can also be successfully applied to bowls and dishes used on the table, the only requirement being that the vessel to be decorated has a smooth surface, free from raised designs. When treated in this manner, the articles will have the appearance of being made up of numerous irregular pieces of brightly colored glass and china. The surface is not easily marred, is waterproof and can be washed when necessary. The work is very interesting and pleasing effects are easily obtained.

The materials required are a bottle of glue and a few bright-colored advertising pictures from a high-class magazine. These pictures are cut up into irregular pieces, regardless of outline. The pieces

are then glued to the outer surface of the jar without system or order, except that the adjacent edges of the paper pieces are trimmed to fit together, and in applying the pieces, care must be taken not to place together colors that "swear" at each other.

When the vessel is completely covered and the glue has dried, all the seams are painted with a small brush or pen that makes a stripe about  $\frac{1}{8}$  in. wide. This stripe must go around each separate piece of paper. Black or colored lacquer can be used for this purpose. The top of the jar is painted with the same color. Gold paint can be used with good effect in some cases. When the paint is thoroughly dry, the entire vessel is given a coat of white shellac or linoleum varnish, which brightens the surface and renders it waterproof. If the object is to be set on a varnished surface, glue a piece of felt on the base.



The Photo Shows a Lamp Base Made from a Pickle Jar by the Simple Method Described in This Article; Very Pretty, as Well as Novel, Effects Are Easily Attained in This Work



Folding Cot Equipped with Casters Is Stored Out of Sight under the Bed

#### Equipping Folding Cot with Casters

In small homes and apartments, where the available bedroom space is limited, a folding cot is useful, but, when collapsed, it is usually too large to set in a clothes closet, and, if kept in the bedroom, it is unsightly. Besides, the mattress is a bulky piece to store during the day, if the cot is in use every night. To overcome these difficulties, one home owner fastened casters to the end posts of the cot, as shown, so that, when these are folded, the cot can be wheeled around easily. The best place to store it, with the mattress left on it, is under the regular bed, where it is entirely out of sight.—L. A. Zaun, San Bernardino, California.

#### Removing Broken Auto Lamp from the Socket

It is difficult to remove a broken auto lamp from the socket and there is considerable danger of cutting one's hands in attempting to do this without the use of any tool. A good method, which avoids this trouble, is to use an ordinary clothespin. It is pinched together, inserted into

the lamp base and then allowed to spring tight. Press down on the clothespin and turn it the same way as you would to remove a lamp.—J. W. Baush, Springfield, Massachusetts.

#### Cutting Core Strips for Transformers

Those who have built transformers know how difficult it is to cut the strips of silicon steel of which the core is built up. Here is a method, however, that is comparatively easy. After a large sheet has been cut into long strips of the required width, take a tinner's snips and clamp one handle in a vise, as shown, keeping the cutting edge horizontal. Put a board under the clamped blade. To this board, on each side of the snips, nail small wooden blocks sufficiently high to be level with the cutting edge, and just so far apart that the free arm can swing. A guide for the strips is nailed to the block on the side of the movable blade, and a stop on the other side. The strip of steel to be cut is placed flat on the block, pushed against the guide, and slid between the blades of the snips until it hits the stop. Then the free arm is pressed down to cut the strip. Two persons can do this work better than one, one to feed and the other to press down the handle. Three hundred pieces were cut in fifteen minutes with

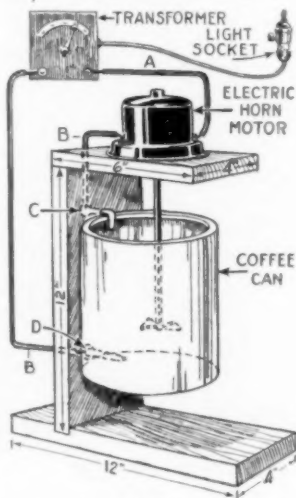


Easy Method of Cutting Transformer Core Strips of Equal Length

this improvised device—ordinarily a job of a couple of hours.

### Homemade Electric Cream Whipper

You can make the electric cream whipper illustrated with very little trouble. It consists of an old auto-horn motor, in good condition, a toy-train or a bell-ringing transformer, a wooden stand to hold the motor and a coffee can for the cream to be whipped. A  $\frac{1}{8}$ -in. rod, about 6 in. long, is welded or brazed to the end of the motor shaft and a small nut or propeller is securely attached to the other end of the rod. The stand is made of two 12-in. lengths of  $\frac{1}{2}$ -in. wood, 4 in. wide, and one 6-in. length of the same stock. The drawing clearly shows how the stand is made and how the motor is mounted on it. Two nails are driven into the vertical section of the stand as indicated, to hold the can. The upper nail is bent downward to hook over the edge of the can, while the lower nail extends straight and serves as a rest. The wiring is also shown so that no mistake need be made. One terminal of the transformer is connected to the lower nail, while one terminal of the motor is connected to the upper nail. The remaining open terminals of the motor and transformer are then wired together. Afterward the cord from the transformer is connected to a light socket or wall plug. If desired, the transformer can be attached to the stand permanently. The can, making contact between the two nails, serves as a switch so that when it is set in place the motor is turned on, and as soon as it is removed, the motor stops. In case no light current is available, the motor can be run on three dry cells or a storage battery. Besides whipping cream, this device will churn butter and can be used for many other purposes.—William Coulbourn, Suffolk, Va.



many other purposes.—William Coulbourn, Suffolk, Va.



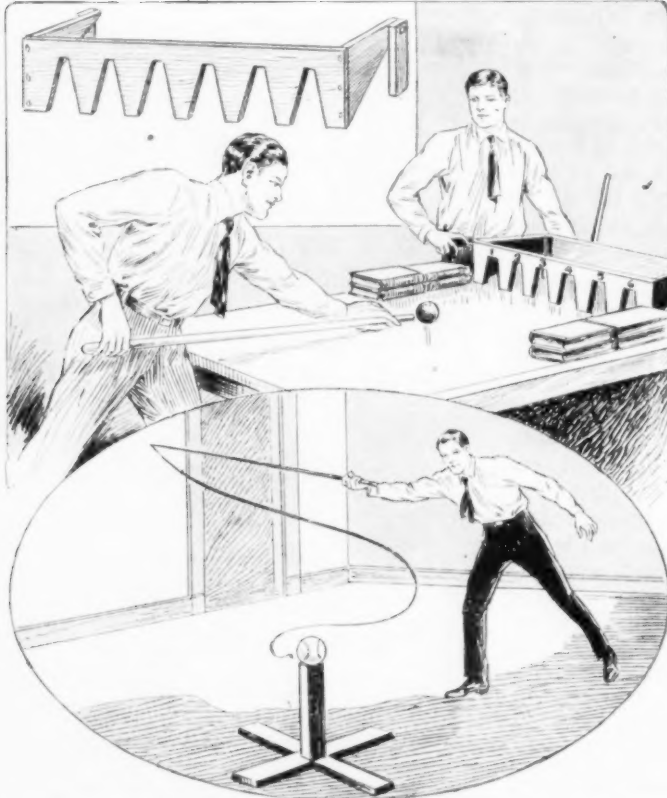
Handy Folding Camp-Fire Grate for the Tourist-Camper Takes Up Little Space in the Car

### Simple Folding Camp Grate

To save space in the car, tourist-campers require collapsible equipment, and for this reason the folding grate shown in the drawing is of interest. It consists of six lengths of  $\frac{1}{2}$ -in. iron rod, four of which are 12 in. and two, 24 in. long. Both ends of the long rods and one end of each short rod are flattened and drilled to receive a pin, permitting them to be folded as indicated in the upper detail. The ends of the short pieces should be ground or hammered to a point so that they can be pushed into the ground easily. In use, the two members are placed about 6 in. apart so that pots and other utensils will stand securely across them.—E. L. MacFarlane, Nashwaaksis, Can.

### Improvised Leather Cushions

Desiring some leather cushions for his auto, but not being able to purchase them, a farmer substituted a few imitation-leather shopping bags. He placed an old sofa pillow in each one, cut off the tops of the bags, punched holes along the edges and laced them with a shoestring. The pillows make good backrests and serve the purpose just as well as any ordinary leather cushions offered in the market.—Chas. Latour, Plattsburg, N. Y.



Two Homemade Games of Skill Which Afford Endless Amusement for Young and Old; Both Are Easy to Make

### Two Homemade Ball Games

Two games, which will afford endless amusement to adults as well as to the younger folks, are shown in the drawing. One is similar to the well-known game played with marbles. A length of 1-in. board, nailed to two end supports so that it can be set on edge, a pair of cues made from old broomsticks and a couple of balls about the size of baseballs are all the equipment required. A number of notches, just a trifle larger than the balls to be used, are cut in the board. This makes it necessary to shoot the ball through the holes squarely, which requires skill. The game is begun by shooting the ball, from a starting point, toward one of the holes. If the hole is missed, the next player takes his turn. If desired, the size of the notches may be graduated so that the smallest hole counts for the greatest number of points. The lower illustration is a game, also novel, in which the player lashes a

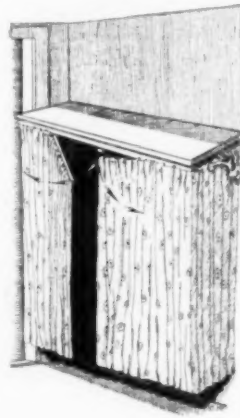
baseball from a pedestal with a whip. Considerable skill and a sure eye are necessary to strike the ball, but one man has become so expert that he can curl the lash around the ball and, with a quick jerk, pull the ball forward and catch it. In this game each player is given a number of chances to dislocate the ball. The whip used consists of a strong wooden stick to which a length of rawhide is tied.—James E. Noble, Toronto, Can.

### Curtain and Shelf Form Neat Wardrobe Space

When building a shelf in a bedroom, which was not provided with a clothes closet, it was desired to hang the clothes under the shelf and this made it necessary to hang a curtain to cover the wardrobe, keeping the clothes out of sight and

protecting them from dust. Instead of the usual method of attaching the curtain so that it could be slid back on a cord, I had a wide hem sewed at the top edge so that two  $\frac{1}{2}$  by  $\frac{7}{8}$ -in. sticks, 18 in. long, could be inserted. These sticks were pivoted with wood screws to the underside

of the shelf so that they could be swung out as shown. Metal clips were provided to support the ends of the sticks at the center of the shelf when the curtain was closed. On the sides and front, the curtain was tacked to the edge of the shelf and to the pivoted sticks.—A. J. Call, Hartsville, Mass.





# SHOP NOTES



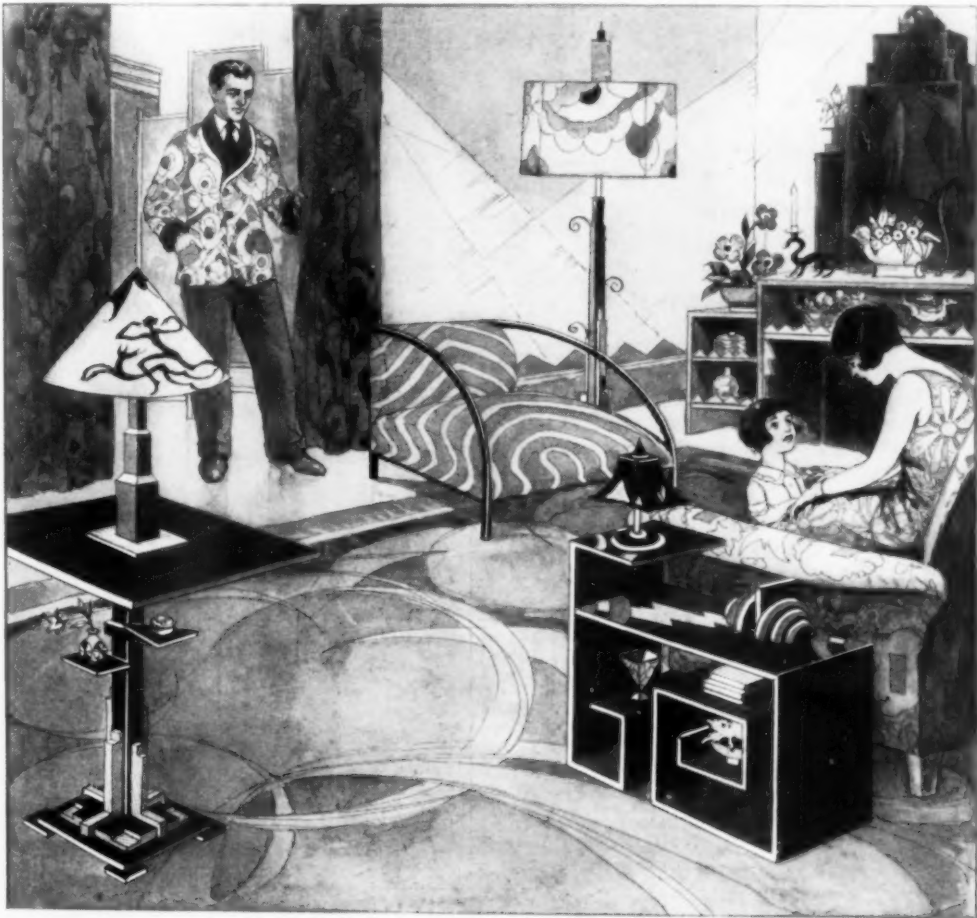
All Shop Notes published in 1927, in book form—Fifty Cents—from our Book Department

## Two Tables in Art Moderne

By E. R. HAAN

**I**NTERESTING, attractive furniture in ultra-modern style is the latest fad. Lamps, tables, stands, etc., in fantastic, bizarre color combinations, which make

these items truly novel, can be seen and purchased at most art and many of the larger department stores. Although generally of simple construction, this type of



Bizarre, Colorful and Attractive Furniture, Executed in Art Moderne, Has Become Extremely Popular, Entire Rooms Being Furnished and Decorated in This Style

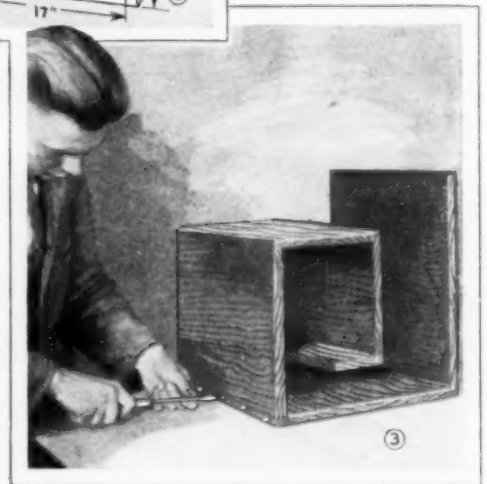
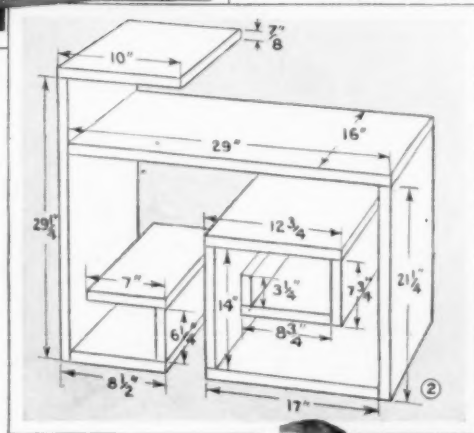


furniture is, at present, rather costly. Many admirers of the work, therefore, do not feel justified in purchasing it, but they may, with very little trouble and care, make it themselves at a fraction of the cost by following the instructions contained in this article. As small tables and stands undoubtedly have the widest range of usefulness and popular appeal, an occasional table and a davenport end table are herewith described and illustrated. Although the exact size, arrangement and color scheme of these items are given, it is permissible to construct them either smaller or larger, and the details may also be varied to suit the ideas of the builder.

The davenport end table is made of  $\frac{7}{8}$ -in. five-ply veneer, which is more expensive than ordinary wood, but has the advantage of being much stronger, and will not warp or crack through atmospheric changes. You can purchase the veneer already cut to specified sizes at most mills that handle this stock. The very cheapest

kind of veneer is satisfactory for making the table, as the surface is to be painted and beauty of the grain therefore need not be taken into account. Thirteen pieces of veneer, 16 in. wide, are used for making the end table. The dimensions of the various pieces are given in Fig. 2. As the method of joining these pieces together must not show on the finished product, 2-in. wood screws are used for this purpose, five of them being driven through adjoining sections, and spaced at equal intervals so that the strain will be well distributed. It is absolutely necessary to drill holes in both adjoining pieces to accommodate the screws. To drill these holes accurately, prick-punch a spot for the center hole,  $\frac{7}{16}$  in. from the edge. Then prick-punch

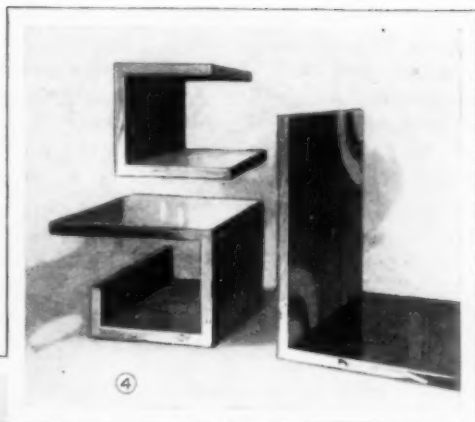
the remaining two, which must be located halfway between the center and the end holes. Drill the holes a trifle larger than the largest part of the screw shank, as in Fig. 1. Counterbore these holes in order to permit sinking the screw heads below the surface. After this has been



done, the drilled piece is placed on the piece to which it is to be attached, and

holes, smaller than the threaded section of the screw, are drilled in the end of the second piece. These holes enable you to drive the screws into the wood easily, and without risk of cracking the wood. To reduce the friction of the screws entering the wood, smear soap or beeswax over the threads. When driving in the screws, care should be taken to avoid slipping of the screwdriver, as this may mar the surface and such marks are very difficult to cover when the table is being finished.

The use of a screwdriver bit in a carpenter's brace is recommended for driving the screws, although any ordinary screwdriver can be used. Fig. 3 shows part of the table joined in this way. When each piece is fitted to its neighbor, the outside edges must be perfectly flush and smooth. As the stock will not always fit exactly, it



surface is smoothed with fine sandpaper.

It must be remembered, however, that it is nearly impossible to apply the design, and to finish the surface properly after the table is completely assembled. Therefore, it has been found convenient to assemble the pieces into four separate sections, three of which are shown in Fig. 4. The remain-

ing section consists of the top, the sides and the upper shelf. The four sections are finished on all sides, but not on the edges, before they are assembled. The finishing of the edges is done when the table is completely assembled, as they have to be planed down and sandpapered smooth to match each other; the table is therefore assembled temporarily, the edges carefully fitted, and the sections taken apart again for finishing.

Water putty or "plastic wood" is used to fill the counterbored holes into which the screw heads are sunk. Force the filler in firmly, allowing a small quantity to project above the surrounding surface. When it has thoroughly dried, which takes from 24 to 48 hours, use a sharp chisel to cut off the surplus neatly. Having done this, apply a coat of shellac all over. This application should be quite



may be necessary to use a small plane to get the edges true, after which their

liberal on the edges where the crossgrain of the core of the veneer is exposed. Allow the first coat of shellac to dry overnight and then apply a second coat. When this is dried, rub the surface down with sandpaper held on a smooth block of wood. Steel wool can be used to remove particles of dust, which may have collected on the surface of the shellac while this was drying. The surface is cleaned thoroughly and a first coat of one of the new quick-drying enamels, or lacquer, is then applied. The entire surface of all the pieces is enameled or lacquered black.

At this point you may become rather anxious to hasten the process of applying successive coats of paint, but each coat must be allowed to dry thoroughly before it can be rubbed down and the next one applied. The enamel or lacquer may dry to the touch within a few moments and may seem hard after a few hours, but do not misjudge the true condition by these appearances. Wait at least 48 hours before you attempt rubbing down the ridges and removing the dust specks that are sure to be found on the dried surface. When painting, which can be done either with a brush or by means of a spray gun, the utmost care should be observed. First, the shop or room where the work is done should be clean, and the air should be as free from dust as possible. Therefore, do not sweep the floor, use a circular saw or a sander, or any other machinery, which is likely to raise dust, just before you apply the paint. Also, it is preferable to keep the windows and doors shut, especially on a windy day, when dust flies about everywhere. Your brush should be thoroughly clean. This is impossible if it is stirred in some old, exposed turpentine, or thinner, and then slapped against a wood surface. This is a dust-collecting rather than a dust-removing process. If the condition of a brush is doubtful, it should first be cleaned thoroughly in the solvent of the paint used, which is turpentine in case of ordinary paints and enamels, and thinner in case of lacquers. Thereafter, give it a thorough washing in clean, soapy water, rinse it well and set it away to dry. Dry brushes should be wrapped up in paper to keep out the dust. Before actually opening the lid of the paint can, raise it all around about  $\frac{1}{8}$  in., and blow the dust

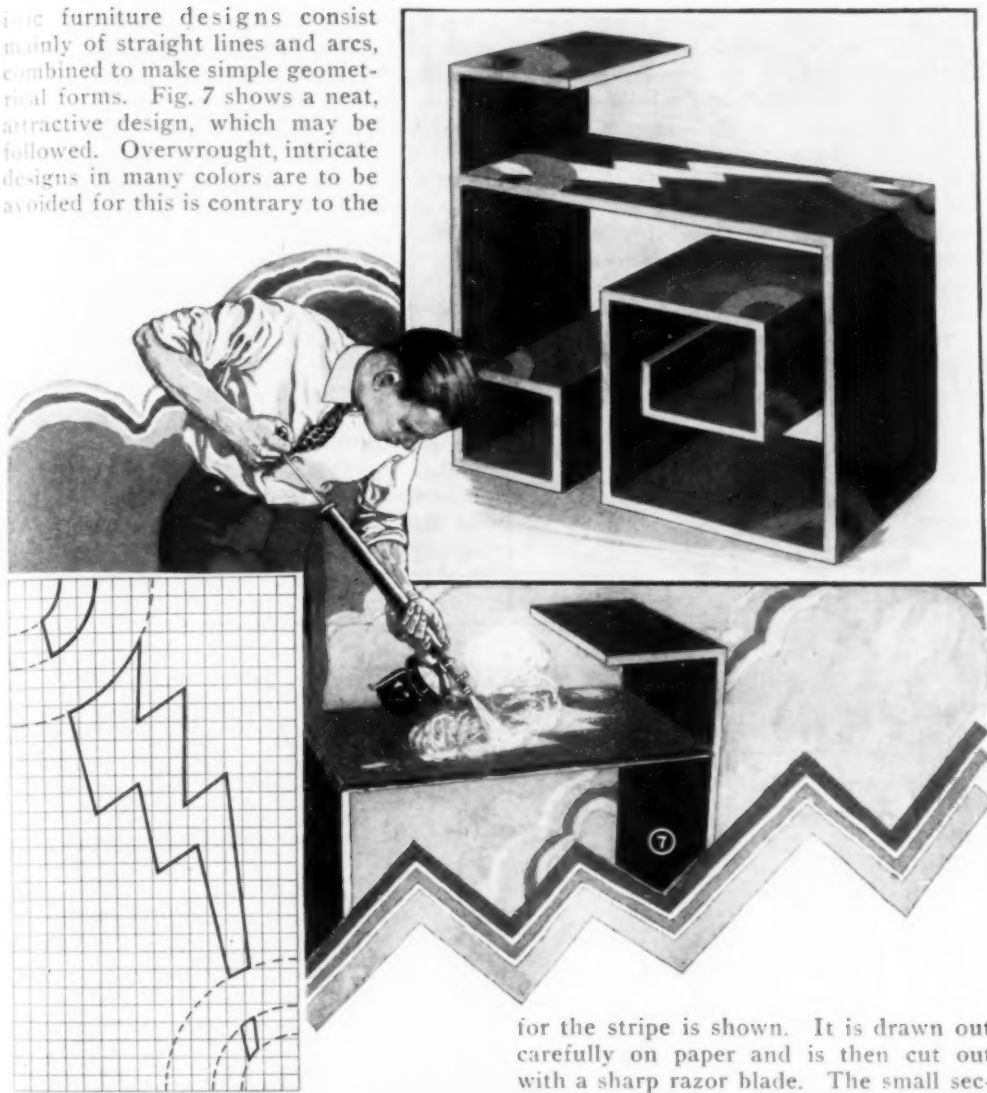
away from the edge of the cover, for paint cans are often packed in sawdust, and some of the dust gets under the edge of the cover, dropping into the paint the moment the cover is removed. When the paint can is not in constant use, keep the cover on. Use a piece of cloth that leaves no lint, or a wide brush, to wipe off the surface just previous to applying the paint.

The precautions just mentioned may seem absurdly "fussy" but these seemingly insignificant details are really the things that count in doing good work, which, under ordinary slovenly methods, is entirely impossible. This is the secret of the beautiful finish which is usually credited only to experienced, capable painters. Brush the paint over the surface evenly, flowing on a moderate quantity, so that brush marks will even out. However, do not apply too much for this may take weeks or months to dry hard. Quick work is necessary when lacquer is used, as it cannot be brushed over a second time, but this must be done immediately after it is applied.

Rubbing down each coat, after it has dried thoroughly, is another trick for obtaining a flawless finish. Fine sandpaper, held on a block, may be used conservatively, that is, it should not be used too vigorously and should not be rubbed on one spot too long. It is much better to use the finest grade of garnet paper on a block, as shown in Fig. 6, keeping the surface well covered with water to prevent the accumulation of loose paint on the paper, which would ruin its effectiveness as an abrasive. After the surface has been cleaned and dried, the second coat of paint or lacquer may be applied. Three or four coats are necessary to permit a good rub-down to a perfect finish. Be sure to use the same kind of paint for each coat. The last coat is rubbed down with greater care than the preceding ones. After the garnet-paper rubdown with water, the surface is dried, and powdered rottenstone is used with rubbing oil to eliminate all the small scratches. A small piece of cloth, tightly wadded, is used to do this rubbing, which will result in a smooth, glasslike finish, rewarding you for your painstaking efforts. In the absence of rubbing oil, use ordinary sweet oil or crude oil.

The design is then applied. Modern-

ific furniture designs consist mainly of straight lines and arcs, combined to make simple geometrical forms. Fig. 7 shows a neat, attractive design, which may be followed. Overwrought, intricate designs in many colors are to be avoided for this is contrary to the



idea of simplicity, which modern art seeks to express. The design illustrated rendered in two colors, such as Chinese, mandarin or oriental red, with aluminum or silver, or a light gray on a black background, stands out in bold relief and is very distinctive. In this case the double quadrants were painted red, the irregular stripe or "lightning flash" aluminum, and all the edges aluminum. The designs can best be applied by means of stencils. This is comparatively easy and accurate results can be obtained. In the lower left-hand corner of Fig. 7, the template

for the stripe is shown. It is drawn out carefully on paper and is then cut out with a sharp razor blade. The small sections fit between the two bands of the quadrants. It is a good idea to cut the stencil for the quadrants at the same time, to be sure that the stencils fit together well. When the stencils are ready, get some rubber cement and apply a thin coat to the underside of the stencil, just around the edge of the cut-outs. Allow the cement to become apparently dry before pressing the stencil down on the surface on which the design is to be applied. The edges of the cut-outs must adhere to the surface securely, or the paint, upon being applied, will run under the stencil and ruin the work. A small hand spray gun of the

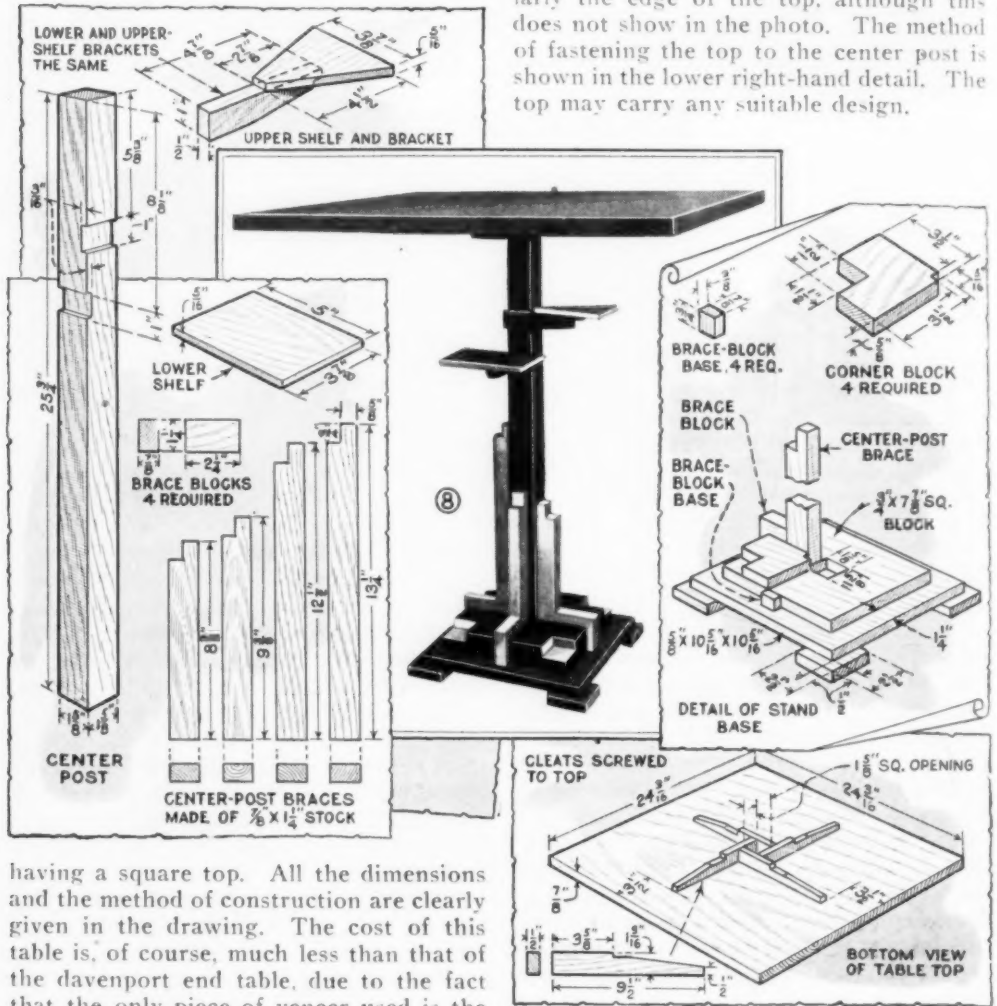


kind shown in Fig. 7 has been found handy for applying the design, care being taken to thin the paint to the consistency most suitable for spraying and adjust the gun to the same end.

After the sections of the table have been completely finished, they are assembled and screwed together securely as described above. The remaining counter-bored holes are filled, and several coats of paint are applied over the putty spots, each coat being rubbed down to match with the surrounding surface. The photo in the upper right-hand corner of Fig. 7 shows the davenport end table finished. Parts of the design are repeated at several corners.

Fig. 8 shows a useful occasional table,

top. Veneer, however, is necessary for the top, as it is of quite large size, and ordinary stock would have a tendency to warp, besides being more easily cracked and broken. All the other parts of this table consist of scrap pieces which anyone can find around the house or shop. They are cut carefully, planed and sandpapered smooth, and assembled as indicated. The color scheme in this case was jade green and oriental red on a black background, which was found very effective. The center-post braces are painted red, the post itself being black. The small square notches in the corners of the base are green, and the edges of the shelves may be painted either red or green, and similarly the edge of the top, although this does not show in the photo. The method of fastening the top to the center post is shown in the lower right-hand detail. The top may carry any suitable design.



having a square top. All the dimensions and the method of construction are clearly given in the drawing. The cost of this table is, of course, much less than that of the davenport end table, due to the fact that the only piece of veneer used is the

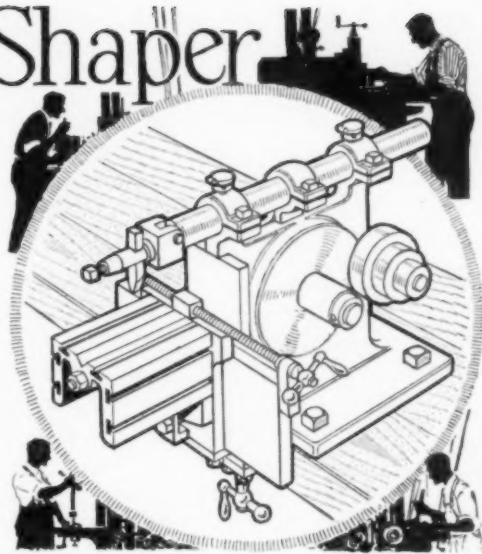
# A 6-in Bench Shaper

by J. V. Romig

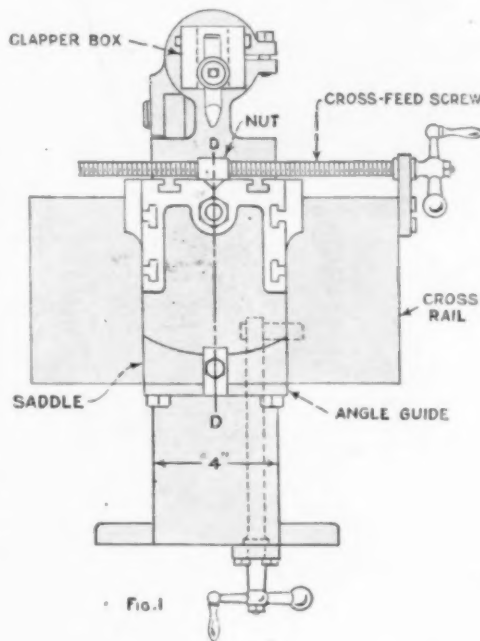
THE VALUE of the shaper as a machine tool is appreciated by every mechanic, but the man in the small shop, much as he may appreciate the advantage of such a tool, is not always in a position to purchase it. Here, however, is a shaper that can be made in any small shop at a reasonable cost, and which, on work within its capacity, will rapidly pay for the labor and slight expense of building.

There are two types of shaper in general use, the push-cut and the draw-cut. Each has its advantages; the draw-cut shaper, for example, is the better for tool work, where profiling to a layout line is to be done, since the layout line faces the operator, and the tool, cutting on the back or draw stroke, cuts clean to the line. On work of this kind the push-cut shaper, cutting on the forward stroke, breaks off the edge of the work, and makes it much more difficult to work close to the line. In addition to this, the draw-cut type takes heavier cuts with less vibration, as the pressure on the slides and the work is toward the main frame. On the other hand, the push-cut type is better for work in which the tool must be carried at an angle, and it permits the use of gooseneck tools. The advantages of both types are combined in this shaper, by the simple expedient of employing two clapper boxes, one of the push-cut and the other of the draw-cut type, either of which can be used to suit the work in hand.

In addition, and by eliminating a



few of the usual components of shaper construction, such as the slide on the ram, a more powerful and rigid tool is obtained. Vertical feed is secured by raising the cross-rail assembly, and angular work is machined by tilting the table. Horizontal movements are obtained in the usual manner, by sliding the table saddle on the cross rail by means of the feed screw.



The main frame of this little shaper is a gray-iron casting, machined to the sizes given in the accompanying drawings. The pattern for the casting is made of white pine, and is quite easy to fashion, even for the amateur patternmaker. All the parts to the right of the frame are cast integral with it, while the parts to the left are separate, and positioned with pins. These portions are the part of the front slide and the base that overhang the center web of the

machine, and the portion of the ram bearings at the top. The housings for the gear mechanism do not need any cores, as the shaft holes can be drilled from the solid. Patterns for the remainder of the parts should be made with sufficient allowance for the machining operations.

The ram is made from a length of cold-rolled steel, machined only on its front end for the clapper boxes. The bar should be tested with an indicator, in the lathe, and straightened. It may seem, at first glance, to be rather long, but this is an advantage, as many jobs that would take a longer stroke than 6 in. can still be done by taking two "hitches" of the ram; also, work that is too far from the front slide to be reached by the tool in normal position can be finished by moving the ram forward. The ram slides in two bearings in the main frame, and is kept from turn-

ing by the clamping member, which is also connected to the rocker arm below. On angular work, clearance for the tool on the return stroke is effected by turning the ram in the clamp the requisite amount. For all straight shaping or slotting work, the clapper

box is, of course, kept in a vertical position. The clapper boxes are made of machine steel, to the drawings, and fastened to the ram with taper pins. The draw-cut box is held with two pins, and has an auxiliary toolholder swiveling on a taper pin. The setscrew that holds the tool tight is reached through the hole in the front of the box. The toolholder for the push-cut box is turned from a length of steel, and is held in the box by its lower flange, which fits in the counterbore in the rear of the box. A serrated tool-steel washer is used between the tool and the front. The tools are 1/2 in. square, or 1/2 by 3/4 in.

When machining the main frame, care must be taken to get the ram-bearing holes square with the front slide, both vertically and horizontally. It is therefore best to machine the front slides first, to get a working surface for the subsequent operations. The ram bearings can be fitted with bronze bushings, although this is not essential. Compensation for wear is secured by splitting the bearings and adjusting with the clamping screws. Use oil cups or sight-feed lubricators on the bearings.

The ram is reciprocated by a crankpin on the main gear, the pin carrying a slide which fits the slot in the rocker arm. The crank may be clamped in any position on the gear, permitting

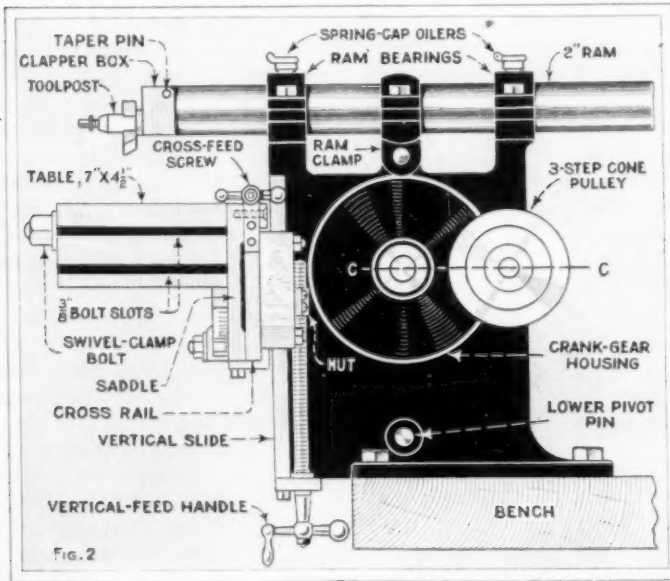


Fig. 2

ing by the clamping member, which is also connected to the rocker arm below. On angular work, clearance for the tool on the return stroke is effected by turning the ram in the clamp the requisite amount. For all straight shaping or slotting work, the clapper

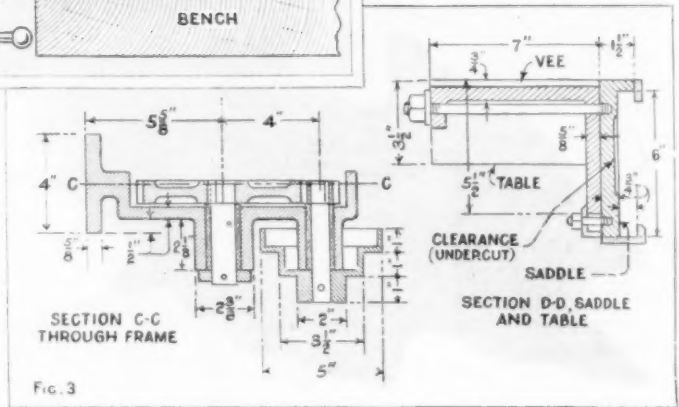
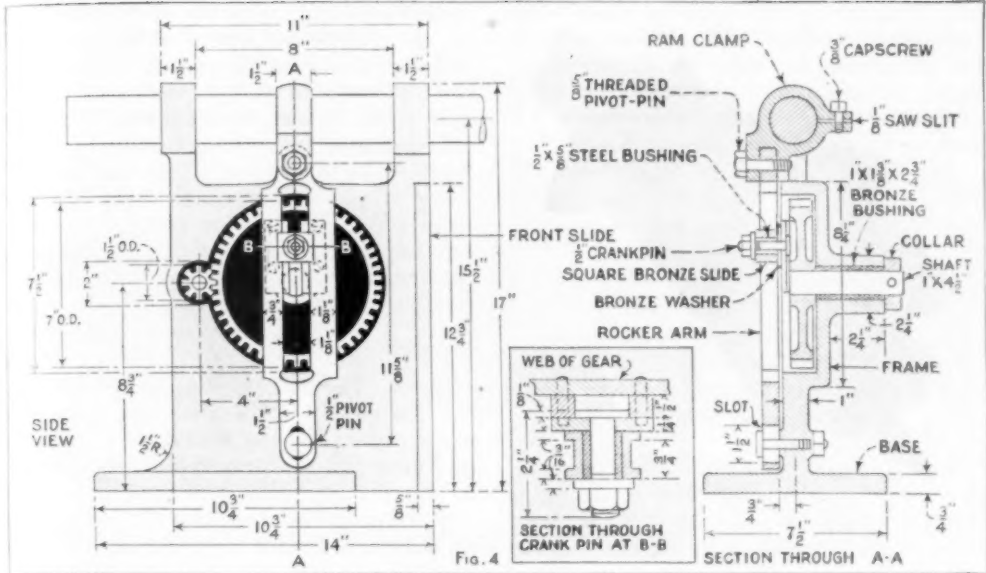


Fig. 3

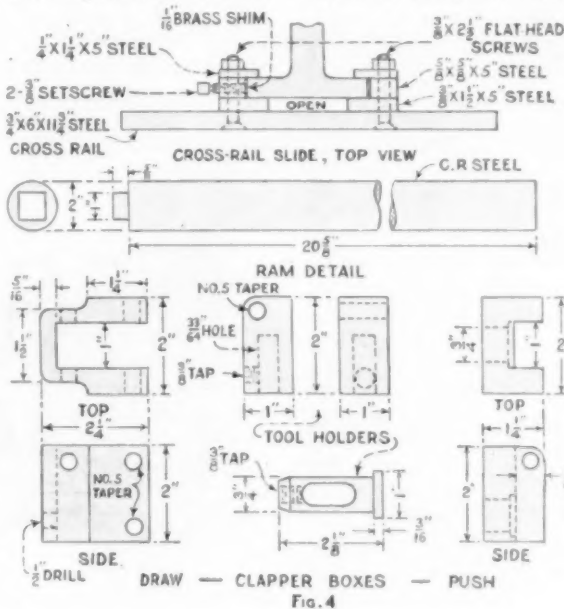


any variation of stroke from zero to 6 in., the range of the machine. The rocker arm is fastened to the ram clamp with a screwed pin, and is pivoted on a pin at its lower end. The fit in the ram clamp should be snug, so as to eliminate play. Oil holes must be drilled and oil grooves cut to provide for the lubrication of all moving surfaces.

The gears are of No. 12 pitch, the smaller having 15 teeth and the larger 82, with a 1-in. face. The maker, of course, can use other ratios if he desires, but he must be careful to figure the center-to-center distance correctly. The large gear should have a solid-web center, so that it can be slotted for the crank-pin adjustment. Both gears are keyed to their shafts, and

should be a light press fit. The shafts run in bronze bushings. A collar is fitted and pinned to the large shaft, and a three-step cone pulley to the smaller one, as detailed.

The cross-rail assembly is built up of flat cold-rolled steel, as in the drawing. Four 3/8-in. flat-head screws connect the cross-rail proper to the guide pieces, and the holes for these screws are drilled 3/8 in. in all the parts except the 5/8-in. square



spacing pieces, which are tapped to secure clamping action. The thin outer plates are fastened with nuts and should be fitted so as to allow free vertical movement, without any play, when they are drawn up tight. Brass shims, 1/16 in. thick, adjusted by 3/8-in. setscrews, regulate the side fit of the slide. All feed screws

are  $\frac{1}{2}$  in., 20 threads per in., fitted with ball-crank handles. All feed-screw nuts are of bronze, the one for the elevating screw being fitted to the rear right-hand slide plate, and the bearing for the cross-feed to the right-hand side of the rail.

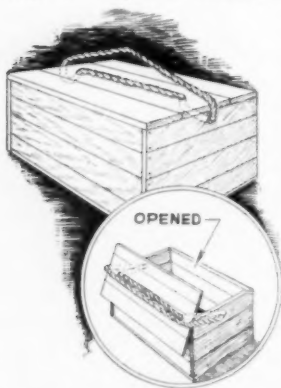
The saddle is a casting, machined as in Fig. 3. It will be noted that the casting is wider at the top than at the bottom; this provision is made because there is greater wear and strain on the top slide than on the bottom one. The worktable

is also a casting, with the bolt slots cored in. It is machined square on all faces, and swiveled to the saddle on a  $\frac{1}{2}$ -in. bolt near the top face, and clamped near the bottom. The lower edge of the table can be laid off in degrees to facilitate setting up angular work. The three faces of the table enable work of almost any shape to be handled from any angle.

When using the draw-cut clapper box, reverse the belt, so as to obtain slow motion on the return stroke.

### Tool Carrier with Hingeless Cover Made from Common Wood Box

Any ordinary wooden box can be made into a serviceable tool box by using a length of rope for a handle. By arranging the rope as shown in the drawing, it



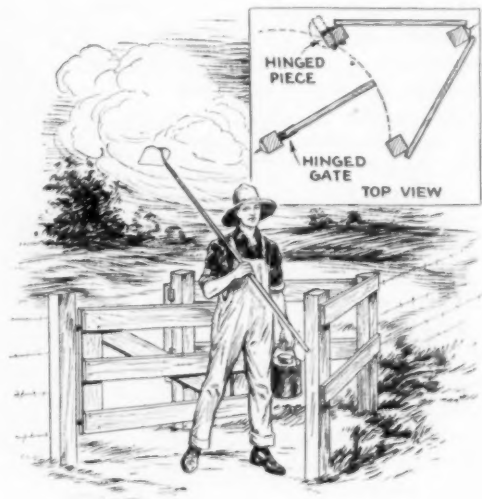
acts not only as a handle but also as a substitute for hinges, and enables one to press the lid on tightly while the box is carried from place to place. Drill a hole in each end of the box, in the center and near the

top edge and two holes in the lid, all four being alined as shown. Pass the rope through the holes and splice or knot it. The length of the rope is determined by the size of the box and should be sufficient to allow the lid to be lifted and swung back out of the way when the box is opened. When carrying the box, the top part of the rope is held in the hand, and the weight of the contents causes the lower part of the rope to press down tightly on the top, so as to keep the lid securely in place.—Harry Moore, Hamilton, Can.

### Handy Gate for the Farm

Always open to pedestrians but closed to stock, the gate shown in the drawing has been found both practical and con-

venient. The trouble of opening and closing the gate is eliminated and it cannot easily be left open by mistake. It consists of four posts set into the earth, about 3 ft. apart. The gate is hinged to one so that it swings between the two side posts as indicated by the dotted line. It is a good idea to arrange one of the side posts so that the gate will just clear it, but then it is necessary to hinge an extra piece of 2-in. stock to this post as shown. Unless it is swung back, this piece prevents the gate from being opened entirely. A hook and screw-eye are used to hold it in place securely. In this way the gate can be opened, when desired, to permit the passage of objects that are too bulky to get through the narrow opening, as, for instance, a wheelbarrow, or the live stock.—I. M. Wilson, Kansas City, Mo.



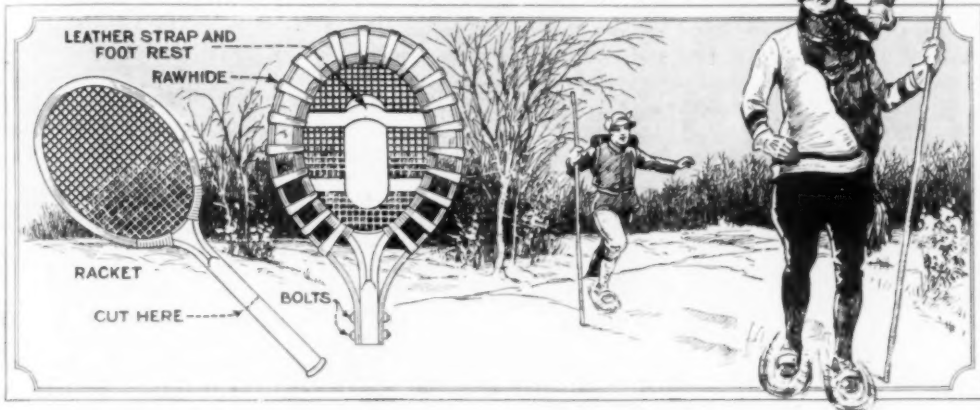
Hinged Gate for the Farm Is Convenient and Cannot Be Left Open by Mistake



### Snowshoes of "Beaver" Pattern Made from Tennis Rackets

You can make a pair of "beaver" design snowshoes from a pair of old tennis

rackets and two ash whips, bolted at the tail of the shoe and bound to the racket with rawhide strips. Fasten the footrest into place with waxed thread or leather strips stitched through the holes around the



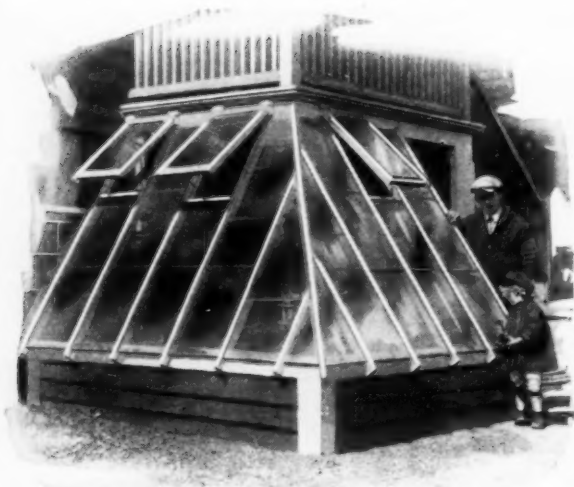
Tramping over Loose Snow Is Great Sport. These Snowshoes Were Made from Old Tennis Rackets and Anyone Handy in the Home Workshop Can Duplicate Them

rackets and two ash whips, bolted at the tail of the shoe and bound to the racket with rawhide strips. It doesn't matter if the tennis rackets are warped badly and have a few broken strings, for they can be replaced with strips of rawhide. Saw off the ends of the racket handles at a point 5 in. from the end. Whittle down two ash poles, each about  $\frac{3}{4}$  in. in thickness, and dry them in the sun or by the fire. Each pole should be long enough to form a space about 3 in. wide about the tennis-racket rim. Then soak them in water until they can be bent into a loop without cracking. Whittle down the ends of each pole and drill two  $\frac{1}{4}$ -in. holes at each end, with a distance of about 4 in. between them. Drill two  $\frac{1}{4}$ -in. holes in the handle of the racket to correspond to the holes in the ash pole, and fasten the pole in place with a pair of small bolts through the handle. Replace any missing gut strings with lengths of leather. Cut a number of long strips from the side of a boot, each  $\frac{1}{2}$  in. wide, and bind the ash rim to the edge of the racket with an over-and-over stitch. Small and shallow notches should be made at intervals in the ash rim to keep the rawhide from slipping out. Cut out a leather footrest and a pair of straps long enough to stretch across the tennis racket. Make rows of holes with an

edge. The rear strap should be fastened in the same way, save that a loop is formed over the footrest so that the toe of the boot can be slipped under it snugly. Give each snowshoe a generous coating of tallow or oil, to keep it from becoming water-soaked. You will have to practice to get on to the "gait." Every time you take a step you must swing the shoe around the other one before setting it down, and the first few steps will probably result in a spill or two. However, you will soon catch on to the step, and after a few trial tramps you will be able to cover considerable distances at good speed and without discomfort or weariness.—G. Everett Van Horn, Milton, Wis.

### Securing Door with Loose-Pin Hinges

Loose-pin hinges on doors of cabinets and other similar constructions often permit intruders to gain entrance by removing the pins and lifting the hinge edge of the door outward. This may be overcome by fixing pins cut from a wire nail into the edge of the casing above the upper and below the lower hinges. Holes drilled into the edge of the door to fit the pins prevent the withdrawal of the door even after the pins are removed from the hinges.—George Niederhoff, St. Louis, Mo.



Cambridge School-Teacher Who Glazed in the Space under His Back Porch to Make a Greenhouse

### Back Porch Used as Small Greenhouse

Even in a city, where you have a very limited space, it is possible to provide a small greenhouse for pleasure or for extra earnings. A school-teacher of Cambridge, Mass., built the one shown in the photo, right under his back porch. It consists merely of a number of sash held in position securely on a suitable frame. Some of the sash are arranged to swing open to permit ventilation. The position of the porch is such that it receives considerable sunshine, and that is, of course, partly the reason why the porch could be used for this purpose.

### Use for Modeling Clay in the Workshop

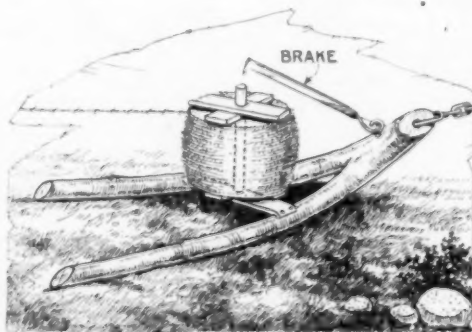
Modeling clay will often be found handy in the shop. A small quantity—25 or 50 cents' worth—is enough for any ordinary job, and pays for itself many times over in saving of time. If a small screw or nut is lost in a maze of machinery, it can be quickly recovered by molding a ball of

clay on the end of a stick or wire and lowering it to make contact with the lost object, which will stick to the clay and can then be lifted up without any trouble. The clay also helps to insert a screw in a tapped hole which is located in a recess of a machine so that one cannot get at it by hand. Fill the slot in the screw head with clay and then push the screwdriver blade into the slot. The screw will stick to the end of the screwdriver and thus be started in the thread. If a drawing is to be made of a casting having an irregularly shaped groove, its contour can be transferred to the drawing as follows: Fill a short space of the groove with clay, carefully remove it without distorting it and shave

down a thin slice. This can be laid on the drawing and its profile traced. Imperfections in a model can be temporarily filled with clay while a casting is made in plaster of paris, and the clay can be reclaimed later.—L. B. Robbins, Harwich, Mass.

### Stringing Barbed Wire Tightly

When stringing barbed-wire fences, many farmers use one-horse sleds of the kind shown in the drawing. If a fence is long, a reel often pays out so loosely that it is necessary to use a wire stretcher several times before the wire can be stapled to the posts. To overcome this trouble, one farmer fitted his sled with a simple brake. It consists of a long hook made of tire iron and is attached to the sled as indicated.



Simple Iron Brake on Sled Holds Reel from Revolving and Takes Up the Slack in the Wire

When not in use, the barb of the hook rests in the end of the pipe axle of the reel, but when it is desired to brake the spool, to take up the slack in the wire, the hook is made to engage with the wire so that the reel cannot revolve.—G. E. Hendrickson, Argyle, Wis.

# How to Make Rush or Fiber Seats

By L. DAY PERRY

WHILE the making or repairing of rush seating appears to be a very complicated process, it is in reality very simple and easy. The seat described here may be made by any careful boy in the home workshop. If well made, the finished piece of furniture will be very interesting, comfortable and serviceable. A working drawing of the seat which may be made by the amateur worker is shown in Figs. 1 and 2. The general dimensions as given are about right, it is well proportioned and may be easily transferred from place to place. However, the seat may be made square and either larger or smaller to suit the owner. The instructions for weaving the seat apply equally well, of course, either to new work or to the repair of old seats.

There are two kinds of serviceable ma-

terial to use for wrapping the seat. One is the natural rush and the other is manufactured fiber. Both may be purchased from dealers in such supplies. If you wish to gather and prepare the rush you may readily do so. The ordinary swamp cat-tail is the plant, the leaves of which are used for rush seating. These leaves are cut in the fall, about the time the tips begin to turn brown, and dried slowly in the shade in basement, shed or loft. Before they are used, they should be soaked for several hours in water, and just before wrapping run through an ordinary clothes wringer to remove excess water.

Fiber is firmly twisted kraft paper procurable by the pound in indefinite length. For seating, it should be about  $\frac{1}{8}$  to  $\frac{3}{16}$  in. in diameter and preferably of natural-brown color. In every way fiber is easier to handle and quite as serviceable as rush.

Oak is probably the best wood for the construction of the frame, for it finishes well, tones in satisfactorily with the fiber, and will stand severe usage. Yellow poplar is also a wood that works well, takes stain beautifully, and is susceptible of fine polish. The worker need not hesitate to use this wood if he likes it.

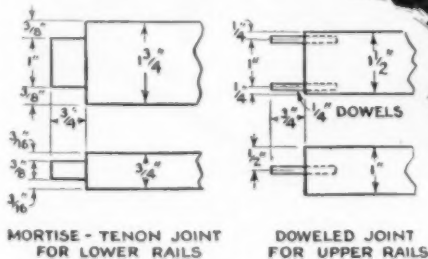
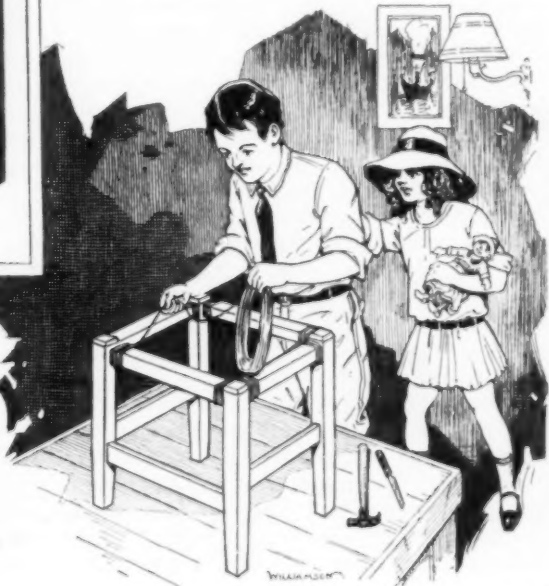
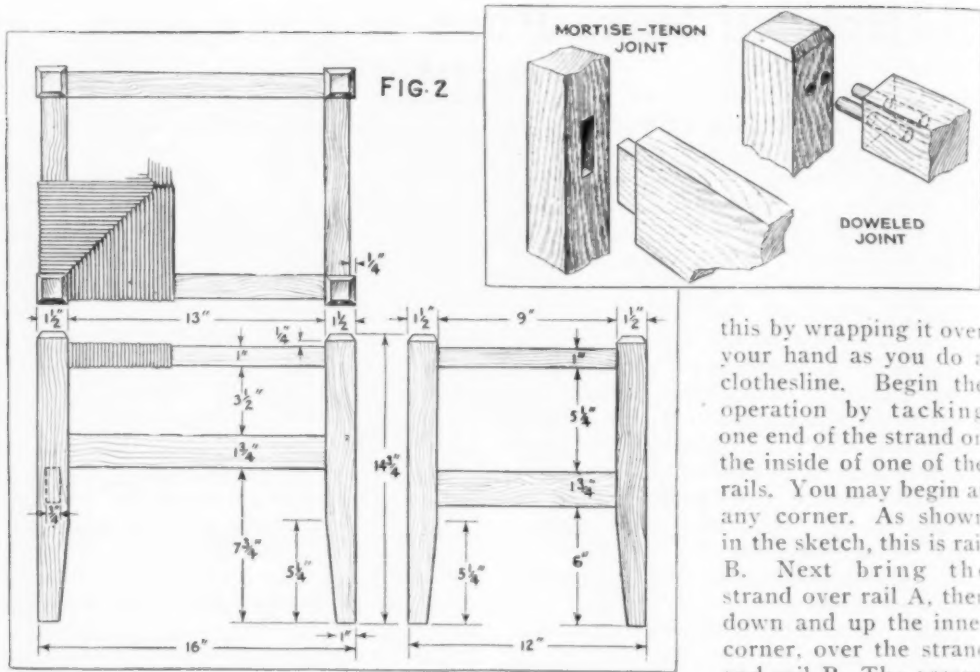


FIG. 1





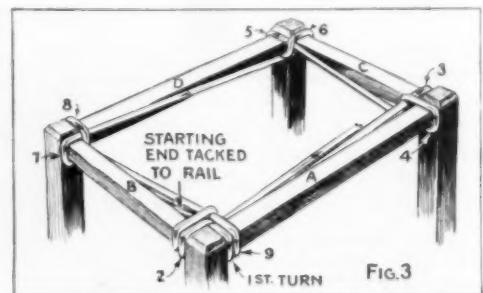
In Fig. 2 are shown two kinds of joints commonly used in furniture construction. One is the mortise-and-tenon joint and the other the doweled joint. Either may be used. Both are used here. The size of each is given in Fig. 1. The doweled joint is used on the upper rails and the mortise-and-tenon on the lower ones. Certain trimming will need to be done where the dowels fit at right angles to the posts.

The holes for the dowel pins must be bored straight and accurate. A doweling jig is an excellent tool to use in centering and boring the holes. This tool is inexpensive and is a very fine one to have in the kit. A dowel bit should be used for boring, as it is a shade less in diameter than the regular bit and assures a tight fit and satisfactory joint. Be sure that each tenon fits into the mortise with a "driving" fit. Put the whole frame together to see that all points fit snugly, then finally assemble it with glue.

The method of wrapping the seat rails is shown in Fig. 3. This general scheme applies to any material which one may use for seating. The description to follow applies particularly to fiber, or fiber cord as it is commercially known. First wind about 25 ft. of the fiber into a coil. Do

this by wrapping it over your hand as you do a clothesline. Begin the operation by tacking one end of the strand on the inside of one of the rails. You may begin at any corner. As shown in the sketch, this is rail B. Next bring the strand over rail A, then down and up the inner corner, over the strand and rail B. The arrows on the sketch point the way. Continue down and under rail B, directly across the inner space to rail C. Wrap over and down rail C, up at the inner corner, then over the strand and rail A. Wrap the strand over and down rail A, then directly across the inner space to the top of rail D. This process is repeated at all corners. The sketch will make the process very clear, as the turns are numbered in the order in which they are made.

The strand of fiber should be pulled firm and tight at all times, and particular care should be taken at the corners, where the strands cross and the turns are made. Add



each new length of fiber by tying a square knot underneath the seat, or tacking the

end of the old strand and the beginning of the new underneath one of the rails. The wrapping is continued until the two short rails are covered. Be sure that the strands are kept close together over the rails. A little tap with a block of wood and hammer will do the trick. When the short rails are filled, the wrapping is not yet complete, for there is an unfilled space on the two longer rails. Continue to wrap the fiber cord over and under these rails until the entire space is filled. Finally tack the end of the last strand under the proper rail. On a square seat, like the one in the photo, all rails are filled at about the same time, but on all rectangular seats the shorter rails fill first.

As the wrapping progresses, there are formed open spaces between the upper and lower strands. This space must be packed firmly with kraft paper such as may be purchased from the local store. Packing is necessary to build up the seat, to prevent sagging with use and to keep the fiber from breaking down at the inner corners of the rails.

If cat-tail leaves are used for the seating, first cut off the butt ends of the leaves as these are too coarse. Twist two or three leaves together to make a strand. Make a long twist and always in one direction. Add another leaf as the strand thins out, for there must be uniformity in thickness if the seat is to look neat and workmanlike. The butt ends are used for stuffing the seat. Aside from making the strand as the wrapping is done, the process for rush is the same as for the fiber cord.

The seat frame may be stained any desired color, and then filled with a paste wood filler. After thorough rubbing and drying, apply a coat of thin white shellac. Sand down the shellac with a fine grade of sandpaper. Apply several coats of good varnish to the fiber. Do not rub the varnish. Wax the frame or give it a coat of varnish and rub it down to a dull finish with pumicestone and water.

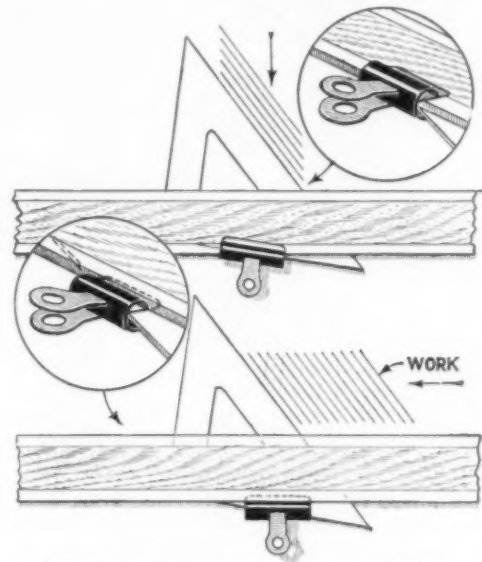
### Tamper Made of Concrete

A tamper for use in the garden or in home concrete construction may be made as follows: Get a tomato can, about  $4\frac{1}{2}$  in. in diameter, and remove the top. Drive nails part way into the end of a broom-

stick, or other round wooden rod, so as to form radiating projections. Insert the broomstick into the can and pour concrete around it. Care should be taken that the handle comes in the center of the can, and that its lower end does not touch the bottom while the concrete is being poured into place. Permit the mixture to harden, and a substantial tamper will result.—W. W. Baldwin, Washington, D. C.

### Drawing Parallel Diagonal Lines

When a number of parallel lines have to be drawn at other angles than the ordinary



Using a Paper Clip to Hold a Triangle in Position for Drawing Parallel Diagonal Lines

triangles provide for, as in shading certain sections, the draftsman will find the use of a paper clip to be of considerable help in holding the triangles in the correct position. If the section to be shaded runs from top to bottom of the paper, the triangle is clipped to the T-square as indicated in the upper detail, and the square, carrying the triangle, is moved down the board as the lines are drawn. If, on the contrary, the shaded section runs horizontally, the clip is attached to the triangle as shown in the lower detail, and the triangle is then slid along under the T-square, with the clip bearing against the lower edge of the square.—W. G. Partin, Cleveland, Ohio.

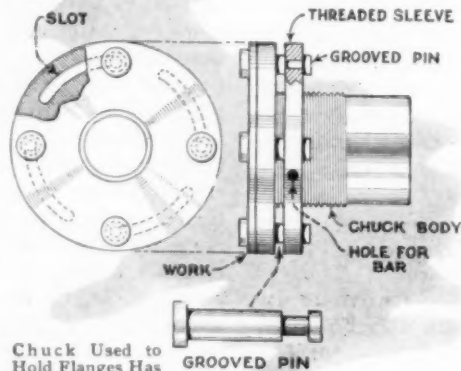




Simple Jig Which Facilitates Cutting Tie Wires for Concrete Forms

#### Handy Jig for Cutting Tie Wire for Concrete Forms

A large number of tie wires, to hold concrete forms together, can be cut to the required length quickly and easily with the improvised device shown in the drawing. It consists of a plank laid across two ordinary sawhorses; a reel pivoted at one end of the plank to hold a roll of wire from which the tie wires are cut, and a tie-wire shaper, which is pivoted at the other end of the plank. The latter is made from a length of 2 by 4 or 2 by 6-in. stock, and a spike driven in at each end to hold the wire in the form of a flat coil, as indicated. The distance between the spikes must be equal to the length of one tie wire. After as much wire has been wound on the shaper as it will hold, or as much as desired, wrap the loose end around one end spike and then, with a large pair of wire cutters, cut through the coil of wire at the exact center between the end spikes. The number of U-shaped lengths of wire thus formed are then of the correct length and ready for use.—A. W. Burg, Lake View, Iowa.



Chuck Used to Hold Flanges Has Novel Method of Tightening

#### Removing Battery Terminals

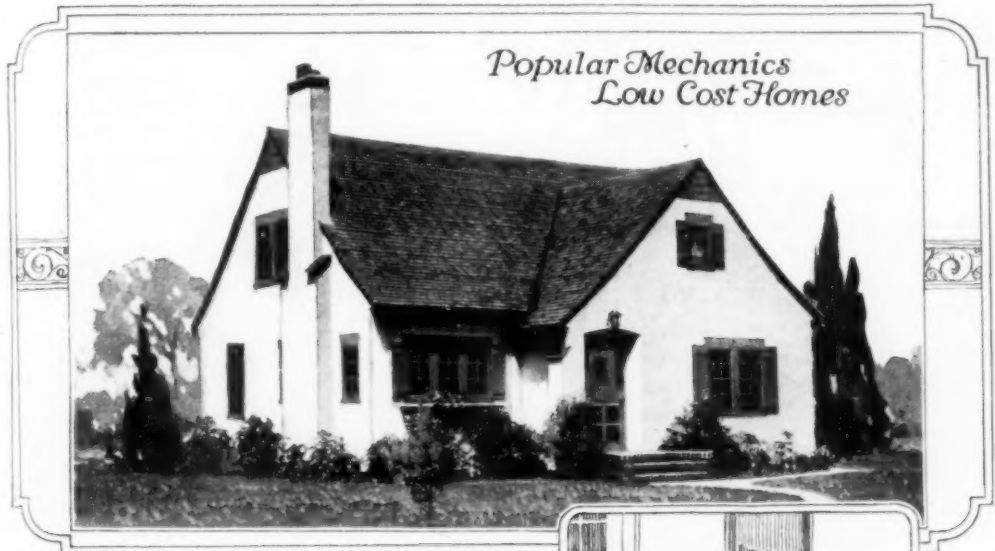
Battery terminals should always be tight. However, a terminal frequently becomes so tight that it is difficult to remove it when necessary. Strong-arm methods may injure the battery by loosening the post, allowing leakage and loss of the acid solution. Sometimes the post is even torn from the battery-plate assembly necessitating an expensive repair. For this reason, when detaching terminals from the posts, care should be observed to put as little strain on the post as possible. Special tools can be had for removing the different types of terminals.—Elmer Whittaker, Segregansett, Mass.

#### Quick-Tightening Grinding Chuck

A chuck with a novel method of tightening was made to hold some flanges while grinding out the taper hole. The flanges had four bolt holes, but instead of using bolts and nuts in the ordinary way, we threaded the chuck at the back and made a tightening sleeve that acted on four plain pins and secured the work by one movement of the sleeve. The pins have a groove cut in them a little wider than the thickness of the sleeve, and the face of the chuck and the sleeve are drilled to match the four bolt holes. The sleeve is also slotted at one side of each hole to suit the diameter at the bottom of the groove in the pins. In use, the four pins are pushed in place through the flange, chuck and sleeve. A bar is then inserted in the hole in the sleeve and this is turned, which causes the grooves in the pins to enter the slots and thus tightens all four pins equally and securely at the same time.—Harry Moore, Hamilton, Can.

☐ Marks at intervals of 6 in. on the handle of a post auger will aid in determining the depth of the hole.

# BUILD A HOME THAT RUNS ITSELF



Copyright, Popular Mechanics

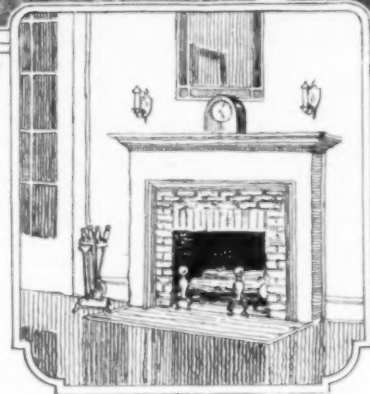
Plan No. 6-S-27

A MAN'S chances of getting an ideal wife, a homemaker, are three out of ten, according to Mrs. G. G. Goodwin, past president of the Illinois federation of women's clubs.

There's hope ahead, however. Mrs. Goodwin believes, that most women would turn out better homemakers if they were given the equipment to make better homes with. What does she mean? Just this: Labor-saving and timesaving machinery; anything that will take the drudgery out of housekeeping and save time for other things. What things?

Here is one answer by 100,000 housewives from all sections of the United States. Eighty-five per cent said recently in reply to a letter by a large manufacturer that they used prepared foods in their homes in order to save time. To save time for what?

For the call of the great out-of-doors, week-end excursions in the new



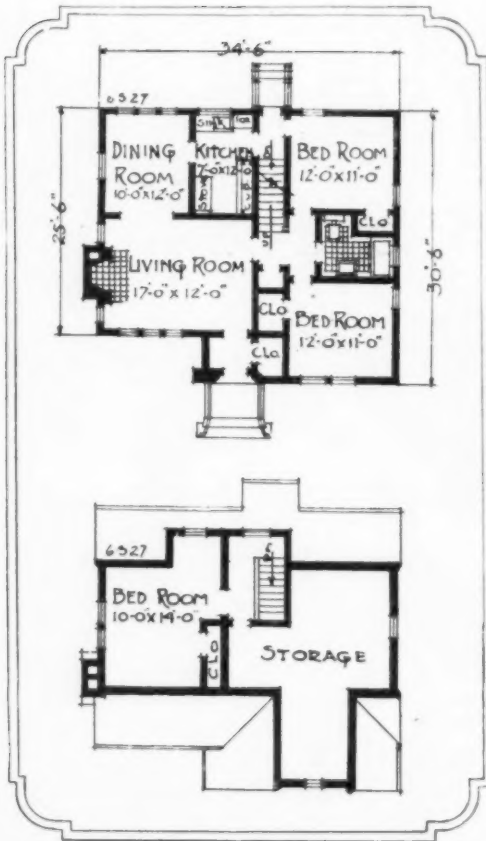
car, camping, picnics, recreation, club work, community service and a long list of privileges which women are entitled to just as much as men.

That brings us to the story of the little

house illustrated above: "A Home That Runs Itself." What a fascinating title! And a very practical idea that will appeal to both men and women who do not want to be overloaded with so large a house and

## 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.



so many responsibilities that little or no time is left for outside interests.

First and foremost, the modern house, in order to save the housewife's time, must be small, compact, in fact almost self-operating. This does not mean that a family must be fitted into a house with the exactitude of sardines in a can. It means only scientific planning. It means that you must put into small houses the same efficiency, comforts and conveniences as you expect in the modern city flat. It can be done at reasonable cost.

This house illustrates the modern time-saving and efficiency idea. Let's investigate it in detail.

First note the compact plan. There is no unused space. Living quarters are all on one floor as in a bungalow or apartment. The kitchenette is small to be sure, but it saves many miles of needless walking each year. There are five good rooms and bath on the ground floor; a third bedroom and large storage space on the sec-

ond floor. It would be easy to convert the storage space into another bedroom.

If you are watching every penny on initial expense, you can save some money by finishing the second floor later.

Now consider the time and labor-saving equipment that women want. If you install an oil burner, thermostatic control, electric refrigeration, washing machine, dishwashing machine, vacuum cleaner and other mechanical devices, you would in truth have a house that almost runs itself. You can close it up for a day or week and return to find it as ready-to-use as a well-kept flat.

You may not be able to install all these things to begin with. But plan for them. And by economizing on construction you may have sufficient cash on hand for several timesavers to start with. Building practices have progressed so far in recent years both in the utilization of entirely new materials for new effects and the adoption of worth-while substitutes for older practices, that the building of a new home is a revelation. Labor costs still remain the big item in building, and the whole trend of development has been toward the reduction of this item through materials that are quicker and cheaper to apply, such as wallboard, metal lath and other large-surface materials. When you plan your home it is possible to work many of them in, and save not only money, but obtain artistic effects.

The house is economical to build. There is no trick roof or complicated construction to pile up costs; fully insulated side-walls, roof and ceilings; stucco exterior; frame construction; either wood-shingle or composition roof. It is what may be called a \$5,500 house, exclusive of lot.

Timesaving plans—houses that are self-operating to a large extent—take the drudgery out of housekeeping, promote happiness for all the family and can be built at moderate cost.

**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.