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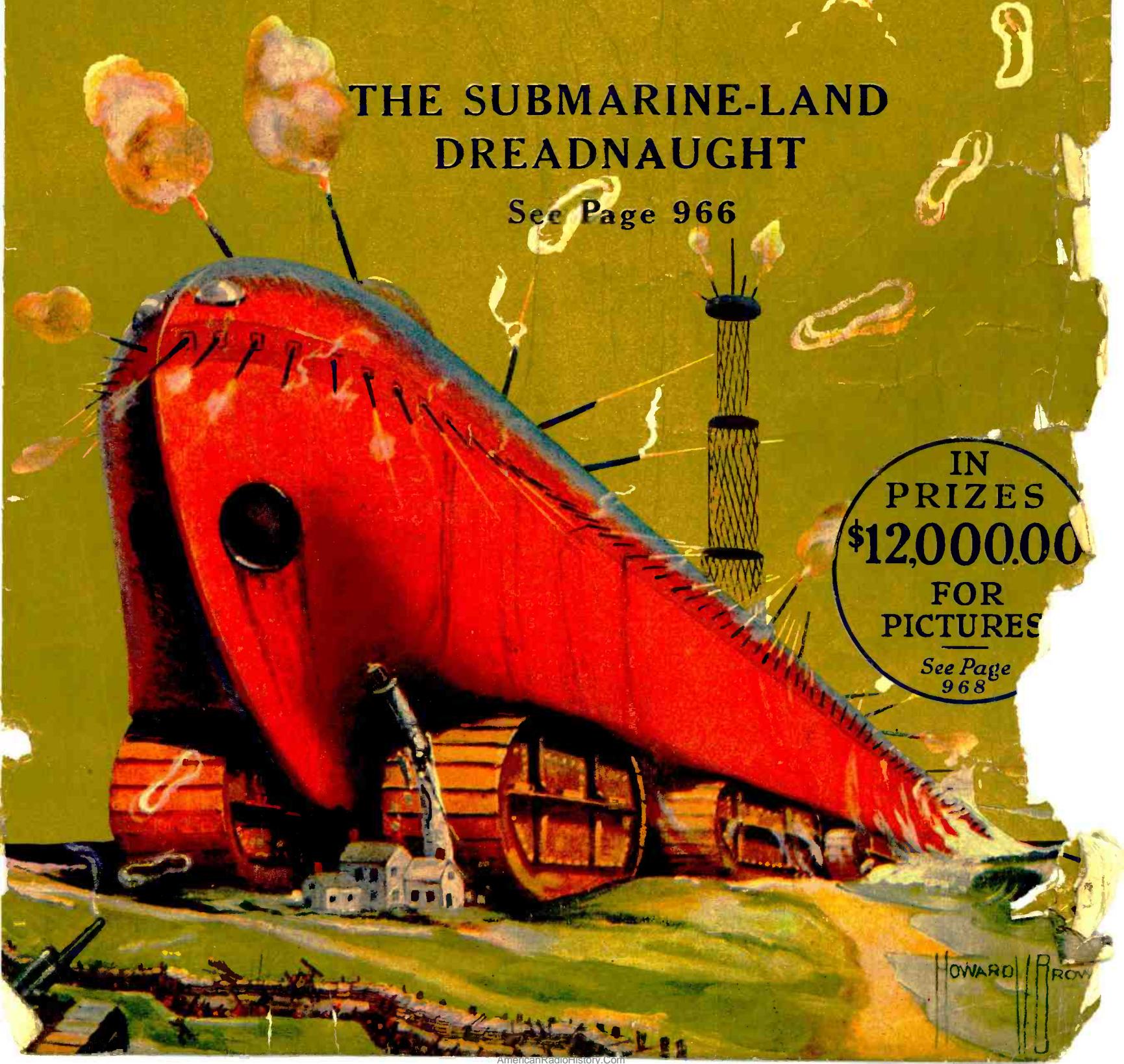
IN PICTURES

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968



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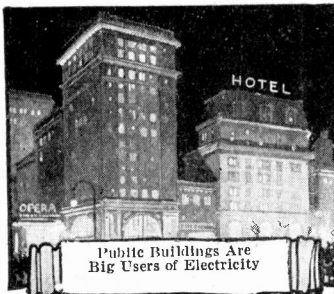
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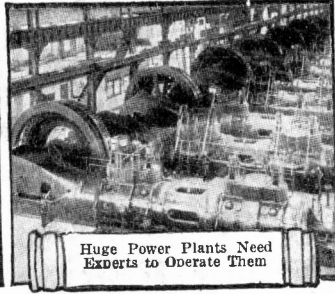


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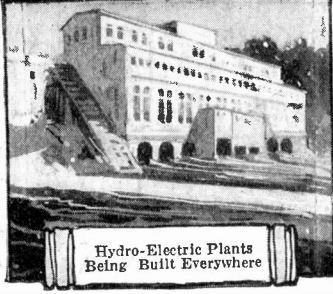
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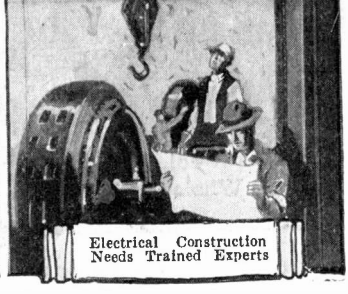
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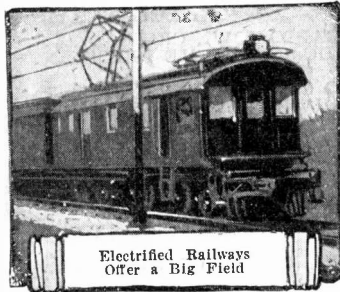
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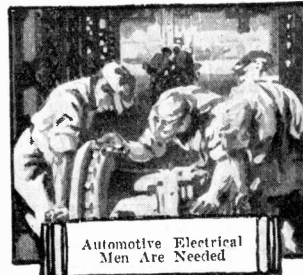
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Science and Invention

FORMERLY
ELECTRICAL EXPERIMENTER

Vol. XI.
Whole No. 130

February, 1924
No. 10

Member Audit Bureau of Circulation.

PUBLICATION OFFICE: 18.430 Jamaica Ave., Jamaica, N. Y.
EDITORIAL & GENERAL OFFICES: 53 Park Place, New York City
Published by Experimenter Publishing Company, Inc. (H. Gernsback, Pres.; S. Gernsback, Treas.; R. W. DeMott, Sec'y).
Publishers of SCIENCE AND INVENTION, RADIO NEWS, and PRACTICAL ELECTRICS

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SCIENCE AND INVENTION is published on the 25th of each month. There are 12 numbers per year. Subscription price is \$2.50 a year in U. S. and possessions. Canada and foreign countries \$3.00 a year. U. S. coin as well as U. S. stamps accepted (no foreign coin or stamps). Single copies, 25 cents each. A sample copy will be sent gratis on request. Checks and money orders should be drawn to order of EXPERIMENTER PUBLISHING CO., Inc. If you change your address notify us promptly, in order that copies are not misrouted or lost.

All communications and contributions to this journal should be addressed to Editor, SCIENCE AND INVENTION, 18,430 Jamaica Avenue, Jamaica, New York, or 53 Park Place, New York City, N. Y. Unaccepted contributions

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T. C.
Cleveland, Ohio.



FOLKS wonder how I can make such an amazing offer. No one ever dared to do it before—to guarantee absolutely to grow hair or the treatment costs nothing at all! Here's the answer. Read the letters printed on this page—letters from those who have tried this startling new method. These are just a few of the many that pour into my office every day—letters which show without a shadow of doubt that my home treatment—in the great majority of cases—positively *does grow hair!*

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"I wouldn't take \$50 for your treatment. It was far beyond my expectations. My hair was dead and had no lustre. Now it is restored to its brilliancy and has begun to grow again. Thanks."

J. B. C.
Hillsboro, Tex.

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"Have been using Merke Treatment 20 days and have received great results. My hair has been falling out for four years and your Treatment has checked it. I had two bald spots on my head where there was not even any fuzz, and there is new hair growing on them now. I wouldn't take \$50 for the Merke Treatment. I think it's the best in the world."

J. M.
Smackouer, Ark.

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"I am satisfied with results. Lots of hair is growing where I was bald. I mean in front where one mostly loses hair first. It was just as bare as the palms of my hands. Now hair is coming again."

C. F.
Brooklyn, N. Y.

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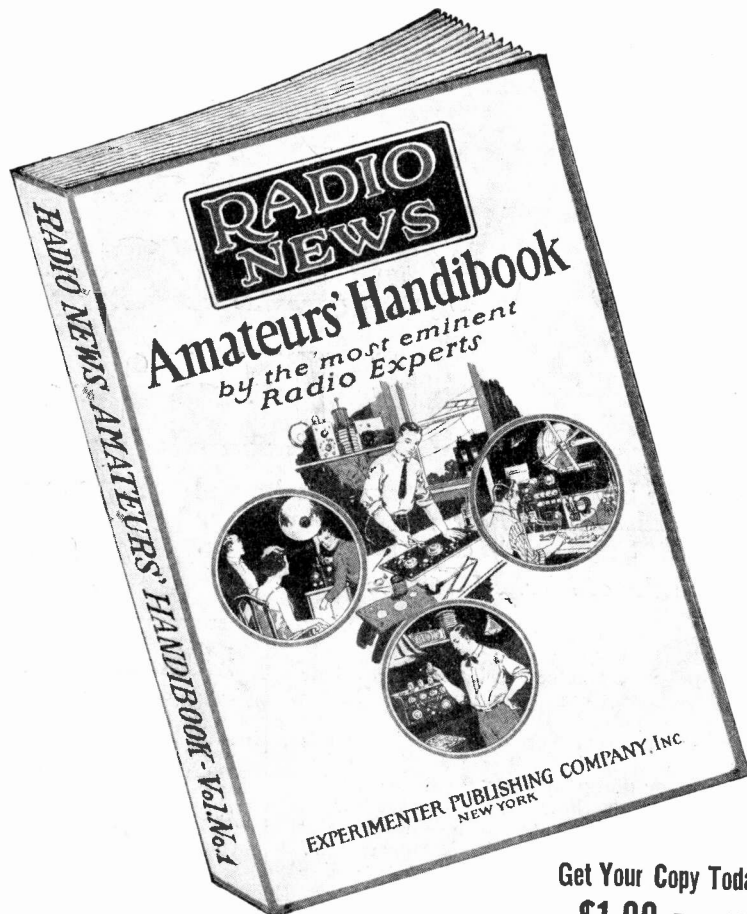
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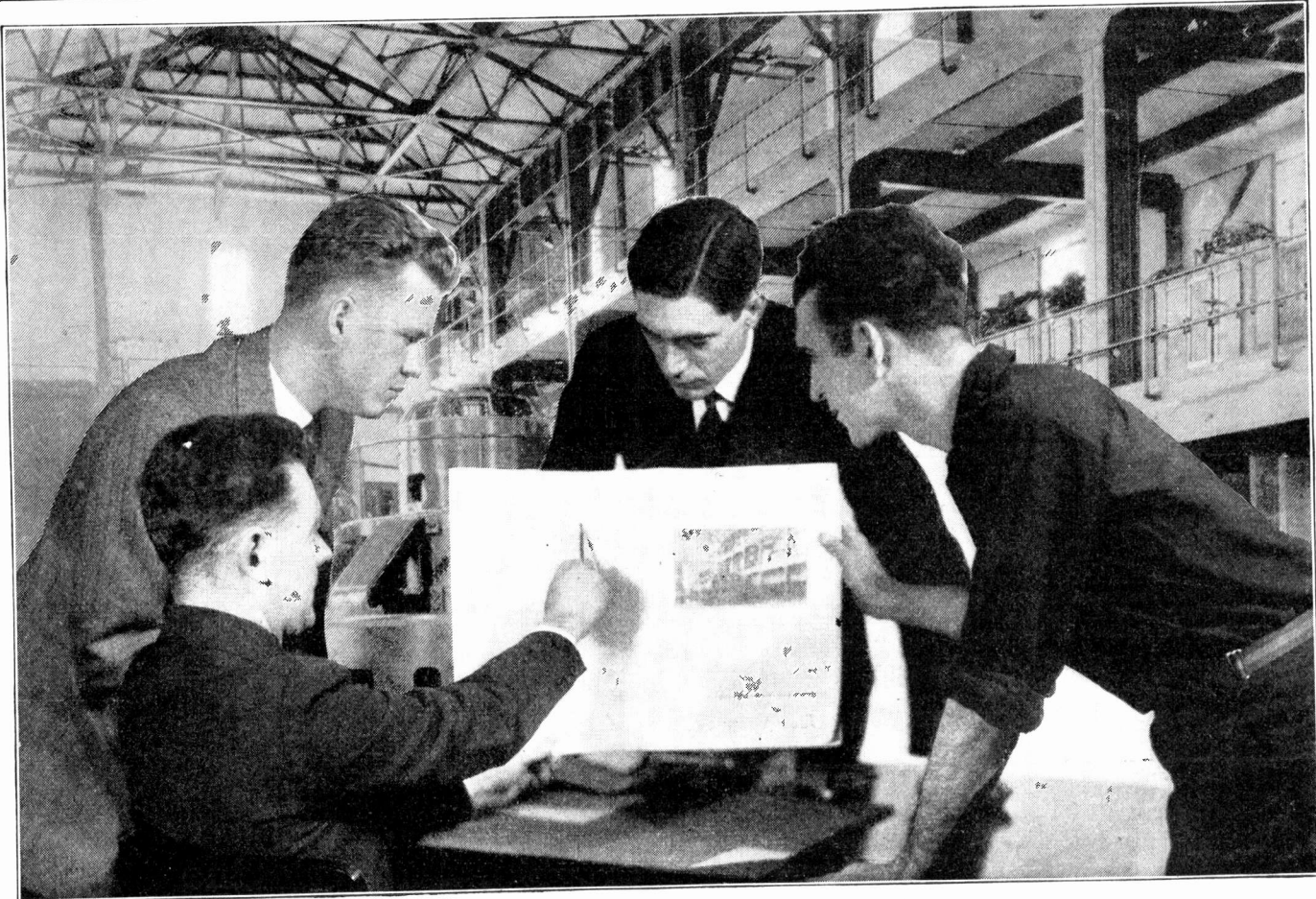
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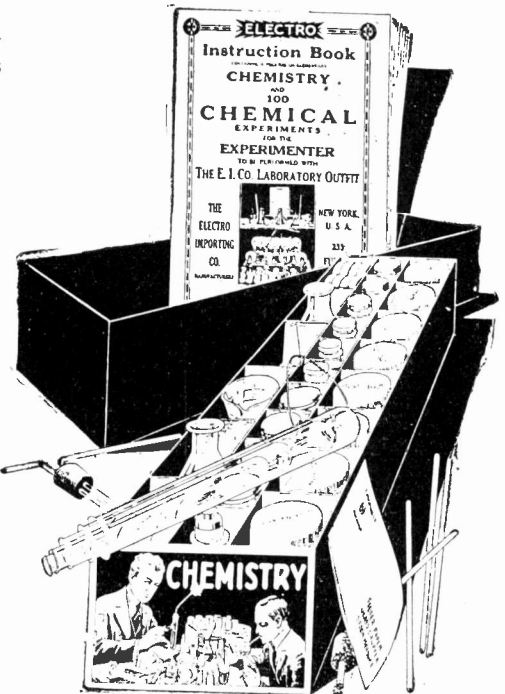
The Instruction Book is a real Chemistry Course for the Beginner. Some of the Contents are: Division of Matter: This is a Treatise on Elementary Chemistry and deals with the theory of the Elements, Molecules and Atoms, etc. Chemical Nomenclature: This explains in simple language the derivation of the chemical names of the elements and their compounds. There is a chapter on Laboratory Operations; Glass Working; First Aid; Fire Extinguishers; Experimenters' Aphorisms, etc.

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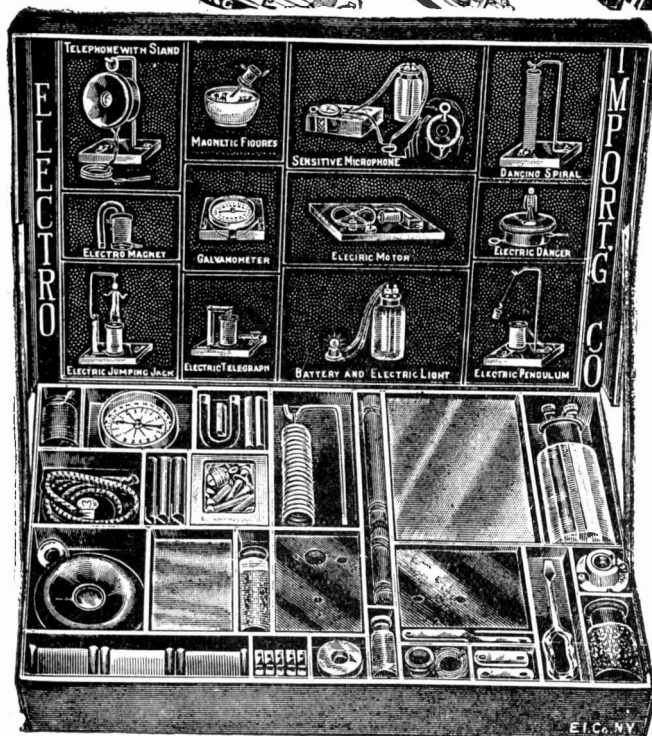
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S.&I.-2-24

S.&I.-2-24



Great Inventors Now Teach You Secrets of Practical Invention

How would *you* like to be the inventor of the tin cap that now corks millions of bottles—and who gets a royalty on every one? How much money would *you* have now if you had invented the simple idea of putting a rubber tip on pencils? The inventor of the Gillette Safety Razor is said to have made as high as \$2,500,000 a year! The inventor of the tiny snap fastener last year paid an *income tax* of \$29,000. The man who invented the Autographic Kodak sold his patent rights for \$500,000!

JUST a single idea can make *you* independently wealthy in a short time. Little things—like the crimped hairpin, the paper safety-match, the metal-tip shoe-lace—brought their inventors hundreds of thousands of dollars. Only recently *Success Magazine* told how one woman built up a splendid business from an invention based on a little wedge-shaped piece of wood!

Couldn't *you* develop an invention as simple as these? Haven't *you* some ideas—even now—for one of these little inventions which can pay you for its such money?

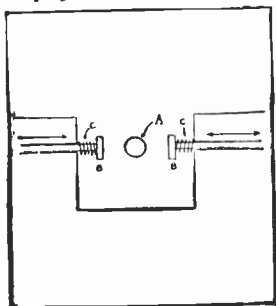
What Invention Is

After all, invention is nothing more than the science of "fixing things." And how many times a day you do "fix things." A leaky faucet, a rattling window, a broken strap—you fix hundreds of things just like these almost every day. You may not know it, but when you "fix things" you are using the principles upon which Inventive Science is based.

Prove it for yourself. Here is shown a very simple problem in invention. See how quickly you can solve it. What would you put on Shaft "A" to force members "BB" to move back? Think of something you know now which can give you the answer. If you have an ordinary electric light switch you will find it in a second.

Invention is not guesswork or blind luck—it is not a God-given faculty possessed by a few favored mortals. The truth is that invention is based upon exact laws which anyone can learn. It is merely a matter of first *seeing* something to be fixed and then of *thinking* of some principle which will fix it. That's all. The whole thing rests on being able to think inventively. The simple problem shown here proves that when you think inventively the whole science of invention becomes as easy to learn as reading or writing.

This test shows how easily you can develop your ability to invent.



Here is an interesting little problem and its solution will be found very simple, if we really think hard. "A" is the end of a shaft. The two members "B B" are free to move in either direction indicated by the arrows. If they are pushed back, the springs "C C" will immediately pull them forward again. Our problem is to put some kind of an attachment on the revolving shaft "A" so that the members "B B" will be pushed back both at the same instant every time the shaft "A" makes a single revolution. The device on shaft "A" must also allow the two members "B B" to come forward once in every revolution. What would you suggest putting on the shaft "A"?

Why More Inventions Are Needed Now

Hundreds of years ago, the world didn't need many new things. That is why few inventions were made each year. But now the world has more needs, more things to be "fixed." And that is why, in the United States alone, over 50,000 inventions are patented every year!

The world wants better and cheaper light and power. It wants an electric light that will be heatless. It wants new motors that will weigh less and produce more power. It wants faster and less costly aeroplanes, motor cars, steam engines. It wants new inventions which will make cooking and housework easier; that will save time and labor in the home, the farm, the factory and the office. It wants new ideas for toys and other amusements. It wants its present inventions to be developed so that they will work better and more economically.

Surely you have at least one idea for an invention—no matter what it is—no matter how great or how small—the world will pay handsomely for even the simplest idea. Every day you see things which can be improved or which must be "fixed." Every day you can get ideas for new inventions. It can be a new kind of mechanical toy, or some device which will make your wife's housework easier. It can even be something as simple as the common nutcracker. The man who invented the Kiddie-Kar, it is reported, made over \$5,000,000!

What Edison Says

Could you ask the advice of any greater authority than Thomas A. Edison? He says: "INVENTION IS A SCIENCE AND SHOULD BE TAUGHT AS A PROFESSION."

And now, for the first time, you can profit by Edison's advice. You can actually learn invention as a profession—exactly as other people are learning electricity, automobile mechanics, law, medicine, as a profession. The Bureau of Inventive Science offers you the first course in practical invention ever devised, it has written down the easy-to-learn principles of Inventive Science so everybody could read them and learn to use them. You want the ability to invent—NOW. All you need, to become successful is this easy, fascinating training which will develop your ability so it will be worth real money.

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tion which every successful inventor knows. They explain how to originate ideas, how to develop and perfect them,

how to get patents. But they tell you even more: Thousands of inexperienced inventors have been defrauded of their rewards because they did not know how to protect their patent rights. This great course tells you everything you want to know—how to sell your invention, how to get royalties—how to get the most money for your ideas.

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Science and Invention

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T. O'CONOR SLOANE, Ph.D., ASSOCIATE EDITOR

FEBRUARY
1924
No. 10

Editorial and General Offices, - - - 53 Park Place, New York

"Those Who Refuse to Go Beyond Fact Rarely Get As Far As Fact" -- HUXLEY

Sleep

By H. GERNSBACK

THERE are few subjects that are understood as little as sleep. Most of us go to sleep every night, as a matter of fact, but how many people really know why we sleep, what the functions of sleep are, and what occurs in our brain when we do sleep. Strange to say, the subject, fascinating as it is,

I BELIEVE
¶ THAT many a fact often turns out to be only a near fact.

is one of the great unexplored spheres of knowledge. There are few books in existence today treating on sleep and every encyclopedia you come across will give a different theory. Summing it up, it would seem that we really know nothing about it at all and that one man's theory is as good as that of the next. Some investigators believe that sleep is due to a gradual accumulation of poisons in the body, a sort of auto-intoxication that finally benumbs our brain, thus putting us to sleep; a plausible theory, which, however, has been disproved as not being founded upon fact. Another theory is that the brain simply tires—just as our muscles become fatigued—and upon relaxing, a sort of suspended animation sets in, thus producing the condition of sleep.

There are different kinds of sleep which might be classified as follows:

1—Natural sleep. 2—Hypnotic sleep. This particular sleep is distinguished from all other varieties by the fact that the subject under hypnosis can sleep with his eyes open. 3—Narcotic sleep produced by drugs. This sleep, similar to the hypnotic sleep, is very sound and much deeper than natural sleep. 4—Sleep produced by blows or by fainting. Also called unconsciousness. 5—Hibernating sleep found in many animals such as bears, etc. This is probably a true hypnotic sleep. During such sleep the animal suspends practically all animation. The heart action, as well as the action of the respiratory organs are greatly decreased. The hibernating sleep is by no means found only in animals, but in human beings as well. The East Indian, particularly, can produce the hibernating sleep. During such sleep the tongue is usually rolled back into the mouth and the subject's body becomes more or less stiff as in a cataleptic stage. Many East Indian performers can thus sleep for weeks at a time without taking any nourishment whatsoever and rising from the long sleep unharmed.

A tremendous amount of research work will have to be done before we really know what happens when we fall asleep. In the meanwhile, the writer ventures a few remarks on the subject which may or may not be disproved in the future.

In the first place, sleep is a habit like many other habits, inbred and inborn in us since prehistoric times. When our ancestors had as yet not reached the human stage, all animation ceased with sun-down, as is the case with most animals today. It appeared dangerous to prowl around during the darkness. After sunset the animal sought its lair or cave and gradually its movements became less until the animal finally stretched out and relaxed. There being no light, the eyes shut tight and soon a total relaxation set in. This is the case today with nearly all animals, including the human race as well. It should be noted here, and the writer lays particular stress upon it, that there seems to be a relation between the optic nerve and the sleep producing

causes, for as long as you keep your eyes open you do not sleep, except hypnotically. This is the case with nearly all animals, with few exceptions. Fish, on the other hand, which do not close their eyes, do not as a rule sleep, with some few exceptions. If you have gold fish in your home you know that they do not relax nor sleep. They keep on swimming ceaselessly. Evidently, they can get along without sleep.

We also know by experience that when we are lying in bed and trying to ward off sleep, one of the best ways to do so is to open the eyes. This would seem to disprove completely the auto-intoxication or poison theory. The writer ventures to say that sleep itself is not absolutely necessary as long as the physical exertions are kept down to a minimum. It is possible that future generations will be able to get along without sleep at all.

Indeed, while we are asleep, the brain itself is not asleep, as might be thought. It still has to take care of all the various functions of the body such as respiration, circulation of the blood and dozens of others. In other words, the brain itself never sleeps. The writer has proven this in connection with his hypno-bioscope, now used commercially to teach things to subjects while sound asleep.

Summing up, the writer is of the opinion that sleep is a partial hypnotic effect produced by a slight self-hypnosis. In other words, in order to sleep you must will to sleep, either consciously or subconsciously. You can fight off sleep merely by mental exertion as everyone knows and it is thus possible to stay awake for many hours. But the instant you have the actual will or desire to sleep, relaxation sets in, while a slight hypnotic state begins which wears off as the night wanes until the room in which you sleep becomes light. Finally, if the sun shines, you will wake up automatically in most cases. A partial proof of this theory would be that you can wake yourself up at a pre-determined hour. For instance: You say to yourself before going to sleep that you will wake up at 5:30 in the morning, and you will unfaillingly do so if you simply will it strongly enough. This would prove in part the self-hypnotic theory in natural sleep.

It should be understood that the above theory relates only to normal-natural sleep. By this is meant the sleep that comes to us under normal, every day conditions. We might call an abnormal-natural sleep, the sleep produced through physical exhaustion. For instance, after taking abnormal exercise for an extended period, we find that we readily fall asleep. While this form of sleep still falls under the normal classification it should be noted that the self-hypnotic influence is not nearly so great in this case as in normal-natural sleep. Of course even when we are exhausted physically we still can keep awake if we will it strong enough, but the effort to stay awake becomes tremendous. In this case it is really the muscular-exertion-reflex that unconsciously forces the mind to will the sleep and we then fall asleep almost automatically.

To prove that we can get along without sleep, in case of necessity we can go for two, three and sometimes four days without any.

I BELIEVE
¶ THAT the quest of knowledge is man's greatest and most exciting sport.

I BELIEVE
¶ THAT ideas of a feather flock together.

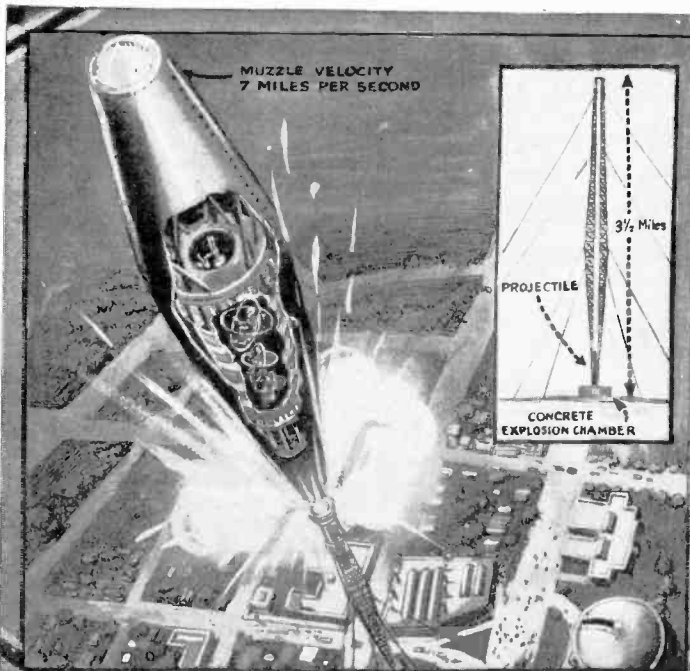
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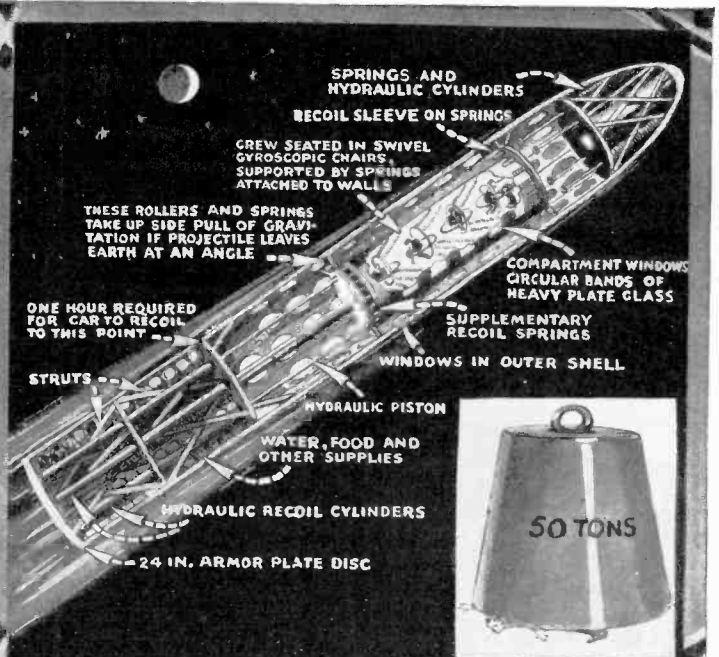
Can We Visit the Planets?

Some of the Problems of Such a Journey.

BY DON HOME.



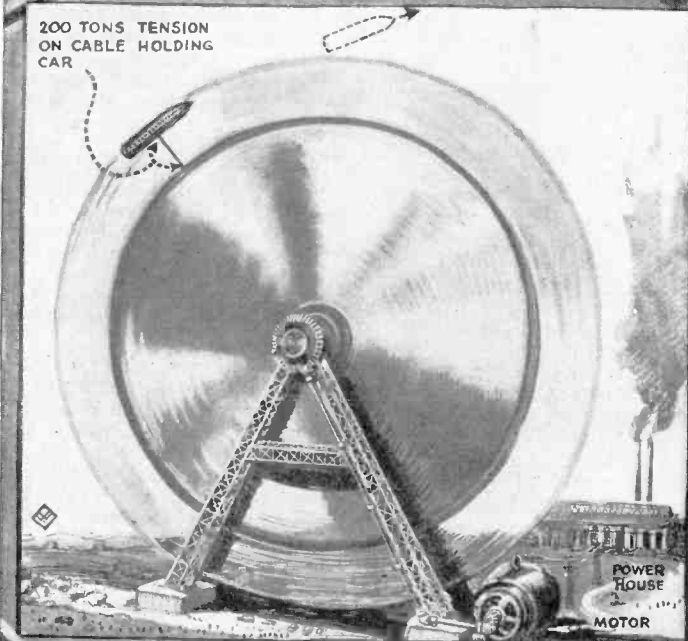
FOR centuries it has been the vision of man to visit other worlds than our own. To do this there is a large number of almost insurmountable problems whose solutions must be found. Not the least of these is a method of obtaining the initial velocity of seven miles per second that must be attained by the projectile which is to carry the man making the visit away against the Earth's power of gravitation, into the realms of space. One of the most obvious devices for gaining such a velocity would be a giant cannon with a barrel $3\frac{1}{2}$ miles long.



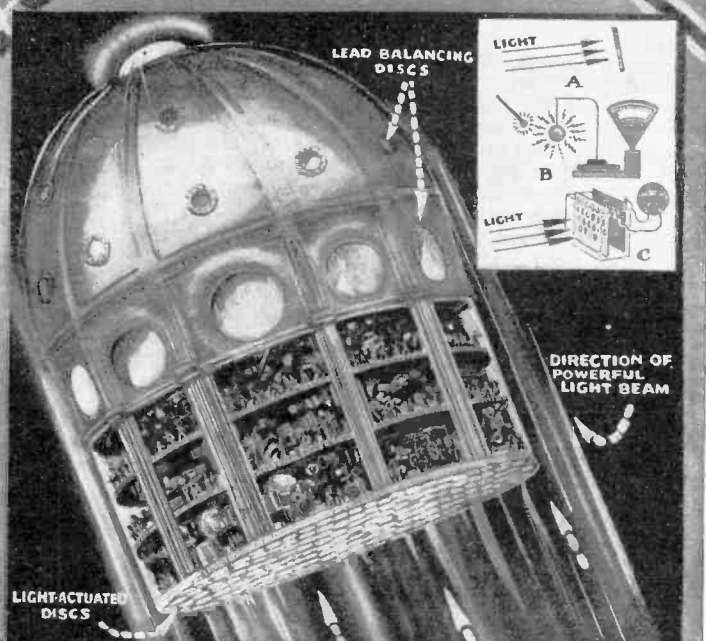
Another grave problem attached to leaving the Earth's surface in any type of vehicle is a means of counteracting the terrific force that the initial velocity would exert on the men in the vehicle. Assuming the initial velocity of seven miles per second, the occupants of the car would be thrown against its walls with a force of more than fifty tons, crushing them into pulp, unless some means of taking up the thrust over a period of an hour could be installed in the car. Above is illustrated one method of absorbing this powerful thrust.

The primary problem of taking up this monstrous thrust might be solved by the hydraulic piston method shown above. Such an arrangement, however, would still leave a considerable power at the end of the operative period of the pistons that would be by no means small. This subsidiary thrust would have to be taken up by another set of springs and pads fixed in the end of the steel cylinder compartment which would serve as the car for the travelers. Each voy-

ager would be fixed, seated, in a gyroscopic swivel chair. The outside framework of the car would be of extra braced steel framework covered with a heavy steel plate. All along the outside walls of the cylinder housing the passengers' cylinder and completely around its circumference there would be glass windows. Near the seat of each of the crew there would also be a window. No matter what position the sliding inside cylinder took the occupants could see out.



Another method suggested for launching an interstellar vehicle into space against the Earth's gravitational pull is illustrated above. A vehicle more or less in the form of a projectile would be lashed to the circumference of a giant fly-wheel and the wheel would be rotated at a circumference speed of a little more than seven miles per second. In such a case some means of protecting the occupants from the crushing power of the centrifugal force would be necessary just as something would be necessary to take up the end thrust in the previous case.



It has been proven that light exerts force on the surface it strikes. (A) Here is a car which would use that force, provided some means of counter-acting gravitation could be found. It has also been noted that by electrification of a lead ball its weight can be lessened, (B), which might be considered ground for the assertion that a means of controlling gravitation will be discovered. Also, light falling on certain bi-metallic cells generates electricity (C), giving another force to move the car.

Radio Town Crier

By H. Gernsback.

THE accompanying illustration shows a gigantic radio loud-speaker which probably will be known in the future as the Municipal Announcer. Experiments made for the past few years have shown that it is possible to so amplify the human voice, by means of huge horns and vacuum tubes, that it will be heard over a radius of from three to five miles so that each and every word will be understood clearly. In our *Electrical Experimenter* of November, 1919 issue, there was illustrated how huge horns placed in a church tower projected sound four to five miles.

The idea of the Municipal Loud Speaker is as follows: Huge sky-scrapers, as shown in the illustration, would be equipped with a number of concrete or non-vibrating metallic horns, pointing downward as shown. In this position, the sounds will be dispersed towards the street and buildings, and will also prevent rain and snow entering the horn itself. In cities like New York and Chicago, such horns would be erected every one or two miles. It goes without saying that present buildings can be equipped with such horns, but in the future probably a new sort of architecture will be evolved to take care of them.

The purpose of these Municipal Announcers will be simple. Any news, either of civic or national importance, can be broadcast so that the whole city can hear every word. By opening your office or home window, it will be possible to listen to every word spoken. Thus a Presidential speech, a talk by the Mayor of the city, or any other important feature can be instantly transmitted to the entire populace.

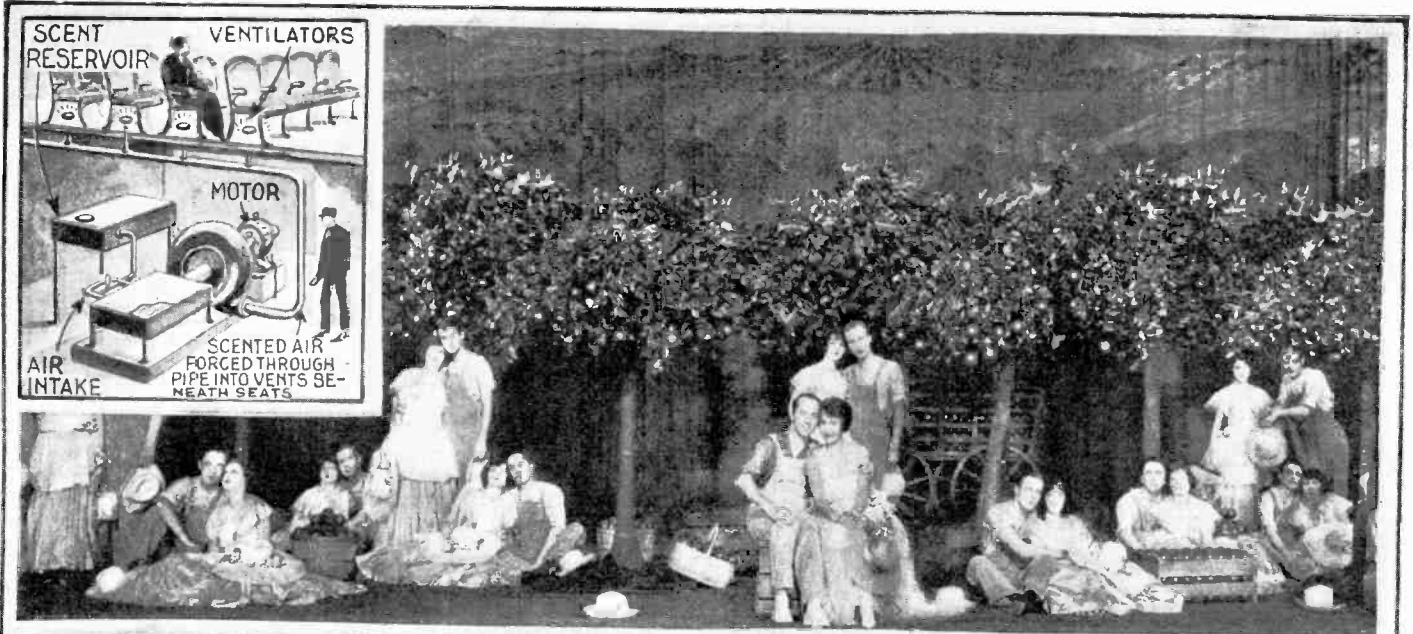
For police work, such a device will be of tremendous importance. Suppose a robbery or a murder is committed; the police headquarters can immediately broadcast this news so that every citizen in the neighborhood will be on the look-out for a certain car and will have a description of the law-breaker. The important part is that the information will be instantaneous, which in the detection of crime, is of utmost importance.



Science Takes Hand In Beauty

Appeal to Another Sense Makes Scene More Beautiful.

AT THE THEATRE



In order to increase the reality, and thereby the beauty and effectiveness of a song setting, Hassard Short, in staging the "Music Box Revue" hit upon the simple expedient of appealing to another of the senses. Ordinarily, on the stage, beauty is gained by appealing to the eye and ear. Here science has gone a step further and not only these two organs are appealed to, but the nose is added to the list. The scene is laid in an orange grove of California (above). Shortly after the characters appear and begin the song a gentle scent floats up over the audience, the magic scent of oranges. Then the lights are dimmed and the oranges on the trees begin

to glow and the scent becomes stronger until at the end of the scene it pervades the whole theatre. The trick is simply done. In the basement there is a large carburetor-like machine, consisting of a large, flat pan containing a synthetic scent—the nature of which the producers refuse to give since it is not patentable—and a centrifugal blower which draws a draft of warm air over the scent. (Insert) This scent impregnated air is forced up through the ventilation pipes to the vents beneath the seats in the theatre. The oranges on the trees, in the crates and in the wagon all house small lights (3,000 are used in the scene) lit at the proper instant.



An even more gorgeous effect is achieved in another scene in the same production with the aid of lights on costumes using complimentary colors. Directly above are seen the figures as they first appear. The body of the costume is an iridescent purple while the trimmings are a pale yellow. The hangings behind the scene follow the same plan. The foot board which rises to the rear of the stage is black, covered with

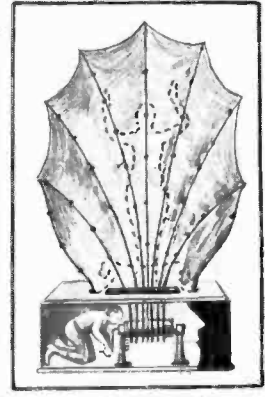
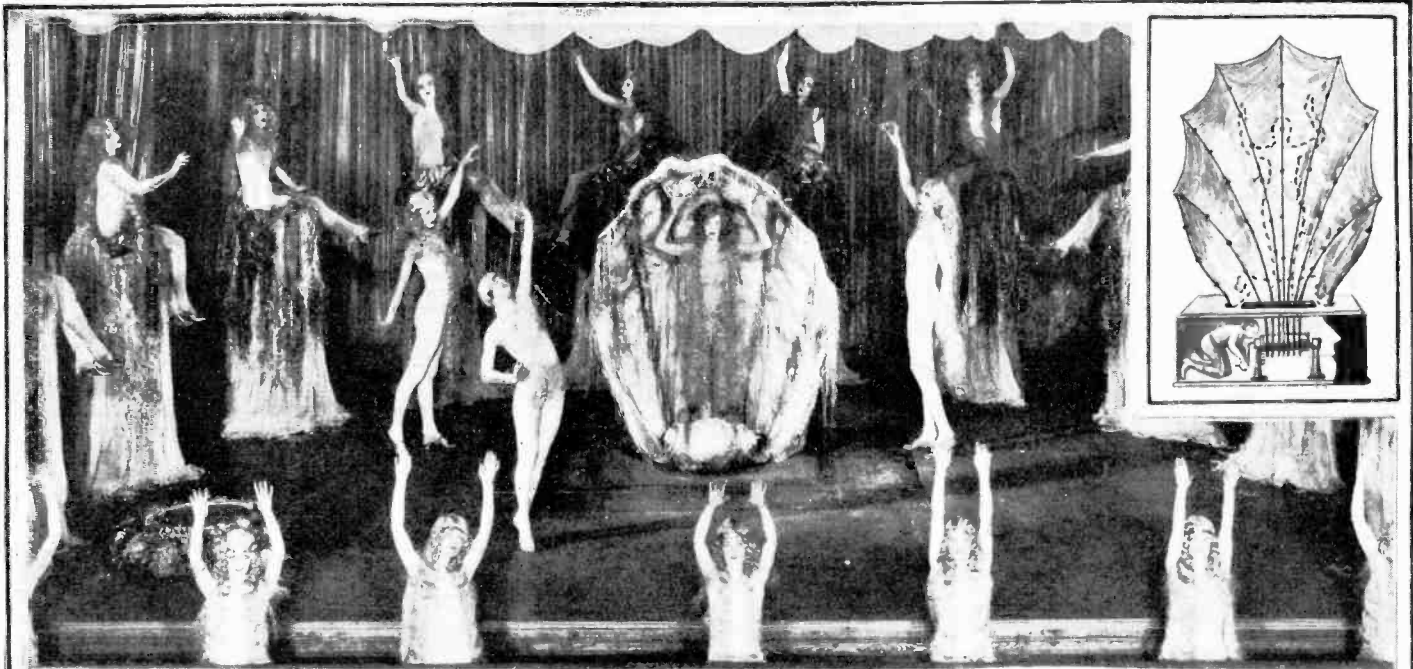
what seems to be sparkling jewels. Then there is a sudden change in the lights—so sudden that it is imperceptible until it has happened. The audience gives a little gasp. The costumes have become checked in gold and purple. Even the hats have become checked. The song continues and the background follows the design of the costumes (above), through all the changes in costume color there

is not the slightest change in the flesh tints of the cast in spite of the changing colors. Then again in the finale (above) the costumes take on other hues with the repetition of the almost unnoticed light change. They become light maroon and gold checked while the trimmings shine out with a tint all their own. The lights that cause the change are all passed through colored gelatine screens.

Mechanics of Gorgeous Revue

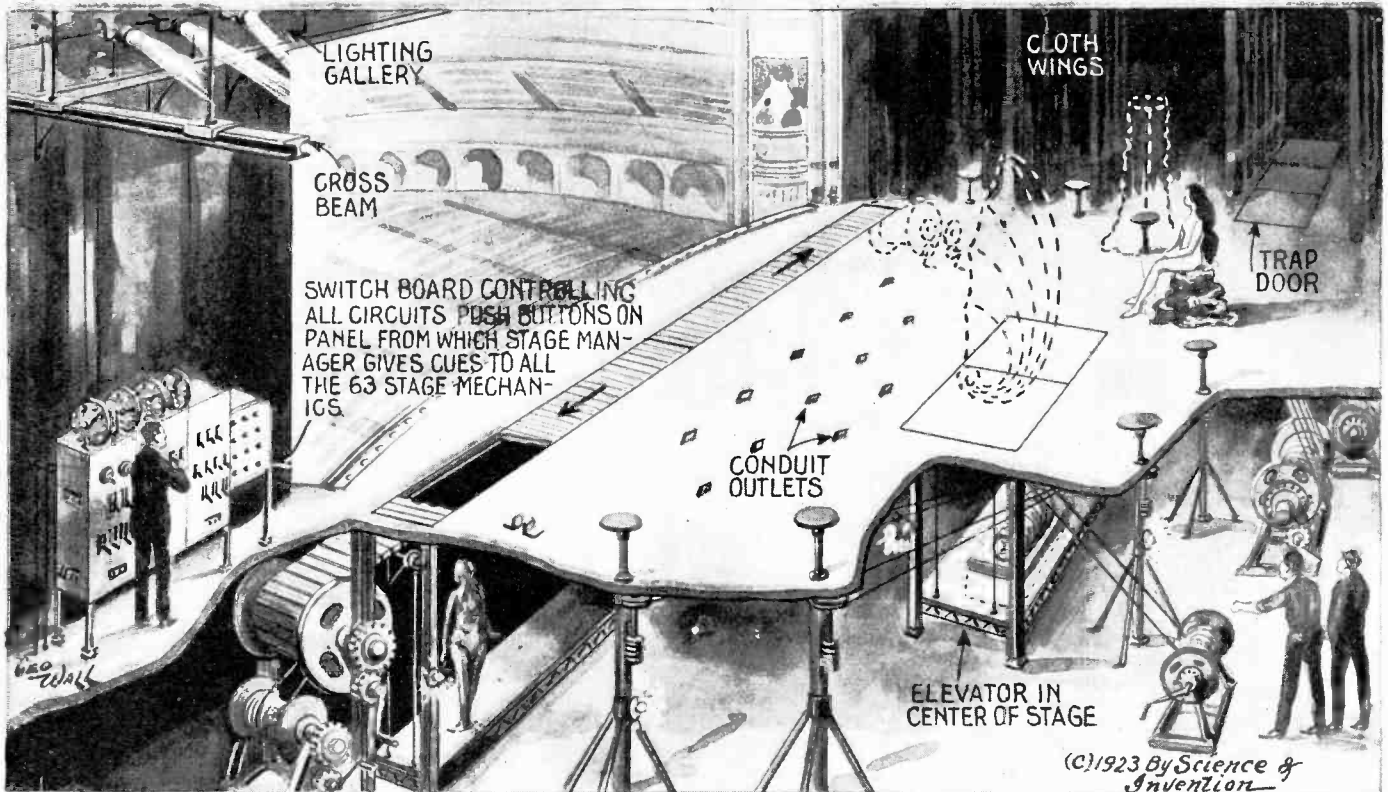
Sixty-three Mechanics Necessary to Operate Stage Devices.

BY W. B. ARVIN



The scene "The Fisherman's Dream" depicted above opens with dim lights on a small fishing craft. The craft is lifted up into the wings out of sight of the audience. Then, as mermaids, flocks of girls appear on the stage. The chiffons that are between the audience and the figures when the scene opens are drawn away and in the center of the stage there arises a closed sea-shell. It begins slowly to open until, when it is full sized, another mermaid appears standing in it. Following this at the front of the stage there is seen gradually arising from beneath it, eight

more of the under-sea maidens, while at the same time a semi-circle of them begin to float up on clumps of seaweed around the rear of the stage. Then the central maiden steps back into the shell, it closes and drops slowly out of sight as do all the other figures. At the insert is shown how the sea shell is made to work. It is constructed of silk held in place by spring steel rods. A boy is secreted in its base and at the proper time he unrolls the cords off the windlass, which cords allow the steel rods to expand into a straight position thereby opening the shell.



Here is shown the mechanical end of the stage which requires 63 men for its operation. A third of the mechanics are in the scene galleries above the stage, another third of them are in the basement beneath. None of these men have ever seen the show from the front, and those who work in the basement have never seen the actual happenings on the stage. All are kept in perfect time by the simple device of having them all work by signal light. The stage manager has a small switch-board which operates all the cue lights and with this he keeps the whole crew in step. Along the front of the stage may be seen the elevator which raises the girls in

the foreground in the scene illustrated at the top of the page. When the elevator is not in use it is covered much like a roll-top desk. This cover is rolled away by a winch as can be seen in the cut-away portion. The elevator is also lifted by the same winch. The stool-like affairs are simply steel rods running in guides (also seen in the cut-away portion). When they are not in use they are flush with the stage floor. The stool tops are removable. All twelve of these stools and the elevator in the center of the stage work from a master winch and clutches. There is a signal light for every piece of apparatus.

(C) 1923 By Science & Invention

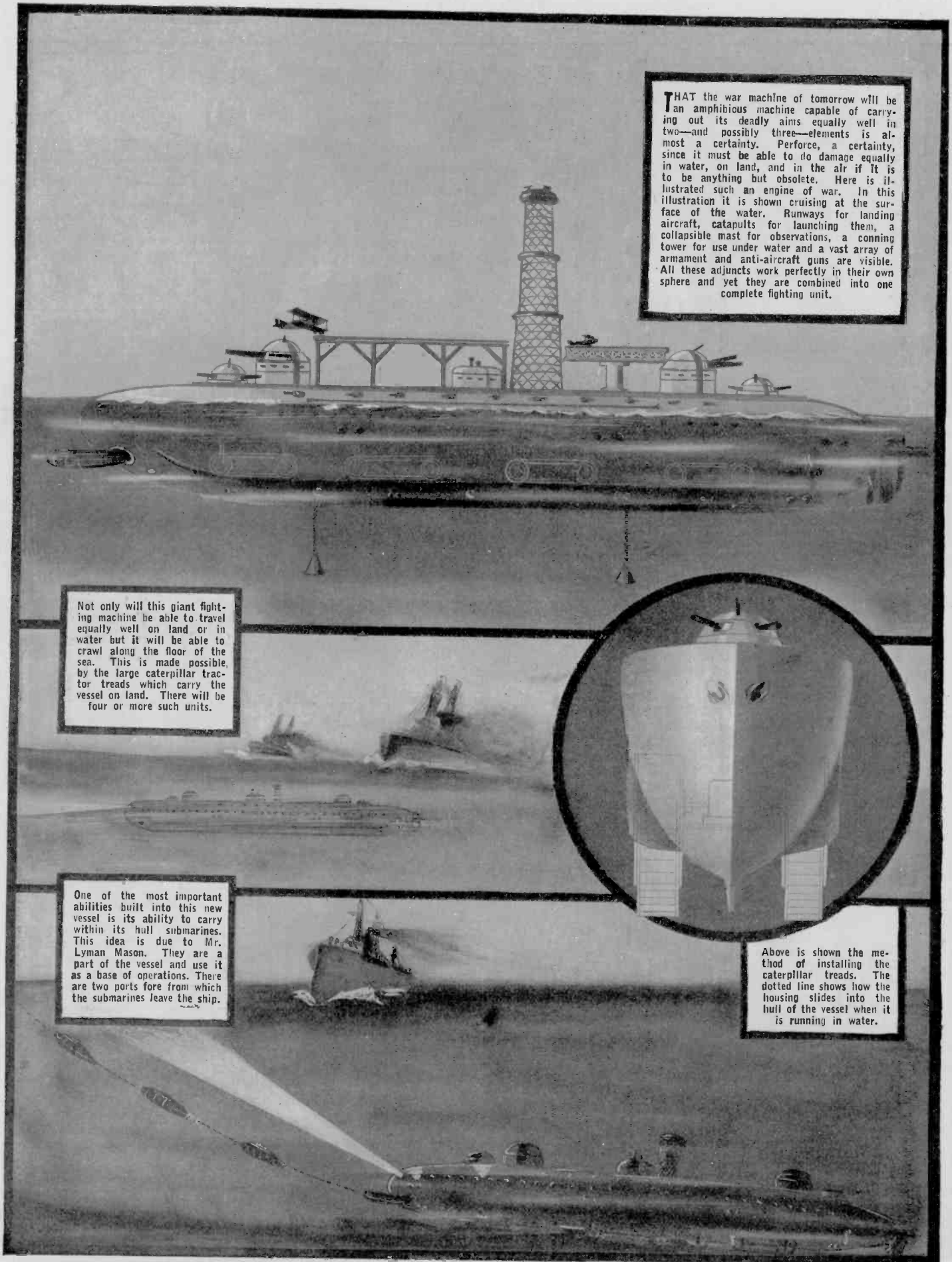
The War Machine of Tomorrow

THAT the war machine of tomorrow will be an amphibious machine capable of carrying out its deadly aims equally well in two—and possibly three—elements is almost a certainty. Perform, a certainty, since it must be able to do damage equally in water, on land, and in the air if it is to be anything but obsolete. Here is illustrated such an engine of war. In this illustration it is shown cruising at the surface of the water. Runways for landing aircraft, catapults for launching them, a collapsible mast for observations, a conning tower for use under water and a vast array of armament and anti-aircraft guns are visible. All these adjuncts work perfectly in their own sphere and yet they are combined into one complete fighting unit.

Not only will this giant fighting machine be able to travel equally well on land or in water but it will be able to crawl along the floor of the sea. This is made possible, by the large caterpillar tractor treads which carry the vessel on land. There will be four or more such units.

One of the most important abilities built into this new vessel is its ability to carry within its hull submarines. This idea is due to Mr. Lyman Mason. They are a part of the vessel and use it as a base of operations. There are two ports fore from which the submarines leave the ship.

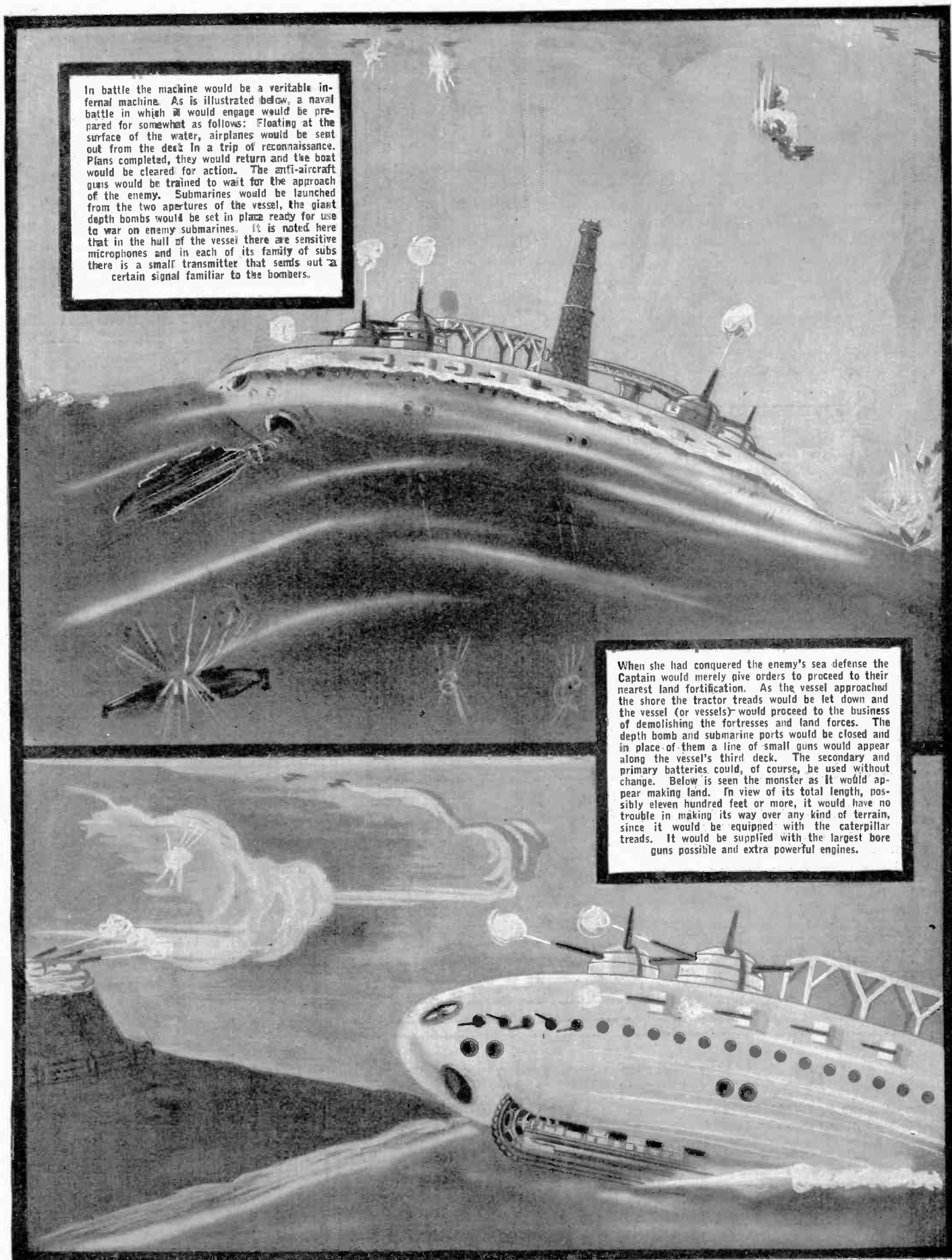
Above is shown the method of installing the caterpillar treads. The dotted line shows how the housing slides into the hull of the vessel when it is running in water.



An Amphibian Beast of Prey

In battle the machine would be a veritable infernal machine. As is illustrated below, a naval battle in which it would engage would be prepared for somewhat as follows: Floating at the surface of the water, airplanes would be sent out from the deck in a trip of reconnaissance. Plans completed, they would return and the boat would be cleared for action. The anti-aircraft guns would be trained to wait for the approach of the enemy. Submarines would be launched from the two apertures of the vessel, the giant depth bombs would be set in place ready for use to war on enemy submarines. It is noted here that in the hull of the vessel there are sensitive microphones and in each of its family of subs there is a small transmitter that sends out a certain signal familiar to the bombers.

When she had conquered the enemy's sea defense the Captain would merely give orders to proceed to their nearest land fortification. As the vessel approached the shore the tractor treads would be let down and the vessel (or vessels) would proceed to the business of demolishing the fortresses and land forces. The depth bomb and submarine ports would be closed and in place of them a line of small guns would appear along the vessel's third deck. The secondary and primary batteries could, of course, be used without change. Below is seen the monster as it would appear making land. In view of its total length, possibly eleven hundred feet or more, it would have no trouble in making its way over any kind of terrain, since it would be equipped with the caterpillar treads. It would be supplied with the largest bore guns possible and extra powerful engines.



Awards of \$1000 Monthly Prizes.

Uniformity of Quality Makes Work of Awards Hard for Judges.

Name	Page	Name	Page
FIRST PRIZE \$100.00			
Raymond Francis Yates	977	Frank W. Nightingale	999
TWO PRIZES \$50.00 EACH			
Don Home	962	M. Wiley, Reporter No. 3527	1003
C. A. Oldroyd	974	Walter Johnson	1010
TEN PRIZES \$25.00 EACH			
Lyman Mason	966	TWENTY PRIZES \$10.00 EACH	
Dr. Albert Neuburger	975	Charles G. Percival	982
Dr. Armin DeMuth	980	Dale R. Van Horn	983
Ismar Ginsberg, B. Sc., Chem. Eng.	982	S. Leonard Bastin	983
Phil Gersdorf	986	Dr. Albert Neuburger	983
Laurence H. Snyder	987	Thomas Reed (Joy Ride Detector)	983
Chas. Marton	988	Dr. Albert Neuburger	984
Harry H. Dunn	990	E. S. Norton	989
L. J. Smith	996	Author of Fly-Gun Article	989
Armstrong Perry	1005	Dr. Albert Neuburger	997
FIVE PRIZES \$20.00 EACH			
George A. Luers	990	Dale R. Van Horn	997
Walter Gibson	994	Dr. Albert Neuburger	997
Leonard J. Edick	996	Harold Jackson	997
W. L. Pearce	1007	Author of "Illusion" Article	999
Paul Oard	1007	V. B. Rickcy	999
TEN PRIZES \$15.00 EACH			
Adolph Ruhland	981	Dr. E. T. Sonendriker	1000
A. F. Anderson	981	Dr. Albert Neuburger	1001
Geo. A. Luers	981	Raymond B. Wailes	1001
L. H. Stuart	981	Orhan R. Coblentz	1001
P. Cedric Wenger	998	J. L. Griggs	1001
Dale R. Van Horn	998	A. O. Wright	1060
J. T. Garver	999	TEN PRIZES \$5.00 EACH	
Twenty Prizes \$2.00 Each			
(No entries)			
Ten Prizes \$1.00 Each			
(No entries)			

Here Is How You Can Get in the Contest:

\$12,000 or More in Gold

Beginning with the January issue, SCIENCE AND INVENTION will pay \$1,000.00 or more each month of the year in prizes. Every article published in the regular news section will receive one of them.

(The departments have awards of their own which they will continue to give.)

Ideas are what the editors want. They must be told simply—so your mother or sister can understand them—in pictures and sketches. Be sure they are NEW and have something to do with science or invention. The editors want pictures and

88 monthly prizes will be given as follows:

FIRST PRIZE \$100.00

2 PRIZES of \$50.00 each

10	"	"	25.00	"
5	"	"	20.00	"
10	"	"	15.00	"
20	"	"	10.00	"
10	"	"	5.00	"
20	"	"	2.00	"
10	"	"	1.00	"

\$12,000 or More in Gold

sketches—must have them—but ideas are wanted most of all.—And they will be handsomely paid for. The rules of the contest will be found on page 534 of the October issue. If you haven't a copy, one will be mailed you free on receipt of your name and address. It will give full details of the rules and hints on submitting articles. The closing date for all prize contributions will be the 15th of the month preceding date of issue, i.e., 15th of December for the February number; the 15th of January for the March number, etc.

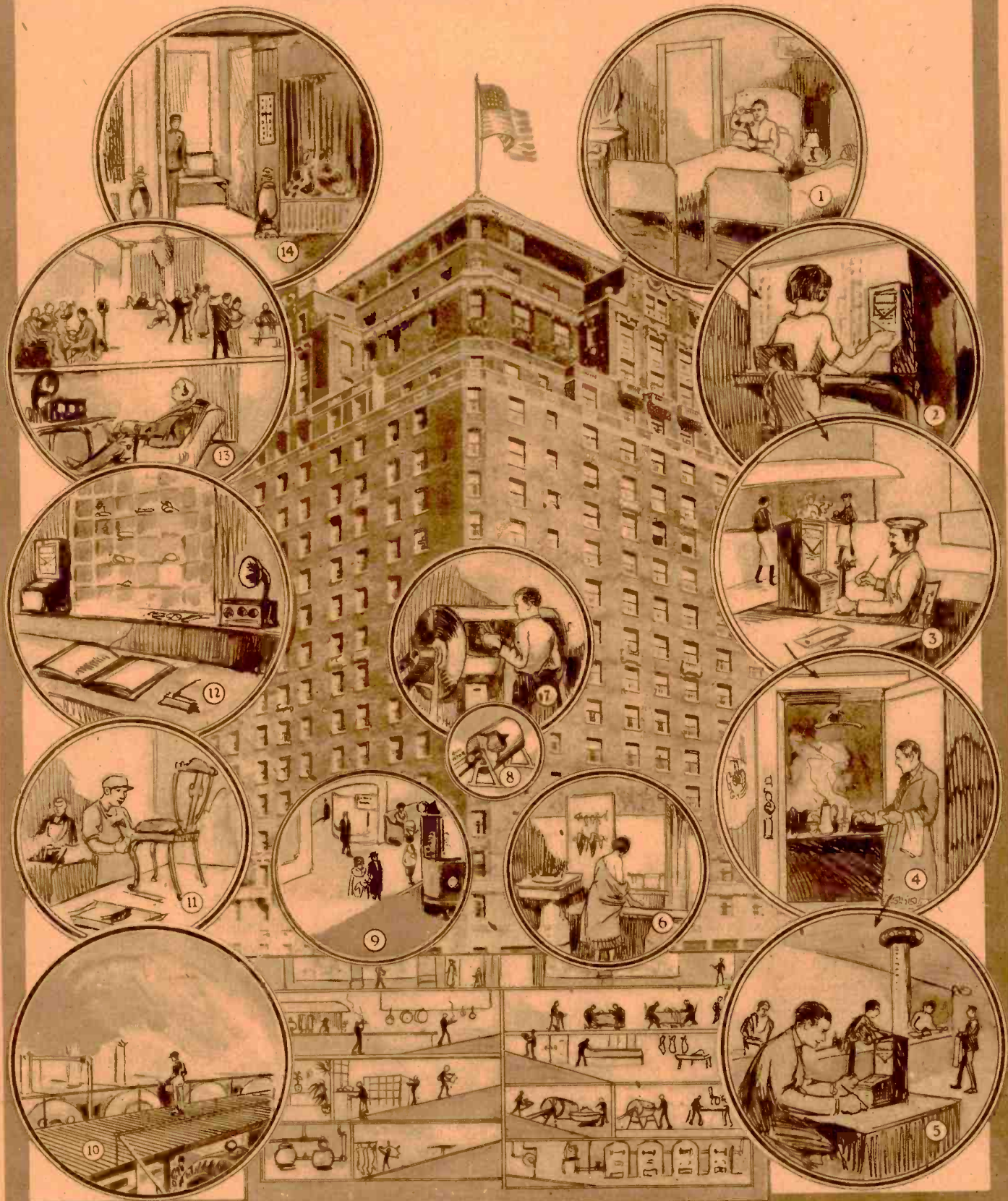
WILL YOU BE OUR REPORTER?

IN Connection with our \$12,000.00 prize contest announced last month, it goes without saying that you will have to hustle to win a prize. The Editors do not wish to make it hard for you; quite the contrary. We want the pictures and want them badly. Herewith is reproduced our reporter's card. We shall be glad to send it to anyone who makes an application. By means of this card you will be able to secure entry into industrial plants, business houses, motion picture studios, steamships, mines, etc. This card will prove an open sesame to you in many instances. Each card is numbered and only one is given to a correspondent. A postal card from you and a request for this reporter's card is all that is necessary for obtaining one. It will be sent you by return mail. Address Field Editor, SCIENCE AND INVENTION, 53 Park Place, New York City.

REPORTER	Science and Invention	CORRESPONDENT REPORTER'S IDENTIFICATION
	NO. 999	
	THE BEARER OF THIS CARD <i>John Roe</i>	
	IS AN AUTHORIZED CORRESPONDENT-REPORTER OF SCIENCE AND INVENTION MAGAZINE THE PUBLISHERS OF SCIENCE AND INVENTION WILL APPRECIATE ANY COURTESY EXTENDED THEIR REPRESENTATIVE.	
(over)	EXPERIMENTER PUBLISHING CO.	<i>H. G. Balk</i> PRESIDENT

SCIENCE SERVES IN NEW HOTEL

Multitude of Mechanical Appliances Make Life Luxurious



In the recently completed Alamac Hotel, New York, begin at the insert 1 and follow through to 5 and see how by one operation of the telephone operator the guest gets his breakfast served to his room without disturbance. The telephone operator takes the order from the guest's telephone, writes it on the telautograph, with the result that the chef, the head waiter, and the bookkeeper all get the order. At the same time the guest leaves an order for the valet. Both orders are copied at the same time and there is no duplication. The servidor enables the hotel attaches

to leave the food for the guest without disturbing him, since the door houses the food (Fig. 4). A microphone on the roof carries music from the orchestra to a broadcast station. Guests in the rooms with receiving sets hear the music without leaving their easy chairs. At 7 and 8 is shown the automatic silver polisher; at 10 the water filters which clean all water used in the hotel; at 11 is shown the repair shop. At 14 are the elevators equipped with seats. At 12 the radio set in the office. Below, four floors beneath the street connected with inclined planes.



The fire came to the surface. The vicinity of the cave was glowing with molten, burning rocks. The ground all around the cave-mouth soon fell inward. A seething crater was exposed where the cave had been—a bottomless pit of lurid, licking flames with black smoke rolling up from it, and the hissing of steam below.

The Man On the Meteor

By RAY CUMMINGS

PART II.

SYNOPSIS OF "MAN ON THE METEOR"

CHAPTER I

WITH no memory of past events, a young man suddenly comes to his senses on a meteor which is part of one of the Rings of Saturn. He finds that, due to the small size of the meteor, his body weighs very little and he experiences great difficulty in walking. Being hungry and thirsty, he looks around for nourishment and finds the mouth of a cave. As he looks toward the cave a girl comes into view. At the same time she catches sight of him. Suddenly she leaps into the air with a motion similar to that of a swimmer in water and sails gracefully away.

The young man, who calls himself Nemo, enters the cave and after traversing some little distance finds it to be illuminated by the phosphorescence of the rocks forming its walls. He finds flowing a stream of milky white fluid. He drinks and refreshes himself and discovers some food.

Lying down on the girl's couch, he soon is lost in slumber. Upon awakening he sees her standing nearby and starts toward her, whereupon she leaps into the air and "swims" to a nearby ledge. He pursues her, but she constantly evades him. Soon, exhausted, he lies down once more and sleeps. He is awakened by the young lady stroking his hair. They become friends. She teaches him how to jump thousands of feet into the air and return, using a peculiar swimming motion. Soon after, they enter the cave, and the girl catches and kills a huge lizard-like creature. They cook and eat the flesh of the animal. Nona, as Nemo has named the girl, watches him intently. Nona comes over to his side. For a moment they are silent, Nemo's heart racing madly. Suddenly, he takes her into his arms.

Thus Nemo has found his habitable world and his mate—beyond which the legitimate needs of man do not go.

YOU ask me to tell you more about Nona and our life on the meteor? You shall have it, of course. But if you are among those who doubt me—if you are the sort inclined to scoff at everything beyond your own knowledge or your intellectual capacity—I beg you to read no further. My narrative is not for such as you.

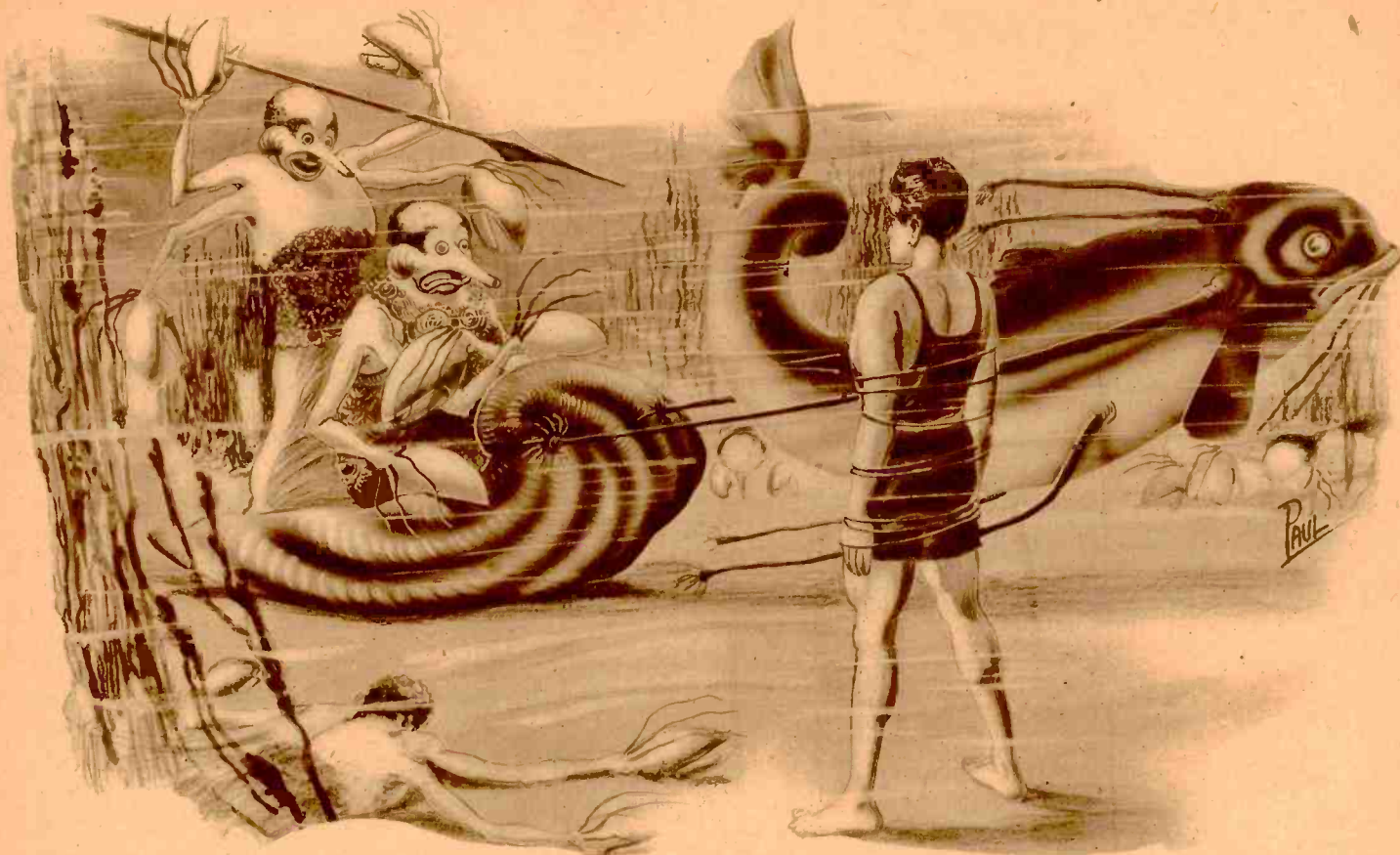
You will recall that my first recollection

of my existence was when I found myself a man of twenty, according to earthly standards, on a tiny meteor in the Rings of Sa-

turn. I detailed my meeting with a girl—woman fashioned like myself—our primitive love and union.



The cave was full of smoke. Beside me was what seemed a pit of fire. The heat from it was intolerable. Across the cave we stood trembling with fright, regarding the red monster of fire that had eaten for itself an open pit in the cave-floor.



In the sleigh were two Marinoid men—the larger of them elaborately clothed. The sleigh halted abreast of us. The smaller of its occupants stood up and shouted vehemently.

And suddenly I realized that he was shouting at me! My captors were lying prone on the sand, and had pulled Nona down with them. . . . but left me standing alone.

The days that followed were happy ones for us both. We lived in our cave and seldom left it. The securing of food, preparing it, eating it, and sleeping until we were hungry again—this was our life.

Animals, yet both of us with the latent intelligence of civilized human beings! Our spoken language came very fast. We seemed to be pent up with words, which once spoken were remembered almost without conscious

effort. So it is with your Earth-child who are the despair of their parents because sometimes they do not talk until they are almost two years old. They have it stored up—and when they do give voice, their fluency is amazing.

Our language? I cannot tell you what it was; I do not know. It seemed almost as though we were inventing it as we went along. Yet all languages seem identical to

their native users; and my English translation here will suffice.

Nona, in her spiritual and mental existence, was the counterpart of myself. Who she was, where she had come from—those questions she could not answer: Her mental life had started on the meteor with herself almost a matured woman. One's mental life, you will realize, is dependent exclusively upon memory. And Nona's memory previous to the time of our meeting, was short and dim. Perhaps human memory only exists with spoken language—or social intercourse or a similar kind. I do not know. Even your hermit speaks, or has spoken to his fellow man.

OTHER INHABITANTS

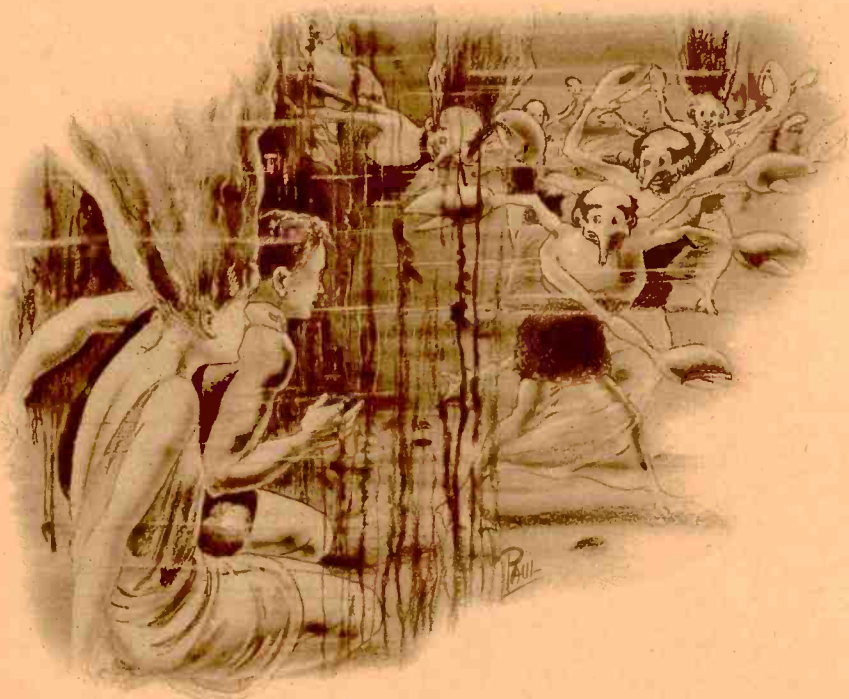
So much for Nona. As I say, we lived and loved in our cave—two human creatures alone on our world. That was a fallacy, as you will shortly see. There were thousands of others—not like ourselves indeed—but “human” never-the-less—on our little meteor. But we did not know it then.

Time passed. How much time I cannot say. A month—five months perhaps. Time is as inconstant as the wind itself, as you would very soon perceive were you to live in semi-darkness, eating when you could get the food, sleeping when you were tired—and with no mechanical timepiece or its equivalent to measure arbitrarily your passing existence.

The securing of a steady and varied supply of food gave us trouble. I mention this because it had a direct bearing upon the extraordinary change in our existence soon to follow. The day came when we could not capture a lizard. The fungus-like stuff Nona was growing I had begun heartily to dislike. I had searched every corner of the cave and its passageways for a lizard and had come back unsuccessful.

Nona had started a fire and was sifting beside it drying her hair. Water was evap-

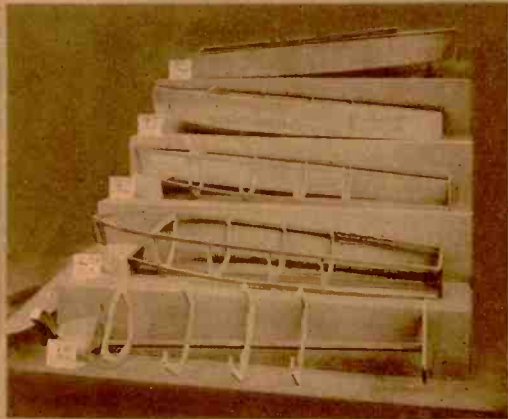
(Continued on page 1042)



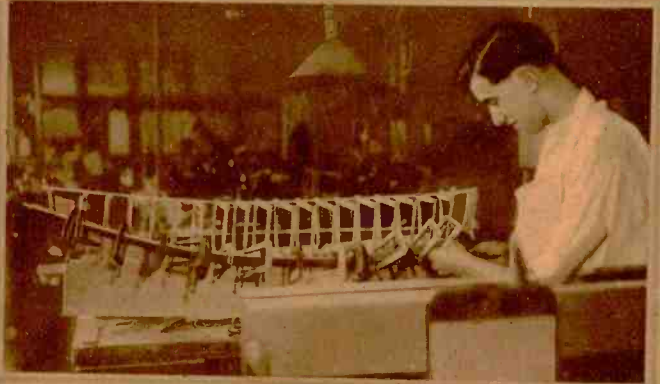
Living things! I would capture and kill one for food. But as they came steadily closer, I saw that each of them was nearly as large as ourselves—and there were ten or more of them. I trembled; and Nona and I drew back into the fern to hide. The things continued to advance. Soon I saw that they were upright, coming along the sand as though walking, slowly but steadily.

Toy Ships that Run

Construction of Toy Ship Models Is America's New Industry and Pastime.



With the increase in speed demanded of boats the "V" bottom has become more and more prominent in the construction of hulls. Above is shown a model boat, with this form of body, under construction.



In many cases the same methods of construction are adhered to in the building of a small model as are used in the erection of the large one. Above is shown a workman placing ribs in the framework of the boat. Note the use of the keel.

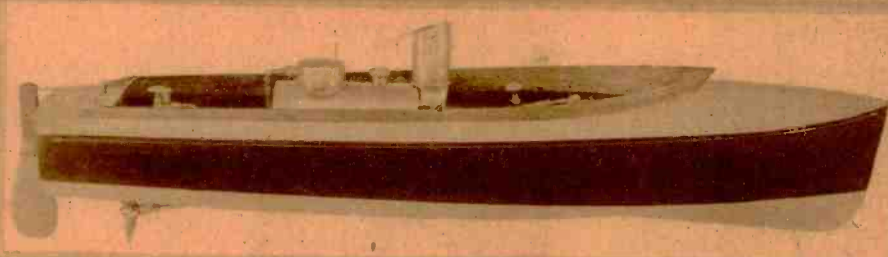


Above: A model of a steam power boat is shown traveling at full speed. This model measures 48" over-all and is capable of a speed of 12 miles per hour. The boiler is tested to 200 pounds pressure.



In some cases the models are built up out of laminations, each one cut the exact size of the body. Above is shown a workman gluing the laminations together to form the body of a small racing yacht. This is a slower process but results in a strong model.

The boat shown below is furnished with a spring motor. It is finished in black with a red underbody, and the deck is varnished. It will run for about five minutes at a speed of five miles an hour, even though it measures only 24" over-all. This model is furnished complete and ready to run, or in knock-down parts to be assembled.



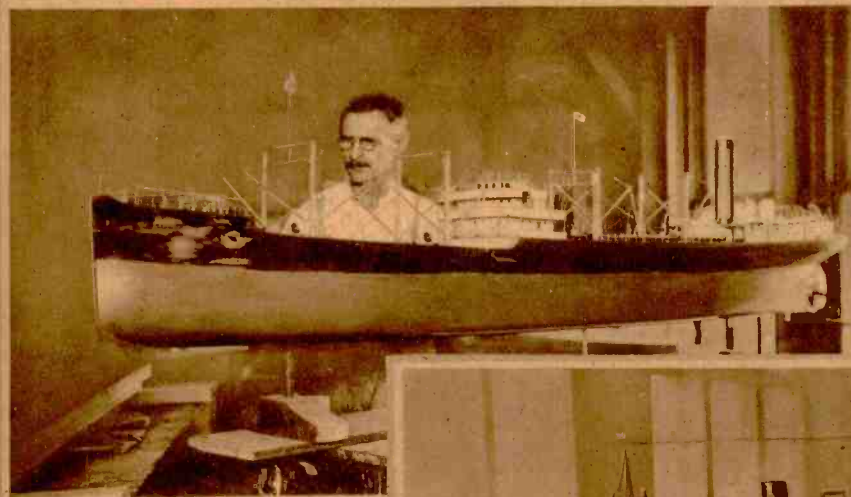
The vessel shown above can be obtained in knock-down form or complete. It is steam-driven, and has a four-cylinder engine and a steam boiler which supplies a super-heated steam to the driving mechanism.

In order that a model sailing boat will be a perfect sailer when it is placed into the water, both sides of the vessel's hull must be exactly alike so that the boat will be perfectly balanced. Below is shown a workman in the process of scraping a completed boat into perfect balance. This work requires great skill.



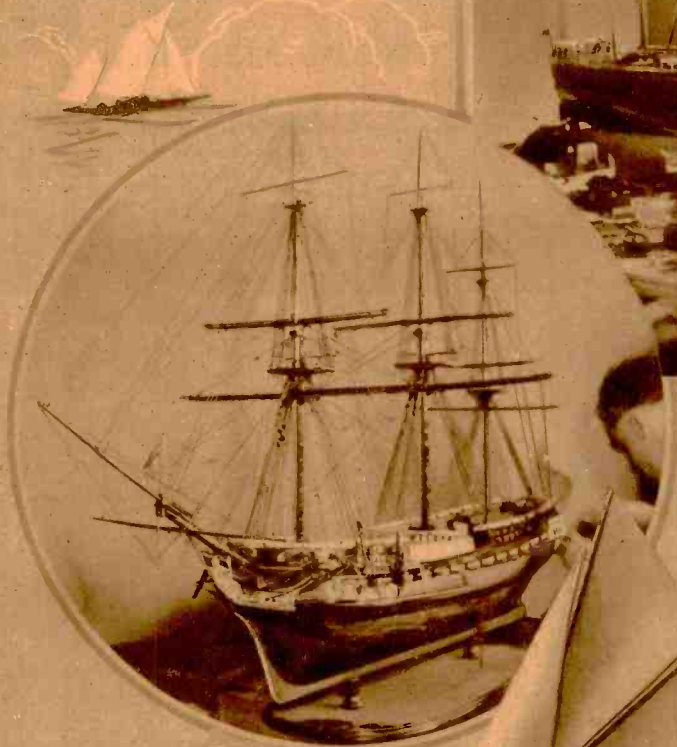
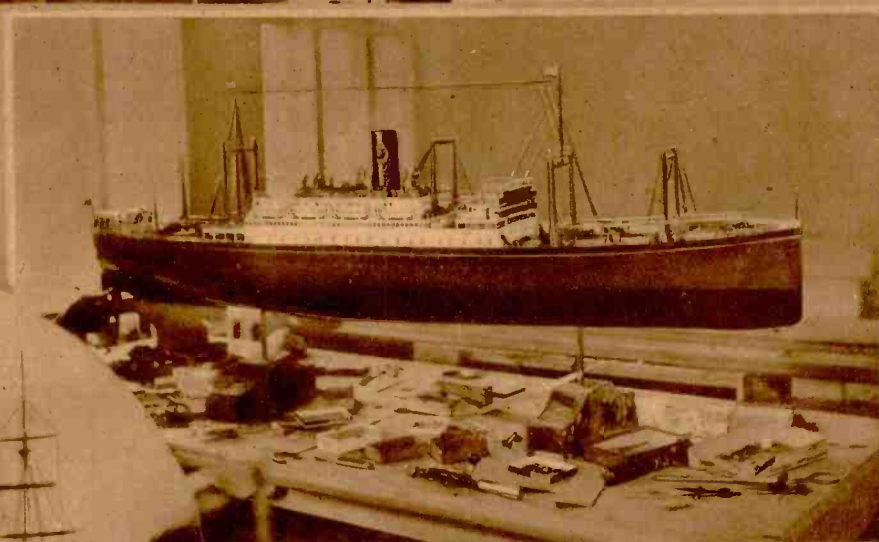
Realism In Ship Models

Small Replicas of Ships Exactly Like the Originals



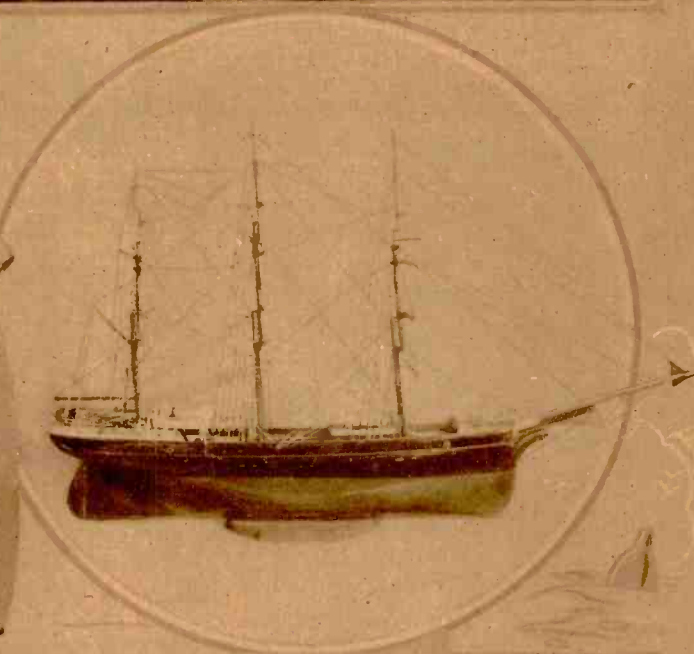
In making this model of the United States Shipping Board boat, "President Madison," practically the same class of skilled workmen were required as were used in the erection of the original. The woodwork involved in making a model such as the one shown to the left requires the services of the most expert pattern-makers and wood carvers.

Although only the best of materials and workmanship go into the construction of models, rough handling and extreme changes in weather conditions cause them to suffer mishaps that make extensive repairs necessary. Below is shown a model in the shop for repair. It is set upon the work table in much the same manner as its larger counterpart is set in the drydock.



Above is shown one of the old British Admiralty models in the shop for repairs. Some of these models cost upwards of \$10,000, not only on account of the exquisite workmanship in them but also on account of their extreme age and the historic value connected to them. Frequently models are the only historic records.

The model of the racing yacht shown to the right is exactly like its original except for size. Mounted as though she were plying under full sail, the owner of the boat might well enjoy almost all the thrills of a real race while sitting before his fire comfortably with the wintry winds howling outside, so real is the effect of the model.

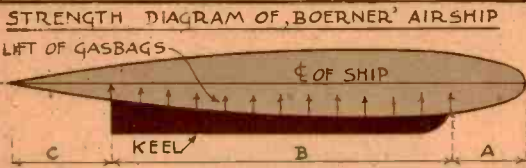
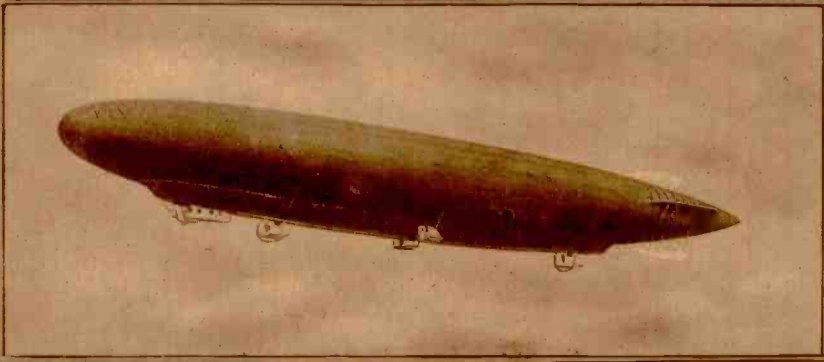


The craze for collecting marine models, such as the above, has taken great hold in the United States in the last few years so that models which used to be a drug on the market now constantly find buyers and many times bring fabulous sums. In the old days sailors on wind-jammers taking long cruises, many times carved some of the most exquisite models of their ships. In port, at the end of the journey, they brought possibly \$5.

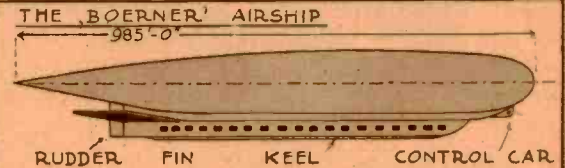
Giant Dirigible of New Design

Air Liner For Trans-Oceanic Service Being Constructed.

BY C. A. OLDROYD.

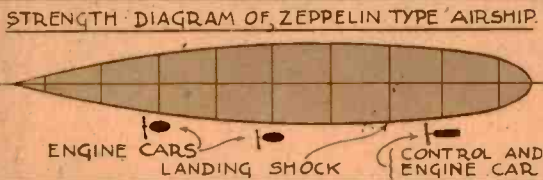


The latest semi-rigid airship called the "P. L. 27." Note the keel underneath the ship and also the engine cars which are arranged as in any modern rigid airship. In the photo above the six propeller car units are spaced evenly along the bottom. The framework and keel are of unit construction. Engine cars, however, would not be found in the Boerner vessel, the propellers of which are secured to out riggers.



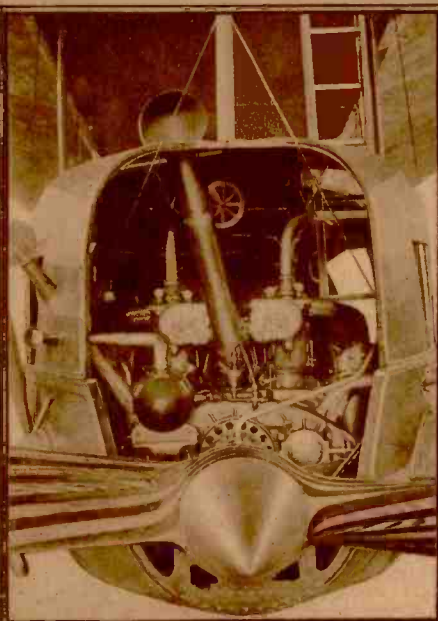
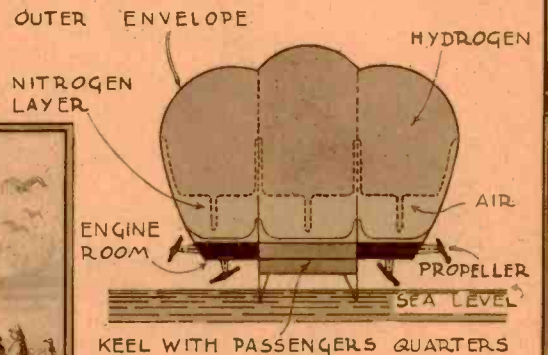
FOLLOWING the keel type construction, the new Boerner trans-oceanic dirigible—the strength diagram of which is shown above—will have a gas capacity of ten million cubic feet and a total lifting power of three hundred tons. The motivating force that will carry it at an average speed of ninety miles per hour will be twenty-four engines developing a total of 6,240 horsepower. It will carry 300 people.

Below is shown a cross-section of the ship. Note that the gas bags or compartments are arranged in units and the air carried under them in order that the bags and the gas will have ample opportunity to expand as the ship rises to great altitudes. For the sake of safety there is a layer of inert nitrogen placed between the air and the hydrogen bags. The ship is fitted with pontoons so that it may land at sea.



In view of the speed the ship will be able to make it will undoubtedly be one of the outstanding mail carriers. Here is illustrated the mail room that is being installed.

SECTION THROUGH BOERNER AIRSHIP



Above is shown one of the power units in the stern car of the "Nordstern." This is the latest type of commercial Zeppelin airship. In the Boerner vessel a ventilating system will be used to drive off all the gas vapors that may be developed.



According to the present plans the accommodations for passengers in this ocean air liner will be fully as good as those on steamships.

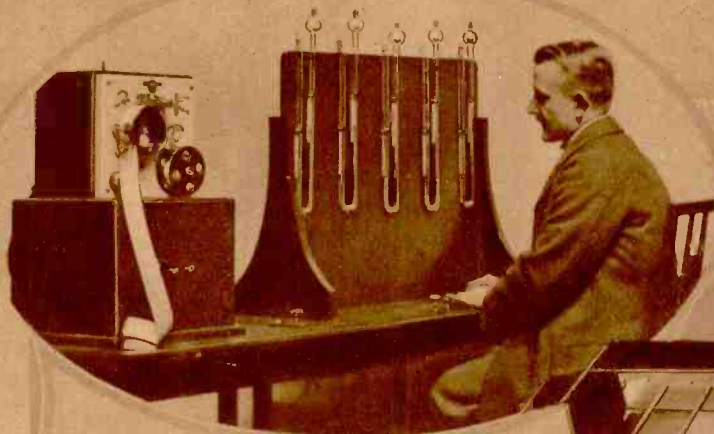
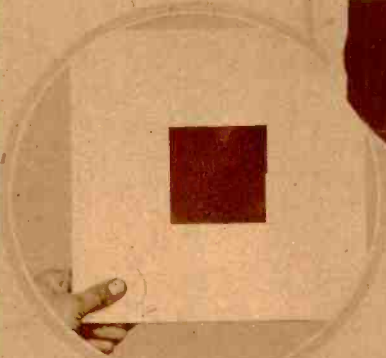


The keel structure of the "P. L. 27" is seen in the above illustration. Note the fuel tanks. At the extreme rear of the ship may be seen one of the power cars. Where it is impossible to land the giant vessel on water on account of its destination being inland, great mooring masts are to be used.

Science Selects Occupation

Tests For Determining the Occupation Best Fitted to Individual

By observing how an individual matches the two halves of the square shown in the photo below, psychologists are able to determine his visual power, according to recent exhaustive tests made by German professors.



Below is shown the apparatus used in testing the tactile sense of the person considering selection of a mechanical career. Obviously, if the individual has no keen sense of touch he could hardly be expected to make an expert



For determining the initial observation point and the ability of the candidate to concentrate, Dr. Porkonsky, the psychologist, uses the above machines consisting of five pressure glasses with keys which the subject must operate in order to keep the liquids in the tubes in a certain relation.



A memory test. Words appear in the slot of the circular machine on the table. After a certain number have passed the candidate must call them.



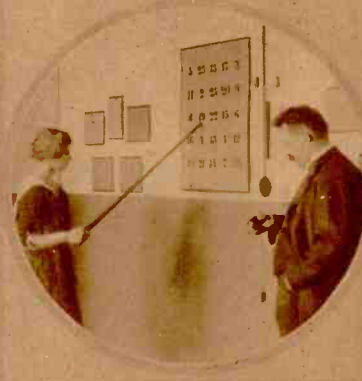
Below is another form of the device shown above. Here the subject must concentrate on the positions of the black dashes on the cloth belts revolving at different speeds and, by key adjustment, keep the dashes opposite each other.



The small discs have two sets of holes, one that fit the wires and one that does not. Stringing them tests the operator's dexterity and nerves.



Test for color sense. The angle of the revolving color disc is changed and the ability of the person tested to differentiate slight shades is noted.

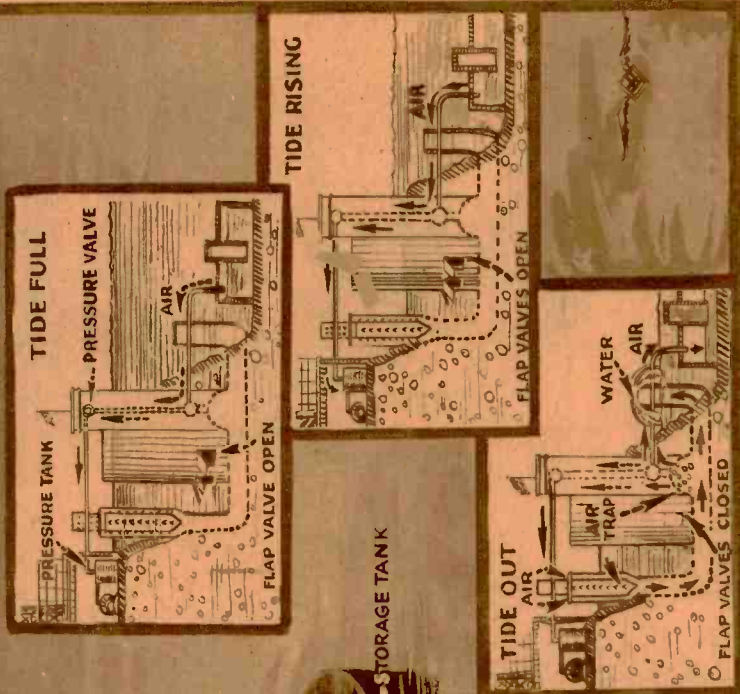
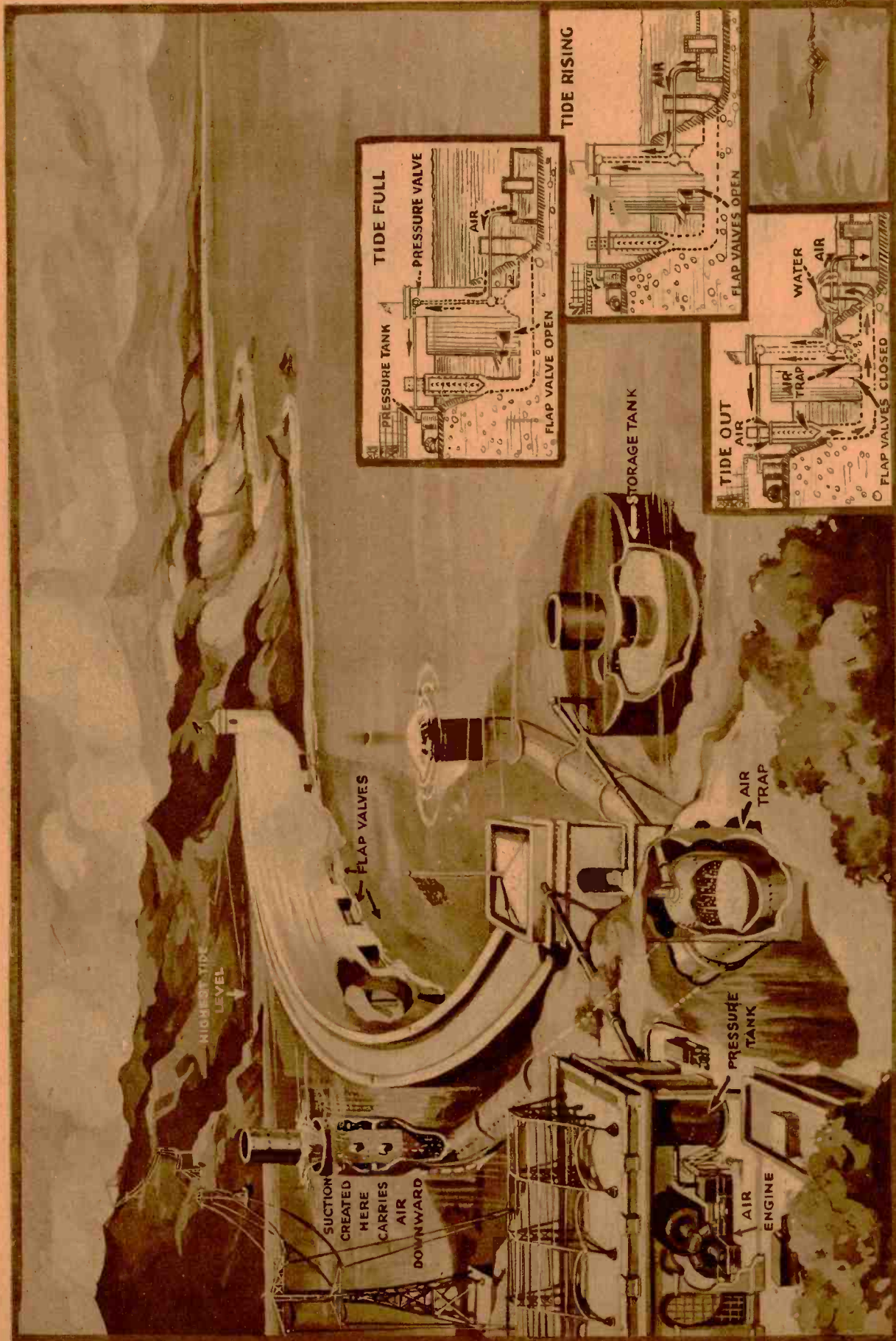


The mental dexterity of an individual with figures is tested by asking her to point to a number called out and then marking the time consumed doing it.

Tides to Develop Power

Making Tides Act as Air Compressors and Using the Power So Developed.

BY JOSEPH H. KRAUS



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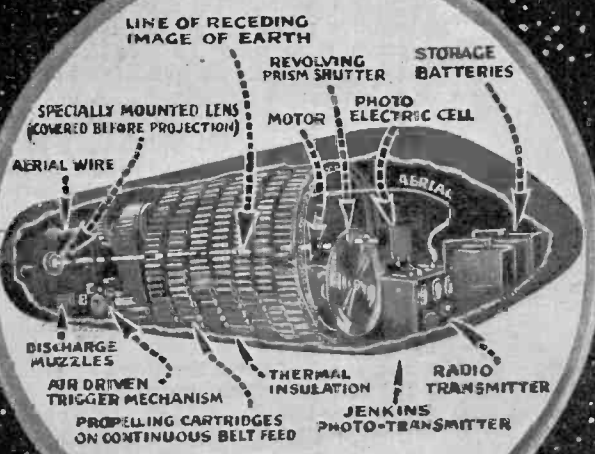
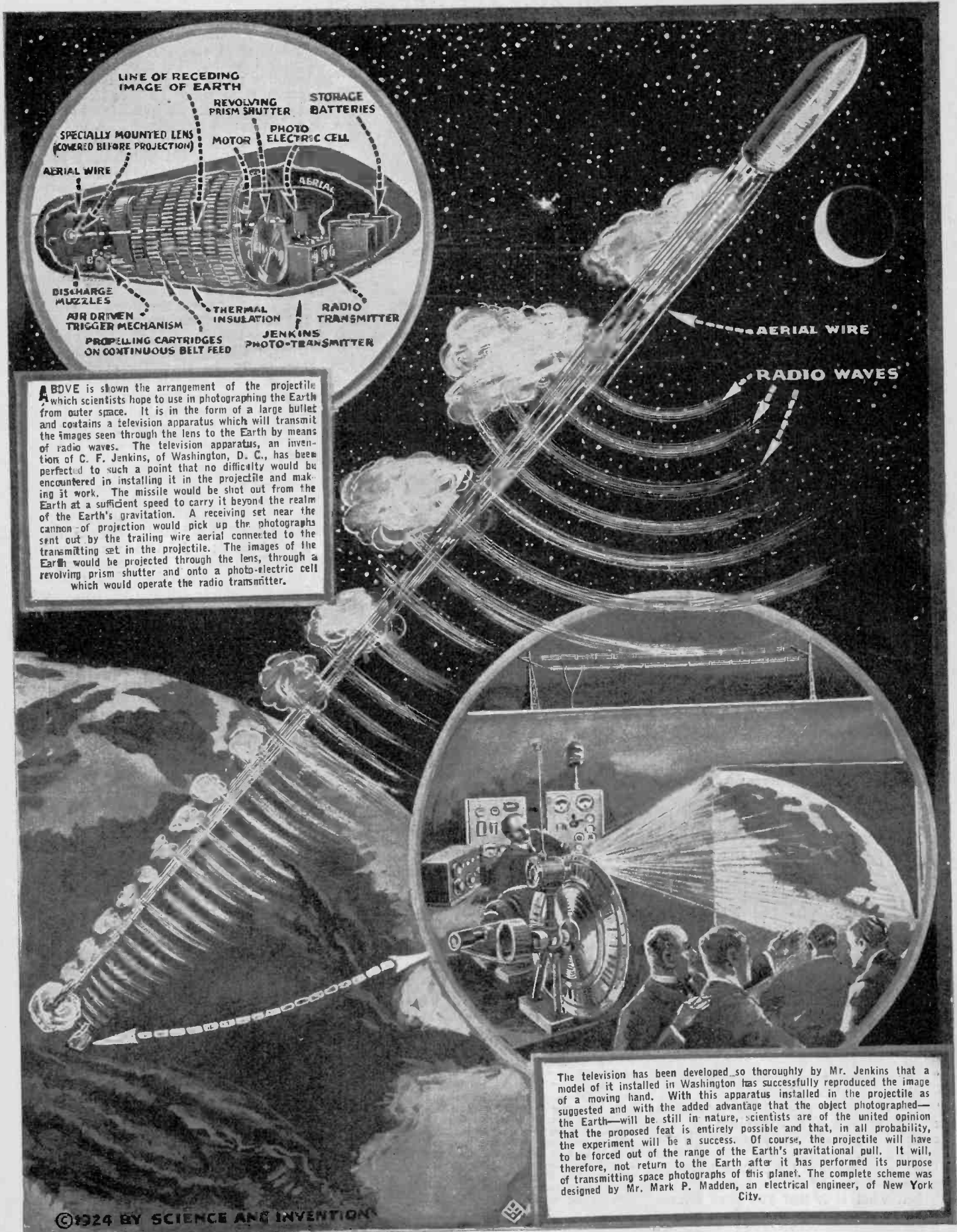
The inventor of this system of producing power from the tides, John S. Leger Ginn, intends to build a wall with crest rising above the highest tide across a natural basin. The wall has openings with hinged gates or flap-valves to allow the water to pass into the basin when the tide is rising, but which will close when the tide falls, preventing the water from leaving the basin. Within the basin a pipe will be built which will pass through the wall to the sea, through which pipe the water as it escapes will flow in. In doing so the water will carry a great quantity of air with it, which is

caught in an air trap. This air, under the pressure it has attained, will then be used to drive the air engines and generators. The question arises, "what happens when the tide is rising or full?" This is answered in the small illustrations. When the tide is full, it is obvious that no power will be developed by the system, because no water is flowing from the basin into the sea. However, there is a storage tank from which the air passes to the generating station. The small tube in the center of the reservoir allows water to pass downward into the storage tank and forces the air out at the top.

Picture of the Earth

Radio Television to Photograph Earth from Space.

BY RAYMOND FRANCIS YATES



ABOVE is shown the arrangement of the projectile which scientists hope to use in photographing the Earth from outer space. It is in the form of a large bullet and contains a television apparatus which will transmit the images seen through the lens to the Earth by means of radio waves. The television apparatus, an invention of C. F. Jenkins, of Washington, D. C., has been perfected to such a point that no difficulty would be encountered in installing it in the projectile and making it work. The missile would be shot out from the Earth at a sufficient speed to carry it beyond the realm of the Earth's gravitation. A receiving set near the cannon of projection would pick up the photographs sent out by the trailing wire aerial connected to the transmitting set in the projectile. The images of the Earth would be projected through the lens, through a revolving prism shutter and onto a photo-electric cell which would operate the radio transmitter.

The television has been developed so thoroughly by Mr. Jenkins that a model of it installed in Washington has successfully reproduced the image of a moving hand. With this apparatus installed in the projectile as suggested and with the added advantage that the object photographed—the Earth—will be still in nature, scientists are of the united opinion that the proposed feat is entirely possible and that, in all probability, the experiment will be a success. Of course, the projectile will have to be forced out of the range of the Earth's gravitational pull. It will, therefore, not return to the Earth after it has performed its purpose of transmitting space photographs of this planet. The complete scheme was designed by Mr. Mark P. Madden, an electrical engineer, of New York City.

Doctor Hackensaw's Secrets

By CLEMENT FEZANDIE

AUTHOR'S NOTE.—The average duration of human life has about doubled in the last hundred years. Before the next century has passed, it is quite possible that the average life of a man may be raised to eighty or one hundred years. The remote future may see this increase extended to a thousand years or more. Scientists have

No. 26. The Secret of Perpetual Youth

"I have discovered 'Reversible Metabolism!' I have discovered how to make the body cells remove the old, decayed portions of the tissue, and so restore to them their

METHOD OF RESEARCH

"I started out with the knowledge that life is practically immortal, or to put the phrase more correctly, every animal alive today is nothing but a continuation of the splitting up of the original speck of protoplasm from which all animals and plants have descended. Every man's ancestry must go back in an unbroken line to this primordial speck. Now an individual whose tissues are already old and decaying can still produce sperm cells or ova capable of starting not only one new life, but a perpetual succession of new lives—in other words, a life that may last hundreds of thousands of years—until all life on this earth is extinct.

"I spent years in my researches. I first studied old age in plants. Why does a tree die? Certain olive trees are said to be two thousand years old. Why should they not live forever? But the study of plants did not help me much. A tree dies because the new wood forms on the outside of the old trunk, while the inner wood decays, leaving the center hollow. The conditions with human beings are totally different: old age may be due to the improper digestion of the food, to troubles with the lungs or the other organs of respiration, or to troubles with the circulation of the blood, or the nervous system—"

"But, doctor," interrupted Mrs. Young, yawning, "I'm afraid I'm too stupid to understand all your scientific terms, and I want to get home in time to attend to the 'metabolism' of my family—my children and grandchildren; and I want the dinner to be especially nice today because I am expecting Mr. Trimble. Mr. Trimble is a widower of forty-five, and to tell you the truth, doctor, I have fallen in love with him. Now I learned that you have discovered the 'Elixir of Youth,' and I came to see if you wouldn't consent to make me young again. I am a rich woman, Doctor Hackensaw. My husband was a multimillionaire and he left me the bulk of his property. I am eighty-five years old now, and I will gladly pay you a million dollars if you succeed in making me young again—"

"And if I fail?"

"If you fail, I lose nothing. I have been suffering lately from a general debility, and the doctors tell me I have only three months more to live—probably three months of pain



Without a tremor, Mrs. Young drew up her sleeve. He then withdrew a few drops of blood, which he wished to have as a control, and he placed them in a test-tube filled with Carrel's solution. Then he injected into the arm a small amount of the pure culture of the new microbe.

only begun to study the causes of old age, and much may be hoped for from systematic research along the path already opened by Metchnikoff and others.

"IS it possible, Doctor Hackensaw, that you have discovered the secret of perpetual life?"

The speaker was a somewhat decrepit old lady of eighty-five, Mrs. Linda Young by name, who had hobbled into the doctor's office on hearing rumors that the doctor was seeking the "Elixir of Life"; that will-of-the-wisp that had been sought, for centuries, by the old alchemists.

Doctor Hackensaw smiled. "No, Mrs. Young," said he, "I should hardly call it 'perpetual life.' But I have discovered what biologists would call 'reversible metabolism.' I suppose you know what anabolism and catabolism are?"

"They're some new-fangled varieties of Socialism, aren't they?"

"No, nothing of the sort. They are terms used in physiology. Anabolism is the growth of any tissue, and catabolism is the decay and death of the tissue. Metabolism is 'life,' and consists in the continual growth and decay of tissue."

"Then what is it that you have discovered?"

freshness and youth. The reason a man grows old and dies is that the tissues of one or more of his organs grow old, that is to say, the tissues either decay or harden; or, through the accumulation of foreign matter, the organ becomes unable to perform its functions properly. The hardening of the walls of the blood-vessels, is, according to Metchnikoff, the chief cause of senility; that is to say, of old age. There are, of course, many other contributing causes, as I discovered when I began my researches on the subject.

But in spite of these efforts, Linda became a babbling eight-months-old baby, incapable of making her wants known except by simple gestures. She could, however, answer Doctor Hackensaw's questions by affirmative or negative gestures, so by calling off the letters of the alphabet in turn he could learn any of her wishes. She retained her liking for cigarettes and cocktails, and it was curious to see this eight months old baby attempting to smoke a cigarette, or sucking a cocktail from her milk bottle. One day she asked to see her children and grand children, wishing to be held by each in turn, and she took a malicious pleasure in striking them and scratching their faces, to make up for the many times they had done the same to her when they were babies.



and suffering. I will most willingly risk losing these three months on the chance of being restored to youth again—"

Doctor Hackensaw hesitated. "My experiments so far," said he, "have all been on animals. I can take a tough old rooster or a cow old enough to make boarding-house steak, and restore them to their pristine youth. I make a business of taking old and worn-out thoroughbred horses and after making them young again, selling them at a handsome profit. Especially am I interested in the finest pedigreed stock whose owners are willing to pay fancy prices for the rejuvenation of a full-blooded bull or stallion. But my experiments on human tissue have been comparatively few, and only on amputated arms and legs—never on an integral human being. Besides, while I have succeeded in making animals grow younger, I have not yet discovered the means of checking this process of reversible metabolism. In other words, even if I should succeed, you would continue growing younger and younger unless I have the good luck of discovering some antidote."

"I will take all risks and assume all the responsibility. I will have my lawyer draw up a paper absolving you from all blame. As I said before, I have nothing to lose, and everything to gain."

"Very well, madam," said the doctor. "Make your will, set your affairs in order and come back next Monday morning. I shall have everything ready for you by that time."

* * *

READY FOR THE OPERATION

"Will the operation be very painful, doctor?" asked Mrs. Young, as she took her seat on the operating chair.

"No more than an ordinary vaccination," replied Doctor Hackensaw. "Had you come to me a year ago I should have had to put you under an anaesthetic while I cut one of your arteries and inserted a T-piece provided with a stop-cock at the cut, so as to be able to remove old blood or inject new ingredients. In fact, in my early experiments I made Siamese twins of my subjects. I attached a young animal to the old one. I wished to rejuvenate, and would daily re-

move a small amount of the old blood. It was thus fresh young blood that coursed through both bodies, and the older animal profited to a great extent by the vitality of the young one. But the process was clumsy, and I found that new blood would not com-

probe that I was able to secure real results."

"Your new microbe?"
 "Yes, the *Bacillus Hackensavii*. While experimenting with a new stain for staining microbes, I came upon an altogether unknown species of bacillus, possessed of the



One day Doctor Hackensaw was electrified by a vision of fairy-like loveliness that swept into his office—an exquisite young girl, looking not more than eighteen entered the doctor's office one night, and astonished that gentleman by throwing her arms around his neck and kissing him affectionately.

pletely restore the hardened or decayed tissues. It would only partially soften the hardened walls of a blood vessel, and it would not remove from the bones the deposits of lime that the years leave, and that change the soft cartilaginous bones of the infant into the brittle bones of the old man. It was not until I discovered my new mi-

most wonderful properties. Instead of attacking healthy tissue, like the disease germs, this one seems only to attack old and decayed tissue. Such being gradually removed, the body can replace the old tissue with fresh new cells."

"But can an old body produce young and fresh cells?"

"Yes, indeed. All new cells when first produced are young and new and capable of indefinite growth. Now, if you will kindly bare your arm, I shall proceed to make the inoculation."

Without a tremor, Mrs. Young drew up her sleeve and Doctor Hackensaw deftly made a slight incision with his lancet. He then withdrew a few drops of blood, which he wished to have as a control, and he placed them in a test-tube filled with Carrel's solution. Then he injected into the arm a small amount of the pure culture of the new microbe.

"There madam," said Doctor Hackensaw, "it's all over!"

"Is it possible? Is that all? Well, doctor, if that little scratch is going to make me young again, you will have earned your million dollars pretty easily—"

"Madam," replied the doctor, "I'll guarantee that, barring accidents, you will soon begin to regain your youth, but as I told you, I cannot promise to stop the process, as I have as yet found no way of checking the action of the microbe."

"Never mind," cried the old lady gayly, "I feel younger already. You needn't be in any hurry about hunting for the antidote!"

A week later Mrs. Young again repaired to the doctor's office.

"I'm afraid something has gone wrong, doctor," she said. "Not only do I not feel any younger than I was, but I feel somewhat older and weaker."

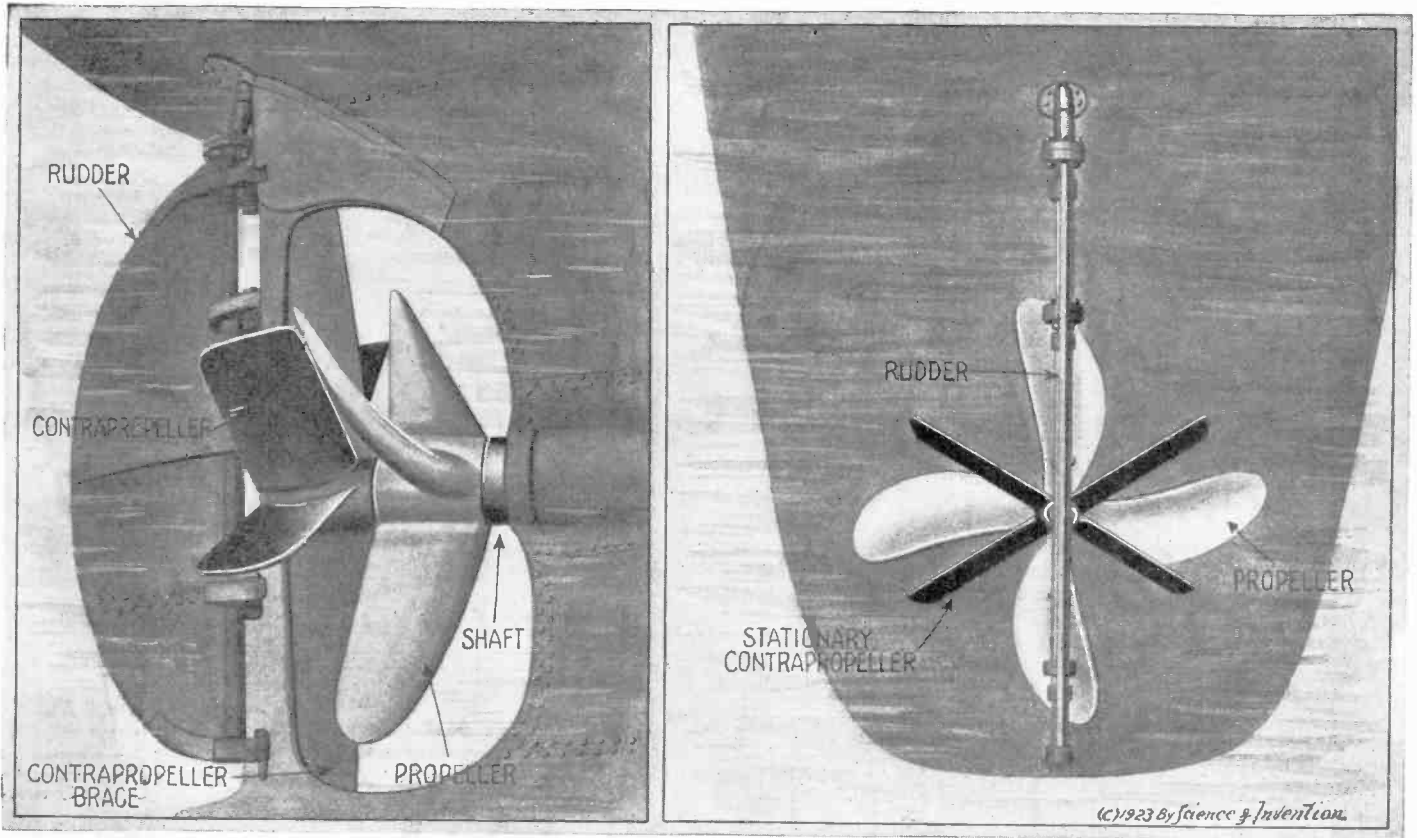
(Continued on page 1053)



And still she grew younger. Doctor Hackensaw would spend hours pacing the floor, with this baby widow in his arms, reading her the newspaper or passages from Milton's "Paradise Lost." Meanwhile his powerful brain was striving hard to devise some means to check the fatal catastrophe that seemed about to terminate the experiment which had begun so favorably.

Contra-Propeller Speeds Ships

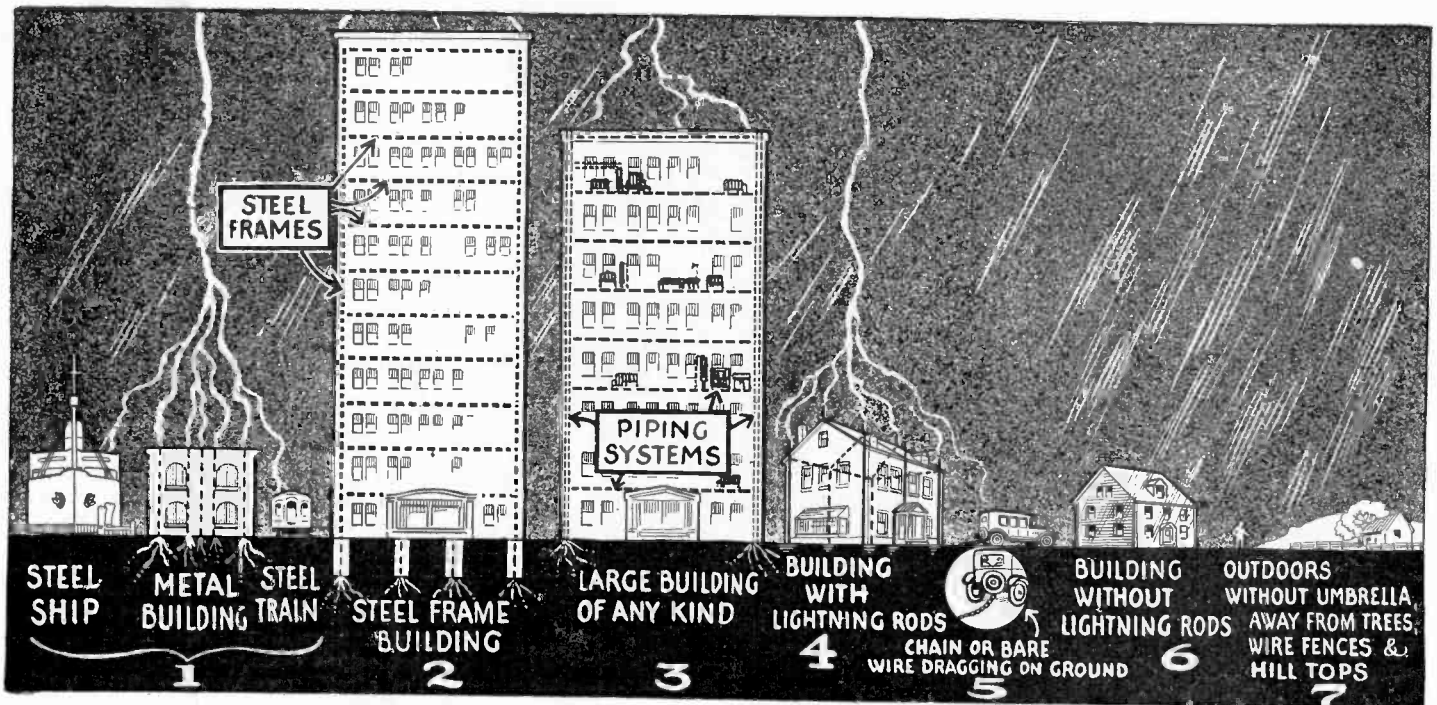
Efficiency of Ship's Screw Increased 15 per Cent.



The contra-propeller for vessels is a four-bladed stationary affair placed just in back of the engine driven propellers. It has been definitely proven that this stationary set of blades materially increase the speed of the ship without increasing power consumption to the extent of even 15 per cent. It has been given a thorough test on sea-going vessels and as

a matter of fact is part of the equipment on a modern German trans-Atlantic liner. The theory of operation is that the whirl of water produced by the propeller ordinarily prevents that portion of the blade nearest the hub from effectively acting on the water. The contra-propeller breaks up the whirl. Contributed by Dr. Armin Demuth.

The Safest Place in a Thunder-Storm

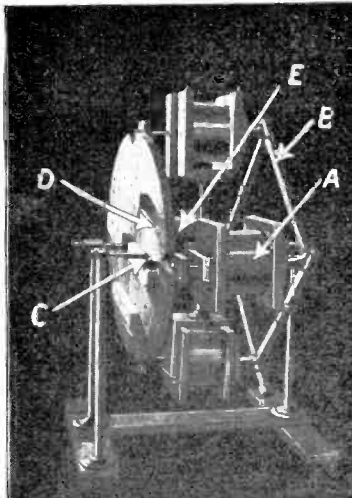


That a modern skyscraper with its mass of steel as a frame-work, is the safest possible place in an electrical storm is the dictum of S. M. Schoon, Chairman of the committee for Protection Against Lightning, of the National Fire Prevention Association. He ranks the places of safety as follows: Steel ships and buildings, first; steel framed skyscraper and

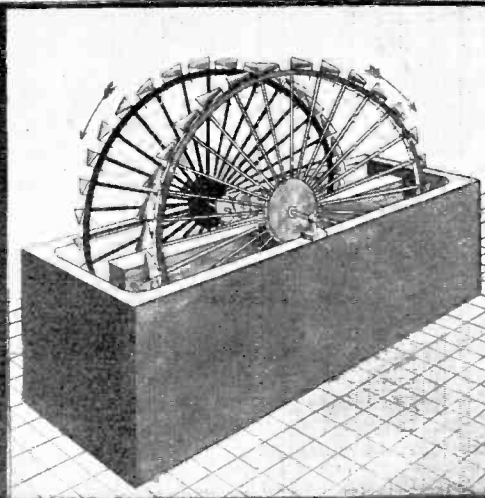
large building of any kind, second and third; a building protected with lightning rods, fourth; steel or metal bodied automobile with chain dragging on the ground, fifth; building without lightning rods, sixth; out of doors without umbrella and away from fences and hill tops last. And keep away from grounded metal objects in houses.

As Ever, the Perpetual Motion

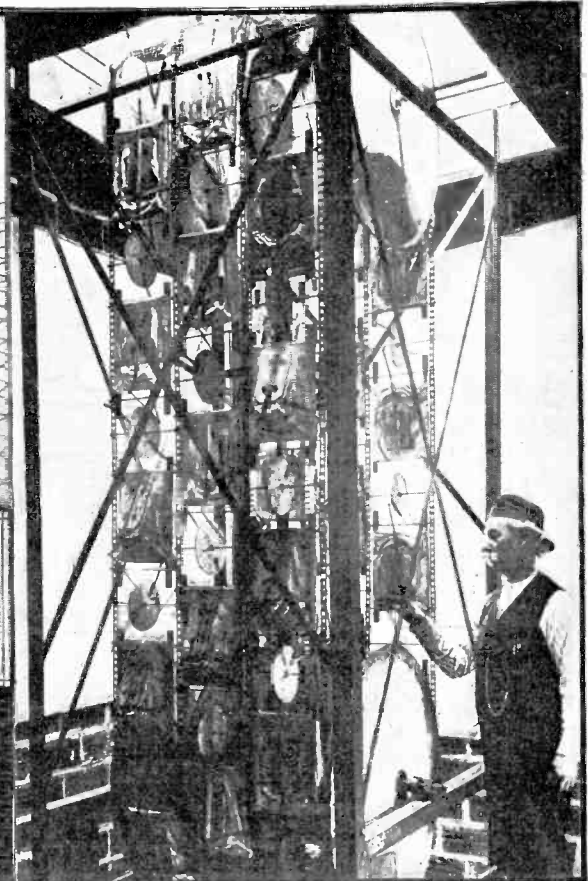
Science & Invention Will Pay \$1,000.00 to Anyone Who Will Demonstrate That Any of These Models Work



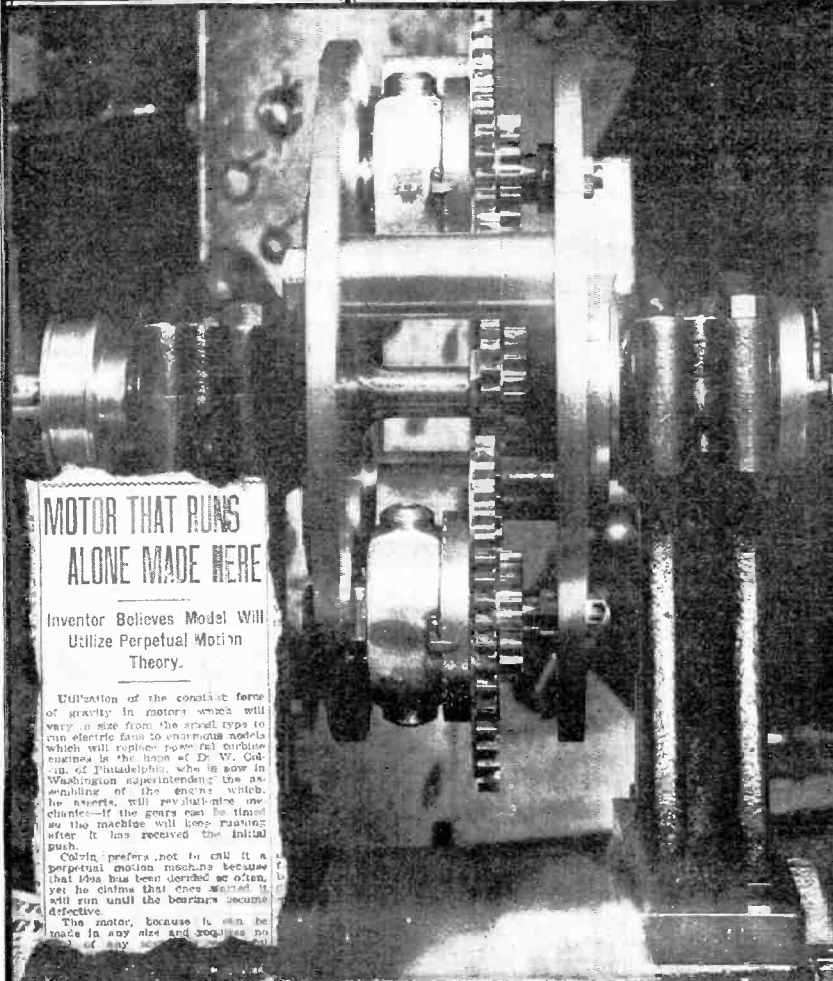
A machine invented by Adolph Ruhland is composed of two collapsible cylinders connected in such a way that the bottom cylinder is filled with air through the pipe, B, from the top cylinder when the two are vertical. The air forced into bottom cylinder raises it to the top where the action repeats.



Here the buoyancy principle is again involved. The little triangle-like affairs around the rim of the wheel are bellows. As the wheel descends into the water, pistons in the spokes connecting with the bellows fall and force air into the collapsible chambers giving them buoyancy. When they reach the top portion of the stroke they return to their former position in the spoke deflating the chambers and so are supposed to keep the wheel moving.



The inventor of this device, Rufus Ames, claims not only that he has invented a perpetual motion machine but that its operation will revolutionize the laws of physics. He calls the contraption the "Still Water Motor," and says that it is the latest source of power. No official tests of the machine have been made. Note the three separate series of rotors. The whole thing is built on a steel frame and the rotors are carried by regular cog chains.



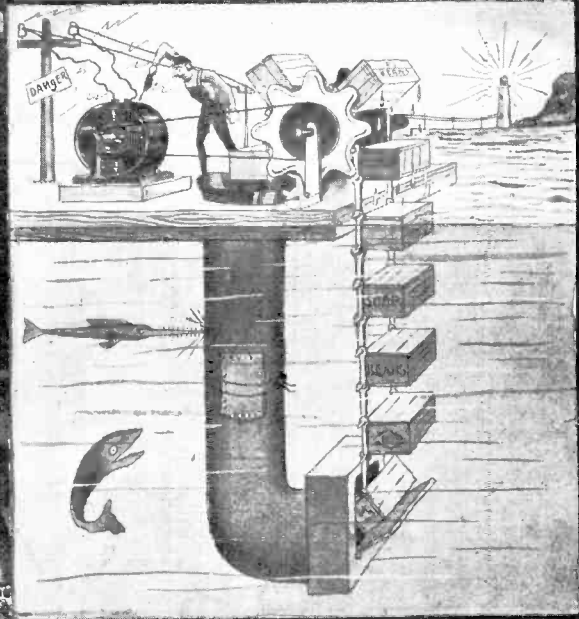
MOTOR THAT RUNS ALONE MADE HERE

Inventor Believes Model Will Utilize Perpetual Motion Theory.

Utilization of the constant force of gravity in motors which will vary in size from the small type to run electric fans to enormous models which will replace power-ful turbine engines is the hope of Dr. W. Colvin of Philadelphia, who is now in Washington supervising the assembling of the engine which, he asserts, will revolutionize one class—if the gears can be timed so the machine will keep running after it has received the initial push.

Colvin prefers not to call it a perpetual motion machine because that idea has been described so often, yet he claims that once started it will run until the bearings become defective.

The motor, because it can be made in any size and requires no fuel of any kind.



But here is the real one! Soap boxes are fastened to a chain which revolves around the gear-like pulley on the float, as shown in the illustration. The boxes go down into the water through a large pipe and pass through a water tight valve. Once in the water they become buoyant and lift themselves up, causing the motor to run. The only trouble with the machine is that no account has been taken of getting the boxes out of the pipe. L. H. Stuart.

More powerful claims yet are made for the machine shown in the above photo. The inventor, W. D. Colvin, of Philadelphia, claims that here (as elsewhere on this page), the constant force of gravitation will be utilized to do the work of the world. At the present time the inventor is in Washington supervising the assembly of a model of his apparatus which he hopes will gain the attention of the scientists. It is said by the inventor that the machine can be made in all sizes and that it will be used in the future to take the place of powerful turbines. G. A. Luers is the reporter of this curious attempt at the impossible.

Auto Cigarette Lighter—Novel Pump

Exhaust Suction and Incandescent Coil Form Car Lighter.

Cigarette cases that throw the cigarette to the smoker are more or less common, but one that drops them into the smokers' fingers lighted, are more or less uncommon. Attached to the dash of a car, the little device shown above does just that. The cigarettes from the package drop into a holder. One end rests against an incandescent coil while the other fits into a receptacle attached to the exhaust which draws a draft of air through the cigarette, lighting it. It then drops to the smoker's fingers.

At the right is shown an English pump with which one man may raise 1,000 gallons of water from a depth of 300 feet per hour. A coil-like cable simply revolves through the water, causing capillary attraction, thus causing a constant stream of water to flow to the top of the well.

—Chas. G. Percival.

The Complete Limestone Cycle

How Artificial Stone Is Made for Building Purposes.

By ISMAR GINSBERG, B. Sc. Chem. Eng.

BLASTED LIMESTONE

GROUND LIMESTONE

INTERMITTENT KILN. CONTINUOUS KILNS ARE FIRED BY GAS, OIL AND COAL OR WOOD

$+ \text{HEAT} = + \text{CO}_2$

HARD ROCK LIMESTONE

QUICKLIME POWDER

CARBON DIOXIDE GAS

BAG OF QUICKLIME

SAND AND WATER

GIVES SAND HYDRATED LIME

$\text{SAND} + \text{WATER} + \text{LIME} = \text{HYDRATED LIME (MORTAR)} + \text{HEAT}$

APPLIED TO WALLS IN ROOMS.

$\text{CO}_2 \text{ IN AIR UNITES MORTAR TO GIVE ORIGINAL LIMESTONE}$

MILD FIRE IN ROOM TO INCREASE CO_2 AND AID IN SETTING OF LIME

THIS PROCESS IS A COMPLETE CYCLE

$\text{LIMESTONE} + \text{HEAT} = \text{LIME} + \text{GAS } \text{CO}_2$

$\text{LIME} + \text{WATER} = \text{MORTAR} + \text{HEAT}$

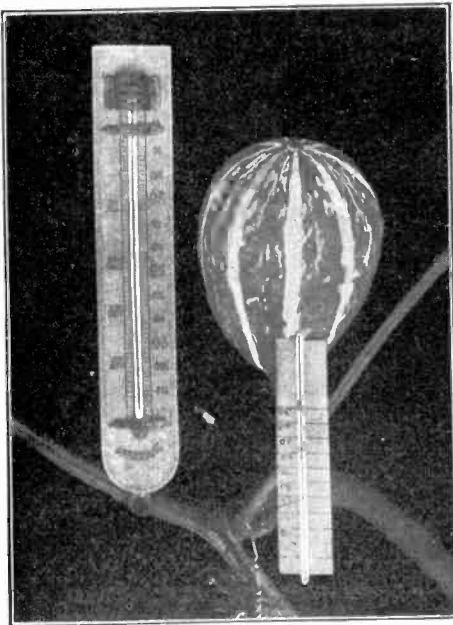
$\text{MORTAR} + \text{CO}_2 \text{ (in air)} = \text{LIMESTONE} + \text{WATER (dried out)}$

THUS, IN BUILDING WALLS, MORTAR HARDENS TO SOLID MASS OF LIMESTONE

The illustration tells graphically how limestone is reduced to lime so that it may be ready for use in building and how it is again turned into stone to give the building strength. The rough stone is heated. The fuel reduces part or all of the carbon dioxide in the stone to carbon monoxide which has no affinity for the calcium of the stone. At the conclusion of

the heating the rock lime is removed and barrelled for sale. In use it is slaked with water which changes the calcium oxide to calcium hydroxide. This is mixed with sand and used in buildings for plaster and mortar. The carbon dioxide of the air then unites with the calcium hydroxide, forming the original limestone again.

Quite Cool



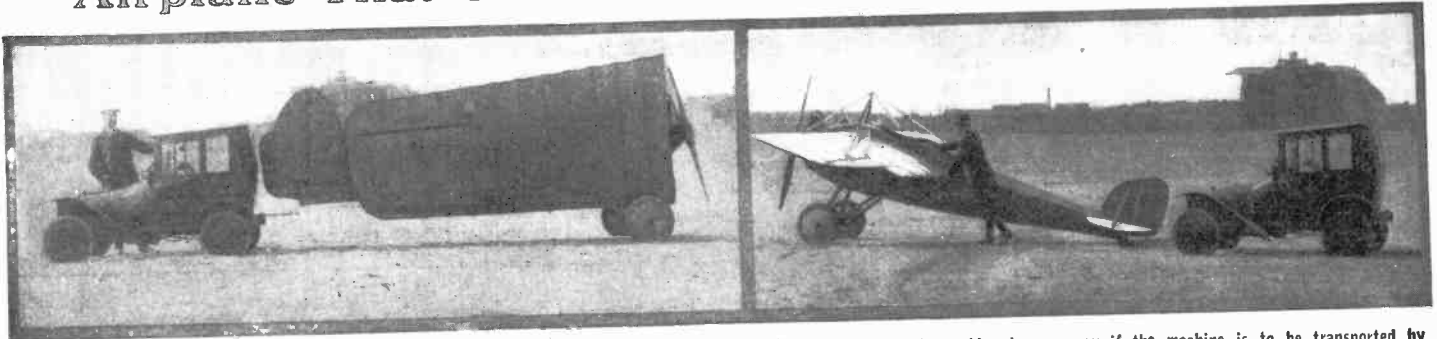
You might be cool as a cucumber and yet lack something in tridity; but to be cool as a squash is quite the bee's knees, so to speak. Above, the photograph shows the interior temperature of the squash to be sixty degrees while the surrounding air swelters at 118.—S. Leonard Bastin.

Pigs' Feet Nature's Feat



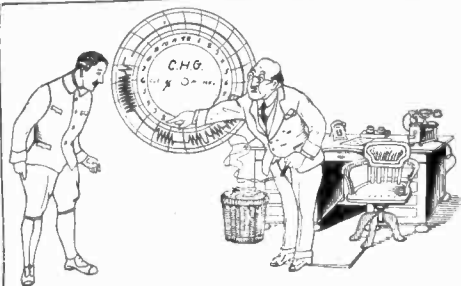
Otherwise healthy in every respect, this pig raised on a Nebraska farm has a wealth of toes—24 of 'em. Its six brothers and sisters born at the same time it was are perfectly normal in every way. —Dale R. Van Horn.

Airplane That Can Be Folded For Transportation



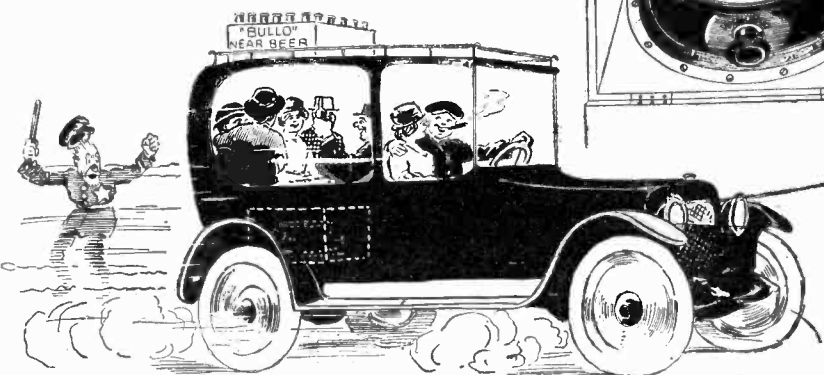
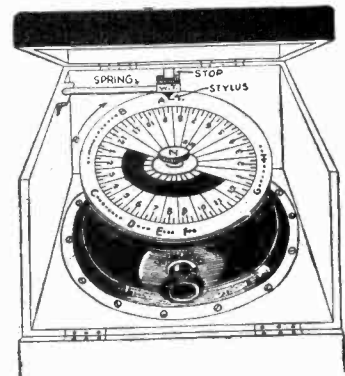
This small one-seater airplane of German make is constructed so that the wings fold on their longitudinal axis and fold back around the body and tail. One man can fold or unfold the plane. No packing is necessary if the machine is to be transported by rail. —Dr. Albert Neuburger.

DETECTOR FOR CHAUFFEUR'S JOYRIDES



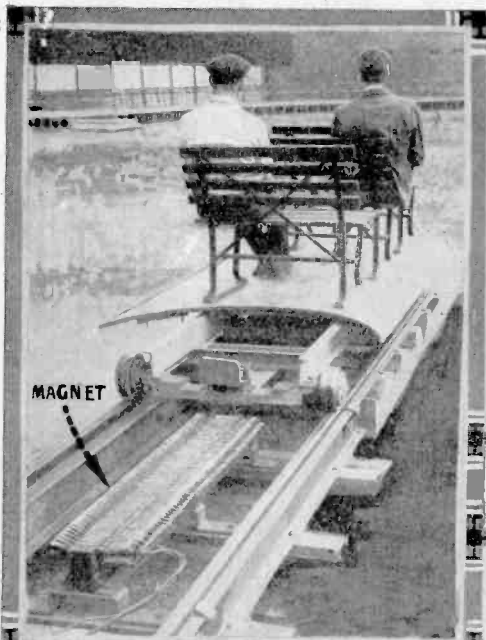
"He figured it would be all right, that chauffeur did, to take his girl and a gang of his cronies for a nice little jaunt," said Brown, the chauffeur's boss, "and he would have gotten away with it, too, and six gallons of my gas, only he didn't know that the garage put in this little card and a dingus to make it register the movements of the car." And here he brought a disk out of his desk. It was circular and had markings for the hours. Around the outside of the disk was a crooked broken line. "That," he said, as he ground his cigar between his teeth, "is where my gas has been going. See that jagged part of the line between nine P. M. and two in the morning. Well, he was out usin' my gas then and thought I

didn't know it, but this disk was revolving on the hour spindle of a clock, under the back seat, and a pen at the end of a spring fixed over the revolving disk bounced up and down on it with the vibrations of the car and gave me the undisputable evidence. Sure I fired him." This instrument is of German manufacture. The idea, however, was put forward in the September, 1919, issue of SCIENCE AND INVENTION, page 414.



THE CHAUFFEURS' "DETECTIVE" UNDER THE SEAT

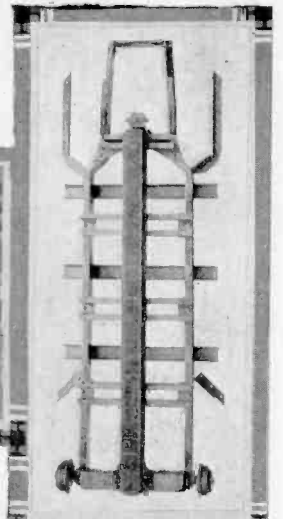
Traveling Walk to Replace Subway



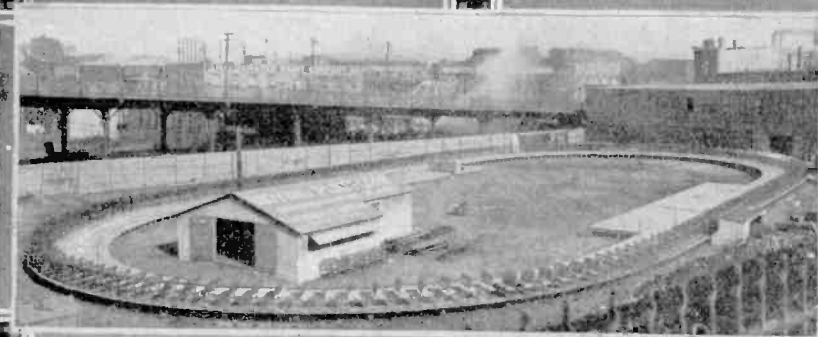
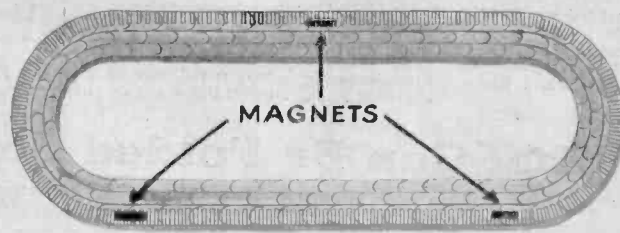
THE world famous subway shuttle across Forty-Second Street in New York City, may be replaced with a moving sidewalk built in three sections running at three, six, and nine miles per hour, respectively. A company has been organized to build the new magnetically propelled carriage and complete working models have been constructed. Above is shown a section of the model and its method of operation. Benches are installed on the fastest moving platform.



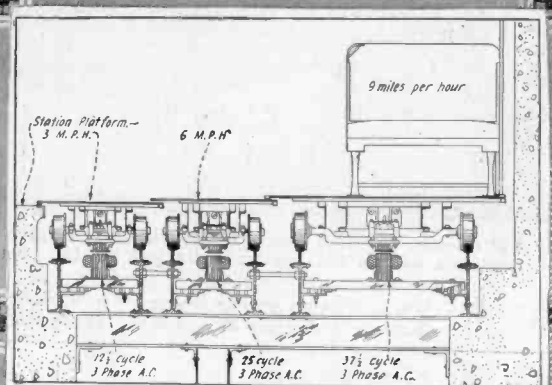
Above is shown a section of the complete arrangement with the three moving platforms. The slots marking the connection point between the sections out of which the device is made may be easily seen. Each section is approximately six feet in length. The floors are of wood, the frames of fabricated steel.



Above is shown the skeleton of one section. The two wheels at the rear run on rails. The front of the platform is supported on the rear of the one before it, to which it is attached.

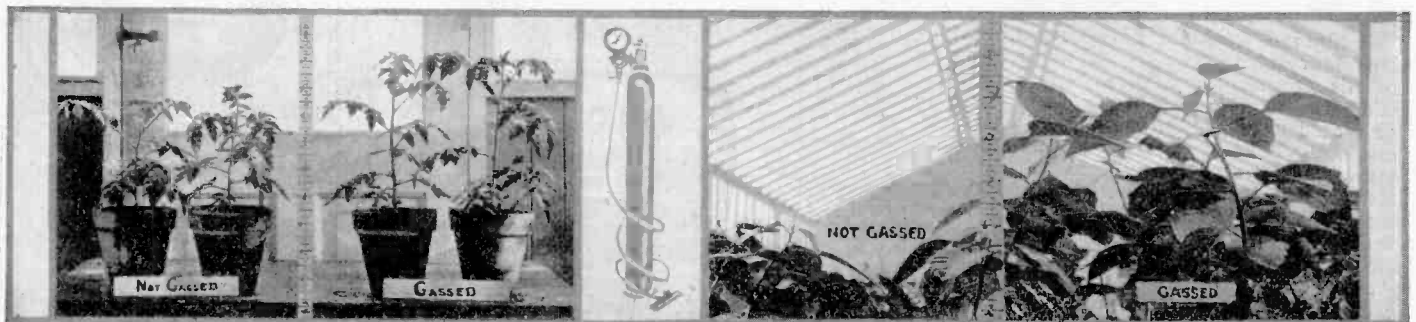


Along the bottom of each section there is a laminated core through which extend copper rods which are connected at both sides of the core. This, similar to the armature of a "squirrel cage" induction motor, running over the top of large field magnets (12 feet long placed beneath the tracks which act as does the field in an induction motor) furnishes the only motive power for the moving platform. Alternating current at three different frequencies are supplied to the field coils.



Above is shown a cross-section plan of the installation of the platforms, showing the placement of the magnets and rails.

Carbon Dioxide Forces Growth of Plants

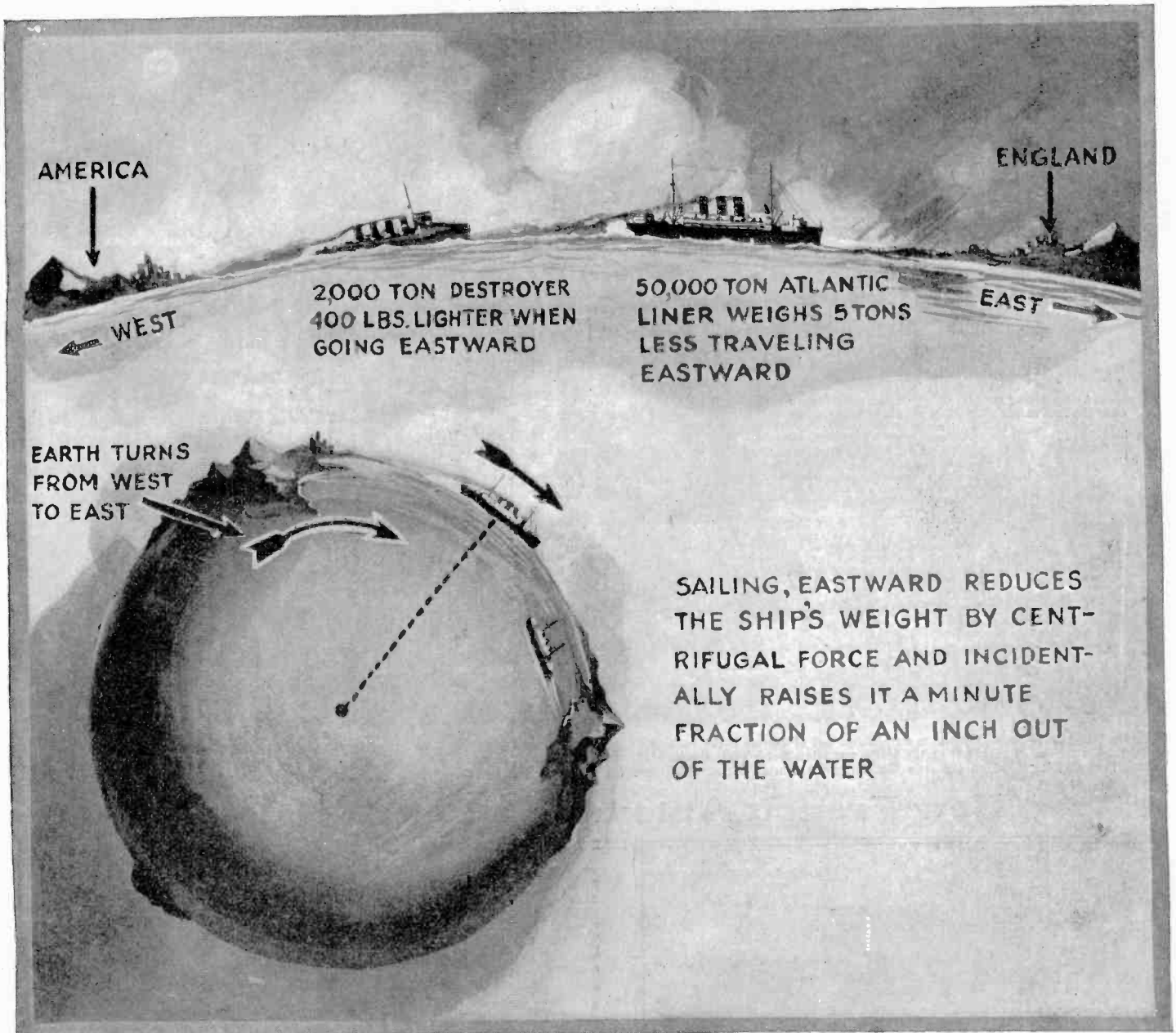


A German scientist, Dr. Riedel, in studying the causes of coal formation and the amount of carbon dioxide in the air found that by subjecting growing plants to a heavy blanket of the gas, mixed with a large amount of water vapors the plants' production could be increased four-fold. In the above two photographs is shown graphically the difference

between plants of the same age and species which were gassed and those which were not submitted to the treatment. Tomato plants were used in the left picture while poinsettias are the subjects in the right one. The experiments were made with gasses drawn from smelting plants.

—Dr. Albert Neuberger,

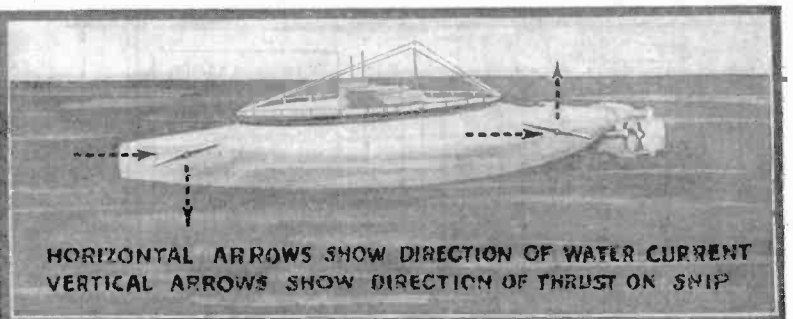
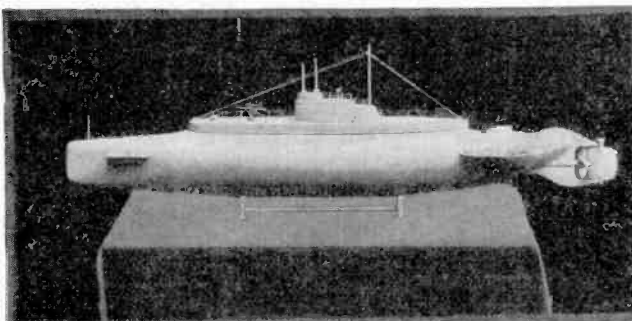
Ships Lighter Traveling East



An English scientist, Professor W. G. Duffield, discovered, during recent experiments, that the centrifugal force of the rotation of the earth has a very appreciable effect on the weight of vessels. He ascertained that a 50,000-ton trans-Atlantic liner lost slightly more than five tons of its weight when going due east or nearly so, as against the same ship's weight

for the westward journey. This difference in weight is accounted for by the fact that the centrifugal force is helped along by the revolution of the earth in the same direction. The difference in weight between the vessel in motion and the vessel stationary was not determined. The force also raised the vessel slightly out of the water.

WORKING MODEL OF SUBMARINE



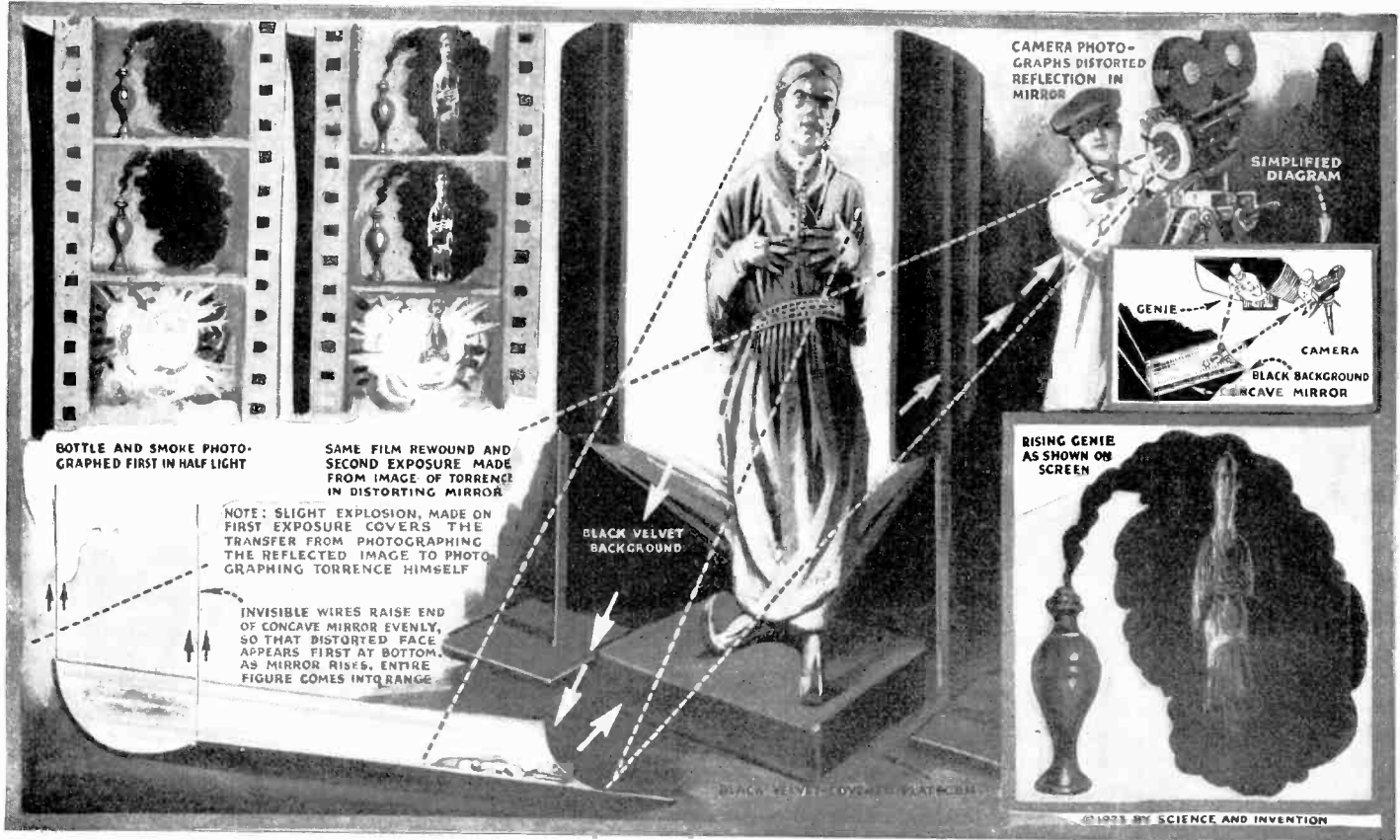
An English shipbuilding firm is marketing the three-foot submarine model shown in the above photograph for the use of inventors and students of Naval warfare. The model is fully equipped with motors, propellers, control devices, and a full set of rigging. It can be made to dive, to run just submerged, or to navigate the surface of the water. The drive as

well as all work of control within the boat is performed electrically, power being furnished by a substantial battery. The boat dives with the aid of a ballast tank and of the hydroplanes shown fore and aft at the sides of the boat. By referring to the sketch at the right the method of operation of these hydroplanes will be understood.

Movie Genii from Bottle

Double Exposure Brings Human Figure from Small Bottle.

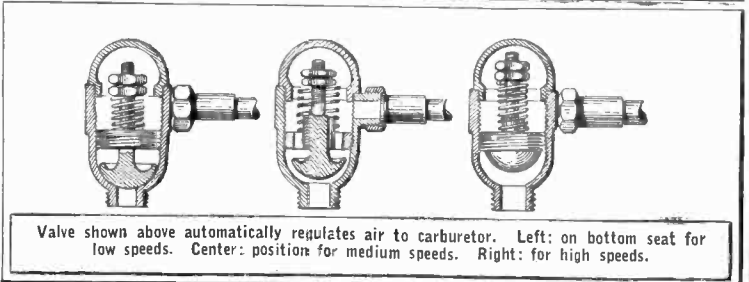
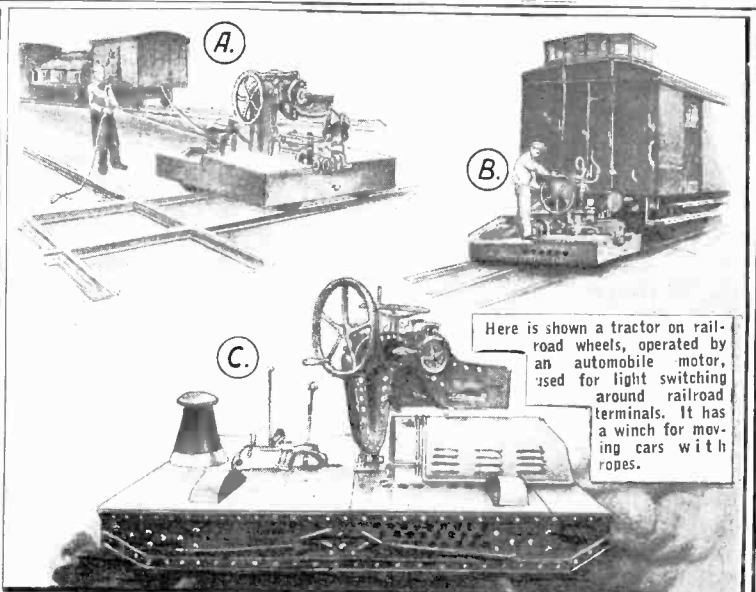
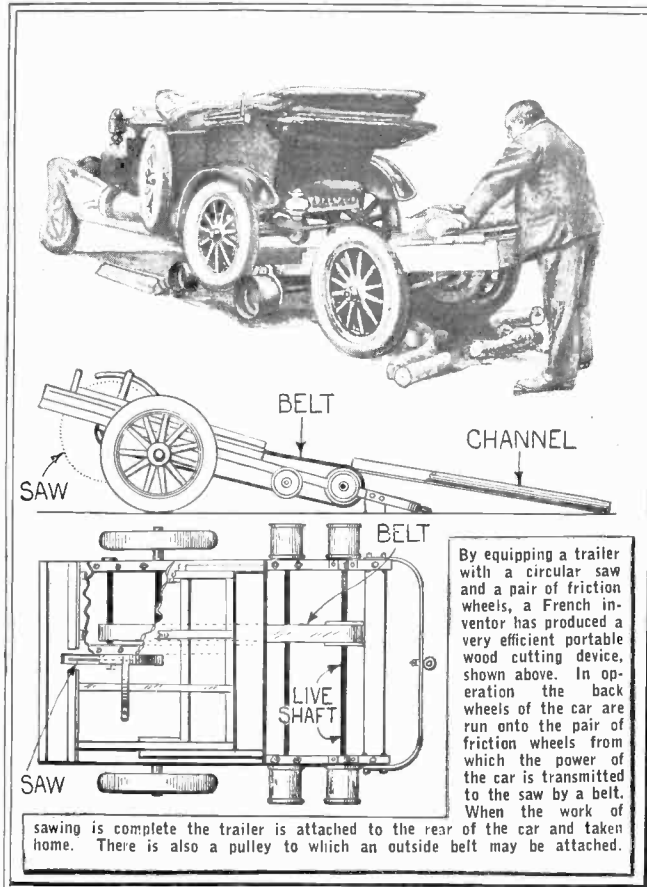
BY PHIL GERSDORF



In filming "The Brass Bottle," the hero materialized out of a brass bottle no higher than his knee. A close-up, in half light of the bottle was taken first. Then, the hero (Ernest Torrence) was photographed on the same film through a concave mirror which gave the

image an eerie effect. By beginning the picture with the mirror down and raising it, the head first appeared out of the smoke from the bottle and then the remainder of the body. The figure changed from the ghostly thing into one of flesh and blood.

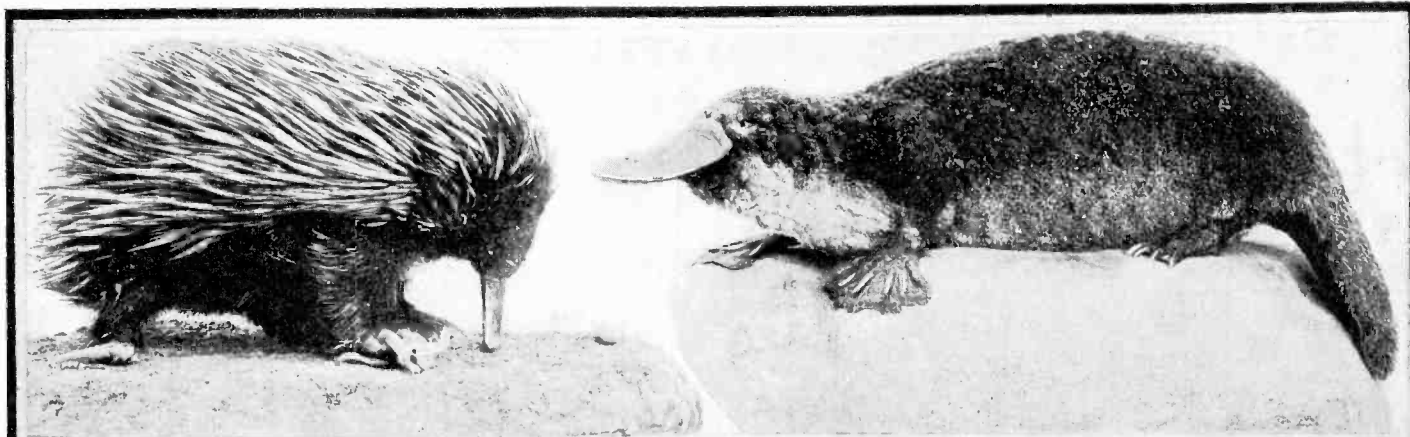
New French Automotive Developments



Animals With Strange Customs

Mammals Departing from the Regular Habits of Their Kind.

By LAURENCE H. SNYDER.



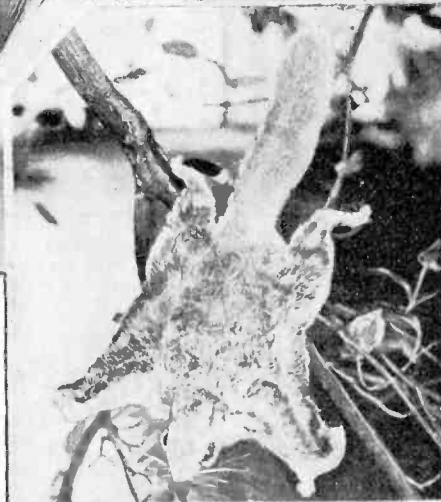
The opossum is the only marsupial of North America. (Below) It carries its young in a pouch on its back and when in danger feigns death. The young of the opossum are born very immature and for some time after birth are helpless.



The duck bill and the spiny ant-eater lay eggs and hatch their young from them, although they are true mammals. They provide milk for their young. The young of the duckbill lick the milk from the mother's hair.



having a membrane connecting the hind and fore legs and the body. This acts as a wing. The duckbill is more or less of an aquatic animal, having webbed feet and making the entrance to its burrow underneath water. In spite of the fact that this animal lays eggs from which the young are hatched it is classed as a mammal and is warm blooded. Other mammals than the bats inhabit the air. The flying squirrel represents a class known as gliders. It does not really fly but by virtue of a fold of skin connecting the animal's fore and hind legs it is enabled to glide from a higher to a lower altitude, sailing through the air. The colugo of South America belongs to this type of mammal, though it is more closely connected with the mole family than it is with the squirrels. Although the general rule is for the mammals to inhabit the earth, the flying squirrels are not alone in the peculiar deviation from the rule. The beaver, muskrat, otter and mink are well known. They are mammals and are warm blooded but they are quite at home in water. They have kept their four-footed anatomy, how-

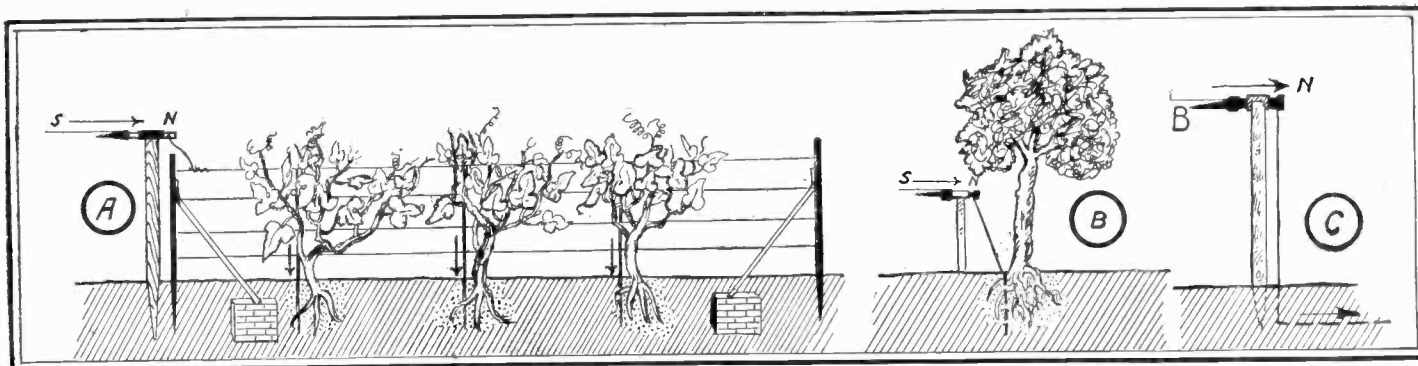


ever, while some other mammals, like the whale and the seal, have been greatly modified. Whales, in adult life even have no teeth. All the water inhabiting mammals, however, breath air through lungs and must come to the surface frequently in order to breathe.

THOUGH mammals are supposed to belong to one great class which bears its young alive and nurses them with milk, there are a number of interesting deviations from this rule. For instance: The bats really fly,

Photos Courtesy of the American Museum of Natural History, N. Y.

A French Electro Culture Idea



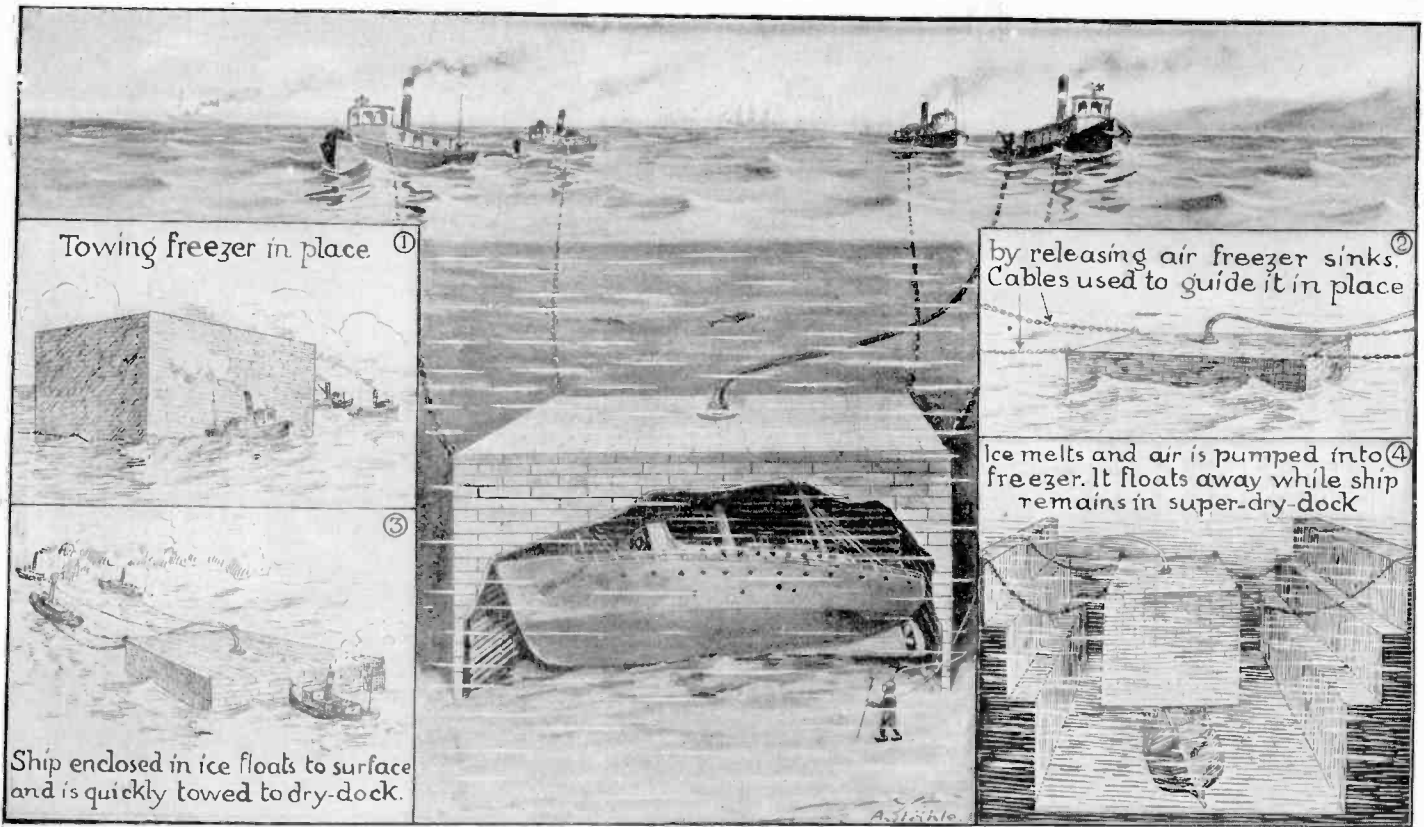
The Abbey Nollet in 1749 and the Abbey Bertholon in 1783 were credited with work on the application of atmospheric electricity to plants, the latter producing some apparatus called the "Electrovegetometer." They are the first on record and were followed by others, and now a French inventor, M. Christoffeau has constructed the apparatus shown in our illustrations, which he calls the "Electro-magnetic Terro-celeste," certainly an imposing name.

At two meters above the surface of the ground, a pointer is placed which is set rigorously north and south. From its unpointed end the wire is taken down to the soil, so as to reach the roots of the plants, or it may by means of a trellis be caused to first traverse their branches and leaves, and then be conducted to the soil with a ground wire for each plant. Very extensive claims are made for this apparatus.

Buoyancy of Ice to Raise Ships

Large Cake of Ice about Sunken Hull Brings it to Surface.

BY CHARLES MARTON.



Towing freezer in place ①

by releasing air freezer sinks. ②
Cables used to guide it in place

Ice melts and air is pumped into ④
freezer. It floats away while ship
remains in super-dry-dock

Ship enclosed in ice floats to surface
and is quickly towed to dry-dock.

By using a large shell, vacuum lined, sinking it over a sunken ship, and then forcing a freezing mixture through cold-storage pipes inside the shell, a large mass of ice is frozen around the hull. Since the specific gravity of ice is less than water, when the freezing is

completed the ice and hull will raise to the surface of the water. It is then towed to dry-dock. The steel shell is fitted with valves for sinking. Attending ships are equipped with refrigerating machinery which is connected to the coils in the caisson by tubes.

Perspiration On Order--Movie Invention



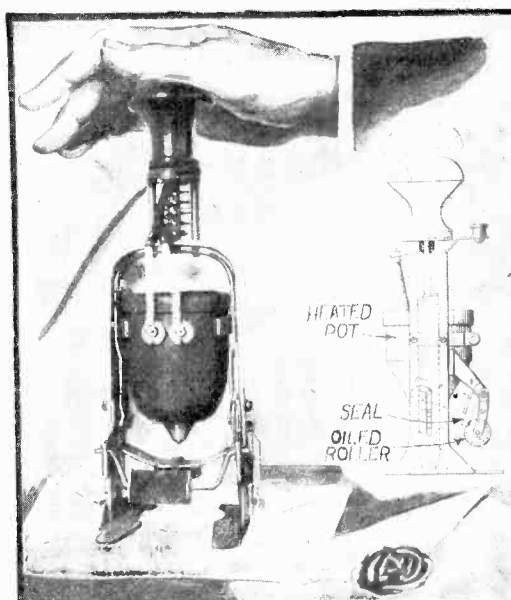
When the cold wintry winds drive you from the street into the movie palace where a close-up shows a star perspiring freely after the terrible work of rescuing the boy hero from the brutes of the stoke-hold, don't envy the star, thinking that the pictures were actually taken next to a red-hot boiler head. In the close-up, remember the boiler head isn't visible and that the pictures may have been made at 30 below.

Here is the way it is done. The camera is set for the close-up and the director's assistant takes a firm grip on the perspiration bulb which is filled with glycerine and water. He holds it tightly and then the director tells him to squeeze it. Then he yells "camera," and behold, in half a second the hard working actress is showing all the signs of her grinding toil. She looks as if she had spent the day sweeping the Sahara Desert. But—

Here is the harness that gives the effect, with a lot less exertion on everybody's part and even does it more effectively. The bulb, filled with glycerine and water is connected with a number of small tubes that run from the back of the actress' neck, through her hair to a point just above the forehead. When the bulb is pressed literal showers of perspiration are released and come tumbling down the actress' face.

Practical Scientific Novelties

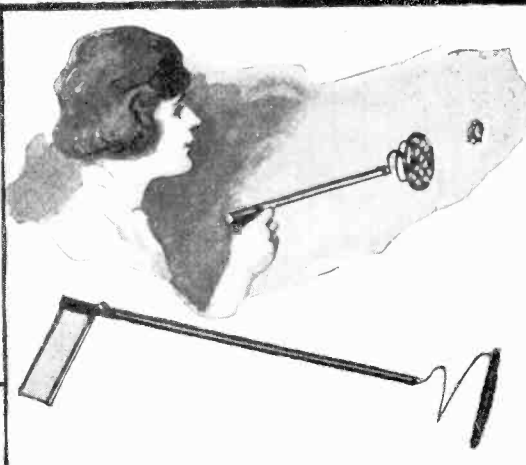
Modern Science Lends An Ear to Our Everyday Wants.



The electric sealing device shown is very ingenious. Pressing upon the handle the first time causes the seal to slide to one side brushing against the oil roller. A quantity of the wax flows upon the envelope. The second pressure imprints the seal.



The check protector shown above is one of those pocket devices which stamp the amount directly into the check, perforating the check at the same time. Each section of the check protector has a numeral upon it, which numerals are made of small needle-like points. In the upper compartment of each section is a small felt pad moistened with ink.



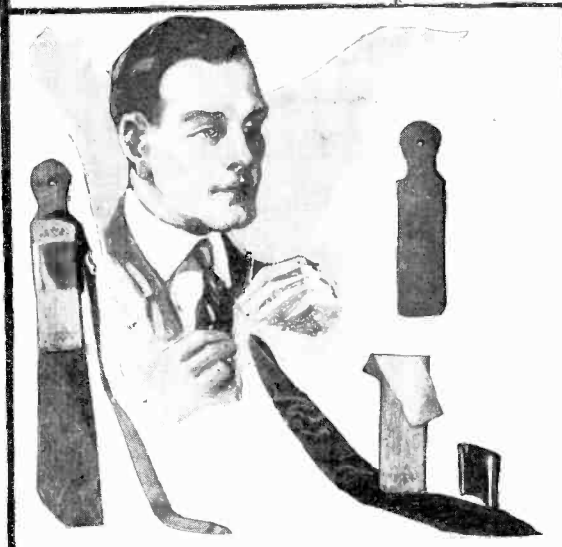
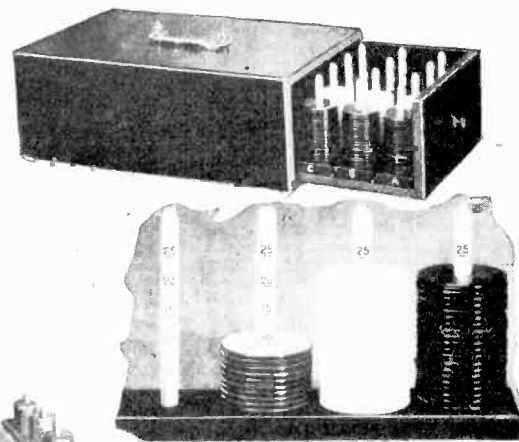
The fly-gun shown above will make it more interesting for the average housewife to eliminate these pests found in every household. A spring in the handle forces the swatting end forward at a rapid speed. The trigger, which fits into a notch in the tube, twists out of this notch when the gun is fired.



The socket wrench for radio outfits is a very desirable accessory to the tool outfit of any one who constructs his own radio set. The socket wrenches come in sets of three fitting the ordinary sized nuts. They are inexpensive, and will find many uses.



The system of poker chips and banking device shown above, is made of the finest quality pyralin. There are chip racks made of mahogany for individual players, and a box holding the entire outfit on the back of which is found a banking device. A small square hole in the center of the chips allows them to be placed on pins and mounted on the chip racks. These pins are calibrated in a way which permits the player to tell at a glance the exact number of chips in his possession. The device on the back of the box is made to correspond to the letters with which each chip rack is designated. The banker inserts a peg in one of the holes opposite a letter indicating the standing of the player to whom the letter applies.



The neck-tie press shown above is made of two pieces of polished mahogany or oak, a small tapering clamp, and a small pad of felt. This felt is moistened and then the neck-tie is placed upon one of the boards, the moist felt pad on top of this, and then the second board is used as a cover, the whole being clamped together.



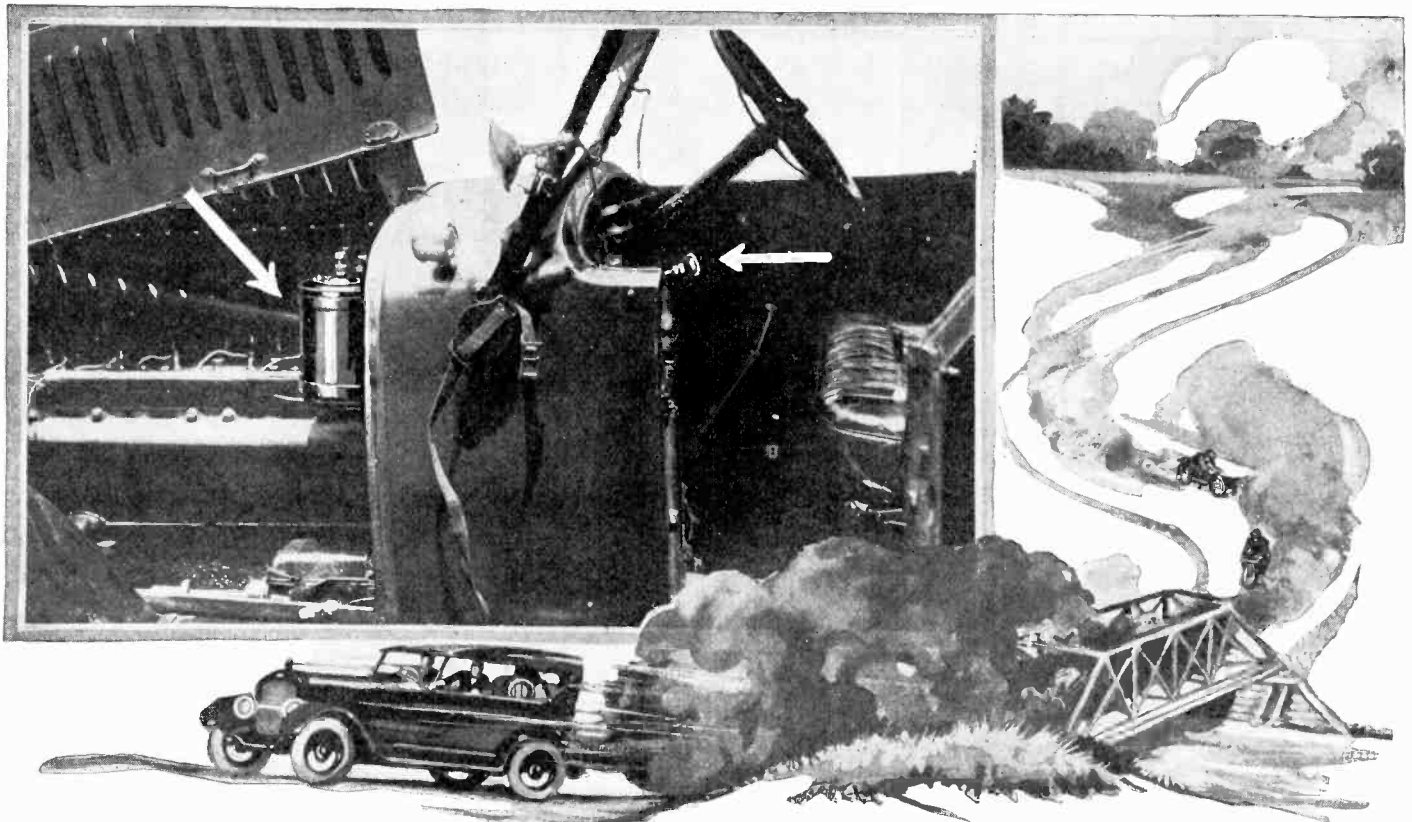
The ingenious knife sharpener illustrated above is made of aluminum, and two hardened steel balls, which rotate in opposite directions when the knife is drawn across them, as illustrated.



The candy container illustrated above acts just opposite to a cigar humidor. In the cover of this candy container we find a small receptacle containing a hygrosopic chemical which absorbs moisture very readily, preventing the candy from becoming sticky.

Rum Runners Adopt Smoke Screen

Dense Smoke Screen Hides Road from Pursuers.

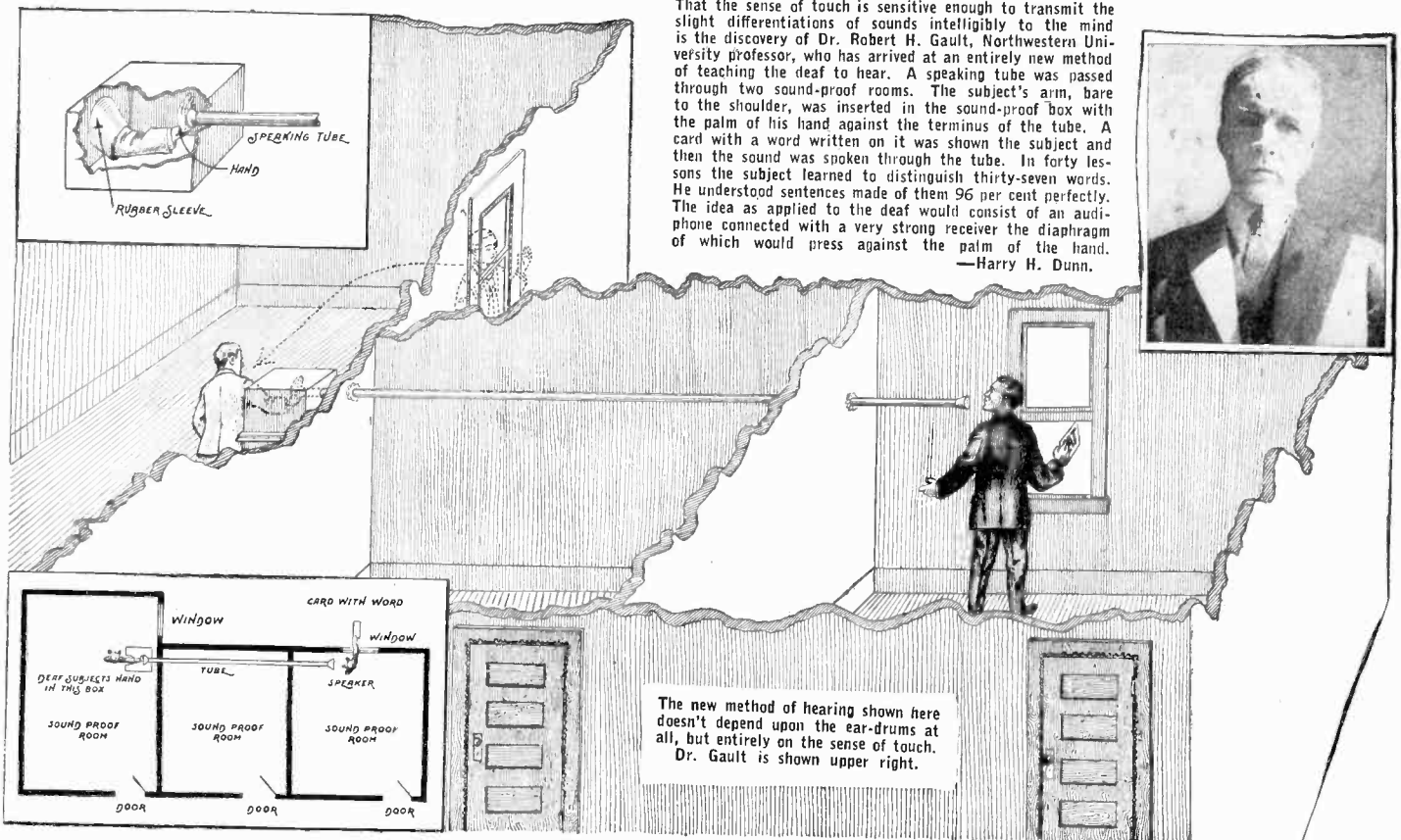


Driving 75 miles per hour, Washington, D. C., police, following alleged rum-runners, were confronted with a cloud of smoke so dense that they could not see their speedometers, last month. The road was practically obliterated for them. On capturing the car it was found that a tank of liquid, supposedly ammonia and glycerine, had been installed back of

the dash of the car and the liquid led to the muffler where it was burned into smoke. The officers were unable to follow their quarry until the fluid had been burned out. The men had no liquor and so could only be charged with creating a smoke nuisance. The smoke burned nearly twelve minutes.

—George A. Luers.

Voice Transmitted Through Arm



That the sense of touch is sensitive enough to transmit the slight differentiations of sounds intelligibly to the mind is the discovery of Dr. Robert H. Gault, Northwestern University professor, who has arrived at an entirely new method of teaching the deaf to hear. A speaking tube was passed through two sound-proof rooms. The subject's arm, bare to the shoulder, was inserted in the sound-proof box with the palm of his hand against the terminus of the tube. A card with a word written on it was shown the subject and then the sound was spoken through the tube. In forty lessons the subject learned to distinguish thirty-seven words. He understood sentences made of them 96 per cent perfectly. The idea as applied to the deaf would consist of an audiophone connected with a very strong receiver the diaphragm of which would press against the palm of the hand.

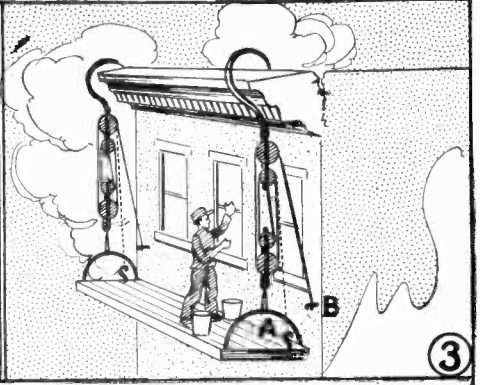
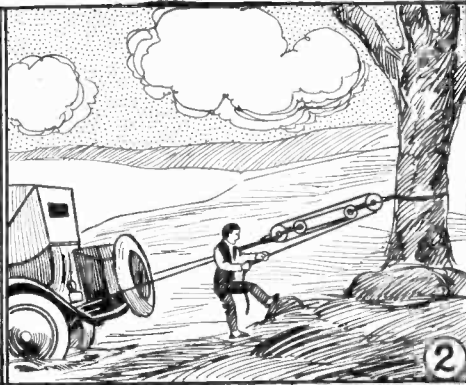
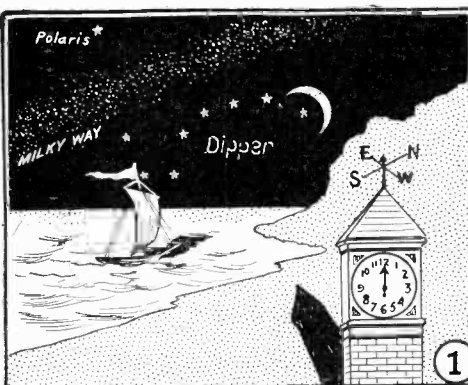
—Harry H. Dunn.

The new method of hearing shown here doesn't depend upon the ear-drums at all, but entirely on the sense of touch. Dr. Gault is shown upper right.

Scientific Problems and Puzzles

A Number of Everyday Scientific Questions That Are Interesting.

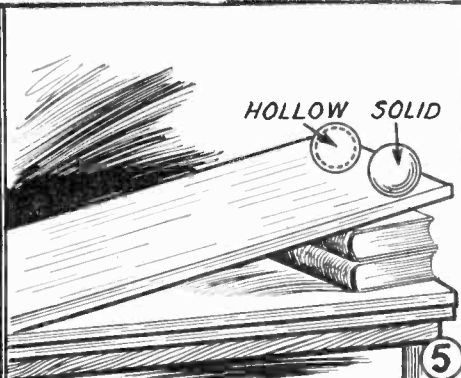
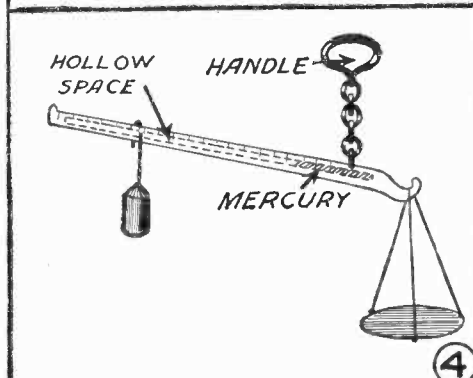
BY ERNEST K. CHAPIN, M.Sc.



How many scientific errors can you see in this picture? Examine it closely. How many things would have to be changed in order to make it correct? The answer to these questions will be found on page 1051.

Is the motorist in the above illustration doing his best scientifically to get his automobile out of the mud? If not, how could he change his tactics with the block and tackle in order to work more efficiently?

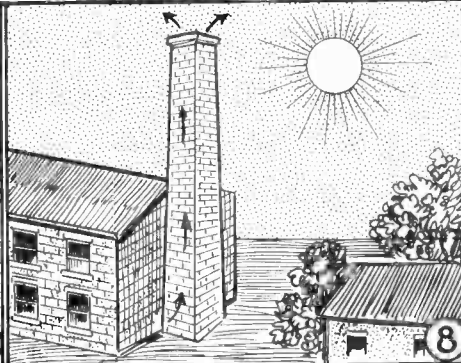
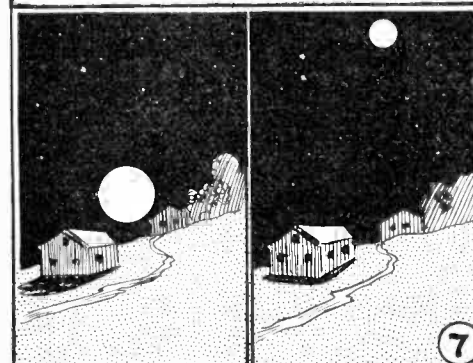
The painter attached his rope holding the scaffold to a peg in the wall at B instead of lashing it to the hook provided in the scaffold itself at A. Why did the cornice break when it held with the rope in the correct position?



A clever Chinese merchant uses the steelyard shown above. It has a mercury counter-balance. If his customer insists on weighing the goods (as he usually does), will not the merchant be cheated at least half the time?

If two balls, one of which is hollow, identical in size and made of the same material, are released from the top of an inclined plane at the same time, which of the two will reach the foot of the plane first? Why?

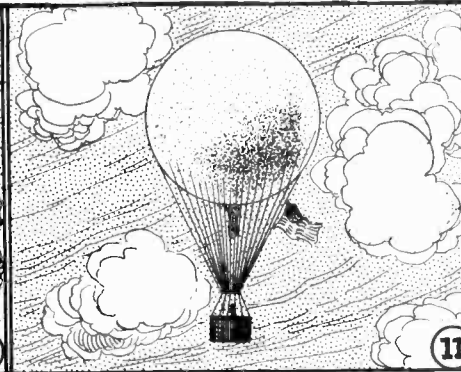
Many times, housewives place large tubs of water in cellars to prevent vegetables and fruit from freezing in cold weather. Will the water keep the fruit and vegetables from freezing and, if so, how?



If the moon is seen when it hangs low down next the horizon where it seems close to trees and houses it seems much larger than when it is riding high up in the sky. Is the moon larger? If an illusion, what accounts for it?

Many times there is considerable draft in tall chimneys although there is no fire in their base. How is this accounted for? Upon what does the establishment of this draft without fire depend?

The white clothes of the washerwoman to the left are not dry while the dark ones of the other, hung out at the same time, are. Why did the dark clothes dry before the white ones when they were in the same temperature?



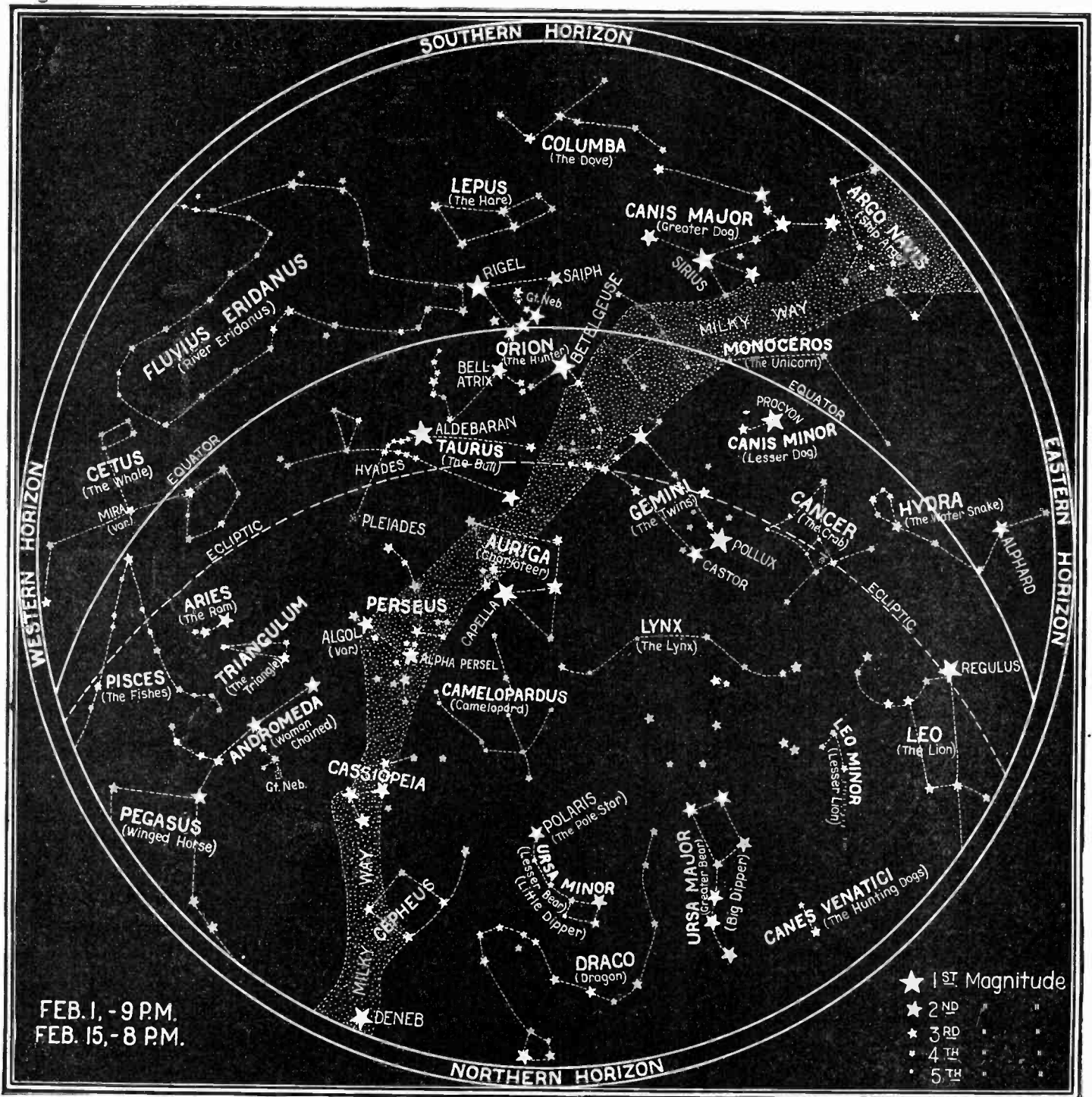
How is the total weight of water against the face of a dam calculated? Does it depend upon the distance the water runs back from the dam, on the velocity of the stream, the depth of the water, or what?

What is the power of ascension of a balloon? Is it the buoyancy of the gas in the bag that furnishes the lifting power? If so, how does it act? Why must the gas used be much lighter than air?

Is it the "power of suction" that causes the soda to be forced up through the straw? If not, what action takes place when the girl sips on it? (Answers on page 1051.)

The Heavens in February

By ISABEL M. LEWIS, M. A.
of the U. S. Naval Observatory



Above is the star map for the month of February. If the chart is held over the head with the "Northern Horizon," north, at nine P. M., February first or eight P. M., February fifteenth the location of the stars in the heavens will coincide with their position on the map and can easily be found.

BY nine o'clock in the evening, the first of February, or eight o'clock on the fifteenth, the magnificent constellation of Orion, the finest in the heavens, will be found a little to the west of south. No one can fail to distinguish this constellation. The three second-magnitude stars evenly spaced a degree apart in a line exactly three degrees long that form the Belt of Orion, immediately attracts the attention of anyone gazing at this part of the heavens. Then there is the huge quadrilateral that outlines the body of Orion. The red Betelgeuse and blue-white Rigel are in diagonally opposite corners, both first-

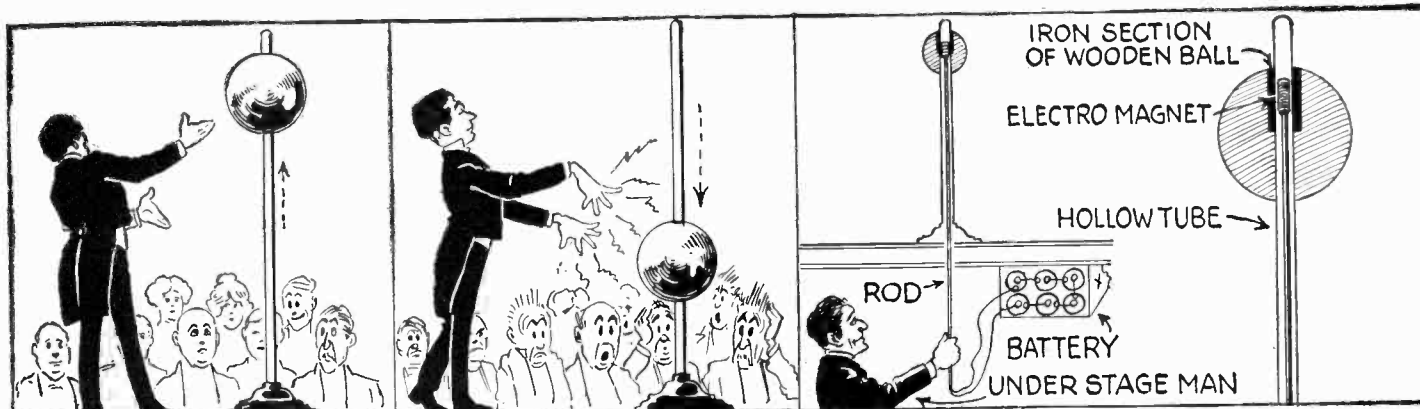
magnitude stars, and in the other two corners are Bellatrix, in the left shoulder and Saiph in the right knee. stars of the second magnitude. Just below the Belt in the Sword of Orion is the Great Orion Nebula, the finest object of its kind in the heavens. The distance of the nebula and its associated stars is estimated to be approximately six hundred light years. To the east and southeast of Orion and now well up above the horizon will be seen the two dogs that follow at the heels of Orion, Canis Major, The Greater Dog, and Canis Minor, The Lesser Dog. Sirius in Canis Major, is by far the brightest of

all the stars and is at a distance of only eight and eight-tenths light years from the earth. Next to Alpha Centauri it is the nearest of all the first-magnitude stars. Canopus the second brightest star in the heavens lies about thirty-five degrees nearly due south of Sirius and cannot be seen north of the thirty-eighth parallel of latitude. It is so distant that its parallax cannot be determined by the trigonometric method. It must be at least several hundred light years from the earth, perhaps much more than this, so intrinsically it is one of the most luminous stars in the heavens, not de-
(Continued on page 1039)

Magic for Everybody

BY PROF. JOSEPH DUNNINGER.

NO. 11 OF A SERIES



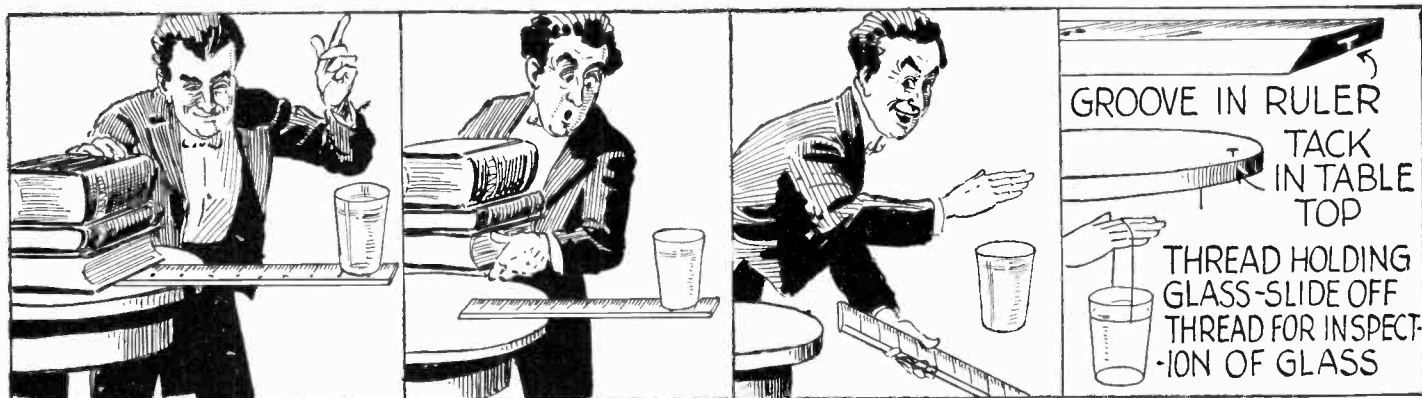
A hollow brass rod secured to a stand is passed for examination, as is a wooden ball with a hole through it, allowing it to move freely on the rod. At the word of command, the ball can be made to rise or fall on the rod. An assistant below the stage is supplied with

another rod sliding freely within the rod of the stand. To the upper end of this a magnet is secured which receives its energy from the batteries beneath the stage floor. The under-stage man causes the ball to rise and fall by sliding the rod up and down.



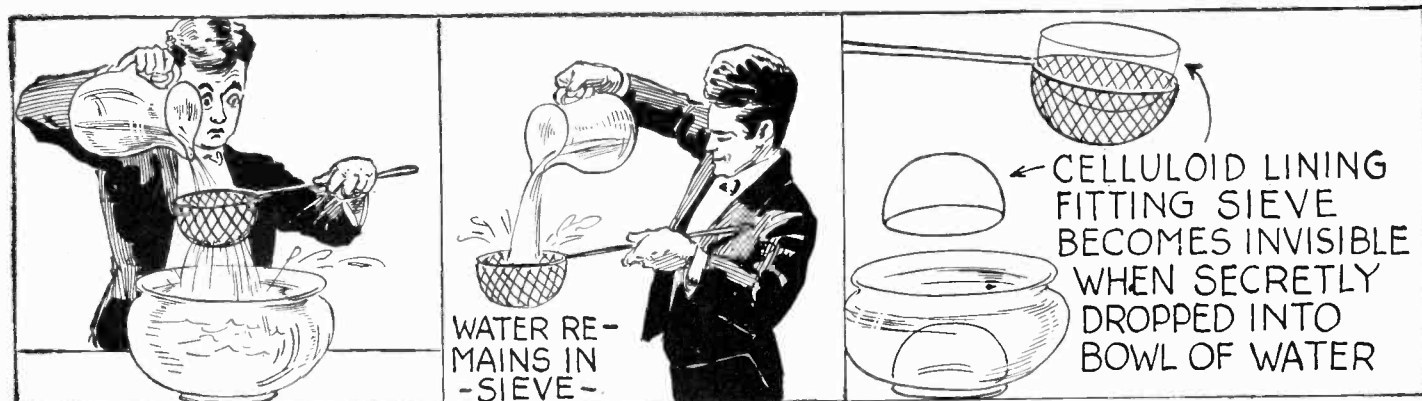
A polite spectator drops a ring into a fish bowl full of water. The magician washes and dries his hands thoroughly to prove that they are unprepared, and then plunges his hand

into the water and withdraws the ring. To the spectator's astonishment, his hands are perfectly dry. Use lycopodium powder, sprinkled upon the water prior to the trick.



A ruler is placed on the edge of the table. A glass of water is balanced on the free end, while the other is held with a few books. The books are now removed, but the glass and ruler still maintain their positions. Finally the ruler is also taken away, but the glass

remains suspended in mid-air. For holding the ruler on the table, the tack in the table and the slot in the base of the rule are very effective. In suspending the glass in mid-air a thin thread is used. This drops off when the glass is passed out for examination.



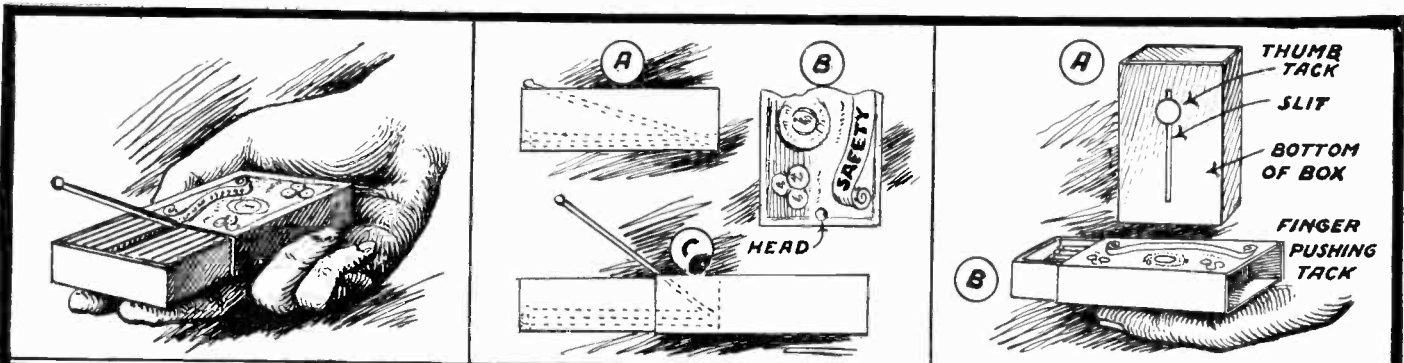
The performer pours water into a sieve and it flows through freely. He repeats the operation, but this time the water remains in the sieve. The water is then poured out by

tipping the sieve as though it were a dipper, and the sieve passed for examination. The performer slipped the invisible celluloid lining out of the sieve when he tipped it.

Scientific Match Box Puzzles

Interesting Tricks Performed With the Aid of Ordinary Matches.

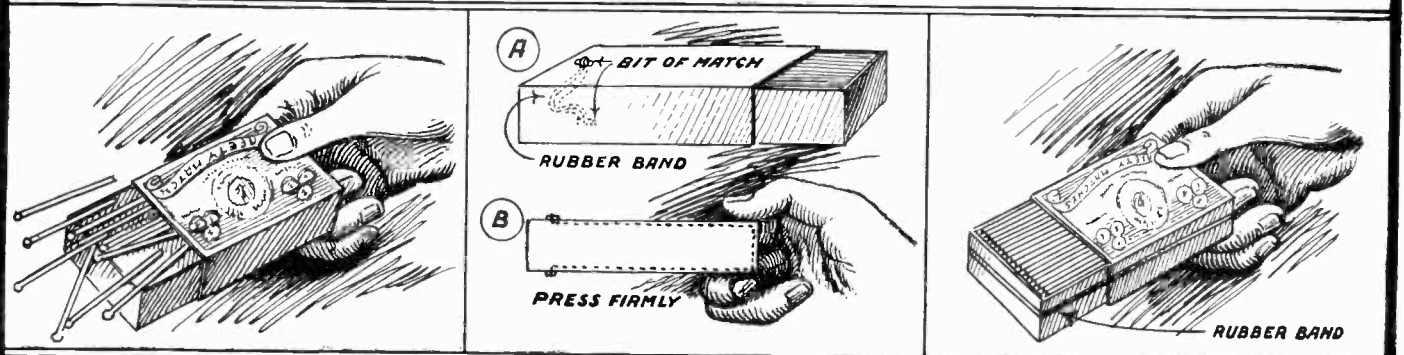
BY WALTER B. GIBSON



The obliging match box. An ordinary safety match box is held in the right hand, and with no apparent motion of the hand, the box slowly opens and one match raises its head. The left hand removes the match and the drawer automatically slides back.

A match raises from the box. A tiny hole is cut in the top of the match box near one end, and with the drawer closed, a match is pushed in through the hole until only the head protrudes. Figs. A, B and C indicate the position of the match.

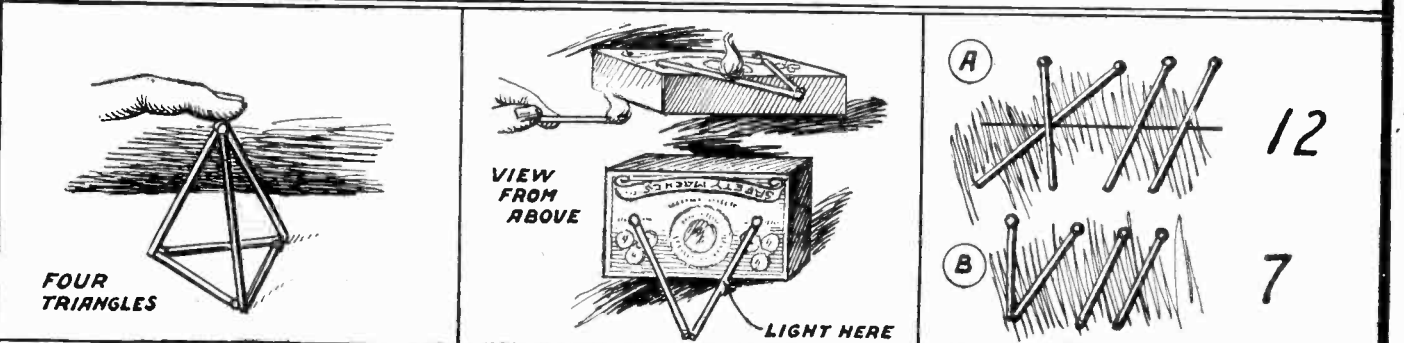
A slot is cut lengthwise in the bottom of the cover of the match box, and at one end of this a thumb tack is inserted into the drawer. Pushing on the thumb tack with the forefinger held underneath the match box, causes the drawer to slide out.



Another more startling automatic match box is shown above. With the query "Have a match?" the drawer of the box slides open and a dozen matches fly out at the surprised spectator. The match box is held in one hand when the trick is performed by the method shown.

A rubber band is passed from cover to cover of the match box, and held in place by bits of matches to which the rubber band has been fastened. As shown at A the match box acts in the ordinary manner. At B it forms a veritable gun.

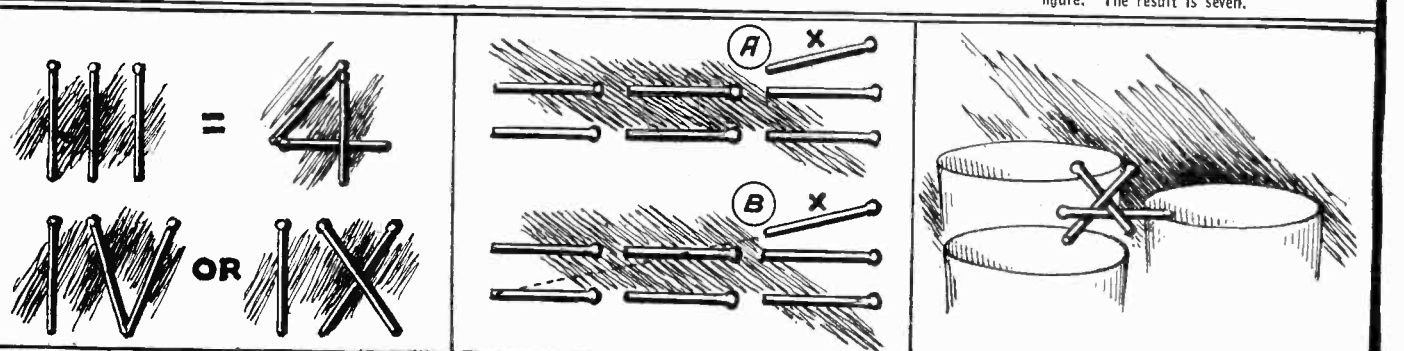
An open box of matches is held out to some one and just as he reaches for them, the match box closes. A rubber band is slipped around the box. Press firmly at the rear to hold it open; when pressure is released the box slides closed.



Lay six matches on the table and challenge anyone to form four equilateral triangles from the six matches. None of the matches may be broken. The problem seems impossible, but the drawing shows how it can be done.

Lay two matches as shown, and light one of them. Then ask how many seconds it will take for the burning match to ignite its companion. Answer is never, because the match burns and curls away from the other.

Half of twelve is seven! Oh, yes, you can prove it. Simply lay matches on the table so as to indicate the Roman numeral 12 and then separate them as shown in the straight line, taking away exactly half of each figure. The result is seven.



How can you make four matches out of three matches without breaking any of them? The answer is very simple. Set the three matches to form the figure four or five Roman figure IV.

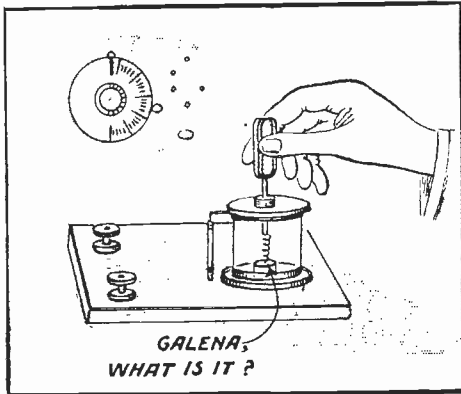
Lay seven matches as shown, and ask where X points. Most will say it points to the head of the first match at the bottom. But it points to the lower end, as is proved with a ruler.

Above is shown a simple method of constructing a bridge which will connect three drinking glasses. The head of each match is to rest on one of the glasses, but the other end must not touch a glass.

Everyday Chemistry

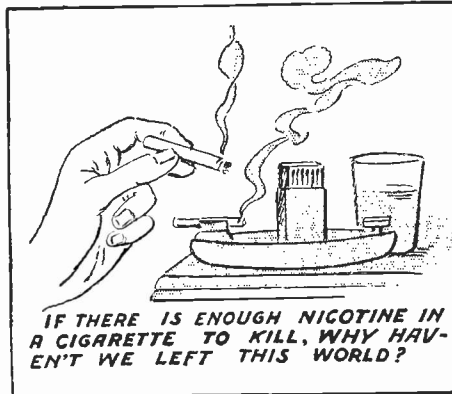
Some Kinks and Compounds in Everyday Use Explained.

BY RAYMOND B. WAILES



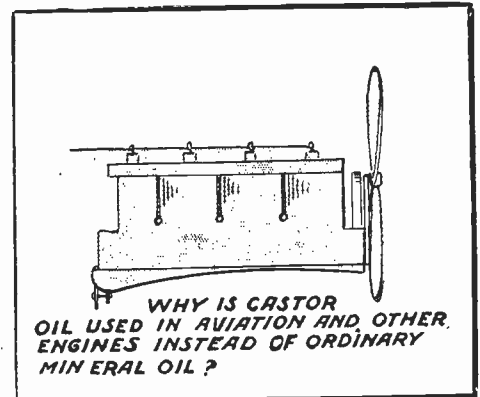
**GALENA,
WHAT IS IT ?**

Galena is native lead sulphide having the formula PbS . It occurs sometimes in massive cubic or octahedral crystals. It is the principal ore of lead, often containing comparatively large quantities of silver.



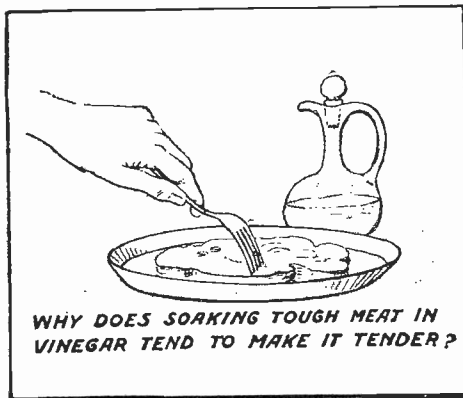
**IF THERE IS ENOUGH NICOTINE IN
A CIGARETTE TO KILL, WHY HAV-
EN'T WE LEFT THIS WORLD ?**

The reason that the nicotine in a cigarette has very little effect on the smoker is because most of it is burnt up. If the nicotine were extracted and administered internally, it would be fatal.



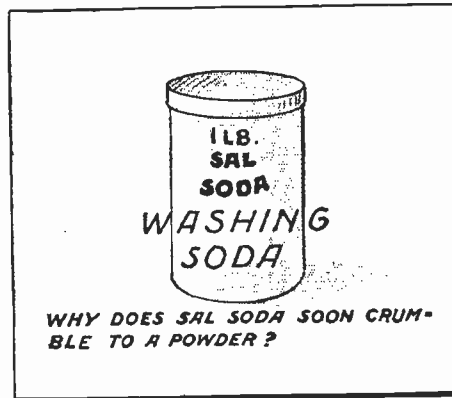
**WHY IS CASTOR
OIL USED IN AVIATION AND OTHER
ENGINES INSTEAD OF ORDINARY
MINERAL OIL ?**

The reason that castor oil is used in aviation engines in preference to ordinary mineral oils, is because this oil does not mix with gasoline, and consequently is not thinned down, thus maintaining its lubricating quality.



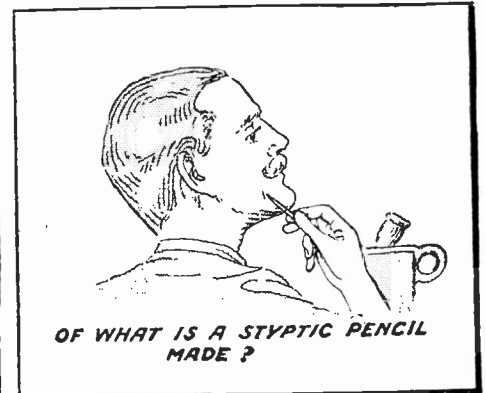
**WHY DOES SOAKING TOUGH MEAT IN
VINEGAR TEND TO MAKE IT TENDER ?**

Soaking meat in vinegar tends to make it tender because the collagen present in the meat swells. By continuous boiling of the meat, this collagen is converted into gelatin. Collagen is a proteid.



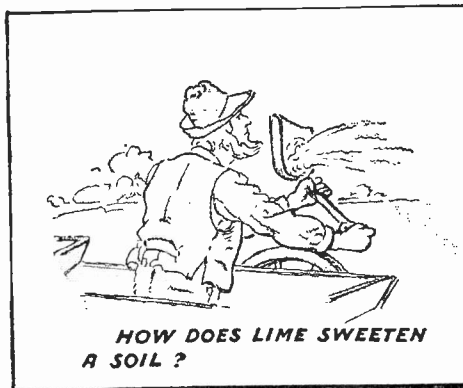
**WHY DOES SAL SODA SOON CRUM-
BLE TO A POWDER ?**

Sal soda and washing soda—the same substances—contain water of crystallization. When this water is driven out by heat, the crystal crumbles to a powder. The water causes the salt to maintain its crystalline form.



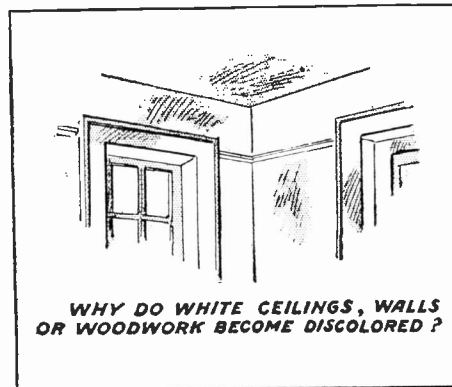
**OF WHAT IS A STYPTIC PENCIL
MADE ?**

The ordinary styptic pencil is made of seventy-five per cent of alum and twenty-five per cent saltpeter. Its astringent properties cause the edges of the wound to constrict, limiting the flow of blood.



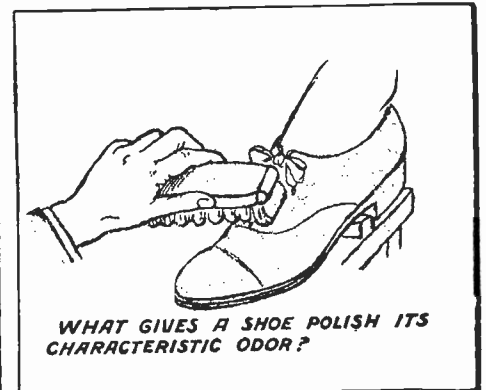
**HOW DOES LIME SWEETEN
A SOIL ?**

Lime when sprinkled on the soil, although not actually sweetening the soil, neutralizes the acids of the soil and thus removes the sourness. Such treatment facilitates the raising of greater crops.



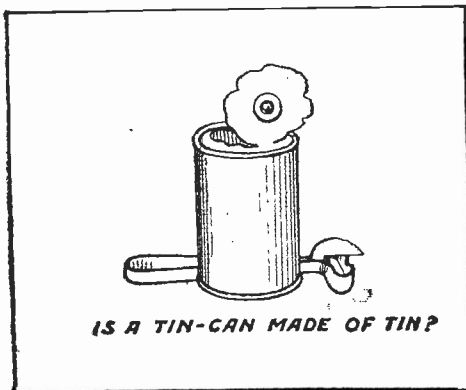
**WHY DO WHITE CEILINGS, WALLS
OR WOODWORK BECOME DISCOLORED ?**

If a special white paint is used, white walls will not discolor in impure air charged with sulphuretted hydrogen. Sometimes zinc white is used as a substitute for white lead.



**WHAT GIVES A SHOE POLISH ITS
CHARACTERISTIC ODOR ?**

The odor of a shoe polish is due to nitro-benzene. This dye base is used in large quantities in the preparation of aniline. The liquid is a pale yellow fluid and is produced by the action of nitric acid on benzene.



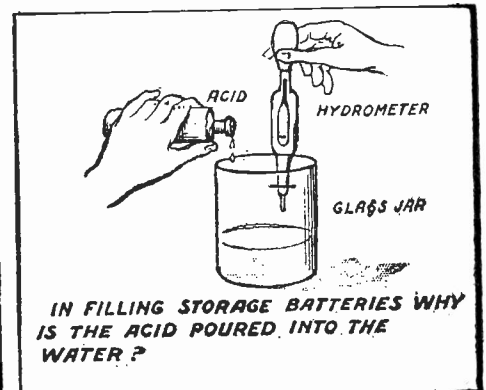
IS A TIN-CAN MADE OF TIN ?

A tin can is not made entirely of tin. Sheet iron forms the base and is coated with tin. This tinning process prevents the iron from rusting. The use of tin entirely would make the cans very expensive.



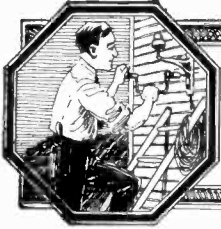
**WHY WILL A RUBBER BAND
DISCOLOR SILVER ?**

A silver spoon is discolored when a rubber band is placed upon it because of the sulphur in the rubber band. Sulphur is used in the vulcanizing process; it combines with the silver forming silver sulphide.

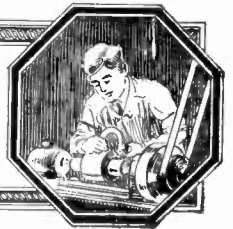


**IN FILLING STORAGE BATTERIES WHY
IS THE ACID POURED INTO THE
WATER ?**

In making a quantity of electrolyte for a storage battery, acid should be poured into the water because the water dissipates the heat of solution. Reversing the process may result disastrously for the mixer.

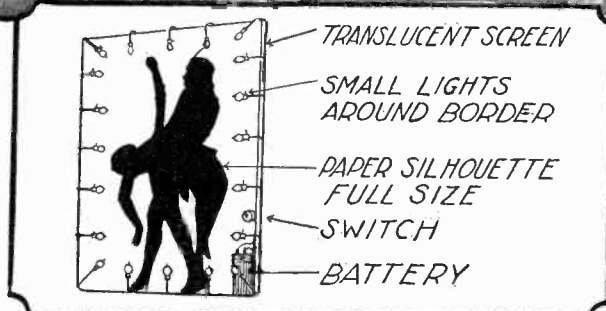
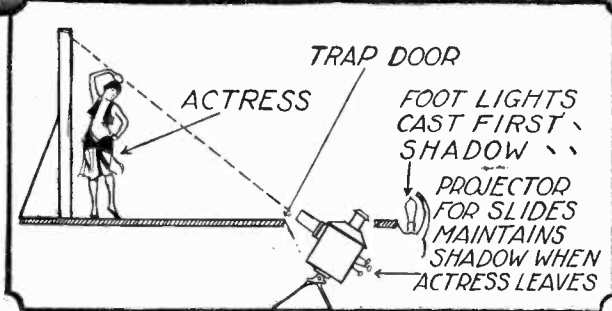
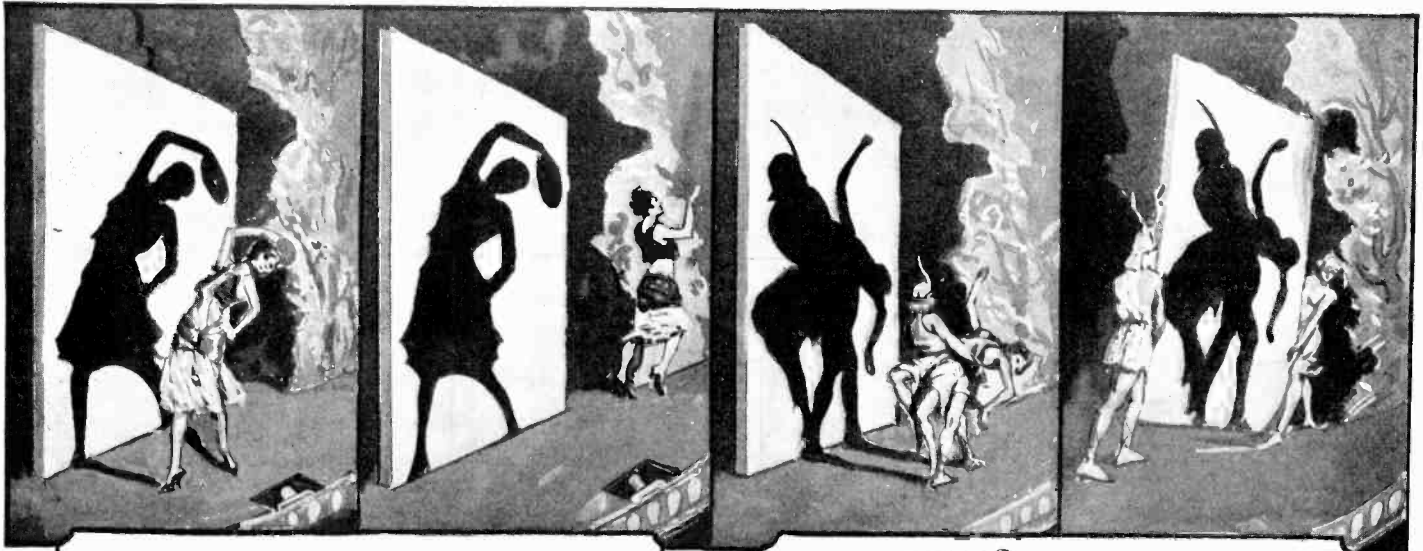


THE CONSTRUCTOR



Mysterious Shadow Illusion

Novel Stage Effect Gained With the Aid of Lighting Plan.



In the illustration above a large silhouette is seen on a screen. The lights are dimmed and the actress steps out from behind the screen while the shadow still remains. The screen is removed from the stage with the shadow still in place. The illusion is gained by using a projector in connection with the concentrated silhouetting lights in front of the screen. The method is illustrated in the sketch. The actress poses in the

predetermined position. The audience sees her shadow. The lights fade but the silhouette remains, thanks to the projector which casts the same silhouette of the actress which is on the slide upon the screen. In the last act the man and girl carry the screen with their shadows still in place off the stage. Two life-sized silhouettes are back of the screen, illuminated by small lights, as shown.

—L. J. Smith.

Perfect Safety for the Hand Luggage

Split in center
Suitcase

Handle slides into receiver
Grip

Wingnuts
Leather handle
Slot for wingnuts

By adjusting small knob handle can be released
Removable handle
Combination
Travelling Bag

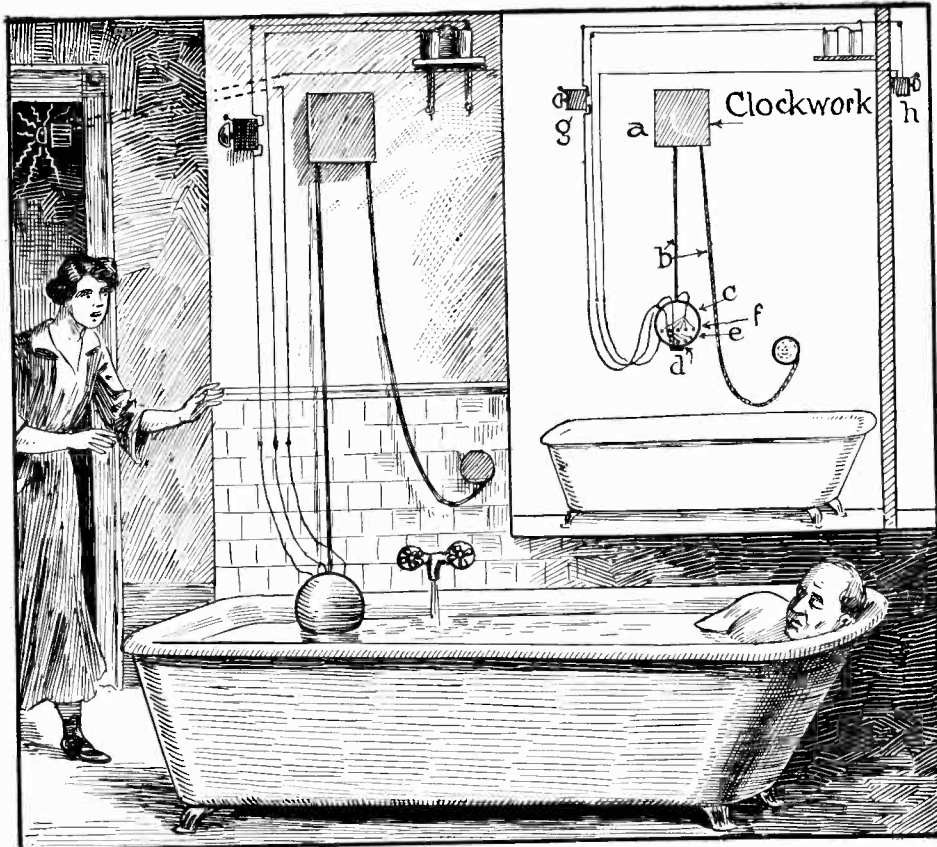
Leather handle
Metal combination plug lock
Travelling bag

Removable handle
Any sort of combination, hook, joint, plug or lock
Suitcase

Perfect safety for the hand luggage is guaranteed by the simple device illustrated here. By a simple expedient of using removable handles, all danger of lost or stolen luggage is removed. As shown at the left, the handles can be made in various shapes and forms. At the right is shown a more complicated arrangement where the handles are fitted with locking devices, so that only the handle belonging to the bag may be used with it. Above is shown a handle equipped with a combination lock which not only serves to carry the bag, but also to lock it. It is also suggested that identification numbers be placed on the bag and on the handle, so that the owner at check stands or similar storage places, will have only to present his handle to redeem his bag, thus doing away with the annoyance of carrying checks.

—Leonard J. Edick.

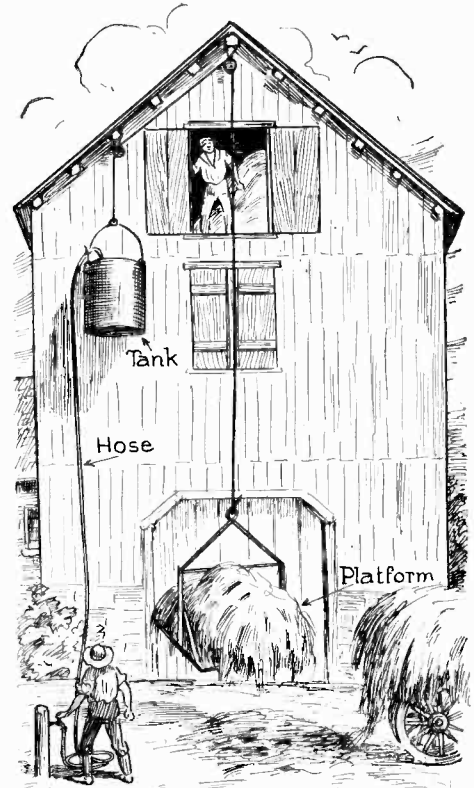
Alarm for Bath



Many accidents are caused by persons falling asleep or being struck with a sudden illness while in the bathtub. Such mishaps may be easily avoided by applying an apparatus such as the one shown in the above illustration. The ball housing the contacts is allowed to gradually sink to the surface of the water by clock-work. If nothing is amiss the bather pulls the ball up to its first position. If something has happened to the bather the ball sinks into the water, ringing the bell in the bathroom; if it is not pulled up, it sinks further, ringing a bell outside the bathroom.

—Dr. Albert Neuberger.

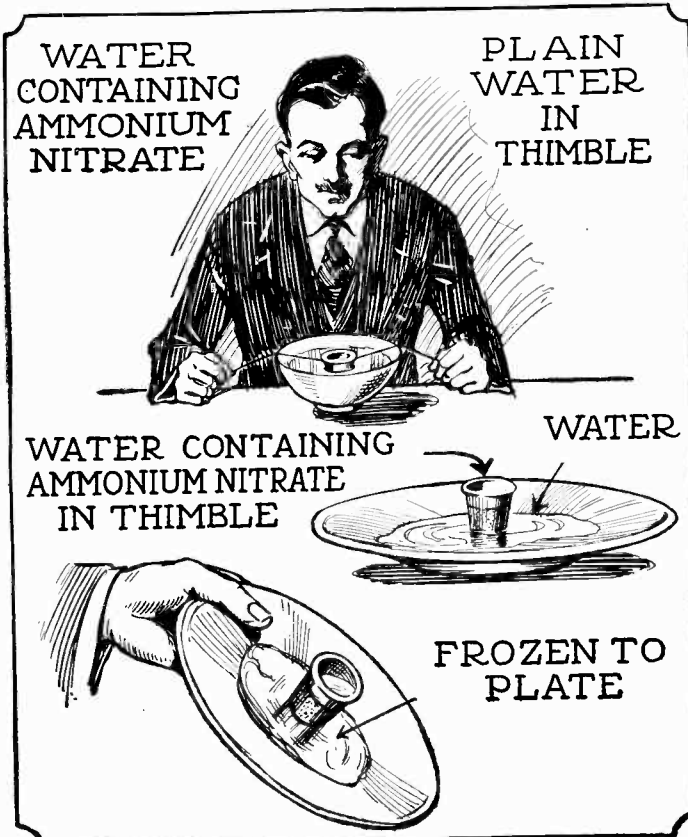
Farm Elevator



Where a supply of water is available, a serviceable elevator for farm work may be easily constructed as shown above. A length of garden hose fills the large container with water, over-balancing the weight of the load, and carrying it up. The water is then turned out of the container, and the elevator is lowered for another loading.

—Dare R. Van Horn.

Thimble Ice Factory



Because of the great amount of heat taken up by the solution of ammonium-nitrate in water, ice is made in a saucer on the hottest day by simply placing a thimble full of the salt dissolved in water in the center of a saucer containing a little water.

—Dr. Albert Neuberger.

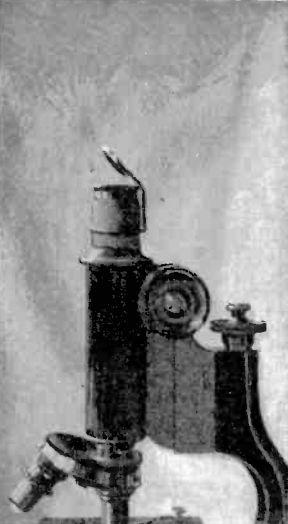
Simple Shower Bath



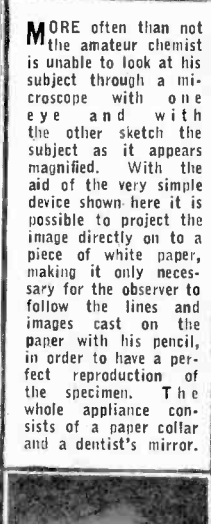
By drilling a few holes in the hose connection attached to the bathroom faucet, and inserting a stopper, as shown above, a very serviceable shower bath attachment is made. A string directs the spray.


—Harold Jackson.


Sketching Attachment for Microscope




MORE often than not the amateur chemist is unable to look at his subject through a microscope with one eye and with the other sketch the subject as it appears magnified. With the aid of the very simple device shown here it is possible to project the image directly on to a piece of white paper, making it only necessary for the observer to follow the lines and images cast on the paper with his pencil, in order to have a perfect reproduction of the specimen. The whole appliance consists of a paper collar and a dentist's mirror.

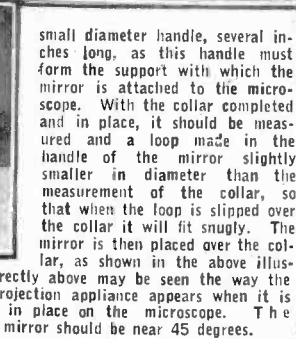




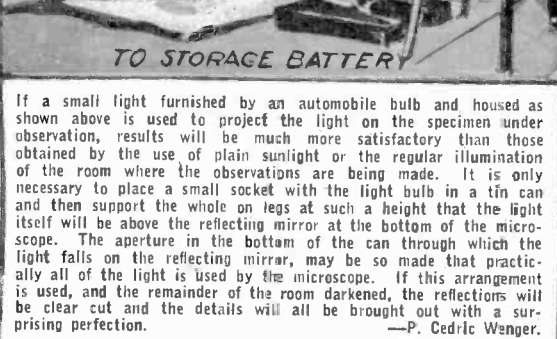


DENTIST MIRROR
SLIDE
SHIELDED HOUSING (TIN CAN)





small diameter handle, several inches long, as this handle must form the support with which the mirror is attached to the microscope. With the collar completed and in place, it should be measured and a loop made in the handle of the mirror slightly smaller in diameter than the measurement of the collar, so that when the loop is slipped over the collar it will fit snugly. The mirror is then placed over the collar, as shown in the above illustration. Directly above may be seen the completed projection appliance appears when it is finished and in place on the microscope. The angle of the mirror should be near 45 degrees.





TO STORAGE BATTERY

If a small light furnished by an automobile bulb and housed as shown above is used to project the light on the specimen under observation, results will be much more satisfactory than those obtained by the use of plain sunlight or the regular illumination of the room where the observations are being made. It is only necessary to place a small socket with the light bulb in a tin can and then support the whole on legs at such a height that the light itself will be above the reflecting mirror at the bottom of the microscope. The aperture in the bottom of the can through which the light falls on the reflecting mirror, may be so made that practically all of the light is used by the microscope. If this arrangement is used, and the remainder of the room darkened, the reflections will be clear cut and the details will all be brought out with a surprising perfection.

—P. Cedric Wenger.

Method for Making Concrete Basins





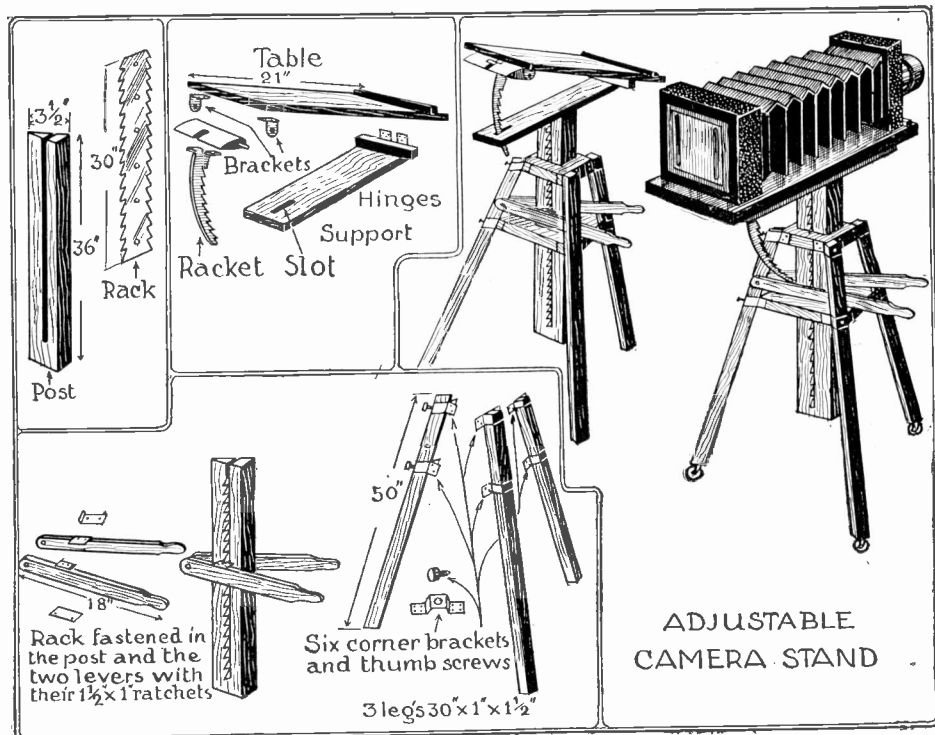




Many uses present themselves for concrete containers or basins but few of them are used by the layman and amateur on account of the difficulties connected with making the forms in which they must be cast. By the method shown here, using two ordinary kitchen pans of different sizes basins of almost any capacity may easily be made with minimum work. The outside pan must be several inches higher than the one used inside to allow for the thickness of the base. A mixture of one part cement and three parts finely screened sand will be found to be most practicable in the manufacture of these dishes. The inside pan is placed carefully concentric with the outer pan and the concrete is mixed to a consistency which will allow its being puddled. The cast should be allowed to dry three days before it is put into use. The finished basin should be painted with cement and water.

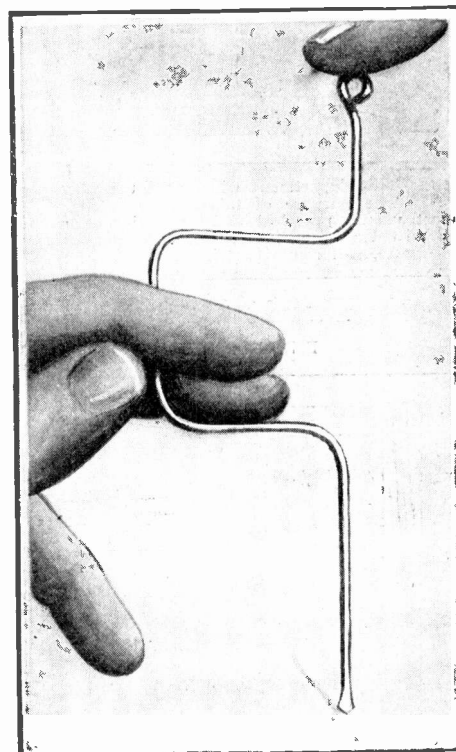
—Dale R. Van Horn.

Serviceable Camera Stand



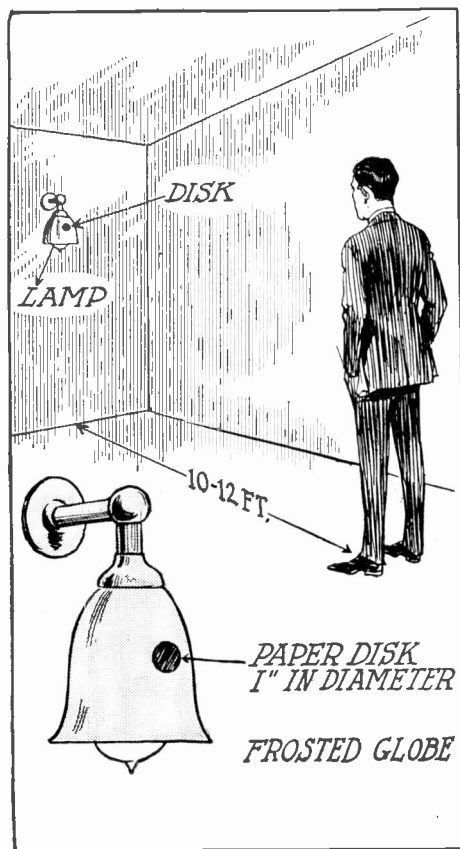
The amateur with a long bellows camera will experience no little difficulty in focusing close-ups on the ordinary tripod or well known stack of books. Just an ordinary camera adequately mounted is half the battle. The sketches illustrate a camera stand constructed by the author which meets all requirements. The sheet iron corner brackets are bent to fit around the legs, which may be easily inserted and are held in place by six thumbscrews. The top or table is 11 by 21 inches, adapting the stand to all sizes of cameras. The camera is raised and lowered vertically by the two levers and tilted by a rack as shown. The triangular shaped vertical post, which has $3\frac{1}{2}$ inch faces and is 36 inches long, is slotted with a rip-saw to receive the rack. This rack, cut out with tin-snips from sheet iron, is 30 inches long. The table is hinged to its support. This support, which is screwed to the top of the post, is slotted to receive the tilting rack. This rack, cut from sheet iron, is mounted on a block of wood which is pivoted with brackets at the sides as shown. —J. T. Garver.

Small Drill



The photograph shows how a small drill may be made in an emergency. The point, of course, must be filed drill-fashion and then tempered. The bent corners should also be tempered unless the wire is very thick and is not in danger of bending under the pressure needed. —V. B. Rickey.

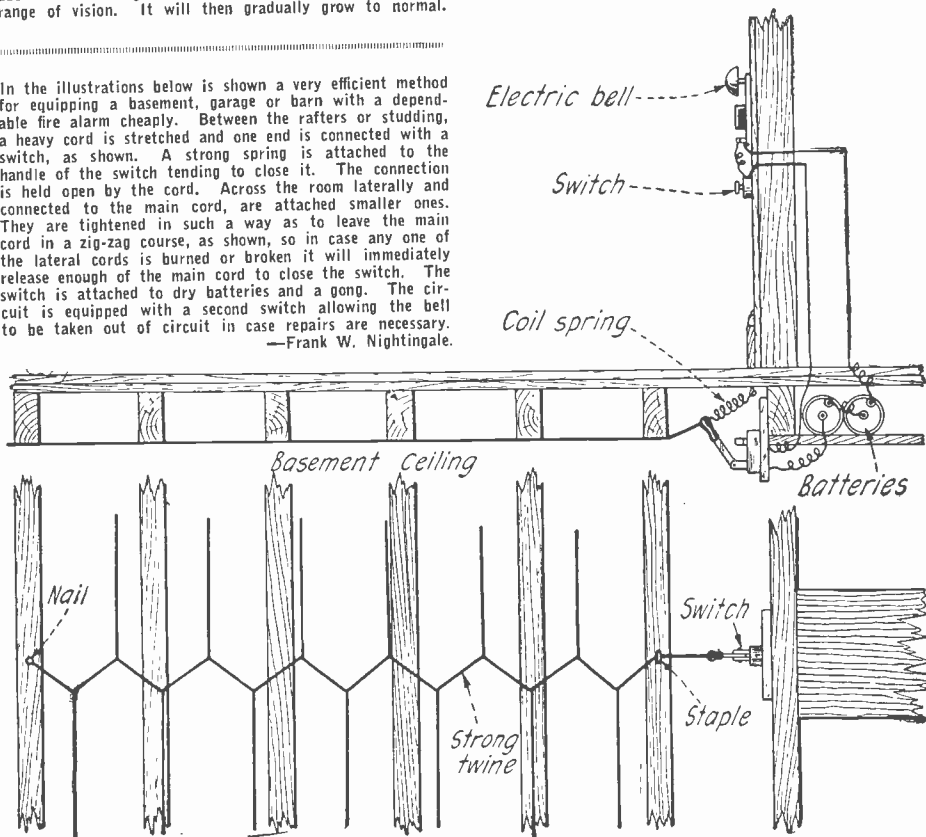
AN INTERESTING ILLUSION



EFFICIENT FIRE ALARM

If a paper disk about an inch in diameter is pasted to a frosted lamp shade as shown at the left, and is looked at from a distance of ten or twelve feet, it will seem only about half its regular size when it first comes into the range of vision. It will then gradually grow to normal.

In the illustrations below is shown a very efficient method for equipping a basement, garage or barn with a dependable fire alarm cheaply. Between the rafters or studding, a heavy cord is stretched and one end is connected with a switch, as shown. A strong spring is attached to the handle of the switch tending to close it. The connection is held open by the cord. Across the room laterally and connected to the main cord, are attached smaller ones. They are tightened in such a way as to leave the main cord in a zig-zag course, as shown, so in case any one of the lateral cords is burned or broken it will immediately release enough of the main cord to close the switch. The switch is attached to dry batteries and a gong. The circuit is equipped with a second switch allowing the bell to be taken out of circuit in case repairs are necessary. —Frank W. Nightingale.





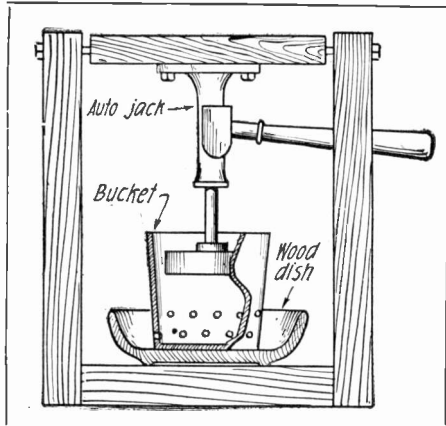
HOW-TO-MAKE-IT



This department will award the following monthly prizes: First prize, \$15.00; second prize, \$10.00; third prize, \$5.00. The purpose of this department is to stimulate experimenters toward accomplishing new things with old apparatus or old material, and for the most useful, practical and original idea submitted to the Editors of this department a monthly series of prizes will be awarded. For the best idea submitted a prize of \$15.00 is awarded; for the second best idea a \$10.00 prize, and for the third best a prize of \$5.00. The article need not be very elaborate, and rough sketches are sufficient. We will make the mechanical drawings. Use only one side of sheet. Make sketches on separate sheets.

Fruit Press

FIRST PRIZE \$15

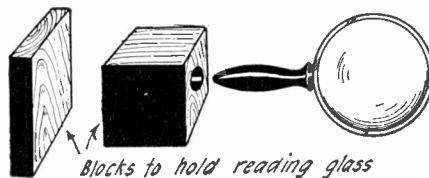
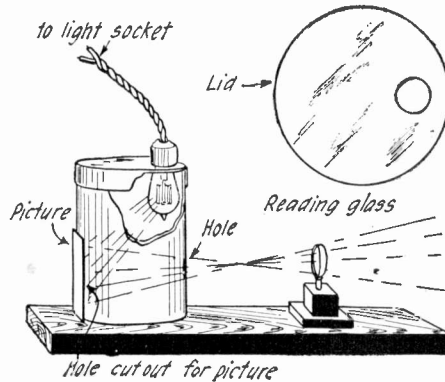


Into a large wood frame constructed as shown above, put a large bucket with two lines of holes drilled around the bottom. Place the fruit to be pressed in the bucket, and on top of it place a circular wooden block, which will fit snugly inside the bucket. Press the fruit by using an automobile jack between the wooden frame and the block on top of the fruit. It is then only necessary to run the jack down, squeezing the fruit through the small holes. For convenience keep a pan beneath the bucket.

—Charles H. Carr.

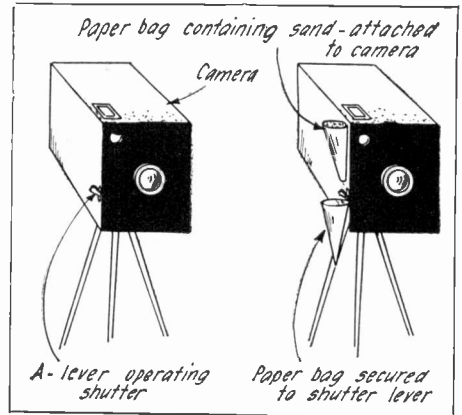
Magic Lantern

SECOND PRIZE \$10



Shutter Trip

THIRD PRIZE \$5



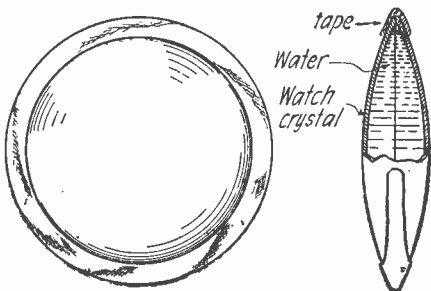
By fastening a paper cone to the shutter of a camera and then placing a second cone of sand above it, allowing the sand to fall into the first one, a time trip is made.

—J. Stevenghagen.

If the light from an ordinary 60-watt lamp is caused to fall on a picture, and the rays passed through a reading glass, a satisfactory magic lantern results. The light and picture are fixed in a bucket or can, as shown. The beams then pass through a hole in the front of the can, then through the reading glass.

—George W. Morton.

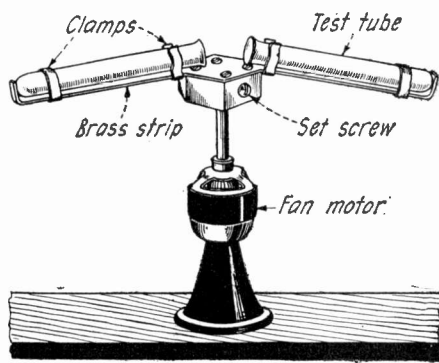
Watch Crystal Lens



A very serviceable lens can be made by filling two watch glasses, which have been thoroughly waxed and polished, with water, and then sealing the edges. A little grease (vaseline) is smeared carefully around the edges of the glasses, after which they are dipped into the water and put together. Be careful that no air is allowed to remain between them. The lens is then removed, bound with surgeon's adhesive tape, and the edges given a slight coat of vaseline.

—Carlyle Weiss.

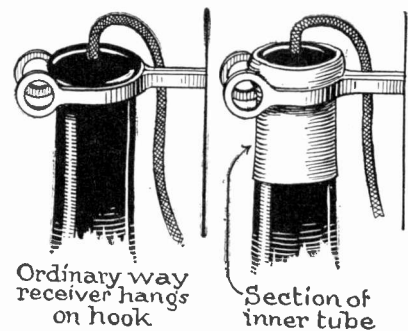
Electrical Centrifuge



By cutting a strip of sheet iron to hold test tubes, as shown above, screwing it tightly to the wooden block, which has a set-screw, and making the whole fast to a fan shaft, an electrical centrifuge is made.

—Dr. E. T. Sonendriker.

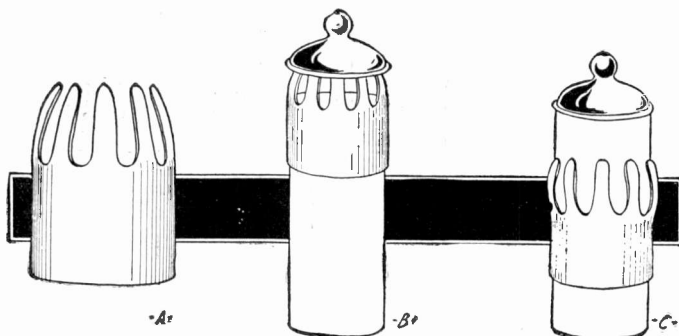
Receiver Silencer



The clatter and mishaps befalling frequently used telephones may be avoided by covering their tops with a short length of inner tube or large rubber hose, as shown above. This precaution will pay for itself many times in broken receiver caps and tempers.

—L. B. Robbins.

Nipple Placer



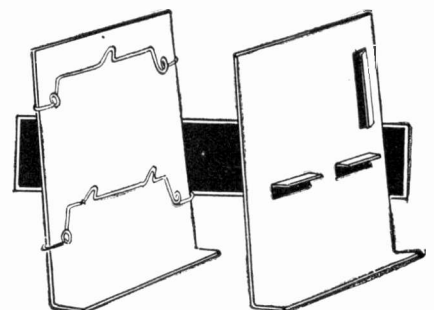
By using the metal cone, constructed as shown in the accompanying illustration, the trouble experienced in placing a nipple on the large-mouthed baby bottles, will be greatly reduced. After use, the cone is removed over the body of the bottle as shown.

—Jay G. Hobson.

Sheets of tin about 20 inches high, cut and fitted with springs, as shown, set behind a typewriter, make excellent copy holders. On the one to the right, the sheets to be copied are merely set on the protruding lugs, while on the one to the left the stenographer's notebook is placed under the spring wire clips.

—Jacob Schmidt.

Typist's Help





WRINKLES

RECIPES & FORMULAS



Edited by S. GERNSBACK

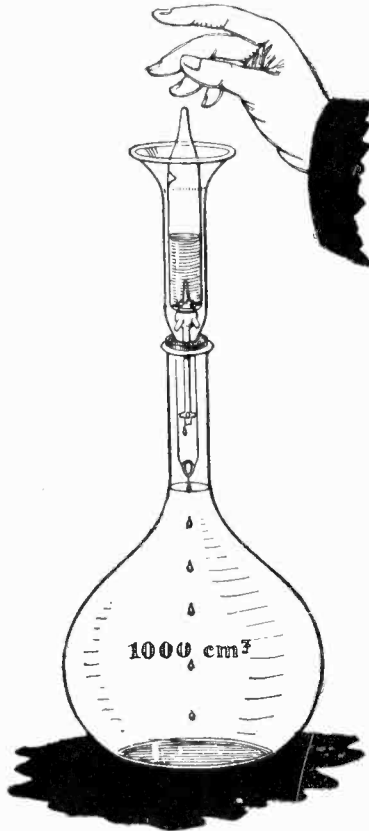
Sugar-Soap Experiments



Above is illustrated an experiment showing the difference of effects caused by the currents formed on top of a basin of water by substances which are porous and non-porous, and are dissolved in water. Small particles of candle grease are dropped on the edge of the water in the basin, as shown. If a lump of sugar is placed in the center of the pan, the particles are attracted to it. If soap is used instead, they are repelled.

—Dr. Albert Neuburger.

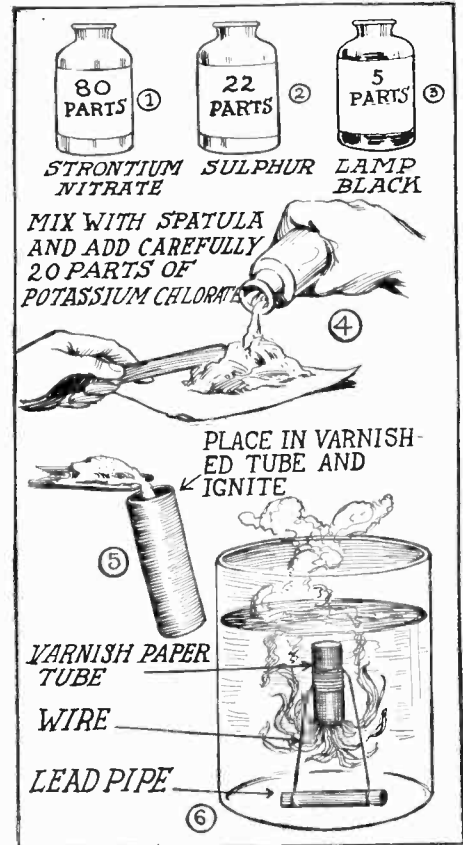
Measured Chemicals



Knowing the difficulty of amateur chemists in analytical work on account of the high price of the necessary balances on which to weigh chemicals in quantitative work, a New York firm has placed small containers of chemicals very accurately weighed, on the market. The chemical comes dissolved in a known amount of distilled water in an hermetically sealed tube. This tube is broken into a special funnel as shown in the drawing above. By this method the amateur may carry on his work with the accuracy of the expert.

—Raymond B. Wailes.

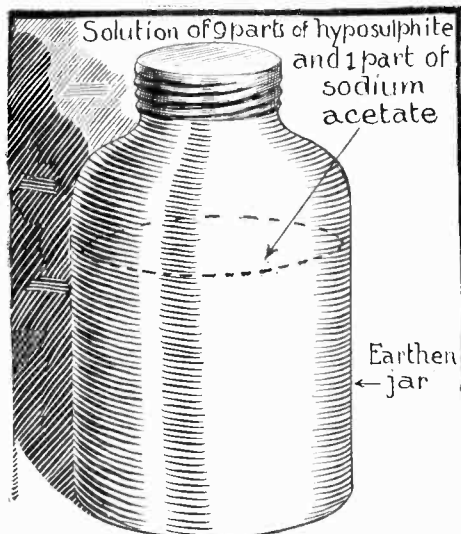
Fire Under Water Stunt



By mixing the chemicals in the ratios shown in the above sketch very carefully, adding the potassium chloride last, and placing them in a varnished tube supported by wires, attached to a lead pipe, igniting the chemicals and placing the whole in a jar of water, the fire can be made to burn and the flames pass up through water. The lead pipe is used to hold the tube and chemicals under the water.

—Orhan R. Coblentz.

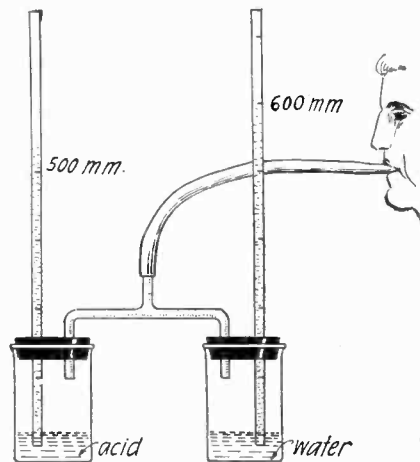
Hot Water Bottle



Above is shown the construction of a simple chemical hot water bottle. An earthenware jar is used into which a solution of nine parts of sodium hyposulphite and one part of sodium acetate are poured.

—Poly Rene.

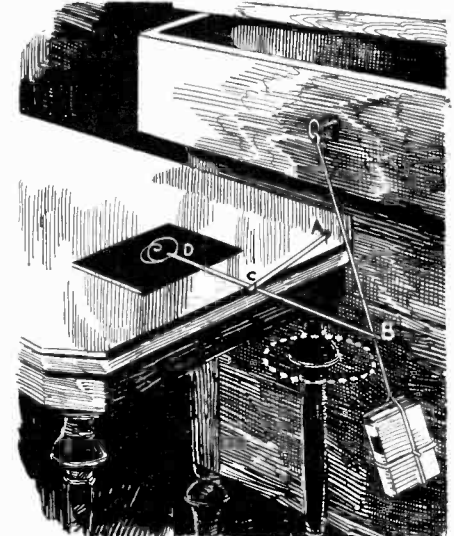
Specific Gravity Balance



By comparing the height of an unknown liquid with the height of water in two equally sized tubes, under the same amount of air pressure, as shown, the specific gravity of the unknown liquid may be ascertained by calculating the ratio of the height of the two liquids used. Fifty centimeter beakers and six millimeter inside-diameter tubes serve well.

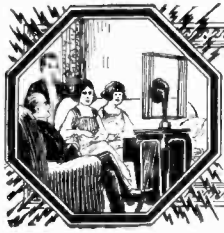
—J. L. Gripps.

Pendulum Graph

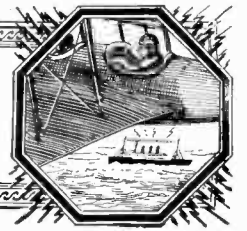


A pendulum made to swing so that it will not pass and re-pass through its vertical position will describe an ellipse which turns slowly about its center. This is proven with the graph apparatus, constructed as shown above.

—Ben Zyt.

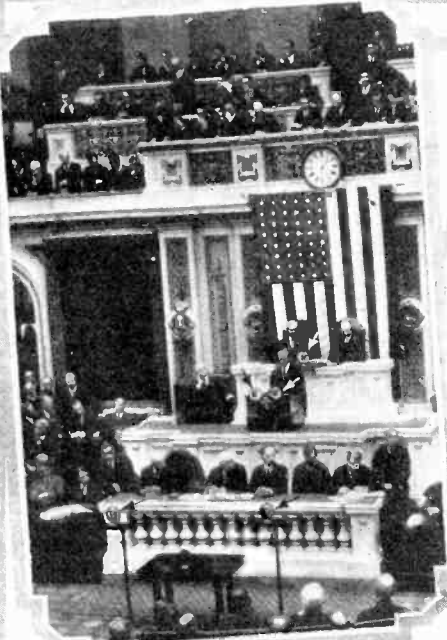


RADIO

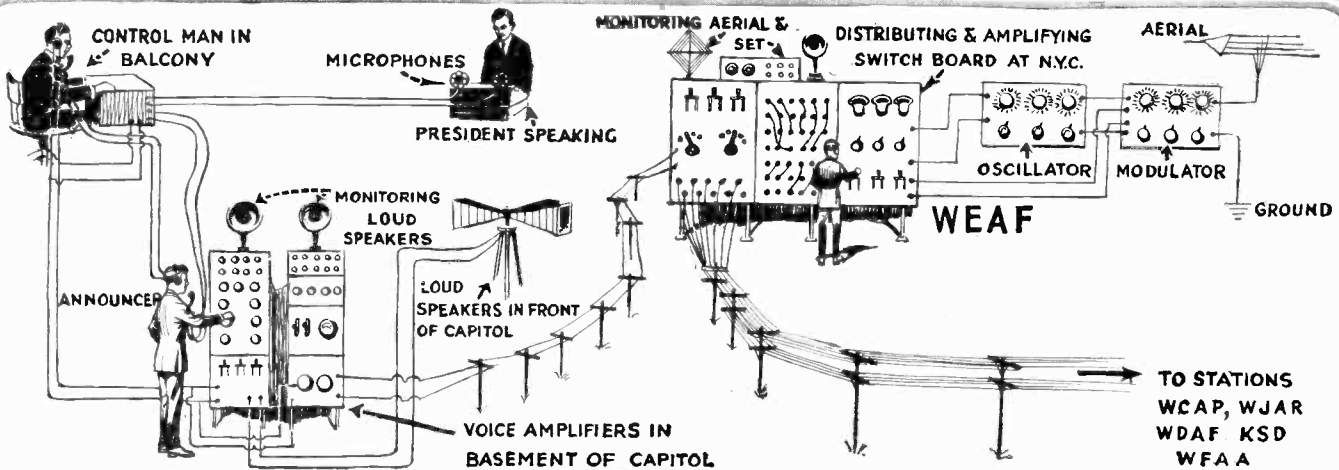


Broadcasting the President's Message

By A. P. PECK.



For the first time in the history of our country, microphones for use in broadcasting speech were installed in the halls of Congress and were used for broadcasting President Coolidge's message to Congress and as a result hundreds of thousands of citizens throughout the United States were able to hear clearly and distinctly every word of the message. The photograph at the left shows the President as he stood delivering his message. Two microphones directly in front of him are indicated by arrows. Other microphones were installed in the House at the places indicated. By means of this system it was possible to send out electric currents fluctuating in accordance with the President's voice to six radio stations throughout the United States. At these stations the message was transformed into radio waves and broadcast. Many telephone engineers of the Bell System were busily engaged for several days in installing the special apparatus used and testing the circuits so that no mishap would occur during the course of the message. Thousands of people also congregated in front of the Capitol and loud speakers were installed on the steps, which worked from the power amplifiers stationed in the basement.

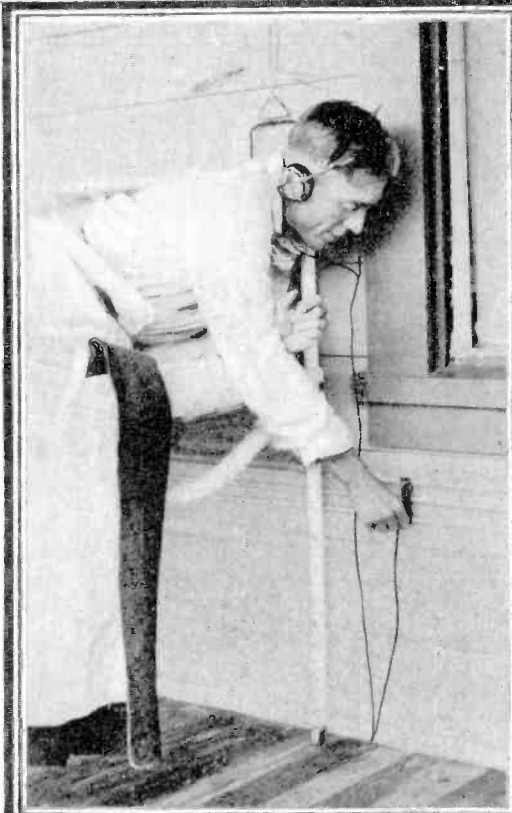


The drawing above shows, in simplified form, the apparatus used for broadcasting the President's address. The microphones directly in front of the President were controlled by an engineer stationed in the gallery of the House. The microphone of the announcer was also connected to the control box. By this arrangement the engineer in the gallery watched the President and other speakers and communicated with the announcer, thus keeping the system working in perfect unity. At this control either the microphone of the announcer or those in front of the President were cut into the voice amplifier circuit. It is interesting to know that every piece of apparatus used in this broadcasting feat was provided in duplicate and so arranged that either one or the other of the instruments could be used. This was just another safeguard provided by the broadcasting company. Every piece of apparatus was carefully watched by a competent telephone engineer and frequently tested.

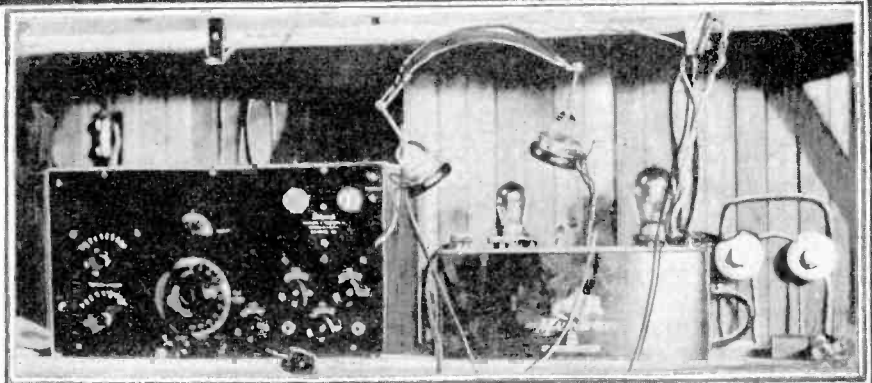


The photograph at the left shows the control engineer with a small switchboard located in the gallery. Note in the diagram, how after being amplified by the instruments in the basement of the Capitol the modulated electric currents were sent out over telephone lines and underground cables to station WEAF, located at 195 Broadway, New York City. Another check-up was made at this point by means of the monitoring set indicated. From the control board at station WEAF telephone lines extended to the various other stations indicated. These stations are located throughout the United States and enabled everyone with a radio set within the borders of the country to hear the President's speech. At various points along the telephone lines from WEAF to Washington and from WEAF to the various other broadcasting stations were located repeater or amplifying stations. These amplifying stations were provided with vacuum tubes which stepped up the incoming current and sent it out on the line again. The current strength was thus maintained until it reached the broadcast station.

Radio Cheers Hospital Patients



The patient in the above photograph is plugging in his head phones on a circuit used for distributing the radio music throughout the hospital. A special type of jack is used so that the volume remains constant at each pair of phones, regardless of the number plugged in the circuit. The volume of music is just sufficient to be plainly audible in the receivers and when a patient does not desire entertainment, all he has to do is remove the plug and take off the phones.

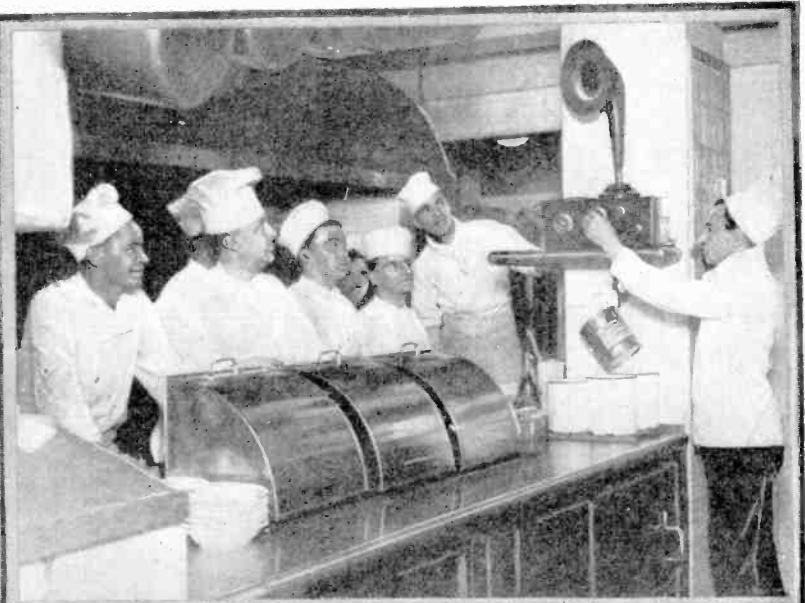


Above will be seen the receiving set used in hospital No. 64, Camp Kearney, California, where convalescent war veterans are cared for. The set consists of a standard short wave broadcast receiver with an external power amplifier so arranged that the signals will be audible in special head phones throughout the building. This is the largest radio installation of its kind in this country.



The above photograph is a view of one of the hospital wards, showing the many patients with receivers on their heads. This form of entertainment has proven highly successful and contributes greatly to the comfort of the inmates of the institution. In this installation 9,000 feet of wire are used for connecting to seven separate wards. One hundred and twenty phones are used.
—M. Wiley—Reporter No. 3527.

The Diversified Uses of Radio



No longer need one who desires a haircut or shave listen to the rambling conversation of the barber. At the left will be seen the method used for eliminating this annoyance. A radio set has been installed in the barber shop and music is constantly forthcoming, thereby turning a duty that used to be borne of necessity into an actual pleasure. Directly above is shown another use of radio by means of which the chefs in a large hotel kitchen are entertained by good music and thereby influenced to turn out better meals. The strains of radio music seem to be an exhilarating effect and cause the men to work faster and take an interest in their duties.

BROADCAST ÷ STATIONS



THE question "What becomes of the hams?" has been asked time and again by those who trouble themselves over such things. The picture at the top and to the right will show what has become of one "ham," as the more advanced amateur radio operators are called. These two photos are of broadcasting station WRAY, Scranton, Pennsylvania, which is owned and operated by John Harvard Jones, known to the listeners acquainted with his wave length and his station as "Casey." The two photos of the station show the interior of the studio. The construction follows the usual principles. One of the greatest problems in connection with operating a broadcasting station in a town of comparatively small population is the problem of supplying talent when there is a program to be given every night. This was one of the greatest problems that confronted the owner and operator of WRAY. He solved it in a truly workmanlike way by running a private wire to the town's two chief places of amusement—a theatre and a concert hall. By careful construction and much experimenting all the kinks were taken out of the land line business until it now delivers the voice to the radio microphone with all clearness.

In the photo below is seen station WIAO, at the School of Engineering, Milwaukee, Wisconsin. The broadcasting is done on a two tube 100 watt set.

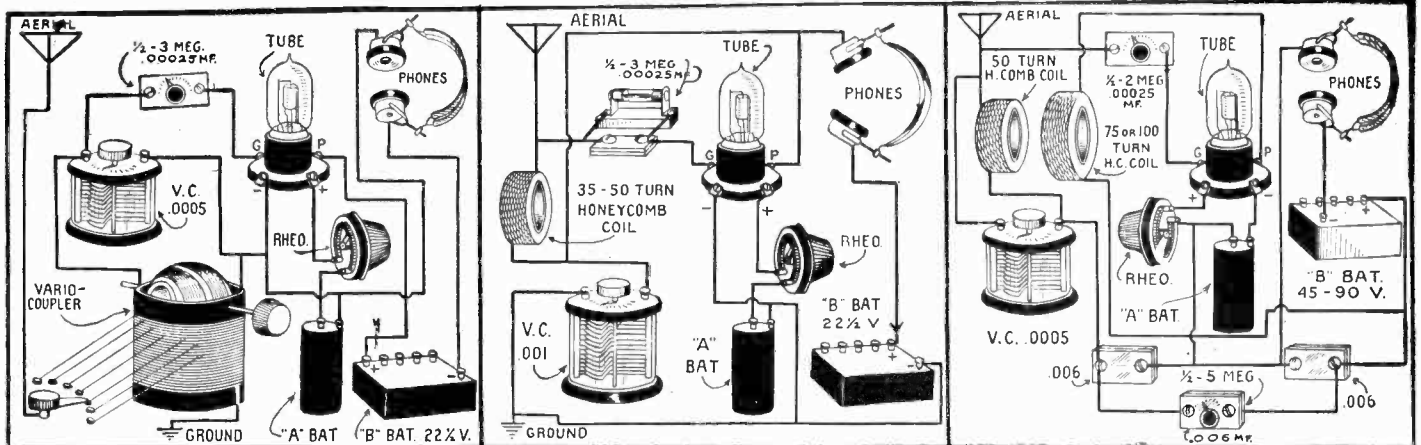


Radio for the Beginner

Information on Circuits of Interest to All Amateurs.

By ARMSTRONG PERRY

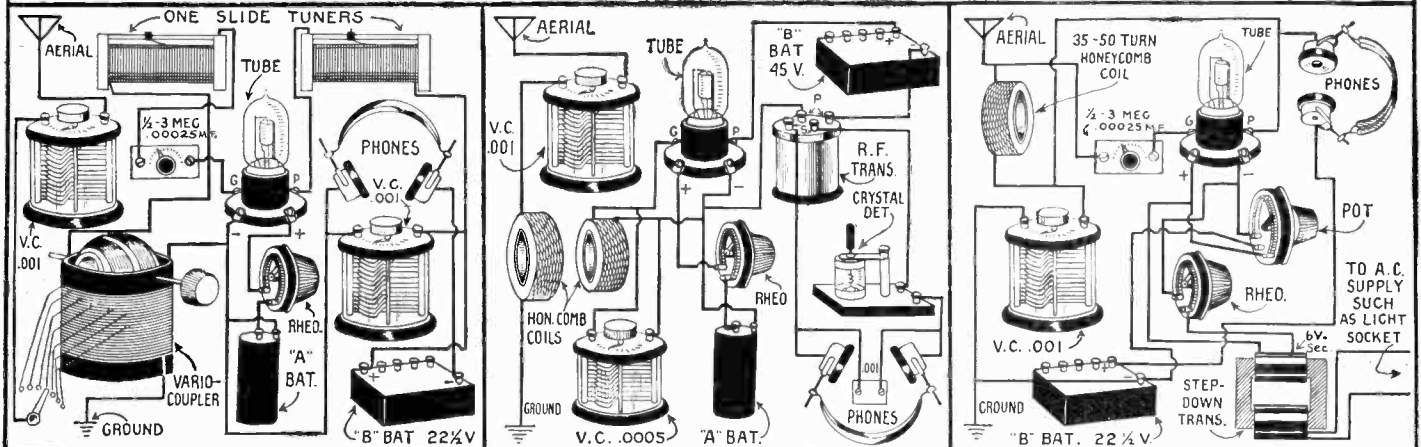
No. 24.—Single Tube Circuits.



The above circuit diagram shows a vacuum tube connected as a straight detector. This circuit serves very well to study the action of the detector tube. For short range reception it gives very clear signals. Practically no distortion will be found in this circuit because of the absence of regeneration.

An adaptation of the De Forest ultra-audio or oscillating circuit is shown above. In this set the tuning controls are reduced to one—the variable condenser. Honeycomb coils of various sizes should be tried in this circuit until the size which gives best results is found. For broadcast reception, use a 35, 50 or 75 turn coil.

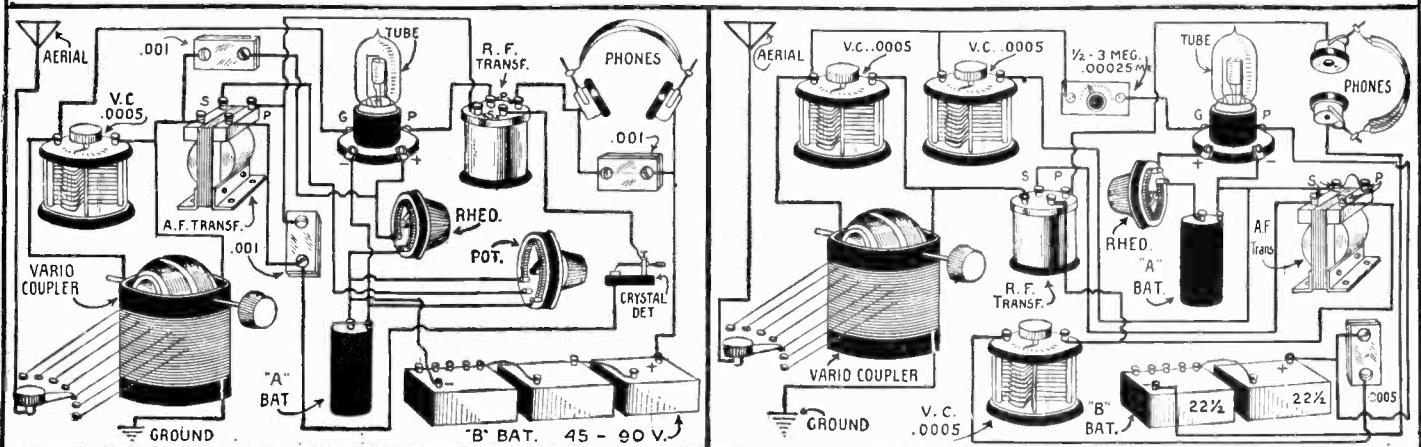
A simplified "super" of the Flewelling type is shown above. Three fixed condensers with a capacity of .006 mf. give rise to the variation frequency; a distinctive feature of any super. Shunted directly across the lowermost condenser in the diagram above is a variable resistance, ranging from one-half to five megohms.



A variation of the standard three circuit tuner consisting of a variocoupler and two variometers is shown above. The two variometers are replaced in this circuit by two one-slide tuners. The operation of this set is similar to a three-circuit tuner. The sliders on the coils, however, are used instead of the knobs of the variometers.

In the circuit diagram shown above, a vacuum tube is employed as a radio frequency amplifier and a crystal detector is placed in the circuit for rectification. The antenna and secondary circuits are tuned with honeycomb coils. Even though no regeneration is used, very good results on "DX" reception may be expected.

It is possible to employ 110-volt A. C. circuit for lighting the filament of a vacuum tube. The hum caused by the A.C. can be cut down by shunting a 200-ohm potentiometer directly across the filament circuit and connecting the grid return to the center post. The potentiometer is varied until the hum is reduced.



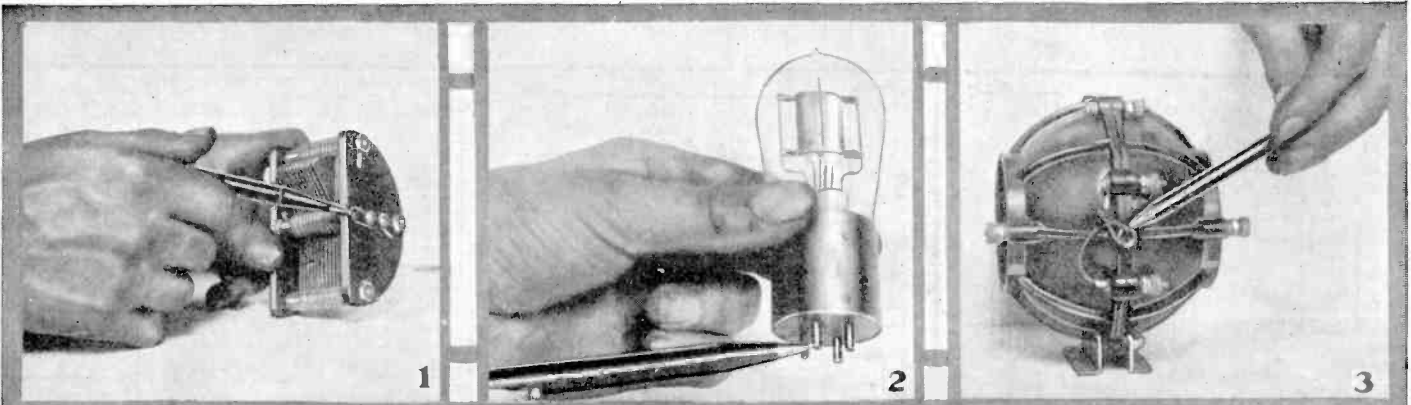
Radio and audio frequency amplification may be accomplished with one tube, using a crystal detector for rectification as shown above. In experimenting with a circuit of this type, the amateur should always have at hand two or three different types of both radio and audio frequency transformers, so that he may experiment with them and check the working qualities of the various types against each other. It is often found that certain types of radio frequency transformers will not give good results.

The above circuit diagram shows how both radio and audio frequency amplification as well as rectification may be obtained with the same vacuum tube. This circuit is very critical and is not one of the type which can be hooked up and made to work properly at once. Considerable experimentation is necessary in connection with the various instruments. Radio frequency amplifying transformers should be carefully selected and tested in a set of this type before one of them is permanently mounted.

Radio Trouble Shooting

Illustrating Several Places Where Trouble May Be Encountered.

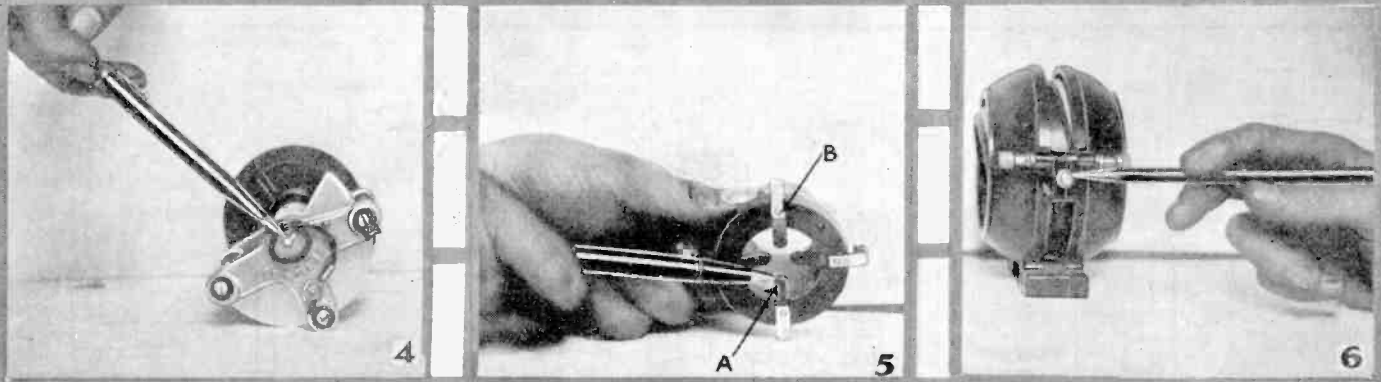
BY JACK MILLIGRAM.



One of the greatest bug-bears of radio instruments is the sliding contact. In the above photo, the pencil points to a sliding contact by means of which connection is made to the rotating plates of a standard type of variable condenser. Great losses are very often found here especially when the contact lever becomes loosened. Such connections should be avoided. If it is necessary to purchase instruments of this type, a flexible lead wire should be used.

Very often the base of a vacuum tube is the seat of trouble in a radio receiving set, but usually this is the last point considered by the amateur when hunting trouble. The pencil in the above photograph points to the end of one of the prongs of a vacuum tube. This point should be carefully cleaned with fine emery paper, making sure that no traces of the emery are left in the soft solder found at this point. Corrosion should not be tolerated at these prongs.

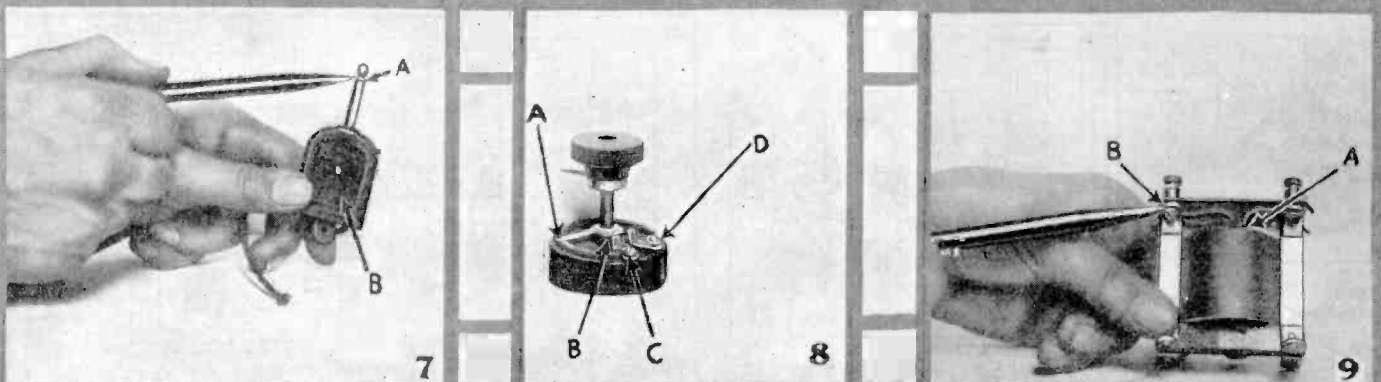
Variometers also have their troubles when it comes to the question of making connections to the interior or rotor coil. Above is shown one of the best forms of making such connections. The shaft on which the rotor is mounted is a hollow brass tube and through it are brought the leads from the rotor windings. These leads are of the flexible or "pigtail" type. Stops must be employed so that the rotor will not turn through more than 360 degrees.



The main trouble with rotary variable condensers was illustrated in Fig. 1. Above in Fig. 4 is shown a standard type of variable condenser in which this trouble is eliminated by the manufacturer. It is necessary for the "pigtail" to turn so as to follow the rotary shaft. Therefore, it must be thoroughly flexible so that it will not break after being turned several times. Here again stops should be provided so that the pigtail cannot twist too far.

Now we come to the troubles of the sockets into which the vacuum tube illustrated in Fig. 2 fits. Many radio ailments are attributed to innocent sources when in reality the blame should be laid on the vacuum tube socket. In the type illustrated above, point A shows one of the lugs bent out so that it does not make contact with the base of the tube. Point B shows where poor contact is very often found between the binding post support and the spring.

The best type of connection for the rotor coils of a variometer is shown in Fig. 3. Above, in Fig. 6, we illustrate a type of variometer which depends upon a sliding contact to connect the rotor coils to the external circuit. Sometimes this works very well, but after much use the bearings usually become enlarged from constant wear and fail to make proper contact. Obviously, such points cannot very well be lubricated and, therefore, the wear increases greatly.

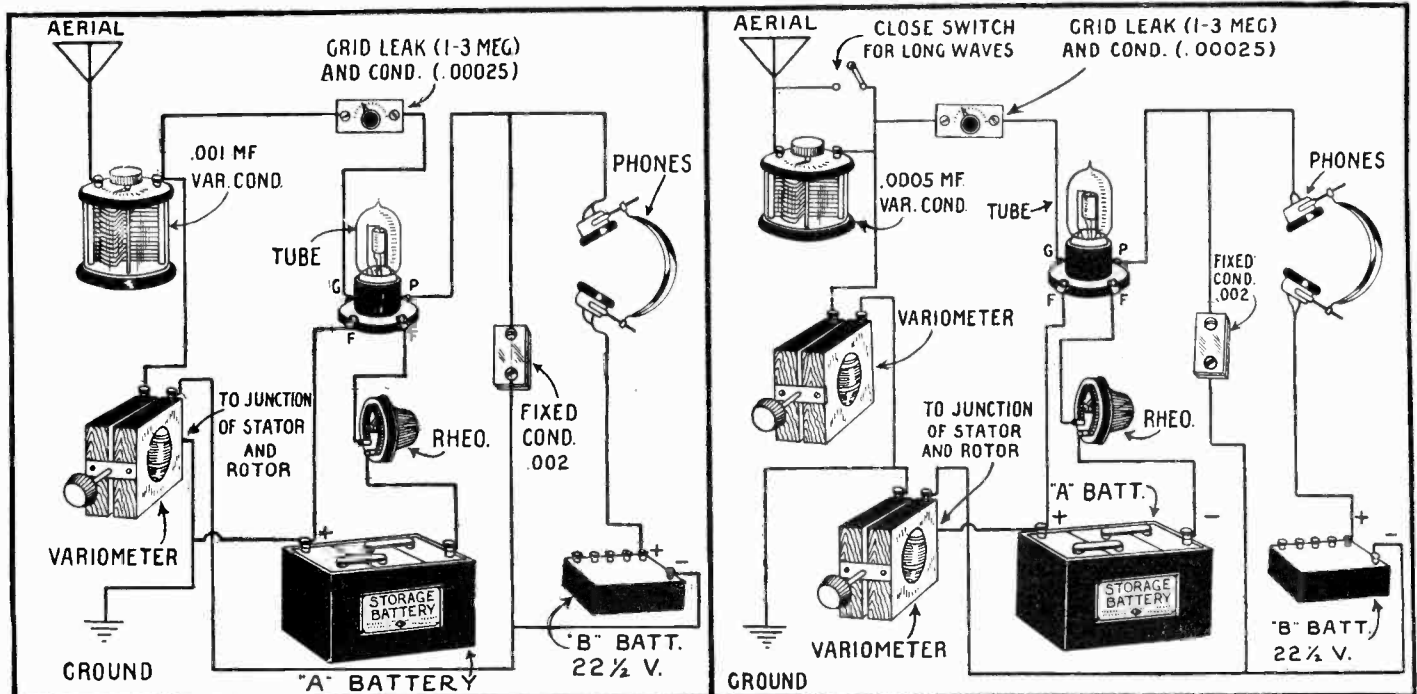


A indicates the small insulating disc placed between the two parts of the plug which make contact with two separate springs in the jack. Very often this ring is made of fibre and when it absorbs moisture from the air it becomes a partial conductor. This point should be watched carefully. B indicates the portion of the plug in which contact is made between the phone tips and the plug. Only the type of plug which grips the phone tips firmly should be used.

There are several points on a rheostat which can give rise to trouble. In the above illustration, A indicates the contact arm. Sometimes this arm becomes loosened or the spring is weakened whereupon it fails to make contact with the coil. B indicates the connection between the switch arm and the shaft. This should be kept tight. At C is connected one end of the resistance wire. The binding posts at C and D should always be kept tight.

Very often the troubles in transformers are due to something which may readily be fixed. For instance, the connection indicated by B very often becomes loose, or if it is soldered, it sometimes becomes unfastened from the base of the binding post. A indicates the connection between the leads to the binding post and the actual windings of the transformer. No amount of strain, however small, should be placed on these leads under any condition.

Variometer and Variable Condenser Receiving Set

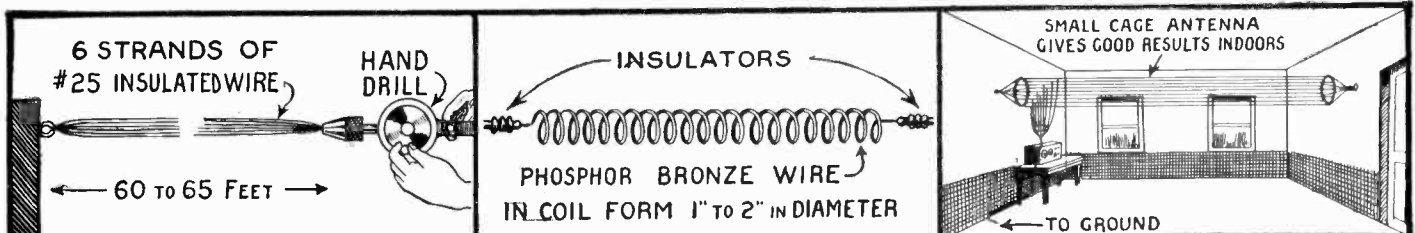


A regenerative receiver having but two controls may be connected up as shown above. Note that the ground lead goes to the junction of the rotor and stator. Since this is the case, only one-half of the total inductance of the variometer tunes the antenna circuit. Therefore, this instrument should be of quite a large size. The "B" battery should be variable from 16 to 22½ volts. Regeneration is accomplished in this case by means of the well known ultra-audion effect. If trouble is found in reaching the required wave-length, the variable condenser may be connected across the variometer from the antenna binding post to the center tap which connects to the ground. In this case, the antenna should be connected directly to the side of the grid leak which goes also to one side of the variometer.

The above circuit diagram shows two variometers connected up in a manner very similar to that originally used by Major Edwin H. Armstrong when experimenting with regenerative circuits. This utilizes a feed-back in which the lower variometer acts both as a feed-back coil and the pick-up coil for the secondary circuit. The antenna circuit is tuned by means of the variable condenser and the upper variometer and the secondary or grid circuit is tuned by means of the latter mentioned instrument. A switch is provided to short-circuit the variable condenser for longer wave-lengths and for still higher results, the variable condenser may be shunted directly across the upper variometer.

—W. L. Pearce.

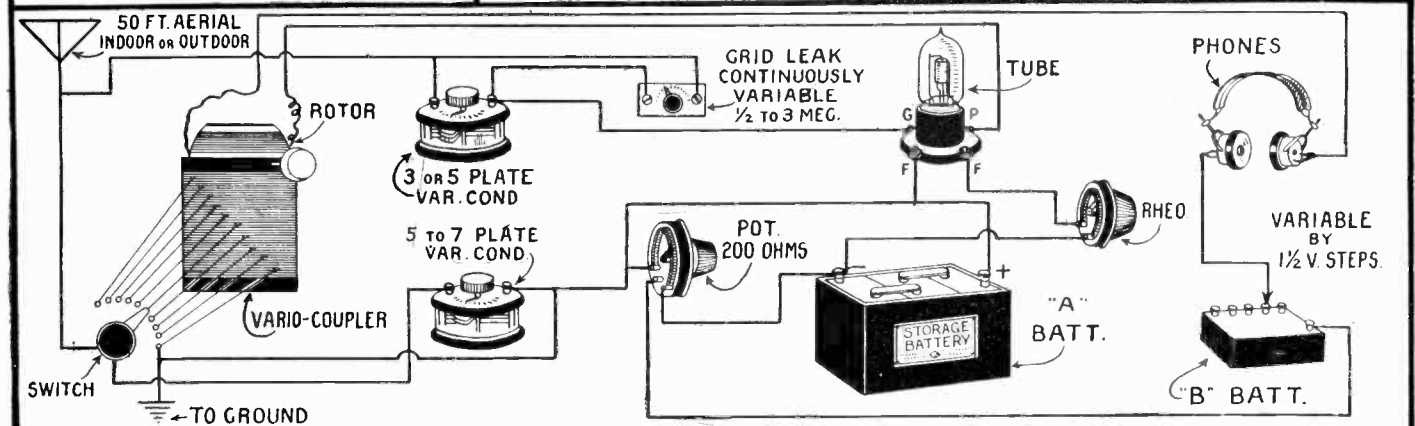
Short Aerials Increase Selectivity



Excellent antenna wire for a short stretch may be made by twisting together six strands of wire with a hand drill as illustrated. The resulting length should be long enough to make both antenna and lead-in.

A coil form of antenna recently placed on the market is illustrated above. This is a coil of phosphor bronze wire about one inch or so in diameter which can be stretched out to as long as 100 feet.

For inside use with a very good receiving set, a cage antenna should be constructed. This aerial may have from 4 to 10 wires and the lead to the set should be composed of the same number.



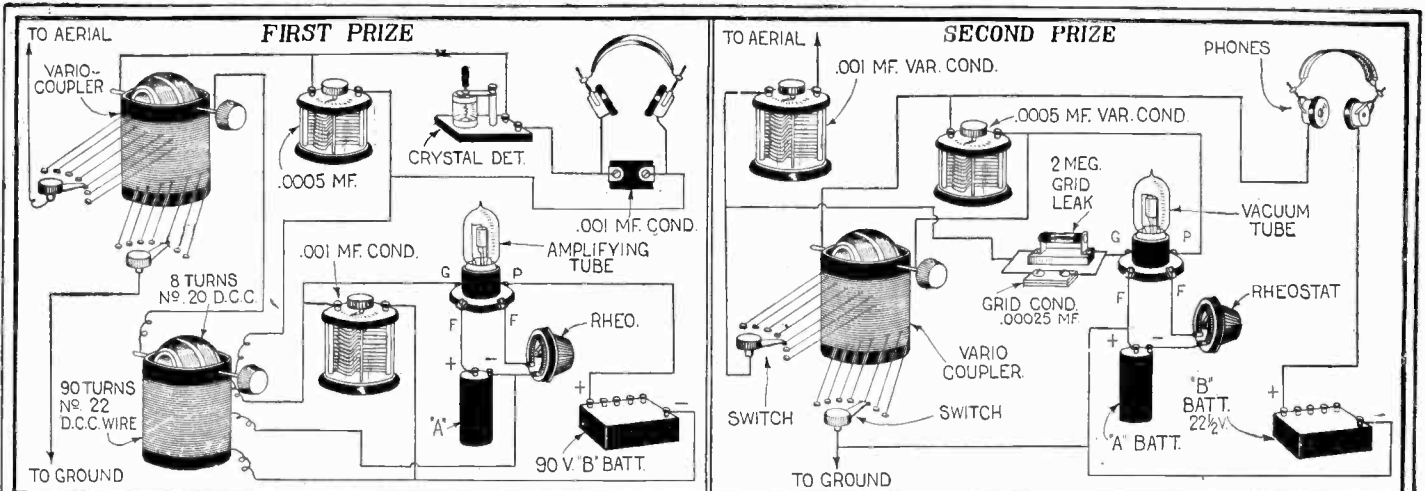
Where very short antennae are used, it will be found that selectivity will be increased considerably and if careful attention is paid to the adjustment of the instruments, there need be no loss in efficiency or volume. In order to obtain these results, only the best of instruments must be used. Bakelite insulation should be demanded on all instruments and that composition known as "mud" should be carefully avoided. The latter causes comparatively great losses as it is very often a

partial conductor. Also in order to attain good results, practically everything on the set should be variable. A variable grid condenser should be used, which should have a maximum capacity of .0003. The ground condenser may be slightly larger, in some cases even as high as .0005 mf. being advisable. A potentiometer should be used in connection with the "A" and "B" battery and the latter should be variable by 1½ volt steps as indicated above.

—Paul Oard.

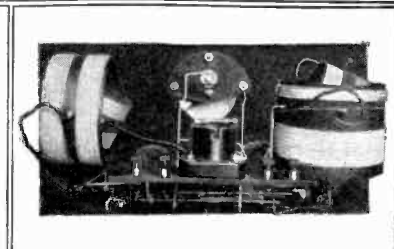
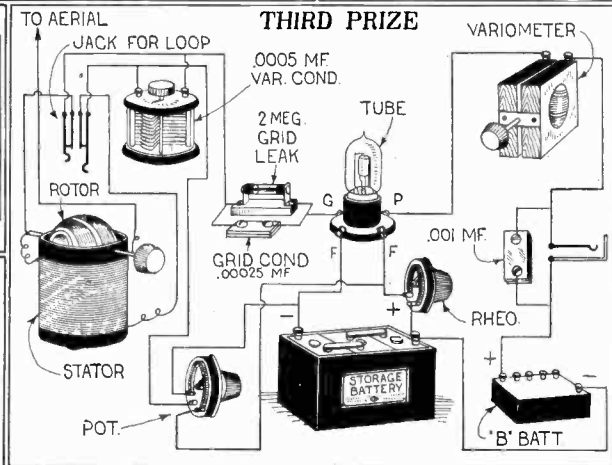
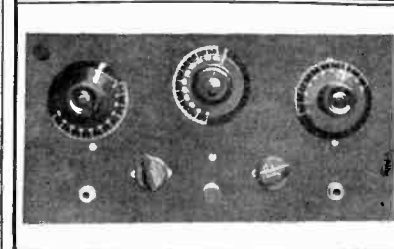
"DX" Prize Winning Circuits

These Five One-Tube Circuits Won \$100.00 in Prizes.



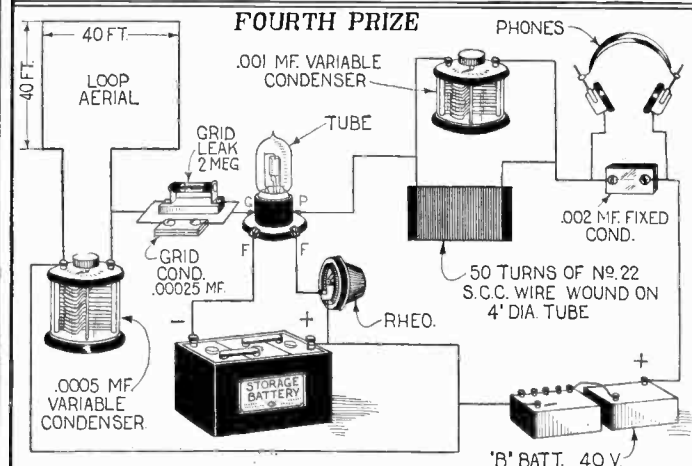
The circuit winning first prize was designed and built by Mr. R. D. B. Washburne and for it he gets a prize of \$50. The circuit is plainly shown above. It consists of an oscillator using a vacuum tube and acting upon a crystal detector circuit. All data on the necessary instruments is given in the circuit diagram. The set is tuned by tuning the coupler in series with the antenna and the .0005 mf. variable condenser. The rotor of the oscillation coupler and the .001 mf. variable condenser are then balanced until the best results are obtained.

The second prize, \$20, goes to Mr. Harry Ackerson. The circuit diagram of Mr. Ackerson's set is shown above. At first glance, it would seem that it is nothing more than a standard single circuit tuner, but there is one addition and therein lies the secret. This is a variable condenser with a small capacity which is shunted across the rotor. This condenser should have a capacity of approximately .0005 mf. The addition of this condenser allows very close tuning and it should be equipped with a vernier so that the set can be handled properly.

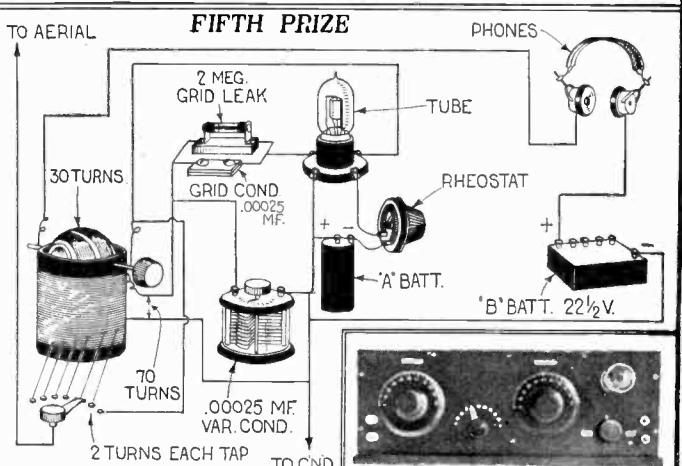


The receiving set designed by Mr. E. H. Cook is illustrated in the photograph above and to the extreme right center of this page. The prize for this set is \$15. The circuit diagram of Mr. Cook's set is shown herewith. Note particularly that no ground is used and that the variocoupler is not hooked up in the standard manner. A double circuit jack is included in the secondary circuit so that a loop may be used for local reception. Mr. Cook states that there are three different types of antennas which will operate satisfactorily with this set. One is a four-foot loop with ten turns of No. 20 wire, the second is an ordinary water pipe and the third is a standard single wire outdoor antenna 75 feet long. He states that with the second type, results almost equal to an outdoor antenna were obtained. The constructional details of the variocoupler and variometer are as follows. The stator of the former is wound

on a bakelite tube 3 1/4 inches long by 4 inches in diameter. It consists of 55 turns of No. 26 D.C.C. wire. The secondary or rotor is wound on a tube 2 inches long by 3 inches in diameter, 60 turns of No. 28 D.C.C. wire being necessary. The variometer has 65 turns of No. 26 D.C.C. wire on the stator and a like number of turns of No. 28 D.C.C. wire on the rotor. Both instruments are assembled in the usual manner and may be mounted as illustrated in the photograph. This receiving set was designed to operate over a band of wave-lengths from 200 to 600 meters. During the winter, Mr. Cook states that he had no difficulty in bringing in stations over a distance of 1,000 to 1,500 miles. He also states that the quality of the reproduced signals is very good and in many cases equal in tone to that brought in by a crystal set, while at the same time the volume is much greater.



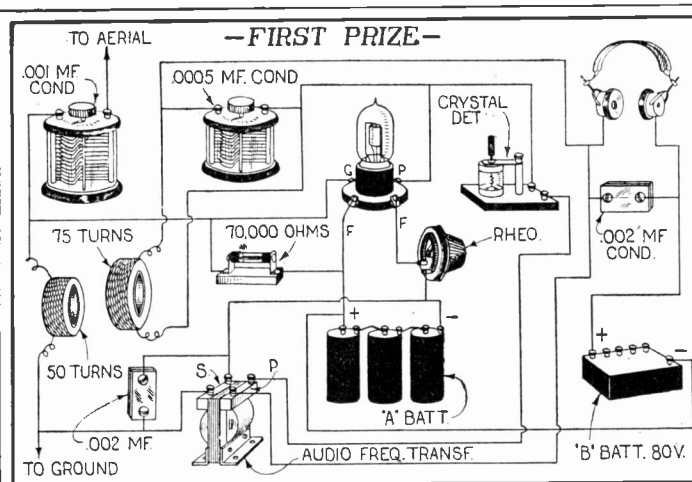
The fourth prize of \$10 goes to Mr. Jack Rogers. He has designed an extremely efficient single tube set to operate on a large outdoor loop placed in a horizontal position. The circuit diagram is given above. This set is an excellent combination of a loop receiver and a tuned plate circuit. The loop being horizontal, does not have a very great directional effect. Because no ground is used, selectivity is increased greatly and no difficulty should be found in bringing in stations over quite a long distance.



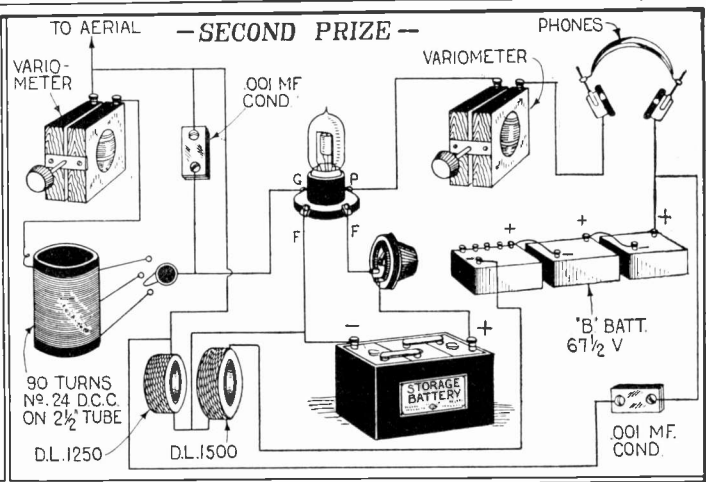
Mr. George E. Johnson, winner of the fifth prize, is awarded \$5.00. The circuit diagram of his "DX" receiver is shown above, while a photograph of the front of the set appears in the lower right corner. The variocoupler stator is wound on a 4-inch tube. Seven switch points are used, six of them connected to taps on the stator and one to the plate. By placing the switch blade on this point, an excellent oscillating circuit is obtained for use in the reception of C.W. signals. On phone and spark, this set tunes rather sharply and will bring in "DX" signals very well.

Loud Talker Set Prize Winners

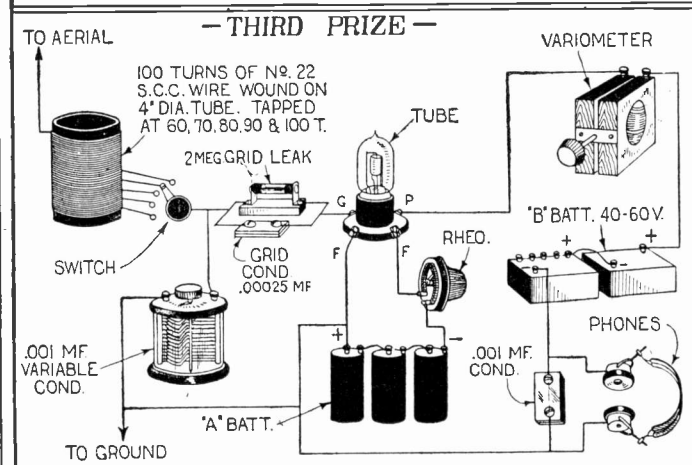
These Five Circuits Were Selected for the Volume Obtained.



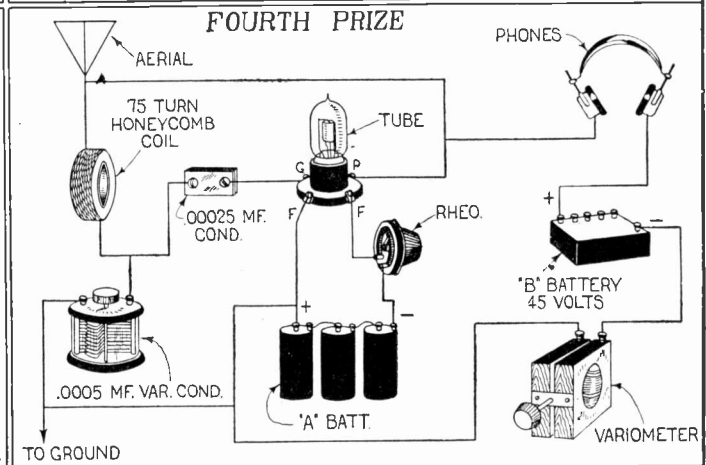
The first prize, \$50, in our Single Tube Loud Talker Contest is awarded to Mr. Harry Hahlbohm for the set; circuit diagram given above. Radio frequency amplification is obtained by means of the tickler feed-back which acts as a tuned impedance radio frequency amplifying coil. Audio frequency amplification is obtained through a standard audio frequency amplifying transformer. The main feature of this circuit which must be followed carefully is the 70,000 ohm resistance connected from the grid to the positive side of the "A" battery.



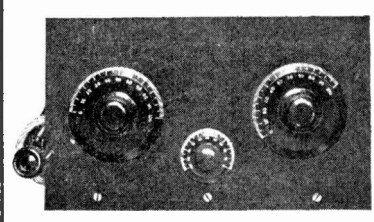
The second prize of \$20 goes to Mr. K. J. Dupee for a variation of the Armstrong super-regenerative circuit which is illustrated above. It will be noted that there are only two tuning controls and one control of regeneration. Two standard types of variometers are used and an extra coil, consisting of 90 turns of wire wound on a 2 1/2-inch tube, is connected in series with the grid variometer. This is tapped in three places. The two honeycomb coils need not be coupled together, but may be laid six to eight inches apart in the same plane.



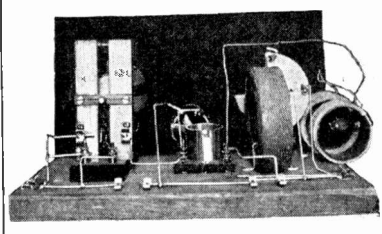
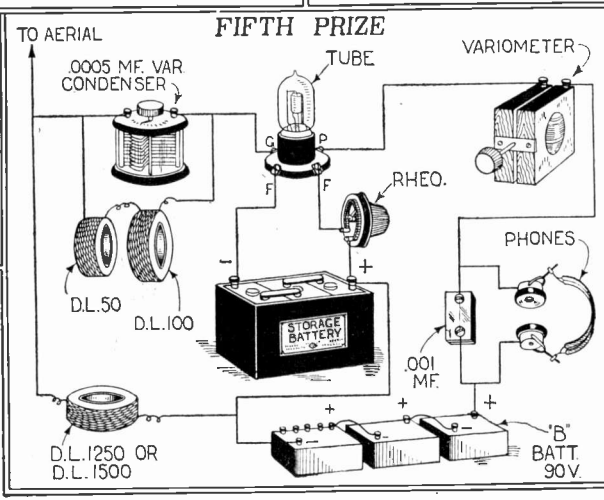
Mr. John H. Odenbach gets the third prize of \$15 for a loud talker circuit employing the tuned plate method of regeneration. The data on the antenna tuning inductance is given above. The variometer should be of a large size so as to cover a wide band of wave-lengths. Either a detector or amplifier tube may be used in this circuit and as much "B" battery as possible should be applied to the plate. Any one of the standard tubes from the 1 1/2-volt dry cell tubes up to the 6-volt tubes will give excellent results.



The fourth prize of \$10 is awarded to Mr. A. Ch'pka, Jr. As will be noted his set is a combination of the deForest ultra-audion oscillating principle and the Armstrong tuned plate method of regeneration. Excellent results are obtained with this circuit in selectivity as well as volume. The ultra-audion effect makes oscillation possible over a wide band of wave-lengths. The size of the honeycomb coil used for tuning the antenna should be determined by experiment and three or four coils should be kept on hand so that they may readily be exchanged and different sizes tried.



Mr. Bernard Guth, a New York City amateur and an enthusiastic experimenter with receiving sets, is awarded a \$5 prize for his set, capable of operating a loud talker on local stations. Mr. Guth's set is of the super-regenerative type and is quite similar to the Autoplex receiver. The main difference between Mr. Guth's set and the Autoplex is that instead of using a variometer to tune the grid circuit, he uses two honeycomb coils placed in variable inductive relation, connected in series and shunted by a variable condenser. This gives very critical adjustment of the capacity and inductance of the grid circuit. Mr. Guth employs two honeycomb coils mounted in a manner original with him. One of the coils is mounted on a short piece of bus bar wire which in turn extends through the panel and has a knob attached. This bus bar wire passes through the center of the stationary coil. By moving the knob



closer to or further away from the panel it is possible to adjust the inductive relation between these two coils. At the same time the variable condenser and the plate variometer are to be balanced until the signals are brought in loudest. Only one large honeycomb coil of either 1,250 or 1,500 turns is necessary to produce the variation frequency or "super" effect. The plate inductance consists of a standard type of variometer, but it should be of a large size and have at least 60 turns of wire on both stator and rotor. A hard or amplifying tube is to be used in this circuit and the "B" battery voltage should be as high as possible. This set, as well as the others awarded prizes in this contest, is subject to considerable experimentation. The instruments should be temporarily connected and tested. Slight changes and additions can then be made until the best operating conditions are found.

Simple Storage "B" Battery

LEAD PLATE
3"
1/8" THICK

SIDE BRACES (TWO)
1/2" LONGER THAN ASSEMBLED ELEMENTS

RUBBER RING

CONNECTION LUGS

FILLER HOLES

END PIECE TWO REQUIRED

CUT OUT ASSEMBLED BATTERY

TOP VIEW OF ASSEMBLED PARTS

Cut from sheet lead three inches square, circles of metal as indicated in the upper left hand corner of this diagram. A lug is formed on one side for connections. There should be as many of these plates as you desire to make cells, plus two extra plates for the ends. Each cell will give approximately 2 volts. Now obtain a quantity of rubber fruit jar rings and cut out a section as indicated. These rings and lead plates are now assembled as shown directly at the left and placed in an assembly frame, the dimensions of which are given above. The appearance of the finished battery is also shown. The rubber jar rings are cemented with rubber cement to the lead plates and placed immediately in the framework as shown. After the cement sets, paint the entire outside of the battery with asphaltum. At least two coats of this paint should be applied, allowing each to dry. Now fill each cell nearly full of a mixture of chemically pure sulphuric acid and distilled water. The electrolyte should have a specific gravity of 1.275. Charge and discharge the battery several times at a rate of one-eighth of an ampere until the plates are formed. It can then be put in use.
—Walter Johnson.

Using a Buzzer Test

to ground post on receiving set switch

X
Y

Buzzer

.001

3 V.

Dry cells fastened to table

Table top

Strap key

Supported by rubber bands

Buzzer

Fish globe or box

Cotton

to set

50 turns #22 D.C.C.
RESONATOR COIL

A buzzer test is a valuable asset to any crystal detector receiving set. Not only will it help to adjust the crystal to its greatest sensitiveness, but sometimes when a signal starts to fade, it can be brought back to its original strength by closing the switch and actuat-

ing the test buzzer for a second. A resonator coil is very often of great assistance, and may be connected in series at X-Y. At the right, in the above illustration, will be seen a suggested mounting for all the buzzer test apparatus.

The Dynaphone--A New Receiver

Earpiece casing

Coil

Diaphragm

Permanent magnet

Hard rubber cap

Diaphragm

Permanent magnet

Coil

A

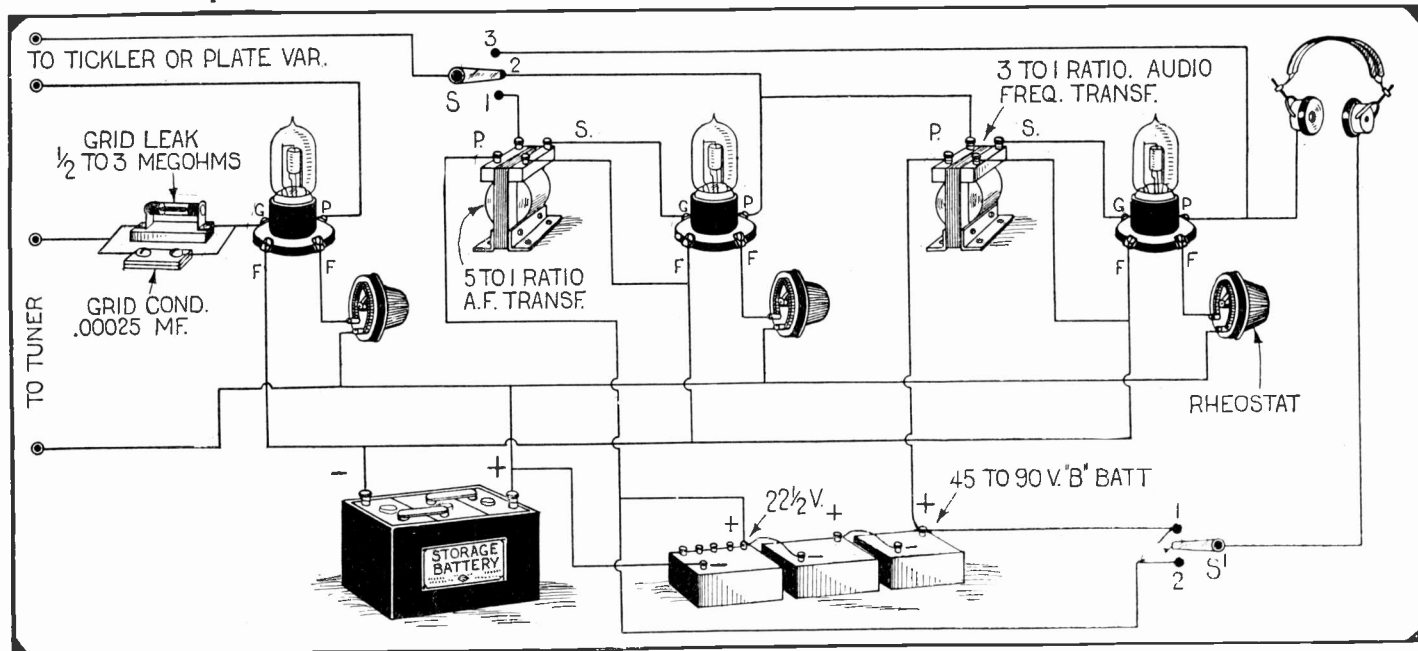
Earpiece casing

Above will be seen the details of a new radiophone receiver which has recently made its appearance in England. It does not have the usual pole pieces with wire wound thereon

as is found in the average phone. Instead, the coil is wound in pancake form and placed within a soft iron casting. The diaphragm is placed over this.

Radio Oracle

In this Department we publish questions and answers which we feel are of interest to the novice and amateur. Letters addressed to this Department cannot be answered free. A charge of 25c is made for all questions where a personal answer is desired.



Q. 218. Since jacks are rather inefficient instruments and often cause trouble because of a slight amount of grit or dirt between the contact points causes an open circuit, they should be avoided. An efficient way of eliminating jacks is to make use of two switches, one of the three point type and the other of the two point type. All the necessary connections are indicated above and the manipulation of the switches is described in the text.

A. F. AMPLIFIER WITH SWITCHES

(218) G. H. Gillis, M. D., Yatesboro, Penna., asks:

Q. 1. Can you give me a circuit diagram of a detector and two stage amplifier unit used either with a single circuit tuner or a three circuit tuner and include thereon a switch for changing from detector to one or two stages of audio frequency amplification without the use of jacks?

A. 1. In the diagram in these columns we show a detector and two stages of audio frequency amplification. Two switches are indicated. When switch S is on switch point 3 and switch S1 is on switch point 2, the detector alone is being used. With switch S on point 2 and S1 on point 1, the detector and one stage of audio frequency amplification are being used. The third tube then acts as the audio frequency amplifier. With switch S on point 1 and switch S1 on point 1, all three tubes are being used.

CHANGING TYPE OF TUBES

(219) C. O. Dieter, Rittman, Ohio, asks:
Q. 1. If I decide to substitute U. V.-199 vacuum tubes for those contained in my set at the present time, will any changes have to be made? The tubes I am using now are a U. V.-200 detector, and U. V.-201 amplifier.

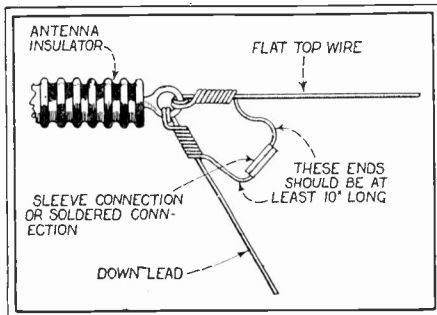
A. 1. In regard to the use of U. V.-199 tubes in your radio set, we would say that no radical changes will be necessary. You will, however, have to either substitute sockets for these tubes as they have different bases than the standard tubes, or else obtain adapters so that the 199s can be used in standard sockets. The above mentioned sockets or adapters can be obtained from companies advertising in the columns of this magazine. You will also have to substitute three dry cells for your present "A" battery and it is advisable to use 30 ohm rheostats.

LEAD-IN CONNECTION

(220) George Rice, Brooklyn, N. Y., asks the Radio Oracle:

Q. 1. What is the best way, mechanically and electrically, to connect a lead-in wire to a standard flat top aerial?

A. 1. We illustrate in these columns one of the best methods of making this connection. The connection between the flat top wire and the lead-in or down-lead has no mechanical strain exerted upon it and, therefore, its



Q. 220. Careful attention should be paid the connection of the lead-in to the aerial proper. Above is illustrated the best method for making this joint so that it will be strong and electrically perfect.

electrical qualities are not subject to change thereby. The joint may either be made with a copper sleeve connector or may be soldered.

INCREASING SELECTIVITY

(221) M. C. Baker, Los Angeles, Calif., asks:

Q. 1. How can I improve the selectivity of my crystal receiving set consisting of a variocoupler with ten taps and a variable condenser across the rotor?

A. 1. The selectivity of your set may be increased somewhat by placing a variable condenser either in series with the antenna or across the stator as may be found best by

experiment. This condenser should have a capacity of .0005 mf.

Since you do not state the length of your antenna it may be that it is too long. If such is the case, you should cut down the length so that it will be no more than 80 to 90 feet long, including the lead-in to the set.

DRY CELLS WITH CRYSTAL SET

(222) C. H. Dorman, Buchanan, Iowa, wants to know:

Q. 1. Can I connect dry cells in the circuit with my crystal receiver so as to increase the efficiency?

A. 1. We would advise you that you cannot use dry cells on this set with any increase in efficiency; in fact, it would decrease the results obtained. Only in the use of certain crystals can dry cells be used and it has been proven by experiment that such crystals do not give as loud reception and as great range of reception as galena or any one of the other crystals sold on the market today.

TROUBLE WITH CRYSTAL SET

(223) T. A. Dew, Bronx, N. Y., says that he has a crystal receiving set which does not operate properly. He states that all his instruments are in good condition and that he is using a short piece of copper wire as a cat-whisker. He asks:

Q. 1. Can you suggest some point that could be the trouble with my set?

A. 1. Since you say that your apparatus is all in good shape and tests up correctly, we would say that the trouble is probably in your crystal. Undoubtedly, the latter is not very sensitive. It may be, however, that your instruments are not connected up properly and we would advise you to send us a circuit diagram for inspection. We would further advise that you use a piece of fairly fine phosphor bronze wire as a cat-whisker, having the same coiled in a spiral.

WANTED!!! RADIO ARTICLES

WE want descriptions of new radio ideas which you have worked out in practice. Take photographs of the important parts and make pencil or pen and ink sketches of the hook-ups or mechanical details, et cetera. We are particularly

desirous of obtaining new hook-ups and descriptions of single tube sets, reflex and other types which have proven satisfactory. We want articles on the latest single tube receptors which require a minimum current from the filament battery.—Editor.

INVERSE DUPLEX

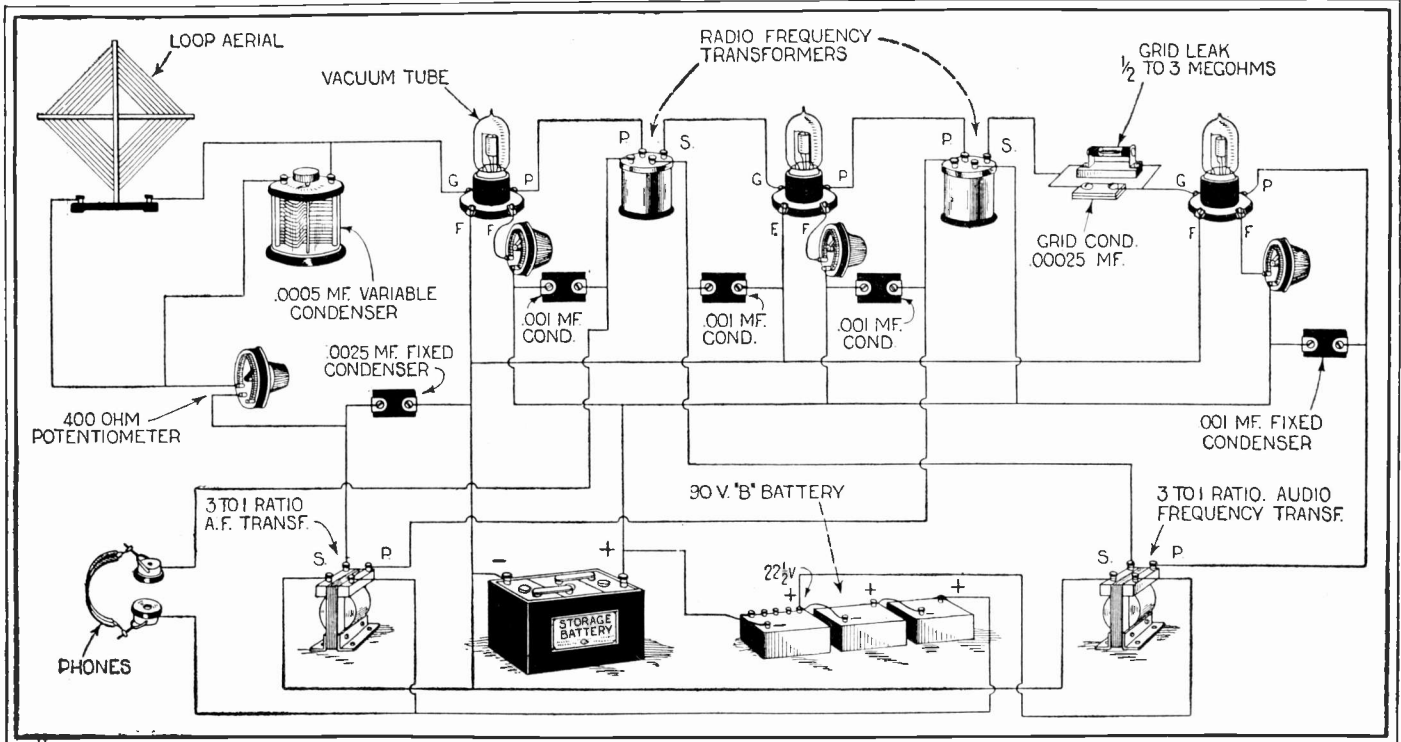
(224) J. P. McKenzie, Ensley, Ala., asks:
 Q. 1. What is the advantage of the inverse duplex type of receiver over the standard reflex circuit?
 A. 1. We will take the circuit diagram published in these columns as an example. Here we see that the first tube on the left acts as the first stage of radio frequency amplification and as the second stage of audio frequency. The center tube acts as the second stage of radio frequency and the first stage of audio frequency. Obviously, the load imposed on the tubes by causing them to act as amplifiers is more equally distrib-

detector, a two stage audio frequency amplifier, without changing the connections therein?
 A. 1. The only way to increase your range to any great extent will be the addition of one or two stages of radio frequency amplification. Unless you are fairly familiar with radio work, however, we would not advise you to attempt this addition as good results would not be obtained without considerable experimental work. If, however, you desire to try such a circuit, send us a description of the tuner, enumerating all the instruments used therein and give a hook-up of the same. We will then show you how

get as many turns of wire as possible without making the receiver too clumsy. The simplest way to rate a telephone would be by its resistance except for one thing—the temptation to dishonest people of putting iron or German silver wire in the coil. This gives resistance, but reduces the ampere turns.

TUNED IMPEDANCE RADIO FREQUENCY AMPLIFICATION

(227) John Moore, Hoboken, N. J., refers to an article appearing on page 258 of the July, 1923, issue of SCIENCE AND INVENTION and asks:



Q. 224. The inverse duplex receiver has the advantage of not overloading the tubes and rendering them inefficient as is the case in the standard straight type of reflex circuit. The connections for a three-tube set of the inverse duplex type are given above. Two radio and two audio frequency transformers are used in connection with the three tubes giving practically the same form as two stages of radio frequency, detector and two stages of audio frequency amplification.

uted than in the standard straight reflex. In the latter circuit, the first tube is the first stage of both radio and audio frequency and the second tube is the second stage of both types of amplification. Therefore, the second tube is severely taxed and does not function properly at all times.

Q. 2. Kindly show a circuit diagram of a three tube inverse duplex receiver using a vacuum tube detector.
 A. 1. The circuit diagram will be found in these columns.

RADIO FREQUENCY AMPLIFICATION

(225) Roy L. Grant, Eureka, Kansas, asks:

Q. 1. How can I increase the receiving range of a set and can the extra instruments be added to a set comprising a tuner,

to add radio frequency amplification in front of your tuner.

RESISTANCE OF PHONES

(226) O. E. Kaufman, Plains, Kan., asks:

Q. 1. Does the actual resistance of phones have anything to do with their efficiency?

A. 1. The resistance of receivers in radio work has very little to do with the efficiency of the phones. It is the number of ampere turns on the magnets that counts. Phones might much better be rated at their impedance, as for very best results this value should be nearly equal to the internal impedance of the vacuum tube. The talking current actuating a telephone is so light that the question of ohmic resistance plays but a small part in practice. The great point is to

Q. 1. What are the capacities of the condensers C3, C4 and C5?

A. 1. Regarding the capacity of condenser C3, we would advise you to use .001 mf. For C4 and C5 use .00025 or .0005 mf.

Q. 2. Kindly give me the correct data for use in winding the radio frequency amplifying impedance coils.

A. 2. In regard to the tuned impedance radio frequency amplifier that you mention, we would advise you to experiment somewhat with the construction of the impedance coil. The best way would be to wind a 3-inch tube with 45 turns of No. 24 wire, tapped at the 25th, 30th, 35th, and 40th turns. Connect up these taps to switch points and you can experiment until you find out exactly what number of turns will give the best results with your particular tubes.

200 ILLUSTRATIONS—100 ARTICLES

is the average of every issue of RADIO NEWS. We doubt if there is a radio magazine in print that can show the diversity of articles and illustrations that is found in this magazine.

But above all, it is the quality of the material that is of prime importance to the man interested in radio. RADIO NEWS appeals to all factions; the Scientist, the Amateur, the Experi-

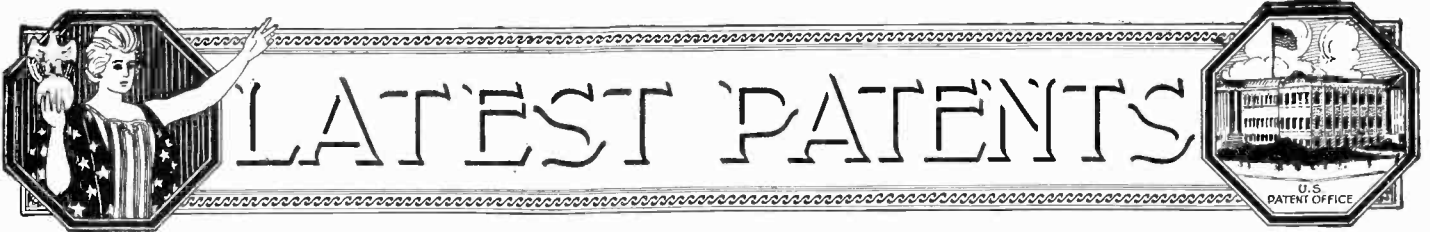
menter, the Broadcast Listener, and the Manufacturer. Each will find articles written especially for him. Every issue of RADIO NEWS is a radio education by itself. Sold on 35,000 newsstands in the United States and in every international book store in every civilized country the world over

A LIST OF INTERESTING ARTICLES APPEARING IN THE FEBRUARY ISSUE OF RADIO NEWS.

The First European Radio-Telephone Service, By Dr. Alfred Gradenwitz.
 Transient Phenomena in Audio Frequency Transformers, By Allen D. Cardwell.

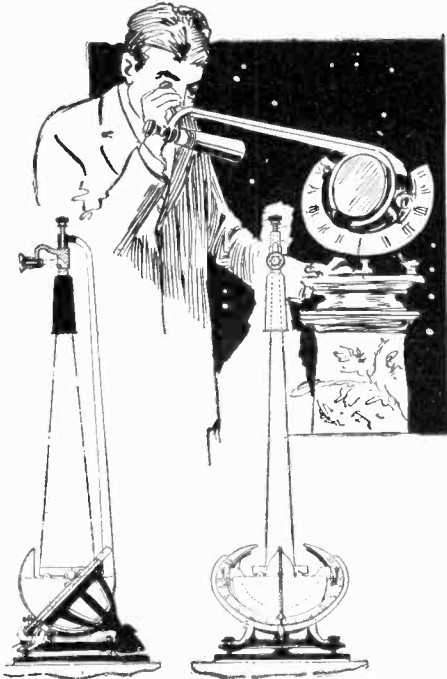
A New Invention For Selective Reception, By John Scott-Taggart, F. Inst. P.
 Engineering Trans-Atlantic Radio Telephony.

The Theory, Construction and Use of an Inductance-Capacity Bridge, By Palmer G. Craig.
 Ultradyne Receiver, By Robert E. Lacault.



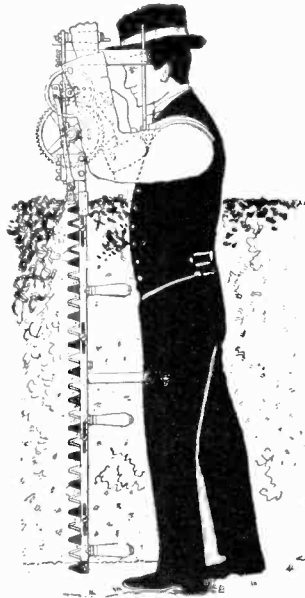
LATEST PATENTS

Reflecting Telescope



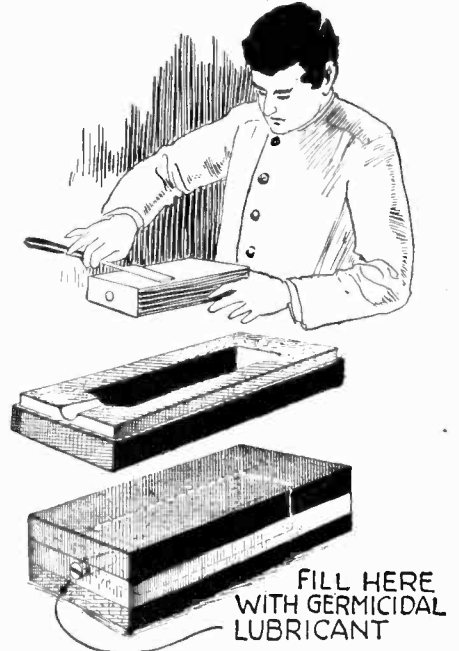
No. 1,468,973 issued to Russell W. Porter. This ornamental garden telescope is capable of relatively rough usage. It comprises an ocular, a concave paraboloidal mirror and a prism or silvered diagonal. The ocular and prism are held at a fixed distance from the mirror, but are capable of adjustment therewith about the polar axis and about the axis of declination. The ocular and prism are likewise rotatable about the optical axis of the mirror, for the convenience of the observer. The entire device is placed out in a garden and protected from the elements merely by its rugged construction.

Hedge Trimmer



No. 1,471,453 issued to John C. Dettra. This hedge trimmer is of light sturdy construction and may be used in various positions so as to enable the trimmer to trim the sides, tops and other portions of the hedge. The actuating mechanism may be adjusted to various positions with respect to the reciprocating cutting blades. This mechanism comprises the operating handle and a train of gears, one of which is connected by means of a rod to the cutting teeth. The device is carried by the user, as illustrated above.

Self-Lubricating Razor Hone



No. 1,470,762 issued to Jesse Lee Renau. Heretofore hones for sharpening razors have been used, but an external lubricant was applied to the exterior of the hone. This lubricant was generally of a germicidal nature, but it soon became absorbed and it was necessary to re-supply the hone with the germicidal material. The inventor of this device has designed a razor hone, which has a recess within it into which the germicidal lubricant is poured. This percolates through the pores of the hone and keeps the surface constantly moist.

Individual Sanitary Saliva Ejector



No. 1,471,207 issued to Napoleon B. Riddle. Ejecting saliva from the mouth of a patient when undergoing dental operations, which make it practically impossible or undesirable to swallow the saliva, is usually done in high-class dental parlors, but the former method was quite unsanitary unless the tube was carefully sterilized. For that reason the inventor believes that the plan which he has patented will serve the purpose. In this method the upper portion of the saliva ejector is made of paper similar to that used in the manufacture of drinking straws found at the soda fountains. This is reinforced and may, of course, be replaced after a patient has used the same.

Pen Holder



No. 1,453,667 issued to James John Gillis. This invention is without a doubt very practical. Every teacher has noticed that her pupils when beginning to write with a pen, press very firmly upon the pen. With this device such pressure will be impossible because the pen point will slide up into the handle of the pen as soon as undue pressure is brought to bear upon it, calling attention that the child is exerting too much pressure in writing. This tension is under control of the teacher who can adjust the collapsing pressure.

Phonograph Records



No. 1,471,862 issued to John J. Reinhold. One has often noticed how difficult it is to remove records from phonograph turn-tables, especially when they are thin. A great number of attachments have been made for the purpose of assisting the player in removing the record more easily. The inventor of this system employs a groove around the edge of the disk, which will engage the finger nails so that the record can be easily lifted from the turn-table or if the records are stacked one on top of the other, the top one may be easily removed without the necessity of sliding the records upon each other.

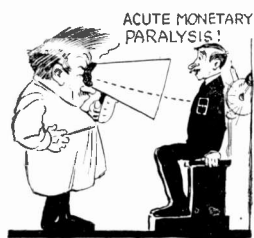
Scientific Humor

The "Mile-Age."—FIRST STENOG. (reading): "Think of those Spaniards going 3,000 miles on a galleon."

SECOND STENOG: "Aw, forget it. Yuh can't believe all yuh hear about them foreign cars."—*Paul K. Beemer.*

The Spendthrift.—There is a New York scientist who is greatly interested in coal mining. He decided to subscribe to a press clipping bureau, to get every new slant on coal. So he said to the service bureau: "I want everything you can find printed about coal."

The first clipping he got was an article about a man who was suing his wife for a separation because she hit him on the head with a lump of coal!—*I. H. Motes.*



This Is Very Transparent.—MR. SHORT: "If an X-ray operator is preparing to take an X-ray picture of you, does he first look through you to determine just what portion of your body he wishes to photograph?"

MR. LONG: "Yes; and not only that, he even looks through your pocketbook to determine whether or not he wishes to photograph any portion of your body at all."—*J. E. Melton.*

Relic of Antiquity.—In the motion picture, "Robin Hood," Lady Marian desires to send a message to the Earl of Huntington and chooses Little John to act as her messenger. She hands John a scroll which is protected by a black case or tube. A small boy in the audience asked his mother what it was. "That is a flashlight," she answered aloud.

"Don't show your ignorance Mary," snapped her husband. "They didn't have flashlights in those days. That's a thermos bottle."—*M. Kipp.*



Coming Dear!—JONES: "Pat's in the hospital with a broken head!"

BROWN: "How come?"

JONES: "He was up trying out that new helicopter of his, and his

wife saw him and motioned for him to come down."

BROWN: "Well?"

JONES: "He did!"—*Merle Holmes.*

My Stars!—TEACHER: "What is the hardest science to master?"

STUDENT: "Astronomy."

TEACHER: "Why?"

STUDENT: "It's all over my head."—*W. J. Shea.*

A "Sticker."—PHYSICS INSTRUCTOR: "Johnny, define and give an example of adhesion."

JOHNNY: "Adhesion is a force that holds unlike particles together, such as powder on a lady's face."

PHYSICS INSTRUCTOR: "Correct! Now define and give an example of cohesion."

JOHNNY: "Cohesion is a force that connects like particles, such as lips in a kiss."—*Kenneth Guth.*

First Prize \$3.00



He Must Be Yellow!—FIRST STUDENT: "See that chap coming out of the Lab., that's Brown, our Chemistry Prof., he likes girls, but he's so bashful he

acts like litmus paper."

SECOND STUDENT: "How's that?"

F. S.: "Why, when he's with a girl he turns pink, and when he's alone he gets blue."—*Fred L. Leonard.*

Flour-Sacks in the Air.—An Institute visitor saw a non-insulated water-pipe running across the basement ceiling. It was dripping water upon flour-sacks which had congealed upon it from the atmosphere.—*Baking Technology (Chicago).*

We receive daily from one to two hundred contributions to this department. Of these only one or two are available. We desire to publish only scientific humor and all contributions should be original if possible. Do not copy jokes from old books or other publications as they have little or no chance here. By scientific humor we mean only such jokes as contain something of a scientific nature. Note our prize winners. Write each joke on a separate sheet and sign your name and address to it. Write only on one side of sheet. No letters acknowledged unless postage is included.

All jokes published here are paid for at the rate of one dollar each, besides the first prize of three dollars for the best jokes submitted each month. In the event that two people send in the same joke so as to tie for the prize, then the sum of three dollars in cash will be paid to each one.

Oh? But He's Beyond the 3-Mile Limit.

PLANETARY GOSSIP (Venus to Saturn over the celestial back fence): "Didn't you hear what happened to old man Sol the other day?"

SATURN: "Why no. What happened to him?"

VENUS: "He was pinched for making moon shine!"—*Emil Guidici.*



A Short Circuit.—PROFESSOR (to boy who has been sent to him for misconduct): "Son, what is your name and why did the teacher send you here?"

BOY: "Sir, my name is Sparks, the teacher saw me gap and it shocked her."—*Thomas J. Adams.*

Perpetual Motion.—Rags make paper. Paper makes money. Money makes banks. Banks make loans. Loans make poverty. Poverty makes Rags.—*G. Clear.*

He Should Try a Radio.—"Ah," said the inventor of mechanical toys, "I've only had one failure in my life."

"And what was the matter with that?" asked his friend.

"It was too realistic."

"What was?"

"I made a toy tramp and it wouldn't work."—*G. Clear.*

Also the First Amplifier.

RAY: "Who was the first radio engineer?"

DIO: "A dam because the first loud speaker was made from his spare parts."

RAY: "Ooo—Oh!"—*L. Grummwadder.*



Chickenfeed.—JOHNSON: "Does you know dat a chicken is the most scientific bird of de world?"

RASTUS: "How come dat?"

JOHNSON: "Yo can eat 'em befo dey is born, and after dey is dead!"—*Foster C. Kitchen.*

An "Antique" Joke.—ARCHIMEDES: "Give me a fulcrum upon which I may place my lever, and I'll move the earth."

SOCRATES: "Use the moon."

DIOGENES: "But what shall we use for a lever?"

SOCRATES: "A sunbeam."—*Frank L. Culley.*

Gassed!

DENTIST: "What! You don't want gas? You insisted on having gas the last time."

VICTIM: "You haven't been eating garlic this time."—*Herman L. Gottlieb.*



As a Matter of Fact.—Carl was in the science class talking with the girls while the teacher was explaining the lesson on the composition of matter.

All of a sudden the voice of the irate teacher was heard:

"What is the matter Carl?"

Carl all surprised answered:

"Matter is anything that occupies space."—*Carlos Otal, Jr.*

Nobody 'Ohm.—PROF: "I wonder why there is so much electricity in my hair?"

SMART SENIOR: "Because it is attached to a dry cell."—*Fred L. Leonard.*

Boy! Page the Missus.—SIMPLE: "They have machines now that can tell when a man is lying. Ever seen one?"

SIMPLER: "Seen one? By gosh, I married one!"—*Merle Holmes.*



THE ORACLE



The "Oracle" is for the sole benefit of all scientific students. Questions will be answered here for the benefit of all, but only matter of sufficient interest will be published. Rules under which questions will be answered:

1. Only three questions can be submitted to be answered.
2. Only one side of sheet to be written on; matter must be type-written or else written in ink, no penciled matter considered.

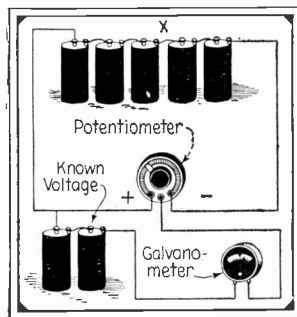
3. Sketches, diagrams, etc., must be on separate sheets. Questions addressed to the department cannot be answered by mail free of charge.

4. If a quick answer is desired by mail, a nominal charge of 25 cents is made for each question. If the questions entail considerable research work or intricate calculations a special rate will be charged. Correspondents will be informed as to the fee before such questions are answered.

MEASURING VOLTAGE

(1616) Morris Black, Jersey City, N. J., asks:
Q. 1. How may the voltage of a battery be measured without a volt meter?

A. 1. This work may be done without the use of a volt meter by connecting up apparatus as shown in the illustration. A standard cell with a



At the left is shown a circuit diagram for connecting a galvanometer and potentiometer so that the unknown voltage of a battery may be found by comparison. For quickest results, the potentiometer should be graduated so that it may be read directly.

known voltage is used as indicated. The slider on the potentiometer should be regulated until the galvanometer indicates that no current is flowing through it. At this point on a potentiometer, count the number of turns between the slider and the positive end and place this number in an equation as being equivalent to the voltage of the standard cell. From this we will get a certain number of turns being equal to one volt. Dividing this number into the total number of coils on the entire potentiometer, we have the voltage of cell X.

An example will not be out of the way. Suppose that the potentiometer has a total of 100 turns, and that the voltage of the standard cell is 2 volts. Then suppose that a balance takes place when the slider is 20 turns from the positive end. Therefore, we will form the equation of $2 = 20$ and from this we get that $1 = 10$. Dividing 100 by 10 we find that the value of the unknown battery is 10 volts.

LIGHT YEARS

(1617) Frank H. Cottrill, Port Washington, Wis., asks:
Q. 1. How is the length of a light year measured?

A. 1. The speed of light per second is 186,000 miles approximately. There are approximately 31,557,600 seconds in a year. By multiplying these two figures together you will get very nearly the distance in miles of the astronomical light-year used as a unit of measurement of stellar space.

Interesting Articles in February "Practical Electrics"

- Power Now Transmitted Without Wires The Radiotron; A Vacuum Tube
By B. S. Havens of General Electric Co.
Simple Oscillograph
By Carter Fiske
- Electrical Animals
Tidal Electric Power
By Albert Staehle
- Voltage Finder
Electrical Destruction of Atoms
By Professor Rogers D. Rusk
- Electric Camera Shutter
By A. Kiedis, Jr.
- Carbon Contact Rheostat
Goertz-Beck Arc Lamp
Analogies and Others
By T. O'Connor Sloane, Ph.D.

EXPANSION OF GASES

(1618) V. C. McKenzie, Brice, Texas, asks:
Q. 1. Are the rates of expansion of various gases different?

A. 1. All the so-called permanent gases expand at very nearly the same rate in accordance with a well known law of physics. A gas at zero degrees C. will expand $1/273$, of $1/49$ of its volume for every degree (Centigrade and Fahrenheit respectively) of rise in temperature.

NICKEL-IRON STORAGE BATTERY

(1619) George M. Lilly, Detroit, Mich., wants to know:

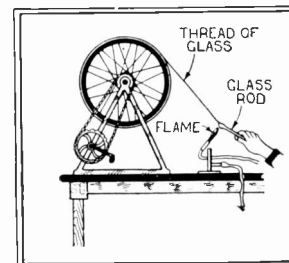
Q. 1. How can I put into service a nickel iron alkaline storage battery which has been idle for some time?

A. 1. Wash out the entire battery thoroughly with warm distilled water. Also make sure that none of the plates are buckled or broken. Then mix the electrolyte as follows: Make a 20 per cent solution of phosphoric acid in distilled water and add enough ordinary household ammonia to neutralize the solution. The neutralization point can be determined by the use of red and blue litmus paper. When neither of the two papers change color when dipped into the solution, it is neutral. After filling your cells to the required depth with this solution, pour a thin layer of mineral oil over the electrolyte in order to retard evaporation. The above solution, while not standard, was recommended to us by a reader who obtained excellent results with the same.

SPUN GLASS

(1620) Milton Peterson, Baltimore, Md., asks the Oracle:

Q. 1. Can you tell me how to spin a small quantity of glass without the use of expensive apparatus? I desire to use the resulting glass as bristles in a brush for use with strong acids.



Fine threads of glass are occasionally desired for constructing small brushes for handling strong acids. These very fine threads may be made by the experimenter by setting up a wheel as shown at the right.

A. 1. The illustration herewith shows a wheel such as a bicycle wheel mounted in a frame and driven by means of a crank. Start the wheel spinning with one hand and melt the end of a good sized rod of glass. Now draw out a thread of molten glass and carry it around the wheel as the latter spins. After the knack of this is obtained, you will find that the thread of glass will grip the rim and by continuing to turn the wheel by hand and at the same time keeping a fresh supply of glass molten, that the wheel will continue to take up a thread of glass. The rod which is supplying the material must not be advanced too far into the flame for if such is done the end from which the thread is being taken will cool and the thread will break. Also the rod must be advanced far enough so that the flame will not melt the thread. When as much glass as desired has been spun, a knife may be drawn across the multiple threads of glass whereupon it will break and the entire quantity may be removed from the rim. This fine glass may then be used in any way desired.

ETCHING GLASS AND STEEL

(1621) J. M. Martin, Pauls Valley, Okla., wants to know:

Q. 1. Can you give me formulas or tell me what chemicals must be used for the etching of glass and tool steel?

A. 1. Probably the best material for you to use for etching glass would be hydrofluoric acid. The part which you do not desire to etch can be protected by means of wax. Dilute nitric acid or sulphuric acid, or solution of copper sulphate (blue vitriol) will readily etch steel tools and in this case wax may also be used for protecting the surface which is not to be attacked by the acid.

OUR \$12,000 PRIZE CONTEST

It will be noted from last month's issue and the present one that our prize contest has been a whale of a success. Over \$1,000 has been paid out this month for worth while contributions to SCIENCE AND INVENTION, either in pictures, suggestions, ideas or articles. We now have on our staff, close to 7,000 correspondent reporters who are scouting the world for

new material that can be written up for SCIENCE AND INVENTION. And the formula is simple—just keep your eyes open. Even if you were totally deaf or blind, you could still win a prize by simply using your head and sending us ideas of a scientific nature, or of a nature directly or indirectly attached to new inventions.

ARTICLES FOR MARCH SCIENCE AND INVENTION

- The Man on the Asteroid—Part III
By Ray Cummings
- The Red Sea Parted—How the Movies Did It
By Edwin Schallert
- What is Luminous Paint?
By Ismar Ginsberg, B.Sc., Chem. Engr.
- Why Our Naval Guns Should Be Elevated
By Graser Schornstheimer, Naval Expert

- Staging Historic Battle Scene for the Screen Old-Fashioned Weather Predictions—Are They Correct?
By E. B. "Farmer" Dunn
- Prize Winners in "Psychic Motor" Contest How to Bind Your Own Books
By Dr. Ernest Bader
- Push-Pull Audio-Frequency Amplifier—How to Build It
By Joseph H. Kraus

- The Airplane Super-Charger—How it Enables Aviators to Fly to Unprecedented Heights
- New York's Need of New Under-River Subways to New Jersey
- Over 40 Popular Radio Articles—Filled With Details You Need to Know in Building Your Own Set

FREE INFORMATION

If you want additional information concerning any of the subjects illustrated and described in this number of SCIENCE AND INVENTION, we shall be glad to give you other data we have at our command. To make this work as easy as possible for our editors, please be brief. Write only on one side of the paper and state exactly in a few words just what it is you desire further information on. We have the original manuscripts and drawings of many of these articles in our files and can furnish much additional data in most cases. Please do not fail to send stamped and self-addressed envelope.

Address all inquiries of this nature to INFORMATION EDITOR c/o Science and Invention, 53 Park Place, New York City.

TWO-CYCLE GASOLINE ENGINE

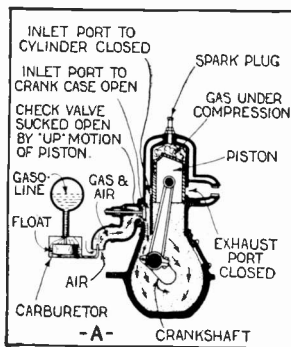
(1622) J. M. Osborne, Detroit, Mich., wants to know:

Q. 1. Has the two-cycle gasoline engine ever been used in large sized power plants such as used in airplanes and other machines propelled by gasoline?

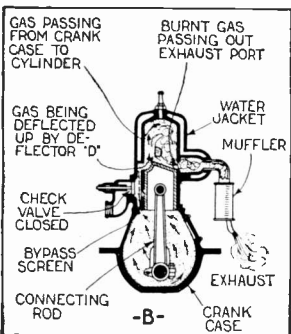
A. 1. The two-cycle gasoline motor has never proven itself efficient when used in high power installations such as are necessary for airplanes. This type has been applied with a fair degree of success to automobiles and motorcycles. It is used for the majority of small boat engines. It has, however, been found practically impossible to get a perfect exhaustion of the burnt gases and a perfect intake of the explosive mixture in this type of motor, with the result that when the mixture in the firing chamber is ignited, the explosion is not as powerful as it should be. Obviously, this is a great disadvantage in airplane use. Also, the gas mixture, being drawn in through the crank case, dilutes the oil therein, resulting in decreased efficiency.

Q. 2. What is the principle of the operation of a two-stroke or two-cycle gasoline engine?

A. 2. The accompanying illustrations show the principle of operation. In Fig. B the piston is at the bottom of its stroke and two actions are taking place. A gasoline and air mixture is entering the cylinder from the crank case through the by-pass port. The burned gas is passing out through the exhaust port. Therefore, we have intake and exhaust occurring simultaneously. As



At the left in "A" will be seen the piston of a two cycle gasoline engine very nearly at the top of its compression stroke. When it reaches the top, a spark flashes and the piston will be forced downward by the explosion of the gas. Note that the vaporized gasoline first enters the crank case.



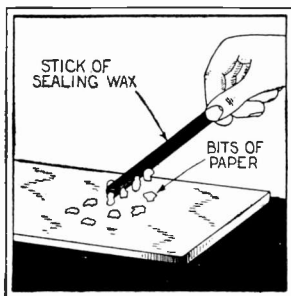
At the left a two-cycle gasoline engine is shown at the end of its firing stroke. The burned gases are now passing out through the open exhaust port and at the same time fresh gasoline vapor is coming in from the crank case to the cylinder. The next upward stroke will compress this gas.

will be noticed, the incoming mixture is thrown up toward the top of the cylinder by means of the deflector D on the piston. In Fig. A the piston is very nearly at the top of its stroke. Here again two actions take place. The gas is being compressed by the piston and the spark is just about to take place. Fresh gas is entering the crank case from the carburetor through the inlet port. When the piston reaches the top of its stroke, the spark plug will fire the mixture and the piston will be forced to the position shown in Fig. B, whereupon the action will be repeated.

FRictionAL ELECTRICITy

(1623) L. B. Edgars, Syracuse, N. Y., asks: Q. 1. What is frictional electricity and how can I produce it experimentally?

A. 1. Frictional electricity may be produced and its results seen by rubbing a stick of sealing



Frictional electricity may be made in an experimental manner by means of a stick of sealing wax and a piece of flannel cloth. The former should be briskly rubbed with the latter, whereupon it will be found that the wax will attract bits of paper.

wax or hard rubber vigorously with a dry warm flannel cloth. Bring the end of the wax or rubber near some shreds of paper and they will fly to it. The electricity so formed is known as static or electricity at rest.

PERPETUAL MOTION?

(1624) A reader has referred to an article appearing on page 225 of the July, 1923, issue of SCIENCE AND INVENTION and states that according to his reasoning the device described therein is actually perpetual motion. He asks our opinion.

In order to obtain an unbiased view of this subject, we have requested Professor Harold F. Richards, a well known authority on scientific matters, to give us his opinion of the practicability of this device. His answer is as follows:

"Theoretically the device is perfectly feasible and can be made to operate. The practical use of the apparatus is, however, another matter.

"There are two kinds of perpetual motion, as the classification goes. One kind is that in which an engine, once started, continues to run without receiving any input of energy. This type is theoretically possible, but not practically so, since all man-made machines have friction. The stellar system approximates to a perpetual motion device of this first class.

"The second type of perpetual motion is that which delivers useful power without requiring any input of power, or, in other words, which delivers more power than it receives. In a machine of such a character there would be actual creation of energy, in violation of the principle of conservation of energy, and, furthermore, in violation of the second law of thermodynamics, which states that heat will not, of itself, pass from a colder to a hotter body. Such a device cannot possibly be made to work, even if we assume ideal con-

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ditions and a perfect efficiency of every working part.

"The article on drawing energy from the hot surface layers of sea-water presents no violation of the foregoing principles. Whenever two sources of heat at different temperatures are available, a power-delivery machine is theoretically possible. In the device in question there are two such sources, and the poor conductivity of the water serves to separate them in the same manner, although not as efficiently, as an insulating wall. A hot and a cold source are available, heat tends to flow from a hotter to a colder body, and so a power-generator is possible.

"So far as practical considerations are concerned, the efficiency will be very low, and probably too low for any utility, on account of the small difference of temperature available. Assuming that the high and low temperatures are 25° and 5° Centigrade, respectively, the ideal or theoretical maximum efficiency would be only 7%, since the limiting efficiency is equal to the difference of the two temperatures divided by the absolute temperature of the hot reservoir. Even this low efficiency cannot possibly be realized in practice, since the working parts cannot be perfectly efficient, and if the generator (electric) has an efficiency of 90%, and the turbine an efficiency of 50%, the resulting efficiency, disregarding losses in pumps, would be the product of all the efficiencies listed above, or (.07), (.90), (.50), which is 0.0315, or about 3%. Even this low efficiency cannot be realized in practice, since work must be done in order to bring the hot and cold reservoirs to the same gravitational level, and it seems quite possible that the work necessarily done by the pumps, together with the frictional losses in the long pipes, would wipe out the remaining 3% of useful efficiency. Even so, the device is not a perpetual motion proposition, since theoretically it can be made to work. However, you will easily see from the foregoing figures that any money invested in the proposition would in all probability be lost.

"The simple reasoning given above shows the way to get at the heart of a suggested invention. The 7% is a limiting efficiency towards which engineers may strive in developing the device, although they cannot possibly hope to attain it, for the reasons given. For your information, I may say that one pound of water would, in cooling 1 degree Fahrenheit per second, liberate 1 B. T. U. per second, or 1.058 kilowatts of energy, so that 1,000 pounds of water, cooling 30 degrees Fahrenheit per second, would liberate 31,740 kilowatts of heat power. Not all of this power would be useful. To change 1 lb. of ammonia from liquid to vapor at 75 degrees Fahrenheit would require the cooling of about 19 pounds of water from 75 to 45 degrees F.

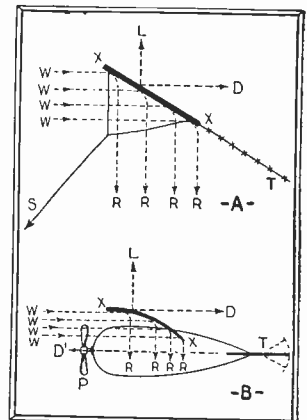
"I think you will see from the foregoing that it is hardly worth while to consider the efficiencies of turbines and pumps in order to find out the exact value of the exceedingly small part of the limiting efficiency (of 7%) which would remain. Practically, I should say, the invention is worthless."

PRINCIPLE OF THE AIRPLANE

(1625) Richard Frank, Louisville, Ky., requests:

Q. 1. Can you explain in a simple manner the comparison between the forces which keep an ordinary kite in the air and those which allow the use of airplanes?

A. 1. The diagram herewith shows the principles of both of the two devices mentioned. In A is an ordinary type of kite which is kept in the air by means of the wind streams marked W.



At the right in Fig. A, will be seen the action of air currents on a kite. The currents coming in the direction W, are deflected toward R, giving rise to the different forces indicated by L and D, known respectively as the lift and drag forces. At B is shown a diagrammatic view of an airplane showing how the same forces act on the plane as on the kite.

When these streams strike the surface they are deflected downward and the reaction of this deflection produces a vertical lift indicated by the arrow L. The kite is held against the pressure of the air stream by the string. The horizontal force which is indicated by the arrow D tends to carry the kite in that direction and is known as the drift force. The tail, T, presumes a stabilizing function and it maintains a constant angle between the surface and the wind.

B in the diagram herewith shows an airplane and the common points between this and the kite can be readily seen. In place of the string on the kite we have the propeller, P, which supplies the resultant required to overcome the drag force indicated by D.

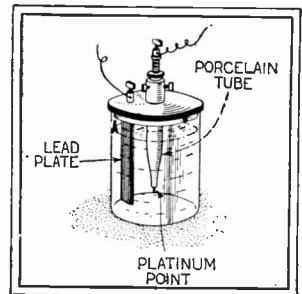
WEHNELT INTERRUPTER

(1626) E. Lucyinski, Snow Hill, Ala., wants to know:

Q. 1. Can you give a diagram showing the construction of a Wehnelt interrupter and tell what solution is used therein?

A. 1. The diagram herewith shows the details of such an interrupter. The anode or central electrode consists of a platinum point and the wiring connecting this point to the external circuit is encased in a porcelain tube. The amount of the anode exposed is so arranged that it can be adjusted by means of sliding the porcelain tube up

A very good form of electrolytic rectifier is illustrated at the right. This takes the place of the mechanical interrupter often found on spark coils and small transformers. It operates without the usual noise and sputter of a magnetic interrupter.



and down. The cathode is a large lead plate as illustrated. The electrolyte used in this cell consists of dilute sulphuric acid at a density of approximately 1.2. It is sometimes found advisable to add a very small quantity of CuSO₄.

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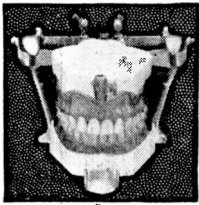
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Radio Broadcast

Revised and corrected to date.

First group of figures indicate the power in watts in the antenna of the transmitting station. The second group gives the wave-length.

Call Letters	Name	Location	Power & Wave Length	Call Letters	Name	Location	Power & Wave Length
KDKA	Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.		1,000—326	KFDL	Knight-Campbell Music Co., Denver, Colo.		5—360
KDPM	Westinghouse Electric & Mfg. Co., Cleveland, Ohio		250—270	KFDO	H. Everett Cutting, Bozeman, Mont.		50—248
KDPT	Southern Electrical Co., San Diego, Calif.		50—244	KDFP	Hawkeye Radio & Supply Co., Des Moines, Iowa		100—278
KDYL	Telegram Publishing Co., Salt Lake City, Utah		50—360	KFDR	Bullocks Hardware & Sporting Goods (Robert G. Bullock), York, Neb.		10—360
KDYM	Savoy Theatre, San Diego, Calif.		50—252	KFDU	Nebraska Radio Electric Co., Lincoln, Neb.		20—240
KDYQ	Oregon Institute of Technology, Portland, Ore.		5—360	KFDV	Gilbrech & Stinson, Fayetteville, Ark.		200—360
KDYS	The Tribune, Great Falls, Mont.		50—360	KFDX	First Baptist Church, Shreveport, La.		100—360
KDYW	Smith Hughes Machinery Co., Phoenix, Ariz.		20—360	KFDY	South Dakota State College of Agriculture and Mechanic Arts, Brookings, S. D.		100—360
KDYX	Star Bulletin, Honolulu, Hawaii		100—360	KFDZ	Harry O. Iverson, Minneapolis, Minn.		5—360
KDZB	Frank E. Siefert, Bakersfield, Calif.		100—240	KFEC	Meier & Frank Co., Portland, Ore.		50—360
KDZE	The Rhodes Co. (Dept Store), Seattle, Wash.		100—455	KFEJ	Guy Greason, Tacoma, Wash.		10—360
KDZF	Automobile Club of Southern California, Los Angeles, Calif.		500—278	KFEL	Winner Radio Corp., Denver, Colo.		50—360
KDZI	Electric Supply Co., Wenatchee, Wash.		50—360	KFEP	Radio Equipment Co. (Jos. L. Turre), Denver, Colo.		10—240
KDZK	Nevada Machinery & Electric Co., Reno, Nev.		25—360	KFEQ	J. L. Scroggin, Oak, Neb.		150—360
KDZQ	Nichols Academy of Dancing (Hal G. Nichols), Denver, Colo.		10—360	KFER	Auto Electric Service Co., Fort Dodge, Iowa		20—231
KDZR	Bellingham Publishing Co., Bellingham, Wash.		50—261	KFEV	Radio Electric Shop, Douglas, Wyo.		100—263
KDZT	Seattle Radio Association, Seattle, Wash.		10—360	KFEX	Augsburg Seminary, Minneapolis, Minn.		100—261
KFAD	McArthur Bros. Mercantile Co., Phoenix, Ariz.		100—360	KFEY	Bunker Hill & Sullivan Mining and Concentrating Co., Kellogg, Idaho		10—360
KFAE	State College of Washington, Pullman, Wash.		500—360	KFEZ	Amer. Society of Mechanical Engineers (F. H. Schubert), St. Louis, Mo.		100—360
KFAF	Western Radio Corporation, Denver, Colo.		500—360	KFFA	Dr. R. O. Shelton, San Diego, Calif.		50—242
KFAJ	University of Colorado, Boulder, Colo.		100—360	KFFB	Jenkins Furniture Co., Boise, Idaho		10—240
KFAN	The Electric Shop, Moscow, Idaho		50—360	KFFE	Eastern Oregon Radio Co., Pendleton, Ore.		10—360
KFAP	Standard Publishing Co., Butte, Mont.		100—360	KFFO	Dr. E. H. Smith, Hillsboro, Ore.		5—229
KFAR	Studio Lighting Service Co. (O. K. Olsen), Hollywood, Calif.		200—280	KFFP	First Baptist Church, Moberly, Mo.		100—275
KFAU	Independent School District of Boise City, Boise High School, Boise, Idaho		150—270	KFFQ	Marksheffel Motor Co., Colorado Springs, Colo.		100—360
KFAV	Abbot Kinney Co., Venice, Calif.		5—224	KFFR	Nevada State Journal (Jim Kirk), Sparks, Nev.		10—226
KFAW	The Radio Den (W. B. Ashford), Santa Ana, Calif.		10—280	KFFV	Graceland College, Lamoni, Iowa		100—360
KFAZ	Virgin's Radio Service (W. J. Virgin), Medford, Ore.		50—283	KFFX	McGraw Co., Omaha, Neb.		250—278
KFBB	F. A. Buttrey & Co., Havre, Mont.		50—360	KFFY	Pincus & Murphey, Alexandria, La.		100—275
KFBC	W. K. Azbill, San Diego, Calif.		20—278	KFFZ	Al G. Barnes Amusement Co., Dallas, Texas (portable)		20—226
KFBE	Reuben H. Horn, San Luis Obispo, Calif.		10—360	KFGC	Louisiana State University, Baton Rouge, La.		100—254
KFBG	First Presbyterian Church, Tacoma, Wash.		50—360	KFGD	Chickasha Radio & Electric Co., Chickasha, Okla.		20—248
KFBK	Kimball-Upson Co., Sacramento, Calif.		100—283	KFGH	Leland Stanford University, (P. O.) Stanford Univ., Calif.		500—360
KFBL	Leese Bros., Everett, Wash.		10—224	KFGJ	Missouri National Guard, 138th Infantry, St. Louis, Mo.		250—266
KFBS	Trinidad Gas & Electric Supply Co., and Chronicle News, Trinidad, Colo.		15—360	KFGL	Arlington Garage, Arlington, Ore.		5—234
KFBU	The Cathedral (Bishop N. S. Thomas), Laramie, Wyo.		50—283	KFGP	Cheney Radio Co., Cheney, Kan.		100—229
KFCB	Nielsen Radio Supply Co., Phoenix, Ariz.		10—238	KFGQ	Crary Hardware Co., Boone, Iowa		10—226
KFCD	Salem Electric Co. (F. S. Barton), Salem, Ore.		20—360	KFGV	Heidbreder Radio Supply Co., Utica, Neb.		10—224
KFCF	Frank A. Moore, Walla Walla, Wash.		50—360	KFGX	First Presbyterian Church, Orange, Texas		500—250
KFCH	Electric Service Station, Inc., Billings, Mont.		10—360	KFGZ	Emmanuel Missionary College, Berrien Springs, Mich.		10—268
KFCI	Colorado Springs Radio Co., Colorado Springs, Colo.		10—258	KFHA	Western State College of Colorado, Gunnison, Colo.		50—252
KFCL	Los Angeles Union Stock Yards, San Antonio, Calif.		500—360	KFHB	Rialto Theatre (P. L. Beardwell), Hood River, Ore.		5—280
KFCM	Richmond Radio Shop (Frank T. Doeing), Richmond, Calif.		100—360	KFHD	Utz Electric Shop Co., St. Joseph, Mo.		100—226
KFCP	Ralph W. Flygare, Ogden, Utah		25—360	KFHF	Central Christian Church, Shreveport, La.		150—266
KFCV	Fred Mahaffey, Jr., Houston, Texas		10—360	KFHH	Ambrose A. McCue, Neah Bay, Wash.		50—283
KFCY	Western Union College, Le Mars, Iowa		50—252	KFHJ	Fallon & Co., Santa Barbara, Calif.		100—360
KFCZ	Omaha Central High School, Omaha, Neb.		100—258	KFHQ	Curtis Bros. Hardware Store (Alfred E. Fowler), Los Gatos, Calif.		5—242
KFDA	Adler's Music Store, Baker, Ore.		5—360	KFHR	Star Electric & Radio Co., Seattle, Wash.		100—270
KFDD	St. Michaels Cathedral, Boise, Idaho		10—252	KFHS	Clifford J. Dow, Lihue, Hawaii		30—275
KFDH	University of Arizona, Tucson, Ariz.		150—360				
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(Continued on page 1020)

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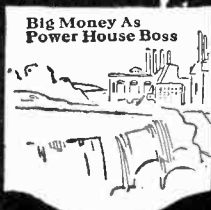
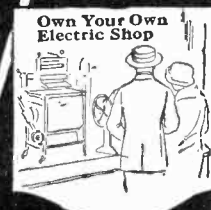
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RADIO BROADCAST

(Continued)

Call Letters	Name	Location	Power & Wave Length
KFHU	M. G. Sateren, Mayville, N. D.		50—261
KFHX	Robert W. Nelson, Hutchinson, Kan.		50—229
KFI	Earle C. Anthony, Inc., Los Angeles, Calif.		500—469
KFIB	Franklin W. Jenkins, St. Louis, Mo.		10—244
KFID	R. Arbuckle's Garage, Iola, Kan.		20—246
KFIF	Benson Polytechnic Institute, Portland, Ore.		100—360
KFIK	Gladbrook Electrical Co., Gladbrook, Iowa		20—234
KFIL	Windisch Electric Farm Equipment Co., Louisburg, Kan.		30—234
KFIO	North Central High School, Spokane, Wash.		50—252
KFIQ	Yakima Valley Radio Broadcasting Association, Yakima, Wash.		50—234
KFIU	Alaska Elec. Light & Power Co., Juneau, Alaska		10—226
KFIV	V. H. Broyles, Pittsburg, Kan.		20—240
KFIX	Reorganized Church of Jesus Christ of Latter Day Saints, Independence, Mo.		250—240
KFIY	Brott Laboratories, Seattle, Wash.		15—236
KFIZ	Daily Commonwealth and Oscar A. Huelman, Fond du Lac, Wis.		100—273
KFJA	Central Power Co., Grand Island, Neb.		100—244
KFJB	Marshall Electrical Co., Marshalltown, Iowa		10—248
KFJC	Seattle Post Intelligencer, Seattle, Wash.		100—233
KFJD	Weld County Printing & Publishing Co., Greeley, Colo.		50—236
KFJE	National Radio Mfg. Co., Oklahoma City, Okla.		20—252
KFJH	The Sugar Bowl (H. R. Shaw), Selma, Okla.		10—273
KFJI	Liberty Theatre (E. E. Marsh), Astoria, Ore.		10—252
KFJJ	Carrollton Radio Shop, Carrollton, Mo.		50—236
KFJK	Delano Radio & Electric Co., Bristow, Okla.		100—233
KFJL	Hardsag Mfg. Co., Ottumwa, Iowa		10—242
KFJM	University of North Dakota, Grand Forks, N. D.		100—229
KFJR	Ashley C. Dixon & Son, Stevensville, Mont. (near)		50—253
KFJV	T. H. Warren, Dexter, Iowa		10—224
KFJW	Le Grand Radio Co., Towanda, Kan.		10—226
KFJX	Iowa State Teachers College, Cedar Falls, Iowa		50—229
KFJY	Tunwall Radio Co., Fort Dodge, Iowa		50—246
KFJZ	Texas National Guard, 112th Cavalry, Fort Worth, Texas		20—254
KFKA	Colorado State Teachers College, Greeley, Colo.		50—248
KFKB	Brinkley-Jones Hospital Association, Milford, Kan.		500—286
KFKH	Denver Park & Amusement Co., Lakeside, Colo.		10—226
KFKQ	Conway Radio Laboratories (Ben H. Woodruff), Conway, Ark.		150—224
KFKV	F. F. Gray, Butte, Mont.		50—283
KFKX	Westinghouse Electric & Mfg. Co., Hastings, Neb.		500—286
KFKZ	Nassau Bros. Radio Co., Colorado Springs, Colo.		10—234
KFLA	Abner R. Willson, Butte, Mont.		5—283
KFLB	Signal Electric Mfg. Co., Menominee, Mich.		20—248
KFLD	Paul E. Greenlaw, Franklinton, La.		20—234
KFLE	National Educational Service, Denver, Colo.		25—268
KFLH	Erickson Radio Co., Salt Lake City, Utah		50—261
KFLP	Everette M. Foster, Cedar Rapids, Iowa		20—240
KFLQ	Bizzell Radio Shop, Little Rock, Ark.		20—261
KFLR	University of New Mexico, Albuquerque, N. M.		100—254
KGB	Tacoma Daily Ledger, Tacoma, Wash.		50—252
KGG	Hallock & Watson Radio Service, Portland, Ore.		50—360
KGN	Northwestern Radio Mfg. Co., Portland, Ore.		100—360
KGU	Marion A. Mulrony, Honolulu, Hawaii		250—360
KGW	Portland Morning Oregonian, Portland, Ore.		500—492
KGY	St. Martins College, Lacey, Wash.		5—258
KHJ	Times Mirror Co., Los Angeles, Calif.		500—395
KHQ	Louis Wasmer, Seattle, Wash.		100—360

(Continued on page 1022)



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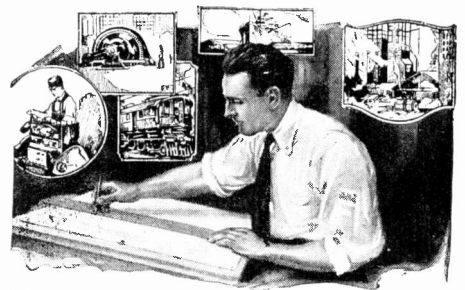
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<input type="checkbox"/> Accountant and Auditor	<input type="checkbox"/> Surveyor—and Mapping
<input type="checkbox"/> Bookkeeper	<input type="checkbox"/> Telephone Engineer
<input type="checkbox"/> Draftsman and Designer	<input type="checkbox"/> Telegraph Engineer
<input type="checkbox"/> Electrical Engineer	<input type="checkbox"/> High School
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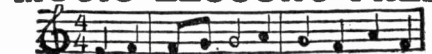
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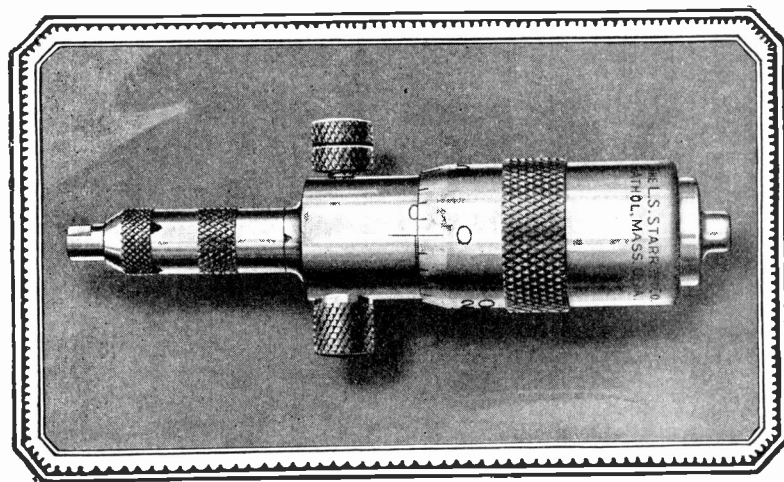
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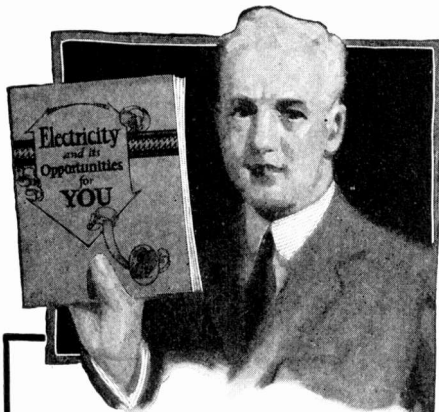
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RADIO BROADCAST

(Continued)

Table with columns: Call Letters, Name, Location, Power & Wave Length. Lists radio stations from KJFU to WABE.

(Continued on page 1024)

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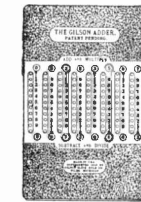
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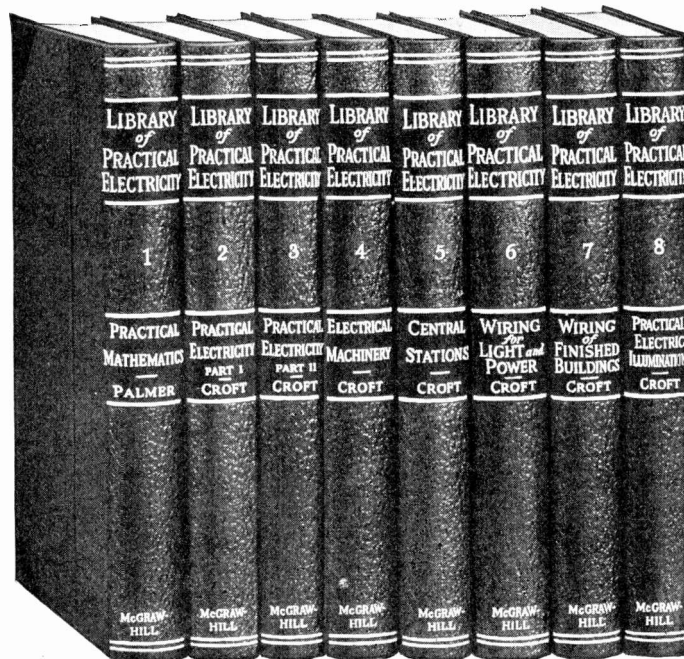
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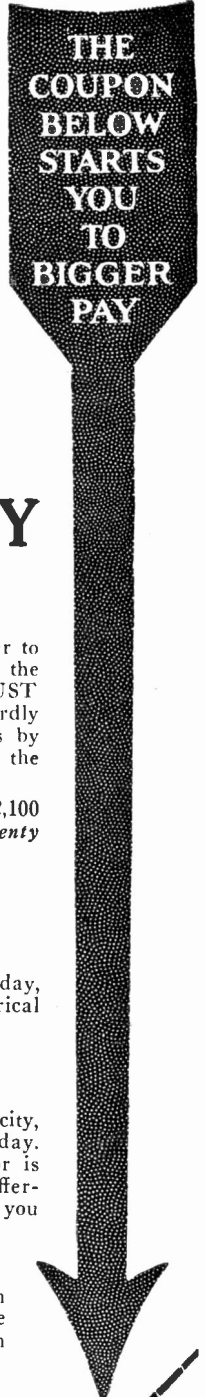
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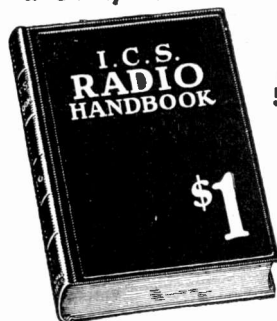
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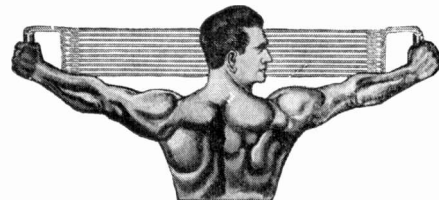
RADIO BROADCAST

(Continued)

WABF	Mount Vernon Register-News Co., Mount Vernon, Ill.	100-234
WABG	Arnold Edwards Piano Co., Jacksonville, Fla.	10-248
WABH	Lake Shore Tire Co., Sandusky, Ohio	20-240
WABI	Bangor Railway & Electric Co., Bangor, Maine	50-240
WABJ	The Radio Laboratories, South Bend, Ind.	10-240
WABK	First Baptist Church, Worcester, Mass.	10-252
WABL	Connecticut Agricultural College, Storrs, Conn.	100-283
WABM	F. E. Doherty Automotive & Radio Equipment Co., Saginaw, Mich.	100-254
WABN	Waldo C. Grover, LaCrosse, Wis.	250-244
WABO	Lake Ave. Baptist Church, Rochester, N. Y.	10-252
WBAA	Purdue University, West Lafayette, Ind.	250-360
WBAD	Sterling Electric Co., Minneapolis, Minn.	100-360
WBAH	The Dayton Co., Minneapolis, Minn.	500-417
WBAN	Wireless Phone Corporation, Paterson, N. J.	100-244
WBAO	James Millikin University, Decatur, Ill.	50-360
WBAP	Wortham-Carter Publishing Co. (Star-Telegram), Fort Worth, Texas	750-476
WBAV	Erner & Hopkins Co., Columbus, Ohio	500-390
WBAW	Marietta College, Marietta, Ohio	250-246
WBAX	John H. Stenger, Jr., Wilkes-Barre, Pa.	20-360
WBAY	Western Electric Co., New York, N. Y.	500-492
WBBA	Newark Radio Laboratories, Newark, Ohio	20-240
WBBC	Sterling Radio Equipment Co., Sterling, Ill.	50-229
WBBD	Barbey Battery Service, Reading, Pa.	50-234
WBL	T & H Radio Company, Anthony, Kan.	100-261
WBS	D. W. May (Inc.), Newark, N. J.	20-360
WBT	Southern Radio Corp., Charlotte, N. C.	500-360
WBU	City of Chicago, Chicago, Ill.	500-286
WBZ	Westinghouse Electric & Mfg. Co., Springfield, Mass.	750-337
WCAD	St. Lawrence University, Canton, Ohio	250-280
WCAE	Kaufman & Baer Co., Pittsburgh, Pa.	500-462
WCAG	Clyde R. Randall, New Orleans, La.	50-268
WCAH	Entrekin Electric Co., Columbus, Ohio	100-286
WCAJ	Nebraska Wesleyan University, University Place, Neb.	500-360
WCAK	Alfred P. Daniel, Asst. Division Mgr., A. R. R. L., Houston, Texas	50-360
WCAL	St. Olaf College, Northfield, Minn.	250-360
WCAM	Villanova College, Villanova, Pa.	150-360
WCAO	The Sanders and Stayman Co., Baltimore, Md.	50-360
WCAP	Chesapeake & Potomac Telephone Co., Washington, D. C.	500-469
WCAR	Alamo Radio Electric Co., San Antonio, Texas	150-360
WCAS	Wm. Hood Dunwoody Industrial Institute, Minneapolis, Minn.	100-246
WCAT	South Dakota State School of Mines, Rapid City, S. D.	50-240
WCAU	Durham & Co., Philadelphia, Pa.	250-286
WCAV	J. C. Dice Electric Co., Little Rock, Ark.	20-360
WCAX	University of Vermont, Burlington, Vt.	50-360
WCAY	Kesselman O'Driscoll Co., Milwaukee, Wis.	250-261
WCAZ	Carthage College, Carthage, Ill.	50-246
WCBA	Charles W. Humbach, Allentown, Pa.	5-280
WCBB	K & K Radio Supply Co. (Charles H. Katzenberger), Greenville, Ohio	100-240
WCBD	Wilbur G. Voliva, Zion, Ill.	500-345
WCE	Findley Electric Co., Minneapolis, Minn.	250-360
WCK	Stix Baer & Fuller Dry Goods Co., St. Louis, Mo.	100-360
WCM	University of Texas, Austin, Texas	500-360
WCX	The Detroit Free Press, Detroit, Mich.	500-517

(Continued on page 1026)

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Tuning Control
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Our New
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Designed for
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One or more Stages will
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or howling

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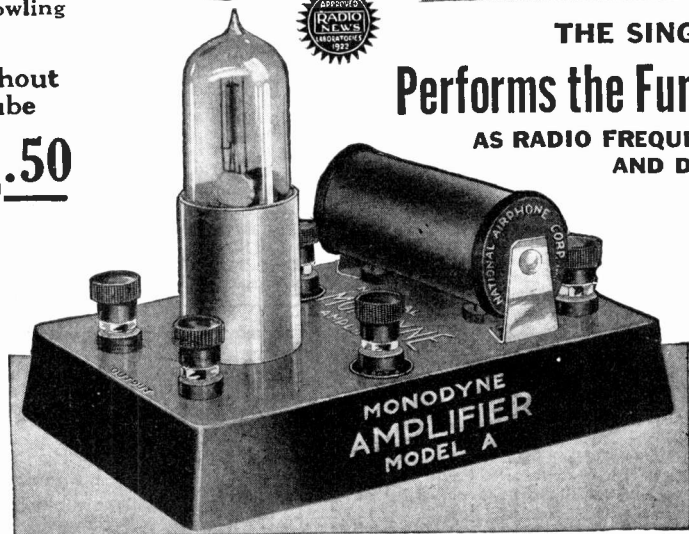


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City State

Education

RADIO BROADCAST

(Continued)

Call Letters	Name	Location	Power & Wave Length
WDAD	Central Kansas Radio Supply Co. (Wm. L. Harrison), Lindsborg, Kan.		10-360
WDAE	Tampa Daily Times, Tampa, Fla.		250-360
WDAF	Kansas City Star, Kansas City, Mo.		500-411
WDAG	J. Laurance Martin, Amarillo, Texas		100-263
WDAH	Trinity Methodist Church (South), El Paso, Texas.		100-268
WDAI	Hughes Radio Corp., Syracuse, N. Y.		100-246
WDAK	The Courant, Hartford, Conn.		100-261
WDAL	Florida Times-Union, Jacksonville, Fla.		100-360
WDAO	Automotive Electric Co., Dallas, Texas		50-360
WDAP	Board of Trade, Chicago, Ill.		500-360
WDAR	Lit Bros., Philadelphia, Pa.		500-395
WDAS	S. A. Waite, Worcester, Mass.		5-360
WDAU	Slocum & Kilburn, New Bedford, Mass.		100-360
WDAX	First National Bank (Appamoose County Farm Bureau), Centerville, Iowa		100-360
WDAY	Radio Equipment Corp., Fargo, N. D.		50-244
WDBC	Kirk, Johnson Co., Lancaster, Pa.		50-258
WDBF	Robert G. Phillips, Youngstown, Ohio		50-261
WDM	Church of the Covenant, Washington, D. C.		50-360
WDT	Ship Owners' Radio Service, New York, N. Y.		500-405
WDZ	J. L. Bush, Tuscola, Ill.		10-278
WEAA	Frank D. Fallain Police Building, Flint, Mich.		150-280
WEAB	Standard Radio Equipment Co., Fort Dodge, Iowa		500-360
WEAF	American Telephone & Telegraph Co., New York, N. Y.		500-492
WEAG	Nichols-Hineline-Bassett Laboratory, Edgewood, R. I.		10-231
WEAH	Wichita Board of Trade, Wichita, Kan.		50-244
WEAI	Cornell University, Ithaca, N. Y.		500-286
WEAJ	University of South Dakota, Vermillion, S. D.		200-360
WEAM	Borough of North Plainfield (W. Gibson Buttrick), North Plainfield, N. J.		100-252
WEAN	Shepard Co., Providence, R. I.		100-273
WEAO	The Ohio State University, Columbus, Ohio		500-360
WEAP	Mobile Radio Co., Mobile Ala.		100-360
WEAR	Baltimore American News Publishing Co., Baltimore, Md.		50-360
WEAS	Hecht Co., Washington, D. C.		50-360
WEAU	Davidson Bros. Company, Sioux City, Iowa		100-360
WEAY	Will Horwitz, Jr., Houston, Texas		250-360
WEB	Benwood Co., St. Louis, Mo.		500-360
WEV	Hurlbut-Still Electrical Co., Houston, Texas		50-360
WEW	St. Louis Univ'ty, St. Louis, Mo.		100-261
WFAA	The Dallas News, The Dallas Journal, Dallas, Texas		500-476
WFAB	Carl F. Woese, Syracuse, N. Y.		200-234
WFAF	H. C. Sprattley Radio Co., Poughkeepsie, N. Y.		20-360
WFAH	Electric Supply Co., Port Arthur, Texas		150-236
WFAJ	Hi-Grade Wireless Instrument Co., Asheville, N. C.		50-360
WFAM	Times Publishing Co., St. Cloud, Minn.		20-360
WFAN	Hutchinson Electric Service Co., Hutchinson, Minn.		100-360
WFAQ	Missouri Wesleyan College, Cameron, Mo.		10-360
WFAT	The Daily Argus-Leader, Sioux Falls, S. Dak.		100-360
WFAV	University of Nebraska, Dept. E. E., Lincoln, Nebr.		500-275
WFI	Strawbridge & Clothier, Philadelphia, Pa.		500-395
WGAL	Lancaster Elec. Supply & Const. Co., Lancaster, Pa.		10-248
WGAN	Cecil E. Lloyd, Pensacola, Fla.		50-360
WGAQ	Glenwood Radio Corp., (W. G. Patterson), Shreveport, La.		100-360
WGAR	Southwest American, Fort Smith, Ark.		20-360
WGAU	Radio Mfg. & Service Co., (Marcus G. Limb), Wooster, Ohio.		20-226
WGAW	Ernest C. Albright, Altoona, Pa.		100-261
WGAY	North Western Radio Co., Madison, Wis.		100-360
WGAZ	The South Bend Tribune, South Bend, Ind.		50-360
WGI	American Radio & Research Corp., Medford Hillside, Mass.		500-360

(Continued on page 1028)



Ten years, and no breakdowns

That's the record which James Bishop's Auto-Wheel Coaster has made. He says: "I have had an Auto-Wheel Coaster for ten years. Have hauled heavy loads most every day on rough ground, but the wagon went through it all without a breakdown."

Auto-Wheel

Superior construction makes Auto-Wheel Coasters sturdy. Bolsters of hard maple; mortised joints; self-contained roller bearings; hound brace; hand brake, special hub cap and locking pin; rubber-tired disc wheels (oversize tires on three largest), or steel-tired disc or wood spoke wheels. Write for catalog of all models of the Auto-Wheel and the Auto-Cart (for little brother or sister). If you send names and addresses of three coaster wagon dealers in your town, telling which sell Auto-Wheel, we give you a year's subscription FREE to the "Auto-Wheel Spokes-man," our magazine.

Auto-Wheel Coaster Co., Inc.
North Tonawanda, N. Y.

Standard of Spanish Army Genuine Astra

\$7.75



Adopted by French During World War

The finest European pistol—Drop Forged Blue Steel Throughout—uses standard ammunition, an accurate, hard-hitting, brand-new weapon.

Bought before recent tariff raise. Buy now from sole U. S. importers and save about 1/2 on these fine guns.

- \$7.75 25 cal., 7 shot ASTRA, C. O. Q. Automatic.
- 8.95 25 cal., 7 shot ASTRA, Automatic.
- 9.98 25 cal., 7 shot ASTRA, triple safety.
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- 16.95 32-20 and 38 cal. swing-out cyl. revolvers.

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Enter this fascinating, uncrowded profession. Many opportunities; meet big railway officials; advancement rapid. Travel or remain near home; healthful, steady, outdoor work.

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Any average man can qualify in 3 mos. spare-time study at home. Easy to understand. Upon graduation, we get you position as per Guarantee Notice. You take no risk!

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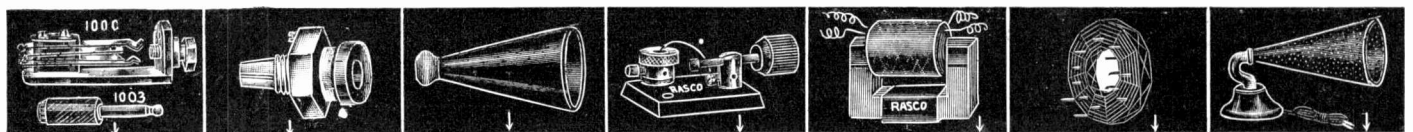
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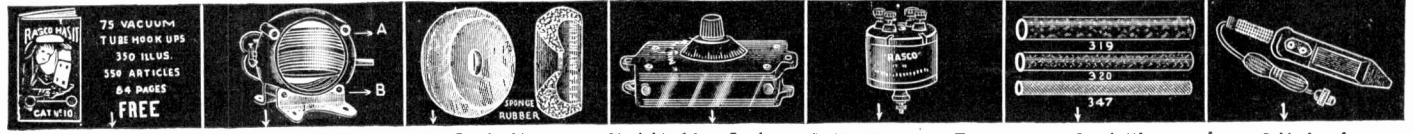
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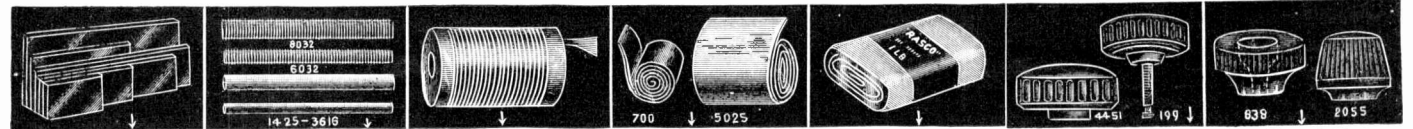
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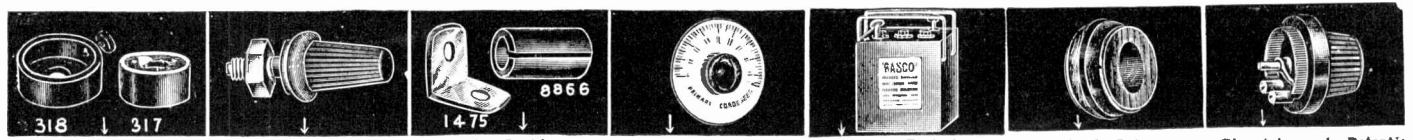
<p>Jacks and Plugs Best materials. Silver contacts. Factory making Postal Telegraph jacks, makes these.</p> <p>F1000 Jack 4 springs \$.65 F1001 Jack 3 springs .75 F1002 Jack 5 springs .80 F1003 Plug .55</p>	<p>Cord Tip Jack Takes place of binding posts. Cord tip firmly gripped by jacks. Made of brass, nickel plated. Screw to attach lead wire. No soldering necessary.</p> <p>F1500 Cord tip jack Each\$1.15</p>	<p>Phonehorn Base consists of Phonodapter into which fits a fine enameled fibre horn. Size of horn 12"; bell 6 1/2". Slip Phonodapter end on a single telephone receiver.</p> <p>F1321 Phonehorn, prepaid\$1.45</p>	<p>Radiocite Detector Base solid black composition. Automatic crystal holder. Triple adjustments. Smallest, neatest detector made. Radiocite crystal. 200,000 in use.</p> <p>F1899 Detector\$.60 F1898 Galena detector\$.50</p>	<p>Audio Frequency Transformer No better transformer made. Highest class materials. Impregnated coils. Silicon steel stampings used. Save 50 per cent by assembling it yourself.</p> <p>F1100 Ratio 4 1/2 to 1 \$2.00 F1150 Ratio 6 1/2 to 1 \$2.00</p>	<p>Duo-Spiderweb Coil For Reinartz circuit, 200-600 meters. 19 taps. Size 4 1/4" diam.; 1 1/2" center opening. Coil is firm and will not fall apart.</p> <p>F2650 Spider-web Reinartz coil\$1.15 F2660 Coil for panel mount. 225-600 met. \$1.90</p>	<p>Melotone Loud Speaker Best popular loud speaker. Fibre horn, heavy metal base, five ft. cord. Nickel goose-neck. Greatest tuned (adjustable) talker. Horn length 11 1/2"; bell 6 5/8"; total height 9".</p> <p>F255 Melotone Speaker\$4.90</p>
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<p>75 VACUUM TUBE HOOK UPS 350 ILLUS. 350 ARTICLES 64 PAGES FREE</p>	<p>Molded Variometer Highly substantial instrument. Silk windings. 1/4" shaft. Flange B when placed into AB direction makes instrument panel mounting. 180 to 650 meters. Money back if this instrument is not all that we claim for it.</p> <p>F5353 Variometer\$3.00</p>	<p>Fonokushions Made of sponge rubber. Make wearing your receivers a pleasure. Positively exclude all noises and make reception a pleasure. Sponge rubber will last for years. Light as a feather.</p> <p>F5050 Fonokushions, set of two\$1.50</p>	<p>Straight Line Condenser Simplest and most practical type of condenser.</p> <p>F4500 "Rico" Condenser .001 mfd. 43 plate capacity\$1.75 F4230 .0005 mfd. 23 plate capacity\$1.75 F4110 .00025 mfd. 11 plate capacity\$1.75 All types no dials \$1.50</p>	<p>Radio Frequency Transformers Best Radio Frequency Transformer developed so far. Designed by R. E. Lacault, Associate Editor RADIO NEWS. Air core type.</p> <p>F2800 Transformer, size 7 1/2"x2 1/2"\$1.50</p>	<p>Spaghetti Varnished flexible cambric tubing. 319 takes No. 22 wire; 320 takes 18 to 20 wire; 21 takes 16 to 18 wire; 344 takes 22 to 28 wire.</p> <p>F319-320-321 Per ft. \$.06 F344 Flexible soft rubber tubing; 10 feet for. \$.20</p>	<p>Soldering Iron Smallest and handiest made. Fits any flat iron or percolator plug. Plug then becomes handle. 5" long. Complete but without plug or wire.</p> <p>F2200 Soldering Iron\$1.45</p>
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<p>Formica Panels Clearance Sale As we are discontinuing these particular sizes, this material is now offered at cost. All 3-16" thick.</p> <p>F352 9x12" each 1.75 F354 6 1/2x19 1/4" each 1.90 F356 6x14" each 1.60 F357 6x4" each65</p>	<p>Brass Rods Sold in 6" lengths only.</p> <p>F8032 Rod 8-32" thread, length\$.08 F6032 Rod, 6-32" thread, length\$.06 F1425 Rod, plain 3/4" round, length\$.10 F3616 Rod, plain 3-16" round, length\$.06</p>	<p>Litz Wire Prices are per foot. E = equals.</p> <p>F823 E No. 25 R&S \$.02 F890 E No. 28 R&S .01 F891 E No. 21 R&S .03 F892 E No. 20 R&S .04</p> <p>10 per cent discount in 100 foot lots.</p>	<p>Copper Ribbon .005" thick.</p> <p>F700 5/8" wide; F701 1/4" wide; F702 3-16" wide. All sizes per foot.....\$.01</p> <p>Copper Foil .001" thick. 4" wide.</p> <p>F5025 Copper Foil per foot\$.10 10-foot length\$.80</p>	<p>Tin Foil All our tin foils come 4" wide. Uniform product throughout.</p> <p>Best grade only. F850 has 1500 sq. inches per lb. F851 700 sq. inches to lb. F850 Tin foil.....lb .35 F851 Tin foil.....lb .35</p>	<p>Switch Knob</p> <p>F199 Knob. 1 1/4" dia. height 5/8"; 8-32 screw. F4451 has 8-32 or 10-52 bushing, no screw.</p> <p>F199 Knob\$.10 F4451 Knob\$.06</p>	<p>Marconi Knob Has central hole of 5-32" and seat to hold screw, dia. 1 1/4", height 1/2".</p> <p>F838 Knob, each\$.13 Fluted Knob With 8-32" bushing. Black composition.</p> <p>F2055 Knob 1" high 1 1/4" diam. each\$.15</p>
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<p>Mounted Crystal-Cup Cup has screw and adjustment nut. Fits all standard mounted crystals. Nickel plated, polished.</p> <p>F318 Nickel Cup\$.20 Radiocite Best most sensitive mounted crystal. U. S. Navy using it. Each tested.</p> <p>F317 Radiocite Crystal\$.25</p>	<p>Rasco Vernier Why use a vernier attachment when a vernier attachment will do anything and everything a vernier condenser accomplishes. Cleverest vernier made. Can be used with any dial. Soft rubber ring engages dial. Nothing to come apart.</p> <p>F1450 Vernier\$.30</p>	<p>Angle Bushing Angle piece used to mount panels on boards, tubes on panels etc. 1,000 uses. 1 1/2" wide, height 7-16".</p> <p>F1475 Angle piece. Each\$.03</p> <p>Adapter Bushing Makes 3-16" dial fit 1/4" shaft. 1/2" long.</p> <p>F8866 Bushing\$.04</p>	<p>Silver Dials Silver surface black enamel lettering. For 3/4" shaft. No set screw required. All 2 1/2" dia.</p> <p>F800 Plate Variometer; F801 Prim. Con.; F802 Sec. Cond.; F803 Coupler; F804 Fil. Rheo.; F805 Grid Variometer. Each style,\$.20 each. Set of six\$1.15</p>	<p>Storage Batteries Guaranteed for two years. Only NEW material used. Acid proof terminals, Patent vents.</p> <p>F2400 Two volt. 40 amp. hours.\$3.90 F640 Six volt. 40 amp. hours 7.25 F666 Six volt. 60 amp. hours 9.50</p> <p>Shipped express collect.</p>	<p>Vario-Rotor Made of hard wood, accurately turned. Takes any finish. Large hole 2" diameter. Width 2", diameter 3 3/4", 2 shaft holes.</p> <p>F343 Rotor\$.30</p> <p>"Rasco" Universal Bearing. Especially made to take above rotor for panel mounting.</p> <p>F1375 Uni. Bearing \$.25</p>	<p>Rheostats and Potentiometers High heat dielectric base. Come with tapered, knurled knob. 2 1/2" dia. Complete with pointer.</p> <p>F4310 6 ohm\$.45 F4311 30 ohm65 F4312 Potentiometer, 200 ohms\$.85</p>
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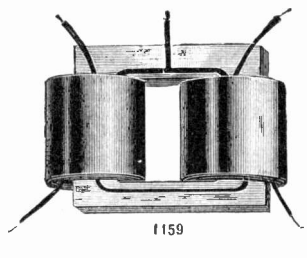
<p>Phone Plugs Sold from 75c. to \$1.00 everywhere. Hard rubber composition shell and patented cord tip holder. Finest workmanship thru-out.</p> <p>F1030 Rasco Telephone Plug, each\$.35</p>	<p>Bakelite Socket Octagon shape. Four nickel binding posts, phosphor bronze contact springs. Best brown bakelite.</p> <p>F6510 Bakelite socket \$.40 F6500 Tube Socket. Made entirely of composition. Best made. Each\$.35</p>	<p>Condensers Best make, paper-impregnated condensers. Capacity guaranteed.</p> <p>F5050 Phone Condenser. .001\$.20 F5056 Grid Condenser. .00025\$.20 F5059 Grid Leak Condenser. .00025\$.30</p>	<p>Name Plates All name plates brass with silver letters. For 3/4" shaft. Comes in 35 styles.</p> <p>F809 Comes in 35 styles. Any denomination, each style\$.04 Metal Scale. 2 1/2", 30". Metal, silver background, black lettering.</p> <p>F715 Scale, Each\$.15</p>	<p>Binding Post Name Plates Dia. 3/4". These styles: Phones, Ground, -, Output, "A" Bat., "B" Bat., -, Loud Speaker, "C" Bat., Aerial, + Input, "A" Bat., +, "B" Bat., +, Loop "C" Bat., +.</p> <p>F6000 Name Plates all styles, each\$.03</p>	<p>"Rasco" Posts Made of black composition.</p> <p>F650-51 Each\$.08 F202 Has nickel-plated bottom, each\$.08 Dozen, each style\$.90 F122 Initialed Binding Posts. Six popular styles. Each\$.12</p>	<p>Cord Tips Standard phone cord tips, nickelled.</p> <p>F315 Each\$.03</p> <p>Separable Cord Tips No solder required. Wire goes in ferrule. Shank holds it tight. Nickel plated.</p> <p>F2900 Each\$.06</p>
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AUTOPLEX CIRCUIT

The famous Autoplex circuit described in RADIO NEWS has taken the country by storm. The only single tube outfit that works a loud-talker. Result guaranteed.

1—F714 Mahogany Cabinet, 7x14"\$3.35
1—F7140 Dilectryte Panel 7x14" 1.20
2—F5353 Moulded Variometer 6.00
2—F3076 4" Dials 80
1—F5014 1250 turn Honeycomb coil 1.95
1—F6500 Vacuum Tube Socket35

Our special price, Complete \$15.25
Complete with Melotone Loud-speaker \$20.00



New! New!! 2 Stage Amplifier

Push Pull Transformer for many new circuits. See any radio magazine. Made of best materials. Coils impregnated. Silicon steel laminations. Save 50 per cent by assembling yourself. Simple instructions furnished. Fully Guaranteed.

F1159 Push Pull Transformer. Ratio 6 1/2 to 1\$4.00

1—F710 Mahogany Cabinet. \$2.60
1—F7100 Dilectryte Panel95
2—F1100 A. F. Transformers 4.00
2—F1100 Double Circuit Jacks 1.30
1—F1003 Rasco Plug55
2—F6500 Tube Sockets70
2—F4311 30 ohm Rheostats 1.30
10—F6050 Post Name Plates .30
10—F201 Rasco Binding Posts 1.00
30 Bg. F6400 Bus Bar Wire 75
Blue Prints and directions... .50

Total, \$13.90

Our Price \$13.50

RADIO SPECIALTY CO., 100 Park Place, New York City

Factories: Brooklyn, N. Y. Elkridge, Md.

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Wins a Welcome

You are always welcome with a sweet-toned Buescher Saxophone. Thousands of men and women, of all ages, have found it a certain key to social popularity. For home entertainment, for church, school or lodge affairs, the Saxophone is the most popular and adaptable instrument. Saxophone players enjoy, also, many opportunities of earning money.



TRUE-TONE SAXOPHONE

The new Buescher Saxophone is a marvelous instrument. It is one of the most beautiful of all musical instruments—by the range and wealth of its tones it takes the place of almost every other instrument—yet it is so perfected and simplified that it is the easiest of all instruments to play.

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RADIO BROADCAST (Continued)

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WGL	Thomas F. J. Howlette,	Philadelphia, Pa.	500—360
WGR	Federal Telephone and Telegraph Co.,	Buffalo, N. Y.	500—319
WGV	Interstate Electric Co.,	New Orleans, La.	100—360
WGY	General Electric Co.,	Schenectady, N. Y.	1000—380
WHA	University of Wisconsin,	Madison, Wis.	500—360
WHAA	State University of Iowa,	Iowa City, Iowa	100—283
WHAB	Clark W. Thompson,	Galveston, Texas	200—360
WHAC	Cole Bros. Electric Co.,	Waterloo, Iowa	10—360
WHAD	Marquette University,	Milwaukee, Wis.	100—280
WHAG	University of Cincinnati,	Cincinnati, Ohio	200—222
WHAH	Hafer Supply Co.,	Joplin, Mo.	250—360
WHAI	Radio Equipment & Mfg. Co.,	Davenport, Iowa	50—360
WHAK	Roberts Hdwe. Co.,	Clarksburg, W. Va.	15—258
WHAL	Lansing Capital News,	Lansing, Mich.	20—248
WHAM	University of Rochester (Eastman School of Music),	Rochester, N. Y.	100—360
WHAP	Otta & Kuhns,	Decatur, Ill.	50—360
WHAQ	Semmes Motor Co.,	Washington, D. C.	10—360
WHAR	Paramount Radio & Electric Co., (W. H. A. Paulus),	Atlantic City, N. J.	10—231
WHAS	Courier-Journal and Louisville Times,	Louisville, Ky.	500—400
WHAU	Wilmington Electrical Specialty Co., Inc.,	Wilmington, Del.	50—360
WHAZ	Rensselaer Polytechnic Institute,	Troy, N. Y.	500—380
WHB	Sweeney School Co.,	Kansas City, Mo.	500—411
WHD	West Virginia University,	Morgantown, W. Va.	250—360
WHK	Radiovox Co., (Warren R. Cox),	Cleveland, Ohio	500—360
WHN	George Schubel,	New York, N. Y.	100—360
WIAB	Joslyn Automobile Co.,	Rockford, Ill.	50—252
WIAC	Galveston Tribune,	Galveston, Texas	100—360
WIAD	Howard R. Miller,	Ocean City, N. J.	10—254
WIAF	Gustav A. DeCortin,	New Orleans, La.	10—234
WIAH	Continental Radio & Mfg. Co.,	Newton, Iowa	10—258
WIAI	Heer Stores Co.,	Springfield, Mo.	20—252
WIAJ	Fox-River-Valley Radio Co.,	Neenah, Wis.	100—224
WIAK	Journal-Stockman Co.,	Omaha, Neb.	200—278
WIAO	School of Engineering of Milwaukee,	Milwaukee, Wis.	100—360
WIAQ	Chronicle Publishing Co.,	Marion, Ind.	10—226
WIAR	Paducah Evening Sun,	Paducah, Ky.	100—360
WIAS	Home Electric Co.,	Burlington, Iowa	100—360
WIAT	Leon T. Noel,	Tarkio, Mo.	15—360
WIAU	American Trust & Savings Bank,	Le Mars, Iowa	20—360
WIK	K & L Electric Co.,	McKeesport, Pa.	500—234
WIL	Continental Electrical Supply Co.,	Washington, D. C.	10—360
WIP	Gimbel Bros.,	Philadelphia, Pa.	500—509
WJAB	American Electric Co.,	Lincoln, Neb.	500—360
WJAD	Jackson's Radio Engineering Laboratories,	Waco, Texas	150—360
WJAF	Press Publishing Co.,	Muncie, Ind.	10—360
WJAG	The Norfolk Daily News,	Norfolk, Neb.	200—360
WJAK	Clifford L. White,	Greentown, Ind.	30—254
WJAM	D. M. Perham,	Cedar Rapids, Iowa	20—268
WJAN	Peoria Star,	Peoria, Ill.	100—280
WJAQ	Capper Publications,	Topeka, Kan.	100—360
WJAR	The Outlet Co., (J. Samuels & Bro.),	Providence, R. I.	50—360
WJAS	Pittsburgh Radio Supply Co.,	Pittsburgh, Pa.	500—360
WJAT	Kelley-Vawter Jewelry Co.,	Marshall, Mo.	10—360

(Continued on page 1030)

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(Continued)

Call Letters	Name	Location	Power & Wave Length
WJAX	Union Trust Co.,	Cleveland, Ohio	500—390
WJAZ	Chicago Radio Laboratory,	Chicago, Ill.	1000—273
WJD	Richard H. Howe,	Granville, Ohio	50—229
WJII	Wm. P. Boyer Co.,	Washington, D. C.	50—273
WJX	De Forest Radio Telephone & Telegraph Co.,	New York, N. Y.	500—360
WJY	R. C. A.,	New York, N. Y.	500—405
WJZ	R. C. A.,	New York, N. Y.	500—455
WKAA	H. F. Paar,	Cedar Rapids, Iowa	100—268
WKAD	Charles Loeff,	(Crescent Park), East Providence, R. I.	10—240
WKAF	W. S. Radio Supply Co.,	Wichita Falls, Texas	100—360
WKAN	United Battery Service Co.,	Montgomery, Ala.	15—226
WKAP	Dutce W. Flint,	Cranston, R. I.	200—360
WKAQ	Radio Corp. of Porto Rico,	San Juan, Porto Rico	100—360
WKR	Michigan Agriculture College,	East Lansing, Mich.	250—280
WKAS	L. E. Lines Music Co.,	Springfield, Mo.	10—360
WKA	Laconia Radio Club,	Laconia, N. H.	50—254
WKA	Turner Cycle Co.,	Beloit, Wis.	10—242
WKA	William A. MacFarlane,	Bridgeport, Conn.	15—231
WKA	Brenau College,	Gainesville, Ga.	10—280
WKC	Joseph M. Zamoiski Co.,	Baltimore, Md.	20—360
WKY	W. K. Y. Radio Shop,	Oklahoma, City, Okla.	100—360
WLAC	North Carolina State College	Raleigh, N. C.	750—360
WLAG	Cutting & Washington Radio Corp.,	Minneapolis, Minn.	500—417
WLAH	Samuel Woodworth,	Syracuse, N. Y.	250—234
WLAJ	Waco Electrical Supply Co.,	Waco, Texas	150—360
WLAK	Vermont Farm Machine Corp.,	Bellows Falls, Vt.	500—360
WLAL	Naylor Electrical Co.,	(Sim Naylor), Tulsa, Okla.	100—360
WLAN	Putnam Hardware Co.,	Houlton, Me.	250—283
WLAP	W. V. Jordan,	Louisville, Ky.	15—360
WLAQ	Arthur E. Schilling,	Kalamazoo, Mich.	20—360
WLAT	Radio & Specialty Co.,	Burlington, Iowa	10—360
WLAV	Electric Shop,	Pensacola, Fla.	15—254
WLAW	Police Dept.,	New York, N. Y.	500—360
WLAX	Putnam Electric Co.,	Greencastle, Ind.	10—231
WLB	University of Minnesota,	Minneapolis, Minn.	100—360
WLW	Crosley Manufacturing Co.,	Cincinnati, Ohio	500—309
WMAB	Radio Supply Co.,	Oklahoma, Okla.	100—360
WMAC	J. Edw. Page (Olive B. Meredith),	Cazenovia, N. Y.	200—261
WMAF	Round Hills Radio Corp.,	Dartmouth, Mass.	100—500—360
WMAH	General Supply Co.,	Lincoln, Neb.	100—254
WMAJ	Drovers Telegram Co.,	Kansas City, Mo.	250—275
WMAK	Norton Laboratories,	Lockport, N. Y.	500—360
WMAL	Trenton Hardware Co.,	Trenton, N. J.	50—256
WMAN	First Baptist Church,	Columbus, Ohio	10—286
WMA	Utility Battery Service,	Easton, Pa.	50—246
WMAQ	Chicago Daily News,	Chicago, Ill.	250—448
WMAV	Alabama Polytechnic Inst.,	Auburn, Ala.	500—250
WMA	Kingshighway Pres byterian Church,	St. Louis, Mo.	100—280
WMAZ	Mercer University,	Macon, Ga.	50—268
WMC	Commercial,	Memphis, Tenn.	500—500
WMI	The Precision Equipment Co.,	Cincinnati, Ohio	10—248
WMU	Doubleday-Hill Electric Co.,	Washington, D. C.	100—261
WNAC	Shepard Stores,	Boston, Mass.	100—278
WNAD	University of Oklahoma,	Norman, Okla.	100—360

(Continued on page 1032)

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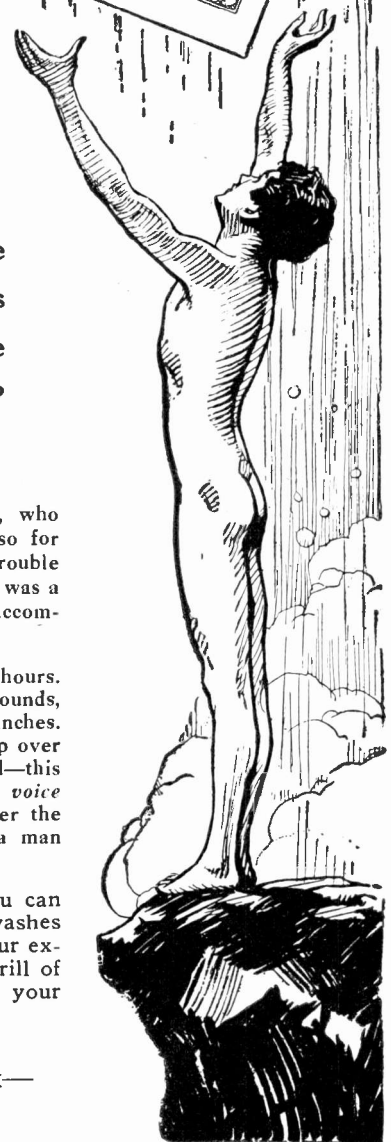
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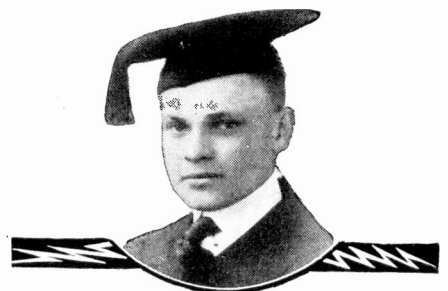
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RADIO BROADCAST (Continued)

Call Letters	Name	Location	Power & Wave Length
WTC	Nushawg Poultry Farm,	New Lebanon, Ohio	50—234
WQAA	Horace A. Beale, Jr.,	Parkersburg, Pa.	500—360
WQAB	Southwest Missouri State Teachers College,	Springfield, Mo.	10—236
WQAC	E. B. Gish,	Amarillo, Texas.	100—360
WQAD	Whitall Electric Co.,	Waterbury, Conn.	50—242
WQAE	Moore Radio News Station,	Springfield, Vt.	50—275
WQAF	Sandusky Register,	Sandusky, Ohio	5—240
WQAH	Brock-Amerson Electrical Eng. Co.,	Lexington, Ky.	10—254
WQAI	Coles County Telephone & Telegraph Co.,	Mattoon, Ill.	10—258
WQAM	Electrical Equipment Co.,	Miami, Fla.	100—360
WQAN	Scranton Times,	Scranton, Pa.	100—280
WQAO	Calvary Baptist Church,	New York, N. Y.	100—360
WQAQ	West Texas Radio Co. (Abilene Daily Reporter),	Abilene, Texas	100—360
WQAS	Prince-Walter Co.,	Lowell, Mass.	100—266
WQAV	Huntington & Guerry (Inc.),	Greenville, S. C.	15—258
WQAW	Catholic University,	Washington, D. C.	5—236
WQAX	Radio Equipment Co.,	Peoria, Ill.	10—360
WQAZ	Greensboro Daily News,	Greensboro, N. C.	30—360
WRAA	Rice Institute,	Houston, Texas	200—360
WRAD	Taylor Radio Shop,	Marion, Kansas	10—248
WRAF	The Radio Club (Inc.),	Laporte, Ind.	10—224
WRAH	Stanley N. Read,	Providence, R. I.	10—231
WRAL	Northern States Power Co.,	St. Croix Falls, Wis.	100—248
WRAN	Black Hawk Electrical Co.,	Waterloo, Iowa	10—236
WRAO	Radio Service Co.,	St. Louis, Mo.	100—360
WRAP	Winter Park Electrical Construction Co.,	Winter Park, Fla.	20—360
WRAU	Amarillo Daily News,	Amarillo, Texas	10—360
WRAV	Antioch College,	Yellow Springs, Ohio	100—360
WRAW	Avenue Radio Shop,	Reading, Pa.	10—238
WRAX	Flaxons Garage,	Gloucester City, N. J.	100—268
WRAY	Radio Sales Corp.,	Scranton, Pa.	100—280
WRAZ	Radio Shop of Newark, (Herman Lubilsky),	Newark, N. J.	50—233
WRC	Radio Corp. of America,	Washington, D. C.	500—469
WRK	Doron Bros. Elec. Co.,	Hamilton, Ohio	200—360
WRL	Union College,	Schenectady, N. Y.	500—360
WRM	University of Illinois,	Urbana, Ill.	500—360
WRR	City of Dallas Police and Fire Signal Dept.,	Dallas, Texas	20—360
WRW	Tarrytown Radio Research Laboratory (Koenig Bros.),	Tarrytown, N. Y.	150—273
WSAB	South East Missouri State Teachers College,	Cape Girardeau, Mo.	100—360
WSAC	Clemson Agricultural College,	Clemson College, S. C.	500—360
WSAD	J. A. Foster Co.,	Providence, R. I.	100—261
WSAG	City of St. Petersburg, (Loren V. Davis),	St. Petersburg, Fla.	10—244
WSAH	A. J. Leonard, Jr.,	Chicago, Ill.	500—248
WSAI	United States Playing Cards Co.,	Cincinnati, Ohio	500—309
WSAJ	Grove City College,	Grove City, Pa.	100—360
WSAK	Foster Egner, (Daily News Pomerooy, O.),	Middleport, Ohio	70—258
WSAL	Franklin Electric Co.,	Brookville, Ind.	10—246
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What Do Chiropractors Mean

by Innate Intelligence ?

THE temperature of a normal human body is approximately 98.6 degrees. You may sit in a room the temperature of which is 80 degrees, or go out of doors when the thermometer registers zero and your temperature, if you are in health, will not vary a single degree, because, resident in your body is an intelligence that generates, distributes and regulates the heat of the body, and instantly adapts it to the change in temperature.

If you start in June to take a plunge in the lake every morning and continue it every day until December, this same power resident in the body will intelligently adapt the body to the seasonal change in temperature.

This innate power gave the polar bear his long hair, that he might live in the land of eternal ice, and the gentle deer his speed, that he might escape his less swift foe. It is this power that in the struggle for existence gave wings to the birds and cunning to the fox, spots to the leopard and strength to the lion. It is this power that elongated the neck of the giraffe so that he could reach the high-hanging foods and for obvious reasons webbed the feet of the duck and goose. This inborn power adapted the stomach of the carnivora to a meat diet, the stomach of the herbivora to a vegetable diet, and the stomach of man to both.

maintains its vigor and then slowly lets the house in which we live decay. During all the circling three-score years and ten it coordinates the physical functions, heals the body's wounds, mends its breaks, adapts it to the change of season, occupation and pursuit and performs the miracle of changing common food into living, breathing, sensate bone and flesh.

It laughs at all our efforts to locate it or to imitate its work and yet some people, because they cannot find it, weigh it or measure it, question its existence and say "Vital force is a chemical phenomenon."

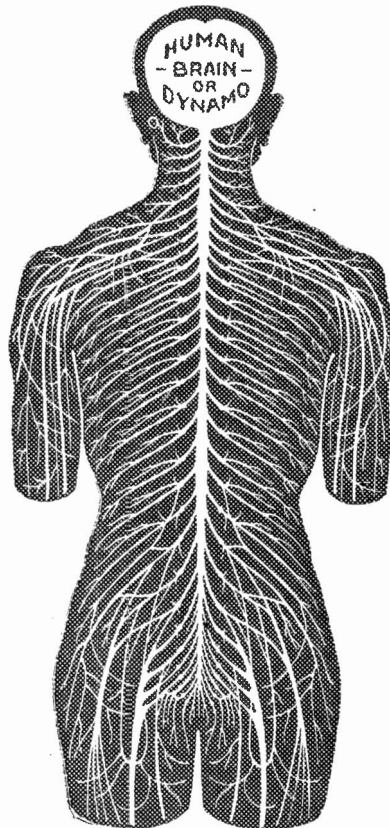
Call it what you will, it's there—a rose by any other name is just as sweet.

This "power within" Chiropractors call Innate Intelligence and all their philosophy, science and art is built upon this fundamental fact. They teach that "Innate Intelligence" functions through the brain and nervous system, and that disease is but the abnormal expression of one or more of the nine primary physical functions. Any pressure of a harder tissue (bone) upon the soft nervous tissue, impairs the conductivity (function or work) of that tissue and results in disease. All that is necessary for a complete restoration to health, is that the impinging tissue be adjusted to normal position, which permits the nerve again to function normally.

Scientists call the *modus operandi* of the "power within" the law of adaptation. Among the professions engaged in getting the sick well, chiropractors alone recognize the existence of the thing itself, and the law of its expression, through the nervous system.

That is the reason Chiropractic succeeds where other methods fail.

This power develops the body from a blastoderm to its full growth in thirty-five years; for ten or more it



DEFINITION
The practice of Chiropractic consists of the palpation and adjustment, with the hands, of the movable segments of the spinal column to normal position for the purpose of releasing the prisoned impulse.



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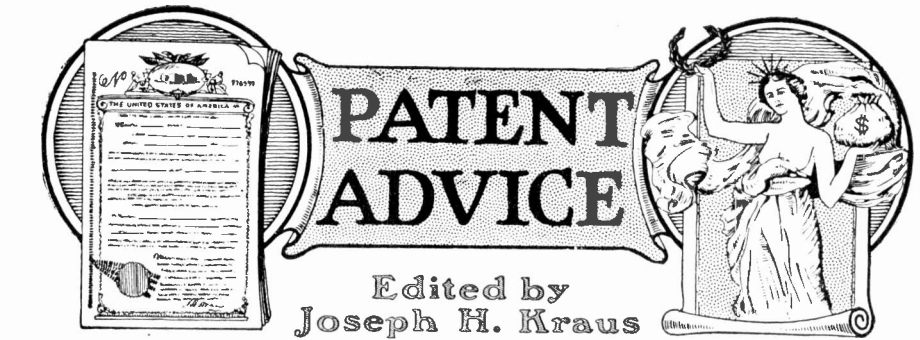
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Edited by Joseph H. Kraus

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Should advice be desired by mail a nominal charge of \$1.00 is made for each question. Sketches and descriptions must be clear and explicit. Only one side of sheet should be written on.

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RAILROAD CROSSING SAFETY DEVICE.

(774) J. A. Pickens, Easley, S. C., has designed a railroad crossing safety system, which comprises a large mound to be erected at the center of the road, diverting truck traffic and causing the driver to "go slow" in making the crossing.

A. Your suggestion for a railroad crossing is not always feasible, as there are so many places where such a large crossing detour could not be employed. Furthermore, diversion of truck traffic, as well as horse and wagon traffic, is not a very good suggestion, as a team ordinarily having a straight haul finds it a good deal easier to get across the railroad tracks than in places where sharp turns are necessary. It makes it very difficult to remove wreckage from such a crossing, and in general, instead of improving the safety of the crossing, acts oppositely. The railroad right of way must be increased in size and cost of the installations are much greater than if the entire road were elevated or depressed above or below the street level. We do not advise that you apply for a patent on this suggestion.

WHY WE DO IT

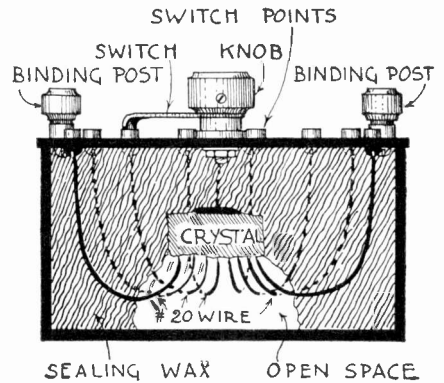
(775) John C. Clark, New York City, asks why it is that so many of the opinions printed in this column are adverse to the inventor and why the Editor of this column does not advise more inventors to attempt to secure patents upon their ideas.

A. The purpose of this department is to stop inventors from making foolish mistakes. It is to teach them the right way to go about securing a patent and apply for patents on those things of value which are almost assured of acceptance. Of course, even the best article may never be placed upon the market due to the fact that the inventor expects to either secure too much for the patent rights, or that he does not handle the project in the proper manner. In other words, he may be a good inventor, but a poor business man. A great many of our decisions are, however, favorable. In fact, we should judge that thousands of favorable decisions have been given. Many of the inventors courteously enough write to the Editor of this department and let him know that their invention has been sold, or that changes have been made in the plans, so as to make the device more marketable. The Editor of this department has received quite a number of letters claiming that inventions have been sold in some cases for thousands of dollars. These letters further advise that the individuals followed comments or suggestions made here. Few of these letters are printed. Many of the good suggestions are kept on file, giving the inventor ample opportunity to proceed with any

improvement he may desire, or permitting him to file his claims. None of the letters on which personal advice is given are published, consequently this limits the number of queries which are published. Do not for one moment suppose that all of our criticisms are adverse. Whenever we can conscientiously give favorable comment upon an idea we do so, even if we modify that favorable opinion.

CRYSTAL DETECTORS

(776) Clyde D. Pace, Detroit, Mich., submits two diagrams of crystal detectors, the first of which is quite ordinary, and the other a multi-point detector.

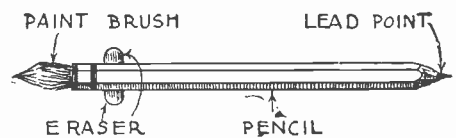


Cost and difficulty of construction are the main objections to this device.


A. The first suggestion of a crystal detector is not new at all, and we do not believe that you could secure any basic patent upon the idea whatever. The second idea is a little more novel, but presents many difficulties in manufacturing. For this reason, we would advise that you build a dozen or more of these detectors, and attempt to place them upon the market, perhaps through one of your local radio stores. You will find that in order to adjust the detector each individual point will have to be sealed to the crystal, one at a time, and tested for sensitivity before being sealed. This will present innumerable difficulties in manufacturing, as before stated. In addition, the switching arrangement is expensive, and after all of the twenty points of the crystal have been burned out it can be practically thrown away, there being no method of changing or replacing it. We would be very skeptical about advising you to apply for a patent upon the idea.

COMBINATION PENCIL, PAINT BRUSH AND ERASER

(777) Ralph M. Williams, Oberlin, Ohio, submits a design of a pencil, paint brush and eraser and requests our opinion.



A quite useless combination.






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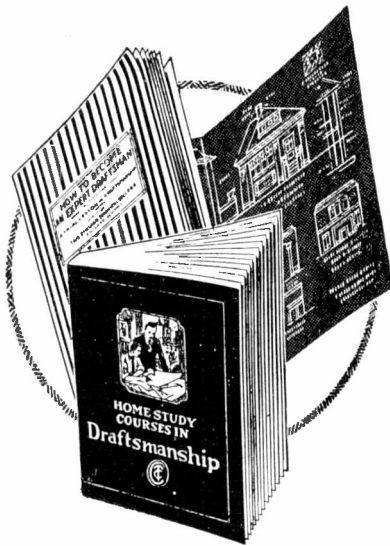
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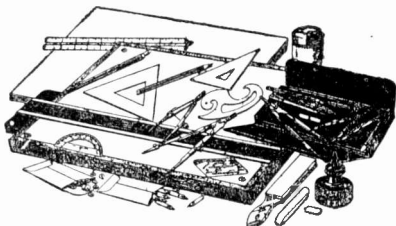
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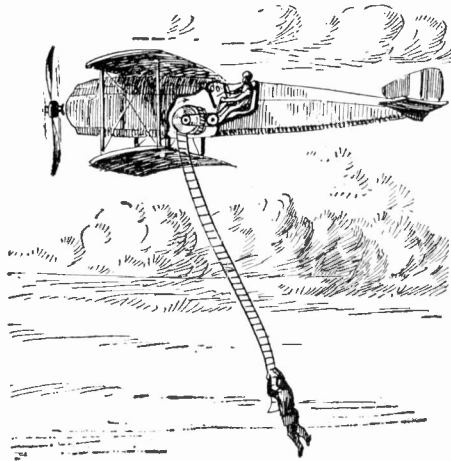
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A. We do not doubt but that you could obtain a patent on your combination pencil, eraser and paint brush, but we would not suggest such patent inasmuch as we do not believe that you could ever realize a value commensurate with the time and money spent in patenting the same or in attempting to place it upon the market. The practical utility of the device is extremely limited.

AIRPLANE LADDER

(778) Harvey Witter, Harrisburg, Pa., submits a design for an airplane ladder which will hoist a man up to the cock-pit of an airplane when he grasps the same.



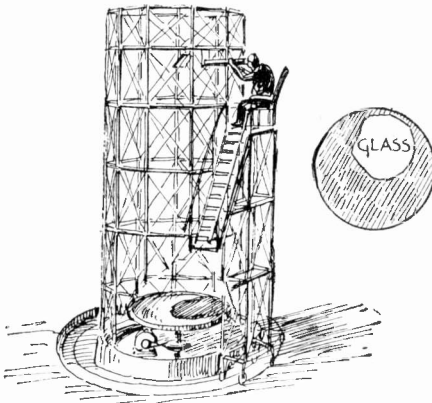
A device for which no practical use can be found.

A. Your suggestion for an airplane ladder is absolutely worthless. It is just as simple for a man to climb up a ladder suspended from an airplane, as it is to hoist him up into safety.

Besides, the number of individuals "hopping" on this ladder from the ground when the airplane is in motion is very limited indeed. Perhaps one movie actor does so once in his lifetime. Often no attempt is made to ruin his features, and a substitute is employed.

TELESCOPIC REFLECTING MIRROR

(779) L. F. Wright, Buffalo, N. Y., asks our advice on a reflector for telescopes made of a large metallic disk with a piece of glass secured to it. The whole is to be rotated at high speed. His other suggestion is to make use of many pieces of glass welded together.



An impractical method of making large telescopes.

A. It is quite impossible to mold together a whole series of small pieces of glass as suggested by you in your recent communication. There is a concern making metal reflectors which they are placing on the market. Those reflectors are just as efficient as the glass reflectors, and may be made in larger sizes. Neither of your suggestions for the use of glass is applicable to telescopic construction, because it would be impossible to weld this glass together without producing air bubbles, crevices or cracks, which are naturally developed in attempted welding processes to a more marked degree than elsewhere.

Mounting pieces of glass upon a large metallic area makes it difficult to grind the glass down, because of the different hardness of the two substances. Of course, an attempt at this would probably be partially satisfactory, and if the entire device were rapidly rotated, some results would be obtained, but they would not be as satisfactory as with those reflectors now employed.

Although your suggestion could be illustrated and probably made the topic of a small feature article, its marketable possibilities are practically negligible, and we would, therefore, not advise any attempt at patenting the idea.

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The Heavens in February

By ISABEL M. LEWIS, M.A.
(Continued from page 992)

pendent for its splendor upon nearness as is the case with Sirius. Compared with this glorious giant star Sirius is but a pigmy.

Procyon, the first-magnitude star in Canis Minor, The Lesser Dog, nearly due east of Betelgeuse, is also a near neighbor of the solar system at a distance of about twelve light years. Both Sirius and Procyon are attended by massive but extremely faint companion stars. Due north of Procyon are the Twins; Castor and Pollux, in Gemini. Pollux is the brighter of the two stars at the present time but there is reason to believe that the relative brightness of the two stars has changed for Pollux is known as Beta, and Castor as Alpha, Geminorum and it was the custom of the ancients to name the brightest star in a constellation Alpha, the second in brightness Beta and so on. The distance of Pollux is about thirty-five light years, that of Castor about forty-five light years from the earth. Castor is the more interesting of the two stars for it is a double star in which each of the two components has a close companion star, making in all a system of four suns. The two principal stars have a long period of revolution about their common center of gravity that at least several centuries are required to complete.

To the northwest of Gemini is Auriga The Charioteer, with its brilliant Capella, The Sea-Goat with The Giedi or Kids, the three faint stars forming a small triangle, close by. Capella is one of the three brightest stars of the northern hemisphere, the other two being Vega and Arcturus.

The Unicorn lies east of Orion and south of Gemini. This group consists of faint stars and are of no particular interest, while it would strain the imagination to see in them any resemblance to the animal they are supposed to represent.

Monoceros is located, in one of the most brilliant portions of the Milky Way which at this time of year stretches from the large and brilliant southern constellation of Argo Navis, a small portion of which now appears in the southeast, in a broad band nearly through the zenith to the north-western horizon. Another brilliant cloud of the Milky Way lies half-way between Perseus and Cassiopeia and in this cloud is the famous cluster of the "Sword Handle of Perseus" a fine object even for a small telescope. Nearly all of the constellation of Perseus lies within the Milky Way in a particularly rich portion. This luminous band composed of the blended light of countless stars too distant to be seen as individual points of light is one of the most beautiful features of the brilliant winter skies as it arches high overhead in this part of its course. It is hopeless to look for it under the glaring lights of our city streets, however. To see the Milky Way in all of its beauty and magnificence one must get out in the open away from all lights except those supplied by the heavens alone on clear, dark moonless nights.

Venus, the most brilliant of all the planets, is now a magnificent object in the evening sky, setting about three hours after the sun the first of February.

Mars, Jupiter and Saturn are still in the eastern heavens visible to the early riser.

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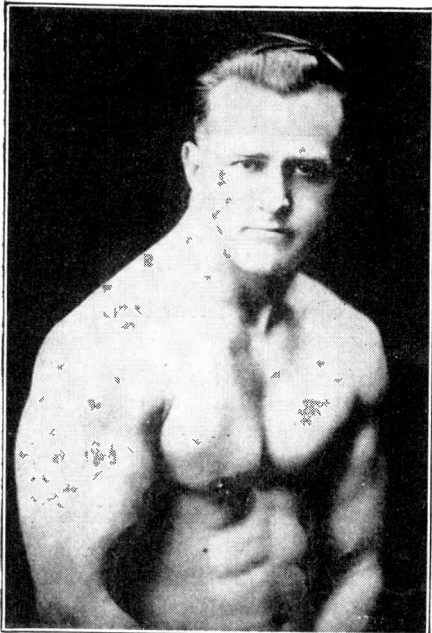
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I am not a medical doctor. I don't claim to cure disease. Neither do I put any self-assumed title of Professor before my name. I am a builder of muscle—internal as well as external. I claim and can prove that by proper exercise you can even build muscle in and around your heart and every vital organ. The kind that shoots a thrill through your veins and reaches every crevice of your body. I add years to your life, and oh boy! what a kick you get out of every day you live. And talk about big, brawny arms and legs, or broad backs and husky chests—just take a look through this winter's copies of Physical Culture Magazine and see for yourself. You will see a few pictures of my pupils there—living examples of the Earle Liederman system—doctors, lawyers, business men, but every last one of them good enough to pose as professional strong men. Some are in better shape than men who are now acting as instructor to others.

Pep Up

What are you going to do about it? Don't sit idle and wish for strength. That will never bring it. Come on and get busy. You must have it, and I'm going to give it to you. I don't promise it, I guarantee it. You don't take any chance with me, so come on and make me prove it.

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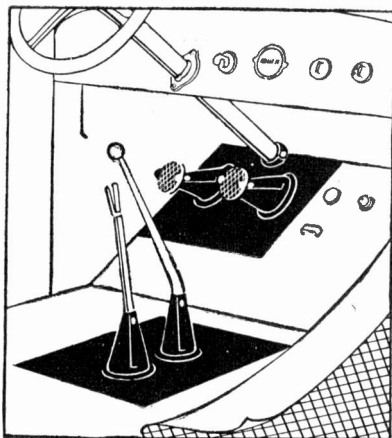
City State.....

RADIO BROADCAST

(Continued)

Call Letters	Name	Location	Power & Wave Length
WSAX	Chicago Radio Lab.,	Chicago, Ill.	20-268
WSAY	Irving Austin (Port Chamber of Commerce),	Chester, N. Y.	100-233
WSAZ	Chase Electric Shop,	Pomeroy, Ohio	50-258
WSB	Atlanta Journal,	Atlanta, Ga.	500-429
WSL	J. & M. Electric Co.,	Utica, N. Y.	100-273
WSY	Alabama Power Co.,	Birmingham, Ala.	500-360
WTAB	Fall River Daily Herald Pub. Co.,	Fall River, Mass.	10-248
WTAC	Penn. Traffic Co.,	Johnstown, Pa.	150-360
WTAD	Robert E. Compton, (First Presbyterian Church),	Carthage, Ill.	10-229
WTAF	Louis J. Gallo,	New Orleans, La.	20-242
WTAG	Kern Music Co.,	Providence, R. I.	10-258
WTAH	Carmen Ferro,	Belvidere, Ill.	10-236
WTAJ	The Radio Shop,	Portland, Me.	50-236
WTAL	Toledo Radio & Elec. Co.,	Toledo, Ohio	10-252
WTAM	Willard Storage Battery Co.,	Cleveland, Ohio	1000-390
WTAN	Orndoff Radio Shop,	Mattoon, Ill.	100-240
WTAP	Cambridge Radio & Elec. Co.,	Cambridge, Ill.	50-242
WTAQ	S. H. Van Gorden & Son,	Osseo, Wis.	100-226
WTAR	Reliance Elec. Co.,	Norfolk, Va.	100-280
WTAS	Charles E. Erbstein,	Elgin, Ill. (near)	500-275
WTAT	Edison Electric Illuminating Co.,	Boston, Mass. (Portable)	100-244
WTAU	Ruegg Battery and Electric Co.,	Tecumseh, Neb.	10-360
WTAW	Agricultural & Mechanical College,	College Station, Texas.	50-280
WTAX	Williams Hardware Co.,	Streator, Ill.	20-231
WTAY	Jodar-Oak Leaves Broadcasting Station,	Oak Park, Ill.	15-226
WTAZ	Thomas J. McGuire,	Lambertville, N. J.	15-283
WTG	Kansas State Agricultural College,	Manhattan, Kansas	1000-485
WWAB	Hoenig, Swern & Co. (John Rasmussen),	Trenton, N. J.	10-226
WWAC	Sanger Bros.,	Waco, Texas	50-360
WWAD	Wright & Wright, Inc.,	Philadelphia, Pa.	50-360
WWAX	Wormser Bros.,	Loredo, Texas	50-360
WWB	Daily News Printing Co.,	Canton, Ohio	100-268
WWI	Ford Motor Co.,	Dearborn, Mich.	50-273
WWJ	Detroit News (Evening News),	Detroit, Mich.	500-517
WWL	Loyola University,	New Orleans, La.	100-280
WWZ	John Wanamaker,	New York, N. Y.	100-360

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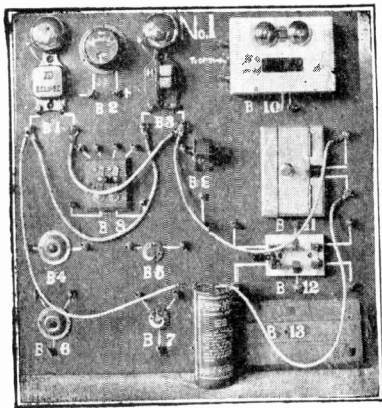
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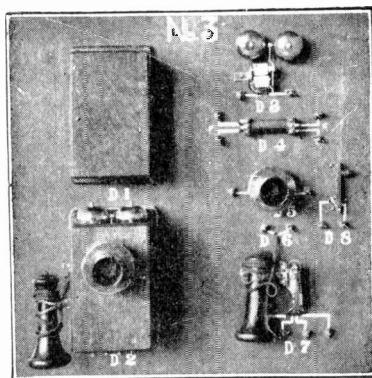


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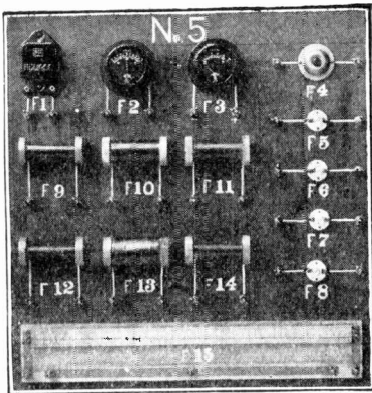
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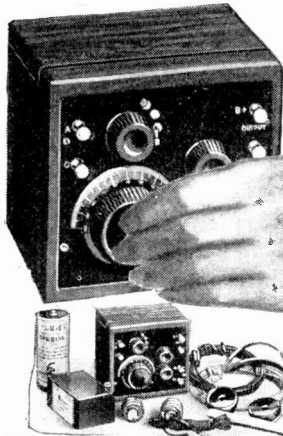
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THE MAN ON THE METEOR

By Ray Cummings

Part II

(Continued from page 971)

orating from her shoulders; she had been in the stream. A few molluscs, or something of the kind, lay at her feet.

"See!" she cried triumphantly. "They are to eat. My man Nemo can get them—they are in the water."

I broke them open and ate one. It was good. I kissed her approvingly and her arms clung about my neck. Nona always was happiest in my approbation; she seemed to think of nothing save how to win it.

When her caresses were passed, I stood up.

"How do I get them?" I demanded. "Nona must show me once—then I will get very many of them for us to eat."

The experience that followed was extraordinary; that is to say it would be so to you here on Earth. To me, that day on the meteor, it was merely frightening. Nona led me to the stream and we waded into it waist deep. I had bathed here, but I had never been further along. Nona had, however. She led me forward to where the water went under a low archway of our cave and thence into the bowels of the meteor.

The river-bed under my feet began sloping downward. The water deepened around me—to my chest, shoulders, almost to my neck. I was terrified. I pulled back from Nona's hand which was drawing me along. Her hair was floating out like golden seaweed around us. The milk-white water was under her uptilted chin.

Her eyes smiled at me tenderly. "No," she said. "My man Nemo never can be afraid."

Afraid! I could not let her see that. I grunted scornfully, and we went forward.

The water rose to my own chin. We were well underground now—the ceiling of this subterranean passageway was hardly a foot above my head. In front of me I could see where the ceiling touched the water.

Suddenly I remembered Nona. One of her hands still held mine—the other was braced against a projection of the side wall to hold us against the gentle current that pressed us forward. The water now almost reached the top of her head. I could see her face beneath the surface. Her mouth was opened round and wide; a stream of air bubbles came gurgling up from it. Her chest was expanding and contracting rhythmically and swiftly, seemingly with great effort, like a man panting after an exhausting fan. *She was breathing the water!*

II

I stared at Nona silently. The air bubbles from her mouth grew less, until soon there were almost none of them. The tidal air in her lungs had been forced out; water had taken its place. Through her opened mouth she was drawing in the water and expelling it—rapid respirations taxing the intercostal muscles almost to their limit.

Nona smiled up at me through the water, which in spite of its milk-white color, was curiously limpid and transparent. I felt the tug of her hand; I stepped forward, and in the deepening water my face went under.

Whatever may have been my previous existence, an experience such as this quite evidently was no part of it. My instinct was to hold my breath. I did so until I could no longer. I struggled against Nona's hand and tried to get my head above the surface. But she held me; and my fear of having

her know me to be afraid was greater than my fear of the water.

BREATHING WATER

At last I let out my pent-up breath. It gurgled from my mouth in bubbles. Then, in a gulp of desperation, I inhaled. The water choked me. I tried to cough; but could not—or at least the cough became my exhalation.

My ears were roaring as though the torrents of your Niagara were rushing past them. My head and chest seemed bursting—icy cold at first, then burning with fire.

My eyes were open. I was standing beside Nona and she was looking up at me. Through the half-light of the water I could see her almost as plainly as through air. She smiled encouragingly at me, and I tried to smile back.

I was drawing the water in and out swiftly now, with my mouth held extended like an expiring fish. It was a tremendous effort, this respiration. The muscles of my chest and diaphragm were tired in a moment. A weight in my chest seemed smothering my heart; I seemed on fire inside—a million inflamed little lung passages rebelling at this unaccustomed medium.

Spots were dancing before my eyes. I was losing consciousness through lack of oxygen. The poisoned venous blood was dulling my brain.

Then I began to feel better. I was respiring now almost as swiftly as Nona, and with far less effort than I had used at first.

You are skeptical? Because you cannot breathe your Earth-water, you assume that I could not breathe this water on my meteor. What quaint logic that is! Yet I find all you Earth-people think on similar lines. It is your inadequate mentality, I suppose, so I must hasten to enlighten you.

There are two fundamental objects of respiration. First: the introduction into the system of oxygen by which the products resulting from the disintegration of the muscular, nervous and other tissues of the body may be converted into compounds easily eliminated. Secondly: the direct removal of the most noxious and therefore most important of these waste products—carbonic acid gas.

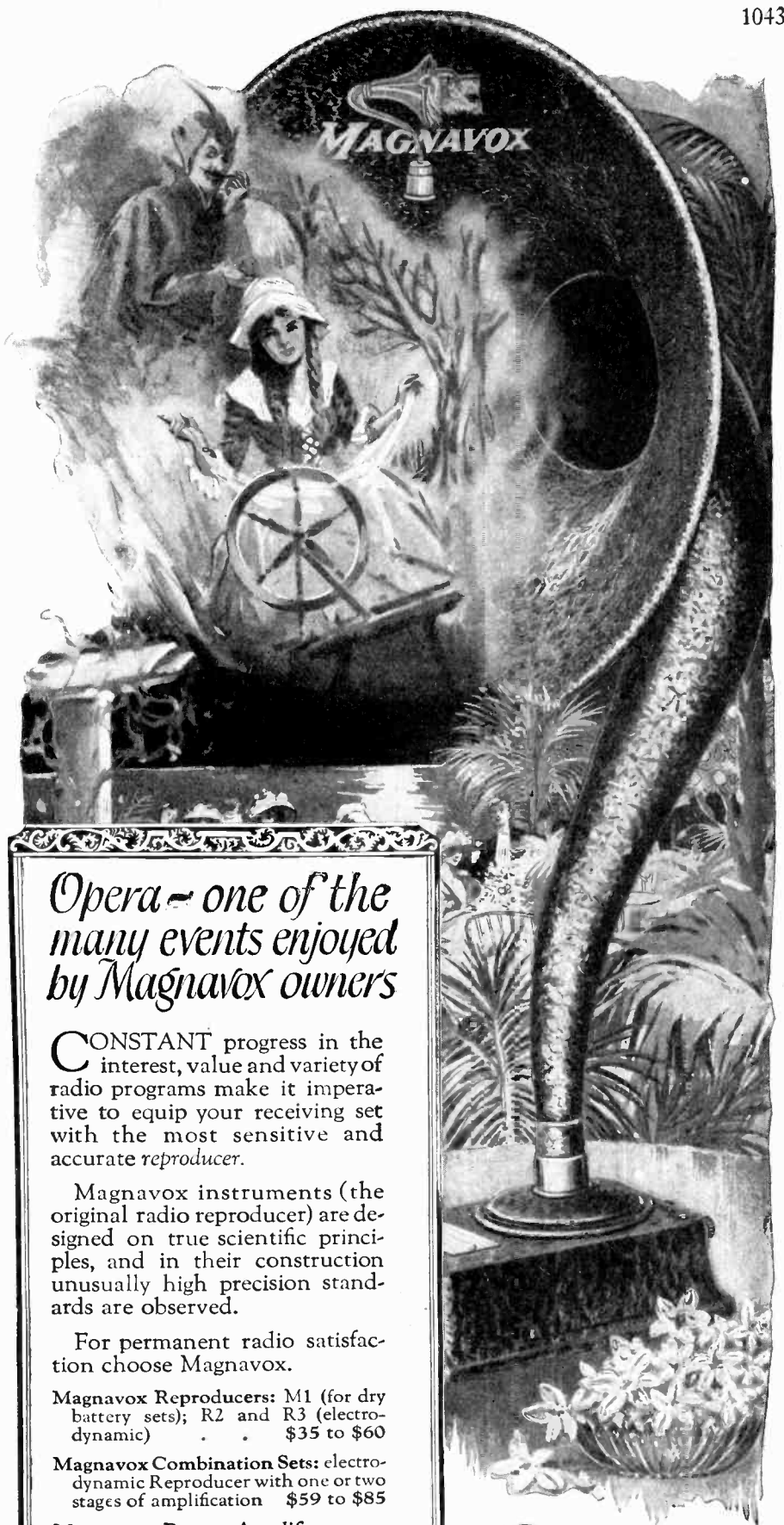
In man, as you know him on Earth, this is accomplished by the lungs. The venous blood, charged with its carbonic acid and its waste products, needing a renewal of oxygen and a removal of the carbonic acid, is pumped by the heart through the lungs. These by their construction present an immense amount of internal surface covered by a vascular net-work, through which the blood flows in innumerable minute streamlets.

In respiration, the inhaled air is separated from the blood only by an extraordinarily thin membrane—less than 1/20,000 of an inch in thickness. Through this membrane the blood absorbs oxygen from the air, giving in return to the air its noxious carbonic acid gas.

Such is the basic process in you Earth-men. In the case, let us say, of your Earth-fishes breathing your water, there is little fundamental difference. The blood in their gills is brought practically into contact with a steadily moving stream of water. But fishes do not get their oxygen from the water in some mysterious fashion. Did you think they did? They get the oxygen, not from water, but from air—the air that is held in solution in the water.

But for two things, you on Earth could breathe your water. First, your lung passages are too minute to receive a substance so heavy, so *unvolatile*, let me say, as is the water of Earth. Secondly, there is not proportionally enough air in your water.

Both these conditions were different on my meteor. You ask perhaps, are my lungs



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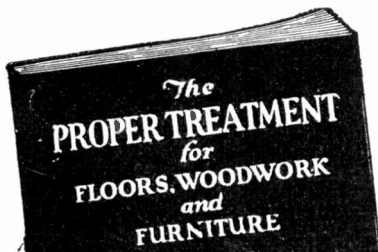
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MY NAME

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the same as yours? I think so, but I do not know. At my death you of Earth will find out, for I have willed my organs to your scientific men.

HOW IT WAS POSSIBLE

But this I do know: this water on my meteor was very different from water as you know it. I have already said it was light and thin. To be exact, I estimate that on your Earth it would have a specific gravity of no more than .18, placing your water at 1.00.

In your sea-water a normally fleshy man will float with a small margin to spare. This water on my meteor was not saline; but more than that, Nona and I stood submerged in it with hardly any perceptible feeling of buoyancy.

Let me make my point still clearer. The low specific gravity of this water compared to yours was principally caused by the large amount of air it held in solution. It was, in a word, highly aerified to an extent proportionally eleven times more than is your average water on Earth. For this reason, my lungs needed but one-eleventh the amount of it from which to secure the necessary oxygen.

On Earth, your normal respiration varies widely; sixteen to twenty times per minute for a healthy adult at rest might be taken as a fair average. I was breathing this water at approximately eighty respirations per minute.

I do not know how long I stood there under the surface with Nona before I attained a semblance of normality. But gradually the burning in my chest and the smothering of my heart subsided. My brain cleared.

I looked about me curiously. The water was clear and transparent to a remarkable degree. There seemed inherent light diffused through it, like a phosphorescence.

We had taken several steps forward and were well below the surface now. Underneath my feet was a sandy soil. To the right and left were rocky walls—the sides of the submerged tunnel. And ahead lay open water, dim in the distance, with the narrow sandy floor sloping downward like a path down a hillside.

Everything was slightly blurred in outline. Nona's hair floated out and above her. The freedom of movement we had had in the air above was gone. We were hampered in moving by the friction of the water.

But it was nothing like the friction of walking in your water. Indeed, it was far more like your Earthly existence on land. Often now, on an oppressively heavy, foggy day here on Earth, I am reminded of it.

I am very specific in detailing these sensations. You will see why in a moment; you will see that this experience was the means of saving both our lives—Nona's and mine—and projecting us into a new era of my existence.

For after the very next time of sleep, the catastrophe to our tiny world overtook us.

III

We found our molluscs and struggled back up the sloping path to shallow water. On the bank I lay and coughed, gasping and struggling to remove the residual water from my lungs and replace it with air. The transition back was far worse than entering the water. Nona, who quite evidently had done it several times before, recovered more quickly than I. As I lay panting and choking upon our couch, she made up a fire. The two stones which she rubbed together ignited in a moment—a slow, sulphurous-looking flame with a little smoke which the slight current of air through the cave carried away. Then, when the first stones were burning, she added other stones which glowed like coal.

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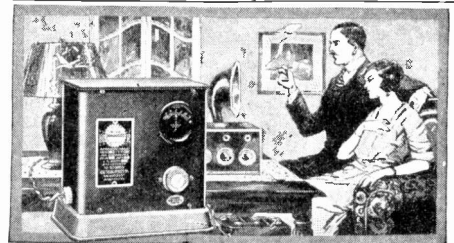
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We ate our meal, and I lay again upon our couch with Nona sitting beside me. I was dozing, thinking over the experience I had undergone and planning how I could get more of this water food.

THE FIRE

I was awakened by a sense of burning and smothering. I sat up, coughed, and twitched at Nona's hair to arouse her.

The cave was full of smoke. Beside me was what seemed a pit of fire. The heat from it was intolerable. I flung Nona into the air and followed her myself with a leap.

Across the cave we stood trembling with fright, regarding the red monster of fire that had eaten for itself an open pit in the cave-floor.

Nona had forgotten to extinguish the fire of our evening meal. These rocks were inflammable. The fire had eaten its way downward, as a fire on your Earth would eat downward into a bed of coal, spreading out beneath the ground.

Nona and I did not reason it out that way at the time. All we knew was that the red fire-monster had broken loose, and we were afraid of it. Blue and red tongues of flame licked up from the mouth of its lair; its hot, poisonous breath was stifling us even across the cave.

I was inactive only for a moment. Bidding Nona keep away, I tried to throw dirt into the little crater-mouth.

But the dirt had no effect. I might have extinguished it with water you say? True, I might, though I think now that the volatile, highly aerated water would have been of little avail.

I did not try the water. I did not know that water and fire were traditional enemies. Nor did Nona. How were we to know that, unless we had chanced to discover it for ourselves, which we had not.

Nona screamed at me and I gave up my futile efforts. The air in the cave was almost suffocating; and with the instinct that comes to any trapped animal underground, we scrambled up the passageway to the surface of the meteor.

It was night, with silver Saturn filling the overhead sky. Trembling, we stood and watched the cave-mouth from which a visible line of smoke was now issuing. Our home was down there; the fire-monster had it—and we could not go down and take it from him.

We never went back to the cave. The meteor's swift days and nights passed in rapid succession; and during several of them we stood helplessly watching.

Presently the fire came to the surface. I realize now that it was eating its way downward as well as upward until the entire vicinity of the cave was glowing with molten, burning rocks.

The ground all around the cave-mouth soon fell inward. A seething crater was exposed where the cave had been—a bottomless pit of lurid, licking flames with black smoke rolling up from it, and the hissing of steam below.

We took instant flight, swimming through the air over our tiny world, until, on its opposite hemisphere we found sanctuary.

There was no evidence of the fire here. We were pleased. We would find another cave, another river, and build our home anew.

We were both famished. I caught a lizard and we ate it—uncooked, for we were both afraid to unleash again the monster that had all but overcome us.

Then we slept; and again, when two of the meteor's brief days and nights were passed, and Saturn was sinking below the horizon to give place to dawning sunlight, we searched for a new cave.



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No cave was to be found. But there was water. A river several hundred yards wide bubbled up from the ground and flowed in a broad shallow stream toward the horizon. We followed it to a tiny line of hills. Into a hole in a cliff-face it plunged downward with an impetuous current.

THE NEW HOME

Here we decided to build our home. There were blue rushes along the river bank. Nona gathered them; she would dry them, plait them into robes for our couch.

Once I flew back to the fire. I could not get very close to it, for the air choked me. The fire seemed to be burning itself out. It was dull, with flickering puffs of flame in the midst of a thick pall of smoke which hung motionless in the still air.

I returned to Nona. "The fire-monster is dying," I said. "But it has eaten our cave."

We were both pleased that it was dying. I know now what was happening. The fire was being smothered for lack of fresh air to sustain its combustion. Had there been any wind I do not doubt but that the entire surface of the meteor would have been consumed.

An almost equally great danger threatened us, however—and presently we were made aware of it. The smothering, smouldering fire gave off steadily a tremendous volume of unconsumed gases. Even without any wind they diffused themselves throughout the meteor's atmosphere, it was so small a world, with so thin a blanket of air about it—an infinitesimal fraction of the air that envelops your Earth. Rapidly it became polluted with poisonous gases from the half-smothered fire—polluted throughout its entire extent.

For a day we were uneasy. Then we grew frightened. There was little evidence of smoke—only a blue haze. But the air seemed to choke us. It was the poisonous breath of the fire-monster come to make us sick.

We tried to go somewhere to escape it. But we were on the opposite side of the world from it already, and no matter which direction we took, inevitably we approached it.

Except upward. We tried higher altitudes. The air was purer up there, but also it was thinner, and we could not live in it for any length of time. Nor could we sustain ourselves aloft indefinitely—to say nothing of sleeping and eating.

Once in desperation we tried swimming off the meteor into Space. But the lack of any breathable air at all soon brought us struggling downward.

That night there was a gentle wind. The breath of the fire-monster swept up over the horizon and came upon us with a deadly blast. We woke up, choking. It was daylight, with a small red-yellow sun dim and blurred by the poisonous haze that enveloped us.

Nona was crying. But suddenly I laughed, triumphantly, for I realized now that the fire-monster could not harm us.

We were lying at the river bank. I seized Nona in my arms and flung her headlong downward into the water. And I plunged in after her. The water here was deep—thirty feet perhaps, as you on Earth would measure it. With arms flying, we sank like stones to the river bottom.

IV

I was presently breathing the water with fair normality. Indeed, after the noxious air we had been struggling with so long, it came almost as a relief. Nona's arms were about my neck; I loosed them, but she clung to my hand. Together we tried to stand upright.

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This river bottom seemed a gray sand. But we could not maintain footing. The water was empty—by which I mean there was no marine vegetation here—nothing that we could grip with our hands. And from behind us, the current wafted us gently but irresistably forward.

I soon discovered that normally we would float in an upright position. We held ourselves so with our toes occasionally touching the soil, bouncing along like feathers in a gentle breeze.

The scene around us now more resembled a misty gray day on one of your sandy Earth-deserts than anything else I can call to mind. The ground was undulating gray sand, sloping upward to one side, and with a steady incline downward in front. And down this slope we were blowing.

Swim, you say? It never occurred to either of us! We were frightened; we clung to each other, striving to remain upright.

Very soon the light from overhead seemed to deepen. But other light—the diffused light inherent to the water itself—grew brighter by contrast. We were swept forward much faster—and down a much steeper hill. I know now that the change was caused by the river having plunged into that cliff-face, to become subterranean.

How far we were carried I cannot say. A mile perhaps. Or more. Rocky cliffs now seemed to pen us in; it was as though we were in a steep canyon, with a powerful wind driving us down through it.

Then abruptly we came to the end of the canyon. Open country lay before us. There were hills in the distance, with the level floor of the sea between us and them. Long stalks of vegetation reared themselves up through the water—so high that I could not see to their tops—slender spires of growing things, rooted below, branching out above with huge air-bladders to keep them floating—the whole waving slowly to and fro. On some of them there seemed what you might term fruit.

THE SUB-SEA HOME

It was a strange, but a beautiful and peaceful scene. This, then, was our new home—our new world! And how much better, more hospitable, it was than the one we had left! My heart swelled with pride as, standing beside my mate, I gazed at our new possessions.

A small living thing—slender and elongated and with a flat, waving tail—went past us waist-high. I clutched at it clumsily; but it eluded me and darted away.

On the ground beneath our feet were living things in shells. I seized one, ate it, and called to Nona.

Sounds? It was very still and quiet down here—but no more so than on the surface of the meteor above. The sound of my voice carried to Nona. Indeed, sounds here in the water carried very far, though somewhat muffled and blurred.

Having eaten of the shell-fish, the berries and the fruits, we lay down on the sand with Nona's hair floating above us. We were in the shelter of a tenuous clump of ferns which spread out like an arbor above us. I twisted my leg in them to hold us from possible drifting; and Nona clung to me.

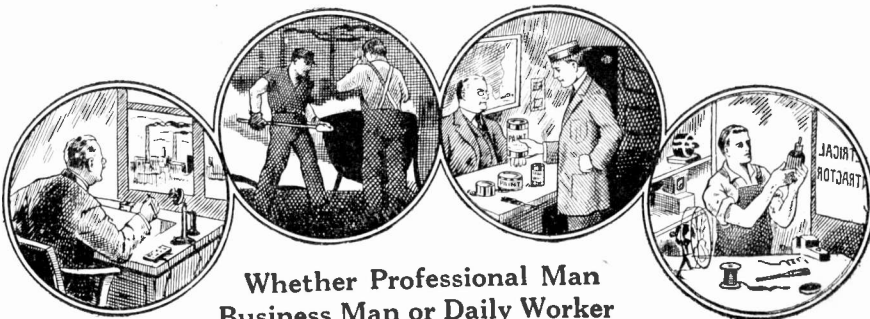
We would rest and then build our home here.

V

How long we slept I do not know. Nona brought me back to consciousness; she was twitching at my arm and whispering in my ear frantically.

"What?" I demanded; but she silenced me. She was pointing with a trembling hand. I saw what it was. Half a mile

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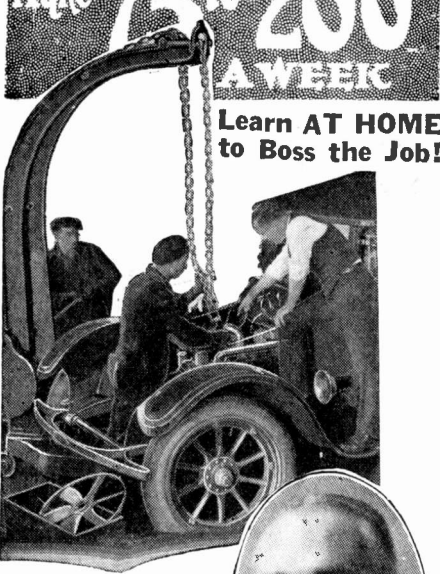
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away perhaps, over the sand hills, I could see figures moving. Living things were advancing toward us along the water-bottom! I sat up, alert. Living things! I would capture and kill one for food.

But as they came steadily closer, I saw that each of them was nearly as large as ourselves—and there were ten or more of them. I trembled; and Nona and I drew back into the fern to hide.

The things continued to advance. Soon I saw that they were upright, coming along the sand as though walking, slowly but steadily. I thought they had not seen us. Nona and I lay very quiet, with our hearts pounding with fright. Soon the things were so close that I could examine them in detail. They were apparently human as ourselves—made after a general plan like our own.

I have since named them Marinoids—a name that may serve as well as any other. The males—or shall I call them men?—were some five feet in height. Their bodies were pink-white, smooth, with a glistening skin. They were clothed—crude greenish garments wrapped around them tightly. They had feet and jointed legs, which, however, were connected by a flapping membrane. Their chests were over-large. There were four arms, two at each shoulder. The arms waved in the water sinuously, like the tentacles of an octopus. At the ends of the arms were fingers—very long and slim—and a huge pincer, like that of a crab.

Yet for all that, these beings seemed in human form. The heads were hairy and round, with two eyes only slightly protruding, a nose, and a mouth not much different from my own save that it was larger.

The women were slightly shorter and more slender than the men, with long dark hair that floated habitually above them.

In this party which now approached us were ten individuals—four of them women. In spite of their size, there was about them—both women and men—a curious aspect of *unsolidity*. I felt less afraid of them as I realized it. They looked as though I could crush them in my arms. Their chests especially seemed no more than thin, inflated membranes, expanding and contracting with extraordinary rapidity.

I wondered, with a sudden flush of triumph, if these things would be good to eat. I whispered it to Nona.

"I can capture one," I said confidently.

"Wait!" she cautioned.

The Marinoids were still walking toward us along the sand—slow dragging footsteps combined with a sort of waddle for their legs were hampered by the membrane which connected them. Their arms were waving back and forth. The backs of most of them were bent, with their faces downward as though they were examining the sand.

I must have made some movement. They saw us! They stopped, and seemed to grow suddenly alert. The men consulted together, pointing at us; the women drew partially behind them as though for protection.

I struggled upright, in spite of Nona's warning and her restraining hold. I would fight these things—kill them for our food. It would be a glorious feast; my Nona was hungry.

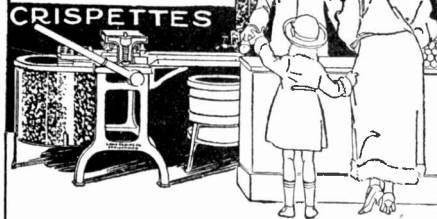
THE FIGHT

I plunged forward. The Marinoids were alarmed—startled, would described their aspect better. The men stood their ground; the women darted upward through the water, swimming on one side with legs waving the connecting membrane like a great fish's tail.

One of the Marinoid men had shouted something. I could hear his voice plainly—words seemingly—a rasping order. Nona was behind me, following me closely, ready to help me fight.

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"Quick!" I shouted. "Catch one, Nona!" It was so futile! The Marinoid men left the sand and darted at us so quickly that we could not have eluded them had we tried. They were upon us in an instant: I was helpless as they threw me down and with surprising strength in those three-foot long tentacles, wrapped them around me and held me.

Three of the men were thus engaged with me; and two were holding Nona. But they did not attempt to hurt us; indeed, they seemed to avoid doing so.

The sixth Marinoid—he who had shouted the order—was hastily gathering long, rope-like segments of the vegetation. At his command, Nona and I were raised upright. The women came down to the sand and they all inspected us curiously, talking among themselves with words to us unintelligible, but gestures which seemed wholly rational.

At last they bound our arms tightly against our sides and started us walking along the sand. They were leading us away, out over the sandy open spaces toward a line of hills in the distance.

The women swam above us; the men walked in a group, pushing Nona and me in front. We could run faster than they, and once we broke away. But they swam after us and caught us in an instant. And one of them warned us with a gesture which was unmistakable.

Soon I saw what this party had been doing before they encountered us. We passed occasionally, huge receptacles made seemingly of woven sea-vegetation. Into these baskets they had gathered various living, shell-backed creatures of the water-bottom. And these baskets in turn would be gathered up and carted away by other Marinoids.

I learned this later; Nona and I understood none of it at the time.

As we advanced, the aspect of things around us changed continually. The vegetation grew thicker, until soon we were in a veritable forest of it. And we seemed to be following a road—a pathway which had been cleared.

Abruptly I heard a shout ahead. The Marinoid women swimming above us came suddenly down. Our leader said something, and they all drew back from the road, pulling us with them.

The shout ahead of us grew louder. A moving object came into view—a sort of sleigh made of a huge shell. It was gliding over the sandy road toward us, pulled by a strange swimming animal.

In the sleigh were two Marinoid men—the larger of them elaborately clothed. The sleigh halted abreast of us. The smaller of its occupants stood up and shouted vehemently. And suddenly I realized that he was shouting at me! My captors were lying prone on the sand, and had pulled Nona down with them. But in their excitement and awe—for this was the ruler of their world—they had left me standing alone.

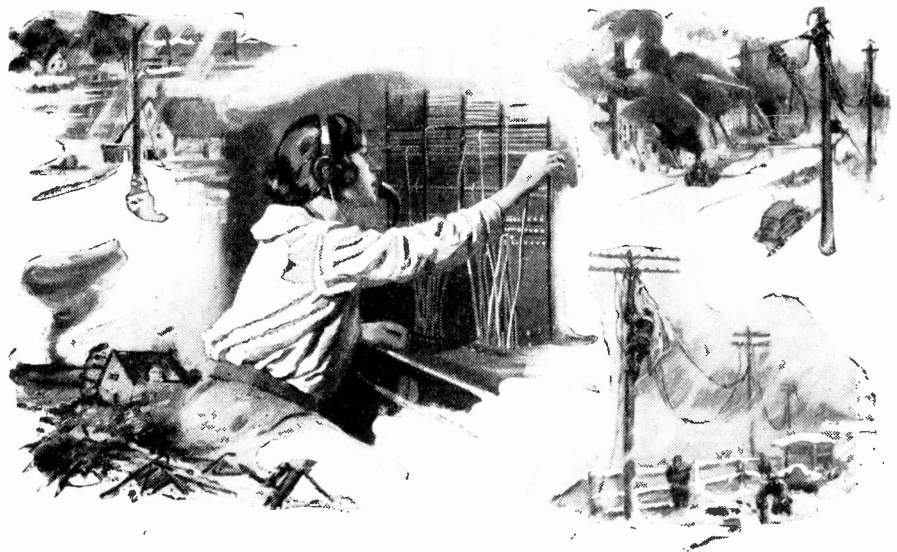
I stared stupidly at the angry figure in the sleigh; and suddenly, in his wrath at the effrontery of my upright posture before his Monarch, he launched something at me. I saw it leave his hand. It was long, thin and pointed. It came through the water like a spear thrown through air. It hit my head a glancing blow.

I sank down to the sand. I heard shouts around me—Nona was screaming. Then my senses faded into blackness.

VI

You have read my tale of the Marinoids—a brief glimpse, and only a glimpse, for I am an old man and my memory is full of strange lapses.

One of your Earth-poets has said: "There are more things in Heaven and Earth than



Priceless Service

Despite fire or storm or flood, a telephone operator sticks to her switchboard. A lineman risks life and limb that his wires may continue to vibrate with messages of business or social life. Other telephone employees forego comfort and even sacrifice health that the job may not be slighted.

True, the opportunity for these extremes of service has come to comparatively few; but they indicate the devotion to duty that prevails among the quarter-million telephone workers.

The mass of people called the public has come to take this type of service for granted and use the telephone in its daily business and in emergencies, seldom realizing what it receives in human devotion to duty, and what vast resources are drawn upon to restore service.

It is right that the public should receive this type of telephone service, that it should expect the employment of every practical improvement in the art, and should insist upon progress that keeps ahead of demand. Telephone users realize that dollars can never measure the value of many of their telephone calls. The public wants the service and, if it stops to think, cheerfully pays the moderate cost.



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are dreamed of in your philosophy." How very true that is! You who breathe air and live on land—on one and only one tiny little Earth among all the billions upon billions of worlds that throng our Universe—how little you dream of the existence of other beings.

I tell you only simple facts, within the failing memory of my own human lifetime. I do not expect you to credit me—your life has been too narrow, your experience limited to one infinitesimal rut in the Creator's vast plan. And though I cannot altogether blame you, since you are thus limited, it makes me smile to realize how fatuous you are with your self-importance. "I have not seen this—I cannot understand it—so it cannot be!"

Only one point in my narrative I wish you to grasp and ponder over. I assume you agree that although Nona and I at the time were merely at the beginning of our mental life, we had latent within us an intelligence the equal of your own. Let us say, we were broadly representative of you. Yet Nona and I were not the intelligent, superior human beings, captured by some strange marine animals—as a man in your waters might be set upon by sharks. Quite the reverse. It was we who were the inferior humans; to those Marinoids we were unknown, savage things who had invaded their world.

That is not theory; it is fact. And so, if by the recital of this narrative, I have even made you stop and think that perhaps you and your kind are not all-important in the Creator's plan—my purpose will have been accomplished.

(To be continued)

Can We Visit the Planets?

BY DON HOME

(Continued from page 962)

Even if such an ideal machine might be made, the possibility ever of spanning the twenty trillion miles to the nearest star is negligible when we consider the time required to get there. Granting that man can withstand a reasonable pressure, and allowing time for starting and stopping the projectile, it is just possible that the trip might be made in less than a life time.

The philosophical results of the theory of relativity lead to an interesting speculation. According to Einstein, no object can attain a velocity greater than that of light and it would be possible for our projectile to approach that speed in about ten years. It happens, however, that the greater his speed the slower his clocks move; in other words, the nearer he reaches the speed of light, the less is his sense of the time passing. The secret of eternal youth, therefore, is to rush on at the terrific speed of 186,000 miles a second. A man might visit the edge of space after only a few years of his time, but centuries of our own, had elapsed.

In the Einstein theory, time and space are inseparable. We ordinarily admit that a person can be two times at the same place, but it seems a paradox that one could be two places at the same time. Nevertheless, this is possible. In order to accomplish this, a person should leave the spot with the speed of light, at which velocity all organic processes would cease and, as he would be conscious of no advance in time, it would seem merely the next instant when he arrives in a part of space far removed from his starting point.

But what may we expect to gain from interplanetary visits? Surely we are not the only living beings throughout infinity! Such egotism is inexcusable.

How to Hook - Up A Transmitter Button to Make an Efficient Loud Talker

A Transmitter button with a few dry cells and a telephone receiver will make a remarkably simple and efficient loud talker. A Microphonic amplifier of this type is just the thing for use with a radio set. The weak music and signals may be amplified many times their original value. It is possible to entertain a large audience with a simple radio equipment if a transmitter button is used in the circuit as explained in diagram A.

The cost is extremely low and the results are comparable with those produced by highest grade of expensive loud talkers.

As may be seen in the diagram, two dry cells or a small storage battery are connected in series with the transmitter button and a 4 to 75 ohm telephone receiver. The transmitter button is secured to the diaphragm of the telephone in the radio receiving set. To accomplish this properly, scrape off the enamel (if diaphragm is enameled) on the face of the diaphragm and solder the small hexagon nut supplied with the button to the exact center. Care should be taken that the thin diaphragm is not bent or otherwise

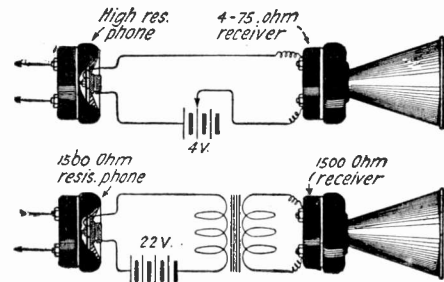


Diagram B, which includes a step-up transformer, is to be used with loud talking receivers of high resistance. The primary of the transformers should have a resistance of about 75 ohms. An ordinary telephone induction coil will serve as the transformer in this circuit. You can get the above-described transmitter button FREE in subscribing to "Practical Electrics Magazine" at \$2.00 per year (12 months). Send your subscriptions today. Make all remittances payable to Practical Electrics Co, 53 Park Place, New York City.

—Adv.

Other life than ours in the solar system seems improbable. It is thought that our four outer planets, Jupiter, Saturn, Uranus and Neptune are very cold—a hundred degrees below zero, Centigrade—perhaps almost entirely composed of ice particles, and surrounded by heavy impenetrable clouds. Mars, though blessed with water and a very thin atmosphere, is also very cold, seldom rising above the freezing point. Venus possesses a heavy atmosphere which appears, however, to contain no oxygen or water vapor. It is probably a desert, scorched by burning winds which so fill the air with dust that our telescopes can never penetrate to the solid layer. Under the blazing sun, the airless bodies, Mercury and the Moon, reach temperatures above boiling water, and during the night rapidly lose any stored up heat from the day time. Evidently there is small chance for life, as we know it, to exist on any of our sister planets.

"But," you say, "Is it not possible that life may take other forms that we know nothing of?" We answer, "Your imagination is as good as ours."

Nevertheless, we prefer to adopt the scientific viewpoint, that life has adapted itself to the requirements of our earth, rather than that we are here merely because the earth is suited to our needs. It will be decades, perhaps centuries, before these problems will be solved. And let us be thankful that science cannot be hurried. The working out of any part of the problem would bring the affair to a climax and the world is not ready for such a step. Be not too hasty for a glimpse behind the veil! As yet no one has solved the mystery of life, but when the other projects have been accomplished, this, too, will cease to be a problem. And pray that the world may be prepared for such a revelation!

Answersto Scientific Puzzles

(Continued from page 991)

1—THE PUZZLE PICTURE

THE following mistakes are represented in the picture:

1. The dipper is shown in the east instead of the north.
2. In the handle of the dipper is shown four stars. In the real dipper there are only three.
3. When the dipper is right side up the handle appears to the left instead of on the right as shown in the picture.
4. The Milky Way never appears in the constellation of the dipper.
5. A crescent moon near the horizon is visible only when the moon is setting. Hence such a moon could not be seen at midnight.
6. The shadows in the picture are toward the moon instead of away from it.
7. A star cannot be seen between the tips of the moon, for a star in such a position would be eclipsed by the moon.
8. The directions on the weather vane are contradictory.
9. The curvature of the crescent cannot be convex upward at night because the curvature must be toward the sun which at night is below the horizon.
10. The pennant and the sail of the boat are indicating that the wind is blowing two ways at once.

2—GETTING THE AUTO OUT

The block and tackle should be reversed so the man will be pulling in the direction in which he wishes the auto to move. At present if he can exert a pull of a hundred pounds on the rope a force of 400 pounds will be applied to the car. But if he turns the block and tackle around a pull of 100



"I Was At The End of My Rope"

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"Other men were getting ahead of me and I knew that I couldn't stand still. I had either to go up or down. And I was afraid it was going to be down!

"Then suddenly one night it came to me like a flash that the reason I wasn't getting anywhere was mainly because I had never made any definite effort to make myself more valuable to the firm.

"I knew my own little routine job, but that was all. I was just one of the force to my employers. There was really no reason why they should think of me when a better position was open.

"That night I made my decision. 'If the I. C. S. can raise the salaries of other men,' I said to myself, 'it can raise mine. If it can help other men to win promotion and have happier, more prosperous homes, it can help me, too. To-night, right now, I'm going to send in that coupon and find out what the I. C. S. can do for me.'

"It was the best move I ever made. My employers heard about my studying and started to take an interest in me. Six months after I enrolled with the I. C. S. I received my first increase in salary. Within two years I was head of my department. And I'm going still higher."

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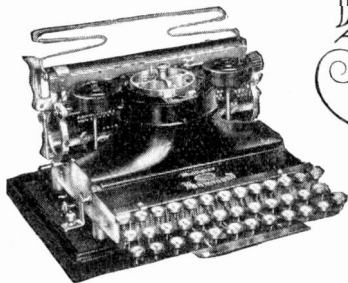


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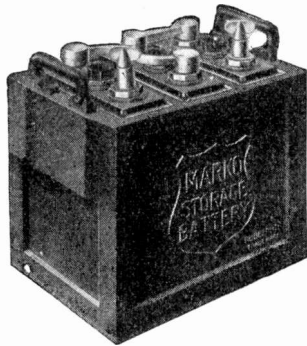


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pounds on the rope will yield him a force of 500 pounds on the car.

3—THE PAINTER'S SCAFFOLD

When the free end of the rope is attached to the scaffold the cornice supports only the weight of the scaffold and whatever is on it, but when the rope is connected to a peg in the wall the cornice has to support in addition the tension in this rope—a force which in this case would be equal to one-fourth the weight of the scaffold and its load.

4—THE MERCHANT'S STEELYARD

The merchant was practically never cheated by his own steelyard. In practice he handed the balance to the customer and let him do his own weighing. If the man were buying from the merchant, the buyer's own cupidity would lead him to adjust the weight so that the arm of the balance would slant upward from the pan. This would let the mercury run toward the pan end of the balance and hence give him short weight for his money. On the other hand, if the man were selling to the merchant the seller would unwittingly adjust the movable weight as far toward the end of the arm as he dared, make this end tip down enough to let it fill with mercury and so in the final adjustment leave the mercury counterbalancing a portion of his goods for which he would receive no pay.

5—THE BALL RACE

A hollow ball will roll down hill more slowly than a solid one because the mass of the hollow ball is concentrated to a considerable degree near the periphery where its inertia or tendency to resist change of motion is most effective.

6—PREVENTING THE FREEZING OF VEGETABLES

Placing tubs or pails of water in a basement often prevents fruit and vegetables from freezing because of the heat given out by the ice when it freezes. Thus each gram of ice on freezing gives out as much as 80 calories of heat, or enough to retard the fall of temperature of the basement until the danger of freezing is over. As most fruits can stand a temperature as low as that of freezing ice but cannot stand a much colder temperature this method for preventing them freezing is quite successful.

7—THE APPARENT SIZE OF THE MOON

The enlarged appearance of the moon when it is near the horizon cannot be attributed to anything but an optical illusion, probably produced by its contrast with buildings and trees which can, at that time, be seen in the same field of vision. The effect disappears when one looks at the moon through a tube that prevents sight of other objects. If the angle of the moon is measured with a sextant it will be found to be always the same.

8—THE DRAFT IN THE CHIMNEY

Most materials of which a chimney is built absorb heat more readily than air. Hence if the sun is shining or has been shining upon an empty chimney the air within the chimney is naturally a little warmer, and therefore lighter than the air surrounding it. The draft is then produced in the usual manner, the lighter and warmer air being forced upward by the pressure of the colder and heavier air entering at the bottom.

9—SOME CLOTHES DRY FASTER THAN OTHERS

Dark objects absorb heat readily; white objects reflect it. Hence water evaporates more rapidly from dark or colored clothes than it does from white goods because the white clothes do not so readily receive the heat that reaches them, much of it being reflected.

10—PRESSURE AGAINST A DAM

The force of water against a dam is independent of the length of the body of

water behind it. The total side push of the water depends only upon the depth and density of the water and upon the area of the dam itself.

11—WHY A BALLOON ASCENDS

A balloon ascends because it is lighter than the air it displaces and not because of any peculiar buoyant force of the gas within the balloon. In fact, if a balloon could be made strong enough to withstand the pressure of the air and yet light enough to make it weigh less than the air which it displaces an empty balloon would be better than one filled with any kind of gas.

12—THE "FORCE OF SUCTION"

Contrary to common opinion, soda water does not rise in a tube because of any "force of suction" pulling the liquid upward. In sucking a liquid through a tube merely the air pressure is reduced within the tube, and the greater pressure of the atmosphere on the surface of the liquid in the bottle or glass forces the liquid upward.

DR. HACKENSAW'S SECRETS

By Clement Fezandié

(Continued from page 979)

Doctor Hackensaw's face grew troubled, but after carefully examining the arm, his countenance cleared.

"It's all right, Mrs. Young," said he. "The microbes I injected are multiplying fast, but there are not yet enough of them to do much good work. You really are a week older than when you came here last. But the bacilli I injected will keep on increasing at a geometrical ratio, and you will soon begin to feel their effects."

"I hope so. But, doctor, what would the insurance and other companies do if people could buy life-annuities or pensions and then go on living forever?"

Doctor Hackensaw laughed. "I guess the companies would find means of stopping the payments after a hundred years or so," he observed.

OPERATION SUCCESSFUL

The doctor was correct. A month later, the old lady was perceptibly better, and after three months she could hold herself erect and walked into the office with a firm tread.

"Doctor," said she, with a laugh. "The charm is working—I feel ever so much younger."

Doctor Hackensaw carefully felt her pulse and listened to her breathing.

"Madam," said he, "allow me to congratulate you. You are really ten years younger than you were when I performed the operation."

"Indeed! That makes me seventy-five. When I get back to forty I shall marry John Trimble. Meanwhile, here is part of the fee I promised you, and the remainder you'll have on my wedding-day!"

A couple of months passed, when one day a lady, apparently about forty years old and remarkably pretty for her age, was ushered into the doctor's sanctum.

"You wish to see me, madam?" asked that worthy.

The lady laughed, a rich, warm laugh. "You do not recognize me, then? I am Mrs. Linda Young. Have I changed so much?"

Doctor Hackensaw gazed at her in astonishment.

"You? Mrs. Young?" he exclaimed, gazing at the luxuriant black hair that had replaced her white locks, and noting her firm,

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I had wonderful success with your dances and have been complimented on my dancing since taking your lessons. I also had a surprise for my friends when I informed them that I learned from your wonderful method of teaching by mail.
Walter Rieh,
Chester, Mass.

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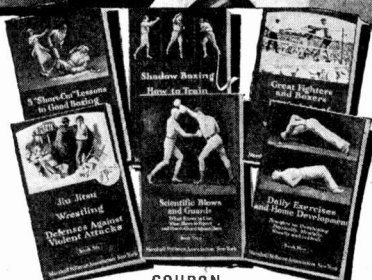
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elastic tread, and the fire of youth that burned in her eye.

"Yes, doctor, your experiment has been successful beyond my wildest dreams, and I have come to invite you to my wedding with Mr. John Trimble. I shall now have two families, for John has a son called Jack, and Jack, who is also a widower, has a little boy named James. But my changed appearance is causing me many complications. The trouble first began at the banks. My new strong signature did not tally with my old feeble one, so I had to learn to forge my own signature, imitating my old scrawl. And when the cashier sent for me, personally, my youthful appearance made him very suspicious. I have been obliged to sell all my real estate, and I must keep changing my banks and my safe-deposit vaults. All my fortune is now invested in coupon bonds, payable to bearer, so that I need not be identified when I want money. All this has cost me a pretty penny, but you can't pay too high a price for youth.

"Would you believe it, doctor, I am now taking dancing lessons, and can fox-trot and shimmy like a giddy young flapper. But I have been obliged to leave my own family, on the pretext of a trip abroad. Just think of it—I am now younger than my own son!"

AND STILL IT WORKS

Another three months elapsed, and then one day Doctor Hackensaw was electrified by a vision of fairy-like loveliness that swept into his office—an exquisite young girl, looking not more than eighteen, and clad in the daintiest of ball dresses, entered the doctor's office one night, and astonished that gentleman by throwing her arms around his neck and kissing him affectionately.

"Doctor," she cried, "How can I ever repay you for what you have done for me!"

"Excuse me, miss," said the doctor, nonplussed, but you have the advantage of me. There is something familiar about your face, but it must be years since I saw you last, for I should never have forgotten such a charming young lady."

"Why, doctor, don't you recognize me? I am Linda Young—Mrs. Linda Young. Your 'Elixir of Youth' is still working in my veins, and seems more potent every day, for I keep growing younger and younger. You have certainly found the fabled 'Fountain of Youth' that Ponce de Leon sought for in vain in Florida."

"Is it possible!" cried Doctor Hackensaw, astonished. "You're not really Mrs. Young, the feeble eighty-five year old woman who hobbled into my office less than a year ago?"

"There's no mistake about it, doctor, and I am on my way to a ball now with my fiancée, Jack Trimble. When I found I was still growing younger I decided that John was too old for me, so I broke the engagement, disappeared for awhile, and have now returned as a different young lady and have won Jack's heart. But I want you to keep me at my present age, because if I keep getting younger at this rate, I don't know what I shall do. I don't want to have to go back to school again!"

"But my dear madam," exclaimed the doctor in dismay, "I have not yet succeeded in finding the antidote. I am no more able to keep you from getting younger than mankind was able, before my time, to keep you from getting older."

"Don't call me 'madam,' please," interrupted the young girl. "It would seem so strange if anyone should hear you. Please do your very best for me. Meanwhile, I want to ask permission to come and live with you as your niece. People are very suspicious of a young girl of eighteen who lives all by herself and has difficulty in furnishing references. I also want you to have

free access to my safe deposit vault, for I experience more and more trouble in doing business with the banks.

"By the way, doctor, why don't you try some of your own elixir? You must have been a handsome man when you were young. Perhaps I might marry you instead of Jack."

"Tut! tut! young lady! Don't talk so. I shall be only too glad to have you as my niece and to take charge of your affairs, but I am afraid you will prove something of a handful to the man who marries you. Besides, I haven't yet found the antidote that will check your growing younger, and I have no desire to go back to babyhood with you."

Matters were accordingly arranged, and next day Doctor Hackensaw's "niece" Linda came to live with him. But, alas, she kept growing younger and younger at such a rapid rate that she was soon obliged to go away and return as her own younger sister. But even this subterfuge was not sufficient. The doctor was obliged to have two apartments and keep moving from one to the other, as a series of new nieces, each younger than the last, came to visit him. Mrs. Linda Young was now a little girl of eight, but curiously enough, she still retained the memories she had possessed before her rejuvenation. Just as in old age, memories of our youth cling to us, so in her return to youth, her adult memories remained, though somewhat obscured.

Linda's great dread was that she would have to be sent back to school again. Fancy a woman of 85—and a married woman at that—having to go back to school as a girl of eight. Retaining, as she did, all the memories of a life-time, think of having to sit all day at a desk surrounded by children studying their first reader! The thought was maddening. She had no desire of passing as an infant prodigy, and she begged the doctor to hasten his experiments!

"Unless you make haste," she cried, "I shall be a baby again before you know it!"

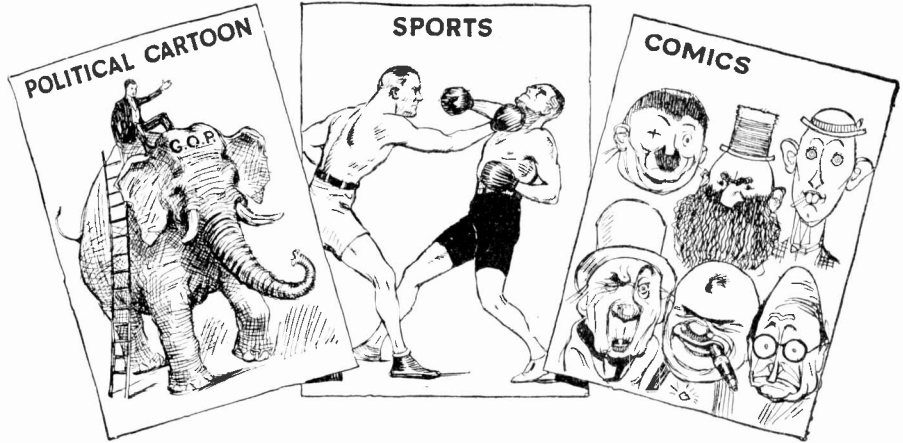
NECESSITY URGES

The poor doctor needed no urging. He saw the troubles ahead as plainly as she did. The microbes were, of course, multiplying now with lightning-like rapidity. The increase was in geometric progression. At the start there had been only the few microbes injected in Mrs. Young's arm. These had grown and split into double the number. The third generation had doubled again, and so the increase went on. Now the change was so rapid that the doctor was obliged to keep Linda confined in her room and attend to all her wants himself. He had no longer the resource of hiring a new servant every day, for even in one day the change was perceptible.

Day and night did he work, using Linda's room as a laboratory, seeking for the much-wished-for antidote. Surely there must be some means of checking or destroying these new microbes without injuring the body tissues! But the days passed by and the doctor found nothing.

When Linda reached the age of four, the doctor resolved on heroic measures. No longer satisfied with experimenting on animals, he determined to experiment on the child herself. He tried everything he could think of, even to the transfusion of blood from an elderly person. But in spite of these efforts, Linda became a babbling eight-months-old baby, incapable of making her wants known except by simple gestures. She could, however, answer Doctor Hackensaw's questions by affirmative or negative gestures, so by calling off the letters of the alphabet in turn he could learn any of her wishes. She retained her liking for cigarettes and cocktails, and it was curious to

(Continued on Page 1061)



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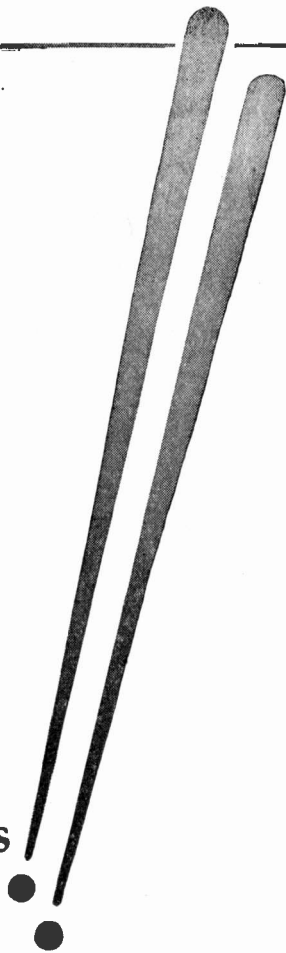
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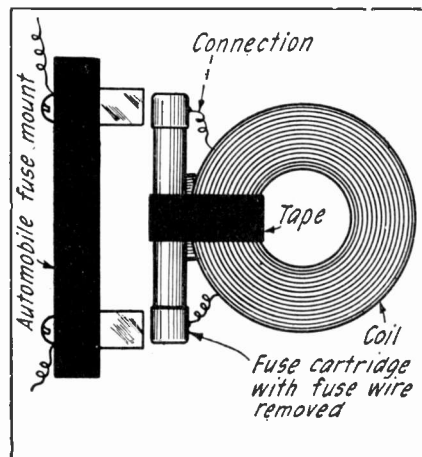
RADIO WRINKLES

EDITED BY
A. P. PECK,

Associate Member Institute Radio Engrs.

UNDER this heading we are going to publish items of interest to everyone who likes to build radio instruments. In order to continue this department it is necessary for our readers to tell us about their latest experiments. Write us a short description of some time- or money-saving kink you have discovered and send it to us along with a few sketches. Our regular prizes will be paid for this material. Be brief and try to put everything in the drawing. Don't be too elaborate. Address "RADIO WRINKLES" editor, care of Science and Invention.

Honeycomb Coil Mounting



An old fuse block is always a potential mounting for a honeycomb coil and the finished instrument made therefrom is illustrated above. The fuse wire is removed from the cartridge and the metal caps replaced. The coil is then fastened to the cartridge by means of tape. The two leads from the coil are then soldered to the brass caps and two clips may be mounted directly on the panel. This provides means whereby coils may be changed at will and also provides a movable mounting. When necessary, the polarity of the coils may easily be reversed; a thing that cannot readily be done with the standard mounting. —Robert Mackenzie.

Small Soldering Iron

A small soldering iron is very useful in radio work and can often be used in small spaces where a large iron will not work. The iron may be made from a section of No. 1 or No. 0 copper wire as illustrated above. The point is then tinned as shown in the lower part of the above illustration. This iron will hold its heat for a fairly long time and can readily be brought to a working heat in a small alcohol flame. —Evermont Fisel.

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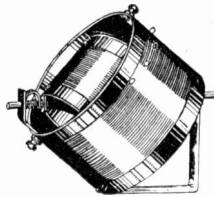
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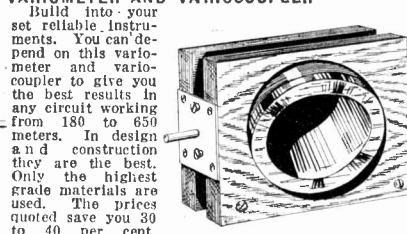
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THE PRICES QUOTED DELIVER THE GOODS TO YOUR DOOR
FAST SERVICE — TRY US AND BE CONVINCED

THIS GUARANTEE PROTECTS YOU—Examine the goods we ship you. They must suit you in every respect. If you are not satisfied with your purchase return the goods at once and we will refund the price you paid.

OUR SPECIAL VARIOMETER AND VARIOCOUPLER



N418 Variocoupler. Each.....\$2.45
The most efficient type of coupler, insures better tuning and louder signals. Primary and secondary wound on natural uncolored genuine bakelite tubes. Handsome green silk windings. Primary tapped for fine tuning. Can be panel or table mounted. 3-16 inch shaft.



N410 Variometer. Each.....\$2.10
Perfect in design and construction. Accurate wood forms thoroughly seasoned. Correct inductive ratios. Solid baked windings. Plenty of large sized wire insures highest efficiency. A strong high grade instrument that will give you lasting service. 3-16 inch shaft.

SOLID BARE COPPER WIRE

Solid bare copper wire for aerials, leads or wiring instruments.

Solid Bare Copper Wire, size 14.
N240 100 ft. coil 48c N242 500 ft. coil \$2.25

Solid Bare Copper Wire, Size 12.
N244 100 ft. coil 67c N245 500 ft. coil \$3.05

STRANDED ANTENNA WIRE

Cabled of fine copper strands. Very flexible. High tensile strength. Best for aerials.
N248 100 ft. coil 58c N249 500 ft. coil \$2.75

MAGNET WIRE

Insulated copper wire. Best quality even drawn wire, one piece to a spool. Prices quoted are for 8 oz. spools unless otherwise stated. Note, our prices are prepaid.

Double Cotton Covered	Enameled Insulation	Green Silk Covered	
Number N990	Number N992	Number N991	
Gauge	Price	Gauge	Price
18	39c	20	35c
20	43c	22	32c
22	48c	24	30c
24	52c	26	28c
26	56c	28	26c
28	60c	30	24c
30	64c	32	22c
32	68c	34	20c
34	72c	36	18c
		38	16c

ANTENNA INSULATORS

N260 Size 1x3/4. Composition, metal eyelets. Two for.....17c
N263 Ribbed Porcelain insulator, 2 1/2 in. long. Ea. 6c. Dozen.....55c
N265 Ribbed porcelain insulator—5 inches long. Each.....15c

LEAD-IN INSULATORS

N270 For 4 inch walls or less.....42c
N271 For 9 inch walls or less.....69c
The only practical lead-in insulator for aerial wires. Small, neat, effective, durable. Fits 1/8 inch hole. Securely locked by two adjustable nuts.

OUTDOOR LIGHTNING ARRESTER

N980 Price.....\$1.55
Protect your instruments with this lightning arrester. Weatherproof porcelain case. Air gap type. Permanent. Durable. Underwriters approved.

JEWELL LIGHTNING ARRESTER

N981 Each.....85c
A dependable protector, always on guard. Small and compact. Weatherproof porcelain case. Easily fastened and connected. Underwriters approved. Lists for \$1.10.

PANEL MOUNTING VARIABLE CONDENSERS

These are especially high grade condensers and we guarantee them to be mechanically and electrically perfect. Fine polished end plates of heavy bakelite. Shafts 1/4 inch diameter. Sturdy, heavy aluminum alloy plates perfectly spaced to insure smooth, even, reliable capacity. Our low prices save you money. These condensers are of the very best make and are not to be compared with many inferior, cheap condensers offered. We guarantee them to please you or your money back. The vernier style has one separately controlled plate which permits of the finest tuning. Quality considered, these values are unapproached by others.

REGULAR STYLE

N815—3 plate.....58c
N816—5 plate.....97c
N814—11 plate .00025 mfd.....\$1.13
N813—31 plate .0005 mfd.....1.27
N812—43 plate .001 mfd.....1.47

VERNIER STYLE

Including Dial and Knobs
N825—14 plate .00025 mfd.....\$2.45
N824—26 plate .0005 mfd.....2.70
N826—46 plate .001 mfd.....2.95

OUR SPECIAL AUDIO FREQUENCY AMPLIFYING TRANSFORMERS

N550 Each.....\$2.25
In quality of tone and volume of sound, these things a transformer is built for we guarantee it to equal or surpass any other transformer. Neat in appearance. Carefully made. Fully mounted with plainly marked binding post connections. Wonderful results on one, two or three steps without distortion or howling. A quality item in every respect.



NATIONAL SHIELDED TRANSFORMER

N551 3 1/2 to 1 Ratio \$2.48
N552 6 to 1 Ratio...2.68
Note that our price is prepaid. The same high grade style of transformer as above enclosed in a metal case which completely shields it from any outside magnetic influences. Free from howling and local disturbances.

OTHER STANDARD BRANDS AUDIO FREQUENCY TRANSFORMERS

Fresh, clean stock in original containers.
N232 THORARSON Ratio 3 1/2 to 1 \$3.30
N233 THORARSON Ratio 6 to 1.....3.70
N553 Acme. Each.....4.20
N554 Coto. Each.....4.45
N555 Federal. Each.....4.45
N712 Radio Corp. Each.....5.70
N234 All American 10 to 1 Shielded 3.80
N239 All American 5 to 1 Shielded 3.80
N236 All American 3 to 1 Shielded 3.60

TRICOIL RADIO FREQUENCY AMPLIFYING TRANSFORMER

N560 For 201A or 301A Tubes.....\$1.58
N561 For 199 or 11 or 12 Tubes.....1.58
This transformer will produce wonderful results in any type of regular or reflex radio frequency circuit. Perfect for one, two or three stages. Compact, convenient form, easily mounted. Range 175 to 600 meters.



OTHER STANDARD BRANDS RADIO FREQUENCY TRANSFORMERS

N568 Our special—as good as any of them.....\$.48
N502 Dubilier. Each.....4.45
N563 Coto. Each.....4.45
N565 Acme. First stage. Each.....4.45
N566 Acme. Second stage. Each.....4.45
N567 Acme. Third stage. Each.....4.45
N714 Radio Corp. Each.....5.95
N995 All American. Each.....3.95
N575 Eria. First stage. Each.....3.45
N576 Eria. Second stage. Each.....3.45
N577 Eria. Third stage. Each.....3.45
N578 Eria. Reflex No. 1, 2 or 3. Each 4.35

LONG NOSE PLIERS

N970 Price.....95c
The handiest pliers for radio work. Made of fine hardened steel. Length, 5 in.



DIAGONAL JAW NIPPERS

N972 Price.....95c
For fine electrical work, made of hardened steel. Length, 5 inches.



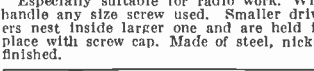
FOUR-IN-ONE DRIVER

N974 Each.....55c
Especially suitable for radio work. Will handle any size screw used. Smaller drivers nest inside larger one and are held in place with screw cap. Made of steel, nickel finished.



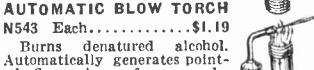
TINOL

N969 Per tube.....19c
A combined solder and flux in handy form. Put a little on the connection, heat with a match, torch or solder iron and you have a neat electrically and mechanically perfect joint.



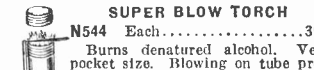
AUTOMATIC BLOW TORCH

N543 Each.....\$1.19
Burns denatured alcohol. Automatically generates pointed flame in a few seconds. Easy to solder joints in hard places. Lights with a match. Burns 20 minutes on one filling. 5 1/2 inches high, 3/4 inch diameter cylinders. Works fine with Tinol listed above.



SUPER BLOW TORCH

N544 Each.....39c
Burns denatured alcohol. Vest pocket size. Blowing on tube produces a hot pointed flame. Lights with a match. Works fast. Burns 10 minutes on one filling. Easy to solder joints in hard places. 3 in. high, 7/8 in. cylinder. Long rubber tube. Produces fine joints with Tinol listed above.



WITH BARAWIK QUALITY RADIO GOODS

VACUUM TUBES
Standard Brands—Cunningham, Radiotron. Every one guaranteed new and perfect. We will ship brand in stock unless you specify otherwise.

- N105 Detector UV200 C300 Each \$4.18
- N112 Amplifier, UV201A (301A) Each 5.42
- N118 5-Watt Transmitter..... 7.70
- N107 WD11 C11, Each..... 5.42
- N101 WD12 C12, Each..... 5.42
- N102 UV199 (299), Each..... 5.42
- N104 UV199 Adapter fits 199 tube to standard socket 39
- N108 WD11 Socket, Each..... 31
- N109 WD11 Adapter, Each..... 45

BAKELITE TUBE SOCKET
N140 Standard base.....39
N141 UV199 base.....39
Moulded of genuine red brown bakelite. Binding post connections. For table or panel mounting. Neat and strong.

199 SOCKET
N145 Each.....49c
Moulded of high insulating material. Sponge rubber base prevents ringing in tube. Plainly marked binding post connections. Neat and compact.

STANDARD TUBE SOCKET
N150 Each.....59c
Bakelite base. Polished nicked tube. Highest quality socket on the market. Best insulation. Positive contact. Marked terminals. For base or panel mounting.

FILAMENT CONTROL RHEOSTATS
N132 6 ohm, Each.....38c
N129 20 ohm, Each.....40c
N131 30 ohm, Each.....44c
N135 6 ohm Verrier.....95c
Best grade. Will give real service. Durable and lasting. High heat resisting base, diam. 2 1/4 in. Tapered polished black knob 1 1/4" diam. Potentiometers. Match above rheostats. Same high grade construction.

OTHER STANDARD BRAND RHEOSTATS and POTENTIOMETERS
N207 Filostat, Each.....\$1.90
N208 Bradleystat, Each.....1.74
N209 Bradleystat 200 ohm, Each.....1.89
N210 Bradleystat 400 ohm, Each.....2.36
N211 Howard 6 ohm Plain Rheo, Ea. .85
N212 Howard 6 ohm Ver. Rheo, Ea. 1.25
N213 Howard 25 ohm Plain Rheo, Ea. .85
N214 Howard 25 ohm Ver. Rheo, Ea. 1.25
N215 Howard 40 ohm Plain Rheo, Ea. .85
N216 Howard 40 ohm Ver. Rheo, Ea. 1.25
N217 Howard 200 ohm Potentiometers, Each.....1.45
N218 Howard 400 ohm Potentiometers, Each.....1.69
N219 Klossner 6 ohm Verrier, Each.....1.19
N221 Klossner 30 ohm Verrier, Each 1.45
N222 Amperite with mounting......95

SUPERIOR RHEOSTATS
N153 6 ohm, Each.....69c
N154 20 ohm, Each.....76c
N155 30 ohm, Each.....83c
The finest rheostats ever made. Even action. Best design, best workmanship. Supplied with attractive dial and knob. A rheostat for high grade sets.
Potentiometers to match above rheostats with dial and knob.....98c
N156 30 ohm.....

QUICK ACTING RHEOSTAT
N124 6 ohm, Each.....79c
N125 15 ohm, Each.....88c
N126 30 ohm, Each.....99c
Verrier adjustment at every degree of resistance. Pushing knob in turns off the filament.

COMPOSITION DIALS
N921 Diam. 2 in. for 3-16 in. shaft, Ea. 16c
N922 Diam. 2 in. for 1/4 in. shaft, Ea. 16c
N923 Diam. 3 in. for 3-16 in. shaft, Ea. 22c
N924 Diam. 3 in. for 1/4 in. shaft, Ea. 22c
Handsome dials moulded in one piece of polished black composition. 2 inch size has 270° scale marked 0 to 100 finely engraved in contrasting white enamel. 3 inch size has 180° scale marked 0 to 100.

BAKELITE DIALS
N931—2 in. Diam for 3-16 in. shaft, Each.....35c
N932—2 in. Diam for 1/4 in. shaft, Each.....35c
N933—3 in. Diam for 3-16 in. shaft, Each.....39c
N934—3 in. Diam for 1/4 in. shaft, Each.....39c
N935—4 in. Diam for 1/4 in. shaft, Ea. 46c
Moulded in one piece of genuine bakelite in polished black finish. Finely engraved scale in contrasting white enamel. Sure grip knob that fits the fingers. Higher grade dials for good sets. Match perfectly.

VERNIER DIAL ADJUSTER
N941 Each.....19c
Easily installed at edge of dial, gives finest vernier adjustment of condenser or inductance. A great value. Polished black knob.

WE PAY TRANSPORTATION CHARGES EAST OF THE ROCKIES PRESERVE THESE PAGES—ORDER FROM THEM AND SAVE MONEY

FAST SERVICE—TRY US AND BE CONVINCED
THE PRICES QUOTED DELIVER THE GOODS TO YOUR DOOR
OUR GUARANTEE PROTECTS YOU—We handle only the best goods, carefully tested and checked by expert radio engineers. You are assured of getting guaranteed apparatus that will give superior results. And while our goods are best, our prices are lowest. Our goods equal or surpass the claims we make for them. We do not attempt to deceive or mislead. Our reputation for fair dealing is our most valued asset.

ENCLOSED DETECTOR
One of the finest crystal detectors on the market, supersensitive galena crystal enclosed in heavy glass shield. Quick, positive adjustment. Brass parts polished nickel finish.
N730 Each.....89c

GALENA DETECTOR
Easy fine adjustment. Crystal mounted in cup. Moulded base and knob. Brass parts polished nickel finish. An unequalled value.
N732 Each.....59c

DETECTOR CRYSTALS
N736 Galena, Arlington tested, piece 19c
N738 Silicon, Arlington tested, piece 19c
N735 Tested, Galena, Mounted, piece 9c
N737 Tested, Silicon, per piece.....9c
N739 Genuine million point crystal, Ea. 29c

STANDARD BRAND FIXED CRYSTAL DETECTORS
The latest development in Crystal Detectors. Give better results and more reliable than old style. Used in Reflex circuits.
N742 Grewol Detector, Each.....\$1.48
N743 B Metal Detector, Each.....2.18
N744 B Metal Crystal, Each.....1.28
N745 Gold Bar Detector, Each......83
N745 Yellow Tip Detector, Each.....1.79
N746 Du-Pee Crystal, Each......27

SUPERIOR VARIABLE GRID RESISTANCE
N167 Each.....80c
N168 With .00025 Condenser.....98c
Eliminates hissing, clarifies signals. Capacity smoothly varied from 0 to 6 megohms by half turn of knob. Easily mounted on any panel.

TUBULAR GRID LEAKS AND CONDENSERS
Very convenient. Permit of quick change of leaks or condensers of varying capacity. Cut shows leak mounted. Leaks and condensers have same appearance. Each part priced separately.
N849 Grid Leak, Each.....15c
Resistances—1/2, 1, 1 1/2, 2, 3, 5, 7, and 10 megohms. Specify which size is wanted.

GRID AND PLATE CONDENSERS
N831 Grid and Plate Condensers, Ea. 39c
Capacities .000025, .0001, .00025, .0005 mfd. Specify which size is wanted.

Mountings. Bakelite base.
N840 Single mounting, Each.....28c
N842 Double mounting, Each.....47c
N844 Triple mounting, Each.....67c

STANDARD BRAND VARIABLE GRID LEAKS
N177 Freshman back of panel style.....59c
N178 Freshman back of panel style with .00025 Condenser 79c
N171 Freshman back mounting type with .00025 Condenser.....79c
N172 Durham Variable Grid Leak with Mounting.....89c
N173 C.R.L. Variable Grid Leak.....\$1.19
N175 C.R.L. Variable Grid Leak with grid condenser.....\$1.48

FRESHMAN MICA CONDENSERS
N512 .00025 mfd.....26c
N513 .0005 mfd.....26c
N514 .01 mfd.....31c
N515 .002 mfd.....31c
N516 .008 mfd.....60c
N517 .01 mfd.....80c

DUBILIER MICADON TYPE 601
N502 .001.....28c N507 .0025.....32c
N503 .00025.....28c N508 .003.....40c
N504 .0005.....28c N509 .004.....40c
N505 .001.....32c N510 .005.....48c
N506 .002.....32c N511 .006.....60c

BARAWIK QUALITY HEADSETS
N770 Per Set, 2000 ohms.....\$2.98
These headsets have proven on rigid tests to be one of the very best on the market. The tone quality is excellent with an unusual volume. Skilled workmen make them from the best selected materials. The receiver cases are fine polished finish with polished black ear pieces. Fabric covered head band comfortably and quickly fitted to the head. Supplied with 5-foot cord. These sets were designed to sell for much higher prices than we ask, and at our price are a wonderful bargain. We guarantee that you will be pleased with them and agree that they are the best value by far yet offered. If they don't suit you we will cheerfully return your money.

STANDARD BRAND HEADSETS
N754 Baldwin Type C with N764 Frost, 2000 ohm \$3.30
universal jack plug \$10.45 N766 Frost, 3000 ohm \$3.95
N755 Western Electric \$9.50 N759 Federal \$3.25
N756 Murdock 56, 2000 ohm.....\$3.25
N757 Murdock 56, 3000 ohm.....\$3.90
N758 Dictograph Aristocrat.....\$6.60

PLATE CIRCUIT "B" BATTERIES

You can make real savings on these batteries. We guarantee them to equal any on the market regardless of price. Extra long life. Don't throw away your money on cheaper inferior useless batteries.
N180 Signal Corps type, small size. 15 cells, 22 1/2 volts. Each.....\$1.10
N182 Large size. 5 taps 10 1/2, 18, 10 1/2, 21 and 22 volts. Each.....\$1.45
N184 Variable Large Navy size. 16 1/2 x 4 3/4 inches 5 taps, giving range from 16 1/2 to 22 1/2 volts in 1 1/2 volt steps. Each \$1.95
N188 Combination Tapped 45 volts, 30 cell. 3x1x3 battery. Tapped to give 45, 22 1/2, 21, 19 1/2, 18 and 16 1/2 volts. Handles both detector and amplifier tubes. Ea. \$3.28

"B" BATTERY METER
N189 Each.....98c
Reads 0 to 50 volts. Accurately tells you the exact condition of your B Battery. Convenient watch size. Polished nickel case with wire lead.

STORAGE "A" BATTERY
A high grade battery. Guaranteed for three years. Made of best new materials. Full capacity. The best battery buy on the market. Try one of these batteries on your set for 10 days. If at the end of that time you are not fully satisfied with the battery return it and we will refund the purchase price.
N194 6 volt, 40-80 ampere size. Ea. \$ 9.90
N196 6 volt, 80-120 ampere size. Ea. \$13.25

HOMECARGER BATTERY CHARGING RECTIFIER
Charge your battery at home overnight for a few cents. Simply connect to any 110 volt 60 cycle light socket, turn on current and rectifier does the rest automatically. Will work for years without attention. Simple connections. Give a tapering charge which batteries should have. You can make it pay a profit charging your friends' auto batteries. Long connecting cords with pair of battery clips.
N201 For 6 volt battery.....\$12.95
N203 For 12 volt battery.....12.95

HYDROMETER
N190 Each.....48c
Accurately tells you the condition of your storage battery. Helps you keep your battery in better condition.

BATTERY CLIPS
N198 Two for.....28c
Clip onto storage battery terminals, lead cord. Make positive non-corrosive contact at all times.

WIRE CONNECTING CLIPS
N199 Per dozen.....30c
Small connecting clips for quickly fastening leads on to binding posts, etc. Handy and useful. Every radiolist should have at least a dozen.

MELTONE LOUD SPEAKER
N611 Price \$4.85
One of the best popular priced speakers. Talks loud and clear. Compares favorably with more expensive makes. Fibre horn. Heavy metal base. Five foot cord. Nickered goose neck. 6 1/4 in. bell. Size over all 14 1/2".

STANDARD BRAND LOUD SPEAKERS AND UNITS
N610 Murdock Loudspeaker.....\$4.38
N613 Barawik with Baldwin unit.....11.25
N615 Pathe Loudspeaker.....15.95
N616 Atlas Loudspeaker.....22.50
N612 Magnavox R3 Loudspeaker.....32.50
N614 Magnavox R1 Loudspeaker.....32.50
N617 Music Master Loudspeaker.....27.00
N615 Genuine Baldwin type C unit.....5.10
N619 Murdock Special Unit.....2.60
N618 Brandes Table Talker.....8.75
N620 Baldwin Loud Speaker.....22.50
N609 Dictograph Dictogrand.....21.50
N608 Atlas Unit, Each.....10.75
N607 Western Electric Unit, Each.....10.75

PHONODAPTER
N771 Each.....39c
The Phonodapter will fit any phone. Metal tube fits any standard phonograph. Make your phonograph a loud talker. Fits Columbia, Victor and Sonora phonographs. It is made entirely of pure soft rubber with brass tube insert.

THE BARAWIK CO. Chicago's Original Radio Supply House Beware of Imitators 102 South Canal St., Chicago, Ill.

IT IS EASY TO BUILD YOUR OWN RADIO SET

GUARANTEED QUALITY GOODS

at money saving prices. There are no strings tied to our prices. Order what you want—be your order large or small. You will get immediate service from the most reliable exclusive radio supply house. Before you consider buying elsewhere, ask your banker as to our responsibility and financial rating. You will find that we stand high in the commercial world and we have earned our standing only through fair dealing, prompt service and by offering merchandise of high quality at prices unequalled by others.

FAHNESTOCK CONNECTORS



N366 Single. Dozen25c
N367 Double. Dozen39c
Handy and convenient for connecting wires or making connections on binding posts or other parts of instruments. Wires held firmly in spring grip but may be instantly removed.

UNIVERNIER CONTROL DIAL

N918 For 3-16 inch shaft.....\$1.15
N919 For ¼ inch shaft.....1.15
Replaces ordinary knob or dial. Gives perfect vernier control on condenser, variometer, variocoupler, tickler, etc. Positive easy action. Looks fine. Easily installed. Especially desirable in tuning neodydyne sets.

RADIO SWITCH

N287 Each28c
Cuts current on and off instantly by a push or pull. Very neat. Well made. Durable. Saves tubes and batteries.

BEZELS

N399 Diameter ¾ inch. Each.....15c
N400 Diameter 1 ½ inch. Each.....15c
Polished nickel finish. Finest quality. Fit any thickness panel. Greatly improve appearance of panel.

CABINETS

Fine looking cabinets solidly built. Elegant hand rubbed dark mahogany finish. You will be proud of your set mounted in one of these cabinets. Hinged tops. Front rabbeted to take panels. Panels not included. Prices are transportation paid. Note that our prices are prepaid.



Panel Size | **Inside Dimensions** | **Art. No.** | **Price Each**

Panel Size	Inside Dimensions	Art. No.	Price Each
6x7"	5 ½" x 6 ½" x 7"	N420	\$1.95
6x10 ½"	5 ½" x 9 ½" x 7"	N422	2.45
7x10"	6 ½" x 9 ½" x 7"	N421	2.60
7x12"	6 ½" x 11 ½" x 7"	N424	3.05
7x14"	6 ½" x 13 ½" x 7"	N423	3.20
7x18"	6 ½" x 17 ½" x 7"	N426	3.45
7x21"	6 ½" x 20 ½" x 7"	N425	3.85
7x24"	6 ½" x 23 ½" x 7"	N429	4.35
7x26"	6 ½" x 25 ½" x 7"	N431	5.50
8x14"	6 ½" x 13 ½" x 10"	N428	3.55
13x14"	11 ½" x 13 ½" x 10"	N430	4.00
13x21"	11 ½" x 20 ½" x 10"	N432	5.05

RADIO "BAKELITE" PANELS

Notice our very low prices on this fine quality material. Others ask as much for hard rubber panels which are worth much less. We supply genuine Bakelite. Condensite Celeron or Formica, all of which are materials of practically identical mechanical, chemical and electrical properties. Machines well without chipping. Won't warp. Waterproof. Highest mechanical and dielectric strength. Attractive natural polished black finish which can be sanded and oiled. Note that our prices are prepaid.

RUBBER COMPOUND PANELS

Made of a special compound having a rubber base. Equal in appearance and in all essential points to any other class of panels. Fine smooth polished finish. Can be drilled or cut without chipping. Guaranteed not to warp and to be a perfect insulator for radio use. Smooth, clean edges. Thickness 3/16 inch. Size given is in inches.

PANELETYPE RADIO PANELS

A new practical radio panel. High dielectric strength, rigid and durable. Easy to drill, tap or refinish. Black in color, polished on one side, matte grain on other side. 3-16 inch thick.

Art. No.	Price	Art. No.	Price	Art. No.	Price
N491	7x10.....\$0.88	N484	7x18.....\$1.60		
N492	7x12.....1.05	N483	7x21.....1.85		
N483	7x14.....1.22	N486	7x24.....2.10		
		N490	7x18.....\$1.28		
N487	7x10......75c	N491	7x21.....1.44		
N488	7x12......84c	N492	7x24.....1.69		

Over 30,000 Barawik Radio Sets Are Operated All Over the World

All of these sets were built with Barawik Standard Radio Parts mostly by persons without any previous radio experience. These home-made sets equal in results the best factory made sets—many are even superior and at a cost only a fraction of the cost of the factory made sets. You can easily equal these results by following directions given in the numerous magazine articles on radio. Also directly below you will find listed Blue Prints, Instruction Packs and Books. With the help of these anyone can successfully make a Radio Set.

RADIO BOOKS

That every Home Builder and Amateur needs. Written in plain simple language everyone can understand.
N631 100 Radio Hookups. Each.....25c
Shows hookups from the simple crystal set to the more elaborate and latest tube circuits. Numerous types of Reflex super-Regenerative, super-Heterodyne, Neodydyne, Reinartz, Flewelling, Bishop, etc.
N632 How to Tune Your Radio Set. Each.....25c
N633 How to Build Loud Talkers. Each.....25c
N634 How to Make Radio-Phone Receiving Sets. Each.....25c
N635 How to Make Radio Frequency Amplifiers. Each.....25c

SPIDER WEB COIL FOR REINARTZ CIRCUIT

N296 Each.....\$1.15
Lists for \$2.50. A very unusual bargain. Made of green silk covered wire, spiderweb wound to produce greatest efficiency and lowest losses, 21 taps so arranged that crossing is avoided. Two fibre strips and wooden rod furnished permit various styles of mounting. With this coil a high grade set can be built at a low cost. Directions included.

ULTRA AUDION COIL

N297 Each.....85c
Spider web wound of green silk covered wire. Four taps. Produces wonderful results. Fibre strips and wooden rod for mounting included. Directions furnished.

COCKADAY COILS

N298 Per Set...\$1.95
Complete set coils for Cockaday circuit. Properly calculated and made to give best results on this new wonder circuit.

NEODYDYNE TRANSFORMERS

N571 Each \$1.75. Per set of three. \$4.95
An air core transformer for use in neodydyne method of reception. Can also be used for tuned radio frequency or as a fixed couple with condenser across secondary. Proper design for results and efficiency. Green silk windings on bakelite tubes with adjustable mounting brackets to fit most any condenser.

NEUTRALIZING CONDENSERS

N572 Per set of two.....40c
Simple, inexpensive, efficient precision type. Micrometer adjustment is attainable. Easily mounted in circuit.

STANDARD NEODYDYNE PARTS

N851 WorkRite Neodydyne (combined transformer and condenser). Each.....\$4.78

N852 WorkRite Neodydyne Kit.....\$14.95
Includes 3 WorkRite Neodydyne parts, 2 WorkRite Neodydyne panel layout, paper template and book of instructions.

N854 Amso Compensating Condenser. Each.....\$2.89
A 3 electrode condenser for balancing the grid charge on amplifying tubes. Stops all local oscillations without detuning amplifier. Shielded against hand capacity. Complete with 2 inch dial. Provides perfect and rapid control of tube.

N853 WorkRite Neodydyne. Each......43c
A very accurate and easily adjusted condenser for neutralizing tube.

N855 Fada Neodydyne Parts.....\$25.00
A combination package of three neodydyne transformers and two neodydyne parts with instruction book.

N856 Fada Parts for 4 tube set. Complete.....\$64.00
N857 Fada Parts for 5 tube set. Complete.....\$65.60
Contain all necessary parts including drilled panel, careful instructions, sockets, dials, condensers, transformers, bus bar wire and fine mahogany finish cabinet.

ANTENNA LEAD-IN

N259 Each.....25c
Solves a hard problem. With it you can bring in the antenna wire without drilling a hole for an insulator. Place on window sill and window can be closed down tight and locked as before. Takes but a minute to install. Perfectly insulated. Can be bent into any shape. Made of copper strip properly insulated. Neat and durable. Place on nearly all standard goods not listed on these pages. Send us your order—we give you the right price.

PRINTS OF POPULAR CIRCUITS

These prints give a full-size panel layout schematic hookup, hook-up showing parts wired and explanatory notes. With them as a guide anyone can build a set that will operate perfectly and bring in the long distance stations.
N621 One Tube Reflex and Amplifier. Each.....10c
N622 Single Circuit Tuner. Each.....10c
N623 Reinartz Tuner using Spider Web Coil. Each.....10c
N624 Radio and Audio Frequency Amplifier. Each.....10c
N625 Short Wave Regenerative Set, using two Variocouplers. Each.....10c
N626 Honeycomb Coil Circuit and Amplifier. Each.....10c

"CONSOLIDATED" RADIO PLAN PACKETS

Designed and laid out by the foremost radio engineers. With their help you can build an outfit that will give the finest results. Every packet contains complete instruction for the construction and tells what tools and parts are needed. Detailed directions for drilling, mounting and wiring, also how to handle set after it is built. Thousands of sets have been built from these plans and are in perfect operation. Folder giving detailed description of each packet sent on request. For more complete description of these packets see the Conrad Co. advertisement in this magazine. Price per packet.....42c

Order item wanted by article number.
N640 How to make a Neodydyne Receiver.
N641 How to make a Reinartz Receiver.
N642 How to make a Regenerative Receiver.
N643 How to make a Cockaday Receiver.
N644 How to make a Reflex Receiver.
N645 How to make Detector and Amplifier Units.
N646 All about aerials and their construction.
N647 Twenty Radio Diagrams of Latest Hook-ups.
N648 14 Radio Formulas and Diagrams.
N649 How to make an Autoplex Receiver.

Complete Sets of Parts for Popular Circuits

Only high grade parts are used in these sets and each part is guaranteed to be perfect. Each one of these circuits has been tried and successfully operated under many different conditions. The detailed instructions and diagrams supplied with each set make it easy for any one without previous experience to build an outfit that will give most satisfactory results.

HAZELTINE NEODYDYNE 5 TUBE CIRCUIT

N858 Complete set parts.....\$38.50
Essential parts licensed under HazelTine patents. A set that will give really wonderful results. Only the highest grade parts are used. The following items are included:
1—7x24x3-16 Formica panel.
2—Rheostats with dials.
3—4 inch Bakelite dials.
5—Bakelite sockets.
8—Composition top binding posts.
3—0005 Bakelite end variable condensers.
1—24 high grade cabinet.
3—Neodydyne transformers.
2—Neutralizing Condensers.
1—Variable grid leak and condenser.
2—Barawik audio transformers.
1—Base board for mounting.
30 ft. tinned bus bar wire.
Instructions for assembling and wiring.

ERLA SINGLE TUBE REFLEX CIRCUIT

N859 Complete set parts.....\$18.95
The following parts are included:
1—Erla Reflex No. 1 Transformer.
1—Audio Transformer.
1—Variocoupler silk windings on bakelite tube.
1—0005 Bakelite end Variable Condenser.
2—Bakelite standard base sockets.
1—002 Mica condenser.
1—001 Mica condenser.
1—00025 Mica condenser.
1—Fixed detector.
1—High grade rheostat.
2—3 inch polished black dials.
8—Binding posts with composition tops.
1 dozen switch points and 4 stops.
2—Switch levers.
1—7x14 ½ Bakelite panel.

N423 Fine 7x14 Cabinet mahogany finish. Extra.....\$3.20

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N860 Complete set parts.....\$13.25
A single tube circuit that brings in signals loud enough for a table talker. The following parts are included:
1—Wood form Variometers silk windings.
1—1x12 ½ Bakelite panel.
2—3 inch polished black dials.
1—1250 turn honeycomb coil.
1—Bakelite socket with standard base.
1—6 ohm rheostat.
8—Composition top binding posts.
8—Name plates.
10 feet bus bar wire.
1—Consolidated Autoplex pattern.
1—Fine 7x12 cabinet mahogany finished.

COCKADAY CIRCUIT

The following parts are included:
N861 Complete set parts.....\$11.35
1—Set Cockaday Coils.
2—3 inch polished black Bakelite dials.
1—Bakelite socket for standard base.
1—Vernier Rheostat.
1—Double Circuit Jack.
8—Composition top binding posts.
2—High grade switch levers.
1 dozen polished nickel switch points.
1—7x14 ½ Formica panel.
1—0005 Bakelite end variable condensers.
1—Base board for convenient assembling.
10 feet nickeled bus bar wire.
Diagram and instructions.
N423 Cabinet extra.....\$3.20

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N864 Complete set of parts.....\$12.39
The following parts are included:
1—7x12x3-16 panel.
1—0005 Bakelite end variable condenser.
3—006 Mica condenser.
1—2 coil honeycomb mount.
1—Variable grid leak and condenser.
1—50 turn honeycomb coil.
1—75 turn honeycomb coil.
2—Coil mounts with straps.
1—3 inch polished black dial.
1—Bakelite socket for standard base.
1—Vernier 6 ohm rheostat.
8—Binding posts with composition top.
1—Base board for assembling.
Instructions for assembling and wiring.

REINARTZ CIRCUIT

N862 Complete set parts.....\$10.75
The following parts are included:
1—7x18x3-16 Bakelite panel.
1—Bakelite socket standard base.
1—Vernier Rheostat.
1—0005 Bakelite end variable condenser.
1—00025 Bakelite end variable condenser.
2—3 inch polished black dials.
3—Switch levers.
1—Green silk insulated coil.
1—Freshman variable grid leak with condenser.
1 dozen insulated top binding posts.
30 ft. tinned bus bar wire.
1—Instructions for assembling and wiring.
N426 Fine 7x18 Cabinet mahogany finish. Extra.....\$3.45

Note:—The above does not include amplifier. Set can be supplied with 2 additional sockets, 2 audio transformers, 2 additional rheostats, and size 7x21 panel.

N863 Complete with two stage amplifier.....\$17.95
N425 Fine 7x21 Cabinet mahogany finish. Extra.....\$4.65

ULTRA AUDION CIRCUIT

N865 Complete set parts.....\$8.95
The following parts are included:
1—Spider web coil with taps.
1—0005 Bakelite end variable condenser.
1—7x12x3-16 panel.
1—Bakelite socket for standard base.
1—Variometer with silk windings.
1—Vernier 6 ohm Rheostat.
1—Variable grid leak with condenser.
8—Binding posts with composition tops.
1—Base board.
10 feet nickeled bus bar wire.
Diagrams and instructions.

N424 Fine 7x12 cabinet mahogany finish. Extra.....\$3.05

The ultra audion circuit gives fine results with two stages of amplification added.

Set as above with 7x18 panel and 2 audio transformers, 2 additional bakelite sockets and 2 additional rheostats.

N866 Complete.....\$15.95
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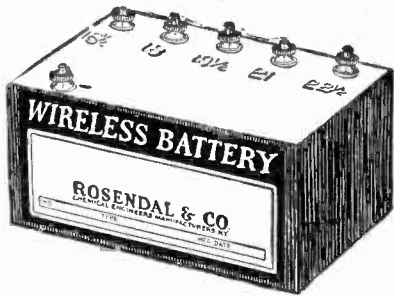
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N251 Each......97c
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N538 Complete.....83c
Handy for soldering radio connections or for general small repair jobs. Consists of soldering copper with handle, sal ammoniac, soldering salts, solder and sand paper.

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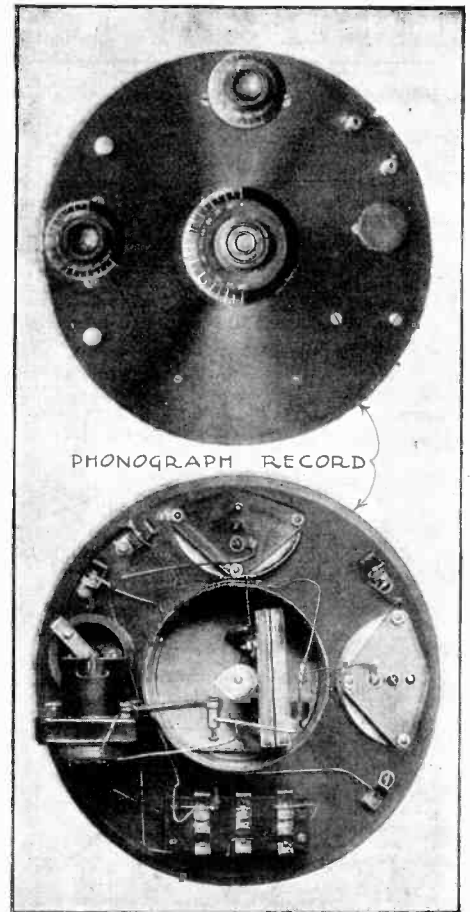
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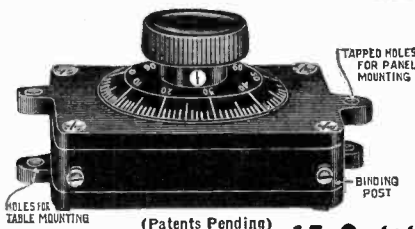


PHONOGRAPH RECORD

The above illustration shows a complete receiving set, including tuner and detector, mounted on a standard 12-inch phonograph record. The tuner consists of an inductance coil and three variable condensers. One of the latter is of the book type, operated by a cam, and is mounted within the inductance coil. If desired, a standard type of condenser may be used in this place, providing the inductance coil is wound on a tube large enough to contain the condenser. With a little ingenuity, almost any type of receiving set may be mounted on a record in this manner and be made to give very good results. Some type of mounting should be devised and this could probably take the form of two brackets which would support the record on edge. Another good scheme would be to make a round box, the bottom composed of a circular disc of wood and the sides of the thin wood used in making cheese boxes. This could readily be bent into the shape required and the phonograph record mounted at the top of this box. Such a set would not only be useful, but ornamental and novel.

—A. O. Wright.

A New RICO Product



CAPACITY EQUALS 43 PLATE CONDENSER
REQUIRES ¼ THE SPACE

THE "RICO" STRAIGHT LINE CONDENSER

This condenser marks a revolution in condenser building. It is the simplest and most practical type of condenser as yet developed for broadcast and amateur work. This condenser has been developed by our engineers after considerable research work and has been pronounced perfect by experts.

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- 1—Large capacity (.001 Mf.).
- 2—Replaces a 43-plate condenser.
- 3—Uses a minimum of space, size 3¼"x2¼"x1¼".
- 4—For panel mounting or for table mounting—universal in its scope.
- 5—One complete revolution of dial adjusts condenser from minimum to maximum.
- 6—Vernier effect.
- 7—Absolute straight line curve.
- 8—Accumulates no dust between plates as is the case with air condensers entirely enclosed.
- 9—Light weight. Condenser only weighs 3 oz.
- 10—Less than 1-30th amount of parts as used in old style mesh plate condenser.
- 11—Can never get out of order.
- 12—Impossible to short circuit. Finest India Mica dielectric used.
- 13—Works in any position, vertical or horizontal. No counterweights needed.
- 14—Lowest in price for high class condenser.
- 15—Compactness. Size only 3¼"x2¼"x1¼" over all. The Rico Straight Line Condenser must be seen to be appreciated. Made of the best materials that money can buy. Stands in a class by itself. All metal parts finished in nickel plate. Money refunded if this condenser is not all we claim for it. No. 450 "Rico" Straight Line Condenser complete with molded dial, \$1.75. No. 451, same condenser but without dial (shaft is for ¼ inch), \$1.50.

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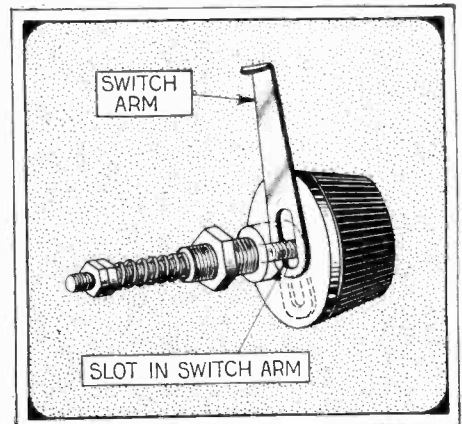
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SWITCH ARM

SLOT IN SWITCH ARM

No more need the amateur drill holes for switch points on his panel and then find that the switch arm will not reach to them or is a little bit too long. The use of the adjustable switch arm illustrated above eliminates this possibility. A slot is cut in the arm as shown and a threaded collar holds the same firmly in place. By loosening the collar, the length of the arm may be adjusted. This switch is now on the market and the above illustration shows all the constructional details.

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This is a 15-shot super automatic like those used by German military officers. Extra magazine free. Never before was any 32-Cal. Automatic offered at this price... \$8.75
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AMPLIFICATION EXPERIMENTS

K. ELECTRIC CO.
15 PARK ROW NEW YORK

Dr. Hackensaw's Secrets
(Continued from page 1055)

see this eight months old baby attempting to smoke a cigarette, or sucking a cocktail from her milk-bottle. One day she asked to see her children and grand-children, wishing to be held by each in turn, and she took a malicious pleasure in striking them and scratching their faces, to make up for the many times they had done the same to her when they were babies.

And still she grew younger. Doctor Hackensaw would spend hours pacing the floor, with this baby widow in his arms, reading her the newspaper or passages from Milton's "Paradise Lost." Meanwhile his powerful brain was striving hard to devise some means to check the fatal catastrophe that seemed about to terminate the experiment which had begun so favorably.

THE LAST MEASURE

When the baby was only five days old, Doctor Hackensaw prepared a baby incubator, and by the time she was minus one day old she was duly installed in her new dwelling. Her rate of rejuvenation had now decreased and she went back through the prenatal stages at about the same rate as she had originally come through them eighty-five years previously. When the foetus was about seven months old, Doctor Hackensaw transferred it to a glass jar full of a suitable culture-fluid, and watched with growing anxiety as she reverted to the tadpole stage, with a well developed tail and gill-slits. It was evident that Mrs. Young would soon be nothing more than the original egg-cell from which she had started. And then what would happen? Would she vanish into nothingness?

Doctor Hackensaw determined on one final effort. He had carefully preserved the few drops of blood he had originally taken from the lady's arm. The foetus was now so minute it could only contain a relatively small number of the microbes of youth. The doctor resolved to risk everything in one final attempt. By the use of an anaesthetic, he endeavored to stop the activities of the microbes, and then introduced into the foetus the drops of blood he had preserved. And then he waited. Anxiously he watched. To his joy he saw that the process of growing younger had ceased. Two, three days passed, and then the foetus began to grow again in the normal manner. Nine months later Mrs. Young was a normal baby again, but her rate of growth now was that of an ordinary child, and she was obliged to pass through all the phases of childhood and youth and finally, at the age of twenty—or, rather, when one hundred five years old—married James Trimble, the grandson of the man to whom she had been originally engaged.

But Dr. Hackensaw gave up his search for the secret of perpetual youth. Of course, to a scientist, it would be a great advantage to remain alive and young for a thousand years or more.

On the other hand, think what a disadvantage it would be to the human race, if all men had an indefinite tenure of life. Progress would be greatly checked; for old ideas and habits are difficult to eradicate. It is the new generations, freed from the prejudices of their parents, that carry the race forward.

Then, too, the physical and mental powers of the race would remain stationary. It is by the survival of the fittest in the past ages, that man has obtained his wonderful intellectual powers, and it is only by the survival of the fittest in coming generations that he can hope to increase them.



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Wide-awake radio fans refuse to miss a good program because of storage battery weakness. For super-service they keep the battery fully charged from the house current with a Tungar. Likewise they use Tungar to charge the auto battery at home. The result is longer battery life and more "pep"—plus convenience.

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GENERAL ELECTRIC

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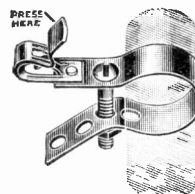
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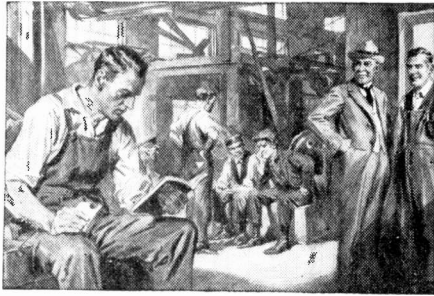


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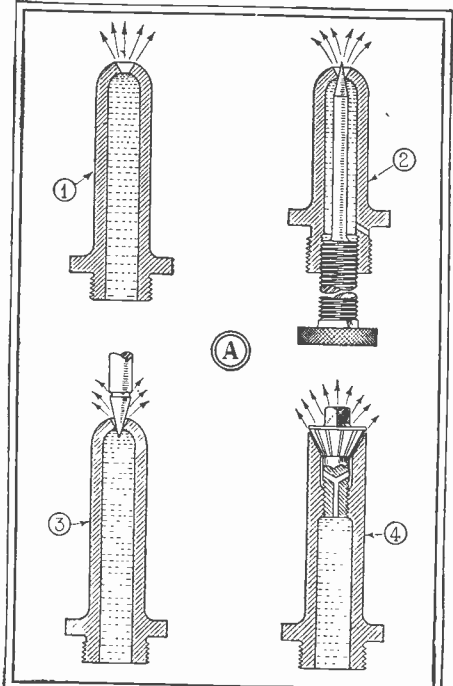
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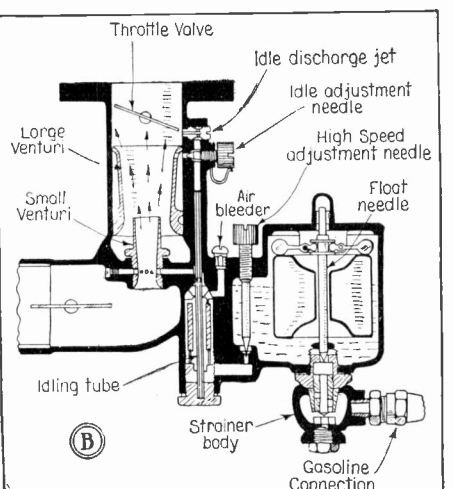
Motor Hints

Carburetion and Carburetor Adjustments

By **TOM C. PLUMRIDGE**
 Automotive Expert



The basis of good operation in an automotive engine is good compression. The basis of economical operation of the same engine is, however, dependent upon good carburetion. One of the most important parts of the carburetor is the spray, or jet that throws the gasoline out into the current of air. Above is illustrated four principal types of jets. At 1 is the plain type which consists of a hollow tube with an aperture at the top. At 2 is a more efficient variety. The internal needle screws up into the hole forcing the gasoline into a better spray. The same principle is used in the spray at 3. The needle fits onto the top instead of beneath the hole. At 4 is the cone type, where a cone is substituted for a needle.



To help vaporization, and suck out the gas from the jet and to thoroughly mix the gas and air, a venturi, or choke tube is used. It is of peculiar shape and formed so that there is a greater velocity of air through the carburetor without restriction. Sketch "B". The air passes through the venturi in a whirling motion which sucks the gasoline from the jet, a small vacuum is formed in the middle of the tube and the gasoline entering this is thoroughly vaporized. The sides of the tube are heated and the gasoline particles that fall on them are vaporized so that all particles are used providing the gasoline is supplied in the correct quantity. The Stromberg carburetor is one that is widely used. This make of carburetor has two adjustments on some models and on others it has three. They are high speed, low speed or idling jet, and the economizer. Sketch "B" shows very plainly the flow of gasoline through the carburetor, and also shows the different positions of the adjustments.



The Improved MIRACO GETS 'EM FROM COASTS TO COASTS

Clearly and distinctly, too! For our users tell us that Cincinnati hears Frisco, Denver hears Schenectady, New York hears Havana! Scores of long distance records were made on these instruments last year so with the many new refinements incorporated the result obtained now will be far better than ever.

HIGHEST QUALITY AT LOWEST PRICE

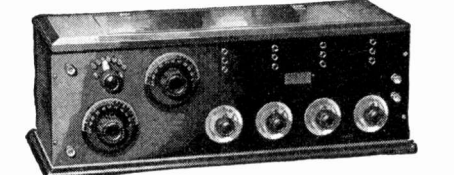
This has always been the MIRACO key-note and the thousands of sets now in use are a fitting tribute to MIRACO'S excellent performance. Many new improvements, such as new sockets resting on shock-absorbing pads—a refinement found only in the most expensive sets—rheostats with multiple resistance windings, making it possible to use either dry cell or storage battery tubes, and a new aluminum shield that prevents annoying body capacity effects, are embodied.

Cabinet is of solid mahogany—workmanship the finest—operation extremely simple yet always dependable.

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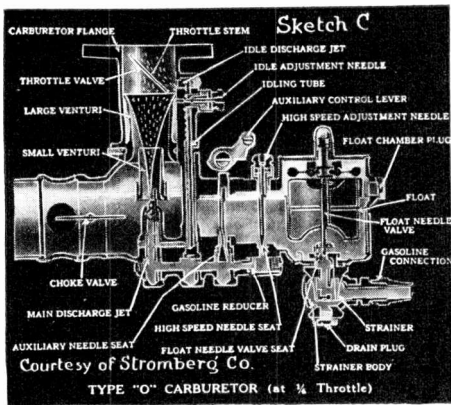
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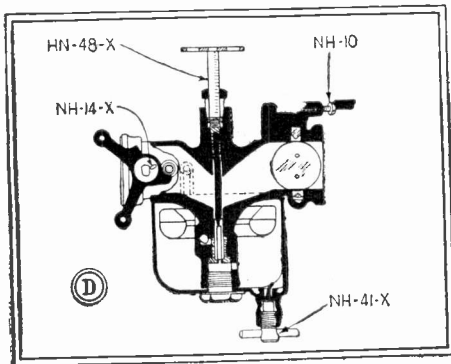
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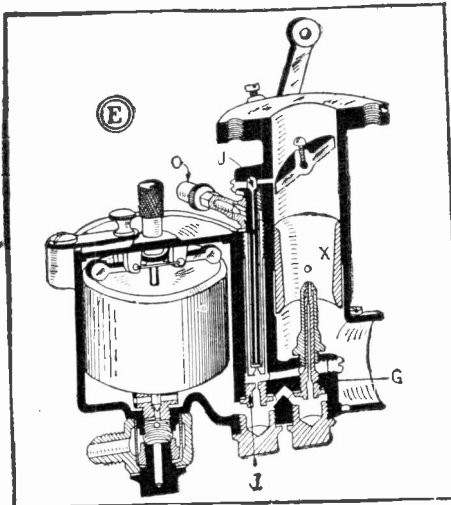
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If this sketch is compared with sketch "B" it will be noticed that there is a little different arrangement in sketch "B". The small venturi acts as a jet, but in sketch "C" a jet is used. If the venturi is enlarged in size the amount of air is also increased. The size of the venturi is determined at the factory and should never be changed. Before any attempt be made at adjustment the engine should be run until thoroughly warmed up to normal operating temperature. Although there are several different models of this make of carburetor they are all adjusted in the same manner.



The Holley carburetor is the kind that is fitted to Ford cars and is of the external needle type, and is one of the easiest to make adjustments on. Referring to sketch "D," the adjustment needle HN 48 X is the only adjustment as far as gasoline regulation is concerned, and the adjustment is made as follows: After the engine has thoroughly warmed up set the ignition lever a little below half advance and the throttle slightly open, screw in the adjustment HN 48 X, until the engine starts to slow down or miss fire, then screw out until the engine runs evenly.



The Zenith carburetor is one that has one adjustment; this is the slow speed or idling adjustment. Referring to sketch "E," after the engine has warmed up, the idling adjustment is made by screwing in the screw O to give less air, and outward to give more air. This screw controls the suction in the idling tube J, through which the gasoline is drawn when the engine is running at idling speed. The sizes of the choke tube X, the compensator I, and the main jet G, are determined at the factory and should not be altered.

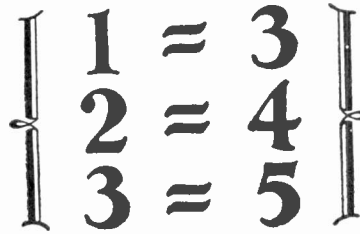
(Continued on page 1065)

Metering pin carrier

By comparing sketch "H," the Stewart Carburetor, with the other illustrations the absence of needle valves and adjustments will be noticed. The operation of this type of carburetor is very interesting. The flow of gasoline into the float bowl is controlled in the usual way, but the operation of the carburetor is very different. When the suction comes there is a vacuum formed in the mixing chamber which causes the metering valve to lift from its seat and air is admitted in exactly the right proportion to the gasoline which is drawn up through the aspirating tube. There is only one adjustment which raises or lowers the tapered metering pin, and thereby increases or decreases the amount of gasoline supplied through the aspirating tube. This adjustment can be operated from the dash board at the will of the operator.

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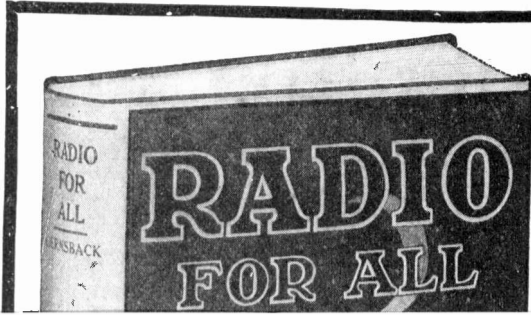
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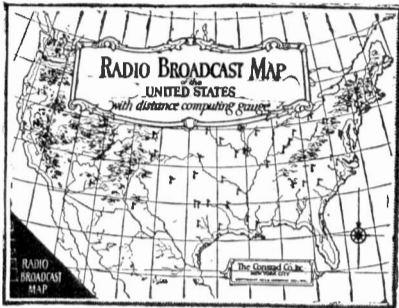
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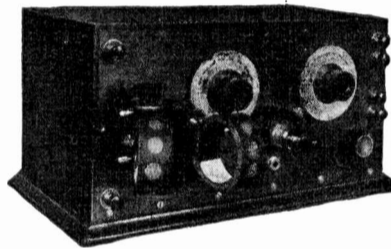
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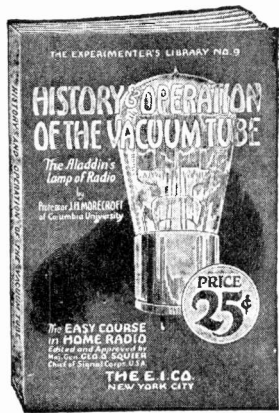
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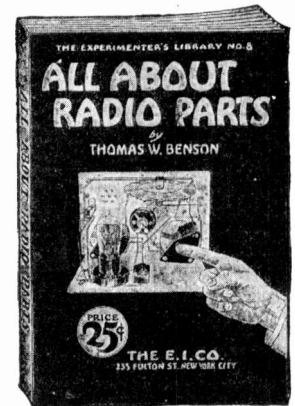
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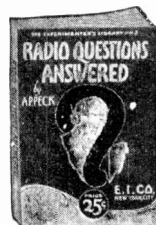
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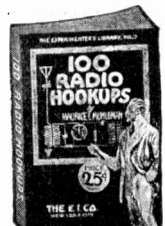
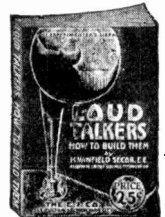
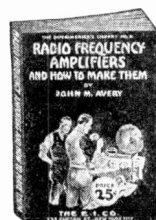
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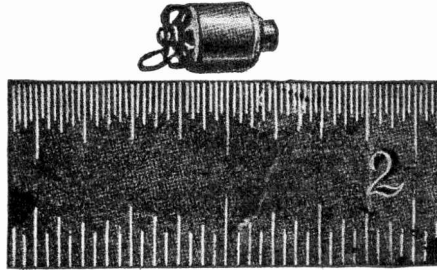
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The February issue now on the news-stands contains 64 pages, over 100 different articles and over 150 illustrations, with an artistic cover in three colors. Professor T. O'Connor Sloane, Ph.D., is associate editor of the magazine.

INTERESTING ARTICLES IN FEBRUARY "PRACTICAL ELECTRICS"

- The Radiotron: A Vacuum Tube By B. S. Havens of General Electric Company
- Simple Oscillograph By Carter Fiske
- Electric Animals
- Tidal Electric Power By Albert Staehle
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- Electrical Destruction of Atoms By Professor Rogers D. Rusk
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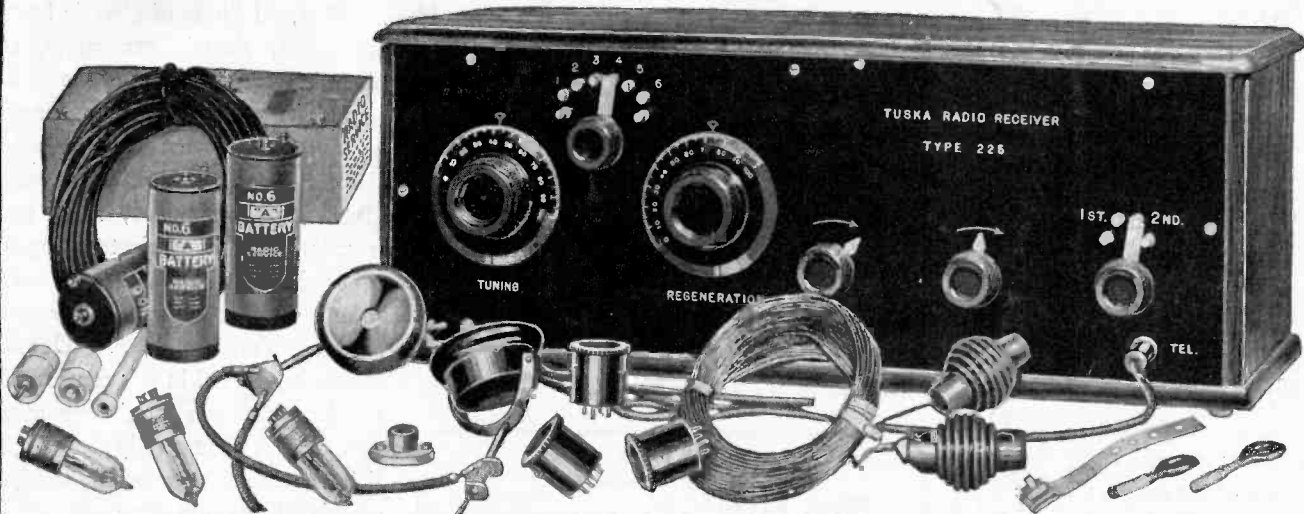
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