

May

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Science and Invention

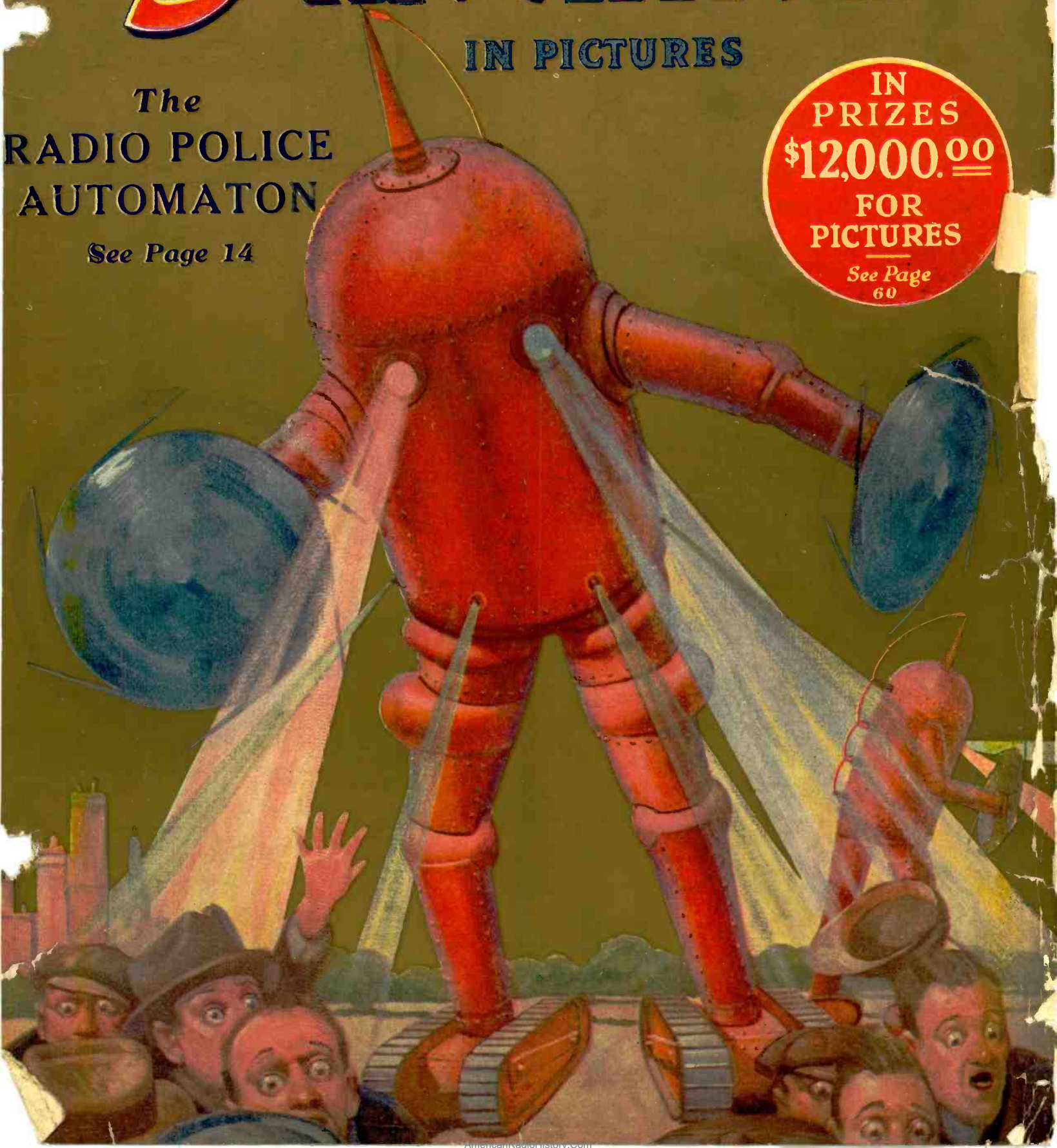
IN PICTURES

The
RADIO POLICE
AUTOMATON

See Page 14

IN
PRIZES
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FOR
PICTURES

See Page
60



MASTERY KEY

THERE IS A

Dorothy Wordsworth in a letter to Coleridge said: ". . . Yes, do send me a book for my birthday, not a bargain book, bought from a haberdasher, but a beautiful book, a book to caress—peculiar, distinctive, individual.

A book that hath first caught your eye and then pleased your fancy, written by an author with a tender whim, all right out of his heart.

We will read it together in the gloaming, and when the gathering dusk doth blur the page, we'll sit with our hearts too full for speech and think it over."

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THE TRUE AND THE BEAUTIFUL**

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Let them be persons of education, refinement and culture, but withal enterprising, energetic and progressive.

But above all be sure to send the names of persons who are interested in causes rather than effects, demonstration rather than theory, the practical rather than the abstract.

Theological abstractions, metaphysical subtleties, ecclesiastical dogmas and scholastic technicalities appeal to the intelligent not at all, the acid test now is—will it work.

If obstacles of every kind seem to be placed in your path—if your most cherished plans seem to be thwarted—if you seem to be forced to do the very thing you do not want to do—if your every action seems to be anticipated by invisible enemies—if you are continually humiliated by events which seem to be beyond your control—simply make use of the "Paths to Power" which you will find in Causation—soon

**"All your troubles will grow wings
Your life be filled with glorious things."**

And so, dear friend, if you will send me these names I will send you a copy of Causation without cost or obligation of any kind, and your name will be used in no way whatever.

You will welcome its coming.

You will soon look upon it as your best friend.

It will brighten and broaden your life.

It will bring you the best of the beautiful.

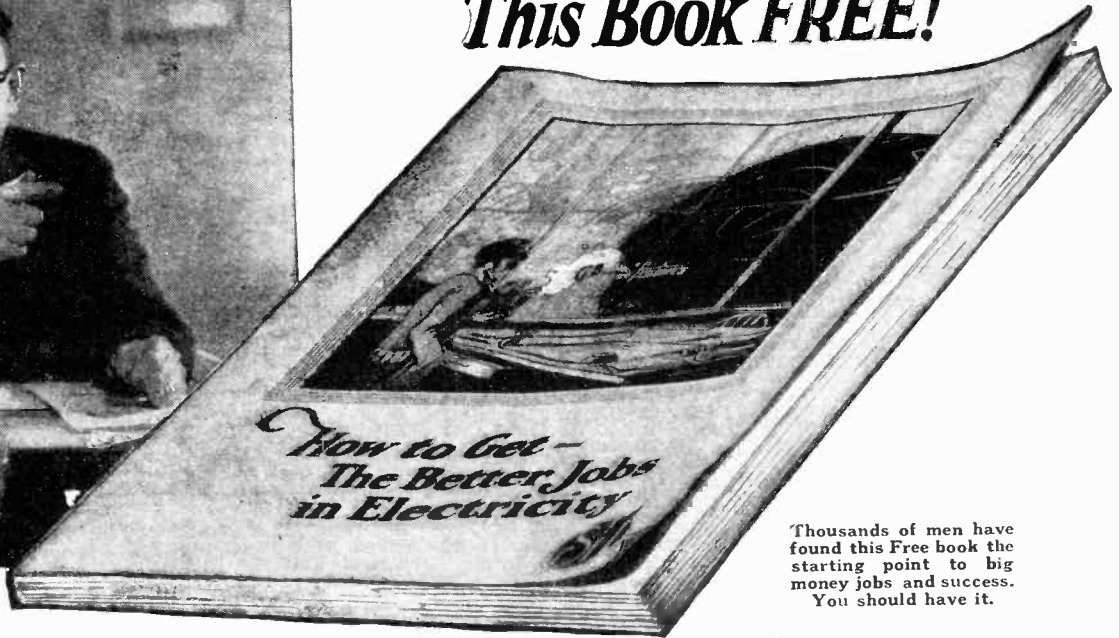
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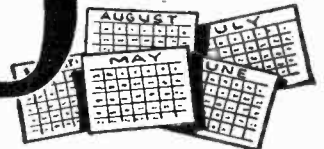
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Science and Invention

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21 Table of Contents for May

POPULAR SCIENTIFIC ARTICLES		
EDITORIAL.....	By H. Gernsback	11
THE THIEF OF BAGDAD.....	By Tamar Lane	12
THE RADIO POLICE AUTOMATON.....	By H. Gernsback	14
GYROSCOPE RACING CAR.....	By Clarence A. Snyder	15
AIRPLANE MAKES CONTACT WITH BALLOON.....	By Corley P. McDarment	15
PAPER ON FIELDS INCREASE YIELD.....	By H. H. Dunn	16
THE SIGNATURE OF SEEDLINGS.....	By Leonard Bastin	16
BEAUTY CULTURE OF TOMORROW.....	By Dorothy Gernsback	17
THE INFINITE VISION.....	By Charles C. Winn	18
THE MAN ON THE METEOR—PART 5.....	By Ray Cummings	20
MORE INTERSTELLAR COMMUNICATION.....	By Chevalier De Terrail	22
WORLD'S HIGHEST CABLE RAILWAY.....	By H. Winfield Secor	23
MARVELOUS ROMAN CLOCK.....	By Charles Beecher Bunnell	24
DRAGON REPRODUCED FOR GERMAN FILM.....	By Dr. Albert Neuburger	25
THE QUEEN'S DOLL HOUSE.....	By Charles Beecher Bunnell	26
A HOTEL OF POMPEII.....	By Ismar Ginsberg, B. Sc. Chem. Eng.	28
ODD USES FOR PAPER.....	By Ernest Jones	29
FINE ART IN GLASS BLOWING.....	By Isabel M. Lewis, M.A.	30
SOME NEW MECHANICAL DEVELOPMENTS.....	By Mark Mellen	31
HOW MOUNTAINS ARE FORMED.....	By John Foley	32
THE HEAVENS IN MAY.....	By Phil Gersdorf	33
A GAMBLER'S TRICKS EXPOSED.....	By Angus Pekerson	34
CHEMICAL HOT WATER BOTTLE.....	By Ernest Jones	35
ELECTRICAL WATCHMAN FOR BOATS.....	By Ernest Jones	35
SOME NEW DISCOVERIES.....	By Ernest Jones	36
AIRSHIP OF SEVENTY YEARS AGO.....	By Ernest Jones	36
MOVIE KINKS FOR SHIP SCENES.....	By Ernest Jones	36
LOGOTYPE—WRITES A WORD A STROKE.....	By Ernest Jones	36
WHIRL AMUSES JOY RIDERS.....	By Ernest Jones	37
NOTED SCIENTIST'S INSTRUMENTS.....	By Ernest Jones	37
GAS GUN TO AID POLICEMEN.....	By Ernest Jones	37
NEW PHONOGRAPH TEACHES LANGUAGES.....	By Ernest Jones	38
SHIP'S PROPELLER REPAIRED AT SEA.....	By Ernest Jones	38
TIMELY TALKS ON TIMEPIECES—CLEANING YOUR WATCH.....	By Ernest Jones	39
MAGIC FOR EVERYBODY—NO. 14 OF A SERIES.....	By Ernest Jones	40
SCIENTIFIC PROBLEMS AND PUZZLES.....	By Ernest K. Chapin	43
PRIZE CONTESTS		
\$100 PRIZE AWARDS OF THE CIGAR-BOX CONTEST.....		41
PHONOGRAPH NEEDLE CONTEST—\$100 IN PRIZES.....		42
HOW-TO-MAKE-IT DEPARTMENT—\$30 IN PRIZES MONTHLY.....		48
\$100 CRYSTAL DETECTOR CONTEST.....		54
SCIENTIFIC HUMOR—PRIZES FOR BEST JOKES.....		59
AWARDS OF \$1,000 MONTHLY PRIZES.....		60
AUTOMOBILES		
GYROSCOPE RACING CAR.....	By Clarence A. Snyder	15
FOR CLEAN TIRES.....		34
SOME NEW DISCOVERIES.....		35
ELECTRICITY		
BEAUTY CULTURE OF TOMORROW.....	By Dorothy Gernsback	17
MORE INTERSTELLAR COMMUNICATION.....	By Chevalier De Terrail	22
WORLD'S HIGHEST CABLE RAILWAY.....	By H. Winfield Secor	23
ELECTRICAL WATCHMAN FOR BOATS.....		34
SOME NEW DISCOVERIES.....		35
WHIRL AMUSES JOY RIDERS.....		37
LATEST PATENTS.....		58
THE ORACLE—QUESTION AND ANSWER BOX.....		61
PATENT ADVICE.....	Edited by Joseph H. Kraus	82
RADIO ARTICLES		
RELAY OF RADIO BROADCASTING.....		50
POSITION FINDING BY RADIO.....	By J. W. Von Stein	51
RADIO EXPERIMENTERS.....		52
NEW USES OF RADIO.....		53
EFFICIENT CRYSTAL RECEIVING SETS.....		54
FOUR EXPERIMENTAL CIRCUITS.....	By A. P. Peck, A. M. I. R. E.	55
RADIO FOR THE BEGINNER—NO. 25—ADDING THE SECOND TUBE.....	By Armstrong Perry	56
RADIO ORACLE.....		57
RADIO WRINKLES.....	Edited by A. P. Peck, A. M. I. R. E.	86
CONSTRUCTOR ARTICLES		
MINIATURE RAILWAY TUNNEL.....	By W. W. Douglas	45
PORTRAIT ATTACHMENT FOR CAMERAS.....	By Edward H. Flaharty	45
AN INEXPENSIVE TELESCOPE.....	By Don Home	46
A GYROSCOPIC PLUMB BOB.....	By C. A. Oldroyd	46
DECORATIVE OBJECTS IN RELIEF.....	By S. W. Ross	47
A LABORATORY VACUUM PUMP.....	By Dr. E. Bade	47
CHEMISTRY ARTICLES		
ODD USES OF PAPER.....	By Ismar Ginsberg, B. Sc. Chem. Eng.	28
CHEMICAL HOT WATER BOTTLE.....	By Ernest Jones	34
GAS GUN TO AID POLICEMEN.....	By Ernest Jones	37
EVERYDAY CHEMISTRY.....	By Raymond B. Wailes	44
WRINKLES, RECIPES AND FORMULAS.....	Edited by S. Gernsback	49
ASTRONOMY ARTICLES		
THE INFINITE VISION.....	By Charles C. Winn	18
MORE INTERSTELLAR COMMUNICATION.....	By Chevalier De Terrail	22
THE HEAVENS IN MAY.....	By Isabel M. Lewis, M.A.	32

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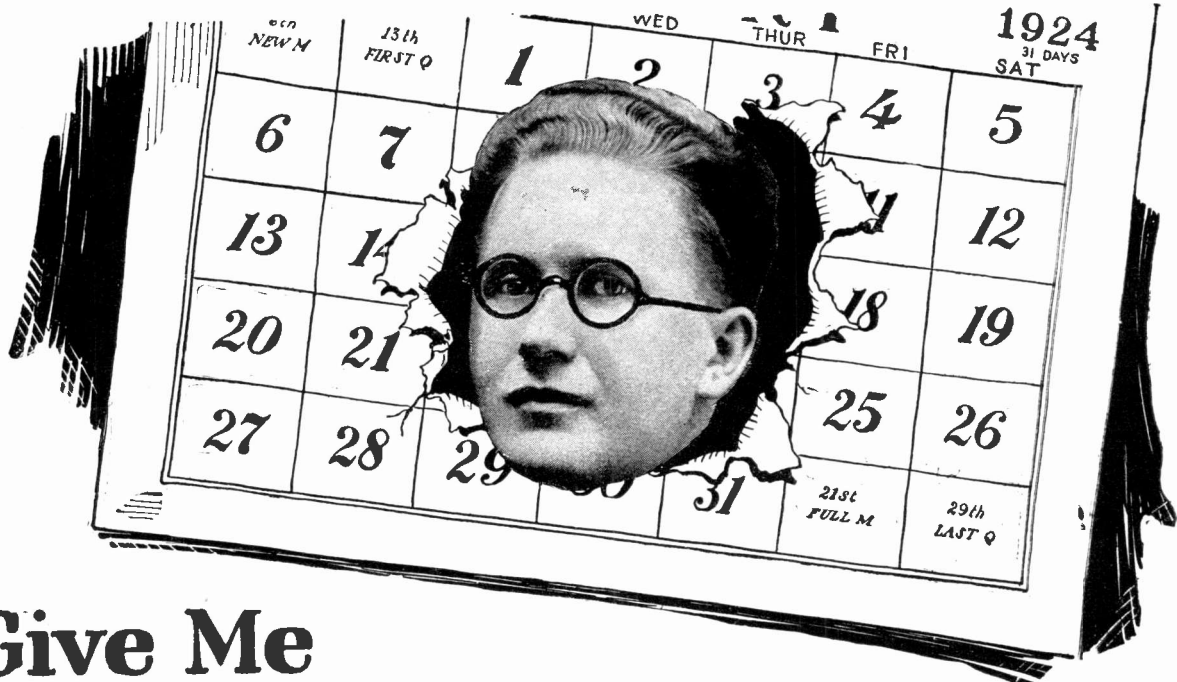
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Up to now many people believed that when hair fell out and ordinary measures failed to grow new hair that the roots were always dead. But from close observations made while treating hundreds of cases of thin, scanty falling hair—I found that in a very great many instances the hair roots were not dead—but merely dormant. The question is how in the world can hair-tonics and so called "restorers" ever grow hair when they do not even approach the cause of falling hair—dormant hair roots.

You would never think of rubbing "growing fluid" on the leaves of a dying plant and expect the plant to grow. Instead you would get right down to the roots and nourish them. It is exactly the same with the hair.

My treatment is the result of long years of experience spent at Heidelberg, Berlin, Paris, Cairo, Ge-

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neva and other centers of scientific research. And I believe that—for the first time in the history of dermatology—my method provides a means of penetrating directly to starving hair roots and supplying them with nourishment to make them grow new hair.

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taken in any home in which there is electricity. Hundreds of men and women who only recently were suffering from loss of hair have through this method acquired hair that is the envy and admiration of many of their friends. And as for dandruff and similar scalp disorders, they usually disappear after the first few treatments. Remember, I do not ask you to risk one penny. You try it on my absolute GUARANTEE that if after using my treatment for 15 minutes each day for a month you are not more than delighted with the growth of hair produced, then I won't keep a cent of your money.

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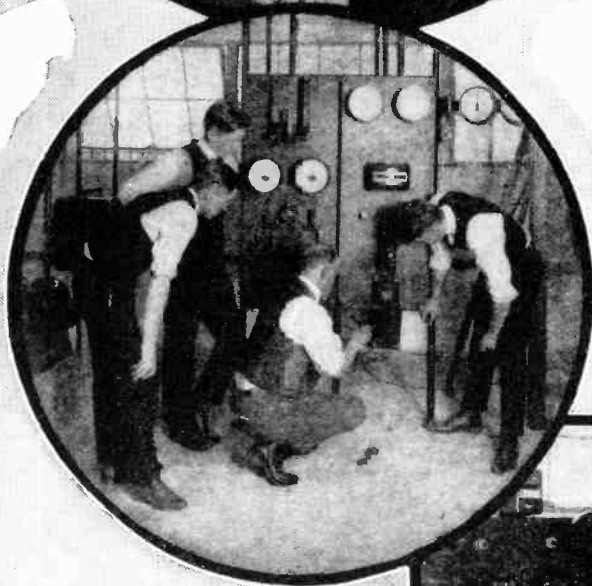
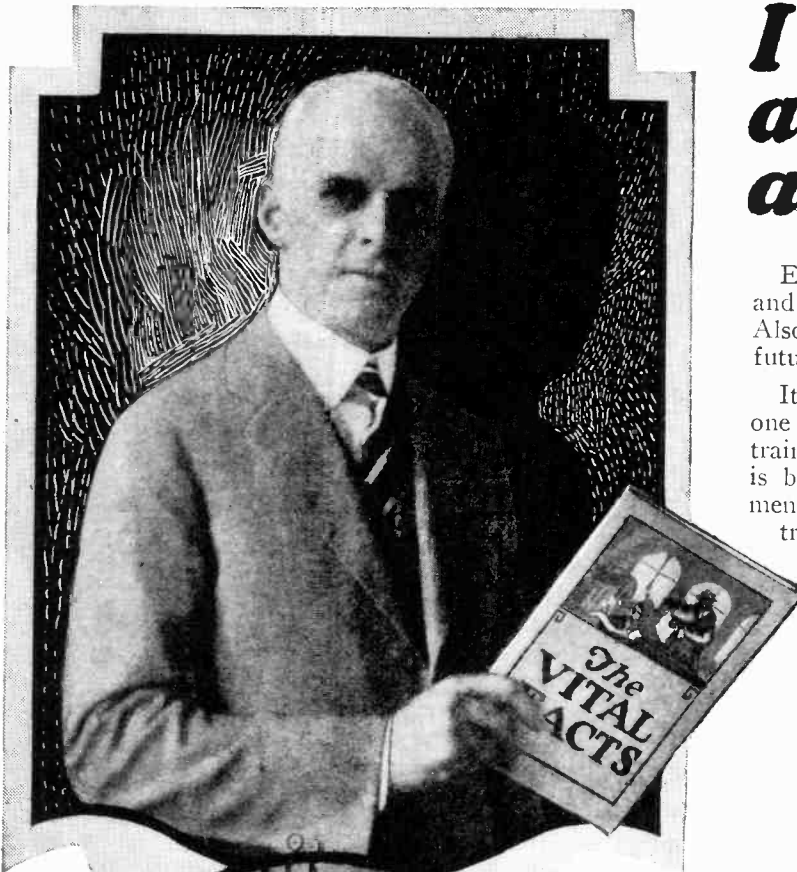
But it's a field where ANY man can quickly reach the top, providing he is ambitious, and willing to learn.

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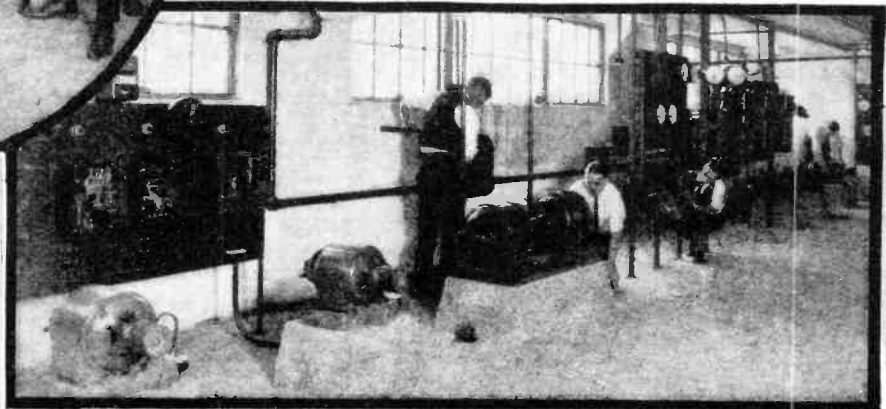
The pictures below show two groups of students doing special work in the C. E. W. Laboratory. This laboratory is a wonderful place, filled with thousands of dollars' worth of the very latest type of electrical machinery and apparatus. Here my students may come for special work, or to work out ideas and inventions of their own. And there is no charge—the use of this laboratory is absolutely free, not only while you are studying, but afterwards, and you may come as often as you like.

And that isn't all. So far as I know the Chicago Engineering Works is the only Correspondence School in the United States that offers free accommodations for its visiting students. We maintain at the Y. M. C. A. in Ravenswood, right near our plant, rooms for such students, and with these rooms go all of the privileges of the "Y"—the "Gym," the "Swimming Pool," Billiard Room, etc.

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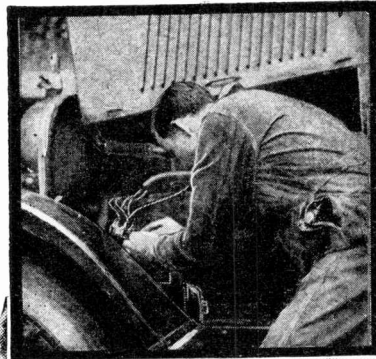
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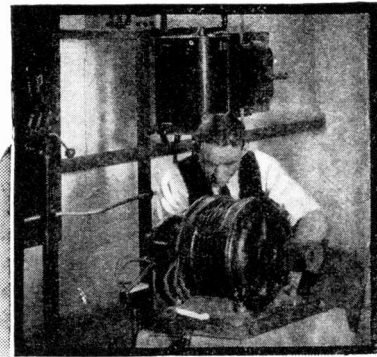
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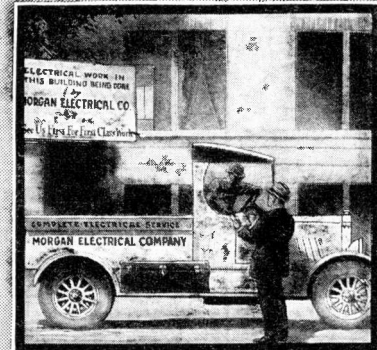
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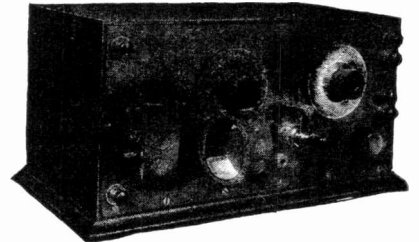
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- 5 How to Make a Reflex Receiver.
- 6 How to Make a Cockaday Receiver.
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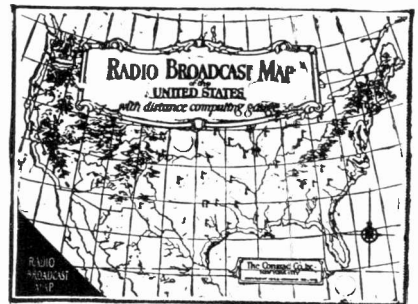
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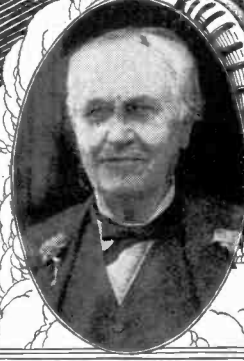
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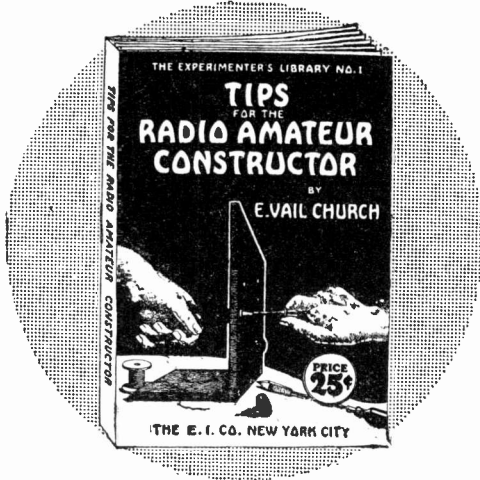
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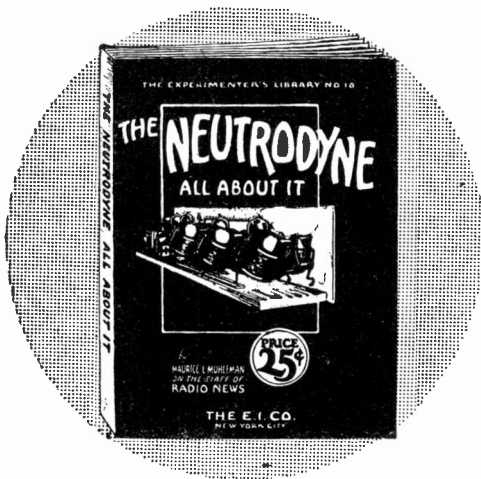
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A Problem in Invention Can You Solve It?

This simple test will show whether or not you have inventive ability; thousands have it and do not know it, or *do not develop it*. Yet invention is the easiest way to earn a fortune. No technical or scientific knowledge necessary. Read below a few instances of how little ideas have made millions of dollars for their inventors.

HOW would you like to get the royalty paid to the inventor of the tin cap used on millions of bottles? How much money would you have now had you thought of the simple idea of putting rubber tips on pencils? Wouldn't you gladly be the inventor of the Gillette Safety Razor, who it is said made as much as **TWO AND ONE-HALF MILLION DOLLARS a year**, or the inventor of the tiny snap-fastener who recently paid an *income tax* of \$29,000, or be the man who invented the President Suspenders, now worth \$5,000,000? Or would you prefer to be the inventor of the autographic attachment for cameras who sold his patent rights for \$300,000.

Ideas Worth Fortunes

One single idea—as simple as any of these—can make you independently wealthy in a short time. Other inventors have made hundreds of thousands of dollars from such common things as the crimped hair-pin, the metal-tip shoe lace, the paper safety match, the ordinary wire paper clip. These are certainly not complicated inventions—they are so simple, in fact, that probably *thousands* of people thought of them but only *one* man DID anything about the idea when it came to him.

You, too, probably have ideas for needed inventions—and the only reason you have not turned your ideas into gold is because, like thousands of other persons, you doubt your own ability. Or, like most persons, you believe that every inventor is a genius who invents things as naturally as other people do their work as bookkeepers, mechanics, doctors or farmers.

Invention Can Be Learned

But this is not true. What were our great inventors *before* they invented anything. Bell was a teacher. Edison was a telegrapher. Gillette and Waterman were traveling salesmen. Better proof than this is that you can satisfy yourself that invention is not limited to geniuses or that it is merely guesswork, luck or chance. You can prove to yourself that invention—*any* invention, from the collar button to the colossal railroad engine—is the result of the same kind of thought that you use in adding a row of figures.

Think, for a moment, what you do in any example in addition. You *see* a problem—the row of figures. You recognize that a result is wanted—the sum of the figures. From these two facts you go ahead and get the result. And because only one answer can be correct for that particular example, you know your problem is solved when you find that answer.

Proof YOU Can Invent

Exactly the same thing is true in invention. This is the proof. At the top right-hand corner of this page is shown a simple problem in invention. What would you put on a shaft "A" to force members "B B" to move back at the same time. A little thought will show you the correct answer within a few minutes.

This test of your inventive ability, simple as it is, illustrates the thought behind every invention. Like your arithmetic example you see first, a problem to be "fixed." Then you think of something which will "fix it," something which is the only correct answer to your problem. That is all—that is *everything*—to invention.



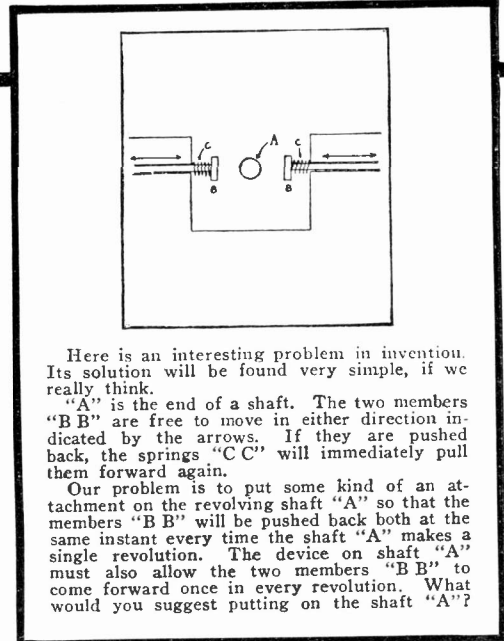
Raymond F. Yates, who with fourteen other famous inventors, now makes it easy for you to learn how to invent in your spare time at home.

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, mechanics, law, medicine.

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 that everybody can read them and learn to use them. It doesn't matter who you are, or what your present work is—you have the native ability to invent. It was *born* in you. What you need now is to develop this ability so you can use it to produce inventions. All you need, to become successful, is this easy, fascinating training which will develop your ability so it will be worth real money. Fifteen famous inventors tell you **WHAT TO INVENT** and **HOW TO INVENT**. They tell you the secrets of inventions 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.



Here is an interesting problem in invention. Its solution will be found very simple, if we really think.

"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"?

New FREE Book

The most fascinating part of this great new course is that it teaches invention by actual practice, right in your own home. No special knowledge of mechanics or science is necessary. With each lesson you are sent some problem in invention—just like the one you worked out here. This fascinating exercise in solving actual problems in invention sharpens your instinct to fix things, gives you an unforgettable, in-

stinctive habit of thinking inventively worth more than you realize. In fact, the lessons and exercises are so simple, so easy to understand, so interesting, that they seem more like a pleasant game than like instruction which can make you a successful inventor.

A wonderful new book, just printed, tells you more about the Bureau of Inventive Science and its simple new course in invention. It costs nothing, so send the coupon at once. Every day you see things which must be improved. Every day you run into problems which a simple idea can solve. It may be a new toy for your children. The man who invented the Kiddie-Kar, it is reported, made over \$5,000,000. It may be a new kind of soap. E. T. Babbitt is worth millions of dollars today. It can even be a new kind of broom to make housework easier for millions of housewives. But no matter what it is—if your idea is practical, if it solves a prob-

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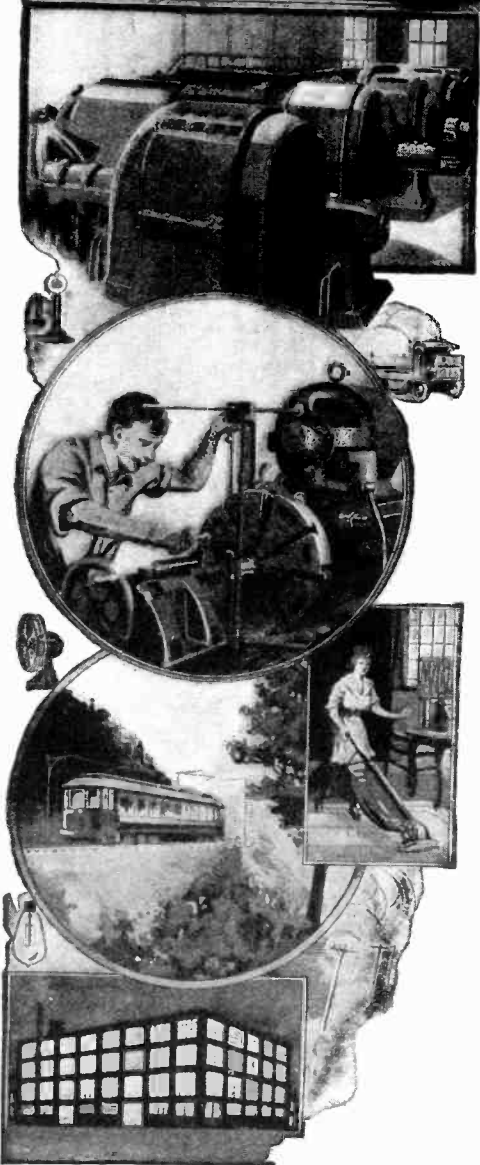
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"Those Who Refuse to Go Beyond Fact Rarely Get As Far As Fact" -- HUXLEY

Inventing As A Business

By H. GERNSBACK

EDISON once was asked by a visitor as to the secret of his inspiration. The visitor was told by him that inventing was "2 per cent inspiration and 98 per cent perspiration." Probably nothing more true has ever been said. The public is still fascinated by the legend that great inventors are born. They consider it a gift the same as any other natural gift. This, however, is only partially true. To be sure there may be people who work by

inspiration only when making inventions. But it is the writer's belief that such indeed are very rare.

The modern inventor pursues entirely different tactics. In the first place, and this is the writer's advice to would-be inventors, *make up your mind what you desire to invent and then go after it.* Inventing falls into

two classes—useful and useless inventions. The first one includes all such devices for which there is an immediate demand because the intended device fills a need not covered at present. The useless class covers those devices which are invented only for the fun of inventing but which nevertheless may be useful in the future. For instance, a man might have invented the vacuum tube such as is used today in radio 50 years ago. It would then have been a useless invention because it could not be used at that time. Today, however, it is a tremendously valuable device.

Practical inventions are of course important all the time as a rule, and Edison for instance has in general made it a rule to concern himself only with devices for which there was an apparent immediate demand.

From the letters that come into this office by the hundreds almost every day, it can be easily seen why there are so many disappointed and disgruntled inventors now in the world. The average inventor gets an idea and then spends every cent he has in perfecting it. After months or years of toil when the device finally works he tries to obtain a patent only to find to his dismay that the idea has long been known in one way or another. This shows how not to do it.

The correct and modern way is as follows: If you have an idea, the first thing should be to spend a reasonable amount of money in literature such as text-books or specialized books treating on the subject and *try to learn everything about the particular article.* You can spend no more fruitful hours in your own or public library than those devoted to find out ALL about your

device. Often you will be surprised to see how many have had practically the same idea. If you cannot find any references in the public library or public press, then you had better get in touch with a patent attorney who will make a search in the patent office and will send to you copies of all the patents that have been issued on the particular class of device such as the one you are now working on. This course is the best one to take as a rule, because a patent attorney who knows his business will pick out references that may be exceedingly valuable to you.

You can also write to the patent office and procure from them copies of some of the existing patents at ten cents for each copy.

After you have ascertained all the facts and you find that your device is original, you can then go ahead with experiments, and model-making with a clear conscience. Even now the battle is not won. It has happened in the past, for instance with the Bell Telephone, that exactly the same idea was filed for patenting on the self-same day by two inventors who did not even know each other. For that reason if you have a good idea and if you desire to obtain a patent on it which may be valuable, speed is necessary after you have once ascertained that the device in question has not as yet been patented. Even a few days' delay may cost you dearly as many inventors have found out to their sorrow. As a rule inventions seem to "be in the air". As the arts and sciences advance the needs for certain devices become apparent, and as a rule many independent investigators start work at the same time. The man

who gets to the Patent Office first usually wins.

We say "usually wins," for it has happened many times in the past that even when a patent had actually been granted to Smith, the battle was not won. Jones, another inventor, may have been working on the same idea before Smith, who obtained the patent, even started his work. If Jones can prove afterwards by documentary evidence and witnesses that his day of conception antedated the one of Smith, then Smith's patent may be declared null and void.

For this reason the careful inventor as soon as he has conceived an idea, writes it down on paper and makes as many sketches as possible illustrating the device. He then takes it to a Notary Public at once, with as many witnesses as he can find and has the document sworn to.

I BELIEVE

¶ THAT all really great ideas are simple.

I BELIEVE

¶ THAT ideas make the world go round.

I BELIEVE

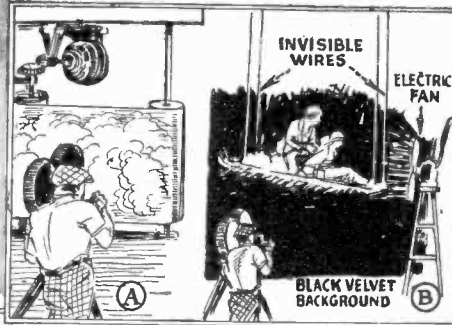
¶ THAT every inventor should take a course in business—he needs it.

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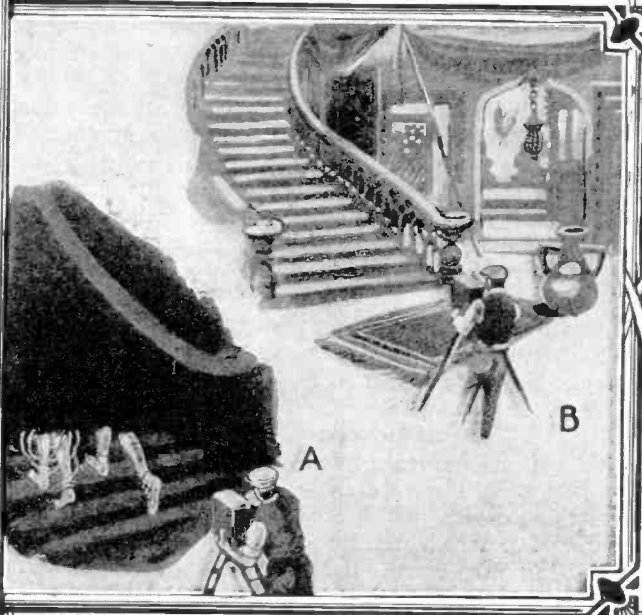
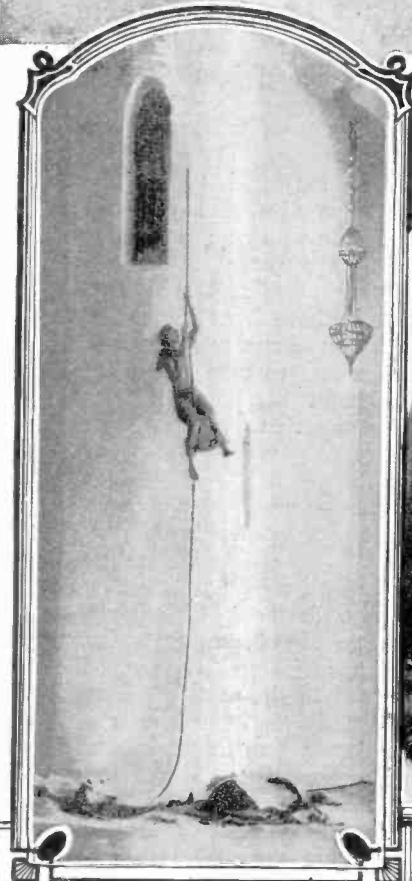
Mechanical Marvels of

By TAMAR LANE



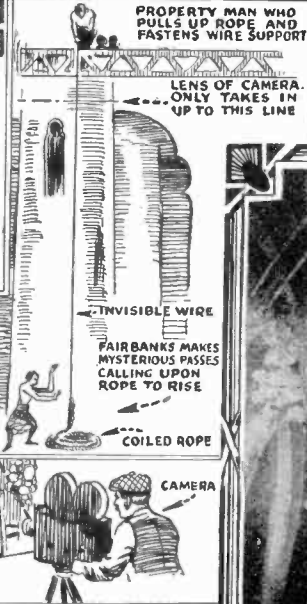
The director said to the engineer, "Let there be a Flying Carpet," and here is the result. The carpet, on a wooden frame, was supported by steel piano wires. It was photographed against a black background and then the film was re-exposed to clouds painted on a rolling canvas, as shown at A above. At B is depicted the carpet suspended and the fan furnishing a breeze as if in flight.

IT is the most perfect piece of movie mechanics that the year has produced, this "Thief of Bagdad," which comes from the studio of Douglas Fairbanks, and in which the incomparable "Doug" takes the leading rôle. The mechanics of it are perfect in spite of the fact that several effects which have never heretofore been attempted by the movie impresarios are used. The success of their workmen and their plans is proved by the fact that even to one accustomed to seeing all the so-called super movies, and educated to all their mechanical tricks, this Bagdad picture holds the illusion. It is as fine a piece of work as a precision observatory clock. Usually, to those accustomed to watch for the mechanics of a production they all turn out to be more or less poorly done mechanically. Not so here.



There were some kinky problems facing the technical director when the plans to film this fantasy were first unveiled in the Fairbanks studio. The cloak of invisibility, the flying carpet, the monster, the flying horse and the magic army were a few of them. This was only a part of the problem, however. There was an idol 300 feet high called for in the script, there were literal acres of castles and cities. Many of these obstacles were simply a matter of mass. Those depicted on these two pages, however, are the ones that demanded ingenuity and a

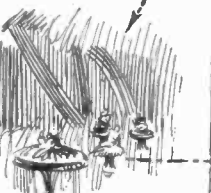
The magic rope—made of a witch's hair, so the caption says—which hangs suspended. Of course, the secret is a piano wire arranged as shown in the sketch at the right. The wire is attached in the center of the rope about two feet from the end. While "Doug" is hanging on the rope which is suspended in the air, seemingly without any support except its own magical powers, he twists the upper end down thus heightening the illusion greatly. The rope is made to rise or fall by saying a magical formula over it.



The Cloak of Invisibility plays an important part in the picture. The set is covered with black velvet and the characters, with the exception of their feet, are covered also and photographed. The cover is then taken off and the set is photographed with the camera in the same position as before without the actors. This second exposure is taken on the same film as that of the first one with the characters' feet showing. Thus it seems to the on-looker that the invisible cloak hides them from view.

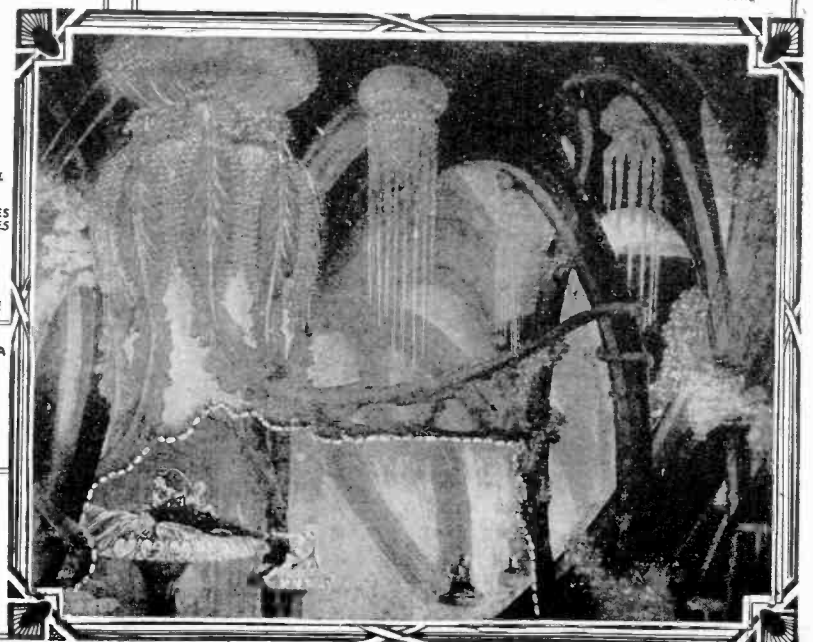
BACK DROP PAINTED TO BE IN ACCORD WITH DESIGN ON GLASS

GLASS PAINTING



CLEAR SPACE ON GLASS THROUGH WHICH FIGURES ARE "PICKED UP"

In his exploits "Doug" is led into the kingdoms under the sea. In one case he falls into the most wonderful crystal palace. Above, the view shows, how the scene was made. At the right is shown the scene itself. The scene was painted on a glass plate which was set in front of the camera. The size of the painted plants was so gauged as to appear in proper relation to the characters. The glass was set about four feet in front of the camera and the characters were seen through a clear portion.



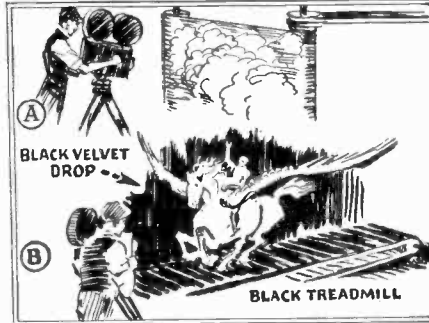
"The Thief of Bagdad"

OF HOLLYWOOD, CALIF.



high skill in carrying out the solution once it was devised.

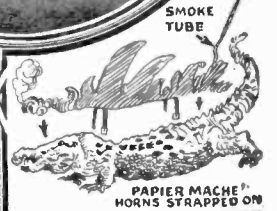
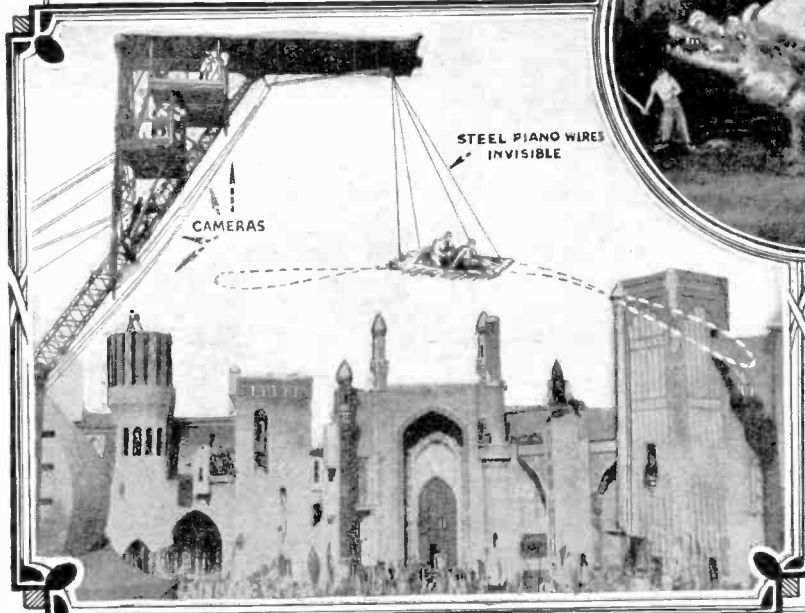
Whether it will be noted by a lay audience or not there is no means of ascertaining, but the fact remains that in every case where a solution to the seemingly miraculous feats was obvious, the director was at pains to show by means of some trick of the actors that the obvious solution was impossible, thereby heightening the illusion. One case of this sort is in connection with the magic rope which hangs suspended in the air with nothing except its magical qualities to hold it.



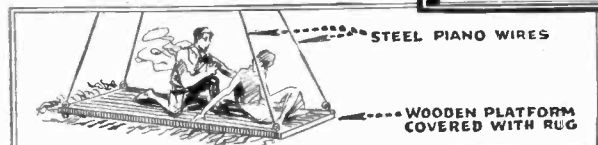
The Flying Horse upon which the Thief rides to the Citadel of the Moon is mystifying, to say the least, until the simplicity with which the scene was made, is explained. The horse and rider were taken against a black background and then the film was rewound and clouds painted on a moving canvas were taken. When developed, a composite view resulted.



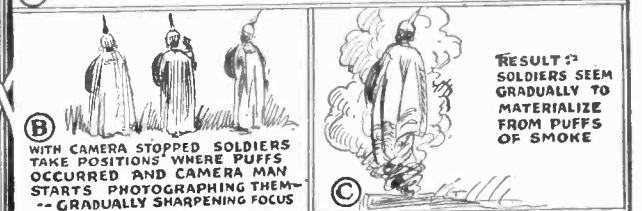
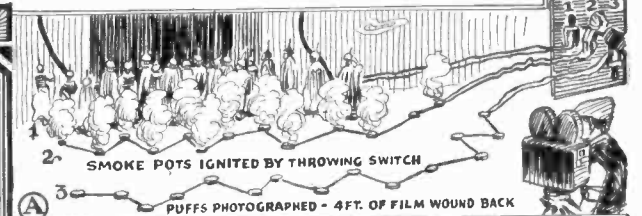
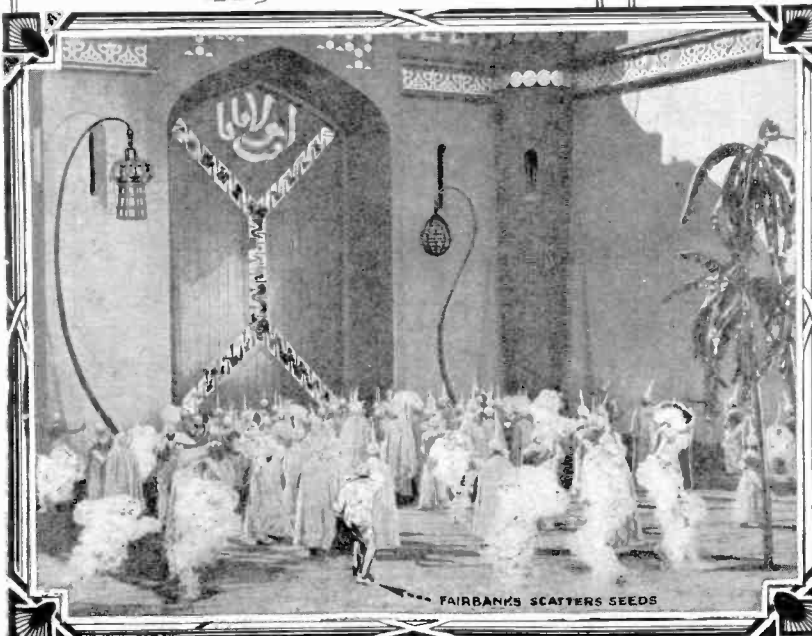
THE on-looker will immediately think—"Ha, it's easy, there's a wire." Immediately he says it, the illusion is gone and the picture loses its effectiveness. But, the mechanical director obviated his saying it. While "Doug" hangs onto the rope he bends the top of it over, showing that there is no wire attached—or making the audience think that there isn't one—for as a matter of truth there is and a good stout steel one, at that. But little tricks of that type give the picture its perfect finish. Where the mechanics would have been obvious the movie engineers have been careful to hide them. The simplicity of method used in obtaining some extremely gorgeous effects should lead to a lot of credit for the studio staff of designers.



There is a terrible monster made by harnessing horns to a crocodile, as shown, and taking an exposure at six feet. "Doug" is then taken on the same film at twenty feet. The distances gives the monstrous size.



The flying carpet comes from a window in the Caliph's castle and circles around over the housetops. This is the way it is made to work: The carpet on a wooden frame is suspended by piano wires from a crane. The cameras are placed on the boom and others on adjacent towers. By swinging the carpet and the cameras at the same time an effect of a wide swing is obtained—a much wider sweep than actually is made. The black canopy at the top of the crane is merely a sun shade that was manipulated in order to obtain the proper light effect.



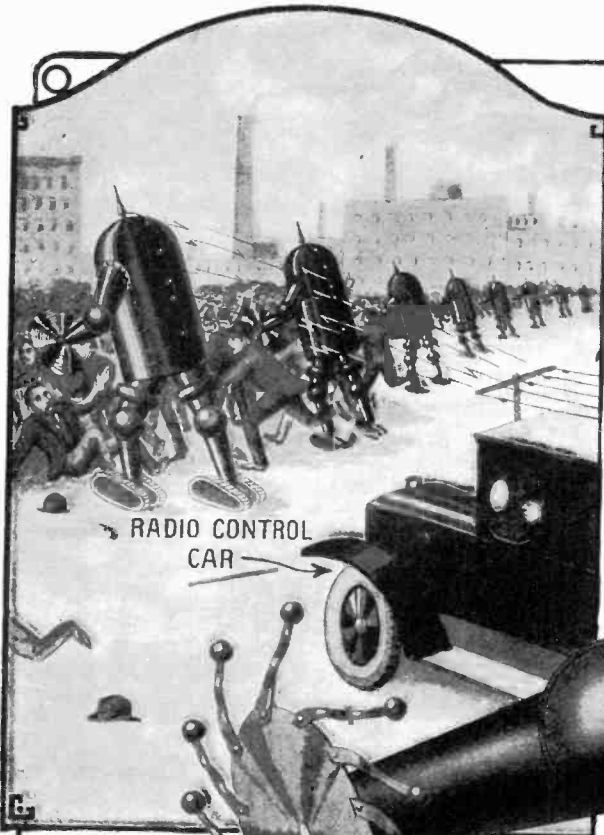
A magic chest full of the most wonderful seeds is obtained in the Citadel of the Moon. In fact, with the aid of these seeds one has only to wish and cast a few of them on the ground and behold—In this case it is an army. Each handful of seeds causes a little puff of smoke out of which soldiers materialize. The sketch explains the trick. Electricity sets off the smoke pots. The camera stops and the soldiers step into the smoke. The camera starts again, slightly out of focus. It is brought gradually into sharpness making the soldiers seem to materialize.

Radio Police Automaton

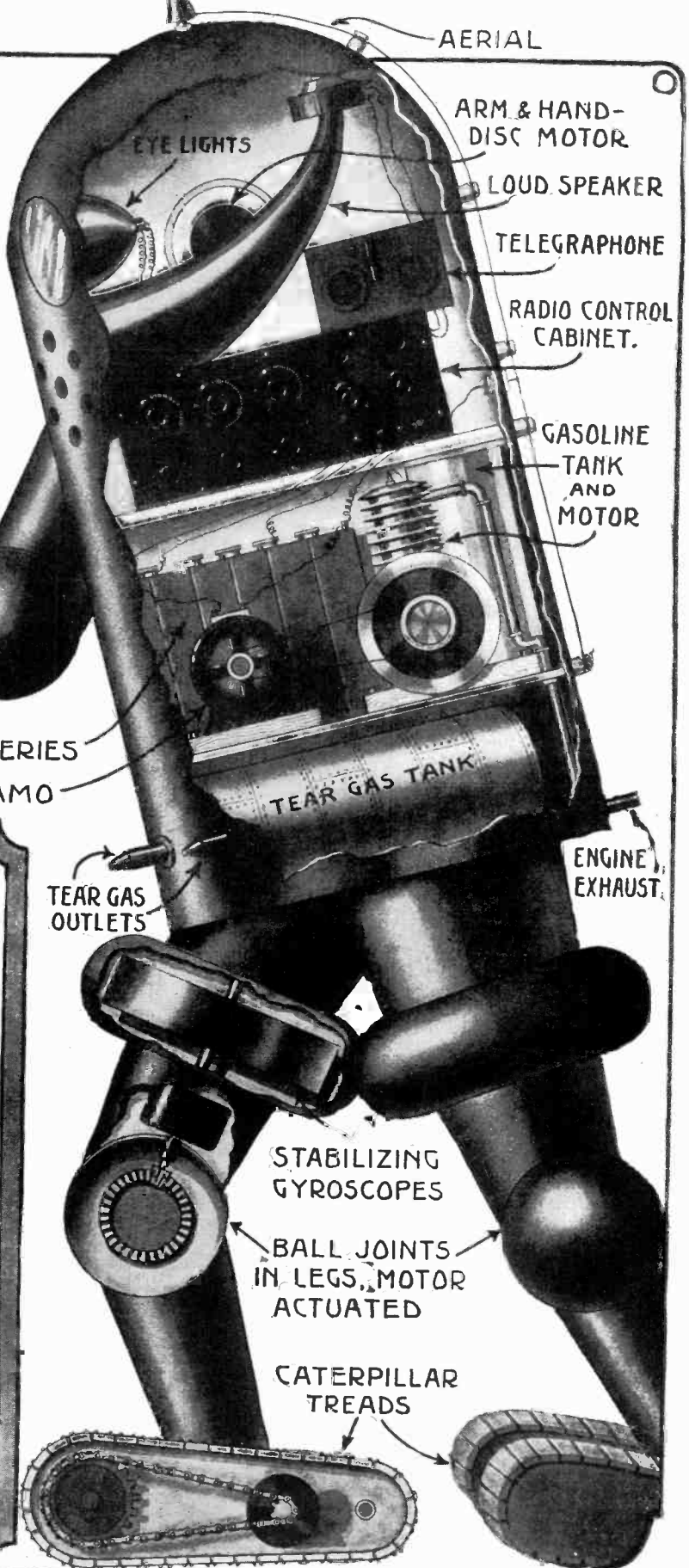
Distant Control by Radio Makes

Mechanical Cop Possible

By H. GERNSBACK



RADIO CONTROL CAR



AERIAL

EYE LIGHTS

ARM & HAND-DISC MOTOR

LOUD SPEAKER

TELEGRAPHONE

RADIO CONTROL CABINET.

GASOLINE TANK AND MOTOR

BATTERIES

DYNAMO

TEAR GAS TANK

ENGINE EXHAUST

TEAR GAS OUTLETS

STABILIZING GYROSCOPES

BALL JOINTS IN LEGS, MOTOR ACTUATED

CATERPILLAR TREADS

AS is well known, radio can be used today to produce mechanical effects at a distance. This new art is known as radio-telemechanics. Many years ago already it was possible to start and operate vehicles and machinery entirely by radio. The United States Navy a little over a year ago operated the warship "Iowa" entirely by radio. The firing of the boilers, the steering of the ship and all the controls were entirely effected by radio.

The Radio Automaton as disclosed on this page and in our cover design is therefore not a wild dream, but it can be constructed by any one with means available today. The Radio Automaton contains the machinery as shown in our illustration which comprises a gasoline engine, a radio control cabinet, a telegraphone, a loud speaker, a gyroscope and other auxiliary apparatus.

The Automaton is kept erect by the stabilizing gyroscopes. The machine does not really walk like a human being, but rather glides along the road over all obstacles by the small caterpillar tractors attached to the feet. This makes it unnecessary for the Automaton to take steps, and the machine will therefore progress by a gliding motion which is quite rapid.

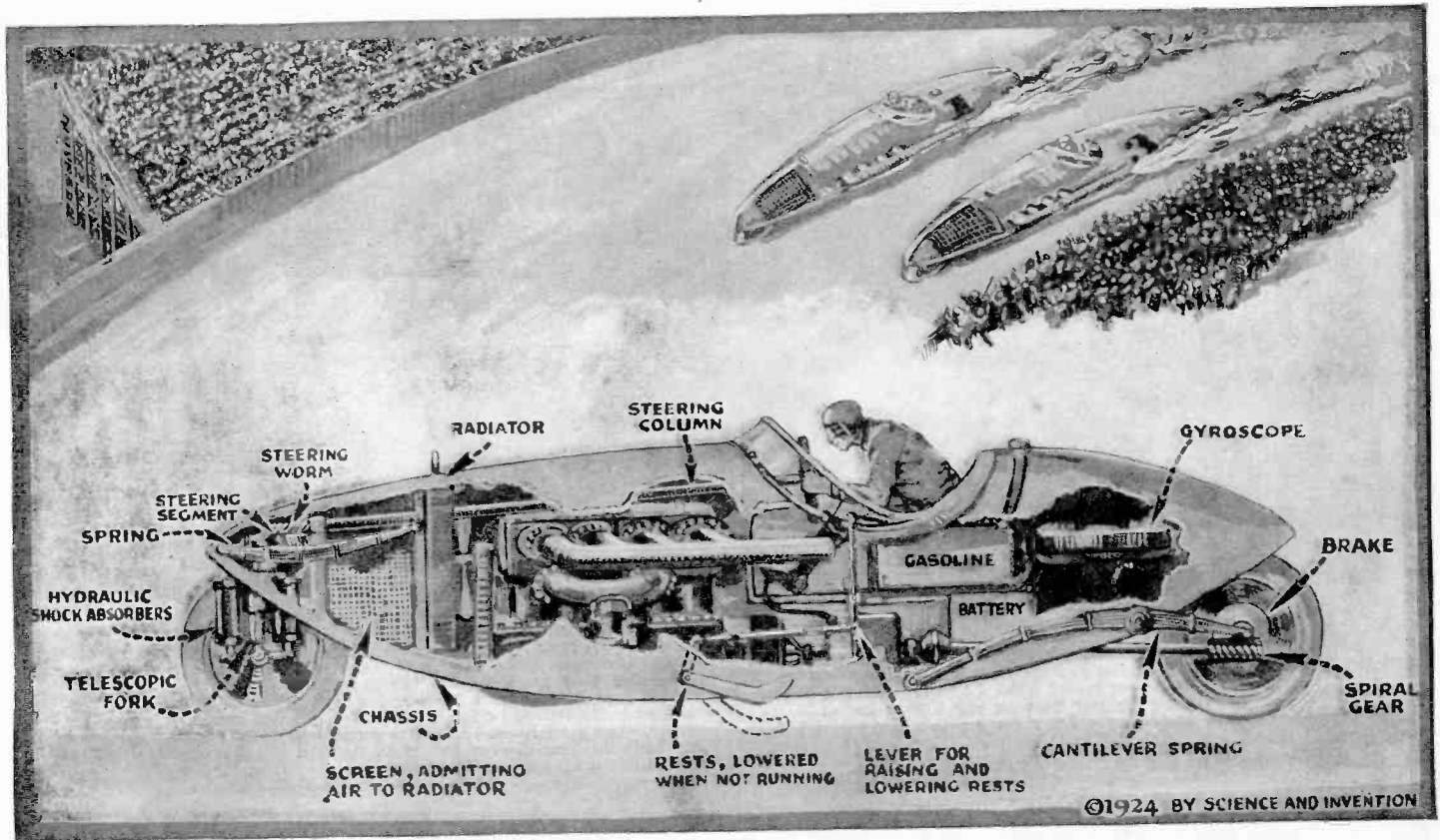
Such a machine would seem to be exceedingly valuable to disperse mobs, or for war purposes and even for industrial purposes. In the upper illustration is shown the police car which controls all the movements of a regiment of such automata. For fighting mobs use is made of tear gas which is stored in a tank under pressure and which alone will quickly disperse a mob if necessary. The arms are provided with rotating discs which carry lead balls on flexible leads. These act as police clubs in action.

For night attack the Automaton is provided with eye-lights and the loud speaker is used to shout orders to the mob which orders can be given direct from the radio control car. Inasmuch as this car is always in the rear of the Automata it can watch their movements and direct them as necessitated by circumstances.

As a close hand-to-hand fighting machine the Radio Automata have no equal. Bullets do not affect them and if equipped with a twenty to forty H.P. engine, they will be well nigh irresistible. They probably have no superior for fighting mobs or for war purposes.

Gyroscope Racing Car

Two-Wheel Contact with Ground Increases Racing Speed

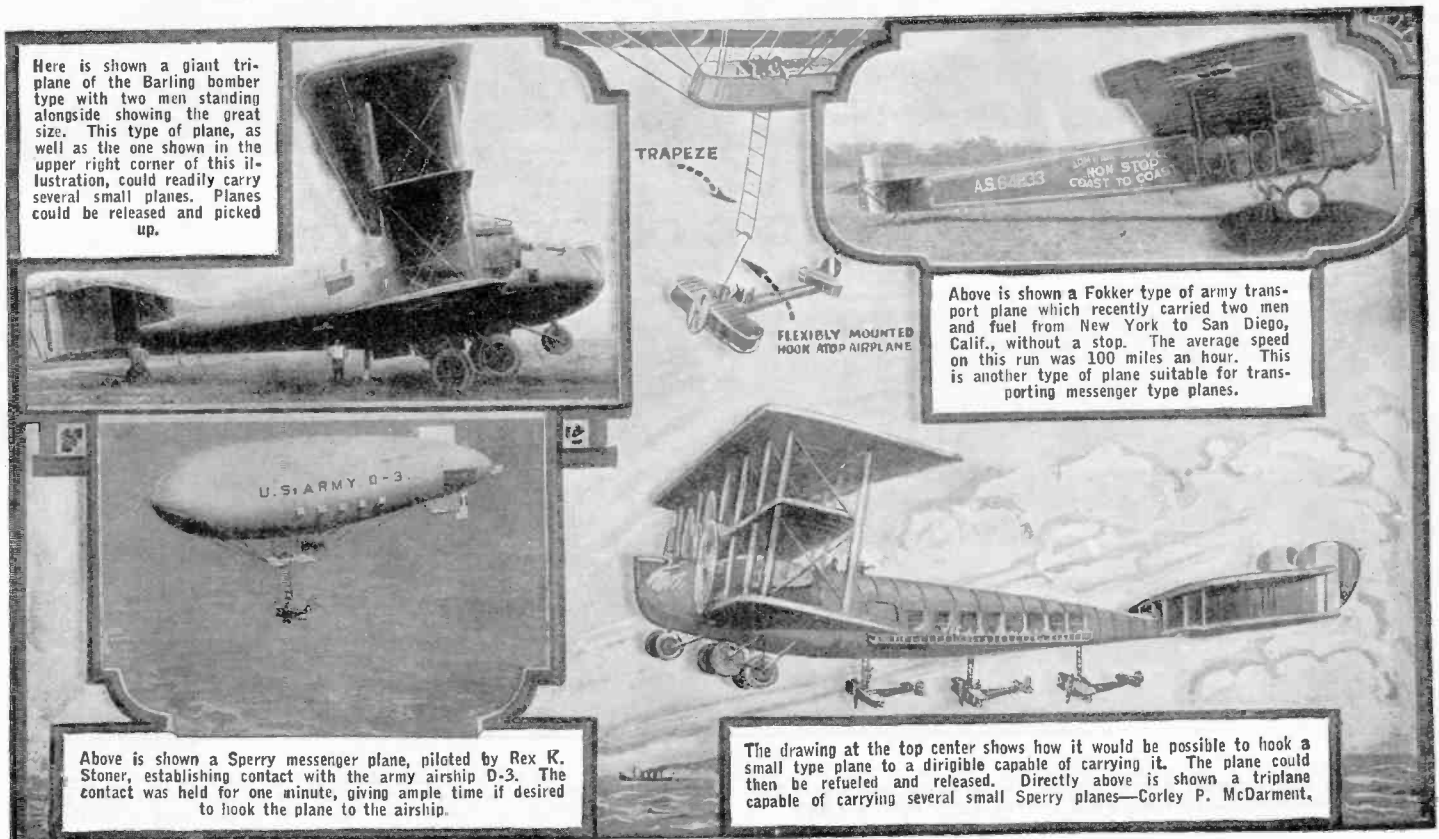


No matter how fast racing cars are designed to go, there is always a demand for more and more speed. This demand must be met and in order to do so those engineers who devote their entire time to the racing game have hit upon the idea of constructing a two-wheel automobile. This was suggested by the fact that motorcycles can travel at the rate of 100 miles an hour, while cars with three or more times the power only average

about 116 miles an hour. However, in order to maintain the heavy engine of an automobile and the other correspondingly large parts in equilibrium it is necessary to provide a gyroscope in order to produce stability. Such a vehicle is illustrated above and we may soon see it tearing around the track at a speed of 175 miles an hour or more.

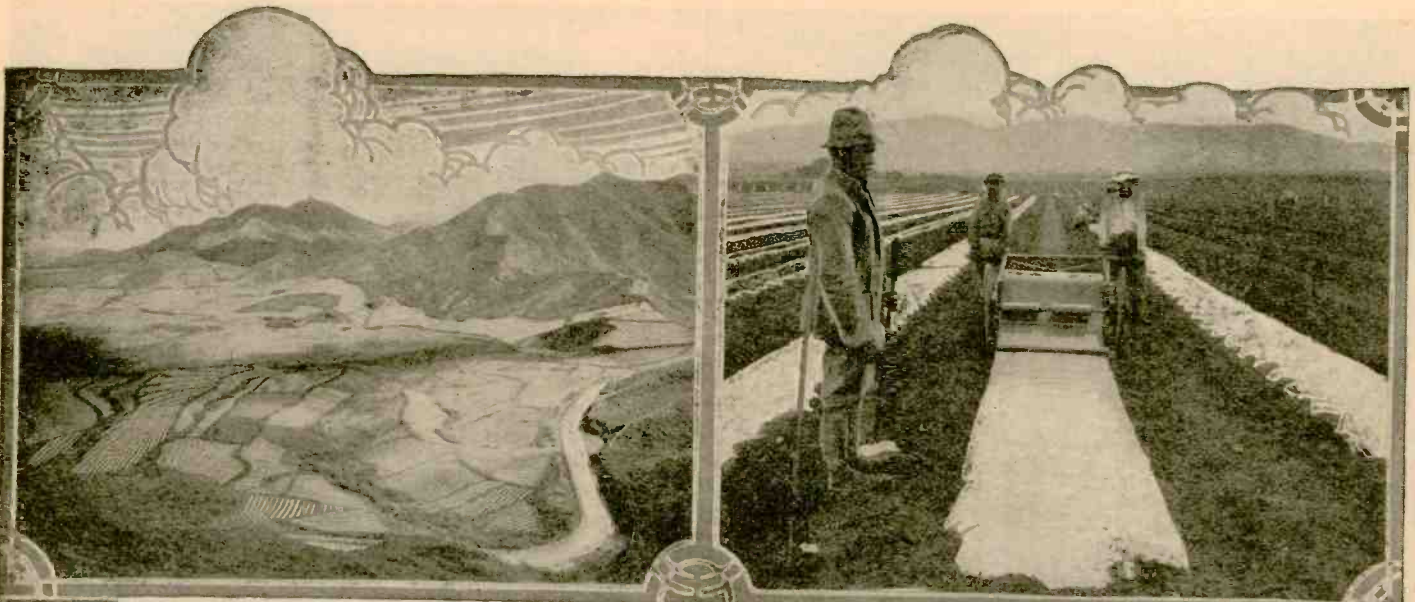
—Clarence A. Snyder.

Airplane Makes Contact With Balloon



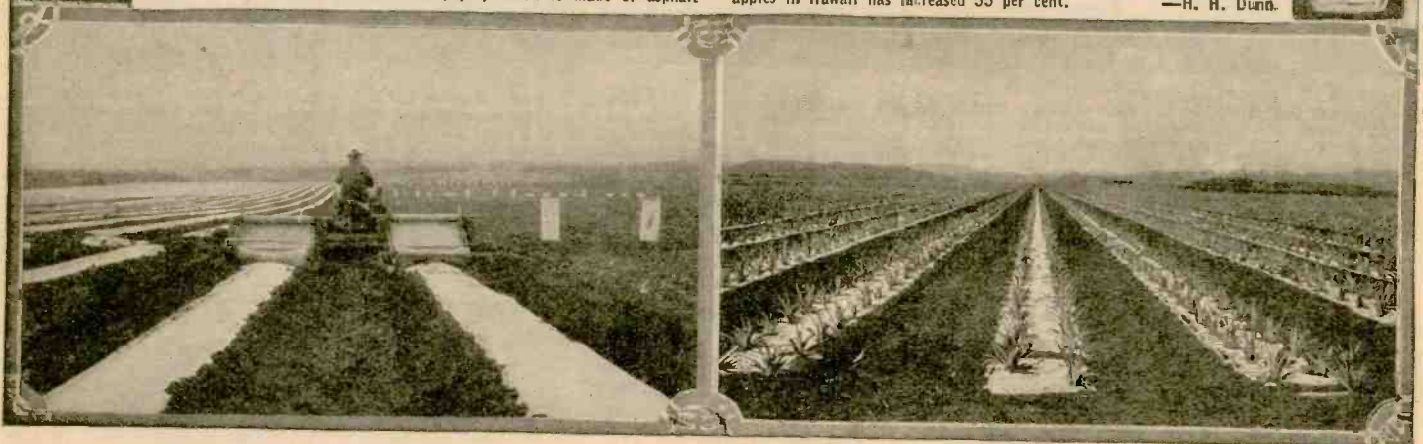
Paper on Fields Increase Yield

New Cultivation Method Does Away With Weeding

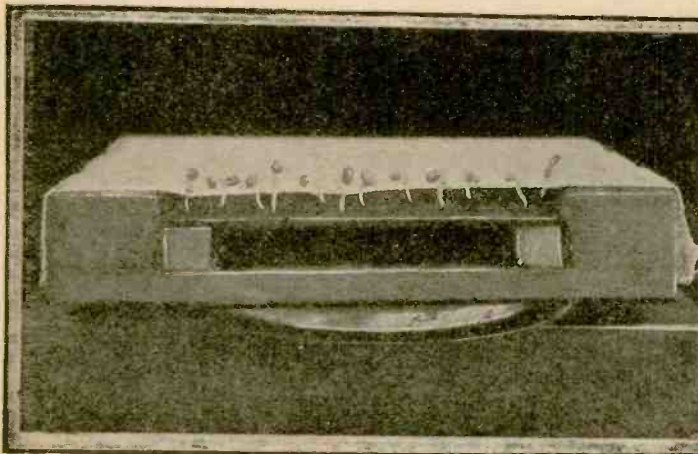


By covering their fields with large strips of paper, Hawaiian pineapple planters have been able to increase their yield between sixty and eighty-five per cent. Above is shown a panoramic view of plantations showing the fields covered with the paper. Below is shown a tractor laying the paper on the plowed field. At the same time it lays the paper it covers the edges of the paper with a small amount of earth which holds it in place. The plants are then placed in the earth through small holes punched in the paper. The planting is done by hand. It has been found that the paper, which is made of asphalt

treated felt, lasts about five years, the ordinary life of the pineapple plant. There are about 4,300 miles of this paper laid in the Hawaiian Islands at the present time. The cost of the paper and installation is approximately \$100 per acre. The increase in yield resulting from using the paper averages about \$170 per acre. Not the least of the advantages gained through its use is that no cultivation or weeding is necessary. This paper is also coming into use with tobacco and tomatoes. Since the introduction of this paper, the total output of pineapples in Hawaii has increased 55 per cent. —H. H. Dunn.



THE SIGNATURE OF SEEDLINGS



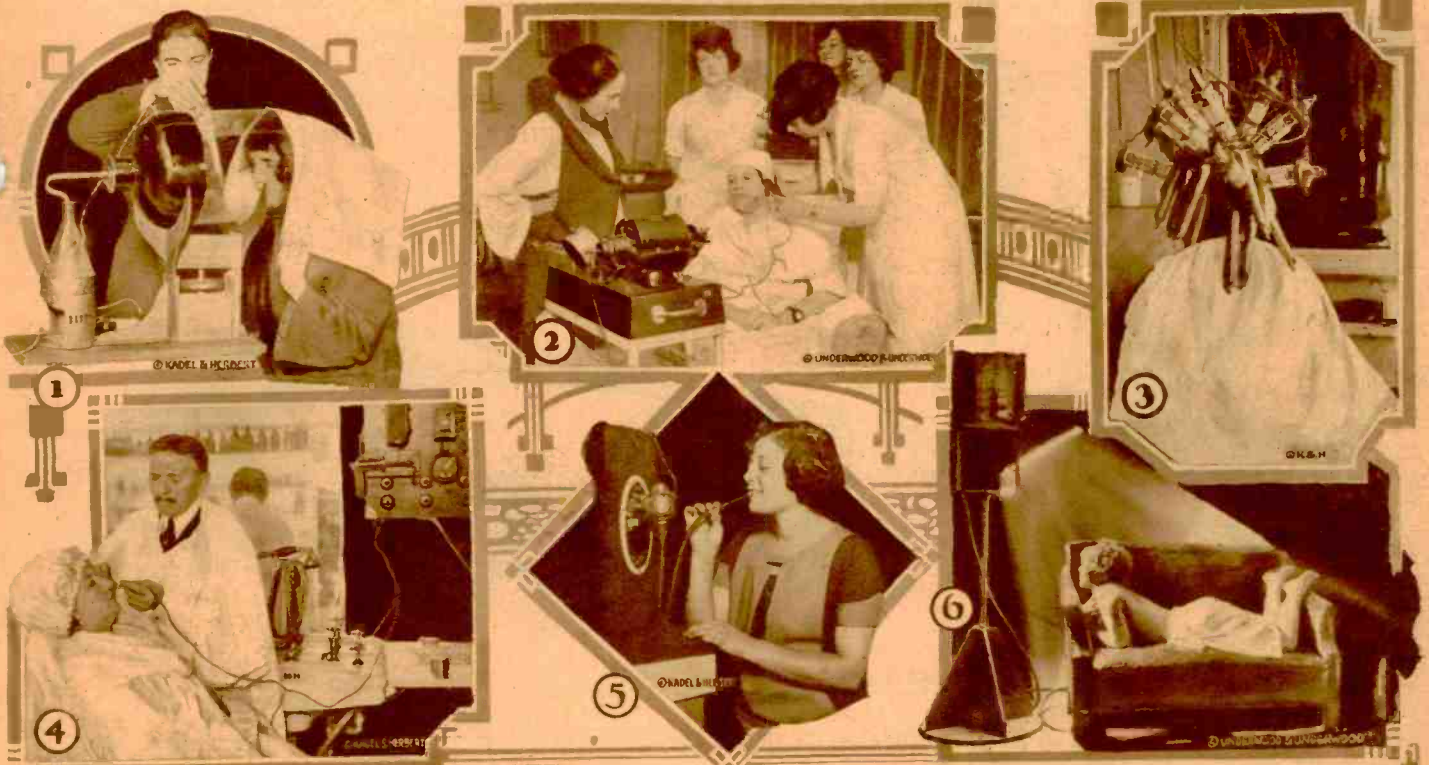
The roots of young plants are constantly moving about, and are so healthy in their operations that their movements may be recorded. A method for setting down their wanderings is shown above. A piece of cloth is stretched tightly across two blocks and kept damp. The seeds are laid on top and allowed to sprout. Beneath is placed a

piece of smoked glass which the roots strike after growing down through the cloth. That they are constantly moving about while they are lengthening, may easily be seen by the designs made on the smoked glass. This ability to move about allows the plant to select the path of least resistance in stony or lumpy soil. —Leonard Bastin.

Beauty Culture of Tomorrow

How Science Will Work Where Nature Sometimes Fails

BY DOROTHY GERNSBACK



IN the rush and hurry of modern life many times Nature's processes are encroached upon, making it necessary for science to step in and make good Nature's default. A number of ways devised by beauty scientists to care for the neglect of Nature are shown here. In the first illustration above is a method of giving the face a Turkish bath in order to bring out the best of the complexion for those who may not live in the open. In the second illustration is shown a mechanical method for removing blue veins that have become discolored by the use of an electric massaging needle. Then at 3 we have the well-known perma-

ment-waving apparatus which is simply a method of winding the hair, immersed in a secret oil, about a cardboard form, inserting the form in an electric heater and baking the hair. At 4 there is illustrated a method by which a Parisian beauty expert removes wrinkles by livening the skin of the face through the agency of an electric needle. And at 5 is the latest in toilette labor saving devices—an electric tooth brush. It is simply a small brush revolved by a motor. A tanned skin is a healthy one, but it is impossible to obtain a tan in winter, so here at 6 is the latest method of obtaining one artificially by means of a powerful light.

BELOW we have some of the beauty adjuncts of the boudoir of tomorrow. The first illustrated at 7 is an electric manicuring device which will shape the nails, remove the cuticle, give a dull or bright finish, all by means of a mechanical arrangement. The shaping of the nails is done by means of rotating rollers. A rotating buffer, to which is applied a polishing compound, gives a finish. At 8 is—ah-hum—a bow-leg straightener, which consists of a stiff aluminum frame adjustable to the shape of the calf and lower leg, but yet held rigidly straight. An electric eyebrow tweezer which does its work painlessly and permanently is

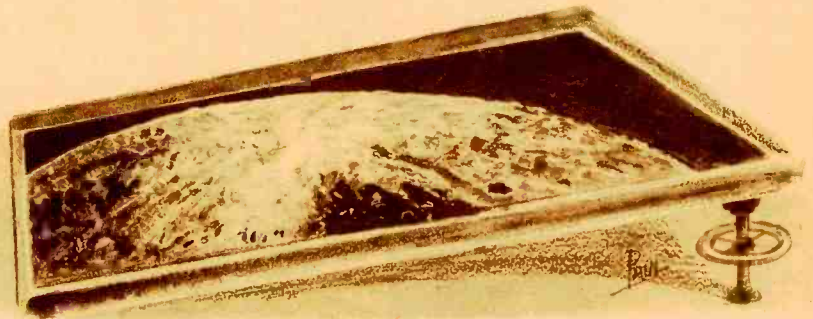
illustrated at 9. An electric current kills the root of the hair. At 10 is a perfume spray, pocket size, which may be used to perfume the breath, etc. The ability of certain electric rays to grow hair is more or less established. This is applied at 11 in an electric eyelash grower. For permanently dying the hair, there will be an electric needle which injects the pigment beneath the scalp, coloring the hair from the roots, thus obviating all trace of artificiality. This is shown at 12. The nose shaper is already known in a different form. At 13 a split casing fits rigidly over the nose forcing it into shape by tightening a few screws.



The INFINITE VISION

BY CHARLES C. WINN

A telescope of such power as to enable us to view the moon's molecules, forms the center around which this story revolves. Scientists found many strange things on our satellite and on the planets.



The last two tubes again faded into darkness, and the view receded to the original ten-thousand foot scene. With an almost imperceptible movement of his hand upon a lever, he brought the landscape flashing across the screen in a glorious panorama.

"TELL you, gentlemen, this is a pretty pass of affairs. Here all the other branches of science are open to practically an unlimited development, while Astronomy is nearly strapped because of one thing—that we have apparently reached the limit of development of the telescope, as evidenced by these plates here. Something must be done. Can't any of you suggest anything?" and the speaker paused and glared around the table.

It was a meeting of the *International Astronomical Society*, gathered to discuss the results of the trial of the giant forty foot mercury reflector telescope which had recently been completed in the great Holton Observatory, situated high up among the South American Andes.

Evidently the results had been none too satisfactory, as evidenced by the grave and thoughtful expressions of the company. Holton, the chairman, with his none too good ordinary humor, was fast working up to a literal tirade of rage.

"Possibly zee mercury reflector might be satisfactorily eemproved," mildly suggested Flambeau, the noted Frenchman, in response to Holton's heated demand.

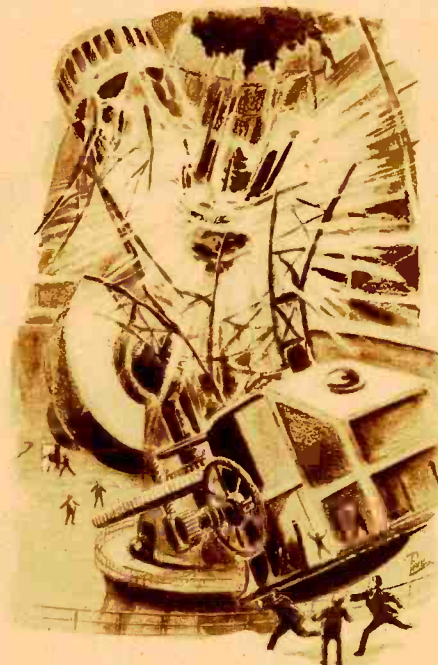
That individual gave a snort of disgust, and his wiry red hair fairly bristled, as he spat out his withering reply.

"What, that d— thing! Why that thing is perfected as far as it lies within the power of mortal man to do it. But look at this plate—magnified enough, but as far as detail goes—! Looks like a striped pancake to me. Vibrationless action. H—! You can't entirely eliminate vibration in any machine. And look what microscopic ripples did in this case. Yes, I'd like to see you do anything with that crazy thing. And if you are fools enough to try it, after spending a million dollars with these results, why I absolutely refuse to have anything to do with it. I quit."

An uneasy silence followed this outburst. Not a man was present but who realized that, in spite of his eccentricities, Henry F. Holton was the greatest astronomical authority of the day. Consequently, no one had the temerity to oppose his views.

All through this stormy session, a tall dark man of about thirty-five sat patiently listening to the discourse. Glenn Faxworthy was, in all probability, the greatest scientific genius present at the meeting that day. Not only was he proficient in Astronomy, but to an even greater degree in Physics and Chemistry. He had disclosed some remarkable things in his day, this quiet forceful man. Curiously enough, however, he had chosen to keep them to himself, biding the day when their revelation might be doubly effective.

Finally when the tenseness of the silence was becoming acute, he arose and addressed the meeting.



With a sudden lurch, the thing on the roof had fallen completely to the perpendicular. There was a second frightful din as it rent asunder all within its path, ripping out the very vitals of the delicate apparatus that gave it life! Then it grew dark.

"Gentlemen," he said. "Put a million dollars available at my hands and I will build you a telescope which will reveal the molecules of the rocks of the moon."

THE PREPARATION

A cold moon was rising over the snow-capped summits of the Andes Range. Upon one of the highest peaks stood the gigantic Holton Observatory, situated in the most favorable location of the world for making observations.

On the steps of the huge concrete building two men stood in earnest conversation. One of them was short and red-haired, with bright blue eyes that snapped belligerently behind thick horn-rimmed spectacles. His companion, tall and dark, had about him an indefinable atmosphere of quiet force and dignity.

For ten years these men had been engaged in intensive labor, the one preparing the huge structure for the reception of the delicate apparatus which his companion was laboring to perfect in a great laboratory far off in the States.

Six months ago he had arrived with it. From that time, with the assistance of a small crew of men, they had worked almost night and day installing it. Only that day had they made the final adjustments which rendered it capable of the mighty function it was to perform.

For some moments the two stood, silently regarding the great looming bulk which contained all their hopes. Then the tall dark man, raising his eyes, glanced at a great red star, which shone threateningly, unblinking in the zenith. He spoke shortly to his companion, and together the two entered the structure.

Two hours later they emerged, their faces transfigured with the light of a great revelation. What they saw that night only ten others have seen, from that day until this.

* * *

Twenty-four hours later the same men entered the building again. This time, however, they were accompanied by ten others, the greatest scientists of three continents.

Harlton, the English physicist, was there: Coron, the American chemist; Flambeau, the Frenchman, together with the heads of the four greatest observatories of the world, and others.

In the center of the room to which they were conducted, stood the massive mercury reflector, the subject of the torrid discussion of ten years before. But now it was strangely altered. No longer was it set immovably upon giant pivots, pointing unalterably to a single spot in the heavens. Now it was fitted into a ponderous equatorial mounting, as delicately balanced as a precision chronometer. And its shining surface no longer needed rapid rotation to maintain its perfect parabolical form. The liquid metal was now set as rigid as steel. The master hand of the physicist had given it eternal solidity.

The party gazed in silence and wonder for a moment at the colossal creation of the human mind, and then turned and followed their guides up a long flight of stairs to a large room under the center of the huge dome.

It was a marvelous room, filled with an intricate complication of ingenious apparatus. Upon one side was banked series after series of vacuum tubes, mounted upon long panels of shining bakelite. Another wall was completely hidden by a huge switchboard, studded with a seemingly endless array of switches, control knobs, rheostats and levers.

In the center of the floor was mounted a shining silver screen about six feet square. Looking down upon it, the men could see the reflection of a strange piece of apparatus pointing directly down upon it, from the ceiling above.

For some moments the party stood gazing in mute wonderment at their surroundings. Then Faxworthy, as you may have guessed the identity of the tall dark man, spoke to them in his ever quiet level voice.



And from its top an enormous ray of unearthly luminescence shot sharply out into space! Again the last two bulbs flashed into light.

THE TELESCOPE

"Gentlemen," he said, "here before you lies the results of ten years of intensive labor by Mr. Holton and myself—the product of the million dollars with which you so kindly provided me. Whether you have received an ample return on your investment, only you can judge tonight. However, I do not expect you to be disappointed."

Then walking over to the board, he threw

one of the switches. Instantly the low hum of an electric motor was heard from below.

"The power comes from a good-sized hydro-electric plant down on the other side of the mountain," he explained. "It was Holton's idea." And, he added, smiling gently, "Holton was an invaluable factor in the construction of the mounting for the reflector and other requisite auxiliary apparatus. If we are successful tonight, he shares all honors."

Then, turning to the board again, he moved a lever which brought the aperture of the huge dome around to the east. Another switch, and upon the very apex of the dome, mounted upon a small steel tower, a weird piece of apparatus, much resembling a huge X-ray tube sprang into life, unseen to the watchers below. Then, guided by the master hand, it swung upward until it pointed full upon the rising moon.

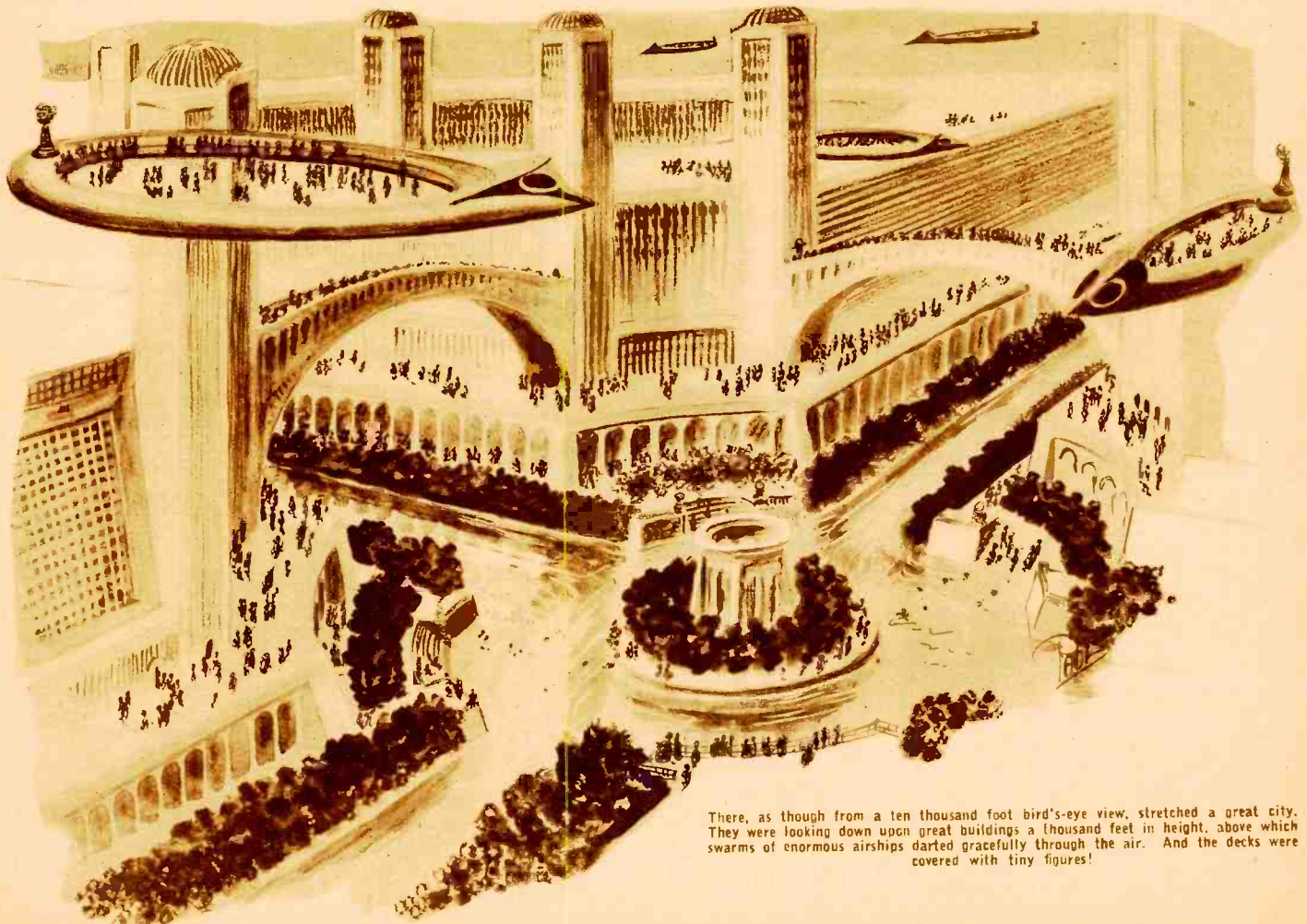
Faxworthy spoke again. "Gentlemen, I now have the reflector in the room below trained upon the moon. Watch the screen closely."

He threw another switch. A low hum came from above, which speedily grew in pitch to a piercing whine, which soon became inaudible to the listeners below.

He turned a control knob, and two of the vacuum tubes lighted up. Simultaneously a strange beam of luminescence shot downward from the apparatus above.

Gazing down upon the screen the men saw an object that riveted their immediate attention. There, as though floating upon the silvery depths, was a beautifully detailed image of the moon.

Rapturously the group looked upon it. Then Faxworthy, with a dexterous twist of his wrist, snapped two more of the tubes into the circuit. The first image faded away, and was replaced by one, filling the entire (Continued on page 70)



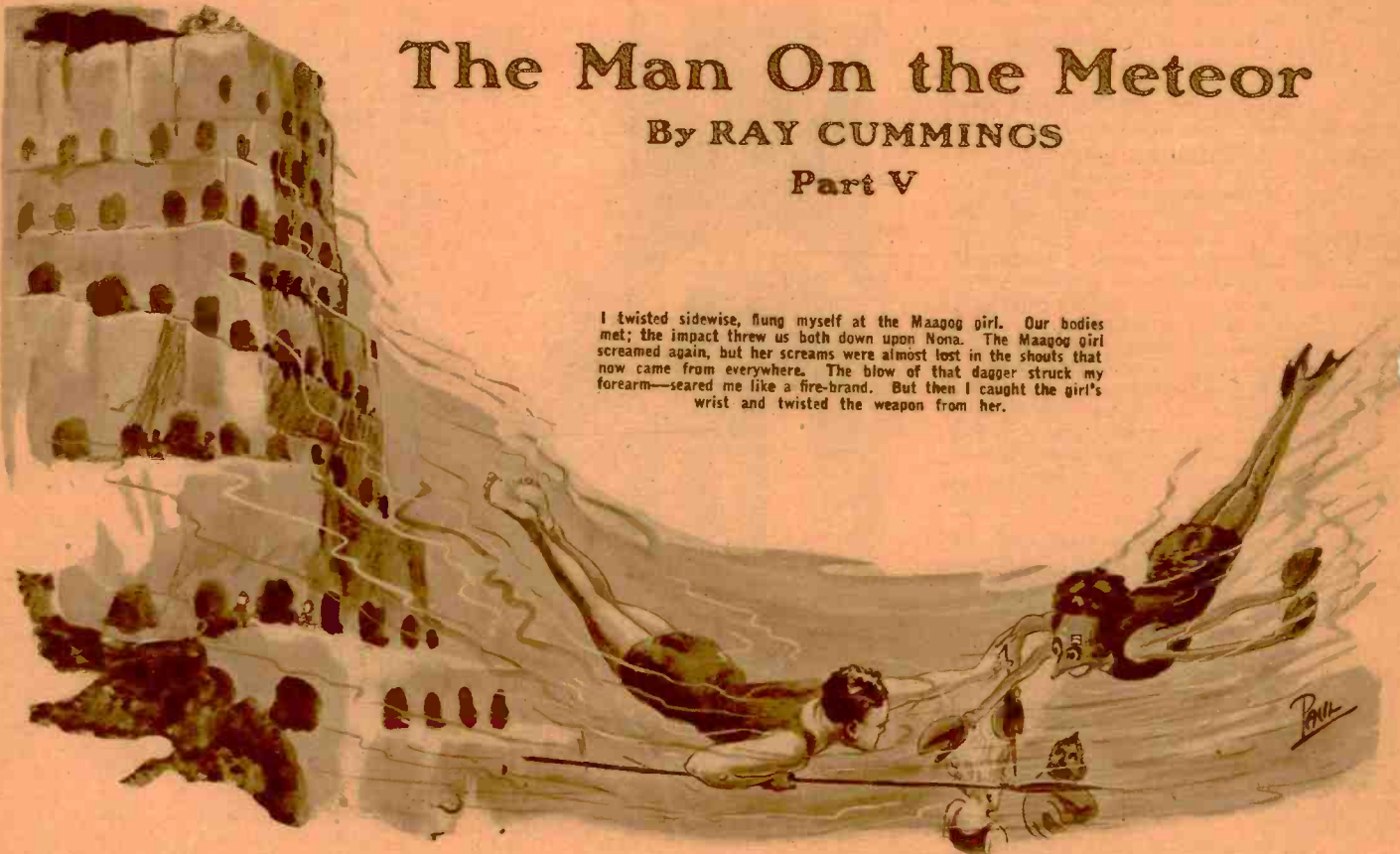
There, as though from a ten thousand foot bird's-eye view, stretched a great city. They were looking down upon great buildings a thousand feet in height, above which swarms of enormous airships darted gracefully through the air. And the decks were covered with tiny figures!

The Man On the Meteor

By RAY CUMMINGS

Part V

I twisted sidewise, flung myself at the Maagog girl. Our bodies met; the impact threw us both down upon Nona. The Maagog girl screamed again, but her screams were almost lost in the shouts that now came from everywhere. The blow of that dagger struck my forearm—seared me like a fire-brand. But then I caught the girl's wrist and twisted the weapon from her.



SYNOPSIS OF "MAN ON THE METEOR"

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. Being hungry and thirsty, he looks around for nourishment and finds the mouth of a cave. As he looks towards the cave a girl comes into view.

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.

The problem of finding sufficient food became paramount in the life of Nona and Nemo. One day upon returning to the cave Nona shows Nemo several mollusks which make good food. She then takes him to the place where she found them to gather more. They wade into the stream and follow it into its cavern. Nemo sees that Nona's head is completely engulfed. Soon his head goes under water and he feels the liquid rush into his lungs. However, by violent effort he is able to breathe. He finds that the water, being so highly aerated, readily supplies his blood with the necessary oxygen to sustain life. They come to a bed of shell-fish, collect enough for their needs and go back to their home in the cave. They start a fire, cook their supper and retire.

In the middle of the night they awake to find their entire cavern in flames. The rock, being of a combustible nature, has become ignited from the cooking fire. They dash toward the mouth of the cave and out to the surface of the meteor. Thus robbed of their home they "swim" through the air to the opposite side of the planet. Here they make their home beside a large stream at a point where it enters a low hill. Soon smoke and fumes from the conflagration drift over to their side of the small meteor. Nemo is suddenly seized with an idea and taking Nona with him he plunges into the water and follows the bed of the stream into the mountain. Soon they find food and devour it, still under water.

At this point they see coming toward them a party of ten people, four men and six women, who are somewhat human in form, but have four arms like the tentacles of an octopus. Nemo and Nona are captured and tied by them. A large vehicle is seen coming along the bed of the stream and the Marinoids, as Nemo calls his capturers, prostrate themselves. Nemo does not follow suit and the occupant of the vehicle throws a spear at him. He is struck and falls senseless.

When Nemo comes to his senses, he and Nona are taken by the Marinoids to the city called Fax. This city is under water and, unlike the cities of our earth, is built of underwater vegetation.

After Nemo and Nona have lived with the Marinoids for some few months, Nemo becomes practically indispensable to the ruler or King of the city and is consulted by him on various occasions. The couple lived in the same home with Caan, a Marinoid, but after their child was born, whom they named Boy, they were given a home of their own. Soon after this a man named

Og insulted Nemo and challenged him to a fight. The fight took place in front of the palace of the ruler and Nemo was defeated because Og had a peculiar property, which was characteristic of the Marinoids, enabling him to send a charge of animal electricity into the body of Nemo, thereby rendering him unconscious. After the fight, Nemo is brought back to consciousness by Nona. He finds, at a later date, that the electricity used was similar to that found in the body of the electric eel, common on the earth. After recovering fully, Nemo starts to look for his recent ad-

versary, but is unable to find him, and he soon learns that Og has left the city.

The life of Nemo and Nona goes on happily, their baby growing rapidly in his under-water home. Nemo has been assigned to a certain amount of work in the underwater city, gathering food to be stored in the government warehouses. For a year things go along peacefully, when suddenly a daughter of one of the workers disappears. This is repeated again and again until thirty of the young women of the city have disappeared. Everyone knew, of course, that the Marinoid women were being stolen and one day a strange figure is seen in the street. Suddenly all light is obliterated and Caan and Nemo, swimming through the darkness, find a woman unconscious, shocked into insensibility by animal electricity from the outsiders who were invading the city. Nemo comes to grips with someone and finds it to be his old enemy Og. The Marinoids disperse the enemy and the streets were relighted. Nemo returns to his home to find that Nona is gone.

The entrance to the Water of Wild Things, an unknown stretch of sea, is carefully guarded as it is from this point that the invaders have come. An expedition is organized and led by Atar, the king's son, and they go into the Water of Wild Things. Atar, Nemo and Caan penetrate a barrier of vegetation and descend the side of a perpendicular cliff. They behold weird phosphorescent animals, some of them headless, together with great fish of unusual shapes. A creature resembling a balloon of white jelly suddenly envelopes them with its sticky yet slimy body. After a long battle, the three would-be rescuers of Nona escape. They descend further along the cliff and soon see lights in some sort of a dwelling place. They go toward it and find it to be a cave lighted with a pale green radiance. They follow a human figure into the cave and find it to be crowded with other humans. Og is seen talking to them and on a raised platform is Nona.

WE crouched there on that upper ledge, staring down through the green water of the cave, and listened to Og as he harangued that pallid, puffy-faced throng. His words came up to us clear—words which, as I have said, were not Marinoid but a corruption of them sufficiently close to the original to be intelligible to us. We listened, breathless. What we heard made the past plain to us; and made our own future—the danger hanging over all the Marinoids—equally plain.

For a moment we forgot our own position there on the ledge—forgot even Nona whom we had come to rescue and who was sitting behind Og on the platform, arms



We drew back, but not before the serpent had become aware of us. It turned over with a long, gliding undulation and came at the mouth of the passageway. I caught a glimpse of opened jaws—fangs half the length of my body. And its breath, a fetid stench, seemed to precede it.

bound at her sides, with scorn on her beautiful face and her eyes flashing fire at her captors.

For Og, with vehement, enthusiastic words, was explaining to these, his own people, how he would soon lead them into battle against the Marinoids! Rax and its sister cities would be captured; the Marinoid men killed or reduced to slavery; and all the beautiful, peaceful Marinoid domain turned over to the rule and the enjoyment of Og and his people!

It made us shudder; but we held ourselves quiet. Caan, older than Prince Atar and I, pulled us back when in our eagerness to hear Og's every word we would have pressed thoughtlessly forward and risked discovery from below.

These people called themselves Maagogs—two long, very harsh syllables. Down here under the Water of Wild Things, hidden away in caves, mud-holes and subterranean tunnels, there were doubtless thousands of them—dragging out a furtive existence, menaced on every hand by monsters of the deep. To them, Nature herself must have seemed an inexorable enemy, as though their very being were against her laws, her wishes.

FACING EXTINCTION

For centuries they had apathetically struggled on. And then, as though to blot them out entirely, Nature had turned on them still further. Of recent years the pallid, dull-eyed Maagog women had borne but one female to three males. The Maagog women were dying out; soon the race would become extinct.

With this dearth of women of their kind, Maagog men of the more prepossessing appearance (a generation before) had smuggled themselves into the Marinoid race. Their children—half-breeds—were living there now, with their Maagog heritage unsuspected by the trusting, simple-minded Marinoids.

All this and more, Og explained to the throng of Maagogs he had assembled before him, as he outlined his plans of what he now proposed to do.

"Quiet!" murmured Caan to Atar and me. Og's voice went on. He had left Rax and come back to the Water of Wild Things because he loved his own people. It had been his idea that they steal the Marinoid women. The Maagog race must go on—on to conquest, to victory!

A cheer rolled out as he said it. But we who listened knew it was Og's own personal advancement—and not love of his people—which actuated him. And his very next words made that plain.

He—Og the Executioner—would lead his people to victory. And he would rule them as King. Og the Executioner! Thus he referred to himself. We did not know at the moment just what he meant. But, as you shall hear, we were soon to learn in very ghastly fashion.



And then, before we could decide in which direction to go, the black fishes swept down upon us. They darted about me, under me, over me, and gripped me from every side. Teeth like needles, ripping, tearing at my flesh.

War with the Marinoids was coming! Og had sent messengers down into all the Maagog community houses with his tidings. The messengers were coming back; and from everywhere came the news that the Maagogs were willing to fight. If their present rulers would urge them on (and here Og turned to the white old men behind him) the Maagog people would mass themselves at Og's command—would follow him against the Marinoids. And when victory had crowned their efforts, he, Og, would rule them in Rax—the most beautiful spot in all the world—where they would all live in peace and security forever. And the beautiful Marinoid women would be their women, and the Marinoid men would be their servants and their slaves!

It was a vigorous, exhilarating speech, and the crowd on the cave-floor responded to it with prolonged cheering, while Og stood silent, smiling upon them triumphantly. Then abruptly he turned toward Nona—my beautiful Nona—who with spirit still unbroken flashed back at him her look of contempt.

And again Og spoke. This woman—this strangely-fashioned woman he had found among the Marinoids—would be his Queen—to rule with him when they had conquered Rax. He approached Nona, laid his hand on her shoulder. I started forward; but Caan held me back.

"Quiet, Nemo! Wait! If they discover us, we are lost."

But my Nona did not shrink away from Og. I knew that every fibre of her revolted at his touch—but she did not show it. Her gaze on his face was steady—and full of that same cold contempt.

"This woman," said Og, as he smiled down at the listening throng, "will be your Queen."

She is frightened now. She will soon see how great am I—how great is the honor I offer her."

He was talking for Nona's benefit, I knew. "I respect her," he said. "I shall conquer the Marinoids first—and she—her love, her admiration—shall be my reward."

He turned away from Nona, and, advancing to the very edge of the platform, held out his arms to the people.

"I—Og the Executioner—will rule you. The waters we will conquer are fair and beautiful. Cool and open—room for us all—and free of monsters. Riches for every one of you!"

The cheering halted him again. The crowd was waving its thin arms.

A MAAGOG TRIANGLE

"Look!" whispered Atar to me.

From across the cave, a niche halfway up the opposite side, a Maagog woman launched herself into the water, swimming downward toward the platform and Og. She seemed not much older than Nona—a girl not unlike a Marinoid girl, but dead white of flesh. And puffy, with huge staring eyes and a mouth that was a gash.

She swam downward slowly and landed upon the platform close beside Og. He confronted her. She spoke to him, pleadingly—but so softly that we on the ledge could not catch her words. Then she gestured toward Nona; and then she threw her arms about Og's neck. He struggled to release himself, while the crowd, silent now, looked on.

A moment, and Og was free, standing erect. The Maagog girl was lying on the platform where he had thrown her. She rose to her feet painfully, flinging at Nona a glance of unutterable hatred. Then again she appealed to Og—a gesture of love, despairing, desperate. It seemed to madden him. He stepped forward and struck her across the face with the flat of his arm. She fell backward, righted herself in the water, and swam slowly, limpingly away. A moment more, and she was back in the wall niche from whence she had come.

Og, with a scowl, went on talking to the crowd—telling them of the coming Marinoid war. Never once did he look up to where the girl was crouched above, watching him silently.

But I—my gaze was no longer for Og. Across the cave from me—almost at the same level and almost as far from Og and Nona as I was—that Maagog girl crouched tense. There seemed something ominous in every line of her—something that filled me with a dread—a horror.

Og's speech rolled on. The crowd applauded. Atar whispered something to me—something about us three going back to Rax at once, to get help to rescue Nona and to prepare for the coming war.

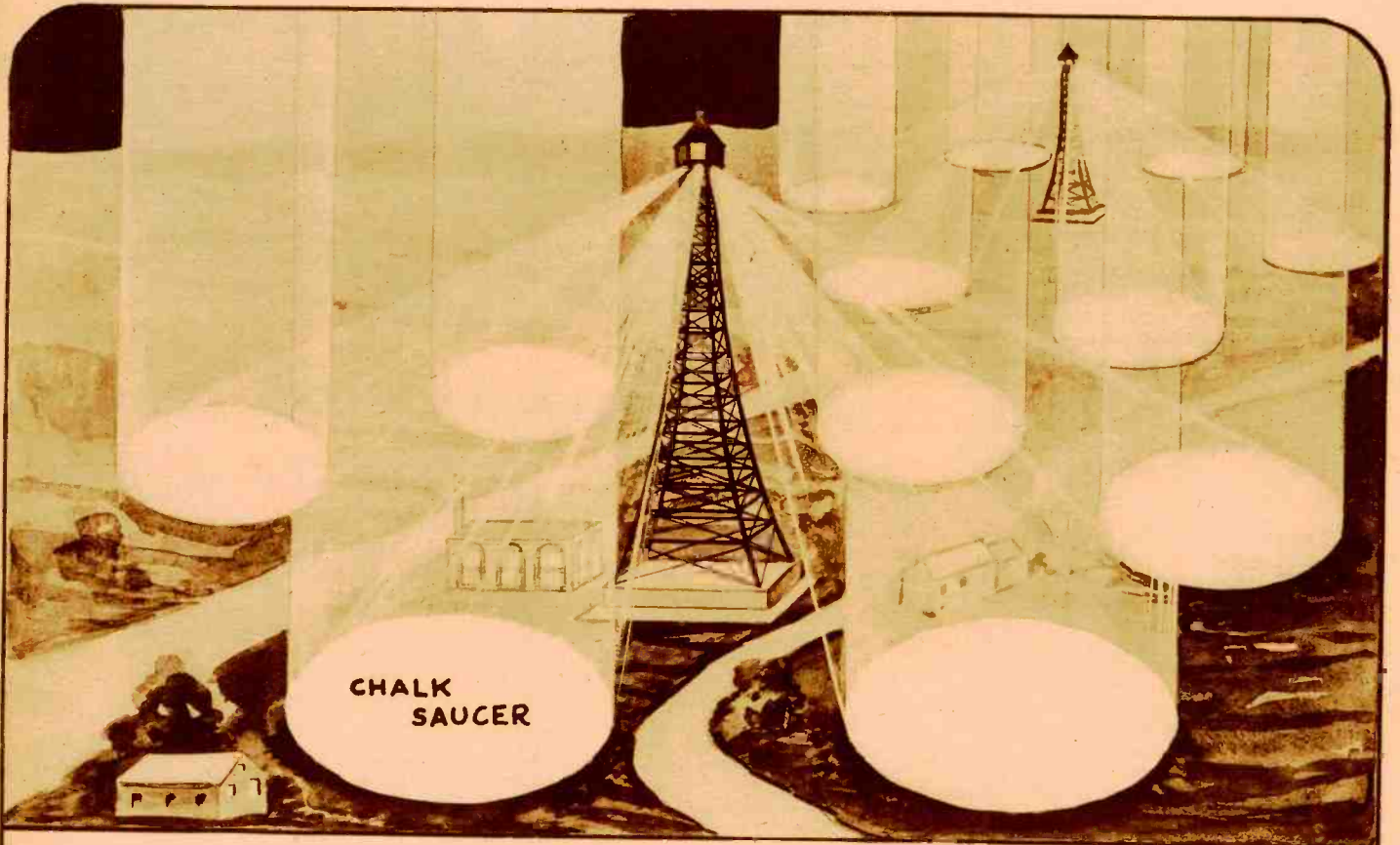
(Continued on page 64)



The baby's body, caught by the current, floated out and downward—slowly at first, then more swiftly. Gradually it turned over. . . . An infant face—big eyes full of staring surprise . . . a puny wail of protest as the water grew hotter. . . .

More Interstellar Communication

BY CHEVALIER DE TERRAIL



CHALK SAUCER

It is always interesting, the possibility of communicating with a sister planet. Here is the latest method—and seemingly one of the most logical and least complicated which has been put forward for some time. This system contemplates the use of huge chalk saucers as reflectors upon which are flashed the beams of powerful searchlights. Towers are erected at long intervals surrounded by a number of these saucers. By means of this system of illumination, a figure of a man or an animal is worked out over a large area. The completed figure may have a height running into the hundreds of miles, at least large enough to be visible from another planet. By making this figure movable through the agency of flashing the lights on and off, a definite sign could be given to another planet showing that life exists on the earth and that communication is desired. This would no doubt elicit an answer if the inhabitants of the other planet—presumably Mars—have reached a state of civilization at all similar to our own.

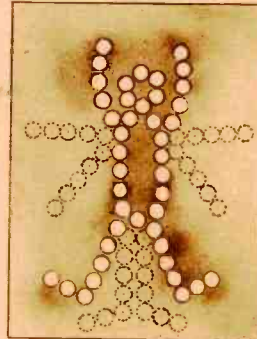
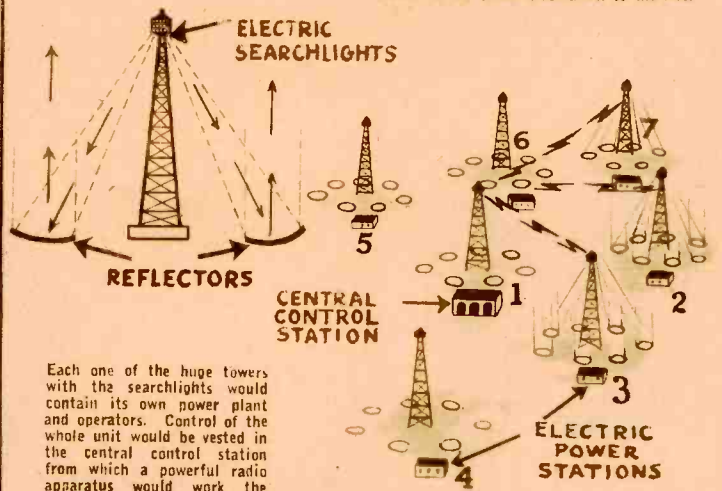


FIGURE COMPOSED OF MYRIADS OF WHITE DOTS
 LIGHT AREAS ADJACENT TO ONE ANOTHER

An idea of how the complete figure would be formed with the dots of light, is illustrated in these sketches. The idea is very similar to that used in half-tone printing, where a great number of dots placed closely together are used to give a solid image. The method of moving the arms or legs or head of the figure depicted, is obvious, since it follows the same principle as that employed in present day animated electric signs. This principle is shown in the small illustration to the left.



An idea of the image formed on the earth's face by this scheme is given in the above illustration. The huge form of the man or animal would stand out in distinct contrast, at night, against the black background of the earth.

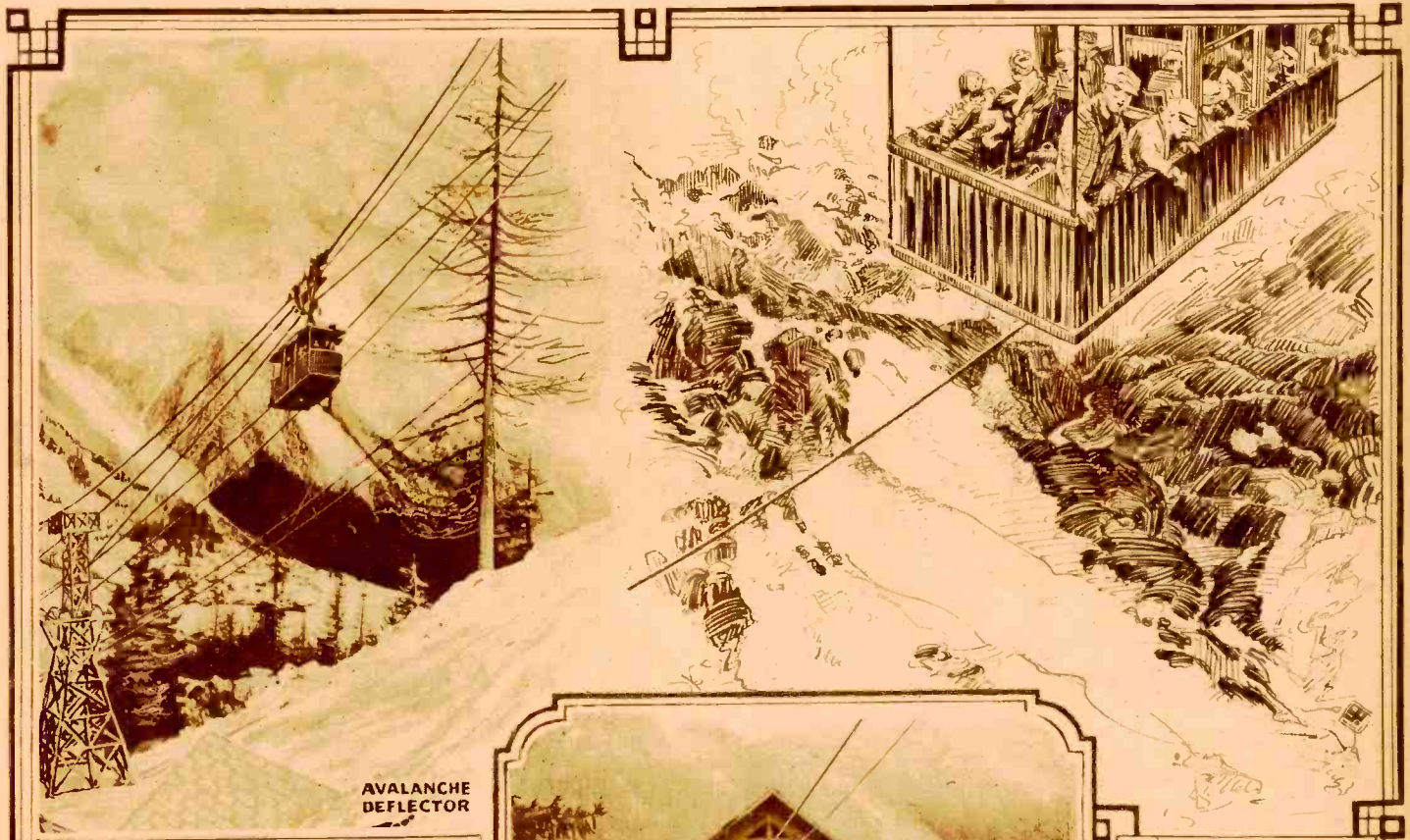


Each one of the huge towers with the searchlights would contain its own power plant and operators. Control of the whole unit would be vested in the central control station from which a powerful radio apparatus would work the towers and power stations, as shown in the illustration here.

World's Highest Cable Railway

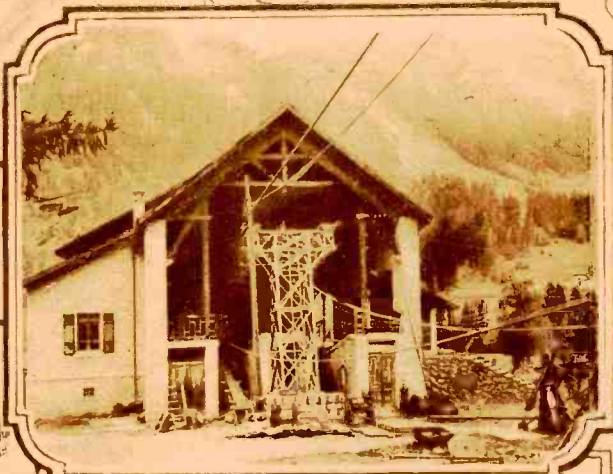
Highest Point of Aerial Railroad Almost Equals Mt. Blanc

BY H. WINFIELD SECOR

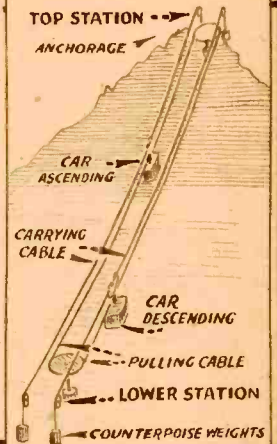


AVALANCHE DEFLECTOR

A cable railway rising over one of the roughest sections of the Alps to a height of 12,600 feet above sea level is in construction at Mt. L'Aiguille Du Midi, Switzerland. Its purpose is to carry tourists from the railway station at the foot of the mountain to a winter resort built at the upper terminals of the railway. At this resort it will be possible to carry on winter sports in July. The railway is a dual one.



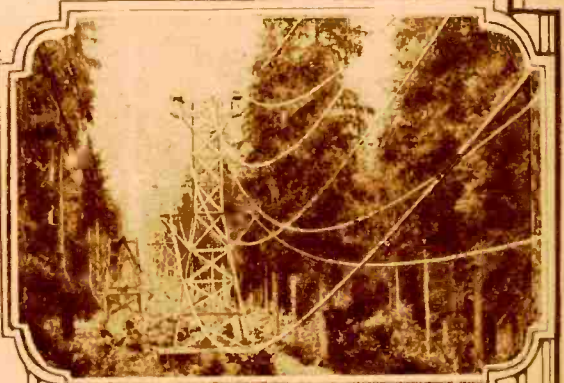
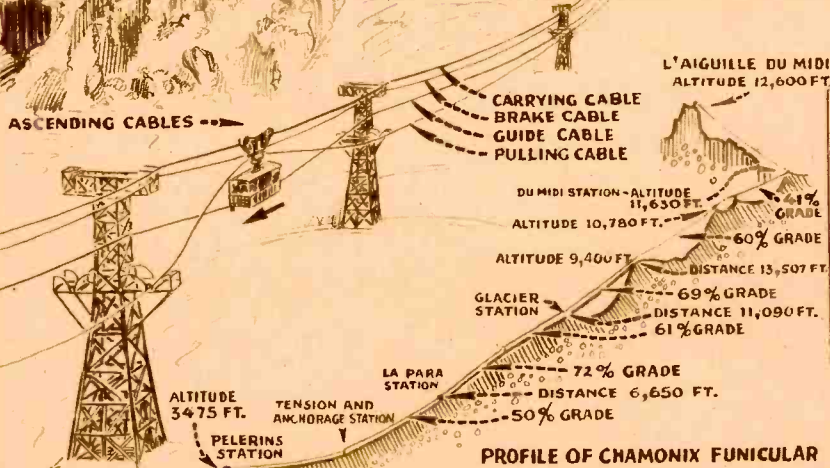
Here is the lower station of the line in the process of construction. Below to the left, the sketch gives an idea of how the car will appear running up the cable carriers. Also, the illustration gives a graphic depiction of the steel tower supports for the cables and their method of suspension. The small sketch at the right shows the cable counterpoise, weights and the method of attaching the power cables to the motor.



L'AIGUILLE DU MIDI TERMINUS



DU MIDI STATION



Here is shown a section of the aerial railway already completed graphically illustrating how the route passes over extremely rough country. No little difficulty was encountered in transporting the various materials.



A marvelous clock dating from the time of Caesar which would probably cost \$350,000 were it constructed today. The Roman day was divided into twelve equal periods as was the Roman night, making the hour of every day of a different length. This clock compensated for all these changes.

Marvelous Roman Clock

BY CHARLES BEECHER BUNNELL

THE subject of our painting is "Watching the Clock." The Clock of our illustration is a Greek Water Clock, invented 280 years before Christ, by Otesibus of Alexandria, and described by his son, Hiero of Alexandria in four books written about that time. Just after Caesar's death Vitruvius wrote a treatise on Clocks. The Vitruvius Clock as it now stands—registers nearly the "sixth hour" of Roman time—which would be nearly quarter to Twelve (meridian) June the 16th. The Romans divided daylight into twelve equal parts—and darkness into twelve equal parts—which they termed hours. In Summer that made

the Roman hours 75 minutes long and in winter they were 45 minutes long. Summer nights the hours were 45 minutes—so that when the minutes of their 24 hours were added together—they were precisely the same as ours. A clock of our illustration owing to the fine almost indiscernible Mosaic Work, would cost to-day at least \$350,000 and require a long time to make.

This method of keeping time really amounted to a daylight saving plan which was accomplished by a variable tubular dial which divided daylight (sun-up to sunset) into twelve parts, termed hours. In winter each hour was approximately 45 minutes in length, from December the hour increased its

minutes until June, when it became approximately 75 minutes long. Then from June it decreased in reverse to December. In all these variations the sum of the variable day hours and night hours were equal in minutes to our 24-Hour Day.

The Roman time followed the Sun coinciding astronomically, physically, mentally and conveniently so there was real harmony throughout the whole empire. Dinner time was always in the middle of the day—and the length of the hours corresponded to men's strength at the season of the year. Thus there was no confusion or profanity through the misnomer we call the present day-light saving time movement.

Dragon Reproduced for German Film

By DR. ALBERT NEUBURGER



Siegfried first beholds the dragon. It actually crawls down the ravine.

POSSIBLY the most beautiful as well as the most well-known legend of the German people is the Nibelungen, and one of the most harrowing episodes in the legend is Siegfried's fight with the dragon. Wagner immortalized the legend with his series of operas, "Das Nibelungenlied." A German film company recently brought out a movie production of the myth complete in every detail. Of course the climax of the film comes when Siegfried slays the dragon. The dragon itself is a masterpiece of stage mechanics. In the photograph at the top of the page is shown the dragon at the spring snorting flames of fire and steam in an attempt to slay Siegfried. The other photographs illustrate different episodes of the fight. The diagrammatic sketch at the bottom shows the way seventeen men were used to operate the huge dragon built on a steel framework and covered with canvas. It was operated entirely by human power. The eyes flashed, the paws smote the stones and the nostrils gave forth venomous streams of fire and steam. Note how four men operated the feet and how men with systems of pulleys and cables switched the tail and the head.

HAND OPERATED DYNAMO FOR LIGHTING EYES AND INTERIOR

MAN SITS AT CONTROL BOARD, FLASHING LIGHTS, AND HANDLING BREATHING APPARATUS AND JETS OF FLAME FROM JAWS

SUCTION AND FORCE PUMPS FOR MAKING BREATHING AND SNORTING EFFECTS

DIRECTOR

MAN WAGS TAIL WITH SYSTEM OF PULLEYS AND LEVERS

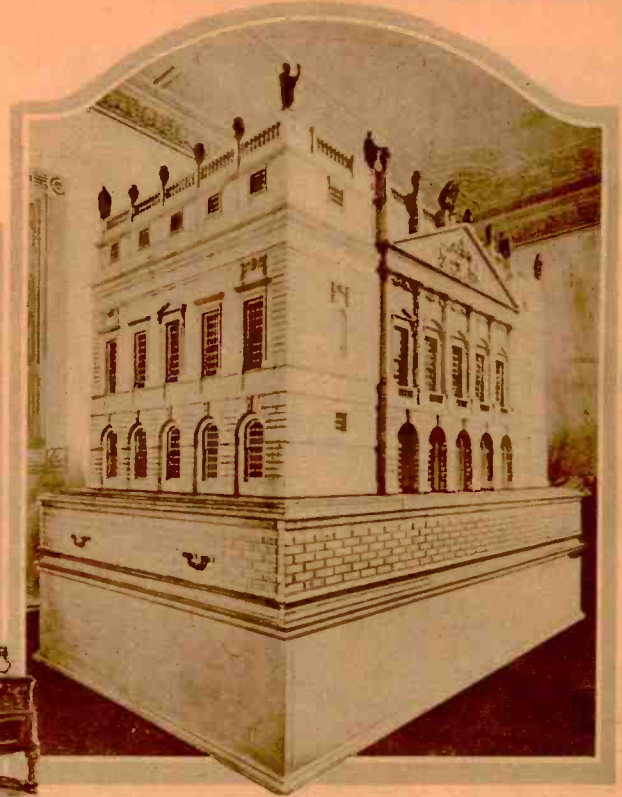
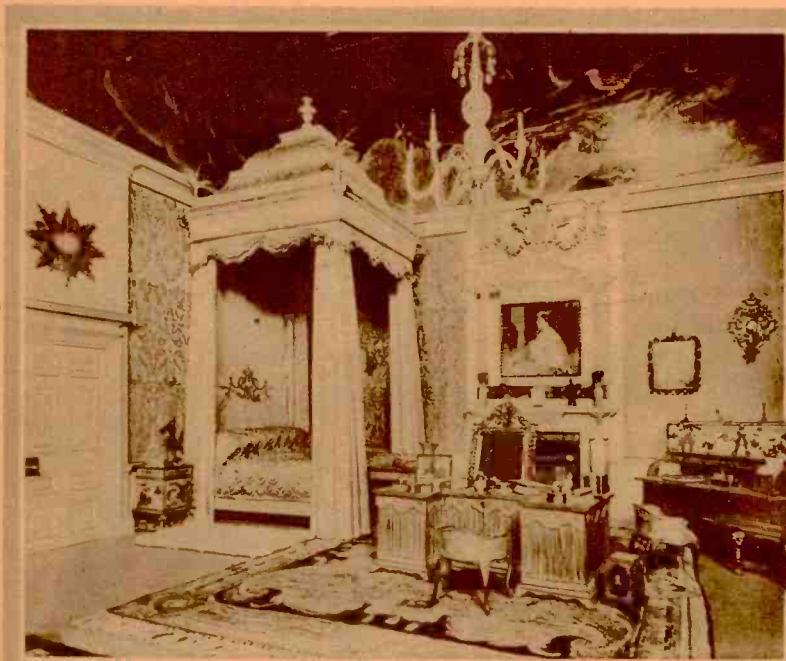
MEN WALK IN OPENINGS IN BELLY AND PUSH DRAGON ALONG

MEN MOVING HEAD AND NECK
MAN STANDS IN EACH LEG AND MOVES IT



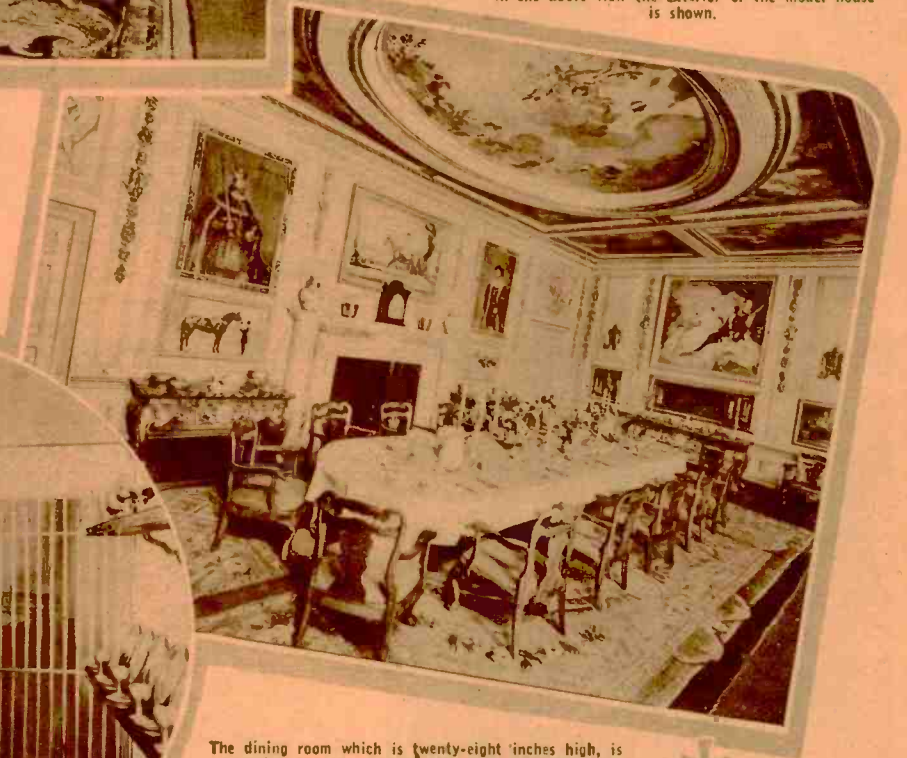
A close-up view of the dragon after having a drink. It is so realistic and so perfectly operated, that water can be plainly seen dripping from the animal's mouth.

The Queen's Doll House

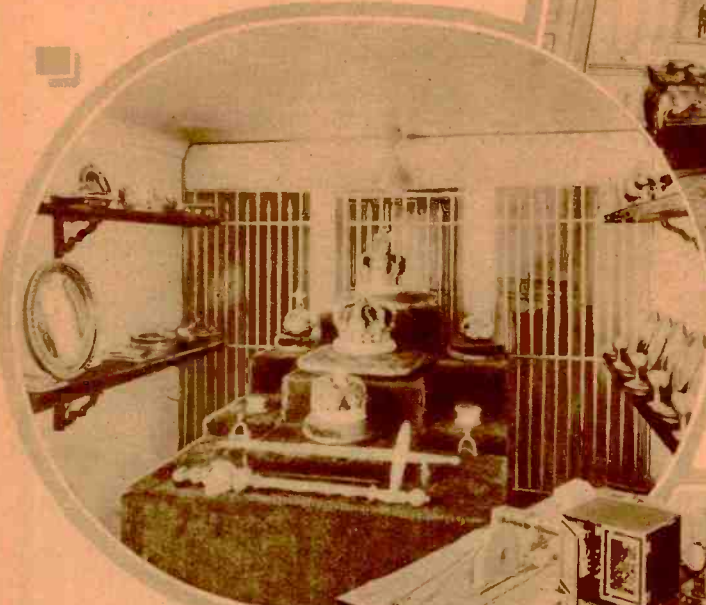


In the above view the exterior of the model house is shown.

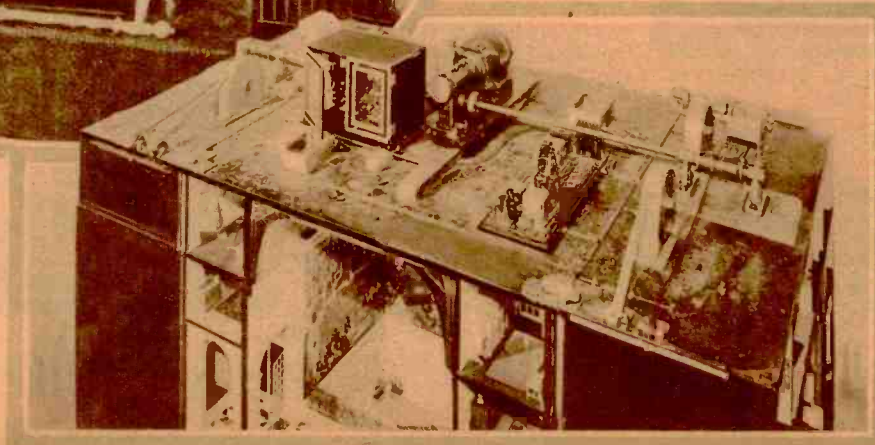
In order that our present day methods of building may not be lost to future generations, Sir Edward Lutyens, an Englishman, has designed and built this model house containing all the best in architecture, mechanical conveniences and interior decoration that can be found today. The complete model measures eight feet six inches long, five feet deep, and about eight feet high. There is a tiny garden, as well as a complete garage with small models of automobiles. Above is shown an interior view of the Queen's bedroom. The ceiling is only twenty-two inches high, yet the gray silk hangings, the walnut furniture, and even the blue enameled toilet set, as well as a small photograph of the King, are exact replicas.



The dining room which is twenty-eight inches high, is complete even to quarter inch high salt shakers.



The house is complete even to a strong room which holds the crown and sceptre, as well as the plate. These are made of real gold studded with extremely small jewels, and are excellent replicas of the original, although only about one-tenth their size. Different firms throughout England furnished the various bits of work and materials that went into the house. Prominent artists did the interior decorating. The bedroom is by Glyn Philpott.

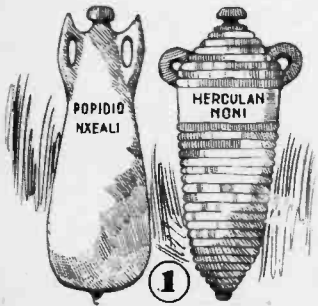


The mechanical details throughout the house are complete. At the left is shown the motors operating the elevators, and the miniature electric plant and the refrigerating unit. There are electric lights in every room, complete mechanical equipment for the kitchen, in fact every modern convenience which is embodied in all the newer large homes. After the exhibition this house will find its way to a museum where it will remain as a record to all future generation.

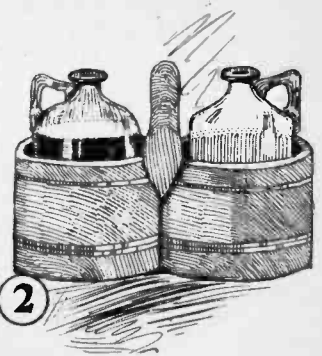
A Hotel of Pompeii

Some Adjuncts of the Ancient Hostelry

BY CHARLES BEECHER BUNNELL



1 Above is shown two wine jars of ancient Pompeii. The name of the vintage was inscribed with a needle on the front of the jar in ink in a space provided.



2 Cooling by evaporation was used in Pompeii, as shown by the above illustration, where the jars to be cooled were set in porous clay baskets filled with water.

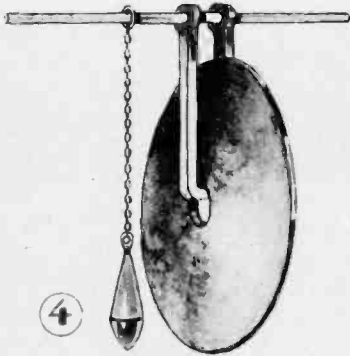
THAT some of the most perfect bronze and copper work of the world was done in ancient Pompeii, has long been known. Some of their work used in inns and hotels, is illustrated on this page. From these bits it will be plainly seen that even in those times, workers in metal were masters of their craft. Not only in metals but even glass and in some degree in paint were these ancients our equals. Many of the forms of the utensils shown on this page differ materially from their present day forms, but the similarity will be at once obvious and the development of the present day style from those that obtained in the thriving days of the ancient Roman city can be traced. Each of the pieces of apparatus illustrated on this page found some definite use in the ancient household. In some cases novel ideas were employed that might be used even today.



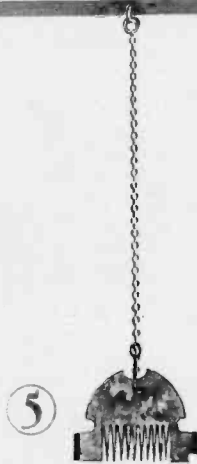
7 They drank their morning coffee in those days out of a glass cup and saucer, one of which is shown in the above illustration.



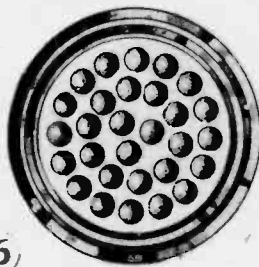
3 Above is shown a street corner traffic bell, many of which were used in the ancient Roman city. They were rung by travelers at night.



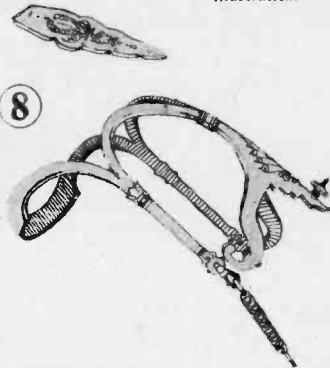
4 In the yard of the inns was usually suspended a gong similar to the one above. The late traveler announced his arrival by ringing it.



5 A bronze comb with its chain suspension. This toilet article was richly inlaid with designs in silver, making it highly decorative.



6 Seemingly the Pompeians had to have their three minute eggs just as we do today. Above is shown the dish in which they cooked them, each egg having a separate compartment.



8 Solid bronze bridles were in vogue among the aristocratic equestrians of Pompeii, as shown by the above bridle which was excavated—like all the other utensils shown on this page—by historians working on the location of the buried city.



9 Women guests of the hotel were supplied with a nail file similar to the one shown above. Like the comb it was made of bronze with inlay work on its back.



10



11



12

Here are three small effects showing that the ancients even as we moderns like entertainment. At the left is a "dead head" or complimentary theatre ticket. The center one is for orchestra, and the one at the right is for "nigger heaven."



14

A bronze razor—used only by noblemen—is shown at the left, while a thimble of the same material is shown above.

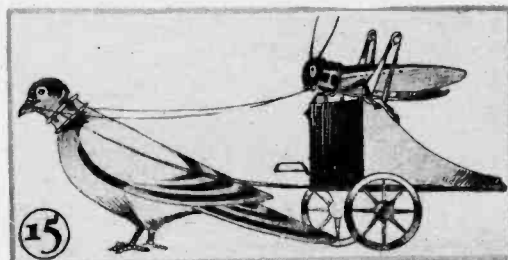


13



16

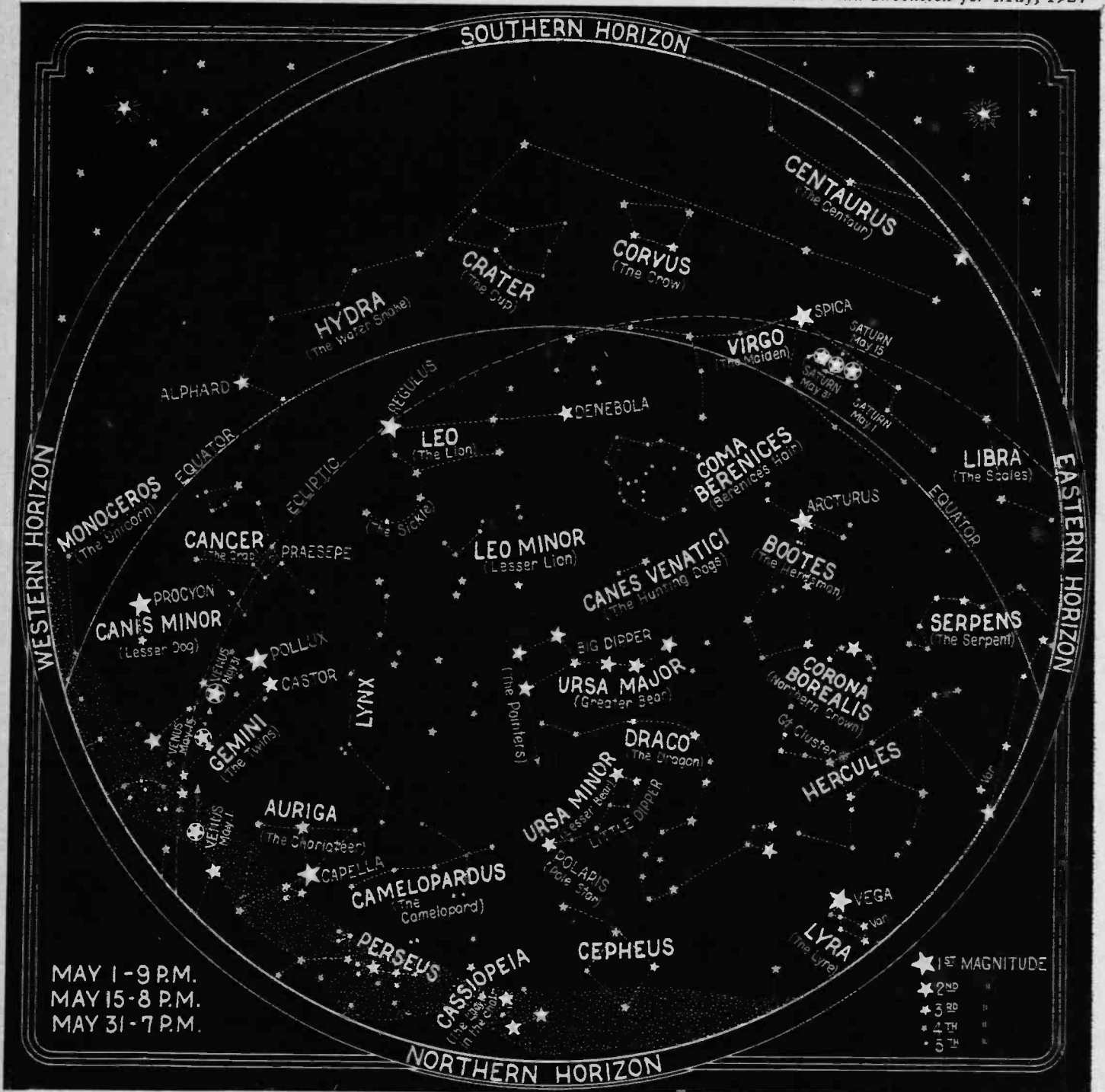
Gamblers in those days were as crooked as they are today. Witness the loaded dice shown above. Also there were anglers—witness the fish hook at the right



15 Above is a reproduction of a mural decoration found on the wall of a small Pompeian inn.



17



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

The Heavens in May

By ISABEL M. LEWIS, M.A.

of the U. S. Naval Observatory

BY nine o'clock in the evening the first of May, or an hour earlier on the fifteenth, the Big Dipper will be found on the meridian, due north at its highest altitude above the pole and the best placed for observation. Cepheus and Cassiopeia are now in the position in which the Big Dipper was to be found six months ago below the pole and close to the northern horizon, so that these two groups are no longer to be seen to advantage. Leo, the leader of the more conspicuous of the spring groups, is now a little to the west of the meridian. Its distinctive sickle-shaped group of stars containing Regulus, its brightest star and one of the twenty

brightest stars in the heavens, will aid us in locating this constellation.

In the days when the astrologers held sway over the masses and played on their ignorance and superstition Regulus was considered to be exclusively the star of royalty, wealth and fame being held to be the heritage of those born under its influence. Cor Leonis, The Heart of the Lion, was also a popular name for this star. Regulus is one of the least brilliant of the twenty leading stars. It is somewhat fainter than the standard star of first magnitude.

Denebola at the tip of the lion's tail is a star of the second magnitude, and with the first magnitude star Spica in Virgo and

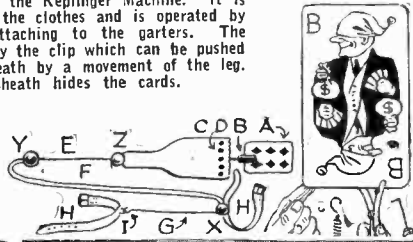
Arcturus in Boötes forms the large equilateral triangle that is always associated with the early evening hours of spring. Spica, which is slightly brighter than Regulus, is bluish-white in color and is one of the hottest and most brilliant of the stars, its surface temperature being probably in the neighborhood of 10,000 degrees. Its brightness is estimated to be about 2,500 times that of the sun. Its distance from the earth is probably between 150 and 250 light years.

A little to the northeast of Spica we will find, in the position indicated on the chart, the planet Saturn which appears as a brilliant, yellowish, first magnitude star brighter

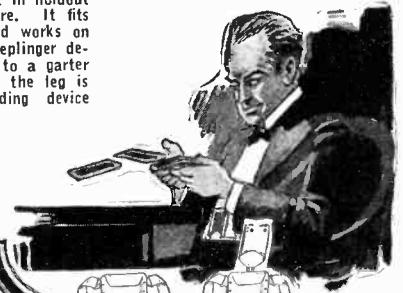
(Continued on page 107)



Here is shown the Keplinger Machine. It is put on under the clothes and is operated by the strings attaching to the garters. The card is held by the clip which can be pushed out of the sheath by a movement of the leg. The sheath hides the cards.



The latest development in holdout machines is shown here. It fits under the trousers and works on the principle of the Keplinger device, cords being run to a garter about the leg. When the leg is moved the card holding device rises up.



Below is shown a modification of the table bottom suction type of hold-out. The only difference between this piece of apparatus and that shown on the opposite side of the page is that this one is equipped with a bent wire to hold the cards instead of the spring clip.

Below is one of the more simple methods that may be used when the gambler is playing with a bunch of suckers with whom there is little danger of detection. The rubber bulb which is held beneath the table by suction has a spring clip which grips the cards being held out.

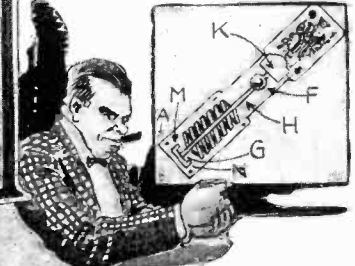
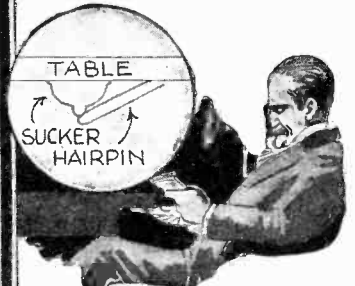
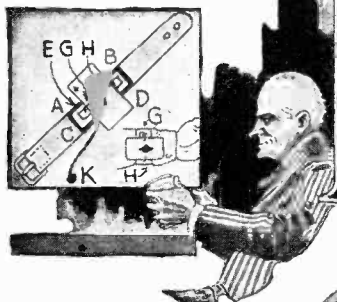
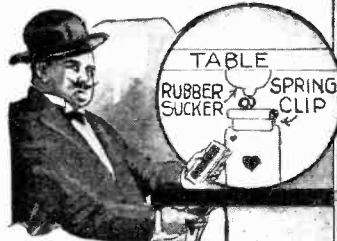
A Gambler's Tricks Exposed

BY MARK MELLEN

The Man Who Fooled P. T. Barnum

THIS month a number of "hold-out" schemes are shown. The value of this procedure to the professional gambler is obvious. In a poker game, with the use of one of the pieces of apparatus shown on this page it is possible for the expert to collect two or three aces by holding them out each time he is dealt one. He conceals his cheating by the methods shown. It is necessary that the apparatus used conceal the cards while they are being held out of the deal. This method is slow and does not always net the gambler a large return unless there are enough good hands around the table to make the betting good. It has the advantage, however, of being a comparatively safe method of beating the laws of chance. I show several more or less well-known—among the professionals, at least—devices and their system of operation. They are mostly extremely hard of detection. The surest check is a count of the deck. Those shown at the top of the page are the best.

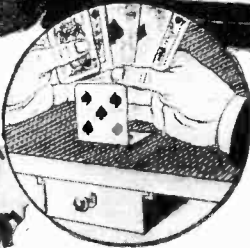
—Mark Mellen.



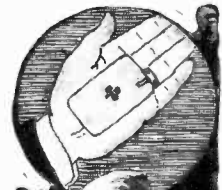
One of the old time methods—and one that still has its adherents among the elite—is that shown above. It consists of a pair of movable clips held in a brass slide which is fixed to a leather arm band. The device is put under the coat. The clips come through the cloth of the coat. An extension lever opens and closes the clips to take the cards and hold them while the cheater is waiting. The lever is designated at K. The strap goes around the arm just enough above the wrist to keep it out of view of the other players.



One of the more elaborate pieces of apparatus to be installed in the sleeve is shown above. The Jacob's-ladder extension works by a spring which is controlled by the ball F. The gambler, by allowing his arm to rest heavily on the table presses the ball forcing the extension down into his hand. He then inserts the card in the clip provided and releases the pressure whereupon the spring exerts its action carrying the card within the lining of the sharp's coat sleeve.



In gambling houses one of the most prevalent forms of hold-out apparatus is the type shown above. The table, at first glance appears to be an ordinary poker table equipped with a chip slot at the banker's position. On examination, however, it turns out that the brass plate forming the chip slot is movable downward and is held in place most of the time by springs. The cheater simply places his cards to be held out on the plate and presses down. The cards are dropped out of sight into the hold-out. To bring them back he simply presses down on the plate and the springs do the rest.



Here is one of the most simple of the types of hold-out apparatus. It is nothing more than a shoemaker's awl with a piece of spring steel attached to it so that when the awl is stuck into the bottom of the table the spring will hold the cards between itself and the bottom of the table as shown. Right—another type of sleeve hold-out.



One of the simplest methods known is that of the palm hold-out. The only trouble with it is that the gambler using it must be a sleight-of-hand performer to operate successfully. It consists of a thin strip of cellulose inserted under a ring which holds the card between itself and the palm of the player's hand.

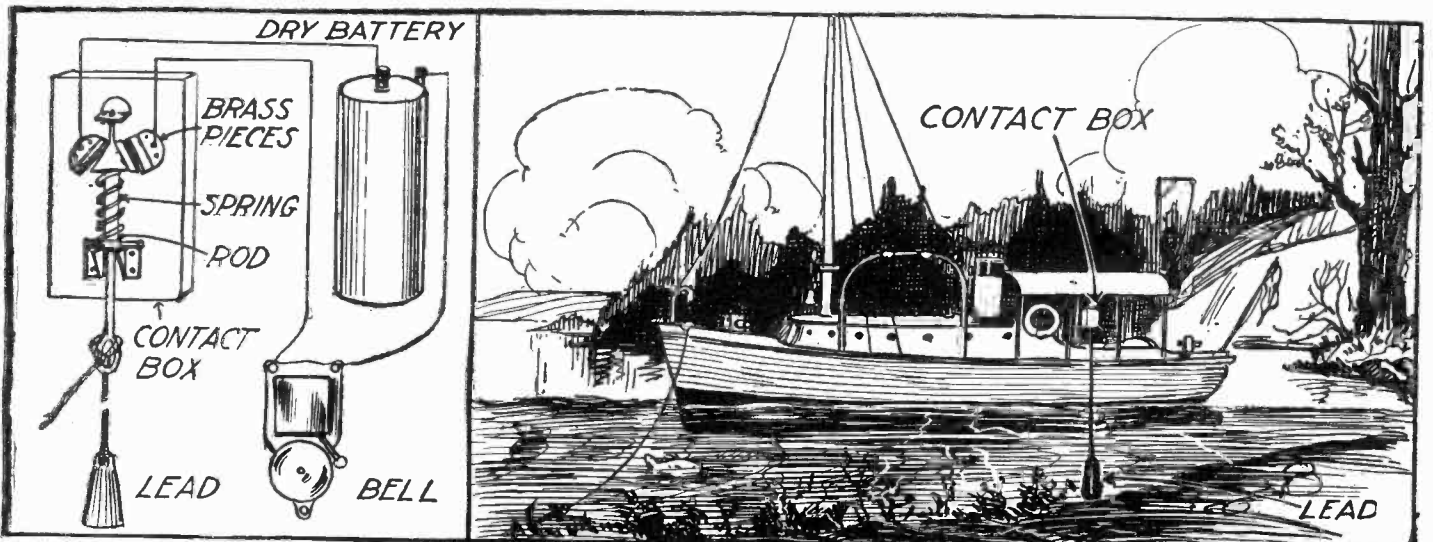
CHEMICAL HOT WATER BOTTLE



The heat produced by the oxidation of iron filings is the heating element of this hot water bottle. The form of the bag is the same as that conventionally used except the bottle has a flap which covers the outlet. The mixture in the bag consists of iron filings

and an ammonia salt which is added to hasten the heating process. It is only necessary to pour three ounces of cold water into the bag and then knead it for a few minutes in order to produce a temperature high enough for use medically.

Electrical Watchman For Boats

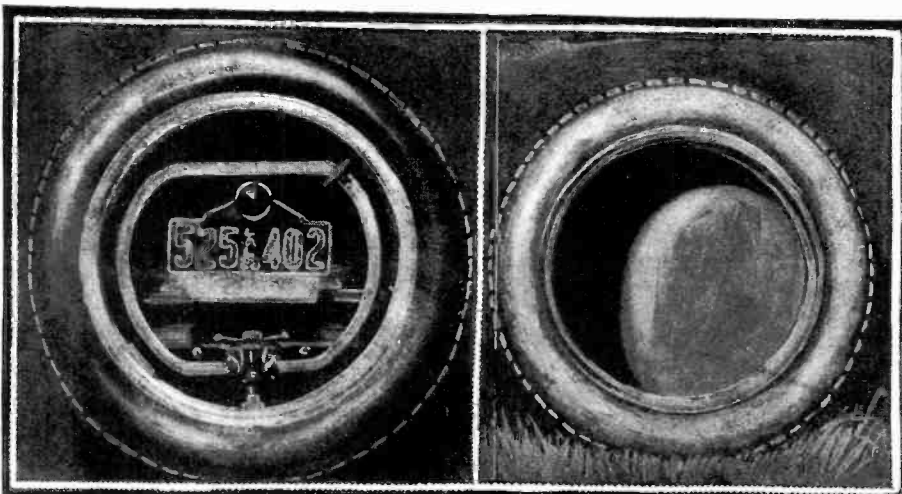


By the simple expedient of attaching a pair of contact points to the lead-line of a motor boat the danger of the boat's running aground or being left high and dry by an out-going tide is forestalled. The arrangement for attaching this electrical watchman to the boat is shown in the above sketch. It also may be used while the boat is running in strange

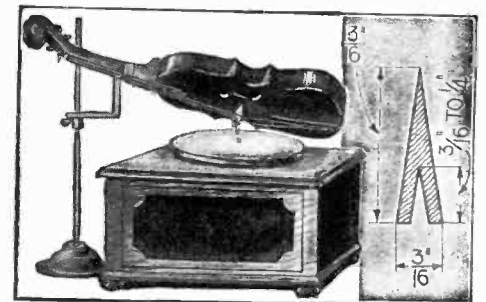
waters and is in danger of going aground. When the keel of the boat comes too close to the bottom of the stream, the lead-line is slackened and the contact (shown in the sketch to the left), is closed by the spring forcing it up against the two lugs, causing the alarm bell to ring.

—Carl Bjork

For Clean Tires



Violin Phonograph



A wonderfully full tone may be obtained from a phonograph by attaching a small hardwood wedge cut in the form shown above, to the bridge of a violin and allowing the wedge to act as the phonograph needle.

—La Nature.

If tires are painted with a solution made of one-half pint of black stove enamel and a quarter of a pint of gasoline, they will at all times present a bright appearance. This is especially useful for application to spare tires.

—E. A. K. Hackett.

Some New Discoveries

New Advances in Automotive and Medical Fields



Above is a new method of removing hair invented by Dr. Jules M. Marton of New York. This is placed on the face in the form of a mask, while warm. It is allowed to cool and the hair, which is gripped in the mask is removed with the mask. X-rays are then applied to prevent the further growth of hair.

The automobile shown below is capable of turning in its own length because it steers from all four wheels. It can be made to negotiate roads entirely too rough for ordinary cars and will climb extremely steep hills. This new automobile is driven from all four wheels, the engine acting on all of them. A four-wheel brake accompanies and completes the improvement. The principle of steering all four wheels of an automobile is by no means new to residents of large communities, as trucks using this principle are very often employed by fire departments. Here, however, the steering is usually done by two men, whereas in the case of the automobile illustrated below, the wheels are connected together in such a manner that the turning of the steering wheel acts upon all four wheels. This feature, in connection with the four-wheel drive and the four-wheel braking system, reduces skidding to a very great extent and makes for much safer driving.

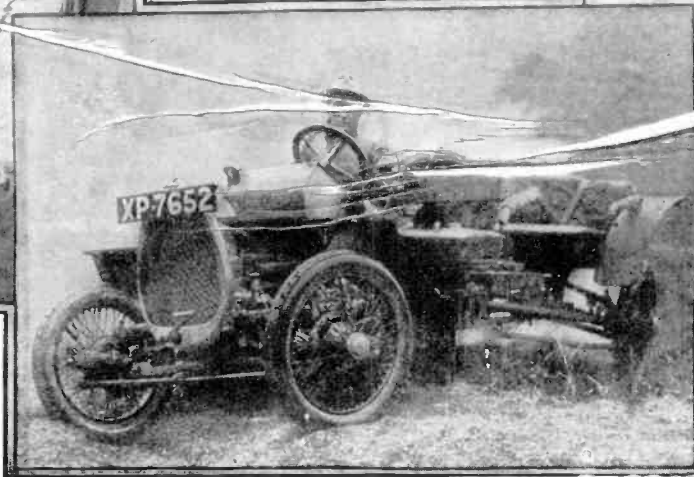
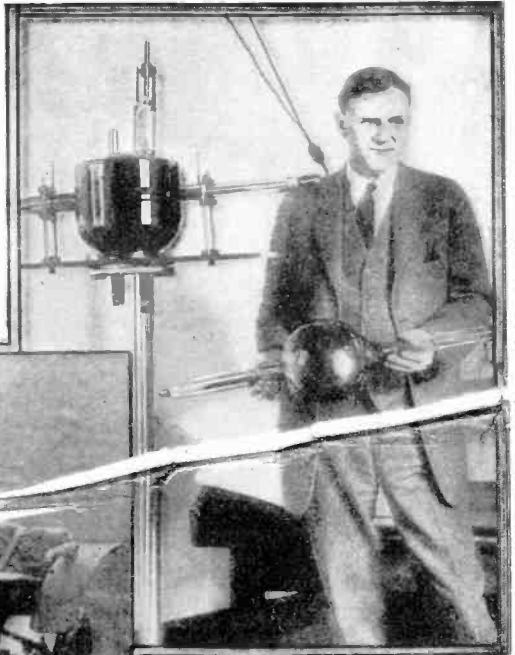
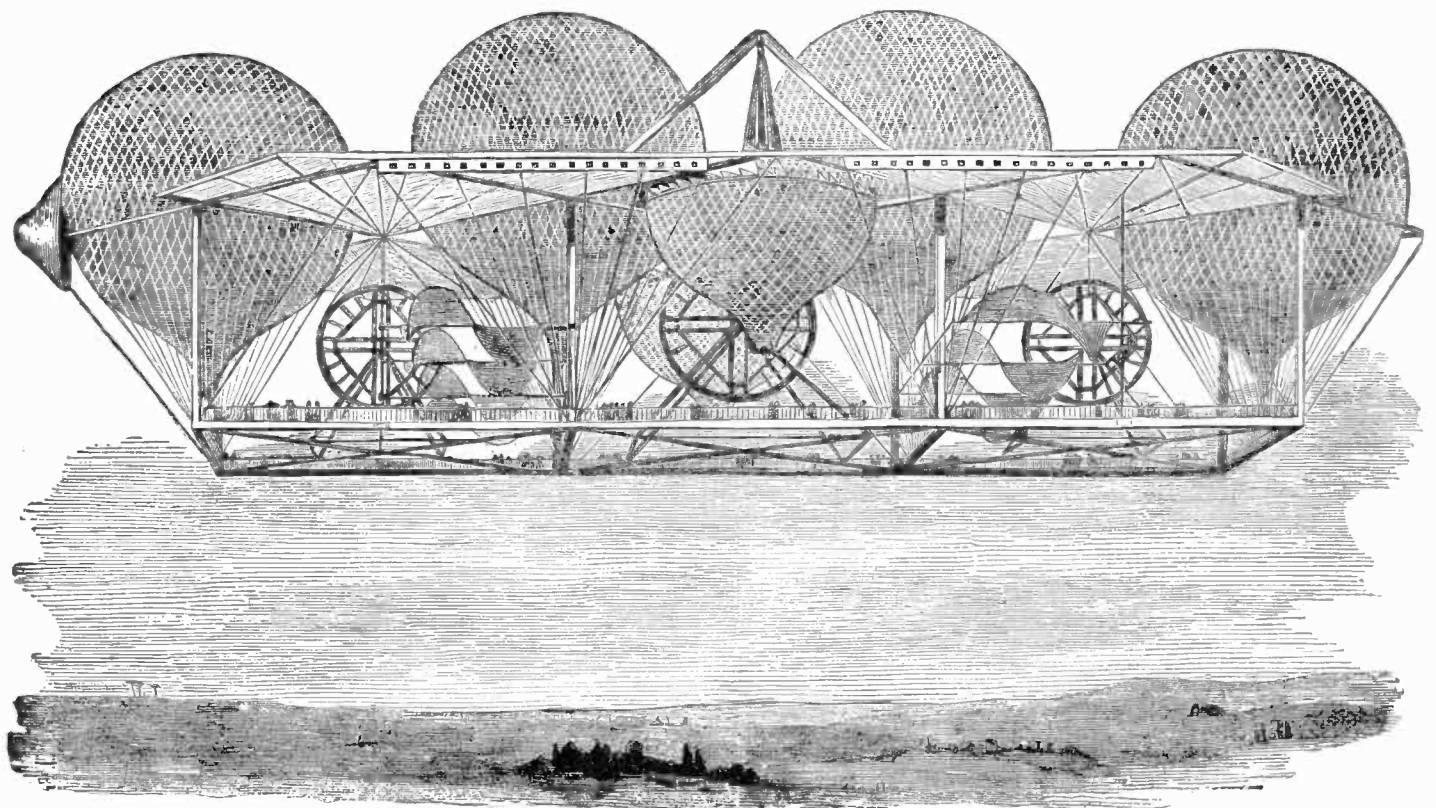


Photo © U. & U.



The above photo shows Dr. Francis C. Wood holding a new X-ray tube which is capable of giving out five or six times the power of the ordinary "modern" tube of today. This X-ray tube is to be used in the treatment of cancer. Dr. Wood is the Director of the Crocker Institute of Cancer Research of Columbia University.

Airship of Seventy Years Ago

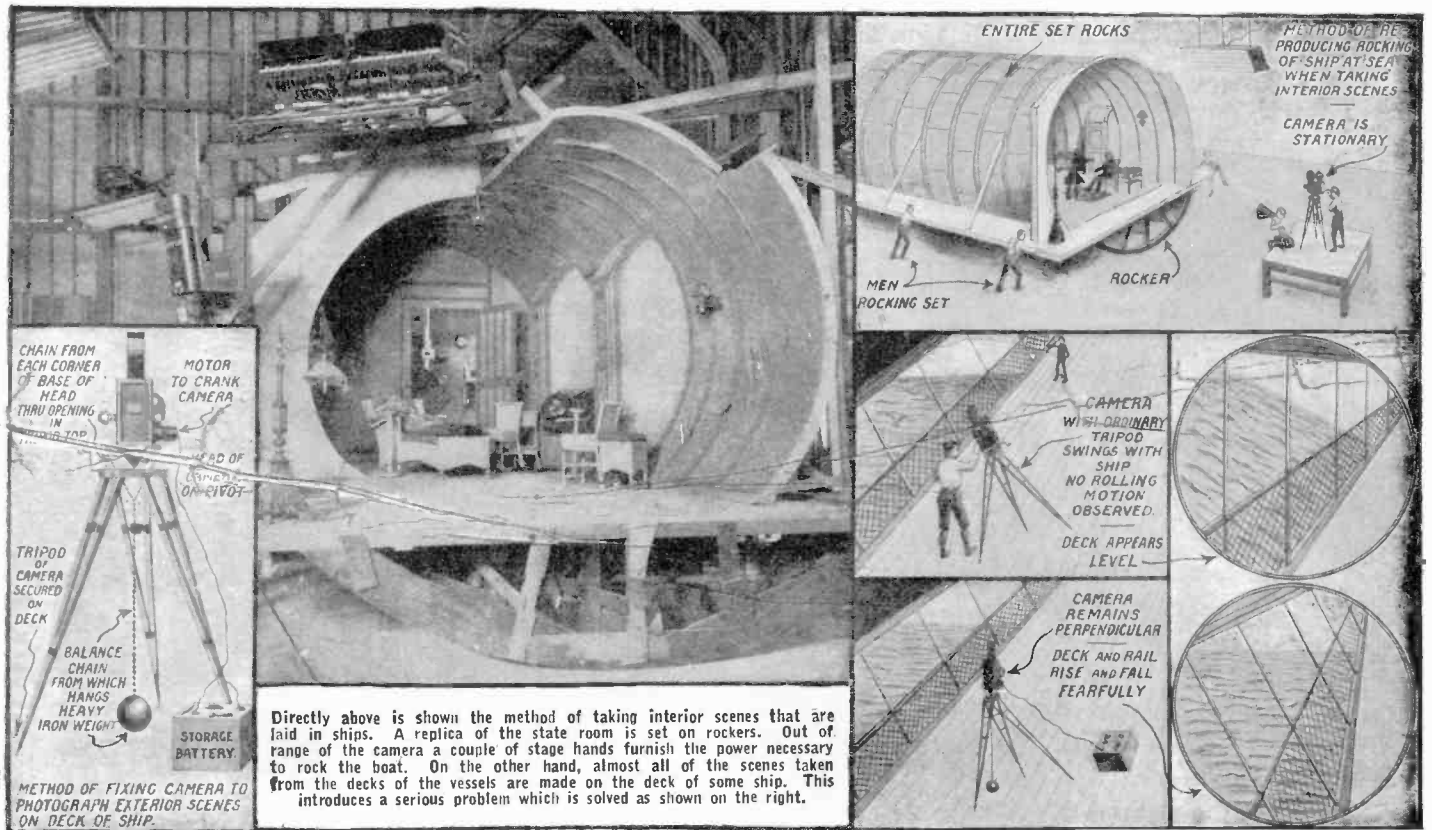


Above is a reproduction of a wood cut from "Gleason's Pictorial Drawing Room Companion," published at Boston, Mass., and which was inscribed "Saturday, Jan. 10th, 1852." It is called "Petin's Air Propeller." At this time Mr. Petin hoped to attain the long-desired

power of rendering the balloon obedient to one's will. Doubt was expressed if the thing would be ultimately consummated. The editor of "Gleason's" then asked what became of the Hoboken flying machine.
—John Foley, Reporter No. 4335.

Movie Kinks for Ship Scenes

METHODS USED BY PHOTOGRAPHERS TO GAIN REALISM



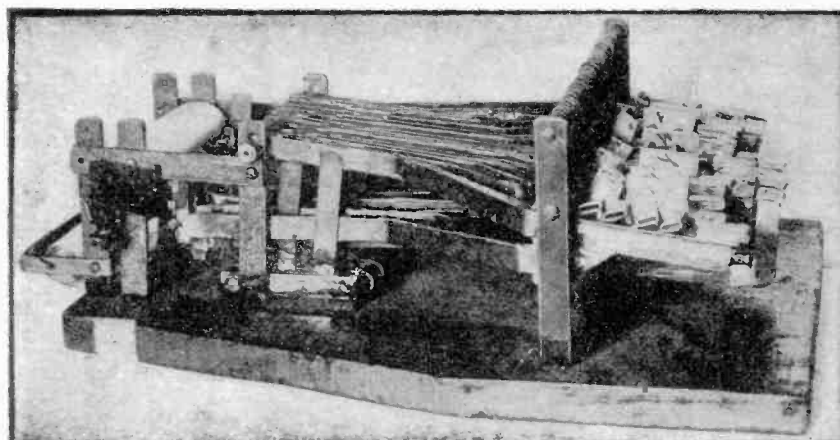
Directly above is shown the method of taking interior scenes that are laid in ships. A replica of the state room is set on rockers. Out of range of the camera a couple of stage hands furnish the power necessary to rock the boat. On the other hand, almost all of the scenes taken from the decks of the vessels are made on the deck of some ship. This introduces a serious problem which is solved as shown on the right.

The close observer at the movie where a number of the scenes are laid on shipboard will notice that in some cases the picture on the screen depicts the sea as moving up and down while the deck remains practically level at all times. In other productions, however, he will note that the deck rolls while the sea remains practically level. This last method will produce so real an effect of the rolling of the ship that the landlubber sitting in a warm, quiet picture theatre will almost become sea-sick at the view cast on the screen before him. The method of obtaining this natural effect is graphically shown in the arrangement of the camera in the inset at the extreme left and in the lower right picture.

By making the tripod fast to the deck, as shown, and supporting the camera on a universal joint, which camera is held horizontal at all times by a heavy weight suspended from it, the actual pitching and tossing of the ship is reproduced on the screen, while in the former method where the rigid camera is simply set up on the deck of the boat, the tossing motion is translated into movement of the sea rather than actually giving the effect of the movement of the ship. In order that the camera may be cranked at a regular speed in spite of its continuous movements with the ship, a small motor is attached to the shaft of the picture machine. A storage battery operates the motor.—Phil Gersdorf.

Logotype--Writes a Word a Stroke

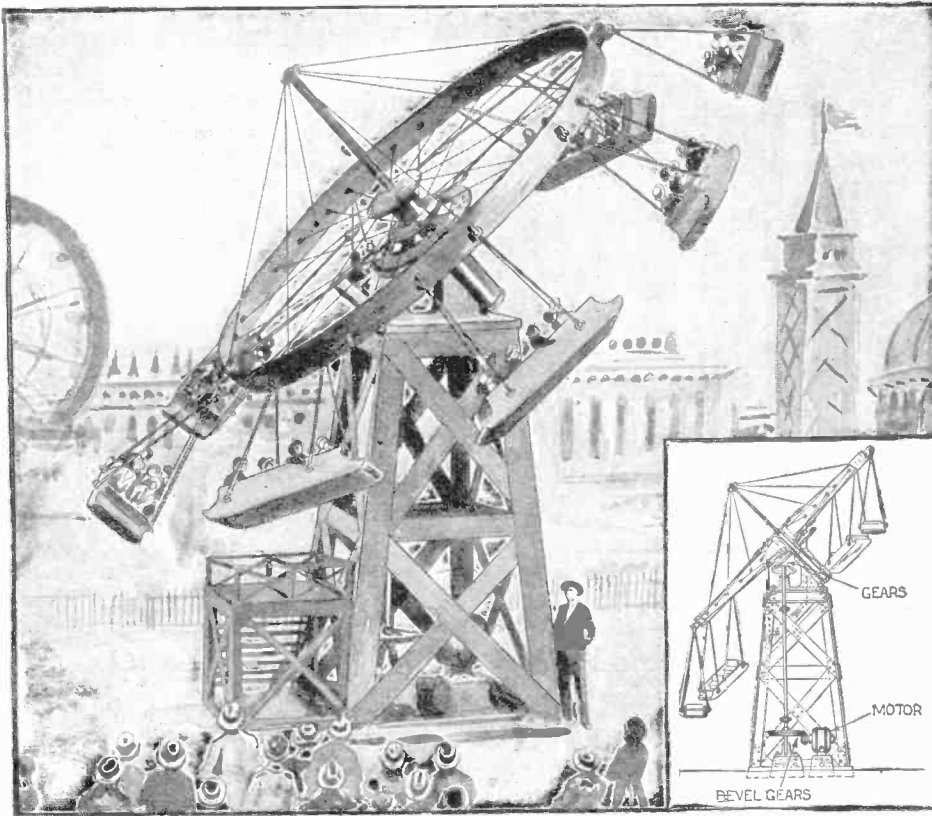
Machine for Taking Dictation Does Not Require a Code



The illustrations here show the latest advance in office mechanics. It enables the stenographer to do away with the old system of taking dictation in shorthand. By constructing the machine with type bars that always strike the same place on the paper and repeating the letters in several places across, the operator may strike as many as fifteen letters at a time. The different bars imprinting the letters do not touch. So the spaces between the letters may be large and uneven. In ordinary uses, such as correspondence, the inventor states that there is no trouble in writing with the machine as fast as the ordinary person speaks.

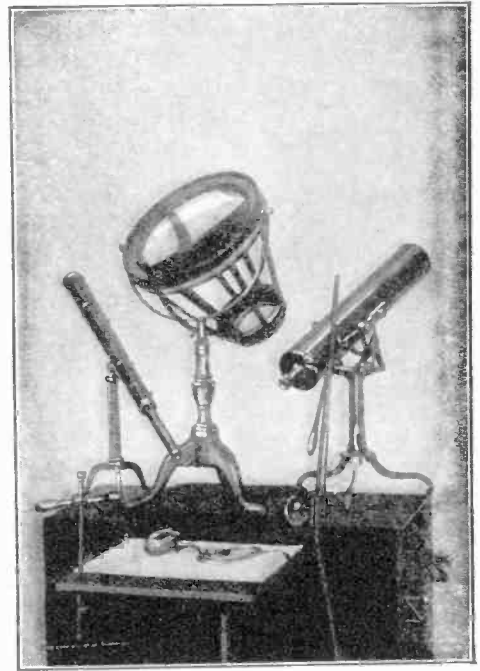
—Angus Pekerson

WHIRL AMUSES JOY-RIDERS--THEIR MONEY AMUSES ITS OWNER



It's just another weapon devised to knock the old Saturday night roll for seven goals, this glorified swing shown above. The sweetest girl in the world says "let's ride!"—You do; and the owner rides home in his limousine. But then as long as it's the s.g.i.t.w. what difference does it make? Domenico Tusso invented this machine.

NOTED SCIENTIST'S INSTRUMENTS



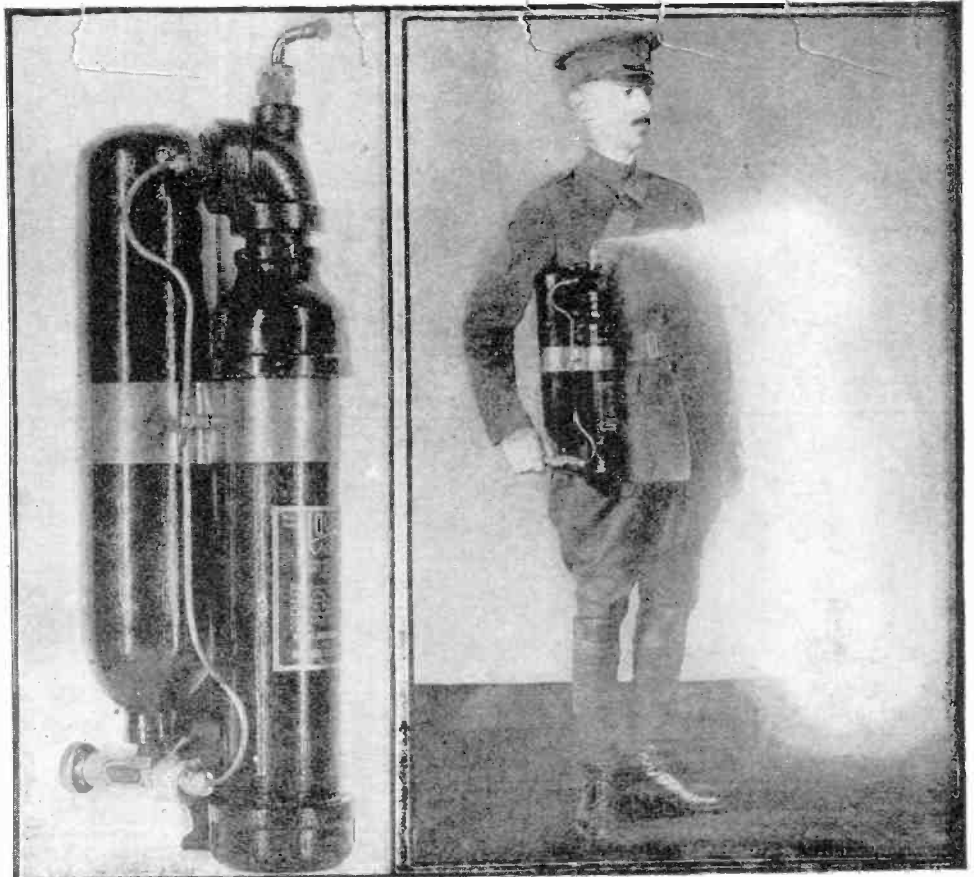
Since Joseph Priestley one day let a tube of mercuric oxide lay beneath the burning glasses shown in the above picture, we are indebted to him for the discovery of oxygen. With the burning glasses are also shown a pair of his telescopes and a flask and tube with ground necks which he used in his experiments. These pieces of apparatus which are the property of Dickinson College, Carlisle, Penn., are some of the most highly prized scientific relics in the country. The college purchased them for \$530 in 1811. —Ernest A. Vuilleumier.

PICKLE TESTER



When pickles are of a bright green color it is more than likely that they have been treated with copper, which is a rank poison. To test them for copper content it is only necessary to mash a small portion of the food into fine particles, place it in a jar and cover it with a solution of equal parts of ammonia and water. Close the jar tightly and shake thoroughly. If copper is present the liquid will be bright blue. —S. Leonard Bastin.

GAS GUN TO AID POLICEMEN IN HANDLING MOBS AND CRIMINALS



Hereafter when a mob becomes menacing a single patrolman will appear on the scene and quell them with tears, gallons and gallons of 'em—if he uses the tear gas gun shown in the photo to the right. This gun will render untenable a circle fifty yards in diameter and in war could be used against a whole company. —Ernest Jones.

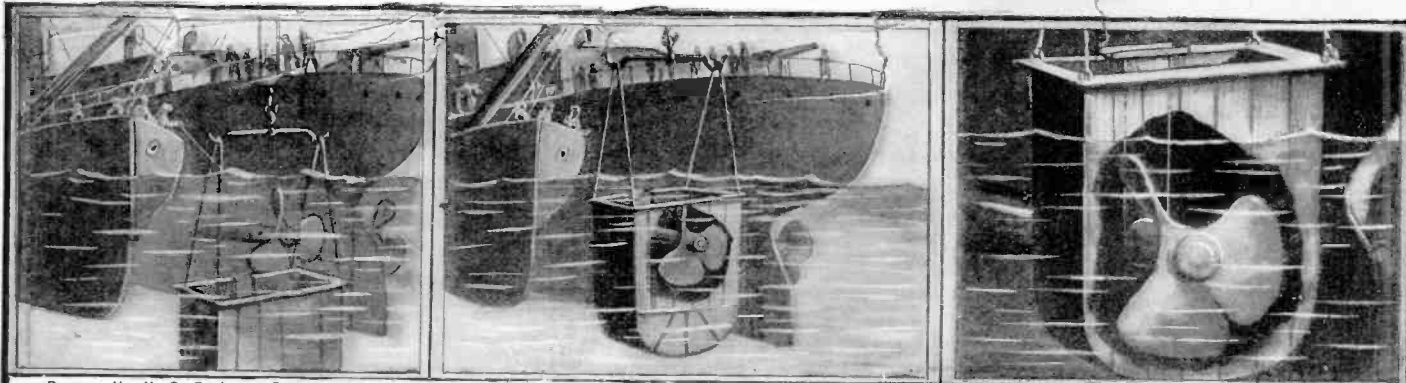
New Phonograph Teaches Languages

FOR teaching languages and other subjects where precision of sound is necessary the newly invented logophone will fill successfully a long felt want. The device is simply a phonograph equipped with an electric reproducer and an amplifier. The current carrying the reproduced voice is led to head telephones similar to those used in radio telegraphy and each student is supplied with a set of the receivers. By using this method of carrying the voice a great amount of interference that would ordinarily be caused by noises in the class room is eliminated. The reproduction of sound in receivers is much better, in cases where great precision is desired, than that obtained by use of a horn. The phonograph has a standard tone arm. The transmitter button is attached to the diaphragm where the sound actuates it instead of passing into the air circuit by the horn. Switches are provided so that the instructor may break into the circuit by speaking through a microphone at any time it may be necessary. This avoids the necessity of removing the receivers in order to hear what the teacher has to say. The phonograph disc is operated by an electric motor.

—O. F. Bond.

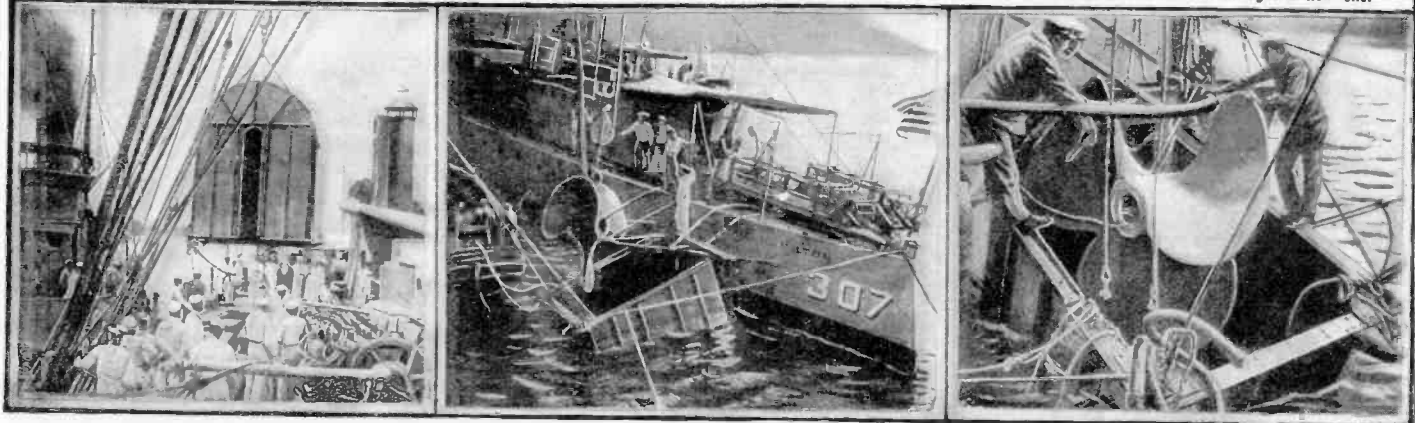


Ship's Propeller Repaired at Sea



Because the U. S. Destroyer Paul Hamilton had a broken propeller and was needed immediately and did not have time to go to dry dock, Navy engineers devised a novel method for repairing the broken screw while the boat was at anchor in the

sea. A steel caisson large enough to accommodate the screw and workmen was made and lowered in place around it. The water was then pumped out and mechanics proceeded with the work of removing the old propeller and installing the new one.



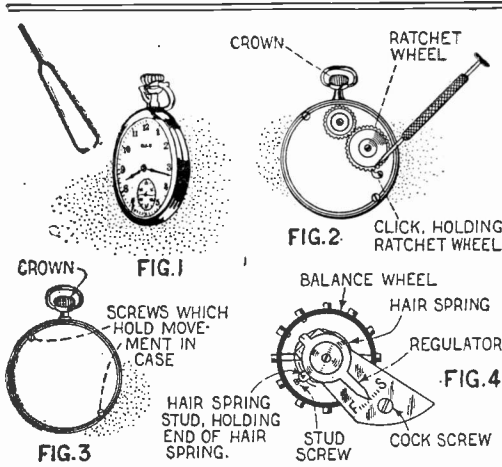
In the above illustrations may be seen the methods used in this unorthodox bit of repairing. Some idea of the size of the task may be gained by noting the size of the caisson

and the booms used in lowering it into place. The job of removing the old screw and lowering the new one into place was no small one. —Lt. Com. H. H. Little, U.S.N.

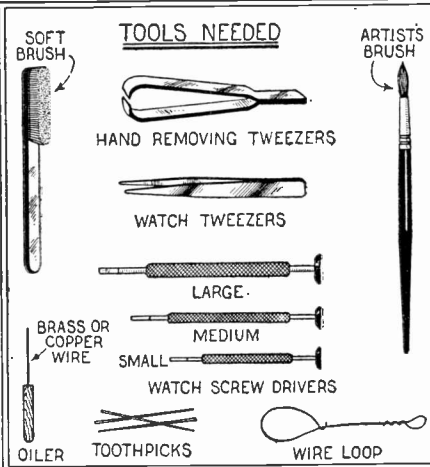
Timely Talks on Timepieces

No. 2 of a Series. Cleaning Your Watch

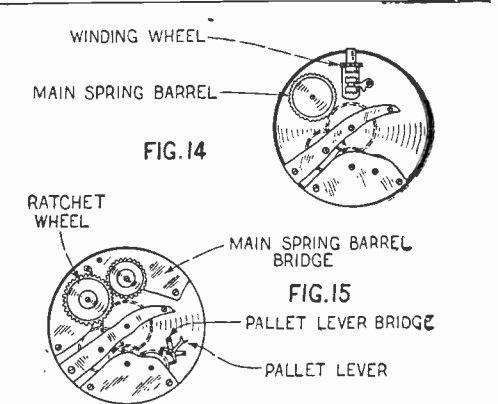
By SAMUEL BERNARD



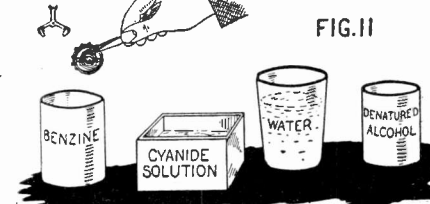
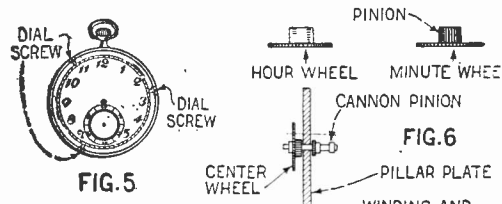
The first step in cleaning the watch is to remove the movement from the case. The hands are taken off with the aid of special tweezers, the main spring is unwound by holding out the ratchet and the balance wheel is removed.



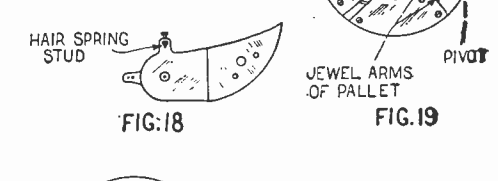
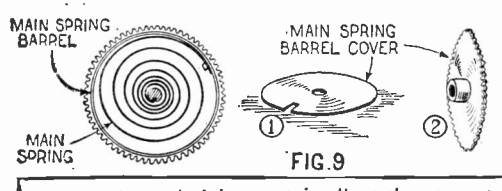
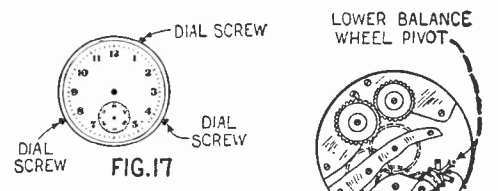
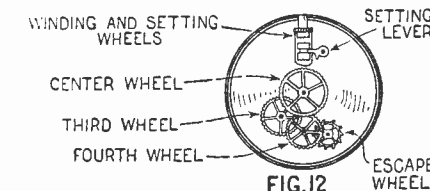
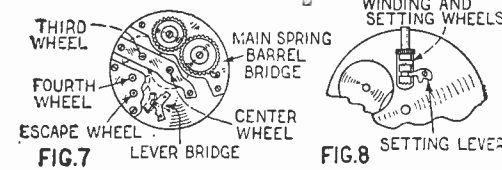
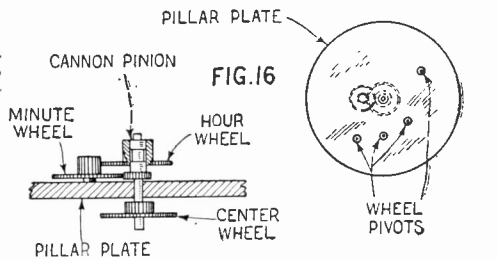
Above are shown the tools necessary for cleaning a watch. They are: three screw drivers of the type shown, brushes, a wire loop, an oiler and toothpicks.



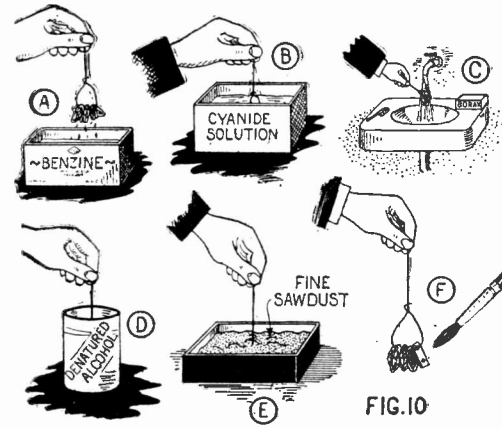
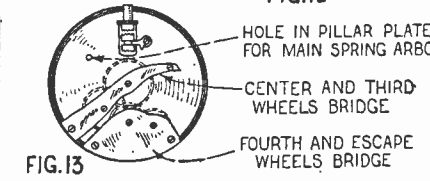
After the first two bridges have been put into place the next step is to place the main spring in position and set the ratchet. The bridge holding it in position is then put into place. Following this operation the pallet lever bridge is put into position and the pallet lever placed and adjusted. A small drop of oil is then placed in each of the cups provided with the aid of the small brass oiler illustrated with the tools. This oil should half fill the cup. All through these operations always handle the fine parts of the instrument with tweezers as contact with the hand is liable to leave a film of grease and dirt on them that will interfere seriously with their proper operation after the complete assembly.



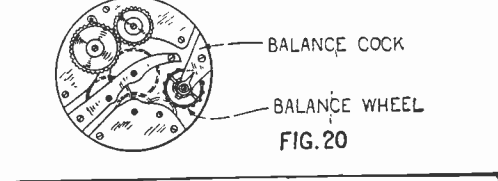
The balance wheel with the hair spring attached is dipped first in benzene, then in the cyanide solution, then in the water and then in the denatured alcohol, as shown above. Then the parts of the balance movement are carefully brushed off with the soft, full artist's brush. Be very careful with the balance and escapement.



Remove balance wheel by unscrewing the cock screw and the hair spring stud which releases the hair spring. Then remove the hour and minute wheels and the main spring with its barrel. Do not touch winding and setting lever.



With the cleaning process finished the assembly and oiling starts. The reassembling of the watch is exactly the reverse of the dismounting process. First the front plate of the watch is set in place with the center, second and third wheels in place, noting that they are all in their proper position in their bearings. Then the center and third wheel bridge is put in place and then the fourth and escape wheel bridge slipped on, care being taken as above that the bearings are all in place. The screws are put lightly in place first and later screwed down tightly.



The final step in the assembly of the watch is the placing of the balance wheel in position and the adjusting of the hair spring attached to it. The illustration above shows how it fits back into place. First attach the tiny spring to the hair spring stud which fits into the side of the cock. Be careful in this operation that no excessive strain is exerted either upon the balance wheel or the fine spring holding it to the cock. After the wheel, spring and stud are attached the wheel is slipped into place and the cock screwed lightly to the frame. See that the jeweled arms of the pallet fall in the proper position. The next step is to place the dial and hands on the watch. This is done with the three screws provided for that purpose. It would be no less than a crime to put a well cleaned movement into a dirty case. The case is cleaned by dipping it in benzene and then drying it thoroughly with sawdust and a careful brushing. After this the movement is put back into the watch with the aid of the two screws which go into the case from the rear. Enough oil should be placed on the main spring before its installation.

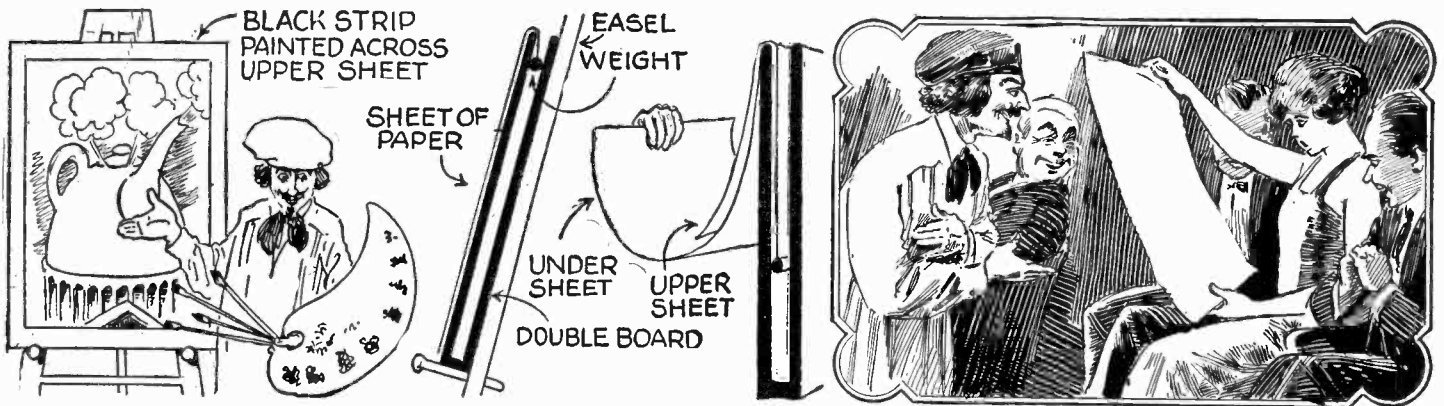
To clean all the parts of the watch with the exception of the balance wheel, hair spring, and escapement movement, the procedure outlined above is followed. The separate parts are placed on the wire loop spoken of and first dipped into a small container of benzene. Then the parts are immersed in the cyanide solution for not more than ten seconds. Following this step, they are removed to a stream of water and allowed to thoroughly rinse for about fifteen seconds. Following this treatment they are placed in a glass of denatured alcohol and then rushed to a box of very fine warm sawdust; then brushed.

WE would not think of running a typewriter without cleaning and oiling it. How much more important is it that such a delicate instrument as a watch should be carefully attended to if its operation is to be efficient. Every watch should be thoroughly cleaned and oiled at least every two years. The period should be shortened if the watch is subjected to hard wear or exceptional conditions. The method for cleaning them is illustrated on this page.

Magic for Everybody

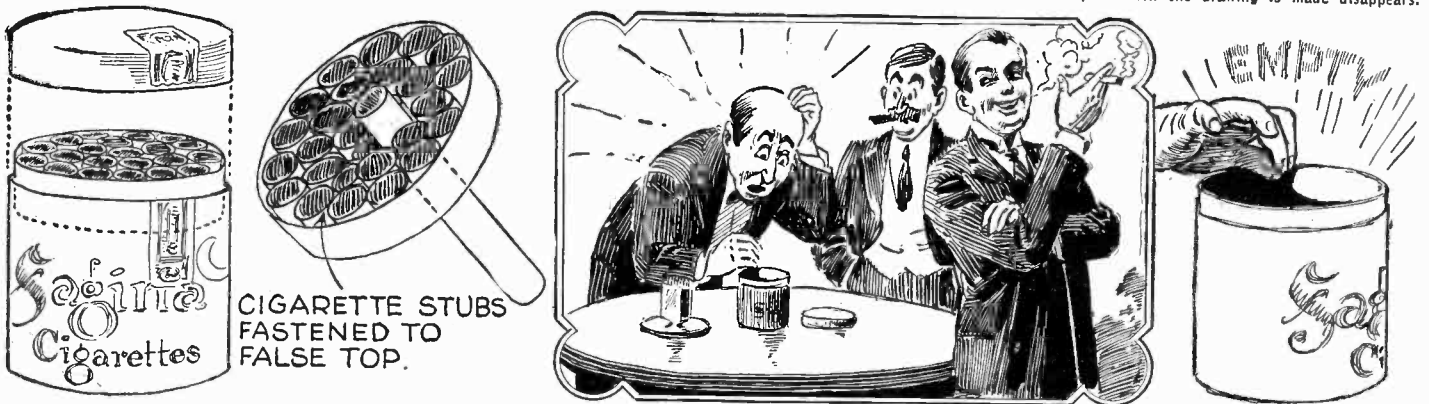
By Prof. JOSEPH DUNNINGER

NO. 14 OF A SERIES



The magician becomes an artist. On an easel a pad of paper is secured. He draws a picture upon the top sheet, and then exhibiting his work to his audience he raised the sheet and tears it off. He walks toward one of his audience and hands her the

sheet, which to her amazement is quite devoid of any sketch. The sheet of paper upon which the drawing is made is weighted and passes over the top of the easel. When the sheet of paper is lifted, the one upon which the drawing is made disappears.



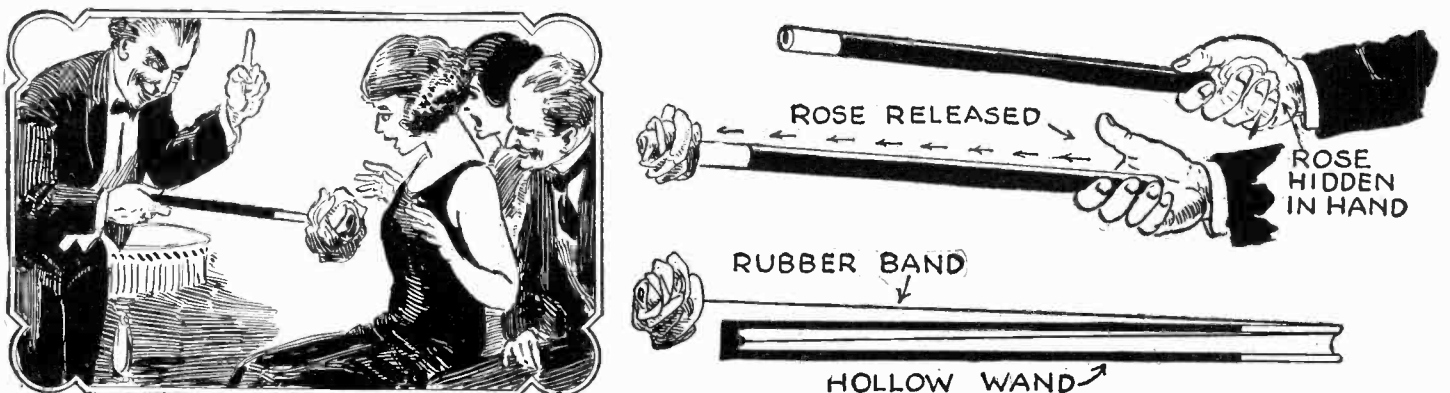
The trickster raises the cover from a box of cigarettes, takes one, lights it and replaces the cover. One of his audience is bound to remark that he is rather stingy with his cigarettes, and he informs him to help himself. When the spectator raises the cover

from the box, it is found to be empty. The box has a false cover to which cigarette stubs are glued, but contains one whole cigarette which the performer removes. This false top comes off with the cover when taken from the box by the spectator.



A glass apparently full of wine is raised to the magician's lips, but the happy grin of anticipation changes to a puzzled expression as the wine is seen to disappear before

it reaches the performer's mouth. When he brings his hand down again the wine glass fills itself. The explanation is given in the illustration above.

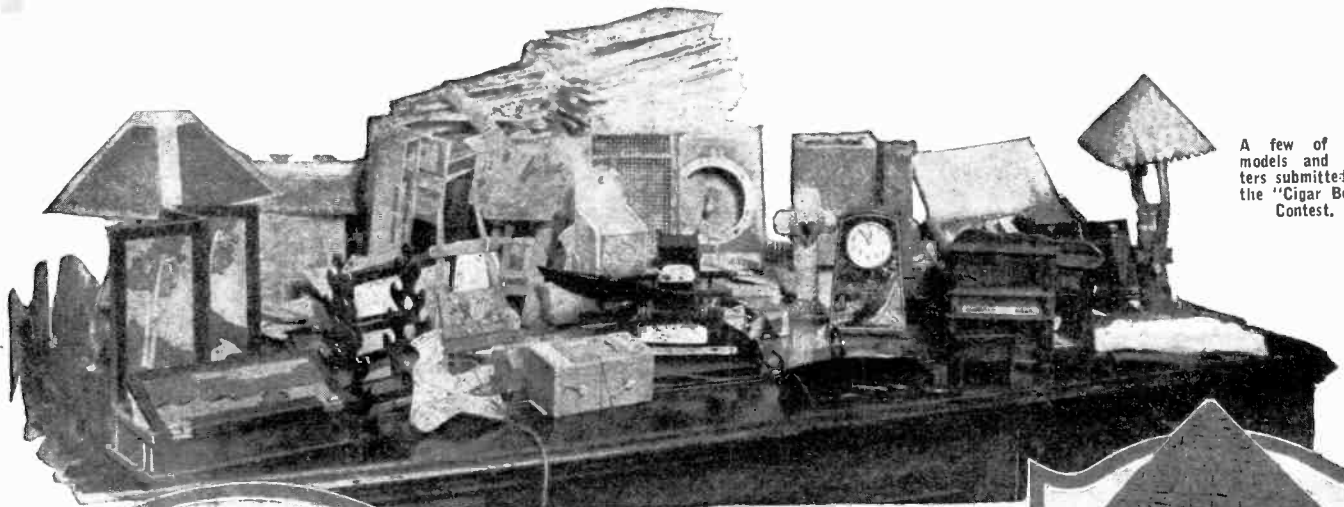


The performer tells one of the fairer members of his group of onlookers that she had better not crush the rose at her waist with her arm. She answers that there is no rose there, but he disagrees with her and passing the end of a wand forward, he with-

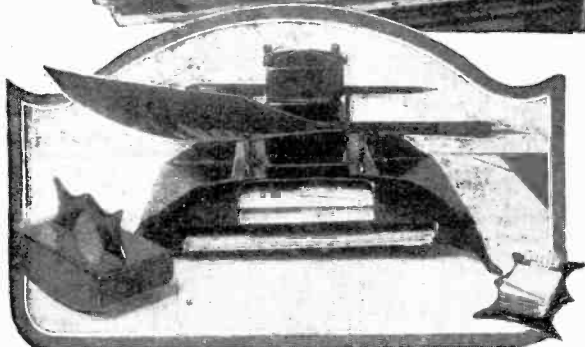
draws it, which to her amazement now has a rose attached to it. He plucks it off and presents her with it. A rubber band passes out through an opening in the wand, and is then tied to a rose which is held in the performer's hand.

\$100.00 Prize Awards--

Cigar Box Contest



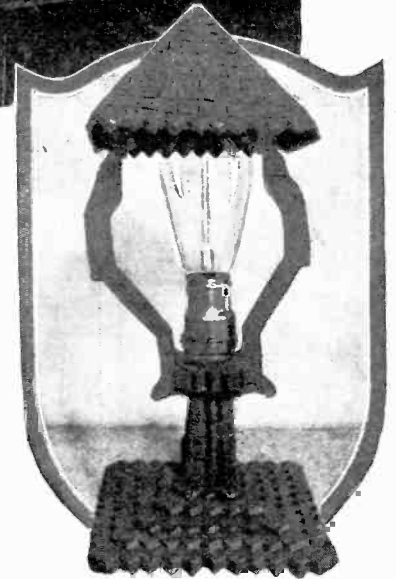
A few of the models and letters submitted in the "Cigar Box" Contest.



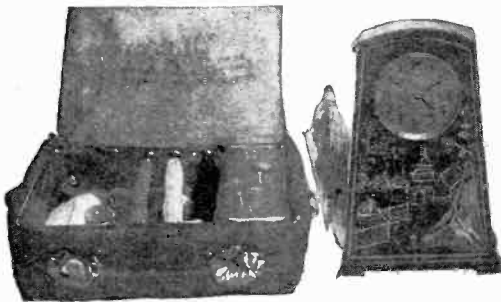
First Prize—\$25.00, for desk set. Winner, Olin Alvin Williams.

In the January issue of this magazine we announced a Cigar Box Contest, in which all the articles submitted were to be constructed of cigar boxes. The cigar boxes could be cut up or used without being cut. This contest offered a prize award totaling \$100.00 for the twelve best items submitted. Altogether there were 8,200 entries, only a few of which are shown in the photograph above. Notice the two stacks of letters in back of the models. Photographs of the prize winning models or ideas are shown on this page. Although an article and a sketch of the device submitted was all that was necessary, in nearly every event those who submitted models won prizes. The only exception to this statement is the eighth prize winning idea.

It is always advisable that readers of this magazine enter the prize contests, which are offered in addition to the \$12,000 prize contest likewise conducted by this journal. One does not have to know how to write in submitting material for any of these contests. Neither do we require finished drawings. The idea is most important and it is the suggestion of some new idea which our readers desire. Members of the fairer sex won two of the prizes. Other announcements are made elsewhere on this page.



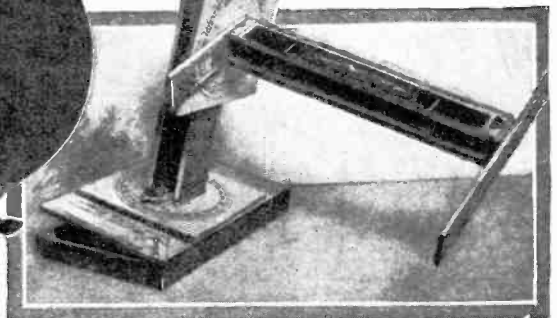
Second prize—\$20.00, for an electric lamp. This lamp contains approximately 157 pieces of wood. The outside of the shade has a veneer shingle effect. Winner, Ward Acton.



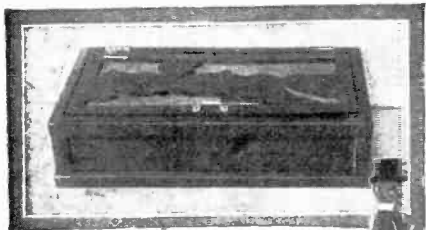
Above left, third prize—\$15.00, for sewing box. Winner, Mrs. J. W. Bowers. Right, fifth prize—\$5.00 for Japanese clock. Winner, Robert Gaskill.



Above, seventh prize—\$5.00 for climbing sailor. Winner, S. J. Cinkus.

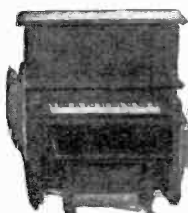


Above, fourth prize—\$10.00, equatorial for pointing out constellations. Winner, Edward Johnston.



Sixth prize—\$5.00, for glove box. Winner J. T. Garver.

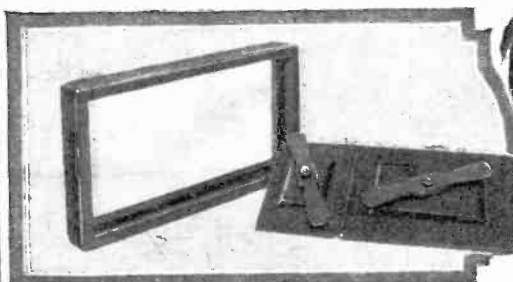
Eighth prize—\$5.00, for hanging wall lamp. Winner, Ferdinand L. Holly.



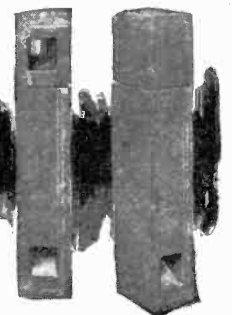
Ninth prize—\$2.50, for piano model. Winner, Mrs. H. G. Jepson.



Tenth prize—\$2.50, for African jigger. Made out of cigar box wood by L. S. Smith.



Eleventh prize—\$2.50, for photographic printing frame. Made of cigar box wood by Olin Alvin Williams, Jr.



Twelfth prize—\$2.50, for a two way periscope. Photo shows both positions. Winner, Chas. V. Spradley.

Phonograph Needle Contest—\$100.00 in Prizes

What Can You Do With Phonograph Needles?

1 A PIVOT POINTS FOR SENSITIVE INSTRUMENTS
Needles
Jewel

2 Needle
PIVOT FOR COMPASS

3 Needle
CORK
IN MAGNETIC EXPERIMENTS

4 Needle
POINTS FOR WOOD BURNING OUTFIT

5 DRIVING HOLE IN COIN
CORK
PENNY

6 Cartridge Shell
Wax
CHEAP PUSH PIN

7 SCRIBER FOR MARKING RADIO PANELS

8 COMPASS POINTS

9 MICROMETER SPARK GAP

10 Paper Sheet
LIGHTNING ARRESTOR

11 Needles Point Inward
BAIT
MOUSE TRAP

12 MAP PINS
COLORED SEALING WAX

13 POINTS FOR TOPS

14 Needle
POINT FOR SILICON DETECTOR

15 WOOD
Needles
GRAINING WOOD

16 Needle
SWITCH STOP FOR RADIOSETS

17 Needles
WASHER
PAPER PERFORATOR

18 DART

19 Needle
ETCHING METAL

20 Needles
FISH SCALE SCRAPER

21 GLASS CUTTER

NEARLY every family in the United States uses phonograph needles, and even if they do not, a small package of needles can be purchased for less than ten cents. A number of uses are described on this page, but there must be a great many more suggestions which are not here indicated. For the purpose of this contest, which is suggested by J. H. White, the device or devices should be constructed wholly or in part by phonograph needles, or phonograph needles must be employed somewhere in the construction of the device. The needles can be glued together, cemented together or soldered together, and must serve a useful purpose. The conditions of this contest are as follows: Contest closes in New York on July 10th at 12:00 o'clock midnight. All material must be in our hands at this time. No prizes will be awarded for models of suggestions found on this page. Participants are not limited as to the number of entries. Every man, woman and child is eligible. A sketch and a 100-word article are all that is necessary, although models should preferably be submitted. In event of a tie for any of the awards, participants so tying will be given prizes identical to those tied for. Name and address of the contestant should appear on each sheet of paper of the manuscript or drawings and likewise upon the model. A small tag with the name and address upon it can easily be attached to any model.

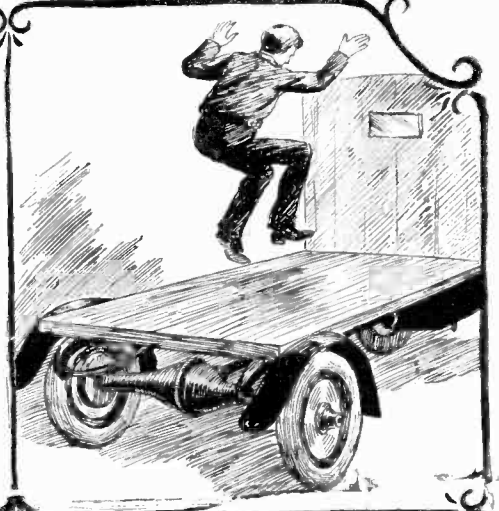
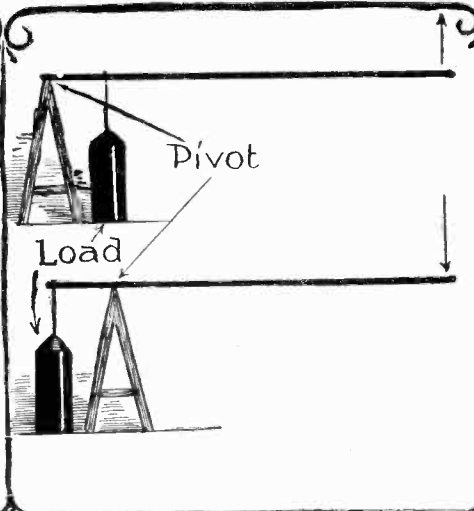
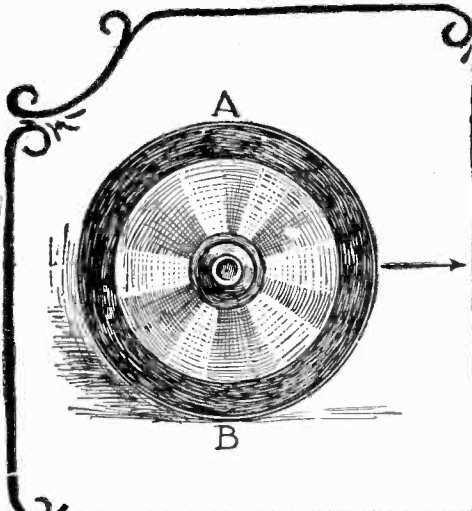
\$100.00 will be awarded
THERE ARE TWELVE PRIZES AS FOLLOWS:

First prize	\$25.00
Second prize	20.00
Third prize	15.00
Fourth prize	10.00
Four prizes, each of	5.00
Four prizes, each of	2.50

Scientific Problems and Puzzles

Some Fundamental Physical Laws Demonstrated

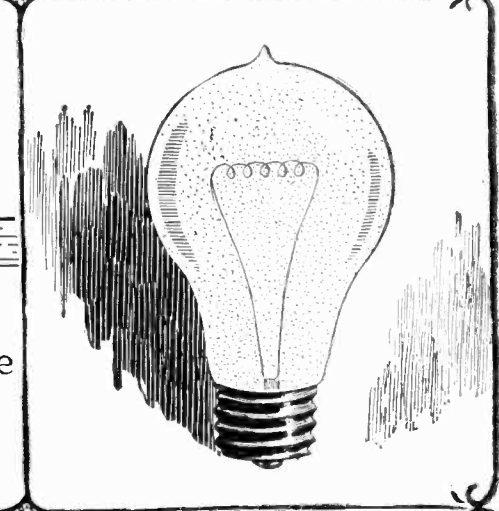
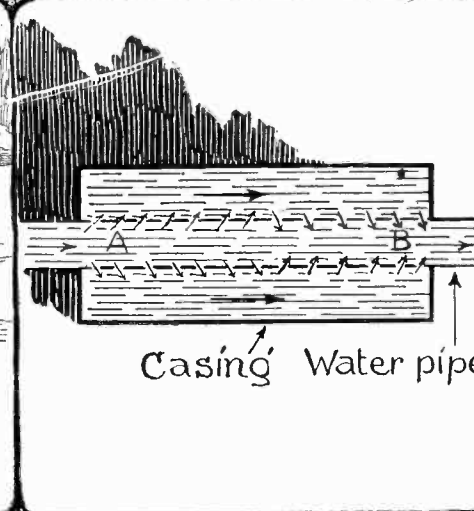
BY ERNEST K. CHAPIN



As the wheel demonstrated in the above drawing rolls along the ground how does the speed of the upper part of the wheel at A compare with the speed of the center of the wheel at the hub? Answer to this problem on page 105.

Which of the two forms of levers shown in the diagram above would give the greatest leverage thereby allowing a given load to be raised with the least effort? Assume that the load is the same distance from the pivot in each case.

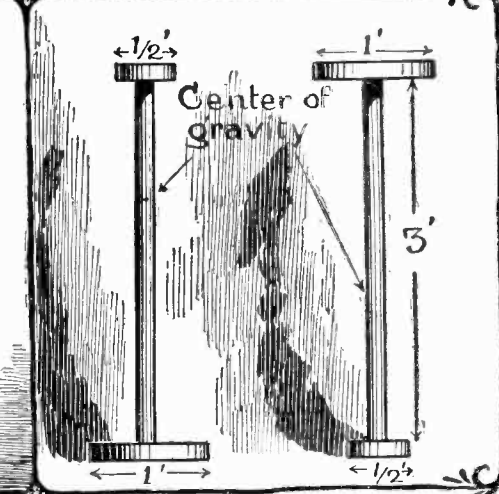
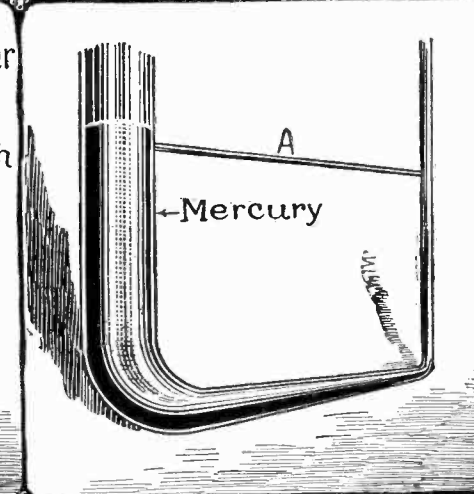
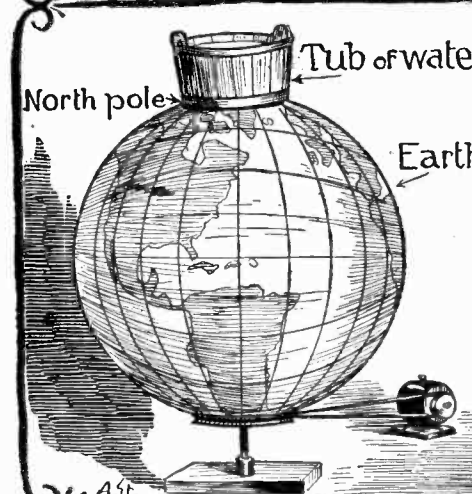
If a man standing on the floor of a swiftly moving truck, as shown in the above illustration, should jump upward would there be any danger of the truck's running out from under him, leaving him to fall to the ground?



The sight of an expert skater passing swiftly over a stretch of comparatively thin ice which would ordinarily not hold the weight of the skater standing still is more or less common. Why is it that the skater passes the thin ice safely?

A section of water pipe carrying water at ordinary pressure is drilled with a number of holes; this section of pipe is surrounded with another casing. Does the water follow the course as indicated by the small arrows?

It is a well known fact that there is an electronic atmosphere surrounding the filament of an ordinary incandescent lamp. Why does not the current cut across between the high resistance filament by means of the electronic flow?



If a tub of water is rotating, the water within the vessel turns slower than the tub on account of inertia. If a tub of water was placed at the North Pole would this obtain on account of the earth's rotation?

When mercury is poured into a U-tube one of the arms of which is of very much smaller diameter than the other, the mercury is higher in the larger tube. Is it possible to level the mercury by connecting the arms by a slanting connector?

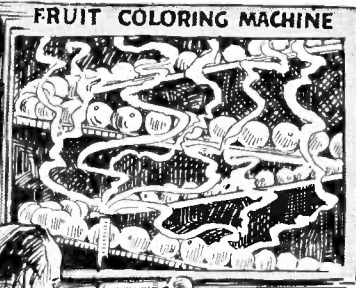
A pedestal with two bases one 1/2 ft. in diameter and the other 1 ft. in diameter is loaded so that the center of gravity falls one foot from the smaller base. Upon which base will the pedestal have greater stability?

Everyday Chemistry

BY RAYMOND B. WAILES

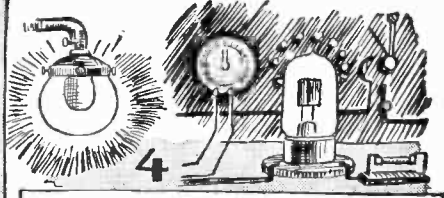


AMBULANCE
Carbon dioxide is not a life sustaining gas but it is put into oxygen resuscitators in order to make the patient breathe more deeply of the life-giving oxygen. The mixture is about 5 per cent carbon dioxide and 95 per cent oxygen.



FRUIT COLORING MACHINE

The pungent smell of burning wet matches on a rainy day is not due alone to the phosphorus or other combustible in the match itself but is more often a result of the formation of ozone, a form of oxygen. Sea air usually contains more ozone than inland air which may account for its added healthful qualities.

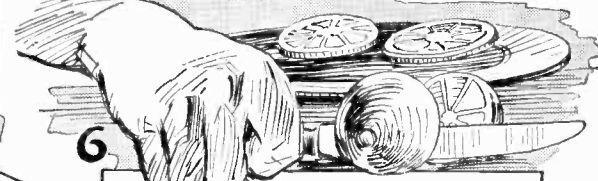


Welsbach mantles contain 99 per cent thoria and 1 per cent ceria. The filaments of radio vacuum tubes contain thoria since it is possible through its use to cause an electron flow at lower temperatures than is the case with a straight metallic filament.



Nowadays much fruit is shipped to the consumer before it has time to thoroughly ripen on the trees. Oranges and lemons may be subjected to an atmosphere of dilute ethylene gas in order to give them the natural color of well ripened fruit. It is this gas in ordinary illuminating gas that gives it its lighting qualities.

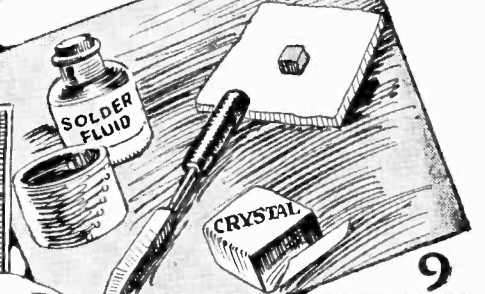
Contrary to the general opinion, there are some lower forms of life that may live without the aid of oxygen. One of the most easily illustrated of this kind is the mother in vinegar. That the mother is actually growing and is a form of life is proven by the fact that it constantly increases in size and may be observed under a microscope. It is constantly in an active state in the vinegar without the aid of oxygen.



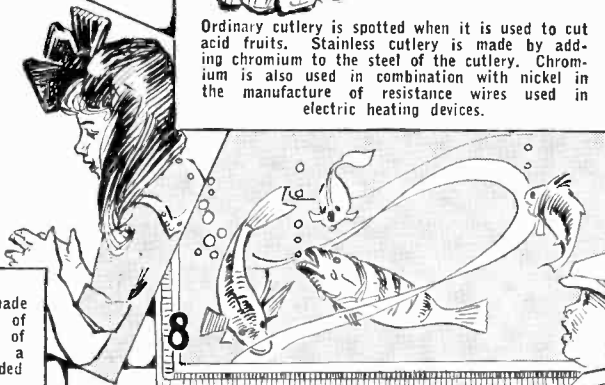
Ordinary cutlery is spotted when it is used to cut acid fruits. Stainless cutlery is made by adding chromium to the steel of the cutlery. Chromium is also used in combination with nickel in the manufacture of resistance wires used in electric heating devices.



Harmless Pharaoh's serpents may be made by mixing 1 part saltpetre, 2 parts of potassium dichromate and 2 parts of sugar with a little water to form a paste. The mixture made is then moulded into the form of small cones.



The ordinary artificial silk with which we are all acquainted is made by squirting cellulose, dissolved in zinc chloride into a suitable liquid. "Raw" cotton and soldering fluid—the zinc chloride solution—produce this commodity.



For many years it was thought that the silver color of certain fishes was due to the refraction of the light falling upon their scales. This has been proven erroneous however with the discovery that the color was imparted to the scales by a substance the scientists call guanin. This discovery was made by chemical engineers and disproved a long popular fallacy.



A cheap fire-proofing liquid may be made by dissolving a pound each of borax and boric acid in two gallons of water. After the solution is made it is only necessary to dip the material to be fire-proofed into the mixture while it is warm. Materials treated so will not ignite easily.

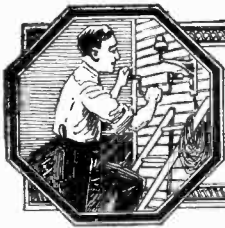


Sulphur combines with the oxygen of the air and forms a "rust" or sulphurous oxide. This acid, sprayed on plants checks the fungus growths. It is only formed in air containing moisture.

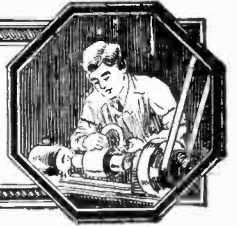


Water promotes the reaction in baking powder when mixed with the dough. The starch in the baking powder coats the grains of the ingredients so that water from the air cannot enter them and cause the reaction to take place before the housewife is ready to bake. This property of coating is termed adsorption and is one of the greatest aids to baking.

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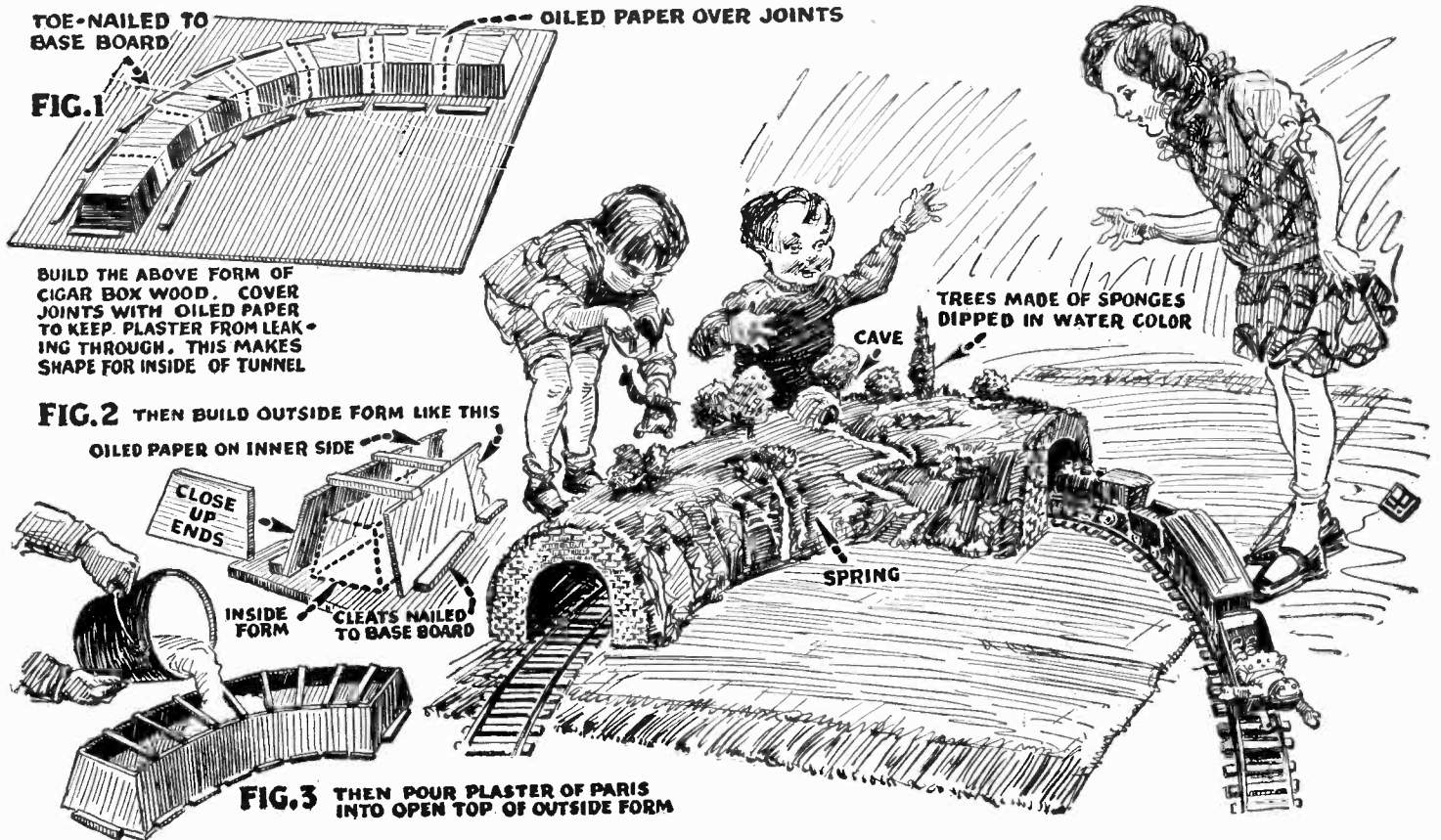


THE CONSTRUCTOR



Miniature Railway Tunnel

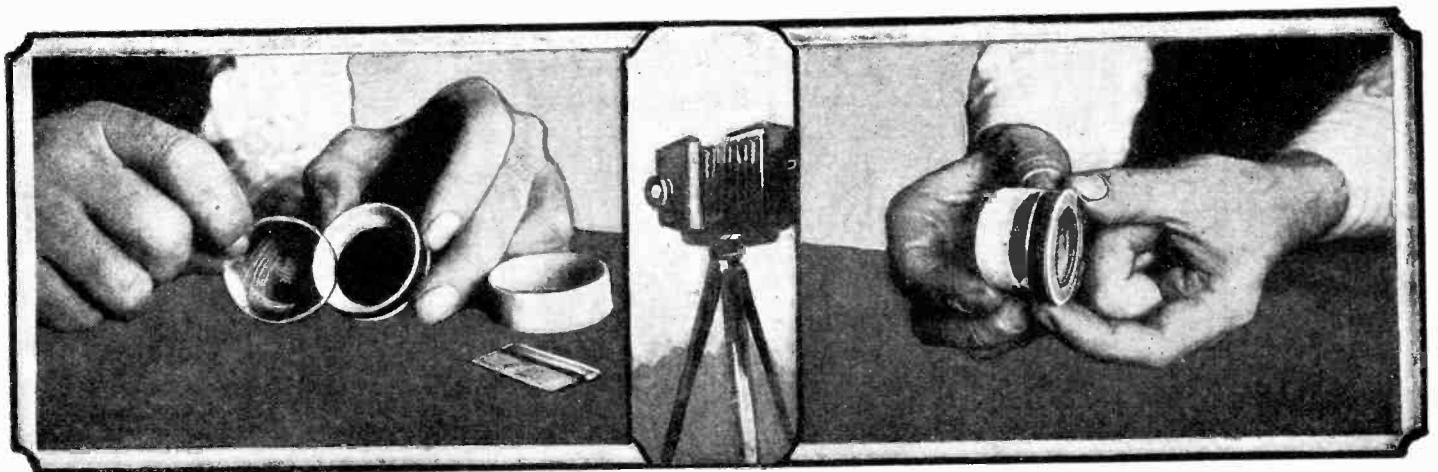
Plaster of Paris and Cigar Boxes Are Materials Used



The construction of the decorative tunnel for miniature railroads, illustrated above, is comparatively simple, and may be made by anyone at a small cost. The interior is first shown in Fig. 1, with cigar boxes. Later the outside form is constructed, as shown at Fig. 2, after which the form is filled with plaster of Paris. About twenty pounds will

be necessary. Then the decorations on the outside of the tunnel are carved and installed with the aid of a sharp knife, some sponges and water color. The inside of the tunnel should be wide enough to give half an inch clearance on both sides of the train, as it passes through. —W. W. Douglas.

Portrait Attachment for Cameras



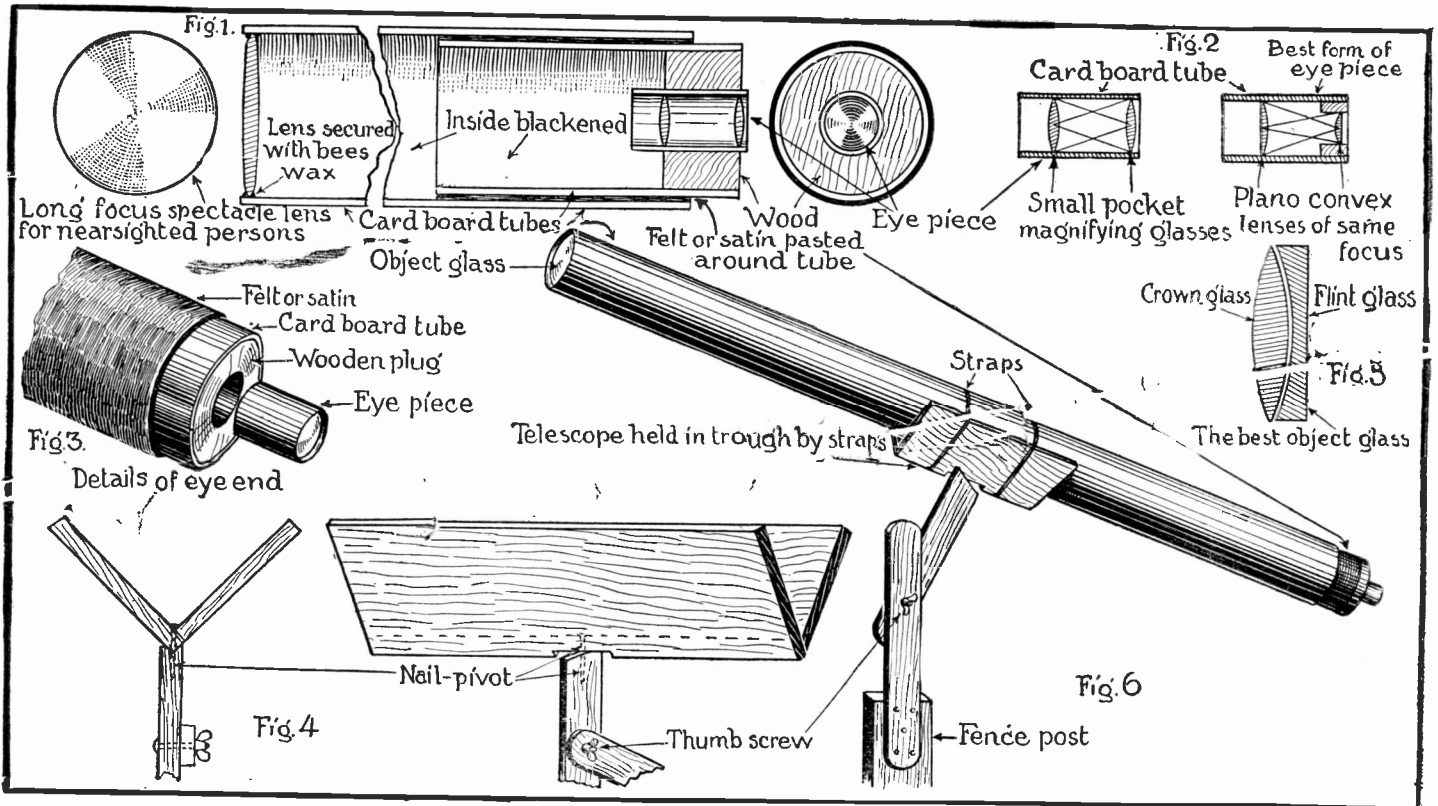
Pill boxes and ordinary spectacle lenses are available in most any locality, and with their aid a short bellows camera can, in some cases, be made to function for copying and portrait work. The construction of the attachment is very simple. First the inside collar is removed from the longer end of the pill box, and a hole is cut through the center of the bottom of the pill box with a sharp safety razor blade, as shown at the

left above. The lens is then placed in the bottom section, and the collar replaced holding the lens. The pill box should, of course, be selected of such a size that it will fit snugly over the regular lens. The proper focus lens and its distance from the camera lens must be determined by experiment. Different arrangements will necessitate different lenses, so that three or four such attachments may be made. —Edward H. Flaherty.

An Inexpensive Telescope

An Instrument Which May be Made with Ordinary Lenses

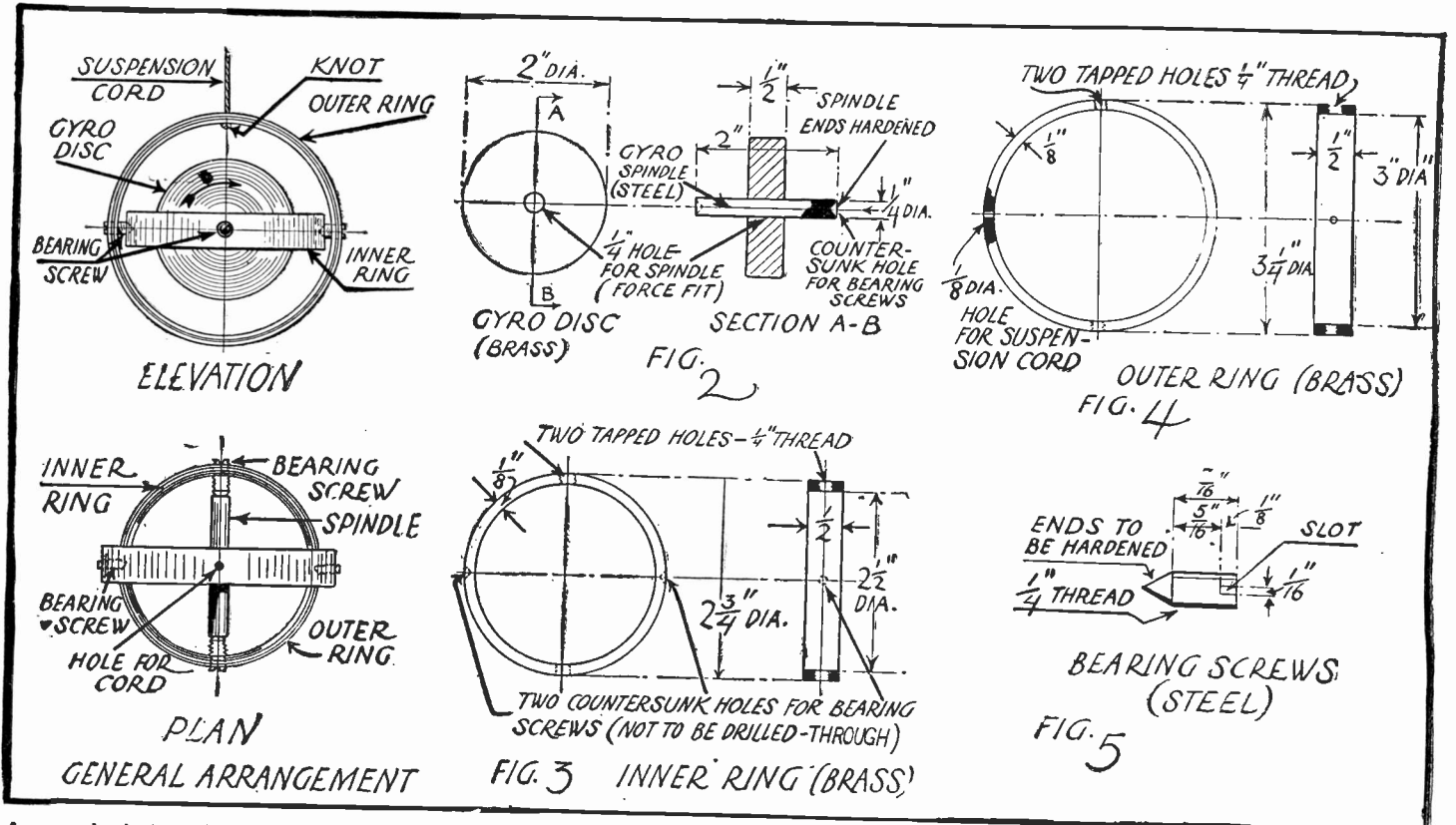
By DON HOME



With the aid of a spectacle lens, a cardboard mailing tube, and a couple of pocket magnifiers, it is possible to make a telescope that will really work. The lens should be such as is employed to correct far-sighted vision and should have a focal length of thirty to forty inches. The outer tube should be slightly shorter than this figure. With this simple telescope the craters on the moon can be distinctly seen. With a dark glass,

sun-spots will be visible and certain stars, single to the naked eye, will appear as double. In order to entirely free the images from color aberration and distortion it is necessary to use the improved eye-piece and object glass. With different sizes of magnifying glasses, it is possible to make several eye-pieces that will give different magnifying powers. The finished instrument can be readily mounted as shown in Figs. 4 and 6.

A Gyroscopic Plumb Bob



A gyroscopic plumb bob is of great assistance when accurate lining up has to be done where a light breeze is present or vibrations are caused by machinery which would cause an ordinary plumb bob to swing. The diagrams above show how a plumb bob may be made which will do away with these annoyances. The elevation and plan views of the finished gyroscope are shown. Fig. 2 shows the gyroscope disc cut from a brass bar

2 inches in diameter. The spindle is made of hardened steel. Fig. 3 gives the dimensions of the inner ring and Fig. 4 those of the outer ring. The shape and the dimensions of the bearing screws are given in Fig. 5. After the instrument is made and assembled as shown, the suspension cord is placed in position and a short, strong cord is wound around the spindle. Draw cord off quickly and disc will rotate. —C. A. Oldroyd.

Decorative Objects in Relief

① Canvas tacked on frame and sketch drawn on canvas.

⑤ Sew or stitch in all expressions.

② Cement Composition used as outline becomes rigid and hard.

⑥ Take out pins again, stretch voile cover.

③ Fill in outline about 1/2" of felt, cotton, silk floss or curled hair.

⑦ Cover all with flesh-colored crepe de Chine.

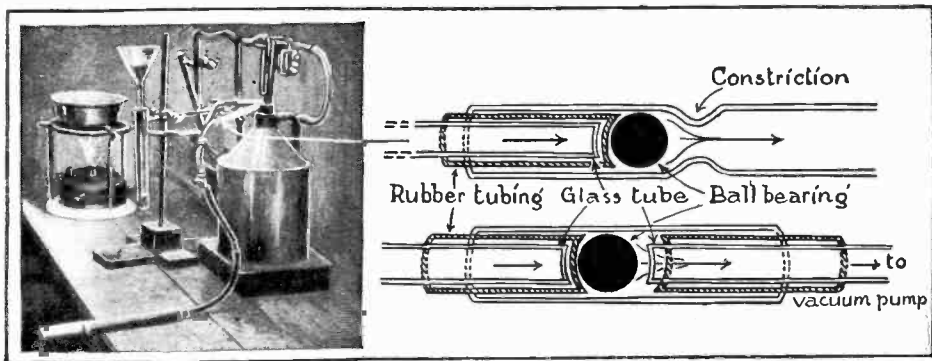
④ Cover with white voile pin around outside of outline.

⑧ The background cut perfectly to figure outline, then turned back and cemented.

After many years of research work and experimenting with different kinds of materials, a method has been developed whereby decorative figures of various sorts, such as human forms, animals, reptiles, landscapes, or, in fact, anything of an outstanding nature, can be reproduced. The coverings of these objects are various colored silks and the effect is startling in the extreme. The finished objects are very lifelike to the eye and make excellent photographs, proof of the same being given in the illustration directly above. For doing this work, the outline of the figure to be reproduced is first sketched on canvas. Around the outline of the figure is painted a secret composition, which becomes rigid and hard. The outline of the figure is next filled in with any padding material, such as felt, cotton, silk floss or upholstery hair. The entire figure is then covered with white voile or other transparent material and pinned all around the outline. Next, if a human figure is being reproduced, all the features and other characteristics of the human being are either sketched in with oil colors or embroidered. Everything should be put on quite strongly so as to stand out against the background, as in the next step the entire figure is covered with flesh-colored crepe-de-chine. Before this is done all the pins surrounding the figure must be removed, and the voile cover is stretched and sewed to the canvas backing. The padding at this stage may be rearranged slightly and the hair reproduced by means of colored yarn arranged to give the desired effect. The crepe-de-chine is then put into position and stretched so as to cover the figure firmly. The figure is then, if desired, dressed in any required costume and cemented against a suitable background, allowing sufficient time for the cement to dry and thoroughly attach the figure to its support. The background may be of the form illustrated directly above or any other desired effect may be produced.

—S. W. Ross.

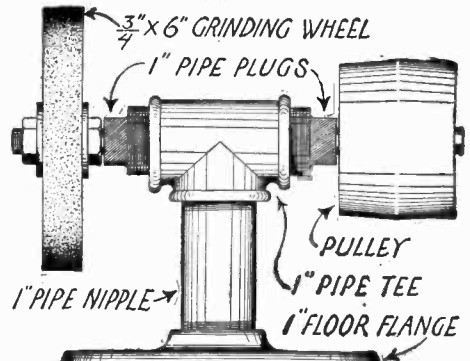
A Laboratory Vacuum Pump



The vacuum pump itself is made by taking a small bicycle pump apart and reversing the washer. A valve is then made by means of two pieces of glass tubing and a length of rubber tubing as shown above. A small bicycle ball-bearing is used as the valve clapper. The connections of such a pump and valve are also shown.

—Dr. E. Bade.

Shop Kink

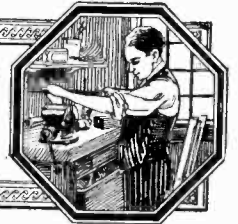


An efficient and rigid emery wheel stand may be made from pipe fittings as shown. The plugs are drilled for a .5-inch shaft and the emery wheel and pulley, mounted on opposite ends of the shaft.

—Harold Jackson.
Reporter No. 2903.



HOW-TO-MAKE-IT

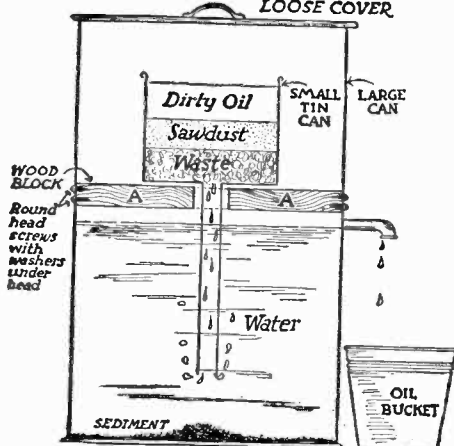


This department will award the following monthly prizes: First prize, \$15.00; second prize, \$10.00; third prize, \$5.00. The purpose of this department is to stimulate experimenters toward accomplishing new things with old apparatus or old material, and for the most useful, practical and original idea 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.

Oil Filter

FIRST PRIZE \$15

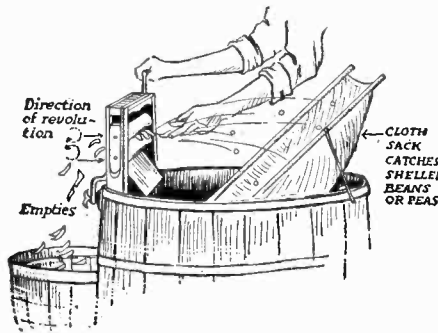
LOOSE COVER



The oil filter illustrated above will bring in many times its value to its owner. Across the center of a 10-gallon can place a wooden shelf to hold the center can, which has a tube attached to its bottom. This can is filled with the filtering substances, sawdust and waste. The oil seeps through, bubbling up through the water.—J. E. Noble.

Bean Sheller

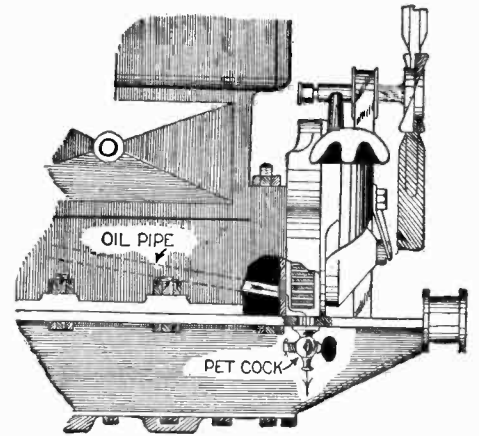
SECOND PRIZE \$10



The old family wash wringer is here given a new use. When beans, peas, etc., are being preserved and consequently shelled in large quantities, the above kink will obviously be found very useful. The pods are fed into the wringer as shown. The squeezing force of the rollers force the beans to shoot back against the cloth catcher and carry the pods through into the waste basket on the other side of the wringer. —N. W. Hopkins.

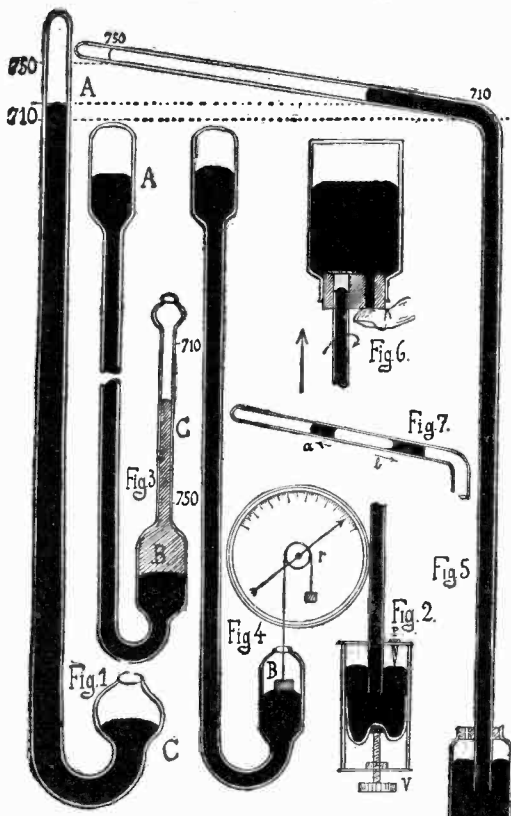
Oil Tests

THIRD PRIZE \$5



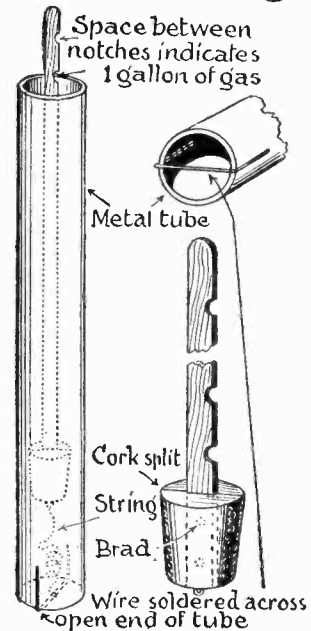
If a small pet cock is installed directly under the large timing gear on a Ford motor an excellent indicator is had as to whether the oil in the motor is circulating properly or not. The pet cock is installed by drilling a small hole in the case just under the timing gear and tapping it to take the cocks shank. —Harold Jackson.

Barometer



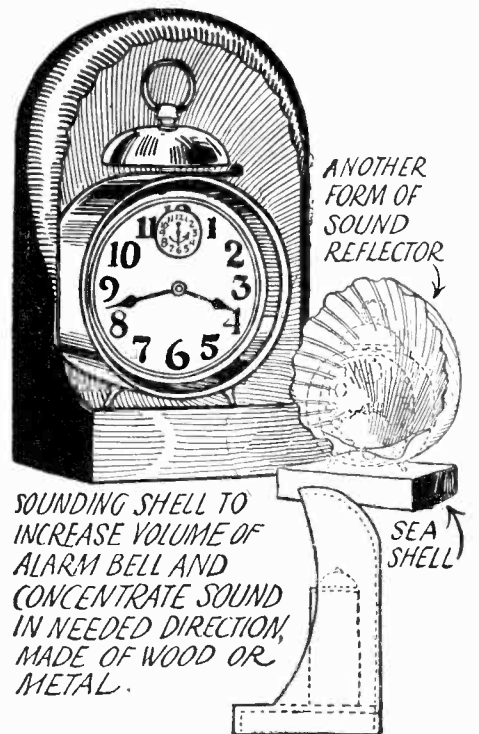
1. The barometer. 2. Fontin's B. Mercury in a chamois bag adjusted by the screw. 3. Huyghens' B. colored liquid gives the reading at C. 4. Hooke's B. the dial and index magnify the reading. 5. The mercury in the inclined tube magnifies the reading greatly. 6. Filling No. 5 the cistern is seen inverted over the lower end of the tube. 7. a Convex meniscus—B. is rising; b Concave or flattened meniscus—it is falling. —P. Medinger, Luxembourg.

Gasoline Gage



For those cars not equipped with direct reading gas gages the above illustration shows a method which will be found exceptionally useful. A tube slightly longer than the depth of the tank has at one end a piece of heavy wire across it. A cork of slightly less diameter than the tube is fitted with the stick as shown. The stick is notched at points indicating full gallons; both stick and cork are shellacked. A screw eye fits in bottom of cork from which a string runs to the wire across the bottom of the tube. To measure the gasoline simply insert the gauge in the tank and count (feet) the notches above the top of the tube. —L. B. Robbins.

Improved Alarm



The above illustration graphically shows a method of concentrating the energy from the alarm clock bell by constructing the resonator-like housing similar to the one shown in the above illustration. The sound from the alarm bell is thus thrown out in one direction so that the greatest volume is obtained where it is needed. This resonator can be constructed of wood, metal or shell. It directs the sound from the alarm in much the same manner as the bell directs the sound of a trumpet or cornet. —Thomas H. Duffy.



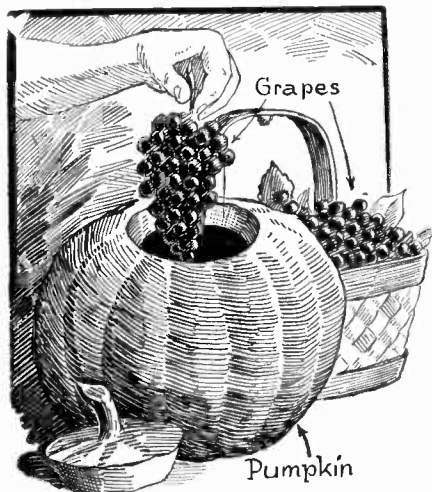
WRINKLES

RECIPES & FORMULAS



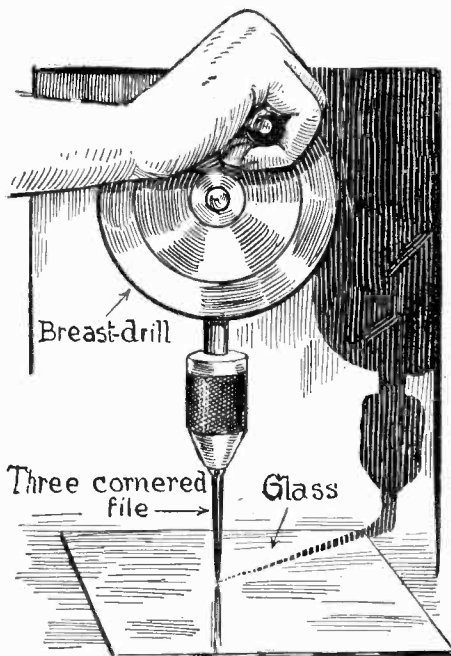
Edited by S. GERNSBACK

Preserving Grapes



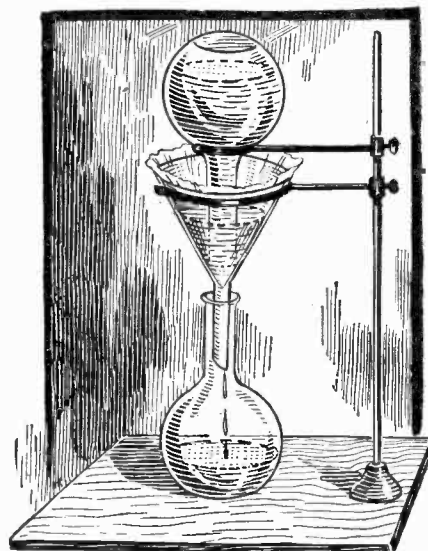
If ripe grapes are inserted in a ripe pumpkin shortly after they are picked and while they are still clinging in a cluster as shown they can be kept fresh for months if the pumpkin is kept in a cool place. —Wm. H. Seitsinger.

Glass Drill



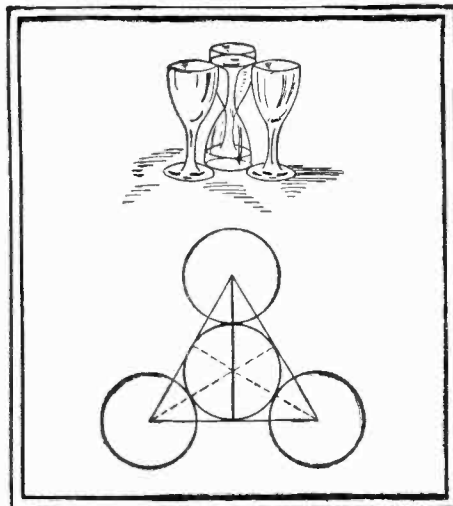
If a three-cornered file is ground down to smoothness and to a fine point with the three sharp edges remaining intact and this is used as a drill in connection with an ordinary brace or breast drill, an efficient glass boring tool results. The drill is lubricated with a mixture of pitch and turpentine mixed to the consistency of glycerine. —W. E. Bramel.

Filter Kink



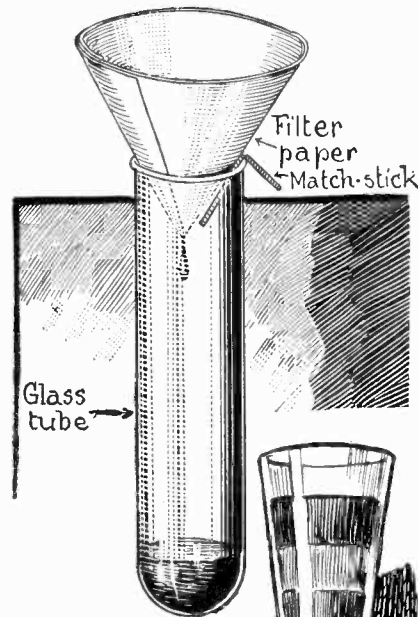
For filtering large quantities of liquid without attention, place the large bottle neck down in the filter funnel and the flow of liquid will adjust itself. —Willard Robinson.

Geometrical Problem



The problem whose solution is shown above is to place four tumblers so that the four centers of their bottoms as well as the four centers of their tops are equi-distant from each other. —Dr. Albert Neuburger.

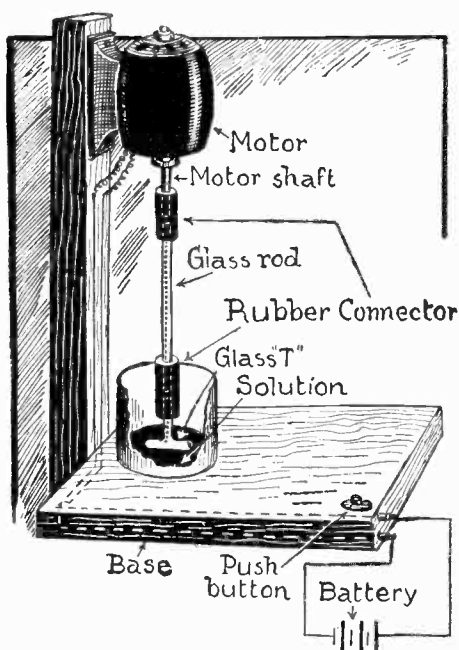
Laboratory Hint



By the method shown above it is possible to filter a liquid without the use of a funnel. The filter paper folded in the regular way is inserted in the test tube. The match allows the escaping of air. —C. R. Mullen.

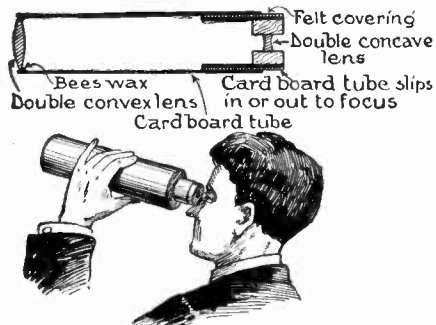
By carefully pouring the following liquids into a glass a decorative effect as illustrated is gained: Heavy sugar syrup, strongly sugared black coffee, water, red wine, olive oil and pure spirit colored with fuchsin. —Dr. A. Neuburger.

Mechanical Mixer

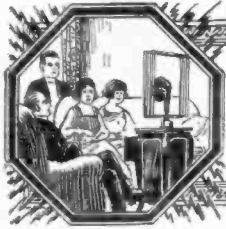


Around the amateur laboratory many times there is a need for a mechanical mixer which will run for a length of time without attention from the experimenter. Such a mixer is shown here. The small motor is mounted on an upright and an extension shaft is fixed to the motor shaft with a stiff piece of rubber tubing. The mixing attachment consists of a glass "T" fixed to the extension shaft with another piece of rubber tubing. —Robert R. Garner.

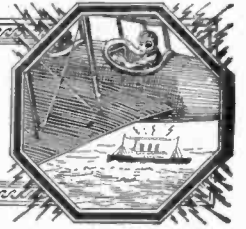
Telescope



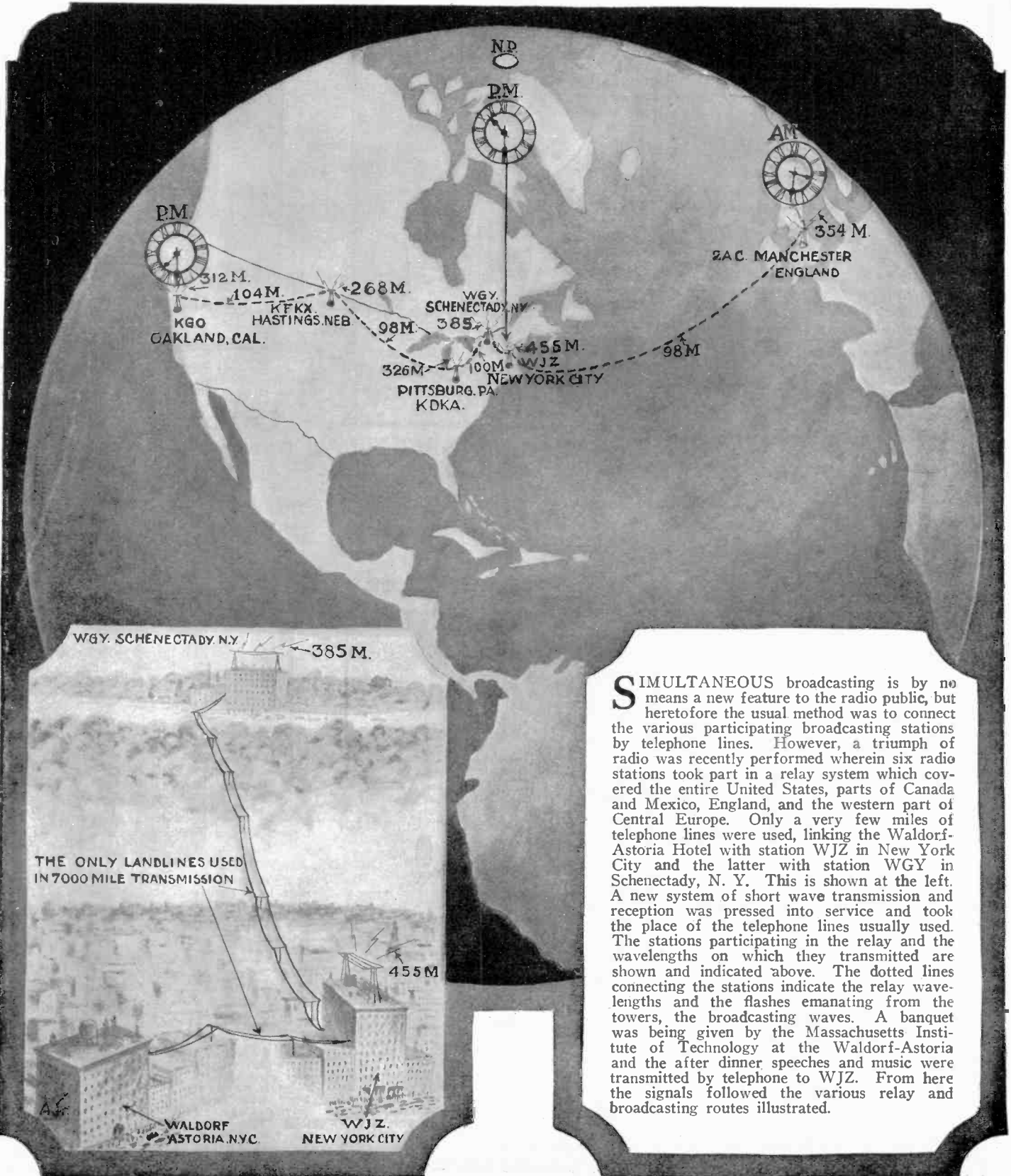
If a double convex lens is held in one end of a card-board tube with beeswax and a small pocket magnifier is placed in the other end of the tube as shown and the lens is focused a telescope results. —Don Home.



RADIO



Relay of Radio Broadcasting



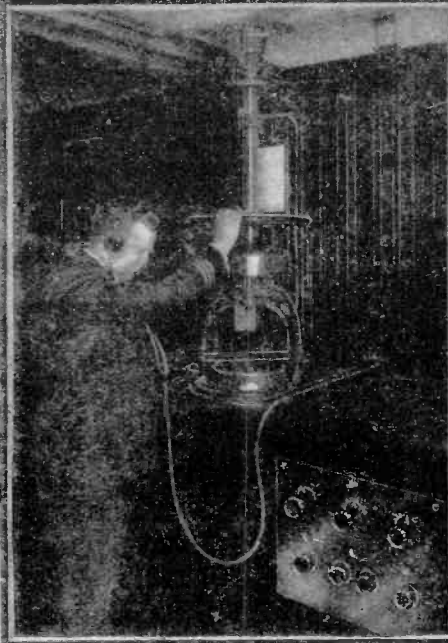
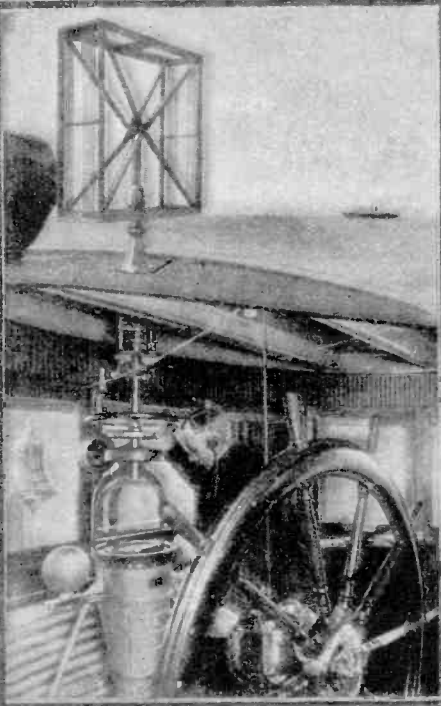
SIMULTANEOUS broadcasting is by no means a new feature to the radio public, but heretofore the usual method was to connect the various participating broadcasting stations by telephone lines. However, a triumph of radio was recently performed wherein six radio stations took part in a relay system which covered the entire United States, parts of Canada and Mexico, England, and the western part of Central Europe. Only a very few miles of telephone lines were used, linking the Waldorf-Astoria Hotel with station WJZ in New York City and the latter with station WGY in Schenectady, N. Y. This is shown at the left. A new system of short wave transmission and reception was pressed into service and took the place of the telephone lines usually used. The stations participating in the relay and the wavelengths on which they transmitted are shown and indicated above. The dotted lines connecting the stations indicate the relay wavelengths and the flashes emanating from the towers, the broadcasting waves. A banquet was being given by the Massachusetts Institute of Technology at the Waldorf-Astoria and the after dinner speeches and music were transmitted by telephone to WJZ. From here the signals followed the various relay and broadcasting routes illustrated.

Position Finding by Radio

Details of the Workings of the Radio Compass

By J. W. VON STEIN*

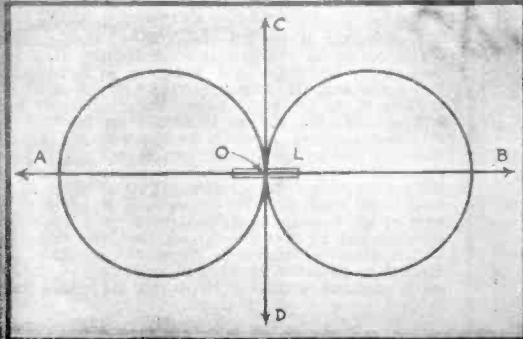
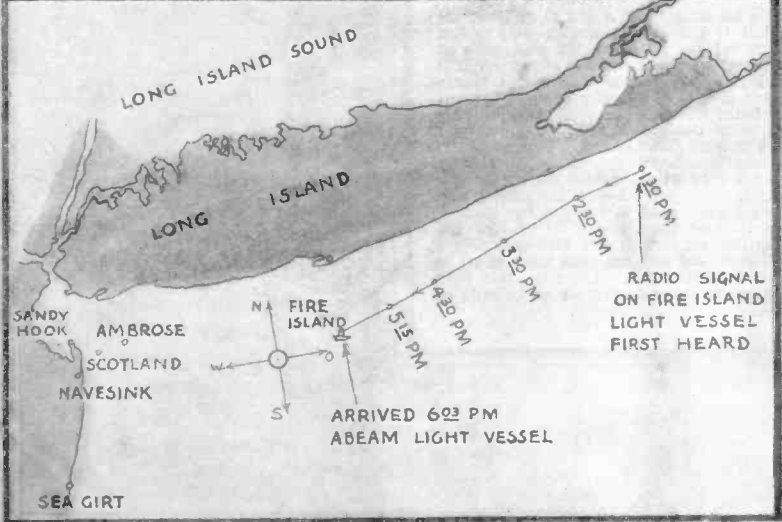
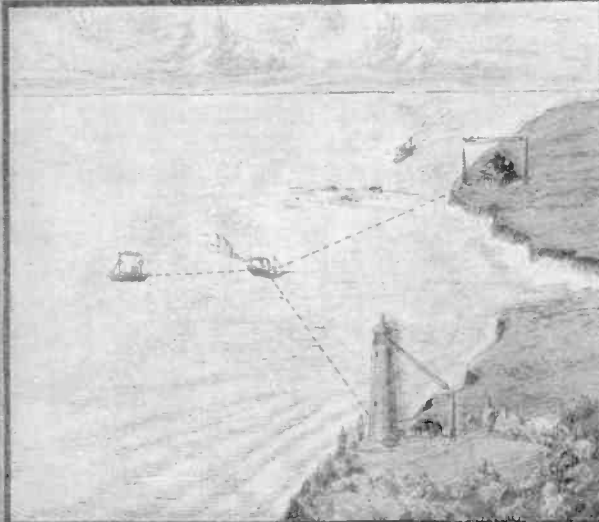
The photograph directly below shows a cross sectional view of the installation of a Kolster radio compass on board ship. The directional loop aerial is so arranged that it can be rotated as desired by means of a hand wheel shown so as to have the plane of the loop in either the direction of the incoming signal or at a right angle to that direction. The position to be used depends upon the type of reading to be taken and the method of working is described at the bottom of this page.



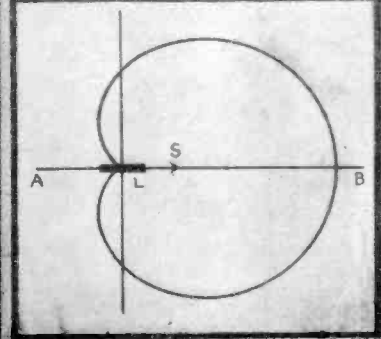
The photograph at the left shows a close-up view of the controlling mechanism of the perfected radio compass. The operator swings the loop by means of the hand wheel shown, at the same time listening in on the radio receiving set which may be seen in the lower right corner of the illustration. The photograph directly below shows a still closer view of the compass itself. The U-shaped arm carries two cross-hairs which are placed directly above each other in order to get the bearing directly on the compass.



The ship equipped with the compass can get its own bearings and can also aid nearby vessels not equipped with the radio compass. This is illustrated in the drawing at the left below. The ship equipped with the compass plots its exact position and then radios it to the nearby vessel. The drawing is, of course, somewhat exaggerated so as to show the arrangement more clearly. The illustration at the right below shows how a vessel was able to proceed through a heavy fog along the coast of Long Island and come to anchor directly off Fire Island, being guided solely by the radio compass, the signals being sent out by the Fire Island radio station.

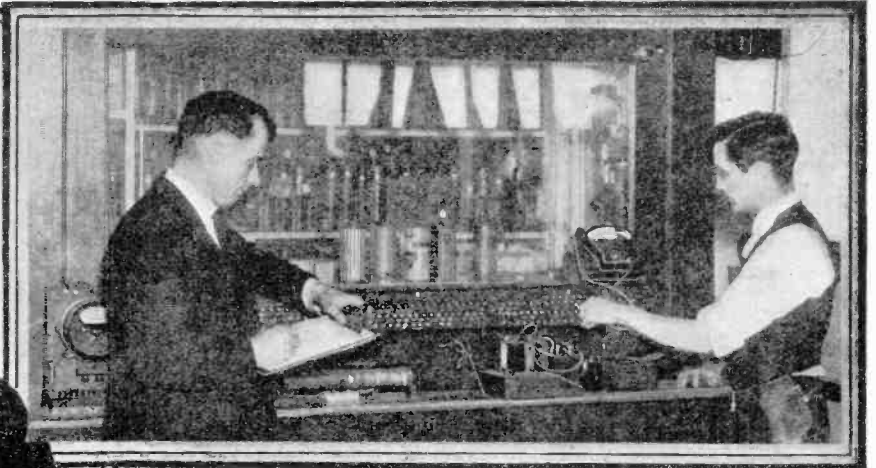
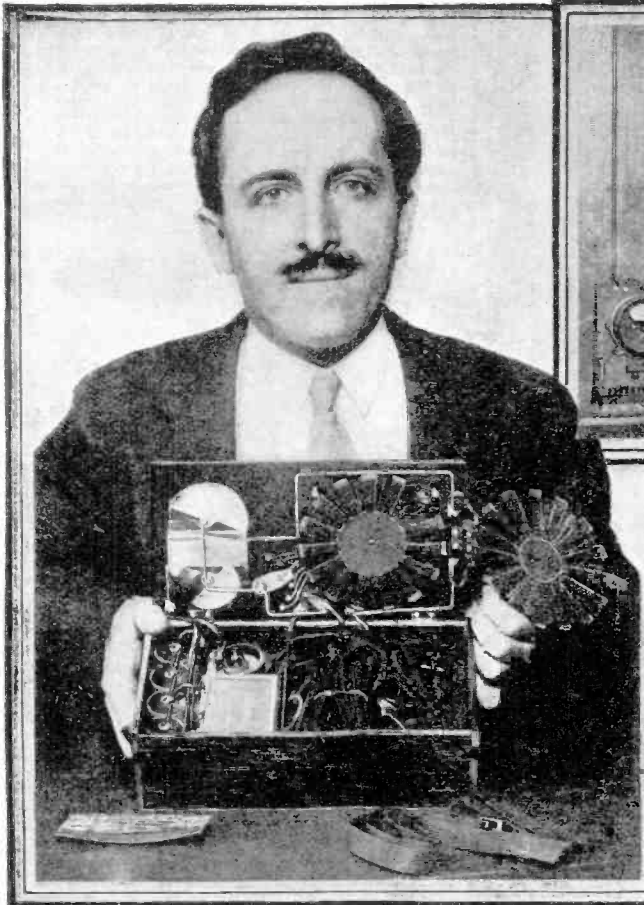


The loop aerial as used in the average radio receiving set is directional in two ways and therefore unless special provisions are made, it cannot be determined in exactly which direction the radio transmitter is located. The curve shown at the left illustrates this. The loop is indicated by L and the station from which reception is good may be either in direction A or B. Signals from stations located in the direction of C or D will be very weak or inaudible. When it is desired to get a unidirectional bearing, certain changes are made in the receiving set whereupon it will be found that the signals will vary in accordance with the curved line in the illustration at the right. Stations in the direction of B will be extremely loud. The directional bearings as illustrated at the left are much more accurate than the unidirectional bearings and therefore both are usually taken; the first to determine the general direction of the transmitter and the second the exact direction. The signals received are standard ones sent out by compass station transmitters.



Radio Experimenters

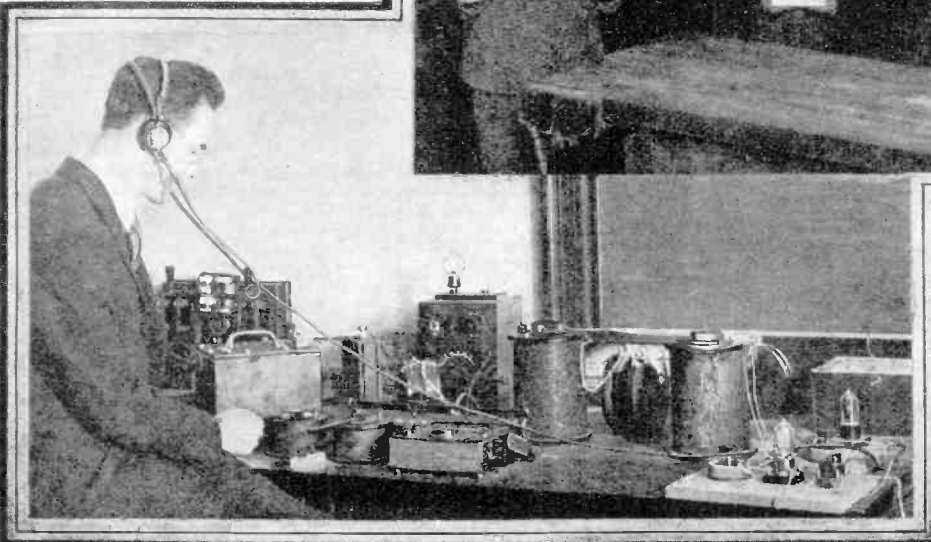
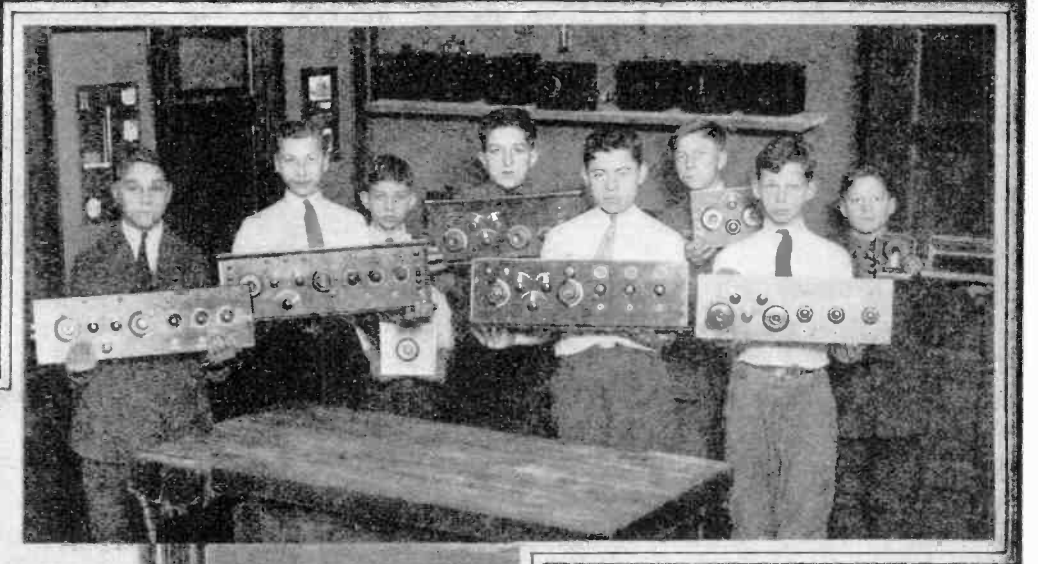
Some Sidelights On Radio Developments



The photograph directly above shows the two men of the Bureau of Standards who are directly responsible for the action of dry cells of all makes, sizes and types. They are Mr. J. P. Schradt (left) and Mr. A. F. Baillio. Their work consists of making comparative tests on dry cells to determine their voltage, amperage and ability to stand up under a heavy drain. This department has been rushed to the limit since the new dry cell vacuum tubes have come out as they have to test all the different types of radio batteries before they are put on the market to make sure that they come up to the claims of the manufacturers. The photograph above shows them at their test table with the apparatus for making the comparative tests arranged in front of them. Complete records are kept so that it is practically impossible for any concern to pass out to the public inferior dry cells, either for "A" or "B" battery use.

Cigar Box Contest enthusiasts attention! The illustration at the left shows just one of the many thousands of uses to which these versatile boxes can be put. Mr. Felian Garcia, a New York City amateur, has built a complete receiving set in a cigar box. The circuit used is that of the well known Flewelling simplified super. The tuner, as will be seen, consists of two spiderweb coils and two variable condensers. The set as illustrated contains everything necessary for reception including two pair of phones. The aerial and ground, of course, are separate, although a small coil of wire can be carried in the compartment with the phones and used as an antenna. For a set of this type, the outfit shown is extremely well built and contrary to the usual portable set it is entirely practical. As will be seen, the "A" and "B" batteries are contained within the cabinet, the "A" battery consisting of four flashlight cells of the type usually employed in tubular flashlights. The spiderweb coils which are arranged on the back of the cover are so placed that when the cover is opened, the coupling between the two coils can be varied at will.

Radio has become such a part of our daily life that it is now being taught in many schools throughout the country. The photograph at the right shows some examples of the sets built by boys in the manual training and science classes of a New York City school. The sets illustrated are the cream of all those made in the school and each one of them have made some enviable "DX" records. They are almost entirely home-made, only those parts which are too complicated to construct having been bought. Thus we see that the schools have changed quite a lot in the past few years as now the boys can play while they work and when they get through with their work have a substantial and practical radio receiving set to show for their labor. The sets made show considerable ingenuity and are workmanlike in the extreme.



The photograph at the left shows Mr. E. H. Youngs of the U. S. Bureau of Standards at Washington, D. C., at work in his laboratory. Mr. Youngs is an authority on the measurement of frequencies and has charge of the checking of the frequency of the transmitted signals from high powered radio stations throughout the country. He is shown operating some of the essential and efficient apparatus used by the Bureau. Mr. Youngs also at times checks up on the outgoing signals of various amateur radio stations throughout the country and keeps them within their lawful frequency. The apparatus used for this work, most of which is shown at the left, is most efficient in operation and all of the scales are accurately calibrated. Various standard instruments are used which have been designed by competent engineers of the Bureau so that the actual work of measuring frequencies is reduced to a minimum.

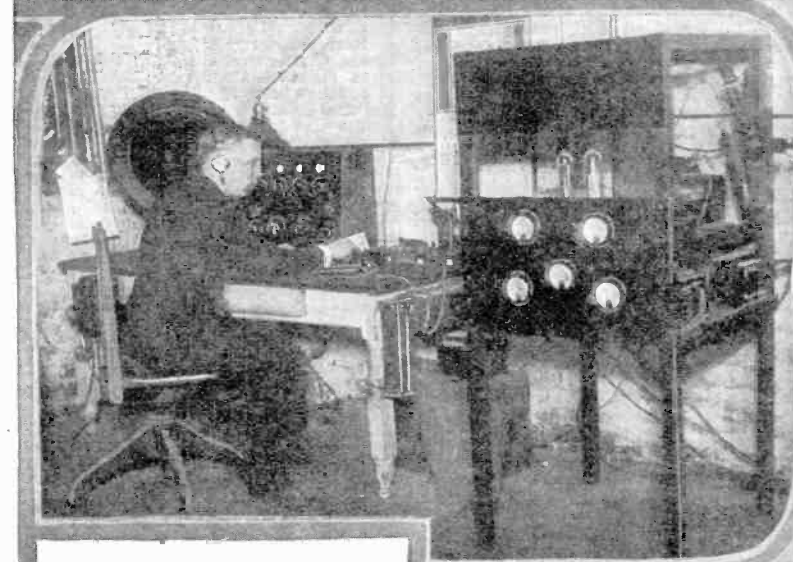
New Uses of Radio

Glimpses of Some of Its Varied Rôles



Will a week or even a day ever go by during which someone will not come out with "the world's smallest radio set?" It seems that every radio bug's chief ambition is to construct a set that, regardless of its efficiency, will be very small in size. We illustrate above a set made by Edmond Campbell of Washington, D. C. The maker, who is only fourteen years of age, estimates its cost at about 80c. The tuning coil is made of wire taken from a door bell buzzer and a small crystal detector is used. The entire outfit is small enough to fit in a match box and the maker claims that it will receive all the local stations quite clearly. However, we question its selectivity.

Who has never heard a broadcast listener say, "Damn that amateur with his dots and dashes," or words to that effect? (usually much stronger than the above and therefore unprintable). In the majority of cases however the dots and dashes or as they should be called the code transmission is not from amateurs, but from the high powered government and commercial stations and ships at sea. If the broadcast listener has a good receiving set which is capable of doing any tuning that can be called tuning, he will not experience interference from these stations unless he is very close to them, and then the best remedy is to move away. We say the above in all sincerity because amateurs do not cause much of the interference as they are confined to certain working hours by the government. The photograph directly above shows the government operators at station NAH, Brooklyn Navy Yard, listening in and determining just who does cause the interference. Amateurs are checked up as to operating hours and wave-length and "called down" if they are in the wrong. The operators at the Navy Yard, however, lay most of the blame on foreign ships and freighters in harbors, lakes and rivers.



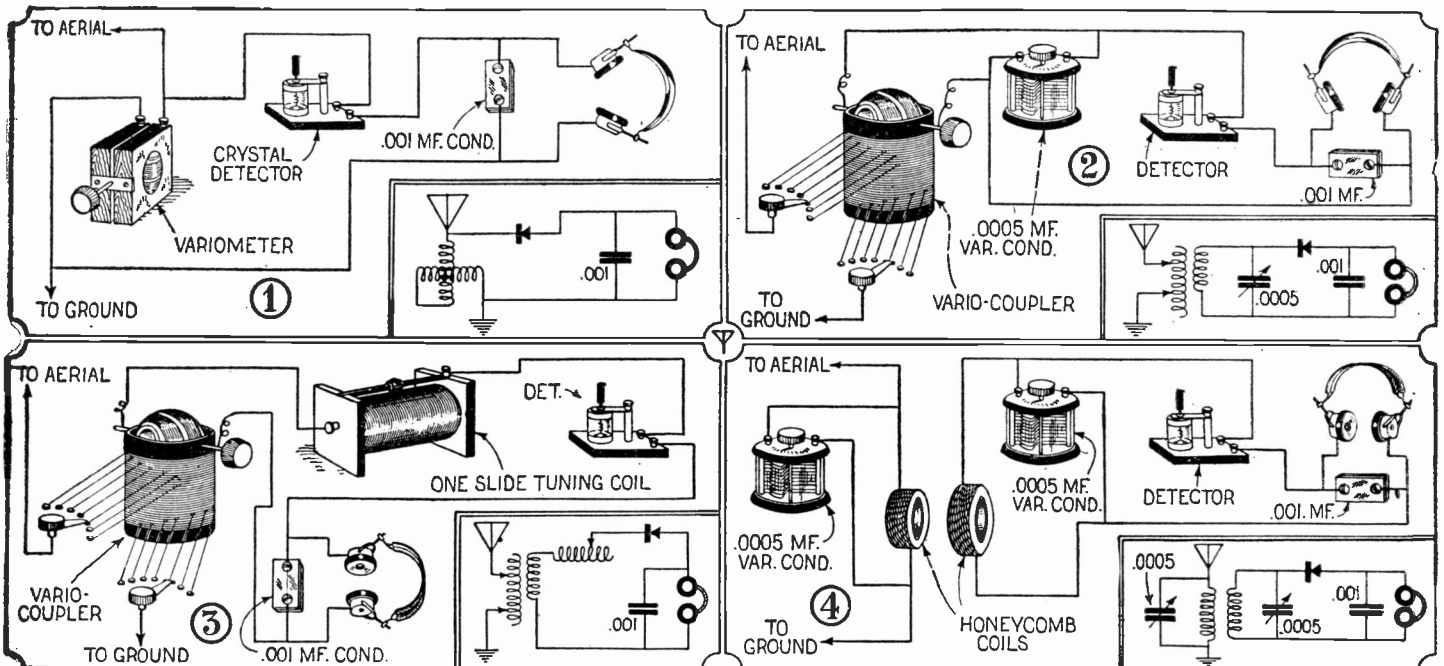
The photograph directly above shows one of the finest amateur radiophone stations ever constructed. It was made entirely by W. E. Schweitzer of Chicago and radio engineers having looked the set over proclaim it to be one of the finest amateur sets which they have ever seen. Mr. Schweitzer spends a considerable amount of his time on his radio set and is a master workman in that line. His receiver is one of the most selective and finely constructed pieces of apparatus which has ever come to our notice and rivals the best manufactured apparatus in appearance, while at the same time beating most of them as to efficiency. His transmitter, which was mostly constructed by himself, is a wonderfully efficient piece of apparatus and Mr. Schweitzer expects to furnish "listeners in" with some interesting material by radio. The photo shows an excellent view of both the receiver and the transmitter, the latter in the right foreground.

Many of our readers will no doubt remember the slot machine radio set described by H. Gernsback, the editor of this magazine in the September, 1922, issue of SCIENCE AND INVENTION. Many people at this time called this a dream and labeled it as impractical. However, the photograph at the right shows that the idea is by no means impractical as a slot machine radio set has been built and made its appearance for the first time in Washington, D. C. The photo at the right shows a little girl seated in the barber's chair listening in on the slot machine radio set while having her hair bobbed. It is only necessary for the listener to drop a nickel in the slot and select the station he or she desires to hear.



Efficient Crystal Receiving Sets

BY A. P. PECK, A.M.I.R.E.



VERY often we hear of crystal detectors receiving radio broadcast programs over distances of 1,000 miles or more. This is usually accomplished under extraordinary conditions and cannot be depended upon. However, the crystal detector, when operated properly and used with a selective tuner, will very often give astonishing results. The writer has personally received from stations 300 miles away using a crystal detector and a circuit similar to that shown in Fig. 2. This work was done very consistently during the fall. The crystal used was a piece of very sensitive galena selected from a pound of the commercial variety. The same work was also done with one of the many synthetic or manufactured crystals now offered for sale. The diagrams given herewith have been carefully selected to give the best results with a minimum of apparatus. The circuit in Fig. 1 is the simplest of them all and with a standard variometer will give excellent results for local reception. It is not, however, very selective. The circuits in Figs. 2 and 3 are very similar, the secondary tuning being done in Fig. 2 with a variable condenser and with a one-slide tuner in Fig. 3.

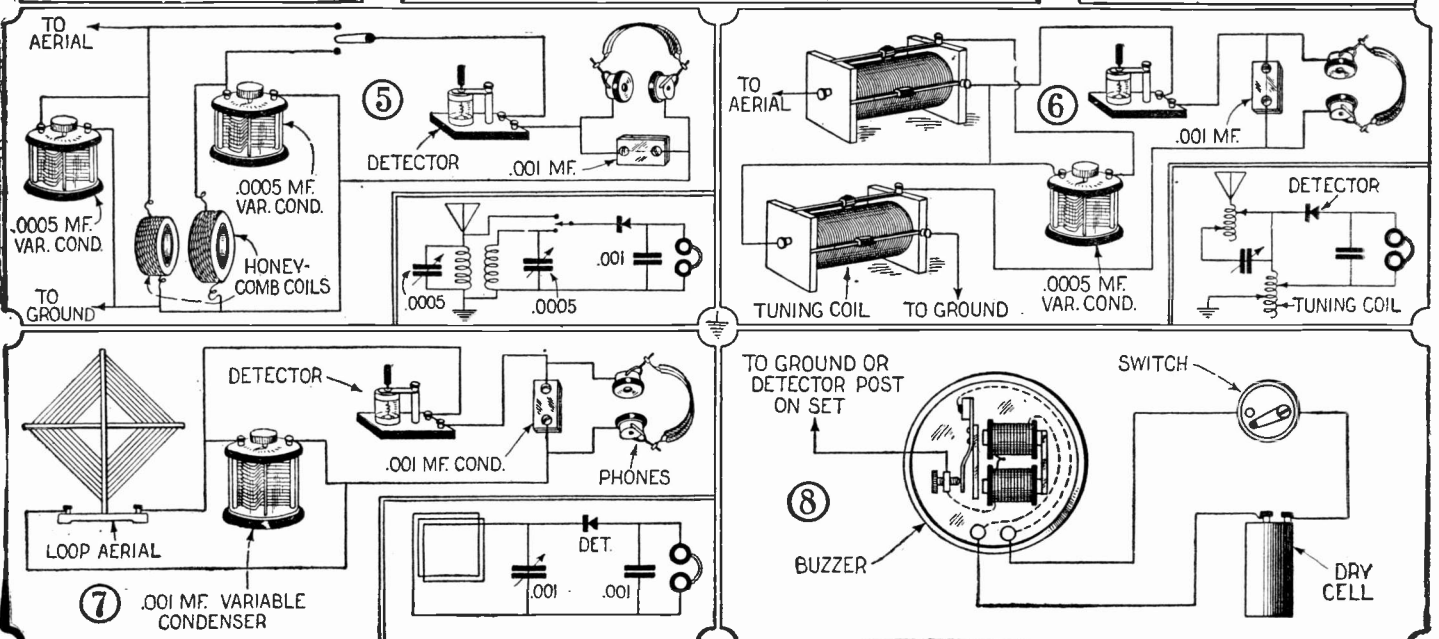
\$100 CRYSTAL DETECTOR CONTEST

THE editor has often mentioned that the use of the crystal detector is not as extended as it might be. For that reason SCIENCE AND INVENTION is offering \$100 in prizes to check up on long distance crystal reception. In order to compete for a prize every entrant must have actually constructed and operated the crystal set which he enters and he must send us photographs, complete detailed data, hook-up, etc., on its construction. He must also send a statement, sworn before a Notary Public, putting forth exactly what long distance stations he has received. At least one witness who has also "listened in" must swear to these facts before a Notary Public as well. To be considered in this contest the crystal set must embody some new and unusual feature or otherwise contain a type of instrument not heretofore used. Any crystal, natural or synthetic, or any combination may be used. All entries for this contest must reach the editor by 5 o'clock, June 5th, 1924. The prizes will be announced in the August issue. Entries cannot be considered if penciled or that do not comply with the rules. Typewrite or write the description and make all sketches in ink. Should two contestants submit the same winning idea, a like prize will be awarded to both. Address all correspondence to Editor, DX CRYSTAL DETECTOR CONTEST, care of this publication, 53 Park Place, N. Y. City

THE PRIZES WILL BE:

First Prize\$50.00 in gold
Second Prize20.00 " "
Third Prize15.00 " "
Fourth Prize10.00 " "
Fifth Prize5.00 " "

Many amateurs are firm exponents of the use of honeycomb coils and, therefore, we show the circuit diagram in Fig. 4 employing these highly efficient coils. Note that small variable condensers are used, being shunted across the two coils. This gives sharp tuning. The sizes of the coils used must be determined by experiment. A variation of the circuit given in Fig. 4 is shown in Fig. 5. The two point switch is added so that for local reception and to obtain slightly louder signals, a single tuned circuit may be used. For selectivity and distance work the switch blade should be placed on the lower point. In radio operator's parlance this is known as a "stand-by and tune" circuit. A combination wave-trap and tuning circuit making use of two standard two slide tuners is illustrated in Fig. 6. For reception from stations located not more than two or three miles away, a loop aerial may be used being connected as illustrated in Fig. 7. The loop should be as large as possible so as to pick up the greatest amount of energy. A buzzer test is a great help in crystal reception both for adjusting and bringing signals that seem to fade. The circuit of a buzzer test is shown in Fig. 8.



Four Experimental Circuits

Circuits Using Only One Tube Which Give Excellent Results

By FOUR EXPERIMENTERS

At the right is shown a circuit diagram of a single tube receiving set which if handled correctly will give very little radiation. The designer of this set put it into use after having used a standard three circuit tuner for some length of time. He found the set illustrated to be better, being more selective and sensitive and having only three controls. In our circuit diagram we have shown honeycomb coils and these may be used and placed in inductive relation to each other if desired, or the following data may be employed. The 20 turn coil may be wound with No. 22 wire on a 2 3/4-inch tube. The 80 turn coil should then be wound with the same size of wire on a three-inch tube, in the same direction as the 20 turn coil and placed within the 3-inch tube. The same construction applies to the 60 and 15 turn coils, the former being wound on a 3-inch tube and the latter on a 2 3/4-inch tube. D.C.C. wire should be used throughout. A standard soft tube may be used as a detector in this circuit or a UV-199 will be found to give very good results. If a tube of the UV-200 type is used, the "B" battery voltage should be approximately 22 1/2.

—L. Ringer.

The circuit diagram at the left shows an excellent set for use with a standard type of loose coupler. If it is desired or if the builder happens to have one on hand, a vario-coupler can be used in place of the loose coupler, in which case a small variable condenser with a capacity of about .0005 mf. should be shunted across the rotor or secondary. This circuit as originally submitted to us used conductive coupling which would cause the set to radiate quite badly. The editor took the liberty of changing the circuit to an inductively coupled type which will reduce radiation considerably and keep this simple set within the limits placed by our fight against radiating regenerative circuits. In this set, a soft detector tube may be used and any one of the standard types will give excellent results. The designer of the set used a WD-12 tube which only requires a single dry cell for operation and with the set in the original form, logged many stations throughout the country, from California to the eastern coast. This was done, using no audio frequency amplification, with the set located in a town in Illinois. The designer of the set is a real experimenter and after trying several other types of circuits has finally settled down to this one.

—William Hoercher.

An adaptation of the standard Flewelling circuit, but one which employs a standard three coil honeycomb set is illustrated at the right. If the reader happens to have a set of the type of coils mentioned in operation, the only change necessary to make the set into this improved Flewelling is to insert a .006 mf. fixed condenser as shown and make the connection from one side of this condenser to the plate circuit. The diagrams at the right show the connections of this set in both perspective and schematic forms. The designer of this set said that when he was using it he had to employ for a while a bed spring as an antenna. Located in Illinois, he heard most of the large stations throughout the United States and several in Canada as well as Cuba. He has not as yet had a chance to try out this set on an out-door aerial, but the editor believes that very good success would be obtained with the same. The writer was able to receive from New York City with the ground alone, but then the set was too noisy. The volume when used with the bed spring aerial was all that could be desired from a single tube and many stations came in almost too loud to listen to with the receivers on the head. The set is rather critical in adjustment and a variable grid leak should be employed.

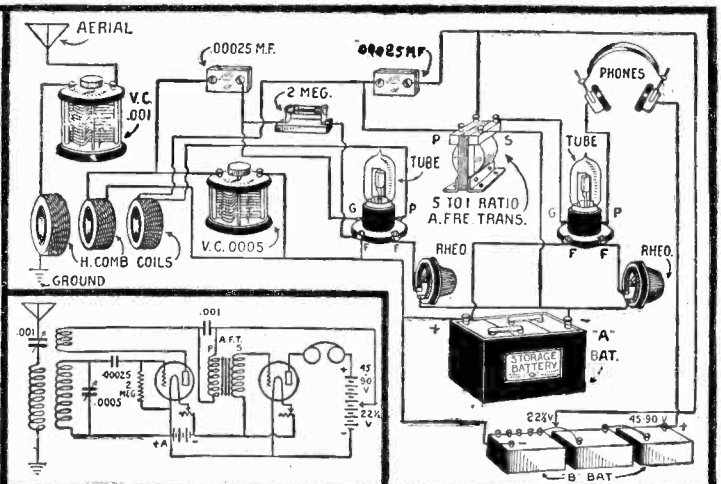
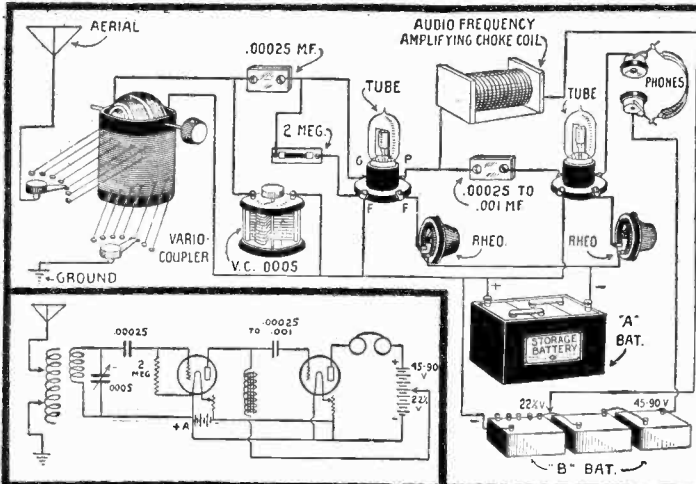
The type of receiver known as the Aeriola Sr. has been quite popular of late and many home-made sets have been made copying that particular outfit. The principle instruments are two variometers, and one of our readers during experimental work found that the addition of a loop aerial made quite a little difference in the reception. The circuit diagram as submitted by this writer is shown at the left. A series antenna condenser is used with a switch for short-circuiting it when a fairly short aerial is employed. The variometer in the plate circuit of the detector tube is of the standard type and size while the other variometer is rewound to the specifications shown. The stator should have 22 turns of No. 22 D.C.C. wire, 11 on each side of the rotor shaft. The rotor should be wound with 54 turns of the same sized wire, 27 turns on each side of the shaft. The rotor and stator are connected in series. Great care should be taken in tuning this set in order to prevent radiation. Capacities of from .001 to .003 mf. should be tried across the phones. The voltage of the "B" battery will depend upon the type of tube used and various voltages should be tried until the best results are arrived at.

—Garold W. Van Vlack.

Radio for the Beginner

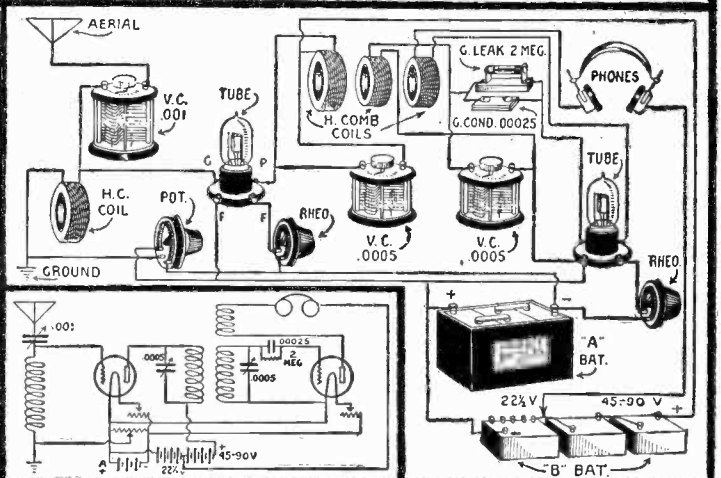
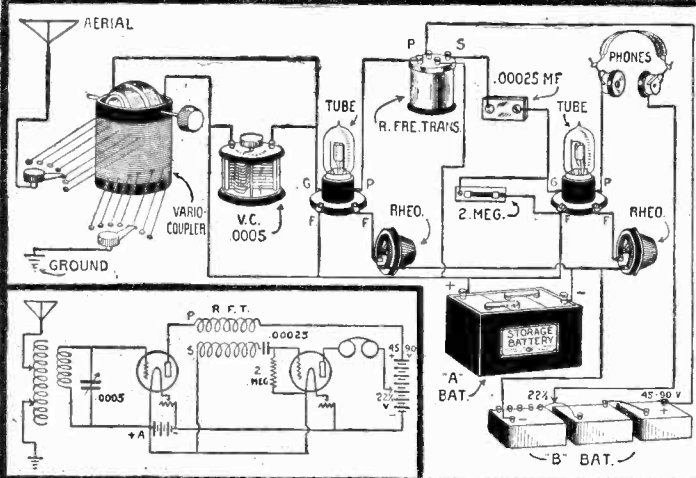
No. 25—Adding the Second Tube

By ARMSTRONG PERRY



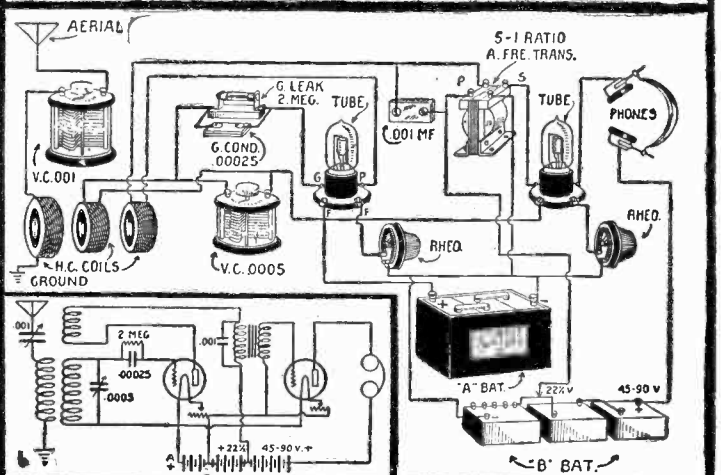
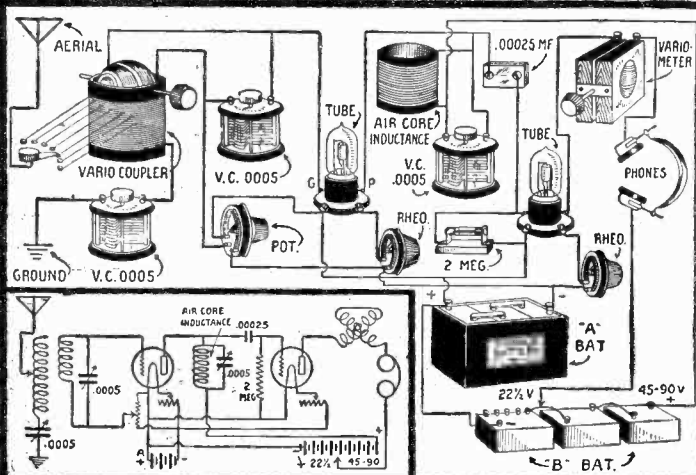
Choke coil audio frequency amplification at one time gained quite a little popularity because of the fact that, contrary to the case of transformer coupled amplifiers, practically as many stages could be used as desired without the usual attendant distortion. The volume delivered by a choke coil coupled amplifier is not quite as great as that from an equal number of stages of transformer coupled but there is less noise and distortion. The diagram above shows one stage of choke coupled amplification.

The diagram above shows how to add one stage of audio frequency, transformer coupled, amplification to a standard three coil honeycomb circuit. This same diagram, that is, the audio frequency amplifier can be adapted to any standard receiving set of any type whatsoever. The audio frequency amplifying transformer should be of a good make so as to give amplification as distortionless as possible. A three to one, five to one, or nine to one ratio audio frequency transformer may be used.



One stage of radio frequency amplification in connection with a straight detection circuit will give slightly better signals than a standard regenerative circuit. However, it has the great advantage of being non-radiating and at the same time the reception is much clearer and more distinct. A circuit diagram showing one stage of transformer coupled radio frequency amplification is given above. It is advisable to use an "A" battery potentiometer connected in the usual manner.

Above is shown one of the most practical and best methods of adding radio frequency amplification to a standard three honeycomb coil receiver. This addition puts an end to radiation from the regenerative circuit even though with such a tuner, radiation is quite low. The honeycomb coil used in the antenna circuit should be of the same size as was formerly used in the primary of the tuner when it was used without the radio frequency amplification.

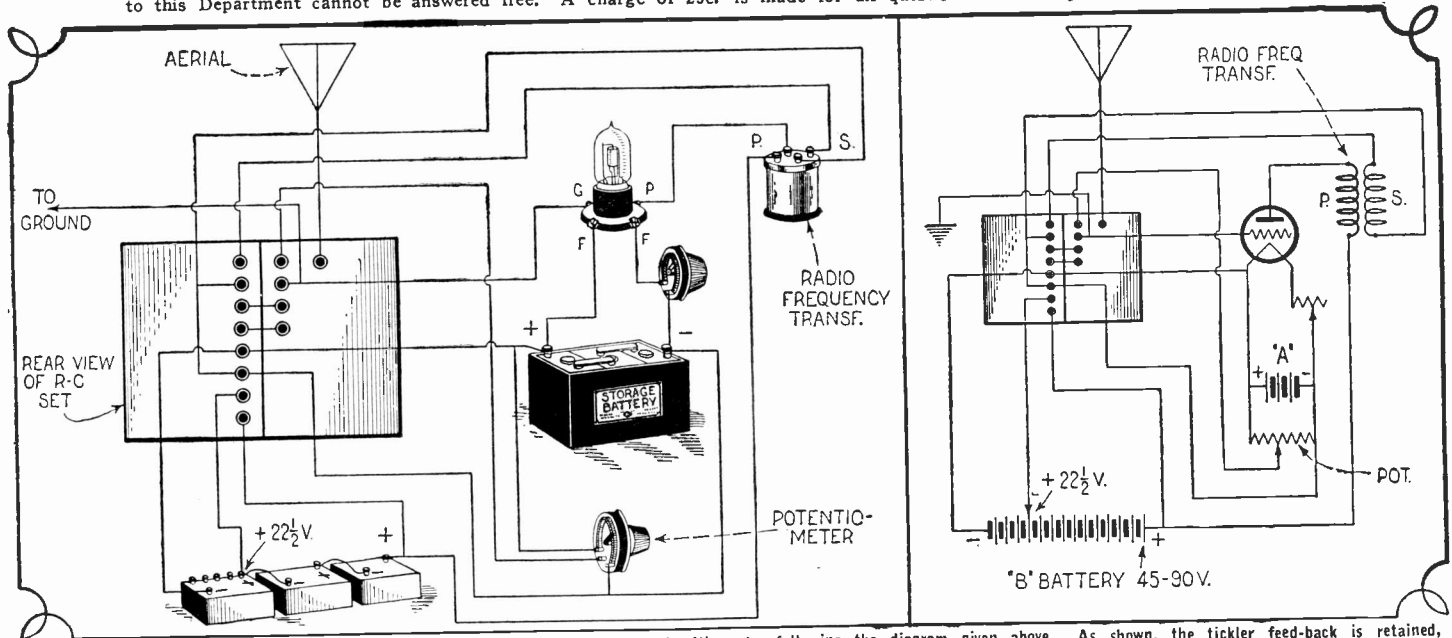


The circuit diagram above shows all the connections for the addition of one stage of tuned impedance coupled radio frequency amplification to a set employing a variocoupler, a variable condenser and a variometer. The detector circuit is regenerative and as a result the set will yield quite loud signals. Selectivity with a circuit of this type is very good. The air core inductance should consist of about 40 turns of No. 22 D. C. C. wire on a 3-inch tube.

The circuit diagram shown above is somewhat similar to that shown in the upper right-hand corner of this page, but there are some changes here which may give the builder several suggestions toward making his set more efficient. It very often happens that a certain tube will operate better with the grid leak connected as shown above than it will with it connected to the grid to the filament. Also the tube may work better with the negative "B" battery connected to the negative "A."

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.



No. 250. Many owners of standard R. C. tuners which are designed to be used with a special detector and two stage audio frequency amplifier often desire to add radio frequency amplification to the same so as to increase the receiving range. This can be accomplished, placing the radio frequency amplification between the tuner and the detector

by following the diagram given above. As shown, the tickler feed-back is retained, feeding back through the R. F. amplifier. If this is not desired, the jumpers shown may be removed and the binding posts on the detector, which formerly connected to the tickler, short-circuited. This will make a much quieter receiving set.

R. F. WITH R. C.

(250) Jim K. O'Neill, Alta., Canada, asks:

Q. 1. Can you give me a circuit diagram for adding one stage of radio frequency amplification to a standard R. C. tuner, detector and two stage amplifier without changing the internal connections of the same?

A. 1. Such a diagram is given in these columns. The view of the R. C. set shown indicates all of the binding posts mounted on the rear of the same. The same "B" battery and "A" battery are used for both the radio frequency amplifier and the set itself.

TROUBLE

(251) Edward B. Sperling, Chicago, Ill., says that he built a radio receiving set following the directions given in an article in this magazine and that when it was mounted on a plain base, he obtained excellent results. He goes on to say that after obtaining these results he decided to mount his set in a cabinet and proceeded to do so. After this work was done the set worked very poorly and only the most powerful nearby stations could be received. He asks:

Q. 1. Can you help me with my trouble?
A. 1. We regret very much to hear that you have had so much trouble with your five tube radio receiving set. It would seem, however, that you certainly must have made a mistake in your wiring or else in changing the instruments from an open base to a panel, you damaged the windings on some of them. We would suggest that you go

over each individual instrument in the tuning and radio frequency circuits and test them carefully for open circuits and look them over to see that nothing is short-circuited.

If there are pigtailed on any of your instruments, make sure that the insulation has not worn through and short-circuited. This would account for noise and also for the broadness of tuning. If your set is considerably noisier than before, we would suspect that there is a feed-back relationship between your various instruments. The antenna inductance coil should be kept at least six inches away from the vario-coupler and variometer. Also the radio frequency transformers should be placed so that their coils run at right angles to each other so that no interaction will take place.

We would advise you to investigate the above mentioned points and if you still do not get results, write us again, giving complete information on the results obtained.

MAGNESIUM "A" BATTERY

(252) Lewis J. Feinstein, Richmond, Va., asks:

Q. 1. Will the battery described on page 885 of the January, 1924, issue of SCIENCE AND INVENTION work as the "A" battery in a radio set?

A. 1. In connection with the battery you mention, we would say that it can very readily be used as an "A" battery on a radio set. It delivers a fairly constant current and is perfectly suitable for the work mentioned.

Of course, when the battery is not in use, the rods must be removed from the solution, as otherwise their life would be shortened considerably and they would rapidly polarize. The size of the rods will depend upon the size of the other elements used, but in general, we would advise the use of a one-half inch magnesium rod of sufficient length to reach the solution. These rods can be purchased from any electrical supply house.

NOISE IN RADIO SET

(253) Charles Horn, New York City, asks:

Q. 1. Can you give me some help toward eliminating the noises in my detector and audio frequency amplifier?

A. 1. Use an "A" battery potentiometer across the filament battery and connect it to the negative "B" battery. Solder all leads. Place the transformers in such a position that no adjacent transformers have their windings parallel to each other. Shield the instruments by means of tinfoil or aluminum sheets placed in back of the panels, and ground these shields. Make sure that there are no loose connections in your transformers, sockets and other instruments. Be sure that the windings of the transformers are not loose on the cores. Keep all leads as short as possible, especially those from the plates of the tubes to the primaries of the amplifying transformers, and also the grid leak. You might also try shielding the transformers from each other by means of aluminum plates or tinfoil sheets and ground same.

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 Experimenter, 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.

IMPORTANT ARTICLES APPEARING IN THE MAY ISSUE OF RADIO NEWS

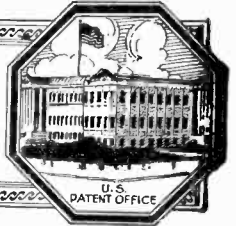
Radio Beacons Non-Directive and Directive.
By F. W. Dunmore.
The Production and Use of Ultra Short Wave-lengths.
By Prof. René Mesny.

Some Recent Radio Developments.
By S. R. Winters.
Radio Television—The Mihaly Telehor Machine.
By Nicholas Langer.

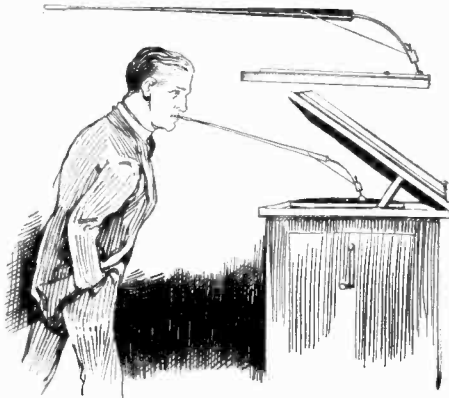
Choosing and Installing a Receiving Set.
By Parker L. Worthington.
The Vacuum Tube and How it Works.
By Prof. John H. Morecroft.
Possibilities of Unique Receiving Circuits.
By Morris S. Strock.



LATEST PATENTS

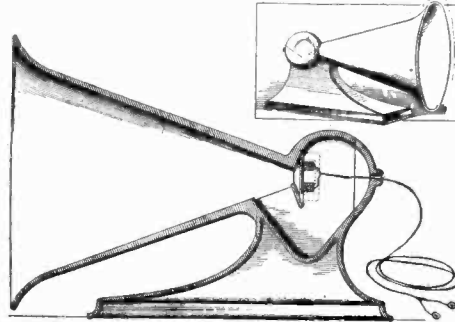


Dentiphone



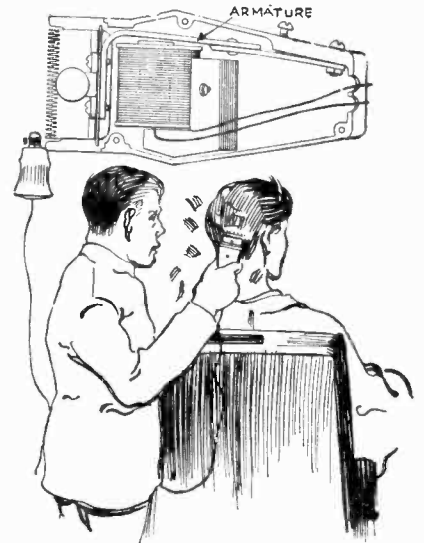
Pat. No. 1,472,214 issued to J. W. Gonce. By means of a phonograph stylus attached to a metal cone arm, connected with an extension, as shown in the above illustration, the inventor of this device communicates sound from the phonograph needle, to the mouthpiece of the extension, and to the user's ear. This invention is an aid to the deaf.

Loud Speaker



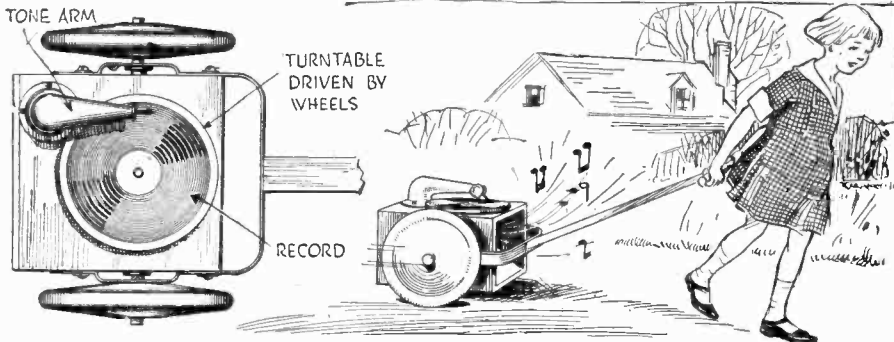
Pat. No. 1,483,159 granted to R. R. Williams and J. G. Malloy. In most loud speakers, according to the claims of the inventors of the above illustrated device, only one direction of the vibration of the diaphragm is used. This device contemplates using both the forward and backward spring of the diaphragm to originate sound waves. The horn is constructed in the fashion shown above. The electrical unit is mounted, as shown, and a hole is made through its rear casing, in order to allow a column of air extending backward to be actuated by the backward stroke of the diaphragm.

Vibrator Clippers



Pat. No. 1,474,128 issued to Leo J. Wahl. Most of the hair clippers on the market at the present time driven by electricity receive their motive power through a flexible shaft from a small motor. This flexible shaft results in a certain stiffness of movement and difficulty in operation. The above illustrated invention circumvents this defect by operating the movable blade of the electrical clipper directly from an iron armature which is acted upon by the magnetic field set up around the coil which receives its current through a flexible lead which may be plugged into any light socket. The clipper can be made to operate on either direct or alternating current, and is constructed so that any type of blade may be used.

Novel Phonograph Toy



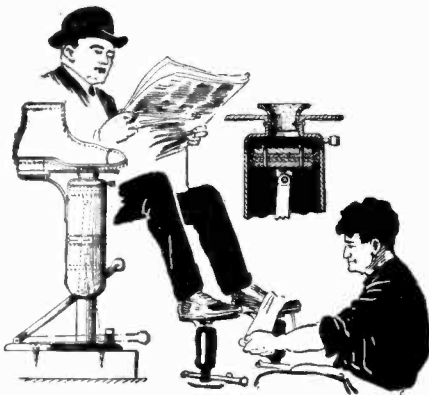
Pat. No. 1,484,965 issued to Warren Ritter. By placing a toy phonograph—or rather a tone arm and a record turn-table on a toy wagon, this invention gives an exceedingly novel idea in the toy field. The rubber tired wheels connect to two friction disks within the body of the wagon, which in turn drive the shaft of the turn-table. The interior of the wagon is built in the form of a sound box, to which the vibrations from the diaphragm and tone arm are communicated. The turn-table is operated through the revolutions of the wheels as the wagon moves forward.

Egg Beater



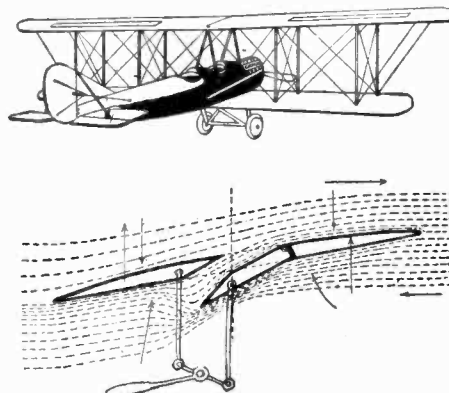
Pat. No. 1,477,943 issued to W. W. Crocker. As extremely valuable though simple improvement on the present-day domestic egg beater is the above shown invention. Instead of the usual crown gear, operating two smaller gears attached to the beating elements, this device consists merely of a spring with an extension arm which carries a rack operating a pinion attached to the beating element. Since this new beater can be operated with one hand, leaving the other one entirely free, it constitutes quite an improvement on the old style which necessitated the use of both hands.

Boot Black Stand



Pat. No. 1,463,631 issued to C. Schonsteiner and T. E. Michael. In order to obviate the discomfort resulting from a shoe slipping off the ordinary boot-black's stand, this invention places a suction cup in the bottom of a stand which is operated by a small piston contained in the stand. The suction acts upon the sole of the shoe being shined, holding it tightly to the foot rest.

Airplane Wings



Pat. No. 1,471,243 issued to H. L. Coffin. The inventor of the arrangement for airplane wings shown in the above illustration, claims that the air resistance of the machine is greatly reduced through the allowance of a flow of air through the central portion of the wing. By making it adjustable, the inventor also claims that maneuvering of the plane is made much easier.

Scientific Humor

AN ITALIAN "HOOK-UP"

From Marconi to Macaroni seems the trend of radio; first, we have the wire, and now we have the spaghetti.—*Ernest Macneuv.*

HE USED HOT AIR

A man met an old friend who was a semi-invalid and had just returned from visiting a famous physician in another city.

"When you consulted the great specialist about your rheumatism, did he prescribe hot baths?" he asked.

"No," replied the sick man, "he didn't soak me that way."—*Jas. J. O'Connell.*

THE LOUD SPEAKER



INTELLIGENT YOUNG SON TO FATHER: "Father, do you know that a device for eliminating sleep has been invented?"

FATHER: "Yes, son, we used to have one in our home when you were a baby."—*Lawrence G. Rowe.*

"STERLING" QUALITIES

SHE: "I've always wondered why poets speak of the moon as silver."

HE: "I guess it's because it's in quarters and halves."—*Milton Konecke.*

A COLD WAVE

HE: "You are the sunshine of my life."

SHE: "Oh Tom."

HE: "You reign alone in my heart."

SHE: "Darling."

HE: "With you at my side I could weather any storm."

SHE: "Just a minute Tom. Is this a proposal or a weather report?"—*F. O'Connell.*



A GREAT LIGHT DAWINED ON HIM

"People never take inventors seriously."

"No, even Edison made light of his theories."—*Fred Boelster.*

SHE HAD HIS NUMBER

He was a new arrival in this country and was none too familiar with the telephone, so he took the receiver and demanded:

"I want to talk to me wife!"

Central's voice came back sweetly: "Number, please."

"Oh," he replied, perfectly willing to help out, "she bane my second wife!"—*W. W. Elmer, Jr.*

NO FREE GRAFT

SOPH: "I'll never be a horticulturist."

MORE: "Why the prejudice?"

SOPH: "I wouldn't want to risk being sent to jail."

MORE: "Where did you get that wild idea?"

SOPH: "Well, a horticulturist has to be a grafter, doesn't he?"—*Howard H. Smith.*

FOR THE "HEAVENLY" SEX

WIFEY (reading): "Hubby, what's the cosmic law?"

HUBBY: "Oh, that's the law of how to put cosmetics on."—*Francis Yraola.*

First Prize \$3.00 CLEAR AS CRYSTAL



HE: "I have a crystal set in a match-box."

SHE: "Yes, I shouldn't wonder, I have a crystal set in a ring."—*Trevor B. Holow.*

AT DYNAMO'S

Oh, chemist of skill, investigate—

Answer this quiz of mine:

I think I know what Carbonate—

But where did Iodine?—*W. W. Elmer, Jr.*

OR DANDRUFF

TEACHER (to class in physics): "What force causes some people to scratch their heads when thinking?"

SMART LAD: "Force of habit, sir."—*David Bone.*

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.

HORSE SENSE

GRID: That storage battery booster of yours that I borrowed is one of the slow horse kind.

LEAK: What d'ye mean, "slow horse."

GRID: It isn't a fast charger.—*W. Derrning Goodale, Jr.*

A GOOD ARRESTER

CHEMISTRY STUDENT: Professor, did you hear about that wonderful chemical change that occurred downtown yesterday?

CHEMISTRY PROFESSOR: No, what was it?

STUDENT: A policeman was talking to a friend, when a pretty girl in short dresses passed by and the "copper" turned to "rubber."—*Julian Warner.*

SHOCKING



JONES: "Who was the first man to be shocked?"

MASON: "Adam."

JONES: "How's that?"

MASON: "Well, wasn't Adam electrified when he saw Eve?"—*Manuel Cadima.*

THE DOC RE-TIRED—

"Hey, Bill, your doctor's out here with a flat tire, and he wants to know what it's going to cost him," announced the garage owner's assistant.

"Diagnose the case as flatulence of the perimeter, and charge him \$8.00," came the answer.—*Harold Sachs.*

THIS JOKE HAS WHISKERS

RADIO BEGINNER: What do you get from the cat-whisker on your crystal set?

RADIO BUG: Why I get a meow every once in a while.—*J. M. Walukonis.*

THE LIGHTWEIGHT

PROFESSOR: "Why do we measure stellar space by light years?"

STUDENT: "Because there's no gravity in space."—*Andrew O'Connell.*



BAIT

STEW: What kind of fish has it's eyes set closest together?

DENT: Dunno, I'll bite. What kind does?

STEW: A little fish, of course, you sucker.—*Howard H. Smith.*

WHY MOTHER EXPLODED

MOTHER (in next room): Is the kettle boiling?

SON (in kitchen): No mother. (10 minutes elapse)

MOTHER (walks into kitchen): I thought you said the kettle wasn't boiling, why it's almost boiled dry.

SON: No it hasn't boiled mother, but the water has.—*James T. Telling, Jr.*

GETTING PRACTICE

JACK: "Why did they kick that medical student out of the library?"

TOM: "They caught him trying to remove the appendix from a book he was reading."—*Paul K. Beemer.*



A WRONG "CALLING"

SMART: "How would you classify a telephone operator? Is her's a business or a profession?"

WEED: I'll bite, which is it?"

SMART: "Neither. It's a calling."—*John Agar.*

SHIFTING THE CENTER OF GRAVITY

PROFESSOR IN PHYSIOLOGY: What is the effect of alcohol upon the body?

PUPIL: It destroy's a man's stability and increases the tendency to translational and rotational motion by removing the center of equilibrium to a point outside the body.—*Edwin Berg.*

"STRIKES ME QUEER," SAID THE NAIL TO THE HAMMER

"Life for me is a perfect bore," said the auger.

"I'm a little board myself," said the plank. "Regular grind," growled the stone.

The work bench said, "I have only one vise." "Let's strike," remarked the hammer.—*A. Zimmerman.*

Awards of \$1000 Monthly Prizes

The Regular Departments Pay Prizes of Their Own. Authors on Contract Receive Their Own Rates; Making the Total Paid for Articles in Excess of \$1500.00 Monthly.

FIRST PRIZE, \$100			
Tamar Lane	12-13	J. T. Garver	86
TWO PRIZES OF \$50.00 EACH		H. R. Francis, Jr.	88
Chevalier de Terrail	22	R. J. Harris	89
Dr. Albert Neuburger	25	Harry Ackerson	90
TEN PRIZES OF \$25.00 EACH		Robert Lehfeldt	91
Clarence A. Snyder	15	James Gordon	92
Corley P. McDarment	15	Leroy Western, Reporter No. 15	93
H. H. Dunn	16	Harry Ackerson	93
Ismar Ginsberg, B.Sc.	28	Robert Lawrence	96
Phil Gersdorf	36	E. A. Lenz	97
Angus Pekerson	36	Howard Fettes	98
O. F. Bond	38	C. B. Kramer, Sr., Reporter No. 6349	99
Lt. Com. H. H. Little, U. S. N.	38	G. A. Luers	108
S. W. Ross	47	TEN PRIZES OF \$5.00 EACH	
J. W. Von Stein	51	Harold Jackson, Reporter No. 2903	47
FIVE PRIZES OF \$20.00 EACH		L. B. Robbins	48
John Foley, Reporter 4335	35	Thomas H. Duffy	48
W. W. Douglas	45	W. E. Bramel	49
Don Home	46	Willard Robinson	49
C. A. Oldroyd	46	Dr. Albert Neuburger	49
Armstrong Perry	56	C. R. Mullen	49
TEN PRIZES OF \$15.00 EACH		Dr. Albert Neuburger	49
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Carl Bjork	34	Wm. Henricks	92
E. A. K. Hackett	34	TWENTY PRIZES OF \$2.00 EACH	
Edward H. Flaharty	45	Leò Carble	87
Dr. E. Bade	47	E. S. Valentine	88
P. Medinger	48	Noah J. Oak	90
L. Ringer	55	Herbert I. Drew	91
Wm. Hoercher	55	Leroy Western, Reporter No. 15	94
C. S. Fish	55	Royal W. Knox	94
Garold W. Van Vlack	55	Francis N. Gilreath	94
TWENTY PRIZES OF \$10.00 EACH		Robert Clark	95
Author Art Removing Hair	35	J. F. Bosmik	95
Ernest H. Vuilleumier	37	G. William Dayton	96
S. Leonard Bastin	37	Harold B. White	97
Ernest Jones	37	F. J. Cartledge	98
Don Home	49	A. Segoll	98
Wm. H. Seitsinger	49	Author Radio Wrinkle Crystal Detector	99
Robert R. Garner	49	Earle F. Rueter	99

(Balance—5 Prizes of \$2.00—No Entries)

TEN PRIZES OF \$1.00 EACH
(No Entries)

Here Is How You Can Get in the Contest:

\$12,000 or More in Gold

EVERY month SCIENCE AND INVENTION pays \$1,000 or more in gold in prizes. Every text article published will receive a prize—(most of the departments have awards of their own which they give every month). Ideas are what the Editors want. The ideas must be told simply, so that your mother or your sister can understand them—in pictures or sketches or both. But the idea must be new and must have something to do with science or invention. The Editors want pictures and sketches—must have them—but what they want most

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

is IDEAS. These ideas will be handsomely paid for. We have published a pamphlet showing the rules of the contest which we shall be glad to send to anyone free on receipt of a postal card with your name and address. The pamphlet gives full details the rules and how to submit articles. The magazine itself shows you what is wanted. Study it closely and submit your ideas.


The closing date for all prize contributions is the 15th of the month preceding date of issue, i.e., the 15th of May for the July issue, the 15th of June for the August issue, etc.

WILL YOU BE OUR REPORTER?

IN connection with our \$12,000 prize contest announced herewith, it goes without saying that you will have to do a little work in order to win a prize. The Editors do not wish to make it hard for you, quite the contrary. We want pictures and ideas and we cannot have too many of them. Herewith is reproduced our reporter's card. Up to now we have issued close to 10,000 of these. Note in our awards how our reporters are winning prizes right along. We shall be glad to send the reporter's card free to anyone who makes an application for it. By means of this card you will be able to secure entry into industrial plants, business houses, motion picture studios, steamships, docks, public buildings, etc. This reporter's card will prove an open sesame to you in many instances. Every 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 to obtain one. It will be sent to you by return mail. With it we will send you a pamphlet giving rules of the contest and how to proceed in order to get photographs, to send in sketches, and other information in order to obtain a valuable prize. Not only will this card help you to obtain material for this magazine, but it will train you to become a news gatherer, and will be the means of helping you to earn a good deal of money during your spare hours.

Address Field Editor, SCIENCE AND INVENTION, 53 Park Place, New York

REPORTER



NO. 999

John Doe

CORRESPONDENT
REPORTER'S
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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.

AVIATION MICROPHONES

(1661) Alvin Munes, Denver, Colo., asks:

Q. 1. How are the microphones used for communication between the pilot and the observer on an airplane constructed?

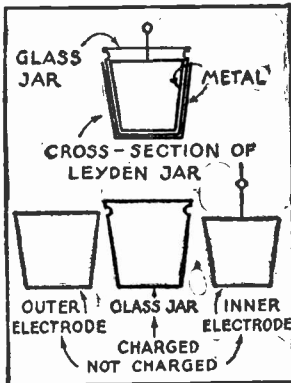
A. 1. The microphones used by aviators for communication between the pilot and the observer are usually of the standard type using carbon balls. These transmitters are strapped to the chests of the operators and when they speak the chest vibrations are transmitted through the microphones to the listener. In this way the sound in the motor does not affect the microphones.

Q. 2. When speech is transmitted by radio, are the vibrations for a certain sound faster or slower than when the words are transmitted to the hearer through the atmosphere in the ordinary manner?

A. 2. The vibrations of the human voice for sounds remain constant no matter how they are transmitted.

LEYDEN JAR PRINCIPLE

(1662) George Englewood, Nashville, Tenn., asks:



Contrary to the popular opinion the charge in a condenser or Leyden jar does not reside on the metal plates but on the dielectric. This can be readily proven by means of the experimental condenser illustrated at the left and described in the text.

Q. 1. When a Leyden jar is charged, where does the electricity accumulate?

A. 1. The charge in a Leyden jar resides, not on the metal electrodes but on the glass dielectric. This can be readily proven by means of a jar constructed on the lines shown herewith. Two metal cups are employed and placed together with a glass jar between them. A rod and ball are connected to the center electrode. The jar is then charged. By means of insulated hooks, the three elements are separated. By means of an electroscope it can be determined that the metal parts retain no charge. Upon approaching the glass portion with the indicating device, however, the presence of an electrical charge will at once be noted.

LOCATING BURIED TREASURES

(1663) W. Jackson, Wichita, Kansas, asks:

Q. 1. Can you give me any information on the apparatus used for locating metallic ores buried below the surface of the earth?

A. 1. There have been many devices made to locate metals and mineral ores buried beneath the surface of the earth. At least, so their makers claim. One of these devices working on the principle of the Hughes balance was described in the August, 1921, issue of this magazine.

TUNED STRING

(1664) Jos. W. Jackson, Brooklyn, N. Y., says

Valuable Articles in May "Practical Electrics"

- High Tension Condensers. By Curtis Kissel.
- Electric Oil Feed for House Furnace. By George G. McVicker.
- Some Primary Batteries. By Dr. Russell G. Harris.
- Building a Thermogalvanometer. By Amedeo Giolitto.
- Battery Charging Switchboard. By R. G. Morgan.
- Efficient Electrophorus and Electroscope. By Horace Brooks.
- Tesla Coil. By Frank W. Godsey, Jr.
- Experimental Microphone. By Henry Harrison.
- Illumination. By F. E. Andrews.
- Novel Frictional Electric Machine.

that one day while he was tuning a musical instrument by matching two different strings, he noticed that when their tones were matched, the vibrating of one would cause the other one to vibrate also. He asks:

Q. 1. Can you explain this?
A. 1. The phenomenon you mention is that of sympathetic vibration. When a tuned string is plucked so that it vibrates, it sets the atmosphere in motion, the waves that it produces having a definite length. These lengths are determined by the various characteristics of the string. If another string is tuned so that when it is plucked it will give out the same wave-length, you will find that it will vibrate when the first string is sounded even though the second one is not touched. This motion is imparted to the second string by the moving air waves.

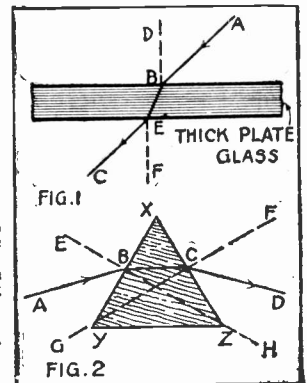
REFRACTION OF LIGHT

(1665) John J. Ross, Schenectady, N. Y., asks:

Q. 1. Can you show by a diagram how light is refracted in thick plate glass and also in a prism?

A. 1. In both cases the refraction or bending of the rays acts in accordance with the well known law put forth by Snell, a Dutch physicist, which is, "When a pencil of light passes obliquely from a less highly to a more refractive medium it is bent toward the normal; when it passes in the reverse direction, it is bent from the normal." Our illustration herewith shows just what happens when a light ray passes through heavy glass and through a prism. Fig. 1 represents a ray of light passing through plate glass. In this part of the illustration, A indicates the incoming or incident ray of light. B is the point where it strikes the glass and bends toward the normal which is indicated by the dotted line BD. The light then passes from B to E and is refracted away from the normal as it leaves the plate glass and enters the air. Its path is then represented by the line EC, normal being indicated by the dotted line EF.

In the case of the prism, which is illustrated in Fig. 2, the ray A strikes the side of the prism at



When light passes from a less highly to a more refractive medium such as from air to glass, the ray is bent toward the normal and vice versa. The exact phenomena which takes place both in thick plate glass and in a prism is shown at the right.

B. is refracted toward the normal EII, passes through the prism from B to C, leaves the higher refractive medium—the glass—and is bent away from the normal toward D. The normal in this case is represented by the light FG.

In connection with this discussion on light, the editor would like to make a correction on an item appearing in this department in the January issue. There it was stated that the angles of incidence and reflection were formed between the incoming and outgoing beams and the mirror. In this case, however, there should have been a perpendicular line drawn from the mirror and the angles of incidence and reflection shown as being between this line and the incoming and reflected rays.

OUR \$12,000 PRIZE CONTEST

IT will be noted from recent issues 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 9,000 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.

INTERESTING ARTICLES TO APPEAR IN JUNE ISSUE OF "SCIENCE AND INVENTION"

- | | | |
|--|--|---|
| Giants in Teacups. By Ernest Brennecke | Timing Cannons Electrically. By Raymond B. Wailes | Building Huge Movie Scenes with Paint and Brush. By Tamar Lane |
| Balloon Tires—Their Advantages and Disadvantages. By W. B. Arvin | Radio Desks—How to Build Four Attractive Models. By Wm. Butterfield | Breathing Tests Make Labor More Efficient. By Dr. Alfred Gradenwitz |
| How Your Lodge Button Is Made. By L. B. Robbins | A New Universe. By Charles T. Dahama | How Ball Bearings Are Made. By George Holmes |
| Raising the Ancient Obelisks. | Remarkable Minerals and Strange Crystals. By O. Ivan Lee, B. Sc., F.M.S.A. | |

FREE INFORMATION

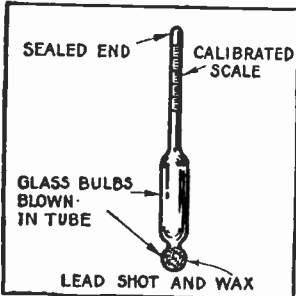
IF you want additional information concerning any of the subjects illustrated and described in this number of SCIENCE AND INVENTION, we shall be glad to give you other data we have at our command. To make this work as easy as possible for our editors, please be brief. Write only on one side of the paper 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.

HYDROMETER CONSTRUCTION

(1666) Robert M. Lundy, Chicago, Ill., asks: Q. 1. What is the construction of a floating hydrometer and how does it operate?

A. 1. The diagram herewith shows the construction of such a hydrometer. The lower end of it, as will be seen, is weighted so that when it is placed in a container filled with a liquid, it will float upright if lighter than the liquid. A scale is provided so that the distance to which the float sinks can be determined. This varies in different liquids, water being a standard, being assigned a specific gravity of 1 at 60° Fahrenheit. This figure is taken as standard and the specific gravity or density of other liquids is referred thereto.



The illustration at the left shows the construction of a standard hydrometer. This little instrument is usually placed within a syringe, the tubular part of the latter being constructed of glass and large enough to allow the float plenty of room.

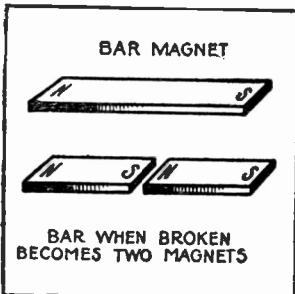
VIBRATIONS

(1667) Richard F. Mooney, Tulsa, Okla., asks: Q. 1. Can you give a table of various frequencies of vibrations from the slowest to the fastest, indicating which bands cover sound, electricity, heat, etc.?

A. 1. The table below gives the desired information.

TABLE OF VIBRATIONS

Octave	Number of Vibrations per Second	
1st	2	
2nd	4	
3rd	8	
4th	16	Sound
5th	32	
6th	64	
7th	128	
8th	256	
9th	512	
10th	1,024	
15th	32,768	
20th	1,047,576	Unknown
25th	33,554,432	
30th	1,073,741,824	Electricity
35th	34,359,738,368	
40th	1,099,511,627,776	
45th	35,184,372,088,832	Unknown
46th	70,368,744,177,644	
47th	140,737,468,355,328	Heat
48th	281,474,976,710,656	
49th	562,949,953,421,312	Light
50th	1,125,899,906,842,624	Chemical Rays
51st	2,251,799,813,685,248	
57th	144,115,118,075,855,872	Unknown
58th	288,230,376,151,711,744	
59th	576,460,752,303,423,488	
60th	1,152,921,504,606,846,976	X-Rays
61st	2,305,843,009,213,693,952	
62nd	4,611,686,018,427,387,904	Unknown



One of the phenomena of magnetism may be observed by breaking or cutting a bar magnet into two or three pieces. Each piece will become a separate magnet as illustrated at the left, unless too much force is used in breaking the magnet or too much heat is applied.

MAGNET QUERY

(1668) Timothy Sanderson, Brooklyn, New York, wants to know:

Q. 1. If a permanent bar magnet is broken into two or more pieces, what becomes of the magnetism?

A. 1. In cases such as mentioned above, two or more permanent magnets will be formed, each having both a north and south pole. This is illustrated herewith.

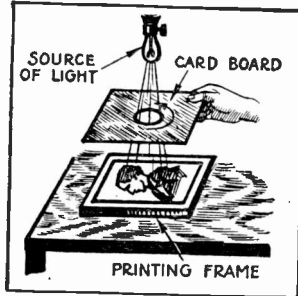
VIGNETTING

(1669) Harold Brown, Pittsburgh, Penna., asks:

Q. 1. How can the vignetting process be carried on successfully in a small experimental way?

I have several portraits on which I desire to use this process so as to obtain an effect of the head and part of the shoulders of the individual sharply defined, surrounded by a sort of a haze, fading off to white.

A. 1. Since you are doing your printing with an exposed lamp, the only apparatus necessary for vignetting is a cardboard sheet about one foot square with a small hole in it. This should be placed between the light and the plateholder as illustrated herewith. Some experimental work



To amateur photographers, the illustration at the left will be valuable. This shows a simple method of vignetting a photograph so as to produce a pleasing effect. It is particularly valuable in portrait work. The method of operation is explained fully in the text.

will have to be done to determine the exact size of the hole and the correct distance away from the plateholder. After the light is turned on, the card board is to be moved with a circular motion, keeping it the same distance from the plateholder. The radius of this circular motion should not be so great as to keep the main part of the direct light away from the cen-

IMPORTANT

TO NEWSSTAND READERS

IN order to eliminate all waste and unsold copies it has become necessary to supply newsstand dealers only with the actual number of copies for which they have orders. This makes it advisable to place an order with your newsdealer, asking him to reserve a copy for you every month. Otherwise he will not be able to supply your copy. For your convenience, we are appending herewith a blank which we ask you to be good enough to fill in and hand to your newsdealer. He will then be in a position to supply copies to you regularly every month. If you are interested in receiving your copy every month, do not fail to sign this blank. It costs you nothing to do so.

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tral portion of the photograph to be printed. The knack of rotating the cardboard sheet can readily be learned. Upon development, it will be found that the desired "fading out" effect has been obtained.

INCREASING ARC HEAT

(1670) William Goodwin, Peterboro, Ont., submits an idea for increasing the heat of an electric arc by having a hollow negative carbon and filling the same with water. The idea is that the water will be volatilized or separated into its component gases whereupon the hydrogen will be consumed in the arc and a greater heat will be produced. He asks:

Q. 1. Is this suggestion of any use?
 A. 1. At no time during the operation of your arc will the water come to such a heat that it will decompose and separate into its component parts. You will not obtain any greater heat by the method you mention, in fact the negative electrode will be cooler than without the water supply. The water will rapidly pass off in steam.

If you wish to obtain a greater heat from the arc, we would advise you to experiment with various core substances, such as magnesium. The heat can be increased considerably by the use of some such material.

CLEANING MERCURY

(1671) A. Hewish, Winnipeg, Man., Canada, asks:

Q. 1. What is a good and simple method of cleaning mercury so as to free it from impurities such as dust and dirt which it has gathered?

A. 1. One of the best ways to clean mercury is to place it in a piece of chamois, draw up the edges so that the mercury lies in a hollow and grasping the edges of the chamois with one hand and pulling them together, twist the neck of the sack thus formed. Upon applying pressure, you will find that the mercury will work through the chamois in fine droplets, but the foreign substances will be retained.

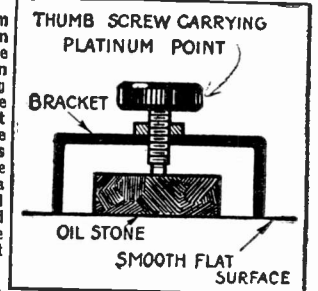
TRUING PLATINUM POINTS

(1672) E. Grimaldi, Ont., Canada, says that very often when replacing the vibrator on the spark coils used in a certain type of automobile, he finds that the contact points on the end of the adjusting screws are worn so that they do not make good contact with the new points on the springs. He asks:

Q. 1. Can you tell me how to true up these platinum points so that the surfaces between the two contacts can be made parallel?

A. 1. In order to do this work, the best method to follow is to construct a strong bracket in the shape shown in the diagram herewith, rounding off the edges of the ends of the legs so that the entire bracket can be moved back and forth on a

When platinum contact points on vibrators become worn and those on the vibrating spring are replaced, the stationary contact point must be straightened. This can readily be done by means of a bracket and an oil stone as illustrated at the right. The bracket must not bend.



smooth surface without too much friction. Drill a hole in the center of the bracket and tap it with the same thread as used on the contact screws. Place a flat oilstone on the surface on which the work is to be done and place the adjusting screw, the contact point of which is to be trued up, in the bracket as shown herewith. Move the bracket back and forth so that the platinum point will be trued up on the oilstone.

GRAVITATIONAL ELECTRIC MACHINE

(1673) R. F. Hoster, Waynesville, N. C., puts forth an idea of a large machine similar to the armature of a large dynamo. He states that this machine is to be so situated that it will cut the gravitational lines of force and induce in the conductors an electric current which is to be collected by means of brushes resting on a commutator and used for any purpose. He asks:

Q. 1. Is this idea of any value?
 A. 1. The machine you have designed would produce a slight amount of electricity by virtue of the lines of force surrounding the earth, but it would not prove very efficient, inasmuch as it would require an extremely large machine to give any noticeable voltage and amperage. The idea is very old.

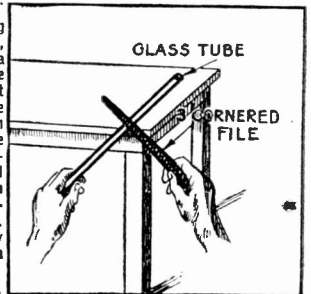
CUTTING GLASS TUBING

(1674) P. Edelman, St. Paul, Minn., says that he finds difficulty in cutting small glass tubing for use in chemical experiments and asks:

Q. 1. Can you tell me how to do this work without splitting the tubes or leaving ragged edges?

A. 1. First lay the tube to be cut on a table or stand as shown herewith and with a three-cornered file make a mark completely around the circumference of the tube at the point at which it is to be cut. The tube can then be readily broken by holding it with one hand on each side of the scratch, pulling it lengthwise and bringing lateral pressure to bear at that point. The edges of such a break will be found to be rather sharp, but they can be readily smoothed off by holding the end of the tubing in the flame of a Bunsen burner until it starts to soften. Remove immediately and the sharp edges will be found to have given place to smooth ones which will not cut the fingers or do other damage. Usually a slight scratch at one place is enough. The great point

When glass tubing is to be cut, scratch it with a three cornered file at the correct point. Then take the tubing in both hands with the scratched point between the hand and apply pressure in the manner described in the text. This will usually result in a clean and even break.



is to pull the glass like a string with some force and to put a slight bending or cross stress on it at the same time.

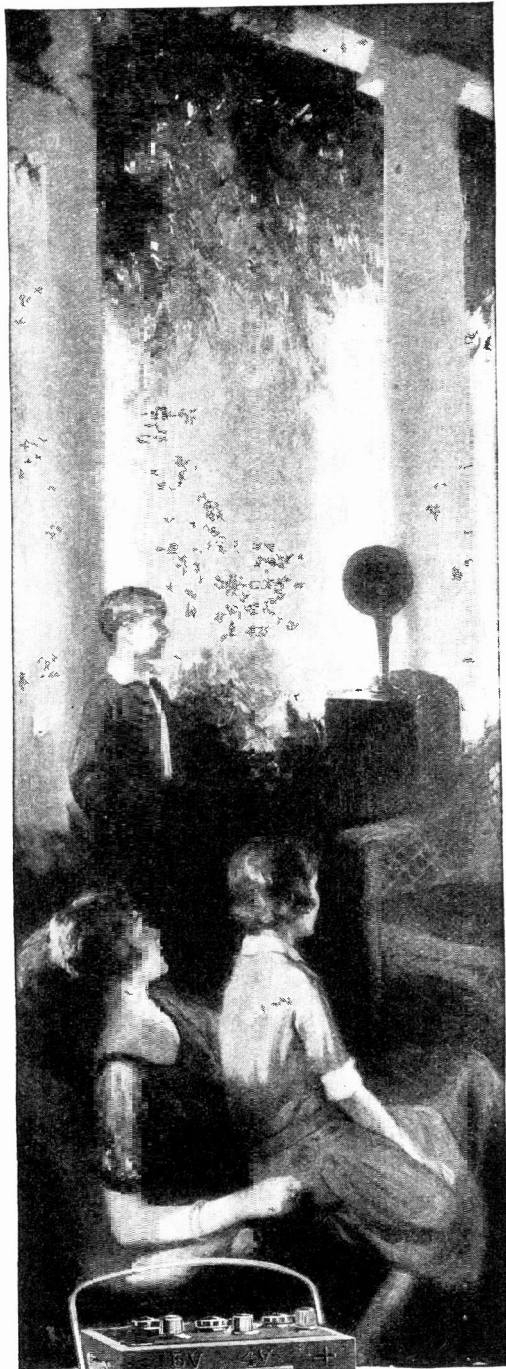
CHARACTERISTIC OF A TUNGAR BULB

(1675) Edward L. Belle, Elizabeth, N. J., asks the Oracle:

Q. 1. What is the filament and plate voltage of a five ampere tungar rectifier bulb and how may a transformer be constructed for use with it?

A. 1. The filament voltage of a five ampere tungar bulb is two and one-half and the plate voltage from twenty-seven and one-half to thirty. See the March, 1923, issue of PRACTICAL ELECTRICS for full data on a tungar rectifier.

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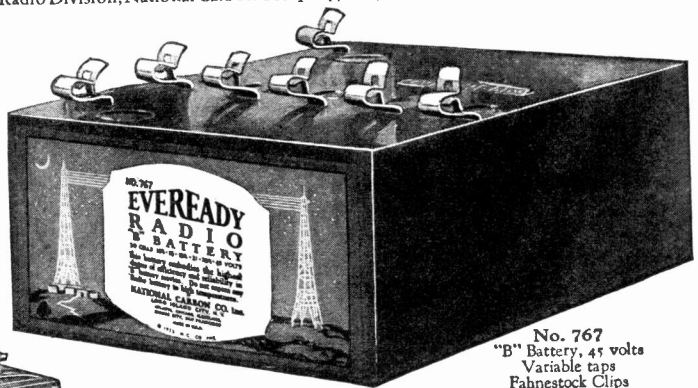
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The Man On the Meteor

By RAY CUMMINGS

(Continued from page 21)

But I did not heed him. That girl on the rock across the cave was still crouching there. The baleful gaze of her huge eyes was downward to the platform—and my heart leaped into my throat when suddenly I realized that she was staring, not at Og, but at Nona.

And then I saw her hand go to her grotesque green robe. It came back; her pincer held a very short gleaming spear—like a dagger.

The crowd was silent, hanging now on Og's words. Of all that throng, only I was watching that menacing figure on the ledge.

Abruptly the silence was split by a scream—the Maagog girl screaming as though at last her rage and jealousy had broken the bonds of her reason. I saw her dive, head downward—diving and swimming, with the blade extended—straight for Nona!

My own reason left me. I leaped forward, thrust back Caan and Atar who would have stopped me—and plunged from the ledge—plunged downward in a long, swimming dive toward the platform where my Nona sat bound and helpless!

II

Plunging head downward, it seemed as though the platform, with Og, Nona and the white old men upon it, was sliding swiftly upward at me. To one side, level with me, the Maagog girl was coming down also; we two formed the sides of a V, converging at Nona.

It all happened very quickly; no more than a few seconds went by as I made that downward plunge—yet during that time my head whirled with a thousand frightened thoughts. And one of them stood out predominant. The Maagog girl, in murderous frenzy, would reach Nona first; would stab her to death before I could intervene.

I was conscious that the crowd had fallen silent. Behind me, high overhead now, I heard Atar shouting. Soon the platform was close under me. The Maagog girl, too, was close—unswerving, seeming not to have seen me. A spear, thrown by someone in the crowd—a crude, heavy sort of spear—came up at me, but I avoided its ponderous flight.

Og in alarm, had slid away; the white old men were cowering. Nona's face was upturned to mine. I twisted sidewise, flung myself at the Maagog girl. Our bodies met; the impact threw us both down upon Nona. The Maagog girl screamed again, but her screams were almost lost in the shouts that now came from everywhere.

I was hardly aware of intercepting the blow of that dagger. It struck my forearm—seared me like a fire-brand. But then I caught the girl's wrist, twisted the weapon from her. She screamed again, screamed with baffled fury. The water around us was white with her struggles.

Atar was beside me! "Quick, Nemo! Nona is free! Nona, come!"

With his spear-edge, Atar had cut Nona's bonds. The Maagog girl was swimming away, still screaming. A figure came at me—a Maagog man, with Og prudently behind him. I plunged the girl's spear into the figure's bulging chest, and waved my spear at Og as the Maagog sank at our feet.

Overhead, Caan was poised in mid-water, shouting defiance at the frightened crowd. I turned. Nona was free! She was mounting upward toward Caan, with Atar covering her retreat.

"Nemo! Nemo!"

It was Nona's voice. Og was backing away, looking for a weapon with which to attack me, and shouting at the crowd to head me off. I mounted after Atar and Nona. Higher up, Caan was now fighting

a Maagog who had risen to attack him. Then the Maagog's body slowly sank, with Caan's spear buried in it.

THE RETREAT

In another moment we were again on the ledge from whence we had come—and my Nona was safe with us! For a brief instant I held her in my arms.

But Caan was dragging us all back into the passageway. Below us the cave was in turmoil. Og had gathered around him a dozen or so who had weapons. They were coming up after us! Frightened groups surrounded the bodies of the two we had killed. One of the white old men had recovered himself and was bawling orders. And over it all the Maagog girl was laughing and screaming with hysterical triumph because Nona had escaped Og and was gone.

"Nemo! Come!"

Ahead of us lay the dark passageway with its barrier of coral. Beyond that, another length of passageway upward to the open Water of Wild Things.

We swam hurriedly forward, but my arm was still around my Nona. Soon we were in the coral barrier. Behind us, down the passageway, we would hear Og and the others shouting as they followed us.

We threaded our way through the coral, slowly, laboriously, as one would force a way through the thick frozen underbrush of your winter forests on Earth. But it was a shallow barrier—two hundred feet through, no more.

Again we were in the open passageway; and Og and his party were approaching the barrier from the other side. We hastened onward and upward. It was a short distance only, and we were at the mouth of the tunnel. The open Water of Wild Things loomed before us. Somewhere up there through that inky void was the entrance which would lead us into Marinoid waters.

Atar gripped me, as with Nona beside me I would have launched myself out of the tunnel-mouth. And I heard Caan's low exclamation of dismay. A light had leaped out of the blackness—a single huge light of green; and then, behind it, a myriad others. Like tiny green stars they dotted the void.

We had no time for conjecture. The darkness out there took shape—a sinuous, serpentine shape. The thing was coming toward us. Its huge head seemed to radiate green fire; the body and tail behind the head were black, but like barnacles, a thousand luminous parasites clung to it, and glowed.

We drew back, but not before the serpent had become aware of us. It turned over with a long, gliding undulation and came at the mouth of the passageway. But it came hastelessly, lazily, as though in its own good time to pick up this food that was offered. I caught a glimpse of opened jaws—fangs half the length of my body. And its breath, a fetid stench, seemed to precede it.

Trembling, we flung ourselves back down the dim tunnel. Ahead through the coral, the vague reflected radiance from the cave was visible. In the coral we could hear Og and his followers, calling to one another as they threaded their way through.

There was no choice. The narrow walls of the passageway hemmed us in; behind us, the serpent was gliding quietly forward. We swam back to the coral. A Maagog forced his way out, and instantly I drove my spear into him. He crumpled with a gasp, and sank in a heap with the spear impaling him from back to chest.

"Nemo!"

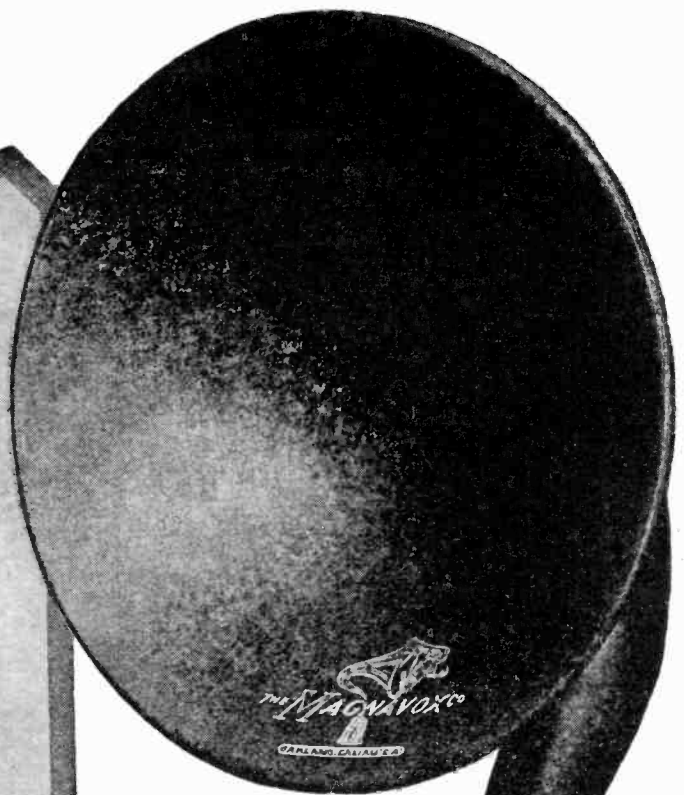
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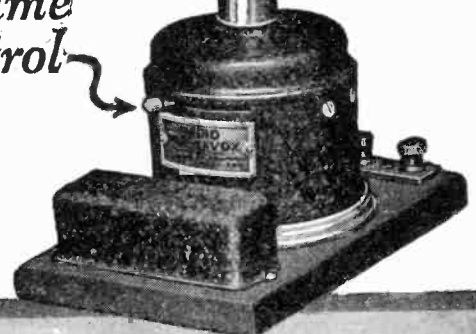
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The Man on the Meteor

(Continued from page 64)

ANOTHER OPENING

I turned, and Nona pushed me to one side. A small black opening was there—an opening at right angles to the main tunnel. It was barely three feet wide and twice as high. Caan and Atar were already in it. Nona glided in, pulling me after her. We swam back a dozen feet and paused. The green head of the serpent was out there in the tunnel we had left; it loomed there a vivid spot of light, at the entrance to this narrow slit which sheltered us—a head too large to enter. It stayed there a moment, and then, as though yielding to the inevitable, it quietly withdrew.

But how far, we did not know. We were terrified and confused. Nona was trembling violently.

"We must go on," said Atar. "Not back there to that—thing."

Ahead of us this narrow, slit-like tunnel seemed to broaden. It was almost black, but not quite, for the mud itself was faintly radiant.

We pressed forward, around a turn to the left, then another to the right. The water in this confined space was foul; it hurt our breathing. We hastened, to get out to the open water as soon as possible. We hoped we would strike it some distance from the mouth of the other passageway—enough to be away from the monster.

How far we went I do not know. Occasionally the tunnel branched, but we always took the larger. We turned several times—ascending, then descending again.

At last a glow showed ahead. The open water, but with a monster on guard there! Our hearts sank.

Abruptly, around a sharp curve, the glow brightened. We slid forward, came to the end of the tunnel. From a tiny, shelf-like ledge, we stared down into the self same cave we had left so precipitately half an hour before! Still up near its ceiling, but now on its opposite side!

III

How can I make clear the dismay, the confusion that swept over us at this unexpected outcome to our supposedly successful escape? What could we do? Retrace our way back through the winding tunnel? There were many diverging passageways: we would lose ourselves hopelessly in this honeycombed mudbank. And before us was the cave, into which we could not venture without the practical certainty of capture.

Too bewildered to do otherwise, we crouched and stared down into the cave. It was less crowded now, but there were still a hundred or more Maagogs on its floor, and dispersed about its wall niches.

Across from us, almost at the same level, was that other ledge on which we had formerly perched. Behind it, its tunnel showed as a small circle of blackness. Perhaps we could swim across the cave unnoticed—get into that other, now familiar, passageway—then through the coral barrier and into the open water. . . To safety. . . Unless the monster were still there. . .

Atar aroused me from these thoughts. He was pointing downward into the cave.

"Nemo. Caan. What is he doing there?"

On the platform, Og and three of the white old men were gathered. Around them, a small school of fishes was swimming. Ten or twenty fishes—short, squat things, two or three feet long, smooth, dull black skins, and with huge distended mouths. For all their size there was about them an aspect of extraordinary strength—their powerful squat build, the alertness of their movements.

My heart almost stopped with the sudden realization that these fishes—or were they fishes?—were not swimming aimlessly, but were waiting for Og's command! Like a pack of trained animals they circled about their master. Then Og called to them. They answered with full-throated, yelping cries! Fishes with voices, you exclaim? You need not be amazed. There are "shouting fishes" even in your own waters of Earth.

Og was bending over the shell where Nona had been bound. The rushes that had bound her and which Atar had cut, were still lying there. At Og's call these swimming creatures gathered around him eagerly. The sound of their voices—yelping, whining—was blood-curdling. Og was raising up the severed bonds—holding them out; and the fishes were smelling of them!

Then, in a pack they gathered; and Og, leading them, swam with them across the cave up near its ceiling to that other ledge from whence, with Nona, we had made our escape.

The black fishes entered the other passageway, with Og and half a dozen other Maagogs after them. As they swept down into it, their gruesome cries died away into the distance.

You, with your knowledge of similar things, will doubtless think it stupid of us to be puzzled at the meaning of all this—at its danger to us. Yet—we had no way of knowing. We stared at each other, relieved that these ugly black things which uncannily answered Og's commands, had disappeared.

"Nemo! You are hurt!" It was Nona, who now had noticed that my arm was bleeding where the Maagog girl's dagger had ripped it.

"Nothing," I said; and I wiped it against my robe.

We tried to plan what we should do. Could we cross the cave? The Maagog girl was still down there, near the platform, with eyes alert to everything around her—eyes that still smoldered with hate and jealous rage. No. To enter the cave would be to court almost certain discovery. We would have to retrace our way—find some other tunnel to lead us out into the open water.

We were starting back, had gone perhaps a hundred yards, when far ahead of us down the narrow passageway, we heard sounds. Yelps! Cries! Whines! Not human—the cries of those squat fishes with their huge slimy jaws!

Panic seized us. We darted back toward the cave. Then forward again, trying to find a side tunnel. But along here there was none.

The yelps grew louder; Og's voice mingled with them. And then, before we could decide in which direction to go, like a pack of eager hounds following a trail and come at last upon their quarry the black fishes swept down upon us. I tried to fight them off—tried to protect Nona. But they darted about me, under me, over me, and gripped me from every side. Teeth like needles, ripping, tearing at my flesh. . . Og's voice shouting a command. . . Caan screaming a warning at me. . . Then something heavy struck my head. Silence and blackness descended upon me.

IV

I recovered consciousness to find myself lying in a bed of mud in a dim, cave-like room. My first sensation was one of heat; the water I was breathing was hot, stifling. My head throbbled.

Nona, Caan and Atar were gathered over

(Continued on page 68)

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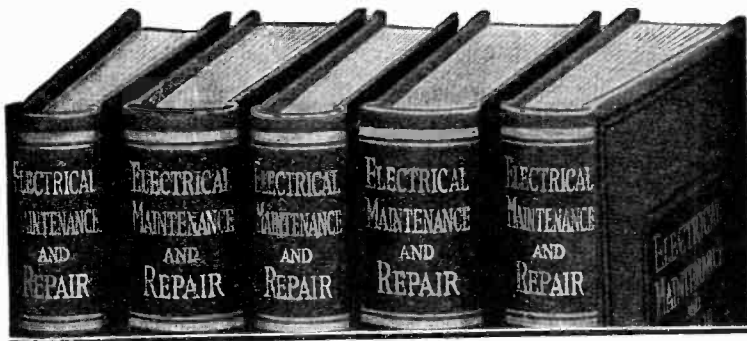
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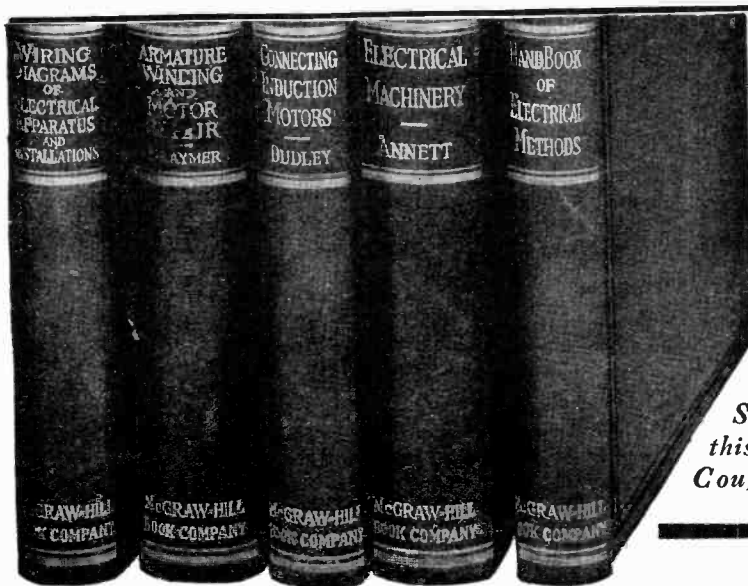
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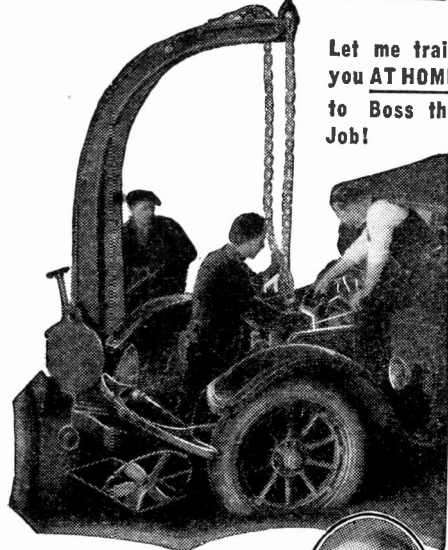
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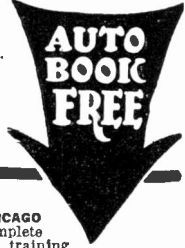
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The Man On the Meteor

(Continued from page 66)

me, waiting anxiously for me to recover my senses. Nona, hearing my weak voice, seeing my eyes open, threw herself down beside me.

I was not greatly injured. Og had struck me on the head with the flat of his spear. It had cut my scalp and raised an ugly lump. Besides that, the flesh of my legs, arms and shoulders was torn by those fishes' teeth as if by needles.

The plight of Caan, Atar, and even my dear Nona, was similar—but with none of us was it serious.

They told me now, that we were captives. Back there in the tunnel Og had called off his attacking fishes—called them from us or we would have been torn to ribbons. Then, floating me with them, the Maagogs under Og's direction had brought us here to this small room adjacent to the main cave—and left us.

I sat up, then swam a little. I was all right! Nona was all right—we were all safe and sound! My hopes revived. Why should we not now escape?

But none of my companions reflected my jubilant mood.

"Let him look around," said Caan to Atar. Never had I heard Caan speak so sourly, so dependently.

I did look around. We were in a black mud room some forty feet square and half as high. It was bare of furnishings; and lighted overhead by a crude sort of illuminated bladder that gave off a dull green glow. On one side against the black wall were beds, hollowed out of the mud. To you they would have looked like shallow graves; and in one of them I had been lying. Across the room was a shelf of mud with a dozen clay seats on it—like a row of huge toadstools.

NO ESCAPE

A third side gave into a tunnel. I approached it eagerly; then drew back shuddering. That pack of blood-hound fishes was out there, circling back and forth, on guard. They saw me, and darted lazily forward. As I stopped, they seemed satisfied, and went back to their endless circling, following every twist and turn of two or three who seemed to lead them.

Caan laughed cynically. "Not there, Nemo, you see."

My arms went protectingly about Nona, and she drew me wordlessly to the fourth side of the room. The wall here was gone. A grating of woven seaweed like prison bars, took its place. I stood on a precipice, gazing through the bars into a black void of water.

Can I make you understand the shuddering fear that possessed me? This water out there was moving swiftly downward, like a torrent, or a subterranean waterfall. Its current, drawing the water out of the room, flattened me involuntarily against the bars.

I had never seen swiftly moving water before. I felt as you would feel gazing from a great height into a dizzy abyss. And this water I could see, was boiling hot down there. But for those bars, I should have been whirled down into it! And from far below I could hear a faint sizzling, as of water dropped on a bed of embers.

I forced myself away from the grating, back into the center of the room; and now I was aware that all the water in the room was coming from the tunnel and passing in a current through those bars.

"You see," said Atar, trying to speak calmly. "You see now—"

But Og abruptly entered from the tunnel.

He hovered before us, leering. Nona shrank against me, and I folded her in my arms.

Og did not glance at Nona. He said to Caan: "Have you decided?"

"No," Caan answered. "He is but this moment recovered. We—"

"Tell him now. I will wait." Og turned away, swam over to the grating and gazed through it to that boiling, tumbling water.

Then Caan told me. Og offered us freedom—us three men. He would send us back to Rax. The price of it was Nona's promise to be his Queen—a willing, smiling Queen, none other would the Maagogs have.

I could feel Nona shudder against me, but she said no word.

"No!" I shouted. "No! No!"

Og heard me and smiled. "There is another way. Tell him, Caan."

And if we did not agree—if Nona did not give her promise—Og, the Executioner, would open the grating and let us three men slip out—down into that boiling water our helpless bodies would be sucked. . .

As Caan said it, my Nona burst out: "And Nona, too. *That* is best."

But even that, Og heard. "No," he smiled. "Not Nona. She will stay here with me—to rule as Queen when I have coaxed the smiles back to her pretty face."

I was suddenly aware of another figure in the room. That Maagog girl had slipped in from the tunnel. She heard Og's words. Her face smoldered with fury; but it was Nona, not Og, at whom she gazed so balefully. And I knew then that if ever Nona were left with Og—if we men were killed—this woman would kill Nona if she could.

Og faced the girl.

"Well, Maaret? Why do you come here?" He addressed her gruffly. "Did I not tell you to stay away?"

She gestured behind her. "The time is on us. They are ready—coming now. And Og, I knew that you had forgotten."

Og grinned. "Yes girl, you speak well—I had forgotten." It was doubtless very amusing; he was chuckling as he whirled on us who were hovering in a huddled group. "A fortunate occurrence, my friends from Rax. You shall swim aside now—and watch me as I perform this little duty of mine. You shall see how cleverly, how gracefully I do it."

He was still grinning; his voice was ironical, mocking—but his eyes were gleaming at Nona. "It will help you to decide, my Queen—help you to choose the fate of your Nemo, your little toy Prince Atar, and your Caan the shell-gatherer!"

There were sounds in the tunnel now—a low wailing, monotonous, like a chant, a dirge. Og waved us imperiously away. Maaret, the Maagog girl, led us to the side of the room near the grating. We followed her, but I kept myself between her and Nona. And there, flattened against the mud wall, we watched and listened.

AN EXECUTION

The wailing swelled in volume, then ceased abruptly. From the tunnel a line of figures came swimming—Maagog women, eight of them. Each held a child; an infant hugged to the mother breast; two or three older little boys dangling in the water held by the mother's hand; and one, a boy almost half grown, swimming close by his mother's side.

The children were all naked—puffed, dead-white little things, with goggling eyes and gaping mouths. One or two were crying.

The line slowly passed me, swung about, and went to the platform. On that row of toadstool seats the mothers took their places.

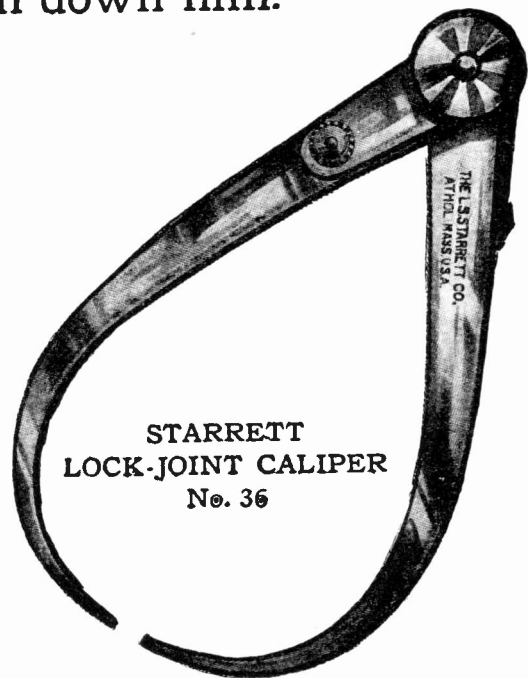
(Continued on page 70)



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The Man on the Meteor

(Continued from page 68)

They sat there drooping, hugging their children. The older boy huddled against his mother's knees; his face, turned my way, showed great, staring eyes, dark with a terror but half understood. He was whimpering a little, but his mother silenced him with a low-spoken word.

Og, swimming slowly, went the length of the line, counting the women, searching their faces, and the faces of the children. Evidently he was satisfied that all who should be, were there.

"You are ready?" he said.

My gaze, following his, swept the line, A woman sobbed; another clutched her infant hungrily; but they all nodded assent. "You first," said Og abruptly. He darted an arm at one of the women. A tremor shook her; a shudder; but obediently she held out her infant to Og. He took it, swam with it to the grating, and opened a little gateway that was there.

As he held the infant poised, his glance turned to me; his eyes were grinning sardonically. Atar was cursing softly. I started forward, but Caan held me back.

"No use, Nemo!"

Og's arms went up; he slid the infant through the little gateway. I heard its mother scream; but my eyes, fascinated, were on that black, tumbling void of water.

The baby's body, caught by the current, floated out and downward—slowly at first, then more swiftly. Gradually it turned over. . . . An infant face—big eyes full of staring surprise . . . a puny wail of protest as the water grew hotter. . . .

Down it went, whirling now—a tiny white blob . . . white, then pink—then turning red. . . .

I sank back, sick and faint. And Nona, who had not looked, whispered tremblingly to me the meaning of it all. There were too many male children being born to the Maa-gogs—too many useless mouths to feed.

After each tenth time of sleep, male children were drawn by lot in the different community houses and sent up here to this death chamber for execution.

Og the Executioner! How efficiently, with a smile on his lips, he performed his grisly duty!

You read of this with a shudder perhaps? You marvel that in even so remote a hole of the Universe as this Water of Wil Things in the bowels of my little meteor, such ghastly, inhuman things should take place? You forget. Can you not recall that on your own fair Earth, not so very long ago, they cast infant girl-babies into the sacrificial waters of the Ganges, to the hungry, eager jaws of the crocodiles?

I did not look again. Occasionally there was a sob—a scream; once, a brief, despairing scuffle as some mother found the ordeal beyond her strength. The little half-grown boy, as he passed me with Og's hand in his, gazed at me with a dumb, terrified appeal. . . . I hated myself as I looked away. . . .

Then—it was all over. The little gateway was replaced. The mothers—empty-armed—swam silently out into the tunnel, through the parted ranks of those alert-eyed, guarding fishes.

Maaret, the girl, had disappeared. Og was again alone with us. His lips were leering triumphantly.

"You see how well I do my work? Quickly—without confusion." The leer abruptly faded into grim menace; his eyes blazed at us.

"You may take your choice. The hot water, there—" His gesture was to the grating—"Or the cool, sweet water of Rax. But in either case, Nona shall be my Queen."

He turned away. At the tunnel entrance, he paused. "Soon I shall come back for your answer."

He was gone.

(To be continued)

The Infinite Vision

By CHARLES C. WINN

(Continued from page 19)

screen. Then, as bulb after bulb flashed in, the screen showed only portions of the golden surface, and the image grew more and more detailed. Now only one great mountain was visible to the watchers; now only a portion of that mountain; now only a half dozen rocks upon its surface, and finally the surface of one rock.

Then the scientist, with an admonition to his companions, threw in a switch which brought the last bank of tubes simultaneously into light.

The former vision faded away, and in its place appeared a whirling mass of transparent spheres, visible only by the opalescent light reflected from their surfaces.

MOON'S MOLECULES

"Gentlemen," said Faxworthy, his usually quiet voice trembling slightly with emotion, "here you see the quartz molecules of one of the rocks on the surface of our satellite. I can only hope that the sight will repay you for the money, which you so kindly provided."

A subdued murmur of approbation was the only reply he received from the enchanted group of scientists, as they rapturously watched the flitting shapes before them.

For some moments they stood, struck with the wonder of it. Then Faxworthy abruptly pulled open the switches, and the image faded from the screen.

"Perhaps you would like a brief explana-

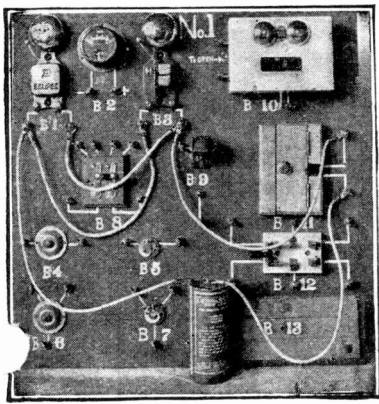
tion of the apparatus, before we engage in the final test of the evening," he suggested, at the same time glancing at his watch.

There was a general nodding of heads in assent and he began. "As you probably know, I have been engaged in research work in Physics and Chemistry, from the age of twenty. During this time I have made some discoveries in these subjects, certain of which have proven very useful in this present undertaking. Up to this time I have revealed their nature to no one except Holton, who has been completely in my confidence. If you will excuse me, gentlemen, I will soon be back with you." And he disappeared up a ladder, leading to a room higher up in the center of the dome.

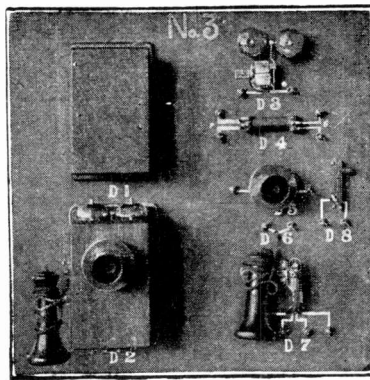
In a moment he returned, holding something tightly clasped in his hand. Opening it, he disclosed a small flat tube, filled with a reddish viscid liquid, in the extremities of which were sealed several fine platinum wires.

"This tube, gentlemen," explained the scientist, "is the very heart of the apparatus you see about you. Without it, all would be entirely useless. It contains a quantity of a previously unknown element, which I call Lucium. It took me and my laboratory assistants twenty years to isolate the amount of Lucium you see in the tube.

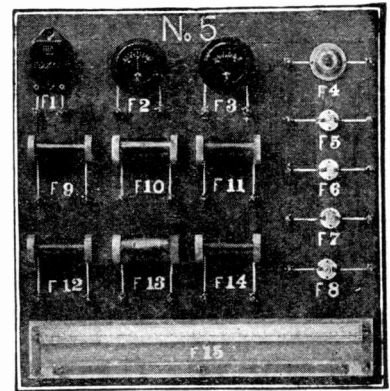
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Dear Sir:

In answer to your complimentary letter of March 5, 1924, I wish to thank you very much for the high standard you have accredited to my work in the Extension Course of the School of Engineering of Milwaukee. I might add that all through the course I have had no help because I wished to get the full benefit of the work by relying on my own efforts.

Before writing you my opinion of the course I decided to wait until I had nearly, or completely finished, so that I might give my opinion of the entire course. Having completed lesson 49 which finishes all of the theory and having completed most of the laboratory work, I am safe in saying that I believe your course to be the clearest, most practical and up-to-date course of its kind published. I have compared it with a number of other courses.

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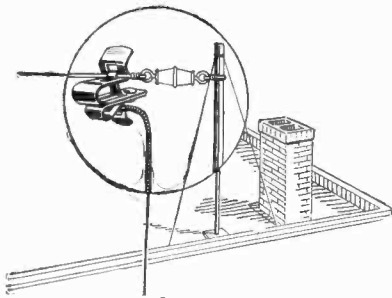
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The Infinite Vision

(Continued from page 70)

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OBSERVING MARS

Then drawing his watch from his pocket, he continued impressively: "In twenty-five minutes, the planet Mars will have reached its closest possible approach to the Earth. Then we shall learn her secret. If you will pardon me a moment, I will return the lucium to its proper place."

He was soon back, and even as he returned, the sound of distant thunder became plainly audible in the clear mountain air.

"One of the summer thunder storms common among these mountains is coming up," he explained simply. "I will adjust the reflector now, lest it give us trouble when it arrives."

"But, Monsieur, it will spoil the observation! Even when it recedes, zee air currents will be atrocious!" cried Flambeau in the first words he had spoken that night.

Faxworthy made no verbal reply, but motioned them out onto a small balcony on the east wall of the structure. He pointed his finger to the moon, which was being slowly obscured. Following his motion, the others gazed in the same direction. What they saw was a ghostly cylinder of faint luminescence issuing from the small tower on the roof, and reaching outward into space as far as the eye could see!

"The dispelling ray," briefly explained their guide. "The ether waves of the fortieth octave which have the property of expelling all matter from their path. The range of this ray in the atmosphere is about six hundred miles, and as long as the telescope aligns in its path, it effectually eliminates all interference from atmospheric or meteorologic conditions."

The wondering silence that followed was broken only by a stifled "Mon Dieu!" from Flambeau. That one man could have produced so many wonders seemed almost incredible to the group of distinguished scientists.

The silence was not broken, even as their guide led them back to the control room. Swiftly he brought the colossal telescope to the zenith, where the great red star still steadily gleamed. Synchronically the unearthly band of light on the dome swung upward until it came to rest in the same direction.

Again the first two vacuum tubes flashed into light; again that strange beam of luminescence shot down from the ceiling, and there came into being upon the screen the image of a great red star, magnified to the diameter of a baseball. Two more of the tubes, and the image doubled in size. Now a complicated network of delicate lines could be discerned upon its dull crimson surface.

(Continued on page 74)

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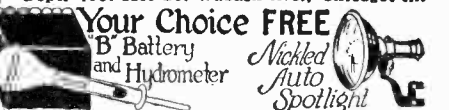
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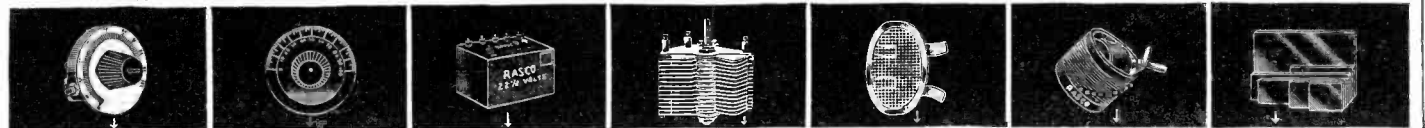
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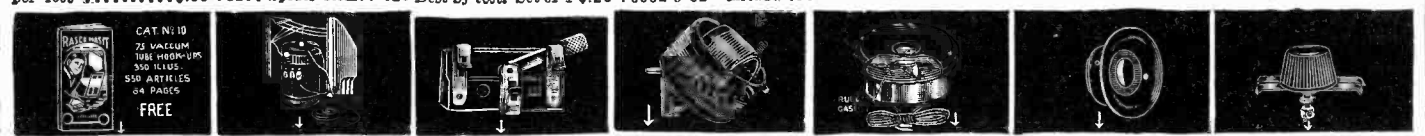
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<p>Rheostats and Potentiometers Come with metal dials and composition knob. Excellent merchandise despite low price. Y4210 6 ohm Rheo. \$.27 Y4211 30 ohm Rheo. .30 Y4212 200 ohm Potentiometer .45</p>	<p>Moulded Dials Only very best grades handed. Bushings absolutely true. Dials cannot wobble. Letters inlaid in fast white enamel. All dials for 1/4" shaft. Y3074 Dial 2"25 Y3075 Dial 3"25 Y3076 Dial 4"40</p>	<p>Tapped "B" Batteries We positively guarantee these batteries to be of long life. We carry only fresh stocks. All with taps. Y2250 Sm. 22 1/2 V. \$.85 Y2251 Medium Navy size, 22 1/2 volt.1.20 Y4500 Large size, 45 volt2.30</p>	<p>Panel Mounting Condensers Positively no better condenser on the market. Shafts 1/2". Save from 40 to 60% by assembling condenser yourself. Y1111 11 plate. . . . \$1.10 Y1211 21 plate. . . . 1.22 Y4343 43 plate. . . . 1.33</p>	<p>"Rasco" Bezels Finest Bezel on the market. Bezel comes entirely nickel plated. Can be used on 1/2 or 3/16" panel. Y1700 Rasco Bezel, 1" \$1.15 Y1701 Bezel, 1 1/2" diam. \$2.20</p>	<p>Rasco 180° Variocoupler Silk wire wound on bakelite tubes. Six taps. Wave length, 150 to 600 meters. For panel mounting. 1/4" shaft. Your money refunded if it is not all we claim. Y3100 Variocoupler prepaidd \$1.50</p>	<p>Difectryte Panels Highest dielectric strength as per Bureau of Standards. Y7100 7x10x3-16" . \$70 Y7120 7x12x3-16" . . .85 Y7140 7x14x3-16" . . .95 Y7180 7x18x3-16" . . 1.25 Y7210 7x21x3-16" . . 1.45 Y7240 7x24x3-16" . . 1.65</p>
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<p>FREE The big "Rasco" catalogue. Contains all Armstrong circuits. Every up-to-date vacuum tube hook-up. Greatest little book printed. Free upon receipt of postal.</p>	<p>The Radiogram The simplest radio outfit made. Includes all parts for tuning: coil, tapped switch, crystal, cat whisker. Y5353 Radiogram, no aerial or phone \$1.75 Y5354 Radiogram, with 1000 ohm phone and 3 ft. cord \$3.75</p>	<p>Throw Switches Mounted on composition block. Small enough for all radio purposes. Y4100 Single pole. . \$2.25 Y4101 Double Throw Y4102 Double Throw Single Pole \$3.50</p>	<p>Bakelite 180° Coupler De Luxe Style Tubes of natural color bakelite, wound with green silk. Cast aluminum bracket, 1/4" shaft. Primary 13 taps. 180 to 550 meters. Y3150 Coupler. . . \$2.35</p>	<p>"Rico" (Adjustable) Loud-Speaker Phone Has rubber gasket underneath diaphragm, making phone fully adjustable. Gives amazing results as loud-talker on 1 and 2 stages of amplification. Y2525 Speaker with 5 ft. cord \$2.65</p>	<p>Soft Rubber Ear Cap At last! Ear Caps that will relieve headaches, earaches, and undue pressure on the ears. Fit plated fittings. Blade radius 1 1/4". Y3500 Ear caps; pair \$1.50</p>	<p>Series Parallel Switch Quick change from one circuit to another. Black composition knob, nickel plated fittings. Blade radius 1 1/4". Y2950 Series parallel switch \$2.25</p>
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The Infinite Vision

(Continued from page 72)

Two at a time, the vacuum tubes were switched into the circuit, and ever the image increased in size and detail. Soon it covered the entire screen. Now only sections of the surface were visible, and slowly the sections grew less in extent, as they grew plainer and plainer in detail. Now the view was from the apparent distance of a million miles, now a thousand, now five hundred.

And slowly the delicate lines had grown in breadth, until only two of them, now broad ochre bands two feet wide, intersected in the middle of the screen, in the form of a large circular spot. The center of this spot was thickly strewn with small black dots, which glistened sharply as they reflected the sun's rays.

MARS AT 10,000 FEET

Then without warning, Faxworthy snapped on all but two of the remaining tubes in the bank. Instantly the image on the screen faded into obscurity, and in its place appeared a wondrous scene. There, as though from a ten thousand foot bird's-eye view, stretched a great city.

They were looking down upon great buildings a thousand feet in height, above which swarms of enormous airships darted gracefully through the air. And the decks were covered with tiny figures!

The last two bulbs flashed into life, and the view came to the apparent distance of fifty feet. *The tiny figures were men.* Perfect men of wonderful physique, with finely chiseled faces. They were clad in a raiment resembling that in which Caesar's legion were dressed centuries ago. There were women also, all of glorious form and feature, robed in exquisitely colored gowns, which gleamed in the sunlight with a myriad opalescent tints.

The last two tubes again faded into darkness, and the view receded to the original ten-thousand foot scene.

With an almost imperceptible movement of his hand upon a lever, he brought the landscape flashing across the screen in a glorious panorama.

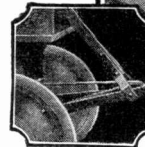
And while they viewed the surface of the dying planet from pole to pole, the storm that had been rising came up and settled over the top of the mountain. Lightnings flashed, and thunder shook the observatory, but so engrossed were they in the wondrous scene before them, and so protected from interruption by the silent, ghastly ray without, that they were completely oblivious to the disturbance.

Now a vast, red, sandy desert was sweeping across the screen, now a waterway, now another city (always situated at the intersection of two canals), and so from the distance of thirty-three millions of miles, they viewed the surface of the planet from ice clad north to ice clad south. Suddenly the lofty summit of a great mountain capped with an enormous black blotch swept across their vision.

With skillful hand, Faxworthy brought the image back to the center of the screen. The black blotch was a huge building completely covering the top of the mountain, and towering five hundred feet into the air—an almost exact replica of the building in which they stood. *And from its top an enormous ray of unearthly luminescence shot sharply out into space!* Again the last two bulbs flashed into light, and they looked down into the polished bowl of an enormous concave mirror two hundred feet in diameter.

"You see," said the scientist significantly, "unseen eyes are ever watching us from space, and they have been doing so for countless ages."

(Continued on page 76)



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I Can Lift Five Million Pounds in Three Hours

By Warren Lincoln Travis

This is an article by Warren Lincoln Travis, telling how he became the world's champion strong man although he was no stronger than other boys in his youth. Shows how little by little he developed every muscle and his general endurance until he was able to

break all World's Lifting Records by lifting five million pounds in three hours and nine minutes. In this article Travis shows how any man can follow his example and have large brawny muscles—quickly. Don't fail to read this article in the May issue of "Muscle Builder." It's well worth while.

You Can Never Swim Again

Johnny Weismuller, World's Champion Swimmer, was told by heart specialists that his career was over. Yet—a few weeks later he was back again in competition. Read the May issue of "Muscle Builder" and learn the important part Weismuller's remarkable muscular development played in carrying him to several new world's records after he was told he would drop dead at any time. Don't miss this article.

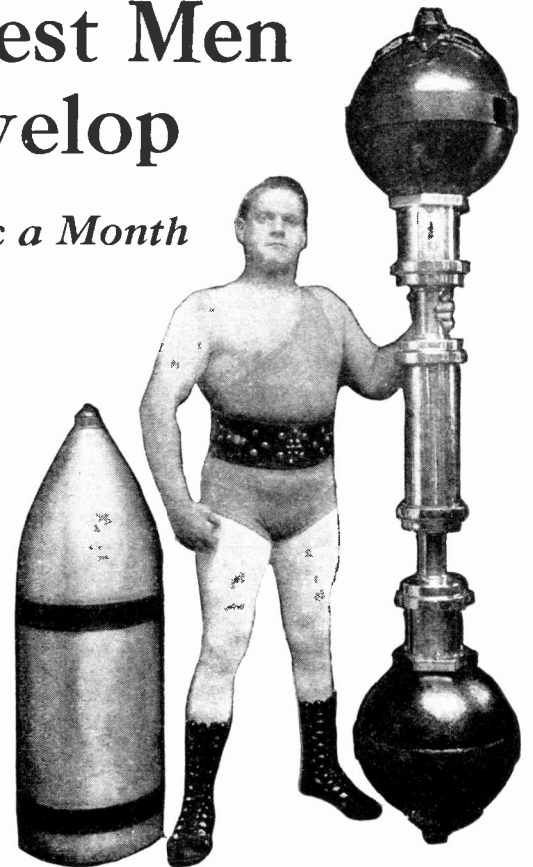
I Have Put On and Taken Off Two Tons

This is a remarkably interesting article by Johnny Dundee, holder of two world's titles, who reduces and gains weight with the bewildering magic of a Harry Thurston. Dundee has fought over 400 ring battles and in each combat has added or

shed an average of ten pounds. How this marvel of the ring "puts it on" and "takes it off" inside of a week or ten days has never been explained before. The answer is told in the May issue of "Muscle Builder" for the first time, where Dundee reveals all his weight-changing methods. Don't miss it.

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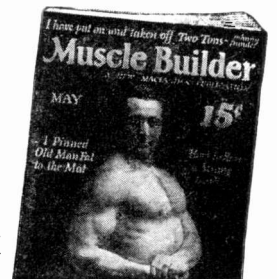


Other Features in the May Issue —Don't Miss Them!

- THE SECRET OF MAKING ALL YOUR MUSCLES ALIVE**
Famous body-building secrets by Edwin Gray, M. D.
 - WRESTLE YOUR WAY TO STRENGTH**
By Nat Pendleton, who guarantees to overpower Jack Dempsey in a barehand rough-and-tumble in less than 10 minutes.
 - THE WEAKLING WHO CAME THROUGH**
The story of the making of a man out of a mollycoddle.
 - MY ARM WAS CRUSHED—"AMPUTATE IT," SAID THE DOCTORS**
By Demetrius Tofalos, whose right arm, that doctors wanted to amputate, became the strongest arm in the world.
 - YOU NEED A STRONG BACK.**
By Bernarr Macfadden.
- In addition to the above articles there are many full pages of "strong man" pictures. Don't miss them!

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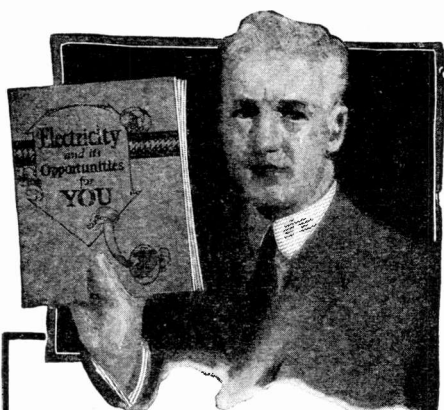
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The Infinite Vision

(Continued from page 74)

Then the storm outside broke into its full fury. Lightning played in rapid streams, and thunder echoed and re-echoed with mighty din.

Suddenly a bolt of blinding light reached down from the sky to the tower upon the dome. The partially fused metal gave to the weight, and the great ray slowly fell in a wide arc to the earth. There was a series of frightful reports, as it tore the mountain asunder with its mighty force.

In the room below the image no longer showed sharp and clear upon the screen, but was entirely obscured by a mass of whirling grayish green. Then as the awful crashes rent the air, Faxworthy gave a terrible cry. "THE RAY!" he shrieked and leaped toward the far end of the switchboard! But it was too late!

With a sudden lurch, the thing on the roof had fallen completely to the perpendicular. There was a second frightful din as it rent asunder all within its path, ripping out the very vitals of the delicate apparatus that gave it life! Then it grew dark.

And above in wild cadence the thunder drums of Nature rolled out a pean of victory, over the shattered fragments of the rash mortals who fain would know her innermost secrets.

THE END

Book Review

FORTY YEARS OF EDISON SERVICE. Paper, 181 pages, 8 vo., illustrated. Published by the New York Edison Co.

This little book, designed primarily for the benefit of the public patrons of the New York Edison Co., gives one of the most interesting hour's reading that we have met in some time. It is a complete, though brief, history of the early operations of the company, setting out how it grew from supplying a small district, shortly after the invention of the incandescent lamp, to the present huge proportions, furnishing power and service for billions of dollars in industry.

One of the most interesting things about the book is the large number of old prints and articles that were published at the time the first successful experiments were carried out and the first plans for the actual production of electric lighting were installed.

MODERN THINKERS AND PRESENT PROBLEMS. By Edgar A. Singer, Jr., Ph. D., Professor of Philosophy in the University of Pennsylvania. Cloth, 322 pages, octavo. Henry Holt & Co., New York. Price \$2.00.

For some reason a large number of philosophical volumes came in for review during the past month. The book whose name heads this review seems to be the most imposing one of the lot. It gives a very plain idea of how a great many of the modern systems of thought arose. Although the connection is not noted so much in later years, this book shows how the philosopher and scientist of former years were usually very closely connected. The book is divided in the form of chapters, each of which deals with a separate thinker. The selections made show that each chapter outlines a decided advance, a sort of new tack. The earlier chapters of the book deal with Bruno, Spinoza, Hume and Kant, the later philosophers then follow.

The treatises are written in a more or less informal style. Since biographical notes concerning the author and the explanation of his theories are worked in together the ponderance usual to such works is overcome to a great extent.

The last chapter in the book is on retrospect and prospect in which the author restates all the facts so that the reader may briefly review what he has read.

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MODERN DEVELOPMENT. By Frank R. Fraprie, S.M., F.R.P.S., Editor of American Photography. Cloth, size 7½"x 5", 70 pages. Published by American Photographic Publishing Co., Boston, Mass., \$1.50.

A most complete book on the subject of development as relating to photography. The first few pages of the volume deal with the theory of the action of light on a photographic plate and take up the reasons for the necessity of development in order to bring out the image. Developing agents are then classified as to use and efficiency and are fully discussed. Various methods of accelerating development are given and the uses of certain developers for different kinds of work are fully treated. The equipment of the laboratory is touched upon and the necessity of a safe dark room is carefully brought out. The major part of the book is taken up by formulas for various developers. With each one is given the methods for using it if any special care or usage is to be observed. The length of time necessary for correct and full development is given in almost every case and sufficient information is presented in a concise form to enable almost anyone to be able to prepare his own developer and use it properly.

The only drawback to this entire book is that despite its complete data and the ability the author shows in handling the various subjects, still there is no index of any kind provided which would enable one, after reading the book, to turn directly to any particular item upon which he wishes to refresh his memory.

TEXT BOOK ON WIRELESS TELEGRAPHY, in two volumes. By Rupert Stanley, B.A., M.I.E.E. Fully illustrated, hard covers, size 8¾"x5½", total 865 pages. Published by Longmans, Green and Co., N. Y. C. Two volumes, \$10.00.

The radio amateur who purchases the two volumes of this book need not worry about his missing anything at all connected with radio theory or practice. These two books and a subscription to an up-to-date radio magazine will give sufficient material for a complete education in radio.

The sub-title of Volume I is *General Theory and Practice* and it covers the field in an excellent manner. The first few pages deal with the relationship between the earth, the atmosphere and the ether. The principles of electricity in its various forms are next taken up and various electrical measurements and calculations dealt with in a thorough manner which is at the same time as free from technicalities as it is possible to make the subject and still put it in the correct form. The theory of various pieces of apparatus such as the condenser, induction coil, alternator, transformer, etc., are next discussed. One of the next chapters deals with the historical side of radio telephony and telegraphy and much interesting data is included therein. The author goes on to discuss various theories and practical devices which will be of interest to all, both experimenter and broadcast listener.

The title of Volume II is *Valve and Valve Apparatus* and therein is found one of the most complete discussions of the vacuum tube ever published. The theory of the valve or vacuum tube is discussed when used both as detector and as an amplifier. The various types of amplifiers, radio and audio frequency, are then theoretically explained and the amateur can find much in these explanations which will enable him to operate his set at a higher efficiency. The latter part of this excellent work deals with various valve transmitting sets for phone, C. W. and I. C. W. The last few chapters touch on various phases of work directly or indirectly connected with radio and such devices as the direction finder and systems of earth telephony are discussed.

NEW LANDS. By Charles Fort (author of "The Book of the Damned") with introduction by Booth Tarkington and blurb by Theodore Dreiser. Cloth, 250 pages. Boni & Liveright, publishers, New York. Price, \$3.00.

This book may not be philosophy but it certainly is philosophical in form. Many iconoclasts will hail its appearance in much the same manner as Joseph Smith embraced "The Golden Plates."

The book begins by stating that the world is gradually growing too small to support a population that is growing by leaps and bounds. "Ergo," says Mr. Fort, "new lands must be found wherein potatoes and cabbages may be raised to feed the ever increasing offspring of a very prolific race." On this hypothesis he continues to the remainder of the 250 pages in contradiction of the laws of astronomy according to the college professors . . . and scientific scholars.

The book is given up almost entirely to a myriad of experiences reported from all parts of the world to prove that astronomers overlooked a lot of important evidence when they were investigating certain celestial phenomena and that a great many such phenomena which should have been considered in their investigations were overlooked entirely. A great amount of this evidence which Mr. Fort puts forth as being of extreme importance consists of noises seeming to emanate somewhere in the upper atmosphere.

Not that he uses it in any way as the genus of proof but more as a sort of importance of gesture. Mr. Fort quotes Mr. George Bernard Shaw as saying that the moon is approximately 37 miles from the earth. Mr. Fort would have us to be-



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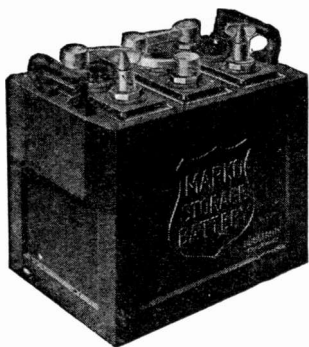
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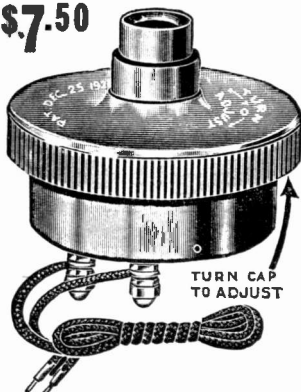
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lieve that there are some sort of other lands lying somewhere in the atmosphere of the earth a short distance from it, which may be investigated if the inhabitants of earth ever find it necessary to make explorations outside of our present range of geography. Which is to say that Mr. Fort has written 250 pages of very interesting and at times extremely amusing alleged proof, which in the final analysis proves nothing.

A THEORY OF KNOWLEDGE. By Charles Augustus Strong. Cloth, octavo, 102 pages. Published by Macmillan Co., New York. Price, \$2.00.

This whole volume is more or less abstruse and it is entirely possible that the man who reads in the subway as he goes to work in the morning will not appreciate this volume. In order to give an idea of the contents and ideas of the book we quote:

"The theory set forth in the following pages rests on two assumptions: that there is a real world in time and space, and that the self is a part of it. . . . I conceive the self as consisting of immediate experience; or feeling. In the first chapter I endeavor to show that there is such a thing as immediate experience; that is, experience in which there is no distinction of subject and object. In the second, I give reasons for thinking that immediate experience is in time and space, and constitutes the inner being or substance of the things we perceive. The self would then be identical with an extract from, or pattern of processes in, the nervous system. In the third chapter I discuss the bearing of this on knowledge. I draw in the fourth chapter the consequences that follow from the theory as regards life and action."

It will be seen from the paragraph quoted from the introduction, that the contents of this are extremely abstract. However, in its field it is good.

DIRECT CURRENT MACHINERY. By Harold Pender, Ph.D. (Fellow, American Institute of Electrical Engineers; Member, American Philosophical Society). Cloth, 314 pages, John Wiley and Sons, New York. Price, \$3.00.

The author of this book, being connected with the Electrical Engineering Department of the University of Pennsylvania, and at the same time being a practical electrical engineer, has seen the need in his engineering experiences, of a textbook on direct current machinery which gives adequate treatment of the theories and performance of these machines and that does not at the same time go deeply into the design of such apparatus. His first few chapters follow the usual order in setting out definitions of the primary laws and theories. Following that, are chapters on commutation, armature reaction, voltage regulation and testing. No words are wasted in his statements of laws, theories and axioms. He is especially terse and to the point. The same holds good throughout the book. It is one of the most easily understood volumes on direct current machinery, which goes fully into the subject, that has come to the attention of this department in some time.

SPARROW. The Chinese Game Called Ma Ch'iau. Ly Yu Sang, M.A., Member Kwong Tung Economic Research Bureau Science Society, etc. Cloth, octavo, 128 pages. Long Sang Ti Chinese Curios Co., Inc., N. Y., Publishers.

Ma Jongg, or, as the author calls it, Ma Ch'iau, may not have a great deal of art in it, but it certainly has a large scientific content. As a matter of fact, it almost takes a blue print to play the game, at least the writer of this review is positive that if he had a complete set of blueprints, he could, after studying them in connection with a complete set of specifications, master this game which for so long filled the idle years of ancient respectable Chinese Mandarins. This work comes near to being the set of blueprints and specifications that the reviewer has said would be helpful in understanding the game. In the first chapter of the book the author deals with the origin and philosophy of the game. It is through this chapter that the reader is given a sort of plan of the game, i.e., the player of the game is given an idea of the allegorical form behind the play.

The latter chapters of the book, of course, are devoted to the rules of the game, together with a number of the accepted plays and some advice to the novice as to what he should do in certain circumstances.

CRYPTOGRAPHY. By Andre Langie, translated by J. C. H. Macbeth. Hard covers, size 5"x7½". 192 pages. Published by E. P. Dutton & Co., New York City. Price, \$3.50.

This book is quite interesting to those devoted to the science of secret writing and many devotees of this art are to be found among us. Some of our periodicals make quite a point of secret writing, and as far back as the days of Edgar A. Poe it was a subject for a journalistic exploitation. Poe himself used to decipher secret writing which was sent to him. In our language Peppy's diary is one of the classic examples of secret writing going way back to the days of the Stuarts and some of the transactions described in it for the credit of the writer were best kept in thoroughly secret writing. To return strictly to our book, we can only say that it treats the subject in a very concise and

thorough way. It gives the simple almost childish methods, and then gives the nearly undecipherable systems available for serious work. The author describes some of his experiences in decoding and relates a curious failure when he proved unable to make any sense out of an alleged cipher sent to him, and his friend had to acknowledge that it was merely a jumble of letters without meaning. It is fair to say that in less than two hundred pages of the book, there are many hours of interesting study if we wish to really appreciate the author's work. It is well translated from the French by a Marconi author.

MAN'S PREHISTORIC PAST. By H. Wilder. Profusely illustrated. Hard covers, size 5½"x8", 463 pages. Published by The Macmillan Co., New York City.

A fascinating and particularly conjectural story of pre-historic man is the subject of this work. It is impossible within the limits of our space to give it an adequate review. The numerous illustrations, all opposite to the text, include pre-historic drawings and designs and rock-painting, sculptures, and ancient implements of bone and horn from cave dwellings. Flint instruments have been most carefully examined and the inscriptions and stories evolved from them are strikingly elaborated. A pre-historic man is pictured as attaining his first sense of possession in a fabricated flint implement. The first of these were of any convenient shape which he might pick up, but when shaped by the owner's labor they became an actual possession. The mounting of some of the tools are quite unknown, and some, it is believed, were used without handles. Inscribed tablets of quite uncertain use are also shown.

RADIOACTIVITY. By K. Fajans. Illustrated. Hard covers, size 5½"x8¾", 138 pages. Published by E. P. Dutton & Co., New York City. Price, \$3.50.

When an old-time student is inclined to flatter himself that he knows something of science, and investigates radioactivity, isotopy of elements, atomic numbers and structure of atoms involving the nucleus and circumambient electrons, he feels that he has got to begin his studies all over again from the kindergarten up. It is impossible to review this book within the limits of our space. We can only recommend it most warmly to our readers. Old time chemists used to treat the atom as the smallest possible division of matter but now the atom becomes fairly gigantic compared to its nucleus and electrons. The book cannot be read rapidly, but it is so well put that it can be treated as a literary production, and we gladly recommend it to our readers.

Radioactivity brings us face to face with the transmutation of metals and with the strange complexity of chemistry involved in isotopes. Some metals exit in varieties of different atomic weights, yet each variety is absolutely indistinguishable from any other by any chemical process. In other words radioactivity in its powers and developments transcends chemistry.

The great mystery of the atomic nucleus is also given attention in a chapter; another chapter treats of the artificial decomposition of atoms.

An excellent selection of tables, fourteen in number, is included, and over ten pages devoted to references and notes give the bibliography of the subject in excellent detail.

WEATHER PROVERBS AND PARADOXES. By William J. Humphreys, Ph.D. Cloth covers 5½"x7¾", 125 pages, profusely illustrated. Published by Williams & Wilkins Co., Baltimore, Md. Price \$1.50.

This handbook on weather proverbs and paradoxes by one of the foremost experts on meteorology, is invaluable and should be on the library table of every well-read scholar. The reviewer found this book intensely interesting, as it explains in a clear untechnical manner, the scientific reasons why some of our old weather rhymes are liable to prove true or the reverse. We find as we read through the book, that many of the old weather proverbs which we modernists are wont to scoff at, have indeed a good scientific basis behind them. Ground Hog Day represents one of the exceptions, as does also St. Swithin's Day. This valuable little work will certainly, we promise you, provide a better education in foretelling the weather than almost any other book that we can think of. The author's style is very entertaining and attractive, and the book is liberally illustrated with some very excellent photographs showing the various forms of clouds, rainbows, fogs, etc., all of which have a distinct bearing on weather forecasting.

THE TOMB OF TUT-ANKH-AMEN. By Howard Carter and A. C. Mace. Cloth covers 6"x9", 334 pages, with many illustrations. Published by George H. Doran Co., New York City. Price \$5.00.

This is the first volume describing the finding and excavation of the tomb of Tut-Ankh-Amen written by men who, with Lord Carnarvon, discovered this famous tomb. This volume provides very interesting reading and the pictures embellishing the work are very fine, having been taken by Mr. Harry Burton of the Metropolitan Museum of Art of New York City. There are one hundred and four illustrations from photographs together with a map of the tomb. The

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forepart of the book opens with an introduction in the form of a biographical sketch of the late Lord Carnarvon by Lady Burghclere.

A very interesting and desirable history of the King and the history of the Valley of the Kings is provided. Chapter 5 takes up the discovery of the Tomb, the preliminary investigation, the survey of the Antechamber, then the clearing of the Antechamber.

One of the most interesting chapters describes the work done in the laboratory to preserve and reconstruct some of the pieces of jewelry and furniture found in the famous cenotaph, and the large type and excellent style in which the story is told, makes the tale a most interesting one, and in fact the reviewer became so imbued with the spirit of the ancient world, that he found it hard to give up the book at bedtime. The later chapters deal with the opening of the Sealed Doorway to the sepulchral chamber, and a well arranged appendix then follows with a description and large photographic representations of the various vases and pieces of furniture found in the Tomb. An adequate index is provided at the end of the work. This authoritative work on the Tomb of Tut-Ankh-Amen is a volume which those who have followed newspaper accounts of the excavations at the Tomb, should certainly read, as the reviewer found it difficult to get the newspaper series to fit together clearly in his mind, particularly due to the fact that the rotogravure photos were published independently, in most cases, with respect to the long textual accounts published in the text.

ROBERT FULTON AND THE SUBMARINE. By Wm. Barclay Parsons. Hard covers, 7"x9 $\frac{3}{4}$ ", 154 pages, illustrated. Published by Columbia University Press, New York City. Price \$4.00.

This work includes a considerable amount of Robert Fulton's own descriptions and drawings of his submarine, while his experiences with both the British and French Governments during his sojourn in those countries, are given in interesting style. Robert Fulton, like many other inventors of the past and present, found plenty of minds which did not concur with his, even after he had demonstrated in a most surprising way that it was possible to use a submarine to attack war vessels and attach a bomb provided with a clock-work or other detonating mechanism. It is surprising to read the description written in Fulton's own words, as to how the submarine could be improved, how the bombs should be built, etc. Who would think for a moment that Fulton had been able to descend under water with his submarine, and stay there for several hours? It is surprising also to note that at that early day, over a century ago, this progressive inventor had experimented with compressed air stored in bombs, so that exhausted air could be released slowly while submerged, in order to remain under water for a greater length of time. One of his calculations demonstrated that by using this compressed air stored in a bomb or reservoir, he could take care of four men and two small candles for six hours. In another test with the compressed air mechanism, he took three companions with him without any candles and plunged to a depth of about five feet with the submarine. At the expiration of one hour and forty minutes, as Fulton states, he began to let off measures of air from the reservoir, and so on from time to time for four hours and twenty minutes without experiencing any inconvenience.

The boat was propelled by a hand-operated screw when submerged, and by sails when on the surface. One of the most astounding tests which Fulton demonstrated for the benefit of the French Government, in his efforts to get Napoleon Bonaparte to recognize the merits of his invention, was where he blew up a small sloop by sneaking up on it with the submarine and firing a bomb close to it. One of the most valuable parts of this well-edited work is Chapter 5, which gives the original "drawings and descriptions" as drawn and written by Robert Fulton himself. Specimens of the original hand writing are reproduced and the original wash drawings are also shown, which proved exceedingly interesting not only for their historic value, but owing also to the ingenuity shown by this genius, who started as an artist and then decided to become an engineer. Strategic schemes for placing the bombs, etc., are shown by the inventor in his drawings, and prove that he was certainly far beyond his time in his philosophy and deductions.

The author of the book says in closing that "The Nautilus, defective as she was in many particulars which Fulton admitted, clearly demonstrated certain facts: firstly, that a boat could be made to plunge and rise at will; secondly, that it could remain under water with a crew of three men for several hours; thirdly that it could be maneuvered and steered by the compass under water as well as on the surface. These features are the essence of the principle of successful submarine practice, and so much Fulton accomplished."

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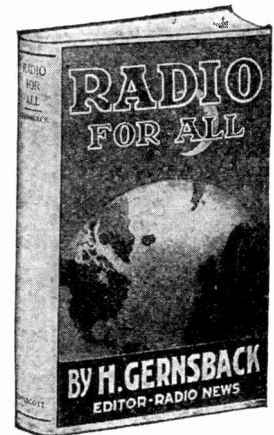
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respondence Schools. The book is well indexed, and will be found of value to all automobilists and those employed in automobile repair work. The forepart of the handbook deals with various types of automobiles, springs, frames and running gear, etc. Then comes a treatise on gasoline engines, both two and four cycle. The explosion and cooling actions in such engines are discussed, as well as the function of the pistons, valves and other moving parts. Vacuum tanks and carburetors are explained and then we come to the speed change gears, steering mechanism, etc. About one hundred pages are devoted to the electric equipment of the modern automobile, and this covers starting motors, lighting, ignition, batteries, etc. A practical section on automobile tires and how to properly inflate, remove and replace them is given with illustrations. American road rules and customs are discussed, and then we find a section on automobile troubles, which should prove valuable for ready reference, as it is sub-divided into sections covering ignition, lubrication, etc. An additional feature at the end of the work is a digest of the automobile laws of the whole country by states.

SYNTHETIC RESINS AND THEIR PLASTICS. By Carleton Ellis. Hard covers 6"x9¼", fully illustrated, 514 pages. Published by The Chemical Catalog Co., Inc., New York City. \$6.00. This book carries us into one of the newer fields of chemistry, one which covers an enormous ground and is leading to very remarkable results. The radio enthusiasts use bakelite for their panels and other parts, and that is merely one of a vast number of synthetic products which are replacing to a certain extent mica, glass, marble, slate, asbestos, and other every-day natural products. Some familiar things among the many treated will be recognized. Condensite we are familiar with as the substance from which phonograph disks may be made. Amber is an old time friend of the chemist and here we find a substitute for it. The book would be of little use without an index, and it is a comfort to find an index of over forty pages at the end of the treatise.

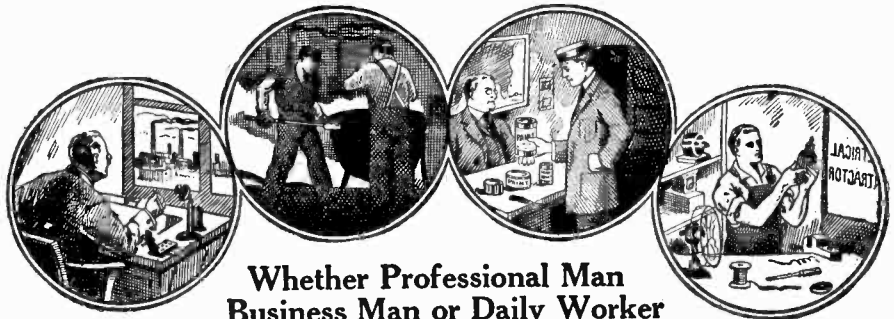
THE ELECTRON IN CHEMISTRY. By Sir J. J. Thomson, O.M., F.R.S. Hard covers, 6½"x9½", illustrated, 144 pages. Published by The Franklin Institute, Philadelphia, Pa. Three things may be said of this book. The author is Prof. J. J. Thomson of Cambridge, England, one of the greatest physicists in the world. The lectures were delivered at the Franklin Institute, Philadelphia, and the subject is the "Electron in Chemistry." It would be presumptuous to review it any further. The author is so eminent a man and the subject is so all-important at the present period, that the book should be read by all who are interested in chemistry and the foundation stones of electricity.

ORGANIC SYNTHESIS. Hard covers, 5¾"x9", 100 pages. Published by John Wiley & Sons, New York City. \$1.50. The old-time house of John Wiley & Sons, with whom all chemists have been for so many years familiar, has undertaken a rather daring task in issuing a book of a hundred pages on the subject of organic synthesis, but everything is so clearly put by the distinguished contributors, and the arrangement is all so compact and systematic, that we warmly recommend it to our chemically disposed readers. To the old-time inorganic analyst this book is especially interesting, as he finds a sort of *terra incognita* treated on the line of groups, such as are the basis of his work with mineral substances.

DIE ENTDECKUNG DER HEIMAT. By R. H. France. Hard covers, 5¼"x8", 77 pages, illustrated. Published by Kosmos, Stuttgart, Germany. The discovery of the home which may be taken as a translation of the title of this book, leaves us rather puzzled as to the subject, but it turns out to be a general review of Mother Earth, who certainly is our home for the present, and is gotten up in the very attractive style of the Kosmos books. The Germans certainly have the talent of producing books of this character with illustrations rather picturesque than elegant, and which tell the story so very well. An index gives the German names of animals and plants from the text, and over two pages are required to give these names in double column, which gives a clue to the thoroughness of the little manual.

VON KLEIDUNG UND GEWEBEN. By Hans Wolfgang Behm. Hard covers, 5¼"x8", 75 pages, fully illustrated. Published by Kosmos, Stuttgart, Germany. This is a book on clothing, and its first picture shows a number of people of dark complexion and certainly not very good examples of clothing. This, however, does not last long, and we find ourselves soon presented with the highly picturesque and elaborate Cypriote costume. Bark cloth is spoken of, the plants which supply fibres, the spinning of fibres, and the treatment of flax are all treated at some length.

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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.

NOTE:—Before mailing your letter to this department, see to it that your name and address are upon the letter and envelope as well. Many letters are returned to us because either the name of the inquirer or his address is incorrectly given.

GASOLINE INDICATOR

(800) Roscoe Cate, Muskogee, Okla., submits a sketch of a gasoline indicator using compressed air to move a column of mercury mounted on the dash of a car, which is graduated for gallons. A piston in a cylinder mounted under the tank holds the gas back and prevents it from flowing into the air supply line.

A. The idea which you have advanced is not new and is very inaccurate. Supposing that we have a gasoline tank as you describe, sealed tightly at the top. In the hot summer days the gasoline evaporates, and consequently we get a higher pressure in the tank. This will mean that the piston, free to move in the cylinder, will be raised higher, compressing the air in the copper tube to a greater extent than normally, and forcing the mercury in the indicator on the dash to rise higher, giving a false reading, but all gas tanks should be supplied with "breather" valves. These could overcome this fault. The copper tube contains a certain quantity of air which changes, expanding and contracting when the atmosphere is heated or cooled. Thus we get a variable effect in the air column alone similar to the action of air-bulb thermometers. The result is that a temperature correction would have to be made. If this copper tube passes beneath the hood near the engine, in order to reach the dash (as that is the only arrangement possible), the heated air, when the engine has been running for some time, will increase the false reading. Coating the copper tube with asbestos, will only partly remedy this fault. Your device cannot be made as an attachment, however, and changing it so that it will become an attachment, may cause it to infringe on another similar device using no valves at all in the system. We frankly believe that your idea is impractical and inapplicable to modern motor cars, and would not suggest applying for a patent on the same.

PHONE CONDENSER

(801) Harry Geduld, New York City, asks if any phone plug has a condenser mounted in it and requests our opinion of the device.

A. To the best of our knowledge, there is no phone condenser patented which is situated within a plug. We do not believe that such a condenser possesses any great merit, as it is just as simple to install the condenser within the set, and leave it there, as it is to insert the same in the plug. In many circuits, it is desirable to eliminate this phone condenser, in which event your plug will be worthless.

PATENT COPYRIGHT AND TRADE SECRETS

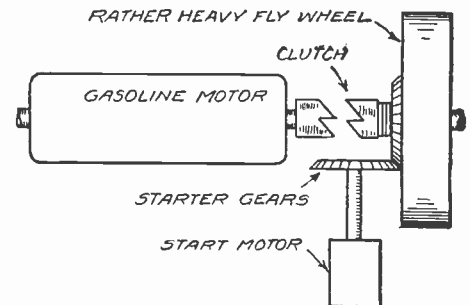
(802) Ernie F. Hiser, San Francisco, Calif., has submitted some fine examples of moving picture films of surgical operations. He asks us whether he should patent the process, keep it as a trade secret, or copyright the method.

A. If you could see your way clear to making the films, similar to those you have forwarded, without patenting the process, we would advise that you do so. As you undoubtedly know, a patent broadcasts your invention, and even though other individuals may be prevented from using the system, there is no possibility of your proving that they have used your principle, and therefore, they could get away with quite a good deal of valuable data. If you find it necessary to have draftsmen or others draw your system, or find it necessary that a doctor or surgeon be at your side while making your photographs, we would advise that you patent those most important processes, and leave the critical systems or portions out of the patent, keeping them as trade secrets. Remember that your trade secrets, if they are learned, will practically "break" you; but if they are retained as your private property, may "make"

you. The patent will protect your system and prevent others from using it, provided that you can prove they did so. A copyright will not protect you adequately. The film itself should be copyrighted however, to prevent other concerns from using it as a whole, or in part, and a frame from each new version of the operation, or each scene should be forwarded to the copyright bureaus. The films are very fine indeed, and we wish you the best of success in your venture.

ENGINE STARTER

(803) Milo Housh, Peters, Neb., asks for our advice on a starting device for gasoline motors. An electric motor is to be geared to a flywheel, and when the momentum of the wheel is sufficiently great the clutch is to be thrown, causing



Novel proposed form of auto engine starter.

the flywheel to engage with the shaft of the gasoline motor.

A. We do not think very much of your starter for gasoline motors, for the reason that when the flywheel is rotated at a high speed, the momentum imparted thereby is excessive. Consequently, when the clutch is thrown in in order to start the engine, the jaws of this particular clutch might not engage effectually, but would rip themselves to pieces. The engine could perhaps be started once or twice, and after that a new pair of clutch jaws would be necessary. For this reason, one cannot start up a hill at low speed and swing into high immediately without danger of either stalling the motor or ripping the teeth of the gears to pieces. It is assumed here that the clutch is not constructed to slip and that the gear ratio is high.

CHILLBLAIN REMEDY

(804) Miss Mattie Hoch, Freeland, Pa., asks whether we advise her to develop a chillblain remedy that gives instant relief, and what legal steps she can take to protect the mixture.

A. If your chillblain remedy does what you claim for it, you may rest assured that it will meet with a favorable market if properly exploited. If alcohol is used in its preparation, you will have to secure the proper alcohol permit. A mixture of chemicals cannot be patented as a rule. Therefore, keeping ingredients of the medicine a secret will be your best protection. The name can be registered as a trade mark. You will have to advertise this remedy extensively in order to make it popular.

TO BECOME A PATENT ATTORNEY

(805) A. Halliwell, Cleveland, Ohio, asks whether he can become a patent attorney, and desires to know the qualifications he must have in addition, to being a graduate lawyer, admitted to the bar.

(Continued on page 84)




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And that is why it pays to be guided by advertising and to buy advertised goods.

Read the advertisements

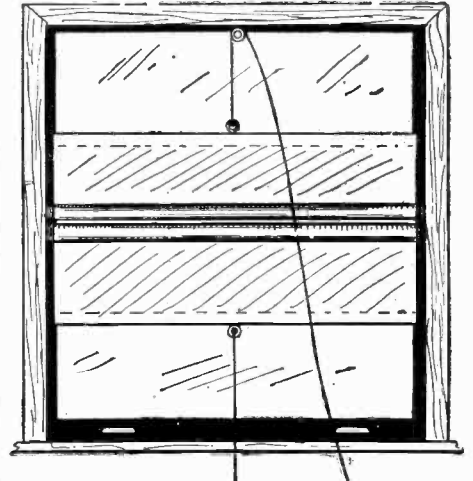
Patent Advice

(Continued from page 82)

A. If you can bring testimonial proof that you have worked for a patent attorney, and have prosecuted a certain amount of cases yourself, we believe that you will have no difficulty in convincing the patent authorities that you have the necessary qualifications for rendering valuable service to applicants for patents. Proof of your service with an attorney and your prosecution of several cases is quite sufficient.

WINDOW SHADES

(806) J. W. Humphreys, Los Angeles, Calif., asks whether we would advise him to apply for a patent on a window shade, which is divided so that two rollers are at the middle of the window frame and each half of the shade is controlled separately.



A window shade control idea which is not new.

A. The suggestion which you have advanced for design in window shades is very old. In many homes in New York, as well as in many public schools, this principle is employed. We are sure a patent would not be granted on the suggestion.

PUZZLE

(807) R. Henkel, Ft. Wayne, Ind., submits a model of a tube and bent-wire puzzle, in which the problem is to separate the pieces.

A. It is relatively easy to secure a patent upon a puzzle, but very difficult to obtain some financial backing, after the puzzle has once been patented, unless the puzzle is a good one. We doubt if you can make this puzzle popular.

The device is not puzzling at all, the writer having solved the same long before your letter accompanying it reached this office, and was able to take it apart and put it together within a two second examination.

We do not believe that a patent upon this idea would be profitable, and consequently would not suggest that you apply for one.

DECIMAL CLOCK

(808) John M. Jensen, Jamestown, N. Y., requests our advice on a clock dividing the day into ten hours, the hour into ten minutes, the minute into ten seconds, the second into ten periods, and the period into ten thoughts.

A. The question is not whether you will be granted a patent on your system, but whether or not the people will look at your idea of a clock with favor. Dividing the day into ten hours, the hour into ten minutes, the minute into ten seconds, etc., will not only completely change modern methods of calculation, but make this calculation absurd. The clock today bears a distinct relation to astronomical movements, that is the reason it is divided as at the present time. Your change would, under no circumstances, be looked upon favorably by individuals in the United States.

METAL VIOLIN

(809) Theo. Hansen, Galveston, Texas, requests our opinion of a metallic violin.

A. The front and back of a violin could be removed and replaced with aluminum. This violin will give out a considerable volume of sound, perhaps equal to the volume of the ordinary wood violin, but the sound of the same will be very metallic. We doubt very much if the harmonics produced by such a violin would exhibit any of the natural fineness of the wooden instrument.

Of course such a model could be used for practicing, but we doubt if it would take the place of the ordinary skeleton violin. The metal will always have a certain coldness, perhaps even act as a condenser of moisture, which the skeleton violin does not do. Further, this metallic violin would have to be protected to a greater extent than the skeleton. A man traveling with the skeleton will pack it in his trunk, or throw it in

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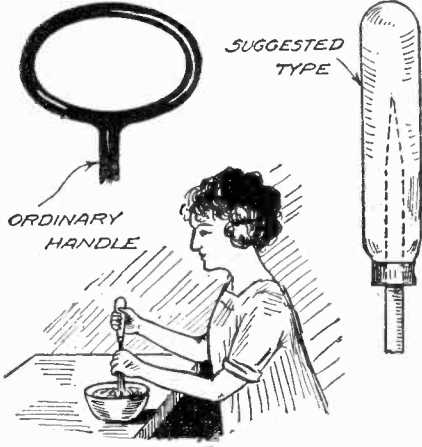
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a corner somewhere, and not think of it again until he has to practise. A metal violin on the other hand, would have to be kept in a case, otherwise it would be dented and damaged.
We doubt if your proposition would meet with very great favor, although a few of these instruments could undoubtedly be sold, if sold cheaply.

EGG BEATER HANDLE

(810) Mr. Charles A. Huntington, W. Somerville, Mass., asks our opinion of a handle for egg beaters, made as illustrated.



Egg beater handle idea proposed for patenting.

A. We do not think very much of your egg beater handle design. The handle of the egg beater does not appear to constitute matter for a patent, inasmuch as your handle does not show any marked improvements over handles of the same kind, used for tools.

Neither do we believe that the device will of its own accord present any marketable value over egg beaters having a cast iron circular handle. We, therefore, would not suggest placing the same on the market, and we do not believe that a patent could be obtained on the idea.

PRIORITY

(811) George C. Halkins, New York City, asks for information concerning inventor's methods of establishing priority, and asks about caveats.

A. With reference to precautions taken by inventors, we would suggest that plans or drawings are not registered. Years ago caveats were given to inventors, which established legal claims of priority. Today the best an inventor can do is to fight for priority. The inventor can build a model, show it to as many friends as possible, and every time a friend sees the same, his name should be signed in a book as well as the date of seeing the same. Be sure to explain the invention to everyone, and have them testify that they understand how the device is to work. Then place full specifications, typewritten manuscript, etc., in an envelope, seal this on the back, front and sides, so that in no manner can the envelope be opened, without breaking the seals, and mail it to yourself, and then carefully tuck it away in your safe. This should be one complete set of specifications of a triplicate, another copy should be on your files, and a third copy should be sworn to before a Notary Public, to which the names of those who have seen it, as well as the dates, should be attached. If photographs are made of the device, further security is guaranteed by having the photos sworn to before a Notary. It is advisable to have the photo made on a paper larger than the actual print, so that the Notary Public's signature and seal can be placed on the paper of the photo. These photos may be distributed to some of your well-known friends, asking them to keep the same on file, and to send you a letter stating that they had received the photo. Any detail worked out on paper establishes no claim whatever, either to priority or to a well protected patent. It is necessary in order to secure a broad claim that an actual working model be built. Even the patent upon the invention is not an absolute surety, providing the inventor has patented the device and made no attempt at building either a model or a complete practical device. The making of this model automatically gives a very solid legal claim. In court cases the device reduced to practice, receives preference.

FLEXIBLE WIRE REEL

(812) Henry Herbert, Independence, Kansas, asks whether he should try to patent a reel for electric light cord.

A. The idea which you have advanced, namely, a reel for electric light cord, is not new at all. Devices of this nature have been upon the market for a great many years, but do not seem to meet with any great degree of favor.

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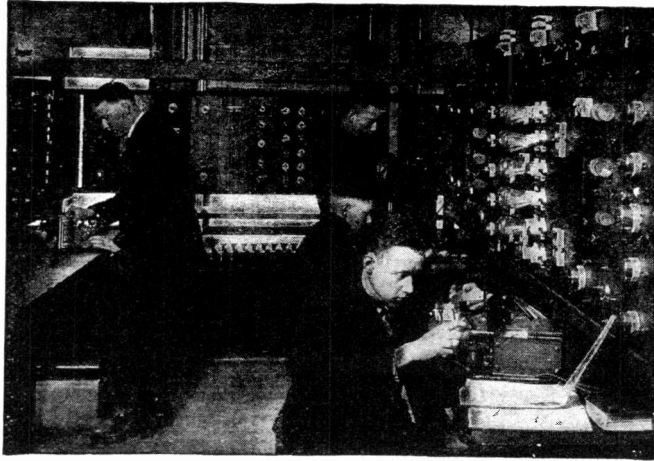
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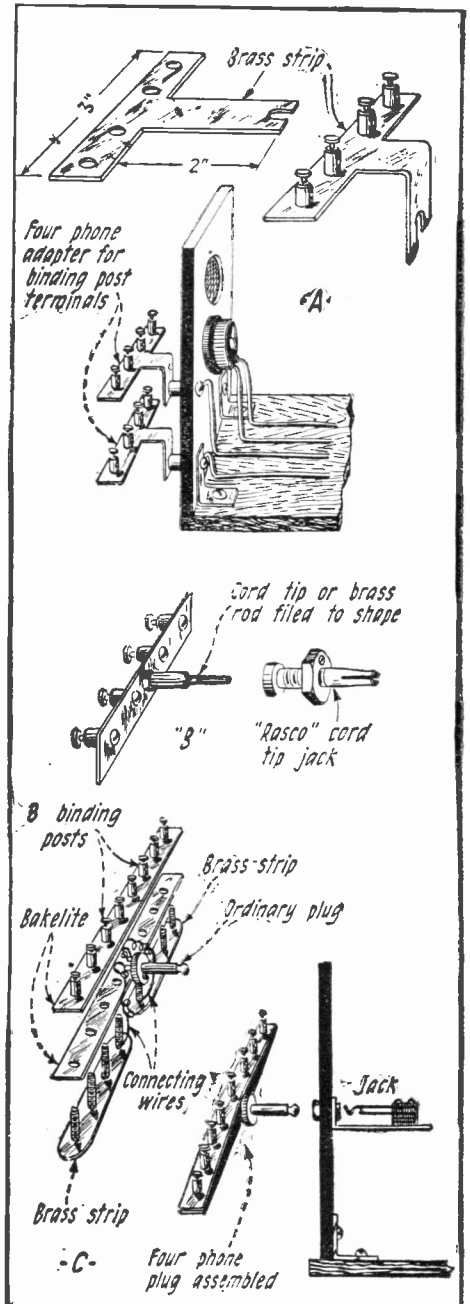
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MULTIPLE PHONE PLUGS



Several ideas for making phone attachments for radio sets so that several pairs of phones may be used are shown above. If binding posts are provided on the set for the attachment of the phones, a multiple phone adapter may be made from two pieces of brass strip as shown at A. Where phone-tip jacks are used, it will be necessary to make two adapters of the type shown at B. For a standard jack, an adapter is made of brass strips and pieces of bakelite which are assembled on a plug as shown at C.

—J. T. Garver.

CONSRAD

PATTERN No. 10

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This receiver is the last word in improved Super-Heterodynes. It employs six tubes and is, without doubt, the most sensitive circuit in existence at the present time. It engages what has been called the "Modulation System" of rectification in place of the usual "Frequency Change" of the received radio currents as in the standard Super-Heterodyne.

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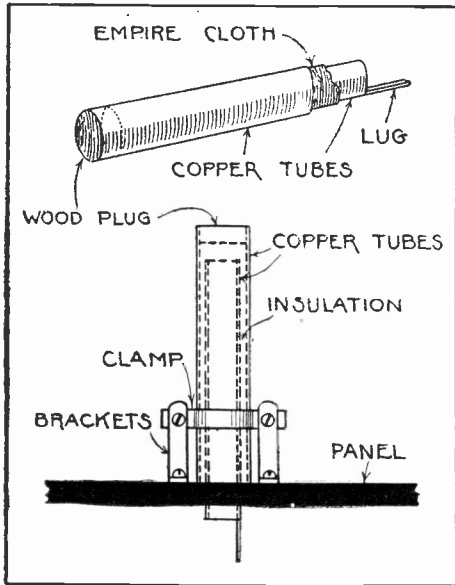
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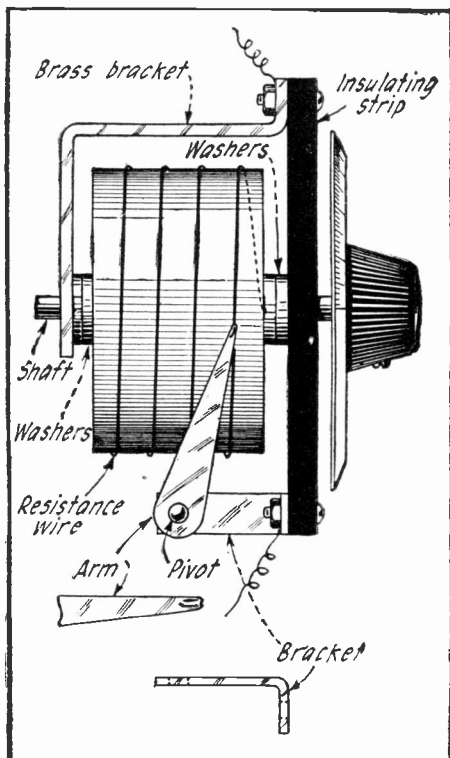
VARIABLE GRID CONDENSER



Two telescoping copper tubes and a piece of empire cloth or other insulating material make a very efficient and easily constructed grid condenser. First, wrap enough of the empire cloth around the smaller tube so that it will fit snugly in the larger tube. Connections are then made to each of the metallic electrodes. A mounting is suggested in the lower part of the above illustration. The connection to the inner electrode can be brought out through the wooden plug.

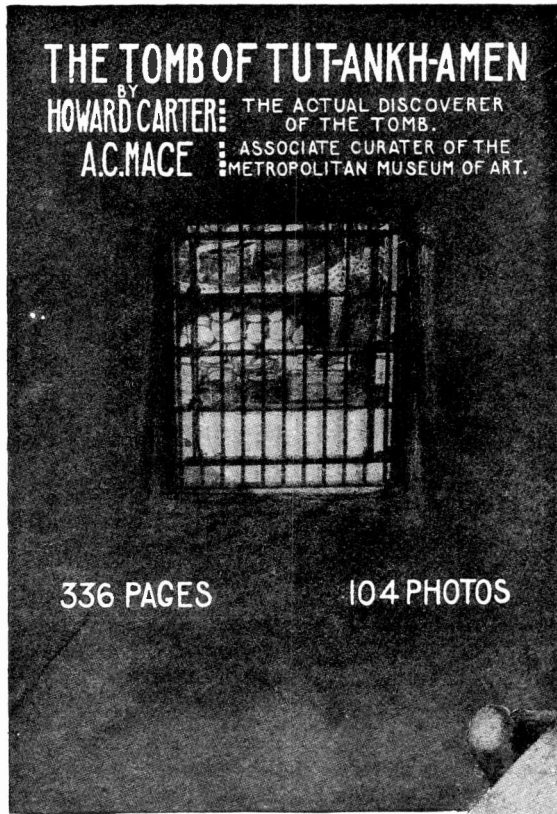
—Leroy Western.

A VERNIER RHEOSTAT



An excellent vernier rheostat can be made by following the above illustration. The first section of two-inch insulating rod is cut to the desired length and wound with several turns of resistance wire. This drum is then fastened to a shaft soldering one end of the resistance wire to the shaft. A suitable mounting is then provided and a pivoted arm arranged as shown. The end of the arm is bent slightly so that as it rests on the wire and the drum is turned, the arm will follow the convolutions.

—Leo Carble.



—behind these doors Howard Carter found the most precious treasures ever revealed to modern man.

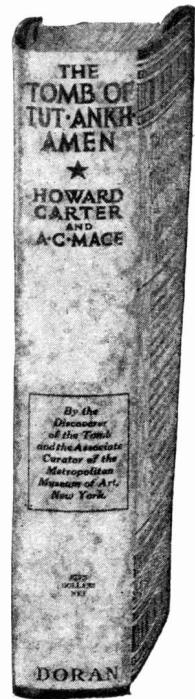
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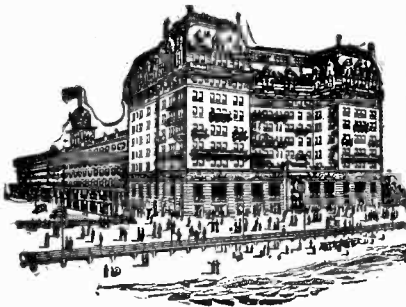
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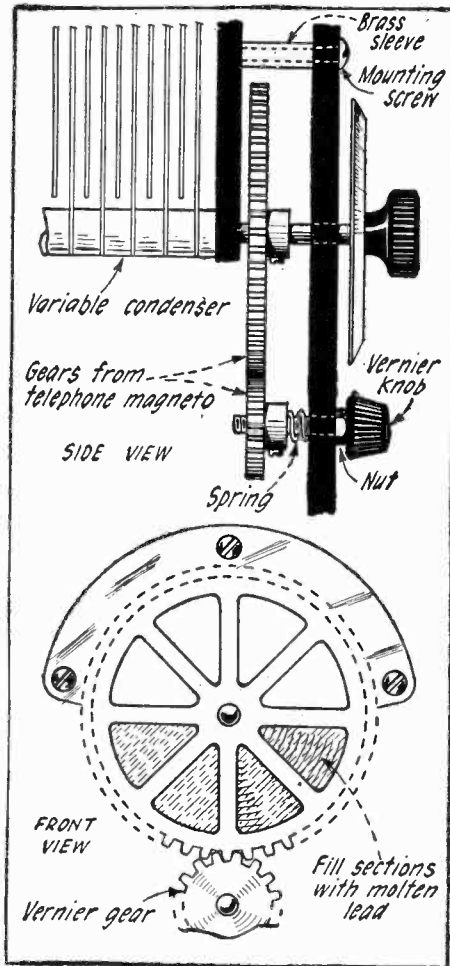
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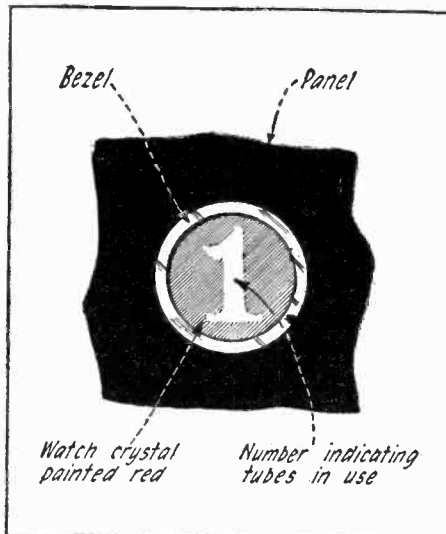
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GEAR VERNIER



By removing the two gears from a standard telephone magneto and mounting the large one on the shaft of a condenser and the small one directly below, an excellent gear controlled vernier will result. It will be found necessary to mount the condenser away from the rear of the panel so as to allow space for the gears and this is done by placing a 3/4-inch section of brass tubing over each one of the mounting screws. In order to counter-balance the weight of the variable condenser plates, a section of the large gear may be filled with lead, as illustrated. This will effectively prevent the condenser from changing its position after it is once set. The portion filled in with lead should be placed at the bottom when the condenser is at full capacity, taking for granted that the condenser is mounted as shown in the lower part of the above illustration. —H. R. Francis, Jr.

GLASS BEZELS



A very neat appearing decoration for the panel of a receiving set may be made by placing watch crystals in standard bezels and painting the glass red. Before painting, outline the number of the tube in front of which the bezel is to be placed and paint all around it. Use the abbreviation DET. for detector and figures to denote the number of stages of amplification in use.—E. S. Valentine.



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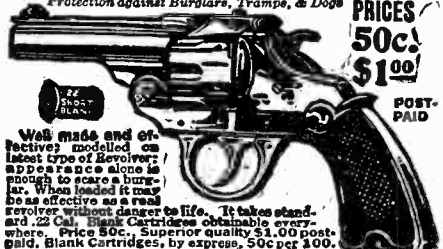
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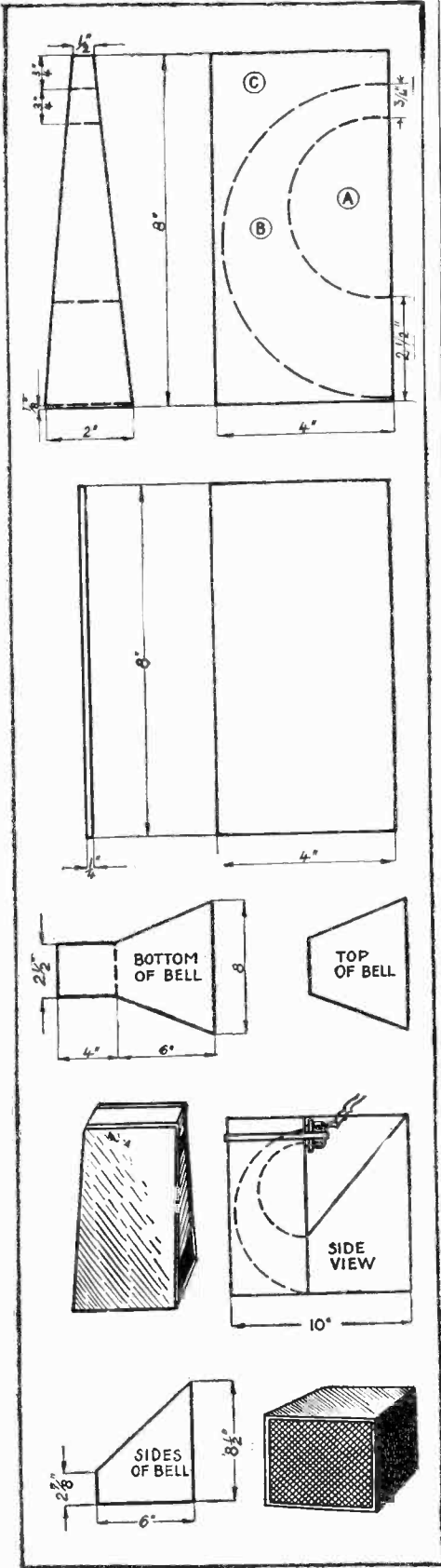
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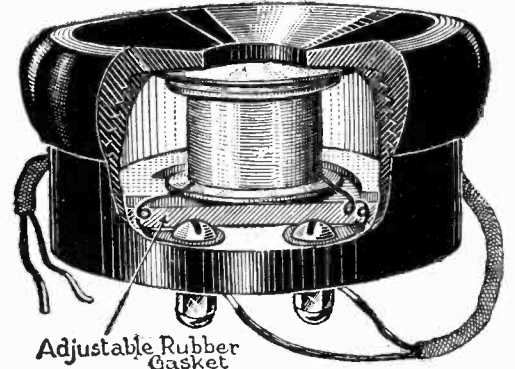
LOUD TALKER HORN



To construct this efficient loud talker horn, obtain an 8-inch piece of 2"x4" lumber and taper it, as shown at the top of the above illustration. Now, with a thin saw, cut out the part B and nail C and A together with two pieces of one-quarter inch wood, 4x8 inches. Next cut the top and the bottom of the bell from the same kind of wood adhering to the figures shown. Make the assembly as illustrated, enclosing the entire unit in a suitable box, after fastening a loud speaker unit to the end of the horn, as shown. A piece of gauze can be fastened over the mouth of the box to give it a finished appearance.
—R. J. Harris.

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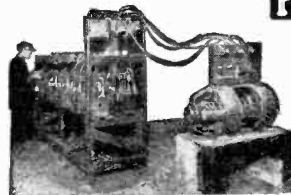
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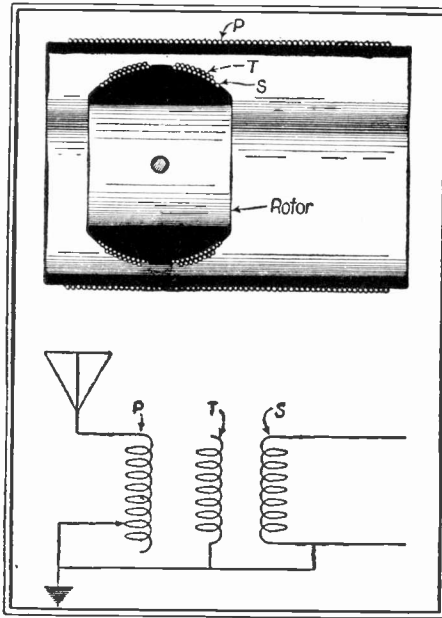
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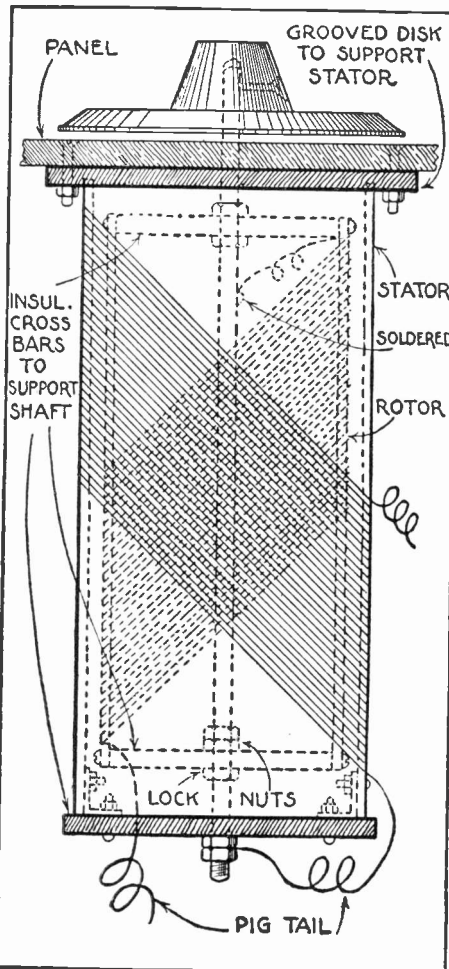
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VARIO-COUPLER KINK



An excellent idea to be used in the construction of vario-couplers is illustrated above. The addition of a third winding, T, reduces body capacity and sharpens tuning. The winding should be placed on the coupler as shown and a few turns more or less used until the correct winding is obtained. The addition or subtraction of turns should be done while the set is in operation. The third winding has only one connection. —Harry Ackerson.

NOVEL VARIOMETER



A variometer which embodies most of the good points of the standard variometer and eliminates some of the bad points is illustrated above. The coils are wound on cardboard tubes and mounted as shown. In order to form the diagonal winding it is advisable to wind the tubes with friction tape first. —Noah J. Oak.



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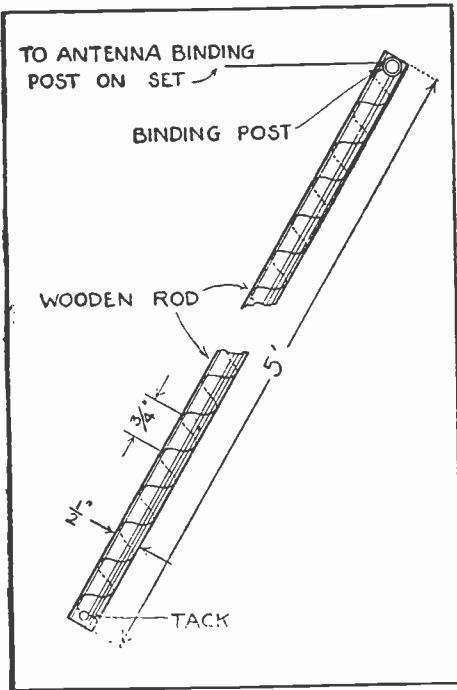
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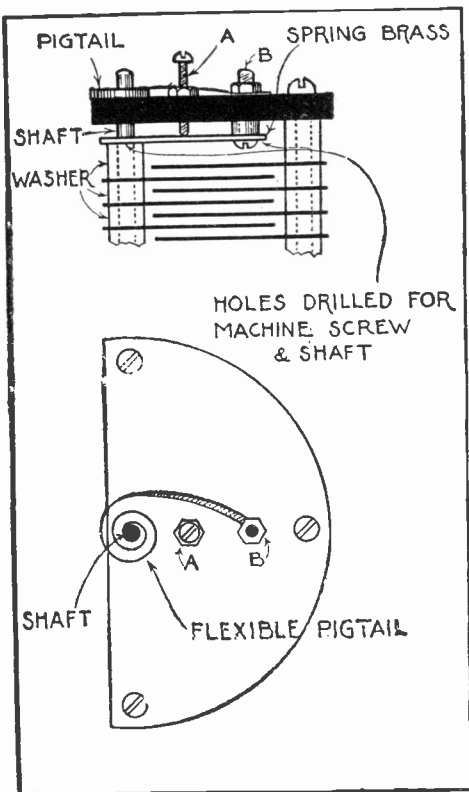
INDOOR AERIAL



For receiving over short distances or for use with very sensitive sets, a very good indoor aerial may be made as illustrated above. This type of collective agency is not very directional and will give quite good results, especially when used on a set with radio frequency amplification. A one-half inch rod is wound with several turns of about No. 18 either insulated or bare wire. The turns should be spaced about three-quarters of an inch.

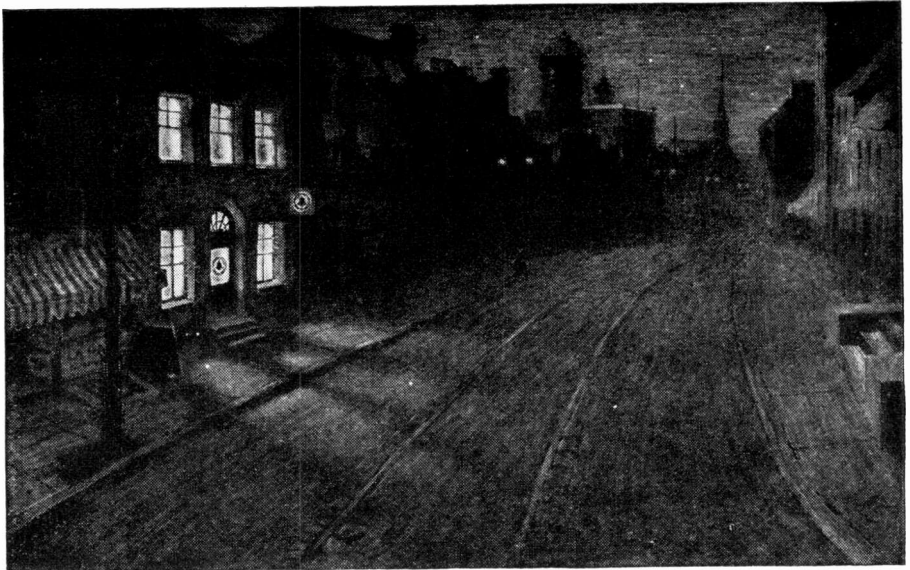
—Herbert I. Drew.

VARIABLE CONDENSER BEARING



Many of the variable condensers on the market today have bearings which soon become loosened through use and if contact is made through this bearing, great losses will occur. This can be eliminated usually by following the suggestion given above. A piece of heavy spring brass is mounted, as shown, by means of machine screws A and B and the other end presses against the shaft, as shown. This pressure prevents the condenser plates turning after being set. The addition of a flexible pigtail connection makes for greater efficiency.

—Robert Leheldt.



In the Dead of Night

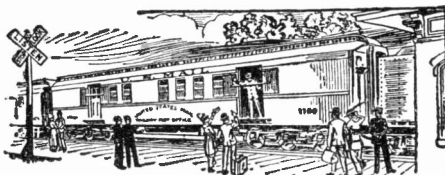
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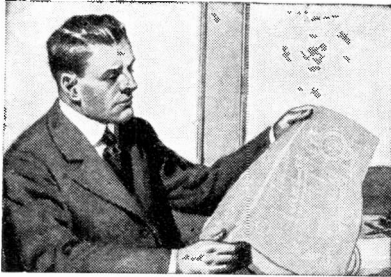
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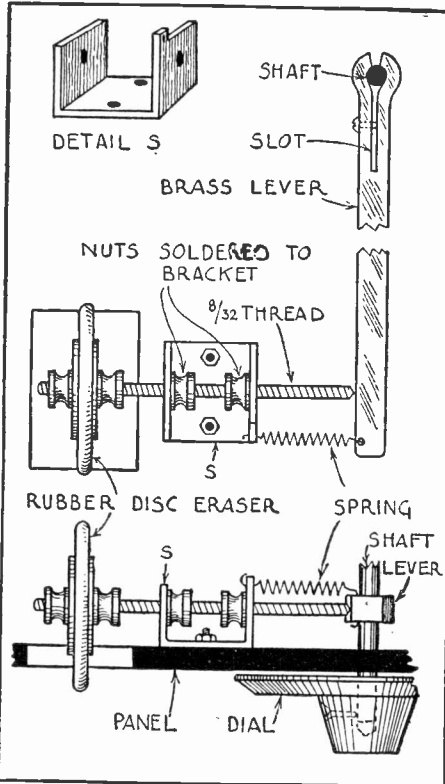
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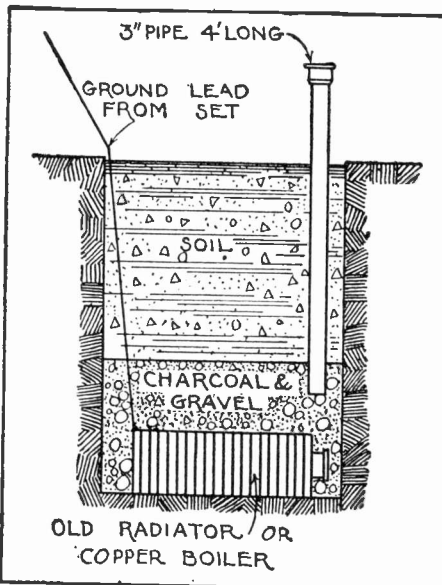
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CONDENSER VERNIER



An adaptation of the lever type of vernier which makes for much finer adjustment is illustrated above. The arm is made of heavy brass slotted at one end and equipped with a set screw so that it may be clamped to the shaft. This joint must not be too tight as the condenser cannot be turned by the regular knob and dial. Next, a bracket, S, is made from sheet brass and two battery nuts are soldered over the holes. This bracket is then mounted in a relative position to the lever shown in the diagram. A threaded brass rod is run through the two nuts, a rubber disc eraser fastened to one end and a spring placed as shown. Turning the knob with the thumb either one way or the other causes the arm to move and, therefore, gives a very fine adjustment to the condenser shaft. Some experimenting will have to be done in order to find the correct adjustment of the set screw. —James Gordon.

AN EFFICIENT GROUND



All too little attention is paid by the average amateur to his ground connection. In localities where it is possible to excavate a very efficient earth connection can be made as shown above. The hole is excavated to a depth of at least five feet and an old radiator or copper boiler placed in the bottom. A heavy ground lead is connected thereto and the entire metallic object covered with charcoal or a mixture of charcoal and gravel. A pipe is inserted, as shown, and the hole filled in with soil. Occasionally a pailful of water should be poured down the pipe to keep the charcoal moist.

—Wm. Henricks.

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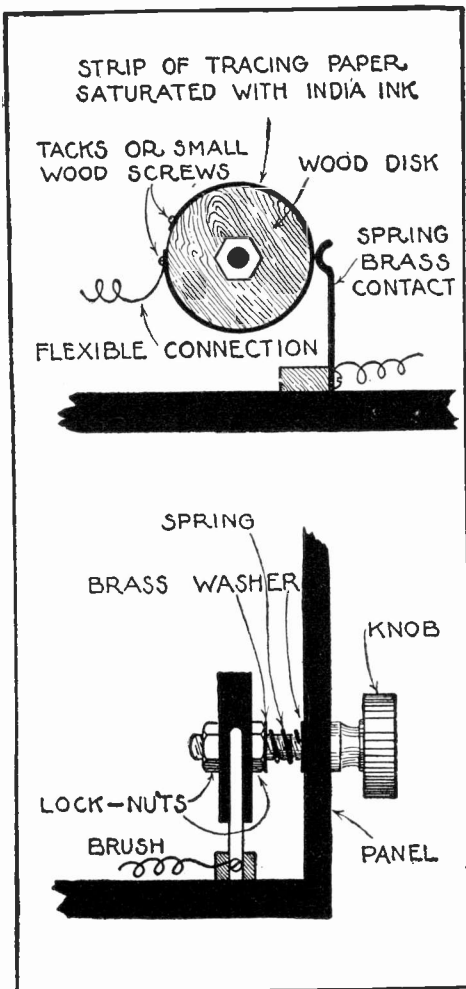
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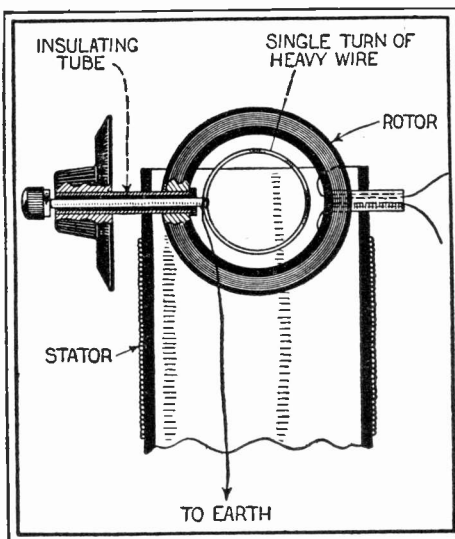
BEFORE AFTER

ROTARY GRID LEAK



A simple yet efficient rotary variable grid leak can be readily made by following the diagram given above. The rotating drum can be made from a wooden checker upon which is tacked a strip of tracing cloth which has been saturated with India ink and allowed to dry. The ends of the strip are not allowed to touch and a connection is made to one of these ends by means of a piece of flexible wire. The other contact is made by a strip of spring brass mounted as shown.
—Leroy Western, Reporter No. 15.

SHADING COIL



Another vario-coupler kink which very often aids considerably in sharp tuning is shown above. Here a single short circuited turn of heavy copper wire, either bare or insulated is mounted within the rotor of a vario-coupler and so arranged that it can be turned independently of the rotor. A standard vernier dial, of the type with an extra knob is employed as shown. The rotor may be controlled by means of the dial and after a station is tuned in fairly well, a small rotation one way or the other of the short circuited turn will be found to help considerably.
—Harry Ackerson.



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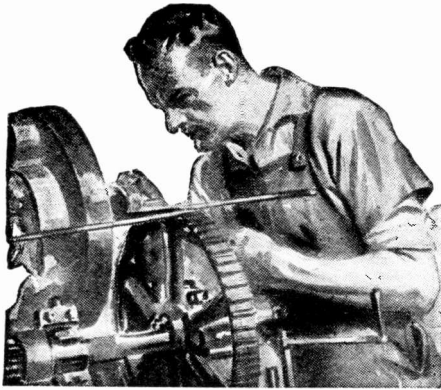
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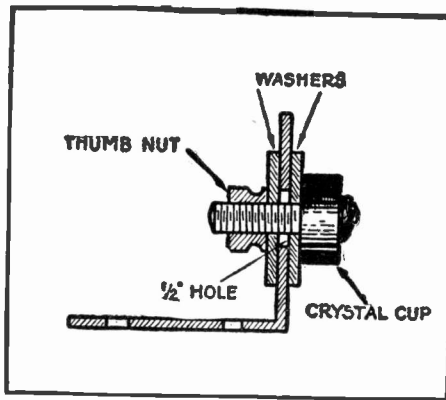
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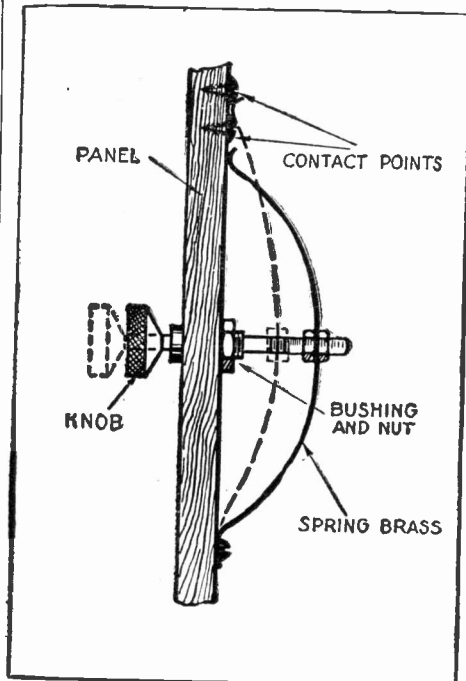
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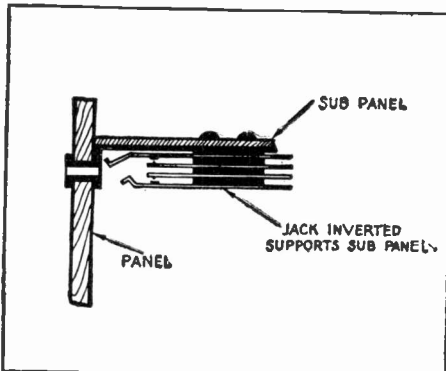
By mounting a crystal as shown above, the cup may be moved over quite a space by loosening the thumb nut and tightening when the correct adjustment is arrived at. —Leroy Western, Reporter No. 15.

PUSH-PULL SWITCH



A very neat switch for use on a radio panel can be constructed from odd parts as shown above. A strip of spring brass is used and actuated by a short brass rod. Two contact points are placed for the end of the brass strip to rest on. The adjustment of the tension and the curvature of the end of the brass strip should be experimented with so as to obtain the correct results. —Royal W. Knox.

SUB-PANEL SUPPORT



In radio sets where sub-panels and jacks are to be used, the former may be supported by the latter by inverting the jack and fastening the sub-panel to it as shown above. Space is saved and the necessity of extra brackets is done away with. This arrangement does not interfere with the working of the jack in any way. —Francis N. Gilrath.

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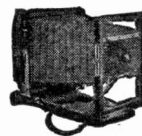
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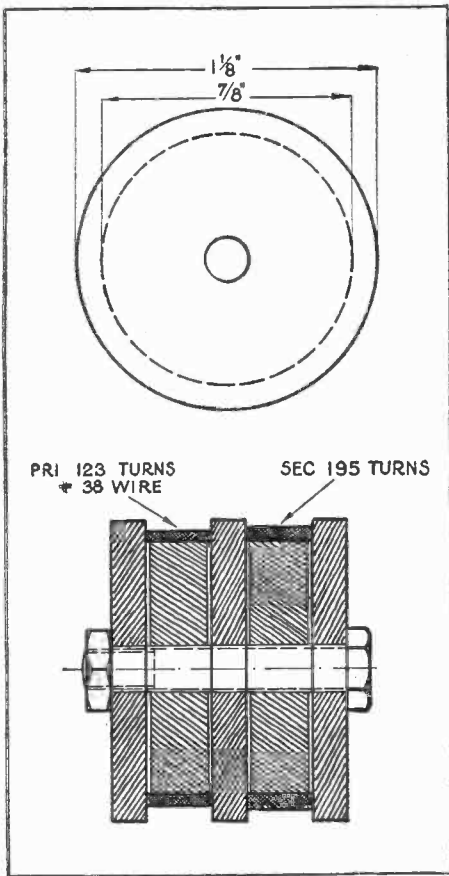
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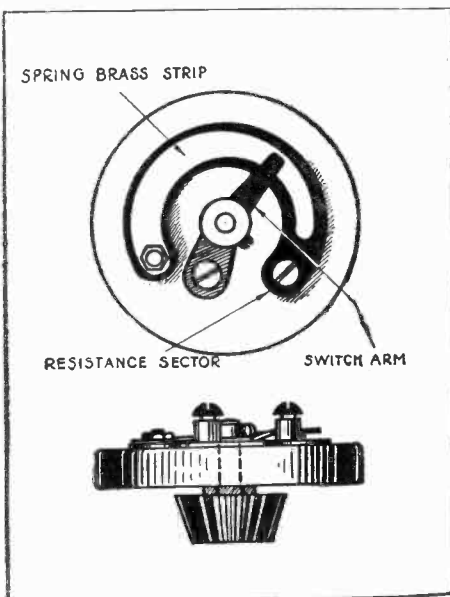
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RADIO FREQUENCY TRANSFORMER



A fairly efficient radio frequency amplifying transformer can be constructed by following the data given in the illustration above. Five disks of wood are cut, three of them 1 1/8 inches in diameter and two of them 7/8 of an inch in diameter. They are then assembled, as shown in the lower part of the above illustration, and held together with a machine screw. In one slot is wound 123 turns of No. 38 enameled wire and in the other 195 turns of the same size wire. This transformer is connected in the usual manner. —Robert Clark.

VARIABLE GRID LEAK



An old rheostat base makes a good mounting for the above illustrated grid leak. First soak a curved section of cloth in India ink and mount on the base. Then cut out a piece of thin strip brass, fastening one end, as shown, and bending the other. Then by rotating the switch arm over the brass strip, the latter will be made to touch the resistance sector and thereby vary the resistance. —J. F. Bosmik.

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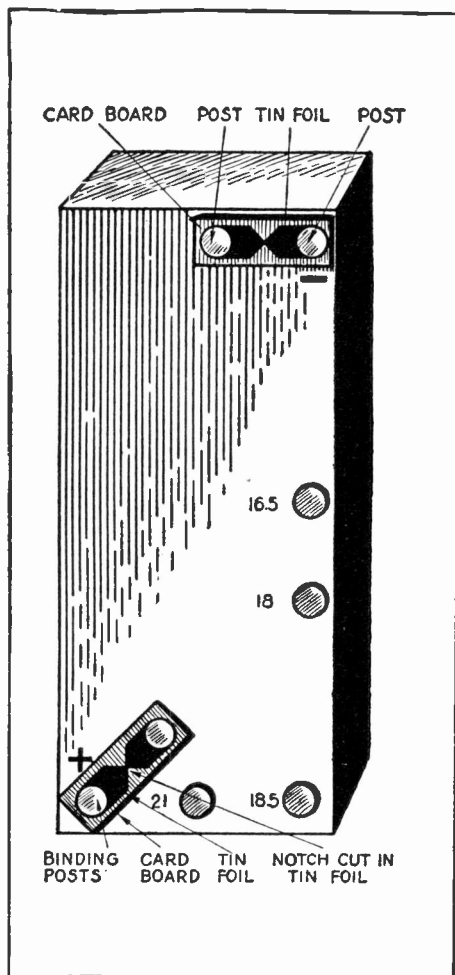
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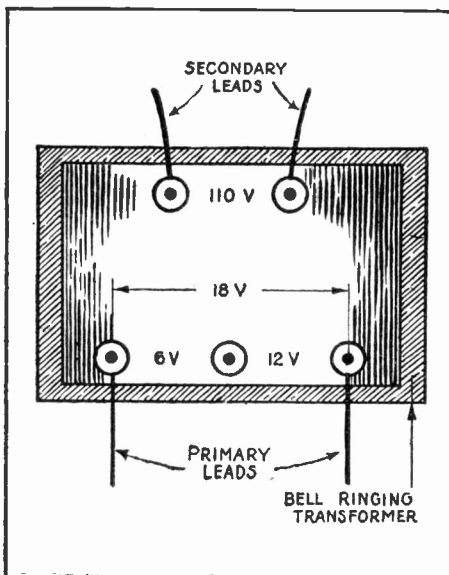
BATTERY FUSE



A fuse for the protection of tubes may be placed on the "B" battery in the manner illustrated above. Melt spots in the wax on top of the battery and insert binding posts therein. Fasten the posts solid with molten wax. Then place on the battery strips of cardboard covered with strips of tin foil, as shown, first cutting notches in the tin foil. The thin metal strip acts as a fuse in case of a short circuit.

—Robert Lawrence.

MAKE-SHIFT TRANSFORMER



The average electrical and radio experimenter usually has at his command one or more bell ringing transformers. These can be impressed into service as audio frequency amplifying transformers by connecting them up in the standard manner, making the connections to the binding posts, as shown above. If an 18-volt transformer is available, take one primary lead from the 18-volt post and the other from the common post.—G. William Dayton.

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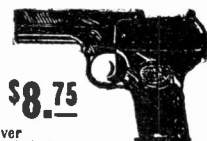
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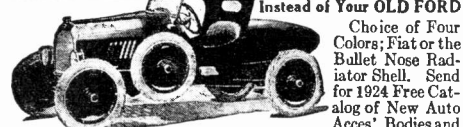
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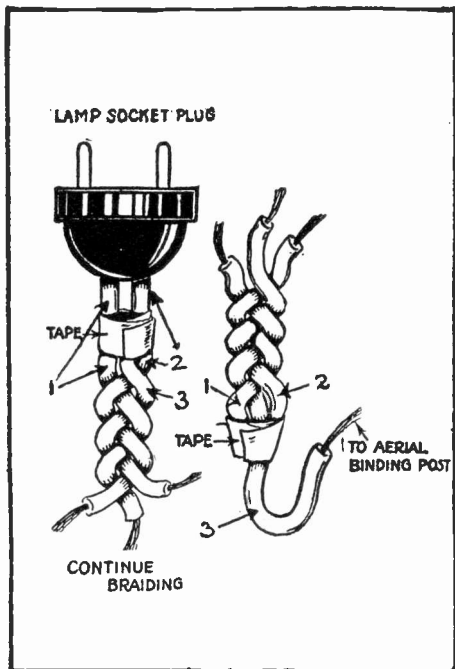
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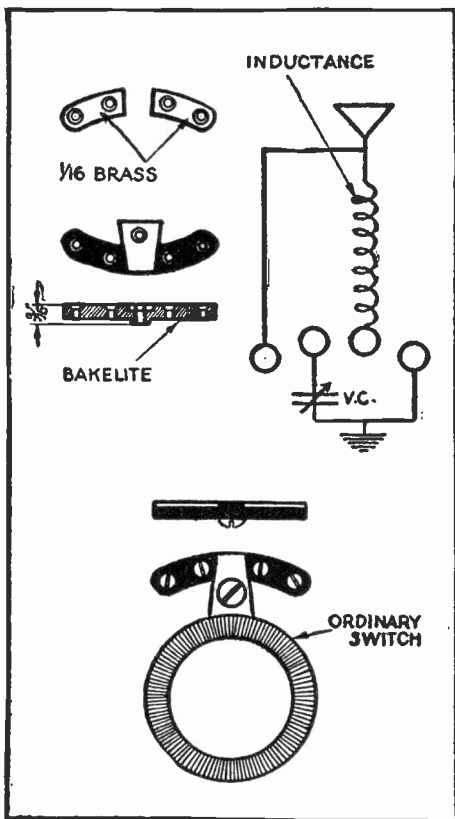
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LAMP SOCKET AERIAL



The ever present antenna problem of the apartment house dweller can be easily and cheaply solved in the manner shown above. Secure an ordinary light plug and three pieces of flexible lamp cord, one piece long enough to reach from the nearest electric light socket to the set and the other two pieces about 5 feet long. Braid them together as shown above, the two short pieces connecting to the prongs of the plug. The third piece does not make any connection whatsoever except to the set. Insert the plug in a socket and it is ready to use.—E. A. Lenz.

SERIES PARALLEL SWITCH



A variation of the series parallel switch which gives greater flexibility may be made as shown above. Two strips of brass are mounted on a bakelite strip, as shown, and the latter mounted on an ordinary switch arm. Four switch points are then mounted on the panel and connected as illustrated. By means of this switch the variable condenser can be placed in parallel or in series with the inductance or the latter can be connected directly to the ground without any external capacity in the circuit.
—Harold B. White.

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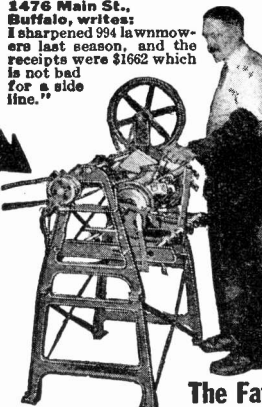
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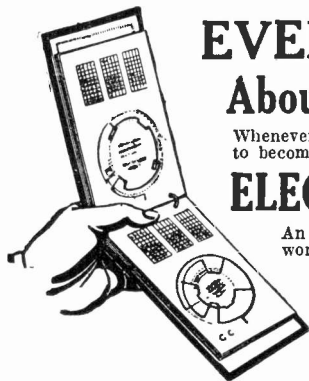
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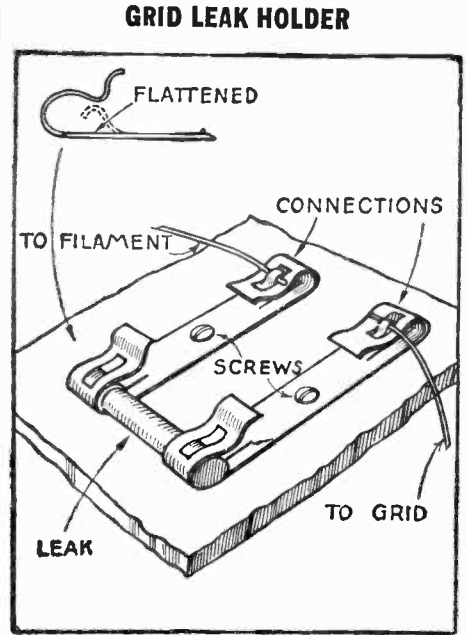
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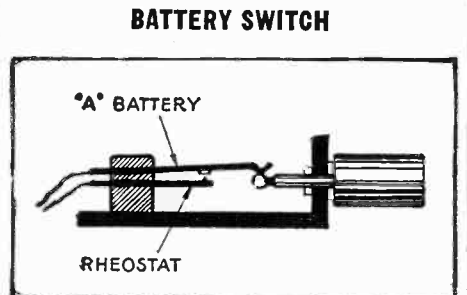
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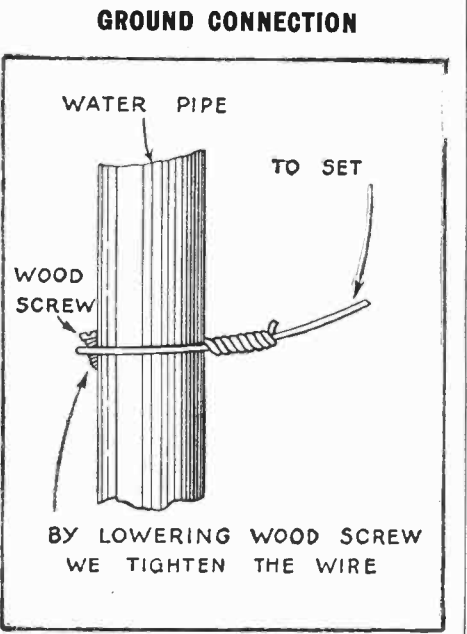
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 —Howard Fettes.



A simple switch for controlling the "A" battery can be made by connecting a jack in the circuit, as shown above. Inserting a plug opens the circuit and withdrawing it closes the circuit.
 —F. J. Cartledge, Jr.



When a ground connection is to be made in a hurry and no ground clamp is available, a substitute may be made as shown above. Simply wind a wire around the pipe, after cleaning the latter thoroughly, and insert the point of a wood screw as shown. By turning the latter in a clockwise direction it will lower itself and hence tighten the wire.
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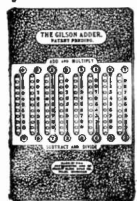
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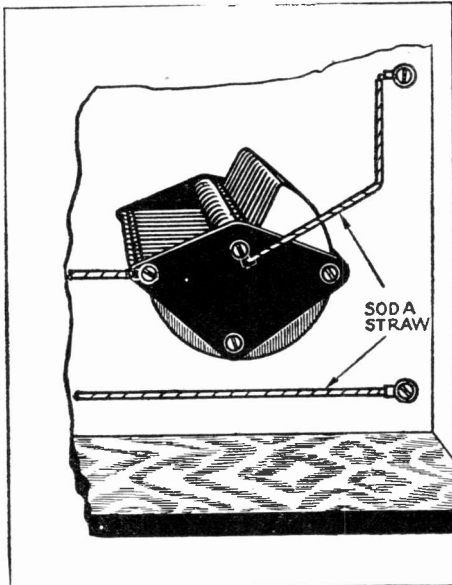
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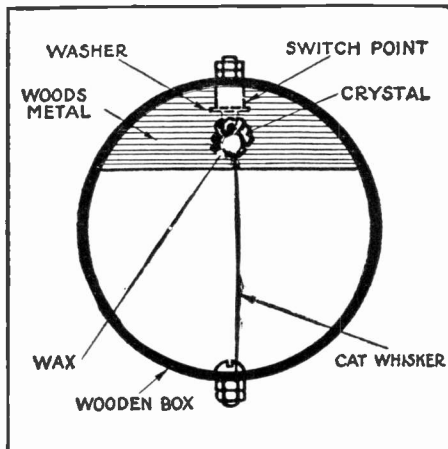
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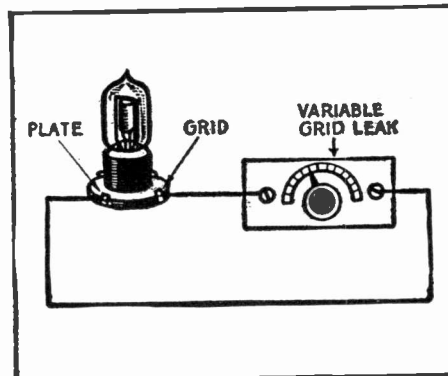
With careful manipulation, ordinary soda straws can be used very successfully as a substitute for the varnished cambric tubing commonly known in radio work as spaghetti. Care must be taken in bending the straws so as not to break them any more than necessary.—C. B. Kramer, Sr. Reporter No. 6349.

FIXED CRYSTAL DETECTOR



A small round wooden box is obtained such as those in which crystals are purchased and two holes drilled in the edges of the base directly across from each other. Place in one of them a switch point to the head of which has been soldered a washer. In the other, place a machine screw to the head of which is soldered a short cat whisker. Place a strip of cardboard across the center of the box to form a mold. Pour into the side on which the switch point and washer are located some melted Woods metal and while still liquid insert a very sensitive crystal. Remove the cardboard and place the detector in a receiving circuit. Adjust the cat whisker, keeping it very short until the signal is loudest, then seal the point of the cat whisker to the crystal with paraffin wax. Place the cover on the base and it is ready for use.

INCREASING EFFICIENCY



The addition of a variable grid leak connected from the plate to the grid of a receiving set will often increase the efficiency many times. This is the system used in the National Monodyne receiver, patented by H. Gernsback, editor of SCIENCE AND INVENTION.

—Earle F. Rueter.



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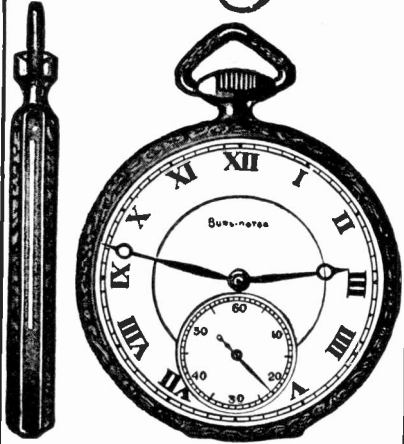


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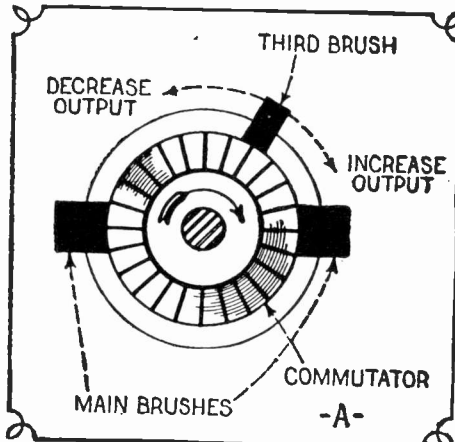
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Motor Hints

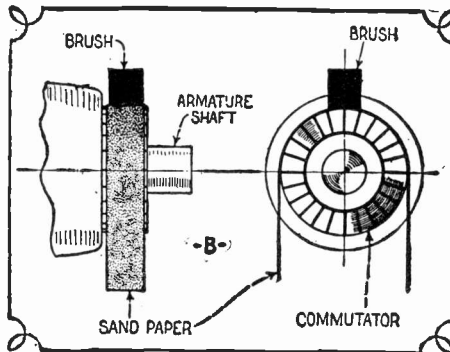
Generator output and adjustments

BY TOM C. PLUMRIDGE

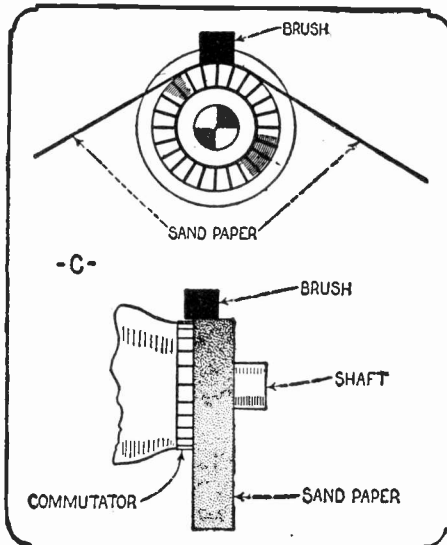
Automotive Expert



It is essential that the generator give its best output in the winter, because the battery must be fully charged as the lights burn longer, and the starter has to do harder work in starting the engine in colder weather, and takes more out of the battery. In most generators the third brush is the form of regulation used and the movement of this brush in the direction of the armature rotation will increase the output of the generator. The above sketch shows the brush in position and the directions to move for increasing and decreasing the output.



The brushes of the generator should be a good fit on the commutator and Sketch B shows the correct way to fit these brushes. Emery cloth should never be used because it will imbed particles of emery in the copper and between the bars of the commutator and injure it. Fine grade sand paper should be used.



Cut a strip of sand paper wider than the brush and place under it with the rough side towards the brush and move it back and forwards taking care to keep the strip well around the commutator so that the brush will have the same radius as the commutator. Sketch C shows what to avoid when fitting the brushes.

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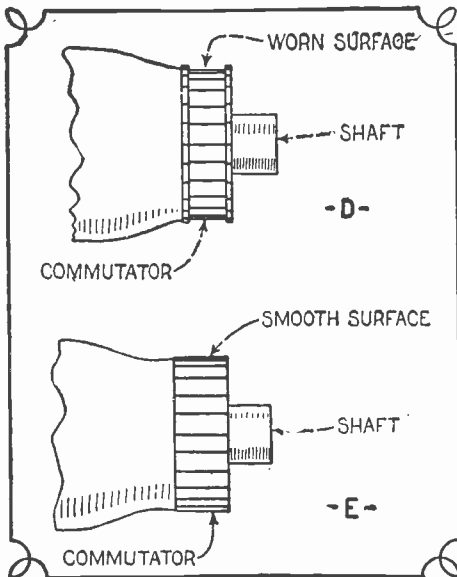
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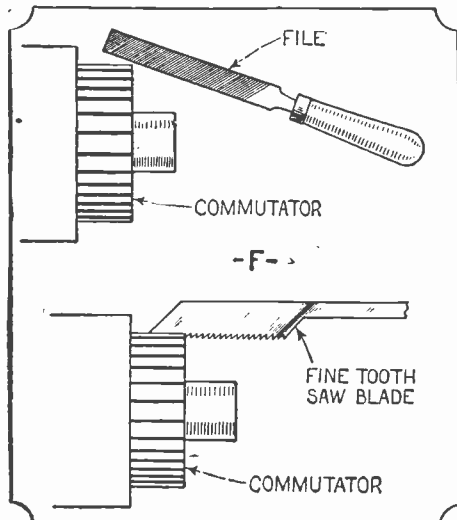
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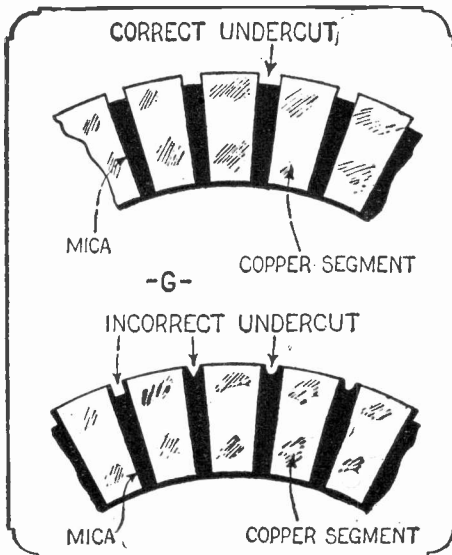
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After a period of service the commutator will become worn down so that it is necessary to take the unit off to have the commutator trued and smoothed up in the lathe. This is the cause of low generator output in many cases of generator troubles. Sketch D shows how the generator wears and Sketch E shows how it should be for good operation.



Between the commutator bars there is a hard black substance called mica, and this being harder than the copper does not wear as fast as the copper and in time stands above the bars and prevents the brushes making good contact. Sketch F shows how this mica may be under cut, and the tools to use.



Sketch G shows how the space between the bars should look after the mica has been undercut. Care should be taken to see that a thin strip of mica is not left at the side of the bars because this will be wiped over the bars and prevent good generation.

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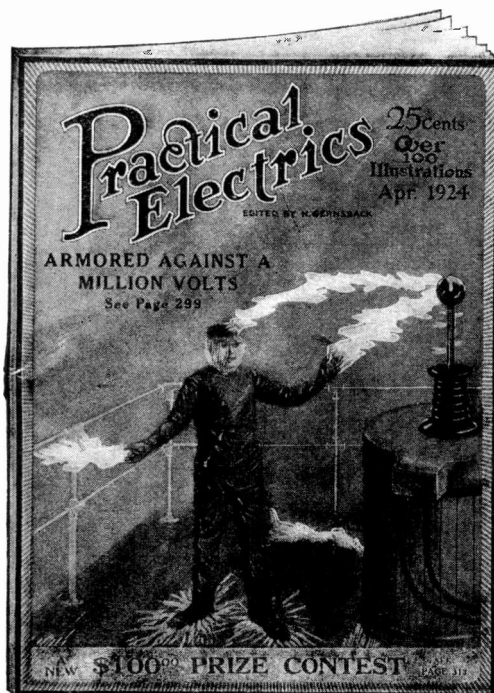
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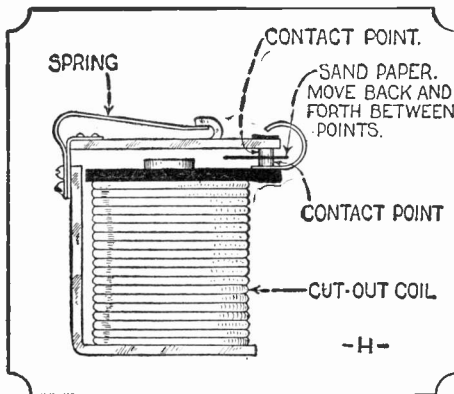
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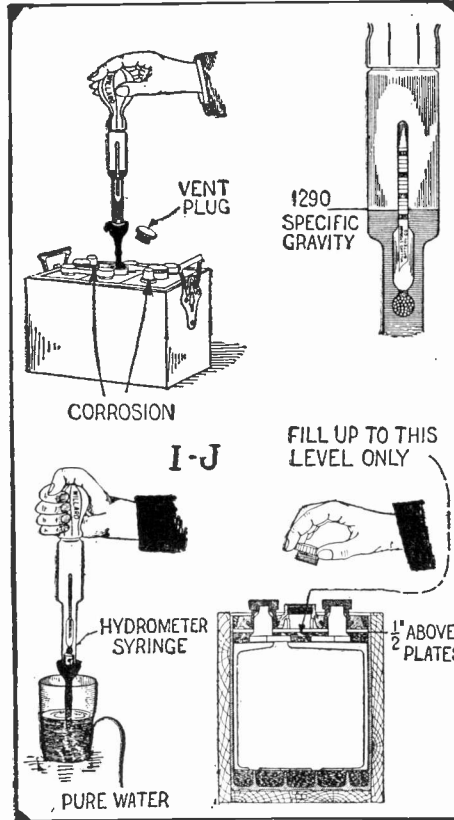
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Motor Hints

(Continued from page 100)



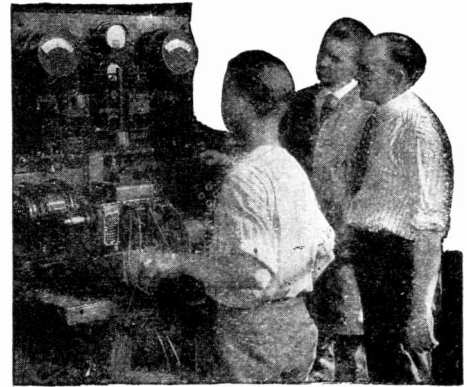
There is an important unit in connection with the generator which controls the connecting of the battery with the generator when the car reaches a certain speed, and does it automatically. This unit is called a cutout. The contact points on it should be clean and make perfect contact with each other. Sketch H shows how these contacts may be cleaned. If this little device should fail to operate the car should not be run until the trouble has been corrected because the generator windings will heat up and burn up the insulation. To clean the points draw a strip of sand paper between the surfaces of the points, white lightly pressing the points together.



A battery should be tested frequently to see if it is fully charged and a hydrometer should be used for this purpose, and Sketch J shows how the test should be made for both the depth of solution test and the hydrometer test. If the battery is fully charged the hydrometer will show a specific gravity of 1.290. A battery should never be allowed to get below a specific gravity of 1.200. Use only distilled water to fill the battery.

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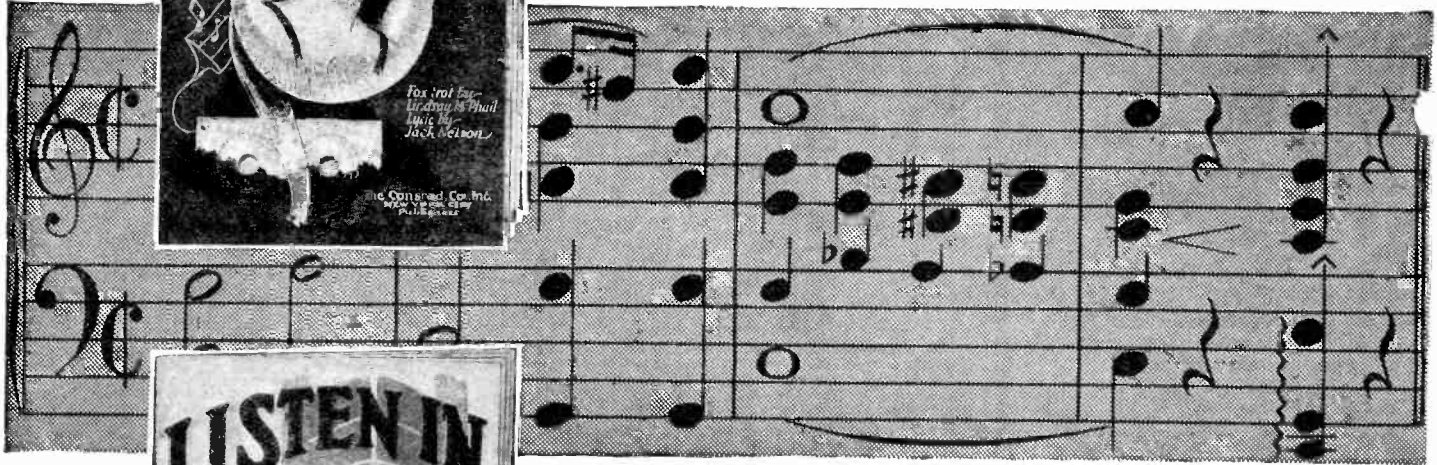
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Answer to Scientific Puzzles

By ERNEST K. CHAPIN
(Continued from page 43)

THE WHEEL PROBLEM

The upper part of the wheel at A is just twice as far from the center of rotation B as is the center of the wheel. Therefore the upper part will travel just twice as fast as the center. Any given point has this double speed only for the instant it is vertically above the point of contact with the ground.

THE LEVER PROBLEM

The lever system shown above is more effective in the development of force than the one below because in the former the effort is applied at the greater distance from the pivot. Thus greater leverage is obtained by the method of the upper system.

JUMPING UPWARD ON A MOVING TRUCK

On jumping upward from a moving object such as a truck a person's body retains the same velocity as that of the moving object. Hence, neglecting the resistance of the air, a person will keep up with the moving object and land back in precisely the same spot as that from which he leaped.

SKATING ON THIN ICE

When thin ice sags and breaks under the weight of a person standing on it, the water below the ice must have time to move out from under the crust of ice. A fast skater may easily skim over a dangerous spot before the water below has had a chance to give way or yield to the pressure of the bending crust.

THE WATER PIPE

It is at once apparent that the rate of flow or quantity of water that passes per second in any one part of a pipe must be exactly equal to the rate of flow in any other. Otherwise there would be an accumulation of liquid in some places and not in others. Yet this is just what would happen if water were to flow as shown in the diagram, for at A where the water is flowing out of the pipe into the casing the pipe would not contain enough water to fill it while at B where the water is re-entering the pipe there would be more water supplied to the exit pipe than it could accommodate.

THE ELECTRIC LAMP

The former problem is in a sense a water analogy of the action that prevents the filament of an electric lamp from being shorted by the electronic atmosphere which it produces. The filament corresponds to the pipe, the glass bulb to the casing, and the electron stream within the filament to the current of water within the pipe. The heat of the filament drives electrons out into the space surrounding it until they are so numerous as to return to the filament just as fast as they are ejected from it. Under such conditions any general movement of electrons between the different parts of the filament would be impossible.

THE EARTH AND THE TUB OF WATER

The daily rotation of the earth would not cause water to circulate once every twenty-four hours inside a tub placed at the north pole because the water like everything else would have the rotational velocity of the earth even before it was introduced into the vessel. Hence as the earth turned the tub around every twenty-four hours the water would rotate once also and thus keep up to the motion of the container.

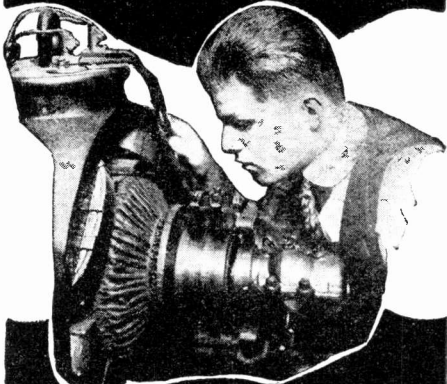
THE U-TUBE OF MERCURY

If capillary action is sufficient to maintain the difference in the levels of the mercury columns it will be sufficient to keep the mercury from flowing down through the tube A joining the two columns.

A QUESTION OF STABILITY

The stability of an object, in general, depends upon the size of the base and the
(Continued on page 107)

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Answers to Scientific Puzzles

(Continued from page 105)

height of the center of gravity of the object above the base. The larger the base the greater is the stability. And the higher the center of gravity the less is the stability. Hence the ratio of diameter of base to height of the center of gravity of the object may be taken as an index of its stability, provided, of course, that the center of gravity is directly over the center of the base as it is in the problem of the pedestal.

If the center of gravity of an object has to be raised in order to overturn it the object is said to be stable. And the higher the center of gravity has to be raised the greater is its stability. Now from the accompanying figure it will be seen that if the pedestal stands on its small base the center of gravity will have to be raised a distance equal to $\sqrt{1\frac{1}{16}}-1$, or about 0.03 feet, while if it stands on its big base the center of gravity will have to be raised $\sqrt{4\frac{1}{4}}-2$, or about 0.06 feet. Hence it is more stable on its larger base.

The Heavens in May

BY ISABEL M. LEWIS, M.A.

(Continued from page 32)

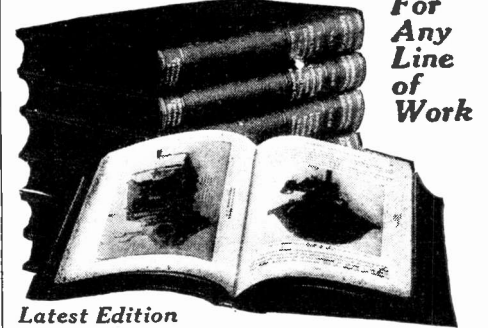
than Spica but a little fainter than Arcturus, which lies not far to the northward. Arcturus is the brilliant orange-colored star in the kite-shaped group of Boötes the Herdsman.

The brilliant blue-white Vega in Lyra, now well above the horizon in the northeast, Capella in Auriga, far over in the northwest and Arcturus, are the three brightest stars of the northern hemisphere. Capella and Arcturus are estimated to be exactly equal in brightness and a shade less brilliant than Vega. There is considerable uncertainty as to the exact distance of Arcturus from the earth. According to some measurements it is less than 20 light years distant and to others nearly 40 light years away. It is one of the most rapidly moving stars. Since the days of Ptolemy, Arcturus has moved in relation to the other stars in its constellation a distance greater than twice the diameter of the moon. Though this is considered to be an unusually large motion for a star, it is less than that of a considerable number of stars. Arcturus is also one of the cooler stars, its surface temperature being about 4,000 degrees.

The Northern Crown, Corona Borealis, is now high in the heavens to the northeast of Boötes. It consists of an almost perfect semicircle of stars. Its brightest star, the jewel in the crown, is a star of the second magnitude called Gemma. The large constellation of Hercules which follows Corona on the northeast contains many stars of third and fourth magnitude, but none brighter. It also contains one of the finest star clusters in the heavens, known as the Great Hercules cluster, visible faintly even to the naked eye. Adjoining Hercules on the northeast is the beautiful little constellation of Lyra, the Lyre, with its magnificent blue-white Vega.

Turning to the south, we see all of the huge form of Hydra, the Water-snake, now fully above the horizon and extending almost entirely across the southern heavens from the southwest to the southeast. Alphard, its brightest star—a second magnitude one—stands alone in the southwest. Hydra's riders, the small constellations of Corvus and Crater, are now almost due south.

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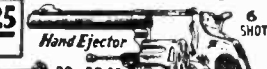
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The last of our old friends of the winter months are approaching the western horizon. Sirius is gone but Procyon may still be found low in the southwest. Capella, in Auriga, is now nearing the northwestern horizon. Perseus is on the horizon and fast disappearing from view, but Castor and Pollux, in Gemini, are still well above the western horizon. Venus, in all its splendor, may now be seen at the time for which our chart is given, to the northwest of Castor and Pollux. It passes from Taurus into Gemini this month and reaches its greatest brilliancy on the 24th of May. There will be no difficulty about identifying Venus, because, as always, it surpasses all other stellar objects in brightness. Jupiter, though not visible at the time for which the chart is made, will come above the southeastern horizon very shortly, as it is now in the constellation of Ophiuchus, which is just appearing in the east, following closely upon Serpens. Mars is now in Capricornus and rises before midnight, but is not visible at the time designated on the chart. It is rapidly increasing in brightness and even now outshines all other stellar objects with the exceptions of Venus and Jupiter, Sirius and Canopus. When it reaches opposition in August it will outshine all of these excepting Venus. The distance of Mars at the coming opposition is very nearly the closest possible approach for this planet.

Of special interest this month will be the transit of Mercury across the face of the sun on May 7th. Owing to the small size of the planet it will not be possible to view the transit without the aid of a telescope. But even the smallest telescope will show the planet on the sun's disk. In the United States the sun will set with Mercury on its face, the transit beginning about 4:45 P. M. in New York, about 3:45 in Chicago and about 1:45 in San Francisco. It will take a little under eight hours for the planet to traverse the sun's disk and the entire transit will be visible in Alaska, the mid-Pacific and the Philippines. Transits of Mercury are comparatively rare phenomena. The last occurred in November, 1914, and the next will occur in November, 1927.

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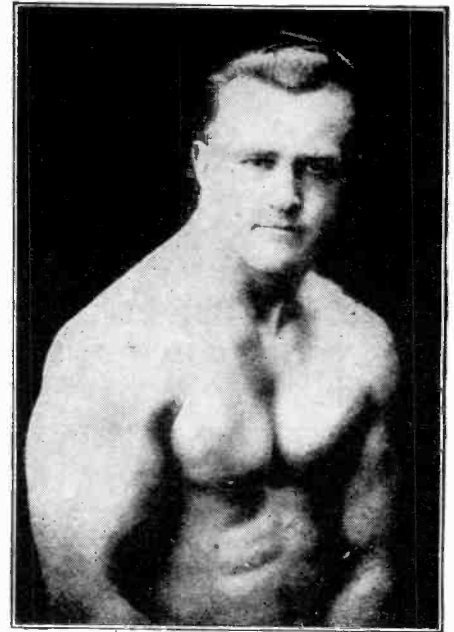
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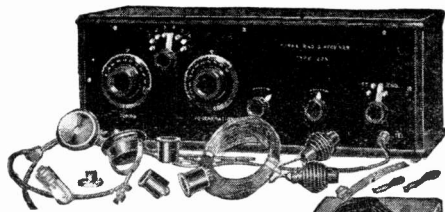
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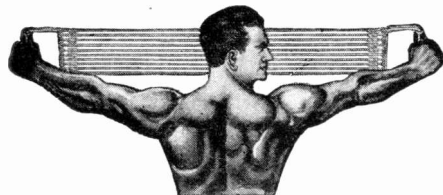
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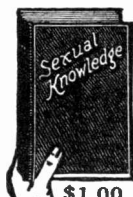
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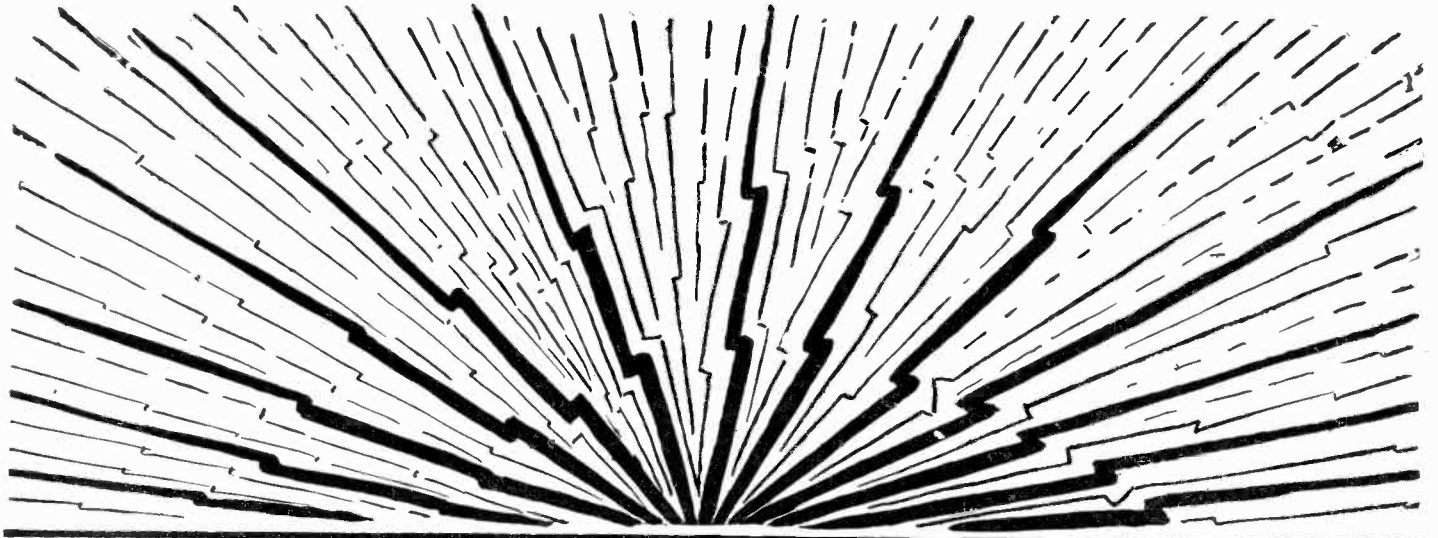
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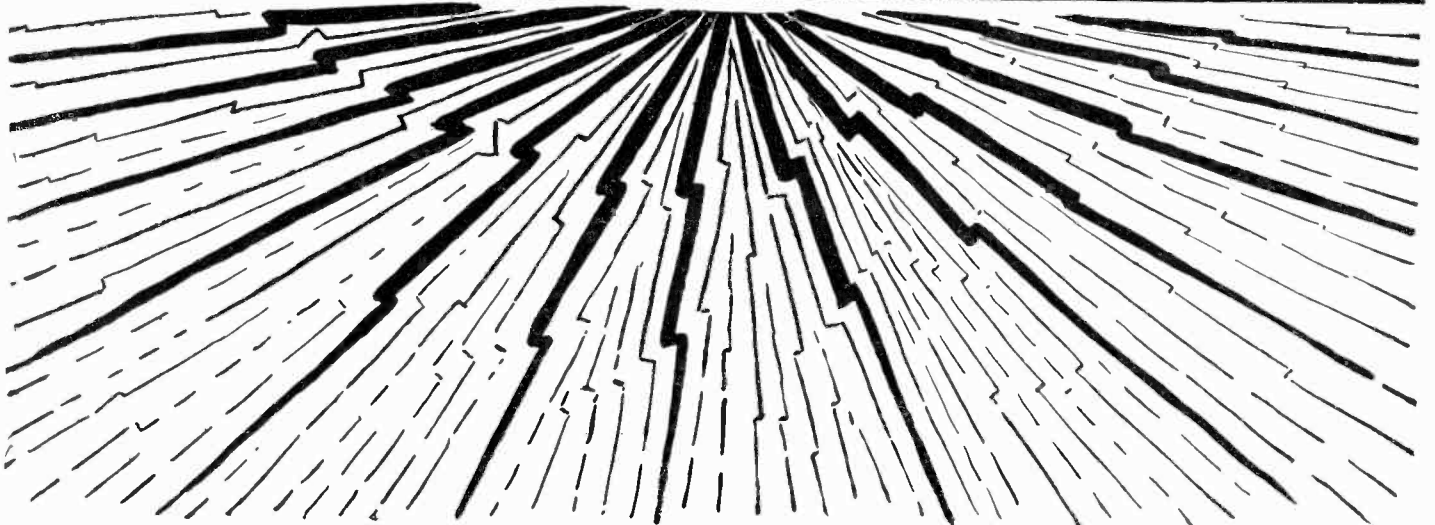
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