A NEW WATER SPORT WHEEL
See Page 118
Earn $3,500 to $10,000 a Year in Electricity

Thousands of Cooke Trained Men Are Doing It!

You want to make big money. You're not satisfied with your $20 or $30 or $40 a week job. Then Electricity is the field for you—the field of BIG PAY and big opportunities. As a trained Electrical Expert—a "Cooke" Trained Man—you can easily earn $50 to $200 a week; just like the men in the pictures to the left, and not work half as hard as you do now.

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

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

Go Into Business for Yourself On My Money

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

Act Now! Get the "Vital Facts"

Learn what I will do for you. Find out about the things I do for my "boys"—things that are not being done by any other school. Get my 16 smashing guarantees. My big book, which includes also letters from more than 300 successful men whom I have trained, explains it all. Clip and mail the coupon to me now. You don't know what guarantees are—you don't know what wonderful things I do for my students—and what I guarantee to do for you—till you get my book—"The Vital Facts." Send it NOW. Read about the most amazing offer ever made to ambitious men.

L. L. Cooke, Chief Engineer
Chicago Engineering Works
Dept. 2-A, 2150 Lawrence Ave.
Chicago, Ill., U. S. A.
Men Past 40 Find Simple New Gland Treatment Ahead of Medicine or Surgery

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

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

According to medical authorities, 65% of all men past a certain middle age suffer from a disorder of the prostate gland that has a depressing—and often painful—effect on the entire body. Some of them recognize the real cause, and resort to surgery or elaborate, expensive treatment that is sometimes beneficial, sometimes ineffective. Others blame their troubles on approaching age and dejectedly resign themselves to the disagreeable symptoms, not knowing how to obtain relief.

What Are the Symptoms?

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

10,000 Find Relief

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

It has brought results where every other method has apparently failed. It has brought new vigor in cases where the surgeon's knife seemed the only remaining course and it has brought relief to a degree that could not be hoped for from an operation. Every man past 40—in fact, every man in his late thirties—should learn about this method—by which he can treat himself at home—the way in which he should find quick, inexpensive, safe and permanent relief, or pay nothing.

Why Many Men Are Old at 40

Above is the title of a book written by a member of the American Asso-

FREE—Discoverer's Book

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

The Electro Thermal Company
4546 Main Street, Steubenville, Ohio

FREE INFORMATION BLANK

THE ELECTRO THERMAL COMPANY
4546 Main Street, Steubenville, Ohio

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

Name __________________________
Address ________________________
City ____________________________ State ________________

This Therapy is not concerned with Violet Ray, Phonograph Records, Electric Treatment, Diets, or course of instruction.

Western Office, Dept. 451, Los Angeles, California
IN OUR NEXT ISSUE

$250.00 for Good Rat Exterminators

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

Have You Ever Seen Spirit Phenomena?

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

Will We Soon Have Talking Movies in Our Homes?

Yes, when the new machine to be described in our next issue is placed on the market we can all have talking movies in our homes without any trouble or a special operator for the projecting machine. The films are sealed in magazines and no trouble is needed except to wind the clockwork of the machine.

What Is Gravitation?

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

The above are just a few of the treats presented by an eminent professor whose articles on various branches of science are familiar to all of our readers.

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Chief Engineer Dunlap

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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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Science and Invention for June, 1925

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? And then you would regret that such things were no longer done. But that is a mistake. They are done—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 Cervantes' 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 flu gases, James Guyot, 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.

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Noted Instructor, Lecturer and Author, Formerly Treasurer American Chemical Society, and a practical Chemist with many well-known achievements to his credit. Not only has Dr. Sloane taught chemicals to a large number of men, he has for many years engaged in commercial chemistry work.
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The drawings of connections for electrical apparatus include Motor Starters and Starting Boxes, Overload and Underload Release Boxes, Reversible Types, Elevator Controllers, Tank Controllers, Starters for Printing Press Motors, Automatic Controllers, Variable Field Type, Controllers for Mine Locomotives, Street Car Controllers, Connections for reversing Switches, Motor and Dynamo Rules and Rules for Speed Regulation. Also, Connections for Induction Motors and Starters, Delta and Star Connections and Connections for Auto Transformers, and Transformers for Lighting and Power Purposes. The drawings also show all kinds of lighting circuits, including special controls where Three and Four Way Switches are used.

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

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

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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
THE shooting scene above was also taken in the studio.

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

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

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

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

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

By J. W. Von Stein

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

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

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

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

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

This mechanical decoy has small mirrors affixed to the moving wings which attract birds to the hunter's locality.
North Pole Junction
By L. B. ROBBINS

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

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

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

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

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

A small pocket sun dial is illustrated at the right. The lines and figures of a vertical dial are arrived at in same way as with the horizontal dial.

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

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

Left: Typical garden sun dial. The lines and figures of a vertical dial are arrived at in same way as with the horizontal dial.
The photo at the right is a mosquito. Here again the detail is not lacking.

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

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

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

The photo at the right is a mosquito. Here again the detail is not lacking.
Nasturtiums grow prolifically under the influence of ultra-violet rays. Most other plants do, but some die.

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

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

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

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

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

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

Uses of Invisible Light
By DR. RUSSELL G. HARRIS
Of the Jefferson Physical Laboratory, Harvard University

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

Quartz mercury vapor lamps kill germs and can purify drinking water.
Vacuum Canning
New Device Gives Perfect Results

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

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

Hydrostatic Dynamometer

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

30 GRAINS SALICYLIC ACID IN 1 QT. WATER

RINSE EVERY NIGHT AND REMOVE DECOMPOSED MATTER

30 GRAINS SALICYLIC ACID IN 1 QT. WATER

RINSE AGAIN IN MORNING AND SNIP OFF TINY PORTION OF STEM

ASPIRIN 5 GRS. IN 1 QT. WATER.

PUT STEMS IN VEGETABLES OR IN FRUITS TO KEEP FLOWERS FRESH.

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

PLACE ON ICE IN BASIN OF STRONG SOAP SUDS.

DIP STEMS IN HOT PARAFFINE THEN PLACE IN SALT WATER

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

On this page we show a few methods of preserving cut flowers. In the system at 6, 7, 8 and 9, a rather elaborate method is shown. The object of this contest is to make flowers last as long as possible by the aid of chemicals or by some other technique. The flowers must remain in their natural state. They cannot be coated by any substance nor can anything be done to impair their beauty or destroy their perfume. Twenty combination pen-pencils which became so popular as awards in the "Inner Tube Contest" will be awarded. These are self-filling gold pens. At the opposite end is a clutch pencil. The description appeared in our March number.

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

Captain Livingstone, an Antarctic explorer, communicates with Dr. Frontenac, a famous scientist who has conducted research involving methods of inducing hibernations in mammals. To Frontenac and Bond McQuestion, a reporter, the Captain recounts a weird tale of discoveries in the Antarctic.

He tells how a land of palm trees and luxurious flowers was found far south of the Antarctic circle and how during part of their exploration trip, several of the members of the party were killed by an invisible "Thing." During further explorations, a cave was discovered and in the ice coated floor they found encased the body of a beautiful girl. The Captain formed the opinion that this girl was not dead, but was in a state of suspended animation. Proceeding further into the cave the explorers discovered a sealed stone doorway guarded by a tremendous carved figure of a harpie. On the way back the only remaining member of the party, with the exception of the Captain, fell into a crevasse, followed by his sled carrying on it photographic records of the trip.

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

Just before establishing their depot on land, the dogs are reanimated with no disastrous effects from their long "hibernation." It was late in the afternoon when we came to the edge of a large open space and saw the camp of the bear people. It was at the farther side, by a little stream, and consisted of a half dozen huts, made of woven branches and dreed with long leaves like those of the pandanus.

The Living Death

By JOHN MARTIN LEAHY

NINTH INSTALLMENT (Conclusion)

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

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

SYNOPSIS.

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

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Just before establishing their depot on land, the dogs are reanimated with no disastrous effects from their long "hibernation." After the long Antarctic night, spent in preparations, the party finally sets out for the cave. They find it and the beautiful girl encased in the ice as told by the Captain. Using twine as a return guide, the party proceeds into the cavern and finds the stone doorway. At this time a voice is heard and suddenly there staggers out of the darkness a horribly emaciated man, naked except for a loin cloth, carrying at his side a skin sack of water. He collapses, then somewhat revives and points at the figure of the harpie carved above the doorway, muttering the word "Ah-cone-cawn-ga." With that he again collapses and dies.

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

NINTH INSTALLMENT

CHAPTER XXXI

WE ENTER

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

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

She stirred, sighed, closed her eyes. The pupils were contracting; the eyes were blue. Then suddenly she turned her head, raised her look to Frontenac's face and spoke!
At that instant the thing stepped into a stream of sunlight, and there it paused, a monster clothed in golden fire, and stood regarding us with stolid interest.

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

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

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

We found the grave—torn open. It was plain that this had been done long before, in all likelihood, I thought, immediately after the departure of Livingstone and Humphrey. The cross lay shattered amongst the flowers, and not far off a skull was found. A careful search everywhere revealed nothing more. The skull—we had no means of knowing whether it was that of Willie, Thompson or Bogardus—we buried, and placed another cross at the head of the grave. A solemn, sad business this, a terrible business that now faced us. As we advanced deeper and deeper into the place, the flora assumed a character more and more tropical. gorgeous flowers, many of them parasitical, were passed. Came the almost continuous drone of insects. Creeping, crawling, flying things were everywhere. Great butterflies flitted in the sunlight and in those gloomy forest depths into which we sent so many searching glances.

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

Our objective was the scene of the tragedy. This, thanks to Captain Livingstone's careful directions, we had no difficulty in finding. Yes, there we stood at last in that very spot where it had dropped upon the three victims.

"Look at that!" suddenly exclaimed Frontenac. He was pointing toward the trunk of the great cypress. There it was, faint but unmistakable—the mark of a great claw.

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

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

"Well, Bond?" Frontenac queried. "Captain Livingstone suggested the possibility that it did not have to move on the ground."

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

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

(Continued on page 174)
How Paper Is Made

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

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

PHOTO ABOVE IS A RIVER SCENE IN THE ADIRONDACKS. THE LOGS ARE ON THEIR WAY TO THE PAPER MILL. PHOTO AT THE RIGHT IS AN EXTERIOR VIEW OF A MODERN NEWSPRINT MILL. MECHANICAL OR GROUND WOOD PULP IS PRODUCED BY FORCING LONG FIBRED WOOD SUCH AS SPRUCE AND BALSAM, WHICH HAS BEEN CUT INTO SHORT LENGTHS, AND FROM WHICH THE BARK HAS BEEN REMOVED, AGAINST THE FACE OF A REVOLVING GRIND-STONE. THE WOOD IS REDUCED TO PULP BY FRICTION. LARGE QUANTITIES OF WATER ARE USED TO REDUCE THE TEMPERATURE OF THE GRINDING. THE PULP ISSUES FROM THE GRINDER AS SLUSH, AND IS THEN SCREENED TO REMOVE KNOTS AND SLIVERS.

PHOTO ABOVE SHOWS A LARGE PILE OF PULP WOOD IN STORAGE.

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

**WET MACHINE**

**LOW GRADE PAPER PULP**

**FLOW BOX**

**PULP SCREEN**

**PULP THICKENER REMOVES WATER**

**STORAGE CHEST**

**PULP FOR SHIPMENT OR STORAGE**

**FILLER, VARNISH ETC. ADDED HERE**

**BEATERS**

**JORDAN ENGINE**

**TO MACHINE CHEST**

**STOCK CHEST**

**FLOW BOX**

**PULP SCREEN**

**PULP THICKENER**

**WET MACHINE**

**SULPHITE PULP**

**STORAGE CHEST**

**PULP FOR SHIPMENT OR STORAGE**

**FINISHING ROOM, WHERE PAPER IS WRAPPED, WEIGHED, STORRED OR TRUCKED TO CARS**

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

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

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

"Sure, Pop!" answered Miss Pepita Perkins, gaily. "Where to?"
"To the South Pole first, and from there possibly on to the Center of the Earth."

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

"Radio waves. What do you mean?"

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

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

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

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

Doctor Hackensaw shook his head. "The results are most puzzling, and I don't dare to publish them—they are so wild and so much at variance with the current scientific theories. Consequently I am determined to make an attempt to penetrate to the center of the earth in order to verify or disprove my theories."
"Gee!" cried Pep. "That's some job you're undertaking. How are you going to dig your way down?"

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

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

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

"And I am wasting time. Now that you know my plan, you will see the necessity for getting on with it."

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

CHAPTER II

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

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

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

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

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

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

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

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

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

"There are no batteries," replied the doctor.

"I thought you said it was electrical?"

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

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

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

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

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

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

(Continued on page 190)
The Efficiency of Light Sources

By DR. RUSSELL G. HARRIS
Of the Jefferson Physical Laboratory, Harvard University

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

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

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

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

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

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

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

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

The maximum possible efficiency of any light depending on the heating of a filament is about 50%. The hotter the filament of a lamp, the greater its efficiency up to about 6000°C, but no present substance will stand this temperature. The above chart shows how the efficiency of a lamp would be increased if the filament could be made twice as hot without burning out.

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

By WILLIAM M. BUTTERFIELD

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

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

By Dr. RUSSELL G. HARRIS

Of the Jefferson Physical Laboratory, Harvard University

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

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

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

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

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

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

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

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

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

Further Tests of Einstein's Theory

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

Prof. Harold Richards.

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

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

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

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

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

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

At Luna Park, Coney Island, the metal fence surrounding the park has been painted and cut out to resemble a volcano. So cleverly has the scene painter arranged this volcano that he has produced a very interesting form of illusion. About a quarter of a mile in back of the fence lies Coney Island's gas works. Frequently both in the daytime and at night its flares illuminate the sky and dense clouds of smoke roll up from its stack. To the patron of the park it would seem that the smoke is coming right out of the mouth of the volcano. Actually, however, the effect is of entirely different origin. The diagram at the left gives a bird's-eye view of the arrangement, whereas the photo above shows the effect as it appears to the spectator.—J. Kay London.
Science and Invention leads again! In December, 1920, Science and Invention magazine described in detail an amphibian type of airplane wherein the wheels folded within the pontoon. An illustration from that issue is shown at the right. Only recently the first American built airplane capable of landing either on water or land was produced. It is illustrated above. With a 420 horsepower inverted Liberty motor a maximum speed of 130 miles an hour is attained.

Accurate Machines

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

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

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

—Allen P. Child.
Novel Wind Turbine

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

Capillary Action in Daily Life

Capillary attraction is sometimes termed absorption.

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

—J. A. Miller.
Novel French Inventions

Taking advantage of the fact that light passes through eggs in a proportion governed by the quality of the egg, the above illustrated cup has been invented which by means of a mirror in the base indicates the quality of the egg. No more need the housewife laboriously mix mayonnaise dressing by hand. The device at the left does this work, being actuated by a water motor. The flow of ingredients from the funnel may be regulated as desired. When leaving the home for the week end, you need not worry that your plants will die for lack of water, if they are planted in a flower pot such as illustrated at the right. Water is fed by a wick from a reservoir to the soil.

Advertising Sign

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

Key Lock

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

Money Changer

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

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

The chart given in Fig. 1 directly above shows how gasoline consumption in standard type of automobile diminishes as a grade is encountered and as the speed of the automobile is kept constant by the driver. This is an important factor, as otherwise, if the car were not kept at a constant speed, other determinants would enter into the calculations which would greatly affect the accuracy of the final results. From the chart it will be seen that a car traveling at 25 miles per hour will consume about one-half as much gasoline on a 4½ grade as on the level.

How British Ships Increase Firing Range

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

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

Simple Telescopes

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

METHOD TO SECURE STEADINESS
2-OUTER ROTATING DISH WITH MAGNETS TO PULL THE IRON MERCURY PAN FLOATING IN OIL
3-OLD STYLE MERCURY PAN
4-BEST

ONE HAS BEEN MADE WITH A 15 FT. FOCUS 20 IN. IN DIAMETER
Everyday Chemistry

By RAYMOND B. WAILES

HOW ARE RUBBING ALCOHOLS MEDICATED

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

HOW CAN WEEDELS BE REMOVED FROM TENNIS COURTS

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

WHAT DO BABY POWDERS CONTAIN

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

WHAT MAKES BRICKS RED

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

DO SMOKED GLASSES CONTAIN Soot OR LAMPBLACK

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

WHAT IS THE BLACK SCALE ON YOUR SOLDERING IRON

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

WHY DO NOT HOME DISTILLERS LIKE TO USE COPPER COILS

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

HOW TO MAKE A GOOD PAINT REMOVER

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

IS CANE SUGAR THE ONLY SUGAR

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

WHERE DOES IODINE COME FROM

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

IS SOLDERING FLUID RELATED TO PERSPIRATION DEODORANTS

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

HOW TO ETCH GLASS WITHOUT GENERATING POISONOUS HYDROFLUORIC ACID GAS

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

By RICHARD HOADELEY TINGLEY

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

HORIZONTAL

1-The boiling point of water.
2-The Greek letter "pi." Place a decimal point after the first number.
9-The square root of 30,000; nearest whole number.
12-One per cent. of the number of pounds in a short ton divided by M.
13-Multiply thirty-two one-hundredths by one hundred and forty-seven thousandths.
14-NE.
15-Three-quarters of a gross divided by twelve.
17-Four U's in a row.
18-Twenty-three
19-One and ninety-eight one-hundredths divided by three X's.
21-Twenty quires of paper.
22-Skidoo.
24-Seven hundred feet more than a hundred miles, in inches.
27-Call it eleven or two, as you please, it makes no difference.
29-Chemical symbol for molybdenum.
31-Fifty-one and one-third furlongs in a year.
32-The ten century mark, minus one.
33-Subtract one from 301; multiply by M, then add the number of days in a year—not a leap year.
34-201 yards, 2 feet and 3 inches more than a hundred and fifty miles, in inches.
35-The square of the so-called unlucky number.
36-Add one thousand feet to a mile and divide by 100,000.
37-The square of D.
38-Fifteen less than a gross of baker's dozens.
39-The square of the number of days in a week.
40-17 times 27.
41-One-tenth of a short ton.
42-One less than the number of cards in a deck.
43-One-tenth of the abbreviation for the doctor.
44-Divide the number of acres in a section by M.
45-Add four to the millennium.
46-Eight stone.
47-Four per cent.
48-Twenty-three
49-Seven per cent. of three-tenths.
50-The third musical note.
51-Divide 3,332,327,327 by 100,000.
52-Chemical symbol for carbon.
53-A dozen dozen.
54-Take 2,232,327,232 and multiply the digits together.
55-A third of the atomic weight of vanadium.
56-Three goose-eggs.
57-The square root of 40,000.
58-Thirty-three and one-half times twelve.
59-The square of twenty and twenty-five hundredths.

VERTICAL

1-One-tenths of a short ton.
2-The price of money a dollar would be worth at 4 per cent, compound interest in five years.
3-A double millennium.
4-The number of cents we sometimes look like.
5-Square inches in a square foot.
6-Square inches in twelve square rods.
7-Pail.
8-Half a cord.
9-M.
10-Natural sine of 45 degrees—or the cosine.
11-Nine C's.
16-Natural cosine of 30 degrees.
18-Twenty stone.
20-One hundred miles in inches.
21-Area of a field 2,000 feet square.
22-128 rods, 4 yards, 2 feet and 2 inches reduced to inches.
23-711 feet less than six miles.
24-An acre is a square foot.
25-The area of a lot 174.2/4 feet by 280 feet.
26-Area of a path 15 feet wide and 37 feet less than a quarter of a mile long.
27-30 cubic inches more than eleven cubic feet.
28-CIC.
30-CIC.
31-Divide the first person singular pronoun by M.
32-The secret of this amazing feat lies in the fact that the Tennessee carries her two small fighting planes which can cruise above the island as illustrated at the left, radioing the position of the target to the battleship and thereby directing the gunners.
33-The atomic weight of vanadium.
34-Ten gross.
35-Add four to the millennium.
36-One per cent. of three-tenths.
37-The square of D.
38-One-tenth of a short ton.
39-One and ninety-eight one-hundredths divided by three X's.
40-17 times 27.
41-Seven per cent. of three-tenths.
42-One-tenth of the abbreviation for the doctor.
43-One-tenth of the abbreviation for the doctor.
44-Divide the number of acres in a section by M.
45-Add four to the millennium.
46-Eight stone.
47-Four per cent.
48-Square V, then square the result.
49-Divide XLIV by 39.
50-The square of V.
51-Divide the first person singular pronoun by M.
52-Chemical symbol for carbon.
53-A third of the atomic weight of vanadium.
54-VI multiplied by X.

(Answers on page 188)
**Sheet Metal Fishing Punt**

By L. B. ROBBINS

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

In the construction of this boat, first cut three forms from one inch cypress for the end and center blocks. Place two about ten feet apart with the third in the center, and fasten the keel in place with wood screws. Then fasten the gunwale and bilge strips as shown, taking care that the surfaces of all the strips come flush with the edges of the forms. The outside covering of this boat consists of a single sheet of light gauge galvanized iron ten feet long and somewhat over four feet wide. Coat the edges of the form with white lead and lay a one and one-half inch wide strip of flannel soaked in white lead over the edges to prevent leakage. With an assistant, lay the sheet iron over the frame and fasten in place with 1 1/2-inch galvanized screws, placing them 2 inches apart. Bend the iron over the gunwale strips and fasten with wire nails. Deck over each end of the boat and insert a seat as shown. Oarlocks and a thorough coat of paint complete the boat.

**An Iceless Refrigerator**

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

—Ruth D. Shultis.
HOW TO MAKE IT

**Water as Weights**

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

C. A. Oldroyd.

**Copying Lens**

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

Don Home.

**Paint Brushes**

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

C. C. Sorensen.

**Car Ventilator**

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

Thomas McCarty.

**Cleaning Bottles**

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

Carlyle Weiss.

**Cleaning Rings**

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

Franklin Price.

**Glass Holder**

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

Truman R. Hart.

**Mechanical Detective**

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

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

**Sodium and White Lead**

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

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

**A. C. or D. C.?**

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

**Uses for Salt**

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

**Warning Mirrors**

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

Editor, Science and Invention: Your editorial entitled, "Needed Inventions," to issue of Science and Invention, revived some of my memories, especially in regard to the "time honored," useless, uncomfortable and, to say the least, unnecessary kind of wearing apparel, the collar. Your suggestion about the need of a "preserver," to do away with the saw-edge of the collar, is something new to me. Why not discard the pointed end of the men's collar? Has the man been enslaved to that bull nose-ring, the collar, long enough? Do we not badly need a "preserver," which will do away not only with the saw edge, but with the yoke itself.

In order to appear dressed up a la mode, the poor man is compelled, even in the hottest summer day, to stick to the "time honored," useless, uncomfortable and, if not actually, choking him almost to death; at the same time being uncomfortable and suffering from the perspiration, and apparently, if not actually, choking him. Every man, and the woman soon finds out too, if she self-restraint breaks, which it usually does, whether the collar is worn on the back or the front, the presence of the fair sex, especially when the belt of the yoke is fastened to the place, is too well known to the man. Consequently, the man who has the pole of the Emancipation of White Collar Slaves, as the editor suggests, would like to know. What usually follows the gratification of these sentiments of our contest, which conditions are merely theoretical, if not original, for the impossible.

One Man, Two, Bigger and Better.

(We are with you to a man, but as long as you want experiments, this is your magazine.

There is an entirely new treatment of radio containing experiments only, 99% of which have been submitted to careful tests written by the foremost authorities in their respective fields, also a monthly educational column.

A first-rate feature section is now added to the magazine. If you want experiments, this is your magazine.

Be sure to reserve a copy from your regular supplier, as this issue is sold out.

The Experimenter has come back! If you are one of the hundred thousand readers of the old ELECTRICAL EXPERIMENTER, you will no doubt be glad to hear that the Experimenter is coming back BIGGER AND BETTER THAN EVER! Practical Electricity has been changed into an entirely new kind of magazine entitled THE EXPERIMENTER.

This magazine has been greatly enlarged and improved. It contains new and improved illustrations and circulation, and you will find the following new departments:

Perpetual Motion Inventors:

Here's your chance for fame! (?) and fortune (?).

The Experimenter will pay $5,000 for demonstration of a working model. Contest closes March 1, 1926. Full details in March, 1925, issue of Science and Invention.

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

Radio News in Photos

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

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

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

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

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

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

Lens disk, 1, illustrated at right in detail revolves at 500 R.P.M. Serrated disk, 2, revolves at 5,000 R.P.M. and light from the object passes through the lens and the serrated disk, affecting the colloidal cell 3, setting up a current which is transmitted by the radio apparatus, 5.

Synchronous motors, 4 and 12, keep the apparatus in time. The radio waves are received on a usual receiving set, 8, and pass through a filter, 9. The picture current is then amplified by 10 and 11, whereupon it lights the lamp, 13. The brilliancy of this lamp depends upon the shadows and high lights of the object in front of the transmitter. This light passes through lens disk, 14, and registers on ground glass, 15.

The inventor has succeeded in transmitting the illustration shown.
Super Radio System

By DR. ALFRED GRADENWITZ

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

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

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

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

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

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

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

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

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

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

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

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

A black water stain can easily be prepared by mixing about 1/4 glass full of water, a piece of ferrous sulphate, a 1/4 teaspoonful of pyrogallic acid, and a color pigment is added until the desired shade is obtained.

Dial indicators may be made by scratching the glass with a sharp file.

After assembling the receiver and putting the tubes in, place the cover on and the receiver is ready for operation.

-Dr. Ernest Bade.
Honeycomb R. F. Transformers

The figure below illustrates the completed honeycomb R.F. transformer ready for use. The leads marked P1 and P2 are connected in series with the plate lead of the first or second tube. The leads marked S1 and S2 are connected to the filament and grid of the radio frequency amplifier tube. A .0005 mfd. variable condenser should be shunted across S1 and S2. By the use of this condenser all the broadcast wavelengths will be covered.

If one of these coils is used for the first tube, then, connect the leads marked P1 and P2 to the aerial and ground posts of the receiver.

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

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

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

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

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

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

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7. The figure below illustrates the completed honeycomb R.F. transformer ready for use. The leads marked P1 and P2 are connected in series with the plate lead of the first or second tube. The leads marked S1 and S2 are connected to the filament and grid of the radio frequency amplifier tube. A .0005 mfd. variable condenser should be shunted across S1 and S2. By the use of this condenser all the broadcast wavelengths will be covered.

8. If one of these coils is used for the first tube then, connect the leads marked P1 and P2 to the aerial and ground posts of the receiver.

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

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

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

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

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

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

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

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

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

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

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

20. The method of winding the radio frequency transformer primary is shown in Fig. 4. Do not wind the coil too tightly as difficulty will be experienced in removing it.
Home-Made Storage “B” Battery

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

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

Radio Loud Speaker

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

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

**Part V.**

The circuits given on this page are different types of audio frequency amplifiers. The two input posts are hooked in series with the plate and "B" battery lead of the detector circuit. The fixed condenser across the input posts is used to by-pass the radio frequency currents. The audio frequency transformer should be of reliable manufacture, the ratio of which should be about 3:1 to 1. Higher ratios may be used but distortion will result. The variable resistance across the secondary of the transformer is used to vary the signal input to the first amplifier tube. It also removes distortion to a certain extent. UV 201-A tubes should be used throughout; however, dry cell tubes will work to perfection, but the volume will be less. One rheostat is sufficient to control the two tubes. The second audio frequency transformer should be of the same ratio as the first. The "B" voltage applied to the tubes may vary from 45 to 100 volts. The condenser across the phones is used to clear up the output to the loud speaker.

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

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

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

T.A.T. SYSTEM

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

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

TELEPHONE JACKS

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

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

A. 1. The telephone jack plays an extremely important part in a radio receiver. Due to the large quantity production basis on which jacks are turned out, their cost is extremely important part in a radio receiver.

A. 2. By the T. A. T. system is meant that there are three circuits; the first one is a tuned circuit, the second is aperiodic and the third is tuned. This may be seen more clearly from the diagram given here-with. The constants are given with the diagram, and you should find no difficulty in making this receiver operate. The reason for the aperiodic circuit between the two tuned ones is so that the circuit will not oscillate and therefore will not radiate or cause interference in neighboring receivers.

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, etc. We are particularly desirous of obtaining new hook-ups and descriptions of single tube sets, reflex and other types which have proven satisfactory. We like articles on new single tube receptors. We will pay good prices for your ideas.

Editor.
REJUVENATING TUBES

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

A. 1. The circuit diagram used in connection with the rejuvenation of vacuum tubes is given herewith. UV-201A tubes are lit with about ten volts on the filament for about five to ten minutes or until they work again until it does work. UV-199 tubes are lit with about four volts on the filament for a while, what may be behind the 50,000 or 30,000 ohms.

Be careful about rejuvenating tubes because there is a possibility of burning them out if carelessly handled.

TOROIDAL COILS

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

A. 1. In the toroidal coil all inductive effects between adjacent coils is removed because the field is concentrated within the coil itself, therefore there is no stray field to induce any currents in coils near them. The easiest method of winding a toroidal coil is to obtain a circular piece of wood about one-half inch in thickness, three and one-half inches outside diameter and one and one-half inch in diameter inside. The form should look like a thick, abbreviated phonograph record with a large opening in the center to allow a spool of wire to be slipped through readily. The secondary should consist of about 200 turns of No. 42 double silk-covered or single cotton-covered wire; about 65 feet of wire is used. The primary consists of about 20 feet of the same wire wound loosely so as to extend over the entire length of the secondary.

BALKITE CHARGER

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

A. 1. The metals used in the Balkite charger are tantalum and lead immersed in the Balkite charger. The metals must be removed, and one-half inch in diameter near the Balkite charger.

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

DRILLING HARD RUBBER

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

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

Guess this Circuit! $100.00 in Prizes

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

For the first time in the history of the radio art, a very novel contest such as has never been held before, is being sponsored by SCIENCE AND INVENTION. Opportunity is given to the readers of SCIENCE AND INVENTION to exercise their mental powers in guessing the correct circuit used in the wiring of the above five-tube receiver. Look at the carefully drawn diagram, and more interesting to solve.

Rules

1. Contestants may submit as many entries as they desire.
2. Circuits must be carefully and clearly drawn in ink on one sheet of white paper. All symbols should be marked as to what they are supposed to represent.
3. The contest closes at noon on Saturday, July 2, 1925.
4. In case of a tie, duplicate prizes will be awarded to each contestant submitting.
5. The correct circuit or the nearest to it will be awarded first prize.
6. All contestants must be members of the society and also must bear the contestant's name and address in the upper right hand corner. The date must also accompany the above.
7. The circuit and photo of the interior of the set will be published in the September or October issue.
Hair Crimper

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

Auto Goggles

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

Match Lighter

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

Carpenter’s Combination

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

Thread Reformer

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

Draft Preventer

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

Bicycle Boat

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

WANTED

Articles pertaining to automobiles such as handy kinks, roadside repairs and anything of interest to the man who drives a car. $50.00 in prizes every month are offered by MOTOR CAMPER AND TOURIST for such articles. Get a copy at your newsstand and see what is wanted. If your newsdealer cannot supply you send for free sample copy to:

MOTOR CAMPER & TOURIST
63 Park Place, New York City.
DID IT APPEAR?

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

She: "Why?"

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

HE WASN'T SO MEASLY

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

The Doctor looked up puzzled. "Aw, get wise, Doc," suggested the small boy, "what'll you give me to go to school and scatter it among all the rest of the kids?"—Warren W. Goodwin.

IS ZAT SO!

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

Disser.: "Why?"

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

GASED!

Lecturer: "Can anyone in the audience give me an example of expansion by heat and scattering it among all the rest of the kids?"

Boy, "What'll you give me to go to school and scatter it among all the rest of the kids?"—Henry A. Courtney.

ALWAYS HUMOR A RUMOR

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

TWAS EVER THUS!

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

Inventor: "Perseveration today; inspiration tomorrow!"—Herbert L. Jillson.

MEET AUNTY CAPACITY

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

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

Radio Dealer: "Well, what is the trouble, body capacity?"

Colored Man: "Yes sir, that might be, my wife weighs about 286 pounds."—H. Duebber.

MME. MODISTE, RADIO ENGINEER

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

Second Bug: "Who did?"

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

WE WANT THE FIRST ONE MADE

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

FIRST PRIZE $3.00 DOGGONE HER

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

Mr. Newlyrich: "What sort will you get, my dear?"

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

THE LOUD TALKER

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

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

YES, AND THEN SOME!

Hy Voltage: "Were there any interruptions while you were 'listening in' last night?"

Guy Wire: "Yes. Dashes and dots."

Hy Voltage: "What did the folks say to that?"


MY STARS!

Group of people watching a bright star rise.

Would-be Astronomer: "I'm watching it run up: "Is it Sirius?"

Non-Astronomer: "No, not at all."—Leo Fletcher.

THEN TRANSFORMER

"What would you do if your girl went back on you, and later came back to you?"

"Meter, receiver and controller."—F. Olandoncheyden, Reporter No. 9,656.

AND MADE NO BONES ABOUT IT

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

ONE ON MUNCHHAUSEN

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

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

WESLEY BARRY, ALIAS "SUN-SPOTS"

1st Beauty Specialist: "Say, I hear a lot about these 'sun-spots.' What are they anyway?"

2nd Beauty Specialist: "Oh, I guess that's just another name for freckles."—E. A. Davison, Reporter No. 17,657.

VALVES WONT BLOW OUT!

Little Boy: "Pop, why do people call a radio bulb a 'tube'?"

Boy's Father: "I guess it's because they 'plug out,' son."—Harry J. Walters, Reporter No. 13,835.

A PESSIONIST

More: "Is the world flat or round?"

ELECTRO-STATIC VOLTMETER

A.1. An electro-static voltmeter consists of a fixed vane and a movable one. When the terminals of an active circuit are connected respectively to the fixed vane and the movable one, there is a difference of potential present, which makes the movable vane rotate and carry a needle over a graduated scale. It will be seen that it does not matter whether any given vane is charged positively or negatively for an attraction or repulsion between the two will always take place, so that a deflection will be given even when the difference of potential is rapidly altered. This property of the instrument makes it exceedingly useful for measurement of voltage when alternating currents are present. Another advantage of this instrument over the high resistance galvanometers that are used as voltmeters is that it does not take any current and therefore does not waste any power.

BATTERY SEPARATORS

(1837) Q. 1. Please give all the necessary data you have concerning the type and disposition of plate insulators and separators as used in storage battery construction.

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

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

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

1. They must be impervious to the action of the electrolytic acid.
2. They must be strong enough to withstand mechanical abrasion and compression resultant from the normal expansion and contraction of the plates when the battery is working.
3. Temperature changes under ordinary conditions of operation must have no effect upon the separators.
4. The material must be of purity such that it contains no substances which might exert a deleterious effect upon any portion of the cell.

After receiving the proper treatment, there have been found most suitable. After having received the proper treatment, they have been found most suitable.

To accomplish this, either the Acid or the Steam bath, or both, are used. The former consists of three stages, namely, the Alkali bath, the Alkali bath or the Steam bath, which consists of three stages, namely, the Steam bath, the Alkali bath, and the Acid bath, the alkali bath, the steam bath, or the acid bath. The former consists of three stages, namely, the steam bath, the alkali bath, and the acid bath, the latter consisting of an alkali bath, or the steam bath, where the separators are placed. After being placed in the acid bath, the separators are placed in a 3% solution of caustic potash, which consists of an alkali bath, or the steam bath, where the separators are placed. After being placed in the acid bath, the separators are placed in a 3% solution of caustic potash.

Electro Static Voltmeter

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Science and Invention for June, 1925

Important Articles to Appear in June Issue of "The Experimenter"

Chemical Flask Motor.

By Earle R. Caley, B.Sc.

Chemical Manipulation.

By T. O'Connor Sloane, Ph.D.

Hydro-Electric Battery Charging, Set.

By J. M. Jones.

Electric Chime Ringer for Clocks.

By H. Winfield Secor, E.E.

220 Volt miniature motor.

Increasing Inductance Efficiency.

A "B" Battery Eliminator for Alternating Currents.

Getting on the Air.

By A. P. Peck, 2MO, Associate I.R.E.

FREE INFORMATION

If you want additional information concerning any of the subjects illustrated and described in this number of SCIENCE AND INVENTION we shall be glad to give you other data we have at our command. To make this work as easy as possible for our editors, please be brief. Write only on one side of the paper and rate exactly in the order in which you wish the information. Please do not fail to send stamped and self-addressed envelope. Make all questions concise and to the point.

Address all inquiries of this nature to INFORMATION EDITOR c/o Science and Invention, 53 Park Place, New York City.
ILLUMINATING GAS (1837) Q. 1. James Smith, West Hoboken, N. J., please describe the laboratory manufacture of illuminating gas.

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

TRANSFORMER ACTION (1838) Q. 1. Miss F. Fort, Scranton, Pa., inquiries how an E. M. F. transformered from the primary to the secondary of a transformer.

A. 1. When it is passed through a coil of wire, magnetic lines of force are produced. If another coil connected to a meter is passed rapidly back and forth through the magnetic lines of force an indication will appear on the meter. If an alternating current is passed through the primary coil and the secondary coil is brought near over a Bunsen burner and after a time so that the gas may not escape.

MAGNETIC LINES OF FORCE

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

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

CLEANER (1839) Q. 1. Robert Dis, Denver, Colo., what is a good formula for cleaning silverware.

A. 1. Into a wide mouth bottle provided with a good cork, put the following mixture: " 1 part Ammonia. 2 parts Chalk. 2 parts Alum. 2 parts Powder the alum and rub up with the other ingredients, and then pour it all into a small amount of water and stir it well. When required, use a sufficient of the powder and with soft linen rags rub the article, careful to rub with pressure as otherwise the thin layer of plating may be cut through. Rinse in hot soap and then in clear water, dry in sowdust.

GASOLINE GUN (1840) Q. 1. E. P. G. wishes to know about the probability of using gasoline instead of powder to propel bullets.

A. 1. If it is to be made very effective, it should be used from the field of work specified in the question.

WELDING TRANSFORMER (1841) Q. 1. Mrs. B. D., Detroit, Mich., asks about the ratio of a welding transformer.

A. 1. The dimensions of the transformer should be as follows: Core, 15 inches long by 85 inches wide having a cross-section of two inches square. The primary winding has 84 turns of No. 10 D.C.C. wire and the secondary is wound with 31 turns of No. 10 D.C.C. wire. Alternating current is mostly used for incandescent welding. However, when carbon arc welding is wanted direct current is preferable.

Medical Page!

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

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

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

REFRACTING LIGHT (1844) Q. 1. Mr. J. S. Smith, San Francisco, Calif., requires an explanation of the refraction of light.

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

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

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

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

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

If you etch sufficiently, the sheet of brass is plunged into running water and washed free of the acid.

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

A. 1. The reason for the use of granulated carbon in telephonic transmitters is that as dissolved carbon is vibrated, the resulting vibrations are alternately compressed and released, which changes the resistance of the circuit and thereby changes the greater or less current to pass through. The many carbon granules give a better effect than one large piece.

Q. 2. Is there any other method of transmitting with a carbon transmitter besides using granulated carbon?

A. 2. There is what is called the condenser microphone, which is a true condenser. The two sets of plates are made in a circuit with a transformer and about 250 volts of "B" batteries. As the diaphragm vibrates, the space between the plates varies, and made greater or smaller, thereby producing changes in the primary of the transformer circuit, which are duplicated in the secondary circuit of the transformer and transferred to the line. In the same way the sound is connected together in series at opposite ends of a line, and act both the secondary and transmitters, but not satisfactorily except for short distances. The result makes the sound to the ear of the two receivers, it is important also to try reversing the polarity of the battery as well as the terminal connections of the receivers.
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Aviation

Suppose it had been pink or purple or vermilion?"

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

"Think it was a ghost, Wilbur?"

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

"I see you have turned supernaturalist."

"Well, what was the thing?"

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

"And no time like the present moment," added our leader, starting toward that spot in which the white object had shown itself and so suddenly, mysteriously had vanished. "I say, boss," protested the musher, "may-be you're walking right into a trap."

Frontenac never paused, made no response.

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

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

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

"What's that?"

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

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

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

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

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

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

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

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

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

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

CHAPTER XXXIII

The Headless Monster

And such indeed it was! And the dark, fearful thoughts that the glimpse of a creature so harmless had sent rushing into our minds—What a thing is a tree!— could not be suppressed any longer. The human brain is, after all! Something of mystery, a fear, and behold—fearsome thoughts, monsters and psychic Gorgons, hydras and chimeras dire!

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

(Continued on page 176)

CHAPTER XXXII

"IT WAS WHITE, HORRIBLY WHITE!"

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

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

Minute followed minute; an hour passed. The forest suddenly turned more sombre and weird than ever—its bushes fallen, heavey portentously. Even the call of a bird broke the stillness now.

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

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

Then came the rain. A few moments, and it was coming through that roof of leaves in a dripping deluge.

"Why in thunder," said Nunatak with a groan, "is a hen?--fnag to the mark of Wilbur's ghost."  

One thing that we had got into.

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

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

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

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

(Continued on page 131)
TROPADYNE SUPERADIO OUTFIT

THIS Superadio 6 Tube Set brings in Station KFXX (Hastings, Nebraska), 1200 miles, in New York City, clearly on a loud speaker, using only the small loop which comes with the outfit.

The outfit advertised here is complete, as listed below, everything needed is included, down to the last screw. The charts, blueprints, directions and photos furnished are complete and explicit so that anyone can build this set and have it working within a few hours. There is nothing additional to buy except the necessary batteries and tubes. Price includes mahogany cabinet and folding loop aerial.

You can pay $150 or more for an outfit, or $200 or more for a set, but you cannot possibly buy a better set than this.

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Ease of Tuning—Only two dials.

Tuned Intermediate Transformers; the only real B.A.L.A.N.C.E.D set of its kind made. Once transformers are tuned they need not be touched again.

Your Money Refunded if this set does not satisfy you in all respects—if after 5 days' fair trial you do not proclaim the TROPADYNE the best radio set you ever listened to.

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By using our new NO-SOD-ER connectors, any one, by means of a screw driver and a pair of pliers, can put this set together. No box, no heat, no flame, no solder, no soldering iron is necessary.

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The Editor of Radio News

In the August 1921 issue, said this about the Tropadyne: "Here is a remarkable receiver which we warmly recommend to our readers. In the first place only 6 tubes are used giving as much volume as the average 8 tube Heterodyne. There is a saving of two tubes as well as an increase of selectivity that it prankishly does not require, thereby not interfering with other receiving stations. A saving of two tubes as well as an increase of selectivity is obtained with this new circuit."
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AGENTS

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Science and Invention for June, 1925

The Living Death

(Continued from page 174)

again; the gloom about us thinned, lifted, crept away into the secret places; and sud- denly they came, those great plumes of the gleaming and flashing on tree-trunk and foliage, enhancing, however, the sombre gloom of the forest depths.

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

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

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

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

We had seen a number of birds in the forest, but none like this creature, which, by the way, was worth far more than our four feet.

The next day was passed in making ready for our expedition into this mysterious and weird land, and in looking around. In the afternoon, Frontenac and I went off with the object of finding the depot left by Capt- tain Livingstone. We had a time of it, for a dense fog enveloped the place, but find it we did at last. There was no telling; the supplies here might come in mighty handy. All the others were shown the spot. Noth- ing, however, was needed. All we did was clear away the snow, which was not near so deep as we had expected to find it.

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

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

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

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

Bearing in mind what awaits us in there," and he waved a hand towards the Gardens of Paradise. "You will, as directed in this paper, remain here until the 15th of December. Then, if all is well back by that date, you will know that something has gone wrong. Under no circumstances, though, will you make a choice among yourselves to leave, and take our fate. You will start at once for Summer Haven. You will, following as closely as possible the instructions given in this paper, how our party would go against the contingency that I might be lost: the great secret is carefully down on paper, in a vault in Seattle, and another will wake the girl in case I do not return."

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

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

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

We headed straight into the Gardens. An hour passed, another, still another, and noth- ing had happened. A half hour more, and then we were back where we had left it, evi- dently, however, not much trodden. Was it that of an animal or—? There was no soon to give us the answer to that singular. The trail ran at right angles to the route we had been pursuing. Which way should we go? To the right or to the left? The right was decided.

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

CHAPTER XXXIV

A MYSTERY No LONGER

The monster upon which we had so sud- denly come near. In the depths of this Ant- arctic forest was nothing more or less than a gigantic colossal. It was a seated female figure—forty feet in height, and, though headless, there was something indescribably cruel and terrific about it. A thing most strange was this: we had reason to believe that we had chanced upon the remains of a god of which we took it to be—had never had a head at all! We were at a loss to ac- count for a circumstance so very singular, besides that our presence at a moment when such a creature along, warning would be certain in case danger (from any living being) was near. But alas, the dog might betray our presence at a moment when such intelligence would spell irreparable and hor- rible disaster.

We had quitted that fearful sylvan cathe- dral, following a well-beaten path but one contigency that I might be lost: the great...
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SUGAR BOWL

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

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

TUMBLING TOY

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

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

RADIO COUPLER

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

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

PATENT RESEARCH

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

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

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CHARGING REGULATOR

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

A. 1. Some years ago a concern tried to put out a device on the market in the form of a little snap switch, which had a "no charge" sign upon it. When the switch was pulled out a carbon resistance was automatically thrown into the charging circuit, so that the generator no longer charged the storage battery, except to the extent of maintaining the charge at a certain definite point to overcome the use of current from the battery when the engine was running. At about the same time another concern placed an ammeter upon the market, in which the change was regulated by simply turning a small dial. The ammeter could be made to regulate the current so that the charge would be regulated from one amperage to another in steps in variable signs of a half amperes per step. This was in the form of a rheostat permanently secured to the ammeter. Neither of the devices have met with a very great sale.

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

CLOTHES DYING

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

A. 1. We believe that it will be difficult for you to dispose of your patent on a clothes handling implement. There is very little demand for a device of this nature. You cannot cover and protect the idea of a variable charging unit to be placed upon automobile. Any other concern making resistance could likewise construct a similar device, advertise it, and sell it without the necessity of paying royalties to you for its use.

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

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

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

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

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

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

Our leader laughed.

"You've got one more weapon now, Louis, than your two and mine, remember?"

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

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

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

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

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

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

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

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

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

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

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

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

There was very little undergrowth here. In this respect, it might have been a scene in some beautiful park. And, coming down an enshaded path on the dead side of the forest, coming straight towards us, was— it! There at last, no more than a hundred feet distant, was the mystery! Fearful the appari-tion which now confronted— but, thank God, the mystery of Paradise was a mystery no longer!

CHAPTER XXXV

What We Saw

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

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

At that instant the thing stepped into a stream of sunlight, and there it paused, a gaunt, leathery, cloaked in mud and stood regarding us with stolid interest. It was now some fifty feet distant.

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

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

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

And that thing which we saw? Imagine the biggest grizzly bear that you ever heard of. That will be a creature terrible enough, I know. But now imagine it turned into a thing half human, and you will have a faint—very faint—idea of the monster which stood before us. Yes, as I hope to see Heaven, that is what it was—a human grizzly, a huge bear-man! Evidently there was that about us which was somewhat of an enigma. I wondered if it was our standing thus resolutely and facing him. Undoubtedly be thought that we were unarmed.

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

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

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

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

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

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

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

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

"No like us."

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

As length we resumed our advance.

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

I was wishing that already! It was late in the afternoon when we came to the edge of a large open space and saw (Continued on page 182)
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the camp of the bear-people. It was at the farther side, by a little stream, and consisted of a half dozen huts, made of woven branches and roofed with long leaves like those of the pandanus.

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

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

"What the devil," said Annatka, "has the feller got?"

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

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

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

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

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

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

"Which same," said Watson, "has the feller got?"

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

CHAPTER XXXVI

Another!

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

The day following things were no better; if anything, they were worse. By midafter-noon, however, we were well around on the northeastern side, and we now ascended to a height of a thousand feet or so to see what lay before us. Our reconnaissance was not a particularly gratifying one. A haze drew its veil over distant objects, whilst the expanse of country over which the eyes could range was in no essential feature dif- ferent from that which lay behind us. I may mention, though, that six in the afternoon we still did not know that a shadow had fallen.

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

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

"It's my head," said Watson. "It's as though August were biting into my brain."

Shortly after midday the victim began to comatose. This we thought the precursor of death. For forty-eight hours he lay, save for short periods, but he did not die, and then suddenly opened his eyes and quietly asked what time it was! In six or eight hours he was almost wholly himself again. Great was our joy at this miraculous re-covery of poor Watson, but, alas, that joy was soon damped. It suddenly became pat-ent that this insidious and most mysterious malady (it certainly was not a fever) had laid its fell hand upon another victim. This was Louis Louisiana. And, just as he was recovering, it seized me, and then came Frontenac's turn. Thus a whole week was lost, and there is no necessity for me to dwell upon what a serious thing for the success of the expedition that loss might prove to be. Also, the possibility must not be blinded that it might bowl us over again. And suppose all of us were seized at the same time and just suppose that a bear-man were to come waddling into the scene—well, it would be bon soir et bonne nuit then with a vengence.

It was on the 22nd that we got under way once more. In the afternoon we crossed
two trails of the bear-people; but we did not linger at those points. We had no desire whatsoever to follow those trails, to see where or to what they led. That mystery had been solved; our purpose now was to clear up the mystery of that race of real men, white men, men like ourselves.

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

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

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

CHAPTER XXXVII

MALIGN FATE

The whole thing must have happened in two seconds. Back went the club for another blow as the bear-man sprang at Frontenac. We fired, the three of us, almost simultaneously, and down the great brute went. His face, Frontenac springing aside to avoid the bullet. That last word had scarcely left Nunatak's lips when a bear-man leaped out from behind a tree-trunk and, with a blow of his club, smashed Watson's head like an eggshell.

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seen what followed—the cooking, the carving and the feasting. Evidently these creatures regard human flesh as the greatest of delicacies. Certain features of the reception accorded the candidating group who arrived in a long armchair, accompanied by wolves and arrows—lead us to believe that the expedition had been one of great hazard. But—where did they get those victuals?

“Believe we got some remarkable photos with telescope-camera. We lay low until all was quiet in the village, then got into canoe and passed the frenzy of gunning that was going on from 11:30 p.m. on. Place in shadow, but sky was a deep blue and mountains on other side; grand in appearance. But the forest makes a fearful seclusion. Is it caused by something in food, the water, the bite of some insect or some noxious exhalation from the warm earth? Wrote no more of learning, but I do know that things are beginning to look pretty bad for us.

“This afternoon Frontenac shot a deer—a lovely little creature, its skin snow-white and beautifully ocellated, like the tail of a peacock or wings of an argus-pheasant. Thank Heaven, hunger is not one of the evils that beset us. And—Frontenac—again! Noon, 9 p.m.—Frontenac still like a dead man. Fear it has me now.

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

“Nov. 29th.—This afternoon Frontenac opened his eyes. Is himself again, though in a weak condition. He says that he has learned a lesson. We do not care. We would rather have him not live than come back a cripple. The canoe was abandoned. Course of action is now obvious. I can’t set down what followed. No, we need not go on. But, if the latter, our lives may not have been worth the fight. But, if the latter, our lives may not have been worth the fight.

“Nov. 30th.—Another day of horror. Even men cannot fight to the end. At two o’clock in the afternoon, we were able to make out a few miles or so. But even that fell enemy that we next met was a sight indeed. The canoe was abandoned. Course of action is now obvious. We have not seen even the ghost of a bear-man. We are not going to start until 11:59! Our outlook as it has been, is that we should have known it soon enough—our first glance would have told us so. But, if the latter, our lives may not have been worth the fight. But the latter, our lives may not have been worth the fight. The canoe was abandoned. Course of action is now obvious. We have not set down what followed. But, if the latter, our lives may not have been worth the fight.

“Now, 24th.—We can begin to wonder if a malignant fate has not locked bane-hounds upon our trail. At 9 a.m. halted to get some sleep. For had had none for over 24 hours. Louis felt queer in head again. We feared another attack of gimletitis—as he has dubbed that fearful malady. And of a truth the pain could scarcely be more excruciating if frontenac was driving a hundred gimlets into the brain. And sure enough it bowled him over. As I write this, at 10 p.m., he lies like a dead man. Why fear a faint? Is it caused by something in food, the water, the bite of some insect or some noxious exhalation from the warm earth? Wrote no more of learning, but I do know that things are beginning to look pretty bad for us.

“Frontenac left a record of our visit, and then, after a last, long look towards that mysterious northeast, we turned and started back on our trail. The canoe we called Rock Disappointment. The canoe was abandoned. Course of river so erratic that we could not make better time on foot. It was not until after the disappearance that the expedition had been one of great hazard. But the forest makes a fearful seclusion. Is it caused by something in food, the water, the bite of some insect or some noxious exhalation from the warm earth? Wrote no more of learning, but I do know that things are beginning to look pretty bad for us.
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Frontenac said "twas very unlikely that he ever should.

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

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

"Then it is true?"

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

"And—and you are going to awake her?"

"Yes, I hope to awake her."

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

He explained, succinctly but clearly.

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

"Of course, she is not breathing."

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

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

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

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

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

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

"Oh, the poor, poor darling!"

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

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

It seems certain that the ghoul would have succeeded, too, had it not been for Mrs. Marshall. She found herself—most fortunately, as it proved—a victim to a terrible insanity, and she was lying there, to be taken care of. The thought of the ghoul was far from her.

"It is all so strange, so inexplicable sound suddenly mingled with the mysterious things which keep you silent when you nothing."

"There it was again—a sound low, metallic, mysterious! She arose and (leaving the room dark) stole to the window and looked out.

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

A guard was at once posted, armed with a repeating rifle—one other than that weapon which Frontenac had carried in the Gardens of Paradise; that was the one she wanted. "And guarded the place is going to be," Darwin told me, the next day, "until I awake her. But that won't be long—only this day and to night, as that is the last moment when she might awaken."

"You are going to awake her tomorrow?"

"Tomorrow, Bond. And I hope my old rifle can stand the cold." "I shall be here—most certainly I shall come. What time?"

"Be here at nine. Only two others are to see it—Charlotte and my old friend, Dr. Hollister. It was to him, you know, that the secret was to pass in case I failed to return from the forests of Paradise. No, no, other—er, a nurse, you're too. Yes, a nurse."

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

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

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

A few minutes after my arrival, Dr. Hollister came, and with him a nurse. We at once went out to the room wherein lay the sleeper—Frontenac, his sister, Dr. Hollister, and the nurse, Mrs. Marshall. The temperature of the chamber we found above the freezing-point. Already the ice which incased Sleeping Beauty was melting.

Frontenac began chipping it away, in which occupation he was ere long joined by Dr. Hollister. It was not a great time, therefore, before the girl lay a dripping figure before us—her hair, however, still ice-incased.

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

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

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

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

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

"Her heart!"

It was Dr. Hollister who spoke. "It beats!"

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

Frontenac's hands ceased to perform those respiration movements.

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

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

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

"Is she awake?"

The Sleeper has spoken—since Frontenac awoke the sleeper. For four or five days, Sleeping Beauty was a very sick girl. The change that occurred in the expiration of that time, however, was a most remarkable one: a day or two, and she had wholly recovered.

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

'Zandara's' acquisition of English promises..."
the mast is just long enough for gravity to balance centrifugal force, then \( a = a' \) and

\[ V = \frac{2\pi D}{86400} \text{ cm. per sec.} \]

Since there are 86,400 sec. in a day. If \( D \) be solved in this equation (using 4,000 miles for the earth's radius) it will turn out to be about 7,000 miles, the distance from center of earth to top of mast. Hence the mast would have to be not less than 33,000 miles high above the earth's surface. If a person climbed to this height on such a mast he would lose all weight and if he could climb higher he might be thrown off into space.

**THE TRACE OF THE FLASHLIGHT**

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**LEAKY FOUNTAIN PEN**

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

**WHY THE BUNSEN BURNER POPS**

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

**THE TWO CAPILLARY TUBES**

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

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CHAPTER III

"Did you say this pit was five miles deep?" asked Doctor Hackensaw, who made a careful examination of the machinery.

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

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

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PHOTOGRAPHIC FACTS AND FORMULAS. By E. J. Wall. Hard cloth covers. 8" x 5\%". 386 pages. Price $4.00. Published by the Alpine Press, Boston, Mass.


Thanks to some of the modern novelists, the theory of rejuvenation has been made more or less popular with the lay public. Obviously, however, a novelist is hardly the proper person to explain the real science of such a charming and revolutionary subject. Dr. Paul Kammerer and his American colleague, Dr. Benjamin, need no introduction to our readers. The question of rejuvenation and its technical applications are as closely interwoven with the names of these two men as it is with that of Dr. Steinach: The sub-title of the book is "Juliet's重要因素". The subject is made extremely clear in this volume with the added advantage that it is dealt with from a purely scientific point of view, so that the reader leaves the book with a clear idea as to just how investigations along this line have proceeded, with their results, and what may be expected of further work.

Of course, the first chapters are given over to the history of rejuvenation. As the consequence, the book is undoubtedly worth many times its price. It is as simple as possible, and not at all frightening to the general reader. The latter half of the book gives some practical examples of rejuvenation which have been carried out and proved successful. There is enough of a discussion on technical details of the operation involved to satisfy the most inquisitive reader. The volume is hereby recommended to those who wish to obtain an authentic and workable foundation upon which to discuss this business of rejuvenation.
Wooden shoes

THE peasants in America do not wear wooden shoes at all, even in the fields!” writes Abbe Pierre, of Gascony. “No, the peasants there wear shoes of leather, although I should think that sabot shoes would be much more serviceable, not only on the roads, but plowing. . . . And wooden shoes are far less expensive. Ah, that America is an extravagant country!”

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The last three or four decades have seen marvelous advances in the field of pure technical physics. There has been a very definite place for some time, which was waiting to be filled by the present volume. Of course, there were no end of books on various discoveries made in the laboratories of the great physicists, but there were few which covered the modern developments and showed at the same time through the correlation of the new discoveries, the new field which natural philosophy now covers.

The present volume begins with a discussion of molecular statistics, continues on up through the development of the electronic theory of matter, then into Bob's original work concerning the atom, with particular attention to the whole of the electromagnetic vibration field. Next, it is given as understandable a discussion of the Quantum Theory as is possible, without including several volumes of calculus with it. This chapter will be found extremely valuable to those who have a craving for dipping their toes in the waters of theoretical physics. Then comes a dissertation upon the latter day theory of chemical elements, and then the famous Einstein Theory, which modified our classical physics. The writer will recommend the rest of the book highly. However, pursuing his regular policy of isolation with regard to the Einstein Theory, he will have no opinion as to this latter question. The reader enters it entirely at his own risk.

We cannot be responsible for physic coasts and hats unless checked with the manager.


The subject of comparative religions is one primarily for discussion by the Bench of Bishops, and not for the man of science, who through natural habits of mind feels himself called upon to deal with practical and real developments in nature, and then to draw his conclusions from the sciences hitherto excluded to him. Besides religion is even a more ticklish business for the man who is not an admitted expert in any other field of human dogma. The present volume has for its thesis the fact that the God of the early Jews, the God of the early Christians, and the God of the present day Christians are exactly three different, separate and distinct Deities. The proof is elaborate, and one not technically schooled in the subject, convincing enough. Mr. McGehee is a fairly convincing writer, which in itself, makes his train of thought plain, and as far as the book goes, it can be recommended.


Mr. Bird has been one of the most prominent among the spiritual investigators in the last several years. In the present volume, he brings before the reader a number of his experiences in connection with investigations of several alleged mediums. He has a long and detailed account of the difficulties usually encountered in such investigations, which gives one an appreciation of some of the problems which have to be faced. The accounts of the investigations themselves each under the heading of a particular seance or medium are complete to the finest detail. To avoid skepticism so-called discussions, this book will be found extremely valuable because of the absence of absolute assertions, of bias, and the fulsome reporting of the details surrounding each of his investigations. It is very seldom indeed that we run across a volume upon this much discussed subject which is not full of spades from one point or another. Mr. Bird takes the whole matter very seriously, and as a serious subject he spreads lots of ink over his pages, covering the subject thoroughly. To those who take the subject seriously, the book will add a hearty welcome.


One always feels a little afraid to turn a boy loose with chemicals. Yet if practised, there need be no accidents and the only criticism one can make of this book is that it is a little beyond the boy. For instance, the making of sulphuric acid by oxidation of sulphur dioxide seems rather advanced for a beginner.
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