June

25 Cents

# Science and Invention

## IN PICTURES

## A NEW WATER SPORT WHEEL

*See Page 118*

40 NON-TECHNICAL RADIO ARTICLES

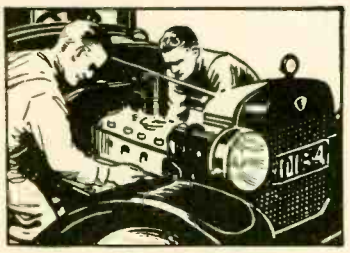
EXPERIMENTER PUBLISHING COMPANY, NEW YORK, PUBLISHERS OF
RADIO NEWS - SCIENCE & INVENTION - THE EXPERIMENTER - MOTOR CAMPER & TOURIST

# Earn $3,500 to $10,000 a Year in Electricity

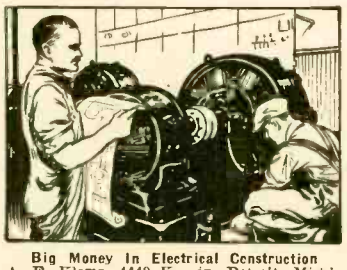
## Thousands of Cooke Trained Men Are Doing It!

**Get Into Electrical Contracting**
John Jirinec, 1133 Fourth Ave., Astoria, L. I., New York, makes $800 to $1000 a month in business for himself. He says Cooke Training is responsible for his success.

**Radio Offers You Hundreds of Opportunities**
$20 to $25 a day in Radio—that's what Jos. Cunningham, Athens, Ohio, is making out of his Cooke Training today.



**Auto Electricity Pays Big**
W. E. Pence, Albany, Oregon, specializes in Auto Electricity and makes $750.00 a month. Was formerly a mechanic earning $30.00 a week.



**Big Money In Electrical Construction**
A. F. Klemz, 4449 Kerwin, Detroit, Michigan, earns over $5000 a year in Electrical Construction work. He formerly earned $5 a day.

You want to make big money. You're not satisfied with your $20 or $30 or $40-a-week job. Then Electricity is the field for you—the field of BIG PAY and big opportunities. As a trained Electrical Expert—a "Cooke" Trained Man—you can easily earn $70 to $200 a week just like the men in the pictures to the left, and not work half as hard as you do now.

### My Training Makes It Easy

Electricity is the world's greatest and fastest growing industry and easiest of all professions to learn, as I teach it. Right in your own home, in your spare time, I will train you, teach you its money-making secrets. As Chief Engineer of the great Chicago Engineering Works, that big Two Million Dollar Institution, I know exactly the kind of training you need, and I'll give you that training. Then I'll show you how and where you can use it to make big money in Electricity. You can read; you can write. That's enough. My training does the rest. It makes you a BIG-PAY man in this BIG-PAY field.

### Make Money Quick—*By Spare-Time Work*

Right at the start—after the first few weeks—I show you how to make extra money doing Electrical jobs in your spare time. I show you how to do them, where and how to get the jobs and I give you four complete outfits of tools and apparatus to work with, including an honest-to-goodness Electric Motor. This spare time work will bring you in several times the monthly payments on my Course. Even though you haven't the ready cash, you can afford my training. It's not an expense—IT PAYS ITS OWN WAY.

### Go Into Business for Yourself On My Money

Every month I give two of my students $500 cash, to go into business for themselves. No strings attached—an out and outright gift. Get details of this remarkable offer—the most amazing offer ever made in the home-study field from my big free book.

### Act Now! Get the "Vital Facts"

Learn what I will do for you. Find out about the things I do for my "boys"—things that are not being done by any other school. Get my 16 smashing guarantees. My big book, which includes also letters from more than 100 successful men whom I have trained, explains it all. Clip and mail the coupon to me now.

**L. L. Cooke, *Chief Engineer***
**Chicago Engineering Works**
**Dept. 2-A, 2150 Lawrence Ave.**
**Chicago, Ill., U. S. A.**

**L. L. Cooke,**
***Chief Engineer***

Cooke Training is backed up with my 20 years of experience—the contribution of 50 other engineers and a staff of 12 practical engineers who work full time for my students.

## Get My 16 Smashing Guarantees

You don't know what guarantees are—you don't know what wonderful things I do for my students—and what I guarantee to do for you—'til you get my book—"The Vital Facts." Send for it NOW. Read about the most amazing offer ever made to ambitious men.

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**L. L. Cooke, Chief Engineer,**
**Chicago Engineering Works,**
**Dept. 2-A—2150 Lawrence Ave.,**
**Chicago, Illinois.**

Please send me, FREE and without obligating me in any way, your big BOOK, "The Vital Facts," and full particulars of your big offer including your 16 guarantees and details of your plan for financing your students.

Name.....

Address.....

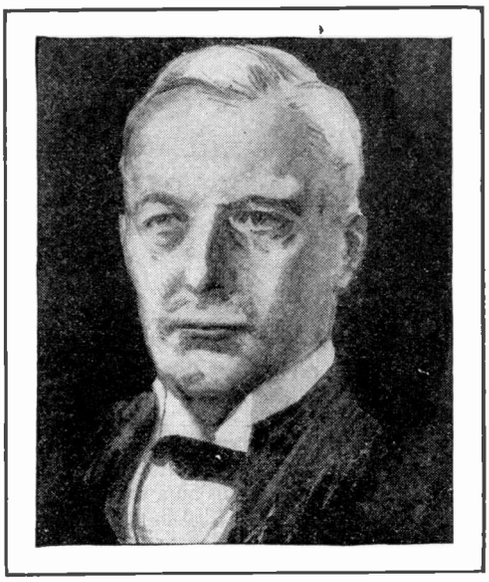
City..... State.....

*The "Cooke" Trained Man is the "Big Pay" Man*

# Men Past 40 Find Simple New Gland Treatment Ahead of Medicine or Surgery

**During the Last Seven Years a Series of Valuable Experiments Have Been Conducted in the Middle West. The Treatment Developed Has Proved Astoundingly Beneficial in the Relief of Certain Painful Conditions Common to Men Approaching or Past the Prime of Life.**

**By Byram C. Kelley, A. M., L. L. D.**



Although two-thirds of all men past a certain age have prostate gland trouble, many do not realize the real cause of their painful or inconvenient symptoms or their "slowing up." The article herewith treats of this subject in an understandable manner and points the way to speedy relief.

ACCORDING to medical authorities, 65% of all men past a certain middle age suffer from a disorder of the prostate gland that has a depressing—and often painful—effect on the entire body.

Some of them recognize the real cause, and resort to surgery or elaborate, expensive treatment that is sometimes beneficial, sometimes ineffective. Others blame their troubles on approaching age and despairingly resign themselves to the disagreeable symptoms, not knowing how to obtain relief.

## What Are the Symptoms?

In prostate trouble the system may seem to have slowed up. One's mental and physical grasp have both lessened. The memory may become treacherous. Physical efforts, once easy, now often leave one panting and exhausted. Nervousness, restlessness and insomnia frequently appear. Often the blood pressure increases to a dangerous degree. Sciatica, weak back, lack of vigor and chronic constipation are frequent symptoms. There is often a great deal of pain in the neighborhood of the prostate gland and through the loins and lower back. One of the most disagreeable features of such troubles—the feature most often apparent—is the necessity for frequent nightly risings which seem to betoken weakness of kidneys and bladder.

**Doctor Obtains Remarkable Relief from Prostate Trouble**

"I was a nervous wreck. I had enlarged prostate gland and had to be up ten to fifteen times at night. I had spent hundreds of dollars trying to get relief. Then I began using your treatment according to directions. In about two months I was greatly relieved. I feel that the trouble is entirely relieved as I have not felt the need of treatment in the last three months. I recommended it to two of my friends who have used it with good results."—Dr. J. Frank McMichael, Union City, Tenn.

## 10,000 Find Relief

More than 10,000 men have already used the treatment which has been developed and perfected during the last seven years. It usually banishes those troubles often blamed on approaching age, because it tones and invigorates the important prostate gland—the keystone of the entire gland system. Then it not only banishes many painful symptoms felt in the neighborhood of the prostate gland itself—thus it also tends to tone up or assist the entire glandular system, helping to re-invigorate every great organ and every bodily function.

It has brought results where every other method has apparently failed. It has brought new vigor in cases where the surgeon's knife seemed the only remaining course and it has brought relief to a degree that could not be hoped for from an operation.

Every man past 40—in fact every man in his late thirties—should learn about this method—by which he can treat himself at home—the way in which he should find quick, inexpensive, safe and permanent relief, or pay nothing.

*Healing Blood Flows Through Prostate Gland and Renews Its Cells.*

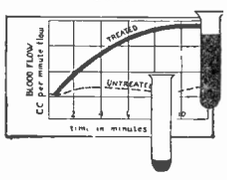



Chart shows the degree to which healing blood is caused to flow through certain treated tissue—strengthening the live cells and replacing diseased or dead cells with new ones.

## Why Many Men Are Old at 40

Above is the title of a book written by a member of the American Association for Advancement of Science. He is the discoverer of this great, new hygienic method and has been actively engaged, with other scientists, in the experiments made during the last seven years. This book gives you much clear explanation about the cause and result of prostate disorder. It makes it possible for you to ask yourself certain questions that should enable you to tell whether or not you are subject to this trouble which results in such a loss of tone, health and capacity to enjoy life. And it discloses this excellent means for treatment.

## FREE—Discoverer's Book

The blank below brings you this book. It will be mailed in plain cover without any obligation at all on your part. Simply fill it out promptly and mail today before the present edition is exhausted. If you wish specific information, mention age, occupation, symptoms and how long you have been troubled.

**The Electro Thermal Company**
**4546 Main Street : : Steubenville, Ohio**
*FREE INFORMATION BLANK*

THE ELECTRO THERMAL COMPANY
4546 Main Street, Steubenville, Ohio

Please send me at once your booklet, "Why Many Men Are Old at 40." And full details about the new Hygiene and Therapy.

Name .....

Address .....

City ..... State .....

*This Therapy is not concerned with Violet Ray, Phonograph Records, Electric Treatment, Diets, or course of instruction.*
Western Office, Dept. 45L, Los Angeles, California

Vol. XIII.
Whole No. 146

# Science and Invention

FORMERLY
ELECTRICAL EXPERIMENTER

June, 1925
No. 2

## IN OUR NEXT ISSUE

### $250.00 *for Good Rat Exterminators*

Do you know a good method for the extermination of that universal pest, the rat? Full details on a contest telling how we will award $250 in prizes will be published in a complete article on this subject appearing in the July issue. Those who have effective methods for killing these pests stand a very good chance of cashing in on their knowledge and at the same time providing other readers of this magazine with useful knowledge.

* * *

### *Have You Ever Seen Spirit Phenomena?*

If you think you have, you have undoubtedly been fooled. Edward Merlin, who has attended hundreds of seances will illustrate in our next issue the methods used by various mediums for producing effects which to the uninitiated have all the appearances of genuine spirit manifestations. The apparatus used and the method in which it is handled will be shown.

* * *

### *Will We Soon Have Talking Movies in Our Homes?*

Yes, when the new machine to be described in our next issue is placed on the market we can all have talking movies in our homes without any trouble or a special operator for the projecting machine. The films are sealed in magazines and there is no tedious work in connecting them with the mechanism.

* * *

### *What Is Gravitation?*

A wonderfully instructive and explanatory article on the above subject will be presented by an eminent professor whose articles on various branches of science are familiar to all of our readers.

* * *

*The above are just a few of the treats in store for our readers in the July issue.*

*Member Audit Bureau of Circulations*

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## Contents for June



HOW TO SUBSCRIBE FOR "SCIENCE AND INVENTION." Send your name, address and remittance to Experimenter Publishing Co., 53 Park Place, New York City. Checks and money orders should be made payable to Experimenter Publishing Co., Inc. Mention the name of the magazine you are ordering inasmuch as we also publish RADIO NEWS, THE EXPERIMENTER and MOTOR CAMPER & TOURIST. Subscriptions may be made in combination with the other publications just mentioned at special reduced club rates. Send postal for club rate card. Subscriptions start with the current issue unless otherwise ordered.

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CHANGE OF ADDRESS: Notify us as far in advance as possible, giving your old address as well as the new one to which future magazines are to go. It takes several weeks to make an address change on our records.

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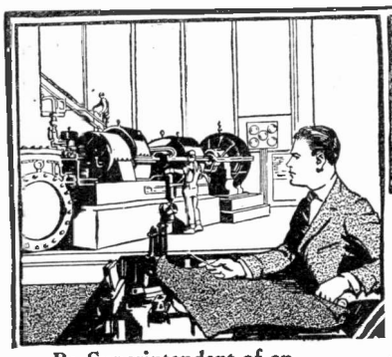
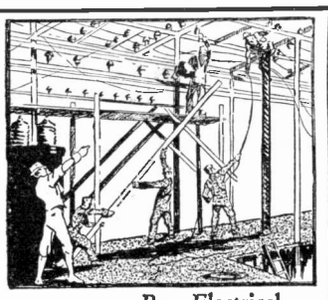
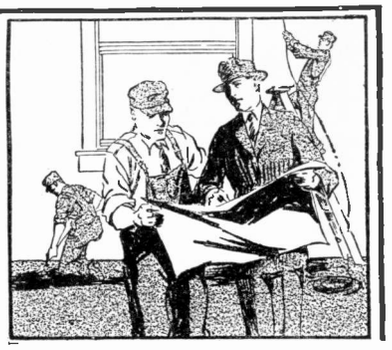


Be Superintendent of an Electrical POWER PLANT

Own Your Own Electrical REPAIR SHOP



Boss Electrical Construction Jobs



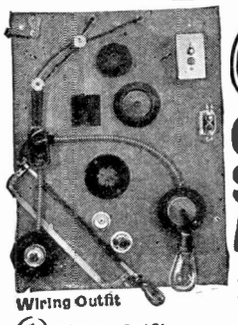
Be an Electrical CONTRACTOR

# I guarantee you a JOB and a 50% RAISE or money refunded

Chief Engineer Dunlap

## If you are now earning less than $40 a week

enroll for my home training in Electricity and I will guarantee you a permanent, satisfactory job after you finish —guarantee you at least 50% more pay —or refund every cent of your money. I give you this written guarantee because my training actually makes you an Electrical Expert. The AMERICAN SCHOOL stands back of this guarantee with resources of over a million dollars.



Wiring Outfit

# GO INTO ELECTRICITY —the Business of a Million Opportunities

## Go to Electrical School AT HOME!

While you're at it, while you're spending your time and money to be a success, *Train* for the big-pay *Boss* jobs in the world's fastest growing industry. The world's work is now being done by Electric power. Autos, ships, buildings, aeroplanes, all electric equipped. Electric lights, everywhere. Think of Radio, Telephones, Telegraph, Electric railways. This business DOUBLED in the last 9 years, and they say it will double again in the next 6 years!

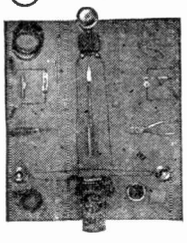
## 22 Noted Electrical Engineers

This is not a one-man, one idea school. 22 famous Engineers and Executives of the following corporations and universities helped me make Dunlap-training the most complete and up-to-date:

1. General Electric Co.
2. Commonwealth Edison Co.
3. Crocker-Wheeler Co.
4. Cutler-Hammer Mfg. Co.
5. American Telephone & Telegraph Co.
6. Westinghouse Electric & Mfg. Co.
7. Western Electric Co.
8. Underwriters Laboratories, Inc.
9. Columbia University
10. Dartmouth College
11. Massachusetts Institute of Technology
12. Lehigh University
13. University of Vermont
14. Armour Inst. of Technology
15. University of Kansas

AND MANY OTHERS

(1) Wiring Outfit



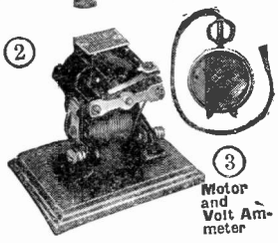
## $60 to $200 a Week for Electrical Experts

Enormous demand for all-around Electrical Experts as Power Plant Superintendents, Chief Electricians, Foremen of Construction, Electrical Draftsmen, Radio Engineers, etc. And with my training you can go into business for yourself with little capital and make $3,000 to $12,000 a year.

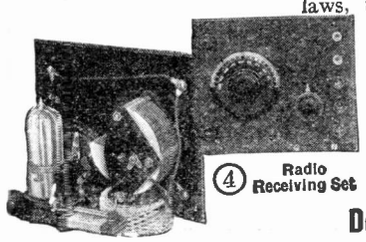
## 4 Electrical Outfits Given

You don't have to leave your home or quit your job, you don't need post-graduate Laboratory courses when you are Dunlap-trained. I send you these 4 costly, complete Electrical Outfits, all the Laboratory and Shop apparatus you need to understand Electrical laws, theories and principles easily and quickly. *Not one penny extra for this equipment.*

(2)



(3) Motor and Volt Ammeter



(4) Radio Receiving Set

## Write Me AT ONCE!

Don't enroll for any home-training until you get a copy of my job-and-raise guarantee — until you get my sensational offers. Compare my 4 outfits with others —compare my training with others—compare my guarantee with others before you decide. I will show you how to become an Electrical Expert right in your own home — in spare time, for the least cost and in double quick time. Mail coupon for free book, surprise offers and complete information.

## Earn While You Learn

As early as your eleventh lesson, I give you special training in wiring, Radio, Electrical repairing, motors, etc., so you can go out and start turning your instruction into cash. It's no trick to earn enough in a single evening to pay one month's tuition cost. So you needn't let lack of ready money or anything else keep you from this wonderful home-training.

**MAIL COUPON QUICK!**

Chief Engineer Dunlap,
AMERICAN SCHOOL,
Dept. EA26 Drexel Ave. & 58th St., Chicago.

Please rush guarantee of a job and a 50% raise, free book, surprise offers and complete information on how I can become a real Electrical Expert at home in spare time.

Name.....

St. No.....

City..... State.....

Chief Engineer DUNLAP, *Electrical Division*

# AMERICAN SCHOOL

Dept. EA 26, Drexel Ave. & 58th St., Chicago

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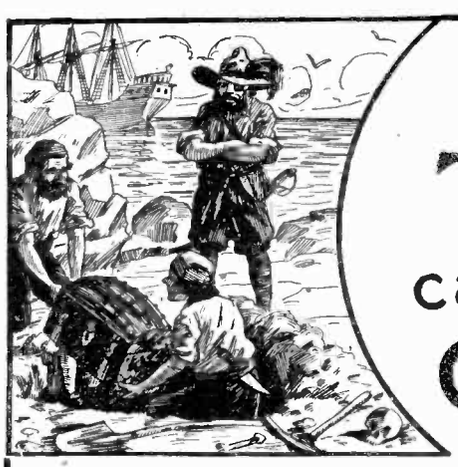


# BURIED TREASURE can still be found in CHEMISTRY

# Good Chemists Command High Salaries

## and you can make yourself independent for life by unearthing one of chemistry's yet undiscovered secrets.

**T. O'CONOR SLOANE, A.B., A.M., LL.D., Ph.D.**
**Noted Instructor, Lecturer and Author. Formerly Treasurer American Chemical Society and a practical chemist with many well known achievements to his credit. Not only has Dr. Sloane taught chemistry for years but he was for many years engaged in commercial chemistry work.**

Do you remember how the tales of pirate gold used to fire your imagination and make you want to sail the uncharted seas in search of treasure and adventure? And then you would regret that such things were no longer done. But that is a mistake. They *are* done—today and everyday—not on desert islands, but in the chemical laboratories throughout your own country. Quietly, systematically, the chemist works. His work is difficult, but more adventurous than the blood-curdling deeds of the Spanish Main. Instead of meeting an early and violent death on some forgotten shore, he gathers wealth and honor through his invaluable contributions to humanity. Alfred Nobel, the Swedish chemist who invented dynamite, made so many millions that the income alone from his bequests provides five $40,000 prizes every year for the advancement of science and peace. C. M. Hall, the chemist who discovered how to manufacture aluminum made millions through this discovery. F. G. Cottrell, who devised a valuable process for recovering the waste from flue gases, James Gayley, who showed how to save enormous losses in steel manufacture, L. H. Baekeland, who invented Bakelite—these are only a few of the men to whom fortunes have come through their chemical achievements.

### What Some of Our Students Say of This Course:

I have not written since I received the big set. I can still say that it far exceeded my anticipations. Since I have been studying with your school I have been appointed chemist for the Scranton Coal Co. testing all the coal and ash by proximate analysis. The lessons are helping me wonderfully, and the interesting way in which they are written makes me wait patiently for each lesson.—MORLAIS COUZENS.

I wish to express my appreciation of your prompt reply to my letter and to the recommendation to the General Electric Co. I intend to start the student engineering course at the works. This is somewhat along electrical lines, but the fact that I had a recommendation from a reliable school no doubt had considerable influence in helping me to secure the job.—H. VAN BENTHUYSEN.

So far I've been more than pleased with your course and am still doing nicely. I hope to be your honor graduate this year.—J. M. NORKUS, JR.

I find your course excellent and your instruction, truthfully, the clearest and best assembled I have ever taken, and yours is the fifth one I've studied.—JAMES J. KELLY.

From the time I was having Chemistry it has never been thus explained to me as it is now. I am recommending you highly to my friends, and urging them to become members of such an organization.—CHARLES BENJAMIN.

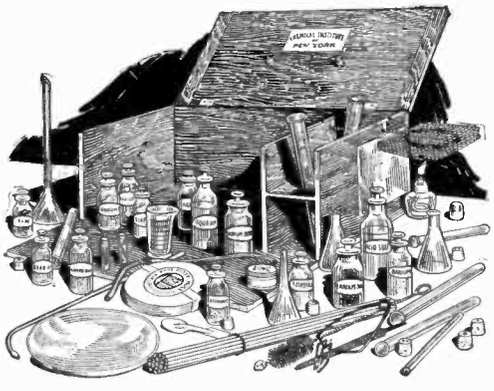
I shall always recommend your school to my friends and let them know how simple your lessons are.—C. J. AMDAHL.

I am more than pleased. You dig right in from the start. I am going to get somewhere with this course. I am so glad that I found you.—A. A. CAMERON.

I use your lessons constantly as I find it more thorough than most text books I can secure.—WM. H. TIBBS.

Thanking you for your lessons, which I find not only clear and concise, but wonderfully interesting. I am—ROBT. H. TRAYLOR.

I received employment in the Consolidated Gas. Co. I appreciate very much the good service of the school when a recommendation was asked for.—JOS. DECKER.



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Not only are there boundless opportunities for amassing wealth in Chemistry, but the profession affords congenial employment at good salaries to hundreds of thousands who merely follow out its present applications. These applications are innumerable, touching intimately every business and every product in the world. The work of the chemist can hardly be called work at all. It is the keenest and most enjoyable kind of pleasure. The days in a chemical laboratory are filled with thrilling and delightful experimentation, with the alluring prospect of a discovery that may spell Fortune always at hand to spur your enthusiasm.

## Experimental Equipment Furnished to Every Student

We give to every student without additional charge this chemical equipment, including forty-nine pieces of laboratory apparatus and supplies, and forty different chemicals and reagents. These comprise the apparatus and chemicals used for the experimental work of the course. The fitted heavy wooden box serves not only as a case for the outfit but also as a useful laboratory accessory for performing countless experiments.

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To qualify for this remarkable calling requires elaborate specialized training. Formerly it was necessary to attend a university for several years to acquire that training, but thanks to our highly perfected and thorough system of instruction, you can now stay at home, keep your position, and let us educate you in Chemistry during your spare time. Even with only common schooling you can take our course and equip yourself for immediate practical work in a chemical laboratory. Dr. Sloane gives every one of his students the same careful, personal supervision that made him celebrated throughout his long career as a college professor. Your instruction from the very beginning is made interesting and practical, and we supply you with apparatus and chemicals for performing the fascinating analyses and experimental work that plays such a large part in our method of teaching, and you are awarded the Institute's official diploma after you have satisfactorily completed the course.

## Easy Monthly Payments

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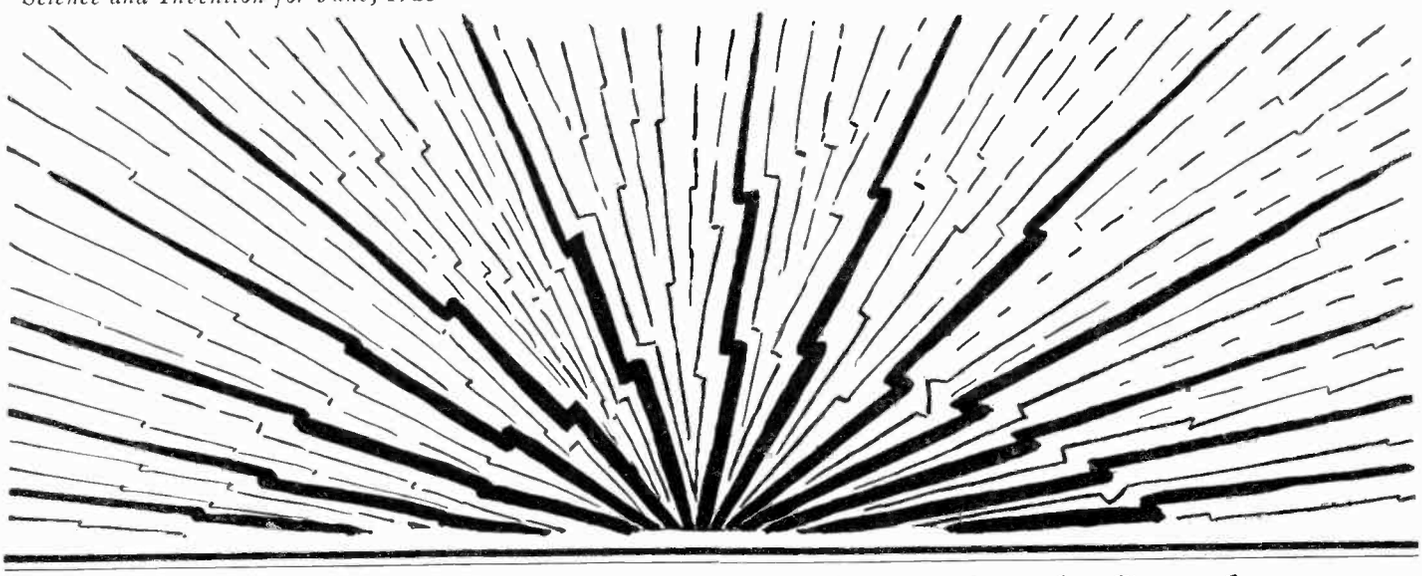

# To Practical Men and Electrical Students:

Yorke Burgess, founder and head of the famous electrical school bearing his name, has prepared a pocket-size note book especially for the practical man and those who are taking up the study of electricity. It contains drawings and diagrams of electrical machinery and connections, over two hundred formulas for calculations, and problems worked out showing how the formulas are used. This data is taken from his personal note book, which was made while on different kinds of work, and it will be found of value to anyone engaged in the electrical business.

The drawings of connections for electrical apparatus include Motor Starters and Starting Boxes, Overload and Underload Release Boxes, Reversible Types, Elevator Controllers, Tank Controllers, Starters for Printing Press Motors, Automatic Controllers, Variable Field Type, Controllers for Mine Locomotives, Street Car Controllers, Connections for reversing Switches, Motor and Dynamo Rules and Rules for Speed Regulation. Also, Connections for Induction Motors and Starters, Delta and Star Connections and Connections for Auto Transformers, and Transformers for Lighting and Power Purposes. The drawings also show all kinds of lighting circuits, including special controls where Three and Four Way Switches are used.

The work on Calculations consists of Simple Electrical Mathematics, Electrical Units, Electrical Connections, Calculating Unknown Resistances, Calculation of Current in Branches of Parallel Circuits, How to Figure Weight of Wire, Wire Gauge Rules, Ohm's Law, Watt's Law, Information regarding Wire used for Electrical Purposes, Wire Calculations, Wiring Calculations, Illumination Calculations, Shunt Instruments and How to Calculate Resistance of Shunts, Power Calculations, Efficiency Calculations, Measuring Unknown Resistances, Dynamo and Dynamo Troubles, Motors and Motor Troubles, and Calculating Size of Pulleys.

Also Alternating Current Calculations in finding Impedance, Reactance, Inductance, Frequency, Alternations, Speed of Alternators and Motors, Number of Poles in Alternators or Motors, Conductance, Susceptance, Admittance, Angle of Lag and Power Factor, and formulas for use with Line Transformers.

The book, called the "Burgess Blue Book," is published and sold by us for one dollar ($1.00) per copy, postpaid. If you wish one of the books, send us your order with a dollar bill, check or money order. We know the value of the book and can guarantee its satisfaction to you by returning your money if you decide not to keep it after having had it for five days.

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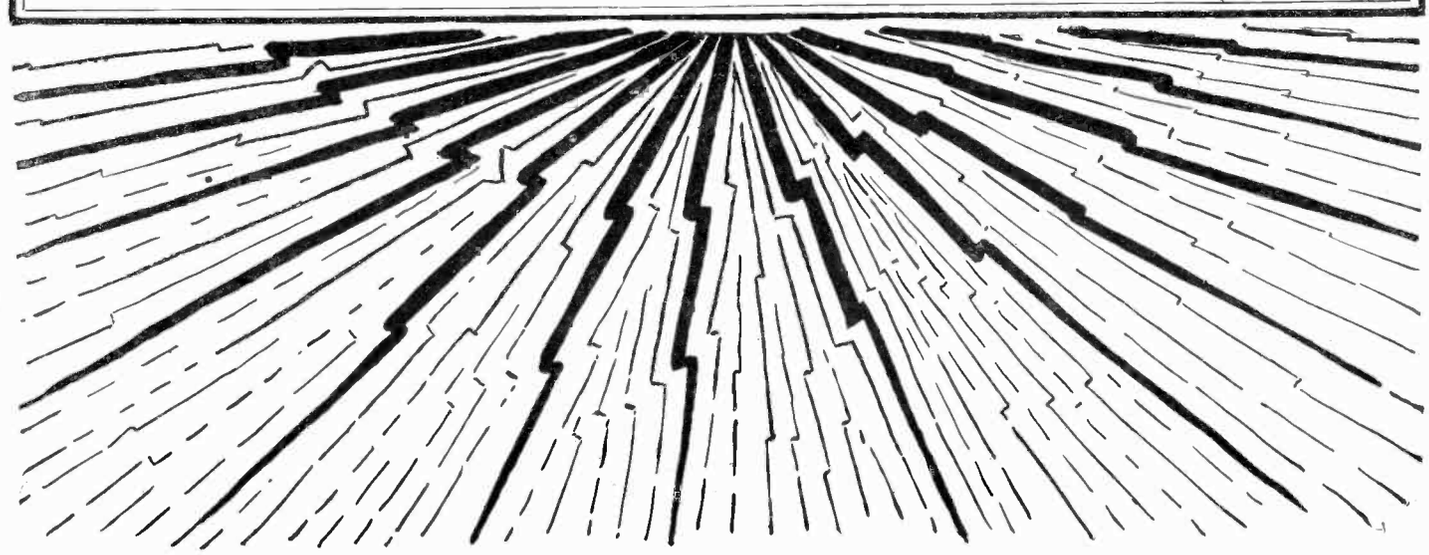
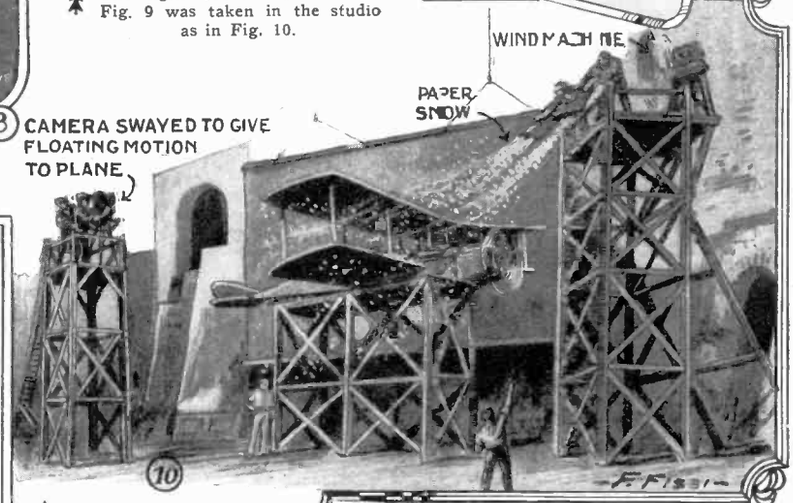


# ...n the Movies

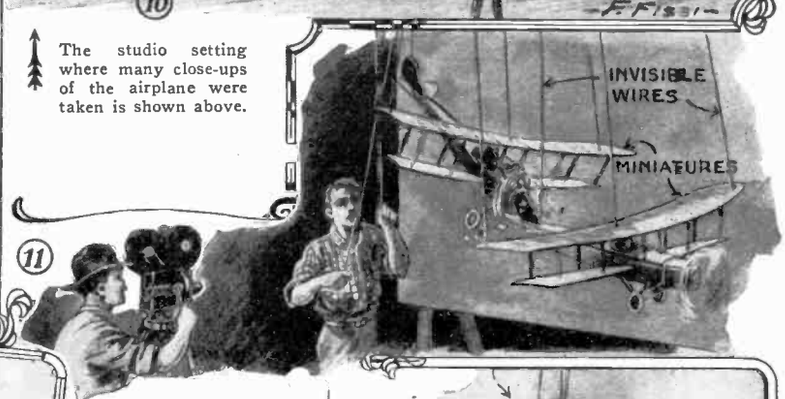
AND A. P. PECK

The shooting scene above was also taken in the studio.

The fight scene illustrated in Fig. 9 was taken in the studio as in Fig. 10.




The studio setting where many close-ups of the airplane were taken is shown above.

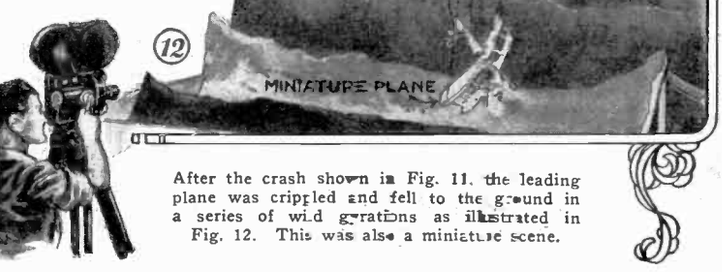



Above: Manipulating the miniature airplanes to produce the effect of a crash in mid-air.

HERE further difficulties are encountered. Other crooks in an airplane arrive on the scene and attempt to capture the mail. Stirring battles such as illustrated herewith occur, culminating in a crash between the hero's plane and that of the thieves. This latter scene was taken in miniature as illustrated in Fig. 11. The close-ups of the hero driving his plane through the snow storm were taken in the studio as in Fig. 10, paper snow being blown across the scene by a wind machine. The effect of flying was given by rocking the camera. After the crash as in Fig. 11, a miniature plane fluttered to the ground as in Fig. 12, whereupon the scene was ...to a close-up of a *property* airplane, minus en... as though it had crashed to the earth.

...re of the picture was the hero's battle with ...ience between right and wrong, illustrated in ...Ghostly figures symbolizing the hero's crooked ... and the air mail pilot who risked his life, and ... lost it, to carry the air mail on the first leg of its ...y across the continent, were cleverly introduced ... the film by double exposure, and lent a touch of ...lism and pathos to the story. "The Air Mail" is a ...e post in cinema production marking a combination ... education and romance in the films.

After the air mail thieves' plane was wrecked, the sheriff and his deputies arrived on the scene and arrested them. A "prop" plane was used as shown.




After the crash shown in Fig. 11, the leading plane was crippled and fell to the ground in a series of wild gyrations as illustrated in Fig. 12. This was also a miniature scene.

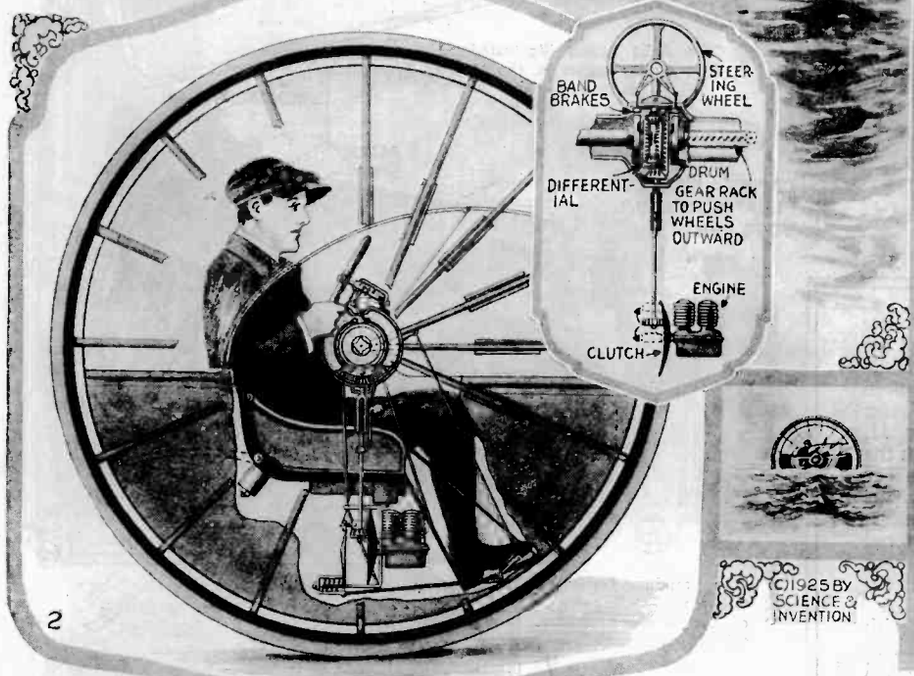
# New Water Sport Wheel

By J. W. VON STEIN

(1)

THE new aquatic sport wheel seen in action in the water at 1 cn this page, is the invention of Charles F. Erickson. This sport wheel is amphibious. It will run both in the water and on land. It is driven by a small two-cylinder gasoline engine and overcomes the difficulty inherent in former unicycles, in that it is easily balanced whether the machine is moving or standing still. The body of the car is completely enclosed. The wheels themselves are capable of being extended from the body when so desired by the operator.

Illustration 2 on this page shows a side view of the machine and the steering control, as well as the position of the engine and operator. Notice here that the gasoline engine is swung beneath the seat. A large cone clutch transmits the power from the engine to a differential, and thence to the driving wheels. Both wheels are equipped with brakes, and when it is desired to steer the mechanism, the operator turns his steering wheel, tightening the brake on one side, which stops the movement of the corresponding wheel. The other wheel free to move the differential, travels a bit faster and consequently the entire mechanism is turned. The gear rack pushes the wheels outward when desired. Fig. 3 shows sectional rear view of the mechanism and illustration 4 shows the device standing still.

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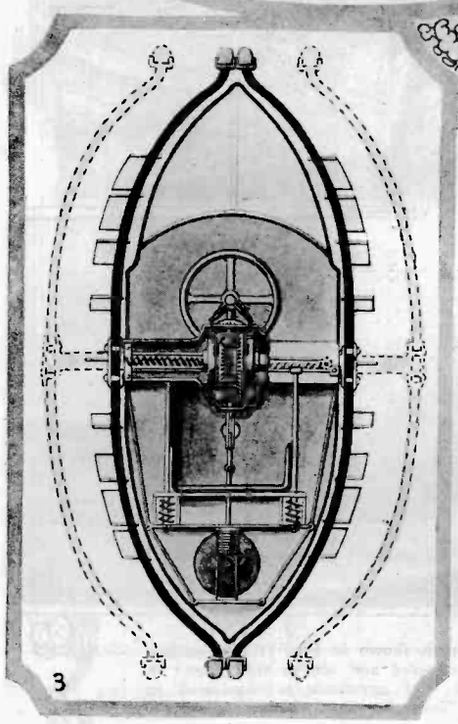

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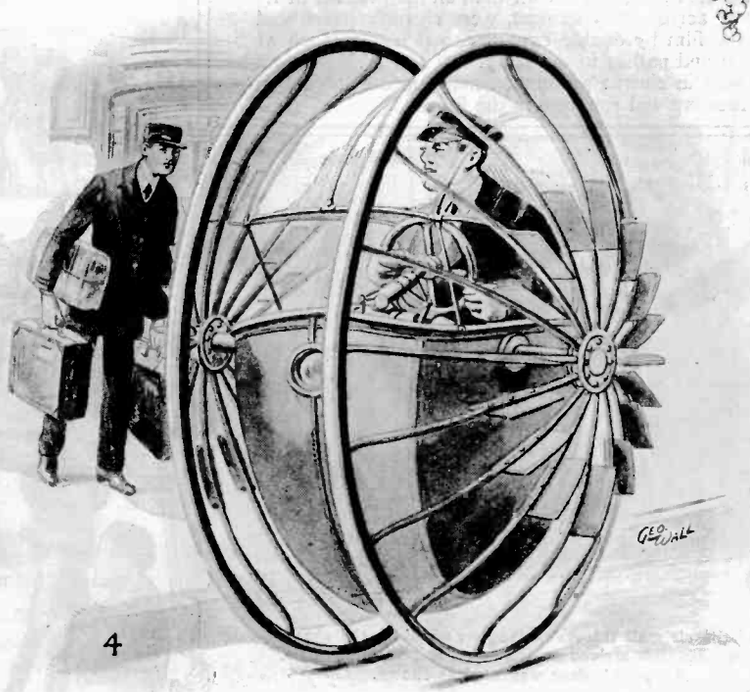
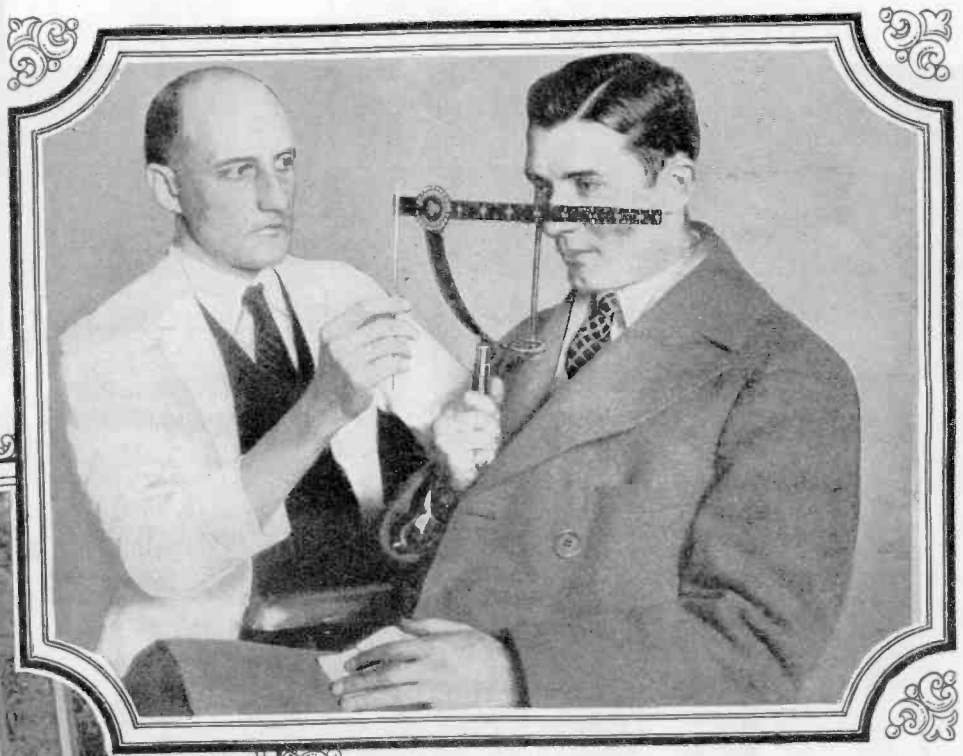


4

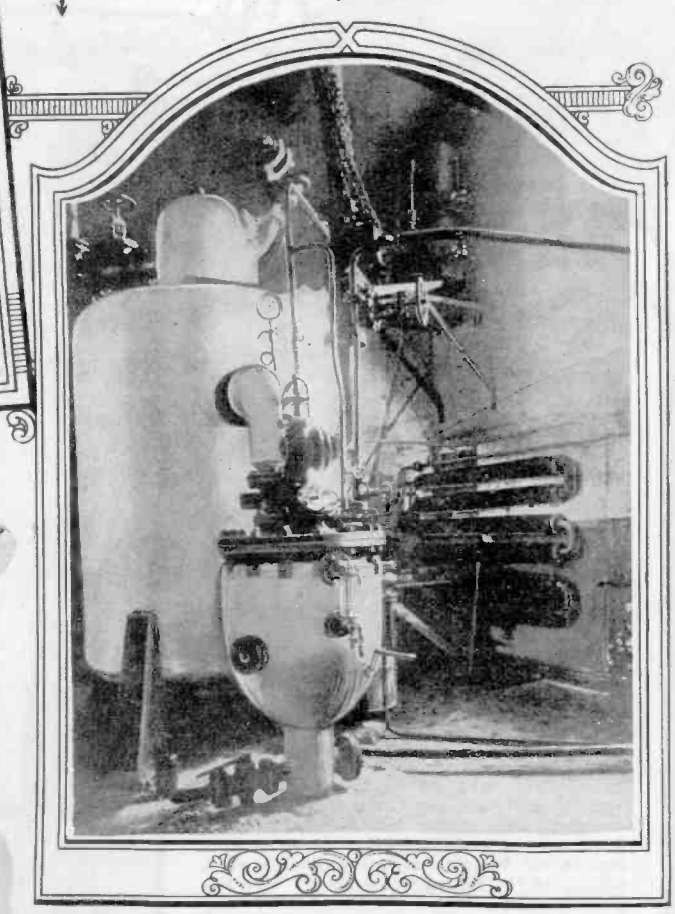
# Timely Scientific Developments

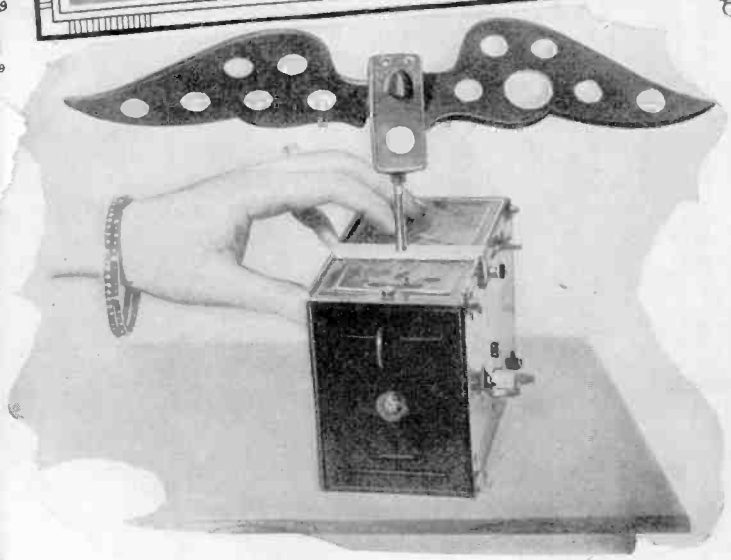
A new vision test for automobile drivers has recently been developed by Dr. J. Fred Andreae of Baltimore, Maryland, as an outgrowth of the recent state requirement that all applicants for automobile driver's licenses be able to read and distinguish signals at a distance of 100 feet or more. This device takes advantage of the foreshortening effect of distance.



An aerial camera for map work has recently been developed by James W. Bagley of the Engineer Corps operating in conjunction with the Army Air Service. The camera is illustrated below and with it it is possible to map approximately 2,000 square miles of territory with one loading of film at an altitude of 15,000 feet.

A burner capable of sustaining flame when submerged below the surface of water and in direct contact with it has recently been designed. This action produces steam capable of driving a locomotive or steamship. The inventor claims that with his device much greater efficiency is realized than with the present-day boilers.

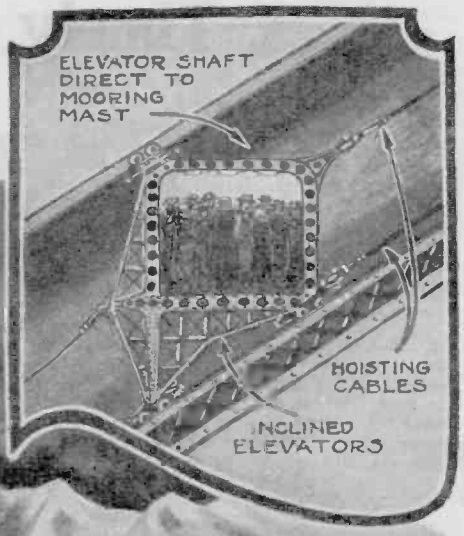




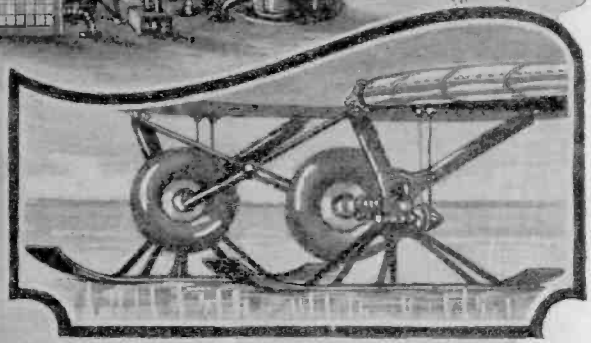
This mechanical decoy has small mirrors affixed to the moving wings which attract birds to the hunter's locality.

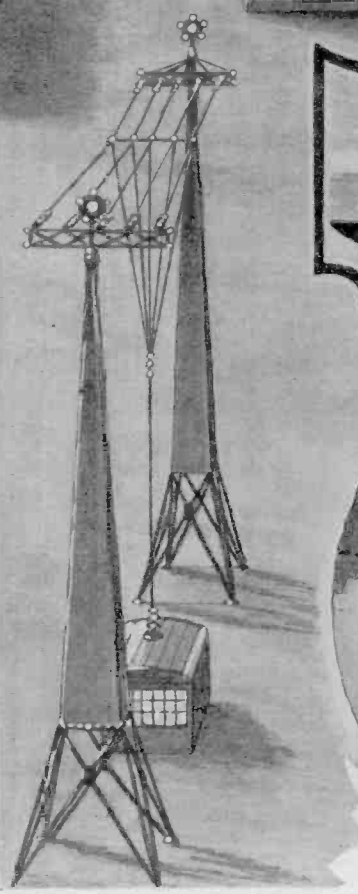
# North Pole Junction

By L. B. ROBBINS







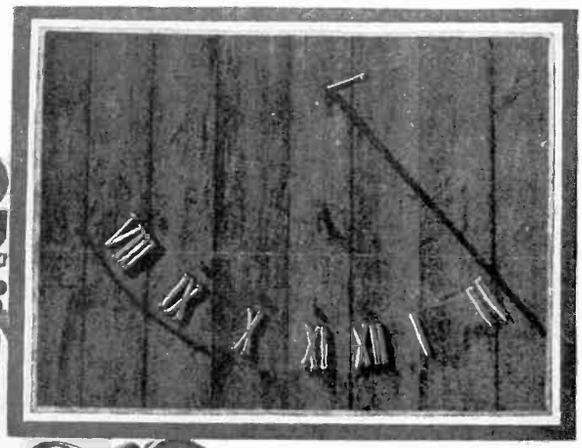

The illustrations on this page show a futuristic solution of the aerial transportation problem. The author contends that there will be a junction at the North Pole, where airships carrying passengers and freight will meet. Here ships from Russia will discharge their passengers and cargo, and take on other passengers and materials for the return trip to their home country. Those desirous of reaching America or those destined for Africa will travel down an inclined elevator shaft to a well lighted and heated waiting room, and will make themselves comfortable until the ship to the Americas or Africa leaves. There will also be stations along the Equator for short local traffic. This may be accomplished by means of airships or high speed airplanes. The northern regions are very rich in coal deposits, and there will be no difficulty in procuring petroleum cheaply or in manufacturing helium gas in these cold climates. As a matter of fact, the quantity of helium gas or petroleum produced would be greater than that in the more temperate sections of the country. This section will likewise have its own radio transmitter where local weather reports will be constantly transmitted to ships coming to the station or leaving it. The airplanes will be provided with skids, which may be let down so that landing may take place on a lake of ice or snow.

# Timely Talks on Timepieces

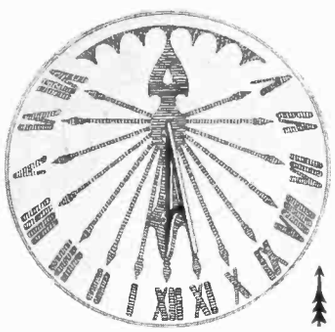
By SAMUEL BERNARD

Early in the history of this world man observed that the shadow the sun cast changed regularly in length and direction as the day progressed toward night. The caveman as illustrated at the right used to tell his mate that he would be back when the shadow of an upright pillar touched a time marking stone.

The multi-face sun dial at the left tells the time in twenty cities in different parts of the world.



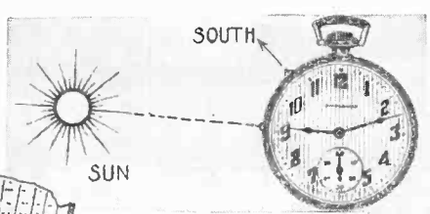
The diagram above illustrates a vertical sun dial on one of the buildings at Union Hill, Md. This has been telling time for over a century. Notice the sharply defined shadow.

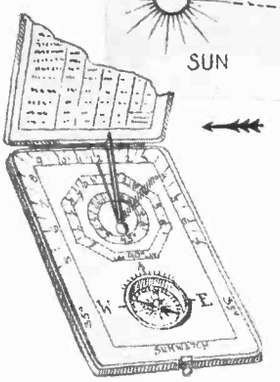


A sun dial may be regarded as the edge of the disk which passes through the center of the earth from the spot where the dial is fixed. To divide the dial, we imagine it surrounded by a cage formed of twenty-four arcs drawn from the North Pole to the South Pole. In its course the sun would cross one of them every hour.

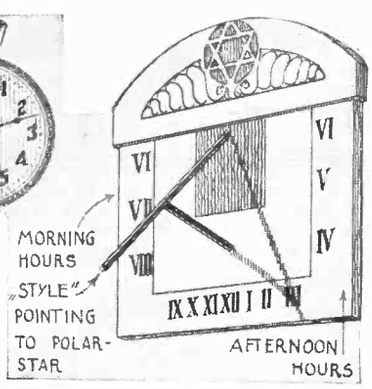



The dial of Ahaz was a curved flight of steps rising like the huge side of a bowl at one end of the palace courtyard. The beam of light is admitted through an opening overhead and touches the different steps of the stairway. The date of this construction is fixed by historians as 742 B. C. The angle of the Gnomen or style is determined by the latitude. Note angles above.

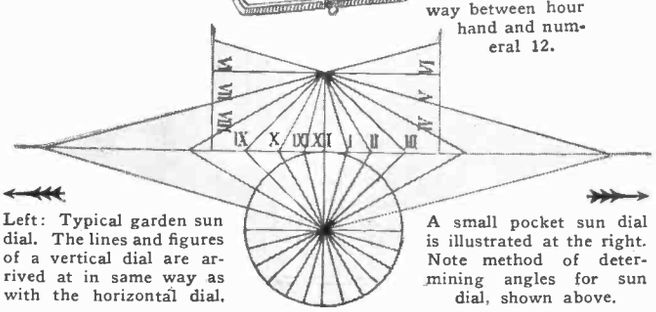


Left, we see a pocket sun dial which is accurate to within a few minutes. Above is the method for using your watch as a compass. Hold watch flat with face upward, point hour hand toward the sun; then south is half way between hour hand and numeral 12.




The style of a sun dial should be parallel to the earth's axis and should point to the polar star.



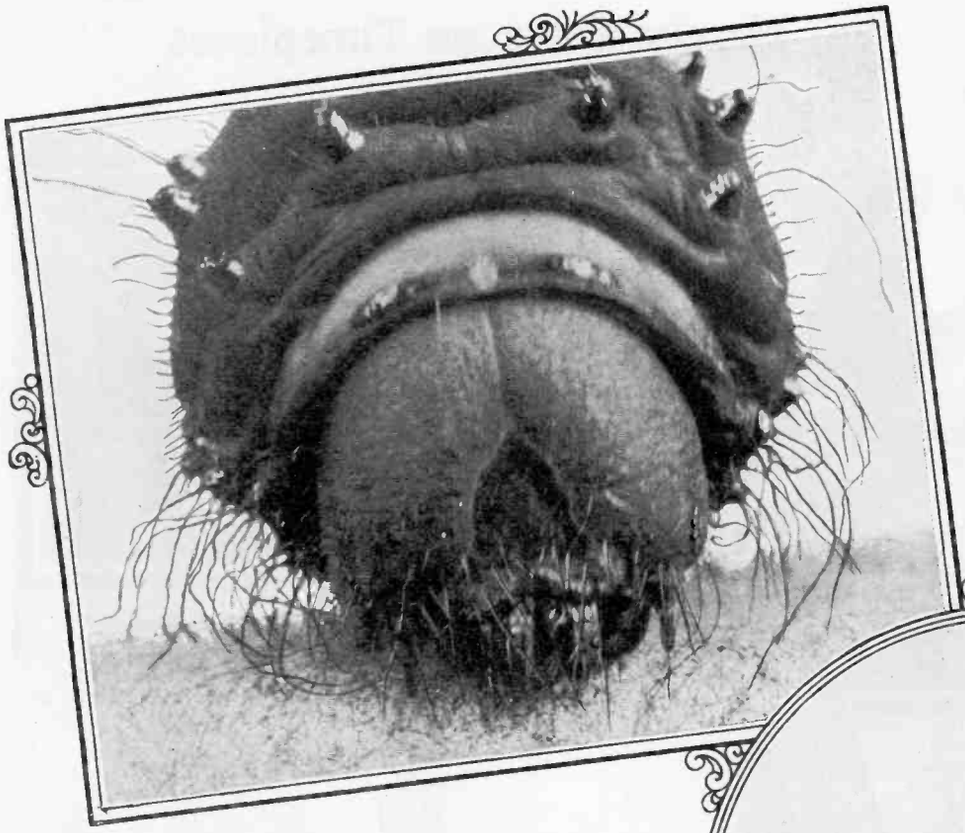
Left: Typical garden sun dial. The lines and figures of a vertical dial are arrived at in same way as with the horizontal dial.

A small pocket sun dial is illustrated at the right. Note method of determining angles for sun dial, shown above.

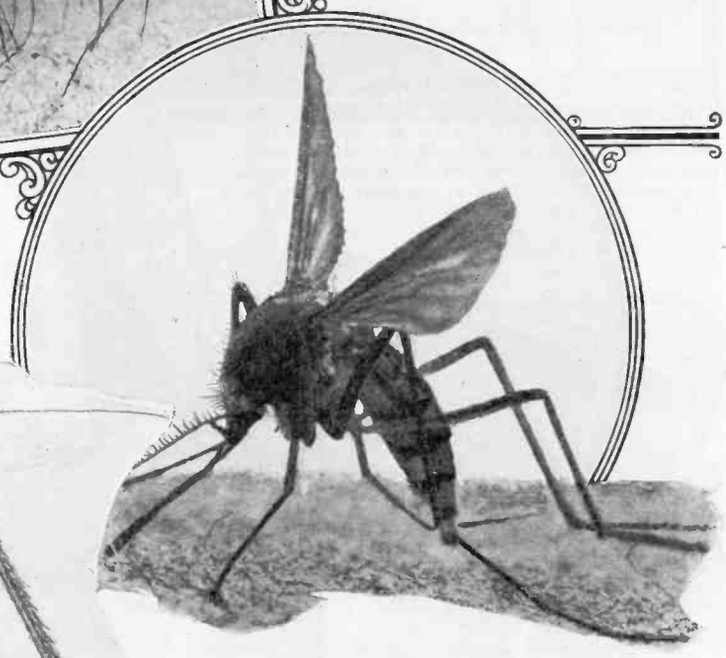
# Giant

## Unusual Methods Used by the Both Alive and Dead Without an Ordinary View Camera The Secret of Obtaining Lies in Method of

By A. G.



To the left we find a photo of the head of a caterpillar. This photo originally occupied the entire area of an 8 x 10 photographic plate. Notice the remarkable detail and the great depth of focus obtained by the use of motion picture lenses, a baking powder can for adjuster, and an ordinary 8 x 10 view camera, using daylight to illuminate the object and concave shaving mirrors to bring out the details.



The photo at the right is a mosquito. Here again the detail is not lacking.

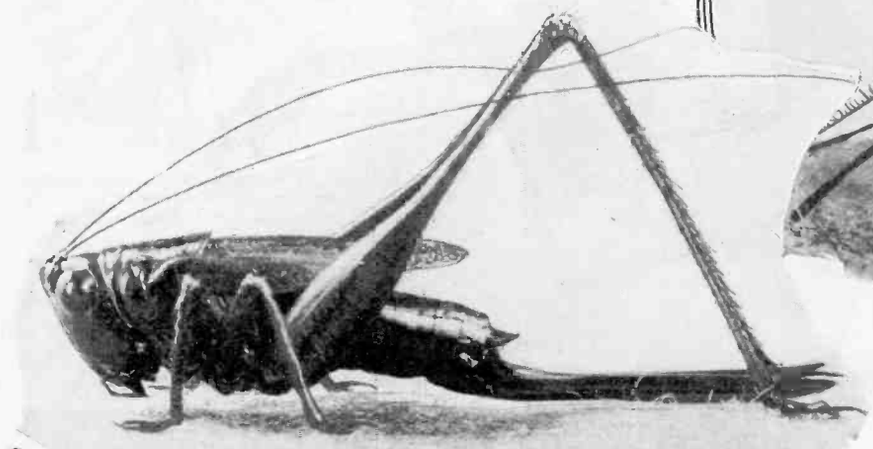
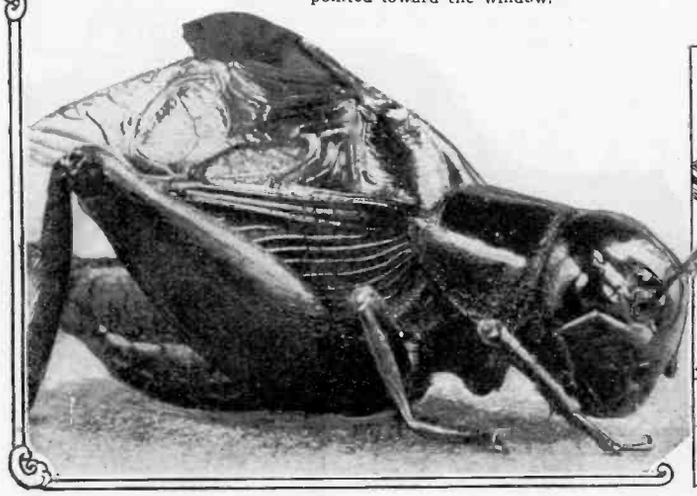
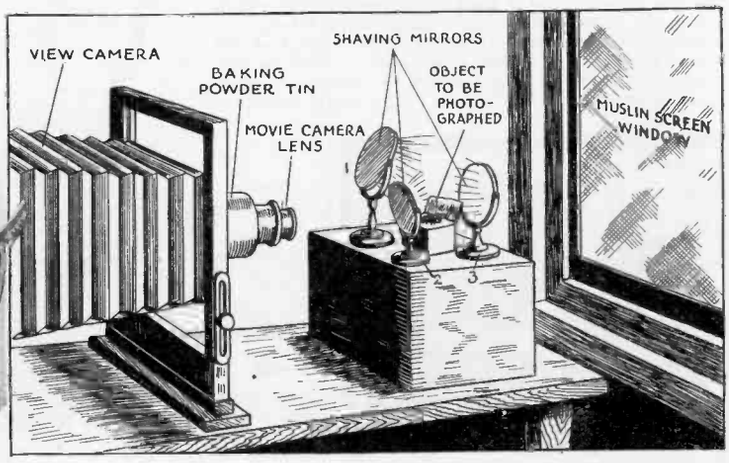


Photo above as well as the one below were also taken by this method. The author used a 32 mm, a 50 mm, a 75 mm and a 150 millimeter motion picture lens, switching them about for the best possible combination. A baking powder tin was mounted on the end of the view camera to hold the lenses. The camera was pointed toward the window.

The exact layout used in photographing insects is illustrated below. Notice that there is a light shield immediately back of the object which is to be photographed. A magnifying glass is used for inspecting the image on the ground glass of the camera to make sure that the instrument is properly focussed. Shaving mirrors then throw light on the object, so as to illuminate both its front and the back more intensely than the middle. In this way the great depth of focus is obtained, and the detail of the hind legs or the head of the animal are not lost. The installation is not expensive.



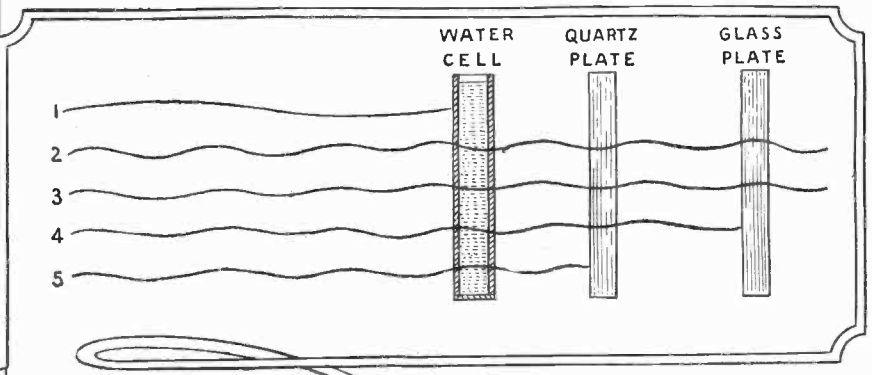


# Uses of Invisible Light

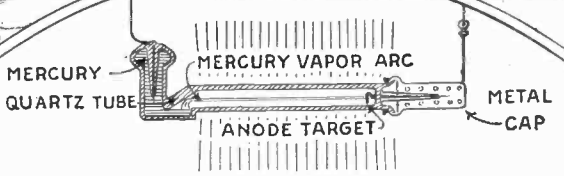
By DR. RUSSELL G. HARRIS

Of the Jefferson Physical Laboratory, Harvard University

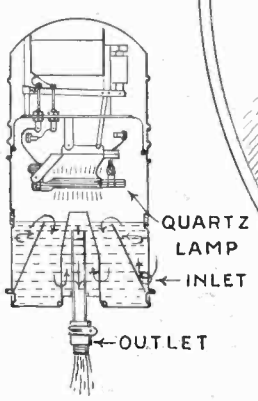
Nasturtiums grow prolifically under the influence of ultra-violet rays. Most other plants do, but some die.



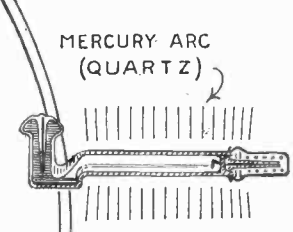

The above diagram shows the relative lengths of light waves and common substances which are transparent or opaque to them. 1—Infra red, relative length of wave 9; 2—red, length 6; 3—blue, length 4.5; 4—long ultra violet, length 3; 5—short ultra violet, relative length 2.




Infra-red rays of light easily penetrate a quartz or glass plate but are stopped by a water cell. The red and blue go through water, quartz and glass. Long ultra-violet rays pass through water and quartz; short ultra-violet rays are stopped by air, although they go through water or quartz to some extent, but not through glass. In this illustration we show a typical ultra-violet ray lamp. By standing near a burning quartz mercury arc for five minutes, a sunburn could be obtained which would require a whole day at the seashore.

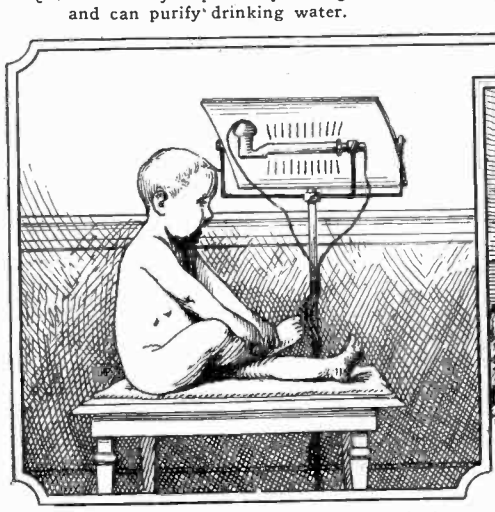



Quartz mercury vapor lamps kill germs and can purify drinking water.






Eggs may be "boiled" without heat by using a quartz lamp and a quartz water cell to cut off the heat. The white of the egg will be found to coagulate quickly.



Babies are cured of rickets and adults of boils by application of the invisible ul' violet rays. Hospitals are now using quartz window panes.

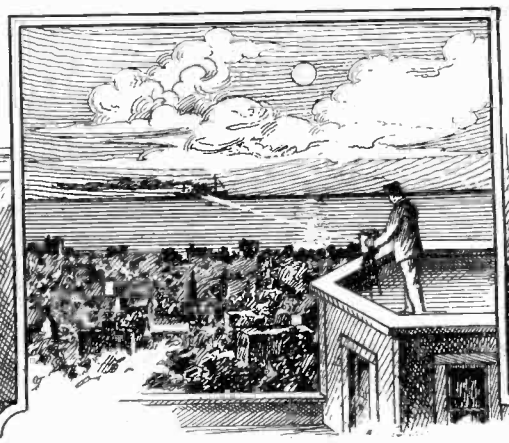


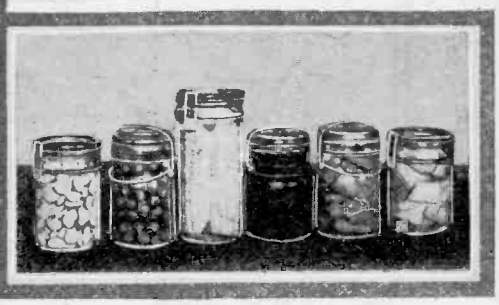
Photo-electric cells respond very readily to infra-red light, and this method can and has been used for invisible signalling.

Workmen welding with electric torches must wear goggles to prevent blindness because of the ultra-violet rays produced during the work.

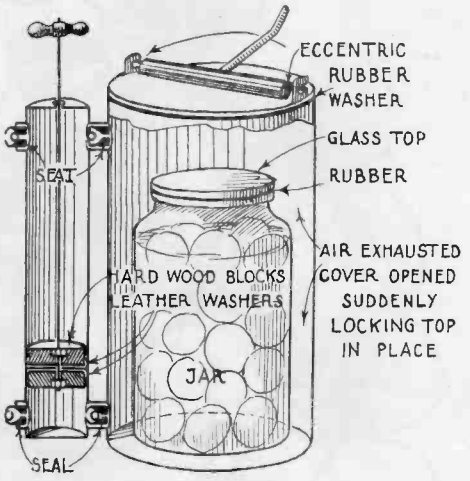
# Vacuum Canning

## New Device Gives Perfect Results

Some examples of edibles packed both hot and cold and sealed by means of vacuum and air pressure are shown directly below. Blanching and boiling times are more than cut in half.

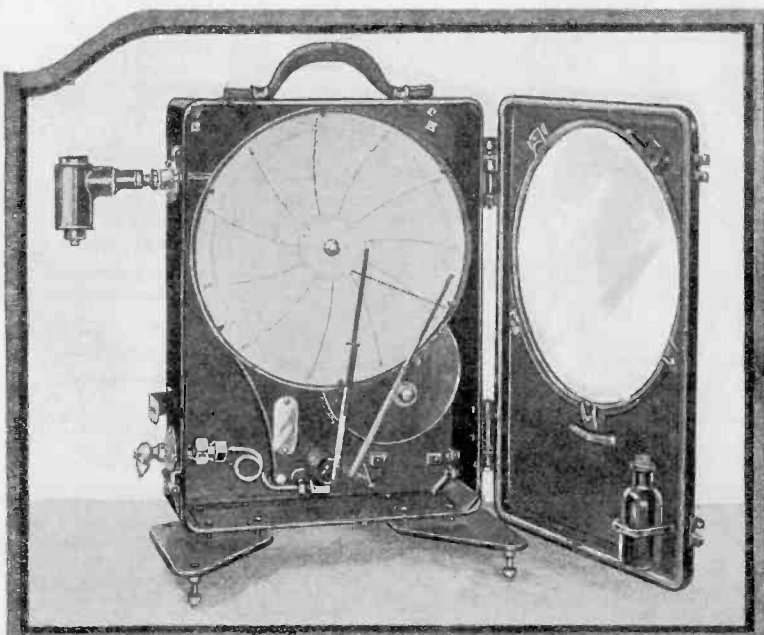


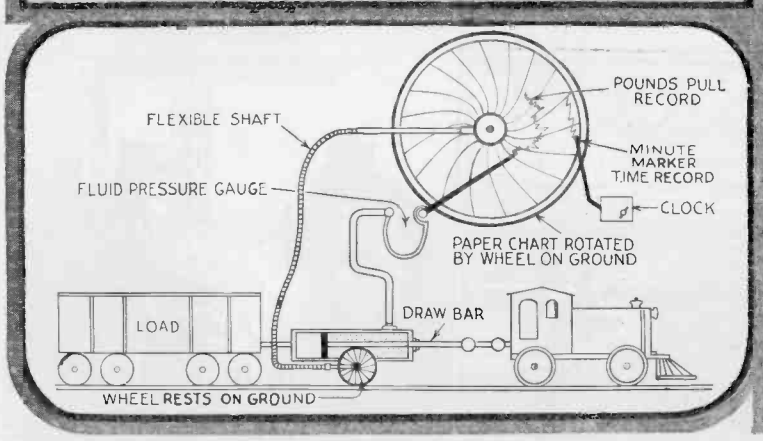
The details of the vacuum pump and the evacuating chamber are shown below.

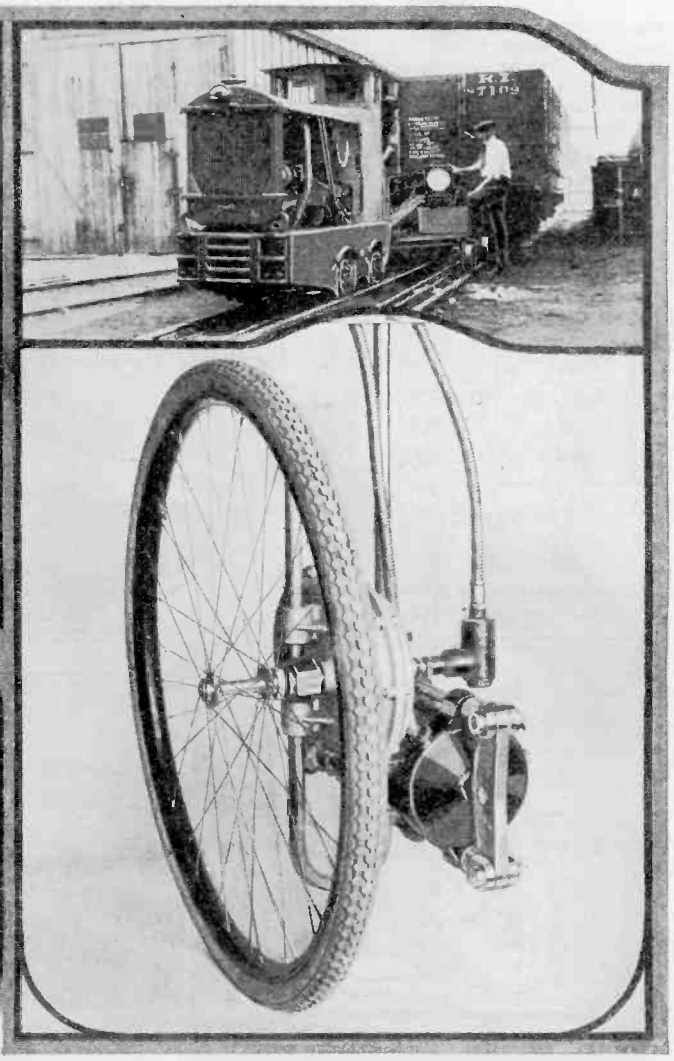



A new device of great assistance to the housewife has recently been invented by A. C. Whitefield and is illustrated in detail above. In use, the foods to be preserved are placed in a standard glass jar, the rubber ring and the glass cover put into position and the cover of the vacuum tank clamped on. A few strokes of the pump serves to create a vacuum of from 25 to 28½ inches within the tank, whereupon when the cover is suddenly removed, atmospheric pressure holds the top of the glass jar firmly in place and protects the contents. This device would prove of great value in the experimenter's laboratory as well as in the kitchen, enabling him to conduct experiments under varying air pressures.

# Hydrostatic Dynamometer





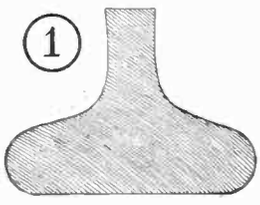
Our illustrations above deliniate the construction and use of a novel type of hydrostatic dynamometer. In use, the draw bar extending from the piston in the oil cylinder is attached to the device under test such as is shown in the illustration of the locomotive directly above. Any strain placed upon this draw bar registers on the fluid pressure gauge which in turn records on the circular chart. A clock also records the minutes and the chart is rotated by the wheel resting on the ground. Therefore, it revolves in accordance with the speed of the device under test. From these records the speed and pull in a given time may be quickly computed and the horse-power of the drawing agent found.

# Cut Flower Contest

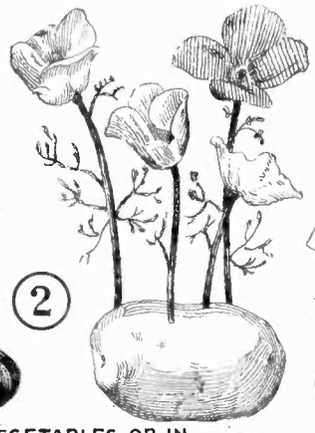
## Twenty Combination Pen-Pencils as Awards

30 GRAINS SALICYLIC ACID
IN 1 QT. WATER

1



2

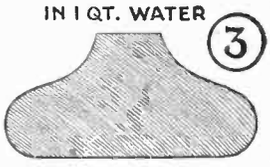


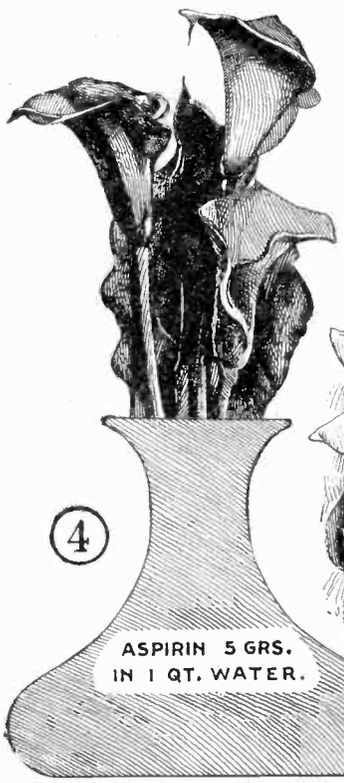
PUT STEMS IN VEGETABLES OR IN

FRUITS TO KEEP FLOWERS
FRESH.

ALL TOGETHER, OR ANY COMBINATION, USE –
5 GRS AMMONIUM PHOSPHATE
5 GRS AMMONIUM CHLORIDE
5 GRS POTASSIUM NITRATE
5 GRS SODIUM CARBONATE
OR 5 GRS CAMPHOR
IN 1 QT. WATER

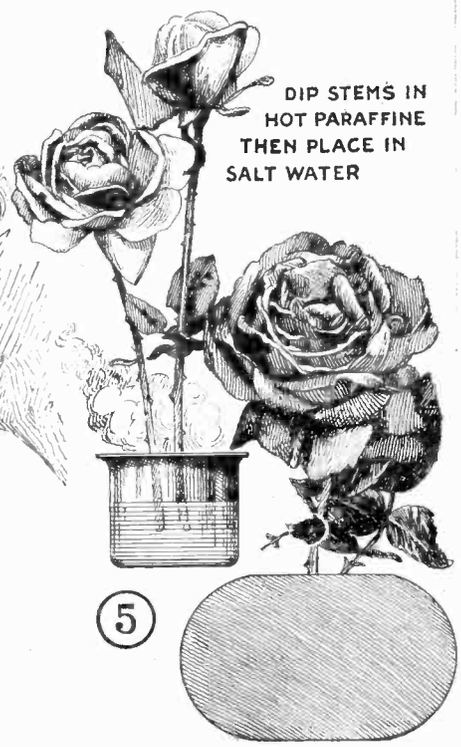
3





4

ASPIRIN 5 GRS.
IN 1 QT. WATER.



DIP STEMS IN
HOT PARAFFINE
THEN PLACE IN
SALT WATER

5

RINSE EVERY NIGHT
AND REMOVE DECOMPOSED
MATTER

6

RINSE AGAIN IN
MORNING AND
SNIP OFF TINY
PORTION OF
STEM

7

PLACE ON ICE IN BASIN OF
STRONG SOAP
SUDS.

8

PLACE
IN WEAK SOLUTION
AMMONIUM SULPHATE –
ALTERNATE NEXT DAY
WITH CLEAR WATER

9

On this page we show a few methods of preserving cut flowers. In the system at 6, 7, 8 and 9, a rather elaborate method is shown. The object of this contest is to make flowers last as long as possible by the aid of chemicals or by some other technique. The flowers must remain in their natural state. They cannot be coated by any substance nor can anything be done to impair their beauty or destroy their perfume.

Twenty combination pen-pencils which became so popular as awards in the "Inner Tube Contest" will be awarded. These are self-filling gold pens. At the opposite end is a clutch pencil. The description appeared in our March number.

This contest will close in New York on July 30th, all entries to be in our hands at that time. A description, 200 words or less, for each system is all that is required and contestants may submit as many ideas as they desire. In event of ties, similar prizes will be awarded to those so tying.

# The Living Death

## By JOHN MARTIN LEAHY

NINTH INSTALLMENT (Conclusion)

It was late in the afternoon when we came to the edge of a large open space and saw the camp of the bear-people. It was at the farther side, by a little stream, and consisted of a half dozen huts, made of woven branches and roofed with long leaves like those of the pandanus.

*SYNOPSIS.*

*Captain Livingstone, an Antarctic explorer, communicates with Darwin Frontenac, a famous scientist who has conducted research work involving methods of inducing hibernations in mammals. To Frontenac and Bond McQuestion, a reporter, the Captain recounts a weird tale of discoveries in the Antarctic. He tells how a land of palm trees and luxurious flowers was found far south of the Antarctic circle and how during part of their exploration trip, several of the members of the party were killed by an invisible "Thing." During further explorations, a cave was discovered and in the ice coated floor they found encased the body of a beautiful girl. The Captain formed the opinion that this girl was not dead, but was in a state of suspended animation. Proceeding further into the cave the explorers discovered a sealed stone doorway guarded by a tremendous carved figure of a harpie. On the way back the only remaining member of the party, with the exception of the Captain, fell into a crevasse, followed by his sled carrying on it photographic records of the trip.*

*The story so interests Frontenac and McQuestion that they decide to accompany the Captain on a return trip. They take with them 102 dogs which are artificially "killed" by Frontenac and placed in a refrigerator on board ship. After they become encased in the ice as far south as they can go, the Captain, while walking over the surface of the ice is suddenly attacked by a killer whale that breaks through the ice and kills him.*

*Just before establishing their depot on land, the dogs are reanimated with no disastrous effects from their long "hibernation."*

*After the long Antarctic night, spent in preparations, the party finally sets out for the cave. They find it and the beautiful girl encased in the floor as told by the Captain. Using twine as a return guide, the party proceeds into the cavern and finds the stone doorway. At this time a noise is heard and suddenly there staggers out of the darkness a horribly emaciated man, naked except for a loin cloth, carrying at his side a skin sack of water. He collapses, then somewhat revives and points at the figure of the harpie carved above the doorway, muttering the word "Ah-cone-cawn-ga." With that he again collapses and dies.*

*The party starts out to explore the cavern from which the Antarctican emerged. Encountering many difficulties, they finally lose both lanterns and one of their number falls through the thin crust of the flooring of the cave and is killed. Rigging a makeshift light, they return to their camp and start for the Gardens of Paradise. Bad weather impedes their progress, but after traveling several days they enter a heavy fog from which they emerge after hours of travel into the warmth of the Gardens of Paradise.*

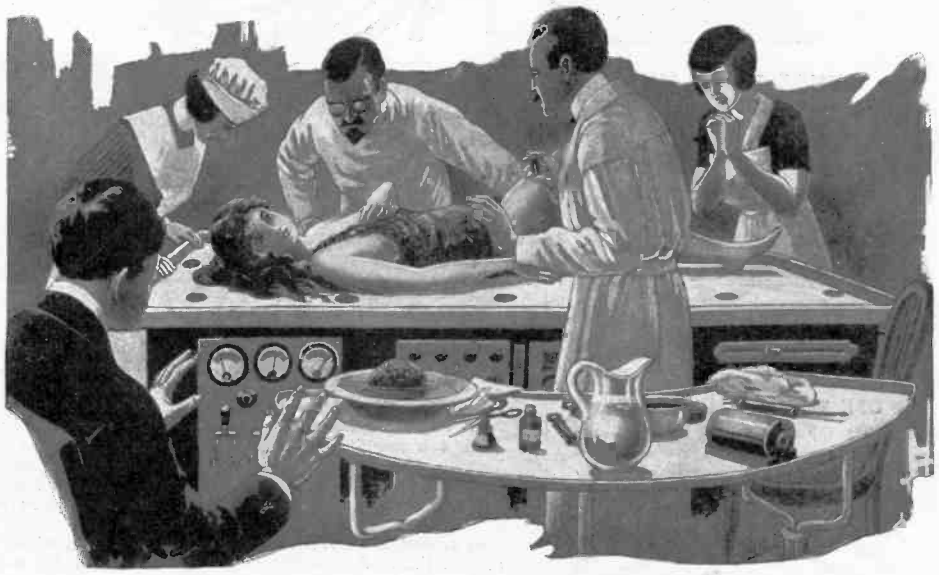
### NINTH INSTALLMENT

### CHAPTER XXXI

### We Enter

I SHALL not attempt to describe the thoughts and feelings that came to us as we stood there and gazed out upon that strange and lovely scene. I believe every man of us, so lovely was it, likened it to a vision of fairyland. But it was not fairyland, despite its beauty and the strange wonder of it all, for 'twas the abode of a frightful monster—the abode of monsters, rather. Somewhere, too, perhaps up there in the invisible northeast, was a race of men—a race of white men. And where human beings are—well, there is not fairyland, however wonderful the land, and the human beings themselves, may be.

*Ah-cone-cawn-ga! Ah-cone-cawn-ga!* What was the meaning of that word syllabled by the Antarctican upon our wondering minds? Would it be ours to rent the veil and see?



She stirred, sighed, closed her eyes. The pupils were contracting; the eyes were blue. Then suddenly she turned her head, raised her look to Frontenac's face and spoke!

Or would it remain (for us) one of the mysteries of this mysterious land?

Everything visible was just as Captain Livingstone had described it. Our view, however, was not so extensive a one as his had been, for a haze, with a strange quality of dreaminess for which we could not account, obscured distant objects, completely concealing, of course, what lay beyond them. The great mountain that rose up in the midst of the valley—named Mount Wilkes by Captain Livingstone—loomed ghostly and evanescent. There, off to the left, was the lake, glittering like a great jewel in the rays of the Antarctic sun. Yes, and there they were—there were the palm-trees!

It was our belief that we had come out at a point somewhat to the left of the place where Captain Livingstone stepped through the fog-curtain; and, on consulting his map, this was found to be the case. The distance proved to be about two miles.

We found the grave—torn open. It was plain that this had been done long before, in all likelihood, I thought, immediately after the departure of Livingstone and Hampden. The cross lay shattered amongst the flowers, and not far off a skull was found. A careful search everywhere revealed nothing more. The skull—we had no means of knowing whether it was that of Wilkie, Thompson or Bogardus—we buried again and placed another cross at the head of the grave. A solemn, sad business this, the first to befall us on our arrival at Paradise—one that enhanced that foreboding which enveloped my very soul in its gloomy shadows.

This sad office performed, we started down, leaving one of the men, Watson, to his colossal chagrin and disgust, to guard the camp. We were, of course, no longer in our zero togs. A good idea of what our divestiture meant will be furnished by the remark that I was now wearing one pair of socks instead of seven!

As for weapons, each of us had a rifle, two revolvers and a goodly supply of ammunition.

It was a strange thing to be moving, here in the very heart of the frozen Antarctic, beneath the branches of stately trees. The sheen of sunlight upon the foliage and moss overhead—some of the moss hung from the great branches in long festoons—was most beautiful. No less beautiful was the sunblaze on the mass of vegetation that clothed the ground. Awful, too, were those dense shadows all roundabout us.

As we advanced deeper and deeper into the place, the flora assumed a character more and more tropical. Gorgeous flowers, many of them parasitical, were passed. Came the almost continuous drone of insects. Creeping, crawling, flying things were everywhere. Great butterflies flitted in the sunlight and in those gloomy forest depths into which we sent so many searching glances.

And this mention of butterflies renders apropos one of the curious entomological discoveries made by Frontenac in these Gardens of Paradise: a butterfly with a "terebrant mouth," as he chose to express it. In other words, this is the first (and the only) butterfly known with a boring mouth; all the others are purely suctorial. The only exception, amongst the great order of the *Lepidoptera,* previously known, is that of some Australian moths—*Ophideres,* I believe—these insects, like *Papillilarius frontenacci,* having boring mouths.

Our objective was the scene of the tragedy. This, thanks to Captain Livingstone's careful directions, we had no difficulty in finding.

Yes, there we stood at last in that very spot where *it* had dropped upon the three victims.

"Look at that!" suddenly exclaimed Frontenac.

He was pointing toward the trunk of the great cypress. There it was, faint but unmistakable—the mark of a great claw.

I felt a shiver run through me and the blood turn cold in my veins.

"Can it be possible," I said, "that the thing which left this mark—?"

"Well, Bond?" Frontenac queried.

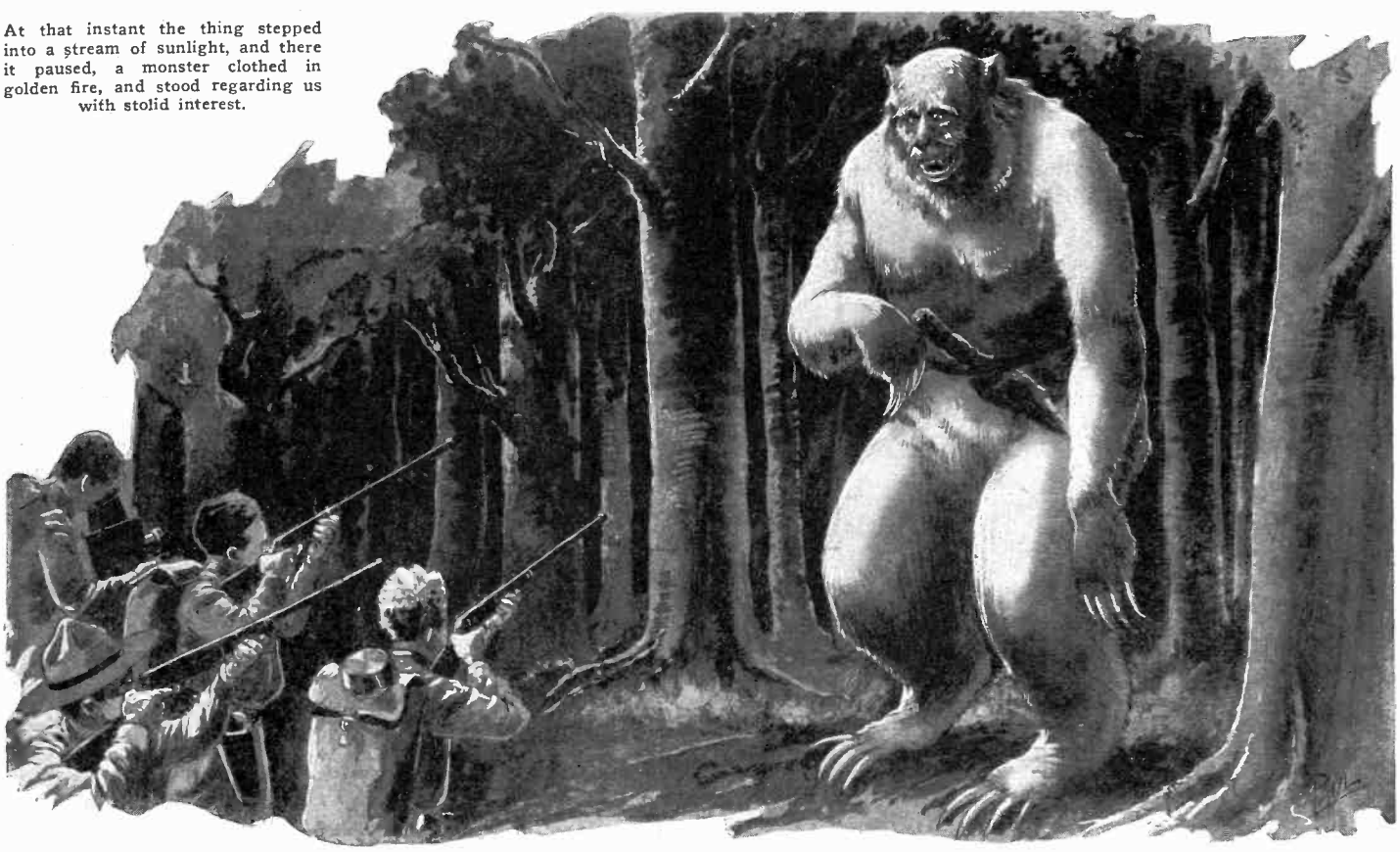
"Captain Livingstone suggested the possibility that it did not have to move *on the ground.*"

. . . . . and there, before our astonished eyes, was the headless monster.

"Bosh! The suggestion is not worthy a second thought. It is preposterous, utterly preposterous. Of course, the thing might be arboreal; but that isn't what Livingtone meant."

Of a truth, it was a dark, mysterious and terrible business that now faced us.

(*Continued on page* 174)



**At that instant the thing stepped into a stream of sunlight, and there it paused, a monster clothed in golden fire, and stood regarding us with stolid interest.**

# How Paper Is Made

By Harry E. Weston

Assistant Professor of Pulp and Paper Manufacture at The New York State College of Forestry, Syracuse University.

In the manufacture of newsprint paper from wood it is first necessary to convert the wood into pulp. The object of the wood pulp processes, two being commonly used in the making of newsprint paper, is to separate the fibres of the wood in such a way that they will form a convenient base for the manufacture of this paper. The first of these processes is mechanical in nature; and the second is chemical. In newsprint paper, the mechanical or ground wood pulp is the chief constituent. Approximately eighty per cent. of the ground pulp is used, while about twenty per cent. of chemical wood pulp is added to it in order to give the paper strength. Pulp manufacture is only one stage in the process.

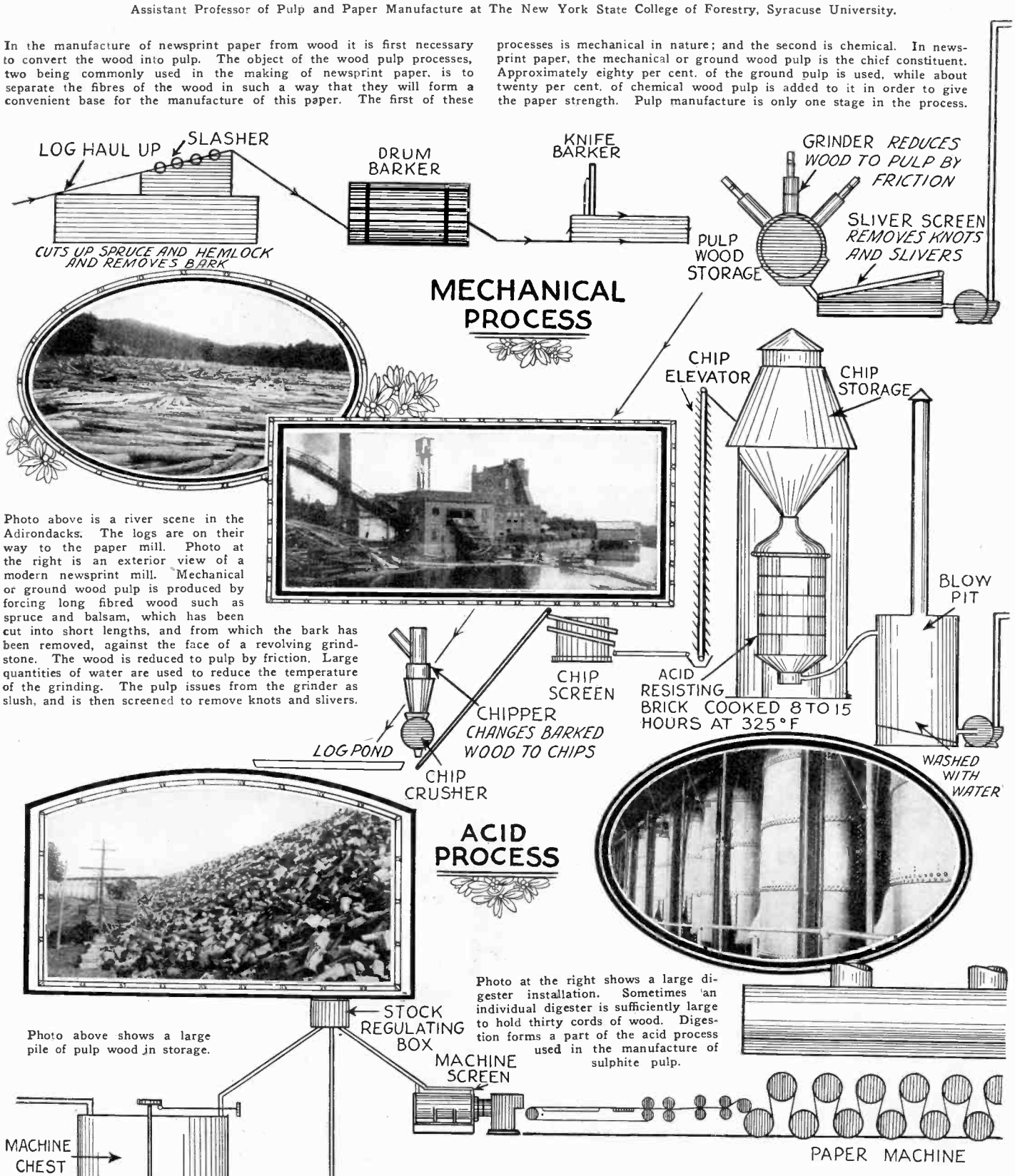



Photo above is a river scene in the Adirondacks. The logs are on their way to the paper mill. Photo at the right is an exterior view of a modern newsprint mill. Mechanical or ground wood pulp is produced by forcing long fibred wood such as spruce and balsam, which has been cut into short lengths, and from which the bark has been removed, against the face of a revolving grindstone. The wood is reduced to pulp by friction. Large quantities of water are used to reduce the temperature of the grinding. The pulp issues from the grinder as slush, and is then screened to remove knots and slivers.

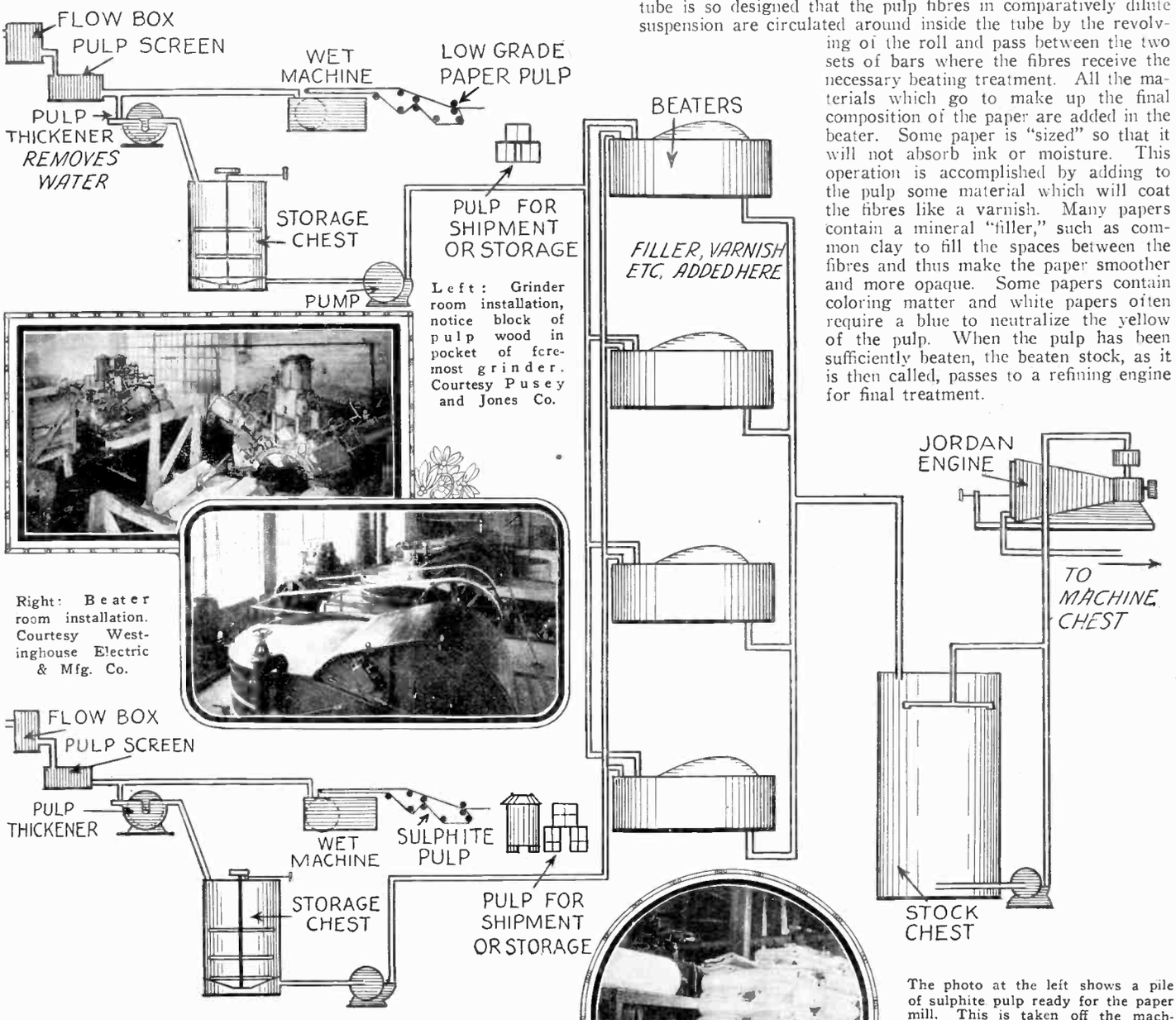
Photo above shows a large pile of pulp wood in storage.

Photo at the right shows a large digester installation. Sometimes an individual digester is sufficiently large to hold thirty cords of wood. Digestion forms a part of the acid process used in the manufacture of sulphite pulp.

After screening the pulp in a mechanical process, it is thickened by removing water from it upon specially designed machines. The pulp is then ready for converting into paper. This pulp represents the lowest grade of paper making fibre, and is seldomly used alone, but is mixed with a certain percentage of chemical pulp to give the paper strength. An acid process, known as the sulphite process, is used for the manufacture of chemical pulp necessary for the making of newsprint. The sulphite acid, the cooking liquor. In the manufacture of sulphite pulp, the barked wood blocks are reduced to small chips. These chips manufactured from long fibred soft woods, such as spruce, hemlock and balsam, are then cooked with the sulphite acid in large steel digesters, which are lined with a special acid resisting brick. Such a cook may last from eight to fifteen hours. The operating pressure is about seventy-five pounds, and the temperature at the end of the cook is 325° F. When the cook is completed, the pulp is blown into a pit where it is washed with water. It is then screened to remove knots and uncooked portions of wood, and to separate well cooked fibres into different grades of pulp. This pulp must also be thickened before being converted into paper.

The mechanical process for the manufacture of pulp is shown on the top of the accompanying two pages. The acid process is described immediately under this. Both pulps pass into the same beaters.

THE actual manufacture of paper begins in a machine called a beater, and in the operation known as beating. The beater is a large oval tub-like machine in which a roll, bearing a number of steel bars on its face, is placed. The bars on this roll, together with the bars of the bed-plate located immediately below the roll, perform the beating operation. The tube is so designed that the pulp fibres in comparatively dilute suspension are circulated around inside the tube by the revolving of the roll and pass between the two sets of bars where the fibres receive the necessary beating treatment. All the materials which go to make up the final composition of the paper are added in the beater. Some paper is "sized" so that it will not absorb ink or moisture. This operation is accomplished by adding to the pulp some material which will coat the fibres like a varnish. Many papers contain a mineral "filler," such as common clay to fill the spaces between the fibres and thus make the paper smoother and more opaque. Some papers contain coloring matter and white papers often require a blue to neutralize the yellow of the pulp. When the pulp has been sufficiently beaten, the beaten stock, as it is then called, passes to a refining engine for final treatment.

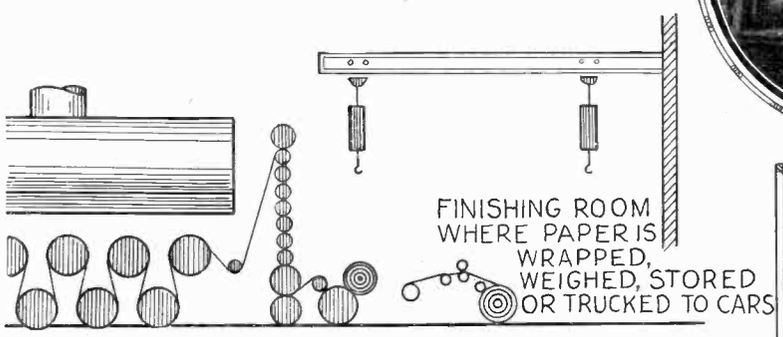



Left: Grinder room installation, notice block of pulp wood in pocket of foremost grinder. Courtesy Pusey and Jones Co.

Right: Beater room installation. Courtesy Westinghouse Electric & Mfg. Co.



The photo at the left shows a pile of sulphite pulp ready for the paper mill. This is taken off the machines as illustrated in the diagram, diagonally to the left, where the artist, by means of an arrow has indicated the pulp "for shipment or storage."




The pulp when emptied from the beater is passed to a refining engine for final treatment before being fabricated into a finished sheet of paper on the paper machine. The paper machine is one of the largest, most complicated, and most expensive individual machines used in any industry. It actually makes the web of paper in the form of a wet sheet from a very dilute suspension of fibres, compacts the wet sheet, drys it, and finishes it by improving or smoothing its surface. As the sheet in a continuous web leaves the calenders, where the finish is being put upon it, it is wound in the form of a long roll on a device called a reel. It is then rewound on a rewinder into rolls of proper length and width; the wide sheet from the reel being slit into webs of the proper width during the rewinding operation. The rolls formed on the rewinder are wrapped in heavy paper and shipped to the consumer ready for the press room. In the manufacture of sulphite acid, the gas of burning sulphur (sulphur dioxide), passes into lime water where it is absorbed.

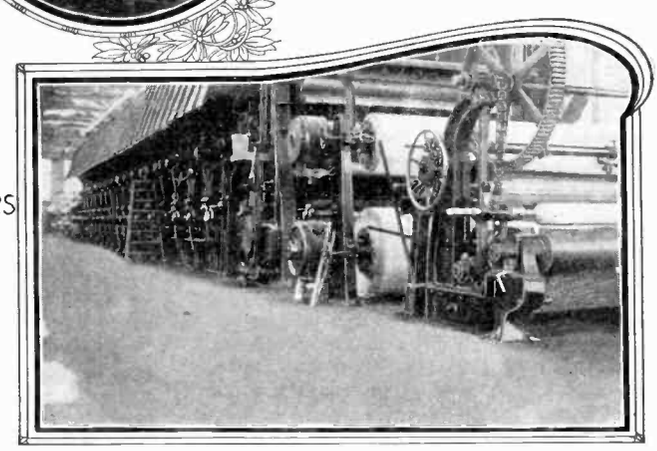


Photo above shows a modern paper machine manufacturing newsprint paper.

# Doctor Hackensaw's Secrets

## By CLEMENT FEZANDIÉ

### No. 5—A Journey to the Center of the Earth. (Part I.)

. . . . . a collection of ice huts which had previously been constructed by a very rapid method, having been made in a mould into which water had been poured and allowed to freeze. On up-ending the mould, the ice-house slid out all ready for occupation. Mr. Sam, the agent, was delighted to see our travelers, and was especially interested in the Doctor's electrical airplane, "The Dart."

CHAPTER I

"PEP!" cried Doctor Hackensaw. "Do you want to take a trip with me?"

"Shure, Pop!" answered Miss Pepita Perkins, gaily. "Where to?"

"To the South Pole first, and from there possibly on to the Center of the Earth."

"What!"

"Yes, Pep. I have decided to penetrate Nature's greatest mystery and discover what lies at the center of our earth. Up to date nobody has the faintest idea of what is to be found there. For many years the center of the earth was supposed to be a liquid mass of white-hot molten matter on the top of which floated the cooled upper crust—about a hundred miles in thickness. This belief was strengthened by the fact that in our mines the temperature increases slowly as the depth increases. It would follow that the center must be a white hot mass. The existence of volcanoes would lend support to the belief. But of late years this view has been gradually abandoned. If the center of the earth were a liquid sea of fire, this sea would be attracted by the sun and the moon and our volcanoes would have daily high tides and low tides the same as our oceans of water. Other circumstances, too, lead to the belief that our earth is not fluid at the center, but is as rigid as steel. However, nothing really definite was known until I, a few years ago, set about exploring the nature of the center of the earth by means of radio waves."

"Radio waves. What do you mean?"

"I mean to say that radio waves in their passage through a medium are modified to a certain extent by the medium through which they are passing. I have accordingly spent a great deal of time in studying just what modifications are produced by passing these waves through different thicknesses of rock, sand, clay, gravel and various metallic ores. Of course, I was obliged to use directed waves, for if the wave passed *around* the obstacle instead of *through* it, it would tell me nothing.

"After I had carefully tabulated the results of my experiments I sent out several radio expeditions to test conditions at the center of the earth. These expeditions were in pairs, each pair was at opposite poles or points on the earth's surface, thence to send and receive radio waves of prearranged strengths and frequencies directed right through the center of the earth. The vessels carrying the radio apparatus were of course timed to be at the same moment at opposite points. Following the same great circle of the earth in the same direction they were always opposite each other and could arrange to stop every hundred miles on their course and exchange new waves. By comparing the results from all these expeditions and eliminating all the differences, I could tell just what resistance was offered by the central portion of the earth and could thus form some idea as to whether it were a mass of molten matter or solid rock. This was supplemented by the work of some other expeditions which instead of following a great circle followed small circles of latitude or longitude. In this case, the radio waves exchanged did not pass through the center of the earth but through the chord of a sliced off portion in this diagram. Dr. Hackensaw here showed Pep a simple sketch of a section of the earth.

"This work served to control the other observations, because in this case the wave did not pass through the center of the earth."

"Well, what did you find the earth is made of?" asked Pep.

Doctor Hackensaw shook his head. "The results are most puzzling, and I don't dare to publish them—they are so wild and so much at variance with the current scientific theories. Consequently I am determined to make an attempt to penetrate to the center of the earth in order to verify or disprove my theories."

A microphone of special construction with a series of amplifying devices . . . .

"Gee!" cried Pep. "That's *some* job you're undertaking. How are you going to dig your way down?"

"I'm going to make use of atomic energy to dig the tunnel. You were with me when we watched the blowing up of the rock in Central Park, so you have some faint idea of what my atomic force can do. Well, I have invented a digging machine for digging deep shafts into the earth—by means of this same energy."

"I understand," said Pep, "but what's your idea in starting from the South Pole? Why not start from here?"

"There are several reasons," replied the doctor. "In the first place we should be tormented here by reporters and curiosity seekers. But my main reason is, that as the earth is flattened at the poles, I shall save several miles of digging. Besides, I have just received word from the agent of my colony at the South Pole that he has now discovered a pit or extinct crater that seems to be about five miles deep. Of course, five miles is very little on a total of four thousand miles, yet every little bit helps. But I am wasting time. Now that you know my plans, are you still willing to come along with me?"

"Sure, Pop, I wouldn't miss it for a circus!"

## CHAPTER II

"Here we are exactly at the South Pole, Pep, and I bet you can't tell me in what direction we are flying."

"I bet I can! We're going due South. We haven't changed our direction."

Doctor Hackensaw's eyes twinkled. "You're wrong, Pep," said he. "We're going due North. A person standing exactly at the South Pole can travel neither East nor West nor South. No matter in what direction he goes, he will be traveling due North. Similarly to a person at the North Pole, all directions are due South."

"How is it that the compass isn't vertical here?" asked Pep.

"For the reason that the magnetic poles do not coincide with the poles of the earth. Scientists are not yet agreed as to the cause of the earth's magnetism, but it is believed to be due to electric currents that circulate around the surface of the earth. It is not the earth itself that attracts the compass, but the needle is acted on by these electric currents, and the currents are probably caused by the heat of the sun striking the earth further and further to the West as the sun apparently travels from East to West between sunrise and sunset.

"Here we are over my polar plantations that we visited once before. We shall not stop there today, but push right on for our goal, fifty miles further on."

A few minutes brought the aeroplane to the spot, and the doctor and Pep alighted to confer with the doctor's agent who had received orders to make all necessary preparations for starting work. By means of atomic energy, the snow and ice had been cleared away from most of the territory with the exception of a collection of ice huts which had previously been constructed by a very rapid method, having been made in a mould into which water had been poured and allowed to freeze. On up-ending the mould, the ice-house slid out all ready for occupation.

Mr. Sam, the agent, was delighted to see our travelers, and was especially interested in the Doctor's electrical aeroplane, "The Dart."

"Where are the storage batteries?" queried Mr. Sam.

"There are no batteries," replied the doctor.

"I thought you said it was electrical?"

"So it is. At least as much as storage batteries are electrical. A storage battery, of course, does not really store up electricity. It stores up *chemical energy*. Electricity is no more stored than it would be if we used the current to decompose water into hydrogen and oxygen, and then burned the gases and used the heat to run a dynamo and produce new electricity.

"In my aeroplane it is atomic energy that is converted into electricity and runs the propellers. But we have no time to lose. Have you cleared out the bottom of the pit so we can begin our digging?"

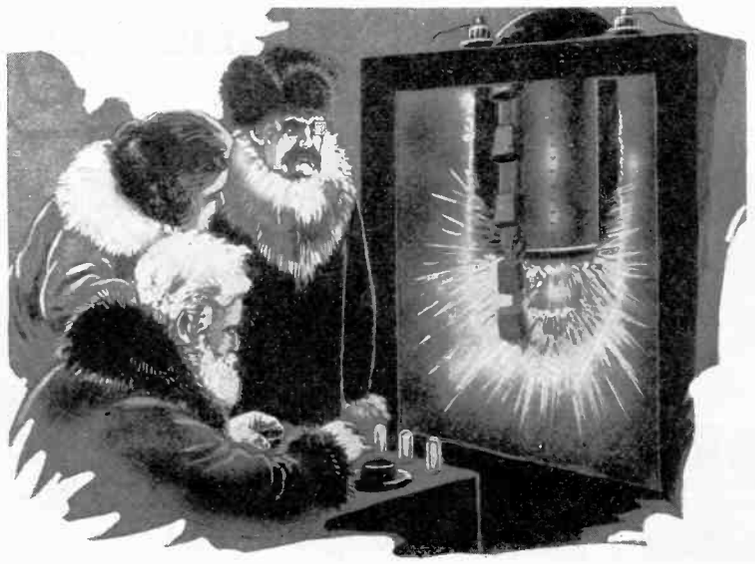
"Everything is ready for the start," said Mr. Sam. "The pit is cleared out and the diamond drill has started."

"How does the diamond drill work?" asked the doctor.

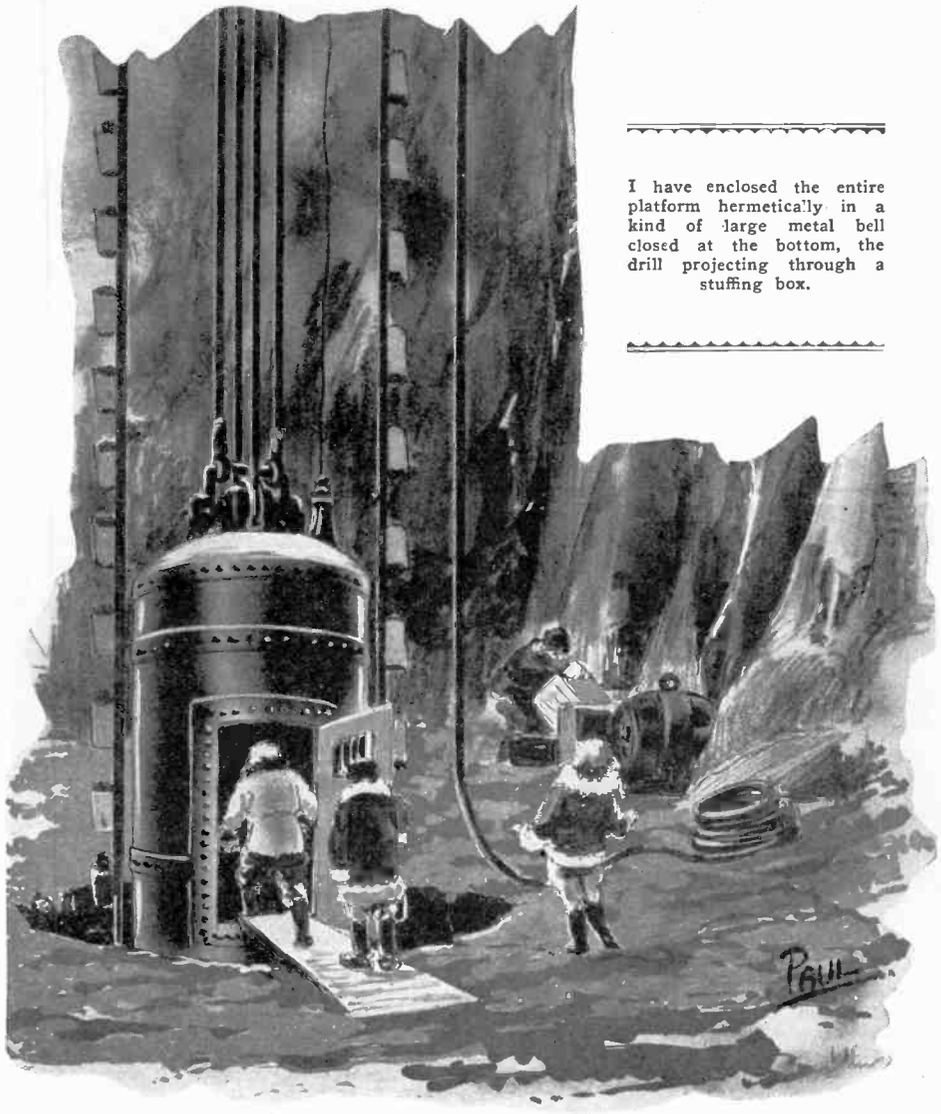
"First rate, but it seems a pity to use those immense diamonds, worth hundreds of thousands of dollars, for the purpose of digging through rocks."

"Don't let that worry you," replied the doctor. "I have found the means of producing large diamonds as cheaply as we can produce graphite. They are nothing but charcoal in another form. But their hardness makes them ideal for drilling work like this. If you'll just jump aboard 'The Dart,'

(*Continued on page* 190)



"I have arranged an X-ray machine so that we can witness the effect of the atomic torch as it digs its way downward through the rocks." Several hours were required to make the change, but Doctor Hackensaw and Pep waited to see the torch well set up in place and started in operation.

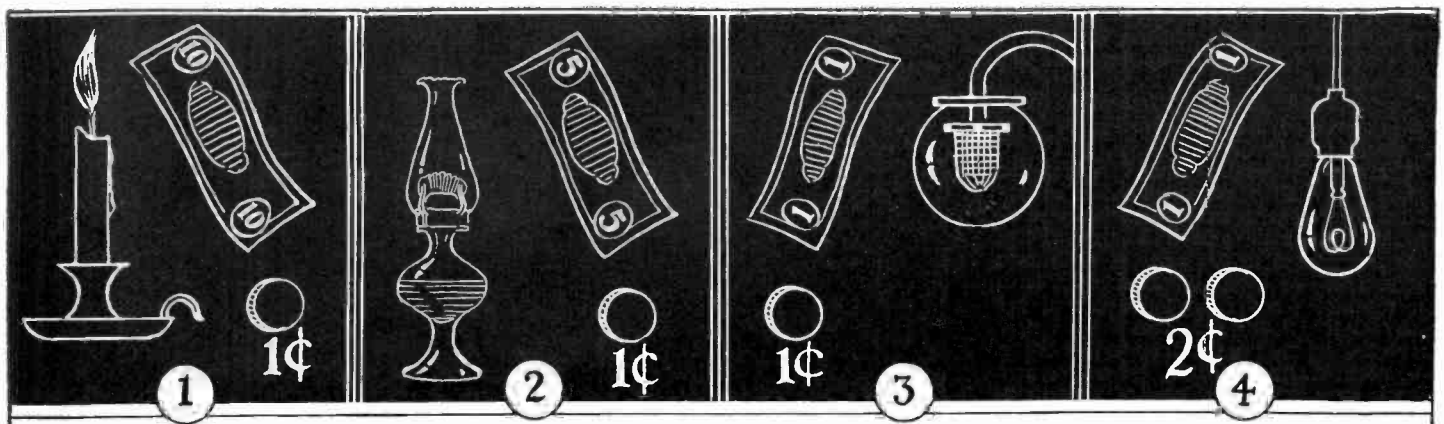



I have enclosed the entire platform hermetically in a kind of large metal bell closed at the bottom, the drill projecting through a stuffing box.

# The Efficiency of Light Sources

By DR. RUSSELL G. HARRIS

Of the Jefferson Physical Laboratory, Harvard University

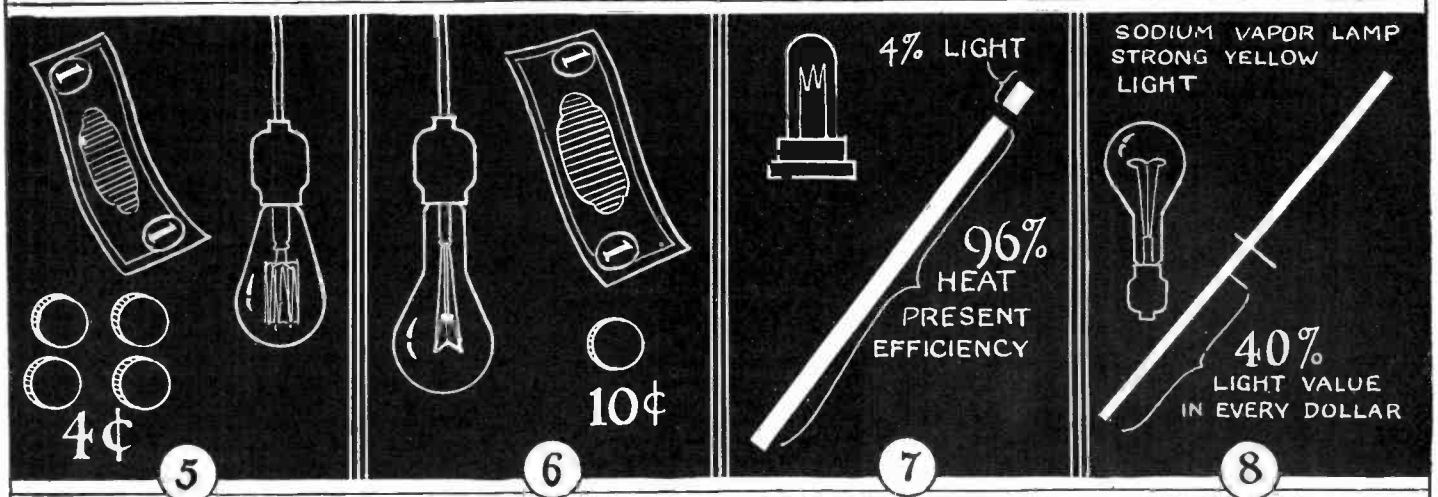



Considering the amount of energy wasted as heat, we receive one cent's worth of light from candles for every ten dollars invested therein.

An oil lamp is about twice as efficient as candles. Five dollars' worth of fuel results in approximately one cent's worth of light.

An inverted gas mantle such as shown above gives us about one cent's worth of light for every dollar paid to the company supplying gas.

The carbon filament incandescent electric lamp is more efficient than a flame or mantle gas burner. One dollar invested returns to us about two cent's worth of light.

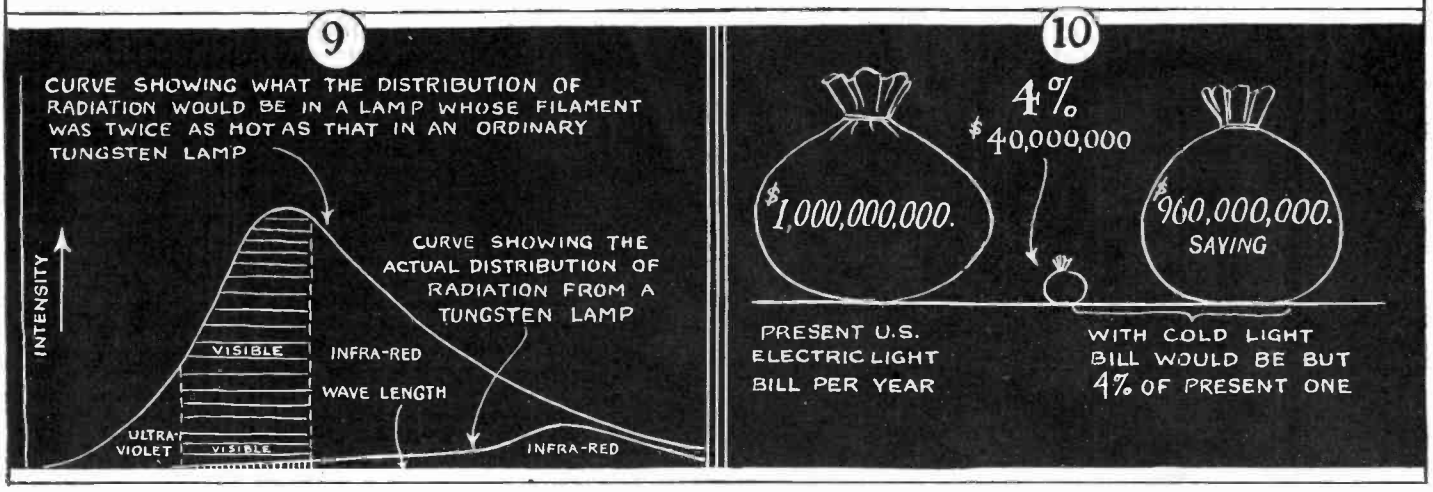



Still further advances give us the tungsten filament incandescent electric lamp, yielding four cents' worth of light for every dollar's worth of electricity used.

The gas filled tungsten lamp can be heated still higher than the plain tungsten type. It returns ten cents' worth of light for each invested dollar.

Of the enormous electric light bill paid by the people of the United States, less than 4% goes into use for light, 96% being wasted in unused heat.

The most efficient light ever built is illustrated above. Its efficiency is shown, but the light is pure yellow and therefore not suitable for commercial lighting.

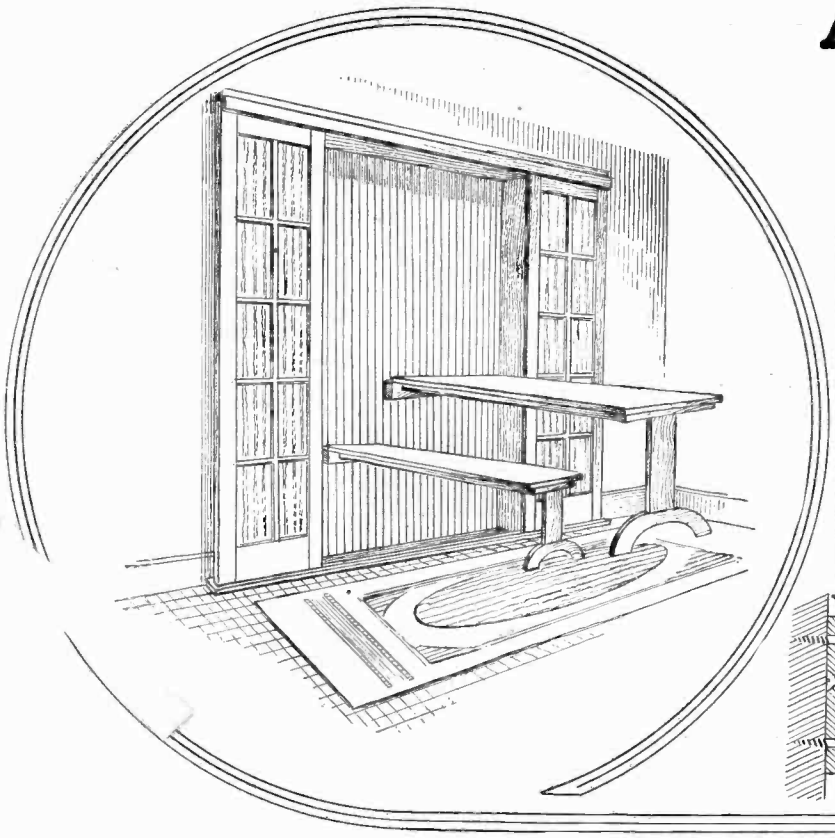


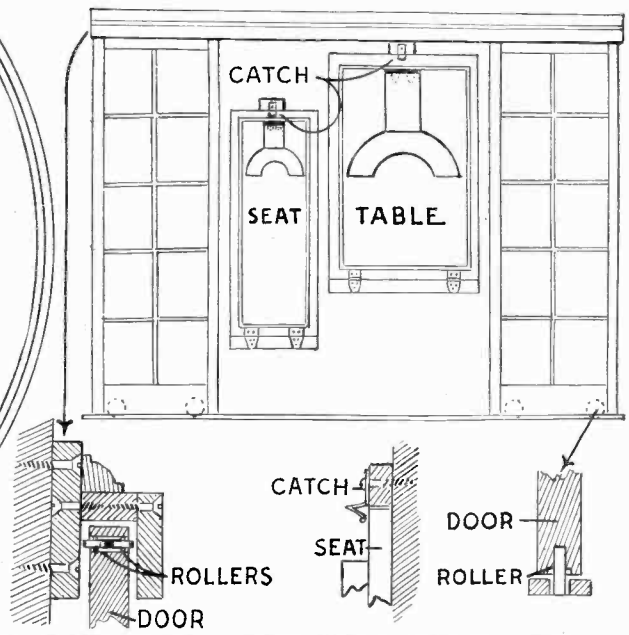

The maximum possible efficiency of any light depending on the heating of a filament is about 50%. The hotter the filament of a lamp, the greater its efficiency up to about 6,000° C., but no present substance will stand this temperature. The above chart shows how the efficiency of a lamp would be increased if the filament could be made twice as hot without burning out.

It may eventually be possible to produce cold light since the fire fly does it. This would involve the turning of electrical or chemical energy directly into light without heating anything. The production of such a light or even an ultra-efficient hot light would render a great saving as illustrated above. Only 4% of the present bill would then have to be paid.

# A "Fold-Up" Dining Room Suite

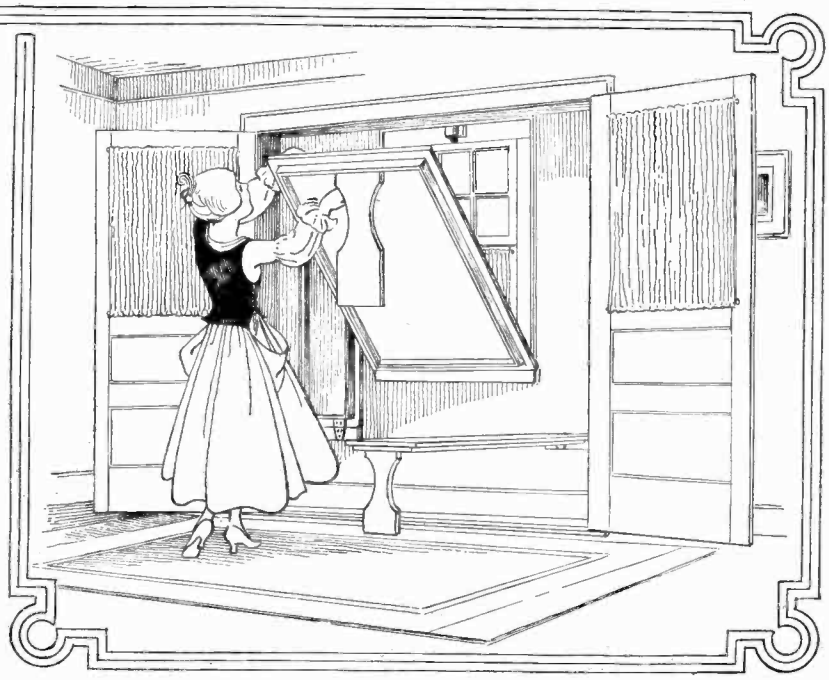
By WILLIAM M. BUTTERFIELD

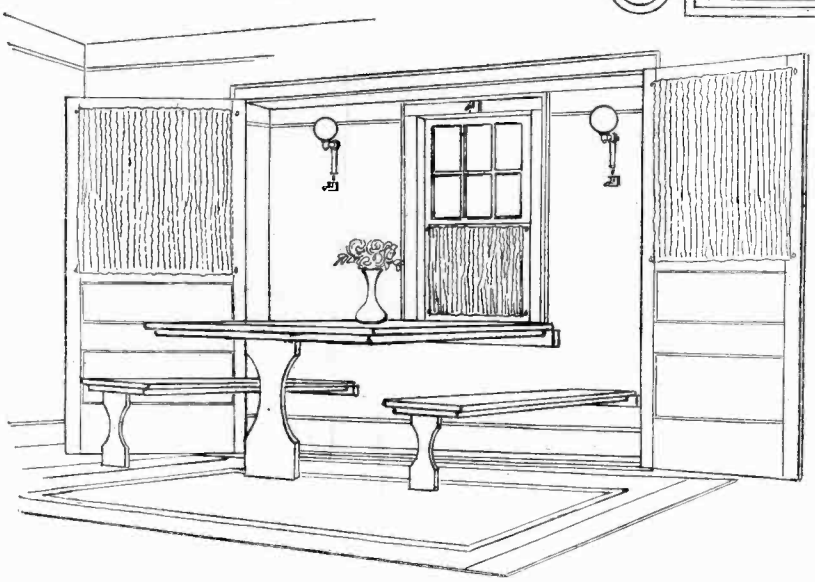


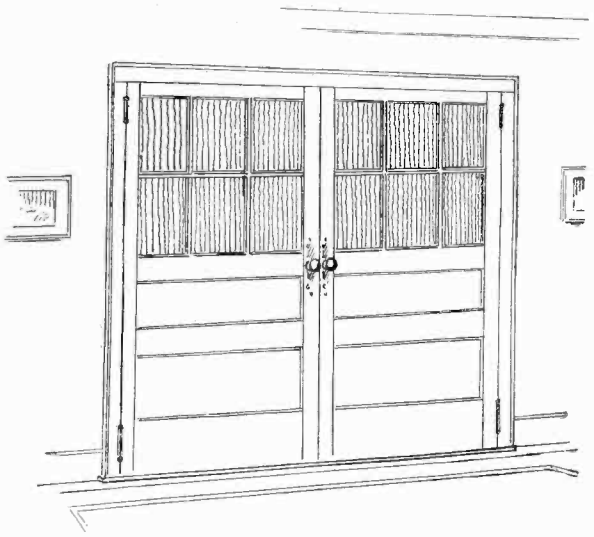



BREAKFAST alcoves or nooks as they are commonly called, have paved the way for the folding dining room suite illustrated herewith. In a small apartment, space is invariably at a premium and any device which will enable the housewife to save it is usually greeted with open arms. On this page are illustrated two different types of folding dining room furniture. The one directly above provides ample space for two. A single bench and a spacious table are provided. These two pieces of furniture fold up against the wall as illustrated in the upper righthand corner and when locked in this position, the rolling doors may be closed and the space appears to be a doorway leading into some other room. Directly below the view of the seat and table folded, are details of the various important parts. The first detail on the left shows how the tops of the rolling doors are guided. Rollers placed at suitable intervals cause the doors to slide readily. The next detail shows a simple type of spring latch which holds both the table and the seat in their folded position. An upward push with the thumb on this catch releases the furniture. The lower part of the door is also equipped with rollers as shown at the right in the detailed views.

Another version of this folding furniture idea is illustrated at the right and below. Swinging doors cover the outfit when not in use. When swung down into position, a window at the wall end of the table provides ample light and a cozy appearance.



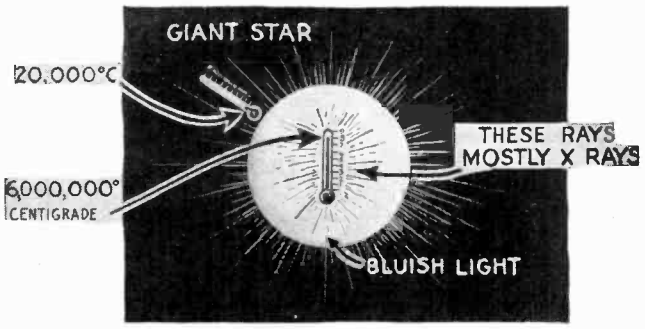




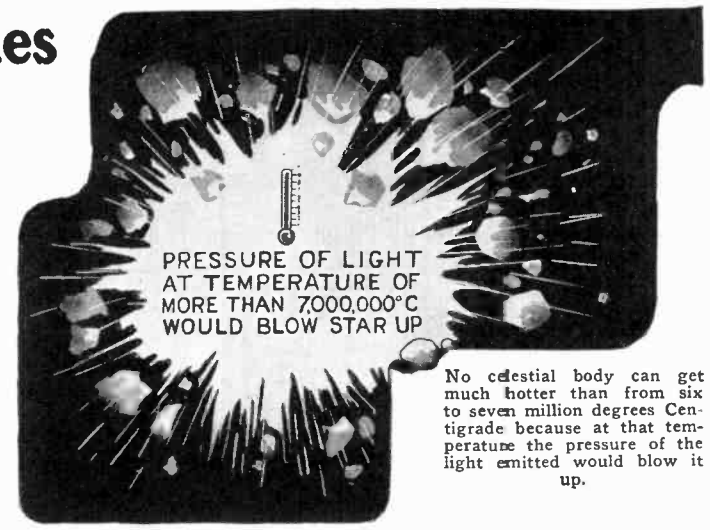
# Nature's Widest Extremes

By Dr. RUSSELL G. HARRIS

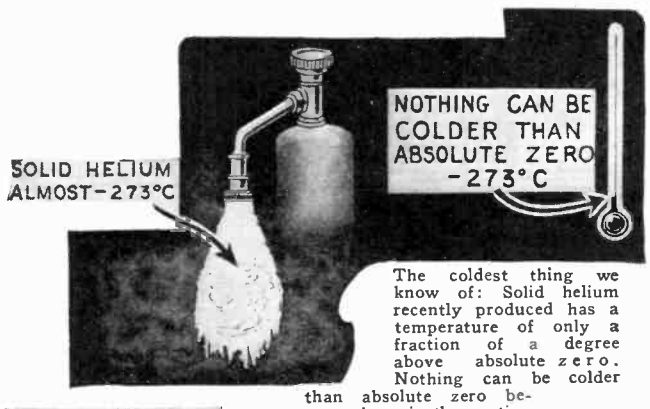
Of the Jefferson Physical Laboratory, Harvard University



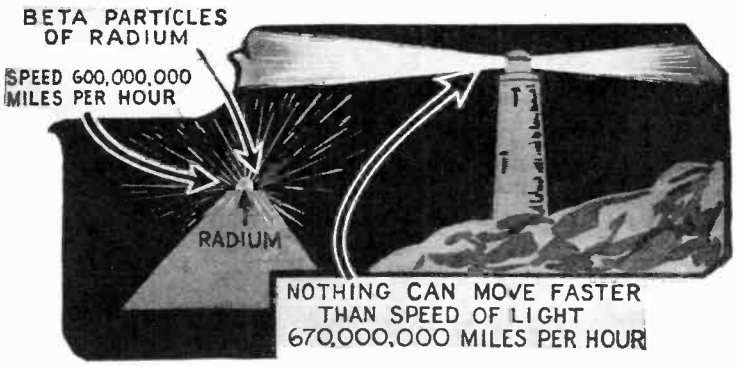

The hottest thing we know of: The center of a giant star where the temperature in some cases is about 6,000,000° C. The light emitted from the center of such a star is mostly X-rays. The outside temperature is at about 20,000° C., and emits a bluish light.



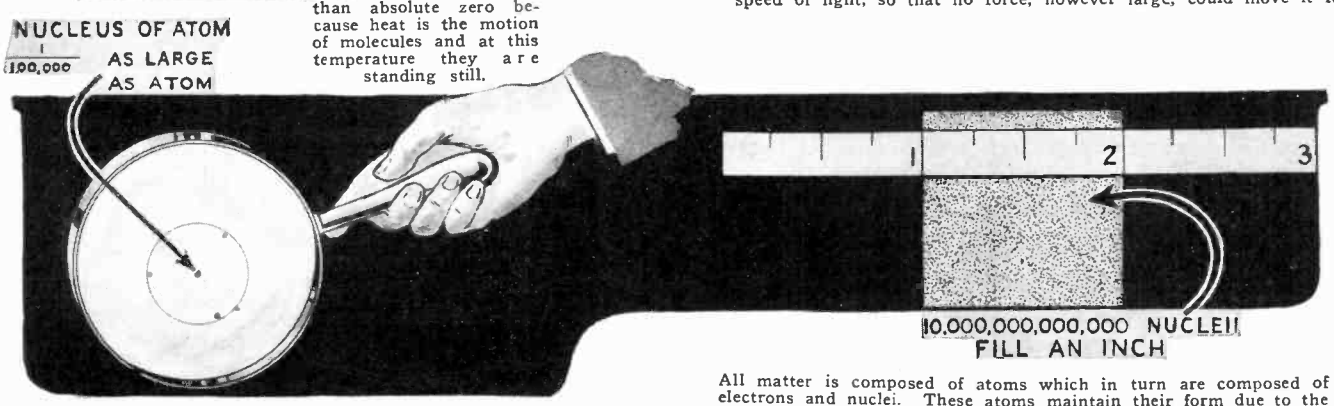

No celestial body can get much hotter than from six to seven million degrees Centigrade because at that temperature the pressure of the light emitted would blow it up.




The coldest thing we know of: Solid helium recently produced has a temperature of only a fraction of a degree above absolute zero. Nothing can be colder than absolute zero because heat is the motion of molecules and at this temperature they are standing still.

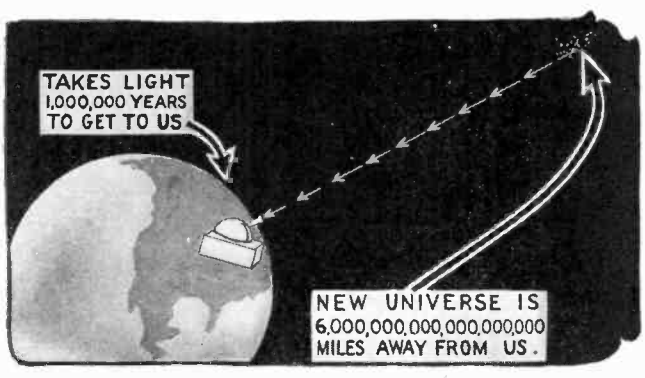



The fastest material thing we know of: Beta particles shot from the nucleus of a radioactive atom. These high speed electrons frequently have over nine-tenths the speed of light, or move at over 600,000,000 miles per hour. Nothing can move faster than the velocity of light (186,000 miles per second—670,000,000 miles per hour) because the mass of a body increases with its velocity, and becomes infinite at the speed of light, so that no force, however large, could move it faster.

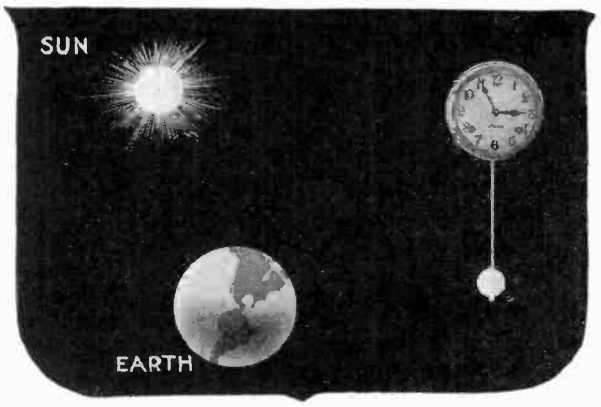



The smallest thing we know of: The nucleus or core of an atom. This is about 1/100,000 as large as the diameter of an atom so that 10,000,000,000,000 (ten trillion) would fill an inch.

All matter is composed of atoms which in turn are composed of electrons and nuclei. These atoms maintain their form due to the forces interacting between the nuclei and the electrons. Were these forces to be suddenly annihilated the actual volume of the electrons would occupy one part in 50,000,000,000,000 of the volume of the atom.



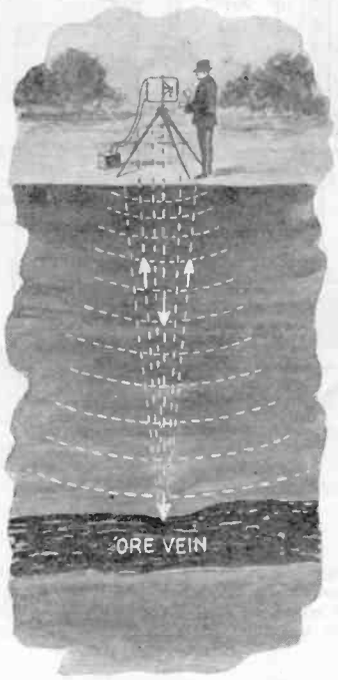

The farthest we have seen: To the new universe recently discovered by astronomers at the Harvard College Observatory. It takes light a million years to get to us from it.

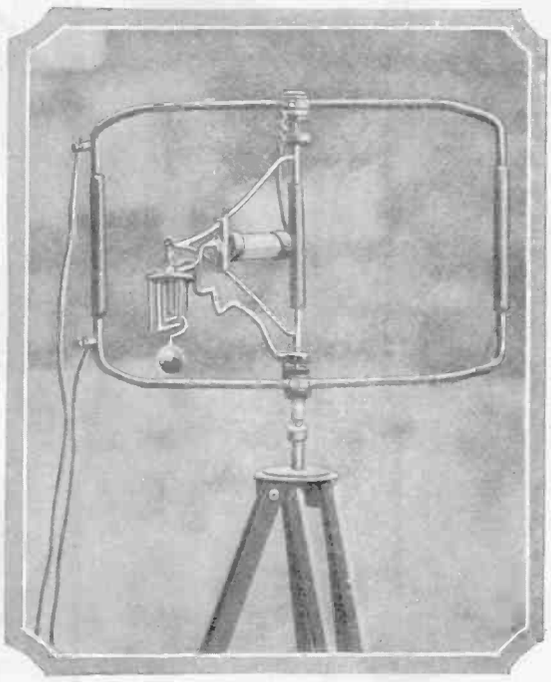



Steadiest thing we know of: The passage of time. Apparently every second is the same length as every other one. As far as we can tell time flows on smoothly, evenly and in one direction. It may not do this for all observers in the universe.

# An Electrical Gold Locator

The device illustrated at the left is the latest invention of a German engineer, E. Woldemar Pastor. Recent dispatches claim that this mechanism, operating on an electrical principle, can locate underground veins of gold-bearing ore.

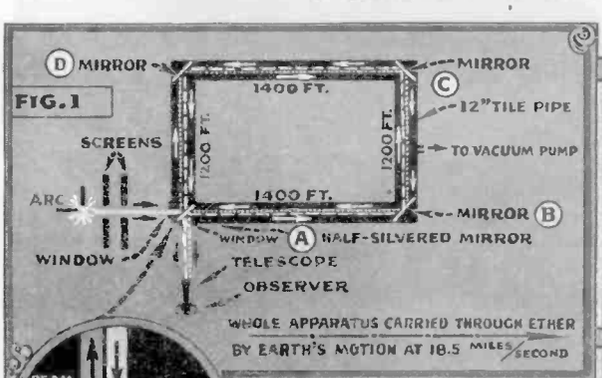


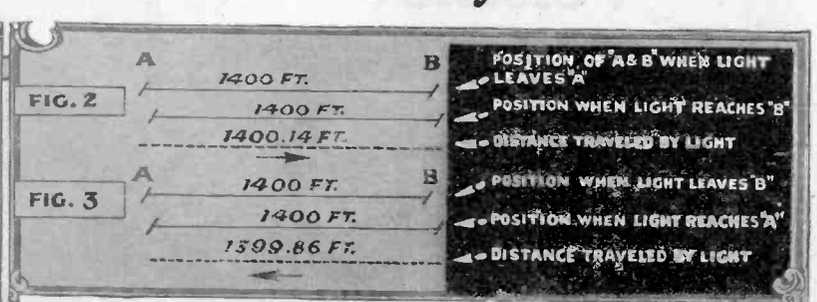



A close-up view of Pastor's mechanism is given in the photograph above. The inventor furthermore claims that the bombardment of the atoms is rendered detectable by rays emanating from his device. Our illustration at the left gives an idea of how this device may operate. The rays emanate from the instrument, radiate until they strike a metallic vein whereupon disturbances are set up which give an indication.

NOT only does this German engineer claim that his device will locate gold and other metals and minerals under ground, but that it will also ascertain the location of subterranean springs and rivers of water. He also claims that well grounded principles of physics form the basis for the operation of his invention. He claims that his extremely sensitive apparatus is able to detect the minute explosions occurring among the atoms that make up these metals. He states that because of the differences in the atomic structure of metals that he can tell what kind of metal is being "indicated" by the device.

# Further Tests of Einstein's Theory




Figs. 2 and 3 show how the earth's motion carries the mirrors through the ether while light travels between A and B, making one beam actually travel further than the other. The time interval of 3 ten billionths of a second is measured by the interferometer method.

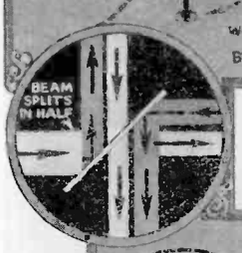



Fig. 1 above shows the mile long vacuum tube used in these experiments. The mirror at A is thinly silvered and splits the light beam in half as shown at the left.

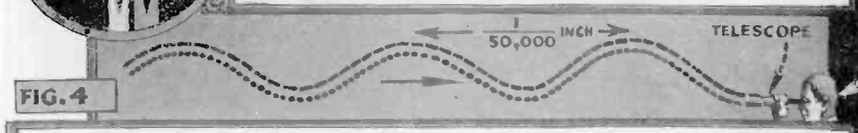
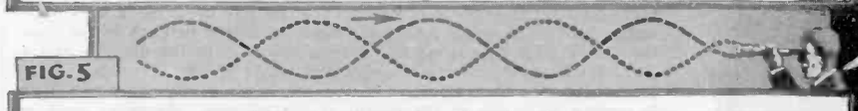



Fig. 4 above shows in exaggerated form the two light-beams which reach the observer indicated in Fig. 1; if there is no ether drift the beams coincide.




If there is an ether drift as proposed by Einstein, the two light-beams in Fig. 1 would be out of step as above. This was noted in every test.

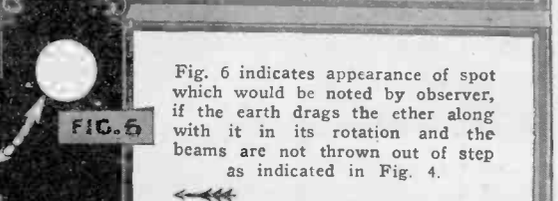
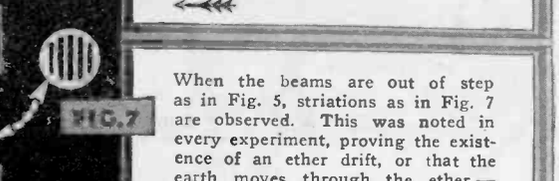
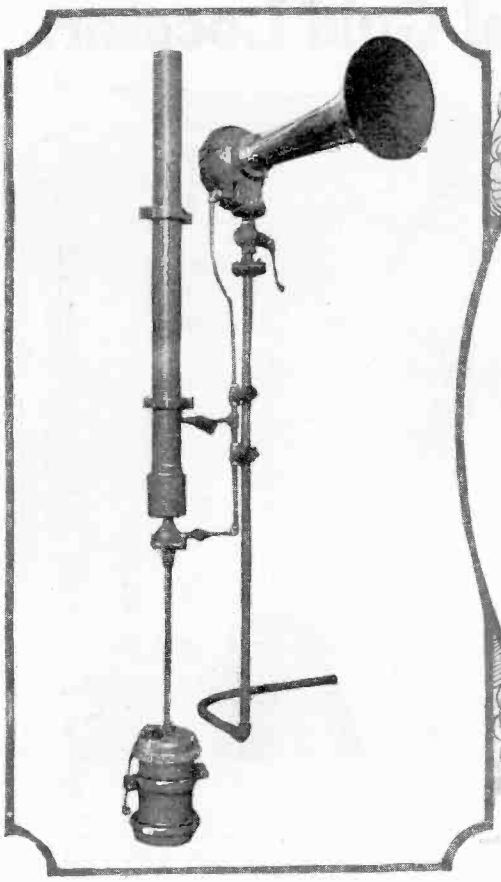


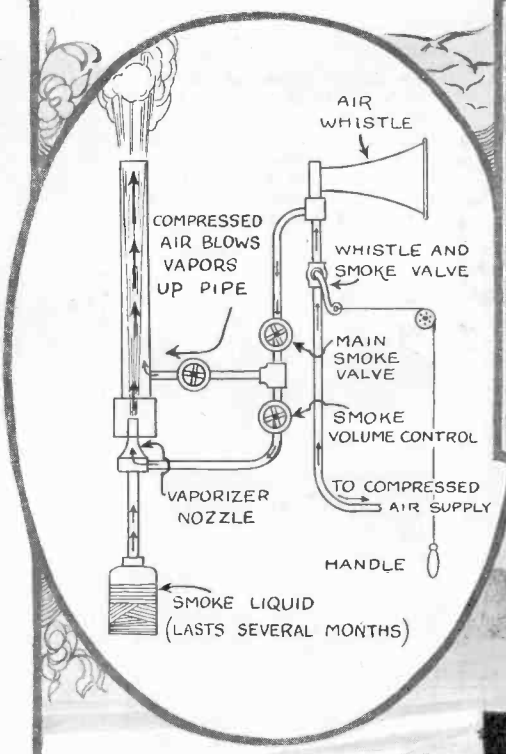

Fig. 6 indicates appearance of spot which would be noted by observer, if the earth drags the ether along with it in its rotation and the beams are not thrown out of step as indicated in Fig. 4.

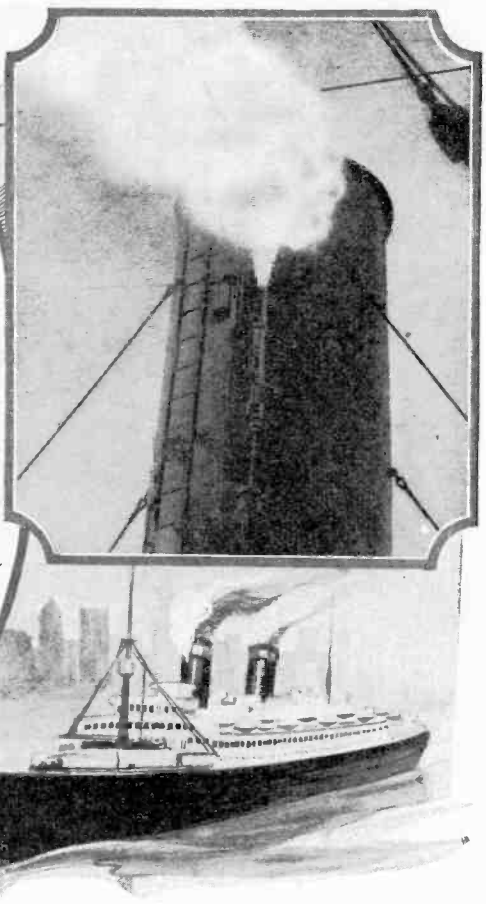



When the beams are out of step as in Fig. 5, striations as in Fig. 7 are observed. This was noted in every experiment, proving the existence of an ether drift, or that the earth moves through the ether.—Prof. Harold Richards.

# Visible Air Whistle





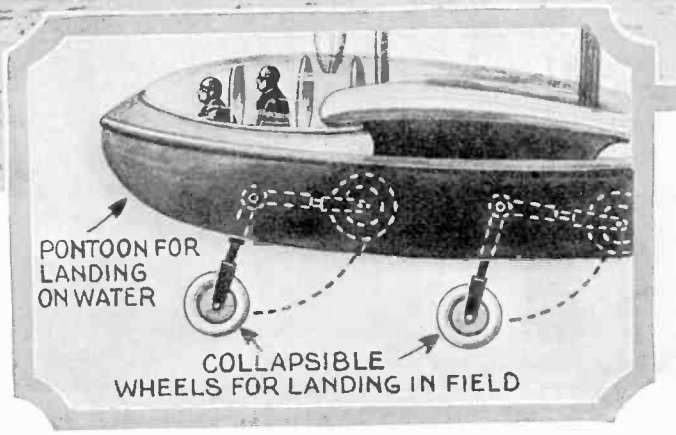



With the coming of gasoline propelled vessels the compressed air whistle was advanced. To mariners, however, not only is the sound from the whistle important but the visibility of the cloud of steam which accompanies the sound is equally as important, particularly in operation in inland waters. This feature is not found in the compressed air whistle and the Sperry engineers accordingly developed a compressed air whistle which forces a liquid through an atomizer, which liquid comes out in the form of a white and dense cloud of smoke.

# Volcano?

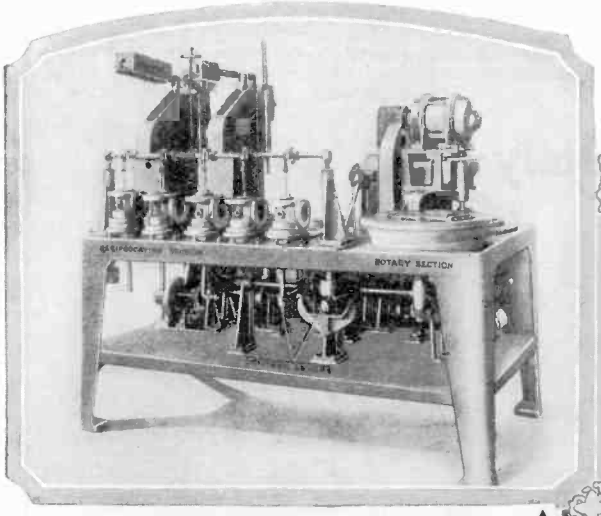

At Luna Park, Coney Island, the metal fence surrounding the park has been painted and cut out to resemble a volcano. So cleverly has the scene painter arranged this volcano that he has produced a very interesting form of illusion. About a quarter of a mile in back of the fence lies Coney Island's gas works. Frequently both in the daytime and at night its flares illuminate the sky and dense clouds of smoke roll up from its stack. To the patron of the park it would seem that the smoke is coming right out of the mouth of the volcano. Actually, however, the effect is of entirely different origin. The diagram at the left gives a bird's-eye view of the arrangement, whereas the photo above shows the effect as it appears to the spectator.—J. Kay London.

# Land and Water Airplane


SCIENCE AND INVENTION leads again! In December, 1920, SCIENCE AND INVENTION magazine described in detail an amphibian type of airplane wherein the wheels folded within the pontoon. An illustration from that issue is shown at the right. Only recently the first American built airplane capable of landing either on water or land was produced. It is illustrated above. With a 420 horsepower inverted Liberty motor a maximum speed of 130 miles an hour is attained.

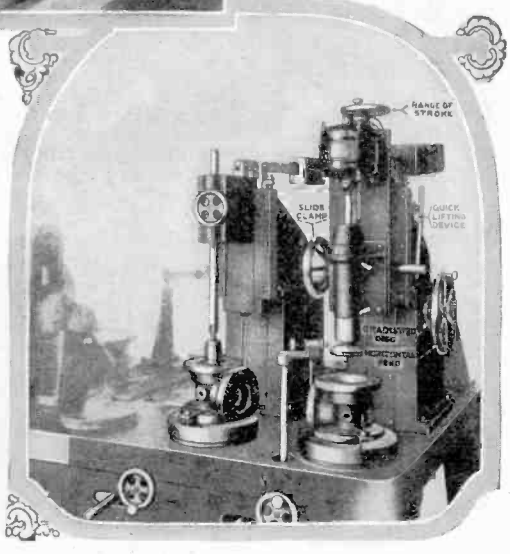
# Accurate Machines

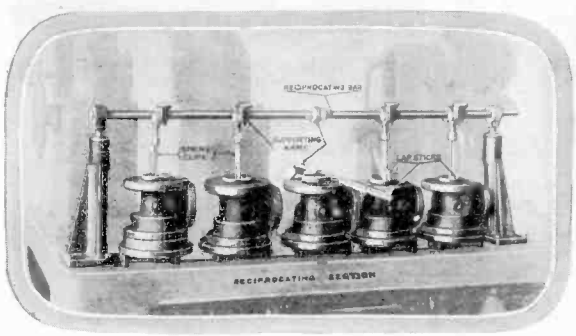



Above is shown the complete machine, three sections of which are illustrated on this page. Each section of machinery on this table is in reality a separate and individual machine. With a layout of this nature, a shop is equipped for doing practically all of the fine work necessary in accurately fitting air brake parts.


Machinery for finishing automobile parts with a nicety as great as those finished by hand is illustrated on this page. Left: One rotary section of the machine is used for refinishing flat unrestricted surfaces and for truing lapping sticks.

The machine illustrated at the right is for grinding worn cylinder bushings and restoring them to shape. The bushing turns as the grinding wheel reciprocates.

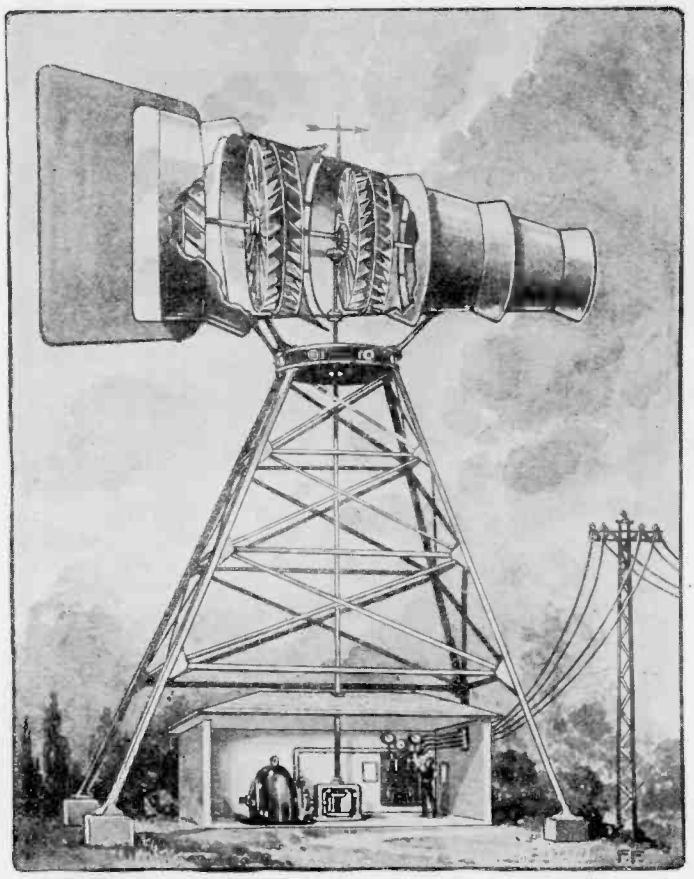


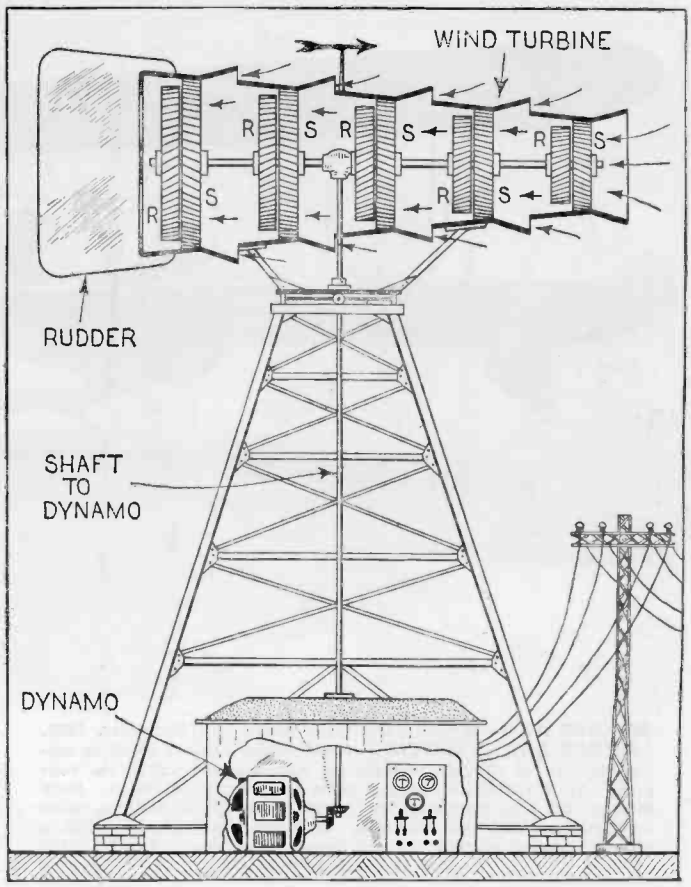




The section at the left illustrates the reciprocating section for refinishing internal seats for slide valves. This device is so made and arranged that at any time during the work a slight upward pull on the supporting arms enables the operator to remove the lap-sticks, remove them so as to inspect the valve, and determine how the work is progressing.

—Allen P. Child.

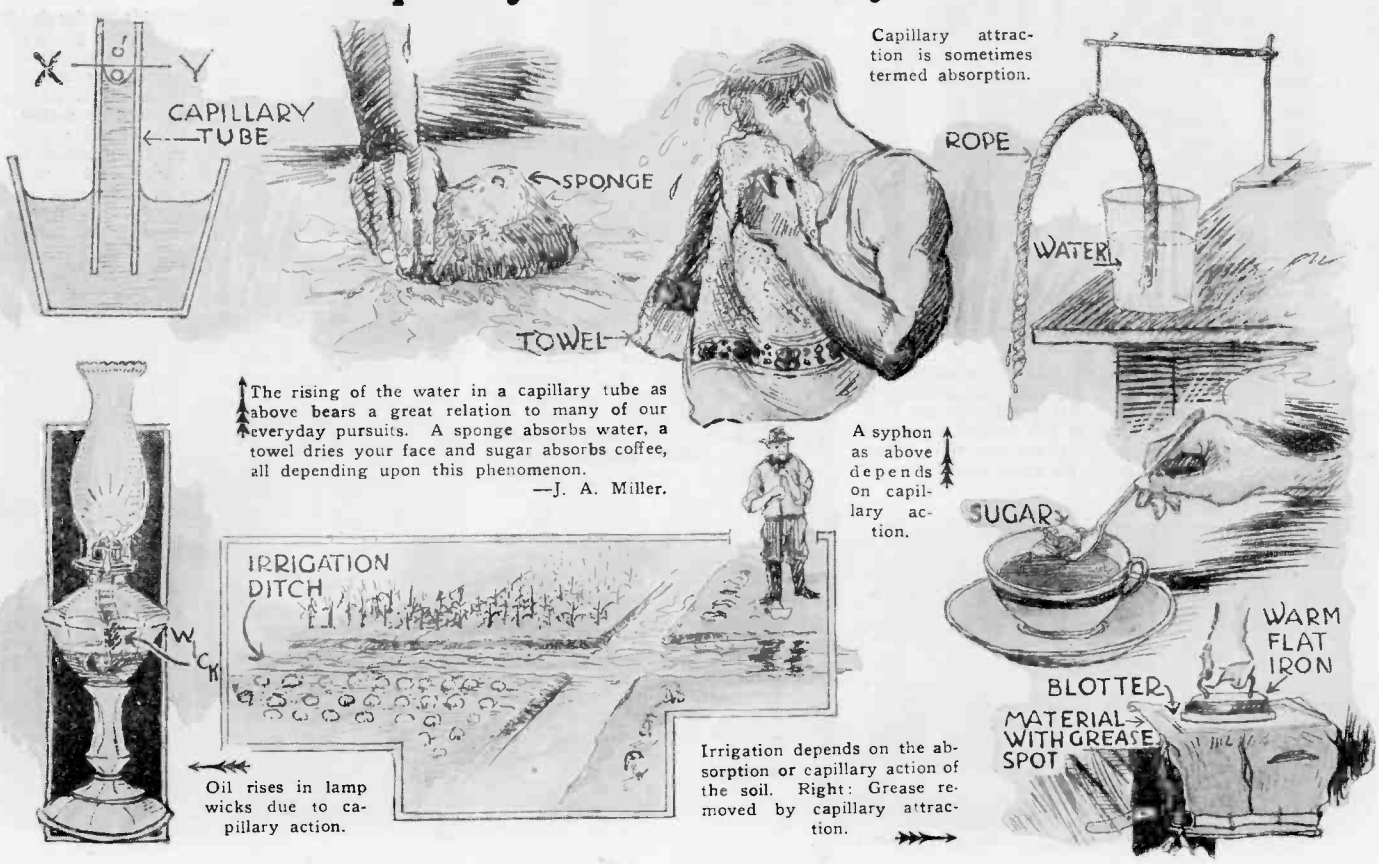
# Novel Wind Turbine






A novel wind turbine of French origin has recently been developed. The device is illustrated in detail above. The drawing at the left shows the power plant in actual operation under working conditions, and the one at the right shows a complete cross section of the working parts and detail thereof. Wind enters the front, is concentrated through a cone shaped entrance and a stationary series of vanes against the first rotor. This it turns and then proceeds to the second rotor. Here it is reinforced by wind entering the second opening and is again concentrated on a rotor. The procedure is followed throughout. The rudder keeps the entire device facing the wind.

# Capillary Action in Daily Life




The rising of the water in a capillary tube as above bears a great relation to many of our everyday pursuits. A sponge absorbs water, a towel dries your face and sugar absorbs coffee, all depending upon this phenomenon.
—J. A. Miller.

Capillary attraction is sometimes termed absorption.

A syphon as above depends on capillary action.

Oil rises in lamp wicks due to capillary action.

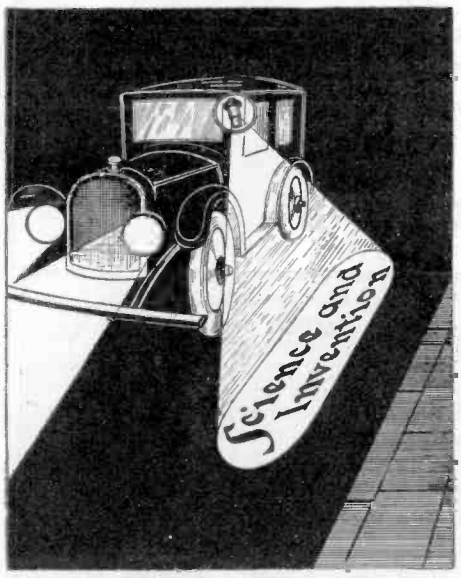
Irrigation depends on the absorption or capillary action of the soil. Right: Grease removed by capillary attraction.

# Novel French Inventions


Taking advantage of the fact that light passes through eggs in a proportion governed by the quality of the egg, the above illustrated cup has been invented which by means of a mirror in the base indicates the quality of the egg. No more need the housewife laboriously mix mayonnaise dressing by hand. The device at the left does this work, being actuated by a water motor. The flow of ingredients from the funnel may be regulated as desired.

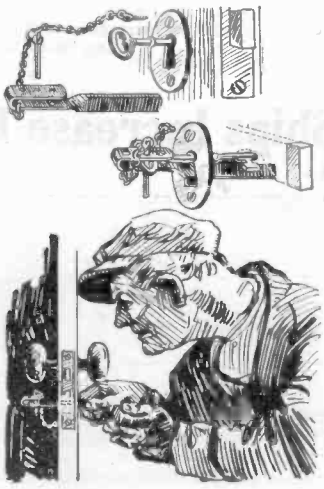
When leaving the home for the week end, you need not worry that your plants will die for lack of water, if they are planted in a flower pot such as illustrated at the right. Water is fed by a wick from a reservoir to the soil.

## Advertising Sign



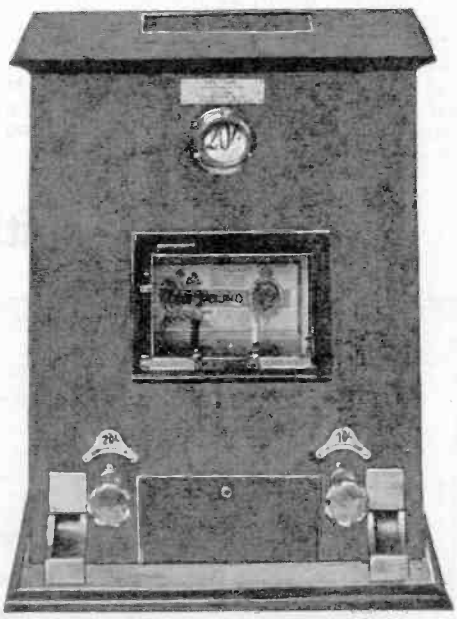

The great attractive value of open air advertising signs is well known. Advantage is taken of this fact in the design of the novel advertising sign illustrated directly above. Here a small projector is attached at an angle to the side of an automobile. Within it is a powerful light and a slide containing the advertisement. The illustration or wording is projected on the pavement in such a manner that it may be easily read by pedestrians. Obviously, such a sign will attract a great amount of attention, particularly on the less crowded thoroughfares.

## Key Lock



Even though doors are securely locked in the ordinary manner, still if the key is left in the lock, a burglar can work it out and pick the lock in the usual manner. If, however, the key is provided with a locking arrangement such as illustrated above, the door will be securely fastened and it will be impossible for an intruder to remove the key from the other side of the door and so proceed to pick the lock. A metal strip is inserted in the lock and holds the key so that it cannot be turned. Furthermore, a pin inserted in the metal portion holds the key firmly.

## Money Changer



A new device for changing bills has recently appeared in public places in England. It consists of a burglar-proof box, capable of making change for one and five-pound notes. These devices are of particular value in small stores where change for large bills is not always available. The machine is protected against counterfeit bills by the responsibility of the owner of the place of business in which the machine is installed. A small fee is charged the proprietor for the installation of the device and it is found to be of great assistance to him.

# Automobiles Use Less Gas On Hills

EXPERIMENTS recently conducted at the Iowa State College to determine the maximum rate of grade that may be permitted on a highway without materially increasing the consumption of gasoline on the part of automotive vehicles, revealed the astounding fact that an automobile actually uses less gasoline on moderately hilly roads than on roads that are practically level. Of course, this does not hold true on long steep hills where the gears must be shifted to ascend, or where the brakes must be used to prevent the car gaining too much speed when descending. It must furthermore be realized that this statement is founded on an average taken during tests. The reason for this remarkable fact is that the efficiency of the automobile engine increases as the load increases, as when ascending hills. —Prof. T. R. Agg.

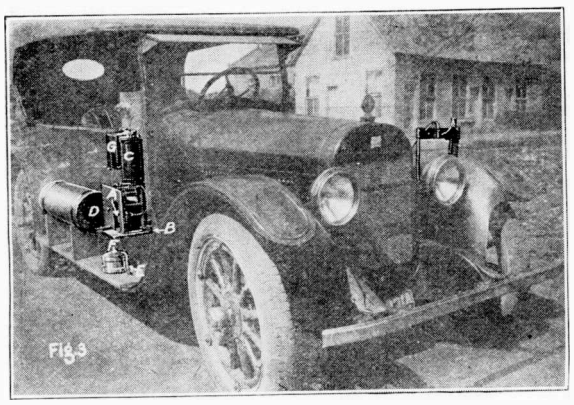
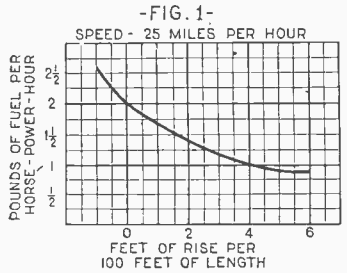
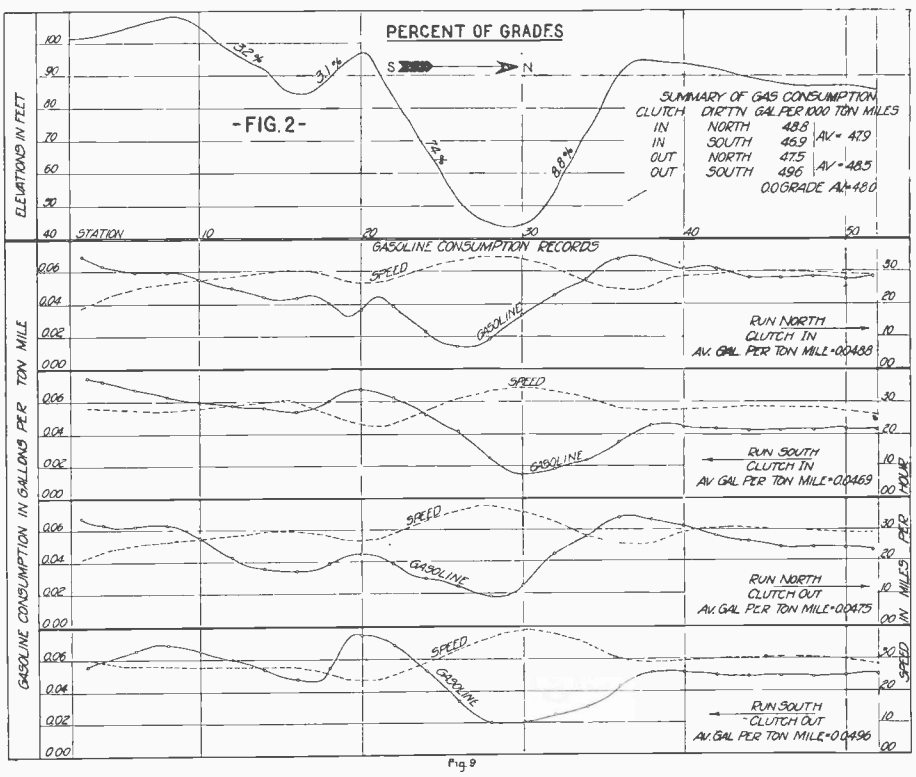



Fig. 3 above shows the apparatus installed on a standard touring car to be used in determining the exact consumption of gasoline during the tests. The device over the left-hand headlight is a Pitot tube for determining air speed so that this factor may enter into the final calculations. A specially designed flow meter illustrated at A and B measures the gasoline taken from the tank D, through the vacuum tank C to the carburetor, while a spark coil G furnishes sparks for perforating a paper record of distance, operated by cable E. F is a clock mechanism used for timing.

-FIG. 1-

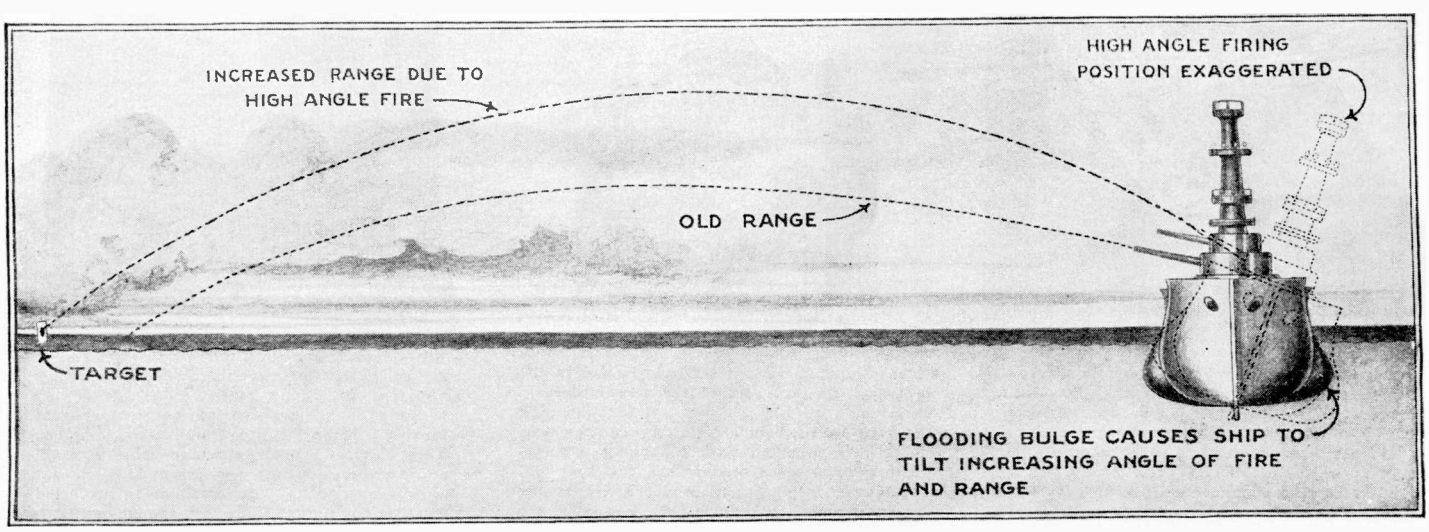



The chart given in Fig. 1 directly above shows how gasoline consumption in standard type of automobile diminishes as a grade is encountered and as the speed of the automobile is kept constant by the driver. This is an important factor, as otherwise, if the car were not kept at a constant speed, other determinants would enter into the calculations which would greatly affect the accuracy of the final results. From the chart it will be seen that a car traveling at 25 miles per hour will consume about one-half as much gasoline on a 4% grade as on the level.



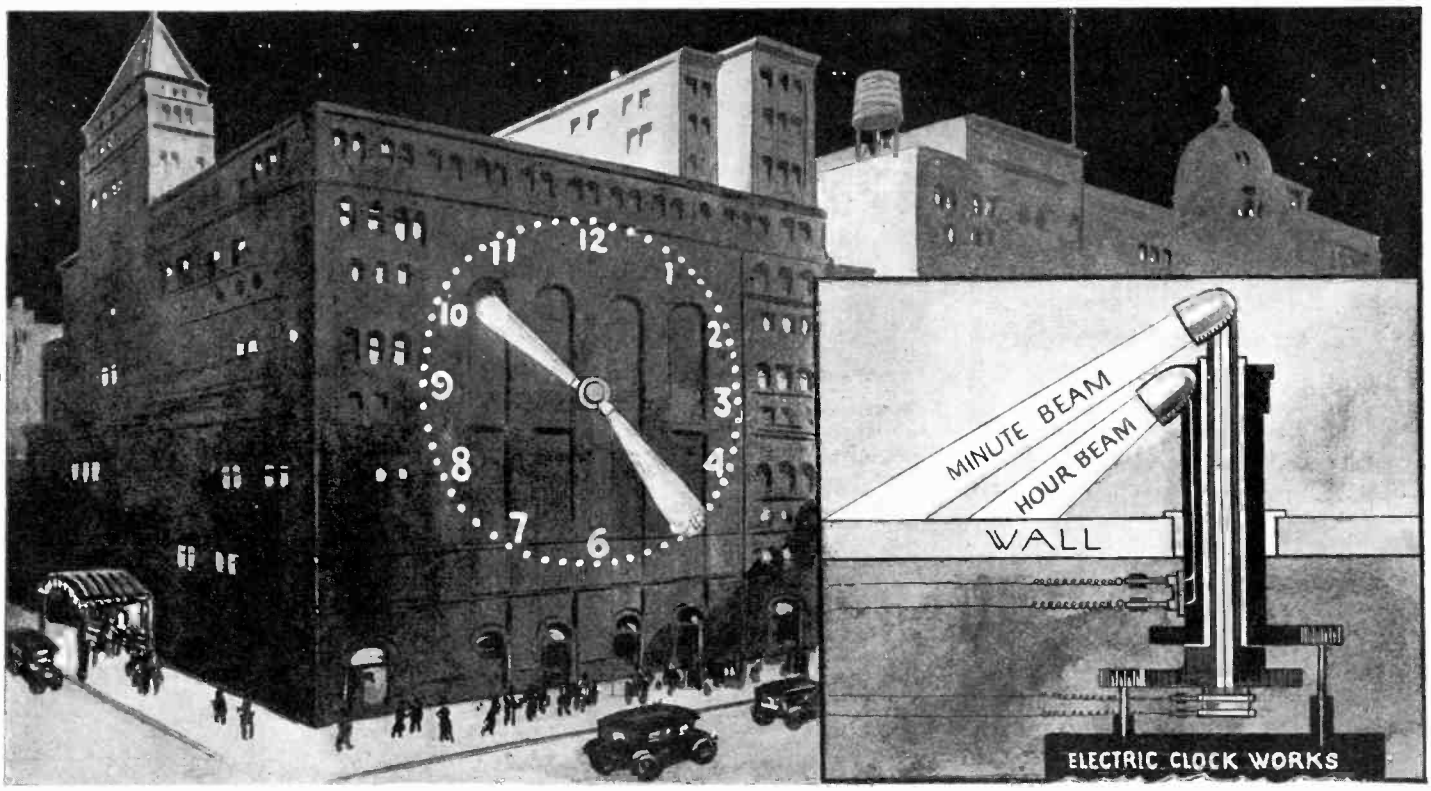

The five charts directly above in Fig. 2 give the results of a series of tests over a measured course. The terms "clutch in" and "clutch out" refer to the fact that when descending hills, the clutch was either engaged or released according to the respective terms used. These charts make an interesting study to anyone interested in automobiles.

# How British Ships Increase Firing Range



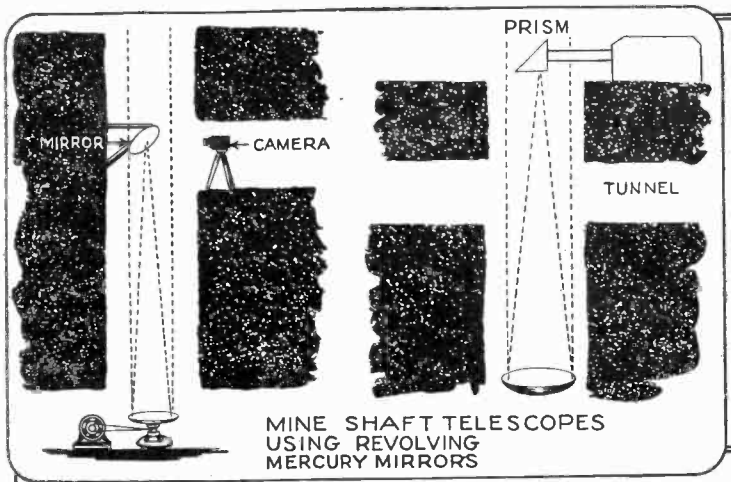

Supposedly secret details of the construction of the Nelson and Rodney, two new British battleships, have recently been disclosed by the United States Naval Intelligence Department. The most important of these is the fact that the ships are equipped with "bulges" on the sides which may be flooded as desired in order to cause the ship to list to one side or the other, thereby increasing the supposedly fixed maximum angle of the guns as illustrated above, giving these guns a much greater firing range and hence making them more effective in battle.

# Light Ray Hands for Clocks

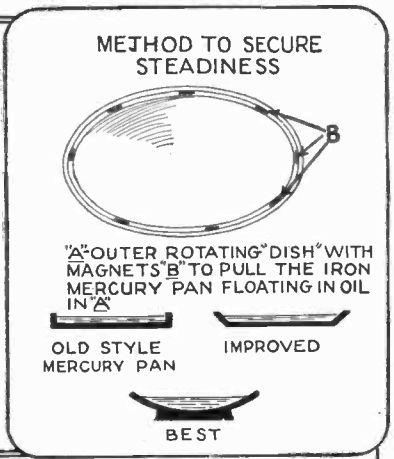


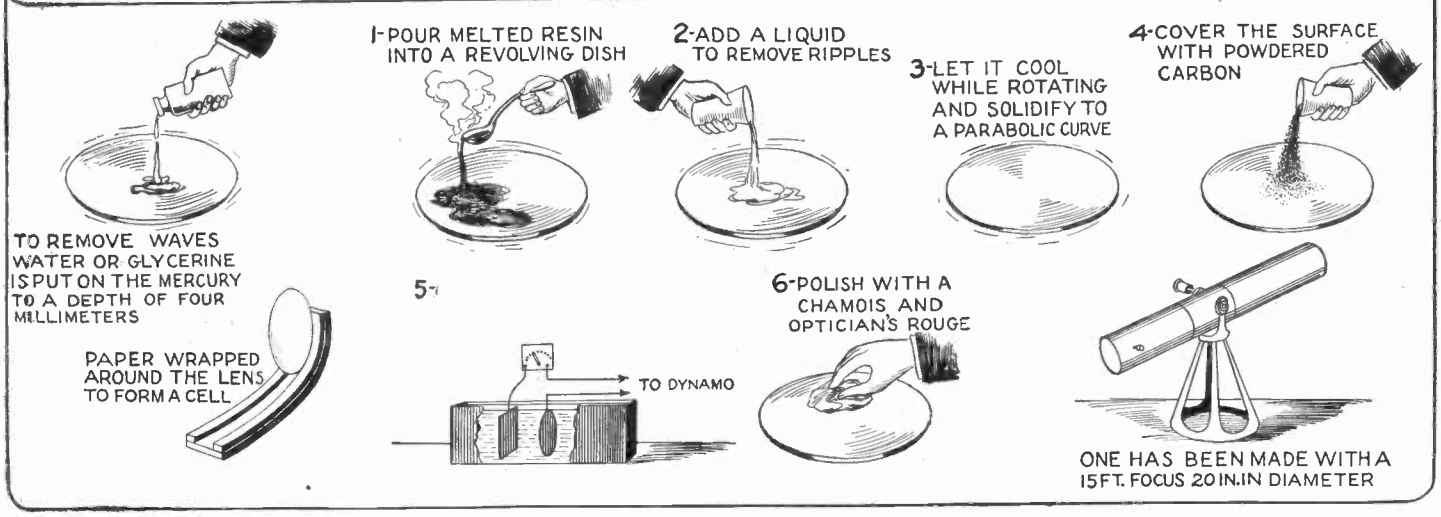

Large clocks have huge bulky hour and minute hands weighing several tons each. These hands may be substituted by spotlights and any window could be employed for installing the clock mechanism, because it is compact. The hour numerals may be painted on the sides of the building.

# Simple Telescopes




On this page are shown several ideas for practical, easily constructed high-powered telescopes. At the left the method of constructing mine telescopes is illustrated. Here an iron pan containing mercury floats in a pan of oil. The mercury pan is revolved rapidiy and a perfect mirror is produced. Water or glycerine is poured on top of the mercury to take out the ripples. A glass lens can easily be wrapped for inserting into a tube as indicated elsewhere on this page and the system of constructing a parabolic mirror is described in necessary detail. In Fig. 5 below the method of depositing copper on the resin "mirror" and plating the copper with nickel, is illustrated.—C. E. Payne.



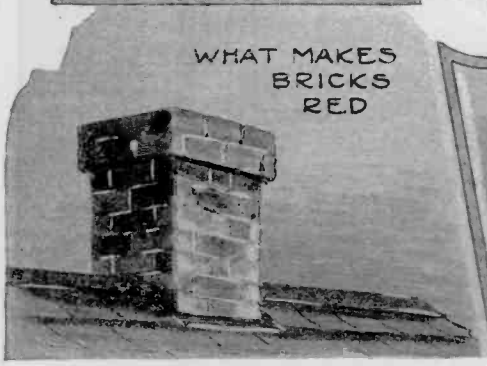
# Everyday Chemistry

By RAYMOND B. WAILES


Usually with acetone and oil of quassia, a bitter ingredient.

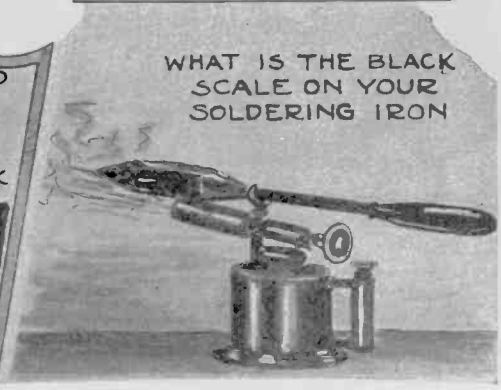

By "watering" with a calcium chloride solution. Keep in stoppered bottle.


A combination of zinc and stearic acid, a harmless acid of animal origin.

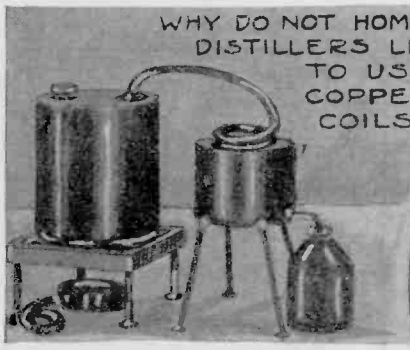



Bricks are usually red because of their high iron oxide content.


No, they contain iron and other oxides which darken glass.




It is an accumulation of copper oxide formed by the union of the copper with the oxygen of the air.




Because the distillate is likely to be poisoned by copper compounds.


Dissolve 2 ounces of oxalic acid in a pint of denatured alcohol.


No, there are very many others included, among them being glucose, levulose, arabinose, etc.


It is a by-product of the working up of sodium nitrate or Chili saltpetre.

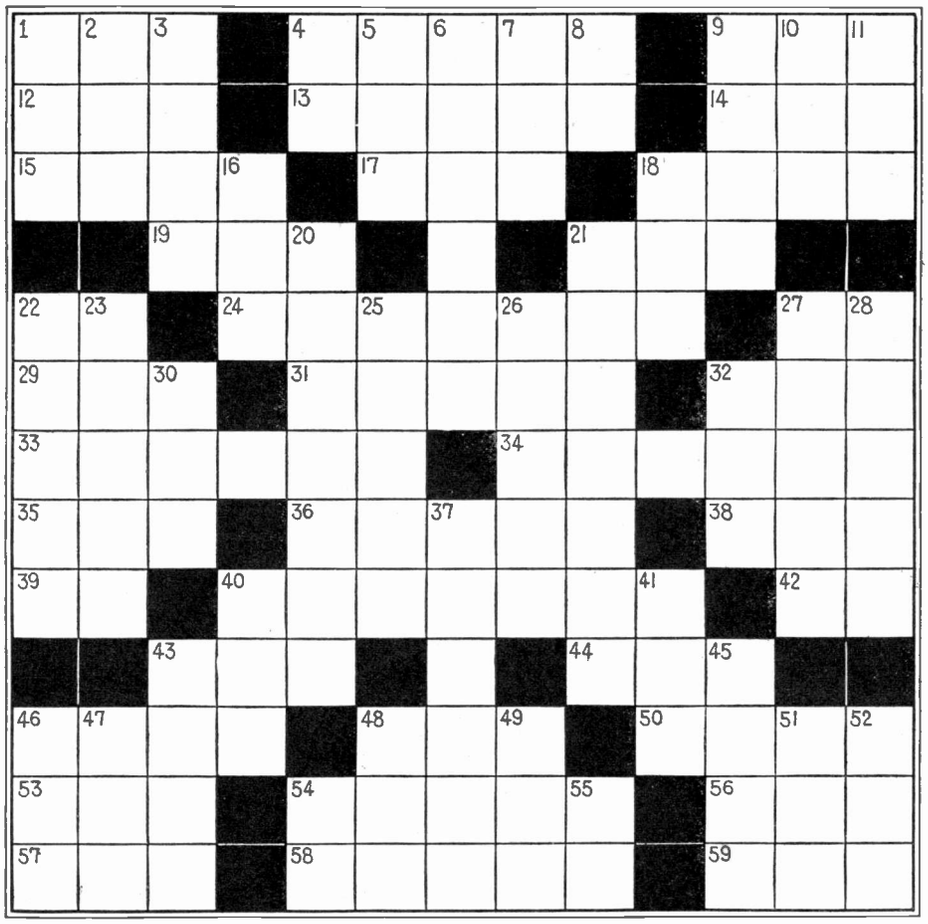

Many deodorants are mainly zinc chloride, an active ingredient of soldering fluids.


Moisten equal parts of barium sulphate, sodium bisulphate and ammonium fluoride. Spread over the glass and allow to stand.

# Mathematical Cross Number Puzzle

By RICHARD HOADLEY TINGLEY

Here you are, cross-word puzzle fans, here is a puzzle that will tax your ingenuity to the utmost. The answers are given on page 188, but for your own sake do not refer to them until you have finished the puzzle or exhausted your fund of information. This puzzle is radically different from the usual type in which letters are inserted in blank space to form words. In this one, definitions are given which by dint of hard thinking can be worked out into numerals which numerals are inserted in the correct order in the blank spaces and which will line up both vertically and horizontally in the same way as the letters do in the ordinary cross-word puzzle. The first answer, 1 horizontal, is 212. We have named this new brain teaser "Cross Number Puzzle" and believe that it will meet with your favor. Let us know how you like this innovation.



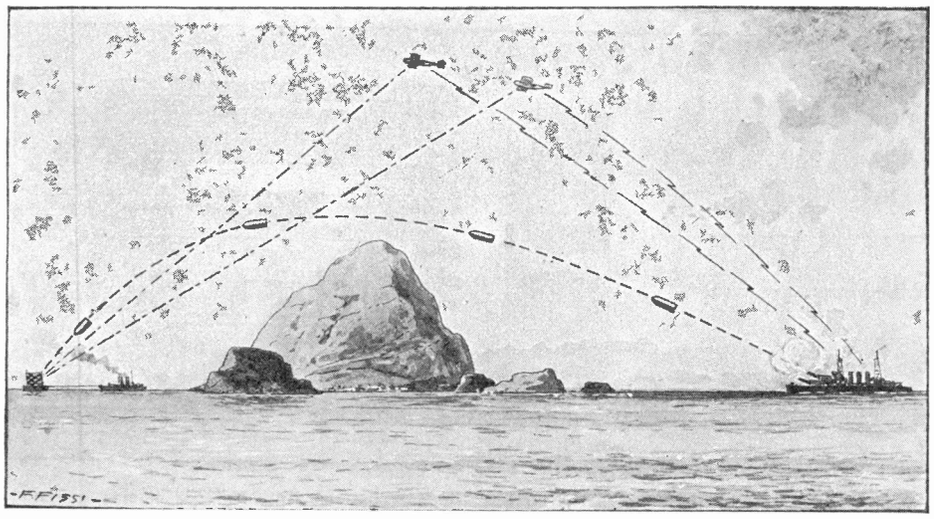
### HORIZONTAL

1—The boiling point of water.
4—The Greek letter "pi." Place a decimal point after the first number.
9—The square root of 30,000; nearest whole number.
12—One per cent. of the number of pounds in a short ton divided by M.
13—Multiply thirty-two one-hundredths by one hundred and forty-seven thousandths.
14—Nil.
15—Three-quarters of a gross divided by ten thousand, carried out to four decimals.
17—Four C's in a row.
18—Twenty-three times ninety.
19—One and ninety-eight one-hundredths divided by three X's.
21—Twenty quires of paper.
22—Skidoo.
24—Seven hundred feet more than a hundred miles, in inches.
27—Call it eleven or two, as you please, it makes no difference.
29—Chemical symbol for didymum.
31—Fifty-one and one-third furlongs in feet.
32—The ten century mark, minus one.
33—Subtract one from DC, multiply by M, then add the number of days in a year—not a leap year.
34—201 yards, 2 feet and 3 inches more than eleven miles, in inches.
35—The square of the so-called unlucky number.
36—Add one thousand feet to a mile and divide by 100,000.
38—Fifteen less than a gross of baker's dozens.
39—The square of the number of days in a week.
40—Take 52,554,533, multiply the digits together, then multiply by 89.
42—One less than the number of cards in a deck.
43—One-tenth of the abbreviation for the doctor.
44—Divide the number of years one must live before attaining a majority by M.
46—Mil.
48—The seat of the Federal Government.
50—The third musical note.
53—A dozen dozen.
54—Take 2,232,327,232 and multiply the digits together.
56—Three goose-eggs.
57—The square root of 40,000.
58—Thirty-three and one-half long tons.
59—The square of twenty and twenty-five hundredths.

### VERTICAL

1—One-tenth of a short ton.
2—The sum of money a dollar would be worth at 4 per cent. compound interest in five years.
3—A double millennium.
4—The number of cents we sometimes look like.
5—Square inches in a square foot.
6—Square inches in twelve square rods.
7—Par.
8—Half a cord.
9—M.
10—Natural sine of 45 degrees—or the cosine.
11—Three C's.
16—Natural cosine of 30 degrees.
18—Twenty stone.
20—One hundred miles in inches.
21—Area of a field 2.000 feet square.
22—128 rods, 4 yards, 2 feet and 2 inches reduced to inches.
23—711 feet less than six miles.
25—An acre in square feet.
26—Area of a lot 174.214 feet by 280 feet.
27—Area of a path 15 feet wide and 37 feet less than a quarter of a mile long.
28—303 cubic inches more than eleven cubic feet.
30—CIC.
32—307 yards in feet.
37—The square of D.
40—17 times 27.
41—Seven per cent. of three-tenths.
43—Ten gross.
45—Add four to the millennium.
46—Eight stone.
47—Four per cent.
48—Square V, then square the result.
49—Divide XCIV by M.
51—Divide the first person singular pronoun by M.
52—Chemical symbol for carbon.
54—A third of the atomic weight of vanadium.
55—VI multiplied by X.

(*Answers on page* 188)



Our illustration above clearly depicts the adverse conditions under which the battleship "Tennessee" undertook target practice off the Californian coast. The relative position of the observation planes, the target and the battleship are indicated.

## Shooting Over a Mountain

THE super-dreadnaught, Tennessee, recently completely overhauled, engaged in target practice off the Pacific coast which practice was spectacular on an enormous scale. Cruising near the island of Santa Barbara off the Californian coast, she hurled 1,400-pound projectiles from her 14-inch guns over the mountains of the island mentioned above and scored on a moving target situated on the opposite side of the island from the battleship and 20 miles' distant, even though the target was totally invisible to the gunners. The secret of this amazing feat lies in the fact that the Tennessee carries with her two small fighting planes which can be launched from her decks and which cruised above the island as illustrated at the left, radioing the position of the target to the battleship and thereby directing the gunners.

# THE CONSTRUCTOR

## Sheet Metal Fishing Punt

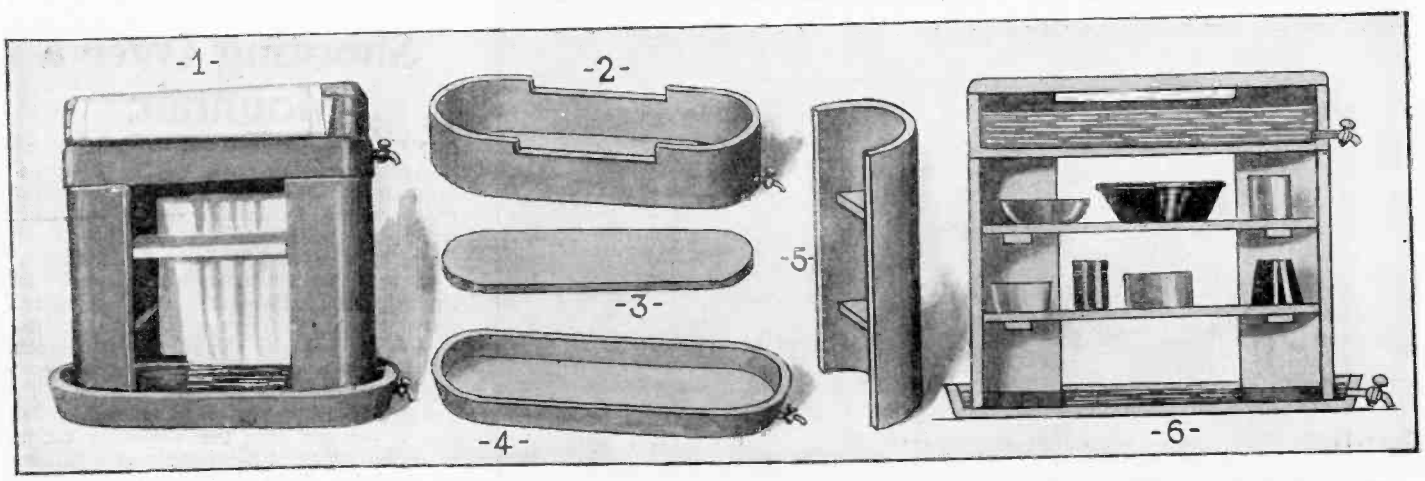
By L. B. ROBBINS

We give herewith the constructional details of a serviceable river punt that can be built of a few pieces of board and some galvanized sheet iron. It will carry two passengers comfortably and calls for no skill in carpentry in its construction.




In the construction of this boat, first cut three forms from one inch cypress for the end and center blocks. Place two about ten feet apart with the third in the center, and fasten the keel in place with wood screws. Then fasten the gunwhale and bilge strips as shown, taking care that the surfaces of all the strips come flush with the edges of the forms. The outside covering of this boat consists of a single sheet of light gauge galvanized iron ten feet long and somewhat over four feet wide. Coat the edges of the form with white lead and lay a one and one-half inch wide strip of flannel soaked in white lead over the edges to prevent leakage. With an assistant, lay the sheet iron over the frame and fasten in place with 1½-inch galvanized screws, placing them 2 inches apart. Bend the iron over the gunwhale strips and fasten with wire nails. Deck over each end of the boat and insert a seat as shown. Oarlocks and a thorough coat of paint complete the boat.

## An Iceless Refrigerator




For use in warm climates and during the summer months in temperate zones, the iceless refrigerator illustrated above is handy and economical. 1 shows the completed assembly with the strip of cloth rolled up. 2, 3, 4 and 5 show the concrete castings to be made. Two ends such as illustrated at 5 are necessary. These parts are assembled as shown in 1 and 6. A cloth is laid over the top tank, its ends dipping in the water in the lower tank. Evaporation keeps any materials placed on the wooden shelves cool and also cools the water in the upper tank which may be used for drinking purposes. Two faucets should be molded directly in the concrete block.

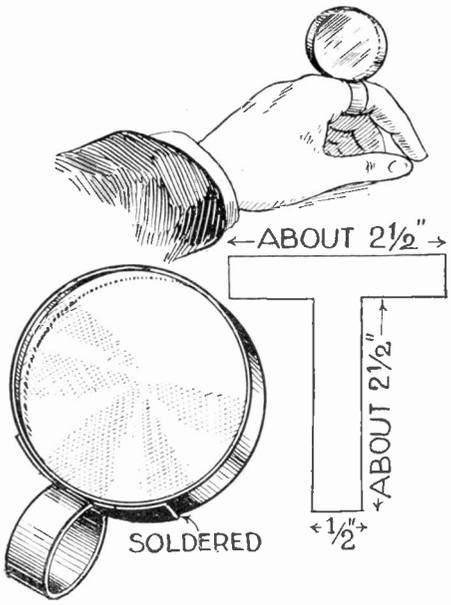
—Ruth D. Shultis.

# HOW TO MAKE IT

## Water as Weights

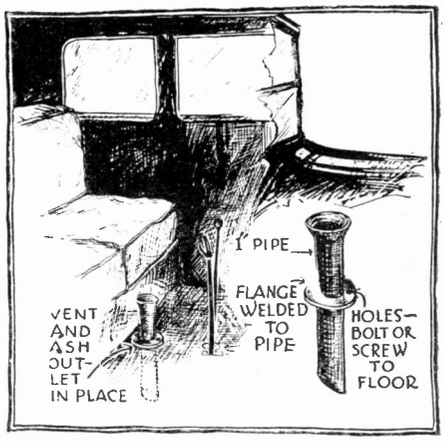

The experimental chemist whose supply of graduated weights is limited may use water instead. Place a graduate on one pan and a weighted box on the other to balance. Then each cubic centimeter of water in the graduate will balance one gram in the opposite pan.
—C. A. Oldroyd.

## Glass Holder



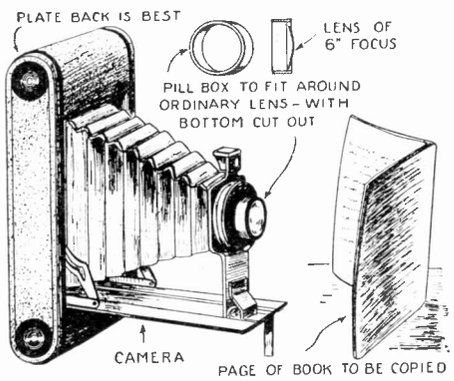

When reading fine type or doing other work which requires the constant use of a small magnifying glass, the usual handle with which these glasses are equipped is rather awkward and tires the hand. If a strip of metal is cut to a T shape with the dimensions shown above and soldered to the metal rim surrounding the glass, the combination may be used as shown.
—Truman R. Hart.

## Car Ventilator




A combination ventilator and ash receptacle for the closed car may be quickly made from pipe fittings as shown above. A 1 inch or larger pipe is flared out at one end and a flange welded to it as shown. The lower end of the pipe is cut off at an angle. Mounted in the floor board as shown, this accessory is very handy as an ash tray and also serves as a ventilator.
—Thomas McCartie.

## Copying Lens

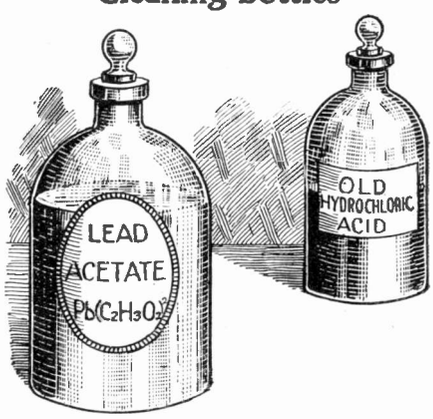



A lens of 6 inch focal length mounted in a pill box and placed over the lens of an ordinary hand camera enables the operator to use the same for copying work. It is best to focus on a ground glass as otherwise it will be necessary to experiment for the correct position.
—Don Home.

## Paint Brushes

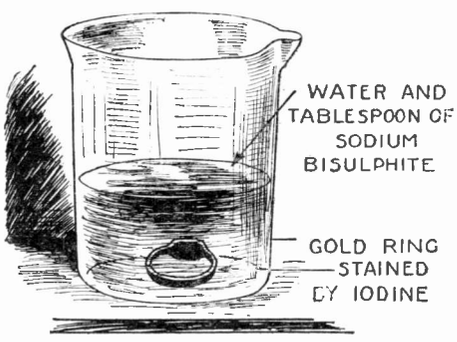

When doing painting where two or more different sizes of brushes are required, one of them is often allowed to remain in the paint can, and when required again it is found that a good portion of the handle is covered with paint both from that dripping down the sides of the can and that in the bottom of the container. This can be eliminated if a hole is drilled in the handle of each brush to be used and a stiff piece of wire provided for suspending the brushes as shown in the above illustration.
—C. C. Sorensen.

## Cleaning Bottles



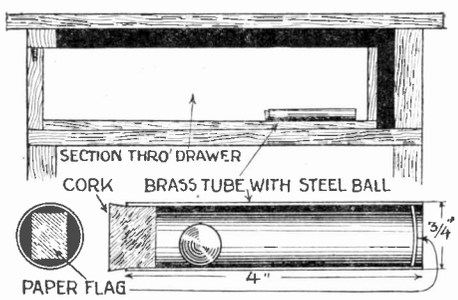

When reagent bottles have been allowed to stand, they are often hard to clean. However, if some old waste hydrochloric acid is placed in the bottle and rolled around the sides it will quickly dissolve the deposit. The bottle is then washed as usual.
—Carlyle Weiss.

## Cleaning Rings




If a gold ring or coin which has been stained with iodine is immersed in a solution of sodium bisulphite for about 15 minutes, the stain will disappear.
—Franklin Price.

## Mechanical Detective



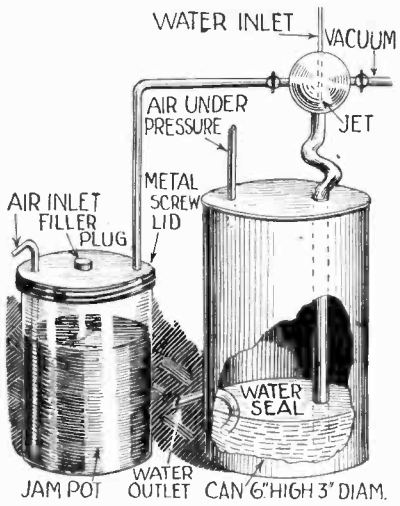

To find out if anyone has opened a drawer during one's absence, make the little device shown above, closing one end of the tube with a small paper strip. If the drawer has been opened, the paper will be found out of the tube.
—C. A. Oldroyd.

# WRINKLES

## RECIPES & FORMULAS

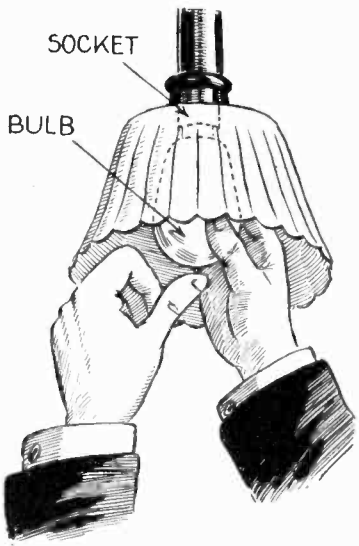
Edited by S. Gernsback

### Air Pump



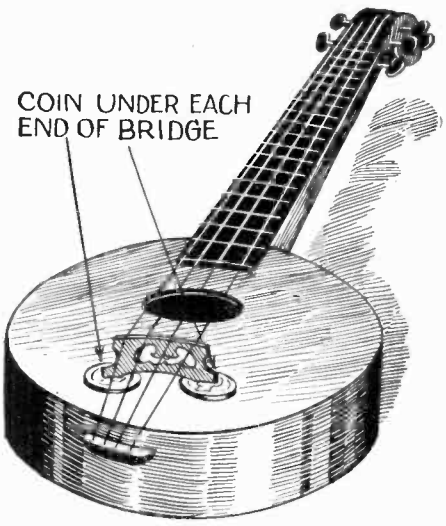

The apparatus illustrated above is to operate by water pressure from the mains and will serve several purposes in the experimenter's laboratory. With water flowing through the jet and the left hand cock closed, a vacuum is created or compressed air is obtained at the points shown, Close the right and open the left cock and vapor can be obtained from any liquid contained in the small jar.—Don Pedder.

### Inserting Bulbs



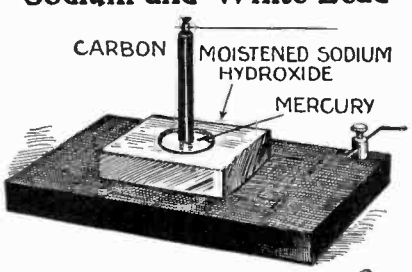

A simple and safe method of taking out and putting electric light bulbs into sockets is illustrated above. Rest the glass tip of the bulb on the thumb and screw the bulb in with the other hand. The thumb prevents the bulb from falling. —Sidney Lang.

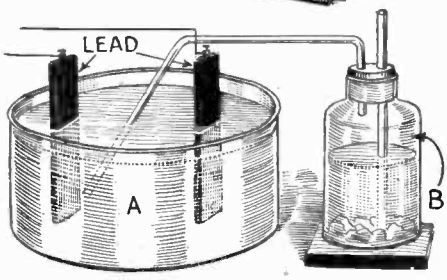
### Musical Wrinkle




If two coins are placed under the bridge of a banjo ukelele in the positions shown in the illustration above, the tone given out by the instrument when played will be found to be of a far better quality than before the addition. Not only will the tone be richer, but if large coins such as half dollars are used, the chords will be much softer.—F. Cariveau.

### Sodium and White Lead

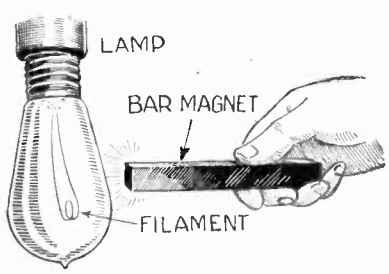



Place a block of moistened sodium hydroxide, in which a small cavity has been made, upon a carbon slab. Fill the cavity with mercury and insert a carbon rod in the position shown. Connect to an electric potential of about ten volts and a sodium amalgam will be formed in the cavity. By evaporating the mercury in a vacuum pure sodium will remain.

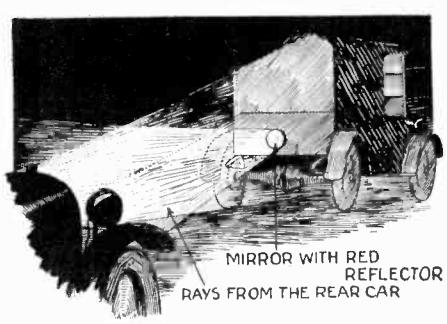
The apparatus shown in the lower part of the above illustration is for the precipitation of white lead. B is a carbon dioxide generator. Liquid A consists of 12 grams of sodium chlorate and 3 grams of sodium carbonate dissolved in one liter of water. Two lead plates are suspended in this solution and connected to a 10-volt source of potential. Direct a stream of carbon dioxide against the cathode. White lead will be precipitated near the anode. Stir the electrolyte constantly. —L. Preisman.

### A. C. or D. C.?




If a bar magnet is held near the filament of a carbon lamp, and D.C. is flowing through that filament, it will bend toward the magnet as shown. If the current is alternating, filament will vibrate. —J. F. Kasak.

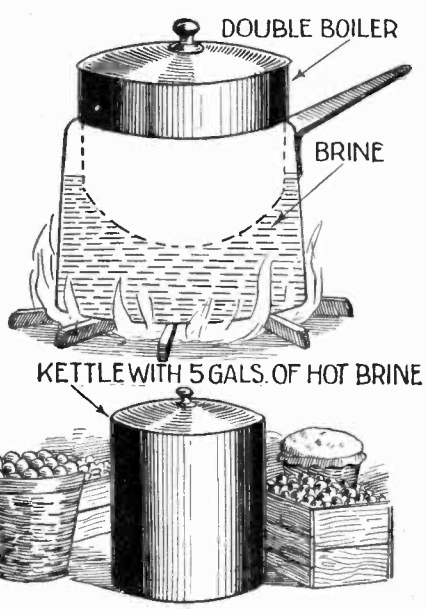
### Warning Mirrors




In case your tail light should go out, you need not be afraid of a rear-end collision if your car is equipped with a red-backed mirror as shown above. Approaching headlights will be reflected toward the driver of the coming car, thereby warning him.

—Martin B. Beline.

### Uses for Salt




As above, using a saturated brine solution in a double boiler will cook cereals quicker because of the greater heat of the brine at its boiling point. When it is thought that foods in a storeroom may freeze over night, salt will aid in preventing this catastrophe. Fill a five-gallon kettle or covered can with a hot, strong, brine solution and place in the room with the perishable material. The heat given out by the brine in cooling will tend to keep the room above freezing.—G. Morgan.

# Readers Forum

**SCIENCE AND INVENTION** desires to hear from its readers. It solicits comments of general scientific interest, and will appreciate opinions on science subjects. The arguments pro and con will be aired on this page. This magazine also relishes criticisms, and will present them in both palatable and unpalatable forms. So if you have anything to say, this is the place to say it. Please limit your letters to 500 words and address your letters to Editor—The Readers Forum, c/o Science and Invention Magazine, 53 Park Place, New York City.

## NEEDED INVENTIONS

*Editor,* SCIENCE AND INVENTION:

Your editorial entitled, "Needed Inventions," in the February issue of SCIENCE AND INVENTION, revived some of my old reflections, especially regarding the "time honored," useless, uncomfortable and, to say the least, unsanitary piece of men's wearing apparel, the collar. Your suggestion about the need of a preserver, to do away with the saw-edge of the collar, is timely, but pray, why have the collar itself? Why not discard the nuisance altogether? Haven't the men been enslaved to that bull nose-ring, the collar, long enough? Yes we badly need a "preserver," which will do away not only with the saw-edge, but with the yoke itself.

In order to appear dressed up *a la mode,* the poor man is compelled, even in the hottest summer day, to stick to the "time honored" tight band of an old rag, which in itself has not a little propensity to stick only too "wiltingly" around his long suffering neck, leaving little or no room for ventilation and drainage of free perspiration, and apparently, if not actually, choking him almost to death; at the same time being uncomfortable as he is, and suffering untold miseries of both mind and the body, he pretends to "look pleasant" and even attemps to smile, especially when in company of ladies, who not being such darn fools as he is, wear little or no bondages around their necks, and still get away with it.

Another nuisance with which the wee man has to put up with is the everlastingly elusive collar button. If there is anything in this world that has more magical propensity to disappear out of one's hold than that infernal slick little article—the collar button—I would like to know. What usually follows upon its disappearance is only too well known to every man, and the woman soon finds out too, if she happens to be on the premises at that time. Were it written down how men commend the beautiful collar and the magical collar button, and praise their inventors, both when alone and in the presence of the fair sex, especially when the belt of self-restraint breaks, which it usually does, it certainly would fill volumes of curious, if not very aesthetic reading. With thousands of my fellow sufferers I cry: O inventor, deliver us from the slavery of the collar and its appendage—the collar button.

A MERE MAN,
Braddock, Pa.

*(We are with you to a man, but as long as fashion decrees that men must wear collars, then we "mere man" can do nothing to gainsay that worthy lady, (or is fashion a gentleman when men's wearing apparel is considered?) Consequently we men must be tortured with collars and elusive collar buttons with very little hope that a collar button retriever will ever be designed and but few expectations that the saw-tooth effect of collars will be eliminated, possibly by some sort of buffer, shaper or finisher.*

*But jesting aside, the semi-soft collar comes closer to our fondest dreams than anything previously designed. Let us hope that man will be the creator of his own fashions instead of following the dictates of a few so-called "fashion creators."*

*Let us start an organization called "Society for the Emancipation of White Collar Slaves."*—EDITOR.

## BACKS PERPETUAL MOTION

*Editor,* SCIENCE AND INVENTION:

In the "Readers Forum" of your January issue I was attracted by the letter and reply headed, "A Suggested Debate." The point Mr. Timblin made by comparing perpetual motion to creation of life did not impress me very favorably, nor did the last paragraph of your reply.

I should like to enlist in Mr. Timblin's cause, for after all, what harm can come by trying to construct perpetual motion machines? I believe that, as the cross-word puzzle is to one's English so is perpetual motion to one's mechanical and mathematical education. I once spent seven consecutive weeks studying the subject, and will testify that I learned more about mechanics than in as many years in grammar school. And may I say without fear of criticism that while working upon some original theory for the impossible (?) perpetual motion, one may stumble upon the secret of inexpensive tide power or bring to light some other great unharnessed force.

Perpetual motion has not been proven. Has it been disproven? Which would be more difficult? Let's go back one hundred years and see how we would have fared trying to prove or disprove the theories of radio, automobile and aviation. "Oh, well, that's different!" But was it any different?

It is surprising that SCIENCE AND INVENTION does not offer some prize for such a device, rather than for spirit manifestations. I am quite sure it would serve humanity far better.

L. KELSEY,
New York City.

(SCIENCE AND INVENTION MAGAZINE *does offer an award for perpetual motion machines. This publication has repeatedly come out with the flat-footed statement that such a thing as perpetual motion is impossible. It is contrary to the laws of mechanics, and if once developed, it would of necessity overthrow basic laws upon which entire principles of mechanics are based. The amount of the award offered for a perpetual motion machine is* $5,000, *and this publication claims no rights to the invention whatever. As soon as a machine is exhibited which will come under the conditions of our contest, which conditions are merely that it is a perpetual motion machine, and that there is no trickery involved in making it operate, the award will be paid. This publication likewise is running a contest for spirit manifestations with a total in prizes amounting to* $11,000.00, *which will be paid to any recognized medium or other individual who can produce psychic manifestations or do any of the other tests specified in the contest rules and regulations. Here again we merely attempt to guard against trickery.*

*We can admit that working upon a perpetual motion machine does develop one's mechanical ability, and we do not deny that his mental condition may be improved by working upon such a machine. As a matter of fact after he stops working upon it, he will find out that he has learned a lot since the time he started. He also will probably learn that perpetual motion is an impossibility as far as he is concerned.*

*Tidal power plants are not perpetual motion; neither are those mechanisms which operate by differences in temperature, differences in barometric pressure or differences in the moisture content of air. Mechanisms can be made to operate using any or all of these forces. Working upon perpetual motion will not develop machines utilizing any of these forces.*—EDITOR.)

## GRAVITATIONAL ATTRACTION

*Editor,* SCIENCE AND INVENTION:

In the August 1923 issue of SCIENCE AND INVENTION, appeared a story, "The Man From the Atom" by G. Peyton Wertenbaker on page 329. In this story by means of an atomic machine, a man could grow to any size. The central character increased in size until the universes were dwarfed in comparison to him. Would not the enormous gravity of such a person draw everything headlong against him? Judging by the statement, "Every mass of matter in the universe attracts every other body directly as the mass and inversely as the square of the distance between them," it seems to me that this is what would happen.

Would a motor actuated by permanent magnets be eligible in your $5,000 prize contest for a perpetual motion machine?

T. M. MITCHELL,
Lancaster, Pa.

*(You are correct in your belief that two bodies attract each other directly as the mass, and inversely as the square of the distance between them. A man growing to an enormous size, much larger than this earth, would attract the earth which we may picture clinging to the sole of his shoes and as that man continues to grow, this world upon which we live will become relatively smaller and eventually become a mere pebble, a grain of sand or even dust in comparison. And as dust adheres to our heels, so would this earth adhere to a giant seemingly developed by means of the atomic machine as described in the story, "The Man From the Atom."*

*It is possible that a motor actuated by permanent magnets could be entered in our prize contest for perpetual motion. It depends on the particular type of mechanism which you have in mind. Currents produced by manually turning magnets in an electric field, would put such a mechanism out of the contest.*—EDITOR.)

## SCIENTIFIC PROBLEMS AND PUZZLES

*Editor,* SCIENCE AND INVENTION:

While on a farm for the past three weeks I had a chance to look over the December issue of your magazine. On page 784 are the Scientific Problems and Puzzles, which always call for my whole attention. I like them very much. I wish to let you know herewith that I found a much simpler solution for the problem No. 4, or the druggist and his beam balance. To weigh one ounce, he does not need the five ounce weight. All he needs to do is to weigh out two ounces of his powder, take the two ounce weight off the balance and divide this powder in two on the plates of the balance.

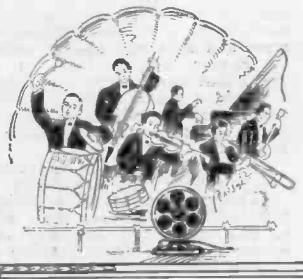
ALFONSO HERING,
Santiago, Chile.

*(The problem is here repeated.*

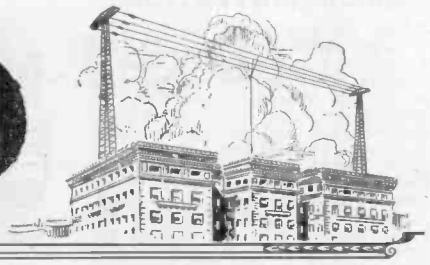
*"A druggist had a very good beam balance and he was called upon on one occasion to weigh out one ounce of powder. He found that he had accidentally misplaced all of his weights, with the exception of the two and the five ounce weights. With only these two weights, how did he manage to weigh out exactly one ounce of powder?"*

*The answer was: Place the five ounce weight in one pan and the two ounce weight together with enough material to balance the five ounce weight in the other. Thus one would have three ounces of the material. Then by putting the three ounces by itself on one pan and counterbalancing with the two ounce weight it would be a simple matter to add enough, namely one ounce, of the material to produce an equilibrium in the balance."*

*The method which you have suggested will of course serve the purpose and you are to be commended for this solution.*—EDITOR.)

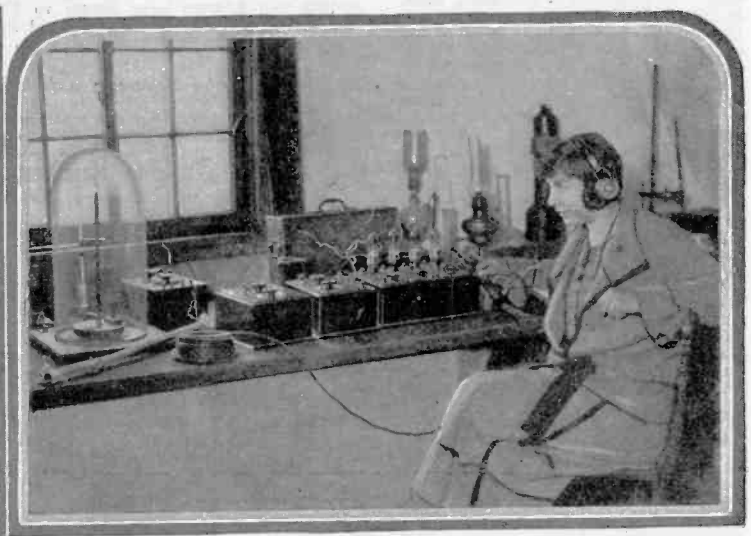


# RADIO

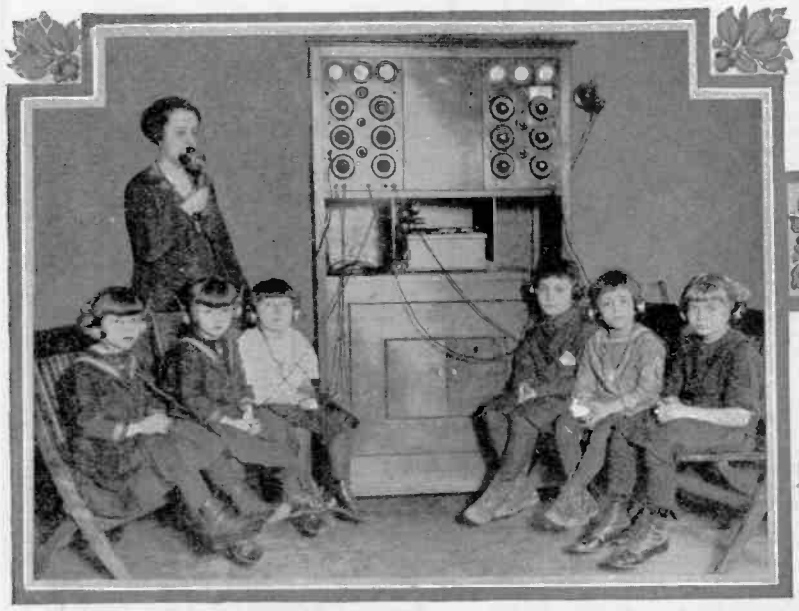


## Radio News in Photos

The above shows novelties in miniature radio sets. The top of the set to the left is removable, and candy is stored in the box. The dials consist of the male part of a snap fastener, and the bezels are made of eyelets. The loud speaker is made of metal and is an exact reproduction of the full sized ones. The only difference is that it cannot speak. To the right is shown a perfume radio set. The loud speaker which fits into the lid contains perfume, as do the tubes, also projecting through the lid. When placed in a lady's boudoir, they present a very pleasing appearance.



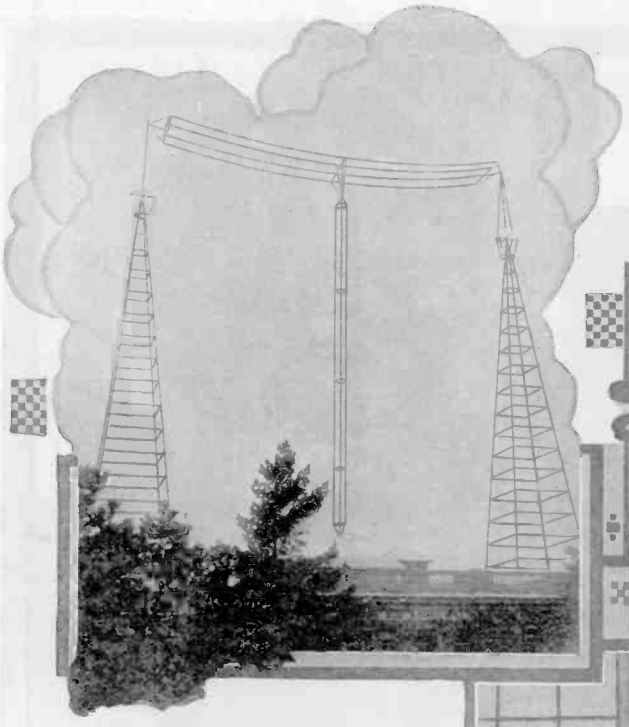
Miss Corder, daughter of the Rev. B. J. Corder, vicar of Radnage, Bucks, England, is shown operating an invention of the Rev. which will speed up ocean cable transmission. Since it takes large sums of money to lay an ocean cable, it is most desirable to get as much use out of them as possible. In the center of the picture is shown a special V.T. amplifier used in connection with the experiments. Capacity and inductive bridges are toward the left of the photograph. Standing in the bell jar is a very sensitive galvanometer used to record the slightest change of E.M.F. in the circuit. Rev. Corder has at last obtained what experimenters have been looking for, he has overcome the inductive and capacitative reactions encountered in oceanic cable transmission. This invention will help to speed up communication between foreign countries and the United States.



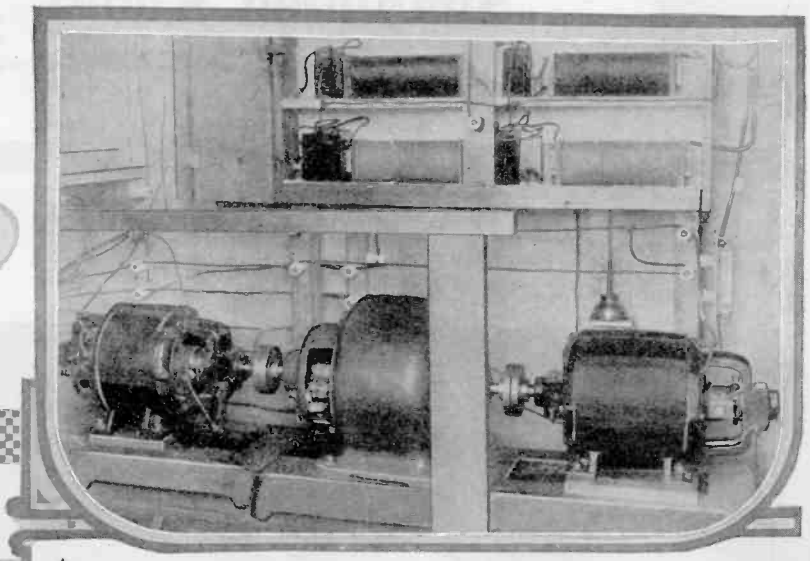
Children who have been previously totally deaf can now enjoy music, by the use of the apparatus pictured above. The new machine shown above, consists of a powerful amplifier to which is connected a phonograph so that the children may be able to hear music and also a microphone so that the instructress may speak to them.

This photo shows Claire Windsor, movie actress, operating one of the smallest practical, and yet complete radio receiving sets devised. The doll holding the receiver accentuates the novelty of the miniature set.

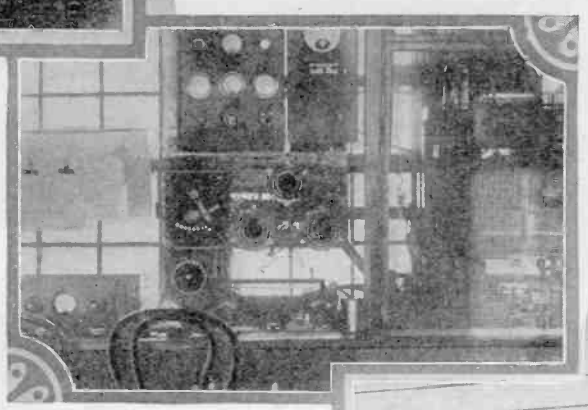
# College Radio

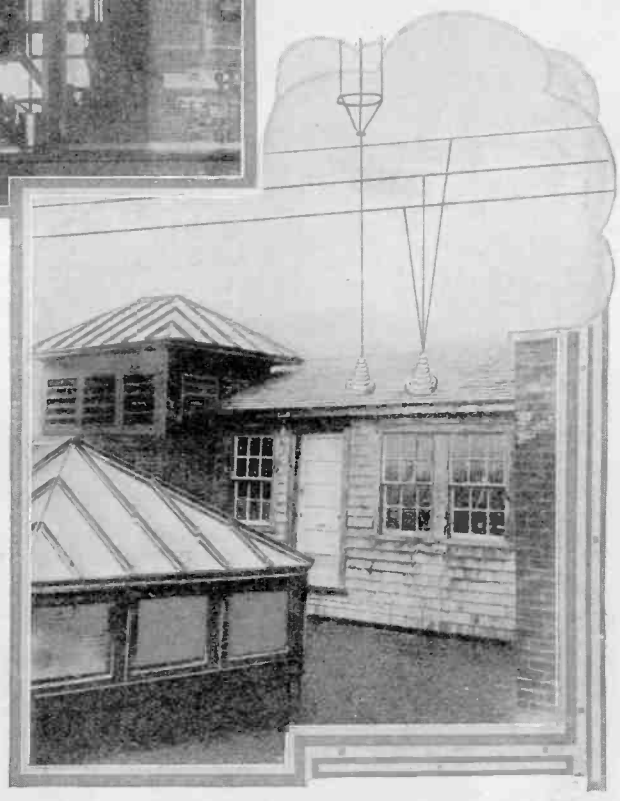


Station 1YB-1XAV, of Dartmouth College, Hanover, N. H., is one of the thousands of active amateur transmitting stations in the country. Its signals have been heard practically all around the globe, reports coming in from Italy, Africa, New Zealand and Australia. Under the capable direction of Dr. Elliott Adams White, one of the directors of the American Radio Relay League, the transmitter consisting of two 250-watt tubes used as amplifiers in conjunction with a 50-watt master oscillator, has been perfected to a high degree. The Undergraduates operate the station, handling hundreds of messages for people all over the world. This service is carried on free of charge.



The power plant of the station which develops 2,500 volts to supply the plates of the ½-kilowatt tubes. Immediately above the motor generator is shown the large filter system which smooths out the commutator ripples in the high voltage DC supply. The use of the filter is known to vastly improve the carrying quality and range of the transmitted signal. It has been found that a pure DC note can be received over greater distances than an interrupted DC wave of the same power. A combination of reactances, condensers and chokes constitute a successful filtering device, if their design is properly executed. Chemical filters, although efficient for low power, are practically worthless at higher power. Above to the left can be seen the antenna which keeps Hanover in constant touch with the far corners of the globe.



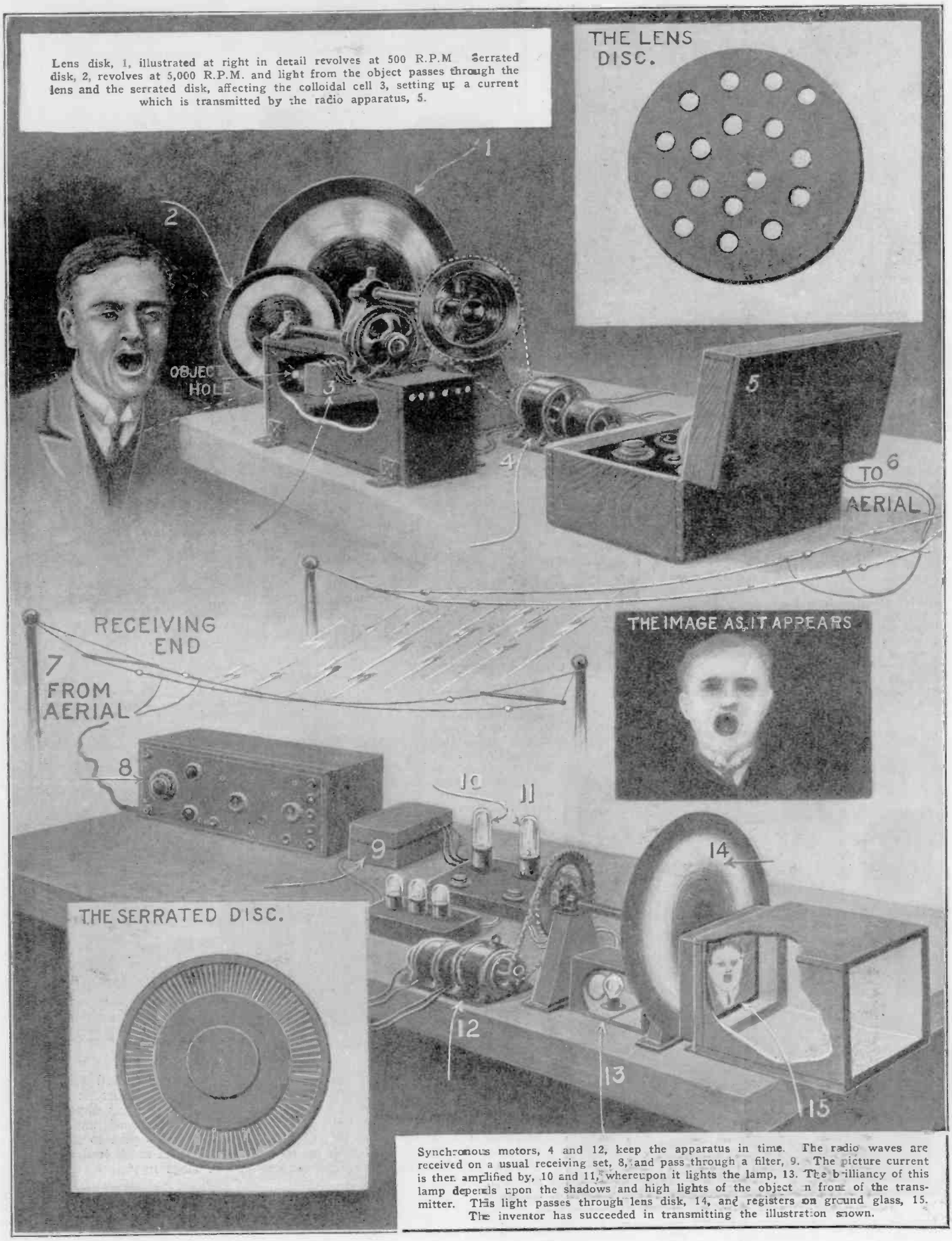


To the right is shown the aerial lead-in and counterpoise. Note the large glazed porcelain insulators which are an absolute essential in preventing loss of energy. Sometimes, even to the most callous of old-time operators, it is sharply brought to mind how wonderful it really is that radio communication can be carried on and used to annihilate distance. And to think that you can send a message to any of your distant relatives, especially when you can send it without cost by amateur radio!

CLARK UNIVERSITY at Worcester, Mass., has achieved reknown through its radio club's station 1XZ. Macmillan on his Arctic Expedition found 1XZ to be one of his mainstay outlets for his press dispatches. This reliability was obtained through careful and arduous work under the supervision of Prof. Robert H. Goddard, famous for his plan to shoot a rocket to the moon. The cards on the wall testify that much traffic, both foreign and domestic, have been handled by the large number of willing students.

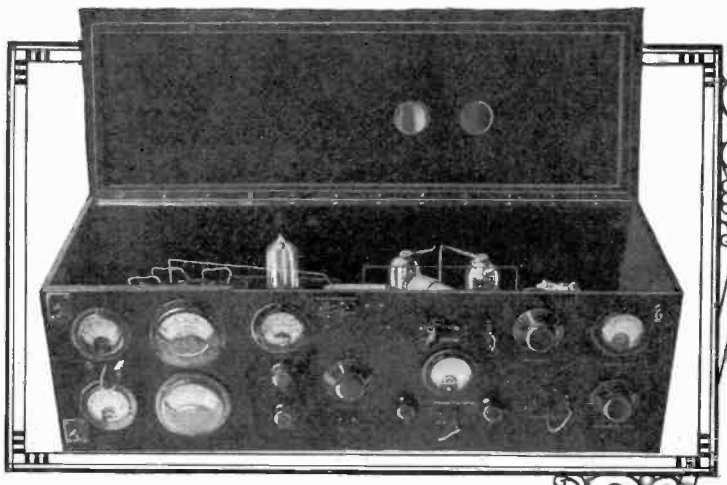
# Simplified Radio Television

## New System Uses Colloidal Photo-Electric Cell



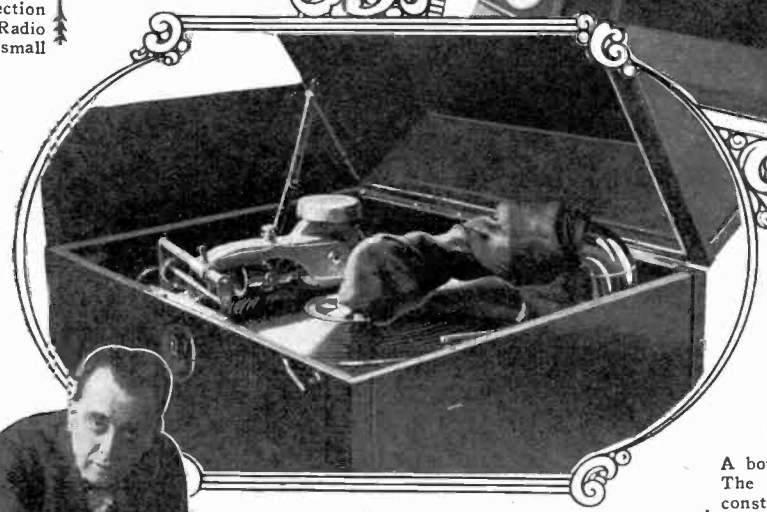
# Super Radio System

By DR. ALFRED GRADENWITZ

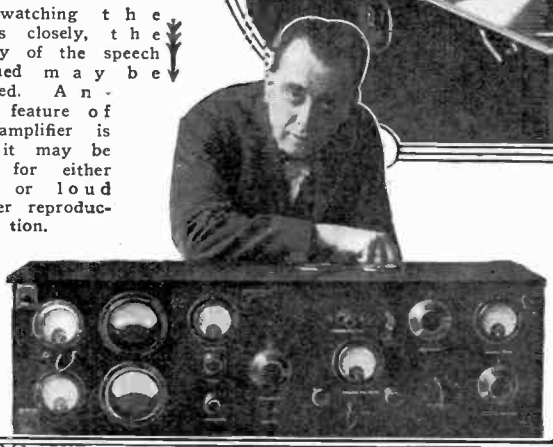


The above photo shows the amplifier used in connection with the Hausdorff Super Radio System, to amplify the small currents coming from the solenoid coil in the reproducing cabinet of the phonograph. The tubes used in the amplification process are of special design. As yet, the circuit is not available.

The above photo shows the assembly of parts used in the super radio system. To the extreme left is shown the battery compartments. Next to the right is shown the reproducer cabinet in which is contained the controlling clock-work and reproducer arm. Above this cabinet is the loud speaker and its auxiliary amplifier.

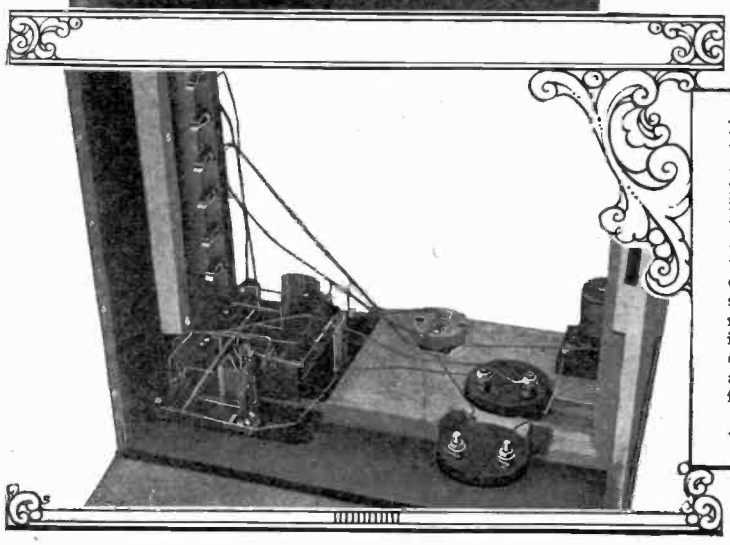


By watching the meters closely, the quality of the speech obtained may be checked. Another feature of the amplifier is that it may be used for either radio or loud speaker reproduction.

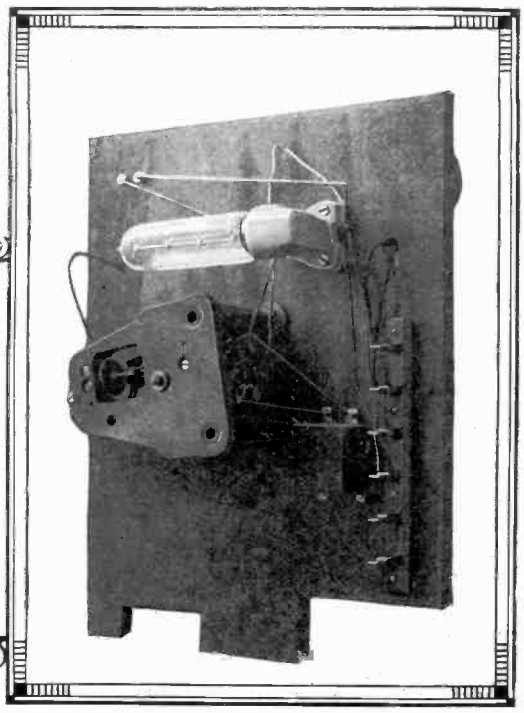


The queer looking tone arm to the extreme left in the above diagram is a brake regulator placed at the rim of the record carrier, which causes the disk to pass under the stylus at a constant speed. According to a new arrangement the clock work is allowed to run unchecked.

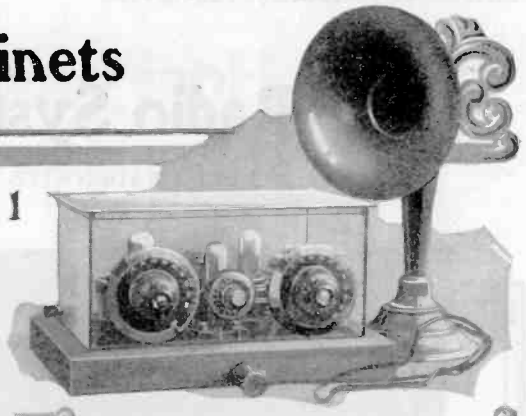
A bottom view of the reproducer is shown below. The ballast lamp keeps the wind-up motor at a constant speed. As may be seen there is no governor on the clockwork thereby allowing it to run free. The clips to the right allow the top plate to be removed from the case for inspection.



In the photo to the left is shown a part of the phonograph cabinet housing battery connections and amplifying transformers for operating the loud speaking apparatus. A switch is provided to control the amount of amplification to be obtained.

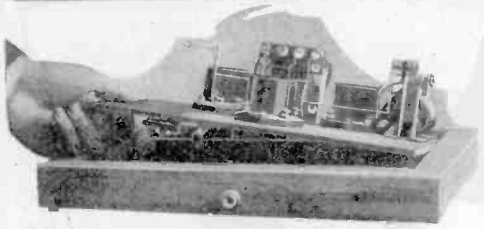


# Glass Panels and Cabinets



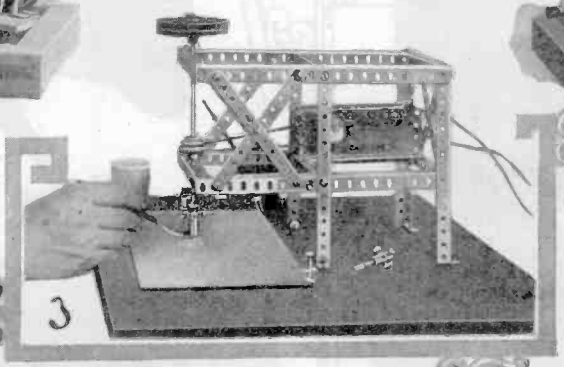
1

The photo to the right shows the finished cabinet in use. As may be seen it is entirely made up of glass and presents a striking appearance.



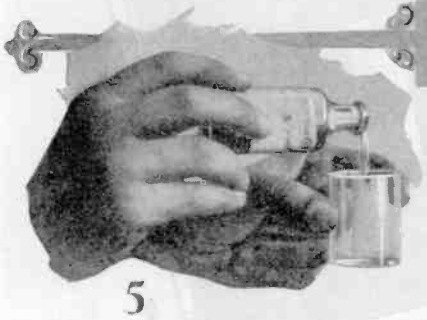
2

The instruments are first mounted on a baseboard and then wired up. The baseboard assembly is then placed in a wooden frame.



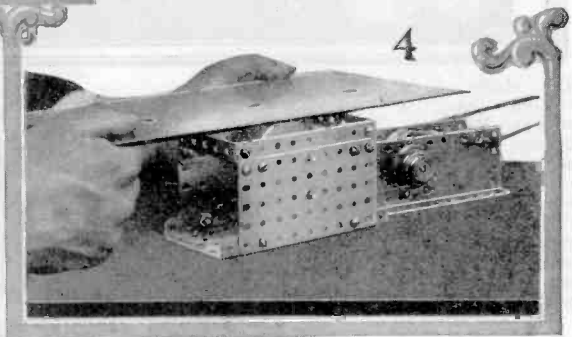
3

As may be seen by the photos to the left and below, the stands for the grinding and drilling apparatus are made from "Erector" parts. The arrangement shown in Fig. 4 is used to roughen the edges of the glass so that the cement can hold better. An emery wheel is used for this grinding process.



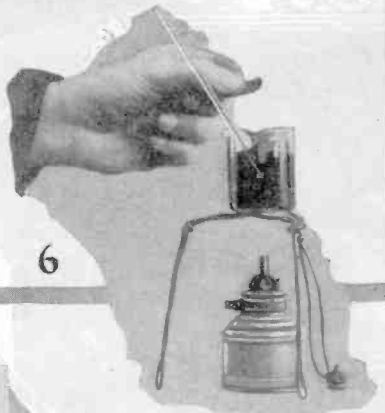
5

Above: It is hard to drill holes in glass ordinarily. The cutting tube consists of a length of brass tubing. Its outside diameter is the size of the hole desired.



4

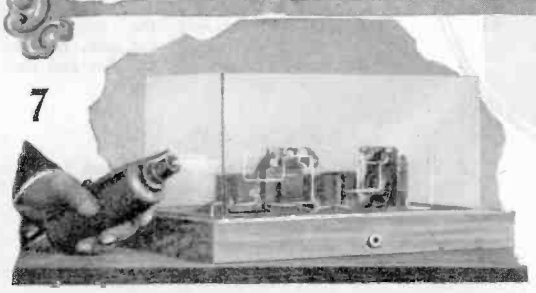
The cement consists of five to ten C.C. of creosote in a beaker which is placed over a flame and heated while adding shellac until a very thick mixture is obtained.



6

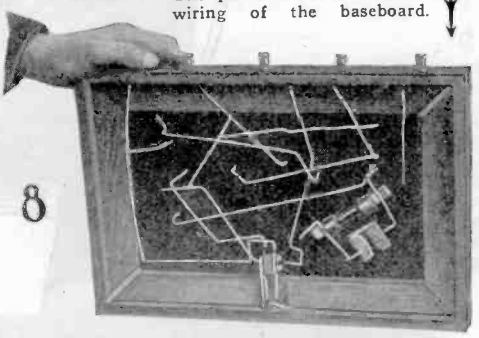
Quite a bit of shellac will be required for even a small amount of creosote. When you think the mixture is thick enough, let it cool and if it is of the right consistency, no impression of the nail will be made when it is dug into the cement.

The photo below shows the wiring of the baseboard.



7

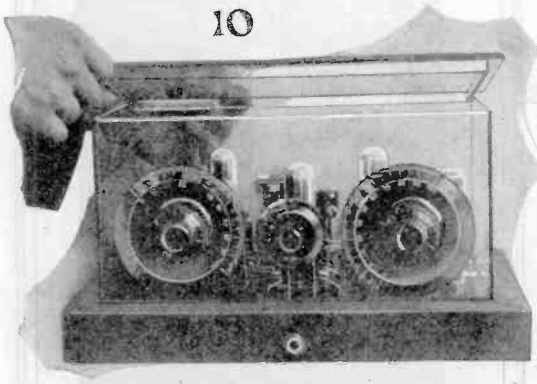
When ready to use, heat the cement until soft and apply to the roughened edges of the glass. Place the two parts quickly together and heat again with a blow torch as shown in the above figure. The joint made by this cement is very rigid.



8

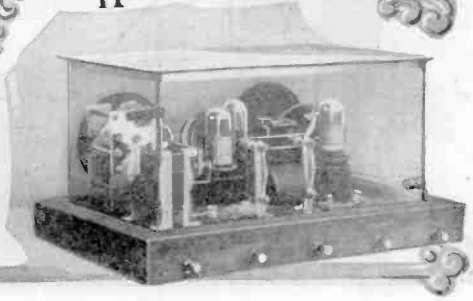
9

A black water stain can easily be prepared by mixing about ¼ glass full of water, a piece of ferrous sulphate, a ½ teaspoonful of pyrogallic acid, and a color pigment is added until the desired shade is obtained.



10

After assembling the receiver and putting the tubes in, place the cover on and the receiver is ready for operation. Dial indicators may be made by scratching the glass with a sharp file.

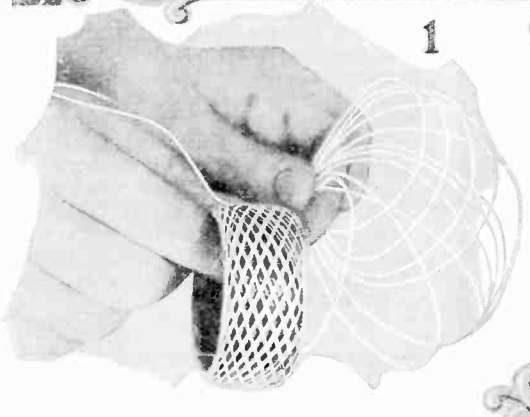


11

Fig. 11 shows the rear view of the completed receiver. It will be noted that the antenna connection is made at the side of the glass. The circuit used in this receiver is an ordinary regenerative detector and two-stage audio frequency amplifier.

—Dr. Ernest Bade.

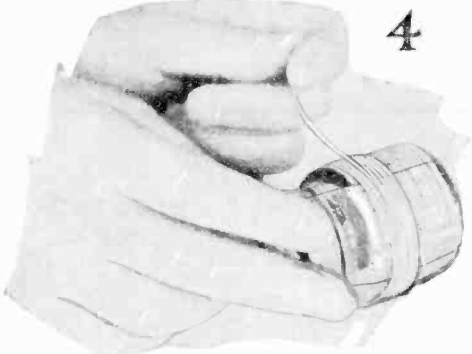
# Honeycomb R. F. Transformers




After obtaining a 75-turn honeycomb coil remove about 10 or 12 turns from it. The turns removed will be used later on to make up the primary coil of the transformer. The remaining coil with a .0005 mfd. variable condenser in shunt, will cover the entire broadcast wavelengths. The reason for the use of honeycomb coils is first, they are compact and secondly, the capacity of the coil is very small. By the use of a set of these coils a compact radio frequency amplifier may be constructed.


Fig. 2 shows the method of fastening the end of the 12th turn after it has been removed. Sealing wax is dropped on the wire which secures it.

The figure to the right shows how to prepare the primary form. Pieces of thread are placed around a vaseline bottle, and fastened by a piece of adhesive plaster. The reason for the use of a vaseline bottle is because everyone has one around the house and it is just the right size for the primary winding. Other forms may be used, however, as this form was handy it was used for the purpose.

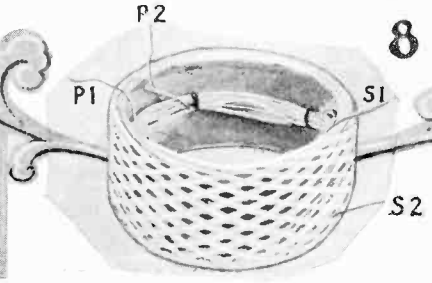

The method of winding the radio frequency transformer primary is shown in Fig. 4. Do not wind the coil too tightly as difficulty will be experienced in removing it.


After the required number of turns are wound on the bottle tie them together with the string which was originally placed around the form. By so doing a low-loss coil is formed as practically nothing holds it except a thin thread of cotton and air. By the use of this method of fastening the winding together, it is an easy matter to change the number of turns at will. In an accompanying figure is shown the completed coil removed from the bottle.


The figure below illustrates the completed honeycomb R.F. transformer ready for use. The leads marked P1 and P2 are connected in series with the plate lead of the first or second tube. The leads marked S1 and S2 are connected to the filament and grid of the radio frequency amplifier tube. A .0005 mf. variable condenser should be shunted across S1 and S2. By the use of this condenser all the broadcast wave-lengths will be covered. If one of these coils is used for the first tube then, connect the leads marked P1 and P2 to the aerial and ground posts of the receiver.


Fig. 7 shows the primary coil being inserted into the secondary. If the primary coil is too large spread the turns so that they will fit the inside of the secondary coil.

—Herbert E. Hayden.

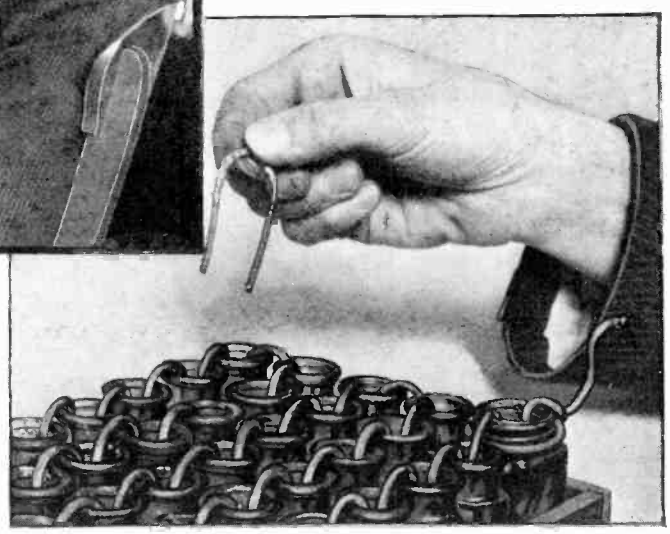



The above figure shows the complete coil removed from the bottle and ready for use as the primary of the honeycomb R.F. transformer. A set of these coils will work very well in any radio frequency amplifying receiver. They are especially adaptable to portable sets on account of their small size. By placing them at right angles to each other very little interaction will result.

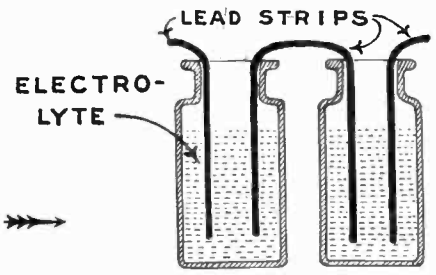
# Home-Made Storage "B" Battery

The photo below shows the head of the Physics Department of the Alexander Hamilton High School testing the home-made storage "B" battery, the construction of which is shown in the accompanying diagram. Actual receiving tests proved this battery very successful, and it is at present giving very good service in the laboratories of the High School.

THE accompanying photos show a very interesting and ingenious storage "B" battery, entirely made up of lead strip and mucilage bottles or ink wells. This battery is now being used in the Alexander Hamilton High School scientific laboratories. It consists of 50 of either of the above-mentioned containers filled with a 6 to 1 solution of sulphuric acid, into which are placed round pieces of lead strip, bent in a U shape. Each cell gives two volts, the whole battery thus giving one hundred volts. The output obtained from a battery of this sort will operate a set for a long time.

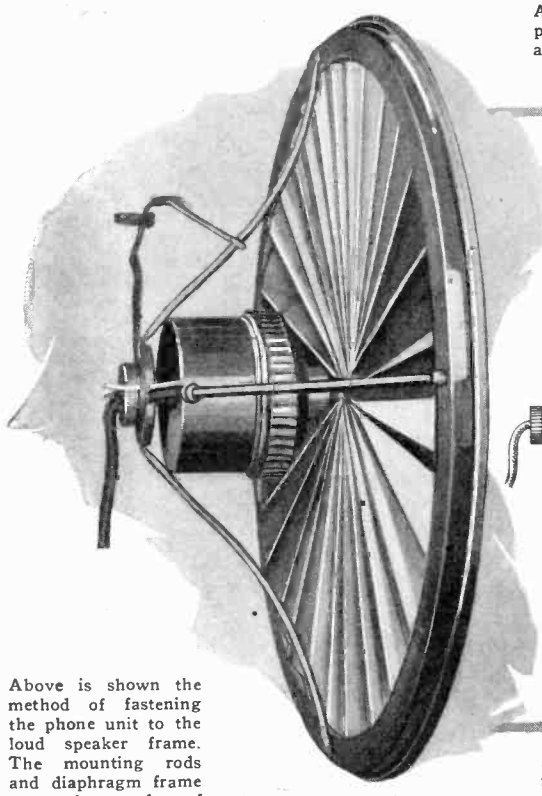


Make a case just the right size so that the containers will all fit snugly into it. Fill the bottles with a 6 to 1 solution of sulphuric acid and place the U-shaped lead strips into position. In order to form the "plates" charge and discharge the battery until they become the same as plates which have been chemically treated.

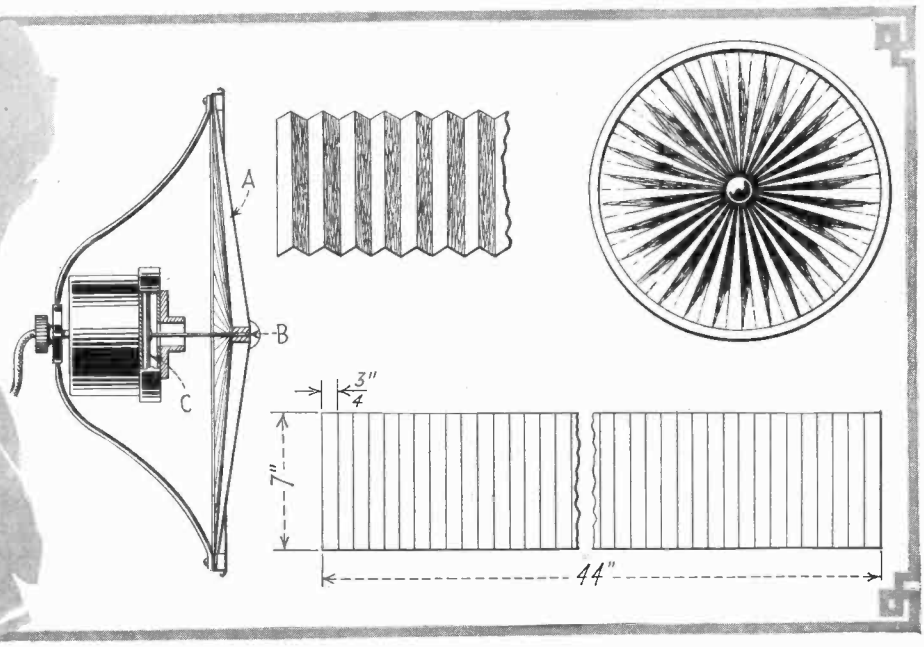



# Radio Loud Speaker

A radio loud speaker which will render tones correctly may be constructed as follows. A paper diaphragm is formed by folding a strip of paper as shown below, the creases being about three-quarters of an inch apart. Score each mark lightly and fold as shown in the photo below. After the length has been folded, the pleated paper is bent into a circle.



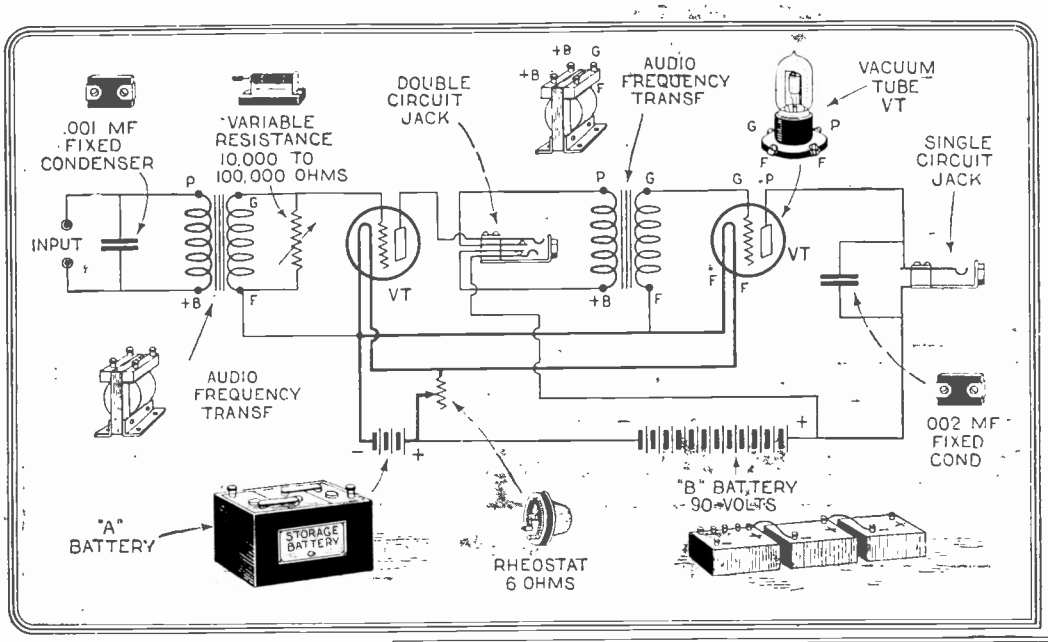
Above is shown the method of fastening the phone unit to the loud speaker frame. The mounting rods and diaphragm frame must be made of rigid construction.




After the two ends of the folded paper are pasted together, mount the resulting cone onto the frame as shown in the central photograph. The connecting rod marked B consists of a piece of wood about the thickness of a match. It is fastened to the phone unit by beeswax and is glued at the other end to the paper diaphragm.—Walter E. Burton, Reporter No. 3209.

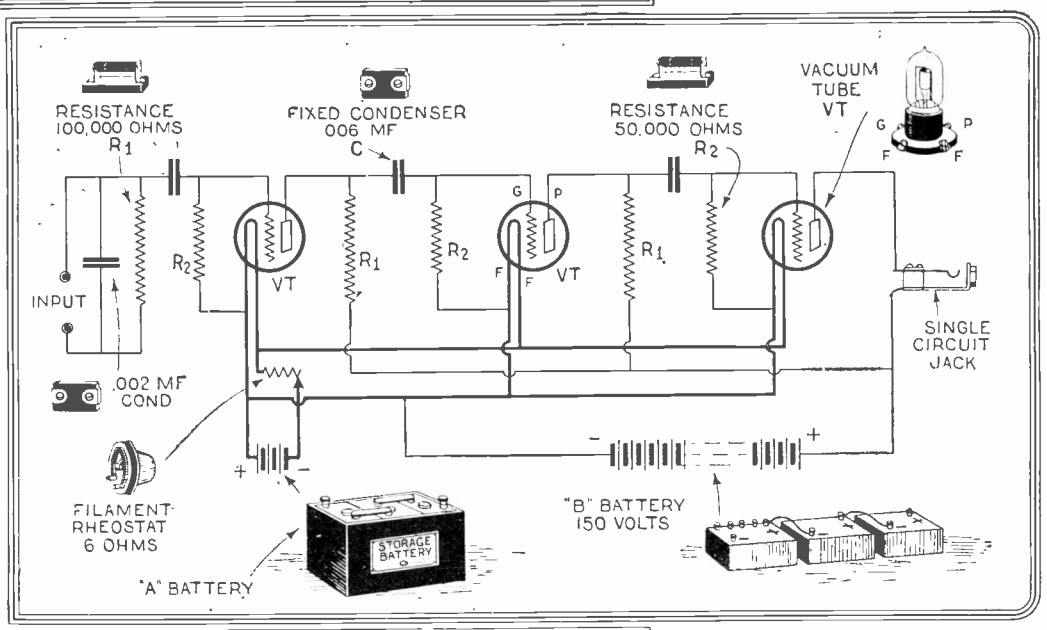
# A Page for the Novice

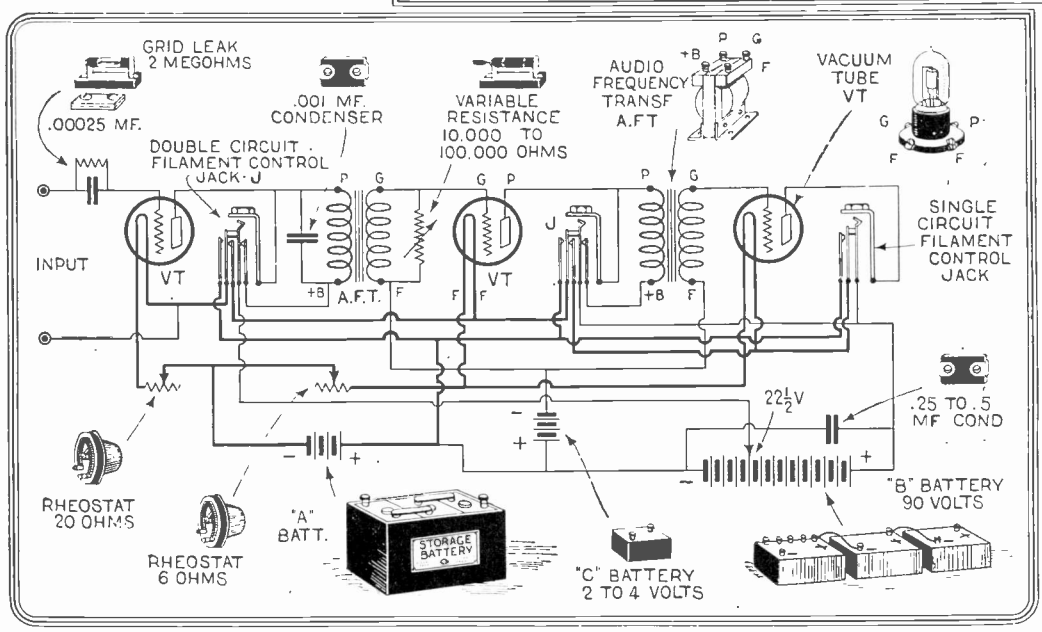
Part V.




THE circuits given on this page are different types of audio frequency amplifiers. The first one shown to the left, is a transformer coupled audio frequency amplifier. The two input posts are hooked in series with the plate and "B" battery lead of the detector circuit. The fixed condenser across the input posts is used to by-pass the radio frequency currents. The audio frequency transformer should be of reliable manufacture, the ratio of which should be about 3½ to 1. Higher ratios may be used but distortion will result. The variable resistance across the secondary of the transformer is used to vary the signal input to the first amplifier tube. It also removes distortion to a certain extent. UV 201-A tubes should be used throughout; however, dry cell tubes will work to perfection, but the volume will be less. One rheostat is sufficient to control the two tubes. The second audio frequency transformer should be of the same ratio as the first. The "B" voltage applied to the tubes may vary from 45 to 100 volts. The condenser across the phones is used to clear up the output to the loud speaker.

THE circuit shown to the right is a resistance coupled audio frequency circuit. The amplification of the resistance coupled type of amplifier is a little less than a transformer coupled type. The input posts are connected to the output of the detector circuit. The resistances R1 are of about 100,000 ohms resistance. It may be well to substitute the fixed resistances by those that are variable, in order to find the exact resistance required to couple the plate of the preceding tube to the grid of the one following it. R2 should be resistances in the order of 50,000 ohms. They may also be variable. The condensers marked C are .006 mf. type. Of course, the best of materials should be used in the construction of this amplifier, otherwise, the results obtained will not be very good. On account of the high resistance in the plate circuit of the tubes more "B" battery than is ordinarily used in a transformer coupled amplifier must be used in the resistance coupled type.

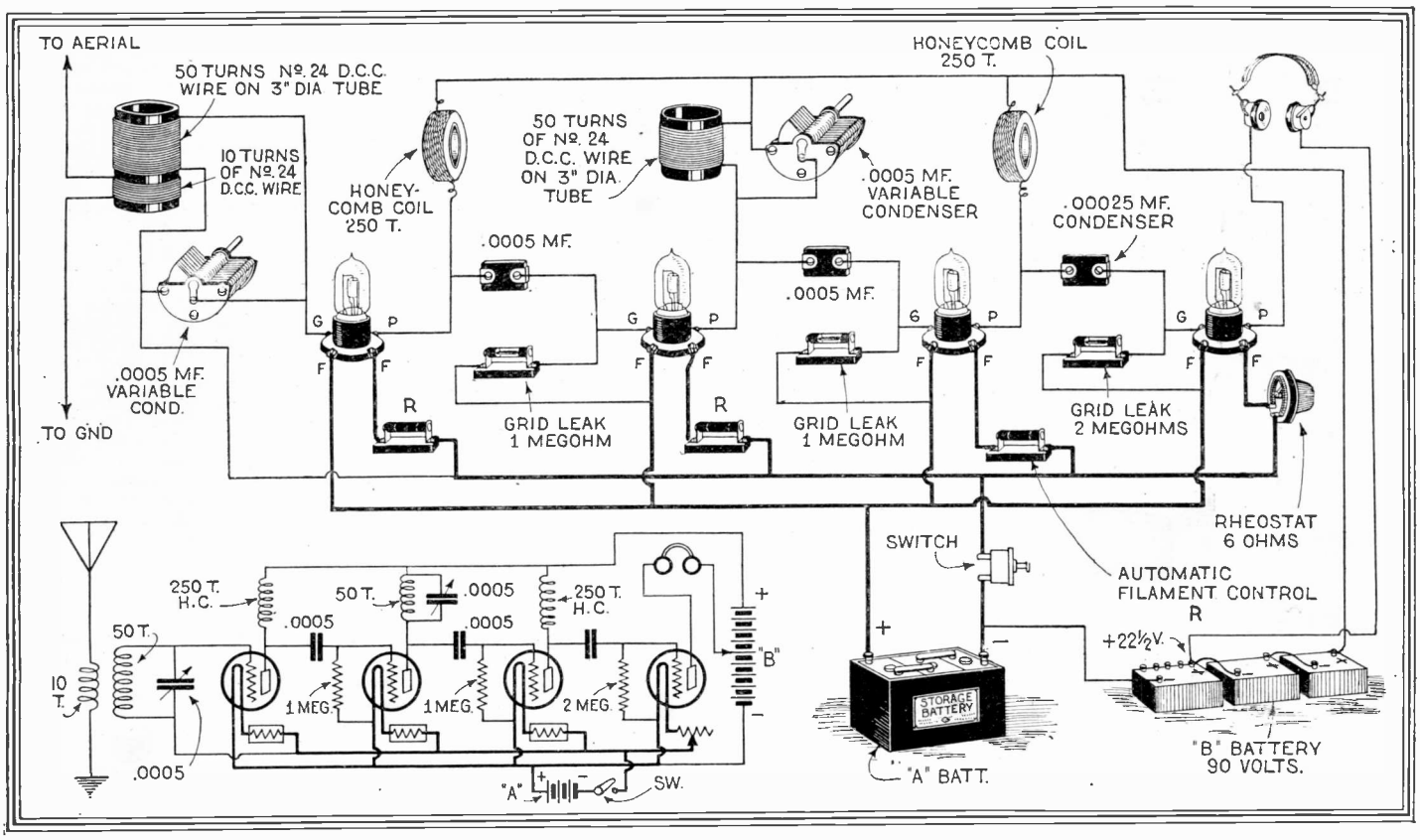



THE circuit given on the left shows the use of a "C" battery and filament control jacks in an amplifier circuit. The "C" battery is used to bias the grid circuits of the amplifier tubes negative to cut down the drain from the "B" batteries. The first tube shown in the circuit is the detector tube. The input posts connect to the tuner circuit and if the circuit is regenerative the tickler coil should be connected in the circuit leading from the plate to the jack. The .001 condenser across the first audio frequency transformer is used to by-pass any radio frequency currents present. Any real good variable resistance is usable. In quite a number of transformer coupled audio frequency amplifiers, there is present some distortion which may be eliminated by the use of a variable resistance across the secondary of the first audio frequency transformer. Transformers of the larger core type are about the best ones to use in a good audio frequency circuit. In the wiring of the filament control jacks, great care should be taken so as not to short-circuit any leads from the batteries or the transformers.

# 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.




The above diagram shows what is called the T.A.T. system. It is used very much in England because it does not oscillate. The reason for this is that an aperiodic circuit is placed between two tuned ones. By following the diagram an efficient and unusual set can be constructed.

### T.A.T. SYSTEM

(350) Q. 1. Mr. Irving Waldman, Brooklyn, N. Y., asks about the T. A. T. system and a circuit for it.

A. 1. By the T. A. T. system is meant that there are three circuits; the first one is a tuned circuit, the second is aperiodic and the third is tuned. This may be seen more clearly from the diagram given herewith. The constants are given with the diagram, and you should find no difficulty in making this receiver operate. The reason for the aperiodic circuit between the two tuned ones is so that the circuit will not oscillate and therefore will not radiate or cause interference in neighboring receivers.

### TELEPHONE JACKS

(351) S. K. Pine, Waterbury, Conn., wants to know:

Q. 1. Is it necessary to use telephone jacks on a receiving set, and can I have some information concerning the same?

A. 1. The telephone jack plays an extremely important part in a radio receiver. Due to the large quantity production basis on which jacks are turned out, their cost is small and, due to this fact, it is easy to come to the false conclusion that they play but a minor part in the operation of a set.

The jack is used mainly to plug in the headphones or loud speaker on any desired stage, from detector to the output of the push-pull power amplifier, thereby enabling the operator to control the volume. Some types, known as filament control jacks, are so constructed as to light up the tubes in the receiver when the plug is inserted and to break the circuit when the plug is withdrawn. It is thus possible to automatically cut out the filaments of the tubes which are not in use, with consequent saving of both "A", "B" and "C" batteries.

Thus, generally speaking, when the phone plug is inserted in the jack, the headphones are placed in series with the plate of the last tube and the positive "B" battery supply, while the rest of the circuit, through the primary of the amplifying transformer, is cut off. Again, when the plug is withdrawn, the circuit is completed through the primary of the next transformer. It is readily seen, therefore, that the jack is always in the output circuit of the tube where the most current is handled, thereby making it important that the best of insulating materials be used, that the contact points, the springs and dimensional features of the jack be as exact and perfect as possible. If the insulating material is faulty, it is evident that a serious leakage of energy will take place.

For the reason of their right-angle construction, jacks will be found very useful as supports for a sub-panel or, mounted flush against a baseboard, to act as panel brackets.

A word about materials. The frame of the jack should preferably be of nickle-plated brass, while the spring leaves should be of the same material, provided with silver contacts riveted into them. Silver will not corrode and is one of the best conductors, making it an ideal material to use for the jack spring contacts. For the insulating material, thin sheets of bakelite are preferable, with short lengths of hard rubber tubing to insulate the holding screws. It is also necessary to have the soldering contacts widely separated, so that ample room remains where heavy bus bar is to be directly soldered to the jack.



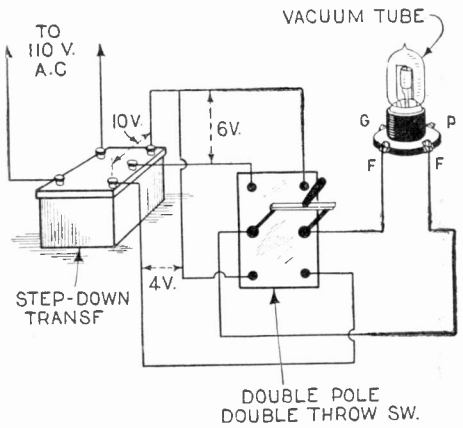
**WANTED!!! RADIO ARTICLES**

WE want descriptions of new radio ideas which you have worked out in practice. Take photographs of the important parts and make pencil or pen and ink sketches of the hook-ups or mechanical details, et cetera. We are particularly desirous of obtaining new hook-ups and descriptions of single tube sets, reflex and other types which have proven satisfactory. We like articles on new single tube receptors. We will pay good prices for your ideas. —Editor.

## REJUVENATING TUBES

(352) Q. 1. Mr. Bert Reith, Oklahoma City, Okla., asks about a method for the rejuvenation of vacuum tubes.

A. 1. The circuit diagram used in connection with the rejuvenation of vacuum tubes is given herewith. UV-201A tubes are lit with about ten volts on the filament for about ten to fifteen minutes. If the tube has not come back in that length of time, try again until it does work. UV-199 tubes are lit with about four volts on the filament for about five to ten minutes or until they work again. Be careful about rejuvenating tubes because there is a possibility of burning them out if carelessly handled.




**If your tube stops functioning and you wish to renew its efficiency, use the above circuit to rejuvenate it.**

## NOISES

(353) Q. 1. Mr. A. Keil, New Orleans, La. How may the noises which occur in an audio frequency amplifier be reduced?

A. 1. It is possible to reduce to some extent the noises from an audio frequency amplifier by connecting a .001 mf. condenser across the primary of the first audio frequency transformer, by connecting a small by-pass condenser of about the same capacity across the secondary of the second audio frequency transformer, or by placing a variable resistance across the secondary of the first audio frequency transformer. This resistance should be of the order of 5,000 to 25,000 or 30,000 ohms.

## TOROIDAL COILS

(354) Q. 1. Mr. P. E. Butterfield, Oakland, Calif. What are the advantages of toroidal coils, and how may they be constructed?

A. 1. In the toroidal coil all inductive effects between adjacent coils is removed because the field is concentrated within the coil itself, therefore there is no stray field to induce any currents in coils near them. The easiest method of winding a toroidal coil is to obtain a circular piece of wood about one-half inch in thickness, three and one-half inches outside diameter and one and one-half inch in diameter inside. The form should look like a thick, abbreviated phonograph record with a large opening in the center to allow a spool of wire to be slipped through readily. The secondary should consist of about 200 turns of No. 24 double silk-covered or single cotton-covered wire; about 65 feet of wire is used. The primary consists of about 20 feet of the same wire wound loosely so as to extend over the entire length of the secondary.

## BALKITE CHARGER

(355) Q. 1. Mr. P. Vinder, Scranton, Pa., wishes to know what metal is used in the Balkite charger.

A. 1. The metals used in the Balkite charger are tantalum and lead immersed in a special solution of sulphuric acid.

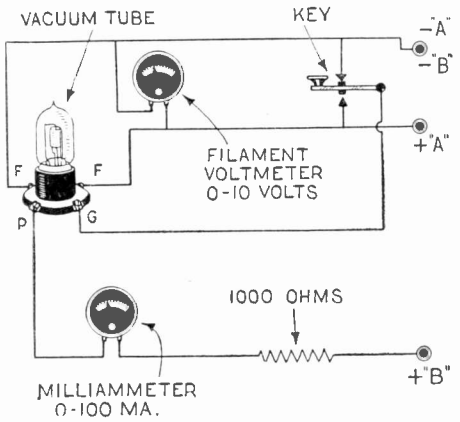
Q. 2. Why must sections be connected in parallel when charging a high voltage battery?

A. 2. Because certain rectifiers only deliver from 30 to 40 volts.

## TUBE TESTER

(356) Q. 1. Mr. A. Weinstein, Brooklyn, N. Y. Kindly give me the circuit of a reliable tube tester.

A. 1. The circuit diagram requested is given herewith. The key which is normally on the negative side of the "A" battery terminals allows the milliammeter to give a certain reading. When the key is depressed a different reading will appear on the milliammeter scale. The greater the change in this reading, the better the tube acts as an amplifier. If the change is less, the tube is a good detector.




**When buying tubes be sure that they come up to the highest possible standard. In order to ascertain this, construct a vacuum tube tester as shown above.**

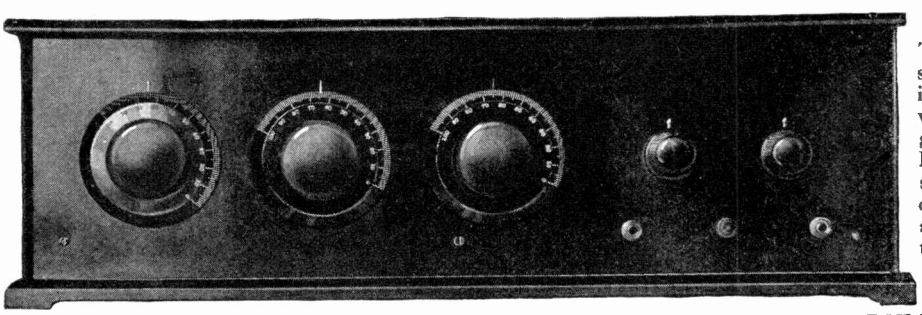
## DRILLING HARD RUBBER

(357) Q. 1. Mr. D. McCarthy, Dallas, Texas, asks what precautions should be taken in the drilling and sawing of hard rubber.

A. 1. When drilling hard rubber, use drills of the best high carbon steel variety. They should always be kept sharp so as to avoid burrs on the face of the panel. When sawing this material use a hacksaw having about 24 teeth to the inch.

# Guess this Circuit! $100.00 in Prizes

**SCIENCE AND INVENTION leads again, something entirely new!! The Mystery Set, a five-tube wonder. Submit its circuit and win a prize.**



**This is not a freak set. The circuit used is a standard one. A wonderful distance getter. Come on, Radio Fans, do your stuff. Better than a crossword puzzle and more interesting to solve.**

FOR the first time in the history of the radio art, a very novel contest such as has never been held before, is being sponsored by SCIENCE AND INVENTION. Opportunity is given to the readers of SCIENCE AND INVENTION to exercise their mental powers in guessing the correct circuit used in the wiring of the above five-tube receiver. Look at it carefully. study minutely the front panel. Ponder a while, what may be behind the panel, the three large dials and the two smaller ones? The three large dials to the left operate—well, we will let the guess-work up to you—maybe they operate condensers or variometers. Probably it is a—well, we will let everything up to you. What are the two small dials for, can they be——? Or are they something else? The size of the panel is seven inches wide by twenty-six inches long. There is nothing hard about it. You may submit as many circuits as you desire. It is not necessary to state the constants of any of the parts, *i. e.*, the capacities, inductances, resistances, etc. All that is essential is a carefully drawn diagram, which should represent your idea as to what circuit is employed in the receiver.

### $100.00 GOLD IN PRIZES

| | |
|---|---|
| 1st Prize | $50.00 |
| 2nd Prize | 20.00 |
| 3rd Prize | 15.00 |
| 4th Prize | 10.00 |
| 5th Prize | 5.00 |

RULES

1—Contestants may submit as many entries as they desire.

2—Circuits must be carefully and clearly drawn in ink on one side of a sheet of white paper. All symbols should be marked as to what they are supposed to represent.

3—The contest closes at noon on Saturday, July 2, 1925.

4—In case of a tie, duplicate prizes will be awarded to each contestant so tying.

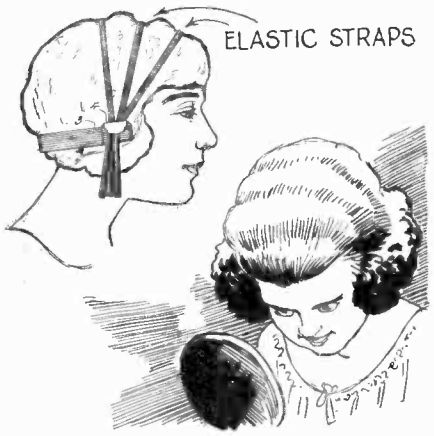
5—The correct circuit or the nearest to it will be awarded first prize.

6—All circuits must bear the contestant's name and address in the upper right hand corner. The date must also accompany the above.

7—The circuit and photo of the interior of the set will be published in the September or October issue.

# LATEST PATENTS

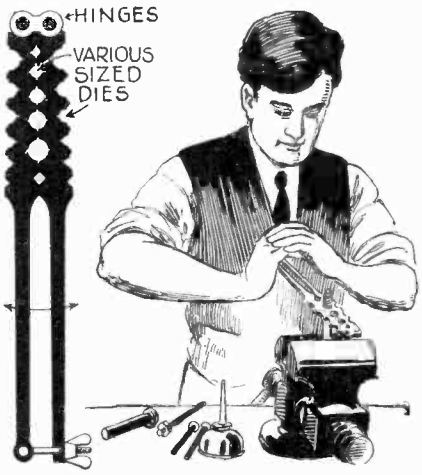
## Hair Crimper




No. 1,511,930 issued to Helen M. Andaloro covers the head-band to be worn while asleep for the purpose of producing a wave effect in the hair. The use and results are shown above.



## Thread Reformer

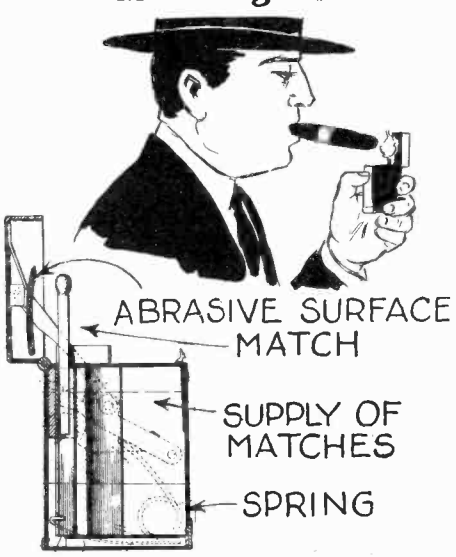



No. 1,521,647, issued to Edwin M. Perry describes the device illustrated above with which damaged threads on bolts and nuts may be quickly re-formed.

## Auto Goggles

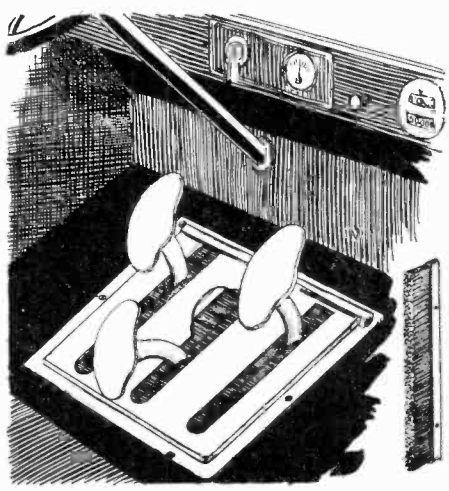

No. 1,511,357, issued to Eldridge Nairne covers the design of automobile goggles shown. By tilting the head, sun or approaching headlight glare can be eliminated.

## Match Lighter




No. 1,513,091, issued to A. Y. S. Album protects match box design illustrated above. When the cover is released and opened by the spring, a match is forced up into the position shown and at the same time is lighted.

## Draft Preventer

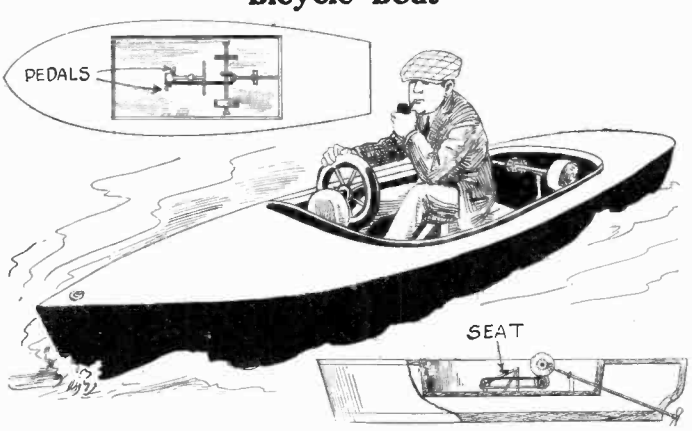


No. 1,511,701, issued to Edwin A. Angell protects the autoist. A series of bristles prevent a draft through the pedal slots.

## Carpenter's Combination

No. 1,514,180, issued to William A. Spitler protects the design of a saw, the back of which is scaled off as shown and carries a lug to which an arm may be attached at right-angles as a square.

## Bicycle Boat




No. 1,522,390, issued to Charles Sanders describes a boat to be propelled by the feet of the occupant as shown in the illustration above. Pedals transmit the power to the propeller.

# Scientific Humor

### DID IT AP-PEAL?

HE: "I had something nice to say to you this evening, but I see you're not in a condition to hear it."

SHE: "Why?"

HE: "Because if your face lights up the powder will go off."—*George Volecsko, Reporter No.* 7000.


### IS ZAT SO!

CON: "The radio will never take the place of newspapers."

DENSER: "Why?"

CON: "You can't start a fire with a radio set."—*W. S. Hood.*

### HE WASN'T SO MEASLY

A small boy called on the Doctor one evening. "Say Doc, I guess I got measles," he said, "but I can keep it quiet."

The Doctor looked up puzzled.

"Aw, get wise, Doc," suggested the small boy, "what'll you give me to go to school and scatter it among all the rest of the kids?"—*W. Brown, Reporter No.* 16,940.

### GASSED!

LECTURER: "Can anyone in the audience give me an example of expansion by heat and contraction by cold?"

FEMININE VOICE FROM AUDIENCE: "Yes, a gas bill."—*Harold Baker.*

### ALWAYS HUMOR A RUMOR

One of the laws of nature is: The intensity and falsity of a rumor increase as the distance from its origin becomes long.—*Rogerio Quiason.*

### 'TWAS EVER THUS!


SCIENTIST: "What's your definition of genius?"

INVENTOR: "Perspiration today; inspiration tomorrow!"—*Herbert L. Jillson.*

### MEET AUNTY CAPACITY

A colored man entered the radio store and said to the dealer from whom he bought his wife's radio:

"My wife says I should tell you her radio is no good."

RADIO DEALER: "Well, what is the trouble, body capacity?"

COLORED MAN: "Yes sir, that might be, my wife weighs about 286 pounds."—*H. Duebner.*

### MME. MODISTE, RADIO ENGINEER

RADIO BUG No. 1: "I bet you can't tell me who invented the first 'hook-up.'"

SECOND BUG: "Who did?"

BUG No. 1: "Why a dressmaker of course."—*Al Klein.*

## First Prize $3.00

### DOGGONE HER


MRS. NEWLYRICH: "I believe I will go down-town today and purchase a good dog of an exclusive breed."

MR. NEWLYRICH: "What sort will you get, my dear?"

MRS. NEWLYRICH: "I think that I shall get one of these DX Hounds which I have been hearing so much about. I haven't noticed that any of my friends have one."—*T. Olin Mathews.*

### WE WANT THE FIRST ONE MADE

The next millionaire will be the man who invents a doorbell that will tell you who is ringing it, so you'll know whether to open the door or not.—*Henry A. Courtney.*

*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. We cannot return unaccepted jokes. Please do not enclose return postage.*

*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.*

### HIS DOWNFALL

1ST MAN: "Yessir, I think I would buy an airplane if it wasn't for the upkeep."

2ND MAN: "I think I would buy one too if I thought I could keep it up.—*Kenneth Steele.*

### OR A RADIO CONCERT

HIGH-SCHOOL PRINCIPAL (to class in geometry): "What would you call that which has length, but no breadth or depth?"

PUPIL: "The prayer of a hypocrite."—*Fred Smith.*

### THE LOUD TALKER

MADGE: "You should have known better than to tell Dolly a secret."

MARJORIE: "But I never imagined she would amplify and broadcast it."—*J. J. O'Connell.*

### YES, AND THEN SOME!

HY VOLTAGE: "Were there any interruptions while you were 'listening in' last night?"

GUY WIRE: "Yes. Dashes and dots."

HY VOLTAGE: "What did the folks say to that?"

GUY WIRE: "Some more dashes and dots."—*E. A. Daansen,* Reporter No. 17,657.

### MY STARS!

Group of people watching a bright star rise.

WOULD-BE ASTRONOMER, running up: "Is it Sirius?"

NON-ASTRONOMER: "No, not at all."—*Leo Fletcher.*

### THEN TRANSFORMER

"What would you do if your girl went back on you, and later came back to you?" "Meter, receiver and controller."—*J. Leo Vanderheyden,* Reporter No. 997.

### PERHAPS, IN THIS CASE

PROFESSOR OF ASTRONOMY (Lecturing on the opposition of Mars): "And now, gentlemen, let us consider the relative positions of the celestial bodies concerned. Let this incandescent lamp represent the sun, this globe shall be the earth, and well, my hat here may represent Mars."

BRIGHT STUDENT: "Professor, is Mars inhabited?"—*L. C. Cartwright,* Reporter No. 9,656.

### AND MADE NO BONES ABOUT IT

Someone pulled a bone when Eve was made out of man's rib.—*Henry A. Courtney.*

### ONE ON MÜNCHHAUSEN

1ST LIAR: "Up where I've been it was so cold that the milk was delivered in chunks of ice."

2ND LIAR: "Aw, that's nothing. Where I was they didn't even need fire ladders. They'd just spill a bucket of water out of the window and slide down."—*Myer R. Skolnick,* Reporter No. 13,440.

### WESLEY BARRY, ALIAS "SUN-SPOTS"

1ST BEAUTY SPECIALIST: "Say, I hear a lot about these 'sun-spots.' What are they anyway?"

2ND BEAUTY SPECIALIST: "Oh, I guess that's just another name for freckles."—*E. A. Daansen,* Reporter No. 17,657.

### VALVES WON'T BLOW OUT!

LITTLE BOY: "Pop, why do people call a radio bulb a 'tube'?"

BOY'S FATHER: "I guess it's because they 'blow out,' son."—*Harry J. Walters,* Reporter No. 13,835.

### A PESSIMIST

MOE: "Is the world flat or round?"

JOE: "Neither—it's crooked."—*J. H. Delaney,* Reporter No. 16,903.

# THE ORACLE

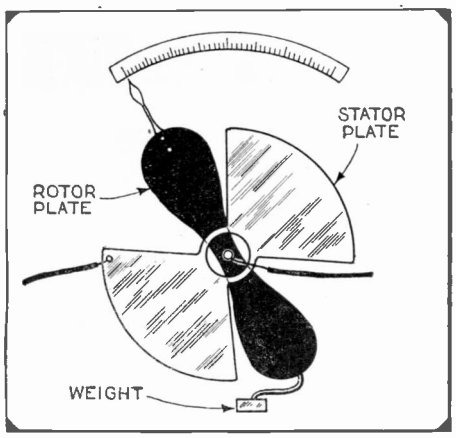
The "Oracle" is for the sole benefit of all scientific students. Questions will be answered here for the benefit of all but only matter of sufficient interest will be published. Rules under which questions will be answered:

1. Only three questions can be submitted to be answered.
2. Only one side of sheet to be written on; matter must be typewritten or else written in ink, no penciled matter considered.
3. Sketches, diagrams, etc., must be on separate sheets. Questions addressed to this department cannot be answered by mail free of charge.
4. If a quick answer is desired by mail, a nominal charge of 50 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.

## ELECTRO-STATIC VOLTMETER

(1834) Q. 1. Mr. Al Allen, Brooklyn, N. Y., asks about the operation of an electro-static voltmeter.

A. 1. An electro-static voltmeter consists of a fixed vane and a movable one. When the




An electrostatic voltmeter may easily be made by using thin variable condenser plates. It must be calibrated from a standard meter.

terminals of an active circuit are connected respectively to the fixed vane and the movable one, there is a difference of potential present, which makes the movable vane rotate and carry a needle over a graduated scale. It will be seen that it does not matter whether any given vane is charged positively or negatively for an attraction or repulsion between the two will always take place, so that a deflection will be given even when the difference of potential is rapidly alternating. This property of the instrument makes it exceedingly useful for measurement of voltage of alternating current circuits. Another advantage of this instrument over the high resistance galvanometers that are used as voltmeters is that it does not take any current and therefore does not waste any power.

## BATTERY SEPARATORS

(1835) A. B. Calcutta, St. Louis, Mo., asks:

Q. 1. Please give all the necessary data you have concerning the type and disposition of plate insulators and separators as used in storage battery construction.

A. 1. In order to meet the requirements of the various applications of the storage battery to different tasks, it has been necessary to install a certain number of plates, consistent with proper mechanical strength, longevity of life and durability, in order to obtain maximum results in current capacity per unit of space. That it might be possible to accomplish this, it has been necessary to reduce the thickness of the plates, packing them closer together and using a superior grade of insulating materials.

The necessary requirements for the construction of separators having a high order of perfection are listed as follows:

They must be impervious to the action of the electrolytic acid.

They should be strong enough to withstand mechanical abrasion and compression resultant from the normal expansion and contraction of the plates when the battery is working.

Temperature changes under ordinary conditions of operation must leave them unaffected.

The material must be of purity such that they contain no substances which might have a deleterious effect upon any portion of the cell. In order to insure proper circulation and diffusion of the acid, or the electrolyte, the separators should possess a fairly high degree of porosity.

The pores of the separators should be small enough to prevent as much as possible the accumulation of any gas bubbles which might collect and increase polarization.

Modern types of separators are of two kinds, wood and rubber. Wood separators are classified according to whether they are plain sawed and ribbed, quarter sawed and ribbed, or unribbed veneered. Rubber separators are known as either of the perforated rubber sheet type which can be ribbed or plain, the slotted rubber sheet type, also either ribbed or plain, the threaded rubber type and the "Ironclad" slotted rubber type which consists of a thin wood veneer separator used in conjunction with the slotted rubber tubes of the positive plates.

Of the wooden separators employed and which are now generally used, it has been found that Basswood, Poplar, Douglas Fir, California Redwood, White Cedar and Cypress, in the order named and after having received the proper treatment, have been found most suitable.

Briefly, the object of treating wood used for separators is as follows:

1. To neutralize a portion of the acetic or other wood acids inherent in the wood.

2. To dilate or soften the fiber structure and thus increase porosity which decreases the resistance and aids materially in accelerating the circulation of the electrolyte into the pores of the plates. This treating process results in the saponification of the fats, and dissolves the resins, gums, and other natural products so as to produce a wood of considerable porosity. To accomplish this, either the Acid-Alkali bath or the Steam bath, are used.

The former consists of three stages, namely, the acid bath, the alkali bath and the washing process. In the acid bath, the separators having been machined by the customary approved methods are placed in a vat containing a sulphuric acid water solution of about 1200 specific gravity at a temperature of from 70 to 80° F. and allowed to soak for a period of two to four days. The next treatment is given in the alkali bath which consists of a 3% solution of caustic potash. The separators are allowed to soak in this solution for a period of 24 to 48 hours, at approximately 80° F. The washing process which is the last step, is a very thorough one, a series of vats being used for the purpose of soaking them in running water from 12 to 24 hours. No less than fifteen changes of water are employed, each change taking about three hours, when continuous running water cannot be had. In view of the fact that this treatment generally enlarges the plates, they are again subjected to a trimming which gives them the correct size and which makes them ready for assembly in the battery. In case the separators are not used immediately after treatment, they are packed in boxes containing excelsior which has been thoroughly moistened with approved battery water to prevent the separators from drying out. If allowed to dry, they become shrunken, buckled, warped or even cracked, thus rendering them unfit for use.

The steam bath treatment in which the separators are treated under pressure for a period of twelve or eighteen hours, gives very good results. The same results can be obtained by boiling the wood in a bath of pure, fresh water from 24 to 48 hours.

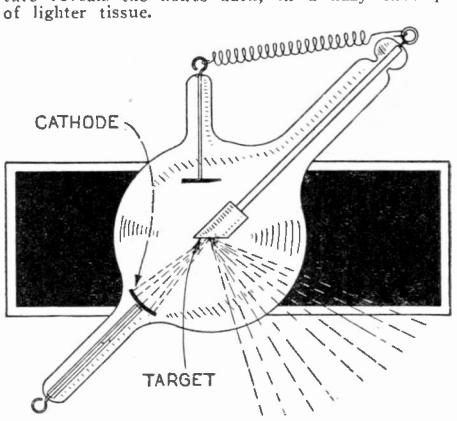
The subject of storage battery construction is indeed highly interesting and its different phases will be described in these columns from time to time.



## X-RAYS—HOW PRODUCED

(1836) Q. 1. G. Reiser, Moberly, Ala., asks how X-rays are produced.

A. 1. When cathode rays strike upon bodies, these bodies emit a species of radiation known as X-rays. While the nature of X-rays is not exactly known, it is fairly certain that they are not material particles like those constituting cathode rays. They are probably wave motions of very high frequency set up in the ether by the impact of the cathode particles against a surface, and proceeding from the surface of impact. In the usual type of X-ray tube, as shown in the accompanying diagram, the anode is a small sheet of platinum inclined at about 45 degrees to the line of discharge, and the cathode is of aluminum, cup-shaped which brings the cathode rays to a focus upon the platinum anode. The latter then emits X-rays. In order to make objects visible, a special screen must be employed. Usually a screen of cardboard coated with a fine layer of some fluorescent substance, as tungstate of calcium, is used, and forms one end of a dark box into which one can look while all outside light is excluded. The fluorescent substance is on the inside. When X-rays, penetrating the cardboard, fall upon the mineral coating within, the inner surface becomes luminous as an effect of the X-rays and the light coming from that surface is not X-rays but common light. If an object such as the hand is placed against the outside of the screen, it intercepts to some extent the X-rays; the flesh permits the rays to pass through without much hindrance and therefore causes slightly diminished fluorescence; the bones are more impervious and consequently the part of the screen covered by them is sheltered and the object looks dark; thus, this shadow picture reveals the bones dark, in a hazy envelope of lighter tissue.




The above shows a common form of X-ray tube. The target may be of platinum, and the cathode of aluminum.

### ILLUMINATING GAS

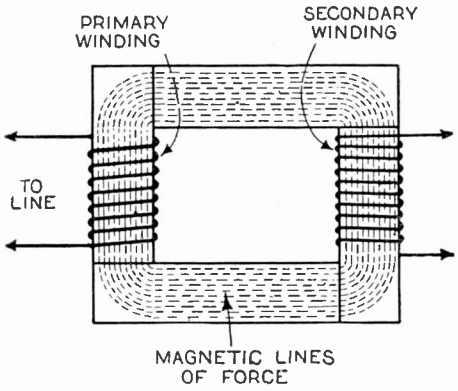
(1837) Q. 1. James Smith, West Hoboken, N. J., please describe the laboratory manufacture of illuminating gas.

A. 1. In a clay pipe place a small quantity of soft coal. Seal the top with cement or clay so that the gas may not escape. Heat the pipe over a Bunsen burner and after a time apply a match to the hole at the stem, whereupon a jet of flame will issue from the end of the stem. The gas is a product of coal brought about by destructive distillation. In some commercial gas works, this distillation is done on the large scale, and by washing and purification the tar, sulphur and ammonia are removed. Aniline dyes and many other products used in everyday life are obtained through the distillation of coal. Illuminating gas is now made in most large works from water gas enriched with petroleum or some of its products.

### TRANSFORMER ACTION

(1838) Q. 1. Mr. L. Port, Scranton, Pa., inquires how is an E. M. F. transferred from the primary to the secondary of a transformer.

A. 1. When an E. M. F. is passed through a coil of wire, magnetic lines of force are produced. If another coil connected to a meter is passed rapidly back and forth through the magnetic lines of force an indication will appear on the meter. If an alternating current is passed through the primary coil and a secondary coil is brought near the primary, an E. M. F. will flow through the secondary. In a transformer the primary is wound over one leg of the core and the secondary over another. When an E. M. F. is passed through the primary coil magnetic lines of force flow through the iron core. As they cut the secondary coil an E. M. F. is produced in those




This cut shows the lines of force present in the iron core of a transformer.

windings only when their field varies in density. This effect may be demonstrated by placing a lamp or a meter across the secondary coil. An alternating circuit is used as the primary. A constant current gives no result.

### CLEANER

(1839) Q. 1. Robert Dix, Denver, Colo., what is a good formula for cleaning silver-ware?

A. 1. Into a wide mouth bottle provided with a good cork, put the following mixture:

| | |
|---|---|
| Cream of tartar | 2 parts |
| Chalk | 2 parts |
| Alum | 1 part |

Powder the alum and rub up with the other ingredients, and cork tightly. When required for use, wet sufficient of the powder and with soft linen rags rub the article, being careful not to rub with pressure as otherwise the thin layer of plating may be cut through. Rinse in hot soap suds and then in clear water, dry in sawdust.

### GASOLINE GUN

(1840) Q. 1. C. P. G. wishes to know about the probability of using gasoline instead of powder to propel a bullet.

A. 1. Its power or pressure produced by its explosive combustion is far too low for the projecting of shells. Its vapor should be mixed with a proper percentage of air; it should be compressed and then exploded. This succession of operations and the inferior result to be anticipated seem to remove it from the field of work specified in the question.

### WELDING TRANSFORMER

(1841) Q. 1. M. MacGrane, Detroit, Mich., asks about the ratio of a welding transformer.

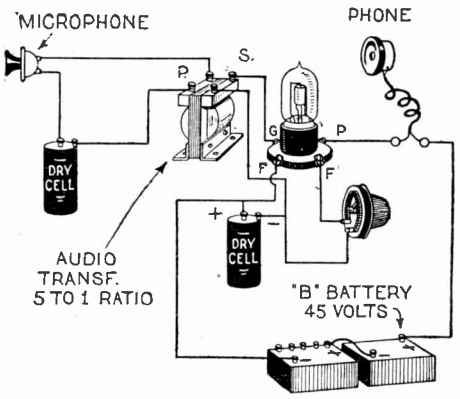
A. 1. The dimensions of the transformer should be as follows: Core, 15 inches long by 8½ inches wide having a cross-section of two inches square. The primary consists of 344 turns of No. 10 D.C.C. wire and the secondary is wound with 31 turns of No. 0 D.C.C. wire. Alternating current is mostly used for incandescent welding. However, when carbon arc welding is wanted direct current is preferable.

## Medical Page!

**In our July number there will appear a digest of the latest medical news and happenings. A page of interest to young and old, lay and professional readers. The review will be illustrated. Look for it!**

### AID TO DEAF

(1842) Q. 1. Mr. Herman Friedberg, Chicago, Ill., asks us to describe a device for making extremely deaf people hear.




This diagram shows the use of a vacuum tube amplifier for aid to deaf people. The batteries may be made very small so that they may fit readily into the pocket.

A. 1. We are giving a diagram showing the use of a vacuum tube amplifier in connection with a sensitive microphone and earphone. The microphone should be connected in series with a dry cell in the primary circuit of a high ratio audio frequency transformer. The usual one stage of audio frequency amplifier circuit is used in connection with a UV-199 tube and about 45 volts of "B" batteries. The amplification obtained by the use of this type of amplifier allows extremely deaf people to hear sound in most cases.

### PLATING REFLECTORS

(1843) Q. 1. Mr. A. Gelala, Atlantic City, N. J. Please give instructions on plating headlight reflectors.

A. 1. You can probably coat your reflectors with silver without the aid of a battery by applying a paste made with two parts of freshly precipitated silver chloride and three parts of potassium bitartrate. The surface to which the paste is to be applied must first be thoroughly cleaned. A little dilute nitric acid will remove rust, dirt, etc., and grease is taken off by immersing for some time in a hot solution of caustic soda. After this immersion the article must not be touched with the fingers. The alkali is removed by thoroughly rinsing with water. To the metal so prepared, the silvering paste is applied with a soft cork. When a sufficient deposit has been made the article should be washed in hot water and it may be dried by shaking with sawdust.

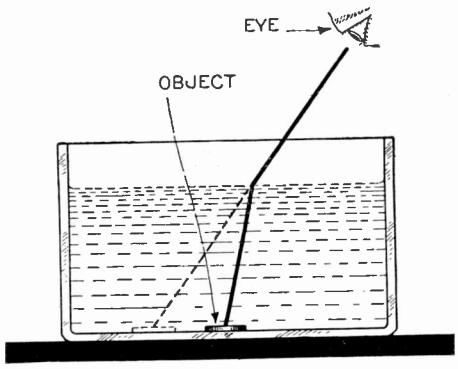
The silver chloride is prepared by dissolving crystallized silver nitrate in distilled water, one part in ten, and adding to the mixture a solution of sodium chloride (common salt) of similar strength, continuing the addition until no more precipitate is formed. The precipitate is then filtered out and washed to free it from any excess of the precipitant.



### REFRACTING LIGHT

(1844) Q. 1. Mr. L. M. Mack, San Francisco, Calif., inquires about the refraction of light.

A. 1. When a beam of light passes obliquely from one medium into another, it is usually bent at the surface separating the two. The amount of refraction depends upon the consistency or composition of the medium; for instance, light rays will be bent more when passing from air through oil than they will be when passing from air through water. If smoke is blown above the water and if the water is very slightly soapy or colored with a fluorescent substance, the path of the beam may be distinctly traced both in the air and in the water. It will then be seen that when the beam is sent vertically downward, it is not bent, but when it is inclined it is sharply bent downward at the surface, and the bending is greater, the more obliquely the beam meets the surface.




The above shows the effect of refraction of light through water.

### ETCHING BRASS

(1845) Q. 1. H. Jones, Denver, Colo., inquires how brass objects can be etched.

A. 1. In order to etch brass you must first form your design in paraffin. The brass is then subjected to the following etching fluid.

Nitric acid, 8 parts, mixed with water, 80 parts, into which solution is poured a hot solution of potassium chloride 3 parts, dissolved in water, 50 parts.

When etched sufficiently, the sheet of brass is plunged into running water and washed free of the acid.

### GRANULATED CARBON

(1846) Q. 1. Mr. J. F. Odenbach, Nome, Alaska, wants to know why granulated carbon is used in a telephone transmitter.

A 1. The reason for the use of granulated carbon in telephone transmitters is that as diaphragm is vibrated by sound waves, the carbon is alternately compressed and released, which changes the resistance of the circuit and thereby allows a greater or less current to pass through. The many carbon granules give a better effect than single contacts.

Q. 2. Is there any other method of transmitting voice by telephone without using granulated carbon?

A. 2. (a). There is what is called the condenser microphone, which is a true condenser. The two sets of plates are connected in circuit with a transformer and about 250 volts of "B" batteries. As the diaphragm vibrates, the space between the two plates varies, and is made greater or smaller, thereby producing changes in the primary of the transformer circuit, which are duplicated in the secondary circuit of the transformer and transferred to the line. (b) Two telephone receivers connected together in series at opposite ends of a line will act both as receivers and transmitters, but not satisfactorily except for short distances. The results may be enhanced in this case by connecting a dry cell or two in series with the two receivers. It is important also to try reversing the polarity of the battery as well as the terminal connections of the receivers.

# Prizes of More Than $28,000.00 Offered by Science and Invention Magazine

## $5,000.00 in Prizes For Perpetual Motion

SCIENCE AND INVENTION MAGAZINE is awarding $5,000.00 in prizes for a perpetual motion machine. This publication does not believe that perpetual motion is possible. It brands as impostors all who have claimed to have developed a perpetual motion machine, but who destroyed the model because they feared that the idea would be stolen. This statement, by the way, is an excuse given by many who produce drawings of perpetual motion machines, claiming that the models actually worked when they added a secret gimmick to the device.

The sum of $5,000.00 is amply sufficient to protect any idea and will more than pay for a patent on the same. The conditions of the contest are that the device be brought or be shipped to the offices of SCIENCE AND INVENTION MAGAZINE; that the editors must be satisfied that there is no trickery in making the mechanism work, and that the device work by gravity. Mechanisms operating by atmospheric pressure changes, temperature changes, or humidity, are not considered perpetual motion devices.

The contest is open to everyone, the date of expiration is March 1st, 1926. We suggest that our readers refer to the March, 1925, issue of this publication.

## $11,000.00 in Prizes For Psychical Phenomena

SCIENCE AND INVENTION MAGAZINE and Mr. Joseph F. Rinn offer a total of $11,000.00 for proof of spiritualism and psychical phenomena. The conditions of Mr. Rinn's offer were explained in the August, 1923, issue of this publication, and the details were again repeated in the October, 1924, issue of SCIENCE AND INVENTION MAGAZINE in the "Readers' Forum" department.

These offers have already been in effect for two years, and they have been extended for the third time to May 1st, 1926. Up to the present time, the editors have met no medium capable of producing any manifestations which were devoid of trickery. If manifestations do occur, if psychical phenomena are present, if messages can be received from the Great Beyond, then the editors of this publication would be familiar with those facts.

Unfortunately no medium or other agency has been able to produce effects which were not fraud at the very onset. This, of course, refers to those who sat before us. Consequently we can state that phenomena did not occur.

This publication, therefore, challenges every medium to produce any sort of manifestation without the aid of trickery.

## Pending Contests

$100.00 in Prizes for Circuit Diagram of the Mystery Set Announced in the May Issue and Again in This Issue. Contest Closes July 2, 1925.

Twenty Combination Pen-Pencils Awarded as Prizes in the Cut Flower Contest Announced in This Issue. Contest Closes July 30, 1925.

# $1000.00 Monthly Contest Awards

**FIRST PRIZE $100.00**

How Paper Is Made, by Prof. Harry E. Weston ..... 132-133

**SECOND PRIZE $75.00**

Giant Insects, by A. G. Penrod ..... 124-125

**TWO PRIZES OF $50.00 EACH**

The "Air Mail" in the Movies, by Edwin Schallert ..... 116-117
Eight Things You Cannot Do, by Dr. Harold F. Richards ..... 126

**THREE PRIZES OF $35.00 EACH**

Chute the Chutes Ferry, by P. Henrikson ..... 114
A New Water Sport Wheel, by J. W. Von Stein ..... 118
Uses of Invisible Light, by Dr. Russell G. Harris ..... 127

**FIVE PRIZES OF $25.00 EACH**

North Pole Junction, by L. B. Robbins ..... 120
Why Are Blue Eyes? by Constance Wardell ..... 122
The Efficiency of Light Sources, by Dr. Russell G. Harris ..... 136
Parlor Juggling, by L. J. Smith ..... 148
Glass Panels and Cabinets, by Dr. Ernest Bade ..... 162

**FIVE PRIZES OF $20.00 EACH**

Nature's Widest Extremes, by Dr. Russell G. Harris ..... 138
Further Tests of Einstein's Theory, by Prof. Harold F. Richards ..... 139
Automobiles Use Less Gas on Hills, by Prof. T. R. Agg ..... 144
Cross Number Puzzles, by Richard H. Tingley ..... 151
Super Radio System, by Dr. Alfred Gradenwitz ..... 161

**TEN PRIZES OF $15.00 EACH**

Vacuum Canning, by J. W. Von Stein ..... 128
Accurate Machines, by Allen P. Child ..... 141
Capillary Action in Daily Life, by J. A. Miller ..... 142
Light Ray Hands for Clock (author please send address) ..... 145
Simple Telescopes, by C. E. Payne ..... 145
Sheet Metal Fishing Punt, by L. B. Robbins ..... 152
An Iceless Refrigerator, by Ruth D. Shultis ..... 152
Sketch With Fire, by James W. Vaden ..... 153
Uses for Odd Pipe Scraps, by J. G. Morris ..... 154
Honeycomb R.F. Transformers, by Herbert E. Hayden ..... 163

**FIFTEEN PRIZES OF $10.00 EACH**

Card Clip, by A. Hussman ..... 153
Automatic Ink Dotter, by Michael Johansen ..... 153
Swing High, by Donald W. Clark ..... 153
Bathing Garters, by Stefan Prospect ..... 154
Musical Instrument, by J. H. Muldoon ..... 154
Water As Weights, by C. A. Oldroyd, Reporter No. 4433 ..... 155
Copying Lens, by Don Home ..... 155
Cleaning Rings, by Franklin Price ..... 155
Paint Brushes, by C. C. Sorensen ..... 155
Car Ventilator, by Thomas McCartie ..... 155
Air Pump, by Don Pedder ..... 156
Sodium and White Lead, by L. Preisman ..... 156
Musical Wrinkle, by F. Cariveau ..... 156
Uses for Salt, by G. Morgan ..... 156
Radio Loud Speaker, by Walter E. Burton, Reporter No. 3209 ..... 164

**TEN PRIZES OF $5.00 EACH**

Glass Holder, by Truman R. Hart ..... 155
Cleaning Bottles, by Carlyle Weiss ..... 155
Mechanical Detective, by C. A. Oldroyd, Reporter No. 4433 ..... 155
Inserting Bulbs, by Sidney Lang ..... 156
A.C. or D.C.?, by J. F. Kasak ..... 156
Warning Mirrors, by Martin B. Beline ..... 156

(No Further Entries)

# $12,000.00 in Prizes for Articles

82 monthly prizes will be given as follows:

| | | | | |
|---|---|---|---|---|
| FIRST PRIZE | | | $100.00 | |
| SECOND PRIZE | | | $75.00 | |
| 2 | PRIZES OF | | $50.00 | each |
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| 5 | " | " | 25.00 | " |
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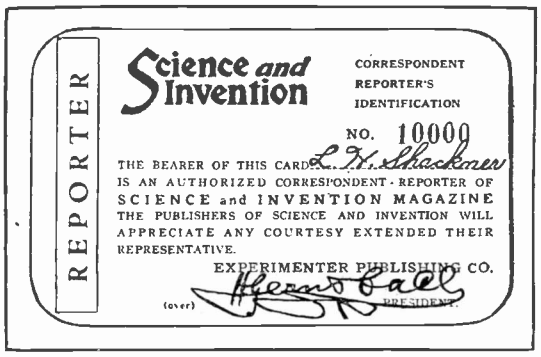
| 15 | " | " | 2.00 | " |
| 15 | " | " | 1.00 | " |

Last year SCIENCE AND INVENTION Magazine paid for articles $13,320.00 to 1,112 prize winners. Hundreds of SCIENCE AND INVENTION reporters won prizes, and up to the time of going to press there were more than 21,000 reporters in the field.

Every month this publication pays $1,000.00 or more in prizes, exclusive of money paid to those authors who are on contract, and who receive their own rates. At the left the list of prizes issued monthly is itemized, and above are the names of the prize winners for this issue. In order to assist our reporter correspondents in securing available material for publication, we issue without charge the reporter's card, a sample of which is illustrated at the right. Send a postal card for one. It will act as an open sesame in securing news. Address Field Editor, SCIENCE AND INVENTION, 53 Park Place, New York City.


REPORTER

Science and Invention

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# The Living Death

By JOHN MARTIN LEAHY

(*Continued from page* 131)

## CHAPTER XXXII

"IT WAS WHITE, HORRIBLY WHITE!"

We examined the spot carefully, thinking that we might find the rifle which the unfortunate men had carried; in the horror of that moment, the weapon easily might have been overlooked by Captain Livingstone and Hampden. But we did not find it; nothing whatever was discovered. What had *it* done with that weapon?

We advanced deeper into the forest, moving, you may be sure, with every sense on the *qui vive*. Not long after we left the scene of the tragedy, the sunlight suddenly disappeared (doubtless the great orb had moved behind one of the mountain peaks) and the woods turned gloomy and awful. Through openings in the dense foliage overhead were caught glimpses of lovely sky of the deepest blue; but this only enhanced the sombre, weird gloom which pervaded the depths of this mysterious forest.

Minute followed minute; an hour passed. The forest suddenly turned more sombre and weird than ever. A silence had fallen, heavy, portentous. Not even the call of a bird broke the stillness now.

"What's goin' on?" queried Nunatak, glancing curiously, apprehensively into the gloom that every moment was deepening about us. "It looks like night was closin' in, but there can't be any night here in Paradise."

I raised my look to the dark canopy of leaves overhead. The openings gave glimpses of a dark and wrathful sky. Came a blinding flash, succeeded in three or four seconds by a fearful rolling roar. There was a sporadic spattering on the leaves overhead. A little space, and the wind began to sigh and moan up there. In the depths where we stood, however, there was as yet not the faintest movement of the air. Another flash, and again the thunder roared and rolled. Then came the rain. A few moments, and it was coming through that roof of leaves in a dripping deluge.

"Why in thunder," said Nunatak with a most aggrieved air, "ain't it snow? A feller would think 'twould be snow and not this here rain that'd make an Oregonian webfoot sit up and stare."

"Why, Louis," asked Frontenac solemnly, "is a hen?"

We were seeking a place of shelter, keeping as far as possible from a tree-trunk, when Addison gave a sharp exclamation. He was pointing fiercely, a tense expression on his features.

"Look at *that!*"

There, in the dense gloom and the rain and the mist, was a moving object, vague, spectral—a moving white thing that in an instant had vanished.

We stood staring, uncertain, wondering, whilst the lightning flashed, the thunder roared and the dripping, streaming deluge descended about us, but the object was not seen again.

"What was it?" said Addison, his voice a whisper.

Nobody answered. That was the very question that each of us was asking himself.

"My God!" Addison exclaimed suddenly.

Frontenac looked at him interrogatively, keenly.

"Did you notice," Addison asked, "the strange color of it? It was—it was *white*, horribly white!"

A bitter smile passed athwart the lean face of our leader.

"Suppose it had been pink or purple or vermilion?"

"White," Addison murmured, "horribly white!"

"Think it was a ghost, Wilbur?"

"I wish somebody would tell me *what* it was. One thing I do know: it wasn't human."

"I see you have turned supernaturalist."

"Well, what was the thing?"

"I haven't the faintest idea," Frontenac told him. "Another little mystery for us to solve.

"And no time like the present moment," added our leader, starting toward that spot in which the white object had shown itself and so suddenly, mysteriously had vanished.

"I say, boss," protested the musher, "maybe you're walking right into a trap."

Frontenac never paused, made no response.

"Well," said the musher resignedly, "I guess it's a case of foller-the-leader."

Ere he ceased speaking, he was moving along in Frontenac's footsteps, finger on the trigger (twigger he called it) of his rifle; the rest of us, too, got in motion.

There was a sudden growl of wind, and the next instant we were fetched up in our tracks by a sound loud and fearful, like a moan drawn from some monster in mortal agony.

"What's that?"

The voice was Hansen's.

Frontenac was moving forward again. He glanced back, and, through the gloom, I saw a smile glimmering in his features.

"Only," he said, "a tree rubbing against another."

A few moments, and he slowed up and began looking all around.

"Must have been right about here," he said.

"A fellow," observed Hansen, "would need a searchlight to find any signs in this dark hole."

It was indeed a gloomy, awesome place that we had got into.

Suddenly Frontenac exclaimed, turned sharp to the left. The next instant he had halted and, heedless of the dripping flood in which he stood, was bending over some object or impression.

"There you are!" said he, glancing up at us and pointing with his rifle. "There is the mark of Wilbur's ghost."

Nunatak was beside him now and bending over the spoor. As we came up, the musher raised his tall form, a grin spreading over his face until I feared it was going to engulf his ears.

"If all our mysteries," said he, "would only prove no more terrible than this one! 'Tis only the mark of some kind of a deer critter!"

## CHAPTER XXXIII

THE HEADLESS MONSTER

And such indeed it was! And the dark, fearful thoughts that the glimpse of a creature so harmless had sent rushing into our minds! What a tricky, untrustworthy thing the human brain is, after all! Something of mystery, a fear, and behold—fearsome thoughts, monsters, ghosts, psychic Gorgons, hydras and chimeras dire!

The lightning soon ceased, but it was fully an hour before there was any diminution in the rain. Once started, though, the change was a rapid, a most striking one. Through the openings overhead the deep blue of an unclouded sky suddenly appeared

(*Continued on page* 176)

# The Living Death

(*Continued from page* 174)

again; the gloom about us thinned, lifted, crept away into the secret places; and suddenly they came, the bright rays of the sun, gleaming and flashing on tree-trunk and foliage, enhancing, however, the sombre gloom of the forest depths.

"Well, boys," said Frontenac, "I think we might as well head for camp."

To this no one offered any objection. We had not cleared up the fearful mystery of these woods; but that had not been our purpose, this first journey into the forests of Paradise being a mere excursion, so to speak—not an expedition of discovery.

The return to camp was not marked by any incident especially worthy of notice. Watson, however, had something to show us—a bird (which he had shot) brown of color and with a white line under each wing.

"Just like," said he, "the one killed by Livingstone's party, and the one seen by Shackleton's men on the other side of the Pole, in latitude 83° 40'. That bird was headed south, in this direction; maybe, for all we know to the contrary, 'tis the very one that they saw."

We had seen a number of birds in the forest, but none like this creature, which, by the way, had a wing spread of four feet.

The next day was passed in making ready for our expedition into this mysterious and weird land, and in looking around. In the afternoon, Frontenac and I went off with the object of finding the depot left by Captain Livingstone. We had a time of it, for a dense fog enveloped the place, but find it we did at last. There was no telling; the supplies here might come in mighty handy. All the others were shown the spot. Nothing, however, was touched. All we did was clear away the snow, which was not near so deep as we had expected to find it.

We were now about to enter upon the grim work of the expedition. The exploring party was to set out the next morning, the 9th of November. What awaited it? Success, failure, disaster, or something of all three?

The party was to consist of Frontenac, myself and two others. Our leader found himself unable to make a choice, and so the men drew lots. Nunatak and Watson made the *lucky* draws. Addison and Hansen were bitterly disappointed, of course, but accepted the result without a murmur. Frontenac was at some pains to impress upon them the necessity of taking no chances whatever, no matter how tranquil and safe everything might seem.

"Whatever happens," said he, "one of you must always be on guard."

Also, he placed in their hands written instructions—which covered one or two rather unpleasant possibilities.

"No man can say what awaits us in there," and he waved a hand towards the Gardens of Paradise. "You will, as directed in this paper, remain here until the 15th of December. If we are not back by that date, you will know that something has gone wrong. Under no circumstances, though, will you make any effort whatever to ascertain our fate. You will start at once for Summer Haven. You will, following as closely as possible the instructions given you in this paper, hew out Sleeping Beauty—leaving her, of course, incased in the ice—and take her with you to the *Multnomah*. Before sailing, I made provision against the contigency that I might be lost: the great secret is carefully down on paper, in a vault in Seattle, and another will awake the girl in case I do not return.

"And now the die is cast. We have done all we can with a prospective regard to success and safety. The rest is in the hands of the Fates."

We got away the next morning at eight o'clock. Each man carried a supply of food sufficient to last him two weeks; then there were our arms and ammunition and other things—which shows that we were not traveling as light as we could have desired.

If we only had one (at least) of the dogs! With such a creature along, warning would be certain in case danger (from any living thing) was near. But, alas, the dog might betray our presence at a moment when such intelligence would spell irrevocable and horrible disaster.

We headed straight into the Gardens. An hour passed, another, still another, and nothing had happened. A half hour more, and then we stepped out into a trail—one evidently, however, not much trodden. Was it that of an animal or—? There was no spoor to give us the answer to that question. The trail ran at right angles to the route we had been pursuing. Which way should we go? To the right or to the left? The right, we decided.

Fifteen or twenty minutes passed, the while we continued our steady, cautious advance. Then suddenly the trail issued into a clearing—a great sylvan chamber rather, for the branches formed an almost unbroken canopy overhead—and there, before our astonished eyes, was the headless monster.

## CHAPTER XXXIV

### A Mystery No Longer

The monster upon which we had so suddenly come here in the depths of this Antarctic forest was nothing more or less than a granite colossus. It was a seated female figure, forty feet in height, and, though headless, there was something indescribably cruel and terrific about it. A thing most strange was this: we had reason to believe that this fearful goddess—for the figure of a goddess we took it to be—had never had a head at all! We were at a loss to account for a circumstance so very singular, but that was our belief—that this colossal granite figure had always been acephalous.

I thought of those heads in Sleeping Beauty's Cavern, there in the pillars of sinter-glass, and I thought of the beheadings of Thompson, Bogardus and Wilkie, and I wondered if there was not some dark and fearful nexus between this figure, sitting here through unnumbered centuries, and those grisly sinter columns and the severed heads of the unfortunate explorers.

We thought it highly probable, too, that there had never been a time, since that day the sculptors ceased work upon it, that this deity had wanted worshippers. Certainly the condition of the great idol itself, after all the ages that had elapsed, and that of the place in which it stood, were such as to strongly substantiate this belief. Whether, however, that had been so or not, there could be no doubt that she had her worshippers *now*. But what manner of beings were they? Strangely enough there was nothing to throw any light whatsoever upon that. But we were soon to have the answer.

"Well," said Frontenac at last, "we have seen all there is here, so let's go on."

So we quitted that fearful sylvan cathedral, following a well-beaten path but one so dark that I could not help likening it to a cavern—and I had had enough of caverns to last me for many a long day! The

(*Continued on page* 180)


## The Simplest Practical Radio Set Made

# $2.50

## A Complete Radio Receiver including Radiogem, Phone and Aerial

### The Complete Outfit Consists of Three Parts

(One)

## The RADIOGEM

The simplest radio outfit made—yet as practical as the most expensive. A crystal receiving set that you can operate and enjoy even though you know absolutely nothing about radio. You receive the RADIOGEM unassembled, together with a clearly written instruction book, which shows you how to quickly and easily construct the set, using only your hands and a scissors. The outfit comprises all the necessary wire, contact points, detector mineral, tube on which to wind the coil, etc., etc. The instruction book explains simply and completely the principles of radio and its graphic illustrations make the assembling of the RADIOGEM real fun.

(Two)

## The GEMPHONE

An adjustable, 1,000-ohm phone complete with 3-ft. cord—the first inexpensive adjustable receiver made. The Gemphone is of standard type and made of the very best grade of materials throughout. The case is made of turned wood, an exclusive feature with the "GEMPHONE." This is responsible for its exceptionally rich, and mellow tone. Like RADIOGEM, the GEMPHONE is sold unassembled. Our Instruction pamphlet shows how to assemble it in two minutes, using only a screw driver.

(Three)

## The AERIAL OUTFIT

Consisting of 100 ft. of standard copper aerial wire and two porcelain insulators.

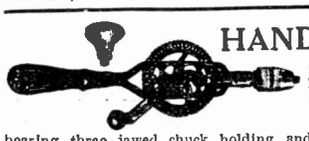
**Complete Radiogem Outfits - $2.50**
**The Radiogem, only - 1.00**
**The Gemphone, only - 1.00**
**Aerial Outfit, only - .50**

# RAGEMCO

## Radio Headquarters for the Finest and BEST Radio Tools

### RADIO TOOLSET

This is the handiest set of tools ever made for Radio Work by the makers of the famous "YANKEE" Tools. It contains the following: 1 Rachet Screw-driver, 6½ in. long holding all attachments; 1 Blade, 5½ x 3-16; 1 Blade, 3½ x ⅛; 1 Blade 2½ x ¼; 1 Countersink; 2 Socket Wrenches for all small nuts; 1 Reamer to enlarge holes in panel from ⅛ x ½; 1 Wrench, one end 5-16" square or hex. for jack, other ½" hex., etc.
**PRICE per set—No. 701 .....$3.00**



### HAND DRILL

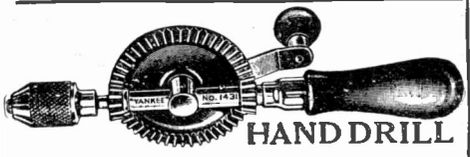
The hardwood handle is hollow to store drills. Iron frame, nickeled parts, ball bearing three jawed chuck holding and centering accurately round shank drills from 0 to 3-16. Length of drill, 12 inches.
**PRICE—No. 303 .....$2.25**

### WIRE BENDING TOOL

For making eyes, loops, bends, and offsets on Bus Bar wire. With this device any Radio Constructor can wire his set to compare favorably with any factory made set. Easier to use and more accurate than pliers. Full directions in box. Made of heavy steel, blued and finished.
**PRICE—No. 203 .....$1.00**

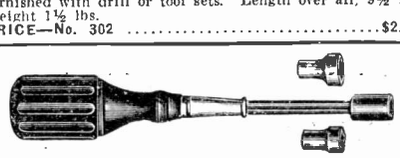
### CIRCLE CUTTER

Especially designed for the Radio Constructor. Made of the finest material and equipped with the highest grade high steel cutting bits. It does three things at once. It drills its own pilot, cuts out plug and puts bead or scroll around the hole in one operation. Cuts holes ¾ to 4 in. in diam.
**PRICE—No. 402 .....$3.00**
401. Same tool but smaller and not fitted with bead or scroll in one operation.
**PRICE—No. 401 .....$2.00**



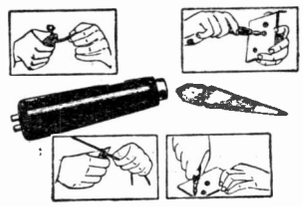

### HAND DRILL

Especially designed for Radio Work by the makers of the famous "Yankee" Tools. A beautiful balanced, small, powerful drill with 4 to 1 ratio of gears for speed. Special chuck 9-32" capacity, to take largest drill, mostly furnished with drill or tool sets. Length over all, 9½ in. Weight 1½ lbs.
**PRICE—No. 302 .....$2.75**



**Three-in-One Nut Wrench.** Consists of handle with hollow stem 6 inches in length and three interchangeable sockets fitting popular sizes of nuts. The hexagon sockets grip the nut solidly.
**PRICE per set—No. 301 .....65c**

**Side Cutting Nipper, Lap Joint.** For cutting all kinds of wire. Jaws hardened and oil tempered. Natural steel finish with polished jaws. Length 6 inches.
**PRICE—No. 201 .....75c**



### RADIO HANDI-TOOL

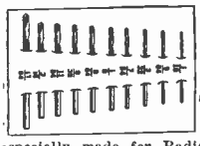
Bends Bus Bar or wire strips and scrapes wire, bores and reams holes, etc. Tool consists of 4 in. black japanned handle, to which is attached wire bending device, with nickeled ferrule and 3 in. long two sided reamer.
**PRICE—No. 702 .....50c**

### TOOL CHEST

Set consists of "LOCK-GRIP" master handle, 5" long, black Rubberoid finish with steel chuck, nickel plated, buffed and with the following 9 tools: Saw, brad-awl, large screwdriver, file, scratch awl, gimlet, reamer, chisel, small screwdriver. Each tool of fine steel, drop forged tempered, hardened, and nicely finished. Set comes in leatheroid box with tray.
**PRICE—No. 703 .....$1.85**

### SCREW STARTER and DRIVER

Holds any screw by its slot with a firm grip, makes it easy to place and start screws in difficult places. Just the tool for the Radio Constructor. All parts heavily nickeled and polished.
**PRICE—No. 304 .....$1.00**

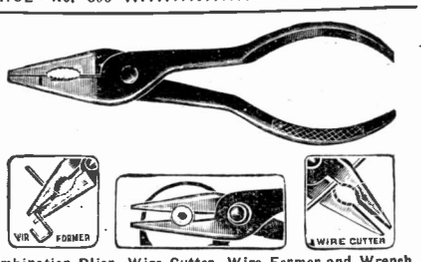


### RADIO DRILL SET

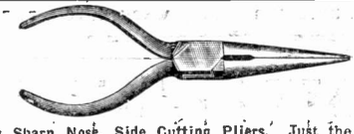
Composed of 10 straight shank twist drills, fitting all hand and breast drills. The selection of these drills has been especially made for Radio Constructors and consists of the following sizes: 1-16, 5-64, 3-32, 7-64, ⅛; 9-64, 5-32, 11-64, 3-16, 17-64. Drills are mounted on white Holland Linen with sizes clearly marked.
**PRICE—No. 305 .....$1.25**

### ELECTRIC SOLDERING IRON

A perfect tool for Radio Work. Operates either on 110-volt A.C. or D.C. The heat element is of Nichrome, which prevents overheating and assures the desired even temperature. Size of Iron, 10½ in. long. A 4-ft. cord and plug is furnished.
**PRICE—No. 800 .....$2.00**




**Combination Plier, Wire Cutter, Wire Former and Wrench.** Drop forged, slender but exceptionally strong. 6 in. long.
**PRICE—No. 202 .....75c**



**Long Sharp Nose, Side Cutting Pliers.** Just the pliers for the radio constructor. Bends and cuts all kinds of soft wire. Nose 1½ inches long, black body, polished jaws. Length 5½ inches.
**PRICE—No. 200 .....75c**

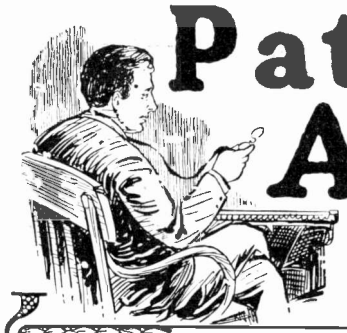
Order all tools by order number. All goods are shipped free of transportation charges to all parts of the United States and possessions the same day as the order is received.

**MONEY REFUND GUARANTEE**

*If you are not satisfied money will be refunded on return of goods.*

# The RADIOGEM CORP., 66-S W. Broadway, New York

# Patent Advice



Edited By
A. P. PECK

In this Department we publish such matter as is of interest to inventors and particularly to those who are in doubt as to certain patent phases. Regular inquiries addressed to "Patent Advice" cannot be answered by mail free of charge. Such inquiries are published here for the benefit of all readers. If the idea is thought to be of importance, we make it a rule not to divulge all details, in order to protect the inventor as far as it is possible to do so.

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.

### SUGAR BOWL

(892) Jacob Furda, Winnipeg, Man., Canada, submits a design of a sugar dispenser which is rather complicated in construction and asks us to comment upon the same.

A. 1. The sugar bowl which you have designed is far from satisfactory. In the first place, the object is large. Secondly, it is not easily passed around the table. In the third place, the spoon must be employed in the same way as it is used at present. Fourth, that the spoon fills itself. This is more of an inconvenience than a convenience. Fifth, the device is difficult to clean. Sixth, the system is too expensive. Seventh, any attempt to obtain a small quantity of sugar will cause the overflow to drop into the tray. We would advise strongly against patenting this device.

### TUMBLING TOY

(893) Louis Kudman, Brooklyn, New York, has devised a new type of toy of which he gives the details and upon which he desires criticism.

A. 1. You could possibly obtain a patent upon the tumbling toy which you have designed, but unless you are financially able to patent and manufacture the device, we would not advise you to proceed. However, in such a case, you could protect your idea by means of an evidence of conception which consists of several sheets on which are drawn full details of the device, as well as a written description of the same. These sheets are all then signed, sealed and dated by a notary public and witnessed. After proceeding in this manner, you could take up the idea with one or more toy manufacturers and possibly make arrangements for one of them to manufacture.

### RADIO COUPLER

(894) Eric Rawcliffe, Argo, Ill., submits the details of a variocoupler designed for radio work in which the rotor and stator are wound on thin bakelite strips. He wishes to know whether or not the device is patentable.

A. 1. Your proposed coupler for radio work is very old, indeed. We would not advise you to try to obtain a patent on the same.

### PATENT RESEARCH

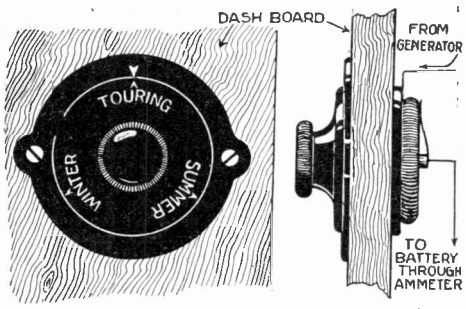
(895) J. Trotten, Tacoma, Wash., desires to know whether or not we will undertake a patent search for him.

A. 1. This department does not undertake patent searches. We would suggest that you communicate with any one of the patent attorneys advertising in our magazine, and have them conduct such a search for you.

### CHARGING REGULATOR

(896) Donald P. Olson, Denver, Colo., submits a design of a rheostat to be used in series with the storage battery on an automobile so as to prevent overcharging the battery in summer, and undercharging it in winter. The design of the rheostat is illustrated herewith. He asks our opinion as to its patentability.

A. 1. Some years ago a concern tried to put a device on the market in the form of a little snap switch, which had a "no charge" sign upon it. When the switch was pulled out a carbon resistance was automatically thrown into the charging circuit, so that the generator no longer charged the storage battery, except to the extent of maintaining the charge at a certain definite point to overcome the use of current from the battery when the engine was running. At about the same time another concern placed an ammeter upon the market, in which the charge was




A regulator for automobile storage batteries, to prevent overcharging.

regulated by simply turning a small dial. The ammeter could be made to regulate the current, so that the charge would be regulated from one ampere to fifteen amperes in variable steps of a half ampere per step. This was in the form of a rheostat permanently secured to the ammeter. Neither of the devices have met with a very great sale.

The difficulty with your system is that a broad and basic patent could not be obtained on it, and although you may cover and protect the idea of a variable charging unit to be placed upon automobiles, any other concern making resistance could likewise construct a similar device, advertise it and sell it without the necessity of paying royalties to you for its use.

Because of the fact that the experiment has already been tried, and a basic patent cannot be obtained upon the idea, we would not suggest that you apply for a patent upon the same.

### CLOTHES DYEING

(897) Mary R. Fennelly, Alexandria, La., asks our advice on a clothes handling implement for use in dyeing materials.

A. 1. We believe that it will be difficult for you to dispose of your patent on a clothes handling implement. There is very little demand for a device of this nature, unless it is cheap.

As a clothes hanger, your device would be of more practical value, but here it would not cause the clothes to hang very straight, and it is inferior to those hangers now found upon the market.

We would suggest that if you want to save money, you forget about advertising the invention and write to those concerns dealing with dyes and dyeproducts, to determine whether or not they would market your device and sell it in conjunction with dyes intended for consumer's use.

# The Living Death

(*Continued from page* 176)

path led to the northeastward—the very direction in which we wanted to go.

We had gone perhaps a mile, and then came the discovery. The trail dipped into a little hollow, through which flowed a sluggish stream. Frontenac, who was leading, came to an abrupt stop, exclaimed and pointed to the ground with his rifle. There, in the soft black earth, was a footprint—but such a footprint as no man of us had ever before looked upon!

"Great guns!" exclaimed Nunatak, straightening up and glancing about into the gloom of the trees, "like a grizzly's!"

There were many marks, coming and going, the marks of huge feet—quasi-human feet with enormous claws.

"What on earth," said Watson, "can they be—the things that left these marks?"

"Giants!" Nunatak muttered. "Giants—or somethin' worse. I tell you, fellers, I sure do wisht that I had another gun!"

Our leader laughed.

"You've got one more weapon now, Louis, than your two hands can manage."

"If only," said Louis Louisiana, "I had practiced up some on pulling twiggers with my toes! I seed a feller once who could do it, and I have an idee 'twould come in handy here."

"And," I said, "'tis such things that worship that horrible colossus. I would rather imagine the scenes that take place there before that figure than be a witness of them."

"Human grizzlies!" muttered Nunatak, gazing at one of the great footprints. "Giants! Monsters! Bear-men!"

"There certainly," Darwin nodded, "is something strikingly ursine about the appearance of this spoor. Bear-men! Well, who knows, Louis?"

"Surely," I exclaimed, "'you don't actually think that—?"

"I didn't say that I thought it, Bond. This only is certain: we'll soon *know*."

We soon did know!

We had gone about a mile farther and had just stopped to examine a plant with long tendrils that moved like live things when touched—reminding me most forcibly of the tentacula of an octopus. Frontenac had just thrust his rifle forth and touched one of the arms, which on the instant had closed about the barrel and now held it in the grip of a vice.

"That thing ain't a plant!" exclaimed Nunatak, his voice touched with horror. "It's *alive!*"

"It's an animal," said Watson, "even though 'tis rooted to the ground."

"A land devil-fish!" Nunatak ejaculated. "Ugh!"

Scarcely had the last word left his lips when a movement, off in the forest, as though a shadow passing, whirled me around.

"Look there!" I cried. "It's coming!"

There was very little undergrowth here. In this respect, it might have been a scene in some beautiful park. And, coming down an enshadowed, sun-flecked aisle of the forest, coming straight towards us, was—*it!* There at last, no more than a hundred feet distant, was the mystery! Fearful the apparition which was approaching—but, thank God, the mystery of Paradise was a mystery no longer!

## CHAPTER XXXV

### What We Saw

Frontenac tore his weapon from the grip of the octopus-plant. The musher flung forth a savage oath and raised his rifle to his shoulder.

"Not so fast, Louis!" said Darwin, thrusting up the muzzle of the other's weapon. "Hold your fire, boys. Let's see what it does."

At that instant the thing stepped into a stream of sunlight, and there it paused, a monster clothed in golden fire, and stood regarding us with stolid interest. It was now some fifty feet distant.

"Your camera, Bond!" whispered Frontenac, keeping his eyes on that fearful apparition. "Try a shot with that."

I did, while the others stood with upraised weapons, fingers on triggers.

Suddenly I whirled. What was that? Surely a sound had come from behind. Was the place full of them? But nothing was to be seen there or anywhere else—only that figure standing there before us framed and clothed in the fire of the sun.

And that thing which we saw? Imagine the biggest grizzly bear that you ever heard of. That will be a creature terrible enough, I know. But now imagine it turned into a thing half human, and you will have a faint—a *very* faint—idea of the monster which stood before us. Yes, as I hope to see Heaven, that is what it was—a human grizzly, a huge bear-man!

Evidently there was that about us which was somewhat of an enigma. I wondered if it was our standing thus resolutely and facing him. Undoubtedly he thought that we were unarmed.

There was a belt round the bear-man's middle; from this belt he suddenly whipped out a great knife—a weapon of flint—and, with a most horrible roar, started towards us.

"Now, Bond, now!" cried Frontenac. "We'll take care of him! Get a picture!"

I snapped just as the monster gave another roar. At that instant, too, Frontenac fired. The bullet went right into the open mouth and out the back of the head, and down the bear-man fell and in a few moments was still.

"Great Heaven," I exclaimed as we stood looking down on the great form, almost as terrible in death as it had been when living, "this is the thing that beheaded Livingstone's men!"

"And this here feller," said Nanatuk, "intended to do somethin' very similar to us, I reckon. Wonder if they got that decapitatin' stunt from the goddess back there."

"I thought of a big ape," Darwin Frontenac said, "but certainly in none of my hypotheses was there ever even the ghost of a bear-man."

He pointed to the feet.

"There's the great claw, about which we have done so much wondering, which made the mystery so fearful. Evidently—look at the hands—the creatures never go on all fours, are true bipeds."

"Why should they go on all fours?" queried Louis Louisiana. "They're bears, but ain't they human like us?"

"Not *like* us, Louis."

"I mean as regards their brains they're human. By the great Harry, I'll say we're in Paradise!"

At length we resumed our advance.

"Probably," said Watson as we moved along the trail of the bear-men, "we'll wish, before we're done with these woods, that we had eyes in the back of our heads."

I was wishing that already!

It was late in the afternoon when we came to the edge of a large open space and saw

(*Continued on page* 182)

# The Living Death

(*Continued from page* 180)

the camp of the bear-people. It was at the farther side, by a little stream, and consisted of a half dozen huts, made of woven branches and roofed with long leaves like those of the pandanus.

A fire was burning, and there were a half dozen figures about it. Three of these were children. The others, which we took to be females, were cooking the evening meal—that is, two of them were; the third stood looking on, holding an infant in her arms, for all the world as any human mother would do.

As we stood, screened by the foliage, looking out upon this strange scene, two bear-men suddenly came into view, one of whom was carrying some dark object.

"What the deuce," said Nunatak, "has the feller got?"

"Turtle," answered Frontenac, the binoculars to his eyes.

For a long time we remained watching these strange beings. There was nothing terrible about them now—though how terrible they could be, that we knew full well. In fact, the scene was merely singular, at times almost comical, reminding us most forcibly of a chapter from some storybook for children.

When our curiosity had been satisfied, we quitted the place, striking out into the pathless forest. After traveling for about two miles, we halted in a fine park-like spot, where we proposed to pass the night—if I may use that word, for here the sun, though at times hidden by a mountain peak, never set at all. The night, then, passed uneventfully, each man taking his two-hour turn as guard.

We were off early next morning, the 10th, steering a course that would take us to the eastern flank of Mount Wilkes. But *there* it did not take us, for, after traveling for about three hours, we found further progress in that direction barred by a great swamp. We turned to the left and at length came to what we thought was the edge of the morass; but the firm ground proved to be only a peninsula, and so, after advancing four miles, we had to retrace our steps. Goodness knows how much headway we made in all our wandering that day; perhaps, indeed, we did not advance one single foot.

The next day, however, about five o'clock in the afternoon, we reached the base of the mountain, where we camped. We had turtle for supper and could have had venison too. There was one consolation in the midst of all those evils which might befall us: there was no danger of our starving to death here in the Gardens of Paradise.

"Which same," remarked Louis Louisiana, "reminds me of the feller who shouted as he tumbled into the nest of yaller-jackets: "'Thank God, they ain't hornets!'"

## CHAPTER XXXVI

### ANOTHER!

We resumed our journey about eight o'clock; this was the 12th of November. When we halted at six in the afternoon, we had made good but eight or ten miles. And that, considering the difficulties with which we had had to contend, was regarded as a *very* good advance. The mountain-side was gashed by ravines and gorges, the bottoms of them strewn with boulders, rock fragments and masses of all shapes and sizes. Countless streams came foaming and cascading down from the snow-fields high above us. Wherever a root could get a hold—and that was everywhere except upon the absolutely naked surface of the rock—trees were growing, forming in some places an almost impenetrable tangle. And through all this we had to make our way, for things were even worse higher up, while below stretched impassable swamp.

The day following things were no better; if anything, they were worse. By midafternoon, however, we were well around on the northeastern side, and we now ascended to a height of a thousand feet or so to see what lay before us. Our reconnaissance was not a particularly gratifying one. A haze drew its veil over distant objects, whilst the expanse of country over which the eyes could range was in no essential feature different from that which lay behind us. I may mention, though, that glimpses were had of a fair-sized stream, the course of which seemed to be a particularly erratic one, and that the swamp which had given us so much trouble evidently ended hereabouts.

Our camp that night was at the base of Mount Wilkes, and here was seen the shadow of the first of those evils which a malign destiny was to loose upon us—though at the time we did not know that a shadow had fallen.

We noticed that Watson had an unnatural look; especially was the expression in his eyes a strange one. On our asking him if anything was wrong, he made light of it, saying that he did feel "kind of queer in the head"—how queer we all were to learn, soon and to our sorrow—but that he would be all right in the morning.

But in the morning Watson was not all right. He declared that he was, however, and so we started, but it was not without grave misgivings. We set out at seven o'clock. About nine our march came to an abrupt end. Then it was that Watson suddenly stopped, sank upon a log, his hands pressed to his temples and said he *guessed* he was sick, after all. The attack was as swift as mysterious. A few minutes, and a strong man lay as helpless as a babe. Nothing in our medicine-kit gave him the slightest relief. We could do nothing but stand there and watch the man suffer.

"It's my head," said Watson. "It's as though augers were boring into my brain."

Shortly after midday the victim became comatose. This we thought the precursor of death. For forty-eight hours he lay, save for his feeble breathing, like a dead man—then suddenly opened his eyes and quietly asked what time it was! In six or eight hours he was almost wholly himself again.

Great was our joy at this miraculous recovery of poor Watson, but, alas, that joy was soon damped. It suddenly became patent that this insidious and most mysterious malady (it certainly was not a fever) had laid its fell hand upon another victim. This was Louis Louisiana. And, just as he was recovering, it seized me, and then came Frontenac's turn. Thus a whole week was lost, and there is no necessity for me to dwell upon what a serious thing for the success of the expedition that loss might prove to be. Also, the possibility must not be blinked that it might bowl us over again. And suppose all of us were seized at the same time and just suppose that a bear-man were to come waddling into the scene—well, it would be *bon soir et bonne nuit* then with a vengeance!

It was on the 22nd that we got under way once more. In the afternoon we crossed

two trails of the bear-people; but we did not linger at those points. We had no desire whatsoever to follow those trails, to see where or to what they led. *That* mystery had been solved; our purpose now was to clear up the mystery of that race of real men, white men, men like ourselves.

It was about half past four when we reached that stream which I mentioned some pages back. Fifteen or twenty minutes afterwards, we discovered the canoe, its bow drawn far up on the sandy shore. Trees overhung the water, out for a distance of fifteen or twenty feet, their branches, which bent down until they touched the surface itself, forming an almost impenetrable screen of foliage before the spot.

"Look!" whispered Louis. "See them tracks in the sand! Another of them grizzlies—maybe more!"

That last word had scarcely left Nunatak's lips when a bear-man leaped out from behind a tree-trunk and, with a blow of his club, smashed Watson's head like an eggshell.

## CHAPTER XXXVII

### Malign Fate

The whole thing must have happened in two seconds. Back went the club for another blow as the bear-man sprang at Frontenac. We fired, the three of us, almost simultaneously, and down the great brute went on his face, Frontenac springing aside to avoid the pitching body.

But he was not dead, this fearful assailant. Up he rose, still clutching that terrible club; but he swayed upon his feet, and the eyes that glared upon us had a wild and glassy look. Bang! and the bear-man fell dead, a bullet from Nunatak's rifle through his brain.

"I wonder," the musher exclaimed, glaring about a little wildly, "if the brute was alone."

"Alone," said Frontenac. "There are no tracks there in the sand but his."

We carried the body of Watson to a spot deep in the forest, where we dug a grave, loosening the earth with our hatchet and our knives and scooping it out with our hands. And there we buried our poor comrade, and at last we came back.

As for the body of the bear-man, we rolled that down the bank and into the river.

It was getting late, but we had no desire to camp at or near that cursed spot. So we got into the canoe—there were two paddles in it—shoved it through the wall of foliage and were on our way down the stream.

But we did not go far. A half hour or so, and we put our craft into a spot where she lay completely hidden by the leaves, and there we passed the night, each man taking the watch for three hours.

At eight o'clock the next morning, the 23rd, we shoved out into the stream and resumed our journey.

The river was very sinuous here, the current rather sluggish.

I transcribe the following from my journal, *verbatim et literatim*:

"Nov. 23d.—Horrible discovery this afternoon, though we had speculated anent the possibility of this very thing. A little after 11 a. m. came to a large village of bear-people. Remained hidden, however, and watched. Not fear, for we believe a few bullets would tame these creatures, but Frontenac is adverse to spilling of blood. Almost as loath to kill one of these brutes as he would be to shoot a human being. About 2 p. m. three large canoes arrived, from down the stream. Much excitement in village and great celebration. We now saw a horrible sight—three human bodies were taken out of the canoes, one that of a woman and everyone *headless*. Wish I had not

seen what followed—the cooking, the carving and the feasting. Evidently these creatures regard human flesh as the greatest of delicacies. Certain features of the reception accorded the canoe party—it was well armed with bows and arrows—lead us to believe that the expedition had been one of great hazard. But—where did they get those victims?

"Believe we got some remarkable photos with telescope-camera. We lay low until all was quiet in village, then got into canoe and passed down unperceived. Writing this at 11:30 p. m. Place in shadow, but sky a deep blue and mountains on other side; grand in sunlight.

"Frontenac has just voiced a curious thought: do these bear-people *hibernate* during the long Antarctic night?

"Nov. 24th.—I began to wonder if a malign fate has not loosed bane-hounds upon our trail. At 9 a. m. halted to get some sleep, for had had none for over 24 hours. Louis felt queer in head again. We feared another attack of *gimletitis*—as he has dubbed that fearful malady. And of a truth the pain could scarcely be more excruciating if fiends were driving a hundred gimlets into the brain. And sure enough it bowled him over. As I write this, at 10 p. m., he lies like a dead man. What can this fearful seizure be? Is it caused by something in food, the water, the bite of some insect or some noxious exhalation from the warm earth? We have no means of knowing, but we do know that things are beginning to look pretty bad for us.

"This afternoon Frontenac shot a deer—a lovely little creature, its skin snow-white and beautifully ocellated, like the tail of a peacock or wings of an argus-pheasant. Thank Heaven, hunger is not one of the evils that beset us here!

"Nov. 25th, 9 p. m.—Louis still like a dead man. Fear it has me now.

"Nov. 28th.—It stretched me out. And now Frontenac is down. This is horrible. We have been out from camp twenty days now, and on the 15th of December Addison and Hansen are to start for Summer Haven. I wonder—but what is the use of wondering?

"Nov. 29th.—This afternoon Frontenac opened his eyes. Is himself again now, though in low spirits over the way things have turned out. It is indeed a bitter disappointment. Our bolt is shot. This is our farthest. Somewhere before us—we wonder how near, how far—is the mystery of *Ah-cone-cawn-ga,* as we call it. But we dare not risk it. Men cannot fight this thing which has brought our purpose to such wreck. Our outlook as it is dark enough truly. We have but two weeks in which to get back to camp—and the journey out has taken three! To advance were madness. Can we make it back in time, or are we doomed to remain in this awful place for years—for the rest of our lives? God knows. But, if the latter, our lives may not be at all like Methuselah's.

"Yes, bitter is our disappointment, whilst we shudder to think of the possibilities that are closing in upon us.

"I have said that this is our farthest, but this is not strictly correct. A mile or so distant, rises a great rock, perhaps 700 or 800 feet in height. In the morning we are going to proceed to this rock and from its summit look out over that region which the Parcae have forbidden us to enter. Even this delay worries me, for every single hour is precious now.

"Nov. 30th.—Another day of horror. Even Frontenac, the man of iron, is shaken.

"We proceeded to the great rock and up to its summit—a rounded mass of naked granite. Weather glorious. Air very clear—clearest we have ever seen it in this valley. Country very hilly and much broken. Mountains drew in until the valley was very narrow. The region up there had a strangely convulsed appearance—the mountains presenting an aspect gloomy, wild and savage, and finally losing themselves in dense vapor. There was something very strange about that vapor—something uncanny. Could make nothing of this most amazing phenomenon, though we studied it carefully through our powerful glasses. It rose in great billows, which swelled out and *burst* and descended in long curving lines like the spray of fountains. Long arms, twisting, swaying, would start out from it and vanished with the suddenness of auroral fires. And from the heart of it shot and leaped and quivered a greenish, a ghostly, a fearful radiance.

"'Tis awful!' cried Nunatak. 'Great Powers, what *can* it be?'

Frontenac groaned.

"'So near!' he said. 'So near to *that*—and we have to go back!

"'Unless,' he added, glancing at us wistfully, 'we'd care to cast in our lot with the Antarcticans—for I have no doubt we could reach their country—until other explorers come.'

"It didn't take Nunatak and me long to annihilate that suggestion!

"Frontenac left a record of our visit, and then, after a last, long look towards that mysterious northeast, we turned and started back. The rock we called Rock Disappointment.

"The canoe was abandoned. Course of river so erratic that we could make better time on foot. It was along about 3 o'clock that it happened. Nunatak was leading. Reached up to move aside a branch and the next instant staggered back with an awful cry, as though he had been stabbed. About his left wrist was wound a serpent, a vivid green and with red spots upon it, its fangs buried deep in the flesh. Nunatak whipped out his knife and slashed it across that coiled horror, badly cutting his knuckles and wrist. I can't set down what followed. Poor Louis! Well, in a half hour it was over. We could not stay there by the grave, so pushed on to this spot, a distance of three miles or so. What malevolent thing is this that dogs our steps? I am beginning to think of viewless entities, spectral shapes—there, there, I mustn't let my mind go like that! If I do, we—at any rate, I— shall never get back at all!"

But we did get back. A different route was chosen, one passing on the other side of Mount Wilkes, and it was well for us that we steered such a course. Had the return been made on our outbound trail, we could never have made it in time—if we had made it at all! To our surprise, not a single bear-man was seen, which means that not a single ursine aborigine, to use a phrase of Frontenac's, saw us. If one had, we should have known it soon enough—our first warning perhaps an arrow between the ribs. Gimletitis met us, however, and stretched us out, one after the other, and for a time I abandoned hope. But even that fell enemy could not make it disaster. I shudder, though, to think how near he came to doing so. For it was on the 15th itself, at four o'clock in the afternoon, that we reached camp. This was, of course, the day that Addison and Hansen were to set out on the long journey to Summer Haven; but, hurrah! they were still there! They had no intention, the loyal fellows, of disobeying the orders of their chief; but—Frontenac had not mentioned any hour, and they were not going to start until 11:59!

We were surprised to learn that they had not seen even the ghost of a bear-man.

"And the dogs," said Addison, "had some glorious concerts, too. Funny the grizzlies didn't pay us a visit."

For two days we remained there, Frontenac and I doing nothing but rest—in other words, doing nothing but nothing.

"I wonder," I said, "if that infernal gimletitis will bowl us over any more."

"I expect it will," returned Frontenac, "but that the severity—a feeble word that—of the attacks will be found to diminish swiftly and that the attacks themselves will ere long cease."

And so it proved.

It was on the 18th that we started, in the early morning. As we were about to enter the fog, we stopped and for a space stood looking out over the Gardens of Paradise. A solemn moment, that. Gladness was ours and sadness too. That weird land; our poor comrades, Watson and Louis; the terrible quasi-human creatures whose home it was; those headless forms we had seen lifted out of the canoes; that swelling, bursting vapor and its greenish, ghostly, fearful radiance—but I cannot set them down, those thoughts that came thronging into my mind, those feelings that gripped my heart.

We turned, started the dogs, and in a few moments everything was hidden by the fog.

It was on the 28th of January, at half-past three in the afternoon, when we reached Summer Haven. Never can any feature, even the slightest, of that scene which followed lose its vividness in my memory—that scene before the hut when Frontenac undid the lashings on his sled, threw off the canvas covering, and they saw Sleeping Beauty lying there in the block of ice.

"Poor little," said Archimedes Bukink; "oh, the poor little kid!"

He made no attempt to hide the tears that dimmed his eyes. His is a kind soul, is Bukink's.

The next day the *Multnomah* was fighting her way northward through the pack.

We arrived at Seattle on the 15th of May.

## CHAPTER XXXVIII

### He Wakes the Sleeper

That very day Frontenac sent a telegram to his sister, Mrs. Charlotte Marshall, who lived down in Portland, urgently requesting that she come up and come prepared to stay for some weeks at least.

"I must have someone here," said he, "to look after this poor Sleeping Beauty, and Charlotte is the one woman in the world. Ever meet Charlotte, Bond?"

I never had.

"You'll fall in love with Charlottle," said Frontenac. "Everybody does. She's a dear, a brick—I suppose, what with these days of unequal rights, I ought to say a brickette. Ten years older than I am, but I'll swear she looks five years younger, and I hardly think that I greatly resemble old Rip Van Winkle. Yes, I won't wake Sleeping Beauty until Charlotte comes—if she doesn't come for ten years!"

But Mrs. Marshall came, and, as will be seen in a moment, it was, indeed, a most fortunate thing that she did. If she had not—well, I shudder every time I think of it.

It chanced, however, that she was out of town at the time, so it was not until the 18th that Frontenac received an answer to his wire:

"Will arrive 19th," it read, "5:45 train."

At 5:30 the next day, Frontenac swung his car to the curb before the station, and we descended to await the arrival of the train from Portland, due in fifteen minutes and, wonderful to relate, on time.

Frontenac had said I would fall in love with his sister; I did—thanked God she was to be there at the awakening of the sleeper.

"Darwin, Darwin," she cried as she clung to him and kissed him, "you foolish boy to go down to South Poles and awful places, and before we could come back even to say good-bye! You must never, never go on such an awful expedition again!"

Frontenac said 'twas very unlikely that he ever should.

"And," said she as we were going up to the auto, "what is this weird story about a girl in ice?"

In a few words he told her. She exclaimed, stopped and looked at him in sheer amazement.

"Then it *is* true?"

"Yes, it is true. I wish we could have kept it a secret, though—from the public, I mean."

"And—and you are going to *awake* her?"

"Yes, I hope to awake her."

"My Heaven! But she must be—surely, Darwin, the girl is dead! There in solid ice!"

He explained, succinctly but clearly.

"But," said his sister, "how can she breathe?"

"Of course, she is *not* breathing."

"I don't mean that. I mean if you *awake* her. In ice! Her lungs must be full of ice, too."

"Oh, no, Charlotte. She was not immersed in water but was covered with snow, and how could snowflakes have got into her lungs?"

"Oh!" said she. "It is all so strange, so awful, so wonderful—I can't begin to understand it."

Immediately on our arrival at Frontenac's house, Mrs. Marshall exclaimed, in low and awe-struck tones:

"Where is she? Let me see her, Darwin."

So we went to the freezing-room, and she saw her.

"Oh, the poor, poor darling!"

For some moments she stood there, then burst into tears and left the chamber—a place as awful, she said, as a tomb.

That very night it was, about two o'clock, that it occurred—one of the most mysterious things in all this strange and weird business: an attempt was made to steal Sleeping Beauty!

It seems certain that the ghouls would have succeeded, too, had it not been for Mrs. Marshall. She found herself — most fortunately, as it proved — a victim to a terrible insomnia, and, as she lay thinking and wondering, it seemed that a low, inexplicable sound suddenly mingled with the sighing of the wind in the trees. Yes, there it was again—a sound low, metallic, mysterious! She arose and (leaving the room dark) stole to the window and looked out.

The night was cloudy, and there was no moon, but it was not so dark as to conceal those figures—there were four—at the entrance to the freezing-chamber. Even as her eyes fell upon them, they vanished, and she knew that they had forced the door and entered. Instantly she gave the alarm—whereupon, of course, the thieves dashed for their automobile (waiting out in the road) and made their escape. Who they were, what purpose lay behind this ghoulish business, that has remained an utter mystery—a mystery, I fancy, which even Mr. Sherlock Holmes himself would say is "really unique, Watson, from some points of view."

A guard was at once posted, armed with a repeating rifle—none other than that weapon which Frontenac had carried in the Gardens of Paradise.

"And guarded the place is going to be," Darwin told me, the next day, "until I awake her. But that won't be long—only this day and to night."

"You are going to awake her tomorrow?"

"Tomorrow, Bond. And I hope my old *tillicum* (partner) will come over."

"I shall be here—most certainly I shall come. What time?"

"Be here at nine. Only two others are to see it—Charlotte and my old friend, Dr. Hollister. It was to him, you know, that the secret was to pass in case I failed to return from the forests of Paradise. No, *three* others—a nurse, too. Yes, a nurse ought to be present. And this time tomorrow, Bond? I wonder——"

I made no response. For a long time there was silence.

The next morning I arrived right on the stroke of nine.

How can I describe what followed? I cannot do so; I can only *tell* it.

A few minutes after my arrival, Dr. Hollister came, and with him the nurse. We at once went out to the room wherein lay the sleeper—Frontenac, his sister, Dr. Hollister, the nurse, Miss Brewster, and myself. The temperature of the chamber we found above the freezing-point. Already the ice which incased Sleeping Beauty was melting. Frontenac began chipping it away, in which occupation he was ere long joined by Dr. Hollister, It was not a great time, therefore, before the girl lay a dripping figure before us—her hair, however, still ice-incased.

Her nostrils were now rubbed with that bright-purple liquid, so unpleasantly oily in appearance; then her face, neck and bosom. The temperature of the room was rising steadily, steadily but very slowly; at last, the thermometer reached 98°, and then it rose no more. Then it was that Frontenac injected the antidote—that bright-purple stuff—into the neck. Oh, that wait which followed! Twenty minutes, thirty minutes—forty! Sleeping Beauty still lay rigid, corpse-like.

Dr. Hollister had drawn a chair to her side, and there he sat waiting, his stethoscope to her bosom—that bosom as still as marble.

"The change—the change at last! Her eyes! *Look at her eyes!*"

And her cheeks! Surely—yes, into the cheeks of the sleeper a faint color was creeping.

Frontenac placed his hands to her sides and began a gentle compression—in imitation of the expiratory and inspiratory movements of breathing.

"Her heart!"

It was Dr. Hollister who spoke.

"It beats?" Frontenac cried.

"It beats! The pulsation weak—but—stronger—stronger!"

Frontenac's hands ceased to perform those respiratory movements.

Look!

The girl's breast slowly rose, fell and rose again!

She stirred, sighed, closed her eyes. The pupils were contracting; the eyes were blue. From time to time she opened them, to close them quickly as though the light were painful.

Then suddenly she turned her head, raised her look to Frontenac's face *and spoke!*

Three weeks have elapsed since then—since Frontenac awoke the sleeper. For four or five days, Sleeping Beauty was a very sick girl. The change that occurred at the expiration of that time, however, was a most remarkable one: a day or two, and she had wholly recovered.

The thing that seemed to astonish her the most, and which was a poignant distress to her, was that no one could understand a single syllable that she uttered. How often the poor girl has broken off and burst into a flood of tears! Only one thing have we learned, and that is her name—Zandara, which I think a very beautiful one. For her part, she soon knew the names of all about her and the names of many objects. And the way she says Darwin Frontenac! It is, as his sister declares, simply adorable.

Zandara's acquisition of English promises

the mast is just long enough for gravity to balance centrifugal force, then $a = a^1$ and

$$\frac{980}{D^2} = \frac{R^2}{D} \frac{V^2}{D}$$

In this formula $V = 2\pi D/86400$ cm. per sec. since there are 86,400 sec. in a day. If D be solved in this equation (using 4,000 miles for the earth's radius) it will turn out to be about 57,000 miles, the distance from center of earth to top of mast. Hence the mast would have to be not less than 53,000 miles high above the earth's surface. If a person climbed to this height on such a mast he would lose all weight and if he could climb higher he might be thrown off into space.

## LEAKY FOUNTAIN PEN

A fountain pen is more apt to leak when nearly empty because the heat of the hand causes the air within the pen to expand and force the ink out. When the pen is well filled with ink there is less air in the pen and hence less pressure produced when the pen is warmed.

## WHY THE BUNSEN BURNER POPS

A Bunsen or air burner is apt to pop if lighted too quickly after the gas is turned on, for in that case there is enough air in the region back of the burner to support combustion; the flame strikes back and a mild explosion takes place in the air manifold back of the burner. If the air damper is opened too much enough air may enter to give the same effect, even if plenty of time is allowed for the gas to get well started. Usually a burner will behave properly after it has once been successfully lighted, but occasionally it pops when it is turned off. In this case it means that the gas is coming at a sufficient rate to prevent the flame from striking back, but once the gas is turned off the flame strikes back for the same reason as that mentioned above. In one case the remedy is to let the gas run a few seconds before applying the match. In the other case the air damper should be closed as much as possible without letting the flame burn yellow.

## THE TWO CAPILLARY TUBES

A drop of mercury in a conical shaped capillary tube will travel toward the larger end. The molecules of mercury do not adhere to glass, as do molecules of water, but tend to cohere or stick close together. This action causes the drop to become as spherical as possible and hence to move toward the large end of the tube. With water the behavior is just the opposite. The molecules tend to stick more closely to the glass than they do to each other. Hence water tends to spread itself out as much as possible when in contact with clean glass. The result, then of the adhesion of water to the glass, is to cause the drop of water to move toward the small end of the tube, where it comes most completely into contact with the glass.

## THE TRACE OF THE FLASHLIGHT

Fig. 8 represents the trace most accurately. The loop near the ground should be smaller than the upper loop, as represented in this figure, for when the light (A) is nearest the ground it is moving more slowly than when it is farthest away. Hence it describes the lower loop more quickly than it does the upper one.

## Doctor Hackensaw's Secrets

By CLEMENT FEZANDIÉ

(*Continued from page* 135)

I'll take you down to the bottom of the pit so we can see how things are progressing."

"By the way," observed Mr. Sam, "I am convinced that this pit must continue much further down. It seems to be blocked up by a fault in the geological strata. This fault completely closes the bottom of the pit, but unless I am very much mistaken, when we dig a little deeper we shall find that the pit extends considerably further."

"In that case," remarked Doctor Hackensaw, "there would be danger of the drilling tool and the workmen dropping right through into the hole below."

"I have guarded against that," explained Mr. Sam modestly. "I have placed the workmen and the drill on a movable platform, and this platform is supported by chains securely fastened above. In fact, I have gone even further. I have enclosed the entire platform hermetically in a kind of large metal bell closed at the bottom, the drill projecting through a stuffing box."

"What was your object in doing that?"

"I had two reasons. In the first place, I wished to protect the workmen in case carbon monoxide or other poisonous gases should be present, and secondly to avoid danger in case there should be a partial vacuum below that might suck down the men."

"You acted very wisely," said Doctor Hackensaw, who made a careful examination of the machinery.

"All right!" said he. "Everything seems o.k., Mr. Sam, and you can start the drill going again.

Mr. Sam pressed a switch and the enormous diamond-pointed auger began cutting its way down through the hard rock as though it had been cheese.

### CHAPTER III

"Did you say this pit was five miles deep?" asked Doctor Hackensaw of his agent.

"Yes," replied Mr. Sam. "That is the approximate depth. I didn't measure it exactly. I merely let a bomb fall into the pit from above and I found that sixty seconds elapsed from the time the bomb left my hand to the time I heard the explosion. Hence, this pit must be nearly five miles deep."

"How do you figure that?" asked Pep.

Doctor Hackensaw explained: "You see, Pep," said he, "a body near the surface of the earth falls 16 feet the first second, 48 feet the second second, 80 feet the third and so on. As a physicist would say, the total distance fallen equals $\frac{gt^2}{2}$ in which g stands for the attraction of gravitation, in other words, the acceleration of 32 feet per second of a body near the earth's surface. If the distance fallen were great this figure would be too large, as the portion of the earth passed through would pull the body backwards. It is sufficiently accurate, however, for the present purpose. To fall five miles, therefore, the body would take 16 $t^2$ seconds. As a mile contains 5280 feet, $t^2 = \frac{5 \times 5280}{16}$ or 1650 seconds. Therefore, the time is the square root of 1650, or a trifle over forty seconds for the bomb to fall the five miles."

"But," objected Pep, "he said it took the bomb sixty seconds to fall."

"No," he said that it was sixty seconds before he heard the noise of the explosion. It takes sound a trifle over four seconds to travel a mile, so it would take twenty sec-

onds for the sound of the explosion to travel the five miles. In other words, it took the sound one-third as long to travel back as it took the stone to fall. Had the pit been a little deeper the stone would have traveled faster than the sound. But, as you see, forty seconds to fall and twenty seconds for the sound to travel back show that the pit is just five miles deep. This will save us quite a little digging."

"How long will it take for the drill to go a mile?" asked Pep. "I hope we won't have to wait an age here."

"We'd have to wait pretty long if I had only the diamond drill to depend on. But I am using that just to get a start. Tomorrow I shall take out the diamond drill and put my atomic drill in its place."

"Will the atomic drill go faster?"

"A great deal faster. In fact, there is no comparison between the two. Atomic energy is a wonderful power, and I have fortunately succeeded in harnessing it up in such a way as to avoid all danger."

"How does the atomic drill work?"

"Well, it's not exactly a drill. I call it that merely for convenience. It is in reality more in the nature of a torch. There is the machine, ready to be put in its place. To understand its working you need only think of a gasoline torch melting a hole through the ice on a skating pond. Swing the torch around in a circle and it will soon dig deep into the ice. My atomic energy torch acts in much the same way. Instead of gasoline, my fuel, if I may call it so, consists of finely pulverized sand which I place in the reservoir of the drill or torch. By means of the ignition device, as I call it that you see near the torch, I am enabled to obtain undreamt of voltage, and am thus enabled to start the disintegration of this dust. As the pulverized sand disintegrates, the liberated energy not only accomplishes work, but causes the disintegration of more of the sand. By feeding the dust slowly to the tip of the torch, or the burner as I call it, the disintegration will continue as long as any sand is left in the reservoir.

"The heat generated in the process is enormous, and melts the rocks and earth as if they were so much light snow."

"How is it that the rocks and the earth do not disintegrate?" asked Pep.

"For two reasons. First, they are not so finely pulverized as the dust I use; and secondly, I am careful not to bring my torch too near. I keep it far enough away so it will melt the rocks without getting them to disintegrate, if I may use the expression."

"How do you get rid of the molten rocks?"

"The molten material is carried up by endless chains of buckets. The work will be done automatically so there will be no risk of the workmen being injured."

"How is it that your torch and your buckets do not melt?"

"They are kept cool by electricity. I haven't time to explain the process now, but it has long been known that the electric current can be used for cooling as well as for heating. Electricity is a wonderful power. There is almost nothing that it is unable to accomplish, if properly directed. But enough of this lecture. The men are stopping the diamond drill now and will soon disconnect it and set up the atomic torch in its place. Then you will see the sparks fly. I have arranged an X-ray machine so that we can witness the effect of the atomic torch as it digs its way downward through the rocks."

Several hours were required to make the change, but Doctor Hackensaw and Pep waited to see the torch well set up in place and started in operation.

It was interesting to see the rapidity with which the rock melted under the impact of the white-hot ionized particles. And the stream of fluid lava was flown into the

buckets by a stream of helium gas. Luckily it was not necessary to carry the molten lava to the surface of the earth. There was a deep side channel a short distance up the pit, and into this the molten rock was poured.

The buckets, the drill and the closed chamber in which the operators stood were all protected from the heat by electrical refrigerating devices. A supply of air in the workroom was furnished from tanks, as the noxious gases generated by the heat would have been irrespirable.

A microphone of special construction with a series of amplifying devices carried to the doctor and his assistants the faintest sounds. It was provided with a sort of tuning device which enabled them to listen at will either to the sound of the revolving torch; to that of the seething lava, or cutting both of these out; it enabled them to listen to whatever other fainter sounds there might be. This precaution was necessary, as the doctor had no idea how deep the "fault" might extend, and to cut completely through into the pit below would have been exceedingly dangerous.

That a cavity existed below was certain. There was a hollow cavernous sound produced by reverberations of the rock through which they were cutting—sounds analogous to those of a drum when rubbed.

Down, deeper down went the torch into the earth's entrails until finally the reverberations became so great that Doctor Hackensaw gave orders to halt the atomic energy torch.

"It sounds as if there couldn't be more than a foot of solid rock below," said he, "and then we shall strike the open pit again. We'd better install the diamond drill once more, or rather a two-inch drill, so as to cut a small hole into the pit."

No sooner said than the work started. The torch was disconnected, and after cooling the rock, the small diamond drill began boring down through the last few inches of the "fault." The work progressed rapidly, when suddenly there was a tremendous suction of air, and with a whistling sound the drill was sucked right into the opening it was making and was only held back by the chuck.

"Good gracious!" cried Doctor Hackensaw. "There's a partial vacuum down below there! Before we can do anything more, we must make an air-lock outside of this working chamber. Then by exhausting the air in the air-lock, it will be possible to draw out the drill and drop a bomb down into the pit to ascertain its depth."

This work occupied several days, but finally all was in readiness. The drill was withdrawn, and at a sign from the doctor, Pep touched a button that allowed a small bomb to drop into the hole.

Then all waited anxiously. One whole minute passed, then another, then a third and the minutes slowly succeeded each other until finally, just as the doctor was about to remark that the bomb must have failed to ignite, the sound of the explosion was plainly heard through the loud talker.

"Good gracious!" exclaimed the doctor again. Allowing for the time it took the sound to travel back to us, it is certain that the pit below us is over a hundred miles deep!"

*(To be continued)*

# BOOK REVIEW

THE STUDY OF LIVING THINGS. By E. S. Russell. Stiff cloth covers. 7½" x 5". 139 pages. Published by Methuen & Co., Ltd., London, England.

A rather abstruse little volume, dealing with methods for the study of living things. It does not occupy itself with a materialistic view, but rather considers the science of life from a philosophical standpoint, which the author claims to constitute a real biography. A student of biology will undoubtedly find this book to be of great value, particularly if he is of a philosophical turn of mind. There is plenty of food for thought distributed throughout the book, but although the author claims that it is as simple as possible, we find it rather deep. The various subjects such as the individuality of the living thing and the study of the behavior of various simple forms of life are well classified and discussed. A quite complete index makes any point treated in the book extremely easy to refer to.

PHOTOGRAPHIC FACTS AND FORMULAS. By E. J. Wall. Hard cloth covers. 8" x 5⅜". 386 pages. Price $4.00. Published by the Alpine Press, Boston, Mass.

Between the covers of this book, the amateur as well as the professional photographer, will find one of the most complete collections of detailed data ever brought together. Not only does the author deals with the ordinary types of photography and the formulas relative thereto, but he treats special methods of intensification and reduction of negatives as well as many methods of producing effects in photography that are not very well known. Throughout the book, hints are continually given for obtaining the best photographic results. As the consequence, the book is one which should be kept at hand throughout all work with photography, as it is one which can be profitably referred to continually. After the author has finished describing the various processes of developing negatives and making prints, he takes up such subjects as mounting finished prints, stereoscopic work, lantern slides, enlarging, flashlight photography, color photography and photomechanical processes. The book ends with an especially complete set of tables covering weights, measures and chemicals used in photography. The book is one which anyone at all interested in photography cannot well afford to do without. Its complete index renders references an easy matter, and it can, therefore, be turned to whenever the owner desires information on any specific photographic process or formula.

REJUVENATION AND THE PROLONGATION OF HUMAN EFFICIENCY. By Dr. Paul Kammerer, with an introduction by Dr. Harry Benjamin. Octavo, stiff covers. 152 pages. Published by Boni & Liveright, New York. Price $2.00.

Thanks to some of the modern novelists, the theory of rejuvenation has been made more or less popular with the lay public. Obviously, however, a novelist is hardly the proper person to explain the real science of such a charming and revolutionary subject. Dr. Paul Kammerer and his American colleague, Dr. Benjamin, need no introduction to our readers. The question of rejuvenation and its technical applications are as closely interwoven with the names of these two men as it is with that of Dr. Steinach. The subject is made extremely clear in this volume with the added advantage that it is dealt with from a purely scientific point of view, so that the reader leaves the book with a clear idea as to just how investigations along this line have proceeded, with their results, and what may be expected of further work.

Of course, the first chapters are given over to a purely physiological discussion of the ductless glands of the endocrine system. Then there is a short history telling very interestingly of the characteristics and functions of each of these small bodies, and conclusions as to what may be expected when their nature is thoroughly explored. The latter half of the book gives some practical examples of rejuvenation which have been carried out and proved successful. There is enough of a discussion on technical details of the operation involved to satisfy the most inquisitive reader. The volume is hereby recommended to those who wish to obtain an authentic and workable foundation upon which to discuss this business of rejuvenation.

THE NEW PHYSICS. By Arthur Haas, Ph.D., Prof. of Physics in the University of Leipsic, translated by Robert W. Lawson, D.Sc., F. Institute P. Hard cloth covers. 165 pages. Published by E. P. Dutton, New York. Price $2.50.

The last three or four decades have seen marvelous advances in the field of pure technical physics. There has been a very definite place for some time, which was waiting to be filled by the present volume. Of course, there were no end of books on various discoveries made by the great physicists, but there were few which covered the modern developments and showed at the same time through the correlation of the new discoveries, the new field which natural philosophy now covers.

The present volume begins with a discussion of molecular statistics, carries the reader on up through the development of the electronic theory of matter, then into Bohr's original work concerning the atom, with particular attention to the whole of the electromagnetic vibration field. Next is given about as understandable a discussion of the Quantum Theory as is possible, without including several volumes of calculus with it. This chapter will be found extremely valuable to those who have a craving for dipping their toes in the waters of theoretical physics. Then comes a dissertation upon the latter day theory of chemical elements, and then the famous Einstein Theory, which modified our classical physics. The writer will recommend the rest of the book highly. However, pursuing his regular policy of isolation with regard to the Einstein Theory, he is without opinion as to this latter question. The reader enters it entirely at his own mental risk. We cannot be responsible for physic coats and hats unless checked with the manager.

THE GOD OF THE EARLY CHRISTIANS. By Arthur Cushman McGiffert. Hard cloth covers. 199 pages. Published by Charles Scribner's Sons, New York. Price $1.75.

The subject of comparative religions is one primarily for discussion by the Bench of Bishops, and not for the man of science, who through natural habits of mind feels himself called upon to deal first with practical and real demonstrations in Nature, and then to draw his conclusions from the actions hereinbefore alluded to. And besides religion is even a more ticklish business for the man who is not admitted an expert than any other field of human dogma. The present volume has for its thesis the fact that the God of the early Jews, the God of the early Christians, and the God of the present day Christians are exactly three different, separate and distinct Deities. The proof is elaborate, and to one not technically schooled in the subject, convincing enough. Mr. McGiffert is a fairly convincing writer, which is to say, he makes his train of thought plain, and as far as the book goes, it can be recommended.

MY PSYCHIC ADVENTURES. By J. Malcolm Bird, Associate Editor, Scientific American. Hard cloth covers. 309 pages. Published by Munn & Co., New York. Price $1.50.

Mr. Bird has been one of the most prominent among the spiritual investigators in the last several years. In the present volume, he brings before the reader a number of his experiences in connection with investigations of several alleged mediums. He has a long and detailed account of the difficulties usually encountered in such investigations, which gives one an appreciation of some of the problems which have to be faced. The accounts of the investigations themselves each under the heading of a particular seance or medium are complete to the finest detail. To the student of spiritistic so-called demonstrations, this book will be found extremely valuable because of the observer's absolute absence of bias, and his meticulous reporting of the details surrounding each of his adventures. It is very seldom indeed that we run across a volume upon this much discussed subject, which is not full of spleen from one point or another. Mr. Bird takes the whole matter very seriously, and as a serious scientist spreads lots of ink over his pages, covering the subject thoroughly. To those who take the subject seriously, the book will find a hearty welcome.

THE BOY CHEMIST. By A. Frederick Collins. Hard covers. 6" x 8". Profusely illustrated. 300 pages. Published by Lathrop, Lee & Shepard Co., New York. Price $2.00.

One always feels a little afraid to turn a boy loose with chemicals. Yet if properly directed, there need be no accidents and the only criticism we can make of this book is that perhaps it goes a little beyond the boy. For instance, the making of sulphuric acid by oxidation of sulphur dioxide seems rather advanced for a beginner.

though the use of a cheap, solid catalyst eliminates most of the risk involved in this preparation. Safety precautions are especially emphasized throughout. The manufacture of salts is nicely given. Hydrochloric acid is made by treating sodium chloride with sulphuric acid. The experiments are very numerous, picturesque and in many cases novel with a liberal choice of alternative methods to accommodate those readers who have but little equipment as well as the ones who possess well-stocked laboratories. An extremely interesting and lucid account of fundamental chemical theory adds greatly to the instructive value of the book. It is to be regretted that the author did not go even further in this direction, as he has the rare power of explaining abstract principles in a simple and entertaining manner. The illustrations are plentiful and are in a sketchy style, which to our mind is very attractive. We are sure the young readers will be greatly interested in some of the final chapters, one on Chemical Magic, one on Photography, another on Safe and Sane Fire Works. The Useful Recipes will be sure to hold a strong appeal for many boys. Their application will effect household economies that cannot help but enlist enthusiasm of parents in the scientific aspirations of their children. We notice one curious omission. There is an alphabetical list of elements and their symbols, but the atomic weights have been left out.

STATEMENT

Of the Ownership, Management, Circulation, Etc., required by the Act of Congress of August 24, 1912, of SCIENCE AND INVENTION, published monthly at New York, N. Y., for April 1, 1925.

State of New York
County of New York
ss.

Before me, a notary public in and for the State and county aforesaid, personally appeared Hugo Gernsback, who, having been duly sworn according to law, deposes and says that he is the Editor of SCIENCE AND INVENTION and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management (and if a daily paper, the circulation), etc., of the aforesaid publication for the date shown in the above caption, required by the act of August 24, 1912, embodies in section 411, Postal Laws and Regulations, printed on the reverse of this form, to wit:

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H. GERNSBACK.

Sworn to and subscribed before me this 23rd day of March, 1925.

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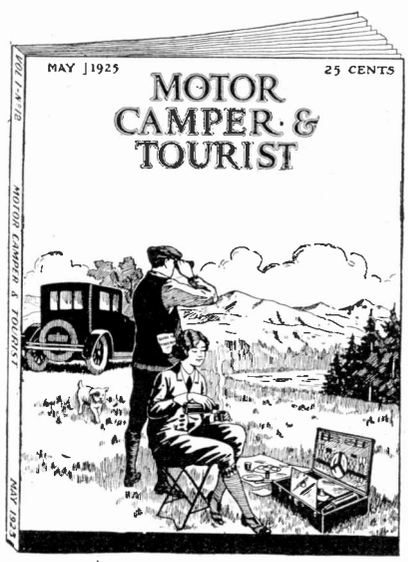


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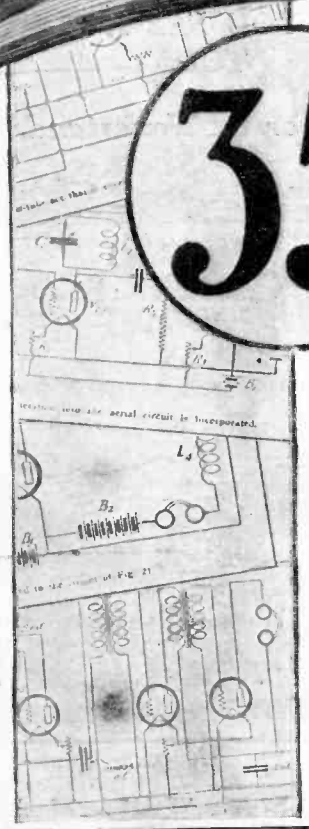

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