Science and Invention

IN PICTURES

LIFE SUSPENDED IN ICE

See Page 406
Good Chemists Command High Salaries

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

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? Then you would regret that such things were no longer done. But that is a mistake. These 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 Cauty, 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 expectations. Since I have been studying with your school I have been employed chemist for the Standard Coal Co. testing all the coal and coke by proximate analysis. The lessons are helping me wonderfully, and the interesting way in which they are written makes me impatient for each lesson.—MORLAIS COUGHEEN.

I wish to express my appreciation of your prompt reply to my request for employment at the General Electric Co. I intend to start my student engineering course at once and continue them for the remainder of the present month, as well as next month, at the same rate. I am a recommendation to the General Electric Co. and must work out the details of a contract with you, but that will not alter the fact that I am a recommendation to the General Electric Co.

I appreciate your haste in sending me this other piece of equipment, and am still doing nicely. I am more than pleased with your course and your instruction, even without the additional charge for your text. I am so glad that I found you.—A. A. CAMERON.

I am so glad that I found your course excellent and your instruction wonderful. I have a recommendation to the General Electric Co. that makes me feel as much as I do a recommendation to the General Electric Co. I am sure you will find your course excellent and your instruction wonderful.—H. VAN BENTHUYSEN.

I have gone through your course and found it as wonderful as you promised. The lessons are written in such an interesting manner that the work is as enjoyable as a novel. It is much the most text books I have ever seen. I am sure you will find your course excellent and your instruction wonderful.—MORLAIS COUGHEEN.

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I Will Train You at Home to Fill a Big-Pay Job!

It's a shame for you to earn $15 or $20 or $30 a week, when in the same six days as an Electrical Expert you could make $70 to $200—and do it easier—not work half so hard. Why then remain in the small-pay game, in a line of work that offers no chance, no big promotion, no big income? Fit yourself for a real job in the great electrical industry. I'll show you how.

Be an Electrical Expert Earn $3,500 to $10,000 a Year

Today even the ordinary Electrician—the "screw driver" kind—is making money—big money. But it's the trained man—the man who knows the whys and wherefores of Electricity—the Electrical Expert—who is picked out to "boss" the ordinary Electricians—to boss the Big Jobs—the jobs that pay $3,500 to $10,000 a year. Get in line for one of these "Big Jobs." Start by enrolling now for my easily learned, quickly grasped, right-up-to-the-minute, Spare-Time Home-Study Course in Practical Electricity.

Look What These Cooke Trained Men Are Earning

FRED G. McNAUGHT, 86 Spring St., Atlanta, Georgia
Makes $700 in 24 Days in Radio
"Thanks to your interesting Course I made over $700 in 24 days in Radio. Of course, this is a little above the average but I run from $10 to $40 clear profit every day, so you can see what your training has done for me."

$70 to $80 a week in Jacquot
"Now I am specializing in Auto Electricity and battery work and make from $70 to $80 a week and am just getting started. I don't believe there is another school in the world like yours. Your lessons are a real joy to study."

A. SCHRECK, Phoenix, Arizona
$20 a Day for Séhreck
"Use my name as a reference and depend on me as a booster. The biggest thing I ever did was answer your advertisement. I am averaging better than $20 a day from my own business now, I used to make $18.00 a week."

GEORGE ILLINGWORTH, 68 Calumet Road, Holyoke, Mass.
Age or Lack of Experience
Get Started Now—Mail Coupon
I want to send you my Electrical Book and Proof Lessons, both Free. These cost you nothing and you'll pay for them when you start today for a bright future in Electricity. Send in coupon now.

You don't have to be a College Man; you don't have to be a High School Graduate, As Chief Engineer of the Chicago Engineering Works, I know exactly the kind of training you need, and I will give you that training. My Course in Electricity is simple, thorough and complete and offers every man, regardless of age, education, or previous experience, the chance to become, in a very short time, an "Electrical Expert," able to make from $70 to $200 a week.

No Extra Charge for Electrical Working Outfit
With me, you do practical work—at home. You start right in after your first few lessons to work at your profession in the regular way and make extra money in your spare time. For this you need nothing but give him time, and he will make the right use of it

Your Satisfaction Guaranteed
So sure am I that you can learn Electricity—no matter what I that after studying with you, you too, can get into the "big money" class in electrical work, that I will guarantee you a refund of every single penny paid me in tuition if, when you have finished your Course, you are not satisfied it was the best investment you ever made. And back of me is the guarantee, stands the Chicago Engineering Works, Inc., a million dollar institution, thus securing to every student enrolled, not only a wonderful training in Electricity, but an unsurpassed student service as well.

Mail Me Once Without Obligation for My Big Illustrated Book and Complete Details of Your Home Study Course in Electricity, Including your outfit and employment service offers.
IN OUR NEXT ISSUE

Did You Ever See the Moon Reversed?

In the southern hemisphere, the moon and the stars appear to be in different positions than in the northern hemisphere. Isabel M. Lewis, M. A., will explain why this is so.

Do You Know What Is Meant by Organic Glass?

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If so, you will recognize some of the tricks used in the description by the Rev. Crawford Trotter.

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No. 486 Eveready Layerbilt

It’s all battery. With every cubic inch packed to capacity, it contains about 30 per cent more electricity-producing material. All chance of loose or broken connections avoided by contact of full area of carbon plate against zinc plate. The scientifically correct construction.

The greatest improvement ever made in “B” Batteries

Absolutely new in construction—perfected through years of research, the new Eveready Layerbilt “B” Battery is as superior to the old type “B” Battery as a tube set is to a crystal.

Heretofore, all dry “B” Batteries have been made up of cylindrical cells—no one knew how to make them any other way. The new Eveready Layerbilt is made of flat layers of current-producing elements compressed one against another, so that every cubic inch inside the battery case is completely filled with electricity-producing material. Layer-building heightens efficiency by increasing the area of zinc plate and the quantity of active chemicals to which the plate is exposed.

After the most rigid laboratory tests, more than 30,000 of these new Eveready Layerbilt “B” Batteries were manufactured and tested by use under actual home-receiving conditions. These tests proved that this new battery is far superior to the famous Eveready Heavy-duty Battery No. 770, which up to now we have ranked as the longest lived “B” Battery obtainable.

On 4-tube sets, 16 mil drain, it lasts 35% longer.
On 5-tube sets, 20 mil drain, it lasts 38% longer.
On 6-tube sets, 24 mil drain, it lasts 41% longer.
On 8-tube sets, 30 mil drain, it lasts 52% longer.

The new Layerbilt principle is such an enormous stride forward in radio battery economy that we will bring out new sizes and numbers in this Layerbilt form as fast as new machinery is installed. For the present, only the extra-large 45-volt size will be available.

Buy this new Eveready Layerbilt No. 486 for heavy drain service. It far exceeds the performance for which Eveready Radio Batteries always have been famous and is, we believe, by far the most economical source of “B” current obtainable.

Manufactured and guaranteed by
NATIONAL CARBON CO., INC.
New York San Francisco
Canadian National Carbon Co., Limited, Toronto, Ontario

EVEREADY HOUR EVERY TUESDAY at 8 P.M.
Eastern Standard Time
Beginning Sept. 29th, 9 P.M. Eastern Standard Time
For real radio enjoyment, tune in the “Eveready Group.” Broadcast through stations:
WEAF New York WGR Buffalo WWJ Detroit
WOR Providence WCBS Newark WOC Minneapolis
WEJ Boston WEAR Cleveland WOC Des Moines
WFI Philadelphia WRAI Cincinnati WOC Des Moines

EVEREADY Radio Batteries
—they last longer
IN every issue of SCIENCE and INVENTION you undoubtedly see numerous articles advertised about which you would like to have further information.

To sit down and write an individual letter to each of these respective concerns, regarding the article on which you desire information, would be quite a task.

As a special service to our readers, we will write the letters for you, thus saving your time and money.

Just write the names of the products about which you want information, and to avoid error the addresses of the manufacturers, on the coupon below and mail it to us.

If the advertiser requires any money or stamps to be sent to pay the mailing charges on his catalogue or descriptive literature, please be sure to enclose the correct amount with the coupon.

We will transmit to the various advertisers your request for information on their products.

This service will appear regularly every month on this same page in SCIENCE and INVENTION.

If there is any Manufacturer not advertising in this month’s issue of SCIENCE and INVENTION from whom you would like to receive literature, write his name, address and the product in the special section of the coupon below.

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**THIS FORM SHOULD NOT BE USED FOR TECHNICAL QUESTIONS**

Use this space if you desire information from a manufacturer whose advertisement does not appear in this month’s issue.

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Your name.

Dealer’s name.

Your address.

His address.

☐ If you are dealer check here.
You may escape the collection — but not the need of Ozarka Service

The satisfaction you receive from your radio depends not on what it does once in a while — but night after night and month after month. Whether you grin or cuss depends on the service behind your radio.

Ozarka radio instruments are only sold by trained factory representatives, men who not only specialize in radio but sell and service Ozarkas only. 3,100 of these men, trained directly under Ozarka engineers constitute a service force, unequalled elsewhere in radio today.

When you buy a radio you'll compare appearance, tone, volume and selectivity by having various instruments set up in your own home but—that isn't enough — compare the service behind each one.

Any Ozarka factory representative will set up an Ozarka in your home—he will not even operate it himself, but depend for his sale on what you yourself do. If you, by your own operating, do not bring in the distance, the volume and tone, you expect a radio to give, then do not buy the Ozarka. If you do buy it, you can rest assured, no matter what happens, a competent service man is at your call at all times. No Ozarka representative can sell Ozarka Instruments without giving Ozarka service. You are entitled to such service — demand it!

The Ozarka Representative knows every part, every wire of the Ozarka. In fact he completely assembles his own instruments. His training on installations, aerials, ground connections, operation and service comes directly under our own engineers who designed and perfected the Ozarka circuit.

That is why our book, “Ozarka Instruments No. 200,” describing all models of Ozarka should be of particular interest to you. This book and the name of the Ozarka representative near you will be sent immediately at your request. Please give the name of your county.

We Have Openings for a Few More Ozarka Factory Representatives

Ozarka Incorporated, is now entering its 4th year. From a beginning with one engineer, one stenographer, one salesman — our present president, the Ozarka organization has grown to over 3100 people. There must be some good reason for this growth.

Ozarka instruments have made good — they have more than met competition. Ozarka representatives have made good not only because Ozarka instruments were right, but because they have been willing to learn what Ozarka engineers were willing and capable to teach them — Ozarka unusual salesmanship and Ozarka service.

There are still openings for the right men in this organization — men who believe in the future of radio — men who are tired of working for some one else — men who want a business of their own. Prove yourself by sales and willingness to learn and exclusive territory will be given you.

The man we want has lived in his community for some time. He has the respect of his fellow men because he has never "put anything over" just to make money. He may not have much money, but he is not broke and is, at least, able to purchase one demonstrating instrument.

Check Coupon for FREE Selling Book

Radio offers a wonderful opportunity to men who are willing to start at the bottom and build. You need not know salesmanship, but will you learn what we will gladly teach you? You may not know radio, but we can and will teach you if you will do your part. With such knowledge and willingness to work, it doesn't seem possible that you cannot make good.

Sign the coupon below, don't fail to give the name of your county. Better still write a letter, tell us about yourself and attach the coupon. If interested in our salesman's plan ask for "Ozarka Plan No. 200."

INcorporated

122 Austin Avenue K
Chicago, Illinois

Gentlemen: I am greatly interested in the FREE book “The Ozarka Plan” whereby I can sell your radio instruments.

Name: __________________________
Address: ________________________
City: ____________________________
County: _________________________
State: __________________________


Name: __________________________
Address: ________________________
City: ____________________________
County: _________________________
State: __________________________
Master Electricity By Actual Practice

The only way you can become an expert is by doing the very work under competent instructors, which you will be called upon to do later on. In other words, learn by doing. That is the method of the New York Electrical School.

Five minutes of actual practice properly directed is worth more to a man than years and years of book study. Indeed, Actual Practice is the only training of value, and graduates of New York Electrical School have proved themselves to be the only men that are fully qualified to satisfy EVERY demand of the Electrical Profession.

The Only Institution of the Kind in America

At this "Learn by Doing" School a man acquires the art of Electrical Drafting; the best business methods and experience in Electrical Contracting, together with the skill to install, operate and maintain all systems for producing, transmitting and using electricity. A school for Old and Young. Individual instruction.

Over 9,500 Graduates are Successful Men in the Electrical World

No previous knowledge of electricity, mechanics or mathematics is necessary to take this electrical course. You can begin the course now and by steady application prepare yourself in a short time. You will be taught by practical electrical experts with actual apparatus, under actual conditions.

The N. Y. E. S. gives a special Automobile Ignition Course as an advanced training for Auto Mechanics, Garage Men and Car Owners. The course covers completely all Systems of Ignition, Starters, Lighting and other electrical equipment on automobiles, motor boats, airplanes, etc.

Let us explain our complete courses to you in person. If you can't call, send now for 64-page book—it's FREE to you.

New York Electrical School
29 West 17th Street, New York
ONE of the great scientific mysteries of all time is one of the best known and most universal of things—Gravitation.

Gravitation is a universal force which permeates everything, not only on earth, but throughout the universe. It is a tremendous force and the entire universe, with all its contents, is under its domination at all times. We can not take a step, can not lift a finger, and we can not make a move, in whatever direction, without remaining under its all-pervading influence.

If you pick up a stone and release it from your hand, the stone falls to the ground. It does so for two reasons; first, because the earth attracts the stone, and second, because the stone attracts the earth. This is according to Newton's law of universal gravitation.

There is a definite gravitational pull between the earth and the stone. The effect of the stone in pulling up the earth is, however, inconsequential, and while the stone does exert a certain amount of pull towards the earth, the earth is so enormously larger that the effect on it is not felt at all.

All we know about gravitation today is the effects it produces. We can calculate these effects to a nicety, not only on falling bodies on our own earth, but, thanks to Newton, we can figure the attraction between falling bodies and its influence on their motions.

Notwithstanding this, we have not the slightest inkling of what this tremendous universal force is. It has, so far, defied all analysis of our scientists, and we know no more about it today than was known in the days of Archimedes, over two thousand years ago.

It is now thought, but this is merely a theory, that gravitation is a wave motion, similar to electro-magnetic waves, which include light waves, as well as our radio waves. It is thought that these gravitational waves pass through solids, just the same as light passes through a block of glass, or as radio waves pass through buildings and through other solid obstructions.

So far, however, no one has succeeded by the use of apparatus or instruments in producing these gravitational waves, if indeed, they are such.

Furthermore, a few minutes' reflection must show that whatever gravitation is, it seems to act instantaneously. The speed of gravitational attraction between two bodies seems to be much greater than the speed of light, which is 186,000 miles per second. The solar system, as well as the universe, could not hold together if there were not instantaneous transmission of the gravitational impulses between the different planets and between the different universes.

In this sense, gravitation must be thought of as a solid substance. For instance, take the earth and the sun. They must be thought of as united by a gigantic solid metallic rod, much stronger than steel, and with no flexibility. If the earth were to budge one yard out of its accustomed course, the moon as well would be dragged along that course instantly, just as if the two bodies were united by the aforementioned rod. This is exactly how gravity acts, and the universe could not hold together unless this were so.

Scientists, of course, have been busy for ages trying to devise a gravity insulator, gravity nullifier, or a gravitation screen, all these terms meaning the same thing. The theory is to invent some sort of a screen or other means, so that if you repeat our stone experiment of opening your hand and letting go of the stone, the stone will rest in exactly the same position in space after you take your hand away. There being no attraction between the earth and the stone, and vice versa, the gravitation having been successfully cut off so that the stone can neither fall nor rise, it must stay suspended in mid-air.

If you were suspended on a trapeze above a gravitation screen, and the gravity were cut off, the trapeze could be removed and you would stay suspended in space. You would then be weightless and you could float around the room by jerking yourself sideways or up and down. This is one ideal which has been sought by scientists.

Instead of dragging around our heavy bodies through our houses and working places we shall probably be relieved of our weight: and we shall be able to work a hundred times as efficiently as we can today, and with practically no effort. Today thanks (?) to gravitation, most of our muscular efforts are to overcome gravitation. Every time you lift your arm in the act of writing, either by pen or by typewriter, you have to work against gravitation: 90 per cent. or 90 per cent. or even more, of the effort is used to overcome gravitation force, while the microscopic balance goes into the work.

I BELIEVE THAT: that it is possible to make synthetic milk from plants without the cow.

I BELIEVE THAT: there will be no revolution in the building of radio sets for years to come.

THE GOLDEN AGE OF SCIENCE is symbolized by the golden cover of SCIENCE & INVENTION, LOOK FOR THE GOLD COVER every month!
Rain-Making Again

By GEORGE F. PAUL

Perched on top of an old oil derrick in Huntington Park, Calif., is the weird building shown in the photograph at the left. Housed in this structure is a high frequency outfit which William Haight and D. W. Davis, the designers, claim will produce rain by bringing about condensation of the water vapor in the air.

The circuit diagram of the connections of the instruments used for this so-called rain-making device is shown herewith. The fan keeps the spark gap from overheating. The high frequency coil is of the usual type.

FORD ENGINE

COND. SPARK GAP

Above: The supply apparatus which furnishes the high potential for operating the large high frequency coil.

The gigantic high frequency coil is illustrated above. This is mounted near the top of the structure placed on the oil derrick and produces the induction, which is supposed to cause rain. The initial current is supplied by the generating plant illustrated directly below.

The theory of operation of this system for producing rain as explained by its inventors is that the positive pulsations of the alternating high-frequency current go to the ground, while the negative pulsations go to the upper strata. From this the inventors deduce that a pulsating direct current is established between the ground and the upper atmosphere and that this current brings about condensation and produces rain. They claim that rain can often be produced even on a clear day in less than an hour after the machinery is started. It is said that they have been able to operate over a range of approximately 15 miles. During one of their tests it is reported that when operating near clouds that have previously reached a fairly heavy point of saturation, a precipitation can be brought down in from 15 to 30 minutes. Changes in barometer readings of from 3 to 10 points have supposedly been noticed in less than an hour after operation was started. With the system now in use, no ground connection is used, the entire apparatus being insulated.
Did "Charleston" Dance Cause Building Collapse?

By JOSEPH H. KRAUS

The photo at the right shows the partially suspended roof of the ill-fated Boston dance hall—the Pickwick Club—which collapsed while merry-making couples were celebrating the Fourth of July. At the time the building collapsed, there were approximately one hundred and twenty-five to one hundred and seventy-five guests at the club.

The theory that the building collapsed due to the partially weakened structure caused by a previous fire, and the dancing of the "Charleston," is held by a great many scientists. District Attorney Thomas E. O'Brien of Boston, Mass., wired this publication that a dance was in progress at the time of the collapse.

When the floors and ceilings of the Pickwick Club fell, forty-four guests were killed and eighteen were injured. That the cause of the fall was due to vibration set up by dancing feet is highly probable. Of course, it is essential that the tempo be identical with that of the natural period of vibration of the floors or building. This might accidentally have been produced at the time of the crash. The experiments illustrated on the right demonstrate how easily such a thing could take place. If a thin steel bar is placed across two supports as illustrated, and water be permitted to drop upon it, the drops can be so regulated that the bar will eventually vibrate vigorously. Thin glasses may be shattered by trying to imitate their sound.
Dirigible Mooring Mast and Landing Platform

This Device Provides for Comfortable Landing Facilities

The illustration directly above shows the dirigible in position on the landing car and the dotted lines show how it can be shifted and reoriented according to the wind. Progressive drawings at the right show the various stages of landing.

This new type of combination mast and landing platforms for dirigibles, designed by Joseph B. Strauss, Chicago engineer, who prepared the designs for the great 4,000-foot bridge across the Golden Gate, consists essentially of a stationary mooring mast and a movable landing platform which is capable of being rotated around the fixed mast as a center or of being drawn into the hangar. This platform is mounted on wheels placed in a series of trucks, as in the insert in the upper right-hand side of this page. The rails upon which the wheels travel are equipped at intervals with turntables, by means of which the trucks can be turned through 90° to adjust the wheels to travel on the circular rails. Similarly, they can be transferred from the circular to the straight tracks. In this way, after landing, the dirigible can be guided into any one of the hangars.

The details of the method used for mooring a dirigible to this new mast are given in the four progressive drawings at the left. First, a line is dropped from the nose of the ship and its end is raised to the top of the mooring mast by means of an elevator. This rope then pulls the nose of the dirigible down until it fits in the socket provided at the top of the tower. Other ropes are then dropped from the ship as in the second illustration and are fastened to winches on the landing car. The ring to which the nose of the ship is moored is then lowered on the mast, while the winches take up the slack in the mooring ropes. Gradually the ship settles until it is securely fastened to the landing car. The entire ship can then be run into a hangar for refueling or for taking on passengers and freight. Thus the work and risk involved in landing a ship of this nature is reduced to a very great extent.
Plants and Animals That Shoot

By DR. ERNEST BADE

The shooting fish captures insects by hitting them with a drop of water as above.

The bombarding beetles throw out a gas attack when pursued by any creature such as a ground beetle, Calosome, above.

The chameleon cannot throw any object but it shoots out its tongue which is almost as long as its own body and tail combined and catches insects on the end of it. In this way it obtains its food.

The horned toad can shoot blood at its attacker during its moulting period.

The ant-lion larva shoots sand at insects which causes them to fall into the ant-lion's sandy funnel where the insect is devoured.

The flowering "touch-me-not" or lady slipper, which shoots seeds to quite a distance.

The ant-lion larva shoots sand at insects which causes them to fall into the ant-lion's sandy funnel where the insect is devoured.

The adult ant-lion is a graceful flying creature far different from the ugly larvae.

The process through which a shooting plant goes is shown above. The seed capsule is closed at 1, partly unfurled at 2, shooting its seeds away, while the empty seed capsule is shown at 3.

The ant-lion larva shoots sand at insects which causes them to fall into the ant-lion's sandy funnel where the insect is devoured.

The adult ant-lion is a graceful flying creature far different from the ugly larvae.

The flowering "touch-me-not" or lady slipper, which shoots seeds to quite a distance.
The "Steam Turbine Drug Mill" of Giovanni Branca of 1629 illustrated above is probably the first actual application of steam to commercial purposes. A turbine effect was produced and the steam was generated in a simple boiler.

Directly below we see an illustration of the forty-fifth proposition of Hero's "Pneumatika" being a small boiler, maintaining a vertical jet of steam on the top of which a ball is supported and dances about. The device is most simple in operation, the large decorated urn is a container for water, and is heated by a fire, and steam, upon being generated, raised the ball from its basket-like cradle.

A generator for super-heated steam constituting the seventy-fifth proposition of Hero's "Pneumatika" is shown below and is described on the opposite page.
Ancient Steam Generators

By CHARLES BEECHER BUNNELL

Our illustration at the right shows Euclid studying the Ctesibius turbine, the steam engine described in Hero's fiftieth proposition. This turbine depends upon the reaction of jets of steam against the atmosphere. The insert (S) shows the details of this device wherein the water is boiled in the caldron at (W) and the steam rises through the pipe (C) into the ball at (B) and out into the atmosphere through the external bent pipes.

Now let us look at the Fig. CS on the opposite page. Refer first to the cross-section of the boiler, which reveals four compartments. FB, in the center, is the fire-box. In operation, water was introduced at (W), shown on the large cross-sectional view, whereupon this liquid filled, or partly filled, the compartment 1. Compartment 2 received water when the snake ornament was removed. Steam from the heated water in compartment 1 would then go through the two upper pipes and join the steam in compartment 2. This steam would then go through the three-way valve (V), the port of which is to be open so that steam can pass through the goose. The jet of steam was then ejected downward into the fire-box, as shown. By turning the valve 90° to the right, the port for the songbird opened and the steam rushing out, blew the whistle with its open end immersed in the water tank (3), producing a warbling note. If the valve (V) was rotated again through 90°, the goose and the songbird were both shut off. The only path left for the steam was through the center port and out through the snake, giving vent to a life-like hiss. The most curious feature of this boiler is the triple flues or pipes. The two upper ones connect both compartments, while the lower flue is only connected to compartment 2 and does not lead into 1. It can be readily seen that this boiler produced super-heated steam.

The steam cannon of Archimedes is illustrated above. Cold water was poured into the cannon, which was mounted on the base 2 and shot heated on furnaces at 4 were rolled up the incline 3 and dropped into the mouth of the gun. The contact between the hot metal and the cold water generated steam under pressure and the shot was forcibly ejected and hurled quite a distance. Another triumph of Archimedes' was the use of compound mirrors to concentrate sunlight and set fire to wooden ships.
Some time ago we ran a fiction story, "The Living Death," by John Martin Leahy. Our readers will remember that in this story the explorers came upon a girl who had been frozen in ice for many years and when the explorers thawed her out, she came to life again.

When we ran this serial, a surprising number of letters were received by the editors, many people wanting to know if there was some process by which this could be done, or whether it was pure fiction. Textbooks and other scientific books, as well as scientific articles, have appeared many times, showing that fish and other forms of life, after being frozen solid, came back to life when thawed out.

We, therefore, thought it best to actually make some experiments to find out whether there was any truth in such contentions and whether or not it was possible to bring back to life living organisms that had been frozen for any length of time.

The writer thought of making the following experiment: He reasoned that, if you take any living organism having blood circulation and freeze it, the blood vessels freeze first. The blood itself then freezes and, in doing so, expands. This expansion bursts the already hardened veins and arteries, making later resuscitation impossible.

On the other hand, the thought occurred to him that if we could suspend animation, instantly, there would be no disintegration of tissues, and life could probably be restored again. The illustration on the left is based upon the theory that if we could suspend animation, instantly, there would be no disintegration of tissues, and life could probably be restored again. The diagram illustrates an immense tank of water in which are the cooling tubes. Nitrous oxide is used to cause a state of sleep when the process is started and oxygen is used for subsequent stimulation of the patient. Heart sounds are amplified before they reach the physician's ears, and an endotherm stimulates blood circulation.
that if the freezing were to be done so rapidly that there was no chance for the individual blood vessels to expand and burst, then, perhaps, there might be some chance of reviving the organism.

That this thought was partially correct was proved afterwards.

We first took a goldfish and put it in a cardboard tray. We then poured liquid air over it, and this froze the fish very rapidly. The boiling point of liquid air is $-191^\circ$ degrees Centigrade or $-311.8$ degrees Fahrenheit.

When the fish was thawed out afterwards, in tepid water, he appeared dead. The writer then took two radio "B" batteries, giving a tension of about 90 volts, and proceeded to attempt resuscitation of fish electrically. This was done as shown in the illustration; namely, by placing one wire in the water near the tail of the fish and dipping the other wire rapidly and intermittently in the water. This, of course, opened and closed the circuit, and part of the current traveled through the fish.

An immediate reflex action was noted, and it could be seen that the fish's gills worked convulsively, and the tail, as well as the fins, seemed to have some life.

The resuscitation process was continued for some minutes, but the fish did not return to life. Only this one experiment was made, but its effect has been sufficient to encourage the writer to think that, if other forms of life, perhaps not as delicate as a goldfish, were frozen, and after thawing out, electrical resuscitation were resorted to, some specimen might be found that will be revived.

The theory of using liquid air is that the freezing process will be done so quickly that the blood vessels will have no time to expand and burst, although, of course, there is a chance that they might do so on thawing out. Nevertheless, in the liquid air experiment, no decomposition of the fish had set in, although similar fish, frozen in ice, started to decompose almost the instant thawing commenced.

The next experiment was to take similar goldfish and freeze them in a pan by artificial Frigidore refrigeration. Our illustration shows how this was accomplished. Two fish were used in the experiment. They were slowly frozen and slowly thawed out. After thawing out, the fish showed decomposition at the gills. There was no reflex effect at all when they were treated electrically, with many different voltages. The nervous system of the fish apparently was just as dead as the fish itself. There was no trace of muscular reaction due to nerve stimulation, as was the case in the liquid air experiment.

The conclusion to be drawn from the experiments is that it is not possible to bring living organisms, after freezing, back to life. The statement found ever so often in text books, that fish in ponds have been frozen solid and thawed out in the spring, may, therefore, be questioned.

Probable upon the approach of a freezing temperature the fish go to unfrozen regions at the bottom of the pond or lake and stay there until the ice thaws out, but we don't very much if fish actually freeze and then come back to life. There may be certain species that do so, but we have yet to find them.

Our cover illustration shows a problematical experiment where this freezing process is applied to a human being. In connection with a warm-blooded being, as our experiments have shown, a slow freezing would be out of the question. If some means could be found of instantly producing a greater cold than that of liquid air, as, for instance, absolute zero, there is just a possibility that at some future date a human being might be frozen instantaneously. This would immediately stop all the various organic processes, and there would be no time for the blood vessels to burst, because the entire body would be frozen in an instant.

It would, of course, be necessary to provide the subject with a mask over his nose and mouth, with a pipe leading to the outside, so that in the ensuing thawing out the subject would not drown—just as shown in our illustration. An endotherm might be employed to cause the arteries to expand and contract as the current is intermittently turned on and off.

As soon as the thawing-out process begins, the resuscitation could be effected by vibratory electrical currents, and there is a chance that the subject would then come to life again.

Of what use would such an experiment be? Frankly, we do not know, but for biological reasons and for scientific purposes, very many things might be discovered during such an experiment that are entirely hidden from us now.

For instance, there are a number of diseases which, under such a treatment, might possibly vanish altogether. Certain bacteria, certain infectious diseases, might be stamped out entirely by a few hours' freezing treatment of this kind. We know from previous experiments that tissue and flesh can be preserved sometimes for years when frozen in ice. We also know that at present most low organisms are killed off, by the icing process. All this is an argument that the freezing process, if it can ever be effected, will in time come to be of great interest to humanity, very much more so than we can discern today.

Furthermore there are a great many sufferers of various diseases for which no cures have as yet been found. If we were able to suspend animation for a period of years, we could take those afflicted with incurable diseases and place them in a large sanitarium and suspend animation there. Attendants would be on hand at all times to keep the temperature constant and to maintain a vigilant watch over those in the frozen state. In later years when scientists actually discover a method for relieving the sufferers of malignant diseases, those afflicted with the particular disease for which a cure has been found, could be brought out of the sanitarium and thawed out to be treated the instant they show signs of life again. Of course this is pure theory.

Refrigeration during the past forty years has done wonders for mankind, our big cities could not possibly be without it today, as they are dependent upon frozen meat from outside.
As pointed out by Prof. Norris F. Hall, of Harvard University, in an interesting new book, "The Next War," the factors concerning dirigibles align themselves as above. A substitute for helium is improbable. Hydrogen mixed with air is combustible.

In his interesting prediction of the role of science in future wars, Prof. Hall predicts that airplanes will refuel in the air, landing on a dirigible supported platform or else connecting with suspended cables and hooks. Zeppelins may refuel from giant submarines at sea, as shown in the interesting picture above. If the dirigibles are filled with non-inflammable helium gas and are heavily armed, they will have a fair chance in battle.

The next war, even if waged within a few years, will be one fought by airplanes and tanks, say our scientists. The infantry will be infantry no longer, for they will go into battle encased in tanks. The reason why the tanks will have such a large share of the work in any future great wars, is due to the fact that first, the men are fairly well protected as compared with their position in trench warfare, and secondly, the tanks are mobile and can transport a large number of troops, which otherwise might be trench-locked for months. A picture of a tank and airplane battle in a war of to-morrow presents a startling spectacle to the mind's eye. Picture hundreds, yes thousands of tanks, traveling over the ground at speeds of twenty-five to thirty miles per hour, knocking down trees, and buildings as they go, and wallowing through seas of water, mud and gas. Military experts are now devising and building tanks which can travel thirty miles per hour or more, and they are being designed gas-tight and water-tight as well. Troops will be moved by huge fleets of tanks as well as by airplanes, and the illustration at the left shows troops being transported to a flanking position.

In the next war, if it should occur, one of the greatest problems the army experts will have to solve will be how to protect our cities and towns from gas attacks by the enemy. Imagine for a moment what it would mean if enemy airplane carriers or large submarines carrying collapsible aircraft, should make a gas attack at night on a city like Philadelphia or New York. It does not take very much gas, such as Lewisite, to render a city uninhabitable. If such an attack was made unexpectedly, or at the start of hostilities, the fatalities would be enormous without a doubt. It seems to the writer that one way of combating a gas spread over a city would be to lay down a neutralizing gas cloud from other aircraft. Prof. Hall describes the scheme illustrated at right, comprising thousands of gas jets kept burning over buildings and streets.
The pictures above show camouflaged tank and two corps of tanks attacking each other. Above: Opposing fleets of battle planes are about to begin an attack. The airplanes on the left are laying a smoke screen above their tanks, so that the enemy planes will have difficulty in bombing the tanks. Anti-aircraft guns will be carried on tanks.

Machine gun nests in pillboxes will be wiped out in the next war by dropping gas as well as thermite bombs on them. And tanks will squash what is left of the pillbox.

Tank carrying submarines of huge size are predicted by Prof. Hall. The picture above shows a fleet of these vessels landing tanks on an enemy shore. Modern tanks carry radio and can also lay land mines. They climb hills easily.

Sectional view of a typical airplane hangar of future type. Several floors are arranged underground with a camouflaged runway, up which the planes will shoot like a swarm of hornets. Anti-aircraft guns are shown firing from defense tanks. Enemy tanks will be trapped in a moat, which may be filled with water if desired. In the event that enemy tanks should get across the moat, they would be immediately blown up by electrically fired mines planted as shown.
The Improved Interferometer

NASMUCH as the Einstein theory is based almost entirely upon its promulgator's assumption that there is no such thing as the luminiferous ether, on which so many scientists have based much of their reasoning, the refutation of this assumption would naturally relegate the theory to the realms of the blasted hopes of many other dreamers. An improved type of interferometer used by Prof. Dayton C. Miller has recently been constructed and tests made with it have gone to show that there is such a substance as ether, and that there is an ether drift; in other words, the earth is going through the ether and setting up an ether wind, just the same as when we travel fast through the air we seemingly set up a breeze. In reality, the air stands still and we go through it. In just the same way, the ether stands still and the earth travels through it. Because of this fact, light will travel faster when going with the ether drift than when going against it, and the interferometer is so constructed as to measure this difference. It makes use of a beam of light divided so as to virtually give two beams of light traveling in different directions, which register according to their speeds. When the speeds are different, interference of the beams is encountered.

The drawing directly above illustrates the action of interferometer with its four sets of mirrors which make the path of each light beam 120 feet long. Using this instrument, it is possible to measure the speed of light down to one part in four billion. A beam of light from S is split by the half-silvered mirror at D, and from this mirror two beams go out at right-angles to each other, with the results described on the opposite page.

An excellent analogy of the ether drift is given in the drawing at the right. Imagine a bobber situated at a point equally distant from four floats in a body of water. If there is no current and the bobber is moved, waves will spread out and will cause each float to move at the same instant. If, however, there is an appreciable current, as indicated by arrow, the waves will be distorted from their circular form and will reach the extreme right float first, taking the courses indicated by the solid lines.

The photograph at the left shows the lines of interference produced by the interferometer.
Maps from Aerial Photos

Specially written for SCIENCE AND INVENTION

By J. B. BEADLE*

If we recall the fascinating novelties of our first railroad journey, we may remember how curiously the landscape seemed to act when watched from the car window. The rails and ties of the track, the telegraph poles, fences and other objects along the right of way seemed to take on a new view of the picture before it; so in aerial mapping each picture overlaps in the order and location of the contour lines.

MEASURING HEIGHTS HORIZONTALLY

In each case the two views of the same thing are affected by parallax; and in each case the parallax is a measure of distances in a direction at right angles to the plates. In the train pictures that direction is horizontal, the plates are vertical and the parallax is a measure of horizontal distances.

PARALLAX USEFUL IN AERIAL MAPPING

Such parallax measurements on photographs are now put to use in aerial mapping. During the war pictures were taken through the car window in quick succession, his pictures would be affected by parallax. The house and tree in the diagram, Fig. 1, have swapped relative positions on his two plates. If the camera is held right, and other conditions are necessary for accurate work.

ADVANTAGES OF AERIAL MAPPING

This process of mapping offers some marked advantages. Its speed exceeds that which was possible by older methods. Its accuracy is beyond that attained by the most complete record of controlling points is carefully plotted. Then each contour in turn is projected to the scale of the drawing or tracing.

All Planets May Be Inhabited

Professor William Campbell, President of the University of California and director of the Lick Observatory has put forth a theory that every one of the planets may be inhabited by some form of life adapted to the particular atmosphere of his habitation. He states, however, that the form of life on other planets may be as different from our conception of human beings as man is from many of the lower animals. In a recent interview, the Professor, referring specifically to the discoveries of William Beebe in the Sargasso Sea said:

"Even on our own planet there are forms of life of which we know hardly anything. Life in the water is developed in conformity with its environments. Thus, forms of life on earth and in the sea are very different. A fish would doubtless wonder how man was able to live on dry ground.

We may yet learn more about our neighbors.
Night Photographs

The camera above has a lens which is almost as big as the film upon which the pictures are taken. With such a camera instantaneous photographs may be taken at night.

The photograph above was taken in England and as the lights show it is a night photograph. The time of exposure was one-tenth of a second, which was sufficient to catch the moving hotel guest.

The photograph above was taken in front of a shop window in London. Here again an exposure of one-tenth of a second overcame all motion and gave this very fine example of night photography with the new camera.

Not only can the camera pictured above be used for outdoor photography at night, but scenes in a theatre may be photographed while the performance is going on. The three photographs immediately above were all taken during the performances of different plays in Europe. Notice that in spite of the fact that action is present in each of the scenes there is no blurring of images in any of them. The photographs were taken with an exposure of one-twenty-fifth of a second from a box seat in a London theatre. Scenes from Tannhäuser, Flora's Awakening and Le Train Bleu.

Drawing

In Fig. 1 above a simple method of learning how to draw is illustrated. A glass upright plate is placed in front of the object to be drawn. The pupil looks at the object through a peep hole and sketches it on the glass with colored chalk. The drawing is subsequently traced on paper as indicated in Fig. 2.—Die Umschau.

How Lake Dried River

Last summer, owing largely to the prevailing drought, Elk Lake, situated on the Century Drive in Oregon, was lower than it ever had been before. As the water lowered, a large number of huge holes in the bottom were revealed—underground outlets. One of these was twenty feet square, others were no more than two feet in diameter. As fast as the outlets showed themselves they were filled with concrete—seventeen in all. Now comes the report that Quinn River, twelve miles away, has reduced in flow to one-tenth its former value. The theory held by geologists in the vicinity is that Quinn River, previously fed by underground channels from Elk Lake, is now deprived of its water supply by the blocking of the holes. It is probable that the springs which fed the stream originated from Elk Lake, reappearing after a subterranean journey of twelve miles.

—Gene Deachem, Ph.D.
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 458, 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 654,323. We have named this new brain teaser "Cross-Number Puzzle."

**Science and Invention for September, 1925**

**Mathematical Cross-Number Puzzle**

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**Insomnia Cure**

A novel device designed to cure insomnia has been patented by an English inventor. The principle of it depends upon the action of light upon the retina of the eye. It flashes a series of 12 different colored rays at a certain predetermined speed and in a definite sequence. It is said that these rays affect the eye in such a way as to induce sleep even in the most stubborn cases of insomnia that have failed to respond to other treatment. The flashing lights are supposed to have no bad effects on the eyesight.

**Answer on page 458**
A new type of folding seat which will appeal to sportsmen and all those who have occasion to carry a chair with them is illustrated above. This device made of strong yet light steel bars and comfortable upholstery can be completely folded until it resembles a hand bag. The photograph shows a view of the seat unfolded and ready to be inverted into a usable position.

The sharp back of the average paring knife will often cut the hand of the user. The little metal device shown above protects this edge and prevents harm.

An eraser which can be made to write in five different colors is illustrated above. It works on the same principle as the average automatic pencil but contains a five barreled magazine which can be rotated so as to bring the desired colored lead into action. This pencil comes supplied with a case containing ten refills.

The carrying case for the small curling iron shown in use at the left is illustrated directly above. The large handle of the iron covers the small gasoline torch supplied for heating purposes, while the prongs of the iron slide into a cylinder fastened to the side of that one containing the gasoline torch. The entire telescoped unit may be carried in the neat case shown beside it.

A pencil which can be made to write in five different colors is illustrated above. It works on the same principle as the average automatic pencil but contains a five barreled magazine which can be rotated so as to bring the desired colored lead into action. This pencil comes supplied with a case containing ten refills.

Something new in the line of an easily carried eraser is shown above. It is similar to the ordinary pencil constructed on the paper roll idea, and requires only a nick from a knife or pin and the removal of a curl of paper to expose a new, clean erasing surface. The eraser is shown compared with an ordinary pencil directly below it.

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Another boon to milady's toilet is the small and compact curling iron illustrated in use below. The device is heated by means of a gasoline torch which is supplied with it and the prongs are then applied to the hair in the usual manner. In this way a young lady may keep her hair looking its best under all conditions. Despite its small size, this iron is said to be effective in every way and perfectly satisfactory in operation.

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SMALL, handy washing machine, easily used over a sink, washbowl, or on a table, has recently been placed on the market for convenience of persons who do not wish to wait for a regular wash day to have cleansing of garments done. It is of special use in the nursery and does a personal wash of dainty pieces in a few minutes, saving them from the wear and tear of an ordinary wash. For the professional or business person who is away from home during the day, it is of particular value as he or she can keep a wardrobe in cleanliness at all times by doing two or three washings a week, taking a few minutes for each time. When not in use all parts of this tiny washer are kept within the container, thus saving space. The device is of great use in the summer home as garments as large as towels and shirts can be washed in it by the mere process of turning the crank.

The device illustrated above is designed for mincing and chopping foods for the preparation of various dishes. Four sharp blades on the end of the rod perform this work.

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Boat Travels on Air

A boat which is designed to be propelled on a somewhat new principle is illustrated above. The young lady at the right is holding a small working model of the boat. One boat which has been completed is shown in operation at the left above. The details of the principle of propulsion are given in the line drawing. A gasoline engine is coupled to an air compressor. This in turn is connected by pipes to a series of holes at the rear of the boat and also to a small series in the bow. A valve controls the flow of air to either set of holes. Air issuing from the stern holes causes the boat to go ahead. Forcing air out of the front holes reverses the action.

—— C. A. Oldroyd.

Lever Propelled Life Boat

A new type of life boat which is propelled by levers instead of oars is illustrated in detail at the right. Pulling and pushing on the levers rotates a gear which drives a pinion, which in turn revolves the propeller.

It is said that the new type of life boat shown herewith is more efficient and much simpler in operation than the ordinary type of oar-propelled boat. With 42 people in one of these boats, eight men at the levers easily maintain a speed of 8 miles an hour. With two men to each lever, facing each other, it is quite possible that the speed would be doubled. One great advantage of this type of boat is that the operators need not be experienced. With just one seaman in the boat for steering, totally inexperienced people can keep the boat moving steadily. A simple reverse lever is incorporated in this boat which reverses the propeller without any change on the part of those operating the levers. In the ordinary oar-propelled boat, inexperienced oarsmen often lose their oars. There are no oars in this type of boat.
There is an old theory that when a man falls from a considerable height, he is dead before he reaches the ground. This theory has at last been exploded by two Army aviators, who leaped from an airplane at Mitchell Field, L. I. A short time ago there was an article in a newspaper concerning a man who jumped off the Brooklyn Bridge, and who was supposed to have died before he hit the water. At least that was the opinion held by the writer of the article. Parachute experts contended that a falling person retains his senses, and a test was attempted. Accordingly Staff Sergeant Randle L. Bose and Corporal Arthur Bergo went aloft in a Martin bombing plane. At a height of 3,000 ft. they jumped. The men shot through the air twisting, whirling, somersaulting. When they reached the level of 2,000 ft., they pulled the rip-cord. This opened the parachute and checked their descent. The parachutes permitted them to sail down to the fields like a couple of birds. Before any of the crowd could question either Bose or Bergo, they again ascended in the bombing plane to repeat the test.

Both men testified that at no time did they lose control of themselves. They experienced the greatest thrill when their flights were suddenly checked by the opening of the parachutes. Of course if they once lost their hold on the cords, they would have had a thrill which one gets but once in a lifetime, but they would have been unable to tell about it. By this test it has been definitely proven that a person leaping from the Woolworth Building will be fully conscious up to the moment he strikes the ground. Only in cases of heart trouble would the person die before his body struck the pavement.

Thin as the parachutes may seem, they certainly have proved their efficacy. Little wonder then that the Army aviators are compelled to equip themselves with parachutes when flying.
Novelties

The photo at the left shows how artificial leopard skin is being made at the present time using the much maligned rabbit fur. A stencil is placed upon the rabbit skin and then an aniline dye is used to produce the spots. After the stencil is removed, the fur appears as indicated in the photo at the right. The fur can then be made into coats, or as was the style during the past year, it may be used to line or half-line a coat. Not only is the coat warm, but it is attractive as well. Milady ought to know, she was wearing a coat lined with imitation leopard fur last year.

The photo at the right shows half a dozen hailstones that fell in the vicinity of New York recently. It appears that they are quite a handful. Each one measures about an inch and a half in diameter. These hailstones are not the largest that have fallen by any means. A few years ago districts thirty miles from New York City suffered a hailstone storm in which the hailstones were as large as baseballs. Naturally hailstones as large as this do considerable damage, breaking windows and often killing poultry and other animals, at the same time destroying crops. The exact formation of a hailstone is not known, although there are several theories as to its formation. One of the most popular is that a small particle of ice is formed, and this is carried up to the colder strata by wind currents. Here the water surrounding the particle of ice freezes. The operation is supposed to be repeated dozens of times.

The instrument shown below is one of the earliest models of an explosion engine known. It was developed in the early part of the Nineteenth Century and was probably the forerunner of our modern internal combustion engines.

It is quite difficult to prepare a fountain-pen for use in temperatures down to fifty or sixty degrees Fahrenheit below zero. Such a pen has been prepared, and is shown in use in the photo below.
Tarrano the Conqueror

THIRD INSTALLMENT

By RAY CUMMINGS

First American and Canadian Serial Rights

CHAPTER V

THE OUTLAWED FLIGHT

DR. BRENDE was dead. We knew it in the moment that followed our sudden assault and capture. Elza knelt there sobbing. Then she stood up, her tears checked: and on her face a look of pathetic determination to repress her grief. Now that we had yielded, the Venus-men, searching us for our weapons, cast us loose. We bent over Dr. Brende, Georg and I. Dead. No power in this Universe could bring him back to us. Georg pressed his lips tightly together. His face, red from the exertion of his fight, went pale. But he showed no other emotion. And, as he leaned toward me, he whispered: "Got us, Jac! Say nothing. Don't put up any show of fight."

Elza now was standing against the wall, a hand before her eyes. I went to her. "Elza, dear—"

Her hand pressed mine.

Our captors stood curiously watching us. There seemed to be at least ten of them—men as tall as myself, though not so tall as Georg. Swarthly, gray-skinned fellows—one or two of them squat, ape-like with their heavy shoulders and dangling arms. Men of the Venus Cold Country. They were talking together in their queer, soft language. One of them I took to be the leader. Argo was his name, I afterward learned. He was somewhat taller than the rest, and slim. A man perhaps 30. Paler of skin than most of his companions—gray skin with a bronze cast. Dressed like the others in fur. But his heavy jacket was open, disclosing a ruffled white shirt, with a low black stock. A shifty-eyed fellow, this Argo. Smooth-shaven, with a mouth slack-lipped, and small black eyes. But his features were finely chiselled; and with that bronze cast to his skin, I guessed that he was from the Venus Central State. He seemed much perturbed that Dr. Brende was dead. Occasionally he burst into English as he rebuked one of the others for the killing.

"No more than a moment had passed," Georg joined Elza and me. We stood waiting. Georg whispered: "They killed Robins and his helpers. In there——" He gestured. "I saw them lying in there. If only I had——"

Argo was standing before us. "This is a very pleasant surprise—" He spoke the careful English of the educated foreigner. His tone was ironical. "Very pleasant——"]

Abruptly he turned away again. But in that instant, his eyes had roved Elza in a way that turned me cold.

They led us away, down a padded hallway into the instrument room. It was in full operation; our Inter-Allied news-tape was clicking; the low voice of the announcer droned through the silence. I started toward the tape, but Argo waved me away. He had volunteered us nothing; and again Georg advised me to be silent.

SYNOPSIS

THE story opens in the year 2325 and is related by Jac, a writer of that time, employed by a large news organization of Great New York. On the afternoon of May 15 of that year, the President of the Anglo-Saxon republic is murdered in the midst of Great New York. On the afternoon of May 12 of that year, the President of the Anglo-Saxon republic is murdered in the midst of Great New York. On the afternoon of May 12 of that year, the President of the Anglo-Saxon republic is murdered in the midst of Great New York.

The President of the Anglo-Saxon republic is murdered in the midst of Great New York. On the afternoon of May 12 of that year, the President of the Anglo-Saxon republic is murdered in the midst of Great New York.

At 9 P. M. Jac was summoned to North Island, off the coast of Maine, by a Dr. Brende. He goes and is welcomed by the Doctor and informed that the Martian message and read in part, "City being at danger of~~

Tarrano, the Doctor states, was at one time a lower official of the Cold Country of Venus. The Doctor then announces that he, Brende, has perfected a medical method whereby human beings may be kept from growing old.

Unable to communicate with the Doctor's laboratory in northern Siberia, they set out for that point in Brende's car. Arriving there they found no one outside and upon entering the laboratory building, were set upon by a group of "Venusmen."

We seemed now to have passed within the patrol line. There were no more official vessels to be seen. We clung low, and at 10:16 that morning we descended in Venia, capital of the Central Latina Province, largest immigrant colony of the Western Hemisphere.
Argo had given his orders. Through a window I saw men carrying apparatus from the house. A small metal frame, of sun-mirrors, prisms and vacuum tubes. Georg whispered: "Father's model!"

"And beyond the window I saw a face." Dr. Brende's notes—and a variety of other paraphernalia. Carrying it back from the shore toward the headlands of the Cape, where I realized now they had an aeroplane secreted.

Argo was at a mirror; he had a headpiece on; he was talking into a disc—talking in a private code. I could see the surface of the small mirror. A room, with windows. Through one of the windows, by daylight, palms and huge banana leaves were visible. A room seemingly in the tropics of our own hemisphere.

Argo was triumphant—explaining, doubtless, that he had captured us. Mangled with his voice, the Inter-Allied announcer was saying:

"Great—New York 10.32 Martian Helio, via Tokyo-Hana: Little People Proclamation—A man standing near the tape switched off the droning voice. At the receiving table, every second came the buzz of the laboratory's call. Wrangel Island again called: When the knob was turned no one paid any heed. Argo finished at the mirror. He glanced over the tape, smiling sardonically. Then, methodically, deliberately, he swept the instrument's direction, jerked out the connections, turned out the current—wrenched it all with a few strokes. A moment later we were taken away.

Outside, from back by the low reaches of the Cape, we saw an aeroplane rising. They had boated it with Dr. Brende's effects, and in it half of the men were departing. It rose vertically until we could see it only as a speck in the blue of the morning sky—a speck vanishing to the North over the Pole. Argo car. We did not pass Dr. Brende's house. A small metal frame, of sun-mirrors, prisms and vacuum tubes. I knew how to operate it—too far to sight it with the naked eye, I realized; but I knew, too, that the Director would see the distant image of us on his finder, even though we refused connection should he call us. And we had no right to be up here in the 18,000-foot lane. They'd order us down—shut off our power, if necessary.

We could not escape observation on this daylight flight. Heading this way, it would take us past the Pole and on Southward, down the Western Hemisphere over the Americas. We could not refuse connection for long. We would be challenged, then brought down. Or, if Argo answered a call, some Director would examine our pit with his finder—would see Elza, Georg and me as prisoners. We could gesture surreptitiously to him. . . .

My thoughts ran on. Argo's soft, ironic voice brought me out of them.

"The wide, Argo." He took the length of wire, glancing white-hot, as the leering, glazing Argo turned the current into it—Tarrano took it, lashed it upon the poor wretch's naked back and legs.

"We will answer the first call that comes," he said smilingly. "You understand? We are the Inter-Allied News on Official Dispatch." He was addressing me, his glance going to the insignia on my cap. "You are, of the Inter-Allied?"

"Yes," I said. "What's your name?"

Tarrano listened impassively.

"Jac II, son of Hallen," he read admissively. "Quiet, Jac!" Georg warned.

"Yes, Division 8, Manhattan," he read from my cap. "Well, when the first Director calls—from the Pole perhaps—you will tell him we are Inter-Allied Officials. He will see us here—I do not believe, the way we are sitting, that he will think anything is wrong. He will see us of Venus. There are Venus-men employed by the Inter-Allied. Is it not so?"

I had to admit that it was. He nodded. "You will fool the Directors, Jac Hallen. You understand? You will get the reports on weather today down the 67th Meridian West. And ask if we can have power to the Equator and below?" His eyes flashed. "And if you attempt any trickery—you will die. You understand?"

I did, indeed. And I knew that his plans were well laid—that I would be helpless to give us over without paying for it with my life—with the lives of Elza and Georg as well.

From up here in the 18th lane, the Polar ocean lay a glittering white and purple expanse beneath us. Then, again, a fog rolled out down there like a blanket. We passed the Pole, a hundred miles or more to one (Continued on page 458)
Tricks of Mediums

By EDWIN MERLIN
A Reformed Spiritualist.

On this page we show a series of pictures illustrating another group of effects that are found in the repertoire of most spiritualists. All of these effects have actually been worked in dark room seances by the author of the article, and are being used by a great many would-be mediums throughout the country, even at the present time. Even though the effects are surprisingly simple, they produce very uncanny results in the dark.

The above illustration shows a medium tied in a sack. On her lap is placed a slate which is held by two sitters. The medium writes with a thin pencil through the meshes of the sack.

The two photographs at the right illustrate a typical effect often performed in a seance room. A heavy cord or wire is passed through the cuff button holes in the sleeves of the medium's shirt. The cord is held by the sitters. The medium slips off the cuffs and does his work without interference, while the sitters believe that his hands are in absolute control.

The luminous band on the end of the trumpet seemingly floats with the trumpet around the room. As it passes the medium's lap, he covers the trumpet band with a black cloth and exposes a round circular band previously hidden in the cloth. This he moves with great dexterity, and at high velocity in front of the sitters' faces, demonstrating in this way remarkable "spirit control."

The medium sits in a creaky chair and rocks it before the seance starts. When the room is darkened, he stands up and rocks the chair with his feet. Joining two trumpets together end to end, he is able to cause the luminous band to move around the room at a distance of ten or more feet from the chair. The creaky noise makes the sitters believe that he still occupies the seat.

The medium knows that spirit manifestations are taking place. He asks Miss Steinmetz to hold his left hand, meanwhile operating the trumpet with his right. He then says, "Hold my right hand, Miss Foote," and he operates the trumpet with his left. After repeating the phrases for a while, he insists that both hands be held tightly. With his hands under control he lifts the trumpet to his mouth with his feet, as the three accompanying photographs illustrate.
A rather unique and novel game has been suggested for army and navy aerial forces. It is called "aerial ball" and resembles football, except that it is played with airplanes instead of the feet. We have horse polo, motor-cycle polo and even automobile polo, so why not a sort of aerial polo? The goal lines are marked by balloons held captive at the two ends of the field, perhaps twenty miles apart. The ball itself is buoyant. The object of the game is to push the ball to the goal. The opposing planes try to knock the ball out of the basket-like pusher and carry it to their own goal line. Skill in maneuvering will prevent accidents, and the great speed at which the planes travel also minimizes the danger. For practice the game is preferably played over a body of water. This game certainly aids war-time maneuvers.—J. Kay London.

Anti-Aircraft Nets

Anti-aircraft nets are the latest developments in modern warfare. These nets were invented by Takeo Takagi, a Japanese, and are being tried out by the Japanese Army and Navy. The nets are fastened between two parachutes and in some cases across four parachutes. The parachutes and nets are then loaded into a shell, and are fired in the path of the enemy planes. When the shell explodes, it releases the net which is expected to foul the propeller and bring the plane down.
Doctor Hackensaw's Secrets
By CLEMENT FEZANDIE

No. 43—A Journey to the Center of the Earth. (Part IV.)
(CONCLUSION)

It was merely one enormous sea of air with islands of various sizes floating in it. These islands were particles of the solid rock which had become broken off and hurled upward.

SYNOPSIS

Dr. Hackensaw, after having determined to explore the center of the earth, and having made preliminary observations, asked his very good friend Pepita Perkins, a newspaper reporter, to accompany him on a trip to the South Pole where the excavation was to be started for the trip to the center of the earth. They arrive at Dr. Hackensaw's village at the South Pole where a crevice in the earth five miles deep has been discovered. Working first with a diamond drill and then with an "atomic force drill" one of Dr. Hackensaw's inventions, they start work on the bottom of the pit. After some hours of drilling, observations made by means of a special microphone show that they are nearing another natural cavern in the interior of the earth. The diamond drill is once more brought into play and soon pierces the remaining shell of the rock into the lower cavity in which a partial vacuum is found to exist.

In the Dart, which has been reconstructed for the special work at hand, Dr. Hackensaw, Pep and Miggs start on their journey toward the center of the earth. Their machine is provided with brakes and automatic speed devices which allow them to travel at an even rate of 100 miles per hour. Soon they find that their weight is greatly reduced. At 1,200 miles below the surface of the earth calculations show that something has gone wrong. At 1,500 miles below the surface the travelers find that their weight, which has been constantly decreasing, is nothing and that they have to hold on to the sides of the car in order to prevent their floating around within it. Upon this fact the Doctor bases an assumption that the center of the earth is hollow, the crust being 3,000 miles thick. After proceeding some distance further on they suddenly see, while looking down through the bottom of the car, a phosphorescent light miles ahead.

Meanwhile, Miggs had caught hold of one of the immovable animals that were rooted to the ground, and he got a violent electric shock for his pains.

"Well, Pep," cried Doctor Hackensaw, "you see I was right! Here we are at the center of the earth and we find there is nothing here but an immense hollow filled with air. My experiments in sending directed radio currents from the surface of the earth, at different points, through the center to the antipodes, had led me to this belief, but it seemed so wild that I could not accept it at first. It seems utterly at variance with all that science has taught us. Calculations show that the average density of the earth must be about five and one-half times that of water, and as it is less than this at the surface, we know that it must be greater than this down below. Then, too, the earth acts like a rigid body. No, I can scarcely believe my own senses."

Pep was not listening. She was gazing earnestly at this wonderful new world that was spread before them. "Please switch off the light," she said, "I want to see what this looks like in the dark."

Doctor Hackensaw obediently turned off the searchlight and the new underground world was revealed in all the beauty of its own phosphorescence. It was an extraordinary sight. Every animal or plant of this grotesque world of creatures seemed to shine by its own light like a gigantic firefly or glow-worm. And yet the colors of the phosphorescence varied in each species, every color of the spectrum being represented from red through green and yellow to blue and violet. And the forms were marvelous;
altogether different from anything our friends had ever seen before.

Plants and animals there were of many varieties and, strange to say, some of the stationary forms appeared to be animals, while some of the movable ones appeared to be plants, capable of flying around in the air from spot to spot, but with seemingly no mouth, eyes or other definite organs except their wings.

Animals, too, there were that could walk around from spot to spot, evidently by means of suction pumps on their feet, similar to those that enable flies to walk along a ceiling without falling. Had it not been for these specialized feet, life would have been difficult to these subterranean creatures, as the muscular exertion of their movements, here, where bodies had no weight, would have shot them up into the air, there to perish miserably from hunger and thirst.

Other creatures there were, but these were provided with wings. A few were quadrupeds, but most of them had six feet. Some were beautiful to look at—others grotesque and uncouth. There was one flying creature with two long trunks, resembling an elephant's trunk, where its eyes should have been, and an eye at the point which its mouth should have occupied. It seemed to have six mouths, one at the extremity of each foot. The snake-like wrigglers through the air have already been mentioned. These did not seem to be provided with wings of any kind, but appeared to glide through the air much as a snake glides through the water.

"Pop!" cried Pep, "can't we land here? I'd like to see these creatures from nearby!"

Doctor Hackensaw hesitated, for in the distance he had caught sight of some huge unearthly-looking monsters half hidden in the peculiar vegetation. However, he was as anxious as Pep was, to get a nearer view of the flora and fauna of this strange land, so he assented, and with a turn of the rudder brought the car right up to the rocks. Here a peculiar problem presented itself. How was he to moor the car to the rocks? As objects now possessed no weight, the slightest wind might blow the car away beyond reach.

"It is something of a problem," remarked the doctor, "but only a secondary one. I can fasten the car to some of this vegetable growth, though I haven't much faith in the strength of these stems. I could at a pinch fasten the car to one of these moving animals. The only drawback would be that the frightened beast would be likely to plunge into the jungle, dragging us after him. A third solution seems to me much more feasible. But before I do anything at all I must ascertain whether this air is fit for us to breathe."

"It must be," replied Pep, "because both animals and plants live here, and animals cannot live without air."

"Nor plants either," replied the doctor, at least, not our terrestrial ones. All animals and plants require some source of energy and obtain that energy from the chemical union of oxygen with some element. Hence they require air. Warm-blooded animals require more oxygen than cold-blooded ones. I have myself kept a sleeping snake under water for 24 hours. As a snake cannot breathe under water he could not obtain any fresh oxygen during that time, and hence his consumption of the element, while asleep, must have been very slight. Plants require still less oxygen, but a delicate thermometer will show an increase of temperature during certain periods of flowering, showing that the vital processes, even in plants, require oxygen. But plants with green leaves manufacture much more oxygen than they consume. Parasitic plants that live on the juices of other plants, and saprophytes (as the botanists call the mushrooms and other plants that live on organic matter formed by other plants or animals), do not manufacture their own oxygen. Some of the bacteria, as a matter of fact, are anaerobic; that is to say, they cannot live in air.

"Well," cried Pep, triumphantly, "that means that I am right, and that the air here must contain oxygen."

"Not necessarily. Conditions here may be, and certainly are, entirely different from those on the surface of the earth. All our (Continued on page 470)
The greatest difficulty encountered in the inauguration of the night air mail between New York and Chicago, and which it is rumored will be extended to cover the entire country, was the provision of suitable landing lights. A flood light giving half a billion beam candlepower was developed, and a photograph taken by its light of a hangar a quarter of a mile distant is shown in Fig. 1.

When leaving the field, the air mail pilot does not make use of the flood light, but switches on the concentrated beam headlights located on either wing and uses them to guide him over the field and into the air. After rising from the ground, these lights are switched off and only the running lights of red and green are left burning.

In Fig. 2, the powerful flood light is shown in action with one of the mail planes making ready to land. The pilot has flown over the field getting his bearings and will swing around in a circle and eventually land on the far side of the field, whereupon he will "taxi" into the hangar. Fig. 4: Flood light in action.

The housing and lens of the enormously powerful flood light are shown in Fig. 5 at the left. This light is of the arc type with a combination of hand and motor feed. The lens is so constructed that, when the housing is completely opened, it will throw out a broad flood beam covering an angle of almost 180°. The switchboard which controls the amount of power supplied to the arc is shown in Fig. 6. The current is obtained from a motor generator unit having an output of 25 kilowatts at 120 volts D.C. The motor is driven from a special 110 volt A.C. line. The two meters on the board indicate the voltage and amperage being fed to the arc contained in its housing just outside of the shelter built over the switchboard.
**Air Mail**

**Report No. 7510**

**Author.** Drawings Made At Hadley Field, New Jersey

**PROBABLY** the most romantic undertaking that has ever been pushed forward to a satisfactory conclusion by the United States Government is the installation of the night air mail. Flying during broad daylight and under ideal flying conditions is one thing, but regular flights during darkness, night after night, regardless of weather conditions, is quite a different proposition. To safeguard the pilots who undertake the hazardous occupation of guiding their mechanical birds through the night, the mail service officials have installed numerous beacons and guide lights along the entire course and have provided excellent landing fields that, when required, are illuminated in the best possible manner. Furthermore, each pilot is equipped with an efficient type of parachute and, at the end of every flight, each plane is thoroughly gone over in every detail. This servicing is as complete as possible and includes inspection of every wire, turnbuckle and hinge on the whole machine. Besides the regular terminal fields where the mail is changed from one plane to another or from the plane to motor trucks or train, there are emergency landing fields located only a few miles apart over the entire course. Each of these fields is equipped with a revolving beacon of 500,000-beam candlepower, such as that shown in Fig. 11, and points between the fields are equipped with other revolving lights of the type shown in Fig. 12, which serve to guide the flier and keep him on his course.

With the new regular service, air mail rates have been reduced enormously and it is now possible to post a letter in New York in the evening and have it delivered by the first mail carrier in Chicago the next morning.

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Fig. 10, above, shows the switchboard built into the side of the flood light housing which controls the speed of the motor which drives the carbons of the arc and keeps them at the correct distance apart. If the carbons burn faster than usual, the motor can be speeded up so as to keep pace with the consumption of the electrodes. Hand adjustments are also provided.

The group of lights shown in Fig. 12 are of the type that will adorn high prominent points along the air mail route. Each one of the lights is tilted at a slightly different angle from the horizon so that one of the beams is sure to catch the eye of the pilot as he flies through the night and thus they keep him on the correct course. A motor located in the base revolves the lights as well as the commutator which allows current to be fed to the incandescent bulbs.

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In Fig. 6, above, the beam headlights and the running lights located on the wing tips of the mail planes are plainly shown. The running lights are each equipped with two lenses showing the standard red and green colors. One of the lenses, pointed forward, warns approaching pilots, whereas the second lens, pointed toward the side, serves to prevent damage by planes flying across the line of flight. These lights are supplied with current by a generator driven from the motor.

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In Fig. 13 is a view taken on the top of the hangar at Hadley Field. The cluster of four lights in the left foreground is placed there for experimental purposes. The large searchlight in the background is the standard landing field guide beacon. Note the wind indicator and lights.
By
THE MAN WHO
MYSTIFIED
Prince of Wales, Ex-President
Harding, Taft, Roosevelt, Pres.
Coolidge and other celebrities
Writes Exclusively for
SCIENCE AND INVENTION
NO. 30 OF A SERIES

The medium is seated in a chair and her arms firmly secured by means of cords knotted and then sealed. The lights are turned out and tambourines, bells and horns are sounded. When the lights are turned on again, the medium is found tied in the same place. The secret lies in the construction of the chair, the arm of which comes out and permits of free movements. The latch for the arms is released when the medium is seated.

A large glass lamp which may be passed for examination is placed upon the table. This is covered with a cloth, which on being removed shows the lamp to have vanished. The lamp is then made to reappear. Under cover of the cloth, the magician fastens the lamp to his back and makes it reappear when he desires.

For the amateur trickster the coin illustrated here is of particular value. The coin is merely a rubber disk, silver colored on one side, and flesh colored on the other. Because of its flexibility, it can be passed around the finger, placed under a ring or concealed between the fingers. A coin of this nature saves many hours of practice and is very deceptive at a distance.

The celluloid ball is tossed into the air by the magician, and finally dropped into a glass globe containing water, to which a little ink has been added to color it. On command the ball sinks or rises. The secret lies in the beeswax pellet to which a hair is attached. The hair passes through a small lead weight, which acts as a pulley. Both weight and ball are dropped into the globe containing the colored water.
A new instrument has been designed for the taking of X-ray photographs of the heart and lungs while they are at rest, and has been placed in practical use at the Phipps Institute of the University of Pennsylvania. This device is to aid in the diagnosis of such diseases as tuberculosis. It was invented by Charles N. Weyl, of the University of Pennsylvania, and is so delicate that even the weakest infant will cause it to operate. It is a known fact that any lesion of the lung may be recorded by the X-ray, but the organs of the chest due to their complex physiological movements often cause a blurred image. Now, however, a photograph may be taken at any cycle of the heart beat. When the patient’s heart beats, an impulse is sent down the air column inside the rubber tube, which operates the diaphragm, and in turn the mirror. The funnel is placed over the carotid artery. The light affecting a selenium cell intermittently permits of the passage of current through the amplifier and controls the relay, which in turn operates the control for the X-ray tube. Thus at a definite phase of the heart beat, the X-ray tube is excited and produces a clear cut picture.

The above schematic drawing shows the outline of the new apparatus which will enable one to take X-ray photographs of the heart and lungs. L is the light, C a condensing lens, M is a mirror pivoted at U, F the funnel, connected by D. The arm on the mirror and projects the current to the relay B, which controls timer on X-ray machine.

A new internal germicide having the germicidal power of about fifty times that of phenol has recently found its way to the market. This product is called Hexylresorcinol. The substance is not toxic when taken by the mouth in therapeutic doses. It passes through the stomach and is absorbed from the intestines. It is then taken up by the blood stream and carried to the kidneys to be excreted into the urine. It is particularly adapted to infections of the urinary tract. As post-operative treatment in such cases as operations of prostaticctomy, the product will often aid in preventing wound infection.

To the left is illustrated a new mastoid bandage to take the place of the old style of bandage. The photo at the top shows the bandage, and the right lower photo shows it applied over sterile fluffs. The photo at the left shows the usual method of bandaging following the operation.—Max Bulock.

The diagram above illustrates the new type of hypodermic syringe fitted with a carpule. Note how the needle punctures one end of the carpule, while the opposite end is pushed forward by the plunger. The photo at the right shows how the hypodermic syringe is loaded.

The photo at the left shows a physician’s kit ready for instantaneous use. The solutions in the carpules are absolutely sterile.

The diagram at the left and the photos below show a new type of hypodermic syringe. This device may well be called the automatic hypodermic syringe, inasmuch as the syringe is loaded from the breech with sterile carpules. These carpules are pushed forward, so as to cause the needle to puncture one end of the carpule. The other end then acts as part of the piston.

Photo at the left shows a similar hypodermic syringe for tonsil operations.

The photo below shows a physician’s kit ready for instantaneous use. The solutions in the carpules are absolutely sterile.
Making A Simple Selenium Cell

1. Covering the smooth, sandpapered surface of a piece of slate 3 inches long by 1 inch wide with carbon from a soft pencil.

2. Cutting the continuous zig-zag line through the carbon coating.

3. Smoothing off the melted selenium on the surface of the cell. Testing the cell with a sensitive meter and a battery.

4. The finished cell with binding posts and tinfoil connections.

To make this cell, cover the surface of a piece of slate with a carbon or graphite deposit from a soft pencil as in 1. With a sharp knife, cut through this coating forming one continuous zig-zag line as in 2A. Place on an iron sheet over a burner and melt selenium on the coated surface of the slate. Spread carefully with the back of a hack-saw blade. Turn down the burner till the glossy black surface slowly turns gray. Increase the heat as much as possible, but do not allow the glossy color to reappear. Keep at this temperature for about an hour and then cool. Strips of tinfoil making contact with the graphite surface are bound around the cell and binding posts provided as in 4.—Raymond B. Walles.

Photo Helps

Fasten strip of cardboard to print trimmer with thumb tacks. Distance from edge of cardboard to edge of trimmer equals width of margin. Line up edge of photo with cardboard and trim. Even margins result.

To a dark room safe-light.

Procure a small can such as varnish comes in and with a can opener cut a rectangular hole in one side as shown. Paint the outside black and the inside with aluminum paint. Place an electric light bulb and socket as shown and fasten a ruby glass over the opening with wide strips of gum paper or adhesive tape.—Sam Y. Caldwell.
Everyone wants a movie camera and who can think of a better way of obtaining one than to make it at home for a very small sum? The writer built the one illustrated herewith for the small sum of $8.00, exclusive of the lens. The case is a light-tight box $3\frac{1}{8}$ x 6 x 9	extquotedbl. A brass plate which serves as a bearing is screwed to the side of the box as in Fig. 8. A door is provided on the opposite side, the joints being lined with velvet to exclude light. The aperture plate is made of $3\frac{1}{8}$" brass, cut, drilled and provided with guide rails as in Fig. 1. The shutter is illustrated in Fig. 2 and the bearing for the same in Fig. 3. The claw which moves the film intermittently is made of $\frac{3}{8}$" thick brass or aluminum as shown in Fig. 5. Two magazines which are nothing more than light-tight boxes are made to fit in back of the case and the take-up reel is fitted with a 1-inch pulley and is belted to the feed sprocket shaft. The crank is attached to the main drive gear as below. A sprocket on the cam shaft, 1 inch in diameter, drives another of the same size located on the shutter drive shaft as in Fig. 8. All of the gears and sprockets can be obtained from a motion picture supply house.
Angle Guide for Artists

By J. Kelley Burleigh

A simple method of determining the correct angles of any building or other object is illustrated herewith. With this system, an outline of the principal features may be made on the spot and the drawing completed at leisure. In essence, the idea is as follows: A drawing board is pivoted at the top and very heavy cardboard is used for drawing. This is also pivoted, being fastened to the drawing board in the center. Vertical lines are determined by looking directly over the drawing board at the object to be illustrated and projecting the lines down. The lines from the eye are indicated by 1. The horizontal lines are obtained by tilting the drawing board until its top edge is parallel with the line to be drawn. The T square is then placed across the board and an accurate reproduction of the line is drawn to scale. Illustrated at 2.

Exposure Meter

-DIRECTIONS-
1. FIND MONTH AND HOUR AT LEFT OF DIAGRAM
2. RISE VERTICALLY TO BASE LINE (HEAVIEST SLANTING LINE)
3. MOVE BRIGHT TO LINE FOR KIND OF LIGHT AND DOWN TO BASE LINE
4. SAME FOR SUBJECT
5. SAME FOR LENS OPENING
6. MOVE RIGHT OR LEFT TO LINE FOR FILM SPEED OR KIND OF FILM
7. MOVE VERTICALLY TO CORRECT EXPOSURE AT TOP OF DIAGRAM.

NOTE: NAMES OF OTHER VERSIONS OF FILM MAY BE WRITTEN IN ON LINES MARKED WITH HYPHEN. USING HYPHEN POLAROID FILM SPEEDS, WHEN USING RAW FILM, ALL STEPS MAY BE OMITTED.


Anti-Rattler

If the gearshift lever on your car rattles, drill a hole in it and place a spring, washer and cotter-pin as shown. The spring should be slightly compressed.

-C. W. Caldwell.

An exposure meter which the author designed for his own use and which has stood the test of many months of actual use is reproduced in detail at the left. Clip the drawing and directions from this page, paste on a piece of cardboard, and keep the meter with your camera. It will come in handy hundreds of times.

-S. I. Phillips.
Simplified Solutions

**GRADUATE**

**FILL UP WITH WATER TO 40 OZ. MARK**

**40% STOCK SOLUTION**

10 OZS. OF 40% STOCK SOLUTION

Accurate percentage solutions can be made up quickly from a 40% stock solution. Use as many ounces of the stock as is represented by figure of desired percentage and fill graduate to 40 ounce mark with water as above for 10% solution. — C. A. Oldroyd, Rep. 4433.

Hammer Head Retainer

Drive in screw half way

File to a point

A screw filed to a point and driven in the end of a hammer handle will hold the head firmly in place. — Pan. (Please send address.)

Odd Fountain

Without an explanation, the experiment illustrated above seems to disprove the fact that water cannot run up hill. However, if two containers are joined as shown, a tube bent as illustrated, inserted and the lower jar filled with pure water while strong brine is placed in the upper, the pure water will flow out of the tube due to the greater density of the brine.

— G. H. Waetjen.

Ice in Boiling Water

A very pretty experiment which illustrates the fact that heated water rises to the top of a container may be made as above. Drop a piece of ice in a test tube and weight it down with a leaden ball. Fill the tube with ice water and hold over a Bunsen burner at a 45° angle. The water will soon boil, but the ice will remain solid. The convection currents in the water have kept the heat away from the ice.

— G. H. Waetjen.

Rubber Stoppers

A substitute rubber stopper may be made from a strip of rubber and a cork as above. Bevel or chamfer the edges of the rubber strip and cement firmly to the cork. A stopper of this nature will hold its place firmly.


Hammer Head Retainer

A screw filed to a point and driven in the end of a hammer handle will hold the head firmly in place. — Pan. (Please send address.)

Printing

A piece of flashlight paper about 1” x 1½” placed about a foot away from a printing frame will give ample light for an exposure. Vary the distance according to the density of the negative. — Morris Goldstein, Rep. 1,029.

Bicycle Horn

A bicycle horn may be made from a tin can if arranged with a metal strip as shown above. Place the unit so that the strip hits the spokes when the cord is pulled.

— B. Piopongco, Rep. 12,894.

Ink Dropper

A simple filler for a drafting pen is shown above. A steel pen thrust into a cork is dipped into the ink and then used as a quill.

— (Author please send address)
**WRINKLES**
**RECIPES & FORMULAS**
Edited by S. Gernsback

### Wire Stands

![Diagram of wire stand](image)

Ring stands and supports for funnels and test tubes may be quickly and easily made from sections of strong wire. The ends and joints should be firmly clamped.


### Repairing Bulb

![Diagram of bulb](image)

A burned out bulb can often be repaired by agitating violently while the current is turned on. The broken ends may weld together.

—S. Lang.

### Stain Removing

![Diagram of stain](image)

Ink stains on a table cloth should be immediately covered with candle wax as above. Washing the cloth in very hot water will remove practically all of the stain. If any remains, use a stain remover.


### Tack Puller

![Diagram of tack puller](image)

A very effective puller for small nails and tacks can be made by pressing a fork into service as above.

—George H. Kuester.

### Easy Erasing

![Diagram of erasing](image)

When erasures are made on a typewritten sheet, place a small piece of glass under the paper, and erase as usual. The work is done quicker and neater. Protect edges of glass with binding tape.


### Keeping Soldering Iron Clean

![Diagram of soldering iron](image)

An iron pipe as above will keep the soldering iron clean while heating it in an open flame. This is particularly advantageous when heating the iron in a coal or wood fire.

—Floyd Burkett.

### Simple Battery

![Diagram of battery](image)

A cent and nickel placed on the tongue as above form a simple battery and a tingling sensation will be felt when they touch each other.

—A. A. Blumenfeld.

### Creeping Coin

![Diagram of coin](image)

Place a dime under a pan which is supported on two nickels as shown. Scratch the cloth with the forefinger and the dime will slowly creep out from under the pan.

—Arthur Kern.

### Blade Holder

![Diagram of blade holder](image)

Razor blades are handy for various purposes but are hard to keep out of danger. Suspending them on a magnet as above solves the problem.

—E. F. Staber.
As many of your readers inform me as to the publication of the manuscript, I am, therefore, taking this opportunity to get you started on the subject of SYNTHETIC GOLD. It is a very interesting topic and one that is not well-known articles, because I have read about it. I wish to state that a magazine cannot be returned to me is because I know it. The number of entries per person is not limited. It is written the way I like; and many that were new to me and interesting. The reason I don't get angry when manuscripts are rejected is because they contribute in a better way. The editors give prizes to professors, doctors, etc., and seem "discovered" a method of soldering, using a piece of carbon connected to the storage battery. This same principle is used in high repute, and consequently his discovery can be taken, but so may the Professor. Prof. Miethe's explanation is that mercury atoms may be only within six or seven miles of being one atom of gold. Nevertheless, if you try hard enough, you will undoubtedly come across this on the ground that it was probably old material, and everyone knows that they are set with staggered rail joints which I measured a length of rail 50-feet long, using a 50-foot tape measure, I measured a length of rail 50-feet long, and if one wishes to ascertain the speed of trains by the method of listening to the clicks produced by the wheels as the wheels "stepping out." Some of these roads are set with staggered rail joints which I measured a length of rail 50-feet long, and if one wishes to ascertain the speed of trains by the method of listening to the clicks produced by the wheels as the wheels "stepping out." I measured a length of rail 50-feet long, using a 50-foot tape measure, I measured a length of rail 50-feet long, and if one wishes to ascertain the speed of trains by the method of listening to the clicks produced by the wheels as the wheels "stepping out." Some of these roads are set with staggered rail joints which I measured a length of rail 50-feet long, and if one wishes to ascertain the speed of trains by the method of listening to the clicks produced by the wheels as the wheels "stepping out." Some of these roads are set with staggered rail joints which I measured a length of rail 50-feet long, and if one wishes to ascertain the speed of trains by the method of listening to the clicks produced by the wheels as the wheels "stepping out." Some of these roads are set with staggered rail joints which I measured a length of rail 50-feet long, and if one wishes to ascertain the speed of trains by the method of listening to the clicks produced by the wheels as the wheels "stepping out." Some of these roads are set with staggered rail joints which I measured a length of rail 50-feet long, and if one wishes to ascertain the speed of trains by the method of listening to the clicks produced by the wheels as the wheels "stepping out."
Circus Broadcast by Relayed Radio

A recent test with a portable short-wave transmitter conducted in connection with one of the standard wave broadcast stations on Long Island, N. Y., resulted quite satisfactorily. A bit of comedy was injected into the test when the portable transmitter, entirely contained in an automobile, stopped at a circus and on its short wave-length sent out the voices of some of the performers and the noises made by the animals. As shown in Fig. 4, these short waves were picked up at the main broadcast station, whereupon they were fed into a standard wave transmitter and again sent out into the ether for the enjoyment of broadcast listeners. Fig. 1 shows the complete traveling unit used in these tests. Even with the short, low antenna shown, quite satisfactory results were achieved. In Fig. 2, Jumbo is shown broadcasting his views on animal evolution to the world at large. He seems to enjoy his experience. In Fig. 3, one of the many merry-makers and his pets are going through their repertoire for the benefit of the listeners-in.
Nowadays when a customer buys property from a real estate agent, he should be shown where his property is located and the effect that his property has on the reception of radio signals. Although it is acceptable from every point of view, the realtor will not be able to sell the property unless radio signals are well received. Every real estate office should have a map, not only showing the location of the property, but also curves illustrating the audibility of signals received from a station.

**Low-Loss Condenser**

The condenser illustrated showed up very well in all laboratory tests. It is of very original construction and has several features worth mentioning. It is of the square law type, and employs a unique bearing arrangement.

Note carefully its excellent mechanical design. A flexible pig-tail connection is used, and insures perfect electrical contact with the rotor. The condenser is provided with a vernier which affords very sharp tuning. The plates are of low resistance stiff and rigid metal, and the insulation employed is of the very best order, being made of small hard rubber strips which hold the stator plates in position. Friction washers permit adjustment without changing the relation of the plates.

**Double Detector**

A novel departure in this British detector is the use of two crystals with a switch mounted on the base for the selection of either crystal.

**Novel Rheostat**

The toggle rheostat shown is something new in the design of rheostats. It can be mounted either on a table or against the panel by using the flanges provided on the sides of the case enclosing the resistance element. British make.
A Suitcase Portable Super-Heterodyne

By SIDNEY E. FINKELSTEIN, Assoc. I. R. E.

In portable receivers, freaks may come and freaks may go, but standard circuits go on forever. Here one of the most complete and compact portable multi-tube sets that it has been the editor's privilege to examine is illustrated in use by the author at the right. A standard seven-tube super-heterodyne circuit is employed, but the parts are so arranged that they take up a comparatively small space and that they operate at their highest efficiencies. Mr. Finkelstein is shown adjusting the rotor or feed-back coil of the combined oscillator and detector tube circuit.

The only instrument that is used in the construction of this Super-Heterodyne that is not found in any ordinary set is the small, compact loud speaker which can be seen above and at the left. Even these small speakers are now coming into extensive use for sets of all types whether portable or permanent. In this particular case, a small space was left in one corner of the cabinet so that the speaker, with its horn removed and placed over the reproducing unit can be tucked away safe from harm. Three dry cells are found amply sufficient to operate the seven UV-199 tubes for a considerable period of time—long enough, in any event, for the usual vacation period.

In the set under discussion, the loop is contained within the carrying case when folded, and consists of a rectangular frame about 1½ inches wide, around which 11 turns of stranded, insulated wire are wound. The loop is then fastened to one half of the specially designed cover by means of three small brass brackets. Flexible leads connect the loop to the correct instruments contained within the case. The directional effect of this part of the equipment is obtained by swinging the entire unit into the desired position.

A top view of this portable super-heterodyne is shown above. The placement of the three dry cells and the four small block "B" batteries can be plainly seen. Note the simplicity of the instrument panel.

A view beneath the panel of this set shows us a series of compactly and neatly arranged instruments, hooked up with short leads. The sockets are mounted between sub-panel and panel proper.

The above circuit diagram shows how simple it is to wire a super-heterodyne of this type. One tube is saved by combining the oscillator and the detector and making the first tube function as both. A small balancing condenser in this circuit aids in keeping the set stable in operation. No potentiometer is used as with the instruments employed it was found unnecessary. For volume, two stages of audio frequency amplification are employed. The .5 mf. condenser connected across the "A" and "B" batteries serves to keep the set quiet in operation even if the "B" batteries run down a little. Use low ratio audio frequency transformers. The balancing condenser has two stator plates, insulated from one another.
Hints to the Radio Builder

By LEON L. ADELMAN, Assoc. I. R. E.

FREE END

GLASS OR PORCELAIN INSULATOR 2 1/2 TO 5" LONG

LEAD-IN END

WIRES AT LEAST \#14 BELL WIRE (SOLID IS BEST)

SPlicing SINGLE WIRES

WESTERN UNION JOINT

1. DIP WIRE INTO FLUX AND THEN INTO MOLTEN SOLDER
2. TURN INSULATION BACK
MENDING A PHONE CORD
3. LAP OVER EACH OTHER AND BIND WITH SEVERAL TURNS OF BARE \#22 WIRE, THEN SOLDER
4. TAPE WELL

PHONE CORDS

SOLDER

PIG TAIL CONNECTIONS

1. TURN COVERING BACK
2. SOLDER ENDS WELL
3. LAP OVER EACH OTHER AND BIND WITH SEVERAL TURNS OF BARE \#22 WIRE, THEN SOLDER
4. TAPE WELL

MAKING TAPS

CONTINUE WINDING

LENGTH OF LEADS for 3 CIRCUIT REGENERATIVE RECEIVER

Fig. 1 shows how the aerial wire and the wire supporting the aerial should be fastened to the insulator. Five or six closely wound turns of wire serve this purpose. At the lead-in end of the aerial, the same piece of wire may be used for both the aerial and the lead-in if a loop is taken in the wire, run through the eye of the insulator and twisted back on the aerial proper, as in Fig. 2. In this way, a joint is avoided.

When splicing single wires, the Western Union joint is the best to use and is illustrated in Figs. 3, 4 and 5. Solder at the point indicated in Fig. 5. Pig-tail connections where wires run parallel and are connected at the ends should be made as in Figs. 6, 7 and 8. Rugged ends for phone cords may be made as in Fig. 9, and flexible wire of this type should be mended as in Fig. 10. The proper method of making taps and of connecting them to switch points on a panel is detailed in Figs. 11 and 12.

On this page we show several hints that will be of interest and value to all of those interested in radio constructional work. Fig. 1 shows how the aerial wire and the wire supporting the aerial should be fastened to the insulator. Five or six closely wound turns of wire serve this purpose. At the lead-in end of the aerial, the same piece of wire may be used for both the aerial and the lead-in if a loop is taken in the wire, run through the eye of the insulator and twisted back on the aerial proper, as in Fig. 2. In this way, a joint is avoided.

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Certain leads in a regenerative receiver should be kept short and a chart which will show you just what leads should be short and which can be long is given in Fig. 13. The facts given apply to any radio receiving set that uses regeneration.

Connections for More Phones or Loudspeakers

Output of 2 Step Amplifier

Short Grid Leak Connections for High Efficiency

To connect several phones or loudspeakers to the same set, use the jack system illustrated in Fig. 14. As shown in the chart, Fig. 13, the grid lead should be very short. This can be best accomplished by mounting the grid leak and condenser on the socket as in Fig. 15.
PROBABLY everyone of our readers who is interested in radio reception is a DX fan and enjoys the thrill of bringing in stations thousands of miles away. For just this type, the set described on this and the three following pages was selected. With its one stage of tuned, neutralized radio frequency amplification, when properly designed and constructed, this system of reception gives excellent results. Used with the two stage amplifier described by the writer in the August, 1925, issue of this magazine, loud speaker results are to be noticed in almost every instance. Usually it is only necessary to use one stage of audio frequency amplification to accomplish this. In the photograph at the right the writer is shown testing the set for volume and selectivity. After the set was properly neutralized and the variable grid leak was set at the correct value, determined by experimentation, local stations could be easily and quickly separated and distant stations tuned in.

The above circuit diagram shows all of the connections for this two-tube Browning-Drake unit. The parts have been carefully selected and the home-made coils wound for the very best results. Follow directions carefully and you will have a set that will justify all your troubles.

A rear view of the completed set is shown above. Note the mounting of the neutralizing condenser in a convenient location and the long supports used for raising the binding post strips to a point where they can easily be reached. The fixed filament resistance, 7, is located on the baseboard under the antenna tuning coil.
Constructors

Browning-Drake Receiver.
The Coils Used.

Assoc. I. R. E.

The illustration directly above gives all of the details for laying out the panel of this receiver and for making the brackets which support the binding post strips. The numbers correspond with those on the photograph on the opposite page. The panel is laid out for using the standard condensers furnished with the Browning-Drake kit and the holes are placed to allow the use of the vernier dials supplied with that kit. When you make the brackets for the binding posts strips, you may have to turn the bases towards the other side in order to get them on the baseboard. In any event, this can be quickly determined when you are arranging the lay-out of the parts.

At the right is given the first of the series of our justly famous progressive wiring diagrams first introduced to our readers in the July, 1925 issue of this magazine. In this diagram, all of the parts are shown with the baseboard and the panel laid flat, instead of at right angles to each other. In this way the parts can be more plainly seen and the wiring diagram is easier to follow. Only the filament connections are shown in this section while those for the grid and plate circuits will be found on the next page. If you proceed with wiring of your set by following these diagrams one at a time, you cannot go wrong. Wire first the filament circuits; then put in the grid connections and finally the plate wires.

(continued on next page)
THE diagram at the right shows all of the connections for the grid and filament circuits of this set. The grid wires are shown in heavy lines while the filament connections that were shown in detail on page 443 appear in fine lines. The neutralizing condenser 4, which is mounted on a little bracket fastened to the antenna tuning condenser is shown here placed on the baseboard for the sake of clarity only. Mount it as shown in the photographs on page 442 when you come to the actual construction of this set. In this way it is easily accessible for neutralizing the set. The combination grid leak and condenser, 8, is placed on the baseboard inasmuch as the leak does not require frequent adjustment. A fixed resistance capable of operating a UV-199 tube directly on a storage battery is shown at 7. In this way, a special rheostat or a tapped "A" battery is not necessary.

The remainder of the connections for this set are shown below in the plate circuit wiring diagram. The fixed condenser, 18, should be connected across the two outside springs of the jack rather than across the two leads to the output binding posts, as shown in the photographs. The reason for this is that with the connections shown below, the condenser will be in shunt with the phones, when they are plugged into the jack, 18, and will also be across the audio frequency amplifying transformer when this two-tube set is used with an additional unit. If the condenser is placed across the output leads, it will not be in the circuit when the phones are used. This is not to be desired. In the diagram below, the rotor, 15, is shown. This is controlled by a long shaft placed beside the detector tuning condenser and protruding through the panel a short distance away from the dial controlling that in-...
A home-made coupler for use in this set is illustrated at the right and the details are shown at 10 and 15 above. For compactness this coil is mounted in back of the variable condenser whereupon a long shaft is necessary for controlling the tickler. To make these self-supporting coils, lay four strips of adhesive tape, with the sticky side up, lengthwise on a round glass bottle and space them equally distant around the circumference. Wind the wire over these strips and when completed fold the ends over as shown. Coat the coil with collodion and remove the bottle. If necessary, break the bottle. The primary is wound in a groove cut in a wooden disk as shown in detail above. The exact number of turns on the rotor or tickler coil can best be determined by experimenting. Use as few turns as possible, but have enough to make the set oscillate steadily when desired.
The "B" eliminators shown in Figs. 1 and 2 use electrolytic rectifiers consisting of lead and aluminum rods or strips of the dimensions indicated, placed in a saturated solution of borax and water. Be sure that you use pure aluminum. Dissolve the borax in warm water and allow to stand for 24 hours. Four off the clear top liquid and use in the rectifier. A layer of oil 1/4 of an inch thick floating on top of the electrolyte will prevent evaporation of the liquid.

In the type of rectifier shown in Fig. 2, 6 jars are used and are supplied with current by means of a transformer, the details and dimensions of which are given. An eliminator of this type will supply sufficient voltage for the largest of receiving sets, whereas the one shown in Fig. 1 is for use on smaller sets. When putting one of these eliminators into use, it will be found that the aluminum plates must be formed. To do this, hook up the entire unit as illustrated and close the A.C. circuit momentarily. Open the circuit and repeat the process several times, never leaving it closed for more than two seconds at any one time. When this has been done for 5 or 10 minutes, the plates will be formed and ready for use.

The eliminators shown in Figs. 3 and 4 use vacuum tubes of the same type that you employ in your receiving set and use them to rectify the A.C. This type of rectifier does not have some of the drawbacks that are found in the electrolytic style, but on the other hand, the vacuum tube rectifier is more expensive to build. Specially designed transformers, the details of which are given on the drawing, are used with these rectifiers and supply both the current for lighting the filaments of the tubes and the voltage that is to be rectified and filtered and eventually used for operating the receiving set. A potentiometer aids considerably in producing pure D.C. at the receiving set and should by all means be included and adjusted to best results.
**"B" Battery Eliminator**

### On Several Types

**Good Results**

In the two vacuum tube rectifiers or eliminators illustrated in Figs. 3 and 4 on the opposite page, the same choke coil illustrated at A, in Fig. 1, is employed in the filter.

In Fig. 5 is shown another type of tube rectifier employing what is known as an "S" tube, which does not have a heated filament. Therefore, the transformer used with this device needs only one secondary winding and all of the details are given. The filter system that we illustrate in connection with this device is different from those shown on the opposite page, inasmuch as three choke coils are used. They may be wound on small audio frequency amplifying transformer cores and are all identical in construction. The electrolytic condensers can be purchased on the market and are far superior to the usual paraffin paper and tinfoil type. They are known as self-healing and if they break down under an abnormal strain, they immediately regain their usefulness automatically.

#### "B" Eliminator Controller

An excellent method of controlling the output of a "B" eliminator is by placing a variable reactance in the primary circuit as in Fig. 6. This is a very simple instrument consisting merely of one-half pound of No. 28 D.C.C. wire, wound on a suitable spool. The core is made up of a bundle of iron wires bound together and provided with a handle. The further the core is inserted into the spool, the lower will be the voltage delivered by the eliminator. This instrument may be used with any type of rectifier by connecting it in series with one side of the A.C. line. It matters not whether a transformer is used.

---

**Above:** The "B" eliminator mounted in a cabinet and ready for use.

---

In connection with this unit, the primary of an audio frequency amplifying transformer is connected directly to the 110 volt A.C. line. The secondary, therefore, furnishes the high voltage which is to be rectified by the single vacuum tube. This transformer is first taken apart by unbolting the frame and taking off the leg of the core opposite the winding. On this core a quantity of No. 28 S.C.C. wire is to be wound. The exact amount will depend upon the other windings of the transformer used. We would suggest that you wind about 450 turns, replace the leg, and hook up the transformer. Measure the voltage across this new winding. If it is not at least six volts, wind on more turns. If it is more than six volts, remove turns until the voltage is correct. This winding supplies the filament of the rectifying tube.

It may be that you will have a little trouble in eliminating all of the hum with this unit. In such a case, try connecting a potentiometer across the filament supply secondary and connecting the wire which leads from the common connection between the two condensers to the filament, to the center post of that instrument. Adjusting this potentiometer will probably aid considerably in smoothing out the current supplied to the set.

---

Here we have a very simple home-made type of "B" eliminator constructed by Max Kuhne from standard parts that can be obtained almost anywhere. Mr. Kuhne makes use of the primary of an audio frequency amplifying transformer for a choke coil and uses two 2 mf. condensers in connection with it for the filter system. If you do not get good results with this instrument, try a larger filter condenser in place of the one that is connected from the B+ side of the audio frequency transformer to the filament binding post on the tube socket. A second audio frequency amplifying transformer provides the current to be rectified and also the filament potential for the rectifying tube. It is re-constructed as described below.

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A view of the interior of Mr. Kuhne's "B" eliminator is shown directly above. The filter condensers are mounted over the two audio frequency amplifying transformers.
Herbert E. Hayden's One Tube Portable Receiver

A splendid type of receiver that is made according to standard practice and which will amply repay the builder for any trouble involved is illustrated in detail on this page and the circuit diagram of the same is given at the right. The set can be incorporated in a cabinet with an over-all height of 9 ½" while the width and depth need only be 8" and 5" respectively. This size allows the placing of the necessary batteries in the base, since the panel size is only 5 ½" x 7 ½". A handle makes the set easily portable and convenient.

A small loud speaker of the type shown makes a good companion for the set.

A view from the base of the receiver showing the jack and socket mountings.

A set of this nature need not be used only for places where a small and compact set is necessary or desirable, but can provide all-around entertainment in the home as well. For this use, while, of course, the phones can be used, it is desirable to have loud speaker volume. In such an event, a three-stage resistance coupled amplifier as shown in the lower center photo above may be connected to the set, or a standard amplifier such as that described in the August, 1925, issue of this magazine may be employed. In either event, excellent results will be obtained.
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 50c. is made for all questions where a personal answer is desired.

REGENERATIVE LOOPS

Q. 1. E. V. Donald, New York City, asks whether it is practical to use regeneration in a single tube which operates with a loop aerial. The entire set is to be used for reception over short distances.

A. 1. This work can be easily done, although it must be realized that a set of this nature cannot bring in any DX. The number of turns in this part of the circuit should be critically adjusted so that can be obtained with a single tube and a loop aerial when regeneration is employed to build up the signal strength.

Q. 2. Robert Phelps, Kansas City, asks whether it is practical to use two loops, one in the grid circuit, as usual, and the other in the plate circuit.

A. 2. A standard loop is used. In the other, a loop with center tap is employed. The directional effect that should enable you to practically eliminate the interference.

Q. 3. Donald Reuss, Easton, Pa., asks if he can buy the fixed resistances which he cannot buy the fixed resistances which are often recommended in the construction of radio sets. These resistances that he mentions are the ones used to control the filament current of the tubes. He asks if rheostats can be used in place of these resistances and whether or not a rheostat is necessary in the filament circuit of each tube.

A. 3. It is entirely possible to replace these fixed resistances with rheostats and the only objection is that the control of the set is thus somewhat complicated. It is not necessary to incorporate one rheostat for each tube, although it is advisable inasmuch as it gives much greater flexibility to the set and allows for the slight differences which are sometimes noticeable in the filament of tubes.

INTERFERENCE

Q. 1. Donald Reuss, Easton, Pa., says that he is operating a radio set a very short distance away from a motion picture theatre in which the projectors are equipped with arc lights. He asks if they affect his reception.

A. 1. They should affect the equipment. Changing the direction and length of his aerial has had little or no effect on the interference. He asks our advice.

Q. 2. A. Hennon, Brussels, Belgium, asks whether or not 7 megohms is the same as 75,000 ohms.

A. 2. Seven megohms means 7,000,000 ohms; 1 megohm = 1 million ohms.

FIXED RESISTANCES

Q. 1. Emile Hennon, Brussels, Belgium, says that in the country where he lives he cannot buy the fixed resistances which are often recommended in the construction of radio sets. He asks if rheostats can be used in place of these resistances and whether or not a rheostat is necessary in the filament circuit of each tube.

A. 1. It is entirely possible to replace these fixed resistances with rheostats and the only objection is that the control of the set is thus somewhat complicated. It is not necessary to incorporate one rheostat for each tube, although it is advisable inasmuch as it gives much greater flexibility to the set and allows for the slight differences which are sometimes noticeable in the filament of tubes.

PORTABLE RECEIVER

Q. 1. Wh. Hampton, Millville, N. J., says that he has been looking for a diagram of a two-tube set that will fit in a small storage battery box. He asks us to furnish him with such a circuit.

Q. 2. The size of the cabinet in which a radio set will fit does not depend at all upon the circuit, but depends upon the parts employed and the mechanical arrangement of them. Practically any two-tube set could be built so as to fit in the box you mention. The mechanical arrangement will depend upon yourself. No special hookup is necessary for such a purpose.

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 receivers. We will pay good prices for your ideas.

Editor.
FRYING NOISE

(379) Q. 1. Jesse L. Fitzwater, Wabasha, Minn., says that he has considerable trouble with his five-tube set in that a continual frying noise is noticeable during reception. He asks us our opinion as to the source of this noise.
A. 1. There are several sources where trouble of this nature could start. The most obvious one is a poor fixed condenser somewhere in the set. This might be the grid condenser or it might be one of the by-pass condensers. Try removing these condensers from the circuit, replacing them with others, and see if any noticeable difference is obtained. If not, try shunting the secondary of the first audio frequency transformer with a variable grid leak and then use a resistance which is variable from 10,000 to 100,000 ohms. One or the other of these resistances may clear up your trouble. Furthermore, make sure that the trouble does not originate in the loud speaker itself. This may be done by substituting another speaker for the one already in use or by trying your present speaker on another receiving set. Try different grid leaks.

SELECTIVE CRYSTAL SET

(380) Q. 1. C. Herman, Chicago, Ill., asks for a circuit diagram of a crystal receiving set employing two inductances and two variable condensers which will be quite selective.
A. 1. Probably the best system for you to use is a series wave-trap and a tuning circuit, such as we have shown in the diagram given herewith.

PHONE TRANSMISSION

(381) Q. 1. R. B. Prichard, St. Peters burg, Fla., asks us to give him the circuit diagram of a phone transmitter to be operated on a wave-length of 80 meters.
A. 1. We must inform you that only C.W. (continuous wave) transmission is allowed on the short wave bands. Phone transmission is not allowable. Do you desire a circuit of a C.W. transmitter for short waves?

INSTRUMENT CHANGE

(382) Q. 1. Oliver Malmberg, Huxley, Iowa, says that he is planning on building a Neutrodyne receiver and asks whether or not a variocoupler can be used in place of the first neutroformer.
A. 1. This change is entirely possible and the only objection to it is that another control will be added to the receiver. If you make this change, the primary of the variocoupler should consist of about 10 or 12 turns of comparatively heavy wire, say No. 18 D.C.C.

COUNTERPOISE

(383) Q. 1. Albert Molyet, Old Fort, Ohio, asks for some information on a counterpoise, how it should be erected and whether or not it would be of any assistance in reception.
A. 1. A counterpoise is merely what might be called a second aerial. It should be about the same length as the regular aerial and may run either parallel with it or at an angle to it. The counterpoise should be about 8 feet above the ground. The use of such an extra aerial is quite common in transmission, but is seldom used for reception. However, some experimenters report good results along this line, and if you are interested we would advise you to try a counterpoise which is to be connected in place of the regular ground. Try your set both with the counterpoise and aerial alone and then with the aerial connected in the regular manner and both a counterpoise and ground connected to the ground binding post.

TYPE OF SET

(384) Q. 1. J. Metcalfe, Spring Hill, Tenn., says that he is trying to build a radio receiving set using a variometer and a 23-plate condenser for the tuning unit. He says that he has not been able to find a hook-up that is satisfactory to him and asks us to help him out.
A. 1. We would advise that you discard your variometer and purchase a three-circuit coupler using this instrument and a variable condenser for your tuning unit. A good constructional article using this type of tuner appeared in the July, 1925, issue of this magazine.

FIXED COUPLER

(385) Q. 1. C. J. Lovell, Fredericstown, Ohio, asks us whether the primary and secondary windings in a static and fixed three-circuit coupler are to be connected together and if so, how?
A. 1. Fixed couplers of the type you mention are usually supplied with these two windings unconnected. However, in some types of sets, the ground binding post of the primary is connected to the filament binding post of the secondary.

STATIC

(386) Q. 1. Ernest F. Prucha, Howells, Nebr., asks us to give him information regarding static, particularly those wave-lengths upon which static is most noticeable, how static can be measured and where complete information on the subject can be obtained.
A. 1. Static manifests itself on all wave-lengths, but at any one particular time it may be stronger on certain bands than on others. There are no fixed rules for this, and on evenings when the broadcast band is comparatively free from static, that manifestation may be so severe on 40 and 80 meters that C.W. (continuous wave) communication becomes impossible. Static exists in all bands which have as yet been investigated. The nature of the discharge is a highly damped radio frequency oscillation. Atmospheres and static can be measured by means of the electrostatic voltmeter. The subject of static receives scant attention by authorities on radio and only mere mention of it is found in a standard text-book. It is a separate study entirely, and we have no record on hand of any book dealing solely with atmospheric electricity as affecting radio receivers.

GRID RETURN

(387) Q. 1. Ted R. Parrish, Belmont, Nebr., wants to know what is meant by the term "grid return."
A. 1. By the grid return is meant the connection which begins at the grid, goes through the secondary circuit and terminates at the positive terminal of the detector tube and negative terminal of the amplifier tube.

RADIO FREQUENCY TRANSFORMERS

(388) Q. 1. R. Benson, Union City, N. J., wants to do some experimental work with radio frequency transformers, particularly toward the determination of the most efficient number of turns for a given band of wave-lengths. He asks what type of form to use for this work.
A. 1. While an ordinary insulating tube may be used for this purpose, a more compact form, and one which is easier to wind, may be made as shown in our illustrations herewith. This may be turned on a lathe from 2-inch stock or may consist of seven discs of 3/4-inch thick wood bolted together as shown. In the latter case, four of the discs will be 2 inches in diameter and three of them will be 1 1/4 inches in diameter. For experimental use, wind the primary in the center slot and the secondary in two halves, each half in a slot on opposite sides of the primary. With a form of this kind you can experiment with the number of turns to your heart's content.

INCREASING WAVE-LENGTH

(389) Q. 1. William G. Parkes, Nashville, Tenn., says that his broadcast receiver will only receive from stations over a band of 200 to 360 meters and asks how he can change the set so as to tune in broadcasting stations up to 550 meters.
A. 1. Would advise that in order to increase the wave-length reception range of your set, you should wind an additional 30 turns on the primary, increasing your aerial if possible also. Replace the grid variometer by means of a 43-plate condenser which is shunted across the secondary. This will increase your wave-length range sufficiently for your purpose. Would advise a 43-plate variometer.

AmericanRadioHistory.com
**Scientific Humor**

**WE'RE WITH HIM!**

**Doctor (to visitor in Observation Ward):** "Yes, he's a very violent case."

**Visitor:** "What's his trouble?"

**Doctor:** "He tried to read and reconcile the conflicting scientific statements in all the various tooth paste advertisements." -Smith O'Brien.

**TWINKLE, TWINKLE, LITTLE STAR**

Scintillate, scintillate, Infinitesimal planetary orb, Incessantly, I interrogate your constituent element, Up above the sphere so high, Similar to an incandescent Rhomboid in the sky — T. H. Buescher.

**OUT JAWED**

"Is that the skull of a man or a woman?" inquired the prosecuting attorney of the expert. "It is a woman's skull," replied the anatomist. "How do you know?"

"By the worn appearance of the jaws." -Adelbert Body, Reporter No. 18,360.

**OR AN INTERFERENCE ELIMINATOR**

**Site:** "What invention would mostly revolutionize kissing?"

**He:** "An asbestos protector for moustaches." -M. W. Harp, Reporter No. 15,578.

**THIS IS RELATIVELY IMPORTANT**

**First Scientist:** (viewing monkey in cage): "It is apparent to me.

**Second Scientist:** "Ah! Really, I did not know you claimed so close a relationship." -Prospero Astrell.

**THE DOUGH-BOY**

**Mother:** "John, why are you feeding the baby yeast?"

**John:** "He swallowed my nickel and I'm trying to raise the dough." -Wm. Willgarter.

**HE ROLLED HIS OWN**

A gambler was arrested on a charge of vagrancy and lack of visible means of support.

"What is your occupation?" asked the judge.

"Well, you might call me an osteopath," the gambler replied. "How so?" the judge enquired.

"Because I make my living rolling the bones," was the gambler's answer. — L. C. Cartwright, Reporter No. 9256.

**THE CHAIR FOR YOU**

"That fellow certainly takes life easily." "How do you mean?"

"He's the chap who turns on the juice in the death chamber at Sing Sing." -Smith O'Brien.

**A CRANK-CASE**

"He: "This controls the brake. It is put on in case of an emergency."


**HANK AGREES**

**Bank:** "What do you think of the Government's failure to make use of the Muscle Shoals' water power?"

**Hank:** "I think it's a dam shame." -Smith O'Brien.

**THE LIGHTNING ARRESTER**

**FRESHMAN:** "So the new professor thought you were a lightning calculator?"

**Co-Ed:** "I guess so. He asked me how fast electricity traveled." -Jat. J. O'Connell.

**EXPOSED!**

"What side would a photographer take in a debate?"

"The negative of course." -Smith O'Brien.

**COUNT YOUR DAYS NOW**

"Doctor, are you absolutely sure that your diagnosis of my case is correct?"

"No, only the autopsy can decide that." -Smith O'Brien.

**GREAT SNACKS**

**Examiner:** "The snake I am speaking of is said to strike with mathematical precision."

**Scholar:** "Mathematical precision! That must be an Adler." -Wm. D. Hoy, Reporter No. 7991.

**"THREE-FACED!"**

You have heard of people being "two-faced," I am submitting the original "three-faced" kid. -F. L. Harris, Reporter No. 21,209.

**PERPETUAL MOTION**

**Customer (to car dealer):** "You say these fuel savers will save twenty per cent. of a car's gas?"

**Dealer:** "Yes sir." -Smith O'Brien.

**Customer:** "Then give me half a dozen and I won't have to buy any more gas." -R. E. Shomaker, Reporter No. 9831.

**PREACHING TO DEAF EARS**

**Professor:** "Can you give me an example of wasted energy?"

**Freshman:** "Yes, sir—telling a hair-raising story to a bald-headed man." -Smith O'Brien.

**AT IT AGAIN**

**The Fan:** "I wonder what's the matter with my radio. It coughs."

**The Smp:** "Perhaps it's on account of the choke coil." -Jat. J. O'Connell.
LATEST PATENTS

Land, Mud and Water Motor Car

No. 1,537,319, issued to W. Luge, covers a radically new design in the body and placement of the wheels in a motor car. The entire vehicle is so designed that when it becomes necessary, it can be made to travel on land, in water or over rough and muddy terrain that otherwise could not be negotiated by an ordinary motor-driven vehicle except of the caterpillar type. The essentials of this vehicle can be seen from our illustrations above. The rear wheels are fitted with a series of paddles, one clamped to each spoke. These serve to propel the vehicle forward when it is in the water. The wheels can be regulated as to position by means of the adjustment shown. In this way, the vehicle can be driven over surfaces of an extremely rough nature and in the capacity of a boat the front wheels can be drawn out of the water, thus lessening resistance when the device is so used. This is shown in the lower right-hand corner above.

Railroad Crossing

No. 1,532,633, issued to W. Noble, protects the idea illustrated above. A series of concrete projections are to be built across the road and equipped with notches through which the wheels of an automobile can easily travel. The purpose is to cause vehicles to slow down when approaching crossings so that the driver can be sure to steer into the grooves. We hesitate to contemplate the catastrophes that would result from the use of this arrangement.

Airplane

No. 1,504,534, issued to I. I. Ziperstein, describes an aeronautical device designed to operate by means of the leg power furnished by the pilot. Connected to the pedals are a series of semi-cylindrical elevating devices, plainly shown above. These are supposed to raise the machine off the ground, whereupon the standard propellers shown will cause it to travel in a forward direction. The power is transmitted to the various parts through a series of gears and drive chains. We fear that Mr. Ziperstein will never leave the ground with this device unless he resorts to the methods suggested in the drawing.

Novel Toy

No. 1,529,568, issued to Hohannis A. Ananian, covers a new type of pin-wheel toy that surely will amuse all the youngsters. A tube of any size desired is employed and a cardboard device shaped like an airplane is mounted upon it by means of a clamp. One end of the propeller of the simulation airplane is directly in front of one end of the tube. Blowing through the tube causes the propeller to revolve, giving a very realistic effect.
Non-Science

Money for Science Mistakes

The newspapers throughout the country, as well as the magazines, occasionally err. Sometimes these errors are misprints. At other times they are pure scientific misstatements. If you happen to see any of these humorous mistakes in the press, we will be glad to have you clip them out and send them to us. Give the name of the newspaper or magazine in which the error appeared and accompany the inclosure with a few humorous lines. The most humorous ones will be printed in this department, and for each one accepted and printed we will pay $1.00. No NON-SC(i)ENCE entry will be accepted, unless the printed original accompanies the same. Address all NON-SC(i)ENCE entries to:

Editor, NON-SC(i)ENCE Dept., c/o Science & Invention Magazine, 53 Park Place, New York City.

PRETTY SOFT—IT STRETCHES

On page 167 of the June issue of Science & Invention Magazine we notice:

"The size of the panel is seven inches wide by twenty-six inches long. There is nothing hard about it."

Wonder if this is one of the new-fangled self-supporting panels or whether it is made of soft rubber, so that the operator can pull the panel toward him without disturbing the set. On the other hand, perhaps it is kneaded into shape. Whatever it is, we would like to see it.—Steve Goff.

A FISHY SCHOOL

In the New York Sunday World of April 26th we note that "Dr. Rogers is the discoverer of the principals of submarine wireless communication." We have heard of the principles, but not of the discoverer of these humorous mistakes in the press. We do not know who discovered them, or if they teach the ether wave theory as being somewhat flat.

WHEELESS AND SENSELESS

In the Lost and Found Column of the Buhl Herald in the June 4th issue I found the following: "Lost—Between Buhl and 5 miles south of Castleford, a Ford differential."

As it is quite likely that the rear wheels and axles went with the differential and a range of 15 miles is allowed for the loss, the versatile Ford must have rambled right along with the signals were picked up. H. G.

THE ELECTRO MOTOR FORCE

Describing how K. D. K. A.'s signals were picked up in Australia, the April 17th issue of the St. Louis Star says: "The signals were picked up on 63 motors (motors?)". We wonder if they teach the Principals of Principles. They must be a brand new species of animals.

NOT PEDIGREED

The following item appeared in the Pasadena Post of May 20th: "For sale—One Jersey bull calf 2 weeks old. Will soon have some real pups, half hound and half sheepdog."

Now I consider this quite a feat for a bull calf. It would have been quite an accomplishment for a cow. Maybe the pups will have kittens, and the kittens, elephants, who can tell.—R. S. French.

AVOIRDUPOIS PLUS

The day following the staging of an annual track meet, the following write-up appeared in the San Francisco Examiner: 100-pound Class—Full of Gas

440-yard relay—Poly won; St. Ignatius, second 770-pound Class—He A-Door-Ed It

So no doubt all the fat men are not in the circus.—Marcel Mailhebuau.

FULL OF GAS

The Birmingham Mail of Feb. 10th advertises as follows: "Electrical engineers must be competent men and capable of putting in wire for gas and power. State wages and experience." Evidently the electrical engineers use some of this new spaghetti wire we have heard so much about. If not, how could the gas travel through the wire? He would have a heck of a time shooting the gas through stranded copper wires.—Sadie Lieding.

BURNING REPORTS

The following item is extracted from the Los Angeles Evening Herald of March 31st, in their daily bulletin describing the movements of vessels, they have as a headline, "Fireless Report." We never knew that reports were liable to fire. If they use a quenched spark gap there is not much danger that the reports would ignite. Furthermore, any damp wave that they send out ought to quench the conflagration quite quickly. Why not report on asbestos? It is fire-proof.—August H. Niemann.

HE A-DOOR-ED IT

The Boston Sunday Post Magazine of May 24th, 1925, contains the following: "Mr. Groten shook his head, and, as soon as the door closed, took it between his hands and seated himself on the edge of the bed.”

Certainly this man Groten has a most disconcerting habit. Imagine a man eccentric enough to take the chamber door in his hands and sit upon the bed. The story does not relate that Groten spread the door-jam (b) on his head. —E. L. Richardson.
FIRE-PROOF INSULATOR

(1887) Q. 1. T. B. Marden, Hyde Cheshire, England, asks how wood can be made both fire-proof and insulated. The answer will be published.

J. 1. Wood is normally a fairly good insulator and if it is coated with several coats of water glass, allowing each coat to dry, it will become quite fire-proof and at the same time its insulating properties are increased because the coat has made the wood water-proof and, therefore, it cannot absorb moisture and become a partial conductor.

GRAVITATIONAL PUZZLE

(1890) Q. 1. Raymond Mack, Fairhaven, Mass., sends us a small illustration which we reproduce below and asks how the carbon is burned from an automobile cylinder and piston without the necessity of removing the head of the engine.

A. 1. We have referred your query to Ernest K. Chapin, well known author of Scientific Problems and Puzzles appearing in this magazine, and the following is his answer:

"In my judgment, the wire would not remain at a constant distance from the earth. Gravity would certainly tend to pull it toward the earth and whatever tension the wire could apply to its metal would become cold upon the passage of a current of electricity in a certain direction. He asks for further details.""
CURLING CELLULOID

(1896) Q. 1. H. R. Gostfried, Erie, Pa., sends us a sample of a piece of celluloid curled in a spiral form. He asks how this can be duplicated with ordinary substances.

A. 1. We are not sure as to the exact process used for causing celluloid to curl as per the sample which you have sent. However, the desired results can be obtained by following the process outlined below. By careful manipulation, you can undoubtedly obtain the desired results.

Protective Device

(1897) Q. 1. D. C. MacDonald, Chicago, Ill., asks if it would not be possible for the average warmed, scrape sired spiral form.

We refer the letter to the author of the article and lie advises us that the caption should not be sodium fluoride.

SPIRIT LEVEL

(1898) Q. 1. R. G. Lewis, Oklahoma City, Okla., refers to an article entitled “Everyday Chemistry” in the December, 1924, issue of this magazine and asks if in regard to item No. 5 wherein the material stated to be sodium chloride should not be sodium fluoride.

A. 1. We refer referred this letter to the author of the magazine and lie states that the caption should read as our correspondent suggests.

The copper sulphate is said that when salt is used copper plates for an electrolytic action is desired. As the common salt used is sodium chloride, is sodium chloride, used in the presence of copper be a chloride of copper?

A. 2. Our correspondent has somewhat misinterpreted the statement. Mr. Wailes’ answer to this queries as follows:

The principle of construction of a spirit level may be seen from the above drawing. Our illustration shows how the usual spirit level tube is slightly curved, following the arc of a large circle. In this tube, the level of the liquid is very sensitive and in this type the curvature of the tube is slight but accurate.

CLEANING STORAGE BATTERY PLATES

(1900) Q. 1. Alfred Lupinacci, New York City, asks how he can arrange an alarm clock so as to make the hour hand jump in a circle of the proper size.

A. 1. The lead plates used in the storage battery you mention are of hydrochloric acid so that they will be thoroughly clean and so that the minute currents in the metal will contain no residual dirt or grease.

SMOKE SCREEN

(1904) Q. 1. Alfred Lupinacci, New York City, requests a formula for a material which when ignited will give forth a large volume of smoke.

A. 1. The following formula is that originated by the United States Navy:

Zinc, 35.4 parts.
Carbon tetrachloride, 41.6 parts.
Sodium chloride, 9.1 parts.
Ammonium chloride, 12.1 parts.
Magnesium carbonate, 8.3 parts.

If the mixture is ignited it makes a cloud which conceals the smoke.

This formula is somewhat similar to that used for sky-writing, but not exactly the same. The exact formula for this work is not available at the present time.

INK ERADICATOR

(1905) Q. 1. Paul Mercham, Bellingham, Wash., asks for a formula and method of operating an ink eradicating machine.

A. 1. We are giving you herewith the formula for a good ink eradicating machine equal parts of citric acid and alum, adding equal volume of carbon tetrachloride. To the part to be erased and after the ink is dissolved, absorb with a blotter. This mixture works very well on practically all inks. Then wash or scrape off thoroughly to remove all traces of the chemicals.

WATER PUMPS

(1906) Q. 1. Alfred Phillips, Utica, N. Y., asks how water is circulated through the radiator of automobiles.

Some cars use what is known as the thermo-siphon system which operates the principle of water rising upon being heated. Other cars use pumps. Two different types are illustrated herewith. One is known as the gear type device, and the other is made to oscillate at a frequency of approximately 350 vibrations per minute.

A. 1. The answer to your query depends on the type of engine and what you desire to do with the oil. If you wish a mechanical method of checking the circuit to the oil, a timing fork is used. If you wish to use the oil to make the mirror to oscillate, a tuning fork of the correct frequency could be used.

TIMING DEVICE

(1908) Q. 1. F. H. Donham, Canton, Ohio, asks how he can arrange a time piece, to vary the length of time that the lamp would stay illuminated.

A. 1. Time pieces of this type are used.

TWO-COLUMN TYPES OF AUTOMOBILE WATER CIRCULATORY PUMPS ARE SHOWN IN A AND B AND DESCRIBED IN THE TEXT.

HILL AND DALE TYPE

LATERAL CUT TYPE

The difference between the two main types of phonograph record grooves is shown above.

Lever arm and producing sound. By variations in the side motion of the needle different sounds will be produced. The combination of these sounds speech and music is produced. In the so-called "hill and dale" records, the needle moves up and down acting on the diaphragm and producing sound as in the other system.
$5,000.00 in Prizes
For Perpetual Motion

Many of our readers have written to ask whether we had received any entries in the Perpetual Motion prize contest. The answer is "Yes," if we have received a great many entries, but not one of the contestants have lived up to the rules and regulations for the Perpetual Motion Contest. They have instead submitted theories and photographs.

We want all of our readers to know that there is not a single working model of a perpetual motion machine that has been entered in this contest. We are not adverse to receiving drawings or photographs, but neither may be entered in the contest. The rules call for a working model, and this we must have before an award is made.

We have no working model on hand, nor have we seen any device working model, and this we must have before an award is made. But neither may be entered in the contest.

We want all of our readers not to invest in perpetual motion stock. If an inventor has a machine which operates, he may submit it to us and we will pay that inventor the sum of $5,000.00 for stock. We have no working model on hand, nor have we seen any device working model, and this we must have before an award is made.

The Perpetual Motion Contest is open to every individual, no matter what he may claim to be the inventor of a perpetual motion machine, and who "de

Other Pending Contests

Thirty combination pen-pencils awarded as prizes in the clock Spring contest announced in the August issue and closes October 1, 1925.

$1,000.00 Monthly Contest Awards

FIRST PRIZE $100.00

SECOND PRIZE $75.00
Maps from Aerial Photos, by J. B. Beadle

THREE PRIZES OF $35.00 EACH
Make Your Own "B" Battery Eliminators, by Moe Joffe

FIVE PRIZES OF $25.00 EACH
Rain Making Again, by George F. Paul

FIVE PRIZES OF $20.00 EACH
Gas chromatography (author please send address)

FIFTEEN PRIZES OF $15.00 EACH
How Lake Dried River, by Gene Deachem

FIFTEEN PRIZES OF $10.00 EACH
Firing Knife, by F. H. Mick

TEN PRIZES OF $5.00 EACH
Washing Machine, B. G. (author please send address)

FIFTEEN PRIZES OF $2.00 EACH
Food Chopper, by J. B. Roswic

Other monthly prizes will be given as follows:

1st Drops (author please send address)

"B" Eliminator Controller, by W. M. Cummings

FIFTEEN PRIZES OF $10.00 EACH
Motor Bandage, by Max Bulock

GEAR SHIFT ANTI-RATTLER, by C. W. Caldwell

Gear Unions, by C. A. Oldroyd, Rep. No. 443

Printing, by Morris Goldstein, Rep. No. 1029

Rubber Stopper, by C. A. Oldroyd, Rep. No. 443

Hammer Head Retained by Pan (author please send address)


Kettle of Soldering Iron Clean, by Floyd Burke

Tack Puller, by George H. Kuester

Stain Removing, by C. A. Oldroyd, Rep. No. 443

Mute, by H. Bernard

Contact, by Robert Williams

Vernier Neutron, by B. McCarthy

Lakeland Stick, by J. J. Salzman, Rep. No. 1280

Radial Eliminator, by E. E. Lauder

FIFTEEN PRIZES OF $5.00 EACH
Racket Horn, by B. C. Shannon

Repairing Bulb, by S. Lang

Blade Holder, by E. F. Staber

Absorption Tuning, by C. A. Oldroyd, Rep. No. 443

Remote Control, by Wayne R. Grieve

Soldier Jack, by F. E. Thompson, Jr.

Crystal Detector, by Charles Mohr

Handy Channel for Robert J. Williams

FIFTEEN PRIZES OF $2.00 EACH
Creeping Coin, by A. H. Frey

Simple Battery, by A. A. Bumlefield

Powder Horn Speaker, by M. W. Heman

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

FIFTEEN PRIZES OF $50.00 each
3 " " 35.00
5 " " 25.00
5 " " 15.00
10 " " 10.00
15 " " 5.00
25 " " 1.00

Other monthly prizes will be given as follows:

Einstein Refuted, by George Appel

How Lake Dried River, by Gene Deachem

"B" Eliminator Controller, by W. M. Cummings

FIRST PRIZE $100.00
SECOND PRIZE $75.00

THREE PRIZES OF $35.00 EACH
Make Your Own "B" Battery Eliminators, by Moe Joffe

FIVE PRIZES OF $25.00 EACH
Rain Making Again, by George F. Paul

FIVE PRIZES OF $20.00 EACH
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No further entries.

Last year SCIENCE AND INVENTION Magazine paid for articles $11,200.00 to 1,122 prize winners. Hundreds of SCIENCE AND INVENTION reporters were given prizes, and up to the time of going to press there were more than 22,000 reporters in the field.

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Tarrant the Conqueror

By RAY CUMMINGS

(Continued from page 421)

side, and headed Southward. No challenge. Under us, occasional local cars swept by; but up here we were clear of traffic.

Elza prepared our lunch, in the little electric galley forward of the observation pit. The Great London-East Indies Mail Flyer crossed us, coming along this same level. It was headed toward the Pole from the British Isles. Its pilot challenged us before it had come up over the horizon. A crusty fellow. His face in the mirror glared at me as I accepted connection. He ordered me down, insisting and oath.

Argo was at my elbow. His pencil-ray dug into my ribs. Had I made a false move it would have drilled me clean with its tiny burning light. I held the pilot we would descend. It pleased him; but he saw Argo's face, mumbled something about damned foreigners—general orders probably coming tomorrow to clean out Venna—damned well rid of the traitors. Then he disconnected. Venna, Georg and I were sure, was where Argo was now taking us. But the rest of his comments I did not clearly understand until later.

We descended, and the flyer came up over the horizon and passed us overhead. We were pointing Southward now, had picked up the 67th West Meridian and were following it down. The Hays station* challenged us; but they were satisfied with my explanation. Argo had us up in speed around 400. We went down Davis Straight, over New York and imprisoned. Had they caught us at

*Hayes Peninsula, Northwest Greenland, near the present site of Ilulissat.

(Continued on page 460)
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Tarrano the Conqueror

(Continued from page 458)

We passed over the Venezuelan Province, over the mountains and into Amazonia, head of the great river—still on Meridiana 67 West. The hills most everywhere were settled; there were, I knew, no more than a dozen standard cities of a million population, or one of Western Brazilians. As we advanced, I noticed an unusual number of the armed government flyers above us. Many were hovering, almost motionless, as though waiting for orders. But none of them molested us.

Near the 10th parallel South latitude, we passed under a fleet of the white official vessels, with a division of the Brazilian patrol joined with them. A hundred vessels hovering up there in an East and West line—a line a hundred miles long it must have been. Hovering there, for what? We did not know; but Argo, leaping up at them insolutely, may have guessed. They challenged us, but let us through.

"You are the last one in," this sub-director of the patrol told us. I could see him in our mirror as his gaze examined our pit—a dapper, jaunty fellow with the uptilted mustache that is almost a feature of the interested man. I could see him in the pit—"You are the last one in—inter-Allied are a nuisance."

He was more particular than those directors we had passed before. My badge and my verbal explanation were not enough. He made me show him the Inter-Allied seal which I always carried, and I gave him the pass-code of the current week.

"Last one in," he said. "And you wouldn't get in now without those refugees with you. Venia's closed after noon of today. But do you know it?"

"No," I said.

"Well, it is. They shut off the power early this morning for all low vibrations—yours and under. Brought 'em all down for a general traffic inspection. They changed their minds and threw it on again. But if you're coming out North again, you've got to be in by three. And you go in at your own peril."

He assumed that Argo and his men were Venus refugees going with me into Venia! I was a little taken aback, but the sudden quiet brought Georg and me to attention. We joined Argo in the pit. He was perturbed, and cursing. We dropped, gliding down, for there was no need of picking a landing with the emergency heli-copter batteries—glided down to the calm surface. For a moment, we lay there, rocking—a dark blob on the water. I heard a sudden sharp swish. An under-surface freight vessel, plowing from Venezuelan ports to the West Indian Islands, came suddenly to the surface. Its headlight flashed on, but missed us. I sped past. I could see the sleek black outline of its wet back, and the lines of foam as it sheered the water. We lay rocking in its wake as it disappeared Northward.

Then, without warning, our power came on again. An inadvertent breach perhaps; or perhaps some local or general orders. We did not know. Argo was picking from the air occasional news, but he said nothing of it to us; and he was sending out nothing, of course.

Dawn found us over the mountains. The Director at Caracas challenged us. Argo kept me by his side constantly now. Dutifully, we answered every call. The local morning papers were jammed with the news, but we mingled with it, at 8,000 feet and more, to clear the mountains comfortably.

Elza again cooked and, with Argo joining us, we had a really good breakfast. Argo was in good nature—continued, as we successfully approached the end of our flight. But still he volunteered no information about the condition of Venia. Elza was grave-faced, solemn. But she did not bother Georg and me with woman's fears. Bravely she kept her own counsel, anxious only to be of help to us.

Continued from page 462

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(Continued on page 460)
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Should advice be desired by mail a nominal charge of $1.00 is made for each question. Sketches and descriptions must be clear and explicit. Only one side of sheet should be written on. Money back absolutely if advice is not given.

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.

CAM LEVER MOVEMENTS

(904) Jack Strobel, Baltimore, Md., asks which is the easiest way of converting cam movements into reciprocating movements in which the reciprocating movement must be larger or smaller, or the power greater or less than that produced at the cam.

A. The ordinary laws of the lever are applicable to the cam transmissions, the simplest of which are indicated here. These, of course, are made to fulfill your requirements as there are other movements than those shown.

SOLID AUTOMOBILE TIRE

(905) C. L. Stocks, Gainesville, Texas, asks if he should patent an automobile wheel of metal using a solid tire but giving resiliency. A. We have had approximately three hundred automobile wheels called to our attention which do not use pneumatic tires. There is but one of these on the market, and this one is just a trifle different from all the others. The hard rubber tire does not seem to operate as well as the pneumatic tire, and it seems as if it is almost impossible to achieve such resiliency in a hard rubber tire as is obtained in the pneumatic type. Skidding on hard rubber tires is much more frequent, and more likely to result disastrously.

We would, therefore, advise that unless you are positively assured of a market for your automobile wheel, you do not waste too much time and effort upon the idea. The possibilities of a market for the same are very slight at present in fact we might even say that there is no market for such a device.

CORK EXTRACTOR

(906) Tracy R. Welling, Riverside, Utah, has designed a cork remover in the form of tweezers flattened at the jaws with small, sharp projections placed at right-angles to the jaws at the extremities. He asks our advice on the practicability and potentiality of this cork extractor.

A. With reference to your cork extractor, we would advise that you disagree with you with regard to the size of corks, which your extractor will remove from bottles. Let us assume that you have an ordinary four-ounce bottle which is quite full, and the cork slips down into the neck. It is evident that the hinge will not permit the jaws of your cork extractor to open sufficiently wide to permit you to grasp the cork. How then would you remove it with this device? This would be particularly true if the bottle had a very narrow, long neck. One of the simplest cork extractors which the writer has seen, and which is almost infallible in its operation, is the device made of four pieces of iron wire. These are all twisted together at the handle and have a sleeve which slides down, permitting the cork to be gripped tightly at four places instead of two, as in your system. The cork, therefore, must come up through the neck of the bottle and must align itself with the neck, of the fact that the bottle is full. It is evident that such an extractor is much cheaper to manufacture and answers the purpose better than your device. We would not advise you to apply for a patent on your system.
was very quiet, perhaps very impressionable. He knew he had nations and worlds to conquer—a destiny to fulfill. Not alone because of you, little Elza. I would not make you think that. But for you to share the Great Tarrano, master of the Universe, and his Lady Elza! Worlds for you to toy with, like gems on a thread adorning your white throat—"

He must have swayed her, the sheer power of him. Impulsively she touched his knee. "I am not worth—"

His face clouded with a frown. "I would not try to buy your love—"

"Oh," she said. "No, I did not mean—"

"You would not try to buy you. I want to share with you—these worlds—as your due. Soon I will be the greatest of all men throughout the ages. And very gentle always, with you, Lady Elza."

A buzz came from the disc at his belt. He answered the call—listened to a voice. "So? Bring him here." He disconnected. "Very gentle with you, my Elza."

His voice drifted away. He seemed waiting, like gems on a thread adorning your world.

"And his Lady Elza! Worlds to conquer—a destiny to fulfill."

"And very queer, perhaps very impressionable."

"The unconscious culprit was carried away."

"Argo flung him closer to Tarrano's feet. Elza shrank away."

"A gesture to Argo, and the man was flung closer to Tarrano's feet. Elza shrank away."

"Left a mirror unattended. So? The wire, Argo." He took the length of wire, gleaming white-hot, as the leering, gloating Argo turned the current into it—Tarrano took it, lashed upon the poor wretch's naked back and legs. Welts arose, and the stench of burning flesh.

"And you fell asleep without asking for a relief?"

"Master, I——"

"Did you?"

"Yes. I did not realize I was sleeping."

"A gesture to Argo, and the man was flung closer to Tarrano's feet. Elza shrank away."

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Doctor Hackensaw's Secrets

By CLEMENT FEZANDIE

(Continued from page 425)

terrestrial animals and plants owe their oxygen to the direct action of the sun. It is only in the sunlight that the chlorophyll or green coloring matter of the leaves can split up the carbon dioxide of the air into carbon and oxygen and so furnish the energy necessary for animal and plant life. Animals and plants obtain this energy by a re-combination of this carbon and oxygen into carbon dioxide again. It is the sun's heat that furnishes the energy used by plants and animals. Even man, with all his boasted inventions, has not yet succeeded in producing food except by means of the direct heat of the sun. If the sun's rays were suddenly cut off from the earth we should starve and suffocate as soon as the existing supply of food and oxygen was consumed. We have, and other mineral products—the storage products of past ages of the sun's heat, but man has not yet found the key that would enable him to utilize these treasures. We shall certainly find it some day—chemistry is making rapid strides every year—but so far we have not yet evolved animals and plants that do not require oxygen in any form. They would, of course, require energy, but energy may be obtained from chemical combinations into which no oxygen enters. In fact, I am inclined to believe that all animals and plants that we see, are dependent for their energy upon some sort of electrical action—due, of course, to chemical action of some sort in their bodies. I imagine these creatures are really nothing but a kind of dry cell. Their phoshorrescence is different from that with which we are familiar in glow-worms and fireflies. This looks more like the discharge witnessed in a Geissler tube. And you will notice occasional flashes and hear crackling noises. Evidently many, if not all, of these animals are highly electrified—probably, like the electric eel, they possess the power of producing this electricity at will. But, however that may be, my first step must be to admit a little of the friction of their bodies in the burrow, and seemed to depend entirely on the friction of their bodies in the burrow to keep them from flying off into the air where it must perish miserably from hunger and thirst unless enabled in some way to get back to land again. Nature laid some provided with wings, others with suction feet resembling those of flies, others still were rooted to the ground like maggots, and some of them strangely suggested terrestrials in their general aspect. One of these creatures a long, pointed bill, armed with sharp teeth, looked angrily at our adventurers and uttered a sound half-scream, half-growl. Three groups like wings, the third vertical on the top of the body, enabled the creature to fly with ease.

Huge monsters there were; too, large, un-
The telephone door

More people enter our homes and offices by telephone than in person. Through the telephone door, traveling by wire, comes a stream of people from the outside world on social and business missions. Important agreements or appointments are made, yet the callers remain but a few seconds or minutes and with a "good-bye" are gone. We go out through our telephone doors constantly to ask or give information, buy or sell things, make personal calls and on dozens of other errands.

None of the relations of life is more dependent upon cooperation and mutual consideration than these daily millions of telephone journeys. It is the telephone company's part to furnish the means of calling and to place courteous and intelligent employees at the service of the public. Good service is then assured when there is a full measure of co-operation between users.

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and using two of his tentacles to drive the creature, he started off in hot pursuit. Though he had no wings of his own he had intelligence enough to use the wings of other creatures.

As usual, mind triumphed over matter. The light dragon-fly, even though encumbered with a rider, was far swifter than the heavier reptile and reached the crocodile just as the latter had opened his enormous jaws to swallow poor Pep.

The rider had no weapons, but he seized the reptile with two of his tentacles and then started his steed for land. Vainly Pep tried to disengage herself from this new monster's grasp. She had escaped one danger only to meet another worse one. Doctor Hackensaw looked vainly on, but dared not fire.

Meanwhile, the crocodile had slowly recovered from the stunning blow it had received, and perceiving that its enemy had not yet landed, it started in pursuit. Possibly it knew that the foe, having discharged its thunder, was powerless for awhile. At any rate, on came the reptile, and, traveling faster than the dragon-fly with its double burden, reached the latter just as the man was about to land, and seizing him by the hindquarters, crushed them in its powerful jaws.

But now Doctor Hackensaw saw his chance. He raised his pistol and shot straight for the crocodile's tail. A tremendous explosion was heard and the rear end of the crocodile's body was hurled skyward in infinitesimal fragments.

The doctor then seized Pep, who, frightened but unhurt, had extricated herself from the loosened tentacles of the wounded man, and unwilling to remain longer in this dangerous region, he regained the car.

The rest of the journey is soon told. Doctor Hackensaw resolved to push on at once to the very center of the earth, and carried this resolution into effect, but he found nothing of special interest. It was merely one enormous sea of air with islands of various sizes floating in it. These islands were particles of the solid rock which had become broken off and hurled upward. Most were barren, but some of them contained animal and plant life.

The largest of these islands was about two miles in diameter; the party landed, and Pep was surprised to find that even on this large island the attraction of gravitation was inappreciable. But Doctor Hackensaw explained the matter as follows:

"Newton's law," said he, "is that the attraction varies as the mass of the attracting body, and inversely as the square of the distance from the center of attraction. Our earth has a radius of 4,000 miles. This island has a radius of one mile. The masses are as the cubes of the radii, hence the mass of the earth exerts 64,000,000,000 times that of the island. But this figure of 64,000,000,000 is partially offset by the fact that here we are only one mile from the center of attraction, while on the earth we are 4,000 miles away. Hence the pull due to nearness is about as great here. Taking both factors into consideration, the attraction on this island is only one four-thousandth of what it is on the earth. Migsrs, who weigh 10 pounds, I believe, 100 pounds would weigh here only one-fortieth of a pound—say, one-third of an ounce.

"Now, if Migsrs were on the earth's surface and weighed only one-third of an ounce, he would shoot up into the air—not like a balloon, but like a sky-rocket. His buoyancy would be greater than that of a cork.
Now if we decide to quit believing in ether, the question arises, how is light transmitted?

Einstein believes that light is really countless little particles of pure energy shot out from the luminous body. He treats these particles as "quanta." In effect this is an abandonment of the wave theory of light, and in the line of a return to the corpuscular theory. Newton, for example, held that light is made up of exceedingly minute corpuscles emitted by the luminous body. Many others of the old-time scientists believed the same. But they conceived tiny particles of matter, where Einstein conceived tiny particles of energy. Perhaps this is a distinction without a difference, for some scientists suspect that the electron, the ultimate particle of matter, is simply a particle of energy.

Certain actions of electrons and of heated bodies seem to give some support to this quantum theory of light.

Then came the question of how gravity operates without any intervening ether. Einstein's explanation was very ingenious. He said "Suppose you step into an elevator carrying a heavy stone in your hand. As the elevator speeds up, the stone feels much heavier because of the resistance of the inertia of the stone to the acceleration. "Now suppose the elevator were off in space, away from the gravitational field of the earth, or of other bodies. When the elevator is at rest, the stone would weigh nothing. If you let go of it, it would float in space. But if the elevator is started, and constantly accelerated, the stone would seem to have weight. It would drop to the floor if you opened your hand. No ether is necessary for this effect."

From this line of reasoning, he predicted a certain shift in the lines of the sun's spectrum, so that it would not quite match up with the spectra of similar elements as observed on the earth. He also reasoned that gravitation has a pulling effect on light, and that during an eclipse it would be found that certain stars near the sun were displaced slightly from their true position, due to the bending of the rays of their light by the gravitational field of the sun.

These two effects are still in controversy. Three eclipses have been observed since 1918, and scientists are still squabbling as to whether they proved or disproved Einstein. The effect is difficult to measure. For example, the refraction of the air, may produce displacement 50 times as great as Einstein's prediction. Moreover the laws governing the refraction of the air are imperfectly known, making this error very difficult to correct.

The spectrum shift is also in difficulties. The most delicate tests with a very sensitive spectroscope at the Mt. Wilson Observatory have failed to reveal it. On the other hand, two students of Bonn University believe they have found it.

But the ether drift is no longer in controversy. Prof. Miller has conclusively demonstrated its existence by an experiment that involves direct readings and no corrections. Unless the Relativity Theory can be modified in that of the ether and ether drift, the prediction of the existence of an experiment that will reveal it. On the other hand, two students of Bonn University believe they have found it.

In the autumn of 1905, the same year in which Einstein published his first paper on relativity, Professors Morley and Miller had a third interferometer built of steel. This they mounted on top of a hill near Cleveland. The location was 300 feet above Lake Erie, or some 800 feet above sea level. The country round about was open and free from large obstructions.
Observations made were made that year, and they indicated an ether drift much greater than the one found in Cleveland. But Prof. Miller wished to be sure, so he made no announcement at that time. The interferometer used was steel, and he feared that the observed effect might be due to some magnetic disturbance. He made another of concrete. Brass and aluminum mountings eliminated every possibility of magnetic effect.

In December 1921, more readings were made with the concrete interferometer, showing the same results.

Though fully satisfied in his own mind, Prof. Miller again withheld announcement to the world. The results involved our whole conception of the universe. The opposing camp of relativists would assail them if they were not beyond all doubt. He did not take any chances. He returned both interferometers to Cleveland, where he subjected them to every possible test until the next two years. Every effort was made to eliminate even the most remote possibility of error. As it had been found that the steel interferometer worked as well as the concrete, it was decided to use it in the final tests.

The steel interferometer was taken back to Mt. Wilson last summer, and during the fall and winter observations were made. Final results were reported to the National Academy of Science last April.

These results indicate a relative motion of the ether and earth of 6 kilometers per second at Mt. Wilson. Allowing for the drag, this is not out of harmony with astronomers' calculations.

Obviously, Prof. Miller concludes, there cannot be an ether drift, and to quote Charles L. Poor, professor of celestial mechanics at Columbia University, "The very basis of the Relativity Theory is destroyed, and the whole Einstein structure collapses."

Prof. Miller himself is reluctant to say that Einstein is wrong. He contents himself with the following statement, which is taken from his address to the National Academy:

CONCLUSIONS—

"The ether drift experiments at Mt. Wilson during the last four years, (1921-1925) lead to the conclusion that there is a relative motion of the ether and the earth at this observatory of about 10 kilometers per second, being one third of the orbital motion of the earth. By comparison with the Cleveland observation this suggests a partial drag of the ether by the earth, which decreases with altitude."

"It is believed that a reconsideration of the earlier Cleveland observations, from this point of view, will show that they are in accordance with the Mt. Wilson results, and will lead to the conclusion that the Michelson-Morley experiment has never given a true zero result, and therefore it cannot be
considered as basic experimental evidence for the Einstein Theory of Relativity.

But that modest statement looks like complete defeat for Einstein. The Swiss scientist himself says: (Section XVI "Relativity")

"Comparison with the discussion in section XII shows that also from the standpoint of the Theory of Relativity, this solution (that of Lorentz and Fitzgerald for the apparent failure of the ether drift experiment in 1887) was the right one.

"According to this theory there is no such thing as a specially favored (unique) coordinate system to occasion the introduction of the ether idea, or any experiment to demonstrate it."

In other words, he says, "there is no ether, no ether drift, and no experiment can demonstrate their existence."

If the other effects predicted by Einstein, had showed up as clear, and beyond doubt, the theory might stand, but apparently they have not.

A clever French mathematician (Painlevé), has recently stated that the mathematical series which is the basis of the Einstein Theory, is one of a great number of similar series. He also says that one of these series corresponds to Newton's law of gravity.

**Trombone Mute**

The illustration at the left shows a new type of wah-wah mute which is made for the trombone. The mute may be removed from the instrument at any time by simply pulling it out of the bell of the horn. The device is operated by the player's thumb who presses upon a small button within his easy reach, opens or closes the mouth of the mute, causing a characteristic sound to be produced. The mechanism is the invention of Mr. H. Bernard, who also designed that small fish-like musical instrument which whitelines like a bird, and which is called the Octavet. Both instruments were featured from Station WRNY recently.

Reader's Forum

(Continued from page 437)

ble. I think that a course of this kind would be welcomed by a great many persons who find that it is rather difficult to follow the meaning in a written explanation.

I would suggest that you give illustrations of easily made apparatus that can be used in such a course. I know that such would be welcome in my case. I have been looking for a suitable textbook on this subject, but find that most of the experiments given in them require rather elaborate equipment.

CLARENCE SAMPSON, Fosston, Minn.

(Many of the important experiments in physics are illustrated in SCIENCE AND INVENTION Magazine. The time-saving "back-and- forth" experiments are generally illustrated in any laboratory physics manual or any college textbook on the subject. Consequently SCIENCE AND INVENTION makes a bid for the better or newer experiments to physics, which are not generally found in these textbooks available to the reading public. Nevertheless, the editors would like to hear from the readers on the points brought up by Mr. Sampson.—EDITOR.)
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Science and Invention for September, 1925

ANOTHER S & I BOOST

Editor, Science and Invention:

I came across Science and Invention on the bookshelf recently, and after a careful study of its contents I am quite convinced that there is nothing like it in "this side of the herring pond." The only other paper in this country that I know of that is something like Science and Invention is so technically dry and likewise so small for the value given for it, that I have been compelled to look elsewhere for something of its nature, and the files were kind to me when the golden cover of Science and Invention caught my eye. (This last looks like poetry, but it was quite unintentional.)

Then again Science and Invention seems to have a broader outlook than any English publication I have read. Mr. Gurneback's article on "Radio as Inventor" has my heartfelt applause, but it would not meet with much encouragement from many of our somewhat narrow-minded educational experts on this side.

JOHN S. MORISON,

Edinburgh, Scotland.

(The constantly increasing number of pleased readers from the other side of the "herring pond show how popular Science and Invention Magazine is becoming in foreign lands. It is the kind approval of readers like myself that do much toward making the magazine what it is.—Editor.)

SUN SPOTS AND THE ICE AGE

Editor, Science and Invention:

In reading your magazine, I have come upon something which is quite puzzling. In your last issue there is an article on "Will There Be Another Ice Age?" In one of the illustrations it is stated that if the sun were to be covered with sun spots, the transmission of heat to the earth would be reduced.

In the May issue there is an article on page 76 wherein it is stated that "when there were few sun spots as in 1923 and 1924, the sun burns low. The time for many sun spots is now approaching, and like a fire when fresh coals are raked forward, the sun will send out more heat."

In reading the latter notice I understand that as the more sun spots there are on the sun, the greater the heat transmission to the earth, while in reading the first article I noted that when there is a lot of sun spots, the heat to the earth is reduced.

Will you kindly advise me of your opinion on this matter?

B. DE GRASSE, JR.,

Vawker, N. Y.

(This interesting letter from Mr. De Grasse, Jr., is answered by Abi M. Leimis, Sci. and the U. S. Naval Observatory, as follows:)

"It is true that if the ENTIRE surface of the sun were covered with sun spots, the transmission of heat to the earth would be reduced for the temperature of the sun spot regions is 3,000 degrees C., while that of the normal solar surface is 6,000 degrees C.

If it is also true that the total solar radiation is protected during the sun spot maximum period, in spite of the increase in the number of sun spots. Sun spots are but one of the signs of an increase in the intensity of solar activity, and though the temperature of these so-called solar storms called sun spots is low and their number and the area they occupy have increased very considerably over what it is at the sun spot minimum period, they still cover but a very small part of the total solar surface. The increase in the intensity of solar radiation from the unspotted areas more than offsets the decrease in radiation from the CONSIDERABLY SMALL sun spot areas. So the statement made in both articles are correct.

"It may seem strange and paradoxical, but it is also true that during the sun spot maximum periods when the solar radiation at a whole is increased, the surface temperature of the earth is lower by about two degrees than it is during the sun spot minimum period.

"This is believed to be due to the fact that there are more radiations of short wave-length from the sun during the sun spot maximum than before at any other time, and the effect of such radiations on the earth's atmosphere is to lower the earth's and other temperature reducing effects, and so lower the earth's surface temperature in spite of the increase in the intensity of radiation from the sun. It is as if Old Mother Earth changed the texture of her atmosphere blankets at such times to protect herself against the increased intensity of the solar radiations."

Both articles are, therefore, correct.—Editor.)

S. & I. GIVES SERVICE

Editor, Science and Invention:

Your Science and Invention Magazine for June, 1925, shows a great improvement over other issues. The articles that proved of most interest to me were those on page 126 by Dr. Harold Nicolson, P. D., and by Dr. Russell C. Harris on pages 137, 138, and 139. Also "The Einstein Theory" on page 39. We hope you will try and encourage this good work. Thanking you for the good service your magazine is rendering me, I am Yours truly,

JOHN N. LEIGHTON,

Leighton, Penn.

(Well, now, isn't that an interesting letter? The editor is able to become conscious of more of this type are sent to them, but they will have their work to become so, and will try to please.—Editor.)
Science and Invention for September, 1925

Book Review

PLAIN AND REINFORCED CONCRETE CONSTRUCTION. By H. A. Saurbrey. Edited by W. S. Lowdnes, Ph.B. Half leather covers, 5¼ x 8½, 96 pages. Published by Industrial Textbook Co., Scranton, Pa. $1.50.

This is one of the most complete and easily understood books on reinforced concrete construction that has come to the reviewer's attention. It is thoroughly illustrated with extra clear line drawings and sketches, and the simple tables and rules given in the treatment on concrete construction will make any mason or layman interested in the subject to compute the amount of sand, cement and rock needed for any size wall. The instructions given are progressive, and carry the theory of the subject right along through the elements of reinforced concrete construction, and simple examples are given on how to carry out this work. The book winds up with several excellent drawings of a large reinforced concrete building, showing how forced concrete construction, and simple examples given are progressive, and carry the cement and rock needed for any size wall. We are informed that Dr. Freundlich here gives us another volume on the Einstein theories and had managed started on more than seven other volumes dealing with the Einstein theories and had managed to write and publish them. He was not forced by any publisher or editor to publish any number of volumes, but he may well have been to do so.

THE THEORY OF RELATIVITY, by Erwin Freundlich. Hard covers, 5 x 7½, 98 pages. Published by E. P. Dutton & Co., New York City. $2.00.

We are informed that this book with a content of only four names and no index is a simple but penetrating exposition of relativity. Alexander Pope in his essay on man, says: "God said let Newton be and all was light." The proposer of the present day would be to apply this quotation to Einstein, but everybody does not have good eyes. The book is by one of his German contemporaries. Viscount Haldane gives a nice introduction, and says that Dr. Freundlich explains his topics with lucidity.

THE FOUNDATIONS OF EINSTEIN'S THEORY OF GRAVITATION, by Erwin Freundlich. Hard covers, 5 x 7½, 140 pages. Published by E. P. Dutton & Co., New York City. $2.50.

Dr. Freundlich here gives us another volume on Einstein. This time he has preceded a short preface by Einstein himself, whose concluding sentence says: "May his booklet prove a source of pleasure to many!" While it is not crowded with mathematics, it is easy to see how it generally runs into the calculus, and the book cannot be read appreciatively unless the reader has a general knowledge of mathematics, and by those who know in the radio field is duly blessed.


This book is quite interesting as it deals with the work on the synthetic resins before coming to Dr. Bakel's great discovery. Some four years he worked with phenol resins, encountered the greatest difficulties in obtaining results, but his last endeavor was successful, and by those who know in the radio field is duly blessed.

SPACE TIME MOTION. By A. V. Vasilev, Alfred A. Knopf, New York. 5 x 7½ inches, stiff cloth cover, $2.50.

This volume by the famous mathematician and physicist, Vasilev, translated from the Russian by Mr. Bertrand Russell, is to the mind of the reviewer a very satisfactory book for any one interested in acquiring a clear understanding of the "absolute" space and time.

In the street, the whole of society, of any one, mathematics—or if he has had them is rather mathematics—this volume will create a desire to dig out the old calculus book so that he may follow the simple, mathematical, conditions which are given. The book brings home the attention—that is probably the best criticism which can be given.

Before attacking this book, the reviewer had studied in depth the various equations, dealing with the Einstein theories and had managed to solve each without the matter sufficiently affecting him, i.e., he was not forced by interest to continue them. Therefore, if you are genro-

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THE AIRPLANE. By Frederick Bedell, Ph.D. Hard covers, 6 x 9 3/4 inches, illustrated, 257 pages, with index. Published by D. Van Nostrand Co., New York City. $3.00.

The author of this book has produced a really admirable manual. It is very practical, bringing out some of the features of airplane suspension, little known to and appreciated by many, illustrating with numerous diagrams the action of the wings or airfoils, which for a long time was so little known, bringing out the curious feature that an airplane will sink if unduly loaded principally by vacuum instead of by the surface of the plane and very little by pressure below. It follows that the important thing about a wing is the curve given to the upper surface, a straight lower surface being practically as good as any.

Lateral stability, the securing of which was one of the chief problems of the Wright Brothers, is discussed, and it is brought out that almost the entire art of aeronautics is one of producing a “counterweight” which is the curve given to the wings, or between them, are now the usual appliances, the winging being but little used. The author gives practical details about flying, such as the approved methods of taking off and landing, but avoids the description of how to do stunts, since he finds the book a conservative touch that is very much to be commended. Mathematics are used, but only elementary ones, within the reach of all, and numerous diagrams clarify the subject.


Looking through the table of contents of this book we find the subjects treated progressively, beginning with the ores of aluminum, including the famous, as we may call it, bauxite. A most interesting point brought out in the introductory portion is synthetic electrolysis. This, it will be remembered, is the solvent of bauxite in the electrolytic production of aluminum, and an enormous amount has been imported from Greenland, but it seems that the synthetic electrolyte is now preferred to the natural mineral. We are told how laharodite, a feldspar, has been used experimentally as a source of aluminum and potassium. It is fair to say that the production of potassium to the wedge is one great end to be achieved, and if the production of aluminum is itself needed, it will be a very epoch-making development.

The production of aluminum receives a complete chapter giving a summary of the number of processes, and going down into such details as the manufacture of aluminum metal. The chemistry, the physics and the mechanics of aluminum alloys is the subject of a most valuable and interesting chapter. Alloys are specifically dealt with in later chapters, the practical manufacture as well as the use therefor, and their qualities being considered. Then comes foundry practice, die casting and general mechanical treatment, and a very elaborate chapter is devoted to the thermal equilibrium of aluminum alloys. We often are asked how to solder aluminum, so here we have a whole chapter devoted to soldering and welding. We note that the spelling “aluminum” is used throughout, and while the spelling aluminum is perhaps often used, we feel that the author has done wisely in taking what is better spelling of the word. The recovery of aluminum from foundry wastes and the like presents quite a problem. The affinity of heated aluminum for oxygen is so great that a finely divided mass of little globules or other scrap in many cases will not coalesce when melted, the coating of oxide preventing the globules from forming in the metal from running together. Even such a fine point as this is treated under the head of secondary aluminum, the term being applied by the author definitely to the re-melting in order to save the metal of aluminum scrap. This naturally, as the author states, is one great end to be achieved, and if the production of aluminum is itself needed, it will be a very epoch-making development.

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**RADIO WRINKLES**

**UNDER** this heading we are going to publish items of interest to everyone who likes to build radio instruments. In order to continue this department it is necessary for our readers to tell us about their latest experiments. Write us a short description of some time- or money-saving kink you have discovered and send it to us along with a few sketches. Our regular prizes will be paid for this material. Be brief and try to put everything in the drawing. Don't be too elaborate. Address "RADIO WRINKLES" editor, care of Science and Invention.

---

**TERMINAL KINK**

If the bare end of a connecting wire is fastened to the ordinary shoe eyelet it makes the matter of fastening a very simple matter. This is a real time-saver and prevents the wire from continually getting shorter due to breakage.

—Demar Stanley.

---

**AERIAL SUPPORT**

When in the course of installing your radio set you find that it is a difficult proposition to place your antenna on the roof because it is of the gable type, you will do well to construct this mast. There is no necessity for drilling holes in your roof or otherwise defacing it.

—Robert J. Williams.

---

**VERNIER-NEUTRODON**

A combination vernier condenser and neutralizing condenser is readily made from the odds and ends found lying about. On a strip of bakelite is mounted a short length of brass tubing in which is placed a piece of glass tubing. A brass rod completes the device.

—B. McCarthy, New Zealand.

(Continued on page 483)
Don't Miss the September Issue which Contains Many Important Features

The Newest Thing in Radio Literature

A complete 100 page illustrated magazine containing hookups and constructional radio articles, gleaned from the entire radio press the world over.

Large magazine size 9 x 12 inches, printed on fine paper and profusely illustrated.

In Every Issue a 16-page Supplement of One Installment of S. Gernsback's Radio Encyclopedia

This real Encyclopedia of Radio explains every word used in radio, by means of photographs, drawings, charts or tables. (Some sample pages are shown in this advertisement). This supplement is arranged in loose-leaf form.

35c the copy on all Newsstands and Radio Stores

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You Can Be Ready in 20 WEEKS

In just 20 weeks you can receive the amazing training of the S. & H. Engineering Company and Lincoln Institute of Technology and be ready to step into big jobs like Utilities and Farmers, or G. Marsh or G. Fields and hundreds of others. No matter what your experience or education, this is an amazing opportunity.

From common laborers to ownerships of the U. & E. Electrical Company is what these boys did.

S. & H. Fits You for Jobs

A

FTEE many years study and experimental work there has been developed this remarkable way of teaching electricity right in your own home. This shop type home training is an effective self-taught course. You run the

absorption tuning

obtain remarkably fine selectivity. A sensitive honeycomb

wood base

combination.

A

old powder or cow's horn makes an excellent loud speaker. An old powder or cow's horn makes an excellent loud speaker. A sensitive honeycomb

wood base

possible.

a wooden base which is possible.

lent loud speaker.

smooth vernier control. --Wayne B. Grieve.

PULLEY

Space for loud speaking phone

powder horn speaker

PULLEY WHEEL

small roller

remote control

variometer

copper pin

fishcord

puller wheel

提供了一个夹具，与公认的法赫克-单板柄夹具结合，使其成为一种方便的装置，它总是很容易连接或断开在任何情况下。无需拧紧是必要的。

- F. E. Thompson, jr.

(Continued on page 485)
The New Radio Stamp Fad

Here is the DX Radio Stamp Album just like the ones we owned in our youth, in which were placed the rare stamps of the countries of the world. Some were hard to get, some couldn't be purchased for love or money; but the fun of the hobby was the seeking of rare stamps and the eventual possession. So it will be with the DX Radio Stamp Album. There will probably be some stamps you will never be able to own, but there will be many you will be proud to have and able to show to other radio enthusiasts. It's an interesting game. Below the Album is shown the "Proof of Reception Cards" of which a generous supply is furnished with each Album. A dime placed in the hole in the card and sent to the station you heard brings back a stamp for your Album.

You can get this handsome Stamp Album FREE

This beautiful EKKO Stamp Album, illustrated above, will be given away absolutely free with a subscription to any one of our four magazines: "Radio News," "Science and Invention," "The Experimenter," "Motor Camper and Tourist."

Don't pass up the opportunity to get this valuable premium. With this album, you can keep through the means of beautiful engraved stamps, a certified record of every broadcast station you have heard on your radio set. Your friends will enjoy seeing it.

The album consists of 96 pages, size 9 x 12 and is bound in extra heavy stiff cover.

With the Album is furnished a large Crams comprehensive radio map of the United States and Canada; a supply of "Proof of Reception Cards" and also some stickers. The Album contains a list of broadcast stations of the United States and Canada with wave-lengths and columns for recording dial setting, a table of stations arranged according to wave-lengths and a section for log records.

We have acquired 1,000 of these Albums especially for our subscribers. The coupon on this page filled out and mailed to us with $2.50 will entitle you to a twelve months' subscription to any one of our four magazines and one of these EKKO Stamp Albums free.

EXPERIMENTER PUBLISHING CO., INC., 53 Park Place, New York, N. Y.

Gentlemen: I have decided to take advantage of your special offer. I am enclosing $2.50 for 1 year's subscription to ( ) "Radio News," ( ) "Science and Invention," ( ) "The Experimenter," ( ) "Motor Camper and Tourist" and one EKKO Stamp Album which you will send me free.

NAME
ADDRESS
STATE
CITY

DON'T FAIL TO USE THIS COUPON

AmericanRadioHistory.Com
Cuts Gasoline Cost
to 10 Cents a Gallon

James A. May of 863-M St., Sioux Falls, S. D.,
has perfected an amazing new device that is en-
abling car owners to cut their gasoline bills
in half by doubling their mileage from gasoline used.
Most owners have made over 15 miles on a gallon. Anyone can install it
in five minutes. Mr. May wants agents, and is.
offering one free to one agent in each locality. Write
him today.

July

McWilliams Selenium Cells

McWilliams selenium cells have a ratio of 10 to 1 for voice mod-
ulation and experiments with the amplification of radio by light
rays. Complete instructions and diagrams for simple experiments
with the amplification of radio by light rays free with each cell, or
sent prepaid on receipt of 50c.

Micro-amp Relay

Works with a current of 10 Micro-ampere.
Contact points will not stick. Works in any
position. Not influenced by shocks or jars.
Double relay action. The most reliable instru-
ment for relay work.

Cuts Gasoline Cost
to 10 Cents a Gallon

James A. May of 863-M St., Sioux Falls, S. D.,
has perfected an amazing new device that is en-
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in half by doubling their mileage from gasoline used.
Most owners have made over 15 miles on a gallon. Anyone can install it
in five minutes. Mr. May wants agents, and is.
offering one free to one agent in each locality. Write
him today.

McWilliams Selenium Cells

McWilliams selenium cells have a ratio of 10 to 1 for voice mod-
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rays. Complete instructions and diagrams for simple experiments
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Battery Prices

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Here is a real battery quality
bought to you at prices
that will extend the life of the
battery buying public. Order Di-
rect From Factory. Put the
Dead Battery in your own po-
est. You actually save much more than half, and so that you can be
convinced, here is a blank for a written plan.

Antenna Mast

VERTICAL LADDER

INCLINED LADDER

DIAGONAL TIES

A very strong and substantial mast for the
antenna support can readily be made by brac-
ting together a few old ladders as shown in
the diagram above. An extension pole, "A," no more than 25 feet long is wired securely
in place.

Handy Wrench

Soldered Here

No. 8 STIFF GALVANIZED WIRE

On many occasions it is necessary to use a
small wrench for placing nuts in position. If
a short length of heavy galvanized wire is
bent and soldered as shown, it is found to be
very useful. Several of these can be made for
the various size nuts employed on a radio set.

Radiation Eliminator

If you have a troublesome regenerative circuit
which squals and is not very selective, con-
struct a wave trap by using a neutroformer in
conjunction with two small fixed condensers.
This acts both as an exceptionally fine wave
trap and radiation eliminator which is bound
to increase your receiving range to a great extent.

Micro-amp Relay

Works with a current of 10 Micro-ampere.
Contact points will not stick. Works in any
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Double relay action. The most reliable instru-
ment for relay work.
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Earn big money fast applying gold initials to auto. Every order 10 letters 50c each—samples free. Write quick. Lithograph Co., Dept. 19, East ONotta, N. Y.
Agents Wanted. Fall or Part Time to Sell on liberal commission basis Thermostatic Automatic Carburetor Control for automobiles. $100 weekly. No special experience needed. Cal. now, address Goldstein & Co., 8211 Manchester Ave., Chicago. Steady job to the last man. Write quick.
Agents Wanted. Full or Part Time to Sell on liberal commission basis Thermostatic Automatic Carburetor Control for automobiles. $100 weekly. No special experience needed. Cal. now, address Goldstein & Co., 8211 Manchester Ave., Chicago. Steady job to the last man. Write quick.

Agents—Best seller: Jim Ruber Repair for tires and tubes; removes vulcanization at a saving of over 60 per cent; just in time. It hardens tubes in minutes and is guaranteed to last the life of the tire or tube; sells at every auto rental and service dealer. For particulars lose no time right down the line. Address American Ruber Co., Dept. 601, Philadelphia, Pa.


Agents—Write for Free Samples. Sell Silvering mirrors, refinishing auto accessories, the opportunity to make money, or anything else, you will find listed here the best and most attractive specials of the month. N. Decae Laboratories, 1133 Broadway, New York. Be successful. Earn $10 daily silvering mirrors, plating and refinishing auto accessories, the opportunity to make money, or anything else, you will find listed here the best and most attractive specials of the month. N. Decae Laboratories, 1133 Broadway, New York.

Agents—Make $75 to $500 a week. First Rubber Repair Sealants guts punctures and elements. Sample free. Marquette Rubber Company, 2523 N. Wallace St., Chicago.


Your spare time—you can make from $3.99 to $9.98 an hour in your spare time for every hour you put in. Provided you really put it in and really work. If you are willing to do this, we are willing to take you, train you and put you in business. Full details with an offer of free transportation, for persons who are unknown or ambitious to be and want to be your own master. It will be to your advantage to study before writing. We don’t bother with time-serving men, but we are willing to train and take from you men who will really make a success of this proposition and make it worth their while and yours. If you are a man with a heart let us hear from you now. We will be glad to give you a quick decision. Address Dept. 101, C. A. Lambert, 1714 W. Adams Ave., Chicago.

Only you talk a day means $250 per month! Marvelous new adding machine. Values $1,500. Stock equals 500 $50 machines. Write quick. B. M. S. Laboratories, 315 Andrews Bldg., Dallas, Texas.


Big money and fast sales. Every owner buys gold initials for his auto. You charge $1.00; make $1.25. Three orders daily easy. Write for particulars and free samples. American Monogram Co., 511 Broadway, New York.

Agents Wanted (Continued)

Agents Wanted.

Large Camera Shop, Providence, R. I. Agents wanted. Must be trustworthy. Free samples. Address Magie Camera Co., 55 Park Place, New York City, N. Y.

Agents Wanted

Business Opportunities (Continued)


Learn a trade and be independent. Complete course in shoe last making. Clean, Easy, and Profiting on Capital for $2.00, no extra. McElroy Co., Kenawa, Indiana.

You want a Big Money making business of your own, a sure winner, write for information on how to make beautiful flower arrangement of the very latest styles. Write quick. Professional Flower Arranging Co., 35 Andrews Bldg., Dallas, Texas.

Correspondence Courses

Use correspondence source of all school kits, rented and remitted. List free. (Courses bought) Lee Mountain, East Clinton, Tenn.

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Learn Chemistry at Home. Dr. T. O’Conor Sloane noted educator and scientific authority, will teach you. No previous knowledge necessary. Your spare time—You can make from $3.00 to $5.00 an hour if you take and train a few men of character who will really work. If you are willing to try your hand at it, we will be glad to put you in the way. We offer you the opportunity to make money, or anything else, you will find listed here the best and most attractive specials of the month. N. Decae Laboratories, 1133 Broadway, New York. Be successful. Earn $10 daily silvering mirrors, plating and refinishing auto accessories, the opportunity to make money, or anything else, you will find listed here the best and most attractive specials of the month. N. Decae Laboratories, 1133 Broadway, New York.

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Agents-Wanted (Continued)

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Science and Invention for September, 1925

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Springs, Mo.

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Patent attorneys must either be qualified to practice law in this State or be members of the Bar of a foreign country. Write for the Full Facts at once. Address Dept. 777, Goodhue Chicago, Ill., or 1431 W. Adams, Chicago.

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Inventors write me about patents. My fees payable monthly. Address L. W. T. Near, Washington, D. C.


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Inventions commercialized, patented or unpatented. Write Adam Fisher Mfg. Co., 205 Enright, St. Louis, Mo.

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2630 Miles Distances with one tube. Any Notice understands our simplified instructions. Write for booklet tells the story. Varco Radio Co., Box 1178, Oakland, Calif.

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Boys, don't overlook this! The 'Harmon' Radio Packer. Great detail right out brought out with molded base. High grade material, latest in location or our catalogue. Detector with Galsie Crystal complete, $1.50; Fuller Crystal, $2.50; Vibrator, $4.50; With Galsie or Fuller Crystal, $7.00, prepaid. Send for yours today. Radio Speciality Company, 100 Park Place, New York.

6000 fully satisfied customers, some distant stations on Larrison Crystal set. Cutprice set $1.00. Complete Kit and prices $2.00. Larron Lamp, 673, Wichita, Kansas.

Powerful, ultra selective, four tube receiver covering 40 to 6000 meters, all solid parts, $2.50. Each when you know how. W. G. Conger, Singer, Missouri.

One tube set, stones, batteries and tube $19.75. Also parts at ten cent store, hardware store, etc., everything new. Baker, 2076 20 Ave., Los Angeles.

Patent Attorneys (Continued)

Volume 4, 1925, plants, minerals, metals, etc. Write for details.

Patents


Inventors—Send for form "Evidence of Conception" to be signed and witnessed. Form, fee, redraw, information free. Lancaster and Allighe, Registered Patents Attorney, United States and Canada, 243 Ourry Blvd., Washington, D. C.


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Salemens—You want the greatest return for your efforts. You set it with our line of all metal tools and overcoats designed for general work at $2.00. This price includes $2.00 for tools, with which you get cash bonus. We have vast home учалити and home territory territory. Our selling outfit is without an equal in selling field. Our selling method involves the training of our salesmen in our factory so that they will come back to you. That is our proposition that is genuine, and you yourself are genuinely interested. Address Dept. 777, Goodhue Chicago, Ill., or 1431 W. Adams, Chicago.

A Salemens wanted in every town or city within 25 miles of a broadcasting station in the United States. Immediate radio receiving set retails for $2.50. With Buddismo you may set up a new shop and buy the outfit itself for the Buddismo purchase price. We will send you the Buddismo purchase price. The Buddismo purchase price pays $2.00 for sample profit. The Buddismo Corp., 68 Broadway, N. Y., C. O.

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Song Poem Writers—Send for proposition. Bay Hilboler, 152, 610 Dickens Ave., Chicago.

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500 Mixed Stamps from 46 different countries, Australia, North Africa, China, United States, Canada, etc. Philatelic, postal, postmark, perforation, paper quality, etc. 3 United States stamps issued before 1872 all for 25c. Highest bargain ever offered, Satisfaction guaranteed or money back. Hugman Stamp Co., Dept. B.S. L., St. Louis, Mo.

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Stamps 100 All Different 3 cents. B. I. Quaker Stamp Company, Toledo, O.

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